New Thermal Generating Station in the Northern Village of Kangiqsujuaq

Environmental and social impact assessment statement

Volume 1 – Report

September 2023

Produced by
Hydro-Québec

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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 thermal generating station in the northern village of Kangiqsujuaq*.

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

- Volume 1 – Report
- Volume 2 – Appendixes
- Volume 3 – Appendixes

This assessment was conducted by Hydro-Québec in collaboration with SNC-Lavalin. The list of main contributors is provided in Appendix A of Volume 2.

Summary

Hydro-Québec is responsible, through the Direction – Réseaux autonomes, for supplying electricity to communities not connected to the main transmission system.

Project description

Hydro-Québec plans to build a new thermal generating station on the territory of the northern village of Kangiqsujuaq to replace the existing one (see Map 2-1). The new generating station will supply electricity to the Kangiqsujuaq community starting in 2028. After this date, the existing generating station will be dismantled. The new generating station will be equipped with three generating sets (855 kW, 1,135 kW and 1,168 kW) for a total installed capacity of 3.16 MW.

The new generating station must be designed for a service life of 50 years. Energy production costs for this off-grid system will be optimized by integrating renewable energy: solar panels will be built at the generation station's construction phase, and a wind farm with an energy storage system will be added later.

The planned site for the new generation station is located almost 900 m south of the center of the village of Kangiqsujuaq. The developed area will be approximately 16,192 m² and will include the generating station, a fuel depot with two 35,000-L outdoor storage tanks, a 4.16-kV step-up substation with two distribution feeder bays and storage spaces for operational needs. A 140-m access road to the generating station will be built. In addition, two distribution lines will start at the substation and run along the access road and the municipal road, stretching approximately 1 km, to connect to the existing power system.

Environmental impact assessment and public participation process

The 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* (EQA), since it will have a capacity exceeding 3 MW.

As part of this impact assessment, Hydro-Québec launched a program to inform and consult the populations affected by the new thermal generating station, namely the northern village of Kangiqsujuaq, the Kativik Regional Government (KRG) and the Ministère des Ressources naturelles et des Forêts (MRNF). From 2020 to 2022, Hydro-Québec held three meetings with the Kangiqsujuaq municipal council as well as a consultation over community radio. However, due to COVID-19, Hydro-Québec had to adjust its information and consultation process so that community members could safely participate.

Environmental impacts of the project

The environmental and social impact assessment has established that, with the application of the proposed mitigation measures, the residual impacts on the various components of the biophysical and human environments will be minor.

The impacts of the project will be felt primarily during construction. The main activities associated with construction of the thermal generating station are excavation and blasting, leveling, backfilling and earthwork, generating station construction, waste management and hazardous waste management, transport and traffic, worker presence and housing, job creation, and the purchase of goods and services. This work will nonetheless be limited, small in scale and carried out over a relatively short period of approximately two and a half years.

Biophysical environment

Components of the biophysical environment likely to be negatively affected during the construction phase are the soil, surface water, and caribou and bird populations. During operation, soil and water quality could be minimally affected due to the potential for accidental spills.

The planned generating station will be built on unconsolidated deposits consisting mainly of sand, gravel, silt and rock outcrops. A total surface area of 1.62 ha will be developed to accommodate the generating station's infrastructure. Earthwork, blasting, and foundation construction could alter the surface soil composition and profile. Based on the type of surface deposits, the risk of rutting from machinery traffic and transportation is low. Permafrost will need to be taken into consideration when planning construction work but will not be impacted by the presence of the generating station.

The generating station site is located nearly 110 m from an intermittent watercourse and 160 m from a perennial watercourse, both of which flow into Baie Wakeham, more than 1.2 km away. The site is also surrounded by wetlands, mainly to the northwest and south, with the closest wetland located 6 m from the bottom edge of the generating station's embankment. The surface water is presumed to flow northwest and west, toward river CE02 and Baie Wakeham. The project has been optimized to avoid negative impacts on wetlands or aquatic environments. That being said, minor changes will be made to the site drainage around the generating station during construction and operation. Sediment supply to the aquatic environment will be negligible since the soil is essentially made up of rock and granular materials. In addition, the platform's slopes will be protected with riprap and geotextile membranes.

No wetlands will be directly affected by the construction of the generating station. Only wetland MH07 may be indirectly disturbed by additional runoff from the construction of the embankment, which is considered beneficial to a certain extent.

The project's extended study area is used by caribou from the Leaf River Herd. The caribou that frequent the Kangiqsujuaq sector are therefore likely to use the spring and fall migration corridors and the summering area. Only a few transient individuals are likely to travel through the project's extended and limited study areas. The various construction activities will result in the loss of approximately 1.62 ha of habitat and minor loss of function owing to human disturbance avoidance behavior. The habitat loss is a minuscule portion of the Leaf River Herd's summering area, which covers approximately 250,000 km^2.

The project site features low bird species abundance and diversity due to its location on a rocky plateau that is not favorable to species of interest, such as waterfowl and shorebirds, nor to birds in general. The principal impacts during the construction phase are tied to habitat loss (1.62 ha) at the generating station site. None of the special-status bird species are likely to be disturbed during construction provided that there is no encroachment on wetlands outside the generating station site.

Human environment

Components of the human environment likely to be negatively impacted during construction and during operation are air quality, greenhouse gases (GHG) and climate change, the sound environment, land use, infrastructure and services, the health and safety of residents, sites of cultural, historical and archaeological interest, and, to a lesser extent, the landscape.

The site for the generating station was chosen with the aim of minimizing negative impacts for the community of Kangiqsujuaq regarding noise and air quality. The project will have a positive effect, since we will be moving an existing and continuous source of noise and air pollution 1 km farther from the village.

The project will help reduce GHG emissions compared to the current situation, as the new generating station will be designed to easily integrate wind energy and battery storage. The integration of renewable energy will optimize the cost of energy production for this off-grid system and should contribute to the reduction of GHG emissions over the entire life of the generating station. Hydro-Québec aims to integrate 38% to 54% wind energy into this power system. The generating station will also have solar panels to supply station services.

The site of the future generating station was chosen with the agreement of the local authorities, in line with the municipal development plan. The project will not affect access to other sites or their use for berry picking or hunting by residents.

Based on the archaeological survey conducted, no archaeological sites were found directly on the site of the new generating station, although the area is deemed to have "moderate" archaeological potential. With regard to the impact on the landscape, the infrastructures will only occasionally be visible to mobile observers and will be barely

visible from the village of Kangiqsujuaq because the generating station will be farther away.

The risk of technological accidents is 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. A sound environment monitoring program will also be implemented during operation to measure actual noise levels from equipment as well as at receivers.

The general mitigation measures set out in Hydro-Québec's Standard Environmental Clauses (SECs) and several specific mitigation measures will be applied during construction and operation.

Project schedule and cost

The construction phase of the new thermal generating station will take two and a half years, from 2026 to 2028, once government approvals are obtained. The facility is scheduled for commissioning in February 2028. The cost of the project is roughly estimated at $104 million, with economic spinoffs for the community anticipated during construction through local hiring and subcontracting.

The project will yield positive employment and economic spinoffs during construction and during the generating station's operation phase. Hydro-Québec will maximize the project's positive impacts for the local community with measures such as hiring labor and subcontractors locally whenever possible.

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1 Introduction

1.1 Proponent's presentation

Hydro-Québec's Groupe – Exploitation et expérience client, through its Direction – Réseaux autonomes, is responsible for supplying electricity to communities not connected to the transmission system. This is the proponent of a project to build a new thermal generating station that will integrate diversified renewable energy and ensure a reliable power supply for the Kangiqsujuaq community.

1.2 Mission and vision

Hydro-Québec's vision is to mobilize the collective strength of Quebecers to accelerate the energy transition, stimulate the economy and build a sustainable future.

Its mission is to deliver reliable electric power and high-quality services tailored to customers' needs at competitive prices. By operating clean, renewable energy sources, Hydro-Québec contributes to Québec's collective wealth and plays a central role in the emergence of a green, sustainable economy. As a recognized leader in hydropower and large transmission systems, Hydro-Québec helps neighboring markets reduce their carbon footprint by leveraging the attributes of its renewable energy. Firm believers in the power of innovation, Hydro-Québec develops state-of-the-art solutions and shares its expertise to help decarbonize the economy and optimize energy consumption.

The Direction – Réseaux Autonomes is responsible for delivering reliable power to the 22 communities in Québec that are not connected to Hydro-Québec's main grid and taking steps to convert to cleaner and less expensive energy sources.

2 Context and project justification

2.1 General presentation of the project

Hydro-Québec plans to build a new thermal generating station on the territory of the northern village of Kangiqsujuaq to replace the existing one (see Map 2-1). The new generating station will supply electricity to the Kangiqsujuaq community starting in 2028. After this date, the existing generating station will be dismantled.

The new generating station will initially be equipped with three generating sets of 855 kW, 1,135 kW and 1,168 kW, respectively, for a total installed capacity of 3.16 MW. The site will feature the generating station, a fuel depot with two 35,000-L outdoor storage tanks, a switching substation with two distribution feeder bays and storage areas. There will also be a battery energy storage system to easily integrate renewable energy. The generating station's yard can accommodate the interconnection substation for a future wind farm, as well as related equipment. The surface area of the platform will be approximately 16,192 m² (including the access road). The access road to the generating station will be approximately 140 m long, starting from the access road to the Kativik garage/warehouse. Lastly, two distribution lines approximately 1 km long will run from the switching substation along the access road and the municipal road, connecting to the existing power system.

The generating station building will house all power generation, protection and control equipment and systems, and all amenities for maintaining and operating the generating station. Approximately 35 solar panels will be installed on the front of the building to contribute to the energy required for station service. In addition, the work of an Inuit artist from the community will be reproduced on a panel on the front of the building. This incorporation of Inuit art will harmonize the building with the local Indigenous culture.

2.2 Project justification

Hydro-Québec currently operates a thermal generating station in the heart of the village of Kangiqsujuaq. Its guaranteed capacity, which dictates the reliability of the system's supply, shows a capacity deficit with respect to the village's constantly growing peak demand. Hydro-Québec has implemented temporary measures to compensate for the lack of firm capacity and ensure system reliability until the new generating station is commissioned. Hydro-Québec's existing building is old and poorly designed and presents a number of issues that can only be rectified by a major renovation and expansion of the existing generating station. This intervention would not provide any economic benefits compared to the construction of a new generating station and is not in line with the development plans of this Indigenous community. Figures 2-1 and 2-2 illustrate the relationship between demand forecast and generating station capacity.

Building a generating station is a cost-effective solution that maximizes social and environmental benefits and is supported by local Indigenous authorities. This new site and its modern infrastructure will have the potential to integrate renewable energy sources and maximize their contribution to Hydro-Québec's goal of carbon neutrality.

Figure 2-1: Relationship Between Demand Forecast and Generating Station Capacity

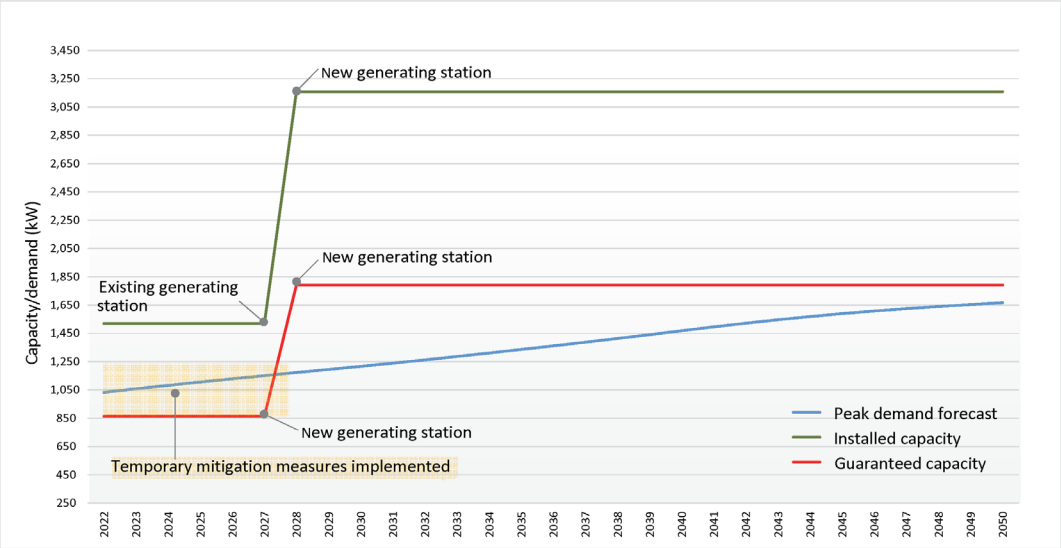
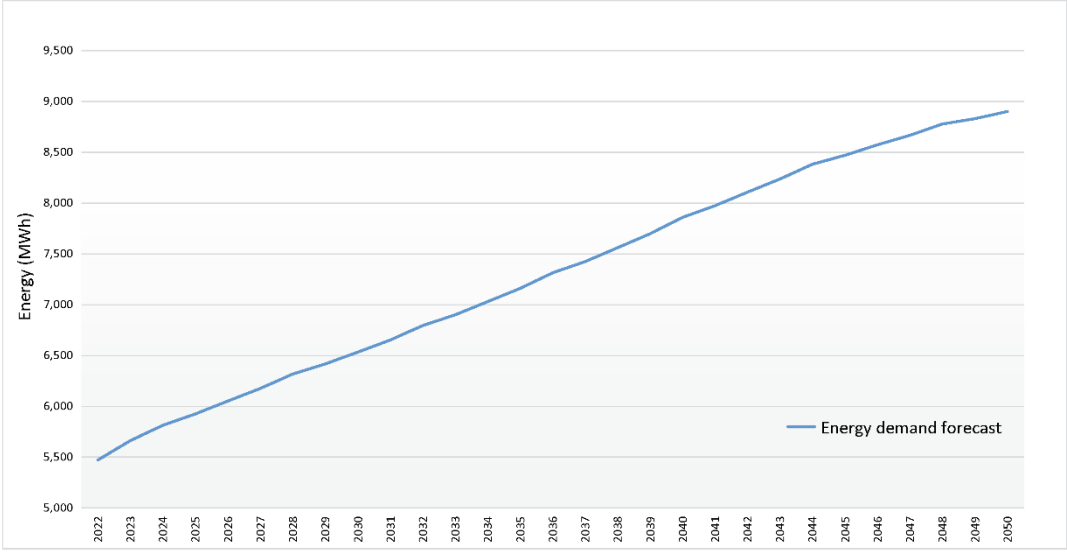
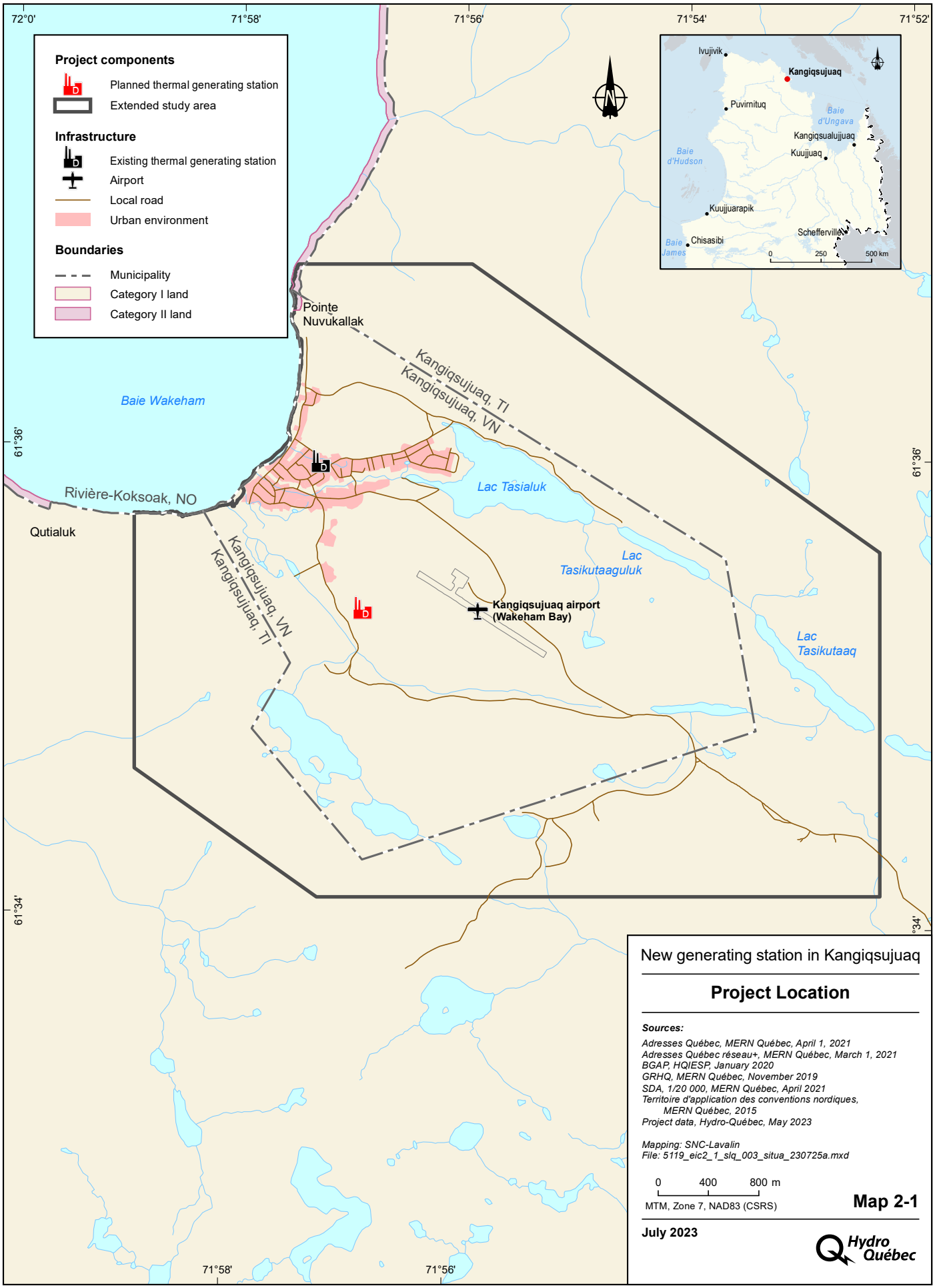


Figure 2-2: Energy Demand Forecast





New generating station in Kangiqsujuaq

Project Location

Sources:

Adresses Québec, MERN Québec, April 1, 2021
Adresses Québec réseau+, MERN Québec, March 1, 2021
BGAP, HQIESP, January 2020
GRHQ, MERN Québec, November 2019
SDA, 1/20 000, MERN Québec, April 2021
Territoire d'application des conventions nordiques, MERN Québec, 2015
Project data, Hydro-Québec, May 2023

Mapping: SNC-Lavalin
File: 5119_eic2_1_slq_003_situa_230725a.mxd

Map 2-1

July 2023

Hydro Québec

2.3 Alternative solutions to the project

Hydro-Québec's thermal generating station is crucial to this system's power supply reliability. Few alternatives are technologically or logistically possible to accomplish this mission. The geographical location of the village and the area surrounding it do not offer any potential for the construction of a hydroelectric facility. The preferred solution remains the operation of a diesel-fired thermal generating station, accompanied by the implementation of one or more renewable energy projects to reduce the environmental impacts associated with the operation of the thermal generating station.

Two options were analyzed: the expansion and renovation of Hydro-Québec's existing generating station, or the construction of a thermal generating station on a new site. The first scenario was discarded, as it presents economic, environmental, social and technical drawbacks. It would make the integration of renewable energy extremely complex, which runs counter to Hydro-Québec's objective of having facilities that facilitate the integration of clean, diversified energy.

The village of Kangiqsujuaq has strong wind and solar potential, which justifies the development of a hybrid solution with the thermal generating station. Hydro-Québec plans to carry out projects with these clean energy sources in collaboration with its partners. The new generating station will facilitate their integration.

Hydro-Québec therefore chose to build a thermal generating station on a new site, because of its high degree of reliability, its resilience to disasters and climate change, and the economic, environmental, social and technical benefits it will deliver.

2.4 Related projects

The thermal generating station project is coupled with the construction of two 4-kV distribution lines approximately 1 km long. These lines, to be built at a later date, will run along the access road and the municipal road, from the new generating station's switching substation to the existing power system.

Other related projects include the construction of an access road and the installation of an energy storage system. They are not specifically mentioned in Schedule A or B of Chapter III, Title II of the *Environment Quality Act* (EQA), but are included in this impact statement to improve overall understanding of the project. Hydro-Québec will ensure that it obtains all necessary government approvals and attestations of exemption from the environmental and social impact assessment and review procedure to build these infrastructure components in a timely manner.

2.5 Legal context

2.5.1 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, Title II of the EQA, the proponent of a project provides preliminary information about the project to the Québec Minister of the Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs (MELCCFP). The Minister then informs the proponent of the nature, scope and extent of the environmental and social impact assessment statement to be prepared, taking into account the opinion of the Kativik Environmental Quality Commission (KEQC). The Minister's directive presents a process aimed at providing the information necessary for the environmental and social impact assessment of the project.

On April 6, 2022, Hydro-Québec submitted preliminary information on the generating station project to the Ministère de l'Environnement et de la Lutte contre les changements climatiques (MELCC), now the Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs (MELCCFP). The Minister sent the guidelines for preparing the impact statement to Hydro-Québec on November 4, 2022.

2.5.2 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 set out in Chapter III of Title II of the EQA
- certification that the energy storage system is not subject to the environmental and social impact assessment and review procedure
- 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*
- MELCCFP authorization for certain components 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 covered by Section 22 of the EQA may 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 assessment statement reports the findings of the proponent's environmental and social impact assessment. It must employ scientific methods and satisfy the requirements of the MELCCFP 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 4.3 of this statement are not subject to the environmental and social impact assessment and review procedure. 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 required to carry out its project are obtained in a timely fashion.

2.5.3 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 commitment to the environment and introduces its strategies surrounding the environment and public health and safety.

Hydro-Québec's *Our Social Role* policy sets out its 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.

In addition, Hydro-Québec implements the following procedures and internal directives:

- 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 international standard ISO 14001:1996(E).
- Environmental acceptability and favorable reception of new projects, restoration work, and operation and maintenance activities (DIR-21). This guidance document stems from the commitments undertaken in the *Our Environment* and *Our Social Role* policies. It sets out criteria, components and company requirements to promote

the environmental acceptability of new structures, restoration work, operation 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 as much as possible.
- 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 guideline 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 sets out the rules to be followed and 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 restoration projects and maintenance activities, while taking the host community's concerns into consideration.
- Audible noise generated by electrical substations (TET-ENV-N-CONT001). The proponent has developed various guidelines, including one that specifies audible noise criteria for substations beyond Hydro-Québec property limits and the conditions for applying these criteria.

Lastly, all calls for tenders issued by Hydro-Québec include Standard Environmental Clauses (SECs), which establish general 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 consultation program focused on informing and consulting people impacted by the new thermal generating station project. The overall objectives of this program are as follows:

- inform the public about the project (description, justification, environmental benefits and schedule)
- identify the community's concerns regarding the project
- respond to and follow up on stakeholders' information needs

Between 2020 and 2022, Hydro-Québec held several meetings with representatives of the Kangiqsujuaq municipal council and the Nunaturlik Landholding Corporation to present the project and keep them informed of its progress.

3.2 Identification of stakeholders

The project is located within municipal boundaries and on Category I land, so to occupy a new site and carry out its project, Hydro-Québec must obtain approval from two sources: the municipal council of the northern village of Kangiqsujuaq and the board of directors of the Nunaturlik Landholding Corporation.

Community members, especially land users, are informed and consulted during the pre-project phase to allow them to express their concerns. Lastly, the Kativik Regional Government (KRG) is also a stakeholder in the project, since it is offering technical support to the northern village, particularly with regard to land use.

3.3 Information and consultation activities conducted

Between 2020 and 2022, Hydro-Québec held four meetings with the Kangiqsujuaq municipal council to present the project and inform them of developments. An initial meeting was held on February 13, 2020, and a second on October 21, 2021. The third and fourth meetings took place on April 11 and November 9, 2022.

Hydro-Québec also presented the project to community members on November 9, 2022, during an information session on local radio.

3.3.1 Information meeting on February 13, 2020

Hydro-Québec held a meeting with representatives of the Kangiqsujuaq municipal council and the Nunaturlik Landholding Corporation to present the various scenarios

evaluated to meet the community's growing energy demand over the next few years. Two scenarios were presented to the Inuit representatives: increasing the capacity of the existing generating station and building a new one. During the meeting, community representatives voiced their disagreement with the first scenario and, by extension, the associated lot expansion request, judging that this project would cause even more nuisance for the surrounding residences. The Board indicated that a resolution confirming this position would be forwarded in the weeks following this meeting.

On February 20, 2020, the Kangiqsujuaq municipal council adopted resolution 2020-13, rejecting Hydro-Québec's lot expansion proposal and asking Hydro-Québec to relocate its generating station outside the community.

3.3.2 Communication of September 2021

In September 2021, Hydro-Québec confirmed by email its willingness to go ahead with the construction of a generating station in Kangiqsujuaq and asked the municipal council, as well as the Nunaturlik Landholding Corporation, to suggest a few potential sites. It also informed them that field surveys were scheduled for October 2021. Hydro-Québec has expressed a desire to meet with the municipal council and the landholding corporation to briefly present the project and discuss potential sites. Inuit representatives welcomed Hydro-Québec's intention to build a generating station on another site and dismantle the existing one.

On September 17, 2021, at Hydro-Québec's request, the Kangiqsujuaq municipal council adopted resolution 2021-23, proposing a potential site for the new generating station.

3.3.3 Information meeting on October 21, 2021

On October 21, 2021, a second meeting was held with the Kangiqsujuaq municipal council and the Nunaturlik Landholding Corporation to present the generating station project and discuss the site proposed by the northern village and other potential sites. Hydro-Québec presented and explained the field surveys it plans to carry out at the various sites. It indicated that this series of surveys will provide data on soil quality at these sites. Following the field surveys, the results of the assessment will be compiled in a report that will indicate the preferred site for the construction of the thermal generating station, before being presented to them in the winter of 2022.

3.3.4 Information meeting on April 11, 2022

A third meeting was held on April 11, 2022, to present Hydro-Québec's recommended site and the results of the assessment of potential sites to representatives of the Kangiqsujuaq municipal council and the Nunaturlik Landholding Corporation. Hydro-Québec also discussed the details of the thermal generating station project (justification, technical specifications, preliminary schedule, environmental studies,

etc.). At the end of the meeting, two potential sites were retained so that Hydro-Québec could proceed with assessments.

3.3.5 Communication of May 11, 2022

On May 11, 2022, Hydro-Québec sent a request to the Nunaturlik Landholding Corporation to confirm and reserve its preferred site for the generating station project. The site proposed by the northern village of Kangiqsujuaq will not be selected by Hydro-Québec, given the technical and environmental issues involved.

On June 22, 2022, the northern village of Kangiqsujuaq confirmed and approved the project and Hydro-Québec's preferred site. A copy of resolution 2022-29 was sent to Hydro-Québec on October 6, 2022.

On October 11, 2022, the Nunaturlik Landholding Corporation confirmed the project and Hydro-Québec's preferred site. A copy of resolution 2022-49 was sent to the latter on October 20, 2022.

3.3.6 Meeting on November 9, 2022

On November 9, 2022, Hydro-Québec held a meeting in Kangiqsujuaq with representatives of the northern village and the Nunaturlik Landholding Corporation to present an update and the next steps in the project.

In the context of the COVID-19 pandemic, Hydro-Québec adjusted its consultation approach for a project carried out in another northern village. As this approach was appreciated and proved effective, Hydro-Québec decided, in conjunction with the Inuit representatives of Kangiqsujuaq, to repeat it for the project concerned by the present impact statement.

Hydro-Québec presented details of the project on local radio, accompanied by the mayor of Kangiqsujuaq, and sent community members a project summary document and a short questionnaire a few days before the meeting. As agreed with community representatives, the public information session took place over the lunch hour and lasted approximately two hours. A total of 16 telephone calls were received during this session.

Key takeaways from the information session were as follows:

- Hydro-Québec presented the project in great detail and asked community members to share their thoughts on land use in the sector of the new generating station, as well as their concerns regarding the construction and operation phases.
- The site is used for hunting and berry picking. It was pointed out, however, that there are several other locations that lend themselves to these activities, and that the site chosen for the generating station will not significantly interfere with them.

- The chosen site is advantageous, as it is a good distance from the residences, but not too far away, making it easier to get around in the event of a blizzard. In addition, it is often cleared of snow to facilitate the transport of drinking water and wastewater.
- Residents want the site to be physically fenced off to protect the public during construction.

To complement the public information session, members of the community were invited to fill out the questionnaire and email it to Hydro-Québec or drop it off at the Town Hall reception desk. English-language questionnaires were distributed to community members' post office boxes. Some paper copies were also available in Inuktitut at the Town Hall reception desk.

Community members who received the questionnaires a few days before the session were able to refer to them (site location) to take part in the radio consultation.

Following the consultation, the people responsible for the northern village were contacted several times to ask if they had received any forms from community members. Representatives of the northern village confirmed that they had not received any.

3.4 Hydro-Québec's commitments

Hydro-Québec has made a commitment to the community to:

- provide information on the progress of the project on a regular basis
- arrange in-person meetings or conference calls with community representatives

4 Project description

4.1 Analysis of options

4.1.1 Site options

4.1.1.1 Potential sites

Hydro-Québec has evaluated various potential sites for the construction of a generating station (see Appendix F). Of these, five were selected for preliminary analysis and community discussion. Hydro-Québec established a number of criteria based on its experience in the Far North.

Siting criteria

The technical siting criteria used to select potential sites are as follows:

- Favor proximity to a road that is cleared of snow at all times by the municipality to facilitate access.
- Avoid the airport area, to comply with building height limits of less than 50 m in the peripheral area around this infrastructure.
- Look for bedrock to avoid problems associated with permafrost.
- Look for an elevated space to facilitate drainage and avoid snow accumulation.
- Give preference to good exposure to prevailing winds in winter to minimize snow accumulation around the generating station.
- Look for the proximity of gravel borrow pits where possible.
- Allow sufficient space around the new generating station to serve as a buffer zone.

The environmental siting criteria are as follows:

- Avoid proximity with the built environment and aim for a distance of more than 500 m from any dwellings to limit any noise nuisance or air pollution for residents.
- Avoid residential and recreational areas.
- Allow sufficient space around the new generating station to serve as 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 away from watercourses.
- Avoid wetlands.
- Avoid habitats of special-status wildlife species.

Description of potential sites

Five sites were preselected. Two are located in the southern part of the village and on the west side of the airport, along Chemin Paurngatarvik, which leads to the water pumping station, and the third is in the southeastern part of the village and on the east side of the airport. Two others are located further south of the village, close to the road leading to the landfill. Map 4-1 shows where the sites are located, and Table 4-1 compares their characteristics.

- Site KAQ-1 is located 1.4 km south of the village, right on lthe road leading to the Kangiqsujuaq wastewater treatment pond and a landfill site. It is also close to a secondary road junction leading to the lake intake that supplies Kangiqsujuaq with drinking water.
- The KAQ-2 site is located approximately 200 m north of site KAQ-1, 900 m south of the village of Kangiqsujuaq and within the protection radius of the airport infrastructure. Its average elevation (60 m), however, is considerably lower than that of the runway (150 m). It also stands on a flat area overlooking the road by approximately 25 m, below the same large hill that borders site KAQ-1.
- Site KAQ-3 is located 1.7 km southeast of the village of Kangiqsujuaq, approximately 800 m southeast of the airport terminal and just 300 m northeast of the airstrip. However, according to preliminary analyses (Octant, 2021), it does not penetrate the approach surfaces. To link it to the existing road, an access road of approximately 150 m would have to be built, along a route optimized for the terrain and the most favorable slopes.
- Site KAQ-4 is located 3.5 km southeast of the village of Kangiqsujuaq and 1.6 km from the southeast end of the airstrip. It lies approximately 100 m southeast of the road leading to the village landfill and 1 km east of the wastewater treatment lagoon. Despite its relative remoteness from the Kangiqsujuaq airport facilities, this site is part of the runway's southeast approach corridor (as it is 1.3 km from the runway) and could pose a nuisance to the safe operation of the airport.
- Site KAQ-5 is located approximately 1 km west of site KAQ-4 and approximately 6 km southeast of the village of Kangiqsujuaq via the road running south of the airport infrastructure. It lies approximately 100 m north of the road leading to the village landfill and approximately 300 m west of a small, unnamed lake with an average diameter of 175 m.

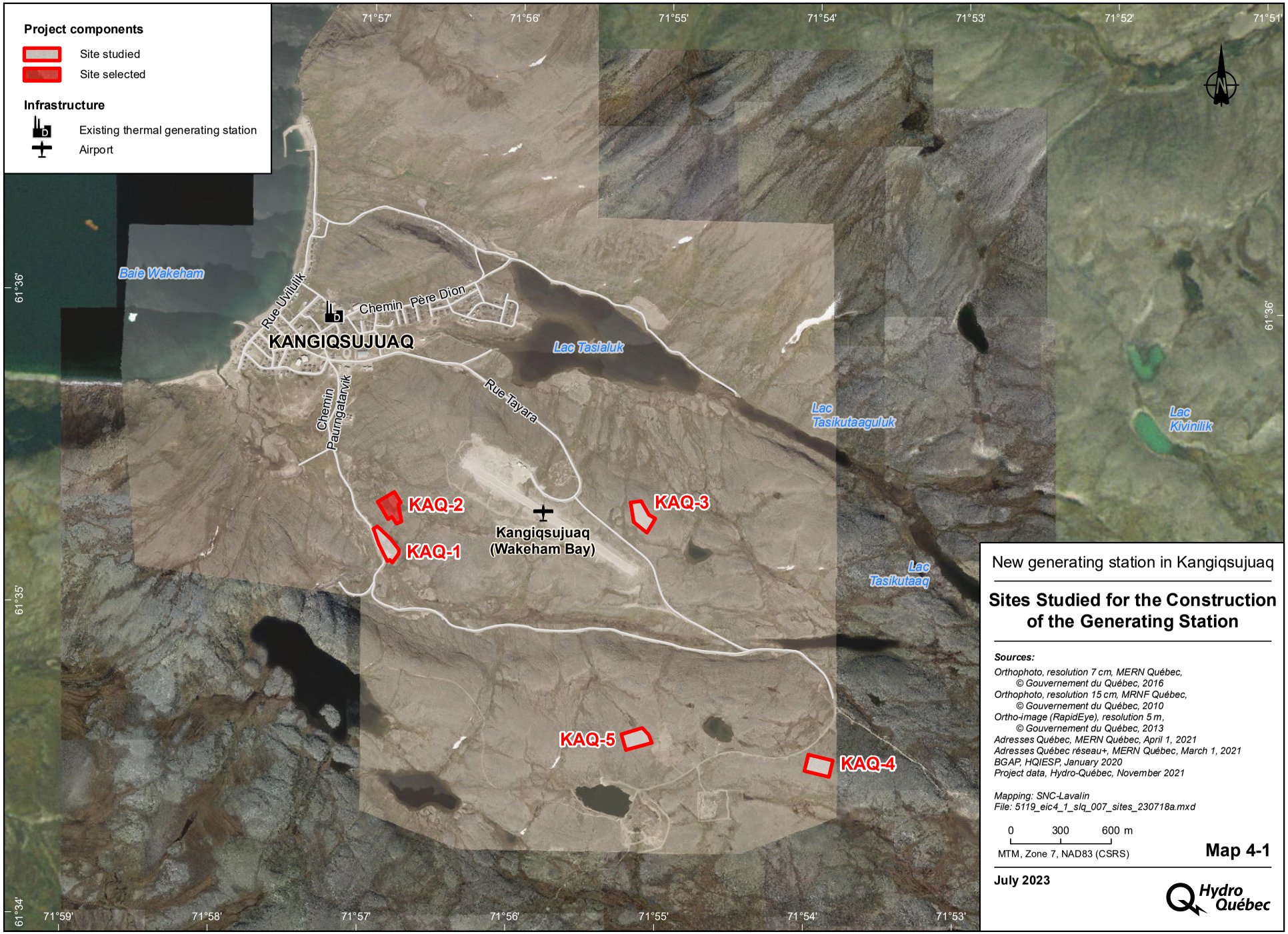
Hydro-Québec and the Kangiqsujuaq municipal council discussed potential locations in October 2021 and April 2022.

Table 4-1: Comparison of Study Sites

Advantages and drawbacks	SITE KAQ-1	SITE KAQ-2	SITE KAQ-3	SITE KAQ-4	SITE KAQ-5
Technical advantages	- The site borders a road that is passable all year round and regularly cleared of snow in winter, so there is no access road to build. - It is relatively close to the village (1.4 km). - A short power line (1.4 km) would have to be built. - The site lies within the protection radius of the airport facilities (50 m), but is at a much lower altitude than the Kangiqsujuaq airstrip (150 m). - Most of the site is underlain by good-quality foundation materials (rock outcropping or covered by a thin layer of granular material [< 2 m]).	- The site is a mere 250 m from a road that is passable all year round and regularly cleared of snow in winter. - It is relatively close to the village (1 km). - The access road to be cleared in winter is relatively short (200 m). - A short power line (1.2 km) would have to be built. - No soil compaction is anticipated as a result of permafrost thawing, due to the thinness of the loose cover (< 2 m) and its coarse texture. - The site lies within the protection radius of airport facilities (60 m), but at a much lower altitude than the Kangiqsujuaq airstrip (150 m). - The site can be expanded.	- The site has excellent foundation materials. Rock outcrops or is very close to the surface (probably < 0.5 m) throughout the site and appears to have few fractures. - Thawing permafrost would have no impact on infrastructure stability. - The topography is favorable, with relatively gentle slopes over most of the site, favoring surface water drainage. - The site is close to a road; an access ramp of around 150 m would have to be built. - A 1.7-km power line would have to be built. - An additional short stretch of road would have to be cleared of snow in winter. - The site can be expanded.	- The site has excellent foundation materials. Rock outcrops or is very close to the surface (< 0.5 m) throughout the site. - Thawing permafrost would have no impact on infrastructure stability. - The site is located alongside an existing all-weather road; a 100-m access ramp would have to be built on solid ground. - The site can be expanded.	- The site has excellent foundation materials. Rock outcrops or is very close to the surface, throughout the site. - Thawing permafrost would have no impact on infrastructure stability. - The topography is generally favorable, with a relatively flat surface and gentle slopes for efficient drainage of surface water. - The site could be extended to the north.
Technical drawbacks	- Rock could not be reached in some exploration wells (waste (refuse) on the permafrost roof at a depth of roughly 2 m). There is a slight risk that the underlying materials will be susceptible to frost, and that slight settlement will occur if the permafrost thaws. Further geotechnical investigations are recommended. - There is little potential to expand the site due to the presence of wetlands to the east and south, and moderate slopes in bedrock on its north and northeast sides.	- The site is located on a slightly NNW sloping hillside, approximately 25 m above the road. An access road approximately 250 m long would have to be built, with an average gradient of approximately 10%. - There is a small butte of rock in the northeastern portion of the site, and rock outcrops in several places around the periphery that could require blasting to varying degrees.	- The site is located on the outskirts of the airport facilities, within the approach corridors (250 m northeast of the runway) and at an elevation of 135 m, which is similar to that of the runway (14 m). This location could pose a problem for air safety (for more information, see Octant's final report). - Development of the site could require blasting to varying degrees, or the installation of relatively thick backfill composed of granular materials not susceptible to frost.	- The surface of the rock shows numerous longitudinal fractures (WNW-ESE) in the form of stair-steps, with gradients varying between 0.5 and 2 m. - Maximum gradients are 3 m in the longitudinal and transverse axes within the site. - Moderate to major earthwork would be required to develop the site (blasting or adding backfill material). - The power line linking the generating station to the existing grid would be around 5 km long. - There would be a long road to clear daily in winter. - The site is located 1.5 km from the southeast end of the runway, directly in the southeast approach corridor. In addition, its average elevation is 160 m, which is slightly higher than that of the runway (150 m). See Octant's final report (February 2022) for a detailed, up-to-date analysis.	- Moderate earthwork would be required. Blasting may be required at the east and west ends of the site. - Numerous boulders 0.5 to 1.0 m in diameter cover the rock surface in the slightly lower area in the eastern half of the site. These boulders will have to be removed before the site is developed. - A new access ramp of around 350 m would have to be built. - The power line linking the new generating station to the existing grid would be between 5.5 and 6 km long and would intersect the axis of the runway's southeast approach corridor. - There would be a long road to clear daily in winter. - No data is available concerning possible constraints on air navigation.

Table 4-1: Comparison of Study Sites (*continued*)

Advantages and drawbacks (*continued*)	**SITE KAQ-1** (*continued*)	**SITE KAQ-2** (*continued*)	**SITE KAQ-3** (*continued*)	**SITE KAQ-4** (*continued*)	**SITE KAQ-5** (*continued*)
Environmental advantages	- The site is sufficiently far from the village to limit the risk of noise pollution and atmospheric emissions. - It is already partially disturbed by human activity (stripping and aggregate stockpiling), has a herbaceous tundra vegetation cover, and presents no environmental constraints. - There are no specific community uses.	- The site is far enough from the village to limit the risk of nuisance from noise or atmospheric emissions. - No wetlands would be affected. - There are no specific community uses.	- There are no environmental constraints on the site, and the plant cover is typical of rocky tundra with lichen. There are no special-status plants, and no wetlands would be affected. - The site is located far enough away from the village to guarantee no nuisance from noise or atmospheric emissions. - There are no specific community uses.	- There are no environmental constraints. Through the rock outcrops, the site's plant cover is typical of rocky lichen tundra, with no special-status plants, and no wetlands would be affected. - The site is far enough away from the village to guarantee no nuisance from noise or atmospheric emissions. - There are no specific community uses.	- There are no environmental constraints. Through the rock outcrops, the site's plant cover is typical of rocky lichen tundra, with no special-status plants, and no wetlands would be affected. - The site is far enough away from the village to guarantee no nuisance from noise or atmospheric emissions. - There are no specific community uses.
Environmental drawbacks	- The site is partially surrounded by a small, perched wetland created by runoff from the nearby hill. The site is separated from the nearby wetland by a ridge of gelifluction, but the latter is only a short distance from the planned site of the new generating station (10 to 20 m).	- The site is around 300 m from a multiplex under construction, outside residential areas, along the road leading to the village. - The site lies on a slightly north-facing slope at an elevation higher than that of the village. The generating station would therefore be visible from the road and from the southwestern end of the village.	There are no environmental drawbacks.	There are no environmental drawbacks.	There are no environmental drawbacks.



4.1.1.2 Selected site

In April 2022, a delegation from the project team traveled to Kangiqsujuaq with an Indigenous Relations Advisor to meet with the municipal council and agree on a site for construction of the generating station. During the meeting, the municipal council voiced its concerns regarding the various locations selected. The potential site with the most technical, environmental and economic advantages is KAQ-3. However, this site was turned down by the council, as the area on the east side of the airport is reserved for residential development. The city council indicated that the area to the west of the airport, where sites KAQ-1 and KAQ-2 are located, raises no concerns and is reserved for industrial development. On the margins of this meeting, Hydro-Québec selected the KAQ-2 site, which was confirmed to the Kangiqsujuaq municipal council. The latter subsequently confirmed the choice of this location in a resolution adopted on June 22, 2022, and subsequently sent to Hydro-Québec. This site meets Hydro-Québec's technical and environmental criteria and is suitable for the development of a wind farm near the generating station. In addition, this use is in line with the council's urban development plans for the southern part of the village. Located far from the village, the selected site facilitates the mitigation of impacts on community activities.

4.1.2 Technological options

For a thermal generating station project in Nunavik, there are limited technological options. The fuel type chosen is Arctic diesel for logistical and supply reasons. The construction of a gas-fired generating station would require Hydro-Québec to take over supply and storage entirely, whereas in the village, tanks provide sufficient diesel fuel year-round.

To meet part of the building's energy demand, in addition to using solar panels installed in the front of the building, engine-heat recovery was chosen over a diesel heating system. The building will therefore not run on fossil fuels.

4.2 Project description

4.2.1 Site preparation

Location

The site of the generating station lies south of the village of Kangiqsujuaq, at the following coordinates: latitude 61,588854°, longitude -71,947260°. It is located on Category I land.

Site preparation

A platform will be built to accommodate the generating station, the switching substation, an interconnection substation for a future wind farm and various equipment, including:

- two 35,000-L fuel tanks
- a shelter for energy storage batteries
- a utility pole rack
- several 20-ft. sea containers for storage
- two hazardous material recovery (HMR) containers
- a garage adjoining the generating station for storing lineworker equipment and the SkyTrak lift truck
- fourteen 8-ft. x 10-ft. (2.4-m x 3-m) tables for storing distribution equipment

Map 4-2 shows the layout of the planned project.

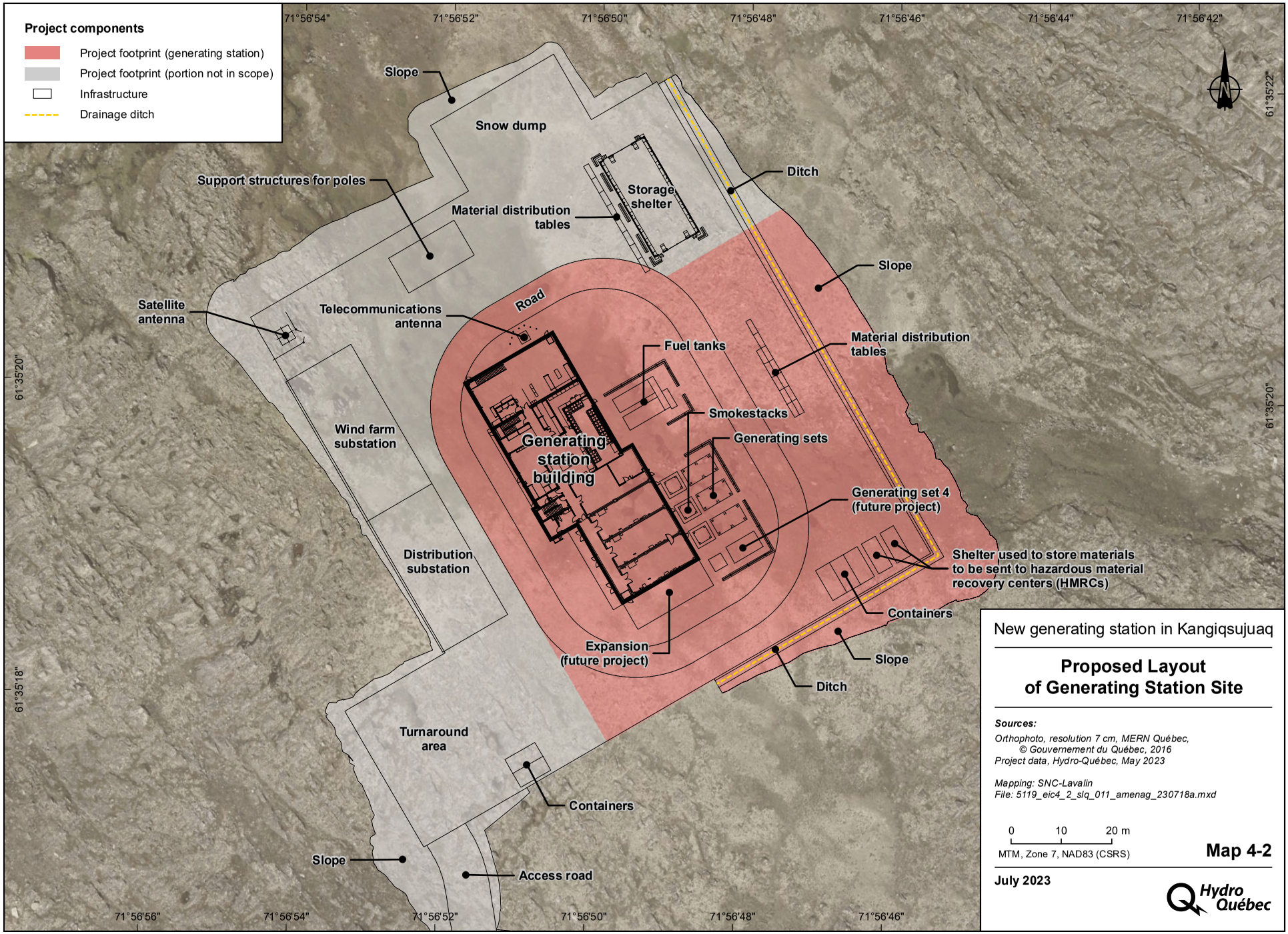
Generating station yard

On the generating station site, a yard measuring approximately 105 x 95 m, for a total surface area of approximately 10,000 m^2 (1.0 ha), will include the generating station, switching substation, and related equipment and buildings.

A fence will be erected around the perimeter of the yard, 1 m from the top of the slope. An access gate will be installed at the main entrance. At two strategic locations within the site fence, snow storage areas will be built into the slope to facilitate snow removal.

Prior to the construction of the yard, roughly 2,800 m^3 of topsoil will have to be stripped, roughly 1,200 m^3 of granular material blasted and roughly 5,140 m^3 of granular overburden material removed. This excavated material will then be reused in areas where a non-frost-susceptible backfill is unnecessary, and the entire yard platform will be completed with MG112-graded granular material (6,600 m^3) up to the level of the yard structure. The yard structure will then be completed using MG20b granular material (2,830 m^3). The average total thickness of granular materials overlying the natural soil will be approximately 1,500 mm.

On the periphery of the yard, the backfill will create an embankment with 2H:1V slopes protected by 795 m^3 of 100- and 200 mm stones on a thickness of 300 mm laid on geotextile. The granular materials will come from borrow pits near the village of Kangiqsujuaq.



Surface water drainage

Drainage of surface water from the new generating station's yard will take place from the high point, located at an approximate elevation of 62.54 m, at the southeast end of the yard and towards the northwest end of the yard, at a surface slope of 1%. The water will then flow over the natural terrain, depending on the topography. The yard slopes will be protected by riprap and geotextile membrane to prevent erosion.

To prevent water from accumulating in the vicinity of the generating station site, an open ditch with a total length of approximately 150 m is planned around the periphery of the platform, i.e., the northeast and southeast sectors. The high point of this ditch will be located at the southern corner of the yard (see Map 4-2).

Finally, a 900 mm–diameter culvert will be strategically located to allow runoff to cross the site access road and reach the receiving environment.

4.2.2 Technical specifications of the generating station

Generating station

The building will cover an area of around 1,025 m^2. The foundations of the generating station will consist of foundation walls on a strip footing. These walls will be supported by a non-frost-susceptible granular cushion resting directly on sound rock, to limit problems associated with freezing and thawing.

The building will be composed of a steel structure assembled on site. The walls will be made of steel sandwich panels, which will serve as an interior finish, vapor barrier, insulation and air barrier. The roof will be made of, among other things, a two-component, elastomeric bitumen–based waterproofing membrane with composite reinforcement that will cover the insulation. It will slope slightly towards drains or the outside of the building. The height of the smokestacks of each unit will be some 12 m from the ground floor of the generating station.

The machine hall will have three separate compartments (each of which will contain a generating set), two overhead cranes for maintenance and repairs, a corridor, a pump room and tanks. A fourth generating unit may be added by expanding the generating station as demand grows.

The first floor will contain a workshop for mechanical repairs, a storage room for hazardous materials and residual hazardous materials, various discipline-specific storage locations and a loading wharf. The second floor will house the control room, operators' offices, the building's mechanical room and the electrical distribution room.

Lastly, a 192-m^2 garage for distribution equipment storage will be built onto the far end of the generating station. The design concept will comply with applicable safety

standards. The building will be given a civil protection classification under the Québec Construction Code, with a security level of 2. Figure 4.1 gives an overview of the generating station.

Figure 4-1: Model of Planned Generating Station

Generating equipment

In the initial phase, the generating station will be equipped with three gensets recovered from the fleet of the Direction – Réseaux autonomes: one 855 kW, one 1,135 kW and one 1,168 kW, for a total installed capacity of 3.16 MW on commissioning. Each unit will be housed in a separate compartment. The engines will be refurbished at the factory and paired with new alternators. It will be possible to replace the units if it becomes necessary to increase their output, depending on needs planning. The generating station yard will also be designed to allow for the installation of a fourth unit to increase the capacity as needed.

Poured-in-place concrete

Approximately 650 m^3 of concrete prepared from locally produced aggregate is expected to be used to build the foundation walls, footings, floor slabs and pilasters built into the foundation walls, as well as the bases of the supports and tanks.

4.2.3 Technical specifications of the switching substation

The new 4.16-kV switching substation will be located on the generating station site. It will be mounted on wooden poles and will link the feeders coming from the 4.16-kV switchgear to the two overhead distribution lines. It will cover an area of around 80 m^2 (8 m x 10 m).

4.2.4 Temporary facilities and infrastructure

During the construction phase, materials for the new generating station, including major components (generating sets, control cabinets, radiators, etc.) will be shipped to the village via the commercial wharf on the north side of the village (see Map A, pocket insert), where barges will transport sea containers and packaged materials. At the landing, wheel loaders will be used to load the material into the transport vehicles. Material will be transported to the site in trailer trucks and wheel loaders, using municipal roads. A material storage area will be provided on the work site. Depending on its needs, the contractor in charge of the work shall submit to Hydro-Québec, for approval, a layout plan for its work-site facilities, storage areas and roadways.

The local supplier will supply the equipment with fuel, transported by tanker truck.

Only retention pits will be used for the storage of wastewater from construction facilities. The municipality will empty them with a vacuum truck like it does for residences.

Once the work is completed, the sites used by the contractor for construction facilities, storage areas and roadways will be restored.

4.2.5 Housing and transportation

Camps belonging to various owners already exist in the village. The contractor hired to do the work may, by agreement with the owner(s) concerned, use one or more of the existing camps to house approximately 30 workers.

4.2.6 Geotechnical surveys

From July 19 to 21, 2022, a 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. A total of 13 observation wells were drilled using a hydraulic shovel rented from the municipality of Kangiqsujuaq and operated by a local operator.

4.2.7 Work methods

The following paragraphs describe the main construction activities.

Work-site preparation

This stage includes loading equipment on the boat and setting up the contractor’s work site. Once the contents of the vessel have arrived at the construction site, the contractor will proceed with the development of the temporary site for its construction facilities (trailers, storage containers, camps if applicable, parking and storage areas, etc.).

Excavation and earthwork

Work will involve stripping the natural terrain (2,800 m^3 of topsoil, 5,140 m^3 of granular overburden and 1,200 m^3 of rock by blasting) and adding layers of granular material (around 6,600 m^3 of MG112 and 2,830 m^3 of MG20b backfill) to create the new yard platform (infrastructure, structure). This stage also includes the construction of open ditches for drainage. This work will be carried out using a variety of heavy equipment such as hydraulic shovels to excavate, dump trucks to transport granular materials, wheel loaders to load materials, in addition to tracked bulldozers and compactors to lay granular materials.

During the construction of the platform, approximately 6,340 m^3 of excavated material from the site is expected to be excavated, blasted and reused to build the foundations for the yard of the generating station and substation below infrastructure level.

Foundation work

The construction of the various foundations for the generating station, radiators and chimneys, tanks and satellite antenna will require excavation, formwork and concreting using hydraulic shovels, a telescopic forklift, a mobile concrete mixer and a compactor.

Generating station

The construction of the generating station will require the following activities: construction of the frame, building envelope and interior architectural components; installation of the building's electrical and mechanical systems; telecommunications work; and installation of the major control equipment, electrical switchgear, and interior and exterior generation equipment (generators, day and storage tanks, heaters, silencers, smokestacks, etc.).

Final earthwork and landscaping of the yard

The laying of granular material for the road surface will complete the earthwork at the generating station site. The yard layout will provide the necessary space for the storage of the operator's materials (storage platform, pole rack, sea containers, containers for storing used or new oil drums, etc.). This work will be carried out using tracked bulldozers, a compactor and a telescopic mast forklift.

Site restoration

Once construction is complete, a full site clean-up will be carried out, including the collection of all construction and other waste materials and their removal from the site. Hydro-Québec and the community of Kangiqsujuaq will reach an agreement to determine what can be sent to the Kangiqsujuaq northern landfill site (NLS) and what will be sent south. The entire site will then be dismantled.

Clause 21 of Hydro-Québec's standard environmental clauses (Direction − Environnement d'Hydro-Québec, 2023; see Appendix C) provides details of the interventions required for site restoration.

4.2.8 Labor

During the construction phase, an average of 19 workers will be required for the work. During the peak of construction, this number could rise to approximately 27, and occasionally even to 30. The workforce will come from various regions of Québec, depending on the contractor selected.

The planned construction work will take place every day for 10 hours a day. The following categories of workers are likely to be required:

- heavy equipment and hydraulic shovel operator
- truck driver
- lifting equipment operator
- carpenter-joiner
- assembler
- day laborer
- painter
- plasterer
- bricklayer
- electrician
- tinsmith
- pipefitter
- welder
- foreman
- superintendent
- project manager
- surveyor
- security guard
- housekeeper

Construction workers will need to have a competency certificate from the Commission de la construction du Québec.

4.2.9 Operation phase

Operating mode

In addition to the new generating station project, Hydro-Québec is working with its partners on a wind farm project. Kangiqsujuaq's power grid will initially be supplied entirely by the new thermal generating station, which will then gradually be operated in hybrid diesel-wind-battery mode. In diesel-only mode, a single generating set will

be sufficient to supply the system. Only during periods of high winter demand will a second generator be required. When the hybrid diesel-wind-battery mode is in operation, a single genset will be running at reduced engine speed, and may even be shut down momentarily, subject to certain technical parameters.

This modern thermal generating station will ensure the long-term reliability and efficiency of the electrical output of the Kangiqsujuaq system. Despite wind energy's variability and intermittency, the design of this new infrastructure, with its stable and reliable energy supply, will provide the grid with the management capabilities required to maintain the stability of the various power flows from a diesel-wind-battery hybrid system. Hydro-Québec plans to vary the engine speeds of the generators throughout the day and the seasons according to needs.

Equipment will be maintained according to a plan based on manufacturer recommendations and Hydro-Québec's expertise, without interrupting service to clients.

Fuel supply

Fuel is supplied and delivered to the Kangiqsujuaq facility through the Fédération des coopératives du Nouveau-Québec (FCNQ), with which Hydro-Québec has a contractual agreement. Fuel will be delivered to the new generating station by tanker truck from the Kangiqsujuaq fuel depot, located near the site. Currently, according to the planning criteria and the contractual agreement between Hydro-Québec and the FCNQ, the fuel depot must ensure a minimum autonomy of six days during periods of high energy demand. However, a 10-day supply of fuel is expected to be available at the generating station site, stored in outdoor tanks. On average, seven fuel deliveries per week are expected after commissioning, and this frequency will decrease once the wind farm is operational, despite the anticipated increase in demand. Table 4-2 shows the autonomy of fuel reserves without the wind farm's energy contribution.

Table 4-2: Autonomy Provided by Fuel Reserves Between 2026 and 2068 Without Wind Farm

Fuel autonomy of new generating station at site KAQ-2 (without wind farm)	
Year	**Autonomy (number of days)**
2028	11.9
2029	11.6
2030	11.4
2031	11.2
2032	11.0
2033	10.8
2034	10.6
2035	10.5
2036	10.3
2037	10.2
2038	10.0
2039	9.9
2040	9.8
2041	9.7
2042	9.6
2043	9.5
2044	9.3
2045	9.3
2046	9.2
2047	9.1
2048	9.0
2049	9.0
2050	8.9
2051	8.9
2052	8.8
2053	8.8
2054	8.7
2055	8.7
2056	8.6
2057	8.6

Table 4-2: Autonomy Provided by Fuel Reserves Between 2026 and 2068 Without Wind Farm (*continued*)

Fuel autonomy of new generating station at site KAQ-2 (without wind farm) [*continued*]	
Year (*continued*)	**Autonomy (number of days)** [*continued*]
2058	8.6
2059	8.5
2060	8.5
2061	8.5
2062	8.4
2063	8.4
2064	8.3
2065	8.4
2066	8.4
2067	8.3
2068	8.3

The diesel storage system at the generating station site consists primarily of a fuel depot with at least two 35,000-L storage tanks, two transfer pumps, two multi-cartridge filter units and a mass flowmeter. The tanks are of the "full containment with interstice open to atmosphere" type and comply with CAN/ULCS601-14. They can hold 110% of the nominal tank volume. The fuel depot is used to store diesel for continuous supply to the generating station engines.

A metering system (mass flowmeter) will be installed between the day fuel tank and the transfer pumps to detect leaks and monitor fuel consumption. Its function is to record the quantity (inventory) of fuel transferred from the storage tanks to the day tank. Among other things, it validates the quantities of fuel delivered against those consumed. Inventory can therefore be tracked after the fuel has been transferred to the day tank when the storage tank is refilled. Tanks will be CAN/ULCS601-14-certified (latest edition) and meet the criteria outlined in the technical specifications.

Monitoring the level of the outdoor tanks will make it possible to validate their integrity in real time. An unexplained 2% drop in level (when the automatic valve is closed) will trigger an alarm and the complete shutdown of generation at the station. In this case, the operator on site will respond quickly.

The storage tanks will be filled by tanker trucks using a filling nozzle located on top of the tanks. A proximity indicator will indicate to the shared services automaton that fueling is in progress so that it can take into account, in its inventory monitoring, a possible transfer of fuel to the day tank.

Labor

The operation phase of the generating station will not generate additional jobs. It will be operated by the employees who already operate the existing generating station and who are residents of Kangiqsujuaq. Specialized employees from outside the village will perform maintenance according to pre-established schedules or in case of outages or breakdowns.

4.3 Developments and related projects

4.3.1 Access road

An access road approximately 140 m long will connect the site of the new generating station to Chemin Paurngatarvik. It will have a rolling width of 7 m over its entire length and a maximum gradient of 6%. The total thickness of the granular structure will be 775 mm. The slopes of the road will be protected by 300 mm thick stones of between 10 and 200 mm across, laid on a geotextile membrane. For the safety of users, guardrails approximately 145 m long will be installed on the curves and alongside the access road.

Finally, a culvert will be strategically located to channel runoff from the other side of the access road to the existing receiving environment.

4.3.2 Borrow pit preparation

The opening of new borrow pits is not planned as part of the project. Instead, Hydro-Québec intends to draw supplies from borrow pits already in operation, although these have not yet been identified. The supply of granular materials will be the subject of a call for tenders, after which one or more suppliers will be selected and will be responsible for obtaining the approvals required to operate borrow pits. The location of the selected borrow pits and volumes drawn from each will therefore depend on the supply strategy retained later. The contractor selected at the end of the tendering process will therefore be responsible for researching and obtaining agreements to operate an existing borrow pit or to obtain approvals to operate a new one. The exact locations of the borrow pits selected by the contractor can be provided once the choice has been made.

4.3.3 Distribution lines

The new generating station will be connected to the distribution system by two 4-kV lines of approximately 1 km long. The two lines will be mounted on wooden poles and will follow Chemin Paurngatarvik from the station to the existing system (see Map A, pocket insert).

4.3.4 Energy storage system

An energy storage system with a capacity of around 2 MW (exact output to be confirmed) is planned. Its batteries will be installed in an unheated shelter on the generating station site and will be connected at 4.16 kV in the switchgears. The storage system will be used to store surplus energy generated by any wind turbines.

4.3.5 Dismantling of the existing generating station

The existing generating station will be dismantled and the site restored once the new station is commissioned, in 2028. However, this project has not begun, and Hydro-Québec does not know, at the time of publication of this document, what will happen to the site once the building has been dismantled. Table 4-3 shows the major decommissioning steps.

Table 4-3: Sequence of Activities for Dismantling the Existing Generating Station and Environmental Restoration of the Site

Stage	Activity	Planned date
1	Dismantle the existing generating station	2029
2	Conduct the environmental characterization of the site	2030
3	Carry out the environmental restoration of the site	2031

4.4 Residual materials and hazardous materials

4.4.1 Residual materials

During the construction phase

Based on the experience gained in the construction of the most recent generating stations of this type, it is estimated that 300 m^3 of construction waste (wood, mineral wool, drywall, metal, etc.) will be generated by the work.

As shown in Table 4-4, residual material will be made up of several types of material in varying proportions.

Table 4-4: Estimated Residual Materials Generated During the Construction Phase of the New Generating Station

Material	Estimated residual materials produced (%)
Wood	39.3
Cardboard	29.5

Table 4-4: Estimated Residual Materials Generated During the Construction Phase of the New Generating Station (*continued*)

Material (*continued*)	**Estimated residual materials produced (%)** [*continued*]
Masonry	14.8
Gypsum	10.0
Plastic	4.9
Steel, aluminum	1.2
Copper	0.3
Total	**100.0**

Hydro-Québec has already held discussions with the municipality of Kangiqsujuaq regarding the use of northern landfill sites (NLSs) during the construction phase. A follow-up with the municipality is also planned before the project begins. Should the site not have sufficient capacity to handle the waste generated by the construction of the new generating station, some or all of the waste can be shipped south for disposal at an authorized site.

On the site, materials are divided into three categories: residual hazardous materials (RHMs), residual materials that can be reused by the community (e.g., building materials in good condition), and, lastly, residual materials for disposal.

During the operation phase

In the operation phase, residual materials (mainly domestic waste) will be managed in the same way that it is at the existing generating station, that is, the municipality will manage it, as is the case for the other buildings in the village and will send the materials to the northern landfill. Although there is no recyclable waste collection in Kangiqsujuaq, Hydro-Québec recycles plastic bottles, printing paper and ink cartridges at its work sites.

4.4.2 Residual hazardous materials

During the construction phase

It is estimated that the construction of the thermal generating station will generate approximately 18 m^3 of residual hazardous materials (RHMs). They will be collected and stored in appropriate containers, then transported twice a year to MELCCFP-authorized treatment facilities in southern Québec. RHMs are stored in accordance with SEQ requirements (Section 16.2 of Appendix C), in particular in hermetically sealed containers.

During the operation phase

In the operation phase, the RHMs generated will mainly come from the operation and maintenance of the generating station's equipment, particularly used oil, porous solids (rags and filters), petroleum products, antifreeze, aerosols (degreasing, painting, cleaning, lubrication and insecticide products), empty containers (epoxy, coating, paint, thinner), fluorescent lights, batteries and distillates (Varsol). They will be sorted and stored on the generating station site according to their format, in containers that comply with the depending on the properties of the materials (e.g., drums and buckets).

RHMs stored in drums (e.g., oil drums) will be placed in double-bottom containers for a maximum of 24 months. If storage is to extend beyond 24 months, approval from MELCCFP will be sought for temporary outdoor storage of solid RHMs. Containers of RHMs will be shipped to hazardous material recovery centers in the southern part of the province (city of Québec) for storage until they are picked up by the companies responsible for processing them. It is estimated that the amount of RHMs generated by the new operating facility will be the same as that of the existing generating station. Table 4-5 presents the types and quantities of RHMs generated during the operation phase.

Table 4-5: Types and Quantities of RHMs Generated During Operation Phase

RHM type	Quantity generated per year
A01 Used oil	1,600 to 2,500 L [a]
A03 Waste oil (oily water)	464 to 2,320 L [a]
D01 Antifreeze	208 to 4,100 L [a]
E16 Dry cells	1 to 3 buckets [b]
L02 Empty aerosols	208 to 416 L [a]
E12 Oil filters	208 to 416 L [a]
L03 Solids containing unspecified flammable liquid (porous materials and filters)	416 to 832 L [a]
L02 Empty, uncleaned packaging waste	416 to 832 L [a]
E16 Nickel-cadmium batteries	208 to 416 L [a]
E15 Lead-acid batteries	416 to 832 L [a]
E23 Fluorescent tubes [c]	20 to 40 L [a]
N10 Petroleum distillates or products	208 to 416 L [a]
M07 Empty gas cylinder	100 to 200 kg

a. The estimated volume of a drum is 208 L (based on data collected for the existing generating station).

b. The volume of a bucket is 20 L.

c. Fluorescent tubes will be gradually replaced with LED fluorescent tubes. This RHM will therefore be less common.

Appendix E presents the method of disposal of RHMs likely to be generated during the construction or operation phases of the new Kangiqsujuaq thermal generating station.

During the shutdown phase of the thermal generating station, all the materials previously listed for the construction and operation phases will also be generated; in addition, the following items will be dismantled:

- generating sets
- tanks

4.5 Completion schedule

For each phase of the new thermal generating station project in Kangiqsujuaq, government approvals, detailed engineering, procurement, construction and commissioning have been planned (see Table 4-6).

Table 4-6: Project Timeline

Activity	Phase
Detailed engineering	From fall 2022 to fall 2024
Government approvals	From summer 2023 to spring 2025
Major material procurement	From spring 2023 to winter 2025–2026
Production, piling of granular material, earthwork and construction of the foundations for the generating station	From summer 2025 to fall 2025
Construction of the generating station	From spring 2026 to fall 2027
Commissioning of the generating station	February 2028

Construction will take two and a half years, and the generating station is expected to be commissioned in February 2028 after a startup period of a few months. The generating station is expected to have a 50-year service life.

4.6 Project costs and local and regional economic spinoffs

The cost of the project has been roughly estimated at $104 million. It will generate local economic spinoffs only during the construction phase. During the operation phase, the economic spinoffs will be the same as those currently generated. Hydro-Québec plans to include incentives for hiring local Inuit workers and subcontractors based in Kangiqsujuaq. In addition to these incentives, the local spinoffs will include air transportation for personnel, housing, food purchases from village businesses, fuel purchases for equipment and local machinery rentals.

5 Description of the environment

5.1 Study areas

5.1.1 Extended study area

The extended study area for the new thermal generating station project covers an area of 2,292.3 ha (see Map 5-1). It lies in the Nord-du-Québec administrative region, more precisely in the territory of Nunavik (north of the 55th parallel), and includes the northern village of Kangiqsujuaq, located on the coast of Baie Wakeham. It was selected to encompass the future generating station, the inhabited part of the village and the main existing infrastructure systems, and to exclude the marine area, since no impact is anticipated there.

This area makes it possible to identify the various components of the environment potentially affected by the project in a more regional context. It is used for the general description of the components of the human and biophysical environments.

5.1.2 Limited study area

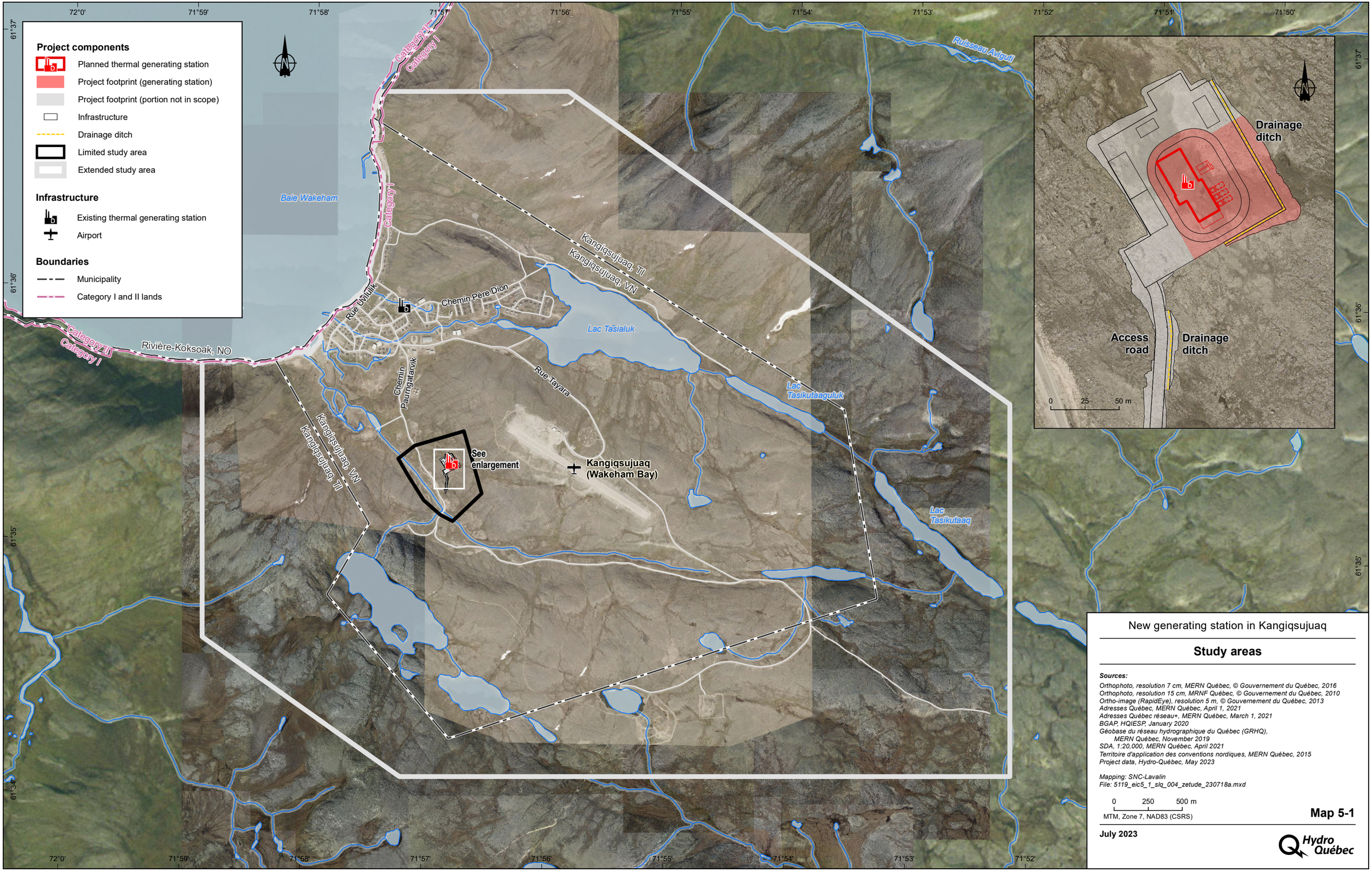
Covering an area of 24.4 ha, the limited study area is located south of the village of Kangiqsujuaq and west of the airport and overlaps the access road leading to two mining sites located south of the limited study area (see Map 5-1). It is used to describe the components of the physical and biological environment that are more directly affected by the project. Where necessary, the existing conditions of the components affected by the project are described in greater detail in Chapter 6, which deals with the impact analysis.

5.2 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
- Ministère de la Culture et des Communications (MCC)
- Ministère des Ressources naturelles et des Forêts (MRNF)
- Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs (MELCCFP)
- 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 environment components focused on the extended study area. The specific methodologies and protocols used for these surveys and for collecting data from the Inuit community, are discussed in their respective sections.



New generating station in Kangiqsujuaq

Study areas

Sources:

Orthophoto, resolution 7 cm, MERN Québec, © Gouvernement du Québec, 2016
Orthophoto, resolution 15 cm, MRNF Québec, © Gouvernement du Québec, 2010
Ortho-image (RapidEye), resolution 5 m, © Gouvernement du Québec, 2013
Adresses Québec, MERN Québec, April 1, 2021
Adresses Québec réseau+, MERN Québec, March 1, 2021
BGAP, HQIESP, January 2020
Géobase du réseau hydrographique du Québec (GRHQ), MERN Québec, November 2019
SDA, 1:20,000, MERN Québec, April 2021
Territoire d'application des conventions nordiques, MERN Québec, 2015
Project data, Hydro-Québec, May 2023

Mapping: SNC-Lavalin
File: 5119_eic5_1_slq_004_zetude_230718a.mxd

0 250 500 m
MTM, Zone 7, NAD83 (CSRS)

Map 5-1

July 2023

Hydro Québec

5.3 Physical environment

5.3.1 Climate

The Kangiqsujuaq area is characterized by a subarctic climate, with a long, very cold period, a short, cool summer and little precipitation, except in summer. This is well represented by climate data from the Kangiqsujuaq airport (YKG) and Kuujjuaq Airport (YVP) stations, both managed by Environment and Climate Change Canada (ECCC) (see Table 5-1). The first station is at an altitude of 140 m, which is much higher than that of the village, 16 m above sea level. The other station is located 435 km south of Kangiqsujuaq, at an altitude of around 35 m.

Given the lack of climate history data at the Kangiqsujuaq airport station, the Kuujjuaq airport station was used to establish climate normals for 1971–2000 and 1981–2010 (see Table 5-1). This is the closest station to the site, with data on the region's climate normals. The CMIP5 column in this table shows data from the Kangiqsujuaq airport station, which is closest to the site.

The average annual temperature for the period 1991–2020 was −6.9°C, while the average minimum temperature in winter was −20.8°C and the average maximum temperature in summer was 6.9°C. Average annual precipitation for the period 1991–2020 was 377.6 mm.

Table 5-1: Climate Normals Recorded at YVP and YKG Stations

Parameter	Time of yr [a]	1971–2000		1981–2010		1991–2020	
		Hist. [b]	CMIP5 [d]	Hist. [b]	CMIP5 [d]	Hist. [c]	CMIP5 [d]
Average daily temp.: (°C)	Annual	−5.7	−7.8	−5.4	−7.3	−6.9	−6.9
	Winter	−22.4	−22.5	−22.4	−21.8	−20.8	−20.8
	Spring	−9.0	−11.9	−8.6	−11.6	−11.1	−11.1
	Summer	9.8	6.2	10.1	6.5	6.9	6.9
	Fall	−1.2	−3.0	−0.6	−2.6	−2.1	−2.1
Total annual precipitation (mm)	Annual	526.8	367.03	541.6	373.1	377.6	377.6
	Winter	97.6	67.1	96.8	69.4	71.6	71.6
	Spring	87.6	62.5	88.1	65.6	66.8	66.8
	Summer	181.1	119.9	180.6	118.6	119.4	119.4
	Fall	160.6	114.5	176.2	116.8	117.1	117.1

Table 5-1: Climate Normals Recorded at YVP and YKG Stations *(continued)*

Parameter *(continued)*	**Time of yr** [a] *(continued)*	**1971–2000** *(continued)*		**1981–2010** *(continued)*		**1991–2020** *(continued)*	
		Hist. [b] *(cont'd)*	**CMIP5** [d] *(cont'd)*	**Hist.** [b] *(cont'd)*	**CMIP5** [d] *(cont'd)*	**Hist.** [c] *(cont'd)*	**CMIP5** [d] *(cont'd)*
Average wind speed (km/h)	Annual	15.1	N/A	14.4	N/A	N/A	N/A
	Winter	15.5	N/A	14.5	N/A	N/A	N/A
	Spring	15.7	N/A	15.2	N/A	N/A	N/A
	Summer	14.0	N/A	13.2	N/A	N/A	N/A
	Fall	15.3	N/A	14.8	N/A	N/A	N/A

General note: N.A. (not available)

a. Winter: December to February; Spring: March to May; Summer: June to August; and Fall: September to November. This definition of times of the year applies to the entire report.

b. Data measured at YVP station (ECCC, 2021a), Canadian climate normals for the periods 1971–2020 and 1981–2010.

c. Data measured and calculated on the basis of raw historical data extracted from the ECCC site (2021b) for the Kangiqsujuaq station.

d. Represents the median of all the CMIP5 climate model simulations for the RCP4.5 emission scenario scaled according to the BCCAQv2 method (ECCC, 2021c) for the area where the YKG station (Kangiqsujuaq airport) is located.

5.3.2 Climate change

This section is a summary of a report produced as part of this project, analyzing the climate change resilience of the existing and planned Kangiqsujuaq thermal generating stations. All relevant references can also be found in this report.

Extreme climatic conditions are at the heart of adaptation to climate change, as they can lead to dangerous situations for the population, the environment or the durability of built components. It is therefore important to collate all available information on past extreme weather conditions to establish a starting point for future events.

Climate projections

The future climate at the selected generating station site is established using data available on the ClimateData.ca portal for a multitude of climate variables and indicators presented on an annual and seasonal scale, as appropriate. These data are derived from projections obtained by all CMIP5 global climate models, which have been downscaled and bias-corrected using the BCCAQv2 method[1].

Table 5-2 shows the historical (2015), short- and medium-term (2040) and long-term (2060; corresponding to the end-of-life of the generating station) projected values for the main climate variables calculated for the moderate (RCP4.5, known as stabilization) and pessimistic (RCP8.5, high and continuous emissions) greenhouse gas (GHG) emission scenarios.

[1] https://climatedata.ca/download/

General temperature increase

Nord-du-Québec is one of the regions of the world most affected by temperature increases because of its high latitude, which leads to a strong influence of polar amplification. With regard to temperatures, the following findings can be extracted from Table 5-2 below:

- Average annual temperature will rise by 1.3°C in 2040 compared with 2015, and by 1.0°C in 2060 compared with 2040, according to the RCP4.5 scenario. The rise will be greater in winter, when an increase of 0.5°C to 4°C could be observed.
- An increase in extreme maximum summer temperatures is expected in 2040 and 2060 compared with 2015 (from +0.7°C to +1.2°C for the RCP4.5 scenario, and from +1.1°C to +2.6°C for the RCP8.5 scenario). The warmest temperature could therefore reach 10.2°C to 16.6°C in 2060, depending on projections. A similar observation can be made for the extreme minimum temperature in winter, with a greater temperature variation (from +2.5°C to +8.0°C) for all scenarios combined (RCP4.5 and RCP8.5).
- The number of hot days (over 30°C) is projected to remain at 0 in 2040 and 2060.

Extreme precipitation

The overall increase in average precipitation is already accompanied by an increase in the intensity and frequency of extreme precipitation events, which will continue to increase (see Table 5-2). Climate projections of intensity-duration-frequency (IDF) curves should still be used with caution, due to the large uncertainties inherent in the statistical methods used, and the lack of good historical data in northern regions (Simonovic et al., 2016).

- Total annual precipitation is expected to increase by 7–8% by 2040 compared to 2015 (+28 to +35 mm) and by 11–17% by 2060 compared to 2015 (+40 to +70 mm). This increase is seen in all seasons, but particularly in fall and winter (+8 to +11 mm by 2040 compared with 2015).
- In parallel with the rise in total precipitation, models predict an increase in maximum daily precipitation, particularly in summer (around 17 mm/d in 2040 and 18 mm/d in 2060, compared with 15.5 mm/d in 2015).
- The frequency of heavy precipitation events (> 20 mm/d) is very low (0 to 1 day per year for horizons 2040 and 2060). Moderate daily precipitation (> 10 mm/d) occurs more frequently. However, climate models suggest an increase in the frequency of these events of the order of 0 to 2 days between the historical horizon of 2015 and the projected horizons of 2040 and 2060.
- With the slight increase in precipitation comes a slight reduction in the maximum duration of consecutive precipitation-free periods, from an average of 25 days in 2015, to 23 days in 2040, and 22 days in 2060.

Table 5-2: Climate Projections for the Generating Station Project Area

Parameter	Time of year	2015 Horizon [a]			2040 Horizon [a]			2060 Horizon [a]		
		RCP4.5 [b]	RCP8.5 [b]	Range [c]	RCP4.5 [b]	RCP8.5 [b]	Range [c]	RCP4.5 [b]	RCP8.5 [b]	Range [c]
Average daily temperature (°C)	Annual	−6.1	−5.9	−7.3 to −4.5	−4.8	−4.0	−5.7 to −0.9	−3.8	−1.9	−3.3 to −5.08
	Winter	−19.7	−19.1	−22.4 to−15.9	−16.9	−15.4	−20.2 to −11.9	−15.1	−11.8	−8.1 to −18.6
	Spring	−10.6	−10.4	−12.4 to−8.30	−9.4	−8.8	−6.2 to −11.4	−8.8	−7.3	−10.8 to −3.4
	Summer	6.7	6.7	5.3 to 7.9	7.5	7.5	6.2 to 9.1	8.1	8.6	6.3 to 10.8
	Fall	−1.4	−2.3	−2.8 to 0.05	−0.5	0.2	−2.0 to 1.7	0.6	3.1	−1.2 to −5.35
Highest temperature (°C)	Summer	10.9	11.1	9.3 to 12.9	11.6	12.2	10.0 to 14.7	12.1	13.7	10.2 to 16.6
Lowest temperature (°C)	Winter	−23.2	−22.7	−25.9 to −19.4	−20.3	−18.7	−23.7 to – 15.1	−18.5	−14.8	−22.1 to −10.9
Number of days with a maximum temperature above 30°C	Annual	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0 to 0.02
Total precipitation (mm)	Annual	392.4	397.0	342.0 to 456.0	421.8	430.7	363.2 to 500.3	434.8	464.9	372.3 to 545
	Winter	75.9	78.9	55.6 to 104.8	84.8	89.9	60.2 to 117.0	90.9	104.0	64.2 to 136.1
	Spring	69.1	67.3	47.2 to 91.5	71.1	73.2%	51.1 to 96.9	73.5	79.5	52.0 to 107.1
	Summer	121.3	125.2	89.6 to 161.9	132.2	131.9	94.5 to 173.5	131.9	125.9	92.9 to 178.7
	Fall	122.3	124.4	153.9 to 96.2	131.7	135.0	101.1 to 166.7	135.5	145.4	105.2 to 179.1

a. Values represent an average (or maximum or minimum, as appropriate) of 29-year climate projections, where 2015 Horizon (historical) = 2006 to 2035; 2040 Horizon = 2031 to 2060; and 2060 Horizon = 2051 to 2080.

b. Represents the median value (P50) of climate projections from all CMIP5 models that have been corrected according to project area for moderate- (RCP4.5) and high- (RCP8.5) emission scenarios.

c. Range where the minimum value is chosen between the 10th percentile (P10) of the CMIP5 climate projections based on the RCP4.5 emissions scenario and the 10th percentile (P10) of the CMIP5 climate projections based on the RCP8.5 emissions scenario, and where the maximum value is the maximum of the 90th percentiles (P90).

Table 5-2: Climate Projections for the Generating Station Project Area (*continued)*

Parameter *(continued)*		**Period of the year** *(continued)*	**2015 Horizon** [a] *(continued)*			**2040 Horizon** [a] *(continued)*			**2060 Horizon** [a] *(continued)*		
			RCP4.5 [b] *(continued)*	**RCP8.5** [b] *(continued)*	**Range** [c] *(continued)*	**RCP4.5** [b] *(continued)*	**RCP8.5** [b] *(continued)*	**Range** [c] *(continued)*	**RCP4.5** [b] *(continued)*	**RCP8.5** [b] *(continued)*	**Range** [c] *(continued)*
Maximum daily precipitation (mm/d)		Winter	7.9	8.8	5.4 to 14.4	8.4	9.4	5.5 to 17.1	8.7	9.6	6.7 to 21.3
		Summer	15.7	15.5	10.1 to 27.1	17.2	16.5	11.2 to 27.1	17.2	17.9	11.5 to 27.3
Number of days with precipitation over:	**20 mm**	0.0	0.0	0.0 to 0.7	0.0	0.0	0.0 to 0.9	0.02	0.0	0.0 to 1.05	0.0 to 1.5
	10 mm	2.3	2.4	0.7 to 4.6	2.9	3.1	1.1 to 5.6	3.1	3.6	1.3 to 6.4	2.2 to 8.9
Maximum number of consecutive dry days		Annual	23.5	26.5	18.3 to 44.1	23.0	23.0	16.0 to 39.5	23.0	21.5	15.0 to 39.5

a. Values represent an average (or maximum or minimum, as appropriate) of 29-year climate projections, where 2015 Horizon (historical) = 2006 to 2035; 2040 Horizon = 2031 to 2060; and 2060 Horizon = 2051 to 2080.

b. Represents the median value (P50) of climate projections from all CMIP5 models that have been corrected according to project area for moderate- (RCP4.5) and high- (RCP8.5) emission scenarios.

c. Range where the minimum value is chosen between the 10th percentile (P10) of the CMIP5 climate projections based on the RCP4.5 emissions scenario and the 10th percentile (P10) of the CMIP5 climate projections based on the RCP8.5 emissions scenario, and where the maximum value is the maximum of the 90th percentiles (P90).

5.3.3 Geology, geomorphology and surface deposits

The extended study area is part of the Péninsule d'Ungava 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). In the extended study area, elevations generally range from 0 to 170 m. However, the elevation of Colline Qarqaaluk varies between 230 and 330 m. More locally, the elevation of the site chosen for the generating station is around 60 m.

The extended study area is located in two geological provinces: the Superior Province (southeast of the area), which occupies the central part of the Canadian Shield, and the Churchill Province (northwest of the area). 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. The Churchill Province surrounds the craton of the Superior Province. It is formed by a series of cratonic blocks of Archean to Paleoproterozoic age, which are bordered by Paleoproterozoic orogens (MERN, 2020).

Kangiqsujuaq is located on the shore of Baie Wakeham, a fjord connected to the Détroit d'Hudson (Hudson Strait). The village is surrounded by high rock faces and was built on two types of terrain: rock for its northern half and coastal sand and gravel for its southern half. The airport sits atop a rocky hill overlooking the valley. The sandy plain to the south of the village, with its ice wedges, seasonal frost blisters, wet depressions and the possible presence of sensitive deep marine clay, suggests that it cannot be safely occupied (Allard et al., 2007). Due to anticipated climate change in Nunavik, thawing permafrost could affect the environment and infrastructure. In the Kangiqsujuaq area, however, the level of susceptibility to ground subsidence associated with permafrost thaw is considered to be low according to the MFFP (2019).

In October 2021, Poly-Géo Inc. carried out a technical and environmental assessment of the five potential generating station sites. The chosen site is located on a flat area approximately 25 m above the road. Seven exploration shafts were excavated by power shovel on the surface of the site. The bedrock was reached in almost all the shafts, at depths of between 1.2 and 1.8 m. All the material excavated in the shafts is non-frost susceptible and coarse-textured. No settlement resulting from thawing permafrost is therefore anticipated. The site's slightly north-sloping surface seems to favor relatively efficient site drainage. It will nevertheless be necessary to build a ditch (partially in bedrock) on its northeast side to collect runoff from the hill to the east.

During a geotechnical study on the site of the planned generating station, 13 exploratory wells were drilled, confirming the presence of bedrock at depths ranging from 0.60 to 2.40 m, as a result of waste (refuse) on the rock. Below the organic soil layer on the surface, the thickness of the deposits varies between 0.45 and 1.75 m. The deposit is mostly composed of sand, gravel and silt in varying proportions (Englobe, 2022a).

5.3.4 Soil

In the Phase I study of the site (Englobe, 2022a; see Appendix F), the federal contaminated sites inventory (Treasury Board of Canada Secretariat website) and the MELCCFP contaminated land inventory were consulted. No sites are listed for the extended study area. According to the analysis of aerial photos consulted and the interpretation of available information, a parcel of land has been used for temporary sand storage, in the southern portion of the study site.

An environmental soil characterization (Englobe, 2022b; see Appendix F) was carried out at the project site. All the samples selected and submitted for chemical analysis showed concentrations for all parameters below criterion "A" of the MELCCFP's Guide d'intervention [response manual]. The parcel of land used for sand storage (to the south) shows no traces of contamination, as do the other soils tested at the project site.

5.3.5 Hydrography, hydrology and drainage

The village of Kangiqsujuaq is located on the shores of Baie Wakeham, which is connected to the Détroit d'Hudson. Several bodies of water lie within the extended study area, including Tasialuk and Tasikutaaguluk lakes. Their effluent flows through the village of Kangiqsujuaq into Baie Wakeham. The other bodies of water are smaller. The only other significant water body, to the southwest of the extended study area, is the village drinking water intake (see Map A, pocket insert). In the limited study area, drainage occurs mainly to the north, toward Baie Wakeham.

5.4 Biological environment

5.4.1 Vegetation

5.4.1.1 Biophysical environment

The extended study area covers a total area of 2,292.3 ha and is located in the prostrate shrub tundra bioclimatic domain (MFFP, 2021a). Vegetation is predominantly shrubs, grasses, mosses and lichens. No tree-like species are present, and shrubs are primarily prostrate species.

The biophysical environment accounts for over 94% of the area here, or 2,156.8 ha (see Table 5-3 and Map A, pocket insert). It is primarily shrub tundra, at 1,820.2 ha representing over 79% of the area, and wetlands, at 159.4 ha (7.0%). The water system is also significant, covering 120.0 ha or 5.2% of the area. It consists of rivers and lakes. The barren surfaces cover an area of 57.3 ha (2.5%) and are represented mainly by rock outcrops. The remainder corresponds to the anthropogenic mixed-use environments (urban environment, infrastructure, and mining site), which represents 135.5 ha, or 5.9% of the extended study area.

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

Type of environment	Surface area (ha)	Proportion (%)
Land	***1,877.5***	***81.9***
Shrub tundra	1,820.2	79.4
Dry barrens	57.3	2.5
Wetlands and aquatic environments	***279.2***	***12.2***
Shrub swamp	99.0	4.3
Undefined swamp	55.2	2.4
Marsh	0.4	< 0.1
Body of water	120.0	5.2
Open bog	0.5	< 0.1
Open fen	4.1	0.2
Human	***135.5***	***5.9***
Varied anthropogenic	135.5	5.9
Total	**2,292.2**	**100.0**

In July 2022, a site visit was conducted to characterize the 24.4-ha limited study area. Table 5-4 shows the primary terrestrial plant species observed in the limited study area. These are mainly shrub species (willow, glandular birch, four-angled mountain heather, blueberry and black crowberry) and herbaceous species (Lapland reedgrass, sedge, fireweed, lapland diapensia).

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

Latin name	English name
Arctostaphylos uva-ursi	Common bearberry
Armeria maritima ssp. sibirica	Siberian sea thrift
Arnica angustifolia	Narrow-leaved arnica
Astragalus alpinus var. alpinus	Alpine milkvetch
Betula glandulosa	Glandular birch
Calamagrostis lapponica	Lapland reedgrass
Campanula rotundifolia	Bluebell of Scotland
Carex norvegica	Norway sedge
Cassiope tetragona	Four-angled mountain heather
Cerastium alpinum	Alpine chickweed
Chamaenerion latifolium	River beauty
Chrysanthemun arcticum ssp. polare	Polar daisy
Diapensia lapponica	Lapland diappensia
Dryas integrifolia ssp. integrifolia	Entire-leaved mountain avens
Elymus trachycaulus ssp. trachycaulus	Slender wildrye
Empetrum nigrum ssp. hermaphroditum	Black crowberry
Equisetum arvense	Field horsetail
Erigeron humilis	Low fleabane
Luzula confusa	Northern wood rush
Melanocalyx uniflora	Arctic bellflower
Micranthes foliolosa	Leafy-stemmed saxifrage
Papaver labradoricum	Labrador poppy

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

Latin name *(continued)*	**English name** *(continued)*
Pedicularis flammea	Red-tipped lousewort
Pedicularis labradorica	Labrador lousewort
Pedicularis lanata	Woolly lousewort
Pedicularis lapponica	Lapland lousewort
Pinguicula villosa	Hairy butterwort
Poa alpina ssp. alpina	Alpine bluegrass
Poa arctica	Arctic bluegrass
Pyrola grandiflora	Arctic pyrola
Rhododendron lapponicum	Lapland rosebay
Rhododendron tomentosum	Northern Labrador tea
Salix herbacea	Snowbed willow
Salix reticulata	Net-leaved willow
Salix uva-ursi	Bearberry willow
Saxifraga cernua	Nodding saxifrage
Saxifraga cespitosa	Tufted saxifrage
Saxifraga hirculus	Yellow marsh saxifrage
Silene acaulis	Moss campion
Silene involucrata	Arctic campion
Stellaria crassifolia	Fleshy starwort
Tofieldia pusilla	Small tofieldia
Vaccinium uliginosum	Bog bilberry
Vaccinium vitis-idaea	Mountain cranberry

Section 5.4.1.3 provides a more specific overview of the at-risk plant species that may be present in the extended and limited study areas.

5.4.1.2 Wetlands and aquatic environments

Wetlands

Wetlands in the extended study area were identified using MELCC maps of potential wetlands in Québec (2019), MFFP maps of northern Québec vegetation (2013) and the MRN database of northern Indigenous villages (2013). A photointerpretation, using 2016 orthophotographs with a resolution of 7 cm, was also carried out in the limited study area prior to the site visit.

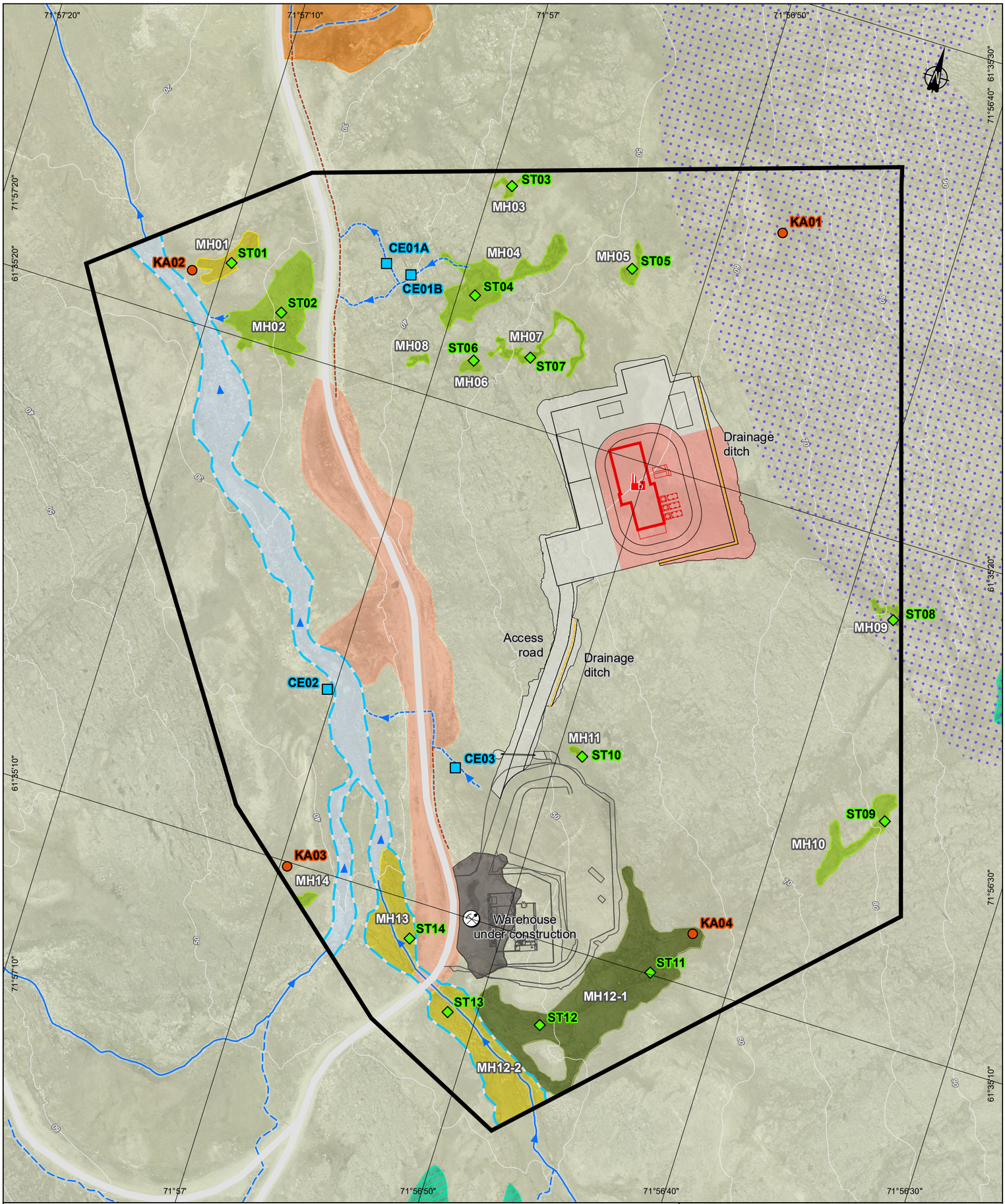
Wetlands cover 159.2 ha (7.0%) of the extended study area. Of this area, 55.2 ha are undefined swamp wetlands (see Table 5-5). Few marshes or bogs are present (< 0.2%).

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

Type of wetland	Surface area (ha)	Proportion of the extended study area (%)
Shrub swamp	99.0	4.3
Undefined swamp	55.2	2.4
Marsh	0.4	< 0.1
Open bog	0.5	< 0.1
Open fen	4.1	0.2
Total	**159.2**	**7.1**

Source: MELCC (2019), MFFP (2013) and MRN (2013).

A visit to the limited study area was conducted in July 2022. During this visit, photointerpretation of the area was validated and corrected as needed and the wetlands in the area were characterized. Within the limited study area, a total area of 1.6 ha of wetlands was mapped and characterized. This represents 6.4% of this area (see Table 5-6). The remainder of the limited study area is covered by aquatic environments (streams), shrub tundra and environments disturbed by human activity. Three types of wetlands covering an area of the same order of magnitude were identified: open fen (0.6 ha), open bog (0.5 ha) and marsh (0.4 ha). Map 5-2 shows the distribution of wetlands in the limited study area.



Hydrography

- Perennial stream
- Intermittent stream
- Stream with indeterminate flow
- Stream and shoreline
- Direction of flow
- Ditch

Wetlands

Potential wetlands

- Undefined swamp (Base de données des villages autochtones [BDVA], 1:2,000, MRN Québec, April 2013)

Characterized wetlands (2022)

- Open bog
- Open fen
- Marsh

Terrestrial environment

- Shrub tundra

Biological surveys (2022)

- CE01 Watercourse characterization station
- ST01 Wetland characterization station
- KA01 Bird point-count location

Human environment

- Institutional and commercial sector
- Abandoned mining site
- Other disturbed environment

Traditional activity

- Berry picking area

Project components

- Planned generating station
- Project footprint (generating station)
- Project footprint (portion not in scope)
- Infrastructure
- Drainage ditch
- Limited study area

New generating station in Kangiqsujuaq

Biophysical and Human Environment Limited Study Area

Sources:

Orthophoto, resolution 7 cm, MERN Québec, © Gouvernement du Québec, 2016
BDVA, 1:2,000, MRN Québec, April 2013
Adresses Québec, MERN Québec, April 1, 2021
Kangiqsujuaq Master Plan 2016-2036, Kativik Regional Government, 2016
Végétation du Nord québécois, MFFP Québec, 2013
Project data, Hydro-Québec, May 2023

Inventory: SNC-Lavalin
Mapping: SNC-Lavalin
File: 5119_elc5_2_slq_005_mnh_zrestreinte_230725a.mxd

0 25 50 m
MTM, Zone 7, NAD83 (CSRS)
Countour interval: 10 m

Map 5-2

July 2023

Hydro Québec

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

Type of environment	Surface area (ha)	Proportion of the limited study area (%)
Wetland	**1.5**	**6.4**
Marsh	0.4	1.8
Open fen	0.6	2.4
Open bog	0.5	2.2
Aquatic environment	**0.9**	**3.5**
Stream (shoreline)	0.9	3.5
Other	**22.0**	**90.1**
Anthropogenic	1.5	6.1
Shrub tundra	20.5	84.0
Total	**24.4**	**100.0**

A total of 14 wetlands are present. They were characterized using 14 stations: 11 in peatlands and 3 in marshes. A complex consisting of an open fen and a marsh has also been characterized and constitutes wetland MH12 (MH12-1 and MH12-2). Table 5-7 shows the surface area of these wetlands within the limited study area, as well as the associated characterization station numbers.

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

Wetland No.	Type	Surface area (m^2)	Characterization station No.
MH01	Marsh	480	ST01
MH02	Open bog	1,970	ST02
MH03	Open bog	100	ST03
MH04	Open bog	1,430	ST04
MH05	Open bog	180	ST05
MH06	Open bog	110	ST06
MH07	Open bog	390	ST07
MH08	Open bog	60	- Conditions similar to those at ST03, ST05, ST06 and ST07
MH09	Open bog	140	ST08
MH10	Open bog	690	ST09

Table 5-7: Surface Area by Wetland Type Characterized in the Limited Study Area *(continued)*

Wetland No. *(continued)*		**Type** *(continued)*	**Surface area (m²)** *(continued)*	**Characterization station No.** *(continued)*
MH11		Open bog	50	ST10
Complex	MH12-1	Open fen	5,880	ST11 and ST12
	MH12-2	Marsh	2,390	ST13
MH13		Marsh	1,620	ST14
MH14		Open bog	80	- Conditions similar to those at ST03, ST05, ST06 and ST07
Total		**-**	**15,570**	**-**

The vast majority of the wetland area is peat bog (1.1 ha). Eleven small open bogs and a single large open fen were characterized. However, the total surface area for each type of environment is similar at 0.5 ha and 0.6 ha, respectively. The three marshes cover a surface area of 0.4 ha.

The main shrub species observed in the bogs and fens that were characterized tend to be recurrent and of limited variability. These include four-angled mountain heather, northern Labrador tea and northern willow (*Salix arctophila*), the latter being the only shrubby species recorded in fen MH12-1. The herbaceous species of open bogs are more diverse; the dominant species are an amalgam of sedges *(Carex saxatilis, C. membranacea, C. lachenalii*), leafy-stemmed saxifrage *(Micranthes foliolosa*), chestnut rush *(Juncus castaneus* ssp. *castaneus, J. pelocarpus*) and red-tipped lousewort *(Pedicularis flammea*). The open bogs observed are generally characterized by large overgrowths of while tufted clubrush (*Trichophorum cespitosum*), while cottongrass *(E. angustifolium* ssp. *angustifolium, E. scheuchzeri*) is found to a lesser extent. The opposite is true of the large fen (MH12-1) adjacent to the riparian marsh (MH12-2). The latter is heavily covered with cottongrass and loose-flowered alpine sedge (*Carex rariflora*), accompanied by fragile and military sedges. The soil of these peatlands is generally saturated with water (The water table is high, ranging from the surface to 40 cm below the surface.) The topography is rugged, with numerous rock outcrops. Bedrock was reached between 5 cm and 40 cm below the surface in all the characterized peatlands. All soil is organic, mainly humic. No mineral horizon was observed before reaching bedrock. Drainage varies from poor to very poor. The peatlands also have shallow pools with varying degrees of dryness, which is characteristic of northern peatlands. Hummocks colonized by terrestrial species with no affinity for wetlands (non-indicative, NI) also dot these habitats.

Two of the three marshes, MH12-2 and MH13, border the CE02 river, while the third lies to the east of the road (MH01). They are mainly made up of herbaceous species that vary according to the environment. Wetland MH01 is largely dominated by tufted

bullrush, wetland MH13, by loose-flowered alpine sedge and military sedge, and wetland MH12-2, which is a continuation of the open fen MH12-1, is dominated by cottongrass and loose-flowered alpine sedge. Northern willow, four-angled mountain heather and bog bilberry (*Vaccinium uliginosum*) are just some of the prostrate shrubs found along the marsh edges. The soil consists of fine sand that is more or less saturated with water. A thin layer of organic matter, varying from 8 to 10 cm thick, was observed in each environment. Drainage varies from imperfect to very poor.

It should be noted that most species observed in the tundra domain do not have wetland water status (obligatory, facultative or non-indicative), as defined in the guide entitled *Identification et délimitation des milieux humides du Québec méridional* (Lachance et al., 2021). Consequently, as agreed upon by MELCCFP and Hydro-Québec under a previous project, the northern species status list currently being developed by the ministry was used. To compensate for the lack of species on the list, we also consulted the status of the Alaskan species presented in Lichvar et al. (2016) and updated in 2020 (U.S. Army Corps of Engineers, 2020). Detailed characterization sheets are provided in Appendix H.

Aquatic environments

The aquatic environments of the extended study area were identified using data from the MRN topographic maps of northern Indigenous villages (2013) and an analysis of LIDAR topographic data. A total area of 120.0 ha (5.2%) is made up of aquatic environments, i.e., watercourses and lakes.

Three watercourses have been identified and characterized in the limited study area: CE01 (sections A and B), CE02 and CE03 (see Map 5-2). CE01 and CE03 are intermittent streams, while CE02 is a perennial river. CE01 originates in wetland MH04 and flows between rocky crevices, over a bed of pebbles and herbaceous vegetation along two channels (A and B), sometimes steeply sloping, before joining the road ditch below. CE03 is a predominantly stony bed fed by underground runoff from the shrub tundra. The runoff joins the roadside ditch before flowing into river CE02 (perennial). CE01 and CE02 offer no habitat for fish, due to steep slopes preventing upwelling, the virtual absence of shelter (very little shelter in the case of CE01A), the absence of a spawning ground and, in the case of CE01B, the absence of a defined bed upstream.

River CE02 crosses the limited study area in a generally north-to-south direction. It features a coarse substrate dominated by boulders, pebbles and cobbles. The river flowed through several channels during the site visit, but the location of the littoral limit (LL) shows that the river must have a larger flow in the same bed during flood periods. Shelters are not very diversified, but they are present (blocks) in large quantities. Being directly connected to Baie Wakeham downstream, the river provides fish habitat that can be used primarily for rearing and feeding. Arctic char *(Salvelinus alpinus*) have also been observed in the bay. Detailed characterization sheets are provided in Appendix H.

Ecological functions of wetlands and aquatic environments

Wetlands and aquatic environments provide many ecological services due to their different functions throughout the ecosystem. These functions, presented below, come from the *Act to affirm the collective nature of water resources and to promote better governance of water and associated environments* (C-6.2, s. 13.1):

> *"(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 ecological function of the wetlands and aquatic environments identified in the extended study area is biodiversity conservation. The northern tundra is not very productive in terms of vegetation. Open bogs and fens with pools, shrub swamps and marshes, as well as watercourses and bodies of water, provide important feeding and shelter areas for northern wildlife. Although the process of organic matter decomposition is reduced at these latitudes (due to climate, reduced growing season, etc.), Arctic fens also play a vital 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.

5.4.1.3 At-risk plant species

A request was submitted to the Centre de données sur le patrimoine naturel du Québec (CDPNQ) to verify the presence of any plant species that are threatened, vulnerable or likely to be so designated (PSTVL) in the extended study area. An analysis of habitat potential for PSTVL was also conducted using the guide *Les plantes vasculaires en situation précaire au Québec* (Tardif et al., 2016), volumes 1, 2 and 3 of *Flore nordique*

du Québec et du Labrador (Payette et al., 2013, 2015 and 2018) and *Atlas des plantes des villages du Nunavik* (Blondeau, 2004). Surveys (in the form of active research) were also conducted in July 2022 to verify the presence of at-risk plant species in the limited study area.

According to data from the CDPNQ, there are no known occurrences of PSTVL in the limited study area. However, two occurrences of herbaceous species likely to be designated as threatened or vulnerable and one occurrence of a non-vascular species (moss; see Table 5-8) have been identified in the village of Kangiqsujuaq. The analysis of the habitat potential for vascular species also showed that the area may have habitat potential for eight other at-risk plant species.

However, no at-risk species were observed in the limited study area during the surveys.

Table 5-8: At-Risk Plant Species Potentially Present in the Extended Study Area

Common name	Latin name	Status in Québec	Habitat [a]	Best observation period	Presence in limited study area	Probability of presence of habitat in limited study area [c]	Presence in extended study area (CDPNQ)
Vascular species							
Regel's chickweed	*Cerastium regelii*	SLDTV [b]	Occurring in palustrine (rocky/gravelly shores) and terrestrial (Arctic tundra) environments, in sunny locations only, on mesic substrates, as well as on river alluvium, solifluous soils and moss carpets.	Summer	Not observed	Moderate	Yes
Cayouette's draba	*Draba cayouettei*	SLDTV	Occurring in palustrine (rocky/gravelly shores) and terrestrial (Arctic tundra) environments, 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	Not observed	Moderate	-
Flat top draba	*Draba corymbosa*	SLDTV	Occurring in saltwater estuarine (rocky/gravelly shores) and terrestrial (exposed rock outcrops/scarp, scree slopes/boulder/gravel fields, fine bare deposits [clay, silt]) environments, in sunny locations only, on dry, basic substrate. Xerophilous, calcicole species well adapted to rocky and stony, exposed summits with little snow cover.	Summer	Not observed	Low	-

Table 5-8: At-Risk Plant Species Potentially Present in the Extended Study Area (*continued*)

Common name (*continued*)	**Latin name** (*continued*)	**Status in Québec** (*continued*)	**Habitat** [a] (*continued*)	**Best observation period** (*continued*)	**Presence in limited study area** (*continued*)	**Probability of presence of habitat in limited study area** [c] (*continued*)	**Presence in extended study area (CDPNQ)** [*continued*]
Vascular species							
Ellesme Island draba	*Draba subcapitata*	SLDTV	Herbaceous perennial present in terrestrial (Arctic tundra, exposed scree slopes/boulder fields/gravels) environments, occurring in sunny places only, on mesic and basic substrate.	Summer	Not observed	Moderate	-
Chamisso's cinquefoil	*Potentilla arenosa ssp. chamissonis*	SLDTV	Occurring in palustrine (rocky/gravelly shores) and terrestrial (exposed scree slopes/boulder fields/gravels) environments, 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 reported in snow patches.	Summer	Not observed	High (along the shores of the river)	Yes
Narrow alkaligrass	*Puccinellia angustata*	SLDTV	Occurring in palustrine (bare muddy shores) and terrestrial (exposed scree slopes/boulder fields/gravels) environments, in sunny places only, on mesic, basic or ultrabasic substrate.	Late summer	Not observed	Moderate	–

Table 5-8: At-Risk Plant Species Potentially Present in the Extended Study Area (*continued*)

Common name (*continued*)	**Latin name** (*continued*)	**Status in Québec** (*continued*)	**Habitat** [a] (continued)	**Best observation period** (*continued*)	**Presence in limited study area** (*continued*)	**Probability of presence of habitat in limited study area** [c] (*continued*)	**Presence in extended study area (CDPNQ)** [*continued*]
Vascular species (continued)							
Sulphur buttercup	*Ranunculus sulphureus*	SLDTV	Occurring in palustrine (rocky/gravelly shores, wet meadows) and terrestrial (Arctic tundra) environments, 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 flooding.	Summer	Not observed	Low	–
Ross' stitchwort	*Sabulina rossii*	SLDTV	Occurring in terrestrial (Arctic tundra, exposed scree slopes/boulder fields/gravels) environments, in sunny places only, on mesic and basic substrate. Two known occurrences, in fens, in snow patches or along rivers.	Summer	Not observed	Low	–
Northern tofieldia	*Tofieldia coccinea*	SLDTV	Occurring in terrestrial (rock outcrops/escarpments) environments, in sunny places only, on mesic and basic substrate. The plant is generally found on dry and mesic grounds, of stony nature, and on rock outcrops. Calcicole species.	Summer	Not observed	Moderate	–

Table 5-8: At-Risk Plant Species Potentially Present in the Extended Study Area (*continued*)

Common name (*continued*)	**Latin name** (*continued*)	**Status in Québec** (*continued*)	**Habitat** [a] (continued)	**Best observation period** (*continued*)	**Presence in limited study area** (*continued*)	**Probability of presence of habitat in limited study area** [c] (*continued*)	**Presence in extended study area (CDPNQ)** [*continued*]
Vascular species (continued)							
Cut-leaved fleabane daisy	*Erigeron compositus*	Vulnerable	Occurring in terrestrial (rock outcrops/escarpments, exposed scree slopes, exposed boulder/gravel fields) environments, in sunny places only, on dry and basic substrate. Bank of sand, gravel, pebbles and boulders.	Summer	Not observed	Low	–
Non-vascular species							
Arctic rock moss	Racomitrium panschii	Vulnerable	Gravelly or rocky sites, exposed and acidic, dry or wet, along watercourses, on rocky slopes in tundra, in scree and in areas of surface runoff in snow patches.	Summer	Not observed	Moderate	Yes

a. According to Tardif et al. (2016), Payette et al. (2013, 2015 and 2018), Tardif et al. (2019) and Blondeau (2004)

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

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

High probability: high presence of potential habitat components (substrate type, vegetation, water conditions, etc.) required for species establishment, and known occurrence in the extended study area.
Moderate probability: high to medium presence of potential habitat components (substrate type, vegetation, water conditions, etc.) required for the species to become established, with or without known occurrence in the extended study area.
Low probability: low presence of potential habitat components (substrate type, vegetation, water conditions, etc.) required for the species to become established, and no known occurrences in the extended study area.
Zero probability: absence of potential habitat components (substrate type, vegetation, water conditions, etc.) required for the species to become established, and no known occurrences in the extended study area.

5.4.2 Wildlife

Wildlife is described in the following sections according to the major vertebrate groups (mammals, reptiles and amphibians, and birds). Each section presents, among other things, the species of precarious status potentially present in the extended study area, while Section 5.4.2.4 provides a summary of these species, as well as an assessment of their probability of occurrence in the limited study area.

5.4.2.1 Mammals

A total of 15 species of terrestrial mammals potentially frequent the extended study area (see Table 5-9). 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, 2022). Caribou are also a species of interest due to their importance to the Inuit and the decline of migratory caribou populations in the Nord-du-Québec region. 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 published in Jutras et al. (2012).

Table 5-9: List of Land Mammal Species Likely to Frequent the Extended Study Area [a]

English name	Latin name	Status in Québec	Status in Canada
Least weasel	*Mustela nivalis*	SLDTV [b]	–
Muskox	*Ovibos moschatus*	–	–
Meadow vole	*Microtus pennsylvanicus*	–	–
Northern bog lemming	*Synaptomys borealis*	–	–
Wolverine	*Gulo gulo*	Threatened	At risk
Woodland caribou	*Rangifer tarandus caribou*	–	–
Ermine	*Mustela erminea*	–	–
Ungava collared lemming	*Dicrostonyx hudsonius*	–	–
Arctic hare	*Lepus arcticus*	–	–
Gray wolf	*Canis lupus*	–	–
North American River otter	*Lontra canadensis*	–	–
Polar bear	*Ursus maritimus*	Vulnerable	At risk
Black bear	*Ursus americanus*	–	–

Table 5-9: List of Land Mammal Species Likely to Frequent the Extended Study Area [a] (*continued*)

English name (*continued*)	**Latin name** (*continued*)	**Status in Québec** (*continued*)	**Status in Canada** (*continued*)
Arctic fox	*Vulpes lagopus*	–	–
Red fox [c]	*Vulpes vulpes*	–	–

a. According to Desrosiers et al. (2002), Feldhamer et al. (2003), Jutras et al. (2012), Naughton (2012), and Fortin and Caron (2015).

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

c. Species observed in the extended study area during wetland, water and bird surveys carried out as part of the present project.

Woodland 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).

The extended study area is located at the same latitudes, but slightly further east, as the calving grounds of the Rivière aux Feuilles Herd (mid-May to late June) presented in Taillon et al. (2016). According to the same source, the Kangiqsujuaq area overlaps with the herd's summer range (from early July to early September). A group of four caribou was observed in the extended study area, but outside the limited study area, during the wetland, water and bird surveys carried out as part of this project (see Map A, pocket insert).

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 to be 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 respective preferred habitats. The presence of this species is still possible in the extended study area and limited study area, based on micromammal-friendly habitats, but should be considered to be undetermined due to the lack of data on its regional distribution.

Wolverines and polar bears

The wolverine would be very rare or extinct in Québec (COSEWIC, 2014a). 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. Considering the scope of their home ranges and movements, as well as their presumed low numbers, the presence of wolverines and polar bears in the extended and limited study areas would be infrequent and of very short duration, if any.

5.4.2.2 Birds

The Kangiqsujuaq area is included in a 10-km by 10-km plot (19CJ43) of the Québec Breeding Bird Atlas. Consultation of these data reveals that the sampling effort (1.8 hours) in this plot was insufficient to provide a complete picture of the local bird population. The minimum time required to study a single plot is 20 hours (AONQ, 2022). The list of possible, probable or confirmed breeding species based on this source is presented in Table 5-10; it contains 19 species (QBBA, 2022). Data from ÉPOQ-eBird (eBird, 2022) were also extracted for this portrait. By combining the various databases available, we were able to identify 24 bird species around the village of Kangiqsujuaq. However, the inventory effort has remained fairly limited over the years, so that new bird species are likely to be added to this list. However, no new species were observed during the field study conducted in 2022.

Table 5-10: Breeding Bird Species and Their Current Status in the Extended Study Area

Species		Status in Québec (ATVS) [a]	Status in Canada (SARA) [b]	Breeding status	Source
Common name	Latin name			Parcel 19CJ43	
Horned lark	*Eremophila alpestris*	–	–	Possible [c]	ÉPOQ-eBird
Canada goose	*Branta canadensis*	–	–	Possible	ÉPOQ-eBird
White-crowned sparrow	*Zonotrichia leucophrys*	–	–	Confirmed	Second Québec Breeding Bird Atlas [d]
Rough-legged hawk	*Buteo lagopus*	–	–	Probable	Second Québec Breeding Bird Atlas
Tundra swan	*Cygnus columbianus*	–	–	Possible	ÉPOQ-eBird

Table 5-10: Breeding Bird Species and Their Current Status in the Extended Study Area (*continued*)

Species (*continued*)		**Status in Québec (ATVS)** [a] (*continued*)	**Status in Canada (SARA)** [b] (*continued*)	**Breeding status** (*continued*)	**Source** (*continued*)
Common name (*continued*)	**Latin name** (*continued*)			**Parcel 19CJ43** (*continued*)	
Common eider	Somateria mollissima	–	–	Confirmed	Second Québec Breeding Bird Atlas
Gyrfalcon	Falco rusticolus	–	–	Possible	Second Québec Breeding Bird Atlas
Peregrine falcon	**Falco peregrinus**	**Vulnerable**	**At risk**	**Probable**	Second Québec Breeding Bird Atlas
Iceland gull	Larus glaucoides	–	–	Possible	Second Québec Breeding Bird Atlas
Glaucous gull	Larus hyperboreus	–	–	Possible	ÉPOQ-eBird
Herring gull	Larus argentatus	–	–	Possible	Second Québec Breeding Bird Atlas
Common raven	Corvus corax	–	–	Probable	Second Québec Breeding Bird Atlas
Black guillemot	Cepphus grylle	–	–	Possible	ÉPOQ-eBird
Snowy owl	Bubo scandiacus	–	–	Possible	ÉPOQ-eBird
Rock ptarmigan	Lagopus muta	–	–	Possible	ÉPOQ-eBird
American robin	Turdus migratorius	–	–	Confirmed	Second Québec Breeding Bird Atlas
American pipit	Anthus rubescens	–	–	Confirmed	Second Québec Breeding Bird Atlas
Red-throated loon	Gavia stellata	–	–	Possible	Second Québec Breeding Bird Atlas
Northern wheatear	Oenanthe oenanthe	–	–	Probable	Second Québec Breeding Bird Atlas

a. *Act respecting threatened or vulnerable species*

b. *Species at Risk Act*

c. Species whose only records come from ÉPOQ-ebird are given minimum breeding status (possible), since they are species observed in their habitat during the breeding period.

d. Second Québec Breeding Bird Atlas (https://www.atlas-oiseaux.qc.ca/index_en.jsp)

At-risk species potentially present in the extended study area

Golden eagle

Known golden eagle nests in Québec are found 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 (Ungava Bay) and in the Côte-Nord region (EROP, 2005). Nests are generally located on a cliff or escarpment and more rarely in a tree, although this species hunts in open areas.

The species has never been reported in Kangiqsujuaq itself, but there are recent records from within 50 km of the village (eBird, 2022). The presence of suitable breeding cliffs in the Kangiqsujuaq area remains to be determined. Although this species was not observed during the 2022 field study, nor historically, its habitat potential remains present for the extended study area, notably due to numerous escarpments suitable for breeding and large bare surfaces for hunting. No potential breeding habitat is present in the limited study area.

Harlequin duck

The harlequin duck has never been observed within the limits of the village of Kangiqsujuaq. However, there are a few records of this species during the breeding period on the eastern side of the Péninsule d'Ungava, including a recent record in July 2017 of a female less than 50 km northwest of the village (eBird, 2022). According to available information, most harlequin ducks breeding in Québec nest along rivers in the Baie d'Hudson and Baie d'Ungava watersheds (Robert et al., 2001). This duck nests on the banks of whitewater rivers, where they feed (Robert, 2019). We can immediately rule out the presence of this waterfowl species in the limited study area, since the streams observed, as well as the river that borders the study area to the west, do not have a high flow rate and are smaller in size. The potential presence of harlequin ducks in the extended study area is therefore considered to be very low, due to the absence of a fast-flowing river in the extended study area.

Peregrine falcon

The peregrine falcon is considered to be a probable breeding bird in the Atlas parcel that includes the village of Kangiqsujuaq. The presence of a couple in the village is also recorded (in 2018), according to the SOS-POP database. Peregrine falcons usually nest on cliffs or escarpments. They do not build nests, but rather settle directly on natural ledges in shallow depressions (Bird et al., 1995; ECCC, 2017; EROP, 2018). The cliffs chosen vary in height from a few metres to several hundred metres. Open spaces close to the breeding site are common, as peregrine falcons can effectively hunt their prey, usually birds captured in flight (Bird et al, 1995).

The presence of the peregrine falcon in the extended study area therefore seems likely, at the very least as a hunting ground. However, breeding potential is dependent on the presence of cliffs, which seem to be absent, in principle, in the limited study area.

Short-eared owl

In Québec, the short-eared owl has a vast range extending from the extreme south of the province to the northern tip of the Péninsule d'Ungava (Ungava Peninsula) (EROP, 2021). However, knowledge of the species' distribution in the Far North of Québec is sparse. The observed warming of the Arctic could, however, enable it to continue its expansion towards northern Canada (Therrien, 2010; Smith et al., 2013; ECCC, 2018). The recent presence of a territorial pair of short-eared owls on the Terre de Baffin (Baffin Island) (Therrien, 2010) prompts us to include this species among the possible special-status species in the extended study area, despite the absence of known records in the project area. Its preferred breeding habitats are open areas such as prairies, Arctic tundra, taiga, bogs, coastal wetlands, coastal heaths, natural prairies dominated by sand sage (*Artemisia sp*), estuaries and marshes (ECCC, 2018).

Although there are no records of short-eared owls in the Kangiqsujuaq area, the species' northern limit in Québec is poorly known due to the limited inventory effort in the Péninsule d'Ungava. The probability of finding this species in the limited and extended study areas is considered to be low, according to current knowledge. During the field study, particular attention was paid to open tundra environments, especially signs of lemming activity, which was scarce. No observations of this species were made during the 2022 field study.

Red-necked phalarope

The red-necked phalarope 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, 2014b). The phalarope's preferred aquatic plants include arctophiles (an aquatic herb whose only species in Canada is pendant grass [*Acrtophila fulva*]) and water sedges (*Carex aquatilis*) (ECCC, 2022a).

The red-necked phalarope is not mentioned directly in the Kangiqsujuaq area. However, the species is reported to nest to the north, west and south of the village, with the nearest records around 100 km away. The small tundra ponds in the extended study area could provide potential habitat for this shorebird. Nevertheless, after the field visit carried out in July 2022, the potential for this species appears very limited in the extended study area, notably due to the absence of productive tundra ponds capable of supporting shorebirds. Therefore, the potential for its presence in the limited study area is non-existent.

Bird surveys

Bird surveys were carried out on July 20, 21 and 22, 2022 in the restricted and extended study areas. The listening stations were all set up on July 21, while the characterization of birds in the extended study area was carried out on all three days.

Methodology

Due to the small surface area of the limited study area, breeding songbirds were counted using four point-count stations, spaced at least 250 m apart. The habitat for each count station was briefly described, all of which were located in a rock-dominated tundra plateau habitat. Listening station locations are shown on Map 5-2.

Point counts were conducted using the fixed-radius point count (FRPC) method (Bibby et al., 1992) and the unlimited-distance point count (UDPC) method (Blondel et al., 1981). The FRPC method consists in counting all birds seen or heard within an imaginary 50-metre radius circle every 5 minutes over a 10-minute period. The UDPC 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 helps to establish a more comprehensive species list. The FRPC method began after a quiet period of approximately five minutes to allow the birds to recover from the disturbance caused by the observers' movements. This survey was conducted during the breeding period, taking into account the northern latitude. To determine the level of certainty of species breeding, breeding evidence from the Québec Breeding Bird Atlas (QBBA, 2022) was used.

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

Results

The various surveys carried out in the restricted and extended study areas identified 17 bird species, including 8 confirmed breeding species and 8 possible breeding species (see Table 5-11). The surveys also revealed the presence of 3 new species: Savannah sparrow, red-breasted merganser and hoary redpoll. The total number of species is therefore 27, including the documentation review and inventories.

Table 5-11: Bird Species Observed in Kangiqsujuaq and Their Breeding Status in the Limited and Extended Study Areas, in 2022

Species	Field observations – July 2022	
	Breeding code [b]	Breeding status in the extended study area
Horned lark – *Eremophila alpestris*	JE	Confirmed
Savannah sparrow – *Passerculus sandwichensis*	AT	Confirmed
White-crowned sparrow – *Zonotrichia leucophrys*	AT	Confirmed
Peregrine falcon – *Falco peregrinus* [a]	H	Possible
Herring gull – *Larus argentatus*	H	Possible
Glaucous gull – *Larus hyperboreus*	H	Possible
Common raven – *Corvus corax*	H	Possible
Black guillemot – *Cepphus grylle*	H	Possible
Red-breasted merganser – *Mergus serrator*	H	Possible
Rock ptarmigan – *Lagopus muta*	JE	Confirmed
American robin – *Turdus migratorius*	H	Possible
American pipit – *Anthus rubescens*	JE	Confirmed
Red-throated loon – *Gavia stellata*	H	Possible
Common loon – *Gavia immer*	JE	Confirmed
Hoary redpoll – *Acanthis hornemanni*	JE	Confirmed
Common redpoll – *Acanthis flammea*	S	Possible
Northern wheatear – *Oenanthe oenanthe*	NJ	Confirmed

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

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

Species observed

Possible breeding
H: Species observed during its suitable breeding period; **S**: Singing male observed in its habitat during the breeding period; **JE**: Recently fledged (nidicolous species) or downy (nidifugous species) young incapable of sustained flight; **AT**: Adult carrying food for young; **NJ**: Nest with one or more young (seen or heard).

At the listening stations, species richness was evaluated at five species (white-crowned sparrow, Savannah sparrow, glaucous gull, common raven, American pipit) according to the data collected, regardless of distance (IPA). Only one breeding pair (see Table 5-12) was recorded at any of the four listening points, which represents exceptionally poor diversity. Listening station locations are shown on Map 5-2.

Table 5-12: Maximum Number of Breeding Pairs of Landbirds at Three Listening Stations in the Limited Study Area

Species	KA01	KA02	KA03	KA04
American pipit	0	0	1	0

The site of the planned generating station is located on a rock-dominated tundra plateau with prostrate shrubs. The Kangiqsujuaq area is steep and, in 2022, only one waterfowl species was recorded, but no shorebird species. On July 20, the presence of a peregrine falcon (in flight), one at-risk species was noted in the extended study area (see Map A, pocket insert). This species breeds on cliffs or in quarries, which are absent from the limited study area, but abundant in the extended study area. Former rough-legged hawk and raven nests have been noted on several escarpments, and these are frequently reused by peregrine falcons (and potentially also by gyrfalcons). Birds of prey reproduction on the Péninsule d'Ungava appears to have been particularly poor in 2022 (Maude Fortier-Boisclair, MFFP, pers. comm.), notably due to a cycle dip in small mammal populations. It was therefore not an ideal year to determine their breeding status in the extended study area, but it seems highly likely that rough-legged hawks, peregrine falcons and gyrfalcons are regular breeders here.

5.4.2.3 Reptiles and amphibians

A search of the Atlas of Amphibians and Reptiles of Québec (AARQ) database through the Saint-Lawrence Valley Natural History Society did not return any records of amphibians or reptiles in the study areas (AARQ, 2022). Temperature is the most significant limiting factor for amphibians and reptiles in northern latitudes (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, 2022). 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 are all from the vicinity of Kuujjuaq, a community formerly known as Fort Chimo (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 for the limited study area, where marshes, peatlands and streams are potential breeding habitats for these species.

The extended study area is also well beyond the range of salamanders, snakes and turtles. Mentions of Québec's most northerly salamanders and reptiles (garter snake) are located 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.

Observations during the biophysical environment surveys

No amphibians were observed during the survey of birds, wetlands and aquatic environments. These results, combined with current knowledge of the area's reptiles and amphibians, strongly suggest the absence of amphibians in the extended study area and the surrounding area. No reptiles were observed, confirming our suspicions.

5.4.2.4 At-risk wildlife species

The CDPNQ did not identify any occurrences of wildlife species that are threatened, vulnerable or likely to be so designated in Québec within the extended study area (MFFP, 2022). Based on known distribution ranges (Desrosiers et al., 2002; Felhamer et al., 2003; Jutras et al., 2012; Naughton, 2012; AARQ, 2022; QBBA, 2022), habitats considered to be suitable for species and habitat availability, eight at-risk wildlife species are likely to frequent habitats located in the extended study area (see Table 5-13). This table also presents the probability of occurrence for each species in the limited study area. The details for each species are presented in sections 5.4.2.1 and 5.4.2.2.

The list of special-status bird species potentially present in the study area was determined using data from the Québec Breeding Bird Atlas (QBBA, 2022) and ÉPOQ-eBird (2022). Although the CDPNQ (2022) does not include any mentions in the extended study area, the Direction régionale du Nord-du-Québec specifies that four special-status bird species are likely to be present (golden eagle, harlequin duck, peregrine falcon and short-eared owl). According to these various sources, four bird species have special status and have previously been in the extended study area (see Table 5-13). During the 2022 surveys, no at-risk species were observed in the limited study area, and only the peregrine falcon was noted in the extended study area.

Table 5-13: Summary of At-Risk Wildlife Species Likely to Be Present 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		Probability of occurrence in the limited study area [c]	Confirmed presence in extended study area
		SARA [b]	COSEWIC		
Mammals					
Least weasel	Species likely to be designated threatened or vulnerable	–	–	Undetermined [d]	No
Wolverine	Threatened	Of special concern	Of special concern	Low	No
Polar bear	Vulnerable	Of special concern	Of special concern	Low	No
Birds					
Golden eagle	Vulnerable	–	–	Low	No
Harlequin duck	Vulnerable	–	–	None	No
Peregrine falcon	Vulnerable	Of special concern	Not at risk	Low	Yes
Short-eared owl	Species likely to be designated threatened or vulnerable	Of special concern	Threatened	Low	No
Red-necked phalarope	–	Of special concern	Of special concern	Low	No

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, mentions recorded 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 appears 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 area.
Zero probability: No potential habitat is present in the limited study area.

d. The situation and ecology of this species in Québec are too little known for a reasonable judgment.

5.4.2.5 Habitats and wildlife sites of interest or regulated

No mapped wildlife habitat, within the meaning of the *Regulation respecting wildlife* (C-61.1, r.18), overlaps the extended study area (MFFP, 2021b).

The MFFP (2022) has not reported any wildlife sites of interest.

5.5 Human environment

5.5.1 Administrative framework and land tenure

5.5.1.1 Land organization

The extended study area is located in the Nord-du-Québec administrative region (10) and is part of Nunavik, which covers the territory north of the 55th parallel (with the exception of Whapmagoostui Cree lands). Nunavik is composed of 14 northern villages, some Inuit owned lands, one Naskapi village and two unorganized territories with no inhabitants. The extended study area is entirely within the boundaries of the northern village of Kangiqsujuaq (see Map 2-1). Note that there is no road 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 state that the Inuit have exclusive rights to the harvesting of certain aquatic species and fur-bearing animals (Gouvernement du Québec, 1998)

The Kangiqsujuaq sector is made up of Category I and III lands. The shoreline along the bay is also designated as Category II land. The extended study area overlaps mainly with Category I lands and intersects only a small portion of Category II lands at the northern end (see Map 2-1).

5.5.1.2 Administrative framework

Nunavik's current administrative structure stems from the JBNQA and the *Act respecting Northern villages and the Kativik Regional Government*. The Act provides for the creation of the Kativik Regional Government (KRG), a regional entity, as well as 14 northern villages (KRG, 2019). Institutions established under the JBNQA include Makivik Corporation, landholding corporations, the Kativik School Board (now Kativik Ilisarniliriniq) and the Nunavik Regional Board of Health and Social Services (NRBHSS).

KRG's mandate is to provide public services to the people of Nunavik in several areas, including economic development, police services 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 center for Nunavik is located in Kuujjuaq.

Makivik Corporation is responsible for protecting the rights, interests and financial compensation arising from the JBNQA, ensuring the integrity of and compliance with this agreement. This non-profit organization is also a major partner in the development of Nunavik (Makivik Corporation, 2019).

Since 2002, the Nunavik Landholding Corporation Association (NLHCA) has represented all landholding corporations for the northern villages. All villages have a landholding corporation that is responsible for administering Category I and II lands.

Lastly, local administration is provided by the municipal council of each northern village, which is the mandatary body for service management and municipal and community administration. Municipal services 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 councilors, elected or appointed. The mayor is head of the council and chief executive of the municipal administration.

5.5.2 Land designation and use

Land use in the extended study area was determined based on the Kangiqsujuaq land use and zoning plan (KRG, 2009), complemented by photointerpretation using orthophotographs at 7-cm resolution taken in 2016. The land use and zoning plan subdivides the urban environment of Kangiqsujuaq into various categories: residential, public and institutional, commercial and services, industrial, special-use areas, airport and communications activities, wharf and beach, conservation and future development area. Table 5-14 shows the land use categories, along with their respective areas and their proportions in relation to the extended and limited study areas. The various land use categories are shown on Map A (pocket insert).

The extended study area is dominated by the biophysical environment, which accounts for 2,157 ha, or 94.1% of its total area. It is primarily made up of shrub tundra (79.4%, 1,820 ha). Wetlands cover 7% (159 ha) of the extended study area and bodies of water cover 5.2% (120 ha).

The human environment covers only 5.9% (136 ha) of the extended study area. The built-up area, which includes the residential, institutional and commercial sectors, covers 48 ha (2.1%), and the industrial area, 3 ha (0.1%). Public infrastructure and services, which include the airport area, the northern landfill and the wastewater

treatment lagoon, account for 0.7% (15 ha) of the extended study area, and active or abandoned mine sites account for 22 ha (0.9%). Multi-use riverbanks that border the village account for 0.2% (5 ha) of the total area of the extended study area. Lastly, 1.8% (42 ha) of the total area is occupied by other disturbed environments of unspecified use.

Table 5-14: Distribution of Land Use Categories in the Extended and Limited Study Areas

Category	Total surface area (ha)	Proportion of the extended study area (%)	Proportion of the limited study area (%)
Biophysical environment	**2,156**	**94.1**	**93.9**
Terrestrial vegetation	1,877	81.9	84.0
Wetland	159	7.0	6.4
Body of water	120	5.2	3.5
Human environment	**136**	**5.9**	**6.1**
Residential sector	29	1.2	0.0
Institutional and commercial sector	20	0.9	0.0
Industrial sector	3	0.1	0.0
Infrastructure and services	15	0.7	0.0
Multi-use bank	5	0.2	0.0
Active or abandoned mining site	22	1.0	1.0
Other disturbed environment	42	1.8	5.2
Total	**2,292**	**100**	**100**

The limited study area is made up of a biophysical environment primarily covered by shrub tundra (84%). There is an extraction site of 0.2 ha (1.0%) and an area of anthropogenic disturbance totaling approximately 1.25 ha (5.1%). The built environment nearest to this area is more than 700 m from its boundary.

The Kangiqsujuaq municipal council accepted the choice of site for the generating station, confirmed by resolution 2022-29, sent to Hydro-Québec on June 22, 2022. A second resolution (2022-49), submitted on October 11, 2022, by the Nunavik Landholding Corporation Association in Kangiqsujuaq, authorizes Hydro-Québec to carry out field surveys on the proposed site.

5.5.3 Development projects

In the village of Kangiqsujuaq, four potential development sectors lie within the project's extended study area (see Map A, pocket insert). The first is near the commercial wharf, the second extends from the southwestern edge of the village, and the last two are near Lac Tasialuk. However, the nature of potential developments in these areas is not known.

Land use by the Inuit

As mentioned above, in the context of the COVID-19 pandemic, Hydro-Québec adjusted its consultation approach for a project in another northern village. Since this approach was well received and provided the necessary information (it should be noted that this success is largely due to the limited size of the study area), Hydro-Québec decided, in conjunction with the Inuit representatives of Kangiqsujuaq, to repeat it for the project concerned by the present study. Hydro-Québec presented the project in detail on local radio, accompanied by the mayor, and submitted a summary document and short questionnaire to members of the community.

The questionnaire was preceded by information 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 extended study area, on which the respondents could make note of their activities, in addition to writing answers for each question in a space reserved for this purpose. As the questionnaire was addressed to all the inhabitants of the house and included no personal questions, no consent form was required.

To present the project and answer any questions, Hydro-Québec held a community consultation on local radio in Kangiqsujuaq on November 9, 2022. To this end, our Indigenous Relations advisors, one of whom was originally from Kuujjuaq, traveled with the project engineer and environmental manager to lead the workshop. The radio show was hosted by the municipality's mayor.

These communications revealed that the site is used for berry picking and hunting. Listeners and the municipal council also mentioned that several other sites could lend themselves to these activities (see Map A, pocket insert, in particular for the gathering area mapped in the 2016 Kangiqsujuaq Master Plan) and that the chosen location will have no significant impact on their practice. The area is also used for snowmobile and ATV activities.

5.5.4 Infrastructure and services

5.5.4.1 Transportation

There is one airport in the extended study area, located southeast of the village center (see Map A, pocket insert). The Kangiqsujuaq airport is under the responsibility of the Nord-du-Québec Coordination Office.

The village of Kangiqsujuaq 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, water intake).

The extended study area also includes a marine infrastructure component in the northern sector of the village, including a commercial wharf, a boat ramp and a breakwater (see Map A, pocket insert).

5.5.4.2 Electrical energy

The existing thermal generating station is located in the northern part of the village. An oil pipeline carries fuel from the village supply boat to the fuel depot in the southern end of the village (see Map A, pocket insert).

5.5.4.3 Telecommunications

There are three telecommunication towers in the extended study area: one at the airport and two in the village. There are also six satellite dishes in the village (see Map A, pocket insert).

5.5.4.4 Drinking water and sewage

The community of Kangiqsujuaq's water intake is located in a lake southwest of the project's limited study area (see Map A, pocket insert). The water is pumped into a tanker truck, which takes it 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 treated, it is pumped into tanker trucks to be distributed to all the buildings in the community of Kangiqsujuaq. Each building is equipped with a drinking water tank and another tank for wastewater. When the wastewater tanks are full, they are also emptied by tanker truck (N360, 2019). Wastewater is directed to a treatment pond located near the southeastern boundary of the extended study area (see Map A, pocket insert).

5.5.4.5 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 must manage the activities 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 stored in the community's landfill. It is located near the southeastern boundary of the extended study area, east of the treatment pond (see Map A, pocket insert). Household waste stored at the landfill is burned 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, 2015). Northern landfills are designed to meet the standards set out in the *Regulation respecting the landfilling and incineration of residual materials* (REIMR).

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, 2015).

5.5.4.6 Extraction site

There are no active surface mineral extraction claims for the extended study area. Several mining sites (quarries or sand pits) are scattered throughout the extended study area, mainly in its northeastern portion (see Map A, pocket insert). An extraction site is also located within the limits of the limited study area, in the southern part.

5.5.4.7 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, Kangiqsujuaq has a fire service with a fire station and a vehicle for ambulance services.

5.5.4.8 Cultural and religious heritage

There are three places of worship in the urbanized area of Kangiqsujuaq: a Catholic church (Mission amérindienne de Sainte-Anne), an evangelical church (Full Gospel Church) and an Anglican church (Church of the Epiphany). There is also a cemetery set back from the village, around 300 m to the northwest of the limited study area (see Map A, pocket insert).

5.5.4.9 Recreational activities

Recreational facilities in Kangiqsujuaq include an arena, a public indoor pool, a community center, a golf course and two playgrounds (see Map A, pocket insert). In the urbanized area, there's also a museum, which serves as the Parc national des Pingualuit visitor and interpretation center.

5.5.4.10 Tourism

The creation of Parc national des Pingualuit in 2004 provided Kangiqsujuaq with a great opportunity to make its mark in the tourism industry, with the construction of hotels and the Parc national des Pingualuit interpretation center (Blais, 2015). The center is located in the village, where Auberge Kangiqsujuaq (12 rooms) and Hôtel de la Coopérative de Kangiqsujuaq (14 rooms) can also be found.

Aventures Kangiqsujuaq offers tourist packages with activities focused on discovering the territory, including kayaking, cycling, hiking, snowmobiling and dog sledding (Tourisme Autochtone, 2022). A sled dog kennel is located in the northern part of the extended study area (see Map A, pocket insert).

5.5.5 Socioeconomic profile

5.5.5.1 Population

According to the latest Statistics Canada census (2022)[2], the Kangiqsujuaq community had a population of 837 in 2021, representing a change of 11.6% since 2016, compared with 7.8% from 2011 to 2016. This variation is higher than that of the overall Québec population (which was 4.1%, from 2016 to 2021, and 3.3%, from 2011 to 2016) and slightly lower than that of the Nunavik population (9.1%) from 2011 to 2016 (Statistics Canada, 2017a). At the 2016 census, women and men each accounted for 50% of Kangiqsujuaq's population of 750.

The average age of the Kangiqsujuaq population (26.5 years) is almost the same as that of Nunavik as a whole (26.8 years) but lower than that of the province (41.9 years; see Table 5-15). It is slightly higher for women (27.2 years) than for men (25.9 years). Kangiqsujuaq has a higher proportion of people under the age of 15 (32.7%) and a lower proportion of people 65 or older (3.3%) as compared to these proportions in the province of Québec (16.3% and 18.3%, respectively). Overall, the proportions of Kangiqsujuaq's population by age category are similar between men and women, with men being slightly more represented in the 0–14 age category, while women are slightly more represented in the 15–64 and 65+ age categories. The distribution of the population of Nunavik based on age is the same as that of the community of Kangiqsujuaq (Statistics Canada, 2017a; 2017b).

Table 5-15: Sociodemographic Data for Kangiqsujuaq, Nunavik and the Province of Québec

Parameter	Kangiqsujuaq			Nunavik	Province of Québec
	Men	Women	Total		
Population in 2021	**N/A**	**N/A**	**837**	**N/A**	**8,501,833**
Population in 2016	375	370	750	13,188	8,164,361
Population in 2011	340	355	696	12,090	7,903,001
Change in population from 2016 to 2021 (%)	–	–	11.6	–	4.1
Change in population from 2011 to 2016 (%)	–	–	7.8	9.1	3.3
% of population aged 0 to 14	33.3	31.1	32.7	33.5	16.3
% of population aged 15 to 64	64.0	67.6	64.7	62.8	65.4
% of population aged 65 or over	2.7	4.1	3.3	3.8	18.3
Average age	25.9	27.2	26.5	26.8	41.9

Source: Statistics Canada, 2017a; 2017b; 2022

[2] At the time this report was drafted, some data from the 2021 census was still unavailable.

5.5.5.2 Households and housing

The average size of a household in Kangiqsujuaq in 2016 was 3.5 people. This average is similar to that of Nunavik, at 3.6 people, but higher than that of all of Québec, which was 2.3 people per private household in 2016. The percentage of single-parent families was higher in Kangiqsujuaq and in all of Nunavik—44.7% and 38.0% of the total number of families—than in all of Québec (16.8%). The majority of Inuit in Nunavik rent their homes, at a rate of 97.8%, compared to 100% in Kangiqsujuaq (Statistics Canada, 2017a, 2017b). Table 5-16 presents the data on households and housing for Kangiqsujuaq, Nunavik and all of Québec.

Table 5-16: Characteristics of Private Households and Housing in Kangiqsujuaq, Nunavik and the province of Québec, in 2016

Parameter	Kangiqsujuaq	Nunavik	Province of Québec
Total number of people in private households	745	13,115	7,965,455
Total number of private households	215	3,630	3,531,665
Average number of people in private households	3.5	3.6	2.3
Single-parent families (%)	44.7	38.0	16.8
Total number of private dwellings	215	3,625	3,531,660
Rented dwellings (%)	100	97.8	38.7

Source: Statistics Canada, 2017a; 2017b.

5.5.5.3 Demographic projections

According to the Institut de la statistique du Québec (ISQ), the population of the KRG (considered 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 should see the greatest increase in population by 2041. While the province of Québec will be subject to an aging 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 the province 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 of Québec (ISQ, 2019).

5.5.5.4 Education and training

Kativik Ilisarniliriniq (formerly the Kativik School Board) is the school board that manages educational services in Nunavik. In the community of Kangiqsujuaq, the Arsaniq school on Tayara Street in the southern part of the urban core provides primary and secondary education. There is also an early childhood center (CPE Mikijuq), next

to the school, and the adult education center (Centre d'éducation aux adultes Nasivvik) further east on the same street (see Map A, pocket insert).

In terms of education levels, Kangiqsujuaq has a much higher percentage of the population with no certificate, diploma or degree (61.4%) than Nunavik (58.3%) and the province of Québec (19.9%; see Table 5-17). This percentage is slightly higher for women in this community (63.5%) than for men (60.0%). The percentage of the population of Kangiqsujuaq with a high school diploma or equivalent certificate is lower (9.9%) than that for Nunavik (15.6%) and for the province of Québec (21.5%). While 58.5% of the population of the province of Québec holds a postsecondary certificate, diploma or degree, that percentage is 28.7% for Kangiqsujuaq and 26.1% for Nunavik (Statistics Canada, 2017a; 2017b). In Kangiqsujuaq, more men have an apprenticeship or trades certificate or diploma, while more women have a university certificate or diploma (see Table 5-17). The rate is similar among men and women with a college, CEGEP or other non-university certificate or diploma, or a university degree below bachelor level.

Table 5-17: Level of Education (Population Aged 15 and up) in Kangiqsujuaq, Nunavik and the Province of Québec, in 2016

Highest level of education achieved	Kangiqsujuaq (%)			Nunavik (%)	Province of Québec (%)
	Men	Women	Total		
No certificate, diploma or degree	60.0	63.5	61.4	58.3	19.9
High school diploma or equivalent certificate	8.0	11.5	9.9	15.6	21.5
Postsecondary certificate, diploma or degree	32.0	26.9	28.7	26.1	58.5
Apprenticeship or trades certificate or diploma [a]	22.0	11.5	16.8	12.5	16.9
College, CEGEP or other non-university certificate or diploma [a]					
University certificate or diploma below bachelor level [a]	4.0	3.8	3.0	5.7	17.6
University certificate, diploma or degree at bachelor level or above [a]	4.0	3.8	3.0	1.6	3.6
	4.0	7.7	5.9	6.3	20.5

Source: Statistics Canada, 2017a; 2017b.

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

5.5.5.5 Economy and employment

The Statistics Canada data (2017a; 2017b) presented in Table 5-18 show that the labor market participation rates in Kangiqsujuaq and Nunavik are higher (75.2% and 70.9%) than that in all of Québec (64.1%). Kangiqsujuaq's employment rate is slightly lower than the rates for Nunavik as a whole and for the province of Québec, at 57.4%, 60.1% and 59.5% respectively. The unemployment rate is higher in Kangiqsujuaq (23.7%) than in Nunavik (15.4%) than in all of Québec (7.2%). The activity rate (78.4%) and employment rate (60.8%) are higher for women in Kangiqsujuaq than for men (74.0%

and 54.0%). In this community, the unemployment rate is higher for men (27%) than it is for women (20%). Nunavik has the highest total average annual household income, at $93,444. This figure is $92,720 for Kangiqsujuaq and $77,306 for all of Québec.

Table 5-18: Labor Market Participation Rate, Employment Rate, Unemployment Rate and Average Income in Kangiqsujuaq, Nunavik and All of Québec, in 2016

Parameter	Kangiqsujuaq			Nunavik	All of Québec
	Men	Women	Total		
Participation rate (%)	74.0	78.4	75.2	70.9	64.1
Employment rate (%)	54.0	60.8	57.4	60.1	59.5
Unemployment rate (%)	27.0	20.0	23.7	15.4	7.2
Total average annual income for population aged 15 and up ($)	37,815	44,660	41,315	–	–
Total average household income ($)	–	–	92,720	93,444	77,306

Source: Statistics Canada, 2017a; 2017b.

The local economy in Nunavik is characterized by local markets at the community level, a high cost of living and doing business, low 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, in 2016, 4.8% of employees worked in the primary sector, compared to 3.2% across Québec (Duhaime et al., 2021). This sector relies mainly on mining exploration and operations. In 2012, it represented over 40% of all economic activities, but it was only 2% for all of Québec (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 the province. In 2010 and 2011, it represented 3.7% of the Nunavik economy, compared to 18.7% for all of Québec. Its importance has continued to decline, with the sector accounting for just 1.9% of Nunavik's economy in 2016, and 17.1% of Québec's economy (Duhaime et al., 2021). Construction is the main area of activity in the secondary sector, while manufacturing is barely represented at all (Duhaime et al., 2015).

The tertiary sector represented nearly 75% of all economic activity in 2010 and 2011, similar to the percentage in all of Québec (Duhaime et al., 2015). This contribution has continued to increase; in 2016, 93.5% of employees in Nunavik worked in the tertiary sector, compared to 79.6% across Québec (Duhaime et al., 2021). The role played by public administration is crucial to the regional economic vitality of Nunavik. Funds

channeled 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 acting as general stores, these cooperatives offer other services such as banking, post office and hotel management, as well as bulk oil and fuel storage (FCNQ, 2018). In some villages, stores from the Northern/North Mart chain also offer food products, clothing and other general merchandise (Northern/North Mart, 2022). These two businesses are major employers in the villages.

More locally, employment in Kangiqsujuaq is primarily associated with sales and service, education and social, community and government services, along with trades, transport, machinery, and related occupations. (Statistics Canada, 2017a). Women are more represented in the sales/service and teaching, sectors, while men are mostly employed in the trades sector, but also in the sales and service sector (Statistics Canada, 2017a).

5.5.5.6 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 provides social services through a local community service center (CLSC), a child- and youth-protection center (CPEJ), an acute-care hospital center (CH), a residential and long-term care center (CHSLD) and a 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, and the Ungava Tulattavik Health Centre, in Kuujjuaq, is responsible for the villages along the coast of Baie d'Ungava (NRBHSS, 2022).

In Kangiqsujuaq, the Qilangnguanaaq Center for the frail elderly and disabled is located in the eastern part of the village, on Tayara Street, opposite the Centre d'éducation aux adultes Nasivvik (adult education center) (see Map A, pocket insert). There's also the Maison de la famille Mianirsivik, on Chemin Père-Dion, in the center of the urban core; this community organization offers a safe place where programs and services are provided to support the well-being of community members (RRSSSN, 2022).

5.5.6 Cultural context

Inuit culture is rooted in a semi-nomadic past of hunters, fishers and gatherers. It was not until the 1950s that the modern world began to disrupt 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 (Gombay, 2005; National Post, 2018).

5.5.7 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). This holistic view of quality of life and well-being "fosters social cohesion that is supported and strengthened by family, friends, community and the nation at large. Positive relationships, including those with the land,

living beings, and ancestors, strengthen the sense of belonging to the world and foster the desire to live well." (Van Campenhout and Lévesque, 2018).

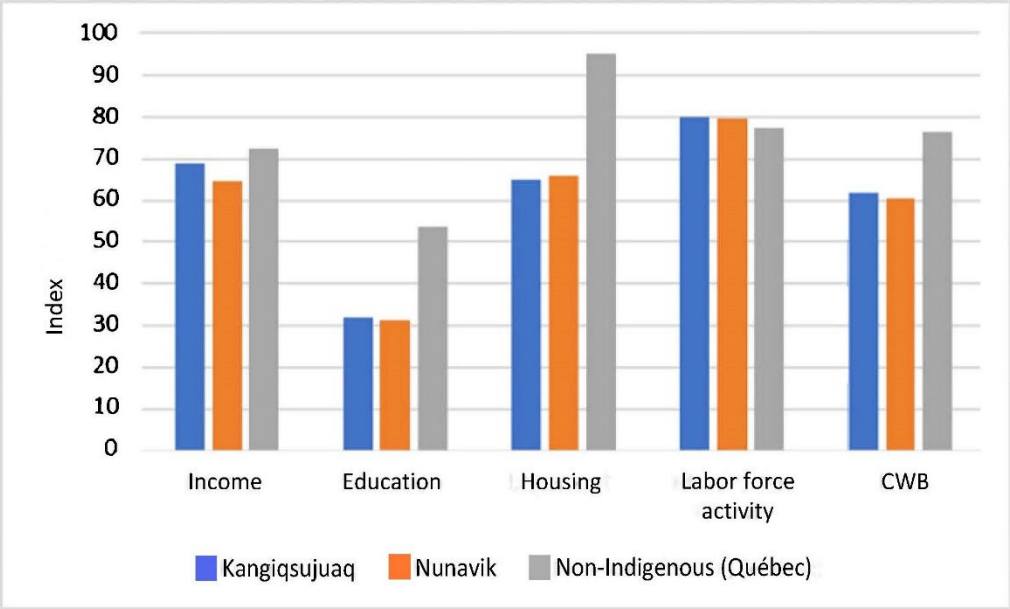
The Inuit of Nunavik are grappling with many social problems, including food insecurity, which affects a significant number of households. According to the Parnasimautik Consultation Report (Makivik Corporation et al., 2014), 44% of annual income is dedicated to food. Seniors are particularly affected by food insecurity. 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 elsewhere in Québec (Duhaime, 2008). Daily household items are 97% more expensive than in southern Québec. Despite the existence of some government incentives or programs that aim to compensate for the effects of remoteness, this phenomenon has more serious impacts for certain groups such as pregnant women and children (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 there is a lack of space and personal privacy. 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.[3] It is calculated using census data collected by Statistics Canada. Figure 5-1 shows the CWB scores for Kangiqsujuaq, 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 Québec's non-Indigenous population.

[3] "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).

Figure 5-1: Community Well-Being Index for Kangiqsujuaq, Nunavik and Non-Indigenous Communities in Québec, in 2016



5.5.8 Air Quality

There is no government air quality monitoring station in Kangiqsujuaq 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 particulate matter ($PM_{2.5}$).

As Kangiqsujuaq is located at 61° 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 sulfur 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 peak at the top of the inversion layer (400 to 800 m above ground) and decrease beyond that. 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.

5.5.9 Heritage and archaeology

5.5.9.1 Regional and historical context

The archaeological potential was analyzed as part of the present study by the Avataq Cultural Institute (2023; see Appendix B). The following sections present the main findings of this analysis.

The community of Kangiqsujuaq is located on the southeastern shore of Baie Wakeham, along the Détroit d'Hudson, in Nunavik. Kangiqsujuaq means "very large bay." The village is located in the Arctic tundra and on continuous permafrost.

Human occupation of Nunavik is relatively recent. Between 80,000 and 6,000 before present (B.P.), most of North America was covered by ice. Approximately 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 traveling eastward in search of game. Two major cultural groups are represented in Nunavik: Pre-Inuit, represented by the Pre-Dorset and Dorset peoples, of the Arctic microlithic (small-tool) tradition, and the Thule culture Inuit, who are the ancestors of the present-day Inuit.

The ancient Pre-Inuit variant is called "Pre-Dorset" by archaelogists, or "Tuniit Sivullingit" in Inuktitut (meaning Tuniit ancestors). The Pre-Dorset people occupied Nunavik between around 4,400 and 2,400 B.P. Highly mobile, they lived in small groups of nomadic hunters and had an economy based on land resources, mainly caribou, but also certain marine mammals, including seals. They supplemented their economy with the products of fishing and gathering, depending on the availability of resources. Their technology is represented by microlithic tools, highly adapted to a nomadic hunting lifestyle, hence the name "Arctic microlithic tradition," and they lived mainly in skin tents. The oldest known site in the region, KcFr-5, is located in Ivujivik and dates back to 4,200 B.P.

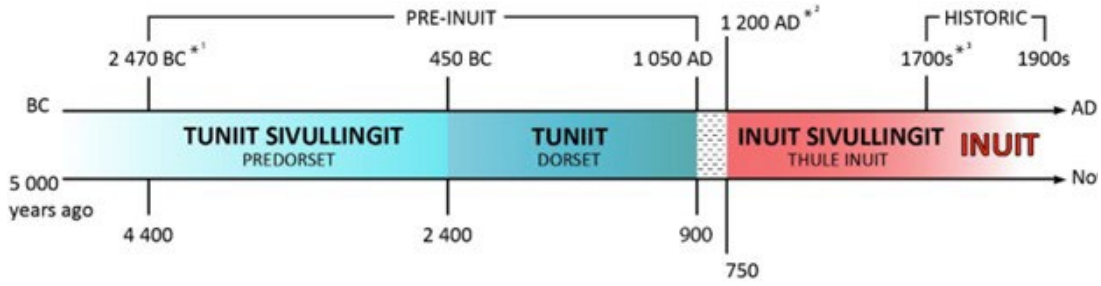
The Dorset or Tuniit people, descendants of the Pre-Dorset people, occupied Nunavut, Nunavik, Labrador and Newfoundland between 2,400 and 900 B.P. Their technologies and settlement patterns are different from those of the Pre-Dorset people. The Dorset people hunted mainly marine mammals, especially walrus, and lived in semi-subterranean houses in winter and tents in summer. Their tools are similar, but probably better adapted to hunting marine mammals. The end of the Dorset period is difficult to explain and has provoked some debate in the archaeological community. Hypotheses linked to the intensification of social interactions between different groups and climatic changes have been put forward to explain the cultural changes among the Dorset people and their disappearance. In Nunavik, there is as yet no evidence of contact between

Dorset and Thule culture Inuit peoples, and the end of the Dorset period seems to precede the arrival of Thule culture Inuit peoples in the region.

Originally from Alaska, the Thule culture Inuit arrived in the Eastern Arctic around 750 B.P. Their settlement pattern and subsistence economy were essentially based on whaling. Their technology is varied, and they benefit from several means of transportation that enabled them to cover great distances quickly, such as kayaks (qajaq), boats (umiaq) and dog sleds (qamutik). To date, the oldest Inuit site in Nunavik, JeGn-2, was discovered on Île Smith (in Akulivik) and dates from 1,200 A.D.

The historical period officially began in the 16th century with the first contact between the Inuit and the European explorers seeking an Arctic passage to Asia. In Nunavik, the historical period is closely linked to the progressive establishment of trading posts and religious missions; the chronology differs from region to region. The first post in the region, Fort Richmond, was established by the Hudson's Bay Company (HBC) in 1750 at Lac Guillaume-Delisle. It closed in 1756 due to lack of profitability. On the Ungava side, the first trading post opened in 1830 at Fort Chimo, near Kuujjuaq. However, supply difficulties made it difficult to maintain, and it closed in 1842. The Inuit of Nunavik then had to make long journeys to Baie-James (James Bay) or the Labrador coast to obtain trade goods (beads, tobacco, tea, needles, etc.), until the reopening of a post at Petite rivière de la Baleine in 1851, at Grande rivière de la Baleine (Kuujjuarapik) in 1852, then at Fort Chimo in 1866.

Figure 5-2: Nunavik Cultural Timeline (Avataq Cultural Institute, 2023)



As for the Kangiqsujuaq area, a weather station was set up at Baie Stupart, southeast of Kangiqsujuaq, in 1884. It was part of the Canadian Hudson's Bay Expedition project. From 1884 to 1887, the Canadian government operated four weather stations along the southern shore of the Détroit d'Hudson: Killiniq, Aniuvarjuaq (Baie Stupart), Saarqajaaq (Îles Digges) and Tujjaat (Île Nottingham). These stations were to collect information on ice and weather conditions, in order to determine the length of the shipping season for the Arctic Sea route. They were the site of numerous exchanges with the Inuit of northern Nunavik, whose customs were still traditional.

During the 1860s and 1870s, Scottish and American whalers regularly sailed Canadian waters. They hunted great whales in Baie Hudson and Détroit Hudson, bringing their products back to the American and British markets. In 1897, the Wakeham Expedition,

led by Captain William Wakeham, not only gathered further information on the length of the navigation season, but also established a degree of Canadian sovereignty in Arctic waters. In 1903, the Canadian government sent another expedition on the *Neptune*, which also stopped in Kangiqsujuaq. These two expeditions made it possible to document and take rare photographs of the region's Inuit at the time.

The arrival of Révillon Frères at Fort Chimo in 1903 put an end to the Hudson's Bay Company (HBC) monopoly on the fur trade. Competition led both companies to expand northwards, with the HBC establishing a post at Cape Wolstenholme (near Ivujivik) in 1909, followed shortly by Révillon Frères at Kangiqsujuaq in 1910, giving it the name "Wakeham Bay."

Four years later, the HBC opened a post first at Baie Stupart, then at Wakeham Bay. In 1928, the HBC also set up an experimental fox farm, which it ran for 12 years. In 1936, Révillon Frère closed up the store and the first Catholic mission was established in Wakeham Bay, followed by a school in 1960, a nursing station in 1961, and finally an Anglican mission in 1963. In 1961, the provincial government changed the name of the village of Wakeham Bay to Sainte-Anne-de-Maricourt, as part of a vast operation to convert place names to French in the Nord-du-Québec region. Although the toponym "Kangirsujuaq" first appeared on an official map of Québec in 1964, it was not until 1980 that the municipality officially adopted this name.

5.5.9.2 Archaeological potential

Method

The archaeological potential study includes a survey of known sites in the study area and an assessment of areas of archaeological potential. This theoretical assessment was made by analyzing different cultural and environmental components related to the geomorphological evolution of the landscape and from the historical sources available for the territory (aerial photos and historical photos, satellite images). Archaeological potential is generally presented according to three degrees of potential: high, average and low to nil.

Known archaeological data

Although many archaeological missions have been carried out in the Kangiqsujuaq area over the past 50 years, few have taken place directly in the community. There are currently 11 archaeological sites, three of which are located within the study area (JjEx-5, JjEx-11 and JjEx-12) and three nearby (JjEx-6, JjEx-10 and JjEx-13) (see Map 5-3). One of these three sites represents historic Inuit occupation, while the others are presumed to be of Dorset origin. Information on these three sites comes from the 1988 report of the Avataq Cultural Institute, written following a survey conducted by Luc Litwinionek; these sites were recorded in 1986 and have never been reinspected.

Site JjEx-5 is an Inuit summer camp established on a small marine terrace, with two historic tent structures (canvas tents with anchor stones). According to the original coordinates, it would be located on a hillside, south of the municipal airport.

Sites JjEx-11 and JjEx-12 are Dorset encampments, established on high marine terraces, with 16 and 6 Dorset tent structures respectively (oval, poorly defined). In 1986, several surveys were carried out, all of which proved negative. According to the original descriptions and coordinates, JjEx-11 should be located on the west side of the municipal airport hill, not far from the FCNQ facilities, while JjEx-12 would be on the north side of the hill, on Rue Tayara.

Areas of archaeological potential

In the study area, four areas with archaeological potential likely to have been occupied or used by Pre-Inuit or Inuit groups have been mapped: three with average potential and one with high potential.

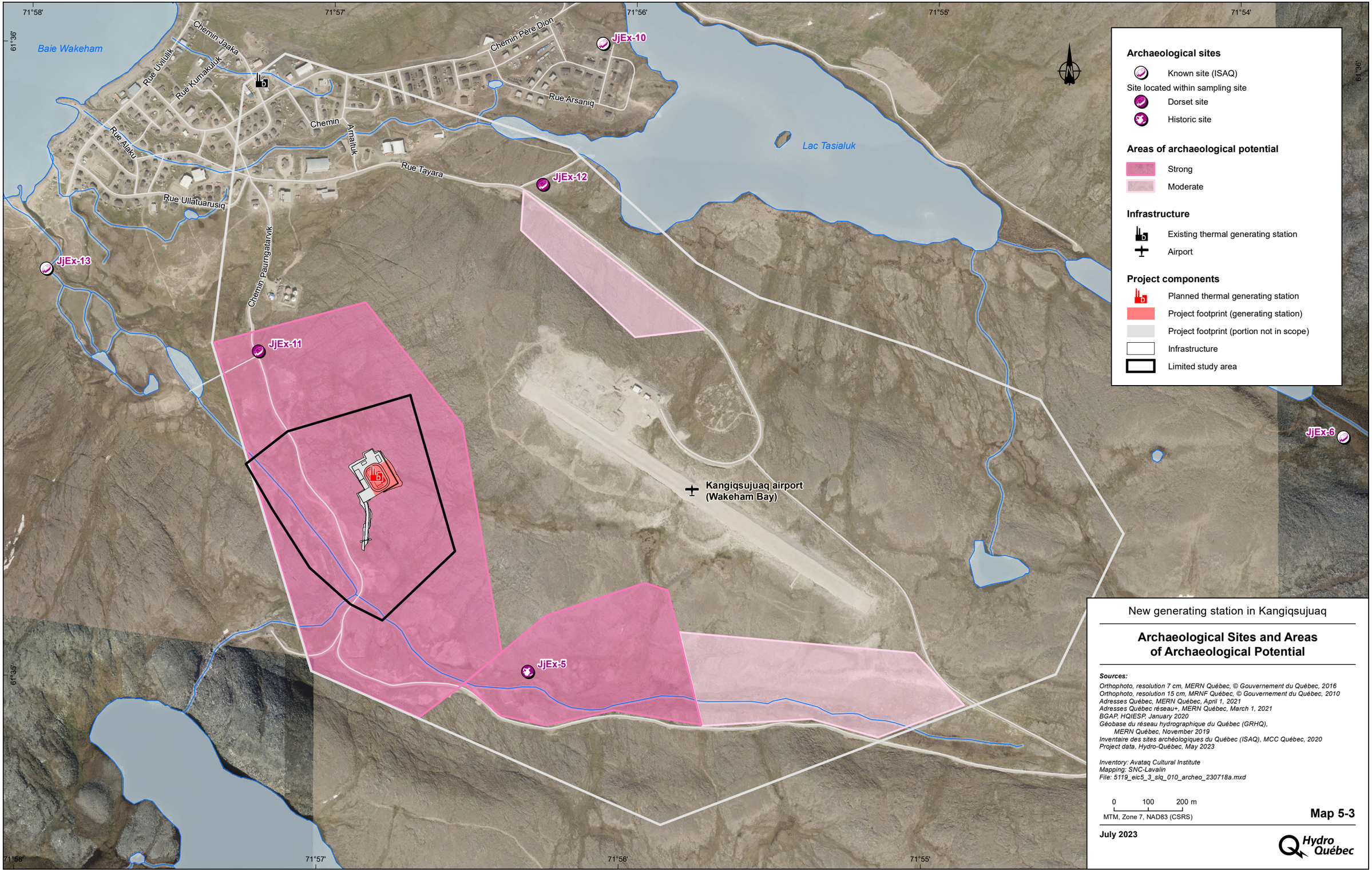
The area of high archaeological potential corresponds to the area of site JjEx-5 (according to the original geographic coordinates), where a small green plateau was observed on satellite images, which could potentially have allowed the identification of new archaeological remains.

Areas with average archaeological potential mainly correspond to areas where documented archaeological sites are thought to be located, but where archaeological potential is also reduced by urbanization. Sites JjEx-11 and JjEx-12 were considered to have moderate archaeological potential, due to the high level of disturbance in their respective areas. A third area of moderate archaeological potential was identified in the eastern part of the study area, due to the presence of presumed sandy flats.

Low-potential areas are not mapped but correspond to areas that have undergone a high degree of municipal development, steep airport hill slopes, seasonal drainage systems and other wetlands.

The sector chosen for the construction of the new Kangiqsujuaq generating station has moderate archaeological potential. Based on satellite imagery, this area appears to be a relatively flat, low ridge, likely formed of reworked till, with several rock outcrops. Between the flats and the outcrops, the low-lying areas consist of numerous swamps and wetlands, which reduces their archaeological potential. A systematic archaeological survey should be conducted to validate the presence or absence of archaeological structures.

Overall, this theoretical assessment of archaeological potential is based on the examination of satellite images, correlated with archaeological data and field experience. Only a visual field inspection by an experienced archaeologist can guarantee the presence or absence of archaeological remains in the limited study area.



New generating station in Kangiqsujuaq

Archaeological Sites and Areas of Archaeological Potential

Sources:

Orthophoto, resolution 7 cm, MERN Québec, © Gouvernement du Québec, 2016
Orthophoto, resolution 15 cm, MRNF Québec, © Gouvernement du Québec, 2010
Adresses Québec, MERN Québec, April 1, 2021
Adresses Québec réseau+, MERN Québec, March 1, 2021
BGAP, HQIESP, January 2020
Géobase du réseau hydrographique du Québec (GRHQ), MERN Québec, November 2019
Inventaire des sites archéologiques du Québec (ISAQ), MCC Québec, 2020
Project data, Hydro-Québec, May 2023

Inventory: Avataq Cultural Institute
Mapping: SNC-Lavalin
File: 5119_eic5_3_slq_010_archeo_230718a.mxd

0 100 200 m
MTM, Zone 7, NAD83 (CSRS)

Map 5-3

July 2023

Hydro Québec

5.5.9.3 Archaeological survey

In July 2022, archaeologists from the Avataq Cultural Institute carried out an archaeological survey. The methodology employed in the field essentially followed the methods of North American prehistoric archaeology. In an Arctic context, locating an archaeological site is essentially a matter of visual inspection, based on key observations: type of visible archaeological features, presence of artifacts, location, and altitude (expressed in metres above sea level).

The archaeological survey was carried out on foot (hiking) and the recognition of archaeological remains was done visually. Archaeological test pits (50 x 50 cm) can be made, depending on the nature of the soil, but in Nunavik, sites are often located directly on bedrock or on a very thin layer of soil overlying bedrock. Documented sites or features (i.e., structures, surface artifacts) are usually georeferenced using a GPS unit (Garmin GPSMAP 66i), measured, described and photographed.

On site, the team first inspected the terrain on Rue Tayara, then Chemin Paurngatarvik, as well as all the flat areas (i.e., remnants of raised beaches and remnants of terraces) around the airport hill. The construction area corresponding to the limited study area was doubly inspected.

No archaeological remains were found in the limited study area or in other areas with archaeological potential. Known archaeological sites in the study area have been assessed. Site JjEx-11, which would have included 16 presumably Dorset tent structures, has now been destroyed and no remains have survived. The other two known archaeological sites in the study area (JjEx-5 and JjEx-12) have now been destroyed.

5.5.10 Landscape

5.5.10.1 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, 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 m, other than in the far northeast of the natural province, near Détroit d'Hudson, where they may reach 650 m. 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).

5.5.10.2 Landscape of the extended study area

The Kangiqsujuaq area is part of the Rivière Wakeham eroded plateau physiographic complex (MELCC, 2018). The village of Kangiqsujuaq is located on the south shore of Baie Wakeham, on the edge of Détroit d'Hudson, in the hollow of a valley surrounded by high mountains (Makivik Corporation, n.d.). The region is dominated by a series of rocky hills that mark the abrupt break in the Plateau de l'Ungava at the Détroit d'Hudson. The rugged terrain continues inland (Société de la faune et des parcs du Québec, 2000).

The landscapes of the extended study area can be divided into four types: the village, disturbed areas, tundra and wetlands, and Baie Wakeham water body. The village is composed mainly of residential, institutional and commercial areas, as well as a few industrial areas. Disturbed areas are concentrated in the village and its outskirts, in the southeastern (airport, mining sites, northern landfill, sewage pond and access roads) and northeastern (mining sites and access roads) portions of the extended study area. Tundra, with extensive wetlands, rock outcrops and several water bodies scattered throughout, is the dominant landscape type in the extended study area. The vast expanse of Baie Wakeham occupies the entire northwestern portion of the extended study area.

The site of the planned generating station is part of a landscape mainly composed of rock outcrops, prostrate shrub tundra, wetlands and watercourses, and is located in an area already disturbed by mining operations along its border. It can be seen mainly by occasional mobile observers using the eastbound road, by temporary workers living in the recently constructed building northwest of the planned generating station, or by residents who use the area for hunting, fishing, trapping, snowmobile and ATV use, and berry picking. Photo 5-1 shows a view of the village from the planned generating station.

Photo 5-1: View (Northwest) of the Village from the Site of the Planned Generating Station

6 Impact analysis and mitigation measures

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 current conditions pertaining to each environmental component that will be affected by the planned facility, including survey results, and present an impact analysis along with mitigation measures. The chapter concludes with Section 6.9, which deals with the cumulative impacts.

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 has four stages:

- Describe the current conditions pertaining to each affected environmental component, with the appropriate level of detail.
- Describe sources of impacts stemming from the construction and operation of the planned 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 K 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: magnitude, scope and duration. Impacts are classified according to their significance as major, moderate or minor.

6.2 Issues

Issues are major concerns raised by the parties involved in the project, the analysis of which could influence the government's decision as to whether or not to approve the project. Issues are determined by taking into account the potential interactions between the project and the valued environmental components and the concerns expressed by the parties involved.

The planned 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 issues of the future Kangiqsujuaq thermal generating station, namely:

- survival and movement of land animals and birds, including special-status species
- maintaining air quality, reducing greenhouse gases and fighting climate change
- preserving the soundscape
- maintaining resident safety and quality of life and protecting public health
- reconciling land uses and the Inuit's traditional activities
- preserving archaeological resources

These issues are presented in the paragraphs hereunder. The valued environmental components targeted for impact analysis, and described in the following section, are related to project issues.

Survival and movement of land animals and birds, including special-status species

Some of the elements for which the project impacts must be assessed include the survival and movement of land animals and birds, as well as the destruction or modification of their habitats or the potential destruction and modification of the habitats of species at risk. Special-status species are also legally protected by the provincial *Act respecting threatened or vulnerable species* and the federal *Species at Risk Act*.

Caribou and birds are valued components that the environmental and social impact assessment (ESIA) for the project must take into account. Caribou were selected for the impact analysis because their presence was confirmed in the extended study area during field surveys, this species is valued by the Inuit and human activities are known to affect caribou behavior. It should be noted that the extended study area overlaps with the annual summer range of the Rivière aux Feuilles Herd (Taillon et al., 2016).

Birds, particularly species at risk, have been selected as a valued component. None of these species is likely to breed in the limited study area, and only the peregrine falcon is likely to breed in the extended study area. Disturbance is one of the main issues for this species.

Maintaining air quality, reducing greenhouse gases and fighting climate change

Québec has adopted the 2013–2020 Climate Change Action Plan. The reduction of GHG emissions is one of the primary measures recommended in the fight against climate change. The province has committed to GHG reduction targets that challenge the entire industrial sector. In addition to meeting these objectives, 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. It is important to mention that the dismantling of the existing thermal generating station, which is at the end of its life and located in the center of the village of Kangiqsujuaq, near several sensitive receptors, will eliminate this source of emissions and other substances.

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.

Preserving the soundscape

Each living environment has its own soundscape, which comes from environmental noise, neighboring noise and existing activity noise. Noise is considered to be a potential source of nuisance that can alter the quality of life and, in the worst cases, have repercussions on psychosocial and human health. Québec and many municipalities have therefore adopted standards and criteria to limit the population’s exposure to noise.

Noise sources are associated with the operation of the thermal generating station. This noise, noticeable around the periphery of the facility, will mainly come from the generators. It is important to mention that the dismantling of the existing thermal generating station, which is located in the center of the village of Kangiqsujuaq, near several sensitive receptors, will eliminate this source of noise.

Preserving the soundscape will help maintain the quality of life of the village's population. This is an issue in the ESIA.

Maintaining resident safety and quality of life and protecting public health

The Québec government's Directive pour la réalisation d'une étude d'impacts sur l'environnement states, among its basic principles, that the purpose of an environmental assessment is to protect human life, health, safety, welfare or comfort. The effects of potential contamination of the biophysical environment on the health of the population must therefore be considered.

For the new generating station project in Kangiqsujuaq, 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 adoption 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.

Reconciling land uses and the Inuit's traditional activities

The land use analysis documented for the project reveals that the study area and the site of the planned generating station are hunting and gathering areas that are also used for snowmobiling and ATV activities. This is a minor issue, as these activities will still be possible, although slightly displaced. Other sites are available nearby, and the location chosen for the new generating station will have no significant impact on the practice of these activities, apart from modifying hunting and gathering and recreational tourism habits.

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 as part of the generating station project showed that the proposed site is located in an area with moderate archaeological potential. Prior to the work, a survey and excavations will be carried out where necessary.

The valued component of sites of cultural, historical and archaeological interest is not an issue, as the preservation of artifacts will be ensured if they are present on the site.

6.3 Identification of valued environmental components

The valued environmental elements of the project were identified by taking into account components 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
- wetlands
- caribou
- birds
- air quality
- GHGs and climate change
- soundscape
- services and infrastructure
- land use
- economic spinoffs
- health, safety and quality of life
- archaeology
- landscape

For the reasons presented in the paragraphs hereunder, the following environmental components were excluded from the impact assessment.

Special-status vegetation and plant species

The project site is covered by shrub tundra and rock outcrops. The shrub tundra is very common in the region, representing almost 80% of the extended study area. No tree-forming species are present on the project site, and the shrubs are prostrate. In addition, no special-status plant species were observed in the limited study area. For these reasons, this component was not included in the impact assessment.

Aquatic environments and wildlife

The surveys carried out for this project confirm that there are two intermittent watercourses (CE01 and CE03) and one perennial watercourse (CE02) in the project's limited study area. The generating station will be built more than 105 m from the nearest watercourse (CE01),

and there will be no permanent or temporary encroachment on the shoreline of these watercourses or their riparian buffer strips.

In addition, as described in Section 6.5, Hydro-Québec's SECs will be applied during the construction phase. They include several protection measures applied to sensitive areas and the aquatic environment, and all work carried out near watercourses or bodies of water 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 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 through existing data sources. Common land 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 unlikely to be affected by minor environmental changes. In the vast majority of cases, the affected individuals will move to adjacent habitats, and mortality due to machinery movement will be negligible.

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 vicinity. Furthermore, this small member of the weasel family is versatile in terms of habitat use; since it has high reproduction rates when its prey is abundant, its population is relatively unlikely to be affected by the environment 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 and limited study areas would be infrequent and of very short duration, if at all, the reducing potential impacts on these two predators. Furthermore, the limited study area does not present any particular interest for these species, and even less so since 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 sources of impact are based on an understanding of the technical specifications of the project, the work methods selected to execute each activity, and the planned mode of operation. The main construction and operation activities that could constitute sources of impact are listed below.

During the construction phase:

- Excavation and blasting
- Leveling, backfilling and earthwork
- Generating station construction
- Waste management
- Transport and traffic
- Worker presence and housing
- Job creation and the purchase of goods and services

During the operation phase:

- Presence of infrastructure
- Operation of generating station and fuel management
- Management of residual hazardous materials
- Maintenance of generating station

Excavation and blasting

At the generating station site, the contractor will blast and excavate approximately 6,340 m^3 of rock to lay the generating station foundation. The excavated material will be reused to level the ground.

Leveling, backfilling and earthwork

The platform will be leveled and backfilled with a volume of granular material of around 15,770 m^3.

Generating station construction

The construction of the generating station includes the following stages:

- The laying of building foundations
- The erection of buildings
- The installation of the equipment

Waste management

The project will generate construction waste (approximately 325 m^3). After agreement with the municipality prior to the work, a decision will be made regarding the destination of the waste, either the municipal landfill site or southern Québec.

Transport and traffic

During the construction phase, transport and traffic will be related to the movement of workers on

the site, heavy vehicles and construction site machinery needed to build the generating station.

Worker presence and housing

During the construction phase, workers will be housed in existing workcamps. Workers from the south of the province will be present in the village for two and a half years.

Job creation and the purchase of good and services

The project will enable us to hire a few local workers, obtain services and buy locally.

Presence of infrastructure

The presence of the generating station, substation and related infrastructure will prevent any land use in the area where they will be located, which may limit certain land uses in the vicinity.

Operation of generating station

The new generating station will operate on a full-time basis and will be equipped with more powerful and efficient generating sets and other equipment than the existing generating station.

Management of residual hazardous materials

Residual hazardous materials (RHM) will be sorted and stored on the generating station site in drums and other types of containers, which will then be shipped to Hazardous Materials Recovery Centers (HMRCs) in southern Québec. It is estimated that the amount of RHM generated by the new operating facility will be the same as that of the existing generating station.

Maintenance of generating station

Maintenance of the generating station includes all operations required to ensure the facility is reliable and functioning properly. It consists in checking the equipment and carrying out repairs or replacements, as is the case for the existing generating station.

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

It should be noted that the activities associated with the construction of the two distribution lines, the dismantling of the existing generating station and the restoration of the site will be carried out at a later date and are not covered in this environmental and social impact assessment.

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

Environmental components	Excavation and blasting	Leveling, backfilling and earthwork	Construction of generating station	Waste management	Transport and traffic	Worker presence and housing	Job creation and the purchase of good and services	Presence of infrastructure	Operation of generating station and fuel management	Management of residual hazardous materials	Maintenance of generating station
Physical environment											
Soil	X	X	X		X				X	X	X
Surface water	X	X			X				X	X	X
Biological environment											
Wetlands	X	X									
Caribou	X	X	X		X				X		
Birds	X	X	X		X						
Human environment											
Air quality	X	X	X		X				X		X
GHG emissions and climate change	X	X			X				X		
Soundscape	X	X	X	X	X				X		
Infrastructure and services				X	X	X					
Land use			X	X	X			X			
Economic spinoffs							X				
Health, safety and quality of life				X	X	X			X		
Archaeology	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) (Direction – Environnement, 2023). 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 C.

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

- Clause 1 – General
- Clause 2 – Noise
- Clause 5 – Snow removal
- Clause 6 – Accidental contaminant spills
- Clause 7 – Drainage
- Clause 9 – Wastewater
- Clause 10 – Excavation and earthwork
- Clause 11 – Drilling and boring
- Clause 15 – Plant and traffic
- Clause 16 – Hazardous materials
- Clause 17 – Waste materials
- Clause 19 – Heritage and archaeology
- Clause 20 – Air quality
- Clause 21 – Site restoration
- Clause 22 – Petroleum product tanks and storage facilities
- Clause 23 – Blasting
- Clause 24 – Contaminated soil
- Clause 25 – Work in water and on shores
- Clause 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. These measures are outlined in the following sections, which pertain to the various impacts on the biophysical and human environments.

Table 7-1 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

6.6.1 Soil

Present conditions

The site slopes to the west, with a gradient of a few metres. It is mostly covered by topsoil or outcropping rock, with a few granular areas. Phase I of the environmental site assessment and environmental soil characterization did not reveal any contamination.

Anticipated construction-phase impacts and mitigation measures

Soil surface and profile

The planned construction work will require the development of a surface area of approximately 16,192 m², including a 7,278-m² area (generating station) within the scope of this assessment and an 8,914-m² area (mainly the access road) not in the scope of this assessment, which will be used for part of the platform and the road to the generating station. Grading, blasting and foundation construction could alter the surface soil composition and profile.

At this stage of the project, it was determined that the granular material would be sourced from existing borrow pits. If the establishment of a new borrow source or the expansion of an existing one were required, the contractor would be responsible for obtaining the necessary authorizations. The exact location of the borrow sources will be known at the time of awarding the mandate for the production and supply of granular materials.

Machinery transport and traffic should not cause much rutting, given the predominant type of surface deposits (sand and rock). In addition, the presence of permafrost will be taken into account during the construction phase.

During construction, to limit the impact on the ground, Hydro-Québec will apply SECs 10, 15 and 23 regarding excavation and earthworks, plant and traffic, and blasting. Upon completion of the work, the work areas and exposed surfaces will be restored in accordance with SEC 21. The slopes of the platform will also be protected with retaining embankments to prevent erosion.

Soil quality

In addition to the measures regarding accidental contaminant spills and contaminated soil, the contractor is required to apply the measures regarding the plant and traffic, as well as waste management and hazardous waste management (see SECs 6, 15, 16, 17 and 24 in Appendix C).

General mitigation measures

The mitigation measures included in Hydro-Québec's SECs will considerably reduce impacts on soils during the construction phase.

In summary, the contractor will apply the following SECs:

- Clause 6 – Accidental contaminant spills
- Clause 10 – Excavation and earthwork
- Clause 15 – Plant and traffic
- Clause 16 – Hazardous materials
- Clause 17 – Waste
- Clause 21 – Site restoration
- Clause 23 – Blasting

Anticipated operation-phase impacts and mitigation measures

Soil surface and profile

No impact on soil stability is anticipated during the operation of the generating station. The platform on which the planned generating station will be installed will be designed according to the design standards for such infrastructure in a northern environment, taking into account the widespread presence of permafrost in the area. Conversely, given the design method employed, the presence of the generating station will have no effect on existing permafrost.

Soil quality

During the operation phase, refueling at the generating station, fuel storage and the management of used oil 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.

The volume of dangerous goods transported will change little during the operation phase, since the new generating station will replace the existing one. Fuel will be transported to the generating station from the Kangiqsujuaq fuel depot by tanker truck over a distance of approximately 1.3 km. An average of seven fuel (diesel) deliveries per week will be made.

Specific mitigation measures

Fuel will be stored in CAN/ULCS601-14-compliant outdoor tanks, while used oil will be collected in accordance with recognized practices inside the main building, where it will also be stored in drums. Used oil and other residual hazardous materials will be shipped by boat to recovery centers in southern Québec for treatment.

As described in Section 8, Hydro-Québec will implement safety measures to prevent accidental spills and an emergency response plan (ERP) outlining the actions required in the event of a spill. The ERP for the existing generating station can be consulted in Appendix I; the ERP for the new generating station will be similar.

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 infrastructure will remain permanently altered. The presence of the station will have no effect on the existing permafrost. Given the general and specific mitigation measures to be implemented during construction and operation, the risks of soil contamination are low. The magnitude of the impact is low and its scope is limited because it will be restricted to a small area, and its duration will be long, as the generating station will be in operation for 50 years. The significance of the residual impact on the soil is therefore considered to be minor.

6.6.2 Surface water

Present conditions

The generating station site is 108 m from an intermittent watercourse and a perennial watercourse, both of which flow into Baie Wakeham more than 1.2 km away. The site is surrounded by a number of wetlands, mainly to the northwest and south; the closest wetland is located 6.0 m from the limit of the lower slope to be developed. The presumed surface water flow in the sector is northwestward and westward, towards river CE02 and Baie Wakeham.

Anticipated construction-phase impacts and mitigation measures

Excavation and earthworks, as well as machinery transport and traffic, during construction, are likely to alter surface water quality through sediment supply and suspension and the risk of water contamination in the event of accidental petroleum product spills. Inadequate management of construction waste is also likely to alter the quality of surface water.

The supply of suspended solids in the nearest aquatic environment during excavation and grading 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 contribution of suspended solids will be negligible during construction, given the limited amount of sediment on the platform and the distance of more than 100 m from the nearest watercourse.

The work required to build the platform over an area of 1.62 ha of natural terrain (including a 0.73-ha area subject to this procedure and a 0.89-ha area not subject to this procedure) 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.

The breakdown of a piece of construction equipment near a wetland or an aquatic environment or the runoff from an accidental spill could lead to water contamination by hydrocarbons. However, the distance between the work area and the watercourses is sufficiently large that this risk is very low. As for nearby wetlands (< 100 m), they are isolated and not hydro-connected with nearby aquatic environments, which limits environmental impact and facilitates restoration/clean-up in the event of an accident.

General mitigation measures

The mitigation measures set out in Hydro-Québec's standard clauses will significantly reduce the impacts on surface water quality and drainage during the construction phase.

The contractor will apply the following SECs:

- Clause 6 – Accidental contaminant spills
- Clause 7 – Drainage
- Clause 9 – Wastewater
- Clause 15 – Plant and traffic

Anticipated operation-phase impacts and mitigation measures

Refueling at the generating station during operation and fuel storage represent the main risk of contamination of surface water in the event of an accidental spill.

Surface water will drain from the center of the generating station yard at a 1% slope to the northwest and a 2% slope to the southeast. The water will then flow over the natural terrain, depending on the topography. To the northeast and southeast of the platform, a drainage ditch will channel water to the southeast and east to prevent it from accumulating near the generating station, and then direct it northwest.

As mentioned in the previous section, the transport, storage and management of petroleum products during the operation of the station will be carried out in accordance with applicable provincial and federal regulations. In addition, Hydro-Québec will implement safety measures to prevent accidental releases and an emergency response plan outlining the actions required in the event of a spill (see Section 8).

Assessment of residual impact

Minor changes will be made to the site drainage around the generating station during construction and operation. Sediment supply to the water environment will be negligible since the soil is essentially rock and granular materials. In addition, the platform slopes will be protected by riprap and geotextile to prevent erosion. The risk of surface water

contamination by petroleum products and oils is low since current mitigation measures will allow for their proper management and thus prevent accidental spills.

The magnitude of the impact is low, its scope is limited, since it is restricted to the location of the generating station, but its duration will be long, as the generating station will be in operation for 50 years. The significance of the residual impact on surface water is therefore considered to be minor.

6.7 Impacts on the biological environment and mitigation measures

6.7.1 Wetlands

Present conditions

Fourteen wetlands have been identified in the limited study area, near the planned generating station: eleven are open bogs, consisting of prostrate shrubs and herbaceous plants; two are marshes, one isolated and the other riparian in perennial watercourse CE02; and the last one is a wetland complex consisting of an open fen and a riparian marsh.

Anticipated construction-phase impacts and mitigation measures

No wetland will be directly affected. Construction of the generating station completely avoids wetlands in the limited study area.

Wetland MH07, an open bog, could be indirectly affected, since it adjoins the generating station platform and is located 6.0 m from the bottom of the slope that will be built (see Map 5-2). During construction, no drainage ditches for surface water collection will be built to the northwest or west of the platform (only to the east and south). Site drainage through surface water runoff and precipitation will occur naturally on the northwestern and western slopes, into this wetland. This indirect impact is considered to be beneficial for wetland MH07, since the construction of the generating station's embankments will, to a certain extent, provide some additional runoff to this environment (see Table 6-2).

Table 6-2: Affected Surface Area of Wetland MH02 by Type of Impact

Source of impact	Type of impact	Wetland No.	Type of wetland	Affected surface area (m²)	Impact on the wetland	Main ecological function affected
Drainage/runoff	Indirect	MH07	Open bog	390.0	Positive—Some additional runoff, to some extent	Water regulation and retention

The wetlands observed provide diverse quality habitats for local wildlife and perform important ecological functions, including maintaining biodiversity, carbon sequestration, as well as water regulation and retention. Their surface area within the extended study area is

sizeable (nearly 25%). The anticipated indirect impact will be positive for the wetland complexes in the limited study area, as the supply of water to them will be enhanced.

General mitigation measures

During construction, wetlands near the generating station will be marked to ensure that they are not directly affected by the construction work. Sediment barriers will be placed around wetlands near the work areas to protect them from sediment flowing from the work site via surface water runoff. The contractor will apply Standard Environmental Clause 25 – Work in water and on shore to protect the integrity of these environments.

Anticipated operation-phase impacts and mitigation measures

No additional impacts are foreseen during operation.

Assessment of residual impact

Given that the anticipated impact is indirect and considered to be positive, and that general mitigation measures will be applied to prevent potential adverse impacts during construction, the magnitude of impact is considered to be low. The scope of the impact is limited, as it will be restricted to a small surface area, and its duration will be long, since the positive impact will be permanent. The significance of the residual (positive) impact is therefore considered to be minor.

6.7.2 Caribou

Present conditions

Caribou found around the limited study area belong to the Rivière aux Feuilles Herd. The extended study area is located at the same latitudes, but slightly further east, as the calving ground for this herd (mid-May to late June) presented in Taillon et al. (2016). According to the same source, the Kangiqsujuaq area overlaps with the herd's summer range (from early July to early September). This information was confirmed by the observation of a few individuals passing through the extended study area during the surveys carried out in 2022. Thus, caribou are likely to use both the extended and limited study areas during the summer.

Anticipated construction-phase impacts and mitigation measures

The various construction projects will result in the loss of approximately 1.62 ha (including a 0.73-ha area subject to this procedure and a 0.89-ha area not subject to this procedure) of shrub tundra. This area represents a tiny portion of the Rivière aux Feuilles Herd's summer range (approximately 250,000 km^2; Taillon et al., 2016). The shrub tundra itself is not a habitat of interest for caribou. During the summer, caribou mainly uses environments rich in grasses and deciduous shrubs, which are not abundant in the shrub tundra present in the limited study area.

A small functional loss of habitat is also anticipated due to possible avoidance of the periphery of the work area. This could be an area of a few hundred metres or even a few kilometres away. The avoidance of human disturbance by migratory caribou is well documented in the scientific literature (reviewed in Plante, 2020). For example, roads, villages, power lines, mineral exploration sites, mines, and other types of industrial disturbances generate avoidance responses that, depending on the nature of the disturbance, can be particularly pronounced (Plante, 2020). Migrating caribou therefore avoid habitats along the periphery of the work area, which results in a functional loss of habitat. If this were the case for the present project, certain habitats of interest (e.g., peat bogs and marshes) would no longer be used by caribou during the construction period, which overlaps with the caribou's period of occupancy in the study area (from around early July to early September for the years 2025, 2026 and 2027).

Moreover, no source of impact poses a risk to the survival of caribou. The risks of collision associated with material hauling and traffic are very low given the slow speed of vehicles on the work site during the construction phase and the good visibility that drivers will have (absence of trees or other visual screens).

Anticipated operation-phase impacts and mitigation measures

The presence of the generating station and the movements of employees could disturb some caribou, which would then move away from the area. However, it is located relatively close to the village and to other existing disturbances (roads, airport, landfill, mining sites, industrial sector), which already reduces the likelihood of using habitats in the area.

Assessment of residual impact

The survival of the caribou affected by the project is not at stake. Avoidance behavior is possible during the construction phase. However, during the operation phase, avoidance would probably be lower, since the various disturbances (e.g., employee movements, machinery noise) would be less than during construction and similar to those already present around the village. The magnitude of the impact is therefore considered to be low. The scope of the impact will be limited, as the area associated with the functional loss of habitat, due to possible avoidance of the generating station sector, would be negligible given the numerous replacement habitats present in the summer range. The duration of the impact will be short during construction, with any effects only being felt for approximately two months (from early July to early September) each year that construction work is planned (2025, 2026 and 2027); but it will be long during the operation phase. The significance of the negative impact on caribou is therefore considered to be minor.

6.7.3 Birds

Present conditions

A total of 24 species of birds are likely to be present in the extended study area. Species abundance and diversity are very low in the limited study area. The site of the planned generating station is located on a rocky plateau, not only unsuitable for the species of interest present in the extended study area, but also for all bird species.

Anticipated construction-phase impacts and mitigation measures

The main impacts during construction are related to the loss of habitat at the generating station site, specifically 1.62 ha (including a 0.73-ha area subject to this procedure and a 0.89-ha area not subject to this procedure) of shrub tundra. The earthworks, which include the removal of vegetation, will take place during the summer and fall seasons, and will overlap with part of the breeding period of the birds found there. According to the Birds Canada nesting calendar query tool (Birds Canada, 2022), the critical period for potential breeding species in the limited study area is approximately May 25 to August 15.

The habitat loss will force some species to seek a new habitat, but the small surface area affected means that the impact will be negligible considering the abundance of similar habitats in the surrounding area. The various construction activities, in addition to transport and traffic, may also disturb the birds and force them to move temporarily. That being said, those that use the habitats affected during the construction phase 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 found in the limited study area. In some years, the cliffs in the extended study area are likely to be home to the peregrine falcon as a breeding bird. An individual was observed on July 20, 2022, near the Kangiqsujuaq airport. However, the cliffs are all located more than 500 m from the limited study area, so no impact on this species (or any other cliff-nesting raptor) is expected. No short-eared owls were identified in the study areas (limited or expanded) during the bird surveys, and historical data do not mention the species. Potential habitat for this species in the extended study area is abundant.

Anticipated operation-phase impacts and mitigation measures

The presence of the generating station will make the loss of habitat permanent, but the birds will have available habitat nearby. No impact on bird populations is anticipated.

Assessment of residual impact

The removal of vegetation and the presence of the generating station will result in a loss of a small area of bird habitat. The scope of the impact will therefore be limited, as the use of the environment by the different bird species will be altered only in the area of the generating

station. The density of birds present in the limited study area of the planned Kangiqsujuaq generating station is exceptionally low according to surveys carried out in the summer of 2022, and no at-risk species breeds there. The magnitude of the impact is therefore considered to be low, since bird numbers are not expected to decline after the generating station is built. The duration of the impact is considered to be short for bird species that will potentially nest in the limited study area, as they will be able to use the nearby tundra environments after construction is completed. The disturbance of birds during the construction phase is also considered to be short term. Overall, the significance of the negative impact on birds is considered to be minor.

6.8 Impacts on the human environment and mitigation measures

6.8.1 Air quality

Present conditions

Air quality is considered to be good in the Kangiqsujuaq area, mainly because of its distance from major urban or industrialized areas. Building and domestic water heating systems fueled by oil, as well as the generation of electricity from the thermal generating station (diesel gensets), are the main sources of air pollutants that could locally affect air quality.

Anticipated construction-phase impacts and mitigation measures

Excavation and blasting, grading, backfilling and earthworks, as well as transport and traffic are likely to generate dust during construction.

Standard air quality mitigation measures, as per clause 20 of Hydro-Québec's SECs, will be implemented to mitigate this impact, including standard dust abatement measures during construction.

Anticipated operation-phase impacts and mitigation measures

An atmospheric dispersion study was conducted to assess the compliance of the emission of atmospheric contaminants by the future generating station with the emission standards and air quality standards set out in Québec's *Clean Air Regulation* (CAR). Odor levels around the plant were also assessed and compared with the MELCCFP's Québec air quality criteria. Appendix J presents the detailed study results.

Section 52 of the CAR, concerning stationary internal combustion engines, is applicable to the engines of the Kangiqsujuaq thermal generating station. This section specifies the maximum quantities of contaminant emissions (nitrogen dioxide (NO_2), carbon monoxide (CO) and hydrocarbons (HC)) per unit of energy supplied by the fuel. Technical data sheets from the engine manufacturers were used to demonstrate that the generating station's emissions comply with CAR emission standards.

The contaminants targeted by the atmospheric dispersion study are nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO), total particulate matter (PM_T) 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* (Leduc, 2005) published by the MELCC Direction du suivi de l'état de l'environnement, and Schedule H of the CAR (Air Dispersion Model). A level 2 dispersion model (AERMOD) was used to estimate the maximum concentration of the target pollutants in the ambient air.

The operation of the generating station involves variable use of the power required, which varies according to the time of year (summer or winter) and the time of day (day or night). The dispersion study considered an operating scenario based on the generating station's expected operating conditions in 2042. For reasons of prudence, and in order to estimate the maximum impacts, we have considered an "all-diesel" scenario, neglecting the connection to a wind farm currently planned to enable operation in hybrid diesel-wind-battery mode.

The atmospheric dispersion study for an "all-diesel" scenario demonstrates that ambient air contaminant concentrations at ground level would all be below the CAR air quality standards throughout the simulation domain, with the exception of hourly and daily NO_2 concentrations. For the latter, exceedances of the standards were calculated in the immediate vicinity of the generating station (25 m) on a few days a year in strong winds, and up to 300 m to the east (towards the airport) on the hillside for a few hours a year in light winds at night. Although the new generating station is located in an area set aside by the local community for industrial development, no document officially designates the generating station area as an industrial area, for which standards are not applicable. The applicability of the CAR standards in the sectors for which standard exceedances have been calculated therefore remains uncertain.

The northern village of Kangiqsujuaq adopted its last master plan in 2009 (KRG, 2009). The area where the generating station will be located is in a "Hinterland," not Industrial, zoning. The master plan defines Hinterland zoning as "zoning where the municipality is not required to accept development projects or provide public services."

The by-law associated with the latter zoning authorizes the following uses: quarries and granular material borrow pits, waste disposal sites, equipment associated with water supply and wastewater treatment, cabins, buildings associated with hunting, fishing and trapping, outfitting camps, cemeteries, seaplane bases, telecommunication equipment, weather stations, outdoor recreational facilities, and construction sites.

However, KRG plans to hold community meetings in 2023–2024 to update its master plan in the coming weeks or months.

According to the latest discussions with the KRG about the master plan, Hinterland zoning has been replaced by Nuna zoning, which is described as follows: "The 'Nuna' designation describes all remaining land between the village and the municipal boundary. Nuna is used to enjoy traditional and recreational activities such as camping, fishing and berry picking.

Dog teams and cottages are therefore permitted to support these activities. Nuna also contains significant community infrastructure that can be located at a distance from the village, such as the water tank, water treatment plant, treatment lagoon, solid waste disposal, quarries and pits."

Discussions between Hydro-Québec and the municipality and the KRG are underway to have the generating station site and its immediate surroundings zoned Industrial.

Odor levels could also exceed Québec's air quality criteria for the 98th annual percentile of hourly maximum 4-minute average odor concentrations. The extent of the exceedance area would be restricted to a distance of 250 m to the northwest and south of the generating station platform, and up to 300 m to the east of the latter.

For the village of Kangiqsujuaq, all the results of the dispersion study are well below the CAR standards, and no odors would be noticeable in inhabited areas.

The dispersion study was carried out for an "all-diesel" scenario for the anticipated electricity demand in 2042. By then, electricity demand will be lower, and the wind farm connection project currently planned to enable operation in diesel-wind-battery twin mode will be completed. The expected impacts in this dispersion study are therefore overestimated in terms of contaminant concentrations and the frequency of potential exceedances of air quality standards and criteria in the vicinity of the generating station.

The impact of the generating station, mainly in terms of nitrogen dioxide, fine particles and odors, would be significant in the vicinity of the generating station (i.e., within a few hundred metres), but would diminish rapidly with distance. In the village, the generating station's contribution to airborne contaminant levels would be negligible, and no odors from the generating station would be noticeable.

Assessment of residual impact

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

During the operation phase of the new generating station, the existing thermal generating station, located in the village of Kangiqsujuaq, will be dismantled. Following the commissioning of the new thermal generating station, a significant improvement in air quality in the village is anticipated due to the distance of the new generating station from the village. Overall, the project's impact on air quality is therefore considered to be positive. Its magnitude is considered to be moderate, its scope, local, and its duration, long. The significance of the (positive) residual impact on air quality will be moderate.

6.8.2 Greenhouse gases and climate change

Present conditions

Building and domestic water heating systems fueled by oil, as well as the generation of electricity from the thermal generating station (diesel gensets), are the main sources of GHG emissions in the Kangiqsujuaq area.

Anticipated construction-phase impacts and mitigation measures

Most of the GHG emissions to the atmosphere will come from the exhaust of land vehicles (on- and off-road) used in the construction of the new Kangiqsujuaq generating station.

An estimate was therefore established for the GHG emissions related to the construction of the generating station. To this end, fossil fuel consumption (gasoline and diesel) was estimated based on the expected number of hours during which fuel-burning equipment will be used. 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.

In addition, consumption data for each type of equipment or a comparable type were extracted from manufacturers' technical data sheets. Emission factors (EF) from Annex 6 of Part 2 of the *National Inventory Report 1990–2020: Greenhouse Gas Sources and Sinks in Canada* were used to calculate project-related GHG emissions (ECCC, 2022b). The global warming potentials drawn from the report of the Intergovernmental Panel on Climate Change (IPCC) were used for the calculation.

During the Kangiqsujuaq generating station construction phase, the consumption of fossil fuels (gasoline and diesel) is estimated at 743,340 L. Combustion of these volumes will emit approximately 1,960 t CO_2 eq. into the atmosphere over the entire project period (see Table 6-3). Table 6-4 shows the detailed GHG emissions for the project.

Table 6-3: Summary of Hours, Total Fuel Consumption and GHG Emissions for the New Kangiqsujuaq Generating Station

Activity	Estimated hours	Fuel consumption (litres)	Emissions t CO_2 eq.
Use of equipment (gasoline and diesel)	50,633	743,340	1,960

Table 6-4: Detailed Hours, Total Fuel Consumption and GHG Emissions for the New Kangiqsujuaq Generating Station

Project phases and equipment	Estimated hours	Fuel consumption (litres)	Emissions t CO_2 eq.
Handling of granular materials and earthwork	2.42E+04	4.70E+05	1.25E+03
Dump truck, 12-wheel	5.00E+03	1.90E+05	5.18E+02
CAT 330CL hydraulic trackhoe excavator (1.60 m^3)	3.03E+03	6.12E+04	1.64E+02
3/4-t 4X4 pickup truck	7.79E+01	6.95E+02	1.61E+00
Concrete mixer, 7.6 m^3	1.51E+02	2.26E+03	6.17E+00
Vibratory plate compactor, 13,500 lb. (28")	1.61E+03	1.02E+03	2.74E+00
CAT D4-C tracked bulldozer 58 kW 78 HP	5.67E+00	4.91E+01	1.32E-01
CAT 416-D or CASE 580 backloader (1.00 m^3)	7.23E+01	3.86E+02	1.04E+00
76 to 115 mm ROC F7 hydr. drill without tip	6.60E+02	1.50E+04	4.04E+01
CAT 953C track loader (1.85 m^3)	2.72E+03	3.48E+04	9.35E+01
Pioneer SN3042 primary crusher	1.00E+03	1.91E+04	5.13E+01
Pioneer M4840 Secondary crusher	1.00E+03	1.91E+04	5.13E+01
Mobile concrete plant and 250 kW generator	1.32E+01	5.52E+02	1.48E+00
GMC J8C042 bucket truck with auger	1.71E+02	5.15E+03	1.38E+01
CASE 580-I backhoe loader (0.67 m^3)	1.71E+02	1.43E+03	3.85E+00
Small tools	1.88E+01	0.00E+00	0.00E+00
CAT D6-H tracked bulldozer, 123 kw (165 HP)	1.99E+03	3.28E+04	8.82E+01
1-t 4x4 pickup truck	3.93E+03	3.53E+04	8.19E+01
BOMAG 9.0-t tandem roller (BW160AD)	1.61E+03	1.69E+04	4.53E+01
MANITEX 35100 31.8 t flatbed truck with crane	5.43E+02	2.74E+04	7.38E+01
Compressor, 250 CFM (117.9L/S)	3.27E+02	2.59E+03	6.95E+00
TRAMAC BRH625 hydraulic breaker, for CAT215 excavator	1.13E+02	4.42E+03	0.00E+00
Construction of the generating station	2.64E+04	2.74E+05	7.15E+02
Telescopic boom lift, gasoline-powered (40')	4.05E+03	5.64E+04	1.52E+02
12-wheel dump truck	1.16E+02	4.39E+03	1.20E+01
3/4-t 4X4 pickup truck	2.24E+03	1.99E+04	4.62E+01

Table 6-4: Detailed Hours, Total Fuel Consumption and GHG Emissions for the New Kangiqsujuaq Generating Station (*continued*)

Project phases and equipment (*continued*)	Estimated hours (*continued*)	Fuel consumption (litres) [*continued*]	Emissions t CO_2 eq. (*continued*)
Concrete mixer (7.6 m^3)	5.15E+02	7.73E+03	2.11E+01
CAT 311D hydraulic excavator (0.59 m^3)	1.01E+02	8.96E+02	2.41E+00
Vibratory plate compactor, 13,500 lb (28")	1.38E+02	8.70E+01	2.34E-01
MANITEX 30124C 27.0 t flatbed truck with crane	3.60E+01	1.33E+03	3.58E+00
Concrete polisher 1,200 mm (gasoline)	3.60E+02	6.39E+02	1.65E+00
Forklift 5,600 to 7,300 kg	3.36E+03	4.39E+04	1.18E+02
Grove RT640E 36.3 t 4x4 mobile (rough terrain) hydraulic crane	9.40E+02	1.63E+04	4.37E+01
Mobile concrete plant + 250-kW generator	2.24E+01	9.36E+02	2.52E+00
Small tools	2.53E+03	0.00E+00	0.00E+00
Electric welder 650 A, DC	1.20E+02	0.00E+00	0.00E+00
50-t truck tractor, 400HP	2.40E+01	9.60E+02	2.58E+00
50-t to 64-t flatbed truck	2.40E+01	0.00E+00	0.00E+00
Telescopic boom lift (85')	4.14E+02	1.56E+04	4.19E+01
1-t 4x4 pickup truck	4.11E+03	3.70E+04	8.57E+01
MANITEX 35100 31.8 t flatbed truck with crane	6.63E+02	3.35E+04	9.01E+01
Compressor, 250 CFM (117.9 L/S)	1.56E+01	1.23E+02	3.31E-01
Compressor, 1,600 to 2,000 CFM (775 to 943 L/S)	4.00E+00	1.79E+02	4.82E-01
28-m truck-mounted concrete boom pump (80 m^3/h)	2.54E+02	3.75E+03	1.01E+01
1.20 m^3 JD-710 or CASE 780C backhoe loader	3.73E+01	3.92E+02	1.05E+00
Forklift, 3,100 to 5,500 kg	8.11E+02	2.00E+04	5.37E+01
400-A DC towable diesel welder	5.00E+01	1.88E+02	5.05E-01
Sanvik DC301R hydraulic drill (38 to 64 mm)	4.00E+01	1.15E+02	3.09E-01
Various tools	4.98E+03	0.00E+00	0.00E+00
Grove RT-770E 50-t 4x4 mobile (rough terrain) hydraulic crane	1.44E+02	3.46E+03	9.30E+00
200HP 20-t tractor truck	1.50E+02	3.00E+03	8.07E+00
CAT 963C track loader (2.45 m^3 bucket)	1.50E+02	2.37E+03	6.38E+00
MANITEZ 1440 12.7-t flatbed truck + crane	2.13E+01	4.05E+02	1.09E+00
Grand total	**5.06E+04**	**7.44E+05**	**1.96E+03**

Operation phase of the new Kangiqsujuaq generating station

This energy transition project will transform the production mode of this system (currently using diesel) into a hybrid diesel-wind-solar-battery mode. To do this, the new generating station will be designed to easily integrate wind energy and battery storage. To meet part of the building's energy demand, 35 solar panels will also be installed on the front of the generating station.

During the operation phase, the fuel consumption quantities are estimated according to two wind power penetration scenarios: the first, called "pessimistic," with 38% wind power (see Table 6-5), and the second, called "optimistic," with 54% wind power integrated (see Table 6-6). In both cases, the energy savings associated with the solar energy produced by the panels are also included.

This new production mode will considerably reduce GHG emissions, by approximately 37% to 52%. This represents savings of 35 and 49 million litres of fuel, respectively, for the two wind power penetration scenarios, over the 50-year life of the project (see Table 6-8). The GHG emission rate was calculated based on the actual measured value of the fuel delivered, i.e., 2,626 kg/L. In addition, Table 6-7 shows the reference values for comparison, i.e., maintaining the existing generating station in diesel operating mode.

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.). Emissions linked to machinery fuel consumption are not quantifiable, since the work involved is highly variable, but they are deemed negligible.

Table 6-5: Estimated Fuel Consumption and GHG Emissions for the New Kangiqsujuaq Generating Station (Hybrid Diesel-Battery-Solar Mode) Coupled with Wind Energy – Pessimistic Scenario, 38% of Penetration Level of Wind-Power Generation

Year	Diesel fuel consumption (litres)	Diesel savings with solar power (litres)	Emissions t CO_2 eq.
2028	1.15E+06	5.77E+03	3.03E+03
2029	1.16E+06	5.77E+03	3.06E+03
2030	1.17E+06	5.76E+03	3.08E+03
2031	1.19E+06	5.75E+03	3.13E+03
2032	1.21E+06	5.75E+03	3.18E+03
2033	1.22E+06	5.74E+03	3.21E+03

Table 6-5: Estimated Fuel Consumption and GHG Emissions for the New Kangiqsujuaq Generating Station (Hybrid Diesel-Battery-Solar Mode) Coupled with Wind Energy – Pessimistic Scenario, 38% of Penetration Level of Wind-Power Generation *(continued)*

Year (*continued*)	Diesel fuel consumption (litres) [*continued*]	Diesel savings with solar power (litres) [*continued*]	Emissions t CO_2 eq. (*continued*)
2034	1.24E+06	5.74E+03	3.25E+03
2035	1.25E+06	5.74E+03	3.29E+03
2036	1.26E+06	5.74E+03	3.32E+03
2037	1.29E+06	5.72E+03	3.38E+03
2038	1.30E+06	5.72E+03	3.40E+03
2039	1.33E+06	5.72E+03	3.49E+03
2040	1.35E+06	5.72E+03	3.54E+03
2041	1.36E+06	5.71E+03	3.58E+03
2042	1.38E+06	5.71E+03	3.62E+03
2043	1.40E+06	5.72E+03	3.68E+03
2044	1.42E+06	5.70E+03	3.73E+03
2045	1.42E+06	5.69E+03	3.73E+03
2046	1.45E+06	5.69E+03	3.81E+03
2047	1.45E+06	5.69E+03	3.81E+03
2048	1.48E+06	5.69E+03	3.89E+03
2049	1.49E+06	5.70E+03	3.91E+03
2050	1.49E+06	5.68E+03	3.92E+03
2051	1.52E+06	5.68E+03	3.99E+03
2052	1.53E+06	5.68E+03	4.02E+03
2053	1.53E+06	5.67E+03	4.02E+03
2054	1.54E+06	5.69E+03	4.04E+03
2055	1.55E+06	5.67E+03	4.07E+03
2056	1.56E+06	5.67E+03	4.09E+03
2057	1.56E+06	5.67E+03	4.11E+03
2058	1.57E+06	5.67E+03	4.13E+03
2059	1.58E+06	5.69E+03	4.14E+03
2060	1.60E+06	5.66E+03	4.19E+03
2061	1.59E+06	5.66E+03	4.17E+03
2062	1.59E+06	5.67E+03	4.18E+03

Table 6-5: Estimated Fuel Consumption and GHG Emissions for the New Kangiqsujuaq Generating Station (Hybrid Diesel-Battery-Solar Mode) Coupled with Wind Energy – Pessimistic Scenario, 38% of Penetration Level of Wind-Power Generation (*continued*)

Year (*continued*)	Diesel fuel consumption (litres) [*continued*]	Diesel savings with solar power (litres) [*continued*]	Emissions t CO_2 eq. (*continued*)
2063	1.61E+06	5.69E+03	4.22E+03
2064	1.62E+06	5.67E+03	4.25E+03
2065	1.64E+06	5.67E+03	4.29E+03
2066	1.65E+06	5.67E+03	4.33E+03
2067	1.67E+06	5.67E+03	4.37E+03
2068	1.68E+06	5.67E+03	4.41E+03
2069	1.70E+06	5.67E+03	4.46E+03
2070	1.71E+06	5.67E+03	4.50E+03
2071	1.73E+06	5.67E+03	4.54E+03
2072	1.74E+06	5.67E+03	4.58E+03
2073	1.76E+06	5.67E+03	4.62E+03
2074	1.78E+06	5.67E+03	4.67E+03
2075	1.79E+06	5.68E+03	4.71E+03
2076	1.81E+06	5.68E+03	4.75E+03
2077	1.83E+06	5.68E+03	4.80E+03
Total	7.49E+07	2.85E+05	1.92E+05

Table 6-6: Estimated Fuel Consumption and GHG Emissions for the New Kangiqsujuaq Generating Station (Hybrid Diesel-Battery-Solar Mode) Coupled with Wind Energy – Optimistic Scenario, 54% of Penetration Level of Wind-Power Generation

Year	Diesel fuel consumption (litres)	Diesel savings with solar power (litres)	Emissions t CO_2 eq.
2028	7.35E+05	5.77E+03	1.93E+03
2029	7.49E+05	5.77E+03	1.97E+03
2030	7.69E+05	5.76E+03	2.02E+03
2031	7.88E+05	5.75E+03	2.07E+03
2032	8.12E+05	5.75E+03	2.13E+03
2033	8.29E+05	5.74E+03	2.18E+03

Table 6-6: Estimated Fuel Consumption and GHG Emissions for the New Kangiqsujuaq Generating Station (Hybrid Diesel-Battery-Solar Mode) Coupled with Wind Energy – Optimistic Scenario, 54% of Penetration Level of Wind-Power Generation (*continued*)

Year (*continued*)	Diesel fuel consumption (litres) [*continued*]	Diesel savings with solar power (litres) [*continued*]	Emissions t CO_2 eq. (*continued*)
2034	8.51E+05	5.74E+03	2.24E+03
2035	8.72E+05	5.74E+03	2.29E+03
2036	9.00E+05	5.74E+03	2.36E+03
2037	9.18E+05	5.72E+03	2.41E+03
2038	9.42E+05	5.72E+03	2.47E+03
2039	9.66E+05	5.72E+03	2.54E+03
2040	9.96E+05	5.72E+03	2.62E+03
2041	1.02E+06	5.71E+03	2.67E+03
2042	1.04E+06	5.71E+03	2.73E+03
2043	1.06E+06	5.72E+03	2.79E+03
2044	1.09E+06	5.70E+03	2.87E+03
2045	1.11E+06	5.69E+03	2.90E+03
2046	1.12E+06	5.69E+03	2.95E+03
2047	1.14E+06	5.69E+03	3.00E+03
2048	1.16E+06	5.69E+03	3.05E+03
2049	1.17E+06	5.70E+03	3.07E+03
2050	1.18E+06	5.68E+03	3.10E+03
2051	1.20E+06	5.68E+03	3.14E+03
2052	1.22E+06	5.68E+03	3.19E+03
2053	1.22E+06	5.67E+03	3.21E+03
2054	1.23E+06	5.69E+03	3.24E+03
2055	1.24E+06	5.67E+03	3.27E+03
2056	1.26E+06	5.67E+03	3.31E+03
2057	1.26E+06	5.67E+03	3.32E+03
2058	1.27E+06	5.67E+03	3.34E+03
2059	1.28E+06	5.69E+03	3.36E+03
2060	1.30E+06	5.66E+03	3.41E+03
2061	1.30E+06	5.66E+03	3.41E+03
2062	1.31E+06	5.67E+03	3.43E+03

Table 6-6: Estimated Fuel Consumption and GHG Emissions for the New Kangiqsujuaq Generating Station (Hybrid Diesel-Battery-Solar Mode) Coupled with Wind Energy – Optimistic Scenario, 54% of Penetration Level of Wind-Power Generation (*continued*)

Year (*continued*)	Diesel fuel consumption (litres) [*continued*]	Diesel savings with solar power (litres) [*continued*]	Emissions t CO_2 eq. (*continued*)
2063	1.31E+06	5.69E+03	3.45E+03
2064	1.32E+06	5.67E+03	3.47E+03
2065	1.33E+06	5.67E+03	3.48E+03
2066	1.33E+06	5.67E+03	3.50E+03
2067	1.34E+06	5.67E+03	3.52E+03
2068	1.35E+06	5.70E+03	3.54E+03
2069	1.36E+06	5.67E+03	3.56E+03
2070	1.36E+06	5.67E+03	3.58E+03
2071	1.37E+06	5.67E+03	3.60E+03
2072	1.38E+06	5.67E+03	3.62E+03
2073	1.39E+06	5.67E+03	3.64E+03
2074	1.40E+06	5.67E+03	3.66E+03
2075	1.40E+06	5.68E+03	3.68E+03
2076	1.41E+06	5.68E+03	3.70E+03
2077	1.42E+06	5.68E+03	3.73E+03
Total	5.78E+07	2.85E+05	1.52E+05

Table 6-7: Estimated Fuel Consumption and GHG Emissions from the Existing Generating Station in Diesel Operating Mode

Year	Diesel fuel consumption (litres)	Emissions t CO_2 eq.
2028	1.74E+06	4.56E+03
2029	1.76E+06	4.62E+03
2030	1.79E+06	4.70E+03
2031	1.82E+06	4.79E+03
2032	1.87E+06	4.90E+03
2033	1.89E+06	4.96E+03
2034	1.92E+06	5.05E+03

Table 6-7: Estimated Fuel Consumption and GHG Emissions from the Existing Generating Station in Diesel Operating Mode (*continued*)

Year (*continued*)	Diesel fuel consumption (litres) [*continued*]	Emissions t CO_2 eq. (*continued*)
2035	1.96E+06	5.14E+03
2036	2.01E+06	5.27E+03
2037	2.03E+06	5.33E+03
2038	2.07E+06	5.42E+03
2039	2.10E+06	5.51E+03
2040	2.15E+06	5.65E+03
2041	2.17E+06	5.70E+03
2042	2.21E+06	5.81E+03
2043	2.24E+06	5.87E+03
2044	2.29E+06	6.01E+03
2045	2.30E+06	6.04E+03
2046	2.33E+06	6.12E+03
2047	2.35E+06	6.17E+03
2048	2.39E+06	6.28E+03
2049	2.40E+06	6.30E+03
2050	2.41E+06	6.34E+03
2051	2.43E+06	6.39E+03
2052	2.47E+06	6.48E+03
2053	2.46E+06	6.47E+03
2054	2.48E+06	6.52E+03
2055	2.49E+06	6.55E+03
2056	2.53E+06	6.64E+03
2057	2.52E+06	6.61E+03
2058	2.54E+06	6.67E+03
2059	2.54E+06	6.68E+03
2060	2.57E+06	6.76E+03
2061	2.57E+06	6.75E+03
2062	2.57E+06	6.76E+03
2063	2.59E+06	6.80E+03
2064	2.60E+06	6.84E+03

Table 6-7: Estimated Fuel Consumption and GHG Emissions from the Existing Generating Station in Diesel Operating Mode (*continued*)

Year (*continued*)	Diesel fuel consumption (litres) [*continued*]	Emissions t CO_2 eq. (*continued*)
2065	2.62E+06	6.88E+03
2066	2.64E+06	6.92E+03
2067	2.65E+06	6.96E+03
2068	2.67E+06	7.01E+03
2069	2.68E+06	7.05E+03
2070	2.70E+06	7.09E+03
2071	2.72E+06	7.13E+03
2072	2.73E+06	7.18E+03
2073	2.75E+06	7.22E+03
2074	2.77E+06	7.26E+03
2075	2.78E+06	7.31E+03
2076	2.80E+06	7.35E+03
2077	2.82E+06	7.40E+03
Total	1.19E+08	3.12E+05

Table 6-8: Estimated Fuel Savings and GHG Emission Reductions Corresponding to the Two Scenarios of Penetration Level of Wind Power Over 40 Years

Scenario	Fuel economy (litres)	Reduction of GHG emissions t CO_2 eq.	Reduction of GHG emissions (%)
38% penetration level of wind power	35,085,237	92,136	37.3
54% penetration level of wind power	48,846,071	128,273	51.9

Specific mitigation measures

The following mitigation measures will be implemented to reduce GHG emissions from the sources presented in Section 6.4 for the construction and operation phases of the Kangiqsujuaq generating station.

Excavation

- The reusable excavated material will be used to restore the land around the generating station, which will reduce heavy trucking for removing excavated material and, consequently, GHG emissions.

Expenditure

- Equipment will be maintained according to a maintenance plan based on manufacturers' recommendations and Hydro-Québec's experience with this type of equipment. Maintenance work will be carried out without any interruption to customer service.
- The solar panels installed on the front of the generating station to meet part of the building's energy demand will result in an estimated total reduction of 614 t CO_2 eq. over the life of the project (see Table 6-5).
- The transition from the current diesel generation to a hybrid diesel-wind-solar-battery mode will reduce GHG emissions by approximately 37% to 52% over 50 years, depending on the wind power penetration scenario (see Table 6-8).

Assessment of residual impact

During construction, the magnitude of the impact is considered to be low and its scope, limited, since most of the work will take place at the site of the new generating station. Also, the duration of the impact will be short, i.e., proportional to certain construction activities. The potential residual impact of the construction phase on GHGs and climate change is considered to be minor.

Furthermore, the reduction of GHG emissions during the operation phase of the new generating station is considered to be a positive impact of low magnitude. Its scope will be local, and its duration, long. The significance of the positive impact will therefore be moderate.

6.8.3 Soundscape

Present conditions

The existing Kangiqsujuaq generating station is located north of the village. No recent noise measurements have been taken in the village. However, the lack of industrial activity suggests that residual noise levels in the village are relatively low, particularly in the middle of the night. In this study, residual noise levels are assumed to be below 40 dBA at night and 45 dBA during the day.

Anticipated construction-phase impacts and mitigation measures

The construction of the new generating station will result in increased noise emissions in the village and may therefore cause disturbances for residents. The most sensitive areas affected are the residences adjacent to the road leading from the unloading dock to the site of the new generating station. The loudest noise will be from truck traffic from the wharf or borrow pits to the site of the new generating station. Given the distance between the site of the new facility and the village, machinery work at the construction site (excavation, backfilling, etc.) will have a low impact.

General and specific mitigation measures

These impacts will be minimized by implementing the general mitigation measures in Hydro-Québec's SEC 2 (Noise) (see Appendix C) and the following specific mitigation measures:

- Inform residents, especially those on streets near the wharf, of the period and times of the construction work before it begins.
- Set up a telephone line to inform the population of the progress of the work and deal with requests relating to specific problems.
- Plan work schedules taking into account the disturbance caused by noise. The construction work will be carried out every day between 7 a.m. and 7 p.m.
- Educate workers, especially truckers, about noise emissions near residences (e.g., prohibit idling of unused vehicles and the use of Jake brakes at the work site and on nearby streets).
- Locate stationary equipment (such as compressors and generators) and other noisy construction equipment as far as possible from the nearest sensitive areas (residences).
- Use variable intensity reversing alarms (automatic adjustment according to ambient noise level) on construction equipment that is likely to reverse frequently.
- Establish a traffic pattern that takes into account the issue of noise from vehicles entering or leaving the work area (e.g., avoid crossing or skirting residential areas whenever possible).

Anticipated operation-phase impacts and mitigation measures

Simulations were carried out using a digital model developed with the specialized software SoundPLAN® (version 8.1), and the noise level of the generating station was calculated according to the ISO 9613-2 method. By calculating the sound attenuation, it is possible to predict the noise level under meteorological conditions that are favorable to the propagation of sound from its emission sources to its receivers. These conditions consist of propagation either downwind or under a well-developed moderate temperature inversion at ground level, as commonly occurs at night. The method takes into account geometric divergence, atmospheric absorption, the effect of hard or porous soil, reflection from surfaces, the

screening effect of buildings and terrain, and other factors, such as the presence of vegetation.

Noise emissions from the generator building envelope that are transmitted to the outside through the walls of the engine compartments and through ventilation openings, and emissions from fuel combustion exhaust, the ventilation of cooling air intake and exhaust, and chillers were assessed. See Appendix D for the noise study report.

Specific mitigation measures

The noise study identified a set of specific mitigation measures that will be implemented to bring the new generating station into compliance with Instructional Note (NI) 98-01 after commissioning.

The following measures are integrated directly into the generating station design:

- the use of a building envelope with enhanced sound performance through the use of rockwool sandwich panels with a sound transmission class (STC) rating of over 32
- the use of a high-grade silencer, with a noise reduction of approximately 50 dBA, for the exhaust outlet of new engines
- radiators emitting no more than 98 dBA of sound power each

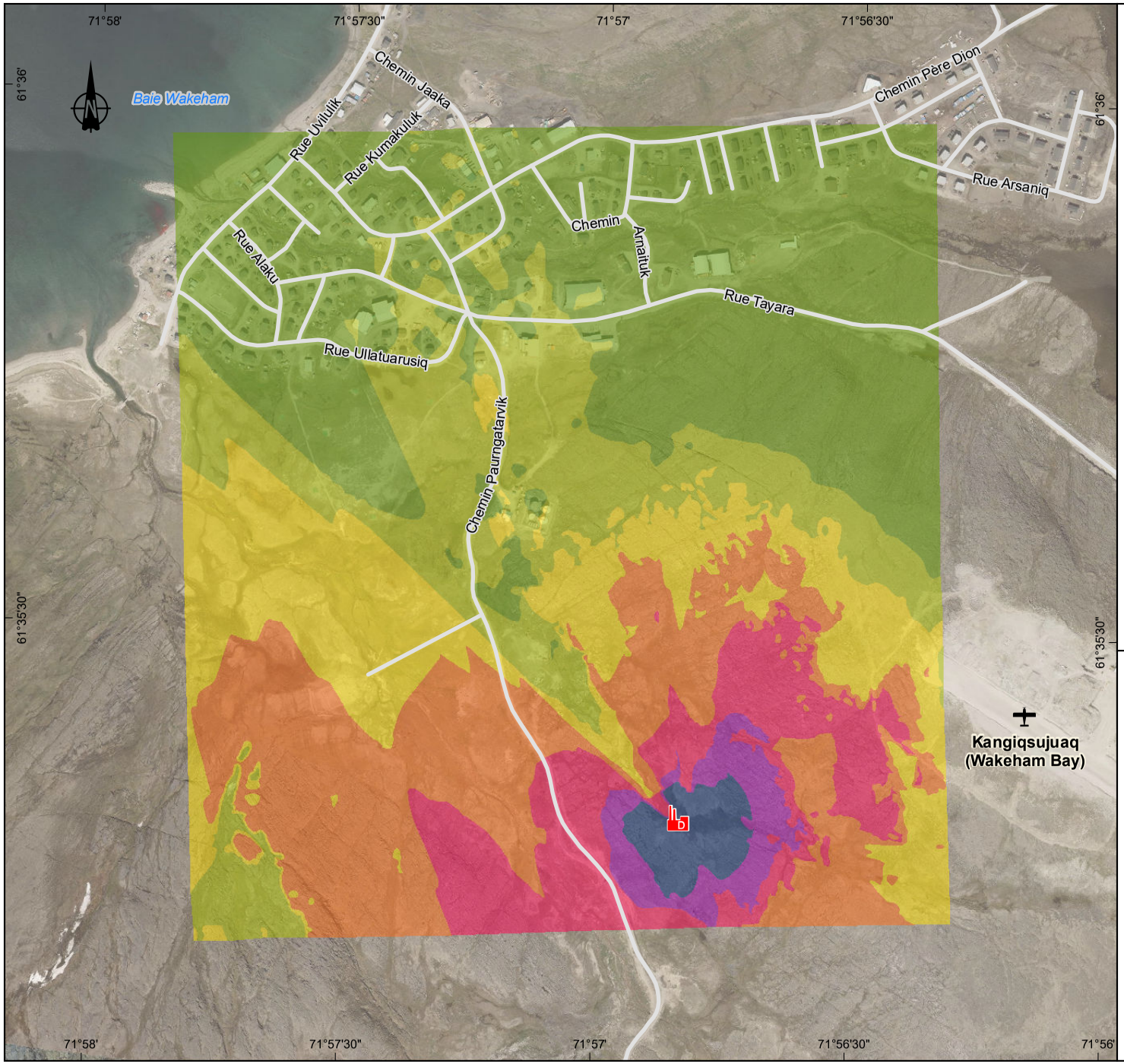
If noise levels are exceeded, the measures that can be added to the final design of the generating station at the detailed engineering stage are as follows:

- installing a noise-absorbing silencer on the air intake duct (noise reduction coefficient [NRC] of 1)
- adding acoustic lagging to the wall penetrations at the base of the engine exhaust silencer (if needed)
- using acoustic louvres at air outlet openings with the minimum insertion losses shown in Table 6-9

Table 6-9: Insertion Loss by Frequency

Frequency (Hz)	Insertion loss (dB)
63	7
125	7
250	7
500	8
1,000	11
2,000	15
4,000	14
8,000	14

The implementation of these mitigation measures ensures compliance with NI 98-01 criteria. Sound monitoring is recommended after the generating station is commissioned. The results of the noise simulations are shown graphically on maps 6-1 and 6-2.



Project components

Planned thermal generating station

Noise level at 1.5 m from the ground in dBA

60
55
50
45
40
35
30

New generating station in Kangiqsujuaq

Expected Sound Levels from the Normal Operation of the Generating Station in Winter, During the Day

Sources:

Orthophoto, resolution 7 cm, MERN Québec,
© Gouvernement du Québec, 2016
Adresses Québec, MERN Québec, April 1, 2021
Project data, Hydro-Québec, May 2023

Modeling: Hydro-Québec
Mapping: SNC-Lavalin
File: 5119_eic6_1_slq_008_bruit_jour_230710a.mxd

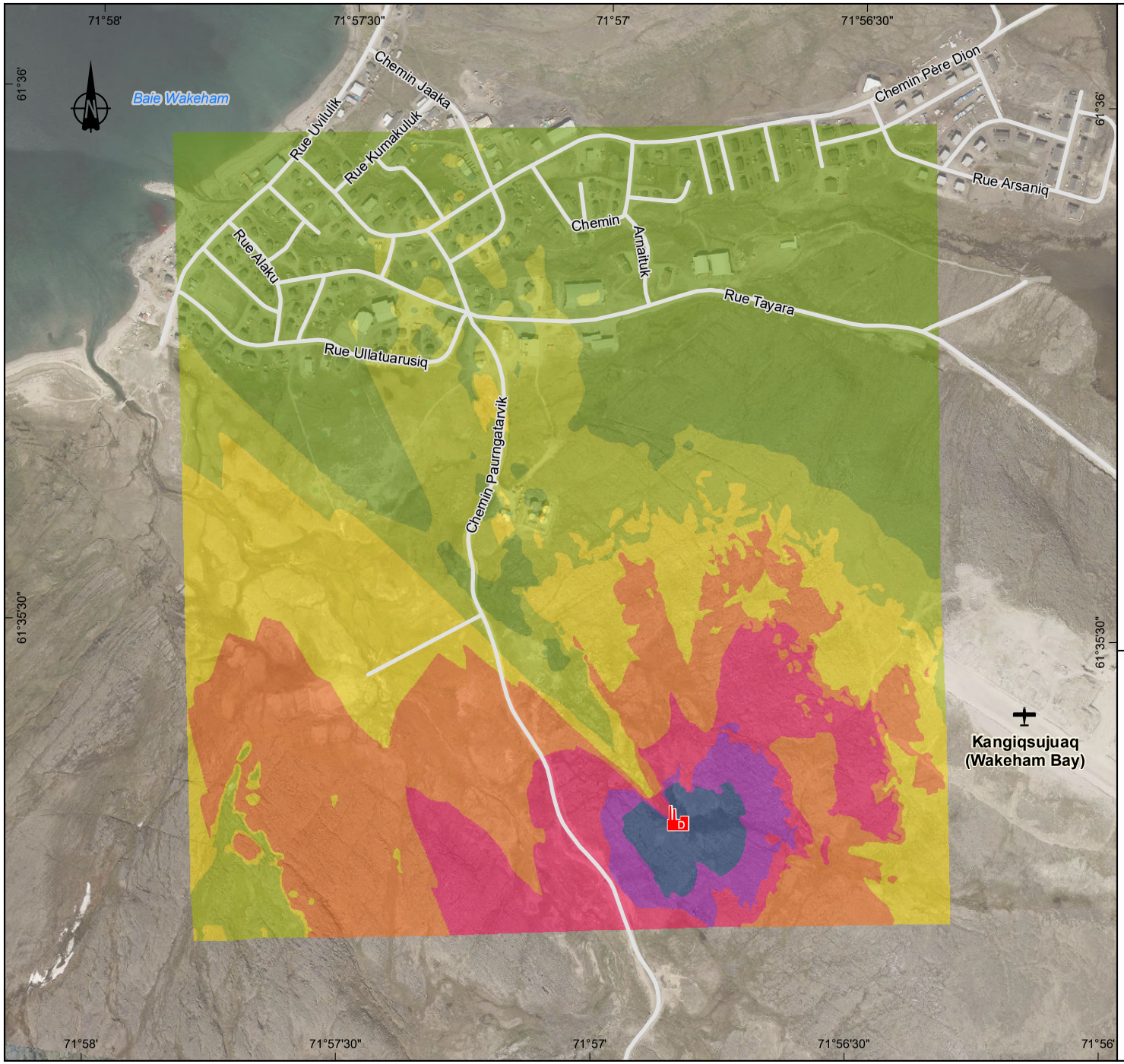
0 100 200 m

MTM, Zone 7, NAD83 (CSRS)

Map 6-1

July 2023

Hydro Québec



Project components

Planned thermal generating station

Noise level at 1.5 m from the ground in dBA

60
55
50
45
40
35
30

New generating station in Kangiqsujuaq

Expected Sound Levels from the Normal Operation of the Generating Station in Winter, During the Night

Sources:

Orthophoto, resolution 7 cm, MERN Québec,
© Gouvernement du Québec, 2016
Adresses Québec, MERN Québec, April 1, 2021
Project data, Hydro-Québec, May 2023

Modeling: Hydro-Québec
Mapping: SNC-Lavalin
File: 5119_eic6_2_slq_009_bruit_nuit_230710a.mxd

0 100 200 m
MTM, Zone 7, NAD83 (CSRS)

Map 6-2

July 2023

Hydro Québec

Assessment of residual impact

During construction, the magnitude of the residual impact on the soundscape is considered to be low, and its duration, short, since the noisiest activities will be related to trucking from the wharf or borrow pits to the construction site. The residual impact is considered to be minor during the construction phase.

During operation, the implementation of the specific planned mitigation measures will make it possible to maintain noise levels below those emitted by the existing generating station in the sensitive areas most exposed to noise. The residual impact on the soundscape is positive during the operation phase, since the current situation is improved and the noise level is below 40 dB near residential areas.

6.8.4 Infrastructure and services

Present conditions

As mentioned in Section 5.5.4.1, there is one airport in the extended study area, located southeast of the village (see Map A, pocket insert). The village of Kangiqsujuaq is served by a local network of paved roads, which allows for movement within the community and does not connect with any other communities in Nunavik. There is also a commercial wharf and boat launch, as well as the existing thermal generating station and a pipeline that transports fuel from the village's supply boat to the fuel farm south of the village (see Map A, pocket insert). The village also has a northern landfill site (NLS) in addition to sewage lagoons. Finally, a garage-warehouse, including outdoor storage space for heavy machinery and containers, is currently under construction just southeast of the site of the new generating station. The facility will also be used to teach courses in mechanics and heavy machinery operation until 2030–2035.

Anticipated construction-phase impacts and mitigation measures

The transport and traffic generated by the construction activity may disrupt local traffic and contribute to the deterioration of roads used by the local population and land users. The degree of disturbance will depend primarily on the location of the borrow pits to be mined by the project and the route of the trucks (approximately 1,200 10-wheel truckloads over a period of approximately 12 weeks) required to transport the material to the site of the future generating station. The existing borrow pits are located northeast, east and south of the village of Kangiqsujuaq. Using the borrow pits to the northeast of the village will force the trucks to drive greater distances and travel through the village. To a lesser degree, the transport of equipment and construction materials from the Kangiqsujuaq wharf will contribute to the disturbance of local traffic.

Local traffic disruptions will be felt by residents and land users, and may temporarily and occasionally affect certain public services (police, fire, drinking water supply, wastewater transport, waste transport, school bus transportation, etc.). Use of the garage/warehouse will

also be temporarily and occasionally disrupted, as the same road will have to be used to access the new generating station. The application of clause 15 of the SECs will mitigate this impact and guarantee the maintenance and protection of roadways for the duration of the construction phase.

During construction of the generating station, between 19 and 30 workers are expected to be employed between spring 2026 and fall 2027. Workers from outside the community, who will be present during the construction phase, will be housed in available camps in the village or in a camp set up by the contractor. Their presence will not significantly affect the community's existing housing infrastructure, whether permanent or temporary (e.g., hotel accommodation).

However, the local supply of various products and services needed by workers could put additional pressure on the availability of these products and services for the community of Kangiqsujuaq. Workers in the camp will have access to health services, drinking water, fuel for vehicles and machinery, and energy sources for construction throughout the duration of the construction work.

Waste generated by the construction work (wood, wool, gypsum, metal, etc.; approx. 300 m^3) could be sent to the Kangiqsujuaq northern landfill site (LEMN) after agreement with the community, while hazardous waste will be sent to southern Québec for treatment.

General mitigation measure

The application of SEC 15 (Plant and traffic) 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 who are expected in the community.
- Establish a plan for transporting equipment and materials, in collaboration with the municipal council.
- Ensure that signage is adequate (Inuit-friendly language and visual references) and that vehicles are clearly visible.
- If necessary, use signalers or a safety escort during maneuvers by trucks or oversize loads.
- Ensure that external contractors obtain and are aware of the code of conduct.

Anticipated operation-phase impacts and mitigation measures

Apart from the supply of fuel to the generating station by tanker truck, there will be no significant increase in traffic during the generating station's operation phase, especially as the planned generating station is located outside the village center and closer to the fuel

depot; traffic generated by the supply of fuel to the generating station by tanker truck will even be reduced. During the operation phase, waste will be managed in the same manner as at the existing generating station. The municipality of Kangiqsujuaq will take charge of domestic waste and send it to Kangiqsujuaq's NLS, while hazardous waste (used oil, empty aerosol cans, etc.) will be sorted and stored on the generating station site before being shipped to recovery facilities in southern Québec for treatment. The capacity of Kangiqsujuaq's other infrastructure components and services (roads, housing, landfill site, etc.) will be sufficient to meet the project's future needs, given the nature and scope of activities at the generating station, the number of employees who will be hired (two permanent employees) and the end of operations at the existing thermal generating station. The operation of the generating station is not expected to have an impact on Kangiqsujuaq's infrastructure and services.

Assessment of residual impact

During the construction phase, the impacts are mainly related to increased truck traffic, depending on the location of the borrow pits. This increased traffic may temporarily and occasionally affect the local road network. This nuisance will be temporary and occasional. Thus, the magnitude of the impact on the community's infrastructure and services is considered to be low. Its scope is local and its duration is medium, since the impact is limited to the construction phase. The significance of the impact is therefore minor.

Since no impact is expected on the infrastructure and services of the community of Kangiqsujuaq during the operation phase, there will be no residual impact during this phase.

6.8.5 Land use

Present conditions

The planned site for the new generating station is located just over 1.0 km from the Kangiqsujuaq community center, between the access road (Chemin Paurngatarvik) leading to the drinking water intake, the airport (to the east), an extraction site (to the south) and the village (to the north). It lies outside the potential development areas indicated on Kangiqsujuaq's most recent zoning map (KRG, 2009). However, Kangiqsujuaq is planning an expansion to the south and southeast of the existing village, where potential development areas have also been identified (see Map A, pocket insert). In addition, the Kangiqsujuaq municipal council accepted the choice of site for the new generating station and, on October 6, 2022, sent Hydro-Québec a copy of resolution No. 2022-29.

On October 11, 2022, the Nunaturlik Landholding Corporation confirmed the project and Hydro-Québec's site choice. A copy of resolution 2022-49 was sent to Hydro-Québec on October 20, 2022.

The limited study area is not suitable for fishing due to the lack of water bodies. It is, however, used by hunters and a few residents for berry picking. The area is also used for snowmobile and ATV activities.

Anticipated construction-phase impacts and mitigation measures

An increase in truck traffic in and around the village is expected for the transport of equipment and materials from the wharf and borrow pits to the construction site. This temporary increase in traffic may occasionally interfere with access to some land use sites but will not prevent access.

In addition to the increase in traffic, the generating station construction work may disrupt the hunting activities of some users, as some animals are expected to avoid the periphery of the work area. The construction work will prevent any activities on the current site.

Specific mitigation measures

The following specific mitigation measures will be applied:

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

Anticipated operation-phase impacts and mitigation measures

Since other sites are available nearby for traditional hunting and gathering and recreational (snowmobile and ATV use) activities, the presence of the generating station will have no impact on current land use in the limited study area. Hunting will take place in the vicinity of the planned generating station, since game should continue to frequent the area. After a period of adaptation, users should be able to continue their current activities.

Routine activities during generating station operation, such as vehicle and truck traffic to the site to allow for the operation and maintenance of the generating station and fuel supply, will be on a small scale and limited to the village and its immediate surroundings. These activities will remain much the same as those carried out at the existing generating station, which will be dismantled.

Assessment of residual impact

Although the planned site is used by a few members of the community for hunting and gathering activities, it was chosen with the agreement of the local authorities, in line with its municipal development plan. In addition, the project will not affect access to or use of other sites.

During construction, the magnitude of the impact is considered to be low, as activities will have little to no effect on the community's access to or use of the land. The scope of the impact is local, as it will be felt by a limited portion of the population and in a small area, and the duration is short, as the impact will occur only during the construction phase. The significance of the impact during construction is therefore minor.

During operation, routine activities will be the same as those currently carried out at the existing generating station. The magnitude of the impact is therefore considered to be low. The scope of the impact is limited, as it involves only the site of the generating station. The duration of the impact will be medium, since the impact will be felt for a limited period once the generating station is operational, i.e., during a period of adaptation for current users of the area. The significance of the residual impact is therefore minor.

6.8.6 Economic spinoffs

Present conditions

The local economy in Nunavik is characterized by local markets at the community level, a high cost of living and doing business, low consumer purchasing power and a low level of education in the active population. Employment in Kangiqsujuaq is primarily in the fields of sales and service, education, social, community and government services, trades, transportation, machinery, and related occupations. According to the latest available statistics, the unemployment rate in Kangiqsujuaq is 23.7%, which is higher than the rate for all Nunavik communities (15.2%).

Anticipated construction-phase impacts and mitigation measures

During construction of the generating station, between 19 and 30 workers are expected to be employed between spring 2026 and fall 2027. Most of them will come from outside the village of Kangiqsujuaq, but there are plans to hire a few local workers, depending on their availability. The presence of workers from outside the community may generate indirect spinoffs through the purchase of goods and services in the community. It can be expected that these 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 help boost local economic spinoffs. Local suppliers will be required primarily to drive heavy machinery and for the transport and supply of granular materials. At this stage of the project, it is difficult to estimate the number of local workers and the percentage of local economic benefits.

Hydro-Québec will apply its Indigenous Relations policy (*Nos relations avec les autochtones*, 2019), which promotes job training and hiring of Indigenous people.

Specific mitigation measures

The following enhancement measures will be applied:

- Establish incentives for hiring Inuit workers and subcontractors in the community of Kangiqsujuaq.
- Give preference to local providers of goods and services.
- Establish incentives for hiring local Inuit labor. Hydro-Québec reimburses a certain amount per Inuit worker hired (skilled workers, housekeepers, helpers, cooks and others).
- Establish incentives for hiring subcontractors based in Kangiqsujuaq.

Anticipated operation-phase impacts and mitigation measures

The operation phase of the generating station will not generate additional jobs. The new generating station will be operated by the two employees who already operate the existing generating station and who are residents of Kangiqsujuaq. Maintenance of the generating station will be carried out by specialized employees from outside the community, based on pre-established maintenance 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, as well as for fuel supply. As mentioned earlier, the transport 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.

Assessment of residual impact

The construction of the generating station will generate positive economic spinoffs for the community of Kangiqsujuaq during its construction phase. The project is expected to generate a few local jobs for two and a half years, including contracts for local businesses, as well as indirect and induced spinoffs for other businesses and services in the community. For the construction phase, the magnitude of the impact is considered to be low to medium, its scope, local, and its duration, medium. The significance of the positive residual impact is low to medium.

During the operation phase, existing jobs and contracts for local businesses will be maintained. No significant change from the current situation is expected.

6.8.7 Health, safety and quality of life

Present conditions

Communities like Kangiqsujuaq face a number of quality-of-life issues, including food security, a lack of housing, a high cost of living and a high rate of violence. This is reflected in the Community Well-Being (CWB) Index for 2016, as shown in Section 5.5.7. The CWB in Kangiqsujuaq is similar to that of Nunavik.

Anticipated construction-phase impacts and mitigation measures

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 taken between the Kangiqsujuaq wharf or the borrow pits and the work site, the trucks will have to travel at times on residential roads or near high-risk sectors (schools, daycare services, playgrounds, etc.).

Construction of the generating station will require the hiring of approximately 19 to 30 workers, mostly from outside the village of Kangiqsujuaq. This presence will be spread out over a period of almost two and a half years. The presence of outside workers could lead to additional pressure on health services in the Kangiqsujuaq community, as well as negative social impacts, particularly regarding alcohol and drug use or smuggling. They may also raise fears based on past negative experiences related to the presence of workers from outside 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.
- Encourage workers to avoid alcohol or drug use while on construction sites.
- Develop a protocol to follow in the event of a worker’s worsening health problem or a serious accident.

Anticipated operation-phase impacts and mitigation measures

During the operation phase, activities with an impact on health, safety or quality of life will remain more or less the same, since the new generating station will replace the existing one.

Other than truck traffic for the supply of diesel to the generating station, no other potential impacts on the health and safety of Kangiqsujuaq residents are anticipated during this 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 8, Hydro-Québec will also implement safety measures and an emergency measures plan during operation.

No negative impacts on the health and safety of Kangiqsujuaq residents are anticipated. The new generating station's distance from the village will help reduce the current nuisances (noise, air quality) and the health and safety risks associated with the existing generating station.

Assessment of residual impact

Once the mitigation measures are in place, the effects on health, safety and quality of life will be mainly related to the increase in traffic during the construction phase. These are temporary and limited effects. Thus, the magnitude of the impact of construction activities on the health, safety and quality of life of Kangiqsujuaq residents is considered to be low, its scope, local, and its duration, medium. The significance of the residual impact is minor.

In the operation phase, the situation will be comparable to the existing one. Thus, no residual negative impact on the health and safety of Kangiqsujuaq residents is anticipated for this phase.

6.8.8 Archaeology

Present conditions

The study area, the planned study corridor and its access roads do not affect any protected elements or elements of heritage, historical, archaeological or cultural interest. The archaeological potential study carried out in 2022 by the Avataq Cultural Institute identified four areas of archaeological potential in the study area, dating back to the prehistoric (Dorset) and historic (Inuit) periods. One of them, located directly in the construction area of the generating station and related work, was surveyed in July 2022. No archaeological remains were discovered during the archaeological survey carried out on the site in July 2022 Site JjEx-11, located close to the site of the new generating station, will not be affected by the planned construction work, as it has already been destroyed. This observation was made during the archaeological survey.

Anticipated construction-phase impacts and mitigation measures

The potential impacts on archaeological heritage are mainly related to grading, excavation, blasting and earthworks. These activities could damage or destroy archaeological remains.

No archaeological remains were discovered during the archaeological survey carried out in the four identified areas of archaeological potential.

General mitigation measures

As indicated in SEC 19, excavation work will be halted in the event of a chance discovery of remains. Hydro-Québec will then inform the Ministère de la Culture et des Communications du Québec and, with the support of the appropriate authorities, determine what additional mitigation measures (protection, excavation, surveys, etc.) need to be implemented.

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 "vulnerability" to traffic and activities outside the site.

Anticipated operation-phase impacts

No impact on archaeological remains is anticipated during the operation phase.

Assessment of residual impact

In the event that archaeological remains are discovered, recording them will help safeguard the contents of the sites uncovered. However, such recording implies controlled destruction of the archaeological site. Given the planned mitigation measures, i.e., the safeguarding of artifacts, the magnitude of the impact is considered to be low. The extent of the impact is site-specific, since only a small part of the area with archaeological potential is affected. The duration of the impact will be long, as the area would be permanently modified. The significance of the residual impact on this component is therefore considered to be minor.

6.8.9 Landscape

Present conditions

The site of the future generating station is part of a relatively homogeneous landscape, composed mainly of rock outcrops, shrub tundra, wetlands and a few watercourses. The topography is uneven in places; the rocky hill to the north and west of the planned generating station acts as a visual screen for the part of the village to the north.

Anticipated construction-phase impacts

During the construction phase, the stripping, excavation and grading of surfaces for the installation of infrastructure and the construction of the access road will result in landscape disturbance within the limited study area. The presence of trucks and machinery will also contribute. The construction of the generating station, buildings and associated infrastructure will gradually change the landscape of this area. During this period, the construction work will be visible mainly to mobile observers traveling on the access road leading to the village's drinking water intake, the mining sites and the NLS, as well as to land users who frequent this sector mainly for hunting and berry picking, as well as for snowmobile and ATV traffic. The nearest residents in the northwestern residential sector of the village of Kangiqsujuaq are likely to have a permanent but distant view of the work area.

Although no mitigation measures are planned during the construction phase, the magnitude of the impact is low, given that the construction site will be far from the village and that few permanent or regular stationary observers are likely to notice it. The extent of the impact is limited, the duration, medium. The significance of the impact is minor.

Anticipated operation-phase impacts

The new thermal generating station will be built outside the village, in an area where the landscape is already disturbed by the presence of mining sites, the drinking water intake, the access road to the village's infrastructure, the airport, located to the east of the village, as well as other undefined disturbed environments. It will include a building housing the generating sets and smaller associated buildings.

A garage/warehouse is located to the south of the planned generating station, on the existing road, from which access to the generating station will be provided. This infrastructure will be built in a landscape already disturbed by recent construction, offering a moderate degree of incorporation.

Although the project area does not include any sites or viewpoints of recognized aesthetic interest, the higher points offer an open and distant view of the territory and river CE02. The observers most likely to have direct visual access to the new generating station are users of the access road that leads to the NLS, the drinking water intake and the mining sites. These are mobile and occasional observers, however. Stationary observers from the residential

sector northwest of the village of Kangiqsujuaq could have a permanent but distant view (more than 1.0 km away) of the new thermal generating station. The slightly sloped topography and lack of forest cover provide open and direct views from this area. Also, residents who use the territory for hunting and berry picking, as well as for snowmobile and ATV traffic near the planned thermal generating station, are mobile observers likely to see the planned generating station occasionally, but year-round. In light of the above, since the facilities will be barely visible to the main observers in the area, the degree of landscape absorption is high.

In collaboration with Hydro-Québec, the municipality will organize a contest inviting artists from the community to produce an Inuit drawing to be displayed on the front of the generating station building.

Assessment of residual impact

Given the medium blending and high absorption levels described above, the magnitude of the impact on the landscape is considered to be low. The extent of the impact (degree of noticeability) is also considered to be low, given that the infrastructure will only be occasionally noticeable to mobile observers and will remain only slightly noticeable from the village of Kangiqsujuaq, due to the remoteness of the generating station and the presence of a rocky hill creating a visual screen in the northwestern part of the village. The duration of the impact will be long, since it will be felt throughout the life of the facility. The significance of the disturbance to the landscape is considered to be minor. No specific mitigation measures are planned for the operation phase.

6.9 Cumulative impacts

The new thermal generating station project in Kangiqsujuaq is intended to replace an existing thermal generating station that has reached the end of its useful life. The new generating station, while in operation, will have a positive effect on some impacts by moving a source of air pollution and noise currently located within the village to a site over 1.0 km away from it. In addition, the project foresees the installation of the latest generation of more efficient generators, which will lead to a reduction in GHG emissions compared to the current situation.

By incorporating best design practices, complying with environmental standards, optimizing its location to avoid sensitive environments and implementing mitigation measures during construction and operation, this project will have no residual negative impact of major significance on the valued environmental components identified in the study.

Given that the project's residual (negative) impacts are all considered to be of minor residual significance, no cumulative effect is anticipated as a result of the project. 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, present or future projects, activities or events.

7 Environmental overview

The project will result in impacts on the environment. To reduce them as much as possible, Hydro-Québec will apply various mitigation measures, including several that it routinely implements in its projects.

7.1 Biophysical environment

The significance of anticipated residual adverse impacts on each valued component of the biophysical environment is assessed as minor. The valued components selected for the impact assessment are the soil, surface water, wetlands, and caribou and bird populations.

Construction activities for the new generating station, including earthwork, blasting, and foundation construction, will have a minor impact on the surface soil composition and profile. The granular materials will come from existing borrow pits. The soil removed from the work areas will thus be restored without any impact on the permafrost. The only area permanently changed is the area occupied by the new generating station's infrastructure. No impact on soil stability is anticipated during generating station operation, and there will be no effect on existing permafrost. The risk of soil contamination during the construction and operation phases is low.

The presumed flow of surface water in the area is northwest and west, toward a perennial river located 160 m from the generating station and Baie Wakeham, located more than 1.2 km from the generating station site. The closest wetland is located 6.0 m from the limit of the lower slope to be developed.

Minor changes will be made to the site drainage around the generating station during construction and operation. Negligible amounts of sediment will flow to the wetlands and aquatic environments, since the soil is essentially made up of rock and granular materials. In addition, the platform slopes will be protected by riprap and geotextile membranes to prevent erosion. The risk of surface water contamination by petroleum products and oils is low, since current mitigation measures will allow for their proper management and thus prevent accidental release.

No wetlands will be directly affected by construction of the generating station, since the station and the access road avoid all identified wetlands. Two wetland complexes adjacent to the generating station platform may be indirectly affected, mainly in a positive way. Drainage of the site will occur naturally along the slopes and will benefit both complexes, to some extent by providing additional runoff.

The construction of the site of the new generating station will result in a loss of 1.62 ha of natural habitat composed of shrub tundra, a tiny portion of the summer range of the

Leaf River Herd. This habitat is of low quality and is not in itself a habitat of interest for caribou. Construction and operation activities will result in only a slight functional loss of habitat due to avoidance of the work area, from roughly one hundred metres to a few kilometres away. Project activities do not pose a risk of impact to the survival of the species.

Although activities associated with the construction of the new generating station and access road will result in the loss of a surface area of 1.62 ha of habitat, the site is located in an area of low abundance and medium diversity of bird species. The kinds of habitats that will be disturbed are not uncommon locally. Part of the construction work may be carried out during the bird breeding period, which is from May 25 to August 15. However, the probability of a nest being present at the work site is low.

7.1.1 General mitigation measures

During construction of the new thermal generating station, the following general mitigation measures, described in detail in Hydro-Québec's Standard Environmental Clauses (SECs) (2023; see Appendix C), will be applied to reduce impacts on the biophysical environment:

- Clause 1 – General
- Clause 5 – Snow Removal
- Clause 6 – Accidental contaminant spills
- Clause 7 – Drainage
- Clause 9 – Wastewater
- Clause 10 – Excavation and earthwork
- Clause 11 – Drilling and boring
- Clause 15 – Plant and traffic
- Clause 16 – Hazardous materials
- Clause 17 – Waste materials
- Clause 21 – Site restoration
- Clause 22 – Petroleum product tanks and storage facilities
- Clause 23 – Blasting
- Clause 24 – Excavation material management
- Clause 25 – Work in water and wetlands
- Clause 26 – Wildlife

7.1.2 Specific mitigation measures

The following specific mitigation measures will be implemented for certain affected components.

Soil and surface water

- Storage and management of fuel and used oil in compliance with regulations

- Shipping and processing of used oil and waste materials to accredited recovery centers
- Establishment of safety measures and an emergency response plan in the event of an accidental spill

Wetlands

- Identification of wetlands in the vicinity of the generating station
- Installation of sediment barriers around the edges of nearby wetlands during construction

Birds

- Performance of construction work, as much as possible, outside the bird breeding period, which is from May 25 to August 15

7.2 Human environment

The atmospheric dispersion study for an "all-diesel" scenario demonstrates that air contaminant emissions from the future generating station comply with the emission standards of the Québec Clean Air Regulation (CAR). It also demonstrates that ambient air contaminant concentrations at ground level would all be below the CAR air quality standards throughout the simulation domain, with the exception of hourly and daily NO_2 concentrations. For the latter, exceedances of the standards were calculated in the immediate vicinity of the generating station (25 m) on a few days a year in strong winds, and up to 300 m to the east (towards the airport) on the hillside for a few hours a year in light winds at night. Although the new generating station is located in an area set aside by the local community for industrial development, no document officially designates the generating station area as an industrial area, for which standards are not applicable. The applicability of the CAR standards in the sectors for which standard exceedances have been calculated therefore remains uncertain. The 2009 master plan defines the location of the future generating station as *"hinterland"* zoning. The KRG is currently discussing the possibility of replacing this zoning with *nuna* zoning in the 2023–2024 master plan. Discussions between Hydro-Québec, the municipality and the KRG are underway to have the generating station site and its immediate surroundings zoned Industrial.

As for odors, the results show that odor levels in the residential area and in the village will be well below Québec air quality criteria.

Table 7-1: Summary of Residual Impacts Related to the Construction of the New Thermal Generating Station

Environmental component	Main sources of impact	Description of impact	Mitigation measures	Magnitude of residual impact
Human environment				
Air quality	Excavation and blasting Leveling, backfilling and earthwork Construction of generating station Transport and traffic Operation of generating station and fuel management Maintenance of generating station	Increase in dust during construction work Emission of air contaminants during operation of generating station Improvement in air quality in village of Kangiqsujuaq after dismantling of existing generating station	General mitigation measures SEC: Clause 20	Minor during construction Moderate during operation (positive impact)

During the construction phase, most of the GHG emissions to the atmosphere will come from the exhaust of land vehicles (on- and off-road). For the entire construction phase, fossil fuel consumption is estimated at 743,340 L of gasoline and diesel, equivalent to a total of approximately 1,960 t CO_2 eq. to the atmosphere for the entire project period. During the operation phase, the GHG emission rate was calculated based on the actual measured value of the fuel delivered, i.e., 2,626 kg/L. The new generating station will be designed to easily integrate renewable energy in order to optimize the cost of energy production and to contribute to the reduction of GHG emissions over the entire life of the generating station.

The existing generating station is located north of the village. Residual noise in the village, with little industrial activity, is relatively low, at less than 40 dBA at night and less than 45 dBA during the day. The construction of the new generating station will result in a temporary increase in noise emissions in the village. The most sensitive areas affected are the residences adjacent to the road leading from the unloading dock to the site of the new generating station. The noisiest work will be related to truck traffic from the wharf and borrow pits to the site of the new generating station. Given its remoteness from the village, the impact of machinery work on the construction site will be low. In the operating phase, the residual impact on the soundscape will be positive due to the improvement in the current situation, since the generating station will be relocated outside the village and noise levels will remain below the 40-dBA threshold in the vicinity of residential areas.

The village of Kangiqsujuaq is served by a local network of roads, some of which are paved. The transport and traffic generated by construction activities may disrupt local

traffic and contribute to the deterioration of roads used by the local population and land users. The magnitude will depend on the location of the borrow pits and the route taken by the trucks, which will have to take a total of around 1,200 loads to the site over a 12-week period, in addition to the number of trips associated with transporting equipment from the commercial wharf. The presence of up to 30 workers during the construction period could put additional pressure on the local supply of products and services. No impact is expected on Kangiqsujuaq's infrastructure and services during the operation phase of the new generating station.

The location of the new generating station is approximately 1.0 km from the center of the Kangiqsujuaq community and was chosen with the agreement of local authorities. It lies outside the areas of potential residential development shown on Kangiqsujuaq's most recent zoning map. The Nunaturlik Landholding Corporation issued Hydro-Québec a development permit.

Activities related to the construction of the generating station may occasionally hinder access to certain land use sites but will not prevent it. Any activity on the planned generating station site will be impeded. The project will not affect access to other sites or their use for berry picking or hunting by residents.

The construction of the new generating station is expected to employ 19 to 30 workers over a two-and-a-half-year period. Most of these workers will come from outside the village of Kangiqsujuaq. A few local workers will be hired, subject to their availability, and trained in accordance with Hydro-Québec's policy on job training and hiring Inuit and integrating them into the labor pool. The presence of outside workers and the hiring of local suppliers of goods and services could generate direct and indirect economic benefits locally. Although the operation phase of the future generating station will not create any additional jobs, certain services will be maintained, including snow removal from the access road and the land adjacent to the station, as well as fuel supply.

The study area, the planned study corridor and its access roads do not affect any protected elements or elements of heritage, historical, archaeological or cultural interest. The archaeological potential study identified four areas with archaeological potential in the study area. One of these, located directly in the generating station construction and associated works area, was reported in July 2022. No archaeological remains were found during the archaeological survey carried out on the site. There is another site close to the site of the new generating station, but it will not be affected by the planned construction work, as it has already been destroyed.

The site of the future generating station is part of a relatively homogeneous landscape composed mainly of shrub tundra, rock outcrops, wetlands and a few watercourses. The new thermal generating station and its infrastructure will be built outside the village, in an area where the landscape is already disturbed by recent construction, offering a medium degree of insertion and a high degree of absorption. The infrastructure will only be noticeable occasionally to mobile observers, while stationary observers in the

residential area to the northwest of the village are likely to have a permanent, though distant, view (over 1 km away) of it. Due to its remoteness, the equipment will be barely noticeable.

7.2.1 General mitigation measures

During construction of the new thermal generating station, the following general mitigation measures, described in detail in Hydro-Québec's Standard Environmental Clauses (SECs) (2023; see Appendix C), will be applied to reduce impacts on the human environment:

- Clause 2 – Noise
- Clause 15 – Plant and traffic
- Clause 19 – Heritage and archaelogy
- Clause 20 – Air quality

7.2.2 Specific mitigation measures

The following specific mitigation measures will be applied during the construction of the new thermal generating station.

Greenhouse gases and climate change

- Reduce heavy trucking by reusing excavated materials to restore the land around the generating station.
- Design the infrastructure to allow for the addition of potential renewable energy sources.
- Maintain equipment during operation according to a maintenance plan that complies with manufacturers' recommendations.
- Install 20 kW of solar panels on the front of the generating station.
- Switch from the current diesel generation mode to the hybrid "diesel-wind-solar-battery" mode with the wind power penetration scenario.

Soundscape

- Inform residents, especially those on streets near the wharf, of the period and times of the work before it begins.
- Set up a telephone line to inform the population of the progress of the work and handle requests relating to specific problems.
- Plan work schedules taking into account the disturbance caused by noise. In principle, the construction work will be carried out every day between 7 a.m. and 7 p.m.
- Inform workers, and particularly truck drivers, about the problem of noise perceived from homes. For example, instruct drivers not to let their vehicles idle, and prohibit the use of Jake brakes at the work site and on nearby roads.

- Locate stationary equipment (such as compressors and generators) and other noisy construction equipment as far as possible from the nearest sensitive areas (residences).
- Use variable intensity reversing alarms (automatic adjustment according to ambient noise level) on construction equipment that is likely to reverse frequently.
- Establish a traffic pattern that takes into account the issue of noise from vehicles entering or leaving the work site (e.g., avoid crossing or skirting residential areas whenever possible).

For the new generating station, the following specific mitigation measures, identified during the noise study, will be implemented in accordance with NI 98-01:

- Use a building envelope with enhanced sound performance through the use of rockwool sandwich panels with a sound transmission class (STC) rating of over 32.
- Use a high-grade silencer, with a noise reduction of approximately 50 dBA, for the exhaust outlet of new engines.
- Use radiators emitting no more than 98 dBA of sound power each.
- Install a noise-absorbing silencer on the air intake duct (noise reduction coefficient [NRC] of 1).
- Add acoustic lagging to the wall penetrations at the base of the engine exhaust silencer (if needed).
- Install acoustic sealing on all wall pipe penetrations (if needed).
- Use acoustic louvers at air outlet openings with specific minimum insertion losses (if needed).
- Carry out sound monitoring after the commissioning of the generating station (if needed).

Infrastructure and services

- Inform the municipal council of the work schedule and the number of workers who are expected in the community.
- Establish a plan for transporting equipment and materials, in collaboration with the municipal council.
- Ensure that signage is adequate (Inuit-friendly language and visual references) and that vehicles are clearly visible.
- If necessary, use signalers or a safety escort during maneuvers by trucks or oversize loads.
- Ensure that external contractors obtain and are aware of the code of conduct.

Land use

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

Economic spinoffs

- Establish incentives for hiring Inuit workers and subcontractors in the community of Kangiqsujuaq.
- Give preference to local providers of goods and services.
- Establish incentives for hiring local Inuit labor. Hydro-Québec reimburses a certain amount per Inuit worker hired (skilled workers, housekeepers, helpers, cooks and others).
- Establish incentives for hiring subcontractors based in Kangiqsujuaq.

Health, safety and quality of life

- 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.
- Encourage workers to avoid alcohol or drug use while in the area for construction work.
- Develop a protocol to follow in the event of a worker's worsening health problem or a serious accident.

Archaelogy

- If archaeological remains are found at the generating station site, consider salvage excavation.
- If archaeological remains are found near the generating station site, mark the remains to indicate their presence and their "vulnerability" to traffic and activities outside the site.

Landscape

- In collaboration with Hydro-Québec, organize a contest inviting artists from the community to produce an Inuit drawing to be displayed on the front of the generating station building.

7.2.3 Summary of impacts and mitigation measures

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

The impacts of the new thermal generating station project will be felt mainly during the construction phase. Since the work is limited, small-scale and carried out over a short period of time, and given the mitigation measures in place, the project's impacts will be low. During the operation phase, Hydro-Québec will continue the activities already under way, so the project should not exacerbate the current negative impacts. The replacement of the existing generating station will have a positive impact on the community of Kangiqsujuaq by displacing this source of pollution (noise and air), currently located in the heart of the village. The community will then be equipped with a modern, less polluting and more efficient generating station that will secure the village's energy supply. The project will also lay the groundwork for a second phase of development: wind power supply that would reduce the use of fossil fuels and the associated greenhouse gas emissions.

Table 7-2: Summary of Residual Impacts Related to the Construction of the New Thermal Generating Station

Environmental component	Main sources of impact	Description of impact	Mitigation measures	Significant of residual impact
Biophysical environment				
Soil	Excavation and blasting Leveling, backfilling and earthwork Construction of generating station Management of residual hazardous materials Transport and traffic Operation of generating station and fuel management Maintenance of generating station	Change in composition and profile of surface soil at platform location Risk of soil contamination in the event of an accidental petroleum product spill Risk of soil contamination due to inadequate waste management	General mitigation measures: SEC: clauses 6, 10, 15, 16, 17, 21, 23 and 24 Specific mitigation measures: Storage and management of fuel in compliance with regulations. Shipping and treatment of used oil and waste to accredited recovery centers. Establishment of safety measures and an emergency response plan in the event of an accidental release.	Minor
Surface water	Excavation and blasting Leveling, backfilling and earthwork Management of residual hazardous materials Transport and traffic Operation of generating station and fuel management Maintenance of generating station	Sediment supply and suspension in the aquatic environment Risk of water contamination in the event of an accidental petroleum product spill Risk of water contamination due to inadequate construction waste management	General mitigation measures: CEN: clauses 6, 7, 9 and 15 Specific mitigation measures: Installation of riprap and geotextile membranes to protect the platform slopes and prevent erosion Storage and management of fuel in compliance with regulations Establishment of safety measures and an emergency response plan in the event of an accidental release	Minor
Wetlands	Leveling, backfilling and earthwork Excavation and blasting Preservation of the quality of the surface water and drainage	Positive—Some additional runoff	General mitigation measures: SEC: clause 25 Identification of wetlands in the vicinity of the generating station Installation of sediment barriers around the edges of nearby wetlands during construction	Minor
Caribou	Excavation and blasting Leveling, backfilling and earthwork Construction of generating station Transport and traffic Operation of generating station and fuel management	Loss of poor-quality habitat of approximately 1.62 ha, consisting of shrub tundra Low functional loss of habitat, due to possible avoidance of the periphery of the work area	None	Minor
Birds	Excavation and blasting Leveling, backfilling and earthwork Construction of generating station Transport and traffic	Negligible loss of habitat of approximately 1.62 ha, consisting of shrub tundra	Specific mitigation measures: Performance of construction work, as much as possible, outside the bird breeding period, which is from May 25 to August 15	Minor

Table 7-2: Summary of Residual Impacts Related to the Construction of the New Thermal Generating Station (*continued*)

Human environment				
Environment component (*continued*)	**Main sources of impact** (*continued*)	**Description of impact** (*continued*)	**Mitigation measures** (*continued*)	**Significant of residual impact** (*continued*)
Air quality	Excavation and blasting Leveling, backfilling and earthwork Construction of generating station Transport and traffic Operation of generating station and fuel management Maintenance of generating station	Increase in dust during construction Emissions of air contaminants during operation of the generating station Improvement in air quality in the village of Kangiqsujuaq after dismantling of the existing generating station	General mitigation measures: SEC: Clause 20	Minor during construction Moderate during operation (positive impact)
Greenhouse gases and climate change	Excavation and blasting Leveling, backfilling and earthwork Operation of generating station and fuel management Transport and traffic (land vehicles)	GHG emissions during construction related to the use of equipment and land vehicles. Reduction of GHGs during operation of the generating station	Specific mitigation measures: Reduction of heavy trucking by reusing excavated materials to restore the land around the generating station Design of infrastructure to allow for the addition of potential sources of renewable energy Maintenance of equipment during operation according to a maintenance plan that complies with manufacturers' recommendations Installation of 35 solar panels on the front of the generating station Transition from the current (diesel-powered) production mode to the hybrid "diesel-wind-solar-battery" mode	Minor during construction Moderate during operation (positive impact)

Table 7-2: Summary of Residual Impacts Related to the Construction of the New Thermal Generating Station (*continued*)

Human environment (continued)				
Environment component (*continued*)	**Main sources of impact** (*continued*)	**Description of impact** (*continued*)	**Mitigation measures** (*continued*)	**Significant of residual impact** (continued)
Soundscape	Excavation and blasting Leveling, backfilling and earthwork Construction of generating station Waste management Operation of generating station Transport and traffic	Increased ambient noise during construction (construction equipment, heavy vehicles and noisy equipment) Maintenance of noise levels below those emitted by the existing generating station in the sensitive areas most exposed to noise	General mitigation measures: SEC: clause 2 Specific mitigation measures: Keeping residents, especially those on streets near the wharf, informed of the construction period and work schedule before the work begins Setting up a telephone line to inform the population of the progress of the work and deal with requests relating to specific problems Planning work schedules that take into account the disturbance caused by noise. In principle, the construction work will be carried out every day between 7 a.m. and 7 p.m. Education of workers, especially truckers, about noise emissions near residences (e.g., prohibit idling of unused vehicles and the use of Jake brakes at the work site and on nearby streets) Location of stationary equipment (such as compressors and generators) and other noisy construction equipment as far as possible from the nearest sensitive areas (residences) Use of variable intensity reversing alarms (automatic adjustment according to ambient noise level) on construction equipment that is likely to reverse frequently Establishing a traffic pattern that takes into account the issue of noise from vehicles entering or leaving the work site (e.g., avoid crossing or skirting residential areas whenever possible) Use of a building envelope with enhanced sound performance through the use of rockwool sandwich panels with a sound transmission class (STC) rating of over 32 Use of efficient silencers at the exhaust outlet of new engines Use of radiators emitting no more than 98 dBA of sound power each Installation of a noise-absorbing silencer on the air intake duct Addition of acoustic lagging to the wall penetrations at the base of the engine exhaust silencer (if needed) Installation of acoustic sealing on all wall pipe penetrations (if needed) Use of acoustic louvers at air outlet openings with the specific minimum insertion losses (if needed) Sound monitoring (recommended) after the commissioning of the generating station (if needed)	Minor during construction Minor during operation (positive impact)

Table 7-2: Summary of Residual Impacts Related to the Construction of the New Thermal Generating Station (*continued*)

Human environment (*continued*)				
Environment component (*continued*)	**Main sources of impact** (*continued*)	**Description of impact** (*continued*)	**Mitigation measures** (*continued*)	**Significant of residual impact** (continued)
Infrastructure and services	Waste management Transport and traffic Worker presence Operation of generating station and fuel management	Temporary traffic disruption on local roads Deterioration of local road conditions Temporary and limited interference with certain public services	General mitigation measures: SEC: clause 15 Specific mitigation measures: Keeping the municipal council informed of the work schedule and the number of workers that are expected in the community Establishment of a plan for transporting equipment and materials, in collaboration with the municipal council Ensuring that signage is adequate (Inuit-friendly language and visual references) and that vehicles are clearly visible If necessary, use of signalers or a safety escort during maneuvers by trucks or oversize loads Ensuring that external contractors obtain and are aware of the code of conduct	Minor during construction Minor during operation Minor
Land use	Leveling, backfilling and earthwork Construction of generating station Waste management Transport and traffic Presence of infrastructure	Limited interference with access to some land use sites Temporary and localized potential disturbance of certain hunting and berry-picking activities	Specific mitigation measures: Keeping the municipal council informed of the work schedule and the number of workers that are expected in the community Establishment of a plan for transporting equipment and materials, in collaboration with the municipal council	Minor
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	Specific mitigation measures: Establishment of incentives for hiring Inuit workers and subcontractors in the community of Kangiqsujuaq Use of local suppliers of goods and services wherever possible Establishment of incentives for hiring local Inuit labor Hydro-Québec reimburses a certain amount per Inuit worker hired (skilled workers, housekeepers, helpers, cooks and others) Establishment of incentives for hiring subcontractors based in Kangiqsujuaq	Low to medium during construction (positive impact)

Table 7-2: Summary of Residual Impacts Related to the Construction of the New Thermal Generating Station (*continued*)

Human environment (*continued*)				
Environment component (*continued*)	**Main sources of impact** (*continued*)	**Description of impact** (*continued*)	**Mitigation measures** (*continued*)	**Significant of residual impact** (*continued*)
Health, safety and quality of life	Waste management Transport and traffic Worker presence Operation of generating station and fuel management	Temporary risk of accidents for residents and road users Temporary increase in ambient noise and dust during construction Temporary additional pressure on health services Temporary traffic disruption on local roads Reduced nuisance and potential health and safety risks compared with the current situation	Specific mitigation measures: Keeping the municipal council informed of the work schedule and the number of workers expected in the community Establishment of 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. Implementation of appropriate road signs to improve user safety If necessary, use of signalers or a safety escort during maneuvers by trucks Ensuring that vehicles are clearly visible as needed Ensuring that the maintenance and cleaning of public roads used by heavy vehicles and use of certified dust suppressants as needed Education of workers from outside the community about the issues tied to their presence by providing them with a code of conduct and ensuring that they read it Ensuring that external contractors read the code of conduct Encouraging workers to avoid alcohol or drug use while in the area for construction work Development of a protocol to follow in the event of a worker's worsening health problem or a serious accident	Minor
Archaelogy	Excavation and blasting Leveling, backfilling and earthwork	Potential alteration of archaeological remains during construction	General mitigation measures SEC: clause 19 Specific mitigation measures If archaeological remains are found at the generating station site, considering salvage excavation If archaeological remains are found near the generating station site, marking the remains to indicate their presence and their "vulnerability" to traffic and activities outside the site	Minor
Landscape	Presence of infrastructure	Change to landscape	Specific mitigation measures: Organization of a contest, in collaboration with Hydro-Québec, inviting community artists to produce an Inuit drawing to be displayed on the front of the generating station building	Minor

8 Technological accident risk management

8.1 Risk analysis during the operation phase

8.1.1 Purpose

The purpose of analyzing the technological risks of the new Kangiqsujuaq thermal generating station project 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 potential accidents or reduce their frequency and consequences.

8.1.2 Scope of analysis

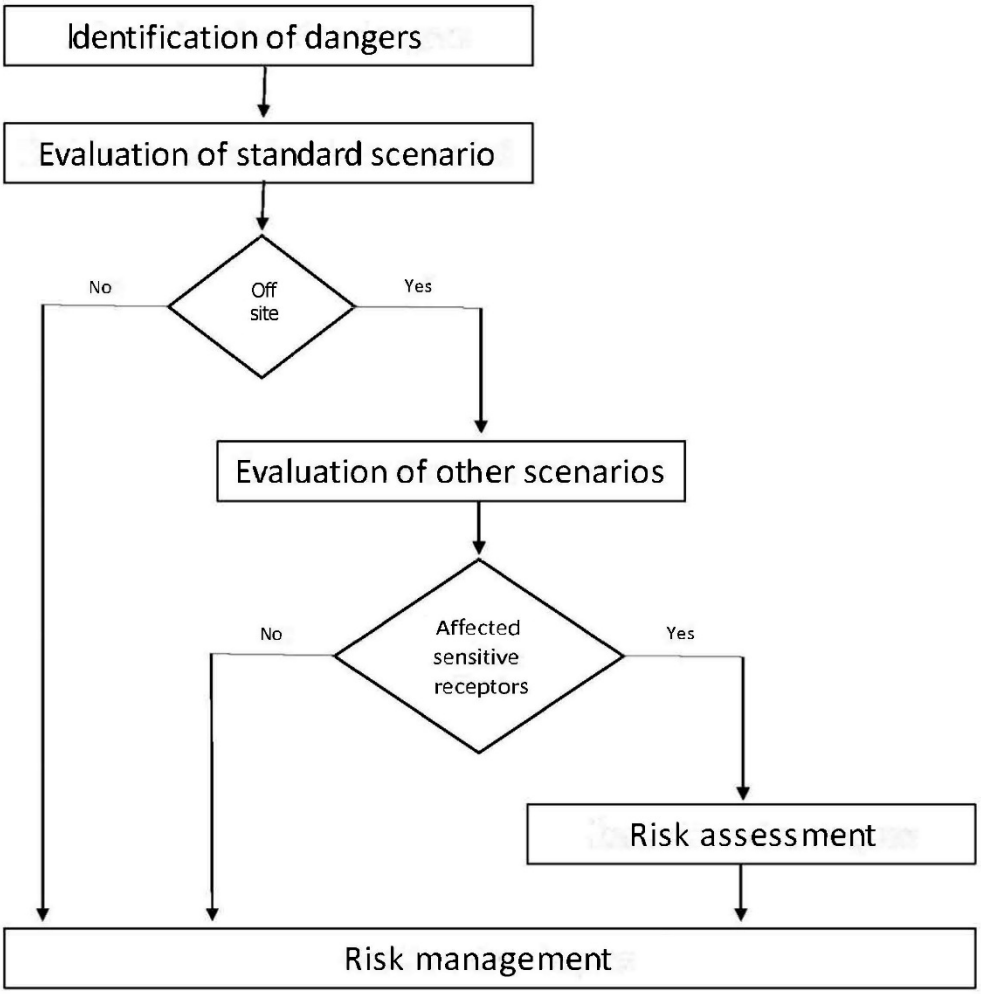
This analysis covers the risks of major accidental events that could have consequences off-site and damage the human or biophysical environment. It does not address the following:

- 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 approach adopted to analyze the project's risks meets the requirements of the technological risk analysis guide of the Ministère de l'Environnement et de la Lutte contre les changements climatiques (MENV, 2002), which are included in MELCCFP's directive for conducting the environmental and social impact assessment of the project. As Figure 8-1 shows, the first step in the analysis is to determine the hazards, taking into account the hazardous substances and activities associated with the project, sensitive elements in the vicinity of the construction site, external sources of risk and past accident history for similar facilities. Then the potential consequences are assessed on the basis of standardized accident scenarios. If the assessment of these scenarios demonstrates that the consequences would remain within the site, we move on to the next stage of the analysis, which focuses on risk management measures. If the consequences extend beyond the site, the analysis continues with the assessment of other scenarios. If the accident scenarios assessed may affect the population, an additional assessment of the frequency and risks may be required. Lastly, the security measures in place are identified 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 these risks:

- Relatively low quantity of diesel stored on the site
- Use of fully contained external diesel tanks
- Retention and storage of spills 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 disturbed by a major accident at the site of the generating station. Table 8-1 lists the main environmental sensitivities present in the extended study area, and Map A shows their location.

The new generating station will be located outside and to the south of the village of Kangiqsujuaq. With regard to the human environment, the nearest residences and public services are currently located more than 700 m north of the construction site. Potential development areas in the village are 500 m or more from the site.

A new Kativik Ilisarniliriniq garage/warehouse stands at the entrance to the access road to the generating station (approximately 200 m to the south). This facility is intended for school bus and truck parking, as well as for storage of various equipment (furniture, appliances, various materials, machinery). It also has office space, meeting rooms and workshops, as well as outdoor storage for shipping containers.

Also nearby is the Kangiqsujuaq airport (approximately 400 m northeast of the site) and the fuel depot (approximately 500 m north-northwest of the site). As for sensitive elements of the biophysical environment (aquatic environment), there is a nearby river (CE02; see Map 5-2) that drains the area south of the airport, and the unnamed lake to the southwest of the site, which empties into Baie Wakeham.

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

Category	Description	Distance from the edge of the generating station site
Population and public buildings	Kangiqsujuaq village	Closest houses at approximately 700 m to the north
	Potential development areas	500 m or more, between northwest and northeast
	Kativik Ilisarniliriniq's new warehouse/garage	Roughly 200 m to the south
	Ungava Tulattavik Health Centre Qilangnguanaaq center Mianirsivik family house Mikijuq childcare center (CPE) Arsaniq school Nasivvik education center Qaggik community center Nurraujaq Forum	In the village, over 700 m away

Table 8-1: Main Sensitive Elements in the Extended Study Area (*continued*)

Category (*continued*)	**Description** (*continued*)	**Distance from edge of the generating station site** (*continued*)
Infrastructure	Airport	400 m northeast (runway) 670 m northeast (terminal building)
	Public road	150 m southwest
	Drinking water intake	500 m southwest
	Water treatment plant	700 m north-northwest
	Telecommunications antennas (3)	800 m and further to the north-northwest
Industries and main businesses	Fuel depot	500 m north-northwest
	Existing thermal generating station	1,100 m north-northwest
Environmental components	River draining the area south of the airport and unnamed lake, emptying into Baie Wakeham	200 m southwest
	Unnamed lake	880 m southwest
	Lac Tasialuk	1,000 m northeast
	Baie Wakeham	1,300 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 proper functioning 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 relatively low (Landry, 2013). Most of the world's earthquakes occur near the boundaries of tectonic plates. Eastern Canada has no such boundaries, and seismic activity appears to be linked to regional stress fields, as earthquakes are concentrated in areas of weakness in the Earth's crust.

According to Natural Resources Canada statistics (2018), approximately 450 earthquakes occur in the country's eastern coast each year. Most of them are too faint or too distant to be noticed, but about 25 earthquakes are experienced by residents in this region each year. Over a 10-year period, approximately three earthquakes are likely to cause damage to buildings; all have a magnitude greater than 5.

Eastern Canada has five areas 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 areas, the seismic risk can be considered very low. Also, the buildings and facilities, including supports and connections to the main tanks, will be built in compliance with the National Building Code of Canada (NBC), which sets standards for every seismic area to ensure that buildings resist seismic loads.

8.1.6.2 Extreme weather conditions

Extreme weather conditions may take the form of heavy rainfall and violent winds. 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 (NRC, 2015) defines local weather data, such as the hourly wind pressure, maximum depth of precipitation, maximum load due to combined snow and rain, which will be taken into consideration at the design stage. The generating station's buildings and equipment will be built in compliance with current codes and regulations to withstand extreme weather conditions.

8.1.6.3 Flooding

Flooding usually occurs upstream of sills (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 only water feature in the vicinity is the unnamed river (identified as CE02 on Map 5-2), which runs approximately 200 m southwest of the site. This river drains a small watershed, and the site of the new generating station is elevated above it. There is therefore no risk of flooding on the project site.

8.1.6.4 Ground instability

The construction of the buildings and equipment will be adapted to the characteristics of the terrain 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 Kangiqsujuaq airport, used only by small aircraft, is approximately 400 m northeast of the site of the new generating station, outside the approach and takeoff area, where the risk of aircraft accidents is higher. As it is outside this area, and due to the low traffic, the new generating station will be exposed to little risk from air transport.

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). Once the detailed engineering is completed or during execution of the project, the required validations with Transport Canada and NAV CANADA will be performed.

8.1.6.6 Industrial and commercial activities

The generating station site is located in an area where there are no industrial activities in the vicinity, with the exception of mining sites and a fuel depot. Located roughly 500 m from the site of the new generating station, the depot does not represent an external risk for the generating station.

8.1.7 Hazardous substances present at the generating station and storage equipment

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. At the site of the new generating station, diesel fuel will be stored in outdoor tanks adjacent to the generating station building, while other hazardous substances will be kept in the hazardous materials and residual hazardous materials (HM-RHM) storage room in the generating station building. Three HM-RHM recovery sheds will also be located on the generating station site to store drums in transit between the shipping line and the generating station. Table 8-2 summarizes the information about these substances, the safety data sheets for which can be found in Appendix I.

Table 8-2: List of the Main Hazardous Substances

Hazardous substance	Type of storage	Maximum quantity on site [a]
Diesel	Two outdoor tanks	2 x 35 m^3
	An indoor day tank	2.5 m^3
Lubricating oil for generating sets	An indoor tank and drums [b]	2.5 m^3 (tank) 6.15 m^3 (thirty 205-L drums)

Table 8-2: List of the Main Hazardous Substances (*continued*)

Hazardous substance (*continued*)	**Type of storage** (*continued*)	**Maximum quantity on site** [a] (*continued*)
Coolant and antifreeze (ethylene glycol) for generating sets	An indoor tank and drums [b]	2.0 m^3 (tank) 0.82 m^3 (four 205-L drums)
Used oil	An indoor tank and drums [b]	2.5 m^3 (tank) 6.15 m^3 (thirty 205-L drums)
Waste oil	An indoor tank and drums [b]	2.5 m^3 (tank) 0.82 m^3 (four 205-L drums)
Coolant and antifreeze	Drums	Undetermined

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

b. The tanks and drums are not normally all full at the same time.

8.1.7.1 Diesel

The generating station's generating sets and the emergency generator will run on 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 40ºC to 90ºC, which means it emits no vapor at room temperature. As its relative density ranges from 0.78 to 0.88 g/mL, it is lighter than water, in which it is considered to be very slightly soluble.

Diesel fuel will be stored outdoors in two fully contained tanks (double-walled, basin-type) with an open interstice to the atmosphere, in compliance with CAN/ULC-S601-14. With an individual capacity of 35 m^3, these tanks will have sufficient storage capacity to supply the generating station for at least six days. Diesel will also be held in a rectangle day tank (double-bottom, 2.5-m^3 capacity), located inside the generating station building and used for the daily supply of the generating sets. Expected diesel consumption is around 1,655 m^3 per year, or an average of 4,500 L per day (this could drop to between 1,163 and 749 m^3 per year with the incorporation of the potential wind farm).

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 approximately 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 drums and then transferred to a tank with a capacity of 2.5 m^3. Its

capacity will be sufficient to allow for a minimum number of oil changes without refills from the drums. This tank will be stored in the generating station.

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

8.1.7.4 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.

These residual materials will be temporarily stored at the generating station, in tanks (each with a capacity of 2.5 m^3) and drums, for subsequent disposal in accordance with regulations.

8.1.7.5 Other

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 Transportation of hazardous substances

The modes of transportation and delivery frequencies for hazardous substances during operation of the new generating station are summarized in Table 8-3. These data are estimates and may vary somewhat during operation.

The diesel used as fuel will be transported to the new generating station in tanker trucks that will be supplied from the fuel depot in the village of Kangiqsujuaq. The distance between this depot and the site of the generating station is approximately 1 km. Lubricating oil, coolant, antifreeze and other substances will be delivered in drums or cans via containers brought to Kangiqsujuaq by sea and then transported by truck from the wharf to the generating station. Residual hazardous materials will be drummed up and transported to the wharf by truck for shipment by boat to authorized centers.

The volume of dangerous goods transported will change little compared to the present situation, since the new generating station will replace the existing one.

Table 8-3: Transportation of Hazardous Substances

Substance	Mode of transportation	Delivery frequency
Diesel	Tanker truck	183 times a year (once every 2 days)
Lubricating oil	Drums transported by truck	Once/year
Coolant and antifreeze (ethylene glycol)	Drums transported by truck	Once/year
Residual hazardous materials	Drums transported by truck	Once/year

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 accident scenarios to analyze. 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 Kangiqsujuaq. Only one incident can be considered to be significant, a spill of 225 L of antifreeze that occurred in November 2018 following the breakage of a pipe connected to the generating set. There were other minor spills (< 25 L), but they are not summarized in this table.

Table 8-5 presents the main diesel spills at other off-grid thermal generating stations in northern Québec since 2010. Two incidents in Ivujivik and Inukjuak in 2015 can be considered to be highly significant. In the first incident, part of the spill reached a stream and Baie d'Hudson. In the second incident, the spilled diesel remained in a very small area in the immediate vicinity of the generating station and did not reach any bodies of water. There were other minor incidents (< 100 L), but they are not summarized in the table. The major spill that occurred at the Îles-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 Kangiqsujuaq generating station.

Table 8-4: Main Spills (of at Least 100 L) From the Existing Kangiqsujuaq Thermal Generating Station Over the Past 10 Years

Date	Substance	Quantity (litres)	Equipment involved	Cause
2018	Antifreeze	225	Hose connected to generator	Pipe disconnection

Table 8-5: Main Diesel Spills (≥100 L) at Other Off-Grid Thermal Generating Stations in Northern Québec Since 2010

Year	Generating station	Quantity (litres)	Cause
2022	Akulivik	200 (confined)	Hydro-Québec equipment failure
2022	Ivujivik	125 (confined)	Hydro-Québec equipment failure
2022	Inukjuak	Approx. 1,000	FCNQ delivery error
2022	Inukjuak	400	Hydro-Québec heating oil tank rupture (UN1202)
2015	Puvirnituq	1,165	FCNQ delivery error
2015	Inukjuak	13,500	Incorrect switching operation during modernization work
2015	Ivujivik	14,200	Equipment failure
2014	Tasiujaq	496	Human error during delivery by FCNQ
2012	La Romaine	100 (confined)	Human error
2012	Kuujjuaq	113	Human error
2010	Umiujaq	9,000	Hydro-Québec equipment failure
2010	Salluit	500	Hydro-Québec equipment failure

8.1.10 Identification of potential accidental events

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

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

This loss of containment or this 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 spill or vapor release is relatively low because these substances have low volatility and high flash points. This is especially true 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 mitigate 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 spills, 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 Releases and Main Safety Measures

Equipment or activity at source of spills	Preventive or protective measures
Diesel	
Main outdoor tanks	• Fully contained containment tanks with an open interstice to the atmosphere, in compliance with CAN/ULC-S601-14 • Manual isolation gate at each tank, accessible from the walkway • Protective housing with watertight bottom and leak detection probe for piping at the bottom of tanks • Monitoring of level variation with alarm • Bollards

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

Equipment or activity at source of release (*continued*)	**Preventive or protective measures** (*continued*)
Diesel (*continued*)	
Tank overfilling (unloading from tanker truck to main tanks)	• Level indicator • Filling enclosure with mechanical fill limiter • Constant presence of an operator during unloading
Flexible hose (unloading from tanker truck to main tanks)	• Manual shutoff valve on the tanker 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	• Solenoid valve closing on loss of energy (near main tanks) • Piping without seal • Corrosion protection (outside) • Impervious (epoxy-coated) basin floor with collection well and detection probes (inside) in tank and pump room
Indoor day tank	• Double-bottom tank complies with CAN/ULC-S602-14 • Waterproof (epoxy-coated) basin floor with collection well and detection probes (inside) in tank and pump room
Overfilling of the indoor day tank	• Level measurement (visual and analog) • Impervious (epoxy-coated) basin floor with collection well and detection probes (inside) in tank and pump room
Circuit between the day tank and the generating sets	Impervious floor with sumps and detection probes
Lubricating oil	
Indoor tank	• Tank in compliance with CAN/ULC-S602-14 • Impervious (epoxy-coated) basin floor with collection well and detection probes (inside) in tank and pump room
Tank overfilling (transfer from drums to tank)	• Visual level indicator and high-level switch connected to the pump • Push button to stop pumping • Transfer constantly monitored • Impervious floor with sumps and detection probes (tank room and bays)

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

Equipment or activity at source of release (*continued*)	**Preventive or protective measures** (*continued*)
Diesel (*continued*)	
Filling of generating sets from the tank	• Push button to stop pumping • Filling continually monitored • Regular inspection and replacement of flexible hoses • Impervious floor with sumps and detection probes
Storage, handling and unloading of drums	Impervious floor (epoxy coating) in MD/MDR room with drain to collection well and detection probes (indoor storage)
Coolant and antifreeze	
Indoor tank	Impervious (epoxy-coated) basin floor with collection well and detection probes (inside) in tank and pump room
Overfilling (during transfer from drums to tank)	• Visual level indicator and high-level switch • Push button to stop pumping • Transfer constantly monitored • Impervious floor with sumps and detection probes (tank and HM/RHM room)
Circuit	• Piping without seal • Corrosion protection (outside) • Impervious floor with sumps and detection probes (indoor circuit)
Filling of the circuit from the tank or drums	• Push button to stop pumping (manual override) • Filling continually monitored • Impervious floor with sumps and detection probes
Emptying of motors to the tank or emptying of tank to the drums	• Push button to stop pumping • Manual valve • Emptying continually monitored • Impervious floor with sumps and detection probes
Storage, handling, loading/unloading of drums	Impervious floor (epoxy coating) in MD/MDR room with drain to collection well and detection probes (indoor storage)

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

Equipment or activity at source of release (*continued*)	**Preventive or protective measures** (*continued*)
Used oil	
Indoor tank	• Tank in compliance with CAN/ULC-S602-14 • Impervious (epoxy-coated) basin floor with collection well and detection probes (inside) in tank and pump room
Tank overfill (emptying of generating sets to the tank)	• Visual level indicator and high-level switch • Push button to stop pumping • Emptying continually monitored • Impervious floor with sumps and detection probes
Emptying of the tank to the drums or emptying of generating sets directly to the drums	• Push button to stop pumping • Manual valve • Emptying continually monitored • Regular inspection and replacement of hoses • Impervious floor with sumps and detection probes
Storage, handling and loading of drums	Impervious floor (epoxy coating) in MD/MDR room with drain to collection well and detection probes (indoor storage)
Waste oil	
Indoor tank	• Double-bottom tank complies with CAN/ULC-S602-14 • Impervious (epoxy-coated) basin floor with collection well and detection probes (inside) in tank and pump room
Tank overfilling (emptying of sumps to the tank)	• Level detection probe • Impervious (epoxy-coated) basin floor with collection well and detection probes (inside) in tank and pump room
Emptying of tank to the drums	• Push button to stop pumping • Manual valve • Emptying continually monitored • Regular inspection and replacement of flexible hoses • Impervious floor with sumps and detection probes (tank and HM/RHM room)
Storage, handling and loading of drums	Impervious floor (epoxy coating) in HM/RHM room with drain to a sump and detection probes (indoor storage)
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 Kangiqsujuaq generating station will be provided primarily by an active (automated) protection system to safeguard the following rooms:

- generating set bay
- indoor tank room
- pump room

In addition to the fire panel and associated detection accessories, an aerosol protection system will be installed. The signals from the panel (alarm, supervision, failure) will be retransmitted to Lac Robertson generating station via the ParaVox system or via the control signals.

Fire protection will also be ensured by strategically placed portable extinguishers and various passive measures (separation of equipment, fireproof 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 approximately 500 m from the nearest point of the runway. In addition, the station will be located outside the airport's approach and takeoff area. Given the location and relatively limited capacity of the generating station, it is expected 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. Diesel is not included in these lists. These guides also indicate that substances must be considered if their potential consequences might have off-site effects.

In accordance with these guides, a standard scenario must be assessed to determine the potential for off-site consequences. This scenario is as follows: an emission of the largest quantity of a hazardous substance contained in the largest container, with the greatest distance of impact, based on passive (not active) protective measures.

For diesel, double-walled tanks are considered to be 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 release: 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, described 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 takes into account northern conditions and the presence of permafrost
- fully contained outdoor diesel tanks
- indoor equipment and tanks located in basin rooms with sumps
- automated fire protection system to protect the genset bay, indoor tank room and pump room
- response equipment in the event of spills (spill 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 operation, a program will be implemented to manage risks that cannot be eliminated with the planned means of protection. Based on existing practices at other Hydro-Québec off-grid 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 substances
    b. hazardous substances 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 substances, piping and connections to the unloading area
7. Safety training for all employees covering the following main components:
    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 for the delivery, unloading and loading of substances transported in drums 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 Emergency measures plan during the operation phase

An emergency measures plan will be prepared for the new generating station's operation phase. It will be incorporated into the existing emergency plan for all Hydro-Québec off-grid thermal generating stations in northern Québec, 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 these emergency measures is presented in Appendix I.3. The municipality and other public authorities that may be affected will be consulted. This plan will be submitted to the MELCCFP before the commissioning of the facilities.

8.4 Risk analysis during the construction phase

During the construction phase, the hazards will mainly be releases or fires that may involve hydrocarbons at the work site. Specifically, the following accidental events could occur:

- fuel leaks 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 work site
- spill or fire at residual hazardous material storage sites at the work site

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 work site to respond quickly to any spills
- portable fire extinguishers to control small fires

Although the machinery available on site is not intended for this purpose, it can be used to limit the extent of a major spill by building trenches or embankments. The use, maintenance and refueling of machinery at the work site will be subject to the following measures:

- Refueling will have to be conducted under continuous supervision and at dedicated locations.
- If fuel tanks are present at the work site, they will have to 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*.

Other measures will apply to residual hazardous materials at the work site:

- A temporary storage area to facilitate consolidation (e.g., filling drums) 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 construction.

8.6 Emergency measures plan during the construction phase

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 release, 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 I.2. The final version will be submitted to the MELCCFP and other authorities before work begins.

9 Climate change resilience analysis

As part of the environmental assessment, Hydro-Québec carried out a study on the climatic resilience of the project to build and operate the new thermal generating station that will supply the Inuit village of Kangiqsujuaq. The study was commissioned by the Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs (MELCCFP). The assessment was also carried out with a view to designing Hydro-Québec's new infrastructure in a way that is resilient to anticipated climate change throughout the project's lifetime. The complete study can be found in Appendix M.

The building for the new 3.2-MW thermal generating station will be equipped with three diesel-powered generating sets and will house all electrical power generation equipment and systems, as well as maintenance and operating facilities. Outside, the site will include fuel tanks, equipment required for the power generation system and storage areas. An energy storage system will be installed in a second building on the same site, facilitating the incorporation of renewable energy. The project has been segmented into 24 physical components on which climate resilience analysis has been carried out systematically. The main components are as follows:

- foundation, roof and building envelope of the generating station
- solar panels
- engine cooling and exhaust systems
- fuel tanks
- switching substation at the generating station and distribution lines to the village
- energy storage system to bridge the gap between diesel and wind power sources
- communication systems
- 1-km road between the village and the generating station, as well as the access road to the latter

9.1 Methodology

The approach adopted to identify the project's climatic vulnerabilities complies with the MELCCFP's climate change adaptation requirements. The climate risk for each project component was determined in five steps, which made it possible to calculate the level of risk, which acts as a scale for quantifying climate risk:

1. Identification of meteorological and climate change hazards applicable to the generating station project.
2. For each climatic hazard, a probability rating is established, defining the level of likelihood that its frequency, magnitude or duration will increase over the lifetime of the new generating station, compared with current conditions. This analysis is

based on climate history and projections for the Kangiqsujuaq area, as well as on findings from technical studies and on the project site. A criterion of uncertainty regarding the choice of probability rating is also incorporated into the assessment.

3. Determination of potential climate vulnerabilities for each component, based on four assessment criteria: financial, business continuity, environmental, as well as employee and public health and safety.
4. Risk analysis for potentially vulnerable components, including:
    a. determining the natural adaptation potential (or that already taken into account by Hydro-Québec) of the component exposed to the climatic hazard
    b. assessment of the severity of the impact of the climatic hazard on the component according to the assessment criterion
    c. incorporation of a confidence criterion for choosing a severity rating based on its potential variability
    d. calculation of initial risk level (very low, low, moderate or high)
5. Development of adaptation or control measures for moderate and high risks, then assessment of the final risk level.

As a prelude to this analysis, the report paints a picture of the climate that allows for an informed assessment of the selection of climate hazard probability ratings and climate vulnerability potential of components, by:

- describing the main project variant and the components of the surrounding receiving environment
- describing recent climatic conditions and trends in the area
- projecting future climatic conditions for the region up to the 2060 horizon (2051–2080), thus encompassing the useful life of the generating station. Following the precautionary principle, the worst-case GHG emission scenario (RCP8.5) has been taken into account, since there is no guarantee that GHG emission reduction measures will achieve the objectives of the RCP4.5 scenario. The scenario (RCP4.5 or RCP8.5) showing the greatest amplitude of change has been prioritized according to climate hazard

9.2 Description of recent and future climate conditions

9.2.1 History of extreme events

The following findings were extracted from historical data at the Kuujjuaq airport weather station. Although this station is located roughly 430 km south of Kangiqsujuaq, it is Québec's main northern station, recording data over several decades that have enabled us to draw up a global picture of the climate in the Far North.

- Extreme heat (maximum reached of 33°C), which remains limited and occasional, is increasing in frequency and intensity, as shown by the upward trend in annual maximum temperatures since 1950 (+0.010°C/y, on average).
- Extreme cold (minimum reached of –50°C) is decreasing in frequency and intensity, in line with the upward trend in extreme minimum temperatures observed since 1950 (+0.035°C/y, on average).
- Heavy daily rainfall (maximum of 56 mm already reached) is more frequent, while heavy snow events are less frequent. Precipitation extremes occur mainly in the summer.
- Gusts have reached 161 km/h in Kuujjuaq in the past and seem to be becoming more frequent, but not necessarily more intense, particularly over the past two decades. In the last three years, gusts have reached up to 117 km/h at the Kangiqsujuaq airport, located on the crest of the hill where the thermal generating station will be built (on the western side). The intensity of gust episodes is statistically higher in Kangiqsujuaq than in Kuujjuaq.
- Kangiqsujuaq is located in an area of continuous permafrost. However, according to a map produced by the Centre d'études nordiques, the site of the new generating station would have underlying deposits that are stable during thawing. However, certain portions of the corridor planned for the power distribution lines are designated as areas at risk from thawing.
- Episodes of snowfall have reportedly occurred on the northern flank of the hill on which the generating station is to be built. They appear to be recurrent upstream of the village and the existing generating station, but much less so on the western side of the hill upstream of the new site, where no episodes of this type have yet been recorded and where the slopes are much less pronounced.

9.2.2 Climate projections

Table 9-1 summarizes the main climate projections for the study region, for the 2060 horizon (2051–2080) and the 2015 horizon (2006–2035), which represents current conditions. Here are the main points to remember:

- There will be a general rise in average temperatures (+2.1°C to +4.0°C at the end of the generating station's service life compared with today), but this will be greater in winter (+4.0°C to +7.3°C). A similar trend is observed for extreme minimum and maximum temperatures. However, according to projections, extreme maximum temperatures will not exceed 30°C in Kangiqsujuaq, even by 2060.
- Total annual precipitation is expected to increase relatively steadily, reaching +10% to +17% (+40 to +70 mm) by 2060 compared to today (395 mm per year). This increase was observed across all seasons. Winter precipitation is also expected to remain mainly in solid form.
- An increase in heavy precipitation of short duration is also anticipated, as demonstrated by the rise in the number of daily precipitation events of over 10 mm. The increase in extreme precipitation is also correlated with the rise in global humidity in the atmosphere, which in turn increases with rising temperatures.

- With temperatures expected to rise above 2°C by 2060, permafrost extent in the Kangiqsujuaq area is expected to decrease from "continuous" to "sporadic."

9.2.3 Climate hazards selected

The climatic hazards included in the risk analysis are: extreme heat, extreme cold, heavy to extreme rainfall events, snowstorms, large hail events, sustained freezing rain, freeze-thaw cycles, violent wind events, spring thaw, thermokarst subsidence and snowflows.

Other climatic hazards were rejected as being irrelevant to the project location or type (e.g., land subsidence due to drying, spring flooding, deterioration of air quality, bank erosion, fog bank formation, landslide, forest fire, hydrological drought, coastal flooding, tornado, heat wave).

Table 9-1: Climate Projections for the Generating Station Project Area

Parameter		Time of year	2015 Horizon [a]	2060 Horizon	
				RCP4.5	RCP8.5
Average daily temp.: (°C)		Annual	–5.9	–3.8	–1.9
		Winter	–19.1	–15.1	–11.8
		Summer	6.7	8.1	8.6
Average daily high (°C)		Summer	11.1	12.2	13.7
Average daily low (°C)		Winter	–22.6	–18.5	–14.8
Maximum temperature extreme (°C)		Summer	21.6	22.7	25.8
Minimum temperature extreme (°C)		Winter	–37.5	–32.8	–31.4
Number of days with freeze/thaw cycle		Annual	40	40	42
Total precipitation (mm)		Annual	395	435	465
Days with precipitation over 10 mm		Annual	2.4	3.1	3.6
Maximum precipitation for a 1:100 return period (mm)	1 hour	N/A	11	15	17
	24 hours	N/A	45	60	68

a. Projection of current conditions based on RCP8.5 emissions scenario, with the exception of maximum precipitation for a 1:100 return period, for which values are taken from historical precipitation data from a meteorological station in Quaqtaq, 140 km from Kangiqsujuaq.

9.3 Key climate change risks identified

The study highlighted eight potential climate hazards with a moderate or high level of risk, targeting a total of four components. The distribution line stands out as the component most sensitive to certain climatic hazards, such as wind gusts, sustained icing events, thermokarst subsidence and snowflows. The access road to the generating

station is another problematic component, since it is the only link between the generating station and the road (and the village), and will be built on the hillside, on a slope that could exacerbate the impact of certain climatic hazards, such as extreme rainfall and snow flows. The generating station may therefore become temporarily inaccessible, depending on the state of the road.

As far as the generating station is concerned, only the satellite antenna is considered to be a potentially vulnerable component; the level of risk is sufficient to require adaptation measures (to wind gusts). Other components, such as the foundation, building envelope and roof, are also somewhat sensitive to certain climatic hazards (wind, rain, ice), without the need for additional design measures beyond those already provided for by Hydro-Québec.

9.4 Control measures and residual risks

Table 9-2 summarizes the key risks and proposed adaptation measures identified by the project's engineering and design team as part of this study. We believe that the implementation of these measures will provide a satisfactory level of resilience to climate change over the life of the project.

It is also important to note that the two risks deemed "high" do not result from a high-risk rating, but rather from a maximum initial severity rating according to the scale established in the report. In these cases, the impact could be very damaging, so control measures have been added to minimize this risk as much as possible, although the probability of occurrence is very low due to the design criteria already considered by Hydro-Québec (e.g., redundancy of the two distribution line feeders).

Table 9-2: Impacts, Risks and Adaptation Measures Associated with Climate Change for the Project

Climate hazard	Component	Criterion [a]	Possible consequences	Initial risk	Adaptation measures	Final risk
Thermokarst subsidence	Switching and distribution substation	O	Simultaneous interruption of power to the village on both feeders in a permafrost area, which could be extended depending on the extent of the damage.	**High [b]**	Prepare an emergency plan (and update it regularly) for sending out emergency repair teams, to restore power within two to five days. Regularly monitor distribution lines to ensure their integrity before a failure occurs; this will reduce the risk of failure and consolidate system redundancy.	**Low**
Snow flow		O	Simultaneous interruption of power to the village on both feeders at the access road. Its duration will depend on the extent of the damage.	**High [b]**		**Low**

Table 9-2: Impacts, Risks and Adaptation Measures Associated with Climate Change for the Project (*continued*)

Climate hazard (*continued*)	**Component** (*continued*)	**Criterion** [a] (*continued*)	**Possible consequences** (*continued*)	**Initial risk** (*continued*)	**Adaptation measures** (*continued*)	**Final risk**
Strong winds	Switching and distribution substation	F	Repair costs for damaged overhead lines	**Moderate**	Ensure that the design criteria for "regular" distribution lines include resistance to gusts of 200 to 220 km/h. Keep a lookout because of the low confidence in wind projections at Kangiqsujuaq and the potential for a steadier wind regime than at Kuujjuaq. Integrate measures to strengthen poles when wind-related problems are detected during annual pole condition monitoring by Hydro-Québec staff.	**Low**
		O	Temporary interruption of power supply to the village, depending on the extent of the damage, despite the redundancy of the two distribution feeders	**Moderate**		**Low**

Table 9-2: Impacts, Risks and Adaptation Measures Associated with Climate Change for the Project (*continued*)

Climate change (*continued*)	**Component** (*continued*)	**Criterion** [a] (*continued*)	**Possible consequences** (*continued*)	**Initial risk** (*continued*)	**Corrective measures** (*continued*)	**Final risk** (*continued*)
Heavy rainfall events	Road and access road	F	Overloading of access road culverts and ditches, creating flooding conditions and possible structural damage to the access road	**Moderate**	Increased design criteria for culverts and ditches to take into account possible future increases in extreme rainfall. A 50% increase in the historical IDF curves is suggested, based on an analysis of projected temperature rises to 2080. This factor will be included in drainage studies to ensure that the system has sufficient capacity.	**Low**
Spring warm spells (flooding)				**Moderate**		**Low**
Strong winds	Communication system	F	Damage to satellite dish due to extreme wind gusts requiring replacement	**Moderate**	Ensure that the satellite antenna's design criteria include resistance to gusts of 200 to 220 km/h. This type of antenna exists.	**Low**

Table 9-2: Impacts, Risks and Adaptation Measures Associated with Climate Change for the Project (*continued*)

Climate change (*continued*)	**Component** (*continued*)	**Criterion** [a] (*continued*)	**Possible consequences** (*continued*)	**Initial risk** (*continued*)	**Adaptation measures** (*continued*)	**Final risk** (*continued*)
Sustained icy episodes	Generating station access and refueling	O	Temporary shutdown of the generating station due to inaccessibility of personnel coupled with another problem disrupting generating station operations and related to icing	**Moderate**	Ensure that employees have access to a secondary means of transportation (snowmobile, ATV, etc.) that allows them to travel easily on ice during emergencies at the generating station.	**Low**
		E	A tanker truck runs off the road due to slippery road conditions, with the road and path sloping in places	**Moderate**	Ensure the presence of standard guardrails along the road leading to the generating station, particularly in areas at risk of road departures.	**Low**

a. F: Financial aspect; O: Business continuity; E: Environmental; S: Employee and public health and safety.

b. Although the level of risk is "low," mitigation measures are planned, since the GB severity rating is maximum (5).

10 Environmental monitoring and follow-up

10.1 Environmental monitoring

To ensure that mitigation measures are applied, Hydro-Québec conducts environmental monitoring at all stages of a project. At the engineering stage, it incorporates all environmental protection measures identified in the environmental assessment into the plans and specifications and other contractual documents for the project.

During preconstruction activities, the Hydro-Québec environmental officer on site ensures that the environmental measures, requirements, standards and other specifications set out in the contract documents for the project are implemented.

At the start of construction, the contract administrator, the site environmental officer and the construction contractor are provided with information on the company's commitments and specific environmental protection measures.

The site manager is responsible for environmental protection on the site. The site manager ensures 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 and specified in the environmental assessment. In addition, the site manager constantly monitors compliance with the company's environmental protection commitments.

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

10.2 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 soundscape 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.

Given the nature of the project's impacts, the limited and temporary nature of these impacts and the effectiveness of the proposed mitigation measures, no further environmental monitoring activities are deemed necessary or relevant.

11 Sustainable development and adaptation to climate change

11.1 Sustainable development

According to the definition in the Québec *Sustainable Development Act*, adopted in April 2006, sustainable development "means development that meets the needs of the present without compromising the ability of future generations to meet their own needs." Based on a long-term approach, the Act's three objectives are to maintain the integrity of the environment, ensure social equity and foster economic efficiency.

Hydro-Québec has been committed to protecting the environment through sustainable development for more than 30 years and is a pioneer in this field. As a Québec government corporation, Hydro-Québec has adhered to the concept of "sustainable development" since 1989, following the work of the United Nations World Commission on Environment and Development in 1987. This undertaking has been formalized in the *Our Environment* and *Our Social Role* policies. Moreover, pursuant to the *Sustainable Development Act*, Hydro-Québec published its first sustainable development action plan in March 2009 for the 2009–2013 period, which aims to integrate sustainable development principles at every level and in all of its fields of activity. Three other sustainability plans followed, for the periods 2013–2016, 2015–2020 and 2020–2024.

Since 2002, Hydro-Québec has reported annually on its sustainable development performance by publishing a report based on the Global Reporting Initiative (GRI), which is supported by the United Nations Environment Programme (UNEP). Prior to this Sustainability Report, Hydro-Québec had been publishing environmental performance reports since 1995.

In 2015, in parallel with the signing of the Paris climate accord, "the first-ever legally binding global climate change agreement," a list of 17 Sustainable Development Goals (SDGs) was adopted by the UN member states, including Canada. Since the March 2018 update of the Québec *Environmental Quality Act* (EQA), Hydro-Québec's *Sustainable Development Plan 2020–2024* has a more ambitious commitment to invest in sustainable development efforts (Hydro-Québec, 2020). This plan is directly based on SDGs, and is structured into three categories: governance, community ("contribute to Québec's social and economic development while improving the social acceptability of our projects and operations") and the environment ("be a sustainable development leader").

With regard to projects, Hydro-Québec has three basic conditions: they must be economically profitable, environmentally acceptable and favorably received by the

host communities. This approach is in line with that of the Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques (MDDELCC) [Québec's department of sustainable development, environment and the fight against climate change], which is based on harmonious incorporation of the environmental, social and economic aspects of development.

The project was developed based on knowledge acquired from the host communities and in the field since spring 2020. Hydro-Québec conducted several studies on the physical, biological and human environments as part of the project. In addition, the information obtained during repeated meetings with land users helped round out the various studies carried out during the pre-project phase.

The following sections present information that allows this project's performance regarding sustainable development to be judged.

11.1.1 Economic efficiency

Hydro-Québec developed the project to build a new thermal generating station that will integrate renewable energy and ensure reliable power delivery to the Kangiqsujuaq community. The project is economically optimal and will generate local economic spinoffs during the construction phase, since Hydro-Québec is planning incentives to hire local Inuit workers and subcontractors based in Kangiqsujuaq. In addition to these incentives, the local spinoffs will include air transportation for personnel, housing, food purchases from village businesses, fuel purchases for equipment and local machinery rentals.

11.1.2 Maintenance of environmental integrity

Physical environment

Studies of the physical environment have highlighted certain sites to be favored for the construction of the generating station. Climate, climate change (particularly general temperature increase and extreme precipitation), geology, geomorphology and surface deposits, soils, hydrography, hydrology and drainage were studied. Knowledge of the physical environment enables us to better integrate the generating station into the environment, while avoiding it as much as possible. If necessary, Hydro-Québec will apply specific mitigation measures to protect components of the physical environment that are considered to be sensitive.

Biological environment

Biological inventories were carried out on vegetation, wetlands, water environments and wildlife. In the extended study area, the biophysical environment covers nearly 94% of the surface area. It consists primarily of shrub tundra (79%) and wetlands (7%). The water system is also significant, covering 5.2% of the surface area. The remainder

is made up of barren surfaces and a man-made environment (urban environment, infrastructure, and mining site).

The surveys and a visit to the limited study area enabled us to gain a better understanding of the environment, validate the photointerpretation and correct it if necessary, as well as characterize the wetlands present. No at-risk species were observed in the limited study area during the surveys.

Wildlife

In terms of wildlife, 15 species of terrestrial mammals potentially frequent the area, three of which have special status. However, there are no reported sightings or signs of these species in the extended study area. The various surveys carried out identified 17 bird species, including 8 confirmed breeding species and 9 possible breeding species. The CDPNQ did not report any occurrence of wildlife species that are threatened, vulnerable or likely to be so designated in Québec within the extended study area. No mapped wildlife habitat, as defined in the *Regulation respecting wildlife*, overlaps the study area. The MELCCFP did not report any wildlife sites of interest.

11.1.3 Social equity

Social equity is a priority for Hydro-Québec. Hydro-Québec implemented a consultation program focused on informing and consulting people impacted by the new thermal generating station project. The aim of the program was to understand the project, inform the affected public, identify community concerns with a view to optimizing the project and reducing its impacts, and meet the information needs of the various stakeholders.

More specifically, Hydro-Québec held four meetings with representatives of the Kangiqsujuaq municipal council and the Nunaturlik Landholding Corporation, from 2020 to 2022, to present the project and keep them informed of its progress.

A total of five sites were preselected for construction. They were evaluated according to their technical and environmental benefits and drawbacks. The choice offering the most technical, environmental and economic benefits was rejected by the municipal council, since the area where the site is located is reserved for residential development. At the end of the discussions, it was determined that the area on the west side of the airport raised no concerns and was earmarked for development of a more industrial nature. During the meeting, the site was selected by Hydro-Québec and confirmed to the municipal council. In addition to being located in the area targeted as an industrial district by the municipality, it meets Hydro-Québec's technical and environmental criteria and is suitable for the development of a wind farm close to the generating station. It also has the advantage of being located fairly far away from the village, which helps mitigate the impact on community activities, particularly the risk of nuisance from noise or air emissions.

In order to reach as many community stakeholders as possible, Hydro-Québec, accompanied by the mayor, gave a detailed presentation of the project on local radio over the lunch hour, as agreed with community representatives.

In addition, the project was also evaluated against the 16 principles of the *Sustainable Development Act* (see Table 11-1).

Table 11-1: Analysis of Project Components According to the Principles of Sustainable Development as Defined in the *Sustainable Development Act*

Principle	Project components
a) Health and quality of life	The preferred solution will improve the community's quality of life by significantly reducing noise, air emissions and contaminants, since the new generating station will be located more than a kilometre from the center of the village of Kangiqsujuaq. Mitigation measures related to the construction work schedule, transportation, traffic and the use of construction equipment are planned during construction to reduce noise and ensure the safety of the public and workers. In particular, workers, especially truckers, need to be educated about the issue of noise emissions near residences (e.g., prohibit idling of unused vehicles and the use of Jake brakes at the work site and on nearby streets), and stationary equipment (compressors, generators) needs to be located as far away from residences as possible. Preserving the soundscape during generating station operation was also a particular consideration. The new generating station will be built much farther away from residential areas than the existing one, and special design criteria will help reduce noise (orientation of noisy equipment, use of a building envelope with enhanced sound performance, use of high-performance silencers, etc.). Finally, the selected site is located outside of hunting and gathering areas.
b) Social equity and solidarity	Improving social equity is one of the three essential conditions for completion of the project. Social acceptability, equality and equity concerns are reflected in the prominence of public participation in all stages of the project. The public participation process was based on the notion of striking a balance between Hydro-Québec's objectives and the needs and expectations expressed by citizens concerned by the project. The overall objective of the process is to achieve the most harmonious possible incorporation of the project into the host environment. As part of the project, the public participation process enabled Hydro-Québec to present the project in detail to representatives of the municipal council of the northern village of Kangiqsujuaq and the board of directors of the Nunaturlik Landholding Corporation, and to allow community members to express their views on land use and their concerns regarding the construction and operation phases. These were the main conclusions. • The site is used for berry picking and hunting. It was pointed out, however, that there are several other locations that lend themselves to these activities, and that the chosen location will not significantly hinder their practice. • The chosen site is advantageous, as it is a good distance from the residences, but not too far away, making it easier to get around in the event of a blizzard. In addition, it is often cleared of snow to transport drinking water and wastewater. • Residents wanted the site to be physically fenced off to protect the public during construction. In addition, the project will include, from the outset, infrastructure that will enable the incorporation of renewable energy (wind) in the short term to produce electricity with a lower carbon footprint. On completion of the work and once the new generating station has been commissioned, the old one will be dismantled and the land made available to the public.

Table 11-1: Analysis of Project Components According to the Principles of Sustainable Development as Defined in the *Sustainable Development Act* (*continued*)

Principle (*continued*)	**Project components** (*continued*)
c) Environmental protection	This principle is the very essence of an environmental impact assessment. To develop the project, Hydro-Québec carried out various studies on the physical (climate, climate change, soils, geology, geomorphology and surface deposits, hydrography, hydrology and drainage), biological (vegetation and wildlife) and human environments potentially affected. The main environmental issues identified for the new Kangiqsujuaq thermal generating station project are as follows: • survival and movement of land animals and birds, including special-status species • maintaining air quality, reducing GHG emissions and fighting climate change Hydro-Québec automatically applies general mitigation measures to reduce, at the source, the impact of its operations on the environment. In addition to these measures, special efforts are planned to reduce the environmental impact of the project: Hydro-Québec monitors environmental compliance at all stages of its projects, adapting its environmental compliance monitoring program to project specifics and the host environment and overseeing the application of mitigation measures in the field. In addition, the company conducts environmental follow-up when it deems it necessary to assess the effectiveness of certain mitigation measures and to measure the actual residual impacts of a project. Finally, the new generating station will be more energy-efficient, resulting in lower GHG emissions and air pollutants per kWh produced (in the operation phase). In particular, the engines from the existing generating station will be recycled.
d) Economic efficiency	Hydro-Québec studied the project in order to meet growing demand and ensure a reliable supply of electricity. The existing building is old, poorly designed and presents a number of issues that can only be rectified by a major renovation and expansion project. This intervention would have no economic benefits over the construction of a generating station and does not fit in with the development plans of this Indigenous community. Building a generating station is an economically advantageous solution, as it maximizes social and environmental benefits and is supported by local Indigenous authorities. To enable the incorporation of renewable energy, the project also includes a battery energy storage system. Later on, the generating station yard will be used for the connection substation and the equipment needed for connection with the future wind farm.

Table 11-1: Analysis of Project Components According to the Principles of Sustainable Development as Defined in the *Sustainable Development Act* (*continued*)

Principle (*continued*)	**Project components** (*continued*)
e) Participation and commitment	Hydro-Québec implemented a consultation program focused on informing and consulting people impacted by the new thermal generating station project. The objectives of this program are as follows: • educate people about the project (description, justification, environmental benefits and work schedule) • identify the community's concerns regarding the project • respond to and follow up on stakeholders' information needs More specifically, Hydro-Québec held four meetings with representatives of the Kangiqsujuaq municipal council and the Nunaturlik Landholding Corporation, from 2020 to 2022, to present the project and keep them informed of its progress. Hydro-Québec also presented the project in detail on local radio, accompanied by the mayor, and submitted a summary document and short questionnaire to members of the community before the meeting. As agreed with community representatives, the public information session took place over the lunch hour and lasted around two hours. A total of 16 telephone calls were received during this session. Before it can occupy a new site and implement the project, Hydro-Québec must obtain approval from the municipal council of the northern village of Kangiqsujuaq, as well as from the board of directors of the Nunaturlik Landholding Corporation, since it is only the tenant of the generating station site. Community members, especially land users, are informed and consulted during the pre-project phase to allow them to express their concerns. Lastly, the Kativik Regional Government (KRG) is also a stakeholder in the project, since it provides technical support to the northern village, particularly with regard to land use. Key takeaways were as follows: • Hydro-Québec presented the project in great detail and asked community members to share their thoughts on land use in the sector of the new generating station, as well as their concerns regarding the construction and operation phases. • The site is used for hunting and berry picking. It was pointed out, however, that there are several other locations that lend themselves to these activities, and that the chosen location will not significantly hinder their practice. • The chosen site is advantageous, as it is a good distance from the residences, but not too far away, making it easier to get around in the event of a blizzard. In addition, it is often cleared of snow to transport drinking water and wastewater. • Residents wanted the site to be physically fenced off to protect the public during construction. Hydro-Québec has made a commitment to the community to: • provide information on the progress of the project on a regular basis • arrange in-person meetings or conference calls with community representatives

Table 11-1: Analysis of Project Components According to the Principles of Sustainable Development as Defined in the *Sustainable Development Act* (*continued*)

Principle (*continued*)	**Project components** (*continued*)
f) Access to knowledge	Hydro-Québec organizes meetings with land managers, Indigenous communities, representatives of groups or organizations, and citizens affected by its projects. It issues newsletters, publishes press releases, organizes open-house events and meets with property owners and community users to solicit input on the project from as many people as possible. The results of specific surveys on wetlands, watercourses and special-status plant and wildlife species will be forwarded to the departments concerned. These data will contribute to the improvement of knowledge on species with special status. The archaeological potential was analyzed by the Avataq Cultural Institute. No archaeological remains were discovered during the archaeological survey carried out in the four identified potential areas. In the event of the accidental discovery of remains during excavation work, Hydro-Québec will inform the Ministère de la Culture et des Communications and, with the support of the relevant authorities, will determine protective measures if additional mitigation is required (protection, excavation, surveys, etc.).
g) Subsidiarity	The entire public participation process and approaches to Indigenous communities are based on the principle of community involvement in development of the project. This process makes it possible to validate and deepen knowledge of the territory, to learn about communities' projects, and to gather comments and register concerns about the project. Hydro-Québec then presents alternative locations for the project in order to ascertain community concerns and expectations. Among other things, these results help determine the optimum location for the project.
h) Inter-governmental partnerships and cooperation	This principle does not apply to Hydro-Québec.

Table 11-1: Analysis of Project Components According to the Principles of Sustainable Development as Defined in the *Sustainable Development Act* (*continued*)

Principle (*continued*)	**Project components** (*continued*)
i) Prevention (in the presence of a known risk)	As it does in all of its projects, Hydro-Québec implements both standard and specific mitigation to reduce the project's impacts. These measures, set out in the impact study, will then be transmitted to contractors in the form of standardized specific environmental clauses included in the tender documents. During construction, the use and refueling of construction equipment and trucks are potential sources of soil, surface water and groundwater contamination in the event of accidental spills of petroleum products. Hydro-Québec requires that the contractor submit, at the beginning of the work, a response plan for dealing with accidental spills of contaminants and for recovering drilling fluids. The contractor must immediately notify Hydro-Québec in such a case, regardless of the quantity spilled, and implement the response plan. Various measures are taken to ensure the safety of local users: signs, bypass roads if necessary, etc. Hydro-Québec implements an environmental monitoring program to ensure that commitments are met and that the work is carried out properly. As well as incorporating environmental clauses into tender documents, the company produces an environmental monitoring guide for construction contractors. The purpose of analyzing the technological risks of the new Kangiqsujuaq 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 potential accidents or reduce their frequency and consequences. The risks covered by this analysis are major accidental events that could have consequences off-site and damage the human or biophysical environment.
j) Precaution (responsibility principle)	Numerous general and specific mitigation measures have been put in place to preserve the integrity of the biophysical and human environments as much as possible. See also the principle of biodiversity preservation below.

Table 11-1: Analysis of Project Components According to the Principles of Sustainable Development as Defined in the *Sustainable Development Act* (*continued*)

Principle (*continued*)	**Project components** (*continued*)
k) Protection of cultural heritage	A survey of cultural heritage, composed of properties, places, landscapes, traditions and knowledge, was conducted as part of the impact study. In addition, an archaeological potential study is carried out at the beginning of the project. Prior to the start of work, archaeological surveys were conducted in locations where areas with archaeological potential have been identified. Should a site be unavoidable or should the moving of the infrastructure cause additional impacts on other components of the environment, the site will be excavated to gather information required for an understanding of its occupancy. Also, if archaeological remains are discovered on the site during construction, measures will be taken to avoid any operation that could compromise the integrity of the site or the remains. In addition, the work of an Inuit artist from the community will be reproduced on a panel on the front of the building. This incorporation of Inuit art will harmonize the building with the local Indigenous culture. Hydro-Québec performed an archaeological survey in 2022 (visual inspections and surveys) prior to beginning construction work to validate the presence or absence of archaeological sites in the planned work area. If archaeological objects, structures or remains are discovered accidentally at the work site in the absence of an archaeologist, the supplier must immediately notify the Hydro-Québec representative and cease work. In the immediate area of the discovery, the supplier must set up a security perimeter, then record the discovery as best they can to avoid any intervention that could compromise the integrity of the site or the remains discovered.
l) Biodiversity preservation	This principle is also fundamental to an environmental impact assessment. As part of the project, Hydro-Québec has established two study areas: an extended area and a limited area. The extended study area covers a surface area of 2,292.3 ha and is located in the Nord-du-Québec administrative region, specifically in the territory of Nunavik (north of the 55th parallel). It encompasses the northern village of Kangiqsujuaq, located on the coast of Baie Wakeham, and has been defined to include the future generating station site, the inhabited part of the village and the main existing infrastructure, and to exclude the maritime area, since no impact is anticipated there. The extended study area is used for the general description of the components of the biophysical and human environments. Covering a surface area of 24.4 ha, the limited study area is located south of the village of Kangiqsujuaq and east of the airport. It is used to describe the components of the physical and biological environments that are more directly affected by the project. Where necessary, the current conditions of components affected by the project are described in Chapter 6, Impact Analysis. The study areas enabled us to document the land, wetland, aquatic and human environments, to target species with special status and to incorporate specific measures to preserve biodiversity, where appropriate.
m) Respect for ecosystem support capacity	See principles c) Environmental protection and l) Biodiversity preservation.

Table 11-1: Analysis of Project Components According to the Principles of Sustainable Development as Defined in the *Sustainable Development Act* (*continued*)

Principle (*continued*)	**Project components** (*continued*)
n) Responsible production and consumption	This principle particularly concerns site teams during execution of the work. Hiring procedures and measures will be defined at the construction stage; this is why there is little description in the impact study of the actions and activities involved. Measures are also taken during the operation phase, including a ban on bringing single-use food containers and cutlery into the facilities. In terms of energy efficiency, 35 solar panels will be installed on the front of the building to help provide energy required for auxiliary services. In addition, a transition from the current (diesel) generation mode to the hybrid "diesel-wind-battery" mode with the wind power penetration scenario will occur within a few years. This will reduce consumption of diesel fuel, which is difficult to obtain in this part of the province. Currently, impact studies and other specialized studies that accompany them are required in paper format by the ministries concerned. **Opportunities for enhancement** Producing a more user-friendly electronic version would, among other benefits, enable government analysts to consult and query the databases for the purposes of their analyses and save paper.
o) Polluter pays	Under Section 31.1 of the EQA, the construction of the thermal generating station and related equipment requires an environmental impact assessment. This study determines and analyzes the impacts of the project and proposes mitigation and compensation measures. These measures are the responsibility of Hydro-Québec. With regard to residual hazardous materials, if they cannot be treated on site, they are placed in watertight containers and transported south, or taken care of by Hydro-Québec, or by a company under contract with Hydro-Québec, to be treated in accordance with current standards and regulations.
p) Internalization of costs	In line with several of the principles listed above, Hydro-Québec incorporates the cost of the mitigation and compensation measures proposed in the impact study into the project cost.

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