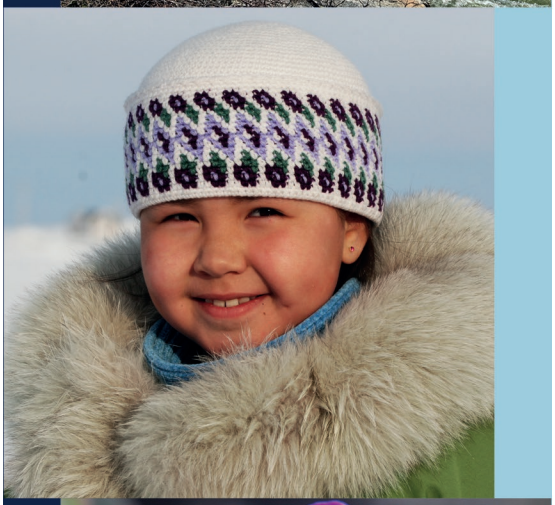

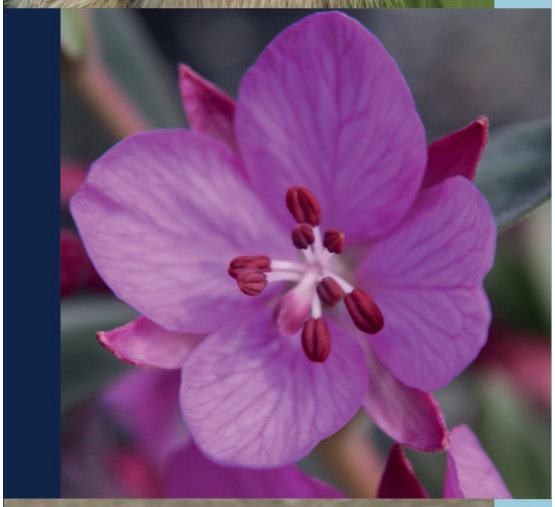

Environmental and Social Impact Assessment

Summary

Innavik Hydroelectric Project

Pituvik Landholding Corporation Inukjuak

INNERGEX

Renewable Energy.
Sustainable Development.

Study filed at the Ministry of Environment and the Fight against Climate Change

File nº 3215-10-05
February 2019

PESCA ENVIRONNEMENT

WSP

PITUVIK LANDHOLDING CORPORATION and INNERGEX RENEWABLE ENERGY

Innavik Hydroelectric Project

Environmental and Social Impact Assessment

Summary

Submitted to the Ministry of the Environment and the Fight against Climate Change

File n° 3215-10-05

February 26, 2019

PITUVIK LANDHOLDING CORPORATION AND INNERGEX INNAVIK HYDROELECTRIC PROJECT

Environmental and Social Impact Assessment Summary

February 26, 2019

PROJECT TEAM

Pituvik Landholding Corporation

President	Eric Atagotaaluk
Vice President	Johnny Mina
Board Member	Andy Moorhouse

Innergex

Manager – Environment	Jeanne Gaudreault, Forest Engineer
Senior Director – Development, Partnerships & Community Relations	Louis Robert, MPM
Senior Advisor – Development, Partnerships & Community Relations	François Morin
Vice President – Engineering	Claude Chartrand, Eng., BScA
Vice President – Environment	Matt Kennedy, MSc, R.P.Bio.
Director – Governmental and Regulatory Affairs	Daniel Giguère

PESCA Environnement

Project Director	Marjolaine Castonguay, Biologist, MSc
Project Manager	Matthieu Féret, Biologist, MSc
Research and Reporting	François Allard, Forest Engineer Nicolas Bradette, Biologist Marie-Flore Castonguay, Land Planner Renaud Quilbé, Hydrologist, PhD Guillaume Arbour, B. Eng., MSc
Mapping	Chantale Landry, Geomatics Technician

CRT Construction

Alain Labonté, Project Director

Lumos Energy

Christopher Henderson, President

WSP

Patrick Lafrance, Environmental Director

☐ TABLE OF CONTENTS

☐ LIST OF TABLES

☐ LIST OF APPENDICES

1 Context and Justification of Project

The Innavik Hydroelctric Project has undergone an environmental and social impact assessment, which was submitted to the Quebec Ministry of Sustainable Development, Environment and Parks (MDDEP) in February 2010 (RSW, 2010). Pituvik Landholding Corporation, the Developer, and its partner Innergex Renewable Energy subsequently responded to four series of questions and comments from the Kativik Environmental Quality Commission (KEQC) as part of the evaluation and review of the impact study (Pituvik Landholding Corporation and Innergex, 2016, 2017, 2018 and 2019). This document is an updated summary of the impact assessment.

1.1 Presentation of Developer

The Developer of the the Innavik Hydroelectric Project is Pituvik Landholding Corporation. Created in 1979, Pituvik Landholding Corporation holds ownership rights to Category I lands associated with the Inukjuak territory and oversees their management for the beneficiaries of the community. The Corporation is a non-profit organization incorporated under the land regime set out in Section 7 of the James Bay and Northern Quebec Agreement and the *Act respecting the land regime in the James Bay and New Québec territories*.

Pituvik Landholding Corporation also holds rights to Category II lands as defined in Section 24 of the James Bay and Northern Quebec Agreement. Under this Agreement, the Inuit enjoy exclusive hunting and fishing rights over the entire territory under their administration.

1.2 Presentation of the Partner

Innergex Renewable Energy (“Innergex”) is the technical and financial partner selected by the Developer in 2015. Innergex is an independent renewable energy producer that develops, acquires, owns and operates hydroelectric plants, wind and solar farms, and geothermal facilities. Headquartered in Longueuil, Quebec, the company operates throughout Canada as well as internationally, namely in the US, France, Chile and Iceland. Innergex manages a significant portfolio of assets that currently include stakes in 68 operating power plants with a total net installed capacity of 2,091 MW (gross capacity of 3,072 MW), including 37 hydroelectric plants, 25 wind farms, 4 solar arrays and 2 geothermal facilities. The company also has interests in five projects under development with a total net installed capacity of 719 MW (gross capacity of 800 MW), two of which are currently under construction, and potential projects at different stages of development, with a total net capacity of 8,382 MW (gross capacity of 9,246 MW). At Innergex, respect for the environment and a balance of the best interests of host communities and the company’s partners and investors are the cornerstones of project development.

1.3 Project Justification

The Northern Village of Inukjuak is not connected to Quebec's main transmission and distribution grid. As in other villages in Nunavik, electricity supply is provided by a diesel-fired generating station operated by the subdivision of Hydro-Québec Distribution responsible for off-grid systems. In its 2005-2014 Supply Plan for off-grid systems presented to the Régie de l'énergie du Québec, Hydro-Québec Distribution mentions that alternatives to thermal production must be considered in order to meet the energy needs of off-grid systems, notably due to the foreseeable increase in the costs of oil. The primary means mentioned notably include the development of renewable energy projects (wind, hydroelectric plants, etc.) as an alternative or complement to thermal production as well as connection to the main grid when this is an option.

In a spirit of sustainable development, the community of Inukjuak plans to develop the hydraulic potential of the Inukjuak River with the goal of minimizing the use of thermal production by commissioning a hydroelectric plant to provide baseload energy as well as space and domestic water heating.

Broadly speaking, the project aims to reduce greenhouse gas emissions while at the same time helping to lower the costs of energy production. Over the duration of its life cycle (40 years), the Innavik plant will allow for a reduction in the order of 696,000 metric tonnes of CO_2 equivalent.

Moreover, the community is hopeful that revenues generated by project operations might represent a significant economic development lever for the completion of various community projects, notably through the establishment of a support centre for the creation of new businesses.

The population of Inukjuak was invited to participate in a contest in order to identify the most meaningful name for the hydroelectric project. The name "Innavik" was retained, which in Inuktitut means a sack in which a flint stone and kindling are kept. This choice of name reflects the local residents' aspirations whereby the project might notably represent a socio-economic lever for the community.

2 Description of Receiving Environment

2.1 Physical Environment

The Inukjuak River originates in the hills of the Canadian Shield and flows slightly more than 300 km before reaching Hudson Bay at the village of Inukjuak. Its watershed spans 11,370 km². Over its course, the river is divided by a number of lakes, including Lake Qattaakuluup Tasinga, which lies approximately 13 km from the river's mouth. Between this lake and the river's mouth, the longitudinal profile of the Inukjuak River is characterized by a series of natural vertical drops and relatively long lentic stretches. The mean annual discharge of the river is estimated at 100 m³/s at its mouth. The downstream segment of the river is affected by tides up until the first section of rapids, approximately 2 km from the river's mouth.

Inukjuak lies in the tectonic province of Lake Superior, the geology of which is dominated by the Minto block. The latter extends over an area of approximately 250,000 km^2 and is divided into six domains, including the Inukjuak domain, which lies at the western extremity of the tectonic province.

The Wisconsin deglaciation and the Tyrrellian transgression have left a multitude of visible formations and deposits across the landscape. It is estimated that the retreat of the ice sheet dates back to approximately 8,000 BCE. At the time of this retreat, the waters of the Tyrrell Sea submerged coastal lands up to an elevation of 190 m.

The climate of Inukjuak is typical for northern Quebec. The average annual temperature is below freezing (-7°C). In summer (July and August), the average temperature reaches 9°C while winter months (January and February) are characterized by an average temperature of -25°C. Overall, temperatures below 0°C are recorded an average of 253 days a year. Rainfall generally occurs between April and November and is most abundant in July, August and September. Snow can occur anytime of the year. Snowfall is generally most abundant in October, November and December with average monthly figures of 33 cm, 50 cm and 32 cm, respectively. The river generally begins to freeze in November and remains covered in ice through late May.

2.2 Biological Environment

The Inukjuak region lies in the Arctic vegetation zone, 140 km north of the tree line. It is part of the natural province of the Ungava Peninsula, a vast plateau dominated by tundra and lichen/shrubby heathland. In Quebec, the Arctic Zone has just one subzone, the Lower Arctic subzone, which is characterized by the absence of trees, continuous permafrost as well as tundra vegetation essentially composed of shrubs, graminoids, mosses and lichens. This subzone is subsequently subdivided into two bioclimatic domains; the project lies in the Arctic shrub tundra domain. Generally speaking, this bioclimatic domain extends from the 58th to the 61st parallel. However, along the eastern shoreline of Hudson Bay, it forms a narrow strip that extends farther south, nearly reaching the 56th parallel.

Soils are generally acidic and low in mineral content. The duration of the frost-free season averages 40 days and the growing season lasts just 80 days. Thus, the shrubby tundra is characterized by a short flowering period. The near continuous blowing of cold, dry winds and the presence of permafrost also restrict plant growth. Where soil is sufficiently developed, particularly in lower areas, shrublands interspersed with wet sedge meadows and ponds may be observed. On the most exposed sites, low shrubs give way to mats of lichens, mosses, and ground-hugging shrubs. Generally speaking, the plant communities are discontinuous and dominated by cryptogams (mosses and lichens) or herbaceous plants punctuated by low woody plants such as ericaceae, willows and birch.

Two summer campaigns were conducted in order to characterize wetlands across the territory in 2016 and 2017. As a result of these campaigns, shrub swamps, wet meadows, wet tundra, herbaceous and shrubby fens, as well as pool/fen complexes were identified, characterized and mapped.

Experimental fishing was conducted in early fall 2008 with the objective of characterizing the composition of the fish community inhabiting the Inukjuak River. A total of ten species were identified, namely brook trout, lake trout, landlocked salmon (ouananiche), lake whitefish, round whitefish, shallow-water cisco, burbot, longnose sucker, threespine stickleback and lake chub. Brook trout and longnose sucker are the most abundant species in the section of the Inukjuak River studied. The substrate characterizing the river bed is essentially composed of bedrock, boulders and pebbles. A number of vertical drops that are deemed impassable are found along the Inukjuak River.

Based on the species' known ranges (Desroches and Rodrigue, 2004; AARQ, 2009), no amphibians or reptiles are likely to be found in the Inukjuak region, the local climate most likely being too harsh.

Low biological productivity, a short growing season and extremely long and cold winters contribute to the harsh living conditions endured by the fauna of the Lower Arctic. Consequently, the number of sedentary bird and mammal species declines rapidly as one moves beyond the tree line and into the tundra. The most abundant or most representative bird species of the natural environment of the Ungava Peninsula include the Canada goose, long-tailed duck, rough-legged hawk, gyrfalcon, ptarmigan, snowy owl, American tree sparrow, white-crowned sparrow, Lapland longspur and common redpoll.

According to a review of literature on the known ranges of the mammals of Quebec (Desrosiers et al., 2002; Environment Canada, 2009; Prescott and Richard, 1982), approximately twenty species of land mammals can be found in the Ungava Peninsula, including five large mammals (caribou, muskox, polar bear, black bear, grey wolf). Species considered abundant or representative of the Ungava Peninsula are the caribou, Arctic fox, Arctic hare and Ungava collared lemming.

2.3 Human Environment

Inukjuak lies in the administrative region of Nunavik in the province of Quebec. This region comprises 14 Inuit communities: Kuujjuak, Inukjuak, Salluit, Puvirnituq, Ivujivik, Kangiqsujuaq, Kangiqsualujjuaq, Kangirsuk, Tasiujaq, Aupaluk, Akulivik, Quaqtaq, Kuujjuarapik and Umiujaq. Nunavik has a population of 13,000, with 90% of the region's residents belonging to the Inuit nation. The administrative centre of Nunavik is located in Kuujjuak.

Inukjuak lies on the Hudson Bay coast. The community of Inukjuak has a population of 1,757 (2016 census). This village comprises approximately 440 private homes as well as basic services including a post office, the Kativik Regional Police Force (KRPF), Inuulitsivik CLSC, a school, a cooperative, etc. The labour force reached 690 persons in 2016 (Statistics Canada). Of this number, 25% of the population works for health care and social services and 25% in the education sector. Approximately 50 persons are employed in the retail industry. According to Statistics Canada, the participation and employment rates are 62% and 48%, respectively, while the unemployment rate is 23%.

Vehicle traffic is mainly concentrated within the boundaries of the village. Overall, traffic intensity is light. An ATV trail extends outward from the village and runs a little more than 10 kilometres along the Inukjuak River. It is mainly used by the local population as an access road to areas used for fishing, hunting and picking wild berries when they are in season. Traffic is light and consists mainly of ATVs.

3 Project Description

The total cost of the Innavik Hydroelectric Project is $104 million. Electricity produced by the run-of-the-river facility will be sold to Hydro-Québec under a 40-year power purchase agreement.

3.1 Site Selection

The project is located 10.3 km from the mouth of the Inukjuak River. It consists of a series of four natural vertical drops, the highest of which is 8.7 m. The four rapids present a total vertical drop of 14.3 m over a distance of 2.7 km. The site is characterized by a narrow valley dominated by rocky outcrops. All temporary and permanent infrastructures of the Innavik project will be built on Category I lands of the Northern Village of Inukjuak.

The site retained makes maximum use of the local topography and the elevation profile of the river. The project includes construction of a rockfill dam and a spillway. Power will be produced by two generating units located in a facility to be built on the right bank. A tailrace channels turbined water back into the river.

The topography does not lend itself well to the construction of large-scale retaining structures. Additionally, any rise in the water level of the forebay would require the construction of outer retention dikes (negating the economic viability of the Project), which in turn would trigger a rise in the level of Lake Qattaakuluup Tasinga farther upstream, which is not the case with the current project.

3.2 Permanent Infrastructures

The Innavik Hydroelectric Project development plan and all project infrastructure (permanent and temporary) are illustrated in Appendix A.

Table 1 summarizes the main characteristics of the project.

Table 1 Characteristics of Innavik Hydroelectric Project

Characteristic	Value
Hydraulic criteria	
Forebay	
Surface area [ha]	113
Average operating level	
- Winter [m]	44.0
- Rest of year [m]	44.6
Maximum operating level during safety flood [m]	46.0
Minimum freeboard [m]	1.0
Crest level [m]	47.3
Tailbay	
Minimum level [m]	22.3
Maximum level [m]	25.3
Spillway	
Safety flood and design flood	1: 1,000 years
Flow associated with safety flood [m^3/s]	784
Plant	
Design flow [m^3/s]	40
Cofferdam	
Design flow [m^3/s]	250
Minimum freeboard [m]	1.5
Material required for construction	
Volume of concrete [m^3]	9,000
Volume to be excavated [m^3]	165,000
Volume of granular material [m^3]	150,000
Number of borrow pits and quarries	3
Total surface area of borrow pits and quarries [ha]	28.8
Related equipment	
Access roads to be built [km]	4.7
Existing roads to be upgraded [km]	8.4
Overhead power line [km]	8.9

3.2.1 Plant

The hydroelectric project will have an installed capacity of 7.5 MW. Power will be produced by two Saxo-type generating units located in a run-of-river plant built on the right bank. The design flow of 40 m^3/s (20 m^3/s per unit) will transit the forebay toward the plant from the water intake via short steel pipes embedded in the concrete.

3.2.2 Dam

The proposed dam is a rockfill structure containing a concrete-filled sheet pile core, which in addition to sealing the impoundment, allows the latter to expand and contract to adapt to the loads associated with cold climate conditions. Such an approach will help maximize the use of on-site material while limiting the quantity of material that must be shipped in, such as cement for the concrete.

Ice-generated forces during the winter months have been taken into account in the dam design. The dam crest will be at the 47.3 m level in order to maintain a water level of 44.0 m during normal operation and to allow a minimum freeboard of 1.0 m, as per the *Dam Safety Regulation*.

3.2.3 Tailrace

The tailrace will channel turbined water back into the river below the rapids. This structure will be excavated in the rock on the right bank over a total length of 390 m. Its width will vary between 10.3 m at the draft tube exit and 35.0 m at its downstream end. The bottom of the channel will be at 34.4 m elevation at the water intake level and will reach 21.6 m at its downstream end.

3.2.4 Spillway

The spillway has been designed to satisfy the safety standards prescribed in the *Dam Safety Act*, notably in terms of safety flood and freeboard. Excavation of the spillway will be performed outside the high water mark (HWM). The spillway crest will have a width of 130.0 m and will be located at the 44.0 m level, i.e. the water level in normal operation.

During plant operations, excess water not passing through the turbine will be discharged through the spillway via an excavated channel that will measure 35 m wide at an elevation of 36.0 m. Subsequently, water will flow along the natural slope to the Inukjuak River below the dam.

3.2.5 Access

The existing access road from the village of Inukjuak will be used to reach the hydroelectric project site, including the section running along Lake Tasiq Tullipaaq. Consequently, the access road will run along the archaeological sites of interest identified by the Avataq Cultural Institute.

According to the archaeologist at the Avataq Cultural Institute, use of this road will not cause additional damage to the site unless construction work requires the road to be widened. Should this be the case, the Developer will communicate with Avataq prior to undertaking any work.

Additionally, the Developer undertakes to apply or adopt practices that aim to minimize impacts to the environment, notably wetlands. Where required, upgrades to sections of the existing road will be completed by constructing a 6 m wide driving surface for a total right-of-way of 10 m. Near the site of installation, the access road will pass by the borrow pits in order to optimize their use. No drainage ditches will be dug along the access roads and "balanced culverts" will be built at wetland crossings.

Construction of a bridge across the Inukjuak River is also planned to provide access to the structures on the left bank (Appendix A). In order to do so, a section measuring approximately 3.6 km will be built.

3.2.6 Transmission Line and Substations

It is planned to install a 25 kV transmission line along the access road to Hydro-Québec's existing switchyard north of the village of Inukjuak. This power line will be installed on wooden poles. The proximity of the access road will facilitate preventive inspections of the transmission line. During the construction phase, the site could be powered by this new transmission line. Otherwise, on-site generators could be used.

The 4.15-25 kV substation will be built within the power generation facility. It will be connected to the substation adjacent to the plant, which in turn will be connected directly to the planned transmission line. The future Hydro-Québec substation will receive the transmission line so that energy produced by the new plant can be distributed to the community.

3.3 Temporary Infrastructures

3.3.1 Camp

The camp will be located at the northern edge of the village at the intersection with the site access road (Appendix A). The camp will have a surface area of 0.9 ha and will be able to accommodate 128 persons. It will be used essentially during periods of construction, which will be spread over the course of 3 years.

Accommodation infrastructures will be in the form of temporary trailers, including the cafeteria and various services. A subcontracting agreement will be signed between the contractor and a local company.

Transportation between the site and the camp will be provided by vehicles supplied by the contractor.

3.3.2 Quarry and Borrow Pits

The existing access road from the village of Inukjuak provides access to the first borrow pit (Appendix A). Upon commencement of construction, a volume of approximately 20,000 m^3 of coarse granular material will be required to surface the access road to the plant as well as the work areas. The identified material deposits are located near the projected power plant area and the work areas.

A total of 28.8 ha is required for the borrow pits and quarries (Table 1). Granular material will be sourced from 3 borrow pits. The Developer will obtain all required authorizations to exploit these mineral substances from local (Northern Village of Inukjuak and Pituvik Landholding Corporation) and provincial (MELCC) authorities. The Developer will also discuss the terms of restoring these sites after exploiting them, given that the availability of granular material is an issue in Nunavik.

Subsequently, excavated material from the diversion channel, the plant and the tailrace will be used to backfill the work and storage areas, widen the access roads and construct the cofferdam and dam. The identified deposits will provide concrete sand.

3.3.3 Crushers and Concrete Batch Plant

A crusher/screen system will be installed on site, near the plant, for optimal use of excavated rock as borrow or as coarse aggregate for concrete production. A concrete batch plant will also be installed on site. Excavated material will be stockpiled in an area near the work site.

3.3.4 Diversion and Cofferdam

Planned construction activities call for a cofferdam to be installed upstream of the site's main vertical drop which is designed to drain the river bed and channel water toward the diversion channel. The cofferdam will be constructed as per the recommendations in MDDELCC's guide entitled "*Aménagement d'un batardeau et d'un canal de dérivation*" [Constructing a cofferdam and a diversion channel] (2015).

The diversion is planned on the left bank via a 15 m wide channel excavated into the rock. The channel will be excavated outside the high water mark (HWM). The total length of the diversion structure will be 180 m. This channel will be closed after construction of the dam to allow for impoundment of the forebay.

The rockfill cofferdam will be built upstream of the structure and will have a geomembrane to ensure that it is well sealed. The cofferdam will be integrated into the permanent structure and will not be dismantled. Furthermore, it does not require any pre-cofferdamming.

3.4 Required Labour

An average of 40 workers will be present on site during construction. At the peak of construction, i.e. in 2020, 2021 and 2022, 100 workers will be present on site. During the operational phase, 1 or 2 resident operators will be hired. The contract with the general contractor aims to encourage the hiring of local staff. However, a portion of the staff will most likely be sourced from outside Nunavik.

The planned work is estimated to require approximately 345,000 man-hours to complete. Meetings have been held with the regional training centre to discuss the needs for qualified labour during the construction phase. Training courses offered in Inukjuak notably cover carpentry, electrical installation and mechanics.

It is anticipated that certain activities will be delegated to local groups in collaboration with the Developer, notably with regard to compensation projects. This expertise could then be applied to other projects carried out in Nunavik in the future.

3.5 Schedule

Construction is planned to begin in Fall 2019 and will last through Fall 2022.

- Mobilization – Installation of camp and upgrades to access roads: Fall 2019
- Construction: 2020, 2021 and 2022
- Plant commissioning: Q4 2022

4 Meetings and Community Consultations

Together with its partner, the Developer has held and continues to hold meetings with various local stakeholders in the context of the Innavik project, notably with the Northern Village of Inukjuak, the Inukjuak Hunting, Fishing and Trapping Association, the Kativik Regional Government (KRG) and Makivik Corporation. The latter entity strongly supports the Innavik project.

Notably, in order to inform and consult with the residents of Inukjuak, an information session was held on June 19, 2017. A total of 50 citizens attended this event. Exchanges revealed that the project enjoys a high level of support among the population. The same conclusion can be drawn from the evaluation forms that participants completed.

In 2010, a poll was taken in the community in an effort to gauge support for the project. With a turnout of 71.5% (654 of 914 registered voters), 83.2% of voters indicated that they were in favour of the project.

The community was consulted in 2008 to get a sense of how community members felt about the project passing from the pre-feasibility stage to the feasibility stage. Approximately 70 individuals were present and the resolution in favour of pursuing the project was approved.

5 Repercussions on the Environment and Proposed Measures

5.1 Main Environmental and Social Issues

Based on the environmental assessment conducted by the Developer as well as meetings held with the community, various local stakeholders and ministries, the main project-related environmental and social issues were identified and are described below.

5.1.1 Water Quality

Maintaining water quality during both the construction and operational phases represents an issue for the population of Inukjuak, as the water intake for drinking water supply to the Northern Village is located at the mouth of the Inukjuak River, approximately 7 km downstream of the project.

Water quality will be monitored continually throughout the construction period. The frequency of analyses will be adjusted as a function of the level of risk and will be validated by the project team. Reports and results will be available for members of the community. A water quality monitoring system will be installed downstream of the construction sites. This system will be used to monitor turbidity (suspended material in the water) and oxygen concentrations and to detect any discharge of organic or inorganic products related to construction activities (notably excavation) or machinery. Analyses will be conducted during the construction period in order to measure the benchmark water quality of the Inukjuak River (reference values). During plant operations and over a 5-year period, water quality monitoring will be carried out on a weekly basis.

An Emergency Action Plan will be implemented. In the event that a degradation in water quality is observed and there are potential repercussions on human health and wildlife habitats, a remediation plan will be implemented. This plan will be developed in collaboration with the community of Inukjuak and the Kativik Regional Government. It will comprise actions to be taken immediately, including the implementation of an alternative source of drinking water, a procedure to identify the source of water quality degradation as well as potential corrective measures to re-establish water quality and avoid any subsequent degradation.

Steps are currently being taken with representatives of the Northern Village and the Kativik Regional Government (KRG) in order to broadly outline the water quality monitoring program and the Emergency Action Plan that will be put into place.

5.1.2 Economic Benefits

The project would create positive socio-economic benefits. Given the scale of work being planned, the construction phase would represent an opportunity not only for members of the Inukjuak community but also for Inuit of other communities across Nunavik to be directly or indirectly involved in completing a major infrastructure project. During the operational phase, the reinvestment of profits generated by energy production into socio-economic development would pave the way for the completion of various projects that would likely enhance the quality of life in the community. Training programs will be put into place in the project host community in order to maximize the number of Inuit workers.

5.1.3 Social Impact

The Developer is aware of the social issues and disturbances that will be triggered by the presence of the work site and the arrival of workers from outside the region. The Developer intends to implement a series of actions and measures throughout the project in order to minimize undesirable consequences and mitigate any adverse impacts.

The Developer will create a Follow-up and Cooperation Committee (hereafter, the “Committee”) as soon as the construction phase commences. The mandate of this Committee will be to ensure that the development, construction and operation of the run-of-the-river plant is carried out in a spirit of cooperation with the host community. During the construction phase, the Committee could meet once a month. In the operational phase, the frequency of such meetings could be based on the needs expressed by Committee members or by the community.

The role of this Committee will notably be to monitor and improve as needed the process of receiving and handling comments and complaints at the Committee's monthly meetings, without being directly involved in their handling. The Committee’s primary goal is to rectify problematic situations as quickly as possible.

At the organizational level, measures will be implemented as early as Q1 2019 in order to fill as many positions as possible using local and regional resources and thereby limit the number of workers from outside the region. To this end, the first meetings will be held beginning in February 2019 and constant recruiting and training efforts will be continually undertaken until the start of construction. Also prior to the commencement of work, a social impact monitoring protocol (including behaviours that are inappropriate or that jeopardize social harmony) will be developed and a confidential mechanism will be put into place to handle grievances and problematic incidents. These measures will be submitted to the Committee, though specific cases will be handled in confidentiality. These measures will all be communicated to the community prior to the commencement of work, as will reminders issued at regular intervals throughout project construction.

All workers will reside at the camp that will be located in proximity to the airport. The contractor will instate a code of conduct before workers begin travelling to Inukjuak. Each and every employee will be obligated to familiarize themselves with this code and sign it. This code of conduct includes sanctions and conditions for expulsion from the construction site. The camp will be “dry”, meaning no alcohol or drugs will be permitted. The contractor will participate in Committee meetings. Any complaint or concern will be adequately addressed by this Committee. The contractor will also be in regular contact with the local police force. A safety officer will be assigned to the camp in order to monitor workers’ comings and goings and ensure compliance with established rules.

By optimizing project timeframes and scheduling, it will be possible to maintain a manageable and community-friendly level of activity while maximizing sustainable economic spinoffs. Additionally, through regular Committee meetings and a suitable communication plan, the Developer will implement exchange mechanisms that will help identify potential issues and continuously take corrective actions. This approach will notably help minimize impacts on traditional uses of the river during the construction phase and subsequent operations.

Lastly, the final year of construction will coincide with the implementation of a “landing” protocol, the objective of which will be to ensure that construction draws to a close in the best conditions possible. This process entails collaboration with the Committee to assess the impacts of construction on the social fabric of the community and the latter’s normal activities and, once again, implementing measures that will facilitate a return to the status quo. The Developer firmly believes that this process must be initiated prior to the end of construction in order to ensure the commitment of all stakeholders.

In order to undertake all the aforementioned measures, the Developer may enlist the services of expert consultants and mobilize other necessary resources.

5.1.4 Mercury

On account of the high water renewal rate along the forebay, the fact that it is a run-of-the-river plant, and the low ratio between the size of the flooded area and the inflows that would pass through this sector on an annual basis, no issues or risks with regard to higher mercury levels in fish are anticipated. However, considering that this is a major concern, the Developer will put the necessary measures in place to verify these repercussions and keep the population informed.

A fish contamination monitoring program will be implemented for the Project to determine and monitor potential changes in mercury concentrations in fish tissue. The program will include a sampling regime that will allow mercury levels in fish tissue to be determined over a 15-year period after initial flooding of the forebay.

5.1.5 Fish Habitat

Fish habitat in the section of Inukjuak River between the dam and the outlet of the tailrace will be modified. A portion of this section (totalling 4,652 m^2) will be permanently exposed between the dam and the spillway outlet. Maximum exposure will be observable during the winter low flow period, when all water from the Inukjuak River will pass through the plant's turbines and none will be discharged via the spillway. In this situation, the maximum surface area exposed would total 36,954 m^2 between the dam and the tailrace outlet. The rest of the year, the extent of the exposed area will vary from season to season as a function of the natural flow of the Inukjuak River.

The section of the Inukjuak River that will be exposed corresponds to a sector of rapids and riffles with a lotic flow of whitewater over a substrate of bedrock and boulders. According to the fish community and habitat characterization study, this section of river could be used as a feeding grounds by brook trout and possibly landlocked salmon (ouananiche).

The Developer is committed to carrying out projects to offset any modification to fish habitat and will do so in consultation with various local stakeholders (Uumajuit warden, municipality, representatives of hunting, trapping and fishing community, etc.). The Developer undertakes to perform monitoring over a 10-year period in spawning areas developed according to recommendations made by community members, who will be consulted in order to develop compensation measures that are appropriate for the modifications sustained by the fish habitat. The monitoring program will be developed in collaboration with MFFP and MPO representatives, as the case may be.

5.2 Impact Assessment

The impacts of the Innavik Hydroelectric Project on the natural and social environments were assessed using a proven methodology and are summarized in Table 2. It has been found that neither the construction nor the operational phase of the project would result in any negative impacts of moderate or major significance. Undeniably contributing in this regard was the application of an integrated project development approach whereby environmental issues were taken into account from the earliest design phases.

The Innavik project is being developed by the community for the community. Only minor negative impacts are anticipated with regard to the following activities:

- Encroachment of land and riparian vegetation due to the building of access roads and work areas during the construction phase;
- Temporary loss of fish habitat associated with encroachment on the aquatic environment by the cofferdam installation and potential repercussions on fish from blasting during the construction phase;
- Possible disturbance of peregrine falcons on account of noise and human presence during the construction period as well as encroachment on habitat used by avifauna due to construction of access roads and work areas;
- Increased construction-related vehicle traffic and noise on the outskirts of Inukjuak, which would likely have an impact on the lives of community members;
- During the operational phase, encroachment on the terrestrial environment by the aquatic environment and planned infrastructures, which might affect the vegetation likely to be found in these encroached areas;
- Loss of terrestrial habitat for avifauna due to rising water levels planned along the forebay during the operational phase;
- Effect of transmission lines on the landscape.

The project will not significantly alter land access; the area will remain accessible at all times, with the exception of certain periods during the construction phase for safety reasons, notably in the event of blasting. Access to the area during the operational phase will be facilitated via upgrades to existing roads and construction of a bridge providing access to the left bank of the Inukjuak River. The Developer will oversee maintenance of the access roads to the facilities for the duration of the power plant's service life.

Table 2 Summary of Impacts of Innavik Hydroelectric Project on the Natural and Human Environments

Component	Project Phase	Description of Impact	Mitigation or Compensation Measures	Significance of Project Impact
Biological Environment				
Vegetation	Construction	Encroachment on terrestrial and riparian vegetation for the creation of work areas.	Efforts will be made to site the access road and work/storage areas on bedrock. Wetlands were avoided as much as possible. No special status plant species was observed during this study in wetland or in terrestrial environments. Backfilling of borrow pits, if it is agreed to do so. Rehabilitation of work areas, spreading of fine material on ground surface and site grading in order to create depressions and develop moister areas conducive to the development of vegetation.	Minor
	Operations	Encroachment of vegetation due to rising water levels and the presence of infrastructures.	No mitigation measures will be applied. The areas concerned will be located on rocky substrates where vegetation is sparse or of low diversity. A variably wide strip of riparian vegetation could become established in the long term at sites presenting a fine substrate and a gentle slope.	Minor
Fish population and their habitats	Construction	Encroachment on aquatic environment for cofferdam installation. Temporary diversion of river. Potential repercussions due to use of explosives.	Diversion channel designed so as to maintain natural water levels upstream. Compensation measures. Compliance with recommendations of Wright (1998) for explosives.	Minor
	Operations	Losses and modifications of habitats due to rising water levels. Fish mortality due to passing through the turbines or being pinned against the water intake.	Compensatory habitat management work. Fish screen to be installed upstream of the water intake.	Minor
Avifauna	Construction	Disturbance due to noise, traffic or human presence. Habitat encroachment.	Monitoring of peregrine falcon nesting at site where bridge will be built across the Inukjuak River. Population and workers to be informed and educated with regard to peregrine falcons.	Minor
	Operations	Loss of terrestrial habitat due to rising water levels.	-	Minor

Component	Project Phase	Description of Impact	Mitigation or Compensation Measures	Significance of Project Impact
Mammals	Construction	Disturbance due to noise, traffic or human presence. Habitat encroachment.	-	Negligible
	Operations	Loss of terrestrial habitat due to rising water levels.	-	Minor
Human Environment				
Socio-economic aspect	Construction	Hiring of labour for construction work. Presence of workers from outside the region	Train a local labour force. Establishment of a Follow-up and Cooperation Committee to maximize benefits, manage complaints and mitigate adverse impacts. The camp will be alcohol-free. A code of conduct shall be followed.	Moderate (positive impact)
	Operations	Creation of permanent and temporary jobs for plant O&M. Reinvestment of profits generated in socio-economic development projects.	Train a local labour force.	Major (positive impact)
Vehicle traffic	Construction	Increase in vehicle traffic on the outskirts of Inukjuak for the transport of material and staff.	It is planned to build the access road outside the village of Inukjuak.	Minor
Landscape	Construction	Temporary modification to landscape due to the presence of equipment and machinery on the construction site.	-	Negligible
	Operations	Modification to landscape due to the presence of infrastructures.	-	Minor
Acoustic environment	Construction	Increase in sound levels due to construction, notably blasting, crushing, traffic and the operation of machinery.	It is planned to build the access road outside the village of Inukjuak. The population of Inukjuak would be kept informed of the construction activity schedule.	Minor
	Operations	Increase in sound levels due to operating turbines.	-	Negligible

Component	Project Phase	Description of Impact	Mitigation or Compensation Measures	Significance of Project Impact
Heritage and archaeology	Construction	Potential encroachment on archaeological sites for construction of access road and work camp.	The access road layout would be designed so as to avoid two archaeological sites. If the event the scope of work is expanded, the Developer undertakes to perform an archaeological dig (salvage excavation) before commencing work. The work camp location was planned so as to be sited away from an archaeological site. Establishment of a buffer zone.	None

5.3 Mitigation or Compensation Measures

The mitigation and compensation measures described in the impact study remain relevant, notably:

- Strive to site the access road and work/storage areas on bedrock and avoid wetlands as much as possible;
- Develop a compensation plan for wetland losses that cannot be avoided by identifying potential compensation projects supported by the community in consultation with local stakeholders (Uumajuit warden, municipality, elders, youth, women, etc.);
- Using the sedimentation pond, treat pumped water and, if necessary, runoff from construction activities before discharging these waters into the hydrographic network;
- Conduct water quality monitoring during the cofferdam installation period and whenever pumping excavation water;
- Conduct drinking water quality monitoring over a 5-year period of the operational phase;
- Ensure that wastewater from the washing of equipment and tools used for concreting work is not discharged into the watercourse or within 20 m of its banks;
- Ensure that water potentially affected by concreting activities is channelled into a specific pond separate from the sedimentation pond for excavation water. This pond is expected to have a high pH value (in the order of 11). Water will be treated in order to re-establish a pH level that meets the criteria for discharge of the said water into the environment;
- Restrict machinery and vehicle traffic in designated work and traffic areas;
- Prohibit the fording of watercourses by construction vehicles and machinery;
- Plan to use sediment barriers, straw bales or any other system to retain soil particles in the event that they are present in the runoff;
- During the construction phase and when filling the forebay, mitigation measures will be implemented to limit the quantity of fine particles in the Inukjuak River. Additionally, water quality will be tracked continually throughout the construction period using a system installed downstream of the construction sites and that will notably allow for turbidity monitoring;
- Upon completion of plant construction, rehabilitate work areas using available granular material, (terms of borrow pit restoration to be discussed with local authorities);
- Design the diversion channel so as to maintain natural water levels upstream during the construction phase and before impounding the forebay.
- To the extent possible, suspend river excavation work in September in order to avoid negative impacts on the spawning of coregonids and salmonids;
- Apply the recommendations of Wright (1998) for the use of explosives in aquatic and riparian environments;
- During the construction phase, relocate downstream of the structure any fish that potentially remain trapped in the residual basins after those areas have drained;

- Develop a fish habitat compensation plan by identifying potential development projects supported by the community. The proponent undertakes to monitor these projects for 10 years, as per recommendations made by members of the community, who will be consulted.

- Implement a program to monitor mercury contamination in fish populations over a 15-year period following flooding of the forebay;

- Install a fish screen upstream of the water intake;

- During the construction phase, conduct monitoring of peregrine falcon nesting at the site where the bridge will be built over the Inukjuak River to access structures on the left bank;

- Inform and educate the population and workers about peregrine falcons with regard to rock scaling, removal of eggs and young, harvesting of individuals as well as protection measures implemented as part of the project (if any);

- Establish a Follow-up and Cooperation Committee;

- During the project's construction phase and whenever possible, wood-based construction materials will be preferred to those made of steel, aluminum, concrete and similar materials, wood being considered a more acceptable solution from an environmental standpoint. To the extent possible, equipment used during project operations will be powered using hydroelectricity produced by the project rather than GHG-emitting fossil fuels. The use of fossil fuel-powered equipment and vehicles will be minimized and idling of equipment will be avoided whenever conditions allow.

6 Surveillance and Monitoring Program

6.1 Surveillance Program

It is planned to carry out environmental surveillance throughout the construction phase. The surveillance program to be applied mainly aims to verify that:

- The proposed mitigation measures are implemented effectively and adequately;
- Activities carried out have been taken into account in the impact assessment;
- Activities are executed in compliance with the *Environment Quality Act* and other applicable regulations.

The Developer indicates that it will create a Follow-up and Cooperation Committee as soon as the construction phase commences. The mandate of this committee will be to ensure that the development, construction and operation of the run-of-the-river plant is carried out in a spirit of cooperation with the host community.

An environmental surveillance form for the proper implementation of mitigation measures would be completed by the construction site supervisor and sent to the Developer upon completion of work.

6.2 Monitoring Program

The monitoring program applied in the operational phase would mainly aim to verify the following:

- Maintenance of water quality between the outlet of Lake Qattaakuluup Tasinga and the mouth of the Inukjuak River;
- Use of compensation measures for the loss of fish habitat;
- Mercury concentrations in fish.

Water Quality Monitoring

An agreement is due to be signed with Makivik Corporation to carry out, as an independent organization, monitoring to ensure that water quality is maintained. Samples would be taken at various sites along the Inukjuak River, upstream and downstream of the planned structure, between the outlet of Lake Qattaakuluup Tasinga and the mouth of the river. Characteristics of the samples would be compared to those of a control sample taken upstream of the outlet of Lake Qattaakuluup Tasinga, at a point where water quality could not be altered by the project. Monitoring would be carried out over a five-year period.

Monitoring of Managed Habitat Use

The Developer undertakes to perform monitoring over a 10-year period in spawning areas developed according to recommendations made by community members, who will be consulted in order to develop compensation measures that are appropriate for the modifications sustained by the fish habitat.

Monitoring of Fish Mercury Concentrations

A fish contamination monitoring program will be implemented for the Project to determine and monitor potential changes in mercury concentrations in fish tissue. The program will include a sampling regime to determine mercury levels in fish tissues over a 15-year period following initial flooding of the forebay.

7 Conclusion

The Innavik Hydroelectric Project will have minor or negligible residual impacts on the biological and human environments, with the exception of positive impacts (of medium to major significance) on socio-economic aspects. Optimization of the project and minimization of residual impacts are possible, notably due to an adapted configuration and application of common and site-specific mitigation and compensation measures.

The Innavik project is compatible with the objectives expressed by the community. Broadly speaking, these objectives called for the completion of a project that would help curb greenhouse gas emissions and contribute to the community's socio-economic development while taking due account of the conditions of the receiving environment.

References

AARQ. Atlas des amphibiens et des reptiles du Québec, 2009, available at www.atlasamphibiensreptiles.qc.ca.

Pituvik Landholding Corporation and Innergex. 2016. Responses to the first series of questions and comments for the Innavik Hydroelectric Project. Submitted to the Ministry of Sustainable Development, Environment and the Fight against Climate Change.

Pituvik Landholding Corporation and Innergex. 2017. Responses to the second series of questions and comments for the Innavik Hydroelectric Project. Submitted to the Ministry of Sustainable Development, Environment and the Fight against Climate Change.

Pituvik Landholding Corporation and Innergex. 2018. Responses to the third series of questions and comments for the Innavik Hydroelectric Project. Submitted to the Ministry of Sustainable Development, Environment and the Fight against Climate Change.

Pituvik Landholding Corporation and Innergex. 2019. Responses to the fourth series of questions and comments for the Innavik Hydroelectric Project. Submitted to the Ministry of the Environment and the Fight against Climate Change.

Desroches, J.-F. and D. Rodrigue. Amphibiens et reptiles du Québec et des Maritimes. Éditions Michel Quintin. Waterloo, 2004.

Desrosiers, N., R. Morin and J. Jutras. Atlas des micromammifères du Québec. Société de la faune et des parcs du Québec. Direction du développement de la faune. Québec City, 2002.

Environment Canada. Faune et Flore du Pays : les espèces sauvages du Canada. Canadian Wildlife Service and Canadian Wildlife Federation, 2009. Available at http://www.hww.ca/fr/.

MDDELCC. 2015. Aménagement d'un batardeau et d'un canal de dérivation. Updated August 2015. Ministry of Sustainable Development, the Environment and the Fight against Climate Change. 18 p.

Prescott, J. and P. Richard. Mammifères du Québec et de l'est du Canada, vol. 2. Éditions France-Amérique. Montréal, 1982.

RSW (2010). Innavik Hydroelectric project, Inukjuak River – Environmental and Social Impact Assessment, prepared by RSW Inc. for Pituvik Landholding Corporation.

Wright, D.G. and G.E. Hopky. Guidelines for the use of explosives in or near Canadian fisheries waters, Canadian technical report of fisheries and aquatic sciences, 1998, iv + 34 p.

Appendix A - Innavik Project Infrastructure Drawings

Innavik Hydroelectric Project

Location of Project Infrastructures

- Preliminary location of the temporary water intake

Project infrastructures

- Existing acces road
- Projected acces road
- Projected transmission line
- Spoil area
- Staging area
- Quarry and borrow pits
- Camp
- Crushers and concrete batch plant
- Materiel stockpile
- Headpond (normal level: 44,0 m)

Others elements

- Contour line (10 m interval)
- Road
- Watercourse
- Water body
- Inukjuak airport
- Municipal boundary
- Category I land
- Category II land

N

1/15 000

0 375 750 1 500 Meters

Projection: NAD 1983 MTM 10

Sources:
© Government of Quebec, all rights reserved, 2017
Projet infrastructures: Innergex, 10-19-2017

August 29, 2018

Our reference: INEINJ00-050_105B

Inukjuak - Northern village

Baie d'Hudson - Unorganized territory

Inukjuak - Category I land

Lake Qattaakkuluup Tasinga

Inukjuak River

Sanirqamaiik Stream

Lake Qikirtalik

Lake Qikirtatuuq

Lake Nirikkaivik

Lake Akullipaaq

Lake Tasiq Tullipaaq

Lake Inussualuk

Little Lake Inussualuk

Plant

Dam

Tailrace

Spillway

Diversion channel

1/3 000

Contour line (1.25 m interval)

386 000 388 000 390 000 392 000 394 000

6 489 000 6 488 000 6 487 000 6 486 000 6 485 000 6 484 000 6 483 000 6 482 000