REPORT – VOLUME 3

SOCIO-ENVIRONMENTAL STUDY

Feasibility Study Final Report Phase I

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ACRONYMS

Acronyms	Definition
AADT	Annual Average Daily Traffic
ACCI	Aanischaaukamikw Cree Cultural Institute
AOP	Areas of potential
ARPP	Archaeological Resource Protection plan
B.P.	Before present
BANQ	Bibliothèque et Archives nationales du Québec
BDH	Billy Diamond Highway
BDHR	Billy Diamond Highway railway
bs	Below surface
CBHSSJB	Cree Board of Health and Social Services of James Bay
CCQ	Commission de la Construction du Québec
CDC	Cree Development Corporation
CDPNQ	Centre de données sur le patrimoine naturel du Québec
CFNW	Cree First Nation of Waswanipi
CIO	Community Information Officers
CIRNAC	Crown-Indigenous Relations and Northern Affairs Canada
CLIC	Chibougamau intermodal logistics centre
CMEB	Cree Mineral Exploration Board
CN	National Transcontinental Railway
CNE	Cree Nation of Eastmain
CNG	Cree Nation Government
CNM	Cree Nation of Mistissini
CNN	Cree Nation of Nemaska
CNWa	Cree Nation of Waskaganish
CNWe	Cree Nation of Wemindji
COFEX-South	Review Panel
COMEV	Evaluating Committee
COMEX	Environmental and Social Impact Review Committee
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
COTA	Cree Outfitting and Tourism Association
CTA	Cree Trappers' Association
CWA	Canada Wildlife Act
DFO	Fisheries and Oceans Canada
EIJBRG	Eeyou Istchee James Bay Regional Government
EIs	Environmental Inspectors
EQA	Environment Quality Act
ESA	Environmental and social impacts
FAMU	Fur-bearing animal management units
FCMQ	Fédération des clubs de motoneigistes du Québec
FMR	Fire Modified Rocks

Acronyms	Definition
FoI	Features of interest
FQCQ	Québec federation of quad clubs
GCC (EI)	Grand Council of the Crees (Eeyou Istchee)
GCR	Grevet-Chapais railway
GHG	Greenhouse gases
GIS	Geographical Information System
GOC	Goverment of Canada
HBC	Hudson's Bay Company
HQ	Hydro-Québec
HSI	Habitat suitability index
IAA	Impact Assessment Act
IDF	Intensity-duration-frequency
IPCC	International Panel on Climate Change
IUCN	International Union for the Conservation of Nature
JBNQA	James Bay and Northern Québec Agreement
KP	Kilometric points
LADTF	Sustainable Forest Development Act
LCMVF	Act respecting the conservation and development of wildlife
LCPN	Natural Heritage Conservation Act
LEA	Local Environment Administrator
LGA	La Grand Alliance
MCC	Ministère de la Culture et des Communications
MELCC	Ministère de l'Environnement et de la Lutte contre les changements climatiques
MELCCFP	Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs
MOU	Memorandum of Understanding
MRNF	Ministère des Ressources naturelles et des Forêts
MTQ	Ministère des Transports du Québec
NTS	National Topographic System
NWC	North-West Company
OBCN	Oujé-Bougoumou Cree Nation
PAH	Polycyclic aromatic hydrocarbons
RCP	Representative concentration trajectory
RTFAP	Territorial reserves for protected area purposes
SARA	Species at Risk Act
SEBJ	Société d'énergie de la Baie James
STBBI	Sexually transmitted and blood-borne infection
TRAF	Rivière aux Feuilles herd
TRG	Rivière George herd
UQCN	Québec union for the conservation of nature
VEI	Vision Eeyou Istchee
VEP	Vastes espaces propices
WSE	Washaw Sibi Eeyou

Acronyms	Definition
YMT	Chibougamau-Chapais Airport (YMT
ZHR	Zone d’habitats en restauration
ZIA	Zone d'information archéologique

9 SOCIO-ENVIRONMENTAL STUDY

9.1 INTRODUCTION

9.1.1 Objectives of the Socio-environmental Study

Development projects cannot be carried out without bringing changes in the environment and to the social environment. The James Bay and Northern Québec Agreement (JBNQA) was established in 1975 to ensure, among other things, that development in the Cree territory is carried out taking into account the protection of the environment and the maintenance of land use by Cree communities for the practice of their traditional activities. The JBNQA also provides a pathway for Cree in the decision-making as part of the environmental assessment process under Chapter 22 of the Agreement.

This Environmental and Social Feasibility Study is an important tool to guide future developers wishing to carry out the Phase 1 of La Grande Alliance (LGA). It is an innovative approach that plans to document, upstream of design by future proponents, the expectations and concerns of affected Cree communities, identify key potential land use conflicts and propose solutions (avoid, mitigate, offset), anticipate key potential impacts and recommend mitigation measures.

The Cree Development Corporation (CDC) made it clear from the beginning of the LGA process that they wanted local community involvement, and environmental and social criteria evaluated at the same level as technical and financial criteria in the infrastructure design and planning. To meet these principles,Vision Eeyou Istchee (VEI) did the following:

- Organised internal bi-weekly meetings and direct exchanges between colleagues to share relevant land use and environmental information with the other study teams as it was collected;
- Used an online database (interactive ArcGIS map) to make land use, environmental and technical data accessible to targeted team members:
- Organized a workshop, bringing together tallymen and engineers, to review the potential BDH railway alignment, and identify main issues;
- Accommodated the tallymen’s recommendations as much as possible.
- Encouraged team members to communicate with the Cree Liaison Officers (CIOs) and have ad-hoc discussions with them.
- Prioritised Cree workers and companies in the organization of field campaigns.
- Invited tallymen and land users to meet the field crews and to participate in fieldwork.
- Reviewed and included information shared by the following organizations:
  - Cree Nation Government (CNG) (Land Use Planning Commission, including the Protected Areas Working Group and Environment Department;
  - Aanischaaukamikw Cree Cultural Institute (ACCI);
  - Cree Outfitting and Tourism Association (COTA);

– Cree companies, Cree communities, and the CIOs.

9.1.1.1 Study Structure

The Environmental and Social Feasibility Study comprises the following topics:

- Cree land use study (Section 9.2)
- Archaeology and cultural heritage study (Section 9.3)
- Servitudes and Titles (Section 9.4)
- Protected areas (Section 9.5)
- Training opportunities (Section 9.6)
- Impacts on community Health (Section 9.7)
- Other regional stakeholders (Section 9.8)
- Flora & fauna and species at risk (Section 9.9)
- Wildlife management (Section 9.10)
- Watersheds, wetlands and critical habitats (Section 9.11)
- Climate changes (Section 9.12)

The literature referenced in these sections are listed in Section 9.15 and appendices are available in Volume 6.

9.1.2 Environmental Legal Context

9.1.2.1 James Bay and Northern Québec Agreement

The JBNQA was signed by the nine communities of Eeyou Istchee (Grand Council of the Cree of Québec) in 1975. The boundaries of the communities and related rights were set out in the JBNQA. The Agreement, which addresses issues such as housing, infrastructure, environmental protection and social and economic development, influences the way in which planning takes place in the nine Cree communities. Section 5 of the Agreement defines the categories of lands (I to III) within the boundaries of the James Bay Territory.

Category I lands are reserved for the exclusive use of the Crees and can be used for residential, community, business, industrial or other purposes[1]. Category II Lands are public lands where the Crees have exclusive fishing, hunting and trapping rights. However, these lands can be used for other economic development as long as they are replaced elsewhere, in consultation with the affected community. Category III lands are public lands where the Crees have harvesting rights, respecting the principle of conservation and so long as it does not conflict with public safety. Note also that specific species are exclusively reserved for Crees, according to Schedule 2 of Section 24 of the JBNQA. Finally, Section 22 defines a process by which the impacts of any project on the environment and the resources upon which the Crees depend are evaluated in a joint manner (as per following paragraph). Category III lands can be used for economic development.

[1] A portion of Category 1B lands were set aside for the Inuit population of Chisasibi, adjacent to the other Category I lands for that community

Section 22 of the JBNQA establishes the environmental and social protection regime applicable in the territory of the JBNQA below the 55th parallel, which includes a complete environmental impact assessment and review process for development projects (Gouvernement du Québec, 1998).

As per section 22.5.1, all developments listed in Schedule 1 are automatically subject to the impact assessment and review procedures. Such list includes solid waste collection and disposal, including land fill and incineration are automatically subject to an assessment (section 5.b).

The Evaluating Committee (COMEV) is responsible for examining preliminary information provided by the initiators of Projects located within the area governed by the JBNQA located south of the 55th parallel. This committee is composed of six members with two members each of the Gouvernement du Québec, Government of Canada and the Cree Nation Government. Based on the information it receives, the COMEV makes recommendations to the JBNQA administrators stating whether or not a project is subject to an assessment of its environmental and social impacts (ESA), pursuant to Section 22 of the JBNQA.

Pursuant of the submittal of the ESA report, projects on Category I lands are then reviewed by the Local Environment Administrator (LEA) and approve or refused by the JBNQ Local Administrator, while projects on Category II lands are reviewed by the CNG with a decision from the JBNQ Regional Administrator. Projects on Category III lands are reviewed by the Environmental and Social Impact Review Committee (COMEX) (provincial (3) and Cree (2) members) or the federal Review Panel (COFEX-South) (3 federal (3) and Cree (2) members) and decision is made by the JBNQ Provincial or Federal Administrator, depending on the nature of the project assessed. The implications of COMEX and/or COFEX-South is determined by the matters that falls into their jurisdiction (provincial vs federal) (COMEX, 2023; GOC, 2022). If the nature of the project has matters of both jurisdiction, both processes are usually triggered at the same time.

9.1.2.2 Environment Quality Act

Projects located on Category II and III Lands, may be subject to the social and environmental impact assessment and review procedure under Chapter II of the Environment Quality Act (EQA) (R,S,Q). The projects automatically subject to the assessment and review procedure are listed in Schedule A of the Act while the projects which are automatically exempted are listed in Schedule B.

Among the projects listed as automatically subject to the assessment and review procedure, the following could apply to the LGA Phase I Project:

- all borrow, sand and gravel pits and quarries, with areas of or over 3 hectares;
- all access roads to a locality or road network contemplated for a new development;
- all port and harbour facilities, railroads, airports, pipelines or dredging operations for the improvement of navigation.

9.1.2.3 Federal Impact Assessment Act

The Impact Assessment Act (IAA) outlines the federal process for impact assessments and the prevention of significant adverse environmental effects. Projects designated by Physical Activities Regulations must undergo the impact assessment process.

Regarding potential IAA triggers, there are two conditions within the Physical Activities Regulations issued under the IAA that may designate this Project under the Act, for which an impact assessment would be required, as follows

- The construction, operation, decommissioning and abandonment of either of the following:
  - (a) a new railway line that is capable of carrying freight or of carrying passengers between cities and requires a total of 50 km or more of new right of way;
  - (b) a new railway yard with a total area of 50 ha or more.
- The construction, operation, decommissioning and abandonment of a new all-season public highway that requires a total of 75 km or more of new right of way.

9.1.2.4 Permitting and Approval

Table 9.1-1 provides a summary of anticipated permits and approvals that are typically required for road and railway projects. It is important to note that the information provided in this table are to be considered preliminary and will be refined once the Project design progresses.

Table 9.1-1 Preliminary List of Permitting and Approvals Required for Phase I of Grande Alliance

Authority	Permit/Approval	Legislation	Component
Fisheries and Oceans Canada (DFO)	Authorization for Works Affecting Fish Habitat	Fisheries Act	The fish and fish habitat protection provisions of the Fisheries Act are the authorities for the regulation of works, undertakings or activities that risk harming fish and fish habitat. Specifically, these include the two core prohibitions against persons carrying on works, undertakings or activities that result in the death of fish by means other than fishing (hereafter referred to as the death of fish) (Subsection 34.4(1)), and the harmful alteration, disruption or destruction of fish habitat (Subsection 35(1)).
Natural Resources Canada	Licence for Explosives Magazine	Explosives Act and associated Regulations	Explosives storage (blasting for mineral extraction)
Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs (MELCCFP)	Section 22	Environment Quality Act and associated Regulations	Modification to the environment
	Subsection 128.7	Act respecting the Conservation and Development of Wildlife	Alteration of a wildlife habitat (fish habitat, threatened or vulnerable wildlife species habitat)
Ministère des Ressources naturelles et des Forêts (MRNF)	Section 47	Act respecting the Lands in the Domain of the States	Authorization to occupy public lands for public service purposes (Lease)
	Section 147	Mining Act	Lease to mine surface mineral substances (gravel and sand) and mining lease (quarry)
	Subsection 73.3	Sustainable Forest Development Act	Authorization to cut trees on public lands for public services

9.1.3 Study Areas

The scope of work (elements of the Phase I LGA Projects) and study area for the socio-environmental feasibility study vary depending on the topics assessed and listed below.

9.1.3.1 Cree Land Use

The following parameters were considered for the Cree land use study.

A study area of 5 km on either side of the alignments was established (corridor of 10 km) for the potential Billy Diamond Highway railway (BDHR), the potential Grevet-Chapais railway and Mistissini 2nd access road as they require disturbance of new land.

A study area of 1 km on either side of the alignments was established (corridor of 2 km) for the existing access roads (Waskaganish, Eastmain, Wemindji, Nemaska and Route du Nord).

The studies areas are illustrated on Maps 9.2.1 to 9.2.8 available in Appendix 6.26.

9.1.3.2 Archaeology and Cultural Heritage

The archaeology and cultural heritage study was conducted for two components of the Project, the potential BDH railway and the potential Mistissini 2nd access road. At this stage of the Project, the other components were not assessed based on the fact that they involve existing infrastructures (access roads and Route du Nord) or previously disturbed lands (potential Grevet-Chapais railway).

Two study areas were assessed:

- Wide corridor: 20 km on either side of the BDH, with the objective of identifying sites of importance that the community may want to protect from any long-term, residual impacts from the work proposed in Phase I – Infrastructure. (Desktop review)
- Narrow corridor: 5 km on either side of the highway for detailed analyses of archaeological potential. (Field surveys)

The corridors are illustrated on Maps 9.3.1 and 9.3.2 available in Appendix 6.26.

9.1.3.3 Servitudes and Titles

Servitudes and titles were assessed for the potential BDH and Grevet-Chapais railways and Mistissini 2nd access road. Note that the scope did not include the existing roads, only the new infrastructures (railways and new access road) as the latter can create new disturbances and encroach existing servitudes and titles.

A study area of 1 km on either side of the three alignments was established (corridor of 2 km).

The study areas are illustrated on Maps 9.4.1, 9.4.2 and 9.4.3 available in Appendix 6.26

9.1.3.4 Physical and Biological Environment

The following components were assessed for the potential BDH and Grevet-Chapais railways and Mistissini 2nd access road:

- protected areas (Section 9.5)
- flora & fauna and species at risk (Section 9.9)
- wildlife management (Section 9.10)
- watersheds, wetlands and critical habitats (Section 9.11)

Note that the scope did not include the existing roads, only the new infrastructures (railways and new access road) as the latter can create new disturbances and affect the above components.

For each component, a study area of 1 km on either side of the three proposed alignments was established (corridor of 2 km). It should be noted, however, that some components of the natural environment, including caribou (forest and migratory) and fish movements, among others, required consideration from a broader spatial perspective. Thus, in these cases, the consideration was carried out at the watershed or region level.

The right-of-way of the alignments were also considered for the impacts on the components, as it represents the project footprint where direct impacts will likely occur.

The alignment of the potential Grevet-Chapais railway follows the former Canadian National (CN) railway alignment which is now used as forestry roads and\or snowmobile trails, thus will not constitute a new disturbance in the natural environment. However, the technical information received, including details concerning the right-of-way, is that of the current configuration of the forest road. Therefore, information such as the extent of the level of roadway modification to accommodate the rails, the need to widen the current right-of-way, and the need to replace or widen bridges and culverts are not precisely defined at this stage of the project. As a conservative approach, analyses of the potential impacts on the loss of natural environments and wildlife habitats were considered s on the current right-of-way, without considering the existing conditions. The assessment of the potential impacts of the route is therefore based on the worst-case scenario.

The alignment of the potential Mistissini 2nd access road (45 km) will overlap approximately 29 km (64%) of existing forest roads. However, as the state of these roads is variable, calculations and analyses of potential impacts were based on a 35 m wide right-of-way for the entire alignment length, without considering existing roads. This approach is conservative, as it represents the worst-case scenario.

Table 9.1-2 Detailed measurements for the three alignments under study.

	Potential BDHR Alignment	Potential Grevet-Chapais Railway Alignment	Mistissini 2nd Access Road Alignment
Length (km)	253	162	45,
ROW Average width (m)	26.70	33.8 m	35.0
ROW Area (km2)	6.74	5.49	1.59
2 km Study Area (km2)	509	328	93

Field work was conducted to document fish communities and fish habitat in the study areas. The fish inventory and habitat characterization were carried out 250 m on either side (upstream and downstream) of the potential BDHR and Mistissini 2nd access road watercourse crossings, or a 500 m survey area. As the Grevet-Chapais railway alignment is located on existing infrastructures (culvert and bridges), the survey area was carried out 100 m on either side of the alignment (200 m corridor). Figure 9.1-1 below provides a visual overview of the different study corridors applied for this evaluation.

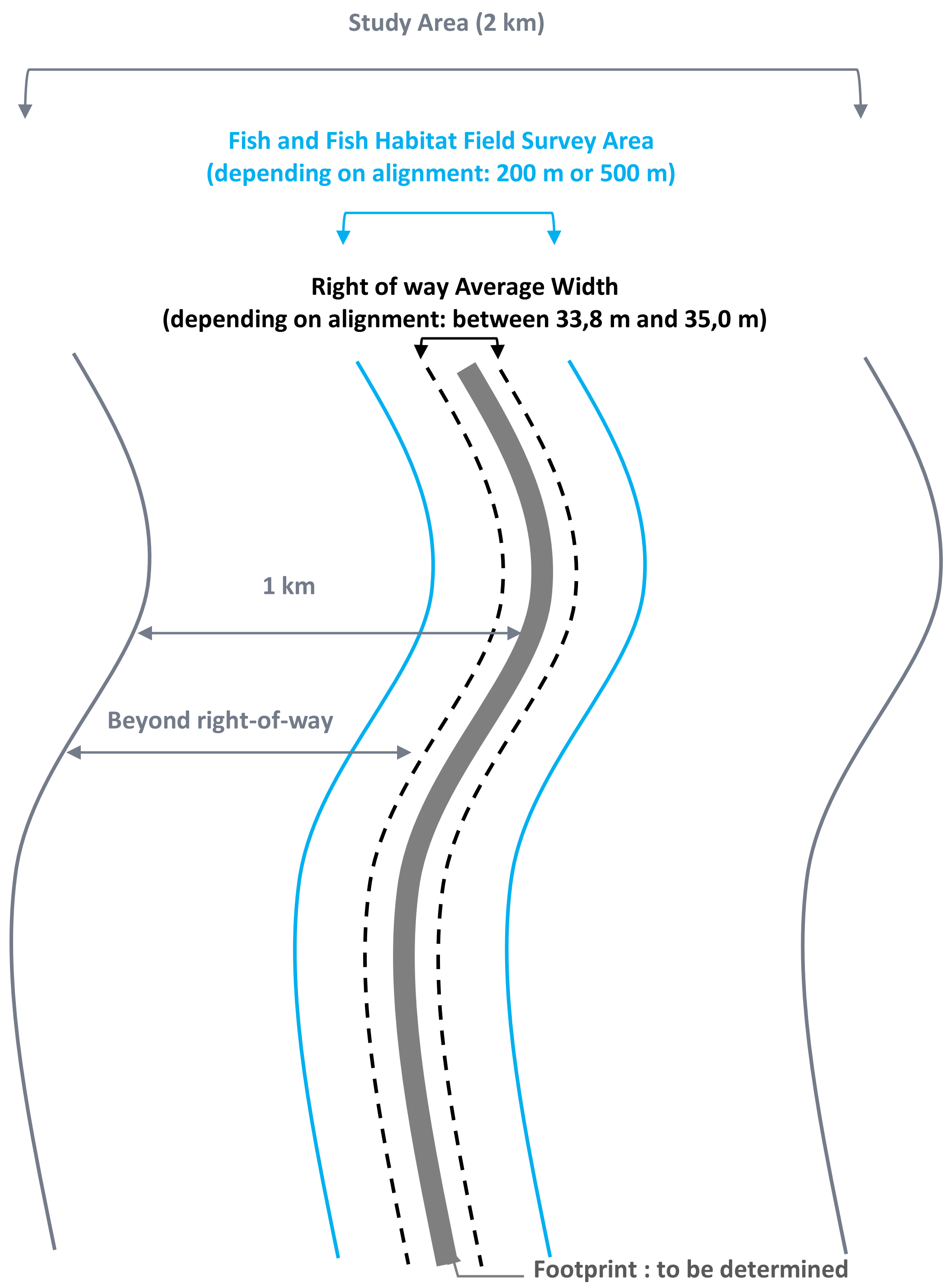


Figure 9.1-1 Configuration of the study areas for the physical and biological environments.

9.1.3.5 Training opportunities

Training opportunities are covered in the Market Study Report. Please refer to Section 10.8 in Volume 4.

9.1.3.6 Impacts on community health

The scope of work related to impacts on community health consisted of conducting a literature review of potential impacts of linear infrastructure projects, such as roadways and railway construction and operation, on public health. Emphasis was putted on Eeyou Istchee James Bay population, and to a larger extent, to northern and moderately remote populations.

9.1.3.7 Other regional stakeholders

Consultation of other regional stakeholders encompassed four Jamesian communities will be directly impacted by the infrastructures proposed in Phase 1: Matagami, Lebelsur-Quillon, Chapais and Chibougamau. All the components were considered for the consultations, including the relocation of the forestry road and the snowmobile trail as part of the design of the potential Grevet-Chapais railway.

9.1.3.8 Road traffic reduction projections

Road traffic reduction projections are covered in the Market Study Report. Please refer to Sections 10.3 and 10.4 in Volume 4.

9.1.3.9 Climate change/ghg reduction projections

No study areas are used for GHG assessment, as the environmental effect associated with GHG emissions is a global phenomenon. This is based on the mixing of GHGs in the atmosphere and the dispersion of their emission sources (IPCC, 2013). However, as a benchmark, the GHG projections will compare the volume of GHG releases during component construction and operation activities to provincial GHG inventories.

9.1.4 Engagement Activities with Crees

In the spirit of LGA's innovative collaborative approach VEI has put the Cree community members and land users at the center of its work, considering them not only as a main source of information for the studies, but also as advisors in the infrastructure design and planning. VEI's engagement strategy relies on a liaison task force composed of two Cree Liaison Officers, one focused on inland communities and the other on coastal communities, and two Liaison Support Members. Having a permanent presence in Eeyou Istchee James Bay has allowed to build strong relationships with the CIOs and community members and facilitated communications.

Initially, presenting LGA to each Cree community's Council and General Assembly was considered the gateway to start building relationships with the communities. The Cree Liaison Officers (CIOs) played a crucial role in facilitating liaison work with community leadership despite COVID restrictions. They helped establish communication channels with the communities and ensured that the project team engaged with the appropriate representatives. As a result, the first contacts with the communities were often with the CIOs, who were able to connect the project team with tallymen and land users who would potentially be impacted by the project. This approach allowed VEI to build relationships with the communities and gain a deeper understanding of local priorities and political context.

In collaboration with the CIOs, and prior to the conduct of individual land use interviews, information sessions were organized specifically for the potentially impacted tallymen and land users of each community (8). Prior to each engagement activity, the Liaison Officers explained to the participants that their presence did not mean that they were in favour of LGA, nor that they accepted the infrastructure to be built. For many tallymen and land users, this was an important clarification and a condition to their participation. VEI also reached out to the tallymen of traplines where fieldwork would take place, to inform them of the works, request their authorization, and encourage them to participate in the campaigns.

Tallymen of the potentially impacted traplines by the BDH railway alignment were all invited to participate in a workshop with engineers to review and discuss the potential alignment. It provided an opportunity to identify main issues with the alignment and to modify it based on tallymen's comments. Table 9.1-3 summarizes engagement activities carried out by VEI.

Table 9.1-3 Summary of Engagement with the Crees

Activity	Details
Presentation at communities' local general assemblies	Oujé-Bougoumou (1) Waskaganish (3) Waskaganish CTA (2) Wemindji (2) Mistissini (1) Washaw Sibi (1)
Presentation at Regional Assemblies	Cree Nation Youth Council (1) Regional CTA (1)
Presentation to local Councils	Mistissini: Informal presentation of the 2nd access road alignments
Engagement with land users of potentially impacted traplines *A total of 57 traplines are potentially impacted by Phase 1 infrastructure * 4 traplines are potentially impacted by Phase 2 infrastructure	Tallymen or land users of at least 52 traplines were engaged through different activities. Tallymen information sessions: Washaw Sibi (1) Waswanipi (1) Oujé-Bougoumou (2) Mistissini (1) Nemaska (1) Waskaganish (1) Eastmain (2) Wemindji (1) 50 land use interviews conducted
Engagement related to fieldwork	Fish habitat characterization Geotechnical surveys Archaeological fieldwork
Workshops and focus groups	Tallymen potentially impacted by BDH railway Mistissini's 2nd access road

Engagement activities and several informal conversations with the Cree answered their questions, and provided understanding of their concerns, their use of the territory, and how the development of the LGA infrastructure could benefit or impact their activities. They also provided VEI team with a wealth of knowledge concerning the territory and a Cree perspective on the infrastructure program. Sensitive areas, potential land use conflicts, and the need to address past issues and previous impacts were highlighted through the process.

Appearing in the photo:

- Johnny Saganash (VEI),
- Sydney Coonishish (Oujé-Bougoumou CIO),
- Oujé-Bougoumou tallymen and land users

Photo 9.1.1 : Tallymen information session in Oujé-Bougoumou.

9.2 CREE LAND USE

9.2.1 Introduction

As part of the socio-environmental study, the mandate included a Cree land use study which covered each proposed infrastructure's study area. The Cree land use study's main goal is to document the land and resources use in the study areas, so as to better identify and understand potential risks, conflicts and opportunities related to the transportation infrastructures under study. More specific objectives of this research include:

- Collect traditional knowledge regarding the area to inform and improve the design of the potential infrastructures.
- Identify valued sites and sensitive areas to be protected from potential development.
- Gather concerns and recommendations in relation to the proposed infrastructure, as well as concerning the LGA process in general.
- Assess preliminary potential impacts from the construction and operation of the infrastructures.
- Identify any potential cumulative effects from previous project impacts as well as in light of the potential infrastructures.
- Propose solutions to potential conflicts and alternate options.

It is important to keep in mind the following limitations regarding this component of the study:

- Novelty of the Grande Alliance study and approach for land users for whom this consists of the first contact regarding the infrastructure components under study;
- Relatively short time allotted to conduct the interviews and the study;
- Difficulty to obtain data from past studies or projects (e.g. sites of special interest to the Cree identified during forestry management exercise, as per the Paix des Braves);
- Difficulty to reach and meet all the potentially affected land users;

- Reluctance from certain land users to participate in the study because they do not want their participation to be interpreted as consent to the proposed infrastructure or to LGA;
- Reluctance from certain land users to share specific information about their activities;
- "Consultation fatigue" of certain land users who have shared their knowledge repeatedly;
- Potential loss of precision due to translation (Cree-English/English-Cree).

The present report should be seen as a first general picture of the land and resources use in the study areas, to be completed in future stages of the process, rather than a complete list of land use features and recommendations. Indeed, it should be noted that the approach adopted by the LGA team is very innovative in engaging land users and community members from the start of the planning process, before the final infrastructure design. If some of the proposed infrastructure works go ahead, engagement with community members will continue and data will be refined.

9.2.2 Methodology

The approach and methodology adopted for the Cree land use study, as well as the consent forms and interview grid were reviewed by and discussed with the CIOs.

9.2.2.1 Data Acquisition and Processing

9.2.2.1.1 Literature review

At the beginning of the study, a review of existing information was conducted. General search by key words was carried out as well as search in specific databases, including:

- Hydro-Québec projects that were subject to an environmental impact assessment (Cherloc);
- Projects evaluated by the COMEX;
- Québec environmental assessment registries (MELCCFP and Bureau des audiences publiques sur l'environnement);
- Canadian impact assessment registry (Government of Canada).

More than 200 documents, concerning at least 40 projects achieved between 1977 and 2021, were consulted. This literature review allowed to collect information about known valued sites and sensitive elements, mainly along the Rupert River on Waskaganish and Nemaska territories. Some information regarding Cree land use near the communities of Waswanipi and Nemaska was also available. However, the literature review also revealed that little information is available for several sectors under study, including:

- Around the community of Wemindji and along the access road;
- Along the Billy Diamond Highway between Matagami and Waskaganish;
- Along the Grevet-Chapais roadbed, except for the Opawica lake area;
- Along the Eastmain access road.

9.2.2.1.2 Land user interviews

At the beginning of the study, traplines that could potentially be touched by the proposed works and infrastructures were identified. The VEI team then asked each CIO to validate the identity of each trapline's tallyman and to identify other land users or knowledge holders who should be invited to participate in the Cree land use study. In collaboration with the CIOs, VEI organized information sessions for tallymen and land users in each community potentially affected by LGA Phase 1 infrastructures (eight communities). Tallymen were invited to bring their family members and land users with them. General information on LGA as well as more specific information about Phase 1 studies and the infrastructures that could potentially go through the local traplines were presented and discussed with the attendees.

Sometime after the information session, the tallymen were invited to an individual land use interview in which their family members and land users were also welcomed to participate. The interviews were semi-structured, with open-ended questions, and were conducted mostly in Cree by one of VEI's Cree Liaison Officers and VEI's anthropologist. Large paper maps were used to locate land use features and information shared by the participants. Prior to starting the interview, the participants were asked if they had questions about LGA, and information about LGA and specific infrastructures was presented to those who had not assisted to the information session. The interview questions touched upon the following themes:

- Description of land use activities and features
  - Harvesting activities (hunting, fishing, trapping, and berries, plants and wood gathering);
  - Habitations sites (camp, cabin, seasonal campsite, tent frame, camping area, house, store, old trading post, old campsite and other building);
  - Trails and travelways (ATV/snowmobile trails, forestry roads, path, boat landing and portages);
  - Social and cultural sites (community, gathering, knowledge transfer, historical, archeological, ceremonial, burial or sacred site, picnic area, landmark).
- Environmental information concerning the study area (traditional ecological knowledge)
  - Wildlife:
    - Species present in the study area, quantity, quality, and potential issues.
    - Trails and migration routes, with special attention to roads and alignments crossings.
    - Calving/kidding aresa.
    - Other areas used by moose or caribou.
    - Beaver lodges/ponds.
    - Goose hunting ponds.
  - Fish:
    - Species present in the study area, quantity, quality, and potential issues.
    - Presence of fish, and species, in each watercourse along the alignments.
    - Spawning and rearing areas.

- Water Resources
- Wetlands, bogs, swamp areas
- Invasive species and changes observed in the last 25 years.

- Condition of the existing infrastructures
- Potential effects and recommendations.

The table below shows the number of traplines potentially touched by each infrastructure and therefore the minimal number of interviews to be conducted.

Table 9.2-1 Number of Traplines Potentially Touched by LGA Phase 1 Infrastructures

Infrastructure	Community	Number of traplines
Potential BDH Railway alignment	Washaw Sibi	1
	Waswanipi	7
	Waskaganish	1
	Nemaska	4
Potential Grevet-Chapais Railway	Washaw Sibi	1
	Waswanipi	10
	Oujé-Bougoumou	2
Community Access Road	Waskaganish	4
	Eastmain	3
	Wemindji	3
	Nemaska	1
Route du Nord	Oujé-Bougoumou	2
	Mistissini	12
	Nemaska	6
	Waskaganish	1
Potential Second Road to Mistissini	Mistissini	4

Once the interviews notes were compiled, the information collected was integrated into a GIS database specifically created for Phase 1 feasibility study, so it could be shared with the technical and the archaeological teams (note that access was limited to a small number of people).

Validation interviews were organized with the study participants, so they can review the data collected, verify its accuracy, and add precisions if required. The georeferenced database was also used during the validation process, to make sure the land use information was properly located. The interview notes were also read with the participants to validate the accuracy and clarify some information, if needed. The validation process also offered the land users an opportunity to share additional data or express additional concerns and recommendations.

It is important to note that some of the information collected is not presented in this report or is mentioned with very few details to preserve confidentiality and respect its sensitive nature. However, it will be provided to the CDC along with relevant non-disclosure agreements.

9.2.3 Community Profiles

9.2.3.1 Washaw Sibi - ᐙᔖ ᓯᐱ

Washaw Sibi was recognized as the tenth Cree First Nation at the 2003 Annual General Assembly of the Grand Council of the Crees / Cree Nation Government (GCC, 2022)[2]. This once semi-nomadic group historically occupied the basin of the Harricana River. Since 2004, the Washaw Sibi Crees have studied various locations to establish their village (Lessard, 2015). The Washaw Sibi Crees' governing body is the Washaw Sibi Eeyou Association, which head office is in Nemaska and its administrative office is in Amos. Their cultural camp is in Joulac, 115 km north of Amos (CNWS,2022). Washaw Sibi's territory is divided into 55 traplines covering approximately 16,288 km^2 (estimated area based on traplines Shapefiles received from the CNG). As of December 2022, the Washaw Sibi Eeyou had a total of 618 registered members (Andriana Trapper, 2022).

The LGA Phase 1 infrastructures located on Washaw Sibi territory are:

- The southern end of the potential BDH railway alignment
- The westhern end of the potential Grevet-Chapais railway

9.2.3.2 Waswanipi - ᐙᔅᐙᓂᐲ

Waswanipi is located near the confluence of the Opawica, Chibougamau and Waswanipi Rivers. The village was founded as a trading post by the Hudson's Bay Company which closed in 1965, so the residents dispersed until 1978. That year, the new village of Waswanipi was built about 45 km upstream the Waswanipi River from the former location (CFNW, 2022). Waswanipi is the southernmost Cree community and can be accessed by highway Route 113. Waswanipi's territory is divided into 62 traplines covering 37,015 km^2 (CMEB, 2022). As of August 2022, the Cree First Nation of Waswanipi had a total registered population of 2,316, with 1,699 members living on reserve, 496 living off reserve, and 121 living on other reserves or Crown land (CIRNAC, 2022a).

The LGA Phase 1 infrastructures located on Waswanipi territory are:

- The southern end of the potential BDH railway alignment;
- Most of alignment of the potential Grevet-Chapais railway

[2] a. The Washaw Sibi community is recognized by the Crees, but is not necessarily legally recognized by the Gouvernement du Québec. In the lens of the study, this community was considered equivalent to all other participating Cree communities. The study team does not allude to make any legal statements regarding their status, but this is rather an initiative to be as inclusive as possible.

9.2.3.2.1 Issues and Vision

In 2017, the Eeyou Planning Commission undertook a consultation process with Waswanipi community members. The results are presented in the "Report on Community Input on Land Use Planning Goals" (EPC, 2017f) and included information on the community's values, issues and vision for the future. Some of it is summarized below:

Issues that Waswanipi faces:

- Forestry
- Non-Cree occupation
- State of animal populations
- Limitations on Cree rights
- State of water resources
- Relationships with proponents
- Mining

Elements of a Waswanipi vision for the future:

- Protection of Waswanipi lands and water
- Greater Cree role in development
- Promotion of Cree language and culture
- Enhance Cree role in governance and lands management

9.2.3.3 Oujé-Bougoumou - ᐆᒉᐴᑯᒨ

Oujé-Bougoumou is located on the shore of Lake Opemiska and can be accessed by the highway Route 113, and then using the Oujé-Bougoumou Road on approximatively 25 km. Between 1920 and 1970, the Oujé-Bougoumou people were forced to relocate seven times, but in the early 1990s an enormous creativity was unleashed and applied to the construction of a new village (OBCN, 2015). Oujé-Bougoumou's territory is divided into 13 traplines covering 10,568 km2 (CMEB, 2022).

As of August 2022, the Cree First Nation of Oujé-Bougoumou had a total registered population of 938, with 791 members living on reserve, 126 living off reserve, and 21 living on other reserves or Crown land (CIRNAC, 2022b).

The LGA Phase 1 infrastructures located on Oujé-Bougoumou territory are:

- The easthern end of the potential Grevet-Chapais railway;
- The southern section of the Route du Nord study area

9.2.3.3.1 Issues and Vision

In 2017, the Eeyou Planning Commission undertook a consultation process with Oujé-Bougoumou community members. The results are presented in the "Report on Community Input on Land Use Planning Goals" (EPC, 2017f) and included information on the community's values, issues and vision for the future. Some of it is summarized below:

The Assinica Park, located at the north of the community, is highly valued not just by the families who have traditionally hunted there, but by an entire community which sought to protect part of it. This area is valued, among other things, because it is nearly unimpacted by the mining and forestry activities compared to the southern part of its territory where there had been so many impacts.

Issues that Oujé-Bougoumou faces:

- Impacts of forestry
- Impacts of mining
- Health of water
- Access to traplines
- The trapline system
- Role of tallymen
- Non-Cree occupation of the territory
- Non-Cree community expansion
- Cultural loss
- Overharvesting

Elements of an Oujé-Bougoumou vision for the future:

- Environmental protection
- Cree-led development
- Better forestry and mining practices
- Larger role in governance
- Ensuring a resilient Cree culture
- Regulation of harvesting
- Reform of traplines

9.2.3.4 Mistissini - ᒥᐢᑎᓯᓃ

Mistissini is an inland community located on the shore of Lake Mistassini, on the north shore of Baie du Poste, and can be accessed by the highway Route 167 and then following the Main Road on approximatively 15 km. From 1802, several trading posts were established on Mistissini's traditional territory. The outlet of Lake Mistassini accommodated a post which was moved in 1835 in the current Baie du Poste (HQ, 2007). The community of Mistissini is in full expansion following, among other things, the signing of the Paix des Braves Agreement in 2002 (HQ, 2008). Mistissini's territory is divided into 76 traplines covering 117,844 km^2 (CMEB, 2022). As of August 2022, the Cree Nation of Mistissini had a total registered population of 4,190, with 3,807 members living on reserve, 252 living off reserve, and 131 living on other reserves or Crown land (CIRNAC, 2022c).

The LGA Phase 1 infrastructures located on Mistissini territory are:

- The southern and central portions of the Route du Nord;
- The entire alignment of the potential Mistissini second access road

9.2.3.4.1 ATO Park

The creation of Albanel-Témiscamie-Otish (ATO) Park is the result of a partnership between the Cree Nation of Mistissini (CNM) and the Government of Québec. ATO Park is located entirely on Cree traditional territory. As part of the ATO Working Group, CNM representatives will ensure that ATO Park's planning, management, and long-term operational sustainability reflect Cree values, knowledge, and expectations.

The Mistissini homeland covers roughly 127,700 km², of which 11,000 km² has been allotted to ATO Park. The territory as a whole is a magnificent and undisturbed wilderness, defined by the vast expanse of its natural landscapes and waterways and the rich biological diversity of its northern boreal forest and wildlife. The Cree have occupied the Mistissini homeland since time immemorial and continue to make active and respectful use of the land in every season of the year. The homeland, where culture and nature thrive in harmonious balance, is the foundation upon which the Cree can build a sustainable future.

9.2.3.4.2 Issues and Vision

In 2017, the Eeyou Planning Commission undertook a consultation process with Mistissini community members. The results are presented in the "Report on Community Input on Land Use Planning Goals" (EPC, 2017f) and included information on the community's values, issues and vision for the future. Some of it is summarized below:

Mistissini lake remains relatively intact and offers many opportunities to practice traditional activities. Also, it plays an important role in the history and culture of the community with historic gathering, hunting and fishing places as well as travel routes to many more remote locations on the Cree territory.

Issues that Mistissini faces:

- Forestry
- Declining Cree occupation
- Declining transmission of Cree culture and language
- Lack of control over development and its impacts
- Access
- Non-Cree occupation

Elements of a Mistissini vision for the future:

- Environmental protection
- Integrate land users into decision-making
- More support for transmission of Cree knowledge
- Recognition of Cree governance
- Preparing the next generation for Cree governance
- Access

9.2.3.5 Waskaganish - - ᐙᔅᑳᐦᐃᑳᓂᔥ

Waskaganish was the first Cree community to be involved in fur trading, at the Rupert House trading post. In 1968, the settlement established at the confluence of the Rupert Bay and the Rupert River changed its name for Waskaganish. Waskaganish's territory is divided into 36 traplines covering 29,711 km^2 (CMEB, 2022). Many rivers cross Waskaganish lands and were used as transportation routes by the Crees, such as the Harricana, Nottaway, Broadback, Rupert and Pontax rivers. The community is accessible by the Billy Diamond Highway and then using the Waskaganish Road on approximately 100 km. As of August 2022, the Cree Nation of Waskaganish (CNWa) had a total registered population of 2,894, with 2,293 members living on reserve, 468 living off reserve and 133 living on other reserves or Crown land (CIRNAC, 2022d).

The LGA Phase 1 infrastructures located on Waskaganish territory are:

- The middle section of the potential BDH railway alignment (note that the northern section of the Phase I BDH railway ends at the Rupert River but is found on Nemaska traplines);
- The entire Waskaganish access road;
- The western end of the Route du Nord.

The Rupert River played a central role in the CNWa's history and is still highly valued by CNWa members. Moreover, during the Eastmain-1-A/Rupert project's environmental impact assessment process, the GCC (EI)/CRA have reiterated that the Rupert River is, and will always be, an essential part of Cree culture and of the Cree way of life, used by generations of Cree people (HQ, 2004c). The Waskaganish access road parallels that river and connects with several paths leading to valued sites along the Rupert River, including: Gravel Pit, Smokey Hill, Bay of Kapeshi Epetupeyach, the Oatmeal Rapids (near the BDH) and the Peat Island sector. Each of these valued sites are briefly described below.

9.2.3.5.1 Gravel Pit (Smokey Hill landing)

Location and infrastructures

Gravel Pit is located some 20 km from the village of Waskaganish and can be accessed by Waskaganish Road. Gravel Pit is a popular community site located on the left bank of the Rupert River, slightly downstream from Smokey Hill. The camp counts about thirty buildings (cabins), more than half of which are located along the river, the others being near the borrow pit along the access road. Gravel Pit is also considered a cultural camp where traditional structures, such as the miichiwaahp and the shaapuhtuwaan, are used for community and religious gatherings. There are also two docks for boats and seaplanes as well as a boat launch (HQ, 2004c, HQ, 2005)

Cree land use

The river is wide at this site and has a rather calm flow (HQ, 2004c). Presence of small shallow pools on the south and the north shores surrounded by wooden platforms are attached to the bank by wooden walkways. Traditional community anadromous cisco fishing is done at this site and fish nets are used around the Gravel Pit settlement. There is a valued cisco spawning ground at this site. The stretch of the Rupert River from Gravel Pit to Smokey Hill also represents a community area for goose-hunting. In winter, the snowmobile trail crosses both banks of the river at this site (HQ, 2004b, c).

Mitigation measure

A rock blanket, built by Hydro-Québec, helps maintain water levels, protects the Gravel Pit wharf at KP 21.3 from centennial flooding, ensures navigation and the free movement of fish at KP 20.4, to maintain the river scenery in this sector and to reduce the risk of freezing in the spawning ponds in winter (HQ, 2004a, b).

Landscape and archaeology

There are many viewpoints towards the river due to the sparse vegetation cover and the location of the buildings very close to the shore (HQ, 2004c). Due to the abundant wetlands around Waskaganish, archaeological sites occur often in and around gravel pits, exposing them to potential damage.

9.2.3.5.2 Rapids of Smokey Hill (Nuutamessanaan)

Location and infrastructures

Smokey Hill is a traditional Cree fishing site established on both sides of the same-named rapids, on the Rupert River, some 22 km from the village of Waskaganish. It can be accessed by the Waskaganish Road, and then using the small access road towards the river. Smokey Hill (Nuutamessanaan), a main spawning ground for the anadromous cisco, has been frequented by the Crees of Waskaganish for many generations, over centuries. This site is one of the oldest community gathering places in use on the river and is therefore highly valued by CNWa members. The site includes a cultural camp where traditional structures, such as the miichiwaahp and the shaapuhtuwaan, are set up (HQ, 2004c).

According to interview participants for the Land Commission Report (EPC, 2017e): “Smokey Hill is a big part of what makes Waskaganish”.

Cree land use

A portage allows bypassing the rapids and accessing navigable areas suitable for fishing upstream on the river. The site is frequented mainly in summer and fall for fishing and for educational, recreational, or traditional purposes. Indeed, the Smokey Hill rapids are a community and traditional fishing ground that is frequented from the end of August until the end of September to catch cisco with a dip net (also called scoop-net fishing or sccoping) (HQ, 2004a, b). An important proportion of the harvested fish is smoked onsite.

Mitigation measure

A rock blanket, built by Hydro-Québec, helps to maintain water levels (HQ, 2004a) in order to preserve traditional dip net fishing activities at Smokey Hill, as much as possible, to ensure navigation and the free passage of fish at KP 20.4, to maintain the visual aspect of the river in this sector, and to reduce the risk of freezing of the spawning ponds in winter. The cisco population was also monitored between 2009 and 2015.

Landscape and archaeology

There are traditional structures and temporary shelters, but the vegetation filters the views of the rapids. On the edge of the river, from the traditional dip net fishing site, the view is however direct on the rapids of Smokey Hill, both upstream and downstream.

At least four burial sites are identified in the area, on both banks of the Rupert River.

9.2.3.5.3 Bay of Kapeshi Eputupeyach

Located at KP 47.8 of the Rupert River, Bay of Kapeshi Eputupeyachis is one of the four main areas used for fishing, but also for goose hunting. Community members travel to the bay by seaplane or by snowmobile (HQ, 2004c). A structure was built at KP 33 of the river to restore the summer water levels in the bay (HQ, 2004b). A burial site was identified on the shore of the bay (HQ, 2004c).

9.2.3.5.4 Oatmeal Rapids

Located at the intersection with the BDH, the Oatmeal Rapids are one of the largest rapids on the Rupert River. A rest area was developed on the south shore of the Rupert River, and a lookout was bilt on the northern shore. The Crees use a boat launch built by the municipality of Baie-James (MBJ) on the south bank, immediately upstream of the rapids. A docking area is also present on the northern bank. Downstream of the Oatmeal Rapids, the Cree land users use an access located behind the km 257 roadhouse to get to the river (HQ,2004c).

The beauty of the rapids in winter was mentioned repeatedly by participants in the July 2003 landscape survey (HQ, 2004c).

9.2.3.5.5 Peat Island sector

The Peat Island sector is one of the four main harvesting areas along the Rupert River. Used for fishing, as well as for goose, moose and caribou hunting this sector is a valued harvesting area. Birth sites were also identified in the area (HQ, 2004c).

9.2.3.5.6 Issues and Vision

In 2017, the Eeyou Planning Commission undertook a consultation process with Waskaganish community members. The results are presented in the “Report on Community Input on Land Use Planning Goals” (EPC, 2017f) and included information on the community’s values, issues and vision for the future. Some of it is summarized below:

Issues that Waskaganish faces:

- State of Cree occupation of the territory
- State of Cree knowledge
- Overharvesting
- Challenges of making an income from life on the land
- Access to the land
- Waste management (Crees)
- Waste management (non-Crees/proponents)
- Impacts of hydroelectric development
- Impacts of mining and forestry
- Climate and other environmental change
- Gravel – lack of material near community
- Population growth

Elements of a Waskaganish vision for the future:

- Enhance Cree occupation of the land
- Protect the land, the animals and the sensitive areas for animal
- Enhance Cree knowledge and culture
- Create development opportunities that sustain Cree lands and culture
- Play a bigger role in governance of territory

9.2.3.6 Nemaska - ᓀᒥᐧᑳᐤ

Nemaska's territory is divided into 15 traplines covering 14,929 km^2 (CMEB, 2022). Nemaska village is located on the shore of Champion Lake. The actual location of the Nemaska village originate from 1977 when, after being displaced due to a potential hydroelectric project, almost a hundred of Nemaska Eenouch decided to gather around Champion Lake, near their original settlement. Those members chose a site recommended by the Elders, where the community is now established (CNN, 2022). The CNN members still frequent their original settlement on the shore of Nemiscau Lake, called Old Nemaska, and consider it a cultural village. The Broadback, Rupert and Nemiscau rivers cross the land. The community is accessible by the Nemaska Road approximately 10 km from the route du Nord. As of August 2022, the Cree Nation of Nemaska had a total registered population of 850 (CIRNAC, 2022e), with 750 members living on reserve, 24 living off reserve and 52 living on other reserves or Crown land.

The LGA Phase 1 infrastructures located on Nemaska territory are:

- The northern portion of the BDH railway;
- The entire Nemaska access Road;
- The northern and western sections of the Route du Nord.

9.2.3.6.1 Old Nemaska

Location and infrastructures

Old Nemaska is the site where the members of Nemaska community originally settled, so it has a special meaning for them and is particularly valued. There are about 60 camps there, an old school, a church and a cemetery. Old Nemaska is a cultural and historical site located on the left bank of Lake Nemiscau. The location is only accessible by boat, mostly freighter canoes. The boat ramp where they depart from includes a large parking and can be accessed by the Route du Nord (KM 321.5) and then using a local road on approximatively 35 km.

Cree land use

In the spring, some CNN members go to Old Nemaska for the goose hunting season. During the summer, community members gather and spend some time there. They frequent the site for cultural, social, and recreational purposes. They go fishing in Nemiscau lake, but also to the east, as far as Nemiscau Point, and north to the Kaupwanaukach Pass. In the winter, ice fishing is practised on the Rupert River south of Lake Ukau Amikap and on the Nemiscau River south of Devoyau Lake (HQ, 2004c).

Canoe brigades departed from Old Nemaska and it serves as a stopover point for expeditions as well.

According to the interview participants for the Land Commission Report (EPC, 2017a): "There is something about Nemaska that has a very rich history. We get a chance to go anytime we want, we get to see our Old Nemaska village, you can go in summertime or in the winter. It's a privilege for us to be able to go see our second home, our old village. To go by vehicle and by boat. Old Nemaska, we are starting to look into planning, what we need there. A community hall, what kind of housing, sanitation?"

Landscape and archaeology

All the buildings are aligned and face the lake. Because the site is on a non-wooded point it provides direct views for a long distance onto Lake Nemiscau and its islands. Valued for its historic and cultural nature, Old Nemaska has been used as a community gathering place since early 1900.

The Native rock painting site at Lake Nemiscau is designated either by its Borden code, EiGf-2, or by its Cree name, Kaapehpeshapischinikanuuch. It is the only Native rock painting site in Cree territory (HQ, 2004c). Due to its size and graphic content, it is the second most important site of its kind in the province (Vaillancourt, 2003).

9.2.3.6.2 Issues and Vision

In 2017, the Eeyou Planning Commission undertook a consultation process with Nemaska community members. The results are presented in the "Report on Community Input on Land Use Planning Goals" (EPC, 2017f) and included information on the community's values, issues and vision for the future. Some of it is summarized below:

Issues that Nemaska faces:

- Size and Design of Community
- Vulnerability to Environmental Hazards such as Forest Fires
- Municipal Infrastructure
- Living on the Land: Access, Knowledge and Skills
- Problems with Non-Cree Hunters
- Challenges to Cree-led Economic Development Initiatives
- Impacts from Industrial Developments
- Limited Land User Input in Decision-Making About the Land
- Governance and Relations with Non-Crees
- Changes in Animals Associated with Environmental Changes

Elements of a Nemaska vision for the future:

- Amenities to Foster a Healthier Community
- Improved Municipal Infrastructure
- Priority of Preserving Cree Culture
- Professional Training and Cree-Led Economic Development
- Continuity of Cree Occupation and Hunting, Fishing and Trapping

- Environmental Protection and Conservation
- Cree Governance: Accountable and Forward Looking

9.2.3.7 Eastmain ᐙᐸᒦᑖᐤ

Eastmain territory is divided into 15 traplines covering 15,240 km^2 (CMEB, 2022). The community, located approximately 100 km from the BDH, is accessible by the Eastmain Road. Named in 1730 by the Hudson Bay Company, Eastmain was at that time the Hudson Bay trading headquarters for the east coast of James Bay and Hudson Bay. The town was originally located on the north shore of the Eastmain River, but in 1762, Eastmain was relocated to the south shore because it provided easier access to the town from the James Bay (CNE, 2022).

As of August 2022, the Cree First Nation of Eastmain had a total registered population of 953 (CIRNAC, 2022f), with 840 members living on reserve, 51 living off reserve and 62 living on other reserves or Crown land.

The only LGA Phase 1 infrastructure located on Eastmain territory is the entire Eastmain Access Road.

According to the Land Commission Report (EPC, 2017b), the Eastmain Crees valued the protection of freshwater sources. they also stated that the freshwater source further away on a hill at kilometer 37 of the access road may be eventually damaged or spoiled by future economic development. Also, the Eastmain Crees stated that they believe that the Eastmain River and its tributaries are highly valuable. Those body of water are valued because of the kinds of fish they host: the habitat of sturgeon and Cisco trout for example.

9.2.3.7.1 Issues and Vision

In 2017, the Eeyou Planning Commission undertook a consultation process with Eastmain community members. The results are presented in the “Report on Community Input on Land Use Planning Goals” (EPC, 2017f) and included information on the community’s values, issues and vision for the future. Some of it is summarized below:

Issues that Eastmain Faces:

- Impacts of hydroelectric development
- Concerns about impact of mineral exploration and exploitation
- Constraints on land use due to activities from southerners
- Lack of forest due to recent large-scale forest fires on their territory
- Littering and pollution
- Over-harvesting and break down of the tallyman system
- Breakdown of the trapline system
- Access to hunting areas

Elements of a Eastmain vision for the future:

- Governance
- Environmental monitoring and management
- Environmental protection

- Maintained and enhanced access to land-based activities
- Addressing potential over-harvesting
- Cree-led development
- New community cultural site

9.2.3.8 Wemindji - ·ᐁᒥᐣᒌ

Wemindji's territory is divided into 21 traplines covering 29,819 km^2 (CMEB, 2022). The main river which crosses the land is the Maquatua River. Moreover, the village of Wemindji is located at the mouth of this river. There are also also many large lakes such as Sakami, Yasinski and Old Factory Lake. The community, located approximately 95 km from the BDH, is accessible by the Wemindji Road. Wemindji is a fairly new community comprising Cree families originally living at the trading post named "Paakumshumwashtikw", known as Vieux-Comptoir or its English equivalent "Old Factory". This trading post was founded in the 17th century and was alternately under British or French control. In 1959 the community was relocated about 45 km north to its present location (where Wemindji is now). As of August 2022, the Cree First Nation of Wemindji had a total registered population of 1,658 (CIRNAC, 2022g), with 1,465 members living on reserve, 141 living off reserve and 52 living on other reserves or Crown land.

The only LGA Phase 1 infrastructure located on Wemindji territory is the entire Wemindji Access Road.

9.2.3.8.1 Issues and Vision

In 2017, the Eeyou Planning Commission undertook a consultation process with Wemindji community members. The results are presented in the "Report on Community Input on Land Use Planning Goals" (EPC, 2017f) and included information on the community's values, issues and vision for the future. Some of it is summarized below:

Issues that Wemindji faces:

- Inadequate monitoring of mineral exploration activities
- Projects happening while undergoing environmental review
- Shortcomings in the consultation process about developments
- Construction contracts in category 3 lands
- Over-fishing and over-hunting
- The need to bring back the tradition of "resting" the animals so they can replenish
- Issues with non-Cree hunters and improper hunting handling of kills
- Issues concerning allocation and landscaping of housing lots

Elements of a Wemindji vision for the future:

- Closely monitored and controlled hunting and fishing
- Continuity of Cree culture and language
- Unity and collaboration across the Cree communities and with other entities
- Proactive Cree-led development

- Economic diversification
- Eco-tourism to balance culture, environment and development

9.2.4 Billy-Diamond Highway Railway Alignment

9.2.4.1 Introduction

The interviews provided a general idea of the land use taking place along the Billy-Diamond Highway (BDH) and in the surrounding areas, rather than a complete picture. The number of land users of the study area, the frequency of their visits and quantity of resources harvested were not estimated since it was not in the scope of the Cree land use study carried out as part of the LGA Phase 1 Feasibility Study.

The land and resources in the study area are used not only by the tallymen, their family members and land users, but also by other Cree land users. Additionally, various non-Cree activities were reported along the BDH. Since the BDH provides easy access to the territory, recreative anglers and hunters, as well as cottage owners and tourists also frequent the study area.

9.2.4.2 Study Area

The study area defined for the potential BDH railway alignment consists of a five km buffer zone on either side of the baseline BDH railway alignment, which goes from Matagami, around km 0 of the BDH, to the Rupert River, around km 257 of the BDH (Map 9.2.1). However, during the interviews with tallymen and land users, if land use activities or features were reported outside the study area, they were noted as well.

As shown in the table below, 13 traplines are intersected by the potential BHD railway alignment.

Table 9.2-2 Traplines Intersected by the Potential BDH Railway Alignment

Community	Number of Traplines	Trapline Intersected
Washaw Sibi	1	43
Waswanipi	7	W13
		W01
		W03
		W07
		54
		52
		W53
Waskaganish	1	N05
Nemaska	4	N20
		N21
		N18
		N23
Total	13	

9.2.4.3 Cree Land Use

9.2.4.3.1 Cree Land Use in Washaw Sibi

Trapline 43

The tallyman of trapline 43 and his wife were interviewed. Their main camp is located at km 208 of Route 109, outside the study area. The tallyman would like to use the various forestry and mining roads that are present in the area to access the territory and conduct harvesting activities, but access was not granted by the owners.

Only the southern portion of the trapline is used by the tallyman and land users as they do not have access to the northern portion. Given all that the tallyman explained (mining and forestry activities, access blocked, water contamination, Matagami’s industrial and residential zones, no shooting zone around the airport), he has concentrated his harvesting and land use activities in the southern part of trapline 43 which is outside the study area. He harvests beaver, rabbit, partridge, lynx, moose, wolf, bear, and marten, and sells the fur to Fourrures Grenier.

A communal area is located on the shore of Bell River, between the BDH and Matagami’s residential zone. Washaw Sibi and Waswanipi people gather there and fish in the river.

A cemetery was reported along the BDH near km 221. There is also a Native cemetery on an island in lac Matagami, where the tallyman’s father is buried. These areas have been noted in the spatial database held by the VEI.

The tallyman also mentioned a small lake polluted by a mine in the southwestern portion of the study area.

9.2.4.3.2 Cree Land Use in Waswanipi

Trapline W13

During the Cree land use interview, the tallyman shared the location of two Cree camps within the study area. His main camp is located around km 24 of the BDH. The tallyman's brother stays there and shares access and use with him.

The other camp mentioned, composed of 2 cabins, is located near km 29 of the BDH. Near that camp, an old 3.5 km-long portage, still in use, provides access to the Olga Lake. Previously, the tallyman collected his fresh water from that lake and from a stream near km 26, bu now he takes it in town.

The tallyman wants to protect a valued area between de BDH (approximately from km 25 to km 28) and the Olga Lake.

The tallyman indicated that he goes goose hunting on the north shore of the Gabrielle Lake. He also hunts geese at the Waswanipi river, near the Olga Lake, and at the mouth of the river. He also mentioned other people harvesting moose in proximity to the BDH.

The Laurier Mountain is found on trapline W13, on the west side of the BDH, and the tallyman indicated its Cree name: “Wishago Uchi”, meaning "Moose Lookout" or "Moose Love Mountain". In a section of the Bell River, the tallyman pointed out a spawning area for sturgeon. Another sturgeon spawning area is located in the Matagami Lake.

Trapline W01

The tallyman of trapline W01 reported locations of three Cree camps. The first one is his main camp, located at km 49 along the BDH and composed of two cabins. The second is used for moose hunting and is located near km 56 of the BDH. The last one is the tallyman's projected camp around km 48. He also mentioned extensively using the study area for hunting moose and goose. He specified six locations for moose hunting. Three of them are located along the BDH, and the three others are near Matagami lake (two areas) and between the BDH and the Waswanipi river. The three goose hunting areas are located at Matagami Lake and along the Waswanipi river. In addition, the tallyman collects spring water in watercourses on both sides of the BDH, around km 48, including at Canet River.

A spawning area for walleye and whitefish was pointed out by the participants in the Waswanipi river.

Finally, the family graveyard, still visible in the middle of chalets, is located on the shore of Matagami Lake, at the end of the access path from km 40 of the BDH.

Trapline W03

During the Cree land use interview, the tallyman shared various locations of Cree camps in the study area. The camp the tallyman mainly uses is located around km 81 of the BDH. Four camps located within the study area belong to family members and friends or can be used during hunting activities. Those camps are all located near the BDH: at km 79, km 83 and two near km 76. Also, two old camps were reported: one on the shore of the lake near km 81 and the other, which is not abandoned, near km 79.

The tallyman collects spring water at Ouescapis Lake and would like to protect the clean water near his camp around km 81. He also mentioned hunting bear in the area of de la Tourbière Lake, and going fishing for walleye and pike in de l'Amphibolite Lake and in the river nearby. He specified that this Lake feeds the Nottaway River.

Trapline W07

The tallyman of trapline W07 reported three Cree camps within the study area. His main camp, located around km 109 of the BDH, and his brother's camp at km 117 of the BDH. The third one belongs to family members and friends or can be used during hunting activities. It is located near Musky River and includes old tent frames that are still in use.

The participant indicated that there used to be trout in the watercourses around km 109, but not anymore since the construction of the BDH. He also shared moose locations in proximity to the BDH.

Forestry roads present on the trapline are used by the tallyman and land users for transportation. The tallyman uses the one between km 109 and km 114 to access the eastern part of his trapline. Additionally, the road intersecting the BDH at km 106 constitutes a major artery, as it is a multi-use road for different logging companies and it is accessible year-round. A snowmobile trail runs along the BDH and crosses it around km 120, then continues up to the neighbouring trapline. Two portages were identified during the interview process. The first one is a 2 km-long route close to the tallyman's main camp, near km 109 of the BDH, that could be intersected by the potential BDH railway alignment. The second one is approximately 1 km long, located in open terrain further from the BDH, and used by feet when the tallyman goes moose hunting. He clears it as he uses it.

At km 109, an old sand pit from the original construction of the BDH was used as a goose pond before there was vegetation growth. No rehabilitation was done at this pit.

Trapline 54

During the Cree land use interview conducted on September 1st, 2022, the tallyman indicated four locations of Cree camps within the study area. His main camp is located some 60-90 m from the BDH, near km 70, while his summer camp is on an island in lac Matagami. His main camp is composed of two cabins and a shed as well as a boat ramp to the Nottaway River. His mother's camp is located close to the BDH, near km 63 and it includes one cabin and two sheds. His father also used to have a camp around km 66 of the BDH, but the tallyman is not sure if it is still there.

The tallyman mainly accesses his trapline using the BDH. Sometimes, he gets to Matagami lake by boat from the Waswanipi River, sometimes he uses the boat ramp to Matagami lake located at the municipal campground. Additionally, an ATV and snowmobile trail parallels the BDH, some 60 m from it. It is approximately 5 km long at the moment, but it is not finished. The tallyman would like it to run approximately from km 60 to km 70 of the BDH.

The participant has two main hunting grounds, one located in the southwestern portion of the trapline, in the study area, and another east of the BDH, near km 66. He also traps beaver and snares rabbit along the BDH and he hunts goose in the small bay of lac Matagami. He fishes sometimes in the small streams, which host pike and walleye, but mostly in lac Matagami. The lake is a good fishing area for walleye, pike and sturgeon. The tallyman mentioned that non-native moose hunters use the forestry roads present in the area and go hunting on trapline 54.

Trapline 52

During the Cree land use interview, the tallyman indicated two locations of Cree camps within the study area. His camp is located along the BDH, around km 76, on trapline W03. The other camp mentioned, between km 78 and 80 of the BDH, belongs to the tallyman's uncle who was the former tallyman.

A snowmobile trail leading to lac La Tourbière was built with Niskamoon funds. However, transport/forestry trucks rolled on it and destroyed the tracks. A former forestry road is now used by the tallyman as a trail from km 80 of the BDH to the lake.

A burial site of one the tallyman's uncles is located north of lac La Tourbière.

The tallyman's main harvesting area, "my pantry, source of all the food", includes lac La Tourbière and surrounding area. The tallyman hunts goose and traps beaver and rabbit in that area. There is no fish in that area nowadays, but there used to be.The tallyman also mentioned a trapping area west of the trail, between the lake and the BDH. He also traps beaver in an area around km 83 of the BDH, and in all the creeks of the area. He also traps marten on trapline 52.

Trapline W53

During the Cree land use interview, the tallyman indicated five locations of Cree camps within the study area. The camp he mainly goes to is located along the BDH, around km 131, at the trapline's northeastern limit. The other camps mentioned during the interview belong to family members and friends or can be used during hunting activities. N20 tallyman has a camp with permanent cabins at km 132. A cluster of cabins (5) was also reported around km 123 of the BDH.

A highly sensitive area from km 122 to km 132 of the BDH, at the trapline's northeastern limit, was also reported. The tallyman recommended an alternate alignment to avoid that area.

9.2.4.3.3 Cree Land Use in Waskaganish

Trapline N05

The tallyman reported several hunting activities in the study area. He mentioned trapping marten and other small fur-bearing animals all around the Rodayer lake. Geese are also hunted in that area during spring, around the flying corridor located west of km 186 to km 190. The whole Rodayer lake is a fishing area used in summer and winter.

The tallyman's main camp is located in the study area, around km 188 of the BDH, and is composed of various structures. However, he indicated that if the railway is constructed, he would relocate his camp near km 190, north of the existing access to the Rodayer lake (boat ramp). That location is also where most of his harvesting activities are concentrated. Finally, the tallyman's mother used to camp near the Rodayer stream, approximately eight km west from the baseline BDH railway alignment.

In addition, the participant shared the location of a grave where a family member, a 4-months old child, is buried.

The tallyman indicated the caribou migration route located on the western side of Lac Rodayer. Caribou cross the BDH around Rodayer lake.

9.2.4.3.4 Cree Land Use in Nemaska

Trapline N20

The tallyman of trapline N20 reported the locations of six Cree camps. All those camps belong to family members and friends or can be used during hunting activities.

He also mentioned presence of clams in the southwestern bay of the Desorsons Lake, beaver activity beside the BDH (both sides), from km 126 to 144 and moose activity on the BDH from km 122 to km 140. Berry (moose berry) are present at the east of km 150-151 of the BDH.

The tallyman indicated going hunting geese within the study area and he specifies two location. One is in the bay south of Katutupisisikanuch Lake around km 167 of the BDH and the other at the watercourses around km 150.

Finally, at the east side of the km 155 of the BDH "further in the woods" is located a burial of two people. Also, the tallyman shared that his wife had a miscarriage when they were in the area at north of km 178 and they buried the baby there.

Trapline N21

The tallyman of N21 trapline reported beaver activity from km 182 to km 188 of the BDH, on both sides. He also shared that the creek going form Dorson Lake was their water source before forestry activities took place.

Trapline N18

During the Cree land use interview, the tallyman shared four locations of Cree camps within the study area. The camp he mainly goes to is located on the side of the BDH around km 121 and is composed of 8 cabins. Those cabins are used by the tallyman and family members. The three other camps mentioned during the interview are not used anymore. Two are located on the shore of the Colomb Lake:

- One at the mouth of Colomb River is in fact an old airport and old workcamp used for workers when the BDH was built. The strip is still there, but not the buildings.

- One at the south shore of the lake is also identify as an archaeological or historical site

The third old camp is near the BDH at km 220.

A trail used by foot, not ski-doo start from approximately km 198 of the BDH and lead to Kawastech Lake in an east west axis. There is also a lot of beaver activity around the area of the trail, at the east of the BDH. The tallyman mentioned that the Woodland caribou are present from Lac Colomb to the east. The tallyman is also fishing at the Colomb Lake multiple species such as pike, walleye, sucker, whitefish. "Everything, except brook trout".

Before the highway was built, they used to get their water around km 214 of the BDH in the watercourse, on the north side.

The tallyman also pointed out the location of a family member's birthplace on the north shore of Marcaut Lake. They were still going every weekend to that area before that person got sick. From there, a trail was leading to Old Nemaska.

Trapline N23

The tallyman shared eight locations of Cree camps within the study area. His main camp, composed of various cabins, is located at Carol Lake (lac du Poisson Blanc). Further up the Broadback River (15-20 km), the tallyman has another camp, on the north shore. Several camps are used by family members which are located along the Broadback River and by ruisseau Tordu.

A portage is used between two sections of the Broadback River around km 231 of the BDH.

A burial site is located near the tallyman secondary camp.

There is beaver activity (beaver lodges and dams) in all the creeks intersected by the BDH, from the Rupert River down to km 230 of BDH approximately. The tallyman and his family members trap them when the MTQ asks them to. The tallyman hunts grouse along the BDH in the fall. In the spring, he hunts goose notably near his mains camp. He fishes in the Broadback River for sturgeon, walleye, pike and whitefish. He is also fishing and beaver trapping in creeks near km 225 of BDH.

A moose area is located a few kilometers west of the BDH, south of the Rupert River. It extends between two creeks: ruisseau Wagamikushish and ruisseau Kaumwakweyuch. Near km 215 of the BDH (bay), there have been hundreds of caribou in the area; nowadays, some of them still frequent the area. The tallyman indicated the presence of bears crossing the BDH in the Broadback River area.

A lake north of km 222 of BDH is a drinking water source.

A former Hydro-Québec camp was located on the north shore of the Broadback River west of the BDH ; it is not there anymore, only waste is left. A municipal campground is located on the shores of the river, next to the BDH.

9.2.4.4 Comments, Concerns and Recommendation

The Cree land use study participants shared a wealth of information regarding the Billy Diamond Highway Railway. Their comments, concerns and recommendations concerning its potential upgrade and paving are presented in the table below:

Table 9.2-3 Comments, Concerns and Recommendations – Billy Diamond Highway Railway

Alignment / Conception
• Concerns expressed with both the optimized and the preliminary alignment. In small traplines, every part of it is vital. Recommendation to build the railway outside of their trapline. • Concerns expressed on potential spills from construction activities or from a train could contaminate creeks at the crossing. One tallyman was particularly concerned by the Bell River, which is valued by land users but which is already "all black". • Concerns regarding potential contamination to the creeks intersected by the railway. The blow-off from blasting, during construction, would fall into the creeks and contaminate them and/or that blasted materials used for the filling will contaminate the soil and water. • Contamination of watercourses could affect the activities on the trapline as there is not a lot of place to relocate them. Tallyman recommended to build the railway outside of his trapline, on any side. • Contamination of fish that are used for consumption. • Based on the pollution a tallyman has observed when the BDH was built, concerns were expressed regarding any additional construction project requiring filling with aggregates and rocks would further pollute lake Rodayer. • Alternate alignment was proposed in northeastern limit of trapline W53.
Operation and Maintenance
• Concerns on water contamination at the various river crossings during operation. One tallyman is particularly concerned by the Bell River, which is valued by land users but which is already "all black". • In every creek crossed by a forestry road, there is beaver activity. Beaver traps installed by the MTQ should be monitored more closely. • There is beaver activity in all the creeks intersected by the BDH, from the Rupert River down to km 230 of BDH approximately. The tallyman and his family members trap them when the MTQ asks them to.
Others
• Camp to be relocated as per tallymen's preference. • The logging companies made a clear-cut the size of a community, and some tallymen are beginning to see the effects on their hunting activities. • A tallyman is of the opinion that the roads in the region should be paved before building a railway, that something else than a railway should be done with that money. • Concerns that Air Creebec and road transportation companies will go bankrupt if a railway is built. • A railway offering passenger service could be interesting as the hunters could get on the train, but that it is not the first purpose of the railway.

- Presence of bears crossing the BDH in the Broadback River area.
- Presence of caribou crossing the BDH in the area of lac Rodayer.

9.2.5 Grevet-Chapais Railway

9.2.5.1 Introduction

The interviews provided a general idea of the land use taking place along the existing Grevet-Chapais trail and in the surrounding areas, rather than a complete picture. The number of land users of the study area, the frequency of their visits and quantity of resources harvested were not estimated since it was not in the scope of the Cree land use study carried out as part of the LGA Phase 1 Feasibility Study.

The land and resources in the study area are used not only by the tallymen, their family members and land users, but also by other Cree and non-Cree land users. Forestry companies as well as snowmobile and ATV clubs currently share the use of the existing Grevet-Chapais trail. It is also an important artery where residents of the region, Cree and non-Cree, circulate by snowmobile, ATV or vehicle on some sections.

During the interviews, tallymen and land users explained that when the Grevet-Chapais railway was built, the Crees moved their camps and activities away from it. Then, when the railway was decommissioned, they gradually came back in the area and established camps in proximity to the Grevet-Chapais trail to take advantage of the ease of access. Several non-Crees have started to frequent the area and build cottages around the waterbodies for the same reason.

9.2.5.2 Study Area

The study area defined for the potential Grevet-Chapais alignment consisted originally of a one (1) km buffer zone on either side of the existing Grevet-Chapais trail, extending from Franquet to Chapais. Following first discussions with Waswanipi tallymen and land users, in November 2021, the original study area was extended to a 5 km buffer to take into account cumulative impacts of past development projects. Therefore, three additional traplines were included in the Cree land use study: two from Waswanipi, and one from Oujé-Bougoumou. During the interviews with tallymen and land users, if land use activities or features were reported outside the study area, they were noted as well.

As shown in the table below, 13 traplines are located in the potential Grevet-Chapais railway corridor.

Table 9.2-4 Traplines Intersected by the Potential Grevet-Chapais Railway Alignment

Community	Number of Traplines	Trapline Intersected
Washaw Sibi	1	55
Waswanipi	10	W24
		W24A
		W19
		W20
		W21
		W21A
		W21B
		W16
		W23
		W23B
Oujé-Bougoumou	2	O54
		O58
Total	13	

9.2.5.2.1 Cree Land Use in Washaw Sibi

Trapline 55

Although listed as a Washaw Sibi trapline, trapline 55 is currently used by Anishinabe land users who are married or related to Cree people. VEI was instructed by the CDC not to interview those land users since no agreement was made with that First Nation for the conduct of the LGA Phase 1 Feasibility Study.

9.2.5.2.2 Cree Land Use in Waswanipi

Trapline W24

The tallyman of trapline W24 reported during the land use interview that he has a fishing camp close to lac Burge. The tallyman's nephews have plans to build cabins on that site. Camps belonging to the tallyman's family members and some community members are located just beside the potential railway (less than 60 m), in the Miquelon hamlet, close to O'Sullivan River. There are also several cottages belonging to non-natives in the area.

The trapline was accessible through Lebel-sur-Quévillon, "but it's all brushed in now". Therefore, the access to trapline W24 is from the north all the way down to the southwest end of the trapline, crossing the existing Grevet-Chapais trail. The tallyman and land users use that access road every day, so if the railway is reinstalled, it would block their access south of the railway. An old trail is linking the lac Burge to the Miquelon hamlet.

The tallyman reported the location of four grave sites around the northern portion of lac Puskitamika south of the alignment.

The location where the power transmission lines are crossing the west shores of lac Puskitamika is named Indian Point, also called “the narrows”.

The tallyman and his family members fish for walleye, pike and bass in lac Burge. He also goes fishing on trapline W23A (outside the study area). He hunts moose at several locations on his trapline, near lakes. The tallyman indicated the locations of several spawning areas, one in a tributary of O’Sullivan River and two in the river itself, in the Miquelon hamlet.

Trapline W24A

VEI was not able to meet with the tallyman of trapline W24A.

Trapline W19

VEI was not able to meet with the tallyman from the trapline W19.

Trapline W20

The tallyman of trapline W20 reported during the land use interview the location of old camp on the shore of lake Waswanipi which was built before the Grevet-Chapais railway was built. The winter camp was used to access to Taylor lake.

The tallyman and his family members do not use the Grevet-Chapais trail nowadays as their main camp is located northwest of it.

The lac Waswanipi is used for fishing walleye, whitefish, pike and sturgeon.

Along the Grevet-Chapais trail, there was the Waswanipi railway station. “Way before the road was built”, it was the way to come to Waswanipi Post (that was located on trapline W20). The tallyman’s late grandfather and father used to be the mailmen and they were picking up the mail at the Waswanipi Station.

Trapline W21

During the Cree land use interview, the tallyman shared two locations of Cree camps within the study area. His camp is located by lake Opawica, north of Gull Island (île au Goéland). Old camps are present by the lake, west of Opawica Island, and an approximately 80 years old graveyard, where 6 of the tallyman’s family members are buried, was reported in that area as well.

The Grevet-Chapais trail is crossing trapline W21 over approximately 20 km. The tallyman uses it to travel east-west on his trapline. He also uses it as a skidoo trail during the winter. Forestry roads connecting to the Grevet-Chapais trail are also used: the main ones are intersecting the Grevet-Chapais trail near lake Billy and between Opawica and Relique lakes. A boat access to travel between lake Opawica and lake Wachigabau is located adjacent to the Grevet-Chapais trail, west of Gull Island.

The tallyman indicated that there are a lot of beavers along the Grevet-Chapais trail. He mentioned using the trail for moose and small game hunting in the fall. He pointed out two goose hunting areas, a moose yard, and a woodland caribou area within the general area of lake Opawica. Additionally, the tallyman shared the location of a fishing area in lake Washigabau, near the Grevet-Chapais trail, and of a spring water source on a tributary of lake Shortt.

Several non-cree cabins were reported on trapline W21, around lake Opawica and south of the Grevet-Chapais trail, in proximity to lake Barbie. The tallyman also indicated that there is forestry activity taking place north of the study area, and that there have been mining activities on the trapline. One of the tailing ponds from the old mine in Desmaraisville is located near km 188 of the Grevet-Chapais trail, between Bachelor and Opawica lakes.

Two washout (erosion) areas were identified along the Grevet-Chapais trail, in the area of a steel bridge at the eastern extremity of Gull Island and a tributary of lac Opiwaca on the same island. The latter may be the result of beaver activity.

The tallyman recommended replacing the steel culverts present in a bay of lake Opiwaca area with plastic culverts and would like the testing of water quality of lake Opawica and some tributaries.

Trapline W21A

The tallyman reported during the land use interview a total of three camps. His main camp is located west of lac Lewis near the Grevet-Chapais trail. He also uses a winter camp on the shore of lac Lapparent. Additionally, the tallyman mentioned his father's camp on the eastern extremity of lac Lewis, which was abandoned after the rail was decommissioned.

A railway between Chapais and Senneterre was put into service in 1960. The tallyman's family started to use the rail to go to their winter camp. The tallyman indicated forestry roads on the north shore of lac Lewis near his main camp and a main road to the highway from lac Shortt.

Two fishing areas are used to fish pike, whitefish, sturgeon, large walleye, one in lac Lewis and the other in lac Lapparent.

The tallyman denoted the location of two commercial camps. A camp used by Kruger is located on lac Relique. This area was heavily used for sending wood to mill in Lac St-Jean. Another camp (Domtar) is located north of lac Opawica, near ruisseau Dalime. His residence is located near lac Shortt, where a mine was located.

Trapline W21B

VEI was not able to meet with the tallyman of trapline W21B.

Trapline W16

The tallyman of trapline W16 reported during the land use interview that his and his family members' cabins are mostly on the northern end of his trapline, outside the study area. However, his brother's camp is by the lac O'Mélia, approximately 2 km south of the Grevet-Chapais trail. An old Kruger logging camp used to be on that site. Also, the tallyman's grandfather had a camp close to the former railway, and he was taking the train from there.

Several trails were cleared by the tallyman's father around lac Mechamego. A ski-doo and pedestrial trail from the south shores of the lake leads to south of ruisseau Mechamego, while another runs towards the trapline southwest limit. There is also a portage from the lake to the watercourse west of it. A trail from the eastern portion of the lake is called "Pituwunan", which means "travelling in between".

A trail called “Four pipes trail“ was also cleared by the tallyman’s father between lac Anville and another waterbody located northwest of it. Another, still used and maintained, mainly for rabbit trapping from lac Houghton leads toward the southwest limit of the trapline. Part of it disappeared because of logging. An old logging road is located along lac Houghton. The Cree name of that lake was “waapush/wapsh saakahiikan” (rabbit lake). There are also scattered access roads from the forestry companies on trapline W16.

The tallyman indicated that all the Grevet-Chapais trail is used as a transportation way by ATVs and by trucks by Cree hunters going to their hunting territories. It provides an easy access to an area where there is no official road. The trail is blocked near KP 231 as a gate was installed with chains and a block. Someone installed it, but the Crees were not informed. The tallyman considers that his heritage trails are impacted by logging activities.

A child burial site of distant relatives of the family who wintered there a long time ago is located near the south shore of lac Mechamego.

A large sector of the trapline is suitable for moose, as they are seen a lot. The tallyman harvested 11 moose in 3 weeks in that area this fall. He added: “that’s nothing! My dad used to get 40 moose in a week”. The tallyman indicated the location of a moose conservation area which is considered a sacred site and a heritage site. It was designated as such following the Paix des Braves. He also identified a corridor used by moose, year-round. That area is also a trapping area for marten, mink, weasel, otter (shukshish), bear, beaver, and lynx. He used to sell the fur from the animals he was trapping, but now he only traps for the meat. Two goose hunting areas were identified in lakes O’Mélia and Mechamego.

Two woodland caribou migratory routes are also present, one south of lac Houghton and another east of lac Mechamego.

The tallyman indicated that there is pike, sucker, red sucker, walleye, whitefish, burbot, and sturgeon in all the watercourses on trapline W16. However, there is no brook trout or lake trout. There used to be brook trout in lac Grenier and some of its small tributaries, but it disappeared due to the forestry activities as the lake and streams dried up. According to the tallyman, his brother is fishing primarily walleye in lac O’Mélia. A rabbit trapping area (wapshugum = rabbit room) was located west of lac Houghton was used by James Cooper’s late.

Land users and “day hunters” hunt along the Grevet-Chapais trail. There is beaver activity throughout the alignment, most creeks intersected by the Grevet-Chapais trail have beaver activity, so people trap them.

All the potential archaeological sites are located on the northern part of the trapline.

Four ages of forestry, or of encroachment, can be observed on trapline W16, phase by phase. The first cycle of logging was done with horses and logs were removed manually. The tallyman indicated that, close to the Grevet-Chapais trail, on the north side of it, is an old logging area, from the 1st wave of commercial logging activities, some 40 years ago. Logging activities took place further north from the Grevet-Chapais trail some 10 to 20 years ago, and now they have expanded in a grid pattern on both sides of it, on approximately one km. Forestry activities are also occurring between lakes Houghton and Mechamego.

Trapline W23

VEI was not able to meet with the tallyman of trapline W23.

Trapline W23B

During the Cree land use interview, the tallyman shared the location of one Cree camp within the study area: his camp located on the shore of lac de la Presqu'île. He has another camp in the southern part of his trapline. Two old camps (more than 50 years old) are located on a small islands outside the study area, but very close to its southern boundary. A third old camp was reported outside the study area, but close to its boundary, on the shore of Lac de la Presqu'Île.

The participant had been using the Grevet-Chapais trail for 12 years when he was met by VEI. He still uses it as an artery to travel by ATV and by skidoo, though most of that part is practicable by vehicle. He takes the old lake Shortt road, on about 11 km, and then hits the Grevet-Chapais trail up to Chapais. It is expensive (fuel cost) to reach his camp by vehicle, so travelling by ATV on the Grevet-Chapais trail represents an ease of access to his trapline. However, he indicated that it is dangerous on the trail when crossing forestry trucks, so he drives on the edges. Some parts of the trail are narrow, some are wide, some embankments are high, and there are 30-40 feet slopes in some parts. The tallyman anticipates the loss of an important access to his trapline as a negative effect of the potential railway. An access road/forestry road is parallel to the Grevet-Chapais and 70-tons overloaded trucks travel on that road.

There are various ski-doo and ATV trails funded by Niskamoon on trapline W23B. The tallyman recommended to make a request to Niskamoon for information concerning the trails.

The tallyman hunts and traps while travelling on the Grevet-Chapais trail, but mostly on his trapline. He harvests mainly moose, goose, bear, marten, and beaver. He reported a moose yard on trapline W23B, and indicated that beaver activity near his camp increased to a point where it is damaging the area, flooding over the trail. The tallyman also harvests small game, like rabbit and grouse, but he has competition from local hunters (from Chapais), and even more since the mine has closed.

He fishes various species in lac de la Presqu'Île as well as in the watercourses on his trapline. Notably, a tributary of the lake is good for fishing brook trout. There is a sewage discharge point (wastewater) from the town of Chapais, so the tallyman doesn't fish in the creeks on the north side of the road (route 113) in that area. He doesn't fish in the southwestern portion of his trapline either to avoid the creeks contaminated by the sludge from a mine tailing ponds.

The tallyman indicated a protected area near the lac de la Presqu'île and directed VEI to the Waswanipi Forestry Department. The "presqu'île" (peninsula) on that lake is a biological refuge, no logging is allowed. There are all kinds of birds there.

Two gravel pits were mentioned by the tallyman, one near the Grevet-Chapais trail and another south of the transmission lines further east. At the end of the Grevet-Chapais trail, in Chapais, there was a big washout in 2008. That landslide was documented because it was a big one which destroyed parts of the trail and of the road. It was caused by the mine's tailing pond: when it burst, it contaminated the area all the way down to Gull Lake. The rocks in proximity to the landslide turned grey. The beavers used the sludge to build their lodges and they were grey too. In the following months/years, the tallyman observed walleye with warts or scabs in that area.

9.2.5.2.3 Cree Land Use in Oujé-Bougoumou

Trapline O58

VEI was not able to meet with the tallyman from the trapline O58.

Trapline O54

Trapline O54 is intersected by the extended Grevet-Chapais study area. The tallyman of trapline O54 took part in a group interview with another tallyman from Oujé-Bougoumou. He reported a moose yard and the presence of speckle trout in lac Springer. Lac Laura is polluted now, like most of the lakes in the area. The tallyman mentioned that it was polluted by forestry activities.

9.2.5.3 Comments, Concerns and Recommendations

The Cree land use study participants shared information and concerns regarding the potential Grevet-Chapais railway. Their comments, concerns and recommendations are presented in the table below:

Table 9.2-5 Comments, Concerns and Recommendations – Grevet-Chapais Railway

Alignment / Conception
• The Grevet-Chapais trail is used as an artery to access the territory. The new railway would impact the access to traplines, for some the main access, and consequently the use of the land. • How to make sure that access to the area will not be dangerous for the land users, especially the younger ones? Building a path/access road adjacent to the potential railway could be a solution. • When the railway was decommissioned, no environmental clean-up was done, and some spikes and old rail ties are still found on/in proximity to the Grevet-Chapais trail. • Concerning the general LGA program, the tallyman said "I don't need it. I am pretty sure that the railroads are not going to be for me. That's for something else; they want something else way more expensive than what I got on my trapline". • The tallyman recommends changing the steel culverts in that area and replacing them by plastic culverts. He would also like water quality of lake Opawica and some tributaries to be tested. • There are numerous unresolved land use conflicts on one trapline. Consequently, the tallyman disagrees with the idea of another infrastructure project being developed on his trapline, at a location which is already subject of a conflict.
Operation and Maintenance
• Concerns expressed regarding noise. Notably, the CN railway operation was loud and that it disturbed hunting activities. • Concerns regarding the potential impacts of the vibrations caused by the train on spawning grounds, silty soils, animals and vegetation. • Concerns on water contamination at the various river crossings during operation.

- Concerns that where the infrastructure/the tracks will be located, all the titles will belong to non-Cree companies and entities in 15-30 years and will impact Crees.
- Beaver activity in the area has increased to a point where it is damaging the area, flooding over the Grevet-Chapais trail and sometimes creating washouts because there is no maintenance.

Others

- When the Grevet-Chapais railway was converted into an official skidoo trail, the tallymen had to pay an annual membership to continue using the trail, even if they were travelling on their own territory. They were also forbidden to circulate with a sled. The obligation to pay a membership to FQCM is still in force, but “they don’t harass like they used to do before”.
- Other users of the area, like the ones using where graves sites are located, should be met collectively and consulted.
- Rail ties and remnants of old tracks still remain along the Grevet-Chapais trail.
- Perhaps it will mean less traffic from “uninvited guests” on the traplines if it is a railway instead of a trail.
- Recommendation to identify and mark (with panels) Cree historical sites along the Grevet-Chapais alignment.
- It was deplored that LGA was “never brought to the Cree population and was discussed behind closed doors”.
- There are still aspects and obligations from the Paix des Braves to be fulfilled before new things are promised.
- Niskamoon should be contacted for information on trails.
- Waswanipi Forestry Department should be contacted to have access to forestry maps.
- A tallyman brought to VEI Team’s attention an unresolved land use conflict on his trapline, in the Grevet-Chapais study area. Consequently, he disagrees with the idea of another infrastructure project being developed on his trapline, at a location which is already subject of a conflict.

9.2.6 Community Access Roads

9.2.6.1 Introduction

The interviews provided a general idea of the land use taking place along each community’s access road and in their surrounding areas, rather than a complete picture. The number of land users of the study area, the frequency of their visits and quantity of resources harvested were not estimated since it was not in the scope of the Cree land use study carried out as part of the LGA Phase 1 Feasibility Study. It is worth noting that such an estimation exercise would be a big undertaking since various community members use the lands in proximity to their community’s access road.

While being relatively recent on the territory, modern roads are widely used by the Cree population. In terms of transportation routes, they have overtaken rivers. The communities’ access roads are not only important to connect with other communities and with “the south”, but also to facilitate land use and harvesting activities. The fact that most land users do not live from the land anymore and occupy paid jobs partly explains the growth in importance of modern roads, as they provide faster access. Major changes in important rivers’ hydrology and ice cover, following hydroelectric development in the last decades or due to climate change, also contributed to the increase in use of modern roads. Since it is now more dangerous, complicated, or sometimes impossible to navigate on some watercourses as well as to travel by snowmobile, roads offer interesting alternate options.

9.2.6.2 Study Area

The study areas defined for the community access roads consist of a 1 km buffer zone on either side of each road's centerline and they extend from the start of the road to its connection with the BDH (Waskaganish, Eastmain, Wemindji) or the Route du Nord (Nemaska). However, during the interviews with tallymen and land users, if land use activities or features were reported outside the study area, they were noted as well.

As shown in the table below, 11 traplines in total are intersected by the four access roads concerned by this study.

Table 9.2-6 Traplines Intersected by the Communities' Access Roads

Infrastructure	Number of Traplines Intersected	Trapline
Waskaganish Access Road	4	N09
		N02
		N01
		N23
Eastmain Access Road	3	RE03A
		RE04
		RE03
Wemindji Access Road	2	VC11
		VC12
Nemaska Access Road	1	VC13
Total	11	

9.2.6.3 Waskaganish Access Road

The construction of the actual Waskaganish access road was completed in 2002 (Jacques Whitford, 2009). The road has a total length of 102 km, from the outskirts of the community to its connection with the BDH, around km 237. Starting west, the first 28 km are already paved. Between km 0 and km 22, the road runs on category I land. It continues on category II lands up to km 94, and on category III lands for the rest of its alignment (approximately 8 km). As shown on Map 9.2.1, the road crosses four traplines, namely N09, N02, N01 and N23. All those traplines are on Waskaganish territory, except trapline N23 which is located on Nemaska territory.

On November 9 and 10, 2021, VEI conducted land use interviews with a total of four (4) participants which included the tallymen of the three (3) Waskaganish traplines intersected by the access road and a family member. Validation interviews took place on April 11 and 12, 2022. Nemaska tallyman was met in July 2022 regarding potential work on Waskaganish access road.

The table below summarizes the Cree land use information collected during the interviews regarding the upgrade and paving of Waskaganish access road.

9.2.6.3.1 Land Use by Traplines

Trapline N09

The tallyman of trapline N09 reported during the land use interviews that his main camp is located in the study area, some 200 m from the road, and is composed of various structures: one cabin, one teepee, one shed, and one tent frame used as a cabin. He mentioned another camp within the study area which is used as a spring hunt cabin for the locals. The access to “Gravel Pit” cultural site as well as the access road to the landfill site were the main transportation routes mentioned in the study area.

The tallyman indicated that he harvests beaver, grouse, and ptarmigan for consumption. Additionally, there are various goose blinds or goose ponds on trapline N09. Some of them were abandoned because they dried up since the construction of the Waskaganish road. According to the tallyman, it may be due to the growth of vegetation (type of grass). The vegetation along the road has changed after construction of the road, and the type of vegetation now present attracts beavers to go there.

There is beaver activity in the first creek (Jimansibish). It will sometimes block the culverts, the water will go up, but not on the road. This is a recurring issue. It will take 4-5 days to undo the beaver lodge. A machine needs to be brought by the Band Maintenance team (since it is on category I lands) to break the beaver lodge.

Moose, bears, wolves, and foxes cross the road between km 4 and km 11 of the road, approximately. There are lots of cranberries in that area. Bears also cross the road around the dumpsite (km 19-20). Small birds, grouse, porcupine, rabbit, fox, snakes, frogs, and squirrels get hit on the road in the area between km 8 and km 12.

Trapline N02

Four camps located within the study area were mentioned by the tallyman of trapline N02 during the interviews. Three of those belong to family members and friends, and the other one is a cultural camp used by the Cree School Board. A trail starting at km 23 of the road and leading to the communications tower, as well as the access road to Smokey Hill were the main transportation routes mentioned in the study area.

The tallyman goes goose hunting and beaver trapping within the study area. He reported several goose hunting blinds on his trapline. He indicated that all along the Waskaganish access road, it is considered a community goose hunting area. However, fur-bearing animals (beaver, bear and moose) are mostly harvested by the tallyman and his sons.

The tallyman mentioned beaver activity on the creek around km 30 of the road and indicated the presence of trout in one of the creeks intersected by the road. Rabbit, fox, bear, sharp-tailed grouse are also observed in proximity to Waskaganish Access Road. Collisions with bears occur around km 28-29 of the road because there are a lot of blueberries in that area. The tallyman also sees a lot of rabbit and fox that get struck on the road.

An important archeological site was encountered around km 29 of the road, where the littoral or the shore drift line was in the past (the Rupert River was larger back then). An arrowhead, a knife made of rock and a skull (unidentified species) were found there. The archaeological site has been documented by Jim Chism.

Trapline N01

The tallyman of trapline N01 indicated during the interviews that he was already the tallyman when the Waskaganish access road was first built. He acted as an advisor and consultant: he determined where the road would pass on his trapline. The tallyman chose an alignment that would go close to certain types of woods that he would later harvest to make different types of tools, like snowshoes and birch toboggan, but that he would also protect. Indeed, some tree stands that he protected are still present along the road.

Before construction of the Waskaganish access road started, the tallyman was already aware of the potential impacts of a new road. One of the main issues that he anticipated was the ease of access to his hunting ground for other parties. Among other resources, the tallyman was hunting caribou, moose, bear, and ptarmigan. Nonetheless, he was “ok” with the idea of building the road. It turned out that what he was thinking happened. Nowadays, people from the community, mostly “day hunters”, go hunting on trapline N01: goose hunting in the spring and moose hunting along the road, since it is far enough from the community and close to areas of moose traffic.

The tallyman’s main camp is located within the study area, some 400 m from the Waskaganish access road. During the interviews, he mentioned three (3) other camps which belong to his family members and friends, or which are used during hunting activities

The tallyman harvests caribou “every few seasons”, depending on their migratory route. Woodland caribou live permanently in the area, but “we don’t see them”. In the 1950s and 1960s was the last time the tallyman had observed migratory caribou in the area, but recently, for three consecutive years, he saw them on his trapline. According to the tallyman, this is related to the powerline that was built approximately six years ago: caribou follows the corridor that was clear-cut.

At the time of the interview, family members had just observed beaver activity up one of the creeks that are intersected by the road and informed the tallyman. So, he was planning to go trap them soon. The tallyman indicated that, since the Rupert River diversion, he relies more on the beaver found away from the Rupert River area.

There are beavers blocking culverts along the road, but not on trapline N01, as the tallyman traps them and allow other land users to trap them too. “I am an active tallyman. When I die, that’s when the beavers will come and block the culverts. People will say: it was nice and dry when the tallyman was around.”.

Several locations of valued fauna and flora species, such as brook trout, moose, beaver, and birch tree, were shared by the tallyman. Berries can be found all over trapline N01, on each side of the road: blueberries are the most common but cranberries, swamp berries, moose berries and raspberries are also present. The tallyman consumes those berries, but he washes them before to remove dust from the road. Several community members go pick berries on trapline N01 and they park roadside.

9.2.6.3.2 Comments, Concerns and Recommendations

The Cree land use study participants shared a wealth of information regarding the Waskaganish access road and made interesting recommendations concerning its potential upgrade and paving. Their comments, concerns and recommendations are presented in the table below.

Table 9.2-7 Comments, Concerns and Recommendations – Upgrade and Paving of Waskaganish Access Road

Alignment / Conception
• When the Waskaganish road was first built, a tallyman had proposed that a rest area be developed. Currently, there is only one place where transport trucks can stop and park along the road. There is also a small parking area (for only one pick-up truck) along the road, but it was made specifically for someone. Several community members go pick berries,

gather wood or hunt along the road, so there is still a need for some parking spots, rest areas and places to stop.

- There is a dangerous curve, around km 48-49 of the road. When coming from Waskaganish, it drops (coming downhill from a ridge) and there is a curve. A guard rail should be installed.
- The turn is too sharp, around km 68 of the road.
- It would be a good idea to pave and widen the Waskaganish road. The shoulders should allow to circulate in ATV, at least on one side.
- Turn-off at Smokey Hill Road should be widened; only one vehicle can pass at time. Shoulders should be widened to park roadside and parking should be enlarged. Sometimes, even buses use that access to get to Smokey Hill.
- Certain curves are dangerous as they do not have markers. The guard rails should be more visible at night and during winter. Guard rails should be installed on both sides of the Waskaganish road for the first 4 km from the community, as people use the road for fitness, for walking or bicycling, since it has been paved.
- The first 4 to 6 km of the road should be enlarged to accommodate pedestrians and bikers. There are more ATVs on the roadside to get to Gravel Pit.
- Dangerous sharp turn where the transmission line crosses the road, around km 9. People use the transmission line right-of-way to travel in ski-doo and they cross the road there. It is dangerous because it is in a curve and also because there are trees on the west side
- Illumination at night: perhaps the first 4 km of the road should be illuminated (at least up to the community's welcome sign).

Operation and Maintenance

- Around km 70-71, there is water accumulation, and it looks wet (the road looks dark). It gets like a pool during spring runoff. The tallyman recommends installing a culvert or something else (there is no culvert at the moment).
- The section of the Waskaganish road around km 88 gets slushy on top of the icy surface of the gravel road. "It seems like mud". The road surface seems to be made from blasted rock.
- There are beavers blocking culverts along the road, but not everywhere.
- Beaver activity on the creek around km 30 of the road. They block the culvert and create flood.
- The turn-off from Waskaganish access road towards the Cultural Camp is eroded due to beaver activity. It is "washed-out" because of flooding.
- There are snow drifts on the road around km 42. It would be a good idea to put plastic fences to prevent that.
- Barriers (guard rails) should be installed in the area of km 42.
- A culvert should be put at km 12 of the Waskaganish access road.
- There is beaver activity in the first creek (parallel to the road between km 0 and km 1). It will sometimes block the culverts, the water will go up, but not on the road. This is a recurring issue. It will take 4-5 days to undo the beaver lodge. A machine needs to be brought by the Band Maintenance team (since it is on category I lands) to break the beaver lodge.
- The vegetation along the road has changed after construction of the road, and the type of vegetation actually present attracts beavers to go there.
- Between km 8 and 16, south of the road, all creeks want to empty in the Rupert River, but there is only one culvert. So, during spring run-off, it turns into a bay. That could become an issue with the washouts if there is a lot of snow.

Safety

- Collisions with bears occur in the area of km 28-29 because there are a lot of blueberries.

- When travelling on the road, heading to the community (going west) around sunset, there is a visibility issue due to the dust, because they are always facing the sun.
- The paving of the Waskaganish access road is positively seen because it would limit the dust issues. The downside of the paving is that the vehicles' speed will increase.
- The garbage dump area is dangerous.

Signage

- Collisions with bears occur in the area of km 28-29 because there are a lot of blueberries.
- When travelling on the road, heading to the community (going west) around sunset, there is a visibility issue due to the dust, because they are always facing the sun.
- The paving of the Waskaganish access road is positively seen because it would limit the dust issues. The downside of the paving is that the vehicles' speed will increase.
- The garbage dump area is dangerous.

Others

- Concern that construction activities (for Waskaganish road or potential BDH railway) could impact water quality.

9.2.6.4 Eastmain Access Road

The construction of the actual Eastmain access road was completed in 1994 (MTQ, 2022). The road has a total length of 104 km, from the outskirts of the community to its connection with the BDH, around km 350. Starting west, the first 5.7 km, located on category I lands, are already paved. The road continues on category IB lands for 48.9 km (km 22 to km 94), then on category II lands for 41.8 km, and on category III lands for the rest of its alignment (approximately 6 km). As shown on Map 9.2.4, the road crosses three traplines, namely RE03A, RE04 and RE03.

On October 20, 2022, VEI conducted land use interviews with a total of four participants which included the tallymen, their family members and/or the land users of two out of three Eastmain traplines intersected by the access road.

9.2.6.4.1 Cree Land Use by Traplines

Trapline RE03

Camps can be reached from the Eastmain access road, but hunting activities are concentrated in the middle of the trapline. There are three old campsites along the road on trapline RE03 where cultural activities are held .

The federated snowmobile trails burned down during the 2013 forest fire, but the Niskamoon trails are still used (one is 28 km long, and the other is approximately 10 km long).

The tallyman reported several hunting activities along the Eastmain access road, and in the surrounding area. Tallyman and land users hunt all types of animals on their trapline, but especially goose and moose. A lot of hunters go on this trapline and it could imply safety issues.

Approximately 85% to 90% of trapline RE03 was touched by a forest fire in 2013. Most berry-gathering areas were burned down and most beaver dams too, except those located on lakes. Most of the area was too dry for vegetation. The peat moss burned as well, so there is only sand now. A catastrophic change in wildlife and vegetation was observed after the forest fire and since then, fish is the main subsistence they can get from the trapline. They fish in a chain of three lakes located south of the Eastmain Road. They catch brook trout, rainbow trout, hybrid trout (like salmon), whitefish, cisco, and walleye. Before the forest fire, they could get around 100 fish in an hour, but it is not like that anymore. It takes seven years for nature to recover from a forest fire, so they tell people from the community to catch and release the fish now. The tallyman and land users take their drinking water at the km 381 road stop. Before the forest fire, they used to get it from the creeks.

The area between km 80 and km 86, approximately, is a sacred spot for the tallyman's family, an area that they want to protect. The participants also mentioned a burial site but did not located it.

The area around the lake located south of the road, near km 95, is used to do a lot of hiking, walking, and canoe.

In the trapline's easternmost area, close to the BDH turn-off, there are fox, wolverine, moose and bear. A bear den can be found near small river. An increase in invasive species is observed on the side of the road. The participants are seeing willow growing on their territory, which was not present before.

Trapline RE03A

The tallymand and land users indicated three camps in the vicinity of the Eastmain access road, which includes the Cree School Board Camp and a cultural camp where the Sun Dance Ceremony takes place. The site is used as a cultural site since 2010. There have been shaking tents ceremony and walking out ceremonies there. Spring water is also collected near one of those camps and along the road. Participants also reported three paths leading to hunting areas, camps and lakes from the access road, and mentioned a projected fishing camp.

Hunting activities mostly for moose, rabbit, geese, and beaver were mentioned. Participants pointed out five goose ponds along the road and indicated some locations where people park on the access leading to the pit or within the pit. Beavers have been active around the culverts located at km 4, 6, 40 and 41 of the Eastmain Road. They moved around, "but they'll be back". Blueberry picking areas were identified along the road and wood cutting activities by community members were reported. There is trout, as well as different species like pike, sturgeon and whitefish, in the lakes along the road.

The beaver creek around km 4 of the road is the Eastmain community's water source, where the pump house is. It pumps into an artificial lake and it creates a reservoir. Anything east of km 4 (upper branch of the stream) is the source of it; anything west of it goes downstream, into the Bay.

9.2.6.4.2 Comments, Concerns and Recommendations

The Cree land use study participants shared a wealth of information regarding the Eastmain access road and made interesting recommendations concerning its potential upgrade and paving. Their comments, concerns and recommendations are presented in the table below:

Table 9.2-8 : Comments, Concerns and Recommendations – Upgrade and Paving of Eastmain Access Road

Alignment / Conception
• The road is too soft in the area of km 48.
Safety
• The curve at km 26 is dangerous. • People ride on bicycles up to km 12 of the road. • The road is too narrow to park roadside, so it is dangerous when people have an emergency.

9.2.6.5 Wemindji Access Road

The construction of the actual Wemindji access road was completed in 1996 (DMC, 2019). The road has a total length of 98 km, from the outskirts of the community to its connection with the BDH, around km 518. Starting west, the first 22.6 km, located on category I lands, are already paved. The road continues on category II lands for 67 km (km 22 to km 89), and on category III lands for the rest of its alignment (approximately 10 km). As shown on Map 9.2.5, the road crosses three traplines, namely VC11, VC12 and VC13.

The resurfacing and paving of the first 16.4 km of the access road was studied in 2017 (Stantec, 2017). The scope of that study provided preliminary information required for the assessment of the project file by the Evaluating Committee. As such, it differs form the current mandate which studied the upgrading and paving of the entire Wemindji Road, taking into account additional upgrading options.

Between June 8 and June 10, 2022, VEI conducted land use interviews with a total of 16 participants which included the tallymen, their family members and/or the land users of the three traplines intersected by the Wemindji access road. One tallyman could not be interviewed, but his brother, who is also a land user of the trapline, was interviewed. The data presented herein will need to be updated after interviewing that tallyman.

9.2.6.5.1 Cree Land Use

Trapline VC11

The section of the Wemindji access road located on trapline VC11 is completely paved. Most of the information shared by the land user during the interview was regarding the location of the camps near the actual access road. A total of seven camps were reported, among which four are used by family or friends and the other three are cultural camps. One cultural camp is located near km 6 and is used by the Cree School Board. The second and third, are respectively located near km 10 and km 20, were also built by the Cree School Board, but are less used than the first one. The tallyman still needs to complement this land use information.

Trapline VC12

The tallyman and his family members reported several hunting activities along the Weminjdi access road and in the surrounding area. Tallyman and land users hunt all types of animals on their trapline, but especially goose, ptarmigan, rabbit, and grouse. Along the road, they harvest small game: beaver, rabbit, and ptarmigan. They hunt moose on the Bay. People from the community hunt ptarmigan and moose along the road/from the road. ‘’We lost count, everybody goes there’’ and they are not informing the tallyman. It is dangerous for people on the trail.

Fishing activities for trout, walleye, pike, and cisco take place in the lakes on both sides of the road. The land users get to trapline VC12 by vehicle using the Wemindji access road, and they also travel in the area by snowmobile and ATV. They mentioned two trails that cross the Wemindji access road, one near km 24 and the other at km 46. However, the participants indicated that the trail at km 46 is not in use anymore. Most of the camps reported during the interviews belong to family members, friends, or others land users. Only one of the 12 camps identified is an old log cabin, not in use anymore.

In addition, participants indicated harvesting blueberries, raspberries and strawberries along the road but especially outside the study area. Jam is made with the extra fruits. Labrador tea can be found on the trapline but they do not harvest or consume it.

Trapline VC13

A total of 16 camps have been identified along the road and in its surroundings. Among these, six (6) are old camps and two are projected camps.

The tallyman and his family members reported many harvesting activities along the Wemindji access road and in the surrounding area. Indeed, they use the area to go hunting, mostly goose, moose, and bear, but also other animals such as beaver and caribou. The tallyman and his family members hunt moose along the road and around the bay. They also hunt white bird along the road, and goose and ptarmigan all over their land. Fishing takes place on the lakes on both sides of the road. Species caught are mostly pike, trout, walleye, and whitefish. In addition, participants indicated harvesting blueberries all along the road, and pointed out two specific locations.

The participants also mentioned three burial sites in proximity to the road. A participant wants the burial site near km 70 of the road to remain untouched. Participants explained that the presence of a curve at km 70 of the road is due to a mass grave that was discovered south of the actual road during construction. Another valued site, a birth site, is located on the north shore of the Anapapatayapuschiwakamich lake, near km 82 of the road.

As for cultural sites, references to the Bigfoot legend were made during the interview. Large human footprints, considered to be the Bigfoot's, were reported south of the road, not too far from an area where a bad smell, "like wet dog", was mentioned.

9.2.6.5.2 Comments, Concerns and Recommendations

The Cree land use study participants shared a wealth of information regarding the Wemindji access road and made interesting recommendations concerning its potential upgrade and paving. Their comments, concerns and recommendations are presented in the table below:

Table 9.2-9 Comments, Concerns and Recommendations – Upgrade and Paving of Wemindji Access Road

Alignment / Conception
• The road should be enlarged. Some people go walking along the road and there is not much space between pedestrians and cars. Also, there is no place to park or where to turn around along the road. • There is no flooding problem on the road, but in spring there is a lot of water, and it drains slowly. Perhaps the culverts are too small. • At km 12 of Wemindji access road, the hill and the sharp curve create a dangerous area. • Around km 20 of Wemindji access road, a collision between a truck and a SUV happened in the curve. • The shoulders are too narrow, the road should be wider • At km 22 of Wemindji access road, the culvert should be risen. • Around km 28 of Wemindji access road, in spring, there is flooding at the culvert. The culvert is not big enough. • Big rock sticking out of the road around km 43. It should be moved, if possible. "At this time, we have been told that there is no funding." • Section from km 26 to km 28 of Wemindji access road: the sharp curve, the slope and the winter road nearby make that area dangerous. A ramp should be installed but not too close to the road

- The creek at km 92-93 of Wemindji access road is too deep. A bridge would be better because there is a big slope going down, and then going up.
- Culvert to be removed at the creek near km 93 of Wemindji access road.

Operation and Maintenance
• The bushes along the road are too close, it can block the view. The tallyman and land users recommend brush-cutting along the Wemindji Road all the way to the BDH. "Perhaps Eeyou lumberjack or Tawich could do the job". • At km 42 and 46 of Wemindji access road, beaver lodges can flood the road. The flooding can contaminate the nearby watercourses. • A trailer used for maintenance of the road should be removed as it is not used anymore.
Safety
• People hunt from the road (ptarmigan and moose) and it is dangerous for people on the trail. • The shoulders should be enlarged. When a vehicle is parked along the road and another vehicle is coming, it is dangerous. • The bridge at km 64 should be enlarged. People park there to go fishing, and when KEPA or CRT transport trucks pass it is dangerous. • Bush trimming needs to be done all along the road to improve the visibility.
Valued Sites
• Old borrow pit, located some 1.8-2 km north of the road, around km 49. ''We want this area to stay unaffected'' • There is a tipi or a tombstone around km 70 of Wemindji access road. Maybe it is a burial, so it should be leave untouched. • The reason why there is a curve around km 70 of Wemindji access road is because a mass grave was discovered and circumvented during the construction of the road. • Old camp near Chaukuchas Lake that the tallyman wants to stay untouched.
Signage
• Signage should be installed to indicate the presence of camps nearby so the drivers can slow down, or "no shooting" signage near camps. • Moose crossing signs should be installed along the road.
Others
• The areas near km 46 and 52 of Wemindji access road have been tested for their potential to operate a borrow pit. ''If they want to operate this borrow pit, it is ok, and maybe they could convert it into a goose pond''. • Near km 61, 67, 74 and 84 of Wemindji access road, there are gravel pits used for goose hunting by community members.

9.2.6.6 Nemaska Access Road

The Nemaska access road has a total length of 10 km and is located on category 1A lands for 4.5 km which are already paved (Stantec, 2017a). The road continues on category II lands from km 3 to km 9 km and on category III lands for the rest of the alignment (approximately 2 km).

The resurfacing and paving of the first 4.5 km of the access road was studied in 2017 (Stantec, 2017a). The scope of that study provided preliminary information required for the assessment of the project file by the Evaluating Committee. As such, it differs form the current mandate which studied the upgrading and paving of the entire Nemaska Road, taking into account additional upgrading options.

As shown on Map 9.2.6, Nemaska access road is entirely located on trapline R16.

Trapline R16

The trapline is used by many land user since it is easily accessible.

The caribou herd doesn't come in the area anymore since the Rupert River Diversion. There are rabbits, lynx, martens, and foxes on the trapline. "Foxes used to be wild, but now you can almost pet them." There are lots of squirrels everywhere; they enter in cabins and made a big mess. People start seeing wolverines in the area again.

Ever since there was a big forest fire, there are lots of berries in the area, especially along the Nemaska Road. However, the trees are starting to grow (e.g.: alders, etc.) and are taking over the vegetation. There is more birches, poplars and alders now than before and poplars are tall, the "brush" below doesn't grow.

Among others, there is an elder's village, composed of several buildings (cabins), in proximity to the "causeway" at km 5. The area is being used for cultural transmission. At km 4, the tallyman indicated a traditional camping area used before the CNN was relocated at the community's actual location. They would leave their winter "stuff" there, so the fire could not reach it since it is located on a natural sandy peninsula. Camps are also within the study area.

The creek at the north of km 6 is special for the tallyman because an albinos beaver was killed there. He named the creek "wabum sibish" after that beaver.

Near km 8, a snowmobile trail is leading to the way to the tower and to the lake, and could also be used by foot.

9.2.6.6.1 Comments, Concerns and Recommendations

The Cree land use study participants shared a wealth of information regarding the Nemaska access Road and made interesting recommendations concerning its potential upgrade and paving. Their comments, concerns and recommendations are presented in the table below:

Table 9.2-10 Comments, Concerns and Recommendations – Upgrade and Paving of Nemaska Access Road

Alignment / Conception
• At km 5, there is a dangerous turn. It is too hard when the road is not graded properly, especially in the fall, when ice starts to build up. The turn is too sharp overall.
Operation and Maintenance
• Since the culverts were installed at the “causeway”, it changed the water dynamics. It is creating current and there is always open water there (not frozen). A better solution should be found; perhaps putting a small bridge instead. The powerline runs in the same spot. • There is no drainage problem on Nemaska Access Road, but there may be in the future. Some water is coming out on the Route du Nord, close to Nemaska, and it gets soft. • There is a visibility problem on the Nemaska Access Road, especially in the evening, when it is warm and there is no wind because dust stays in the air.
Other
• Paving the community road would be beneficial because it would reduce the dust. The end of the fall is the worst period for the dust. • Studies must be conducted about bears. Some dens are found under the roots, so when the roots are rotten it collapses, while the dens found under rocks stay longer (as such, they are better dens). When a tallyman observes a good bear den, he should protect the area. • Various cumulative impacts from development on trapline R16

9.2.7 Route du Nord

9.2.7.1 Introduction

The interviews provided a general idea of the land use taking place along the Route du Nord (RDN) and in its surrounding areas, rather than a complete picture. The number of land users of the study area, the frequency of their visits and quantity of resources harvested were not estimated since it was not in the scope of the Cree land use study carried out as part of the LGA Phase 1 Feasibility Study.

While being relatively recent on the territory, modern roads are widely used by the Cree population. In terms of transportation routes, they have overtaken rivers. The RDN is not only important to connect the community of Nemaska with “the south”, but also to facilitate access to the southeastern part of Eeyou Istchee Baie-James, and potentially to the Saguenay-Lac-Saint-Jean region, by members of other Cree communities. Additionally, the presence of the RDN provides an easy access to the traplines intersected by it. The fact that most land users do not live from the land anymore and occupy paid jobs partly explains the growth in importance of modern roads, as they provide faster access. Major changes in important rivers’ hydrology and ice cover, following hydroelectric development in the last decades or due to climate change, also contributed to the increase in use of modern roads. Since it is now more dangerous, complicated, or sometimes impossible to navigate on some watercourses as well as to travel by snowmobile, roads offer interesting alternate options.

9.2.7.2 Study Area

The study area defined for the RDN consists of a one (1) km buffer zone on either side of the road's centerline and it extends from the start of the road, in Chibougamau, to its connection with the BDH, around km 275 of the BDH. However, during the interviews with tallymen and land users, if land use activities or features were reported outside the study area, they were noted as well.

As shown in the table below, 22 traplines in total are intersected by the RDN.

Table 9.2-11 Traplines Intersected by the Route du Nord

Community	Number of Traplines	Trapline Intersected
Mistissini	12	M57/057
		M56
		M45A
		M49C
		M49B
		M49A
		M41
		M40
		M39
		M38A
		M38
		M33[3]
Nemaska	6	M33[3]
		N25
		R21
		R20
		R16
		R17
Oujé-Bougoumou	2	M57/057
		O55
Waskaganish	2	R14

[3] Trapline M33 is shared between Mistissini and Nemaska communities. There are then two tallymen: one from Mistissini and the other from Nemaska.

Community	Number of Traplines	Trapline Intersected
		R13
Total	22	

9.2.7.3 Cree Land Use

9.2.7.3.1 Cree Land Use in Mistissini

Trapline M57/O57

Trapline M57 is the southernmost of the RDN study area. Since Route 167 Nord acts as the trapline's western boundary and the RDN's km 0 is at the intersection with Route 167 nord, only a small portion of trapline M57 falls in the study area.

The tallyman of trapline M57 reported beaver activity at the creeks near the crossing of RDN with Route 167 Nord. He indicated the presence of moose, bears, lynx and foxes all along the 167 Nord Road. The tallyman does not hunt bears in the study area, but elsewhere. The tallyman does not go fishing in the area because there are bigger lakes on the eastern side of his trapline. He does not pick berry in or nearby the study area. The participant harvested geese at the crossing of the RDN and Route 167 N. There is no goose blind, but he saw some geese when he was driving, on the way to his cabin, and hunted them. There is also an old camp composed of tent frames at the crossing of those roads.

Forestry companies built the accesses on the eastern side of the RDN which the tallyman and land users use as trails.

Trapline M56

During the Cree land use interview, the tallyman and family members shared that the RDN is located south of their territory and that area is mostly used by other land users instead of family members. All the family members' camps are located northeast of the RDN, which is also their main hunting area. However, they reported several activities around Winsch Lake, at km 4 of the RDN, among which is fishing for lake trout, pike and whitefish. The tallyman indicated the presence of a camp belonging to an Oujé-Bougoumou land user as well as a boat landing to access Nibiischii fishing camp at Lake Waconichi.

A moose corridor and the location of caribous tracks were pointed out in proximity to the RDN.

Trapline M45A

No information shared during the interview with the tallyman of M45A trapline related to the Route du Nord.

Trapline M49C

Trapline M49C is at the crossing of the Route du Nord and the proposed alignment for the 2nd access road to Mistissini. Some information intersects both study areas.

The tallyman of trapline M49C reported during the interview that the camp he mainly goes to is located around km 38.5 of the RDN. He hunts goose in the bay north of the camp. He also goes fishing for pike and sucker in the area.

Additionally, the participant shared the location of two old camps, one around km 39 and the other near the crossing of the proposed second access to Mistissini with the RDN, at km 34. Also near the proposed crossing, there is an area used primarily for forestry activities.

The tallyman mentioned beaver activity areas in proximity to the RDN, at km 36 and around km 38, and indicated that he traps beaver at various locations on his trapline. Him and other land users hunt bear near km 36. All along the road, they hunt ptarmigan, lynx, and rabbit.

Trapline M49B

VEI was not able to meet with the tallyman of trapline M49B.

Trapline M49A

The tallywomen of trapline M49A shared during the interview the locations of three camps used by family members. The primary tallywoman mainly goes to a camp located at km 62 of the RDN and composed of 9 cabins. That camps is also used by her husband, her brothers and some friends. A family member plans to build a camp on the other side of the road. In that area of the RDN, a lot of people stop to have a view of the landscape and to walk. People even use their private toilet. According to the tallywomen, more halts (rest stops), like the Broadback halt, should be developed and more restrooms should be built along the road.

The participants indicated that there is beaver all over the trapline, but no caribou observed. People trap beaver on trapline M49A, but the tallywomen do not really bother because there are plenty of them. A goose hunting area around km 62 of the RDN, on its west side, was mentioned.

A fishing area where the CNM sends people (non-native and tourists) was reported around km 66 of the RDN, and a spawning area for walleye was identified at another location.

The tallywomen and the land users bring their garbage near km 99 of the RDN for garbage collection. They also go near this place to collect fresh water that they use as their drinking water. They get drinking water at Lac Villebois too.

Berries are found all along the forestry road.

An access used by 4-wheeler and truck is located at km 63 of the RDN. They have asked Barrette-Chapais if they could fix the forestry road that they use to access the camps because it is muddy when it rains and during spring. However, Barrette-Chapais replied that they will not do it because it is too close to river. There is also an access going down to the lake from km 67. That road is good because it goes to an outfitting camp.

Trapline M41

The tallywoman of trapline M41 and some family members reported during the interview the location of three camps used by family members. One of those camps is located around km 78 of the RDN, near the access path to the "Blueberries Hill", a berry picking area. The three other camps are located near km 81. One of them is a camp composed of four cabins where the tallywoman and her family do ceremonies, and the two others are used by the family.

All along the RDN and the forestry roads, there are lots of blueberries that they can gather. There are also a lot of beavers, and "Native poachers" kill them. Additionally, the tallywoman identified several moose yards within the study area and a spawning area for brook trout.

Before 2002, the tallywoman and land users used to see a lot of caribou in the area. There is still woodland caribou on trapline M41 nowadays, not far from the study area. The family established a protected area where they hang: “It is not marked, but it is protected by the government apparently.” In spring, the tallywoman and land users see woodland caribou and moose close to their camp. If they harvest caribou, it is only one or two and it is for food. They dry the meat and it is really good. The reason why they do not see migratory caribou anymore is that the Rupert river is never frozen since the diversion; the caribou cannot cross. They go along the coast now.

Trapline M40

During the Cree land use interview, the tallyman shared six locations of Cree camps within the study area. His main camp, aroud km 100 of the RDN, is composed of approximatively ten (10) cabins, on both sides of the road, and is used by the tallyman’s family and extended family (several uncles and cousins). The tallyman’s father had his camp there for a long time. There is an access, and the forestry company improves it sometimes. Also, there is a goose hunting area. The tallyman and land user trap marten because “they chew their stuff” that is stored there. The other camps mentioned during the interview are used by the tallyman’s family or during hunting activities:

- Main hunting camp before the RDN was constructed, located by lake Frotet
- Their neighbours’ camp composed of 5 or 6 cabins and an access
- Extended family camp

There is beaver in almost every creek; they move around the territory. All the same fish species are found in the various lakes on the trapline because they are all connected.

The family’s main hunting and fishing locations were in the Lake Frotet area, but following the construction of the RDN, they changed their harvesting locations.

Since there has been a forest fire 5 or 10 years ago which affected the trapline, there were lots of berries in the old burnt area, but now trees start to grow again and there are less berries.

The tallyman and the other land users do not hunt small game, but they see ptarmigan, partridge, and rabbits all along the RDN.

Trapline M39

The tallyman of trapline M39 and a family member reported during the interview the location of his main camp and of two camps used by family members. The camp he mainly goes to is located near km 131, by the Broadback River shore, and is somewhat away from the road to avoid the noise as well as the transmission line which makes a lot of noise too when it is raining. On the other side of the road is located the family camp, an extension to the main camp. The tallyman’s nephew also has a camp on the east side of km 141 at the shore of the lake.

There is beaver activity all along the road. The beavers clog the culverts, but most of the time, the MTQ undoes the dam before there is any damage. Some people kill beavers on trapline M39 or they see a trap and take the beaver, then they can escape by the forestry road at km 148 of the RDN.

There is a network of forestry roads on trapline M39, leading south to Waswanipi or Oujé-Bougoumou. Other than the two forestry roads used to access the camps, near km 140 and 148, the shorter ones are more of a disturbance to their harvesting activities as they are used by “day hunters”: “Some people even take the beaver from the trap.”. There is bear all over the trapline since it is a blueberry country. The area is the location of an old forest fire, so they can get blueberries almost everywhere. There are fishing areas all over the water system. There is moose all over the trapline but no known collision on the RDN. All along the road there are lynx, foxes, rabbits, and ptarmigans. Also, they have observed wolves and caribou tracks. Recently they saw deer.

Trapline M38A

During the Cree land use interview, the tallyman shared four locations of Cree camps within the study area. His main camp is located by the RDN, around km 159. On the other side of the road, a friend of the tallyman's family has a camp by the lake. The third camp, near km 154 of the RDN, is composed of two cabins and is used by the tallyman's first cousin.

The tallyman also shared the location of three burial sites within the study area, but on trapline M38.

Trapline M38

The tallyman of trapline M38 reported during the interview the locations of his main camp and of a camp used by a family member. The tallyman's main camp is composed of nine or ten (10) cabins and located approximately at km 177 of the RDN, near the watercourse. A land user also has a cabin there. A family member of the tallyman has his camp on the other side of the watercourse. They fish lake trout at this location but go hunting to another place which has a better access. The tallyman also collects drinking water at the creek near this camp area.

The tallyman goes fishing to three areas within the study area. He does trout fishing and collects springwater at the lake on the east side of the road, near km 161. He also does walleye fishing at the lake on the west side of the road. between km 169 and 176.

Two snowmobile trails start from the RDN and lead to harvesting locations. One trail starts near km 177 and can be seen on Niskamoon's maps since it was a Niskamoon project. The other starts near km 176 and leads to several lakes on the east side of the road, up to km 172.

Trapline M33

The tallyman of M33 trapline shared during the interview the location of four Cree camps within the study area. The camp he mainly uses is located at km 221 along the Route du Nord and is composed of 18 or 19 cabins. The three others are old camps. The tallyman's family used to stay in tent frames near km 212 of the RDN, but they are not in use anymore.

The participant identified three locations of moose yards. Moose are present along the RDN from km 177 to 180 and between km 184 and 200. He also indicated a spawning ground for lake trout, walleye, and pike, and another one for walleye and whitefish.

The tallyman hunts geese at several locations along the road, and specified five particular goose hunting areas. He also reported harvesting marten and lynx between km 189 and km 195. Caribou were very present on trapline M33 during the years 2003 to 2005. Until 2012, tallyman and land users used to see them, but not after that. Their migratory route moves around.

Finally, a boat ramp to access the Rupert River is located near km 220. According to the tallyman, the access path leading to this boat landing is very busy.

9.2.7.3.2 Cree Land Use in Nemaska

Trapline M33

VEI was not able to meet with the tallyman from Nemaska of trapline M33.

Trapline N25

During the Cree land use interview, the tallyman shared several camp locations within the study area which are mostly used by him and his family members. They have camps all along the RDN. He pointed out a camp he has with his sister, his cousin, his daughter and his niece in the Jolly Bay, near km 234 of the RDN. The camp is composed of 5 cabins and considered a cultural site by the tallyman and his family. They do Walking Out Ceremonies there. On the other side of the RDN is an old access road to the transmission line. The tallyman uses it to go hunting and trapping. The tallyman wants to keep it, so he will make a proposal for a Niskamoon project.

Another camp composed of 6 cabins belonging to the tallyman and his family members is located some 2 km from km 210 of the RDN, down on the old HQ access road that was used to build the weirs. There is a goose pond near that camp. From there, the tallyman's cousin and his family can access their goose hunting camp, composed of 5 cabins, by an ATV trail.

Near km 236 of RDN, in the Rupert River forebay, below the dike is located a goose pond. It was seeded to attract geese. Once the soil dries up, jack pines start to grow, "but now it's changing". This part of the river is also an old fishing area (net fishing), but it is dry now. The tallyman does not put fish nets in the Rupert reservoir because they will lose them due to the presence of waterlogs. He indicated fishing areas for speckle trout, sucker, walleye, pike, and whitefish, and mentioned that small brook trout can be found in most creeks. Sturgeon is found on trapline N25 as well, but outside the study area. Concerning the area surrounding the first rapids, the tallyman said that "It's a rich place for everything".

An old portage used to bypass the rapids on the Rupert River is located near km 237. They are called the "whirlpool rapids", but the pool below the bridge is dry now. It is the narrowest part of the Rupert River. The portage is not in use since the Rupert River diversion because it was not renovated. The alternate portage used in spring and summer is located near km 22 of the RDN. Students participating in the Canoe Program use it, among others.

There is beaver, moose, and bear all along the RDN. The tallyman used to trap lynx, marten, and beaver "back then", but there is no market anymore, the prices have dropped. As a comparison, he said: "We used to kill around 100 beavers per year in the peak (in the 1970s), but now only around 10". However, "There is no beaver blocking culverts on my trapline" indicated the tallyman.

Multiple land users, mostly family members, participate in harvesting on trapline N25. People from outside the tallyman's family ask his authorization if they want to trap, and he "doesn't care" if people from outside go hunting on his trapline. A major forest fire affected the trapline in 1998, so there are lots of blueberries growing on it now. There is also a lot of old burned wood still standing and community members collect it.

Trapline R21

Two Cree land use interview were held for the R21 trapline, first with the tallyman and second with the former tallyman and now land user. The tallyman shared that his main camp is in proximity to PK 290 of the Rupert River, "further down towards Luke Tent's territory (trapline R18)" (to the west). Most of his camps are by the Rupert River. Those river cabins are used until they are not accessible anymore because of the snow. Even if the tallyman would have the access graded in wintertime, he doesn't want to because he restricts the access to the area. There is a moose yard in that area that he wants to protect from other moose hunters. Within the study area, near km 241 of RDN, on the shore of Rupert River, the tallyman has his camp where he has year-round access. A little further west Freddie Jolly has his camp composed of 4 cabins. Around this location, at the bay, is the goose hunting area.

The tallyman's family camps are traditionally located along the Rupert River. They used to get to their trapline by the Rupert River before the Route du Nord was constructed; it was taking about 3 to 5 days paddling from Old Nemaska. Within the study area, near km 245 of RDN, on the shore of Lemare River, the tallyman's cousin, Harry has his camp.

Some 3 000 m down west of km 246 is located one cabin and a burial of a little girl. The burial is over 70 years old.

Around km 250 of RDN, following the ridge is a moose area. There is a ridge on the north side of trapline R21, so there are moose and blueberries in that area. There used to be woodland caribou, a larger herd, around Kenny Jolly's original camp, but he only saw 3 last summer. They used to come to the area around the RDN in winter. There is a lot of beaver activity on trapline R21. The tallyman's brothers trap the nuisance beavers along the Route du Nord. The younger family members are trapping fur-bearing animals. There is grouse, ptarmigan, rabbit, and fox along the RDN; wolves are further south.

There is trout in the lakes all along the RDN where there are hills/high grounds, and walleye, pike, and whitefish where it is lower. There is sturgeon in the Rupert River. The main harvesting activity that Kenny Jolly and his family conduct along the RDN is fall moose hunting.

Trapline R20

During the Cree land use interview, the tallyman and his wife shared several location of camps, trail and hunting area. Thus, camps are located on booth side of the river around km 279 of RDN and a skidoo trail follows the river. A Little further south, at km 279 of RDN, is located a large camp, community site composed of more than 20 cabins. The other side of the river is located the bible camp. Around the bay near those camps, is a goose hunting area. In the area of the bible camp, human bones were found there, in the slope, dating some 400 years ago. It was a girl that might have been collecting berries and collapsed.

At km 278 of RDN, the tallyman's brother named the bay after himself because he has a camp there.

At km 275 of RDN because of the Nemaska Lithium mine, they cannot fish in that area anymore.

Around the Spodumène Lake, at km 274 of RDN, is located the Community beach with two parking areas and the old game warden's house. It is never used. "The bats are using it". Cranberries are growing at the site. This lake, is a fishing area for trout, pike, walleye, whitefish and burbot.

At km 267 in between the two mountain ranges are located moose yard: one north of the Route du Nord (RDN), and one south of it. It also follows the powerline. At km 257 of RDN, the skidoo trail follows the road.

Also, the community members use the RDN for hunting lynx, fox and ptarmigan. There is not much porcupine in the area because the species of tree they eat is disappearing. There is beaver in every creek: they go every other year in one creek. Beavers have impacts on the RDN because of the flooding they create, but the tallyman or the MTQ manage to trap them. Moose and bear are seen on the RDN all the way to Albanel.

Trapline R16

The crossing of the RDN and the Nemaska access road is located on trapline R16. Some information intersects both study areas.

During the Cree land use interview, the tallyman shared several locations of fauna. Moose are present in some areas along the RDN and around the airport, especially in the fall. Bears are present around km 290 of the RDN and they cross it near km 300 and km 305. Caribou are seen in proximity to the RDN as well. The tallyman also reported the presence of porcupine on his trapline and of fox all along the RDN. They walk the road to “clean it” from the road kills, and sometimes they get hit by cars. Crows also follow the road, early in the morning, for the same reason. Marten can be found along the road too, as they are scavengers. There are rabbit trails from Mountain Lake to the BDH. There are lots of rabbits on trapline R16 and the tallyman harvests them. After the forest fire, rabbit had disappeared from the area, but it is coming back some 30-40 years later.

An important walleye fishing spot for the tallyman is located around km 235 of RDN. There is a little inlet and a stream that feeds into the lake. It is intersected by the road, so the tallyman mentioned that it is important to protect the water there. He also fishes pike, walleye and sturgeon in lake Champion, and pike, walleye, whitefish, sucker and trout in another lake. A trout spawning area was also pointed out in a stream connecting to this lake.

Land users use the year-round skidoo and ATV trail that crosses the RDN at km 307 and km 313. There is no road sign indicating those crossings. The tallyman indicated that people stop everywhere along the RDN to pick berries. In the July and August evenings, when people finished working, there is a lot of berries picking along the road. Cars are parked along the road in blind spots and it is dangerous.

Trapline R17

During the Cree land use interview, the tallyman shared several locations of camps, trails, and hunting areas. There are several camps along the RDN. One camp, composed of 2 cabins, is located at km 367, and two others, each composed of one cabin, are located around km 370 and km 376 of the RDN. They are all used by the tallyman and his family members. Those camps are located less than 100 m away from the RDN, but there is an access from the RDN to get to the camp and a parking.

Between km 347 and 348 of the RDN is located the site of a community sweat lodge, wich has an access, a parking and a cabin. Southeast of km 350 of the RDN, close to lac Jolliet, is located a camp composed of approximately 10 cabins. The tallyman also pointed out two old camp sites, around km 352 and km 377 of the RDN.

There are bears everywhere on trapline R17 and they cross the RDN. Fox and rabbit are also observed everywhere along the road on trapline R17. Beaver lodges are present notably around km 366, but away from the RDN, and in the vicinity of km 371.

An access road leading to the former Old Nemaska boat launch, located 26 km from the RDN, starts from km 343 of the RDN. The tallyman and his family members use it to get to their family camp at lac Jolliet by vehicle. Lac Jolliet is a major fishing area and the site of the Regional Fishing Derby. Therefore, the tallyman recommends paving the first part of the access road, up to lake Jolliet.

The tallyman and other members of the community hunt ptarmigan between km 248 and km 351. The tallyman reported hunting mainly moose, bear and occasionally caribou. Fishing for walleye, pike, and whitefish is done in the lake south of km 348 of the RDN. “Everyone fishes there, even HQ employees.” Brook trout are also found in the creek intersected by the RDN at km 366.

Skidoo trails intersect the RDN at km 367, 359, 352 and 351 of RDN. In addition, an ATV trail some 4 km long, going north up to the lake intersects the RDN close to km 344.

9.2.7.3.3 Cree Land Use in Oujé-Bougoumou

Trapline M57/O57

The tallyman indicated during the land use interviews that they already have less access to their traplines than before because of the skidoo trails, ATV trails. The snowmobilers and ATV associations do not want the Cree land users to travel on the trails where their fathers used to travel before. They have other negative impacts from development on their territories such as encroachment from potato farms, blueberry farms, non-native municipalities expanding, building on their traplines without consent. They sought legal advice from Gowlings to go through that.

Almost at the junction of route 167 and Route du Nord is located the former settlement, historic site where James Wapachee’s family used to go every summer and do blueberry picking. The area was burned before, so there were lots of berries. Now, there is a lot of vegetation, so they don’t do blueberry picking anymore. There is a Nibiishii office in the area too.The other side of the road (at km 0), is Goose hunting area. The tallyman and his family members cleared a goose landing corridor there. It is a very swampy area, so it is a good place for goose hunting although there is a lot of traffic nearby. This stream is also an old canoe route. “We used to paddle on that river.” “It’s a good river for paddling and also you will see a million geese.” The old portage was crossing the road near KM 0 of RDN. This Old portage was used by the Hudson Bay Company to portage their supplies, from the river to lac “Oreille”. It was also used by the Crees before the roads were constructed. The tallyman and his family members have tried to preserve the old portage; they have identified it as a protected area on the forestry maps that they did. The lake nearby, the Lac Oreille is Fishing area where he fished a lot when he was young.

Brook trout sanctuary is located in the stream at km 262 of route 167, which connects with lac Waconichi (outside of the study area). It is a good thing that there is a sanctuary because the brook trout population seems to be declining due to the salt used on the roads (that runoff and enter into the streams).

Trapline O55

VEI was not able to meet with the tallyman of trapline O55.

9.2.7.3.4 Cree Land Use in Waskaganish

Trapline R14

VEI was not able to meet with the tallyman of trapline R14.

Trapline R13

VEI was not able to meet with the tallyman of trapline R13.

9.2.7.4 Comments, Concerns and Recommendations

The Cree land use study participants shared a wealth of information regarding the Route du Nord. Their comments, concerns and recommendations concerning its potential upgrade and paving are presented in the table below:

Table 9.2-12 Comments, Concerns and Recommendations – Route du Nord

Alignment / Conception
• Several recommanded paving the RDN because there are safety issues with dust problem, especially on warm days without wind. • A tallyman mentioned that the asphalt used on the Oujé-Bougoumou access road is hard on tires. • The material used for the foundations of the Route du Nord expands during the winter. Notably, there is washboard in the area between km 258 and km 279. All the top portion of the road slides to the sides. • Areas that are too steep: between km 240 and 241 (presence of camps), km 252 and in proximity to Albanel substation (km 258 of the RDN). Several location where transport trucks get stucked where identified: around km 150, steep slope after by curve near KM 193 big dip around km 244. The area around km 82 of Route du Nord is called ‘’the Swing’’ because trucks must go fast in that section to go up the hill. • The ditches at KM 34 to 38 are high and the road is curvy • For safety issues, a tallyman and land users would like the road to be enlarged from km 16 to km 17 of Route du Nord because there is only one lane. • A tallyman recommends developing a ramp with a “give way”. • Dangerous stretches or curves were identified by different tallymen: km 108, km 230, km 236, km 258, km 328, between km 349 and km 356. • “permanent washboard area” from km 256 to km 260 of the RDN. • A tallyman recommended to fix the bridges at km 241 and km 245 of the RDN and replacing those wooden bridges by metal bridges, especially for when the mine will be in operation. • Recommendations to install guardrails and road signs at key turns, and on sections where creeks or river crossings are in curves. • Wooden guardrails on the bridge should be replaced by higher metal guardrails and installing them higher. Participants recommends installing more guardrails, mostly in curves and on bridges.
Operation and Maintenance
• No calcium is used along some section of the Route du Nord. All the RDN gets icy. Participant would like if calcium could be put all along the Route du Nord and especially near camps. Participant indicated that it is better to use a mix of sand and salt to de-ice it during the winter. • Add anti-dust at his main camp at km 38 of Route du Nord • Almost flooding or flooding area by the beaver dam at the creek near km 92, km 189, km 193, km 201, km 215 to 216, between 112 to 114 and 220 to 221 of Route du Nord • At the stop at KM 62, people go to the toilet, but no toilet paper is provided so they use the tallywoman tissues. Could be nice to provide enough. Also, it could be nice to have a parking and proper facilities • In early spring, when there is still ice in the culverts, the water can rise because ice is blocking the pipe, so the tallyman goes with a generator, heat a “hot rod”, thaw the ice, and unblock the culverts.

• Spring and fall are the worst periods on the road because of water. There are a lot of potholes during the fall. "I want to see the road (RDN) fixed and paved; it would be much safer. It's going to be risky for people to drive on that road. " • Participants highlighted the poor maintenance of the RDN: rocks stick out of the road; brush-cutting needs to be done on the sides of the road to improve visibility, especially in the curves and have more road surface; sides are too soft, the road is hard only in the middle; the grader doesn't pass regularly and computerized grader doesn't do a good job. • The vegetation should be slashed at the access of main camp to improve the view. • There are guardrails in several sections of the RDN, but people doing maintenance and plowing roll over them and leave it like that.
Safety
• Participants finds the RDN "kind of rough". • There has been an accident on trapline R21, but not on N25. There has been fatal accident on trapline R20, around km 162, km 156 and km 161. • "Every year, we see more vehicles on the RDN and it's going to grow more. When I hear those mines are going to use the RDN, I imagine how many people will be using that road. We want to prevent accidents." • People stop everywhere along the RDN to pick berries. There are cars parked along the road in blind spots and it is dangerous. Small parking and dangerous shoulder to park at the boat ramps at KM 100 and near KM 99 of Route du Nord • Big trucks circulating on the RDN remove the materials and, in certain curves, it can make you slide towards the ditch. • The Route du Nord is more dangerous during summer with the presence of loggers' trucks. When you follow a logger's truck, there is a lot of dust: "it is dangerous because we cannot see anything, and we cannot pass them". • Even with a warning sign to slow down HQ employees don't respect it. • Section of the RDN, in a curve between km 357 and km 358, between km 369 and 370 and around 350 where there are collisions with moose.
Signage
• Add signage near camp for Cree camp and/or to reduce speed along the Route du Nord (km 38, km 220-221) • Participant recommends adding warning signs at the crossing (intersection) of Route du Nord and Route 167 Nord to make it more visible • KM 80 (off map) dangerous area without signage and metal guard rails • Participant recommends installing road signs to indicate traplines boundaries (the CTA should provide them), so it would that land is occupied and for outside developers to know who to contact and consult. • Road signs indicating moose and bear crossings could be useful (including km 360). • road sign indicating the skidoo trail crossing (including: km 351 and km 352 of the RDN.)

Others
• A participant told that : "If you upgrade the Route du Nord, upgrade all the accesses to our camps". • Would like a parking for future camp • In the area of a Cree camp located near km 81 and at km 220-221 of the Route du Nord (off map) the access to the camp should be improve (by adding MG20, for example) • Participant recoomends gates be installed in front of each Cree camp along the RDN. • Beside the two forestry road located near KM 128 and at KM 148 of Route du Nord, the other smaller forestry roads are a disturbance to the tallyman family hunting activities • Moose yard is in the Moblan lithium mine study area and due to a lot of disturbance, there are less moose than before. • Part of the Route du Nord has been fixed and resurfaced 5 years ago. • Participants indicated having some issues with the Barrette-Chapais forestry company: – They do not maintain the roads – They leave exploited areas in bad condition – They do not fulfil their commitments to the tallymen – The consultation they do is not ''meaningful '', it is only a procedure – The species planted for reforestation are not those that were present, but those for their commercial purposes. J. Blacksmith commented: "I don't know why they plant jack pine. We don't use jack pine over here. It is nothing to us. Yes, it grows fast, but the wood we need is black spruce.". – They are told that they cannot cut wood on their trapline." • Do not touch the esker near KM 139 of Route du Nord • "Use caution when working in proximity to Broadback River crossing as it is an important fishing area" • Concern about the water quality during the construction, for the animals

9.2.8 Second Access Road to Mistissini

9.2.8.1 Introduction

Members and leadership of the Cree Nation of Mistissini had identified the need for a second access road leading to their community a couple of years ago. Indeed, it could increase public safety as it would provide an evacuation route if the only access to Mistissini is not practicable or blocked due to a natural disaster (forest fire, flooding). Additionally, it would facilitate access to that part of Mistissini's territory where residential development, operation of a borrow pit and forestry activities are considered by the CNM.

The interviews provided a general idea of the land use taking place in the area located west and extending southwest of the village, on the other side of the bay. Land and resources in proximity to the community are used by several CNM members, therefore the tallymen and their family members, while frequenting this area too, use mostly other parts of their traplines.

9.2.8.2 Study Area

The study area defined for a potential second access road to Mistissini consists of a 1 km buffer zone on either side of the proposed alignments and it extends from the start of the potential road, west of the village, on the other side of the lake, to its connection with the Route du Nord (total length between 42 and 45 km). However, during the interviews with tallymen and land users, if land use activities or features were reported outside the study area, they were noted as well.

As shown in the table below, four traplines would be intersected by the study area.

Table 9.2-13 Traplines Intersected by the 2nd access road to Mistissini

Community	Number of Traplines	Trapline Intersected
Mistissini	4	M45
		M45A
		M49C
		M50

9.2.8.3 Cree Land Use

9.2.8.3.1 Cree Land Use by Traplines

Traplines M45 and M45A

The tallymen of traplines M45 and M45A reported a camp used by the family for hunting activities within the study area. A camp located north of Option 2 of the alignment, approximately 7 km from the potential junction with the RDN, is mainly used by one of the tallymen. A portage could be intersected by the proposed second access road in this area. A SEPAQ outfitting camp is established in the southern part of the study area.

The tallymen mentioned beaver activity in a waterbody along Option 1 and at the crossing of Option 1 and Option 2. One of the tallymen pointed out a goose pond in a swamp located south of Option 2. Additionnally, he mentionned collecting his drinking water in a lake in the southern part of the study area, near the potential junction with the RDN.

Pénicouane Bay, especially the area around the ‘’ Y ‘’, is a valued site for the tallymen who consider it a sacred site. This is where they grew up, as well as their parents, and where their hunting stories are. Tallymen remember observing and trapping muskrat and beaver along the Pénicouane Bay. A portage and a very old grave of an unknown person were also reported in the area. According to the participants, there may be archeological potential, as there were markings from when their parents were hunting. Both tallymen and land users use the area around that river (Pénicouane Bay); they go out every first Friday of June and only return after Labour Day, “once the tourists are gone”. Therefore, they would like that area to be protected from development instead of building facilities for a borrow pit, for example.

Tallymen used to observe and trap muskrat and beaver around the lakes located near the potential junction with the RDN.

Both tallymen go fishing for trout in a lake near Option 2 of the alignment.

Trapline M49C

Trapline M49C's southeastern boundary follows the RDN on a couple of kilometres and the junction with the potential 2nd access road to Mistissini could be located in that area. Therefore, the tallyman was interviewed regarding the upgrade and paving of the RDN as well as the potential 2nd access road to Mistissini. Some information shared concerns both study areas.

The tallyman reported the location of an old camp, where his father used to go, in the study area, close to km 34 of the RDN. Near the potential junction with the RDN, a "primarily forestry activities area" was identified. The tallyman mentioned beaver activity in the area close to the RDN, especially around km 36, and bear hunting by land users around the hill in that same area.

Trapline M50

The tallyman of trapline M50 and a family member indicated that there is no camp yet in that part of the study area. They mentioned the presence of land users from the community in the southern part of trapline M50. Therefore, they are more likely to go to the northern part of their trapline, which is outside the study area, to conduct harvesting activities. They do not have much control on what happens on that part (southern and around the village) of the trapline, so they conduct less activities in that part.

9.2.8.4 Comments, Concerns and Recommendations

The Cree land use study participants shared a wealth of information regarding a potential 2nd access road to Mistissini and made interesting recommendations for its development. They appreciated that the Team came to Mistissini and listened to them, so they can voice their opinions: "The others, like forestry or even the Council, do not really consult the tallymen and listen to their opinions.". Comments, concerns and recommendations from study participants are presented in the table below:

Table 9.2-14 Comments, Concerns and Recommendations – 2nd Access Road to Mistissini

Alignment / Conception
• Option 2 (the red one on VEI map) is better because the road is already in use and the alignment stays on one trapline. • The alignment should use the old winter road that was converted into a forestry road at km 6 of the RDN. • The alignment should be as straight as possible. • An variant to Option 2 of the alignment was proposed.
Borrow Pits and Quarries
• There is a potential gravel pit close to variant 1 of Option 1. The potential road should facilitate access to borrow pits.
Others
• The Pénicouane Bay area should be protected from development instead of building facilities for a borrow pit, for example. • Offer construction and maintenance contracts to tallymen and their family members. • When the community builds something on a trapline, they should compensate the tallymen and land users like the forestry companies or the mines offer.

9.3 ARCHAEOLOGY AND CULTURAL HERITAGE

9.3.1 Introduction

The Vision Eeyou Istchee (VEI) consortium of professionals formed by Stantec, DESFOR and SYSTRA was awarded by Cree Development Corporation (CDC) the mandate to study the feasibility of Phase I of the Grand Alliance (LGA) project, which consists of:

- A new rail line adjacent to the Billy Diamond Highway (BDHR) from Matagami to the Rupert River.
- Return to service of the Grevet-Chapais railway line.
- The establishment of transshipment areas on both lines.
- Upgrading the access roads off the Billy Diamond Road to Waskaganish, Eastmain and Wemindji.
- Upgrading the Route du Nord Access Road to the Cree Community of Nemaska.
- Creating and alternate access road to Mistissini

An archaeology and cultural heritage study was conducted for two components of the Project, the potential BDH railway and the potential Mistissini 2nd access road. At this stage of the Project, the other components were not assessed based on the fact that they involve existing infrastructures (access roads and Route du Nord) or previously disturbed lands (potential Grevet-Chapais railway).

Two study areas were assessed:

- Wide corridor: 20 km on either side of the BDH, with the objective of identifying sites of importance that the community may want to protect from any long-term, residual impacts from the work proposed in Phase I – Infrastructure. (Desktop review)
- Narrow corridor: 5 km on either side of the highway for detailed analyses of archaeological potential. (Field surveys)

The corridors are illustrated on Maps 9.3.1 and 9.3.2 available in Appendix 6.26

The following report describes the biophysical, archaeological, and historical context of the study region. This followed by a description of the methods and elements used to create an archaeological potential predictive model that was used to generate a GIS based model for use as a planning and design tool. This is followed by a report of the 2022 field test of the GIS Model including recommendations to revise and improve the predictive model. Finally, this section suggests mitigation measures for archaeological and cultural resources and recommendations for future actions and studies.

9.3.2 Background Research

This section presents a high-level overview of the background information useful for understanding the distribution and nature of archaeological sites in the study area. It begins with the geomorphological constraints on site age and location, then presents a brief overview of the archaeological record, and the historic fur trade period.

9.3.2.1 Geomorphology

This section considers the geomorphological evidence that is relevant to a predictive model for locating archaeological sites in the two study areas. The geomorphology of an area determines the nature of the landforms and drainages that might be suitable for habitation or travel, and the nature of the lithic, plant, and animal resources that might be available. The glacial history determines when an area would be ice-free and open for habitation, and the maximum age that an archaeological site could be.

The project components are in the Canadian Shield. The BDHR is in the Superior Province of the Canadian Shield, an area of hard, weathering-resistant Precambrian bedrock, glacially scoured, and covered with a network of lakes and rivers and considerable relief.

Lake Mistassini is in the Mistissini Basin, also in the Superior Province, but bordering the division between the Superior Province to the north and west, and the Grenville Province to the south and east, which is one of the youngest divisions of the Canadian Shield (Figure 9.3-1). The Grenville Province is composed of metamorphic rocks, in a major discontinuity of the continent resulting from the last tectonic event shaping the Canadian shield, an orogenic event resulting from continental collision. It is the root of an ancient mountain belt. The formations trend from NE to SW, roughly paralleling the St Lawrence River. The alignment of Lake Mistassini and the lakes and rivers that flow from it also trend NE to SW, following the edge of the Superior/Grenville boundary that lies to the east (SIGEOM, 2022). The Mistissini Hills are in a sedimentary basin formed within a depression in the older underlying Shield rocks, which also contains Mistissini Lake. The sedimentary rocks include both marine and terrestrial rocks and have sources of lithic material suitable for stone tools (cherts, fine-grained quartzite, and conglomerates) that are not present in adjacent areas of the Shield (Denton, 2020).

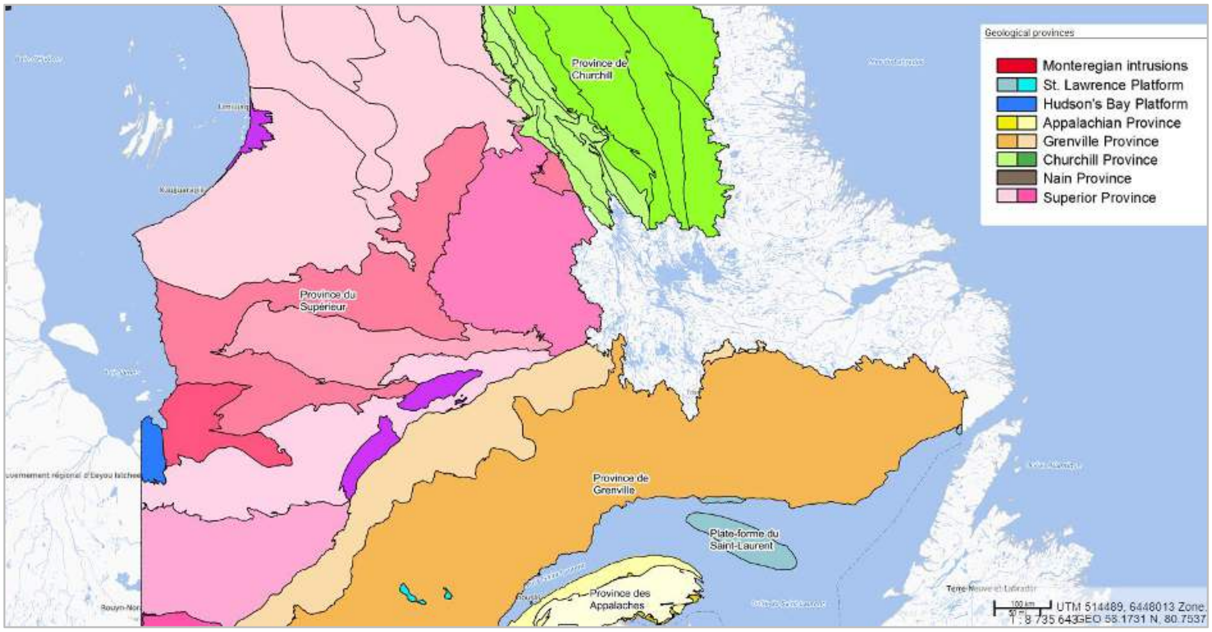


Figure 9.3-1 Location of the Superior and Grenville Provinces (from SIGEOM, 2022)

Glacial Lake Ojibway was one of the large glacial lakes formed below the retreating ice fronts. It was one of the last such lakes to form, and one that seems to have drained catastrophically, but the drainage process and routes are still not well understood. The lake was at its greatest extent by around 8,200 years before present (B.P.) Extending in an arc through northwestern Québec and into Ontario, it formed at the base of the retreating Labrador Ice sheet once the Nipissing – Ottawa – Great Lakes outlets were freed (Veillette, 1994; Coleman, 1909). At 8200 B.P., the southern front of the Labrador ice sheet extended southeast from the mouth of the Rupert River to Chibougamau (Veillette, 1994). The Cochrane ice sheet at the foot of James Bay formed the northwestern boundary of Lake Ojibway (Figure 9.3-2)

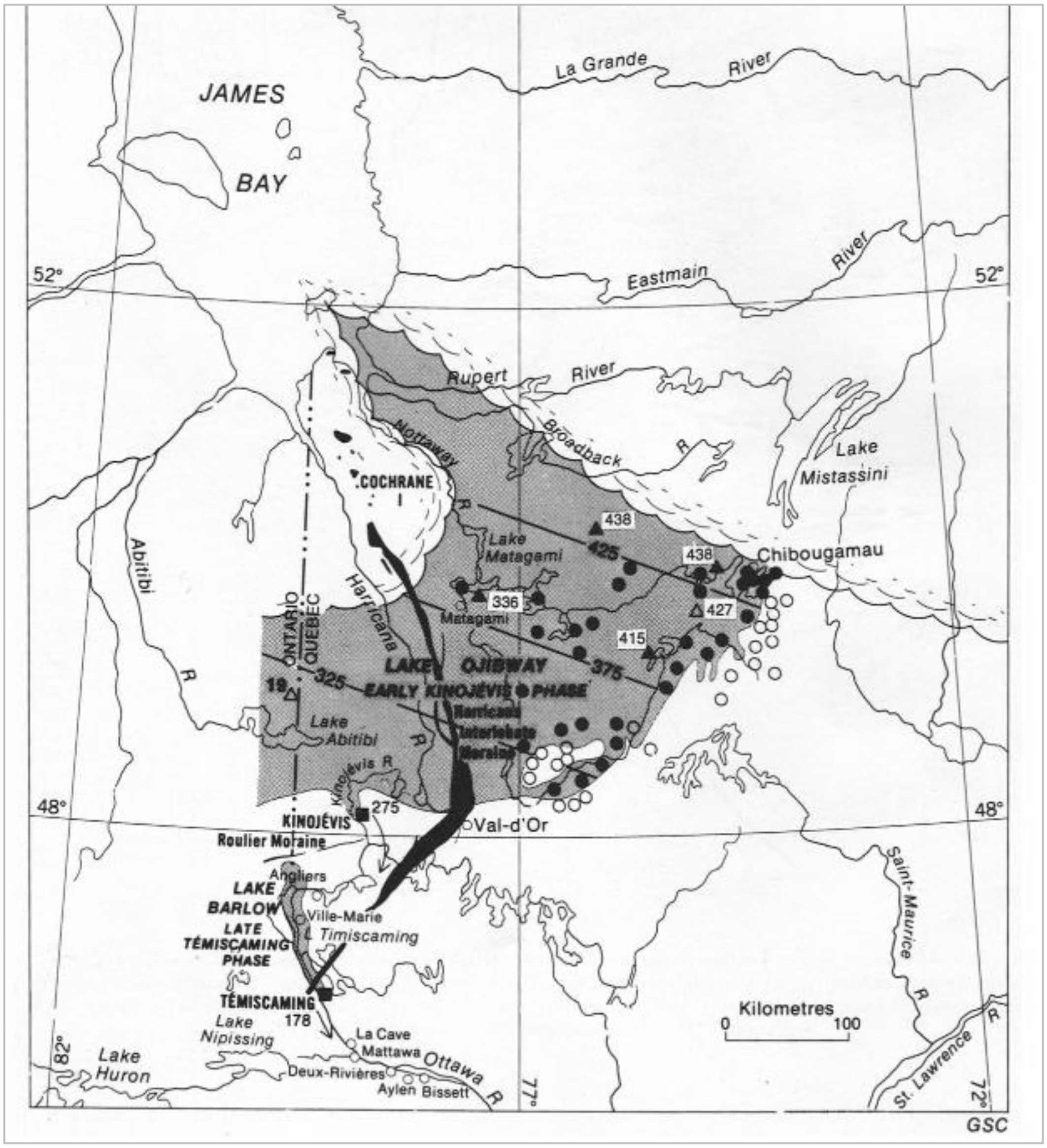


Figure 9.3-2 Glacial Lake Ojibway at about 8,200 B.P., and the adjacent Labrador and Cochrane ice sheets (from Viellette 1994:956)

In the study area, therefore, no sites earlier than this would be found. At 8200 B.P., the Mistissini study area would have been under the glacier, and the BDHR under glacial Lake Ojibway. There would be no sites of comparable age to the Early Precontact Period that is known in the Maritimes or western Canada, typified by Clovis and later spear point technology. Sites might be predicted along the shores of the glacial lakes; the locations of these would have changed as the lakes advanced and retreated, and some of these locations might today be far away from current lake shores. However, the identification and dating of the glacial lake boundaries and drainage channels as they changed over time has not been done. It is quite possible that early period site locations have been obliterated by changes in water levels and establishment of new river drainages.

During the subsequent periglacial periods, many of the landforms would have undergone significant reworking. Glacial erratic trains and drumlin formations are known east of Lake Mistassini, trending from the northeast to the southwest (SIGEOM, 2022), along with a series of aeolian dunes. A series of large eskers trending NNW to SSE or N to S are found to the southeast of Matagami. These are found in the area that had been glacial lake Barlow-Ojibway and can be up to 100 km long and 50 m high (Allard, 1974). Primarily composed of sand and gravel lenses, they were deposited in the periglacial lake during glacial retreat, the trending direction controlled by the underlying bedrock formations. The sands of the eskers have subsequently been reworked by deposition from the glacial beach sands, and ongoing aeolian processes; the cross sections show strata reflecting advancing and retreating dune crests. Between the eskers is a clay plain formed by sedimentation in the bottom of the large glacial lake. The relevance is that the high linear landforms would provide a natural travel route and dry camping areas above low-lying and wet areas in the boreal forest, and so might contain sites.

From the southern tip of James Bay to the west, along the west shore of Hudson Bay and James Bay, the geomorphology is different. The landform is the Hudson Bay Lowlands, and the bedrock here is sedimentary, a legacy of marine inundation.

Beginning in the mid to late Holocene period, the process of isostatic rebound after glacial retreat has significantly changed the coastline of James Bay. These areas were inundated by the Tyrrell Sea in the immediate post-glacial times, but as the glaciers retreated and the land elevation rebounded from the weight of the ice, younger and younger landforms were progressively exposed, as the shoreline was displaced further and further to the west. Pendea (Pendea et al., 2011; Pendea et al., 2017; Ferguson and Pendea, 2018; Izaguirre et al. 2017) has mapped the changes along the east coast of James Bay during the last 7000 years. The maximum period of postglacial marine transgression in the eastern Hudson/James Bay occurred at around 8500 B.P., followed by a rapid fall in relative sea level due to isostatic uplift in the early part of the deglaciation period. The rate of shoreline emergence was initially rapid (6.5 m of elevation/100 yr) between 6850 and 6400 B.P., then slowed (1.4 – 2 m/100 yr) during the Late Holocene. The north-south line of the BDHR roughly follows the coastline as it was about 6850 years B.P. To the east, the landforms reflect the glacially scoured Shield, an area of many lakes and smaller interconnecting rivers following an irregular course. To the west, the landforms are postglacial, and the rivers run generally straight east-west to their mouths in James Bay.

Research has also been done into the role of humans and anthropogenic fire in shaping the evolving Holocene landscape and vegetation regimes in these newly exposed lands (Pendea et al., 2011), and the implications this has for resources available to the Indigenous communities. In part, this has been done with palynological evidence from archaeological sites (for example the Old Factory Lake site, although this site is north of the project area). Vegetation regimes continue to change. In very recent times, rapid climate warming is having a real impact on ecosystems such as peatlands, and freshwater lake communities, as the stable cold conditions become warmer and less predictable (Keller et al., 2014).

In the study area, therefore, the earliest sites that could be found in the BDH area would be from about 6850 B.P, and all sites to the west would be progressively younger. Sites that reflect a coastal settlement and resource use may be found well inland from the present coastline. Recent archaeological work at sites near the study area includes modelling of shoreline locations at the time of occupation. For example, the Sander's Pond site just south of km 28 on the Waskaganish access road, occupied at about 4200 B.P., was then near the 60 m shoreline, on a headland between the Rupert and Broadback river valleys (Denton, 2014; Izaguirre et al. 2017).

The potential BDH railway corridor and the proposed second access road to Mistissini are within the subarctic zone; an area comprised predominantly of wetlands, and permafrost in its most northern portion. There are no dry seasons. Within the ecological classification system for Québec, the study areas lie within the closed boreal forest subzone of the boreal zone (Gouvernement du Québec, 2022). This subzone is described as dominated by balsam fir and black spruce, but with a mix of spruce, pines, birch, larches, balsam fir, and poplars, and a ground cover of Labrador tea, sheep laurel (*Kalmia angustifolia*), blueberries, bunch berries, various moss-types, and *Cladonia rangiferina*.

9.3.2.2 Archaeology of the eastern James Bay area

Archaeological sites in the Eeyou Istchee James Bay region reflect a long precontact Indigenous occupation. There are also post European contact Indigenous sites, as well as historic sites linked to early Euro-Canadian exploration, the fur trade, and settlement. Archaeological interpretation is made difficult by the highly acidic nature of Shield soils, which do not often allow for good preservation of organic or datable material such as bone or plant parts, as well as the transient nature of many occupations.

Very broadly, the Québec precontact archaeological record has been divided into three periods. At the end of the Pleistocene epoch, much of Québec was still glaciated, and the earliest sites known elsewhere in Canada are not found in the project area. Sites from the Palaeo-Indian period are known in the St Lawrence and Eastern Townships, typified by spear points. Archaic period cultures (9500 – 3000 B.P) developed a seasonal round focused on hunting, trapping, fishing, and gathering a variety of resources. Archaic cultures differ slightly in their focus depending on the particular resources that are regionally available. Sites seem to have been focussed on fishing, and hunting caribou at river fords, narrows, or other constrained and predictable locations. Native copper was used, although copper tools are uncommon, and there is evidence of long-distance trading in lithic material. The later Woodland period (3000 – 450 B.P.) begins with the addition of pottery to the same diverse tool kit needed for the varied seasonal resource use that continued from the Archaic period (Wright, 1981). Wright noted the relative similarity of the precontact period archeological assemblages throughout the large area of the Canadian Shield, which he attributed to the nature of the boreal environment and suggested that people moved around a lot. The river and lake network of the Shield provided effective means of travel and communication, indeed the only easy means of travel. Reliable food resources (fish, waterfowl, beaver, and caribou) were associated with these water routes and fording places. Fire history shows a regime of very wide-spread fires, that would have made people and animals move in response to the post-fire vegetation succession. Small hunting groups and regional bands, with their flexible residence and marriage patterns, allowed wide-spread social connections, and the flexibility needed to live in the boreal forest. These factors contribute to the similarity of lifestyle and artifacts that is seen throughout this large area over thousands of years, and in the historically known Algonquin cultures. Wright notes that the Hudson Bay lowlands appear to have been little occupied until the historic period, when people were drawn to the fur trading posts.

However, with an increase in the amount of archaeological research in the Subarctic regions, a more nuanced understanding of the precontact period is developing (Holly and McCaffrey 2012; McCaffrey 2006). It is becoming possible to discuss the nature and variability of the archaeological record in particular areas.

The archaeology of the Eeyou Istchee James Bay area reflects this general pattern of small camp sites following the seasonal round of food resource availability. In the 1980s, little archaeological research had been done in the eastern James Bay area, and it was not possible to give a detailed account of culture history (Francis and Morantz, 1983; Wright, 1981). The earliest recorded site known at that time was inland on Lake Caniapiscau, dated at about 3500 B.P. (Denton and McCaffrey 1988). The typical small campsites provide a picture of small mobile hunting groups of several families, primarily subsisting on beaver and caribou, but exploiting a wide range of other animal resources. Larger summer camp sites can be found, particularly at locations near reliable fishing grounds. Little mention is made of gathered food sources, but plant exploitation must have been important for food and tool making. Some later period sites contain Middle and Late Woodland pottery, and pottery from the early historic period, suggesting regular contact with their more southerly neighbours.

The archaeological work done since then has allowed Denton (2020) to propose a more detailed culture history for Eeyou Istchee, although he still notes that most work has been survey and recording, with very few excavated sites and radiocarbon dated components. Denton proposes a three-part precontact period culture history: Early, Intermediate, and Recent. These periods are summarised below.

Early Period (5500 – 3200 B.P.) The oldest sites are on the southern margin of the area, where sites are found with Mistassini quartzite tools, but little other clues about the nature of the occupation. Surveys in the Eastmain-1 reservoir and Rupert diversion have located sites with radiocarbon dates between about 5000 and 2000 BP (Bibeau et al. 2015). Coastal sites near Waskaganish are known from 4300 B.P., with polished stone tools, and some tools made of Ramah chert, a lithic source on the north coast of Labrador. Mistissini quartzite is found in sites in southern Québec and New England, so clearly there were well-established long-distance travel and trading contacts. The source of Mistissini quartzite on the Témiscamie River is known as Waapushukamikw or “la colline blanche”. This is a protected archaeological site as well as a national historic site. The fine-grained white quartzite found at the Waapushukamikw quarry has been used by First Nations for thousands of years, and was the major quarry site for hundreds of kilometers in any direction. To the Mistissini Cree, Waapushukamikw is a place of spiritual significance and a respected place of memory (Parks Canada, 2009).

Intermediate Period (3200 – 1600 B.P.) There is a marked increase in the number of dated occupations, dominated by Mistissini quartzite tools. There are also larger campsites, most likely built up by repeated short-term occupations, rather than a longer-term occupation. The largest known site is Chisheyatischiskâu, a gathering place for hunters at the junction of the Lemare and Rupert Rivers that is now underwater in the Rupert forebay, flooded as a result of the Rupert River diversion. There are also significant sites on Lake Mistassini by 2000 B.P.

Recent Period (1600 – 300 B.P.) There is a marked increase in the number of radiocarbon dated sites, and the first ceramics, from the Laurel Tradition, appear in the southern part of the area. At the end of this period, Iroquoian ceramics appear. There is a greater range of lithic raw materials, and the points become smaller, including both bifacially flaked and flake points.

Early Fur trade/Colonial Period The 17th century marks the appearance of European items, at first exchanged by indirect trade with the French. The Mistassins are referred to in the records of the early French traders and Jesuits. Later in the 17th, Hudson’s Bay Company (HBC) posts are established on the Hudson and James Bay coasts and direct trade begins.

Roy (2009) provides a summary of fur trade posts in Québec that have been archaeologically recorded. In the study area, these include Rupert House, EiGq-1, which has been recorded and tested. Mistissini Post (B133), EcFl-4, has been tested by Roy (2009). Nemiscau post, EhGf-1, has been recorded and tested. The Revillon Frères post at Nemiscau, EhGf-2, has been recorded. None have been excavated in any detail. Some smaller posts, such as Chibougamau, have not been assigned a Borden number. Outside of the study area, Kenyon conducted archaeological excavations at Fort Albany in the early 1960s (Kenyon, 1986), guided by the notes of de Troyes, and excavated the Charlton Island depot in the 1970s. Charlton Island has been more recently excavated (Roy 2017, 2018). Fort George, FlGr-1 has been excavated, and it is threatened by ongoing bank erosion; the Big River post, FlGr-4, has been excavated by Roy (2009).

The extensive James Bay hydroelectric projects have been preceded by substantial archaeological and ethnohistorical research. The large volume of archaeological mitigative work needed for the hydroelectric projects in the 1970s led to the formation of the first contract archaeology firms in Québec (Gates St-Pierre, 2018). For example, Chism et al. (1977) prepared an overview of the very few sites recorded in the Nottaway, Broadback, and Rupert River hydroelectric project, and a model of archaeological potential in the proposed reservoirs. The known sites were concentrated at the mouth of the Rupert River, at the outlets to Lake Evans and some of the smaller lakes along the Rupert River, and along the shores of Lake Mistassini. Rousseau and Dumais, (1981) did an impact assessment of proposed access roads near the Nottaway, Broadback, and Rupert Rivers, testing only two sites.

In recent years, the provincial government has downloaded some of the responsibilities for management of archaeological heritage to municipalities and land owners (Gates St-Pierre, 2018). Today, the Cree Nation Government retains full time archaeologists, and supervises contract archaeologists for work in the territory of Eeyou Istchee James Bay. For example, Denton (2020) prepared an archaeological overview of a proposed development near the Mistissini community. Bibeau et al. (2015) and Denton and Izaguirre (2018) describe the results of projects in the Eastmain-1 and 1-A reservoirs and river diversions, projects combining the work and interests of Cree communities, elders, archaeologists, geographers, educators, and ethnologists. Guindon (2013) describes the impact of the Rupert River Diversion on the hunting grounds of one Mistissini Cree family, as a way of understanding cultural resiliency, and understanding the archaeological record of both recent occupations and occupations in the deeper past. In these projects, archaeology is one component of a broader programme, which aims to compile an archive of the cultural values of the land and promote a reconnection between the land and community.

An overall map of the known sites in Québec (Figure 9.3-3, Gates St-Pierre, 2018) shows a concentration along the Grande and Eastmain Rivers, which reflects the mitigative work for the hydroelectric projects. There are also sites recorded along the James Bay coast, and the south shore of Lake Mistassini. Large areas of the interior remain blank, however, which shows that there is still much inventory work to be done.

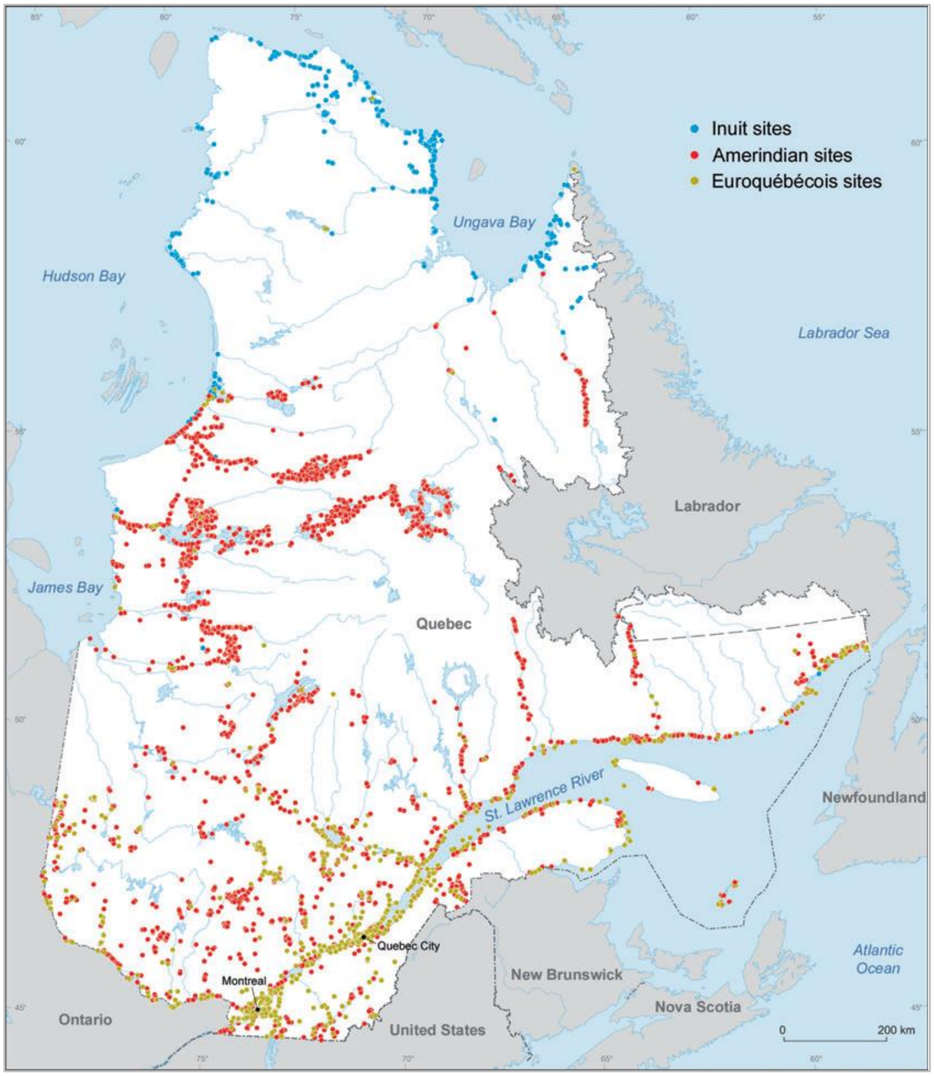


Figure 9.3-3 Location of the known archaeological sites in Québec, (from Gates St-Pierre 2018:2)

9.3.2.3 The James Bay Fur Trade

The following account of the development of the fur trade in eastern James Bay is largely taken from Innis (1930), Kenyon (1986) and Francis and Morantz (1983). The trade had a substantial impact on settlement patterns in eastern James Bay, as permanent settlements gradually became established around the posts at the mouth of the major rivers (Figure 9.3-4), in an area that had only known transient camps before. Inland posts were established much later, largely along lakes and rivers that had long been travel routes and camp sites.

In the early 17th century, English merchants sponsored a series of expeditions in search of a northwest passage through the Arctic to the riches of the Orient (Kenyon, 1986). In 1610, Henry Hudson sailed the Discovery through the western end of Hudson Strait, entering what he though to be the western seas. Alas, after a difficult wintering at the southern end of James Bay, the crew mutinied and returned to England without Hudson. A series of English expeditions followed, some led by members of Hudson's crew, as well as a Danish voyage led by Jens Munk in 1619, that gradually built up a knowledge of the coastlines of Hudson and James Bay, and the straits and islands of the

Arctic waters to the north of Hudson Bay. One of these was the 1631-1632 voyage of the Henrietta Maria, sponsored by Bristol merchants, and led by Thomas James. James mapped the southern reaches of Hudson Bay and James Bay, searching for a passage that might lead inland to the St Lawrence, but was forced by weather and the difficulties of navigating in a shallow bay filled with shoals to overwinter at a settlement they named Charles Towne, or Charlton (an island just north of where Rupert Bay meets James Bay). James had discovered no passage in the lower reaches of Hudson Bay. Given this and given the difficulties of travel through the ice of the higher latitudes, the search for the Northwest Passage was abandoned for two centuries.

At the same time, French fur traders were becoming well established along the St Lawrence River, beginning with the establishment of Tadoussac and other posts in the late 1500s (Denton, 2020). French traders continued to explore farther inland, as beaver were progressively depleted in the settled areas (Innis, 1930), and Montreal was established in 1642. Independent traders worked outside of the monopoly that the French government sought to enforce. Among these were Radisson and des Groseilliers, who travelled with the Huron in the 1650s in the country north of Lake Superior, bringing tales of a great river that flowed north. Radisson and des Groseilliers convinced English backers to support a trading voyage to Hudson Bay, in an attempt to reach this river and the rich fur country directly. In 1668, the Nonsuch, carrying Médard Chouart, Sieur des Groseilliers of the soon to be charted Hudson Bay Company, wintered at the mouth of Rupert River at Charles Fort (Waskaganish), returning to England with a fine cargo of beaver pelts. In 1670, the Hudson’s Bay Company (HBC was granted a charter to exclusive trade in Rupert’s Land, an extensive charter including all the lands that drained into Hudson Bay.

Even at this early contact, the Indigenous people in James Bay were peripherally involved in the fur trade. They possessed some of the standard trade items and knew how the trade was carried out. The James Bay Cree were at the outer edge of a trade network that carried goods from the St Lawrence region to the north and carried furs back to the French. The early trade with the Mistissini Cree was controlled by Innu intermediaries (Denton, 2020). A delegation of French traders had reached Lake Nemiscau via Lake Mistassini and the Rupert River in 1663 but did not continue on to James Bay (Francis and Morantz, 1983). This was one of several established routes. The growing presence of the HBC on James Bay swung the focus of the trade to the north and west, where the Cree communities could trade directly with the HBC. The Cree played an informed role as partners in the fur trade, in this period a relationship of mutual interest and interdependence (Morantz, 1980).

Another factor pushing the trade towards James Bay was the northern expansion of the Iroquois, partly as a result of the wars between the Iroquois and the French and their Algonquian allies. Iroquois were bent on breaking the Huron communities and their prime role as middlemen in the fur trade. Iroquois reached James Bay in the 1660s, likely along the Nottaway River, and a period of raiding and violence lasted into the 1680s. After this time, the HBC was well established.

The HBC established a post on the west side of James Bay at Moose Factory (Factory Island) in 1673, and at Fort Albany sometime between 1674 and 1679. The post at the mouth of Rupert River continued in seasonal use. There are few records known from the early seasons at these posts. They were manned by relatively few men, and supply ships arrived annually. These coastal forts were in shallow, shoaly water, and Charlton Island was used as a staging depot for the large sea-going ships, where the outfit of goods from England was transferred on smaller vessels to the coastal forts, and where the furs were received.

The French regarded the English presence on Hudson and James Bay as a direct threat to their own trade and the monopoly they were trying to enforce. In addition, independent traders periodically operated in both areas. The

Compagnie du Nord were granted a royal charter to trade into Hudson Bay in 1685, and a post was established at Lake Nemiscau. A French post was established near the mouth of the Nelson River on the northwest shore of Hudson Bay, to rival Fort Nelson (later York Factory), but French traders were driven out after three years. Pierre de Troyes travelled overland from Québec in 1686 and captured three coastal HBC posts (Albany, Moose, and Charles), although he failed to take Fort Nelson. There was an established overland route from Tadoussac through Lake Mistassini to Rupert House, but this difficult route involved hundreds of portages and falls, and de Troyes followed instead a route up the Ottawa River to Timiskaming, Abitibi, and thence to Moose Factory. The English retook Fort Albany the next year, but a French supply ship burned the posts at Moose and Rupert rivers. With the destruction of Charles Fort (later Rupert House) in 1693, there were no European fur traders remaining on eastern James Bay.

French traders continued to work out of posts on Lakes Mistassini and Abitibi. However, HBC traders were soon dispatched seasonally from Fort Albany to the east James Bay shores, particularly at the mouth of the Eastmain River. In addition to furs, this was an area where Cree came to hunt geese and fish, and these foods were taken back to supply Fort Albany along with the furs. A wintering house was built at Eastmain in 1719, and a more fortified settlement in 1723.

A complicated back and forth struggle between French and English held for much of the 17th and early 18th centuries, one of taking prisoners and ships, establishing rival forts, taking and burning forts, and competing for the loyalty of Indigenous communities. This continued until one of the provisions of the Treaty of Utrecht in 1713 restored Hudson Bay to the British and recognized the HBC title to Rupert's Land. The intense commercial competition continued, although in less violent form, right up to the merger of the North-West Company (NWC) and the HBC in 1821. The HBC continued to strengthen the fortifications on their Hudson Bay posts, and by the 1730s had re-established full time occupation of the three posts at the southern end of James Bay (Moose Factory, Albany House, and Eastmain). The Nottaway River was understood to be the dividing point between trade going to Eastmain House or to Moose Fort.

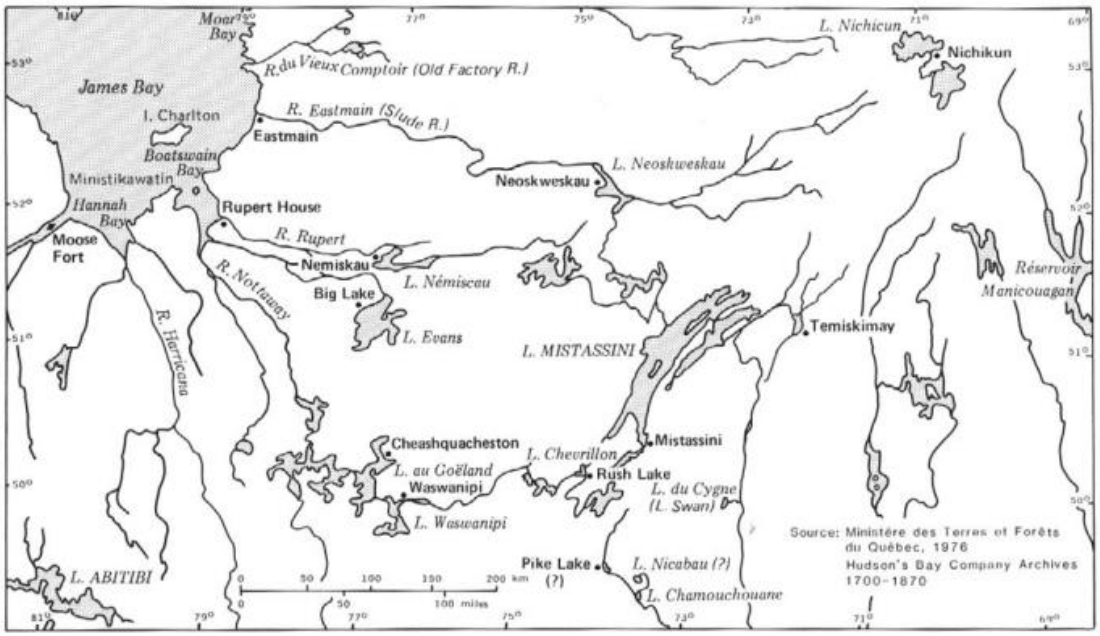
It was not until the late 18th century that the HBC began to establish a network of inland posts in eastern James Bay, extending up rivers to the height of land that divided Rupert's Land from the St Lawrence French territory. This was in response to an increase in French traders moving into the eastern James Bay land, and intercepting Cree on their way to the coastal posts, an activity that increased considerably after the end of the Seven Years War between French and English, 1756 – 1763. The Cree were able to take advantage of this rivalry to some degree, moving their trade to the most advantageous offer, although the rivalry often took the form of one trader intercepting Indigenous families on their way to the coastal posts and forcing them to trade. For the period where trading posts were limited to the shores of Hudson and James Bays, the late 17th century to the late 18th century, trade into the interior was largely done through Indigenous middlemen. Ray (1978) examined the ways in which assemblages of trade goods in archaeological sites in the hinterland of the Hudson Bay posts might differ between areas of direct trade with the post, areas of middlemen, and areas where trade is completely indirect. For example, sites with a low number of European trade goods are often assumed to be from the very early contact period, when they may instead represent a site where middlemen in the established trade had in fact traded on their goods farther into the hinterland as second-hand items, after a few years of use, rather than discarding them locally.

The first HBC expansion post was Rupert House in 1776, near the site of the old Charles Fort, at the mouth of Rupert River. Charles Fort was established in 1668. It was captured by the French between 1686 and 1693, when it was known as Fort Saint-Jacques, and little used after that. The HBC re-established a post here because it was on an important river route, and was an area with plenty of geese, important in provisioning both HBC traders and Cree. Rupert House eventually became the most important fur trade post on the east coast and continued to serve the eastern James Bay region as the main post for inland supply brigades well into the 20th century. Cree people largely managed and operated the supply brigades and constructed brigade canoes at the Rupert's House factory until the late 1970s.

There are extensive post journals and correspondence books available for Rupert's House. The Archives of Manitoba (2022) have records covering the years 1777 to 1941, for post number B186. The Rupert's House journal of Henry Connolly, 1838-1839, for example, contains "extensive commentary on Indian movements, hunting, and the conduct of the fur trade in James Bay" (Library and Archives Canada, 2022a).

After 1800, the Montreal-based NWC (formed in 1779 and absorbing some of the smaller traders) was the major trading competition for the HBC in eastern James Bay. The NWC opened posts at Abitibi, Waswanipie, and Mistassini Lakes, intercepting Indigenous groups on their way to the coast. In 1803 the NWC sent ships into James Bay, to Charlton Island, and built posts near several of the established HBC posts, including Frenchman's Island (where the James Knight 1692 – 1693 expedition had wintered; this post has been excavated). The difficulties of supplying these posts overland from Montreal was a handicap, and they were abandoned by the NWC in 1806, although their inland trade continued. In 1821, both companies acknowledged the costs of competition across all of Rupert's Land were too high, and they merged under the HBC name.

Meanwhile, the inland expansion of HBC posts continued between 1770 and 1820. For example, a post at Neoskweskau Lake was established in 1793, and a temporary post on Lake Nemiscau in 1794. After several failed attempts, the HBC established a post on Lake Mistassini in 1818. This expansion would not have been possible without the assistance and knowledge of the Indigenous people. The HBC men needed to learn hunting and travelling skills appropriate for the inland country, and local guiding knowledge and family connections made travel possible. Cree people manned the canoe brigades, and were more direct participants in the trade, which began to intensify the effect on the traditional Cree way of life and changed the seasonal patterns of movement. Increasingly, for the coastal Cree communities in particular, work for the HBC replaced seasonal subsistence activities, including building and maintaining canoes, and manning the brigades (Morantz, 1980). By 1821, the HBC had penetrated the hinterland of eastern James Bay, and maintained a network of trading posts that extended from Nichikun in the northeast to Waswanipi in the south. Attempts had been made to expand posts into the far north on Hudson Bay, but these had met with less success. After 1821, some of the interior James Bay posts were also closed, and others opened. Mistassini, Rupert House, and Waswanipi remained open continuously.



Zone Two: Eastern James Bay, historic and modern place-names

Figure 9.3-4 Eastern James Bay, historic and modern place names (Francis and Morantz, 1983: xix)

9.3.2.4 Fur Trade posts and inland brigade routes

After the merger of the HBC and NWC in 1821, HBC posts continued to serve communities in the study area until the 1970s. Charlton Island continued to be used as a staging supply depot for the HBC deep sea ships until 1931, when the railway arrived at Moosonee, near Moose Factory.

The regular canoe brigades from Rupert House on James Bay supplied inland posts between about 1812 and 1925. The inland posts included Nemiscau, Mistassini, Neoskweskau, Nichikun, Waswanipi, and Senneterre. Of concern to this study is the route from Rupert House to Nemiscau Post, east along the Rupert River, crossing the northern end of the proposed Billy Diamond railway. From there, the northwest side of Lake Mistassini was reached by two routes: along the Marten River, or along the Rupert River through a series of interconnected lakes (Figure 9.3-5) Mistassini Post was at the far south end of Lake Mistassini, and the supply routes have also been to the south, connecting Mistassini and the other NWC posts, and later the CN railway at Oskelaneo.

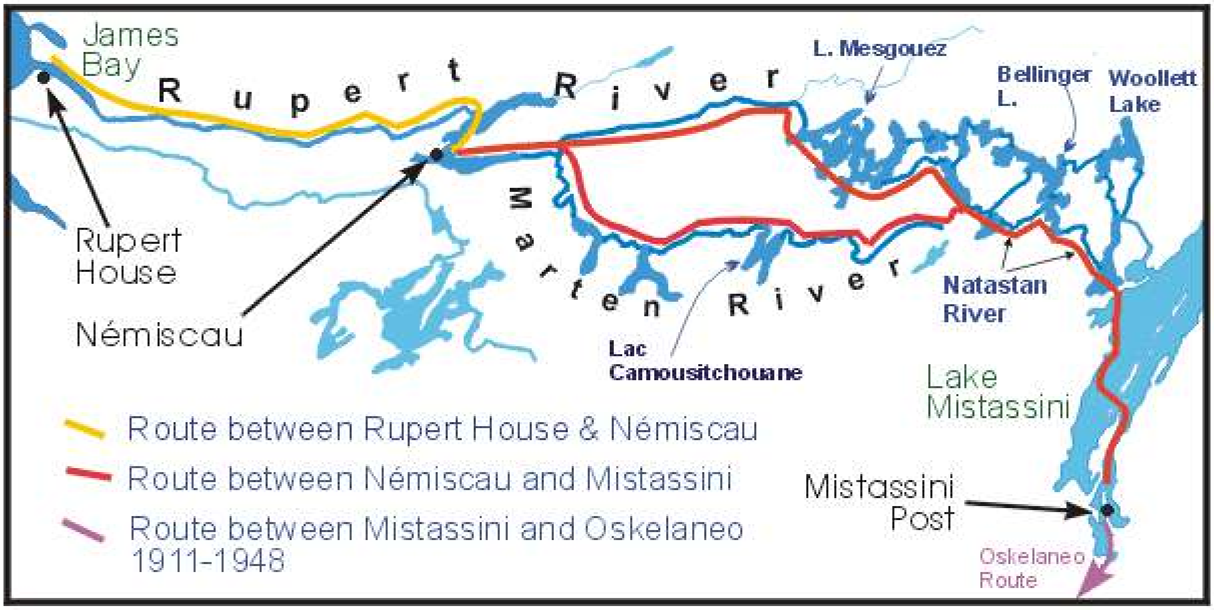


Figure 9.3-5 Rupert canoe brigade routes (Ottertooth, 2022a)

Nemiscau Post (or Nemiskau) was east of Rupert's House, about 70 km downriver from the confluence of the Rupert and Marten Rivers. It has been used sporadically since 1661. The HBC re-established the post in 1908 and ran it until 1970. The Archives of Manitoba (2022) has post journals and correspondence from 1794 to 1809, and 1929 to 1941 for post number B142. In the early 1900s, the HBC attempted to construct a winter road between Rupert House and Nemiscau. A competing international fur trading company, Revillon Frères, re-opened the road in 1912, building stables and bunkhouses along the line, but the heavy snowfall made the route impractical.

Mistissini Post (also known as Mistassini Post) was established by the NWC in 1802, at the south end of Lake Mistassini. The HBC established a second post nearby in 1818. After the merger of the NWC with the HBC in 1821, the post was fully supplied by the canoe brigades from Rupert House, largely staffed by Cree (Innis, 1930). The Archives of Manitoba (2022) has post journals and account books from 1814 to 1941 for post number B133.

With the arrival of the National Transcontinental Railway in 1910 (later the CN), it became cheaper to use rail to ship goods to the eastern James Bay posts. At Mistissini Post, from 1911 to 1925 furs were transported west to Rupert's House, while supplies came north from the railway station at Oskelaneo. In 1926, the HBC established a post and supply depot at Oskelaneo, and from 1926 until 1948, both the fur brigade and supplies used the Oskelaneo route. This route also supplied posts at Obiduan and Chibougamau, on the way north to Mistissini Post (Figure 9.3-6). In 1948, a road reached Chibougamau, but supplies for Mistissini still needed to be barged across Lake Waconichi, and the pattern of a single annual order and delivery to Mistissini Post was maintained until the road arrived at Mistissini in 1970 (Smith, 2001).

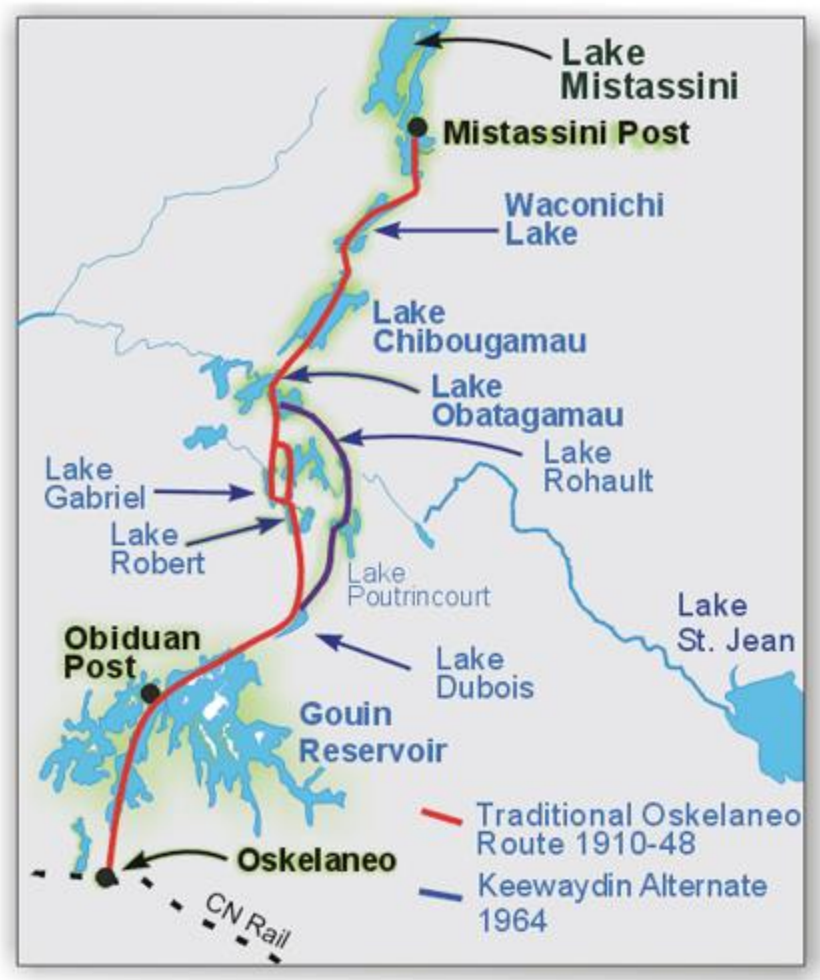


Figure 9.3-6 Mistassini – Oskelaneo brigade route (Ottertooth, 2022b)

In the 20th century, canoeists have rediscovered the fur trade brigade routes and portages, and a number of websites are dedicated to both contemporary and historical accounts and route maps (Ottertooth, 2022a). These include expeditions from Camp Keewaydin in Temagami, which ran extensive canoeing trips along historic routes in northern Québec and Ontario in the late 1930s, and into the 1960s. These included trips in the Rupert River and Mistassini area. Some of the modern canoeists have followed the maps of Albert Peter Low, a staff geologist at the Geological Survey of Canada, who mapped Lake Mistassini, the Rupert and Eastmain Rivers in 1885 (Kampouris, 2003). The modern canoe travellers generally note the difficulty of these routes. Some of the older routes are impossible to retrace, given how hydroelectric projects have extensively reshaped the landscape (see for example Mihell [2020] on the Eastmain River route).

Survey plans can be found that show portages and campsites along the canoe routes. For example, Henry O'Sullivan drew a plan of the canoe route to Lake Mistassini via River du Chef and File Axe Lake in the late 1800s (Bibliothèque et Archives nationales du Québec, 2022). There is an 1896 sketch map of the route from Waswanipi to Mistassini, showing the HBC posts at Waswanipi and Mistassini, along with the usual canoe route and portages (Library and Archives Canada, 2022b). This was drawn by Robert Bell, who first arrived in James Bay in 1877, for the Geological

Survey of Canada. These plans can be used in predictive modelling of site locations, as the good places for landings, camps, and portages are likely to have been good places in the pre contact times as well.

By the 1860s, Rupert House catered to two Cree populations, with differing lifestyles (Morantz, 1980, 1987). There were the “coasters”, hunters who lived close to the post, going inland only in February, and coming into the post frequently with furs or supplies of country food for the traders, and obtaining much of their provisions and tools from the post. They were employed by the post to provide geese and fish, to cut marsh grasses for hay, and perform other labour as needed. There were also the “inlanders,” who arrived at the post once yearly in June to trade, but otherwise lived a largely unchanged subsistence hunting and trapping lifestyle. Resource scarcity was a constant for the inlanders, but also for the coastal people.

This began to change when influences other than the HBC and the other traders began to impact Cree life. Formal missions and schools were established. Government surveyors from the Geological Survey of Canada began to arrive in 1877. The Canadian Pacific Railway was completed in 1886 to a point 10 days’ travel from Moose Factory, and gradually regional rail lines made travel and contact much easier. The rail allowed a much more efficient delivery of supplies, but also brought devastating diseases, and more white trappers. The pressure from the influx of trappers, who were not local and unconcerned with sustainability, decimated the game and fur bearer populations, resulting in real hardship for the Indigenous people. In the 1930s, Rupert House factor James Watt and Maud Watt established a system of beaver sanctuaries to restore the beaver population. These were eventually taken under provincial control and played an important role in restoring modern Cree economies (Smith, 2001; Morantz, 1987). The rail line reached Moose Factory in 1932.

The inland lifestyle involved minimal contact with provincial services or Indian Agents right up to the 1960s, when the province began to take an interest in the James Bay area. At this time there began to be provision of government services in the French language. The HBC began closing many of the smaller posts in the early 1960s, leaving Mistissini as the major post in the region (Smith, 2001). The HBC store at Oskelaneo was closed in 1962 (Ottertooth, 2022b). The James Bay hydroelectric projects brought considerable disruption. However, the James Bay Cree continue to maintain a distinct culture, still attuned to the seasonal changes in the land and its resources (Francis and Morantz, 1983; Guindon, 2015; Peloquin, 2007).

9.3.3 Development of Predictive Model of Archaeological Potential [wide corridor]

The following sections describe a model for the prediction of landscapes with the potential to contain archaeological sites to inform a preliminary archaeological survey of selected areas within the LGA study areas listed above. The archaeological survey, conducted in the autumn of 2022, sampled areas predicted by this model to be of high, moderate, or low archaeological potential. Based on the results of the preliminary survey, the model has been refined and revised accordingly to enhance its value as a tool for planning future archaeological surveys of the LGA.

The predictive model applies a web-based Geographical Information System (GIS) and is intended as a planning tool for constraint mapping, proposed design, and archaeological survey as well as a platform for compiling information relevant to the cultural landscape of the regions. As such, the GIS product of this predictive model (GIS Model) will remain a “living document” and will be updated as new information comes available. Therefore, the GIS Model at the time of delivery represents the current state of information, which is incomplete, unevenly distributed, and collected from a broad variety of sources. The determination of low, moderate, and high archaeological potential described below refer to the potential for the discovery of significant archaeological resources. It should be remembered that archaeological resources may be found anywhere and the GIS Model is a measure of likelihood based on Indigenous knowledge, past studies, environmental proxy indicators, and empirical testing.

9.3.3.1 Spatial Boundaries

For the purpose of this study, the following spatial boundaries have been applied to the components (Maps 9.3.1 and 9.3.2)

- Grevet-Chapais Roadbed 1 and 5 km buffers
- Billy Diamond Highway 1, 5, and 20 km buffers
- Waskaganish, Nemaska, Eastmain, Wemindji Communities 1, km buffer
- Mistissini Alternate Road 1 km buffer

9.3.3.2 Predictive Modelling

Predictive modelling relies on either inductive reasoning (general to specific) and requires the archaeologist to consider how people in the past made decisions regarding where and how they would conduct their adaptive strategies and daily activities (Hamilton et al., 1994a). Archaeological predictive modelling studies for the Canadian Shield and boreal forest have been conducted in Manitoba (Ebert, 2002), northwest Ontario (Hamilton et al., 1994b) and northern Saskatchewan (Gibson and McKeand, 1996). In general, important proxy variables that determine high archaeological site potential in the boreal forest are distance to water, slope, elevation, and vista (Ebert, 2002). Testing the model applies deductive (specific to general) reasoning where by empirical data gathered from field observation will be applied the confirming, revising, or generating alternatives to the model presented herein.

Predictive modelling does not always apply to certain site types. Butchering/skinning sites, which involve the initial processing of the animal, may predict the location where a kill/trap event has occurred. Generally, these sites are randomly distributed, especially hunting sites, occupied for a short time and are seldom horizontally or vertically extensive. Although trapping/skinning or kill/butchering sites are difficult to predict in the archaeological record, contemporary harvesters share these data through traditional land and resource use interviews, map biographies and oral histories. As interview and map data have been shared by contemporary harvesters as a part of this project, this information has been integrated into the predictive model.

The predictive modelling approach taken for this study is to identify variables that are proxies for past human activities including proximity to water, topography, proximity to known archaeological sites, proximity to portages and trails, and past and current land use to identify areas for subsequent testing in the field (Table 9.3-1). Using the predictive modelling approach described herein, 41 variables were ranked from the most likely to the least likely to be associated with archaeological sites. The highest rank is 3 and includes:

- Proximity to known graves
- Proximity to known archaeological sites (Table 9.3-2)
- Proximity to Cree Land Use sites including camps and cabins
- Proximity to waterfalls
- Proximity to fish spawning areas
- Proximity to banks of watercourses excluding bogs and muskegs

- Beach ridges (Tyrell Sea)
- High archaeological potential areas as identified by previous studies (Arkéos inc., 1999, 2003 and 2005, Denton, 2020)
- Archaeological sites and high potential areas identified ground-truthing (field work in 2022)

The lowest ranking is -3 for steep slopes greater than 40% grade, which are unlikely for human activity (or the preservation thereof).

The 41 variables were mapped using the 1:50,000 National Topographic System (NTS) maps, satellite imagery, other government map sources, surficial and bedrock geology maps, and forest cover maps.

Additionally, data shared through the Cree Land Use study were compiled according to the following categories (Table 9.3-3):

- Cree Camps (with subcategories)
- Non-Cree Activities (with subcategories)
- Harvesting Activities (with subcategories)
- Environmental Data (with subcategories)
- Transportation Routes (with subcategories)
- Valued Sites and Areas (with subcategories)
- Cultural Sites (with subcategories)

There were included on the GIS with buffers ranging from 0 to 750 m and ranking from 0 to 3 for the purpose of influencing the predictive model (Table 9.3-1, see Maps 9.3.3 and 9.3.4 in Appendix 6.26)

Knowing the Cree names of landscape features in the study area was a key consideration in characterizing the cultural landscape and recognizing important places in developing the predictive model. John Bishop (pers. comm. 2022) shared toponomy data in a meeting with the project team and also shared Shapefiles to allow inclusion on the GIS. These features are variously ranked depending on the cultural significance of a name. while some names refer to general landforms and features, others refer to specific events and peoples names. These specific named features are ranked higher in the predictive model.

These data were then compiled according to ranking and buffer on the GIS for the project. The rankings were cumulative and range from -3 the lowest potential to 30, the highest potential and colour coded from no colour through yellow, to dark amber, with no colour being lower potential areas and dark amber being higher potential areas (see Maps 9.3.3 and 9.3.4 in Appendix 6.26).

The intent of the resulting map is to be able to chose areas for the preliminary archaeological survey to test the accuracy of the model as a tool for predicting archaeological site locations.

9.3.3.3 Predictive Modelling Variables

Proximity to water, particularly for a summer occupation, is probably the most important site determining factor within the predictive modelling process (Ebert, 2002). The importance of water is reflected in its use for transportation (summer by canoe and boat and winter by snowshoes, dog sleigh, and snowmobile) harvestable resources, subsistence (drinking water, fish, water fowl and eggs, and other trapped and hunted species), and in the integral role it plays for most of the various orders within the life cycle. Water sources are abundant in the study area and areas within 100 m of river banks, lake shores and the confluences of rivers and stream or rivers and lakes are considered to have a high archaeological potential (Table 9.3-1).

Landforms and general topography influenced people's movements, faunal forage habits and settlement patterns. Elevated areas could have been used as human and mammal corridors to access upland areas. The elevated areas often contain outcrops that were quarried for stone tool production. Therefore, areas within 100 m of an upland landscape feature. Are considered to have a moderate to high archaeological potential. Landscape features such as eskers, drumlins, heights-of-land, and beach ridges that could be recognize from topographic base maps were included as upland area (Table 9.3-1). It is likely that elevated areas near water have higher archaeological potential than elevated areas that are at a great distance from water sources. The archaeological sites in more remote uplands could be hunting and other resource extraction sites that have a smaller footprint and, therefore, a reduced opportunity for archaeological discovery. The assumption is based on the archaeological inventory and the Cree Land Use study for this feasibility study (Table 9.3-2 and Table 9.3-3). Both demonstrate a strong correlation with water courses and water bodies (see Maps 9.3.3 and 9.3.4 in Appendix 6.26).

Low-lying or marshy areas were often selected as kill sites because game can be mired in the wet substrate and harvested. Low-lying areas are also important trapping areas, especially for beaver and muskrat. However, the resultant archaeological record from these activities generally consists of a horizontally small, shallowly buried site that is difficult to discover. Current use of lands by traditional harvesters interviewed for the Cree Land Use study suggests that low-lying areas such as muskegs and flood plains are important for hunting and trapping, therefore, these areas are considered to have a moderate potential for discovery archaeological resources as well.

Proximity to known archaeological sites is an important variable within the context of the study area because these data indicate that past cultural activity has been recorded and additional sites are potentially present. For predictive modelling, locations within 100 m of known archaeological sites are considered to have moderate to high potential (Maps 9.3.3 and 9.3.4 in Appendix 6.26 and Table 9.3-1).

Proximity to known graves has the highest rank to highlight these areas for avoidance through design and to influence archaeological survey planning to visit these sites (if appropriate) to facilitate avoidance (Table 9.3-1 , Table 9.3-2 and Table 9.3-3). Though reported burials have a buffer of 100 m in the predictive model, it is recommended that confirmed graves be avoided by at least 500 m through design.

Proximity to known trails, portages, and transportation routes was also considered as a predictive modelling variable. Trails, portages, and transportation routes are corridors that link culturally valued areas. Sites along routes may be small concentrations of items lost in transit or from brief stop-overs, while there is the possibility for camp sites at the start or terminus of the trail, portage, or transportation route. For predictive modelling, areas within 100 m of known portages, trails and transportation routes are considered to have moderate to high potential. This category considers rapids and waterfalls as well, as these features may require a portage (Table 9.3-1).

Surficial and bedrock geology influence the predictive model. Well drained sandy and gravelly soils are often associated with habitations as they are less likely to retain water in the spring snow melt or after rainfalls. Exposed bedrock may be a source for tool stone or another high and dry location for habitations or other harvesting/cultural activities. These areas are considered to have moderate archaeological potential (Table 9.3-1).

As with surficial and bedrock geology, vegetation was considered a proxy variable for archaeological site prediction based, again, on how well-drained an area is. Stands of pine and aspen are likely to occur in higher, drier areas, more suitable for habitation than lower, wetter areas, as represented by stands of willow, river alder, or tamarack (Table 9.3-1).

Magnitude of previous disturbances by past land use is another variable integral to predictive modelling. Occasionally the nature and extent of the past disturbance cannot be ascertained until a detailed archaeological assessment of the area has been completed. Available historical documentation or information from key interview people who have knowledge of a site or area can also assist in obtaining baseline information.

Table 9.3-1 Summary of Proxy Indicators for Predictive Modelling

Rank	Buffer	Indicator	Objective	Data source
3	100 m	recorded archaeological site	recorded archaeological site	Aarchaeological inventory/2022 Field Verification Study (Section 9.3.4)
3	100	areas of archaeological potential from field studies	incorporate previous field study results	Denton, 2020; Arkéos inc., 1999; 2003 and 2005; 2022 Field Verification Study (Section 9.3.4)
3	500 m	Cemetery	human burials	NTS 1:50,000/Cree Land Use Study
various	various	Cree place name	place of cultural importance	Place names from CNG toponymy Eeyou Istchee
2.5	100 m	confluence of water courses excluding muskeg/bogs	transportation, drinking water, food source needed for habitation/seasonal harvesting, landmark	NTS 1:50,000; base maps, Imagery
2.5	100 m	confluence of water course with water body excluding muskeg/bogs	transportation, drinking water, food source needed for habitation/seasonal harvesting, landmark	NTS 1:50,000; base maps, Imagery
3	100 m	banks of water courses excluding muskeg/bogs	transportation, drinking water, food source needed for habitation/seasonal harvesting	NTS 1:50,000; base maps, Imagery
2.5	100 m	south-facing shores of water bodies greater than 1 km long/wide excluding muskeg/bogs	transportation, drinking water, food source needed for habitation	NTS 1:50,000; base maps, Imagery
2	100 m	shores of water bodies greater than 1 km long/wide	transportation, drinking water, food source needed for habitation	NTS 1:50,000; base maps, Imagery

Rank	Buffer	Indicator	Objective	Data source
		excluding muskeg/bogs		
-3		steep slopes greater than 40%	inappropriate for habitation	NTS 1:50,000; base maps, Imagery
1	100 m	level, well-drained areas near muskeg/bog	source of plant foods and medicines, furs (beaver, muskrat) and animals (moose, woodland caribou)	NTS 1:50,000; base maps, Imagery
0		muskeg/bog	inappropriate for habitation/important for harvesting	NTS 1:50,000; base maps, Imagery
1	100 m	heights of land (highest point in 5 km radius)	vista/vantage point in pre-forest landscape/tool stone source in bedrock	NTS 1:50,000; base maps, Imagery
2.5	25 m	established trail	travel route (with camps associated at intervals)	NTS 1:50,000; base maps, Imagery, hiking maps
2.5	100 m	portages	transportation/stopping place; long-term use over generations	NTS 1:50,000; base maps, Imagery, canoe route maps
3	100 m	modern campsites	appropriate for habitation	NTS 1:50,000; base maps, Imagery, provincial park maps
3	100 m	trapper cabins	appropriate for habitation	NTS 1:50,000; base maps, Imagery,
3	100 m	reused camp/ gathering place	appropriate for habitation	
2	100 m	pine (PI, PG, PR, PS), aspen (PT), white spruce (EB)	indicate well-drained lands appropriate for habitation	forest cover maps
-2	-	willow (-), tamarack (ME, MH, MJ, ML), black spruce (EN), balsam poplar (PA)	indicate poorly drained lands inappropriate for habitation	forest cover maps
2.5	100 m	sandy soil	indicate well-drained lands appropriate for habitation	surficial geology maps
2.5	100 m	gravelly soil	indicate well-drained lands appropriate for habitation/source of tool stone	surficial geology maps
2	100 m	esker (top)	indicate well-drained lands appropriate for habitation and transportation route	surficial geology maps
2	100 m	drumlin (top)	vista/vantage point in pre-forest landscape and notable landmark	surficial geology maps
2.5	100 m	beach ridges	indicate well-drained lands appropriate for habitation and locations of greater antiquity when shoreline	surficial geology maps
2	25 m	exposed bedrock	source of tool stone	surficial geology maps

Rank	Buffer	Indicator	Objective	Data source
2	100 m	rapids/waterfalls	travel stopping points, spiritual areas, named locations.	NTS 1:50,000; base maps, Imagery, canoe route maps
3	750 m	fish spawning areas	food source with associated (repeated) season habitation	Fish and fish habitat survey conducted by VEI
3	100 m	spring (water source)	identified source of drinking water	Cree participant in 2022 Field Verification Study
3	750 m	beaver trapping areas	harvesting and associated habitations and processing areas	

Table 9.3-2 Known Archaeological Sites in the Study Area

Borden	Nom du site	Map	Localisation	Cultural identity	Auteur	Date	Sujet	Éditeur
DkGh-1	Lac Olga	32 F/14	Lake Olga, west bank at the first narrow to Elizabeth bay.	Indeterminate prehistoric Native American (12,000 to 450 BP)	Pintal, Jean-Yves	2005f	La collection Rogers.	Administration régionale crie, unpublished report, 64 p.
DkGh-1	Lac Olga	32 F/14	Lake Olga, west bank at the first narrow to Elizabeth bay.	Indeterminate prehistoric Native American (12,000 to 450 BP)	Rogers, E. S. et Bradley, R. A.	1953	An archaeological reconnaissance in south-central Québec, 1950.	American Antiquity, vol. 19, no 2 (octobre), p. 138-144.
DkGj-1	Historical burials of prospectors J.Rivard and A.Bédard	32 F/13	On part of the west shore of the mouth of the Bell River and the south shore of Lake Matagami.	History 1900-1950	Corporation Archéo-08	2011a	Inventaire archéologique, rivière Bell, été 2008.	Conférence régionale des élus de la Baie-James, unpublished report, 59 p.
DkGj-2	Rapides de l'Anse	32 F/13	On the eastern tip of the mouth of the Bell River and the south shore of Lake Matagami, a few tens of metres east of the Dkgj-1 site.	Indeterminate prehistoric Native American (12,000 to 450 BP)	Corporation Archéo-08	2011a	Inventaire archéologique, rivière Bell, été 2008.	Conférence régionale des élus de la Baie-James, unpublished report, 59 p.

Borden	Nom du site	Map	Localisation	Cultural identity	Auteur	Date	Sujet	Éditeur
DkGj-2	Rapides de l'Anse	32 F/13	On the eastern tip of the mouth of the Bell River and the south shore of Lake Matagami, a few tens of metres east of the Dkgj-1 site.	Prehistoric Native American (3,000 to 450 B.P..)	Corporation Archéo-08	2011 a	Inventaire archéologique, rivière Bell, été 2008.	Conférence régionale des élus de la Baie-James, unpublished report, 59 p.
DkGj-2	Rapides de l'Anse	32 F/13	On the eastern tip of the mouth of the Bell River and the south shore of Lake Matagami, a few tens of metres east of the Dkgj-1 site.	Indeterminate prehistoric Native American (12,000 to 450 BP)	Corporation Archéo-08	2011 a	Inventaire archéologique, rivière Bell, été 2008.	Conférence régionale des élus de la Baie-James, unpublished report, 59 p.
DkGj-3	Lac Matagami	32 F/13	On a point south of Lake Matagami, at the mouth of the Bell River, 100 m west of the DkGj-2 site.	Indeterminate prehistoric Native American (12,000 to 450 BP)	Corporation Archéo-08	2011 a	Inventaire archéologique, rivière Bell, été 2008.	Conférence régionale des élus de la Baie-James, unpublished report, 59 p.
DkGj-4	Lac Matagami	32 F/13	On the largest island of the archipelago of "Rapides de l'Anse", facing the mouth of the Bell River in Lake Matagami, directly opposite sites DkGj-1, 2 and 3.	Indeterminate prehistoric Native American (12,000 to 450 BP)	Corporation Archéo-08	2011 a	Inventaire archéologique, rivière Bell, été 2008.	Conférence régionale des élus de la Baie-James, unpublished report, 59 p.
DkGj-4	Lac Matagami	32 F/13	On the largest island of the archipelago of "Rapides de l'Anse", facing the mouth of the Bell River in Lake Matagami, directly opposite sites DkGj-1, 2 and 3.	Modern historical Native American 1900 to 1950	Corporation Archéo-08	2011 a	Inventaire archéologique, rivière Bell, été 2008.	Conférence régionale des élus de la Baie-James, unpublished report, 59 p.
DlGf-1	Lac au Goéland	32 F/15	North shore of the Waswanipi River, at its western mouth on Lac au Goéland.	Natine american middle Woodland period (2,400 to 1,000 BP)	Pintal, Jean-Yves	2005f	La collection Rogers.	Administration régionale crie, unpublished report, 64 p.

Borden	Nom du site	Map	Localisation	Cultural identity	Auteur	Date	Sujet	Éditeur
DlGf-1	Lac au Goéland	32 F/15	North shore of the Waswanipi River, at its western mouth on Lac au Goéland.	Native american middle Woodland period (2,400 to 1,000 BP)	Rogers, E. S. et Bradley, R. A.	1953	An archaeological reconnaissance in south-central Québec, 1950.	American Antiquity, vol. 19, no 2 (octobre), p. 138-144.
DlGf-1	Lac au Goéland	32 F/15	North shore of the Waswanipi River, at its western mouth on Lac au Goéland.	Archaic Prehistoric Native American (9,500 to 3,000 BP)	Rogers, E. S. et Bradley, R. A.	1953	An archaeological reconnaissance in south-central Québec, 1950.	American Antiquity, vol. 19, no 2 (octobre), p. 138-144.
DlGf-1	Lac au Goéland	32 F/15	North shore of the Waswanipi River, at its western mouth on Lac au Goéland.	Archaic Prehistoric Native American (9,500 to 3,000 BP)	Pintal, Jean-Yves	2005f	La collection Rogers.	Administration régionale crie, unpublished report, 64 p.
DlGf-2	Lac Waswanipi	32 F/15	Shore of a tributary of the Waswanipi River.	Indeterminate prehistoric Native American (12,000 to 450 BP)	Rousseau, G. et Dumais, P.	1981	Aménagement hydroélectrique des rivières Nottaway, Broadback, Rupert, routes d'accès Matagami, Goéland, Ponchenille et Evans.	La société d'énergie de la Baie James (SEBJ), Environnement, unpublished report, 61 p.
DlGh-1	Lac Matagami	32 F/14	South shore of Matagami Lake near the mouth of the Waswanipi River.	Indeterminate prehistoric Native American (12,000 to 450 BP)	Pintal, Jean-Yves	2005f	La collection Rogers.	Administration régionale crie, unpublished report, 64 p.
DlGh-1	Lac Matagami	32 F/14	South shore of Matagami Lake near the mouth of the Waswanipi River.	Indeterminate prehistoric Native American (12,000 to 450 BP)	Rogers, E. S. et Bradley, R. A.	1953	An archaeological reconnaissance in south-central Québec, 1950.	American Antiquity, vol. 19, no 2 (octobre), p. 138-144.

Borden	Nom du site	Map	Localisation	Cultural identity	Auteur	Date	Sujet	Éditeur
DlGh-2	Lac Matagami	32 F/14	On a point on the north shore of the mouth of the Canet River into Lake Matagami.	Indeterminate prehistoric Native American (12,000 to 450 BP)	Corporation Archéo-08	2011 a	Inventaire archéologique, rivière Bell, été 2008.	Conférence régionale des élus de la Baie-James, unpublished report, 59 p.
DlGh-3	Camping Matagami	32 F/14	On the south-east bank of the Matagami, on the grounds of Camping Matagami.	Prehistoric Lower Woodland Native American (3,000 to 2,400 BP)	Corporation Archéo-08	2011 a	Inventaire archéologique, rivière Bell, été 2008.	Conférence régionale des élus de la Baie-James, unpublished report, 59 p.
DlGj-1	Lac Matagami	32 F/13	At the bottom of the bay west of the mouth of North Bay and Lake Matagami.	Indeterminate prehistoric Native American (12,000 to 450 BP)	Corporation Archéo-08	2013 h	Inventaire archéologique aux lacs Chibougamau et Matagami, été 2012.	Conférence régionale des élus de la Baie-James, unpublished report, 12 p.
DlGk-1	Pointe aux Chalets	32 F/13	On a point of sand, on the west shore of Lake Matagami, not far from the mouth of the Allard River. North of Pike Island	Indeterminate prehistoric Native American (12,000 to 450 BP)	Corporation Archéo-08	2011 a	Inventaire archéologique, rivière Bell, été 2008.	Conférence régionale des élus de la Baie-James, unpublished report, 59 p.
EhGi-1	Lac du Poisson Blanc	32 N/3	Northeast corner of Lac du Poisson Blanc.	Undetermined historical Native American 1500 to 1950	Chism, James V.	1973 a	A brief archaeological examination of certain areas within the James Bay development territory (Québec), 1972.	Musée national de l'Homme, Ottawa, unpublished report, 43 p.

Borden	Nom du site	Map	Localisation	Cultural identity	Auteur	Date	Sujet	Éditeur
EiGi-1	Peat Island	32 N/6	Southwest shore of Peat Island.	Modern historical Native American 1900 to 1950	Chism, James V.	1973 a	A brief archaeological examination of certain areas within the James Bay development territory (Québec), 1972.	Musée national de l'Homme, Ottawa, unpublished report, 43 p.
AOP 40 DkGj-5	Bell River	See section 9.3.5.1.2	Elevated, level, well-drained terrace with a well-defined edge and a southwest facing aspect overlooking the Bell River. Canopy of balsam fir, poplar and birch, and ground covers of bunch berries and moss.	Indeterminate prehistoric Native American (12,000 to 450 BP)	Burns, M.	2022		Manuscript report, MCC Permit 22-STAN-01
AOP 48 DlGg-1	Waswanipi River between Lake Olga and Lake aux Goélands	See section 9.3.5.1.1	Elevated, level, well-drained intact terrace with mature trees and a thick litter mat. West facing aspect overlooking an unnamed watercourse flowing downstream to the Waswanipi River. Canopy of balsam fir, and jack pine, and a ground cover of moss.	Indeterminate prehistoric Native American (12,000 to 450 BP)	Burns, M.	2022		Manuscript report, MCC Permit 22-STAN-01
AOP 47 EcFl-6	Mistissini Lake and the mouth of the Pipounichouane River	See section 9.3.5.2.1	The site is on an elevated, level, and well-drained terrace with a well-defined edge and forming a point with a west facing aspect overlooking Mistissini Lake and the mouth of the Pipounichouane River .	Indeterminate prehistoric Native American (12,000 to 450 BP)	Burns, M.	2022		Manuscript report, MCC Permit 22-STAN-02

Table 9.3-3 details the categories of data shared in the Cree Land Use study, the buffers applied to the GIS, and the predictive model ranking assigned to each. These were included in the overall predictive model to arrive at the cumulative ranking and colour coding as illustrated in Maps 9.3.3 and 9.3.4 in Appendix 6.26.

Table 9.3-3 Contemporary Land Use

Category	Feature	Buffer (m)	Rank/weight for archaeology model
Cree Camps	Main Camp	250	3
	Secondary camp	250	2
	Cultural Camp	250	2
	Projected camp	100	1
	Old Camp	250	3
Non-Cree Activities	Non-Cree Camp	100	1
	Outfitting Camp	100	2
	Camping	100	1
	Other building	100	1
Harvesting Activities	Goose Hunting	250	2
	Moose Hunting	100	1
	Caribou Hunting	100	1
	Bear Hunting	100	1
	Beaver Trapping	250	2
	Other Fur Bearing Animals	100	1
	Fishing	250	3
	Berry picking	100	1
	Wood Gathering	250	2
	Plant Gathering	100	1
	Spring Water Source	100	3
Environmental data	Goose		0
	Moose		0
	Caribou		0
	Caribou Migration Corridor		0
	Bear		0
	Beaver		0
	Other Fur Bearing Animals		0
	Fish		0
	Spawning Ground	250	3
	Berry		0
	Trees		0
	Plant		0
	Spring Water Source	100	2

Category	Feature	Buffer (m)	Rank/weight for archaeology model
Transportation - Routes	Boat	100	2
	Snowshoe or dogsled	100	3
	Snowmobile	100	1
	4-wheeler	100	1
	Truck -Car	100	1
	Portage	100	3
	Airplane landing Site		0
	Boat Landing	100	3
	Old Routes	100	3
	Obstacle	100	2
Valued Sites and Areas	Valued Site and Area	250	3
	Burial Site	250	3
	Birth Site	250	3
	Highly Sensitive Area		0
	Protected Area		0
Cultural Sites	Place Name	250	3
	Legend Site	250	3
	Sacred Site	250	3
	Archeological or Historical Site	250	3

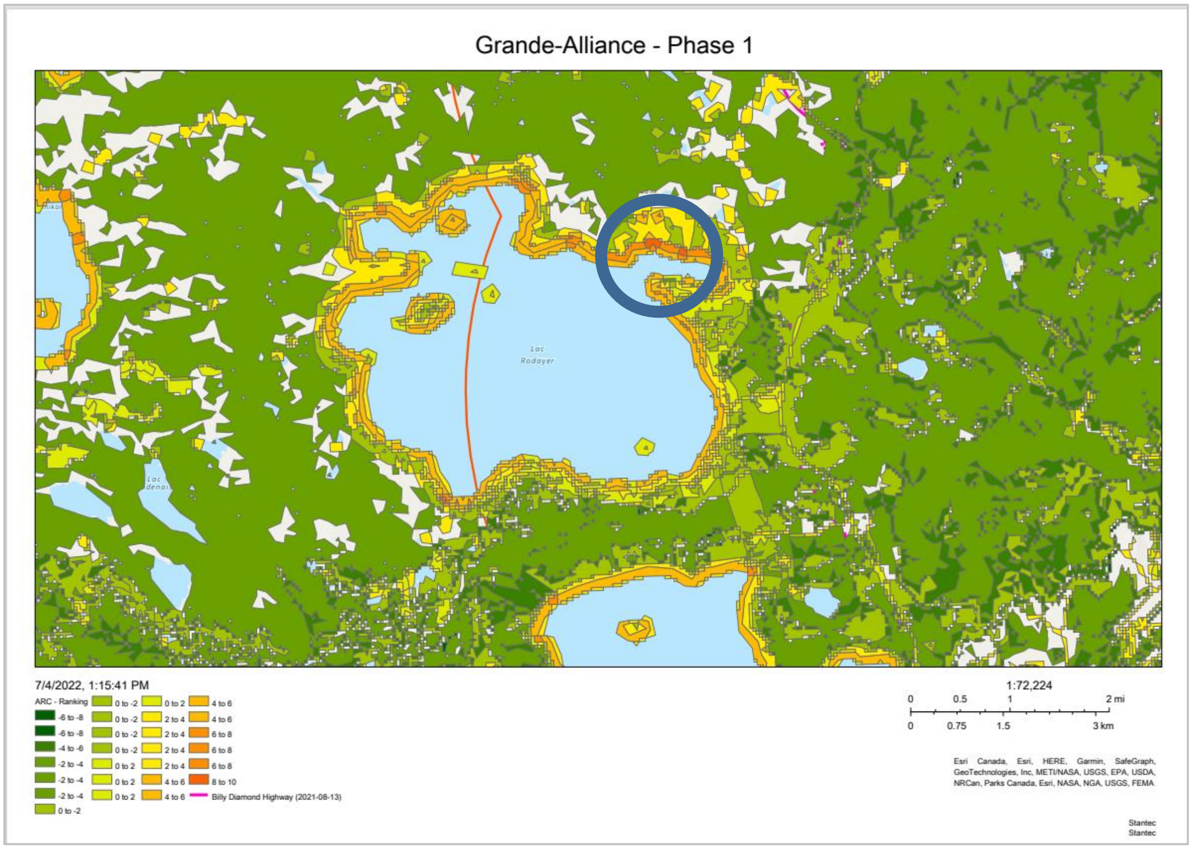


Figure 9.3-7 Example of the Predictive Model at Lac Rodayer

Figure 9.3-7 illustrates a large scale section of the GIS Model that shows areas ranging from low (no colour) to high (dark amber) archaeological potential. By way of example, an archeological survey within the circled area would provide the opportunity to examine the range of landscapes ranked by the predictive model from lowest to highest potential. The GIS Model was used to plan the survey areas for the preliminary archaeological study in 2022 (described below), based on the needs and priorities of the Aanischaaukamikw Cree Cultural Institute (ACCI), and the proponent, with the goal of gathering data to further refine and strengthen the GIS Model as a tool for site prediction, design planning, and archaeological assessment.

9.3.4 Field Verification of Predictive Model [narrow corridor]

As stated below in section 9.3.3, the objective of the 2022 archaeological field program was to test the accuracy of the predictive model by conducting a preliminary archaeological survey that sampled areas predicted by the model to be of high, moderate, and low archaeological potential. To do so, the 2022 field program consisted of both pedestrian survey and shovel testing. The preliminary survey was not meant to be an exhaustive study of potential. The field work did not thoroughly test the model but kept to areas of safe access within the narrow corridor. Archaeological sites and areas of archaeological potential identified as well as in this preliminary survey have been used to refine the model presented above.

The preliminary archaeological survey consisted of four 8- day field shifts, for a total of 32 days of field work. Field work occurred between August 15th and October 5th, 2022. The first three shifts focused on the potential BDH railway corridor, and the fourth shift focused on the proposed Second Access Road to Mistissini.

Nine Cree field technicians from Waskaganish, Oujé-Bougoumou, and Mistissini participated in the field work over the four shifts. In addition, an archaeologist from ACCI joined the crew for the third and fourth shifts.

A condensed course explaining the basics of what archaeology is, and how it is practiced, and a lithic (stone tool making) workshop were offered to the participants.

During field work, the Cree field technicians shared information concerning animals' behaviour, hide processing, how to setup a camp, wood splitting, and how to move through the land during both snow-free and snow-covered conditions.

The 2022 preliminary archaeological survey resulted in the identification of over 60 areas of potential (AOPs) and numerous features of interest (FoIs). The AOPs are locations identified for subsurface testing, which has the potential to yield subsurface archaeological material (pre- and post-contact periods), and the FoIs are visible features and/or remnant traces of past occupations such as *taashipitaakin* (storage structure), *tâkwâchistaaukamikw* (Cree winter lodge), *maahkii* (Cree cabin), *waapishtaaniwinihiichaau* (marten trap), and *ishkutehkaan* (hearths).

Six newly identified archaeological sites were recorded and recommended to the Ministère de la Culture et des Communications (MCC) du Québec for protection. Five of these sites consist of surface and subsurface lithic belongings, and one site consists of an historic metal trap for hunting small game. In addition, several contemporary and remnant Cree camps, trails (pedestrian, small game, snowmobile, portage), fishing, hunting, and trapping activity areas, and wood harvesting evidence were also recorded. Details of these finds are discussed below.

9.3.4.1 Method

The 2022 field verification of the predictive model focussed its effort within an approximate 1 to 2 km-wide area along the Billy-Diamond Highway and a similar buffered area for the proposed Second Access Road to Mistissini. The field crew examined various types of terrain and environment to enhance the value of the predictive modelling tool. Portions of large river systems such as the Rupert, the Broadback and the Bell Rivers were examined. As well, small named and unnamed creeks and associated wetland systems were examined. Small and larger lakes were also visited. While the shorelines of these various watercourses were prioritized considering the well-documented uses of waterway as travel routes for the Cree, areas further away from the shorelines were also considered during the field program to document archaeological potential, especially associated with wintering activities and palaeo-shorelines, meaning shorelines that existed in the geologic past.

To reiterate, this year's preliminary survey was not meant to be an exhaustive study of potential. The field work did not thoroughly test the model but kept to areas of safe access. The results of this study should not be considered a full illustration of archaeological potential for the Project.

9.3.4.2 Permitting

The potential BDH railway corridor is located on Categories II and III land and is entirely subject to the Loi sur le Patrimoine Culturel du Québec for which an archaeology permit issued by the ministère de la Culture et des Communications (MCC) is required (P-9.002 - Loi sur le patrimoine culturel (gouv.qc.ca) and P-9.002, r. 2.1 -

Règlement sur la recherche archéologique (gouv.qc.ca)). A portion of the proposed Second Access Road to Mistissini is located on Category II land, while the remaining is on Category I federal land and is not subject to the MCC permitting process. Although the federal land portion of the Project is not subject to the MCC permitting, the study team committed to following the provincial standards and guidelines for the entire proposed Second Access Road to Mistissini. The 2022 preliminary archaeological survey was carried out in accordance with the methods described in the applications for MCC Permits 22-STAN-01 (proposed Billy Diamond railway), and 22-STAN-02 (proposed Second Access Road to Mistissini).

9.3.4.3 Survey

Crews of two (2) to ten (10) people–with survey transects spaced generally between 5 m to 20 m intervals–traversed the landscape within the constraints of the study area to identify areas of archaeological potential. Visibility across the study area ranged from 10 to 50 m and GIS-based survey records were buffered accordingly for graphic representation. Where surface exposures were encountered along stream channels and rock outcrops and where subsurface exposures such as tree throws, roads, recreational, trails, and/or game trails were encountered, the exposures were inspected for cultural material. When identified, surface artifacts (and other potential cultural materials) were mapped and collected for further analysis. Locally, indicators of high archaeological potential include level, well-drained areas. More generally, landforms such as banks, terraces or benches near rivers, streams, and lakes, and minor topographic changes within otherwise undifferentiated and featureless terrain, such as discrete knoll or ridge features, or stream crossings, would also constitute areas of high archaeological potential. Areas of low archaeological potential include areas of saturated, poorly drained terrain, moderately to steeply sloping terrain, and areas disturbed by roads or industrial development, such as aggregate pits.

9.3.4.4 Areas of Potential (AOPs), Features of Interest (FoIs) and Low Potential Areas

AOPs are areas exhibiting high or moderate archaeological potential for the presence of surface and/or buried cultural resources. They are locations considered the most likely to have supported past human activity within the landscape and may have left physical evidence behind. Indicators of high and moderate archaeological potential can include well-defined elevated landforms in proximity to water bodies or wetlands, travel corridors, or resource procurement areas. AOPs selected for subsurface testing during the 2022 field season were randomly selected.

Feature of interest (FoIs) are any traces of human occupation that reflect used of the lands, such as camps, travel corridors and portage routes, fishing, hunting, and trapping activities, and a broad range of other activities such as firewood and medicinal plants harvesting, berry picking, and birch trees stands (for canoe making), that are easily accessed by canoe in the summer or by snowshoes, dog sleigh, and snowmobile in the winter as waterways are at the centre of the Eeyou way of life. These traces of occupation pointing to traditional land uses are used in this study as possible indicators of ancient human occupations.

In-field identification of AOPs and FoIs in areas modelled as having high and moderate archaeological potential helped confirmed the efficiency or effectiveness of the GIS Model as a planning tool. Where AOPs and FoIs were identified in areas modelled as low archaeological potential the GIS Model was refined and revised to capture these areas accordingly to their in-field potential. The GIS-based approach, as described above, is intended to be iterative to allow for continuous improvement and upgrade when new results and information become available.

When considering low archaeological potential, it is important to keep in mind that:

- The absence of recorded sites, AOPs and FoIs is not always indicative of low archaeological potential, but rather the lack of previous studies in a given area.
- Low archaeological site potential does not mean no potential. There is a limited likelihood of finding sites within areas modelled as low by the archaeological predictive model.

9.3.4.5 Shovel Testing

Shovel tests were excavated to at least a few centimeters within the podzol layer. Displaced sediments were passed through 6 mm (0.25 in.) wire mesh screen. Shovel tests were situated in a general 5 m to 10 m grid where practicable (i.e., except where constrained by dense vegetation, structures [e.g., cabins], or steep slopes). Shovel tests measured at least 40 cm to a side. Representative stratigraphy was recorded for negative (no cultural evidence) shovel tests and detailed stratigraphy was recorded for each positive (presence of cultural evidence) shovel test and for those shovel tests (including negative) where stratigraphy differed from the representative test stratigraphy.

The depth excavated at each test location varied accordingly to the thickness of the soil excavated. The soil in the study areas consist of podzol, which is typical of boreal forest environment. Podzol generally consists of a litter mat (Of horizon), a dark humic organic layer (H horizon), an eluviated horizon (Ae horizon) consisting of either fine sand or fine silt varying from white to grey, and of an illuvial layer (B horizon) beneath consisting generally of an orange-brown sandy or silty matrix with pebble and cobble. The B horizon was excavated at least 10 cm in to confirm its culturally sterile nature. All shovel tests were backfilled.

9.3.4.6 Lithic Analysis

All recovered lithic (stone) artifacts/belongings were classified by material type, manufacturing technique, and artifact type with the aim of providing general inferences about the nature of the cultural activities conducted at the site. Metric attributes (length, width, thickness, and weight) were recorded for each artifact/belonging, and other specific attributes such as retouch, use-wear, function, and date ranges were recorded, where appropriate (Appendix 6.26).

Lithic raw material classification was visually determined at a macroscopic level. The identification of lithic raw material was first classified per rock genesis—sedimentary, igneous, and metamorphic, achieved primarily through examination of lithic composition and texture (Andrefsky, 2005). The specific rock type was then determined through the analysis of attributes including texture, grain size, color, and mineral composition specific to and established for each rock class (see for example Andrefksy, 2005, Hamblin and Howard, 1971, Kooyman, 2000, Luedtke, 1992). Where possible trade or source identification was deemed possible, raw lithic materials were considered for non-destructive geochemical analysis.

Lithic artifacts/belongings classification followed the macroscopic approach established by Andrefsky (2005), with primary classification into broad *Artifact Class(es)*—debitage, cores, and tools. Debitage was classified into three debitage *Types*: flakes-complete or proximal (flakes with a singular interior surface, a striking platform, and intact margins), incomplete flakes (flakes with a singular interior surface, lacking a striking platform and intact margins), and block shatter (stone debris lacking a singular interior surface, striking platform and intact margins) (after Andrefsky, 2005). Complete flakes were further analyzed using the reduction stage approach (Magne, 1989), and classified into early-, middle and late-stage types (Kooyman, 2000).

The stone tool and core analysis follow Andrefsky's (2005) generalized morphological typology for chipped stone tools. Cores are first classified into a *Sub-class* (intact cores or core fragments). Intact cores are further classified into core *Types* (i.e., multidirectional, bidirectional and unidirectional). Analysis of chipped stone tools first classifies the artifact/belong into a *Sub-class* (bifacial tools, flake tools, core tools, and pebble/cobble tools). Subsequently, it is classified into a *Type* (i.e., utilized flake tool, microblade, projectile point, etc.) and less frequently applicable, a *Sub-type* (i.e. unstemmed projectile point, lanceolate biface, etc.). Chipped tool and core identification considers those defined primarily by Andrefsky (2005) and aided by definitions provided by Loy and Powell (1977) and Kooyman (2005).

Artifacts/belongings produced by alternative manufacturing techniques, such as ground, polished, pecked, and sawn, are typologically classified after Classes, Sub-classes and Types described by Stewart (1973, 1977, and 1984) and Loy and Powell (1977). Where possible inferred function and culturally/chronologically diagnostic associations are reported on for artifacts/belongings of all techniques of manufacture.

Lithic analysis was completed at the Aanischaaukamikw Cree Cultural Institute (by archaeologists Dario Izaguirre (ACCI) and David Laroche (Stantec). All artifacts are currently held at the ACCI.

9.3.4.7 Potential Billy Diamond Highway Railway Corridor

9.3.4.7.1 Project Settings

The potential BDH railway corridor is a north—south railway line parallel to the BDH between Matagami and the Rupert River, located at the kilometric points (KP) 0 to 257 of the BDH.

Previous archaeological studies along the Bell River in Matagami have been completed for various projects (Archéo-08, 2011 and 2014). Several studies for Hydro-Québec, along the Rupert River corridor, and for the construction of the road leading to Waskaganish were completed (Arkéos inc., 1999, 2003 and 2005; Archéotec, 2008; Chism et al., 1977; Pentz et Marcoux 2009; Rogers and Bradley 1953; Rousseau et Dumais, 1981). And a few studies along the Waswanipi River and the area surrounding the confluence of the Waswanipi River and Lake Matagami were completed for Hydro-Québec in the 1980s and for small local projects later on (Rousseau et Dumais, 1981). Otherwise, the potential BDH railway corridor is sparse when it comes to archaeological inventories and impact assessment studies. See the literature review section of this report for details concerning previous archaeological works for the Project. While the 2022 LGA field season focused on areas not surveyed by previous consultants, the data from these previous studies were incorporated in our potential modelling analysis.

At a macro level (large-scale patterns) the area within our modelled corridor has high archaeological potential for cultural resources due to several factors. The southern portion include major waterways networks which used to make the "highways of the past". The Bell River, Matagami Lake, the Waswanipi River and several others were important travel corridors linking gathering, harvesting, hunting, and spiritual places to name a few into a broader cultural landscape. These waterways allowed human to exploit its surroundings environment, and as a result offering the possibility for archaeologists to find remnants of past human occupation and adding to the broader cultural history of the region. The southern reaches of the potential BDH railway corridor may have been used as a trading and exchange area over time between different cultural groups, opening the door for new research questions to be addressed.

The Broadback River located in the northern reaches of the potential BDH railway corridor is a major river in Eeyou Istchee James Bay. The Broadback River drained west into Rupert Bay (a small bay south of James Bay), and connects with Evans Lake, a lake which has seen a fair amount of archaeological research over the years resulting in the identification of numerous archaeological sites. Unlike the Rupert River, the Broadback River has never been impacted by hydro developments. Practically no archaeological research has been done along this river, at least within our modelled corridor. The relatively intact aspect of the environment along the Broadback offer tremendous opportunities to learn more about the area from an archaeological as well as traditional land uses point of view. The Rupert River runs roughly east to west and is at the northern reaches of the potential BDH railway corridor. The general area within our modelled corridor has high archaeological potential for cultural resources due to several factors. The Rupert River was one of the main east-west travel corridors in Eeyou Istchee. A few archaeological sites, some dating back from a few thousand years, have been documented in the vicinity of the Rupert River. The *Kaumwakweyuch* Rapids ("eat fish eggs;" Oatmeal Rapids) located east of the BDH bridge was the site of a long portage. The well-documented portage route is located on the north shore of the Rupert River increasing the likeliness to identified sites on both ends, and along the route. The Rupert River saw regular canoe brigades from Rupert House (Waskaganish) on James Bay supplied inland posts between about 1812 to 1925. The inland posts included Nemiscau, Mistassini, Neoskweskau, Nichikum, Waswanipi, and Senneterre.

As for the large area in between these majors' rivers systems mentioned above, little is known at this time. In this specific case, the absence of recorded archaeological sites is not indicative of low archaeological potential, but rather the lack of previous studies in the area. The vast networks of lakes, creeks, and rivers offer ways to travel year-round through the landscape, with numerous options for resources procurement along the way. Traditional lands used data obtained through the CNG and the VEI socio-economic and environment team support the potential for archaeological resources .

9.3.4.8 2022 Field Results

9.3.4.8.1 Bell River (sector Matagami) --HUM Cree Trapline W13

The Bell River -sector Matagami, is within the southern reaches of the potential BDH railway corridor. Portions of both sides of the Bell River were examined in 2022. The potential BDH railway corridor is bound to the north by Matagami Lake and to the east and west of the river by a series of terraces and sloping and undifferentiated terrain with numerous relic or seasonal drainages bisecting the area. Existing paved roads and access roads, as well as snowmobile trails crossing the areas examined were observed. In addition, an aggregate pit and a cross-country skiing cabin and its associated trails network were noted. The eastern side of the Bell River is partially occupied by the town of Matagami. The residential, recreational, and industrial areas of the town have caused numerous impacts to the landscape and the environment. The vegetation across the area examined is typical for the region and includes balsam firs, spruces, aspen and birch, as well as blueberries, huckleberry, Labrador tea, sheep laurel (*Cornus canadensis*) and moss.

Field examination in 2022 of the Bell River -sector Matagami resulted in the identification of fifteenth AOPs (also referred to as subsurface test locations), and thirteenth FoIs (also referred to as traces of occupation) (see Maps 9.3.5-B and 9.3.5-C in Appendix 6.26). Of these fifteenth AOPs identified only two were subject to subsurface testing during the 2022 field program (AOPs 40 and 41). While AOP 41 yield negative result, AOP 40 was positive for surface and subsurface lithic as well as an FoI consisting of some fire cracked rocks associated with a small hearth – *ishkutehkaan.* Following reporting of the finds, the MCC attributed the following Borden number to the newly identified archaeological site, DkGj-5, making it a protected site under the "*Loi sur le Patrimoine Culturel du Québec*". In addition, one isolated surface find was recovered on the beach along the Bell River. The find consists of a small, chipped pebble recovered at the foot of an eroded bank adjacent to a level terrace (AOP 26). Following reporting of the finds, the MCC did not attributed a Borden number, but did attribute a “zone of archaeological interest”[4] to the area surrounding site 22-Stantec-MB-07.

Details concerning the AOPs and the FoIs recorded during the 2022 field program are listed in Table 9.3-4 and Table 9.3-5 below.

The archaeological potential observed during the 2022 field program along the Bell River was reflective of the potential modelling predictive tool. Small adjustments were made to the model based on field work results to improve its effectiveness.

Table 9.3-4 Bell River, Trapline W13, Areas of Archaeological Potential Recorded in 2022 for the potential BDH railway corridor

AOP Name	Mapbook Page	Model Ranking*	Description, Topography, Vegetation	Tested (Y/N)**
AOP 23	9.3.5-B	Moderate	Elevated, level to gently undulating terrain with a west facing aspect, overlooking some rapids on the Bell River. Canopy of balsam fir, spruce, and poplar, with a ground cover of moss and the odd bunch berries. Evidence of rabbits’ presence was observed.	N
AOP 24	9.3.5-B	High	Elevated, level, well-drained terrace with a well-defined edge and a south-southwest facing aspect overlooking the Bell River. Canopy of balsam fir, odd poplar and spruce trees, and a ground cover of moss and some bunch berries.	N
AOP 25	9.3.5-C	High	Elevated, level, well-drained terrace with a well-defined edge and a west facing aspect overlooking a small quiet bay of the Bell River. Canopy of balsam fir, poplar and birch, and ground covers of bunch berries and moss.	N
AOP 26	9.3.5-C	High	Elevated, level, moderately drained terrace with a southwest facing aspect overlooking the low-lying marsh area along the Bell River. Canopy of balsam fir, poplar and birch, and ground covers of bunch berries and moss. Tin cans and glass jars were recorded at this test location, suggesting recent past occupation.	N
AOP 27	9.3.5-C	High	Elevated, relatively level, with gently undulating areas, moderately well-drained terrace. Southwest facing aspect overlooking the Bell River. Canopy of balsam fir and a ground cover of moss, and mushrooms.	N
AOP 40 DkGj-5	9.3.5-C, 9.3.7-2 and 9.3.8-2	High	Elevated, level, well-drained terrace with a well-defined edge and a southwest facing aspect overlooking the Bell River. Canopy of balsam fir, poplar and birch, and ground covers of bunch berries and moss. Nineteenth shovel tests were excavated at this location. Three tests yielded positive results for a subsurface archeological component. One flake, one piece of shatter, and some fire crack rocks associated with a small hearth -- *ishkutehkaan* were identified during testing of portion of the landform. In addition, one surface find was recovered along the shoreline below the point of land. The surface find consists of an hammerstone.	Y (19)

[4] Zone d'information archéologique (ZIA), Ministère de la Culture et des Communications du Québec

AOP Name	Mapbook Page	Model Ranking*	Description, Topography, Vegetation	Tested (Y/N)**
			Borden number DkGj-5 has been given to this site by the MCC following reporting of the finds. See Site Discussion section 9.3.5.1.2 for details, photos, and figures.	
AOP 41	9.3.5-C	High	Elevated, relatively level, moderately drained terrace with a west facing aspect overlooking a low-lying marsh area along the Bell River. Canopy of poplar and the odd birch trees, and ground covers of bunch berries and moss. Twenty-four shovel tests were excavated, all negative for cultural material.	Y (24)
AOP 64	9.3.5-B	High	Elevated, level to gently undulating terrain with a southeast facing aspect, overlooking the Bell River, near a rapids section. Canopy of balsam fir, and poplar, with a ground cover of moss and bunch berries.	N
AOP 68	9.3.5-B	High to moderate	Elevated, gently undulating, and somewhat undifferentiated terrain but worth some exploratory testing. Northeast facing aspect, overlooking the Bell River. Balsam fir, juvenile's trees, with a ground cover of moss and some bunch berries. Evidence of selective logging for firewood were observed suggesting trace of occupation in recent past.	N
AOP 69	9.3.5-B	High	Elevated, gently undulating, and somewhat undifferentiated terrain but worth some exploratory testing. Northwest facing aspect, overlooking the Bell River. Poplar and balsam fir, both juvenile's trees, with a ground cover of moss and bunch berries.	N
AOP 70	9.3.5-C	High	Elevated, relatively level, moderately well-drained terrace. Southwest facing aspect overlooking the Bell River. Canopy of balsam fir and a ground cover of moss.	N
AOP 71	9.3.5-C	High	Elevated, relatively level, moderately well-drained terrace. Southwest facing aspect overlooking the Bell River. Canopy of balsam fir and a ground cover of moss. A homemade barrel stove was recorded at this test location, evidence of recent past occupation nearby.	N
AOP 72	9.3.5-C	High	Elevated, relatively level, moderately well-drained terrace. Southwest facing aspect overlooking the Bell River. Canopy of balsam fir and a ground cover of moss, and mushrooms. Pieces of plywood and tin sheets, a metal bucket, and a snow shovel were recorded, as well as a storage structure –taashipitaakin; both evidence of recent past occupation.	N
AOP 73	9.3.5-C	High	Elevated, level, well-drained terrace with a well-defined edge and a southwest facing aspect overlooking the Bell River. Canopy of balsam fir, poplar and birch, and ground covers of bunch berries and moss.	N
AOP n/a (FoIs 27-28-29)	9.3.5-C	High	Elevated, level, well-drained terrace with a southwest facing aspect overlooking the Bell River. Canopy of balsam fir and poplar, and a ground cover of moss. A older Cree camp (~ 1980s perhaps?) was recorded. Three cabins were recorded as well as their associated historical belongings (bed frames, chairs, bottles, etc.).	N

*GIS model ranking (low, moderate, high) at time of survey between August to October 2022.
**If the landform was tested, the number in bracket is indicating the numbers of shovel tests excavated at this location.

Table 9.3-5 Bell River, Trapline W13, Features of Interest (Traces of Occupation) Recorded in 2022 for the potential BDH railway corridor

FoI Type	FoI Number	Mapbook Page	Model Ranking*	Description
Hide processing activities	23	9.3.5-B	Moderate	Cree participants indicated some of these standing dead trees (punky wood) may be good to harvest to use during hide processing related activities, to provide an even coloring of the hides.
Fishing activities	24	9.3.5-B	Moderate	Cree participants indicated this area may be a good place for fishing.
Wood cutting	25, 26	9.3.5-B, 9.3.5-C	Moderate	Harvesting area for firewood, selective logging. The area was recorded as traces of past occupation.
Historical belongings	27, 28	9.3.5-C	High	Historical belongings such as tin cans and glass jars were recorded as traces of past occupation (Photo 9.3.3).
Cree camp (post-1970s)	29	9.3.5-C	High	Cree camp: three collapsed cabins (plywood and canvas frames) and associated historical belongings' such as bed frames, chairs, ceramic dishes, etc. were recorded (Photo 9.3.4).
Taashipitaakin, storage structure	30	9.3.5-C	High	Taashipitaakin, storage structure. This one is in poor condition (Photo 9.3.1). This type of Cree structure is usually associated with winter lodge. Georgekish (1996:51) mentions that "this type of structure is used to deposit belongings and other valuable possessions when people are moving to another camp. It is used in both summer and winter."
Tin sheets & plywood	31	9.3.5-C	High	Some sheets of tin and some of plywood, likelihood of a remnant camp nearby, were recorded as traces of past occupation.
Homemade stove	31	9.3.5-C	High	Old gasoline barrel modified to be used as a stove (Photo 9.3.2). Cree participants and the ACI archaeologist mentioned this is typical of the Cree camps, especially during the second half of the 20th century. This stove was recorded as trace of past occupation.
Goose hunting	32	9.3.5-C	High	Cree participants informed of the area being a good place for goose hunting. During our field visit, some geese were feeding in the intertidal area.
Cache, storage	33	9.3.5-C	Moderate	A small island near the eastern shoreline of the Bell River. Cree participants and the ACI archaeologist mentioned such small island were used at times in the past to store goods and food.
Fire crack rocks -- *ishkutehkaan*	34	9.3.5.1-1B, 9.3.8-2	High	Fire crack rocks associated with a small hearth -- *ishkutehkaan* identified during testing of portion of the landform AOP 40/ DkGj-5**.**

*GIS model ranking (low, moderate, high) at time of survey between August to October 2022


Photo 9.3.1 FoI 30 Taashipitaakin, storage structure


Photo 9.3.2 FoI 31 Homemade stove


Photo 9.3.3 FoI 27 Historical Belongings


Photo 9.3.4 FoI 29 Post-1970s Cree camp: a collapsed cabin

9.3.4.8.2 Lake Matagami -sector of the Bay Dunlop (located west of Lake Gouin), --HUM Cree Trapline W13

The Lake Matagami -sector Bay Dunlop, is also within the southern reaches of the potential BDH railway corridor. The area is on the southern shore of the Lake Matagami. No pedestrian survey was completed due to private housing development, but a drive by allowed the crew to acknowledge potential in this area (Table 9.3-6). Field work is recommended if future development(s) proposed to impact the area.

Table 9.3-6 Lake Matagami -sector Bay Dunlop, Trapline W13, Area of Archaeological Potential Recorded in 2022 for the Potential BDH Railway Corridor

AOP Name	Mapbook Page	Model Ranking*	Description, Topography, Vegetation	Tested (Y/N)**
AOP 77	n/a	Moderate to high	No pedestrian survey completed due to private housing development, but a drive by allowed the crew to acknowledge potential in this area. Field work is recommended if future development(s) proposed to impact the area.	N

*GIS model ranking (low, moderate, high) at time of survey between August to October 2022.
**If the landform was tested, the number in bracket is indicating the numbers of shovel tests excavated at this location.

9.3.4.8.3 Lake Matagami -sector Campground KM 37, --HUM Cree Trapline W13

The Lake Matagami -sector Campground KM 37, is within the southern portion of the potential BDH railway corridor. The examined area is on the south shore of the Lake Matagami and is bound to the east by the Waswanipi River and to the west and south by a mix of raised and level landforms, as well as sloping, undifferentiated, low-lying, and moderately to poorly drained terrain with some relic or seasonal drainages bisecting the area (Photo 9.3.5) The Lake Matagami KM 37 campground is on the southern end of the examined area. Numerous construction (cabins, boat ramp, test area, access roads and trails, parking lots, etc.) associated with the Lake Matagami KM 37 campground have disturbed the landscape and the environment. The vegetation across the area examined is typical for the region and includes balsam firs, spruces, aspen and birch, as well as blueberries, Labrador tea, sheep laurel (*Kalmia angustifolia*) and various types of moss.

Assessment in 2022 of the Lake Matagami -sector KM 37 campground resulted in the identification of three AOPs (see Map 9.3.5-D in Appendix 6.26). In addition, two known archaeological sites were revisited (DlGh-1 and DlGh-3). Conditions for both sites are good, with no recent disturbances noted. None of the three AOPs identified in 2022 were tested. No FoIs were recorded in this area.

Details concerning the three AOPs recorded, and the two known archaeological sites revisited during the 2022 field program are listed in Table 9.3-7 below.

The archaeological potential observed during the 2022 field program along the Lake Matagami was reflective of the modelling predictive tool potential. Small adjustments were made to the model based on field work results to improve its effectiveness.

Table 9.3-7 Lake Matagami -sector Campground KM 37, Trapline W13, Areas of Archaeological Potential Recorded in 2022 for the Potential BDH Railway Corridor

AOP Name	Mapbook Page	Model Ranking*	Description, Topography, Vegetation	Tested (Y/N)**
AOP 75	9.3.5-D	Moderate to high	Elevated, level, well-drained terrace with a well-defined edge, and a southwest facing aspect overlooking Matagami Lake and associated sandy beach. Canopy of balsam fir, birch trees, and alder, and a ground cover of moss, and bunch berries. Previous disturbances associated to the Matagami campground (path, outbuildings, and stairs)	N
AOP 28	9.3.5-D	High	Elevated, level, moderately to well-drained terrace with a southwest facing aspect overlooking Matagami Lake and associated sandy beach (Photo 9.3.5). Canopy of balsam fir, birch trees, and alder, and a ground cover of moss, fern, and bunch berries.	N
AOP 29	9.3.5-D	Moderate to high	Elevated, level to gently undulating terrain, well-drained terrace with a well-defined edge and a southeast facing aspect overlooking the mouth of the Waswanipi River and Matagami Lake (Photo 9.3.6). Canopy of balsam fir, birch trees, and the odd poplar, and a ground cover of moss, clubmoss, and some bunch berries. Evidence of selective logging for firewood were observed suggesting trace of occupation in recent past. Evidence of rabbits' presence was also observed.	N
DlGh-1	9.3.5-D	High	Site revisit. Site is in good condition, no sign of recent disturbance, no sign of vandalism. Surface inspection completed: no cultural material identified.	N
DlGh-3	9.3.5-D	High	Site revisit. Site is in good condition, no sign of recent disturbance, no sign of vandalism. Surface inspection completed: no cultural material identified.	N

*GIS model ranking (low, moderate, high) at time of survey between August to October 2022.
**If the landform was tested, the number in bracket is indicating the numbers of shovel tests excavated at this location.


Photo 9.3.5 AOP 28 to north


Photo 9.3.6 AOP 29 to south-southwest

9.3.4.8.4 Riviere Waswanipi – sector Lake Matagami, --HUM Cree Trapline W01

The Waswanipi River is within the southern portion of the potential BDH railway corridor. The area examined in 2022 is on the east shore of the Waswanipi River. The area examined is bound to the north by Lake Matagami and to the east and south by a combination of raised and level landforms, as well as sloping, undifferentiated, low-lying, and moderately to poorly drained terrain with some relic or seasonal drainages bisecting the surveyed area (see Map 9.3.5-D in Appendix 6.26). Existing paved roads and access roads, as well as snowmobile trails crossing the area examined were observed. In addition, some contemporary Cree camps were noted. The vegetation across the area examined is typical for the region and includes balsam firs, spruces, aspen and birch, as well as blueberries, Labrador tea, sheep laurel (*Kalmia angustifolia*) and moss.

Assessment in 2022 of the Waswanipi River -sector Lake Matagami resulted in the identification of nine AOPs, and eight FoIs (also referred to as traces of occupation) (see Map 9.3.5-D in Appendix 6.26) Of these eight AOPs identified two were subject to subsurface testing during the 2022 field program (AOPs 43 and 55). All subsurface tests excavated within AOP 43 and AOP 55 were negative for cultural material. One isolated surface find was recovered on a sandy beach along the Waswanipi River near its confluence with Lake Matagami. The surface find consists of a single end scraper made of Hudson Bay Lowland chert. Following reporting of the finds, the MCC did not attributed a Borden number, but did attribute a “zone of archaeological interest” to the area surrounding site 22-Stantec-MB-03.

Details concerning the AOPs and the FoIs recorded during the 2022 field program are listed in Table 9.3-8 and Table 9.3-9 below.

The archaeological potential observed during the 2022 field program along the Waswanipi River -sector Lake Matagami was reflective of the modelling predictive tool potential. Small adjustments were made to the model based on field work results to improve its effectiveness.

Table 9.3-8 Waswanipi River -sector Lake Matagami, Trapline W01, Areas of Archaeological Potential Recorded in 2022 for the Potential BDH Railway Corridor

AOP Name	Mapbook Page	Model Ranking*	Description, Topography, Vegetation	Tested (Y/N)**
AOP 19	9.3.5-D	High	Relatively level, well-drained terrace with a southeast facing aspect overlooking the Waswanipi River (Photo 9.3.7). The area is sheltered from the winds and located at the foot of a hill (to the north). Canopy of balsam fir, and a ground cover of moss.	N
AOP 30	9.3.5-D	High	Level to gently undulating, moderately to well-drained terrace with a south facing aspect overlooking the Waswanipi River. Canopy of balsam fir, and a ground cover of moss.	N
AOP 31	9.3.5-D	Moderate to high	Elevated, level, well-drained terrace with a well-defined edge, and a west facing aspect overlooking the mouth of the Waswanipi River and Matagami Lake (Photo 9.3.8). Canopy of balsam fir, birch trees, and alder, and a ground cover of grass and moss. Previous disturbances associated with the housing development on this terrace were observed.	N
AOPs 43 and 55	9.3.5-D	High	Elevated, level, well-drained terrace with a well-defined edge, and a south-southeast facing aspect overlooking the Waswanipi River. Canopy of mature balsam fir, maple, birch, poplar trees, and the odd black spruce, and a ground cover of moss, bunch berries, blueberries, raspberries. Disturbances from of a modern Cree camp along the edge of the landform was noted. Testing occurred in the northern and western portions of the landform which were relatively intact.	Y (16)

AOP Name	Mapbook Page	Model Ranking*	Description, Topography, Vegetation	Tested (Y/N)**
AOP 44	9.3.5-D	High	Elevated ridge oriented north-south, relatively level with a south facing aspect overlooking the Waswanipi River to the south and a small low-lying poorly drained area to the west. Canopy of balsam fir, birch and poplar trees, and a ground cover of moss and bunch berries.	**N**
AOP 45	9.3.5-D	Moderate	Elevated, level, well-drained point of land with a south facing aspect overlooking the Waswanipi River. Canopy of balsam fir, birch and poplar trees, and a ground cover of moss, and bunch berries.	N
AOP 56	9.3.5-D	High	Elevated, level to gently undulating, moderately to well-drained terrace with a west facing aspect overlooking the Waswanipi River. Canopy of balsam fir, and a ground cover of moss. Numerous historical belongings were recorded in proximity to AOP 43, as well as a 1970s *Tâkwâchistaaukamikw* (a winter log cabin), and a modern Cree camp.	N
22-Stantec-MB-03	9.3.5-D, 9.3.5.1-1C and 9.3.8-3	High	Sandy beach shoreline. No defined landform. An isolated find, consisting of one Hudson Bay Lowland chert end scraper, was recovered on the surface of the beach during pedestrian survey. See Site Discussion section 9.3.5.1.3 for details, photos, and figures.	N

*GIS model ranking (low, moderate, high) at time of survey between August to October 2022.
**If the landform was tested, the number in bracket is indicating the numbers of shovel tests excavated at this location.

Table 9.3-9 Waswanipi River -sector Lake Matagami, Trapline W01, Features of Interest (Traces of Occupation) Recorded in 2022 for the Potential BDH Railway Corridor

FoI Type	FoI Number	Mapbook Page	Model Ranking*	Description
Modern Cree Camp (post-1970s)	37-38	9.3.5-D	High	Contemporary Cree camp. Two cabins, and associated features such as a tipi kitchen, hide processing area, racks to store and dry the fishing nets, an area to pluck grouse and quail, and a few second half of the 20th century middens (detritus dumped). Currently used by family members.
Historical Belongings	39	9.3.5-D	High	Historical belongings' such as' such as tin cans and glass jars were recorded as traces of past occupation (Photo 9.3.10).
Modern Cree Camp (post-1970s)	39	9.3.5-D	High	Contemporary Cree camp. One cabin. Currently used by family members.
Fire Modified Rocks	40	9.3.5-D	High	Remnant of a small hearth (campfire). Concentration of FMR. Observed on the surface of the beach. No date.
Tâkwâchistaaukamikw (Cree winter lodge)	41	9.3.5-D	High	A *Tâkwâchistaaukamikw* is a winter lodge, made of logs stacked horizontally for the bottom half of the cabin, and the upper top is covered with canvas (thick cotton) (Photo 9.3.9). Evidence of chainsaw suggest post-1970s; before then axes were used instead (ACI person. comm. 2022). Near this FoI numerous historical belongings were noted, with the majority suggesting a late 1970s to 1980s occupation.

FoI Type	FoI Number	Mapbook Page	Model Ranking*	Description
Fire Modified Rocks	42	9.3.5-D	High	Remnant of a small hearth --*ishkutehkaan* (campfire). Concentration of FMR. Observed on the surface of the beach underneath a large unrooted spruce tree (deadfall). No date.
Fire Modified Rocks	43	9.3.5-D	High	Concentration of FMR. Observed on the surface of the beach. No date.

*GIS model ranking (low, moderate, high) at time of survey between August to October 2022


Photo 9.3.7 AOP 19 to north


Photo 9.3.8 AOP 31 to southwest


Photo 9.3.9 FoI 41 Tâkwâchistaaukamikw (Cree winter lodge)


Photo 9.3.10 FoI 39 Historical belongings

9.3.4.8.5 River Canet, --HUM Cree Trapline W01

The river Canet is within the southern reaches of the potential BDH railway corridor (see Map 9.3.5-5 in Appendix 6.26). No pedestrian survey was completed due to time constraint, but a drive by and an informal interview with the tallyman for the area (trapline W01) allowed the crew to acknowledge potential in this area (Table 9.3-10). Field work is recommended if future development(s) proposed to disturb areas along the river Canet.

Table 9.3-10 River Canet, Trapline W01, Features of Interest (Traces of Occupation) Recorded in 2022 for the Potential BDH Railway Corridor

FoI Type	FoI Number	Mapbook Page	Model Ranking*	Description
Old Cree Camp (pre-1970s)	44	9.3.5-E	High	Pre James-Bay Road (pre 1970s), now the Billy Diamond Highway, the tallyman informed us during an informal in-field interview that before the construction of the James-Bay Road his family camp was closer to the Riviere Canet. The camp had to move due to road construction and the footings for the Riviere Canet bridge.
Modern Cree Camp (post-1970s)	45	9.3.5-E	High to moderate	Modern Cree camp of Tallyman Trapline W01 (Waswanipi). The camp is on the north side of the Canet River. The tallyman indicated to us during an informal discussion that his family has been hunting in the area.

*GIS model ranking (low, moderate, high) at time of survey between August to October 2022

9.3.4.8.6 Waswanipi River between Lake Olga and Lake aux Goélands, --HUM Cree Trapline W01

The Waswanipi River is within the southern portion of the potential BDH railway corridor. The north shore of the Waswanipi River, between Lake Olga and Lake aux Goélands, was examined in 2022. General terrain consists of a combination of raised and well-defined level landforms with south facing aspect, as well as sloping, undifferentiated, low-lying, and moderately to poorly drained terrain with some relic or seasonal drainages bisecting the examined area (see Map 9.3.5-F in Appendix 6.26). A campground and its associated access road and parking lot, as well as a boat ramp were observed within the examined area. The vegetation across the area examined is typical for the region and includes balsam firs, spruces, jack pines, aspen and birch, as well as blueberries, Labrador tea, sheep laurel (*Kalmia angustifolia*) and a variety of mosses.

Assessment in 2022 of the Waswanipi River between Lake Olga and Lake aux Goélands resulted in the identification of nine AOPs, and six FoIs (also referred to as traces of occupation) (see Map 9.3.5-F in Appendix 6.26). None of these AOPs identified were subjected to subsurface testing during the 2022 field program.

During surface inspection of an unnamed watercourse bank three scrapers, and one flake were recovered. These finds likely come from the on-going erosion of the adjacent terrace (AOP 48). The surface finds were collected due to the risk of being submerged and displaced. Following reporting of the finds, the MCC attributed the following Borden number to the newly identified archaeological site, DlGg-1, making it a protected site under the "*Loi sur le Patrimoine Culturel du Québec*". See Site Discussion section 9.3.5.1 for details, photos, and figures.

Details concerning the AOPs and the FoIs recorded during the 2022 field program are listed in Table 9.3-11 and Table 9.3-12 below.

The archaeological potential observed during the 2022 field program along the Waswanipi River between Lakes Olga and aux Goélands did not match well the results of the modelling predictive tool potential. The landforms recorded and the newly identified archaeological (lithic, precontact) site were determined in the field to have high archaeological potential. Several adjustments have been made since to the model based on field work results and the predictive modelling tool now reflect the high potential of this area.

Table 9.3-11 Waswanipi River between Lake Olga and Lake aux Goélands, Trapline W01, Areas of Archaeological Potential Recorded in 2022 for the Potential BDH Railway Corridor

AOP Name	Mapbook Page	Model Ranking*	Description, Topography, Vegetation	Tested (Y/N)**
AOP 48 (DlGg-1)	9.3.5-F, 9.3.7-1 and 9.3.8-1	Moderate	Elevated, level, well-drained intact terrace with mature trees and a thick litter mat. West facing aspect overlooking an unnamed watercourse flowing downstream to the Waswanipi River. Canopy of balsam fir, and jack pine, and a ground cover of moss. Two scrapers, one retouched flake, and one flake were recovered during surface inspection of the watercourse bank, likely from on-going erosion of the adjacent landform. The surface finds were collected due to the risk of being submerged and displaced. Borden number DlGg-1 has been given to this site by the MCC following reporting of the finds. See Site Discussion section 9.3.5.1.1 for details, photos, and figures.	N
AOP 49	9.3.5-F	Moderate	Elevated, level, well-drained point of land with a south facing aspect overlooking an unnamed watercourse flowing downstream to the Waswanipi River (Photo 9.3.12). Canopy of balsam fir, and jack pine, and a ground cover of moss.	N
AOP 50	9.3.5-F	Moderate to low	Small, contained, level bench at the foot of a steep slope to the north and a well-defined edge to the south. Canopy of balsam fir, and a ground cover of moss.	N
AOP 53	9.3.5-F	Moderate	Relatively level to gently undulating, well-drained terrace with a south-southwest facing aspect overlooking the Waswanipi River. Canopy of balsam fir, and a ground cover of moss. The southern portion of the terrace has been heavily impacted by previous development (access road to the boat ramp). Additional disturbances, trees clearing were also noted on the portion of the landform remaining.	N
AOP 54	9.3.5-F	Moderate	Relatively level to gently undulating, well-drained terrace with a south facing aspect overlooking the Waswanipi River. Canopy of balsam fir, and jack pine, and a ground cover of moss.	N
AOP 57	9.3.5-F	Moderate	Elevated, level, well-drained intact terrace with a well-defined edge and mature trees canopy and a thick litter mat (Photo 9.3.11). Southwest facing aspect overlooking the confluence of unnamed watercourse and the Waswanipi River. Canopy of white spruce, jack pine, balsam fir, black poplar, and birch, with a ground cover of moss.	N
AOP 62	9.3.5-F	Moderate	Micro topography, small, barely there but gently raised (0.5 m) point-type landform. Likely forming from the sand blowing and cumulating at the foot of the hillside located to the north. This micro topographic landform is likely made of recent fluvial and aeolian deposits from its proximity to the Waswanipi River and the wind corridor effect. Some level of exploratory testing is recommended due to geographic context, along a major well-documented travel corridor.	N
AOP 63	9.3.5-F	Moderate to low	Small, contained, level bench at the foot of a steep slope. Canopy of balsam fir, and a ground cover of moss.	N

AOP Name	Mapbook Page	Model Ranking*	Description, Topography, Vegetation	Tested (Y/N)**
AOP 74	9.3.5-F	Moderate	Relatively level to gently undulating, moderately to well-drained ridge with a south facing aspect overlooking the Waswanipi River. Canopy of balsam fir, and a ground cover of moss.	N

*GIS model ranking (low, moderate, high) at time of survey between August to October 2022.
**If the landform was tested, the number in bracket is indicating the numbers of shovel tests excavated at this location. Outside of our permitted area. Visual inspection and pedestrian survey only.

Table 9.3-12 Waswanipi River between Lake Olga and Lake aux Goélands, Trapline W01, Features of Interest (Traces of Occupation) Recorded in 2022 for the Potential BDH Railway Corridor

FoI Type	FoI Number	Mapbook Page	Model Ranking*	Description
Hunting activities	46	9.3.5-F	Moderate	Cree participants informed of the area being a good place to hunt moose, bear, and goose (Photo 9.3.13). During our field visit, both wolf and moose tracks were observed along the shoreline of the Waswanipi River.
Wood cutting	47	9.3.5-F	Moderate	Harvesting area for firewood, selective logging. The area was recorded as traces of past occupation (Photo 9.3.14).
1920s Cree Camp	48	9.3.5-F	Moderate to low	In-field informal interview with the tallyman for the trapline W01 informed us of the location of his family's cabin up to the 1920s. The cabin was located near today's boat ramp and campground. In-field inspection could not relocate the old camp; no evidence remained.
Fire Modified Rocks	49	9.3.5-F	Moderate	Concentration of FMR. Observed on the surface of the beach. No date.
Wood cutting	50-51	9.3.5-F	Moderate	Harvesting area for firewood, selective logging (axe marks). The height of the cuts suggests winter cutting (standing on snowbank). The area was recorded as traces of past occupation.

*GIS model ranking (low, moderate, high) at time of survey between August to October 2022

Photo 9.3.11 AOP 47 to North

Photo 9.3.12 AOP 49 to North-northeast

Photo 9.3.13 FoI 46 Hunting activities area

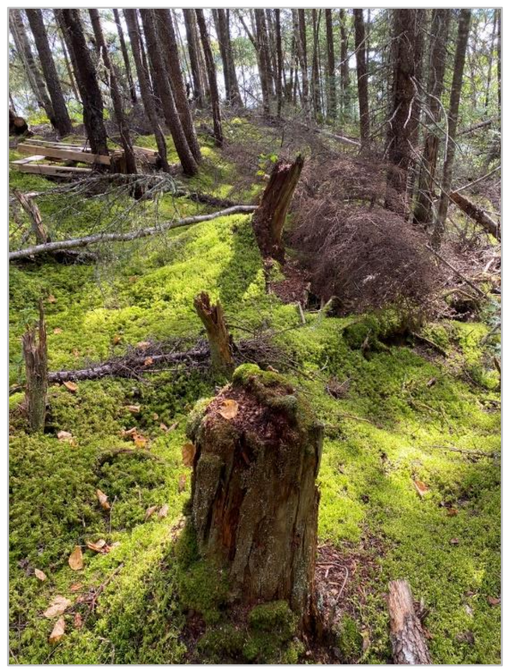


Photo 9.3.14 FoI 47 Wood cutting

9.3.4.8.7 Westcapis Lake, --HUM Cree Trapline W03

The Westcapis Lake is within the southern-central portion of the potential BDH railway corridor. A small portion of the southern end of the lake was examined in 2022. General terrain consists of sloping, undifferentiated, and moderately to poorly drained terrain with some relic or seasonal drainages bisecting the examined area. A few poorly defined landforms were noted (see Map 9.3.5-G in Appendix 6.26). The vegetation across the area surveyed is typical for the region and includes balsam fir, spruces, aspen and the odd birch, as well as blueberries, bunch berries, Labrador tea, sheep laurel (*Kalmia angustifolia*) and a variety of mosses.

Assessment in 2022 of the Westcapis Lake resulted in the identification of one AOP, and three FoIs (also referred to as traces of occupation (see Map 9.3.5-G in Appendix 6.26). All seven subsurface tests excavated within AOP 32 were negative for cultural material.

Details concerning AOP 32 and the three FoIs recorded during the 2022 field program are listed in Table 9.3-13 and Table 9.3-14 below.

The archaeological potential observed during the 2022 field program along the Westcapis Lake was reflective of the predictive modelling tool potential. Small adjustments were made to the model based on field work results to improve its effectiveness.

Table 9.3-13 Westcapis Lake, Trapline W03, Area of Archaeological Potential Recorded in 2022 for the Potential BDH Railway Corridor

AOP Name	Mapbook Page	Model Ranking*	Description, Topography, Vegetation	Tested (Y/N)**
AOP 32	9.3.5-G	Moderate	Relatively level, moderately to well-drained bench with a south-southeast facing aspect overlooking the Westcapis Lake (Photo 9.3.15). Canopy of juvenile poplar tree, and recently formed litter mat. This landform has been previously disturbed by unknown development (from the adjacent large machine trench perhaps aggregate exploration?). Additional disturbances, such as trees clearing, and machine tracks were also noted.	Y (7)

*GIS model ranking (low, moderate, high) at time of survey between August to October 2022.
**If the landform was tested, the number in bracket is indicating the numbers of shovel tests excavated at this location.

Table 9.3-14 Westcapis Lake, Trapline W03, Features of Interest (Traces of Occupation) Recorded in 2022 for the Potential BDH Railway Corridor

FoI Type	FoI Number	Mapbook Page	Model Ranking*	Description
Historical belongings	52	9.3.5-G	Moderate	Historical belongings such as tin cans and glass jars and bottles were recorded as traces of past occupation (Photo 9.3.16).
Cree camp --*maahkii*	52	9.3.5-G	Moderate	A *maahkii* is a fall and/or winter lodge, made of a few logs stacked horizontally for the foundation of the cabin, with the remainder of the structure covered with canvas (thick cotton) (ACI person. comm.). This maahkii is in poor conditions, with only the level footprint and four corners visible within the overgrown vegetation (Photos 9.3.17-9.3.18). Parts of a homemade stove were observed nearby. In-field informal interview with the tallyman for trapline W01 suggest the late Stewart Ottereyes' family had a cabin in this area in the 1980s.
Wood cutting	53	9.3.5-G	Moderate	Harvesting area for firewood, selective logging (axe marks). The height of the cuts suggests winter cutting (standing on snowbank). The area was recorded as traces of past occupation.

*GIS model ranking (low, moderate, high) at time of survey between August to October 2022


Photo 9.3.15 AOP 46 to south-southwest


Photo 9.3.16 Historical belongings near maahkii


Photo 9.3.17 Crew Standing within the remnant maahkii


Photo 9.3.18 Excavated Corner of a Cree camp maahkii

9.3.4.8.8 Lake Katutupisisikanuch, --HUM Cree Trapline N20

The Lake Katutupisisikanuch is within the central portion of the potential BDH railway corridor. A small portion of the southern end of the lake was examined in 2022. General terrain consists of rolling, undifferentiated, and moderately to poorly drained terrain. A few relatively small landforms were noted (see Map 9.3.5-H in Appendix 6.26) . The vegetation across the area examined is typical for the region and includes balsam firs, spruces, and aspen, as well as blueberries, Labrador tea, sheep laurel (*Kalmia angustifolia*), and a variety of mosses.

Examination in 2022 of the Lake Katutupisisikanuch resulted in the identification of three AOPs, and six FoIs (also referred to as traces of occupation) (see Map 9.3.5-H in Appendix 6.26). None of the AOPs were tested in 2022.

Details concerning the AOPs and the FoIs recorded during the 2022 field program are listed in Table 9.3-15 and

Table 9.3-16 below.

In general, the archaeological potential observed during the 2022 field program along the Lake Katutupisisikanuch was reflective of the predictive modelling tool potential. Although, a few FoIs were recorded in areas modelled as low potential. Small adjustments were made to the model to reflect field observations and therefore improve the effectiveness of the predictive modelling tool.

Table 9.3-15 Lake Katutupisisikanuch, Trapline N20, Areas of Archaeological Potential Recorded in 2022 for the Potential BDH Railway Corridor

AOP Name	Mapbook Page	Model Ranking*	Description, Topography, Vegetation	Tested (Y/N)**
AOP 14	9.3.5-H	High	Relatively level, moderately to well-drained terrace with a south facing aspect overlooking the Katutupisisikanuch Lake. Canopy of mixed juvenile and mature balsam firs, and ground cover of moss, club moss, and bunch berries. Evidence of rabbits' presence was observed, and the in-field Cree participant noted the area would be good for rabbit, marten, and squirrel trapping-related activities.	N
AOP 15	9.3.5-H	Moderate	Relatively level, moderately to well-drained terrace with a south facing aspect overlooking the Katutupisisikanuch Lake. Canopy of mixed juvenile and mature balsam fir, spruce, some alder, and ground cover of moss, club moss, and bunch berries. Evidence of rabbits' presences were observed, and the in-field Cree participant noted the area would be good for rabbit, marten, and squirrel trapping-related activities.	N
AOP 16	9.3.5-H	Moderate	Relatively level to gently undulating, moderately to well-drained terrace with a northeast facing aspect overlooking the Katutupisisikanuch Lake. Canopy of mixed juvenile and mature balsam fir, spruce, some alder, and ground cover of moss, club moss, and bunch berries.	N

*GIS model ranking (low, moderate, high) at time of survey between August to October 2022.
**If the landform was tested, the number in bracket is indicating the numbers of shovel tests excavated at this location.

Table 9.3-16 Lake Katutupisisikanuch, Trapline N20, Features of Interest (Traces of Occupation) Recorded in 2022 for the Potential BDH Railway Corridor

FoI Type	FoI Number	Mapbook Page	Model Ranking*	Description
Hunting activities	54, 57	9.3.5-H	High to moderate	Cree participant noted the area would be good for rabbit, marten, and squirrel trapping-related activities.
Historical belongings	55	9.3.5-H	Low	Historical belongings such as tin cans and glass jars and bottles were recorded as traces of past occupation. In addition, some metal scraps, parts of a porcelain toilet, homemade stove parts, and some plywood were also observed.
Taashipitaakin, storage structure	56	9.3.5-H	Low	*Taashipitaakin*, storage structure. This one is in good condition, still in used. At time of field work a snowmobile sled was stored atop (Photo 9.3.19).
Beaver activities	58	9.3.5-H	Moderate	Evidence of trees being chewed/cut by beavers. And a modern (metal) beaver crate was observed (Photo 9.3.20). Cree participants shared it was common to trap beaver alive to move them either due to repopulate area of low beaver density, or because of flooding potential damage to nearby Cree camps.
Modern Cree Camp (post-1970s)	59	9.3.5-H	Moderate	Contemporary Cree camp. Three cabins. Currently used by family members.

*GIS model ranking (low, moderate, high) at time of survey between August to October 2022


Photo 9.3.19 FoI 56 Taashipitaakin, storage structure


Photo 9.3.20 FoI 58 Beaver activities

9.3.4.8.9 Lake Rodayer, --HUM Cree Trapline N05

The Lake Rodayer is within the central to northern portion of the potential BDH railway corridor. A small portion of the eastern shoreline of the lake was examined in 2022. General terrain consists of rolling, undifferentiated, and moderately to poorly drained terrain. Three AOPs were recorded, of which one, AOP 11, had been recently used as a temporary camp (see Map 9.3.5-I in Appendix 6.26). The vegetation across the area examined is typical for the region and includes balsam fir, spruces, and aspen, as well as blueberries, Labrador tea, sheep laurel (*Kalmia angustifolia*) and a variety of mosses.

Examination in 2022 of Lake Rodayer and a nearby unnamed creek resulted in the identification of three AOPs, and seven FoIs (also referred to as traces of occupation) (see Map 9.3.5-I in Appendix 6.26). None of these AOPs were tested in 2022.

Details concerning the AOP and the FoIs recorded during the 2022 field program are listed in Table 9.3-17 and

Table 9.3-18 below.

The archaeological potential observed during the 2022 field program along the shoreline of Lake Rodayer was reflective of the predictive modelling tool potential. Small adjustments were made to the model to reflect field observations and therefore improve the effectiveness of the predictive modelling tool.

Table 9.3-17 Lake Rodayer, Trapline N05, Area of Archaeological Potential Recorded in 2022 for the Potential BDH Railway Corridor

AOP Name	Mapbook Page	Model Ranking*	Description, Topography, Vegetation	Tested (Y/N)**
AOP 11	9.3.5-I	High	Relatively level to gently undulating, moderately to well-drained, so gently elevated, 0.5 m above a narrow sandy beach, shoreline with a west facing aspect overlooking the Lake Rodayer (Photo 9.3.21). Canopy of balsam fir, and poplar trees, and a ground cover of moss and bunch berries. The area was previously cleared for both a camp and a canoe access. Historical belongings suggest recent years occupation to no more than ~20-30 years ago.	N
AOP 12	9.3.5-I	Moderate	Relatively level to gently undulating, moderately to well-drained terrace with a northeast facing aspect overlooking an unnamed creek. Canopy of juvenile balsam fir, juvenile spruce, some alder, and ground cover of moss, and bunch berries.	**N**
AOP 13	9.3.5-I	Moderate	Relatively level to gently undulating, moderately to well-drained terrace with a northeast facing aspect overlooking an unnamed creek. Canopy of juvenile balsam fir, juvenile spruce, some alder, and ground cover of moss, and bunch berries.	**N**

*GIS model ranking (low, moderate, high) at time of survey between August to October 2022.
**If the landform was tested, the number in bracket is indicating the numbers of shovel tests excavated at this location.

Table 9.3-18 Lake Rodayer, Trapline N05, Features of Interest (Traces of Occupation) Recorded in 2022 for the Potential BDH Railway Corridor

FoI Type	FoI Number	Mapbook Page	Model Ranking*	Description
Modern Cree Camp (post-1970s)	60	9.3.5-I	Moderate	Contemporary Cree camp. A few cabins. Currently used by family members.
Canoe run and historical belongings (AOP 11)	61-62	9.3.5-I	High	Small sandy beach. A good area to stop when paddling, traveling in canoes. The area was previously cleared to make an accessible path between the lake and a sheltered camp area (Photo 9.3.22). The area was previously cleared for both a camp and a canoe access. Historical belongings suggest recent years occupation to no more than ~20-30 years ago.
Pedestrian trail	n/a	9.3.5-I	High	Trail following the shoreline of Lake Rodayer. Evidence of clearing to maintain a clear travel path (Photo 9.3.23). The trail starts at the BDH campground and lead to, and end to AOP 11.
Hunting activities	63-64	9.3.5-I	High to moderate	Cree participant noted the area would be good for rabbit, marten, and squirrel trapping-related activities (Photo 9.3.24).
Beaver activities	65	9.3.5-I	Moderate	Beaver dam and lodge.

*GIS model ranking (low, moderate, high) at time of survey between August to October 2022

Photo 9.3.21 AOP 11 to west

Photo 9.3.22 FoI 61 Canoe run to west-northwest

Photo 9.3.23 Pedestrian trail to north

Photo 9.3.24 FoI 64 Potential hunting ground

9.3.4.8.10 Lake Colomb, --HUM Cree Trapline N18B

The Lake Colomb is within the central to northern portion of the potential BDH railway corridor. A small portion of the northeastern shoreline of the lake was examined in 2022. General terrain consists of sloping, undifferentiated, and moderately to poorly drained terrain with some relic or seasonal drainages bisecting the examined area. Two landforms (AOPs) were noted (see Map 9.3.5-J in Appendix 6.26 The vegetation across the area examined is typical for the region and includes balsam fir, spruces, and aspen, as well as blueberries, Labrador tea, sheep laurel (*Kalmia angustifolia*) and a variety of mosses.

Assessment in 2022 of Lake Colomb resulted in the identification of two AOPs, and nine FoIs (also referred to as traces of occupation) (see Map 9.3.5-J in Appendix 6.26). None of these AOPs were tested in 2022.

Details concerning the AOPs and the FoIs recorded lpduring the 2022 field program are listed in Table 9.3-19 and Table 9.3-20 below.

The archaeological potential observed during the 2022 field program along the Lake Colomb was reflective of the predictive modelling tool potential. Small adjustments were made to the model to reflect field observations and therefore improve the effectiveness of the predictive modelling tool.

Table 9.3-19 Lake Colomb, Trapline N18B, Areas of Archaeological Potential Recorded in 2022 for the Potential BDH Railway Corridor

AOP Name	Mapbook Page	Model Ranking*	Description, Topography, Vegetation	Tested (Y/N)**
AOP 09	9.3.5-J	Moderate	Relatively level, moderately to well-drained, well-defined, and elevated terrace with a north facing aspect overlooking Lake Colomb. Canopy of balsam fir, and odd spruce, some willows, and ground cover of moss.	N
AOP 10	9.3.5-J	Moderate to high	Relatively level to gently undulating, moderately to well-drained terrace with a north-northwest facing aspect overlooking Lake Colomb (Photo 9.3.25). Canopy of balsam fir, and odd spruce, some alder, and ground cover of moss, and mushrooms. Evidence of rabbits' presence was observed. And a canoe ramp and two fibreglass canoes (in good conditions) were noted in the eastern portion of this AOP, supporting recent used of the surrounding area.	N

*GIS model ranking (low, moderate, high) at time of survey between August to October 2022.
**If the landform was tested, the number in bracket is indicating the numbers of shovel tests excavated at this location.

Table 9.3-20 Lake Colomb, Trapline N18B, Features of Interest (Traces of Occupation) Recorded in 2022 for the Potential BDH Railway Corridor

FoI Type	FoI Number	Mapbook Page	Model Ranking*	Description
Modern Cree Camp (post-1970s)	66	9.3.5-J	High	Contemporary Cree camp. A few cabins. Currently used by family members.
Cree Camp (post-1970s)	67 to 71	9.3.5-J	High to moderate	Cree camp. One small cabin, a cellar, two outhouses, as well as two footprints for tent frames were recorded. No historical belongings observed, it appears the camp has been stripped of all belongings. Only the structures remain.
Beaver activities	72	9.3.5-J	Moderate	Evidence of trees being chewed/cut by beavers.
Canoe (boat)	73	9.3.5-J	High	Two fibreglass canoes, both in good condition.
Canoe ramp	74	9.3.5-J	High	A skid ramp made of same size logs to create an access, perpendicular, to the lake (Photo 9.3.26). In relatively good condition.

*GIS model ranking (low, moderate, high) at time of survey between August to October 2022

Photo 9.3.25 AOP 10 to north-northeast

Photo 9.3.26 FoI 74 Canoe ramp to north

9.3.4.8.11 Broadback River, --HUM Cree Trapline N23

The Broadback River runs roughly east to west and is within the northern reaches of the potential BDH railway corridor. The area examined on the south side of the river consisted of rock cliffs and steep sloping terrain, and the north side of the river was characterized by a series of terraces and sloping and undifferentiated terrain with numerous relic or seasonal drainages bisecting the north shore (see Map 9.3.5-K in Appendix 6.26). The only disturbances noted were associated with the construction of the Billy Diamond Highway and its associated bridge and rest/campground area. The vegetation across the area surveyed is typical for the region and includes balsam fir, spruces, aspen and birch, as well as blueberries, Labrador tea, sheep laurel (*Kalmia angustifolia*), *Cladonia rangiferina,* and a variety of mosses.

Assessment in 2022 of the Broadback River resulted in the identification of five AOPs, and sixteenth FoIs (also referred to as traces of occupation) (see Map 9.3.5 in Appendix 6.26) . Of these five AOPs identified only one was subject to subsurface testing during the 2022 field program (AOP 18a). AOP 18a yield negative result for cultural material.

Details concerning the AOPs and the FoIs recorded during the 2022 field program are listed in Table 9.3-21 and Table 9.3-22 below.

The archaeological potential observed during the 2022 field program along the Broadback River was reflective of the predictive modelling tool potential. Small adjustments were made to the model to reflect field observations (palaeo shoreline) and therefore improve the effectiveness of the predictive modelling tool.

Table 9.3-21 Broadback River, Trapline N23, Areas of Archaeological Potential Recorded in 2022 for the Potential BDH Railway Corridor

AOP Name	Mapbook Page	Model Ranking*	Description, Topography, Vegetation	Tested (Y/N)**
AOP 08	9.3.5-K	Moderate	Small contained and elevated bench, relatively level, moderately drained with a north facing aspect overlooking the Broadback River. Canopy of spruce and balsam fir, and ground cover of moss. Previous disturbances from the construction of the bridge and the highway were noted. Although the landform has seen some level of disturbances, it may be worth excavating a few tests to assess the subsurface component for presence/absence of intact sediments and/or artifacts.	N
AOP 17	9.3.5-K	Moderate	Elevated, palaeo shoreline, relatively level, gently sloping (3-5 degrees) trending north to south, moderately drained terrace with a south facing aspect overlooking the Broadback River (Photo 9.3.27). Canopy of spruce, with the odd tamarack and balsam fir, and ground cover of moss, *Cladonia rangiferina* and blueberries.	N
AOPs 18a and 18b	9.3.5-K	Moderate	Elevated, palaeo shoreline, relatively level, moderately to well-drained terrace with a south facing aspect overlooking the Broadback River. Canopy of mostly juvenile spruce, and the odd tamarack, poplar, and balsam fir, and ground cover of moss and blueberries. Previous disturbances were observed; clearing and levelling (ground exposure), remnant of an older camp (1980-1990s?), and an ATV trail were recorded.	18a Y (11), and 18b N
AOP 22	9.3.5-K	Moderate	Elevated, relatively level to gently undulating, moderately to well-drained terrace with a south facing aspect overlooking the Broadback River. Canopy of mostly juvenile spruce, and poplar and ground cover of moss and blueberries.	N

*GIS model ranking (low, moderate, high) at time of survey between August to October 2022.
**If the landform was tested, the number in bracket is indicating the numbers of shovel tests excavated at this location.

Table 9.3-22 Broadback River, Trapline N23, Features of Interest (Traces of Occupation) Recorded in 2022 for the Potential BDH Railway Corridor

FoI Type	FoI Number	Mapbook Page	Model Ranking*	Description
Fishing activities	76, 78, 82, 83, 84, 91	9.3.5-K	High to moderate	Cree participants indicated these areas may be good places for fishing and scooping (Photo 9.3.28).
Tipi	77	9.3.5-K	Moderate	Makeshift shelter, tipi, underneath the Broadback River Bridge. A pack of cigarette and other detritus suggest the tipi was used in recent weeks, or months at most.
Taashipitaakin, storage structure	79	9.3.5-K	Moderate	A *taashipitaakin*, a storage structure, was recorded near the edge of the Broadback River (northern shore), downstream from a rapids section. A fibreglass canoe was stored on the *taashipitaakin.*
Cree camp (post-1970s)	80	9.3.5-K	Moderate	No cabin. The area has been cleared, and historical belongings suggest short-term occupation, perhaps a night, a few at best. The area is adjacent to the *taashipitaakin* and has easy access to the river, downstream from a rapids section.
Canoe run	81	9.3.5-K	Moderate	Small silty beach. A good area to stop when paddling, traveling in canoes. The area was previously cleared and is downstream from a rapids section. At time of field work, three canoes with six persons were having lunch at this location.
Cree camp (post-1970s)	85 to 90	9.3.5-K	Moderate	Cree camp. One small cabin taken apart, with footprint visible and plywood walls stacked beside the footprint. No historical belongings observed, it appears the camp has been stripped of all belongings. This camp is on the upper palaeo terrace.

*GIS model ranking (low, moderate, high) at time of survey between August to October 2022


Photo 9.3.27 AOP 17 to east


Photo 9.3.28 One of many, area good for fishing and scooping along the Broadback River

9.3.4.8.12 Lac du Poisson Blanc, --HUM Cree Trapline N23

The Lac du Poisson Blanc is within the northern portion of the potential BDH railway corridor. A small portion of the southern shoreline of the lake was examined in 2022. General terrain consists of sloping, undifferentiated, and moderately to poorly drained terrain. The vegetation across the area examined is typical for the region and includes spruces and aspen, as well as blueberries, Labrador tea, sheep laurel (*Kalmia angustifolia*) and a variety of mosses.

Assessment in 2022 of lac du Poisson Blanc resulted in the identification of two AOPs, and six FoIs (also referred to as traces of occupation) (see Map 9.3.5-L in Appendix 6.26). None of these AOPs were tested in 2022.

Details concerning the AOPs and the FoIs recorded during the 2022 field program are listed in Table 9.3-23 and

Table 9.3-24 below.

The archaeological potential observed during the 2022 field program along the Lac du Poisson Blanc was reflective of the predictive modelling tool potential. Small adjustments were made to the model to reflect field observations and therefore improve the effectiveness of the predictive modelling tool.

Table 9.3-23 Lac du Poisson Blanc, Trapline N23, Areas of Archaeological Potential Recorded in 2022 for the Potential BDH Railway Corridor

AOP Name	Mapbook Page	Model Ranking*	Description, Topography, Vegetation	Tested (Y/N)**
AOP 06	9.3.5-L	High	Elevated, level, well-drained and well-defined terrace with a northwest facing aspect overlooking the Lac du Poisson Blanc. Canopy of jack pine with the odd spruce, and willows and ground cover of moss and bunch berries. Previous disturbances associated with lake access, clearing and forestry activities, and nearby aggregate pit were observed.	N
AOP 07	9.3.5-L	Moderate	Elevated, relatively level, well-drained terrace with a northwest facing aspect overlooking the Lac du Poisson Blanc. Canopy of jack pine with the odd spruce, and willows and ground cover of moss and bunch berries. Previous disturbances associated with clearing and forestry activities were observed.	N

*GIS model ranking (low, moderate, high) at time of survey between August to October 2022.
**If the landform was tested, the number in bracket is indicating the numbers of shovel tests excavated at this location.

Table 9.3-24 Lac du Poisson Blanc, Trapline N23, Features of Interest (Traces of Occupation) Recorded in 2022 for the Potential BDH Railway Corridor

FoI Name		Mapbook Page	Model Ranking*	Description
Modern Cree Camp (post-1970s)	93	9.3.5-L	High	Contemporary Cree camp. A few cabins. Currently used by family members.
Maahkii, Cree camp (post-1970s)	94	9.3.5-L	High	Cree participant suggested spring-time cabin (*maahkii*) by the style and location. In poor condition (Photo 9.3.29).
Wood cutting	95, 97	9.3.5-L	High	Harvesting area for firewood, selective logging (axe marks). The height of the cuts suggests winter cutting (standing on snowbank). The area was recorded as traces of past occupation.
Canoe run	96	9.3.5-L	High	Small beach. The area was previously cleared to make an accessible path between the lake and an area where evidence of wood cutting was observed (Photo 9.3.30). The gently elevated, relatively level area nearby could have potential for wintering.
Hunting activities	n/a	9.3.5-L	High to moderate	Cree participant noted the area would be good for beaver, rabbit, and marten trapping-related activities.

*GIS model ranking (low, moderate, high) at time of survey between August to October 2022

Photo 9.3.29 : ***Maahkii***, Cree camp to east (post-1970s)

Photo 9.3.30: FoIs 96-97 Canoe run and evidence of firewood harvested during winter time

9.3.4.8.13 Rupert River, --HUM Cree Traplines N23 and R13

In 2022, the south side of the river was the focus of the preliminary archaeological field program. The southern shore is characterized by a series of terraces and sloping and undifferentiated terrain with numerous relic or seasonal drainages bisecting the examined area (see Map 9.3.5-M in Appendix 6.26). Disturbances associated with the construction of the Billy-Diamond Highway, laydown, and maintenance areas, the Rupert River bridge and rest/campground areas were noted. In addition, aggregate pits, a boat ramp, and a network of access roads were observed in the vicinity. A contemporary Cree camp was observed from the southern shoreline located on the north side of the river. The vegetation across the area examined is typical for the region and includes balsam fir, spruces, aspen and the odd birch, as well as blueberries, Labrador tea, sheep laurel (*Kalmia angustifolia*), *Cladonia rangiferina,* and a variety of mosses.

Assessment in 2022 of the Rupert River resulted in the identification of ten AOPs, and nine FoIs (also referred to as traces of occupation) (see Map 9.3.5-M in Appendix 6.26) and confirmed the high archaeological potential of the Rupert River area. Of these ten AOPs identified two were subject to subsurface testing during the 2022 field program (AOPs 01 and 02). Both AOPs yield negative result for cultural material.

Details concerning the AOPs and the FoIs recorded during the 2022 field program are listed in Table 9.3-25 and Table 9.3-26 below.

The archaeological potential observed during the 2022 field program along the Rupert River was reflective of the modelling predictive tool potential. Small adjustments were made to the model to reflect field observations and therefore improve the effectiveness of the predictive modelling tool.

Table 9.3-25 Rupert River, Traplines N23 and R13, Areas of Archaeological Potential Recorded in 2022 for the Potential BDH Railway Corridor

AOP Name	Mapbook Page	Model Ranking*	Description, Topography, Vegetation	Tested (Y/N)**
AOP 01	9.3.5-M	High	Elevated, level, moderately to well-drained terrace with a south facing aspect overlooking the Rupert River (Photo 9.3.31). Canopy of balsam fir and poplar, and ground cover of moss, huckleberry, cranberry, Labrador tea, and bunch berries. A *taashipitaakin*, a storage structure, was recorded near the edge of the landform. A fibreglass canoe was stashed beneath the *taashipitaakin*. Previous disturbances associated with lake access, ATV trail, and selective logging were observed.	Y (13)
AOP 02	9.3.5-M	High	Elevated, level, moderately to well-drained terrace with a south-southwest facing aspect overlooking the Rupert River. Canopy of balsam fir, poplar, and some spruce, and ground cover of moss, huckleberry, and bunch berries. A small hearth -- *ishkutehkaan* (campfire) was recorded on the point of this landform. Testing of the landform yield negative results for lithic and other cultural material. Previous disturbances associated likely with the old James Bay camp at KM 257, and a floatplane/boat access ramp were observed.	Y (14)
AOP 03	9.3.5-M	High	Well-defined, elevated, level, and well-drained terrace with a west facing aspect overlooking the Rupert River. Canopy of balsam fir, birch and poplar, and ground cover of moss, and bunch berries. This landform is south of the *Kaumwakweyuch* Rapids (Oatmeal Rapids). A cleared path connecting the terrace to the river was recorded. Evidence of an older camp were noted. A	N

AOP Name	Mapbook Page	Model Ranking*	Description, Topography, Vegetation	Tested (Y/N)**
			marten trap was recorded nearby. Historical belongings observed suggest recent years occupation to no more than ~20-40 years ago. Evidence of rabbits' presences were observed, and the in-field Cree participant noted the area would be good for rabbit, marten, and squirrel trapping-related activities.	
AOP 04	9.3.5-M	High	Elevated, relatively level, moderately to well-drained terrace with a northwest facing aspect overlooking the Rupert River and a seasonal drainage located to the northeast. Canopy of birch, spruce and poplar, and ground cover of moss, huckleberry, and bunch berries. Evidence of rabbits' presence was observed, and the in-field Cree participant noted the area would be good for rabbit, marten, and squirrel trapping-related activities.	N
AOP 05	9.3.5-M	High	Elevated, relatively level, moderately to well-drained terrace with a northwest facing aspect overlooking the Rupert River. Canopy of juvenile birch, spruce, poplar and alder trees, and ground cover of moss, huckleberry, and bunch berries. Previous disturbances, clearing and levelling activities were observed on portions of the landform, likely from the Rupert Bridge and highway construction. Portions remained relatively intact and would benefit from some testing.	N
AOP 20	9.3.5-M	Moderate	Open, elevated, relatively level, and well-drained terrace (point of land) with a western facing aspect overlooking a calm water bay of the Rupert River. This AOP is southeast of the *Kaumwakweyuch* Rapids (Oatmeal Rapids). Canopy of balsam fir, and ground cover of moss.	N
AOP 21	9.3.5-M	High	Open, elevated, level, and well-drained terrace with a northeast facing aspect overlooking the *Kaumwakweyuch* Rapids (Oatmeal Rapids) of the Rupert River. Canopy of spruce, poplar and willows, and ground cover of moss, and bunch berries. Evidence of rabbits' presence was observed, and the in-field Cree participant noted the area would be good for rabbit, marten, and squirrel trapping-related activities.	N
AOP 34	9.3.5-M	High	Elevated, relatively level, moderately to well-drained terrace with a northwest facing aspect overlooking the Rupert River and a seasonal drainage located to the southwest. Canopy of birch, spruce and poplar, and ground cover of moss, huckleberry, and bunch berries. Evidence of rabbits' presence was observed, and the in-field Cree participant noted the area would be good for rabbit, marten, and squirrel trapping-related activities.	N
AOP 37	9.3.5-M	Moderate	Open, elevated, level with gently undulating portions, and relatively well-drained terrace with a southwest facing aspect overlooking a calm water bay of the Rupert River (Photo 9.3.32). This AOP is southeast of the *Kaumwakweyuch* Rapids (Oatmeal Rapids). Canopy of balsam fir, and ground cover of moss. Portion of a trail (small game?) was noted. Evidence of rabbits' presence was observed, and the in-field Cree participant noted the area would be good for rabbit, marten, and squirrel trapping-related activities.	N
AOP 42	9.3.5-M	Moderate	Elevated, level, moderately to well-drained terrace with a south-southwest facing aspect overlooking the Rupert River. Canopy of balsam fir, poplar, and some spruce, and ground cover of moss, huckleberry, and bunch berries.	**N**

*GIS model ranking (low, moderate, high) at time of survey between August to October 2022.
**If the landform was tested, the number in bracket is indicating the numbers of shovel tests excavated at this location.

Table 9.3-26 Rupert River, Traplines N23 and R13, Features of Interest (Traces of Occupation) Recorded in 2022 for the Potential BDH Railway Corridor

FoI Type	FoI Number	Mapbook Page	Model Ranking*	Description
Round depression	99	9.3.5-M	Moderate	Circular depression, approximately 2 meters in diameter, and 1 meter in depth. No berm observed. Even circular shape. Could be natural (old tree throw) but could also possibly an old cache. Possibly a *waayaauhkihiikin* (cache), as described by Georgekish (1996:55). Further investigation is required to confirm the nature of this FoI.
Taashipitaakin, storage structure	100	9.3.5-M	High	A *taashipitaakin*, a storage structure, with a fibreglass canoe stored beneath the *taashipitaakin* was recorded.
Ishkutehkaan, hearth	101	9.3.5-M	High	A small hearth -- *ishkutehkaan* (fire pit) was recorded on the point of this landform (see AOP 02) (Photo 9.3.33).
Waapishtaaniwinihiichaau, hunting activities	102	9.3.5-M	High	A marten trap – *waapishtaaniwinihiichaau* was recorded (Photo 9.3.34). And the Cree participant noted the area would be good for rabbit and marten trapping-related activities.
Portage	103	9.3.5-M	High	Possibly part of a portage route.
Fishing activities	104	9.3.5-M	High	Cree participants indicated this area may be a good place for fishing.
Hunting activities	105	9.3.5-M	High	Cree participant noted the area would be good for beaver, rabbit, and marten trapping-related activities.
Portage	106	9.3.5-M	n/a	*Kaumwakweyuch* Rapids (Oatmeal Rapids)
Beaver activities	107	9.3.5-M	Low	Beaver dam and lodge.

*GIS model ranking (low, moderate, high) at time of survey between August to October 2022

Photo 9.3.31 AOP 1 to east A fibreglass canoe was stashed

Photo 9.3.32 AOP 19 to east-southeast beneath a taashipitaakin

Photo 9.3.33 FoI 101 A small hearth -- ishkutehkaan feature (AOP 02)

Photo 9.3.34 FoI 102 A marten trap – waapishtaaniwinihiichaau

9.3.4.9 Proposed Second Access Road to Mistissini

9.3.4.9.1 Project Settings

The proposed Project will consist of the construction of a new secondary access road to Mistissini via the Route-du-Nord.

The general area within our modelled corridor for the proposed Second Access Road to Mistissini has high archaeological potential for cultural resources due to several factors. The areas surrounding Mistissini Lake have been the sites of numerous gatherings, trading, and spiritual places for thousands of years. Mistissini Lake was the focal point of numerous north-south and east-west travel routes in Eeyou Istchee. A few archaeological sites, some dating back from a few thousand years, have been documented in the vicinity of Mistissini Lake. Mistissini was the location of an important Hudson Bay trading post. In addition, Waapushukamikw, known as "*la Colline Blanche*" is a protected archaeological site as well as a national historic site. Waapushukamikw is a white quartzite hill that has been used by First Nations for thousands of years as a lithic procurement site. The quarry offers a distinctive fine-grained white quartzite and as a result was the major quarry site for hundreds of kilometers in any direction. To the Mistissini Cree, Waapushukamikw is a place of spiritual significance and a respected place of memory (Canada's Historic Places. 2023).

Previous archaeological studies within the proposed Second Access Road to Mistissini include the location of the old Mistissini Hudson Bay Company post (Pintal 1998, 2005; Roy 2001, 2009). In 2019, Denton (2020) completed an archaeological potential study on the west side of the community of Mistissini bridge. A few studies overlap the south-western portion of the Project along the Route-du-Nord (Arkéos inc., 1993 and 1995). The areas previously surveyed were not resurveyed in 2022 for LGA project. The reminder of the proposed Second Access Road to Mistissini is sparse when it comes to archaeological inventories and impact assessment studies. See the literature review section of this report for details concerning previous archaeological works for the Project. While the 2022 LGA field season focused on areas not surveyed by previous consultants, the data from these previous studies were incorporated in our potential modelling analysis.

The entire proposed secondary access road to Mistissini offer tremendous opportunities to learn more about the area from an archaeological as well as traditional land uses point of view.

9.3.4.10 2022 Field Results

9.3.4.10.1 Bay Penicouane, --HUM Cree Trapline M45A

The southern end of the Bay Penicouane is within the southwestern-end portion of the proposed Second Access Road to Mistissini. A small portion of the southern shoreline of the bay as well as small portions of two unnamed lakes were examined in 2022 (see Map 9.3.6-C and D in Appendix 6.26) General terrain consists of undifferentiated, rolling, and moderately to poorly drained terrain. The vegetation across the area examined is typical for the region and includes spruces, balsam fir, aspen, and the odd birch trees, as well as blueberries, bunch berries, Labrador tea, sheep laurel (*Kalmia angustifolia*) and a variety of mosses.

Examination in 2022 of the southern ends of the Bay Penicouane resulted in the identification of three AOPs, and twelve FoIs (also referred to as traces of occupation) (see Maps 9.3.6-B, C and D in Appendix 6.26). Two of these AOPs were tested in 2022, both yield negative results for pre-contact cultural material.

Details concerning the AOPs and the FoIs recorded during the 2022 field program are listed in Table 9.3-27 and Table 9.3-28 below.

The archaeological potential observed during the 2022 field program along the southern end of the Bay Penicouane was reflective of the predictive modelling tool potential. Small adjustments were made to the model to reflect field observations and therefore improve the effectiveness of the predictive modelling tool.

Table 9.3-27 Bay Penicouane, Trapline M45A, Areas of Archaeological Potential Recorded in 2022 for the proposed Second Access Road to Mistissini

AOP Name	Mapbook Page	Model Ranking*	Description, Topography, Vegetation	Tested (Y/N)**
AOP 65	9.3.6-C	Moderate	Elevated, poorly defined, somewhat level to gently undulating, moderately drained bench with a south facing aspect, but no view and at a distance from an unnamed lake. Spruce and odd poplar, with a ground cover of moss, Labrador tea, blueberries, and cladonia.	Y (14)
AOP 66	9.3.6-C	Moderate	Level, well-drained and well-defined terrace with a northeast facing aspect overlooking an unnamed creek (Photo 9.3.35). Canopy of spruce and poplar, and ground cover of moss, few bunch berries, and some blueberries. Previous disturbances such as structure footprints, levelling and grading are associated with the adjacent contemporary Cree camp were observed.	Y (7)
AOP 67	9.3.6-D	High	Elevated, relatively level to gently undulating, moderately to well-drained terrace and associated lower bench feature with an eastern facing aspect on the bay Penicouane. Spruce and poplar on the outskirt of the landforms, with a ground cover of moss, Labrador tea, blueberries, and cladonia.	N

*GIS model ranking (low, moderate, high) at time of survey between August to October 2022.
**If the landform was tested, the number in bracket is indicating the numbers of shovel tests excavated at this location.

Table 9.3-28 Bay Penicouane, Trapline M45A, Features of Interest (Traces of Occupation) Recorded in 2022 for the proposed Second Access Road to Mistissini

FoI Name		Mapbook Page	Model Ranking*	Description
Goose hunting	01	9.3.6-B	Moderate	Goose hunting ground of one of the Cree participants (Photo 9.3.36). Hunting blinds were visible in the distance.
Wood cutting	02, 04	9.3.6-C	Moderate	Harvesting area for firewood, selective logging (Photo 9.3.38).
Tâkwâchistaaukamikw (Cree winter lodge)	03	9.3.6-C	Moderate	A *Tâkwâchistaaukamikw* was recorded between the unnamed lake and the contemporary Cree camp. Near this *tâkwâchistaaukamikw* numerous historical belongings were noted (beds, chairs, kid clothing, bottles, etc.), with the majority suggesting a 1980s occupation (Photo 9.3.37). This was confirmed with in-field informal interview with the tallyman for trapline M45A. It was the dwelling of Stanley Miscuam's grandfather.
Modern Cree Camp (post-1970s)	05	9.3.6-C	Moderate	Contemporary Cree camp. Seven cabins. Currently used by tallyman and family members for trapline M45A.
Cree Camp (post-1970s)	06	9.3.6-C	Moderate	Remnant of a camp emplacement. No more cabins standing but footprints are visible through the vegetation, and some historical belongings are partially buried in the surrounding area.
Taashipitaakin, storage structure	07	9.3.6-C	Moderate	Remnant of *a taashipitaakin*, storage structure (likely for canoe).
Canoe	08	9.3.6-C	Moderate	One canoe, in good condition.

FoI Name		Mapbook Page	Model Ranking*	Description
Modern Cree Camp (post-1970s)	09, 10, 11, 12	9.3.6-D	High	Contemporary Cree camp. Three cabins, and associated features such as a tipi kitchen (*miichiwaahp*), hide processing area, smokehouse, and racks to store and dry the fishing nets. Currently used by family members of tallyman M45A.

*GIS model ranking (low, moderate, high) at time of survey between August to October 2022

Photo 9.3.35 : AOP 66 to east-northeast

Photo 9.3.36: FoI 01 Goose hunting area

Photo 9.3.37 FoI 03 Historical belongings (kids boot, tablecloth, selective spring mattress)

Photo 9.3.38 FoI 02 Harvesting area for firewood, near tâkwâchistaaukamikw logging.

9.3.4.10.2 Vicinity of Lake Diereville, --HUM Cree Trapline M50

The area examined in the vicinity of Lake Diereville is within the central portion of the proposed Second Access Road to Mistissini. Due to difficulties accessing the central portion of the study area, only a small portion of was examined in 2022 (see Map 9.3.6-E in Appendix 6.26). General terrain consists of undifferentiated, rolling and sloping, and moderately to poorly drained terrain. But a few level and well-drained landforms were observed in the distance. A network of unnamed creeks bisects the area examined in 2022. The vegetation across the area examined is typical for the region and includes spruces, aspen, as well as blueberries, Labrador tea, sheep laurel (*Kalmia angustifolia*) and a variety of mosses.

Assessment resulted in the identification of two FoIs (also referred to as traces of occupation) (see Map 9.3.6-E in Appendix 6.26). No AOPs were recorded.

Details concerning the FoIs recorded during the 2022 field program are listed in Table 9.3-29 below.

The archaeological potential observed during the 2022 field program in the vicinity of Lake Diereville was reflective of the predictive modelling tool potential. Small adjustments were made to the model to reflect field observations and therefore improve the effectiveness of the predictive modelling tool.

Table 9.3-29 Vicinity of Lake, Trapline M50, Diereville Features of Interest (Traces of Occupation) Recorded in 2022 for the proposed Second Access Road to Mistissini

FoI Name		Mapbook Page	Model Ranking*	Description
Wood cutting	13	9.3.6-E	Moderate	Harvesting area for firewood, selective logging (axe marks). The height of the cuts suggests winter cutting (standing on snowbank) (Photo 9.3.39). The area was recorded as traces of past occupation.
Hunting activities	14	9.3.6-E	Low to moderate	Cree participants informed of the area being a good place to hunt moose and bear, as well as small game such as marten and beaver (Photo 9.3.40). During our field visit bear, moose, and wolf tracks were observed along the examined area.

*GIS model ranking (low, moderate, high) at time of survey between August to October 2022

Photo 9.3.39 FoI 13 Harvesting area for firewood.The height of the cuts suggests winter cutting

Photo 9.3.40 FoI 14 Hunting activities area

9.3.4.10.3 Mistissini Lake and River Pipounichouane, --HUM Cree Trapline M50

Mistissini Lake and River Pipounichouane are at the northern end portion of the proposed Second Access Road to Mistissini. A small portion of the Mistissini Lake shoreline, as well as small portions of the river Pipounichouane were examined in 2022 (see Maps 9.3.6-F and G in Appendix 6.26). As mentioned previously, the areas examined in 2019 by Denton (2020) were not reassessed during the 2022 field program for LGA. General terrain consists of undifferentiated, with some rolling and gently sloping sections, and moderately to poorly drained terrain. The vegetation across the area examined is typical for the region and includes spruces, balsam fir, larch, aspen, and the odd birch trees, as well as blueberries, Labrador tea, sheep laurel (*Kalmia angustifolia*), and a variety of mosses such as cladonia.

Assessment in 2022 of small portions of the Mistissini Lake and River Pipounichouane shorelines resulted in the identification of thirteen AOPs, and eight FoIs (also referred to as traces of occupation) (see Map 9.3.6-F and G in Appendix 6.26) . Of these thirteen AOPs identified only two were subject to subsurface testing during the 2022 field program (AOPs 38 and 47). While AOP 38 yielded negative results, AOP 47 was positive for surface and subsurface lithic. Following reporting of the finds, the MCC attributed the following Borden number to the newly identified archaeological site, EcFl-6, making it a protected site under the "*Loi sur le Patrimoine Culturel du Québec*". In addition, one isolated surface find was recovered. The find consists in a metal trap used for trapping/hunting small game. The trap was recovered in the water on some river cobbles along the Pipounichouane River shoreline. There is no landform associated with the trap. Following reporting of the finds, the MCC did not attributed a Borden number, but did attribute a "zone of archaeological interest" to the area surrounding site 22-Stantec-MB-05. Also, one isolated surface find was recovered in a disturbed context: on the surface of a graded gravel-dirt road. The belonging, a Mistissini quartzite multidirectional core, was either imported during the construction/maintenance of the road or displaced from its original context somewhere in the vicinity of the find. Following reporting of the finds, the MCC did not attributed a Borden number, but did attribute a “zone of archaeological interest” to the area surrounding site 22-Stantec-MB-06. See Site Discussion section 9.3.5.2.3 for details, photos, and figures.

Details concerning the AOPs and the FoIs recorded during the 2022 field program are listed in Table 9.3-30 and

Table 9.3-31 below.

The archaeological potential observed during the 2022 field program along portions of the Mistissini Lake and River Pipounichouane shorelines did not match accurately the results of the predictive modelling tool potential. The landforms recorded and the newly identified archaeological site, the traditional land use sites identified and some of the FoIs (traces of occupation) were determined in the field to have high archaeological potential. Several adjustments have been made since to the model based on field work results and the predictive modelling tool now reflects the moderate to high potential of this area.

Table 9.3-30 Mistissini Lake and River Pipounichouane, Trapline M50, Areas of Archaeological Potential Recorded in 2022 for the proposed Second Access Road to Mistissini

AOP Name	Mapbook Page	Model Ranking*	Description, Topography, Vegetation	Tested (Y/N)**
AOP 33	9.3.6-G	Moderate to low	Elevated, level, well-drained, elongated ridge trending NNE-SSW overlooking remanence of a glacio-fluvial feature to the northwest, and the Pipounichouane River in distance to the north (Photo 9.3.41). Previous disturbances associated with forestry activities, clearing and grubbing, were observed. Second growth, juvenile tamarack and balsam fir, some spruce and poplar, and ground cover of moss, blueberries, cladonia, and Labrador tea.	N
AOP 35	9.3.6-F	Low	Gently undulating, moderately to well-drained low elevation bench feature with a northeastern aspect alongside the Pipounichouane River. Spruce and poplar with a ground cover of moss, Labrador tea, blueberries, and cladonia.	N
AOP 36	9.3.6-G	High to moderate	Relatively level, well-drained point of land on the southern tip of a small peninsula on the southern shore of Mistissini Lake. The area is the site of an older Cree camp and of a boat ramp. Regenerated forest composed of spruce and poplar, shrubs, and a ground cover of moss, Labrador tea, and blueberries.	N
AOP 59	9.3.6-G	High to moderate	Level, well-drained point of land on the northern tip of a small peninsula on the southern shore of Mistissini Lake. The area is the site of a contemporary Cree camp. In addition to the recent camp, three *tâkwâchistaaukamikw* were previously recorded by Denton (2020). In addition to recording these three Cree older dwellings, Denton also recovered one flake from a shovel test. Vegetation includes spruce and poplar, shrubs, with a ground cover of moss, Labrador tea, and blueberries. The presence on this point of land of lithic belonging, older Cree dwellings, and recent cabins demonstrates used of this area over various periods overtime.	N
AOP 38	9.3.6-G	High	Relatively level, moderately to poorly drained, poorly defined area at low elevation, with a west facing aspect overlooking Mistissini Lake. Vegetation includes shrubs, with a ground cover of moss, and Labrador tea. Nine tests were excavated, all were negative for cultural material.	Y (9)
AOP 39	9.3.6-G	High to moderate	Elevated, level, well-drained and well-defined elongated knoll with a west facing aspect overlooking Mistissini Lake. Vegetation includes spruce and poplar, shrubs, with a ground cover of moss, Labrador tea, and blueberries.	N
AOP 46	9.3.6-G	High	Elevated, level, well-drained and well-defined elongated knoll with a west facing aspect overlooking Mistissini Lake. Vegetation includes spruce and poplar, shrubs, with a ground cover of moss, Labrador tea, and blueberries.	N

AOP Name	Mapbook Page	Model Ranking*	Description, Topography, Vegetation	Tested (Y/N)**
EcFl-6 (AOP 47)	9.3.6-G, 9.3.5.1-1E and 9.3.8-5	High	The site is on an elevated, level, and well-drained terrace with a well-defined edge and forming a point with a west facing aspect overlooking Mistissini Lake and the mouth of the Pipounichouane River. Native vegetation is sparse as the area has been previously logged. Ten shovel tests were excavated at this location. Two tests yield positive results for a subsurface archeological component. In addition, seven surface finds were recovered and three clusters of fire modified rocks were recorded on the surface. Borden number EcFl-6 has been given to this site by the MCC following reporting of the finds. See Site Discussion section 9.3.5.2.1 for details, photos, and figures.	Y (10)
AOP 60	9.3.6-G	Low	Elevated, level, well-drained and well-defined terrace with a west-northwest facing aspect overlooking the Pipounichouane River. Canopy of odd balsam fir and odd spruce, and ground cover of moss, blueberries, cladonia, and Labrador tea.	N
AOPs 51-52	9.3.6-F	Low	Elevated, level, well-drained and well-defined elongated knoll with a northeast facing aspect overlooking the Pipounichouane River (Photo 9.3.42). Canopy of balsam fir and odd spruce, and ground cover of moss, blueberries, cladonia, and Labrador tea.	N
22-Stantec-MB-05	9.3.6-G, 9.3.7-6 and 9.3.8-6	High	This site consists of an isolated metal trap for trapping/hunting small game. The trap was found in the water on some river cobbles along the Pipounichouane River shoreline. There is no landform associated with the trap. Beside the riverbank, where the trap was found, is a steep slope up to elevated but sloping and undifferentiated terrain. See Site Discussion section 9.3.5.2.2 for details, photos, and figures.	N
22-Stantec-MB-06	9.3.6-F, 9.3.7-7 and 9.3.8G	Moderate to low	Isolated surface find in a disturbed context, on the surface of a graded gravel-dirt road. The belonging, a Mistissini quartzite core, was either imported during the construction/maintenance of the road or displaced from its original context somewhere in the vicinity of the find. See Site Discussion section 9.3.5.2.3for details, photos, and figures.	N

*GIS model ranking (low, moderate, high) at time of survey between August to October 2022.
**If the landform was tested, the number in bracket is indicating the numbers of shovel tests excavated at this location.

Table 9.3-31 Mistissini Lake and River Pipounichouane, Trapline M50, Features of Interest (Traces of Occupation) Recorded in 2022 for the proposed Second Access Road to Mistissini

FoI Name		Mapbook Page	Model Ranking*	Description
Portage	15	9.3.6-F	Moderate to low	Possible, small length, portage section due to some rapids along a tributary of the Pipounichouane River.
Hunting activities	16	9.3.6-G	High	Cree participants noted the area would be good for small game trapping-related activities. An isolated metal trap for trapping/hunting small game was found in the water on some river cobbles along the Pipounichouane River shoreline confirming the participant's statement.
Cree camp (post-1970s)	17, 18	9.3.6-G	High, moderate, low	Old Cree camp location. Remaining is the smokehouse, and racks to store and dry the fishing nets (Photo 9.3.43).
Modern Cree Camp (post-1970s)	19	9.3.6-G	Moderate	Contemporary Cree camp. A few cabins. Currently used by tallyman and family members for trapline M50.
Tâkwâchistaa ukamikw (Cree winter lodge) (AOP 37)	20, 21, 22	9.3.6-G	Moderate	Three *tâkwâchistaaukamikw* were recorded on the northern point of the small peninsula overlooking the Lake Mistissini (Photo 9.3.44) (Isserhof family lands). These features were previously recorded for another project (Denton, 2020). One lithic, a Mistissini quartzite flake, was recovered during the surface inspection of the area in 2020.

*GIS model ranking (low, moderate, high) at time of survey between August to October 2022

Photo 9.3.41 AOP 33 to northeast

Photo 9.3.42 AOP 52 to south-southeast

Photo 9.3.43 Smokehouse and racks to store and dry the Tâkwâchistaaukamikw

Photo 9.3.44 Remnant footprint of a fishing nets, to west (Cree winter lodge)

9.3.5 Sites Discussion

Six newly identified archaeological sites were recorded and recommended to the MCC for protection. Three sites were assigned Borden Numbers. Five of these sites consist of surface and subsurface lithic belongings, and one site consists of an historic metal trap used for hunting small game. Details for each site are provided below.

9.3.5.1 Potential Billy-Diamond Highway railway corridor

9.3.5.1.1 DlGg-1 (AOP 48)

DlGg-1 (AOP 48) is a surface lithic site, consisting of three scrapers, and one flake recovered during surface inspection of the unnamed watercourse bank (Photos 9.3.45-9.3.46). The location of the finds is likely from on-going erosion of the adjacent landform (see Maps 9.3.5-F, 9.3.7-1 and 9.3.8-1 in Appendix 6.26). The surface finds were collected due to the risk of being submerged and/or displaced.

The surface finds were recovered adjacent to an elevated, level, well-drained intact terrace with mature trees and a thick litter mat, with a west facing aspect overlooking an unnamed watercourse flowing downstream to the Waswanipi River (Photo 9.3.47). Vegetation in the area consists of a canopy of balsam fir, and jack pine, and a ground cover of moss. The intact terrace, AOP 48, was not tested during the 2022 preliminary field survey.

Photo 9.3.45 General view of site DlGg-1 to south southwest-

Photo 9.3.46 Scrapers in situ

Photo 9.3.47 AOP 48, an intact terrasse adjacent to an unnamed watercourse where the lithic belongings were recovered, to west-southwest

Four lithic artifacts were found on the surface during the inventory of site DlGg-01. Three of the artifacts are scrapers (Photo 9.3.48) and the other, a pièce esquillée (splitting wedge). Two of the scrapers are made of Mistassini quartzite. The white quartzite scraper (DlGg-01.1) has only one retouched edge while the pink quartzite scraper (DlGg-01.2) is retouched on its distal and a lateral surfaces to its base, as is the Hudson Bay Lowland chert scraper (DlGg-01.3). The fourth artifact is a small flake of chert Hudson Bay Lowland chert. It is interesting to note that the white quartzite scraper (DlGg-01.1) has traces of thermal flakes that have not detached, but which demonstrates that the tool has been modified by heat (refer to the artefact catalogue in Appendix 6.27).

Photo 9.3.48 Scrapers found at DlGg-01

The full extent of the site was not determined due to Project objectives and limitations. The intention of the 2022 field assessment was to evaluate the potential model. Additional archaeological impact assessment would be required to define site boundaries beyond their recorded extent and to evaluate the nature of cultural deposits. In addition, any work in the general area of the site should include an archaeological impact assessment to determine the site does not extend into the development area. Mitigation is recommended prior to development within the site boundaries.

9.3.5.1.2 DkGj-5 (AOP 40)

DkGj-5 (AOP 40) is a surface and subsurface site consisting of one flake, one piece of shatter, and a concentration of fire modified rocks (FMR) associated with a small hearth – *ishkutehkaan*. (see Maps 9.3.5-C, 9.3.7-2 and 9.3.8-2 in Appendix 6.26) In addition, one surface find was recovered along the shoreline below the point of land. The surface find consists of an hammerstone. The lithic artifacts/belongings and the feature were identified during surface inspection and subsurface testing of the landform. The belongings were collected, but the FMR were left in situ and backfilled upon recording to protect the feature and provide context in case of future research at the site. The small hearth – *ishkutehkaan* is on the point of land overlooking the Bell River. The terrasse appears to be intact, no obvious previous disturbances were observed.

The site is on an elevated (~ 1.5 meter above shoreline), level, well-drained terrace with a well-defined edge and forming a point with a southwest facing aspect overlooking the Bell River (Photo 9.3.49). Vegetation in the area consists of a canopy of balsam fir, poplar and birch, and ground covers of bunch berries and moss.

Nineteen shovel tests were excavated at DkGj-5 (AOP 40), with three tests positive (Photo 9.3.50, 9.3.51). Tests were placed approximately 2 to 6 m intervals and were excavated to a depth between 10 to 25 cm below surface (bs). Stratigraphy of the site generally consists of a brown humic layer over light grey silt with no inclusions, over a light grey brown silty loam with 1% sub rounded pebbles, terminating on compact light grey silty clay with 1% sub angular pebble (lacustrine sediment).

Photo 9.3.49 General view of DkGj-5 (AOP 40), an intact terrasse overlooking the Bell River, to southwest

Photo 9.3.50 Fire modified rocks forming a small hearth feature – ishkutehkaan, to north

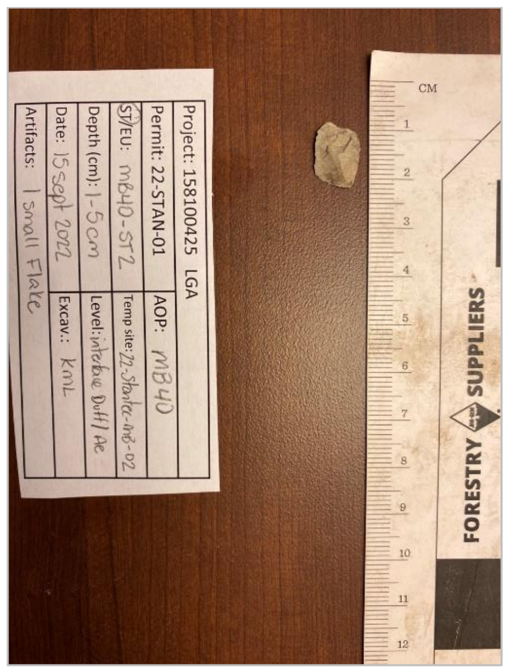


Photo 9.3.51 A small flake recovered from at the interface of the duff and the Ae layers

Two lithic artifacts were found during the survey of the DkGj-05 site: a small flake of rhyolite found in situ and a granite hammerstone (Photo 9.3.52) found on the surface. Traces of use can be observed on the hammerstone at the distal ends and a smoother lateral surface that indicates polish as a result of abrasion following its use (refer to the artefact catalogue in Appendix 6.27).

Photo 9.3.52 Hammerstone found at DkGj-05

The full extent of the site was not determined due to Project objectives and limitations. The intention of the 2022 field assessment was to evaluate the potential model, and if sites were identified to evaluate the nature of cultural deposits. Additional archaeological assessment would be required to define site boundaries beyond their recorded extent. In addition, any work in the general area of the site should include an archaeological impact assessment to determine the site does not extend into the development area. Mitigation is recommended prior to development within the site boundaries.

9.3.5.1.3 22-Stantec-MB-03

22-Stantec-MB-03 is a surface lithic site, consisting of an isolated find, a Hudson Bay Lowland chert scraper recovered on the surface of the sandy beach during pedestrian survey of the Matagami Lake shoreline (Photos 9.3.53, 9.3.54) (see Maps 9.3.5-D, 9.3.7-3 and 9.3.8-3 in Appendix 6.26). The surface find was collected due to the risk of being submerged, displaced, and/or collected by the public. No shovel testing completed at this location.

Photo 9.3.53 General view of the isolated find to south-southwest

Photo 9.3.54 Hudson Bay Lowland chert scraper

Due to the isolated nature of this find, no additional field work is recommended within the current site boundary. However, additional archaeology field work is recommended in the vicinity of the find, especially alongside the trees/beach line to inspect the nearby landforms.

9.3.5.2 Proposed Second Access Road to Mistissini

9.3.5.2.1 EcFl-6 (AOP 47)

EcFl-6 (AOP 47) is a surface and subsurface site consisting of ten flakes, and one retouched flake tool. In addition, three clusters of FMR were recorded. The artifacts/belongings were collected, but the FMR were left in situ.

The site is on an elevated (~3 meter above shoreline), level, well-drained terrace with a well-defined edge and forming a point with a west facing aspect overlooking Mistissini Lake and the mouth of the Pipounichouane River (Photo 9.3.55) (see Maps 9.3.6-G, 9.3.7-5 and 9.3.8-5 in Appendix 6.26). Native vegetation is sparse as the area has been previously logged. Vegetation in the area consists of regenerated juvenile fir and spruce, and a ground cover of shrubs, blueberries, and moss. The terrace is in good condition, with only minor's disturbances from past logging activities.

Ten shovel tests were excavated at EcFl-6 (AOP 47), with two tests positive for cultural material. Nine surface finds were identified. See Map 9.3.8-5 in Appendix 6.26 for details.

Tests were placed approximately 2 to 5 m intervals and were excavated to a depth between 10 to 25 cm bs. Stratigraphy of the site generally consists of a redeposited (disturbed) mottled brown silty loam layer over a dark brown humic layer over light grey silt with no inclusions, over a orange brown silty loam with 1% sub rounded pebbles, terminating on compact light yellow brown silty clay with 1% sub angular pebble (Photo 9.3.56).

Photo 9.3.55 General view of site EcFl-6 to north-northwest

Photo 9.3.56 Positive ST01 typical stratigraphy

Photo 9.3.57 Mistissini quartzite flake in situ

The quartzite flakes of Mistassini (n=9), Nastapoka chert (n=3), chert (n=1) and quartz (n=1) found during the inventory of the EcFl-6 site come from the first phases of the lithic reduction. The retouched quartzite flakes of Mistassini quartzite are done on a lamelar flake with removals on one end (Photo 9.3.58). A use-wear analysis could inform us if these removals come from its use or a finishing touch-up (refer to the artefact catalogue in Appendix 6.27).

Photo 9.3.58 Lamelar retouched flake found at EcFl-06

The full extent of the site was not determined due to Project objectives and limitations. The intention of the 2022 field assessment was to evaluate the predictive model, and if sites were identified to evaluate the nature of cultural deposits. Additional archaeological assessment would be required to define site boundaries beyond their recorded extent. In addition, any work in the general area of the site should include an archaeological impact assessment to determine the site does not extend into the development area. Mitigation is recommended prior to development within the site boundaries.

9.3.5.2.2 22-Stantec-MB-05

22-Stantec-MB-05 is a surface site consisting of an isolated metal trap used for trapping/hunting small game (see Maps 9.3.6-G, 9.3.7-6 and 9.3.8-6 in Appendix 6.26). The trap was found in the water on some cobbles along the Pipounichouane River shoreline (Photos 9.3.59, 9.3.60). There is no distinct landform associated with the location of the trap. Beside the riverbank, where the trap was found, is a steep slope up to elevated but sloping and undifferentiated terrain.

Photo 9.3.59 General view to north

Photo 9.3.60 Metal trap in situ

Due to the isolated nature of this find, no additional field work is recommended within the current site boundary. However, additional archaeology field work is recommended in the vicinity of the find, especially alongside the shoreline to inspect the nearby landforms.

9.3.5.2.3 22-Stantec-MB-06

22-Stantec-MB-06 is a surface lithic site from a disturbed context, consisting of an isolated find, a Mistissini quartzite core recovered on the surface of a gravel road during pedestrian survey of the Pipounichouane River and its surrounding areas (Photos 9.3.61, 9.3.62) (see Maps 9.3.6-F, 9.3.7-7 and 9.3.8G in Appendix 6.27). The surface find was collected due to the risk of being displaced during future road maintenance, and/or collected by the public. No shovel testing completed at this location.

Photo 9.3.61 General view of the isolated find

Photo 9.3.62 Mistissini quartzite core in situ

Due to the isolated nature of this find, and its disturbed context, no additional field work is recommended within the current site boundary. However, additional archaeology field work is recommended in the vicinity of the find, especially alongside the shoreline to inspect the nearby landforms.

9.3.6 Preliminary Mitigation Plan

The preferred mitigation for archaeological and cultural resources is avoidance through project design. The GIS Model described above is a tool for project design that will facilitate avoidance of known archaeological sites, Cree Land Use sites, as well as cemeteries and burial locations. The GIS Model will also help project designers avoid areas predicted to have a high potential for cultural sites. Applying the GIS Model to route selection along with meaningful engagement with the CNG regarding preferred routes will mitigate some cultural resource concerns. Not all archaeological site locations or Cree Land Use sites are known or included in the GIS Model so any proposed project would benefit greatly from a pre-impact archaeological assessment and Cree Land Use study specific to the proposed footprint. Important cultural sites discovered in pre-impact assessment can still be avoided through changes to the final design footprint. Effects of construction on cultural sites that cannot be avoided can, in collaboration with and the support of CNG, be mitigated through mapping and photogrammetric recording, artifact collection, archaeological excavation, and construction monitoring. This presupposes significant advance scheduling of a pre-impact assessment to permit time for adequate engagement and mitigatory measures.

The GIS Model can facilitate the design of a pre-impact archaeological assessment by highlighting areas known or predicted to be of high to moderate archaeological potential. Because archaeological assessments do not examine 100% of a project footprint, it is important to develop, in collaboration with/oversight by the CNG and the ACCI, an Archaeological Resource Protection plan (ARPP). Low archaeological potential does not mean no potential, but low potential areas are rarely included in pre-impact assessments. There is a limited likelihood of finding sites within areas modelled as low by the GIS Model but any project should be prepared with an ARPP for the discovery of an archaeological site during construction to address the potential for exposing chance artifact finds, archaeological sites, and/or ancestral remains during project construction.

The ARPP is key to addressing these risks in a single document and should include training for all construction personnel on what to look for, a prescribed protocol if archaeological resources are encountered, and establish clear lines of communication and protocols to follow if ancestral remains/burial(s) are encountered. The ARPP should provide direction on the process, roles, responsibilities, lines of communication (who informs whom, when), and actions required in the event of a chance find. Contacts from the MCC would be included in the ARPP for possible chance find occurrences, for areas within provincial lands.

Training sessions for crews on the ground regarding artifacts, sites, site features, ancestral remains, should have photos (where appropriate and descriptions of the typical site / cultural belonging types likely to be found in the project footprints. The ARPP should include a constraints map based on the GIS Model and field work results that can drive decision making regarding actions triggered by a chance find. Construction teams should include Cree Environmental Inspectors (EIs) and/or specific Archaeological monitors.

9.3.7 Closure and Recommendations

The 2022 preliminary survey was not meant to be an exhaustive study of potential, but rather a way to test and improve the predictive modelling tool. Based on the results of the 2022 field season, the model has been refined and revised to enhance its value as a tool for planning future archaeological surveys of LGA.

The results of this study should not be considered a fixed illustration of archaeological potential for the LGA projects. The GIS-based approach is intended to be iterative to allow for continuous improvement and upgrade when new results and information become available.

If impacts are planned within the potential BDH railway corridor and/or within the proposed Second Access Road to Mistissini, the projects will require a thorough pre-impact archaeological assessment, which will include a desktop evaluation that, once reviewed by the MCC, the CNG, and the ACCI, will drive the field assessment portion. Archaeological permit(s) from the MCC and possibly a land ownership permit(s) from the MERN may be required to proceed with an impact assessment.

9.3.7.1 Archaeological Predictive Model:

The GIS Model should be considered a guidance tool for planning and design. A complete archaeological predictive model will require the entire project footprint including borrow locations and aggregate sources.

The GIS Model is only as strong as the baseline data used to construct the GIS. For instance, topographic data are variable and too coarse to identify subtle landscape features of high archaeological site potential. The addition of LiDAR will improve the accuracy of the predictive model. The model is iterative and will evolve as new information becomes available. It is a living document that will not have a final version.

The 2022 field work highlighted strengths and weaknesses in the GIS Model. The field work did not thoroughly test the model but kept to areas of safe access. Additional fieldwork will provide more comprehensive testing of the model, allowing for that continued evolution of the model.

The GIS Model would be strengthened through more field testing. In addition, adding LiDAR for the entirety of the study areas will improve the accuracy of the predictive model. LiDAR is currently available only for some areas.

9.3.7.2 Archaeological Impact Assessment:

The seasonality of field assessments: archaeology field work can only occur under snow-free and thawed-ground conditions. This may result in effects to project schedule, as footprint changes cannot be immediately assessed. Provincial permitting through the MCC also adds potential delay between a determination to conduct additional field assessment and the field assessment itself. For these reasons, the impact assessment is planned well in advance. It must be remembered that any changes to the project footprint during the impact assessment phase should be subject to archaeological review and further field assessment may be recommended if/where the project footprint is revised to include areas of high or moderate potential that have not been previously assessed.

9.3.7.3 The Cultural Landscape

The GIS Model would be an effective platform to compile what is known of the cultural landscape, that is the interaction of people and the environment through time, in the study region. Information from Cree Land Use studies, further literature review, toponymic information, oral tradition and history could provide a base layer of cultural data to provide a broad context for any studies of land use, history, geography, or archaeology done in the region. As a cumulative record, compiling cultural landscape data could influence decision-making, project and study design as well as interpretation of results for future work in the region.

VEI wants to thank all Cree field technicians as well as the archaeologist from the ACCI, and the Community Information Officers (CIO) from both Waskaganish and Mistissini, for their participation in the 2022 field program, their hard work, and the valuable information they shared with the VEI team (Photo 9.3.63).

Photo 9.3.63 Shift # 4 Field Crew for the proposed Second Access Road to Mistissini

9.4 SERVITUDES AND TITLES

Servitudes and titles have been identified and compiled for the potential BDHR and Grevet-Chapais railways and Mistissini second access road alignments within a 2-km corridor (one kilometre on each side of the alignment). They comprise public utilities, including rights-of-way; mining rights and mining claim applications; leases granted on public lands in the domain of the State; some structured and unstructured wildlife territories; and Cree communities' land use elements.

9.4.1 Information common to all three alignments

9.4.1.1 Public lands

According to the JBNQA, the Nord-du-Québec territory is divided into three categories: Category I, Category II and Category III lands.

Category I lands are lands set aside for the exclusive use and benefit of the James Bay Crees. They are located within and around Cree communities and are administered by them. Easements may be granted for certain activities such as exploration and mining. Communities must, however, be compensated in the form of land or monetary compensation for these easements. The northern portion of the potential Mistissini second access road is the only alignment located (partially) on Category I lands.

Category II lands refer to provincial public lands, where James Bay Crees have the exclusive right of hunting, fishing and trapping. Category II lands are of provincial jurisdiction. Lands within Category II which is removed for development must be compensated for. None of the three corridors are located on this category of lands.

Category III lands are provincial public lands. General access to these lands is in accordance with Québec laws and regulations relating to the domain of the state. The corridors for the potential BDHR and Grevet-Chapais railway alignments are located entirely on Category III lands. The southern portion of the Mistissini second access Road alignment is also located on this category of lands.

In addition, development projects must be implemented in accordance with the provisions of Chapter 22 of the JBNQA (see section 9.1.2).

Also, the vast majority of the three corridors are located on the domain of the Sate, but a total of 550 lots from the cadastre of Québec have been identified for the potential BDHR and Grevet-Chapais railway corridors. While 499 of them are of private tenure and will be discuss later, 51 are of public tenure. They are mostly managed by the ministère des Ressources naturelles et des Forêts (MRNF). No cadastre was identified within the potential Mistissini second access road corridor.

9.4.1.2 Utilities and rights-of-way

There are public utilities-related constraints associated with Hydro-Québec facilities, namely government reserves or power transmission lines that pass over the corridor in one of the alignments (MERN, 2022b). The government reserves have no impact on the project, since they were issued for hydroelectric development on Nottaway, Broadback and Rupert rivers, referred as the complex NBR project, that is no longer relevant since the Paix des Braves agreement of 2002. However, the transmission lines are constraints to keep in mind in the potential BDHR and Grevet-Chapais railway corridors because agreements will need to be reached with Hydro-Québec.

A number of snowmobile trails and logging roads have also been identified in the three corridors (MERN, 2022a). In some places, these trails cross the alignments, while in other places the alignments perfectly overlap the current trails. In the first case, special attention should be given to signage and user safety on the trails, while in the second case, certain portions of the snowmobile trails will need to be relocated. Any relocation will require active discussions with the users of these trails to ensure that the new trail responds to their needs. Preliminary consultation was conducted with the main stakeholders (tallymen, forestry companies, snowmobile clubs, etc.) and will pursue during the next steps of planning. Furthermore, the cost of the relocation will need to be integrated as part of the project construction costs.

9.4.1.3 Leases on public lands in the domain of the State

Leases granted by the government on public lands may be used for a variety of purposes. Note that, based on chapter 24 of the JBNQA, Crees do not require leases to build camps on Category III lands. Therefore, the Cree camps are not included here. There are 61 leases that have been identified in the three corridors, comprising the following (MERN, 2022c):

- 6 leases for vacation purposes (dwelling offering a wilderness stay). Note that there is an administrative suspension in the territory since 2012 and new leases have not been issued since then.
- 3 Leases for a rough shelter in the forest (building limited to 20 m2, without a permanent foundation, for carrying out activities in the forest). Note that this type of lease is no longer issued in Québec.
- 3 leases for a primary residence
- 2 leases for additional purposes (addition to public land to develop a boathouse, garage, parking area, etc.)
- 1 lease for commercial, recreational or tourism purposes, with lodging
- 5 leases for private purposes (addition to private land to develop a boathouse, garage, parking area, etc.)
- 5 leases for a telecommunications tower (to be used as a commercial communication tower)
- 18 industrial leases (for extraction or transformation of raw materials)
- 9 commercial leases (for carrying out profit-making activities)
- 3 public utilities leases (for a water distribution system, landfill, water treatment, recreational activities, etc.)
- 1 lease for non-profit community usage (aimed at offering free or low-cost activities that are open to the entire population)
- 4 leases for municipal activities (for a parking area, building, swimming pool, park or green space)
- 1 lease for conservation and protection of the forest

9.4.1.4 Private land tenure

Private land tenure can also be found in the study areas. There are 499 private lots that have been identified in the potential BDHR and Grevet-Chapais railway corridors. None have been identified along the potential Mistissini 2nd access road corridor.

At this stage, the information is preliminary. Use of the property (e.g., residential, commercial, industrial) was not determined. It requires the purchase of the lot data, which will be done in subsequent steps of the project.

9.4.1.5 Mining rights and mining claim applications

With regard to mining rights, note that there are no active mines in any of the three corridors (MERN, 2022b). There are, however, 900 active mining claims along the potential BDHR and Grevet-Chapais railway alignments; these claims were issued to 48 claim holders (MERN, 2022b). The mining claim entails an exclusive right to carry out exploration work and searches for mineral substances. This right was granted by the Québec government under the *Mining Act* (L.Q. 1998, chapter M-13.1). The mining claim holder does not hold surface rights; i.e., land referred to in the lease may also be subject to development by other developers. As such, the existence of mining claims is not considered to be a project constraint.

Exclusive leases to mine surface mineral substances and non-exclusive leases to mine surface mineral substances are extraction rights that are also regulated by the *Mining Act*. Exclusive leases allow for the extraction or mining of specific mineral substances, while non-exclusive leases are issued on unconsolidated deposits for construction purposes.

The potential BDHR alignment is the only one for which claim applications have been registered and exclusive leases issued (MERN, 2022b). Non-exclusive leases have also been issued in the BDHR and Grevet-Chapais corridors (MERN, 2022b). No active mining titles (claim, exclusive lease or non-exclusive lease) have been identified along the Mistissini Road alignment.

9.4.1.6 Structured and unstructured wildlife territories

Structured wildlife territories are used for conservation, where wildlife harvesting is controlled. They consist of the following territory types:

- Controlled harvesting zones
- Outfitters with exclusive rights

In contrast, unstructured wildlife territories do not necessarily have a legal status, where activities are limited so that productivity can be controlled. They relate to outfitters without exclusive rights.

None of the above-mentioned territory types exist in any of the three corridors (CRRNTBJ, 2009; MERN, 2019). Furthermore, no access to these territory types has been identified.

Structured and unstructured wildlife territories used for conservation or development of natural environments, e.g., projects related to parks, wildlife reserves, beaver reserves, wildlife sanctuaries, biodiversity reserves, migratory bird sanctuaries, important bird and biodiversity areas, and wildlife habitats, are discussed in section 9.5.

9.4.1.7 Tenure and use of designated lands

Together, the three corridors are home to six Cree communities: Mistissini, Nemaska, Ouje-Bougoumou, Washaw Sibi, Waskaganish and Waswanipi. Each community has its own territorial boundaries and trapping areas, called trapline. A trapline refers to a traditional family territory where the Cree practise their traditional way of life, notably hunting, fishing and trapping. Each trapline has a designated representative, the Tallyman, who is named by their family members and is recognized as the authority figure for the trapline according to the chapter 24 of the JBNQA.

The rules governing the role of tallymen and traplines in the management of the territory and, in particular, traditional activities remain, to this day, informal and traditional. The Cree Trappers' Association recognize a Cree Hunting Law that often formalizes many of these roles, but this has not necessarily been officially adopted by other entities. Nevertheless, it is usually understood that it is customary that the tallyman should be kept informed of all harvesting activities on their trapline as well as overseeing the fair distribution of resources found within the trapline to all land users active on the trapline.

Consultations with the various communities have helped identify the location of Cree camps on each corridor. These are discussed in section 9.2. According to the trapline limits provided by the CNG, the Phase 1 study areas are located entirely on Cree traplines. However, since the southern portions of the BDHR and Grevet-Chapais study areas are relatively easy to access, the territory is still used by many Algonquin and Jamesian residents of the region.

9.4.2 Potential BDHR alignment

9.4.2.1 Public lands

There are 29 lots from the cadastre of Québec that are located on public land tenure for the BDHR corridor. They cover 1.6 km² of area within the corridor, including 0.1 km² within the alignment right-of-way. A total of 10 lots are within the alignment right-of-way (Table 9.4.1). The alignment directly crosses 2.2 km of public lots. Measures will need to be taken to divert the alignment or reach agreements with the ministries. Another lot is identified near KP 6 of BDH, but is located at a distance of 9 m from the alignment right-of-way.

Table 9.4-1 Public lots within the potential BDHR alignment right-of-way

Location	Number of lots	Alignment length on cadastre (in meters)	Area of cadastre in alignment right-of-way (in square meters)
Matagami (near km 219 of Route 109)	3	319	11 808
Matagami (near km 222 of Route 109)	1	1 199	25 265
Matagami (km 3 of BDH)	1	180	3 739
Near km 10 of BDH	1	23	510
Km 257 of BDH	4	522	17 715
Total	10	2 243	59 037

9.4.2.2 Utilities and rights-of-way

The potential BDHR alignment corridor crosses or intersects government reserves that are related to the complex NBR hydroelectric development project (MERN, 2022b). As previously mentioned, the NBR project has been abandoned with the Paix des Braves agreement and those reserves are obsolete.

The Eastmain1-A/Rupert electric transmission line is also crossed by this alignment at its northern end (km 257 of the BDH) (Map 9.4.1).

The government reserves there are deemed as having no impact on the project. For the passage of an electric transmission line under the right-of-way, agreements will need to be reached with Hydro-Québec before carrying out the project.

Moreover, in the sector of the City of Matagami, local and regional snowmobile trails cross the corridor (MERN, 2022a). Part of the local trail, between km 222 of Route 109 and km 1 of the BDH, is located on the exact site of this alignment; it will have to be relocated. Seven other sections of local and regional trails cross this alignment; signage should therefore be installed in collaboration with the Ministère des Transports du Québec (MTQ) to ensure user safety in those areas.

9.4.2.3 Leases on public lands in the domain of the State

There are 26 leases that have been issued on lands in the domain of the State for the potential BDHR corridor (MERN, 2022c) (Map 9.4.1). Table 9.4.2 indicates the types of leases issued and the proximity of their centroid to the alignment. In the majority of the identified leases, the centroid is located more than 100 m away from the alignment right-of-way. The latter are deemed as having no impact on the project. Still, two leases along the potential BDHR alignment deserve particular attention.

A lease for a telecommunications tower is located 30 m from the alignment (at km 219, east of Route 109); thus, the project’s right-of-way corridor could have an impact on this telecommunications tower. Measures will need to be taken to divert the alignment or move the telecommunications tower if deemed necessary by any of the parties.

Similarly, the lease for recreational, sports or educational purposes (for non-profit community usage) could be affected by the project. While the lease’s centroid is located 396 m away (at km 2 of the BDH), it lies on a golf club whose outer boundary is approximately 80 m from the alignment. As such, discussions about potential impacts should be undertaken with the leaseholder.

Table 9.4-2 Number of leases issued in the potential BDHR corridor, and distance between their centroid and the alignment right-of-way (as of October 11, 2022)

Type of lease issued	Number of leases	Distance of each lease from the alignment right-of-way (in metres)
Lease for vacation purposes	0	-
Lease for a rough shelter in the forest	1	306
Lease for a primary residence	0	-
Lease for additional purposes	1	867
Lease for commercial, recreational or tourism purposes, with lodging	0	-
Lease for private purposes	0	-
Lease for a telecommunications tower	5	27, 392, 563, 727, 826
Industrial lease	5	111, 259, 266, 267, 313
Commercial lease	9	155, 281, 282, 284, 295, 308, 417, 863, 983
Public utilities lease	0	-
Lease for recreational, sports, or educational purposes, for non-profit community usage	1	388
Lease for municipal activities	4	86, 90, 159, 826

9.4.2.4 Private land tenure

There are 389 private lots from the Cadastre of Québec that have been identified for the potential BDHR corridor. They represent a total of 1.3 km² of private land within the corridor, including 0.03 km² within the alignment right-of-way. Most of them are located in the City of Matagami, but some are also found along the BDH.

Table 9.4-3 indicates the private lots located within the alignment right-of-way. The railway crosses 3 private lots over 1.5 km of its alignment (Table 9.4.3). Measures will need to be taken to divert the alignment or reach agreements with the owners.

Table 9.4-3 Private lots within the potential BDHR right-of-way

Location	Number of lots	Alignment length on cadastre (in meters)	Area of cadastre in alignment right-of-way (in square meters)
Matagami (near km 219 of Route 109)	1	1,303	21,955
Matagami (km 0 of BDH)	1	30	821
Matagami (km 2 of BDH)	1	186	4,894
Total	**3**	**1,519**	**27,670**

9.4.2.5 Mining rights and mining claim applications

As of October 11, 2022, there were 315 mining claims along the potential BDHR alignment (MERN, 2022b). Two claim applications have also been filed along this alignment; both are located in the northern part of the alignment, at km 208 of the BDH (Map 9.4.1).

Table 9.4-4 shows the exclusive leases to mine surface mineral substances as well as the non-exclusive leases that are active or pending renewal along the BDHR corridor (as of October 11, 2022) (MERN, 2022b). Except for one, all identified leases are located at least 300 m from the alignment and are, therefore, deemed not to be affected by the project nor having any impact on it.

Table 9.4-4 Exclusive and non-exclusive leases issued in the potential BDHR corridor, and distance between their centroid and the alignment right-of-way (as of October 11, 2022)

Lease type	Leaseholder	Surface mineral substance	Distance from alignment right-of-way (meters)
Exclusive lease	James Bay Development Corporation	Crushed stone	0
	Trimix béton inc.	Crushed stone	960
Non-exclusive lease	Construction Norascon inc. (Renewal pending)	Sand	656
	Resolute Forest Products Inc.	Sand	656
	Scierie Landrienne	Sand	656
	James Bay Development Corporation	Sand	971
	James Bay Development Corporation	Gravel	291

The exclusive lease identified as being affected by the project is that held by the James Bay Development Corporation, for the mining of crushed stone. Located near km 35 along the BDH, the lease's centroid is under the alignment right-of-way. Discussions should therefore be undertaken with the leaseholder for the sake of minimizing or compensating for the project impacts.

9.4.2.6 Tenure and use of designated lands

The potential BDHR alignment is located on the traditional territory of four Cree communities (Map 9.4.1): Washaw Sibi, Waswanipi, Waskaganish and Nemaska.

A total of 16 traplines have been identified as overlapping the corridor for this alignment. Three of these belong to the Washaw Sibi community, seven of them to the Waswanipi community, two to the Waskaganish community and four to the Nemaska community. See section 9.2 for further details on the use of this territory by the Cree.

9.4.3 Potential Grevet-Chapais railway alignment

9.4.3.1 Public lands

There are 22 lots from the Cadastre of Québec that are located on public land tenure for the Grevet-Chapais railway corridor. They cover 0.9 km² of area within the alignment corridor. None are located within the railway right-of-way.

9.4.3.2 Utilities and rights-of-way

The Grevet-Chapais railway alignment also crosses a government reserve related to the NBR complex project, which was abandoned with the Paix des Braves agreement (MERN, 2022b). The alignment also crosses the Radisson-Hervey-Jonction power transmission line south of Cavan Lake, approximately 12 km from the City of Chapais (Map 9.4.2).

For the passage of an electric transmission line under the right-of-way, agreements should be reached with Hydro-Québec before carrying out the project.

In addition, the Potential Grevet-Chapais railway alignment is located on the site of the Trans-Québec 93 snowmobile trail or the Trans-Québec 90 quad trail, on lands in the domain of the State, for a total distance of approximately 100 km (MERN, 2022a). These portions of the trails will need to be relocated to ensure user safety. For trails located on public lands, authorizations need to be issued by MRNF, while the MTQ takes care of signage for the trails. However, these trails are maintained by snowmobile clubs affiliated with the Fédération des clubs de motoneigistes du Québec (FCMQ) and quad clubs affiliated with the Fédération québécoise des clubs de quad (FQCQ – Québec federation of quad clubs). The Potential Grevet-Chapais railway alignment trails are maintained by the following three clubs: the Chapais snowmobile club, the Lebel sur Quevillon snowmobile club, and the Eeyou Istchee James Bay quad club. All these stakeholders, as well as the potentially affected tallymen, are to be involved in the trail relocation process. In fact, discussions have already been initiated with these groups.

The alignment also overlaps with certain portions of the road network, including several logging roads under the responsibility of the MRNF (MERN, 2022a). Approximately 100 km of logging roads will need to be relocated.

9.4.3.3 Leases on public lands in the domain of the State

There have been 36 leases issued on lands in the domain of the State, for the Potential Grevet-Chapais railway alignment corridor (MERN, 2022c) (Map 9.4.2). Table 9.4.5 indicates the types of leases issued and the proximity of their centroid to the alignment. In the majority of the identified leases, the centroid is located more than 100 m away from the alignment. The latter are deemed as having no impact on the project. However, six leases included in the Potential Grevet-Chapais railway alignment corridor deserve particular attention because the project's right-of-way corridor could have an impact on the following leases:

- Lease for additional or incidental use of a non-profit community recreational trail located 2 m from the alignment right-of-way (near Du Calumet Lake);
- Industrial lease on land located 18 m from the alignment right-of-way (near Lara Lake, at km 345 along Route 113);
- Lease for vacation purposes on land located 17 m from the alignment right-of-way (near Wachigabau Lake, south of Île Goéland);
- Lease for a rough shelter in the forest on land located 19 m from the alignment right-of-way (near Wachigabau Lake, south of Île Goéland);
- Lease for primary residence purposes on land located 32 m from the alignment right-of-way (in the hamlet of Miquelon);
- Lease for commercial, recreational or tourism purposes, with lodging, on land located 65 m from the alignment right-of-way (also in the hamlet of Miquelon).

Table 9.4-5 Number of leases issued in the potential Grevet-Chapais railway alignment corridor, and distance between their centroid and the alignment right-of-way (as of October 11, 2022)

Type of lease issued	Number of leases	Distance of each lease from the alignment right-way (metres)
Lease for vacation purposes	6	17, 224, 807, 827, 920, 933
Lease for a rough shelter in the forest	2	39, 111
Lease for a primary residence	3	32, 254, 945
Lease for additional purposes	1	2
Lease for commercial, recreational or tourism purposes, with lodging	1	85
Lease for private purposes	5	443, 466, 495, 567, 588
Lease for a telecommunications tower	0	-
Industrial lease	14	18, 333, 377, 420, 437, 473, 502, 516, 545, 563, 608, 653, 655, 658
Commercial lease	0	-
Public utilities lease	3	106, 150, 435
Lease for recreational, sports, or educational purposes, for non-profit community usage	0	-

Type of lease issued	Number of leases	Distance of each lease from the alignment right-way (metres)
Lease for municipal activities	0	-

9.4.3.4 Private land tenure

There are 110 private lots form the Cadastre of Québec that have been identified for the potential Grevet-Chapais corridor. They represent a total of 1.17 km² of private land within the corridor, including 0.2 km² within the alignment right-of-way. Most of them are found in inhabited areas such as the hamlets of Miquelon and Desmaraisville as well as in the surrounding area of the City of Chapais. Table 9.4-6 indicates the lots located within the alignment right-of-way.

Table 9.4-6 Private lots within the potential Grevet-Chapais railway right-of-way

Location	Number of lots	Alignment length on private land (in meters)	Area of private land in alignment right-of-way (in square meters)
Hamlet of Miquelon	2*	93	55
Barrette Chapais Ltée (near km 346 of Route 113)	2	700	191 038
Total	4	793	191 093

*Management by both public and private institutions

The private lands in the hamlet of Miquelon and the ones from the enterprise Barette Chapais Ltée could be impacted by the project. Measures will need to be taken to divert the alignment or reach agreements with the owners.

9.4.3.5 Mining rights and mining claim applications

As of October 11, 2022, there were 585 mining claims along the Grevet-Chapais railway alignment (MERN, 2022b) (Map 9.4.2).

Three non-exclusive leases have also been identified in the potential Grevet-Chapais railway alignment corridor (Table 9.4-7) (MERN, 2022b). Note that no exclusive leases have been issued along this alignment.

Table 9.4-7 Exclusive and non-exclusive leases issued in the potential Grevet-Chapais railway alignment corridor, and distance between their centroid and the alignment right-of-way (as of Oct. 11, 2022)

Lease type	Leaseholder	Surface mineral substance	Distance from alignment right-of-way (in meters)
Non-exclusive lease	Barrette-Chapais Ltée	Gravel	336
	Les Entreprises Marc Forget	Gravel	85
	City of Chapais	Gravel	85

Among the non-exclusive leases identified, two are located less than 100 m from the alignment right-of-way. The leaseholders will have to be consulted to determine potential encroachment of the alignment on the operating sites of these leases.

9.4.3.6 Tenure and use of designated lands

The potential Grevet-Chapais railway alignment is located on the traditional territory of three Cree communities (Map 9.4.2): Washaw Sibi, Waswanipi and Ouje-Bougoumou.

A total of 10 traplines have been identified that overlap the corridor. One of these belongs to the Washaw Sibi community, eight belong to the Waswanipi community and one belongs to the Ouje-Bougoumou community. See section 9.2 for further details on the use of this territory by the Cree.

9.4.4 Potential Mistissini 2nd Access Road alignment

9.4.4.1 Utilities and rights-of-way

The potential Mistissini 2nd access road corridor is the only one where constraints have been identified in connection with the presence of experimental forests (MERN, 2022b) (Map 9.4.3). In fact, two experimental forests exist in the corridor for this alignment: the Plamondon forest, which has part of its site in the southern portion of the corridor; and the Beaulieu forest, which has five sites at the southern end of the corridor, on the periphery of km 32 along the Route du Nord.

9.4.4.2 Tenure and use of designated lands

The potential Mistissini 2nd access road alignment is located on traditional territory of a single Cree community (Mistissini) where a total of four traplines overlap the corridor. See section 9.2 for further details on the use of this territory by the Crees.

9.4.5 Potential impacts and mitigation

The project's various potential impacts were set out in the previous sections. Most of these impacts will require discussions and agreements with Cree Communities and leaseholders, while some impacts may possibly lead to relocation or compensation. Affected elements, which are mainly located less than 100 m from the alignment, are summarized below:

- Eight different leases (two on the BDHR and six on the Grevet-Chapais railway), including a telecommunications tower and primary residence, among others

- One exclusive lease on the BDHR
- Two non-exclusive leases along the potential Grevet-Chapais railway alignment
- Several Cree sites (camps and other culturally important sites)

Furthermore, the main impact is the presence of the snowmobile trail (length: 93 km) and logging roads (length: 84 km) currently located along the potential Grevet-Chapais railway alignment, which will need to be relocated and require additional signage for areas where the railway crosses them, where applicable.

9.4.6 Limitations

The analysis of titles and easements is limited to the information available from the MRNF and on the various government platforms consulted.

9.5 PROTECTED AREAS

A protected area is a terrestrial, aquatic or marine territory specifically intended for the conservation of natural environments, protection and maintenance of biodiversity and of the natural and cultural resources associated with it (IUCN, 1994).

For the province of Québec, but also across the planet, protected areas play a critical role on many levels (UQCN – Québec union for the conservation of nature, 2003):

- Maintaining biodiversity (resting, breeding and feeding areas for wildlife, away from human activity, to promote the natural evolution of species)
- Protecting landscapes (natural beauty of sites, conservation of an aesthetically pleasing environment)
- Maintaining ecological processes that are essential to life and to our planet's balance (oxygen production, carbon and pollutant sequestration, soil regeneration and climate regulation)
- Serving as scientific study areas (natural "laboratories," control areas or reference sites for an ecosystem)
- Educating and sensitizing people about the importance of natural environments (connection with nature)
- Possessing social, cultural and spiritual dimensions (traditional and ancestral living environment for hundreds of communities)
- Offering economic benefits (diversification of economies, ecotourism, preservation of environments intended for subsistence activities)

As part of the Grande Alliance, protection is a pre-requisite to development (LGA, 2021). The Eeyou Istchee Conservation Strategy (CNG, 2015) has several objectives, including the creation of an interconnected network of culturally or ecologically significant areas, and the sustainability of wildlife populations. Currently, 23% of the Eeyou Istchee James Bay territory is protected and a further 7% of land is planned to be added to the protection list until 2030. Eeyou Istchee represents two environmental realities, divided by the commercial forestry limit. Below the limit, conservation approaches focus on protecting areas that remain intact or undisturbed by industrial activities. Above the limit, an opportunity still exists to build a network of key habitats, ecosystems and areas to maintain cultural and ecological integrity.

The Grande Alliance is based on the idea that development that respects its environment and uses protection as a guiding principle could be accepted by communities. Its objective is to protect areas everywhere on the territory, but especially to ensure that conservation of more untouched land remains a focus (LGA, 2022).

9.5.1 Information common to all three alignments

9.5.1.1 Federal legislation

At the federal level, several laws (and associated regulations)[5] provide a framework for the creation of protected areas:

Canada Wildlife Act (CWA, 1973), allowing for the establishment of national wildlife areas

- Migratory Birds Convention Act (1994), to create migratory bird sanctuaries
- Species at Risk Act (2002), which increases the power of the CWA regarding species at risk and their critical habitats
- Impact Assessment Act (S.C. 2019, c. 28, s. 1), which requires carrying out a thorough assessment of a project's potential repercussions when it relates to a protected area
- Oceans Act (1997), which allows for the establishment of marine protected areas in the context of a national network
- Canada National Parks Act (S.C. 2000, c. 32), which outlines its obligations and powers regarding protected areas under its responsibility
- Canada National Marine Conservation Areas Act (S.C. 2002, c. 18), which requires a consideration of ecosystem consequences in the planning and subsequent management of marine conservation areas

However, 62% of all conserved areas in Canada have actually been established (and therefore managed) by provincial and territorial authorities. Conserved areas under federal jurisdiction are deemed to represent, respectively, 28% (Parks Canada) and 10% (Environment and Climate Change Canada) of all protected areas identified across the country (ECCC, 2021).

In the 2019 Throne Speech, Canada committed to protecting 25% of its lands and oceans by 2025. By the end of 2020, Canada had conserved 12.5% of its land territory (with protected areas accounting for 11.7% thereof) and 13.8% of its marine territory (with protected areas accounting for 8.9% thereof). The purpose of conserved areas is to preserve biodiversity for current and future generations. In such areas, pressures exerted by human activity are reduced, and people are given the possibility to access nature. <u>The term "conserved areas" encompasses protected and other areas aimed at conserving biodiversity, but it does not meet the official definition of a protected area</u> (ECCC, 2021).

[5] https://www.canada.ca/en/environment-climate-change/services/national-wildlife-areas/protected-area-reference-documents/acts-regulations.html

9.5.1.2 Provincial legislation

Throughout Québec, responsibility for establishing and managing protected areas is split primarily between two ministries and is governed by a number of laws:

Provincial law	Ministry
Act respecting the conservation and development of wildlife (LCMVF) – for wildlife habitats, preserves and sanctuaries	MELCCFP
Act respecting threatened or vulnerable species – habitats for threatened or vulnerable species	MELCCFP
Natural Heritage Conservation Act (LCPN) – for marine reserves, biodiversity reserves, ecological reserves and human-made landscapes, as well as recognition of nature reserves on private land	MELCCFP
Parks Act (c P-9) governs the establishment and administration of parks	MELCCFP
Sustainable Forest Development Act (LADTF)	MRNF

The purpose of the LCMVF is to conserve wildlife habitats, preserves and sanctuaries and to develop them sustainably, as well as to recognize every individual's right to hunt, fish and trap in accordance with the law. To that end, it establishes various prohibitions regarding conservation of wildlife resources and various safety standards and sets forth the rights and obligations of hunters, fishers and trappers.

The purpose of the *Act respecting threatened or vulnerable species* is to protect and restore wildlife and plant species that have been designated as threatened or vulnerable. Further, a plant habitat is a protected area that holds at least one plant species that is designated as threatened or vulnerable and is identified in section 7 of the *Regulation respecting threatened or vulnerable plant species and their habitats*. To date, 52 plant habitats have been established.

The LCPN (C-61.01), adopted in 2002 and amended in 2021, takes its inspiration from the definition established by the International Union for the Conservation of Nature (IUCN), which stipulates that a protected area is a "clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystems services and cultural values." Thus, any activity carried out in a protected area of Québec must preserve the biological character of the area. If a conflict arises as a result of differing management objectives, the conservation of nature must take precedence.[6]

The *Parks Act*, adopted in 1977, governs the establishment and administration of parks and the adoption of related regulations. It stipulates that all forms of prospecting, and any utilization, harvesting or harnessing of resources related to logging, mining or the production of energy, and the laying of oil or gas pipelines or power lines, are prohibited within the confines of a park. Hunting or trapping of any kind is also prohibited.

[6] https://www.environnement.gouv.qc.ca/biodiversite/aires_protegees/aires_Québec.htm#def Accessed on April 20, 2022

The LADTF was adopted in 2013 and focuses on sustainable development of forests from environmental, social and economic standpoints. It also therefore ensures protection of biological refuges.

Register of protected areas:

Pursuant to the LCPN, the Register of protected areas in Québec aggregates and integrates all protected areas throughout the province, whether they fall under federal or provincial jurisdiction.

To comply with international conservation standards, all protected areas registered in Québec are also assigned a management category corresponding to the IUCN's globally recognized classification system (2008). These categories are found in Table 9.5-1.

Table 9.5-1 IUCN protected area management categories used in Québec

IUCN categories	Designation	Main features
Ia	Strict nature reserve	• Protect biodiversity, outstanding ecosystems and geodiversity • Relatively low visitation, human impacts strictly controlled • Must ensure minimal disturbance • Conserve cultural and spiritual values associated with nature
Ib	Wilderness area	• Protect the long-term ecological integrity • Provide for public access, educational and scientific research activities while preserving the area for future generations • Enable indigenous communities to maintain their lifestyle and customs • Free of modern infrastructure, development and industrial activity • Free of excessive human presence
II	National park	• Protect biodiversity and promote education and recreation • Maintain viable wildlife populations • Manage visitor use at a level which will not cause degradation • Take into account the needs of indigenous people and local communities • Contribute to the economy through tourism
III	Natural monument or feature	• Protect a specific natural feature and its associated biodiversity and ecosystem • Conserve traditional spiritual and cultural values of the site • Managed in much the same way as category II
IV	Habitat/species management area	• Maintain, conserve and restore species and habitats • Develop public education • Provide access to nature for urban residents • Protect at-risk species or fragments of habitats that require often active management to conserve them • Provide stepping-stones or breeding sites for wildlife
V	Protected landscape or seascape	• Protect and maintain important landscapes/seascapes that have been shaped by interactions with humans and traditional management practices • Maintain a balanced interaction between nature and culture • Socio-economic activity (recreation, tourism)

IUCN categories	Designation	Main features
		• Provide natural products and environmental services
VI	Protected area with sustainable use of natural resources	• Protect natural ecosystems while enabling sustainable resource use • Sustainable use of natural resources considered a *means* of achieving conservation • Promote the social and economic benefits to local communities • Facilitate scientific research and environmental monitoring • Facilitate recreation and small-scale tourism

1 Source: https://www.environnement.gouv.qc.ca/biodiversite/aires_protegees/registre/ and Dudley, 2008

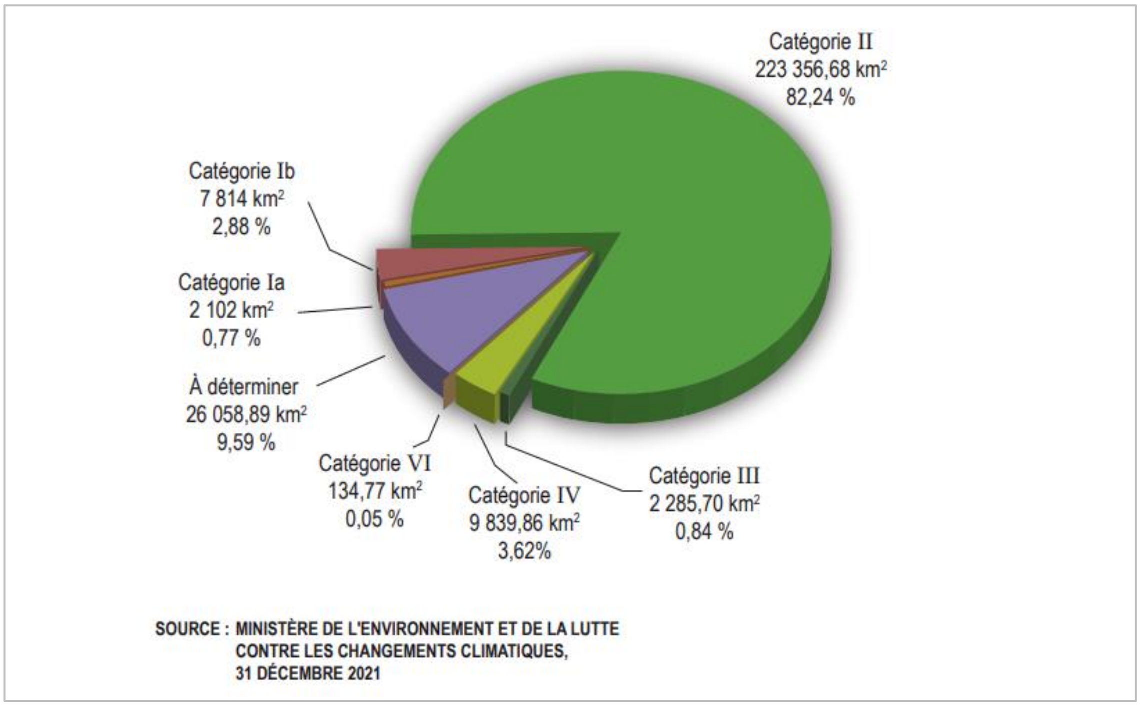


Figure 9.5-1 : Breakdown of protected areas in Québec by IUCN category

As of March 31, 2022, there were 32 designated protected areas in the Register of protected areas.[7] They are listed in

[7] https://www.environnement.gouv.qc.ca/biodiversite/aires_protegees/registre/reg-design/index.htm Accessed on April 13, 2022

Table 9.5-2 below. The types of protected area that occur in the study areas for this project are also highlighted. For each of the alignments, the study area includes the final road or railway alignment, as well as a buffer zone one kilometre wide on either side of the alignment (i.e. a 2-km wide corridor).

In addition, since it was amended in 2021, the LCPN allows Indigenous nations to propose their own conservation projects on lands that can later be designated as protected areas by the Québec government. These are referred to as Aboriginal-led protected areas (LCPN, section 4.3).

Lastly, protected areas with sustainable use are another category that was created with the updated law (pilot project on Anticosti Island).[8] A protected area with sustainable use is characterized by "the presence of natural conditions on the greater part of the land and by sustainable use of its natural resources. The land must be developed for the benefit of the local and Aboriginal communities concerned. Its management must be exemplary, and the communities' participation must be encouraged" (LCPN, section 47).

As shown in

[8] https://www.environnement.gouv.qc.ca/infuseur/communique.asp?no=4577 Accessed on April 20, 2022

Table 9.5-2 below, four types of protected area are found in the study area of the Grande Alliance – Phase 1 project: biological refuges (designated and proposed), proposed biodiversity reserves, proposed aquatic reserves and territorial reserves for protected area purposes (RTFAP).

Biological refuges

Falling under the aegis of the MRNF, biological refuges are small forest areas (about 200 hectares) where forest development is prohibited and where habitats and species (plant and wildlife) are protected on a permanent basis. These refuges are mature or overmature forests that are representative of Québec's forest heritage or young forests that are being allowed to age naturally, thus promoting the establishment of habitats conducive to species associated with old-growth forests. Such refuges are spread out across the province and can serve as "dispersal corridors" that contribute to biodiversity conservation. Thus, biological refuges can form stepping-stones between larger protected areas. [Translation] "Conservation of biological diversity is one of the six criteria for sustainable forest development in the LADTF ."[9]

In the **majority** of biological refuges, mining is also prohibited. In these cases, biological refuges can be officially recognized as protected areas and are then registered in the MELCCFP's register of protected areas in Québec.

9 https://mffp.gouv.qc.ca/les-forets/amenagement-durable-forets/objectifs-de-protection-et-de-mise-en-valeur-des-ressources-du-milieu-forestier/les-refuges-biologiques-des-forets-mures-ou-surannees-representatives-du-patrimoine-forestier-du-Québec/ Accessed on April 20, 2022

Table 9.5-2 Designation of 32 types of protected areas in Québec, as of March 31, 2022

Type of protected area	IUCN classification	Manager	Occurrence in study areas		
			Billy Diamond	Grevet-Chapais	Mistissini
Exceptional forest ecosystem:					
• Ancient forest	III - VI	MRNF			
• Rare forest	III	MRNF			
• Forest refuge	III - VI	MRNF			
Wildlife habitat					
• Waterfowl gathering area	IV	MELCCFP			
• White-tailed deer yard	IV	MELCCFP			
• Cliff inhabited by a colony of birds	Ia - VI	MELCCFP			
• Island or peninsula inhabited by a colony of birds	VI	MELCCFP			
• Habitat of a threatened or vulnerable wildlife species	II - VI	MELCCFP			
• Muskrat habitat	VI	MELCCFP			
• Heronry	VI	MELCCFP			
• Salt lick	IV	MELCCFP			
Marine park	II	Parks Canada and MELCCFP			
Voluntary conservation of natural settings	Ia - III – IV – VI Y[3]	Various owners[2]			
National Capital Commission park (Canada)	II	National Capital Commission (Canada)			
National park or national park reserve in Canada	II	Parks Canada			
Québec provincial park	II - III	MELCCFP			
Biological refuge	IV	MRNF	X		
Migratory bird refuge	Ia – III – IV - M[3]	Canadian Wildlife Service, ECCC[1]			
Wildlife refuge	IV - M[3]	MRNF[1]			
Aquatic reserve	II	MELCCFP			
Proposed aquatic reserve	II - Y – M[3]	MELCCFP		X	
Biodiversity reserve	II- III	MELCCFP			
Proposed biodiversity reserve	Ib – II - III	MELCCFP	X		X

Type of protected area	IUCN classification	Manager	Occurrence in study areas		
			Billy Diamond	Grevet-Chapais	Mistissini
Québec provincial park reserve	II	MRNF			
Territorial reserve for protected area purposes	II - Y - M[3]	MELCCFP	X		
Ecological reserve	Ia	MELCCFP			
Proposed ecological reserve	Ia - M[3]	MELCCFP			
Marine reserve	II	MELCCFP			
National wildlife reserve	Ia – III - IV	Canadian Wildlife Service and ECCC			
Recognized natural reserve	Ia- II – III - IV – VI - Y - M[3]	MELCCFP and various owners			
Land set aside	Y[3]	MELCCFP			
Proposed human-made landscape	N/A[3]	TBD			

1 In some cases, there is joint responsibility with other entities, such as federal authorities, conservation agencies, cities, town or municipalities.
2 Responsibility for conservation of the natural heritage on private land by the land owners
3 Y = unallocated; M = multiple allocations, N/A = no information in the register. IUCN allocations can vary from case to case.

Source: https://www.environnement.gouv.qc.ca/biodiversite/aires_protegees/registre/reg-design/index.htm

Proposed aquatic reserve

The purpose of a proposed aquatic reserve is to protect biodiversity in aquatic settings, as well as adjacent areas. To carry out work in this type of reserve, a proponent must complete an application for authorization to the MELCCFP. All mining, harnessing of energy or harvesting of forest resources is prohibited in these areas. This type of protected area can, however, be used for recreation, ecotourism or educational activities.[10]

[Translation] " A proposed aquatic reserve must therefore be considered land intended for the protection of the natural environment, discovery of nature and recreation," *Stratégie québécoise sur les aires protégées* [Québec protected area strategy] (SQAP, 2018a)

Lastly, the conservation plan specific to each proposed aquatic reserve allows for an additional legislative framework to be introduced in order to strengthen the reserve's protection, where the LCPN in itself is not sufficient (SQAP, 2018a).

[10] https://www.environnement.gouv.qc.ca/biodiversite/aquatique/index.htm Accessed on April 21, 2022

Proposed biodiversity reserves

On the same principle as the proposed aquatic reserve, the purpose of a proposed biodiversity reserve is to maintain biodiversity, this time on land. The provisions and measures that apply to the two types of reserves are similar. The goal of a biodiversity reserve, whether designated or proposed, is to protect natural areas that are representative of Québec and its broad diversity.[11]

Territorial reserve for protected area purposes

A territorial reserve for protected area purposes makes it possible to recognize land until it is legally protected. Any harvesting or harnessing of resources is prohibited (mining, energy, logging) until the status is assigned. Such reserves are designed to conserve nature and meet the international criteria for a protected area. For that reason, they are registered with the register of protected areas in Québec.[12]

Land intended for the protection of woodland caribou

Woodland caribou are an iconic species of Québec's north and play a central role in traditional Cree culture. Considered vulnerable throughout the province since 2005 and a threatened species federally (COSEWIC, 2017, see sections 9.9.1.2 and 9.9.1.3), the woodland caribou has been the subject of a number of provincial government measures to limit the loss of its habitat (ERCF, 2013a,b and 2020).

Below the northern territorial boundary of attributable forests, mosaic forest management disrupts woodland caribou habitat. The practice increases fragmentation and loss of woodland caribou habitat, as well as regeneration of hardwood forests, which favours moose. Conversely, the abundance of moose is also favourable to its predators (wolf and black bear), which see caribou as a substitute prey, driving up caribou mortality rates (Rudolph and coll., 2012).

Provincially, the woodland caribou strategy (under development) includes establishment of vast suitable tracts (*vastes espaces propices*, or VEP), habitat rehabilitation zones (*zone d'habitats en restauration*, or ZHR) and connectivity landscape features south of the attributable forest boundary in order to preserve the preferred woodland caribou habitat in this forest harvesting zone. The preferred woodland caribou habitat consists of mature and undisturbed softwood stands that are home to land lichens, which form the basis of their diet.

The initiatives that are likely to apply in the three strategy zones are as follows:

- **VEP**: maintain a low rate of disturbance to foster population self-sufficiency (about 35%), protect stands as long as they fulfill their ecological functions, spread out cutting areas to maintain adequate connectivity between stands in the VEP, demolish the majority of forestry roads.
- **ZHR**: disturbed lands about 5,000 km2 in surface area frequented by woodland caribou. Remediation work would take place to ensure self-sufficiency of caribou populations.
- **Connectivity landscape features**: disturbed land frequented sporadically by caribou; work would take place to maintain or restore the features of habitats conducive to exchange between populations.

[11] https://www.environnement.gouv.qc.ca/biodiversite/reserves-bio/index.htm Accessed on April 21, 2022

[12] https://www.environnement.gouv.qc.ca/biodiversite/reserves-territoires/index.htm Accessed on April 21, 2022

The official strategy was to be published in June 2022, but tabling has been postponed until 2023 and strategy implementation to 2024. An independent commission was also set up in late 2021, which is expected to submit its recommendations sometime in 2023.

Pending the establishment of the above-mentioned strategy, interim measures are in place to protect the habitat from 2019 to 2024 (initial date for strategy implementation). The purpose is to stabilize the target habitat until the strategy can be implemented, by for instance protecting sensitive stands in potential areas and reducing the long-term footprint of harvesting operations. In current and additional protected areas, no harvesting operation is authorized until March 31, 2023.

9.3.1.1 Cree Nation

Published in October 2015, the Cree regional conservation strategy sets milestones for protection of Cree land, water and resources in Eeyou Istchee, while safeguarding Cree rights. The strategy was developed by the Eeyou committee on protected areas at the initiative of the Cree Nation.

It should be noted that the hunting, fishing and trapping rights granted under the JBNQA in 1975 take precedence over all other laws regarding protected areas (provincial, federal) for those governed by the agreement. Other agreements have since strengthened those rights, in particular by shaping the conservation approach to biodiversity in Cree territory, such as the new Cree-Québec relationship, also referred to as the “Paix des Braves” agreement (2002).

The objectives of the strategy include:

- Creation of an interconnected network of conservation areas of ecological and cultural importance in order to safeguard biodiversity
- Conservation of the wildlife population and improvement of food security for current and future generations

The creation of conservation areas on Cree territory begins with the tallymen and local communities. [Translation] “ These protected area and conservation area projects are led by the tallymen and communities and form the cornerstone of a regional network of conservation areas.” The strategy also states that a global picture is essential to ensure connectivity and coverage of protected areas throughout the territory (CNG, 2015).

Lastly, the strategy also identifies a number of types of protected areas, such as:

- Basic conservation areas, where no industrial activity is allowed
- Conservation corridors, where wildlife can move and ecosystems can flow downstream
- Specific management areas, where activities must meet certain conditions
- Buffer zones, which surround the main conservation areas to guarantee their integrity

<u>Eeyou Istchee protected areas</u>

Throughout the Eeyou Istchee James Bay region, 23 new RTFAP were registered in the register of protected areas in Québec on March 31, 2021. This initiative made it possible to increase the proportion of protected areas in Eeyou Istchee from 12% to 23%, with the goal of achieving 50% protection of Northern territory by 2035. Eventually, the RTFAP are expected to be designated as biodiversity reserves or even national parks in some cases. This step, inspired by the Paix des Braves, is the culmination of a cooperative effort by the Cree Nation and the Québec government as part of the Grande Alliance project.

Initiated in spring 2018, the process took place pursuant to Article 25 of the Agreement to Resolve the Baril-Moses Forestry Dispute between the Cree Nation of Eeyou Istchee and the Québec government. According to that article, the proposed lands are areas of special ecological, environmental or cultural importance for the Cree. In addition, a number of the lands make significant contributions to connectivity, throughout the landscape, of habitats for the woodland ecotype of caribou, which is designated as "vulnerable" under Québec's *Act respecting threatened or vulnerable species* (c E-12.01) (Gouvernement du Québec, 2020).

Protected areas were established under the Paix des Braves: sites of special interest (1 % of each trapline) and site of special wildlife interest (25% of productive forest of each trapline). The location of theses areas was not available due to their confidentiality.

9.5.2 Potential BDHR alignment

9.5.2.1 Existing protected areas

The existing protected areas presented in this section are those identified as such in the register of protected areas in Québec as of December 31, 2021.

- Biological refuge 08665R006: protected since 2008, surface area 8.01 km^2, located near Soscumica Lake, shortly after km 80 in the direction of Waskaganish. This protected area is in the potential BDHR corridor. The railway alignment was modified to bypass the refuge. Although the alignment no longer impinges on the boundary of the protected area, it passes within 100 m of it in several places.

This refuge is a category IV management area or an "area of habitat or species management" as defined in the IUCN's Guidelines for Applying Protected Area Management Categories (Dudley, 2008).

9.5.2.2 Proposed protected areas

The proposed protected areas inventoried in the study area (2-km corridor) are as follows:

- Proposed Chisesaakahiikan and Broadback River biodiversity reserve: protected since 2018, surface area 4,978 km2. The area runs alongside the BDH to the east for about 27.4 km, starting at km 189 and moving northward.
- Chisesaakahiikan territorial reserve for protected area purposes: protected since 2020, surface area 866 km2 (Category II) located on either side of the BDH at km 189. The reserve notably includes Evans Lake.
- Proposed biological refuge with logging prohibited (08665R005): surface area 8.32 km2, located between Matagami and Olga lakes at km 28 heading toward Waskaganish.[13]

Note that about 3 km to the west of the edge of the study segment is the Waskaganish territorial reserve for protected area purposes (Map 9.5.1; SQAP, 2008).

[13] Source: Biological refuge (designated and proposed), Partenariat Données Québec, https://www.donneesQuébec.ca/recherche/dataset/refuge-biologique-designe-et-en-projet [accessed on July 6, 2022]

The primary objectives of the **proposed Chisesaakahiikan Broadback River biodiversity reserve** are to preserve natural settings that are characteristic of the Matagami Depression natural regions and the High Rupert plateau and to guarantee the pursuit of traditional activities engaged in by the Cree Nation. The reserve is aimed notably at protecting the old Hudson Bay Company trading post and the old Nemaska community village. For this protected area, the permanent protection status sought is a biodiversity reserve (SQAP, 2018b). This proposed protection area is categorized under IUCN category II, or national park.

This reserve is part of the Abitibi Lowlands and Mistassini Highlands natural provinces. The water flowing through it is mainly part of the Broadback River watershed and to a lesser extent the Rupert River watershed. The wetlands are made up primarily of peat bogs and occupy a large percentage of the territory, made up of plains and hills (elevation varying between about 240 and 380 m). The reserve encompasses a few old-growth forests: preferred habitat for the woodland caribou (sections 9.9.2). The reserve is also likely to shelter moose, Canadian lynx, American marten, beaver, lake trout and lake sturgeon.

The territory is not fragmented: there are a few forestry roads in the southern part and two power lines intersect it to the east.

As mentioned in section 9.5.1, the reserve is protected by the LCPN, but also by a conservation plan that legally strengthens its protection (SQAP, 2018b). The potential BDHR alignment will run alongside the boundaries of this proposed reserve, but does not cross into it.

The **Chisesaakahiikan territorial reserve for protected area purposes** is adjacent to the southern part of the proposed Chisesaakahiikan-Broadback River biodiversity reserve (Map 9.5.1). This proposed protection area is in IUCN category II, or national park. Located on Category III land, it was created to enhance the proposed biodiversity reserve by including a number of bodies of water and thus foster maintenance of water quality: Evans Lake (Chisesaakahiikan), Dana Lake and, in the section to the west of the BDH and railways alignment, Rodayer Lake (Pikutameyâsh sâkahikan). This sector also holds an area of significant cultural heritage, with burial sites, historical sites, camps and historical canoe routes (section 9.2). Lastly, the land reserve is also intended to encourage woodland caribou movement, in particular connectivity between the Assanica and Nottaway herds.[14]

9.5.2.3 Land intended for the protection of woodland caribou

The corridor of the potential BDHR alignment intersects a 42-km section of current interim protection zones established for woodland caribou, between km 150 and km 192 of the BDH, south of the proposed protected areas presented in section 9.5.2.2.

This distance goes up to 60 km for the Broadback VEP proposed in the future strategic plan (maps 9.5.2 and 9.5.3), between km 192 and km 122 of the highway.

In these areas, the rail alignment has been situated less than 100 metres from the BDH in order to minimize the impact on woodland caribou and its habitat.

[14] https://www.environnement.gouv.qc.ca/biodiversite/reserves-territoires/eeyou-istchee-baie-james/chisesaakahikan.htm Accessed on April 21, 2022

9.5.3 Potential Grevet-Chapais railway alignment

9.5.3.1 Existing protected areas

The existing protected areas presented in this section are those included as such in the register of protected areas in Québec as of December 31, 2021 (Map 9.5.4).

No existing protected area currently intersects the proposed Grevet-Chapais railway alignment (alignment itself and buffer zone of 1 km on each side).

It should be noted, however, that four biological refuges are located nearby. The first (08763R020) is 3 km from the alignment as the bird flies to the north of Route 113 at km 212. The second (02665R003) is 1.7 km south of the alignment, after Relique Lake in the direction of Chapais. The third (02665R005) is 4 km south of the alignment, in the immediate vicinity of MacIntosh Lake. The fourth and last (02666R018) is 4.5 km from the alignment, at the edge of the alignmentsouth of Chapais.

9.5.3.2 Proposed protected areas

Two proposed areas have been identified along the potential Grevet-Chapais railway alignment:

- <u>Proposed Waswanipi Lake aquatic reserve</u>, protected since 2018, surface area 577.4 km^2, located near km 204 of Route 113 toward the northwest. This proposed protected area is in IUCN category II, or national park.
- <u>Proposed biological refuge excluded from logging</u> (02665R007), located along Cavan Lake about 630 m south of the alignment (7 km from Chapais as the bird flies)

The main objectives of the **proposed Waswanipi Lake aquatic reserve** are to preserve the natural settings characteristic of the Chibougamau Depression natural region as well as Waswanipi Lake in the Nottaway River watershed. For this proposed area, permanent protection status as an “aquatic reserve” is being sought. This proposed protected area is an initiative of the community of Waswanipi to preserve traditional Cree activities on this land, in particular some of the historical waterways. The proposed aquatic reserve also protects the site of Vieux-Poste, location of the original village of Waswanipi (SQAP, 2018a).

On the land portion of the proposed reserve, the vegetation is made up primarily of softwood forests, dominated by black spruce and mixed forest. There are numerous forestry roads here. The elevation is between 258 and 341 m. This reserve is likely to form a refuge for a number of species representative of the Mistassini Highlands natural province, such as moose, American marten, beaver, lake trout and lake sturgeon. The following aquatic species are also found in Waswanipi Lake and are species of interest to the Cree: pike, whitefish, walleye and yellow perch (SQAP, 2018a).

As indicated in section 9.5.1, this reserve is protected both by the LCPN, but also by a conservation plan that legally strengthens its protection (SQAP, 2018a).

Note that a number of proposed biological refuges are also located near the potential Grevet-Chapais railway alignment, but outside the 2-km corridor. They include proposed refuge 08763R010, which is adjacent to Barbie Lake, south of Route 113 (km 230) and approximately 2.4 km south of the rail alignment; proposed refuge 02665R006 near Macintosh Lake, south of Route 113 (km 309) and 2.3 km south of the railway alignment; proposed refuges 02664R019 and 02664R018, located past Chapais along forestry road R1009, at the edge of the alignment and immediately to the north of Route 113, at km 347.

9.5.3.3 Land intended for the protection of woodland caribou

No land intended for the protection of woodland caribou intersects the potential Grevet-Chapais railway alignment, which is located further to the south.

9.5.4 Potential Mistissini 2nd access road alignment

9.5.4.1 Existing protected areas

The existing protected areas described in this section are those listed as such in the registry of protected areas in Québec, as of December 31, 2021.

There are no existing protected areas that currently intersect the Mistissini–Route du Nord alignment (which includes a 1-km-wide corridor on each side).

9.5.4.2 Proposed protected areas

Only one proposed protected area intersects the potential Mistissini 2nd access road corridor (Map 9.5.5): the proposed Albanel-Témiscamie-Otish biodiversity reserve, which covers an area of 11,871.3 km^2 and has been protected since 2007. The corridor intersects the southwestern edge of this reserve where it narrows to a thin ribbon of land just under 1 km wide. The boundaries of the proposed reserve are 200–300 m from the alignment at this spot.

This proposed protection area is classified as IUCN category II, or national park. It mainly consists of the Mistassini Highlands natural province. The sources of the Rupert, Eastmain and La Grande rivers (which flow into James Bay) as well as of the Péribonka, Outardes and Manicouagan rivers (which are tributaries of the St. Lawrence River), all lie within this area (SQAP, 2012).

This area also features three vegetation zones characteristic of Northern Québec: boreal forest, taiga and tundra. Old forest ecosystems along the historical canoe route that linked Lac Saint-Jean to James Bay via Lac à l'Eau Froide are refuges for woodland caribou. The southern portion of the proposed reserve is also habitat for two other special-status animal species: the southern bog lemming and the hoary bat (SQAP, 2012).

As mentioned in section 9.5.1, this proposed biodiversity reserve is protected by both the LCPN and a conservation plan that legally strengthens its protection (SQAP, 2012).

9.5.4.3 Lands intended for the protection of woodland caribou

The proposed access road linking Mistissini to the Route du Nord (between km 32 and km 34) intersects a woodland caribou connectivity landscape feature (see section 9.9.1.2) for approximately 12 km in the western section of the alignment before it joins the Route du Nord (Map 9.5.6).

9.5.5 Potential visitor access points

[Translation] “Any activity carried out in a protected area must preserve the area’s essential biological character. In the event of conflict between different management objectives, nature conservation shall take precedence.” – Excerpt from the MELCCFP website accessed on April 12, 2022 (MELCCFP, 2022a).

Recreational and tourism activities are currently permitted in existing or proposed aquatic or biodiversity reserves in the three study areas. Furthermore, recreational, tourism and educational activities are presumed to be compatible with biological refuges but require authorization if they involve cutting down trees (Poulin, 2014).

In general, the development of existing visitor access points should be prioritized so as to minimize habitat fragmentation and preserve large areas where wildlife will not be disturbed by visitors. To a lesser extent, this would also lessen anthropogenic impact on areas designated primarily for wildlife conservation.

9.5.5.1 Proposed BDHR alignment

Visitors would be able to access the protected areas in this study area by several access roads: to the south by the BDH, which is accessible from Matagami or Lebel-sur-Quévillon on Route 1005; to the north by the BDH, which is accessible from Nemaska on the Route du Nord or from the Waskaganish road. The BDH is also accessible further north from Eastmain, Wemindji and Chisasibi.

An existing campsite and boat launch at km 80, just before the alignment passes through a nearby designated biological refuge, is located in a spot that could be used as a visitor access point for biological refuge 08665R006.

The proposed Chisesaakahiikan–Broadback River biodiversity reserve and the Chisesaakahiikan territorial reserve for protected area purposes could share a common access point near km 192 on the BDH, which also has an existing campsite and boat launch at km 189 (Map 9.5.1). Moreover, access to protected areas should be developed outside the preferred habitats of woodland caribou (e.g., vast suitable tracts) and be designed to minimize fragmentation of protected areas. Recreational and tourism activities should therefore be located on the periphery of protected areas rather than towards their centre.

9.5.5.2 Potential Grevet-Chapais railway alignment

The proposed Waswanipi Lake aquatic reserve could be accessed at km 189 on Route 113, where a forestry access road already leads to this proposed reserve and there is already an existing campsite and boat launch. This railway alignment also intersects Route 113 just after km 190, which would represent another possible access point nearby.

9.5.5.3 Potential Mistissini 2nd access road alignment

The proposed Albanel-Témiscamie-Otish biodiversity reserve could be accessed from the two points closest to the boundaries of the future protected area (Baie Pénicouane and Nord-Ouest just outside Mistissini). In fact, access seems to already exist at these two locations and could simply be redeveloped, if necessary.

9.5.6 Potential impacts and mitigation

9.5.6.1 Construction phase

9.5.6.1.1 Information common to all three alignments

Protected (or conservation) areas can be disturbed by many pressures from their immediate vicinity. They can also be disturbed by activities that take place several kilometres away (airborne or waterborne pollution, for example) (Tardif, 1999).

The potential impacts on protected areas due to construction activities, as well as the related protection and mitigation measures, are general and standardized. These impacts and measures therefore apply to each alignment without any individual specificity.

Potential impacts and mitigation measures to be adopted for conservation areas during construction are summarized in general for the three study alignments in Table 9.5-3 . Some of these impacts and mitigation measures will then be described in subsequent sections according to individual alignments as applicable.

Table 9.5-3 Description of potential impacts and mitigation measures for conservation areas during construction phases

Potential Impacts	
1	Encroachment of the construction work into the peripheries of conservation areas
2	Disturbance of wildlife, including woodland caribou within lands designated for their protection (due to noise, vibration, etc.),
3	Introduction of non-indigenous species (fauna or flora) via materials (sludge, plant fragments, etc.) on machinery coming from the south
4	Isolation of conservation areas due to deforestation on their peripheries
5	Pollution (air or water) in the event of an accident or spill (contamination of the food chain by heavy metals, alteration of water quality, etc.)
Protection / Mitigation	
1	Encourage the construction of work camps away from conservation areas
2	Establish buffer zones between the construction work and the boundaries of conservation areas in order to minimize disturbance due to the work
3	Minimize deforestation and the destruction of natural environments in work areas
4	Close secondary roads opened during construction once they are no longer in use
5	Apply prevailing environmental standards (operate far from watercourses, spill kits available, etc.) to prevent contamination in the event of an accident
6	Make employees aware of the existence of sensitive environments near worksites
7	Preferably schedule work in the most sensitive areas during the winter months in order to limit deforestation, the opening of access roads, and disturbances to the local environment
8	Prior to the work, demarcate all the no-activity areas (sensitive environments) as determined beforehand
9	Encourage the use of temporary bridges wherever machinery crosses watercourses
11	Manage fill and cut materials to prevent deposits from leaching into watercourses and minimize soil erosion in or near sensitive areas
12	Restore sites after the construction work (e.g., by leveling, revegetation, natural drainage, etc.)

9.5.6.1.2 Potential BDHR alignment

Potential impacts

Several conservation areas are located near the proposed BDHR alignment. The proximity of the construction work could therefore have negative impacts on these sensitive environments (see

Table 9.5-2 in the previous section). Besides disturbing the wildlife that frequent such areas for resting, feeding or breeding, the work could encroach on the peripheries of the following adjacent conservation areas:

- Proposed biological refuge excluded from logging (08665R005)
- Designated biological refuge 08665R006
- Chisesaakahikan territorial reserve for protected area purposes
- Proposed Chisesaakahikan–Broadback River biodiversity reserve

The proposed BDHR alignment intersects approximately 42 km of existing interim protected areas for woodland caribou. Noise and other impacts of the work could therefore drive away caribou, potentially preventing them from reaching their habitual feeding and resting areas.

Mitigating potential impacts

To minimize the impacts of the construction phase of the BDHR on the protected areas listed in the previous section, the mitigation measures described in

Table 9.5-2 should be implemented.

In particular, since some protected areas lie within the alignment corridor or within the alignment right-of-way, it is preferable to locate work camps away from these areas.

Furthermore, given the proximity of the four protected areas, it is also strongly recommended to establish buffer zones between protected areas and work areas in order to minimize the impact of the construction work on the land bordering the protected areas. The required width of these buffer zones should be determined onsite by professionals based on the exact nature of the terrain and the protected area concerned (watercourses, topography, species present, etc.). Note: The width of the buffer zones may need to be considerable (400 m), depending on evidence of the presence of special-status species such as a bald eagle nest. This issue will be addressed in section 9.9.5, which covers both impacts and mitigation measures for special-status species.

These buffer zones could also serve as corridors connecting the conservation areas to preferred peripheral habitats for the species that use them and thereby limit the disturbance of woodland caribou. In addition, work should not be undertaken when caribou females are pregnant or nursing their young. More details on mitigation measures related to this species are provided in section 9.9.5.

9.5.6.1.3 Potential Grevet-Chapais railway alignment

Potential impacts

Two proposed protected areas are located within the potential Grevet-Chapais railway corridor:

- Proposed Waswanipi Lake aquatic reserve
- Proposed biological refuge excluded from logging (02665R007)

The proposed Waswanipi Lake aquatic reserve is listed in the registry of protected areas in Québec and therefore has the same legal status and protection as a protected area. This is not the case for the proposed biological refuge 02665R007.

The boundaries of the proposed aquatic reserve border the potential Grevet-Chapais railway alignment right-of-way. The reserve includes Waswanipi Lake and its tributaries that run directly alongside the alignment.

Since this aquatic environment is in the vicinity of the work that will be undertaken along the alignment, it will be necessary to mitigate how the water environment will be impacted by factors such as erosion, water contamination, leaching of soil disturbed by the work into watercourses, fish habitat degradation, and increased sediment and suspended solid loads in water. Impacts and mitigation measures associated with water and wetland environments are covered in greater detail in section 9.11.5.

The proposed biological refuge 02665R007 is located within the 2-km corridor, but approximately 700 m from the railway alignment right-of-way. The risk of impact from the work therefore primarily relates to waterborne or airborne pollution (e.g. noise or contaminants) being carried from the work to parts of the refuge of further away.

Mitigating potential impacts

In order to minimize the impacts of the construction phase of the Grevet-Chapais railway on the proposed protected areas listed in the previous section, the mitigation measures described in

Table 9.5-2 should be implemented.

If feasible, it would be highly desirable to establish a buffer zone between the work and the boundary of the proposed Waswanipi Lake aquatic reserve. If this is impossible due to the proposed reserve's close proximity to the railway alignment (a few metres in some spots), restoration of the environment to its natural state prior to the work should be planned to take place after the work has been completed. This may include revegetation, levelling affected land, restoring damaged habitats, and implementing other related compensatory measures. Furthermore, if the work encroaches within the boundaries of the proposed aquatic reserve, it may be necessary, depending on the nature of the work, to request authorization from the MELCCFP before starting the work, since this area enjoys legal status (SQAP, 2018a).

With regard to the proposed biological refuge, the establishment of a buffer zone does not seem essential given the distance of the proposed reserve from the alignment. On the other hand, establishing a no-go perimeter for machinery as a precaution could be considered a feasible preventive measure. Keeping the work away from watercourses and limiting noise and airborne particles are the main mitigation measures applicable in this case. Restoration of the work site should also be considered if this proves to be necessary for the proposed biological refuge's connectivity with other nearby wildlife habitats of interest.

9.5.6.1.4 Potential Mistissini 2nd access road alignment

Potential impacts

The potential Mistissini 2nd access road alignment passes near the proposed Albanel-Témiscamie-Otish biodiversity reserve and its corridor encroaches upon the reserve's boundaries at one spot. The area concerned is an aquatic environment (portions of Baie Pénicouane) and the impacts likely to occur there during the work are therefore the same as those likely to apply to other water environments (see section 9.11.5 for more details). In particular, the main potential impacts are the following: erosion, eutrophication, water contamination, leaching of soil disturbed by the work into watercourses, fish habitat degradation, and increased sediment and suspended solid loads in the water.

This alignment also intersects a woodland caribou connectivity landscape feature. Note: Connectivity landscape features in this context are areas intended for woodland caribou conservation and are defined as disturbed areas frequented occasionally by the species. Habitat restoration work would encourage exchanges between the various wildlife populations (section 9.9.1.2). Although work-related disturbances could very well drive caribou away from their usual migration routes in the area, this species is only in this area from time to time and is primarily concentrated further north.

Mitigating potential impacts

In order to minimize the impacts of the construction phase of the Mistissini 2nd access road alignment on the protected areas mentioned in the previous section, the mitigation measures described in

Table 9.5-2 should be implemented.

In order to mitigate the impacts of the work on the parts of the proposed biodiversity reserve within the alignment's corridor, the regulatory distances for working near watercourses will need to be respected and the associated measures for protecting the water environment implemented (see section 9.9.5). The establishment of a buffer zone would also be desirable in order to limit the deterioration of the natural environments bordering the proposed protected area. Details on the relevance of establishing buffer zones between work areas and sensitive environments are also provided in the previous sections covering the Proposed BDH and Grevet-Chapais railway alignments.

With regard to the woodland caribou connectivity landscape feature upon which the road to join the Route du Nord encroaches, it would be advisable to minimize the impact of construction work on the environment and then either restore the site or implement appropriate compensatory measures after the construction work has been completed so as to avoid further degrading the forest stands and preferential habitats that could very well be located within the 2-km corridor.

9.5.6.2 Operating phase

9.5.6.2.1 Information common to all three alignments

9.5.6.2.2 Proposed BDHR alignment

<u>Potential impacts</u>

Construction of the railway will result in additional natural disturbance to the BDH and may affect the quality of wildlife connectivity between portions of these protected areas on either side of the alignment.

Implementation of the rail network will provide greater accessibility to the area, if stops and landings were developed between the communities (2 goods trains per day and 4 passenger trains per week, i.e., 18 trips per week). One of the purposes of the existing and proposed protected areas in the BDHR study area is to provide for recreational, tourism and educational activities. If there are more visitors to these areas because of greater accessibility, the human footprint on these sensitive ecosystems might very well increase. However, in the absence of railway stops, the primary access to the protected areas would continue to be the existing BDH. The railway would therefore not be a significant factor in increasing visitor numbers.

Table 9.5-4 Total length of the three alignment study areas crossing protected areas

Components	Billy Diamond[1]	Grevet-Chapais[2]	Mistissini Road[3]
Cumulative distance (km) through areas retained for woodland caribou conservation	59.83	0	11.85
Cumulative distance (km) through protected areas and biological refuges	0	162.44	0
Cumulative surface (in km^2) of protected areas and biological refuges within the COR[4]	32.66	5.69	0.67

[1] Billy Diamond right-of-way: average width 26.7 m length: 252.52 km
[2] Grevet-Chapais right-of-way: average width 33.8 m length: 162.43 km
[3] Mistissini 2nd access road right-of-way: maximal width by default 35.0 m length: 45.44 km
[4] COR : 2-km corridor (1 km on each side of alignments):

- Billy Diamond COR: 1,020.37 km^2
- Grevet-Chapais COR: 661.05 km^2
- Mistissini 2nd access road COR: 92.59 km^2

Mitigating potential impacts

Linear infrastructure should be added so that it is as contiguous as possible to the BDH right-of-way. This is particularly important along the above-defined 72 km for woodland caribou. The rationale for this approach is as follows:

- The BDH is a linear fragmentation element to which wildlife in the area have had to adapt since the 1970s. The juxtaposition of a railway to the existing road will inevitably widen the corridor that wildlife will have to cross but will not constitute an entirely new disturbance.
- Development of a railway alignment far from the BDH would fragment and destroy habitat deeper into the forest environment, thereby creating a second disturbance that could affect wildlife migration patterns, while also creating enclosed habitats between the two infrastructures. This would also increase the risk of collisions.
- In the case of woodland caribou specifically, a railway alignment far from the BDH could increase predation risk by facilitating predator movement into newly accessible habitat. Conversely, wolves and black bears would only have limited access to new hunting areas with an alignment close to the existing road. The case of woodland caribou is also covered in more detail in section 9.9.5.

Another consideration is that if more visitors are attracted to the conservation areas in these regions due to increased accessibility, recreational and educational activities there should be supervised so as to minimize the human footprint and not disturb the wildlife in these environments, which they may use for resting, feeding or breeding.

9.5.6.2.3 Potential Grevet-Chapais railway alignment

Potential impacts

Four biological refuges are located near the Grevet-Chapais railway alignment. However, these are between 1.7 km and 4.5 km away from the alignment. This means that their wildlife will not be subject to potential long-term environmental impacts except in the case of the species most sensitive to noise that could potentially be disturbed by the repeated passage of trains. Note: Since the Grevet-Chapais railway alignment follows the bed of a former railway, it does not constitute a new disturbance within or on the periphery of local protected areas.

With regard to the southern boundary of the proposed Waswanipi Lake aquatic reserve which runs along approximately 6.0 km of the potential Grevet-Chapais railway, road maintenance work will need to avoid encroaching within the protected area's boundaries.

If more frequent train service makes both the existing and proposed biological refuges and protected areas more accessible, the human footprint will increase on these ecosystems that have so far been relatively undisturbed. However, the current use of the potential Grevet-Chapais railway alignment for transportation (forestry) and recreation/tourism (snowmobiling) already constitutes existing access.

Another consideration is that the potential Grevet-Chapais railway alignment is located entirely outside the lands intended for woodland caribou protection.

Mitigating potential impacts

With regard to the immediate proximity of the railway alignment to the proposed Waswanipi Lake aquatic reserve, the boundaries of this reserve will need to be clearly established so that track maintenance or servicing operations do not encroach into this protected area.

As in the case of the proposed BDHR alignment, if the Grevet-Chapais railway results in more visitors to conservation areas in the vicinity, this should be controlled to minimize the human footprint.

9.5.6.2.4 Potential Mistissini 2nd access road alignment

Potential impacts

A portion of the potential Mistissini 2nd access road alignment runs along approximately 12 km of a woodland caribou connectivity landscape feature before the road joins the Route du Nord. Connectivity zones in this context are areas intended to woodland caribou conservation and are defined as disturbed areas frequented by the species from time to time. Habitat restoration work would encourage exchanges between the various wildlife populations in these areas (section 9.9.1.2). Connectivity landscape features therefore cannot be classified as sensitive environments in the same way as protected areas, for example.

On the other hand, traffic-related disturbances could very well displace caribou from their migration routes in this area, even though this species is only in the area from time to time and is primarily concentrated further north. More information about potential impacts on this protected species is provided in section 9.9.5.

Mitigating potential impacts

As in the case of the proposed BDH and Grevet-Chapais railway alignments, if increased local traffic results in more visitors to nearby conservation areas, use of these areas should be controlled so as to minimize the human footprint, while adhering to the regulations for the type of protected area concerned and the local community's conservation measures (e.g., conservation plan and/or tallymen), particularly with regard to possible fishing and hunting pressures caused by outside visitors. The risks and mitigation measures relating to wildlife and natural resource management (hunting, fishing and trapping) are covered in sections 9.9 and 9.10.

9.5.7 Limitations

There are significant uncertainties associated with the above description of the protected areas and the assessment of the potential impacts of the construction and operating phases of the three alignments. These uncertainties are primarily of two kinds, both of which relate to the proposed protected areas. On the one hand, the proposed protected areas that are documented or known at the time of writing may never materialize or their size or boundaries may always be subject to revision.

On the other hand, new protected areas may be designated in the time between this feasibility study and construction planning. An example of this is the planned implementation of lands for woodland caribou protection in the northern section of the proposed BDHR alignment, whose inclusion in the Québec network of protected areas is not yet clearly defined.

In the final analysis, the configuration of the study alignments has been assessed according to the existing context, even though this context is likely to change, perhaps significantly, in the future.

9.6 TRAINING OPPORTUNITIES

The development of the Grand Alliance is a business opportunity for the community. Seizing this opportunity will entail local training and capacity building and constitute a driving force behind collective value creation. This subject is developed in the market study report (Section 10.8, Volume 4).

9.7 IMPACTS ON COMMUNITY HEALTH

9.7.1 Scope of the preliminary health impact assessment

The assessment of impacts on communities considers all Cree communities that the components may impact.

The present mandate is to conduct a first step of a health impact assessment of the Grande Alliance Phase I components. It is based on desktop research which considered:

- all potentially affected populations, including workers and locals from Cree communities.
- the expected changes in human exposures and the project's effects on these communities downward to the individual level.
- any changes in human contact with infectious diseases or their vectors.

This study highlights all potential impacts based on an extensive literature review of a similar projects:

- Impacts on the physical health of potentially exposed populations.
- Impacts on socio-cultural well-being.
- Impacts on health care facilities and occupational health services.

9.7.2 Methodology

The main objective has been to provide a portrait of potential impacts of railroad development and operation on public's health based on documented existing similar projects and contexts. VEI used the population health approach / health determinants framework, which is an assessment of traditional health status indicators, to include the Cree holistic view of health that goes beyond the absence of diseases.

The complete state of wellbeing, called *miyupimaatisiiun*, is the balanced relationship between social, economic, and environmental elements. It has an individual-centered approach that prioritizes health and wellbeing over diagnosis (the desire to know) and cure (the absence of disease) (Adelson, 1998; Shrivastava et al., 2020). Therefore, being healthy is a multidimensional and united concept that starts with their connection to the environment. As many anthropologists described, the abundance and healthiness of natural resources used to define families, which relied on its territory as a source of food (Adelson, 2000; Preston, 2014). Fishing, hunting, and gathering come with particular skills embedded with cultural meanings, which were passed on from generations. Although the Cree cultural identity has been altered by colonialism, many actions regarding the control over the territory combined with self-determination to govern have driven the Cree to reclaim their cultural heritage (Vanthuyne, 2021). Their adaptive responses concerning long-term landscape changes such as hydroelectric projects and climate change reflect a commitment to traditional activities and places as an important connections with their past (Sayles & Mulrennan, 2010). In that perspective, health impact assessment must consider not only Cree cultural realities and values, but also reflect their vision of health when examining how the construction and the operation of railway and road corridor can affect communities. Therefore, VEI proposes determinants that provide stronger connections among environmental, social, and cultural components and may present an opportunity for a more holistic approach to health impact assessment in the Eeyou Istchee.

9.7.2.1 Analytical Framework

First, the analysis starts with the premise that an impact can be described as a change actually experienced by humans (at individual, group or society levels) in either a corporal (physical) or cognitive (perceptual) sense (Van Schooten et al., 2003; Vanclay, 2002). According to this definition, many impact variables are not in themselves impacts, but rather represent measurable outcomes of social change processes. Depending on the context, these processes may or may not produce impacts. For example, the purported impact called 'population change' does not meet the definition of an impact. An increase in population is not in itself a condition 'felt' or 'experienced' by an individual or a group. Of course, 'population change' does lead to impacts. After a population increases, people may experience increased demand for health services, leading to longer waiting hours or delays in having an appointment, and possible annoyance resulting from these changes. Therefore, a change in population is a social process. Population is an important social indicator, and it is necessary to understand how a change or a stressor can affect a population. Identifying actual impacts and scale and distinguishing them from processes is essential because it leads to a better understanding of how a single change produces a single impact and cumulative impacts.

As a second step, based on a recent health assessment review (Myette & Riva, 2021) and reports of health determinants (Hydro-Québec, 2015; Torrie et al., 2005), a corpus of scientific articles and reports that were relevant to health assessment, Cree communities, railroad developments or northern Canadian projects was assembled (INSPQ, 2014; Brisson et al., 2015; Durocher, 2017; Hackett et al., 2018; Hydro-Québec, 2015; Reading & Wien, 2009; St-Pierre, 2021). Reading through this literature, concepts related to a wide range of social and environmental mechanisms used to understand baseline health conditions or assess the project's potential impacts on health and well-being were highlighted.

Finally, a text analysis was carried out using a selection of NVivo codes and sub-codes considered pertinent for a Cree health impact analysis. We sorted out and classified these codes by relevance to the project and its background. As shown inTable 9.7-1, eight social processes were retained related to four types of impacts that could occur given the project's nature and context to produce health outcomes. These processes were related to changes emerging from the construction and operation of railways, and these processes could impact communities and individuals in numerous ways. A complete list of indicators detailing each of these processes and impacts is available after the conclusion.

Table 9.7-1 Summary of major social processes and impacts

Stressor	Social Processes	Impacts
Railway and road construction Railway and road operation	• Presence and nature of new project employment • Local economy and influx of money • Population and demographic • Social structures • Physical and mental well-being • Community cohesion and sense of belonging • Quality and access to the environment • Institutional, political, and equity	• Health infrastructure and services • Food security • Mental and physical health • Subsistence activities

Most indicators are documented and monitored through different federal or provincial agencies (e.g., mortality rate, literacy rate). However, it is important to highlight that some variables present some challenges to report on (e.g., loss of cultural cohesiveness). In contrast, others can only be acknowledged (e.g., colonialism or self-determination). The fact that an indicator cannot be quantified or easily documented does not undervalue its impact on society.

9.7.3 Potential impacts of linear infrastructures (rail and road) on public health

From the analysis and coding of scientific literature, four possible scenarios of impacts were constructed. They vary in time and magnitude. The scenarios are illustrated with diagrams, and they are built using a causal chain that addresses social processes and impacts associated with different phases of the project (construction vs. operation). In considering the importance of Cree *miyupimaatisiiun* pathways, three key impacts scenarios were identified: health infrastructure and services, subsistence activities, and food security.

9.7.3.1 Health infrastructure and services

The construction of infrastructures creates employment opportunities and attracts Cree and southern workers. In general, population growth results in an inexorably growing demand for health services (MacNeill et al., 2021). In the past hydroelectric projects, workers, primarily men, were accommodated in work camps near the project sites. As shown in Figure 9.7-1, the mass influx of primarily male workers who seek female companionship might impact the teen pregnancy rate and the spread of infectious diseases such as flu and sexually transmitted and blood-borne infections (STBBIs).

Moreover, projects are likely to put more pressure on social and health services in the Baie-James region. According to reports on health determinants (Hydro-Québec, 2015; Torrie et al., 2005), when the Eastmain-1 project started in 2003, the number of hospitalizations for self-inflicted injury and assault more than doubled. Those rates were much higher in Eeyou Istchee than in the rest of Québec. Follow-up on these indicators could shed light on the influence of a large project on mental health issues.

In the short term, higher demand for health services could occur: pressures on the system leading to delays in treatment resulting in more advanced stages of the disease. Moreover, remote communities are typically understaffed with physicians and other health care professionals and increasing caseloads could exacerbate this problem. In the long term, it could affect healthcare workers, their availability, and the quality of care provided.

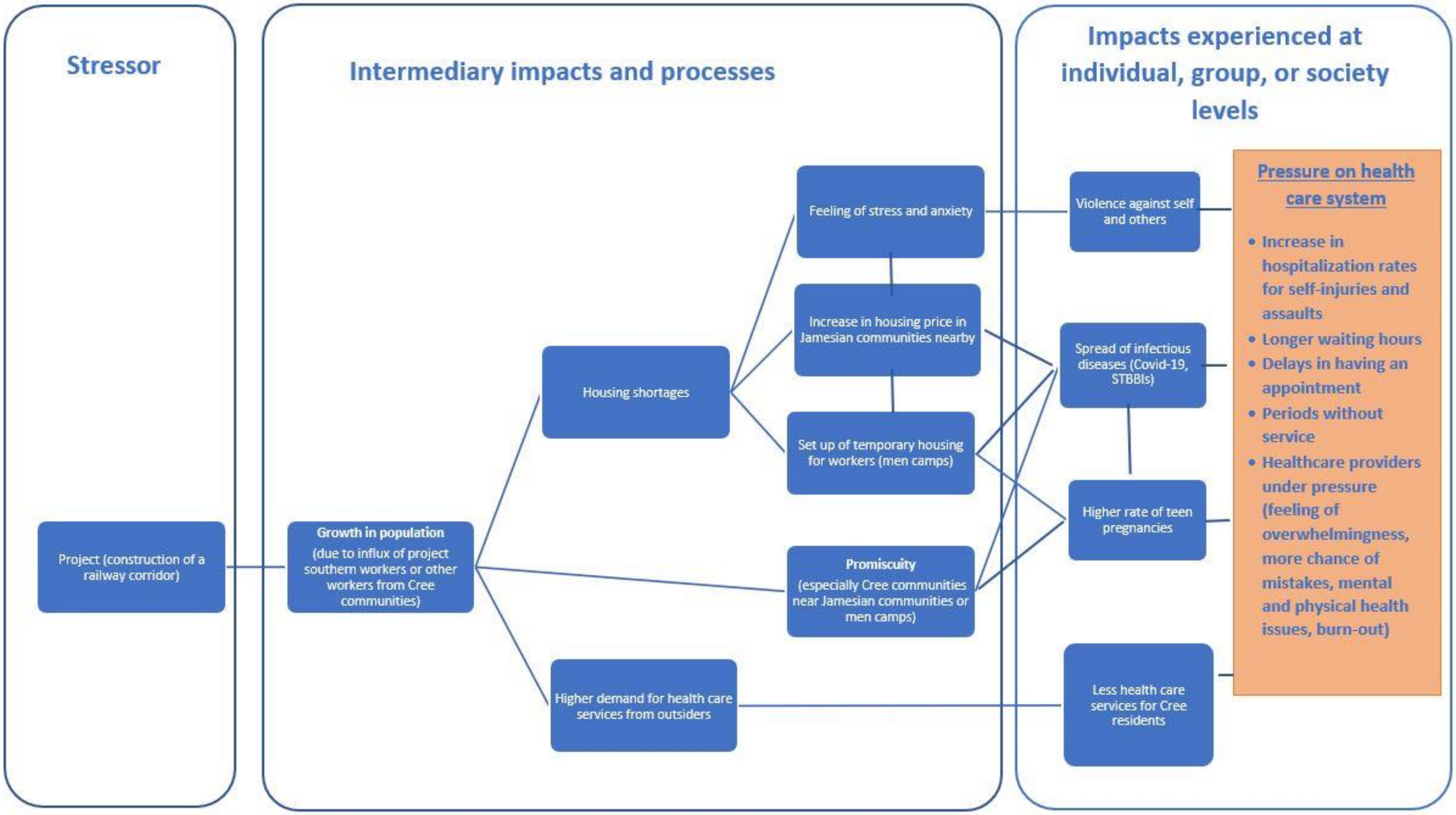


Figure 9.7-1 Potential impacts of construction of a linear infrastructure on health infrastructures and services

9.7.3.2 Food security

The construction of infrastructure such as railways and roads can be disruptive to the environment in many ways such as deforestation, territory segmentation, the introduction of contaminants. In Figure 9.7-1, the diagram starts on the left side with the stressor – construction activities – that set in motion changes to the environment, including disturbance or destruction of animal habitats and disruption of migration routes for animals, such as caribou for example (Dylan et al., 2013). Therefore, the availability of game animals could be compromised in the short term. However, in the long term, a possible resurgence in animal population and vegetation could be observed.

The land disturbances could also result in accessibility restrictions to the territory. The loss or reduced access to the hunting, gathering, trapping, and fishing grounds could reduce the time individuals spend in nature. Going out on the land is an essential cultural practice (Moore et al., 2017) that affects Crees' attachment to their territory, their personal and collective identities, and their feeling of belonging to a larger entity, which all contribute to the individual health and well-being (INSPQ, 2014). However, some communities could report positive impacts resulting from the railway and road operations over time. As shown in Figure 9.7-2, a positive advantage from the use of the train to gain access to hunting grounds more easily can be expected. Notably, the train could also be used to transport hunting equipment (e.g., snowmobile, quads) or big wildlife game meat (e.g., moose carcass).

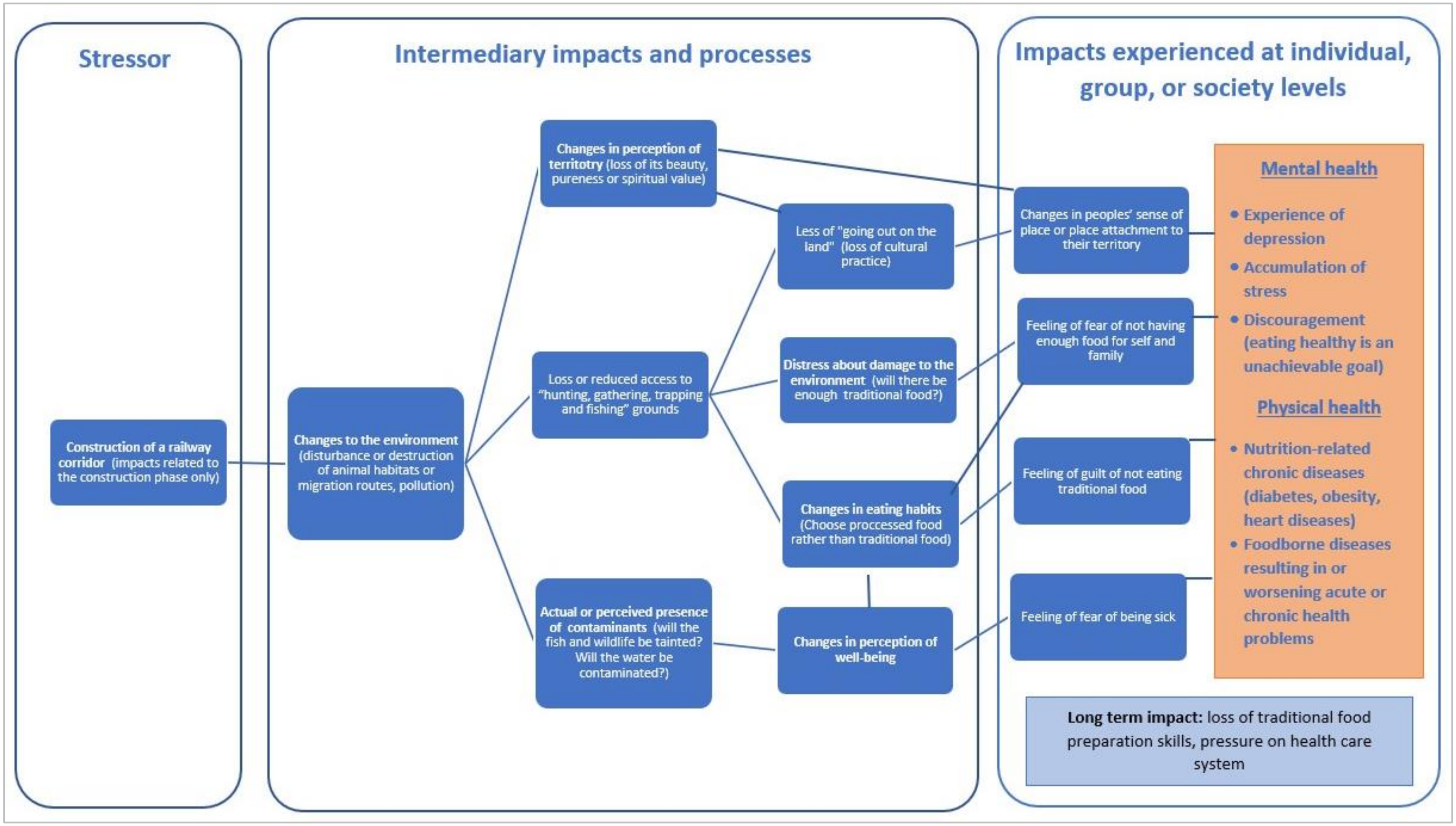


Figure 9.7-2 Potential impacts of construction of a linear infrastructure on food security

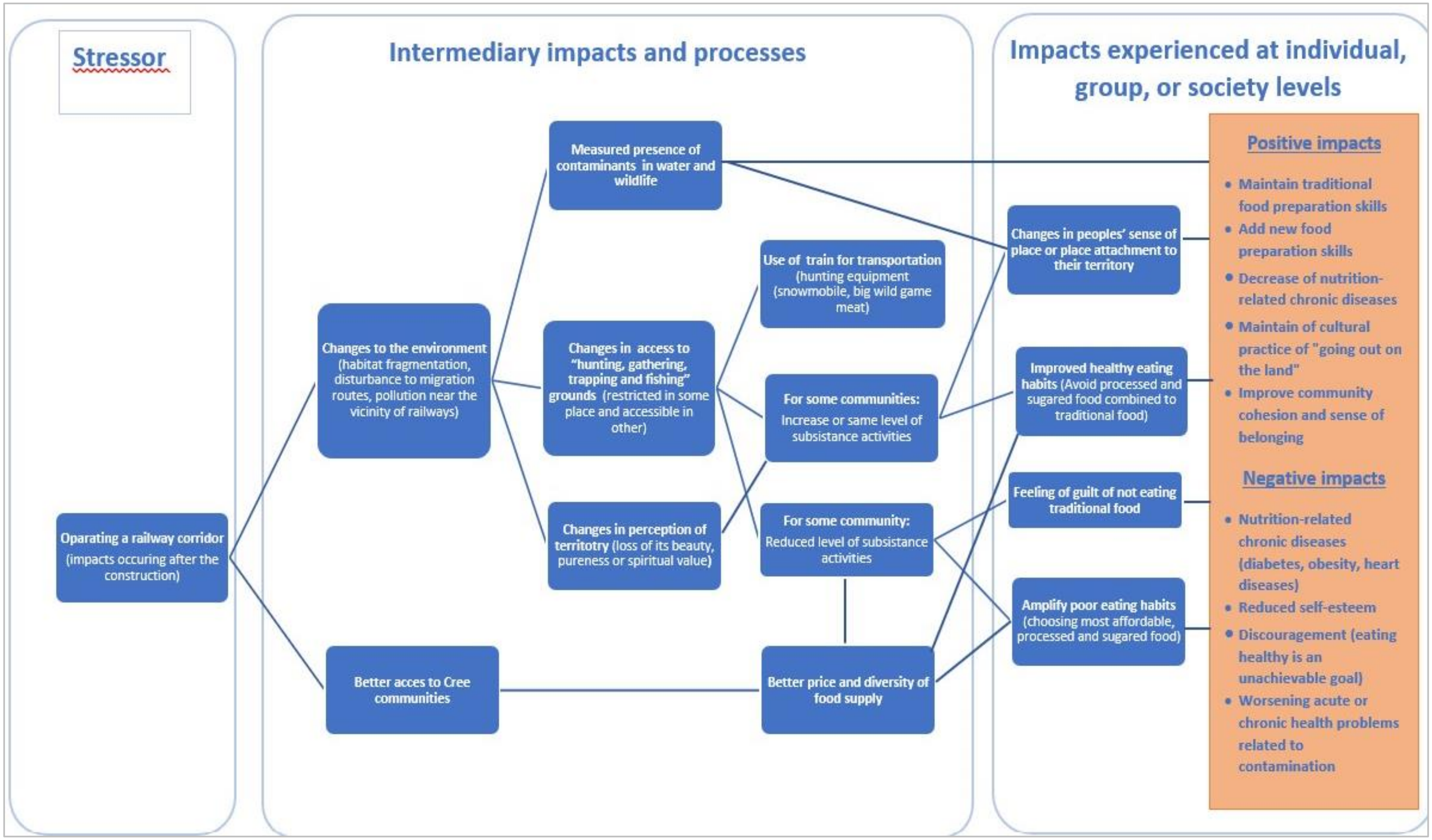


Figure 9.7-3 Potential impacts of operation of a linear infrastructure on food security

Another important point that came out of the scenario is the possibility of water and wildlife contamination. There are two general categories of contamination identified along railway corridors: residual contamination present along any stretch of corridor and contamination associated with industrial uses alongside it (Lucas et al., 2017). The potential contaminants can include:

- Railroad ties treated with industrial wood preservatives (creosote, chromate, copper arsenate)
- Coal ash and cinder containing lead and arsenic
- Spilled or leaked liquids such as oil, gasoline, cleaning solvents
- Herbicides
- Fossil fuel combustion products (PAHs)
- Transformers (contain oil) and Capacitors (contain aluminum oxide)

Railroad ties leaching creosote, chromate copper arsenate, or any preservatives pollute local watersheds and adjacent grounds. Studies have shown the presence of polycyclic aromatic hydrocarbons (PAH) in ballasts and ditch water alongside the railway corridors, where leaks of all sorts occur and ties slowly release chemicals (Brooks, 2004; Wan, 1991). PAH-contaminated sediments and water discharging into fish habitats impact fish development (Ownby et al., 2002). However, the tainting of aquatic organisms from exposure to creosote has not been fully addressed and may have implications for the human use of fish. This indicator should be documented.

Research also documented contamination of track surrounding grounds (Malawska & Wiołkomirski, 2001; Wilkomirski et al., 2011). It was found that contamination of the soil and plants was the highest in the railway siding. The toxicology analysis revealed the presence of heavy metals (Pb, Cd, Cu, Zn, Hg, Fe, Co, Cr, Mo). Since the surroundings of the railroad are open spaces, some plants take advantage of more light and grow readily on the side of roads. Over time, these plants could be unsafe to eat by wildlife or humans (EPA, 2021; Calder et al., 2016; Medeiros et al., 2017). Waste and other pollutants present concerns near the site during the construction phase and can remain concerns long after operating the railway. Although all evidence points to a local, near the tracks, ground contamination, which humans can avoid, more studies should be conducted to support this hypothesis.

The actual or perceived presence of contaminants can compromise food and water security. Human exposure to mercury, lead and PBCs has been an issue in the Eeyou Istchee since 1970s. For the twenty years to follow, the level of these contaminants in human tissues has been documented and characterized as moderate to high in comparison to other population groups (Torrie et al., 2005). Health authorities has been juggling for decades with the dilemma of promoting traditional food consumption for its health benefits while warning against overexposure to contaminants. Fear of being sick from foodborne illnesses, either founded or groundless, can lead someone to change his eating habits. As food in local stores in remote communities can be costly, choice over traditional food is often the most affordable food available (transformed and sugared). This change can result in a myriad of impacts varying from a feeling of guilt for not eating traditional food to an increase in diabetes prevalence in the community. On the contrary, it could be argued that local supermarkets could supply a greater diversity of food at a better price with better access to Cree communities via the train. This could have a positive impact, such as introducing new nutritious food and learning new cooking skills.

9.7.3.3 Subsistence activities

One of the most important benefits for Cree workers in infrastructure projects is new employment opportunities. We could expect various hiring opportunities for men and women, ranging from on-site construction jobs to cafeterias, housekeeping, and office work. Access to the labour market and training programs are ways of improving economic conditions. However, as shown in Figure 9.7-4, an increase in income can be a double-edged sword. On the one hand, it could be said that well-budgeted income improves the economic well-being of families and the self-esteem of individuals. On the other hand, it could be a steppingstone to deviant social behaviors such as gambling, drug use, and alcohol addictions.

While Cree workers would gain from employment through the project, it is essential to note that work schedules can impact families' organization and subsistence activities. Well-documented studies from the Canadian extraction industries have shown that companies offering shift arrangements of one week on, 1-3 weeks off were considered advantageous by some indigenous workers (Bernauer, 2011; Koutouki et al., 2018; Nightingale et al., 2017; Saxinger, 2021). The time-off was considered long enough for them to engage in subsistence activities, which usually involves going on land for more than two days. The regular schedule of 5-day in, 2-day off does not offer this opportunity. Moreover, the additional income from employment helped finance hunting equipment, like all-terrain vehicles, guns, and ammunition, to increase access to and availability of traditional food (Shandro et al., 2017; Southcott & Natcher, 2018). This additional income can also help to make store-bought food more affordable.

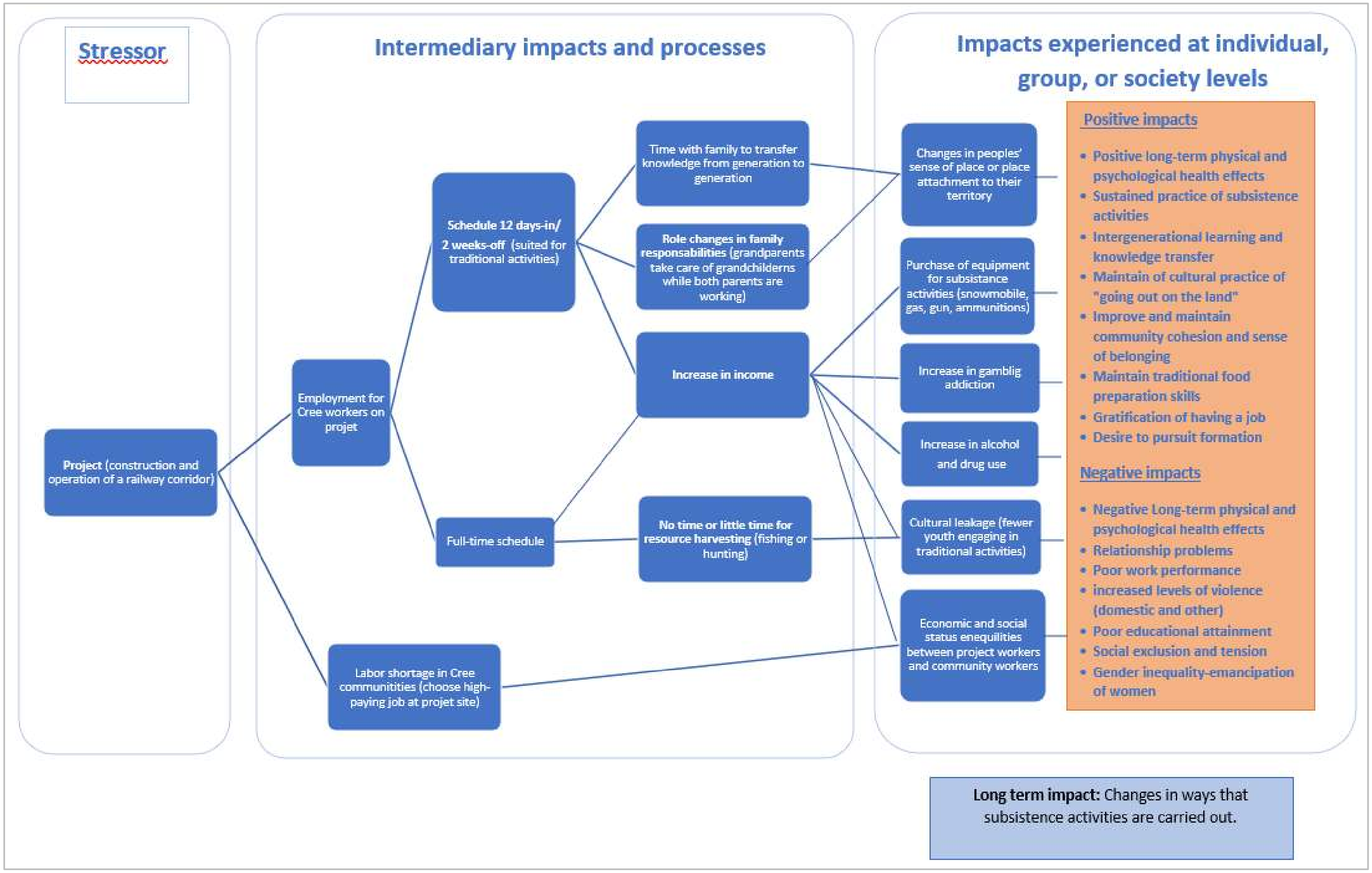


Figure 9.7-4 Potential impacts of construction of a linear infrastructure on subsistence activities

However, the one week on-two weeks off schedule was not advantageous for everyone (Markantoni et al., 2018). Among the negative reasons cited in studies, spousal relationships issues and family responsibilities were frequently mentioned. It has been acknowledged that the two-week rotation has contributed to gossip and rumors of infidelity that caused relationship problems. Equally important are childcare responsibilities and lack of childcare facilities, which meant that children were left under the supervision of a partner or family member. Despite this change in family structure, some studies have found that grandparents are often involved in the care of children when parents are away working, which has a positive impact on traditional knowledge transfer (Davison & Hawe, 2012). Either way, if one or both parents are working, family support is needed to reduce stress and prevent conflicts. It could be an incentive to include grandparents when possible or the setting up of daycares.

Throughout the literature, substance use and abuse are some of the most common health impacts of projects in remote areas (Arruda & Krutkowski, 2017; Joly & Westman, 2017; Torrie et al., 2005). Workers' drug and alcohol consumption rates are well documented in extraction site projects in Northern Canada (Dorow & Jean, 2021; Saxinger, 2021). Those problems are often attributed to the recruitment of young men, who have high disposable income levels, the hardship of the work, and the remoteness of sites. Many described a constant fight against instant gratification—the temptation of buying goods, partying, or gambling. Some workers get trapped in a vicious cycle of working hard, playing hard, and thus of debt. However, could we reach the same conclusion for Cree workers? According to the Hydro-Québec report (2015), Cree workers who worked and lived near hydroelectric projects did not change their substance use. The ones consuming alcohol and drugs in their Cree communities carried on consuming at the work camp. However, this study falls short of documenting drug use and alcohol consumption habits in the communities. It might be pertinent to look for such changes since the ripple effects of the project will be felt not only by workers but their families and, finally, the whole community.

9.7.4 Conclusion

The concept of *miyupimaatisiiun* is important since the Cree Nation generally wants to continue to rely on subsistence harvesting for a significant amount of their food and medicine. There is a need for an integrated health assessment, which considers health risks and benefits to wellness from traditional social aspects and land use. Therefore, the *miyupimaatisiiun* indicators should be documented by and with Cree communities. The monitoring should not be limited to human health and nutrition but include a broad environmental program and its nexus with cultural, spiritual, and linguistic practices. However, literature on health assessment generally focuses on negative impacts and presents very few examples of pragmatic, positive solutions. This perspective draws a dark picture of the future instead of finding ways of mitigating possible impacts which should also be presented.

Considering the size of the Grande Alliance Phase I program, it is anticipated that the train itself will not have the most impact rather than the projects developed afterward. Northern communities depend on extracting their natural resources to economically sustain development activities and public services. It is not an impossible mission as in other parts of Canada, resource industry jobs allowed Indigenous people to maintain prosperous livelihoods in their communities and have been recognized as contributing to more sustainable self-government (Procter, 2016). Therefore, the choice of future projects and the imposed boundaries to realize them by the Cree government will be crucial. The cumulative effects of small actions, including the railway construction, operation, and the industrial projects developed along the route, will eventually lead to long-term social impacts. Therefore, it would be essential to document these changes and their evolution .

Based on the impacts presented above, it should be determined whether or not a complete Health Impact Assessment is relevant. Although an HIA is not required by the legislation and regulatory processes, the Cree Board of Health and Social Services of James Bay prefers this approach to understand and identify potential impacts. Therefore, the following steps should entail pinpointing the most crucial determinants to be considered, as well as setting up boundaries and level of effort to complete the study. Example of health indicators are listed in Table 9.7-2.

Table 9.7-2 Health processes and impacts emerging from the construction and operation of railways

Intermediary social processes		Affiliated impacts		Data
Category	Name of process	Example of impact variables	Example of indicators	Sources of indicators
Economic well-being	Presence and nature of new project employment	Access to project employment	Number of Cree workers employed in the project by community	Promoter
			Number of Cree workers employed in the project by field of employment	Promoter
			Number of Cree workers in the project by employer	Promoter
			Duration of employment on the project	Promoter
		Labor shortage in Cree communities	Unemployment rate	Statistics Canada, National Household Survey
			Employment rate	Statistics Canada, National Household Survey
			Average employment income based on Indigenous identity	Statistics Canada, National Household Survey
	Changes to the economy and influx of new money	Increase in income	Median and average individual income	Statistics Canada
			Low-income family rate	Statistics Canada
			Number of participants to the Income Security Program for Cree Hunters and Trappers	OSRCPC
			Gini Index	DIALOG
			Number of new vehicles purchased and or registered by Cree (Snowmobiles, off-road vehicles, quads, cars, trucks)	Revenu Québec – Refund of GST and QST paid on certain goods and services SAAQ – Chisasibi
		Economic inequities between project workers and community workers	Resentment among community members	No source readily available (interviews with community members)
		Better price and diversity of food supply	Price index and types of products	No source readily available (Interviews with distributors or grocery managers)
		Housing shortage	Rental price	Canadian Rental Housing Index

Intermediary social processes		Affiliated impacts		Data
Category	Name of process	Example of impact variables	Example of indicators	Sources of indicators
Population and demographic	Migration and resettlement		Number of persons per room in an apartment	Statistics on Indigenous populations of Statistics Canada
			Number of workers per men camps	Project managers– housing subcontractors
Social structures	Social well-being	General social well-being through Community Well-Being index	Community Well-Being index (Education, labor force activity, income and housing)	The Community Well-Being index – First Nation report
	New training opportunities	Access to training programs	Proportion of the population with a high school diploma	Statistics Canada
			Skills development	No source readily available
			Desire to continue working on the project (operating railroad corridor)	No source readily available
		Desire to pursue a professional certificate	Number of new students	Cree School Board
			Graduation rate	Taux de diplomation des écoles secondaires cries Ministère de l'Éducation, du Loisir et du Sport du Québec (MELS)
			Number of Cree workers with certificates of qualification from the Commission de la Construction du Québec (CCQ)	CCQ
	Deviant social behavior	Drug and alcohol use	Conflict and tension within families, neighborhoods, groups	CBHSSJB
		Increase in gambling addiction	Financial difficulties (personal bankruptcies, increased debt load)	No source readily available (A study was completed in 2011 by the program Action concertée. This could be documented again through the same program)
			Relationship conflicts	
		Promiscuity	Number of STBBIs cases	Cree Board of Health and Social Services of James Bay (CBHSSJB)
		Teen pregnancy	Occurrences of teen pregnancies	CBHSSJB
		Self-Injury rate	Injury hospitalization rates	CBHSSJB
	Criminal behavior	Exposure to violence (domestic or other conflicts)	Public security	Sûreté du Québec Québec Securite Publique
	Social disintegration	Cultural leakage – abandonment and lack of relevance of traditional cultural practices	Youths - Time spent doing traditional activities	Possible source of information: Niskamoon

Intermediary social processes		Affiliated impacts		Data
Category	Name of process	Example of impact variables	Example of indicators	Sources of indicators
	Alteration of family structure	Changes in family dynamics	Number of kinship caregivers	No source readily available (could be documented through a survey)
		Difficulties for children	Interventions from schools or social services	Social services - CBHSSJB
		Spousal relationships issues	Number of divorces, separations	No source readily available (could be documented through a survey)
Physical and mental well-being	Physical health	Spread of infectious diseases (Covid-19, childhood illnesses, STBBIs)	Number of infectious disease cases/outbreaks	Santé publique du Québec CBHSSJB
		Changes in eating habits (+ or -) and food insecurity	Prevalence of nutrition related chronic illnesses (diabetes, obesity, heart disease)	CBHSSJB
		Foodborn illnesses caused by contamination	Worsening acute or chronic health problems	CBHSSJB Ministère de l'Agriculture, des Pêcheries et de l'Alimentation (MAPAQ)
			Contaminant detection or testing	
	Mental health	Food insecurity	Stress, anxiety, and gilt related to food	CBHSSJB
		Fear of contamination	Changes in eating habits	CBHSSJB
		Gratification of having a job	Workers' elf-esteem	No source readily available (could be documented through a survey)
		Positive aspiration for self and family	Workers and their family perception of future	No source readily available (could be documented through a survey)
Community cohesion and sense of belonging	Intergenera tional knowledge transfer	Time spent with family doing traditional activities (preparation of tradition food, etc.)	Number of hours - Preparing traditional food - Hunting, fishing… - Doing traditional activities	Possible source of information: Niskamoon No source readily available (could be documented through a survey)
	Engaging in traditional activities	Cultural practice of "going out on the land"	Number of hours "going out on the land"	No source readily available (could be documented through a survey)
Quality and access to the environmen t	Environmen tal degradation and dispossessio n	Presence of contaminants (lasting effects on land)	Monitoring of toxic contamination of fish and wildlife	Ministère de l'Environnement et de la Lutte contre les changements climatiques Santé et des Services sociaux First Nations Environmental Contaminants Program (federal)

Intermediary social processes		Affiliated impacts		Data
Category	Name of process	Example of impact variables	Example of indicators	Sources of indicators
			Changes in peoples' sense of place attachment to their territory	No source readily available (could be documented through a survey)
		Changes in access to territory (restricted in some place and accessible in other)	Use of train for transportation	Future train operation statistics
			Participation in traditional activities	
		Changes in perception of territory (loss of its beauty, pureness, or spiritual value)	Peoples' sense of place attachment to their territory	No source readily available (could be documented through a survey)
		Loss of sacred territory	Inter-generational differences because of inability to pass along cultural practices	Possible source of information: Niskamoon
			Loss of traditional knowledge and skills	No source readily available (could be documented through a survey)
			Deep feelings of loss and grief	
Institutional, political and equity	Health care staff turnover (go work for the project)	Lack of qualified personnel	Reduced access to health care	CBHSSJB
			Number of opening hours of health clinics	
		Quality of care (care givers not aware of Cree culture)	Number of new workers	CBHSSJB

9.8 OTHER REGIONAL STAKEHOLDERS

Phase I of the La Grande Alliance infrastructure program includes the rehabilitation and reactivation of the Grevet-Chapais railway and the construction of a new railroad along the Billy Diamond Highway up to the Rupert River. It also includes upgrading and paving the Route du Nord accessible from Route 167, north of Chibougamau, as well as the access roads to Waskaganish, Eastmain, Wemindji and Nemaska. At Cree stakeholders' request, a second access road to Mistissini was added to the infrastructure studied as part of Phase I.

The entire study area is with in the Eeyou Istchee-Baie James Regional Government jurisdiction, in the Nord-du-Québec Administrative Region. This includes nine Cree communities, four Jamesian towns and five unconstituted localities. The Jamesian towns potentially impacted by the development of these infrastructures are Chibougamau, Chapais, Lebel-sur-Quévillon and Matagami. In Phases II and III, the new railroad is to be continued up to the Trans-Taïga road in the first place and secondly, extended to Whapmagoostui. This extension would impact the locality of Radisson.

A general review of existing information concerning the Jamesian towns, population, stakeholders, as well as land use and economic activity in the region was conducted. Based on the information collected, a brief profile of each town was drawn, presented in sections 9.8.3 to 9.8.7.

A series of information and consultation sessions took place in 2022 to meet citizens, elected officials, and stakeholders from each potentially affected town to understand how they use the territory and how the development of these infrastructures could benefit or impact their activities. Those engagement activities are presented at the end of each Jamesian town profile, and they are summarized in section 9.8.8.

9.8.1 Historical Context

Historically, Northern Québec was not part of New France. The lands were part of Rupert's Land and initially administered by the Hudson's Bay Company as early as the 16th century. Since the Hudson's Bay Company deemed this territory unsuitable for settlement, it transferred Rupert's Land to the new Dominion of Canada in 1870, two years after the Canadian Confederation. In 1898, following a series of expansions, the Parliament of Canada set the new northern limits of the province of Québec to the Eastmain River. Following the Québec Boundaries Extension Act of 1912, the northern boundary of the province was extended to its present location (Britannica, 2022; Turgeon, 1992).

Settlers first appeared in the James Bay region in the 1930s and 1940s at the localities of Valcanton and Villebois, west of the study area. In the 1950s, an economic boom in the mining and forestry industries contributed to the migration of the French-speaking population to the northern frontier regions to take advantage of the new jobs available in Chapais, Chibougamau and Magamie (Girard, 2012a,b).

In the 1970s, the Gouvernement du Québec began pursuing the development of mining, forestry and other potential resources starting with the James Bay Hydroelectric Project. The provincial government announced the latter project in April 1971, before any consultations or negotiations with the Cree, Inuit and Naskapi populations of the region (Lacasse, 1985). After lengthy negotiations, the governments of Canada and Québec and representatives of the Cree and Inuit communities signed the JBNQA in November 1975.

After decades of court battles between the Cree and the Gouvernement du Québec for the implementation of existing obligations of the Québec government to the Cree people under section 28 of the JBNQA, a new agreement was signed in 2002: *Agreement Concerning a New Relationship Between le Gouvernement du Québec and the Crees of Québec*, commonly referred to as the "Paix des Braves." It provided for the sharing of revenues and joint management by the Cree and the Gouvernement du Québec

of mining, forestry, and hydroelectric resources in Eeyou Istchee (Desbiens, 2013; Girard, 2012a).

9.8.2 Eeyou Istchee James Bay Regional Government

The Eeyou Istchee James Bay Regional Government (EIJBRG) was created in 2014. The Regional Government exercises the same jurisdictions, functions, and powers over Category III lands in the territory as those formerly attributed to the Municipalité de Baie-James, adding the responsibility of managing natural resources and acting as a regional development authority. It is the largest municipality in the world with just over 275,000 km^2 of territory (ISQ 2021). The Eeyou Istchee James Bay is inhabited by some 31,947 people: 18,570 Cree and 13,377 essentially non-indigenous (ISQ 2021). The Jamesian population is mainly concentrated in the towns of Chapais, Chibougamau, Matagami, Lebel-sur-Quévillon, and Radisson. A small portion of Jamesians live in the rural areas of Valcanton and Villebois, the isolated hamlets of Desmaraisville and Miquelon, and in the vicinity of Radisson. The region also encompasses nine Cree communities. Five of these are located along the James Bay Coast at the mouths of the main waterways (Waskaganish, Eastmain, Wemindji, Chisasibi, Whapmagoostui) and four are located inland (Mistissini, Oujé-Bougoumou, Waswanipi and Nemaska,). A Council, formed and based on equal numbers of Crees and Jamesians, directs the EIBJRG.

The Cree communities, established on Category I lands, have a governance structure based on the election of a Chief, a Deputy Chief and councillors. They are elected by universal suffrage by the registered Band members. The Jamesian towns, established on Category III lands, are headed by a Mayor, and have a number of elected councillors based on population, with a minimum of 6 seats for municipalities with fewer than 20,000 inhabitants. However, the localities, also located on Category III lands, are governed by a chairperson, and a local council of up to five members elected every four years.

9.8.3 Chapais

9.8.3.1 Profile

9.8.3.1.1 Establishment and Population

At the beginning of the 20th century, many copper deposits were discovered in the Chibougamau Lake area and south of Lake Opémisca. The mining industry started flourishing in the area in the 1930s and mining camps were established. In 1953, the Opémiska Company started to exploit copper deposits in the Chapais area which lead to the opening of the Springer and Perry mines (Girard, 2012a; SHRC, 2022). To house the workers and their families, the mining company established a work camp. It was developed and run by the company and was planned with a suite of amenities such as houses, stores, church, school, hospital, and all the public services. In 1960, Chapais changed its status from a company town to a municipality managed by a City Council. During its period of prosperity, Chapais counted more than 3,000 inhabitants (permanent and temporary) (DSP 2003). In 1974, Paradis & Fils sawmill (later Barette-Chapais ltée) opened and diversified the town’s economic activities. When the mines (Opémiska Copper Mines and Lac Shortt mine) closed in the 1990s due to the depletion of mineral reserves and insufficient funding for mining exploration, this forestry company became one of the most important employers in town. Since then, the population has slowly decreased to stabilize at 1,500 inhabitants for the last decade (Réjean Girard 2012a) (Table 9.8-1).

Table 9.8-1 Chapais – Demographic Evolution (ISQ, 2022; Statistiques Canada, 2007)

Year	1991	1996	2001	2006	2011	2016	2021
Number of Inhabitants	2,391	2,030	1,795	1,630	1,610	1,499	1,556

The population is mainly located in the town centre (Figure 9.8.1). The town of Chapais has a territory of 63 km^2 and forms an enclave within the Regional Government. However, the residential and commercial footprint represents only 8% (5 km^2) of the town territory (Chapais, 2021). Chapais has a compact and well-organized urban structure. The urban perimeter of Chapais includes the sectors on either side of Route 113 (Springer Boulevard). The development of the city and the densification of its urban fabric is articulated and consolidated around this main artery, between 1st Avenue and 6th Avenue to the east, which is distinct from the other sectors of the city. A concentration of businesses, services and community and institutional facilities of a local and regional nature can be found west of the City Hall. Finally, the particularity of the urbanized territory of Chapais is that it is surrounded by public land, managed by the EIJBRG, limiting its development beyond its urban perimeter.

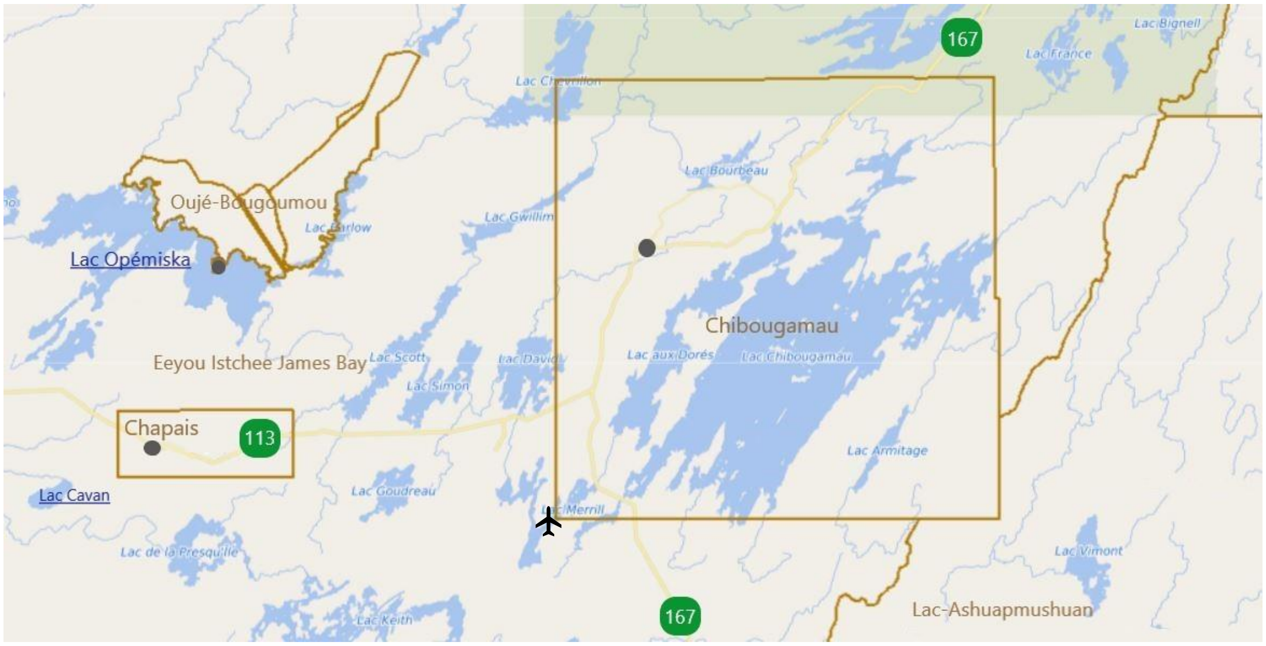


Figure 9.8-1 Region around Chapais

Around Chapais, there are several recreational sites, on the EIJBRG territories, including the campground at Lake Opémiska. The seasonal population is estimated at 570 vacationers (Table 9.8.2) (Chapais, 2021).

Table 9.8-2 Number of Permanent Residents Outside Town Limits (Chapais 2022)

Location	Permanent residents	Number of single-family residences	Number of cottages	Number of buildings
Baie-Demers	10	5	5	10
Buckell Lake	18	6	12	18
Cavan Lake	35	15	36	51
David Lake	24	19	5	24
Dulieux Lake	13	11	2	13
Opémiska Lake	72	26	71	97
TOTAL	**172**	**82**	**131**	**213**

Lake Cavan is located 8 km southwest of Chapais and it is the closest residential area to the former Grevet-Chapais railroad line, which is located north of the lake. In the southern portion of the lake, the shores are occupied by a residential sector comprising 51 lots, 15 of which are inhabited year-round (Chapais, 2022). It is surrounded by forestry roads, quads, and snowmobile trails. Five tributary rivers are attached to Cavan Lake as shown in Figure 9.8-2.

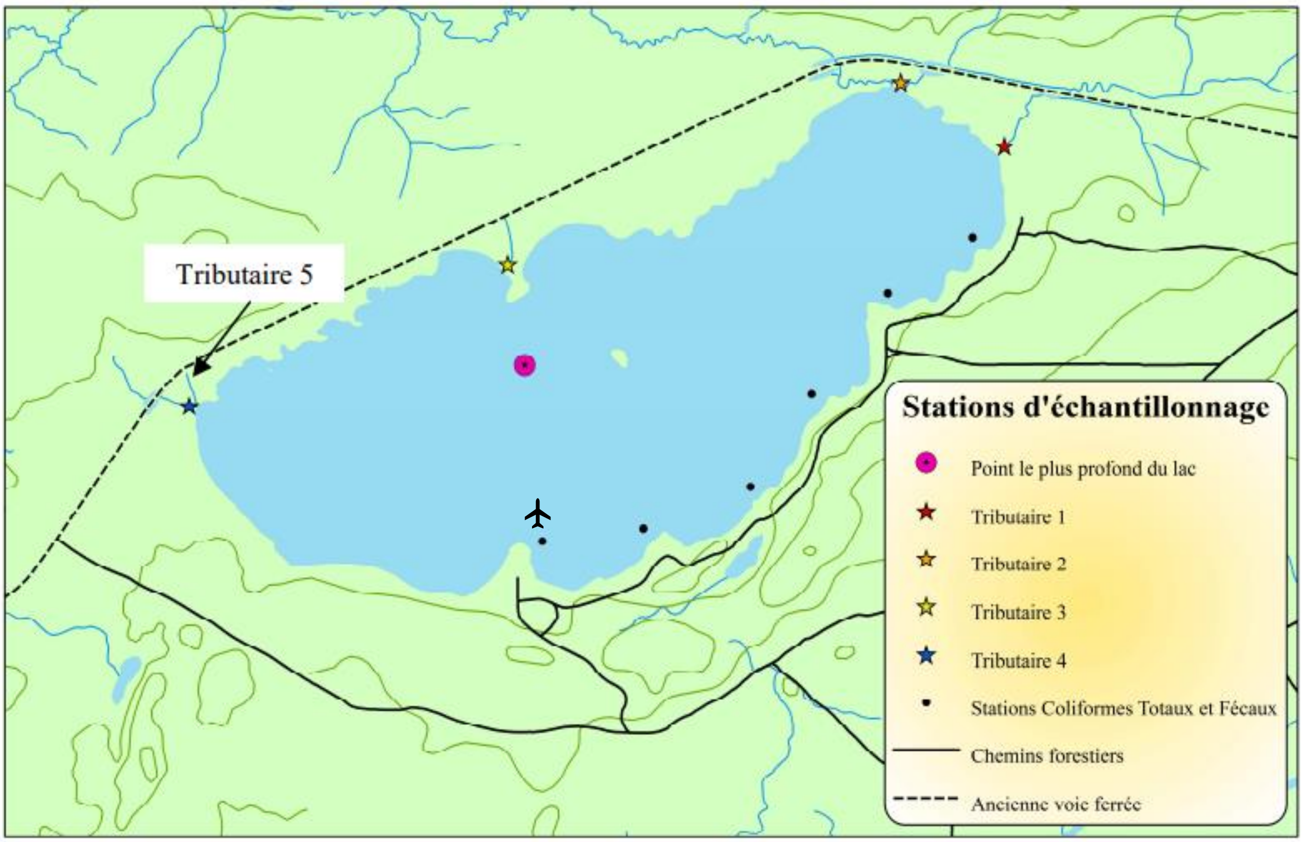


Figure 9.8-2 : Tributary rivers around Cavan Lake (FaunENord, 2012, p. 11)

Recently, the city has proposed to annex 103 km^2 of surrounding Category III lands (Lord, 2022). This expansion would have to be approved by the EIJBRG. By expanding its territory, the Town of Chapais aims to secure its drinking water source (Presqu'île Lake), but also to add tax revenues, particularly from corporations and residences located on Opémiska and Cavan lakes. The town also wishes to add territory to simplify its development because as it is, some parcels located south of the town limit are owned and managed by the MERN, and the territory outside the city's boundaries are under the EIJBRG jurisdiction. If the land were under the city's jurisdiction, it would ease permitting. South of Route 113, the land is secured for industrial development. The extension would unfold into two phases including future industrial lots along and beyond what used to be the Grevet-Chapais railway (Figure 9.8.3). A transhipment area is also planned adjacent to the railway.

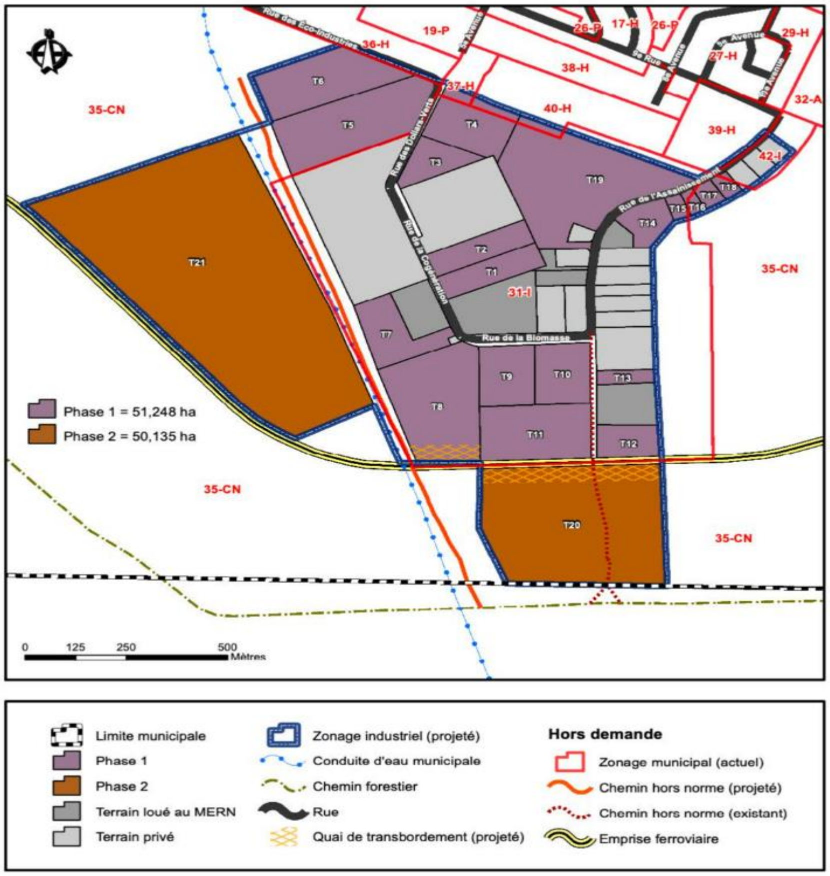


Figure 9.8-3 : Chapais - Industrial Park Extension: 2 Phases of Development (Chapais 2021).

9.8.3.1.2 Accessibility

Chapais is accessible by Route 113 which starts at Route 167, near Chibougamau, and ends at Route 117 from nearby Val-d'Or, which then continues to Rouyn-Noranda, Ontario, Gatineau-Ottawa, and Montreal. Routes 113 and 167 form the only direct east-west link between Saguenay-Lac-Saint-Jean and Abitibi-Témiscamingue this far north in Québec. Chapais is located 27 km east of the regional Chibougamau-Chapais Airport (YMT). Route 113 is heavily used by trucking from mining and forestry operations. Trucks travel through town and share the road with residents and vacationers.

The town is also accessible via the subgrade of the former CN Chapais Subdivision railway, which previously linked Abitibi to Lac-Saint-Jean. It was partially abandoned in 1994 when the track was removed between Franquet and Chapais. Now, the dismantled section is currently used as a forestry road by overweighted trucks to carry wood logs to sawmill plants, by snowmobiles in wintertime, and by ATVs. Trail 93 is part of the national snowmobile trail network, and it is open from December 15 (sometimes early December) until the end of March (sometimes until April 10).

The railroad track between the Barette-Chapais sawmill and the Chapais industrial park is still in existence, but not used.

9.8.3.1.3 Tourism industry

The region is well known for snowmobiling. The abundance and quality of snow make the reputation of the local and federated trails from December to April. Plentiful quad and all-terrain vehicle trails are accessible from May to November. There are many places along the route to stop refuelling and some hotels even offer packages to simplify the travel organization.

There are no outfitters within the city limits.

9.8.3.1.4 Logging Industry

The land around Chapais is allocated to natural resources extraction such as logging and mining. The forestry industry is collecting and manufacturing wood products for the construction, energy, and pulp and paper industries. A total of five companies share the harvest quota in each of the forest management units in the Chapais vicinity (Figure 9.8.3) (MFFP, 2022).

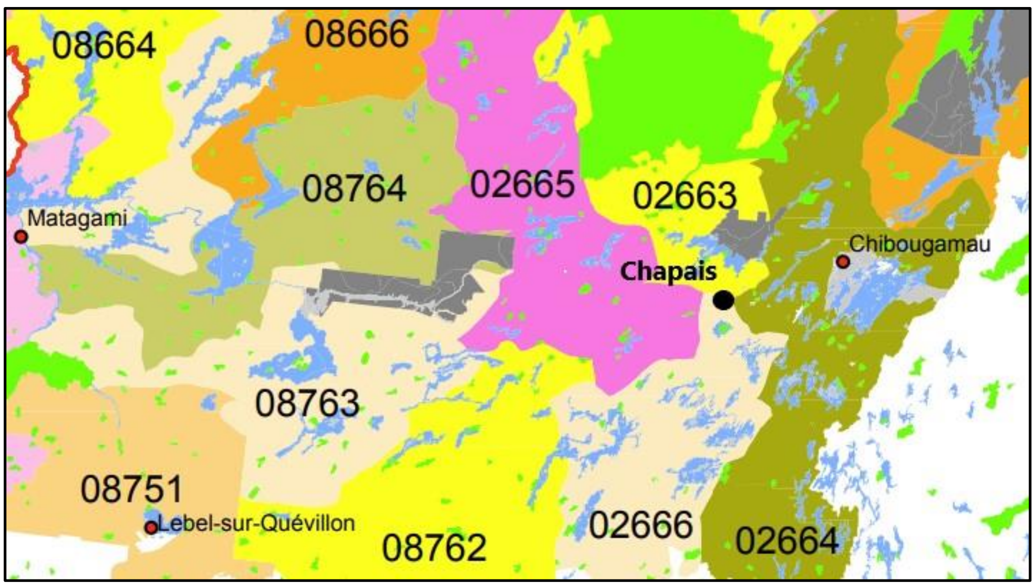


Figure 9.8-4Forest Management Units Map - 2018-2023 - Nord-du-Québec (MFFP, 2022)

The lumber is trucked out and transformed at the local Barrette Chapais Inc sawmill, located 10 km from Chapais, outside of town limits. Barrette Chapais is the most important sawmill in the Nord-du-Québec region with 350 employees (Chapais 2021). Transportation of lumber is done by over-dimensioned trucks on forestry roads, including the subgrade of the former Grevet-Chapais railway. Since this section of the railway was dismantled, Barrette Chapais has invested significant amounts of money to upgrade and maintain roads and bridges to access the forest resource and should be using this infrastructure for several years given the quantity of timber in Eeyou Istchee Baie-James.

9.8.3.1.5 Mining Industry

The town, originally created by the Opémiska Copper Mines, is adjacent to four extraction sites (Springer, Perry, Robitaille and Cooke) (Figure 9.8.4) (MERN, 2022b). These mining sites have been operated at intervals since 1953 and the tailing ponds and piles are still visible. It is not excluded that other mining industries operate in the region as all Chapais territory and its surroundings are covered by active mining claims. According to new drilling done by

QC Copper on the former Opémiska mining complex, some sites could reopen to extract copper and gold (Figure 9.8.5) (Copper 2022).

Figure 9.8-5: 5 Active Mining Claims around Chapais (MERN 2022)

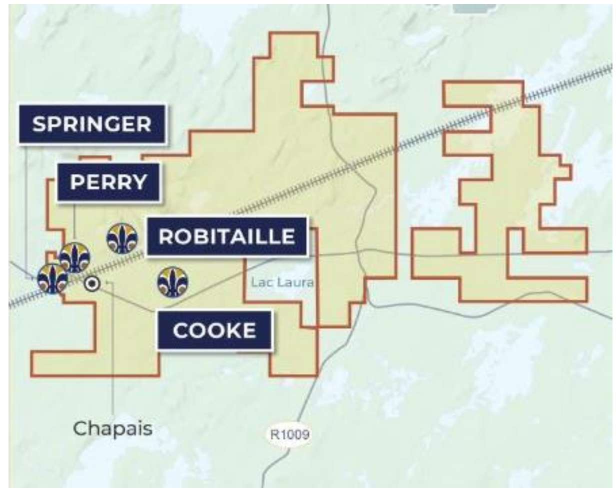


Figure 9.8-6 : Possible Reopening of Mines Near Chapais, Properties of QC Copper (Copper 2022).

9.8.3.2 Potential impacts of LGA

The rehabilitation and reactivation of the Grevet-Chapais Railway line (B1 for 225 km) was the only component of the LGA Phase I Feasibility study that would affect Chapais directly. The potential negative impacts anticipated by Chapais citizens are:

- Nuisances from the train for residents of Cavan Lake (noise, vibration, and visual aesthetics);
- Partial loss of access on Chemin du lac Cavan (eastern part);
- Loss of access to cottages around Opawica Lake;
- Relocation of snowmobile and ATV trails currently using the Grevet-Chapais subgrade (snowmobile trail Trans-Québec 93);
- Increased safety risks where the train would intersect existing trails and paths;
- Risk of malfunctions and spills causing water contamination.

Following first discussions with regional stakeholders, where the importance of snowmobile trail 93 for the region was highlighted, a study concerning an alternate snowmobile trail was added to the Phase 1 Feasibility Study.

9.8.3.3 Public Consultations

A face-to-face information and consultation meeting with the population took place at the Chapais community centre on May 25, 2022. It reunited 24 residents of Chapais and surrounding lakes. A second round of consultation was completed May 26, 2022, with the principal stakeholders: *Ville de Chapais, Association des résidents du Lac Opémisca, Association des résidents du Lac Cavan, Tourisme Baie James, Table jamésienne de concertation minière* and *Association de la villégiature de Chibougamau – Chapais*. Five conversation topics were identified and discussed at both meetings such as the access to Opawika Lake, environmental concern at Cavan Lake, safety and traffic congestion, tourism attractiveness and development of northern railway routes.

Opawika lake residents have access to their properties via the former Grevet-Chapais railway subgrade. The railroad has been dismantled 30 years ago and people have been using this pathway for as long. Participants were wondering how they will access their cottages if the railroad is reinstated. They suggest building a service road adjacent to the railway.

The former Grevet-Chapais railway subgrade is running north of Cavan Lake, very close to the shore (15 m at some point). Residents located on the south shore are worried that the train will be noisy and have an impact on their quality of life and property value. Moreover, in 1978, an accidental oil spill by CN occurred near the lake outlet. The site was cleaned up and the results of the water testing done in 1982 by the *Ministère du Loisir, de la Chasse et de la Pêche* showed no evidence of lasting contamination (CRRNTBJ 2012). However, considering this incident, residents are worried about a potential spill into the lake and surroundings if the railroad is reinstated. Road crossing is also an issue close to Lake Cavan. If the railroad were to be rebuilt, it would cross the main access road at two points, rising security and traffic issues. Participants suggested building a rail bypass south of Cavan Lake and following the actual road.

One participant, working in Chibougamau, acknowledged the current traffic congestion at Faribault (near Chibougamau) level crossing. With the reopening of the Grevet-Chapais line, an increase in the frequency of trains per week would be expected, possibly increasing delays at level crossings.

The tourism industry is marketing the region by offering travel packages, with planned itineraries and predictable stays. Therefore, it would be advantageous if the train could accommodate passengers. The participant cited as an example the Sept-Îles-Schefferville line, which is multi-use.

As highlighted by some stakeholders, from Canadian and global development perspectives, developing a northern transportation corridor would save shipping time and make Canada competitive on a global scale. The Grevet-Chapais railway would link Saguenay and Abitibi regions. As the price of copper has risen 125% since 2020, this rail line would connect the only copper smelter in the northwest to existing and potential mines (Norland 2022).

9.8.4 Chibougamau

9.8.4.1 Profile

9.8.4.1.1 Establishment and Population

In the early 1900s, the area attracted mining prospectors searching for gold and copper. Many exploration campaigns occurred but a permanent community was not established until 1952. The settlement, founded as a company town by the mining industry, was incorporated as a municipality in 1954 (Réjean Girard 2012a; SHRC 2022). Many companies have owned and operated mines around the city and still, nowadays, the mining industry is a large investor. Chibougamau is also the centre of a large logging and sawmill industry and more recently, the development of the tertiary sector. Chantiers Chibougamau, a sawmill founded in 1961, is the most important employer followed by the *Centre régional de santé et de services sociaux de la Baie-James*, the *Commission scolaire de la Baie-James* and the *Gouvernement du Québec* (Crown Corporations & 7 departments) (V.d. Chibougamau 2017).

Like most neighbouring communities, the golden age of industrial development happened in the 1970s and 1980s. The acceleration of economic and industrial growth was combined with an increase in population and social services (V.d. Chibougamau 2017). Although its population declined since its highest level in the 1980s (10 732 inhabitants), it is still the largest community and the most important service centre in the Nord-du-Québec region (ISQ 2021). The demographic history over the last two decades is shown in Table 9.8-3.

Table 9.8-3 Chibougamau – demographic evolution (ISQ, 2022; Statistiques Canada, 2007)

Year	1991	1996	2001	2006	2011	2016	2021
Number of Inhabitants	8,855	8,664	7,922	7,563	7,541	7,504	7,233

Chibougamau's seasonal population is mainly associated with the presence of casual workers in the mining and forestry sectors. Summer and winter tourism are also a source of fluctuations in the seasonal population. Although there is no data available to quantify the size of the seasonal population in Chibougamau, the city has a relatively large accommodation capacity. On the territory, there are 12 hotels and inns offering more than 270 units, three lodges for a total of 10 units, two outfitters and a campground with 45 sites (V.d. Chibougamau 2017).

The city of Chibougamau has a territory of 1,034 km^2 and, about 5 km^2 is urbanized where most of the population is concentrated (density of 10 inhabitants/km^2) (MAMH 2022). The city is almost entirely circumscribed by the territory of the Regional Government, except at its southeastern limits, where it is bordered by the unorganized territory of Lac-Ashuapmushuan (Figure 9.8-7). The closest communities are Chapais (40 km) and Oujé-Bougoumou (55 km).

Figure 9.8-7: Chibougamau city limits (Google Earth, 2022)

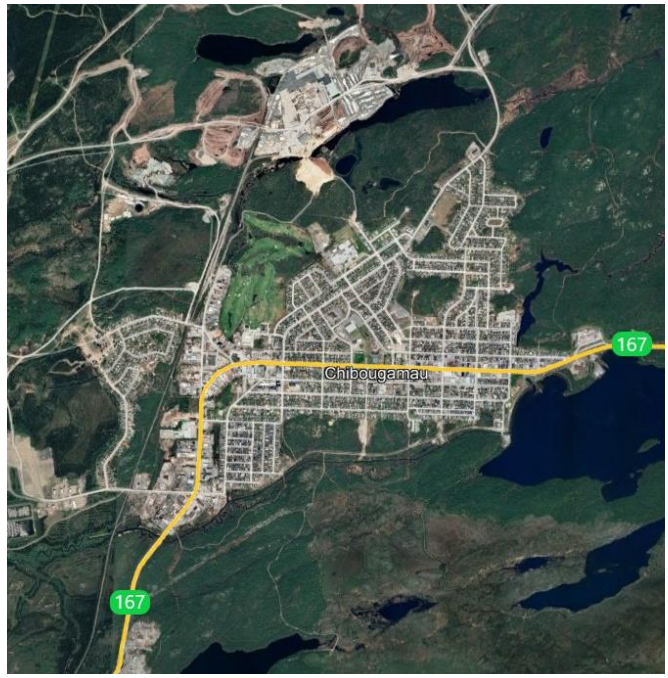


Figure 9.8-8: Urban area - Chibougamau (Google Earth, 2022)

The urban fabric of Chibougamau (Figure 9.8-8) is articulated around the main street named 3rd Street (road 167) where a concentration of businesses, community and institutional facilities of a local and regional nature can be found. On each side of the main road, are located residential areas. Chibougamau borders the shores of Gilman Lake, where there is a beach and a walking trail. It also has a golf course located north of the main street.

Outside of the urban area, the city has a large territory. According to the zoning plan, this land is zoned industrial, vacation cottages restricted, forestry or conservation.

9.8.4.1.2 Accessibility

The city is located at the intersection of Route 113, Route 167, the Route du Nord, and the Monts Otish Road. From the Lac-Saint-Jean region, the town is accessible by Route 167 which crosses the Ashuapmushuan Wildlife Reserve. Access is also possible from the Abitibi-Témiscamingue region, via Route 117 and then Route 113, which crosses the municipalities of Val-d'Or, Senneterre, Lebel-sur-Quévillon as well as the Cree village of Waswanipi and the municipality of Chapais before reaching Chibougamau. The Route du Nord is an alternate road to reach the lower part of the Billy Diamond Highway. Monts Otish Road is the extension of Route 167-Nord towards the Otish Mountains and ends at kilometre 143, a little to the north of Matoush Camp (COMEX 2012). Around Chibougamau, forestry roads cover thousands of kilometres and act as an actual web connecting the city to a vast territory with an abundance of forest and mine resources.

Chibougamau is accessible by train from the Lac St-Jean region. Historically, Chibougamau was connected first to the Abitibi-Témiscamingue region through the lane coming from Chapais built in 1957 (Réjean Girard 2012a). It allowed copper transportation to the Horne smelter in Rouyn-Noranda. This line was dismantled in 1998. In order to reduce the distance between Chibougamau and the closest deep-water ports accessing the St. Lawrence River, the CN completed in 1959 another rail connection between Chibougamau and Saguenay (Girard, 2012). This line is still in service today and will eventually be connected to a trans-shipping yard called Chibougamau intermodal logistics centre (CLIC) (Figures 9.8-9 and 9.8-10). This hub would allow shifting from trucking to rail for the shipment of minerals to the south (COMEV 2022). It would be located on route 167, next to the CN railway and south of the city. The CLIC would be accessible by forest roads L-208 and R-1040 that are connected to the North Road, thus bypassing the city centre. That access road would allow trucks from the Wabouchi Mine to reach the trans-shipping hub (Lithium 2017).

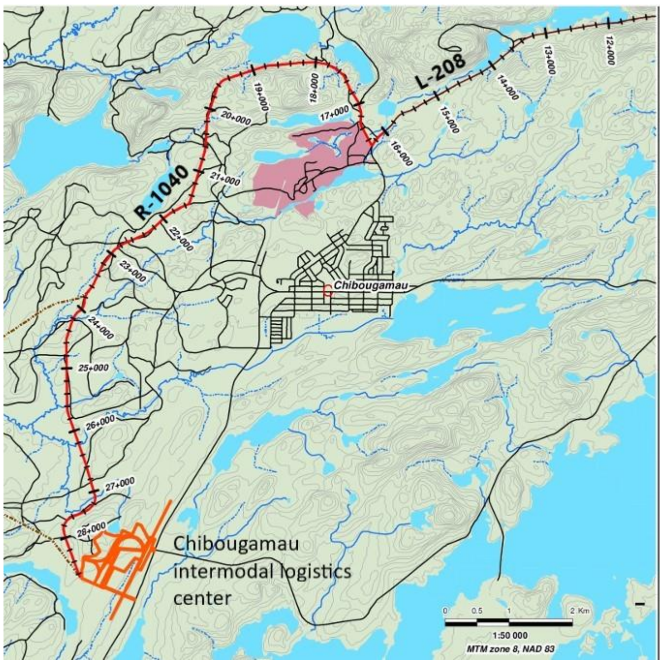


Figure 9.8-9 Potential path of the access road to the site using existing forest roads (Lithium 2017)

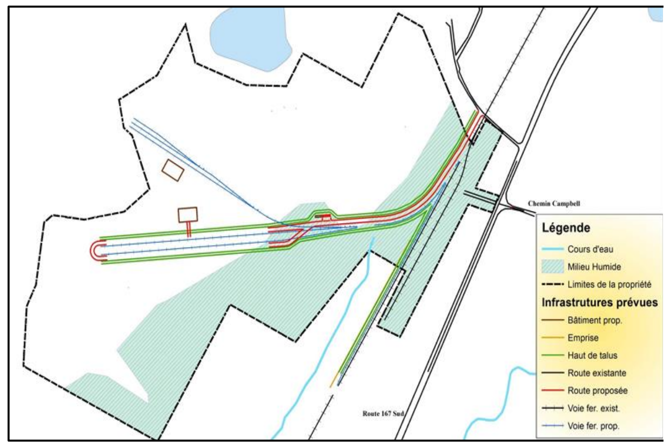


Figure 9.8-10 Implementation plan of the Chibougamau intermodal logistics centre (COMEV 2022)

Chibougamau is served by regular commercial flights from Montreal and Québec via the regional Chibougamau-Chapais Airport which is located 22 km southwest of the urban area. In wintertime, the town can be reached by snowmobile. The Trail 93, which connects Lac St-Jean and Abitibi-Témiscamingue regions, follows the Routes 167 and 113 towards Chapais (Figure 9.8-11) (FCMQ 2022). Local trails link the national pathway to the city. In the summertime, there is a wealth of quads and all-terrain vehicle trails used to commute, for leisure and for tourism (Figure 9.8-12). Like the snowmobile trails, they connect all regions (FQCQ 2022).

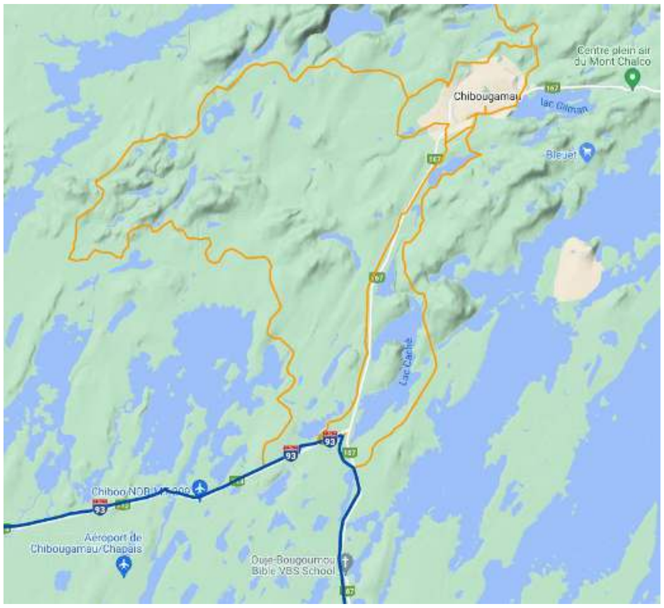


Figure 9.8-11 : Snowmobile trails in Chibougamau (FCMQ 2022)

Figure 9.8-12 : Quad trails in Chibougamau (FQCQ 2022)

9.8.4.1.3 Tourism Industry

Many lakes in the vicinity have residential parcels on their shore, especially along Route 167. The orthophoto analysis confirms the presence of permanent constructions on their lots, probably cottages.

The region is well known for snowmobiling. The abundance and quality of snow make the reputation of the local and federated trails from December to April. Plentiful quad and all-terrain vehicle trails are accessible from May to November. There are many places along the route to stop refuelling and some hotels even offer packages to simplify the travel organization.

There are no outfitters within the city limits. The closest outfitter, which is without exclusive rights for fishing only, is located south of Chibougamau on the Obatogamau Lake.

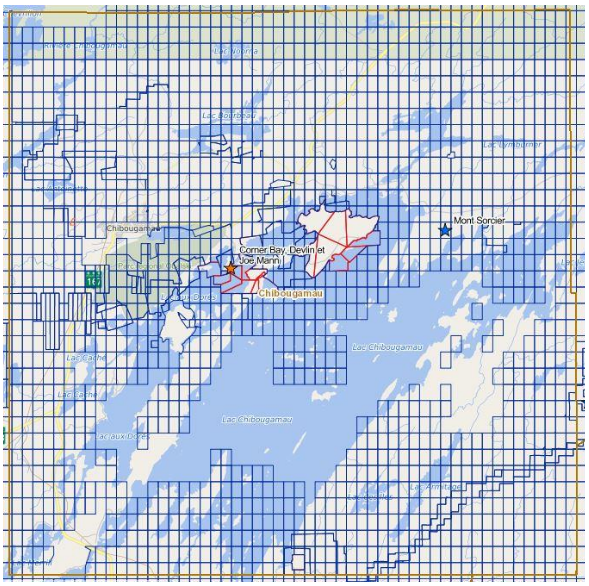
9.8.4.1.4 Logging Industry

Most of the land zoned for forestry purposes are owned by the provincial government and a total of four companies share the harvest quota in the forest management unit 026-64 which surrounds the town (MFFP, 2022). The logging industry is dominant and Chantiers Chibougamau is an important company collecting and manufacturing lumber that is used in the making of engineered wood products for the construction industry (C. Chibougamau 2022).

9.8.4.1.5 Mining Industry

The Chibougamau region area is covered by active mining claims (Figure 9.8.-13) (MERN 2022). The Chibougamau mining district used to regroup various mine owners and operators and numerous changes of ownership occurred between the 1950s and 2010s. However, in 2012 all these mining properties were transferred to Chibougamau Independent Mines Inc. including portions of Lemoine, McKenzie, Obalski, Roy, Barlow, McCorkill and Scott Townships (CIM 2022). As of March 2017, the aggregate of registered units (claims/cells) held by Chibougamau

Independent Mines Inc. totalled 259 units and 11,131 hectares. The majority of the former mines and unmined deposits are located 15 km east-south-east from the town of Chibougamau with some claim groups near Lake Dore and Lake Chibougamau (Figure 9.8-14). The most recent project to be developed in this region is proposed by BlackRock Metals Inc. and includes a mine and concentrator near Chibougamau as well as a processing plant in Saguenay. Métaux BlackRock Inc. plans to mine a deposit for the production of a concentrate of iron-vanadium ore located in the Lac Doré geological complex in the municipality of Chibougamau. The company announced in June 2022 that it successfully went through a restructuring process, enabling it to continue the development of its projects (Telbec 2022).



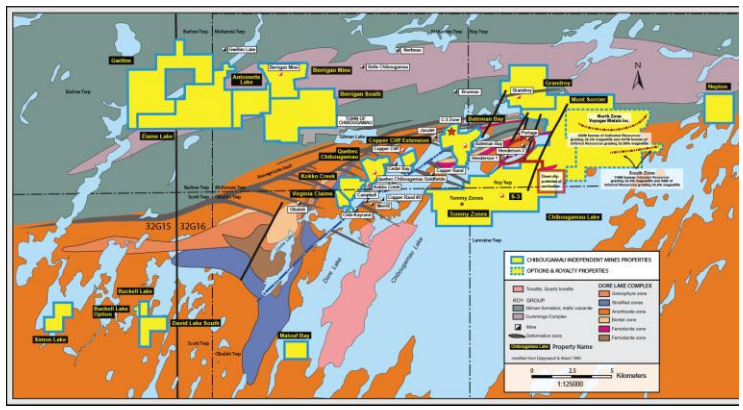


Figure 9.8-13: Units (claims/cells) held by Chibougamau Independent Mines Inc. (CIM 2022)

Figure 9.8-14: Active mining claims around Chibougamau (MERN 2022)

9.8.4.2 Potential Impacts of LGA

The first phase of the LGA infrastructure program would impact Chibougamau indirectly as none of the proposed infrastructure are located within the city limits. The city is already served by the CN network from Saguenay-Lac-St-Jean region, and the reactivation of Grevet-Chapais railway would increase the access to the territory and benefit transit of natural resources by train on an east-west axis. This would echo Chibougamau's vision to consolidate rail transportation as the city authorized the building of a transshipment hub. The paving of the Route du Nord would also impact Chibougamau as it could potentially increase downtown traffic.

The potential negative impacts anticipated by Chibougamau citizens are:

- Increased hunting and fishing pressure on wildlife due to the influx of workers during construction;
- Increased pressure on local housing and accommodation.

9.8.4.3 Public Consultations

A face-to-face information and consultation meeting with the population took place at the Chibougamau City Hall on September 27, 2022. It reunited 15 residents of Chibougamau. A second round of consultation was completed September 28, 2022, with the principal stakeholders: elected officials and employees of City of Chibougamau, ministère des Transports, Jamesian Mining Table, Chibougamau Chamber of Commerce, Québec Federation of ATV Clubs, tourism and environmental organizations. Here is a list of themes raised at these two meetings:

- Quad and snowmobile trails
- Landscape and tourism attractiveness
- Wildlife and scientific data
- Concerns from the ministère des transports
- Information sharing
- Development of the rail network
- Port and transportation
- Port and tourism
- Land access
- Greenhouse gases
- Borrow pits to build the road and railroad
- Poaching
- Temporary infrastructure for worker housing
- Professional school curricula

Five topics were discussed at length during meetings with representatives and stakeholders. THese are summarized below.

The mayor and the representatives of Table jamésienne de concertation minière expressed some skepticism regarding the project's justification only at a regional or provincial level. To justify the rehabilitation and reactivation of the Grevet-Chapais Railway line, the analysis must encompass more than the regional market, which is not sufficient for such infrastructure. The project must be looked at from a global perspective, considering the Canadian market as a whole, which would support the construction of an east-west railway corridor.

A national vision is preferred because the mining industry is a cyclical sector and transportation must be integrated into a larger framework. Many participants were supporting the idea of processing metals and ores nearby and not just exporting them. To attract processing plans, an effective transportation system must be developed further to gain fluidity. Intermodality is also considered a key element to be improved.

The construction and road maintenance were also important issues. The long-term operation and maintenance of infrastructure are considered a main challenge. In the short term, participants wonder where the workers would stay taking into consideration there is a shortage of apartments in the region. It was mentioned that work camps would better accommodate workers. It was deplored that the jobs created would be on the fly-in fly-out model and the camp infrastructure would be ephemeral. The planning or reuse of the structures should be examined once the work is completed.

It was asked whether interesting viewpoints were considered and preserved when planning the route. The participants from the tourism sector identified the need for infrastructure (rest areas, rest stops) to be developed while highlighting interesting landscapes.

9.8.5 Lebel-sur-Quévillon

9.8.5.1 Profile

9.8.5.1.1 Establishment and Population

Forest resources are very abundant in the Chapais, Matagami and Senneterre regions. Lebel-sur-Quévillon was developed in 1966 as a company town by the Dominion Tar Pulp and Chemical Plant (Domtar) to support its activities in the surrounding regions. This logging company housed its workers who worked in the newly opened pulp and paper plant. Five years later, the company opened a sawmill that became the heart of an important industrial complex. In 1981, Domtar was the first employer in town with more than 700 workers for a population of 3,681 (Réjean Girard 2012a).

In the 1990s, the discovery of zinc, copper, silver, and gold lode mining led to the opening of mine sites which diversified the local economy that was mainly concentrated on forestry. The Langlois mining project (formerly Grevet mine) located approximately 40 km north of the city, opened in 1994. Miners would live in Lebel-sur-Quévillon since there was no worker housing on the site. Operation of the mine began in 2007 but was suspended after metal prices collapsed in 2008. Production began again in 2012, a few months after the mine was purchased by the firm Nyrstar (COMEX 2022). The Langlois mine is now the largest employers in town, with 241 employees; followed by Produits Forestiers Résolu, a sawmill that produces lumber, with 78 employees (Lebel-sur-Quévillon 2021).

The instability in natural resource exploitation influenced greatly Lebel-sur-Quévillon demography. Since the closure of the Domtar plant in 2008, the community is struggling to revitalize its industrial activities to retain its population. In fact, since 1991, the population of Lebel-sur-Quévillon has been decreasing, losing an average of 44 inhabitants per year (Table 9.8-4) (ISQ, 2022; Statistiques Canada, 2007). However, many mining projects are about to resume which might attract newcomers to town (Landry 2022, 2021).

Table 9.8-4 Lebel-sur-Quevillon – demographic evolution (ISQ, 2022; Statistiques Canada, 2007)

Year	1991	1996	2001	2006	2011	2016	2021
Number of Inhabitants	3,414	3,416	3,236	2,729	2,159	2,187	2,091

The population mainly lives in the urban area which is located on a peninsula southwest of Lake Quévillon. When seen from above, the city's territory of 43,62 km^2 has the shape of a plane. The grid, designed by Domtar, represents a tree, being symmetrical on a central axis of commercial and institutional buildings with branches represented by residential neighbourhoods (Figure 9.8-15) (Réjean Girard 2012a, Lebel-sur-Quévillon 2021).

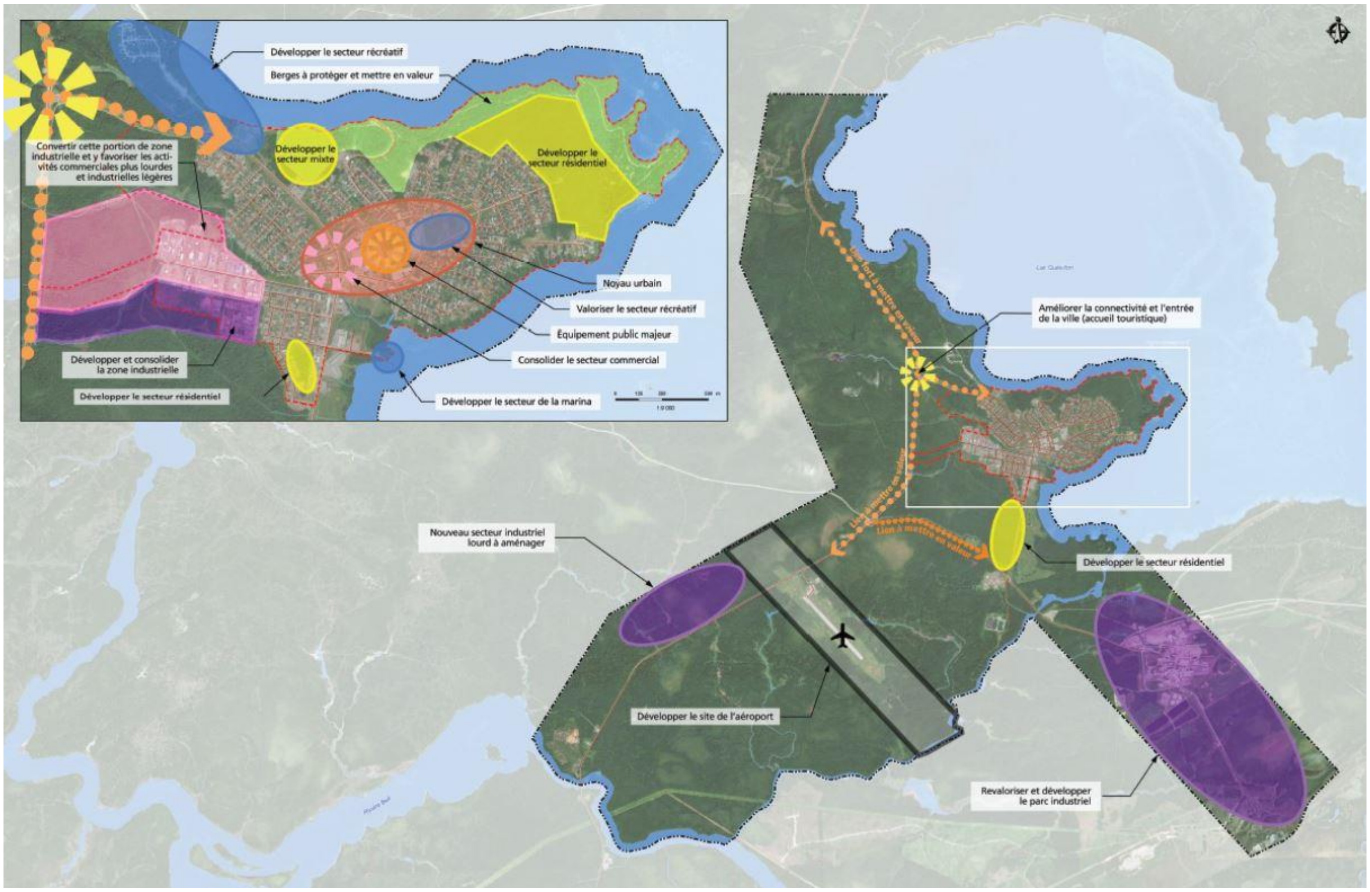


Figure 9.8-15 Development orientations for Lebel-sur-Quevillon (Lebel-sur-Quévillon 2021)

9.8.5.1.2 Accessibility

Lebel-sur-Quévillon is located at the southern limit of the Nord-du-Québec region, 87 km north of Senneterre and 151 km northeast of Val-d'Or. Although the territorial limits of Lac-Despinassy and Senneterre are located less than 2 km from its southern border, the city of Lebel-sur-Quévillon is enclosed by the municipality of Eeyou Istchee Baie-James.

It can be reached by Route 113, which connects Lac-Saint-Jean to Abitibi via Chapais and Chibougamau. It can also be reached by a network of forestry roads including R-1005 (Chemin du moulin), R-1050 and R-0853 (Figure 9.8-16) (EIJBRG 2022). Although the R-1005 is a logging road, it is used by the travelling public as a link between Matagami and Lebel-sur-Quévillon. Users who prefer not to use this type of road must use the Abitibi-Témiscamingue road network, which increases the distance by 200 km.

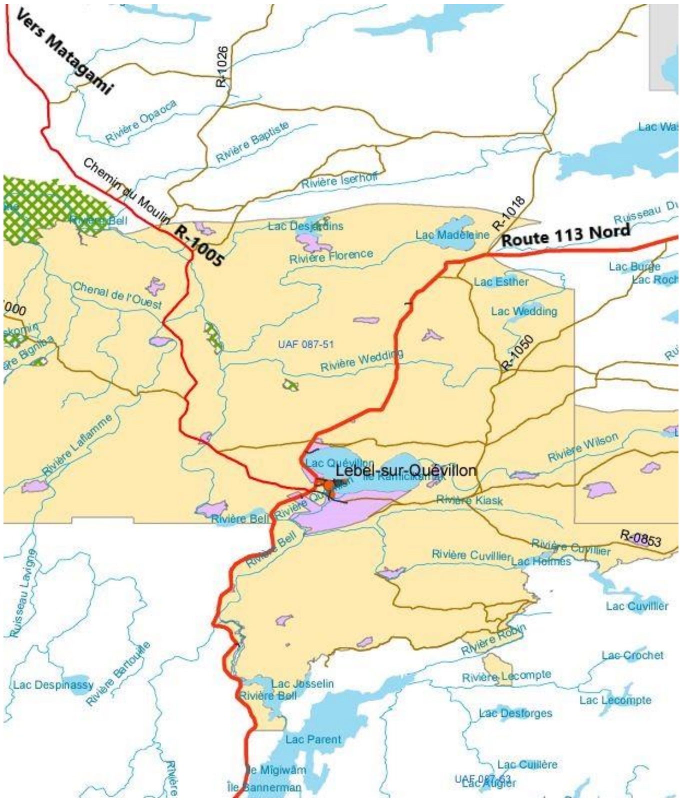


Figure 9.8-16: Roads around Lebel-sur-Quévillon (EIJBRG 2022)

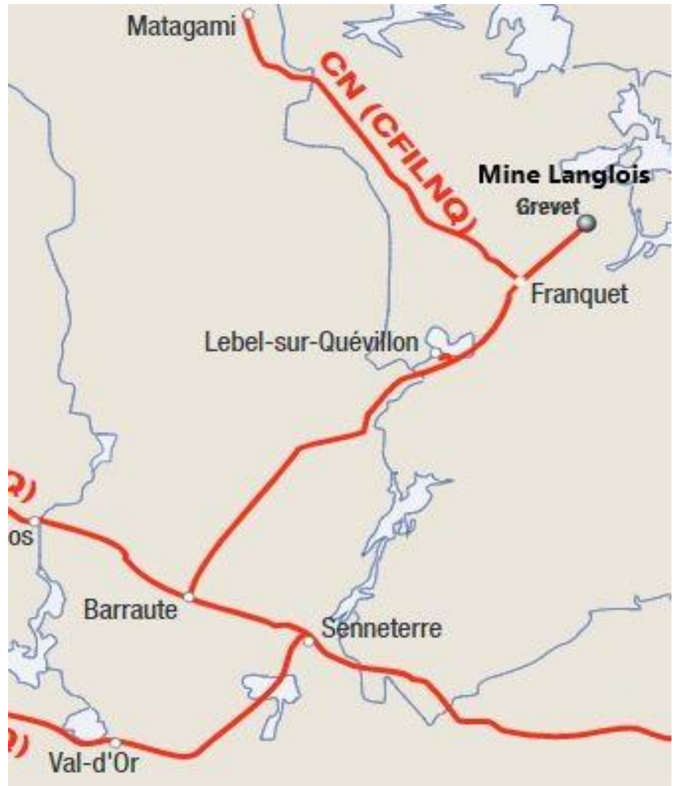


Figure 9.8-17: Railways lines around Lebel-sur-Quévillon (MTQ 2012)

It is also accessible via planes as there is a public aerodrome within the city limits. Since the facility does not have an airport certification, there are no direct commercial flights serving the region. However, it is possible to charter planes and land at the municipal airport (MTQ 2005).

The railway network of the region, owned by CN, passes at the south-east limits of the city (Figure 9.8-17) (MTQ 2012). Located next to an industrial park, it does not have a trans-shipping yard that would allow shifting from trucking to rail. The closest transfer yard is in Matagami.

9.8.5.1.3 Tourism Industry

As the other towns, the Lebel-sur-Quévillon is well known for snowmobiling and ATV. The abundance and quality of snow make the reputation of the local and federated trails from December to April. Plentiful quad and all-terrain vehicle trails are accessible from May to November. There are many places along the route to stop refuelling and some hotels even offer packages to simplify the travel organization.

Located one kilometre from downtown, near the beach, the municipal campground has 77 sites, a sanitary block and a community hall. There are no outfitters within the city limits. The closest outfitter without exclusive rights (fishing only) is located east of Lebel-Sur-Quévillon on the Wetetnagami Lake.

9.8.5.1.4 Logging Industry

Most of the land zoned forestry is owned by the government and Nordik Kraft owns the largest harvest quota in the forest management unit surrounding Lebel-sur-Quévillon (MFFP, 2022). The kraft pulp mill (formerly the Domtar mill) was bought by Chantiers Chibougamau in 2017. Since acquiring the plant, more than CA$400 million has been invested to modernize the processing facilities (C. Chibougamau 2022).

9.8.5.1.5 Mining Industry

The Lebel-sur-Quévillon region area is covered by active mining claims (Figure 9.8-18). However, contrarily to Chibougamau, Chapais, and Matagami, there are no active or former mine sites in the vicinity of the urban centre. The closest mines are located 40 km north (Langlois mine) and 100 km East (Osisko mine). Adjacent to city limits, there are two areas where mining activities are restricted (Figure 9.8-19).

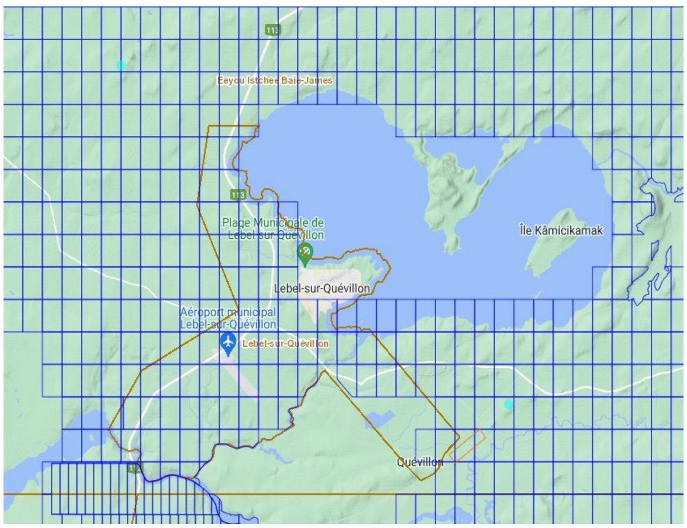


Figure 9.8-18: Active mining claims around Lebel-sur-Quévillon (MERN 2022).

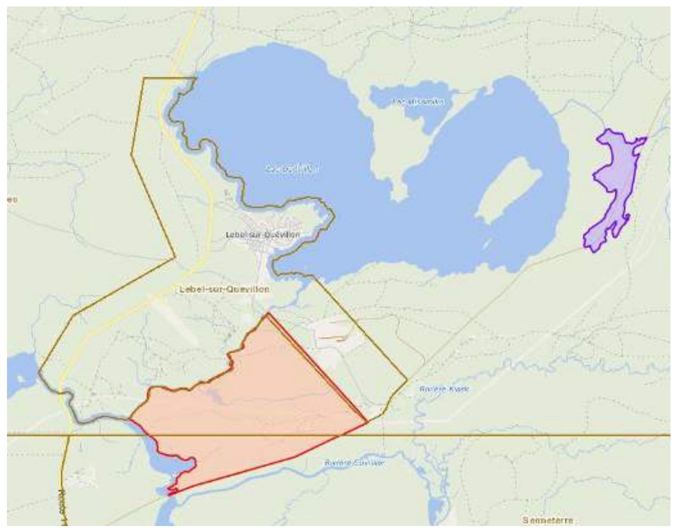


Figure 9.8-19: Restriction to mining: biological refuge (violet), industrial facility (orange) (MERN 2022).

9.8.5.2 Potential impacts of LGA

The first phase of the LGA infrastructure program would impact Lebel-sur-Quévillon indirectly as none of the proposed infrastructure are located within the city limits. However, the building of a new railway beyond Matagami and the reactivation of Grevet-Chapais railway would increase the access to the territory and benefit transit of natural resources by train. On a long run, it would certainly increase the need for a transshipment hub in Lebel-sur-Quévillon.

The potential negative impact anticipated by Lebel-sur-Quévillon citizens is the relocation of snowmobile and ATV trails currently using the Grevet-Chapais subgrade (snowmobile trail Trans-Québec 93). The new trail, wherever il would be relocated, should connect with the existing trail in Lebel-sur-Quévillon.

9.8.5.3 Public Consultation

A face-to-face information and consultation meeting with the population took place at the Lebel-sur-Quévillon City Hall on September 28, 2022. It reunited 13 residents of Lebel-sur-Quévillon. The second round of consultation was completed on September 29, 2022, with the principal stakeholders: elected officials and municipal employees of the City of Lebel-sur-Quévillon, local business owners, and snowmobile association representatives.

The topic raised at both meetings encompassed the creation of a corridor of northern transportation on an east-west axis, the relocation of the snowmobile trail, the mining industry, and the possible economic impacts for the community.

Participants expressed concern over the lack of communication and collaboration between the national snowmobile federation and local associations over the trail new layout between Grevet and Chapais. They felt that each group was planning on their side and were not sharing information. Participants looked forward to discussing the new snowmobile route with all groups.

The improvement of intra-regional links is a significant concern for road users. The use of the R-1005 between Lebel-sur-Quévillon and Matagami, which is an unpaved road raise security issue. This concern is well known by the ministère des Transports as it mentioned the problem in its 2005 diagnostic (MTQ 2005). Participants also stressed that the absence of a direct road link between Lebel-sur-Quévillon and Matagami does not allow for the improvement of intercity transportation services in the south of the territory. It weakens the economical visibility of the city impacting its tourism and service industries as road users do not stop in Lebel-sur-Quévillon. They rather pursue their trip in direction of Matagami. All participants requested the paving of a road link between Matagami and Lebel-sur-Quévillon.

One mentioned the lowering of the maintenance level of the railroad infrastructure in recent years having therefore a reduced speed of transportation. If the Grevet Chapais were to be rebuilt, the parameters of the new section should be applied to each of the older sections.

In summary and according to the participant, the city's priorities should be the paving of the road R-1005 and the elaborating new layout for the snowmobile trail that advantages Lebel-sur-Quévillon visibility and tourism industry.

9.8.6 Matagami

Economic and community development drivers, the mines are at the origin and growth of the city of Matagami. In the mid-1950s, five mining companies joined forces to explore the Matagami region. It was a fruitful approach because, by 1960, three mining sites were established: Orchan (1952-82), New Hosco (1958-70) and Mattagami Lake (1956- still active). Another decisive element that influenced the creation of a settlement was the construction of the Amos/Matagami road in 1959 which brought Matagami out of its isolation since the settlement was only accessible by seaplane. The following year, Québec Premier Antonio Barrette announced the construction of a four-season road that would a few years later reach Radisson (Radio-Canada 2013). Matagami was founded in 1963 and grew rapidly as hydroelectric projects developed in the James Bay region. The La Grande project was at the heart of Matagami's economic development in the early 1970s as transportation companies settled permanently to distribute and transport the products and services necessary for hydroelectric development (Lacasse 1985).

Once the hydroelectric projects were completed, Matagami returned to being the mining and forestry town it was in the 1960s. During its 60-year history, Matagami has seen 12 mines open and close on or near its territory with its ups and downs typical of the mining cycles (Radio-Canada 2013).

Table 9.8-5 Matagami - demographic evolution (ISQ, 2022; Statistiques Canada, 2007)

Year	1991	1996	2001	2006	2011	2016	2021
Number of inhabitants	2,467	2,243	1,939	1,555	1,526	1,453	1,340

The Matagami population has slowly declined since the 1980s and today, there are 1,340 inhabitants living in the urban nucleus established on the Bell River banks and surrounded by forest (Figure 9.8-21). Most of its territory is zoned industrial (in yellow, Figure 9.8-20) and are mining sites. According to orthophoto analysis, there are some pockets of residential areas on the south shore of Matagami Lake and they are located outside of the city limits. Matagami is enclosed by the territory of the municipality of Eeyou Istchee Baie-James.

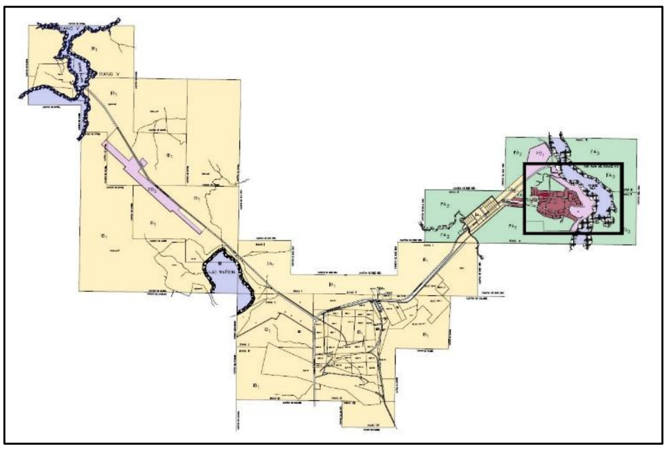


Figure 9.8-20: City of Matagami urban plan (Matagami 2015)

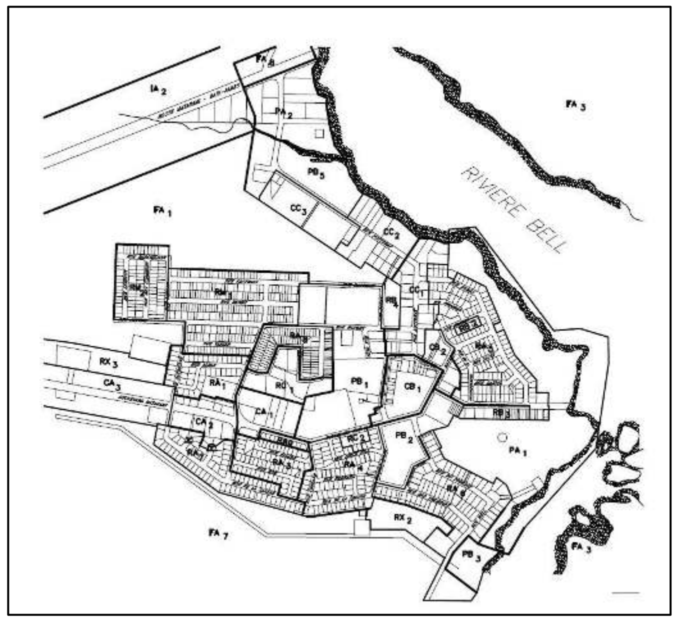


Figure 9.8-21: Matagami urban centre (Matagami 2015)

9.8.6.1 Accessibility

The town of Matagami is located at the northern end of Route 109 and at kilometre 0 of the Billy Diamond highway. It is accessible via the unpaved road R-1005 (Chemin du moulin) coming from Lebel-sur-Quévillon and all the forestry road network (Figure 9.8-22).

The town has an airport within the city limits. The facility is used by the MTQ for its special needs as fighting forest fires in Québec and Canada, aerial surveillance of the territory and aeromedical evacuations. There are no commercial flights serving Matagami airport.

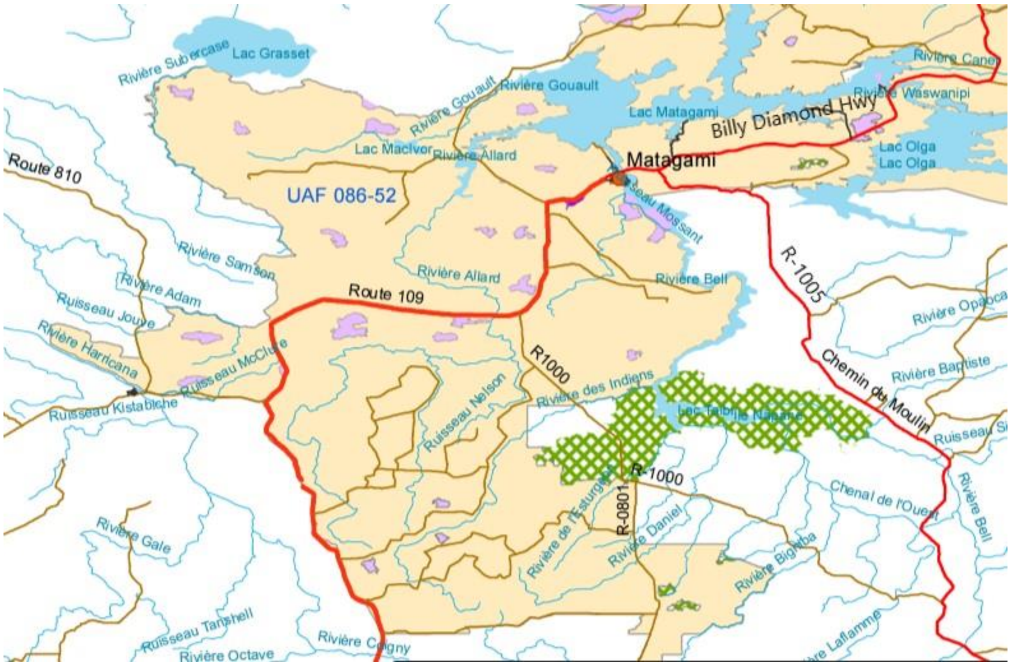


Figure 9.8-22: Roads around Matagami (EIJBRG 2022)

Matagami is the last station and trans-shipping yard of the Senneterre railway line operated by CN. The transshipment yard belongs to the City of Matagami. It is the northernmost point in western Québec to reach the national rail network. It is also the junction between the rail network and the non-standard road network. Its intermodality with the Billy Diamond highway makes it a critical location for freight transportation. Although the line has a slightly slower speed than the mainline, significant investments were made during the summer of 2016 to ensure its smooth operation (Matagami 2022). This railway section is essential for the supply and maintenance of the La Grande hydroelectric complex.

9.8.6.2 Tourism Industry

The economic structure of Matagami is based on three main sectors: mining, forestry and transportation. The tourism industry constitutes only a small part of Matagami's economy since it is almost essentially limited to outdoor activities and visits to the James Bay hydroelectric facilities. The region has many natural assets (rivers, forests, wildlife) that can be exploited for tourism purposes but lack visibility.

As the other cities, Matagami is well known for snowmobiling and ATVs. The abundance and quality of snow make the reputation of the local and federated trails from December to April. Plentiful quad and all-terrain vehicle trails are accessible from May to November. There are many places along the route to stop refuelling and some hotels even offer packages to simplify the travel organization.

Located 37 kilometres from downtown on the shore of Matagami Lake, there is a campground with 76 sites, a sanitary block and a community hall. There are no outfitters within the city limits. The closest outfitter without exclusive rights (fishing only) is located east of Matagami on the Goéland Lake.

9.8.6.3 Logging Industry

Most of the land zoned forestry is owned by the government and Interfor (formerly EACOM Timber Corporation) owns harvest quotas in forest management units surrounding Matagami (MFFP, 2022). Interfor's Matagami sawmill is in the industrial park outside the urban perimeter and produces lumber for the construction industry.

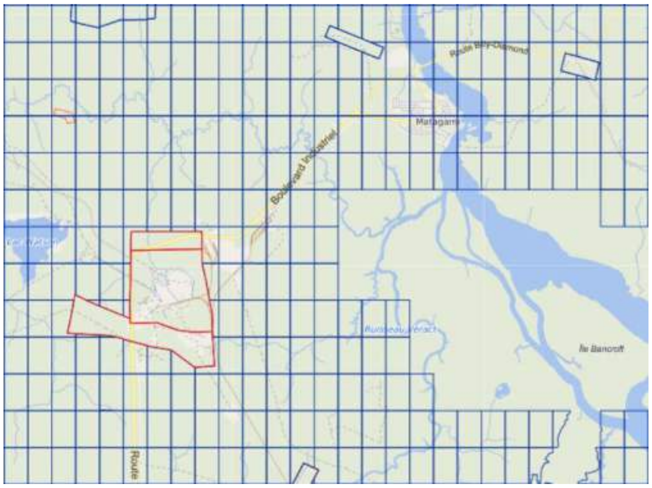


Figure 9.8-23: Active mining claims around Matagami (MERN 2022).

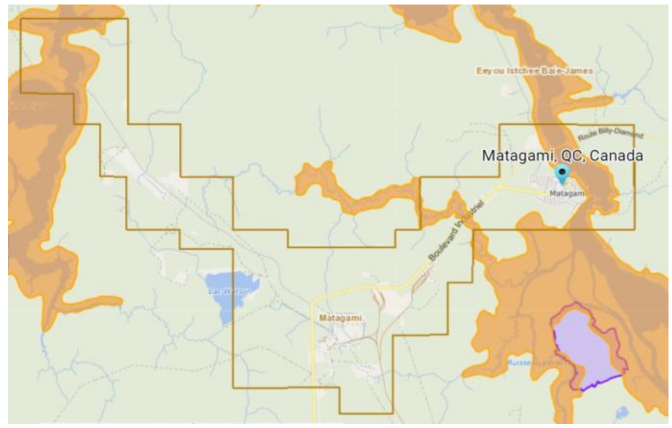


Figure 9.8-24: Restriction to mining: biological refuge (violet), Soscumica-Matagami hydroelectric reservoir (orange) (MERN 2022).

9.8.6.4 Mining Industry

Matagami was founded by the mining industry, and it is still an important economic sector in the region. Most of its territory is covered by active mining claims (Figure 9.8-23). The Mattagami Lake mine, located 8 km southwest within the city limits, is still active and extracting zinc.

In May 2021, the Québec government granted 5 million dollars for the rehabilitation of the road facilitating access to the Sunday Lake geological fault (west of Matagami), which presents a high mining potential (Lemay 2021). This implies repairs to a logging road and route N-810. Along similar lines, the Fenelon gold project might be developed 70 km west of Matagami. Wallbridge Mining Limited wishes to operate an underground mine from an existing ramp in a pit that was dewatered in 2018 and aims to extract gold ore (COMEX 2022a).

There are restrictions to mining in the region. Exploration is allowed under conditions in the Soscumica-Matagami lake watersheds as it presents a hydroelectric potential for future development (Figure 9.8-24).

9.8.7 LGA

The first phase of the LGA infrastructure program would impact Matagami directly as one of the proposed infrastructures is located within the city limits and include the building of a new railway between the town of Matagami and km 257 of the Billy-Diamond Highway.

9.8.7.1 Public consultation

Due to the restrictions taken to limit the human and economic impact of the COVID-19 pandemic, virtual information and consultation meetings with the population, elected officials and stakeholders were held in January and February 2022.

One participant pointed out the necessity to coordinate the various government entities to obtain the many permits required for this large project.

Another participant commented that LGA is innovative in its process but proposes solutions from another era. The train is no longer adequate, and the surrounding lines are outdated. The CN would have to be an investing partner as it would control access to the national network. This participant was uncertain if the train would attract mining projects as they have been developing without it, regardless of the existing road infrastructure.

He mentioned, however, that a power line would be more likely to attract new projects to the region as the need for electricity is high and the distribution network is not adapted to the northern reality. For example, he cited that the city of Matagami has not been able to host a lithium project for lacking electricity for processing. The participant fears that as the projects unfold, the capacity to supply electricity is insufficient requiring electrical infrastructure expansion. Consequently, the costs of any mining proposal can soar, and the project abandoned.

Québec's National Mining Institute promotes the digital transition of mining organizations and operations. The participant, who cited the Autonomous Mines 2030 conference organized by this institution, believes that Canadian mining companies are moving towards the electrification of mining equipment and the automation of processes. As all new mines are being designed to incorporate automation with some being fully automated, investments should include telecom infrastructure, fibre optics and telemetry. Artificial intelligence will be commonplace in mining operations, as workers will use it to interpret data from smart sensors and will need high-performance wireless networks to operate remotely automated vehicles. Training of the workforce must respond to an increasing number of positions related to new technologies to manage operating systems, communications, telemetry and geolocation.

9.8.8 Radisson

9.8.8.1 Profile

9.8.8.1.1 History

Established on the south shore of the Grande Rivière, at the very end of the Billy Diamond highway, Radisson is the only non-indigenous community in Québec located north of the 53rd parallel. The town's existence is intimately linked to the construction of the hydroelectric dam LG-2 (nowadays called Robert-Bourassa generating facilities). The settlement was built by the SDBJ as a work camp in 1974 to accommodate workers and their families. During the peak of the project work, between 1975 and 1978, 620 families and 2,500 residents lived in Radisson (Réjean Girard 2012a). After experiencing unprecedented prosperity in the 1970s, Hydro-Québec implemented an 8-6 work schedule (8 day-work for 6 days off) at the end of 1979. As a result, workers could live thousands of miles away from Radisson and fly to work. In addition, the maintenance of the James Bay hydroelectric facilities was, and is still done from the Centre d'exploitation régional de la région la Grande Rivière located in Rouyn-Noranda, which eliminates the choice for these workers to remain permanently in the vicinity (Municipalité de la Baie James 2003). The population of Radisson has thus fluctuated according to the major phases and commissioning of hydroelectric development: the construction of LG-2 completed in 1985, LG-2A completed in 1992, and LG-1 completed in 1995. At the end of these projects, the number of permanent residents abruptly declines reaching 352 permanent residents in 2005. To prevent the migration of the population, the town, which was privately owned by the SDBJ, became officially part of the James-Bay Municipality in 1984. It became a locality ten years later.

Table 9.8-6 Radisson - demographic evolution (ISQ, 2022; Statistiques Canada, 2007, Réjean Girard 2012a)

Year	1978	1987	1991	2005	2011	2016	2021
Inhabitants	About 2,500	About 950	NA	352	270	468	203

Over the decades, several infrastructures were built, and Hydro-Québec set up administrative offices as well as the Complexe Pierre-Radisson to receive temporary workers. Hydro-Québec is the primary employer in the community. There are also a few businesses, government offices and a tourism sector that has been slowly developing since the deprivatization of the James Bay Road in 1986 and the creation of Tourisme Baies James in 1990 (Réjean Girard 2012a).

Despite all these initiatives, the status and future of the small town have been uncertain for the past 40 years. As early as 1980, the SDBJ wondered about the town's future and considered two scenarios: dismantle the village and keep only one service point for temporary workers or make Radisson a permanent town to serve Northern Québec. The second option was endorsed by the provincial government, but this announcement was not well received by the Jamesian towns further south (Réjean Girard 2012a). Because of this opposition, Hydro-Québec kept the 8-6 work schedule brittling even more the status and role of Radisson. Over the decades, local actors have attempted to advocate for a change in work policy without success (Municipalité de la Baie James 2003; Consultations 2022). Subsequently, the population decreased and stalled at its lowest with 203 inhabitants in 2021.

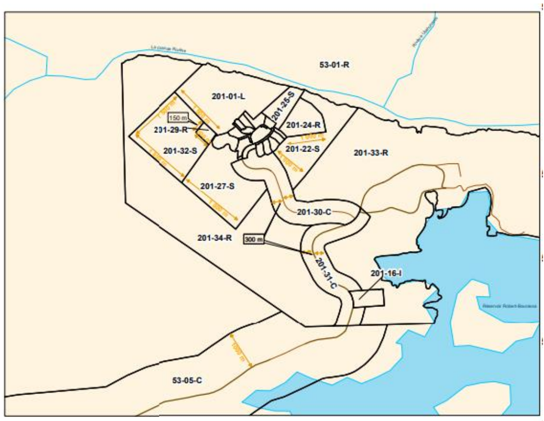


Figure 9.8-25: Locality of Radisson's zoning plan (Baie-James 2022)

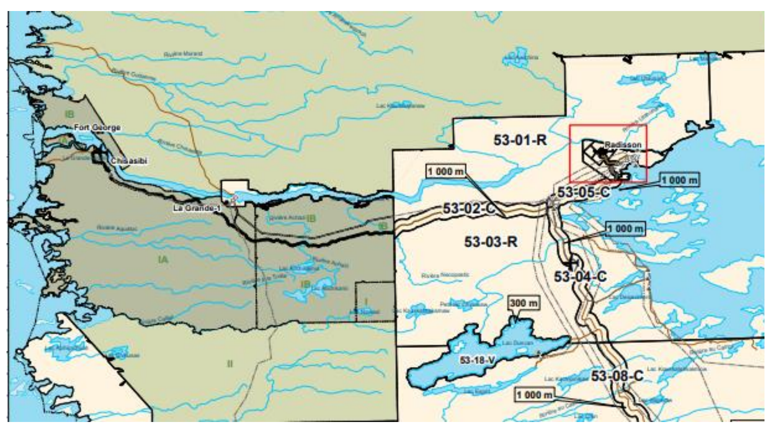


Figure 9.8-26: Regional zoning plan (Baie-James 2022)

The population lives in the urban area. When Radisson was planned, the Joliet Street area was intended for temporary residences. Today, this sector is devoid of houses and only the municipal campground is located there. The Groseillers Avenue sector was reserved for permanent residences. Over time, the number of houses has decreased by a third due to the demographic decline. The zoning plan (Figure 9.8-25) is part of the greater plan of the entire EIBJG (Figure 9.8-26) (Baie-James 2022).

9.8.8.1.2 Accessibility

Radisson is located at the end of Billy Diamond Road (km 617). It can also be accessed by plane via the La Grande airport located 30 km outside town. Mostly used to shuttle Hydro-Québec personnel, many flights from Montreal and Québec are serving the locality. There are no federated snowmobile trails coming from Matagami. However, there are some local trails.

9.8.8.1.3 Hydro-Québec

The local economy revolves around providing services, such as excavation, supply or transportation (Air Inuit and airport) and storage, to Hydro-Québec. There are also residents working for the public sector (education and health) and lodging and food services (Publique 2005, and 2022 consultations).

9.8.8.1.4 Tourism Industry

The locality is five kilometres from the Robert-Bourassa generating complex (LG-2), one of the largest hydroelectric stations in the world. The facility is well known for its dam, reservoir and spillway which looks like a giant staircase. Some 65 km away from Radisson, La Grande-1 hydroelectric facility is the second most powerful run-of-river generating station in Québec. Both facilities are open to public through organized tours and are the main tourist attractions near Radisson. There is one outfitter located in town that offers day trips around to fish and hunt.

9.8.8.1.5 Logging and mining industry

There are no logging activities occurring in the vicinity of Radisson and no forestry management units are allocated above the 52nd parallel (MERN, 2022). There are no mining claims near the town as most of the land is located near a hydroelectricity dam or reservoir and cannot be claimed for mining activity (Figure 9.8-27) (MERN, 2022).

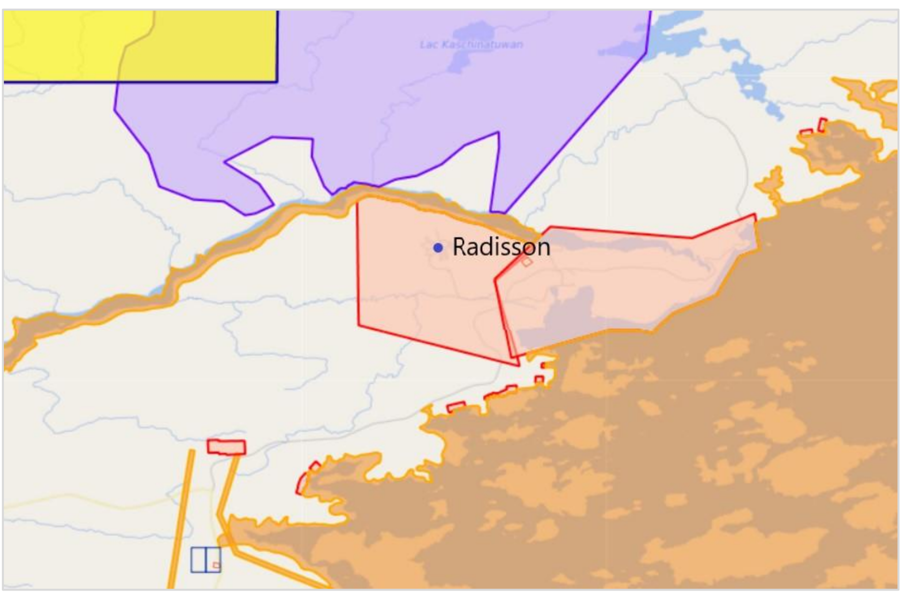


Figure 9.8-27: Restriction to mining: biological refuge (violet), hydroelectric facilities (orange) (MERN 2022)

9.8.8.2 Potential impacts of LGA

The first phase of the LGA infrastructure program would not impact Radisson as the proposed railroad covers the portion between Matagami (KM 0) and the Rupert River (KM 257). However, phases II and III of the program would have a great impact on the locality. The second phase entails the extension of the railway from Rupert River (KM 257) to the turnoff to the Trans-Taiga Highway (km 544), and the extension of the Billy-Diamond Highway to the communities of Whapmagoostui/Kuujjuarapiik. Finally, during the third and final phase, the railway would be extended to Whapmagoostui/Kuujjuarapiik where a new harbour would also be built. So, Radisson would lose its "end of the road" status to become a service and "go through" town.

9.8.8.3 Public Consultation

A face-to-face information and consultation meeting with the local committee took place at the Radisson community centre on June 1, 2022. A second round of consultation was completed the same day with the population and reunited 17 residents of Radisson.

The residents welcomed the proposed infrastructure program. They pointed out that the coming of the railway would be positive for the supply of food, materials, and raw and secondary materials. They added that the train emits less GHG and would have a reduced impact on climate change.

As mentioned above, the locality has a precarious status because of Hydro-Québec work's schedule and workers flying in and out, rather than living in Radisson. This point was lengthily discussed. However, certain participants perceived LGA to improve this situation since it will bring colossal work and the economy will boom. This strengthening of the local economy outside of Hydro-Québec could help Radisson to become a municipality. Many participants acknowledged that local shops and services are closing. Recently, the local branch of the Caisse Populaire Desjardins closed, and the grocery store is on the verge of leaving. Someone added that all these little things that they are losing are bringing them near to closing the community. They would need more workforce to sustain an economic activity.

One participant noted that the future of Radisson would be compromised if the road continued to Whapmagoostui. Many anticipated the loss of services as they would be moved to the end of the road. Others commented that there would be an important adaptation period for the Inuit communities who will learn to coexist with southerners, saying they are not ready for this contact because they have been isolated from "unscrupulous whites". Many fear that Radisson will become the town for drugs, alcohol, and prostitution.

Many residents mentioned experiencing racism from the Cree and being told they do not belong there, so they fear that losing their "end of the road" status would foster the closing of the locality.

9.8.9 Summary of Engagement with Jamesian Stakeholders

The LGA team, composed of VEI, WSP and Edelman representatives, met with elected officials, citizens, and socio-economic actors of the five main Jamesian towns mentioned in the above sections.

Introductory meetings were held virtually with the director general and elected officials of each municipality or locality. Then, public information sessions were organized in each town and took place in person, except for Matagami where it was held virtually due to the Covid-19 protocols in force at that time. Socio-economic actors from Lebel-sur-Quévillon, Chapais and Chibougamau participated in workshops with LGA team to discuss local issues, concerns, and potential opportunities more in depth.

Those meetings allowed the team to discuss with over 100 Jamesians, to answer their questions, and to understand their concerns, their use of the territory, as well as how the development of the LGA infrastructures could benefit or impact their activities.

The participants appreciated being informed about LGA and having an opportunity to share their concerns and visions of local development. They saluted the fact that La Grande Alliance provides a unique opportunity for Crees and Jamesians to collaborate, to coordinate interests, and to build together a vision of development that will benefit to everyone on the territory. They highly valued the ideas of development predictability and of balance between protection and development which form core parts of LGA.

Jamesians highlighted the importance of connectiveness with existing infrastructures and of positioning the potential infrastructures within a global context. For example, the Grevet-Chapais railway could be part of a Canadian east-west northern route, and the deep-sea port in Whapmagoostui, connected to the BDH railway, could play an important role with the development of a northwest maritime link. Intermodality was mentioned as a staple of the infrastructure program and passengers transportation was seen as a must.

According to some participants, building new railways in Eeyou Istchee Baie-James could increase the attractiveness of local industrial parks, for mining processing plants among others, and could favour tourism. Investments in new technologies and telecom infrastructures should be made in parallel as the mining industry is leaning towards automating its operations. There will be a need for training in automation/robotization, artificial intelligence and communication network. Additional electrical power should be made available for mining and transformation projects development.

New railways could also improve the supply of food, raw and second materials, while having a positive impact on climate change by reducing the number of trucks on the roads. However, since the surrounding existing lines are in poor condition, they would require investments from the CN, so the new railways could connect to a network.

For some stakeholders, as transportation by ship is more efficient and cheaper than by train, it would justify the construction of a deep-water port in the north. They consider that this infrastructure should be accompanied by parallel investments though, mainly in the social and education sectors.

The main concerns expressed by Jamesians in relation to the infrastructures under study were:

- Nuisances from the train for residents of Cavan Lake (noise, vibration, and visual aesthetics);
- Partial loss of access on Chemin du lac Cavan (eastern part);
- Loss of access to cottages around Opawica Lake;
- Relocation of snowmobile and ATV trails currently using the Grevet-Chapais subgrade (snowmobile trail Trans-Québec 93) and connection with existing trails, especially in Lebel-sur-Quévillon;
- Increased safety risks where the train would intersect existing trails and paths;
- Risk of malfunctions and spills causing water contamination;
- Increased hunting and fishing pressure on wildlife due to the influx of workers during construction;
- Increased pressure on local housing and accommodation.

The addition of a study analyzing potential costs and alignment for an alternate snowmobile trail was very well received by snowmobilers and Jamesians in general. VEI had communications with representatives of the FCMQ and of local snowmobile clubs, then organized a meeting with all of them together. That allowed to answer questions, clarify timelines of the infrastructure program, address concerns, and discuss the criteria to be considered in the elaboration of an alternate snowmobile trail.

Photo 9.8.1 Public information session in Chapais. Paul Wattez (WSP), Marie-Hélène Côté (VEI), Samuel Lessard (Edelman) and Stéphanie Houde (ville de Chapais)

Photo 9.8.2Marie-Hélène Côté (VEI), Joanie Landry Désaulniers (WSP) and Samuel Lessard (Edelman) during a workshop with Lebel-sur-Quévillon socio-economic actors

Jamesian stakeholders showed an interest in reviewing and discussing the results of the various studies that compose Phase I Feasibility Study. VEI recommends continuing to engage with Jamesians through different channels, for example:

- Visit the Jamesian towns again to present and discuss the studies' results;
- Organize focus groups with economical actors;
- Use different means of communications to disseminate information about LGA, such as local newspaper, radio stations, and web sites;
- Prepare and distribute summaries of different aspects of the studies in French;
- Send news and updates to mayors and directors general;
- Organize a day of discussions with all Jamesian mayors and directors general.

9.9 PLANTS, WILDLIFE & SPECIES AT RISK

9.9.1 Methodology and data sources

The current evaluation, as part of the Phase-1 of the Grande Alliance, relates on the two following data sources :

1) Field surveys, which were limited to fish and fish habitat inventories at watercourses crossing locations along the alignments in 2021 and 2022, in order to depict a general appreciation of the fish communities (Appendix 6.28). A sample of 13 % (76 sites) of all 575 watercourse crossings (all alignments combined) were surveyed.

2) Desktop review based on available existing data and their analysis. These sources included, but not limited to :

- All government and private agencies reports, scientific publications and reports,
- Wild game and furbearer harvesting records,
- Geomatics analysis information (GIS) databases, including online interactive maps,
- MFFP data with inventory data and telemetry monitoring on large ungulates populations (caribou : migratory and woodland, and moose). This includes habitat suitability index (HSI) for woodland caribou and moose provided by the MFFP for the present study. The HSI GIS model that estimates the ability of an area to meet the food and cover requirements of an animal species. HSI is a tool intended to inform planners of the probable impacts on wildlife associated with interventions on the landscape. It is a tool that should augment the expertise of resource specialists with site-specific knowledge. The output of the woodland caribou HSI is expressed into 5 classes of suitability, from 1 being the least suitable to 5 that correspond to the highest suitability. For moose, the output is in 3 categories, low – medium – high suitability. Parameters used to generate the HIS includes criteria such as forest cover characteristics (age, species composition and stand density, distance between resting and feeding habitats, etc.).
- Data from the Centre de données sur le patrimoine naturel du Québec (CDPNQ) on the flora and fauna species in the province,

9.9.2 Information common to all three alignments

9.9.2.1 Plants

9.9.2.1.1 Canada's ecological classification

The Government of Canada classify forests in four main ways: ecozones, forest regions, forest compositions and plant hardiness zones. Together, these classifications give forest managers a science-based foundation for making decisions at the national, provincial and territorial levels.

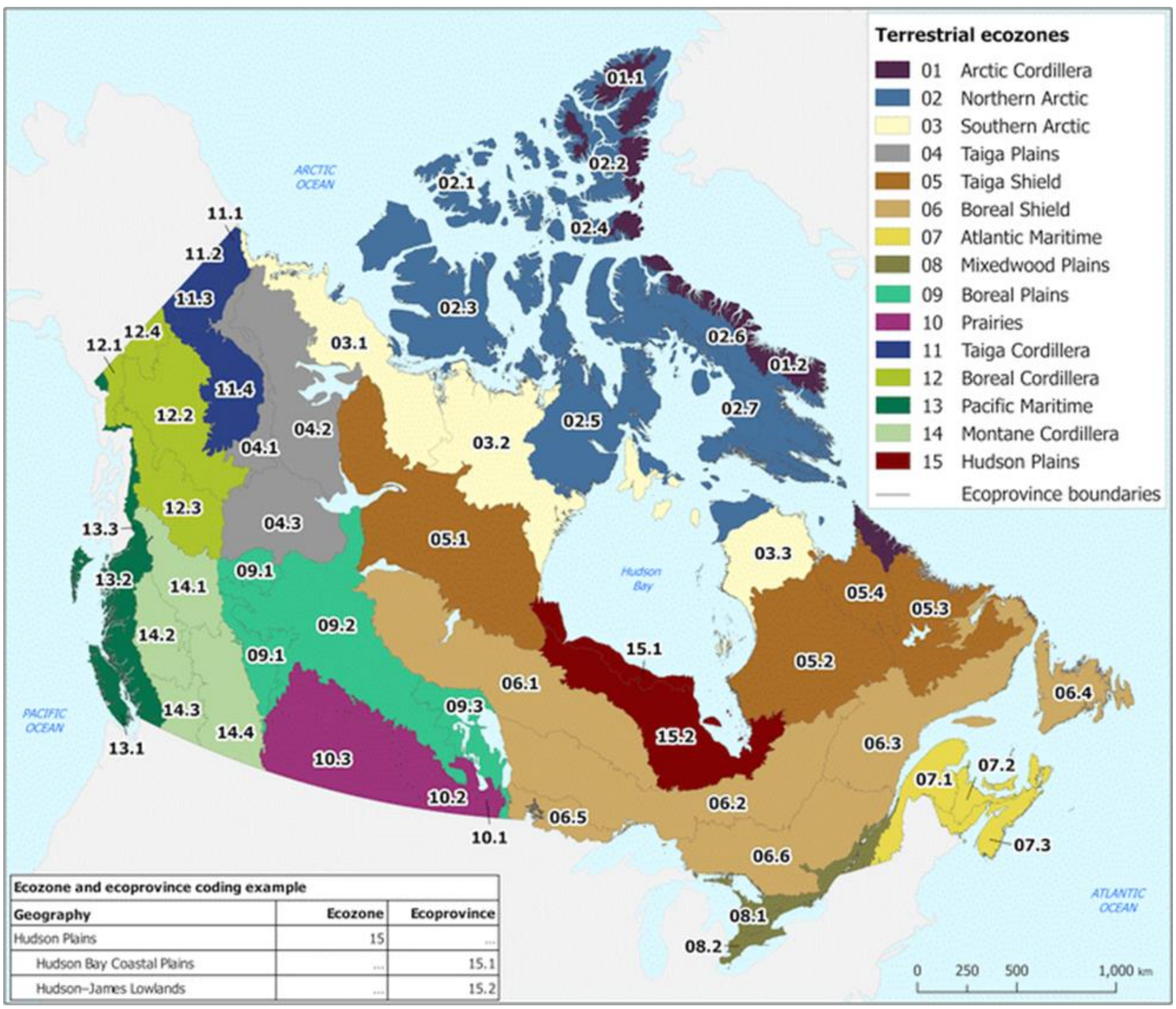
An **ecozone** is an area of Earth's surface representing large, very generalized ecological units. Each ecozone is characterized by a unique interplay of geologic, climatic, vegetative, wildlife and human activity factors (Park Canada, 2003). Canada has 20 ecozones: 15 terrestrial and 5 marine. The 15 terrestrial ecozones are divided into 53 ecoprovinces (Figure 9.9-1).

The study alignments are mostly located in the Boreal Shield ecozone (Ecozone 6) and the Mid-Boreal Shield ecoprovince (Ecoprovince 6.2). A small portion of the northern tip of the potential BDHR alignment (Phase-I) lies within the Hudson Plains ecozone (Ecozone 15), in the Hudson-James Lowlands ecoprovince (15.2).

The following description taken from Environment Canada (2000):

"The Boreal Shield ecozone stretches 3,800 km, from the eastern tip of Newfoundland to the northeastern corner of Alberta. This evergreen, granite-studded landscape is geographically defined by the overlap of the Canadian Shield and the boreal forest. The largest of Canada's 15 terrestrial ecozones, the Boreal Shield ecozone includes parts of 6 provinces, covers over 1.8 million square kilometres, encompasses almost 20% of Canada's land mass, and accounts for 22% of the country's freshwater surface area. The ecozone displays a wide range of ecological diversity, reflecting coastal versus continental regimes, a broad range of growing season lengths, and variations in regional climate, soils, and vegetation patterns. In spite of this diversity, the Boreal Shield's character is fairly consistent from one end to the other.

The climate of this ecozone is generally continental, with long, cold winters and short, warm summers. Moist air masses over Hudson Bay bring relatively high levels of precipitation to much of the area, from 400 mm in the west to 1 000 mm in the east. The temperature averages -15°C in January and 17°C in July. Regions bordering the Great Lakes and the Atlantic Ocean tend to be warmed in winter and cooled in summer by the moderating effect of large water bodies. The average annual number of frost-free days ranges between 60 and 100, with some regions having fewer than 40."



Ecozone and ecoprovince coding example		
Geography	Ecozone	Ecoprovince
Hudson Plains	15	...
Hudson Bay Coastal Plains	...	15.1
Hudson–James Lowlands	...	15.2

Figure 9.9-1 : Ecozones and ecoprovinces of Canada (source: Parks Canada, 2003)

9.9.2.1.2 Québec's ecological classification

The provincial ecological classification differs from that of the federal ecozones, as it is broken down into more refined bioclimatic domains.

The potential alignments are all located within the western spruce-moss forest bioclimatic subdomain. They intersect four ecological regions (MFFP: Blouin and Berger, 2005) (Map 9.9.1):

- Rupert Bay ecological region (region 6b)
- Opemisca Lake ecological region (region 6c)
- Mistassini Lake ecological region (region 6f)

Due to the harsh weather conditions in the western spruce-moss forest bioclimatic subdomain, the vegetation examined in the four ecological regions is relatively unvaried and uniform. A description of the vegetation will be produced for the entire bioclimatic subdomain and will thus include plant conditions for all three alignments, since all are geographically situated in this subdomain.

In the western spruce-moss forest, we find a high proportion of softwood stands due to the very even terrain. Black spruce (*Picea mariana*) is the most frequently seen softwood species; it is found throughout the landscape. The balsam fir (*Abies balsamea*) is less frequent here than in the ecological regions further east and is usually found in more uneven terrain (hillsides).

Paper birch (*Betula papyrifera*) and trembling aspen (*Populus tremuloides*) are almost the only hardwood trees that grow in the area. Aspen are located on fairly even sites with a finely textured ground layer, at stations where the ground cover is thin or at the base of slopes, as well as in large clearings and areas of recent wildfire. Paper birch occurs much more rarely and is generally found alongside balsam fir, preferring hillsides with long regular slopes covered with a thick layer of till.

Black spruce is found in fairly vast, wet depressions covered by an organic mat. They also grow in poorly drained mineral layers with varying textures. These forest stands are covered with sphagnum mosses and heath shrubs. Mesic sites with an even or flat terrain are colonized by stands of black spruce, jack pine (*Pinus banksiana*) or a mix of the two. These stands have abundant understory heath shrubs and mosses. Their dynamics are influenced more by fire than by windfall and insect infestations.

In the broad clay plain, black spruce and jack pine are found in varying proportions alongside trembling aspen. Cutting activities promote a higher percentage of hardwoods. When the terrain is somewhat more uneven (hills with gently sloping sides, for example), stands of black spruce are found. Heath shrubs and mosses are abundant here. At the more productive stations, latifoliate trees are found. Towards the east, in region 6a, where the terrain is more uneven, the hills and slopes are colonized by stands of white birch.

9.9.2.2 Wildlife

This section addresses wildlife description under a large to smaller terrestrial species, within specific groups (ex.: large mammals, furbearers), with fish being a distinct sub-section.

9.9.2.2.1 Terrestrial

Information on the presence and distribution of mammals, amphibians and reptiles has been documented only for the overall Eeyou Istchee James Bay territory, not for more specific geographic areas as the present study areas.

The main species of large wildlife present in Eeyou Istchee territory are caribou (*Rangifer tarandus*), both migratory and woodland ecotypes, moose (*Alces alces*) and black bear (*Ursus americanus*). These species are covered in more detail in specific subsections in this section. Although the polar bear (*Ursus maritimus*) occasionally ventures inland, it is primarily a coastal species.

A total of 17 species of small mammals are found in James Bay territory and accordingly are potentially present near the study alignments, based on the available habitats (Table 9.9-1). In addition, there are five medium-sized species, i.e. the northern flying squirrel (*Glaucomys sabrinus*), snowshoe hare (*Lepus americanus*), groundhog (*Marmota monax*), North American porcupine (*Erethizon dorsatum*) and least chipmunk (*Eutamias minimus*).

The chiroptera community in Eeyou Istchee includes six species of bat (Table 9-9-2).

Th Eeyou Istchee territory has a high percentage of the fur-bearing animals found in Québec, with 19 species (Table 9-9-3), although some, such as the polar bear and Arctic fox, are not found in the southern part of the territory. Among these species, black bear and beaver plays a central role, in both subsistence and cultural aspects.

Due to the harsh climate in Eeyou Istchee territory, the population of herpetofauna is not diverse, with just 10 species of amphibians and one species of reptile (Table 9.9-4).

Table 9.9-1 Species of small wildlife reported in Eeyou Istchee James Bay territory (source: James Bay regional land and natural resource commission, 2010)

Common name	Latin name	General species distribution
Small mammals and rodents		
Gapper's red-backed vole	*Myodes gapperi*	Confirmed presence to approximately the 54th parallel
Eastern meadow vole	*Microtus pennsylvanicus*	Abundant throughout the territory
Rock vole	*Microtus chrotorrhinus*	Abundant south of the 52nd parallel. Just one mention north of this parallel
Northern bog lemming	*Synaptomys borealis*	Appears to be rare south of the 53rd parallel, according to the inventories
Southern bog lemming	*Synaptomys cooperi*	No mention in the inventories
Star-nosed mole	*Condylura cristata*	Not inventoried, but present throughout the territory
Northern short-tailed shrew	*Blarina brevicauda*	Occurs rarely throughout the territory. Identified up to south of the 51st parallel
Ungava collared lemming	*Dicrostonyx hudsonius*	Historical mentions starting north of the 53rd parallel. Southern boundary of its distribution area
Arctic shrew	*Sorex arcticus*	No mention in the inventories, but present throughout the territory
Common shrew	*Sorex cinereus*	Abundant throughout the territory
Smoky shrew	*Sorex fumeus*	Occurs rarely throughout the territory. Identified up to south of the 50th parallel

Common name	Latin name	General species distribution
Northern water shrew	*Sorex palustris*	Abundant south of the 52nd parallel. Appears to be less frequent north of this parallel, according to the inventories
American pygmy shrew	*Sorex hoyi*	Abundant throughout the territory
Western heather vole	*Phenacomys intermedius*	Abundant throughout the territory
Woodland jumping mouse	*Napaeozapus insignis*	Abundant south of the 52nd parallel. No mention north of this parallel
Meadow jumping mouse	*Zapus hudsonius*	Abundant throughout the territory
Deer mouse	*Peromyscus maniculatus*	Abundant throughout the territory
Other species		
Northern flying squirrel	*Glaucomys sabrinus*	Present throughout the territory
Snowshoe hare	*Lepus americanus*	Present throughout the territory
Groundhog	*Marmota monax*	Present throughout the territory
North American porcupine	*Erethizon dorsatum*	Present throughout the territory
Least chipmunk	*Eutamias minimus*	Present in the southwest of the territory

Table 9.9-2 Species of chiroptera reported in Eeyou Istchee James Bay territory (source: James Bay regional land and natural resource commission, 2010)

Common name	Latin name	General species distribution
Silver-haired bat	*Lasionycteris noctivagans*	Just two mentions south of the 50th parallel. Migratory species
Hoary bat	*Lasiurus cinereus*	Frequently detected up to the 52nd parallel. Migratory species
Northern long-eared bat	*Myotis septentrionalis*	Abundant south of the 52nd parallel. No mention north of this parallel. Resident species
Eastern red bat	*Lasiurus borealis*	Present to the 52nd parallel. Migratory species
Big brown bat	*Eptesicus fuscus*	Present to about the 52nd parallel. Resident species
Little brown bat	*Myotis lucifugus*	Confirmed presence to the 54th parallel. Resident species

Table 9.9-3 List of fur-bearing animals reported in Eeyou Istchee James Bay territory (source: James Bay regional land and natural resource commission, 2010)

Common name	Latin name	General species distribution
American marten	*Martes americana*	Present throughout the James Bay territory
American mink	*Mustela vison*	Present throughout the James Bay territory
Arctic fox	*Alopex lagopus*	Present along the coastal regions of James Bay
Beaver	*Castor canadensis*	Present throughout the James Bay territory
Black bear	*Ursus americanus*	Present throughout the James Bay territory
Canada lynx	*Lynx canadensis*	Present throughout the James Bay territory
Cougar	*Felis concolor*	Present in the southern part of the territory to about the 50th parallel
Coyote	*Canis latrans*	Present in the southern part of the territory
Fisher	*Martes pennanti*	Present in the southern part of the territory up to north of the 50th parallel
Grey wolf	*Canis lupus*	Present throughout the James Bay territory
Least weasel	*Mustela nivalis*	Present throughout the James Bay territory
Long-tailed weasel	*Mustela frenata*	Present in the southern part of the territory up to the 51st parallel

Common name	Latin name	General species distribution
Muskrat	*Ondatra zibethicus*	Present throughout the James Bay territory
North American beaver	*Castor canadensis*	Present throughout the James Bay territory
North American river otter	*Lutra canaensis*	Present throughout the James Bay territory
Polar bear	*Ursus maritimus*	Coastal regions of James Bay and sometimes inland to south of the 52nd parallel
Red fox	*Vulpes vulpes*	Present throughout the James Bay territory
Stoat	*Mustela erminea*	Present throughout the James Bay territory
Striped skunk	*Mephitis mephitis*	Present in the southern part of the territory to about the 52nd parallel
Wolverine	*Gulo gulo*	Present in the northern part of the territory starting at the 51st parallel

Table 9.9-4 List of amphibians and reptiles reported in Eeyou Istchee James Bay territory (source: James Bay regional land and natural resource commission, 2010).

Common name	Latin name	General species distribution
Amphibians		
American toad	*Bufo americanus americanus*	Possibly present throughout the territory
Wood frog	*Rana sylvaticus*	Possibly present throughout the territory
Northern leopard frog	*Rana pipiens*	Present in the southern part of the territory to about the 54th parallel
Northern green frog	*Rana clamitans melanota*	Present in the southern part of the territory to about the 52nd parallel
Mink frog	*Rana septentrionalis*	Possibly present throughout the territory
Spring peeper	*Pseudacris crucife crucifer*	Present in the southern part of the territory to about the 54th parallel
Boreal chorus frog	*Pseudacris maculata*	Present only in Rupert Bay and surrounding bays
Northern two-lined salamander	*Eurycea bislineata*	Present in the southern part of the territory to about the 54th parallel
Blue-spotted salamander	*Ambystoma laterale*	Present in the southern part of the territory to about the 54th parallel
Spotted salamander	*Ambistoma maculata*	Present in the southern part of the territory to north of the 51st parallel
Reptiles		
Common garter snake	*Thamnophis sirtalis*	Possibly present throughout the territory

9.9.2.2.2 Migratory caribou

Two migratory caribou populations live in the subarctic and arctic region of Québec and Labrador, and each one has affiliations based on geographic fidelity to two distinct calving areas. The Rivière aux Feuilles herd (TRAF) frequents the western and northern Ungava Peninsula in Québec (Map 9.9.2) and the Rivière George herd (TRG) extends across northeastern Québec and central Labrador towards the north (COSEWIC, 2017).

The two herds have decreased significantly in size over the past decade. The decline was deemed sufficiently serious to warrant both subpopulations being given endangered status under the *Species at Risk Act* [SARA]). In Québec, the migratory caribou is not specifically protected under the *Act respecting threatened or vulnerable species*.

Migratory behaviour allows caribou to take advantage of the seasonal productivity of certain ecosystems. The fall and spring caribou migrations ensure that it finds the best conditions to complete the three stages of its annual life cycle. Herds travel through vast portions of Québec's north to their winter area, summer areas and calving areas (MFFP: Taillon and coll., 2016). The caribou migrate from their summer and calving areas in the Ungava peninsula to their winter area, which is in the Nemiscau sector to the south, based on MFFP 2016 data (Taillon and coll., 2016) (Map 9.9.2).

During the 1970s and 1980s, the annual range was located north of the 55th parallel and was limited to certain sectors of the Ungava Peninsula. By the 1990s, their range had spread southward, albeit still north of the 52nd parallel. In the early 2000s, the TRAF herd's range had expanded even further to the south during the winter, towards the James Bay taiga (MFFP: Taillon and coll., 2016).

9.9.2.2.3 Woodland caribou

In Québec, the woodland caribou ecotype (*Rangifer tarandus caribou*) is found primarily in the western spruce-moss forest and spruce-lichen forest bioclimatic domains between the 49th and 55th parallels.

In James Bay territory, there are four relatively distinct populations, or herds, extending from west to east, with partial overlapping of their respective ranges (Map 9.9.3). For the purposes of our study, we are concerned primarily with the Nottaway, Assinica and Témiscanie herds.

The woodland caribou has been designated a threatened species by COSEWIC federally (Canada) and vulnerable provincially (Québec). The areas covered by the planned woodland caribou conservation strategy and its status as a species at risk are discussed in further detail in the report sections on protected areas (section 9.5).

The regional habitat suitability index (HSI) for woodland caribou is presented on Map 9.9.4.

9.9.2.2.4 Moose

Most of the information regarding moose in the study area comes from moose management plans prepared by the MFFP, the most recent of which was produced in 2015 and covers the period 2012 to 2019 (MFFP: Lefort and Massé, 2015). The information below is taken from this source.

Management plans are adjusted for the different hunting management zones in Québec. The BDHR, Grevet-Chapais and Mistissini Road alignments cover three hunting management zones: zones 16, 17 and 22. However, zone 16 is only represented by a small portion of the southern boundary of the potential BDHR study area. We've thus limited our analysis to the information for zone 17 for the Grevet-Chapais alignment and zone 22 for the BDHR and Mistissini Road alignments (Map 9.9.5). A recent aerial moose inventory (2021) was carried out by the MFFP in zone 17, extending into a portion of zone 22 to the north (Map 9.9.6). Figure 9.9-2 presents the hunting management zones discussed below, as well as the wildlife management areas they cover.

It should be noted that based on the results of the 2021 aerial surveys by the MFFP and in compliance with obligations under the James Bay and Northern Québec Agreement (JBNQA), moose hunting activities in zone 17 now limited to harvesting by Indigenous people for subsistence hunting (Gouvernement du Québec, 2023). The decline in the population of moose observed in this area implies a decrease in harvesting.

In the landscapes of the study alignments, past and current forest management practices promote rejuvenation of the boreal forest, which in turns increases moose density by creating habitats suitable for them, i.e. more abundant hardwoods. In zone 17 and the southern portion of zone 22, forest cutting results in a loss of habitat in the short term, but in the medium term younger forests are favourable for moose. A number of locations are regenerating and some are likely to provide good potential habitat for moose.

The regional HSI for moose is presented on Map 9.9.7.

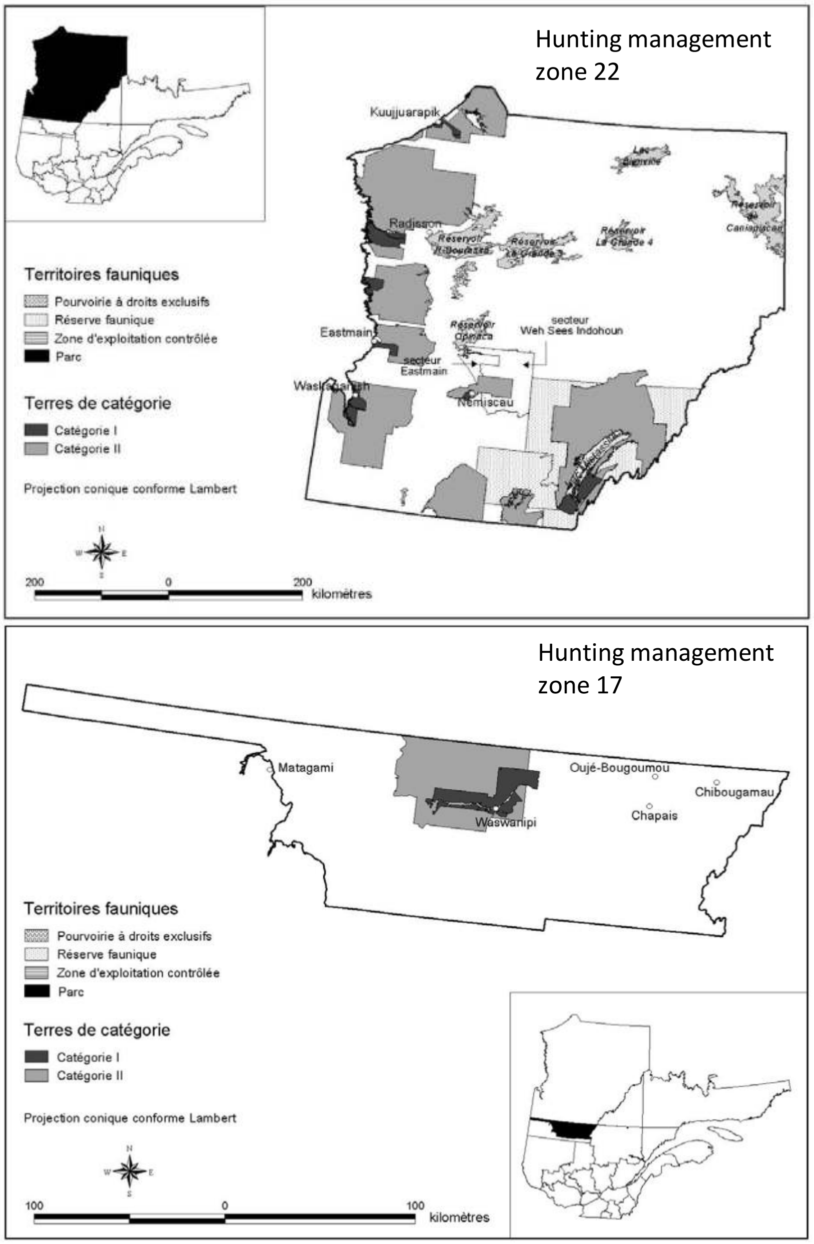


Figure 9.9-2 Wildlife management boundaries and areas in hunting management zones 17 and 22 (source: MFFP: Lamontagne and coll., 2006).

9.9.2.2.5 Black bear

As in the case of moose, most of the information regarding black bears in the study area comes from species management plans prepared by the MFFP. The most recent plan covers the period 2020 to 2027, however at the time of writing the document was not yet available. The information has therefore been taken from the previous management plan published in 2006 and covering the period 2006 to 2013 (MFFP: Lamontagne and coll., 2006).

Under the JBNQA, sport hunting for black bear is prohibited in hunting management zones 17 and 22. *The Act respecting hunting and fishing rights in the James Bay and New Québec territories* (RSQ, c D-13.1) and Schedule 2 of Section 24 of the JBNQA also lists species reserved for exclusive use for Crees, including black bear. This species is highly revered in Cree culture.

For the purposes of wildlife management, in addition to the various hunting management zones, Québec is divided into fur-bearing animal management units (FAMU) (Map 9.9.8). The three study alignments are in two hunting management zones (17 and 22) and primarily three management units (88, 90 and 91).

9.9.2.2.6 Birds

Of the 467 bird species identified in the province of Québec, approximately 250 are found in James Bay territory, either as resident, breeding migratory or passing migratory species (CRRNTBJ, 2010). Just 17 of those are reportedly present in the territory year-round.

Further, about 40 of the 250 species identified in the territory are considered to have been rare or accidental observations. The full list of bird species reported in James Bay territory is provided in Appendix 6.28.

9.9.2.2.7 Waterfowl

The inland aquatic habitats of the Eeyou Istchee are host for wide variety of waterfowl species (Table 9.9-5). which constitue important subsistence and cultural ressources for Cree communities. Amongst the duck and geese species, the Canada goose (all sub-species) occupies a central importance as a keystone species imbedded in Cree culture (Giroux and coll., 2022). Therefore, for the present study, the emphasis was placed on the Canada goose.

Table 9.9-5 Common waterfowl species of the Eeyou Istchee inland territory

Common name	Latin name	Habitat
American black duck	*Anas rubripes*	Wetland habitats in both freshwater, in and around marshes, swamps, ponds, lakes, bays, estuaries, and tidal flat
Brant goose	*Branta bernicla*	Marshy edges with sedges and other emergent
Canada goose (Atlancic)	*Branta canadensis sb. canadensis*	Various types of wetlands, bogs and fens important
Canada goose (Interior)	*Branta canadensis sb. interior*	Various types of wetlands, bogs and fens important
Canada goose (Maxima)	*Branta canadensis sb. maxima*	Various types of wetlands, bogs and fens important
Common goldeneye	*Bucephala clangula americana*	Lakes, rivers or wetlands. Typical breeding sites feature lakes with and clear water offering good visibility and little emergent vegetation
Eurasian teal	*Anas crecca*	Freshwater ponds, marshes, shallow edges of lakes
Mallard	*Anas platyrhynchos*	Shallow waters such as ponds, lakes, marshes, and flooded field
Northern pintail	*Anas acuta*	Lakes, rivers, marshes and ponds in grasslands, barrens, dry tundra, open boreal forest
Snow goose	*Anser caerulescens*	Breeds on the tundra, various habitat during migration
Tundra swan	*Cygnus columbianus*	Open tundra marshy lakes and ponds and sluggish streams
Wood duck	*Aix sponsa*	Quiet inland waters near woodland, such as wooded swamps, flooded forest, greentree reservoirs, ponds, marshes, and along streams

The available data on northern distribution, i.e. waterfowl nesting areas, including Canada goose, are produced on larger scales corresponding to Canada's terrestrial ecozones (ESWG, 1996) on the one hand and aquatic environment demarcations by landscape and avian usage features on the other. No specific information was found for sectors in proximity to the study alignments.

The Canada goose is the most widespread and abundant species of goose in North America. In Québec, it is a breeding migratory species. Most of Canada's populations breed in remote northern regions and then migrate south for the winter. Nesting starts later for populations that nest in the north, depending on when spring conditions are established in their nesting area. Breeding pairs tend to use the same nesting area year after year (CEAEQ, 2005).

Numbers of temperate-breeding Atlantic and Mississippi Flyway Canada geese have greatly increased since the 1980s. Consequently, numbers of yearlings, sub-adults and failed breeders undertaking pre-molt migration to northern latitudes has also increased, potentially providing additional hunting opportunities for Cree hunters living in the James Bay region. These juveniles and failed breeder residents originating from the Mississipi flyway migrate north in early summer to moult and then fly back (Sorais *et al*., 2023). The Crees know these species as "long-necks".

In Québec, the Canada goose nests primarily in two distinct types of habitats, i.e. the bogs and fens of boreal forests and the Arctic tundra. In bogs, it primarily chooses to nest on small islands less than 4 metres in diameter located in shallow expanses of water (CEAEQ, 2005). Canada geese can also nest in small watercourses, marshes and lakes with small or larger islands that pepper the boreal forest and taiga (CWS, 2013).

Breeding pair density is highly variable depending on the region (one pair can have a range between 0.6 and 4.2 km^2) (CWS, 2013). In its northern nesting area, the highest breeding pair density of Canada geese is found in the coastal Hudson Bay Lowlands and Ungava Bay. Figure 9.9-3 shows that in the area covering the study alignments, breeding pair density varied from 4 to 33 pairs/100 km^2 in 2009. For other waterfowl species, the CWS (2013) this information is limited to American black duck with a range from 4 to 33 pairs/100 km^2 and mallard with a range of 1 to 12 /100 km^2.

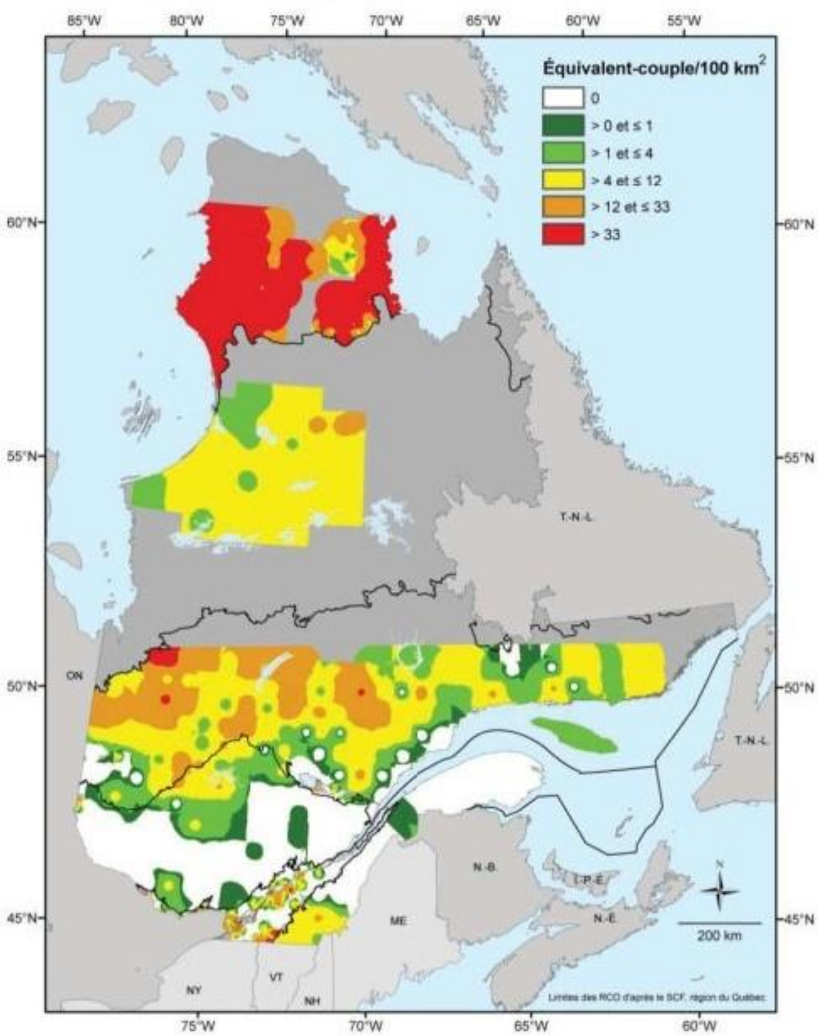


Figure 9.9-3 Canada goose distribution and density (pair equivalents/100 km²) in Québec, 2009 (source: Canadian Wildlife Service, 2013)

9.9.2.3 Fish and fish habitat

According to the (federal) *Fisheries Act,* a fish habitat “means water frequented by fish and any other areas on which fish depend directly or indirectly to carry out their life processes, including spawning grounds and nursery, rearing, food supply and migration areas.”

Under the (provincial) *Regulation respecting wildlife habitats*, a fish habitat “means a lake, a swamp, a marsh, a flood zone delimited by the mean boundary of the littoral zone for a 2-year period or a watercourse, frequented by fish, including the St. Lawrence River and its estuary or any other territory under water situated in the Gulf of St. Lawrence or the Chaleurs Bay and demarcated on a chart prepared by the Minister.”

Interventions in fish habitat may require authorization, both federal and provincial levels (see section 9.1.2.4).

Inventory surveys

Field inventories were conducted in summer and early fall in 2021/2022 in order to depict a general appreciation of the fish communities. They included the following data from the selected watercourses: experimental fisheries (electrofishing, nets, etc.) and counting of catches; presence of spawning, feeding or rearing habitats; and presence of aquatic plant communities. The complete methodology for the study on fish and their habitat is provided in Appendix 6.29.

A total of 76 watercourses crossing one of the study alignments were chosen for a field visit. These watercourses were chosen for their steady flow and chosen to obtain a good spatial representativeness on the scale of the study areas.

The fish inventory field work and characterization of habitats were conducted as follow :

2021 (early fall) : 48 water crossings along the potential BDHR alignment and 10 along the Grevet-Chapais railway alignment. The field surveys were carried out along the BDHR and Grevet-Chapais railway alignment. The fish inventory and related habitat characterization covered 250 m on either side (upstream and downstream) of the crossings, i.e., a 500 m study corridor (0.5 km) for the potential BDHR alignment, and 100 m upstream and downstream of the crossings (200 m study corridor) for the Grevet-Chapais railway alignment. This was necessary because the planned railway track will be laid on the trackbed of an old railway line. There are fewer potential impacts associated with the construction and presence of the railway in the case of this alignment than with the potential BDHR alignment, which will entail an entirely new construction.

2022 (late summer) : 21 water crossings along the Mistissini secondary Road alignment. Water crossings surveyed included the Mistissini secondary Road alignment and its various options still under consideration at the time of the field work. Of the 21 crossings visited, but three (3) of the stations planned for the inventory could not accommodate fishing or a full characterization, due to unsafe hydrological and access conditions when the work was taking place on site. The data gathered is therefore limited to 18 stations.

Appendix 6.29 provides tables with detailed results of all monitoring from 2021 and 2022.

Particular attention was given to eight specific species, due to their precarious status or their value to people for subsistence or sport fishing. The species in question are :

- Lake sturgeon (*Acipenser fulvescens* – species designated as a special concern by the COSEWIC and likely to be designated as threatened or vulnerable in Québec)

- Walleye (*Sander vitreus*)
- Sauger (*Sander canadensis*)
- Brook trout (*Salvelinus fontinalis*)
- Northern pike (*Esox lucius*)
- Lake whitefish (*Coregonus clupeaformis*)
- Mooneye (*Hiodon tergisus*)
- Goldeye (*Hiodon alosoides*)

To verify the presence of these eight species at water crossings, the following data were consulted in addition to the field inventories: data available from tallymen and the CDPNQ, and data from Hydro-Québec's environmental monitoring. When relevant, these data were gathered and integrated into the analyses.

The critical habitats were subjected to a more thorough analysis for the eight fish species listed above, due to their precarious status or their value to people for subsistence or sport fishing, as identified in the previous section.

9.9.2.4 Species at risk

At the provincial level, vascular plants and wildlife in a precarious situation comprise the following four species categories, in accordance with the *Act respecting threatened or vulnerable species* (Tardif and coll., 2016):

- Threatened species: extremely precarious situation, fear of extirpation/extinction, limited or diminished range and population size
- Vulnerable species: survival deemed precarious and uncertain for the medium and long term. Without protection, possible regressive evolution of the population or deterioration of habitat
- Species vulnerable to harvesting (plants only): commercial harvesting pressure
- Species likely to be designated as threatened or vulnerable: requires particular attention, monitoring and documentation of populations to legally designate them or withdraw them from the list

Federally, the categories of plant and wildlife species in precarious situations (other than those already extinct) are deployed at three levels under the SARA*:*

- Endangered species: a wildlife species facing imminent extirpation or extinction
- Threatened species: a wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction
- Special concern species: a wildlife species that may become threatened or endangered because of a combination of biological characteristics and identified threats

9.9.2.4.1 Plants

The majority of vascular plants in a precarious situation in Québec are concentrated in the southern part of the province, where the impacts on ecosystems from human activity are the greatest. The ecosystems in Eeyou Istchee south of the attributable forest boundary experience anthropogenic disturbances caused by logging and mining, as well as natural disturbances in the form of forest fires and insect pest epidemics. The number of listed plants in a precarious situation is, however, more modest there than in the southern parts of the province, where the existence of vulnerable plant species has more to do with the fact that the present habitats are naturally rarer. Moreover, the difference in abundance (number of plant species in a precarious situation) between the province's north and south is not due to a lack of data or coverage sampling bias but, rather, can be explained by geographic factors, plant affinity for more basic substrates (in the south), human footprint, scarcity of certain northern habitats and lower biodiversity in northern regions, among other things (Tardif and coll., 2016).

To date, 65 vulnerable plant species have been listed in northern Québec (Tardif and coll., 2016). The CDPNQ mentions the presence of 26 plant species likely to be designated as threatened or vulnerable and one threatened species in the greater study area surrounding the alignments. None of these has federal protection status under the SARA *(*Appendix 6.30).

Table 9.9-6 Plant species at risk listed by the CDPNQ in the region of the study area

Species	Provincial status[1]	Federal status[2, 3] SARA / COSEWIC
Northern wild comfrey (*Andersonglossum boreale*)	Likely to be designated	None / None
Brown-edged pussytoes (*Antennaria rosea subsp. Confinis*)	Likely to be designated	None / None
Leafy arnica (*Arnica chamissonis*)	Likely to be designated	None / None
Tilesius wormwood (*Artemisia tilesii*)	Likely to be designated	None / None
Calypso (*Calypso bulbosa var. americana*)	Likely to be designated	None / None
Great northern aster (*Canadanthus modestus*)	Likely to be designated	None / None
Richardson's sedge (*Carex richardsonii*)	Likely to be designated	None / None
Sartwell's sedge (*Carex sartwellii*)	Likely to be designated	None / None
Sickle-leaved claw moss (*Dichelyma uncinatum*)	Likely to be designated	None / None
Field forklet moss (*Dicranella staphylina*)	Likely to be designated	None / None
Ojibway waterwort (*Elatine ojibwayensis*)	Likely to be designated	None / None
James' monkeyflower (*Erythranthe geyeri*)	**Threatened**	None / None
Chain Pincerwort (*Fuscocephaloziopsis catenulata subsp. Catenulata*)	Likely to be designated	None / None
Macoun's Fringed Gentian (*Gentianopsis virgata subsp. Macounii*)	Likely to be designated	None / None
Dagger-leaved rush (*Juncus ensifolius*)	Likely to be designated	None / None
Long-styled rush (*Juncus longistylis*)	Likely to be designated	None / None
Forest notchwort (*Lophozia silvicola*)	Likely to be designated	None / None
Blue lettuce (*Mulgedium pulchellum*)	Likely to be designated	None / None
Northern twayblade (*Neottia borealis*)	Likely to be designated	None / None
Seneca snakeroot (*Polygala senega*)	Likely to be designated	None / None
Canada gooseberry (*Ribes oxyacanthoides var. oxyacanthoides*)	Likely to be designated	None / None
Little-tree willow (*Salix arbusculoides)*	Likely to be designated	None / None
McCalla's willow (*Salix maccalliana*)	Likely to be designated	None / None
False mountain willow (*Salix pseudomonticol*)	Likely to be designated	None / None
Purple meadowrue (*Thalictrum dasycarpum*)	Likely to be designated	None / None
Delicate notchwort (Tritomaria capitata)	Likely to be designated	None / None
Marsh notchwort (Tritomaria laxa)	Likely to be designated	None / None

Legend:
1 *Act respecting threatened or vulnerable species* and regulations

2 *Species at Risk Act* (Appendix 1)

3 Status defined by the COSEWIC

The only threatened species listed in the region is the James' monkeyflower (*Erythranthe geyeri*). This perennial herb is found in swamps and wet meadows. However, the recorded occurrences for this plant are far outside the study areas in the case of the three alignments.

9.9.2.4.2 Wildlife

The following section was completed primarily based on information provided by the CDPNQ and MFFP (now the MELCCFP), as requested from them in connection with this project. The eBird online database was also consulted to help complete the observation data related to birds.

Table 9.9-7 summarizes all wildlife species at risk that are likely to be found in the study area, taking into account their regional distribution and their preferences in terms of habitats. As for the federal status of listed species, a distinction is made between the status assigned by the most recent COSEWIC assessment and the legal status in Canada under the SARA. When no distinction is made between these two categories, assignments are identical. A 2-km-wide corridor was also examined around each alignment proposed to identify the documented presence of listed species at risk in these two areas.

However, it is crucial to emphasize that an absence of confirmed sightings in the study corridor does not mean that the species in question is not likely to be found there. In fact, in its responses to our request for wildlife information dated January 25 and May 24, 2022 (Appendix 6.31) the MFFP specified that (1) extensive inventories had not been carried out for the entire territory and (2) the distribution and presence of listed species reflects current knowledge. These may need to be updated or expanded and are by no means a definitive representation of species distribution.

To assess the quality of observations listed, the CDPNQ uses various ratings to determine the quality of the identified data and the viability of associated species. The following rankings were used: **excellent** – **good** – **fair** – **weak** – **existing, to be determined** – **not found** – **historical** – **extirpated** – **impossible to assign** – **not assigned**.

The CDPNQ also mentioned the presence of several species at risk on a regional level. Yet, considering the location of the occurrences provided, the information quality rating (see details below) and the occurrence date, it is unlikely that these species could be found near or in the alignment areas. Consequently, the following species have not been included in summary Table 9.9-7.

- Harlequin duck, eastern population (*Histrionicus histrionicus*, pop. 1): one CDPNQ occurrence about 55 km northeast of the Chisasibi community, classified as existing – **to be determined** and dating from 1992, federal status = special concern, provincial status = vulnerable
- Least weasel (*Mustela nivalis*): one CDPNQ occurrence in Eastmain, classified as **historical** and dating from the year 2000, federal status = none, provincial status = likely to be designated as threatened or vulnerable
- Nelson's sparrow (*Ammospiza nelsoni*): several occurrences in Rupert Bay near Waskaganish, classified as **existing, to be determined**, federal status = not at risk, provincial status = likely to be designated as threatened or vulnerable
- Boreal chorus frog (*Pseudacris maculata*): several occurrences near Rupert Bay, classified as existing – **to be determined**, federal status = none, provincial status = likely to be designated as threatened or vulnerable

- Yellow rail (*Coturnicops noveboracensis*): all occurrences located in Rupert Bay and Boatswain Bay, classified as **existing, to be determined**, federal status = special concern, provincial status = threatened

The following sections also provide details on the location of the presented species in each alignment, where relevant. When information is available, a distinction is made between the observation of a bird species and the observation of that bird's nesting site. In fact, the presence of a breeding habitat is particularly important, since any disturbance thereto could alter the reproductive success of the associated species at risk and, thereby, the viability of its population.

Table 9.9-7 At-risk wildlife species potentially present in the region of the study area

Species	Status[1,2,3]		Status assignment reason	Habitat	Detected presence in study area (2 km corridor)		
	Federal	Provincial			BD	GC	MR
Mammals							
Rock vole (*Microtus chrotorrhinus*)	None	Likely	Populations monitored in Québec since 1996, never observed at high densities	Climatic zones of the sugar maple-yellow birch stand and spruce forest Cliffs and rock outcrops			
Southern bog lemming (*Synaptomys cooperi*)	None	Likely	Species rare to Canada, found only sporadically in suitable habitats Very little data available in Québec	Northern range, spruce forest climatic zone Grassy marshes and mixed-wood forests surrounding bogs		X	
Woodland caribou ecotype (*Rangifer Tarandus Caribou*)	Threatened	Vulnerable	Widespread decline in various populations, isolation, fragmentation, wolf predation, competition from moose	Spruce-moss forest, spruce-lichen forest and mature black spruce forest bioclimatic domains	X	X	X
Little brown bat (*Myotis lucifugus*)	Endangered	None	Decline of 94% due to white-nose syndrome in known Canadian hibernating populations Increasing range of syndrome	Hibernation in cold, damp mines and caves Foraging area: above water, at forest edges and along watercourses		X	
Silver-haired bat (*Lasionycteris noctivagans*)	None	Likely	No data available on fluctuations in the Québec population, potentially threatened by forest pest prevention measures, since it feeds on insects	Wooded areas, foraging area: hunts insects by flying along lakes and ponds Migrates south to the United States in winter		X	

Species	Status[1,2,3]		Status assignment reason	Habitat	Detected presence in study area (2 km corridor)		
	Federal	Provincial			BD	GC	MR
Hoary bat (*Lasiurus cinereus*)	None	Likely	Very little data available in Québec, loss of habitat caused by a decrease in snags, human disturbances in winter areas, forest pest prevention efforts could be threats	Forest-dwelling, presence in spruce stands but not abundant Wooded and semi-wooded areas, foraging area: clearings and water bodies. Migrates south in the winter		X	
Northern long-eared bat (*Myotis septentrionalis*)	Endangered	None	Decline of 94% due to white-nose syndrome in known Canadian hibernating populations Increasing range of syndrome	Hibernation in cold, damp mines and caves Foraging area: forest gaps, forest edges and along watercourses		X	
Insects, mollusks							
Yellow-banded bumble bee (*Bombus terricola*)	Special concern	Likely	Relatively abundant in the northern part of its range Recent decline of 34% in southern Canada Possible causes: pesticides, spread of pathogens, habitat conversion	Extensive range across Canada: mixed-wood forest, farmlands, boreal environments Nests in pre-existing cavities, such as rotted tree trunks or abandoned burrows			
Pointed lake limpet (*Acroloxus coloradensis*)	(COSEWIC), None (SARA)	Likely	Species identified in only a few locations in Canada Cryptic species probably found in numerous other locations	Freshwater Alpine lentic habitat, bedrock			
Birds							

Species	Status[1,2,3]		Status assignment reason	Habitat	Detected presence in study area (2 km corridor)		
	Federal	Provincial			BD	GC	MR
Golden eagle (*Aquila chrysaetos*)	Not at risk (COSEWIC), None (SARA)	Vulnerable	Very sensitive to nesting habitat changes. Main potential threats: loss of habitat (mines, hydroelectricity, forestry), accidental trapping, disturbance, limited breeding population	Open black spruce-moss or spruce-lichen forests, grasslands and shrublands. Nests on cliff ledges or tall trees, hunts in relatively open areas			X
Common nighthawk (*Chordeiles minor*)	Special concern	Likely	Steep decline in populations in the country's southern parts since 1970, though a slowing trend. Boreal population seems abundant Threats: human activity and climate change affect the availability of food and breeding areas	On the ground, open, unvegetated habitats such as deforested or burned areas, rockland, bogs and marshes, lake and watercourse shores	X	X	
Short-eared owl (*Asio Flammeus*)	Threatened (COSEWIC), Special concern (SARA)	Likely	Decline of at least 30% in Canadian population over the past three years Impact of climate change on Southern Arctic vegetation and, consequently, prey availability and predation	Variety of open habitats like tundra, bogs and marshes. Breeding in the tundra with areas of small willows Habitat choice related especially to abundance of prey, nests on the ground			
Bank swallow (*Riparia riparia*)	Threatened	None	Decline of 98% in Canadian population over 40 years (though slowing) Loss of breeding and feeding habitats, pesticides, collisions with vehicles, climate change	Resting areas: wetlands Breeding areas: ephemeral burrows in riverbanks, vertical faces, quarries, road trenches (silt and sand substrate) near open areas for feeding	X	X	

Species	Status[1,2,3]		Status assignment reason	Habitat	Detected presence in study area (2 km corridor)		
	Federal	Provincial			BD	GC	MR
Olive-sided flycatcher (*Contopus cooperi*)	Special concern (COSEWIC), Threatened (SARA)	Likely	Long-term decline, though slowed in the past decade Reduction in flying insects, loss of winter areas, impact of climate change on breeding areas	In the boreal forest: open areas such as clearings, forest edges, openings in or near wetlands	X	X	X
Canada warbler (*Cardellina canadensis*)	Special concern (COSEWIC), Threatened (SARA)	Likely	Long-term decline, though slowed as of 2003, with a stable increase since 2012 Land clearing of winter areas in South America	Various forest environments, including wet woodlands or mixed-wood forests with a well-developed shrub layer, regrowth environments	X		
Rusty blackbird (*Euphagus carolinus*)	Special concern	Likely	Degradation of winter areas in the United States Degradation of breeding areas in Canada (mercury, loss of wetlands)	Boreal forest: wetland shorelines In winter: wet woodlands and cultivated fields	X	X	X
Bald eagle (*Haliaeetus leucocephalus*)	Not at risk (COSEWIC), None (SARA)	Vulnerable	Population increase in Québec at last inventory (2006–2008) Threats: loss of habitats, pesticides, accidental capture and killing, wind farms and human activity near breeding grounds Low breeding bird population size in Québec	Nests in mature forests near large bodies of water, where it hunts. Also frequents islands Presence in mixed-wood forests in northern Québec		X	X
Fish							
Lake sturgeon, southern Hudson Bay–James Bay pop.	Special concern	Likely	Harvesting and dams. Future developments could have an impact on this long-lived species	Freshwater and estuarine waters, in lakes, reservoirs and rivers (medium- and larger-sized)	X	X	

Species	Status[1,2,3]		Status assignment reason	Habitat	Detected presence in study area (2 km corridor)		
	Federal	Provincial			BD	GC	MR
(*Acipenser Fulvescens*)			Very little information on populations in northern Québec	Generally lives in depths of less than 10 m, on mud, sand, gravel or clay bottom Migrates long distances to spawn			

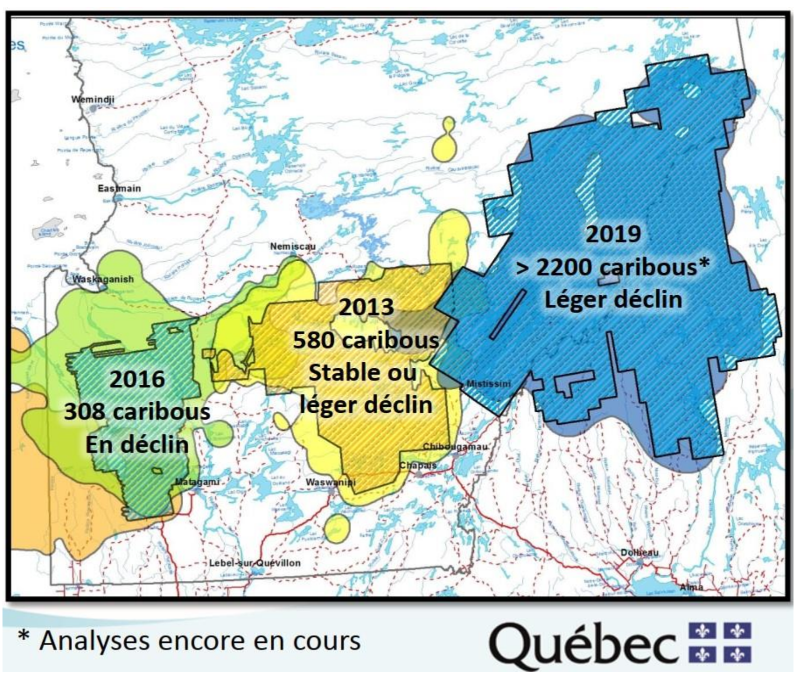
Legend:
1 *Act respecting threatened or vulnerable species* and regulations
2 *Species at Risk Act* (Appendix 1)
3 Status defined by the COSEWIC;
Likely = Likely to be designated as threatened or vulnerable
Sources: COSEWIC status reports on species, list of threatened or vulnerable wildlife species – MFFP, Species at risk public registry – Government of Canada

9.9.2.4.3 Specific *information* on woodland caribou

Due to population decline that began more than a century ago, woodland caribou have been classified in Canada as a threatened species under the federal SARA since 2003. In Québec they have been classified as a vulnerable species under the province's *Act respecting threatened or vulnerable species* since 2005. Estimated recent numbers and trends for the Nottaway, Assinica and Temiscamie woodland caribou herds are shown in Figure 9.9-4.

In the past, sport hunting was considered a primary factor in the historical decline of woodland caribou populations. However, today this decline is attributed more to predation by grey wolves and black bears (ERCF, 2013a). Today, the current forest management is pointed out as to the most detrimental factor for woodland caribou, as it encourages leafing and fragmentation of the forest landscape within the woodland caribou range area (Rudolph and coll., 2012). The habitats resulting from these changes are suitable for moose which prefer this type of forest environment–unlike woodland caribou, which prefer mature or old-growth non-fragmented forests. High densities of moose feed the growth of wolf populations. This in turn makes caribou more subject to opportunistic predation by wolves (MFFP, 2021). As a result, woodland caribou face a combination of problems due to increased predation and direct loss of old-growth forest (Rudolph and coll., 2012; MFFP, 2019).

In addition, the construction of roads and highways required for logging as well as other types of linear infrastructure (e.g., pipelines, railways, power transmission lines, seismic lines, etc.) exacerbates habitat fragmentation, lowers caribou habitat suitability, and facilitates predator movement (ERCF, 2013a; MFFP, 2019; DeMars and coll., 2020).



[2016 308 caribou – in decline / 2013 580 caribou – stable or in slight decline / 2019 > 2,200 caribou* – in slight decline / *Analyses still ongoing]

Figure 9.9-4 Estimated woodland and mountain caribou herd populations: Nottaway (green), Assinica (yellow) and Temiscamie (blue) (MFFP, 2019).

Finally, in June 2023, the Gouvernement du Québec will announce new measures to protect woodland caribou and their habitat.

9.9.2.4.4 Legal wildlife habitats in Québec

The object of the *Act respecting the conservation and development of wildlife* (R.S.Q., chapter C-61.1) is "the conservation of wildlife and its habitat [and] their development in keeping with the principle of sustainable development." This Act specifically protects the wildlife habitats defined in the *Regulation respecting wildlife habitats* (R.S.Q., chapter C-61.1, r.18), which applies to lands in the domain of the State. Section 128.6 of the Act states that "no person may, in a wildlife habitat, carry on an activity that may alter any biological, physical or chemical component peculiar to the habitat of the animal or fish concerned." However, section 128.7 of the Act allows the Minister to "authorize the carrying on of an activity that alters wildlife habitat."

Of the 11 types of wildlife habitats defined in the Act, only those that pertains to the study areas are described in Table 9.9-8.

Table 9.9-8 Description of the legal wildlife habitats in Québec, as defined in the *Regulation respecting wildlife habitats potentially present in the Eeyou Istchee region*

	Description
Waterfowl gathering area	Site of a swamp, a flood zone delimited by the mean boundary of the littoral zone for a 2-year period, and intertidal zone, a water plant community or a band of water measuring no more than 1 km wide as measured from the low-water mark and no less than 25 ha in area, that is frequented by geese or ducks during nesting or migration seasons and where there are at least 50 birds of those species per kilometre of shoreline measured along a straight line drawn between the 2 most distant points on the shoreline or 1.5 birds per hectare; where the limits of a flood zone cannot be established as indicated, they shall correspond to the boundary of the littoral zone.
Area frequented by caribou south of the 52nd parallel	A site where a herd of at least 50 caribou calves, breeds and feeds during the winter.
Caribou calving area north of the 52nd parallel	A territory frequented by at least 5 caribou cows per square kilometre from 15 May to 1 July.
Cliff inhabited by a colony of birds	A cliff, and the cliff top back to a depth of 100 m, where there are at least 10 seabird nests per 100 m of cliff face.
Habitat of a threatened or vulnerable wildlife species	A habitat defined by the *Regulation respecting threatened or vulnerable wildlife species and their habitats*.
Fish habitat	A lake, a swamp, a marsh, a flood zone delimited by the mean boundary of the littoral zone for a 2-year period or a watercourse, frequented by fish, including the St. Lawrence River and its estuary or any other territory under water situated in the Gulf of St. Lawrence or the Baie des Chaleurs and demarcated on a chart prepared by the Minister; where the limits of a flood zone cannot be established as indicated, they shall correspond to the boundary of the littoral zone.
Muskrat habitat	A swamp or a pond at least 5 ha in area, inhabited by muskrats.
Great blue Heron nesting colony	A site where at least 5 nests have been used by great blue herons, black-crowned night herons and American egrets during at least 1 of the past 5 nesting seasons, including a strip of surrounding land 500 m wide or, where the layout of the land makes it impossible to extend the strip to 500 m, a smaller surrounding strip.
Island or peninsula inhabited by a colony of birds	An island or a peninsula less than 50 ha in area, where there are at least 25 nests per hectare of colonizing bird species other than herons.
	Site of a swamp, spring or body of water, including a strip of surrounding land 100 m wide, that is frequented by moose and contains mineral salts in concentrations greater than 3 parts per million of potassium and greater than 75 parts per million of sodium.

9.9.3 Potential BDHR alignment

9.9.3.1 Plants

The potential BDHR alignment covers almost the entire length of the Matagami Lake Plain ecological region (region 6a) and, at its northern end, crosses into the Rupert Bay ecological region (region 6b) (see Map 9.9.1).

9.9.3.2 Terrestrial wildlife

9.9.3.2.1 Migratory caribou

The potential BDHR alignment is located at the southernmost point of the annual range of the TRAF (see Map 9.9.2). The summer range and calving grounds of migratory caribou are therefore not included in our analyses. However, special attention was paid to this herd’s winter range of this herd due to its proximity to the study area.

In the 1990s, the TRAF used two separate wintering grounds north of the 55th parallel. Since the early 2000s, most of the herd on their fall migration have gradually moved south to below the 51st parallel. However, the recent winter range was mainly north of the 52nd parallel. Indeed, according to telemetry data, the winter range has been exclusively south of the 55th parallel since 2006. In the winters of 2010-2011 through 2014-2015, the TRAF winter range was almost exclusively north of the La Grande hydroelectric power station.

9.9.3.2.2 Woodland caribou

As shown in Maps 9.9.3 and 9.9.9, much of the upper half of the potential BDHR alignment intersects of the woodland caribou range. This portion of the alignment also lies on the eastern boundary of the Nottaway herd's range and near the western boundary of the Assinica herd's range. This territory therefore probably represents an area of occasional overlap between the two herds.

The portion of the BDHR alignment that intersects caribou ranges runs for 100 km between KP 135 and KP 235 of the BDH (Broadback River) (MTQ kilometre points or KPs) (Map 9.5.3). This stretch is therefore where the main issues concerning woodland caribou arise. Caribou numbers are higher on the west side of the alignment.

Habitat suitability

The MELCCFP has established habitat suitability models, including HSIs (Leblond and coll., 2014). These are mathematical models that combine several factors deemed important to the habitat suitability of the species concerned to arrive at a weighted value. The exercise was applied to habitats within the range of woodland caribou (MFFP, 2021).

There is an almost total lack of moderate to high suitable habitat within the railway right-of-way: over 95% of the right-of-way (100 m) is comprised of the two lowest habitat suitability classes (Map 9.9.4), whereas 88% of the railway corridor falls into the two lowest habitat suitability classes cover, and 12% is of moderate habitat suitability.

9.9.3.2.3 Moose

Hunting management zone 22 covers an area of approximately 340,000 km^2. The estimated area of moose habitat in this zone is approximately 200,000 km^2 (59%), primarily located south of the northern boundary of attributable forests around the 51st parallel (Map 9.9.6) (MFFP: Lefort and Massé, 2015). The habitat in this zone north of the 51st parallel is more suitable for woodland and migratory caribou.

The most recent aerial inventory of zone 22 was conducted in 1991. At that time, the post-hunt moose population was estimated at 8,841 individuals or 0.26 moose/10 km^2. In 1997, a simulated moose density estimate showed that the density could be as high as 0.31 moose/10 km^2. The only inventories that have been conducted in zone 22 since 1991 were carried out as part of the pre-project studies and monitoring program for the Eastmain-1A and Rupert diversion hydroelectric project. The area covered (2002, 2004, 2006 and 2008) was confined to the Eastmain and Weh-Sees Indohoun sectors. In 2012, the MFFP estimated the number of moose in zone 22 to be approximately 9,872, which is equivalent to a density of 0.5 moose/10 km^2. According to the MFFP (Lefort and Massé, 2015), these results appeared to show an upward trend. A density of even 0.5 moose/10 km^2 is considerably lower than that found in the rest of Québec to the south, where densities range from 11.0 moose/10 km^2 in the Lower St. Lawrence region and 2.7 moose/10 km^2 in the Lanaudière and Laurentians region, for example.

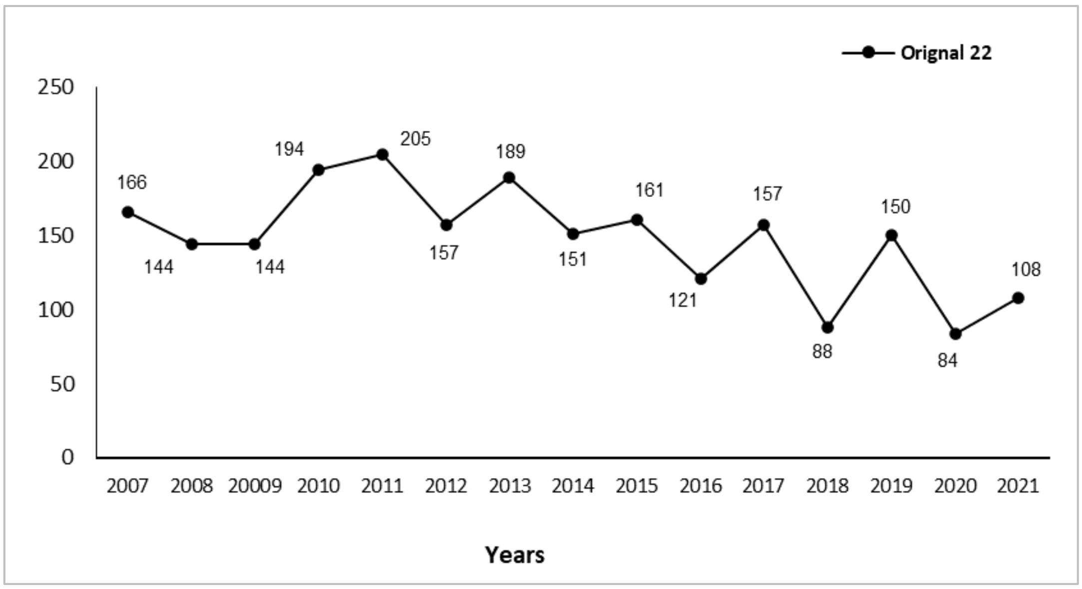


Figure 9.9-5 Annual moose harvest by hunting from 2007 to 2021 in zone 22 (source: MFFP: large wildlife statistics webpage).

Habitat suitability

Moose HSIs provided by the MFFP (2022 as part of this study) are available for almost the entire length of the potential BDHR alignment, except for the last 20 km at its northern end.

The various index classes are fairly evenly distributed within the railway right-of-way, ranging from 35% (low), 24% (moderate) and 40% (high) (Map 9.9.7). Moderate-and high-suitability indices comprise nearly 60% of moose habitat within the right-of-way. This pattern is similar throughout the corridor where almost 60% of the habitats are either moderate or highly suitable.

9.9.3.2.4 Black bear

Almost all of the potential BDHR alignment is in zone 22, with only a small portion in zone 17 to the south. In hunting zone 22, bear harvesting is reserved for Crees.

The 340,000 km^2 of zone 22 include approximately 280,000 km^2 (82%) of suitable black bear habitat. According to the MFFP (Lamontagne and coll., 2006), the estimated density is 0.20 bears/10 km^2 or a total of 5,600 bears for zone 22. This density is particularly low compared to most other hunting management zones in Québec (Lamontagne and coll., 2006), with 2.3 bears/10 km^2 in the Lower St. Lawrence region and 2.4 bears /10 km^2 in the Lanaudière and Laurentians region, for example.

The area of suitable black bear habitat in zone 17 is approximately 20,000 km^2 (87%) of the zone's total area of approximately 23,000 km^2. Black bear density in this zone is 1.10 bears/10 km^2 or about 2,000 bears for the whole zone.

In terms of FAMUs, the potential BDHR alignment is divided almost evenly by FAMU 88 in its southern half and FAMU 90 in the northern portion. The number of bears captured over the past two decades (2002-2021) has varied considerably from none reported to 20 in 2006 (Table 9.9-9). The most bears captured, both annually and for the entire 2002-2021 period, were in FAMU 88. As black bear is reserved for Crees north of 52nd parallel, it is possible that the reported bears are voluntary reports from Cree trappers.

No information concerning habitat suitability (HSI) is available for black bears in relation to the potential BDHR alignment.

Table 9.9-9 Black bear harvest in FAMUs 88 and 90 from 2002 to 2021) (source: MFFP, 2022).

Year	FAMU 88	FAMU 90	Total bears/year
2002	1	-	1
2003	9	-	10
2004	-	-	-
2005	3	2	5
2006	20	7	27
2007	-	-	-
2008	-	-	-
2009	-	-	-
2010	2	-	2
2011	1	-	1
2012	5	-	5
2013	1	-	1
2014	1	3	4
2015	3	-	3
2016	-	-	-
2017	3	3	6
2018	16	1	17
2019	9	4	13
2020	1	-	1
2021	1	-	1
Annual average	5.1	3.3	4.8
Total	76	20	96

9.9.3.3 Waterfowl

The density of nesting pairs of geese was reported to be between 12 and 33 pairs/km^2 on the southern half of the potential BDHR alignment (CWS, 2013). Density in the northern portion at 4 to 12 pairs/km^2 was lower.

9.9.3.4 Fish and fish habitat

A total of 48 water crossings were inventoried along the potential BDHR alignment, including 16 where fish were confirmed to be present. The inventorying involved catching 830 fish representing 12 species (Table 9.9-10).

Allegheny pearl dace (*Margariscus margarita*), brook stickleback (*Culaea inconstans*), and white sucker (*Catostomus commersonii*) constituted around 95% of the total catch.

The compiled existing data together with the field inventory results confirm the presence of the eight fish species of interest. The presence of these species at the various water crossings is shown in Table 9.9-11and Table 9.9-12 with the assessed habitat suitability for each station shown in Map 9.9.10. More details are also available in Appendix 6.28.

Table 9.9-10 Fish species and catch numbers for the field inventory conducted at the 48 water crossings on the potential BDHR alignment in 2021.

Common name	Latin name	Number caught	% of total catch
Walleye	*Sander vitreus*	3	0.4
Brook stickleback	*Culaea inconstans*	77	9.3
Lake sturgeon	*Acipenser fulvescens*	1	0.1
Northern pike	*Esox lucius*	7	0.8
Mooneye	*Hiodon tergisus*	1	0.1
Goldeye	*Odon alosoides*	3	0.4
White sucker	*Catostomus commersonii*	63	7.6
Lake chub	*Couesius plumbeus*	27	3.3
Allegheny pearl dace	*Margariscus margarita*	643	77.5
Brook trout	*Salvelinus fontinalis*	3	0.4
Trout-perch	*Percopsis omiscomaycus*	1	0.1
Yellow perch	*Perca flavescens*	1	0.1
Total	-	830	100

Table 9.9-11 Distribution of individuals belonging to species of interest at the 48 water crossings on the potential BDHR alignment according to the various compiled sources.

Common name	Latin name	Number of crossings with individuals belonging to species of interest
Walleye	*Sander vitreus*	5
Sauger	*Sander canadensis*	3
Lake sturgeon	*Acipenser fulvescens*	3
Northern pike	*Esox lucius*	9
Lake whitefish	*Coregonus clupeaformis*	2
Mooneye	*Hiodon tergisus*	3
Goldeye	*Odon alosoides*	2
Brook trout	*Salvelinus fontinalis*	6

Sensitive species and habitats

Ten of the 48 water crossings inventoried on the potential BDHR alignment have features rated as high sensitivity, with another 30 having features rated as medium sensitivity (**Erreur ! Source du renvoi introuvable.**).

A high sensitivity crossing indicates either, or both, the presence (potential or confirmed presence) of lake sturgeon (designated species at risk) and/or the presence (confirmed or potential) of a spawning ground of a subsistence or sport fishing species (walleye and sauger, brook trout, northern pike, lake whitefish, mooneye and goldeye).

A medium sensitivity crossing indicates either, or both, the presence (potential or confirmed presence) of a subsistence or sport fishing species (walleye and sauger, brook trout, northern pike, lake whitefish, mooneye and goldeye) and/or the presence of plant community, or nursery or feeding area for these species.

A low sensitivity crossing indicates the absence of the above criteria.

Table 9.9-12 : BDHR fish and fish habitat sensitivity at water crossings (48)

Watershed	Watercourse	Station # and Sensitivity [1]	FISH (presence confirmed or potential)		FISH HABITAT [3] (presence confirmed or potential)	
			Species at risk [2]	Valued species [3]	Spawning ground	Shelter, nursery or feeding areas
Broadback	Kakaskutatakuch Creek	15				X
	Pisimwetach Kayspaich Creek	16				X
	Pisimwetach Kayspaich Creek	17				X
	Kawaseyapiskau Lake Tributary	18		X		
	Kawaseyapiskau Lake Tributary	19				
	Mouliers Lake tributary	20				X
	Mouliers Lake tributary	21				
	Rodayer Lake tributary	22				X
	Rodayer Lake tributary	23				
	Colomb Lake tributary	24				X

Watershed	Watercourse	Station # and Sensitivity [1]	FISH (presence confirmed or potential)		FISH HABITAT [3] (presence confirmed or potential)	
			Species at risk [2]	Valued species [3]	Spawning ground	Shelter, nursery or feeding areas
	Colomb Lake tributary	25		X		
	Colomb Lake tributary	26			X	
	Colomb Lake tributary	27			X	
	Colomb Lake tributary	28			X	
	Colomb Lake tributary	29			X	
	Colomb Lake tributary	30		X		X
	Colomb Lake tributary	31				X
	Ouasouagami River tributary	32				X
	Ouasouagami River	33			X	
	Broadback River tributary	34				
	Broadback River	35			X	
	Colomb Lake tributary	47				X
Nottaway	Bell River	1	X			
	WC Matagami Lake (Dunlop Bay)	2				
	Waswanipi River	3	X			
	Canet River	4		X		
	Canet River tributary	5				X
	Amphibolite Lake tributary	6				X
	Amphibolite Lake tributary	7		X		X
	Nottaway River tributary	8				
	Unknown lake tributary	9		X		
	Muskiki River	10		X		X
	Muskiki River tributary	11				
	Muskiki River	12				X
	Muskiki River Tributary	13				X
	Muskiki River Tributary	14				X
	Waswanipi River	41	X			
	Waswanipi River tributary	42				X
	Unknown lake tributary	43				X
	Muskiki River tributary	44				
	Muskiki River tributary	45				X
	Nottaway River tributary	46				X
Rupert	Tordu Creek tributary	36		X		
	Tordu Creek	37		X		X
	Kaumwakweyuch Creek tributary	38				X
	Kaumwakweyuch Creek	39		X		
	Rupert River	40			X	
	Kaumwakweyuch Creek tributary	48		X		

[1]: Scale of sensitivity : **Red High** / **Yellow Medium** / **Green Low**

[2]: Lake sturgeon

[3]: Walleye and sauger, brook trout, northern pike, lake whitefish, mooneye and goldeye

9.9.3.5 Species at risk

9.9.3.5.1 Plants

There are no plant species at risk currently reported within the potential BDHR corridor.

One occurrence of a plant species at risk—forest notchwort (*Lophozia* silvicola)—was reported in the vicinity but outside the study corridor, near KP 149 on the BDHR 2 km east of the potential BDHR alignment. Although this species was observed at this location in 2013 and is likely to be designated as threatened or vulnerable at the provincial level, it has no specific status at the federal level.

9.9.3.5.2 Wildlife

A total of 11 wildlife species at risk require attention:

- Woodland caribou: GPS collar surveys provided by the MFFP confirm the presence of woodland caribou in the study corridor, particularly between KP 140 and KP 230 on the BDH.
- Polar bear: The potential, albeit unusual, presence of polar bears, particularly in the northern portion of the potential BDHR alignment, is worth mentioning. Indeed, although this area is located south of the current range of the southern Hudson Bay polar bear population (COSEWIC, 2018), it is highly but not totally unlikely that an individual polar bear could venture south beyond the species' current range. Polar bears (belonging to the southern Hudson Bay population) are considered vulnerable at the provincial level and threatened at the federal level.
- The Gaspé shrew (*Sorex gaspensis*) has been recorded in the vicinity of the BDHR study corridor, northeast of Matagami. However, this occurrence dates back to 1953 and, according to the data provided by the MFFP, no other observations seem to have been made at the regional level since then. The Gaspé shrew is likely to be designated as a threatened or vulnerable species in Québec and is considered not at risk at the federal level (COSEWIC).
- Rock vole: Although this species is not present in the study corridor, it presence were reported throughout this area, which could indicate possible presence in suitable habitats in the vicinity of the alignment (Table 9.9-7).
- Southern bog lemming: Although this species is not present in the study corridor, it could be present in the vicinity of the alignment, given the abundance of bogs and neighbouring forests throughout the area (Table 9.9-1).
- Common nighthawk: Several occurrences within the study corridor along the alignment are listed in the eBird database.
- Short-eared owl: A single eBird occurrence has been recorded outside the study corridor, 3.5 km east of the potential BDHR alignment. Since short-eared owls are associated with marshes and several other open habitats like the moist meadows found along the alignment, this species is likely to be present.

  Bank swallows: Three nesting sites for this species within the study corridor are listed in the database maintained by the CDPNQ. From mid-April to late August this species uses nesting sites more than 2 m off the ground on slopes (Figure 9.9-6). This time of the year is therefore the most sensitive for this species near its nesting sites. A few occurrences of this species in relation to the study corridor are also included in the eBird database. However, these lie outside the study corridor, mainly near Matagami at the corridor's southern end.

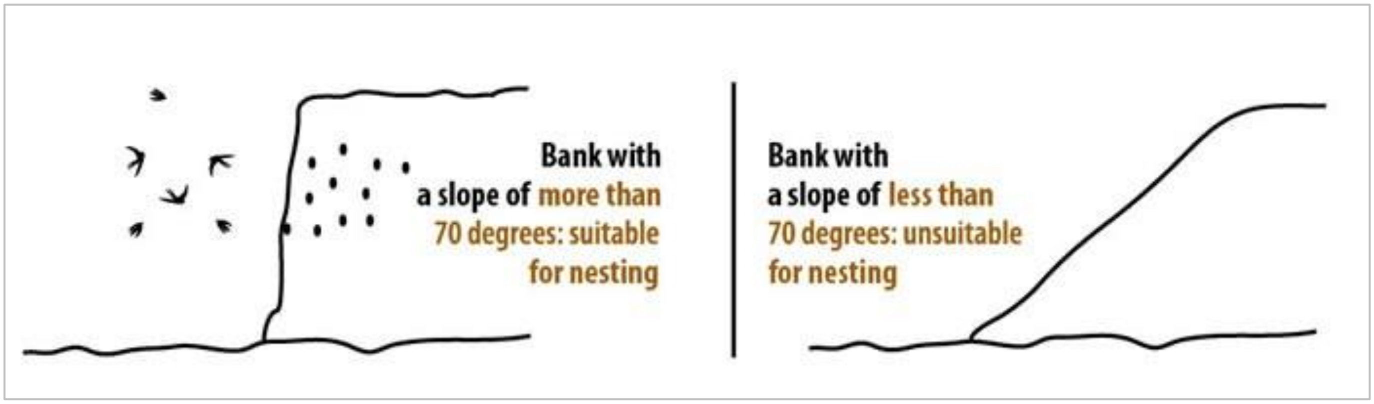


Figure 9.9-6 Bank slopes suitable for bank swallow nests. Source: Bank Swallow (*Riparia riparia*): in sandpits and quarries. Canada.ca

- Bald eagle: A few individuals of this species have been observed in the vicinity of the alignment but always outside the study corridor. A bald-eagle nesting habitat has also been identified at KP 97 of the BDH, about 10 km west of the alignment. Bald eagles prefer to nest in large trees in mature forests near large bodies of water (e.g., large lakes and fast-flowing rivers). Since the potential BDHR alignment is surrounded by these types of environments, this species could very well be present.
- Rusty blackbird, Canada warbler and olive-sided flycatcher: Several occurrences of these three species within the study corridor are reported in the eBird database.
- Lake sturgeon: According to Fisheries and Oceans Canada (2022), lake sturgeon are found in several rivers crossed by the alignment and its study corridor.

The distribution of the various recorded species at risk is shown on Maps 9.9.11 and 9.9.12.

9.9.4 Potential Grevet-Chapais railway alignment

9.9.4.1 Plants

The potential Grevet-Chapais railway alignment is split almost evenly between two ecological regions, with the western half located in the Matagami Lake Plain ecological region (region 6a) and the eastern half in the Opemisca Lake ecological region (region 6c) (Map 9.9.1).

9.9.4.2 Terrestrial wildlife

9.9.4.2.1 Migratory caribou

The potential Grevet-Chapais railway alignment lies outside the annual migratory caribou range.

9.9.4.2.2 Woodland caribou

The potential Grevet-Chapais railway alignment is located at the southern boundary of the Assinica herd's range (maps 9.9.3 and.9.13). Although caribou occurrences are mainly concentrated north of the potential Grevet-Chapais railway alignment, more isolated pockets have been noted south of the alignment, which indicates occasional caribou movement on either side of the alignment. Lastly, the telemetry locations also indicate that caribou seem to use the eastern half of the potential Grevet-Chapais railway alignment to a greater degree. Within the corridor, there are just six telemetry locations along the approximately 160-km stretch of the potential Grevet-Chapais railway alignment.

Habitat suitability

Based on the HSI results received from the MFFP, within the boundaries of the railway right-of-way, there is no medium- to high-suitable habitat. The corridor is made up entirely of the two lowest classes of habitat suitability (Map 9.9.4).

9.9.4.2.3 Moose

Hunting management zone 17 covers an area of approximately 23,000 km^2, and favourable moose habitat makes up about 20,000 km^2 (87%) of this area (MFFP: Lefort and Massé, 2015). Zone 17 is located in boreal forest dominated by black spruce-moss forest, peat bogs, jack pine and mixed tree stands. There are more mixed stands in the southwestern part than on the eastern side and it is indeed in the southwest sector that the highest moose density is found.

In zone 17, moose density was estimated at 0.8 moose/10 km^2 following an aerial inventory carried out in the winter of 2009. The aerial inventory recently conducted by the MFFP established a density of 0.52 moose/10 km^2 in the same area in 2021 (MFFP, 2021). The estimated number of moose is thus 35% lower than in the 2009 inventory. This moose herd decline also appears to be reflected in the hunting statistics starting in 2015, after an increase from 2007 to 2012 (Figure 9.9.5-2).

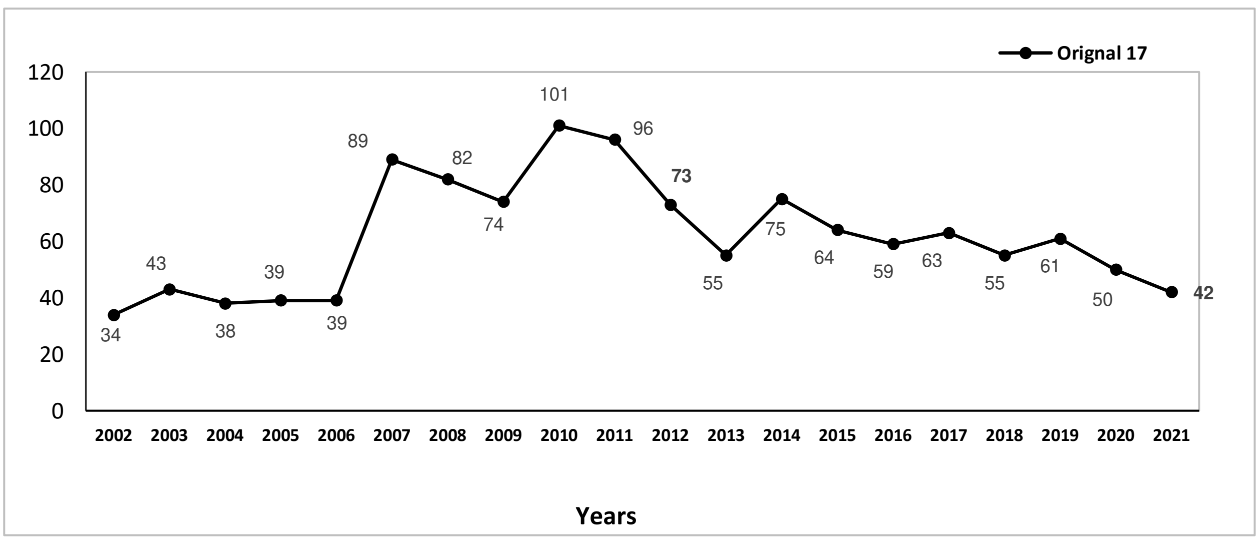


Figure 9.9-7 Annual moose hunt numbers, 2002 to 2021, in hunting management zone 17 (source: MFFP, February 2015)

It should be noted that based on the results of the 2021 aerial surveys by the MFFP and in compliance with obligations under the James Bay and Northern Québec Agreement (JBNQA), moose hunting activities in zone 17 now limited to harvesting by Indigenous people for subsistence hunting (Gouvernement du Québec, 2023). The decline in the population of moose observed in this area implies a decrease in harvesting.

Habitat suitability

HSI results calculated by the MFFP are available for moose for nearly all of the Grevet-Chapais alignment, with the exception of the last 20 km on the northern end, which were calculated by the MFFP.

Within the boundaries of the railway right-of-way, the different index classes are spread out fairly evenly, from 28% (low) to 32% (medium) and 40% (high) (Map 9.9.7). The medium- and high-quality habitats make up over 70% of the moose habitat within the right-of-way as well as the corridor.

9.9.4.2.4 Bears

The potential Grevet-Chapais railway alignment is only in hunting management zone 17 and FAMU 88.

Within hunting management zone 17, which covers an area of approximately 23,000 km^2, the area of habitat conducive to black bears is about 20,000 km^2 (87%) (MFFP: Lamontagne and coll., 2006). In zone 17, the black bear density is 1.10 bears/10 km^2, or about 2,000 overall in the zone.

In FAMU 88, aside from five years when no trapping was reported, the number of black bears captured annually varied from 1 to 20 between 2002 and 2021, with a total of 76 captured over that 20-year period (Table 9.9-13). As black bear is reserved for Crees north of 52nd parallel, it is possible that the reported bears are voluntary reports from Cree trappers.

No information is available regarding the habitat suitability for black bears in the potential Grevet-Chapais railway alignment.

Table 9.9-13 Black bear numbers in FAMU 88, 2002 to 2021 (source: MFFP, 2022).

Year	Number of bears	Year	Number of bears
2002	1	2012	5
2003	9	2013	1
2004	-	2014	1
2005	3	2015	3
2006	20	2016	-
2007	-	2017	3
2008	-	2018	16
2009	-	2019	9
2010	2	2020	1
2011	1	2021	1
Annual average			3.8
Total bears, 2002-2021			76

9.9.4.3 Waterfowl

The density of nesting Canada goose pairs was variable along the potential Grevet-Chapais railway alignment in 2009 at between 1.0 and 33 pairs/km^2 (CWS, 2013)

9.9.4.4 Fish and fish habitat

A total of 10 crossing sites were inventoried along the potential Grevet-Chapais railway alignment, including six where the presence of fish was confirmed. During the inventory, 10 individuals representing five species were caught (Table 9.9-14).

Walleye, northern pike and Allegheny pearl dace accounted for 80% of the catch.

The existing data were added to the results of the field inventory and indicate the presence of eight species of interest in the potential Grevet-Chapais railway alignment area. The occurrence of these species according to the compiled data is presented in Table 9.9-15.

Sensitive species and habitats

Of the 10 water crossings inventoried in the potential Grevet-Chapais railway alignment, five have components deemed to be highly sensitive due to the presence of lake sturgeon, whereas the other five crossings display moderately sensitive components (Table 9.9-16). Map 9.9.14 presents the habitat suitability of the water crossings visited for fish.

A high sensitivity crossing indicates either, or both, the presence (potential or confirmed presence) of lake sturgeon (designated species at risk) and/or the presence (confirmed or potential) of a spawning ground of a subsistence or sport fishing species (walleye and sauger, brook trout, northern pike, lake whitefish, mooneye and goldeye).

A medium sensitivity crossing indicates either, or both, the presence (potential or confirmed presence) of a subsistence or sport fishing species (walleye and sauger, brook trout, northern pike, lake whitefish, mooneye and goldeye) and/or the presence of plant community, or nursery or feeding area for these species.

A low sensitivity crossing indicates the absence of the above criteria.

Table 9.9-14 Fish species and catch numbers from the field inventory conducted at 10 water crossings in the potential Grevet-Chapais railway alignment in 2021

Common name	Latin name	Number caught	% of total catch
Walleye	*Sander vitreus*	3	30
Northern pike	*Esox lucius*	3	30
Longnose sucker	*Catostomus catostomus*	1	10
Allegheny pearl dace	*Margariscus margarita*	2	20
Brook trout	*Salvelinus fontinalis*	1	10
Total	-	**10**	**100**

Table 9.9-15 Water crossings (10) in the potential Grevet-Chapais railway alignment containing critical species or habitat according to the various compiled sources.

Common name	Latin name	Number of crossings with species occurred
Walleye	*Sander vitreus*	8
Sauger	*Sander canadensis*	3
Lake sturgeon	*Acipenser fulvescens*	5
Northern pike	*Esox lucius*	8
Lake whitefish	*Coregonus clupeaformis*	4
Mooneye	*Hiodon tergisus*	2
Goldeye	*Odon alosoides*	2
Brook trout	*Salvelinus fontinalis*	3

Table 9.9-16 Grevet-Chapais fish and fish habitat sensitivity at water crossings (10)

Watershed	Watercourse	Station # [1]	FISH (presence confirmed or potential)		FISH HABITAT [2,3] (presence confirmed or potential)	
			Species at risk [2]	Valued species [3]	Spawning ground	Shelter, nursery or feeding areas
O'Sullivan	O'Sullivan River	49	X			
	O'Sullivan River tributary	50	X			
Bachelor	Bachelor River	51	X			
	Bachelor River	53	X			
Opawica	Opawica Lake	54	X			
	Opawica Lake	52				X
	Opawica Lake tributary	55		X		
Obatogamau	Hancock Lake tributary	56		X		X
	Obatogamau River	57		X		
	Cavan Creek	58		X		

[1]: Scale of sensitivity : **Red High** / **Yellow Medium** / **Green Low**
[2]: Lake sturgeon
[3]: Walleye and sauger, brook trout, northern pike, lake whitefish, mooneye and goldeye

9.9.4.5 Species at risk

9.9.4.5.1 Plants

No plant species considered at risk have currently been inventoried in the potential Grevet-Chapais railway corridor.

9.9.4.5.2 Wildlife

As for wildlife species at risk, the following species merit attention:

- Woodland caribou: The GPS collar survey information provided by the MFFP confirms the occasional presence of some woodland caribou in the corridor.
- Rock vole: This species' closest occurrence to the alignment is a little less than 5 km to the south, at KP 224 on Route 113 (MTQ kilometre points). No other occurrence has been identified in the corridor around the

alignment. Since various occurrences are noted in the region, it is possible the species may in fact frequent the corridor in habitats suitable to it.

- Southern bog lemming: One occurrence in the corridor, 25 m from the alignment, just before Chapais. The species may be present in various other locations near the alignment given the abundance of peat bogs and adjoining forests throughout the region.
- Little brown bat and northern long-eared bat: The two species are present in the potential Grevet-Chapais railway corridor, in an old mine near Chapais (hibernacula). In 2001 and 2003, 240 little brown bats were counted, while 110 northern long-eared bats were counted. Observations of the two bat species were also recorded in a number of locations in the corridor along the alignment (visual and sonogram identification, data provided by the MFFP).
- Hoary bat and silver-haired bat: Two occurrences of hoary bat and one occurrence of silver-haired bat were recorded in the corridor.
- Common nighthawk: Two occurrences were identified in the eBird database, in the corridor along the alignment (Cavan Lake and km 333 of Route 113).
- Bank swallow: Two colonies and a nesting site were recorded in the corridor near Chapais. The nesting sites are located more than 2 m high on slopes and are used from mid-April to late August. This is therefore the most sensitive period for this species near its nesting sites.
- Bald eagle: A number of occurrences are recorded in the corridor for this alignment in the eBird database. A nesting site is also identified in the CDPNQ database, again in the corridor, at Opawica Lake.
- Rusty blackbird and olive-sided flycatcher: A number of occurrences are recorded for the corridor in the eBird database.
- Yellow-banded bumblebee: The closest inventoried presence of this species was nearly 5 km south of the potential Grevet-Chapais railway alignment, outside the corridor, at the east end of the alignment (Chapais end). Occurrences have also been noted in and around Chibougamau, northeast of the alignment. The proximity to the alignment of the yellow-banded bumblebee means it is potentially present in the corridor.
- Lake sturgeon: According to Fisheries and Oceans Canada data, lake sturgeon is present in a number of rivers crossed by the study alignment and corridor.
- Rocky Mountain capshell: Four occurrences recorded in a sector west of the end of the potential Grevet-Chapais railway alignment, outside the corridor. However, due to the difficulty of spotting this species, it is possible it could be found in lakes corresponding to its habitat within the corridor.

The distribution of the various species at risk identified is provided on maps 9.9.15 and 9.9.16.

9.9.5 Potential Mistissini 2nd access road alignment

9.9.5.1 Plants

The potential Mistissini 2nd access road alignment lies almost entirely in the Mistassini Lake ecological region (region 6f). Just a small part on the western end of the alignment crosses into the Opemisca Lake ecological region (region 6c) (Map 9.9.1).

9.9.5.2 Wildlife

9.9.5.2.1 Migratory caribou

The potential Mistissini 2nd access road alignment lies outside the annual migratory caribou range.

9.9.5.2.2 Woodland caribou

According to the distribution of woodland caribou herds in James Bay territory (Map 9.9.3), the potential Mistissini 2nd access road alignment is located between the boundaries of the Assinica herd (to the west) and the Temiscamie herd (to the east). Just the ends of the alignment are found within the ranges of these two herds. The general alignment axis being east-to-west, the potential for hindering caribou movement between the two herds is low. Within the corridor, only nine telemetry locations are found along the 60 km of the potential Mistissini 2nd access road alignment (Map 9.9.17).

The western end of the alignment slightly overlaps the Assinica herd's range. This sector forms the junction of the potential Mistissini 2nd access road alignment with the Route du Nord and is an area of existing disruption. To that extent, this short section connecting the two roads at the very edge of the range would not constitute a notable impact.

As for the eastern end of the alignment, it starts in the community of Mistissini and follows an existing road for 2 km, which essentially places it outside the range of the Temiscamie herd.

Habitat suitability

HSI for woodland caribou do not exist for the sector of the potential Mistissini 2nd access road corridor.

9.9.5.2.3 Moose

Similar to the potential BDHR corridor, the corridor for the potential Mistissini 2nd access road is located in hunting management zone 22.

Hunting management zone 22 covers an area of approximately 340,000 km^2. The estimated area of moose habitat in this zone is approximately 200,000 km^2 (59%), primarily located south of the northern boundary of attributable forests around the 51st parallel (Map 9.9.6) (MFFP: Lefort and Massé, 2015). The habitat in this zone north of the 51st parallel is more suitable for woodland and migratory caribou.

The most recent aerial inventory of zone 22 was conducted in 1991. At that time, the post-hunt moose population was estimated at 8,841 individuals or 0.26 moose/10 km^2. In 1997, a simulated moose density estimate showed that the density could be as high as 0.31 moose/10 km^2. The only inventories that have been conducted in zone 22 since 1991 were carried out as part of the pre-project studies and monitoring program for the Eastmain-1A and Rupert diversion hydroelectric project. The area covered (2002, 2004, 2006 and 2008) was confined to the Eastmain and Weh-Sees Indohoun sectors. In 2012, the MFFP estimated the number of moose in zone 22 to be approximately 9,872, which is equivalent to a density of 0.5 moose/10 km^2 (Lefort and Massé, 2015). According to the MFFP (Lefort and Massé, 2015), these results appeared to show an upward trend. A density of even 0.5 moose/10 km^2 is considerably lower than that found in the rest of Québec to the south, where densities range from 11.0 moose/10 km^2 in the Lower St. Lawrence region and 2.7 moose/10 km^2 in the Lanaudière and Laurentians region, for example.

Habitat suitability

Within the boundaries of the road right-of-way, 65% of the habitats present are low quality for moose, whereas just 12% are high quality (Map 9.9.7).

The picture is similar throughout the corridor, where low-quality habitat makes up 65% of the habitat present, and less than 12% is high quality.

9.9.5.2.4 Bears

The potential Mistissini 2nd access road alignment is limited to hunting management zone 22 and FAMU 91. Black bear harvesting is reserved to Crees in zone 22.

As mentioned in section 9.9.2.2.4, approximately 280,000 km^2 of hunting management zone 22 (82%) is habitat favourable to black bears, out of a total of about 340,000 km^2. According to the MFFP (Lamontagne and coll., 2006), the estimated density is 0.20 bear/10 km^2, or a total of 5,600 bears in this zone.

In FAMU 91, 45 bears were captured in 2006, i.e. more than half of the 86 bears caught between 2002 and 2021 (Table 9.9-17). As black bear is reserved for Crees north of 52nd parallel, it is possible that the reported bears are voluntary reports from Cree trappers.

No information is available regarding the quality of the habitat for black bears in the potential Mistissini 2nd access road alignment.

Table 9.9-17 Black bear harvest in FAMU 91, 2002 to 2021) (source: MFFP, 2022)

Year	Number of bears	Year	Number of bears
2002	22	2012	-
2003	1	2013	-
2004	-	2014	-
2005	-	2015	-
2006	45	2016	3
2007	-	2017	-
2008	1	2018	-
2009	11	2019	1
2010	1	2020	1
2011	-	2021	-
Annual average			4.3
Total number /2002-2021			86

9.9.5.3 Waterfowl

According to information collected for 2009, the density of Canada goose breeding pairs in the potential Mistissini 2nd access road alignment sector was about 4.0 to 12.0 pairs/km^2 (CWS, 2013).

9.9.5.4 Fish and fish habitat

A total of 21 water crossing sites were inventoried along the potential Mistissini 2nd access road. Of those stations, 18 were successfully completed. The presence of fish was confirmed in the field at 11 sites. During the inventory 71 fish representing eight species were caught (Table 9.9-18).

Allegheny pearl dace, brook trout and fallfish accounted for over 80% of the catch.

A compilation of existing data and the field catch together confirmed the presence of two of the eight species of interest, i.e. brook trout (7 crossings) and northern pike (3 crossings). The occurrence of these species is provided in Table 9.9-19.

Sensitive species and habitats

Of the 18 water crossings inventoried in the potential Mistissini 2nd access road, three have highly sensitive components in connection with the presence of potential spawning grounds for species of interest, whereas 13 other crossings display moderately sensitive components (Table 9.9-20). The quality of the fish habitat at the water crossings visited is shown in Map 9.9.18.

A high sensitivity crossing indicates either, or both, the presence (potential or confirmed presence) of lake sturgeon (designated species at risk) and/or the presence (confirmed or potential) of a spawning ground of a subsistence or sport fishing species (walleye and sauger, brook trout, northern pike, lake whitefish, mooneye and goldeye).

A medium sensitivity crossing indicates either, or both, the presence (potential or confirmed presence) of a subsistence or sport fishing species (walleye and sauger, brook trout, northern pike, lake whitefish, mooneye and goldeye) and/or the presence of plant community, or nursery or feeding area for these species.

A low sensitivity crossing indicates the absence of the above criteria.

Table 9.9-18 Fish species and catch numbers for the field inventory conducted at 18 water crossings in the potential Mistissini 2nd access road alignment in 2022

Common name	Latin name	Number caught	% of total catch
Brook trout	*Salvelinus fontinalis*	18	25
White sucker	*Catostomus commersonii*	2	3
Northern pike	*Esox lucius*	4	6
Yellow perch	*Perca flavescens*	3	4
Allegheny pearl dace	*Margariscus margarita*	32	45
Fallfish	*Semotilus corporalis*	9	13
Brook stickleback	*Culaea inconstans*	2	3
Mottled sculpin	*Cottus bairdii*	1	1
Total	-	71	100

Table 9.9-19 Distribution of species of interest at 18 water crossing in the potential Mistissini 2nd access road alignment, compiled from various sources

Common name	Latin name	Number of crossings with species of interest
Brook trout	*Salvelinus fontinalis*	7
Northern pike	*Esox lucius*	3

Table 9.9-20 Fish and fish habitat sensitivity at water crossings (10) in potential Mistissini 2nd access road alignment

Watershed	Watercourse	Station # [1]	FISH (presence confirmed or potential)		FISH HABITAT [2,3] (presence confirmed or potential)	
			Species at risk [2]	Valued species [3]	Spawning ground	Shelter, nursery or feeding areas
Blaiklock	Mistissini Lake tributary	W1			X	
Mistago	Mistago River tributary	W3		X		X
	Mistago River tributary	W5		X		
	Mistago River tributary	W17				X
	Mistissini Lake tributary	W2			X	
	Mistissini Lake tributary	W4				
	Mistissini Lake tributary	W6		X		
	Mistissini Lake tributary	W7			X	
	Pipounichouane River tributary	W9				X
	Pipounichouane River	W10				X
	Pipounichouane River	W12				X
Rupert	Pipounichouane River	W13		X		
	Mistissini Lake tributary	W14				
	Mistissini Lake tributary	W16				
	Pipounichouane River tributary	W18		X		X
	Mistissini Lake tributary	W19				X
	Pipounichouane River tributary	W20				X
	Mistissini Lake tributary	W21				

[1]: Scale of sensitivity : **Red High** / **Yellow Medium** / **Green Low**
[2]: Lake sturgeon
[3]: Walleye and sauger, brook trout, northern pike, lake whitefish, mooneye and goldeye

9.9.5.5 Species at risk

9.9.5.5.1 Plants

No plant species considered at risk have currently been inventoried in the corridor.

9.9.5.5.2 Wildlife

A few occurrences of designated species were recorded in the corridor and vicinity, i.e.:

- Woodland caribou: A number of scattered observations are noted in the corridor. Most of the observations provided by the MFFP are taken from GPS collars and indicate that the species distribution is observed primarily about 15 kilometres northwest of the alignment and, to a lesser extent, about 50 km north of the alignment, and again 10 km northeast of Mistissini.

- Rock vole and southern bog lemming: One occurrence of each of these species was noted in the corridor, at the eastern edge of the alignment near Mistissini. However, the data date back to 1947 and are considered historical by the MFFP. It is possible that these two species can still be found along the study alignment in habitats suitable to them (Table 9.9-21), given their presence regionally.
- Golden eagle: One occurrence was identified just at the boundary of the corridor, to the north, in the western portion of the potential alignment. The data (eBird) do not indicate whether the observations were at nesting sites or not.
- Bald eagle: A number of occurrences were noted in the corridor near Mistissini, at the eastern edge of the alignment. The data (eBird) do not indicate whether the observations were at nesting sites or not.
- Olive-sided flycatcher: One occurrence was noted in the corridor at the western edge of the alignment, near the junction with the Route du Nord.
- Rusty blackbird: Two occurrences were identified at the edge of the alignment, on the Mistissini side.

The distribution of the various species at risk identified is provided in maps 9.9.19 and 9.9.20.

9.9.6 Potential impacts and mitigation

The documentation that was consulted and data sources used to identify the potential impacts and mitigation measures are found in Table 6 of Appendix 6.27. The legislative provisions related to environmental assessments are found in Appendix 6.29.

9.9.6.1 Construction phase

The three study alignments consist of linear infrastructure. Accordingly, they share the same fundamental potential impacts and environmental protection and mitigation measures to prevent or minimize those impacts.

This section will therefore deal with information common to all three alignments and covers the primary potential impacts on the various components and associated mitigation measures. The following sections will deal with each alignment specifically and address the information and features specific to each alignment.

9.9.6.1.1 Plants

During initial site preparation, construction site and access road development as well as earthwork will necessarily involve removal of vegetation. Loss of vegetation will be permanent in the location of the new rights-of-way. It will be temporary, however, in the work zones and storage areas and on the temporary access roads because restoration of those areas will take place upon completion of the work.

The proposed BDHR and Grevet-Chapais rights-of-way have approximately 3.5 km^2 (350 ha) and 2.25 km^2 (225 ha) of terrestrial vegetation respectively. As for the right-of-way for the proposed second Mistissini access road, terrestrial vegetation takes up an area of about 1.6 km^2 (160 ha). The exact area of the permanent losses will be clarified and optimized during the final project design. The surface area calculation includes permanent loss of vegetation over the full width of the right-of-way, which in the end will not necessarily be the case. In addition, it is anticipated that the proposed Grevet-Chapais alignment will follow the right-of-way of the former CN rail line, which will reduce the encroachment.

A substantial proportion of the BDHR alignment study corridor also includes areas of existing disturbance. Below the northern attributable forest boundary (~75% of the alignment), the corridor is made up mostly (65%) of regenerating forest as a result of logging and burns. Above the attributable forest boundary (~25% of the alignment), the disturbance consists of burned areas taking up 15% of this portion of the corridor.

The use of machinery and vehicles from off-site poses a risk of introducing exotic and invasive species that could destabilize the surrounding plant communities. The northern site conditions could, however, limit the growth of many of these species. Also, many special status plants are found on the shores of rivers and near wetland areas, such that special attention to these areas prior to doing any work nearby.

Machinery and vehicle use, movement, fuelling and maintenance have the potential to contaminate the vegetation with hydrocarbons in the event of a breakdown, accident or accidental spill.

The main impacts on plants as a result of the construction work are identified in Table 9.9-21 The impacts may be permanent, may in some cases be avoided and in others minimized by the adoption of the measures presented in the table (non-exhaustive list). In particular, to reduce the extent of forest cutting in natural environments required to access the various work zones, it will be important to select areas of existing disturbance where possible to locate the zones required for the work and related activities.

Table 9.9-21 Potential impacts on plants during the construction phase and proposed mitigation measures

	Potential Impacts
1	Loss of vegetation during initial site preparation (removal of vegetation)
2	Risk of introduction of invasive plant species into the environment by machinery and vehicles
3	Accidental spill of hydrocarbons into the environment during machinery use, movement, fuelling and maintenance
	Protection / Mitigation Measures
1	Group linear infrastructure, where possible, with other linear disturbances, to minimize the effects of fragmentation of and encroachment on natural vegetation
2	Plan operations, camp sites and storage areas in a way that limits need for cutting to what is strictly necessary
3	Identify and demarcate all planned areas and accesses for construction work (on plans and in the field) and contain work and traffic within the marked zones
4	Stockpile soil separate from cut materials for reuse during restoration
5	Restore roads, accesses and temporary storage areas once they are no longer needed
6	Clean any new construction equipment arriving on site to minimize the risk of introducing or spreading species of exotic or invasive vascular plants
7	Adopt measures to prevent contaminant leakage or spillage, particularly during routine equipment maintenance and inspection; use containment trays, train personnel on correct use of refuelling equipment, implement safety procedures for this activity. Keep spill kits on site and train employee on how to use them. Document emergency response procedures and train employees on how to apply safe response procedures and produce reports.
8	Immediately restore disturbed areas as work progresses in order to limit the duration of the disturbance.

9.9.6.1.2 Wildlife

Terrestrial wildlife and waterfowl

Construction site and access road development will require removal of vegetation. Loss of vegetation (terrestrial and wetlands) and consequently of wildlife habitat will be permanent in the location of the new rights-of-way. It will be temporary, however, in the work zones and storage areas and on temporary access roads. The surface area of terrestrial wildlife and waterfowl habitat in the rights-of-way is approximately 6.74 km^2 (674 ha) for the BDHR alignment, 5.49 km^2 (549 ha) for the Grevet-Chapais alignment and 1.6 km^2 (160 ha) for the second Mistissini access road. As indicated in section 9.9.5.1.1, the permanent loss of surface area will be clarified and optimized during the final project design. The habitat loss will mean that wildlife will move nearby suitable habitats.

Removal of vegetation during bird nesting could destroy or disturb active nesting sites.

The work will also cause disruption of wildlife frequenting the area near the work. The disruptions, caused primarily by noise, traffic and the presence of machinery, could cause wildlife to avoid the work zone temporarily. The impact will be more significant for species whose home range is more restricted (small mammals). Most of the species likely to frequent the study areas are widespread throughout the territory, however, and habitats suitable to them are also abundant near the alignments. The feeding, breeding and rearing of some species could be disturbed depending on when the work is undertaken. For example, females with their young-of-year could travel to calmer areas. However, the presence of undisturbed habitats in the study area combined with the mobility of most of these species and the temporary nature of the work will reduce the impact on these species.

The intensity of the impact of the disruption of wildlife present near the BDH and the forestry roads in the other two proposed alignments will be mitigated by the presence of this infrastructure, because wildlife are already conditioned to a certain degree of disruption generated by the traffic on those roads. Further, proximity of the roads and planned alignments makes it possible to reduce the extent of the disruptions and the cutting required to access the various work zones.

Machinery and vehicle use, movement, fuelling and maintenance have the potential to degrade the wildlife habitat in the event of a breakdown, accident or accidental spill.

Hauling of materials and machinery traffic can also increase the risk of wildlife collisions and fatalities.

The impacts on wildlife and terrestrial habitat, including that of waterfowl, as a result of the construction work are presented in Table 9.9-22 as well as proposed mitigation measures (non-exhaustive).

Generally speaking, the work implementation schedule should inasmuch as possible prohibit forest cutting during the nesting period of birds, which runs from late April to mid-August. According to Canadian law, "anyone who kills, hunts, captures, injures or harasses a migratory bird or damages, destroys, removes or disturbs their nests, eggs or residence (burrow) without a permit commits a punishable offence."

Table 9.9-22 Potential impacts on terrestrial wildlife during the construction phase and proposed mitigation measures

Potential Impacts	
1	Loss of habitat from forest cutting or exposure of plant cover during initial construction site preparation and earthwork
2	Destruction or disturbance of bird nesting

3	Disruption caused by transportation and traffic, presence of workers and construction activity in general that may force nearby animals to alter their home ranges temporarily based on neighbouring habitats
4	Accidental spill of hydrocarbons into the environment during machinery use, movement, fueling and maintenance
5	Increased risk of collisions with wildlife
Protection / Mitigation Measures	
1	Grouping of linear infrastructure, where possible, with other linear disturbances, to minimize the effects of fragmentation of and encroachment on natural vegetation
2	Planning of operations, camp sites and storage areas in a way that limits need for cutting to what is strictly necessary.
3	Grouping of linear infrastructure, where possible, with other linear disturbances, to minimize the effects of fragmentation and disruption of wildlife
4	To minimize deforestation of natural plant cover and wildlife habitats, zones with existing disruption (forest cuts, borrow pits, etc.) should be chosen for establishment of camps and storage areas in particular. Likewise, the use of existing roads should be prioritized for transportation and vehicle movement.
5	Identification and demarcation of all areas and accesses planned for the construction work (on plans and in the field) and containment of work and traffic within the marked zones
6	Planning of clearing activities outside of migratory bird nesting season wherever possible. **Restricted period:** **late April to mid-August** **Work period:** **mid-August to late April**
7	Development of a wildlife awareness program for worksite personnel
8	Development and maintenance of a log for wildlife species encounters and collisions
10	Marking of sensitive zones **(e.g.: shoreline areas, wetlands, etc.)** prior to the start of clearing and construction
11	**Restoration of roads, accesses and temporary storage areas once they are no longer needed**
12	Store food and waste on site properly to avoid attracting animals
13	Raise workers' awareness of the importance of not feeding animals and of managing waste on the construction site
14	Adopt measures to prevent contaminant leakage or spillage, particularly during routine equipment maintenance and inspection; use containment trays, train personnel on correct use of refuelling equipment, implement safety procedures for this activity. Keep spill kits on site and train employee on how to use them. Document emergency response procedures and train employees on how to apply safe response procedures and produce reports.
15	Use vehicles at appropriate speeds and give way to wildlife
16	Use approved mufflers on all equipment to reduce potential environmental effects of noise
17	If clearing of vegetation is necessary during the bird nesting period, a qualified biologist or environmental specialist should conduct surveys within seven days of the work to check for presence of active nests that would be affected by construction. If nests are discovered, establish buffer zones as soon as they are discovered in the work zones and protect active migratory bird nests until the fledglings' first flight.
18	Immediately restore disturbed areas as work progresses in order to limit the duration of the disturbances.

Fish and fish habitat

During initial site preparation, construction site and access road development will require removal of vegetation and exposure of the soil. Exposure of bare soil on slopes and banks, as well as excavation and traffic in the littoral zone, can cause leaching of sediment into the watercourse, downstream transport, and deposition on the waterbed. Sediment introduction temporarily affects water quality, but can also alter fish habitat quality after deposition on the waterbed.

Work within the littoral zone, including the use of cofferdams and building of water diversion channels, if required, can temporarily alter the free movement of fish on either side of the work (upstream or downstream). Inherent consequences include alteration of the flow system, increase in water turbidity downstream of the work and disruption of fish caused by machinery and personnel movement.

Construction of bridges and culverts using structures within the littoral zone (e.g. abutments, piers) will result in the permanent loss of fish habitat. Depending on the nature of the loss, the authorities may require a fish habitat compensation plan to be prepared and implemented.

The use of machinery for construction activities that uses hydrocarbons involves a risk of accidental spills into the aquatic environment. Such spills would have impacts on fish species and their habitat.

The main impacts on fish and fish habitat as a result of the construction work as well as proposed mitigation measures are presented in Table 9.9-23 (non-exhaustive).

Table 9.9-23 Potential impacts and mitigation measures for fish and fish habitat during the construction phase

	Potential Impacts
1	Disturbance of fish habitat due to sediment introduction and emission of turbidity plumes
2	Temporary obstacle to free fish movement on either side of the work site (upstream/downstream)
3	Relocation of some species due to habitat disruption and modification
4	Permanent and temporary encroachment into fish habitat
5	Accidental spill of hydrocarbons into fish habitat during machinery use, movement, fuelling and maintenance, leading to deterioration of fish habitat or mortality/adverse physiological effects on aquatic organisms
	Protection / Mitigation Measures
1	Plan work within the littoral zone outside of fish breeding season: **Restricted period: September 16 to July 14** **Work period: July 15 to September 15**
2	Identify and demarcate all planned areas and accesses for the construction work (on plans and in the field) to minimize the footprint in watercourses and ensure containment of work and traffic inside the marked zones. Use temporary bridges to cross watercourses and protect banks from erosion and compaction
3	Prepare and implement a fish habitat compensation plan
4	Apply the standard directives for reducing effects on fish and fish habitat (e.g.: DFO measures to protect fish and fish habitat [DFO 2020])
5	Establish and clearly identify a riparian buffer zone prior to the start of work. Limit disturbances in that zone to activities associated with restoration and naturalization.

	Protection / Mitigation Measures
6	Establish designated machinery refuelling zones at a safe distance (minimum 30 m setback from top of bank) from any watercourse or wetland. Use vegetable oil as a lubricant for machinery in or on the edge of watercourses
7	Prior to starting work in water, ensure that all necessary equipment and materials for accidental spills is available on site. Spill kits and containment equipment must be on site in designated locations where the risk of a spill is considered highest (e.g.: refuelling zones).
8	Install erosion- and sediment-control equipment in appropriate places adjacent to watercourses and/or bodies of water or according to the instructions of the environmental monitor(s). Appropriate temporary structures for controlling erosion and sediment must be installed, maintained and monitored throughout all construction phases. Standard erosion- and sedimentation-control and mitigation measures include but are not limited to: - Erosion-control fences and nets/curtains ; - Containment dams; - Sediment-control ponds, as necessary; - Staking of construction zones, to minimize exposure of soil; - Stockpiling of existing vegetation as long as possible; - Planting and mulching in stripped zones; - Diversion of runoff away from stripped zones; - Optimization of the length and incline of slopes; - Maintenance of low runoff flow; - Adequate sizing and protection of drainage channels and outlets; - Interception of sediment on site.
9	Limit work in water to a single continuous event until the work in the watercourse is complete and carry out the work as quickly as possible.
10	Keep machinery out of the littoral zone for the duration of work
11	During the work, keep machinery movement in the work zone and nearby to a minimum to avoid compacting the soil or creating ruts
12	No earthwork or excavation near watercourses during high water periods or heavy rain
13	Limit grubbing, scraping and levelling of slopes to access watercourses or bodies of water to the minimum necessary to allow safe movement of equipment and completion of work.
14	Ensure that water from channels, dams and pumps, diversion or other methods does not cause erosion or introduce sediment into the waterbed. Based on the volume of pumping (surface or groundwater) required for the work, check whether authorizations are required.
15	When clearing vegetation, cut down trees far away from watercourses and bodies of water. Immediately remove the trees, debris or soil deposited accidentally within the boundary of the littoral zone (formerly called the high water mark) of a watercourse.
16	Ensure that water intakes and pumping reduce or prevent disturbance of the waterbed and that they are equipped with screens in accordance with DFO guidelines on end-of-pipe fish protection screens for small water intakes in freshwater (DFO 2020).

	Protection / Mitigation Measures
17	Retrieve fish before dewatering waterproof partitions installed for work in watercourses. Have the fish retried by a qualified aquatic biologist, in necessary, in accordance with permit conditions. Release the captured fish into areas of the same watercourse into a suitable habitat outside the work zone.
18	Complete dewatering of waterproof partitions installed for work in watercourses in a manner that does not cause erosion and does not allow sediment to re-enter a watercourse or body of water by using appropriate sediment-control devices.
19	Monitor turbidity levels in watercourses and sediment-control measures regularly during construction, particularly following major storm events or heavy rains.
20	Immediately restore disturbed sites as the work progresses.
21	Collect and treat runoff before discharging it into the watercourse.
22	The contractor must at all times control erosion that may occur due to surfaces being disturbed or earthwork, whether cut or fill materials;
23	If the work must be suspended due to heavy or extended rain: - Anchor a temporary protective geotextile to sloped surfaces or on excavated material left in place using wooden stakes; - Apply temporary straw mulch over flat surfaces at a rate of 500 grams/m².
24	Remove all temporary isolation and sedimentation structures on completion of the work and leave the area in a condition at least equivalent to its original condition.

9.9.6.1.3 Species at risk

No vulnerable plant species have been inventoried in the three study corridors to date.

A number of at-risk species of wildlife have been identified in or near the study corridors (Table 9.9-24).

Table 9.9-24 Species at risk present or potentially present in the three study corridors

Group	Species		Confirmed (C) or potential (P) presence in the study corridors		
	Common name	Scientific name	BDH	Grevet Chapais	Mistissini
Birds	Golden eagle	*Aquila chrysaetos*			C
	Common nighthawk	*Chordeiles minor*	C	C	
	Bank swallow	*Riparia riparia*	C	C	
	Olive-sided flycatcher	*Contopus cooperi*	C	C	C
	Canada warbler	*Cardellina canadensis*	C		
	Bald eagle	*Haliaeetus leucocephalus*	P	C	C
	Rusty blackbird	*Euphagus carolinus*	C	C	C
Mammals	Rock vole	*Microtus chrotorrhinu*	P	P	C
	Southern bog lemming	*Synaptomys cooperi*	P	C	C
	Woodland caribou	*Rangifer tarandus caribou*	C	C	C
	Silver-haired bat	*Lasionycteris noctivagans*		C	
	Hoary bad	*Lasiurus cinereus*		C	
	Northern long-eared bat	*Myotis keenii*	P	C	
	Little brown bat	*Myotis lucifugus*	P	C	
Fish	Lake sturgeon	*Acipenser fulvescens*	C	C	
Molluscs	River limpet	*Ancylus fluviatilis*		P	
Insects	Yellow-banded bumblebee	*Bombus terricola*	P	P	P

The wildlife impacts and recommendations (section 9.9.5.1.3) also apply to wildlife species at risk. However, due to their particular risk status, additional mitigation measures may be required.

Generally speaking, the work schedule should to the extent possible prohibit forest cutting during the above-mentioned bird nesting period from late April to mid-August. If cutting is required during that period, an inventory of nests must be taken within seven days before the start of work. If any active nests are discovered, a protective zone would need to be installed around the nest for the duration of nesting.

Woodland caribou

The woodland caribou area of concentration is located in the upper half of the BDHR alignment. This sensitive section of the alignment covers a distance of approximately 113 km, between KP 122 and KP 235 (Broadback River) (MTQ kilometre points) of the BDH (Map 9.5.3). This is therefore the area where there are issues regarding woodland caribou.

Along the Grevet-Chapais alignment, the woodland caribou area of concentration is located mainly in the eastern half of the alignment, according to the telemetry data obtained. This is therefore the area where there are issues regarding woodland caribou in the case of the Grevet-Chapais alignment.

The second Mistissini access road alignment, for its part, is located in an enclave between the boundaries of the Assinica herd to the west and the Temiscamie herd to the east and according to the telemetry data is a sector of little caribou movement. Only the edges of the alignment are within the ranges of these two herds and the potential for caribou disruption by the work will be very low in this sector.

The main sources of construction work impacts on the woodland caribou are forest cutting, hauling of materials, vehicle movement and the presence of workers. During the work, construction activities will cause the caribou to temporarily alter their land use near the work zones temporarily based on nearby habitats. Nevertheless, the caribou already make little use of the areas located near zones disturbed by human activity.

In the more sensitive segments for woodland caribou, it is recommended that cutting be planned outside the breeding period, including calving and two to four weeks afterwards (estimate May 20 to June 30). Indeed, this period is critical for calf survival and it is important to limit disruption of mother/calf pairs. Further, this period is within the restricted period for migratory bird nesting (late April to mid-August).

It has been shown that woodland caribou give a 9- to 13-km berth of cutting zones. Given the magnitude of this distance, a post-work replanting program favouring the types of stands used by woodland caribou will be essential to restore degraded habitats. Reforestation of temporary work zones along these sections should favour planting of softwood species to encourage future development of forest cover that is more favourable to caribou, i.e. not hardwoods, shrubs or grasses.

Rock vole

This species is found on cliffs and rock outcrops, the edges of clearings in mountainous regions, near wet slopes, between moss-covered rocks and near water sources.

No specific protection or mitigation measures have been documented for the rock vole.

Bats

In the case of bats that may be found in or near the work areas, it is important not to disturb their hibernacula during the winter (caves, grottos, old mines, etc.). Vibrations, noise and human activity are all factors that can disturb the rest of bats. If they are awoken, it uses significant energy, which compromises their survival to the end of winter. In addition, it is important not to disturb the animals' access to the hibernacula (excavated or stockpiled materials, etc.) or to modify the air circulation.

Lastly and more generally, a number of designated species depend on wetlands and water for refuge, feeding areas or reproduction. It will therefore be important to limit the impact of the work on those areas, restore them on completion of the work and implement compensation measures where necessary.

Golden eagle

In Québec, the proposed protection measure is as follows: a full protection zone around the nest with a buffer zone around that (Gouvernement du Québec, 2017), i.e. a circle with a 300-metre radius around the nest, whether the nest is on a cliff or in a tree, and a 400-metre buffer zone around the protective circle. No forest management activity is allowed in the protection zone. Activity is permitted in the buffer zone from September 1 to March 15, i.e. outside the species' nesting period. These activities must not involve installation of permanent infrastructure (road, building, etc.).

Common nighthawk

This species nests on the ground and reproduces in a wide range of open habitats, including sandy areas, open forest (mixed stands, conifers, burnt areas, clear-cut sites, etc.), grassland, shrubland, wetlands and riverbanks, gravelly or rocky areas and some cultivated or developed zones (parks, military bases, airports, blueberry fields, orchards, cultivated fields, etc.). The common nighthawk does not yet have any specific protection measures. In its species re-establishment program for Canada, Environment Canada (2015) is currently relying on knowledge gathering efforts.

The restriction period covering the migratory bird breeding season (early April to mid-August). is primarily designed to protect breeding pairs that nest in the forest. Because the nighthawk nests on the ground, it is more complicated to avoid nests during work to clear open areas. Parks Canada (2019) has put out a mitigation measure for such cases, which involves taking surveys of nesting birds in open areas before removing surface soil.

Bank swallow

A number of bank swallow nesting sites are found in or near the study corridors for both proposed railways according to data provided by the MFFP. This species reproduces in transient burrows in vertical slopes and banks, as well as in quarries and roadside ditches (substrate: sand and silt) near open areas for feeding.

The species nests from late-May to mid-August. If forest cutting needs to be done during this period, an inventory must be completed within seven days prior to the start of work and a buffer zone of at least 50 metres should be installed around any nesting areas and nests inventoried.

Yellow-banded bumblebee

The yellow-banded bumblebee is a generalist when it comes to habitat. It can be found in a wide variety of open areas, particularly meadows located in forests or stands of conifers, hardwood or mixed wood, taiga, grassland, riverbanks, urban parks, gardens and farmland zones, as well as roadsides (ECCC, 2022a).

ECCC's recommended species mitigation and conservation measures (2022) include restoration and creation of indigenous foraging habitats (i.e. flowers with short or open corollas, blooming through the active season), nesting habitat (underground burrows or nesting boxes) and overwintering habitat (rotting logs, loose soil, mulch).

Table 9.9-25 Summary data on potential impacts of the three study alignments on plants, wildlife and species at risk

Components	Billy-Diamond [1] (ROW [2] :6.74 km^2) (2 km COR[3]:509.06 km^2)		Grevet-Chapais (ROW: 5.49 km^2) (2 km COR[3]:327.88 km^2)		2nd Mistissini access road (ROW: 1.59 km^2) (2 km COR[3]:92.59 km^2)	
PLANTS & WILDLIFE AND SPECIES AT RISK						
Regenerating forest (within the 2 km COR)						
Natural disturbance	143.64		10.91		33.05	
Forestry	123.47		92.37		14.68	
Aquatic habitats (at surveyed crossings)						
Number water crossings with high habitat quality	10		5		3	
Number water crossings with medium habitat quality	30		5		11	
Lake sturgeon habitat (in km^2) crossed within the 2 km COR[4]	4.76		10.47		4.76	
Large mammals (moose and woodland caribou)						
Total moose occurrence within the 2 km COR	2		0		0	
➔ **Moose habitat suitability** (in km^2 and %)						
Direct habitat loss within ROW						
Low suitability	2.15	*35.5*	1.81	*27.98*	1.03	*64.8*
Medium suitability	1.46	*24.1*	2.06	*31.84*	0.37	*23.3*
High suitability	2.45	*40.4*	2.6	*40.19*	0.19	*11.9*
Habitat disturbance within the 2 km COR beyond ROW						
Low suitability	168.7	*36.16*	97.02	*29.6*	60.12	*64.9*
Medium suitability	125.24	*26.85*	89.08	*27.2*	21.95	*23.7*
High suitability	172.59	*36.99*	141.78	*43.2*	10.53	*11.4*
➔ **Woodland caribou habitat suitability (in km2 and %)**						
Direct habitat loss within ROW						
1 (lowest suitability)	2.09	*33*	1.83	*50.7*	ND	

Components	Billy-Diamond [1] (ROW [2] :6.74 km^2) (2 km COR[3]:509.06 km^2)		Grevet-Chapais (ROW: 5.49 km^2) (2 km COR[3]:327.88 km^2)		2nd Mistissini access road (ROW: 1.59 km^2) (2 km COR[3]:92.59 km^2)
2	4.13	*65.1*	1.78	*49.3*	ND
3	0.12	*1.9*	0	*0*	ND
4	0	*0*	0	*0*	ND
5 (highest suitability)	0	*0*	0	*0*	ND
Habitat disturbance within the 2 km COR beyond ROW					
1 (lowest suitability)	121.84	*26*	111.18	*56*	ND
2	295.91	*62*	88.86	*44*	ND
3	59.85	*12*	0	*0*	ND
4	0	*0*	0	*0*	ND
5 (highest suitability)	0	*0*	0	*0*	ND
Species at risk (within the 2 km COR)					
Number of plant species	0		0		0
Number of wildlife species[5]	6		6		5

[1] Billy-Diamond ROW: average width 26.7 m length: 252.52 km
Grevet-Chapais ROW: average width 33.8 m length: 162.43 km
Mistissini road ROW: maximal width by default 35.0 m length: 45.44 km
[2] ROW: Right-of-Way
[3] 2 km COR: 2 km study corridor (1 km on both sides of alignments)
[4] Data from Department of Fisheries and Oceans Canada
[5] Only wide-ranging species were considered, namely birds and woodland caribou.

9.9.6.2 Operation phase

9.9.6.2.1 Plants

No additional encroachment on vegetation is expected during the operation phase for the railways and the second Mistissini access road.

Degradation of vegetation could occur in the case of accidental hydrocarbon releases from road and rail traffic and maintenance of this infrastructure. However, the application of mitigation measures, such as those proposed in the construction phase section of this report could help minimize this impact.

Vegetation along roadsides could also be affected by salt splashes and runoff when road salts are applied in winter.

9.9.6.2.2 Wildlife

Terrestrial wildlife and waterfowl

No additional encroachment on wildlife habitats is expected during the operation phase for the railways and the second Mistissini access road. Compared to the two railway alignments, only parts of the second Mistissini access road will consist on entirely new segments.

The presence of linear infrastructure causes disturbance in the natural environment and fragmentation of habitat continuity. This infrastructure can also affect the quality of the connectivity for wildlife movement, whether as a physical obstacle or by the perception of danger associated with the forest canopy opening or with disruptions arising from traffic in the case of transportation infrastructure (roads, railways and snowmobile or recreational vehicle trails) (Jalkotzy, 1997; Jackson, 2000; Borda-de-Água, 2017; Bourgeois and coll., 2005).

The presence of linear infrastructure leads to a functional habitat loss caused by disturbances (traffic, noise, vibrations, increased human footprint) (Leblond, 2013). Moreover, these infrastructure types usually represent a constraint to the free movement of wildlife between their habitats and to the movement of larger wildlife on a landscape level (Jalkotzy and coll., 1997; Ditmer and coll., 2018). Species are generally reluctant to cross linear infrastructure without the presence of any cover, especially when there is traffic (MFFP, 2005; McClure and coll., 2013; Brandenburg, 1996; Leblond, 2013).

The collision and fatality risks for wildlife, as well as for human safety, are also an aspect raised in the literature on road or rail traffic issues related to wildlife habitats (Cassady St. Clair and coll., 2020; Backs, 2020; Carvalho and coll., 2017).

To mitigate the potential impacts, wildlife crossings could be developed along the various proposed alignments. This type of mitigation measure is described more fully in section 9.9.7.2.5.

<u>Migratory caribou</u>

The BDHR alignment is located at the southern boundary of the TRAF winter area. According to recent telemetry locations obtained from the MFFP, observations of migratory caribou at the northern end of the BDHR alignment seem to entail occasional forays south of the winter area central core, located approximately 150 km farther north, between Wemindji and Chisasibi.

The Grevet-Chapais alignment is located at the southern margin of the Assinica herd range, very far away from the central core of this herd (Map 9.9.13). The alignment of the second Mistissini access road is located entirely outside the migratory caribou range.

No significant potential impact is anticipated for the migratory caribou.

Moose

The moose habitat is located primarily south of the attributable forest boundary. In 2012, the MFFP estimated the moose population to have very low densities in hunting zones 17 and 22. Consequently, while the addition of a railway could increase the functional habitat loss along the alignment, the potential impacts would affect a very limited number of moose. Furthermore, in addition to creating suitable habitats through logging, climate change could benefit moose at the northern boundary of their range.

Road avoidance behaviour by moose is also well documented (MFFP, 2004 and MFFP, 2005; Wattles, 2018). The reported impacts on moose behaviour include the following:

- Moose exhibit avoidance behaviour that can vary between 100 m and 1,000 m, depending on the study, the animal's gender and the season.
- Along roadsides and during their crossings, moose tend to move faster than they do in other habitats—a sign of stress associated with road proximity.
- The use of de-icing salt attracts some moose to roadsides, thereby increasing the risk of collisions.

Winter areas, i.e., sectors where moose are concentrated in the winter season and where they find protection and food, are critical seasonal habitats for moose. However, no data are available for this along the three study corridors. Considering the road avoidance behaviour of moose, it seems unlikely that the latter frequent potential winter areas very close to the road (Cassady St. Clair and coll., 2019).

Additional collision risks are relatively low and would not be an issue for the moose population in the area, based on the following considerations: the tendency of moose to avoid roads, their low territorial density, and the fact that moose have already modified their behaviour in response to road traffic (BDH and forest roads) in the various corridors proposed.

Black bear

Black bears exhibit avoidance behaviour that can take them up to one km away from roads, depending on road type, traffic, adjacent habitats, animal gender and season (Brandenburg, 1996; Ditmer and coll., 2018). Black bears frequent regrowth environments for their food. As a result, a portion of this environment type within the three corridors could see a functional habitat loss.

According to the MFFP, the estimated density of black bears in this sector would be 0.20 bears/10 km^2 in zone 22. Given this low density, even if the addition of a railway could increase functional habitat loss along the alignment, the potential impacts would affect a very limited number of black bears. What's more, there would be very few direct habitat losses per alignment right-of-way compared to the availability of suitable bear habitats in that region.

Some studies have suggested that railway rights-of-way change the plant community and promote the appearance and maintenance of food sources (berries and fruit) sought by bears, and that the frequenting of these rights-of-way by bears increases the collision risk (Pollock, 2017). In the study area, the abundance of regrowth environments offering this type of food is relatively substantial, due to logging. As such, the attraction of food in the railway right-of-way will be reduced.

Fish and fish habitat

During the operation phase, no additional fish habitat losses are expected. There are potential impacts associated with the risk of accidental hydrocarbon releases from road and rail traffic and from the maintenance of these infrastructures.

Winter maintenance of these roads (sand application) could lead to an increase in suspended particulate matter (turbidity) in watercourses on either side of the proposed second Mistissini access road. If road salts are used, they end up getting into watercourses sooner or later, whether as direct runoff into surface water or by infiltration in soil and groundwater. Road salts that are present in surface water can be harmful to freshwater fish, especially issues related to erosion and clogging of spawning grounds.

To mitigate the potential impacts, abrasives will be used instead of road salt in winter, as much as possible. If a snow storage area is required, it is recommended that this be located at a minimum distance of 30 m from any watercourse.

9.9.6.2.3 Species at risk

Woodland caribou

Woodland caribou movements are concentrated primarily in the upper half of the BDHR alignment, which consists of the identified approximately 113-km-long sensitive section (MTQ KP 122 and KP 235 of the BDH). Consequently, the woodland caribou issues pertain mostly to this particular section. The section also covers a major juxtaposition of existing and planned protected areas as well as the territories targeted for woodland caribou protection (Map 9.5.2). We emphasize however that the caribou HSI is poor in both the right-of-way and the 2-km study corridor.

The linear infrastructure avoidance behaviour of woodland caribou is known and has been documented (CRCF, 2013; MFFP, 2014; Dyer, 2002; Rudolph and coll., 2012). This avoidance level is influenced by a range of variables, including the extent of the residual forest cover; infrastructure width and position in the landscape; traffic intensity in the case of transportation infrastructure; and the total number of these structures in the population range, among other things.

The MFFP (Leblond and coll., 2014) conducted a study on behavioural responses of woodland caribou before, during and after the expansion of Route 175 in the Laurentians wildlife reserve, using telemetry monitoring from 2004 to 2011. That study is of interest here, as it can be used for comparative purposes when assessing the potential impacts of the transportation corridor expansion associated with the addition of a railway alignment parallel to the BDH.

The results obtained in this study illustrate the following:

- Woodland caribou react to the presence of Route 175 by generally avoiding crossing it.
- The Route 175 crossing rate—already low even before the rehabilitation work started on it—showed a downward trend during and after the rehabilitation work.
- Many woodland caribou avoided Route 175 at the landscape level and preferred establishing their home range far from there.
- The woodland caribou crossing rate for Route 175 in Charlevoix (0.5 crossings per individual per year) was less than the crossing rate observed for moose in that same region (4.6 crossings per individual per year).

- Caribou crossing the road increased their rate (speed) of movement near Route 175, which could be a behavioural response to anthropogenic disturbance.
- Woodland caribou that crossed the road did so even when traffic was high, but they modified their movement rate by crossing the road more quickly.
- The woodland caribou's avoidance of all natural habitat classes up to 5 km from Route 175 indicates that the potential benefits of using resources that individuals could find there were not enough to compensate for the perceived risk near the road. These results suggest then that the disturbance caused by Route 175 deteriorated the woodland caribou's perception of habitat quality for up to 5 km from the road, indicating functional habitat loss.

Close to roads, caribou therefore changed their movements, decreased their foraging and modified their energy balance after higher rates of movement and increases in vigilant behaviours. Overall, the results of the MFFP study (2014) illustrate that the roads affected the Charlevoix woodland caribou, by increasing their energy expenditures related to space usage.

The authors of the MFFP study (Leblond and coll., 2014) also concluded that the impact of linear infrastructure on caribou behaviour could have long-term consequences for population dynamics. Should there eventually be an interruption in caribou road crossings, it would divide the population into two subgroups, with each group being more susceptible to local extinction.

Several other studies examining the impact of linear infrastructure on woodland caribou behaviour are all consistent with the MFFP study, even if some of them nuance the significance of the impacts according to type, scale and other factors related to the infrastructures in place, as well as road traffic volume (MFFP, 2014; Dyer, 2002; Rudolph and coll., 2012). Furthermore, some studies underscore the fact that behaviour can vary greatly from one animal to the next in their response to linear corridors (Jackson, 2000).

While the MFFP pointed out (2014) that traffic flow did not influence the number or frequency of caribou crossings, any comparison between Route 175 and BDH still needs to be nuanced, as does the extrapolation of results obtained in the former study when applying it to BDH. In fact, it should be remembered that the annual average daily traffic on Route 175 is 5,000 vehicles—more than 30 times the traffic of the BDH, which averages 155 vehicles (2019 data). The "permeability" of the BDH is possibly more advantageous for caribou and for wildlife in general. It remains to be seen whether the juxtaposition of the railway will affect this permeability and, if so, to what extent.

Using telemetry positioning data received for the current study, a summary analysis was conducted to verify whether the woodland caribou exhibit avoidance of the BDH. The analysis pertained to a 115-km segment, including between KP 130 and KP 245 (MTQ kilometre points), which therefore covers the sensitive 100-km section previously identified in this report. Distance intervals of 0.5 km, 1.0 km, 2.5 km and 5.0 km on either side of the road were map-generated. Telemetry locations of caribou provided by the MFFP were superimposed, and a count was taken of telemetry locations in each interval, for both sides (east and west) of the road. Moreover, a 50-km interval was added for the purpose of verifying the local distribution of caribou using all telemetry data received.

The number of telemetry locations for each distance interval and the number of locations per km^2 are listed in Table 9.9-26. We can see that on the east side of the road, the results are less telling than on the west side, with a slight increase in the number of locations/km^2 from one interval to the next. The weaker density of locations on the east side might limit the ability to differentiate between intervals.

The number of telemetry locations per km² in each interval on the west side of the road increases sharply after one km. This continuous increase up to the spatial limit of the telemetry data received could, however, simply correspond to the progression of intervals toward the central core of the Nottaway caribou herd range. To verify the discrepancies between intervals, a calculation was made of the growth factor for the number of locations (Table 9.9-27 On the eastern side, the most notable increase occurs between the 0.5 km and 1.0 km intervals. On the western side, a substantial increase is found between the 1.0 km and 2.5 km intervals, followed by stabilization.

Based on the information processed, it would seem that the caribou were less present along the BDH roadside for a distance varying from 0.5 km to more than 1.0 km. Yet the summary analysis conducted here does not take into account the HSI for the caribou within these intervals, which is poor for areas close to the road. To the extent that caribou already exhibit a form of road avoidance, the question remains whether the presence of a railway would amplify this avoidance and, if so, to which extent.

At the very least, the telemetry data seem to confirm that the BDH passes through the eastern margin of the Nottaway herd range. In fact, the monitored caribou are less present on the east side of the road than they are on the west side.

A constant increase has been noticed in the density of locations on the west side as of the first kilometre, extending to the spatial limit of the telemetry data received. A railway alignment joined with the BDH would reduce potential impacts, by avoiding a disturbance closer to the central core of the range frequented by the Nottaway caribou herd.

Table 9.9-26 Absolute number of woodland caribou locations per km² within four distance intervals on the BDH west and east sides

Distance intervals (km)	West		East		Total/interval	
	Number	*Number/km²*	Number	*Number/km²*	Number	*Number/km²*
0.5	10	*0.17*	5	*0.09*	15	*0.26*
1.0	18	*0.31*	15	*0.26*	33	*0.57*
2.5	350	*2.03*	47	*0.27*	397	*2.30*
5.0	648	*3.76*	105	*0.61*	753	*4.37*
50.0	24,582	*4.65*	4,931	*0.93*	29,513	*5.58*

Table 9.9-27 Growth factor for number of woodland caribou locations per km² between distance intervals on the BDH west and east sides

Distance intervals (km)	West	East	Total/interval
0.5 to 1.0	1.8	3.0	2.2
1.0 to 2.5	6.5	1.1	4.0
2.5 to 5.0	1.9	2.2	1.9
5.0 to 50.0	1.2	1.5	1.3

Mitigation of potential impacts

For the BDHR alignment, the railway tracks need to be added adjacent and as close as possible to the BDH right-of-way. This is particularly important for the sensitive 113 km section (between MTQ KP 122 and KP 235 of the BDH) (Map 9.5.3). The rationale behind this approach is broken down as follows:

- The BDH, which has existed since the 1970s, is a linear fragmentation element with which the area's wildlife is already familiar (Cassady St. Clair and coll., 2019).
- The juxtaposition of a railway with the current road will inevitably mean an expansion of the infrastructure that wildlife need to cross, although without it being an entirely new disturbance in this sector's landscape.
- Developing an alignment far away from the BDH would cause fragmentation and the loss of habitats farther away in the forest environment, thereby creating a second disturbance that could affect wildlife movement, in addition to creating habitat enclaves between the two infrastructures.
- An alignment that is closer to the BDH would help reduce predation risks for woodland caribou, by limiting predators' ability to travel in newly accessible habitats. Conversely, an alignment developed far away from the existing route would offer predators increased accessibility to new hunting sites.

While adjustments to the alignment would be required in certain locations, based on technical, optimization and safety factors, and joining the alignment to the road would be desired along its entire length for the abovementioned reasons, the problem associated with such an adjustment would be mitigated by the following considerations:

- The adjustments could be limited to specific areas that need this.
- Reducing the alignment curvature effect helps integrate a mitigation measure to address the risk of collisions with wildlife. In fact, sharp curves along railways have been documented as being a major factor for collisions with larger wildlife species, by reducing animals' ability to detect oncoming trains (Cassady St. Clair, 2020).

Adjusting the BDHR alignment in problem areas would help reduce the risk of collision with terrestrial wildlife species.

The expected train frequency along the BDHR alignment is 18 trains weekly. The disruption created by a train's passage could be more intense and last longer than a disruption caused by road traffic (including the passage of heavy vehicles). However, in terms of disruption frequency, the contribution of the railway would be relatively little compared with the expected 155 daily road vehicle passages, of which 50 are heavy transport vehicles.

Bats

Train passage disruptions could eventually provoke some sensitive species to leave suitable habitats located near the alignment. This could be the case especially for northern long-eared bats and little brown bats during the winter. A shared winter roost exists for these two species in the study corridor. Noise and vibrations caused by the repeated passage of trains during the hibernation period could eventually provoke these bats to leave their hibernation habitat in this sector.

<u>Mitigation of potential impacts</u>

Apart from the mitigation measures taken during construction, compensation habitats could be developed to enrich these species' preferred habitats (for example, nesting structures) and promote the medium- and long-term maintenance/re-establishment of their populations. Monitoring activities focused on the most vulnerable populations could also help identify multi-year trends in habitats close to the alignment.

9.9.6.2.4 Review of specific mitigation measures

Measures to protect wildlife, specifically in terms of mitigating how they might be impacted by rail or road traffic, have two primary objectives:

1) provide territorial linkage or connectivity so that wildlife species can move between landscape units divided by the new infrastructure;
2) prevent or minimize the risk of collision between animals and trains or road vehicles.

Certain measures help achieve these two objectives.

9.9.6.2.5 Wildlife crossings

Wildlife crossing structures

The description below of wildlife crossing structures is taken from Raibaldi (2020).

Overpasses

Overpasses in this context are structures, such as wildlife crossing bridges and wildlife footbridges, that span roads or highways (Figure 9.9-8).

Wildlife crossing bridges: These are the largest type of wildlife crossing. From 70 m to 100 m wide, they span highways and are preferably located in valleys or other steeply banked areas. Since they are large structures designed exclusively for the movement of wildlife, they can accommodate the restoration of habitats consistent with the adjacent landscape. These bridges are used by a large variety of animals, both large and small.

Wildlife footbridges: These structures are primarily designed for large wildlife. Their size of 40m to 70 m wide (smaller than that of wildlife crossing bridges) limits the possibility of re-creating habitats as elaborate as those of wildlife crossing bridges. Wildlife footbridges can be used by herpetofauna, bats, birds and small mammals, provided that they have suitable features that meet these species' needs.

Underpasses

Underpasses are designed to pass beneath roads and are generally much more economical to construct than overpasses. Underpasses are installed when road infrastructure is being built or refurbished (Figure 9.9-8).

Viaducts: Viaducts are the largest type of underpass that can be used by wildlife. Although not usually built for this specific purpose but rather to span rivers or deep valleys in rugged terrain, their size and openings suit a wide variety of animal species since disturbance of habitats, vegetation and riparian environments can be minimized when these structures are being built.

Underpasses for large wildlife: This type of crossing is designed for the movement of large wildlife. Since ungulates prefer good visibility and sufficient clearance, the minimum recommended size for this type of crossing is 12 m wide by 4.5 m high, even though the MTQ reports that moose use smaller crossings (6 m x 2 m) on Route 175. This type of crossing can accommodate small and medium-sized mammals, especially if the immediate surroundings offer natural substrate and vegetation cover consistent with the adjacent environment.

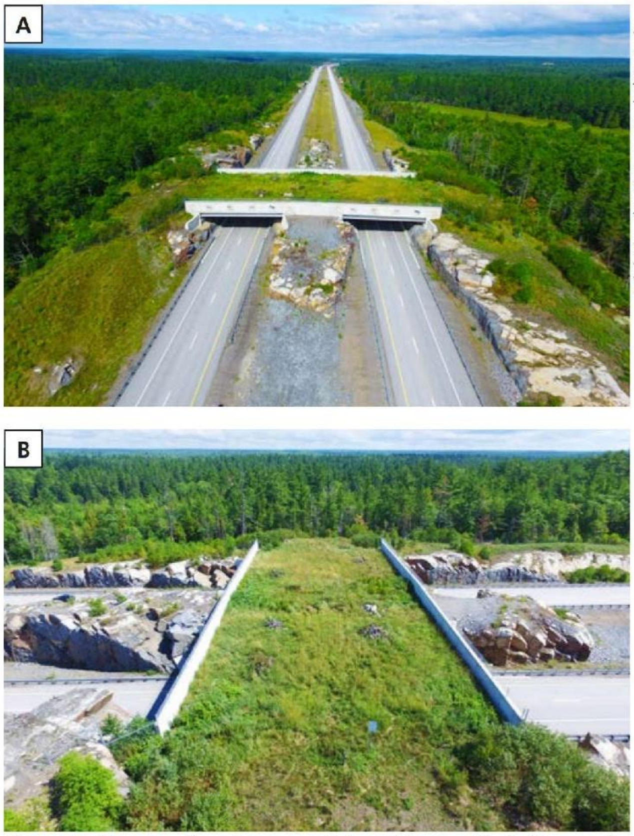


Figure 2. Passage faunique supérieur (écopont) de Burwash: a) implantation au niveau d'un point de concentration des collisions véhicules-faune, afin de réduire les impacts de la construction de l'autoroute sur le corridor de déplacement de la faune; b) plantation d'espèces indigènes d'arbres, d'arbustes et d'herbacées sur le tablier de l'écopont.

Figure 3. Le passage faunique inférieur (écoduc) de Burwash comprend 2 ponceaux carrés identiques et une ouverture médiane clôturée.

Figure 9.9-8 Wildlife overpass crossing (left) and underpass crossing over Route 69 in in Burshaw, Ontario. (right) (Source: Healy, 2019).

Location

Identifying where wildlife crossings are to be located is the primary determinant of their efficacy (USDT, 2011; Gratton, 2014). The most effective crossings are located near established wildlife trails. Suitable locations can be identified using road accident data, telemetry studies, local users, and observations of trails and regular animal crossings (Clevenger 2012; MTO, 2017; Beaulieu, 2018). Connectivity between habitats also needs to be analyzed and considered when selecting wildlife crossing locations. Determining this connectivity and ensuring usage consistent with the surrounding landscape require mapping as well as analysis of data pertaining to vegetation, topography, drainage and anthropogenic land use (Majka and coll., 2007).

Finally, literature and experimenting are not necessarily adapted to the context int he north, such that a more exact number should be subject to more rigorous investigation at future stages.

Distances between wildlife crossings

Another important consideration is determining the necessary distances between wildlife crossings. The distance between crossings primarily depends on landscape fragmentation. The more fragmented the landscape with few places where habitat connectivity is possible (e.g., agricultural landscapes), the fewer the number of crossings. In this regard, the locations of crossings are relatively easy to identify (USDT, 2011) (Figure 9.9-9).

Crossing sites in the case of large, continuous natural areas along the infrastructure need to be determined on the basis of road accident data, telemetry studies, regular animal crossings, etc. The potential migration levels of the species targeted by the new structures must also be considered. In this type of natural space, the number of crossings will need to be relatively high to ensure wildlife movement across the landscape (USDT, 2011) .

In France, experts recommend a wildlife crossing every 400 m (Bédard and coll. 2012). In Québec, researchers found that when white-tailed deer crossings were spaced 1.6 km apart, 71% of the species present in their traditional territory use these facilities (Bissonette and Adair, 2008). The literature suggests that this spacing is consistent with many other examples of wildlife crossings in North America, where documented spacing averages 1.9 km (range: 1.5 km to 6.0 km) (USDT, 2011). Also, eight crossings for large wildlife are slated for Phase III of the construction of Route 85 in Québec—the 40 km section covered by this phase, i.e., 1 crossing / 5 km (MTQ, 2022).

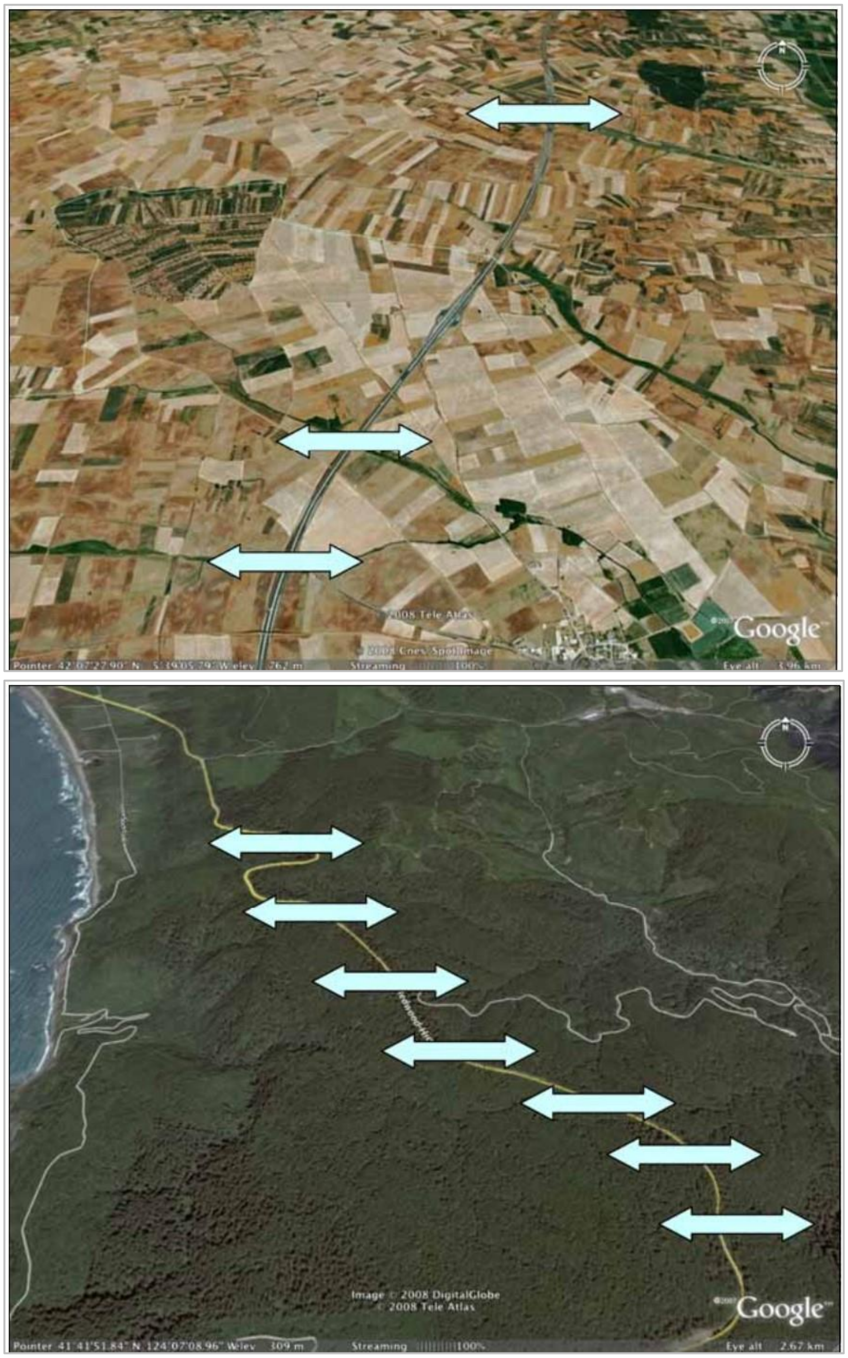


Figure 9.9-9 Comparison of the number of wildlife crossings between a fragmented landscape (left) and a continuous natural landscape (right) (Source: U.S. Department of Transportation, 2011).

Other considerations

The installation of exclusion fencing is necessary to reduce collisions between vehicles and large wildlife by keeping the animals away from the road and directed towards wildlife crossings. Fences should extend at least 100 m into wildlife territory (Beaulieu, 2018; Gratton, 2014) and should not be installed in a way that isolates wildlife covert from major feeding or resting areas.

Wildlife crossings should be provided exclusively for wildlife and not shared with humans. This is because the presence of humans can drive some species away and discourage them from using the crossings (Clevenger, 2012).

Daily and seasonal variations in wildlife activity can influence wildlife preferences for certain types of crossings. Infrastructure maintenance must also be carefully considered in terms of these patterns (Gratton, 2014).

The costs associated with the construction of wildlife crossings are significant. For example, a wildlife footbridge overpass was constructed at Burwash, Ontario as part of the widening of Route 69 (completed in 2012) (Healy, 2019). The total dimensions of this structure are 70 m long and 30 m wide. The ultimate cost of that overpass at the time was CAD$2.9 million, excluding maintenance. A wildlife underpass consisting of two 5 m × 5 m square concrete culverts was also built beneath the highway in the same project at a final cost of approximately CAD$1 million.

Finally, some researchers have proposed that wildlife crossings increase predation rate of prey near these structures. However, there is too much debate on this assumption in the scientific literature to state on this aspect at the present time.

9.9.6.2.6 Collision prevention measures

The aim of the second category of mitigation measures is to modify animal behaviour. For example, in the reflector method, roadside light reflectors are installed facing towards the adjacent natural environment (Carvalho and coll., 2017) (Figure 9.9-10). This is to recreate the situations whereby animals caught in the glare of car headlights cause collisions by the tendency to freeze and then be hit. The reflectors have the effect of making wildlife freeze at a considerable distance from roads.

Audible warning systems designed to reduce collisions between trains and wildlife have received considerable attention over the past decade (Babińska-Werka and coll., 2015; Backs and coll., 2017; Backs, 2020). These devices consist of electronic detectors triggered by passing trains that transmit signals to audible transmitters further down the track (Figure 9.9-10). Animals then become conditioned to associate audible signals with an approaching train. Based on average train speed, the device provides an interval of approximately 30 seconds to 3 minutes of reaction time before the train arrives. These devices have been effective in reducing collisions, particularly on railway tracks with sharp curves that make it difficult for animals to detect trains (Muzzi and Bisset, 1990; Babińska-Werka and coll., 2015).

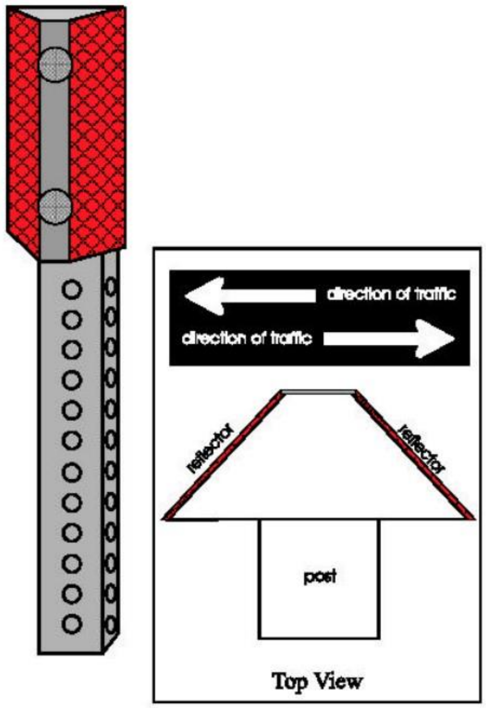


FIGURE 1 Deer reflector example (side and top view) (11).

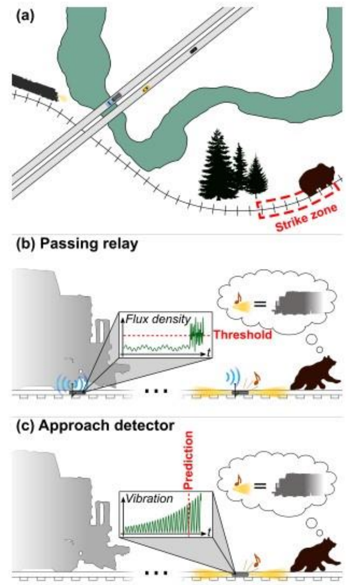


Figure 3.1: Concept for a train-triggered wildlife warning system. (a) Warning signals produced by trains are inconsistently available at some locations: light and sound from the train can be obscured, distorted, masked, or imitated by the surroundings. As a result, wildlife may be unaware of approaching trains or confused by the stimuli and become surprised when the train is very near. (b) The passing relay uses a sensing device to detect trains and relay triggers to a remote warning device. (c) The approach detector uses in-rail vibrations to detect trains at a distance and trigger integrated warning signals. For both warning systems, we rely on animals to associate the warning signals with train approach. Animals that have learned this association leave the track when the warning activates.

Figure 9.9-10 Examples of wildlife warning systems as roadside or railway reflectors (left; source: Iowa state University, Institute for Transportation), and audible warning systems (right; source: Carvalho and coll., 2017).

9.9.6.2.7 Applicability to the alignments

Proposed BDHR alignment

The BDHR alignment runs for some 260 km through an essentially natural and continuous landscape. The construction of wildlife crossings is a highly complex option for this alignment. In fact, there is no information on wildlife collisions on the BDH because such information has not been compiled. It is therefore not possible to characterize the situation in terms of parameters like collisions, riskier locations, species involved, and possible seasonal patterns. Preliminary studies to gather a significant amount of data over several years would therefore be required. This lack of information is directly reflected in a lack of indicators concerning potential crossing locations for wildlife, particularly for wide-ranging species like moose, black bears, wolverines, etc.

In addition, moose inventory data (2021) only cover the winter season and the species is more prevalent in the southern half of the BDHR alignment. Furthermore, since moose density, like black bear density, is very low in this area, it may be difficult to identify migration corridors.

On the other hand, the telemetry monitoring data for woodland caribou are more complete. These show a relatively homogeneous north-south distribution pattern on each side of the sensitive 113 km section of the BDH (MTQ KP

122 to KP 235). This distribution may suggest that caribou cross the road without precise corridors, which is likely in view of the continuous natural environment along this road.

Given the low daily traffic volumes on the BDH, wildlife collisions are likely to be low. However, increased traffic on the BDH over the next few decades could lead to more collisions.

The number of wildlife crossings to provide landscape-scale connectivity for extremely migratory species, like large wildlife, needs to be high. Based on recommendations in the literature, the spacing between crossings along the 260 km of the BDH should be every 1.5 km to 6.0 km, which would mean from 43 to 173 crossings. The number of crossings over the 113 km of the sensitive section would then be between 19 and 75.

Fencing to direct animals towards these crossings would also need to be installed. In fact, connectivity at the scale covered by these structures might end up being more affected by fencing than by the railway track adjacent to the road. The precarious situation of woodland caribou is basically due to a high rate of predation, which is accentuated when predators have access to roads or other features that help them prey on caribou. Predators may benefit from some predictability in caribou migrations when caribou use crossings on a fairly regular basis. However, this aspect remains debatable.

In keeping with the objectives of enhancing wildlife connectivity or preventing wildlife collisions, wildlife crossings would need to be extensive to cover both the BDHR and the BDH. Wildlife crossings and the considerable extent of associated fencing would inevitably affect wildlife movement, including that of species important to hunters and trappers. This redirected wildlife movement would result in reduced wildlife traffic at some traplines, while other traplines closer to the crossings would benefit.

The use of sound repellents to avoid or minimize collisions between trains and wildlife, especially large species, could be considered for stretches of the track where crossing is particularly risky, e.g., large water crossings and railway sections with sharp curves.

Proposed Grevet-Chapais railway alignment

The Grevet-Chapais alignment, consisting of a former railway line that is currently used as both a logging road and as a snowmobile trail during the winter months, is 162 km long. The rehabilitation of this alignment does not entail any new landscape fragmentation or wildlife barriers because the wildlife already using this area are accustomed to crossing the existing road. Additional structures to facilitate wildlife movement would probably not offer significant improvements in connectivity.

As with the BDHR alignment, the entire length of the Grevet-Chapais alignment lies within a continuous natural landscape. Based on recommendations in the literature, the spacing between crossings should be from 1.5 km to 6.0 km, which represents between 28 and 110 crossings along the entire route.

In this case as well, fencing to direct animals into the crossings and ensure that the crossings are effective will need to be installed. At the scale inherent in these facilities, connectivity might ultimately be more affected by fencing than by the railway itself. The precarious situation of woodland caribou is basically due to a high rate of predation, which is accentuated when predators have access to roads or other features that help them prey on caribou. Predators may thus benefit from some predictability in caribou migrations when caribou use crossings on a fairly regular basis.

Wildlife crossings and the considerable extent of associated fencing would inevitably affect wildlife movement, including that of species important to hunters and trappers. This redirected wildlife movement would result in reduced wildlife traffic at some traplines, while other traplines closer to the crossings would benefit.

Although the Grevet-Chapais alignment has few sharp curves, the use of sound repellents to prevent or minimize collisions between trains and wildlife, particularly large species, could be considered wherever stretches of the track, such as large water crossings, pose specific risks.

Proposed second Mistissini access road

Construction of wildlife crossings on this road does not appear to be necessary for the following reasons: the relatively modest size of the proposed road, the integration of a relatively large portion of existing forest roads into the proposed new road, and minimal use of this area by woodland caribou. Furthermore, the likely limited traffic on this road will not constitute a significant issue in terms of vehicle collisions with wildlife.

9.9.7 Limitations

There are inherent limitations when existing environmental data are used in feasibility studies due to the approximate nature of the data in both spatial and temporal terms.

9.9.7.1 Wildlife

9.9.7.1.1 Woodland caribou

Important, precise and relatively complete information at all relevant scales was drawn from the telemetry locations transmitted by the MFFP concerning the frequency and distribution of caribou near the alignments, based on the monitoring of 151 woodland caribou from 2005 to 2021. The quality of woodland caribou habitat along the alignments and potential impacts at this level can also be assessed from the habitat quality index for woodland caribou.

9.9.7.1.2 Moose

Moose density in the vicinity of the Grevet-Chapais alignment can be calculated from the relatively precise information on moose obtained from the aerial survey of moose conducted in winter 2021 in hunting zone 17 where the alignment is located. A moose inventory is however conducted at the moment of the present writing in zone 22, but results will not be ready for publication yet.

Conversely, there are significant limitations to the accuracy and timeliness of this kind of information in the case of hunting zone 22 where the BDHR and Mistissini road alignments are located. Indeed, the last moose inventory in zone 22 dates back more than 30 years, while other moose density figures for this vast zone since then are limited to estimates. No information is therefore available on moose activity near these two alignments or on the actual moose population in these areas.

The quality of moose habitat along the alignments and potential impacts at this level can also be assessed using the habitat quality index for moose.

9.9.7.1.3 Black bear

Information on black bears is limited to density estimates over extremely large areas, namely, hunting zones 17 and 22 and FAMUs 88, 90 and 91. Information about black bears in relation to the alignments is therefore not available.

9.9.7.2 Waterfowl

Although observations of Canada geese are reported in the databases consulted, these do not necessarily correspond to specific nesting sites in the vicinity of the proposed alignments. It is therefore not possible to determine where waterfowl nests are located near the alignments.

On the other hand, the regional map of potential wetlands provides relevant information on potential goose nesting sites near the alignments. Moreover, since waterfowl prefer nesting sites on ombrotrophic and minerotrophic peat bogs, the number of potential nesting habitats near the alignments can be estimated.

9.9.7.3 Fish and fish habitat

The three study alignments involve a total of approximately 650 water crossings and water bodies of various sizes. In 2021 and 2022, approximately 20% of these (the largest) were selected for field inventories and habitat characterization for the fish present.

To meet the Phase 1 feasibility study timelines for the Grande Alliance report, fish inventories were conducted in late summer (Mistissini) and early fall (BDHR and Grevet-Chapais). However, this time of the year is not optimal for obtaining a representative inventory of the environment. With the exception of lake whitefish and brook trout, the populations of several species are lower at this time of year—unlike spring, for example, which coincides with the spawning period for some species (e.g., lake sturgeon, pike, walleye and sauger). Late summer when warmer water is conducive to greater fish activity (movement) is another good time of the year for taking fish inventories.

Another limitation is the length of time the fishing equipment was being used: nets were only set for a few hours in order to prevent fish from becoming trapped and dying, as opposed to 12-hour periods or full nights. The likelihood of catch in terms of both numbers of the same species and an overall picture of the diversity of species present was therefore significantly reduced.

9.9.7.4 Species at risk

Using existing databases to document the prevalence of species at risk, whether plants or wildlife, involves inherent uncertainty because of a lack of field validation. Indeed, the confirmed presence of a species at risk in a specific location by a field survey indicates that the species was present only at a given time. However, even if existing databases show no species at risk at a particular location, it cannot be concluded that there are no such species there if the site has not recently been the subject of a field survey. In the case of the study alignments, the absence of records of certain species at risk near the alignments does not mean that these species are not present. Furthermore, the identified presence of certain species at risk in habitats in the region similar to those near the alignments under study indicates that some species at risk are potentially present along the entire length of these alignments.

9.10 WILDLIFE MANAGEMENT

The implementation and execution of large-scale infrastructure projects, such as railways, require large contingents of workers to come to the work sites. The Eeyou Istchee James Bay territory is a vast area with large tracts of forest and bodies of water that support a variety of terrestrial and aquatic wildlife. Some of these wildlife species are prized for sport hunting and fishing. The arrival of workers who engage in these activities on a recreational basis would result in potential over-harvesting of wildlife resources and risk of land use conflicts with the Cree communities who depend on these resources for subsistence and cultural purposes.

This section therefore addresses the issues and potential solutions for ensuring harmonious use of wildlife resources by the Cree communities and non-Indigenous users, including workers and other sport hunters and fishers.

9.10.1 Information common to all three alignments

A common denominator for the three study alignments is the short duration of the work requiring large numbers of workers.

9.10.2 Potential impacts and mitigation measures

The documentation that was consulted and data sources used to assess the potential impacts and mitigation measures are found in Table 6 of Appendix 1. The legislative provisions related to environmental assessments are found in Appendix 4.

9.10.2.1 Construction phase

The potential impacts on wildlife resources would occur primarily during the construction phase, as this is when the largest number of workers would be in the area.

As indicated earlier in this section, the main impacts during the construction phase would be as follows:

- Over-harvesting of wildlife resources due to the sudden arrival of large numbers of workers who could practise sport hunting and fishing during the entire construction phase, i.e. a number of years.
- Added pressure on wildlife resources that could also lead to potential conflict with the Cree communities who depend on these resources for subsistence and culture.

These are important issues and, in light of past experience, there is an understandable need to structure and manage hunting and fishing during the construction phase. To that end, the Weh-Sees Indohoun hunting and fishing management system provides a highly relevant precedent.

9.10.2.1.1 Weh-Sees Indohoun management plan

During the construction phase of the Eastmain-1 and Eastmain-1-A–Sarcelle–Rupert hydroelectric complexes (2003-2011), Hydro-Québec and the Cree stakeholders, via the Weh-Sees Indohoun Corporation, with the support of the Québec ministère des Ressources naturelles, de la Faune et des Parcs (now the MELCCFP), established a sport hunting and fishing management system. The plan involved the following steps and components:

- A special management zone covering more than 15,000 km^2 was accessible to workers who wanted to engage in hunting and fishing. This zone encompassed all of both hydroelectric complexes and the workers' camps (with the exception of Camp Oujeck).

- A wildlife management and protection plan (restrictive regulations) was developed in conjunction with tallymen affected by the presence of the construction sites and camps.
- Presence of information officers
- Establishment of the Weh-Sees Corporation, comprising a committee to supervise the special management zone

Some activities, such as trapping of hares and fishing for sturgeon and whitefish, were restricted to those covered by the James Bay and Northern Québec Agreement (JBNQA) across the entire territory. Hunters and fishers not covered by the JBNQA were subject to the laws and regulations in force in the territory and had to have sport hunting or fishing licences issued by the Québec government and applicable to all category III lands. To hunt and fish on category I or II land, authorization had to be issued by the band councils involved.

Sport hunting and fishing activities were monitored throughout the construction phase to assess their impact, promote wildlife and ecosystem conservation and manage the harvesting of wildlife resources. At the behest of the Cree communities, the Cree Trappers Association and the Cree Nation Government, the WSI special zone remained in effect for seven years after the Eastmain-1-A—Sarcelle—Rupert complex was commissioned, i.e. until 2018.

Regulations governing sport fishing also included the following measures in particular:

- Recreational fishers had to obtain a special fishing licence. Each licence was valid for just one day and for one specific body of water.
- Catches had to be registered (declared);
- Some sections of watercourses or lakes were closed for fish harvesting;
- Daily and annual catch limits were set.
- A maximum quota was applied to each species and each body of water. Once the quotas were reached, the water body was closed for the season.
- The catch limits were more restrictive.
- The regulations governing sport hunting included the following measures in particular:
- Hunting of caribou was prohibited;
- Some sectors of the special management zone were closed to moose hunting;
- In the sectors where moose hunting was permitted, restrictions applied, including harvesting limited to males and calves and an abbreviated hunting season.
- For waterfowl and small game, the provincial regulations applied.

In the end, the Weh-Sees Indohoun management plan measures were successful in ensuring conservation of resources in the lakes where fishing was permitted and the tallymen were satisfied with the steps taken. In addition, the management and protection measures and the mandatory declaration of catches made it possible to closely monitor the special management zone and no overharvesting was reported.

Considering the scale of the construction sites and the number of workers that would be required for the construction work, particularly for the BDH and Grevet-Chapais railway alignments, implementation of a protection and management plan similar to the Weh-Sees Indohoun plan would be appropriate, if not essential. However, implementation of a wildlife management plan in the context of vast construction sites would require a great deal of planning and coordination in advance of the start of work.

9.10.2.1.2 Sensitive areas and habitats

The WSI management plan included specific considerations for protected areas, as well as for existing sensitive environments and habitats, including closure of zones or bodies of water, reduction of quotas and tighter monitoring of use. Indeed, the goals set out for protected areas, including territorial reserves for protected area purposes, biological refuges, aquatic reserves, biodiversity reserves and land intended for the protection of woodland caribou, could be compromised by sudden or excessive use of wildlife resources. We reiterate that protection of such lands is intended notably to:

- Maintain biodiversity (resting, breeding and food supply areas for wildlife, away from human activity, to promote the natural evolution of species)
- Protect landscapes (natural beauty of sites, conservation of an aesthetically pleasing environment)
- Maintain ecological processes that are essential to life and to our planet’s balance (oxygen production, carbon and pollutant sequestration, soil regeneration, climate regulation);
- Serve as scientific study areas (natural “laboratories,” control areas or reference sites for ecosystems);
- Educate and raise awareness of the importance of natural environments (connection with nature);
- Protect social, cultural and spiritual dimensions (traditional and ancestral living environment for some communities)
- Offer economic benefits (diversification of economies, ecotourism, preservation of environments intended for subsistence activities).

9.10.2.1.3 BDHR alignment

Potential impacts

The BDHR alignment stretches over approximately 253 km, consisting of a linear construction zone directly touching a minimum of 13 traplines.

There are numerous bodies of water with species of fish for sport fishing and subsistence near the alignment that may be accessible by forestry roads. The water bodies include the following, among others:

Matagami Lake – Olga Lake – Waswanipi River – Poncheville Lake – Ouescapis Lake – Desorsons Lake

Rodayer Lake – Colomb Lake – Broadback River – Rupert River

Taking one example, if we consider access to wildlife resources in a 5-km corridor (2.5 km on each side of the alignment), we’re talking about 1,300 km^2 of surface area that would be likely to face pressure from sudden hunting and fishing over the entire construction period.

Unlike the above-mentioned Weh-Sees Indohoun special management zone, the BDHR construction site would be linear and stretch for 253 km.

In addition, the northern portion of the alignment would cross or run alongside about 90 km of significant conservation areas. These include:

- 40 km of land intended for the protection of forest resources;
- 15-km stretch alongside the Chisesaakahiikan territorial reserve for protected area purposes;
- 35-km stretch alongside the proposed Chisesaakahiikan and Broadback River biodiversity reserve.

Hunting and fishing are permitted in most protected areas. Excessive harvesting of wildlife resources and significant disruption of wildlife associated with larger numbers of people in the conservation areas are likely to be a critical issue, however, given the conservation goals set for these areas of land. Within the management plan itself, careful consideration must be given to this issue.

The construction work on the BDHR alignment would not result in a significant increase in access to the territory. Indeed, for most of its path, the BDHR alignment runs beside or very near the highway. Access to the construction site would therefore not necessarily require construction of roads over long distances in the natural environment.

Mitigating potential impacts

Given the linear nature of the railway infrastructure, a general special management zone could involve a strip on either side of the alignment of a width to be determined that would encompass all work sites and workers' camps. Current users affected by the creation of the special zone (e.g.: the tallymen) would participate in defining the terms and conditions for managing the harvesting of wildlife resources (hunting prohibited in certain zones, closure of lakes to fishing, reduction of quotas, etc.).

9.10.2.1.4 Grevet-Chapais alignment

Potential impacts

Although the Grevet-Chapais railway alignment is not as long as the BDHR alignment, it still stretches for approximately 162 km, would directly cross at least 10 traplines and has sizeable bodies of water nearby:

Waswanipi Lake – Pusticamica Lake – Bachelor Lake - Opawica Lake –Wachigabau Lake – Lewis Lake

Lapparent Lake

Further, one of the bodies of water, Waswanipi Lake, is designated as the "proposed Waswanipi Lake aquatic reserve," covering an area of 577.4 km^2. Although fishing is permitted in this type of protected area, a sudden increase in pressure on fish communities from harvesting (overuse) could compromise conservation of the aquatic biodiversity in this aquatic reserve.

Mitigating potential impacts

Similar to the BDHR alignment, a special management zone could be established within a corridor on either side of the alignment, according to terms and conditions like those identified above for the BDHR.

The construction work on the Grevet-Chapais alignment would not result in an increase in access to the territory, because it is set entirely on an existing trackbed that is already in use, with traffic from trucks and recreational vehicles in the winter.

9.10.2.1.5 Mistissini road alignment

Potential impacts

Construction of the Mistissini road would not involve a large construction zone, compared with the requirements for the BDHR and Grevet-Chapais alignments. Nevertheless, throughout the construction phase, during which the services of workers from outside of Mistissini may be required, some of those workers may be interested in hunting and fishing opportunities near the community. There is therefore a potential for overharvesting of wildlife resources and conflict with Cree users in the sector. The Mistissini road alignment would also intersect three traplines.

A portion of the western boundary of the Mistissini road alignment is located in a woodland caribou connectivity landscape feature, running for approximately 12 km before it joins the Route du Nord. Note that a connectivity landscape feature is an area intended for woodland caribou conservation and is defined as a disturbed area frequented by the species from time to time.

Mitigating potential impacts

Although construction of the Mistissini road would not require a large number of workers for a lengthy period, hunting and fishing activities should nevertheless be structured to some degree. Some lakes could be designated for sport fishing and be subject to wildlife resource management and protection measures similar to those identified earlier in this section. The woodland caribou connectivity landscape feature should not be included in the designated sport hunting zones.

9.10.2.1.6 Operation phase

During the operation phase, there would be a potential increase in pressure on wildlife resources as a result of greater access to wildlife, but there would be no new road construction permitting increased traffic deeper into the territory.

9.10.2.2 BDHR alignment

Operation of the BDHR would not require the extended presence of personnel on site. The pressure on wildlife resources and the risk of potential conflict with Cree communities would be approximately the same as the conditions that were in existence before the construction of the railway.

The existence of the railway would not significantly increase access to the territory. Indeed, for most of its path, the BDHR alignment runs beside or very near the highway, which has been in existence since the 1970s and already provides access to the territory. Therefore, construction site access would not result in the appearance of new roads giving access to the natural environments over long distances.

9.10.2.2.1 Grevet-Chapais alignment

Operation of the Grevet-Chapais railway would not require the extended presence of personnel on site. The pressure on wildlife resources and the risk of potential conflict with Cree communities would be approximately the same as the conditions that were in existence before the construction of the railway.

Operation of the Grevet-Chapais railway would not increase access to the territory, because the alignment lies entirely on an existing trackbed that was already in use, with traffic from trucks and recreational vehicles in the winter.

9.10.2.2.2 Mistissini road alignment

Operation of the Mistissini would not require the extended presence of personnel on site.

The road would, however, represent a new opening to the territory that could potentially increase the use of wildlife resources locally.

9.10.3 Limitations

Processing of the information for the wildlife management component did not require interpretation of quantitative information or existing data. The usual caveats and warnings about limitations are therefore not necessary.

9.11 WATERSHEDS, WETLANDS AND SENSITIVE HABITATS

9.11.1 Information common to all three alignments

9.11.1.1 Watersheds

A watershed is an ecosystem that includes both surface water and groundwater and corresponds to the area of land drained by a watercourse (including its tributaries), lake or wetland, within which water accumulates as it leaves its upstream source and runs downstream to a single exit point, i.e. the watershed outlet (AGRCEQ, 2017). Every watercourse, lake or wetland has a watershed, with smaller ones fitting into the larger ones. Thus, depending on their size, watersheds can be classified into one of eight levels, with level 1 representing the largest, territorial-level watersheds (multi-scale hydrographic basins of Québec, MELCCFP).

The watersheds (or hydrographic basins) in northern Québec are among the largest in the province. The study areas (BDHR, Grevet-Chapais, Mistissini) intersect three major watersheds (level 1): Nottaway (65,786 km^2), Broadback (20,849 km^2) and Rupert (43,253 km^2) (Map 9.11.1) (James Bay regional land and natural resource commission, 2009).

More than two decades ago, the watershed was chosen as the best entity for global, integrated water management (AGRCEQ, 2017). Within the boundaries of the watershed, ecosystems, land uses and human activities influence water quality from upstream to downstream.

The components of the watershed ecosystem are closely tied and interdependent, involving synergistic interactions between runoff, groundwater and wetlands, with wetlands modulating water quality, flow and aquatic habitats in the watershed (AGRCEQ, 2017).

It should be noted that the hydroelectric developments at La Grande and Eastmain-1-A-Sarcelle complexes have modified the region's hydrographic network (James Bay regional land and natural resource commission, 2009).

9.11.1.2 Fish movement

Given the extent of the water system in the study areas and the presence of fish throughout the watersheds they intersect and because the connectivity of all lakes and watercourses could not be assessed on a case-by-case basis, all of the study sectors are considered fish habitat. It should be noted that an obstacle is considered impassable for fish if any of the following are present:

- Waterfall more than 1 m in height
- Laminar flow over bedrock with a slope greater than 10% over a distance of at least 8 m where the water depth is less than 5 cm
- Cascade with a slope greater than 15% over more than 20 m
- Significant difference in elevation more than 3 m in length

It should be noted that depending on the species present and the hydrological conditions at a given time, more restrictive conditions could be used to define passability of an obstacle.

During field visits to the selected water crossings in 2021 and 2022 (more details in section 9.9.1.2.3 and Appendix 6.29), no impassable obstacle was identified. Most of the obstacles observed were beaver dams and these were deemed to have "qualified passability," i.e. they could be passed by fish most of the time except in certain hydrological conditions, such as low water periods.

Since the three study areas are considered fish habitat on a precautionary basis, bridge and culvert development must be carried out in compliance with the regulations and the applicable guides for work in the area of water flow (e.g.: *Regulation respecting the regulatory scheme applying to activities on the basis of their environmental impact*, *Regulation respecting activities in wetlands, bodies of water and sensitive areas*) and must allow for free fish movement. The details of each structure should be assessed on a case-by-case basis at the final design stage according to the legislation in force.

Since water crossing infrastructure (bridges and culverts) will be built in accordance with provincial and federal directives, which have been established in order to ensure that hydrological conditions and free passage of fish are maintained, fish movement in the watersheds should therefore not be affected by the presence of such structures in the water body.

Lastly, in a context of climate change, the dynamics of northern water systems could be modified and the design of the proposed new infrastructure (bridges, culverts) will have to take such changes into account (e.g.: higher peak flows). In particular, some models (Ouranos, 2017) suggest that precipitation will increase, including extreme precipitation events (over short periods of time). Moreover, a decrease in precipitation in the form of snow in winter and an early spring are also anticipated in these models, a trend that has already be observed in the data collected to date.

9.11.1.3 Wetlands

The wetlands in the watershed play an important role in ecosystem functions and watershed dynamics. These areas influence watershed hydrology and water quality, because they recycle nutrients, filter certain pollutants and play a role in climate processes by absorbing and storing elements like carbon and sulphur (Hanson and coll., 2008). Furthermore, wetlands restore the water table and provide unique habitats for fish, waterfowl and many other wildlife species. They also form natural sun screens and windbreaks and contribute to landscape quality. Wetlands are valued by Cree users for their intrinsic value and their ecological functions, but also for the practice of their activities (e.g.: waterfowl hunting, plant collection).

There are numerous wetlands in Eeyou Istchee and it would therefore be difficult to characterize all of them in detail. However, based on the map of potential wetlands in Québec (2019), it is possible to classify the potential wetlands present according to the following types:

- Shallow water: permanent presence of standing or running water. When vegetation is present, it is made up of floating or submergent plant species. This type of wetland is a transition stage between a wetland and a watercourse.
- Marsh: permanently or periodically inundated, but with a waterlogged substrate most of the time. Vegetation is made up of emergent hydrophilic grasses.
- Swamp: dominated by woody plants with seasonal flooding or a high water table with a mineral or organic substrate:
  - Tree swamp: vegetation more than 4 m high on >25% of the cover;

   - Shrub swamp: shrubs from 0 to 4 m high on > 25% of the cover.

- Bog/fen: substrate of peat at least 30 cm thick, made up primarily of fragments of sphagnum moss and partially decomposed organic material, with plant cover dominated by sphagnum mosses and an acidic environment:
   - Wooded peatland: woody vegetation more than 4 m high over >25% of the cover;
   - Open minerotrophic peatland (fen): woody vegetation covering <25%, fed by runoff;
   - Open ombrotrophic peatland (bog): woody vegetation covering <25%, fed by rainwater.

9.11.1.4 Sensitive habitats

The critical habitats for fish in general, such as breeding or nursery sites, identified during the field work in 2021 and 2022 are covered in the sections pertaining to the study alignments in section 9.9 on wildlife (see also maps 9.9.10 to 9.9.12).

9.11.1.5 Legal wildlife habitats in Québec

Of the 11 wildlife habitats identified in the *Regulation respecting wildlife habitats* (lands in the domain of the State, MFFP, 2015) and discussed in section 9.9.1.4 of this document pertaining to wildlife, five involve aquatic or semi-aquatic species:

- A water fowl gathering area;
- Fish habitat;
- Muskrat habitat;
- Heronry;
- Island or peninsula inhabited by a colony of birds.

9.11.1.6 Lake sturgeon habitat

Lake sturgeon, which is a species of special concern federally and likely to be designated as threatened or vulnerable in Québec, is present in the area covered by the three study alignments, which is within the designatable unit for lake sturgeon (UD7: south Hudson Bay and James Bay populations) (Map 9.11.2).

9.11.1.7 Sensitive environments of importance to Cree users

The wetlands and habitats that are important to Cree users (e.g.: waterfowl hunting, fishing zones) have also been taken into account. The data collected during consultations with area users were compiled in the section on land use (section 9.2), including potential impacts and mitigation measures.

9.11.2 Potential BDHR alignment

9.11.2.1 Watersheds

The BDHR alignment intercepts 271 sub-watersheds located in the greater Nottaway, Rupert and Broadback watersheds (Level 1), including 112 that qualify as surface flow, with no watercourse. Of the 159 watersheds that have watercourses, the most significant hydrographic systems are as follows (see Map 9.11.3):

Bell River - Waswanipi River - Broadback River - Rupert River - Muskiki River

The BDHR alignment will potentially cross 282 watercourses and water bodies.

The details related to water crossings (culverts and bridges) are presented in Table 9.11-1.

Table 9.11-1 Details of planned structures for crossings for the potential BDHR alignment

Characteristics	Bridges	Arch culverts	Closed culverts
Number	16	39	259
Average width of watercourse (m)	79.7	10.1	N/A
Minimum	10.0	5.0	N/A
Maximum	16.6	30.0	N/A
Average diameter (m)	N/A	5.3	1.0
Minimum	N/A	2.2	0.6
Maximum	N/A	11.3	2.2
Average width of right-of-way (m)	43.8	36.7	27.3
Minimum	16.6	16.7	15.4
Maximum	78.8	66.9	70.0

9.11.2.2 Wetlands

The proposed BDH railway could affect 3.24 km^2 (324 ha) of wetlands, considering encroachment of the total width of the right-of-way. The wetlands are divided into different categories as detailed in Table 9.11-2 and on Map 9.11.4. The types of wetlands most heavily affected (86%) by the proposed railway right-of-way are swamps and ombrotrophic peatland or bogs. These are the most abundant types of wetlands within the study corridor and accordingly may be the most abundant locally as well.

Table 9.11-2 Wetlands potentially affected within the proposed BDH railway ROW

Class	Potential encroachment area (ROW)	
	Area (km^2)	Proportion (%)
Shallow open water	0.05	1.5
Marshes	0.0	0.0
Swamps	1.56	48.1
Bogs	1.23	38.0
Fens	0.17	5.25
Unclassified wetlands	0.23	7.1
Total	3.24	100.0

9.11.2.3 Sensitive habitats

The critical habitats identified for fish that are specific to the potential BDHR sector are presented in section 9.9.2.3.

9.11.2.4 Legal wildlife habitats

None of the wildlife habitats defined in the *Regulation respecting wildlife habitats* are found within 30 km of the potential BDHR alignment.

9.11.2.5 Lake sturgeon habitat

Throughout the watersheds of the potential BDHR alignment, a number of rivers and lakes are identified as lake sturgeon habitats (see Table 9.11-3). The BDHR alignment intersects four rivers and one creek designated as lake sturgeon habitat (Fisheries and Oceans Canada, 2022), i.e. the Bell, Waswanipi, Nottaway and Rupert rivers and Kaumwakweyuch Creek.

Table 9.11-3 Watersheds, sub-watersheds and lakes near the potential BDHR alignment identified for presence of lake sturgeon habitat

Watersheds	Sub-watersheds	Lakes
Bell River	Bell River	-
Waswanipi River	Waswanipi River	Matagami
		Olga
		Au Goéland
		Maicasagi
		Chensagi
Nottaway River	Nottaway River	Dusaux
		Soscumica
	Soscumica Lake tributary (KP 70)	-
Broadback River	Broadback River	Lac Giffard
		Keniapiscau
		Quénonisca
		Opataouaga
		Poncheville
		De La Hauteur Des Terres
Rupert River	Rupert River	Mesgouez
	Kaumwakweyuch Creek	-
	Jolliet River	Jolliet
	Nemiscau River	Nemiscau

Note:
Grey shading indicates watercourses or water bodies crossed by the alignment.

9.11.3 Potential Grevet-Chapais railway alignment

9.11.3.1 Watersheds

The Grevet-Chapais alignment intersects 128 sub-watersheds in the Nottaway River watershed (level 1). They are divided into two sub-watersheds (level 2), i.e. the Waswanipi River sub-watershed, which covers about 96% (158 km) of the alignment and the Bell River sub-watershed, which accounts for about 4% (7 km) at the western end of the alignment (Map 9.11.5). Of the 128 sub-watersheds, three do not have a watercourse.

The Grevet-Chapais alignment intercepts 335 watercourses and water bodies varying in size. All are in the Waswanipi River sub-watershed, with the exception of one crossing in the Bell River sub-watershed. The most significant hydrological systems influenced by the alignment are as follows:

O’Sullivan River - Bachelor River - Opiwaca River - Obatogamau River

9.11.3.2 *Wetlands*

Table 9.11-4 and on Map 9.11.6. The types of wetlands most heavily affected (72%) by the alignment are swamps and ombrotrophic peatland or bogs, which are in fact the most abundant types of wetlands within the study corridor and accordingly may be the most abundant locally as well.

Table 9.11-4 Wetlands potentially affected within the potential Grevet-Chapais railway right-of-way

Class	Potential encroachment area (ROW)	
	Area (km^2)	Proportion (%)
Shallow open water	0.53	*16.4*
Marshes	0.00	*0.0*
Swamps	1.54	*47.5*
Bogs	0.82	*25.3*
Fens	0.32	*9.9*
Unclassified wetlands	0.03	*0.9*
Total	**3.24**	*100.0*

9.11.3.3 *Sensitive habitats*

The critical habitats identified for fish specific to the Grevet-Chapais sector are presented in section 9.9.3.4.

9.11.3.4 *Legal wildlife habitats*

None of the wildlife habitats identified in the *Regulation respecting wildlife habitats* are found within 15 km of the potential Grevet-Chapais railway alignment.

9.11.3.5 *Lake sturgeon habitat*

The watersheds in the potential Grevet-Chapais railway alignment sector have sizeable surface areas for lake sturgeon habitat (Table 9.11-5). The existing alignment intersects two rivers and one lake designated as lake sturgeon habitat, i.e. the Waswanipi and Obatogamau rivers and Opawica Lake.

Table 9.11-5 Watersheds, sub-watersheds and lakes near the potential Grevet-Chapais railway alignment identified for presence of lake sturgeon habitat

Watersheds	Sub-watersheds	Lakes
Bell River	Bell River	Taibi
		À La Pluie
		Parent Boucane
		Faillon
	Daniel River	-
	De l'Ouest channel	-
	Baptiste River	-
	Laflamme River	-
	Florence River	-
	Wedding River	-
	Quévillon River	-
	Culliver River	-
	Taschereau River	-

Watersheds	Sub-watersheds	Lakes
Waswanipi River	Waswanipi River	Matagami
		Waswanipi
		Olga
		Au Goéland
		Maicasagi
		Chensagi
	Opawica River	Opawica
		Wachigabau
		Lichen
		Céré
		Lessard
		La Ronde
	Chibougamau River	-
	Obatogamau River	Mechamego
	Deux Orignaux River	De La Tête De Héron
		Kapunapotagen

Note:
The grey shading indicates watercourses or water bodies crossed by the alignment.

9.11.4 Potential Mistissini 2nd access road alignment

9.11.4.1 Watersheds

The potential Mistissini 2nd access road alignment intersects 11 sub-watersheds within the major Rupert and Nottaway river watersheds (level 1). This alignment crosses 38 watercourses and water bodies, of which the most significant hydrological systems are the Pipounichouane River and the upper sections of the Mistago and Blaiklock river watersheds (Map 9.11.7).

9.11.4.2 Wetlands

Table 9.11-6 and on Map 9.11.8. The types of wetlands most heavily affected by the alignment (90%) are swamps and ombrotrophic peatland or bogs. These are also the most abundant types of wetlands in the alignment and accordingly may be the most abundant locally as well.

Table 9.11-6 Wetlands potentially affected within the proposed 2nd Mistissini access road right-of-way

Class	Potential encroachment area (ROW)	
	Area (km2)	Proportion (%)
Shallow open water	0.0006	*0.3*
Marshes	0.0000	*0.0*
Swamps	0.0900	*52.9*
Bogs	0.0680	*40.0*
Fens	0,007 0	*4.1*
Unclassified wetlands	0.0060	*3.5*
Total	0.17	*100.0*

9.11.4.3 Sensitive habitats

The critical habitats identified for fish specific to the Mistissini sector are presented in section 9.9.4.3.

9.11.4.4 Legal wildlife habitats

No wildlife habitat identified in the *Regulation respecting wildlife habitats* is found within 20 km of the potential Mistissini 2nd access road alignment.

9.11.4.5 Lake sturgeon habitat

The potential Mistissini 2nd access road alignment does not have any watersheds with recognized lake sturgeon habitat.

9.11.5 Potential impacts and mitigation measures

9.11.5.1 Construction phase

The potential impacts on watersheds, wetlands and critical habitats as a result of the construction work, as well as protection and mitigation measures, are general and standardized. Therefore, the impacts and measures apply to all three alignments, with no need for specific details for each one.

9.11.5.1.1 Watersheds

Watersheds are geographic spaces defined according to their drainage system that converges at a lower point (watercourse). The main impacts of the construction work are potential degradation of surface water and groundwater quality and restriction of flow in the watercourses. These impacts have already been covered in the section on impacts on fish habitat (see section 9.9.5.1).

9.11.5.1.2 Wetlands

During initial site preparation, construction site and access road development will require removal of vegetation, including in wetlands. Loss of wetlands will be permanent in the location of the new rights-of-way. Losses may also occur if the new infrastructure cuts off water supply to the remaining wetlands. Installation of drainage pipes under the infrastructure to ensure flow to the remaining wetlands may offset that impact, where it is technically viable.

The potential BDHR and Grevet-Chapais alignments could refer to the entire backfill area, i.e. approximately 3.24 km^2 (324 ha) of wetlands each. The right-of-way for the potential Mistissini 2nd access road, for its part, intersects 0.17 km^2 (17 ha) of wetlands. The exact area of the permanent losses will be clarified and optimized during the final project design. The surface area calculation includes permanent loss of vegetation over the full width of the right-of-way, which in the end will not necessarily be the case. In addition, it is anticipated that the proposed Grevet-Chapais alignment will follow the right-of-way of the former CN rail line, which will reduce the encroachment in wetlands.

The loss of wetlands will be temporary in the work zones, storage areas and temporary access roads because those locations will be restored on completion of the work. The ecological functions of these areas will be restored once vegetation begins to grow again.

The wetlands temporarily disturbed by the work and the wetlands adjacent to the construction site may also be indirectly affected if sediment-laden water (runoff that contacts soil) or contaminants (accidental spill of hydrocarbons or other hazardous substances on site) from the construction site reaches them.

Use of machinery and vehicles from off-site poses a risk of introducing exotic and invasive species into the wetlands. The northern site conditions could, however, limit the growth of many of these species.

Table 9.11-7, along with mitigation measures that will make it possible to reduce or minimize those impacts.

To minimize removal of natural plant cover in or near the wetlands, zones with existing disturbance (forest cuts, borrow pits, etc.) should be chosen for establishment of camps and storage areas in particular. Likewise, the use of existing roads should be prioritized for transportation and vehicle movement.

Aside from a few exceptions applying to the St. Lawrence Estuary and the Gulf of St. Lawrence, the land north of the 49th parallel is not subject to the *Regulation respecting compensation for adverse effects on wetlands and bodies of water* (c Q-2, r. 9,1, Schedule I). However, for some projects, when the local communities involved so desire, compensation measures for loss of wetlands can be required on a discretionary basis by the Minister pursuant to section 46.0.11 of the *Environment Quality Act*. Such measures are then authorized by the northern committees, including Comex for the study project area.

Table 9.11-7 Potential impacts and mitigation measures for wetlands during the construction phase

Potential Impacts	
1	Loss of wetlands during initial site preparation and earthwork (removal of vegetation)
2	Disturbance of wetlands due to sediment introduction from the work site
3	Risk of introduction of invasive plant species into wetlands
4	Risk of accidental spill of hydrocarbons into the environment during machinery use, movement, fueling and maintenance, as well as use and storage of hazardous substances, if required
Protection/Mitigation Measures	
1	Plan operations, camp sites and storage areas and accesses in a way that has the least impact on wetlands.
2	Identify and demarcate the construction zone (on plans and in the field).
3	Identify and demarcate all areas and accesses planned for the construction work (on plans and in the field) and contain the work and traffic within the marked zones.
4	Group linear infrastructure, where possible, with other linear disturbances, to minimize the effects of fragmentation and encroachment on natural vegetation and wetlands.
6	Mark the wetlands adjacent to the work prior to the start of clearing and construction.
7	Restore roads, access and temporary storage areas once they are no longer needed.
8	Perform manual cutting where possible near sensitive wetland areas.
9	Clean any new construction equipment arriving on site to minimize the risk of introducing or spreading species of exotic or invasive vascular plants.
10	Apply standard erosion- and sediment-control measures, in particular: Erosion-control fences and nets/curtains; Containment dams; Sediment-control ponds, as necessary; Staking of construction zones, to minimize exposure of soil; Stockpiling of existing vegetation as long as possible; Planting and mulching in stripped zones; Diversion of runoff away from stripped zones; Optimization of the length and incline of slopes; Maintenance of low runoff flow; Adequate sizing and protection of drainage channels and outlets; Interception of sediment on site; Inspection and maintenance of the above control measures.
11	Adopt measures to prevent contaminant leakage or spillage, particularly during routine equipment maintenance and inspection; use containment trays, train personnel on correct use of refuelling equipment, implement safety procedures for this activity, and establish designated machinery refuelling zones at least 30 m from any watercourse or wetland. Keep spill kits on site and train employee on how to use them. Document emergency response procedures and train employees on how to apply safe response procedures and produce reports.
12	Immediately restore disturbed sites as the work progresses to limit the duration of the disturbance.

9.11.5.1.3 Sensitive habitats

For sensitive plant and wildlife habitats, refer to the measures identified in table 9.9.19 to 9.9.22 in section 9.9 of this document entitled: Plants, wildlife and species at risk.

9.11.5.2 Operation phase

9.11.5.2.1 Watersheds

As indicated in the section on the construction phase, the potential impacts on the watersheds are related to water quality and flow. These impacts were covered in the section on impacts on fish habitat (see section 9.9.5.2).

Drainage in the watersheds is expected to change as a result of climate change. According to the climate profiles for the sectors covered by the project (see section 9.13.2), rain precipitation will increase, as will the intensity and frequency of precipitation events. In the upcoming design phases, the water crossing infrastructure design will have to incorporate these new data to ensure that the structures are adequately adapted to climate change.

9.11.5.2.2 Wetlands

No additional encroachment on wetlands is anticipated during the operation phase for the railways or the second Mistissini access road.

Degradation of wetlands could occur in the event of accidental hydrocarbon releases from road and rail traffic as well as from infrastructure maintenance. However, application of mitigation measures such as those proposed in Table 9.11-7 will make it possible to minimize the impact.

The wetlands along the roadsides could also be affected by salt splashes and runoff, if road salts are applied during the winter.

9.11.5.2.3 Sensitive habitats

For sensitive plant and wildlife habitats, refer to the measures identified in tables 9.9.19 to 9.9.22 in section 9.9 of this document entitled: Plants, wildlife and species at risk.

Table 9.11-8 Summary data on potential impacts of the three study alignments on watersheds and wetlands

Components	Billy Diamond [1] (ROW [2] : 6,74 km^2) (COR [3] : 509.06 km^2)		Grevet-Chapais[1] (ROW : 5,49 km^2) (COR [3] : 327.88 km^2)		Mistissini roa[1]d (ROW : 1,59 km^2) (COR [3] : 92.59 km^2)	
Watersheds						
Number of water crossings	264		275		36	
Number of lakes in ROW	18		60		2	
Number of watersheds crossed by ROW (by watershed level)[2]						
Level 1 (largest)	3		1		2	
Level 2	13		2		2	
Level 3	5		5		1	
Level 4	4		7		2	
Level 5 (smallest)	0		2		3	
Wetlands	km2	%	km2	%	km2	%
Cumulative encroachment of ROW within shallow open water	0.05	1.5	0.53	16.4	0.00057	0.3
Cumulative encroachment of ROW within marshes	0	0.0	0.00	0.0	0.000	0.0
Cumulative encroachment of ROW within swamps	1.56	48.1	1.54	47.5	0.090	52.9
Cumulative encroachment of ROW within bogs	1.23	38.0	0.82	25.3	0.068	40.0
Cumulative encroachment of ROW within fens	0.17	5.25	0.32	9.9	0.007	4.1
Cumulative encroachment of ROW within all unclassed wetlands	0.23	7.1	0.03	0.9	0.006	3.5
Total encroachement	3.24	100.0	3.24	100.0	0.17	100.0

1 Billy-Diamond ROW : average width 26,7 m length : 252,52 km
Grevet-Chapais ROW : average width 33,8 m length : 162,43 km
Mistissini road ROW : maximal width by default 35,0 m length : 45,44 km
2 Data available on Données Québec only: all the watersheds are not available/ modelled, especially for northern regions. No data available for the study areas for watershed levels 6 to 8
ROW : Right of way
COR: Study area – 1 km buffer on each side of the alignment

9.11.6 Limitations

The main limitations regarding the components of this section have to do with the conditions of the wetlands and the lake sturgeon habitat.

The map of potential wetlands in Québec, released in 2019 by the Direction de la connaissance écologique at the ministère de l'Environnement et de la Lutte contre les changements climatiques (MELCC, now the MELCCFP), provides the most up-to-date information on the potential presence of wetlands throughout the province of Québec. The map is an aggregate of different databases produced for other purposes and on differing scales. The results of this compilation therefore depend on the precision and accuracy of each of the data sources. The MELCC points out that users should be aware of the limitations of the data and that the map must not substitute for a detailed field inventory. The profile of the wetlands along the study alignments is therefore approximate.

In the case of lake sturgeon presence and habitat, the information in this study is based on the mapping of the species-at-risk habitat produced by the Department of Fisheries and Oceans Canada, field inventories completed in 2021 and 2022 at a sample of water crossings, as well as the database available on certain watercourses near the alignments. Therefore, for all other watercourses crossed by the alignments, it is not possible to confirm or deny the presence of lake sturgeon in those locations.

9.12 ROAD TRAFFIC REDUCTION PROJECTIONS

The purpose of this activity is to assess the incremental costs between the do nothing r scenario and one involving rail infrastructure. The traffic situation was based on data available from the SDBJ and the MTQ.The vehicle projections for both light and heavy vehicles was be derived in the market study report (see Sections 10.3 and 10.4, Volume 4).

9.13 CLIMATE CHANGE/GHG REDUCTION PROJECTIONS

9.13.1 GHG Emissions

As part of its evaluation of the components and their operation scenarios, the Grande Alliance included in his scope a high-level assessment of the greenhouse gases (GHG) emissions, i.e. CO_2, CH_4 and N_2O, generated during the construction phase as well as the operation phase. The following sub-sections describe the scope of the GHG assessment for both for the construction and operation phases, the quantification methodologies followed, the results and a discussion on the relative importance of the Project's carbon footprint in comparison to provincial level GHG emissions.

9.13.2 Construction Phase

9.13.2.1 Scope and quantification methodology

The scope of the GHG assessment for the construction phase targeted the following categories of emission sources:

- Combustion of fossil fuels in mobile equipment such as heavy vehicles and machinery used at the construction sites. It should be noted that at the time this assessment conducted, information on the equipment and machinery that will be used by sub-contractors involved in construction activities was not available.
- Combustion of fossil fuels in generators used to provide electricity to, among other equipment, construction trailers.

- Deforestation conducted for the construction of railway lines and other permanent accessory installations.

The quantification of GHG emissions from the above noted sources was performed following the methodologies and principles presented in the quantification guideline published by the MELCCFP (2022b) (hereinafter the "GHG quantification guideline").

Input data regarding the use of mobile heavy equipment and machinery, as well as generators, was taken from a preliminary work schedule prepared for the study which is divided into seven (7) segments,

- Route du Nord,
- Access roads to Eastmain, Nemaska, Waskaganish and Wemindji,
- Potential Billy Diamond Highway railway
- Potential Grevet-Chapais railway
- Potential 2nd access road to Mistissini

For each of those segments, an approximate number of months or hours of operation for each type of heavy equipment was determined. Rates of fuel consumption (liters/hour) were also established for each type of heavy equipment to calculate a total volume of fuel (diesel) consumed for all the segments of the construction phase. The GHG quantification guideline provides emission factors[15] for the combustion of diesel fuel in mobile equipment as well as stationary equipment, such as the generators that will be used at the construction sites. These emission factors, along with the fuel consumption volumes, were used in Equation 2 (for fixed sources) and Equation 3 (for mobile sources) of the GHG quantification guideline (both equations have the same structure) to calculate emissions of CO_2, CH_4 and N_2O:

$$GHG\ Emissions = \sum_{i=1}^{i=n} Quantity\ of\ fuel\ consumed \times Emission\ factor$$

Deforestation was also considered in this GHG assessment as the construction of the Billy Diamond railway, the recommissioning of the Grevet-Chapais railway, and construction of the Mistissini 2nd access road will require earthworks and landscaping. The area affected by the components was estimated and used to calculate the GHG emissions resulting from the removal of sequestered carbon present in the organic matter, and its eventual release in the atmosphere. Equation 10 of the GHG quantification guideline was used to calculate the GHG generated by the removal of vegetation:

$$GHG\ Emissions\ (tonnes\ CO2) = N_H \times t_{MSh} \times (1 - T_x) \times CC \times 44/12$$

where:

- Nh = Deforestation area in hectares
- tMSh = Tons of dry matter (biomass) per hectare
- Tx = Proportion of underground biomass versus aboveground biomass
- CC = Carbon content of wood, expressed as ton of carbon per ton of dry matter

[15] Emission factors for mobile and fixed sources used in this assessment are presented in Table 5 of the GHG quantification guideline.

- 44/12 = Molar mass ratio between CO_2 and carbon

This calculation methodology is based on the International Panel on Climate Change (IPCC) recommendations detailed in its guideline "Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4: Agriculture, Forestry and Other Land Use". The parameters required in Equation 10, except for the deforestation area, can be obtained from the IPCC's guideline. To obtain the GHG emissions expressed as "tons CO_2 equivalent", the individual GHGs were multiplied by their global warming potential, which for CO_2 is 1, for CH_4 is 25, and for N_2O is 298.

9.13.2.2 Results and discussion

The table 9.13.1 below presents a summary of the results of the GHG emissions calculations for the construction phase of the study. Tables 9.13.2 to 9.13.4 present a breakdown per segment of the GHG emissions for the three types of sources.

Table 9.13-1 Construction Phase GHG Emissions

Equipment type / activity	CO_2 (t)	CH_4 (t)	N_2O (t)	CO_2 eq. (t)
Heavy machinery use	193,638	7.9	10.9	197,087
Generator use	5,178	0.26	0.78	5,416
Deforestation	175,489	-	-	175,489
TOTAL	**374,305**	**8.16**	**11.68**	**377,993**

Table 9.13-2 Construction Phase GHG Emissions – Heavy machinery

Segment	CO_2 (t)	CH_4 (t)	N_2O (t)	CO_2 eq. (t)
Route du Nord	57,726	2.37	3.25	58,754
Eastmain Access Road	9,991	0.41	0.56	10,169
Nemaska Access Road	1,240	0.05	0.07	1,262
Waskaganish Access Road	10,504	0.43	0.59	10,691
Wemindji Access Road	9,410	0.39	0.53	9,578
Grevet-Chapais Railway	31,941	1.31	1.80	32,510
Billy Diamond Highway Railway	66,412	2.72	3.74	67,595
Mistissini 2nd Access Road	6,414	0.26	0.36	6,528
TOTAL	**193,638**	**7.94**	**10.91**	**197,087**

Table 9.13-3 Construction Phase GHG Emissions – Generators

Segment	CO_2 (t)	CH_4 (t)	N_2O (t)	CO_2 eq. (t)
Route du Nord	1,382	0.069	0.208	1,446
Eastmain Access Road	383	0.019	0.057	400
Nemaska Access Road	34	0.002	0.005	35
Waskaganish Access Road	383	0.019	0.057	400
Wemindji Access Road	383	0.019	0.057	400
Grevet-Chapais Railway	1,333	0.067	0.200	1,395
Billy Diamond Highway Railway	1,127	0.056	0.169	1,179
Mistissini 2nd Access Road	154	0.008	0.023	161
TOTAL	**5,178**	**0.259**	**0.778**	**5,416**

Table 9.13-4 Construction Phase GHG Emissions – Deforestation

Segment	CO_2 (t)	CH_4 (t)	N_2O (t)	CO_2 eq. (t)
Grevet-Chapais Railway	113,615	-	-	113,615
Billy Diamond Highway Railway	23,068	-	-	23,068
Mistissini 2nd Access Road	38,806	-	-	38,806
TOTAL	**175,489**	**-**	**-**	**175,489**

The results presented in Table 9.13-1 Construction Phase GHG Emissionsindicate that the GHG emission resulting from deforestation could account to a large degree to the total emissions of the construction phase. Based on the current calculations, the deforestation represents approximately 45% of the total GHG emissions. It should be noted that the assumptions taken were conservative when selecting some of the parameters required by Equation 10 of the GHG quantification guideline, notably the tonnage of dry organic matter per hectare. The IPCC guideline presents a range of values that can be used in Equation 10, from 10 to 90 tons of dry biomass per hectare, and, as a conservative approach, the value of 90 tons per hectare was used for this assessment.

To put in perspective the total GHG emissions of the construction phase of the study, the total 2020 GHG emissions for the Québec province, considering all activity sectors that report their emissions to the government, was 74,016 kt CO_2 eq (MELCCFP, 2022c). The GHG emissions of the construction phase of the study represent approximately 0.5% of the 2020 provincial emissions. It should be noted that this proportion does not consider the fact that the construction work schedule of the study will extend over multiple years.

9.13.3 Operation Phase

9.13.3.1 Scenarios assessed

The GHG assessment of the operation phase of the study included the calculation of the GHG emissions for the following scenarios:

1. Projected use of current roadways by vehicles and trucks for the transportation of raw materials and goods, without the use of rail transport.
2. Projected use of current roadways considering the addition of a diesel-powered train travelling on railroads along the Billy Diamond Highway and Grevet-Chapais segments.

3. Projected use of current roadways considering the addition of an electric-powered train travelling on railroads along the Billy Diamond Highway and Grevet-Chapais segments.
4. Projected use of current roadways considering the addition of a hybrid-powered (diesel and electric) train travelling on railroads along the Billy Diamond Highway and Grevet-Chapais segments.

The comparison of scenario no 1 with each of scenarios nos 2 through 4 will help determine which generates the largest reduction in GHG emissions.

9.13.3.2 Scope and quantification methodology

The sources of GHG emissions considered in the scenarios described in the previous section are the following mobile sources:

- Light passenger vehicles, including cars, pick-up trucks, and SUVs
- Heavy vehicles including, among others, box trucks, dump trucks, trailers trucks, and flatbed trucks
- Freight and passenger trains

Equation 2 of the GHG quantification guideline, described in the previous section 9.13.1.1.1, was used to calculate the GHG emissions from the combustion of gasoline and diesel fuel in light and heavy vehicles, and trains. Light and heavy vehicle traffic data projections, expressed as the Annual Average Daily Traffic (AADT), for various segments of roadways of the study were used to determine the total daily distance travelled (in km) for each segment. The projected AADT used in the calculations are the values estimated for year 2031. Average fuel consumption rates (Liters/100 km) were established for light and heavy vehicles at 48,1 L/100 km (Transports Canada, 2020)[16] and 11 L/100 km[17] (Natural Resources Canada, 2022) respectively. These consumptions rates, along with the kilometers travelled, were used to calculate the total annual fuel consumption. Emission factors used in the calculations for the combustion of diesel fuel in heavy vehicles and gasoline in light vehicles were those published respectively in the GHG quantification guideline and the Québec Regulation respecting mandatory reporting of certain emissions of contaminants into the atmosphere.

The indirect GHG emissions originating from the production of electricity used in the electric powered (battery) and hybrid trains were calculated using the emission factor provided in Environment and Climate Change Canada's national GHG inventory report (ECCC, 2022b), as recommended by the GHG quantification guideline. The emission factor for electricity production in the province of Québec for 2019 is 1,5 g CO_2 eq./kWh[18].

9.13.3.3 Results and discussion

Table 9.13-5 and Table 9.13-6 below present a summary of the results of the GHG emissions calculations for the scenarios considered for the operation phase of the Project.

Table 9.13-5 Operation Phase GHG Emissions – Without the use of railway transport (scenario n^{o} 1)

Transportation mode	CO_2 (t/y)	CH_4 (t/y)	N_2O (t/y)	CO_2 eq. (t/y)
Light vehicle traffic	57,026	3.5	0.5	57,026

[16] The fuel consumption rate used is the one attributed to heavy vehicles of weights equal or above 15 tons.
[17] The fuel consumption rate used in this assessment represents the average of the consumption rates (combined city/highway) for cars, pick-up trucks, and SUVs presented in this document.
[18] Value taken from Table A13-6 of ECCC's National Inventory Report (2022).

Heavy vehicle traffic	112,635	4.6	6.3	114,641
TOTAL	**169,661**	**8.1**	**6.9**	**171,667**

Table 9.13-6 Operation Phase GHG Emissions – With the use of railway transport (scenarios n^{os} 2, 3 and 4)

Transportation mode	CO_2 (t/y)	CH_4 (t/y)	N_2O (t/y)	CO_2 eq. (t/y)
Light vehicle traffic	55,976	3.4	0.53	56,220
Heavy vehicle traffic	60,929	2.5	3.4	62,014
Rail transport – diesel (scenario n° 2)	4,540	0.25	1.7	5,051
Rail transport – electric (scenario n° 3)	19	-	-	19
Rail transport – hybrid (1) (scenario n° 4)	1,923	0.11	0.71	2,139
TOTAL – scenario n° 2	121,445	6.2	5.6	**123,285**
TOTAL – scenario n° 3	**116,924**	**5.9**	**3.9**	**118,253**

(1) Data for this scenario was only available for the Billy Diamond segment.

The tables above demonstrate that there is a reduction of GHG emissions with either scenario n^{os} 2, 3 or 4, considered for the study with respect to the status quo (scenario n° 1). Indeed, the study scenarios n° 2 (diesel powered train) and n° 3 (electrically powered train) generate reductions in the GHG emissions of 28 and 31% respectively. The data available for scenario n° 4 (use of a hybrid motorization for the train), was limited to the Billy Diamond segment, therefore the comparison exercise could not be performed. However, it is possible to state that the GHG emissions of scenario n° 4 would fall between scenarios n^{os} 2 and 3, with its GHG emissions being closer to the order of magnitude of the scenario n° 2 emissions. With a hybrid motorization, the train would be using diesel fuel when traveling on railways, which represents the main energy demand and contributor to the GHG emissions, while the electric motor would only be used when the train is moving at low speeds at maintenance yards or when leaving a station.

The use of an electric powered train generates a significant reduction in GHG emissions, of over 99%, when compared to those of a diesel-powered train. However, this reduction only represents about 4% of the total GHG emissions of scenarios n° 3. This can be explained by the fact that the use of freight and passenger railway transportation does not have a significant impact on the roadway vehicle traffic projections, which are the main contributors to the GHG emissions. The railway freight and passenger modes of transportation are expected to result in a decrease of approximately 30% of heavy vehicle traffic and less than 1% reduction in light vehicle traffic.

Based on historical GHG emission data made available by the MELCCFP (2022c), the total annual emissions of scenarios n^{os} 2 and 3 each represent approximately 0.4% of the total 2020 emissions from the roadway and railway transportation sectors of the province of Québec, which totaled 30,000 kt CO_2 eq.

9.13.4 Vulnerability to Climate Change

9.13.4.1 Introduction

Climate change is a global issue, but it is particularly important for northern regions. Communities in these regions have already noticed, for several years, that the frequency and intensity of certain events such as episodes of strong winds, heavy rains, extreme heat, and winter precipitation are changing.

For the planning of large-scale projects that have a lifespan of several decades, it is essential to consider not only the historical data, but also the effects that climate change will have on the entire lifespan of the infrastructures. Therefore, a climate profile of the region was developed for the time horizons of 2020, 2050 and 2080. This profile will be useful to carry out the design of the proposed new infrastructures.

Climate describes the "average weather conditions" of a given location. Specifically, it is a statistical description of the average and degree of variability of meteorological factors such as temperature, precipitation and winds, over a certain period, normally 30 years. Climate profiles are essential tools as they provide a picture of recent climate trends (i.e., over the past 30 years or more) and future climate conditions, thereby influencing the design and adaptation of our infrastructure and built heritage. A climate profile is based on historical climate data (in the form of data from weather stations) to describe recent climate, and climate projections (derived from global climate models, or GCMs) to describe future climate. The historical climate profile provides context for future climate projections. For example, the performance of the infrastructure can be evaluated in both historical and future climatic conditions, which makes it possible to understand whether modifications (and which ones) need to be implemented to ensure the durability and functionality of the structure in the future.

When developing the climate profile of a region, it is preferable to have data over the last 30 years to obtain a representative estimate of the recent climate at a given location. Data over longer periods of time is all the more beneficial, as it strengthens our understanding of the region's climate history. In Canada, Environment and Climate Change Canada maintains and makes available to the public the largest database of climate observations.

In addition to considering recent trends, climate projections describing future climate have also been considered. These are most often derived from GCMs developed by different entities around the world. It is not recommended to use a single GCM to estimate future climate, but rather to use the average of several GCMs to obtain the most reliable estimate of future climate.

To produce the climate profile for this project, Stantec experts used high-resolution projections, focusing on specific areas of Canada, from the Pacific Climate Impacts Consortium (Cannon, 2015; Cannon et al., 2015). These were produced from an extract of 24 of the 40 GCMs that were used in the fifth Coupled Model Intercomparison Project (CMIP5; Taylor et al., 2012), which forms the basis of the Fifth Assessment Report (RA5; IPCC, 2013) of IPCC.

In addition to uncertainties in the physical mechanisms of GCMs, the achievement of GHG emission reduction targets is also a significant source of uncertainty in future climate projections.

The IPCC adopted four representative concentration trajectory (RCP) scenarios, based on different future GHG concentration scenarios. The climate profile used in the study is based on the so-called "business as usual" scenario, RCP 8.5 since, to date, global GHG concentrations follow the trajectory of RCP 8.5, despite international agreements and GHG emission reduction targets (Smith and Myers, 2018) – see Figure 9.13-1below.

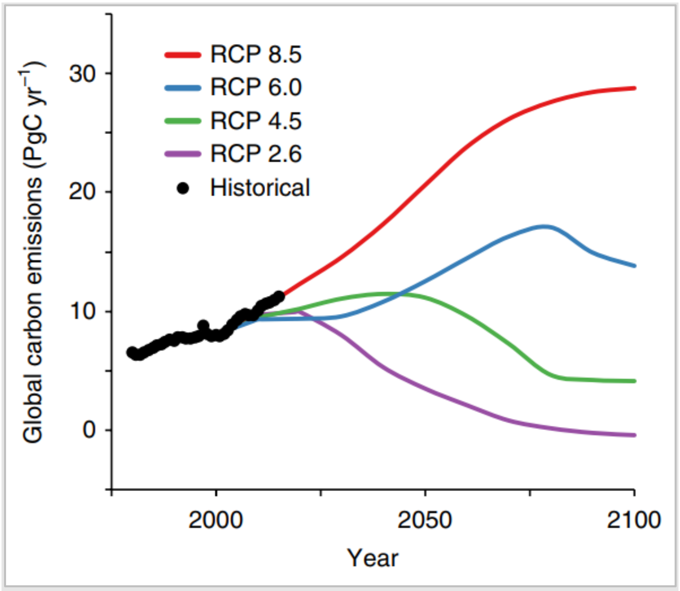


Figure 9.13-1 Historical CO2 emissions between 1980 and 2017, and trajectories projected by the 4 RCP scenarios up to 2100. GHG emissions to date follow the trajectory of the RCP 8.5 scenario. Figure from Smith and Myers (2018).

High temperature events were chosen to identify the effect on railway speed restrictions and high intensity rain precipitation to help with the design of resilient water control elements of the project.

9.13.4.2 High Temperature Events

Days where the maximum daily temperature is greater than 25°C are important for railway speed restrictions. Figure 9.13-2 show the approximate location of the proposed horizontal segment of the Grande Alliance 1 railway reopening (Chapais to Matagami) and the historical and projection data for 'Days per year where Tmax ≥ 25°C' along the line. The location and relative distances, as labelled, are approximate.

Figure 9.13-2 Map showing horizontal segment of the proposed Grande Alliance 1. Location and relative distances, as labelled, are approximate

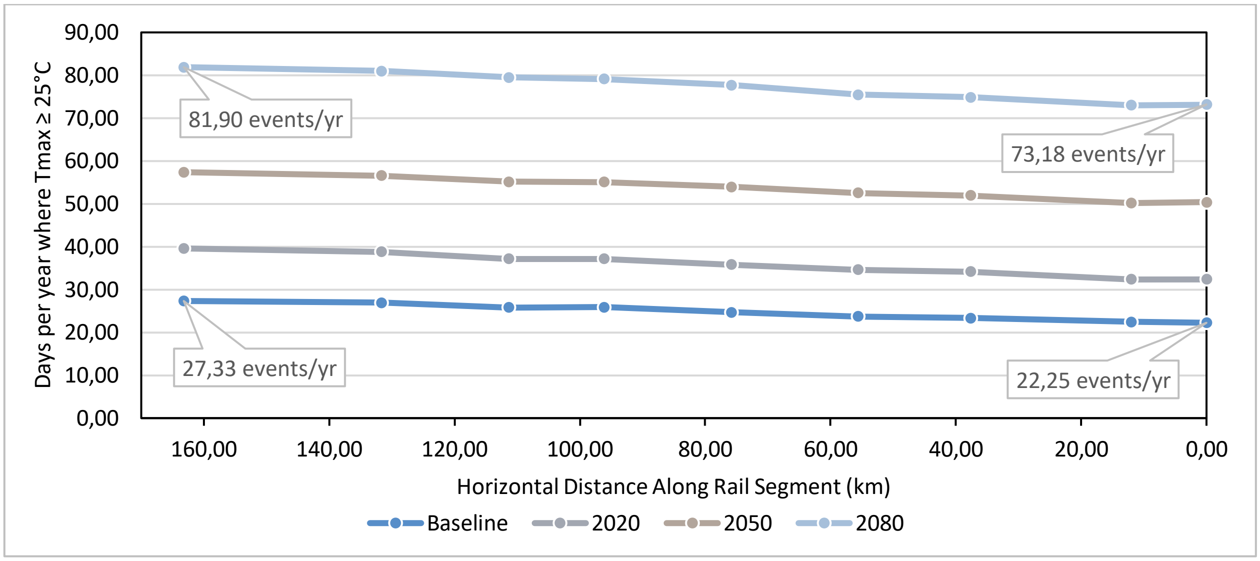


Figure 9.13-3 - Plot of days per year were Tmax ≥ 25°C along the proposed horizontal segment of the rail line

Figure 9.13-4 and Figure 9.13-5 show the approximate location of the proposed vertical segment of the proposed Grande Alliance 1 railway expansion (Matagami, northward) and the historical and projection data for 'Days per year where Tmax ≥ 25°C' along the line. The location and relative distances, as labelled, are approximate.

Figure 9.13-4 -Map showing vertical segment of the proposed Grande Alliance 1 rail expansion. Location and relative distances, as labelled, are approximate

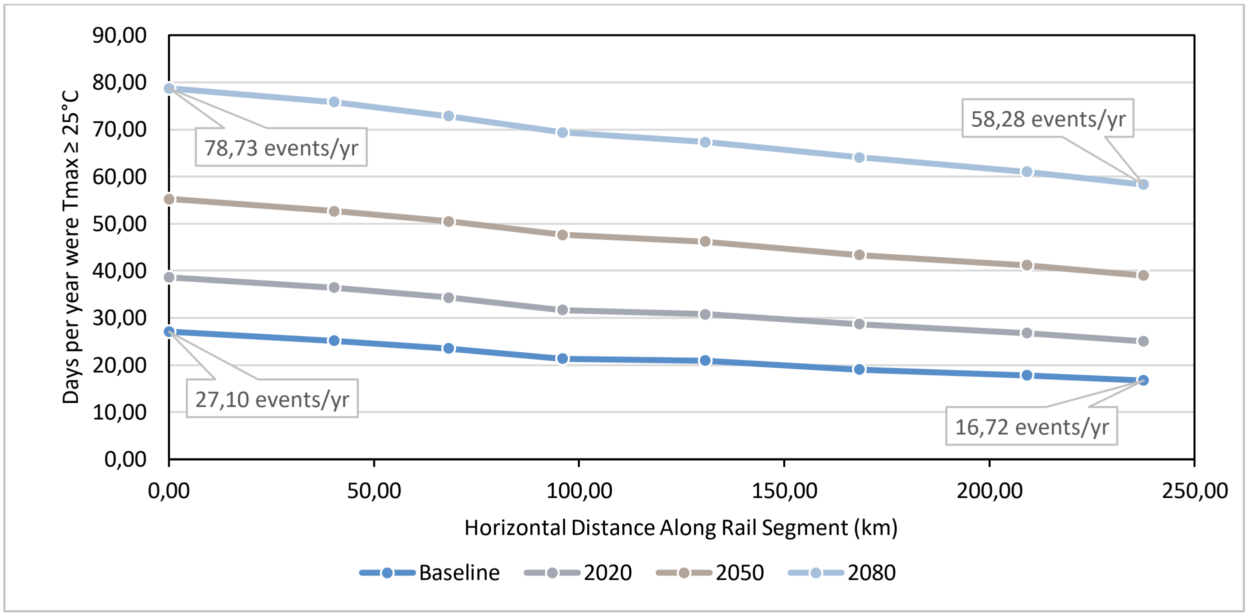


Figure 9.13-5 - Plot of days per year were Tmax ≥ 25°C along the proposed vertical segment of the rail line

9.13.4.3 Discrete Storm Events

Short-duration, high-intensity rainfall, highlighting the 1/50-year storm, are presented in Figure Figure 9.13-6 where total rainfall accumulation associated with the 1/50-year storm for the Chapais weather station (Station ID: 7091299, data range: 1964-2017), Matagami A weather station (Station ID: 7094639, data range: 1969-1990), and data from an interpolated grid of data for Matagami (location: 49.77, -77.82, data range: 1979-2013), and Nemaska (location: 51.68, -76.15, data range: 1979-2013), represent the approximate geographical bounds of the Grande Alliance 1 project. Note that for this analysis the Matagami A weather station was complimented by interpolated grid data in order to corroborate its data given that the station only provides data records for the period between 1969 and 1990 (20 years), which is not ideal for capturing the state of the current climate (i.e. the observation data here is dated with too few years of data).

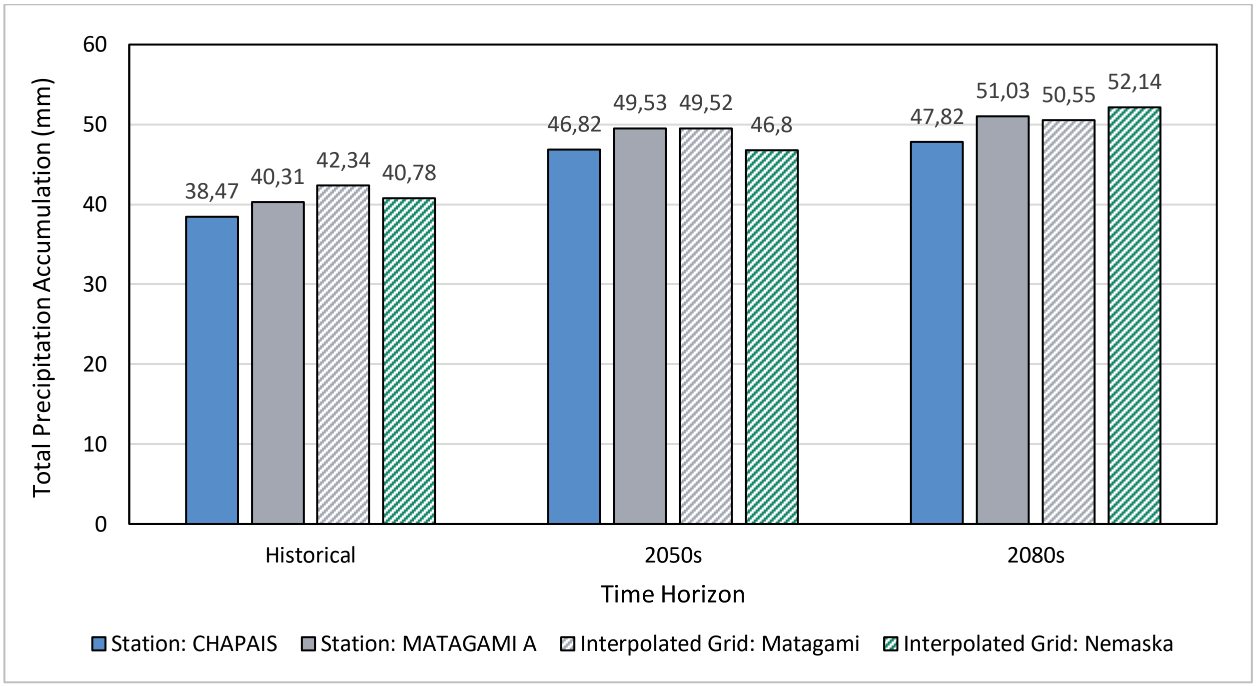


Figure 9.13-6 - Total precipitation accumulation (mm) of the 1/50-year storm by time horizon and location near the Grande Alliance 1 project. Column labels show the total accumulation associated with the 1/50-year storm at each location and time period

Intensity-duration-frequency (IDF) data for the 2, 5, 10, 20, 25, 50, and 100-year storms at durations 5, 10, 15, and 30 minutes, and 1, 2, 6, 12, and 24 hours is provided in Appendix 6.31, as well as the percent change in total rainfall accumulation from the historical data to the projected data for the 2050s and 2080s. The percent change in rainfall volume is provided alongside the projection values, the exact magnitude of change depends on the location and storm characteristics.

The minimum and maxium values percent change in rainfall volume are summarized in Table 9.13-7.

Table 9.13-7 Summary of the range of change (as minimum and maximum percent change) between historical and projected short-duration, high intensity rainfall accumulation values

	Chapais		Matagami A		Matagami (gridded)		Nemaska (gridded)	
	Min	Max	Min	Max	Min	Max	Min	Max
Historical → 2050s	6.1%	35.2%	4.8%	35.5%	10.2%	17.4%	10.1%	17.7%
Historical → 2080s	14.7%	43.6%	9.7%	36.7%	15.2%	20.2%	19.4%	28.6%

9.14 CONCLUSION

This socio-environmental study was conducted to support the decision of the CDC in planning the development of transportation infrastructure projects in the Phase I of the Grande Alliance. The CDC is placing social acceptability and community engagement at the forefront. VEI was mandated to ensure that the requirements of communities and the opinions of its members were incorporated in the Phase I feasibility study.

VEI has put the Cree community members and land users at the center of its work. Engagement activities were conducted throughout the study by a liaison task force in conjunction with the CIOs. The purposes of the engagement activities were not only to gather information on the environmental settings and land use, but also to provide feedbacks and advises in the infrastructure design and planning.

Tallymen of the potentially impacted traplines (56) by the Phase I were all invited to participate in a workshop with engineers to review and discuss the potential alignments. In collaboration with the CIOs, VEI organized information sessions for Tallymen. Individual land use interviews were also conducted with the Tallymen and family members.

Opening a new railway corridor on the territory entails the loss of use of part of the affected traplines. This represents a major concern for tallymen and land users who have seen the area of their harvesting territory severely reduced over the years by other development projects (mining, hydroelectric, forestry) and trapline subdivision (some traplines were divided by former tallymen resulting in smaller traplines), particularly in the southern part of the study area. Given the proximity of some of their camps and harvesting areas to the BDH and former CN rail, many tallymen and land users were concerned about the noise, vibration, dust, and safety hazards caused by the train.

Tallymen and land users are in favour of the upgrading and paving their community's access road and of the Route-du-Nord, as it would greatly improve road safety. Various other upgrading ideas and recommendations were expressed by the study participants. Several were already integrated in the concept (e.g. small parking areas along the roads). The only inconvenience that was mentioned in relation to the paving of the roads is that vehicles' speed would increase since the road condition would be better.

The LGA team, composed of VEI, WSP and Edelman representatives, met with elected officials, citizens, and socio-economic actors of the five main Jamesian towns (Chapais, Chibougamau, Lebel-sur-Quevillon, Matagami et Radisson). Introductory meetings were with the director general and elected officials of each municipality or locality. Then, public information sessions were organized in each town to discuss local issues, concerns, and potential opportunities more in depth.

The participants appreciated being informed about LGA and having an opportunity to share their concerns and visions of local development. Jamesians highlighted the importance of connectiveness with existing infrastructures and of positioning the potential infrastructures within a global context. According to some participants, building new railways in Eeyou Istchee Baie-James could increase the attractiveness of local industrial parks, for mining processing plants among others, and could favour tourism. New railways could also improve the supply of food, raw and second materials, while having a positive impact on climate change by reducing the number of trucks on the roads. However, since the surrounding existing lines are in poor condition, they would require investments from the CN, so the new railways could connect to a network.

The main concerns expressed by Jamesians in relation to the infrastructures under study included nuisances from the train and the loss of access to cottages, the relocation of snowmobile and ATV trails currently using the Grevet-Chapais subgrade (snowmobile trail Trans-Québec 93) and connection with existing trails, especially in Lebel-sur-

Quévillon. Increased safety risks where the train would intersect existing trails and paths and risk of water contamination (accidental spill) and increased hunting and fishing pressure on wildlife due to the influx of workers during construction were also mentioned, as well as increased pressure on local housing and accommodation.

Cree and Jamesian stakeholders showed an interest in reviewing and discussing the results of the various studies that compose Phase I Feasibility Study. VEI recommends continuing engagement activities through different channels, for example:

- Visit the Cree communities and Jamesian towns to present and discuss the studies' results;
- Maintain CIOs role and implication in each Cree communities;
- Organize focus groups with economical actors;
- Use different means of communications to disseminate information about LGA, such as local newspaper, radio stations, and web sites;
- Prepare and distribute summaries of different aspects of the studies in Cree, English and French;
- Send news and updates to Chief and Council, mayors and directors general;
- Organize discussion~~s~~ sessions with all Jamesian mayors and directors general.

An archaeology and cultural heritage study was conducted for a broad territory along the BDHR and the Mistissini 2nd access road (buffer of 20 km) to identify sites of importance that the community may want to protect from any long-term, residual impacts from the work proposed in Phase I – Infrastructure.

A predictive model was prepared for the broad study area based on the background research (e.g. historical information, known archaeological sites, etc.) and several variables adapted to boreal forest (e.g. distance to water, slope, elevation, and vista). An archaeological field program was conducted in 2022 in a narrower corridor (5 km buffer) to test the accuracy of the predictive model by conducting a preliminary archaeological survey that sampled areas predicted by the model to be of high, moderate, and low archaeological potential. Over 60 areas of potential and numerous features of interest were identified. Six newly identified archaeological sites were recorded and recommended to the MCC for protection. Three sites were assigned Borden Numbers. Five of these sites consist of surface and subsurface lithic belongings, and one site consists of an historic metal trap used for hunting small game.

The 2022 preliminary survey was not meant to be an exhaustive study of potential, but rather a way to test and improve the predictive modelling tool. Based on the results of the 2022 field season, the model has been refined and revised to enhance its value as a tool for planning future archaeological surveys of LGA. If impacts are planned within the potential BDH railway corridor and/or within the proposed Second Access Road to Mistissini, the projects will require a thorough pre-impact archaeological assessment, which will include a desktop evaluation that, once reviewed by the MCC, the CNG, and the ACCI, will drive the field assessment portion. Archaeological permit(s) from the MCC and possibly a land ownership permit(s) from the MERN may be required to proceed with an impact assessment.

This study was a good opportunity to work with Cree community members interested in archaeological resources and to collaborate with the Aanischaaukamikw Cree Cultural Institute. A total of nine Cree field crew received a one-day training and worked under the supervision of VEI's archeologist. During field work, the Cree field crew shared information concerning animals' behaviour, hide processing, how to set up a camp, wood splitting, and how to move through the land during both snow-free and snow-covered conditions.

Some servitudes and titles are in conflict (less than 100 m from the alignment) with the proposed new infrastructures (public leases, extraction leases, Cree camp sites) and will require discussions and agreements with Cree Communities and leaseholders or landowners, while some impacts may possibly lead to relocation or compensation.

A number of snowmobile trails and logging roads have also been identified in the railway and Mistissini 2nd access road corridors, either cross or overlapping the alignments. In the first case, special attention should be given to signage and user safety on the trails, while in the second case, certain portions of the snowmobile trails or forestry roads will need to be relocated. Any relocation will require active discussions with the users of these trails to ensure that the new trail responds to their needs. Preliminary consultation was conducted with the main stakeholders (tallymen, forestry companies, snowmobile clubs, etc.) and will pursue during the next steps of planning. Furthermore, the cost of the relocation will need to be integrated as part of the project construction costs.

Four types of protected areas are found in the study areas of the proposed new infrastructures: biological refuge, projected aquatic reserve, projected biodiversity reserve and territorial reserve for protected area purposes. The BDHR alignment was modified to avoid two biological refuges. None of these protected areas are located within the proposed new any infrastructure' right-of-way (railways, new access road). Areas dedicated to the protection of woodland caribou were also included in the analysis, although they do not possess the status of "protected areas" as implied by the current legislation. The corridor of the potential BDHR alignment intersects a 100-km section of sensitive areas for woodland caribou. As these areas are located on both sides of the highway, it was not possible to avoid them. In order to mitigate impacts on the woodland caribou, the railway was located close to the highway (within 100 m).

Protected areas were established under the Paix des Braves: sites of special interest (1 % of each trapline) and site of special wildlife interest (25% of productive forest of each trapline). The location of theses areas was not available due to their confidentiality. It will be important during the next steps to confirm that the infrastructure alignments are not impacting these protected areas. Depending on the timing of these next steps, additional protected areas may also need to be considered as the Gouvernement du Québec is planning to increase the proportion of protected areas in the Eeyou Istchee territory from 23% to 50 % by 2030.

A first step of a health impact assessment of the Grande Alliance Phase I components was conducted. A total of eight social processes were retained related to four types of impacts (health infrastructure and services, food security, mental and physical health and subsistence activities) that could occur given the project's nature and context to produce health outcomes. These processes were related to changes emerging from the construction and operation of railways, and these processes could impact communities and individuals in numerous ways.

Considering the size of the Grande Alliance Phase I program, it is anticipated that the train itself will not have the most impact rather than the projects developed afterward. Northern communities depend on extracting their natural resources to economically sustain development activities and public services. Therefore, the choice of future projects and the imposed boundaries to realize them by the Cree government will be crucial. The cumulative effects of small actions, including the railway construction, operation, and the industrial projects developed along the route, will eventually lead to long-term social impacts. Therefore, it would be essential to document these changes and their evolution.

Based on the impacts presented above, it should be determined whether or not a complete Health Impact Assessment is relevant. Although an HIA is not required by the legislation and regulatory processes, the Cree Board of Health and Social Services of James Bay prefers this approach to understand and identify potential impacts. Therefore, the following steps should entail pinpointing the most crucial determinants to be considered, as well as setting up boundaries and level of effort to complete the study.

Due to harsh climatic conditions in the Eeyou Istchee territory, the vegetation is not very diverse. There is a high proportion of conifer stands due to the very uneven terrain, with black spruce as the most common in the landscape. Numerous wetlands are also present in the study areas and are difficult to avoid due to their large distribution in the landscape. They cover 48% and 59% of the BDHR and Grevet-Chapais railway ROW and 11% of the Mistissini 2nd access road ROW. Such environments are vital for hydrological cycles and provide important habitats for many species, especially waterfowl. The three considered alignments (Billy Diamond Highway, Grevet-Chapais and Mistissini) intersect three main watersheds, which are amongst the most significant ones in the province of Québec: Nottaway, Broadback and Rupert. A total of 575 watercourse crossings and 80 lake crossings will be required for all three components. The territory hosts over 40 terrestrial wildlife species, 250 bird species (most of which are migratory species), and 36 fish species. A total of 18 animal species at risk are reported within the study corridors (new infrastructures). The woodland caribou, black bear and the Canada goose are keystone species embedded in the Cree culture, while lake sturgeon, also highly valued by the Cree, is a sensitive species which is also present.

The proposed new infrastructures consist of linear infrastructures. Therefore, they are likely to generate similar potential impacts. The site preparation will potentially result in the loss of vegetation, including wetlands and wildlife habitat and the destruction or disturbance of bird nesting. The exact area of the permanent losses will be clarified and optimized during the final project design. The surface area calculation includes permanent loss of vegetation and wetlands over the full width of the right-of-way, which in the end will not necessarily be the case. In addition, it is anticipated that the proposed Grevet-Chapais alignment will follow the right-of-way of the former CN rail line, which will reduce significantly the encroachment on vegetation for this alignment. The presence of workers and construction activity and the use of equipment and vehicles may alter the surrounding habitat by introducing invasive plant species and may also cause nuisance that may force nearby animals relocate in nearby other suitable habitats. Accidental spill of hydrocarbons into the environment could occur during machinery use, movement, fuelling and maintenance. Finally, in-water works may impact water quality and fish and fish habitat due to sediment introduction and emission of turbidity plumes, temporary obstacle to free fish movement, permanent and temporary encroachment into fish habitat and accidental spills.

Potential impacts from the operation phase on vegetation, wetlands and fauna include the accidental spill of hydrocarbons into the environment, accidental hydrocarbon releases from road and rail traffic and maintenance of this infrastructure, and the alteration of vegetation by salt splashes and runoff when road salts are applied in winter and increase of collision and fatality risks for wildlife, as well as for human safety. The operation of the new structures may generate loss of functional habitat caused by disturbances (traffic, noise, vibrations, increased human footprint), as well as the fragmentation of habitat and change to the quality of the connectivity for wildlife movement. However, as part of design criteria, both railways are located in or near disturbed areas to mitigate such impacts. When feasible, the BDHR would be built within 100 m of the Billy Diamond highway and the Grevet-Chapais line alignment is following the former CN railway alignment. As for the 2nd access road to Mistissini, existing loggings roads were considered as well to reduce the area of undisturbed habitat as much as possible.

Mitigation measures should be implemented to reduce the potential impacts. Notably, bridge and culvert design will have to guarantee the free movement of fish and construction activities should be carried out outside wildlife sensitive period. As wildlife species at risk were identified in or near the study corridors, additional mitigation measures specific to each species may be required (e.g. avoid work during sensitive period specific to the species at risk such as nest protection buffer).

The Eeyou Istchee James Bay region supports a diverse terrestrial and aquatic fauna, among which some species are prized for hunting and sport fishing. The arrival of workers practicing these activities in their spare time leads to a potential overexploitation of wildlife resources, as well as a risk of land use conflicts with Cree communities, who depend upon these resources on a subsistence and cultural basis. The potential impacts on wildlife resources lie mainly in the construction phase, during which the largest contingents of workers will be present on the territory. These are important issues, that need to be addressed by structuring and managing hunting and fishing activities. To this end, the Weh-Sees Indohoun hunting and fishing management system sets a very relevant example to follow. Identified sensitive areas or habitats should receive further special management considerations.

As part of its evaluation of the components and their operation scenarios, the Grande Alliance included in its scope a high-level assessment of the greenhouse gases (GHG) emissions, i.e. CO2, CH4 and N2O, generated during the construction phase as well as the operation phase. The total GHG emissions of the construction phase (378 kt CO2eq) represent 0.5% of the total 2020 GHG emissions for the province of 74,000 kt CO2eq. The addition of the Billy Diamond Highway and Grevet-Chapais railways would reduce travelling on roads and therefore generate approximately 30% less of GHG emissions compared to a status quo.

The socio-environmental study was conducted based on a preliminary concept. Most of the information presented is based on a desktop review and is dependent on data available by the public or obtained from the ministries. The proposed new transportation infrastructures (railways, new access road) in Phase I of the Grande Alliance will likely require a social-environmental impact study under the JBNQA, the EQA and IAA and obtain permits as per several regulations prior to its implementation. The next steps will require notably an update of available data as well as field work programs to document the existing conditions prior to development and allow to refine the location of the alignments to reduce impacts on the biophysical and social environments. The early engagement of Cree and Jamesian communities was very well received and resulted in changes in the preliminary concept. The continuum of the engagement activities throughout the project will be key in reaching social acceptability and will need to be expanded to include stakeholders who have not yet been included (e.g. Algonquins, leaseholders, etc.).

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