8 Identification and assessment of impacts

This chapter presents the methodology used to assess the impacts of the mining project (section 8.1) and the impact assessment itself (section 8.2). The impacts are assessed for each of the VECs selected, which are grouped under the issue that includes them, as defined in the previous chapter. The order in which they are presented in no way reflects their priority and is based solely on the arbitrary numbering system that has been chosen.

8.1 Method for identifying and assessing impacts

This project is based on an environmental assessment approach that takes into account important issues related to the project. Through a consultation process led by both government agencies and the proponent, this approach requires the identification of key project issues raised by the stakeholders concerned.

During the impact analysis stage, this traditional approach first identified all valued ecosystem components (VECs) for the area concerned and the various project activities during the pre-construction, construction, operations, and closure phases. It then considered the possible interactions between the project activities and the ecosystem components, and assessed the significance of the impacts on the selected ecosystem components, i.e., those that could be impacted.

Two preliminary steps have been added to this approach given the issues at stake: identifying the issues on which there is consensus among stakeholders and identifying, among the VECs described in Chapter 6, those stemming from each of these issues. These two steps were completed in Chapter 7.

In this chapter, only the possible interaction between the selected VECs stemming from the issues and the various project activities is considered. The assessment of the significance of the resulting residual impacts is also presented as for the traditional approach.

8.1.1 Identification of potential impacts

At this stage, the possibility of interaction between the project activities (defined in Chapter 5 and presented on the y-axis of Table 8-1) and the VECs selected for each of the project issues (defined in Chapter 7 and presented on the x-axis of Table 8-1) is assessed using an interaction grid as illustrated in Table 8-1. Each possible interaction identified and corresponding to a potential impact is presented in the interaction grid. It should be noted that there may be various types of interactions for the same VEC/activity pair. For example, a given activity could have both positive and negative potential impacts on the same component.

Due to space constraints, the issues are not named in the interaction grid, but they are listed below:

- Issue 1: Preservation of aquatic habitat quality;
- Issue 2: Preservation of soil and groundwater quality;
- Issue 3: Preservation of wetlands and habitats of interest to terrestrial fauna and flora;

- Issue 4: Preservation of the quality of life of the local population;
- Issue 5: Preservation of the health, safety, and socioeconomic conditions of the regional population;
- Issue 6: Preservation of the traditional activities and practices of the Indigenous population and the activities and practices of the non-Indigenous population;
- Issue 7: Consideration of climate change.

Table 8-1 Grid of possible interactions between the ecosystem components and the activities

		Issue 1			Issue 2		Issue 3				Issue 4	Issue 5			Issue 6				Issue 7
Environmental component		**Hydrodynamic and hydro-sedimentary conditions**	**Surface water quality**	**Aquatic fauna and habitats**	**Soil quality**	**Groundwater quality**	**Wetlands and water environments**	**Wildlife species of special status**	**Terrestrial wildlife (large wildlife and other mammal species, avifauna)**	**Forest cover**	**Air quality**	**Physical, psychological, and social health**	**Economic activities**	**Road safety**	**Hunting and trapping of terrestrial wildlife and waterfowl**	**Fishing**	**Harvesting of valued plant species**	**Well-being on the land**	**Climate change mitigation (GHG emissions)**
Activities																			
Construction	Site organization, stripping, and clearing																		
	Surface preparation and access layout																		
	Construction of structures and infrastructure																		
	Transportation and traffic related to materials and supplies																		
	Production and management of residual and hazardous materials																		
	Workforce and procurement																		
Operations	Presence and operation of new infrastructure																		
	Water use and management																		
	Transportation and traffic related to ore and supplies																		
	Production and management of residual and hazardous materials																		
	Workforce and procurement																		
Closure	Presence of site remains																		
	Transport and traffic during the work																		
	Final restoration																		
	Production and management of residual and hazardous materials																		
	Workforce and procurement																		

Negative impact

Positive impact

Negative and positive impact

Lastly, it should be noted that the description of the potential impact will be included in the assessment of residual impacts as a description of the baseline impact occurring between a selected VEC and the various project activities that may affect it.

8.1.2 Assessment of residual impacts

Impact assessment involves determining the magnitude of the anticipated residual impacts on the selected VECs that will be caused by the various project-related activities. This assessment will be carried out for each phase of the project, namely construction, operations, and disassembly. A distinction will be made between positive and negative impacts. This assessment takes into account measures incorporated into the project design, as well as applicable mitigation and enhancement measures, and focuses on impacts that remain after these measures have been implemented.

The significance of the residual impact on a given VEC depends on three criteria: its intensity (determined based on the value of the component and the degree of disturbance anticipated), its extent, and its duration. The probability of occurrence is also assessed, but separately, as an additional qualifier of the impact. These elements are presented in Appendix 8-1.

Lastly, common mitigation measures that relate to the implementation of best practices or resulting from the legal application of laws, regulations, standards, or guidelines, which are considered an integral part of the project at this stage, are presented in Appendix 8-2. In addition to these common mitigation measures, specific mitigation measures tailored to the project can then be developed to reduce the significance of negative impacts on VECs; measures to enhance positive impacts can also be developed. These specific measures are presented in the sections on the analysis of residual impacts for each VEC selected.

Residual impacts classified as “high” will be considered as requiring mitigation measures. This need will be highlighted during the assessment process of the significance of residual impacts, but offsetting measures will be presented in Chapter 14.

8.2 Assessment and mitigation of project impacts

8.2.1 Issue No. 1 – Preservation of aquatic habitat quality

8.2.1.1 Hydrology (Hydrodynamic and hydro-sedimentary conditions)

Hydrology deals with the hydrodynamic and sediment-related conditions associated with the movement of water (flow rate, volume, etc.) and sediments (sediment transport, bank erosion), which may be disrupted by construction, operations, and restoration work. It should be noted that, within the scope of the project, hydrology is of interest due to the changes it may undergo, notably due to the significant hydrological modifications resulting from works associated with the development of the La Grande Complex. A **medium** ecosystem value was assigned to this VEC to reflect this level of interest.

Summary of current conditions

To determine the existing hydrological conditions in the biophysical LSA, eleven calculation points were selected within the three main watersheds that make up the area: those of the La Grande River, Lac de la Corvette, and Lac Pontois. With regard to average monthly flow rates, most of the stations (6 out of 11) show values well below 1 m^3/s, while one station (Lake L633) shows flow rates ranging from 0.09 m^3/s to 1.35 m^3/s. The three stations in the immediate vicinity of the mine site (Lake L01, Lake L27, and Watercourse CE15) show greater variability in average monthly flow rates, ranging from 0.4 m^3/s to 14.1 m^3/s. Finally, the last station, located at Lac de la Corvette, shows very high average monthly flow rates ranging from 13.8 m^3/s to 113 m^3/s.

As for ice conditions, the data show that ice cover begins to form between mid- and late November on small lakes and watercourses, but not until late November or early December on Lac de la Corvette. Similarly, the ice melts earlier in smaller lakes and watercourses (mid- to late May) than in Lake Lac de la Corvette (late May to early June).

Construction phase

Statement of potential impact

Changes in hydrodynamic and hydro-sedimentary conditions.

Sources of the impact

- Site organization, stripping, and clearing.
- Surface preparation and access layout.
- Transportation and traffic related to materials and supplies.

Detailed description of the impact

Two main factors may affect hydrodynamic and hydro-sedimentary conditions during the construction phase: the construction of the diversion channel and its connection upstream of the existing outflow from Lake L01, as well as the installation of culverts along access and traffic roads on the mine site.

Construction of the diversion channel

The primary impact associated with hydrodynamic and hydro-sedimentary conditions during the construction phase is linked to the opening of the diversion channel between Lake L01 and Lake L05 and the closure of Watercourse CE1 (the natural outflow from Lake L01), which currently flows into Lake L07. This diversion could lead to changes in the volume of water received (risk of flooding) and the flow rate of water in Lake L05 and Watercourse CE8, and could cause erosion and changes in existing sediment accumulation areas. In addition, the inflow of water from Lake L01 via Lake L05 and the Watercourse CE8 into Lake L07 could also cause changes in the dynamics of water movement and in the sediment deposition areas in this lake. It is also possible that areas of riparian erosion could develop in the vicinity of the outlet of Watercourse CE8 where it flows into Lake L07.

The study conducted by AtkinsRéalis (2025) (Appendix 8-3) on the modelling of flood zones and erosion caused by the construction of the diversion channel shows that:

- Annual flooding primarily affects vegetated areas, the rights-of-way of the affected watercourses, associated lakes, and the floodplains surrounding these water bodies for most return periods, except in the case of a 100-year flood, when they extend to Lakes L08 and L218, located immediately north of the drainage network between Lake L01 and Lake L27.
- Under normal conditions, the floodplain area between Lake L05 and Lake L27 covers 19.5 hectares, and this area could increase to 43.2 hectares when flood conditions exceeding a 100-year flood (or the maximum probable flood level) occur—a 120% increase from current levels. Table 8-2 shows the increase in these areas as a function of flood recurrence periods, and
  Figures 8-1 and 8-2 illustrate the flooded areas for a 2-year return period and in the event that the probable maximum flood occurs (>1:100 years).
- In the case of a 2-year return period (used for modelling because it is more frequent), erosion and deposition processes are possible in four areas between the outlet of the diversion channel into Watercourse E05 and Lake L27 (Figure 8-3), namely:
  - in Watercourse CE08, approximately 1.2 km downstream from the channel's outlet;
  - at the outlet of Lake L07, in Watercourse CE11, approximately 2.2 km downstream from the channel's outlet;
  - in Watercourse CE11, just upstream of Lake L10, approximately 2.9 km downstream from the channel's outlet;
  - in Watercourse CE15, approximately halfway between Lakes L10 and L27 and about 3.6 km downstream from the channel's outlet.

Table 8-2 Increase in flooded area by return period

Return period	Flooded area (ha)	Increase in the floodplain area (ha)	Increase in the flooded area (%)
Normal conditions	19.5	0	0
2 years	20.2	0.7	4
10 years	22.3	2.8	14
25 years	24.1	3.6	18.5
50 years	25.3	5.8	30
100 years	26.3	6.8	35
Probable maximum flood (>100 years)	43.2	23.7	121

These erosion processes could cause the affected areas to deepen by up to 0.4 m. However, modelling also shows that much of the eroded material is redeposited a short distance downstream from the erosion zone (10 m to 20 m further downstream). This is likely caused by a decrease in flow velocity associated with widenings in the flow channel and a decrease in flow velocity.



Figure 8-1 Areas flooded with a 2-year return period

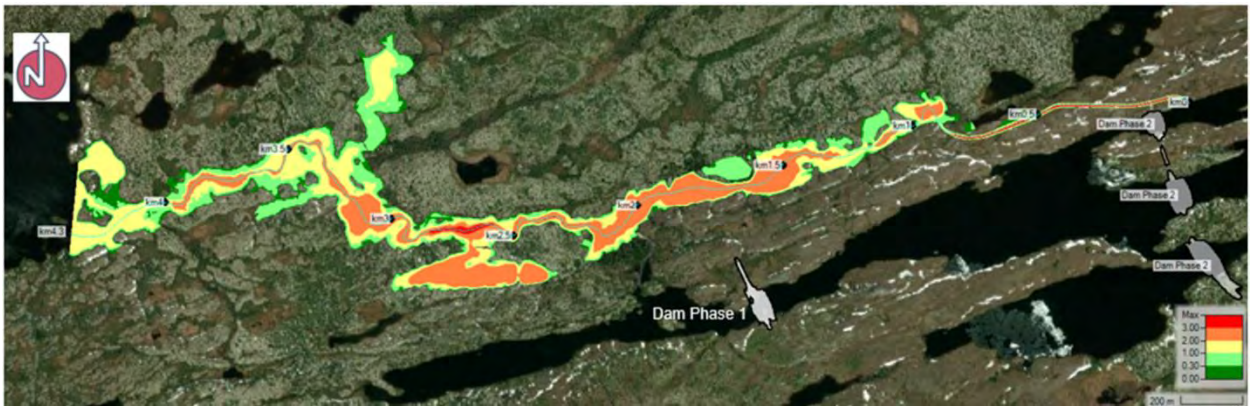

Figure 8-2 Areas flooded in the event of probable maximum flood (>100 years)



Figure 8-3 Potential erosion areas between the diversion channel and Lake L27

In general, the modelling results show that:

- although there has been a significant increase in the surface area subject to flooding, the consequences are minor since they do not affect any sensitive components;
- despite the presence of four erosion zones along the flow path between the diversion channel and Lake L27, the modelling shows only a minimal effect on the morphology of watercourses and bodies of water, while only minor changes are anticipated in the steeper flow zones.

Culvert installation

The installation of culverts along roads and traffic routes on the mine site may require temporary interruptions or diversions of the flow of the affected watercourses. In addition, this work involves excavation along the banks and at the bottom of the watercourse to install the culvert, as well as backfilling to restore the banks before the traffic route is completed. This work risks introducing sediment into the watercourse, altering the sediment distribution downstream of where the work is being carried out. Lastly, the culvert can act as an obstacle to water flow, slowing the flow rate upstream and creating a zone of accelerated flow at its outlet.

Mitigation measures

The common mitigation measures are presented in Appendix 8-2; in particular, some measures from the "Soil, surface water, and sediment quality" section apply to this VEC. However, with regard to this VEC, several measures were incorporated into the project design from the outset to minimize the anticipated impacts, including:

- the location and design of the diversion channel in an area of rocky substrate to minimize the risk of erosion in and around the channel;
- the design of the channel to ensure its capacity to handle the volumes potentially generated by various flood events (up to >100-year floods);
- reconnecting the channel to the same network of lakes and watercourses to which the current natural outflow is connected;
- the development of a model of the channel's potential effects on local hydrodynamic and hydro-sedimentary conditions (discussed above) to determine whether action will be required and, if so, in which location;
- the design of the culverts to be installed so that they allow water to flow freely, in accordance with the requirements of the *Regulation respecting the sustainable development of forests in the domain of the State* (RADF).

In addition to the common measures and those incorporated into the project design, the following specific measures are proposed:

- An environmental supervisor will conduct regular inspections of work areas, ensure that all parties strictly comply with the various commitments, obligations, measures, and other requirements, assess the quality and effectiveness of the measures implemented, and document any non-compliance observed (P24).
- Develop and implement a monitoring program for the diversion channel to confirm its capacity to manage water volumes originating from Lake L01 and the absence of signs of erosion along its alignment (P30).
- Develop and implement a monitoring program to assess free water flow and erosion processes along the network of lakes and watercourses between the diversion channel connection point at Lake L05 and the mouth of watercourse CE15 at Lake L27. Areas at risk of erosion identified through the modelling conducted by AtkinsRéalis (2025) shall be specifically included in this program (P31).

Assessment of residual impact

During the construction phase, the implementation of the various proposed mitigation measures is expected to result in a **moderate** level of disruption to hydrodynamic and hydro-sedimentary conditions. Given the low value assigned to this VEC, the impact intensity is **low**. This impact will be felt at the local level during the construction and operations phases (**medium** duration), resulting in a residual impact of **minor significance**. The likelihood of these impacts occurring is high, and the reversibility potential is **low**, as there are no plans to close the diversion channel once the work is complete, so as to avoid creating further disruption to this VEC after the system has stabilized during the operations phase.

Impact on hydrodynamic and hydro-sedimentary conditions			
Intensity:	Low	**Significance:**	Minor
Extent:	Local		
Duration:	Medium		
Probability of occurrence:		High	
Reversibility:		Low	

Operations phase

Statement of potential impact

Changes in hydrodynamic and hydro-sedimentary conditions.

Sources of the impact

- Water use and management.
- Transportation and traffic related to ore and supplies.
- Dewatering and keeping the mine dry.

Detailed description of the impact

The impacts associated with the operations phase are primarily related to the diversion of surface or groundwater that normally flows into certain watersheds to the watershed receiving the mine effluent. The volumes associated with the pumping of water from the underground mine and the open pit are determined through modelling, and these results are used in the calculations to determine the effect of water diversion on the average flows of the affected hydrological network. The sections below describe the process of pumping dewatering water and the results of the associated modelling, as well as the implications of water diversion.

Dewatering of the underground mine and the pit

The pumping operations required to dewater the underground mine and the pit will take place during the operations phase and will result in changes to the flow patterns of groundwater and, potentially, surface water. In fact, during the various stages of operations, groundwater seeping into the mine and the pit will be pumped to the surface to keep the work areas dry, thereby creating a drawdown cone.

A lowering of the water table in the rock and in the unconsolidated deposits thus will be observed on the perimeter of the underground infrastructure. The impact of dewatering activities on the flow regime is determined by hydrogeological characteristics, namely the hydraulic properties of geological formations and their connection to the surface water system. These characteristics are particularly complex in the case of hydrogeological systems in the fractured rock environment, as encountered on the site. This is why it is usual to proceed by digital modelling to represent the hydrogeological system and assess the potential impacts of the dewatering activities.

Hydrogeological modelling was performed to assess the impact of mining operations on the surrounding environment (drawdown of the water table) and to estimate dewatering flows at various stages of operations (Appendix 6-11: Mailloux, 2026). Predictive simulations were conducted to assess the rate of water seepage into the mine and the pit, as well as the anticipated drawdown. The final drawdown was evaluated and is shown in Map 8-1. Drawdown of the water table will reduce the contribution of groundwater to the base flow of watercourses. The drawdown of the water table extends 1,300 m to the southeast of the pit footprint, 1,100 m to the northwest, and 1,100 m to the southwest, according to Mailloux's simulations (Appendix 6-11). The decrease in base flows of lakes compared to current conditions was assessed during the modelling process and was used to estimate the anticipated reductions in average flows (Table 8-4). Groundwater infiltration estimates for the base case were calculated for 2032, 2036, 2040, 2044, and 2049 (Appendix 6-11). The expected dewatering flows at the end of operations (2049) are 3,200 m^3 per day for the open pit and 4,900 m^3 per day for the underground mine.

Catchment and diversion of surface water

During the operations phase, the anticipated impact on hydrodynamic and hydro-sedimentary conditions is primarily associated with the encroachment on portions of watersheds and the diversion of water (water catchment, pumping for drinking water, dewatering) from these watersheds to the one receiving the mine effluent, and more specifically into Watercourse CE11. Since some of the collected water did not flow through this sub-watershed, the mine effluent will add additional volume, which could exacerbate flooding and erosion. In addition, the surface water catchment from the mine site, as well as the pumping of drinking water and dewatering water, will affect the various sub-watershed concerned (Maps 8-1 and 8-2), since the diverted water will no longer flow into them.

-73°57'
-73°54'
53°33'
53°30'
INF-09
CV24-608
CV24-624
CV24-633
CV24-633A
INF-08
CV24-611
CV24-642
CV24-601
CV24-594
CV24-588
INF-04
CV24-569
INF-02
CV24-640
INF-01
CV24-640A
CV24-575
CV24-658
CV24-557
INF-07-B
INF-07-A
INF-06
CV24-566
CV24-544
CV24-729
CV24-560
INF-05
CV24-553
CV24-580
CV24-657
CV24-552
CV24-673
CV23-167
CV23-186
CV24-548
CV24-672
CV24-537
CV24-547
CV24-780
CV24-782
CV23-159
CV23-145
CV23-155
CV24-533
CV24-696
CV23-166
CV23-144
CV24-536
CV24-784
CV24-534
10
5
3
1
La Grande-4
Réservoir La Grande 4
La Grande 4 Reservoir
Réservoir La Grande 3
La Grande 3 Reservoir
Route Transtaiga
Transtaiga Road
Lac de la Corvette
0
15 km

Zones d'étude / *Study Areas*

- Projet / *Project*
- Régionale - Biophysique / *Regional - Biophysical*
- Locale - Biophysique / *Local - Biophysical*

Composantes du projet / *Project Components*

- Projetées / *Projected*

Hydrogéologie / *Hydrogeology*

- Puits d'observation / *Monitoring well*

Rabattement simulé (fin exploitation) / *Simulated drawdown (end of exploitation)*

- 10 (m)
- 1 (m)

Infrastructures / *Infrastructures*

- Centrale hydroélectrique / *Hydroelectric generating station*
- Ligne de transport d'énergie / *Electric power transmission line*

Réseau routier / *Road Network*

- Route collectrice municipale / *Municipal collector road*

Composantes de l'écosystème / *Ecosysteme Componant*

- Milieu terrestre / *Terrestrial environment*

Milieux humides et hydriques / *Wetlands and Hydrous Environments*

- Marécage arborescent / *Treed swamp*
- Marécage arbustif / *Shrubby swamp*
- Tourbière minérotrophe boisée / *Treed fen*
- Tourbière minérotrophe ouverte / *Open fen*
- Tourbière ombrotrophe boisée / *Treed bog*
- Tourbière ombrotrophe ouverte / *Open bog*
- Marais / *Marsh*
- Eau peu profonde / *Shallow water*
- Plan d'eau / *Waterbody*

Cours d'eau / *Watercourses*

- Intermittent / *Intermitent*
- Permanent / *Permanent*

Projet minier Shaakichiuwaanaan / *Shaakichiuwaanaan Mining Project*

Étude d'impact sur l'environnement / *Environmental Impact Assessment*

Carte 8-1 / *Map 8-1*
Rabattement simulé - fin de l'exploitation/ *Simulated drawdown - End of Exploitation*

Sources / Sources

AQréseau+, réseau routier, MERN, 2016
BDGA, 1M, MERN, 2014
CanVec, 250k,RNCan, 2017

0 350 700 m

UTM, fuseau 18, NAD83 (CSRS)

2026-03-24

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Dessin / Drawn by : M. Dupraz
Approbation / Approved by : M-H. Brisson
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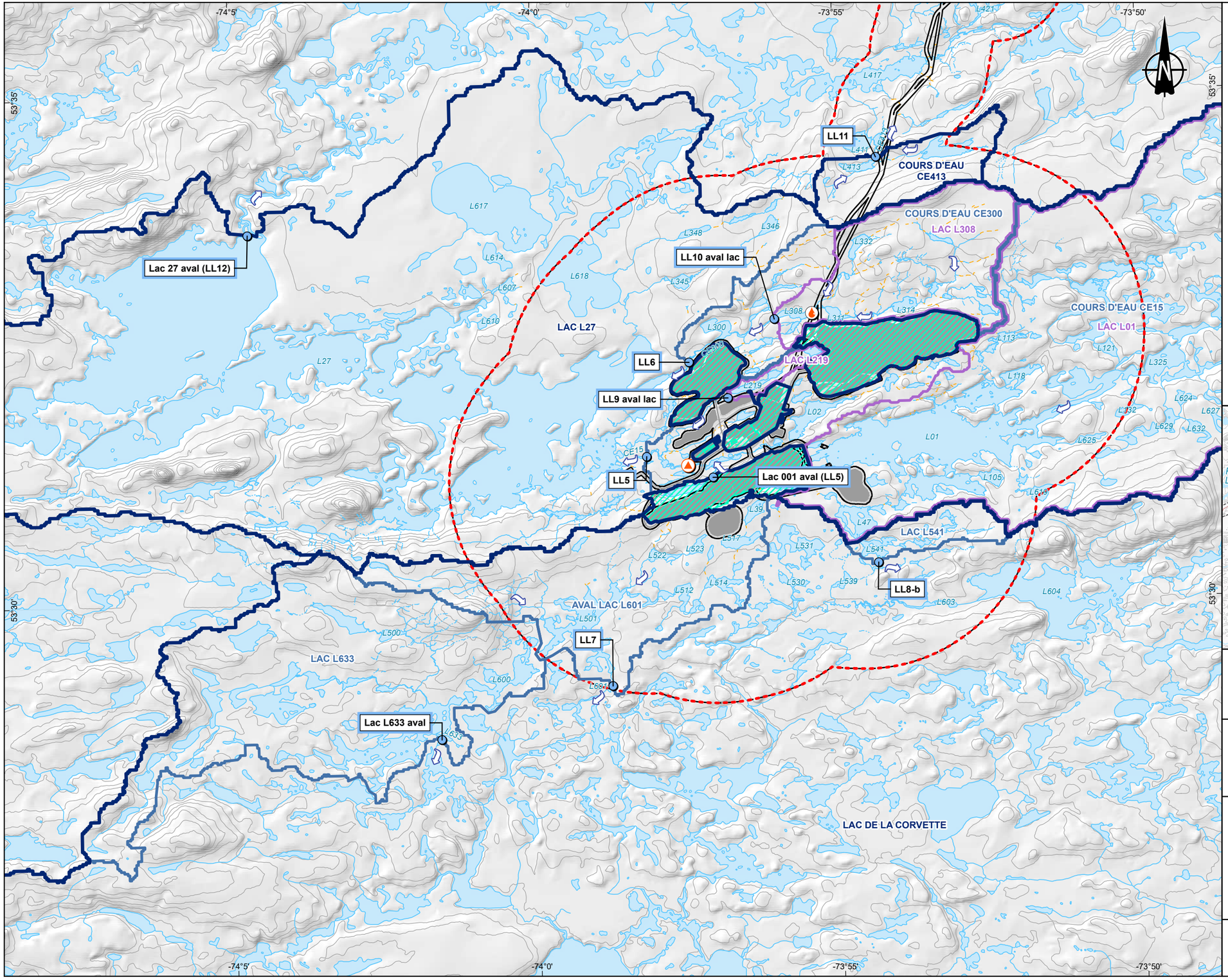
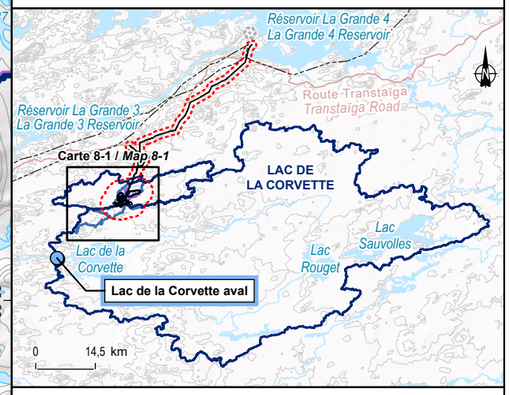
CA0001724_3318_eie_c08_1_151_rabattement_260324

La précision des limites et les mesures montrées sur ce document ne doivent pas servir à des fins d'ingénierie ou de délimitation foncière. Aucune analyse foncière n'a été effectuée par un arpenteur-géomètre. / Boundary accuracy and measurements shown on this document are not intended for engineering or land delineation purposes. No land analysis has been performed by a land surveyor.





Zones d'étude / *Study Areas*
- Projet / *Project*
- Locale - Biophysique / *Local - Biophysical*

Hydrologie / *Hydrology*
- Sens d'écoulement de l'eau / *Waterflow direction*
- Point de calcul / *Calculation point*
- Zone de collecte d'eau de ruissellement / *Runoff water collection area*

Bassins versants projetés / *Projected Watersheds*
- Principal / *Principal*
- Intermédiaire / *Intermediate*
- Sous-bassin versant / *Sub-watershed*

Composantes du projet / *Project Components*
- Effluent minier / *Mining effluent*
- Prise d'eau / *Water intake*
- Autres composantes projetées / *Other projected components*

Hydrographie / *Hydrography*
- Plan d'eau / *Waterbody*

Cours d'eau / *Watercourses*
- Intermittent / *Intermitent*
- Permanent / *Permanent*
- Souterrain / *Underground*

Projet minier Shaakichiuwaanaan / *Shaakichiuwaanaan Mining Project*

Étude d'impact sur l'environnement - Impacts / *Environmental Impact Assessment - Impacts*

Carte 8-2 / *Map 8-2*
Bassins versants, bassins intermédiaires et sous-bassins potentiellement affectés par le projet / *Watersheds, Intermediate Basins, and Sub-Watershed Potentially Affected by the Project*

Sources :
CanVec, 1/250 000, RNCan, 2017
BDGA, 1M, MERN, 2014
Cartographie écologique de la végétation du Nord Québécois, MFFP, 2013

0 700 1 400 m
NAD 1983 CSRS UTM Zone 18N

2026-03-24

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CA0001724_3318_eie_c08_2_109_hydrologie_260324

According to the results (Table 8-3), the sub-watersheds that will be most affected are those of Lakes L219 and L308, located to the north and northeast of Stockpile 02, as well as the sub-watershed of watercourse CE300, which receives water from the sub-watershed of Lake L308 before discharging it into Lake L27. The Lake L219 sub-watershed is expected to see a reduction in its average flow of approximately 34% over the course of each year, while Lake L308 is expected to see a reduction in its average flow ranging from 12% to 17%, with the largest reductions occurring from December through April. Lastly, the sub-watershed of Watercourse CE300 would experience a reduction in its average flow ranging from 11% to 15%, with the largest reductions occurring during the months of December through April. These sub-watersheds will be primarily affected by the pumping of water from Lake L308 to supply the mine site with drinking water and by the encroachment of Stockpiles 01 and 02, while runoff collected from these areas will be directed to treatment facilities before being discharged into Watercourse CE11 via the mine effluent.

An intermediate watershed located south of the open pit—specifically that of Lake L601—will also experience a reduction in its average flow. This reduction will be significantly smaller, as it is estimated to be around 3% for each year. This reduction is likely due to the encroachment of the pit and Stockpile 04, as well as the pumping required to dewater the pit.

All encroachments and diversions of surface water will have only a minor effect on the average flow at the outlet of Lake L01, with an estimated average annual reduction of 3.6%.

Mine effluent

With regard to the impact of mine effluent, modelling carried out by AtkinsRéalis (2025) shows that the addition of the associated volumes will have only a minor to negligible effect on rising water levels and on the morphology of the affected water bodies. As for the effects on average flow, estimates were made for Watercourse CE15 and the outlet of Lake L27 (Table 8-3). Hydraulic modelling and flow calculations show a slight decrease in flow at these two points during May and June, possibly caused by surface water being retained in the watersheds, thereby reducing the spring flood. For all other months, the results show an increase in average flow due to effluent inflow, which is particularly noticeable during the winter months, when inflow from natural sources is reduced but effluent inflow remains steady.

Mitigation measures

The common mitigation measures are presented in Appendix 8-2; in particular, some measures from the “Soil, surface water, and sediment quality” section apply to this VEC. However, with regard to this VEC, several measures were incorporated into the project design from the outset to minimize the anticipated impacts, including:

- The development of a model of the potential effects of mine effluent on local hydrodynamic and hydro-sedimentary conditions (discussed above) to determine whether action will be required and, if so, in which location;
- The development of a model of hydrological conditions and flow calculations to anticipate the effects of the diversion of surface water from certain peripheral watersheds into Watercourse CE11.
- The design of the surface water collection and treatment system at the mine site to ensure sufficient retention capacity and facilitate control of the flow of mine effluent into Watercourse CE15.

Table 8-3 Impact (in %) of catchment and diversion of water, as well as mine effluent, on the average flow of watersheds

Watershed name	Average flow rate (%) per month											
	January	February	March	April	May	June	July	August	September	October	November	December
Lake L01 (LL1)	-3.6	-3.6	-3.6	-3.6	-3.6	-3.6	-3.6	-3.6	-3.6	-3.6	-3.6	-3.6
Lake 27 (LL12)	6.1	8.5	10.7	3.2	-1.2	-0.8	5.3	4.7	0.7	0.3	3.9	2.5
Lake L633	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lac de la Corvette	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
CE15 (LL5)	12.8	17.5	21.7	7.4	-1.2	-0.5	11.1	10.0	2.3	1.7	8.5	5.9
CE300 (LL6)	-13.4	-14.1	-14.7	-12.6	-10.9	-11.0	-11.5	-11.4	-11.3	-11.4	-11.5	-12.4
Downstream Lake L601 (LL7)	-3.1	-3.1	-3.1	-3.1	-3.1	-3.1	-3.1	-3.1	-3.1	-3.1	-3.1	-3.1
Lake L540 (LL8-b)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lake L219 (LL9)	-34.2	-34.2	-34.2	-34.2	-34.2	-34.2	-34.2	-34.2	-34.2	-34.2	-34.2	-34.2
Lake L308 (LL10)	-15.3	-16.2	-17.0	-14.1	-11.8	-12.0	-12.6	-12.5	-12.3	-12.5	-12.7	-13.8
CE413 (LL11)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

In addition to the common measures and those incorporated into the project design, the following specific measures are proposed:

- Develop and implement a monitoring program to track water flow and erosion along the network of lakes and watercourses receiving mine effluent, particularly where they intersect with transportation routes (P32).
- Develop and implement a program to monitor the quality of dewatering water before it enters the polishing pond to confirm the absence of contaminants (other than suspended solids) that may require treatment (P37).

Assessment of residual impact

During the operations phase, based on the results of the projected flow rate calculations and with the implementation of the various proposed mitigation measures, it is expected that there will be only a **minor** impact on hydrodynamic and hydro-sedimentary conditions. Given the low value assigned to this VEC, the impact intensity is **low**. This impact will be felt at the local level throughout the entire period of operations (medium duration), resulting in a residual impact of **minor significance**. The likelihood of these impacts occurring is **high**, and the reversibility potential is **low** regarding the effects of surface water diversion and effluent inflow, since the stockpiles as well as the effluent will need to be managed beyond the closure phase.

Impact on hydrodynamic and hydro-sedimentary conditions			
Intensity:	Low	**Significance:**	Minor
Extent:	Local		
Duration:	Medium		
Probability of occurrence:		High	
Reversibility:		Low	

Closure phase

Statement of potential impact

Restoration of hydrodynamic and hydro-sedimentary conditions.

Sources of the impact

- Final restoration.

Detailed description of the impact

As part of mine site closure, the diversion channel will be left in place, and a breach will be created in one of the dikes in order to restore the natural flow of water into the open pit. The open pit will fill gradually until reaching a piezometric equilibrium with the surrounding environment.

Water collection and diversion around the waste rock piles and the treated mine effluent will also be maintained during the post-operations period until the completion of restoration works. However, a reduction in flow is anticipated for this effluent, as most of the site will be regraded to restore natural runoff conditions, with the exception of drainage capture at Waste rock stockpile 02. Overall, no impacts are anticipated on this component, aside from very minor risks of disturbance of watercourses and water bodies during restoration works, and a slight positive effect associated with the reduced flow from the mine effluent.

During the post-restoration period of the project, once water quality has been confirmed, dismantling of the water management system—including the creation of breaches in the dikes of the collection ponds associated with waste rock stockpiles 01 and 02—and site topography will result in four final effluents to be monitored, namely two effluents at waste rock stockpile 01 and two effluents at waste rock stockpile 02. The final effluent at the outlet of the project's water treatment system will have been dismantled.

Mitigation measures

The common mitigation measures are presented in Appendix 8-2; in particular, some measures from the "Soil, surface water, and sediment quality" section apply to this VEC.

Assessment of residual impact

During the closure phase, the implementation of the various proposed mitigation measures is expected to result in only **minor** disruption and improvement in hydrodynamic and hydro-sedimentary conditions. Given the low value assigned to this VEC, the intensity of the negative and positive impacts is **low**. These impacts will be felt locally and only during restoration activities (short-term) in the case of negative impacts, whereas positive impacts will be felt beyond the closure (long-term). The result is a negative residual impact of **minor significance** and a positive impact of **moderate significance**. The probability of the negative impact occurring is **low**, whereas the probability of the positive impact occurring is **high**. As for the potential for reversibility, it is **high** for negative impacts.

Impact on hydrodynamic and hydro-sedimentary conditions			
Intensity:	Low	**Significance:**	Minor (-) and moderate (+)
Extent:	Local		
Duration:	Short (-), Long (+)		
Probability of occurrence:		Low (-) and high (+)	
Reversibility:		High (-)	

8.2.1.2 Surface water quality

Surface water quality refers to all surface waters (runoff, watercourses, lakes) that may be affected by construction, operations, and closure activities. It should be noted that, within the scope of the project, surface waters are assigned a medium ecosystem value, as they are of significant interest and their conservation and protection are a priority. They are also considered to have significant socioeconomic value because they are deemed essential and are used by a significant portion of the affected populations. Since the value to be applied is the higher of the two, a **high** value will be used to analyze the impacts of this VEC.

Summary of current conditions

A total of 29 sampling stations located throughout the biophysical LSA—six in the area exposed to mine effluent and 23 in the reference area—were sampled for surface water quality between 2022 and 2025. Detailed results can be found in the sectoral report on surface water and sediments (Niigaan, 2025) presented in Appendix 6-7.

All of the lakes under consideration are oligotrophic, slightly acidic (average pH 6–6.5), well oxygenated at the surface, and have low biological productivity. The main exceedances observed in surface water samples were for pH, dissolved oxygen, and certain total extractable metals, notably aluminum, iron, and mercury. A few instances of exceedances of fluoride and zinc concentrations were also observed. The metals with the highest exceedances were aluminum (CWQG) and mercury (CPC [EO], CPC [O], and CFTP). These exceedances may be related to the local geology and rock composition of the region.

Finally, it should be noted that samples taken from the reference lake located to the northwest outside the biophysical LSA exceeded quality criteria for pH, dissolved oxygen, and aluminum.

Construction phase

Statement of potential impact

Alteration of surface water quality.

Sources of the impact

- Site organization, stripping, and clearing.
- Surface preparation and access layout.
- Transportation and traffic related to materials and supplies.
- Production and management of residual and hazardous materials.

Detailed description of the impact

Surface water quality can be altered physically by increased turbidity associated with particulate emissions, or chemically by the introduction of contaminants. TSS or contaminated water can be introduced directly or indirectly, via runoff water.

Increase of TSS in surface waters

During construction work, particulate matter may be carried into watercourses through dust raised by the work and through runoff flowing over exposed surfaces. In fact, during the stripping, clearing, and development of the areas required for the mine site (storage areas, areas for buildings and support infrastructure, new access roads), large tracts of bare land will be exposed to wind and runoff for the duration of the work. Dust stirred up by the wind and generated by passing vehicles can, as it settles, contribute to increased TSS concentrations in nearby water bodies and watercourses. Runoff will carry particulate matter—released as a result of soil exposure—into watercourses and bodies of water located near the work site.

Accidental introduction of petroleum hydrocarbons and other contaminants into surface water

Construction work can lead to accidental leaks and spills of petroleum hydrocarbons associated with the use of, among other things, mobile equipment. These leaks and spills can be caused by breakdowns in mobile equipment or by improper handling of petroleum products during refuelling or when receiving and storing them. Surface water contamination can occur directly if construction work or the handling of petroleum products takes place near a body of water or a watercourse. Contamination can also be indirect, as runoff carries contaminants spilled onto the ground into water bodies and watercourses. Another source of contamination is associated with the handling and management of hazardous waste that may have been improperly stored and exposed to the elements.

Mitigation measures

Common mitigation measures are presented in Appendix 8-2; in particular, those measures in the "Ambient air" and "Soil, surface water, and sediment quality" sections apply in whole or in part to this VEC. In addition to these, the following specific measures must be taken into account:

- Whenever possible, preserve the forest cover along the road of the mine site and revegetate bare areas with native plants after completion of the work (P23).
- An environmental supervisor will conduct regular inspections of work areas, ensure that all parties strictly comply with the various commitments, obligations, measures, and other requirements, assess the quality and effectiveness of the measures implemented, and document any non-compliance observed (P24).

Assessment of residual impact

As mentioned above, the value assigned to this VEC is high. The degree of disturbance is considered **low** because the anticipated impacts, after application of the mitigation measures, do not alter the integrity of surface water quality or its use, resulting in an impact of **medium** intensity. The extent of the impact will be limited to the **project** area, and it will be felt over the **short** term—specifically, only during the construction phase (less than two years). The significance of the residual impact is therefore **minor** for impacts related to TSS and contaminant spills or leaks. Despite the implementation of numerous mitigation measures designed to control the release of TSS into watercourses during construction, the probability of such an occurrence remains **medium**, whereas the probability of contamination by hydrocarbons or other substances is considered **low**. As for the potential for reversibility, it is considered **high** for both types of impacts.

<table>
<tr><th colspan="4">Impact on surface water quality</th></tr>
<tr><td>Intensity:</td><td>Medium</td><td rowspan="3">Significance:</td><td rowspan="3">Minor</td></tr>
<tr><td>Extent:</td><td>Project</td></tr>
<tr><td>Duration:</td><td>Short</td></tr>
<tr><td colspan="2">Probability of occurrence:</td><td colspan="2">Medium (TSS)/Low (contamination)</td></tr>
<tr><td colspan="2">Reversibility:</td><td colspan="2">High</td></tr>
</table>

Operations phase

Statement of potential impact

Alteration of surface water quality.

Sources of the impact

- Water use and management.
- Transportation and traffic related to ore and supplies.
- Production and management of residual and hazardous materials.

Detailed description of the impact

Given that, as a result of the construction work, a surface water catchment system will have been installed in the work areas and on access and traffic routes, the main sources of surface water contamination are associated with three primary sources: the discharge of TSS and other contaminants when the catchment system is overwhelmed by the volume of water collected, dust emissions, and mine effluent.

Introduction of TSS and other contaminants into surface water

In the operations phase, the network of ditches that redirects all surface water (both contact and non-contact) on the mine site—so that it can be treated and recirculated into the mine process or discharged into the environment—will be functional. Particulate matter washed away by runoff at the mine site should therefore not enter the natural watercourses and bodies of water. All collected runoff water will be treated either directly in the sedimentation pond, followed by the polishing pond or via the industrial wastewater treatment plant, followed by the polishing pond (see Chapter 5, Figure 5-8).

In addition, wind erosion of tailings and bare surfaces, as well as vehicle and machinery traffic on the site, is likely to generate dust that can be carried over a certain distance (Section 8.2.4.1 on air quality) and eventually settle in water bodies and watercourses, contributing to increased TSS concentrations.

Mine effluent

Water management includes collection, analysis, treatment of collected water on the mine site (runoff and contact water), and recirculation in the treatment plant process or discharge in the final effluent. The increase in mining operations will result in changes in the quality of contact water (i.e., water that has come into contact with potentially acid-generating tailings and waste rock), which will be treated accordingly to comply with the various applicable standards. In fact, the water treatment plant is designed so that the final effluent meets the discharge criteria set out in MELCCFP Directive 019 as well as those of the Metal and Diamond Mining Effluent Regulations (MDMER; see Table 8-4). In addition, it was designed to produce treated effluent that generally meets the surface water quality standards necessary to protect aquatic life, in accordance with the best available technology economically achievable (BATEA; AtkinsRéalis, 2026, see Appendix 5-10). AtkinsRéalis (2026) calculated the anticipated concentrations of contaminants in the final effluent. Table 8-3 presents the maximum concentrations calculated over a one-year period under normal precipitation conditions, as well as the quality criteria from Directive 019.

Table 8-4 Maximum metal concentrations calculated in the final effluent and quality criteria set forth in Directive 019 and the MDMER

	Aluminum (mg/l)	Antimony (mg/l)	Arsenic (mg/l)	Cadmium (mg/l)	Copper (mg/l)	Lithium (mg/l)	Nickel (mg/l)	Uranium (mg/l)
Final effluent	0.04	0.019	0.063	0.005	0.001	0.012	0.012	0.005
Directive 019	-	-	0.1	-	0.1	-	0.25	-
MDMER	1	-	0.1	0.1	0.25	-		

Following water treatment, parameters that will differ from the initial state established will possibly be found in low concentrations in the effluent water while complying with the water quality criteria in force.

An accidental spill of untreated water could occur exceptionally via the emergency spillways of the retention structures. An accidental spill (e.g., breach of tailings and waste rock management infrastructure, treatment equipment failure) could also result in an accidental discharge of untreated contaminated water. However, the consideration of this technological risk is addressed in Chapter 12, Accident risk management.

Mitigation measures

The same common mitigation measures recommended in the construction phase will be applied in the operations phase when work involves the same sources of potential impacts. Protection of water quality is governed by several regulations and standards, particularly for mining projects. These will be strictly followed, along with the mitigation measures set out in Appendix 8-2. Finally, the following specific mitigation measures will also be applied:

- An environmental supervisor will conduct regular inspections of work areas, ensure that all parties strictly comply with the various commitments, obligations, measures, and other requirements, assess the quality and effectiveness of the measures implemented, and document any non-compliance observed (P24).
- The non-active areas of the stockpiles will be watered using a water truck as needed (P28).
- Dust suppressants will be used on the slopes and final (outer) surfaces of the stockpiles (P29).
- A program to monitor the quality of dewatering water before it enters the polishing pond will be developed and implemented to confirm the absence of contaminants (other than TSS) that may require treatment (P37).

Assessment of residual impact

Overall, the degree of disturbance is considered low at the effluent discharge point because; without compromising its environmental integrity, the impact results in a barely noticeable reduction in water quality due to compliance with standards for the protection of aquatic life. Given that the VEC value is high, this results in a **medium** intensity. The extent of the impact will be **local.** The impact of the effluent discharge will be felt over the medium term, i.e., for a period not exceeding the project's lifespan and its closure. The significance of the residual impact is therefore **moderate** over the entire period of operations. The probability of occurrence is **high**, but **low** for accidental spills. The potential for reversibility is considered medium. Finally, it should be noted that a monitoring program will be implemented to assess the quality of the surface water receiving the effluent and to determine the effluent's range of influence (Chapter 13).

Impact on surface water quality			
Intensity:	Medium	**Significance:**	Moderate[1]
Extent:	Local		
Duration:	Medium		
Probability of occurrence:		High (effluent) / low (spill)	
Reversibility:		Medium	

[1]It should be noted that the expected residual impact on water quality is minor, as the design of the industrial wastewater treatment plant is intended to ensure compliance with the requirements of Directive 019. The medium significance rating is mainly attributable to the assignment of a medium duration to this impact based on the established definitions, although this duration does not in any way affect effluent quality.

Closure phase

Statement of potential impact

Alteration of water quality.

Gradual improvement in surface water quality.

Sources of the impact

- Final restoration.
- Production and management of residual and hazardous materials.

Detailed description of the impact

Alteration of water quality

During the closure phase, the demolition of buildings and infrastructure, soil remediation work (loosening, reprofiling, and spreading of organic soil), as well as the vehicle and machinery traffic required for these activities, may generate dust that, when settled, can contribute to increased TSS concentrations in water bodies and watercourses in the area surrounding the site. In addition, the operation of motorized equipment that requires the use of various pollutants (fuels, oils, etc.) can be a source of direct or indirect accidental contamination (via runoff) of water bodies and watercourses adjacent to the construction site. Improper handling and storage of these hazardous materials and the resulting hazardous waste can also contribute to such contamination.

Improvement of water quality

In general, the rehabilitation of the mine site and the revegetation of bare areas, including the various stockpiles, will significantly reduce dust emissions and limit the TSS load in runoff water.

It should also be noted that the water treatment plant and the polishing pond will remain in operation to treat leachate, particularly from Stockpile 02, which contains potentially acid-generating materials. This equipment must remain operational until the objectives of the post-restoration follow-up program for mine effluent (see Chapter 13, Section 13.2.2.7) are met. During this period, the mine effluent could continue to discharge contaminants which, although they would comply with current standards, could exceed baseline concentrations for some parameters.

Mitigation measures

Common mitigation measures are presented in Appendix 8-2; in particular, those in the "Ambient air," "Soil, surface water, and sediment quality," and "Vegetation and wetlands" sections apply in whole or in part to this VEC. In addition to these, the following specific measure must be taken into account:

- Work together with the tallyman of trapline CH39 in carrying out rehabilitation, restoration, and revegetation activities and returning the site to its natural state (P22).
- An environmental supervisor will conduct regular inspections of work areas, ensure that all parties strictly comply with the various commitments, obligations, measures, and other requirements, assess the quality and effectiveness of the measures implemented, and document any non-compliance observed (P24).

Assessment of residual impact

The anticipated impact on surface water quality is negative specifically with regard to the site closure work, but positive with regard to the site rehabilitation.

Thus, in terms of negative impacts, the level of disturbance is considered **low** after the implementation of mitigation measures. In fact, the effects will remain limited because, although they are similar to those during the construction phase, the work carried out during the closure phase is on a smaller scale. The intensity of the expected impact is therefore **medium.** This impact will be limited to the **project** area and will have a **short** duration, lasting only while the closure work is being carried out. Consequently, the residual impact is considered to be of **minor** significance. The probability of occurrence was assessed as **medium** and reversibility as **high**. Consequently, the residual impact is of **minor** significance.

The restoration of the site, including the revegetation of the areas and the gradual reduction of discharges into the mine effluent, has a positive impact. The degree of improvement is considered **high** for this VEC, resulting in a **high** positive impact. Stopping the effluent discharge will allow the environment to return to conditions similar to those found in natural environments, and the effects will be felt further downstream, throughout the mixing zone (**local** extent). These changes will naturally take several years to be felt, but for the stoppage of discharge, the impact will be immediate and long-term. The result is a positive impact of **major** significance. The probability of occurrence of the impact is assessed as **high**.

Impact on surface water quality			
Intensity:	High	**Significance:**	Minor (-)/Major (+)
Extent:	Project (-)/Local (+)		
Duration:	Short (-)/Long (+)		
Probability of occurrence:		Medium (-)/High (+)	
Reversibility:		High (-)	

8.2.1.3 Aquatic wildlife (fish) and habitats

Aquatic wildlife and habitats include all aquatic species (fish, benthos) and habitats (bodies of water, watercourses) that may be disturbed by construction, operations, and closure activities. It should be noted that, within the scope of the project, aquatic wildlife and habitats are assigned a medium ecosystem value, as they are of significant interest and their conservation and protection are a concern. They are also assigned a medium socioeconomic value, as they are considered important and are used by a proportion of the populations concerned. Since the value to be applied is the higher of the two, a **medium** value will be used to analyze the impacts of this VEC.

Summary of current conditions

Inventories were conducted in 2022, 2023, 2024 and 2025 to characterize fish and benthic invertebrate habitats. These inventories covered all bodies of water and watercourses likely to be directly or indirectly affected by the project, including those exposed to the anticipated mine effluent. Reference components were also characterized to detect any changes in the aquatic environment. The detailed results of these inventories are presented in the sectoral reports prepared by Niigaan in 2025, which is available in Appendices 6-16 and 6-17.

Inventories of fish and fish habitats made it possible to avoid the placement of mine tailings or waste rock within their habitat and to preserve habitat integrity and have confirmed the presence of several species in the biophysical LSA, the most significant of which, for both Indigenous and non-Indigenous communities, are the northern pike, brook trout, lake trout, whitefish, and burbot. No rare, threatened, or vulnerable species were identified in the study area or within a 10-kilometre radius of the project site. No invasive alien species were detected.

The biophysical LSA had been subdivided into seven sectors to facilitate the organization of data from the inventories. Three of these sectors are most likely to be affected by mine operations: Lake L01, La Grande A, and Lake L27. Most of the bodies of water, as well as eight watercourses in the Lake L01 sector, are considered fish habitats, and eleven other watercourses are considered potential habitats. Lake L01 stands out in the sector for its wide variety of fish, as well as for its physical characteristics that are conducive to growth, feeding, and spawning (on coarse substrates and in vegetated areas). However, despite favourable environmental conditions, the targeted inventory of potential spawning shoals proved inconclusive, and the potential for lake trout remains limited due to the presence of clogged substrate.

The La Grande A sector (north of Lake L01) includes 27 bodies of water and 106 watercourses. Nearly all bodies of water and 35 watercourses are confirmed fish habitats, and 6 other watercourses are potential habitats. In this sector, Lake L10 stands out for having the greatest diversity of fish species, with 10 species identified.

The L27 lake sector comprises 42 bodies of water and 82 watercourses, of which 6 bodies of water and a significant number of watercourses have been confirmed as fish habitats. Lake L27 plays a key structural role in the sector.

For benthic inventories, a total of 13 stations were used in the reference area and 6 in the area exposed to mine effluent. Most stations showed considerable variability in the structure of their benthic communities, and six exhibited high organism density, significant taxonomic richness, and indicators suggesting diverse and well-distributed communities. From a taxonomic point of view, arthropods dominate most stations, mainly represented by chironomids, followed by mollusks (bivalves and gastropods).

Construction phase

Statement of potential impact

Disturbance of wildlife activities and aquatic habitats.

Sources of the impact

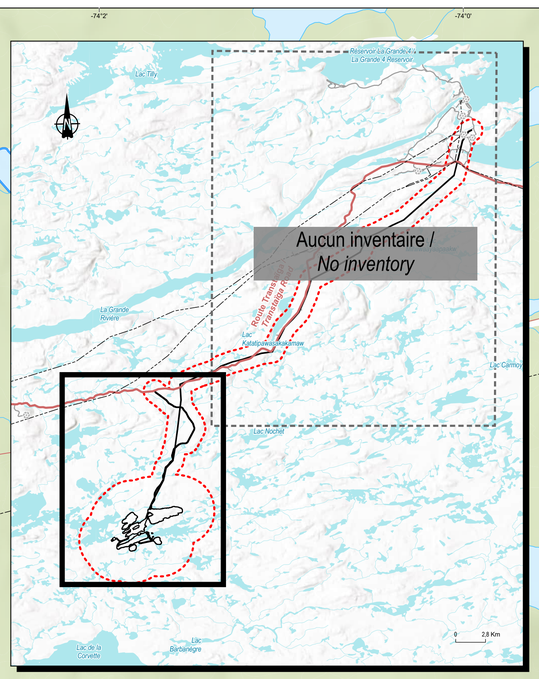
- Site organization, stripping, and clearing.
- Surface preparation and access layout.
- Transportation and traffic related to materials and supplies.
- Production and management of residual and hazardous materials.

Detailed description of the impact

In accordance with the development plan, the first phase of the project involves diking and draining on approximatively 13,5% of Lake L01 to create an open pit mine, which will result in the direct loss of approximately 57 hectares of fish habitat and will require the relocation of the existing fish populations (Map 8-3). The second phase, which involves the development of an underground mine, will involve the construction of dikes and diversion channels designed to maintain hydraulic connectivity and ensure the free passage of fish locally.

Habitat loss primarily affects the littoral areas with coarse, fine, and rocky substrates, shoals, and two pools ranging in depth from 6 to 8 metres. It also affects various functional habitats used for feeding, shelter, and potentially spawning by lithophilic species, including lake trout, brook trout, whitefish, and chub. These habitats are located primarily along the shoreline and near an islet in Lake L01, situated at the point where the lake's outflow—Watercourse CE1—begins, in areas exposed to prevailing winds. The loss also includes the isolation of habitats suitable for spawning by phytophilic species, particularly pike. These habitats are located in the littoral zone near the shoreline of the SH7 segment of the lake (Map 6-15), where there is a concentration of aquatic vegetation at the mouths of tributaries. In addition, potential spawning areas for lake trout are found in segment SH5, which is characterized by an abundance of pebbles, boulders, and coarse substrate. Segment SH9, on the other hand, offers spawning potential for brook trout due to the presence of finer, well-oxygenated substrates.

The drainage work will temporarily alter the waterline and expose the substrate, which will directly disrupt aquatic fauna—particularly benthic communities—even before fish relocation operations begin. Subsequently, the dike construction, pumping for drainage, and commissioning of the diversion channel will cause hydraulic changes in the bodies of water and watercourses located downstream of Lake L01. These operations could cause a one-time rise in water levels, as well as fluctuations in flow rate and velocity in some watercourses leading to Lake L27. Such variations are likely to affect the stability of riverbeds and banks, alter the distribution of available habitats, and influence the conditions necessary for fish migration, feeding, and reproduction.



Zones d'étude / *Study Areas*
- Projet / *Project*
- Locale - Biophysique / *Local - Biophysical*

Composantes du projet existantes / *Existing project components*
- Chemin d'accès / *Access road*
- Chemin d'accès à démanteler / *Access road to be dismantled*

Caractérisation de l'habitat / *Habitat Characterization*
- Herbier aquatique / *Aquatic plant*

Habitat du poisson / *Fish Habitat*
- Habitat / *Habitat*
- Pas un habitat / *Not a habitat*

Hydrographie / *Hydrography*
- Plan d'eau / *Waterbody*

Cours d'eau / *Watercourses*
- Intermittent / *Intermittent*
- Permanent / *Permanent*
- Permanent partiellement souterrain / *Permanent partially underground*
- Souterrain / *Underground*

Infrastructures / *Infrastructure*
- Centrale hydroélectrique / *Hydroelectric generating station*
- Ligne de transport d'énergie / *Electric power transmission line*

Réseau routier / *Road Network*
- Route collectrice municipale / *Municipal collector road*

Projet minier Shaakichiuwaanaan /
Shaakichiuwaanaan Mining Project

Étude d'impact sur l'environnement /
Environmental Impact Assessment

Carte 8-3 / *Map 8-3*
Empiètement du projet sur l'habitat du poisson / *Project Encroachment on Fish Habitat*

Sources / Sources
AQhistoire+, Réseau routier, MERN, 2016
BDGA, 1M, MERN, 2014
Carrivec, 250k,RNCan, 2017

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UTM, fuseau 18, NAD83 (CSRS)

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CA0001724_3318_eie_c08_3_hab_poisson_260317_A0

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La précision des limites et les mesures montrées sur ce document ne doivent pas servir à des fins d'ingénierie ou de délimitation foncière. Aucune analyse foncière n'a été effectuée par un arpenteur-géomètre. /
Boundary accuracy and measurements shown on this document are not intended for engineering or land delineation purposes. No land analysis has been performed by a land surveyor.

At the same time, activities such as stripping, material handling, pumping, and traffic in the construction zone will lead to an increase in airborne particulate matter. Particulate matter resulting from changes in the hydrological regime, soil erosion, and mine effluent will degrade water quality by increasing turbidity, which will reduce light penetration and limit oxygen availability for aquatic organisms. This increased turbidity will lead to sediment deposition in the Lake L27 outflow basin as well as in certain sections of downstream watercourses when hydrological conditions are conducive to particulate transport. These deposits could degrade habitat quality by clogging the substrates used for spawning and by affecting benthic communities, which serve as a vital food source for many fish species.

Mitigation measures

Common mitigation measures are presented in Appendix 8-2; in particular, those in the "Ambient air," "Soil, surface water, and sediment quality," and "Wildlife and wildlife habitat" sections apply in whole or in part to this VEC. In addition to these, the following specific measures must be taken into account:

- An environmental supervisor will conduct regular inspections of work areas, ensure that all parties strictly comply with the various commitments, obligations, measures, and other requirements, assess the quality and effectiveness of the measures implemented, and document any non-compliance observed (P24).
- Develop and implement a monitoring program for the diversion channel to confirm its capacity to handle the water volumes coming from Lake L01 and to ensure there are no signs of erosion along its course (P30).
- Develop and implement a monitoring program to track water flow and erosion along the network of lakes and watercourses from the point where the diversion channel connects to Lake L05 to the mouth of Watercourse CE15 at Lake L27. The areas at risk of erosion identified by the modelling carried out by AtkinsRéalis (2025) must be specifically included in this program (P31).
- Develop and implement a monitoring program to track water flow and erosion along the network of lakes and watercourses receiving mine effluent, particularly at their intersections with transportation routes.(P32).

Assessment of residual impact

Despite the implementation of the proposed measures—including on-site environmental monitoring, water management, stabilized diversion, fish rescue, and operational control via weirs—the loss of aquatic habitat associated with the drainage of Lake L01 remains significant throughout the mine's operations phase. This loss accounts for the bulk of the impacts associated with construction. The effects on water quality—including increased turbidity and sediment deposition—as well as the effects on hydrology, such as local variations in water levels and flow rates into Lake L27, are temporarily exacerbated during the work. However, these effects are considered reversible once the structures have been stabilized and the environment restored. Specific monitoring of the diversion channel and the receiving segments, namely Lake L05, Watercourse CE15, and Lake L27, is planned to confirm the effectiveness of the measures implemented and to allow for corrective actions to be taken as needed.

In summary, the degree of disturbance is considered **high**, resulting in an impact of **medium** intensity. The extent of the impact will generally be limited to the **project** area in the immediate vicinity of the work, and the impact will be felt over a **medium** duration, specifically during the construction and operations phases. This results in a residual impact of **moderate** significance. The probability of occurrence of these impacts is **high**, and the reversibility potential is **medium**, as a return to baseline conditions cannot be achieved for all disturbed aquatic habitats.

Impact on wildlife and aquatic habitats			
Intensity:	Medium	**Significance:**	Moderate
Extent:	Project		
Duration:	Medium		
Probability of occurrence:		High	
Reversibility:		Medium	

Operations phase

Statement of potential impact

Disturbance to wildlife activities and aquatic habitats due to mine effluent discharge.

Sources of the impact

- Water use and management.
- Transportation and traffic related to ore and supplies.
- Production and management of residual and hazardous materials.

Detailed description of the impact

The operations phase, expected to last between 17 and 20 years, is characterized by the continued partial drainage of 13,5% Lake L01, which represents a continuation of the impact that began during the construction phase—namely, the permanent loss of aquatic habitats in the pit area. During operations, hydrological conditions and water quality in the receiving environments, including the system consisting of Lake L05, Watercourse CE15, and Lake L27, will be regulated through water management and the operation of the diversion channel. Although local variations in flow rates or water levels may occur, these will remain stable over the long term, allowing aquatic ecosystems to adapt and reach a new state of functional equilibrium. Effects on water quality remain possible, although they are limited by the presence of the industrial wastewater treatment plant, the domestic wastewater treatment facility, and the polishing pond.

Dust emissions from mining operations may also contribute to the degradation of fish habitats by settling in them. Lastly, blasting operations can cause vibrations that disrupt the health and activities of fish. The following watercourses and bodies of water could be affected by vibrations generated by blasting activities: CE01, CE05, CE08, L01, L02, L03, L04, L05, and L72.

Mitigation measures

Common mitigation measures are presented in Appendix 8-2; in particular, those in the “Ambient air,” “Noise and vibration,” “Soil, surface water, and sediment quality,” and “Wildlife and wildlife habitat” sections apply to this VEC. In addition to these, the following specific measures must be taken into account:

- An environmental supervisor will conduct regular inspections of work areas, ensure that all parties strictly comply with the various commitments, obligations, measures, and other requirements, assess the quality and effectiveness of the measures implemented, and document any non-compliance observed (P24).
- Develop and implement a monitoring program for the diversion channel to confirm its capacity to handle the water volumes coming from Lake L01 and to ensure there are no signs of erosion along its course (P30).
- Develop and implement a monitoring program to track water flow and erosion along the network of lakes and watercourses from the point where the diversion channel connects to Lake L05 to the mouth of Watercourse CE15 at Lake L27. The areas at risk of erosion identified by the modelling carried out by AtkinsRéalis (2025) must be specifically included in this program (P31).
- Develop and implement a monitoring program to track water flow and erosion along the network of lakes and watercourses receiving mine effluent, particularly at their intersections with transportation routes (P32).
- Make the required adjustments to the blasting pattern to comply with vibration standards for fish habitat in the affected watercourses and water bodies (CE01, CE05, CE08, L01, L02, L03, L04, L05 and L72) (P44).

Assessment of residual impact

The residual impact is considered to be of moderate significance, primarily due to the prolonged nature of the loss of aquatic habitat associated with the drainage of Lake L01. However, the hydrological and water quality impacts are considered to be medium, localized, and stable over time, provided that management and monitoring measures are maintained.

In summary, the degree of disturbance is considered **high**, resulting in an impact of **medium** intensity. The extent of the impact will generally be **local**, extending beyond the immediate work area, and the impact will be felt over a **long** period of time, that is, beyond the closure phase—specifically, until the open pit has been completely refilled with water. This results in a residual impact of **moderate** significance. The probability of occurrence of these impacts is **medium**, and the reversibility potential is **medium**, as a return to baseline conditions cannot be achieved for all disturbed aquatic habitats.

Impact on wildlife and aquatic habitats			
Intensity:	Medium	**Significance:**	Moderate
Extent:	Local		
Duration:	Long		
Probability of occurrence:		Medium	
Reversibility:		Medium	

Closure phase

Statement of potential impact

Gradual restoration of the ecological functions of aquatic environments and improvement of habitat quality.

Sources of the impact

- Final restoration.

- Production and management of residual and hazardous materials.

Detailed description of the impact

At mine closure, the pit will fill naturally and gradually, allowing water to be gradually reintroduced into the aquatic system. The hydraulic structures, including the diversion channel, dikes, and weirs, will be left in place to ensure the hydraulic stability of the site during and after the pit is filled. The closure work will include sustained efforts to restore vegetation in riparian zones and disturbed areas, promoting soil stabilization, reducing erosion, and gradually improving the quality of aquatic and riparian habitats. There may be one-time disruptions in the short term while the work is underway, but these will be temporary and localized.

Mitigation measures

Common mitigation measures are presented in Appendix 8-2; in particular, those in the "Noise and vibration," "Soil, surface water, and sediment quality," and "Wildlife and wildlife habitat" sections apply to this VEC. In addition to these, the following specific measures must be taken into account:

- Work together with the tallyman of trapline CH39 in carrying out rehabilitation, restoration, and revegetation activities and returning the site to its natural state (P22).
- An environmental supervisor will conduct regular inspections of work areas, ensure that all parties strictly comply with the various commitments, obligations, measures, and other requirements, assess the quality and effectiveness of the measures implemented, and document any non-compliance observed (P24).

Assessment of residual impact

In the long term, the aquatic habitats are expected to return to a new state of ecological stability, supported by the cessation of mining activities, the gradual filling of the pit, and restoration efforts. The residual impact is considered low to medium, as most of the effects are reversible, with the exception of the initial loss of habitat resulting from the drainage of Lake L01, which remains partially irreversible but is mitigated by the planned restoration and compensation measures.

In summary, the degree of disturbance is considered **low**, resulting in an impact of **low** intensity. The extent of the impact will generally be at the **project** area level, and the impact will be felt over a **short** period of time, specifically during the closure phase. This results in a residual impact of **minor** significance. The probability of occurrence of these impacts is **medium**, and the reversibility potential is **high**, as a return to baseline conditions cannot be achieved for all disturbed aquatic habitats.

Impact on wildlife and aquatic habitats			
Intensity:	Low	**Significance:**	Minor
Extent:	Project		
Duration:	Short		
Probability of occurrence:		Medium	
Reversibility:		High	

8.2.2 Issue 2 – Preservation of soil and groundwater quality

8.2.2.1 Soil quality

Soil quality concerns all surface soils that may be disturbed by construction, operations, and closure activities. It should be noted that, within the scope of the project, while there is some interest in soil quality, it is not a major concern; for this reason, a **low** ecosystem value was assigned to this VEC.

Summary of current conditions

An assessment of natural background levels (NBL) was conducted at the project site. In general, a layer of organic soil was found at the surface, with a thickness ranging from 0.05 m to 0.67 m. This layer was generally followed by two main horizons consisting, respectively, of sand and gravel with traces of gravel, and sand and till with traces of till. These two horizons were used in the site's NBL calculations. The results showed NBLs in the A-B range for silver and arsenic in both soil horizons considered. All the other metals were below the generic criterion A of the MELCCFP. This study also confirmed that the site is unlikely to have been contaminated by human activities other than those associated with mineral exploration.

Construction phase

Statement of potential impact

Alteration of the physical and chemical quality of soils.

Sources of the impact

- Site organization, stripping, and clearing;
- Surface preparation and access layout;
- Transportation and traffic related to materials and supplies;
- Production and management of residual and hazardous materials.

Detailed description of the impact

During the construction phase, the main risks relate to:

- disturbance of existing soil horizons through various construction activities involving excavation and earthwork;
- soil exposure to erosion caused by clearing, stripping, and excavation work;
- compaction caused by repeated passage of vehicles and machinery;
- contamination of surface soil resulting from accidental leaks and spills of petroleum products or other hazardous materials caused by the operation of equipment that uses these products or simply during their handling.

Mitigation measures

The common mitigation measures are presented in Appendix 8-2; those in the "Soil, surface water, and sediment quality" section apply to this VEC. With the implementation of standard mitigation measures, the following specific measure may be applied:

- An environmental supervisor will conduct regular inspections of work areas, ensure that all parties strictly comply with the various commitments, obligations, measures, and other requirements, assess the quality and effectiveness of the measures implemented, and document any non-compliance observed (P24).

Assessment of residual impact

During the construction phase, the implementation of the various proposed mitigation measures is expected to result in a **medium** level of disturbance to the soil. Given the low value attached to soil, the intensity of the impact is **low**. This impact will be felt at the **project** area level and only during the construction period (**short** duration), resulting in a residual impact of **minor significance**. The probability of occurrence for this impact is **medium** in terms of contamination and erosion risks, while it is **high** in terms of compaction and disturbance of natural soil horizons. The reversibility potential of this impact is **high**, as measures can be taken to address potential contamination aas well as the compaction and disturbance of natural soil horizons.

Impact on soil quality			
Intensity:	Low	**Significance:**	Minor
Extent:	Project		
Duration:	Short		
Probability of occurrence:		Medium to high	
Reversibility:		High	

Operations phase

Statement of potential impact

Alteration of the physical and chemical quality of soils.

Sources of the impact

- Transportation and traffic related to ore and supplies.
- Production and management of residual and hazardous materials.

Detailed description of the impact

During the operations phase, the main risks relate to:

- The potential for surface soil contamination through accidental leaks or spills of hazardous materials, or through the deposition of metal-rich dust—both of which are generated by vehicle and machinery traffic on site—as well as by the handling of hazardous materials, tailings, and ore.

- The risk of erosion on the various types of soil and tailings accumulated in the various storage areas. Stacking these materials, which will be exposed to the elements, can cause them to slide and carry fine particles into watercourses.
- Transportation and traffic on roads and access routes can cause localized erosion (vibrations caused by vehicle traffic) that leads to sediment entering watercourses.

Mitigation measures

The common mitigation measures are presented in Appendix 8-2; those in the"Soil, surface water, and sediment quality" section apply to this VEC. With the implementation of standard mitigation measures, the following specific measure may be applied:

- An environmental supervisor will conduct regular inspections of work areas, ensure that all parties strictly comply with the various commitments, obligations, measures, and other requirements, assess the quality and effectiveness of the measures implemented, and document any non-compliance observed (P24).
- Leave the non-active surfaces of stockpiles covered with snow in winter: for the winter months, the passive surface, final slopes, and inner slopes are considered covered and inactive (P27).

Assessment of residual impact

During the operations phase, the implementation of the various proposed mitigation measures is expected to result in a **low** level of soil disturbance. Given the low value attached to soil, the intensity of the impact is **low**. This impact will be felt at the **project** area level and only during the operations phase, resulting in a residual impact of **minor significance**. The probability of occurrence of this impact is **high**, and the reversibility potential is **high**.

Impact on soil quality			
Intensity:	Low	**Significance:**	Minor
Extent:	Project		
Duration:	Medium		
Probability of occurrence:		High	
Reversibility:		High	

Closure phase

Statement of potential impact

Remediation of affected soils.

Sources of the impact

- Transport and traffic during closure operations.
- Final restoration.
- Production and management of residual and hazardous materials.

Detailed description of the impact

As part of the site's closure, most of the activities will have a positive impact on the site, as a large portion of the occupied areas will be freed up and replanted. The various stockpiles will also be profiled to ensure their long-term stability and revegetated after a layer of soil suitable for the roots of the sown and planted vegetation has been laid. Work areas that may have been contaminated by hazardous materials (hazardous materials storage areas, temporary ore storage areas, concentrator installation areas, etc.) will be assessed, and if contaminated soil is detected, it will be excavated and managed in accordance with provincial standards.

However, it is possible that traffic and transportation related to this work could result in the compaction of additional soil surfaces, as well as accidental leaks or spills.

Mitigation measures

The common mitigation measures are presented in Appendix 8-2; those in the"Soil, surface water, and sediment quality" section apply to this VEC. With the implementation of standard mitigation measures, the following specific measure may be applied:

- Cooperate with the tallyman of trapline CH39 in the rehabilitation, restoration, and revegetation activities and returning the site to its natural state (P22).
- An environmental supervisor will conduct regular inspections of work areas, ensure that all parties strictly comply with the various commitments, obligations, measures, and other requirements, assess the quality and effectiveness of the measures implemented, and document any non-compliance observed (P24).

Assessment of residual impact

As mentioned above, most of the activities related to the site's closure will have positive impacts on the various environmental components involved, including soil quality; therefore, there will be a **high** degree of improvement, resulting in a positive impact of **high** intensity. This positive impact will be felt in the project area and will continue beyond the closure activities (**long** duration). It will therefore have a **major** significance and a **high** probability of occurrence.

As for any potential negative impacts, they will be promptly addressed and resolved before the work is completed. For this reason, the anticipated level of disturbance is **low**, resulting in a **low** intensity, an extent limited to the project area, and a short duration. The residual impact will of **minor significance** and the reversibility potential is high.

Impact on soil quality			
Intensity:	Low (-) and High (+)	**Significance:**	Minor (-) and Major (+)
Extent:	Project		
Duration:	Short (-) and Long (+)		
Probability of occurrence:		Low (-) and High (+)	
Reversibility:		High (-)	

8.2.2.2 Groundwater quality

Groundwater quality refers to the quality of all water found in the different soil horizons that may be disturbed by construction, operations, and closure activities. It should be noted that, within the scope of the project, groundwater is assigned a medium ecosystem value, as it is of interest and its conservation and protection are a concern. It is also assigned a medium socioeconomic value, as it is considered important and can be utilized by a portion of the populations concerned. Since the value to be applied is the higher of the two, a **medium** value will be used to analyze the impacts of this VEC.

Summary of current conditions

Groundwater quality was determined based on samples collected from 23 wells in 2023 and 2024 (Appendix 6-8). These wells include 15 wells installed in the bedrock aquifer and 8 in sandy deposits. Exceedances of drinking water criteria were obtained for dissolved antimony, dissolved arsenic, dissolved manganese, molybdenum, ammonia nitrogen, sulphide, and fluoride. Exceedances were also observed for the criterion regarding the resurgence of copper and sulphides in surface waters. The various results obtained show that the majority of radionuclides were not detected.

Construction phase

Statement of potential impact

Alteration of groundwater quality.

Sources of the impact

- Site organization, stripping, and clearing.
- Surface preparation and access layout.
- Construction of structures and infrastructure.
- Transportation and traffic related to materials and supplies.
- Production and management of residual and hazardous materials.

Detailed description of the impact

Road transportation, traffic and refuelling of mobile equipment and temporary storage or handling of residual and hazardous materials will represent potential sources of accidental spills that could contaminate the soils and reach the water table. Such a spill, if it occurs, will contaminate the soils of the spill site. The impact of a potential spill would depend, among other things, on the volume of contaminants spilled, the one-time occurrence (spill), or the repetition (leak) of the problem.

If the volume spilled is significant, a portion of product not fixed to the soil grains would migrate by surface runoff to the bodies of water and eventually to the water table. Infiltration to the water table would leave a dissolved phase floating in the groundwater. In the case of heavy solvents, the product would infiltrate until it is completely absorbed by the soil particles or until it reaches an impermeable horizon.

The access roads and traffic routes must be maintained to ensure the workers' safety. The use of melting agents (mixture of salt and abrasive), to ensure the safety of the traffic routes in winter, could result in an increase in the salt concentration in the neighbouring soils and affect water quality. Surface water seepage into the sol risks entrainment of a portion of these melting agents to the water table. The salinity of the groundwater could increase under the access roads at the locations where the aquifer is more vulnerable. The salt-abrasive mixture that will be used will be a common type approved by the MTQ or the MELCCFP.

Mitigation measures

Common mitigation measures are presented in Appendix 8-2; in particular, those in the "Soil, surface water, and sediment quality" section as well as those in the "Hydrology and hydrogeology" section, apply to this VEC. In addition to the common measures, the following specific measure may be applied:

- An environmental supervisor will conduct regular inspections of work areas, ensure that all parties strictly comply with the various commitments, obligations, measures, and other requirements, assess the quality and effectiveness of the measures implemented, and document any non-compliance observed (P24).

Assessment of residual impact

During the construction phase, the implementation of the various proposed mitigation measures is expected to result in a **medium** degree of disturbance to groundwater quality. Given the medium value assigned to groundwater, the impact intensity is **medium**. This impact will be felt within the **project** area and only during the construction period (**short** duration), resulting in a residual impact of **minor significance**. The probability of occurrence of this impact is **low** in terms of contamination risks, as it is linked to an accidental event or poor practices. The reversibility potential of this impact is **medium** as measures can be taken to address any potential contamination. However, if action is not taken immediately, it may be difficult to effectively remove contaminants from the water.

Impact on groundwater quality			
Intensity:	Medium	**Significance:**	Minor
Extent:	One-time		
Duration:	Short		
Probability of occurrence:		Low	
Reversibility:		Medium	

Operations phase

Statement of potential impact

Alteration of groundwater quality.

Sources of the impact

- Existence and operation of new infrastructure (water infiltration beneath the infrastructure).
- Water use and management (percolating water, dewatering, etc.).
- Transportation and traffic related to ore and supplies.

- Production and management of residual and hazardous materials.

Detailed description of the impact

Waste rock and tailings storage facilities

The project includes plans for two storage areas for waste rock and tailings. The first will be used to store waste rock that is non-leachable and not potentially acid-generating (Stockpile 01). The second will be used for the storage of materials that are potentially acid-generating (waste rock and tailings). Some of the waste rock and tailings will be stored in the same stockpile, namely Stockpile 02. This stockpile could therefore have an impact depending on the geochemical characteristics of the stored materials. Thus, during operations, runoff water could percolate through the stockpile and leach metals, particularly arsenic (Atkins, 2026).

According to geochemical studies, some of the waste rock and tailings are classified as leachable (for certain metals) under D019. Certain lithologies would also have variable potential for acid generation.

It is unlikely that water containing metals will reach the aquifers, given the design measures that are planned. In fact, the presence of a leak-proof membrane lining the bottom of the stockpile and sealed ditches will minimize the risk of seepage into the soil and thus the potential contamination of groundwater. All runoff will be recovered via a system of perimeter ditches and a lined collection pond, which will prevent water from seeping into the underlying aquifer. Water from the collection ponds will be pumped to a water treatment system and then transferred to the polishing pond before being discharged via the mine effluent (see Section 8.2.1.2, Surface water quality).

Atkins (2026) developed a contaminant transport model to assess the risk of dispersion. The results of the contaminant transport model indicate that Lake L02 is the most at-risk receiving environment due to its proximity to and location downstream of Stockpile 02. However, the measures developed during the design phase and that will be implemented should be effective, since modelling shows that metal concentrations reaching environmental receptors remain below applicable criteria even after 200 years. The sensitivity study conducted shows that the membrane properties are the factor that most strongly influence on the concentrations reaching the receptor, underscoring the importance of proper installation during construction.

Dewatering water

The mine dewatering water could be contaminated with metals and contain traces of nitrites and nitrates. There are few groundwater contamination risks related to dry maintenance activities. Water pumped from underground operations will undergo initial treatment to reduce TSS; the water will then be pumped to a retention pond and treated before being discharged into the natural environment.

Risk of groundwater contamination by the accidental introduction of petroleum hydrocarbons, contaminants or hazardous materials

The description of the impact presented in the construction phase applies for the operations phase.

Throughout the operations period, there will be a risk of accidental spills of petroleum hydrocarbons due to the use of mobile equipment and the storage and handling of hazardous materials (including petroleum hydrocarbons). As in the construction phase, spills may result from the failure of mobile equipment containing a limited quantity of petroleum products, or from the improper storage or handling of hazardous materials. However, since the entire site is surrounded by water management infrastructure, the spread of these substances into the environment will be limited.

Management of residual and hazardous materials

The operations phase will generate residual materials and hazardous products, which will be managed off site. Improper storage that exposes contents to the elements, combined with improper handling, could result in a leak or accidental spill, posing a risk to groundwater quality.

Risk of groundwater contamination by seepage of contaminants from use of melting agents in winter

The description of this impact is the same as the one presented in the construction phase.

Mitigation measures

Common mitigation measures are presented in Appendix 8-2; in particular, those in the "Soil, surface water, and sediment quality" section as well as those in the "Hydrology and hydrogeology" section, apply to this VEC. In addition to the common measures, the following specific measures may be applied:

- An environmental supervisor will conduct regular inspections of work areas, ensure that all parties strictly comply with the various commitments, obligations, measures, and other requirements, assess the quality and effectiveness of the measures implemented, and document any non-compliance observed (P24).
- Develop and implement a monitoring program for dewatering water quality prior to its entry into the polishing pond in order to confirm the absence of contaminants (other than TSS) that could require treatment (P37).

Assessment of residual impact

Given the fact that all the infrastructure at risk will be developed on lined membranes and that the runoff water will be recovered via lined ditches, the degree of disturbance is considered **low**, resulting in a potential impact of **low** intensity. Any mining operation, by its nature, could have a certain impact on groundwater quality. In this case, the extent of the impact will be limited to the **project** area in the event of an accidental spill, but could be **local** if the infiltration is detected late. Similarly, the duration (in the case of accidental spills) will be **long** (if water seeps beneath the stockpiles and ponds) and the probability of occurrence for these elements is **low** since they are linked to poor infrastructure design, improper handling, or accidents. The significance of the residual impact is thus **minor** for the risks of groundwater contamination due to spills, and although unlikely, it may be medium in the case of seepage linked to a failure of the membranes beneath the stockpile. The probability of occurrence is **low** given the planned developments. The reversibility of the impact is considered **medium**, since if an incident occurs, the recovery of contaminants from the groundwater may prove difficult.

Impact on groundwater quality			
Intensity:	Low	**Significance:**	Minor
Extent:	One-time to local		
Duration:	Short to long		
Probability of occurrence:		Low	
Reversibility:		Medium	

Closure phase

Statement of potential impact

Gradual improvement in groundwater quality.

Sources of the impact

- The presence of site remnants (particularly stockpiles).
- Final restoration.
- Production and management of residual and hazardous materials.

Detailed description of the impact

During the restoration phase, the negative impacts related to the risks of groundwater contamination by an accidental spill of petroleum hydrocarbons and hazardous materials and spreading of melting agents in winter are anticipated on the same basis as in the construction period. Furthermore, the impacts are similar to those of the operations phase in terms of contact water infiltration from storage areas, given that the infrastructure (stockpiles) will remain in place despite the site's restoration. Contaminant transport modelling carried out on Stockpile 002 (AtkinsRealis 2026l Appendix 6-12) has shown that the long-term impact is negligible, given the presence of a leak-proof membrane beneath the stockpile. Furthermore, once the site is closed, Stockpile 002 will be covered with a low-permeability layer. The covering will serve to limit or eliminate rainwater runoff into the stored materials, which should result in a reduction in metal leaching and acid generating potential and their percolation into groundwater.

Mitigation measures

Common mitigation measures are presented in Appendix 8-2; in particular, those in the "Soil, surface water, and sediment quality" section, as well as those in the "Hydrology and hydrogeology" section, apply to this VEC. In addition to the common measures, the following specific measure may be applied:

- An environmental supervisor will conduct regular inspections of work areas, ensure that all parties strictly comply with the various commitments, obligations, measures, and other requirements, assess the quality and effectiveness of the measures implemented, and document any non-compliance observed (P24).

Assessment of residual impact

The intensity of the impact on groundwater quality is considered **low**, given the **low** degree of disturbance and the **medium** value attached to the VEC. The extent is considered **local**. Water infiltration through tailings and waste rock, even if minimal, will always be present; the duration is therefore considered **medium**, as for the other risks, since the site will be rehabilitated upon closure. The probability of occurrence is considered **low** given the level of protection provided by the structures (membranes), and the reversibility is considered **medium**. The significance of the residual impact is considered **minor**.

In the closure phase, final restoration provides for revegetation of the tailings storage facility and the waste rock stockpile, dismantling of the mine infrastructure, and rehabilitation of soils if they exceed the criteria established for the restoration work. Removing potential sources of soil contamination thus represents a **high** degree of improvement, resulting in a positive impact of **high** intensity. The extent of this positive impact is **local**, and its duration is **long**, making it of **major** significance. Its probability of occurrence is **high**.

Impact on groundwater quality			
Intensity:	Low (-) High (+)	**Significance:**	Minor (-) Major (+)
Extent:	Local (-) (+)		
Duration:	Medium to Long (-) Long (+)		
Probability of occurrence:		Low (-) High (+)	
Reversibility:		Medium (-)	

8.2.3 Issue 3 – Preservation of wetlands and habitats of interest to terrestrial wildlife and plants

8.2.3.1 Wetlands and water environments

Wetlands and water environments include all types of wetlands (marshes, swamps, peatlands), shorelines (bodies of water and waterways), and banks that may be disturbed by construction, operations, and closure activities. It should be noted that, within the scope of the project, wetlands and water environments are assigned a medium ecosystem value, as they are of significant interest and their conservation and protection are a concern. They are also assigned a medium socioeconomic value, as they are considered important and are used by a proportion of the populations concerned. Since the value to be applied is the higher of the two, a **medium** value will be used to analyze the impacts of this VEC.

Summary of current conditions

In the biophysical LSA (20,661 ha), wetlands cover 2,430 ha, or 11.8% of the area, and consist of eight types of groupings. Among all wetland vegetation groupings, wooded ombrotrophic bogs and open ombrotrophic bogs predominate. In fact, these two types of plant communities account for 63.7% of the wetlands in the biophysical LSA (1,548 ha out of 2,430 ha). Other groupings include open and wooded fens (177 ha and 67 ha), shrub swamps (245 ha), treed swamps (372 ha), ponds and shallow waters (15 ha), and marshes (6 ha).

Only 4% of the characterized wetlands had been disturbed by human activities (roads, partial logging, drainage), while approximately 11% had been disturbed by natural events, such as recent forest fires (10%), or by beaver activity (1%).

Construction phase

Statement of potential impact

Loss of surface area and disruption of the quality of wetlands and water environments.

Sources of the impact

- Site organization, stripping, and clearing.
- Surface preparation and access layout.
- Transportation and traffic related to materials and supplies.
- Production and management of residual and hazardous materials.

Detailed description of the impact

The project's impact on wetlands and water environments during the construction phase is closely linked to site preparation (clearing, earthwork) for the installation of the infrastructure, buildings, and equipment required to bring the mine site into operation. More specifically, the impacts are related to the construction of the new power line and associated substations, as well as storage areas, areas designated for buildings and equipment, and the access roads required at the mine site. The access road connecting the mine site to the Trans-Taiga Road is not taken into account because it is already in place.

This work results in a permanent loss of total wetland and water environment area (footprints of work and storage areas, internal routes, transmission line towers, and substations) of 120.2 ha, including 104.7 ha of wetlands and 15.5 ha of water environments (excluding fish habitat surface areas, which are considered in Section 8.2.1.3) (Map 8-3, Table 8-5). This surface area accounts for approximately 5% of the total area of these habitats within the biophysical LSA. In terms of wetlands, the main types affected include, in order of importance, wooded ombrotrophic bogs (30%), open ombrotrophic bogs (27%), treed swamps (25%), and shrub swamps (14%).

It should also be noted that wetlands and water environments can also be impacted by dust stirred up during construction work and settling on surrounding surfaces.

Table 8-5 Summary of estimated losses in wetlands and water environments

Environment	Class	Category	Type	Surface area impacted (ha)		
				Not a fish habitat	Fish habitat	Total
Water	Coastal	Watercourse		-	0.78	0.78
		Body of water		0.03	56.35	56.38
		Wetland below the coastal zone	Shallow water	0.06	-	0.06
			Marshes	-	0.05-	0.05
			Tree swamp	0.05	-	0.05
			Shrub swamp	0.86	-	0.86
			Wooded fen	0.76	-	0.76
			Open fen	2.88	-	2.88
			Wooded ombrotrophic bog	0.02	-	0.02
			Open ombrotrophic bog	0.30	-	0.30
			Subtotal	**4.97**	**57.18**	**62.15**
Water (continued)	Bank 10m	Forest environment	Regenerating	4.59	-	4.59
			Softwood	1.50	-	1.50
		Wetland	Tree swamp	0.46	-	0.46
			Shrub swamp	0.10	-	0.10
			Wooded fen	0.14	-	0.14
			Open fen	0.04	-	0.04
			Wooded ombrotrophic bog	0.86	-	0.86
			Open ombrotrophic bog	2.03	-	2.03
		Non-forest environment	Scrubland	0.59	-	0.59
			Island	0.21	-	0.21
			Lichen tundra	-	-	-
			Bare surface	0.02	-	0.02
			Subtotal	**10.53**	**-**	**10.53**

Environment	Class	Category	Type	Surface area impacted (ha)		
				Not a fish habitat	Fish habitat	Total
Wetland			Shallow water	0.02	-	0.02
			Tree swamp	26.28	-	26.28
			Shrub swamp	14.44	-	14.44
			Wooded fen	3.31	-	3.31
			Open fen	0.14	-	0.14
			Wooded ombrotrophic bog	31.85	-	31.85
			Open ombrotrophic bog	28.64	-	28.64
	Subtotal			**104.68**	**-**	**104.68**
Total				**120.19**	**57.18**	**177.36**

Mitigation measures

Common mitigation measures are presented in Appendix 8-2; in particular, those in the "Ambient air," "Soil, surface water, and sediment quality," and "Vegetation and wetlands" sections apply in whole or in part to impacts on wetlands and water environments. In addition to these, the following specific measures must be taken into account:

- Whenever possible, preserve the forest cover along the road of the mine site and revegetate bare areas with native plants after completion of the work (P23).
- An environmental supervisor will conduct regular inspections of work areas, ensure that all parties strictly comply with the various commitments, obligations, measures, and other requirements, assess the quality and effectiveness of the measures implemented, and document any non-compliance observed (P24).

Assessment of residual impact

During the construction phase, despite the implementation of the various proposed mitigation measures, the work will result in a permanent net loss of wetlands and water environments, suggesting that these environments will be significantly disturbed. Given the medium value assigned to wetlands and water environments, the impact intensity is **high**. This impact will be felt at the project site throughout the construction and operations phases (**medium** duration), resulting in a residual impact of **moderate significance**. The probability of occurrence of this impact is **high**, and its reversibility potential is **medium**, as it is relatively complex to recreate wetlands and water environments.

Impact on the quality of wetlands and water environments			
Intensity:	Medium	**Significance:**	Moderate
Extent:	Project		
Duration:	Medium		
Probability of occurrence:		High	
Reversibility:		Medium	

Operations phase

Statement of potential impact

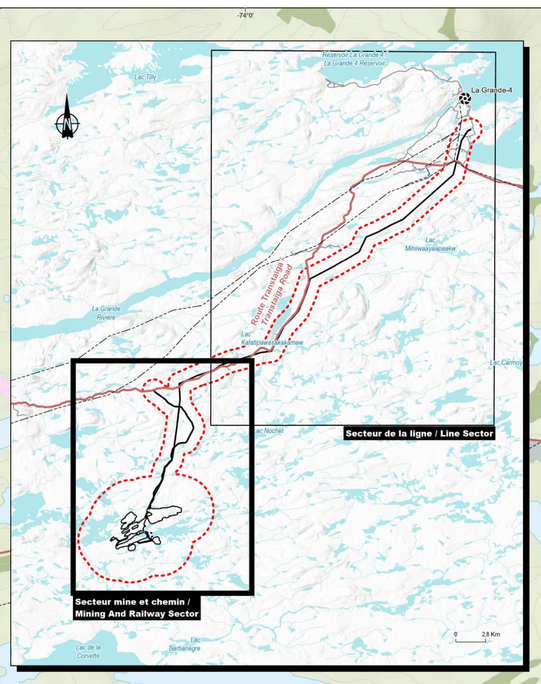
Disruption of the quality of wetlands and water environments.

Sources of the impact

- Water use and management.
- Transportation and traffic related to ore and supplies.
- Production and management of residual and hazardous materials.

Detailed description of the impact

During the operations phase, the impact on wetlands is primarily associated with the generation of dust that can settle in these environments as a result of various traffic and material-handling activities at the mine site. Some of these environments may also be indirectly affected by the drawdown of the water table (dewatering of the pit and the underground mine), which could slightly reduce the levels of resurgence. For water environments, which include shorelines and riverbanks, in addition to the problems caused by dust deposition, issues related to slope instability and the onset of erosion may arise, particularly due to changes in flow rates in certain watercourses (contribution from mine effluent and the diversion channel) and at intersections with traffic routes (vibrations caused by vehicles).



Empiètement du projet / *Project Encroachment*

Zone d'empiètement du projet / *Project encroachment area*

Infrastructures / *Infrastructure*

Centrale / *Power plant*

Ligne de transport d'énergie / *Electric power transmission line*

Réseau routier / *Road Network*

Route d'accès aux ressources / *Resource access route*

Composantes de l'écosystème / *Ecosystem Components*

Milieux humides et hydriques / *Wetlands and Hydrous Environments*

- Marécage arborescent / *Treed swamp*
- Marécage arbustif / *Shrubby swamp*
- Tourbière minérotrophe boisée / *Treed fen*
- Tourbière minérotrophe ouverte / *Open fen*
- Tourbière ombrotrophe boisée / *Treed bog*
- Tourbière ombrotrophe ouverte / *Open bog*
- Marais / *Marsh*
- Eau peu profonde / *Shallow water*
- Plan d'eau / *Waterbody*
- Rive de 10 m / *10 m shore*

Cours d'eau / *Watercourses*

- Intermittent / *Intermittent*
- Permanent / *Permanent*

Milieux terrestres / *Terrestrial Environments*

- Feuillu / *Deciduous*
- Mixte / *Mixed-wood*
- Résineux / *Softwood*
- Arbustaie / *Scrubland*
- Lande à lichens / *Lichen tundra*
- Régénération / *Regeneration*

Autres milieux / *Other Environments*

- Anthropique / *Anthropogenic*
- Champ de blocs / *Boulder field*
- Île / *Island*
- Surface dénudée / *Dry barren*

Projet minier Shaakichiuwaanaan / *Shaakichiuwaanaan Mining Project*

Étude d'impact sur l'environnement / Environmental Impact Assessment

Carte 8-4a / *Map 8-4a*

Empiètement du projet en milieu humide et hydrique - Secteur de la mine et du chemin/ *Project Encroachment in Wetland and Hydrous Environments - Mining And Road Sector*

Sources / Sources

AOrléneux+, réseau routier, MERN, 2016
BDGA, 1M, MERN, 2014
CanVec, 250k,RNCan, 2017
MRNF, Végétation du Nord québécois, 2013
WSP, Photo interprétation et validation terrain, 2024-2025 / BBA, Photo interprétation, 2023.
GRHQ, Réseau hydrique, 2024

0 190 380 m
UTM, fuseau 18, NAD83 (CSRS)

2026-03-20

Préparation / Prepared by V. Roy
Dessin / Drawn by M. Dupraz
Approbation / Approved by M.-H. Brisson
CA0001724_3318_ele_c02B_c03_04_260311.aprx
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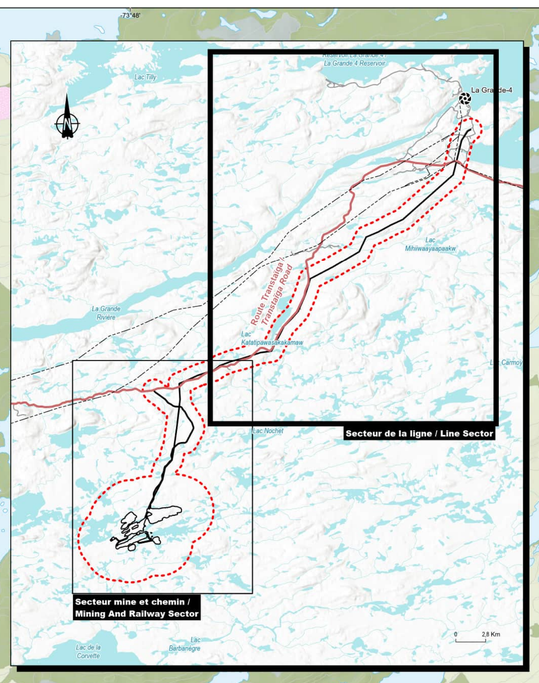
wsp

La précision des limites et les mesures montrées sur ce document ne doivent pas servir à des fins d'ingénierie ou de délimitation foncière. Aucune analyse foncière n'a été effectuée par un arpenteur-géomètre. / Boundary accuracy and measurements shown on this document are not intended for engineering or land delineation purposes. No land analysis has been performed by a land surveyor.



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Mitigation measures

Common mitigation measures are presented in Appendix 8-2; in particular, those in the "Ambient air," "Soil, surface water, and sediment quality," and "Vegetation and wetlands" sections apply in whole or in part to the impacts on the quality of wetlands and water environments. In addition to these, the following specific measures must be taken into account:

- Gradually restore Stockpiles 1 and 2 to reduce the areas susceptible to wind erosion and erosion from runoff (P01).
- Whenever possible, preserve the forest cover along the road of the mine site and revegetate bare areas with native plants after completion of the work (P23).
- An environmental supervisor will conduct regular inspections of work areas, ensure that all parties strictly comply with the various commitments, obligations, measures, and other requirements, assess the quality and effectiveness of the measures implemented, and document any non-compliance observed (P24).
- Spray water on the non-active areas of the stockpiles using a water truck when necessary (P28).
- Apply dust suppressants on the slopes and top surfaces (exterior) of the stockpiles (P29).
- Develop and implement a monitoring program for the diversion channel to confirm its capacity to handle the water volumes coming from Lake L01 and to ensure there are no signs of erosion along its course (P30).
- Develop and implement a monitoring program to track water flow and erosion along the network of lakes and watercourses from the point where the diversion channel connects to Lake L05 to the mouth of Watercourse CE15 at Lake L27. The areas at risk of erosion identified by the modelling carried out by AtkinsRéalis (2025) must be specifically included in this program (P31).
- Develop and implement a monitoring program to track water flow and erosion along the network of lakes and watercourses receiving mine effluent, particularly at their intersections with transportation routes (P32).

Assessment of residual impact

During the operations phase, the implementation of the various proposed mitigation measures is expected to result in a **low** degree of disturbance to wetlands and water environments. Given the medium value attached to wetlands and water environments, the intensity of the impact is **low**. This impact will be felt at the local level (dust emissions) and throughout the entire operations phase (medium duration), resulting in a residual impact of **minor significance**. The probability of occurrence of this impact is **high**, and the reversibility potential of this impact is **medium**.

Impact on the quality of wetlands and water environments			
Intensity:	Low	**Significance:**	Minor
Extent:	Local		
Duration:	Medium		
Probability of occurrence:		Low	
Reversibility:		Medium	

Closure phase

Statement of potential impact

Restoration of wetlands and water environments.

Sources of the impact

- Final restoration.
- Production and management of residual and hazardous materials.

Detailed description of the impact

During the closure phase, the impact is primarily positive due to the freeing up of most of the space occupied by mining facilities and its restoration (soil and slope rehabilitation, revegetation).

Nevertheless, restoration work can lead to impacts related to dust generation and the onset of localized erosion.

Mitigation measures

Common mitigation measures are presented in Appendix 8-2; in particular, those in the "Ambient air," "Soil, surface water, and sediment quality," and "Vegetation and wetlands" sections apply in whole or in part to the impacts on the quality of wetlands and water environments. In addition to these, the following specific measures must be taken into account:

- Gradually restore Stockpiles 1 and 2 to reduce the areas susceptible to wind erosion and erosion from runoff (P01).
- Work together with the tallyman of trapline CH39 in carrying out rehabilitation, restoration, and revegetation activities and returning the site to its natural state (P22).
- Whenever possible, preserve the forest cover along the road of the mine site and revegetate bare areas with native plants after completion of the work (P23).
- An environmental supervisor will conduct regular inspections of work areas, ensure that all parties strictly comply with the various commitments, obligations, measures, and other requirements, assess the quality and effectiveness of the measures implemented, and document any non-compliance observed (P24).

Assessment of residual impact

During the closure phase, the implementation of the various proposed mitigation measures is expected to result in a **low** degree of disturbance and a **high** level of improvement to wetlands and water environments. Given the medium value assigned to wetlands and water environments, the intensity of the negative impact is considered **low**, whereas the intensity of the positive impact is considered **high**. The negative impact will be felt within the area of the project's footprint and only during the closure phase (short duration), resulting in a residual impact of **minor significance.** As for the positive impact, it will also be felt primarily within the area of the project's footprint, but over the long term, resulting in an improvement of **major** significance. The probability of occurrence of these impacts is **high**, and the reversibility potential of the negative impact is **medium**.

Impact on the quality of wetlands and water environments			
Intensity:	Low (-) and High (+)	**Significance:**	Minor (-) and Major (+)
Extent:	Project		
Duration:	Short (-) and Long (+)		
Probability of occurrence:		High (-) (+)	
Reversibility:		Medium (-)	

8.2.3.2 *Wildlife species of special status*

Wildlife species of special status refers to all wildlife species that have been granted provincial protection status (likely to be designated, vulnerable or threatened) or federal protection status (special concern, threatened, endangered, or extinct) and that may be disturbed by construction, operations, and closure activities. It should be noted that, within the framework of the project, wildlife species of special status are assigned **high** ecosystem and socioeconomic value, as there is a consensus on their conservation and protection, and they are subject to legal and regulatory protection.

Summary of current conditions

Inventories and literature reviews on wildlife have identified 21 wildlife species of special status, 17 of which have been confirmed to be present in the biophysical LSA and one of which is uncertain, including 11 bird species (among them the red crossbill, for which the presence of the subspecies of special status, *percna*, remains uncertain), caribou (*Rangifer tarandus caribou*, forest ecotypes), 5 bat species, and the southern bog lemming.

For the woodland caribou, the scarcity of mature forest stands and the prevalence of young, regenerating environments could explain its very low use of the biophysical LSA, a finding supported by the lack of telemetry data for this ecotype in this area.

Among the bird species, six have nesting potential: the short-eared owl (*Asio flammeus*), the lesser yellowlegs (*Tringa flavipes*), the common nighthawk (*Antrostomus vociferus*), the bank swallow (*Riparia riparia*), the olive-sided flycatcher (*Contopus cooperi*), and the rusty blackbird (*Euphagus carolinus*).

It should be noted that, in addition to the five bat species of special status, the big brown bat—which does not have any special status—was also recorded at the site during the inventories. Since this is the only bat species without a special status to be observed at the project site and its ecological characteristics are similar to those of other species, the potential impacts on this species are also discussed in this section.

Construction phase

Statement of potential impact

Disturbance of activities and loss of habitat of wildlife species of special status.

Sources of the impact

- Site organization, stripping, and clearing.
- Surface preparation and access layout.

- Construction of structures and infrastructure.
- Transportation and traffic related to materials and supplies.
- Production and management of residual and hazardous materials.

Detailed description of the impact

Large wildlife and other mammals

During the construction phase, the main risks involve the loss and fragmentation of breeding and feeding habitats, as well as disturbance caused by noise and other nuisances.

Loss and fragmentation of breeding and feeding habitats due to site preparation, stripping and clearing activities

The southern bog lemming typically inhabits wetlands rich in vegetation and covered with a thick layer of organic soil, such as peatlands, marshes, and nearby moist mixedwood forests, as well as fields, grasslands, and clear-cut areas (Desrosiers et al., 2002; Rose and Linzey, 2021). The project's impact on wetlands and water environments could result in habitat loss for the southern bog lemming, which feeds primarily on sedges (Carex sp.) (Gouvernement du Québec, 2026), a group of plants that grow mainly in these environments.

The direct impacts of mining and electrical infrastructure construction on woodland caribou are manifested primarily through habitat loss and fragmentation, the creation of physical barriers, and the degradation of food resource quality (Saint-Laurent *et al.*, 2012; Saint-Laurent *et al.*, 2014; Dickie *et al.*, 2023; Lessard *et al.*, 2026). The fragmentation caused by the construction of a new power transmission line (PTL) can reduce connectivity between high-quality habitat patches and limit the movements necessary for foraging, reproduction, and dispersal (Polfus *et al.*, 2011; Leblond *et al.*, 2012). According to Lesmerises *et al.* (2013), woodland caribou rarely cross PTLs and exhibit a significant increase in movement speed when crossing them, suggesting a negative perception of the right-of-ways.

These anthropogenic infrastructures also result in a functional loss of habitat well beyond the physical footprint of the developments (Saint-Laurent *et al.*, 2014; Dickie *et al.*, 2023; Lessard *et al.*, 2026), meaning that patches of habitat become inaccessible or underutilized, even if they offer conditions suitable for caribou (Polfus *et al.*, 2011; Leblond *et al.*, 2012). The areas of influence around infrastructure can thus extend for several kilometres (Weir *et al.*, 2007), restricting the use of large portions of the habitat (Weir *et al.*, 2007; Saint-Laurent *et al.*, 2014). For example, Weir *et al.* (2007) showed that caribou density was significantly reduced within a 4-kilometre radius of an active mine site. Avoiding optimal habitats located near human-made infrastructure may cause caribou to make greater use of suboptimal habitats to reduce the risk of predation (Polfus *et al.*, 2011; Rudolph *et al.*, 2012).

Taking into account the planned mining and electrical infrastructure, the rate of disturbance to the woodland caribou habitat within the biophysical LSA was estimated relative to the baseline condition. Three methods were used to estimate the rate of habitat disturbance for woodland caribou in the biophysical LSA. The first method is based on those recommended by the Government of Quebec, with the addition of a 500-meter buffer zone around all anthropogenic disturbances, with the exception of the mine site, for which a 4-kilometre buffer zone was added, while excluding the surface water network from the total area (Weir *et al.*, 2007; MFFP, 2021). The second method is the one recommended by the Government of Canada, which involves adding a 500-metre buffer zone around all anthropogenic disturbances and taking into account the total area, including the surface water network within that total area (EC, 2011; ECCC, 2020a; ECCC, 2024). The third method is the one proposed by the Cree Nation Government, which involves establishing a 750-metre buffer zone around the proposed mining infrastructure and the PTL, while excluding the surface water system from the total area. For more details on the methods used, see the sectoral report on caribou in Appendix 6-21.

According to the Quebec government's methodology, the overall habitat disturbance rate for woodland caribou is estimated at 49.0% (Table 8-6), an increase of 0.8% compared with the baseline estimate. According to the Government of Canada's methodology, the overall disturbance rate is estimated at 42.6% (Table 8-7), an increase of 0.1% compared with the baseline estimate. Lastly, according to the Cree Nation Government's method, the overall disturbance rate is estimated at 49.4% (Table 8-8), which represents a difference of 6.8% compared with the Government of Canada's method. The project's encroachment on the potential habitat of the woodland caribou is shown in Map 8-5.

An analysis of the project's impacts on potential forest caribou habitat was also conducted. Taking into account the addition of a 750-m buffer zone around the proposed mining infrastructure, the proportion of potential forest caribou habitat (i.e., coniferous stands >40 years old, lichen woodlands, and wetland and aquatic environments) affected was also estimated at 0.1% of the terrestrial area of the biophysical LSA, corresponding to an area of approximately 6.5 km². Within this buffer zone, which covers a terrestrial area of 24.7 km², habitat areas exhibiting permanent and temporary disturbances under baseline conditions were estimated at 6.1 km² and 10.0 km², respectively, covering the majority of the buffer zone's terrestrial area (i.e., 24.5% and 40.3%). These temporary disturbances consisted of forest fires that occurred between 2001 and 2010 (Appendix 6-21, Map 6). These habitats therefore comprised vegetation communities aged 16 to 25 years under baseline conditions, which are potentially favourable to moose due to the availability of food resources (Courtois et al., 2007; Leblond et al., 2013; Raymond-Bourret, 2017). However, these habitats could become potential forest caribou habitat in the medium to long term. Several small- to medium-sized wetlands are also intersected by the infrastructure and its 750-m buffer zone. As a result, the construction of the mining infrastructure leads to a permanent loss of habitat for forest caribou, which may also tend to avoid the area over several kilometres, as suggested by the 4-km buffer zone illustrated in Map 8-5 (Weir et al., 2007).

Taking into account the addition of a 750-m buffer zone around the transmission line (TL), the proportion of potential forest caribou habitat affected by the construction of the TL was estimated at 0.1% of the terrestrial area of the biophysical LSA, corresponding to an area of approximately 7.2 km². Within this buffer zone, which covers a terrestrial area of 73.7 km², habitat areas exhibiting permanent and temporary disturbances under baseline conditions were estimated at 32.6 km² and 32.5 km², respectively, covering the majority of the buffer zone's terrestrial area (i.e., 44.2% and 44.0%).

Relative to areas that were already disturbed under baseline conditions, the creation of new disturbances associated with the new TL particularly affects the segment located approximately between 30 and 50 km from the mine's zone of influence. As illustrated in Map 8-5, the 750-m buffer zone surrounding this TL segment is dominated by forest fires. This sector is more specifically affected by fires that occurred between 2001 and 2010, and to a lesser extent by fires that occurred between 1987 and 1990 (Appendix 6-21, Map 6). These habitats therefore comprised vegetation communities aged 16 to 39 years under baseline conditions, which are potentially favourable to moose due to the availability of food resources (Courtois et al., 2007; Leblond et al., 2013; Raymond-Bourret, 2017). However, these habitats could become potential forest caribou habitat in the medium to long term. Several small- to medium-sized wetlands are also intersected by this TL segment and its 750-m buffer zone.

Furthermore, habitats enclosed by the existing TL and the segment of the new TL located approximately between 30 and 50 km from the mine's zone of influence consist of forest fires and potential forest caribou habitat. These habitats could, however, become functionally inaccessible to forest caribou due to the addition of a TL. Nevertheless, the direct loss of potential forest caribou habitat appears negligible along the TL segment located between the mine site and approximately 30 km, as its construction is planned along existing roads whose baseline footprint largely encompasses that of the new TL.

Forest clearing associated with the construction of infrastructure may promote increased densities of moose (*Alces alces*), which in turn support higher populations of gray wolf (*Canis lupus*) and indirectly increase predation pressure on caribou, a phenomenon known as 'apparent competition' (Courtois et *al*., 2007; Leblond et *al*., 2013; Raymond-Bourret, 2017). Although predators may use the infrastructure as early as the construction phase, this phenomenon is more likely to be observed during the operational phase. This aspect is also addressed in greater detail in the section covering impacts during the operations phase.

Composante du projet / *Project Component*

- Projet minier Shaakichiuwaanann / *Shaakichiuwaanann Mining Project*

Zones d'étude / *Study Areas*

- Projet / *Project*
- Local - Régionale / *Local - Biophysical*
- Zone d'influence de la mine / *Mine's area of influence*

Habitat potentiel / *Potential habitat*

- Jeunes peuplements résineux matures (40-80 ans) / *Mature young softwood stands (40-80 years)*
- Vieux peuplements résineux matures (> 80 ans) / *Mature old softwood stands (> 80 years old)*
- Lande à lichens / *Lichen tundra*
- Milieux humides et hydriques / *Wetlands and hydrous environments*

Perturbations / *Disturbances*

Conditions actuelles / *Currents Conditions*

- Anthropique et naturelle / *Anthropogenic and natural*

Conditions futures / *Futures Conditions*

- Anthropique - Permanente (Zone tampon 500 m) / *Anthropogenic - Permanent (Buffer 500 m)*
- Anthropique - Permanent (Zone tampon 750 m) / *Anthropogenic - Permanent (Buffer 750m)*
- Anthropique - Permanent (Zone tampon 4 km) / *Anthropogenic - Permanent (Buffer 4 km)*

Infrastructures / *Infrastructure*

- Prélèvement d'eau potable / *Drinking water withdrawal*
- Aérodrome / *Aerodrome*
- Hydroaérodrome / *Hydroaerodrome*
- Site d'extraction ouvert / *Open extraction site*
- Bâtiment industriel / *Industrial building*
- Tour de télécommunication / *Telecommunication tour*
- Centrale hydroélectrique / *Hydroelectric power plant*
- Poste électrique / *Electrical substation*
- Ligne de transport d'énergie / *Electric power transmission line*

Réseau routier / *Road Network*

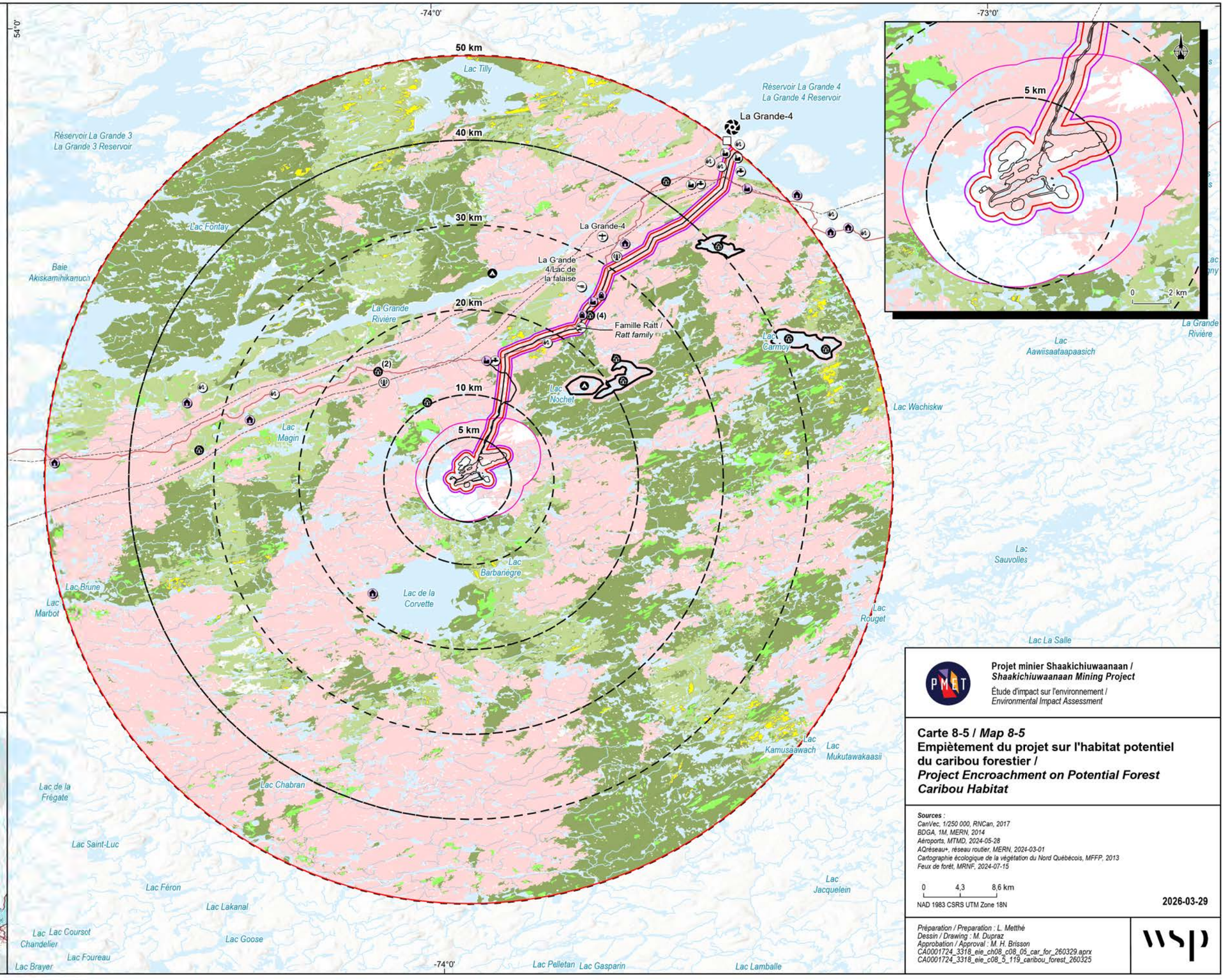
- Route collectrice municipale / *Municipal collector road*
- Locale / *Local road*

Utilisation du territoire / *Land Use*

Baux / *Leases*

- Fins de villégiature / *Leisure purpose*
- Fins commerciales / *Commercial purpose*
- Fins industrielles / *Industrial purpose*
- Camp cri permanent / *Cree permanent Camp*
- Campement cri temporaire / *Cree temporary camp or campsite*
- Aire de camps et de campements / *Camps and campsites area*
- Autre type de camp / *Other camp type*
- Site de chasse / *Hunting site*





Projet minier Shaakichiuwaanann / *Shaakichiuwaanann Mining Project*

Étude d'impact sur l'environnement / *Environmental Impact Assessment*

Carte 8-5 / *Map 8-5*

Empiètement du projet sur l'habitat potentiel du caribou forestier / *Project Encroachment on Potential Forest Caribou Habitat*

Sources :

CanVec, 1/250 000, RNCan, 2017
BDGA, 1M, MERN, 2014
Aéroports, MTMD, 2024-05-28
AQréseau+, réseau routier, MERN, 2024-03-01
Cartographie écologique de la végétation du Nord Québécois, MFFP, 2013
Feux de forêt, MRNF, 2024-07-15

0 4,3 8,6 km

NAD 1983 CSRS UTM Zone 18N

2026-03-29

Préparation / Preparation : L. Metthé
Dessin / Drawing : M. Dupraz
Approbation / Approval : M. H. Brisson
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CA0001724_3318_eie_c08_5_119_caribou_forest_260325

Zones d'étude / *Study Areas*

- Projet / *Project*
- Local - Régionale / *Local - Biophysical*
- Zone d'influence de la mine / *Mine's area of influence*

Habitat potentiel / *Potential habitat*

- Jeunes peuplements résineux matures (40-80 ans) / *Mature young softwood stands (40-80 years)*
- Vieux peuplements résineux matures (> 80 ans) / *Mature old softwood stands (> 80 years old)*
- Lande à lichens / *Lichen tundra*
- Milieux humides et hydriques / *Wetlands and hydrous environments*

Perturbations / *Disturbances*

Conditions actuelles / *Currents Conditions*

- Anthropique et naturelle / *Anthropogenic and natural*

Conditions futures / *Futures Conditions*

- Anthropique - Permanente (Zone tampon 500 m) / *Anthropogenic - Permanent (Buffer 500 m)*
- Anthropique - Permanent (Zone tampon 750 m) / *Anthropogenic - Permanent (Buffer 750m)*

Infrastructures / *Infrastructure*

- Prélèvement d'eau potable / *Drinking water withdrawal*
- Aérodrome / *Aerodrome*
- Site d'extraction ouvert / *Open extraction site*
- Bâtiment industriel / *Industrial building*
- Tour de télécommunication / *Telecommunication tour*
- Ligne de transport d'énergie / *Electric power transmission line*

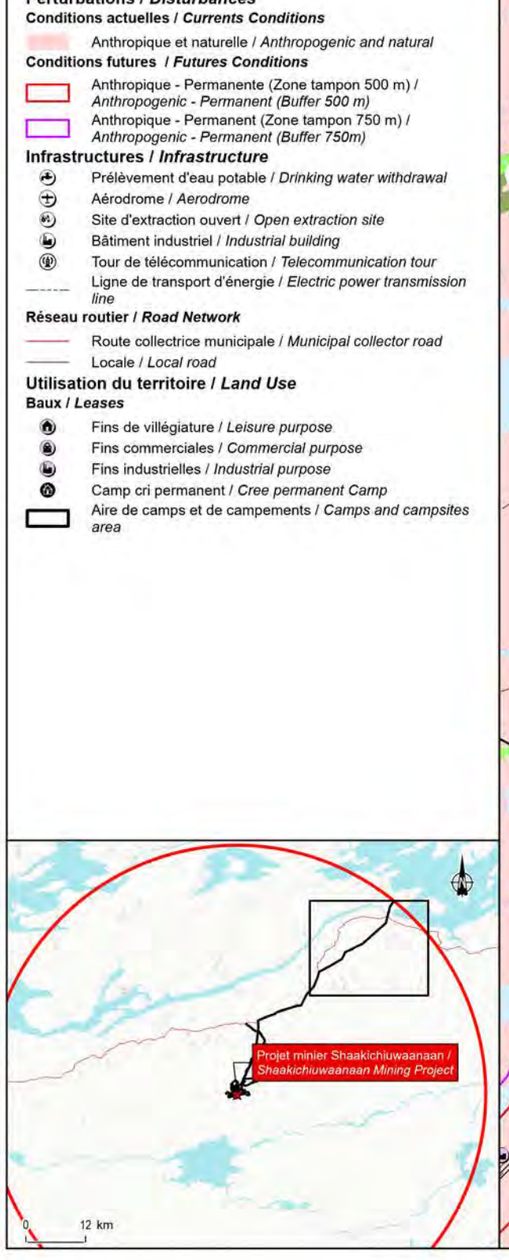
Réseau routier / *Road Network*

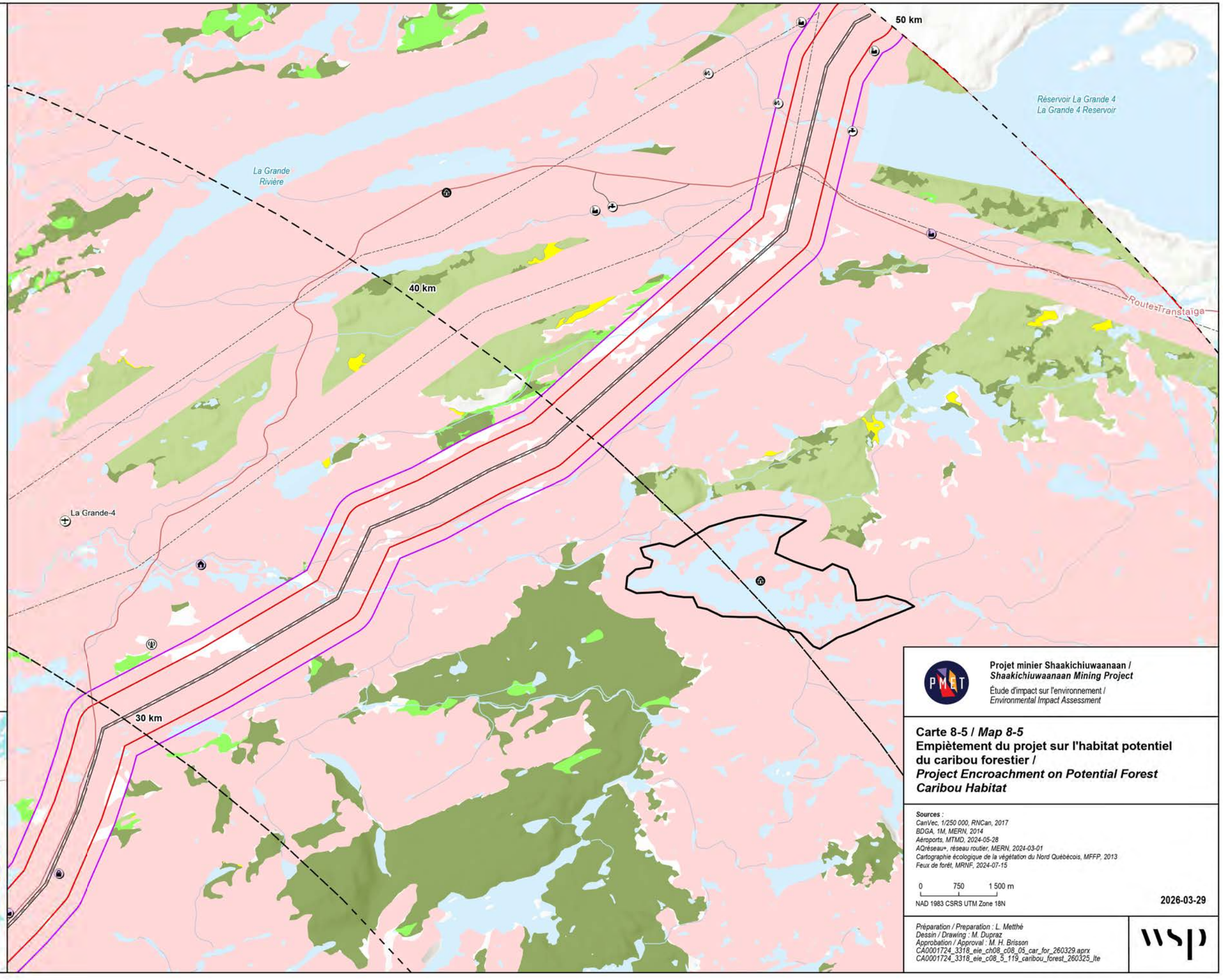
- Route collectrice municipale / *Municipal collector road*
- Locale / *Local road*

Utilisation du territoire / *Land Use*

Baux / *Leases*

- Fins de villégiature / *Leisure purpose*
- Fins commerciales / *Commercial purpose*
- Fins industrielles / *Industrial purpose*
- Camp cri permanent / *Cree permanent Camp*
- Aire de camps et de campements / *Camps and campsites area*





Projet minier Shaakichiuwaanaan / *Shaakichiuwaanaan Mining Project*

Étude d'impact sur l'environnement / *Environmental Impact Assessment*

Carte 8-5 / *Map 8-5*
Empiètement du projet sur l'habitat potentiel du caribou forestier / *Project Encroachment on Potential Forest Caribou Habitat*

Sources :
CanVec, 1/250 000, RNCan, 2017
BDGA, 1M, MERN, 2014
Aéroports, MTMD, 2024-05-28
AQréseau+, réseau routier, MERN, 2024-03-01
Cartographie écologique de la végétation du Nord Québécois, MFFP, 2013
Feux de forêt, MRNF, 2024-07-15

0 750 1 500 m
NAD 1983 CSRS UTM Zone 18N

2026-03-29

Préparation / Preparation : L. Metthé
Dessin / Drawing : M. Dupraz
Approbation / Approval : M. H. Brisson
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CA0001724_3318_eie_c08_5_119_caribou_forest_260325_lte

Table 8-6 Rate of disturbance to woodland caribou habitat in the biophysical LSA according to the approach of the Quebec government

Mine's area of influence (km)	Type of disturbance	Area (km²)					Proportion of disturbed surfaces (%)
		Permanent	Temporary	Subtotal	Without disturbance	Total[1]	
0–5	Anthropogenic	61.8	0.0	61.8	0.6 (1.0%)	62.4	99.0
	Natural	N/A	0.0				0.0
5–10	Anthropogenic	49.2	0.1	114.9	77.5 (40.3%)	192.4	25.6
	Natural	N/A	65.6				34.1
10–20	Anthropogenic	87.1	0.1	469.1	280.3 (37.4%)	749.4	11.6
	Natural	N/A	382.0				51.0
20–30	Anthropogenic	90.9	0.0	559.8	763.1 (57.7%)	1,322.8	6.9
	Natural	N/A	468.8				35.4
30–40	Anthropogenic	84.5	0.0	891.0	995.6 (52.8%)	1,886.7	4.5
	Natural	N/A	806.6				42.8
40–50	Anthropogenic	107.7	0.0	1,105.2	1,220.0 (52.5%)	2,325.2	4.6
	Natural	N/A	997.5				42.9
0–50	**Anthropogenic**	**481.1**	**0.2**	**3,201.7**	**3,337.1 (51.0%)**	**6,538.9**	**7.4**
	Natural	**N/A**	**2,720.4**				**41.6**

Notes: 1 Excluding the surface water network.
N/A not applicable.

Table 8-7 Rate of disturbance to woodland caribou habitat in the biophysical LSA according to the Government of Canada's methodological approach

Mine's area of influence (km)	Type of disturbance	Area (km²)					Proportion of disturbed areas (%)
		Permanent	Temporary	Subtotal	Without disturbance	Total	
0–5	Anthropogenic	23.3	0.0	39.3	39.2 (50.0%)	78.5	29.7
	Natural	N/A	16.0				20.4
5–10	Anthropogenic	7.3	0.2	105.9	129.5 (55.0%)	235.5	3.1
	Natural	N/A	98.6				41.9
10–20	Anthropogenic	98.1	0.1	484.4	457.4 (48.6%)	941.8	10.4
	Natural	N/A	386.2				41.0
20–30	Anthropogenic	104.2	0.0	585.5	984.2 (62.7%)	1,569.7	6.6
	Natural	N/A	481.3				30.7
30–40	Anthropogenic	91.5	0.0	946.3	1,251.3 (56.9%)	2,197.5	4.2
	Natural	N/A	854.8				38.9
40–50	Anthropogenic	128.8	0.0	1,184.6	1,638.7 (58.0%)	2,823.3	4.6
	Natural	N/A	1,055.8				37.4
0–50	**Anthropogenic**	**453.3**	**0.3**	**3,345.9**	**4,500.3 (57.4%)**	**7,846.2**	**5.8**
	Natural	**N/A**	**2,892.6**				**36.9**

Note: N/A not applicable.

Table 8-8 Rate of disturbance to woodland caribou habitat in the biophysical LSA according to the Cree Nation Government's methodological approach

Mine's area of influence (km)	Type of disturbance	Area (km²)					Proportion of disturbed areas (%)
		Permanent	Temporary	Subtotal	Without disturbance	Total[1]	
0–5	Anthropogenic	24.1	0.0	37.3	25.1 (40.2%)	62.4	38.6
	Natural	N/A	13.2				21.2
5–10	Anthropogenic	9.1	0.0	103.4	89.0 (46.3%)	192.4	4.7
	Natural	N/A	94.3				49.0
10–20	Anthropogenic	90.8	0.0	471.0	278.4 (37.2%)	749.4	12.1
	Natural	N/A	380.2				50.7
20–30	Anthropogenic	94.1	0.0	560.5	762.3 (57.6%)	1,322.8	7.1
	Natural	N/A	466.4				35.3
30–40	Anthropogenic	89.5	0.0	891.7	995.0 (52.7%)	1,886.7	4.7
	Natural	N/A	802.1				42.5
40–50	Anthropogenic	110.5	0.0	1163.8	1,638.2 (70.5%)	2325.2	4.8
	Natural	N/A	1,053.3				45.3
0–50	**Anthropogenic**	**418.1**	**0.0**	3227.7	**3,788.0 (57.9%)**	**6538.9**	**6.4**
	Natural	**N/A**	**2,809.6**				**43.0**

Notes: 1 Excluding the surface water network.
N/A not applicable.

Disturbances caused by vibrations, noise, light, and dust from infrastructure construction and equipment installation, as well as the risk of collisions associated with transport and heavy vehicle and equipment traffic, which can lead to mortality.

Mining projects have direct impacts through noise and dust pollution, as well as contamination of food sources, particularly lichens (Best et al., 2025; Lessard et al., 2026). Dust generated by mining infrastructure can reduce lichen cover over several kilometres around mine sites and lead to the accumulation of heavy metals in caribou tissues, with potential effects on health and reproduction (Lessard et al., 2026). Chen *et al*. (2017) found, in particular, that dust generated by mining transport can raise soil pH and significantly reduce lichen cover, thereby decreasing the availability of lichen to caribou within a radius of about 1 km around major roads.

Although roads are normally avoided by caribou, roads in the summer can also become an attractive food source for some caribou due to the deciduous vegetation and herbaceous plants growing along their edges (Post and Klein, 1999). However, proximity to roads increases the risk of collisions with vehicles (Fahrig and Rytwinski, 2009) and the likelihood of encounters between caribou and their predators (Whittington et al., 2011).

Chiropterans

During the construction phase, the main risks include the loss and fragmentation of breeding and feeding habitats, disturbance caused by noise, and a decline in habitat quality.

Loss and fragmentation of breeding and feeding habitats due to site preparation, stripping, and clearing activities

According to the *Recovery Strategy for the Little Brown Myotis, the Northern Myotis, and the Tri-coloured Bat* (ECCC, 2018), habitat loss is one of the greatest threats to these species after white-nose syndrome (WNS). Most of the bat species found in the project area are arboreal (Tremblay and Jutras, 2010): the red, hoary, and silver-haired bats primarily use arboreal shelters, while bats of the genus *Myotis* use a combination of arboreal structures, buildings, and rocky structures(Tremblay and Jutras, 2010). The big brown bat uses buildings or rocky structures (Tremblay and Jutras, 2010), but also mature trees with cavities (woodpecker holes, crevices, etc.) (Willis et al., 2006). Therefore, clearing and other work associated with the construction of the work and storage areas will cause a direct loss of roost sites for chiropterans and will contribute to changes in the microclimate of the immediate environment, which could also result in the loss of roost sites or decrease their quality.

The loss of wetlands and water environments will result in the loss of feeding sites for chiropterans. These environments are indeed key habitats to meet the feeding needs of chiropterans since they usually support large quantities of prey (Grindal et al., 1999). For bats using these areas, the loss of these sites could imply increased displacement to alternate foraging sites.

Disturbances caused by vibrations, noise, light, and dust from infrastructure construction and equipment installation, as well as the risk of collisions associated with transport and heavy vehicle and equipment traffic, which can lead to mortality.

Activities that generate noise, vibration, and dust, such as earth-moving, construction, excavation, transportation, and traffic activities could cause disturbance to chiropteran populations.

In fact, since chiropterans use echolocation to navigate and to locate and capture their prey, the presence of anthropogenic noise could interfere with these activities. For “acoustic” predators such as bats, noise pollution is therefore likely to decrease hunting efficiency (Senzaki et al., 2016; Finch et al., 2020). The impact of this type of disturbance varies according to the species of chiropteran, each of which uses its own range of ultrasound frequencies (Bunkley et al., 2015). Therefore, the frequency of noise generated by road traffic, which varies between 0 kHz and 50 kHz, but mostly between 1 kHz and 20 kHz (Schaub et al., 2008), will probably cause more disturbance to species using low frequencies, but will also affect other species, since their minimum frequencies are generally between 35 kHz and 45 kHz. Among the species potentially present in the project area, those using low frequencies are the silver-haired, hoary, and big brown bats. At their roosts, the presence of noise could also affect chiropterans by disturbing their sleep. As a result, a decrease or disappearance of the quality of daytime roosts available for local chiropteran populations could be observed in the area surrounding the project site.

Similarly, vibrations generated by some activities near certain habitats, such as maternity colonies, could result in a reduction in reproductive success and cause bats to abandon some sites to find others (ECCC, 2018; McCracken, 2011). It should be noted, however, that the inventories carried out did not confirm the presence of a bat maternity roost on the project site, although the presence of such a habitat within the biophysical LSA remains a possibility. This area has numerous snags, and several species of bats regularly change their summer roosts using a network of sites in the same area (ECCC, 2018; ERCSQ, 2019). It is therefore possible that the sites inspected were used by chiropterans at another time, or that areas containing several snags that are less suitable were used preferentially.

Moreover, as chiropterans are mainly nocturnal, they are especially likely to be disturbed by light pollution (Stone et al., 2015). It would appear that the presence of artificial light would disrupt the movements of certain species of chiropterans (Stone et al., 2009) and may direct them to suboptimal alternate flight paths. These alternate flight paths may require greater energy expenditures and may pose greater predation risks (Stone et al, 2015). However, it is difficult to assess the actual effect as a result of the project, since the impact of a flight path change varies depending on the available habitats in the surrounding environment. In addition, some chiropteran species, including the big brown, hoary, and red bats and species of the genus *Myotis*, use artificial light sources for feeding under certain conditions as they tend to concentrate many flying insects (Rydell, 1992; Stone et al., 2015 (Rydell and Racey 1995; Hickey et al. 1996).

Although there is little research on the subject, dust stirred up during construction work can also affect bats, particularly because of its likely negative impact on the insect populations on which they depend for food.

In summary, certain disturbances caused by construction activities (noise, vibration, and light pollution) can have various impacts on bats using the biophysical local study area. These can result in behavioural disturbances in individual bats, particularly in relation to their movements and feeding, or in a decline in the quality or even a loss of certain habitats, such as daytime shelters, maternity roosts, and feeding grounds. However, positive impacts can result from certain sources of disturbance such as the creation of linear landscape elements during deforestation or the attractive effect of lights on insects.

Road traffic can also pose a risk to chiropterans by causing direct mortality due to collisions with mobile equipment (ECCC, 2018). The season, surrounding environment, and traffic density influence the number of collisions and deaths caused by mobile equipment. Low-flying species, such as the northern long-eared bat and tri-coloured bat, appear to be more vulnerable to the risk of mortality due to collision (Fensome and Mathews, 2016). This risk is also higher in juveniles than in adults, likely because young bats are less experienced and less skilled in flight (Fensome and Mathews, 2016). The height of the roadside tree canopy may also affect the risk of mortality due to collision.

For example, little brown bats were observed to cross roads at canopy height and when the canopy was low (<6 m), they crossed at a lower height and thus closer to mobile equipment (Russel et al., 2009).

Deterioration of the quality of the environment due to accidental leaks and spills of petroleum products or other hazardous materials into surface water and soil caused by the operation of equipment that uses these products or simply during their handling

Accidental spills of hazardous materials, particularly from equipment maintenance activities or from traffic and breakdowns of mobile equipment, could, in some cases, have an indirect impact on chiropterans. In fact, the possible contamination of a watercourse, water body, or wetland could alter the survival or reproduction of the insects that chiropterans feed on. Certain contaminants could also accumulate in the tissues of insects and thus cause contamination in chiropterans. Moreover, insofar as bats use this type of environment for drinking, direct contamination of individuals is also possible (Clarke-Wood et al., 2016; Korine et al., 2015; Pilosof et al., 2014).

Avian fauna

Loss and fragmentation of nesting and feeding habitats due to various construction projects involving clearing, soil stripping, earthwork, and drainage

Among the six bird species of special status likely to nest within the local study area, all will experience some loss of potential habitat due to the planned project footprint (Table 8-9, Maps 8-6 to 8-8). For the Common Nighthawk, the total area affected is estimated at 601.2 ha, representing 5.6% of its potential habitat within the LSA. In the case of the Bank Swallow, the planned activities will result in a loss of 10.8 ha, corresponding to 13.0% of its potential habitat within the LSA. For the Olive-sided Flycatcher, the projected footprint will cover an area of 277.3 ha, equivalent to 6.1% of its potential habitat within the LSA. With respect to the Lesser Yellowlegs and the Rusty Blackbird, which share the same habitat type, a total of 85.3 ha will be removed from their potential habitat, representing 7.3% of that habitat within the LSA. Finally, 4.8 ha of potential Short-eared Owl habitat will be affected, corresponding to 2.3% of its potential habitat within the LSA. A summary of the criteria used to delineate potential habitat for each species is presented in Table 8-10.

Table 8-9 Areas and Project Footprint of Potential Habitats for Bird Species of Special Status

Species	Surface area (ha)								Percentage of Encroachment within the Biophysical LSA
	Project Footprint within the Project Area						Biophysical LSA		
	Access road	Electrical line	Proposed component	Total	Access road	Ligne électrique	Proposed component	Total	
Common Nighthawk	62.3	151.9	387.1	**601.2**	1,397.1	5,200.7	4,066.9	**10,664.7**	5.6
Short-eared Owl	0.0	4.8	0.0	**4.8**	0.0	112.6	98.9	**211.5**	2.3
Bank Swallow	2.9	2.4	5.5	**10.8**	21.5	48.7	12.9	**83.0**	13.0
Olive-sided Flycatcher	23.6	69.5	184.1	**277.3**	587.5	2,209.4	1,781.1	**4,578.1**	6.1
Rusty Blackbird and Lesser Yellowlegs	3.7	20.7	60.8	**85.2**	117.7	604.8	448.1	**1,170.5**	7.2

Table 8-10 Summary of Criteria Used to Identify Potential Habitats for Target Species of Special Status

Species	Summary of selection criteria
Common Nighthawk	Outcrops, beaches, gravel pits, industrial sites, plantations older than 10 years, burns aged 0 to 20 years, dry barren areas, power transmission line rights-of-way, cutblocks 10 years old or less, open peatlands, lichen woodlands, shrublands, and regenerating stands.
Short-eared Owl	Open habitats (open peatlands, swamps, marshes) covering 50 ha or more.
Bank Swallow	Sand or silt banks with slopes ranging from 70 to 105°, or anthropogenic sites including aggregate quarries (sand and gravel pits), soil stockpiles, or road cut trenches.
Olive-sided Flycatcher	Open habitats of 10 ha or more, located within coniferous or mixed forests that are relatively open (Class D) and within 100 m of a water body. Also includes burns, edges of forest cutblocks, clearings or peatlands, wooded shorelines of streams and beaver ponds, and lichen woodlands.
Rusty Blackbird Lesser Yellowlegs	Open wetlands (open peatlands, swamps, marshes), shallow ponds, or alder swamps.

Disturbances caused by vibrations, noise, light, and dust, as well as the risk of collisions associated with transport and heavy vehicle and equipment traffic, which can lead to mortality

Indirect impacts caused by increased disturbances—such as vibrations, noise, light, and dust emissions—are to be expected during the construction phase due to infrastructure work and equipment installation.

The effect of noise has been shown in the literature to have a potential negative effect on avian wildlife (Ortega, 2012; McClure et al., 2013; Kunc and Schmidt, 2019; Senzaki et al., 202). The threshold at which impacts could be felt is 40 dBA (Reijnen et al., 1997; Shannon et al., 2015). In fact, noise from infrastructure construction, site traffic, and refuelling and maintenance of mobile equipment could result in avoidance of certain noisy areas, changes in the reproductive success of certain species, and changes in interspecific communication. Human presence would also result in the avoidance of areas used by certain bird species. However, the noise generated by the project on the outskirts of the mine site is not expected to exceed this threshold by a significant margin, since the prescribed noise limits are 40 dBA at night and 45 dBA during the day (hourly average).

Few studies have been done on the impact of vibration on birds. However, Ferguson-Lee and Christie (2005) suggest that the upper limit is 10 kHz to 20 kHz and the lower limit is 50 kHz to 300 Hz. In some species of birds of prey, it would be between 1 kHz and 6 kHz (Yamazaki et al., 2004). The main source of vibration during the construction phase of the project will be surface blasting activities. It should be noted, however, that these activities will be carried out on a sporadic basis and will be concentrated in specific areas, such as for the construction of roads and ponds.

In the case of light disturbance, nighttime lighting could have an effect on migrating birds, attracting groups of birds to operations and diverting them from their migratory route. This may occur particularly under foggy conditions, resulting in a risk of mortality from collisions (Ogden, 1996).

Heavy vehicles and equipment traffic also pose a risk to birds of special status. In Canada, it is estimated that 3,462 birds per 100 km are struck by vehicles each year during the breeding season (Bishop and Borgan, 2013). Owls are particularly vulnerable to this threat, as is the case with the short-eared owl (COSEWIC, 2021). Speed limits at various construction sites and during mining operations help mitigate this danger. The access road, where speeds are higher, is the area most prone to collisions.

Deterioration of the quality of the environment due to accidental leaks and spills of petroleum products or other hazardous materials into surface water and soil caused by the operation of equipment that uses these products or simply during their handling

Accidental spills of hazardous materials—particularly those related to equipment maintenance, traffic, or breakdowns of mobile equipment—could, in some cases, have direct and indirect impacts on birdlife. Contamination of soil or surface water can expose birds to various hydrocarbons. This exposure can cause the feathers to become fouled, compromising their waterproofing and thermal insulation properties, as well as causing toxic effects resulting from the ingestion or inhalation of contaminants. Some products may also have an impact on embryonic development and thus affect reproduction (King et al., 2021). Such exposures can alter behaviour, reduce survival rates, and compromise the reproductive success of birds. Similarly, heavy metals such as lead and mercury are known to affect the nervous, endocrine, and reproductive systems (ECCC, 2020b).

Contamination of surface water and soil can also have indirect effects by degrading habitats or affecting the survival and reproduction of food sources, such as plants, insects, and small mammals. Some contaminants can accumulate in the tissues of these prey animals, leading to secondary contamination in the birds that feed on them.

-74°0'

-73°54'

53°36'

53°30'

-74°0'

Carte 8-6b

Carte 8-6a

Lac Tilly

Réservoir La Grande 4 / La Grande 4 Reservoir

Route Transtaïga / Transtaiga Road

Lac Mihiwasiyalupaskw

Lac Katalopaskw Tamimiga

La Grande Rivière

Lac Carmoy

Lac Nochet

0 2,8 km

Route Transtaïga / Transtaiga Road

Zones d'étude / *Study Areas*

- Projet / *Project*
- Locale - Biophysique / *Local - Biophysical*

Faune aviaire à statut particulier / *Special-Status Avian Species*

Observation / *Observation*

- Hirondelle de rivage / *Bank swallow*
- Moucherolle à côtés olive / *Olive-sided Flycatcher*

Habitat potentiel / *Potential Habitat*

- Hirondelle de rivage / *Bank swallow*
- Moucherolle à côtés olives / *Olive-sided Flycatcher*

Infrastructures / *Infrastructure*

- Centrale hydroélectrique / *Hydroelectric generating station*
- Ligne de transport d'énergie / *Electric power transmission line*

Réseau routier / *Road Network*

- Route collectrice municipale / *Municipal collector road*

Composantes de l'écosystème / *Ecosystem Components*

Milieux humides et hydriques / *Wetlands and Hydrous Environments*

- Marécage arborescent / *Treed swamp*
- Marécage arbustif / *Shrubby swamp*
- Tourbière minérotrophe boisée / *Treed fen*
- Tourbière minérotrophe ouverte / *Open fen*
- Tourbière ombrotrophe boisée / *Treed bog*
- Tourbière ombrotrophe ouverte / *Open bog*
- Marais / *Marsh*
- Eau peu profonde / *Shallow water*
- Plan d'eau / *Waterbody*

Cours d'eau / *Watercourses*

- Intermittent / *Intermittent*
- Permanent / *Permanent*

Milieux terrestres / *Terrestrial Environments*

- Feuillu / *Deciduous*
- Mixte / *Mixed-wood*
- Résineux / *Softwood*
- Arbustaie / *Scrubland*
- Lande à lichens / *Lichen tundra*
- Régénération / *Regeneration*

Autres milieux / *Other Environments*

- Anthropique / *Anthropogenic*
- Champ de blocs / *Boulder field*
- Île / *Island*
- Surface dénudée / *Dry barren*

Projet minier Shaakichiuwaanaan / *Shaakichiuwaanaan Mining Project*

Étude d'impact sur l'environnement / Environmental Impact Assessment

Carte 8-6a / *Map 8-6a*

Empiètement du projet sur l'habitat potentiel des oiseaux terrestres / *Project Encroachment on Potential Habitat for Terrestrial Birds*

Sources / Sources

ADirection, réseau routier, MERN, 2016
BDGA, 1M, MERN, 2014
CanVec, 250k,RNCan, 2017
MRNF, Végétation du Nord québécois, 2013
WSP, Photo interprétation et validation terrain, 2024-2025 / BBA, Photo interprétation, 2023
GRHQ, Réseau hydrique, 2024

0 210 420 m

UTM, fuseau 18, NAD83 (CSRS)

2026-03-25

Préparation / Prepared by : C. Villeneuve
Dessin / Drawn by : M. Dupraz
Approbation / Approved by : É. D'Astous
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CA0001724_3318_ele_c08_6_130_pis_terrest_260325_A0

wsp

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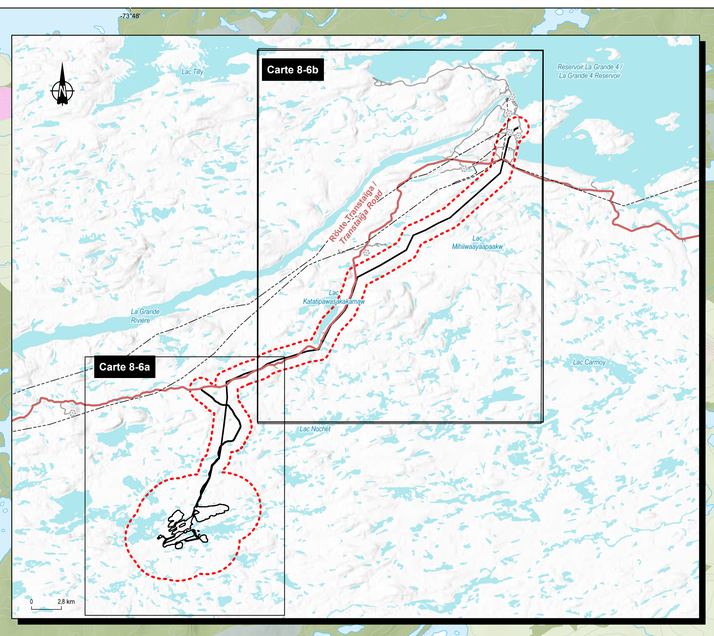

Zones d'étude / *Study Areas*
- Projet / *Project*
- Locale - Biophysique / *Local - Biophysical*

Habitat potentiel / *Potential Habitat*
- Hirondelle de rivage / *Bank swallow*
- Moucherolle à côtés olives / *Olive-sided Flycatcher*

Infrastructures / *Infrastructure*
- Centrale hydroélectrique / *Hydroelectric generating station*
- Ligne de transport d'énergie / *Electric power transmission line*

Réseau routier / *Road Network*
- Route collectrice municipale / *Municipal collector road*
- Locale

Composantes de l'écosystème / *Ecosystem Components*

Milieux humides et hydriques / *Wetlands and Hydrous Environments*
- Marécage arborescent / *Treed swamp*
- Marécage arbustif / *Shrubby swamp*
- Tourbière minérotrophe boisée / *Treed fen*
- Tourbière minérotrophe ouverte / *Open fen*
- Tourbière ombrotrophe boisée / *Treed bog*
- Tourbière ombrotrophe ouverte / *Open bog*
- Marais / *Marsh*
- Eau peu profonde / *Shallow water*
- Plan d'eau / *Waterbody*

Cours d'eau / *Watercourses*
- Intermittent / *Intermitent*
- Permanent / *Permanent*

Milieux terrestres / *Terrestrial Environments*
- Mixte / *Mixed-wood*
- Résineux / *Softwood*
- Arbustaie / *Scrubland*
- Lande à lichens / *Lichen tundra*
- Régénération / *Regeneration*

Autres milieux / *Other Environments*
- Anthropique / *Anthropogenic*
- Champ de blocs / *Boulder field*
- Île / *Island*
- Ligne de transport d'énergie / *Electric power transmission line*
- Surface dénudée / *Dry barren*

Projet minier Shaakichiuwaanaan / *Shaakichiuwaanaan Mining Project*

Étude d'impact sur l'environnement / Environmental Impact Assessment

Carte 8-6b / *Map 8-6b*
Empiètement du projet sur l'habitat potentiel des oiseaux terrestres / *Project Encroachment on Potential Habitat for Terrestrial Birds*

Sources / Sources

ADIIslatur, Réseau routier, MERN, 2016
BDGA, YM, MERN, 2014
Caribou, 2SLRNCan, 2017
MRNF, Végétation du Nord québécois, 2013
WSP, Photo interprétation et validation terrain, 2024-2025 / BBA, Photo interprétation, 2023
GRHQ, Réseau hydrique, 2024

0 310 620 m
UTM, fuseau 18, NAD83 (CSRS)

2026-03-25

Préparation / Prepared by : C. Villeneuve
Dessin / Drawn by : M. Dupraz
Approbation / Approved by : E. D'Astous
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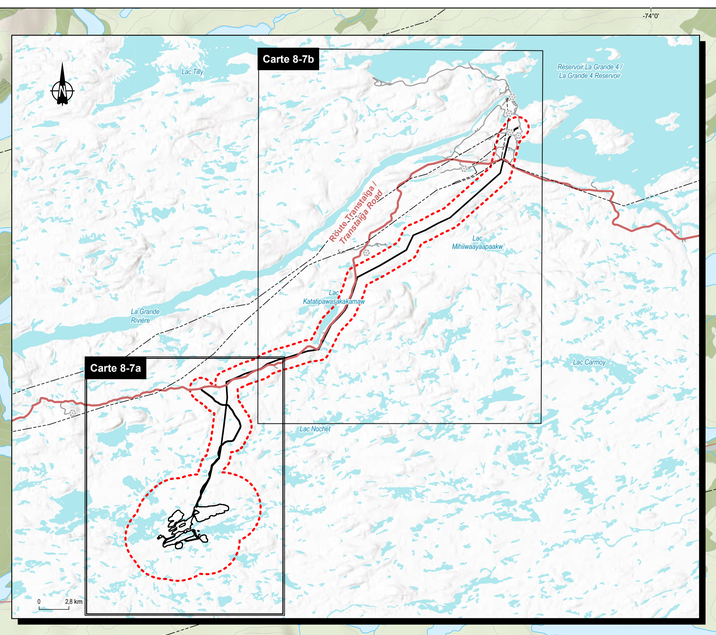

Zones d'étude / *Study Areas*

Projet / *Project*

Locale - Biophysique / *Local - Biophysical*

Faune aviaire à statut particulier / *Special-Status Avian Species*

Observation / *Observation*

Petit chevalier / *Lesser Yellowlegs*

Quiscale rouilleux / *Rusty blackbird*

Habitat potentiel / *Potential Habitat*

Quiscale Rouilleux et Petit chevalier / *Rusty blackbird and Lesser Yellowlegs*

Infrastructures / *Infrastructure*

Centrale hydroélectrique / *Hydroelectric generating station*

Ligne de transport d'énergie / *Electric power transmission line*

Réseau routier / *Road Network*

Route collectrice municipale / *Municipal collector road*

Composantes de l'écosystème / *Ecosystem Components*

Milieux humides et hydriques / *Wetlands and Hydrous Environments*

Marécage arborescent / *Treed swamp*

Marécage arbustif / *Shrubby swamp*

Tourbière minérotrophe boisée / *Treed fen*

Tourbière minérotrophe ouverte / *Open fen*

Tourbière ombrotrophe boisée / *Treed bog*

Tourbière ombrotrophe ouverte / *Open bog*

Marais / *Marsh*

Eau peu profonde / *Shallow water*

Plan d'eau / *Waterbody*

Cours d'eau / *Watercourses*

Intermittent / *Intermittent*

Permanent / *Permanent*

Milieux terrestres / *Terrestrial Environments*

Feuillu / *Deciduous*

Mixte / *Mixed-wood*

Résineux / *Softwood*

Arbustaie / *Scrubland*

Lande à lichens / *Lichen tundra*

Régénération / *Regeneration*

Autres milieux / *Other Environments*

Anthropique / *Anthropogenic*

Champ de blocs / *Boulder field*

Île / *Island*

Surface dénudée / *Dry barren*

Projet minier Shaakichiuwaanaan / *Shaakichiuwaanaan Mining Project*

Étude d'impact sur l'environnement / *Environmental Impact Assessment*

Carte 8-7a / *Map 8-7a*
Empiètement du projet sur l'habitat potentiel des oiseaux associés aux milieux humides / *Project Encroachment on Potential Habitat for Wetland-Associated Birds*

Sources / Sources

ADIrésolu+, réseau routier, MERN, 2016
BDGA, YM, MERN, 2014
Carrières, 250k,RNCan, 2017
MRNF, Végétation du Nord québécois, 2013
WSP, Photo interprétation et validation terrain, 2024-2025 / BBA, Photo interprétation, 2023
GRHQ, Réseau hydrique, 2024

0 210 420 m

UTM, fuseau 18, NAD83 (CSRS)

2026-03-25

Préparation / Prepared by : C. Villeneuve
Dessin / Drawn by : M. Dupraz
Approbation / Approved by : E. D'Astous
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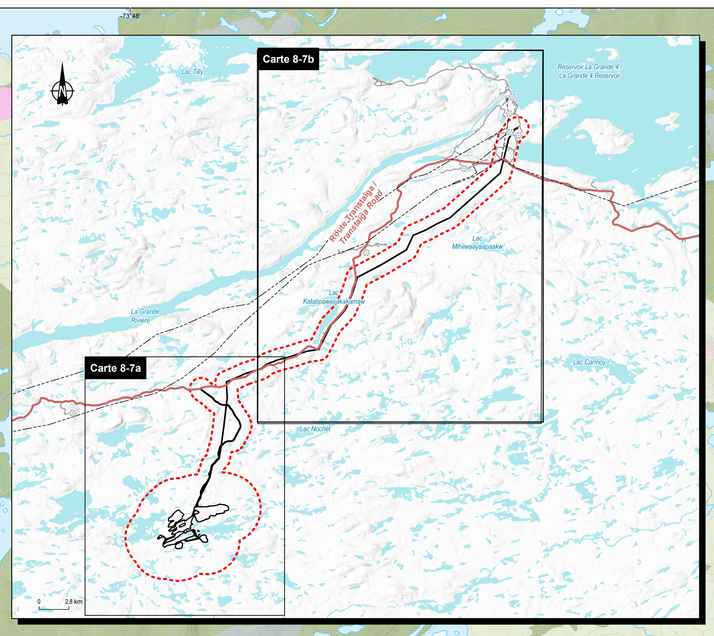

-73°48'
-73°42'
-73°36'
-73°30'
53°54'
53°48'
53°42'

Réservoir La Grande 4

Route Transtaïga / Transtaiga Road

Lac Nochet

Zones d'étude / *Study Areas*
- Projet / *Project*
- Locale - Biophysique / *Local - Biophysical*

Habitat potentiel / *Potential Habitat*
- Quiscale Rouilleux et Petit chevalier / *Rusty blackbird and Lesser Yellowlegs*

Infrastructures / *Infrastructure*
- Centrale hydroélectrique / *Hydroelectric generating station*
- Ligne de transport d'énergie / *Electric power transmission line*

Réseau routier / *Road Network*
- Route collectrice municipale / *Municipal collector road*
- Locale

Composantes de l'écosystème / *Ecosystem Components*

Milieux humides et hydriques / *Wetlands and Hydrous Environments*
- Marécage arborescent / *Treed swamp*
- Marécage arbustif / *Shrubby swamp*
- Tourbière minérotrophe boisée / *Treed fen*
- Tourbière minérotrophe ouverte / *Open fen*
- Tourbière ombrotrophe boisée / *Treed bog*
- Tourbière ombrotrophe ouverte / *Open bog*
- Marais / *Marsh*
- Eau peu profonde / *Shallow water*
- Plan d'eau / *Waterbody*

Cours d'eau / *Watercourses*
- Intermittent / *Intermitent*
- Permanent / *Permanent*

Milieux terrestres / *Terrestrial Environments*
- Mixte / *Mixed-wood*
- Résineux / *Softwood*
- Arbustaie / *Scrubland*
- Lande à lichens / *Lichen tundra*
- Régénération / *Regeneration*

Autres milieux / *Other Environments*
- Anthropique / *Anthropogenic*
- Champ de blocs / *Boulder field*
- Île / *Island*
- Ligne de transport d'énergie / *Electric power transmission line*
- Surface dénudée / *Dry barren*

PMBT

Projet minier Shaakichiuwaanaan / *Shaakichiuwaanaan Mining Project*

Étude d'impact sur l'environnement / Environmental Impact Assessment

Carte 8-7b / *Map 8-7b*
Empiètement du projet sur l'habitat potentiel des oiseaux associés aux milieux humides / *Project Encroachment on Potential Habitat for Wetland-Associated Birds*

Sources / Sources
ADIrésolu+, Réseau routier, MERN, 2016
BDGA, YM, MERN, 2014
Caribou, 250k,RNCan, 2017
MRNF, Végétation du Nord québécois, 2013
WSP, Photo interprétation et validation terrain, 2024-2025 / BBA, Photo interprétation, 2023
GRHQ, Réseau hydrique, 2024

0 310 620 m
UTM, fuseau 18, NAD83 (CSRS)

2026-03-25

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Dessin / Drawn by : M. Dupraz
Approbation / Approved by : E. D'Astous
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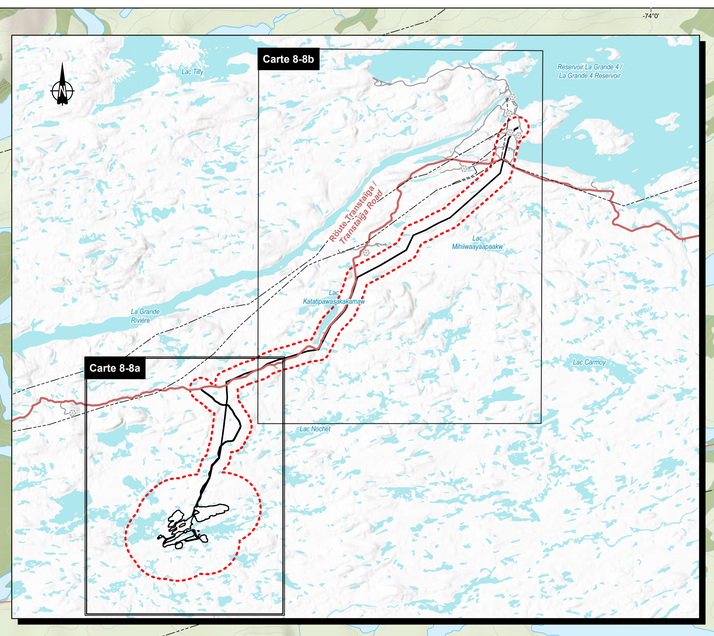

Zones d'étude / *Study Areas*
- Projet / *Project*
- Locale - Biophysique / *Local - Biophysical*

Faune aviaire à statut particulier / *Special-Status Avian Species*

Observation / *Observation*
- Engoulevent d'Amérique / *Nighthawk*
- Hibou des marais / *Short-eared owl*

Habitat potentiel / *Potential Habitat*
- Engoulevent d'Amérique
- Hibou des marais / *Short-eared owl*

Infrastructures / *Infrastructure*
- Centrale hydroélectrique / *Hydroelectric generating station*
- Ligne de transport d'énergie / *Electric power transmission line*

Réseau routier / *Road Network*
- Route collectrice municipale / *Municipal collector road*

Composantes de l'écosystème / *Ecosystem Components*

Milieux humides et hydriques / *Wetlands and Hydrous Environments*
- Marécage arborescent / *Treed swamp*
- Marécage arbustif / *Shrubby swamp*
- Tourbière minérotrophe boisée / *Treed fen*
- Tourbière minérotrophe ouverte / *Open fen*
- Tourbière ombrotrophe boisée / *Treed bog*
- Tourbière ombrotrophe ouverte / *Open bog*
- Marais / *Marsh*
- Eau peu profonde / *Shallow water*
- Plan d'eau / *Waterbody*

Cours d'eau / *Watercourses*
- Intermittent / *Intermitent*
- Permanent / *Permanent*

Milieux terrestres / *Terrestrial Environments*
- Feuillu / *Deciduous*
- Mixte / *Mixed-wood*
- Résineux / *Softwood*
- Arbustaie / *Scrubland*
- Lande à lichens / *Lichen tundra*
- Régénération / *Regeneration*

Autres milieux / *Other Environments*
- Anthropique / *Anthropogenic*
- Champ de blocs / *Boulder field*
- Île / *Island*
- Surface dénudée / *Dry barren*

Projet minier Shaakichiuwaanaan / ***Shaakichiuwaanaan Mining Project***

Étude d'impact sur l'environnement / *Environmental Impact Assessment*

Carte 8-8a / *Map 8-8a*
Empiètement du projet sur l'habitat potentiel des oiseaux crépusculaire / *Project Encroachment on Potential Habitat for Crepuscular Birds*

Sources / Sources
AQréseaux, réseau routier, MERN, 2016
BDGA, 1M, MERN, 2014
CanVec, 250k,RNCan, 2017
MRNF, Végétation du Nord québécois, 2013
WSP, Photo interprétation et validation terrain, 2024-2025 / BBA, Photo interprétation, 2023
GRHQ, Réseau hydrique, 2024

0 210 420 m
UTM, fuseau 18, NAD83 (CSRS)

2026-03-25

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Dessin / Drawn by : M. Dupraz
Approbation / Approved by : E. D'Astous
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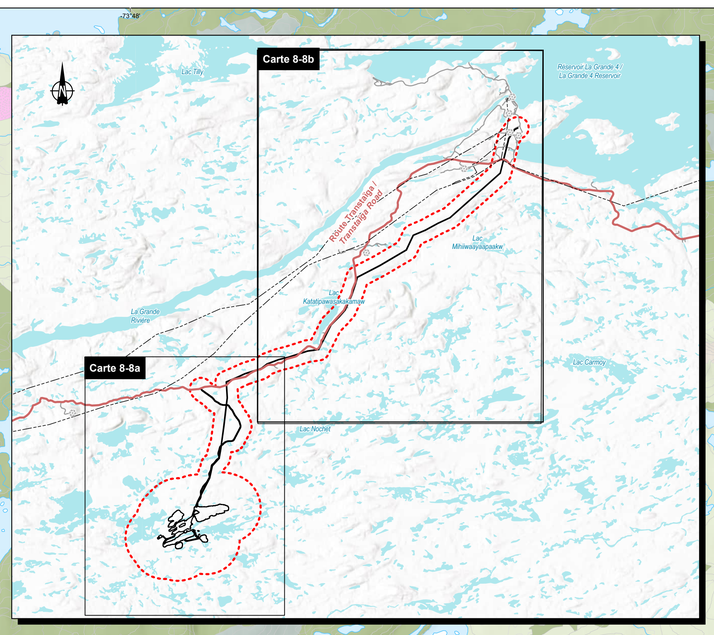

-73°48'
-73°42'
-73°36'
-73°30'
53°54'
53°48'
53°42'

Réservoir La Grande 4

Route Transtaiga / Transtaiga Road

Lac Nochet

L781 L780 L762 L822 L792 L771 L770 L804 L805 L815 L816 L817 L820 L821 L812 L806 L798 L768 L769 L764 L761 L759 L758 L753 L752 L728 L831

Zones d'étude / *Study Areas*
- Projet / *Project*
- Locale - Biophysique / *Local - Biophysical*

Habitat potentiel / *Potential Habitat*
- Engoulevent d'Amérique
- Hibou des marais / *Short-eared owl*

Infrastructures / *Infrastructure*
- Centrale hydroélectrique / *Hydroelectric generating station*
- Ligne de transport d'énergie / *Electric power transmission line*

Réseau routier / *Road Network*
- Route collectrice municipale / *Municipal collector road*
- Locale

Composantes de l'écosystème / *Ecosystem Components*

Milieux humides et hydriques / *Wetlands and Hydrous Environments*
- Marécage arborescent / *Treed swamp*
- Marécage arbustif / *Shrubby swamp*
- Tourbière minérotrophe boisée / *Treed fen*
- Tourbière minérotrophe ouverte / *Open fen*
- Tourbière ombrotrophe boisée / *Treed bog*
- Tourbière ombrotrophe ouverte / *Open bog*
- Marais / *Marsh*
- Eau peu profonde / *Shallow water*
- Plan d'eau / *Waterbody*

Cours d'eau / *Watercourses*
- Intermittent / *Intermittent*
- Permanent / *Permanent*

Milieux terrestres / *Terrestrial Environments*
- Mixte / *Mixed-wood*
- Résineux / *Softwood*
- Arbustaie / *Scrubland*
- Lande à lichens / *Lichen tundra*
- Régénération / *Regeneration*

Autres milieux / *Other Environments*
- Anthropique / *Anthropogenic*
- Champ de blocs / *Boulder field*
- Île / *Island*
- Ligne de transport d'énergie / *Electric power transmission line*
- Surface dénudée / *Dry barren*

Projet minier Shaakichiuwaanaan / *Shaakichiuwaanaan Mining Project*

Étude d'impact sur l'environnement / Environmental Impact Assessment

Carte 8-8b / *Map 8-8b*
Empiètement du projet sur l'habitat potentiel des oiseaux crépusculaire / *Project Encroachment on Potential Habitat for Crepuscular Birds*

Sources / Sources

ADIrésion, Réseau routier, MERN, 2016
BDGA, 1M, MERN, 2014
CanVec, 250k,RNCan, 2017
MRNF, Végétation du Nord québécois, 2013
WSP, Photo interprétation et validation terrain, 2024-2025 / BBA, Photo interprétation, 2023
GRHQ, Réseau hydrique, 2024

0 310 620 m
UTM, fuseau 18, NAD83 (CSRS)

2026-03-25

Préparation / Prepared by : C. Villeneuve
Dessin / Drawn by : M. Dupraz
Approbation / Approved by : É. D'Astous
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CA0001724_3318_ele_c08_8_132_ois_crepusc_260325_A0

wsp

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Mitigation measures

Common mitigation measures are presented in Appendix 8-2; in particular, those in the "Ambient air," "Noise and vibrations," "Soil, surface water, and sediment quality," "Vegetation and wetlands," "Wildlife and wildlife habitat," and Planning, land use, and land tenure" sections may apply in whole or in part to this VEC. In addition to these, the following specific measures must be taken into account:

All wildlife groups

- During the orientation training, employees will be educated about the species of special status that can be observed at the Shaakichiuwaanaan site. As part of the forestry road traffic procedure, wildlife signage will be added (P02).
- An environmental supervisor will conduct regular inspections of work areas, ensure that all parties strictly comply with the various commitments, obligations, measures, and other requirements, assess the quality and effectiveness of the measures implemented, and document any non-compliance observed (P24).
- Develop a training module to teach employees how to identify and manage the presence of species of special status and nests of migratory birds (P38).

Large wildlife and other mammals

- Develop a system for reporting sightings of large wildlife (P41).

Chiropterans

- If an active shelter or maternity roost used by bats is discovered, establish a 100-metre buffer zone, free of human activity, around the perimeter of the habitat and maintain it until a biologist has confirmed that the bats have left (P03).
- If one or more natural cavities or old tunnels are discovered that are not flooded, verify whether they are used as hibernacula by bats and, if so, establish a 500-metre buffer zone free of human activity around the entire underground network constituting the habitat used, and notify the MELCCFP of the discovery (P04).
- Whenever possible, preserve the forest cover along the road of the mining site and revegetate bare areas with native plants after completion of the work (P23).

Avian fauna

- Regrade the slopes of borrow pits to an incline of less than 70° where feasible, in order to reduce the attractiveness of active borrow pits as nesting habitat for bank swallows (P39).

Assessment of residual impact

Large wildlife and other mammals

During the construction phase, despite the implementation of the various proposed mitigation measures, the work will result in a net loss of potential habitat for caribou and southern bog lemming, leading to a **medium** level of disturbance for these species. Given the high value placed on wildlife species of special status, the intensity of the impact is **high**.

The loss of breeding and feeding grounds accounts for the majority of the impacts on these species caused by construction. These impacts will be felt within the **project site** throughout the construction and operations phases, which will last for a **medium** duration. This will result in a residual impact of **moderate** significance. The probability of occurrence of these impacts is **high**, and the reversibility potential is **medium**, as habitat rehabilitation will be carried out during the restoration phase.

Despite the implementation of the various proposed mitigation measures, the risk of disturbance from nuisances (noise, vibrations, light, and dust) and mortality from collisions remains. These will result in a **medium** level of disturbance, which, combined with the high value placed on these species, will lead to a **high** intensity of impact. These impacts will be felt within the **project area** throughout the construction and operations phases, which will last for a **medium** duration. The residual impact is therefore of **moderate** significance in terms of disturbance and collision risk. The probability of occurrence of the disturbance is **high**, whereas the probability of a collision is **medium**. The reversibility of these impacts is considered **high** because the construction-related activities that could cause them will cease once this phase is completed.

<table>
<tr><th colspan="4">Impact on the activities of large wildlife species and other mammals of special status</th></tr>
<tr><td>Intensity:</td><td>High</td><td rowspan="3">Significance:</td><td rowspan="3">Moderate</td></tr>
<tr><td>Extent:</td><td>Project</td></tr>
<tr><td>Duration:</td><td>Medium</td></tr>
<tr><td colspan="2">Probability of occurrence:</td><td colspan="2">High (habitat loss, disturbance)
Medium (collision risk)</td></tr>
<tr><td colspan="2">Reversibility:</td><td colspan="2">Medium (habitat loss)
High (disturbance and collision risk)</td></tr>
</table>

Chiropterans

During the construction phase, despite the implementation of the various proposed mitigation measures, the work results in a net loss of potential habitat for bats of special status, leading to a **medium** level of disturbance for these species. Given the high value placed on wildlife species of special status, the intensity of the impact is **high**. The loss of preferred breeding habitat for bats at the project site is estimated at 406.7 ha for the mine area, 69.2 ha for the power transmission line area, and 44.3 ha for the access road area, respectively, for a total of 550.2 ha. This represents 10.1% of the total area of this habitat within the local study area (5,140.2 ha). The loss of preferred breeding habitat accounts for the majority of the impacts associated with construction. These impacts will be felt within the footprint of the **project** area and will last no longer than the operations phase (**medium** duration), as habitat restoration (revegetation with native species) will be carried out during the closure phase. Therefore, the resulting residual impact is of **moderate** significance. The probability of occurrence of these impacts is **high**, and the reversibility potential is **medium**, as habitat rehabilitation will be carried out during the restoration phase.

With regard to disturbances (noise, vibrations, dust, and light) as well as the risks of collisions that could result in mortality and contaminant spills, these impacts will be felt within the **project area** during the construction phase, i.e., for a **short duration**. Therefore, the resulting residual impact is of **moderate** significance. The probability of occurrence is **high** for disturbance, **medium** for collision risk, and **low** for accidental spills. The reversibility of the impact of disturbance/mortality is considered **high**, since these effects cease as soon as the activities causing them come to an end. Accidental spills have **medium** reversibility, as there remains a possibility that some contaminants will persist in the environment despite remediation efforts.

Impact on the activities of bat species of special status			
Intensity:	Medium	**Significance:**	Moderate
Extent:	Project		
Duration:	Medium (habitat loss) Short (disturbance/collision risk and accidental spills)		
Probability of occurrence:		High (habitat loss/disturbance) Medium (collision risk) Low (accidental spills)	
Reversibility:		High (disturbance/collision risk) Medium (habitat loss, accidental spills)	

Avian fauna

The construction phase will result in a net loss of potential habitat for bird species of special status, which translates to a **medium** level of disturbance for these species. Given the high value placed on wildlife species of special status, the intensity of the impact is **high**. The impact of habitat loss will be felt within the footprint of the **project area** for a period not exceeding that of the operations phase (**medium** duration), since habitat restoration (revegetation with native species) will be carried out during the closure phase. This results in a residual impact of **moderate** significance.

Several proposed mitigation measures address impacts related to disturbance, the risk of collisions that could result in mortality, and the potential for accidental spills. Thus, the degree of disturbance is considered **low** for an impact of **medium** intensity. Among birds, population density decreases in the vicinity of infrastructure, and this effect can extend up to approximately 1 km (Benítez-López et al., 2010), which corresponds to the **local study area**. Noise, vibration, and light levels harmful to birds are not expected to extend beyond this area. As for potential spills and collision risks, they will be limited to the **project area**. The disturbance and collision risks associated with construction activities are of **short** duration, as they cease once this phase is completed. Accidental spills also have impacts of **short** duration, as they result from one-time events. As a result, the residual impact is of **moderate** significance in terms of disturbance and of **minor** significance in terms of collision risks and accidental spills.

The probability of occurrence is **high** for habitat loss and disturbance, **medium** for collision risk, and **low** for accidental spills. The reversibility potential of habitat loss is **medium** since habitat similar to that which existed prior to the work will be restored during the restoration process. The reversibility of the impact of the disturbance and the risk of collision is considered **high**, since these effects cease as soon as the construction activities causing them are completed. Accidental spills have **medium** reversibility, as there remains a possibility that some contaminants will persist in the environment despite remediation efforts.

Impact on the activities of bird species of special status			
Intensity:	High (habitat loss) Medium (disturbance/collision risk and accidental spills)	**Significance:**	Moderate (habitat loss, disturbance/collision risk) Minor (collision risk, accidental spills)
Extent:	Local (disturbance) Project (habitat loss, collision, accidental spills)		
Duration:	Medium (habitat loss) Short (disturbance/collision risk, accidental spills)		
Probability of occurrence:		High (habitat loss, disturbance) Medium (collision risk) Low (accidental spills)	
Reversibility:		High (disturbance/mortality) Medium (habitat loss, accidental spills)	

Operations phase

Statement of potential impact

Disturbance of activities of wildlife species of special status.

Sources of the impact

- Presence and operation of new infrastructure.
- Water use and management.
- Transportation and traffic related to ore and supplies.
- Production and management of residual and hazardous materials.

Detailed description of the impact

Large wildlife and other mammals

Alteration of predator–prey dynamics associated with mining activities, buildings, and infrastructure.

As noted for the construction phase, recent forest clearings required for the development of certain infrastructure may ultimately promote an increase in moose densities, which in turn supports higher populations of gray wolves and indirectly increases predation pressure on caribou (Courtois et al., 2007; Beauchesne et al., 2013; Leblond et al., 2013; Raymond-Bourret, 2017). Habitat fragmentation also increases caribou vulnerability to predation by making movements more predictable and by concentrating individuals within residual habitat patches (St-Laurent et al., 2014; Dickie et al., 2023). Finally, the presence of open areas and edge habitats may benefit the American black bear (Ursus americanus) due to increased food resource availability, which may in turn increase predation on forest caribou calves (Raymond-Bourret, 2017).

Relative to baseline conditions, the segment of the transmission line located approximately between 30 and 50 km from the mine's zones of influence could generate the most significant impact in terms of predator accessibility and predation risk for forest caribou (Figure 8-5). Around this segment of the transmission line, existing linear infrastructure under baseline conditions includes the Trans-Taiga Road and existing transmission lines, which already function as travel corridors used by predators. However, increased linear infrastructure further facilitates predator movements, particularly for gray wolves (Whittington et al., 2011). This new infrastructure could therefore enhance predator access to habitats located southeast of this transmission-line segment, increasing encounter rates between wolves and caribou and, consequently, the risk of predation on caribou (Whittington et al., 2011).

Considering that the nearest mature forest stands to the new TL segment are located approximately 2 to 3 km away (taking into account the infrastructure footprint), forest caribou are more likely to encounter predators within these potential habitats. In addition, because this TL segment is largely surrounded by habitats with vegetation communities aged 16 to 39 years under baseline conditions, predation risk for forest caribou could increase over the medium to long term, assuming that caribou would make greater use of these forest stands once they reach 40 years of age or older.

Although moose, an alternative prey species for forest caribou, generally avoid heavily used roads (Laurian et al., 2008), a study conducted in Norway suggested that moose do not avoid transmission lines and may even use these corridors for movement when topography allows (Bartzke et al., 2015). Under baseline conditions, habitats disturbed by 16- to 39-year-old forest fires surrounding the TL alignment may provide cover for moose but do not necessarily offer the food resources they seek. However, the construction of a new TL, whose right-of-way is maintained, creates potentially attractive habitat for moose due to increased food availability. As a result, apparent competition may occur south of the 30–50 km TL segment, potentially leading to increased predation risk for forest caribou. Consequently, this TL segment could result in long-term changes to predator–prey dynamics through increased availability of alternative prey and predators. Such effects are not expected along the TL segment extending from the mine site to approximately 30 km, an area that may be avoided by moose due to proximity to the road (Laurian et al., 2008).

Around the mining infrastructure, food availability for moose depends on a range of factors. In the event that food resources are abundant and moose become habituated to human presence, gray wolves could benefit from higher moose densities. Although these infrastructures are not expected to substantially alter predator accessibility, an increase in prey availability could lead to greater gray wolf presence in habitats adjacent to mining infrastructure. However, the impact of increased gray wolf presence on forest caribou may remain negligible due to the potential avoidance of mining infrastructure by caribou (Weir et al., 2007).

Disturbances caused by vibrations, noise, light, and dust, as well as the risk of collisions associated with transport and heavy vehicle and equipment traffic, which can lead to mortality

Most of the impacts associated with disturbance and the risk of collision are essentially the same as during the construction phase. Disturbances caused by mining operations and traffic on roads built for this purpose could affect caribou habitat selection and behaviour (Weir *et al.*, 2007; Lessard *et al.*, 2026) throughout the duration of the mine's operations. Despite the woodland caribou's tendency to avoid anthropogenic infrastructure and activities, the risk of collisions with vehicles remains.

Chiropterans

Disturbances caused by vibrations, noise, light, and dust, as well as the risk of collisions associated with transport and heavy vehicle and equipment traffic, which can lead to mortality

Most of the impacts associated with disturbance and the risk of collision are essentially the same as during the construction phase. The impacts associated with disturbances (noise, light, vibration, dust) resulting from site operations during the operations phase will include, in particular, mining operations and equipment use and movement.

Deterioration of the quality of the environment due to accidental leaks and spills of petroleum products or other hazardous materials into surface water and soil caused by the operation of equipment that uses these products or simply during their handling

As the anticipated effect is similar to what was assessed for the construction phase, it was not considered necessary to describe in detail the impacts already discussed in the previous section.

Avian fauna

Disturbances caused by vibrations, noise, light, and dust, as well as the risk of collisions associated with transport and heavy vehicle and equipment traffic, which can lead to mortality

The indirect impacts caused by increased disturbance—such as vibrations, noise, light, and dust emissions—during the operations phase will be comparable to those identified for the construction phase.

Deterioration of the quality of the environment due to accidental leaks and spills of petroleum products or other hazardous materials into surface water and soil caused by the operation of equipment that uses these products or simply during their handling

The risk of spills is the same as that anticipated during the construction phase.

Mitigation measures

Common mitigation measures are presented in Appendix 8-2; in particular, those in the “Ambient air,” “Noise and vibrations,” “Soil, surface water, and sediment quality,” “Vegetation and wetlands,” “Wildlife and wildlife habitat,” and Planning, land use, and land tenure” sections that apply in whole or in part to this VEC. In addition to these, the following specific measures must be taken into account:

All wildlife groups

- During the orientation training, employees will be educated about the species of special status that can be observed at the Shaakichiuwaanaan site. As part of the forestry road traffic procedure, wildlife signage will be added (P02).
- An environmental supervisor will conduct regular inspections of work areas, ensure that all parties strictly comply with the various commitments, obligations, measures, and other requirements, assess the quality and effectiveness of the measures implemented, and document any non-compliance observed (P24).
- Develop a training module to teach employees how to identify and manage the presence of species of special status and nests of migratory birds (P38).

Large wildlife and other mammals

- Develop a system for reporting sightings of large wildlife (P41).

Chiropterans

- If an active shelter or maternity roost used by bats is discovered, establish a 100-metre buffer zone, free of human activity, around the perimeter of the habitat and maintained until a biologist has confirmed that the bats have left (P03).
- If one or more natural cavities or old tunnels are discovered that are not flooded, verify whether they are used as hibernacula by bats and, if so, establish a 500-metre buffer zone free of human activity around the entire underground network constituting the habitat used, and notify the MELCCFP of the discovery (P04).

Avian fauna

- Regrade the slopes of borrow pits to an incline of less than 70° where feasible, in order to reduce the attractiveness of active borrow pits as nesting habitat for bank swallows (P39).

Assessment of residual impact

Large wildlife and other mammals

Despite the implementation of the various proposed mitigation measures, risks related to disruption of predator–prey dynamics, as well as disturbance and collision, remain present at the project site, resulting in a moderate level of disturbance and leading to a high impact intensity. The impacts will be felt within the project area over a **medium** duration. The residual impact is therefore of **moderate** significance in terms of disturbance and collision risk. The probability of occurrence of the disturbance and collision risk is **high**, and reversibility is considered **high** since these impacts will disappear at the end of operations.

Impact on the activities of large wildlife species and other mammals of special status			
Intensity:	High	**Significance:**	Moderate
Extent:	Project		
Duration:	Medium		
Probability of occurrence:		High	
Reversibility:		High	

Chiropterans

During the operations phase, despite the implementation of the various proposed mitigation measures, impacts related to disturbance, collision risk, and habitat degradation caused by accidental spills will persist. However, the expected level of disturbance is **low** for these species. Given the high value placed on wildlife species of special status, the intensity of the impact is **medium**. These impacts will be felt within the **project** area. The duration will be **medium** for disturbance and collision risk, as these will persist throughout the operations phase. However, the duration will be short for accidental spills, which typically trigger rapid responses to contain and recover the contaminated material. The residual impact is therefore of **moderate** significance for disturbance and collision risk, and **minor** for accidental spills.

The probability of occurrence is **high** for disturbance, whereas it is **low** for collision risks and accidental spills. The reversibility of the impact of the disturbance and the risk of collision is considered **high**, since these effects cease as soon as the activities causing them are completed. Accidental spills have **medium** reversibility, as there remains a possibility that some contaminants will persist in the environment despite remediation efforts.

<table>
<tr><th colspan="4">Impact on the activities of bat species of special status</th></tr>
<tr><td>Intensity:</td><td>Medium</td><td rowspan="3">Significance:</td><td rowspan="3">Moderate (disturbance/collision risk)
Minor (accidental spills)</td></tr>
<tr><td>Extent:</td><td>Project</td></tr>
<tr><td>Duration:</td><td>Medium (disturbance/collision risk)
Short (accidental spills)</td></tr>
<tr><td colspan="2">Probability of occurrence:</td><td colspan="2">High (disturbance)
Low (collision risk, accidental spills)</td></tr>
<tr><td colspan="2">Reversibility:</td><td colspan="2">High (disturbance/collision risk)
Medium (accidental spills)</td></tr>
</table>

Avian fauna

The residual impacts related to disturbance, collision risk, and the potential for accidental spills during the operations phase will be comparable to those during the construction phase. Several proposed mitigation measures target these impacts. Thus, the degree of disturbance is considered **low** for these residual impacts, given the **medium** intensity of the impact and the high value placed on wildlife species of special status.

These impacts will be felt within the footprint of the **project** area. Disturbance and collision risk are impacts of medium duration, as they will be felt throughout the operations phase. However, the duration will be **short** for accidental spills, which typically trigger rapid responses to contain and recover the contaminated material. The residual impact is therefore of **moderate** significance for disturbance and collision risk, and **minor** for accidental spills.

The probability of occurrence for disturbance is **high**, but it is **low** for collision risk and accidental spills. The reversibility of the impact of disturbance and collision risk is considered **high**, since these effects cease as soon as the operations phase ends. Accidental spills have **medium** reversibility, as there remains a possibility that some contaminants will persist in the environment despite remediation efforts.

Impact on the activities of bird species of special status			
Intensity:	Medium (disturbance/collision risk and accidental spills)	**Significance:**	Moderate (disturbance/collision risk) Minor (accidental spills)
Extent:	Project (disturbance, collision risk, accidental spills)		
Duration:	Medium (disturbance/collision risk) Short (accidental spills)		
Probability of occurrence:		High (disturbance) Low (collision risk, accidental spills)	
Reversibility:		High (disturbance/mortality) Medium (accidental spills)	

Closure phase

Identification of potential impacts

Improvement of habitats favouring the resumption of activities by wildlife species of special status

Sources of the impact.

- Presence of site remains.
- Final restoration.
- Production and management of residual and hazardous materials.

Detailed description of the impact

Large wildlife and other mammals, chiropterans and avian fauna

During the closure phase, the main risks to these two wildlife groups include disturbance caused by nuisances, the risk of collisions that could result in mortality, and accidental spills or leaks of petroleum products or other hazardous materials. In addition, habitat restoration and the significant reduction in activities at the site will have a positive impact.

Disturbances caused by vibrations, noise, light, and dust, as well as the risk of collisions associated with transport and heavy vehicle and equipment traffic, which can lead to mortality

The anticipated impacts on disturbance, collision risk, and mortality will be similar to those assessed during the construction and operations phases, but on a smaller scale, as only restoration work will be taking place.

Deterioration of the quality of the environment due to accidental leaks and spills of petroleum products or other hazardous materials into surface water and soil caused by the operation of equipment that uses these products or simply during their handling

The anticipated impact will be similar to what was assessed in the construction and operations phases.

Restoration of habitats/Temporary shelter or use as maternity roosts/Use of the site (feeding)/Reduction of population disturbance

The restoration of the mine site involves the removal of most of the buildings and infrastructure, soil remediation (soil loosening and reprofiling), the spreading of organic soil set aside for this purpose, and the revegetation of the cleared areas as well as the various tailings and overburden stockpiles. This work will allow the various species involved to reclaim these areas for some of their activities.

It should be noted that the buildings and other structures that will be dismantled are likely to be used as temporary shelters or as maternity roosts by the big brown bat or, to a lesser extent, bats of the genus *Myotis* (Tremblay and Jutras, 2010).

Mitigation measures

Common mitigation measures are presented in Appendix 8-2; in particular, those in the "Ambient air," "Noise and vibrations," "Soil, surface water, and sediment quality," "Vegetation and wetlands," "Wildlife and wildlife habitat," and Planning, land use, and land tenure" sections that apply in whole or in part to this VEC. In addition to these, the following specific measures must be taken into account:

All wildlife groups

- Cooperate with the tallyman of trapline CH39 in the rehabilitation, restoration, and revegetation activities and returning the site to its natural state. (P22).
- An environmental supervisor will conduct regular inspections of work areas, ensure that all parties strictly comply with the various commitments, obligations, measures, and other requirements, assess the quality and effectiveness of the measures implemented, and document any non-compliance observed (P24).
- Develop a training module to teach employees how to identify and manage the presence of species of special status and nests of migratory birds (P38).

Large wildlife and other mammals

- Develop a system for reporting sightings of large wildlife (P41).

Chiropterans

- If an active shelter or maternity roost used by bats is discovered, establish a 100-metre buffer zone, free of human activity, around the perimeter of the habitat and maintain it until a biologist has confirmed that the bats have left (P03).
- If one or more natural cavities or old tunnels are discovered that are not flooded, verify whether they are used as hibernacula by bats and, if so, establish a 500-metre buffer zone free of human activity around the entire underground network constituting the habitat used, and notify the MELCCFP of the discovery (P04).
- Before demolishing buildings and other structures during the closure phase, carry out an inspection to verify the possible presence of bat hibernacula or maternity roosts, or bird nests (P42).

Avian fauna

- Before demolishing buildings and other structures during the closure phase, carry out an inspection to verify the possible presence of bat hibernacula or maternity roosts, or bird nests (P42).

Assessment of residual impact

During the closure phase, the negative impacts are related to disturbance, collision risk, and accidental spills, affecting all wildlife groups of special status. However, these impacts will be less significant than during the construction and operations phases. In addition, the project will have a positive impact by restoring habitats through a revegetation campaign.

Thus, the degree of disturbance is considered **low** for these negative residual impacts, with a **medium** intensity for the impact, considering the high value placed on wildlife species of special status. The impacts will be felt in the **project** area for a **short** duration, as the spills, disturbances, and collision risks will cease once the restoration work is complete. The anticipated residual impact is expected to be of **minor** significance. The probability of occurrence is **high** for disturbances and **low** for collision risks and spills. The reversibility of the impact of the disturbance and the collision risk is considered **high**, since these effects cease as soon as the activities causing them are completed. Accidental spills have **medium** reversibility, as there remains a possibility that some contaminants will persist in the environment despite remediation efforts.

The closure phase will result in the creation of habitats for species of special status, leading to an expected **medium** degree of improvement for these species and, consequently, a **high** intensity of positive impact. The impact of habitat creation will be felt in the **project** area and will persist beyond the restoration work (**long** duration), resulting in a **positive** residual impact of **major** significance. The probability of occurrence is **high**.

<table>
<tr><th colspan="4">Impact on the activities of species in various wildlife groups of special status</th></tr>
<tr><td rowspan="3">Intensity:</td><td>High (+ habitat creation)
Medium (- disturbance and collision risk, spills)</td><td rowspan="3">Significance:</td><td rowspan="3">Major (+ habitat creation)
Minor (- disturbance and collision risk, spills)</td></tr>
<tr><td>Extent:</td><td>Project (-) (+)</td></tr>
<tr><td>Duration:</td><td>Long (+ habitat creation)
Short (- disturbance/collision risk, spills)</td></tr>
<tr><td colspan="2">Probability of occurrence:</td><td colspan="2">High (-) (+)</td></tr>
<tr><td colspan="2">Reversibility:</td><td colspan="2">High (- disturbance/collision risk)
Medium (- spills)</td></tr>
</table>

8.2.3.3 Terrestrial wildlife (large wildlife and other mammal species, avian fauna including migratory birds)

Terrestrial wildlife includes all large wildlife species (e.g., moose, bear, wolf), other mammal species (e.g., beaver, hare, fisher), and birds that may be disturbed by activities in the construction, operation, and closure phases. It should be noted that, within the framework of the project, terrestrial wildlife is assigned a low ecosystem value because, although it attracts interest, there is little concern regarding its conservation and protection. It is also assigned a medium socioeconomic value, as it is considered important and is utilized by a portion of the populations concerned. Since the value to be applied is the higher of the two, a **medium** value will be used to analyze the impacts of this VEC.

Summary of current conditions

Large wildlife and other mammals

The project's biophysical LSA is home to several species of large wildlife of ecological and cultural significance, including woodland and migratory caribou, moose, black bears, and grey wolves. Large wildlife remains at the heart of conservation and sustainable land management efforts, both for biodiversity and for Indigenous and non-Indigenous communities.

The sectoral report on caribou indicates that migratory caribou from the LRH use the biophysical LSA, but their presence may have declined since 2015, which could be linked to the reduced availability of suitable habitat and the extent of recent anthropogenic disturbances (Map 8-9).

The aerial survey conducted in January 2023 identified 27 moose divided into 14 groups within the biophysical LSA. The moose density was estimated at 0.23 moose per 10 km² after adjusting for detectability, which is expected at the northern limit of this species' range. According to sport hunting data, it appears that the population in Hunting Zone 22, where the project is located, is stable or even growing (Société de la faune et des parcs, 2003; Gouvernement du Québec, 2025c). This potential growth could be due to improved habitat conditions, particularly in connection with an increase in the area of mixedwood and hardwood stands. The biophysical LSA habitat of the project, characterized by a mosaic of regenerating environments and older softwood forests, appears favourable to moose, providing both feeding sites and winter cover (Niigaan, 2023).

According to the most recent data (from the 1990s), the black bear has an estimated density of approximately 0.20 bears per 10 km² in Hunting Zone 22, corresponding to a population of about 5,600 individuals. Incidental observations made during field surveys confirmed its presence in the project area. For black bears, habitat selection is particularly guided by the availability of food resources. Regenerating forest stands—resulting from logging or natural disturbances and abundant in the project area—provide an abundance of small fruits (berries) and insects, making them highly valuable habitats for the species (Samson, 1996; Desnoyers and Dussault, 2014) in the spring and summer. In the fall, the species tends to prefer hardwood forests with tree species that produce hard fruits (e.g., acorns, walnuts, beechnuts). Bears have a very varied diet, but may opportunistically prey on moose and caribou calves.

According to Jolicoeur and Hénault (2002), the grey wolf is estimated to have a population density in Hunting Zone 22 of between 0.3 and 0.5 wolves per 100 km². In the boreal forest, grey wolves prefer large, unfragmented forest areas with little human presence and sufficient availability of their main prey to ensure the viability of their packs. In the James Bay region, habitat fragmentation, increased road access, and trapping pressure may locally influence the distribution and dynamics of grey wolf packs. Although wolves generally avoid areas with high human infrastructure density, they may use linear infrastructure, such as forest roads and power lines, to facilitate their movements and access certain food resources, including ungulate carcasses left behind after hunting or trapping (Whittington et al., 2011; Lesmerises *et* coll., 2013). Moose are among their favourite prey, but they also hunt caribou.

An inventory of small mammals was carried out, resulting in the capture of eight species within the biophysical LSA, the most abundant of which were the southern red-backed vole and the deer mouse. These species have been observed in a variety of habitats, including softwood stands, regenerating environments, peatlands, and lichen tundra.

No specific inventory has been conducted for other mammals, but several species are likely to be present, including the snowshoe hare, the American porcupine, the muskrat, the beaver (which has been observed within the biophysical LSA), the American marten, the ermine, the least weasel, the American mink, the river otter, the coyote, the Canadian lynx, the red fox, the Arctic fox, the striped skunk, the red squirrel, the northern lying squirrel, and the woodchuck. Several of these species are of great importance to Indigenous communities, which consume animals such as the snowshoe hare and the porcupine and trap muskrats, American martens, least weasels, and American minks for their fur.

Avian fauna

The various inventories carried out in 2023, 2024, and 2025 identified 25 species of waterfowl and other water birds, 9 species of shorebirds, 15 species of birds of prey, and 65 species of land birds, for a total of 114 species.

Most of these species are migratory; only thirteen species were observed during the winter inventories.

Construction phase

Statement of potential impact

Disturbance of the activities of terrestrial wildlife (large wildlife and other mammal species, avian fauna including migratory birds).

Sources of the impact

- Site organization, stripping, and clearing.
- Surface preparation and access layout.
- Transportation and traffic related to materials and supplies.
- Production and management of residual and hazardous materials.

Detailed description of the impact

Large wildlife and other mammals

Loss and fragmentation of breeding and feeding habitats due to site preparation, stripping and clearing activities

The construction of mining and electrical infrastructure results in a direct loss of functional habitat for migratory caribou, primarily due to avoidance behaviours toward infrastructure at various spatial scales (Plante *et al*., 2018). Studies have shown that migratory caribou from the Leaf River herd (LRH) and the George River herd (GRH) actively avoid various types of anthropogenic disturbances, including mines, mineral exploration sites, roads, and buildings, thereby reducing their use of significant portions of their seasonal ranges (Plante et al., 2018; Plante *et al*., 2020). The areas of influence associated with mine infrastructure could extend for several kilometres, reaching up to approximately 23 km in some cases (Boulanger *et al*., 2012; Plante *et al*., 2018).

The rate of disturbance to the habitat of migratory caribou in the biophysical LSA was estimated by comparing the impacts of the mining project with the baseline condition. The method used takes into account the inclusion of avoidance zones for migrating caribou, encompassing not only disturbances but also the functional loss of habitat associated with these disturbances. Thus, the buffer zones associated with anthropogenic disturbances were determined based on the work of Plante *et al*. (2018) on the migratory caribou of the Leaf River herd. For more details on the method used, see the sectoral report on caribou in Appendix 6-21. The rate of habitat disturbance for migratory caribou in the biophysical LSA is estimated at 71,1% (Table 8-11), an increase of 0.1% compared to the baseline estimate. The project's encroachment on the potential habitat of the woodland caribou is shown in Map 8-9.

For migratory caribou, the transmission line could be associated with asymmetric habitat use on either side of the infrastructure, reflecting habitat fragmentation and a reduction in local connectivity, as observed in wild reindeer in Norway (Vistnes et al., 2004). During the winter period, when mobility is constrained by snow cover and energy balance is particularly sensitive, this barrier effect may limit access to certain foraging or resting areas and constrain movements to longer or less energetically favorable routes (Vistnes et al., 2004; Plante et al., 2018; Plante et al., 2020). During this time of year, fragmentation caused by linear infrastructure may therefore limit the ability of migratory caribou to finely adjust space use in response to snow conditions, resource availability, and predation risk, thereby reducing their resilience to interannual environmental variability (Vistnes et al., 2004; Plante et al., 2018; Plante et al., 2020).

Landscape connectivity is essential to maintaining the large seasonal migrations of migratory caribou, which enable individuals to access wintering and calving areas and support population maintenance or growth (Boulanger et al., 2024; Fullman et al., 2025). However, analyses of habitat use by the TRAF migratory caribou, presented in the sectoral report (see Appendix 6-21), suggest that the proposed location of the new transmission line could have negligible impacts on TRAF migratory behavior. Indeed, during the 2016–2024 period, part of the proposed transmission-line alignment was encompassed within overall use areas (95% and 99% kernel ranges), indicating low use of this sector. Two areas appeared to be more intensively used by TRAF caribou (50% and 75% kernel ranges). One of these areas was located north of the Trans-Taiga Road, while the other was located west of Lac de la Corvette. This suggests that TRAF caribou may cross more regularly the segment of the Trans-Taiga Road and existing transmission lines, but would infrequently cross the segment located northeast of the mine site, where the new transmission line is planned.

Finally, the work of Vistnes et al. (2004) also showed that transmission lines, particularly when parallel to or combined with roads, may be associated with marked differences in lichen biomass on either side of the infrastructure, with higher biomass observed in areas that have become less accessible to caribou.

For moose, the available data cover Hunting Zone 22 and indicate a stable and potentially growing population. The small area of potential habitat lost—approximately 519 hectares of forest cover (softwood and regenerating) within Hunting Zone 22—does not pose a significant risk to the population trends of this species.

Table 8-11 Rate of disturbance to migratory caribou habitat in the biophysical LSA

Mine's area of influence (km)	Type of disturbance	Area (km²)			Proportion of disturbed areas (%)
		Disturbance	Without disturbance	Total[1]	
0–5	Anthropogenic	62.4	0.0 (0.0%)	62.4	100.0
	Natural	0.0			0.0
5–10	Anthropogenic	192.4	0.0 (0.0%)	192.4	100.0
	Natural	0.0			0.0
10–20	Anthropogenic	621.0	55.4 (7.4 %)	749.4	82.9
	Natural	73.0			9.7
20–30	Anthropogenic	646.7	328.3 (24.8 %)	1,322.8	48.9
	Natural	347.7			26.3
30–40	Anthropogenic	655.5	600.4 (31.8 %)	1,886.7	34.7
	Natural	630.7			33.4
40–50	Anthropogenic	686.7	904.3 (38.9 %)	2,322.8	29.6
	Natural	731.9			31.5
0–50	**Anthropogenic**	**2,864.7**	**1,888.5 (28.9 %)**	**6,536.5**	**43.8**
	Natural	**1,783.4**			**27.3**

Note: 1 Excluding the surface water network.

Similarly, for black bears and grey wolves, the anticipated loss of forest cover is not expected to have a significant negative impact on these species. The bear's opportunistic nature allows it to make use of the wide variety of habitats surrounding the site. Although black bears tend to avoid areas with high human activity, the presence of new potential food sources (such as food waste) could attract them to the outskirts of facilities. As for the grey wolf, it appears that the presence of new forest roads—such as those built for the project—may enhance the wolf's hunting success by facilitating its movement across the territory.

What's more, habitat loss will affect all other mammals, though to varying degrees depending on their relative abundance in the area, the land area required for their survival, and their dependence on a specific type of habitat. It should be noted, however, that of the 519 hectares of forest cover to be cleared by the project, 96% of this area consists of softwood stands and regenerating stands—two vegetation types that dominate the territory of the biophysical LSA and RSA. Thus, among other mammals, the species most likely to be affected include those that may occur in higher densities (e.g., small mammals, hares, squirrels) and whose displacement due to habitat loss could lead to increased competition for their respective territories.

Disturbances caused by vibrations, noise, light, and dust, as well as the risk of collisions associated with transport and heavy vehicle and equipment traffic, which can lead to mortality

Although work on power transmission lines is generally temporary, disturbances associated with noise, vehicle traffic, and human presence can lead to localized avoidance of adjacent habitats during the winter, a period when caribou have limited ability to compensate energetically for such disturbances (Plante *et al*., 2018).

In fact, according to Shannon *et al*., 2015; Kunc and Schmidt, 2019; and Mancera, 2017, noise can have a negative effect on mammals in general. It appears that noise levels exceeding 52 dBA may cause animals to avoid noisy areas, affect reproductive success, and impair communication among gregarious species. The noise levels modelled for the construction phase show that this noise level (Leq, 12h) is only perceptible at the construction site and within a radius of approximately 700 metres around the site.

The risk of collisions increases due to the higher number of vehicles and machinery moving around the site. However, the relatively low density of various large wildlife species in the area reduces the risk of collisions, although such incidents remain possible. In fact, all mammals, due to their constant movement in search of food and other resources, are at risk of being struck by vehicles or machinery.

Composante du projet / *Project Component*

- Projet minier Shaakichiuwaanann / *Shaakichiuwaanann Mining Project*

Zones d'étude / *Study Areas*

- Projet / *Project*
- Biophysique - Régionale / *Biophysical - Regional*
- Zone d'influence de la mine / *Mine's area of influence*

Habitat potentiel / *Potential habitat*

- Arbustaie / *Scrubland*
- Lande à lichens / *Lichen tundra*
- Résineux / *Softwood*
- Tourbière ouverte / *Open peatland*

Perturbations / *Disturbances*

Conditions actuelles / *Currents Conditions*

- Anthropique et naturelle / *Anthropogenic and natural*

Conditions futures / *Futures Conditions*

- Anthropique - Permanente / *Anthropogenic*

Infrastructures / *Infrastructure*

- Prélèvement d'eau potable / *Drinking water withdrawal*
- Aérodrome / *Aerodrome*
- Hydroaérodrome / *Hydroaerodrome*
- Site d'extraction ouvert / *Open extraction site*
- Bâtiment industriel / *Industrial building*
- Tour de télécommunication / *Telecommunication tour*
- Centrale hydroélectrique / *Hydroelectric power plant*
- Poste électrique / *Electrical substation*
- Ligne de transport d'énergie / *Electric power transmission line*

Réseau routier / *Road Network*

- Route collectrice municipale / *Municipal collector road*
- Locale / *Local road*

Composante du milieu / *Component of the Environment*

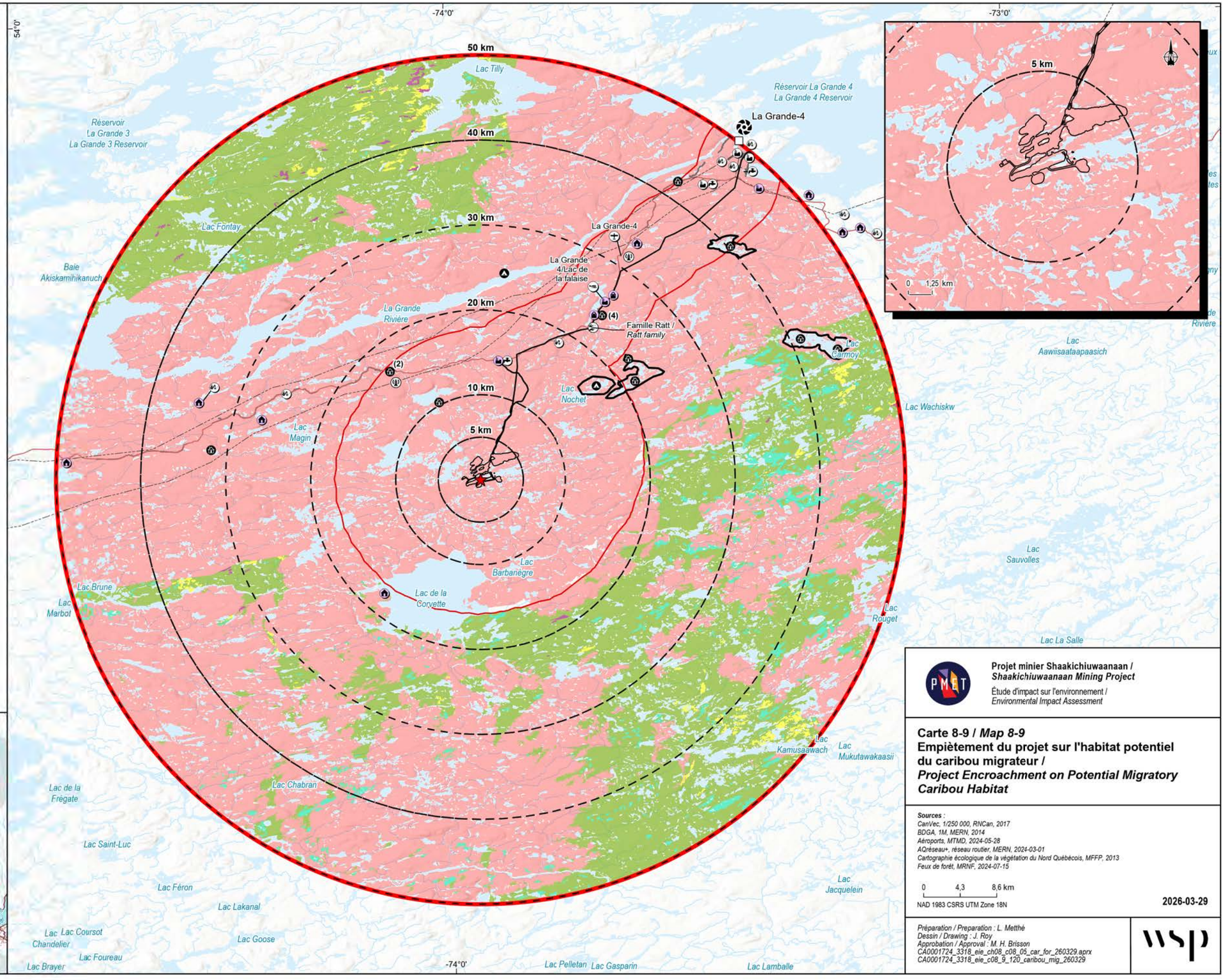
- Anthropique / *Anthropogenic*

Utilisation du territoire / *Land Use*

Baux / *Leases*

- Fins de villégiature / *Leisure purpose*
- Fins commerciales / *Commercial purpose*
- Fins industrielles / *Industrial purpose*
- Camp cri permanent / *Cree permanent Camp*
- Campement cri temporaire / *Cree temporary camp or campsite*
- Aire de camps et de campements / *Camps and campsites area*
- Autre type de camp / *Other camp type*
- Site de chasse / *Hunting site*





Projet minier Shaakichiuwaanann / *Shaakichiuwaanann Mining Project*

Étude d'impact sur l'environnement / Environmental Impact Assessment

Carte 8-9 / *Map 8-9*

Empiètement du projet sur l'habitat potentiel du caribou migrateur / *Project Encroachment on Potential Migratory Caribou Habitat*

Sources :

CanVec, 1/250 000, RNCan, 2017
BDGA, 1M, MERN, 2014
Aéroports, MTMD, 2024-05-28
AQréseau+, réseau routier, MERN, 2024-03-01
Cartographie écologique de la végétation du Nord Québécois, MFFP, 2013
Feux de forêt, MRNF, 2024-07-15

0 4,3 8,6 km

NAD 1983 CSRS UTM Zone 18N

2026-03-29

Préparation / Preparation : L. Metthé
Dessin / Drawing : J. Roy
Approbation / Approval : M. H. Brisson
CA0001724_3318_ele_ch08_c08_05_car_for_260329.aprx
CA0001724_3318_ele_c08_9_120_caribou_mig_260329

Avian fauna

The impacts on migratory birds are similar to those identified for bird species of special status (Section 8.2.3.2).

Loss and fragmentation of nesting and feeding habitats due to various construction projects involving clearing, soil stripping, earthwork, and drainage

During the construction phase (and throughout the life of the mine), the overall footprint of the infrastructure will result in the loss of terrestrial habitats and wetlands used by migratory birds. In total, 519 hectares of forest cover will be affected, including softwood forests (250.4 ha), regenerating forests (246.6 ha), scrubland (19.6 ha), and lichen tundra (2.59 ha). In addition to this loss, there will be a permanent reduction of 177.4 hectares of wetlands and water environments, including 104.7 hectares of wetlands consisting of wooded ombrotrophic bogs (30%; 31.9 ha), open ombrotrophic bogs (27%; 28.6 ha), treed swamps (25%; 26.3 ha), and shrub swamps (14%; 14.4 ha), as well as 57.2 ha of water environments.

Disturbances caused by vibrations, noise, light, and dust, as well as the risk of collisions associated with transport and heavy vehicle and equipment traffic, which can lead to mortality

Indirect impacts caused by increased disturbances—such as vibrations, noise, light, and dust emissions—are to be expected during the construction phase due to infrastructure work and equipment installation.

The effect of noise has been shown in the literature to have a potential negative effect on avian wildlife (Ortega, 2012; McClure et al., 2013; Kunc and Schmidt, 2019; Senzaki et al., 202). The threshold at which impacts could be felt is 40 dBA (Reijnen et al., 1997; Shannon et al., 2015). In fact, noise from infrastructure construction, site traffic, and refuelling and maintenance of mobile equipment could result in avoidance of certain noisy areas, changes in the reproductive success of certain species, and changes in interspecific communication. Human presence would also result in the avoidance of areas used by certain bird species. However, the noise generated by the project on the outskirts of the mine site is not expected to exceed this threshold by a significant margin, since the prescribed noise limits are 40 dBA at night and 45 dBA during the day (hourly average).

Few studies have been done on the impact of vibration on birds. However, Ferguson-Lee and Christie (2005) suggest that the upper limit is 10 kHz to 20 kHz and the lower limit is 50 kHz to 300 Hz. In some species of birds of prey, it would be between 1 kHz and 6 kHz (Yamazaki et al., 2004). The main source of vibration during the construction phase of the project will be surface blasting activities. It should be noted, however, that these activities will be carried out on a sporadic basis and will be concentrated in specific areas, such as for the construction of roads and ponds.

In the case of light disturbance, nighttime lighting could have an effect on migrating birds, attracting groups of birds to operations and diverting them from their migratory route. This may occur particularly under foggy conditions, resulting in a risk of mortality from collisions (Ogden, 1996).

Heavy vehicles and equipment traffic also pose a risk to birds. In Canada, it is estimated that 3,462 birds per 100 km are struck by vehicles each year during the breeding season (Bishop and Borgan, 2013).

Deterioration of the quality of the environment due to accidental leaks and spills of petroleum products or other hazardous materials into surface water and soil caused by the operation of equipment that uses these products or simply during their handling

Accidental spills of hazardous materials—particularly those related to equipment maintenance, traffic, or breakdowns of mobile equipment—could, in some cases, have direct and indirect impacts on birdlife. Contamination of soil or surface water can expose birds to various hydrocarbons. This exposure can cause the feathers to become fouled, compromising their waterproofing and thermal insulation properties, as well as causing toxic effects resulting from the ingestion or inhalation of contaminants. Some products may also have an impact on embryonic development and thus affect reproduction (King et al., 2021). Such exposures can alter behaviour, reduce survival rates, and compromise the reproductive success of birds. Similarly, heavy metals such as lead and mercury are known to affect the nervous, endocrine, and reproductive systems (ECCC, 2020b).

Contamination of surface water and soil can also have indirect effects by degrading habitats or affecting the survival and reproduction of food sources, such as plants, insects, and small mammals. Some contaminants can accumulate in the tissues of these prey animals, leading to secondary contamination in the birds that feed on them.

Mitigation measures

Common mitigation measures are presented in Appendix 8-2; in particular, those in the "Ambient air," "Noise and vibration," "Soil, surface water, and sediment quality," "Vegetation and wetlands," "Wildlife and wildlife habitat," and "Planning, land use, and land tenure" sections that apply in whole or in part to this VEC. In addition to these, the following specific measures must be taken into account:

All wildlife groups

- An environmental supervisor will conduct regular inspections of work areas, ensure that all parties strictly comply with the various commitments, obligations, measures, and other requirements, assess the quality and effectiveness of the measures implemented, and document any non-compliance observed (P24).
- Develop a training module to teach employees how to identify and manage the presence of species of special status and nests of migratory birds (P38).

Large wildlife and other mammals

- Develop a system for reporting sightings of large wildlife (P41).

Avian fauna

- Regrade the slopes of borrow pits to an incline of less than 70° where feasible, in order to reduce the attractiveness of active borrow pits as nesting habitat for bank swallows (P39).

Assessment of residual impact

Large wildlife and other mammals

During the construction phase, despite the implementation of the various proposed mitigation measures, the work will result in a net loss of potential habitat for large wildlife and other mammals, leading to a **medium** level of disturbance for these species. Given the medium value placed on wildlife species of special status, the intensity of the impact is **medium**.

The loss of breeding and feeding grounds accounts for the majority of the impacts of construction on large wildlife and other mammals. These impacts will be felt within the **project site** throughout the construction and operations phases, which will last for a **medium** duration. This will result in a residual impact of **moderate** significance. The probability of occurrence of these impacts is **high**, and the reversibility potential is **medium**, as habitat rehabilitation will be carried out during the restoration phase.

Despite the implementation of the various proposed mitigation measures, the risk of disturbance from nuisances (noise, vibrations, light, and dust) and mortality from collisions remains. These will result in a **medium** level of disturbance, which, combined with the high value placed on these species, will lead to a **medium** intensity of impact. These impacts will be felt within the **project area** throughout the construction and operations phases, which will last for a **medium** duration. The residual impact is therefore of **minor** significance in terms of disturbance and collision risk. The probability of occurrence of the disturbance is **high**, whereas the probability of a collision is **medium**. The reversibility of these impacts is considered **high** because the construction-related activities that could cause them will cease once this phase is completed.

<table>
<tr><th colspan="4">Impact on the activities of large wildlife and other mammal species</th></tr>
<tr><td>Intensity:</td><td>Medium</td><td rowspan="3">Significance:</td><td rowspan="3">Moderate (habitat loss)
Minor (disturbance and collision)</td></tr>
<tr><td>Extent:</td><td>Project</td></tr>
<tr><td>Duration:</td><td>Medium (habitat loss)
Short (disturbance and collision)</td></tr>
<tr><td colspan="2">Probability of occurrence:</td><td colspan="2">High (habitat loss and disturbance)
Medium (collision risk)</td></tr>
<tr><td colspan="2">Reversibility:</td><td colspan="2">Moderate (habitat loss)
High (disturbance and collision)</td></tr>
</table>

Avian fauna

The construction phase will also result in a net loss of potential habitat for migratory birds. Most of the residual impacts will result from this habitat loss, which suggests a **medium** degree of disturbance for these species and, consequently, a **medium** impact intensity, given the **medium** value assigned to terrestrial wildlife. The impact of habitat loss will be felt within the **project** area until the end of operations (**medium** duration), resulting in a residual impact of **moderate** significance.

Several proposed mitigation measures target impacts related to disturbance, collision risk, and the potential for accidental spills. Thus, the degree of disturbance is considered **low** for these residual impacts, with a **low** impact intensity. Among birds, population density decreases in the vicinity of infrastructure, and this effect can extend up to approximately 1 km (Benítez-López et al., 2010), which corresponds to the **local** study area. Noise, vibration, and light levels harmful to birds are not expected to extend beyond this area. As for potential spills, they will be limited to the **project area**. Disturbances and collision risks are impacts of **medium** duration, as they begin during the construction phase and persist throughout subsequent phases. However, the impacts of accidental spills are of **short** duration, as they result from one-time events. The residual impact will therefore be of **minor** significance for both of these aspects.

The probability of occurrence of habitat loss and disturbance or collision-related mortality is **high**, but **low** for accidental spills. The reversibility potential for habitat loss is **medium** because habitats can be restored to a predetermined target state, but it is difficult to fully restore them to their original condition in the short term, especially in the case of mature stands or wetlands. The reversibility of the impact of disturbance or mortality is considered **high**, since these effects cease as soon as the activities causing them come to an end. Accidental spills have **medium** reversibility, as there remains a possibility that some contaminants will persist in the environment despite remediation efforts.

<table>
<tr><th colspan="4">Impact on the activities of terrestrial wildlife (avian fauna, including migratory birds)</th></tr>
<tr><td>Intensity:</td><td>Medium (habitat loss)
Low (disturbance/collision and accidental spills)</td><td rowspan="3">Significance:</td><td rowspan="3">Moderate (habitat loss)
Minor (disturbance/collision risk, accidental spills)</td></tr>
<tr><td>Extent:</td><td>Local (disturbance/collision risk)
Project (habitat loss, accidental spills)</td></tr>
<tr><td>Duration:</td><td>Medium (habitat loss, disturbance/collision risk)
Short (accidental spills)</td></tr>
<tr><td colspan="2">Probability of occurrence:</td><td colspan="2">High (habitat loss, disturbance/collision risk)
Low (accidental spills)</td></tr>
<tr><td colspan="2">Reversibility:</td><td colspan="2">High (disturbance/collision risk)
Medium (habitat loss, accidental spills)</td></tr>
</table>

Operations phase

Statement of potential impact

Disturbance of the activities of terrestrial wildlife (large wildlife and other mammal species, avian fauna).

Sources of the impact

- Presence and operation of new infrastructure.
- Transportation and traffic related to ore and supplies.
- Production and management of residual and hazardous materials.

Detailed description of the impact

Large wildlife and other mammals

Alteration of predator–prey dynamics associated with mining activities, buildings, and infrastructure.

This impact is primarily associated with migratory caribou. For other large wildlife species and other mammals, impacts related to habitat loss and fragmentation are similar to those described for the construction phase.

Linear infrastructure can indirectly influence the risk of predation faced by migratory caribou. Roads, access roads, and right-of-ways associated with PTLs can facilitate the movement of predators, such as the grey wolf, by providing more efficient movement corridors in snow-covered landscapes, which may increase the likelihood of predator-prey encounters (Plante *et al.*, 2020). A detailed description of this impact is provided in Section 8.2.3.2, *Species with Special Status*, under the subsection addressing large wildlife and other mammals.

Disturbances caused by vibrations, noise, light, and dust, as well as the risk of collisions associated with transport and heavy vehicle and equipment traffic, which can lead to mortality

Throughout the operations phase, disturbances associated with noise, vehicle traffic, and human presence may cause localized avoidance of adjacent habitats during the winter, a period when caribou have limited ability to compensate energetically for such disturbances (Plante et al., 2018). In addition, migrating caribou may occasionally forage along roadsides (Post and Klein, 1999), increasing the risk of collisions with vehicles (Fahrig and Rytwinski, 2009).

For other species of large wildlife and other mammals, the impacts associated with habitat loss and fragmentation are similar to those described for the construction phase. It should be noted that, with regard to the noise levels modelled during the operations phase, it appears that levels exceeding 52 dBA (Leq, 1h) are only perceived at the construction site and within a radius of 1,500 m to 2,000 m around the site.

Avian fauna

Disturbances caused by vibrations, noise, light, and dust, as well as the risk of collisions associated with transport and heavy vehicle and equipment traffic, which can lead to mortality

The indirect impacts caused by increased disturbance—such as vibrations, noise, light, and dust emissions—during the operations phase will be comparable to those identified for the construction phase.

Deterioration of the quality of the environment due to accidental leaks and spills of petroleum products or other hazardous materials into surface water and soil caused by the operation of equipment that uses these products or simply during their handling

As far as spill risks are concerned, they are the same as those anticipated during the construction phase.

Mitigation measures

Common mitigation measures are presented in Appendix 8-2; in particular, those in the “Ambient air,” “Noise and vibrations,” “Soil, surface water, and sediment quality,” “Vegetation and wetlands,” “Wildlife and wildlife habitat,” and Planning, land use, and land tenure” sections that apply in whole or in part to this VEC. In addition to these, the following specific measures must be taken into account:

All wildlife groups

- An environmental supervisor will conduct regular inspections of work areas, ensure that all parties strictly comply with the various commitments, obligations, measures, and other requirements, assess the quality and effectiveness of the measures implemented, and document any non-compliance observed (P24).
- Develop a training module to teach employees how to identify and manage the presence of species of special status and nests of migratory birds (P38).

Large wildlife and other mammals

- Develop a system for reporting sightings of large wildlife (P41).

Assessment of residual impact

Large wildlife and other mammals

Despite the implementation of the various proposed mitigation measures, risks of disruption to predator–prey dynamics, as well as disturbance and collision, remain present at the project site, causing a medium degree of disturbance that results in an impact of **high** intensity. The impacts will be felt within the project area over a **medium** duration. The residual impact is therefore of **moderate** significance in terms of disturbance and collision risk. The probability of occurrence of the disturbance and collision risk is **high**, and reversibility is considered **high** since these impacts will disappear at the end of operations.

Impact on the activities of terrestrial wildlife (large wildlife and other mammal species)			
Intensity:	High	**Significance:**	Moderate
Extent:	Project		
Duration:	Medium		
Probability of occurrence:		High	
Reversibility:		High	

Avian fauna

Several proposed mitigation measures target impacts related to disturbance, the risk of collision-related mortality, and the potential for accidental spills. Thus, the degree of disturbance is considered **low** for these residual impacts, with a **low** impact intensity given the **medium** value assigned to terrestrial fauna.

Noise, vibration, and light levels harmful to birds are not expected to extend beyond the **local** study area. As for potential spills, they will be confined to the **project** area. Disturbance and collision risk are impacts of medium duration, as they occur throughout the operations phase. However, the impacts of accidental spills are of **short** duration, as they result from one-time events. As a result, the residual impacts of these factors are of **minor** significance.

The probability of occurrence of disturbance or mortality due to collisions is **high**, but **low** for accidental spills. The reversibility potential of the impact of disturbance or mortality is considered **high**, since these effects cease as soon as the activities causing them come to an end. Accidental spills have **medium** reversibility, as there remains a possibility that some contaminants will persist in the environment despite remediation efforts.

Impact on the activities of terrestrial wildlife (avian fauna, including migratory birds)			
Intensity:	Low (disturbance/collision and accidental spills)	**Significance:**	Minor (disturbance/collision risk, accidental spills)
Extent:	Local (disturbance/collision risk) Project (accidental spills)		
Duration:	Medium (disturbance/collision risk) Short (accidental spills)		
Probability of occurrence:		High (disturbance/collision risk) Low (accidental spills)	
Reversibility:		Low (habitat loss) High (disturbance/collision risk) Medium (accidental spills)	

Closure phase

Statement of potential impact

Habitat improvements that promote the resumption of activities of terrestrial wildlife (large wildlife and other mammal species, avian fauna).

Sources of the impact

- Presence of site remains.
- Final restoration.
- Production and management of residual and hazardous materials.

Detailed description of the impact

Large wildlife and other mammals and Avian fauna

Disturbances caused by vibrations, noise, light, and dust, as well as the risk of collisions associated with transport and heavy vehicle and equipment traffic, which can lead to mortality

As in the construction and operations phases, dismantling activities and the moving around of mobile equipment will cause disturbances and pose a risk of fatal collisions.

Deterioration of the quality of the environment due to accidental leaks and spills of petroleum products or other hazardous materials into surface water and soil caused by the operation of equipment that uses these products or simply during their handling

As for these spill risks, they are the same as those anticipated during the construction and operations phases.

Habitat creation through site restoration

At the end of operations, habitats will be restored or recreated and may once again serve as habitats for some of the bird species of special status. In the short term, the restored areas may be used by some bird species, including those that inhabit regenerating environments with sparse vegetation or young stands.

Mitigation measures

Common mitigation measures are presented in Appendix 8-2; in particular, those in the "Ambient air," "Noise and vibration," "Soil, surface water, and sediment quality," "Vegetation and wetlands," "Wildlife and wildlife habitat," and "Planning, land use, and land tenure" sections that apply in whole or in part to this VEC. In addition to these, the following specific measures must be taken into account:

All wildlife groups

- Work together with the tallyman of trapline CH39 in carrying out rehabilitation, restoration, and revegetation activities and returning the site to its natural state (P22).
- An environmental supervisor will conduct regular inspections of work areas, ensure that all parties strictly comply with the various commitments, obligations, measures, and other requirements, assess the quality and effectiveness of the measures implemented, and document any non-compliance observed (P24).
- Develop a training module to teach employees how to identify and manage the presence of species of special status and nests of migratory birds (P38).

Large wildlife and other mammals

- Develop a system for reporting sightings of large wildlife (P41).

Avian fauna

- Before proceeding with the demolition of buildings and other structures during the closure phase, inspect them to check for the possible presence of bat hibernacula or maternity roosts, or bird nests (P42).

Assessment of residual impact

During the closure phase, the negative impacts are linked to disturbance, collision risk, and accidental spills, affecting all terrestrial wildlife. However, these impacts will be less significant than during the construction and operations phases. In addition, the project will have a positive impact by restoring habitats through a revegetation campaign.

Thus, the degree of disturbance is considered **low** for negative residual impacts, with a **low** impact intensity given the **medium** value assigned to terrestrial fauna. The impacts will be felt in the **project** area for a **short** duration, as disturbances and collision risks will cease once restoration work is complete. The anticipated residual impact is expected to be of **minor** significance. The probability of occurrence is **high** for disturbances and **low** for collision risk and spills. The reversibility of the impact of the disturbance and the collision risk is considered **high**, since these effects cease as soon as the activities causing them are completed.

The closure phase will result in the creation of habitats for species of special status, leading to an expected **medium** degree of improvement for these species and, consequently, a **high** intensity of positive impact. The impact of habitat creation will be felt in the **project** area and will persist beyond the restoration work (**long** duration), resulting in a **positive** residual impact of **major** significance. The probability of occurrence is **high**.

Impact on the activities of terrestrial wildlife			
Intensity:	Medium (+ habitat creation) Low (- disturbance/collision and - accidental spills)	**Significance:**	Medium (+ habitat creation) Minor (- disturbance/collision risk, - accidental spills)
Extent:	Local (+ habitat creation, - disturbance/collision risk) Project (- accidental spills)		
Duration:	Long (+ habitat creation) Short (- accidental spills, disturbance/collision)		
Probability of occurrence:		High (+ habitat creation, - disturbance) Low (- accidental spills, collision)	
Reversibility:		High (- disturbance/collision risk) Medium (- accidental spills)	

8.2.3.4 Forest cover

Forest cover refers to all terrestrial plant communities that may be disturbed by activities in the construction, operations, and closure phases. It should be noted that, within the framework of the project, forest cover is assigned a medium ecosystem value because, while it attracts significant interest, there is not necessarily a consensus on its conservation and protection. It is also considered to have low socioeconomic value because, due to its nature and low density, it is rarely harvested. Since the value to be applied is the higher of the two, a **medium** value will be used to analyze the impacts of this VEC.

Summary of current conditions

The biophysical LSA is located within the spruce-lichen stand bioclimatic domain (western subdomain) and within the Eastmain and Sakami River, Robert Bourassa Reservoir, and Lac Naococane ecological regions. The landscapes of the open boreal forest are not very diverse due to harsh climatic conditions and frequent vegetation fires. They are heavily dominated by black spruce. Black spruce-lichen stands, characterized by an open forest canopy and a lichen mat are the most abundant type of stand in the area (MRNF, 2023).

More specifically, the main groupings of terrestrial vegetation include, in order of increasing area, regenerating forest areas, coniferous stands, lichen tundra, scrubland, mixedwood stands, and hardwood stands. They cover a total of 15,513 hectares of the biophysical LSA, or 75.1% of the total surface area of the biophysical LSA, which is 20,661 ha. Of these groups, two stand out, namely:

- Regenerating forest areas, which account for 42.5% of the biophysical LSA (8,774 ha). They are primarily the result of disturbances caused by forest fires that occurred several decades ago. The tree stratum is not dominant there, as most tree species are still in the shrub stage.

- Softwood stands, which account for 26.1% of the biophysical LSA (5,814 ha). They consist mainly, in order of importance, of spruce-moss stands, spruce-lichen stands, and jack pine stands. The dominant species in spruce stands is the black spruce.

Two other types of mixedwood and hardwood stands are present, but in smaller quantities, accounting for only 0.1% (28 ha) and 0.002% (0.3 ha) of the LSA, respectively. Finally, scrubland, which consists of areas undergoing regeneration but containing less than 10% trees, accounts for 1.8% (378 ha) of the LSA, while lichen tundra—open habitats where lichens dominate over shrubs—account for 2.5% (519 ha) of the LSA.

Construction phase

Statement of potential impact

Loss of forest cover associated with clearing land required for mine infrastructure and operations

Source of the impact

- Site organization, stripping, and clearing
- Surface preparation and access layout

Detailed description of the impact

The primary impact associated with forest cover stems from the permanent loss of vegetation due to clearing the areas required for the development of mining facilities (roads, the main mine site, stockpiles and other storage areas, as well as the locations of power transmission towers and substations), totalling 519 ha, or 2.5% of the LSA. The stands in question include softwood forests (250.4 ha), regenerating forests (246.6 ha), scrubland (19.6 ha), and lichen tundra (2.59 ha). Preparing the surfaces and traffic routes requires the removal of stumps, roots, and the organic layer (which is stored in stockpiles for potential future site restoration), thereby eliminating any possibility of natural regrowth on these surfaces for the duration of the facilities' operational life. As for the right-of-way of the power line (excluding the locations of the towers), only the tree canopy will be cleared; stumps, saplings, shrubs, and other vegetation will be left in place. The area of the right-of-way where the tree layer will be affected by this impact (in terrestrial and wetland environments) is estimated at 201.5 ha.

Mitigation measures

Common mitigation measures are presented in Appendix 8-2; in particular, those in the "Soil, surface water, and sediment quality," "Vegetation and wetlands," "Wildlife and wildlife habitat," and Planning, land use, and land tenure" sections that apply in whole or in part to impacts on forest cover. In addition to these, the following specific measures must be taken into account:

- Work together with the tallyman of trapline CH39 in carrying out rehabilitation, restoration, and revegetation activities and returning the site to its natural state (P22).
- Whenever possible, preserve the forest cover along the mining site road and revegetate bare areas with native plants after completion of the work (P23).
- An environmental supervisor will conduct regular inspections of work areas, ensure that all parties strictly comply with the various commitments, obligations, measures, and other requirements, assess the quality and effectiveness of the measures implemented, and document any non-compliance observed (P24).

Assessment of residual impact

During the construction phase, the implementation of the various proposed mitigation measures, combined with the abundance of the main types of forest cover in the biophysical LSA, suggests that the level of disturbance to the affected plant groupings will be **low**. Given the medium value attached to soils, the intensity of the impact is **low**. This impact will be felt within the project area throughout the construction and operations phases (medium duration), resulting in a residual impact of **minor significance**. The probability of occurrence of this impact is **high**, and its reversibility potential is **high** due to the possibility of regenerating the affected areas once operations have ceased.

Impact on forest cover			
Intensity:	Low	**Significance:**	Minor
Extent:	Project		
Duration:	Medium		
Probability of occurrence:		High	
Reversibility:		High	

Operations phase

Statement of potential impact

Disturbance of forest cover maintained on the edges of the site (damage caused by traffic, dust)

Source of the impact

- Presence and operation of new infrastructure.
- Transportation and traffic related to ore and supplies.

Detailed description of the impact

During the operations phase, the main impacts on forest cover and its components include:

- any potential need for additional space that has not yet been anticipated and that would result in further cutting;
- damage caused to vegetation bordering the facilities by off-road vehicle and machinery traffic;
- dust generated by activities can settle on plants, potentially limiting their growth (by reducing their ability to photosynthesize).

Mitigation measures

Common mitigation measures are presented in Appendix 8-2; in particular, those in the "Ambient air," "Soil, surface water, and sediment quality," "Vegetation and wetlands," "Wildlife and wildlife habitat," and Planning, land use, and land tenure" sections that apply in whole or in part to impacts on forest cover. In addition to these, the following specific measures must be taken into account:

- Work together with the tallyman of trapline CH39 in carrying out rehabilitation, restoration, and revegetation activities and returning the site to its natural state (P22).
- Whenever possible, preserve the forest cover along the road of the mine and revegetate bare areas with native plants after completion of the work (P23).
- An environmental supervisor will conduct regular inspections of work areas, ensure that all parties strictly comply with the various commitments, obligations, measures, and other requirements, assess the quality and effectiveness of the measures implemented, and document any non-compliance observed (P24).
- Spray water on the non-active areas of stockpiles using a water truck when necessary (P28).
- Apply dust suppressants on the slopes and final (outer) surfaces of the stockpiles (P29).

Assessment of residual impact

During the operations phase, the implementation of the various proposed mitigation measures is expected to result in a **low** level of disturbance to the affected plant groupings. Given the medium value attached to soils, the intensity of the impact is **low**. This impact will be felt primarily within the project area, but also at the local level (dust), throughout the entire operations phase (medium duration), resulting in a residual impact of **minor significance**. The probability of occurrence of this impact is **high**, and its reversibility potential is **high** due to the possibility of the affected areas regenerating once operations cease, and due to regular rainfall from spring through fall, which washes some or all of the dust off the vegetation.

Impact on forest cover			
Intensity:	Low	**Significance:**	Minor
Extent:	Local		
Duration:	Medium		
Probability of occurrence:		High	
Reversibility:		High	

Closure phase

Identification of potential impacts

Potential damage to forest cover components and area not cleared for revegetation

Restoration of cleared areas through revegetation.

Source of the impact

- Transport and traffic during the work.
- Presence of site remains.
- Final restoration.

Detailed description of the impact

The main impact during the closure phase is positive, as it involves the freeing up and restoration of a large portion of the surface area associated with the project. The restoration of these areas involves loosening the soil, spreading organic matter stored for this purpose, and replanting with native tree species typical of the local forest cover. Nevertheless, transportation and traffic can cause certain temporary impacts by encroaching beyond the work zones, and the presence of mine site remnants may limit the ability to fully revegetate the previously occupied areas.

Mitigation measures

Common mitigation measures are presented in Appendix 8-2; in particular, those in the "Soil, surface water, and sediment quality," "Vegetation and wetlands," and Planning, land use, and land tenure" sections that apply in whole or in part to impacts on forest cover. In addition to these, the following specific measures must be taken into account:

- Cooperate with the tallyman of trapline CH39 in the rehabilitation, restoration, and revegetation activities and returning the site to its natural state (P22).
- Whenever possible, preserve the forest cover along the mining site road and revegetate bare areas with native plants after completion of the work (P23).An environmental supervisor will conduct regular inspections of work areas, ensure that all parties strictly comply with the various commitments, obligations, measures, and other requirements, assess the quality and effectiveness of the measures implemented, and document any non-compliance observed (P24).

Assessment of residual impact

During the closure phase, the implementation of the various proposed mitigation measures is expected to result in a **low** level of disturbance to the affected plant groupings and a **high** degree of improvement. Given the medium value assigned to soils, the intensity of the negative impact is **low**, while that of the positive impact is **high**. These impacts will be felt primarily within the project area, only during the closure period in the case of negative impacts (short duration) and over the long term in the case of positive impacts. The result is a negative residual impact of **minor significance**, whereas the positive impact will be of **major significance**. The probability of occurrence of these impacts is **high** and the reversibility potential of the negative impact is **high** due to the very nature of the ongoing work, which is ultimately aimed at restoring the site.

Impact on forest cover			
Intensity:	Low (-) and high (+)	**Significance:**	**Minor (-) and Major (+)**
Extent:	**Project**		
Duration:	**Short (-) and Long (+)**		
Probability of occurrence:		High (-) (+)	
Reversibility:		High (-)	

8.2.4 Issue 4 – Preserving the quality of life of the local population

8.2.4.1 Air quality

Air quality refers to compliance with existing standards for concentrations of air pollutants and dust that may be affected by construction, operations, and closure activities. It should be noted that, within the framework of the project, air quality is a subject of significant interest and concern; for this reason, a **medium** ecosystem value has been assigned to this VEC.

Summary of current conditions

According to data from the Radisson station of the National Air Pollution Surveillance (NAPS) program—the nearest station at a latitude equivalent to that of the project site—the initial concentrations specified for northern projects in the *Guide d'instructions – Préparation et réalisation d'une modélisation de la dispersion des émissions atmosphériques – Projets miniers* ["Instruction Manual – Preparation and Implementation of Atmospheric Emission Dispersion Modelling – Mining Projects"] (MELCCFP, 2025a) as well as those in the *Normes et critères de qualité de l'air du Québec [NCQQA v10](MELCCFP, 2025b)*, Quebec's air quality standards and criteria, the initial concentrations selected and considered to be existing at the mining site are presented in Table 6-5. Based on the concentrations measured, air quality in the project area is considered very good to excellent.

Construction phase

Statement of potential impact

Alteration of air quality due to the emission of air pollutants and dust

Sources of the impact

- Site organization, stripping, and clearing.
- Surface preparation and access layout.
- Construction of structures and infrastructure.
- Transportation and traffic related to materials and supplies.
- Production and management of residual and hazardous materials.

Detailed description of the impact

Construction work during the preparation of the mine site will involve several types of activities that may generate air emissions, including:

- Exhaust emissions from various types of mobile construction equipment, which are sources of particulate matter and combustion gases (nitrogen oxides, sulphur dioxide, hydrocarbons, carbon monoxide, volatile organic compounds, etc.).
- All operations involving the unloading, handling, and compaction of fill material that result in fugitive emissions of particulate matter.
- Vehicle traffic on unpaved sections is also a source of particulate matter.
- Blasting and drilling operations for the extraction of granular material used in the preparation of road surfaces and building foundations, as well as site preparation, are sources of particulate matter and combustion gases.

Anticipated emissions during the construction phase were not assessed through the dispersion modelling presented in the sectoral atmospheric dispersion modelling report, as it was determined that atmospheric emissions would be significantly lower during construction than during the operational phase. Indeed, it is expected that even during the most intensive construction days, the various parameters considered—including total and fine particulate matter, CO, NO_2, SO_2, VOCs, metals, and crystalline silica—would not exceed applicable criteria and standards at sensitive receptor locations.

Mitigation measures

Common mitigation measures are presented in Appendix 8-2; in particular, those in the “Ambient air” and “Vegetation and wetlands” sections that apply in whole or in part to the impacts on air quality. In addition to these, the following specific measures must be taken into account:

- Gradually restore Stockpiles 1 and 2 to reduce the areas susceptible to wind erosion and erosion from runoff (P01).
- Establish an Environmental Monitoring Committee, the terms of which will be specified in the IBA, to discuss and develop solutions to the issues that may arise during the mine’s phases (P18).
- Whenever possible, preserve the forest cover along the road of the mine and revegetate bare areas with native plants after completion of the work (P23).
- An environmental supervisor will conduct regular inspections of work areas, ensure that all parties strictly comply with the various commitments, obligations, measures, and other requirements, assess the quality and effectiveness of the measures implemented, and document any non-compliance observed (P24).
- Spray water on the non-active areas of stockpiles using a water truck when necessary (P28).
- Apply dust suppressants on the slopes and final (outer) surfaces of the stockpiles (P29).

Assessment of residual impact

During the construction phase, the limited concentrations emitted, the distance from sensitive receptors, and the implementation of the various proposed mitigation measures suggest that the degree of disturbance related to changes in air quality will be **low**. Given the medium value attached to soils, the intensity of the impact is **low**. This impact will be felt within the **local** area and only during the construction period (**short** duration), resulting in a residual impact of **minor significance**. The probability of occurrence of this impact is **high** for exhaust emissions associated with machinery operation and blasting, but **medium** for the risk of dust emissions. The reversibility potential of these impacts is **high** because the air emissions generated during the construction phase will cease once that phase is over.

Impact on air quality			
Intensity:	Low	**Significance:**	**Minor**
Extent:	**Local**		
Duration:	**Short**		
Probability of occurrence:		High (exhaust emissions, blasting) Medium (dust emissions)	
Reversibility:		High	

Operations phase

Statement of potential impact

Alteration of air quality due to the emission of air pollutants and dust.

Sources of the impact

- Presence and operation of new infrastructure;
- Transportation and traffic related to ore and supplies;
- Production and management of residual and hazardous materials.

Detailed description of the impact

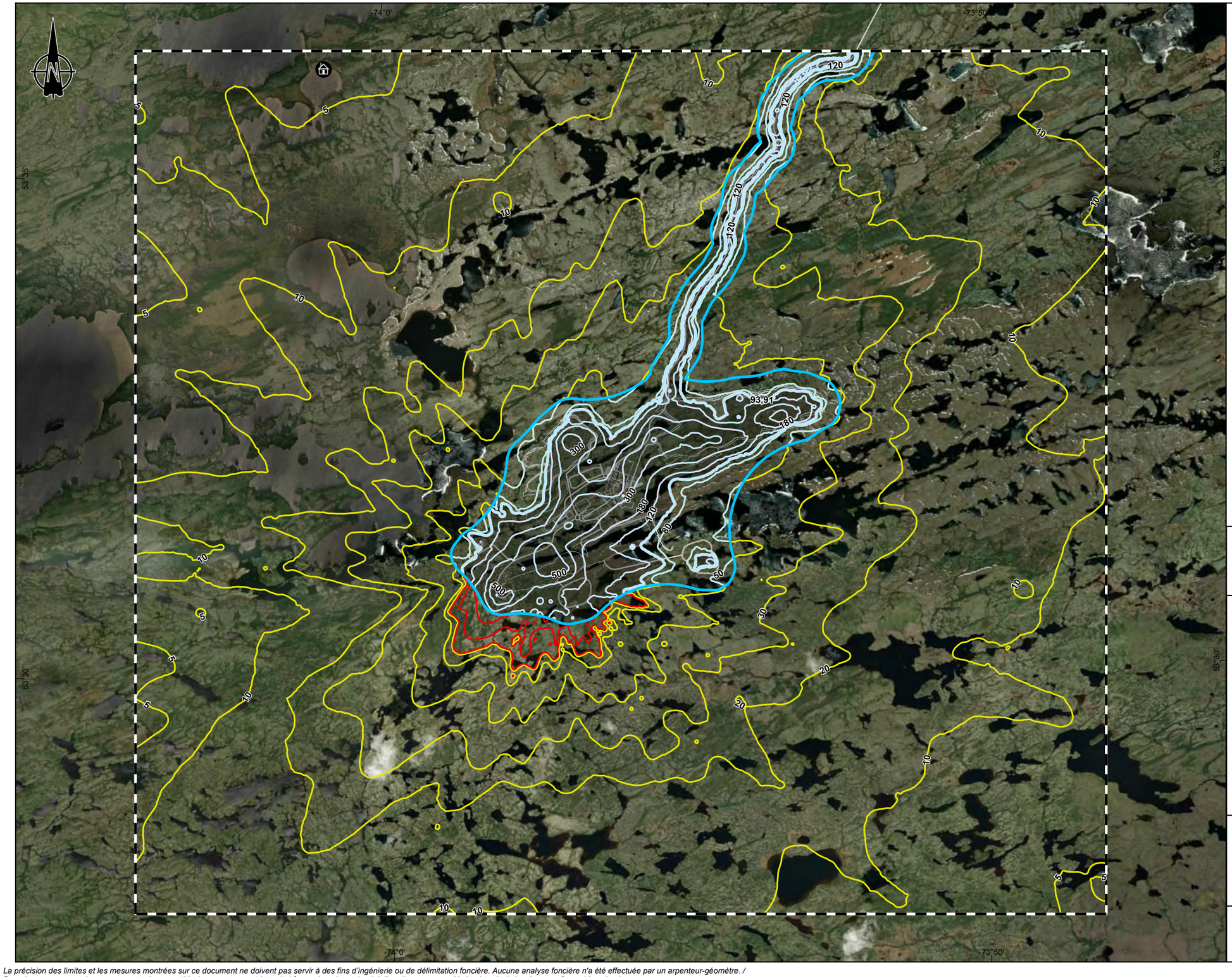
Operations at the mine site will involve several sources of air emissions, including:

- Exhaust emissions from various types of mobile equipment used in mine operations, which are sources of particulate matter and combustion gases (nitrogen oxides, sulphur dioxide, hydrocarbons, carbon monoxide, volatile organic compounds, etc.).
- All operations involving the loading, handling, and unloading of ore and various tailings that are sources of fugitive particulate matter emissions.
- Vehicle traffic on the mine site's internal road network and on the Trans-Taiga Road, which are unpaved, also contributes to fugitive emissions of particulate matter.
- Blasting and drilling operations for the extraction of overburden and ore are sources of particulate matter and combustion gases.

- The presence and operation of new point sources, including dust collectors and generators, will also contribute to air emissions.
- The exhaust outlets of the underground mine's ventilation equipment, which will emit combustion gases and particulates.
- The release of metals and metalloids present in the dust generated by mine operations.

Projected emissions during the operations phase were estimated using a modelling approach described in detail in the sectoral report on atmospheric dispersion modelling (Appendix 6-1). The modelled concentrations were evaluated over a domain measuring 16 km by 18 km (area of 592.4 ha). Based on the results of this modelling, the following conclusions can be drawn:

- All substances considered in the modelling comply with the Quebec and Canadian standards and criteria applicable to the various sensitive receptors (5) identified around the site. These receptors are located at distances ranging from approximately 6 km to 15.5 km from the mine site.
- Quebec's criteria and standards for some of the substances are exceeded within the modelling area (beyond 300 m from the mining infrastructure) , specifically:
  - Total particulate matter emissions over a 24-hour period for an area to the south, near the open pit (Map 8-10). This exceedance is detected over a distance of less than 1.5 km and is believed to be primarily caused by dust emitted by passing trucks (+95%). It should be noted that although these exceedances could occur throughout the entire duration of operations, they will rarely be noticeable at the maximum modelled distance (approximately 1.5 km).
  - Fine particulate matter ($PM_{2.5}$) emissions over a 24-hour period for an area to the south, near the open pit (Map 8-11). This exceedance is noticeable over a distance of approximately 500 metres and is believed to be primarily due to dust generated by truck traffic (75%), as well as emissions from the process plant and vehicle exhaust (25%). It should be noted that although these exceedances could occur throughout the entire duration of operations, they will rarely be noticeable at the maximum modelled distance (approximately 500 m).
  - Acetaldehyde emissions over a 4-minute period in a southern section near the open pit (see Appendix 6-1 for more details). This exceedance is detected over a distance of approximately 325 m from the infrastructure (25 m from the application limit) and is believed to be primarily due to emissions from vehicle exhaust. This concerns sporadic and infrequent events.
  - Crystalline silica emissions over a 1-hour period during blasting and without blasting in the pit (Map 8-12, see Appendix 6-1 for the infrequent scenario involving blasting). When there is no blasting, the impact over a one-hour period is primarily felt south of the open pit within a distance of less than 2.5 km and is believed to be mainly caused by dust generated by truck traffic. During blasting operations, the impact is felt for an hour around the site within a radius of less than 6 km. It should be noted that blasting operations are currently scheduled only two to three times a week, whereas the modelling assumed a frequency of one blast per day. These are therefore rare occurrences whose effects subside within an hour or so after the blasting.
  - Crystalline silica emissions over a one-year period for all mining operations (Map 8-13). The impact is felt throughout the site within a radius of less than 3 km and is believed to be primarily caused by dust kicked up by passing trucks.



Composante du projet / *Project Component*

Infrastructure actuelle ou projetée / *Existing or projected infrastructure*

Modèle de dispersion atmosphérique / *Atmospheric Dispersion Model*

Domaine de modélisation / *Modeling domain*

Limite d'application des normes et critères / *Limits of application of standards and criteria*

Récepteurs / *Receptors*

Camp permanent / *Permanent camp*

Courbes isoconcentrations / *Isoconcentrations Curves* (µg/m³)

Supérieure à la valeur limite / *Above the limit value*

Inférieure à la valeur limite / *Below the limit value*
(considérant la concentration initiale) /
(considering the initial concentration)

Hors domaine d'application / *Outside application domain*

Valeur limite : 120 µg/m³ / *Limit: 120 µg/m³*
Concentration initiale : 26.09 µg/m³ / *Initial concentration: 26.09 µg/m³*

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Carte 8-10 / *Map 8-10*

Concentrations maximales modélisées
Substance : Particules totales (PMT)
Période : 24 heures
Scénario : Exploitation
Type de limite : MELCCFP (Norme)

Maximum Modelled Concentrations
Substance : Total Particulates (PMT)
Period : 24-hours
Scenario : Operations
Limit type : MELCCFP (Standard)

Sources / Sources
AQréseau+, réseau routier, MERN, 2016
BDGA, 1M, MERN, 2014
CanVec, 250k,RNCan, 2017

0 700 1 400 m
UTM, fuseau 18, NAD83 (CSRS)

2026-03-25

Préparation / Prepared by : V. Lamothe
Dessin / Drawn by : S. Samson
Approbation / Approved by : J. Poirier
CA0001724_3318_eie_ch08_c10_13_260325.aprx
CA0001724_3318_eie_c08_10_13_resultat_260325

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Composante du projet / *Project Component*

Infrastructure actuelle ou projetée / *Existing or projected infrastructure*

Modèle de dispersion atmosphérique / *Atmospheric Dispersion Model*

Domaine de modélisation / *Modeling domain*

Limite d'application des normes et critères / *Limits of application of standards and criteria*

Récepteurs / *Receptors*

Camp permanent / *Permanent camp*

Courbes isoconcentrations / *Isoconcentrations Curves* (µg/m³)

Supérieure à la valeur limite / *Above the limit value*

Inférieure à la valeur limite / *Below the limit value*
(considérant la concentration initiale) /
(considering the initial concentration)

Hors domaine d'application / *Outside application domain*

Valeur limite : 30 µg/m³ / *Limit: 30 µg/m³*
Concentration initiale : 10.42 µg/m³ / *Initial concentration: 10.42 µg/m³*

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Carte 8-11 / *Map 8-11*

Concentrations maximales modélisées
Substance : Particules fines ($PM_{2,5}$)
Période : 24 heures
Scénario : Exploitation
Type de limite : MELCCFP (Norme)

Maximum Modelled Concentrations
Substance : Fine Particulates ($PM_{2,5}$)
Period : 24-hour
Scenario : Operations
Limit type : MELCCFP (Standard)

Sources / Sources
AQréseau+, réseau routier, MERN, 2016
BDGA, 1M, MERN, 2014
CanVec, 250k,RNCan, 2017

0 700 1 400 m
UTM, fuseau 18, NAD83 (CSRS)

2026-03-25

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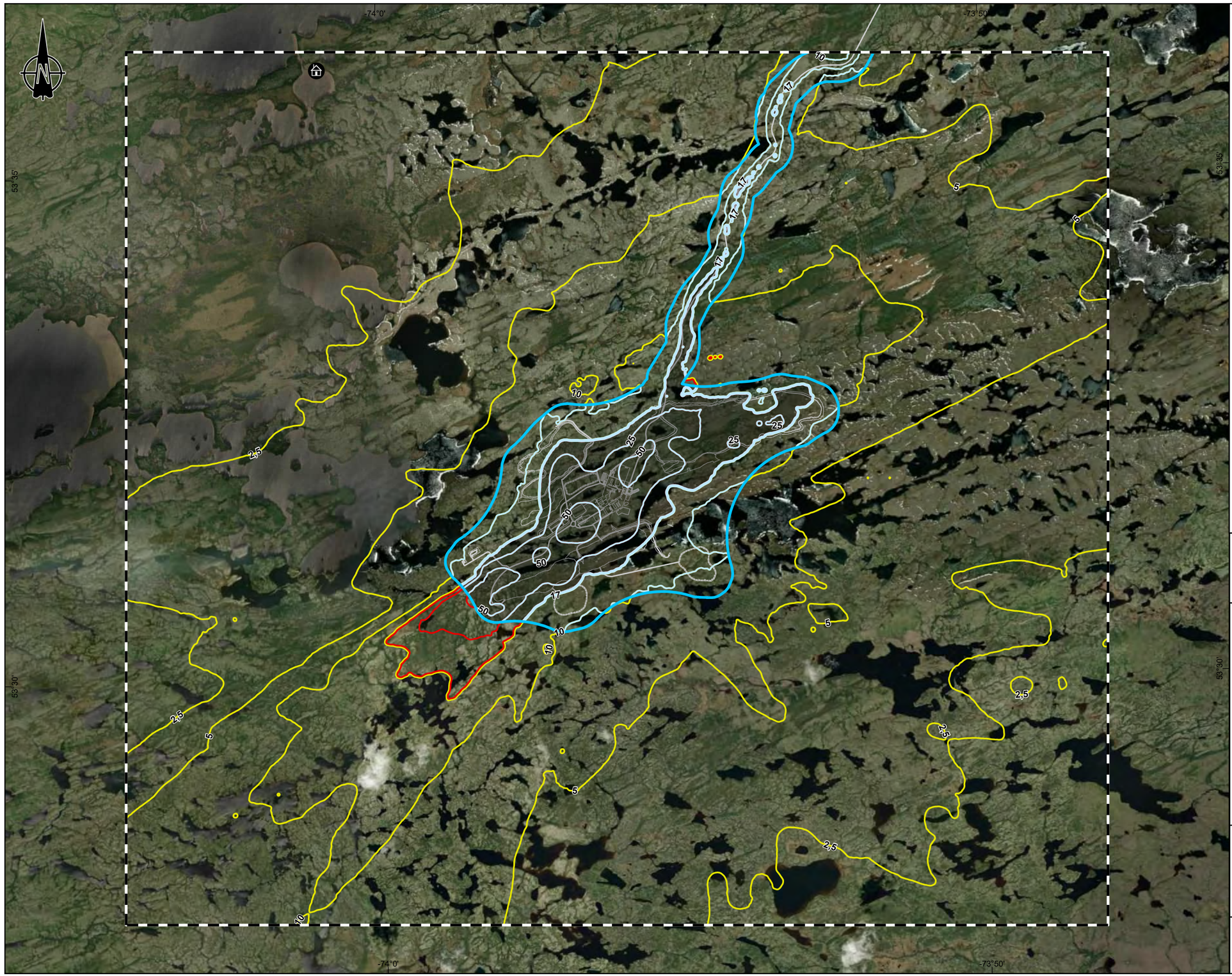

Composante du projet / *Project Component*

Infrastructure actuelle ou projetée / *Existing or projected infrastructure*

Modèle de dispersion atmosphérique / *Atmospheric Dispersion Model*

Domaine de modélisation / *Modeling domain*

Limite d'application des normes et critères / *Limits of application of standards and criteria*

Récepteurs / *Receptors*

Camp permanent / *Permanent camp*

Courbes isoconcentrations / *Isoconcentrations Curves* (µg/m³)

Supérieure à la valeur limite / *Above the limit value*

Inférieure à la valeur limite / *Below the limit value*
(considérant la concentration initiale) /
(considering the initial concentration)

Hors domaine d'application / *Outside application domain*

Valeur limite : 23 µg/m³ / *Limit: 23 µg/m³*
Concentration initiale : 6 µg/m³ / *Initial concentration: 6 µg/m³*

Projet minier Shaakichiuwaanaan /
Shaakichiuwaanaan Mining Project
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Environmental Impact Assessment

Carte 8-12 / *Map 8-12*

Concentrations maximales modélisées
Substance : Silice cristalline (SiO_2)
Période : 1 heure
Scénario : Exploitation - Sans sautage
Type de limite : MELCCFP (Critère)

Maximum Modelled Concentrations
Substance : Crystalline Silica (SiO_2)
Period : 1-hour
Scenario : Exploitation - No Blasting
Limit type : MELCCFP (Criterion)

Sources / Sources
AQréseau+, réseau routier, MERN, 2016
BDGA, 1M, MERN, 2014
CanVec, 250k,RNCan, 2017

0 700 1 400 m
UTM, fuseau 18, NAD83 (CSRS)

2026-03-25

Préparation / Prepared by : V. Lamothe
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Approbation / Approved by : J. Poirier
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CA0001724_3318_eie_c08_10_13_resultat_260325

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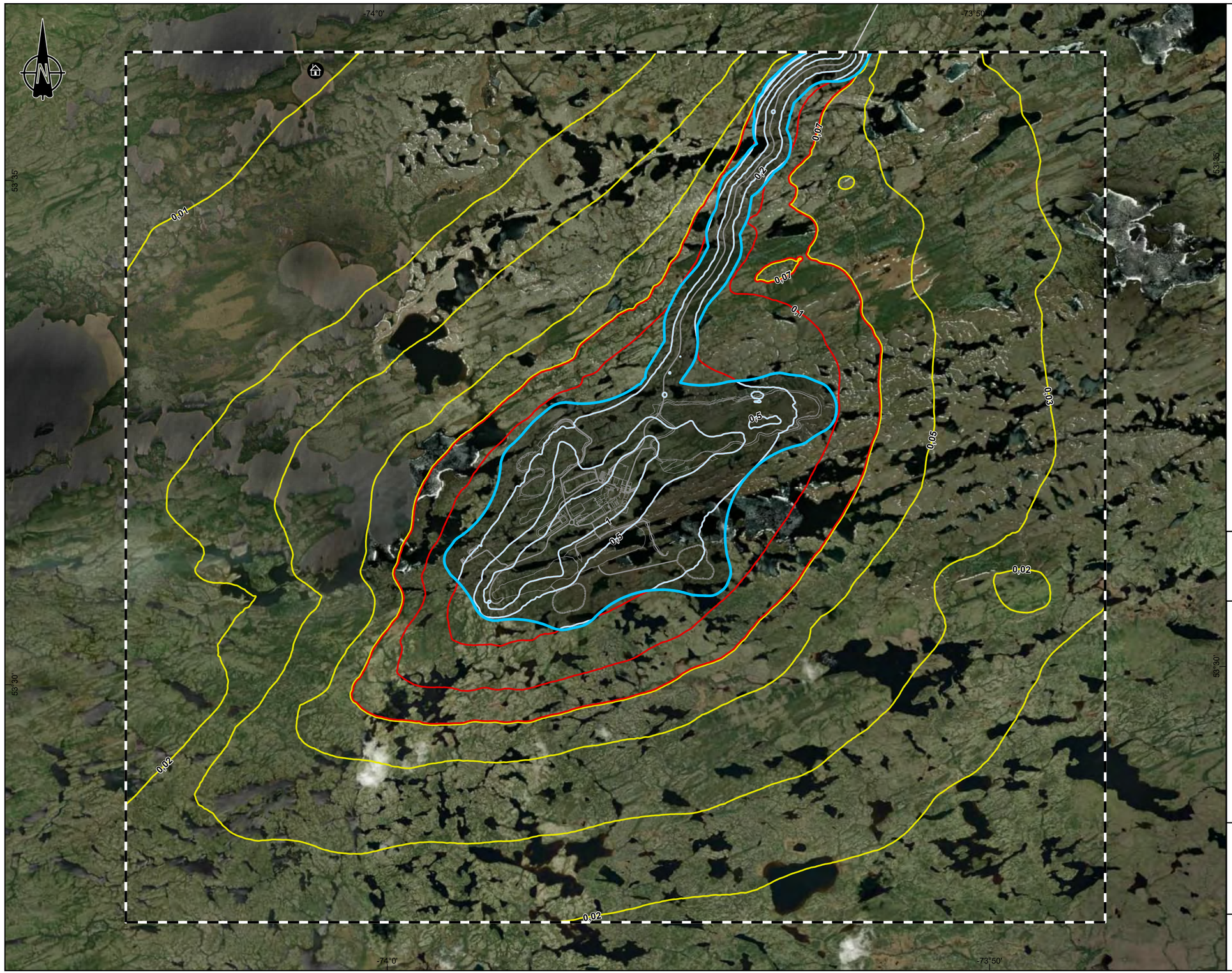

Composante du projet / *Project Component*

Infrastructure actuelle ou projetée / *Existing or projected infrastructure*

Modèle de dispersion atmosphérique / *Atmospheric Dispersion Model*

Domaine de modélisation / *Modeling domain*

Limite d'application des normes et critères / *Limits of application of standards and criteria*

Récepteurs / *Receptors*

Camp permanent / *Permanent camp*

Courbes isoconcentrations / *Isoconcentrations Curves* (µg/m³)

Supérieure à la valeur limite / *Above the limit value*

Inférieure à la valeur limite / *Below the limit value*
(considérant la concentration initiale) /
(considering the initial concentration)

Hors domaine d'application / *Outside application domain*

Valeur limite : 0.07 µg/m³ / *Limit: 0.07 µg/m³*
Concentration initiale : 0 µg/m³ / *Initial concentration: 0 µg/m³*

Projet minier Shaakichiuwaanaan /
Shaakichiuwaanaan Mining Project
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Environmental Impact Assessment

Carte 8-13 / *Map 8-13*

Concentrations maximales modélisées
Substance : Silice cristalline (SiO_2)
Période : 1 an
Scénario : Exploitation
Type de limite : MELCCFP (Critère)

Maximum Modelled Concentrations
Substance : Crystalline Silica (SiO_2)
Period: 1-year
Scenario : Operations
Limit type : MELCCFP (Criterion)

Sources / Sources
AQréseau+, réseau routier, MERN, 2016
BDGA, 1M, MERN, 2014
CanVec, 250k,RNCan, 2017

0 700 1 400 m
UTM, fuseau 18, NAD83 (CSRS)

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- Canada's criteria and standards for certain substances are exceeded within the modelling area, namely:
  - Fine particulate matter, for the same reasons outlined above regarding Quebec's standards and criteria (see Appendix 6-1 for more details).
  - The one-hour nitrogen dioxide (NO_2) concentration that would be felt around the site within a radius of less than 4.5 km (results do not take into account the initial concentration used in the modelling, which is 50% of the Canadian standard). (see Appendix 6-1 for more details). These emissions are primarily related to vehicle engine emissions.

These results show that Quebec and Canadian standards and criteria are met for the majority of the substances in question. For the few substances where exceedances are noticeable, their effects are generally only observed at relatively short distances, and at greater distances, only during infrequent (one-time) events. Lastly, it must be emphasized that under no circumstances do the emissions affect the sensitive receptors located around the mine site.

Mitigation measures

Common mitigation measures are presented in Appendix 8-2; in particular, those in the "Ambient air" section that apply in whole or in part to impacts on air quality. In addition to these, the following specific measures must be taken into account:

- Gradually restore Stockpiles 1 and 2 to reduce the areas susceptible to wind erosion and erosion from runoff (P01).
- Establish an Environmental Monitoring Committee, the terms of which will be specified in the IBA, to discuss and determine solutions to the issues that may arise during the mine's phases (P18).
- An environmental supervisor will conduct regular inspections of work areas, ensure that all parties strictly comply with the various commitments, obligations, measures, and other requirements, assess the quality and effectiveness of the measures implemented, and document any non-compliance observed (P24).
- Spray water on the non-active areas of stockpiles using a water truck when necessary (P28).
- Apply dust suppressants on the slopes and final (outer) surfaces of the stockpiles (P29).

Assessment of residual impact

During the operations phase, the limited concentrations emitted, the distance from sensitive receptors, and the implementation of the various proposed mitigation measures suggest that the degree of disturbance related to changes in air quality will be **low**. Given the medium value attached to soils, the intensity of the impact is **low**. This impact will be felt primarily at the **local** level, which will be the value used for the analysis. In fact, although the results for crystalline silica indicate a regional extent (with an impact radius of between 3 km and 6 km), these impacts occur sporadically and are detectable for only very short periods—a few hours at most. The effects of changes in air quality will be noticeable throughout the operations phase **(medium** duration), resulting in a residual impact of **minor** significance. The probability of occurrence of these impacts is **high**, and the reversibility potential is also **high**, as the air emissions generated during the operations phase will cease once that phase comes to an end.

Impact on air quality			
Intensity:	Low	**Significance:**	Minor
Extent:	Local		
Duration:	Medium		
Probability of occurrence:		High	
Reversibility:		High	

Closure phase

Statement of potential impact

Progressive improvement of air quality.

Sources of the impact

- Transport and traffic during the work.
- Final restoration.
- Production and management of residual and hazardous materials.

Detailed description of the impact

The impact associated with this VEC in the closure phase is primarily positive, as the main activities generating air emissions and dust will cease, the vacated areas and stockpiles will be revegetated, and the pit will gradually fill with water, reducing the amount of exposed bare ground. However, the restoration work associated with this phase will require machinery operations and traffic, demolition work, and the reworking of the topsoil to prepare it for planting and to restore the natural flow of rainwater and meltwater. These activities will generate air emissions and dust, although to a lesser extent than during the construction phase. Since modelling has shown that emissions during the construction phase did not exceed the relevant standards and criteria and did not affect sensitive receptors, it is anticipated that the same conclusion will apply during the closure phase.

Mitigation measures

The common mitigation measures are presented in Appendix 8-2; in particular, those listed in the Ambient air section that apply to and improve the expected positive impact for this VEC. No specific measures are required for this VEC during the closure phase.

Assessment of residual impact

During the closure phase, the limited concentrations emitted, the distance from sensitive receptors, and the implementation of the various proposed mitigation measures suggest that the degree of disturbance due to the negative impact related to changes in air quality will be **low**. Given the medium value assigned to this VEC, the impact intensity is **low**. This impact will be felt at the **local** level and only during the closure phase (**short** duration), resulting in a negative impact of **minor significance**. The probability of occurrence of this impact is **high**, and the reversibility potential is also **high**.

As for the positive impact, the degree of improvement will be **high**, resulting in a **high** intensity. The extent of this impact will be **local** and it will have a **long** duration. As a result, it will have a positive impact of **major** significance, with a **high** probability of occurrence.

Impact on air quality			
Intensity:	Low (-) High (+)	**Significance:**	Minor (-) Major (+)
Extent:	Local (-)		
Duration:	Short (-) Long(+)		
Probability of occurrence:		High (-) (+)	
Reversibility:		High (-)	

8.2.5 Issue 5 – Preservation of the health, safety, and socioeconomic conditions of the regional population (Health, social, and economic conditions of Indigenous Peoples)

8.2.5.1 Physical, psychological, and social health

Physical, psychological, and social well-being encompasses all the factors that define the overall condition of a community (in this case, Indigenous and non-Indigenous communities), which may be disturbed by construction, operations, and closure activities. It should be noted that, within the framework of the project, this VEC is considered essential to community activities and is a major concern if it deteriorates, which is why it has been assigned a **high** socioeconomic value.

Summary of current conditions

The baseline state of human health in the study area is characterized by a close interaction between the biophysical and social determinants of health. For the Cree communities of Eeyou Istchee, health is understood through a holistic approach to well-being (*miyupimaatisiiun*), which encompasses physical, mental, social, cultural, and spiritual dimensions and is rooted in a close relationship with the land. The use of traditional lands, particularly the traplines associated with the Cree communities of Chisasibi, Wemindji, and Mistissini—including areas along the Billy-Diamond Highway and the Trans-Taiga Road—is a key determinant of health. These areas are used for traditional, cultural, and subsistence activities (hunting, fishing, gathering, and campsite stays), contributing to food security, cultural continuity, social connections, and the psychosocial well-being of individuals and families.

The regional context is shaped by structural and historical factors, including the lingering effects of colonialism, forced displacement, and past development projects, which influence the observed social inequalities in health. At the systemic level, communities have access to Indigenous health and social services, but these services face challenges related to geographic remoteness, the burden of travel to access specialized care, and population growth. The key health challenges identified in the baseline assessment include the high prevalence of certain chronic diseases, mental health vulnerabilities, and safety concerns that disproportionately affect certain groups, particularly women and people in vulnerable situations. These conditions are also influenced by immediate factors such as housing, the cost of living, food insecurity, and the continuity of cultural and territorial practices.

Construction and operations

Statement of potential impact

Disruption to the physical, psychological, and social health of regional populations.

Sources of the impact

- Water use and management;
- Transportation and traffic related to materials and supplies.
- Production and management of residual and hazardous materials.
- Labour and purchase of goods.

Detailed description of the impact

A more detailed description of the impact is provided in the sectoral report on health.

The project is likely to have multifaceted impacts on human health, due to the mobilization of a large workforce—most of whom will shuttle to and from the site—and changes in land use, which is a key determinant of health and well-being for the Cree.

In terms of the socioeconomic determinants of health, job creation and increased income serve as protective factors, contributing to financial security, self-reliance, and the ability to meet family needs. For several Cree workers, these benefits can indirectly support health by facilitating access to food, housing, and participation in community and cultural life, particularly through the acquisition of equipment that enables them to engage in activities on the land.

However, working conditions in the mining industry (irregular schedules, long periods of absence, fatigue, and sleep disturbance) pose risks to the physical and mental health of workers. The presence of a highly male-dominated work culture, combined with the stigma surrounding mental health, can limit access to support services and encourage risky coping strategies, such as alcohol or substance use. These challenges can exacerbate pre-existing health conditions and negatively impact psychological well-being in the medium and long term. At the camp, women—and Indigenous women in particular—may be at risk of becoming victims of gender-based violence.

The effects on health also extend to the family environment, particularly among the families of workers who shuttle between home and work. Spouses—mostly women—take on an increased burden in their partner's absence, which can lead to stress, burnout, social isolation, and constraints on employment or community participation. These family dynamics influence mental health, family cohesion, and, indirectly, children's well-being.

Furthermore, the land is a fundamental determinant of the Cree people's overall, cultural, and spiritual well-being. Changes associated with the project—noise, dust, increased traffic, linear construction, new infrastructure, and the prolonged presence of workers—can affect the quality of life and, consequently, well-being in the area, causing stress and contributing to a sense of loss of control over an environment that is essential to well-being.

Traditional activities at the CH39 traplines, which are attended by more than 40 people from Chisasibi (not counting children), include fishing, hunting, and gathering, which directly contribute to well-being (miyupimaatisiiun) through food security, cultural continuity, and psychosocial health. Fishing takes place on lakes in the area, including Lake 027—which has been identified as a lake indirectly receiving mine effluent—and gatherers are already selecting sites away from road dust. In this context, the projected changes in surface water quality associated with the discharge of effluent—assessed as a low, local residual impact during the operations phase—may result in indirect health effects. Regardless of compliance with discharge standards, concerns about the safety of fish and water may lead to avoidance behaviours already observed in situations of uncertainty (abandonment of sites, non-consumption), with potential repercussions on the consumption of country foods, food security, and the psychosocial well-being associated with spending time on the land.

The results of the environmental characterization and the analysis of potential exposure sources indicate that the project is not expected to result in exceedances of the regulatory criteria for contaminants in the air (8.2.4) at sensitive receptors (camps) or water (8.2.2) for biological environments likely to be used by local populations. Atmospheric dispersion models and assessments of surface and groundwater quality show that the anticipated concentrations of contaminants remain below established quality standards at sensitive receptors and in lake L27, both for the protection of human health and for the protection of ecosystems.

In this context, no complete and significant pathway of exposure has been identified for human receptors, including exposure through inhalation, drinking water, or eating country foods. In the absence of anticipated exceedances of standards and measurable health risks, a quantitative human health risk assessment (HHRA) is not required. However, given the significance of land use, the consumption of country foods, and the concerns raised during consultations, a precautionary approach and proactive monitoring have been adopted. An environmental follow-up program will be implemented to track changes in the quality of environments that may indirectly affect public health. This program includes;

- monitoring the quality of surface water;
- monitoring to detect any potential contamination in fish meat, game meat (snowshoe hare), and plant tissues (fruits – blueberries and leaves – Labrador Tea) that are consumed by Indigenous communities;

These follow-up measures will help confirm the environmental assessment's assumptions, quickly detect any unexpected changes in contaminant concentrations, and, if necessary, guide the implementation of appropriate mitigation or adaptive management measures.

Safety issues on the land are also a major determinant of health, particularly for women, girls, and the most vulnerable. Increased traffic on unpaved roads, the duration of construction work, and the presence of a large number of workers can heighten stress, feelings of insecurity, and the perceived risk of accidents. It may also increase the exposure of women, girls, and 2LGBTQ+ individuals to vulnerable situations in remote contexts, exacerbating the risks identified by the National Inquiry into Missing and Murdered Indigenous Women and Girls regarding safety, gender-based violence, and mental and psychosocial health issues, as well as barriers to safe access to the land.

Changes in access to the land (new paths on the mining site, restrictions, fences, or increased access) have mixed effects on health. While they may make access easier for some, they can also lead to increased visitor numbers, a perceived decline in tranquility, and a reduction in the abundance and quality of resources, which can affect mental health, spiritual well-being, and the transmission of traditional knowledge and practices, particularly among younger generations.

Lastly, certain factors may have occasional positive effects on health and well-being, such as access to certain camp services for local residents or the opportunity for some Cree workers to spend more time on the land thanks to their employment. However, these effects vary depending on the individual and the uses.

Mitigation measures

Common mitigation measures are presented in Appendix 8-2; in particular those in the "Ambient air," "Noise and vibrations," "Soil, surface water, and sediment quality," "Vegetation and wetlands," "Wildlife and wildlife habitat," "Planning, land use, and land tenure," "Quality of life and well-being," and "Traditional land use by Indigenous Peoples," which apply in whole or in part to the impacts on this VEC. In addition to these, the following specific measures must be taken into account:

- Continue to inform the public about the progress of the project, the major work to come, the environmental impacts and the preventive measures to mitigate them, as well as the safety measures in place (P14).
- Continue to raise awareness of all non-Indigenous workers and subcontractors about Cree culture and traditional practices during the orientation session and subsequent training activities for the supervisors (P15).
- Continue to organize cultural activities to promote intercultural exchange and a respectful work culture (P16).
- Continue to raise workers' awareness of the various forms of harassment and implement complaint procedures. Ensure compliance with the Workplace Harassment Policy and take appropriate corrective action when a report is found to be substantiated (P17).
- Establish an Environmental Monitoring Committee, the terms of which will be specified in the IBA, to discuss and determine solutions to the issues that may arise during the mine's phases (P18).
- Construct a cultural site that incudes a teepee so that workers can meet and practise traditional activities, particularly cooking and handicrafts and sharing stories handed down by their ancestors, as well as a recreation centre accessible to all workers (P19).
- Continue the psychosocial support program to help Cree and non-Cree workers balance work and family life (P20).
- Ensure that reliable means of communication are offered at the work camp to facilitate communication between workers and their families (P21)
- Whenever possible, preserve the forest cover along the road of the mine site and revegetate bare areas with native plants after completion of the work (P23).
- An environmental supervisor will conduct regular inspections of work areas, ensure that all parties strictly comply with the various commitments, obligations, measures, and other requirements, assess the quality and effectiveness of the measures implemented, and document any non-compliance observed (P24).
- Obtain the contact information of permanent or regular users in the area to set up a notification system for reaching them in the event of an accident and informing them of safety instructions for evacuating to a safe location (P26).
- In the FjFl-2 archaeological area (Area 126), an archaeological excavation must be carried out in the event that an unplanned activity occurs on the site (P36).
- Work with the tallyman of trapline CH39 to implement a program to improve wildlife habitats around the mine site (P43).

- Work collaboratively with local and regional services to monitor the impacts of hiring workers on community needs for child and family services (P45).
- Develop policies that promote healthy lifestyles for employees, taking into account gender-differentiated realities, including by promoting healthy food options in the cafeteria that meet diverse needs, as well as dedicated time for physical activity and accessible mental wellness programs tailored to all employees (P46).
- Operation of the workers' camp will be governed by the Proponent's alcohol and drug management policies applicable to field activities and worksites, which prohibit the possession and consumption of alcohol and drugs on site (P47).
- In collaboration with Cree health stakeholders, communities, and workers, develop complementary measures to the Employee and Family Assistance Program (EFAP) for off-duty periods to support psychosocial well-being and prevent isolation, stress, and high-risk behaviours (P48).
- Develop recurring mental health promotion campaigns, with particular attention to subgroups that may be reluctant to seek support (men and 2SLGBTQ+ individuals) (P49).
- A member of the nursing staff will be on site and, as needed, will be able to follow up with employees who have specific medical needs (such as diabetes or hypertension). Preference will be given to staff with experience providing culturally safe, trauma-informed care (P50).
- Establish collaboration with Cree and non-Indigenous health services for emergency management and the management of specialized medical follow-ups (P51).
- Medical services at the project camp must have sexual health expertise and be trained to respond appropriately to situations involving sexual assault (P52).
- Explicitly prohibit hitchhiking and informal transportation by workers; prohibit and actively monitor off-camp travel (hours, routes, behaviours); and apply clear sanctions in cases of non-compliance (P53).
- Include women's safety in discussions with the SDBJ transportation department (P54).
- Mandatory, recurring training for all workers and contractors, including all subcontractors required to travel on the Project roads (ore transport, construction), on Indigenous women's safety and gender-based violence, and required as a contractual condition. Where possible, ensure the training is co-developed with Cree women representatives (P55).
- Prohibit the use of personal vehicles for work purposes (P56).
- Translate all signage at the worksite into Cree (P57).
- Provide financial literacy services to workers, with the option to access them in Cree (P58).
- Organize, together with the community, or support activities to recognize the contribution of the company's Indigenous workers (P59).
- Communicate anticipated workforce needs to local and municipal authorities and to regional housing organizations to better anticipate potential housing needs (P60).
- Communicate with local and municipal authorities regarding their planned strategies and residential development projects (P61).

It is also worth noting the development of an environmental follow-up program, described in Chapter 13, which includes a component addressing the risk of bioaccumulation in animal and fish flesh as well as in plant tissues.

Assessment of residual impact

Although the project's anticipated impacts affect recognized determinants of health and well-being, the extent of the disturbance is considered **low** according to the assessment grid, as they do not result in any substantial, irreversible, or structural changes to the health status of the population or the functional integrity of the territory. The qualitative analysis highlights real and complex psychosocial effects; however, strictly speaking, according to the classification criteria, these effects do not result in a structural impairment of the health component, which justifies the assessment of the level of disturbance as low. The identified effects stem primarily from indirect and mediated mechanisms, such as perceptions of risk, temporary adjustments to practices, or social reorganizations associated with working arrangements and the project's presence, without causing any lasting change in the quality, distribution, or use of the valued components. Land use, cultural practices, and support networks remain generally viable and active, although they may vary across time or space for certain individuals or subgroups. Given the high socioeconomic value of health and well-being, the **intensity of the impact is considered medium.**

Its extent is **regional**, as it affects both local residents and, more broadly, the non-Indigenous and Indigenous communities in the region. The duration of the impacts is considered **medium**, as they are primarily associated with the construction and operations phases of the project. The anticipated effects are temporary, likely to change over time as activities stabilize, and are not permanent in nature; they will not persist beyond the final restoration period and are expected to subside once project activities cease. Thus, **the significance of the residual impact is moderate.**

The probability of occurrence is medium, in that the anticipated effects are plausible and were raised during consultations, but they vary depending on individuals and families, the time period, and the project's progress. Furthermore, these impacts are closely tied to contextual factors (intensity of activities, traffic, dissemination of monitoring results, quality of communications), which limits their inevitability.

Reversibility is considered medium because the impacts on health determinants are manifested within a resilient social system based on strong political and social self-determination.

<table>
<tr><th colspan="4">Impact on the physical, psychological, and social health of regional populations</th></tr>
<tr><td>Intensity:</td><td>Low</td><td rowspan="3">Significance:</td><td rowspan="3">Moderate</td></tr>
<tr><td>Extent:</td><td>Regional</td></tr>
<tr><td>Duration:</td><td>Medium</td></tr>
<tr><td colspan="2">Probability of occurrence:</td><td colspan="2">Medium</td></tr>
<tr><td colspan="2">Reversibility:</td><td colspan="2">Medium</td></tr>
</table>

Closure phase

Identification of potential impacts

Disturbance of the physical, psychological, and social health of the regional population

Sources of the impact

- Presence of site remains.

- Final restoration.
- Production and management of residual and hazardous materials.
- Workforce and procurement of goods and services.

Detailed description of the impact

The closure of the project is likely to result in temporary socioeconomic and psychosocial impacts, primarily related to job losses and changes in family and community dynamics. However, it is associated with positive effects on the land and the well-being of the community, particularly through the reduction of nuisances, the restoration of sites, and the gradual reclaiming of the land. The impacts associated with the closure work remain temporary and localized, and the long-term effects depend primarily on the socioeconomic resilience of the individuals and communities affected.

Mitigation measures

Common mitigation measures are presented in Appendix 8-2; in particular those in the "Ambient air," "Noise and vibrations," "Soil, surface water, and sediment quality," "Vegetation and wetlands," "Wildlife and wildlife habitat," "Planning, land use, and land tenure," "Quality of life and well-being," and "Traditional land use by Indigenous Peoples," which apply in whole or in part to the impacts on this VEC. In addition to these, the following specific measures must be taken into account:

- Maintain and ensure the visibility of job opportunities in the local community by participating in various local and regional initiatives (e.g., career day) (P06).
- Continue the development of specific and transferable employee skills by supporting professional development activities in line with the employee's duties and PMET's needs (P10).
- Participate in implementing a committee on business opportunities, training, and employment governed by the potential Impact and Benefit Agreement (IBA) with the Cree First Nation of Chisasibi and the Cree Nation Government (P11).
- Prioritize the reassignment of local employees to mine closure activities (P13).
- Continue the psychosocial support program to help Cree and non-Cree workers balance work and family life (P20).
- Cooperate with the tallyman of trapline CH39 in the rehabilitation, restoration, and revegetation activities and returning the site to its natural state (P22).
- Establish an employee assistance program to support employees during the transition to the end of operations (P40).
- Develop policies that promote healthy lifestyles for employees, taking into account gender-differentiated realities, including by promoting healthy food options in the cafeteria that meet diverse needs, as well as dedicated time for physical activity and accessible mental wellness programs tailored to all employees (P46).
- In collaboration with Cree health stakeholders, communities, and workers, develop complementary measures to the Employee and Family Assistance Program (EFAP) for off-duty periods to support psychosocial well-being and prevent isolation, stress, and high-risk behaviours (P48).

- Explicitly prohibit hitchhiking and informal transportation by workers; prohibit and actively monitor off-camp travel (hours, routes, behaviours); and apply clear sanctions in cases of non-compliance (P53).
- Include women's safety in discussions with the SDBJ transportation department (P54).
- Mandatory, recurring training for all workers and contractors, including all subcontractors required to travel on the Project roads (ore transport, construction), on Indigenous women's safety and gender-based violence, and required as a contractual condition. Where possible, ensure the training is co-developed with Cree women representatives (P55).
- Prohibit the use of personal vehicles for work purposes (P56).

Assessment of residual impact

The intensity of the impacts is **low** because the project's closure may result in temporary psychosocial impacts, primarily related to the stress and uncertainty associated with career transitions and loss of income for some workers and households, without causing long-term harm to the health of the population. The extent of the impacts is **regional**, as they affect both local land users and, more broadly, the non-Indigenous and Indigenous communities in the region. The effects will be of **medium** duration, as they are primarily linked to the transition period following the closure, and will tend to diminish as career, family, and community trajectories stabilize in the years following the closure. Thus, the significance of the residual impact is considered **moderate**. The probability of occurrence is **high** and the reversibility potential is considered **medium**.

The closure is also associated with positive effects on well-being, particularly through the reduction of nuisances, improved peace and quiet, a greater sense of safety and a better connection to the land following the site's restoration. The impact will be **medium** in intensity and will be felt at the **regional** level for a **long** duration. The positive impact is therefore considered to be of **major** significance.

Impact on the physical, psychological, and social health of regional populations			
Intensity:	Low(-) Medium (+)	**Significance:**	Moderate (-) Major (+)
Extent:	Regional (-) (+)		
Duration:	Medium (-) Long(+)		
Probability of occurrence:		High (-) (+)	
Reversibility:		Moderate (-)	

8.2.5.2 Economic benefits (job creation, economic partnerships)

The economic benefits VEC encompasses all initiatives aimed at ensuring the vitality of local and regional development (job creation, procurement of goods and services, vocational training, etc.) that could be disturbed by construction, operations, and closure activities. It should be noted that, within the framework of the project, this VEC is considered essential because it affects all local and regional communities involved in the project. It was therefore assigned a **high** socioeconomic value.

Summary of current conditions

In 2022, the gross domestic product (GDP) of the Nord-du-Québec administrative region reached $5.8 billion, representing approximately 1% of the provincial GDP. Between 2014 and 2022, the region experienced an average annual growth rate of 6.7%, the highest among all of Quebec's administrative regions. Despite this economic performance, labour force participation and employment rates there remained lower than those observed across the province as a whole, while the unemployment rate was comparable.

Mineral resource extraction alone accounted for 18.1% of the region's GDP. Investments made by mining companies operating in the region accounted for 1.8% of total mining sector investments in Quebec. In addition, the Nord-du-Québec region accounted for 4,075 direct mining jobs, representing 26.1% of total employment in the sector province-wide.

In Radisson, the labour force participation rate (86.7%) and the employment rate (76.7%) were well above the Quebec averages (64.1% and 59.3%). In contrast, Matagami had lower rates (62.6% and 59.1%), which were below the provincial average. In terms of unemployment, Radisson (7.7%) was close to overall Quebec rate (7.6%), while Matagami had a lower rate (4.9%). In both localities, the economy relied heavily on the energy, mining, and forestry sectors. The primary sector accounted for 10.6% of employment there, a significantly higher proportion than in the Nord-du-Québec region as a whole (7.1%).

The Cree communities of Chisasibi, Wemindji, and Mistissini had lower labour force participation and employment rates than those observed across Quebec as a whole. The unemployment rates in Chisasibi (8.0%) and Wemindji (8.8%) were higher than the provincial average, while Mistissini had a rate of 5.9%. Employment in these communities was concentrated primarily in the service sector, particularly in public administration, health care, and education.

Construction phase

Statement of potential impact

Contribution to local and regional economic development.

Sources of the impact

- Site organization, stripping, and clearing.
- Surface preparation and access layout.
- Construction of structures and infrastructure.
- Transportation and traffic related to materials and supplies.
- Workforce and procurement.

Detailed description of the impact

During the construction phase, the anticipated impact is primarily positive, as construction of the open-pit mine is expected to support approximately 7,500 person-years of employment in Québec, including nearly 3,400 direct jobs. This corresponds to an average of approximately 2,200 jobs per year over the duration of the construction phase, including about 180 jobs per year at the regional level. For the underground mine, the construction phase is expected to support approximately 3,600 person-years of employment in Québec, including about 1,400 direct jobs, representing an annual average of approximately 1,000 jobs, including nearly 75 regional jobs per year.

Mitigation measures

The common measures are presented in Appendix 8-2, particularly those in the "Population, economy and employment" and the "Quality of life and well-being" sections that apply to and enhance the expected positive impact of this VEC. In addition to the standard measures, the following specific enhancement measures will be applied:

- To favour the hiring and retention of women that are equally qualified, as well as a local and First Nations workforce, with priority given to the people of the Cree First Nation of Chisasibi, the other Cree Eeyou Istchee communities, the regions of Nord-du-Québec and Abitibi-Témiscamingue, Quebec, and Canada, all in accordance with the existing Hiring Policy (P05).
- Maintain local procurement and participation of local suppliers of goods and services in supply chain opportunities, applying the existing Responsible Procurement Policy (P07).
- Encourage the development of local businesses aligned with PMET's needs and requirements, more specifically businesses held by Indigenous Peoples, as provided in the Responsible Procurement Policy (P08).
- Continue holding regular information sessions with the local entrepreneurs of the Cree community of Chisasibi to inform them about the future needs for services in relation to the mine's activities (P12).

Assessment of residual impact

During the construction phase, the implementation of the various proposed mitigation measures is expected to result in a **medium** level of improvement in economic benefits. Given the high value assigned to this VEC, the impact intensity is **high**. This impact will be felt at the **regional** level and only during the construction period (**short** duration), resulting in a positive impact of **major significance**. The probability of occurrence of this impact is **high**, and since the impact is primarily positive, the reversibility potential does not apply.

Impact on economic benefits			
Intensity:	High	**Significance:**	Major (+)
Extent:	Regional		
Duration:	Short		
Probability of occurrence:		High	
Reversibility:		N/A	

Operations phase

Statement of potential impact

Contribution to local and regional economic development.

Sources of the impact

- Presence and operation of new infrastructure.
- Transportation and traffic related to ore and supplies.
- Workforce and procurement.

Detailed description of the impact

During the operation phase, the anticipated impact is primarily positive, as over the entire operating period, which includes operations and sustaining capital, the project is expected to support approximately 66,200 person-years of employment in Québec, including about 43,600 direct jobs, corresponding to an average of approximately 3,500 jobs per year. At the regional level, economic benefits are estimated at an average of approximately 490 jobs per year over the duration of the operating phase.

It should be noted that, as operations wind down, there will be phased layoffs leading up to the complete closure. These layoffs could have a negative impact on the local and regional economy.

Mitigation measures

Common mitigation measures are presented in Appendix 8-2, particularly those in the “Population, economy, and employment” and “Quality of life and well-being” sections that apply to and enhance the expected positive impact of this VEC. In addition to these, the following specific measures must be taken into account:

- To favour the hiring and retention of women that are equally qualified, as well as a local and First Nations workforce, with priority given to the people of the Cree First Nation of Chisasibi, the other Cree Eeyou Istchee communities, the regions of Nord-du-Québec and Abitibi-Témiscamingue, Quebec, and Canada, all in accordance with the existing Hiring Policy (P05).
- Maintain local procurement and participation of local suppliers of goods and services in supply chain opportunities, applying the existing Responsible Procurement Policy (P07).
- Encourage the development of local businesses aligned with PMET’s needs and requirements, more specifically businesses held by Indigenous Peoples, as provided in the Responsible Procurement Policy (P08).
- Continue holding regular information sessions with the local entrepreneurs of the Cree community of Chisasibi to inform them about the future needs for services in relation to the mine’s activities (P12).
- Establish an Environmental Monitoring Committee, the terms of which will be specified in the IBA, to discuss and determine solutions to the issues that may arise during the mine’s phases (P18).

Assessment of residual impact

During the operations phase, the implementation of the various proposed commitments is expected to result in a **medium** level of improvement in economic benefits. Given the high value assigned to this VEC, the impact intensity is **high**. This impact will be felt at the regional level and throughout the operations phase (medium duration), resulting in a positive impact of **major significance**. The probability of occurrence of this impact is **high**, and since the impact is primarily positive, the reversibility potential does not apply.

With regard to the phased layoff process, the proposed measures suggest that disturbances during this phase of the project will be **low**. Given the high value assigned to this VEC, the impact intensity is **medium**. This impact will be felt at the regional level and throughout the operations phase (medium duration), resulting in a negative impact of **moderate significance**. The probability of occurrence of this impact is **high**, and since the impact is mainly positive, the reversibility potential is **medium**.

Impact on economic benefits			
Intensity:	Low(-) and High (+)	**Significance:**	Moderate (-) and Major (+)
Extent:	Regional		
Duration:	Medium		
Probability of occurrence:		High (-) (+)	
Reversibility:		Moderate (-)	

Closure phase

Statement of potential impact

Loss of local and regional economic benefits.

Sources of the impact

- Final restoration.
- Workforce and procurement of goods and services.

Detailed description of the impact

In the closure phase, the anticipated impact is both positive and negative. It is positive because some jobs will be retained for the duration of the restoration work, as well as for the various follow-up activities to be carried out after the facilities close. It takes on a negative aspect in terms of the loss of most of the jobs that had been created during the operations phase.

Mitigation measures

Common mitigation measures are presented in Appendix 8-2, particularly those in the “Population, economy, and employment” and “Quality of life and well-being” sections, which apply to and mitigate the negative impacts associated with the economic activities. In addition to these, the following specific measures must be taken into account:

- To favour the hiring and retention of women that are equally qualified, as well as a local and First Nations workforce, with priority given to the people of the Cree First Nation of Chisasibi, the other Cree Eeyou Istchee communities, the regions of Nord-du-Québec and Abitibi-Témiscamingue, Quebec, and Canada, all in accordance with the existing Hiring Policy (P05).

- Maintain local procurement and participation of local suppliers of goods and services in supply chain opportunities, applying the existing Responsible Procurement Policy (P07).
- In partnership with the local training institutes, continue collaborating in the development of training programs adapted to the mining industry and the regional context (P09).
- Continue the development of specific and transferable employee skills by supporting professional development activities in line with the employee's duties and PMET's needs (P10).
- Participate in implementing a committee on business opportunities, training, and employment governed by the potential Impact and Benefit Agreement (IBA) with the Cree First Nation of Chisasibi and the Cree Nation Government (P11).
- Continue holding regular information sessions with the local entrepreneurs of the Cree community of Chisasibi to inform them about the future needs for services in relation to the mine's activities (P12).
- Establish an Environmental Monitoring Committee, the terms of which will be specified in the IBA, to discuss and determine solutions to the issues that may arise during the mine's phases (P18).
- Implement an employee assistance program to support employees during the transition to the end of operations (P40).

Assessment of residual impact

During the closure phase, the implementation of the various proposed mitigation measures is expected to result in a **low** degree of improvement and disturbance to the economic benefits. Given the high value assigned to this VEC, the intensity of the impact is **medium** for both positive and negative impacts. This impact will be felt at the regional level; the positive impact will be of **short** duration, while the negative impact will be of **medium** duration, resulting in a positive and negative impact of **moderate significance.** The probability of occurrence of these impacts is **high**, and the reversibility potential is **medium** for the negative impact.

<table>
<tr><th colspan="4">Impact on economic benefits</th></tr>
<tr><td>Intensity:</td><td>Medium</td><td rowspan="3">Significance:</td><td rowspan="3">Moderate(+)(-)</td></tr>
<tr><td>Extent:</td><td>Regional</td></tr>
<tr><td>Duration:</td><td>Short (+)
Medium (-)</td></tr>
<tr><td colspan="2">Probability of occurrence:</td><td colspan="2">High</td></tr>
<tr><td colspan="2">Reversibility:</td><td colspan="2">Medium (-)</td></tr>
</table>

8.2.5.3 Road safety

Road safety concerns issues related to traffic on the Trans-Taiga Road and the Billy-Diamond Highway, which may be disrupted by increased traffic volumes during various phases of the project. It should be noted that, within the framework of the project, this VEC is considered to be of considerable importance as it affects a significant proportion of the local and regional populations involved in the project. It was therefore assigned a **medium** socioeconomic value.

Summary of current conditions

Traffic volumes on the Trans-Taiga Road are relatively low, as demonstrated by the results of two camera-based traffic count campaigns conducted over two 7-day periods in March and May 2025. In March, a total of 181 vehicles were recorded in both directions, including 74 heavy vehicles, mainly on weekdays (Monday through Friday). In May, a total of 374 vehicles travelled in both directions, including only 64 heavy vehicles, and traffic was still primarily weekday traffic. The increase in traffic in May was due to the Goose Break, which led to an increased movement of Indigenous community members travelling to and from their hunting grounds.

Construction phase

Statement of potential impact

Increased risks of deterioration in road safety.

Sources of the impact

- Transportation and traffic related to materials and supplies.

Detailed description of the impact

Road safety can be affected in three main ways, which are, in fact, closely related. This involves an increase in the number of vehicles travelling on the roads in question, particularly the Trans-Taiga Road and the Billy-Diamond Highway, which poses a risk of deterioration in the condition of these roads and an increased risk of accidents.

A traffic study was conducted to assess existing traffic on the Trans-Taiga Road and the impact of the additional vehicles and trucks required for the construction and operations of the mine site (WSP, 2025; Appendix 6-20). This study found that the Trans-Taiga Road, which is unpaved, had a capacity of several hundred vehicles per hour. Camera counts were conducted during two distinct periods: one week in March, representing a typical week of activity, and one week in May, during the “Goose Break” when many members of the Cree communities go goose hunting. The results showed that the peak traffic flow in March was fewer than 10 vehicles per hour, with an average daily maximum of 51 vehicles. During the month of May, the peak hourly traffic volume was similar on weekdays but exceeded 10 vehicles per hour on weekends (reaching up to 12 vehicles per hour on Sundays). The maximum 24-hour traffic volume was 80 vehicles. Given that the Trans-Taiga Road has a capacity of several hundred vehicles per hour, current traffic volumes leave significant room for growth before reaching potential capacity limits. As for Billy-Diamond Highway, since it is paved and the speed limit ranges from 70 km/h to 90 km/h, its theoretical capacity would be between 1,500 and 1,800 vehicles per hour.

With regard to accident risks in the Jamésie RCM—which includes the Trans-Taiga Road and the Billy-Diamond Highway but excludes the specific territories of the Cree communities—a total of 177 accidents were reported in 2024. These accidents resulted in 6 deaths, 6 serious injuries (requiring hospitalization), and 59 minor injuries (SAAQ, 2026). Nevertheless, according to data from the SAAQ 2024, consulted online in 2026, for the Nord-du-Québec region, an 18% decline in accidents was observed between 2018 and 2022, with a total of 298 accidents in 2022. The 2024 data appear to confirm this downward trend, with a total of 266 accidents in the Nord-du-Québec region—an additional 11% decrease (SAAQ, 2026).

During the construction phase, the traffic study shows that the projected increase in vehicle traffic will result in an average daily increase of 3 to 12 vehicles, the majority of which are heavy-duty vehicles delivering construction equipment and materials, supplies (food, chemicals, cement, etc.), and fuel (diesel and natural gas). This additional number of vehicles will have only a minor impact on current traffic flow. Therefore, no significant impact on road deterioration or accident risks is anticipated.

Mitigation measures

Common mitigation measures are presented in Appendix 8-2, particularly those in the "Quality of life and well-being," "Traditional use of land by Indigenous Peoples," and "Infrastructure and public services" sections that apply in whole or in part to this VEC.

In addition to these, the following specific measures must be taken into account:

- Develop and implement a transportation management plan for the project (P25).
- Implement a mandatory road safety training program for employees who are required to travel on the Trans-Taiga Road and Billy-Diamond Highway, regardless of the type of vehicle (P33).
- Consider setting up a GPS tracking system to monitor the speed of vehicles travelling on the mine site and on the Trans-Taiga Road and Billy-Diamond Highway. (P34).
- Establish an official link with the SDBJ's transportation department (P35).

Assessment of residual impact

During the construction phase, the implementation of the various proposed mitigation measures is expected to result in a **low** level of disturbance on road safety. Given the medium value assigned to this VEC, the impact intensity is **low**. This impact will be felt at the **regional** level and during the construction phase (**short** duration), resulting in a residual impact of **minor significance**. The probability of occurrence of these impacts is **low**, and the reversibility potential is **high**, specifically once the work is completed.

Impact on road safety			
Intensity:	Low	**Significance:**	Minor
Extent:	Regional		
Duration:	Short		
Probability of occurrence:		Low	
Reversibility:		High	

Operations phase

Statement of potential impact

Increased risks of deterioration in road safety.

Sources of the impact

- Transportation and traffic related to ore and supplies.

Detailed description of the impact

During the operations phase, the traffic study shows that the projected increase in vehicle traffic will result in an average of 70 to 71 additional vehicles per day, the majority of which are heavy-duty vehicles transporting concentrate to Matagami (59 trucks per day) or supplies to the mine site (approximately 10 trucks per day). This additional number of vehicles will have only a moderate impact on current traffic flow. Therefore, no significant impact on road deterioration or accident risks is anticipated.

Mitigation measures

Common mitigation measures are presented in Appendix 8-2, particularly those in the "Quality of life and well-being," "Traditional use of land by Indigenous Peoples," and "Infrastructure and public services" sections that address, in whole or in part, and enhance the expected positive impact for this VEC.

In addition to these, the following specific measures must be taken into account:

- Develop and implement a transportation management plan of the project (P25).
- Implement a mandatory road safety training program for employees who are required to travel on the Trans-Taiga Road and Billy-Diamond Highway, regardless of the type of vehicle (P33).
- Consider setting up a GPS tracking system to monitor the speed of vehicles travelling on the mine site and on the Trans-Taiga Road and Billy-Diamond Highway . (P34).
- Establish and maintain an official link with the SDBJ's transportation department (P35).

Assessment of residual impact

During the operations phase, the implementation of the various proposed mitigation measures is expected to result in a **low** degree of disturbance to road safety. Given the medium value assigned to this VEC, the impact intensity is **low**. This impact will be felt at the regional level throughout the entire period of operations (medium duration), resulting in a residual impact of **medium significance**. The probability of occurrence of these impacts is **low**, and the reversibility potential is **high** once operations cease at the end of the operations.

<table>
<tr><th colspan="4">Impact on road safety</th></tr>
<tr><td>Intensity:</td><td>Low</td><td rowspan="3">Significance:</td><td rowspan="3">Moderate</td></tr>
<tr><td>Extent:</td><td>Regional</td></tr>
<tr><td>Duration:</td><td>Medium</td></tr>
<tr><td colspan="2">Probability of occurrence:</td><td colspan="2">Low</td></tr>
<tr><td colspan="2">Reversibility:</td><td colspan="2">High</td></tr>
</table>

Closure phase

Statement of potential impact

Reduced risk of road safety disruption.

Sources of the impact

- Final restoration.

Detailed description of the impact

During the closure phase, the number of vehicles on the road will have decreased significantly as operations cease, which will have a positive impact on this VEC. It should be noted, however, that a number of vehicles will remain in operation—albeit mainly at the mine site—during the restoration work. This number is expected to be lower than during the construction phase, and therefore no significant impact on road deterioration or accident risks is anticipated.

Mitigation measures

Common mitigation measures are presented in Appendix 8-2, particularly those in the "Quality of life and well-being," "Traditional use of land by Indigenous Peoples," and "Infrastructure and public services" sections that address, in whole or in part, and enhance the expected positive impact for this VEC.

In addition to these, the following specific measures must be taken into account:

- Develop and implement a transportation management plan for the project (P25).
- Implement a mandatory road safety training program for employees who are required to travel on the Trans-Taiga Road and Billy-Diamond Highway, regardless of the type of vehicle (P33).
- Consider setting up a GPS tracking system to monitor the speed of vehicles travelling on the mine site and on the Trans-Taiga Road and Billy-Diamond Highway. (P34).
- Establish and maintain an official link with the SDBJ's transportation department (P35).

Assessment of residual impact

During the closure phase, the implementation of the various proposed mitigation measures is expected to result in a **low** level of disturbance to road safety, whereas the suspension of traffic associated with the operations phase will result in a **medium** level of improvement. Given the medium value assigned to this VEC, the intensity of the negative impact is **low**, whereas the intensity of the positive impact is **medium**. These impacts will be felt at the **regional** level: the negative impact will be felt during the closure phase (**short** duration), while the positive impact will be felt for a **long** duration. The result is a negative residual impact of **minor significance** and a positive impact of **major significance**. The probability of occurrence of the negative impact is **low,** while that of the positive impact is **high**. Lastly, the reversibility potential of the negative impact is **high**, as the traffic associated with the closure will cease once the work is completed.

Impact on road safety			
Intensity:	Low (-) and Moderate (+)	**Significance:**	Minor (-) and Major (+)
Extent:	Regional		
Duration:	Short (-) and Long (+)		
Probability of occurrence:		Low (-) and high (+)	
Reversibility:		High	

8.2.6 Issue 6 – Preservation of the traditional activities and practices of the Indigenous population and the activities and practices of the non-Indigenous population (Current use of lands and resources for traditional purposes)

8.2.6.1 Hunting and trapping of terrestrial wildlife and waterfowl

Hunting and trapping of terrestrial wildlife and waterfowl encompasses all such activities, carried out by both Indigenous and non-Indigenous people, that may be disturbed by construction, operations, and closure work. It should be noted that, within the framework of the project, this VEC is considered to be of considerable importance as it affects a significant proportion of the local populations involved in the project. It was therefore assigned a **medium** socioeconomic value.

Summary of current conditions

The project site including all associated infrastructure is located on trapline CH39. The tallyman and his family spend time at the trapline mostly from March to November, but also during other months of the year, except for July, which is considered too hot and prone to mosquitoes. They go goose hunting in the spring, mainly from late March to late April, particularly during the “Goose break.” The tallyman and his family have a camp 11 km northwest of the project site, built by PMET in 2024, which they use during goose hunting season, as it is located in an area valued for goose hunting. In the past, goose hunting took place mainly along the Trans-Taiga Road, due to easier access. Other areas, including the tallyman’s main campsite, are still used for goose hunting. Moose hunting, which takes place mainly in the fall, is conducted at various locations throughout the trapline. The tallyman does not hunt every year, given the large amount of meat provided by a single animal taken. As for caribou, users of the traplines continue to hold their annual hunt, even though they have observed a decline in the population in the area and that the Chisasibi Council recommends avoiding this activity to allow population recovery. Some also report a change in the taste of the meat, which they attribute to a possible decline in the health of the herds. The tallyman and his family also hunt ptarmigan. Some users argue that traffic on the Trans-Taiga Road affects the quality of the meat, claiming that birds taken from disturbed areas are less palatable than those from more remote areas. Beavers, porcupines, and hares are also hunted, while bears are hunted and trapped in the fall and spring. Several users have noted that the presence of infrastructure (hydroelectric facilities, transmission lines, the Trans-Taiga Road, borrow pits, etc.) has led to a significant decline in small mammals. However, they have observed an increase in the number of Arctic foxes and bird species that were previously rare in the area.

The project site is located approximately 20 km from the VC26 trapline (Wemindji). The co-tallymen and their families hunt there in the fall and winter. According to them, access to the territory for hunting is governed by a customary right specific to Cree communities, which is little known to outside users. With workers arriving at the site, they fear increased pressure on wildlife resources in the area. The co-tallymen also hunt geese, ducks, and bears there in the fall and spring.

The project site is also located approximately 2 km from the M02A trapline (Mistissini). The tallyman and other users, who come from various Cree communities, visit the trapline mainly in the spring, for goose hunting, and in the fall. There are several goose hunting areas identified there. Hunters also hunt ptarmigan, spruce grouse, moose, and caribou there, particularly in March and December, as well as bears and beavers. Camps belonging to the tallyman and his family are located on trapline CH39. Their use varies from year to year. A goose hunting camp located on trapline CH39, about 20 km east of the project, was destroyed in the 2023 wildfires, while two other goose hunting camps are located in the eastern part of the trapline, farther from the site (approximately 60 km northeast and 70 km east of the site). The tallyman of the M02A trapline has reported several areas likely to have moose on the CH39 and M02A traplines, particularly in the Lac de la Corvette region.

Despite a decline in enrollment over the years, a significant proportion of residents in Chisasibi, Wemindji, and Mistissini benefit from the Economic Security Program (ESP)—17%, 10%, and 8%, respectively. The program encourages the Cree to continue their traditional activities (hunting, trapping, and fishing) by providing a guaranteed income, benefits, and other incentives.

Twelve leases issued for vacationing purposes are listed in the local study area, including one located 18 km southwest of the mine site, on the western shore of Lac de la Corvette. There are no outfitters in this area. The former Mirage outfitter, located approximately 75 km east of the project at km 358 of the Trans-Taiga Road, was transferred to the Chisasibi First Nation in 2024. Since the ban on recreational caribou hunting, several outfitters in the region have ceased operations.

It should be noted that an ecotoxicological analysis to determine the natural concentrations of metals in the edible parts of the hare will be conducted before construction begins.

Construction phase

Statement of potential impact

Disturbance of hunting and trapping activities.

Sources of the impact

- Site organization, stripping, and clearing.
- Surface preparation and access layout.
- Transportation and traffic related to materials and supplies.

Detailed description of the impact

Any activity that has a negative impact on wildlife is likely to indirectly affect hunting and trapping. Site preparation, stripping of surfaces, and tree clearing are likely to disturb wildlife in the vicinity of the work areas. However, the noise generated by the construction work is expected to remain below regulatory thresholds, and the main vibrations—caused by surface blasting—are expected to be sporadic and limited to specific areas. Site preparation, stripping, and clearing could also result in the loss or fragmentation of breeding and feeding habitats. The increase in transport of materials and supplies could also have an impact on wildlife. Although speed is monitored at construction sites, traffic on the Trans-Taiga Road and the access road to the mine site moves at high speeds, increasing the risk of local-scale collisions with wildlife.

The activities planned for the construction phase are therefore likely to disturb some wildlife species found near the project site. These nuisances could cause wildlife to temporarily move to quieter areas, thereby forcing those who use the land to adapt their practices. However, the overall harvest potential will remain unchanged, as wildlife is expected to redistribute itself to the outskirts of the work zones and resource availability will remain stable. It should also be noted that users have already made adjustments in response to the displacement of large wildlife caused by previous mining exploration activities. Although construction activities are not expected to have a significant impact on traffic volume and flow on the Billy-Diamond Highway and the Trans-Taiga Road (see Section 8.2.5.3. Road safety), they could cause occasional disruptions and inconveniences for members of the local communities who use these roads. These roads remain important access routes to traplines, including those without road access.

PMET strictly prohibits any recreational hunting by its employees on the mine site, and this rule will remain in effect. However, it is possible that some employees may violate this policy. Only the tallyman of the CH39 trapline and his family members are authorized to harvest large game on the Shaakichiuwaanaan property.

Mitigation measures

Common mitigation measures are presented in Appendix 8-2, including those in the “Quality of life and well-being,” “Traditional use of land by Indigenous Peoples,” “Planning, land use, and land tenure," “Wildlife and wildlife habitat,” and “Noise and vibrations” sections that apply in whole or in part to this VEC. In addition to these, the following specific measures must be taken into account:

- Continue to inform the public about the progress of the project, the major work to come, the environmental impacts and the preventive measures to mitigate them, as well as the safety measures in place (P14).
- Continue to raise awareness of all non-Indigenous workers and subcontractors about Cree culture and traditional practices during the orientation session and subsequent training activities for the supervisors (P15).
- Establish a new Environmental Monitoring Committee, the terms of which will be specified in the IBA, to discuss and develop solutions to the issues that may arise during the mine’s phases (P18).
- Whenever possible, preserve the forest cover along the road of the mine site and revegetate bare areas with native plants after completion of the work (P23).
- An environmental supervisor will conduct regular inspections of work areas, ensure that all parties strictly comply with the various commitments, obligations, measures, and other requirements, assess the quality and effectiveness of the measures implemented, and document any non-compliance observed (P24).
- Work with the tallyman of trapline CH39 to implement a program to improve wildlife habitats located around the mine site (P43).

Assessment of residual impact

During the construction phase, the implementation of the various proposed mitigation measures is expected to result in a **low** level of disturbance to the hunting and trapping of terrestrial wildlife and waterfowl, while construction activities will cause some hunting activities to be relocated but will not compromise their practice. Given the medium value assigned to this VEC, the impact intensity is **low**. This impact will be felt at the regional level due to transportation, as many users hunt and trap along the Trans-Taiga Road and Billy-Diamond Highway, and during the construction period (short duration), resulting in a residual impact of **minor significance**. The probability of occurrence of these impacts is **high**, and the reversibility potential is **high**, once the work is completed.

Impact on hunting and trapping activities			
Intensity:	Low	**Significance:**	Minor
Extent:	Regional		
Duration:	Short		
Probability of occurrence:		High	
Reversibility:		High	

Operations phase

Statement of potential impact

Disturbance of hunting and trapping activities.

Sources of the impact

- Presence and operation of new infrastructure.
- Water use and management.
- Transportation and traffic related to ore and supplies;

Detailed description of the impact

Mining operations will disrupt hunting and trapping activities for terrestrial wildlife and waterfowl due to the proximity of the proposed infrastructure. Users of the CH39 traplines, will need to adjust to the presence of the mine and its daily operations. However, this adaptation process would already be underway, since exploration activities have been taking place for some time and construction work will have been completed. Some users of the CH39 trapline may temporarily relocate part of their activities to other areas while the mine is in operation. Perceptions of the quality of wildlife resources harvested near the site could also be affected, leading to a loss of interest in this area.

Mining operations could degrade the quality of wildlife habitats due to the generation of noise and dust. However, these disturbances would remain confined to the project area. Furthermore, the impact on water quality will be limited by the presence of the industrial wastewater treatment plant, the sewage treatment plant, and the polishing pond, as well as compliance with the discharge standards set forth in Directive 019.

The anticipated increase in project-related traffic on Billy-Diamond Highway and the Trans-Taiga Road during the operations phase could increase the risks of collision relative to the construction phase.

Finally, the ban on recreational hunting on the site for employees will remain in effect throughout the operations phase.

Mitigation measures

Common mitigation measures are presented in Appendix 8-2, including those in the "Quality of life and well-being," "Traditional use of the land by Indigenous Peoples," "Planning, land use, and land tenure," "Wildlife and wildlife habitat," "Noise and vibrations," and "Soil, surface water, and sediment quality" sections that apply in whole or in part to this VEC. In addition to these, the following specific measures must be taken into account:

- Continue to inform the public about the progress of the project, the major work to come, the environmental impacts and the preventive measures to mitigate them, as well as the safety measures in place (P14).
- Continue to raise awareness of all non-Indigenous workers and subcontractors about Cree culture and traditional practices during the orientation session and subsequent training activities for the supervisors (P15).
- Establish an Environmental Monitoring Committee, the terms of which will be specified in the IBA, to discuss and determine solutions to the issues that may arise during the mine's phases (P18).
- An environmental supervisor will conduct regular inspections of work areas, ensure that all parties strictly comply with the various commitments, obligations, measures, and other requirements, assess the quality and effectiveness of the measures implemented, and document any non-compliance observed (P24).
- Work with the tallyman of trapline CH39 to implement a program to improve wildlife habitats around the mine site (P43).

It is also worth noting the development of an environmental monitoring program, described in Chapter 13, which includes a component addressing the risk of bioaccumulation in animal flesh.

Assessment of residual impact

During the operations phase, the implementation of the various proposed mitigation measures is expected to result in a **low** level of disturbance to the hunting and trapping of terrestrial wildlife and waterfowl, while activities during the operations phase will cause the relocation of certain hunting sites and activities, though without compromising the practice of hunting itself. Given the medium value assigned to this VEC, the impact intensity is **low**. This impact will be felt at the local level due to transportation, as many users hunt and trap along the Trans-Taiga Road, and will persist throughout the mine's 24-year lifespan (**long** duration), resulting in a residual impact of **moderate significance**. The probability of occurrence of these impacts is **high**, and the reversibility potential is **high**, once operations cease.

Impact on hunting and trapping activities			
Intensity:	Low	**Significance:**	Moderate
Extent:	Regional		
Duration:	Long		
Probability of occurrence:		High	
Reversibility:		High	

Closure phase

Statement of potential impact

Gradual improvement in hunting and trapping conditions.

Sources of the impact

- Presence of site remains.
- Final restoration.
- Production and management of residual and hazardous materials.

Detailed description of the impact

The activities associated with the mine's closure will have effects similar to those observed during the construction and operations phases, but of lesser intensity and over a shorter period of time. This work could therefore disrupt the hunting and trapping activities of the Cree users of the CH39 trapline. Users of the VC26 and M02A traplines, as well as those engaging in trapping activities near Billy Diamond Highway and the Trans-Taiga Road, may also be affected by road traffic.

The closure phase will generate waste and hazardous materials, which will be managed off-site. Improper storage or inadequate handling at the site could lead to a leak or accidental spill, posing a risk to the quality of hunting territories and to hunted species.

In addition, the planned work will restore habitats for local wildlife, allowing for the gradual reclaiming of the land for traditional activities, including hunting and trapping. They will also help restore the site's natural character, in harmony with its surroundings. Where possible, some infrastructure, including the multi-use path that facilitates access to trapline CH39, may be left in place at the tallyman's request.

Mitigation measures

Common mitigation measures are presented in Appendix 8-2, including those in the "Quality of life and well-being," "Traditional use of the land by Indigenous Peoples," "Planning, land use, and land tenure," "Wildlife and wildlife habitat," "Noise and vibrations," and "Soil, surface water, and sediment quality" sections that apply in whole or in part to this VEC. In addition to these, the following specific measures must be taken into account:

- Work together with the tallyman of trapline CH39 in carrying out rehabilitation, restoration, and revegetation activities and returning the site to its natural state (P22).

– An environmental supervisor will conduct regular inspections of work areas, ensure that all parties strictly comply with the various commitments, obligations, measures, and other requirements, assess the quality and effectiveness of the measures implemented, and document any non-compliance observed (P24).

Assessment of residual impact

During the closure phase, the implementation of the various proposed mitigation measures is expected to result in a **low** level of disturbance to the hunting and trapping of terrestrial wildlife and waterfowl. Although the work may cause some nuisances, users will have long since moved their hunting and trapping activities outside the project area and its surroundings. Given the medium value assigned to this VEC, the impact intensity is **low**. This impact will be felt within the **project area**, although it could also be felt at the local level in the event of poor management of waste materials and hazardous substances, and during the closure phase (**short** duration), resulting in a residual impact of **minor significance.** The probability of occurrence of these impacts is **high**, and the reversibility potential is **high**, upon completion of the work.

Once the project area has been restored, users of the CH39 trapline will once again be able to hunt and trap there. The work planned for the project's closure phase is therefore expected to result in a **medium** intensity improvement, which will become apparent as users begin to reuse and reclaim the mine site for hunting and trapping. The positive impact will be felt primarily within the **project area**, but for a **long** duration, resulting in an improvement of **major** significance. The probability of occurrence of the improvement is **high**.

Impact on hunting and trapping activities			
Intensity:	Low (-) Medium (+)	**Significance:**	Minor (-) Major (+)
Extent:	Project (- and +)		
Duration:	Short (-) Long (+)		
Probability of occurrence:		High (-) High (+)	
Reversibility:		High (-)	

8.2.6.2 Fishing

Fishing affects all Indigenous and non-Indigenous communities that engage in it and who may be disturbed by construction, operations, and closure activities. It should be noted that, within the framework of the project, this VEC is considered to be of considerable importance as it affects a significant proportion of the local and regional populations involved in the project. It was therefore assigned a **medium** socioeconomic value.

Summary of current conditions

The tallyman of CH39 and his family fish for various species, including sturgeon, brook trout, and chub, on their trapline. Fishing takes place mainly in the La Grande River and in certain lakes within the region, which users prefer not to name. Although the tallyman and his family regularly visit the area around the LG-2 dam to fish—where they may stay for up to a month—they generally avoid reservoirs, believing that the quality of the fish there is inferior.

Lake *Shaakichiuwaanaan Anaadohyateh* (L27) is rarely fished by the tallyman and his family, despite the presence of whitefish, lake trout, and brook trout. In addition, the family is cautious about eating fish from Lake Mihiiwaayaapaakw, as they are concerned about mercury contamination and the history of hydroplane activity associated with the former Nouchimi outfitter. Lastly, the Elders of the family believe that the wildfires that occurred in 2023 may have affected fish populations in the area. According to them, it takes about six years for lakes located in the heart of wildfires to recover their fish populations.

The co-tallymen of VC26 and their families primarily fish for lake trout, walleye, lake whitefish, and sturgeon, particularly in the Pontois and Corvette rivers as well as in certain lakes within the trapline. According to the tallyman, the walleye is found in the spawning grounds near a culvert on the Trans-Taiga Road, and the sturgeon feed on the eggs there. This species, which is valued by users, is caught in the spring and fall. However, users refrain from overfishing and avoid using nets or fishing in spawning areas and during spawning seasons.

Lac de la Corvette is a valued fishing spot for users of the M02A trapline, who catch many different species there. The area is, in fact, designated as a protected area by the Cree Nation Government.

The holder of a lease for vacationing purposes on the west shore of Lac de la Corvette fishes primarily on this body of water. He fishes there for walleye, pike, and both lake and brook trout.

Lastly, it should be noted that two species traditionally fished—pike and lake trout—have undergone ecotoxicological tests to determine the natural concentrations of metals in the parts of these fish that are consumed. To this end, four sampling quadrats were selected: two located within the project's potential area of influence based on prevailing winds, and two located outside this area. The initial results do not indicate any concentrations that would raise concerns.

Construction phase

Statement of potential impact

Disturbance of fishing activities.

Sources of the impact

- Site organization, stripping, and clearing.
- Surface preparation and access layout.
- Transportation and traffic related to materials and supplies.
- Production and management of residual and hazardous materials.

Detailed description of the impact

Any activity that has a negative impact on fish populations is likely to indirectly affect fishing practices. The first phase of the work, which includes diking and partial draining of Lake L01 to create an open pit mine, will result in the direct loss of approximately 56 hectares of fish habitat. Despite the relocation of the fish to the eastern part of the lake, the draining of the lake will directly disturb aquatic wildlife—particularly benthic communities—even before the planned relocation takes place. Subsequently, the diking activities, the pumping required for drainage, and the commissioning of the diversion channel will alter the hydrology of the bodies of water and watercourses located downstream of Lake L01, all the way to Lake L27. These changes could affect the stability of riverbeds and banks, alter habitat distribution, and influence the conditions essential for fish passage, feeding, and reproduction.

Stripping, material handling, pumping, and traffic on the site will cause an increase in suspended solids in certain bodies of water, particularly Lakes L01 and L27. This increase will cause higher turbidity, reducing light penetration and oxygenation for aquatic organisms. It will also cause sediment to settle in the outflow basin of Lake L27 and in some downstream watercourses. These deposits could degrade habitat quality by clogging spawning substrates and disturbing benthic communities, which serve as a vital food source for several fish species.

Construction work could result in accidental oil leaks or spills, particularly those associated with the use of mobile equipment. Surface water contamination can occur directly when these activities take place near a body of water or a watercourse. It can also be indirect when runoff carries contaminants from the soil into aquatic environments. Poor management of hazardous waste—particularly if it is improperly stored or exposed to the elements—could also be a source of contamination in fish habitats.

PMET strictly prohibits any recreational fishing by its employees on the mine site, and this rule will remain in effect. However, it is possible that some employees may violate this policy.

Mitigation measures

Common mitigation measures are presented in Appendix 8-2, particularly those in the "Soil, surface water, and sediment quality," "Hydrology and hydrogeology," "Vegetation and wetlands," and "Traditional use of land by Indigenous Peoples" sections that apply in whole or in part to this VEC. In addition to these, the following specific measures must be taken into account:

- Continue to inform the public about the progress of the project, the major work to come, the environmental impacts and the preventive measures to mitigate them, as well as the safety measures in place (P14).
- Continue to raise awareness of all non-Indigenous workers and subcontractors about Cree culture and traditional practices during the orientation session and subsequent training activities for the supervisors (P15).
- Establish an Environmental Monitoring Committee, the terms of which will be specified in the IBA, to discuss and determine solutions to the issues that may arise during the mine's phases (P18).
- An environmental supervisor will conduct regular inspections of work areas, ensure that all parties strictly comply with the various commitments, obligations, measures, and other requirements, assess the quality and effectiveness of the measures implemented, and document any non-compliance observed (P24).

Assessment of residual impact

During the construction phase, the anticipated impact suggests that there will be a **low** level of disturbance to fishing, given that Lake L01 is not used for fishing by the tallyman of CH39 and his family, while Lake L27 is used very little for that purpose. Furthermore, the impact is expected to limit the abundance of the resource but not prevent fishing on Lakes L01 and L27. The water bodies and watercourses located on traplines VC26 and M02A, as well as Lac de la Corvette, will not be affected. Given the medium value assigned to this VEC, the impact intensity is **low**. This impact will be felt within the **project area**, affecting Lake L01, the bodies of water and watercourses located downstream of it, all the way to Lake L27, and during the construction period (**short** duration), resulting in a residual impact of **minor significance.** The probability of occurrence of the impact is **low**, as it is not expected to affect the lakes used by the tallyman of CH39 and his family. In addition, the reversibility potential is **high**, as users can resume their fishing activities once the work is completed.

Impact on fishing activities			
Intensity:	Low	**Significance:**	Minor
Extent:	Project		
Duration:	Short		
Probability of occurrence:		Low	
Reversibility:		High	

Operations phase

Statement of potential impact

Disturbance of fishing activities.

Sources of the impact

- Water use and management.
- Transportation and traffic related to ore and supplies.
- Production and management of residual and hazardous materials.

Detailed description of the impact

The operations phase is characterized by the continued impact that began during the construction phase, namely the loss of aquatic habitats due to the continued partial draining of Lake L01. The effects on water quality, particularly in the bodies of water and watercourses located downstream of Lake L01, all the way to Lake L27, will be mitigated by the industrial wastewater treatment plant, the sewage treatment unit, the polishing pond, and the diversion channel.

During the operations phase, the use of mobile equipment could still result in accidental oil spills or leaks. The generation and management of waste and hazardous materials also remain potential sources of contamination of fish habitats, particularly when managed improperly.

PMET will maintain the strict ban on recreational fishing by its staff at the mine site.

Mitigation measures

Common mitigation measures are presented in Appendix 8-2, particularly those in the “Soil, surface water, and sediment quality,” “Hydrology and hydrogeology,” “Vegetation and wetlands,” and “Traditional use of land by Indigenous Peoples” sections that apply in whole or in part to this VEC. In addition to these, the following specific measures must be taken into account:

- Continue to inform the public about the progress of the project, the major work to come, the environmental impacts and the preventive measures to mitigate them, as well as the safety measures in place (P14).
- Continue to raise awareness of all non-Indigenous workers and subcontractors about Cree culture and traditional practices during the orientation session and subsequent training activities for the supervisors (P15).

- Establish an Environmental Monitoring Committee, the terms of which will be specified in the IBA, to discuss and determine solutions to the issues that may arise during the mine's phases (P18).
- An environmental supervisor will conduct regular inspections of work areas, ensure that all parties strictly comply with the various commitments, obligations, measures, and other requirements, assess the quality and effectiveness of the measures implemented, and document any non-compliance observed (P24).

It is also worth noting the development of an environmental monitoring program, described in Chapter 13, which includes a component addressing the risk of bioaccumulation in fish flesh.

Assessment of residual impact

During the operations phase, the anticipated impact suggests that there will be a **low** level of disturbance to fishing, given that Lake L01 is not used for fishing by the tallyman of CH39 and his family, while Lake L27 is used very little, which mitigates the extent of the disturbance. Furthermore, the impact is expected to limit the abundance of the resource but not prevent fishing on Lakes L01 and L27. Given the medium value assigned to this VEC, the impact intensity is **low**. This impact will be felt in the **local** area, affecting Lake L01 and the bodies of water and watercourses located downstream of it, all the way to Lake L27, and will persist throughout the operations period (**medium** duration), resulting in a residual impact of **minor significance**. The probability of occurrence of the impact is **low**, as it is not expected to affect the lakes used by the tallyman of CH39 and his family, nor Lac de la Corvette or the lakes fished by users of traplines VC26 and M02A. In addition, the reversibility potential is **high**.

Impact on fishing activities			
Intensity:	Low	**Significance:**	Minor
Extent:	Local		
Duration:	Medium		
Probability of occurrence:		Low	
Reversibility:		High	

Closure phase

Statement of potential impact

Gradual improvement in conditions for fishing activities.

Sources of the impact

- Final restoration.
- Production and management of residual and hazardous materials.

Detailed description of the impact

Once the mine closes, the pit will gradually fill up naturally. Existing hydraulic structures, such as diversion channels and dikes, will be maintained to ensure the hydraulic stability of the site during and after this filling process. PMET will also carry out revegetation of riparian zones and disturbed areas, thereby promoting a gradual improvement in the quality of aquatic and riparian habitats.

Once again, the use of mobile equipment could lead to accidental oil leaks or spills, and the generation and management of waste and hazardous materials remain a potential source of contamination.

Mitigation measures

Common mitigation measures are presented in Appendix 8-2, particularly those in the “Soil, surface water, and sediment quality,” “Hydrology and hydrogeology,” “Vegetation and wetlands,” and “Traditional use of land by Indigenous Peoples" sections that apply in whole or in part to this VEC. In addition to these, the following specific measures must be taken into account:

- Work together with the tallyman of trapline CH39 in carrying out rehabilitation, restoration, and revegetation activities and returning the site to its natural state (P22).
- An environmental supervisor will conduct regular inspections of work areas, ensure that all parties strictly comply with the various commitments, obligations, measures, and other requirements, assess the quality and effectiveness of the measures implemented, and document any non-compliance observed (P24).

Assessment of residual impact

During the closure phase, the implementation of the various proposed mitigation measures suggests that the level of disturbance to fishing will be **low**. Although the work may cause only some nuisances, land users should not use Lake L01, as well as the ponds and waterways located downstream from it, all the way to Lake L27. Given the medium value assigned to this VEC, the impact intensity is **low**. This impact will be felt within the **project area** and during the closure phase (**short** duration), resulting in a residual impact of **minor significance**. The probability of occurrence of this impact is **medium**, and the reversibility potential is **medium**.

Once the pit is filled, users of trapline CH39 will be able to fish in Lake L01. The work planned for the project’s closure phase is therefore expected to result in an improvement of **medium** intensity, which will become apparent as users will begin to use and reclaim the restored water bodies and watercourses in the mine area for fishing purposes. The positive impact will be felt primarily within the **project area**, but over a **long** duration, resulting in an improvement of **moderate** significance. The probability of occurrence of the improvement is **medium.**

<table>
<tr><th colspan="4">Impact on fishing activities</th></tr>
<tr><td>Intensity:</td><td>Low (-)
Medium (+)</td><td rowspan="3">Significance:</td><td rowspan="3">Minor (-)
Moderate (+)</td></tr>
<tr><td>Extent:</td><td>Project (- and +)</td></tr>
<tr><td>Duration:</td><td>Short (-)
Long (+)</td></tr>
<tr><td colspan="2">Probability of occurrence:</td><td colspan="2">Moderate (-)
Medium (+)</td></tr>
<tr><td colspan="2">Reversibility:</td><td colspan="2">High (-)</td></tr>
</table>

8.2.6.3 Harvesting of valued plant species

The harvesting of valued plant species primarily concerns Indigenous communities and includes both the gathering of fruits and other edible plants as well as plants with medicinal properties. This activity may be disturbed by construction, operations, and closure work. It should be noted that, within the framework of the project, this VEC is considered to be of considerable importance as it affects a significant proportion of the local populations involved in the project. It was therefore assigned a **medium** socioeconomic value.

Summary of current conditions

Users of the CH39 trapline harvest various berries in the area, away from the future mine site, including blueberries, blackberries, gooseberries, cloudberries, and mountain cranberries. They use a particular spot at kilometre 310 of the Trans-Taiga Road because it is easy to access. Areas affected by wildfires are also sought-after harvesting spots.

During plant inventories, special attention was given to the species valued by the tallyman of CH39, his family, and members of the Cree Nation of Chisasibi. More than 200 species were identified in the study area, 48 of which have traditional uses: 7 tree species, 25 shrub species or genera, 15 herbaceous species or genera, and a group of non-vascular species (peat mosses). Overall, the plant species of interest are abundant both within the study area and at the regional level.

Two traditionally used species, blueberries and Labrador tea, were subjected to ecotoxicological tests to determine the natural concentrations of metals in the parts of the plants that are consumed. To this end, four sampling quadrats were selected: two located within the project's potential area of influence based on prevailing winds, and two located outside this area. The initial results do not indicate any concentrations that would raise concerns.

Construction phase

Statement of potential impact

Disturbance of activities involving the gathering of valued plant species.

Sources of the impact

- Site organization, stripping, and clearing.
- Surface preparation and access layout.
- Transportation and traffic related to materials and supplies.
- Production and management of residual and hazardous materials.

Detailed description of the impact

Any activity that could adversely affect valued plant species may indirectly impact harvesting activities. The stripping and clearing required for the development of the facilities will result in an estimated permanent loss of 519 hectares of vegetation, consisting mainly of softwood forests, regenerating stands, scrubland and lichen tundra. Surface preparation and the construction of access roads will prevent any natural regeneration from occurring in these areas for the entire duration of the mine's operations. Within the power line right-of-way, only the tree canopy will be removed; stumps, saplings, shrubs, and other vegetation will be left in place. The project will also have a permanent impact on wetlands during the construction phase, primarily due to site preparation and the construction of access roads. The work will result in a net loss of 104.7 hectares of wetlands, including wooded and open ombrotrophic bogs, as well as treed and shrub swamps.

Wetlands and terrestrial plant habitats could also be affected by dust deposited as a result of construction work and traffic.

Surface soils that support habitats of interest to valued plant species could be contaminated by accidental leaks or spills of petroleum products or hazardous waste.

In addition, the work being carried out in the project area could cause nuisances to users wishing to collect valued plant species there.

Mitigation measures

Common mitigation measures are presented in Appendix 8-2; in particular, those in the "Ambient air," "Soil, surface water, and sediment quality," "Vegetation and wetlands," "Planning, land use, and land tenure" and "Traditional land use by non-Indigenous peoples" sections may apply in whole or in part to this VEC. In addition to these, the following specific measures must be taken into account:

- Continue to inform the public about the progress of the project, the major work to come, the environmental impacts and the preventive measures to mitigate them, as well as the safety measures in place (P14).
- Continue to raise awareness of all non-Indigenous workers and subcontractors about Cree culture and traditional practices during the orientation session and subsequent training activities for the supervisors (P15).
- Establish an Environmental Monitoring Committee, the terms of which will be specified in the IBA, to discuss and develop solutions to the issues that may arise during the mine's phases (P18).
- Whenever possible, preserve the forest cover along the road of the mine site and revegetate bare areas with native plants after completion of the work (P23).
- An environmental supervisor will conduct regular inspections of work areas, ensure that all parties strictly comply with the various commitments, obligations, measures, and other requirements, assess the quality and effectiveness of the measures implemented, and document any non-compliance observed (P24).

Assessment of residual impact

During the construction phase, the anticipated impact suggests that there will be a **low** level of disturbance to harvesting activities, given that users of trapline CH39 have stated that they do not gather within the project area. Furthermore, the valued plant species appear to be abundant both within the study area and regionally. Given the medium value assigned to this VEC, the impact intensity is **low**. This impact will be felt within the **project area** and during the construction phase (**short** duration), resulting in a residual impact of **minor significance.** The probability of occurrence of this impact is **low**, as it is not expected to affect the harvesting sites used by the tallyman of CH39 and his family. In addition, the reversibility potential is **high**, as users can resume their harvesting activities once the work is completed.

Impact on activities involving the gathering of valued plant species			
Intensity:	Low	**Significance:**	Minor
Extent:	Project		
Duration:	Short		
Probability of occurrence:		Low	
Reversibility:		High	

Operations phase

Statement of potential impact

Disturbance of activities involving the gathering of valued plant species.

Sources of the impact

- Presence and operation of new infrastructure;
- Water use and management;
- Transportation and traffic related to ore and supplies;
- Production and management of residual and hazardous materials;

Detailed description of the impact

During the exploration phase, the impact on the harvesting of valued plant species is characterized by the continuation of that impact into the construction phase. The presence and use of new infrastructure will prevent the natural regeneration of vegetation and wetlands that have been removed, thereby reducing potential habitats for valued plant species. This will also limit harvesting activities within the project area.

Mining operations could degrade the quality of plant habitats if petroleum products or hazardous materials accidentally leak or spill into the soil . However, such incidents would remain confined to the project areaand would be mitigated promptly.

Traffic-related dust generation could be higher during the operations phase due to the expected increase in traffic resulting from the transport of spodumene concentrate.

Lastly, it is possible that PMET staff would still collect valued plant species within the project area.

Mitigation measures

Common mitigation measures are presented in Appendix 8-2; in particular, those in the "Ambient air," "Soil, surface water, and sediment quality," "Vegetation and wetlands," “Planning, land use, and land tenure" and “Traditional land use by non-Indigenous peoples” sections may apply in whole or in part to this VEC. In addition to these, the following specific measures must be taken into account:

- Continue to inform the public about the progress of the project, the major work to come, the environmental impacts and the preventive measures to mitigate them, as well as the safety measures in place (P14).

- Continue to raise awareness of all non-Indigenous workers and subcontractors about Cree culture and traditional practices during the orientation session and subsequent training activities for the supervisors (P15).
- An environmental supervisor will conduct regular inspections of work areas, ensure that all parties strictly comply with the various commitments, obligations, measures, and other requirements, assess the quality and effectiveness of the measures implemented, and document any non-compliance observed (P25).

It is also worth noting the development of an environmental monitoring program, described in Chapter 13, which includes a component addressing the risk of bioaccumulation in plant tissues.

Assessment of residual impact

During the operations phase, the implementation of the various proposed mitigation measures is expected to result in a **low** level of disturbance, as users do not visit the project area to engage in harvesting activities. Given the medium value assigned to this VEC, the impact intensity is **low**. This impact will be felt within the **project area** and throughout the life of the mine—24 years (**medium** duration)—resulting in a residual impact of **minor significance.** The probability of occurrence of these impacts is **low**, and the reversibility potential is **high**, upon completion of operations.

Impact on activities involving the gathering of valued plant species			
Intensity:	Low	**Significance:**	Minor
Extent:	Project		
Duration:	Medium		
Probability of occurrence:		Low	
Reversibility:		High	

Closure phase

Identification of potential impacts

Gradual improvement in harvesting conditions for valued plant species

Sources of the impact

- Presence of site remains;
- Final restoration;
- Production and management of residual and hazardous materials.

Detailed description of the impact

During the closure phase, the anticipated impacts are mostly positive due to the freeing up of spaces previously occupied by mining facilities and due to their restoration. The site restoration involves loosening the soil, adding organic matter, and replanting with native species. However, the presence of site remains could limit the full revegetation of the previously occupied areas. In addition, at the request of the tallyman of CH39, some infrastructure—including the access road—could be kept in place to facilitate access to new harvesting areas and support the continuation of this traditional activity.

The work planned during the closure could nevertheless have certain impacts—albeit on a smaller scale—related to dust generation, localized erosion, and the management of waste and hazardous materials.

Mitigation measures

Common mitigation measures are presented in Appendix 8-2; in particular, those in the "Ambient air," "Soil, surface water, and sediment quality," "Vegetation and wetlands," “Planning, land use, and land tenure" and “Traditional land use by non-Indigenous peoples” sections may apply in whole or in part to this VEC. In addition to these, the following specific measures must be taken into account:

- Continue to inform the public about the progress of the project, the major work to come, the environmental impacts and the preventive measures to mitigate them, as well as the safety measures in place (P14).
- Work together with the tallyman of trapline CH39 in carrying out rehabilitation, restoration, and revegetation activities and returning the site to its natural state (P22).
- Whenever possible, preserve the forest cover along the road of the mine site and revegetate bare areas with native plants after completion of the work (P23).
- An environmental supervisor will conduct regular inspections of work areas, ensure that all parties strictly comply with the various commitments, obligations, measures, and other requirements, assess the quality and effectiveness of the measures implemented, and document any non-compliance observed (P24).

Assessment of residual impact

During the closure phase, the implementation of the various proposed mitigation measures is expected to result in only a **low** level of disturbance to harvesting activities. As the work may cause some nuisances, land users should not enter the project area for this purpose. Given the medium value assigned to this VEC, the impact intensity is **low**. This impact will be felt within the **project area** and during the closure phase (**short** duration), resulting in a residual impact of **minor significance**. The probability of occurrence of these impacts is **low**, and the reversibility potential is **high** once the work is completed.

Once the final restoration work is complete, land users will be able to reclaim the project site, if they wish, for harvesting purposes. Keeping the access road could even make it easier to reach the area. The work planned for the project’s closure phase is therefore expected to result in an improvement of **medium** intensity, which will become apparent as land users begin to use and reclaim the site of the project area. The positive impact will be felt primarily within the **project area**, but over a **long** duration, resulting in an improvement of **moderate** significance. The probability of occurrence of the improvement is **medium.**

Impact on activities involving the gathering of valued plant species			
Intensity:	Low (-) Medium (+)	**Significance:**	Minor (-) Moderate (+)
Extent:	Project (- and +)		
Duration:	Short (-) Long (+)		
Probability of occurrence:		Low (-) Medium (+)	
Reversibility:		High (-)	

8.2.6.4 Well-being on the land

Well-being on the land refers to all activities carried out on the land that are closely linked to Indigenous culture (the transmission of values and language, mental health and healing, ancestral memory, etc.). After assessment, it was determined that this VEC largely overlaps with the one related to physical, psychological, and social health. The project's impacts on well-being on the land were therefore addressed in Section 8.2.5.1 on health.

8.2.7 Issue 7 – Consideration of climate change

8.2.7.1 Climate change mitigation (GHG emissions, Energy transition)

Climate change mitigation concerns all construction, operations, and closure activities that generate GHG emissions likely to contribute to climate change. The scientific consensus is that these GHG emissions are causing global climate change phenomena. Quantities of GHG emissions, which consist primarily of carbon dioxide (CO2), methane (CH4), and nitrous oxides (N2O), are determined using MELCCFP (2025a) and Environment and Climate Change Canada (2025) estimating methodologies.

It should be noted that, within the framework of the project, this VEC is considered to be of considerable importance as it affects a significant proportion of the local and regional populations involved in the project. It was therefore assigned a **medium** socioeconomic value.

Summary of current conditions

In Canada, total GHG emissions, based on 2023 data, amounted to 694 Mt CO_2eq, while for the mining sector, the total was 78 Mt CO_2eq.

In Quebec, total GHG emissions, based on 2023 data, amounted to 78 Mt CO_2eq, while emissions from the Industry category—which includes mining activities—amounted to 24.7 Mt COeq.

Construction phase

Statement of potential impact

Contribution to the overall increase in GHG emissions.

Sources of the impact

- Site organization, stripping, and clearing.
- Surface preparation and access layout.
- Construction of structures and infrastructure.
- Transportation and traffic related to materials and supplies.
- Production and management of residual and hazardous materials.

Detailed description of the impact

The inventory boundaries considered for the project description correspond to the construction activities for the waste rock, overburden, and ore stockpiles; the tailings storage facility; the process plant; the water and mine effluent treatment plant; the paste backfill plant; and the conventional infrastructure for a hybrid mining project. The quantities of GHG emissions were compared to the reporting thresholds of the two levels of government, provincial and federal, and put in context by comparison with total emissions on a federal and provincial basis.

During the construction phase, the main sources of GHG emissions are associated with vehicle and machinery traffic in work areas, clearing activities, and logistics-related transport (supply). A technical note in Appendix 5-12 provides a detailed breakdown of the calculations and references used to describe GHG emissions during the construction phase, and Table 8-12 summarizes the emissions generated during the work.

In Canada, the project's average annual GHG emissions during the construction phase are estimated to account for 0.0006% of emissions from this industry, which totalled 78 MT of CO_2eq in 2023. The contribution of direct emissions associated with the project's construction is therefore negligible.

In Quebec, the project under study is part of the Industry sector. During the construction phase, annual GHG emissions would account for 0.002% of emissions from the Industry sector—which totalled 24.7 Mt CO_2eq in 2023—and 0.0006% of total provincial emissions (78 Mt CO_2eq in 2023). The contribution of direct emissions is therefore negligible.

Table 8-12 Summary of GHG emissions during the construction phase

Source	Consumable	GHG emissions (Kt CO_2eq)
Machinery (Construction)	68,867 litres diesel	0.2
Machinery (Pre-production)	1,585,000 litres diesel	4.3
Deforestation	1122 ha of vegetation	88.0
Logistics-related transport	768,805 litres diesel	2.1
TOTAL:		**94.6**
Annual average (over 2 years)		47.3

Mitigation measures

Common mitigation measures are presented in Appendix 8-2, particularly those in the "Ambient air" and "Vegetation and wetlands" sections that apply in whole or in part to this VEC. In addition to these, the following specific measures must be taken into account:

- An environmental supervisor will conduct regular inspections of work areas, ensure that all parties strictly comply with the various commitments, obligations, measures, and other requirements, assess the quality and effectiveness of the measures implemented, and document any non-compliance observed (P24).
- Develop and implement a transportation management plan for the project (P25).

Assessment of residual impact

During the construction phase, the implementation of the various proposed mitigation measures is expected to result in only a **low** level of disturbance to climate change mitigation. Given the medium value assigned to climate change mitigation, the intensity of the impact is **low**. This impact will be felt at the regional/provincial level and only during the construction phase (**short** duration), resulting in a residual impact of **minor significance** (for total emissions during the construction phase). The probability of occurrence of this impact is **high**, and the reversibility potential is **low**, since once emitted, GHGs are difficult to eliminate in the short or medium term.

Impact on climate change mitigation (GHG emissions, energy transition).			
Intensity:	Low	**Significance:**	Minor
Extent:	Regional/provincial		
Duration:	Short		
Probability of occurrence:		High	
Reversibility:		Low	

Operations phase

Statement of potential impact

Contribution to the overall increase in GHG emissions.

Sources of the impact

- Presence and operation of new infrastructure;
- Transportation and traffic related to ore and supplies;
- Production and management of residual and hazardous materials.

Detailed description of the impact

The inventory boundaries considered for the project description correspond to the activities involving the stockpiles (waste rock, overburden, and ore), the tailings storage facility, the process plant, the water and mine effluent treatment plant, the paste backfill plant, and the conventional infrastructure for a hybrid mining project. The quantities of GHG emissions were compared to the reporting thresholds of the two levels of government, provincial and federal, and put in context by comparison with total emissions on a federal and provincial basis.

During the operations phase, the main sources of GHGs are associated with generators, natural gas-powered equipment (heating, concentrator plant equipment, etc.), the fleet of vehicles and machinery, the use of explosives, electricity consumption, logistics-related transport (transport of concentrate to Matagami and supply), and rail transportation (between Matagami and the La Baie port facility in Saguenay). A technical note in Appendix 5-12 provides a detailed breakdown of the calculations and references used to describe GHG emissions during the construction phase, and Table 8-13 summarizes the emissions generated during the work.

In Canada, the project's average annual GHG emissions during the construction phase are estimated to account for 0.0011% of emissions from this industry, which totalled 78 MT of CO_2eq in 2023. The contribution of direct emissions associated with the project's construction is therefore negligible.

In Quebec, the project under study is part of the Industry sector. During the construction phase, annual GHG emissions would account for 0.0034% of emissions from the Industry sector—which totalled 24.7 Mt of CO_2eq in 2023—and 0.0011% of total provincial emissions (78 Mt of CO_2eq in 2023). The contribution of direct emissions is therefore negligible.

Table 8-13 Summary of GHG emissions during the operations phase

Sources	Emissions	Consumables	t CO_2 eq
Additional clearing	Total project	855 ha of vegetation	**90,000**[1]
Generator[2]	Total project	1,895,431 litres diesel	**5,199**
Natural gas equipment	Annual average	163,087 GJ	8035
	Total project	3,261,743 GJ	**160,692**
Mobile equipment (off-road)	Annual average	16,438,150 litres diesel	44,901
	Total project	328,659,012 litres diesel	**897,736**
Explosives	Annual average	6,178 tonnes of explosives	1,050
	Total project	21,000 tonnes of explosives	**123,560**
Electricity	Annual average	258,961 MWh	492
	Total project	4,920,262 MWh	**9,348**
Logistics-related transport (truck)	Annual average	9,393,412 litres diesel	25,768
	Total project	187,866,054 litres diesel	**515,354**
Total annual average:			85,006 (85 Kt)
Total project:			**1,711,889 (1,711.9 Kt)**

1 This total was added to that of the generators, then spread over 20 years of operations (4,760 t CO_2eq/year) and added to the total annual average.

2 It was assumed that the generators would operate continuously for two years at the start of production until the connection to the Hydro-Québec grid was completed.

Mitigation measures

Common mitigation measures are presented in Appendix 8-2, particularly those in the “Ambient air” and “Vegetation and wetlands” sections that apply in whole or in part to this VEC. In addition to these, the following specific measures must be taken into account:

- An environmental supervisor will conduct regular inspections of work areas, ensure that all parties strictly comply with the various commitments, obligations, measures, and other requirements, assess the quality and effectiveness of the measures implemented, and document any non-compliance observed (P24).
- Develop and implement a transportation management planfot the project (P25).

Assessment of residual impact

During the operations phase, the implementation of the various proposed mitigation measures is expected to result in only a **low** level of disturbance on climate change mitigation. Given the medium value placed on climate change mitigation, the intensity of the impact is **low**. This impact will be felt at the regional/provincial level and during the operations phase (**medium** duration), resulting in a residual impact of **moderate significance** (for total emissions during the operations phase). The probability of occurrence of this impact is **high**, and the reversibility potential is **low**, since once emitted, GHGs are difficult to eliminate in the short or medium term.

Impact on climate change mitigation (GHG emissions, energy transition).			
Intensity:	Low	**Significance:**	Moderate (total emissions during operations)
Extent:	Regional/provincial		
Duration:	Medium		
Probability of occurrence:		High	
Reversibility:		Low	

Closure phase

Statement of potential impact

Reduction in overall GHG emissions.

Sources of the impact

- Transport and traffic during the work.
- Final restoration.
- Production and management of residual and hazardous materials.

Detailed description of the impact

During the closure phase, the activities likely to generate GHG emissions are mainly associated with dismantling of infrastructure. The work planned during this phase will have similar or lesser impacts than during the construction phase. The GHG emissions were not calculated because the necessary details for dismantling are not confirmed at this project stage.

Mitigation measures

Common mitigation measures are presented in Appendix 8-2, particularly those in the "Ambient air" and "Vegetation and wetlands" sections that apply in whole or in part to this VEC. In addition to these, the following specific measures must be taken into account:

- An environmental supervisor will conduct regular inspections of work areas, ensure that all parties strictly comply with the various commitments, obligations, measures, and other requirements, assess the quality and effectiveness of the measures implemented, and document any non-compliance observed (P24).
- Develop and implement a transportation management plan for the project (P25).

Assessment of residual impact

During the closure phase, the implementation of the various proposed mitigation measures suggests that the degree of disturbance on climate change mitigation will be **low**. Given the medium value assigned to climate change mitigation, the intensity of the impact is **low**. This impact will be felt at the regional level and only during the closure phase (short duration), resulting in a residual impact of **minor significance** (for total emissions during the closure phase). The probability of occurrence of this impact is **high**, and the reversibility potential is **low**, since once emitted, GHGs are difficult to eliminate in the short or medium term.

Nevertheless, the cessation of mining activities represents the elimination of a source of GHGs at the regional level for a long period, which constitutes a medium-intensity positive impact alongside a positive residual impact of **major** significance.

Impact on climate change mitigation (GHG emissions, energy transition).			
Intensity:	Low(-) Medium(+)	**Significance:**	Minor (-) Major (+)
Extent:	Regional/provincial		
Duration:	Short (-) Long(+)		
Probability of occurrence:		High (-) (+)	
Reversibility:		Low (-)	

9 Cumulative Impact Assessment

Under the requirements of the EQA, cumulative impacts must be considered in the environmental assessment of a project. Furthermore, the Directive issued for the Shaakichiuwaanaan mining project (ref. 3214-14-072; March 2024) indicates the elements to be considered and the method to be employed in the cumulative impact assessment, i.e., the project's effects on a given valued ecosystem component (VEC) combined with other past, present, or future activities (with a high probability of occurrence).

Cumulative impacts must be assessed in relation to the main project issues and, more specifically, to the VECs that have been selected for the impact assessment. The choice of the various parameters must be justified. The methodology applied is presented in Section 9.1, the various parameters selected are defined in Section 9.2, and the cumulative impact assessment for the VECs selected is carried out in Section 9.3. Section 9.4 provides a brief summary of the conclusions of this assessment.

9.1 Methodology

Cumulative impacts are changes to the environment that are caused by an action in combination with other past, present, and future human actions. Human actions include events, actions, projects, and activities of an anthropogenic nature (Hegmann et al., 1999). Natural disturbances must also be taken into account.

This definition suggests that any impact associated with a given project may interfere, temporally or spatially, with the effects of another past, current, or future project, thereby causing additional direct or indirect consequences on one or more environmental components.

The methodological approach applied for the cumulative impact assessment involves the following steps:

1. the identification of VECs;
2. the determination of the spatial and temporal boundaries of each VEC, as well as a description of the indicators used;
3. the identification of projects, actions, or events that may have affected the VECs, that are currently affecting them, or that are very likely to affect them in the future;
4. the description of the reference state of each VEC and their historical trends;
5. Identification and assessment of cumulative impacts for each VEC, including assessment of the need to apply additional mitigation measures or monitoring programs to those applied in the study of direct and indirect impacts.

To be selected as a VEC, an ecosystem component must:

Be a key project issue , which means that it must:

a. be highly valued by the populations concerned or by specialists, or be protected or designated by legislation;

b. be likely to be significantly disrupted or altered by the project;

c. be likely to be altered by a combination of project-specific and external sources of impact;

d. be amenable to analysis based on reliable and sufficient information and data, both for the reference state and for historical trends.

The cumulative impact assessment is covered in a separate chapter so that readers can clearly distinguish cumulative impacts from the direct or indirect impacts of the project.

9.1.1 Selected valued components

The assessment of the project's effects helped identify the main project issues and potential impacts on the physical and social environment. It also helped identify the main concerns of the local land users and the Cree Nation of Chisasibi, which were gathered during information and consultation activities. These two aspects combined made it possible to identify the VECs associated with the project and, where appropriate, to select those that should be subject to a cumulative impact assessment.

In fact, the cumulative impact assessment requires that VECs be issues within the scope of the project, that there be potential for cumulative effects between VECs and other projects or actions in the cumulative impact assessment area(s), and that sufficient data be available to carry out the assessment.

9.1.2 Determination of spatial and temporal boundaries

This step involves identifying the spatial and temporal boundaries of the VECs selected for the cumulative impact assessment to provide a framework for their analysis.

9.1.2.1 Spatial boundaries

Spatial boundaries should encompass an area large enough to cover all locations where cumulative impacts may be felt, without being overly extensive (Hegmann et al., 1999). However, overly narrow boundaries may overlook certain impacts. Therefore, the areas of influence of the various projects or actions under consideration (past, present, and future) must be determined, and boundaries must be set beyond which the cumulative effects are likely to become negligible. Spatial boundaries can be adapted to each VEC selected. The choice of spatial boundaries therefore implies:

- understanding the spatial distribution of the effects of the project under study;
- identifying the similar effects of other projects, activities, events, and other factors that overlap geographically;
- ensuring that boundaries take into account the abundance and distribution of VECs;

- ensuring that the boundaries are acceptable from an ecological and social perspective;
- ensuring that the boundaries allow for the collection and analysis of measurable data for each VEC.

According to Hegmann et al. (1999), spatial boundaries must be flexible. It is preferable to set multiple spatial boundaries, i.e., boundaries that expand or contract depending on the ecological or social relationships observed and the VECs analyzed.

9.1.2.2 Temporal boundaries

With regard to temporal boundaries, two boundaries must be identified, one being in the past and the other in the future. Theoretically, the boundary in the past begins before the effects of the actions or projects considered in the assessment occur, while the boundary in the future corresponds to the point at which the environmental conditions that prevailed before the project will be restored or when these baseline conditions will have returned to a certain equilibrium (Hegmann et al., 1999).

Thus, boundaries in the past can be chosen by considering the following aspects:

- the importance of choosing a period for which sufficient information is available on VECs to provide a good description of the baseline or reference state;
- when the effects associated with the proposed action first occurred;
- the point in time at which effects similar to those of concern first occurred;
- the time at which a certain land use designation was made;
- pre-disturbance conditions (i.e., the historical baseline).

Boundaries in the future can be chosen by considering the following aspects:

- the end of operational life of a project;
- after project closure and site reclamation;
- after recovery of VECs to pre-disturbance conditions;
- the availability of information relating to other projects.

In practice, it should be noted that when looking far back in time (more than 10 years) and projecting into the future (more than 5 years), information becomes difficult to obtain and analysis can therefore become speculative. As a result, uncertainty about forecasts increases in line with the duration of the projection of cumulative effects into the future. It is generally accepted that it is very difficult to predict with certainty the likelihood of future projects or actions occurring beyond a 10-year period (Bérubé, 2007).

9.1.3 Identification, selection, and description of past, present, and future activities, projects, and events

As part of the cumulative impact assessment, it is necessary to compile as comprehensive an inventory as possible, based on available information, of projects, activities, and other interventions that may have had an effect on the VECs selected for assessment, that are currently affecting them, or that may affect them in the future. This assessment must be carried out within the specified spatial and temporal boundaries. This inventory must include:

- projects of any kind;
- human actions of any kind;
- events of any kind;
- the laws and regulations of the two main levels of government (Quebec and Canadian governments) that influence or are likely to influence the VECs studied.

Next, it is necessary to identify the actions, projects, events, laws, and regulations that may have had a significant impact on each VEC and briefly describe this impact using indicators. Cumulative impact assessment focuses only on the negative effects caused by an action (Hegmann et al., 1999).

Indicators are known elements that can be used to gauge the impact of the various actions and other interventions mentioned above throughout time and space. It should be noted that VECs can themselves be indicators (Hegmann et al., 1999).

9.1.4 Description of the baseline conditions and historical trends

The baseline conditions correspond to the situation that prevailed a certain number of years ago, i.e., the temporal boundary in the past. This state is described based on the available information. For some VECs, this information will be very limited. This is why the data available for each VEC must be considered when establishing the temporal boundary.

Historical trends are established based on an analysis of the combined influence of the most significant projects, actions, and events. These trends incorporate the results of identifying actions that could significantly affect VECs; they are expressed starting from the reference state to the completion of the project-specific impact assessment.

9.1.5 Identification and significance of cumulative effects

This step involves determining, for each VEC, whether or not there are cumulative effects or whether there is potential for cumulative effects. The determination is based on the consideration of the following factors:

- historical trends;
- projects, actions, events, and other activities, whether ongoing or probable (within the initially determined temporal boundary in the future).

According to Hegmann et al. (1999), in the case of a cumulative impact assessment, determining the significance of effects is fundamentally the same as in an impact assessment, i.e., cumulative effects can be assessed in terms of intensity, duration, and extent. Incorporating these criteria makes it possible to classify a project's cumulative residual impacts as very low, low, medium, high, or very high, according to the impact assessment grid.

Cumulative impact assessment may involve quantitative analysis and discussions of qualitative aspects. Qualitative analysis is used when there is no quantitative analysis technique available or when it is relevant to examine qualitative aspects. The analysis of cumulative effects remains essentially qualitative overall. It is carried out using resources that will experience a residual effect after the mitigation measures identified in the project impact assessment have been implemented.

The cumulative effect will be significant if experts determine that the project contributes significantly to the degradation of the VEC. Conversely, the cumulative effect will be considered insignificant if the VEC is not significantly affected by the project relative to all actions on it. If the information is insufficient and does not allow a decision to be made on the project's cumulative effect on a component, the cumulative effect will be unknown.

Hegmann et al. (1999) specify that the following issues must be considered when assessing the likelihood of a cumulative effect resulting from the implementation of a project:

- Are the environmental effects adverse?
- Are the adverse environmental effects significant?
- Are the significant adverse effects likely?

9.2 Assessment parameters

9.2.1 Review of the project's issues

According to the Project's EIA guidelines issued by the MLECCFP, it is the responsibility of the proponent to define the key issues relating to their proposed project. PMET organized several information and discussion sessions with government regulators, project stakeholders, and Indigenous communities between 2022 and 2025. These sessions will continue throughout the life of the project. These various consultation sessions brought to light a variety of concerns that were taken into account in the project planning, and PMET will continue to consider them in the further design and development of its project. Seven key issues stood out and were selected as the issues to be assessed in the EIA:

- **Preservation of aquatic habitat quality.** This issue is associated with four valued ecosystem components (VECs): hydrodynamic and hydro-sedimentary conditions, surface water quality, sediment quality, and wildlife and wildlife habitats. It should be noted that only three of these VECs were moved forward into the impact assessment. The VEC relating to sediment quality was not selected because, due to the water quality control measures put in place, no long-term effects on sediment quality are expected. The cumulative potential of the three selected VECs will be assessed in the following section to determine whether they will be included in the cumulative impact assessment.

- **Preservation of soil and groundwater quality.** This issue is associated with two VECs: soil quality and groundwater quality. Since both VECs were selected for impact analysis, they will be evaluated in the following section to determine whether they will be included in the cumulative impact assessment.
- **Preservation of wetlands and habitats of interest to terrestrial wildlife and plants.** This issue is associated with six valued ecosystem components (VECs): wetlands and water environments, special-status wildlife species, special-status plant species, invasive plant and wildlife species, terrestrial wildlife (large wildlife and other mammal species, avian fauna), and terrestrial forest cover. It should be noted that only three of these VECs were selected for the impact assessment. The three VECs that were not moved forward into the impact assessment were special-status plant species, invasive plant and wildlife species (as none of these species were recorded in the project study area), and terrestrial forest cover (as the impact on this was assessed to be marginal). The potential of the three VECs selected for the impact assessment will be assessed in the following section to determine whether they will be included in the cumulative impact assessment.
- **Preservation of the quality of life of the local population.** This issue is associated with four valued ecosystem components (VECs): air quality, noise environment and vibration, ambient light, and landscape. It should be noted that only air quality was selected to be included in the impact assessment. The other three VECs were not selected due to the distance between the project study area and identified sensitive receptors. The cumulative potential of air quality will be assessed in the following section to determine whether this VEC will be included in the cumulative impact assessment.
- **Preservation of the health, safety, and socioeconomic conditions of the regional population (Health, social, and economic conditions of Indigenous Peoples).** This issue is linked to three VECs: physical, psychological, and social health; economic activities; and road safety. As these three VECs were selected for the impact analysis, they will be evaluated in the following section to determine whether they will be included in the cumulative impact assessment.
- **Preservation of the traditional activities and practices of the Indigenous population and the activities and practices of the non-Indigenous population (Current use of lands and resources for traditional purposes).** This issue is associated with six valued ecosystem components (VECs): hunting and trapping of terrestrial wildlife and waterfowl; gathering of valued plant species; fishing; well-being on the land; navigation; and archaeological remains, natural and cultural heritage. It should be noted that only four of these VECs were selected for the impact assessment. The two VECs that were not selected were navigation (because the study area does include navigable waterways of interest to local communities) and archaeological remains (because the project study area does not include areas with high archaeological potential). The cumulative potential of the four VECs selected will be assessed in the following section to determine whether they will be included in the cumulative impact assessment.
- **Consideration of climate change**. This issue is associated with two valued ecosystem components (VECs): adapting infrastructure to climate change and mitigating climate change (GHG emissions). It should be noted that only the second component was selected for the impact assessment. The adaptation of infrastructure to climate change has not been included as it is addressed separately in a dedicated chapter of the impact assessment. The cumulative potential of climate change mitigation will be assessed in the following section to determine whether it will be included in the cumulative impact assessment.

It should be noted that, as communication activities related to the project continue, changes may be made to these issues and other issues may eventually be identified.

9.2.2 Identification and rationale for selected VECs

As mentioned in the introduction to this chapter and in Section 9.1.1, the VECs that will be assessed to determine whether they could experience a cumulative effect are those that are associated to a project issue and for which an impact assessment has been conducted.

For a VEC to be included in the cumulative impact assessment process, the residual impact assigned to it must be medium or high, and sufficient reliable information and data must be available, both on its baseline condition and on the associated historical trends. Lastly, it should be noted that VECs that result in a positive residual impact on the project have not been selected for the cumulative impact assessment.

Table 9-1 presents, for each of the project's issues, the VECs that were selected for the assessment of the project's environmental impacts. For each of these VECs, the table indicates whether it has been selected for the cumulative impact assessment and provides the rationale for this decision.

Table 9-1 Identification of VECs selected for the cumulative impact assessment

Environmental component	Selected		Rationale
	Yes	No	
Issue 1: Preservation of aquatic habitat quality			
Hydrodynamic and hydro-sedimentary conditions		**X**	The hydrodynamic and hydro-sedimentary conditions in the project area have undergone significant changes due to the construction of various dams and dikes as part of the overall James Bay hydroelectric project. These changes occurred during the 1970s and 1980s, and since then a new artificial equilibrium (maintained by the presence of dams and dikes) has been established. Any further disturbance of the existing conditions could have an effect on the existing equilibrium. The changes brought about by the project mainly concern the construction of dams on Lake L01 and a diversion between this lake and Lake L05. A Technical Note prepared by Atkins Realis in September 2025 on the effects of this work on the risks of flooding, erosion, and contaminant dispersion showed that only limited impacts on erosion at specific locations are anticipated, resulting in minor residual impacts. Given these results, this VEC has not been selected for the cumulative impact assessment.
Surface water quality	**X**		The project's impact on surface water quality will mainly be felt in a limited portion of the biophysical LSA. All intercepted surface water as well as water generated by mining activities will be collected and treated to established discharge standards before being released into Watercourse CE11 located just upstream of Lakes L09 and L10, watercourse CE15 and Lake L27. A moderate residual impact is anticipated for this component, and it has therefore been selected for the cumulative impact assessment.
Aquatic wildlife (fish) and habitat	**X**		The Project will cause various encroachments on fish habitat as a result of project construction and the draining of part (13%) of Lake L01 to access the ore via an open pit. In addition, water drawdown caused by pumping from the open pit and underground mine, as well as the redirection of some surface water from the stockpile area, will affect water levels in certain fish habitats. Given its impacts, the residual impact is anticipated to be of medium significance, and this VEC has been selected for the cumulative impact assessment.

Environmental component	Selected		Rationale
	Yes	No	
Issue 2: Preservation of soil and groundwater quality			
Soil quality		**X**	The impacts on soils will be localized within the project footprint and are unlikely to generate cumulative impacts, given the absence of other activities that could cause physical or chemical disturbance to the soil. The significance of the residual impact for this VEC was deemed minor. This component is therefore not included in the cumulative impact assessment.
Groundwater quality		**X**	The potential project impacts on this component involve contamination risks and some drawdown of the water table. However, the highly localized nature of the effects experienced (generally limited to the project study area) and the implementation of common mitigation measures will limit the residual impacts to a low level. For these reasons, this component will not be included in the cumulative impact assessment.
Issue 3: Preservation of wetlands and habitats of interest to terrestrial fauna and flora			
Wetlands and water environments	**X**		Wetlands are relatively well represented in the project study area, and significant impacts are generated during the construction phase, resulting in potential water level declines. The recognized importance of these sensitive and fragile ecosystems, combined with the effects described above, supports the inclusion of this component in the cumulative impact assessment.
Special-status wildlife species	**X**		A total of 16 special-status species have been confirmed within the project's biophysical LSA, including woodland caribou, 11 bird species, 4 bat species, and one small mammal. Habitat loss and disturbance caused by the construction and operation of the project, as well as the increased risk of collision with some of these species (road traffic), have led to the medium residual impact for this VEC during the construction and operations phases. It is therefore included in the cumulative impact assessment.
Terrestrial wildlife and wildlife habitats (large wildlife and other mammal species, avian fauna including migratory birds)	**X**		The various project developments (access road, electrical corridor, physical installations, stockpiles, and tailings storage facility) will result in a loss of terrestrial wildlife habitat and disturbances in the use of the land by terrestrial wildlife, as well as an increased risk of collisions with these species (road traffic). The various disturbances anticipated on this VEC have led to the assignment of a medium impact during the operations phase and its selection for the cumulative impact assessment.
Forest cover		**X**	The forest cover to be cleared for the project is very common in the region and consists mainly of regenerating forest and low-density softwoods, which has led to the assignment of a minor impact for this VEC. Forest cover has therefore not been selected for the cumulative impact assessment.
Issue 4: Preserving the quality of life of the local population			
Air quality		X	The atmospheric emission modeling results for the project show that air emissions comply with the various provincial and federal standards and criteria for sensitive receptors located around the project site. Therefore, this component is not included in the cumulative impact assessment.

Environmental component	Selected		Rationale
	Yes	No	
Issue 5: Preservation of the health, safety, and socioeconomic conditions of the regional population (Health, social, and economic conditions of Indigenous Peoples)			
Physical, psychological, and social health of the regional population	**X**		The project's construction poses a risk of reigniting tensions observed during major developments in the region since the 1970s. Furthermore, the arrival of additional non-native workers may exacerbate certain social issues that have arisen since the region's initial development including a stress increase on existing social services such as health care facilities and difficulties for women to integrate a male dominated work environment such as the mining sector. The project also may limit access to parts of the territory, thus affecting transmission of traditional knowhow. This component is therefore included in the cumulative impact assessment.
Economic benefits (job creation, economic partnerships)		**X**	The project's impact on economic activities adds to a series of other projects that have helped develop the region's economy and secure long-term, high-quality jobs for local workers. As this VEC represents a positive impact, it has not been selected for the cumulative impact assessment.
Road safety	**X**		Although the project will result in a significant increase in vehicle traffic on the Trans-Taiga Road and Billy-Diamond Highway, this will have little effect on traffic flow, as these roads were designed to handle much higher volumes. The project increases the risk of traffic accidents, due to the increase in heavy truck traffic and the deterioration of road infrastructure, mainly during the operations phase. These factors led to the assignment of a residual impact of medium significance. For these reasons, this VEC has been selected for the cumulative impact assessment.
Issue 6: Preservation of the traditional activities and practices of the Indigenous population and the activities and practices of the non-Indigenous population (Current use of lands and resources for traditional purposes)			
Hunting and trapping (terrestrial wildlife and waterfowl)	**X**		The physical presence of the project is considered a source of disturbance to wildlife and a potential source of bioaccumulation of contaminants (metals), making the occupied and surrounding areas less attractive for hunting and trapping. This VEC has therefore been selected for the cumulative impact assessment.
Fishing		**X**	The limited use of lakes L01 and L27 by the CH39 tallyman and his family, along with the continued access to these lakes during the harvesting season, results in a minor residual impact. Therefore, this VCE is not included in the cumulative impact assessment.
Harvesting of valued plant species		**X**	Interviews with the CH39 tallyman established that his family did not use the project site area for harvesting valuable plants. Therefore, the residual impact is of minor significance. This VCE is thus not included in the cumulative impact assessment.
Well-being on the land	**X**		The physical presence of the project could affect the Cree people's traditional land use and way of life. This VEC was therefore selected for the cumulative impact assessment.
Issue 7: Consideration of climate change			
Climate change mitigation (GHG emissions) (Energy transition)	**X**		Given the importance placed on Quebec and Canada's GHG reduction targets, any increase in emissions be taken into account to ensure an up-to-date picture at the provincial and national levels. A cumulative impact assessment was therefore considered for this component.

In summary, the following ten VECs were retained and will be assessed for cumulative impacts:

- surface water quality;
- aquatic wildlife (fish) and habitat;
- wetlands and water environments;
- special-status wildlife species;
- terrestrial wildlife and habitats (large wildlife and other mammal species, avian fauna including migratory birds);

- the physical, psychological, and social health of the regional population (health, social, and economic conditions of Indigenous Peoples);
- road safety;
- hunting and trapping (terrestrial wildlife and waterfowl);
- well-being on the land;
- climate change mitigation (GHG emissions) (Energy transition).

These VECs are related to five of the seven environmental issues raised during the various consultations held for this project (see Section 9.1.1). The only issues not represented are issue no. 2: Preservation of soil and groundwater quality and no. 4: Preserving the quality of life of the local population.

9.2.3 Spatial and temporal boundaries

Table 9-2 presents the spatial and temporal boundaries as well as the indicators for each valued component selected for the cumulative impact assessment. It should be noted that due to the specific characteristics of each valued component, they may have different spatial and temporal ranges.

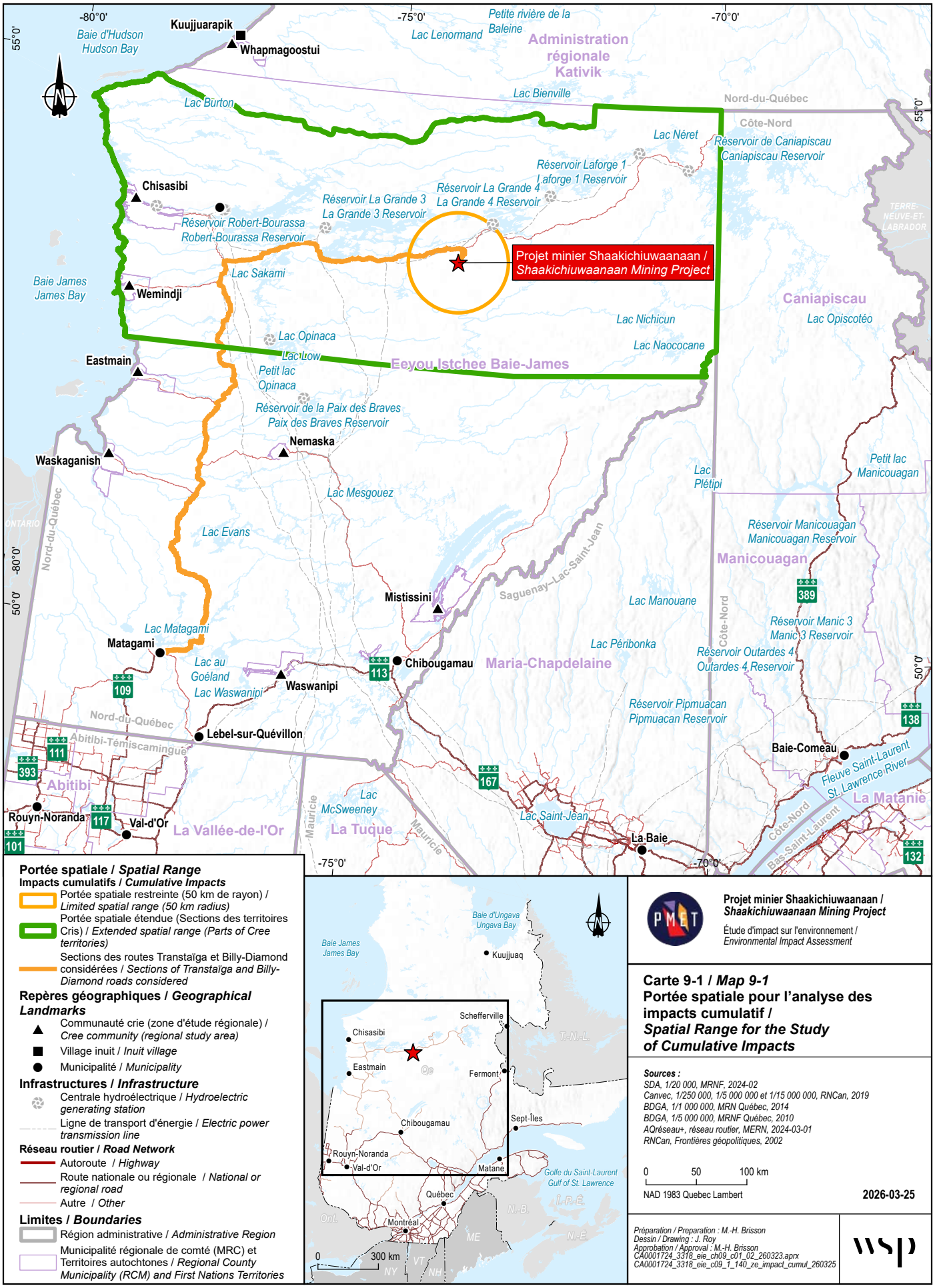
Table 9-2 Temporal and spatial boundaries and indicators related to the valued components selected for the cumulative impact assessment

Valued component	Indicator	Temporal boundaries	Spatial boundaries
Issue 1: Preservation of aquatic habitat quality			
Surface water quality	Number of watercourses receiving effluent	1970–2035	Limited (50 km radius around the project site)
Aquatic fauna and habitats	Surface area of wildlife habitat affected	1970–2035	Limited (50 km radius around the project site)
Issue 2: Preservation of soil and groundwater quality			
No VECs related to this issue were selected for the cumulative impact assessment.			
Issue 3: Preservation of wetlands and habitats of interest to terrestrial fauna and flora			
Wetlands and water environments	Surface area affected	1970–2035	Limited (50 km radius around the project site)
Special-status wildlife species	Surface area affected	1970–2035	Limited (50 km radius around the project site)
Terrestrial wildlife and wildlife habitats (large wildlife and other mammal species, avian fauna including migratory birds)	Surface area affected	1970–2035	Limited (50 km radius around the project site)

Valued component	Indicator	Temporal boundaries	Spatial boundaries
Issue 4: Preserving the quality of life of the local population			
No VECs related to this issue were selected for the cumulative impact assessment.			
Issue 5: Preservation of the health, safety, and socioeconomic conditions of the regional population (Health, social, and economic conditions of Indigenous Peoples)			
Physical, psychological, and social health of the regional population	Set of indicators specific to these aspects	1970–2035	Extended (Land cutting through all or part of the communities of Chisasibi, Mistissini, and Wemindji)
Road safety	Data on the frequency of maintenance work to repair the Trans-Taiga Road and Billy Diamond Highway Number of accidents associated with traffic involving project vehicles.	1970–2035	Specific (Route of the Trans-Taiga Road and Billy Diamond Highway)
Issue 6: Preservation of the traditional activities and practices of the Indigenous population and the activities and practices of the non-Indigenous population (Current use of lands and resources for traditional purposes)			
Hunting and trapping (terrestrial wildlife and waterfowl)	Possible area of interaction	1970–2035	Limited (50 km radius around the project site)
Well-being on the land	Set of indicators specific to this aspect	1970–2035	Extended (Land cutting through all or part of the communities of Chisasibi, Mistissini, and Wemindji)
Issue 7: Consideration of climate change			
Climate change mitigation (GHG emissions) (Energy transition)	% increase in emissions	2008–2035	Extended (Land cutting through all or part of the communities of Chisasibi, Mistissini, and Wemindji)

Map 9-1 shows the boundaries of the study areas considered for the cumulative impact assessment. It presents the three main areas considered for the cumulative impact assessment, namely:

- a circular area centred on the proposed mining site with a radius of 50 km (Limited spatial boundary);
- an area including the boundaries of the ancestral territory of the community of Chisasibi, most of the ancestral territory of the community of Wemindji, and part of the ancestral territory of the community of Mistissini (Extended spatial boundary);
- 3 km on either side of the Trans-Taiga Road between the access to the mine site and the Billy-Diamond Highway (Specific spatial boundary).



Portée spatiale / *Spatial Range*

Impacts cumulatifs / *Cumulative Impacts*

- Portée spatiale restreinte (50 km de rayon) / *Limited spatial range (50 km radius)*
- Portée spatiale étendue (Sections des territoires Cris) / *Extended spatial range (Parts of Cree territories)*
- Sections des routes Transtaïga et Billy-Diamond considérées / *Sections of Transtaïga and Billy-Diamond roads considered*

Repères géographiques / *Geographical Landmarks*

- Communauté crie (zone d'étude régionale) / *Cree community (regional study area)*
- Village inuit / *Inuit village*
- Municipalité / *Municipality*

Infrastructures / *Infrastructure*

- Centrale hydroélectrique / *Hydroelectric generating station*
- Ligne de transport d'énergie / *Electric power transmission line*

Réseau routier / *Road Network*

- Autoroute / *Highway*
- Route nationale ou régionale / *National or regional road*
- Autre / *Other*

Limites / *Boundaries*

- Région administrative / *Administrative Region*
- Municipalité régionale de comté (MRC) et Territoires autochtones / *Regional County Municipality (RCM) and First Nations Territories*

Projet minier Shaakichiuwaanaan / *Shaakichiuwaanaan Mining Project*

Étude d'impact sur l'environnement / *Environmental Impact Assessment*

Carte 9-1 / *Map 9-1*
Portée spatiale pour l'analyse des impacts cumulatif / *Spatial Range for the Study of Cumulative Impacts*

Sources :

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AQréseau+, réseau routier, MERN, 2024-03-01
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0 50 100 km

NAD 1983 Quebec Lambert

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CA0001724_3318_eie_c09_1_140_ze_impact_cumul_260325

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La précision des limites et les mesures montrées sur ce document ne doivent pas servir à des fins d'ingénierie ou de délimitation foncière. Aucune analyse foncière n'a été effectuée par un arpenteur-géomètre. / Boundary accuracy and measurements shown on this document are not intended for engineering or land delineation purposes. No land analysis has been performed by a land surveyor.

9.2.4 Projects, activities, and events considered in the assessment

An exhaustive inventory of past, current, and future local and regional projects, activities, and events was made through a review of available documentation and various meetings with Indigenous and non-Indigenous regional stakeholders. Numerous websites, such as those of the MELCCFP, the James Bay Advisory Committee on the Environment, the IAAC, the MRNF, Hydro-Québec, EIJBRG, etc., and environmental impact assessment reports for projects in the same territory as the mine project or nearby (e.g., the Bonterra mine project) were consulted to obtain information on the relevant effects of these projects.

Tables 9-3 and 9-4 present a list of past, current, and future projects, actions, and events for each of the selected VECs. This list is organized into six themes:

- use of natural resources, mainly mining activities and electricity generation (dams, levees, reservoirs, and power plants). There are no forestry operations;
- infrastructure and services: including power substations and power lines, as well as roads, airports, airfields, and railways (planned);
- land use (recreational hunting and fishing activities), mainly including campsites and temporary shelters, as well as a former outfitting operation that has been converted into an activity centre for the Cree Nation of Chisasibi;
- wildlife areas or protected areas, including parks;
- natural and other disturbances, mainly forest fires;
- governance and land use planning, including laws, agreements, development plans, restoration plans concerning Indigenous communities, and the protection of environmental components.

Map 9-2 presents the projects, past or present, considered for the assessment of cumulative impacts affecting the area and for which location data is available.

Tableau 9-3 Projects, actions, and events likely to influence the valued components selected for the cumulative impact assessment

Projects, activities, and events	Past	Present	Future	Surface water quality	Aquatic fauna and habitats	Wetlands and water environments	Terrestrial wildlife and wildlife habitats	Special-status wildlife species
Natural resource development								
Mining exploration activities	X	X	X	Contribution to the degradation of local surface water quality through discharge associated with mining exploration activities.	Contribution to the degradation of aquatic habitats due to mining exploration activities.	Contribution to the loss of wetland and water environment surface area and to their degradation due to mining exploration activities.	Contribution to the loss/disturbance of terrestrial wildlife habitats and disturbance of associated wildlife due to mining exploration activities.	Contribution to the disturbance of habitats and activities of special-status wildlife species due to mining exploration activities.
Shaakichiuwaanaan mine		X	X	Contribution to the degradation of local surface water quality due to discharge associated with mine construction and operations.	Contribution to the degradation and loss of aquatic habitat due to discharge associated with mine construction and operations.	Contribution to the loss of wetland and water environment surface area and to their degradation due to construction, the presence of facilities, and mining activities.	Contribution to the loss/disturbance of terrestrial wildlife habitats and disturbance of associated wildlife due to construction, the presence of facilities, and operations.	Contribution to the disturbance of habitats and activities of special-status wildlife species due to construction, the presence of facilities, and operations.
Adina mine	X	X	X	Contribution to the degradation of local surface water quality due to discharge associated with mine construction and operations.	Contribution to the degradation and loss of aquatic habitat due to construction and operations and the presence of mine components.	Contribution to the loss of wetland and water environment surface area and to their degradation due to construction, the presence of facilities, and mining activities.	Contribution to the loss/disturbance of terrestrial wildlife habitats and disturbance of associated wildlife due to construction, the presence of facilities, and operations.	Contribution to the disturbance of habitats and activities of special-status wildlife species due to construction, the presence of facilities, and operations.
Tilly mine			X	Contribution to the degradation of local surface water quality due to discharge associated with mine construction and operations.	Contribution to the degradation and loss of aquatic habitat due to construction and operations and the presence of mine components.	Contribution to the loss of wetland and water environment surface area and to their degradation due to construction, the presence of facilities, and mining activities.	Contribution to the loss/disturbance of terrestrial wildlife habitats and disturbance of associated wildlife due to construction, the presence of facilities, and operations.	Contribution to the disturbance of habitats and activities of special-status wildlife species due to construction, the presence of facilities, and operations.
Cancet mine			X	Contribution to the degradation of local surface water quality due to discharge associated with mine construction and operations.	Contribution to the degradation and loss of aquatic habitat due to construction and operations and the presence of mine components.	Contribution to the loss of wetland and water environment surface area and to their degradation due to construction, the presence of facilities, and mining activities.	Contribution to the loss/disturbance of terrestrial wildlife habitats and disturbance of associated wildlife due to construction, the presence of facilities, and operations.	Contribution to the disturbance of habitats and activities of special-status wildlife species due to construction, the presence of facilities, and operations.
Éléonore mine	X	X	X	Contribution to the degradation of local surface water quality due to discharge associated with mine construction and operations.	Contribution to the degradation and loss of aquatic habitat due to construction and operations and the presence of mine components.	Contribution to the loss of wetland and water environment surface area and to their degradation due to construction, the presence of facilities, and mining activities.	Contribution to the loss/disturbance of terrestrial wildlife habitats and disturbance of associated wildlife due to construction, the presence of facilities, and operations.	Contribution to the disturbance of habitats and activities of special-status wildlife species due to construction, the presence of facilities, and operations.
Renard mine	X	X	X	Contribution to the degradation of local surface water quality due to construction and operations and the presence of mine components.	Contribution to the degradation and loss of aquatic habitat due to construction and operations and the presence of mine components.	Contribution to the loss of wetland and water environment surface area and to their degradation through construction, the presence of facilities, and site maintenance activities.	Contribution to the loss/disturbance of terrestrial wildlife habitats and disturbance of associated wildlife due to construction, the presence of facilities, and site maintenance activities.	Contribution to the disturbance of habitats and activities of special-status wildlife species due to construction, the presence of facilities, and site maintenance activities.
Borrow pits	X	X	X	Contribution to the degradation of local surface water quality due to the opening and use of borrow pits.	Contribution to the degradation and loss of aquatic habitat due to the opening and operation of borrow pits.	Contribution to the loss of wetland and water environment surface area and to their degradation through the opening and use of borrow pits.	Contribution to the loss/disturbance of terrestrial wildlife habitats and disturbance of associated wildlife due to the opening and use of borrow pits.	Contribution to the disturbance of habitats and activities of special-status wildlife species due to the opening and use of borrow pits.
Power generation facilities located within the territory, including La Grande-1, La Grande-2A, Robert-Bourassa, La Grande-3, La Grande-4, Laforge-1, Laforge-2, Brisay, and Sarcelle (offices, dams and dikes, powerhouses, and related infrastructure).	X	X	X	Contribution to the deterioration of local surface water quality due to the filling of reservoirs and the use of these facilities.	Contribution to the degradation of aquatic habitat quality due to the filling of reservoirs and the presence and use of these facilities.	Contribution to the loss of wetland and water environment surface area and to their degradation due to construction, the presence of facilities, and mining activities.	Contribution to the loss/disturbance of terrestrial wildlife habitats and disturbance of associated wildlife due to construction, the presence of facilities, and operations.	Contribution to the disturbance of habitats and activities of special-status wildlife species due to construction, the presence of facilities, and operations.

Projects, activities, and events	Past	Present	Future	Surface water quality	Aquatic fauna and habitats	Wetlands and water environments	Terrestrial wildlife and wildlife habitats	Special-status wildlife species
Infrastructure and services								
Various existing stations and lines related to Hydro-Québec projects	X	X	X	Contribution to the degradation of local surface water quality during their construction and due to some operations and maintenance activities.	Contribution to the degradation of aquatic habitat quality due to the presence and use of these facilities.	Contribution to the loss of wetland and water environment surface area and to their degradation due to the construction of facilities and operational activities.	Contribution to the loss/disturbance of terrestrial wildlife habitats and disturbance of associated wildlife due to construction, the presence of facilities, and operations.	Contribution to the disturbance of habitats and activities of special-status wildlife species due to construction, the presence of facilities, and operations.
New 120 kV line, approximately 53 km (Option 1), between the Tilly substation and the Shaakichiuwaanaan mine site (2028–2029) (BBA, 2025) This project includes two substations, one 315-120 kV substation near the Tilly substation and a second 120 kV/13.8 kV substation at the mine site. The line will be installed on a 21-metre-high H-shaped wooden structure. The right-of-way will be 38 m wide.			X	Contribution to the degradation of local surface water quality during its construction and maintenance.	Contribution to the degradation of aquatic habitat quality due to the construction, presence, and operations of these facilities.	Contribution to the loss of wetland and water environment surface area and to their degradation due to the construction of facilities and operational activities.	Contribution to the loss/disturbance of terrestrial wildlife habitats and disturbance of associated wildlife due to construction, the presence of facilities, and operations.	Contribution to the disturbance of habitats and activities of special-status wildlife species due to construction, the presence of facilities, and operations.
Trans-Taiga Road (unpaved), Billy-Diamond Highway (paved), and James Bay Road (unpaved), as well as various access roads in the area.	X	X	X	Contribution to the deterioration of local surface water quality during their construction, operation, and maintenance activities.	Contribution to the degradation of aquatic habitat quality during their construction, operation, and maintenance activities.	Contribution to the loss of wetland and water environment surface area and to their degradation due to the construction of facilities and operational activities.	Contribution to the loss/disturbance of terrestrial wildlife habitats and disturbance of associated wildlife due to construction, the presence of facilities, and operations.	Contribution to the disturbance of habitats and activities of special-status wildlife species due to construction, the presence of facilities, and operations.
La Grande Alliance – Levelling and paving of the access road to Wemindji from the Billy-Diamond Highway (150 km).			X	Contribution to the deterioration of local surface water quality during levelling and paving works and through future maintenance.	Contribution to the degradation of aquatic habitat quality during levelling and paving works and through future maintenance.	Contribution to the loss of wetland and water environment surface area and to their degradation during levelling and paving work and through future maintenance.	Contribution to the loss/disturbance of terrestrial wildlife habitats and disturbance of associated wildlife during levelling and paving work and through future maintenance.	Contribution to the disturbance of habitats and activities of special-status wildlife species during levelling and paving work and through future maintenance.
La Grande Alliance – Development of a section of road connecting Route 167 to the Trans-Taiga Road (approximately 125 km)			X	Contribution to the deterioration of local surface water quality during any construction work and due to its future maintenance.	Contribution to the degradation of aquatic habitat quality during any construction work and due to its future maintenance.	Contribution to the loss of wetland and water environment surface area and to their degradation during any construction work and due to its future maintenance.	Contribution to the loss/disturbance of terrestrial wildlife habitats and disturbance of associated wildlife during any construction work and due to its future maintenance.	Contribution to the disturbance of habitats and activities of special-status wildlife species during any construction work and due to its future maintenance.
La Grande Alliance – Development of a road between Radisson and Wapmagoostui (approximately 175 km)			X	Contribution to the deterioration of local surface water quality during any construction work and due to its future maintenance.	Contribution to the degradation of aquatic habitat quality during any construction work and due to its future maintenance.	Contribution to the loss of wetland and water environment surface area and to their degradation during any construction work and due to its future maintenance.	Contribution to the loss/disturbance of terrestrial wildlife habitats and disturbance of associated wildlife during any construction work and due to its future maintenance.	Contribution to the disturbance of habitats and activities of special-status wildlife species during any construction work and due to its future maintenance.
La Grande Alliance – Development of a rail corridor from km 257 of the Billy-Diamond Highway to the intersection with the Trans-Taiga Road (287 km)			X	Contribution to the deterioration of local surface water quality during any construction work and due to its future maintenance.	Contribution to the degradation of aquatic habitat quality during any construction work and due to its future maintenance.	Contribution to the loss of wetland and water environment surface area and to their degradation during any construction work and due to its future maintenance.	Contribution to the loss/disturbance of terrestrial wildlife habitats and disturbance of associated wildlife during any construction work and due to its future maintenance.	Contribution to the disturbance of habitats and activities of special-status wildlife species during any construction work and due to its future maintenance.
Airports and airfields (La Grande, LG-3, LG-4, Fontange, Lac-Pau, Chisasibi, Wemindji, Pourvoirie Mirage, Éléonore mine, and Renard mine)	X	X	X	Contribution to the degradation of local surface water quality during their construction, operations, and maintenance work.	Contribution to the degradation of aquatic habitat quality during construction, operations, and maintenance work.	Contribution to the loss of wetland and water environment surface area and to their degradation due to the construction of facilities and operations.	Contribution to the loss/disturbance of terrestrial wildlife habitats and disturbance of associated wildlife due to construction, the presence of facilities, and operations.	Contribution to the disturbance of habitats and activities of special-status wildlife species due to construction, the presence of facilities, and operations.

Projects, activities, and events	Past	Present	Future	Surface water quality	Aquatic fauna and habitats	Wetlands and water environments	Terrestrial wildlife and wildlife habitats	Special-status wildlife species
Infrastructure and services								
Landfills	X	X	X	Contribution to the degradation of local surface water quality during their construction and due to their operations.	Contribution to the degradation of aquatic habitat quality during their construction and operations.	Contribution to the loss of wetland and water environment surface area and to their degradation due to their construction and use.	Contribution to the loss/disturbance of terrestrial wildlife habitats and disturbance of associated wildlife during the construction and use of these facilities.	Contribution to the disturbance of habitats and activities of special-status wildlife species due to the construction and operations of these facilities.
Telecommunications towers	X	X	X	Not applicable	Not applicable	Not applicable	Contribution to the loss/disturbance of terrestrial wildlife habitats and disturbance of associated wildlife during the construction and maintenance of these towers.	Contribution to the disturbance of habitats and activities of special-status wildlife species due to the construction and maintenance of these facilities.
Human occupation on the land								
Cree community villages (Wemindji and Chisasibi)	X	X	X	Villages can generate wastewater and rainwater runoff that can affect surface water quality.	Villages can generate wastewater and rainwater runoff that can affect the quality of aquatic habitats.	Villages can generate rainwater runoff that can affect the quality of wetlands.	Village activities can disturb the activities of surrounding wildlife.	Village activities can disturb the activities of special-status wildlife species in the surrounding area.
Temporary and permanent Cree campsites	X	X	X	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Campsite and temporary shelter (non-Indigenous). An administrative suspension of private vacation leases is currently in effect in the Eeyou Istchee James Bay region. Only those already allocated are therefore considered.	X	X	X	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Wildlife or protected area								
National parks, territorial reserves for protected area purposes, and proposed biodiversity reserve	X	X	X	Protection of water quality by controlling activities that may take place on these lands.	Protection of the quality of aquatic habitats and associated wildlife by controlling activities that may take place on these lands.	Protection of wetlands and water environments by controlling activities that may take place on these lands.	Protection of the quality of terrestrial wildlife habitats and associated wildlife by controlling activities that may take place on these lands.	Protection of special-status wildlife species and their habitat by controlling activities that may take place on these lands.
Natural and other disturbances								
Forest fires (cyclical phenomenon).	X		X	Disturbance of surface water quality due to ashes (TSS, pH, etc.) entering the water.	Disturbance of aquatic habitat quality due to ashes (TSS, pH, etc.) entering the water.	Disturbance of the quality of wetlands and water environments due to the burning of plant species and ashes (MES, pH, etc.) entering these environments.	Disturbance of the quality of terrestrial wildlife habitats and associated wildlife due to the burning of the vegetation stratum, which alters existing habitats, as well as health problems (smoke inhalation, burns) and wildlife mortality.	Disturbance of the quality of terrestrial wildlife habitats and associated special-status wildlife species due to the burning of the vegetation stratum, which alters existing habitats, as well as health problems (smoke inhalation, burns) and wildlife mortality.
White-nose syndrome (WNS) (detected in Quebec in 2010).	X	X	X	Not applicable	Not applicable	Not applicable	Infection of chiropterans and increased mortality in their populations. Changes in the dynamics of various species (resident vs. migratory).	Seven of the eight chiropteran species in Quebec have federal or provincial protection status. Among these, three species are susceptible to being affected by WNS. Infection of chiropterans and increased mortality in their populations. Changes in the dynamics of various species (resident vs. migratory).
Governance and land use planning								
Residential schools	X	X	X	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Signing of the JBNQA (1975)	X	X	X	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable

Projects, activities, and events	Past	Present	Future	Surface water quality	Aquatic fauna and habitats	Wetlands and water environments	Terrestrial wildlife and wildlife habitats	Special-status wildlife species
Governance and land use planning								
Paix des Braves Agreement, Nadoshtin, Boumhounan, and Niskamoon Agreements, and Agreement on Governance in the Eeyou Istchee James Bay Territory.	X	X	X	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Plan Nord	X	X	X	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
La Grande Alliance	X	X	X	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Woodland Caribou Recovery Plan (2005-2012) and Plan update (2012-2022).	X	X		Not applicable	Not applicable	Not applicable	Not applicable	Protection and implementation of a recovery plan for caribou populations.
Assignment of special status under the Species at Risk Act and the Act respecting threatened or vulnerable species that involves protection of the habitat of special-status species.	X	X	X	Not applicable	Protection of fish species and their habitat	Not applicable	Protection of species and their habitat	Protection of species and their habitat

Table 9-4 Projects, activities, and events that may influence valued components

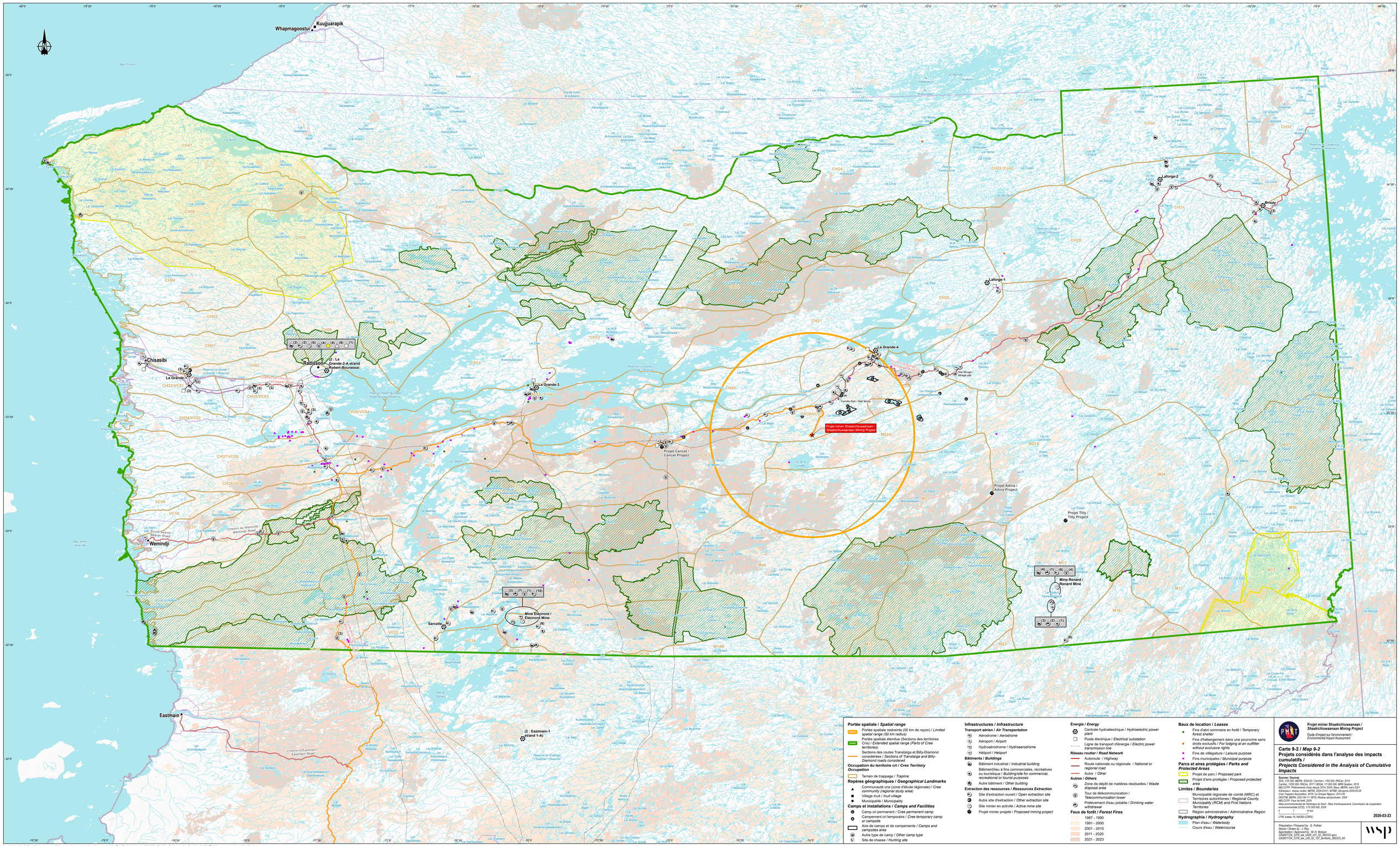
Projects, activities, and events	Past	Present	Future	Physical, psychological, and social health of the regional population	Road safety	Well-being on the land	Hunting and trapping	Climate change mitigation (GHG emissions)
Natural resource development								
Mining exploration activities	X	X	X	Potential for social tensions within communities and concerns about negative influences resulting from contact with workers who are not from the region. Concern for the health of workers in the region involved in these activities.	Contribution to the deterioration of the Trans-Taiga Road and Billy-Diamond Highway and increased risk of accidents due to increased traffic from trucks and other vehicles.	Decline in the quality of the land experience due to restrictions on access to resources, and a reduction in the quality of the environment, peacefulness, and sense of security.	Increased wildlife harvesting pressure and changes in land and resource use due to improved land access (creation of new access roads). Loss of territory caused by the increase of access roads and drilling areas. Changes in land use patterns.	Contribution to regional and provincial GHG emissions through the transportation and operation of equipment and vehicles.
Shaakichiuwaanaan mine		X	X	Potential for social tensions within communities and concerns about negative influences resulting from contact with workers who are not from the region. Concern for the health of workers in the region involved in the project.	Contribution to the deterioration of the Trans-Taiga Road and Billy-Diamond Highway and increased risk of accidents due to increased traffic from trucks and other vehicles.	Decline in the quality of the land experience due to restrictions on access to resources, and a reduction in the quality of the environment, peacefulness, and sense of security.	Increased wildlife harvesting pressure and changes in land and resource use due to improved land access (creation of new access roads). Loss of land caused by the increasing number of access roads and the development of facilities. Changes in land use patterns.	Contribution to regional and provincial GHG emissions through the transportation and operation of equipment and vehicles.
Adina mine	X	X	X	Potential for social tensions within communities and concerns about negative influences resulting from contact with workers who are not from the region. Concern for the health of workers in the region involved in the project.	Contribution to the deterioration of the Trans-Taiga Road and Billy-Diamond Highway and increased risk of accidents due to increased traffic from trucks and other vehicles. However, it is possible that traffic will be routed via a new road connecting the Trans-Taiga Road to Route 167 N.	Decline in the quality of the land experience due to restrictions on access to resources, and a reduction in the quality of the environment, peacefulness, and sense of security.	Increased wildlife harvesting pressure and changes in land and resource use due to improved land access (creation of new access roads). Loss of land caused by the increasing number of access roads and the development of facilities. Changes in land use patterns.	Contribution to regional and provincial GHG emissions through the transportation and operation of equipment and vehicles.
Tilly mine			X	Potential for social tensions within communities and concerns about negative influences resulting from contact with workers who are not from the region. Concern for the health of workers in the region involved in the project.	Contribution to the deterioration of the Trans-Taiga Road and Billy-Diamond Highway and increased risk of accidents due to increased traffic from trucks and other vehicles. However, it is possible that traffic will be routed via a new road connecting the Trans-Taiga Road to Route 167 N.	Decline in the quality of the land experience due to restrictions on access to resources, and a reduction in the quality of the environment, peacefulness, and sense of security.	Increased wildlife harvesting pressure and changes in land and resource use due to improved land access (creation of new access roads). Loss of land caused by the increasing number of access roads and the development of facilities. Changes in land use patterns.	Contribution to regional and provincial GHG emissions through the transportation and operation of equipment and vehicles.
Cancet mine			X	Potential for social tensions within communities and concerns about negative influences resulting from contact with workers who are not from the region. Concern for the health of workers in the region involved in the project.	Contribution to the deterioration of the Trans-Taiga Road and Billy-Diamond Highway and increased risk of accidents due to increased traffic from trucks and other vehicles. However, it is possible that traffic will be routed via a new road connecting the Trans-Taiga Road to Route 167 N.	Decline in the quality of the land experience due to restrictions on access to resources, and a reduction in the quality of the environment, peacefulness, and sense of security.	Increased wildlife harvesting pressure and changes in land and resource use due to improved land access (creation of new access roads). Loss of land caused by the increasing number of access roads and the development of facilities. Changes in land use patterns.	Contribution to regional and provincial GHG emissions through the transportation and operation of equipment and vehicles.
Éléonore mine	X	X	X	Potential for social tensions within communities and concerns about negative influences resulting from contact with workers who are not from the region. Concern for the health of workers in the region involved in the project.	Contribution to the deterioration of the Trans-Taiga Road and Billy-Diamond Highway and increased risk of accidents due to increased traffic from trucks and other vehicles.	Decline in the quality of the land experience due to restrictions on access to resources, and a reduction in the quality of the environment, peacefulness, and sense of security.	Increased wildlife harvesting pressure and changes in land and resource use due to improved land access (creation of new access roads). Loss of land caused by the increasing number of access roads and the development of facilities. Changes in land use patterns.	Contribution to regional and provincial GHG emissions through the transportation and operation of equipment and vehicles.

Projects, activities, and events	Past	Present	Future	Physical, psychological, and social health of the regional population	Road safety	Well-being on the land	Hunting and trapping	Climate change mitigation (GHG emissions)
Natural resource development								
Renard mine	X	X	X	Not applicable	As the mine is currently closed, traffic on Route 167N is minimal, so this aspect is not applicable.	Decline in the quality of the land experience due to restrictions on access to resources, and a reduction in the quality of the environment, peacefulness, and sense of security.	Increased wildlife harvesting pressure and changes in land and resource use due to improved land access (creation of new access roads). Loss of land caused by the increasing number of access roads and the development of facilities. Changes in land use patterns.	Not applicable as the mine is currently not in operation.
Borrow pits	X	X	X	Not applicable	Using these borrow pits generates road traffic that can lead to road deterioration and increase the risk of accidents.	Not applicable	The use of borrow pits can disturb hunting and trapping activities in surrounding areas.	The use of borrow pits can contribute to GHG emissions through the machinery and trucks required.
Power generation facilities located within the territory, including La Grande-1, La Grande-2A, Robert-Bourassa, La Grande-3, La Grande-4, Laforge-1, Laforge-2, Brisay, and Sarcelle (offices, dams and dikes, powerhouses, and related infrastructure).	X	X	X	Confirmed social tensions within communities and documented problems regarding negative influences resulting from contact with workers who are not from the region. Some documented effects on the health of workers associated with the project.	Contribution to the deterioration of the Trans-Taiga Road due to truck and other vehicle traffic during the operation and maintenance of facilities.	Decline in the quality of the land experience due to restrictions on access to resources, and a reduction in the quality of the environment, peacefulness, and sense of security.	Increased wildlife harvesting pressure and changes in land and resource use due to improved land access (creation of new access roads). Loss of land caused by more access roads as well as production facilities and reservoirs. Changes in land use patterns.	Contribution to regional and provincial GHG emissions through the transportation and operation of equipment and vehicles.
Infrastructure and services								
Various existing stations and lines related to Hydro-Québec projects		X	X	Confirmed social tensions within communities and documented problems regarding negative influences resulting from contact with workers who are not from the region. Some documented effects on the health of workers associated with the project.	Contribution to the deterioration of the Trans-Taiga Road and some secondary roads due to truck and other vehicle traffic during the operation and maintenance of facilities.	Decline in the quality of the land experience due to a reduction in the quality of the environment, peacefulness, and sense of security.	Increased wildlife harvesting pressure due to the creation of a new right-of-way to facilitate access to the area. Alteration and loss of territory caused by the presence of the right-of-way and the power line. Changes in land use patterns.	Contribution to regional and provincial GHG emissions due to the movement and operation of equipment and vehicles used in the operation and maintenance of these facilities.
New 120 kV line, approximately 53 km (Option 1), between the Tilly substation and the Shaakichiuwaanaan mine site (2028–2029) (BBA, 2025) This project includes two substations, one 315-120 kV substation near the Tilly substation and a second 120 kV/13.8 kV substation at the mine site. The line will be installed on a 21-metre-high H-shaped wooden structure. The right-of-way will be 38 m wide.			X	Potential for social tensions within communities and concerns about negative influences resulting from contact with workers who are not from the region. Concern for the health of workers in the region involved in the project.	Contribution to the deterioration of the Trans-Taiga Road and some secondary roads due to increased traffic from trucks and other vehicles during the construction and maintenance of facilities.	Decline in the quality of the land experience due to a reduction in the quality of the environment, peacefulness, and sense of security.	Increased wildlife harvesting pressure due to the creation of a new right-of-way to facilitate access to the area. Alteration and loss of territory caused by the presence of the right-of-way and the power line. Changes in land use patterns.	Contribution to regional and provincial GHG emissions due to the movement and operation of equipment and vehicles used in the operation and maintenance of these facilities.

Projects, activities, and events	Past	Present	Future	Physical, psychological, and social health of the regional population	Road safety	Well-being on the land	Hunting and trapping	Climate change mitigation (GHG emissions)
Infrastructure and services								
Trans-Taiga Road (unpaved), Billy-Diamond Highway (paved), and James Bay Road (unpaved), as well as various access roads in the area.	X	X	X	Generation of social tensions within communities due to the pros and cons of greater accessibility to the land.	Not applicable	Decline in the quality of the land experience due to a reduction in the quality of the environment, peacefulness, and sense of security.	Increased wildlife harvesting pressure due to the creation of new access roads to facilitate access to the area. Alteration and loss of territory caused by the presence of roads and access roads. Changes in land use patterns.	Contribution to regional and provincial GHG emissions from the movement and operation of equipment and vehicles for their maintenance.
La Grande Alliance – Levelling and paving of the access road to Wemindji from the Billy-Diamond Highway (150 km).			X	Potential for social tensions within communities and concerns about negative influences resulting from contact with workers who are not from the region. Concern for the health of workers in the region involved in the project.	Improvement of road safety on this access road through levelling and paving.	Decline in the quality of the land experience due to a reduction in the quality of the environment, peacefulness, and sense of security.	Not applicable	Contribution to regional and provincial GHG emissions from the movement and operation of equipment and vehicles related to the completion of the work and its future maintenance.
La Grande Alliance – Development of a section of road connecting Route 167 to the Trans-Taiga Road (approximately 125 km)			X	Potential for social tensions within communities and concerns about negative influences resulting from contact with workers who are not from the region. Concern for the health of workers in the region involved in the project.	Contribution to the deterioration of the Trans-Taiga Road and Route 167 N due to increased traffic from trucks and other vehicles during the construction of the new road.	Decline in the quality of the land experience due to a reduction in the quality of the environment, peacefulness, and sense of security. Increased wildlife harvesting pressure due to the creation of new access roads to facilitate access to the area.	Increased wildlife harvesting pressure and changes in land and resource use due to improved land access (creation of new access roads). Loss of land caused by the new road. Changes in land use patterns.	Contribution to regional and provincial GHG emissions from the movement and operation of equipment and vehicles related to the construction and maintenance of this new road.
La Grande Alliance – Development of a road between Radisson and Wapmagoostui (approximately 175 km)			X	Potential for social tensions within communities and concerns about negative influences resulting from contact with workers who are not from the region. Concern for the health of workers in the region involved in the project.	Contribution to the deterioration of the Trans-Taiga and the Billy-Diamond Highway due to increased traffic from trucks and other vehicles during the construction of the new road.	Decline in the quality of the land experience due to a reduction in the quality of the environment, peacefulness, and sense of security. Increased wildlife harvesting pressure due to the creation of new access roads to facilitate access to the area.	Increased wildlife harvesting pressure and changes in land and resource use due to improved land access (creation of new access roads). Loss of land caused by the new road. Changes in land use patterns.	Contribution to regional and provincial GHG emissions from the movement and operation of equipment and vehicles related to the construction and maintenance of this new road.
La Grande Alliance – Development of a rail corridor from km 257 of the Billy-Diamond Highway to the intersection with the Trans-Taiga Road (287 km)			X	Potential for social tensions within communities and concerns about negative influences resulting from contact with workers who are not from the region. Concern for the health of workers in the region involved in the project.	Contribution to the deterioration of the Trans-Taiga and the Billy-Diamond Highway due to increased traffic from trucks and other vehicles during the construction of the new road.	Decline in the quality of the land experience due to a reduction in the quality of the environment, peacefulness, and sense of security. Increased wildlife harvesting pressure due to the creation of a new railway line facilitating access to the land.	Increased wildlife harvesting pressure and changes in land and resource use due to improved land access (creation of new access roads). Loss of land caused by the new railroad. Changes in land use patterns.	Contribution to regional and provincial GHG emissions from the movement and operation of equipment and vehicles related to the construction and maintenance of this new railway.
Airports and airfields (La Grande, LG-3, LG-4, Fontange, Lac-Pau, Chisasibi, Wemindji, Pourvoirie Mirage, Éléonore mine, and Renard mine)	X	X	X	Generation of social tensions within communities due to the pros and cons of greater accessibility to the land.	Contribution to the deterioration of the Trans-Taiga Road and Billy-Diamond Highway due to truck traffic and other vehicles involved in their use and maintenance.	Decline in the quality of the land experience due to a reduction in the quality of the environment, peacefulness, and sense of security.	Increased wildlife harvesting pressure and changes in land and resource use due to improved land access (creation of new access roads). Loss of land caused by the facilities. Loss and changes in land use patterns.	Contribution to regional and provincial GHG emissions due to the movement and operation of equipment and vehicles used in the operation and maintenance of these facilities.
Landfills	X	X	X	Landfills can contribute to health deterioration depending on the nature of the materials buried and the risks of exposure to local populations.	Road traffic associated with the use of these sites can contribute to the deterioration of road quality and an increase in local and regional traffic.	Decline in the quality of the land experience due to a reduction in the quality of the environment, peacefulness, and sense of security.	The use of the landfill may disturb hunting and trapping activities in the surrounding areas.	Vehicle traffic and machinery operation associated with landfill operations contribute to GHG emissions.
Telecommunications towers	X	X	X	Not applicable	Road traffic associated with the construction of these towers may contribute to the deterioration of road quality and an increase in local and regional traffic.	Not applicable	The construction of these towers may disturb hunting and trapping activities in the surrounding areas.	Vehicle traffic and machinery operation associated with tower construction contribute to GHG emissions.

Projects, activities, and events	Past	Present	Future	Physical, psychological, and social health of the regional population	Road safety	Well-being on the land	Hunting and trapping	Climate change mitigation (GHG emissions)
Human occupation on the land								
Cree community villages (Wemindji and Chisasibi)	X	X	X	Not applicable	Traffic associated with the presence of these villages contributes to road deterioration and increased local and regional traffic.	Not applicable	The presence of villages limits hunting activities and can disturb trapping activities in surrounding areas.	The various activities associated with villages are sources of GHG emissions (traffic, heating, etc.).
Temporary and permanent Cree campsites	X	X	X	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Campsite and temporary shelter (non-Indigenous). However, an administrative suspension of private vacation leases is currently in effect in the Eeyou Istchee James Bay region. Only those already allocated are therefore considered.	X	X	X	Not applicable	Not applicable	Decline in the quality of the land experience due to a reduction in peacefulness and sense of security.	Disruption of traditional hunting and trapping activities. Decreased sense of security.	Not applicable
Wildlife or protected area								
National parks, territorial reserves for protected area purposes, and proposed biodiversity reserve	X	X	X	Protecting habitats and natural resources for future generations	Not applicable	Not applicable	Safeguarding the way of life of First Nations communities and supporting biodiversity.	Not applicable
Natural and other disturbances								
Forest fires (cyclical phenomenon).	X		X	Possible health effects on residents of the region due to exposure to smoke. Risk of property damage, injury, and death associated with the spread of these fires to regional communities	Possible damage to the road surface of Billy-Diamond Highway and other paved road segments due to heat from fires. Risk to the safety of road users travelling through fire zones.	Decline in the quality of the land experience due to a reduction in the quality of the environment and sense of security.	Disruption of wildlife harvesting activities. Changes in land and resource use. Temporary loss of land.	Contribution to GHG emissions parallel to human activities.
White-nose syndrome (WNS) (detected in Quebec in 2010).	X	X	X	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Governance and land use planning								
Residential schools	X	X	X	Not applicable	Not applicable	Have caused significant social and economic upheaval and cultural erosion, limiting the use of the land by these generations of Indigenous people.	Have caused significant social and economic upheaval and cultural erosion, limiting the use of the land by these generations of Indigenous people.	Not applicable
Signing of the JBNQA (1975)	X	X	X	Not applicable	Not applicable	Establishment of the Program to assist hunting, fishing and trapping Exclusive harvesting rights on the land. Marking of common use areas and responsible administrative entities (land categories). Reduction in the time devoted to traditional activities on the land (full-time jobs in the various institutions created), leading to changes in land use patterns.	Establishment of the Program to assist hunting, fishing and trapping Exclusive harvesting rights on the land. Marking of common use areas and responsible administrative entities (land categories). Reduction in the time devoted to traditional activities on the land (full-time jobs in the various institutions created), leading to changes in land use patterns.	Not applicable

Projects, activities, and events	Past	Present	Future	Physical, psychological, and social health of the regional population	Road safety	Well-being on the land	Hunting and trapping	Climate change mitigation (GHG emissions)
Governance and land use planning								
Paix des Braves Agreement, Nadoshtin, Boumhounan, and Niskamoon Agreements, and Agreement on Governance in the Eeyou Istchee James Bay Territory.	X	X	X	Not applicable	Not applicable	Increased control over the land and its use by Cree communities. Increase in the number of projects on the land.	Increased control over the land and its use by Cree communities. Increase in the number of projects on the land, thereby reducing hunting and trapping areas.	Not applicable
Plan Nord	X	X	X	Not applicable	Not applicable	Interference between industrial development and land use (perception of environmental contamination)	Interference between industrial development and subsistence activities (perception of environmental contamination)	Promotes the expansion of transportation infrastructure northward as well as resource development projects, which will lead to increased GHG emissions due to higher traffic and projects that use hydrocarbons in their operations.
La Grande Alliance	X	X	X	Not applicable	Several projects to repair existing roads will improve road safety. However, there will also be plans for new roads that will increase traffic in the area, which could lead to safety issues.	Increased access to the area through the construction of new roads and railways, promoting greater use of the area by Indigenous communities. However, it also promotes access to the area for non-Indigenous people.	Increased access to the area through the construction of new roads and railways, facilitating travel for hunting and trapping, but further fragmenting wildlife habitats.	Increased traffic of internal combustion vehicles due to improvements in road and rail networks, which will increase the region's GHG emissions.
Woodland Caribou Recovery Plan (2005-2012) and Plan update (2012-2022).	X	X		Not applicable	Not applicable	May lead to certain restrictions on land use, particularly in relation to hunting.	May mean a restriction on hunting this species to promote its recovery.	Not applicable
Assignment of special status *under the Species at Risk Act and the Act respecting threatened or vulnerable species* that involves protection of the habitat of special-status species.	X	X	X	Not applicable	Not applicable	May result in certain restrictions on land use, particularly in relation to hunting, trapping, fishing, and gathering.	May mean restrictions on hunting and trapping these species to promote their recovery.	Not applicable


Whapmagoostui
Kuujjuarapik
Chisasibi
Radisson
La Grande-1
La Grande-2-A et/and Robert-Bourassa
La Grande-3
La Grande-4
Wemindji
Eastmain
Sarcelle
Mine Éléonore / Éléonord Mine
Projet minier Shaakichiuwaanaan / Shaakichiuwaanaan Mining Project
Projet Cancet / Cancet Project
Projet Adina / Adina Project
Projet Tilly / Tilly Project
Mine Renard / Renard Mine
Laforge-1
Laforge-2
Brisay
Eastmain-1 et/and 1-A)
Chemin de Wemindji / Wemindji Road
Chemin d'Eastmain / Eastmain Road
Route Billy-Diamond / Billy-Diamond Road
Baie James / James Bay
Baie d'Hudson
Hudson Bay
Lac Champion
Lac Guyer
Lac Evans
Lac Opinaca
Lac Boyer
Lac Bonnet
Lac Bourier
Lac Cancet
Lac Mistaouac
Lac Mistassini
Lac Nemiscau
Lac Matagami
Lac Soscumica
Lac Waconichi
Lac Gayot
Lac Lemare
Lac Lemoine
Lac Lemaitre
Lac Lemarchand
Lac Lemoyne
Lac Lemeunier
Lac Lemesurier
Lac Lemoine
Lac Lemaire

9.2.4.1 Natural resource development

This theme covers various past, present, and planned activities related to the use of natural resources, including mining, borrow pits, forestry, and energy production (power plants).

Mining activities

The area under consideration for mining activities corresponds to that designated for land use by Indigenous communities, primarily those of Chisasibi, Wemindji, and Mistissini. This vast territory is mainly used for mineral exploration activities, but also includes four mine sites that are either under development or in operation.

Mining exploration is concentrated along two main axes (SIGÉOM, 2025a), namely:

- Along an east-west axis located south of the reservoirs of the La Grande hydroelectric complex, stretching from the Robert-Bourassa reservoir in the west to Lac Nichicun in the east. This area is being explored mainly for lithium, but also for copper and gold, and to a lesser extent for various other metals (molybdenum, cobalt, nickel, silver, tantalum, iridium, palladium, platinum, rhodium, rubidium, etc.). Most of the designated exploration areas do not have a defined level of development (development stage unknown on SIGEOM) or are at the basic or intermediate exploration stage.
- Along a northwest/southeast axis between Robert-Bourassa Reservoir and Lac Sakami. This area is divided between gold and lithium exploration activities, with a few areas focused on nickel and another on total rare earth elements. Prospecting for other metals is also carried out at certain sites, particularly for silver, copper, iridium, palladium, platinum, and rhodium. These sites are mainly at the basic or intermediate exploration stage of development. Some areas do not have a defined level of development (development stage unknown on SIGEOM).

The areas subject to mineral exploration occupy part (mainly near the southern boundary) of Chisasibi's traditional territory, part of the northern boundary of Mistissini's traditional territory, and about one third of Wemindji's traditional territory (central part of the land).

With regard to mining operations, the following three sites have moved beyond the exploration stage (SIGÉOM, 2025a):

- The Shaakichiuwaanaan Project formerly known as the Corvette mine site (project currently under assessment). This lithium mine project, managed by the proponent PMET Resources Inc. (Innova Lithium Inc.) is in the development stage and is currently undergoing an environmental impact assessment. Exploration work is also still ongoing.
- The Adina mine site, covering an area of 46 km², is being developed and managed by the proponent Winsome Resources Ltd. Discovered in 2014, it has undergone exploratory drilling since 2018, which has confirmed the deposit's potential and led Winsome Resources to submit its preliminary economic assessment technical study in October 2024 (Winsome Resources, 2025a). There had been plans to develop the Adina mine by converting the Renard mine's mineralized material processing plant to process lithium ore. However, due to market conditions in 2025, Winsome has decided not to proceed with the acquisition of the Renard mine site, at least for the time being. Drilling work is continuing and technical and environmental studies have been initiated.

- The Tilly mine project site, covering an area of 47 km², is located 20 kilometers southeast of the Adina mine project. This project is part of Winsome Resources Ltd.'s portfolio. It is a potential lithium deposit that underwent extensive exploration in 2025, with the collection of 56 samples (Windsome Resources, 2026) reportedly revealing high-quality lithium mineralization. Further exploration work is planned for the potential development of the site.
- The Cancet mine project site, covering an area of approximately 200 km², is located approximately 155 km east of Radisson as the crow flies. This project is part of Winsome Resources Ltd.'s portfolio. This is a potential lithium deposit that has been the subject of numerous drilling operations (5216 m to date) and metallurgical tests (Windsome Resources, 2026). These operations reportedly confirmed the presence of high-quality lithium ore (2.91% Li2O). Exploration work is ongoing.
- The Renard mine, which was operated for diamond extraction by the developer Stornoway Diamonds Inc. (Canada). Development of the site began in July 2014 and it became operational in 2016. However, mining operations have faced various financial problems, particularly due to the fall in the value of diamonds. It permanently ceased operations in the fall of 2023. In April 2024, Winsome Resources signed an exclusive option agreement to purchase the mine site with a view to eventually converting its infrastructure to process lithium ore extracted from the Adina mine, located approximately 60 km north of the Renard mine (Journal de Montréal, 2024, Winsome Resources, 2025b). However, as indicated above, this option has been abandoned for the time being.
- The Éléonore mine was inaugurated in 2015 by Goldcorp to mine a gold deposit. It produces approximately 245,000 ounces of gold per year. A transaction led to the sale of the deposit to the American company Newmont in 2019 and, most recently in 2024, to a British company, Dhilmar (La Presse, November 26, 2024). The mine is expected to operate for 22 years, with an estimated extraction of nearly 14 million ounces of gold (COMEX, 2025). The site includes an underground mine accessed via a shaft reaching a depth of 1,500 metres. The extracted ore is processed on site at a plant with a capacity of 3,500 tonnes per day, which can be increased to 7,000 tonnes per day. The process includes crushing, gravity concentration, a sulphide flotation unit, cyanide leaching, and gold recovery using a carbon-in-pulp (CIP) process. The mine is connected to the Billy-Diamond Highway by an unpaved access road stretching over 140 km. It has its own airport and is supplied with electricity by Hydro-Québec via a 120 kV power line.

Borrow pits

Several open borrow pits (>40) are present throughout the area defined by the extended spatial boundary covering parts of the Cree territories of Chisasibi, Wemindji and Mistissini. These borrow pits are mainly located along existing roads and around the facilities of the various Hydro-Québec generating stations.

Energy production

The region represents the source of the most important energy production in the province, in the form of hydroelectric power, which included the large scale construction of dams and reservoirs on the La Grande River in the 1970s and 1980s. Some of the energy production facilities in this complex also required the diversion of the Caniapiscau River and part of the Grande Rivière de la Baleine basin via the Laforge River diversion, as well as diversions from the Eastmain and Rupert Rivers. The complex created a new watershed covering more than 200,000 km², significantly altering the affected areas.

Along the La Grande River, there are eight hydroelectric power plants generating more than 15,000 MW, requiring the construction of 304 dams, six 735 kV power lines, one 450 kV direct current line, six airports, seven villages, and 2,100 km of roads (SEBJ, 2025). The power plants include, from west to east, La Grande-1, Radisson, La Grande-3, La Grande-4, Laforge-1, Laforge-2, Brisay, and Caniapiscau.

The area covered by the extended spatial boundary also includes the Sarcelle generating station, which is part of the Eastmain-Sarcelle-Rupert complex. This station has an installed capacity of 150 MW and is located at the outlet of the Opinaca Reservoir, at the level of the Eleonore mine (Hydro-Québec, 2026). Construction began in 2007 and it was commissioned in 2013.

9.2.4.2 Infrastructure and services

Substations and power lines

Within the extended spatial boundary considered for the cumulative impact assessment, there are several substations and power lines of various voltages. The various infrastructure facilities are as follows, from east to west:

- At the La Grande-4 (LG-4) power station, there are two electrical substations: the 735 kV LG-4 substation and the 735/315 kV Tilly substation. Two 735 kV lines begin at the LG-4 substation and connect to the 735 kV Lemoyne substation at Lac Goyer, following the Trans-Taiga Road on the south side. Another 735-kilovolt line begins at the Tilly substation and also connects to the Lemoyne substation, following the Trans-Taiga Road on the north side. Lastly, a 315 kV line from the Nikamo substation (at the Laforge-1 power plant) enters the Tilly substation, bypassing the LG-4 reservoir to the south.
- At the La Grande-3 (LG-3) power station, there are two 735 kV electrical substations: the LG-3 and Chisasibi substations. Two 735 kV power lines start at the LG-3 substation. One reaches Lemoyne substation by following the Tans-Taiga Road on the north side, and the other crosses this road and descends southward to reach Albanel substation at Nemasaka. A 735 kV line begins at the Chisasibi substation and runs to the Sakami-1 substation along the north side of the Trans-Taiga Road.
- Two 735-kilovolt lines start at the 735-kilovolt Lemoyne substation and connect to the Albanel substation.
- The Robert-Bourassa power plant sector includes numerous electrical substations operating at various voltages ranging from 44 kV to 735 kV. The hydroelectric complex itself includes the La Grande-2 (735 kV), La Grande-2-A (315 kV), Radisson (735 kV), Carcajou and Des Groseillers (69 kV), and Brisson (44 kV) substations. A bit further south, there are also the Desaulniers and Duncan Limnimètre-020 substations (69 kV) and the Électrode Duncan substation (44 kV). There is also a decommissioned 69 kV substation, known as the Despins substation.
- Two 735 kV lines begin at the LG-2 substation: one connects to the Sakami substation located at the lake of the same name south of the Robert-Bourassa reservoir and along the Trans-Taiga Road, and the other connects to the Albanel substation.
- Two 735 kV lines begin at the Radisson substation and connect to the Opinaca-2 and Opinaca-3 substations near the community of Eastmain. A 450 kV line also begins at this substation and connects to the Grondines substation in the municipality of Deschambault-Grondines.

- A 515 kV line connects the La Grande-2A, Radisson, and La Grande-1 substations located near the LG-1 power plant.
- A 69 kV line connects the LG-2, Carcajou, Des Groseillers, Desaulniers, and Duncan Limnimètre-020 substations.
- A 44 kV line connects the Radisson, Brisson, and Électrode Duncan substations.
- At the LG-1 power plant, there is only the LG-1 substation. This substation is connected to the Radisson substation by a 315 kV line running along the north side of James Bay Road. It is also connected to the Chisasibi substation by a 120 kV line that supplies power to the community of the same name. Lastly, a second 120 kV line connects to the Wemindji substation, which supplies this community.

Road network

The main roads in the area considered within the extended spatial boudary include:

- The Trans-Taiga Road, which is unpaved. It connects Billy-Diamond Highway (to the west) to the Caniapiscau hydroelectric site (to the east), where it ends.
- The Billy-Diamond Highway, which is a 620 km paved road connecting the LG-1 power plant site to Matagami in the south.
- The James Bay Road, which is a paved road approximately 100 km long that connects the LG-1 power plant area to the community of Chisasibi.
- The unpaved Wemindji Road, approximately 100 km long, which connects the community of the same name to the Billy-Diamond Highway.
- Part of the unpaved access road to the Éléonore mine, which joins the Billy-Diamond Highway further south after a stretch of more than 140 km.

Apart from these roads, the various sites of the LG-1 power plants in Caniapiscau include a local network of paved and dirt roads. Lastly, there are also various forest roads in the area connecting to power lines, borrow pits, mining exploration areas, isolated campsites and, further south, logging areas.

Development projects planned under the Grand Alliance

La Grande Alliance, signed in 2020, is a memorandum of understanding between the Cree Nation Government and the Quebec government aimed at greater collaboration to improve connectivity, development, and protection of the land. As part of the discussions arising from this protocol, various projects have been proposed for the study area under consideration to assess the cumulative impacts on land use by Indigenous communities, including (Grande Alliance, 2021):

- improving access to the community of Wemindji (Phase I);
- the construction of a railway parallel to the Billy-Diamond Highway to kilometre 544 (Phase II);
- the construction of a road between Radisson and Whapmagoostui (approximately 175 km) (Phase II), for which a preliminary route was presented in 2023 (Grande Alliance, 2023);
- the extension of Route 167 to connect it to the Trans-Taiga Road (approximately 175 km) (Phase II);

- a railway connecting Radisson and Whapmagoostui/Kuujjuarapik (approximately 225 km) (Phase III);
- the extension of the Trans-Taiga Road to Schefferville (approximately 200 km) (Phase III).

To date, only the feasibility study for these projects has been completed in 2022, and an initial route for the Radisson-Whapmagoostui Road has been presented. No fieldwork has been completed, and there is no schedule available for the planned work.

Airport, airfield, and hydroplane base

Three airports and seven airfields are located within the study area defined for the assessment of cumulative impacts on land use by Indigenous communities. One airport and four airfields are associated with the various hydroelectric power plants, namely:

- La Grande Airport, which has served the La Grande-1 and Radisson sites since 1970 and whose buildings were rebuilt in 1991, is managed by the Société de Développement de la Baie-James (SDBJ) (Ministère de la Culture et des Communications, 2025). The airport has an asphalt runway and lighting that allows aircraft to land 24 hours a day, 7 days a week. It is accessible via the Billy-Diamond Highway and is located approximately 30 km south of the Radisson facilities.
- The La Grande-3 and La Grande-4 airfields, which serve the sites of the same name and are managed by Hydro-Québec. These facilities are located along the Trans-Taiga Road, near the hydroelectric facilities of the same name.
- The Fontange airfield, which serves the Laforge-1, Laforge-2, and Brisay sites and is managed by the SDBJ. This airfield is located along the Trans-Taiga Road near the Laforge-2 facilities.
- The Lac-Pau airfield, which serves the Caniapiscau site and various outfitters via a hydroplane base, is also located on Lac Caniapiscau. These facilities are located on the shores of Lac Pau at the eastern end of the Trans-Taiga Road.

The other two airports are located in the communities of Chisasibi and Wemindji. They are used by both communities and are located along the La Grande River, at the northern end of the village of Chisasibi and inland to the northwest of the village of Wemindji. The last three airfields are private facilities managed by the community of Chisasibi (near the site of the former Mirage outfitter), the Renard mine, and the Éléonore mine, respectively. The airfield of the former Mirage Outfitter is located along the Trans-Taiga Road, southeast of the LG4 reservoir. The Renard mine airfield is located along the extension of Route 167, which connects the mine site to the town of Chibougamau. Lastly, the Éléonore mine's airfield is located immediately north of the mine facilities, which are connected to the Billy-Diamond Highway by an access road.

Two private seaplane bases are also located in the extended spatial area: one on the shores of Lake Katatipawasakakamaw, on the northern edge of the Trans-Taiga Road south of LG-4 Airport, and the other near the Mirage site airfield. Finally, a heliport is located at the level of the Cancet mining project facilities.

Landfills

According to the MELCC's 2021 list of authorized and operational trench landfill sites (LEET), only four LEETs are located within the areas considered for the cumulative impact assessment, namely:

- The LG-4 trench landfill site, for which the operating permit is held by Hydro-Québec, a government corporation.
- The Radisson trench landfill site, whose operating permit holder is the Eeyou Istchee James Bay Regional Government.
- The Éléonore mine's trench landfill site, for which Goldcorp Canada was the permit holder in 2021. As this mine site has since been sold to the British company Dhilmar, it is assumed that Dhilmar is now the holder of the permit.
- The Renard mine trench landfill site, whose permit holder is Stornoway Diamonds (Canada) Inc.
- Two landfill sites of uncertain nature and ownership, that is one located between the Laforge-2 and Brisay power plants, north of the Trans-Taiga road and another located southwest of the Brisay power plant.

Telecommunications towers

Thirty telecommunications towers have been located within the local human study area. These towers are mainly located near the various roads, at Hydro-Québec power plants and at active mining sites.

9.2.4.3 Human occupation on the land

Cree communities

Two Cree communities are located within the area considered for the cumulative impact assessment: the communities of Wemindji and Chisasibi. Section 6.4 of the EIA present a full description of these communities. The community of Chisasibi, founded in 1978, is located on the banks of the La Grande River, near its mouth at James Bay. This community of over 5,000 inhabitants is the largest in the James Bay area. Heavily influenced by the development of hydroelectric complexes on the La Grande River, the population divides its time between traditional activities and various jobs in the public service, services, tourism, various Hydro-Québec sites, mining exploration work, and active mining projects. The community is connected to Billy-Diamond Highway by James Bay Road.

The community of Wemindji is located on the banks of the Maquatua River, near its mouth on James Bay. The community has just over 1,400 inhabitants, and its population makes extensive use of the land, continuing traditional activities such as hunting, trapping, fishing, and gathering. The people also hold positions in infrastructure and land management, contribute as workers in the region's major mining projects, and are employed by Hydro-Québec and forestry operations. The village is connected to the Billy-Diamond Highway by the Wemindji Road, which is approximately 100 km long.

Both communities have their own airport as well as a range of residential, commercial, and public areas.

Indigenous campsites

Temporary and permanent Cree campsites have been identified within the restricted spatial boundary. Two temporary campsites have been identified, one on the banks of the La Grande River north of the Trans-Taiga Road, at the intersection of the project access road and the Trans-Taiga road. The other temporary campsite is located about 15 kilometres northeast of the project. Seventeen permanent campsites have been located, eight of which are along the Trans-Taiga Road and the other nine scattered across the area south of the Trans-Taiga Road, mainly between the project area and the eastern edge of the social LSA. The nearest permanent campsite is located approximately 9 km northwest of the project.

Campsites and temporary shelters (non-Indigenous)

Across the entire extended spatial area, leases for temporary shelters (17), community camping (4), outfitting without exclusive rights (8), and vacation properties (102) were identified. The vast majority of these leases are located on either side of the territory's main roads (Tans-taïga and Billy-Diamond) while the remainder are widely dispersed. Precise information on the landowners is not available.

9.2.4.4 Wildlife areas or protected areas

National parks

The northern section of the new Parc national Nibiischii, which extends from Lac Mistissini to the Renard mine (east of the mine), is included in the area considered for the assessment of cumulative impacts related to Indigenous land use. This park, created in December 2024, covers nearly 12,000 km^2 and will be managed by the Mistissini Cree community. It protects a significant portion of the wildlife and plants typical of the boreal forest north of the 50th parallel.

Territorial reserves for protected area purposes and proposed biodiversity reserves

Two proposed biodiversity reserves and eight territorial reserves for protected area purposes are located wholly or partly within the boundaries of the area considered for the cumulative impact assessment relating to Indigenous land use.

The listed proposed biodiversity reserves include:

- The Paakumshumwaau-Maatuskaau Reserve, located between the communities of Wemindji (approximately 20 km to the south) and Eastmain (approximately 32.5 km to the north), covers a vast area of 453,900 ha stretching from the shores of James Bay to the east of the Billy-Diamond Highway (Gouvernement du Québec, 2010). This reserve is located in the natural province of the Grande-Rivière low hills, in the natural region of the Lac Duncan plain and the Opinaca hills. It will protect a representative sample of the James Bay coastline, as well as a hydrographic system and part of the lower Opiniaca River plateau.

- The Hirondelle Reserve covers an area of 32,204 ha approximately 300 km northeast of the village of Mistissini (Gouvernement du Québec, 2009). Located on Category III lands under the James Bay and Northern Quebec Agreement, it overlaps three Cree traplines. It is crossed by the boundary between the natural provinces of the Nord-du-Québec Central Plateau and the low hills of the Grande Rivière, and more specifically, it is part of the natural region of the Buttons des lacs Noacocane and Nichicun, as well as the Lac Orillat buttes. It is characterized by the lichen-spruce bioclimatic domain and is dominated by spruce-moss stands and wooded heathland with shrubs, sometimes accompanied by lichens.

Territorial reserves for protected area purposes allow for the recognition of an area until its legal protection status is confirmed. The reserves are located north and south of the La Grande complex and its reservoirs. They include:

- The Namewaakamiishtikw-Piskuchitishu-Siipii Reserve, located between the Paakumshumwaau-Maatuskaau proposed biodiversity reserve and the village of Eastmain (MELCCP, 2025a). Covering an area of 229,800 ha, this reserve is intended to protect the traplines of the Eastmain community. It corresponds to the watersheds of the Conn and Pêche rivers.
- The Wichishkw-Uubauquushduuk Reserve consists of two separate spatial units located east of the proposed Paakumshumwaau-Maatuskaau Biodiversity Reserve and southwest of Lac Corvette (MELCCFP, 2025b). This 351,600-hectare reserve is heavily used by the Wemindji community as hunting grounds. It is part of the Sakami River watershed, which flows into the Grande Rivière, and is part of the wintering grounds of the migratory caribou herd of the Rivière aux Feuilles (Leaf River).
- The Pipunishiwin-Saahkamiishtikw Reserve is located east of the Wichishkw-Uubauquushduuk Reserve and the proposed Hirondelle Biodiversity Reserve, southeast of Lac Corvette (MELCCFP, 2025c). This reserve covers an area of 508,600 ha and was selected to represent the territorial area of the Rogen plain, which is part of the Pontois river basin. This territory is also part of the wintering grounds for the migratory Leaf River caribou herd.
- The Nord-Est-du-Lac-Nichicun reserve is located south of the Caniapiscau reservoir and immediately north of Nibiischii National Park (MELCCFP, 2025d). This reserve covers 259,700 ha and aims to protect the Caniapiscau Depression area and provide connectivity between the reserves located north of the La Grande Complex and those to the south. This territory is closely linked to the Cree community of Mistissini and is part of the range of the Caniapiscau woodland caribou population.
- The Minahiku-Wachî reserve is located immediately west of the Caniapiscau reservoir and south of the Lafroge-2 and Brisay power plants (MELCCFP, 2025e). Covering an area of 221,200 hectares, this reserve, like the previous one, protects part of the Caniapiscau Depression area. It is also part of the range of the Caniapiscau woodland caribou population.
- The Aawiitakuch Reserve consists of three distinct areas separated by the Trans-Taiga Road: two sections on the south side and one on the north side, at the LG-3 reservoir (MELCCFP, 2025f). The reserve covers a total area of 170,200 ha and, like the two previous reserves, its main purpose is to preserve the characteristics of the Caniapiscau Depression. It also includes numerous family camps belonging to Cree communities and is part of the wintering grounds of the Leaf River migratory caribou herd.

- The Rivière-Kanaaupscow-et-Lac-Kukamaw reserve is a group of areas of varying sizes located north of the Robert-Bourassa and LG-3 reservoirs (MELCCFP, 2025g). This reserve, covering a total area of 571,900 hectares, aims in particular to protect a representative area of the rolling plains of the Rivière à la Baleine. It also addresses the need to protect many cultural elements of the Cree community of Chisasibi.
- The Lac Burton-Rivière Roggan-et-la-Pointe-Louis-XIV reserve is a vast territory covering 875,000 ha located north of the community of Chisasibi, stretching from the shores of James Bay and Hudson Bay to the Radisson power plant (MELCCFP, 2025h). It provides protection for sites of interest such as Point Louis XIV, which has unique climate, plant, and wildlife that are characteristic of this latitude. It also includes one of the most remarkable drumlin fields and part of the Sakami Moraine.

9.2.4.5 Natural and other disturbances

Forest fires

Forest fires periodically affect Cree traplines and terrestrial ecosystems in the areas considered for the cumulative impact assessment. These areas are entirely located in the northern protection zone of the Société de protection des forêts contre le feu (SOPFEU).

SOPFEU provides statistical information on forest fires that have occurred in two main zones, the intensive prevention zone and the northern zone. The 50- and 100-kilometre cumulative impact assessment zones are entirely located in the northern region that covers northern Quebec from Lebel-sur-Quévillon. The available statistics for the northern region indicate that in 2023 and 2024, a total of 313 fires were recorded, with 147 in 2023 and 166 in 2024. The fires recorded in 2023 burned 3.2 million hectares, while those in 2024 burned 177,306 hectares.

According to data available on the website of the Ministère des Ressources naturelles et des Forêts, consulted in April 2025 (MRNF, 2025b), 36 fires occurred within a 100 km radius of the project site between 2007 and 2023, including six fires covering 5 000 ha or more. All of these fires affected a total of approximately 1,536,000 ha. It is important to note that all of the fires that occurred between 2007 and 2022 (26 in total) accounted for only 2% of the affected area, with only one fire covering more than 5,000 ha, which occurred in 2012 and came within 10 km southeast of the mine site. The vast majority of the area affected by forest fires was burned in 2023, when 10 fires occurred within a 100 km radius of the project site, covering a total of approximately 1,498,000 ha. Three of these fires covered areas greater than 155,000 ha, namely:

- A fire that burned 155,500 hectares and came within approximately 52 km southeast of the mine site.
- A fire that covered 376,650 hectares and came within approximately 54 kilometres north of the mine site. This fire remained just north of the LG-3 and LG-4 reservoirs.
- A fire that covered 837,701 hectares and came within 25 km south-southeast of the mine site. This was the largest fire to affect the Eeyou Istchee James Bay Territory in 2023.

In addition to these three major fires in 2023, three other fires covering more than 5,000 hectares were also recorded in the same year, namely:

- A fire covering 8,242 hectares located on the south bank of the LG-4 reservoir and 47 km northeast of the mine site.
- A fire covering 25,290 hectares located on both sides of the Trans-Taiga Road, near the LG-3 reservoir. It was 35 km west of the mine site.

- A fire covering 91,351 hectares, only a tiny fraction of which is within a radius of 100 km. This fire occurred near Lac des Vœux, on both sides of the Trans-Taiga Road, approximately 94 km northeast of the mine site.

White-nose syndrome

WNS is a fungal infection that affects bats, particularly cave-dwelling species, in northeastern North America including Quebec. Bat populations affected by this disease often suffer mass mortalities accompanied with a characteristic whitish fungal growth on parts of the body, particularly the nose (Gouvernement du Québec, 2026; ECCC, 2018).

Discovered in the winter of 2006–2007 in Howe Cave, New York, WNS spread to the provinces of Ontario and Quebec in 2010. Since WNS is spreading at a rapid rate of 300 km per year, the area and number of bats at risk continue to increase year after year. Therefore, WNS is currently the primary threat to bat populations in northeastern North America (ECCC, 2018).

9.2.4.6 Governance and land use planning

Residential schools system

The residential school system refers to schools (religious) and day schools (schools administered by the federal government) for Indigenous Peoples (including First Nations) that have existed since the 17th century, but during the 19th and 20th centuries, a formal system was established, only to be shut down by the federal government in the early 1970s (Parks Canada, 2025). In Quebec, some schools were open as early as the 1930s. Indigenous children were forced to leave their families to become boarders at these schools, where they were separated from their brothers and sisters and forbidden to speak their language. Compulsory attendance at these schools has been described as “cultural genocide,” since it was aimed at the cultural assimilation of Indigenous Peoples. The absence of children from their families caused family units to break down, deprived children of the education provided by their parents, and prevented the transmission of cultural knowledge. All of this was compounded by physical and sexual violence.

It should be noted that on June 11, 2008, Prime Minister Harper issued a full apology on behalf of Canadians regarding Indian residential schools (Government of Canada, 2025). In addition, on September 1, 2020, the Government of Canada announced the designation of the Residential School System as a national historic event through the National Program of Historical Commemoration. Lastly, several of these former residential schools have since been designated as national historic sites (Parks Canada, 2025).

Signing of the JBNQA (1975)

When major dam projects were launched in James Bay and the Nord-du-Québec region in 1971, Indigenous and Inuit communities opposed the projects, going so far as to file a lawsuit that is still ongoing (La Sentinelle, 2015, The Canadian Encyclopedia, 2019). The court required the parties to reach a negotiated agreement on land management, which led to the signing of the James Bay and Northern Quebec Agreement in 1975. By signing the Agreement, Crees and Inuit ceded their rights to the territory in exchange for various specific rights and financial compensation. The Agreement established harvesting rights, defined land categories, and put in place resource management regimes. It also led to the establishment of school boards, the restructuring of health services, and the creation of regional governments.

The three land categories resulting from the Agreement (Cree-Québec Forestry Board, 2018) are:

- Category I lands, which are exclusively used by Cree and Inuit communities, generally villages and their surrounding areas;
- Category II lands, on which the Cree and Inuit have exclusive hunting, fishing, and trapping rights, but not mineral rights;
- Category III lands, on which the Cree and Inuit have exclusive trapping rights and the exclusive right to establish outfitters. Although they do not have exclusive hunting and fishing rights, they may engage in these activities on these lands.

Paix des Braves Agreement, Nadoshtin, Boumhounan, and Niskamoon Agreements, and Agreement on Governance in the Eeyou Istchee James Bay Territory.

The Paix des Braves Agreement was signed in February 2002 with the Cree communities and is valid for 50 years (Gouvernement du Québec, 2002). This political and economic agreement is intended to facilitate the implementation of major hydroelectric, mining, and forestry projects in Cree territory, in exchange for:

- the establishment of a “nation-to-nation” (Cree and Quebec) relationship;
- a partnership based on cooperation, trust, and mutual respect for the development of the region;
- greater autonomy for the Cree and recognition of their increased responsibility for their economic and community development;
- respect for the principles of sustainable development and the traditional Cree way of life.

The agreement also implies that the two nations will share the revenues generated by projects carried out on Cree territory.

The Nadoshtin Agreement was signed in 2002 by the Grand Council of the Crees, certain Cree band councils, Hydro-Québec, and the SEBJ (Commission de la construction du Québec—CCQ, 2008). It granted authorization for the construction of the Eastmain-1 power plant. It aims to promote partnerships and job creation for Cree communities as part of this project.

The Boumhounan Agreement, signed in 2002, is similar to the previous agreement but includes the establishment of an implementation process and full Cree participation in the environmental study leading to the construction of the Eastmain-1-A and Sarcelle power plants and the diversion of the Rupert River (CCQ, 2008).

In 2005, the Niskamoon Agreement was signed between the Grand Council of the Crees and Hydro-Québec (CCQ, 2008). The main purpose of this new agreement was to merge the old agreements and other accords to simplify their management mechanisms and facilitate their implementation.

The Agreement on Governance in the Eeyou Istchee James Bay Territory was ratified in July 2012 between the Cree and the Government of Quebec (Grand Council of the Cree, 2025). This agreement builds on the JBNQA and the Paix des Braves agreements to establish a partnership between the Cree, Quebec, and the Jamesian communities for the governance of the Eeyou Istchee territory. This agreement has two main components: it provides for greater Cree autonomy on Category II lands (jurisdiction, functions, and power) with respect to land and natural resource planning and management, regional development, and municipal management. It also provides for the creation of a public Regional Government on Category III lands. Composed equally of representatives of the Cree and the Jamesian communities, this government exercises powers of municipal management, economic development, and resource planning.

Plan Nord

The first version of the Plan Nord was proposed in 2010, but it was poorly received by Indigenous communities, who felt excluded. However, after several years of numerous working meetings, it was relaunched in 2015 (Gouvernement du Québec, 2015). The Société du Plan Nord was created to coordinate the development of the territory in consultation with all stakeholders and to structure government interventions by the relevant departments and agencies. The plan also calls for the creation of a marketing office to liaise between Quebec companies, Indigenous businesses, and contractors regarding the goods and services needed to carry out the projects. At the same time, the Fonds du Plan Nord aims to finance strategic infrastructure and social, economic, and environmental measures for the development and protection of the territory.

The Plan aims to enhance the economic potential of the territory while seeking to protect 50% of it by 2035 (Gouvernement du Québec, 2011 and 2015). It also aims to improve the quality of life of northern communities, notably through enhanced support for community planning and structuring, the promotion of education and training, the advancement and recognition of cultural development, and support for families and seniors.

More recently, the Government of Québec released the Northern Action Plan 2023–2028, which builds on the Plan Nord and serves as an updated operational framework. Coordinated by the Société du Plan Nord, this action plan is intended to address the specific economic, social, and environmental development challenges of the territory located north of the 49th parallel. It provides for total investments exceeding $2.5 billion over a five-year period, involving more than 25 government ministries and agencies.

The Northern Action Plan is structured around major orientations that include improving connectivity and transportation and telecommunications infrastructure, strengthening northern economic sectors and the local benefits of major projects, supporting community vitality, and protecting the environment while promoting a transition toward less polluting energy sources. These orientations constitute a structuring framework within which development projects are carried out.

La Grande Alliance

Signed in February 2020, La Grande Alliance is a memorandum of understanding aimed at increasing collaboration between the Cree Nation and the Quebec government to connect, develop, and protect the territory. The agreement provides for investments to improve and develop transportation infrastructure (roads, railway, and deep-water port), as well as the electrification of some projects and the protection of part of the territory to safeguard its environmental uniqueness and the traditional activities and sites located there. The proposed projects will be developed in three distinct phases over a 30-year period (Radio-Canada, 2020 and 2021).

Species at Risk Act (federal) and Act respecting threatened or vulnerable species (provincial)

Adopted in 2002, the main objective of the Species at Risk Act is to prevent the disappearance of Canada's wildlife species by providing for the recovery of those species that no longer exist in the wild in Canada (extirpated), that are endangered, or that are threatened as a result of human activities. It also manages species of special concern to prevent them from becoming endangered or threatened species. As of November 2025, a total of 23 extirpated species, 291 endangered species, and 146 threatened species are listed in Schedule 1 of the Act (Government of Canada, 2025b).

Adopted in 1989, the objective of the Act respecting threatened or vulnerable species is to:

- prevent the disappearance of species living in Quebec;
- prevent a decline in the population of wildlife or plant species designated as threatened or vulnerable;
- ensure the conservation of habitats of species designated as threatened or vulnerable;
- restore populations and habitats of species designated as threatened or vulnerable;
- prevent any species from becoming threatened or vulnerable.

This law allows the government to establish a list of species that may be designated as threatened or vulnerable, implement programs and activities to assess the status of species, determine the characteristics of the habitats of designated species, and implement appropriate protection measures (Ministère des Ressources naturelles et de la Faune, 2010). As of November 2025, a total of 86 plant species and 64 wildlife species are designated as threatened or vulnerable, and 422 plant species and 115 wildlife species are likely to be designated as threatened or vulnerable (MELCCFP, 2025i).

Woodland Caribou Recovery Plan

The Woodland Caribou Recovery Plan was created in 2005 following the work of a recovery team established in 2003 and the recommendation of Quebec's advisory committee on threatened or vulnerable wildlife species (CAEFMVQ), which led the Government of Quebec to grant woodland caribou vulnerable species status under the Act respecting threatened or vulnerable species (Woodland Caribou Recovery Team, 2013). The first Plan covered the period from 2005 to 2012 and was replaced in May 2013 by a new Recovery Plan covering the period 2013–2023.

The main goal of the recovery plan is to enable woodland caribou to return to a satisfactory status throughout their range so that they can be removed from the list of threatened or vulnerable species. To achieve this, four main objectives have been defined, namely:

- conserve habitats suitable for woodland caribou;
- attain and maintain a population of at least 11,000 woodland caribou (1.7 caribou per 100 km²), distributed evenly throughout the Plan's area of application;
- obtain public support and the involvement of First Nations and stakeholders in the territory;
- continue acquiring knowledge.

A total of 30 actions divided into 11 measures have been planned to achieve these objectives.

9.3 Cumulative impact assessment

9.3.1 Surface water quality

The cumulative impact assessment for surface water is addressed in conjunction with the Aquatic fauna and habitat VEC, as both VECs address the same cumulative aspects and impacts.

9.3.2 Aquatic wildlife (fish) and habitat

The assessment of cumulative impacts on aquatic fauna (fish) and habitat refers to the project's residual impacts on this VEC, which may potentially be additive to those of other existing projects or events, or those that may occur within the territorial boundaries (spatial scope) set out in Table 9-2.

9.3.2.1 Baseline conditions

The area under consideration for establishing the reference state of aquatic wildlife and habitat encompasses two secondary watersheds within the primary watershed of the La Grande River: those of the La Grande A and Pontois Rivers. This area includes a number of facilities and infrastructure concentrated in its northern half, on either side of the Trans-Taiga Road. The main facility is the LG-4 power plant and its associated infrastructure (dam, power plant, dikes, substation, work camp, various buildings, etc.), located on the northeastern edge of the area in question. Power line corridors are also present and extend westward from Substation LG-4 to the Lemoyne substation, located west of the 50 km study area under consideration. Lastly, still in connection with the LG-4 power plant, there is an airport south of the Trans-Taiga Road, about ten kilometres southwest of the power plant. In addition to these facilities and those associated with the mining project, the area in question includes a few camps, borrow pits, and telecommunications towers. Despite the presence of these facilities and infrastructure, the vast majority of the area remains unoccupied and is characterized by a high density of bodies of water and watercourses, the main features of which are a section of the La Grande River and Lac de la Corvette.

The water quality sampling campaign conducted in the water bodies within the biophysical LSA revealed a slightly acidic pH (average pH of 6 to 6.5), good oxygenation of surface waters, and, in general, low biological productivity. The main exceedances observed in surface water samples were for pH, dissolved oxygen, and certain total extractable metals, notably aluminum, iron, and mercury. A few instances of exceedances of fluoride and zinc concentrations were also observed. The metals with the highest exceedances were aluminum (CWQG) and mercury (CPC [EO], CPC [O], and CFTP). These exceedances are likely related to the local geology and rock composition of the region. Lastly, samples taken from the reference lake located to the northwest outside the biophysical LSA also exceeded quality criteria for pH, dissolved oxygen, and aluminum.

A total of ten fish taxa were recorded in the biophysical LSA. Some occurrences were identified at the species level, while others were identified only at the genus or family level. The fish recorded in the inventory that have not been identified at the species level belong to the Cottidae, Salmonidae, Cyprinidae, and Catostomidae families (Table 9-5).

Table 9-5 List of fish species recorded in the biophysical LSA (Niigaan, 2025)

Common name	Scientific name	Code	English name	Cree name	Guild
Sculpin sp.	Cottidae sp.	COSP	Sculpin	-	Phyto-lithophilic
Whitefish sp.	Coregonus sp.	CRSP	Whitefish	-	Lithophilic
Cyprinid sp.	Cyprinidae sp.	CYPR	Cyprinids	-	Phyto-lithophilic
Northern pike	Esox Lucius	ESLU	Northern pike	Cinusew	Phytophilic
Lake whitefish	Coregonus clupeaformis	COCL	Lake whitefish	Atihkamek	Lithophilic
Burbot	Lota lota	LOLO	Burbot	Miyâhkatuw	Lithopelagophilic
Round whitefish	Prosopium cylindraceum	PRCY	Round whitefish	-	Lithophilic
White sucker	Catostomus commersoni	CACO	White sucker	Namepiy	Lithophilic
Longnose sucker	Catostomus catostomus	CACA	Longnose sucker	-	Lithophilic
Sucker sp.	Catostomus sp.	CASP	Sucker	-	Lithophilic
Lake chub	Couesius plumbeus	COPL	Lake chub	-	Lithophilic
Pearl dace	Margariscus margarita	MAMA	Pearl dace	-	Lithophilic
Char sp.	Salvelinus sp.	SLSP	Char	-	Lithophilic
Brook trout	Salvelinus fontinalis	SAFO	Brook trout	Mâsamek	Lithophilic
Lake trout	Salvelinus namaycush	SANA	Lake trout	Namekuss	Lithophilic

It should be noted that no rare, threatened, or vulnerable species have been recorded in the biophysical LSA or within a 10-kilometre radius of the project site. No invasive alien species were detected.

Niigaan has identified a total of 140 bodies of water and 390 potential watercourses or streams within the biophysical LSA. Of these, several were not selected for sampling because the characteristics observed suggested low or even no potential for fish habitat. In the end, 136 bodies of water and 202 watercourses were sampled to determine whether they contained fish habitat. The results indicate that 76 bodies of water and 126 watercourses serve as fish habitats, while three bodies of water and 56 watercourses have the potential to serve as fish habitats.

Benthic inventories revealed considerable variability in the structure of benthic communities and several instances where high organism density, significant taxonomic richness, and indicators of diverse and well-distributed communities were confirmed. From a taxonomic point of view, arthropods dominate most stations, mainly represented by chironomids, followed by mollusks (bivalves and gastropods).

9.3.2.2 Historical trends

The area under consideration for the cumulative impact assessment (a 50-kilometre radius around the mine site) overlaps with a territory in which the northern third has undergone significant changes to aquatic habitats attributable to the development of the La Grande hydroelectric complex. This development, which took place mainly during the 1970s and 1980s, involved the construction of dams and dikes to create large reservoirs, resulting in significant changes to the hydrological regimes in the La Grande River watershed. In addition to these physical disturbances, a mercury contamination issue has arisen as a result of the decomposition of trees that were cut down and left at the bottom of the reservoirs. Although mercury concentrations have now returned to levels comparable to those found in nature, Hydro-Québec continues to monitor mercury levels in the flesh of fish consumed by Indigenous communities (Hydro-Québec, 2002).

The community of Chisasibi is the community most affected by Hydro-Québec projects. Eight of the eleven dams are located on their traditional territory. Their traplines were impacted by flooding and it resulted in major environmental changes and impacts on the land users' way of life. The fish tastes differently in the reservoirs, the river doesn't freeze anymore and there is often a mist over it.

In the immediate vicinity of the project—that is, in the area surrounding the biophysical LSA—there had been little or no change attributable to human activities prior to the start of project-related exploration activities. However, the facilities planned for the project involve diverting a portion of the surface water and discharging mine effluent into Watercourse CE11, which flows into Watercourse CE15 and Lake L27, both of which are considered fish habitats.

With regard to the quality of aquatic habitats, a characterization study was conducted on watercourses and bodies of water that will and will not be exposed to mine effluent. In general, components of the aquatic environment that will not be exposed to the mine effluent exceed several provincial and federal standards for aluminum, iron, mercury, zinc, and fluorides. In addition, these bodies of water and watercourses have dissolved oxygen levels below the federal standard (CWQG) and a pH below the optimal range. For aquatic components that will be exposed to the mine effluent, issues similar to those observed in reference environments have been noted. However, these components are also affected by the presence of copper, which was detected at a sampling station.

Given the physicochemical characteristics of the proposed mine effluent, the implementation of a water treatment system that complies with regulatory requirements, and the planned management measures, it is anticipated that the discharge of mine effluent could cause localized changes in water quality in the receiving aquatic environments, primarily in the immediate vicinity of the discharge point. The parameters most likely to be affected include certain dissolved metals, suspended solids, and general physicochemical conditions (pH, dissolved oxygen). However, treatment of the mine effluent prior to discharge will ensure that concentrations downstream of the discharge point remain in compliance with provincial and federal criteria for the protection of aquatic life. Thus, although measurable deviations from baseline conditions may be observed, the anticipated effects of mine effluent discharges on the quality of aquatic habitats and fish habitats are expected to be low.

9.3.2.3 Significant projects, activities, or events

Significant projects, activities, or events that could have a cumulative impact on aquatic wildlife and habitats in conjunction with the project are those that could affect, within a 50-kilometre radius of the project, one of the two main watersheds involved in the project: those of the La Grande and Pontois rivers. These include the following:

- mining exploration activities.

- operational activities of the borrow pits located on either side of Trans-Taiga Road.
- operations and maintenance activities at the La Grande-4 facility.
- maintenance work at the LG-4 and Tilly substations, as well as on the lines connecting these substations to the Lemoyne substation (to the west) and the Laforge substation (to the east).
- any maintenance work on the Trans-Taiga Road.
- operations and maintenance activities associated with LG-4 Airport;
- operation of the LG-4 landfill site.
- the effects of some forest fires.

9.3.2.4 Cumulative impacts

The project's impacts on aquatic wildlife (fish) and habitats that could result in cumulative effects when combined with other projects, activities, or events include the loss of aquatic habitat (the partial drainage of Lake L01, the diversion of surface water altering flow rates in some water bodies and watercourses) and the introduction of a treated effluent into the aquatic environment. Among the selected projects, only exploration activities and forest fires are likely to cause similar disturbances to the aquatic components of the watersheds associated with the project. Aquatic habitat loss due to mining exploration and forest fires is unlikely. However, they can be a source of contaminants (hazardous materials, the introduction of suspended solids, and changes in pH due to ash deposition) that can reach water bodies and watercourses. However, the likelihood that these effects will occur in the same watersheds as those affected by the project is low. Taking these various factors into account, a low-intensity effect, of local extent, and of short to medium duration is anticipated for this VEC, primarily in connection with mineral exploration activities. This results in a cumulative impact of low significance.

9.3.2.5 Mitigation, compensation, and follow-up measures

No additional mitigation measures or environmental follow-up other than those identified in Chapter 8 and the table in Appendix 8-2 are required for aquatic fauna (fish) and habitat. Note also that an important fish habitat compensation program is planned as detailed in Chapter 14.

9.3.3 Wetlands and water environments

The assessment of cumulative impacts on wetlands and water environments refers to the project's residual impacts on this VEC, which may potentially be additive to those of other existing projects or events, or those that may occur within the territorial boundaries (spatial scope) set out in Table 9-2.

9.3.3.1 Baseline conditions

In the biophysical LSA, wetlands cover 2,430 ha, or 11.8% of the area, and consist of eight types of groupings. Among all wetland types, wooded ombrotrophic bogs and open ombrotrophic bogs are the most prevalent, covering 1,548 hectares, or 63.7% of all wetlands in the area. In addition to these two groups, the biophysical LSA includes open (177 ha) and wooded (67 ha) fens, shrub (245 ha) and treed (372 ha) swamps, ponds and shallow waters (15 ha), and marshes (6 ha).

Wetlands in the area of the mine site are distributed throughout the biophysical LSA, with a higher concentration to the northeast of Stockpile 02 and to the southwest of the open pit. There is another area with a concentration of wetlands, bounded on the east by the access road to the mine site and on the west by the power line. These habitats are also relatively abundant along the power line from the mine site to roughly where LG-4 airport is located. Further on, up to the Tilly substation, wetlands are less common along the power line, with the exception of the area near and at the intersection with the Trans-Taiga Road.

9.3.3.2 Historical trends

To date, only 4% of the wetlands characterized in the biophysical LSA had been disturbed by human activities (roads, partial logging, drainage), while approximately 11% had been disturbed by natural causes, such as recent forest fires (10%), or by beaver activity (1%). However, it is certain that within the 50 km spatial scope defined for this VEC, other human and natural disturbances have occurred, particularly in connection with the development of various facilities at the La Grande-4 Hydroelectric Complex, the construction of LG-4 Airport, power line corridors, and substations, the construction of the Trans-Taiga Road, the borrow pits located on both sides of the road, and various forest fires that occurred in this area.

The project will encroach on 104.7 hectares of wetlands and 15.5 hectares of aquatic environments, for a total of 120.2 hectares.

9.3.3.3 Significant projects, activities, or events

Significant projects, activities, or events that could have a cumulative impact, when combined with the project, on wetlands and water environments are those located within a 50-kilometre radius of the project. These include the following:

- mining exploration activities.
- operational activities of the borrow pits located on either side of Trans-Taiga Road.
- operations and maintenance activities at the La Grande-4 facility.
- maintenance work at the LG-4 and Tilly substations, as well as on the lines connecting these substations to the Lemoyne substation (to the west) and the Laforge substation (to the east).
- any maintenance work on the Trans-Taiga Road.
- operations and maintenance activities associated with LG-4 Airport;
- the operation of the LG-4 landfill.
- The effects of some forest fires.

9.3.3.4 Cumulative impacts

Among the selected projects, only exploration activities and forest fires are likely to cause additional wetland loss. Mining exploration is relatively extensive within the 50 km zone, while the unpredictability of forest fires makes it difficult to predict a cumulative effect. Taking these various factors into account, an effect of moderate intensity, local extent, and medium duration is anticipated for this VEC, primarily in relation to mining exploration activities. This results in a cumulative impact of moderate significance.

9.3.3.5 Mitigation, compensation, and follow-up measures

No additional mitigation measures or environmental follow-up other than those identified in Chapter 8 and the table in Appendix 8-2 are required for wetlands and water environments. Note that an important wetland compensation program is planned for the project as detailed in Chapter 14.

9.3.4 Wildlife species of special status

The assessment of cumulative impacts on wildlife species of special status refers to the project's residual impacts on this VEC, which may potentially be additive to those of other existing projects or events, or those that may occur within the territorial boundaries (spatial scope) set out in Table 9-2.

The species of special status selected for cumulative impact assessment are those confirmed to be present during inventories carried out in the project study area in 2023, 2024, and 2025 (WSP, 2025). A total of 18 wildlife species of special status were confirmed as present, including 11 bird species (golden eagle, common nighthawk, peregrine falcon, red crossbill [*percna* subspecies], evening grosbeak, short-eared owl, bank swallow, olive-sided flycatcher, lesser yellowlegs, bald eagle, and rusty blackbird), one large mammal (woodland caribou), five bat species (little brown bat, northern long-eared bat, silver-haired bat, hoary bat, and eastern red bat), and one small mammal (southern bog lemming).

It should be noted that, in addition to the five bat species and the bat species complex of special status, the big brown bat—which does not have any special status—was also recorded at the site during the inventories. Since this is the only bat species without a special status and its ecological characteristics are similar to that of the other species, the potential impacts on this species are also discussed in this section.

9.3.4.1 Baseline conditions

Large wildlife and other mammals

Of the large wildlife species found in the area, only the woodland caribou is protected under both provincial and federal laws. The biophysical RSA is located in the northeastern portion of the James Bay Sector, a knowledge-gathering area for woodland caribou. This population is characterized by a scattered distribution, low density, and limited knowledge of its population dynamics.

Knowledge-gathering initiatives have been carried out in recent years to document the presence and abundance of woodland caribou in the James Bay Sector. During a survey conducted in 2020, 82 individuals, divided into small groups, were observed in the western sector of the survey area, which encompasses the biophysical RSA. After adjusting for detection rates, the total abundance was estimated at approximately 166 caribou for the West James Bay Sector, and the average density at approximately 0.17 caribou per 100 km² (Szor and Gingras, 2020). During another survey conducted in 2023 by Niigaan, no woodland caribou were observed. These results suggest that woodland caribou make little use of the biophysical RSA.

Furthermore, no telemetry tracking data for woodland caribou fitted with telemetry collars has been reported within the biophysical RSA for the period 2004–2024. However, this lack of data does not completely rule out the possibility that the area is being used, given the small proportion of individuals being tracked via telemetry in this region.

A few opportunistic caribou sightings were reported in 2025 near the exploration camp and along the Trans-Taiga Road, including a group of approximately 30 individuals observed in the spring. However, uncertainty remains regarding the ecotype of these observed individuals, particularly for observations made in the spring, given that telemetry tracking data compiled between 2004 and 2024 showed that migratory caribou from the Leaf River herd used the biophysical RSA between October and May.

An analysis of the disturbance rate of woodland caribou habitat within the biophysical RSA reveals a high level of disturbance, primarily attributable to forest fires. Although ongoing anthropogenic disturbances remain relatively limited within the biophysical RSA, the high proportion of natural disturbances reduces the availability and connectivity of high-quality habitats, contributing to a regional situation that is unfavourable for maintaining a self-sustaining population of woodland caribou. Although current knowledge does not provide a clear picture of the population trend for woodland caribou in this area, the likelihood of stable or increasing numbers could be relatively high (ECCC, 2024). According to a recent assessment of the vulnerability of woodland caribou populations in Quebec, the population in the James Bay Sector faces a “moderate to very high risk of extinction” (MELCCFP, 2026a).

The only species of small mammal of special status that has been recorded is the southern bog lemming. This species was captured in three areas of the biophysical LSA where inventories of small mammals were conducted. A higher abundance was observed in the western pit area, characterized by the presence of lichen tundra, as well as in the northern part of the biophysical LSA, where a variety of habitats—including peatlands and water bodies—appears to favour its presence. However, this species was less common in the central area, which was dominated by regenerating stands, suggesting that this type of habitat is less favourable to the species. Although it was not detected during the 2023 inventory in the biophysical LSA, the rock vole (*Microtus chrotorrhinus*)—another species that could be classified as threatened or vulnerable—is likely to be present there, as its preferred habitat is presumably found in the area. Therefore, this species should be considered potentially present. Although these two species are found throughout much of the province, they are closely associated with quite specific habitats and are therefore relatively rare within their range (Desrosiers et al., 2012; Gouvernement du Québec, 2025).

Chiropterans

A total of five bat species and species complexes of special status were recorded within the biophysical LSA during fixed-point acoustic surveys conducted between 2023 and 2025, including bats of the *Myotis* genus, the northern long-eared bat, the silver-haired bat, the hoary bat, and the red bat. The *Myotis* genus includes the northern long-eared bat and the little brown bat, both of which are species of special status. It should be noted that the big brown bat has also been recorded, but this species does not have a special status.

Of all the species recorded at the site, the hoary bat stands out for its abundance: up to 91% of the recordings are of this species. Other species have been recorded only sporadically, particularly during the breeding season. Overall, the activity levels recorded for the various bat species were very low (fewer than one sighting per night per station across all years and periods), despite a significant survey effort.

It should be noted that field surveys did not identify any hibernacula or maternity roosts. However, the presence of maternity roosts in the biophysical local study area remains a possibility. The study area of the local biophysical environment has numerous snags, and several species of bats regularly change their summer roosts using a network of sites in the same area (ECCC, 2018; ERCSQ, 2019). It is therefore possible that the sites inspected were used by chiropterans at another time, or that areas containing several snags that are less suitable were used preferentially.

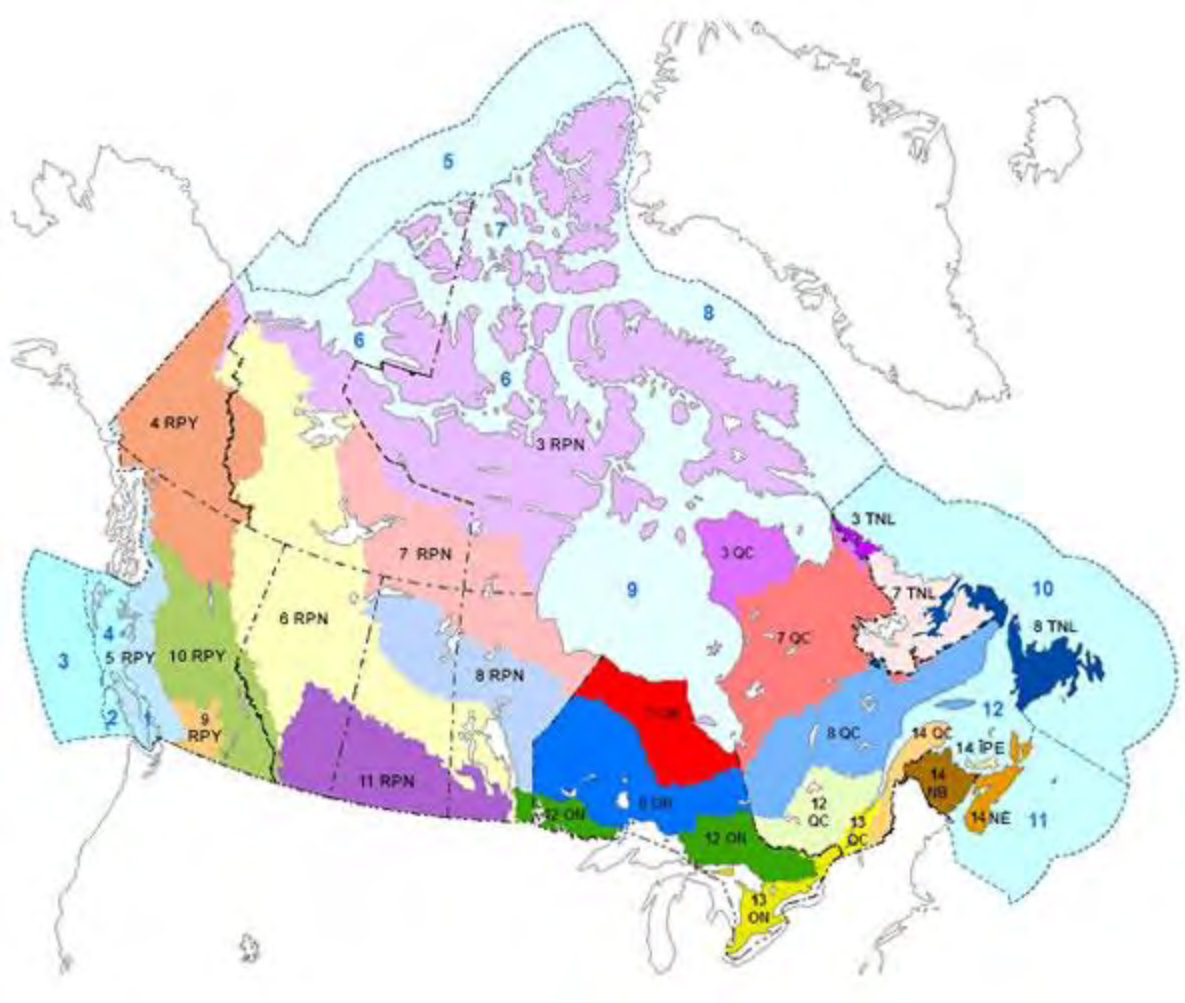
Avian fauna

A total of fifteen species of special status are potentially present in the biophysical LSA. Of these species, eleven were identified during inventories conducted from 2023 to 2025. Six of these species have the potential to nest in the biophysical LSA: the short-eared owl, the lesser yellowlegs, and the bank swallow, each of which has been recorded on a few occasions, as well as the rusty blackbird, the olive-sided flycatcher, and the common nighthawk, which have been observed frequently. For the other species, their potential to nest was ruled out due to their range, the absence of breeding-related behaviour, the lack of suitable nesting habitats, or the fact that historical records or inventory data were collected outside the breeding season.

The information presented below has been compiled for species of special status that are likely to nest to establish a quantifiable reference state of their use of the biophysical LSA. Several occurrences of short-eared owls have been recorded, including one report of probable nesting, where a pair was observed on several occasions in suitable habitat. As for the lesser yellowlegs, no signs of nesting or presence during the breeding season were observed in the biophysical LSA, but potential habitats for this species have been identified, and some will be affected by the project. An active colony of bank swallows has been confirmed, comprising approximately 30 to 35 occupied cavities and at least 14 adults. The common nighthawk has been consistently detected, with 42 individuals observed during twilight surveys at 18 of the 24 stations visited in 2024 and 14 individuals at 10 of the 15 stations visited in 2025. For land birds whose density was calculated using point counts in 2024 (the year with the highest number of stations sampled), the olive-sided flycatcher had a density of 0.5 indicated pairs per hectare across all habitat types, while the rusty blackbird had a density of 3.3 indicated pairs per hectare.

Bird Conservation Regions (BCRs) are ecologically distinct regions in North America with similar bird communities, habitats, and resource management approaches (Birds Canada and NABCI, 2014). They are delineated by the Commission for Environmental Cooperation (CEC) and are based on a flexible-scale hierarchical framework of nested ecological units.

The project is located in BCR 7, which is associated with the Taiga Shield and the Hudson Plains. The establishment of the reference status for the six selected species is therefore based on data from BCR 7, which were analyzed for the geographic analysis level covering the Taiga Shield and the Hudson Plains on the Canadian scale (Figure 9-1).



Source: EC, 2017

Figure 9-1 Bird Conservation Regions (BCRs) in Canada

For each of the selected species, the annual index is presented in Table 9-6 for the years 1970, 2016, and 2023. The index recorded in 2023 is still lower than that of 1970, indicating a potential decline in the populations of these species.

Table 9-6 Annual index of abundance of bird species of special status for the BCR 7 in Canada for the reference year (1970), 2016, and 2023

Species	Annual index[1]		
	1970	2016[2]	2023[3]
Common nighthawk	0.16	0.05	0.06
Short-eared owl [4]	n/a	n/a	n/a
Bank swallow	2.03	1.87	1.40
Olive-sided flycatcher	1.50	0.87	0.81
Lesser yellowlegs	7.93	2.19	1.79
Rusty blackbird	12.40	1.71	1.46

Notes: 1 Indicates the estimated average abundance along the transects of the Breeding Bird Survey (BBS) long-term monitoring program for breeding bird populations, as recorded by an average observer during a given year.
2 2016 corresponds to a period prior to the first drilling operations carried out by PMET.
3 The most recent year that reliable data is available for BCR 7 is 2023.
4 Insufficient data for the analysis of annual indices.
n/a Not applicable.
Source: Smith et al., 2025

9.3.4.2 Historical trends

Large wildlife and other mammals

On the Quebec scale, the woodland caribou experienced a marked and prolonged decline during the 20th century (Courtois et al., 2003). Historical data indicate varying population densities, ranging from nearly 7 caribou per 100 km² (e.g., 6.67 caribou per 100 km² in the Praslin-Betsiamites area in 2006) to less than 0.5 caribou per 100 km² (e.g., 0.21 caribou/100 km² north of Saguenay–Lac-Saint-Jean in 2004). Since the 2010s, estimated densities have more frequently been less than 2 caribou per 100 km², although some populations have higher densities, reaching more than 3 caribou per 100 km² (e.g., 6.29 caribou per 100 km² north of the Manicouagan Reservoir). For woodland caribou populations that have been surveyed at least twice, the trend is generally toward a decline in abundance and density (MFFP, 2021). On the Quebec scale, recent surveys suggest that the population of woodland caribou ranges between 6,800 and 8,900 individuals (MELCCFP, 2026a).

Population studies indicate that several local populations of woodland caribou in Quebec have annual survival rates for adult females below the 85% threshold required for stability, as well as recruitment rates below the threshold of 28.9 calves per 100 females, which contributes to the overall downward trend (Courtois et al., 2003; MFFP, 2021; MELCCFP, 2026a).

On the scale of the James Bay Sector, survey results suggest a very low density of woodland caribou. In 2020, the estimated average density for the entire surveyed area was approximately 0.55 caribou per 100 km², but the distribution of individuals was heavily skewed toward the eastern sector of the survey area, while the western sector showed sparse and discontinuous occurrence (Szor and Gingras, 2020). In 2001, a survey conducted in the southwestern part of James Bay indicated a significantly higher density of 3.5 caribou per 100 km² (Paré and Jourdain, 2002), suggesting a marked decline in caribou abundance in that area.

There is little data available on the two species of small mammals of special status whose presence in the region has been confirmed or is suspected: southern bog lemming and the rock vole (Gouvernement du Québec, 2025). Available data suggest that southern bog lemming populations experience significant fluctuations in population size from year to year (Desrosiers et al., 2012), as is the case for most species of small mammals (Hanski, 2001; Korpimäki, 2005). The rock vole, on the other hand, is rarely captured and has been recorded only in low densities in Quebec (Desrosiers et al., 2012; Gouvernement du Québec, 2025). It is therefore not possible to identify historical trends for these two species.

Chiropterans

Information concerning chiropterans in the Nord-du-Québec region is too scarce and fragmentary to define historical trends for the populations of the various species. Only the data from the *Réseau québécois d'inventaire acoustique de chauves-souris*, the Quebec network of acoustic bat inventories (the Network), published in the CHIROPS newsletter (Desrosiers and Berthiaume,2024), provide annual monitoring data for the city of Chibougamau from 2003 to 2020. However, the number of observations is too small to make a meaningful comparison of relative abundances from one year to the next. Furthermore, it is known that, as a result of climate change, several bat species are experiencing a northward expansion of their range (Festa et al., 2023), although data are currently lacking to assess this trend in Quebec.

The main factor affecting chiropteran population trends is undoubtedly the emergence of white-nose syndrome (WNS), first identified in Quebec in 2010 (U. S. Fish and Wildlife Service, 2025; RCSF, 2026) and observed since the winter of 2011–2012 in the Nord-du-Québec region up to Chibougamau (U. S. Fish and Wildlife Service, 2025; RCSF, 2026). WNS has indeed caused significant mortalities (more than 90% of known populations) in resident bat populations, particularly among species of the *Myotis* genus (U. S. Fish and Wildlife Service, 2025).

The effects of human development projects on bat populations are mainly associated to habitat loss (Tremblay and Jutras, 2010). In northern Quebec, several development projects have resulted in the alteration or loss of bat habitat, even though these projects are very localized. Whether they involve infrastructure and service projects (e.g., the construction of the La Grande hydroelectric complex [see Section 9.3.2.2] or mining projects [e.g., the James Bay-Galaxy lithium mine project], all involve clearing and encroachment on wetlands, which are potential sources of bat habitat loss and alteration. These projects are also associated with the creation of roads and/or power transmission corridors that also contribute to these habitat losses, but may also be sources of positive effects for chiropterans. In fact, when moving from one site to another, bats generally use linear forest structures for guidance, such as road or power line rights-of-way (Grindal and Brigham, 1998; Henderson and Broders, 2008). Forest edges are also potential feeding sites for several species (ERCSQ, 2018).

In addition, several forest fires also occurred within the spatial boundaries considered for cumulative impacts, particularly in 2023, affecting large areas of forest habitat, some of which likely served as potential habitats for bats. It should be noted that clearing activities, as well as forest fires, also contribute to fragmentation of forest habitats and result in the creation of linear features that will be used by some chiropteran species (ECCC, 2018).

In 2012, noting the mass mortality of bats caused by WNS, COSEWIC recommended endangered status for three bat species: tri-coloured bat, little brown bat, and northern long-eared bat. This status was reviewed and confirmed in November 2013 (COSEWIC, 2014), and these species were subsequently added to Schedule 1 of SARA on December 17, 2014 (Government of Canada, 2014). The little brown bat and the northern long-eared bat had no special provincial or federal status until then. Since 2023, these three species have also been added to Quebec's list of threatened species (Gouvernement du Québec, 2025).

In 2023, COSEWIC recommended that the three species of migratory bats—the silver-haired, hoary, and red bats—be classified as “endangered” (COSEWIC 2023). Although there is little data on population status and exact decline rates, migratory species face several threats, the most significant of which is mortality in wind farms (COSEWIC 2023). At this time, these three species have not been added to Schedule 1 of the SARA (Government of Canada, 2026). In Quebec, the hoary bat and the silver-haired bat are likely to be designated as threatened or vulnerable, while the red bat is considered vulnerable (Gouvernement du Québec, 2025).

In conclusion, due to the lack of specific data on regional population dynamics, there is no clear trend for the study area considered. We can therefore only assume that the populations there have declined in a similar way to the rest of Quebec, since the main cause appears to be WNS. Habitat loss is also a major concern for bats, although in northern Quebec, disturbances generally remain localized. Furthermore, climate change could lead to shifts in community composition and changes in the relative abundance of certain species, but there is still insufficient data to identify a trend.

Avian fauna

As with the reference state, the data compiled for BCR 7 were used to describe the historical trends of the six selected species. Since data for BCR 7 covering only Quebec are not available, data for the entire BCR 7 region were used. It should be noted that there was insufficient data on the short-eared owl to allow for analysis.

Thus, long-term population trends in BCR 7 show a certain decline. In fact, historical trends assessed since 1970 show that numbers have declined for all bird species included in the cumulative impact assessment. However, in the short term, the trends appear to be more favourable. In fact, common nighthawk populations are showing an increasing trend. In addition, the downward trend observed in the bank swallow, the olive-sided flycatcher, and the rusty blackbird is less pronounced. Only the trend for lesser yellowlegs populations remains virtually unchanged in both the short and long term, i.e., they are declining.

Data on population sizes available for the entire BCR 7 region in Canada indicate that this region is home to 300,000 common nighthawks, 5,100 short-eared owls, 82,000 bank swallows, 110,000 olive-sided flycatchers, and 4,600,000 rusty blackbirds, representing 1.30%, 0.22%, 0.28%, 5.79%, and 67.65% of the total numbers of these overall populations, respectively (PIF, 2020; Table 9-7). Therefore, the majority of the common nighthawk breeding population is located in BCR 7. On the Quebec scale, 32.35% of the overall population of the rusty blackbird is found in BCR 7.

As for the short-eared owl, trends are difficult to estimate given the scarcity of data. Overall, however, the various sources agree that there has been a marked and widespread decline in the population, despite uncertainty regarding the exact extent of this decline. The best estimates indicate that the Canadian population consists of approximately 31,000 mature individuals, and that the species has experienced significant declines, ranging from 70% to 79% since 1970, as well as around 30% over the past three generations (COSEWIC, 2021).

For the lesser yellowlegs, although the population estimation method used on the BCR scale does not include shorebirds (PIF, 2020), the overall population is estimated at a minimum of 527,000 mature individuals, of which approximately 80%, or nearly 422,000, nest in Canada (COSEPAC, 2020).

Table 9-7 Population trends of bird species of special status that are likely to nest in the RSA

Species	Population (number)			Proportion of the population		Annual population trend (%)	
	BCR 7-Quebec	BCR 7-Canada	Overall	BCR 7-Quebec/Overall	BCR 7-Canada/Overall	BCR 7-Canada	
						Short term	Long term
Common nighthawk	n/a	300,000	23,000,000	n/a	1.30 %	-3.87	-1.65
Short-eared owl [1]	n/a	5,100	2,300,000	n/a	0.22 %	n/a	n/a
Bank swallow	45,000	82,000	29,000,000	0.16 %	0.28 %	-2.04	-5.86
Olive-sided flycatcher	42,000	110,000	1,900,000	2.21 %	5.79 %	-0.75	-1.20
Lesser yellowlegs[2]	n/a	n/a	660,000	n/a	n/a	-2.81	-2.77
Rusty blackbird	2,200,000	4,600,000	6,800,000	32.35 %	67.65 %	-2.35	-3.95

Notes: 1 Insufficient data for the analysis (n/a)
2 Population estimates were calculated only for land birds (n/a)
n/a Not applicable
Sources: Smith et al., 2025; PIF, 2020; ECCC and Birds Canada, 2024

9.3.4.3 Significant projects, activities, or events

Significant projects, activities, or events that could have a cumulative impact, in conjunction with the project, on wildlife species of special status are those located within a 50-kilometre radius of the project. These include the following:

- Mining exploration activities;
- The operational activities of the borrow pits located on either side of Trans-Taiga Road.
- Operations and maintenance activities at the La Grande-4 facility.
- Maintenance work at the LG-4 and Tilly substations, as well as on the lines connecting these substations to the Lemoyne substation (to the west) and the Laforge substation (to the east).
- Any maintenance work on the Trans-Taiga Road;
- Operations and maintenance activities associated with LG-4 Airport;
- The operation of the LG-4 landfill site;
- The effects of some forest fires;
- White-nose syndrome (WNS).

9.3.4.4 Cumulative impacts

The project's effects on wildlife species of special status—which could result in cumulative impacts when combined with the effects of other projects, activities, or events—relate to three main aspects: the loss and fragmentation of existing habitats (vegetation clearing and site grading), disturbance of their activities in the area (noise, dust, and light), and, to a lesser extent, the risk of habitat degradation (accidental spills or leaks of contaminants).

Of the projects, events, and activities listed in the previous section, only mining exploration activities and forest fires are likely to contribute to habitat loss and fragmentation for the various wildlife groups under consideration.

With regard to the disruption of the activities of the species in question, all of the projects described above are likely to cause adverse effects, including WNS, which can harm the health of bats and even cause their death. It should be noted, however, that apart from mining exploration activities, forest fires, and WNS, other activities are located too far away (>5 km) from the project site for the nuisances they generate (related to site operations and maintenance) to have a cumulative effect with those generated by the project. With regard to forest fires, it appears that the largest fire near the project site occurred in 2012 and came within about 10 km to the southeast. The areas affected by the fire are currently undergoing forest regeneration.

Lastly, the risks of habitat degradation due to accidental spills or leaks of contaminants are associated with isolated incidents that are closely linked to the project's area of operations. The only activities that could potentially pose a contamination risk near the project site are those associated with mineral exploration.

Large wildlife and other mammals

The anticipated significance of the project's overall residual impact on woodland caribou and the southern bog lemming is moderate. Given that mining exploration activities in the area in question may have cumulative effects, as may past forest fires—the most recent of which occurred in 2012—and considering that the woodland caribou is very scarce and that habitats suitable for the southern bog lemming are relatively abundant, make it possible to anticipate a low-intensity effect, of local extent and medium duration. The resulting cumulative impact would therefore be of **low** significance.

Chiropterans

The anticipated significance of the project's overall residual impact on bats is moderate to low. Given that only the mining exploration activities taking place in the area in question are likely to have cumulative effects, and considering the most recent forest fires dating from 2012 (the extent of WNS in the region is unknown), the anticipated cumulative impacts will likely be negligible and will consist mainly of increased disturbance to bats in the vicinity of the project, as well as isolated losses and alterations to their habitat. Consequently, a low-intensity effect, of local extent and medium duration, is anticipated, resulting in a cumulative impact considered to be **low**. . Therefore, the project will not result in significant cumulative impacts on chiropterans.

Avian fauna

The anticipated significance of the project's overall residual impact on bird species of special status is moderate to low. Given that mining exploration activities in the area in question, as well as past forest fires—the most recent of which occurred in 2012—may have a cumulative effect on habitat loss and fragmentation, an effect of moderate intensity, local extent, and medium duration is anticipated, and a **moderate** cumulative impact is anticipated. As for disturbances associated with nuisances, only activities related to certain mining exploration sites located near the project are likely to have an effect of which the intensity is considered to be low, with local extent and medium duration, resulting in a cumulative impact of **low** significance.

9.3.4.5 Mitigation, compensation, and follow-up measures

No additional mitigation measures or environmental follow-up other than those identified in Chapter 8 and the table in Appendix 8-2 are required for wildlife species of special status

9.3.5 Terrestrial wildlife and wildlife habitats

The assessment of cumulative impacts on terrestrial wildlife and wildlife habitats refers to the project's residual impacts on this VEC, which may potentially be additive to those of other existing projects or events, or those that may occur within the territorial boundaries (spatial scope) set out in Table 9-2.

9.3.5.1 Reference state

Large wildlife and other mammals

The biophysical RSA overlaps the range of the Rivière-aux-Feuilles migratory caribou herd (RAFH). Although a few individuals from the Rivière George herd (RGH) have also used the biophysical RSA, the area was predominantly used by individuals from the RAFH during the 2004–2024 period.

The biophysical RSA is a potential wintering area for migratory caribou. Telemetry tracking data collected between 2004 and 2024 show that migratory caribou, primarily of the LRH, were present in the biophysical RSA between October and May, with marked year-to-year variations. The number of individuals that visited the biophysical RSA was highest in 2009, at 113. Starting in 2016, a significant decline in the annual number of individuals visiting the biophysical RSA has been observed, with the number ranging from 1 to 7 through 2024. However, it is important to note that individuals fitted with telemetry collars represent only a small proportion of the caribou population. The population density of migratory caribou is unknown.

For moose (*Alces alces*), an aerial survey conducted in 2023 in the biophysical RSA identified 27 individuals divided into 14 groups, corresponding to a low density of 0.23 moose per 10 km². The observed population structure (37% females, 41% males, and 22% calves) suggests a balanced composition in a northern context. In addition, within the biophysical LSA, four moose were observed near the access road (Niigaan, 2023).

No targeted survey of black bears (*Ursus americanus*) has been conducted in the study area, but the species is known to be present throughout the James Bay region. Historical regional estimates for Hunting Zone 22 indicate a density of approximately 0.20 bears per 10 km², although these values are based on indirect methods and are subject to a high degree of uncertainty (Lamontagne et al., 1999; Société de la faune et des parcs, 2003). The presence of black bears in the biophysical LSA is also confirmed by opportunistic sightings made during field surveys in the summer of 2022 (BBA, 2022).

No specific survey has been conducted for the grey wolf (*Canis lupus*) in the biophysical RSA. However, its presence in the James Bay region is constant and well documented. In 2002, wolf densities north of the 50th parallel were estimated to be between 0.3 and 0.5 wolves per 100 km² (Jolicoeur and Hénault, 2002).

With regard to small mammals, the survey conducted in 2023 to establish the project's reference state for wildlife (Niigaan, 2025) identified eight of the twelve species potentially present in the biophysical LSA. However, there is no data on population trends, particularly at this latitude. Small mammals are in fact known for the marked cyclical fluctuations in their populations, particularly as a result of predation (Hanski, 2001; Korpimäki, 2005).

Avian fauna (including migratory birds)

The various inventories conducted in 2023, 2024, and 2025 identified 114 species, including 25 species of waterfowl and other water birds, 9 species of shorebirds, 15 species of birds of prey, and 65 species of land birds. The total estimated density of land birds based on point count surveys was 3.7 indicated pairs per hectare across all habitats in 2024, and 3.5 in 2025. Based on an average of 3.6 indicated pairs per hectare, it is estimated that the biophysical LSA is home to 74,520 indicated pairs, including 4,320 in the project study area.

Bird Conservation Regions (BCRs) are ecologically distinct regions in North America with similar bird communities, habitats, and resource management approaches (Birds Canada and NABCI, 2014). They are delineated by the Commission for Environmental Cooperation (CEC) and are based on a flexible-scale hierarchical framework of nested ecological units.

The project is located in BCR 7, which is associated with the Taiga Shield and the Hudson Plains. Data from BCR 7 on the Quebec and Canadian scales were consulted to document the reference status of bird populations, particularly migratory birds. Bird populations in the Quebec portion of BCR 7 are estimated to number approximately 155 million individuals, based on assessments of 51 land species, representing an average of 5.39% of the overall population for all species (PIF, 2020). On the Canadian scale, there are an estimated 596 million birds in BCR 7 across the 105 land species analyzed, representing an average of 10.16% of the overall population for these species.

However, an analysis of population trends in the course of developing the bird conservation strategy for BCR 7 in the Quebec region highlights a major obstacle: a widespread lack of monitoring data, attributable to the vast expanse and limited accessibility to the territory. For example, 57% of priority species are assigned the "Assess/maintain" status due to a lack of sufficient information to clearly document their population trends. In total, 52 of the 54 priority species are identified as requiring critical improvements in our understanding, which underscores the fragmentary nature of the historical data available.

9.3.5.2 Historical trends

Large wildlife and other mammals

The LRH and GRH have experienced significant population fluctuations in recent decades. The LRH migratory caribou population experienced strong growth between the 1970s and the early 2000s, rising from approximately 56,000 individuals in 1975 to an estimated peak of 628,000 caribou in 2001, before entering a phase of sustained decline beginning in 2013 (Couturier et al., 2004; Taillon et al., 2016). According to the most recent data, the LRH population has been estimated at 136,000 caribou in 2025, representing a decline of approximately 78% since the population peak reached in 2001.

The GRH migratory caribou reached a population peak in the late 1980s and early 1990s, numbering approximately 800,000, before experiencing a significant decline in numbers beginning in 1993. In 2018, the population reached its lowest recorded level, with 5,500 caribou. In 2020, the population size was estimated at 8,100 caribou (Brodeur et al., 2022). According to the most recent data, the GRH population has been estimated to be 8,600 caribou in 2025, representing a decline of approximately 99% since the population peak reached in 1990.

In Quebec, moose populations grew significantly between the early 1990s and the late 2000s, roughly doubling to reach nearly 120,000 individuals in 2010. This expansion phase was followed by a slowdown in growth between 2004 and 2010, and a stabilization of populations in several hunting zones, particularly north of the St. Lawrence River (Lefort and Massé, 2015). On the Quebec scale, the moose population monitoring indicators recently published by the Quebec government suggest that the moose population is relatively stable (MELCCFP, 2026b).

According to the Quebec government, the black bear population in Quebec has been growing steadily since 1998. This increase is attributed to the species' high adaptability, increased food availability in managed landscapes, and prudent harvest management. The most recent estimates put the black bear population in Quebec at between 70,000 and 75,000 individuals, and trends are considered generally stable to slightly increasing, although they vary by region (Bédard, 2023).

Population trends for the grey wolf in Quebec are documented indirectly using harvest data (trapping and hunting) and provincial harvest reports. These data suggest that the grey wolf is present throughout most of Quebec north of the St. Lawrence River, and that its populations have remained generally stable for several decades, despite local fluctuations (MELCCFP, 2022).

Due to the lack of available data on small mammals at this latitude, and especially given the significant year-to-year fluctuations in their population sizes—primarily linked to predation and, more specifically, to the impact of specialist predators (Hanski, 2001; Korpimäki, 2005)—it is not possible to assess historical trends for the various species recorded or potentially present in the region.

Avian fauna (including migratory birds)

Due to a lack of data, general trends in the bird populations of BCR 7 remain difficult to assess, particularly on the Quebec scale. For many species, there is insufficient data to calculate trends.

On the Canadian scale, the report entitled "The State of Canada's Birds" (Birds Canada and ECCC, 2024) assesses 463 bird species regularly observed across the country. Of these species, 36% are declining, 31% are increasing, 21% are relatively stable, and 12% lack sufficient data to determine a trend. Despite some notable improvements in certain groups, several bird categories are experiencing marked and persistent declines, reflecting significant pressures on ecosystems across the country.

However, some groups are responding positively to conservation measures. Historical data show a cumulative increase of 46% for waterfowl, 35% for birds of prey, and 21% for wetland birds since 1970, reflecting the effectiveness of targeted strategies such as wetland restoration and the reduction of environmental contaminants (e.g., the ban on DDT).

In contrast, several guilds are experiencing severe and ongoing declines. Grassland birds are the most affected group, with a 67% decline in their populations since 1970, primarily due to agricultural conversion and widespread degradation of native grasslands. Shorebirds, many of which migrate across continents, have also seen a substantial decline of 42%. Aerial insectivores have shown a cumulative decline of 43%, consistent with the documented decline in insect populations and the intensification of agricultural practices. Despite a recent stabilization, current levels remain well below historical averages.

With regard specifically to migratory birds, long-distance migrants have experienced a marked population decline, with an estimated 29% decrease in their numbers since 1970. Short-distance migrants, which primarily migrate to the temperate regions of North America and Europe, show a more moderate decline of 12%. By comparison, resident species showed a net increase of 9% over the same period. These contrasting findings suggest that long-distance migration exposes the species in question to a range of additional environmental stresses, including habitat degradation outside Canada, the cumulative impacts of climate change, and an increase in human-induced threats along migration routes.

9.3.5.3 Significant projects, activities, or events

Significant projects, activities, or events that could have a cumulative impact on terrestrial wildlife and wildlife habitats in conjunction with the project are those located within a 50-kilometre radius of the project. These include the following:

- Mining exploration activities;
- The operational activities of the borrow pits located on either side of Trans-Taiga Road.
- Operations and maintenance activities at the La Grande-4 facility.
- Maintenance work at the LG-4 and Tilly substations, as well as on the lines connecting these substations to the Lemoyne substation (to the west) and the Laforge substation (to the east).
- Any maintenance work on the Trans-Taiga Road;
- Operations and maintenance activities associated with LG-4 Airport;
- The operation of the LG-4 landfill site;
- The effects of some forest fires.

9.3.5.4 Cumulative impacts

The project's effects on wildlife species and wildlife habitats—which could result in cumulative impacts when combined with the effects of other projects, activities, or events—relate to three main aspects: the loss and fragmentation of existing habitats (vegetation clearing and site grading), disturbance of their activities in the area (noise, dust, and light), and, to a lesser extent, the risk of habitat degradation (accidental spills or leaks of contaminants).

Of the projects, events, and activities listed in the previous section, only mining exploration activities and forest fires are likely to contribute to habitat loss and fragmentation for the various wildlife groups under consideration.

With regard to the disruption of the activities of the species in question, all of the projects described above are likely to cause nuisances. It should be noted, however, that apart from mining exploration activities and forest fires, other activities are located too far away (>5 km) from the project site for the nuisances they generate (related to site operations and maintenance) to have a cumulative effect with those generated by the project. With regard to forest fires, it appears that the largest fire near the project site occurred in 2012 and came within about 10 km to the southeast. The areas affected by the fire are currently undergoing forest regeneration.

Lastly, the risks of habitat degradation due to accidental spills or leaks of contaminants are associated with isolated incidents that are closely linked to the project's area of operations. The only activities that could potentially pose a contamination risk near the project site are those associated with mineral exploration.

Large wildlife and other mammals

The anticipated significance of the project's overall residual impact on migratory caribou, moose, black bears, grey wolves, and other mammals is moderate to low. Given that mining exploration activities in the area in question may have cumulative effects, as may past forest fires—the most recent of which occurred in 2012—and given that migratory caribou are scarce while other mammal populations in the area are stable,a low-intensity effect, of local extent and medium duration, is anticipated, resulting in a cumulative impact of **low** significance on this wildlife group.

Avian fauna

The anticipated significance of the project's overall residual impact on the avian fauna of the biophysical LSA is moderate to low. Given that mining exploration activities in the area in question, as well as past forest fires—the most recent of which occurred in 2012—may have a certain cumulative effect on habitat loss and fragmentation, an effect of moderate intensity, local extent, and medium duration is anticipated, resulting in a moderate cumulative impact. As for disturbances associated with nuisances, only activities related to certain mining exploration sites located near the project are likely to have an effect of low itensity, with local extent and medium duration. This results in a cumulative impact of **low** magnitude.

9.3.5.5 Mitigation, compensation, and follow-up measures

No additional mitigation measures or environmental follow-up other than those identified in Chapter 8 and the table in Appendix 8-2 are required for terrestrial wildlife and wildlife habitats.

9.3.6 Physical, psychological, and social health of the regional population (health, social, and economic conditions of Indigenous Peoples)

The assessment of cumulative impacts on the physical, psychological, and social health of the regional population refers to the project's residual impacts on this VEC, which may potentially be additive to those of other existing projects or events, or those that may occur within the territorial boundaries (spatial scope) set out in Table 9-2.

9.3.6.1 Baseline conditions

The overall health status of Cree communities is characterized by a lower life expectancy at birth than that of the Nord-du-Québec region and Quebec as a whole, but life expectancy begins to approach provincial averages starting at age 65 (WSP, 2026). The higher infant mortality rate is believed to be due to the lack of access to prenatal care, perinatal and postnatal care, and family support.

In terms of physical health, type 2 diabetes was a significant concern, as it affected more than 30% of the population. Cancer rates are similar to those in the rest of Quebec, with the most common types being kidney, lung (the most prevalent in the region, accounting for 44% of cases), colon, and breast cancer. Its prevalence has risen from 2.1% 30 years ago to 3.6% of the population today. High blood pressure is the leading risk factor for cardiovascular disease, with one in three people in the region reportedly affected. Although the data are not fully representative, it appears that heart disease and chronic obstructive pulmonary disease (COPD) are more prevalent in the Nord-du-Québec region than in the rest of the province. Sexually transmitted diseases have shown a significant decline in recent years, while hepatitis C and HIV are reportedly rare or nonexistent. However, teenage pregnancy rates are significantly higher among 14- to 17-year-olds and 18- to 19-year-olds. Lastly, the hospitalization rate is significantly higher than in the rest of Quebec, with the most common causes related to the respiratory system, the digestive system, injuries, the circulatory system, and the genitourinary system. These are more or less the same factors that account for the majority of causes of death.

With regard to mental health, the suicide rate per 100,000 residents is slightly lower than that of the rest of the province, but the number of hospitalizations for suicide attempts is nearly four times higher. Between 2014–2015 and 2020–2021, a 7% increase in cases of psychological distress was observed among people aged 15 and older across Quebec, rising from 32% to 39%. However, this trend did not appear to extend to the Nord-du-Québec region, which remained relatively stable during the same period (33% to 34%). Women and high school students are reportedly the most likely to be affected. Lastly, the proportion of people reporting high levels of daily stress was only 12% in the Nord-du-Québec region between 2019 and 2020, compared to 23% for the rest of the province.

9.3.6.2 Historical trends

The Cree communities of Eeyou Istchee have been deeply affected by colonial policies that have led to persistent structural injustice, resulting in significant impacts on their physical, psychological, and social health (WSP, 2026).

Among the events that were most disruptive to Cree communities were:

- The residential school system, which caused intergenerational trauma, the loss of languages and cultures, as well as physical and psychological abuse. These effects have led to major upheavals in the transmission of traditional knowledge and practices.
- Displacement resulting from hydroelectric development, as well as the loss of land and valuable sites that have been submerged by the reservoirs. This relocation led to major social and economic changes, and trauma persists in Chisasibi due to the hydroelectric facilities upstream from the village.

It is also important to highlight the challenges associated with the often-necessary travel to healthcare facilities located outside the region, which are rarely culturally appropriate, thereby compromising the quality of care. However, some medical care is provided by the Chisasibi Hospital, which will soon be replaced by the Eeyou Istchee Regional Health Centre (currently under construction).

On the other hand, the development of families, of communities, and of First Nations, as well as culture, the land, and self-determination, are identified as factors that promote protection and resilience at both the individual and collective levels. These factors, which are believed to mitigate the effects of racism, structural discrimination, and historical trauma, are reflected in a series of events that have contributed to them, namely:

- The signing of the JBNQA in 1975 marked a major milestone for Cree self-determination by recognizing their territorial rights and enabling the establishment of their own governance structures, which led to the creation of regional institutions to manage essential services.
- The establishment of the Cree Board of Health and Social Services of James Bay (CBHSSJB), which manages health and social services for people living permanently or temporarily in the region. This Board enables the Cree people to take charge of their own services while advancing their self-determination, strengthening their collective resilience, and helping to reduce social inequalities in health. The CBHSSJB regularly consults with communities to improve services and adopts a holistic approach that better aligns with the expectations of the communities involved.

9.3.6.3 Significant projects, activities, or events

Significant projects, activities, or events that could have a cumulative effect, in conjunction with the project, on the physical, psychological, and social health of the regional population are those that may have an impact within the territory encompassing all or part of the communities of Chisasibi, Mistissini, and Wemindji. These include the following:

- Mining exploration activities, including in particular those associated with the Cancet and Tilly projects of Winsome Resources Ltd.
- Operations at the Éléonore and Andina mines;
- The operations of borrow pits located within the defined area;
- Operations and maintenance activities at the facilities of the La Grande complex and Sarcelle complex;
- Maintenance and operation of all substations and power lines within the defined area;
- The operation and maintenance of the Trans-Taiga Road and the Billy-Diamond Highway;
- The completion of various road and rail projects planned under the Grand Alliance agreement;
- The operation and maintenance of the various airports and airfields located within the defined area;
- The operation of landfills located within the defined area;
- The construction and presence of telecommunications towers within the defined area;
- Forest fires occurring within the area;
- Residential schools;
- The signing of the JBNQA (1975);
- The Paix des Braves agreement and other accords;
- The Plan Nord
- La Grande Alliance.

9.3.6.4 Cumulative impacts

The project's effects on the health and well-being of Indigenous communities in the region include:

- Restrictions on access to certain areas of the territory;
- The fragmentation of this territory;
- The opening of new access routes to the territory;
- The physical and mental health risks associated with working outside the community;
- The social disruption caused by the growing presence of non-Indigenous people in the area and by the increasing wealth of a segment of the community.

All resource development projects taking place within the area in question may have a cumulative impact on the members of the communities living in that area. When combined with existing roads and airports, they result in some restrictions on access to the area while contributing to the fragmentation of its components. More frequent contact between members of Indigenous communities and predominantly non-Indigenous environments can contribute to the erosion of the social fabric through the adoption of non-traditional lifestyles. Several mining projects are already underway or in the planning stages, not to mention mining exploration, which remains very active. In addition, the Great Alliance agreement calls for the implementation of major infrastructure projects (roads, ports, railways) that will further open up the territory of the Cree communities while providing them with easier access to non-Indigenous communities in the south. These projects, combined with forest fires, will generate various pollutants that could alter the quality of life for Indigenous communities and affect their health in the medium and long term. It should be noted, however, that many of the anticipated projects are only planned for the medium to long term, and that some of the existing mining projects could be completed before these new ones are even launched. Nevertheless, given the importance of this VEC to Indigenous communities, an effect of moderate intensity, regional extent, and medium duration is anticipated, resulting in a cumulative impact of **moderate** significance.

9.3.6.5 Mitigation, compensation, and follow-up measures

No additional mitigation measures or environmental follow-up other than those identified in Chapter 8 and the table in Appendix 8-2 are required for this VEC. Nevertheless, it would be important for PMET to consider participating in any regional committee established by the Government of Eeyou Istchee to ensure better management of the territory and its development, as well as greater involvement of Cree communities in decision-making processes related to their territory.

9.3.7 Road safety

The assessment of cumulative impacts on road safety refers to the project's residual impacts on this VEC, which may potentially be additive to those of other existing projects or events, or those that may occur within the territorial boundaries (spatial scope) set out in Table 9-2.

9.3.7.1 Baseline conditions

The baseline conditions for road traffic is based on two distinct categories of information: the existing capacity—in terms of traffic volume—of the Trans-Taiga Road and the Billy-Diamond Highway, as well as the most recent available statistics on accidents that have occurred within the territory of the Jamésie RCM, where these two roads serve as the main thoroughfares.

With regard to current traffic volumes on the Trans-Taiga Road, a traffic study conducted as part of the project shows that they are relatively low for a road with a theoretical capacity of several hundred vehicles per hour in both directions. In fact, as shown by the results of two camera-based traffic count campaigns conducted over two 7-day periods (March and May 2025), the maximum hourly traffic volumes peaked at less than 10 vehicles during the March 2025 campaign and at a maximum of 12 vehicles during the May campaign. Although no recent traffic counts have been conducted on Billy-Diamond Highway, data covering the period from 2014 to 2017, provided by Quebec's transport ministry (Ministère des Transports du Québec) in 2018 as part of another project, showed an annual traffic volume of approximately 56,000 vehicles (in both directions), consisting mainly of pickup trucks (65%) and semi-trailers (20%). By spreading this figure over the course of the year and then over 12 hours of active traffic per day, a very rough estimate of 13 vehicles per hour is obtained for a road with a theoretical capacity of at least 1,500 vehicles per hour in both directions.

With regard to accidents recorded in the Jamésie RCM, primarily on the Trans-Taiga Road and the Billy-Diamond Highway, SAAQ statistics (2026) show a total of 177 accidents in 2024, resulting in 6 fatalities, 6 serious injuries (requiring hospitalization), and 59 minor injuries.

9.3.7.2 Historical trends

There is no doubt that since the construction of the Billy-Diamond Highway and the Trans-Taiga highway in the 1970s, traffic in the area has been particularly heavy throughout the development of the La Grande hydroelectric complex and, later, the Laforge and Caniapiscau power plants. Subsequently, traffic levels stabilized in line with the operational needs of these power plants and the traffic associated with the Cree communities along James Bay. The gradual upgrading of the Billy-Diamond Highway beginning in 2015 (L'Aurore, 2025) coincides with significant mining exploration activities and the development of certain mature mining projects. Nevertheless, most of the projects currently under development are located south of the Trans-Taiga Road, and the increase in traffic that may result from them primarily affects the Billy-Diamond Highway. Exploration activities targeting the formation, which includes spodumene pegmatite intrusions that are a key focus of the project, will help increase traffic on both the Billy-Diamond Highway and the Trans-Taiga Road. However, the expected increase in traffic resulting from the project will mean an additional 70 to 71 vehicles per day during the operations phase, which remains well below the capacity of the two roads. Several other projects, primarily mining projects, could also increase traffic on these two roads, but no data is currently available regarding the expected number of additional vehicles.

Lastly, the various projects outlined in the Grand Alliance agreement could change this picture, since:

- The Billy-Diamond Highway should be extended to Whapmagoostui, where a deep-water port should be built. The new section could increase traffic on existing roads, but the port's opening could provide a new supply route for communities and various development projects and active sites, thereby reducing traffic on the Billy-Diamond Highway.

- Extending Route 167 to the Trans-Taiga Road could provide an additional route to the south for the supply and transport of mining and other products generated by various projects, thereby reducing traffic on certain sections of the Trans-Taiga Road and the Billy-Diamond Highway.
- Extending the railway from Matagami to, eventually, Whapmagoostui could lead to a significant reduction in heavy truck traffic on the Billy-Diamond Highway, as supplies to the region and the transport of resources southward could be handled by this new mode of transportation.

However, it should be noted that projects related to this agreement are planned for a minimum period of 30 years, theoretically beginning in 2028.

According to data from the SAAQ (2026), in the Nord-du-Québec region, which includes the Jamésie RCM, an 18% decline in accidents was observed between 2018 and 2022, with a total of 298 accidents in 2022. The 2024 data appear to confirm this downward trend, with a total of 266 accidents in the Nord-du-Québec region—an additional 11% decrease.

9.3.7.3 Significant projects, activities, or events

Significant projects, initiatives, or events that could have a cumulative impact on road safety in conjunction with this project include those that may affect the Trans-Taiga Road between the former Mirage outfitter's airfield and its junction with the Billy-Diamond Highway, as well as the Billy-Diamond Highway between that intersection and the transfer station in Matagami. These include the following:

- mining exploration activities;
- operations at the Éléonore Mine;
- operations at the borrow pit;
- operations and maintenance activities at the facilities of the La Grande complex;
- the maintenance and operations of all substations and lines that use these roads as access routes;
- the use and maintenance of the Trans-Taiga Road and the Billy-Diamond Highway;
- the completion of various road and rail projects planned under the Grand Alliance agreement;
- the operation and maintenance of the various airports and airfields connected to these two roads;
- the operation of the landfills connected to these two roads;
- the construction and maintenance of telecommunications towers accessible via these roads;
- the various Cree villages that use these roads for the transportation of their people and supplies;
- forest fires occurring in the area that could affect the pavement of the Billy-Diamond Highway.

9.3.7.4 Cumulative impacts

The main risks to road safety stem from increased traffic and deteriorating road conditions, which lead to a higher risk of accidents. The preceding sections show that existing roads have design capacities that exceed both current traffic volumes (which are considered low) and the traffic volumes anticipated with the addition of traffic generated by the project. Since 2015, Billy-Diamond Highway has undergone major improvements to both its alignment and its road surface. The most recent work began in 2024 (L'Aurore, 2025) and includes, in particular, the replacement of 259 culverts. In the Trans-Taiga Road section, apart from mining exploration activities, no other major projects that could significantly increase traffic on this road are planned in the short or medium term. However, regarding the Billy-Diamond Highway, several mining projects located south of the Cree community of Wemindji are expected to begin operations at the same time as the project. Lastly, it is worth noting the significant shift in current traffic patterns that will result from the construction of a deep-water port in Whapmagoostui and the northward extension of Billy-Diamond Highway and Route 167. This is in addition to the expected gradual reduction in truck traffic on the Billy-Diamond Highway, which should result from the planned extension of the railway from Matagami to, eventually, Whapmagoostui.

Lastly, given the factors outlined above and the strict measures that will be implemented to regulate the flow of project vehicles, a low-intensity effect, of regional extent and medium duration, resulting in a cumulative impact of **moderate** significance on road safety.

9.3.7.5 Mitigation, compensation, and follow-up measures

No additional mitigation measures or environmental follow-up other than those identified in Chapter 8 and the table in Appendix 8-2 are required for road safety.

9.3.8 Hunting and trapping

The assessment of cumulative impacts on hunting and trapping refers to the project's residual impacts on this VEC, which may potentially be additive to those of other existing projects or events, or those that may occur within the territorial boundaries (spatial scope) set out in Table 9-2.

9.3.8.1 Baseline conditions

Hunting and trapping are very important activities for the three Cree communities whose territories overlap with the spatial scope considered for this VEC. The area in question is primarily accessed via the Trans-Taiga Road, and hunting and trapping areas that are not directly accessible from the roadside are reached by all-terrain vehicle and snowmobile. Although certain areas are more suitable for hunting and trapping specific species, these activities take place throughout the entire region. The following are the species that are commonly hunted:

- Wild geese, which are primarily hunted in the spring; they migrate extensively across the region as many families head to hunting camps. These are occasions for festive gatherings that are very popular with the communities.
- Ducks in the fall and spring; ptarmigans and grouse year-round.
- Moose, in the fall and winter and sometimes in the spring, particularly in the Lac de la Corvette area.

- Caribou, although hunting for this species is less common due to its scarcity in the territory.
- Bears in the spring and fall.
- Various other mammals, including beavers, porcupines, and hares.

9.3.8.2 Historical trends

The information gathered from the tallymen does not indicate any issues regarding hunting success, except for caribou, whose population has declined sharply in the region since the development of the La Grande complex. Nevertheless, opening up the territory makes it more accessible, particularly to people who do not belong to communities with direct traditional rights to these hunting grounds. Concerns have been raised about overhunting, particularly with regard to moose. The gradual fragmentation of the land is also a cause for concern regarding the potential impact on the population decline of certain species and the loss of prized hunting grounds. It was mentioned that the right-of-way for the new power line will cross a hunting site belonging to the tallyman of trapline CH39. Lastly, several community members reported that meat from game hunted in areas disturbed by various activities tasted worse than meat from game harvested in undisturbed areas.

At this time, aside from the project itself, only mining exploration activities could pose new threats to hunting and trapping (loss of access and bioaccumulation). The only other mining project currently under development in the vicinity, the Adina mine, is located 100 km southeast of the project. Nevertheless, the surge in demand for lithium could lead to the development of additional mining sites in the sector over the medium to long term.

Finally, it is important to note that since the 1970s, various agreements have been signed with provincial and federal governments granting Cree communities increasing control over the regional territory, particularly with regard to its use and development. One significant outcome was the creation of traplines, which allow the families associated with them to exclusively harvest wildlife resources within those areas.

9.3.8.3 Significant projects, activities, or events

Significant projects, activities, or events that could have a cumulative impact on hunting and trapping activities in conjunction with the project are those located within a 50-kilometre radius of the project. These include the following:

- mining exploration activities, in particular those of the Tilly and Cancet projects of Winsome Resources Ltd.
- operational activities of the borrow pits located on either side of Trans-Taiga Road.
- operations and maintenance activities at the La Grande-4 facility.
- maintenance work at the LG-4 and Tilly substations, as well as on the lines connecting these substations to the Lemoyne substation (to the west) and the Laforge substation (to the east).
- any maintenance work on the Trans-Taiga Road, as well as the increase in traffic observed there;
- operations and maintenance activities associated with LG-4 Airport;
- the operation of the LG-4 landfill site;
- campsites and temporary shelters associated with non-Indigenous activities;
- the effects of some forest fires;

- the governance issues that have had both negative and positive impacts on the activities of Indigenous communities include residential schools, the signing of the JBNQA and the Paix des Braves agreement (and related agreements), agreements related to the Plan Nord and the Grande Alliance, the Caribou Recovery Plan, and regulations concerning the protection of wildlife species of special status.

9.3.8.4 Cumulative impacts

Past projects (the La Grande complex) and ongoing activities have significantly altered habitats in the area along the Trans-Taiga Road and to the north of it, but the subsequent establishment of traplines has allowed for the redistribution of hunting grounds among Indigenous communities. The Trans-Taiga Road and various access roads that have been built have opened up the region, making new hunting grounds accessible to members of Cree communities, but potentially also to hunters from other communities (both Indigenous and non-Indigenous). Mining exploration activities may disrupt hunting, but such disruptions generally affect limited areas over sporadic stretches of time. The agreements signed between governments and Cree communities have enabled these communities to exercise greater control over their territory and the management of their resources, particularly wildlife. Other projects, activities, and events primarily cause occasional disturbances, mainly related to noise and dust emissions, which are only noticeable in the immediate vicinity of these sites. Taking these factors into account, along with their distribution over time, the effects of the project's activities on this component—combined with impacts of other past, present, and future projects—is considered of moderate intensity, local extent and medium duration, resulting in a cumulative impact of **moderate** significance.

9.3.8.5 Mitigation, compensation, and follow-up measures

No additional mitigation measures or environmental follow-up other than those identified in Chapter 8 and the table in Appendix 8-2 are required for hunting and trapping activities.

9.3.9 Well-being on the land

Well-being on the land refers to all activities carried out on the land that are closely linked to Indigenous culture (the transmission of values and language, mental health and healing, ancestral memory, etc.). After assessment, it was determined that this VEC largely overlaps with the one related to physical, psychological, and social health. The cumulative impacts related to well-being on the land were therefore addressed in Section 9.3.6 on physical, psychological, and social health.

9.3.10 Climate change (GHG emissions, energy transition)

The assessment of cumulative impacts on climate change mitigation refers to the project's residual impacts on this VEC, which may potentially be additive to those of other existing projects or events, or those that may occur within the territorial boundaries (spatial scope) set out in Table 9-2.

9.3.10.1 Baseline conditions

The baseline conditions for GHG emissions are presented in Section 8.2.7.1 of the chapter on impact analysis. Thus, in Canada, total GHG emissions, based on 2023 data, amounted to 694 Mt CO_2eq, while for the mining sector, the total was 78 Mt CO_2eq.

In Quebec, total GHG emissions, based on 2023 data, amounted to 78 Mt CO_2eq, while emissions from the Industry category—which includes mining activities—amounted to 24.7 Mt COeq.

9.3.10.2 Historical trends

At the provincial level, recent major trends are reported below (MELCC, 2025):

- From 1990 to 2023, GHG emissions in Quebec have decreased by 8.5% and during this period, the population has increased by 26.5%. Meanwhile, they rose by 14.4% in Canada.
- In the short term, from 2019 to 2023, Quebec's GHG emissions decreased by 4.7%, from 81.8 Mt CO_2eq in 2019 to 78.0 Mt CO_2eq in 2019.
- In 1990, Quebec's GHG emissions were 86.7 Mt CO_2eq. Then, from 2003 to 2020, these emissions gradually declined, reaching 74 Mt in 2020, during the pandemic. Subsequently, emissions rose to nearly 80 Mt CO_2eq, before beginning to decline again in 2023 to 78 Mt CO_2eq.
- The sector that produced the most GHG emissions in Quebec in 2023 was transportation (road, air, sea, rail, and off-road) (34.9 Mt CO_2eq). Between 1990 and 2023, GHG emissions from the transportation sector increased by 27.7%.
- The industrial sector, which includes mining projects, ranked second, with 24.7 Mt CO_2eq, accounting for 31.7% of total emissions in 2023.
- From 1990 to 2023, emissions from the industrial sector decreased by 22.6%, from 32.1 to 24.7 Mt CO_{2eq}.
- The residential, commercial, and institutional (building heating) sector ranked third, with 6.2 Mt CO_{2eq}, or 7.9% of emissions (2023).

The proposed project is a lithium mine that would produce approximately 800,000 tonnes per year of lithium concentrate. Lithium is an essential input in the manufacture of lithium-ion batteries, which are used notably in electric and plug-in hybrid vehicles, energy storage systems associated with renewable energy sources, and various technological applications. As such, lithium supply is closely linked to the energy transition and economic decarbonization objectives pursued by the Government of Québec. Lithium mining projects therefore support the deployment of technologies related to electrification and energy storage by providing a raw material recognized as necessary for these uses, in accordance with provincial strategies related to critical and strategic minerals.

9.3.10.3 Significant projects, activities, or events

Significant projects, activities or events that could have a cumulative effect on climate change mitigation, along with the project, are generally those that generate GHGs. These include the following:

- mining exploration activities;
- operations at the Éléonore and Andina mines and activities related to the monitoring of the Renard mine;
- operations of borrow pits located within the defined area;
- operations and maintenance activities at the facilities of the La Grande complex;
- maintenance and operation of all substations and power lines within the defined area;
- the use and maintenance of the Trans-Taiga Road and the Billy-Diamond Highway;

- the completion of various road and rail projects planned under the Grand Alliance agreement;
- operation and maintenance of the various airports and airfields located within the defined area;
- operation of landfills located within the defined area;
- the construction and presence of telecommunications towers within the defined area;
- Cree community villages;
- the governance aspects of the Plan Nord and the Grande Alliance that promote development in the Nord-du-Québec region.

Forest fires also generate atmospheric emissions, but the Quebec government generally accounts for these separately from emissions resulting from human activities.

It should be noted that total GHG emissions remain an unknown factor, as only a portion of the emissions associated with the significant projects, activities, or events mentioned above are accounted for and included in the provincial and federal annual inventories for the relevant sector (industry, forestry, transportation, etc.).

9.3.10.4 Cumulative impacts

In 2023, Quebec's total GHG emissions were 78 Mt CO2eq, or 8.8 t per capita, representing 11.3% of Canada's total emissions of 693.9 Mt CO2eq. During operations of the Shaakichiuwaanaan project, GHG emissions (both direct and indirect) are estimated to average approximately 108.2 kt CO_2eq/year. These emissions account for 0.0044% of annual emissions from the industrial sector (24.7 Mt of CO_2eq) and 0.0014% of total emissions province-wide.

In addition to past and current activities that are included in the annual GHG emissions reports prepared by the Quebec government, there are also GHG sources that will eventually be added to the overview by the end of project activities. These sources include:

- The construction and operation of the Adina lithium mine, whose emissions are likely to be on a similar scale to those of the project.
- The various infrastructure projects outlined in the Grand Alliance agreement, which will eventually contribute to GHG emissions due to the major construction work they entail and the increased traffic they will generate (road, rail, and port). Nevertheless, although these projects have already undergone pre-feasibility studies outlining preliminary routes and locations, their implementation is expected to span a minimum of 30 years, with a tentative "Year 0" set for 2028 (WSP, 2024). It is therefore possible that some of these projects may not yet have been initiated—or at least completed—by the time the mining project ceases operations (scheduled for 2048 to 2052).

Given the temporal scope under consideration (2008 to 2035) and the project's very limited contribution to the GHG emissions balance at the industrial level and at the provincial level, the anticipated effect would be of low intensity, with regional extent and medium duration, resulting in a **low** magnitude ofn anticipated cumulative impact of the mining project, combined with other existing and foreseeable activities.

9.3.10.5 Mitigation, compensation, and follow-up measures

No additional mitigation measures or environmental follow-up other than those identified in Chapter 8 and the table in Appendix 8-2 are required for this valued component (GHG).

9.4 Review of cumulative impacts

An analysis of the cumulative impacts on the ten assessed components leads to the conclusion that the project is expected to result in only moderate cumulative impacts on wetlands and water environments, species of special status (avian fauna), terrestrial wildlife and wildlife habitat (avian fauna), the physical, psychological, and social health of the regional population, well-being on the land, and hunting and trapping. Low cumulative impacts are anticipated on surface water quality, aquatic fauna (fish) and habitat, wildlife species of special status (mammals and chiropterans), terrestrial wildlife and wildlife habitat (mammals), road safety, and climate change mitigation.

Consequently, no mitigation measures or monitoring are specifically required for cumulative impacts, beyond those already planned for direct and indirect impacts (Chapter 8 and Appendix 8-2). However, it is important to ensure rigorous implementation of existing measures and ongoing collaboration with communities to monitor the evolution of social, cultural, and environmental issues within a territory undergoing change.

10 Summary of residual impacts on issues

The project will have positive and negative impacts on various components of the physical, biological, and social environments. The significance of residual impacts after application of the mitigation or enhancement measures in the various phases of the project (construction, operations, and closure) is summarized in the project's environmental summary (Tables 10-1). A complete list of mitigation measures is provided in Appendix 8-2.

From this residual impact analysis, a few issues emerge that represent negative impacts of moderate residual significance. Recognition of these impacts is essential to help select which environmental components should be subject to a cumulative impact assessment (Chapter 9) and possible environmental monitoring measures (Chapter 13). Components with moderate residual impacts (no major residual impacts are generated by the project) include:

- **Surface water quality**, which will be subject to a moderate residual impact during the operations phase due to a constant inflow of water from mine effluent. Although this effluent will be regularly monitored and its treatment will ensure compliance with standards, a minor increase in loads is anticipated in the receiving environment downstream of the effluent over the duration of operations.
- **Aquatic wildlife (fish) and habitats**, which will be subject to a moderate residual impact during the construction and operations phases. During construction, the impact will be linked to the loss of aquatic habitat due to the draining of part of Lake L01 to create the open pit and the installation of the diversion channel to drain water from Lake L01. In fact, the natural effluent from Lake L01 is located in the part that needs to be drained. The diversion channel will introduce water from the lake upstream of the natural effluent. During the operations phase, the anticipated effect of the effluent on surface water quality will cause the moderate impact.
- **Wetlands and water environments**, which will be subject to a moderate residual impact during the construction phase due to the encroachment on 120.4 ha of wetlands.
- **Wildlife species of special status**, which will be subject to a moderate residual impact during the construction phase mainly associated with habitat loss (deforestation). A moderate residual impact during operations is also anticipated due to the effects of disturbance and the risks of collision and mortality.
- **Terrestrial wildlife (large wildlife, avian fauna including migratory birds)**, which will be subject to a moderate residual impact during the operations phase, mainly due to the effects of disturbance and the risks of collision and mortality.
- **Physical, psychological, and social health**, which will be subject to a moderate residual impact at all phases of the project. During the construction and operations phases, the impact will mainly be related to job creation, which will provide additional income for some members of the community and require them to be absent from home to work at the mine. Although these effects may seem positive at first glance, they can cause tensions within the community between those members who are chosen and those who are not. Furthermore, contact with non-Indigenous people could generate tensions and various social problems. During the closure phase, the loss of well-paid jobs would be the main source of impact.

- **Road safety**, which will be subject to a moderate residual impact in the operations phase. In fact, increased traffic on the Trans-Taiga Road and Billy-Diamond Highway due to ore transport to Matagami and supply needs could lead to accelerated road deterioration and increase the risk of accidents.
- **Hunting and trapping of terrestrial wildlife and waterfowl**, which will be subject to a moderate residual impact during the construction phase. This impact will mainly be caused by the loss of land available for these activities as well as the opening up of the area to hunters who are not from the region's Indigenous communities.
- **Well-being on the land** refers to all activities carried out on the land that are closely linked to Indigenous culture (transmission of values and language, mental health and healing, ancestral memory, etc.). After assessment, it was determined that this VEC largely overlapped with that relating to physical, psychological, and social health, and the analysis of the impacts of these two VECs was addressed in the section on health.
- **Climate change mitigation (GHG emissions, energy transition)**, which, during the operations phase, will have a moderate residual impact due to the regional nature of the impact and the larger quantities of GHGs generated during this phase.

Besides the residual negative impacts, the project will also have various positive impacts including:

- In terms of the physical environment, during the closure phase, the drained section of Lake L01 will be gradually refilled with water, and restoration work will be carried out to return the soil, surface water, and groundwater to their pre-project conditions.
- In terms of the biological environment, during the closure phase, the restoration of vegetation cover, wetlands, and watercourses will contribute to improving the habitats of fish, terrestrial wildlife, and wildlife species of special status.
- In terms of the social environment, the work during the construction, operations, and closure phases will generate economic benefits for the regional population. In addition, a positive impact is anticipated during the closure phase for users of the CH39 trapline, as facilities will be removed from the land and the nuisance will cease. Lastly, the end of mining activities at this site will allow traditional land use to return somewhat to pre-project conditions.

Table 10-1 Summary of impacts by issue

Affected component	Project phase	Primary source of impact	Description of potential impacts	Common and specific mitigation (or enhancement) measures (Appendix 8-2)	Significance of residual impact
Issue No. 1 - Preservation of aquatic habitat quality					
Hydrology (Hydrodynamic and hydro-sedimentary conditions)	Construction	Site organization, stripping and clearing, surface preparation, access development, transport and traffic related to materials and supplies	Alterations to hydrodynamic and hydrosedimentary conditions associated with the construction of the Lake L01 diversion channel	Common mitigation measures: Section: Soil, surface water, and sediment quality Specific mitigation measures: P31 and P32	Minor
	Operations	Water use and management, as well as transport and traffic related to ore and supplies	Alterations in hydrodynamic and hydro-sedimentary conditions associated with mine effluent	Common mitigation measures: Section: Soil, surface water, and sediment quality Specific mitigation measures: P33	Minor
	Closure	Final restoration	Avoids additional impact by leaving the diversion channel in place and refilling the mine pits connected to Lake L01	Common mitigation measures: Section: Soil, surface water, and sediment quality Specific mitigation measures: N/A	Moderate (+) Minor (-)
Surface water quality	Construction	Site organization, stripping and clearing, surface preparation and access development, transport and traffic related to materials and supplies, production and management of residual and hazardous materials	Alteration of surface water quality	Common mitigation measures: Sections: Ambient air; Soil, surface water, and sediment quality Specific mitigation measures: P24 and P25	Minor
	Operations	Water use and management, transport and traffic related to ore and obtaining supplies, production and management of residual and hazardous materials	Alteration of surface water quality	Common mitigation measures: Sections: Ambient air; Soil, surface water, and sediment quality Specific mitigation measures: P25, P29, P30, and P38	Moderate[1]
	Closure	Final restoration, production and management of residual and hazardous materials	Gradual improvement in water quality Low risk of contamination during restoration work	Common mitigation measures: Sections: Ambient air; Soil, surface water, and sediment quality; Vegetation and wetlands Specific mitigation measures: P23 and P25	Major (+) Minor (-)
Aquatic wildlife (fish) and habitats	Construction	Site organization, stripping and clearing, surface preparation and access development, construction of structures and infrastructure, transport and traffic related to materials and supplies	Disturbance of wildlife activities and aquatic habitats due to loss of fish habitat surface area	Common mitigation measures: Sections: Ambient air; Soil, surface water, and sediment quality; Wildlife and wildlife habitat Specific mitigation measures: P25, P31, P32, and P33	Moderate
	Operations	Water use and management, transport and traffic related to ore and supplies, production and management of residual and hazardous materials	Disturbance of wildlife activities and aquatic habitats due to mine effluent discharge	Common mitigation measures: Sections: Ambient air; Soil, surface water, and sediment quality; Wildlife and wildlife habitat Specific mitigation measures: P25, P31, P32, P33, and P46.	Moderate
	Closure	Final restoration, production and management of residual and hazardous materials	Progressive restoration of aquatic ecosystem functions and improvement of habitat quality Low risk of contamination during restoration work	Common mitigation measures: Sections: Ambient air; Soil, surface water, and sediment quality; Wildlife and wildlife habitat Specific mitigation measures: P23 and P25	Minor

[1] It should be noted that the expected residual impact on water quality is minor, as the design of the industrial wastewater treatment plant is intended to ensure compliance with the requirements of Directive 019. The medium significance rating is mainly attributable to the assignment of a medium duration to this impact based on the established definitions, although this duration does not in any way affect effluent quality.

Affected component	Project phase	Primary source of impact	Description of potential impacts	Common and specific mitigation (or enhancement) measures (Appendix 8-2)	Significance of residual impact
Issue No. 2 – Preservation of soil and groundwater quality					
Soil quality	Construction	Site organization, stripping and clearing, surface preparation and access development, transport and traffic related to materials and supplies, and production and management of residual and hazardous materials	Alteration of the physical and chemical quality of soils	Common mitigation measures: Section: Soil, surface water, and sediment quality Specific mitigation measures: N/A	Minor
	Operations	Transport and traffic related to ore and supplies, production and management of residual and hazardous materials	Alteration of the physical and chemical quality of soils	Common mitigation measures: Section: Soil, surface water, and sediment quality Specific mitigation measures: N/A	Minor
	Closure	Transport and traffic during closure work, final restoration, and production and management of residual and hazardous materials	Remediation of affected soils Low risk of temporary soil disturbance and contamination during closure work	Common mitigation measures: Section: Soil, surface water, and sediment quality Specific mitigation measures: N/A	Major (+) Minor (-)
Groundwater quality	Construction	Site organization, stripping and clearing, surface preparation and access development, construction of structures and infrastructure, transport and traffic related to materials and supplies, and production and management of residual and hazardous materials	Alteration of groundwater quality	Common mitigation measures: Sections: Soil, surface water, and sediment quality; Hydrology and hydrogeology Specific mitigation measures: P25	Minor
	Operations	Water use and management, transport and traffic related to ore and supplies, production and management of residual and hazardous materials	Alteration of groundwater quality	Common mitigation measures: Same as for the construction phase Specific mitigation measures: P25 and P38	Minor
	Closure	Final restoration, production and management of residual and hazardous materials	Gradual improvement in groundwater quality Low risk of contamination during closure work	Common mitigation measures: Same as for the construction phase Sections: Soil, surface water, and sediment quality; Hydrology and hydrogeology Specific mitigation measures: P25	Major (+) Minor (-)
Issue No. 3 – Preservation of wetlands and habitats of interest to terrestrial wildlife and plants					
Wetlands and water environments	Construction	Site organization, stripping and clearing, surface preparation and access development, transport and traffic related to materials and supplies, production and management of residual and hazardous materials	Loss of area and disruption of the quality of wetlands and water environments.	Common mitigation measures: Sections: Ambient air; Soil, surface water, and sediment quality; Vegetation and wetlands Specific mitigation measures: P24 and P25	Moderate
	Operations	The presence and operation of new infrastructure , water use and management, transport and traffic related to ore and obtaining supplies, production and management of residual and hazardous materials	Disruption of the quality of wetlands and water environments	Common mitigation measures: Same as for the construction phase Specific mitigation measures: P01, P245, P25, P29, P30, P31, P32 and P33	Minor
	Closure	Final restoration, production and management of residual and hazardous materials	Restoration of wetlands and water environments Low risk of contamination of wetlands and water environments during closure work	Common mitigation measures: Same as for the construction phase Specific mitigation measures: P01, P23, P24, and P25	Major (+) Minor (-)
Wildlife species of special status	Construction	Site organization, stripping and clearing, surface preparation and access development, construction of structures and infrastructure, transport and traffic related to materials and supplies, production and management of residual and hazardous materials	Disturbance of activities and loss of habitat for wildlife species of special status	Common mitigation measures: Sections: Ambient air; Acoustic environment and vibrations; Soil, surface water, and sediment quality; Vegetation and wetlands; Wildlife and wildlife habitat; Planning, land use, and land tenure Specific mitigation measures: P03, P04, P24, P25, P39, P40, P41, and P43	Moderate
	Operations	The presence and operation of new infrastructure, water use and management, transport and traffic related to ore and supplies, production and management of residual and hazardous materials	Disturbance of activities of wildlife species of special status	Common mitigation measures: Sections: Ambient air; Acoustic environment and vibrations; Soil, surface water, and sediment quality; Vegetation and wetlands; Wildlife and wildlife habitat; Planning, land use, and land tenure Specific mitigation measures: P03, P04, P25, P39, P40, P41, and P43	Moderate
	Closure	The presence of site remnants, final restoration, production and management of hazardous waste materials	Improvement of habitats favouring the resumption of activities by wildlife species of special status Low risk of habitat contamination during closure work	Common mitigation measures: Same as for the construction phase Specific mitigation measures: P03, P04, P23, P25, P39, P40, P41, and P43	Major (+) Minor (-)

Affected component	Project phase	Primary source of impact	Description of potential impacts	Common and specific mitigation (or enhancement) measures (Appendix 8-2)	Significance of residual impact
Terrestrial wildlife (large animals, avian fauna including migratory birds)	Construction	Site organization, stripping and clearing, surface preparation and access development, transport and traffic related to materials and supplies, production and management of residual and hazardous materials	Disturbance of terrestrial wildlife activities due to nuisances and habitat loss	Common mitigation measures: Same as for the construction phase Specific mitigation measures: P25, P39, P40, P41, and P43	Minor to Moderate
	Operations	The presence and operation of new infrastructure, transport and traffic related to ore and supplies, production and management of residual and hazardous materials	Disturbance of terrestrial wildlife activities due to nuisances	Common mitigation measures: Same as for the construction phase Specific mitigation measures: P25, P39, P41, and P43	Moderate
	Closure	The presence of site remnants, final restoration, production, and management of residual and hazardous materials	Improvement of habitats favouring the resumption of terrestrial wildlife activities Low risk of habitat contamination during closure work	Common mitigation measures: Same as for the construction phase Specific mitigation measures: P23, P25, P39, P41, P43, and P44	Moderate (+) Minor (-)
Forest cover	Construction	Site organization, stripping and clearing, surface preparation, and access development	Loss of forest cover associated with clearing land required for mine infrastructure and operations	Common mitigation measures: Sections: Soil, surface water, and sediment quality; Vegetation and wetlands; Wildlife and wildlife habitat; Planning, land use, and land tenure Specific mitigation measures: P23, P24, and P25	Minor
	Operations	Presence and operation of new infrastructure, transport of mineral, procurement and traffic	Disturbance of forest cover maintained on the edges of the site (damage caused by traffic, dust)	Common mitigation measures: Same as for the construction phase Specific mitigation measures: P23, P24, P25, P29, and P30	Minor
	Closure	Transport and traffic during the work, site remnants, and final restoration	Restoration of cleared areas through revegetation Potential damage to forest cover components and area not cleared for revegetation	Common mitigation measures: Same as for the construction phase Specific mitigation measures: P23, P24, and P25	Major (+) Minor (-)
Issue No. 4 – Preserving the quality of life of the local population					
Air quality	Construction	Site organization, stripping and clearing, surface preparation and access development, construction of structures and infrastructure, transport and traffic related to materials and supplies, production and management of residual and hazardous materials	Alteration of air quality due to the emission of air pollutants and dust	Common mitigation measures: Sections: Ambient air; Vegetation and wetlands and water environments Specific mitigation measures: P01, P19, P24, P25, P29, and P30	Minor
	Operations	The presence and operation of new infrastructure, transport and traffic related to ore and supplies, and the production and management of residual and hazardous materials	Alteration of air quality due to the emission of air pollutants and dust	Common mitigation measures: Same as for the construction phase Specific mitigation measures: P01, P19, P25, P29, and P30	Minor
	Closure	Transport and traffic during the work, final restoration, production and management of residual and hazardous materials	Gradual improvement in air quality Low risk of temporary disruption to air quality during closure work	Common mitigation measures: Ambient air section Specific mitigation measures: N/A	Major (+) Minor (-)
Issue No. 5 – Preservation of the health, safety, and socioeconomic conditions of the regional population					
Physical, psychological, and social health	Construction	Water use and management, Transport and traffic related to materials and supplies, production and management of residual and hazardous materials, workforce, and purchasing of goods	Disruption to the physical, psychological, and social health of regional populations	Common mitigation measures: Sections: Ambient air; Acoustic environment and vibrations; Soil, surface water, and sediment quality; Vegetation and wetlands; Wildlife and wildlife habitat; Planning, land use, and land tenure; Quality of life and well-being; Traditional land use by Indigenous peoples Specific mitigation measures: P14, P15, P16, P17, P19, P20, P21, P22, P24, P25, and P45	Moderate
	Operations	Water use and management, transport and traffic related to ore and supplies, production and management of residual and hazardous materials			
	Closure	The presence of site remnants, final restoration, production and management of residual and hazardous materials, workforce, and purchasing of goods and services	Disruption to the physical, psychological, and social health of regional populations Gradual reclaiming of the land	Common mitigation measures: Same as for the construction and operations phases Specific mitigation measures: P06, P10, P11, P13, P21, P23, and P42.	Moderate (-) Major (+)

Affected component	Project phase	Primary source of impact	Description of potential impacts	Common and specific mitigation (or enhancement) measures (Appendix 8-2)	Significance of residual impact
Economic benefits (job creation, economic partnerships)	Construction	Site organization, stripping and clearing, surface preparation and access development, construction of structures and infrastructure, transport and traffic related to materials and supplies, workforce, and purchasing of goods and services	Contribution to local and regional economic development	Common mitigation measures: Sections: Population, economy, and employment; Quality of life and well-being Specific mitigation measures: N/A	Major (+)
	Operations	The presence and operation of new infrastructure, transport and traffic related to minerals and supplies, workforce, and purchasing of goods	Contribution to local and regional economic development	Common mitigation measures: Same as for the construction phase Specific mitigation measures: P19	Major (+) Moderate (-)
	Closure	Final restoration, workforce, and purchasing of goods and services	Loss of local and regional economic benefits	Common mitigation measures: Same as for the construction phase Specific mitigation measures: P09, P10, P11, P19, and P42	Moderate (-) (+)
Road safety	Construction	Transport and traffic related to materials and supplies	Increased risks of deterioration in road safety	Common mitigation measures: Sections: Quality of life and well-being; Traditional land use by Indigenous peoples; Infrastructure and public services Specific mitigation measures: P26, P34, P35, and P36	Minor
	Operations	Transport and traffic related to ore and supplies	Increased risks of deterioration in road safety	Common mitigation measures: Same as for the construction phase Specific mitigation measures: P26, P34, P35, and P36	Moderate
	Closure	Final restoration	Reduced risk of road safety disruption	Common mitigation measures: Same as for the construction phase Specific mitigation measures: P26, P34, P35, and P36	Major (+) Minor (-)
Issue No. 6 – Preservation of the traditional activities and practices of Indigenous peoples and the activities and practices of non-Indigenous peoples					
Hunting and trapping of terrestrial wildlife and waterfowl	Construction	Site organization, stripping and clearing, surface preparation and access development, transport and traffic related to materials and supplies	Disturbance of hunting and trapping activities	Common mitigation measures: Sections; Acoustic environment and vibrations; Quality of life and well-being; Traditional land use by Indigenous peoples; Planning, land use, and land tenure; Wildlife and wildlife habitat Specific mitigation measures: P14, P15, P19, P24, P25, and P45	Minor
	Operations	The presence and operation of new infrastructure, water use and management, transport and traffic related to minerals and supplies	Disturbance of hunting and trapping activities	Common mitigation measures: Sections: Acoustic environment and vibrations; Soil, surface water, and sediment quality; Quality of life and well-being; Traditional land use by Indigenous peoples; Planning, land use, and land tenure; Wildlife and wildlife habitat Specific mitigation measures: P14, P15, P19, P24, P25, and P45	Moderate
	Closure	The presence of site remnants, final restoration, production and management of residual and hazardous materials	Gradual improvement in hunting and trapping conditions Low risk of contamination of hunting and trapping areas during the work	Common mitigation measures: Same as for the operations phase Specific mitigation measures: P23 and P25	Major (+) Minor (-)
Fishing	Construction	Site organization, stripping and clearing, surface preparation and access development, transport and traffic related to materials and supplies, production and management of residual and hazardous materials	Disturbance of fishing activities	Common mitigation measures: Sections; Soil and surface water quality; Hydrology and hydrogeology; Vegetation and wetlands; Traditional land use by Indigenous peoples Specific mitigation measures: P14, P15, P19, and P25	Minor
	Operations	Water use and management, transport and traffic related to minerals and supplies, production and management of residual and hazardous materials	Disturbance of fishing activities	Common mitigation measures: Same as for the construction phase Specific mitigation measures: P14, P15, P19, and P25	Minor
	Closure	Final restoration, production and management of residual and hazardous materials	Gradual improvement in fishing conditions Low risk of contamination of fishing areas during closure work	Common mitigation measures: Same as for the construction phase Specific mitigation measures: P23 and P25	Moderate (+) Minor (-)

Affected component	Project phase	Primary source of impact	Description of potential impacts	Common and specific mitigation (or enhancement) measures (Appendix 8-2)	Significance of residual impact
Harvesting of valued plant species	Construction	Site organization, stripping and clearing, surface preparation and access development, transport and traffic related to materials and supplies, production and management of residual and hazardous materials	Disturbance of activities involving the gathering of valued plant species	Common mitigation measures: Sections: Ambient air; Soil, water, and sediment quality; Vegetation and wetlands; Planning, land use, and land tenure; Traditional land use by Indigenous peoples Specific mitigation measures: P14, P15, P19, P24, and P25	Minor
	Operations	The presence and operation of new infrastructure, water use and management, transport and traffic related to minerals and supplies, and the production and management of residual and hazardous materials	Disturbance of activities involving the gathering of valued plant species	Common mitigation measures: Same as for the construction phase Specific mitigation measures: P14, P15, and P25	Minor
	Closure	The presence of site remnants, final restoration, production and management of residual and hazardous materials	Gradual improvement in harvesting conditions for valued plant species Low risk of contamination of fishing areas during closure work	Common mitigation measures: Same as for the construction phase Specific mitigation measures: P14, P23, P24, and P25	Moderate **(+)** Minor (-)
Well-being on the land	Well-being on the land refers to all activities carried out on the land that are closely linked to Indigenous culture (transmission of values and language, mental health and healing, ancestral memory, etc.). After assessment, it was determined that this VEC largely overlapped with that relating to physical, psychological, and social health, and the analysis of the impacts of these two VECs was addressed in the section on health.				
Issue No. 7 – Consideration of climate change					
Climate change mitigation (GHG emissions, Energy transition)	Construction	Site organization, stripping and clearing, surface preparation and access development, construction of structures and infrastructure, transport and traffic related to materials and supplies, production and management of residual and hazardous materials	Contribution to the overall increase in GHG emissions	Common mitigation measures: Sections: Ambient air; Vegetation and wetlands Specific mitigation measures: P25 and P26	Minor
	Operations	The presence and operation of new infrastructure, the transport and traffic related to minerals and supplies, production and management of residual and hazardous materials	Contribution to the overall increase in GHG emissions	Common mitigation measures: Same as for the construction phase Specific mitigation measures: P25 and P26	Moderate
	Closure	Transport and traffic during construction, final restoration, production and management of residual and hazardous materials	Reduction in overall GHG emissions Low contribution to GHG emissions during closure work	Common mitigation measures: Same as for the construction phase Specific mitigation measures: P25 and P26	Major (+)Minor (-)

11 Climate change resilience

The guidelines for conducting an impact assessment require climate change to be taken into account in the environmental assessment of the project. The project's impact on the issue of combating climate change through the reduction of GHG emissions was discussed in Chapters 8 and 9.

This chapter addresses the adaptation and resilience of the project to current and future climate conditions, while taking climate change into account. It presents a summary of the methodology and main results of the project's climate change risk and vulnerability assessment, the detailed report of which can be found in Appendix 11-1.

It is important for PMET to emphasize that the traditional Indigenous knowledge of local communities can serve as a valuable source of information for understanding the local impacts of climate change. PMET recognizes the value of this knowledge and is committed to continuing dialogue with Cree land users in order to better incorporate their observations, whenever possible, into the project's adaptation and monitoring efforts in response to climate change.

11.1 Methodology

The following steps were taken in accordance with the guidelines set out in the document *Les changements climatiques et l'évaluation environnementale Guide à l'intention de l'initiateur du projet* [Climate Change and Environmental Assessment: Guide for project initiators] (hereinafter, "the Guide") from the Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs (MELCCFP), which are themselves compliant with the requirements of ISO 31000:2018 on risk management and ISO 14901:2021 on climate change adaptation.

Preliminary step

- Description of the project, its environment, its lifespan, and applicable codes.

Step 1: Identify climate hazards that could affect the project, as well as the components of the site that could be affected by these hazards. Positive impacts (opportunities) will also be identified

- Identification of project components for the different phases (operations, dismantling/restoration, post-restoration).
- Identification of climate hazards relevant to the project.
- Identification of interactions between various climate hazards and project components for the operations phase and restoration/post-restoration phases.

Step 2: Define the vulnerability of components by assessing their sensitivity and adaptability to each climate hazard

- Assessment of the sensitivity of each component to potential impacts, taking into account infrastructure and environmental design criteria and thresholds (i.e., the project's potential to be exposed to and affected by identified climate hazards, based on mitigation/adaptation measures already in place).

- Assessment of the resilience of project components to potential impacts (i.e., the project's ability to adapt to climate change, including weather variability and extreme events, mitigate potential damage, take advantage of opportunities, or cope with the most significant impacts).
- Assessment of the vulnerability level of each potential impact by combining sensitivity and adaptive capacity.

Step 3: Establish the likelihood of impacts, which depends on the likelihood of observing changes in the occurrence of climate hazards and the vulnerability of components to these hazards

- Assessment of the likelihood of each potential impact, considering the likelihood of climate change and the vulnerability of components. When the impact likelihood score is low or very low, the interactions are not retained for the rest of the process.

Step 4: Determine the initial risk level for each climate-component interaction, based on the likelihood of impacts and the severity of consequences

- Assessment of the severity of the consequences for each impact identified and the resulting level of risk.

Step 5: Propose adaptation measures to reduce the risk level

- Determination of risk reduction and adaptation strategies for risks identified as moderate, high, or very high to improve the resilience of the project.
- Consultation with Cree land users to understand their views on the proposed climate change adaptation strategies.

11.2 Future trends in climate hazards that may impact the project

Climate change will have an impact on the water cycle and the frequency of extreme weather events. These effects can be positive or negative and will affect both construction costs and the lifespan of infrastructure. Therefore, climate hazards that could impact the project must be identified.

A climate hazard is defined as a hazard whose origin is wholly or partly related to one or more climate variables. Certain characteristics, such as intensity, probability of occurrence or recurrence, and spatial location, can be used to identify climate hazards that are likely to have an impact.

The relevant climate hazards have been selected for the site and can be categorized as follows:

- extreme precipitation/flooding;
- freezing rain;
- heat waves;
- freeze-thaw cycles and winter thaw;
- drought and forest fires;
- strong winds and thunderstorm activity;
- snowfall;

- extreme cold snaps;
- longer summers.

Table 11-1 presents the potential impacts identified for each component of the infrastructure considered, as well as interactions with the climate.

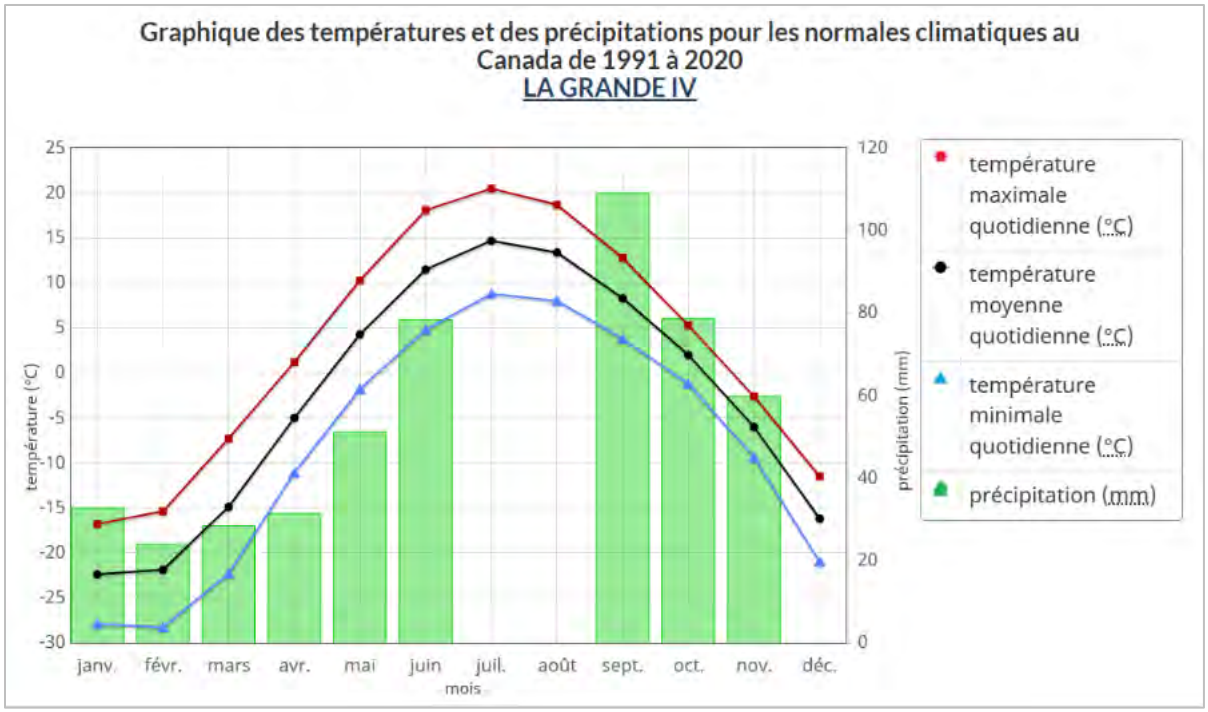
Table 11-1 Interactions considered between component categories and climate hazards (operations phase)

Component category	Extreme precipitation/flooding	Freezing rain	Heat waves	Freeze-thaw cycles and winter thaws	Drought and forest fires	Strong winds and thunderstorm activity	Snowfall	Extreme cold snaps	Longer summers
Mining infrastructure	Y	N	N	Y	Y	Y	Y	N	N
Buildings	Y	Y	Y	Y	Y	Y	Y	Y	N
Water treatment infrastructure	Y	N	N	N	Y	N	Y	N	N
Energy infrastructure	Y	Y	Y	Y	Y	Y	Y	N	Y
Transportation and support infrastructure	Y	Y	N	Y	N	N	Y	N	Y
Mining operations	Y	Y	Y	N	Y	Y	Y	Y	N

11.2.1 Reference climate profile

According to the Köppen classification, the study area is characterized by a cold and humid continental climate (Dfb), the main features being high seasonal variability in average daily temperature and evenly distributed average annual precipitation throughout the year. The average annual temperature is -2.7°C, with average daily maximum and minimum temperatures of 2.8°C and -8.1°C, respectively (ECCC, 2025).

Figure 11-1 shows the monthly climate norms for temperature and precipitation recorded between 1991 and 2020 at the La Grande IV weather station.



Source : ECCC, 2025

Figure 11-1 Monthly climate norms for temperature and precipitation

11.2.2 Future climate profile

Climate projections were established using the SSP5-8.5 scenario and time horizons covering the project's lifetime, i.e., short term (2011–2040), medium term (2041–2070), and long term (2071–2100).

These indicate a marked increase in annual temperatures, with hotter summers and milder winters, although winter cold spells remain possible. The number of days with temperatures above 28 C is expected to increase significantly. Precipitation is also expected to intensify, particularly liquid precipitation. Extreme precipitation events, both in duration and intensity, are also on the rise, which could lead to increased risks of flooding and erosion. Snow load could be affected by increased frequency of rain on snow and freeze-thaw cycles, influencing infrastructure stability. Freezing rain is expected to remain relatively stable, but could become slightly more frequent in the medium term under the moderate scenario and in the long term under the high scenario. Finally, wind projections are subject to considerable uncertainty, but the trend shows an increase in the number of dusty days.

Furthermore, indicators related to forest fires show an upward trend, particularly the duration of the fire season and the Fire Weather Index (FWI).

A summary of climate projections is provided in Table 11-2.

Table 11-2 Summary of climate projections (SSP5-8.5)

Climate hazard	Indicator name	Unit	Historical value (50th percentile)	Short-term projections (2011–2040)			Short-term[1] trend	Medium-term projections (2041–2070)			Medium-term trend	Long-term projections (2071–2100)			Long-term trend
				10th percentile	50th percentile	90th percentile		10th percentile	50th percentile	90th percentile		10th percentile	50th percentile	90th percentile	
Extreme precipitation/flooding	Maximum 1 day rainfall	mm	23	18	25	37	↑	20	27	42	↑	21	30	42	↑
	Extreme precipitation 15 min (1:10 years)[2]	mm/hr	N/A	N/A	N/A	N/A	↑	N/A	N/A	N/A	↑	N/A	N/A	N/A	↑
	Extreme precipitation 24 h (1:100 years)[2]	mm/hr	N/A	N/A	N/A	N/A	↑	N/A	N/A	N/A	↑	N/A	N/A	N/A	↑
	Total annual rainfall	mm	702	645	754	867	↑	701	811	943	↑	767	908	1063	↑
Freezing rain	Intense freezing rain events (≥10 mm)	-	0.05	0.03	0.07	0.18	↑	0.01	0.06	0.19	↑	0.03	0.13	0.23	↑
Heat waves	Number of days with a maximum temperature above 28°C	Days	1	0	4	12	↑	2	10	31	↑	6	24	60	↑
	Number of days with a maximum temperature above 34°C	Days	0	0	0	1	-	0	0	5	-	0	2	17	↑
Freeze-thaw cycles and winter thaws	Number of winter freeze-thaw cycles	Cycles	0	0	0	3	-	0	1	3	↑	0	1	6	↑
Drought and forest fires	Number of consecutive days with less than 1 mm of precipitation	Days	65	59	66	73	↑	59	66	73	↑	58	65	73	-
	FWI May to September[3]	-	3	-	3	12	-	-	4	14	↑	-	5	16	↑
Strong winds and thunderstorm activity	Number of days with maximum wind speed > 17.2 m/s (number of storm days)	Days	0	0	0	0	-	0	0	1	-	0	0	1	-
	Number of days with maximum wind speed > 5.6 m/s (number of dusty days)	Days	215	204	219	238	↑	197	226	244	↑	205	230	247	↑
Snowfall	Annual total snowfall	mm	229	189	238	290	↑	185	239	299	↑	174	238	306	↑
	Combined rain and snow load	kPa	2.5	2.1	2.6	3.1	↑	2.1	2.6	3.3	↑	2.0	2.7	3.3	↑
	Average daily spring temperature	°C	-5.2	-6.3	-3.7	-1.0	↑	-4.5	-1.5	1.8	↑	-1.8	1.6	5.8	↑
Extreme cold snaps	Annual number of days with a minimum temperature below -30 °C	Days	34	5	20	36	↓	0	5	20	↓	0	0	4	↓
Longer summers	Growing degree-day (GDD) (10 °C)	°C-days	60	55	103	187	↑	106	199	360	↑	205	364	692	↑
	Cooling degree days (CDD)	°C-days	17	10	37	91	↑	29	87	229	↑	79	201	496	↑

Notes:
1. The trend is established by comparing the median of the future horizon with the historical median.
2. Projections for short-term extreme precipitation indicators are not available (see Section 4.2.2).
3. The available data are the mean and the 95th percentile.

11.3 Climate change impacts in the construction and operations phases, and mitigation measures

No assessment of the impact of climate change has been specifically carried out on construction activities, as these are carried out over a short period of time. However, the short-term horizon (2011–2040) allows us to draw up a risk profile under current conditions.

Table 11-3 below presents the risk profile between climate hazards and components in the operations phase, which was assessed for the time horizons relevant to this phase, i.e., the short-term horizon (2011–2040) and the medium-term horizon (2041–2070).

Table 11-3 Risk profile of the operations phase for future horizons (SSP5-8.5)

Risk level	Number of interactions	
	2011–2040	2041–2070
Very low	0	0
Low	9	8
Moderate	2	3
High	14	12
Very high	4	6

It is expected that very low and low risks can be managed largely through existing design standards and maintenance operations and standards. Consequently, the remainder of the assessment and recommendations focus on moderate to very high risks.

Table 11-4 below details the adaptation measures according to the associated impacts and risks, as well as the estimated level of residual risk if the measures are implemented.

In addition to the measures provided, it is recommended that all emergency plans be reviewed, taking into account the increased frequency and intensity of future climate events such as storms, heat waves, and forest fires. It is also recommended that existing budgets for repairs and replacements be adjusted after such events. Finally, it is likely that site operations will be disrupted more frequently in the future.

An anticipated residual risk level is provided, which is a subjective estimate of the level of risk that may remain after implementation of the proposed resilience measures. Although the adaptation measures provided are intended to reduce the initial level of risk, this residual level of risk can only be confirmed after the measures have been implemented. The effectiveness of measures can vary greatly depending on the extent to which they are implemented.

Table 11-4 Risks and adaptation measures for the operations phase

Category	Systems/components	Potential impacts	SSP5-8.5 Preliminary risk score 2020	SSP5-8.5 Preliminary risk score 2050	Proposed adaptation measures	Final risk rating (residual risk)
Mining infrastructure	Pit for mining the CV5 spodumene pegmatite deposit; underground mine, ramps, portals, including underground ventilation infrastructure	Water accumulation in the pit and underground mine and increased pumping demand	High	Very high	Monitor water levels regularly, especially after extreme events. Have backup pumping equipment available to use in case of breakdown or extreme events.	Low
	Waste rock and tailings storage facilities	Increased metal leaching and treatment requirements	Very high	Very high	Develop a site-specific climate dataset in accordance with industry standards, including Appendix B of the Mining Association of Canada's Guide on Climate Change Adaptation for the Mining Sector (2021), to support climate-conscious planning and design. The focus should be on developing relevant variables related to extreme precipitation to support water balance modelling and water management. Continuous improvement practices should be considered to review and update the climate dataset, either as part of a regular review cycle or when sufficient climate data or projections become available (e.g., the publication of a new assessment report by the Intergovernmental Panel on Climate Change).	Moderate
	Pit for mining the CV5 spodumene pegmatite deposit; Waste rock and tailings storage areas; Overburden storage areas; HG and LG blending piles; Organics storage area; Run-of-mine (ROM) storage areas	Loss of slope stability/slope erosion	High	Very high	Develop a site-specific climate dataset in accordance with industry standards, including Appendix B of the Mining Association of Canada's Guide on Climate Change Adaptation for the Mining Sector (2021), to support climate-conscious planning and design. The focus should be on developing relevant variables related to extreme precipitation to support water balance modelling and water management. Schedule regular inspections of slopes, especially after extreme precipitation events and in the spring when snowmelt is accompanied by heavy rains, to anticipate potential failures.	Low
Buildings	Process plant (crusher and concentrator); Paste backfill plant; Aggregate crushing plant; Wastewater treatment plant (mine water treatment plant); Camp; Administration building and laboratory; Site's guard post (gatehouse); Warehouse; Fire station; First Nations cultural centre; Workshop; Laboratory; Mill office; Concrete plant; Compressor room; Construction site container; Mechanical service garage; Dry room; Emulsion plant and explosives storage buildings; Potable water treatment plant	Major damage caused by forest fires or extreme wind events	Very high	Very high	Schedule building envelope inspections to proactively detect weaknesses or deterioration. Provide firebreaks around buildings. Ensure that weather alerts and active fire alerts are included in safety protocols and evacuation and containment plans for personnel in the event of forest fires near the site. Close all air inlets in the event of a fire to preserve air quality inside buildings and underground mines.	Moderate
		Inadequate roof drainage, water infiltration	High	High	Ensure that site-specific climate projections are taken into account in the design of roof drainage systems. Ensure increased maintenance of joints to prevent water infiltration. Plan for potential overflow from gutters and downspouts and ensure that water is directed away from buildings.	Low
		Risk of blocked drains/gutters and increased need for snow and ice removal	Moderate	Moderate	Schedule inspection and preventive cleaning of roof drainage systems before and during winter to prevent blockages caused by ice or debris. Design roofs to promote natural drainage and limit accumulation.	Low
	Emulsion warehouse and explosives storage buildings	Potential decrease in product stability; explosions	Very high	Very high	Provide enhanced thermal insulation to maintain a stable temperature inside the warehouse and factory. Provide climate-controlled storage for heat-sensitive detonators and emulsions. Ensure that there is a firebreak around the warehouse and factory. Ensure that the factory has dedicated water tanks and firefighting equipment. Have an evacuation plan in place in case of a fire nearby. Provide personnel training on climate risks related to forest fires and on emergency protocols.	Moderate

Category	Systems/components	Potential impacts	SSP5-8.5 Preliminary risk score 2020	SSP5-8.5 Preliminary risk score 2050	Proposed adaptation measures	Final risk rating (residual risk)
Water treatment infrastructure	Management of mine water/contact water (ditches, contact water treatment pond, contact water and process water treatment pond, contaminated contact water pond, sedimentation pond and polishing pond, pumping stations, contact snow deposit area)	Exceeding the capacity of water collection and storage infrastructure/Insufficient pumping	High	High	Develop a site-specific climate dataset in accordance with industry standards, including Appendix B of the Mining Association of Canada's Guide on Climate Change Adaptation for the Mining Sector (2021), to support climate-conscious planning and design. The focus should be on developing relevant variables related to extreme precipitation to support water balance modelling and water management. Continuous improvement practices should be considered to review and update the climate dataset, either as part of a regular review cycle or when sufficient climate data or projections become available (e.g., the publication of a new assessment report by the Intergovernmental Panel on Climate Change). Identify at-risk ponds. Monitor the water level in at-risk ponds based on weather forecasts and ensure that pumps are working properly to prevent overflow in the event of excessive accumulation.	Low
	Mine water treatment plant	Increase in mine water and decrease in downstream capacity to convey flow; Increased need for treatment and increased maintenance	High	High	Develop a site-specific climate dataset in accordance with industry standards, including Appendix B of the Mining Association of Canada's Guide on Climate Change Adaptation for the Mining Sector (2021), to support climate-conscious planning and design. The focus should be on developing relevant variables related to extreme precipitation to support water balance modelling and water management. Ensure that pond capacity is sufficient to accommodate water during peak flow periods. Ensure that the capacity of the wastewater treatment plant takes into account site-specific climate projections. Anticipate extreme events by integrating weather forecast monitoring and adjusting process operations. Schedule more frequent maintenance of equipment to account for increased use, with a view to preventing breakdowns, extending its service life, and ensuring its proper functioning.	Low
Energy infrastructure	Power supply line (120 kV); Main electrical substation on site and electrical distribution network on site	Prolonged power outages; Damage to electrical equipment	High	High	Ensure that critical equipment is connected to an emergency generator to guarantee its operation in the event of more frequent and/or prolonged power outages linked to the intensification of extreme weather events. Plan to install lightning arresters or surge protection devices on electrical equipment to limit damage caused by lightning storms and ensure continuity of operations. Be prepared to elevate electrical equipment if there is a risk of local flooding. Ensure that the emergency plan incorporates scenarios involving more frequent and/or prolonged power outages.	Moderate
	Fuel storage area and refuelling station (fuel storage and distribution); Propane tanks	Increased soil saturation leading to increased pressure on foundations, damaging tanks and silos	Low	Moderate	Plan for tank protection and regular maintenance. Include peripheral drainage systems (ditches) to remove water. If areas at risk of saturation or surface water accumulation are anticipated, raise the tank bases to prevent damage. Schedule inspections of areas after extreme events and after winter to identify cracks, subsidence, or deformation.	Low
	Communication services following an Industry 4.0 style operation (i.e., short-interval control, predictive maintenance, VOD, on-site teleoperation, and a local integrated operation centre)	Decreased or lost communication	High	High	Ensure that systems critical to operations are connected to generators or that redundancy can be added. Provide a backup communication method (satellite, radios).	Moderate
Transportation and support infrastructure	Access roads, secondary roads, haul roads, bridges, and culverts	Deterioration of roads	Moderate	Moderate	Set aside a contingency budget to cover any increase in premature deterioration. Establish a program of regular road inspections to detect early signs of deterioration, such as potholes and cracks. Schedule preventive maintenance activities, especially after winter.	Low
	Access roads, secondary roads, haul roads, bridges, and culverts	Increased need for snow removal/de-icing/abrasives	High	High	Adopt an operations planning approach that is flexible enough to adapt to unexpected changes in weather conditions. Prioritize weather monitoring and make arrangements for snowplows, de-icing salt, and abrasives accordingly.	Low
	Bridges, culverts, and ditches (non-contact water)	Insufficient drainage of site, service roads, and access roads (low risk); Risk of blockages	High	High	Develop a site-specific climate dataset in accordance with industry standards, including Appendix B of the Mining Association of Canada's Guide on Climate Change Adaptation for the Mining Sector (2021), to support climate-conscious planning and design. The focus should be on developing relevant variables related to extreme precipitation to support water balance modelling and water management. Ensure regular maintenance of ditches to maintain their drainage capacity.	Low
	Lake L01 dams	Dam failure (due to pressure or erosion) and flooding	High	High	Develop a site-specific climate dataset in accordance with industry standards, including Appendix B of the Mining Association of Canada's Guide on Climate Change Adaptation for the Mining Sector (2021), to support climate-conscious planning and design. The focus should be on developing relevant variables related to extreme precipitation to support water balance modelling and water management. Provide hydrological modelling of the watershed that takes climate change into account to anticipate new flow regimes by integrating climate scenarios into water management plans. Develop emergency response plans to react quickly in the event of early signs of dam failure (this may include mobilizing response resources). Establish continuous monitoring systems to track the stability of dams, especially after extreme weather events.	Moderate

Category	Systems/components	Potential impacts	SSP5-8.5 Preliminary risk score 2020	SSP5-8.5 Preliminary risk score 2050	Proposed adaptation measures	Final risk rating (residual risk)
	Lake L01 diversion channel	Exceeding channel capacity/channel erosion and flooding	High	High	Develop a site-specific climate dataset in accordance with industry standards, including Appendix B of the Mining Association of Canada's Guide on Climate Change Adaptation for the Mining Sector (2021), to support climate-conscious planning and design. The focus should be on developing relevant variables related to extreme precipitation to support water balance modelling and water management. Schedule inspections and preventive repairs of the diversion channel. Schedule post-event inspections to detect weakened or damaged areas. Provide a secondary or emergency diversion channel to absorb excess water.	Moderate
Mining operations	Personnel getting around; Getting supplies; Operations and maintenance	Difficulty getting around; Disruption to operations and/or loss of productivity at work	High	High	Develop emergency plans and management procedures to deal with climate disruptions. Include protocols for personnel safety, infrastructure protection, and continuity of operations specific to climate disruptions. Ensure strategic reserves of materials, critical equipment, and spare parts are in place to minimize the impact of supply chain delays.	Moderate
	Operations and maintenance	Poor outdoor working conditions; Disruption of operations and/or loss of productivity at work	High	High	Raise awareness and train staff on the risks associated with extreme high temperatures. Ensure that they are aware of the signs of heat-related illness (e.g., heatstroke) and the preventive measures to take. Modify work schedules to minimize exposure to the highest temperatures of the day. Schedule the most physically demanding tasks during the cooler hours of the day.	Moderate
	Staff getting around; Getting supplies	Loss of accessibility and isolation of the site	High	High	Develop comprehensive emergency plans that include specific procedures for dealing with temporary site isolation in the event of a weather event. These should include safety aspects, supply needs, emergency medical care, and communication with local authorities. Train staff to respond effectively in the event of temporary isolation, with an emphasis on personal safety, supply management, and emergency protocols. Develop flexible logistics plans that take into account seasonal variations and climate risks. Ensure that suppliers and carriers are aware of potential challenges. Ensure that systems critical to operations are connected to generators or that redundancy can be added. Provide a backup communication method (satellite, radios).	Moderate
	Transportation of the product (spodumene concentrate); Supply	Site access closed due to forest fires	Very high	Very high	Develop emergency plans and management procedures to deal with climate disruptions. Include protocols for personnel safety, infrastructure protection, and continuity of operations. Develop an operations continuity plan in case of restricted access. Plan a flexible schedule for critical activities to avoid high-risk periods. Plan alternative evacuation routes, including fire and monitoring services, to bypass high-risk areas. Integrate SOPFEU alerts to anticipate closures. Train personnel on the risks associated with forest fires and on emergency procedures. Monitor the spread of the fire and ensure that evacuation is completed well before access is cut off. Ensure that the immediate area around buildings does not contain any flammable materials (refer to the FireSmart guide for more details).	High

11.4 Climate change impacts in the closure phase and mitigation measures

Table 11-5 below presents the risk profile between climate hazards and components in the restoration and post-restoration, which was assessed for the time horizons relevant to this phase, namely the medium term (2041–2070) and the long term (2071–2100).

Table 11-5 Risk profile of the restoration and post-restoration phase for future horizons (SSP5-8.5)

Risk level	Number of interactions	
	2041–2070	2071–2100
Very low	0	0
Low	2	1
Moderate	2	3
High	1	0
Very high	1	2

It is expected that very low and low risks can be managed largely through existing design standards and maintenance operations and standards. Consequently, the remainder of the assessment and recommendations focus on moderate to very high risks.

Table 11-6 below details the adaptation measures according to the associated impacts and risks, as well as the estimated level of residual risk if the measures are implemented.

In addition to the measures provided, it is recommended that all emergency plans be reviewed, taking into account the increased frequency and intensity of future climate events such as storms, heat waves, and forest fires. It is also recommended that existing budgets for repairs and replacements be adjusted after such events.

An anticipated residual risk level is provided, which is a subjective estimate of the level of risk that may remain after implementation of the proposed resilience measures. Although the adaptation measures provided are intended to reduce the initial level of risk, this residual level of risk can only be confirmed after the measures have been implemented. The effectiveness of measures can vary greatly depending on the extent to which they are implemented.

Table 11-6 Risks and adaptation measures for the restoration and post-restoration phase

Systems/components	Potential impacts	SSP5-8.5 Preliminary risk score 2050	SSP5-8.5 Preliminary risk score 2080	Proposed adaptation measures	Final risk rating (residual risk)
Covering of storage areas (Stockpiles 001 and 002)	Erosion of piles Increase in dust	Moderate	Moderate	Implement temporary erosion control measures and best management practices to reduce the risk of erosion during the first few years (until vegetation is well established). Plan to monitor vegetation cover to detect barren or sensitive areas	Moderate
Diversion/drainage structures	Surface erosion of spillways due to runoff. Regressive erosion (internal) that can lead to dam failure Water infiltration that raises the water table and can affect slope stability Exceeding the capacity of structures	Very high	Very high	Take into account site-specific climate change projections when designing diversion and drainage structures. Provide excess water diversion channels, secondary diversion channels, or emergency overflow channels to prevent flooding. Stabilize riverbanks to limit erosion.	Moderate
Roads, ditches, bridges, and culverts	Damage to roads resulting in loss of accessibility to restored sites for monitoring purposes. Ice formation in culverts and reduced drainage capacity. Increased need for de-icing and snow removal Increased dust concentration	Moderate	Moderate	Consider site-specific climate change projections when designing culverts and ditches. Plan for increased road monitoring and maintenance activities due to climate change to maintain access to monitoring activities. Anticipate potential delays for monitoring activities due to extreme events that pose a danger to workers. Raise awareness among workers about the dangers and precautions to be taken.	Low
Vegetation	Difficulties in planting vegetation due to extreme heat, strong winds, and drought Forest fires could destroy vegetation on the site, leading to increased runoff and erosion	High	Very high	Implement soil stabilization measures, such as vegetation cover that is resistant to drought and extreme temperatures. Develop a post-event revegetation plan with species adapted to extreme weather conditions.	Moderate
Monitoring activities	Loss of accessibility to restored sites for monitoring purposes (damage to access roads)	Low	Moderate	Plan for increased road monitoring and maintenance activities in connection with climate change to maintain the access required for monitoring activities. Anticipate potential delays for monitoring activities due to extreme events that pose a danger to workers. Raise awareness among workers about the dangers and precautions to be taken.	Low

12 Accident risk management

12.1 Introduction

A thorough understanding of potential accidents and failures related to planned project activities, including the associated risks in terms of the probability and consequences of such unforeseen events, is essential for PMET's risk management and emergency preparedness.

The first line of defence against accidents and failures is the implementation of current best practices in environmental protection, health, and safety. Thus, potential accidents and failures are associated with risks that will remain after the following measures have been implemented, even with exemplary and rigorously applied management systems:

- best management practices;
- use of the most advanced technologies;
- rigorous control of permitted discharges into the environment and residual environmental effects;
- implementation of training programs and tools to ensure safe operation of facilities.

Despite prevention, if such events do occur, it is essential to be able to minimize the effects on the environment through planning and designing effective mitigation measures and implementing an emergency response plan (ERP).

The project is located at a considerable distance (more than 10 km) from any dwellings and poses little risk to local populations in the event of an accident. However, an accident could affect people on site, property, and the environment. The site is also located more than 300 km away from municipal emergency services. It is therefore important to identify the risks so that the resources are in place to respond diligently and confidently in the event of a major accident.

The project was conceived with these measures in mind during its design and planning, and on site emergency response will be put in place over the project's entire life cycle. The probability of occurrence of unforeseen accidents and malfunctions is therefore reduced. The implementation of preventive measures will also reduce the consequences of any unplanned event or accident. This approach is part of a responsible management approach whose objective is to reduce risks at the source and mitigate the effects unplanned events could have on the environment.

PMET is committed to ensuring that the risk management process, adapted and applied within the framework of the project, will sufficiently reduce the plausible consequences of identified accident scenarios to keep the level of risk as low as reasonably practicable.

12.2 Assessment of major technological accident risks

12.2.1 Objectives and scope

The purpose of the risk analysis of major technological accidents related to the project is to identify potential hazards and assess their possible consequences. It also serves to identify protective measures to prevent these potential accidents or reduce their frequency and consequences.

The risks covered by this analysis are major unplanned events that could have consequences beyond the project site and harm the public or the environment. It does not cover risks to the health and safety of workers during normal operations.

12.2.2 Methodology for determining risks

The concept of risk involves the following components:

- the dangers that are identified in accident scenarios;
- the severity of the consequences of these accident scenarios;
- the probability of these accident scenarios occurring.

The approach used meets the requirements of the MELCCFP's guide to analyzing major technological risks entitled: *Analyse de risques d'accident technologiques majeurs* (Théberge, 2002), hereafter referred to as the MELCCFP Guide. The analysis also complies with the main recommendations of the Risk Management Guide for Major Technological Accidents published by the Major Industrial Accidents Reduction Council (CRAIM, 2017).

The first steps involve identifying sensitive environmental elements and external hazards related to activities, infrastructure, or equipment present on site, as well as establishing a history of past accidents at similar facilities. Subsequently, accident scenarios related to risks are developed.

In subsequent steps, the potential consequences of the scenarios are identified, and the probabilities of occurrence are estimated. The safety measures to be implemented are also determined to eliminate or reduce the risk of accidents. A risk management plan, including a contingency plan, will also be established to manage residual risks that cannot be eliminated.

The methodologies used in the various stages mentioned are explained in the following subsections.

12.2.2.1 Hazard identification and accident scenario development

Hazard identification aims to list the specific hazards associated with the project. The following hazard sources are assessed:

- external hazards of natural origin;
- external hazards of anthropogenic origin;
- hazards related to activities on the site (project infrastructure and equipment).

The purpose of this identification is to establish the worst-case accident scenarios, their causes, and the preventive and control measures to be implemented.

12.2.2.2 Assessment of the severity of the consequences of accident scenarios

The severity of the consequences of each of the worst accident scenarios identified was determined by experts. Two substances stored at the project site are listed in Schedule 1 of ECCC's Environmental Emergency Regulations. These are compressed natural gas and ammonium nitrate. Their concentrations and quantities stored exceed the thresholds specified in Schedule 1 of the Regulations. The consequences of scenarios involving these substances have therefore been quantified using modelling.

12.2.2.3 Estimation of probabilities of occurrence

Accident scenarios were analyzed for their likelihood. The probabilities were mainly established based on accidents that occurred at similar sites in previous years.

12.2.2.4 Determination of risk levels

Criteria that consider the severity of the consequences of the incident and the probability of the event occurring were used to assess the level of risk.

These criteria are presented in the following tables:

- Table 12-1: Probability of occurrence level;
- Table 12-2: Level of severity of consequences;
- Table 12-3: Risk grid;
- Table 12-4: Acceptability criteria.

Probability of occurrence level

The probability of occurrence is the potential for an identified hazard to cause an incident or accident.

The probabilities of occurrence were established qualitatively based on accident history, analysis of the project facilities, and the preventive measures put in place. Table 12-1 defines the probability levels that have been established.

Table 12-1 Probability of occurrence level

Probability level	Definition
Very high	Common event: may occur more than once a year Will occur in the short term
High	Highly probable event: may occur less than once a year May occur several times during the project
Moderate	Probable event: may occur less than once every five years May occur once during the lifetime of the project
Low	Improbable event: may occur less than once every 20 years Could happen, has happened in the industry (globally)
Very low	Highly improbable event: likely to occur less than once every 100 years Not impossible given current knowledge, but not encountered globally over many years of production. Would only occur in exceptional circumstances

Level of severity of consequences

The following factors may be taken into account when determining the level of severity:

- People: health and safety of workers on site and people within the radius of impact at the time of the incident.
- Environment: direct impacts on the environment (water, air, soil, wildlife, plants).
- Property: damage to infrastructure and property, and impacts on operations.

The severity levels of the consequences are determined according to the consequences described in Table 12-2.

The severity level of each element taken into account (people, environment, and/or property) is determined. The final severity level, however, is that of the highest. For example, an accident could have a low level of severity in terms of property damage, but a high level of severity in terms of environmental damage. The severity level of the accident would then be high.

Risk level

Once the probability of a risk and its severity have been assessed, it is then possible to determine the risk level of an event using the grid shown in Table 12-3.

The risk level identified takes into account the prevention and mitigation measures in place, provided that these measures are robust and reliable.

Table 12-4 presents the risk acceptability criteria.

Table 12-2 Level of severity of consequences

Level of severity of consequences	Community	Workers	Environment	Property
Very high	– Several members of the community significantly affected – Potential evacuation of the community – Significant impacts on lifestyle (traditional land use, access to roads, access to services)	– Human loss caused by the results of the accident, such as explosion or dam failure	– Regional contamination of watercourses, soil, air, or groundwater – Disturbance of wildlife and/or plant species at the regional level – Contamination of aquifers and potable water sources	– Major damage to property rendering buildings unusable – Interruption of operations for more than a month
High	– Several members of the community potentially affected – Measurable impacts on lifestyle (traditional land use, access to roads, access to services)	– Permanent disability(ies)	– Contamination of watercourses, soil, air, or groundwater extending beyond the site – Disturbance of wildlife and/or plant species in an area extending beyond the site – Local contamination of the aquifer	– Major damage to property that renders buildings unusable – Interruption of operations for more than a week, less than a month
Moderate	– Some members of the community potentially affected – Minor impacts on lifestyle (traditional land use, access to roads, access to services)	– Serious injuries – Temporary disabilities	– Minor short-term contamination of watercourses, soil, air, or groundwater that may locally extend beyond the site. – Disturbance of wildlife and/or plant species in an area extending near the site, or the presence of habitats with sensitive elements, or the presence of a special-status wildlife or plant species	– Significant damage – Interruption of operations lasting more than one day but less than one week
Low	– Some members of the community potentially affected	– Injuries requiring medical attention – Injuries requiring changes to work duties – Loss of quality of life – Minor illnesses	– Major incident whose impacts remain within the boundaries of the site – Some of the wildlife and/or plant species present on the site are subject to negative impacts.	– Minor damage – Interruption of operations for one day

Level of severity of consequences	Community	Workers	Environment	Property
Very low	– No measurable impact on the community	– Injury requiring first aid – Minor impact on quality of life (mild discomfort)	– Minor incident – No risk of contamination of sensitive environments (watercourses, wetlands) – No disturbance to wildlife and/or plant species	– No damage – Interruption of operations for twelve hours or less

Notes:
- In the event of a spill, severity levels are determined in order of importance (minor, major, significant, very significant). The order of importance takes into account the quantity spilled as well as the nature and characteristics of the product involved (e.g., toxicity, flammability).
- A contained hazardous material spill means that the spill can be controlled/contained on site using mitigation or prevention measures that are in place.

Table 12-3 Risk levels

Level of severity of consequences	**Very high**	Moderate	High	Very high	Very high	Very high
	High	Moderate	Moderate	High	Very high	Very high
	Moderate	Low	Moderate	Moderate	High	Very high
	Low	Low	Low	Moderate	Moderate	High
	Very low	Very low	Low	Low	Moderate	Moderate
		Very low	**Low**	**Moderate**	**High**	**Very high**
	Probability of occurrence					

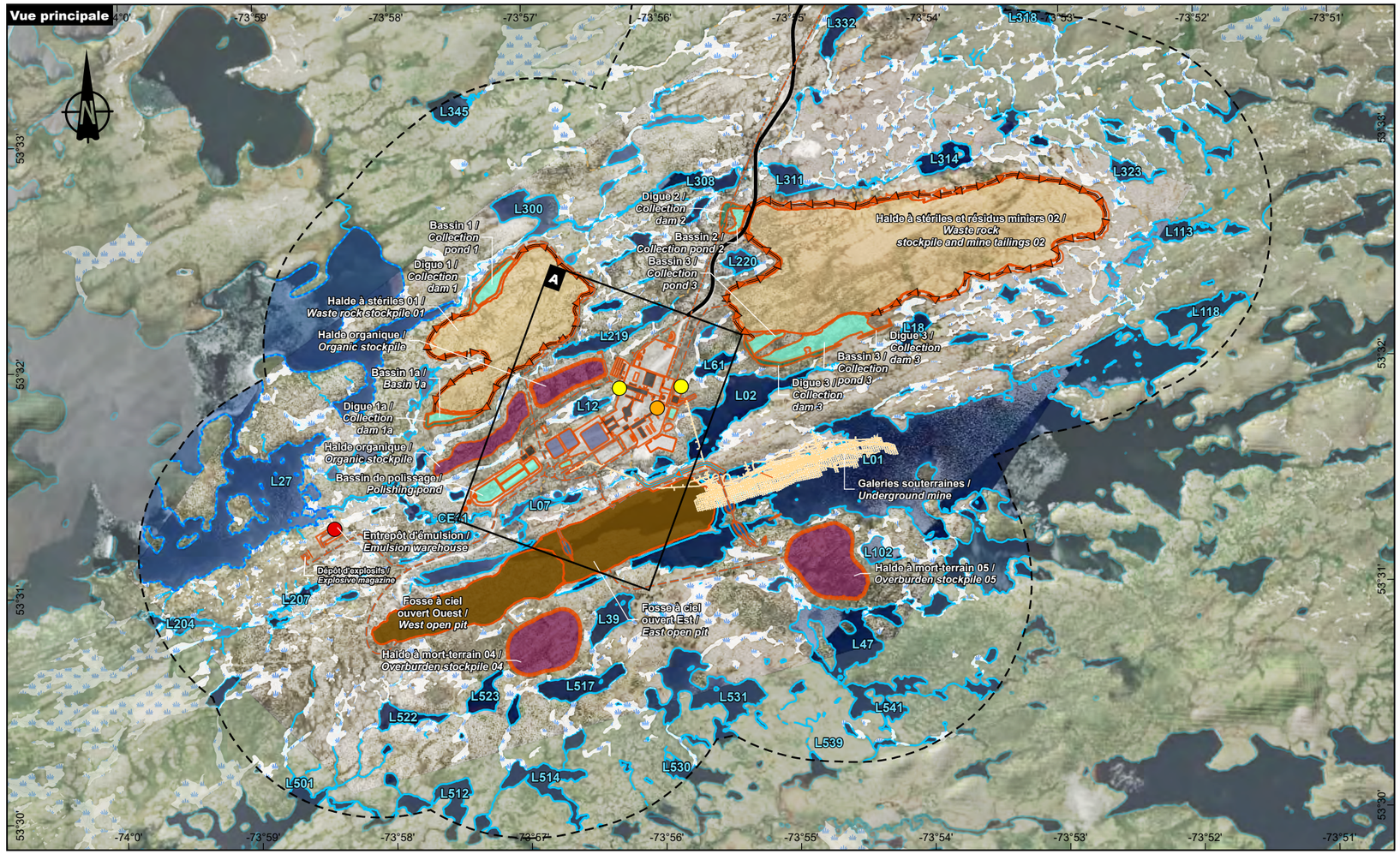
Table 12-4 Project acceptability criteria

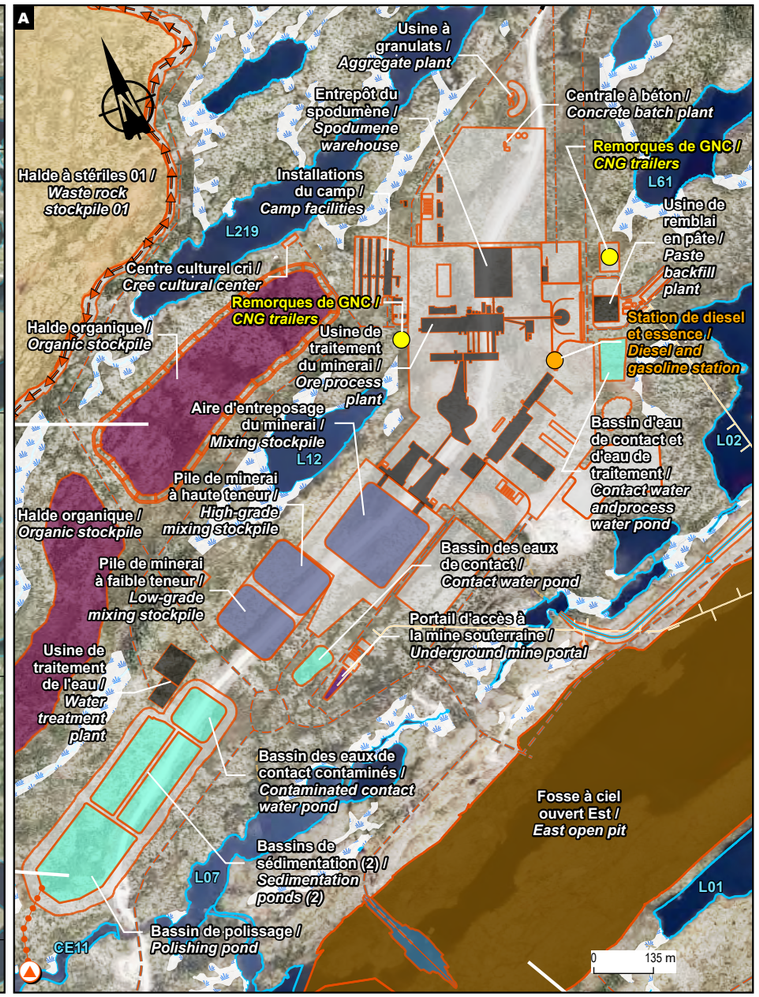
Risk level	Definition
Very high	Unacceptable risk likely to cause major damage. Management is advised and must ensure that alternative solutions are put in place.
High	Risk that requires preventive control measures and risk reduction plans, as well as regular risk reassessment.
Moderate	Risk that is reasonably reduced but must be subject to continuous improvement to achieve, under economically acceptable conditions, the lowest possible risk level, taking into account the state of knowledge and practices and the vulnerability of the facility's environment.
Low	Acceptable risk. Control measures must be known and applied. Periodic monitoring is necessary.
Very low	Negligible risk

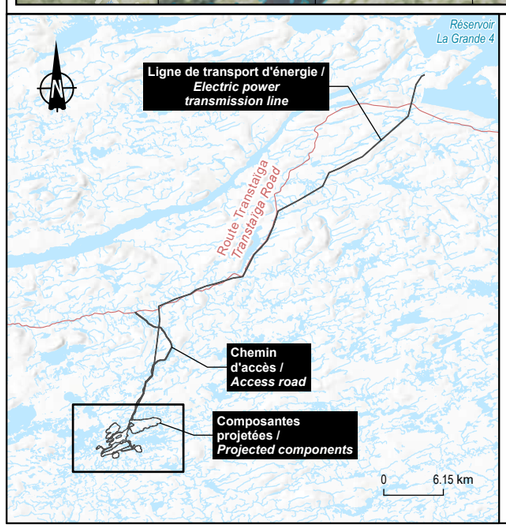
12.2.3 Identification of sensitive environmental components

The sensitive environmental components to be considered for the purposes of this technological risk analysis are those that, due to their proximity, could be affected by a major accident occurring at the project site. These are mainly public places, infrastructure, and sensitive or protected environmental elements. Sensitive elements were identified within a radius of approximately 1.5 km around the facilities (Map 12-1).

The following sections identify the major sensitive elements considered for this project.







Zones d'étude / *Study Areas*

- Projet / *Project*
- Éléments sensibles / *Sensitive elements*

Composantes du projet / *Project Components*

Existante / *Existing*

- Chemin d'accès / *Access road*

Infrastructures à risque / *At-risk Infrastructure*

- Entrepôt de nitrate d'ammonium / *Ammonium nitrate storage area*
- Remorques de GNC / *CNG trailers*
- Station de diesel et essence / *Diesel and gasoline station*

Projetées / *Projected*

- Effluent minier / *Mining effluent*
- Barrage / *Dam*
- Canal / *Channel*
- Canal de dérivation / *Diversion Channel*
- Chemin secondaire / *Secondary road*
- Fossé / *Ditch*
- Galerie souterraine / *Underground mine*
- Ligne de transport d'énergie / *Power transmission line*
- Aire d'entreposage du minerai mixte / *Mixed ore stockpile*
- Autre / *Other*
- Bâtiment ou équipement / *Building or equipment*
- Digue / *Dam*
- Bassin / *Basin*
- Digue des bassins / *Basins dam*
- Fosse / *Pit*
- Halde à mort-terrain et organique / *Overburden stockpile*
- Halde à stériles et/ou résidus / *Waste rock and/or tailings stockpile*
- Portail d'accès à la mine souterraine / *Underground mine portal*

Composantes de l'écosystème / *Ecosystem Components*

- Milieux humides / *Wetland*

Milieux hydriques / *Hydrous Environments*

- Plan d'eau / *Waterbody*

Cours d'eau / *Watercourses*

- Intermittent / *Intermitent*
- Permanent / *Permanent*
- Souterrain / *Underground*

Projet minier Shaakichiuwaanaan / *Shaakichiuwaanaan Mining Project*

Étude d'impact sur l'environnement / *Environmental Impact Assessment*

Carte 12-1 / *Map 12-1*
Emplacement des infrastructures à risques et milieux sensibles / *Location of at-Risk Infrastructure and Sensitive Environments*

Sources / Sources

SDA, 1/20 000, MERN, 2024-02
CanVec+, 1/50 000, RNCan, 2014
CanVec, 1/250 000, RNCan, 2017
BDGA, 1/1 000 000, MRN Québec, 2014
BDGA, 1/1 000 000, MRN Québec, 2002
AQréseau+, réseau routier, MERN, 2024-03-01
G Services Miniers, Composantes projetées, CASN-A-001-GE-SKE-0005-A, 2025

0 420 840 m

UTM, fuseau 18, NAD83 (CSRS)

2026-03-31

Préparation / Prepared by : M. Lemieux
Dessin / Drawn by : M. Dupraz
Approbation / Approved by : M-H. Brisson
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CA0001724_3318_eie_c12_01_105_risques_260331

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12.2.3.1 Hydrology

The project site is located within two primary watersheds, namely those of the La Grande and Pontois rivers, the Pontois River itself being a tributary of the La Grande River.

The watersheds are composed of several rivers and lakes, as shown on Map 12-1. The most significant lakes located near the planned facilities are Lakes L01 and L27.

12.2.3.2 Social environment

Infrastructure

The main road in the regional study area is Billy-Diamond Highway, formerly known as James Bay Highway. The Trans-Taiga Road begins at kilometre 544 of this road. The project site is located south of the Trans-Taiga Road, approximately 20 km from kilometre 270.

The Trans-Taiga Road leads to Caniapiscau and provides access to several facilities at the La Grande hydroelectric complex. This is a gravel road administered by Hydro-Québec but maintained by the SDBJ, stretching 666 km, generally in an east-west direction (James Bay Road, undated).

The Billy-Diamond Highway, which connects Matagami to Radisson, has a truck stop at kilometre 381 (the only place along the highway with a gas station) and six emergency telephones.

Current use of land and resources for traditional purposes

The project is located in the Eeyou Istchee James Bay territory, which has nine Cree communities and more than 300 traplines. The communities of Chisasibi, Wemindji, and Mistissini are the three communities most likely to be affected by the project.

However, all of the project site infrastructure is located in area of trapline CH39, which is part of the traditional territory of the Cree community of Chisasibi. Several campsites set up in this area are used by the community. These campsites are mainly located in the northern section of the traplines, along the Trans-Taiga Road or the La Grande River. Two campsites are located at kilometre 258 of the Trans-Taiga Road, and three other campsites are located at two sites in the Lac Katatipawasakakamaw area north of the Trans-Taiga.

12.2.3.3 Natural environment

Vegetation

The project site is located in the spruce-lichen stand bioclimatic domain (western subdomain) and in the Eastmain and Sakami River, Robert Bourassa Reservoir, and Lac Naococane ecological regions.

These three regions and this domain are composed of natural environments resulting from disturbances, most of which can be attributed to forest fires dating back several decades. These areas do not have a dominant tree stratum, but rather regeneration consisting mainly of black spruce, jack pine, and tamarack (*Larix laricina*) in the shrub stage, with a canopy cover of more than 10%. It is therefore estimated that these areas will become wooded again in the long or short term if they are not disturbed again.

In addition to the immature forest surrounding the site, there are also a few wetlands. The main types of wetlands are, in ascending order of surface area, wooded ombrotrophic bogs, open ombrotrophic bogs, tree swamps, shrub swamps, open fens, wooded fens, ponds or shallow waters, and marshes.

Terrestrial fauna

Inventories conducted confirmed the presence of woodland caribou, migratory caribou, moose, black bears, and grey wolves at the project site. The migratory caribou is the species of greatest concern given its importance to the Cree community and the rapid decline of its population.

The inventories also identified eight species of small mammals: the southern red-backed vole, the deer mouse, the western heather vole, the meadow vole, the northern bog lemming, the southern bog lemming, the meadow jumping mouse, and the cinereus shrew. These species have been observed in a variety of habitats, including softwood stands, regenerating areas, peatlands, and lichen tundra.

Fish and fish habitat

The project includes several bodies of water classified as fish habitat, such as lakes L01, L07, L02, L12, L61, L219, and L220. The effluent from mine water treatment is directed to Watercourse CE11, then to Lake L27, which are also fish habitats.

All information concerning the reference state of fish and benthic invertebrate habitat and analysis of metal content in fish flesh is available in appendices 6-16 to 6-18.

Avian fauna

Across all seasons, the various inventory methods used in the study area identified 109 bird species at the project site, including 11 at-risk species and 94 migratory bird species as defined by the Migratory Birds Convention Act, 1994. The 11 species at risk are the red crossbill *percna* subspecies, the evening grosbeak, the rusty blackbird, the olive-sided flycatcher, the common nighthawk, the short-eared owl, the bald eagle, the golden eagle, the peregrine falcon, the bank swallow, and the lesser yellowlegs.

Chiropterans

The inventory confirmed the presence of five species and a two-species complex at the site, namely bats of the genus *Myotis*, the northern long-eared bat and the big brown bat among the resident species, and the silver-haired bat, hoary bat, and red bat for the migratory species, as well as the big brown bat/silver-haired bat complex. However, most of the recordings obtained during the inventories were of the hoary bat.

No critical habitats (maternity roosts or hibernacula) were observed during the specific field research conducted, nor were any suggested by the results of the acoustic inventory. However, the presence of maternity roosts within the survey area remains a possibility, given the density of stumps observed on the site.

12.2.3.4 Archaeological sites

Four archaeological sites have been identified on the shores of Lac du Requin Marteau (Lake Katatipawasakamaw), 30 km northeast of the project site, along the Trans-Taiga Road. No other known sites are located near the project site.

12.2.4 Historical record of accidents

The historical record of accidents helps identify hazards and to establish the accident scenarios that will be used in the risk assessment. It can also be used to improve the design of infrastructure and equipment, to determine the required safety equipment, and to better define the risk management plan.

The ARIA database of the Bureau d'analyse des risques et pollutions industriels (BARPI) of the French ministry of ecology and sustainable development was consulted on their website. This database is widely used in industrial risk prevention and includes feedback on major accidents with human and/or environmental impacts worldwide.

This research is not intended to be exhaustive; its purpose is to help identify potential accident scenarios, assess their causes and potential consequences, and estimate their probability of occurrence. Furthermore, not all of the accidents identified necessarily occurred at sites with the same characteristics as the Project (type of mine [open pit or underground], ore mined, processing method used, operating conditions, etc.).

12.2.4.1 Accidents related to project activities

Since ore mining is not specific to the lithium industry, the ARIA database search was extended to the project's activities in general. Accidents that have occurred between January 2015 and December 2025 in the context of the following activities were investigated:

- B.07.10: mining of iron ores;
- B.07-21: mining of uranium and thorium ores;
- B.07.29: mining of other non-ferrous metal ores;
- B.08.99: other mining activities;
- 20.11Z — Manufacture of industrial gases;
- 35.21Z — Production of gaseous fuels;
- 20.15 — Manufacture of fertilizers and nitrogen compounds;
- 49.41 — Freight transport by road;
- 42.2 — Construction of utility projects.

The search results are presented in Table 12-5.

Among the recorded accidents related to extractive activities, the most relevant to the project were selected. They were classified by type of event, i.e., dam failures, collapses/landslides, discharge of contaminated water to the environment, fires, explosions, and others.

Since January 2015, 14 incidents related to extractive activities have been recorded. The accidents included:

- landslides, collapses, rockfalls, in approximately 7.1% of cases (1 accident);
- a dam failure or storage pond overflow, in approximately 21.4% of cases (3 accidents);
- an explosion in approximately 14.3% of cases (2 accidents);
- a fire in approximately 28.6% of cases (4 accidents);
- a spill or leak of contaminants in approximately 28.6% of cases (4 accidents).

Table 12-5 Accidents related to extractive activities

Date	Country	ARIA number	Description of the incident	Causes (if known)
Dam failure/Overflow				
25/01/2019	Brazil	53027	In the early afternoon, one of the three dams holding back liquid waste from an iron mine broke. A breach in the 86 m high embankment structure caused its collapse and the release of 12.7 million m³ of toxic effluents. A destructive wave of mud buried the site's administrative buildings and part of the village downstream. The consequences of the accident were considerable. According to the reports of May 2019, there were 243 dead, 27 missing, and hundreds injured. Rescue efforts were suspended for one day due to the risk of a second dam failure at the site. The manager pumped out the associated reservoir before resuming the search. Most of the victims were mine employees who were in a canteen on the site when it was destroyed by the mudslide. Heavy material damage was noted: houses destroyed, railway bridge washed away, drinking water and electricity supply networks out of order, vehicles buried… The toxic flow spread over dozens of km² destroying crops, as well as all flora and wildlife. Drinking water sources were rendered unsafe for consumption.	Assumptions: – Inadequate internal drainage combined with high groundwater levels. – The attainment of maximum undrained strength due to internal creep and loss of suction in the material above the groundwater level. – A dam structure not designed to contain liquefied materials.
13/09/2015	France	49416	On Friday, September 11, staff at a uranium mine received a Météo-France alert announcing a major rainfall episode. The levels in the 10,000 L and 50,000 L effluent storage basins were then lowered. On Saturday, September 12, the rainfall caused a greater than 50-year flood event in MAS D'ALARY. The mine site was flooded. The staff encountered difficulties in accessing the site; the roads were cut off, and the automatic gate at the entrance was out of order. They entered the site at 9:30 p.m. and found that the 10,000-litre basin was 75% full. The 4 pumps were working to return the water to the 50,000 L basin. The lack of ferric chloride caused the pH of the treated water to rise. The safety valve then opened to return the water to the 10,000 L basin, which contributed to it also being filled. To limit this flow, the staff forced the pH safety valve to close. In spite of these interventions, the 10,000 L basin overflowed on Sunday, September 13, at 5:00 a.m., for 49 hours. Untreated water was discharged into the natural environment. The normal uranium content in MAS D'ALARY was 1.6 mg/l. During the flooding, the concentration rose to 3.81 mg/l. With daily monitoring, the return to normal was noted in December 2015. Measurements from the various piezometers around the site did not show any impact on the groundwater.	Weather conditions Management error

Date	Country	ARIA number	Description of the incident	Causes (if known)
05/11/2015	Brazil	47369	At 3:30 p.m., a breach occurred in a dam retaining iron ore waste. Draining of the reservoir had been initiated, but the structure breached at 4:20 p.m. The reservoir emptied completely into the valley below, causing a second dam to break. A mudslide of about 60 million tonnes engulfed a village of 620 inhabitants. The operator notified some residents by phone, but the list of residents was incomplete. The operator was not equipped with an alarm siren as required by good operating practice. No public alert or evacuation plan was in place. Nineteen people died and an ecological disaster was caused. Small tremors were recorded in the area on the day of the accident, but no link to the failure of these embankment dams was established. The dam was at the limit of its capacity and was in the process of being raised. The accident scenarios had largely minimized the magnitude of the flow of tailings in case of failure; they were based on a construction height of 45 m in 2008, whereas the dam was twice as high on the day of the accident.	Poor design and structural failure
Collapse/Landslide				
11-11/2023	France	61485	A resident discovered a hole 10 metres deep and 3 metres wide at the surface near a path. This hole was caused by ground subsidence linked to the presence of an old uranium mine tunnel close to the surface. A security perimeter was established, then expanded and reinforced over the following days. The former operator commissioned a consulting firm to determine how to fill in the subsidence and secure the site in the long term. This ground movement was probably caused by the heavy rains of the previous days.	Weather conditions
Discharge of contaminated water into the environment				
28/04/2022	France	58978	At the end of the day, emergency services responded to reports of an orange/reddish discolouration on the NIVE and its tributary, the LAXIA. The origin of this discolouration was the collapse of the riprap installed when the old iron pyrite mines were closed in 1978. This caused the release of water containing ferruginous mud contained within. The pH of the water dropped from 7 to 5.8. Acidification caused the death of fish, which were found on the banks of the LAXIA. The conurbation's water authority, in collaboration with the water supply network operator, put in place monitoring and emergency measures to enable nearby residents to continue drinking tap water without any risk. Downstream water intakes on the LAXIA were shut down as a precautionary measure, while other intakes were being monitored. A fish farm downstream was also alerted. An impact assessment on wildlife and plants was carried out. As a precautionary measure and pending the results of tests to detect any dangerous metals, particularly arsenic and mercury, the prefect decided to temporarily ban freshwater fishing on the LAXIA. The Inspectorate of facilities classified for environmental protection conducted an investigation to consider solutions for filling in the mine entrance. A municipal decree prohibited access to watercourses and former mine sites. The next day, the pH was back to normal, but there were still small amounts of polluted water coming out of two tunnels, including some coloured water from one of them. A deposit of ferruginous sludge was present on the bottom of the riverbed and on the banks. Trout and almost all macroinvertebrate wildlife were found dead over a stretch of several hundred metres. Various observations on the fish confirmed that the water was loaded with sulphuric acid.	-

Date	Country	ARIA number	Description of the incident	Causes (if known)
			A fish inventory was carried out by the fishing federation to estimate the extent of the impact on fish stocks. Furthermore, the riverbed still contained a significant amount of muddy material that had been deposited there. It seemed highly likely that, at the next flood, this material would be remobilized by the runoff, causing the colour of the river to turn orange again. However, the impact was not expected to be the same, as the substance responsible for the mortality appeared to be sulphuric acid emitted by the rock present in the mine and carried along with the underground water flow.	
15/10/2018	France	52510	Following floods in the Aude region, arsenic pollution from a gold mine that had been closed since 2004 was suspected. According to press reports, the floods caused the collapse of mine effluent retention ponds filled with arsenic, cyanide, and heavy metals, impacting the ORBIEL valley. The riverbed was stripped to a depth of nearly 3 m. Health monitoring was set up. The toxic legacy of the mine included arsenic (a toxic carcinogen), lead, and cyanide. A public health investigation was launched. In August 2019, the local regional health agency announced that 38 children living near the former mine had higher than average levels of arsenic. The first cases had been discovered two months earlier.	Weather conditions
04/07/2018	France	56140	The Office National des Forêts, accompanied by 2 gendarmes, noticed some pollution at the Kokioko Creek where a gold mine was located. The rate of suspended solids was 4,800 times higher than the legally permitted rate. The site's basins were open, allowing the muddy water to flow directly into the creek. The discharge of mud increased the turbidity, which decreased the oxygen level, clogged the soil, asphyxiated the flora, and destroyed natural habitats and biodiversity. Rehabilitation of the site with revegetation should have begun in the dry season, and not in rainy weather, to avoid sludge runoff that would damage aquatic fauna and flora. The operators were brought before the criminal court two years later for these actions. The environmental protection associations are civil parties alongside the France Nature Environnement federation. The prosecutor requested an 80,000-euro penalty.	
06/08/2015	United States	46802	The environmental agency was conducting an engineering study at a former gold mine to assess the mine's water discharges, ways to treat the water, and options for reclaiming the site. As workers excavated above an old access tunnel, pressurized water escaped and spilled into the nearby stream. Approximately 11,500 m^3 of coloured water loaded with lead, copper, arsenic, iron, and zinc polluted 160 km of downstream rivers. The authorities prohibited navigation, swimming, watering of farm animals, and consumption of water from certain catchments. Lead and arsenic levels were 12,000 and 26 times higher than acceptable levels respectively.	-

Date	Country	ARIA number	Description of the incident	Causes (if known)
Fires				
12/05/2025	France	64452	During the night, a fire broke out on several crushers in a quarry. The fire went out on its own. The staff noticed the damage the next morning. Several crushers were damaged. The supply of talc from the quarry to the processing plant was interrupted for a few days, but alternative solutions were quickly found. The restoration work was expected to take at least 10 months. The operator has estimated the cost of the incident at around €3 million (destroyed equipment, rental of replacement equipment). The analysis of CCTV footage confirms that the fire was started deliberately.	Malicious intent
8/12/2020	France	56528	At around 1:30 p.m., demonstrators tried to break into a cobalt and nickel hydrometallurgical plant. The PPI (specific emergency response plan) was initiated. Non-essential personnel was evacuated. The site was secured and the installations were shut down according to the emergency procedure. Around 11:30 p.m., 2 days later, the gendarmerie responded after shots were fired. Mining machines were stolen. Various production shutdown scenarios were considered due to the risk of SO_2 and SO_3 release: – rapid shutdown of the acid solution plant; – shutdown of the acid solution plant within 24 to 48 hours. A cold shutdown was carried out 4 days after the beginning of the incidents. The fusion component restarted. The SO2 was converted to SO3 to avoid corrosion and to empty the SO2 pipeline, thus preventing the risk of pollution in case of malicious acts. The discharge and neutralization plant was reactivated as well as the lime production plant. The access road to the mine was unusable, concrete blocks prevented access to the mine site, and 80% of the heavy machinery was immobilized. Around 2 a.m., 7 days after the event had started, a major fire broke out on the mine site, affecting technical facilities and numerous vehicles. After the site was secured by the police, the plant's security teams began fighting the fire. Most of the extinguishing water was collected in a special retention basin. Following the numerous rains of the previous days, the already high water level in the retention basin overflowed at the end of the night before daybreak. Firefighters left the site 19 days later. A technical facility, numerous vehicles, and containers with 2 m^3-3 m^3 of coolant and 10 m^3 of engine oil were destroyed. An oil spill was detected on the KWE due to the overflow of the retention basin. The protests were sparked by the sale of the site to a consortium.	Malicious intent
21/12/2018	France	52805	At around 12:30 p.m., a fire broke out in a cavity in an underground quarry. Municipal services secured access to the cave. A homeless person was overcome by smoke inhalation. The fire weakened two support pillars.	-

Date	Country	ARIA number	Description of the incident	Causes (if known)
09/07/2017	France	49980	A fire broke out at approximately 4:30 a.m. on an 11 km-long fixed conveyor used to transport ore at a mining facility. The operator's staff detected the fire and extinguished it. A 350 m-long section of a conveyor belt and metal supports were damaged by the fire. The damage was estimated at several hundred thousand euros. The operator proceeded with repairs. Activities resumed 8 days after the fire. The cause of the fire was believed to be malicious intent. A similar fire had already occurred on this fixed conveyor 5 months earlier.	Malicious intent
Explosions				
21/03/2017	Saint Lucia	49423	Shortly before 5:30 p.m., a container of dynamite exploded in a quarry. The explosion killed 3 people and injured about 20 others. Some of the injured were taken to Martinique for treatment. The site was burned and the operating machinery was completely destroyed. The explosion was heard for miles around. Some witnesses reported that the walls of the houses shook and that they thought it was an earthquake. Several workers were welding the top of a barrel containing explosives. It is believed that sparks ignited the barrel and caused the disaster.	Incorrect work procedure
24/12/2015	Nigeria	47520	A tank truck carrying gas exploded at around 1 p.m. at a gas complex in southern Nigeria, causing a violent fire. The fire lasted several hours, plunging the city of Nnewi into a thick cloud of black smoke. The fire destroyed gas tanks, cars, and gas cylinders.	Unknown

12.3 Hazard identification

External hazards are events from natural or anthropogenic sources that can affect the proper functioning or integrity of the site.

12.3.1 External hazards of natural origin

12.3.1.1 Climate change

According to the climate change risk and vulnerability assessment, the most concerning climate risks mainly relate to extreme precipitation, forest fires, high winds, and extreme temperatures, which affect the stability of mining infrastructure, worker safety, and operational continuity. Water accumulation in the pit and underground mine, as well as in treatment ponds, represents a major challenge that can lead to increased pumping demand and exceed the capacity of water management systems. Extreme precipitation and freeze-thaw cycles also increase the risk of erosion and slope instability in waste rock stockpiles and ore storage areas.

Therefore, the risk of flooding in the pit and underground mine in the project area is taken into account in this assessment. It should be noted that this risk can be reduced by implementing the recommendations mentioned in the climate change risk and vulnerability assessment, presented in Appendix 11-1.

12.3.1.2 Earthquakes

Eastern Canada is located in a stable continental region of the North American Plate, resulting in relatively low seismic activity. According to the National Earthquake Database (Gouvernement du Canada, 2026), no earthquakes have been recorded since 1980 within a 200 km radius of the project site. The earthquake risk is therefore considered negligible.

It should be noted that all structural facilities will comply with the seismic standards of the Quebec Construction Code and the National Building Code of Canada.

12.3.1.3 Floods

Flooding usually occurs upstream of sills (raising of the watercourse or narrowing of the banks) that impede the flow of water. Ice jams can also contribute to flooding by obstructing the flow of water, particularly at stream constrictions during spring freshet.

Several watercourses are located near the project site and could cause flooding. Extreme precipitation events, rapid snowmelt, and increased rain-on-snow events are all events that can increase the likelihood of flooding. However, in terms of the project site, this would likely result in local accumulation. The water would then be drained through the existing drainage system.

The risk of major flooding at the project site is considered low.

12.3.1.4 Ground instability

The site's elevation varies between 335 m and 340 m above mean sea level (BBA, 2025). The site is relatively flat, with a slight slope toward the north (BBA, 2025).

Given the low gradient encountered at the project site, and considering that the project site is located in an area with very low susceptibility to landslides, the risk associated to the instability of surface deposits is considered negligible. However, landslides are likely to be affected by climate change. Therefore, stockpile erosion and landslides could occur at the site through triggers or exacerbating factors such as extreme precipitation events and increased total annual precipitation.

12.3.1.5 Extreme weather events

Extreme weather events can occur in summer in the form of heavy rain, hail, and strong winds. In winter, these conditions can include heavy snowfall, strong winds, or freezing rain. All these phenomena are caused by specific conditions associated with temperature and humidity gradients between different air masses.

The consequences of these extreme weather conditions can be direct or indirect. Wind, precipitation, snow, and ice can cause overloading, directly compromising the structural integrity of buildings and equipment.

The design of buildings and equipment will comply with applicable codes and regulations to withstand the additional loads created by extreme weather conditions. In addition, excessive snow and ice loads will be removed as required. However, extreme weather conditions remain a plausible accident scenario to consider, especially given the impact of climate change on the frequency of such incidents.

12.3.1.6 Forest fires

The Ministère des Ressources naturelles et des Forêts (MRNF) is responsible for forest fire management in Quebec. However, the Ministère is supported by the Société de protection des forêts contre le feu (SOPFEU) in the prevention, detection, and fighting of fires. The project site is located in the northern protection zone of the SOPFEU classification of the territory. Unlike the intensive zone, where all fires are fought, the northern zone focuses on observation and targeted intervention to protect communities and strategic infrastructure. A human-caused fire prevention program is also in effect (Gouvernement du Québec, 2026).

The geographic location of the assessment site indicates a relatively high probability of forest fires developing around the site. In addition, the number of days conducive to the spread of forest fires will increase by 2050 due to climate change, according to projections outlined in the site's climate change resilience study sectoral report provided in Appendix 11-1.

Consequently, the risk of forest fires in the project area is considered to be very high.

12.3.2 External hazards of anthropogenic origin

12.3.2.1 Air transportation

The closest airport to the site under study is La Grande-4 Airport. It is located approximately 50 km, as the crow flies, southwest of the site.

The risk of airplane crashes is highest in the landing and take-off maneuvering areas. For large aircraft, this area is approximately 8.5 km long from the end of the runways and approximately 5 km wide. For small aircraft, this area forms a circle of about 4 km around the centre of the runway (De Grandmont, 1994). The project site is therefore located outside the landing and take-off maneuvering areas of any airfield.

In addition to the risk of accidents being high over the immediate surroundings of an airport, the risks are also high in air traffic corridors. Excluding these areas, the probability of an aircraft crash at any given location is considered very low.

12.3.2.2 Power transmission

The power transmission line located near the site is Hydro-Québec's transmission corridor (735 kV), located 14 km north of the site, along the Trans-Taiga Road. A 120 kV substation will be built near Hydro-Québec's Tilly substation, along with a 53-km-long power line to bring electricity to the site.

During the construction phase, prior to the installation of this power line, a diesel-powered thermal power plant will be set up to meet the site's energy needs.

12.3.2.3 Vandalism and trespassing

The project site could be the target of ill-intentioned individuals. Trespassing and vandalism are potential dangers. However, the following measures limit the risks:

- there will be a gatehouse at the site entrance;
- site access controllers will be able to track on-site personnel and material;
- surveillance cameras will be installed on site and linked to the gatehouse;
- an intercom system will be available;
- fencing will also be installed to prevent access to the site from forest roads;
- explosives (ammonium nitrate) will be stored underground.

12.3.3 Identification of hazards related to site activities

The main infrastructure planned for the project is as follows. It is presented in Map 12-1:

- an open pit;
- an underground mine;

- a mine garage and a wash bay;
- an area for loading and handling explosives;
- a concentrate loading area;
- a tailings loading area;
- a paste backfill plant;
- tailings storage facilities;
- a waste rock and overburden stockpile;
- water management structures;
- electricity supply infrastructure;
- a main access road and internal roads;
- a workers' camp;
- mechanical workshops;
- warehouses;
- a fuel storage area and a refuelling station;
- an emulsion warehouse and an explosives warehouse.

The main hazards identified on the site are related to the following activities:

- operation of a mining pit;
- operation of an underground mine;
- ore processing
- use of air treatment systems;
- storage and use of chemicals;
- storage and use of explosives;
- storage and use of petroleum products;
- storage and use of flammable gases;
- operation of a sewage treatment plant;
- storage of waste rock, overburden, and tailings;
- presence of retention dikes;
- transport of mine tailings;
- transportation of hazardous materials and concentrates.

12.4 Potential accident risks

12.4.1 Open pit mining

This section covers the risks associated with the mining pit. Two accident scenarios have been identified:

- Flooding of the pit.
- Rockfall along the walls of the pit.

12.4.1.1 Pit flooding

Water infiltration is an inherent hazard in mining operations. Surface or groundwater could enter the pit as a result of damage to the rock caused by blasting, or due to faults in the rock structure exhibiting excessive cracking, which could lead to water flowing into the pit or significant flooding. Any excess water that seeps into the pit will then need to be pumped out, resulting in a halt to pit operations.

Preventive and control measures

The following preventive and control measures will be in place to reduce the risk of flooding in the pit:

- Conducting geological and geotechnical studies to characterize the site.
- Monitoring the effects of blasting (in pits) on the formation of excessive cracking.
- Installation of pumps to bring water to the surface.
- Diversion of rainwater from areas not affected by mining operations, as much as possible, to prevent it from reaching the mine pit.
- Design and operation of the pit in accordance with the criteria of the Canadian Dam Association and the *Dam Safety Act* (R.S.Q. c. S-3.1.01).
- Use of the structure's operating manual issued by the designer.
- Implementation of an inspection program according to the designer's specifications.
- Monitoring water levels.

Probability of occurrence

Flooding of the pit due to water infiltration could occur, as this type of incident has occurred at similar sites. Furthermore, disruptions related to climate change tend to increase the likelihood of such an event occurring. The probability of occurrence is considered **moderate**.

Severity

The consequences of such a flood would potentially include injuries, as well as the shutdown of pit operations from one day for up to a month. The severity level is considered **moderate**.

Estimation of the risk level

Table 12-6 Risk level for the open pit – Flooding due to water infiltration

Probability of occurrence	Severity level	Risk level
Moderate	Moderate	Moderate

The risk level is based on risks to people and property.

12.4.1.2 Rockfall and landslides along the walls of the pit

Preventive and control measures

The following preventive and control measures will be in place to reduce the risk of rockfall and landslides along the pit walls:

- Conducting geological and hydrogeological studies to characterize the site.
- Design of pit slopes in accordance with the *Regulation respecting occupational health and safety in mines* (R.R.Q., c. S-2.1, r. 14)
- Implementation of a monitoring system for potential landslides or rockfalls in the pit.
- Dimensioning of sill and rib pillars to ensure the stability of the mining pit slope.

Probability of occurrence

Rockfalls or the sliding of unconsolidated deposits along the pit walls could occur. The accident history shows that this type of accident has already occurred several times at similar sites. However, given the preventive measures taken, the probability of occurrence is considered **low**.

Severity

This type of accident can cause injuries ranging from permanent disability to significant economic damage. The severity level is considered **high**.

Estimation of the risk level

Table 12-7 Risk level for the open pit – Rockfall along the pit walls

Probability of occurrence	Severity level	Risk level
Low	High	Moderate

The risk level is based on risks to people and property.

12.4.2 Underground mine

This section covers the risks associated with the underground mine. Three accident scenarios have been identified:

- Mine flooding.
- Fire in the underground mine.
- Underground subsidence.

12.4.2.1 Mine flooding

Water infiltration is an inherent hazard in mining operations. In an underground mine, fractures in the rock connected to water tables above the excavation could lead to flooding.

Preventive and control measures

The following preventive and control measures will be in place to reduce the risk of flooding in the underground mine:

- Design of the pumping system, following a hydrogeological study, by oversizing the pumps to remove all anticipated mine drainage water.
- Installation of a water-level sensor at the bottom of the mine, with a continuous monitoring system.
- Redundancy in water evacuation pumps.
- Temporary suspension of underground operations in the event of a hazardous situation.
- Refuge stations that comply with the requirements of the *Regulation respecting occupational health and safety in mines*.
- Maintaining an up-to-date emergency response plan, including an evacuation procedure for the underground mine.
- Monitoring water levels.

Probability of occurrence

Flooding of the underground mine due to water infiltration could occur, as this type of incident has occurred at similar sites. The probability of occurrence is considered **low moderate**.

Severity

The consequences of such a flood would potentially include injuries, as well as the shutdown of underground operations between one day and one week. The severity level is considered **moderate**.

Estimation of the risk level

Table 12-8 Risk level for flooding due to water infiltration in the underground mine

Probability of occurrence	Severity level	Risk level
Low	Moderate	Moderate

The risk level is based on risks to people and property.

12.4.2.2 Fire in the underground mine

A fire could break out in various parts of the mine, leading to consequences for workers, mine evacuation, and financial losses.

The main potential sources of fire include flammable materials, fuels (such as diesel), hydraulic and lubricating oils, vehicle tires, conveyor belts, explosives, and electrical equipment.

Preventive and control measures

The following preventive and control measures will be in place to reduce the risk of fire in the underground mine:

- An on-site team of mine rescue workers trained by the CNESST.
- Fire fighting equipment in vehicles.
- Automatic fire-extinguishing systems in vehicles and in facilities storing fuel and flammable liquids.
- Preventive vehicle maintenance.
- Operating procedures, particularly for refuelling vehicles.
- Inspection program for vehicles and facilities storing fuel and flammable liquids.
- Refuge stations that comply with the requirements of the *Regulation respecting occupational health and safety in mines*.
- Maintaining an up-to-date emergency response plan, including an evacuation procedure for the underground mine.
- Maintaining an up-to-date emergency response plan, including a procedure for responding to fires in underground mines.

Probability of occurrence

Fires may occur during the lifetime of the future underground mine. The probability of occurrence is considered **moderate**.

Severity

A fire in an underground mine could cause injuries that could lead to disability. The severity level is considered **moderate.** However, mitigation measures (refuge stations, fire-extinguishing systems, firefighting equipment) help to minimize the risk of loss of life.

Estimation of the risk level

Table 12-9 Fire risk level in the underground mine

Probability of occurrence	Severity level	Risk level
Moderate	Moderate	Moderate

The risk level is based on risks to people and property.

12.4.2.3 Underground subsidence

Unstable rock or high stress levels within the rock can cause rockfall.

Preventive and control measures

The following preventive and control measures will be in place to reduce the risk of underground subsidence.

- Mining design based on the stability characteristics of the rock mass.
- Continuous monitoring by staff specializing in rock mechanics.
- Surface monitoring in accordance with health and safety standards in mines.
- Procedure for inspecting rock mechanics.
- Monitoring of underground stresses.
- Closure of areas at risk of subsidence or collapse.
- Maintaining an up-to-date emergency response plan, including an evacuation procedure for the mining area.

Probability of occurrence

Subsidence could only occur in exceptional circumstances. The probability of occurrence is considered **very low**.

Severity

Subsidence in underground mines could result in serious injury to workers and/or loss of life, as well as causing a significant disruption to production, leading to major economic losses. The severity level is considered **very high**.

Estimation of the risk level

Table 12-10 Risk level for underground subsidence

Probability of occurrence	Severity level	Risk level
Very low	Very high	Moderate

The risk level is based on risks to people and property.

12.4.3 Ore processing

This section covers the risks associated with ore processing. Four accident scenarios have been identified:

- Fires.
- Dust emissions.

12.4.3.1 Fires

A fire may break out in the ore processing facilities. Potential causes may include:

- Welding on equipment with an internal rubber lining.
- Friction of conveyor belts.
- Short circuit or overheating in an electric motor.
- Use of faulty backup heating equipment or systems.
- Negligence while performing hot work.

Preventive and control measures

The following preventive and control measures will be in place to reduce the risk of fire at the ore processing facilities:

- Maintenance of conveyor to prevent belt misalignment and friction.
- Use of lubricating oil with a low flash point.
- Monitoring and preventive maintenance of hydraulic systems.
- Installation of thermostatic sprinklers on the conveyors, as well as a water leak alarm system connected to the fire control panel.
- Design based on National Fire Protection Association (NFPA) standards.
- Fire extinguishers at each conveyor drive unit and in all areas where there is a risk of fire.
- Firefighting water supply network and hydrants.
- Sprinkler systems in offices, workshops, and throughout the plant.
- Fire brigade training.
- Maintaining a sufficient supply of water for firefighting at all times.
- Maintaining an up-to-date emergency response plan, including a fire response procedure.

Probability of occurrence

A fire could break out at the future facilities, as this type of incident has already occurred at similar sites. However, this is not a likely event given the preventive measures in place. The probability of occurrence is considered **low**.

Severity

In general, when a fire breaks out in a building, the consequences are primarily health effects associated with thermal radiation and toxic fumes. The severity of a fire can vary, but it can result in serious injury or even permanent disability. It can also result in financial losses (business disruption, significant damage to expensive equipment, etc.).

If an incident were to spread beyond buildings and infrastructure, the natural environment could be affected. The anticipated impacts would mainly include vegetation mortality, disruptions to forest development, and the relatively long-term loss of habitat or plant species that support the presence of various wildlife species. Vegetation fires affect the ecological role of forests at every level: species, stand, and landscape. The water quality of the affected watercourses could also be affected by the discharge of particulate matter and other contaminants into the water.

The severity level is considered **high**.

Estimation of the risk level

Table 12-11 Fire risk level at ore processing facilities

Probability of occurrence	Severity level	Risk level
Low	High	Moderate

The risk level is based on risks to people, the environment, and property.

12.4.3.2 Discharge environmentally non-compliant (atmospheric discharge)

Handling, crushing and conveying operations may release dust into the atmosphere. The process plant will be fitted with dust collectors in the required locations to control dust emissions. However, the following events could result in the accidental release of dust into the atmosphere:

- Malfunction in a cleaning system: design or operational error, human error, breakdown, etc.
- Monitoring equipment failure or damage.

Preventive and control measures

The following preventive and control measures will be in place to reduce the risk of exposure to dust:

- Preventive maintenance of dust collectors.
- Monitoring of pressure inside the filters.
- Ducted dust extraction system.
- Water spraying in areas where tailings are handled, as well as on access roads.
- Inspection program.

Probability of occurrence

Dust emissions and exposure to dust could occur during the facility's operational life. This is believed to be a likely incident. The probability of occurrence is considered **moderate**.

Severity

Such emissions are likely to have an impact on the health of workers in the vicinity. The main product likely to be emitted is spodumene. However, it is not a highly toxic product.

Dust emissions in traffic and handling areas can reduce visibility. At the environmental level, the impact will be limited to the property. Vegetation near traffic areas and handling areas may be affected in some locations. Consequently, the severity level is considered **low**.

Estimation of the risk level

Table 12-12 Risk level for dust exposure

Probability of occurrence	Severity level	Risk level
Moderate	Low	Moderate

The risk level is based on risks to people and the environment.

12.4.4 Storage and use of chemicals

Products, some of which are classified as dangerous goods under the *Transportation of Dangerous Goods Regulations* (SOR/2008-34) or the *Controlled Products Regulations* (SOR/88-66), are used as reagents or additives for ore processing in the process plant and for the treatment of mine wastewater.

Table 12-13 lists the main products used in ore processing, along with their storage methods and estimated quantities. Table 12-14 shows the characteristics of these products.

Accidental spills of chemical(s) may occur during the transport, use, handling, or storage of these products. Equipment failure or human error can also be the cause of such spills.

Table 12-13 Main products used in ore processing

Product	Use	Storage method	Annual quantity used (t)	Maximum quantity stored (t)
Ferrosilicon (Ferrosilicium [FeSi])	Weighting agent	1-tonne flexible bags, stored on pallets in a dry, well-ventilated warehouse	1000	50
Magnafloc 10	Anionic flocculating agent	25 kg bags on pallets, stored in a dry, well-ventilated room	10	2

Table 12-14 Characteristics of the main products used in ore processing

Product	Characteristics			
	State	Colour	Reactivity	Classification
Ferrosilicon (Ferrosilicium [FeSi])	Solid	Silver-grey metallic powder	Reacts with strong acids, may react with water to create hydrogen vapours. Dust is flammable.	
Magnafloc 10	Solid	White powder and granules	Non-reactive. However, dust can be an irritant and makes surfaces slippery when it comes into contact with water.	Non-hazardous

Table 12-15 lists the main products used for water treatment, along with their storage methods and estimated quantities. Table 12-16 shows the characteristics of these products.

Table 12-15 Main products used for water treatment

Product	Use	Storage method	Annual quantity used (t)	Maximum quantity stored (t)
Ferric sulphate	Coagulant	Stored in 1 m^3 containers	224.4	20
Anionic polymer	Coagulant	Stored in original bags on wooden pallets	2.24	1
Cationic polymer	Coagulant	Stored in original bags on wooden pallets	1.22	1

Table 12-16 Characteristics of the main products used for water treatment

Product	Characteristics			
	State	Colour	Reactivity	Classification
Ferric sulphate	Liquid	Reddish brown	Non-reactive, incompatible with carbon steel, bronze, carbon, alloys, nylon, and aluminum.	
Anionic polymer	Solid (powder)	White	Non-reactive.	-
Cationic polymer	Solid	White	Non-reactive.	-

Preventive and control measures

The preventive and control measures listed below will be implemented to reduce the risk of chemical spills.

Storage

Storage will be in accordance with compatible product classes as defined by the Workplace Hazardous Materials Information System (WHMIS-GHS), the *National Fire Code* (NFC), and the *Regulation respecting hazardous materials*.

Dedicated storage areas will be provided, and storage procedures will take into account any incompatibilities between products.

Secondary containment systems at transfer points shall be designed to contain the worst-case spill scenario. The volume to be contained will be specified for each reagent supplied in bulk, based on the transfer rates and the supplier's recommendations.

All used chemicals that cannot be reused will be stored for up to one year in accordance with the *Regulation respecting hazardous materials.* Spent hazardous materials will be recovered by companies authorized to recover the products concerned. Safe collection areas with specialized containers for categorized waste and used hazardous materials will be provided at appropriate locations depending on the production site. These temporary storage areas will be inspected on a regular basis and their operating procedures will be made clear to all employees to avoid mixing errors or container spills.

Handling

Chemicals will be used in accordance with supplier guidelines and applicable regulations. When handling chemicals, appropriate personal protective equipment (e.g., safety glasses or goggles, chemical-resistant gloves [neoprene, butyl rubber, rubber, or leather], appropriate protective clothing [e.g., face shields]) shall be mandatory. Equipment to be used in critical areas will be indicated by signs. They will also be defined in advance in an occupational health and safety program.

Training

Employees responsible for handling and transporting hazardous materials will have received specific training on the handling and hazards involved, such as Transportation of Dangerous Substances, WHMIS, or other training appropriate to the task. Employees must be familiar with the information contained in the material safety data sheets of the hazardous products used.

Transport

Plans are in place for the chemicals to be transported to the site by truck. Transportation procedures will then comply with the *Transportation of Dangerous Substances Regulation* and the Transportation of dangerous substances guide (Ministère des transports, 2019). Hazardous materials will be placed in compliant, leak-proof containers to limit the risk of a spill should they be tipped over by the transporter.

Emergency response equipment

Spill kits specific to the nature and quantities of the substances will be strategically placed on the site (storage and refuelling areas). The contents of these kits will be checked periodically.

Emergency showers and eye wash stations will also be installed in areas where chemicals are used.

Emergency response plan

An emergency plan will be drawn up and kept up to date. It will include a procedure for responding to spills of hazardous materials, including chemicals.

Probability of occurrence

A chemical spill is an unlikely event given the preventive measures in place. However, it could happen, as it has occurred at similar sites. The probability of occurrence is considered **low**.

Severity

In the event of a chemical spill, the substance, if solid, will accumulate near its storage bag. Even in liquid form, it is unlikely to reach a watercourse. The severity level of the environmental impact is considered low given the quantities involved, the fact that these products will be used and stored indoors, and the mitigation measures put in place. The impact would therefore be very localized.

However, in the event of a spill:

- When ferrosilicon comes into contact with water, it releases a flammable, highly explosive gas as well as a toxic gas, phosphine (or hydrogen phosphide).
- Magnafloc can irritate eyes and the respiratory system and, when it comes into contact with water, can make floors slippery, posing a slip hazard to staff working in the area.
- When exposed to temperatures above 300 °C, ferric sulphate can produce sulphur oxide or flammable hydrogen, which may result in an explosion. In the event of a spill, it is recommended that workers be evacuated.

The severity level is considered **high** due to the reactivity of ferrosilicon.

Estimation of the risk level

Table 12-17 Risk level associated with chemical spills

Probability of occurrence	Severity level	Risk level
Low	High	Moderate

The risk level is based on risks to people and the environment.

12.4.5 Storage and handling of explosives

Blasting in the pit and underground mine will be carried out using two types of emulsion explosives: Fortis Clear, consisting of ammonium nitrate and petroleum distillate (naphtha), and Subek Charge, composed of ammonium nitrate, sodium nitrate, petroleum, and surfactant. Storage operations will be carried out in an above-ground storage facility and in the temporary explosives storage area located in the underground mine.

Quantity of ammonium nitrate emulsion on site will be a maximum of 31,500 tonnes, with a concentration of between 60% and 80%.

Ammonium nitrate is listed in the RUE as a substance with the potential to cause a major industrial accident (CAS No. 6484-52-2). The specified threshold quantity is 20 metric tonnes. The quantity intended for storage is therefore greater than this threshold quantity.

This section covers the risks associated with the use and storage of ammonium nitrate. Two major accident scenarios have been identified:

- Uncontrolled explosions (above ground or underground).
- Theft of explosive materials.

12.4.5.1 Uncontrolled explosions

An uncontrolled explosion could occur as a result of an accident involving a transport vehicle, a fire at an explosives storage site, or a poorly controlled blast.

Preventive and control measures

The preventive and control measures listed below will be implemented to reduce the risk of uncontrolled explosions on the surface.

Use

- To prevent any negligence or error, the handling and use of explosives will be entrusted to an accredited service provider specializing in this field.
- Workers handling explosives must hold an explosives certificate issued by the Sûreté du Québec.
- All sources of heat and open flames, as well as other pyrotechnic or flammable materials, must be removed before beginning to recover the dispersed products, as an explosive may detonate if it comes into contact with a fire.
- Specific checks will be carried out to verify the dimensions, depth, and orientation of the blast holes, as well as the charges.
- Weather conditions (e.g., rain, wind) can affect the effectiveness of a blast. If there is water in the blast holes, the detonation will not be as effective as in dry conditions. Some of the explosives, namely ammonium nitrate, could also turn into nitrogen oxide vapours, a toxic gas. The blasting schedule will be drawn up taking weather conditions into account to minimize the risk of failed blasts and to protect workers.
- Blasting operations must comply with the requirements of the *Regulation respecting occupational health and safety in mines* (R.R.Q., c. S-2.1, r. 14).
- No-smoking signs will be posted in the explosives assembly area and within the blasting zones.
- Particular attention will be paid to emissions resulting from the detonation of wet explosives or faulty blasts, so as not to harm workers' health or the environment.

Storage

The management of facilities for the storage and preparation of explosives will also be the responsibility of the specialized contractor. The contractor must ensure that:

- The storage conditions (location, distance, dimensions, etc.) comply with the relevant provincial and federal regulations, including the *Regulation respecting hazardous materials* (R.S.Q., c. Q-2, r. 32), the quantity-distance principles of the Explosives Regulatory Division (ERD), and the Guidelines for Bulk Explosives Facilities (Ressources naturelles Canada, 2018).
- Explosives are stored in warehouses. These warehouses will be secured to prevent unauthorized access and will comply with provincial and federal explosives legislation (CQLR c E-22, r 1 and R.S.C., c. E-17) regarding construction standards, safety distances from site buildings, protective measures, and well-ventilated, moisture-free locations.
- The products used are clearly identified.
- Explosives and blasting agents are stored separately.

Transport

The transport of explosives will also be carried out by a specialized contractor, in accordance with the requirements set out in the *Regulation respecting hazardous materials*. Vehicles used to transport explosive materials will be clearly marked, and the personnel transporting them will have the necessary training and skills.

Emergency response plan

An emergency plan will be drawn up and kept up to date. It will include a response procedure for accidents involving explosives.

Probability of occurrence

Explosions could occur, but only in exceptional circumstances. The probability of occurrence is considered **very low**.

Severity

The use of ammonium nitrate in explosives results in the emission of gases, namely carbon dioxide (CO_2), nitrogen (N_2), hydrogen (H_2), nitrogen oxides (NOx), sulphur dioxide (SO_2), and carbon monoxide (CO). Under normal operating conditions during blasting operations, none of these gases poses a risk to the health of workers. However, the nitrogen oxide fumes produced by burning ammonium nitrate are extremely toxic.

An explosion is a physical phenomenon involving the rapid release of a large amount of energy in the form of high-pressure, high-temperature gas. It is a pressure wave accompanied by fragmentation effects (shrapnel) and/or thermal effects (heat emission). Impact distances are difficult to estimate as they depend on the terrain, the presence of obstacles and/or buildings in the vicinity, and the quantity of explosive materials involved.

An explosion can cause flammable materials to ignite due to the heat generated or the projection of burning debris. In such cases, the impacts on environmental components, as well as the preventive and control measures, will be those established for fires.

Such incidents could result in serious injury or, in the worst-case scenario, loss of life. Depending on where the explosion occurs, it could also cause significant damage to property and result in operations being suspended for around a month.

Vegetation near the site of the explosion could be destroyed by the heat. As the distance from the explosion site increases and in the absence of a fire, the potential impacts on vegetation will be linked to the effects of the blast and flying debris. As for the wildlife within the impact radius, the potential consequences include injury or even death. There are also concerns about the reduced availability of feeding grounds and shelter when habitats are disturbed. Lastly, the water environment could also be affected by debris and contaminants entering the water.

Therefore, the severity level is considered **very high**. To better assess the consequences of such incidents, a quantitative impact assessment was carried out. The results are presented in Section 12.5.

Estimation of the risk level

Table 12-18 Risk level for an uncontrolled surface explosion

Probability of occurrence	Severity level	Risk level
Very low	Very high	Moderate

The risk level is based on risks to people, the environment, and property.

12.4.5.2 Theft of explosive materials

Stolen explosives could be used for criminal purposes.

Preventive and control measures

The following preventive and control measures will be implemented to reduce the risk of theft of explosive materials:

- Supervised delivery of explosives at all times.
- Keeping inventory records of explosives and detonators up to date.
- Warehouses located within fenced-off areas.
- Keeping the emergency response plan up to date. It will include a procedure for responding to thefts of explosives.

Probability of occurrence

Theft of explosive materials could occur, but only in exceptional circumstances, particularly given the considerable distance between the site and public areas; the likelihood is therefore considered to be **very low**.

Severity

The malicious use of stolen explosives could result in serious injury and/or loss of life. The severity level is considered **very high**.

Estimation of the risk level

Taking into account both probability and severity, the risk level for the theft of explosive materials is assessed as **moderate**.

Table 12-19 Risk level for the theft of explosives

Probability of occurrence	Severity level	Risk level
Very low	Very high	Moderate

The risk level is based on risks to people and property.

12.4.6 Storage and use of petroleum products

During the construction phase, a 20,000-litre diesel tank is to be used to meet the site's requirements.

During Phase 1 of operations, three diesel tanks will be added. Each will have a capacity of 50,000 litres and will be installed at the fuel farm. These tanks will be above-ground and double-walled.

Three additional diesel tanks, each with a capacity of 50,000 litres, will be installed from the third year onwards.

Finally, a backup power plant consisting of three diesel generators, each with a capacity of 2 MW, will ensure the continuity of critical operations in the event of a power failure.

The fuel will be delivered by tank trucks. The characteristics of diesel fuel are shown in Table 12-20.

Table 12-20 Diesel fuel characteristics

Product	State	Flash point (°C)	Self-ignition temperature (°C)	Flammability limits		Reactivity	Classification
				LFL	UFL		
Diesel	Liquid	>40	>225	0.7	6	Strong oxidizing agents and strong acids	

Diesel is a product of petroleum distillation and is composed of various hydrocarbons in the C_{10} series and higher. It appears as a clear, yellow liquid. It is not very volatile at room temperature, but can emit vapours that form an explosive mixture with air when heated. Diesel is less dense than water (density of 0.85) and insoluble in water.

The risk of flammability associated with flammable products is linked to:

- the release of the product into the atmosphere in such quantities that it falls within the flammability range;
- the presence of an ignition source.

Diesel is listed in the RUE as a substance with the potential to cause a major technological accident (CAS 68334-30-5, CAS 68476-30-2, CAS 68476-31-3, CAS 68476-34-6). The specified threshold quantity is 2,500 metric tonnes. The quantity intended for storage is therefore below this threshold.

Lastly, hydraulic and lubricating oils, as well as grease, will also be used. These oils are hydrocarbons and come from a relatively heavy fraction of petroleum. They are viscous and have high flash points.

This section covers the risks associated with the transport, storage, and use of petroleum products. Three accident scenarios have been identified:

- Petroleum product spills.
- Fires and/or explosions of petroleum products.
- Oil and grease spills.

12.4.6.1 Petroleum product spills

The main factors likely to cause accidental spills of petroleum products are:

- accidents involving the transport of a petroleum product by truck on the site;
- collisions causing fuel tank breakage (vehicle, machinery, or other);
- leaks in valves, pipes, or connections;
- machinery breakdowns;
- corrosion of equipment;
- overflowing tanks or other containers during filling;
- human error.

Preventive and control measures

The preventive and control measures listed below will be implemented to reduce the risk of petroleum product spills.

In the construction phase

- Plan sufficient emergency petroleum and chemical recovery kits and place them at sensitive locations.
- Frequently inspect machinery to ensure it is in good condition (it must be clean and free from any leaks of contaminated substances) and that fuel and lubricant tanks are completely leakproof. If a leak is found, repair it immediately.
- Take the usual precautions when carrying out maintenance (oil changes, lubrication, etc.) and refuelling machinery on the work site to prevent any accidental spills. Maintenance work must only be carried out in authorized areas designated for this purpose (garage, mechanical workshop); refuelling must take place within the areas marked out for this purpose.
- All fixed equipment containing oil and/or fuel (e.g., lighting towers, generators, crushers, screens) located within 60 metres of a watercourse or body of water must be fitted with a leakproof recovery system. The equipment must carry absorbent material to respond quickly and effectively to accidental spills.
- No maintenance of vehicles or machinery is permitted outside the areas designated for this purpose.

- Mark out access points, routes, and work areas before starting work, and prohibit parking and the movement of machinery and vehicles outside these areas.
- Fuel for the machinery will be supplied by road. All suppliers must comply with the *Transportation of Dangerous Goods Act* and the *Regulation respecting hazardous materials*. They will need to draw up safety and emergency procedures.
- Contractors must hold a licence to operate high-risk petroleum equipment if they install or use an above-ground tank with a capacity of 10,000 litres or more of diesel fuel, or a tank with a capacity of 2,500 litres or more of gasoline. This licence comes with monitoring and maintenance requirements.

In the operations phase

- The design of transfer points, equipment, and tanks will comply with the requirements of applicable regulations, standards, codes, and industry best practice.
- The tanks will be installed on a concrete slab.
- The tanks will be double-walled and will have a secondary containment basin with a capacity sufficient to hold 110% of the stored volume.
- A fuel tank level detection system will be installed. This equipment will be used to check the level of the tanks to prevent any overflow and to confirm the structural integrity of the double walls.
- A separator will be installed downstream of the fuel depot to treat accidental spills before they enter the drainage system.
- A procedure for the receipt and distribution of petroleum products will be drawn up.
- Tanks and associated equipment will undergo preventive maintenance to prevent breakdowns and premature wear and tear.
- Workers involved in the transfer and handling of bulk petroleum products will receive training.
- Spill kits containing absorbent materials will be placed near transfer and handling points.
- A routine inspection program for petroleum product transfer and storage facilities will be introduced.
- The emergency response plan will include a procedure for dealing with spills of hazardous materials, including petroleum products.

Probability of occurrence

A petroleum product spill, regardless of the quantity spilled, could occur several times over the course of the mine's operational life. The probability is considered **high**.

Severity

A spill of petroleum products into a retention pond or onto a waterproof surface such as a concrete slab will have no consequences once it has been cleaned up.

In the event of an uncontained spill of petroleum products, the product could flow onto the ground by gravity and accumulate in a low-lying area. In the worst-case scenario—although this is highly unlikely—the spill could reach a wetland, Lake L12, and Lake L02, which flows into Lake L07.

A spill of petroleum products could also cause a fire if the oil slick catches fire. This scenario is assessed in the following section.

Although such a spill could be major, it would be contained at the site of the incident, given the preventive measures in place (double-walled tanks, containment systems, etc.) and the response resources available (spill kits and containment measures) The affected environment may be the soil, a wetland or, in the worst-case scenario, a watercourse, depending on the location, the volume, and the containment level of the spill. The severity level can range from l**ow (soil) to moderate (wetlands or watercourses).**

Estimation of the risk level

Table 12-21 Risk level associated with spills of petroleum products

Probability of occurrence	Severity level	Risk level
High	Moderate	High

The risk level is based on environmental risks.

12.4.6.2 Fires and/or explosions of petroleum products

A fire involving petroleum products could occur in the diesel storage area or during its transport and distribution.

Preventive and control measures

The following preventive and control measures will be implemented to reduce the risk of fire and/or explosion involving petroleum products:

- The design of transfer points, equipment, and tanks will comply with the requirements of applicable regulations, standards, codes, and industry best practice.
- Installation of the tanks on concrete slabs.
- Diesel tank level detection: instrumentation designed to monitor tank levels to prevent overflow and to ensure the structural integrity of the double walls.
- Development of a procedure for the receipt and distribution of petroleum products.
- Preventive maintenance of tanks and associated equipment to prevent breakdowns and premature wear.
- Training for workers involved in the transfer and handling of bulk petroleum hydrocarbons.
- Fire brigade training.
- Assessment of risks and compliance at transfer and storage facilities for petroleum products as part of internal inspections.
- A water reserve for fire protection.
- Maintaining an up-to-date emergency response plan, including a fire response procedure.

Probability of occurrence

A fire or even an explosion involving petroleum products could occur in exceptional circumstances, such as a fire near petroleum product tanks or the ignition of fuel following a spill. The probability of occurrence is considered **very low**.

Severity

Fires

In the event of a fire involving petroleum product tanks, it is unlikely that the fire will spread to neighbouring infrastructure given their location. Therefore, only impacts on the people present, on infrastructure, and on vegetation are taken into account due to the heat released.

Explosions

An explosion is a physical phenomenon involving the rapid release of a large amount of energy in the form of high-pressure, high-temperature gas. It is a pressure wave accompanied by fragmentation effects (shrapnel) and/or thermal effects (heat emission). Impact distances are difficult to estimate, as they depend on the terrain, the presence of obstacles and/or buildings, and the quantity of explosive materials involved.

An explosion involving petroleum products can cause flammable materials to ignite as a result of the heat generated or flying burning debris. In such cases, the impacts on environmental components, as well as the preventive and control measures, will be those set out in the previous section. However, this type of incident could cause permanent disability or even loss of life within the blast radius, as well as significant damage to nearby buildings and infrastructure, requiring a halt to production and resulting in substantial economic losses. In terms of the impact on the environment, the vegetation near the site of the explosion (the petroleum product storage area) could be destroyed by the heat. As the distance from the explosion site increases and in the absence of a fire, the potential impacts on vegetation will be linked to the effects of the blast and flying debris. With regard to wildlife within the blast radius, the potential effects could include injury or even death.

The severity level is considered **very high**.

Estimation of the risk level

Table 12-22 Risk level for fire involving petroleum products

Probability of occurrence	Severity level	Risk level
Very low	Very high	Moderate

The risk level is based on risks to people and property.

12.4.6.3 Oil and grease spills

A spill of petroleum products such as lubricating oils and grease could occur. The causes could include equipment failure, operator error, or a spill from equipment.

Preventive and control measures

The following preventive and control measures will be in place to reduce the risk of oil and grease spills:

- The design of transfer points, equipment, and tanks will comply with the requirements of applicable regulations, standards, codes, and industry best practice.
- Equipment for containing spills in storage, distribution, and usage areas.
- Environmental protection and awareness training for workers;
- Spill kits containing absorbent materials will be kept near transfer and handling points.
- Maintaining an up-to-date emergency response plan that includes a procedure for dealing with spills of hazardous materials, including oils and grease.

Probability of occurrence

An oil and grease spill is unlikely given the preventive measures in place. However, it could occur. The probability of occurrence is considered **low**.

Severity

The severity level of the impact on the natural environment is considered **low** given the quantities involved, the fact that these products will be used and stored indoors, and the mitigation measures that have been put in place. The impact will be **low** and, as a result, very localized.

Estimation of the risk level

Table 12-23 Risk level for oil and grease spills

Probability of occurrence	Severity level	Risk level
Low	Low	Low

The risk level is based on environmental risks.

12.4.7 Storage and use of flammable gases

Compressed natural gas (CNG) will be used to heat the concentrator and auxiliary buildings, as well as the camp. This will be delivered by a supplier via a high-pressure (up to 4,300 psi) trailer system, serving as both delivery and mobile storage units.

Up to three trailers can be stored at two locations, for a total of six trailers. Each trailer contains four tanks, with a total capacity of 11,700 m^3 of CNG.

The characteristics of CNG are shown in Table 12-24.

Table 12-24 CNG characteristics

Product	State	Flash point (°C)	Self-ignition temperature (°C)	Explosive limits		Reactivity	Classification
				LFL (%)	UFL (%)		
CNG	Gas	-188	>580	5	15	Not compatible with oxidants	

CNG is primarily (83% to 95%) composed of methane (CH_4), along with ethane and propane. It looks like a colourless gas and smells of sulphur, or rotten eggs. CNG is less dense than air (density of 0.56).

The explosion risk associated with CNG is linked to:

- a rise in temperature;
- an energy source causing an explosion due to pressure in the tanks;
- the presence of an ignition source.

Methane, ethane and propane are listed in the RUE and in the MELCCFP Guide as substances with the potential to cause a major technological accident. The threshold quantity specified for this gas is 4.5 metric tonnes. The quantity intended for storage is therefore greater than this threshold quantity.

Two accident scenarios have been identified:

- Fire affecting a CNG tank.
- Explosion of a CNG tank.

12.4.7.1 Fire affecting a CNG tank

A fire could break out if CNG leaks in the presence of an ignition source. The gas could then ignite. Such a leak could be caused by a tank failure, or by a collision with a vehicle travelling in the area.

Preventive and control measures

The following preventive and control measures will be in place to reduce the risk of fire affecting a CNG tank:

- Design of storage facilities, equipment, and trailers in accordance with the requirements of applicable regulations, standards, codes, and industry best practices.
- Development of a procedure for the receipt and distribution of CNG.
- Preventive maintenance of trailers and related equipment to prevent breakdowns and premature wear and tear.
- Training for workers involved in the transfer and handling of CNG and the decompression unit.
- Fire brigade training.
- Assessment of risks and compliance at CNG transfer and storage facilities as part of internal inspections.
- A water reserve for fire protection.
- Maintaining an up-to-date emergency response plan, including a fire response procedure.

Probability of occurrence

Ignition of CNG may occur in exceptional circumstances. The probability of occurrence is considered **very low**.

Severity

In the event of CNG igniting, it is highly likely that the blast will spread to neighbouring infrastructure given its location. Consequently, the severity level is considered **high**. To better assess the consequences of such incidents, a quantitative impact assessment was carried out. The results are presented in Section 12.5.

Estimation of the risk level

Table12-25 Risk level for fire involving a CNG tank

Probability of occurrence	Severity level	Risk level
Very low	High	Moderate

The risk level is based on risks to people and property.

12.4.7.2 Explosion of a CNG tank

A cloud of CNG vapour could form following a leak from a pipe or valve caused by equipment failure. These vapours are likely to accumulate, creating explosive concentrations.

Preventive and control measures

The following preventive and control measures will be in place to reduce the risk of a CNG tank exploding:

- Design of storage facilities, equipment, and trailers in accordance with the requirements of applicable regulations, standards, codes, and industry best practices.
- Development of a procedure for the receipt and distribution of CNG.
- Preventive maintenance of trailers and related equipment to prevent breakdowns and premature wear and tear.
- Training for workers involved in the transfer and handling of CNG and the decompression unit.
- Fire brigade training.
- Assessment of risks and compliance at CNG transfer and storage facilities as part of internal inspections.
- Maintaining an emergency response plan that includes a procedure for responding to CNG leaks.

Probability of occurrence

A CNG tank could explode in exceptional circumstances. The probability of occurrence is considered **very low**.

Severity

An explosion of a CNG tank can cause flammable materials to ignite due to the heat generated or flying burning debris. It could also potentially cause nearby tanks to explode, leading to loss of life and major damage to the surrounding infrastructure, resulting in significant disruption to production and major economic losses.

In terms of the impact on the environment, the vegetation near the site of the explosion (the CNG trailer storage area) could be destroyed by the heat. As the distance from the explosion site increases and in the absence of a fire, the potential impacts on vegetation will be linked to the effects of the blast and flying debris. With regard to wildlife within the blast radius, the potential effects could include injury or even death.

Consequently, the severity level is considered **very high**. To better assess the consequences of such an incident, a quantitative assessment was carried out. The results are presented in Section 12.5.

Estimation of the risk level

Table 12-26 Risk level for explosion of a CNG tank

Probability of occurrence	Severity level	Risk level
Very low	Very high	Moderate

The risk level is based on risks to people and property.

12.4.8 Mine water treatment

Malfunction of the water treatment system could result in the accidental release of deleterious substances to the final effluent. Potential causes may include:

- A malfunctioning water treatment system.
- Failure or damage to monitoring equipment.
- Design, operational, or human error.

Preventive and control measures

The following preventive and control measures will be implemented to reduce the risk of non-compliant discharges into the final effluent:

- Monitoring the effectiveness of the treatment through regular tests.
- Continuous measurement of environmental discharge standards (continuous for pH and flow) as required by Directive 019 and the MDMER.
- Continuous monitoring of pH and turbidity by instruments connected to the site's automation network, with data available in the plant control room.

Probability of occurrence

It is possible that the final effluent fails to comply with the required standards, as this has already occurred at similar sites. Consequently, the probability of occurrence is considered **low**.

Severity

Discharge of untreated or partially treated contact water or water from mine dewatering could contaminate surface waters (watercourses and water bodies) in violation of the *Metal and Diamond Mining Effluent Regulations* (MDMER) and Directive 019 on the mining industry.

In addition, the release of environmentally harmful substances could result in impacts to wildlife and/or plant species in an area extending beyond the site.

The discharge of untreated effluent is likely to have an impact on the water quality of Lake 07, Lake L27, Lake L01 and Watercourse CE11. These lakes and watercourses are all fish habitats.

Fish can ingest toxic substances and pass them on to the predators that eat them. Discharge of untreated raw water into the aquatic environment can affect the health of fish communities. In general, fish populations may be affected by a discharge at different times of the year if their habitat or prey are affected with respect to spawning, nursery, feeding, migration, and overwintering.

Fish with the ability to move through their habitat and potentially move to a less contaminant-exposed environment during a spill are less likely to experience the effects of such an event, except during the spawning and egg incubation period.

Consequently, the severity level is considered **high**.

Estimation of the risk level

Table 12-27 Risk level associated with the discharge of water that does not meet final effluent standards

Probability of occurrence	Severity level	Risk level
Low	High	Moderate

The risk level is based on risks to the environment.

12.4.9 Accumulation areas and retention structures

Accumulation (containment) areas will be established around the process plant, the open pit and the underground tunnels:

- South of the open pit and underground tunnels: overburden stockpiles.
- North of the process plant: two organics stockpiles and one waste rock stockpile.
- Northeast of the process plant: a waste rock tailings stockpile.

A seepage bond for runoff and seepage water, together with a dike, will be constructed around each of the containment areas (Map 12-1).

This section covers the risks associated with accumulation areas and retention structures. The identified risks are:

- Collapse of a stockpile.
- The failure of a retention dike or dam.

12.4.9.1 Collapse of a stockpile

Instability in the slopes of the stockpiles could cause tailings or waste rock to collapse (slide) outside the containment area. This instability could be caused by extreme weather conditions, or by errors and omissions during construction.

Preventive and control measures

The following preventive and control measures will be implemented to reduce the risk of a stockpile collapsing:

- Hydrogeological and geotechnical studies.
- Analysis of slope stability.
- Establishment of a monitoring program.

Probability of occurrence

Collapse could occur, but it is an unlikely scenario. Consequently, the probability of occurrence is considered **low**.

Severity

Depending on the location of the collapse, there could be repercussions on infrastructure (buildings, power lines, roads, etc.). The presence of workers at the time of the collapse would also increase the severity. Consequently, the severity level is considered **high**.

Estimation of the risk level

Table 12-28 Risk level for a stockpile collapsing

Probability of occurrence	Severity level	Risk level
Low	High	Moderate

The risk level is based on the risk to workers and property.

12.4.9.2 Failure of a retention structure

The failure of a retention dike or dam could be caused by:

- an extreme weather event (extreme flooding, very heavy rain, strong winds, etc.);
- an earthquake;
- errors or omissions during dam construction;
- aging of the structure.

Preventive and control measures

The following preventive and mitigation measures will be put in place to reduce the risk of dam failure:

- Conducting a risk assessment of dam failures and their potential consequences.
- Design of retention structures in accordance with the criteria of the Canadian Dam Association, the *Dam Safety Act*, and its regulations.
- The design and construction of diversion channels.
- Conducting geological and hydrogeological surveys, including assessments of dam stability.
- Incorporation of local seismic data into dam design.
- Ongoing implementation of the operational manual for the structures, which will be issued by the designer.
- Establishment of an inspection and maintenance program for the retention structures.
- Monitoring equipment.
- Maintaining an up-to-date emergency response plan, including a procedure for responding to dam failure (to be provided).

Probability of occurrence

Failure can occur, but it would be an exceptional situation. Consequently, the probability of occurrence is considered **very low**.

Severity

A breach of the west pit dike would result in flooding of the pit, which has sufficient retention capacity to contain the water from Lake L01.

A breach of the east pit dike would, in turn, result in the release of water from Lake L01 into watercourse CE15. This water would then flow toward Lake L027, thereby causing impacts beyond the boundaries of PMET's property. Such a failure would lead to significant downstream flooding. A dam breach study is presented in Appendix 12-1. This study classifies both retention structures (the east and west dikes) of Lake L01 as having high consequences in the event of failure (High Consequences).

Consequently, the level of severity is considered to be **very high** for environmental components.

Estimation of the risk level

Table 12-29 Risk level for the failure of a retention structure

Probability of occurrence	Severity level	Risk level
Very low	Very high	Moderate

The risk level is based on the risk to people, the environment, and property.

12.4.10 Road transportation

The site will be accessible exclusively via the Trans-Taiga Road. Two categories of hazards that can lead to major accidents have been identified for road transportation:

- Accidents involving hazardous materials.
- Accidents involving trucks carrying spodumene.

12.4.10.1 Accident involving hazardous materials

Hazardous materials and other chemicals will be transported using tank trucks and 53-foot enclosed trucks. An accident involving hazardous materials on the Trans-Taiga Road could result from a spill from a tank truck containing petroleum products (diesel, gasoline) or chemicals (solid or liquid). The causes may be:

- loss of control of the vehicle by the driver due to adverse weather conditions, human error, or illness;
- collisions with other vehicles or with animals.

Preventive and control measures

The following preventive and control measures will be in place to reduce the risk of hazardous material spills on the road network:

- Use of roads designed in accordance with the standards of the Ministère des Transports et de la Mobilité durable (MTMD) for heavy goods vehicle transport.
- Training for drivers assigned to transport dangerous goods.
- Preventive vehicle maintenance to prevent breakdowns and premature wear and tear.
- Maintaining an emergency response plan, including a procedure for responding to road traffic accidents.

Probability of occurrence

Spills of hazardous materials on the road network are possible, as these types of situations have already occurred. However, these incidents are unlikely. Consequently, the probability of occurrence is considered **low**.

Severity

The severity of the incident will depend on the nature of the substance involved, its state (solid or liquid), the quantity spilled, and the location of the spill. Depending on where it occurs, the spill could reach a watercourse or simply contaminate the local soil.

Land-based spills

Some of the product, if it is liquid, will seep into the soil until it encounters an impermeable layer or a water-saturated zone such as an aquifer. The ratio of runoff to infiltration depends on the permeability of the soil and the characteristics of the spilled product. Some components of the spilled product may eventually volatilize into the air. Upon contact with groundwater, some of the product is also likely to solubilize.

The extent of the impact of a land-based spill will depend on the time of year, weather conditions, the characteristics of the spilled product, the quantity spilled, and the penetration depth of the product into the soil, among other factors.

Potential impact on vegetation

The likely effects of a hazardous materials spill on vegetation would be:

- loss of pigmentation in leaves, the appearance of spots on leaves, and a reduction in plant density, stem height, and the number of leaves per stem;
- alteration of the reproductive strategy of plants;
- the death of exposed plants;
- the relatively long-term loss of plant habitats or species that support the presence of several wildlife species.

Potential impact on wetlands

In the event of a spill of hazardous materials into a wetland, the product would come into contact with plants, sediments, and the underlying soil. A spill in such an environment would cause damage to the ecosystem and to aquatic wildlife and plants, including the relatively long-term loss of plant habitats or species that are conducive to the presence of wildlife species. It would also result in the use of complex remediation techniques and, subsequently, the replacement of the environment. The costs of restoring these environments are significant and depend largely on the volume of spilled material, the response time, and the effectiveness of the response strategies employed. The environmental impact will depend on the ecological value of the wetland affected.

Potential impact on terrestrial wildlife and avian fauna and their habitats

Spills of hazardous substances can cause health problems for any animal that comes into direct or indirect contact with the substance. Mammals, reptiles and various species of birds that come into direct physical contact with the spilled products could, depending on the product, suffer skin and eye damage or chemical burns, which could be fatal.

Animals affected by the spilled product may experience reproductive difficulties due to illness or disruption to their normal reproductive patterns. Birds may experience a reduction in both the number of their eggs and their shell thickness. Generally speaking, mammal and bird populations may be affected by a land-based spill if their habitat or prey are affected in terms of reproduction, rearing of young, feeding and/or wintering.

However, mammals and birds that are able to move around their habitat and relocate to an area less exposed to contaminants in the event of a spill are likely to be less affected by such an incident.

Potential impact on herpetofauna and their habitats

Herpetofauna populations living in terrestrial habitats may be affected by such a spill if their habitat or prey are affected in terms of reproduction, rearing, feeding, and wintering.

Herpetofauna are a group with limited mobility and find it more difficult to move to an environment less exposed to contaminants in the event of a spill. This group is more likely to be affected by such an event, particularly during the breeding season, the egg-incubation period, and the larval stages.

The potential effects on herpetofauna are:

- the mortality of individuals who have come into contact with the product;
- a decreased production of eggs and larvae;
- the deterioration of the quality of breeding, feeding, and shelter sites.

Spill into the aquatic environment

As mentioned earlier, in the event of a spill of hazardous materials into the soil, the substance will flow by gravity and could reach a watercourse. The environments likely to be affected would therefore be water environments, as well as benthic fauna and fish and their habitats.

Potential impact on water environments

Several watercourses and bodies of water are present along the roads leading to the site.

Most petroleum products are insoluble in water. When they spill into water, they spread across the surface, where they form an oily film, or sink to the bottom in the case of heavy petroleum products. Most chemicals are water-soluble and are quickly diluted. In any case, a deterioration in water quality is expected, including sediment contamination.

Potential impact on benthos and its habitat

Potential effects on the benthic community would be contamination that could lead to their mortality, a decrease in benthic abundance and diversity, as well as a decrease in recruitment (eggs and larvae), food consumption, and growth rate.

Potential impact on fish and fish habitat

Fish, mollusks, and crustaceans can ingest toxic substances and pass them on to the predators that eat them. A spill of hazardous substances into the aquatic environment can seriously harm the next generation of fish, mollusks, and crustaceans.

In general, fish populations may be affected by a discharge at different times of the year if their habitat or prey are affected with respect to spawning, nursery, feeding, migration, and wintering.

Fish with the ability to move through their habitat and potentially move to a less contaminant-exposed environment during a spill are less likely to experience the effects of such an event, except during the spawning and egg incubation period.

In view of the above, the level of severity may vary from **low to high** depending on the circumstances. By conservative estimates, it is considered **high**.

Estimation of the risk level

Table 12-30 Risk level for a road accident involving hazardous materials

Probability of occurrence	Severity level	Risk level
Low	High	Moderate

The risk level is based on risks to the environment.

12.4.10.2 Accidents involving trucks carrying ore concentrate.

The spodumene ore concentrate will be transported in closed semi-trailer trucks. Trucks transporting spodumene could cause road accidents resulting in spodumene spills.

The causes may be:

- loss of control of the vehicle by the driver due to adverse weather conditions, human error, or illness;
- collisions with other vehicles or with animals.

Preventive and control measures

The following preventive and mitigation measures will be implemented to reduce the risk of ore spills on the road network:

- Use of roads designed in accordance with the standards of the Ministère des Transports et de la Mobilité durable (MTMD) for heavy goods vehicle transport.
- Training for drivers assigned to transport dangerous goods.
- Preventive vehicle maintenance to prevent breakdowns and premature wear and tear.
- Maintaining an emergency response plan, including a procedure for responding to road traffic accidents.

Probability of occurrence

Spodumene could spill onto the road network. However, these incidents are unlikely. Consequently, the probability of occurrence is considered **low**.

Severity

The anticipated impacts on the natural environment will be confined to the location of the spill. As spodumene is solid, it will only spread if it reaches a watercourse, in which case it will tend to settle at the bottom. The severity level is considered **low**.

Estimation of the risk level

Table 12-31 Risk level for a road accident involving ore concentrate

Probability of occurrence	Severity level	Risk level
Low	Low	Low

The risk level is based on risks to the environment.

12.4.11 Risks associated with outside hazards

12.4.11.1 Forest fires

Several forest fires have occurred in previous years near the project site. Forest fires can result from human activity, but the most common cause is lightning.

Preventive and control measures

The following preventive and control measures will be implemented to reduce the impact of forest fires:

- Removal of peat down to the bedrock, over a 35-metre radius around the ore processing facilities, the mine water treatment plant, and the explosives storage site.
- Clearing the site of undergrowth.
- Implementation of a regular inspection program.
- Raising staff awareness of the issue of forest fires.
- Agreement reached with SOPFEU.
- Regular review of fire hazard information provided by SOPFEU.
- A water reserve for fire protection.
- Water supply network with a fire hydrant.
- Training of a brigade to combat forest fires.
- Maintaining an emergency response plan that includes a procedure for responding to forest fires.

Probability of occurrence

Given the history of forest fires in the project area, the probability of occurrence is considered **high**.

Severity

A forest fire threatening the facilities could result in serious injury to emergency personnel and significant damage to the infrastructure if the fire were to reach it. However, this will be minimized due to the mitigation measures in place.

The impact on environmental components will vary depending on the scale of the fire and how it spreads.

Potential impact on vegetation

There are several types of fire, each with different impacts on terrestrial vegetation:

- Crown fires burn trees along their entire length right up to the top. These are the most intense and dangerous of all wildfires.
- Surface fires burn only the litter and humus. These are the easiest fires to put out and the ones that cause the least damage to forests.
- Ground fires (sometimes known as underground fires or deep fires) occur in large accumulations of humus, peat, and other similar dead plant matter that become dry enough to burn. These fires move very slowly, but can be difficult to extinguish completely. Sometimes, particularly during long periods of drought, such fires burn deep underground throughout the winter and resurface when spring arrives.

In the event of a fire, the anticipated impacts would mainly include vegetation mortality, disruptions to forest development, and the relatively long-term loss of plant habitats or species that support the presence of several wildlife species. Vegetation fires affect the ecological role of forests at every level: species, stand, and landscape.

Potential impact on terrestrial wildlife and avian fauna and their habitats

Fires have an impact on terrestrial wildlife and avian species, whose need for shelter and food forces them to move as the type of forest changes. Closely linked to the vegetation of its habitat, terrestrial wildlife responds to fire by fleeing and avoiding the area, both during the event and in the wake of changes to the vegetation cover.

In the event of a fire, the anticipated impacts on terrestrial wildlife and avian fauna include potential mortality during the rearing season, a reduction in the availability of foraging areas and shelter when habitats are disturbed, and the destruction of eggs during the nesting season.

Potential impact on water environments

A fire could affect water quality by introducing particulate matter and other contaminants into the water and causing them to spread.

Potential impact on herpetofauna and its habitat

Forest fires have an impact on herpetofauna, whose need for shelter and food forces them to move as the type of forest changes. Closely linked to the vegetation of its habitat, herpetofauna responds to fire by fleeing and avoiding the area, both during the event and in the wake of changes to the vegetation cover.

In the event of a fire, the anticipated impacts on herpetofauna include potential mortality and the destruction of eggs during the incubation period, as well as a reduction in the availability of feeding grounds and shelter when habitats are disturbed.

In view of the above, the severity is considered **moderate**.

Estimation of the risk level

Table 12-32 Forest fire risk level

Probability of occurrence	Severity level	Risk level
High	Moderate	High

The risk level is based on the risk to property and the environment.

12.4.11.2 Extreme weather conditions

Unusual, or even extreme, weather conditions may occur. These could include strong winds, heavy snowfall, periods of freezing rain, lightning, etc.

Preventive and control measures

The following preventive and mitigation measures will be implemented to reduce the risks associated with extreme weather conditions:

- Design of infrastructure in compliance with applicable laws, regulations, and codes.
- Emergency generators on site.
- Spare electrical parts on site.
- Emergency response plan covering evacuation procedures for the mine area.

Probability of occurrence

Extreme weather conditions may occur. However, these would be exceptional situations. The probability of occurrence is therefore considered **very low**.

Severity

The consequences of such conditions can vary, but could include significant damage to infrastructure and power lines, leaving the site without electricity for an extended period and causing a major disruption to operations. Such a situation might require the evacuation of mine workers for their own safety.

The severity level is considered **high**.

Estimation of the risk level

Table 12-33 Risk level for extreme weather conditions

Probability of occurrence	Severity level	Risk level
Very low	High	Moderate

The risk level is based on the risk to people, the environment, and property.

12.4.12 Summary of risks

The technological risks identified in the preceding sections are summarized in Table 12-34.

Table 12-34 Summary of technological risks

Number	Risk	Probability	Severity	Risk level
1	Pit flooding	Moderate	Moderate	Moderate
2	Rockfall and landslide	Low	High	Moderate
3	Underground mine flooding	Low	Moderate	Moderate
4	Fire in the mine	Moderate	Moderate	Moderate
5	Underground subsidence	Very low	Very high	Moderate
6	Fire at ore processing facilities	Low	High	Moderate
7	Environmentally non-compliant atmospheric discharge	Moderate	Low	Moderate
8	Chemical spill	Low	High	Moderate
9	Uncontrolled explosion	Very low	Very high	Moderate
10	Theft of explosive materials	Very low	Very high	Moderate
11	Petroleum product spill	High	Moderate	High
12	Fires and/or explosions of petroleum products	Very low	Very high	Moderate
13	Oil and grease spill	Low	Low	Low
14	Fire involving a CNG tank	Very low	High	Moderate
15	Explosion involving a CNG tank	Very low	Very high	Moderate
16	Discharge of raw effluent	Low	High	Moderate
17	Collapse of a stockpile	Low	High	Moderate
18	Failure of a retention structure	Very low	Very high	Moderate
19	Accident involving hazardous materials	Low	High	Moderate
20	Accident involving a truck carrying ore concentrate.	Low	Low	Low
21	Forest fires	High	Moderate	High
22	Extreme weather conditions	Very low	High	Moderate

12.5 Quantitative assessment of consequences

12.5.1 Incident involving hazardous materials

As part of the risk analysis of major technological accidents associated with the project, a modelling exercise was performed to assess the consequences of accidents involving CNG and ammonium nitrate emulsion (Appendix 12-2). These are two substances present on the site during the operations phase in concentrations and quantities exceeding the RUE thresholds and posing a high risk of significant consequences.

12.5.1.1 Methodology

The methodology used and the parameters employed in the modelling are described in detail in the modelling report included in Appendix 12-2.

The PHAST (Process Hazard Analysis Software Tool) model, version 7.2, was used to perform the CNG consequence modelling. The PHAST model was developed by DNV GL based on a publication by the Dutch committee for disaster prevention. Analytical models included in PHAST for release, dispersion, and explosions of gaseous and liquid hazardous materials include flow and spray discharge, pool evaporation, vapour cloud dispersion, vapour cloud explosion, heat flux of fires (jet fires, pool fires, and boiling liquid expanding vapour explosion), and vessel rupture.

Version 7.2 of PHAST is unable to model explosions involving solid or semi-solid materials such as ammonium nitrate emulsion. It is limited to the assessment of substances in liquid or gaseous form. Therefore, the Kingery-Bulmash blast parameter calculation for a hemispherical free field air-blast was employed.

12.5.1.2 Flammability range

The emission of CNG is a fire or explosion hazard under the following conditions:

- presence of a flammable substance;
- presence of an oxidizer (oxygen/air);
- presence of an ignition source (spark/high heat).

The flammable or explosive range is defined by the lower flammability limit (LFL) and the upper flammability limit (UFL). At concentrations below the CNG lower flammability limit (40,321 ppm), the mixture is too lean to burn.

12.5.1.3 Overpressure effect

The overpressure levels normally evaluated to determine the consequences of an explosion accident are shown in Table 12-35.

Impact distances were assessed for a 1 psi overpressure explosion. This would result in partial demolition of buildings (rendering them unusable with 90% of the windows broken) and is considered the threshold for minor damage to structures. This threshold is also the level at which irreversible effects can occur and is considered the zone of significant danger to human life. This is the threshold for emergency planning recommended by CRAIM,

the Conseil pour la réduction des accidents industriels majeurs [Council for the reduction of major industrial accidents].

Table 12-35 Thresholds of overpressure effects

Overpressure		Effects on structures	Effects on humans
kPa	Psi		
2.1	0.3	Safe distance (0.95 probability of no serious damage below this value); damage limited to the ceilings of houses; 10% windows breaking.	Effect thresholds delimiting the area of indirect effects of windows breaking on humans.
6.9	**1**	Partial demolition of houses making them uninhabitable, 90% of windows broken, threshold for slight damage to structures.	Thresholds of irreversible effects delimiting the "zone of significant danger to human life."
13.8	2	Partial collapse of ceilings and walls of houses. Possible damage to large hydrocarbon tanks.	Thresholds of lethal effects delimiting the "zone of serious danger to human life."
20.7	**3**	The steel structures of the buildings are deformed and torn from their foundations, threshold of significant destruction of windows, thresholds of domino effects.	Thresholds of lethal effects delimiting the "zone of very serious danger to human life."

12.5.1.4 Thermal exposure

The thermal exposure that can be experienced by people exposed to a fire depends on several factors and will vary between individuals. It is usually quantified by limiting the physical calculations to the fire source, i.e., the thermal radiation flux (kW/m^2) and the exposure time (seconds) of individuals. The exposure time may be limited by the duration of the fire and/or the reaction time of the exposed individuals.

The various thermal exposure thresholds are presented in Table 12-36.

Table 12-36 Thermal exposure thresholds

Flux (kW/m^2)	Load $(kW/m^2)^{4/3}.s$	Effects on structures	Effects on humans
3	600	n/a	Thresholds of irreversible effects delimiting the "zone of significant danger to human life."
5	**1,000**	Threshold of significant destruction of windows.	Second-degree burns after 40 seconds, threshold of lethal effects delimiting the "zone of serious danger for human life."
8	**1,800**	Threshold of domino effects and corresponding to the threshold of serious damage on structures.	Thresholds of lethal effects delimiting the "zone of very serious dangers to human life."

n/a: not applicable.

The impact distances were evaluated at a thermal radiation of 5 kW/m^2 since at this level there is a significant destruction of glass and it is the threshold of lethal effects delimiting the zone of serious danger for human life (second-degree burns after 40 seconds). This is the threshold for emergency planning recommended by CRAIM.

12.5.1.5 Domino effect

CRAIM defines a domino effect as follows: “A first incident which, by its consequences, may generate or result in other event(s) or accident(s) whose consequences will add to the first, either inside or outside the site.” Domino effects are a chain reaction following a first accident resulting from the relative proximity of equipment.

To trigger a second event, the consequences resulting from the first accident must reach certain thresholds that are damaging to the nearby equipment. The thresholds used to evaluate domino effects are those provided in the CRAIM guide, i.e., 20.7 kPa (3 psi) for overpressure and 8 kW/m^2 for thermal radiation.

12.5.1.6 Assessed scenarios

Compressed natural gas

It should be noted that there are plans to install three 11,700 m^3 CNG trailers at two locations on the site, bringing the total to six trailers. Each trailer is divided into four tanks, each with a capacity of 2,925 m^3.

The following scenarios were considered:

- Worst-case scenario: Catastrophic failure of a CNG tank (a tank in a trailer).
- Alternative scenario: A leak from a 0,5 cm opening in a CNG tank.
- Domino effect: Given the proximity between the four tanks that make up one trailer and the other two trailers, two domino effects were considered, namely:
  - A domino effect on the four tanks of the same trailer;
  - A domino effect on the tanks of the three trailers (12 tanks).

Ammonium nitrate

The following scenario was selected for the assessment of the consequences of storing ammonium nitrate emulsion:

- Worst-case scenario: Explosion of the entire stock of ammonium nitrate emulsion stored in the surface storage facility (30,000 kg).

12.5.1.7 Modelling results (impact distances)

Compressed natural gas

Worst-case scenario

The scenario involving a CNG tank, which has the greatest impact distance, is the worst-case scenario (complete emptying of the tank). In such a scenario, the greatest calculated impact distances are:

- 1,425 m for thermal radiation of 5 kW/m^2;
- 1,313 m for a 1 psi. overpressure.

Alternative scenario

With regard to the alternative scenario assessed (a leak escaping from a 0,5 cm diameter hole in a CNG tank), the calculated impact distances for the thermal effect and overpressure are 16 and 17 metres respectively.

Domino effect

The impact distances calculated for the domino effect thresholds are:

- 1,119 m for thermal radiation;
- 667 m for overpressure.

As a result, the explosion of a CNG tank in a trailer would cause the other tanks in that trailer to explode, as well as the trailers nearby.

If one of the two trailers explodes (four tanks), the maximum impact distances calculated are:

- 2,120 m for thermal radiation of 5 kW/m^2;
- 2,084 m for a 1 psi. overpressure.

For the explosion of the tanks on the three trailers, i.e., 12 tanks, the maximum impact distances calculated are:

- 2,890 m for thermal radiation of 5 kW/m^2;
- 3,006 m for a 1 psi. overpressure.

The explosion of all 12 tanks is quantified as the most catastrophic scenario for this product.

Summary of calculated maximum impact distances

Table 12-37 Maximum impact distances calculated for different scenarios involving CNG (emergency planning thresholds)

Scenario	Effect	Impact distance (m)
Worst case (1 tank)	Thermal	1,425
	Overpressure	1,313
Alternative (1 tank)	Thermal	16
	Overpressure	17
Domino effect (4 tanks)	Thermal	2,120
	Overpressure	2,084
Domino effect (12 tanks)	Thermal	2,890
	Overpressure	3,006

Further details on the various scenarios assessed and the impact distances calculated for CNG are presented in the modelling report included in Appendix 12-2). The figures used to visualize these distances on a map of the site are also presented in this appendix.

Maps 3, 5 and 7 in Appendix 12-2 show the calculated impact distances for the domino-effect thresholds. It appears that, in the event of an incident involving one or more CNG tanks on the same trailer, the trailers present at the other location, as well as the diesel storage tank, would fall within the domino-effect zone. It should be noted, however, that the presence of infrastructure between the tanks may provide attenuation of the overpressure wave, which was not taken into account in the analysis.

Ammonium nitrate

The explosion of an ammonium nitrate emulsion tank would cause all tanks stored in the surface depot to explode, resulting in the explosion of 30,000 kg of emulsion. This scenario is the most catastrophic for this product. The calculated blast wave for 1 psi and resulting from this scenario extends over a distance of 648 m around the storage site.

Further details are provided in the modelling report included in Appendix 12-2.

12.5.1.8 Potential impacts on sensitive environments

Several sensitive environments could be affected by an accident involving compressed natural gas or ammonium nitrate.

Incidents involving CNG would have major impacts on buildings and infrastructure and would therefore require the evacuation of all workers present on site.

An explosion could also affect the stability of nearby waste rock piles or retention structures. The explosion and subsequent incidents could impact nearby lakes and watercourses (L01, L07, L02, L12, L61, L219, L220, CE11 and L27), as well as the wetlands surrounding the site. Ultimately, the impact could extend to fishing areas located west of the site.

An explosion involving ammonium nitrate emulsion would, in turn, have major impacts on explosive storage and handling facilities and would require the evacuation of workers in the affected area. It would also impact lakes L27 and L207, as well as wetlands and fishing areas located near the explosives facility.

12.5.2 Failure of a retention structure

A breach study of the Lake L01 water retention structures (the east and west pit dikes) was conducted by AtkinsRéalis. It is presented in Appendix 12-2, where the methodology used is described. The following sections summarize the results of this study.

The failure of the western dike of Lake L01 would have an impact on the open pit. Since this scenario has no impact outside the PMET property, the failure assessment did not quantitatively assess the water level that would be reached in the pit.

The failure of the dike located west of Lake L01 is the scenario with the greatest impact on people and the environment.

Table 12-38 shows water levels and arrival times at various sensitive points in the event of a breach of the west dike, for the scenario involving favourable weather conditions.

Table 12-38 Water levels and wave arrival times at various sensitive points for the scenario involving favourable weather conditions

Affected environment	Distance from the dike (km)	Maximum water level (m)	Wave arrival time (h)	Time to reach maximum level (h)
Lake L01 dike	0.0	5.6	<1	<1
Effluent into the environment	0.5	1.4	<1	<1
Watercourse CE15	1.5	2.3	<1	1.4
Lake L027 inflow	2.5	1.3	<1	2.2
Cottages	13.5	0.6	12	96

Table 12-39 shows water levels and arrival times at various critical points in the event of a breach of the west dike, for the scenario involving worsening weather conditions.

Table 12-39 Water levels and wave arrival times at various sensitive points for the scenario involving worsening weather conditions

Affected environment	Distance from the dike (km)	Maximum water level (m)	Wave arrival time (h)	Time to reach maximum level (h)
Lake L01 dike	0.0	7.0	<1	<1
Effluent into the environment	0.5	2.1	<1	<1
Watercourse CE15	1.5	2.8	<1	<1
Lake L027 inflow	2.5	1.1	<1	24
Cottages	13.5	1.1	4	27

Further details on the results of the failure assessment and figures illustrating these results are presented in Appendix 12-1.

12.5.2.1 Potential impacts on sensitive environments

In the event of a breach of the east dike, the open pit would need to be evacuated. However, the water could be contained within the pit.

In the event of a breach of the west dike, the resulting flood wave could reach the natural environment outside the site over a distance exceeding 13,5 km. A cabin located on the west side of Lake L27 would be reached by the flood wave within 4 to 12 hours, and water depths could reach up to 1,1 m.

12.6 Risk management program

To ensure the safety of workers, the public, and the environment during mining activities, a risk management program will be established. The main features of this program will be as follows:

- implementation of an environmental and health and safety management system;
- environmental monitoring during the construction and operation phases;
- development of standard operating procedures;

- setting up an equipment maintenance program and a periodic inspection program;
- training workers, particularly on the operation of equipment, the risks inherent in activities, as well as safe work methods and personal protective equipment;
- visual identification system for stored chemicals, piping, and connections to loading and unloading areas;
- safe storage of chemicals;
- investigation of accidents and incidents to determine causes and implement corrective actions;
- rigorous change management process.

Accordingly, policies have been developed. These are environmental policies and health and safety policies. These are available in PMET's internal documentation.

12.7 Preliminary emergency response plan (ERP)

An ERP is an indispensable tool to ensure a quick and effective response when an emergency situation arises. A preliminary plan has been developed for the project and is presented in Appendix 12-3.

The emergency response plan will be provided to internal stakeholders, updated annually, readily available in emergency situations, and easy to consult. It will provide a link between municipal/regional authorities and the project operations team.

Response measures will be in accordance with applicable regulations and industry best practices. When required, this plan will be revised and adapted to any new activity on the site.

13 Preliminary monitoring and follow-up program

In connection with activities relating to the construction, operation and closure phases of the Shaakichiuwaanaan project (the Project), PMET Resources Inc. (PMET) will allocate the necessary human and financial resources to implement the project's environmental monitoring and follow-up program. The following sections outline the activities proposed for the program.

13.1 Environmental monitoring

The project will be subject to environmental monitoring to ensure that the proponent complies with its environmental commitments and obligations, as well as with applicable laws, regulations, and conditions. A due diligence review will be carried out to ensure compliance with the specific provisions set out in the government decree and with all contractual conditions included in the plans and specifications. The implementation of the mitigation measures and commitments set out in the impact assessment, as well as in the addenda submitted in response to questions and comments from the MELCCFP and IAAC or any other authority, will also be monitored as part of this monitoring process. This will begin as soon as work starts on site, continue throughout the construction phase, and remain in place until the environment has been rehabilitated.

A key part of the program is to ensure that all the necessary applications for authorizations and permits have been submitted to the relevant authorities and that these authorizations or permits have been issued before work begins.

In collaboration with the main contractor, the site managers, and the environmental supervisor will organize a kick-off meeting at the start of the work. One of the main aims of this meeting will be to inform and raise awareness among site staff about the environmental monitoring program and the safety measures applicable during the work and monitoring activities. In general, the environmental supervisor will carry out regular inspections of work areas, ensure strict compliance with commitments, obligations, measures, and requirements, assess the effectiveness of the measures implemented, and record any non-compliance observed. The findings will be forwarded to the site manager so that preventive and corrective measures can be implemented promptly, if necessary. The supervisor will also ensure that any spill is reported immediately to the relevant authorities.

During the work, mitigation measures will be strictly adhered to, particularly when carrying out work near sensitive areas, watercourses, or bodies of water. Particular attention will be paid to emissions of suspended solids in the water and to the detection of any accidental spills of petroleum products. Photographs will be taken to document how the work is carried out.

The restoration work carried out during the site's closure will also be subject to appropriate monitoring, based on the requirements applied during the construction phase.

The main activities included in the environmental monitoring program include:

- Following up and supervising all actions that require preventive, mitigation or corrective measures.

- Ensuring that work is carried out in compliance with laws, regulations, and the terms of authorizations and permits, and establishing mechanisms to track potential non-compliance (protection of water environments, air quality, management of residual and hazardous materials, etc.).
- Monitoring the construction of ponds and the management of excavated soil.
- Monitoring retaining structures during the operations phase.
- Ensuring that work areas are properly marked off and preventing machinery from encroaching on them.
- Providing environmental support and raising worker awareness of the impacts of their activities.
- Ensuring compliance with refuelling procedures for petroleum-powered equipment.
- Verifying the presence and effectiveness of containment measures for fuel tanks on mobile equipment (pumps, generators, etc.).
- Overseeing and following up on procedures for accidental spills, including managing the temporary storage of contaminated soil, if necessary.
- Ensuring compliance with biological rest periods and the proper implementation of the environmental follow-up measures associated with the project.
- Ensuring that all necessary authorizations and permits have been obtained. In this regard, a consolidated list of the conditions and commitments resulting from the environmental impact assessment and the permits issued will be prepared and kept up to date.

It is important to note that the proposed monitoring activities have been presented to the concerned Cree communities, and more specifically to the tallyman of trapline CH39. In addition, PMET commits to working collaboratively with the Cree communities to develop a land guardian program, whose members will be involved in monitoring and environmental follow-up activities.

13.2 Environmental follow-up

An environmental follow-up program will be implemented during the construction, operations, and closure phases of the project. The closure phase consists of two distinct periods: the post-operations sub-phase, which covers the interval between the cessation of production and the completion of restoration work, and the post-restoration sub-phase, which begins once restoration work is completed and continues until a condition deemed satisfactory for the protection of the receiving environment is achieved.

The restoration program and related follow-up activities will be reviewed every five years, in accordance with the requirements of the Mining Act and the procedures set out in the *Guide de préparation du plan de réaménagement et de restauration des sites miniers au Québec* [“Guide for preparing mine site reclamation and restoration plans in Quebec”] (MRNF, 2024).

This environmental follow-up program will be adjusted in accordance with the conditions set forth in the permits issued for the project. Its purpose is to detect and document any environmental changes from the reference state, whether or not they are attributable to the project, to verify the accuracy of the impact assessment, and to evaluate the effectiveness of the mitigation measures outlined in the EIA.

Throughout the various stages of the project, the proposed follow-up will focus on, but not be limited to, the following aspects:

- follow-ups associated with mining operations;
- follow-ups associated with the physical environment;
- follow-ups associated with the biological environment;
- follow-ups associated with the social environment;
- other follow-ups associated with habitat compensation projects;
- the annual monitoring and follow-up report;
- the follow-up calendar.

The following sections outline the various aspects of the overall environmental follow-up program. This program will be carried out in accordance with the relevant municipal and government requirements for the project. It is possible that the follow-ups may be adjusted based on the results obtained, or that additional follow-ups may be proposed as the project progresses. The overall schedule for environmental follow-ups is presented in Appendix 13-1.

13.2.1 Mining operations

13.2.1.1 Geochemistry of ore, waste rock, and tailings

As part of the activities related to the restoration plan, which must be updated every five years, a geochemical characterization of the tailings, waste rock, and ore will be conducted. This study will cover the sectors that are scheduled to begin operations within the next five years. This characterization will begin in the year prior to the renewal of the site restoration plan and will be based on the recommendations of the *Guide de caractérisation des résidus miniers et du minerai* [“Guide to the characterization of tailings and ore”] (MELCC, 2020a) to ensure that the tests meet expectations, particularly regarding the number of samples, the nature of the tests to be conducted, and the content of the reports presenting the results. The characterization of the ore, waste rock, and tailings will be completed by the end of the operations phase.

Sampling plans

Waste rock

The sampling plan for the mine’s waste rock is set out below:

- Collect annual grab samples (approximately 2 kg each) annually from the waste rock pile, ensuring that there are at least one and no more than five samples per major waste rock lithology mined during the period.
- Ensure that the samples collected are visually representative of the various materials/lithologies placed on the stockpile within the allotted time and are reasonably distributed across the surface of the freshly placed materials (i.e., materials placed since the previous sampling).

- The schedule for sample collection may vary but should not exceed once a year. A recommended frequency for sample collection is twice a year.
- Samples must be collected by a certified geologist with experience in geochemistry who can confirm that the samples collected are representative.

It should be noted that construction rock (if sourced from waste rock) will be subject to a standard operating procedure to confirm that it is non-acid generating (non-PAG). This procedure includes systematic sampling of waste rock potentially intended for construction activities and its analysis to ensure proper segregation between non-PAG materials and those that are PAG.The amount of waste rock(i.e., truckloads/t) placed at each level of the mine's rock stockpiles and/or used for construction purposes will be recorded by the mine planning department and reported to the mine geologist. This information will be provided to the project geochemist prior to the annual geochemical inspection of the site, so that the inspection can be planned and the annual report prepared.

Tailings

The sampling plan for the tailings is set out below:

- Collect tailings samples throughout each year, representative of the variability in the ore processed during the period covered by each sample; this number is subject to revision following analysis of the results.
- Sampling must be performed or supervised by a qualified person who can certify the samples (usually a geologist or an engineer). A detailed description of the sampling method must be documented.

Testing program

Samples of waste rock and tailings will undergo certain static tests at a laboratory accredited by the Centre d'expertise en analyse environnementale du Québec (CEAEQ) for the tests performed. This program consists of a set of standardized methods and specific tests designed to provide information on the acid-generating potential and metal mobility of the sampled mining materials.

The following static tests are recommended for all samples collected:

- Analysis of the metallic composition in the solid phase according to method MA.200 - Met 1.2 (MELCCFP, 2023a): Br, Ag, Al, As, B, Ba, Be, Bi, Ca, Cd, Co, Cr, Cu, F, Fe, Hg, K, Li, Mg, Mn, Mo, Na, Ni, P, Pb, Sb, Se, Si, Sn, Sr, Th, Ti, Tl, U, V, W and Zn;
- Acid-base balance (ABB), including total sulphur, sulphate (SO_4), total carbon (C), and total carbonate (CO_3), in accordance with standard MA.110 ACISOL 1.0 (MELCCFP, 2024).

A subset of samples must be subjected to a leaching test. The subsets must include at least 50 % of the samples collected, ensuring that all samples with solid-phase metal concentrations (MA.200) exceed the respective criteria for Soil A, as outlined in the *Guide de caractérisation des résidus miniers et du minerai* ["Guide to the characterization of tailings and ore"] (MELCC, 2020a), are included in the selected subset. The following leaching tests must be carried out:

- Leaching test conducted using the synthetic precipitation leaching procedure (SPLP), which simulates acid rain in accordance with the MA method. 100-Lix.com.1.1 (MELCCFP, 2023b).
- Leaching test according to the CTEU-9 procedure, which uses a pH-neutral water leachate, in accordance with the MA method. 100-Lix.com.1.1 (MELCCFP, 2023b).

- Leaching test in accordance with the TCLP (*Toxicity Characteristic Leaching Procedure*) using the MA method 100 - Lix.com.1.1 (MELCCFP, 2023b).
- Analysis of the following parameters in the leachate from the two leaching tests (SPLP, CTEU-9.): Ag, Al, As, B, Ba, Be, Bi, Ca, Cd, Co, Cr, Cu, Fe, K, Li, Mg, Mn, Mo, Na, Ni, total P, Pb, Sb, Se, Si, Sn, Sr, Th, Ti, Tl, U, V, W, Zn, Hg, F, Cl, SO_4, PO_4, NO_2, NO_3, Br, pH, acidity, alkalinity, conductivity, carbonates, and bicarbonates.

Frequency and duration of follow-up

It is recommended that an annual site visit be carried out by a geologist with expertise in geochemistry to carry out:

- Sampling of waste rock and tailings, as described in Section 14.2.1.1, for geochemical analysis.
- A visual inspection of the rocks and tailings at the site, and any signs of acid rock drainage (ARD).

Follow-up report

The results of the geochemical tests will be interpreted internally by a certified professional and included annually in the site's follow-up report. Every five years, a comprehensive report will be prepared that will present the results of sampling and ongoing follow-up of tailings and waste rock. Although it is recommended that a separate annual geochemical report be prepared by a geologist with expertise in geochemistry, it is also acceptable to include the results of the geochemical follow-up as part of other reporting requirements.

13.2.1.2 Water management and retention structures

A follow-up program for water retention structuresis required under *Directive 019 on the mining industry* (MELCCFP, 2025b). These follow-up activities will be carried out by PMET and will include all water management structures located on the project site. These structures will undergo routine visual inspections throughout the year (starting from the time of their construction), namely:

- Regular inspections, conducted on a weekly basis, consisting of a detailed visual examination of the dikes.
- A detailed seasonal visual inspection, conducted at least four times a year by a qualified person who has received appropriate training, consisting of a detailed examination of the relevant infrastructure components to ensure that there are no defects. The components to be inspected will include retaining structures, ditches, spillways, culverts, and pipelines.
- An annual statutory inspection conducted by a specialist in geotechnical engineering and structural design, which involves visually assessing the condition of the components whose proper functioning ensures the safety of the site. This inspection should ideally be performed in the spring, after the snow has melted but before vegetation begins to grow. An inspection report, accompanied by photographs, will be drawn up and sent to the Ministère.
- If necessary, a specific inspection will be conducted to track the progress of any abnormal observations noted during previous detailed or statutory inspections.

These inspections will be carried out in accordance with best practices and in compliance with the requirements of *Directive 019 on the mining industry* (MELCCFP, 2025b). The details of these conditions will be set forth in the ministerial permits to be issued for the project.

13.2.1.3 Environmental incidents and accidents

The project-related accident risk analysis, conducted as part of the environmental impact assessment (EIA) process, identified the incidents and accidents most likely to occur and that could have an impact on the environment. Accordingly, a preliminary emergency management plan has been developed and is included in the appendix (Appendix 12-3).

The results of the analysis suggest that the events most likely to occur are those associated with spills of petroleum products, forest fires, and mine fires. A summary of the identified risks is presented in Section 12.4.12 of this report. Risk mitigation measures are listed for each of the risks identified in the previous chapter. In addition, Section 12.6 of this report describes PMET's risk management program.

13.2.1.4 Residual and hazardous materials management

Various types of residual and hazardous materials will be generated during the construction, operations and closure phases of the project.
The follow-up measures implemented will aim to confirm that the volumes and types of non-hazardous residual materials estimated in the EIA are being adhered to, and that their treatment and sorting are carried out in accordance with the procedures established at the various sites authorized by the MELCCFP.

The environmental team will follow up with employees to ensure that sorting and recycling methods are being properly implemented. The site environmental manager will conduct regular inspections of the storage areas and report any non-compliance observed to the relevant users and supervisors so that the required corrective actions can be taken.

Additional follow-up will also ensure that cardboard waste is stored and reused to feed the on-site composter, and that the compost produced is used for progressive restoration work.

PMET will ensure that the site is kept clean at all times.
Outdoor trash cans will be emptied daily, containers will be kept tightly closed, and the team will ensure that no waste accumulates around the sorting centre facilities or in areas where trash cans are located.

Lastly, the environmental manager will ensure compliance with the hazardous materials management plan—which must be developed prior to submitting the application for ministerial authorization—and will oversee the implementation of its requirements on site.

13.2.1.5 Drinking water distribution network

During the operations phase, the camp will have an accommodation capacity of 672 beds.To supply drinking water to the entire camp, PMET will draw surface water from Lake L308, located approximately 1.5 km from the camp.

PMET will implement a drinking water quality testing program, conducted prior to the construction of the facilities to establish baseline conditions, and maintained throughout the operations phase. This follow-up will ensure that the water used to supply the camp meets applicable standards at all times and remains in compliance with public health requirements and those of the MELCCFP.

Location and number of sampling stations

The locations and number of sampling stations (3 stations) are based on the *Guide de caractérisation physicochimique de l'état initial du milieu aquatique avant l'implantation d'un projet industriel* ["Guide to the physicochemical characterization of the baseline conditions of the aquatic environment prior to the implementation of an industrial project"] MDDELCC, 2017). The three stations will be spread out to cover the entire surface of the lake.

Follow-up to establish the baseline water quality

In accordance with the *Guide de conception des installations de production d'eau potable, volume 1* ["Design guide for drinking water production facilities, volume 1"] (MDDELCC, 2015a), the water will undergo comprehensive analytical tests for 180 days, or 90 days if filtration is used. All parameters listed in Tables 6-1 (microbiological, inorganic, and physical parameters) and 6-2 (organic parameters) of the guide will be analyzed. The frequency of testing will vary depending on the parameters (see Tables 6-1 and 6-2 in the guide).

Follow-up during the operations phase

The sampling frequencies and the various physicochemical and biological parameters for drinking water samples are taken from the *Regulation respecting the quality of drinking* water (Q-2, r.40) and are presented in Table 13-1.

Table 13-1 Sampling frequency and applicable physicochemical and biological parameters

Substance	Clients served	Minimum number of samples	Sampling period
Total coliforms and E. coli	21 to 1,000 persons	2	Monthly
Some substances listed in Schedule 1 of the Regulation respecting the quality of drinking water[1, 2]	≥21	1	Annually, between July 1 and October 1
Nitrates + Nitrites	≥21	1	During each of the quarters beginning on January 1, April 1, July 1, and October 1 respectively, with a minimum interval of two months between the dates of the samplings
Lead and copper	≥501 and ≤5000	5	Annually, between July 1 and October 1
Chlorites, chlorates[3]	All	1	During each of the quarters beginning on January 1, April 1, July 1, and October 1 respectively, with a minimum interval of two months between the dates of the samplings
Trihalomethanes	≥21 and ≤5000	1	
Turbidity	All	1	Monthly

Notes: 1 Antimony, arsenic, barium, boron, bromates, cadmium, chromium, cyanides, fluorides, mercury, lead, selenium and uranium.
2 Iron and manganese will be added to this list since they are specifically targeted by the treatment being applied.
3 The pH must be measured at the time of sampling and recorded on the test request form.

13.2.1.6 Sewage water

Given that workers will be present on site during the construction, operations and closure phases, the sewage treatment system will need to be monitored throughout these phases.

The sewage treatment system to be installed at the project site will require regular follow-up to ensure that its components are functioning properly and to detect any defects that could lead to contamination. As mentioned in Chapter 5 (Section 5.4.7) of this EIA, the sewage treatment system will consist of a modular biological treatment system combining primary sedimentation, biofiltration, and UV disinfection. An analysis program for the proposed system will be developed in accordance with the MELCCFP's requirements, specifying the parameters to be analyzed and the sampling frequency. This analysis program will be finalized upon receipt of the ministerial authorization for the sewage system to be issued for the project.

Test results will be sent to a laboratory accredited by the MELCCFP, when required for the relevant parameter. It should be noted that treatment targets will be established during the authorization process. These standards will be based on the final treatment units selected and the *Guide pour l'établissement des normes de rejet d'une installation de traitement des eaux usées d'origine domestique* ["Guide for establishing discharge standards for domestic wastewater treatment facilities"] (MELCC, 2020b).

Ultimately, the sewage treatment process will generate sewage sludge, which will be dewatered on site and then transported by a specialized contractor to a facility authorized to manage it.

13.2.2 Physical environment

13.2.2.1 Ambient air

The ambient air quality follow-up program will have two components: one focusing on emissions from diffuse sources and the other on emissions from stationary sources.

Emissions from diffuse sources

The objective of the ambient air quality follow-up program for emissions from diffuse sources is to measure the impact of mining activities on air quality and to determine whether these activities comply with and are acceptable under applicable standards and criteria.

During the construction phase, potential impacts will stem primarily from stripping and clearing, the construction of structures and infrastructure, as well as transportation and traffic on roads. The planned follow-up will ensure that air emissions comply with the limit values set by the standards and criteria and that mitigation measures (such as road watering using tank trucks) are effective.

During the operations phase, potential impacts will stem primarily from drilling and blasting activities, the transport of ore and waste rock, loading, crushing, and grinding operations, outdoor storage, and diesel engines. *Directive 019 on the mining industry* does not specify the frequency of air quality follow-up—this is determined on a case-by-case basis. In this case, ambient air quality follow-up will begin as soon as operations start, using permanent sampling stations, and may be adjusted based on the results obtained. The locations of the sampling points will be determined based on the prevailing wind directions specific to the site, which will be obtained from data collected by the on-site weather station. The location will also be determined based on the results of the modelling and the position of the sensitive receptors. The exact location of the sampling stations will be specified when the construction permit application is submitted.

The ambient air quality follow-up program for the project will cover all air emissions resulting from the project's operations, namely:

- total suspended particulates (TSP) and fine particulate matter ($PM_{2.5}$);
- crystalline silica dust;
- metals and metalloids.

Sampling will be conducted in accordance with the methods set forth in the document, *List of Designated Reference and Equivalent Methods* (US EPA, 2024). The results of the tests will be compared to the standards set forth in the document, *Normes et critères québécois de qualité de l'atmosphère, version 10* (Quebec standards and criteria for air quality, version 10) published by the *Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs* (MELCCFP, 2025a). If the tests show that an air quality standard has been exceeded, the situation will be investigated, and corrective measures will be taken as appropriate. Table 13-2 summarizes the applicable standards for currently identified parameters to be assessed at the project site.

Table 13-2 Air quality standards and criteria applicable to the parameters assessed at the project site

Substance	Type of particles in the standard	Period	Limit value[1] (µg/m³)	Type of reference value
Total suspended particulates (TSP)	-	24 hours	120	Standard
Fine particulate matter (PM2.5) -	-	24 hours	30	Standard
Silver (Ag)	TSP	1 year	0.23	Standard
Arsenic (As)	TSP	1 year	0.003	Standard
Barium (Ba)	TSP	1 year	0.05	Standard
Beryllium (Be)	TSP	1 year	0.0004	Standard
Cadmium (Cd)	TSP	1 year	0.0036	Standard
Cobalt (Co)	TSP	1 year	0.1	Criteria
Chromium [hexavalent chromium compounds (CrVI)]	TSP	1 year	0.004	Standard
Chromium [trivalent chromium compounds (CrIII)]	TSP	1 year	0.1	Standard
Copper (Cu)	TSP	24 hours	2.5	Standard
Mercury (Hg)	TSP	1 year	0.005	Standard

Substance	Type of particles in the standard	Period	Limit value[1] (µg/m³)	Type of reference value
Lithium (Li)	TSP	1 hour	2	Criteria
Magnesium (Mg)	TSP	1 hour	24	Criteria
Manganese (Mn)	PM10	1 year	0.08	Criteria
Nickel (Ni)	PM10	24 hours	0.07	Standard
Nickel (Ni)	PM10	1 year	0.02	Standard
Lead (Pb)	TSP	1 year	0.1	Standard
Antimony (Sb)	TSP	1 year	0.17	Standard
Selenium (Se)	TSP	1 hour	2	Criteria
Crystalline silica (SiO_2)	PM10	1 hour	23	Criteria
Crystalline silica (SiO_2)	PM4	1 year	0.07	Criteria
Tin (Sn)	TSP	4 minutes	2	Criteria
Tin (Sn)	TSP	1 year	0.1	Criteria
Titanium (Ti)	PM10	24 hours	2.5	Criteria
Vanadium (V)	TSP	1 year	1	Standard
Zinc (Zn)	TSP	24 hours	2.5	Standard

Notes: [1] MELCCFP, 2025a. Normes et critères québécois de qualité de l'atmosphère, version 10, Québec, Direction de la qualité de l'air et du climat, [online]. www.environnement.gouv.qc.ca/air/criteres/index.htm

Emissions from stationary sources

In addition to emissions from diffuse sources generated by general project activities, the ore processing and paste backfill plants will include various chimneys, each of which will be a stationary source of emissions. These emissions will also be monitored using the standard methods outlined in the *Sampling Guide for Environmental Analysis – Booklet 4 – Sampling of Atmospheric Emissions from Stationary Sources* (MDDELCC, 2016a). As stipulated by the *Clean Air Regulation (CAR)*, sampling must begin no later than one year after the plants begin operations and must be repeated every three years.

For each stationary emission source, as required by *Directive 019 on the Mining Industry* (MELCCFP, 2025b), the following information must be provided:

- the nature of contaminants, quantity emitted (MT/year), flow rate (m^3/h), gas temperature (°C) and contaminant concentration (mg/Nm^3);
- purification systems or measures taken to prevent, eliminate, or reduce the release of contaminants, and the percentage of efficiency;
- how and where dusts are stored, deposited, or disposed of (if dry dust collectors are used).

Ambient air quality follow-up will end at the time of plant dismantling.

13.2.2.2 Greenhouse gases

Monitoring greenhouse gas (GHG) emissions is a legal requirement under the *Regulation respecting mandatory reporting of certain emissions of contaminants into the atmosphere* (RDOCECA) at the provincial level and the *National Pollutant Release Inventory* (NPRI) at the federal level. This requirement applies to the construction, operations and closure phases of a facility, provided that certain minimum thresholds are met.

As part of the GHG estimates presented in the EIA, the following project activities have been identified as sources of GHG emissions and are therefore included in the GHG emissions follow-up:

- fuel consumption (diesel, gasoline, compressed natural gas) of machinery and equipment during the construction phase;
- fuel consumption (diesel, gasoline, compressed natural gas) of machinery and equipment during the operations phase;
- fuel consumption (diesel, compressed natural gas) from stationary sources during the construction and operations phases;
- electricity consumption from the grid.

For each piece of equipment, the data obtained through the emission calculation protocols will be added up by converting CH_4, N_2O, and refrigerant emissions into CO_2 equivalents, using the global warming potential (GWP) of these gases. These GWP values are listed in the *Guide de quantification des émissions de gaz à effet de serre* ["Guide to quantifying greenhouse gas emissions"] (MELCCFP, 2025c). The emissions inventory will also comply with the reporting requirements of the *Federal GHG Reporting Program*. It will also include follow-up related to the federal government's NPRI.

Reports will be submitted through the electronic platforms of both levels of government, and the reports will be certified by a third party acting as an auditor. Every three years, in the interest of transparency, the auditing firm will be changed. At this time, it is not anticipated that the developer will be subject to the Cap-and-trade (C&T) system, as emissions from stationary sources are estimated to be below 25,000 t CO_2 eq per year.

13.2.2.3 Acoustic environment and vibrations

The purpose of this follow-up is to assess changes in ambient noise, vibrations, and air overpressure that may result from project activities. It will be used to assess the effectiveness of the mitigation measures that have been implemented and, if necessary, to adjust them. Acoustic follow-up will also help identify the sources of noise responsible for noise levels that could cause disturbances or discomfort for workers and land users. As for monitoring vibrations and air overpressure, the goal will be to confirm compliance with applicable standards and, if necessary, to adjust the blasting plan.

Acoustic environment

According to *Directive 019 on the mining industry* (MELCCFP, 2025b), the operator of a mine under construction or in operation must establish a self-monitoring program to track noise levels associated with construction and operations. In addition, the assessment of ambient noise must be conducted in accordance with the requirements of the new guidelines (MELCCFP, 2026)[1]. During construction, these standards must be supplemented by the *Lignes directrices relativement aux niveaux sonores provenant d'un chantier de construction industriel* ["Guidelines on noise levels from industrial construction sites"] (MDDELCC 2015b).

[1] Directive 019 respecting the mining industry refers to Instruction Note 98-01 (NI 98-01). However, NI 98-01 was recently (January 2026) replaced by the Environmental Noise Management Guidelines.

At the federal level, Health Canada recommends assessing the impacts of noise on human health based on changes in the percentage of the population experiencing significant annoyance (% HA) by type of noise (tonal noise, impact noise, etc.) (Health Canada, 2017).

Frequency and duration of the follow-up

Noise levels are monitored at least once at the start of each major phase of construction work. The sampling period for a noise monitoring study covers a 12-hour workday (between 7 a.m. and 7 p.m.) and is used to determine the daytime assessment noise level as defined in the technical guidelines. The need for additional noise monitoring during any of the construction phases is assessed based on the baseline noise level, measured over a 12-hour period, obtained during the initial noise monitoring for each phase of the work. In addition, should there be a change in work methods or the addition of new equipment, these changes will be subject to a new noise follow-up assessment. Measurements are taken between May and October.

During operations, noise levels are monitored twice per season, between May and October, on a day that is representative of the project's activity. The first measurement is taken at the start of the season, and the second is taken when an operational change occurs that is likely to result in a significant change in noise levels. Each acoustic monitoring session lasts 24 hours.

At the monitoring station, noise measurements are taken every five seconds. The exact location of the monitoring stations will be specified at the time the construction authorization application is submitted. These measures take into account the average noise level (A- and C-weighted) as well as the maximum level observed. A more detailed analysis by frequency band is also performed to better characterize the sounds. Based on this data, statistics are generated every hour to provide an overview of noise trends. Audio recordings and audio signals are also stored, making it easier to identify the source of the noise heard, whether they are traffic-related, human activity, impact noises, or ambient sounds. Lastly, the GPS coordinates of the measurement point are recorded to accurately locate each data point.

The proponent must also maintain a record of noise-related complaints and submit it to the Ministère upon request. For each complaint, specific information must be recorded and kept for a period of five years.

Report

An annual report is prepared summarizing the results of the measurements and data processing, including the sound levels measured with or without recording, in third-octave frequency bands, and sound levels as needed.

During the construction period, the report also provides the following information:

- the date of the noise measurements;
- the exact sampling period and position;
- hourly weather conditions:
  - temperature;
  - wind speed and direction;
  - relative humidity;

    - road conditions (dry or wet);
    - precipitation;
- noise levels measured without recording (ambient noise): $L_{Aeq\text{-}1h}$, $L_{Ceq\text{-}1h}$, $L_{d(7\ a.m.\ to\ 10\ p.m.)}$, $L_{n(10\ p.m.\ to\ 7\ a.m.)}$, L_{dn}, $L_{AF1\text{-}1h}$, $L_{AF10\text{-}1h}$, $L_{AF50\text{-}1h}$, $L_{AF90\text{-}1h}$, $L_{AF95\text{-}1h}$, and $L_{AFTmax5}$;
- the hourly linear equivalent continuous sound pressure levels measured in third-octave bands ($L_{Zeq,1h\ (1/3\ oct.)}$) will be provided;
- sound levels measured and recorded (specific noise): $L_{Aeq\text{-}1h}$;
- the assessment of hourly noise levels and the necessary corrective measures:
    - equivalent sound level of the specific noise: $L_{Aeq\text{-}1h}$;
    - corrective terms (K_I, K_T and K_S);
    - profiles of the $L_{Aeq\text{-}5s}$ and $L_{Aeq\text{-}1h}$ sound levels and wind speed;
    - an assessment of the percentage of people who are highly annoyed (HA);
    - analysis of the results against the specified limits;
    - the additional mitigation measures that have been implemented in the event that limits are exceeded.

During the operations phase, an annual report is prepared. It contains the same information as that provided during the construction phase, with the following exceptions:

- noise levels measured without recording (ambient noise): $L_{Aeq,\ 24\ h}$, $L_{Aeq,\ 12h\ (7\ a.m.\ to\ 7\ p.m.)}$, $L_{Aeq,\ 12h\ (7\ p.m.\ to\ 7\ a.m.)}$, $L_{Ceq\ 24h}$, $L_{Aeq\text{-}1h}$, $L_{Ceq\text{-}1h}$, $L_{d(7\ a.m.\ to\ 10\ p.m.)}$, $L_{n(10\ p.m.\ to\ 7\ a.m.)}$, L_{dn}, $L_{AF10\text{-}1h}$, $L_{AF50\text{-}1h}$, $L_{AF90\text{-}1h}$, $L_{AF95\text{-}1h}$, and $L_{AFTmax5}$;
- sound levels measured and recorded (specific noise): $L_{Aeq\text{-}1h}$, $L_{Ceq\text{-}1h}$.

The report must also include any complaints received.

Vibrations

A program for the self-monitoring of blasting operations and vibration monitoring has been developed to meet the requirements of Directive 019 (2025 version). Given the proximity of the work camp (less than 1 km away), this program aims to protect workers, land users, critical infrastructure, and aquatic habitats from the potential effects of ground vibrations and air overpressure. The main objectives are to:

- ensure that blasting complies with regulatory standards;
- minimize impacts on sensitive receptors (human and aquatic);
- ensure transparency by setting up a communication program.

Frequency and duration of the follow-up

As specified in Section 3.4.3 of *Directive 019 on the mining industry* (MELCCFP, 2025b), PMET will comply with the requirements regarding ground vibrations and air pressure surges, namely:

- the maximum permissible particle velocity during blasting, which is 12.7 mm/s, measured at the point of impact;

- the maximum air overpressure, which is 128 linear decibels, measured at the point of impact, except for water supply wells;
- that no mineral substances are projected outside the mine site;
- that clear communication will be maintained with local residents and workers regarding blasting schedules.

Vibration monitoring is performed during every blasting operation. The measured parameters include, in particular, the frequency and peak velocity of the particles, which are systematically compared to the applicable maximum limit.

The results are recorded in a database and kept for a minimum of five years. If regulatory thresholds are exceeded or emissions are observed outside the site, the MELCCFP is notified immediately, and appropriate corrective measures are taken.

Additional follow-up is conducted in the aquatic environment. A hydrophone will be installed in Lake L01, located near the pit, to measure pressure changes caused by the detonations. The data collected is used to verify compliance with the 100 kPa threshold established by federal standards (Wright and Hopky, 1998) for fish protection and, if necessary, to adjust the propagation calculations based on observed conditions. The follow-up program also takes into account the protection of potential spawning grounds in Lake L01 and the surrounding watercourses and water bodies, for which a limit of 13 mm/s is enforced during the egg incubation period of salmonids (August 31 to June 1) and other species of interest (April 15 to June 1).

Report

All collected data, including vibration measurements, air overpressure readings, weather conditions, blasting parameters, and quality control results, are recorded in a specific logbook and kept for a minimum of five years. This logbook must include:

- the identity of the person responsible for the measurements;
- the geographic coordinates of the measurement points and the affected residences;
- the technical specifications of the instruments used and the date of their last calibration;
- the observed weather conditions and any relevant observations related to the context of the measurements;
- the dates and times of the measurements;
- a statement confirming that all procedures were performed in accordance with current monitoring protocols and best practices.

The recorded data is used to verify the compliance of blasting operations, adjust prediction models, and optimize the planning of future operations.

An annual summary of ground vibration and air overpressure results is included in the operational activity report submitted to the MELCCFP, in accordance with the requirements of Directive 019 (MELCCFP, 2025b).

13.2.2.4 Ambient light

No specific follow-up is planned for ambient light, except for a follow-up of the mitigation measures presented in Appendix 8-2.

13.2.2.5 Soil

In accordance with the requirements of Section 3.12.2.1 of Directive 019 on the mining industry (MELCCFP, 2025b) and Section 31.51 of the Environment Quality Act (EQA), soil characterizations of the mining site will be carried out prior to construction activities in order to establish baseline conditions for existing soil quality. Another characterization will be conducted prior to restoration work. The purpose of this assessment is to identify and limit potential contaminant emissions and, if necessary, to adjust the restoration work based on the results obtained.

13.2.2.6 Hydrology

Hydrological monitoring focuses primarily on variations in water volumes at the effluent, on the development of a diversion channel for waters from Lake L01, as well as on potential changes to the hydrological regimes of water bodies that may experience a reduction in water inputs as a result of watershed loss and groundwater drawdown. During the construction phase, water volumes in the receiving watercourse of the mine effluent, as well as effects on the watersheds of the affected water bodies, will gradually increase until the start-up of mining operations.

The environmental monitoring program applicable to construction activities will be implemented by the environmental monitor assigned to the site. The environmental monitor will ensure the rigorous implementation of the planned mitigation measures and compliance with these measures by all teams working on the site.

Flow and Water Level Monitoring

In order to assess the effects of the mining project on flows and water levels in watercourses within the study area, the following activities are proposed:

- The installation of six water-level monitoring probes is planned in Lakes L308, L219, L01, L02 and L07, as well as in watercourse CE15 (Map 13-1). Some of these probes will be installed at the same locations as those used during field campaigns conducted to establish baseline conditions, allowing for comparison of pre- and post-project conditions. Additional probes will also be installed at strategic locations to more thoroughly document the Project's potential impacts. Finally, one probe will be installed in a watercourse not affected by the mining project to serve as a reference site and to allow analysis of interannual variations independently of the Project's influence. The probes will therefore be installed at the following locations:
  - Locations previously used for baseline conditions:
    - Lake L02 (LL13)
    - Lake L219 (LL9)
    - Lake L308 (LL10)
    - CE15 (LL5)

- New locations:
  - Lake L01 (eastern portion)
  - Lake L07

- Water-level monitoring probes will be installed in the spring, after ice-out of lakes and watercourses, and retrieved in the fall, prior to freeze-up. This approach will allow documentation of periods of high hydrological activity, notably following snowmelt and during fall precipitation events, as well as summer low-flow periods.
- Precipitation will be recorded continuously between the spring and fall monitoring campaigns using the meteorological station already in place at the mine site. These data will be used to interpret variations in water levels measured by the probes and to distinguish potential Project-related effects from natural interannual variability in hydrological conditions.
- Flow measurements will be conducted at the locations where probes are installed in watercourses, or at lake outlets for probes located in lacustrine environments. These measurements, based on the determination of flow velocities to derive discharge, will be carried out twice per year: in the spring during probe installation and in the fall during probe removal. This frequency will provide data representative of contrasting hydraulic conditions, including both low- and high-flow periods.

Erosion Monitoring

- According to the hydraulic study conducted by Atkins Réalis (Appendix 8-3), the opening of the diversion channel between Lake L01 and Lake L05 and the closure of watercourse CE01 (the natural outlet of Lake L01) could result in changes to received flow volumes (flooding risks) and generate downstream erosion.
- For a 1:2-year return period (used for modelling purposes, as it is more frequent), erosion and deposition processes may occur in four sectors between the outlet of the diversion channel into watercourse CE05 and Lake L27 (Map 13-1), namely:
  - in watercourse CE08, approximately 1.2 km downstream of the diversion channel outlet;
  - at the outlet of Lake L07, in watercourse CE11, approximately 2.2 km downstream of the diversion channel outlet;
  - in watercourse CE11, immediately upstream of Lake L10, approximately 2.9 km downstream of the diversion channel outlet;
  - in watercourse CE15, approximately midway between Lakes L10 and L27 and about 3.6 km downstream of the diversion channel outlet.

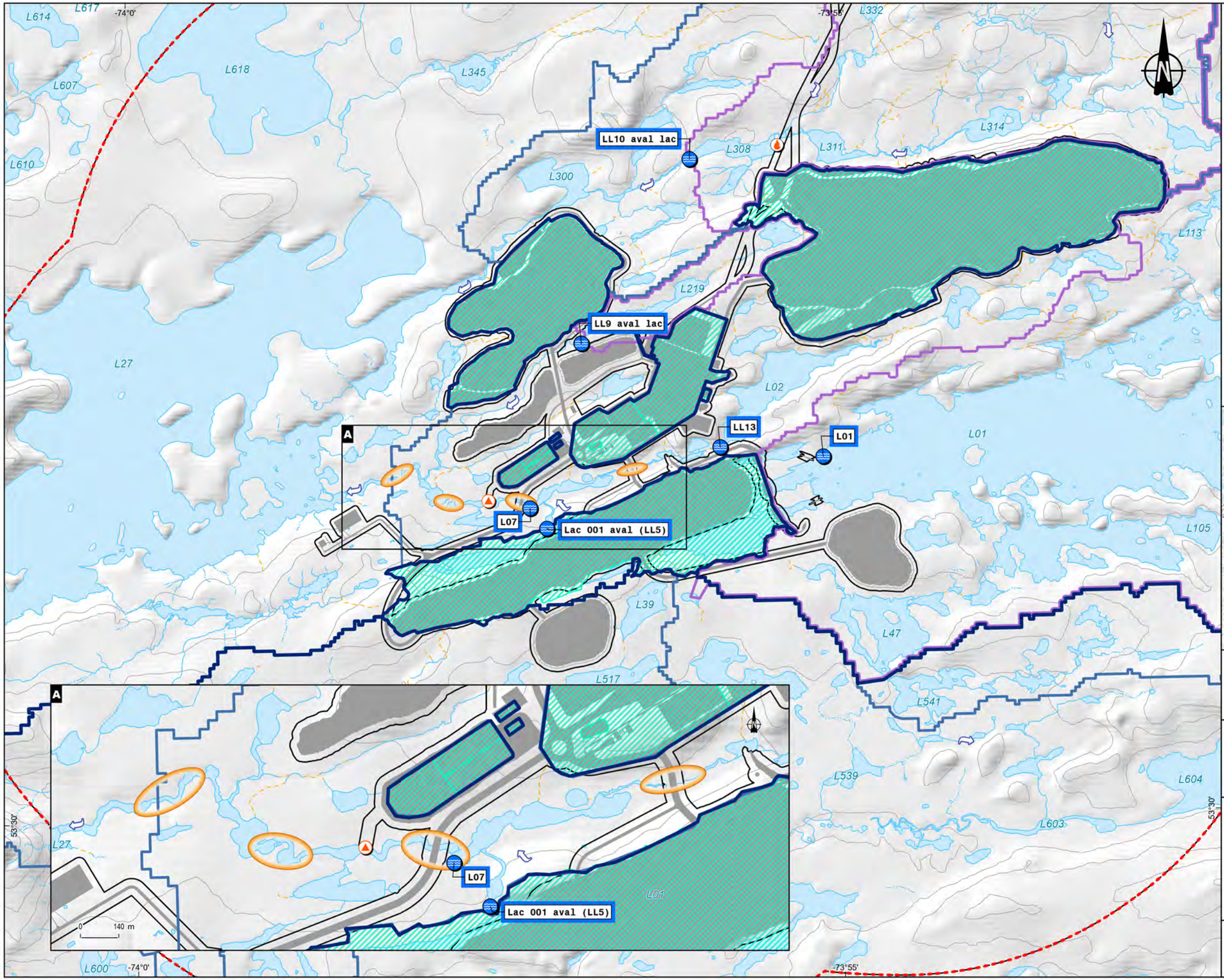
Monitoring of field conditions in these four sectors is therefore planned to ensure the maintenance of their integrity and to confirm that the increase in flow does not adversely affect the stability of the watercourses. To this end, the following activities are planned:

- Site visits to the four potentially problematic sectors will be conducted on foot three times per year. In particular, one visit will take place immediately following snowmelt, which represents a period of high hydrological activity during which the effluent is expected to operate at maximum capacity and therefore constitutes a critical period from an erosion-potential perspective. These visits may be carried out concurrently with hydrological monitoring, where feasible and relevant.

- During each visit, photographic and descriptive documentation will be collected to record the condition of the watercourse, particularly the banks, at different times of the year.
- Attention will also be given to changes in hydraulic conditions unrelated to the Project, including, but not limited to, the formation or failure of beaver dams and the presence of woody debris accumulations.
- Field observations will be analyzed in conjunction with water-level and flow data collected as part of the hydrological monitoring program, in order to establish relationships between measured hydraulic conditions and the morphodynamic evolution observed in the field.
- Should erosion phenomena be observed, the frequency of inspections may be increased to more closely document ongoing processes. Where applicable, localized bank-stabilization measures, such as riprap, may be implemented.

This monitoring will be carried out in Years 1 and 2, then in Years 5 and 6, as well as once at the end of site restoration activities. A monitoring report presenting the data collected, their analysis, and the associated conclusions will be prepared at the end of each monitoring period.

No specific hydrological monitoring is planned during the closure phase, as the natural environment is expected to return to an equilibrium state comparable to that observed prior to Project implementation.



Zones d'étude / *Study Areas*

Projet / *Project*

Locale - Biophysique / *Local - Biophysical*

Composantes du projet / *Project Components*

Effluent minier / *Mining effluent*

Prise d'eau / *Water intake*

Autres composantes projetées / *Other projected components*

Hydrologie / *Hydrology*

Sens d'écoulement de l'eau / *Waterflow direction*

Zone de collecte d'eau de ruissellement / *Runoff water collection area*

Suivi des débits et niveaux d'eau / *Flow and Water Level Monitoring*

sondes de mesure des niveaux d'eau / *Water level monitoring sensors*

Zone de suivi de l'érosion / *Erosion monitoring zone*

Bassins versants projetés / *Projected Watersheds*

Principal / *Principal*

Intermédiaire / *Intermediate*

Sous-bassin versant / *Sub-watershed*

Hydrographie / *Hydrography*

Plan d'eau / *Waterbody*

Cours d'eau / *Watercourses*

Intermittent / *Intermitent*

Permanent / *Permanent*

Souterrain / *Underground*



Projet minier Shaakichiuwaanaan /
Shaakichiuwaanaan Mining Project

Étude d'impact sur l'environnement - Impacts /
Environmental Impact Assessment - Impacts

Carte 13-1 / *Map 13-1*
Stations de suivis hydrologiques et des zones d'érosion potentielles / *Hydrological Monitoring Stations and Potential Erosion Zones*

Sources :
CanVec, 1/250 000, RNCan, 2017
BDGA, 1M, MERN, 2014
Cartographie écologique de la végétation du Nord Québécois, MFFP, 2013

0 300 600 m
NAD 1983 CSRS UTM Zone 18N

2026-03-28

Préparation / Preparation : E. Sormain
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CA0001724_3318_eie_ch13_c01_c02_260328.aprx
CA0001724_3318_eie_c13_01_171_suivi_erosion_hydro_260328

13.2.2.7 Mine effluent

The purpose of monitoring mine effluent is to verify that the effluent quality complies with applicable standards and criteria at all times, as well as to collect the information needed to evaluate and interpret the results of biological follow-up (benthos and fish). This monitoring includes characterizing the mine effluent and conducting lethal and sublethal toxicity tests using samples taken from the effluent.

In accordance with Directive 019 on the mining industry (MELCCFP, 2025b) and the Metal and Diamond Mining Effluent Regulations (MDMER), regular follow-up of the final effluent continues until the project proponent submits an application to transition to post-restoration follow-up. The provisions of Part 4 of the MDMER set forth the requirements that operating mines must meet to be recognized as closed. In addition, depending on the nature of the ore, the process, the tailings, or the environmental discharge objectives (EDOs), additional requirements applicable to the discharge point of the final effluent may be specified when the ministerial authorization is issued.

A summary of the general parameters under assessment is presented below.

Directive 019

In accordance with Directive 019 on the mining industry (MELCCFP, 2025b), samples will be collected using the methods prescribed in *Cahier 2 – Échantillonnage des rejets liquides* [Booklet 2 – Sampling of liquid discharges] and its addendum, *Types et méthodes d'échantillonnage* [Sampling types and methods] (MDDELCC, 2016b). A grab sample or a 24-hour composite sample shall be collected daily, and the parameters listed in Table 3.3 of the directive (Table 13-3 below) shall be measured at the frequencies indicated.

Sampling of the parameters associated with Columns II, III, and IV must be accompanied by measurements of flow rate and pH. The parameters in Columns III and IV must be sampled simultaneously with one of the samplings carried out for the parameters in Column II, and the parameters in Column IV must also be sampled at the same time as those in Column III. The prescribed frequencies are maintained until the start of post-operations follow-up.

For the parameters in Columns II, III, and IV, for which testing is required on a tri-weekly, weekly, monthly, or quarterly basis, a minimum interval of 24 hours, 4 days, 15 days, and 45 days, respectively, must be observed between two measurements or two sampling campaigns.

Table 13-3 Sampling, analysis, and measurement frequencies for routine monitoring of the final effluent

	Frequency			
	Column I	**Column II**	**Column III**	**Column IX**
	Continuous[1]	3/wk.	1/wk.	Another frequency
Parameter	pH	TSS	As	Acute toxicity Rainbow trout (*Oncorhynchus mykiss*) and Daphnia (*Daphnia magna*) (1/month) Petroleum hydrocarbons C_{10}-C_{50} (1/quarter) Radium 226 (1/quarter)
	Flow rate	Flow rate	Cu	
		pH	Fe	
			Ni	
			Pb	
			Zn	
			Total cyanides[2]	
			Ammoniacal nitrogen	

Notes: 1 For facilities generating more than 1,000 m³/day of effluent (annual average calculated based on days with effluent discharge), continuous measuring of pH and flow rate is required.
2 Applies only to the final effluent from facilities that use or have used cyanides in their processes.

Metal and Diamond Mining Effluent Regulations (MDMER)

Monitoring of the final effluent also includes measuring all physicochemical parameters at the frequencies specified by the MDMER. Table 13-4 provides details of the tests required under this regulation. Sampling and measurements will be conducted in accordance with the requirements of Directive 019 on the mining industry (MELCCFP, 2025b), the MDMER, and the *Sampling Guide for Environmental Analysis – Booklet 2* and its addendum (MDDELCC, 2016b).

Standard precautions will be followed to prevent contamination during sampling, handling, and transport of samples. Parameter tests will be carried out by a MELCCFP-accredited laboratory in accordance with the testing methods recognized by the MELCCFP. Strict quality control and quality assurance measures will be implemented for all sampling and testing activities.

The follow-up requirements (parameters, frequencies, detection limits, etc.) and reporting procedures will be specified in the permits issued at the start of operations These follow-up activities will be carried out by the proponent in accordance with the conditions established by government authorities.

Table 13-4 Parameters and measurement or sampling frequency for final mine effluent under the MDMER

Parameters	Frequency
pH, temperature, As, Cu, Ni, Pb, Zn, Ra-226, total cyanides, total suspended solids, un-ionized ammonia	Once a week[1, 3]
Acute lethality	Once a month[2]
Hardness, alkalinity, conductivity, nitrate, chloride, sulphate, phosphorus, Al, Cd, Cr, Co, Fe, Hg, Mn, Mo, Se, Tl, U	Four times a year
Sublethal toxicity [test for measuring the inhibition of growth using the freshwater macrophyte, *Lemna minor* (Reference method EPS 1/RM/37), published by the Ministère de l'Environnement and applied to the biological parameter based on the number of thalli]	Twice a year

Notes:
1 The owner or operator of a mine, other than a uranium mine, may reduce the frequency of conducting tests relating to the concentration of radium 226 at a final discharge point to not less than once in each calendar quarter, each test being conducted at least one month apart, if the concentration of radium 226 at that final discharge point is less than 0.037 Bq/L for 10 consecutive weeks
2 The owner or operator of a mine may reduce the frequency of conducting an acute lethality test at a final discharge point to once in each calendar quarter if the effluent from that final discharge point is determined not to be acutely lethal by that acute lethality test for 12 consecutive months.
3 The owner or operator of a mine may reduce the frequency of conducting tests relating to the concentrations of arsenic, copper, cyanide, lead, nickel, zinc or un-ionized ammonia at a final discharge point to not less than once in each calendar quarter, each test being conducted at least one month apart, if that substance's monthly mean concentration at that final discharge point is less than 10% of the value set out in column 2 of Schedule 4 of the MDMER for 12 consecutive months.

Post-closure environmental monitoring will be conducted over a period of four years, until the completion of restoration activities. During this period, the mine water management system will remain operational.

During the post-operations phase, all potential sources of contamination located upstream of the final effluent discharge point will be monitored. The quality of runoff water from any other potential source of contamination will also be checked. Sample collection and flow measurement at the sampling station will be conducted in accordance with the frequencies and durations specified in Table 3.3 of Directive 019 on the mining industry (MELCCFP, 2025b), i.e., Table 13-3 above.

Post-restoration environmental monitoring will be conducted over a five-year period. Following restoration of the mining site, there will be two effluents at Waste Rock Pile 01 and two effluents at Waste Rock Pile 02, due to the creation of breaches in the dikes of the water management ponds associated with these waste rock piles. As a result, four surface water effluents will be monitored. Sampling frequencies will comply with the requirements of Directive 019, namely six times per year. Mine wastewater monitoring will be carried out in accordance with Section 3.11 of Directive 019. A sampling station will be installed at each discharge point, and the water will be treated as required prior to discharge to the environment.

Over the previous five years of water quality follow-up, if the requirements of Section 3.11.3 of Directive 019 are met and downward trends in contaminant concentrations are observed, the gradual discontinuation of certain follow-up activities may be considered, subject to approval by the MELCCFP.

13.2.2.8 Surface water

Surface water quality follow-up will be conducted in addition to the characterization of mine effluent required under the MDMER. The goal is to monitor the project's performance and track changes in environmental conditions in the waters of the receiving environment. The monitoring will also provide measurements of environmental variables to support the interpretation of the results of the biological follow-up (benthos and fish). The surface water quality monitoring parameters for the receiving environment targeted by the MDMER are presented in Table 13-5.

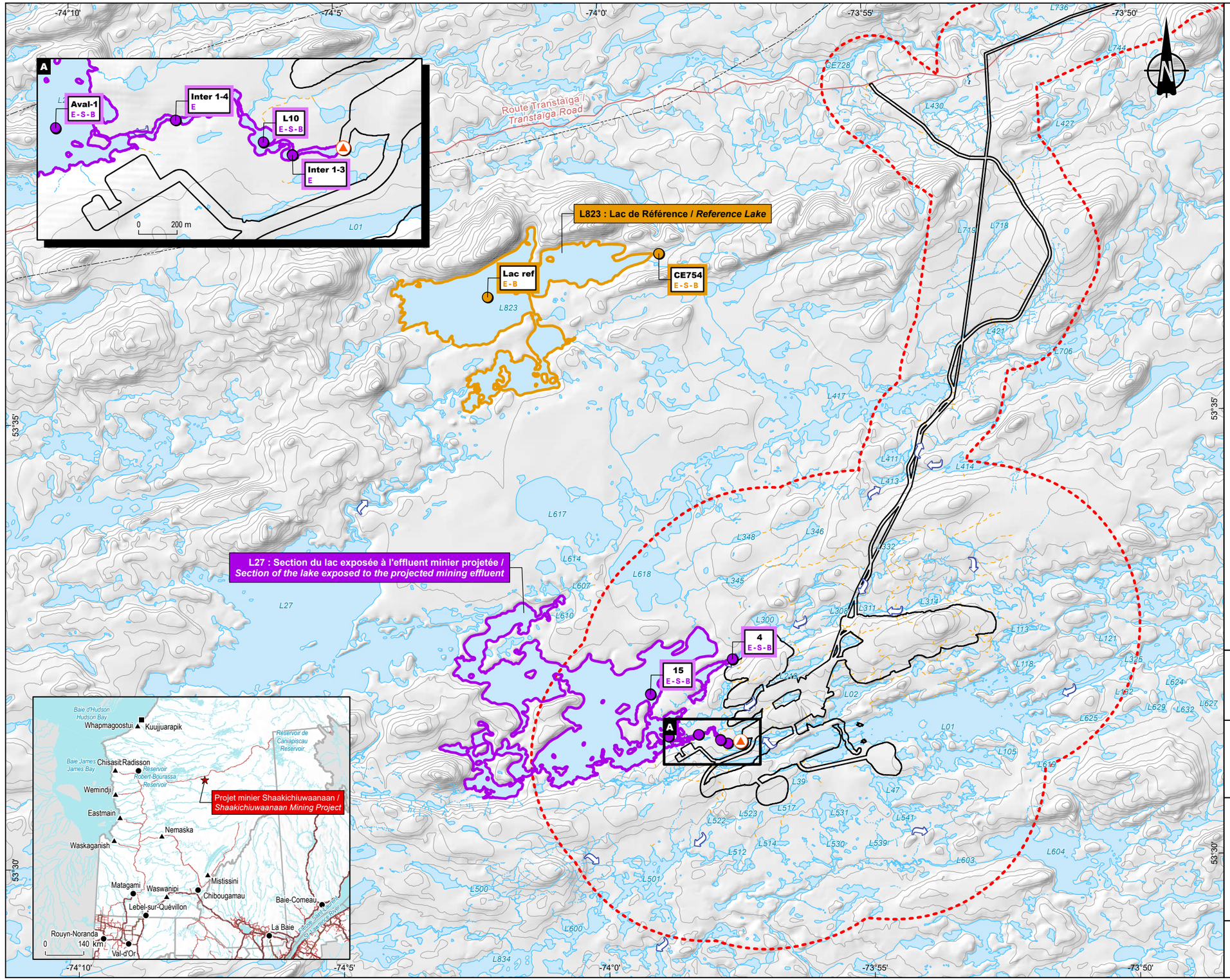
Table 13-5 Parameters considered for surface water monitoring under the MDMER

Parameters	Frequency
pH, hardness, alkalinity, conductivity, temperature, dissolved oxygen	Four times a year
Harmful substances referred to in Article 3 (As, Cu, total cyanide, Pb, Ni, Zn, TSS, Ra-226, un-ionized ammonia)	
Substances listed in paragraph 4(1) of Schedule 5 (Al, Cd, Cr, Co, Fe, Hg, Mn, Mo, Se, Tl, U, nitrate, chloride, sulphate, phosphorus)	

Monitoring conducted under the MDMER during exploration activities will continue through the post-restoration phase. Surface water sampling stations will be located at the sites designated for the project, specifically downstream of the mine effluent in watercourses CE11 and CE15 and Lakes L10 and L27, as well as in the reference lake and watercourse (Lake 823 and its tributary) (Map 13-2). Sampling and measurements will be conducted in accordance with the requirements of Directive 019 on the mining industry and the MDMER.

Standard precautions will be followed to prevent contamination during collection, handling, and transport of samples. Parameter tests will be carried out by a MELCCFP-accredited laboratory in accordance with the testing methods recognized by the MELCCFP. Strict quality control and quality assurance measures will be implemented for all sampling and testing activities.

The detection limits specified in the MDMER will be rigorously verified to ensure that all test results are compliant.



Zones d'étude / *Study Areas*

- Projet / *Project*
- Locale - Biophysique / *Local - Biophysical*

Composantes du projet projetées / *Projected Project Components*

- Effluent / *Effluent*

Stations de suivi / *Monitoring Stations*

Eau de surface, sédiment et benthos / *Surface Water, Sediment and Benthos*

- Exposée à l'effluent minier projetée / *Exposed to the projected mining effluent*
- Référence / *Reference*

Communautés de poisson / *Fish Communities*

- Exposée à l'effluent minier projetée / *Exposed to the projected mining effluent*
- Référence / *Reference*

Étiquette / *Label*

15
E-S-B

- Nom de la station / *Station name*
- Type d'échantillon/ *Sample type*

Code / *Code*	Échantillon / *Sample*
E	Eau de surface / *Surface water*
S	Sédiment / *Sediment*
B	Benthos / *Benthos*

Hydrographie / *Hydrography*

- Plan d'eau / *Waterbody*

Cours d'eau / *Watercourses*

- Intermittent / *Intermitent*
- Permanent / *Permanent*
- Permanent partiellement souterrain / *Partially underground permanent*
- Intermittent partiellement souterrain / *Partially underground intermittent*
- Souterrain / *Underground*
- Sens d'écoulement de l'eau / *Waterflow direction*

Infrastructures / *Infrastructure*

- Ligne de transport d'énergie / *Electric power transmission line*
- Centrale hydroélectrique / *Hydroelectric generating station*

Réseau routier / *Road Network*

- Route collectrice municipale / *Municipal collector road*

Projet minier Shaakichiuwaanaan / *Shaakichiuwaanaan Mining Project*

Étude d'impact sur l'environnement / *Environmental Impact Assessment*

Carte 13-2 / *Map 13-2*

Stations de suivi de l'eau de surface, des sédiments, des communautés de poissons et de benthos / *Surface Water, Sediment, Fish and Benthos Monitoring Stations*

Sources :

CanVec, 1/250 000, RNCan, 2017
BDGA, 1M, MERN, 2014
Cartographie écologique de la végétation du Nord Québécois, MFFP, 2013
Synergis, État de référence du milieu aquatique pour le projet Shaakichiuwaanaan, 12-2025

0 800 1 600 m
NAD 1983 CSRS UTM Zone 18N

2026-03-27

Préparation / Preparation : I. Cartier
Dessin / Drawing : P. Boulay
Approbation / Approval : M.-H. Brisson
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13.2.2.9 Sediments

Sediment monitoring will be conducted at the same locations and with the same frequency as the monitoring of surface water and benthic invertebrate communities (Map 13-2) to determine whether mine operations are affecting the quality of sediments in the receiving environments. The methodology to be applied is described in detail in Chapter 7 of the *Metal Mining Technical Guidance for Environmental Effects Monitoring* (Government of Canada, 2012). The sediment monitoring parameters at the project site are the following:

- total organic carbon, total phosphorus, humidity, total solids;
- sediment grain size distribution.

Since the choice of parameters to be measured in sediments varies from site to site and since the determination of total metal concentrations is not a requirement of the national Environmental Effects Monitoring (EEM) program, it is suggested that a baseline analysis be conducted by measuring, at a minimum, the same applicable parameters as those specified for surface water, namely:

- Al, As, Cd, Cl^- (chloride), CN^- (total cyanide), Co, Cr, Cu, Fe, Hg, Mn, Mo, NH_3 (partially), Ni, NO_3^-, P (phosphorus), Pb, Se, SO_4^{2-} (sulphate), Tl, U, Zn, Ra-226.

13.2.2.10 Hydrogeology and groundwater quality

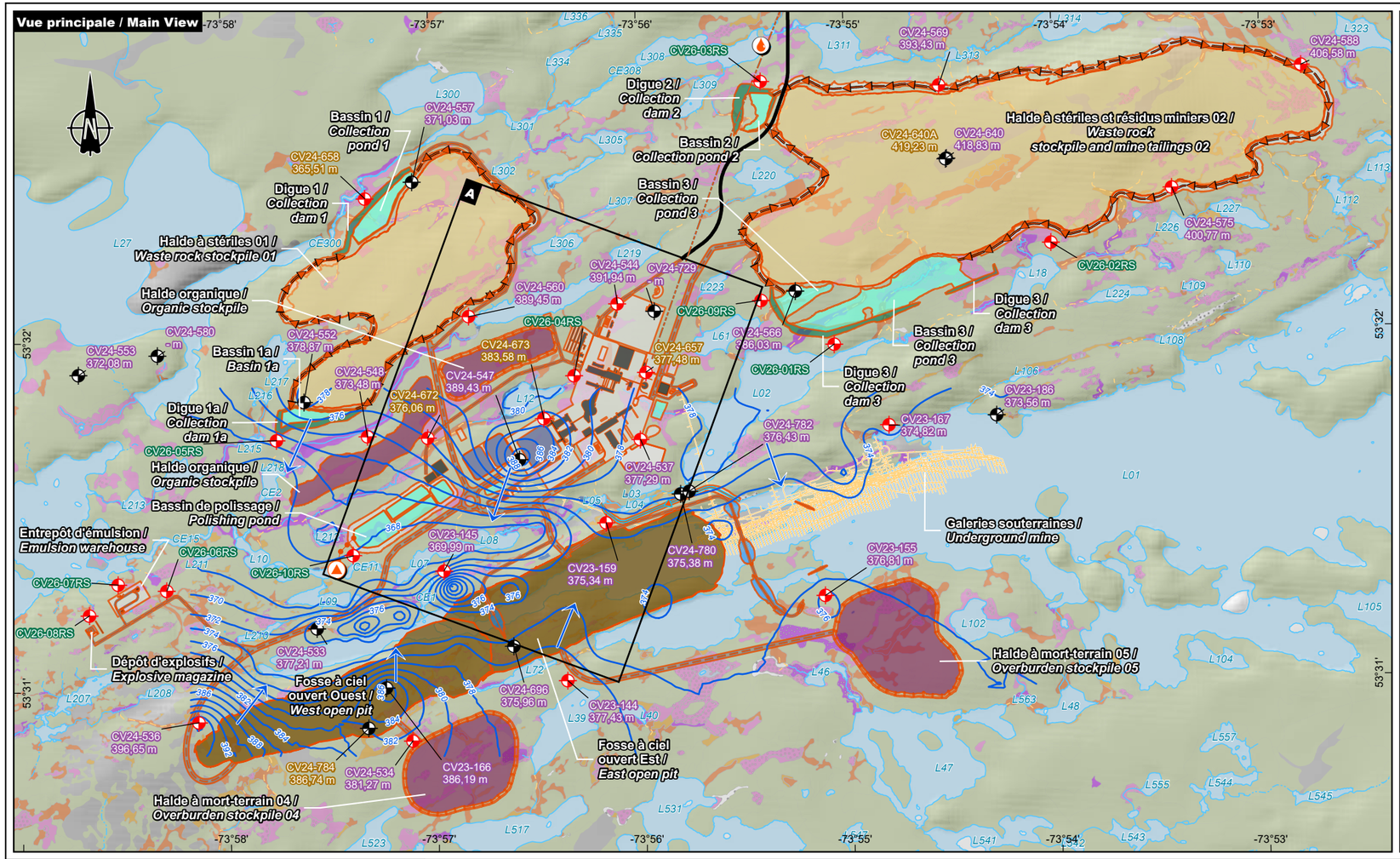
According to Directive 019 on the mining industry (MELCCFP, 2025b), a groundwater quality monitoring program, including piezometric monitoring, must be set up near any high-risk facility such as a process plant, a tailings storage area, a petroleum or chemical storage area, etc. The monitoring thus verifies the potential for significant degradation of groundwater quality during mining operations. This follow-up will continue through the post-restoration period.

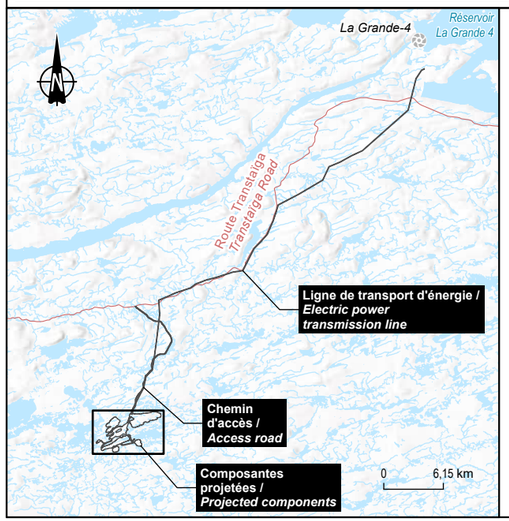
Monitoring water levels

Piezometric monitoring will be conducted at locations where observation wells are installed to monitor groundwater quality (Map 13-3). In accordance with Directive 019 on the mining industry (MELCCFP, 2025b), measurements must be taken at least twice a year—in the spring and summer—to account for periods of high and low water flow.

The general procedure will consist of:

- identifying the observation well;
- taking GPS coordinates (if previously surveyed);
- measuring the height of the casing in relation to the ground;
- measuring water elevation (static level) relative to the casing prior to sampling;
- sampling groundwater.





Zone d'étude / *Study Area*

- Projet / *Project*

Composantes du projet / *Project Components*

Existante / *Existing*

- Chemin d'accès / *Access road*

Projetées / *Projected*

- Effluent minier / *Mining effluent*
- Prise d'eau / *Water intake*
- Barrage / *Dam*
- Canal / *Channel*
- Canal de dérivation / *Diversion Channel*
- Chemin secondaire / *Secondary road*
- Fossé / *Ditch*
- Galerie souterraine / *Underground mine*
- Ligne de transport d'énergie / *Power transmission line*
- Aire d'entreposage du minerai mixte / *Mixed ore stockpile*
- Autre / *Other*
- Bâtiment ou équipement / *Building or equipment*
- Digue / *Dam*
- Bassin / *Basin*
- Digue des bassins / *Basins dam*
- Fosse / *Pit*
- Halde à mort-terrain et organique / *Overburden stockpile*
- Halde à stériles et/ou résidus / *Waste rock and/or tailings stockpile*
- Portail d'accès à la mine souterraine / *Underground mine portal*
- Voie de circulation / *Roadway*

Piézométrie / *Piezometry*

- Courbe piézométrique (m) / *Piezometric level curve (m)*
- Direction d'écoulement / *Flow direction*

Composantes du projet / *Project Components*

- Puits d'observation / *Observation well*
- Puits d'observation proposé pour le suivi / *Proposed observation well for monitoring*
- CV24-536 396,65 m — Nom de la station / *Station name*; Élévation du niveau d'eau / *Water level elevation*; Couleur / *Color*; Unité hydrostratigraphique / *Dydrostratigraphic unit*
- CV24-536 — Roc / *Rock*
- CV24-536 — Dépôt meuble/ *Unconsolidated deposit*
- CV26-01RS — Roc et dépôt meuble / *Rock and unconsolidated deposit*

Composantes de l'écosystème / *Ecosystem Components*

- Milieux terrestres / *Terrestrial Environments*

Cours d'eau / *Watercourses*

- Intermittent / *Intermitent*
- Permanent / *Permanent*
- Souterrain / *Underground*

Milieux humides et hydriques / *Wetlands and Hydrous Environments*

- Plan d'eau / *Waterbody*
- Marécage arborescent / *Treed swamp*
- Marécage arbustif / *Shrubby swamp*
- Tourbière minérotrophe boisée / *Treed fen*
- Tourbière minérotrophe ouverte / *Open fen*
- Tourbière ombrotrophe boisée / *Treed bog*
- Tourbière ombrotrophe ouverte / *Open bog*
- Marais / *Marsh*
- Eau peu profonde / *Shallow water*

Projet minier Shaakichiuwaanaan / *Shaakichiuwaanaan Mining Project*

Étude d'impact sur l'environnement / *Environmental Impact Assessment*

Carte 13-3 / *Map 13-3*
Réseau de surveillance des eaux souterraines / *Groundwater Monitoring System*

Sources / Sources

SDA, 1/20 000, MERN, 2024-02
CanVec+, 1/50 000, RNCan, 2014
CanVec, 1/250 000, RNCan, 2017
BDGA, 1/1 000 000, MRN Québec, 2014
BDGA, 1/1 000 000, MRN Québec, 2002
AQréseau+, réseau routier, MERN, 2024-03-01
G Services Miniers, Composantes projetées, CASN-A-001-GE-SKE-0005-A, 2025

0 260 520 m
UTM, fuseau 18, NAD83 (CSRS)

2026-03-27

Préparation / Prepared by : A. Hamel
Dessin / Drawn by : M. Dupraz
Approbation / Approved by : M-H. Brisson
CA0001724_3318_eie_ch13_c3_260317.aprx
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La précision des limites et les mesures montrées sur ce document ne doivent pas servir à des fins d'ingénierie ou de délimitation foncière. Aucune analyse foncière n'a été effectuée par un arpenteur-géomètre. /
Boundary accuracy and measurements shown on this document are not intended for engineering or land delineation purposes. No land analysis has been performed by a land surveyor.

Groundwater quality follow-up

Groundwater sampling will be conducted using recognized standard methods at the stations shown on Map 13-2. During sampling, the following parameters will be measured: pH, electrical conductivity, dissolved oxygen, oxydo-reduction potential (ORP), and temperature. Procedures are described in the *Sampling Guide for Environmental Analysis: Booklet 3 – Groundwater Sampling* (MDDEP, 2011). Well-water is usually sampled using dedicated systems in each well to limit the risk of cross-contamination.

The parameters to be tested are those specified in Table 3.1 of Section 3.1.1 of Directive 019 on the mining industry (MELCCFP, 2025b), with the exception of total suspended solids, as well as major ions (Ca^{+2}, HCO^{3-}, K^{+}, Mg^{+2}, Na^{+}, Cl, $SO4^{-2}$), phosphorus, pH, and electrical conductivity. For groundwater, however, dissolved metals will be measured (rather than extractable metals). Depending on the type of ore, process, or tailings, additional parameters may be included in the groundwater quality monitoring requirements specified in authorizations issued by government authorities. Analytical parameters will therefore include the following:

- petroleum hydrocarbons C_{10}-C_{50};
- major ions (bicarbonates, calcium, chlorides, magnesium, potassium, sodium, and sulphates);
- dissolved metals (antimony, silver, arsenic, barium, boron, cadmium, cobalt, copper, iron, manganese, total chromium, mercury, molybdenum, lithium, nickel, lead, selenium, uranium, zinc);
- nitrites, nitrates, ammoniacal nitrogen;
- sulphides, total phosphorus;
- pH, electrical conductivity;
- radium 226.

To confirm the validity of the methods used to measure the various parameters, a quality control program will be implemented. Replicate samples will be taken during monitoring, corresponding to at least 10% of the samples taken. These samples will be sent to the laboratory for testing and to check that their results match those of the original samples. Field blanks and travel blanks are also taken during each campaign and sent to the laboratory.

The results of the chemical tests will be compared to the Resurgence in Surface Water Criteria (RSW) outlined in the *Guide d'intervention – Protection des sols et réhabilitation des terrains contaminés* ["Response guide – Soil protection and contaminated site remediation"] (Beaulieu, 2021). In addition, RES criteria for metals will be adjusted according to a hardness that is representative of the water in the surrounding environment. If required, recommendations regarding corrective actions or modifications to the groundwater monitoring program will be provided.

In accordance with the requirements of Section 3.10 of Directive 019 on the mining industry (MELCCFP, 2025b) and Section 31.51 of the EQA, PMET will conduct a characterization of the mine site prior to carrying out restoration work to identify and limit the release of contaminants and, ultimately, to adjust the work to be performed as necessary.

13.2.3 Biological environment

13.2.3.1 Vegetation and wetlands

Revegetation of affected areas

The proposed restoration work at the site includes revegetation of all areas affected by mining activities, in accordance with the *Guide de préparation du plan de réaménagement et de restauration des sites miniers au Québec* [“Guide for the preparation of mine site reclamation and restoration plans in Quebec”] (MRNF, 2024).. To ensure that the species planted are appropriate, that they grow well, and that the site’s future use is taken into account, the site restoration will be planned in collaboration with the Cree tallyman.

Post-revegetation monitoring during the post-restoration period will be conducted for a minimum of five years in the form of annual inspections and for a period of fifteen years in the form of triennial inspections. Inspections will primarily consist of a visual assessment of various parameters, including plant condition, surface area showing vegetation establishment, soil erosion, among others. Following each site inspection, a report will be submitted annually to the MRNF for a period of five years. After this period, if applicable, a request to discontinue this monitoring will be submitted to the MRNF.

13.2.3.2 Ichthyofauna

Biological follow-up is required under the EEM program (Government of Canada, 2012), a requirement of the MDMER. This follow-up program involves developing a study plan, followed by the sampling and testing of sentinel fish populations in areas exposed to mine effluent and in a reference area. Effluent toxicity tests are also required.

Before conducting the biological follow-up, a study plan must be submitted to and approved by Environment and Climate Change Canada (ECCC) at least six months before fieldwork begins. Its purpose is to describe the procedure for the biological monitoring study. The study plan must include information relevant to site characterization, sampling methods and time frames, testing methods, and the quality assurance and quality control measures that will be implemented to validate the study in question, as well as a summary of information from previous biological studies. Once the study plan has been approved, biological monitoring can begin. For the project site, biological monitoring includes the following:

- monitoring of sentinel fish populations;
- monitoring of benthic invertebrate communities;
- monitoring of environmental support variables and sediment quality.

Monitoring will be conducted on two fish populations to determine whether the mine effluent has an impact on the ichthyofauna. The water bodies studied will be Lake L823 (reference water body) and Lake L27 (exposed water body) (Figure 13-2). Two sentinel species will be proposed for the project, including the northern pike. The second species will be identified when the study plan is submitted to federal authorities. Monitoring these populations will help determine whether there are differences in their growth, reproduction, survival, and condition, and will allow for the monitoring of mercury concentrations in fish tissues, as needed (an indicator of the fish's suitability for consumption). Samples will be collected from the exposed area of Lake L27 and the unexposed reference area of Lake L823 to statistically compare any significant differences in the following parameters:

- age (survival);
- height by age (body weight by age);
- relative gonadal weight (gonadal weight relative to body weight, energy use, and reproduction);
- condition (body weight relative to body length, energy storage, and fitness);
- relative liver weight (liver weight relative to body weight, energy storage, and condition).

No specific monitoring has been implemented for lake sturgeon, given the absence of this species within the local study area.

13.2.3.3 Benthos

In accordance with regulatory requirements, mining companies must conduct a study of benthic invertebrate communities to assess the potential impact of their effluents on fish habitat. For this purpose, samples of benthic invertebrates will be collected in the same areas as those selected for monitoring surface water and sediments (Map 13-2). The assessment of the potential effects of the effluent on benthic communities will be based on an analysis of the following community descriptors:

- total invertebrate density;
- richness (number of taxa);
- evenness.

Sampling will be conducted during the mine's operations phase, beginning no sooner than one month after the mine has reached a regular and stable operating regime. Sampling will take place between September and October, a period when the diversity of benthic invertebrate communities in watercourses is at its highest. Periodic follow-up of benthic invertebrate communities is recommended and will continue as long as the mine effluent remains subject to the requirements of the Metal and Diamond Mining Effluent Regulations (MDMER).

13.2.3.4 Herpetofauna

No monitoring of herpetofauna is currently planned, apart from the monitoring of the mitigation measures presented in Appendix 8-2.

13.2.3.5 Avian fauna

The bird follow-up program aims to identify and document any changes in the environment (whether or not related to the Project) compared to the reference state established between 2023 and 2025. It will also be used to verify the accuracy of the impact assessment and to assess the effectiveness of the mitigation measures outlined in the EIA.

Monitoring frequency

A bird inventory will be conducted during the first year of construction and the first year of operations. Depending on the results obtained during these initial years of monitoring, the program may continue every five years thereafter, until the post-restoration period.

Migratory birds

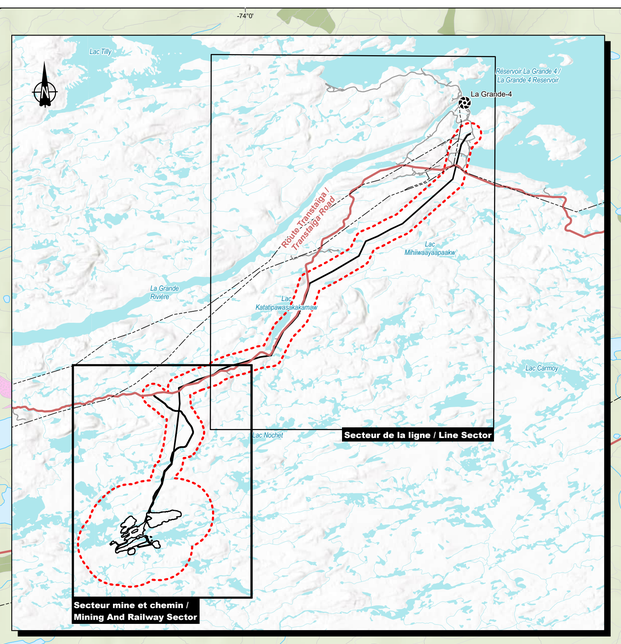
Bird monitoring includes carrying out inventories of migratory birds, particularly forest-dwelling and wetland-associated birds. The methods selected are primarily designed to detect species of special status, but they also serve to identify all species present in the local study area. Daily surveys by point counts.

Sampling plan

The sampling plan was designed to ensure representative coverage of the various habitats frequented by forest and wetland-associated land birds. Habitats found within the biophysical local study area include softwood, mixedwood, hardwood, and regenerating forests; lichen tundra; scrublands; closed and open wetlands; bare ground; boulder fields; and anthropogenic environments. As shown in Map 13-4, 60 daytime listening stations were set up in the biophysical LSA. Table 13-6 lists the listening stations that will be included in this biological monitoring program. To ensure that the data collected is independent, all stations are located at least 300 metres apart. The stations were located within one kilometre or less of the LSA and do not include the northeast sector of the power line, as no surveys were conducted there between 2023 and 2025. Should new surveys be carried out in this sector, additional listening stations could be added to enable comparative monitoring.

The listening stations selected are primarily from inventories conducted between 2023 and 2025. Some stations were relocated or added to better target a diversity of habitats and to cover all areas surrounding the mine infrastructure. In addition to areas targeting diurnal species with special status. (33 stations), additional stations were also included to ensure a balanced representation of the main habitats used by migratory birds in the study area (27 stations). The data collected during the baseline studies will also be used for comparison purposes.

It should be noted that the number and location of listening stations may be revised during the construction and operations phases depending on changes in habitats and available access.



Route Transtaïga / Transtaiga Road

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Zones d'étude / *Study Areas*
- Projet / *Project*
- Biophysique - Locale / *Biophysical - Local*

Infrastructures / *Infrastructure*
- Centrale / *Power plant*
- Ligne de transport d'énergie / *Electric power transmission line*

Réseau routier / *Road Network*
- Route collectrice municipale / *Municipal collector road*

Station d'inventaire / *Inventory Station*

Types d'inventaire / *Inventory Types*
- Engoulevent d'Amérique / *Common nighthawk*
- Hibou des marais / *Short-eared owl*
- Hirondelle de rivage / *Bank swallow*
- Point d'écoute / *Listening station*

Composantes de l'écosystème / *Ecosystem Components*

Milieux humides et hydriques / *Wetlands and Hydrous Environments*
- Marécage arborescent / *Treed swamp*
- Marécage arbustif / *Shrubby swamp*
- Tourbière minérotrophe boisée / *Treed fen*
- Tourbière minérotrophe ouverte / *Open fen*
- Tourbière ombrotrophe boisée / *Treed bog*
- Tourbière ombrotrophe ouverte / *Open bog*
- Marais / *Marsh*
- Eau peu profonde / *Shallow water*
- Plan d'eau / *Waterbody*

Cours d'eau / *Watercourses*
- Intermittent / *Intermitent*
- Permanent / *Permanent*
- Permanent partiellement souterrain / *Partially underground permanent*
- Souterrain / *Underground*

Milieux terrestres / *Terrestrial Environments*
- Feuillu / *Deciduous*
- Mixte / *Mixed-wood*
- Résineux / *Softwood*
- Arbustaie / *Scrubland*
- Lande à lichens / *Lichen tundra*
- Régénération / *Regeneration*

Autres milieux / *Other Environments*
- Anthropique / *Anthropogenic*
- Champ de blocs / *Boulder field*
- Île / *Island*
- Surface dénudée / *Dry barren*

Projet minier Shaakichiuwaanaan / *Shaakichiuwaanaan Mining Project*
Étude d'impact sur l'environnement / *Environmental Impact Assessment*

Carte 13-4a / *Map 13-4a*
Plan d'inventaire de la faune aviaire / *Avian Fauna Inventory Plan*

Sources / Sources
ADIréseau+, réseau routier, MERN, 2016
BDOA, TM, MERN, 2014.
CanVec, 250k,RNCan, 2017

0 190 380 m
UTM, fuseau 18, NAD83 (CSRS)

2026-03-24

Préparation / Prepared by : C. Villeneuve
Dessin / Drawn by : P. Boulay
Approbation / Approved by : É. D'Astous
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Boundary accuracy and measurements shown on this document are not intended for engineering or land delineation purposes. No land analysis has been performed by a land surveyor.

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-73°36'
-73°30'
53°54'
53°48'
53°42'

Réservoir
La Grande 4

Lac Nochet

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Transtaiga Road

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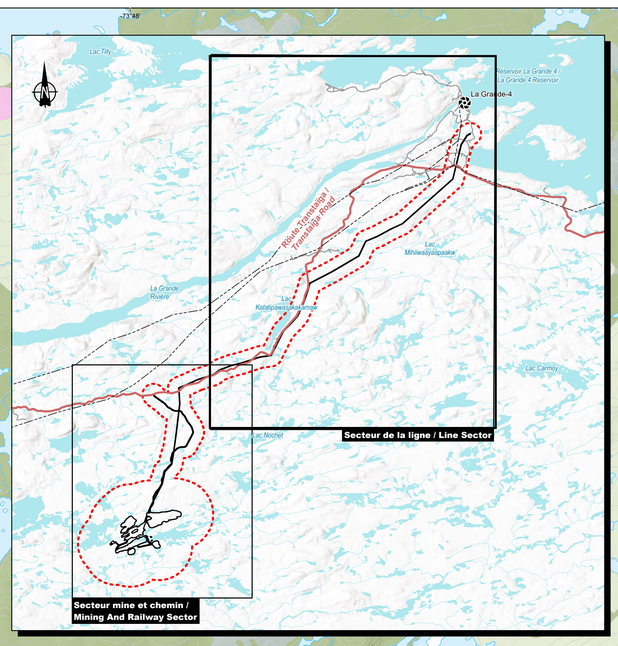

Zones d'étude / *Study Areas*
- Projet / *Project*
- Biophysique - Locale / *Biophysical - Local*

Infrastructures / *Infrastructure*
- Centrale / *Power plant*
- Ligne de transport d'énergie / *Electric power transmission line*

Réseau routier / *Road Network*
- Route collectrice municipale / *Municipal collector road*
- Autre / *Other*

Station d'inventaire / *Inventory Station*

Types d'inventaire / *Inventory Types*
- Hibou des marais / *Short-eared owl*

Composantes de l'écosystème / *Ecosystem Components*

Milieux humides et hydriques / *Wetlands and Hydrous Environments*
- Marécage arborescent / *Treed swamp*
- Marécage arbustif / *Shrubby swamp*
- Tourbière minérotrophe boisée / *Treed fen*
- Tourbière minérotrophe ouverte / *Open fen*
- Tourbière ombrotrophe boisée / *Treed bog*
- Tourbière ombrotrophe ouverte / *Open bog*
- Marais / *Marsh*
- Eau peu profonde / *Shallow water*
- Plan d'eau / *Waterbody*

Cours d'eau / *Watercourses*
- Intermittent / *Intermittent*
- Permanent / *Permanent*
- Permanent souterrain / *Underground permanent*
- Souterrain / *Underground*

Milieux terrestres / *Terrestrial Environments*
- Mixte / *Mixed-wood*
- Résineux / *Softwood*
- Arbustaie / *Scrubland*
- Lande à lichens / *Lichen tundra*
- Régénération / *Regeneration*

Autres milieux / *Other Environments*
- Anthropique / *Anthropogenic*
- Champ de blocs / *Boulder field*
- Île / *Island*
- Ligne de transport d'énergie / *Electric power transmission line*
- Surface dénudée / *Dry barren*

Projet minier Shaakichiuwaanaan /
Shaakichiuwaanaan Mining Project
Étude d'impact sur l'environnement /
Environmental Impact Assessment

Carte 13-4b / *Map 13-4b*
Plan d'inventaire de la faune aviaire / *Avian Fauna Inventory Plan*

Sources / Sources
ADIréseaux, réseau routier, MERN, 2016
BDGA, 1M, MERN, 2014
CanVec, 250k,RNCan, 2017

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UTM, fuseau 18, NAD83 (CSRS)

2026-03-24

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La précision des limites et les mesures montrées sur ce document ne doivent pas servir à des fins d'ingénierie ou de délimitation foncière. Aucune analyse foncière n'a été effectuée par un arpenteur-géomètre. /
Boundary accuracy and measurements shown on this document are not intended for engineering or land delineation purposes. No land analysis has been performed by a land surveyor.

Table 13-6 List of stations where avian fauna are monitored

Type of inventory	Target species	Station	Habitat	Geographic coordinates	
				Latitude	Longitude
Nightawk observation point	Common Nightawk	ENAM-01	Anthropogenic	53,64396	-73,911152
Nightawk observation point	Common Nightawk	ENAM-02	Regenaration	53,638201	-73,897659
Nightawk observation point	Common Nightawk	ENAM-04	Regenaration	53,618424	-73,860826
Nightawk observation point	Common Nightawk	ENAM-04	Regenaration	53,630248	-73,874508
Nightawk observation point	Common Nightawk	ENAM-05	Regenaration	53,598828	-73,883474
Nightawk observation point	Common Nightawk	ENAM-06	Regenaration	53,593076	-73,889444
Nightawk observation point	Common Nightawk	ENAM-07	Regenaration	53,580618	-73,89987
Nightawk observation point	Common Nightawk	ENAM-08	Regenaration	53,549067	-73,916508
Nightawk observation point	Common Nightawk	ENAM-09	Regenaration	53,545496	-73,877239
Nightawk observation point	Common Nightawk	ENAM-10	Regenaration	53,541893	-73,952202
Nightawk observation point	Common Nightawk	ENAM-11	Regenaration	53,51831	-73,977165
Nightawk observation point	Common Nightawk	ENAM-12	Regenaration	53,517642	-73,906973
Nightawk observation point	Common Nightawk	ENAM-13	Regenaration	53,51018	-73,951775
Nightawk observation point	Common Nightawk	ENAM-14	Regenaration	53,561504	-73,913889
Short-eared owl observation point	Short-eared owl	HIMA-01	Shrub swamp	53,757028	-73,625651
Short-eared owl observation point	Short-eared owl	HIMA-02	Regenaration	53,643983	-73,887569
Short-eared owl observation point	Short-eared owl	HIMA-03	Coniferous	53,64084	-73,899726
Short-eared owl observation point	Short-eared owl	HIMA-04	Open ombrotrophic bog	53,504326	-73,959627
Bank swallow observation point	Bank swallow	HIRI-01	Roadside	53,645153	-73,913803
Bank swallow observation point	Bank swallow	HIRI-02	Quarry	53,64099	-73,904506
Bank swallow observation point	Bank swallow	HIRI-03	Quarry	53,636408	-73,895329

Type of inventory	Target species	Station	Habitat	Geographic coordinates	
				Latitude	Longitude
Bank swallow observation point	Bank swallow	HIRI-04	Roadside	53,632848	-73,889538
Bank swallow observation point	Bank swallow	HIRI-05	Roadside	53,632454	-73,877985
Bank swallow observation point	Bank swallow	HIRI-06	Quarry	53,593303	-73,890317
Bank swallow observation point	Bank swallow	HIRI-07	Quarry	53,591306	-73,888465
Bank swallow observation point	Bank swallow	HIRI-08	Quarry	53,580279	-73,900549
Bank swallow observation point	Bank swallow	HIRI-09	Roadside	53,57262	-73,903912
Bank swallow observation point	Bank swallow	HIRI-10	Quarry	53,549263	-73,915052
Bank swallow observation point	Bank swallow	HIRI-11	Quarry	53,527411	-73,934963
Listening point	Rusty Blackbird Lesser yellowlegs	PE-01	Open ombrotrophic bog	53,641052	-73,899067
Listening point	Olive-sided Flycatcher	PE-02	Regenaration	53,638464	-73,897119
Listening point	Rusty Blackbird Lesser Yellowlegs	PE-03	Open ombrotrophic bog	53,629975	-73,87257
Listening point	Migratory birds	PE-04	Regenaration	53,629806	-73,877084
Listening point	Rusty Blackbird Lesser Yellowlegs; Olive-sided Flycatcher	PE-05	Open ombrotrophic bog	53,624361	-73,869866
Listening point	Migratory birds	PE-06	Scrubland	53,62118	-73,868415
Listening point	Olive-sided Flycatcher	PE-07	Open ombrotrophic bog	53,618451	-73,866558
Listening point	Olive-sided Flycatcher	PE-08	Open ombrotrophic bog	53,615756	-73,865475
Listening point	Rusty Blackbird Lesser Yellowlegs	PE-09	Open ombrotrophic bog	53,606954	-73,881171
Listening point	Olive-sided Flycatcher	PE-10	Open ombrotrophic bog	53,604006	-73,880579
Listening point	Migratory birds	PE-11	Coniferous	53,573785	-73,898246
Listening point	Migratory birds	PE-12	Coniferous	53,569338	-73,906171
Listening point	Migratory birds	PE-13	Lichen tundra	53,566963	-73,896946
Listening point	Migratory birds	PE-14	Regenaration	53,565432	-73,924325
Listening point	Migratory birds	PE-15	Coniferous	53,563627	-73,892888
Listening point	Migratory birds	PE-16	Coniferous	53,562842	-73,898017
Listening point	Rusty Blackbird Lesser Yellowlegsr	PE-17	Open ombrotrophic bog	53,562577	-73,924291
Listening point	Migratory birds	PE-18	Regenaration	53,562173	-73,930302
Listening point	Migratory birds	PE-19	Regenaration	53,560095	-73,902261
Listening point	Olive-sided Flycatcher	PE-20	Treed swamp	53,557185	-73,908388

Type of inventory	Target species	Station	Habitat	Geographic coordinates	
				Latitude	Longitude
Listening point	Migratory birds	PE-21	Regenaration	53,557017	-73,913392
Listening point	Rusty Blackbird Lesser Yellowlegsr	PE-22	Marsh	53,553249	-73,911725
Listening point	Migratory birds	PE-23	Regenaration	53,552348	-73,878847
Listening point	Olive-sided Flycatcher	PE-24	Open ombrotrophic bog	53,551818	-73,884441
Listening point	Rusty Blackbird Lesser Yellowlegsr	PE-25	Open ombrotrophic bog	53,550673	-73,905674
Listening point	Olive-sided Flycatcher	PE-26	Coniferous	53,550116	-73,91834
Listening point	Rusty Blackbird Lesser Yellowlegs	PE-27	Open ombrotrophic bog	53,549973	-73,873706
Listening point	Olive-sided Flycatcher	PE-28	Regenaration	53,549729	-73,928197
Listening point	Rusty Blackbird Lesser Yellowlegs	PE-29	Open ombrotrophic bog	53,549226	-73,879571
Listening point	Rusty Blackbird Lesser Yellowlegs	PE-30	Treed swamp	53,548271	-73,923747
Listening point	Rusty Blackbird Lesser Yellowlegs	PE-31	Open ombrotrophic bog	53,546892	-73,90171
Listening point	Migratory birds	PE-32	Coniferous	53,546464	-73,91992
Listening point	Migratory birds	PE-33	Regenaration	53,546002	-73,906207
Listening point	Rusty Blackbird Lesser Yellowlegs	PE-34	Treed swamp	53,545955	-73,875441
Listening point	Rusty Blackbird Lesser Yellowlegs	PE-35	Treed swamp	53,545955	-73,875441
Listening point	Migratory birds	PE-36	Lichen tundra	53,541966	-73,944313
Listening point	Olive-sided Flycatcher	PE-37	Coniferous	53,537171	-73,901505
Listening point	Migratory birds	PE-38	Coniferous	53,536811	-73,932387
Listening point	Olive-sided Flycatcher	PE-39	Coniferous	53,536638	-73,926168
Listening point	Rusty Blackbird Lesser Yellowlegs	PE-40	Treed swamp	53,53487	-73,904527
Listening point	Olive-sided Flycatcher	PE-41	Regenaration	53,530112	-73,96589
Listening point	Migratory birds	PE-42	Open ombrotrophic bog	53,528192	-73,959259
Listening point	Olive-sided Flycatcher	PE-43	Regenaration	53,523318	-73,960999
Listening point	Olive-sided Flycatcher	PE-44	Regenaration	53,520426	-73,953291
Listening point	Migratory birds	PE-45	Coniferous	53,520365	-73,908825
Listening point	Migratory birds	PE-46	Lichen Tundra	53,517829	-73,969218
Listening point	Migratory birds	PE-47	Coniferous	53,515896	-73,906639
Listening point	Migratory birds	PE-48	Regeneration	53,511486	-73,957231
Listening point	Migratory birds	PE-49	Lichen Tundra	53,511446	-73,97491
Listening point	Migratory birds	PE-50	Lichen Tundra	53,511307	-73,969394
Listening point	Rusty Blackbird Lesser Yellowlegsr	PE-51	Open ombrotrophic bog	53,510592	-73,983239

Type of inventory	Target species	Station	Habitat	Geographic coordinates	
				Latitude	Longitude
Listening point	Olive-sided Flycatcher	PE-52	Coniferous	53,510388	-73,907376
Listening point	Migratory birds	PE-53	Regeneration	53,510225	-73,914518
Listening point	Rusty Blackbird Lesser Yellowlegsr	PE-54	Open ombrotrophic bog	53,508995	-73,952762
Listening point	Rusty Blackbird Lesser Yellowlegsr	PE-55	Open ombrotrophic bog	53,508995	-73,952762
Listening point	Migratory birds	PE-56	Lichen Tundra	53,508224	-73,977146
Listening point	Migratory birds	PE-57	Regeneration	53,507513	-73,913265
Listening point	Rusty Blackbird Lesser Yellowlegsr	PE-58	Open ombrotrophic bog	53,506748	-73,908559
Listening point	Olive-sided Flycatcher	PE-59	Regeneration	53,506513	-73,955951
Listening point	Migratory birds	PE-60	Lichen Tundra	53,506293	-73,963266

Follow-up period

For migratory birds, one point count survey is scheduled per follow-up year, between June 11 and July 13. In fact, according to the nesting calendar query tool for the ecoregions covering the study area, the nesting period for most forest-dwelling and wetland-associated land birds falls within these dates (Birds Canada, 2026). This approach will not pose a significant challenge in interpreting the results for early- and late-breeding species, given that the breeding season is relatively short at this latitude.

During the inventories, birds will be recorded for 10 minutes at each station, starting half an hour before sunrise and continuing until approximately 5 hours afterward, on days when weather conditions are optimal—that is, with no rain and little or no wind. The distance between the individuals detected and the observer will also be recorded in three categories: between 0 m and 50 m, between 50 m and 100 m, or more than 100 m. In addition, at the end of each listening period, song playback will be used to increase the probability of detecting the target species.

Methodology

For migratory birds, the daytime survey approach using point counts will be used (Environment Canada, 1997) to obtain quantitative data on the densities of breeding pairs of the target species (Blondel et al., 1981; Bibby et al., 1992; Ralph et al., 1995).

While travelling between stations, sightings of new species, rare species, or at-risk species will also be recorded. Any recorded entries of species of special status will be georeferenced. Special attention will also be paid to bird behaviour to determine their breeding status according to the codes of the Quebec Breeding Bird Atlas (AONQ, 2026).

The data collected will be analyzed to determine the number of indicated pairs per hectare (IP/ha)—a measure of density—for the target species and other species inventoried in their habitat and across the study area, with a view to comparing data across different monitoring years. Abundance (number of IP per listening station) will also be analyzed.

Applicable criteria

Density (number of pairs per hectare) and abundance (total number of pairs) are the quantitative parameters that will be used to assess the extent of changes relative to the reference state. Birds Canada's population trends will also be compared with the results obtained (ECCC, 2025).

Follow-up report

For each station used for the inventory, the following information will be recorded on a field data sheet:

- the number of the point count location;
- the date and time of the visit;
- the name(s) of the observer(s);
- weather conditions;
- any other relevant information.

In addition, for each individual observed, the following information will be recorded:

- the species;
- the number of individuals;
- sex (male, female, or undetermined);
- age group (adult, immature, or juvenile);
- behaviour (singing, flying, calling, etc.);
- the distance(s) from the observer.

The results of these follow-ups will be forwarded to the relevant authorities.

Species of special status

Species of special status that are likely to nest in the biophysical local study area are the focus of this follow-up program.

Six species of special status could be affected by the Project during the nesting season: the common nighthawk (*Chordeiles minor*), the short-eared owl (*Asio flammeus*), the bank swallow (*Riparia riparia*), the olive-sided flycatcher (*Contopus cooperi*), the lesser yellowlegs (*Tringa flavipes*), and the rusty blackbird (*Euphagus carolinus*).

This document also outlines the procedure to follow if bird nests are discovered.

Lastly, it should be noted that if an issue involving a bird species of special status were to arise during the follow-up, corrective measures would be proposed in the follow-up report and could be discussed with the relevant authorities.

Olive-sided flycatcher, rusty blackbird, and lesser yellowlegs

Sampling plan

The sampling plan for the olive-sided flycatcher, the rusty blackbird, and the lesser yellowlegs was developed based on the potential habitats of each species and the records from baseline studies. As shown in Figure 13-4, 60 daytime listening stations were set up in the biophysical LSA. Table 13-6 lists the listening stations that will be included in this biological monitoring program. To ensure that the data collected is independent, all stations are located at least 300 metres apart. The stations were located within one kilometre or less of the ZEP and do not include the northeast sector of the power line, as no surveys were conducted there between 2023 and 2025. Should new surveys be conducted in this sector, additional listening stations could be added to enable comparative monitoring.

The listening stations selected are primarily from inventories conducted between 2023 and 2025. Some stations were relocated or added to better target habitats of species with special status and to ensure coverage of all areas surrounding the mine infrastructure. In addition to stations targeting a variety of habitats for migratory birds (27 stations), areas where diurnal species of special concern were detected during the nesting season, as well as stations located within their potential habitat, were included (33 stations). The data collected during the baseline studies will also be used for comparison purposes.

It should be noted that the number and location of listening stations may be revised during the construction and operations phases depending on changes in habitats and available access.

Follow-up period

As with the monitoring of migratory birds, only one inventory per listening site is scheduled per monitoring year, between June 11 and July 13. Thus, the inventory period covers the entire nesting season of the species of special concern included in the follow-up program, including the olive-sided flycatcher, the rusty blackbird, and the lesser yellowlegs.

Methodology

For migratory birds, the daytime survey approach using point counts will be used (Environment Canada, 1997) to obtain quantitative data on the densities of breeding pairs of the target species (Blondel et al., 1981; Bibby et al., 1992; Ralph et al., 1995).

While travelling between stations, sightings of new species, rare species, or at-risk species will also be recorded. Any recorded entries of species of special status will be georeferenced. Special attention will also be paid to bird behaviour to determine their breeding status according to the codes of the Quebec Breeding Bird Atlas (AONQ, 2026).

The data collected will be analyzed to determine the number of indicated pairs per hectare (IP/ha)—a measure of density—for the target species and other species inventoried in their habitat and across the study area, with a view to comparing data across different monitoring years. Abundance (number of IPs per listening station) will also be analyzed.

Applicable criteria

Density (number of pairs per hectare) and abundance (total number of pairs) of the target species are the quantitative parameters that will be used to assess the extent of change relative to the reference state. Birds Canada's population trends will also be compared with the results obtained (ECCC, 2025).

Follow-up report

For each station used for the inventory, the following information will be recorded on a field data sheet:

- the number of the point count location;
- the date and time of the visit;
- the name(s) of the observer(s);
- weather conditions;
- any other relevant information.

In addition, for each individual observed, the following information will be recorded:

- the species;
- the number of individuals;
- sex (male, female, or undetermined);
- age group (adult, immature, or juvenile);
- behaviour (singing, flying, calling, etc.);
- the distance(s) from the observer.

The results of these follow-ups will be forwarded to the relevant authorities.

Common nighthawk

Sampling plan

The sampling plan was designed so that the inventory stations cover habitats potentially used by this species. The stations inventoried as part of the 2024 and 2025 baseline studies have been prioritized. These stations are located primarily along access roads, near open areas. As shown in Map 13-4, 14 twilight listening stations were set up in the biophysical LSA. Table 13-6 lists the listening stations that will be included in this biological monitoring program.

It should be noted that the number and location of listening stations may be adjusted during the construction and operations phases depending on changes in habitats and available access, particularly if new open habitats are created following clearing.

Monitoring period

In accordance with the Birds Canada protocol (2025), nighttime surveys will be conducted between June 15 and July 15 to monitor the common nighthawk. The point counts, each lasting six minutes per station, will begin no earlier than 30 minutes before sunset and will end at nightfall. The ideal inventory conditions are fair weather, little or no wind, and clear skies. It should be noted that, since inventories are conducted during daylight hours—that is, between 30 minutes before sunset and nightfall—they do not need to be conducted on a night when there is a full moon.

Methodology

Nighttime surveys will be conducted at listening stations in accordance with the Birds Canada protocol (2025) and its subsequent revisions. Inventories will thus be conducted in the species' potential habitat located on the periphery of the mine, as well as near infrastructure where the species might nest or forage.

Applicable criteria and quality control

The abundance of common nighthawk, estimated by the number of pairs, is the quantitative parameter that will be used to assess the extent of changes relative to the reference state. Bird population trends in Canada will also be compared with the results obtained (ECCC, 2025).

Monitoring report

Each observation will be recorded on a field data sheet containing the following information:

- the name(s) of the observer(s);
- the date and time of the site visit;
- the number of the observation point.

If one or more individuals were heard, these details will be listed:

- the species name;
- the number of individuals heard;
- the age group of the individuals (adult, immature, or juvenile);
- the time of listening;
- weather conditions;
- the type of detection (wingbeat, call, sighting, or undetected);
- any other relevant information.

The results of these follow-ups will be forwarded to the relevant authorities.

Short-eared owl

Sampling plan

The sampling plan was designed so that the inventory stations cover habitats potentially used by this species. As shown in Map 13-4, 4 observation stations were set up in the biophysical LSA. These stations are located primarily along access roads, near open areas. Table 13-6 lists the listening stations that will be included in this biological monitoring program.

It should be noted that the number and location of stations may be adjusted during the construction and operations phases depending on changes in habitats and available access points, particularly to ensure safe movement at night.

Monitoring period

Inventories are carried out on evenings when there is no rain or fog, and winds are light (≤ 20 km/h or ≤ 3 on the Beaufort scale). They range from 10 minutes to 100 minutes before civil twilight.

During inventory years, two field surveys are conducted in the summer: the first between May 1 and 25, followed by the second between June 5 and 30. If there is still snow on the ground, the first visit may be postponed until the ground is sufficiently clear. The second visit must take place at least 10 days after the first.

Methodology

The inventory method used for this species is based on the protocol developed by the Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs (MELCCFP, 2025d).

Applicable criteria and quality control

The abundance of long-eared owl, estimated by the number of pairs, is the quantitative parameter that will be used to assess the extent of changes relative to the reference state. Bird population trends in Canada will also be compared with the results obtained (ECCC, 2025).

Follow-up report

The location of each short-eared owl (or any other bird of prey) heard or seen is marked on a map and recorded in the field data sheet, which will include the following information:

- the name(s) of the observer(s);
- the date and time of the visit;
- the number of the observation point;
- the weather conditions.

If one or more individuals are observed, the following details are recorded:

- species name;
- number of individuals observed;
- age group of the individuals (adult, immature, or juvenile);

- time of observation;
- behaviour (resting, hunting, intraspecific or interspecific aggression, courtship, copulation, and food transport);
- any other relevant information.

The results of these follow-ups will be forwarded to the relevant authorities.

Bank swallow

Sampling plan

The sampling plan was designed so that the inventory stations cover habitats potentially used by this species. As shown on Map 13-4, 11 observation stations have been set up in the biophysical LSA. These stations are specifically located in the species' potential habitats, near sites where individuals have been observed in the past. Table 13-6 lists the listening stations that will be included in this biological monitoring program.

It should be noted that the number and location of stations may be adjusted during the operations phase depending on changes in habitats and available access, particularly if new sites containing aggregates emerge during the construction and operations phases.

Follow-up period

Each year of the follow-up, a site visit will be conducted at the stations during the species' nesting season and the migratory bird inventory period, specifically from June 11 to July 13.

In addition, on-site staff will conduct bimonthly surveys of this species each year of operations, from late April through mid-August, at all designated quarries used for material extraction from the site and at existing colonies in the wild. Any chance sightings of nesting signs will also be recorded.

Methodology

The bank swallow typically nests on embankment walls with a gradient greater than 70° (Government of Canada, 2022b). This species is therefore likely to use the borrow pits in the LSA during the nesting season. Precautions are therefore being taken to reduce the likelihood of the bank swallow nesting in the project's borrow pits. These precautions are described in the mitigation measures in Appendix 8-2.

Surveys are conducted using observation points (visual counts) to tally the number of nests and birds at various sites. Inventories and site visits are carried out by a qualified professional.

Applicable criteria

For bank swallows, the number of colonies, cavities, active nests, and individuals observed are the quantitative parameters that will be used to assess the extent of changes relative to the reference state. Bird population trends in Canada will also be compared with the results obtained (ECCC, 2025).

Follow-up report

For each station included in the inventory, the following information will be recorded on a field data sheet:

- the number of the observation point (borrow pit visited);
- the date and time of the visit;
- the name(s) of the observer(s);
- the weather conditions.

In addition, should the borrow pit be used by a colony of bank swallows, the following data will be recorded:

- the number of cavities observed;
- the condition of the cavities (e.g., destroyed cavity);
- the number of individuals observed;
- the behaviour of individuals (restlessness, flying, feeding, bringing food to the nests, etc.);
- the age group of the individuals (adult, immature, or juvenile);
- the time of observation;
- any other relevant information.

The results of these follow-ups will be forwarded to the relevant authorities.

Procedure to follow if nests are discovered

If a bird's nest is discovered during the **construction** phase, the proposed procedure consists of the following five steps:

- Step 1: Registering a nest;
- Step 2: Establishment of the protection zone;
- Step 3: Marking out the protection zone;
- Step 4: Monitoring of nests and construction work carried out in the vicinity;
- Step 5: Monitoring report.

Step 1: Registering a nest

When a nest is located, the species, location (GPS coordinates), habitat, and stage of development of the nest are recorded. Clearing and construction activities will then be reassessed to determine whether the work can be relocated, delayed, or modified so as not to impact the birds, their eggs, or the nest.

Step 2: Establishment of the protection zone

If activities cannot be relocated, postponed, or modified in a way that avoids impacting the birds, eggs, or nest, an appropriate protection zone (buffer zone) will be established and enforced on-site to protect the nest location. The boundaries of this protection zone will be determined by a qualified person, based on the species and habitat, as well as the type, intensity, and duration of the disturbance. The guidelines established by the Government of Canada (2023) to minimize disturbances to migratory birds will be followed.

Examples of protection zones are shown in Table 13-7. These distances are provided for reference only and will be adjusted based on various factors, such as the birds' prior exposure to disturbances, the intensity of the disturbance, and the type of habitat.

Table 13-7 Recommended buffer zones around bird nests

Species	Protection zone (m)
Sandhill crane	100 m to 1,000 m
Birds of prey – active	1,000 m
Birds of prey – inactive	50 m to 1,000 m (depending on the level of disturbance)
Species of special status	Up to 100 m
Water birds and shorebirds	Up to 100 m
Waterfowl	10 m to 30 m, up to 50 m
Colony of swallows	10 m to 25 m, up to 50 m
Most passerine birds and other small birds	1 m to 5 m up to 10 m to 50 m

Note: 1 Shorter distances are often associated with urban or industrial environments, whereas longer distances are associated with urban areas.

Step 3: Marking out the protection zone

The buffer zone will be established using painted survey stakes, flagging tape, or other marking materials to clearly delineate its boundaries. The nest itself will not be identified or marked to minimize the risk of predation.

The nest's coordinates will be included on the marking, along with its direction. Once the buffer zone has been established, a qualified person will regularly monitor the nest from a distance to detect any signs of disturbance. If necessary, work will be suspended immediately, and the buffer zone will be reassessed. In addition, the work in question will be reassessed to reduce the level of disturbance, and, if necessary, it may be postponed until the chicks have left the nest.

Step 4: Monitoring of nests and construction work carried out in the vicinity

None of the buffer zones established may be cleared or developed until a qualified person has confirmed that the birds have left the nest and the surrounding area (fledglings). All of this will be determined based on the stage of development observed during the initial survey and on estimates derived from the species' life cycle (incubation period and fledging time), as well as on field observations. It should be noted that it is prohibited to damage, destroy, remove, or disturb the nests of migratory birds when they contain a live bird or a viable egg (Government of Canada, 2022b).

If a nest is located near a path or road, vehicles may proceed with caution. However, they will not be allowed to stop in the recommended buffer zone. Places where stopping is prohibited will be clearly marked.

Step 5: Monitoring report

The presence of nests belonging to migratory birds and species at risk, as well as the measures taken to ensure their protection, will be documented in an environmental monitoring report.

Annual report

An annual report summarizing the results of the observations conducted will be prepared and submitted at the end of each completed monitoring year. Among other things, the report will address the following:

- The accuracy of the environmental assessment, including an evaluation of the effectiveness of the mitigation measures implemented by PMET to address the project's adverse environmental impacts on migratory and/or at-risk bird species, including their nests and eggs.
- The extent of environmental changes relative to the baseline conditions established in the EIA that require the implementation of modified or additional mitigation measures.
- According to the results obtained during the year-long bird monitoring study, the assessment—namely, whether the technically and economically feasible mitigation measures that PMET will implement to reduce impact levels to below the target levels—shows that the impact levels have been met or exceeded.
- The status of specific, measurable milestones that must be achieved by the end of the follow-up program, while putting the findings into perspective with regard to the accuracy of the environmental assessment and/or the effectiveness of the mitigation measures.
- Reviewing follow-up and monitoring programs and, if necessary, updating them to ensure that the objectives pursued are aligned with the nature of the results obtained.

13.2.3.6 Mammals – Large wildlife

Due to their large size and weight, certain species of large wildlife are particularly vulnerable to road collisions, which can have serious consequences both for the animals involved (e.g., severe injuries, mortality, loss of offspring) and for the safety of road users. For this reason, PMET will establish and maintain a specific register of all wildlife-vehicle collisions occurring within the project site boundaries and along the access road.

In particular, all incidents involving the following species will be recorded: woodland or migratory caribou (*Rangifer tarandus caribou*), moose (*Alces alces*), black bear (*Ursus americanus*), and grey wolf (*Canis lupus*). All injured animals will be reported to the appropriate authorities without delay. The register shall include, at a minimum, the following information:

- the species involved;
- the number of animals involved;
- the date and time of the incident;
- the exact location where the collision occurred;
- the condition of the animal (or animals) after the incident (i.e., immobilized or still moving).

PMET will maintain a second register compiling sightings of the same species (i.e., woodland caribou, moose, black bear, and grey wolf) within the boundaries of the mine site (including borrow pits). The following data will be recorded in the register:

- the species observed;
- the number of animals observed;
- the date of observation;
- the exact location where the animal was observed.

The information compiled in these registers will be used to assess potential issues and, if necessary, develop appropriate corrective measures. By incorporating this data, PMET will be able to implement appropriate protection strategies, particularly during critical periods or in areas where animals are most active. Such measures will promote better coexistence with wildlife by reducing the impact of project activities on animal populations, while improving safety for workers and road users.

Woodland and migratory caribou

PMET will document the presence of caribou, specifically the population in the West James Bay sector (woodland) and the Leaf River herd (LRH) (migratory), recorded within the project's biophysical RSA. PMET wishes to enter into a partnership agreement with MELCCFP to fit and use telemetry collars on woodland caribou that may be found in the biophysical RSA. This will provide the data needed to conduct geospatial analysis and improve our understanding of the migration patterns of these populations, while offering real-time visualization of how woodland caribou use the land during the follow-up period agreed upon with the MELCCFP. At the end of the follow-up period, a report will be prepared and submitted to the MELCCFP on a confidential basis. Given the sensitive nature of the data collected, it will not be made public.

Black bear

The black bear is a species found within the project's biophysical LSA, with individual bears and signs of their presence frequently observed. The presence of bears near mining operations is not necessarily a problem, especially if these animals feed on natural organic matter found in the surrounding environment. However, anthropogenic food products can attract black bears. That is why they must remain out of reach of wild animals at all times, especially black bears.

To achieve this, PMET has implemented a waste management system in accordance with the 3R-RD principles, which includes:

- a fully fenced sorting centre (with underground fencing and a motorized gate);
- a composter located at the sorting centre;
- trash containers equipped with bear-proof lids;
- a changing daily schedule for collection of trash from the containers.

This waste management system will remain in place throughout the mine's construction and operations phases. These measures will, in particular, reduce the risk of black bears becoming accustomed to human presence. Despite this, bears may be attracted by the odours given off by trash—even if it is out of reach—as well as by odours coming from kitchens or any other place where food is stored.

Bears attracted by food sources may thus venture close to buildings or attempt to enter them, which could pose a public safety risk. In situations where PMET determines that the presence of a bear poses a risk to worker safety, the local wildlife protection office of the Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs (MELCCFP) will be notified immediately so that a qualified person can assess the situation and determine the appropriate measures to be taken. If the competent authorities decide to euthanize the animal and if this procedure can be performed safely, a tallyman may be called upon to assist, thereby ensuring that the edible meat is utilized.

In addition, workers will be provided with educational materials aimed at preventing the feeding of wild animals, whether intentional or resulting from the presence of food waste accessible to wildlife. This measure is intended to promote safe coexistence with black bears and to limit the negative impacts of human activities on the bear populations in the project area.

13.2.3.7 Mammals – Chiropterans

The bat monitoring program described in this section is intended to limit disturbances that could harm bats and, to the extent possible given the very low levels of activity recorded during the surveys, to investigate any potential effects of light and noise on their activities during the various phases of the project.

This biological monitoring program covers all bat species found at the site. With regard to resident species, which overwinter in the province, acoustic surveys conducted from 2023 to 2025 confirmed the presence, within the project's biophysical LSA, of two species and one species complex: the big brown bat (*Eptesicus fuscus*), the northern long-eared bat (*Myotis septentrionalis*), and the *Myotis* complex, which, at this latitude, includes the northern long-eared bat and the little brown bat (*Myotis lucifugus*), although the latter was not specifically identified. The little brown bat and the northern long-eared bat are considered threatened in Quebec (Gouvernement du Québec, 2025) and endangered in Canada (Government of Canada, 2025). These surveys also revealed the presence of three migratory bat species: the silver-haired bat (*Lasionycteris noctivagans*), the red bat (*Lasiurus borealis*), and the hoary bat (*Lasiurus cinereus*). These migratory species are included in the List of vulnerable wildlife species (red bat) or species which are likely to be designated as threatened or vulnerable (silver-haired and hoary bats) in Quebec (Gouvernement du Québec, 2025). Furthermore, these three species are considered endangered in Canada by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC, 2023), although they have not yet been listed in Schedule 1 of the *Species at Risk Act* (SARA; Government of Canada, 2025).

Monitoring of potential maternity roosts

The surveys conducted identified several potential maternity roost sites (rock outcrops or rocky structures) within the study area. However, this study was limited to certain areas, largely due to the limited accessibility of the study area, and bats are known to frequently change roost sites, even during a given breeding season (ECCC, 2018). Consequently, monitoring will focus on this type of habitat more generally when it is located in the immediate vicinity of project activities. It will also examine potential anthropogenic maternity roosts that might be provided by the mine's various facilities.

Throughout the various phases of the project, special attention will be paid to signs of bat presence in both anthropogenic and natural structures located in the immediate vicinity of project activities. These signs may include noises (scratching or vocalizations), the presence of guano (droppings similar to those of mice, but longer, tapered, and segmented) on surfaces or on the ground, or the smell of damp earth ("old damp cellar") (MELCCFP, 2023d). These signs of presence will be monitored during the bat breeding season, which, at this latitude, runs from June 15 to August 14 (MELCCFP, 2023).

With regard to potential sites of anthropogenic origin, this opportunistic monitoring will focus on buildings or other structures that may provide potential entry points for bats. These may include hollow spaces in exterior siding, poorly aligned metal panels, or ventilation openings without grills, all of which could provide access to potential empty spaces within the building structure. As for natural structures, attention will be focused on snags or hollow trees with a fairly large diameter at breast height (DBH) (30 cm or more), as well as on south-facing rock formations, which could be used by bats (Tremblay and Jutras, 2010).

If such habitats are identified—in the immediate vicinity of planned construction projects liable to cause their disappearance (clearing of trees or dismantling of anthropogenic structures) or to impair their quality (particularly through noise or vibrations)—a biologist or wildlife technician will conduct a survey to look for signs of bats. If the presence of a maternity roost—that is, a group of female bats that gather to give birth and raise their young—is suspected, the MELCCFP will be notified immediately.

Procedure to follow if an occupied maternity roost is discovered

Step 1: Establishment of a buffer zone

If a maternity roost or shelter occupied by bats is identified during the breeding season (June 15 to August 14 at this latitude), and if activities cannot be relocated, delayed, or modified in a way that does not affect this maternity roost or resting site, a protection zone with a radius of 100 m (buffer zone) will be established to ensure its protection throughout the breeding season.

Where appropriate, particularly for certain activities that generate significant noise pollution (such as blasting), the establishment of a buffer zone could be replaced by the installation of a noise barrier (vertically mounted sound-insulating panels).

Step 2: Marking out the protection zone

The protection zone will be marked using painted survey stakes, flagging tape, or any other marking materials. The maternity roost itself will not be marked, and no markers will be placed in its immediate vicinity to minimize the risk of predation. The site's coordinates will be marked on the marker, along with the direction and distance from the site.

Step 3: Monitoring of the maternity roost and construction work being carried out nearby

Once the protection zone has been established, a qualified person will closely monitor the site for any signs of disturbance, such as bats emerging from the maternity roost or flying around it during the day. If such observations are made, construction activities must cease immediately, and the protection zone must be reassessed. The activity in question will then be postponed until the end of the bat breeding season (August 15) or until the young bats have left the site.

No designated protection zone may be cleared of trees or developed before the end of the bat breeding season (August 15), or until a biologist or wildlife technician has confirmed that the young bats have left the site following a routine check of bat activity (visual and acoustic).

If a maternity roost is located near a path or road, vehicles may drive through with caution. However, they will not be allowed to stop in the recommended buffer zone. Places where stopping is prohibited will be clearly marked.

Step 4: Monitoring report

PMET will use monitoring reports to document the possible presence of bat maternity roosts, as well as the measures taken to ensure their protection. The monitoring reports will be included in the annual environmental report on PMET's operations.

Monitoring of bat activity

During the construction and operations phases, bat activity will be monitored in the vicinity of the mine site's facilities. This monitoring program is designed to assess any indirect habitat loss that may be associated with disturbances to bats, particularly those caused by ambient noise and nighttime lighting.

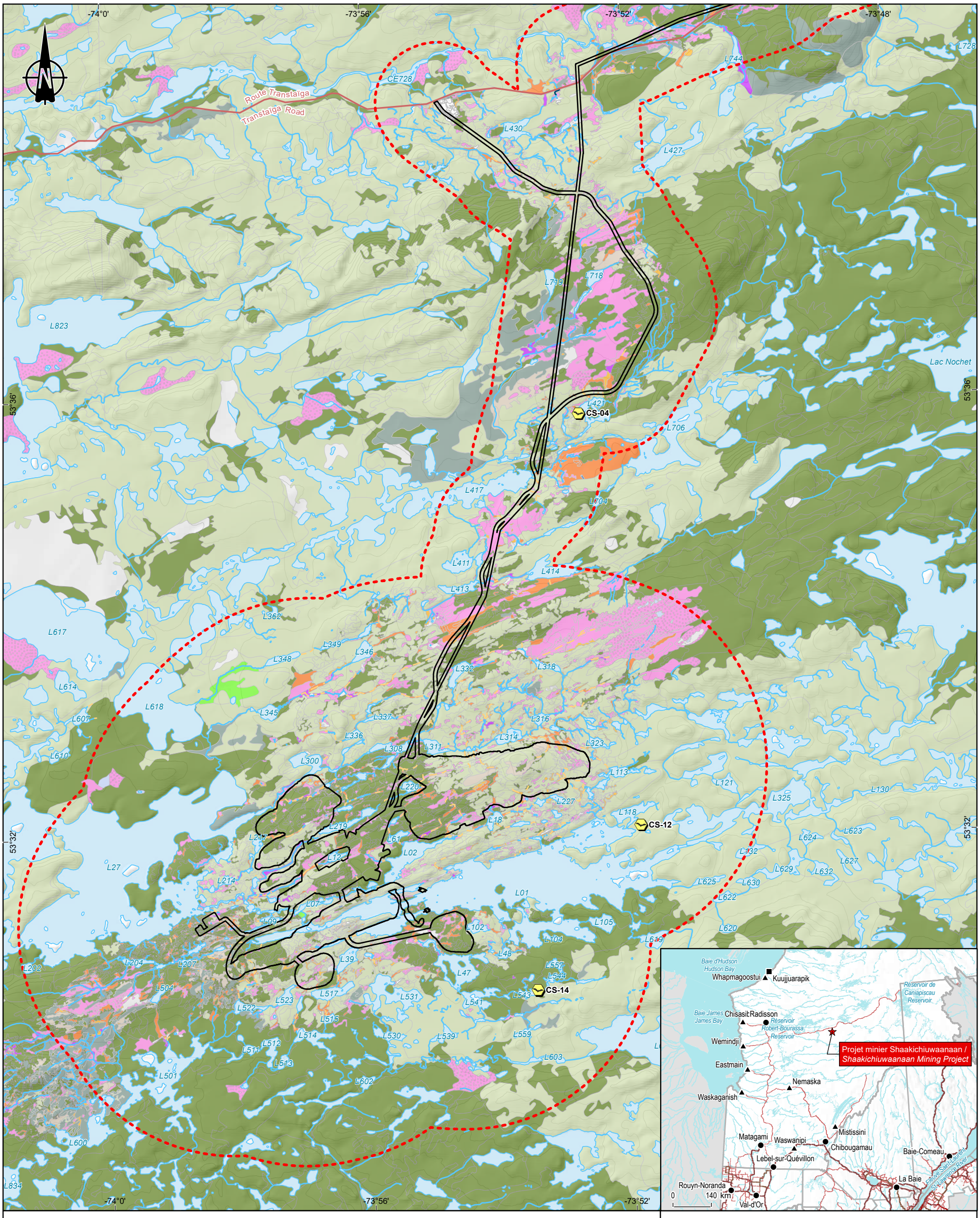
Sampling plan

For this follow-up, some of the monitoring stations used during the 2023, 2024, and 2025 surveys will be re-established to cover different noise levels, based on the noise modelling carried out during the impact assessment, as the highest levels could potentially disturb the bats. Given the project's northern location, the relatively limited diversity of habitats, and the very low levels of activity observed during bat inventories, three monitoring stations should in principle be sufficient for this program. Thus, the CS-04, CS-12, and CS-14 stations used for the 2023–2025 inventories will be retained for monitoring, covering anticipated noise levels ranging from 30 dB to 50 dB(A). Map 13-5 shows the locations of the sampling stations.

Sampling method

At each sampling station, bat activity will be measured using ultrasonic detectors (SM4 Wildlife Acoustics), as in acoustic surveys. These will be paired with two other automated measuring devices, enabling the simultaneous recording of bat activity and changes in noise levels and nighttime light levels (intrusive light). These parameters are, in fact, the main components that could disturb bats.

Lastly, for each sampling station, the habitat will be briefly described (main species, canopy height, etc.).



Zones d'étude / *Study Areas*

- Projet / *Project*
- Biophysique - Locale / *Biophysical - Local*

Réseau routier / *Road Network*

- Route collectrice municipale / *Municipal collector road*

Chiroptères / *Chiroptera*

- Station acoustique / *Acoustic station*

Composantes de l'écosystème / *Ecosystem Components*

Milieux humides et hydriques / *Wetlands and Hydrous Environments*

- Marécage arborescent / *Treed swamp*
- Marécage arbustif / *Shrubby swamp*
- Tourbière minérotrophe boisée / *Treed fen*
- Tourbière ombrotrophe boisée / *Treed bog*
- Tourbière ombrotrophe ouverte / *Open bog*
- Marais / *Marsh*
- Eau peu profonde / *Shallow water*
- Plan d'eau / *Waterbody*

Cours d'eau / *Watercourses*

- Intermittent / *Intermitent*
- Permanent / *Permanent*
- Permanent partiellement souterrain / *Partially underground permanent*
- Souterrain / *Underground*

Milieux terrestres / *Terrestrial Environments*

- Feuillu / *Deciduous*
- Mixte / *Mixed-wood*
- Résineux / *Softwood*
- Arbustaie / *Scrubland*
- Lande à lichens / *Lichen tundra*
- Régénération / *Regeneration*

Autres milieux / *Other Environments*

- Autre milieu / *Other environments*

Projet minier Shaakichiuwaanaan / *Shaakichiuwaanaan Mining Project*

Étude d'impact sur l'environnement / *Environmental Impact Assessment*

Carte 13-5 / *Map 13-5*
Stations de suivi des chiroptères / Location of Chiroptera Monitoring Stations

Sources / Sources

AQréseau+, réseau routier, MERN, 2016
BDGA, 1M, MERN, 2014
CanVec, 250k,RNCan, 2017

0 650 1 300 m

UTM, fuseau 18, NAD83 (CSRS)

2026-03-25

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La précision des limites et les mesures montrées sur ce document ne doivent pas servir à des fins d'ingénierie ou de délimitation foncière. Aucune analyse foncière n'a été effectuée par un arpenteur-géomètre. / Boundary accuracy and measurements shown on this document are not intended for engineering or land delineation purposes. No land analysis has been performed by a land surveyor.

Frequency and duration of follow-up

Each year of the follow-up, the nocturnal activity of bats will be continuously monitored during the breeding season, from June 15 to August 14. Given the very low levels of activity observed during the bat surveys carried out between 2023 and 2025, all surveyed nights will be included in the analysis, regardless of weather conditions, so as to limit the risk of losing observations collected on nights when conditions are less favourable. Ambient noise and nighttime light levels will be monitored simultaneously during the same period (June 15 to August 14), with measurements taken during nighttime hours at intervals to be determined later based on the equipment used.

The activity levels recorded for bats can thus be analyzed in conjunction with the noise and nighttime light measurements taken simultaneously during bat breeding season.

This follow-up will initially cover the construction phase and the first year of the operations phase. Depending on the results obtained during these initial years of monitoring, the program may continue every five years thereafter.

Applicable criteria

The data collected during the monitoring should help confirm the continued presence of bats in the monitored habitats and, if necessary, assess the actual effects of the project on bat activity. Bat activity at monitoring stations will also be compared with the overall activity levels recorded during acoustic surveys conducted from 2023 to 2025; however, any differences observed should be interpreted with caution, as surveys conducted during the breeding seasons of 2024 and 2025 revealed significant year-to-year variations.

Follow-up report

For each follow-up year, a detailed report presenting the results will be produced. This report will correlate bat activity (number of sightings per night) with the noise and light levels recorded at each station. The report will also highlight changes in bat activity and in noise and light levels recorded at the site over the years of follow-up, comparing the results with the reference state or with data from previous years of follow-up.

13.2.3.8 Mammals – Other species

No monitoring is currently planned for other mammal species, apart from the monitoring of mitigation measures presented in Appendix 8-2.

13.2.3.9 Wildlife and plant species of special status

The various species of special status present or potentially present in the project's local study area, as well as the components to which they relate in the preceding sections, are presented in Table 13-7. The "Reference" column in the follow-up program refers to the sections of this document where information related to this species can be found.

Table 13-8 Species of special status that are present or potentially present in the local study area

French name	Scientific name	Status		Confirmed presence in the local study area (Yes/No)	Reference in the follow-up program
		Quebec[1]	Canada[2]		
Flora					
Brown-edged pussytoes	*Antennaria rosea subsp. confinis*	LDTV	–	No	Vegetation and wetlands (Section 13.2.3.1)
Modest aster	*Canadanthus modestus*	LDTV	–	No	
Spatulate moonwort	*Botrychium spathulatum*	LDTV	–	No	
Botrychium ascendens	*Botrychium ascendens*	LDTV	–	No	
Ojibway waterwort	*Elatine ojibwayensis*	LDTV	–	No	
Rocky Mountain willowherb	*Epilobium saximontanum*	LDTV	–	No	
Limestone swamp bedstraw	*Galium brevipes*	LDTV	–	No	
Nahanni oak fern	*Gymnocarpium continentale*	LDTV	–	No	
Purple meadow-rue	*Thalictrum dasycarpum*	LDTV	–	No	
McCall willow	*Salix maccalliana*	LDTV	–	No	
Ichthyofauna					
Yellow sturgeon	*Acipenser fulvescens*	SDMV	P	No	Ichthyofauna (Section 13.2.3.2)
Avian fauna					
Golden eagle	*Aquila chrysaetos*	V	NAR	Yes	Avian fauna (Section 13.2.3.5)
Harlequin duck	*Histrionicus histrionicus*	V	SC	No	
Short-billed dowitcher	*Limnodromus griseus*	-	TH	No	
Common nighthawk	*Chordeiles minor*	LDTV	SC	Yes	
Peregrine falcon	*Falco peregrinus*	LDTV	NAR	Yes	
Evening grosbeak	Coccothraustes vespertinus	–	SC	Yes	
Short-eared owl	*Asio flammeus*	LDTV	SC (COSEWIC: TH)	Yes	
Bank swallow	*Riparia riparia*	–	TH	Yes	

French name	Scientific name	Status		Confirmed presence in the local study area (Yes/No)	Reference in the follow-up program
		Quebec[1]	Canada[2]		
Olive-sided flycatcher	*Contopus cooperi*	V	SC	Yes	
Lesser yellowlegs	*Tringa flavipes*	–	TH	Yes	
Bald eagle	*Haliaeetus leucocephalus*	V	NAR	Yes	
Rusty blackbird	*Euphagus carolinus*	LDTV	SC	Yes	
Mammals					
Woodland caribou (forest)	*Rangifer tarandus caribou*	V	TH	Yes	Large wildlife (Section 13.2.3.6)
Little brown bat	*Myotis lucifugus*	TH	ES	Yes	Chiropterans (Section 13.2.3.7)
Northern long-eared bat	*Myotis septentrionalis*	TH	ES	Yes	
Silver-haired bat	*Lasionycteris noctivagans*	LDTV	– (COSEWIC: ES)	Yes	
Hoary bat	*Lasiurus cinereus*	LDTV	– (COSEWIC: ES)	Yes	
Red bat (eastern)	*Lasiurus borealis*	V	– (COSEWIC: ES)	Yes	
Southern bog lemming	*Synaptomys cooperi*	LDTV	-	Yes	
Rock vole	*Microtus chrotorrhinus*	LDTV	-	No	

Note: Species potentially present in the local study area were identified through a literature review as part of the of the present environmental impactassessment conducted in 2025–26. This documentary research consisted of conducting a literature review and consulting geospatial databases within a 50 km radius of the mine site's centroid.

1: Species status in Quebec (July 2025): LDTV: Likely to be designated as threatened or vulnerable; V: Vulnerable; TH: Threatened.

2: Species status in Canada (SARA) (July 2025): SC: Special concern; Th Threatened; ES: Endangered species; NAR: Not at risk.

13.2.4 Social environment

13.2.4.1 Cree communities, localities, and municipalities, and the regional economy

Socioeconomic conditions

In collaboration with the affected Cree communities, PMET will ensure a follow-up of the available annual statistics regarding employment and income for Cree workers employed at the mine site and those within these communities. The goal will be, on the one hand, to determine whether there is a correlation between the statistics for the small group working at the mine and those for the community. If there are discrepancies in the statistical data, measures will be developed in collaboration with representatives from these communities to promote hiring and, if necessary, review the associated incomes.

Community well-being and human health

Grievance mechanism

PMET will develop a grievance mechanism for handling complaints directly related to PMET operations, comments, and concerns to ensure the well-being of Cree community, Chisasibi community and the Jamésiens representatives who may be affected by the project. This mechanism will be designed to ensure formal and transparent management of feedback from land users. They will be able to submit their complaints, concerns, or comments through various channels, including electronically or by contacting staff directly at the Shaakichiuwaanaan site (by phone, email, or in person). When a complaint or comment is registered in the mechanism, the relevant parties will be notified. A resolution process involving the review of the complaint or comment and the preparation of an appropriate response will then be initiated. Each case will be tracked and documented to ensure transparency and efficient handling.

The user who has made a complaint or comment will be kept informed throughout the process about the measures taken and the resolutions reached. The mechanism will become operational at the start of the mining project's construction phase and will continue through the end of the restoration phase. This continuity will ensure that stakeholder feedback is always appropriately considered and handled throughout the project life cycle.

Current use of land resources and resources for traditional purposes

Fish flesh

Fish populations will be monitored every three years as part of the EEM program, continuing until after the mine closes. The purpose of this study is to determine whether mine effluent has an impact on the fish population. The water bodies studied will be those identified by ECCC, which currently include Lake L823 (a non-exposed water body) and Lake L27 (an exposed water body) (Map 13-2). The sentinel species selected for the project will be the northern pike and another species proposed when the study plan is submitted to ECCC. The follow-up will determine whether there are differences in growth, reproduction, survival, and the condition of the populations exposed to mine effluent, and will monitor mercury concentrations in fish tissues, if necessary (an indicator of the fish's potential for consumption).

A study on metals in fish flesh will be conducted only if the REMMMD thresholds are exceeded. As part of the monitoring of fish flesh contamination, only one species (the northern pike) will be tested. Fish flesh (muscle) will be tested for mercury and scanned for other metals.

Plants valued by the Cree

Monitoring the plants traditionally valued by Cree land users will help assess the metal content in the parts of the plants that are consumed. The purpose of this follow-up is to identify and document any changes in the environment compared to the baseline levels established in 2025, and assess if these changes could be related to the project development. This follow-up will also be used to verify the accuracy of the predictions included in the impact assessment and to assess the effectiveness of the project's mitigation measures.

Sampling plan

Samples taken in identified areas that are considered both exposed or not exposed to potential impacts from project activities will form part of the environmental follow-up program. Four sampling quadrants (PL-01 through PL-04) were selected, in consultation with the family of the tallyman of trapline CH39, to measure existing metal concentrations in the vegetation (Map 13-6). Two of the quadrants were located within the biophysical LSA and fall within the project's area of influence (PL-01 and PL-02), while the other two are located outside the area of influence of the particulate matter emission concentrations predicted by atmospheric dispersion modelling (PL-02 and PL-04).

A total of 72 structural tissue samples (excluding replicate field samples) will be collected, including Labrador tea leaves and blueberry plant fruits. Approximately 20 g (wet weight) will be collected for each sample of leaves and berries. Fruits and leaves that have reached full maturity will be selected whenever possible.

As part of this project, one replicate field sample per species is to be collected from each quadrant (eight replicate samples in total). These replicates represent at least 10% of the total samples submitted for analysis for each plant species.

Table 13-9 shows the quadrant distribution details by habitat type.

Tableau 13-9 Distribution of plant quadrats by habitat type

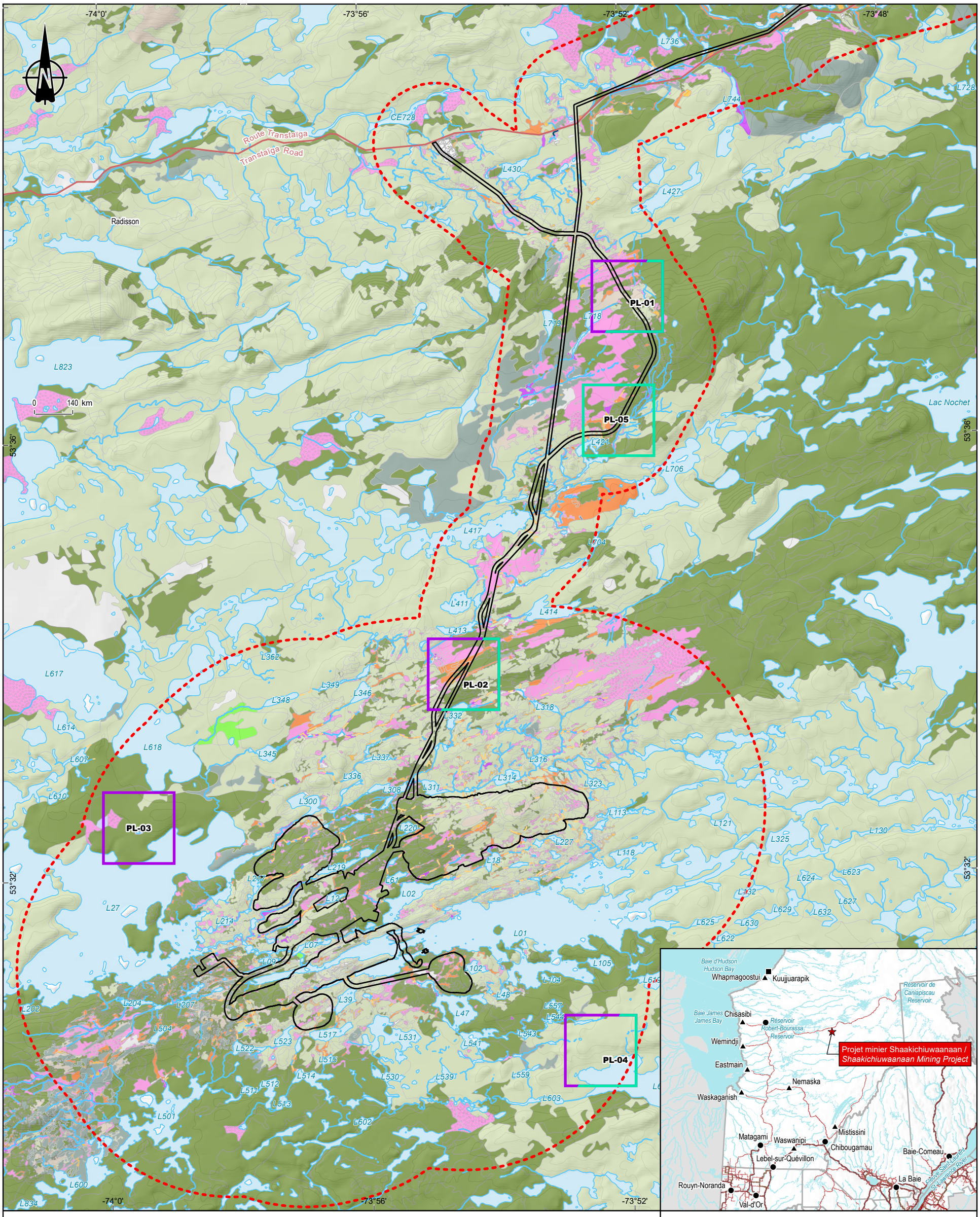
Quadrant name	Natural environment	Latitude	Longitude	Quadrant in areas potentially affected by the mine site
PL-01	Regenerating forest, softwood stand, wooded ombrotrophic bog	53.618518	-73.864205	Yes
PL-02	Regenerating forest, softwood stand	53.566078	-73.902136	Yes
PL-03	Softwood stand	53.543649	-73.989786	No
PL-04	Regenerating forest	53.507653	-73.872916	No

Methodology

A sampling protocol will be followed to minimize sources of contamination from the environment, the specimens being sampled, and the laboratory handling. Nitrile gloves will be used for sampling and replaced between sampling quadrant. To be as representative as possible of traditional harvesting conditions, no cutting tools will be used. A separate bag will be used for each sample within each quadrant.

Samples will be frozen within 24 hours of collection in preparation for metal assay. Samples will be stored in hermetically sealed “Ziploc” or equivalent bags, and kept at a minimum of -20 °C. Prior to freezing, tissues will be kept cool, ideally at 4°C in a cooler.

The tissue analysis will be conducted in a laboratory accredited by the Quebec government. A laboratory quality assurance and quality control program will be implemented in accordance with best practices. The parameters to be analysed are listed in Table 13-10.



Zones d'étude / *Study Areas*

- Projet / *Project*
- Biophysique - Locale / *Biophysical - Local*

Réseau routier / *Road Network*

- Route collectrice municipale / *Municipal collector road*

Écotoxicologie / *Ecotoxicology*

- Placette d'échantillonnage de gibier/ *Game sample plot*
- Placette d'échantillonnage de plante / *Plant sample plot*

Composantes de l'écosystème / *Ecosystem Components*

Milieux humides et hydriques / *Wetlands and Hydrous Environments*

- Marécage arborescent / *Treed swamp*
- Marécage arbustif / *Shrubby swamp*
- Tourbière minérotrophe boisée / *Treed fen*
- Tourbière ombrotrophe boisée / *Treed bog*
- Tourbière ombrotrophe ouverte / *Open bog*
- Marais / *Marsh*
- Eau peu profonde / *Shallow water*
- Plan d'eau / *Waterbody*

Cours d'eau / *Watercourses*

- Intermittent / *Intermitent*
- Permanent / *Permanent*
- Permanent partiellement souterrain / *Partially underground permanent*
- Souterrain / *Underground*

Milieux terrestres / *Terrestrial Environments*

- Feuillu / *Deciduous*
- Mixte / *Mixed-wood*
- Résineux / *Softwood*
- Arbustaie / *Scrubland*
- Lande à lichens / *Lichen tundra*
- Régénération / *Regeneration*

Autres milieux / *Other Environments*

- Anthropique / *Anthropogenic*
- Champ de blocs / *Boulder field*
- Ile / *Island*
- Surface dénudée / *Dry barren*

Projet minier Shaakichiuwaanaan /
Shaakichiuwaanaan Mining Project

Étude d'impact sur l'environnement /
Environmental Impact Assessment

Carte 13-6 / *Map 13-6*
Localisation des placettes d'échantillonnage des plantes et du gibier par type de milieu / Location of Plant and Game Sampling Plots by Habitat Type

Sources / Sources
AQréseau+, réseau routier, MERN, 2016
BDGA, 1M, MERN, 2014
CanVec, 250k,RNCan, 2017

0 650 1 300 m
UTM, fuseau 18, NAD83 (CSRS)

2026-03-25

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Boundary accuracy and measurements shown on this document are not intended for engineering or land delineation purposes. No land analysis has been performed by a land surveyor.

Table 13-10 List of parameters to be analysed in leaf tissue and berry samples

Parameters to be tested		
Aluminum (Al)	Cobalt (Co)	Lead (Pb)
Antimony (Sb)	Copper (Cu)	Selenium (Se)b
Silver (Ag)	Tin (Sn)	Strontium (Sr)
Arsenic (As)	Iron (Fe)	Titanium (Ti)
Barium (Ba)	Lithium (Li)	Uranium (U)
Beryllium (Be)	Manganese (Mn)	Vanadium (V)
Boron (B)	Mercury (Hg)	Zinc (Zn)
Cadmium (Cd)	Molybdenum (Mo)	
Chromium (Cr)	Nickel (Ni)	

Applicable criteria and quality control

For statistical analysis, it is recommended that concentrations below the reporting detection limit (RDL) be converted to half of the limit. The means, maximum and minimum values, and standard deviation must be calculated for each parameter analyzed.

It should be noted that there are no thresholds to respect (criteria) for the parameters analyzed in the case of these plants. In fact, there are currently no standards set by the Canadian Council of Ministers of the Environment (CCME) or the MELCCFP for the presence of metals in vegetation. In this case, the tests are only used to document the concentrations of metals present in the leaves and fruits of the two species sampled.

The documents available on the MELCCFP website regarding ecotoxicology and risk assessment were taken into account in the preparation of this report. In addition, several guides and guidelines were consulted for the characterization, assessment, and presentation of the results:

- *Procédure d'évaluation du risque écotoxicologique pour la réhabilitation des terrains contaminés* ["Procedure for ecotoxicological risk assessment for the remediation of contaminated sites"] (CEAEQ, 1998);
- *Supplemental guidance on human health risk assessment for country foods (HHRA Foods) – Federal contaminated site risk assessment in Canada* (Health Canada, 2010);
- *Lignes directrices pour la réalisation des évaluations du risque toxicologique d'origine environnementale au Québec* ["Guidelines for conducting environmental toxicological risk assessments in Quebec"] (INSP, 2012).

Frequency and duration of follow-up

The scheduling of the vegetation sampling program depends primarily on blueberry berry production, since this is the only plant species whose fruit will be harvested. Consequently, plant collection is scheduled to take place once the fruit has been produced, i.e., toward the end of summer (August). Follow-up will be carried out during the construction and operations phases of the mine, as follows:

- summer 2025 (baseline condition);
- construction phase (Year 1);
- operations phase (Years 1, 5, 10, 15, 20, 25).

The frequency of monitoring may be revised, subject to the results obtained during the operations phase, if results show that there has been no significant increase in metal concentrations compared to baseline levels.

Follow-up report

A report will be prepared after each year of sampling and analysis and will be included in the annual report submitted by PMET to the MELCCFP. This report will include the methodology (gathering method, plant locations, brief description of the plants), the results obtained, and recommendations.

Game valued by the Cree

Monitoring of game valued by Cree land users will help assess the metal content in the parts of the game that are consumed. The purpose of this program is to identify and document any changes in the environment relative to the reference state that will be established in the winter of 2027, and assess whether or not they may be related to the project development.. This program will also be used to verify the accuracy of the impact assessment and to assess the effectiveness of the project's mitigation measures.

The snowshoe hare is currently the game species selected for follow-up. This species was chosen because it is an important food source for the Cree community and is abundant in the biophysical LSA. Furthermore, because this species has a short life cycle, it allows for the assessment of short-term bioaccumulation and thus helps identify the project's potential impacts on the species. However, it is currently proposed to replace monitoring of the snowshoe hare with monitoring of the beaver or the porcupine, in accordance with requests expressed by land users. This revision to the monitoring program will be presented at the time of submission of the project-related authorization applications.

Sampling plan

The capture of animals and the collection of samples will be carried out in collaboration with the tallyman and his family. Trapping will take place in the winter, when the species is consumed by community members.

The targeted areas are located within the project's area of influence, in zones where fine particulate matter is deposited, as indicated by the atmospheric modelling. The main target area is located northeast of the planned infrastructure (Map 13-6).

The number of animals selected for follow-up has been set at 15. However, given the cyclical nature of the snowshoe hare population, this number could be adjusted upward or downward. It is also known that the home range of this species generally varies between 1.4 and 17 hectares under suboptimal conditions, which is likely to influence the spatial distribution of captures and the number of individuals sampled per sector (Godbout et al., 2001). The final locations of the capture areas and the final number of animals to be captured will be determined in consultation with the tallyman and his family, based on the planned harvesting activities.

Methodology

Selection of organs

The organs to be monitored were selected based on available information regarding the consumption of snowshoe hares by Cree users on the land and on available literature. Two tissues capable of accumulating metals will therefore be used for monitoring: muscle and liver.

Capture of animals

To comply with all the terms and conditions of the permit issued by the Ministère for the capture of wild animals for scientific, educational, or wildlife management purposes (SEG permit), field forms will be used to collect the following information:

- When setting traps, record the following information for each trap: date, time, type of trap installed, location coordinates, habitat type, and a description of the site where the trap was set.
- For each capture, the snowshoe hare will be assigned a unique identification number, and the following information will be recorded: sex, approximate age, measurements (total length with and without the tail, as well as weight), and any other relevant distinguishing characteristics.

If a snowshoe hare is captured, one of the following two options will be implemented:

- Leave the trap in place if it is believed that there may be another snowshoe hare nearby or remove the trap and move it to a different location.
- If no animals are captured after a trap-night, the trap will be left in place or moved.

Sampling method

A sampling protocol will be followed to minimize sources of contamination between the environment, the specimens being sampled, and the samples during handling. The following factors will be taken into consideration:

- To ensure the safety of field personnel when handling nitric acid (10%) and thereby minimize accidents that could lead to environmental discharges, nitrile gloves and safety goggles must be worn. Gloves must be changed after each capture.

Laboratory instruments (scalpels, forceps, scissors, etc.) should be washed with 10% nitric acid and rinsed with demineralized water before taking samples. This procedure must be repeated between each type of sample.

- A separate bag must be used for each type of sample and each carcass. The bags must be sealed tightly and labelled as follows: [Year] — [Location] — [Snowshoe hare ID] — [Tissues].
- To ensure the quality of the sampling procedures, a replicate sample must be collected in the field. Regardless of the total number of captures, which is subject to change, replicate samples must be collected. The specimens selected for the duplicates should be adult snowshoe hares whose organs are large enough to yield two samples of at least 20 grams each. The same procedures and precautions mentioned earlier must be followed when collecting the replicate samples. However, their identifiers will vary according to the following naming convention: REP—[Year] — [Location] — [Snowshoe hare ID] — [Tissues].

It should be noted that the skinning of snowshoe hares caught according to the culture and methods of the Cree family of the tallyman may be performed before tissue samples are collected, since the tissues are not exposed. Once the skin has been removed, an incision must be made in the carcass to take muscle and liver samples using previously disinfected dissection tools. Each organ must then be placed in an airtight bag.

Storage method

To ensure the integrity of the tissue samples, they must be frozen at -20 °C within 24 hours of collection. Within this time frame, the tissues must be stored in a cool place, ideally at 4°C in a cooler. The cooler used for transport must be equipped with ice packs to maintain this temperature.

Laboratory and test parameters

The tests will be conducted in a laboratory accredited by the Quebec government. A laboratory quality assurance and quality control program must then be implemented in accordance with best practices. The parameters to be tested are listed in Table 13-11.

Table 13-11 List of parameters to be analyzed in biological samples from the snowshoe hare

Aluminum (Al)	Cobalt (Co)	Lead (Pb)
Antimony (Sb)	Copper (Cu)	Selenium (Se)b
Silver (Ag)	Tin (Sn)	Strontium (Sr)
Arsenic (As)	Iron (Fe)	Titanium (Ti)
Barium (Ba)	Lithium (Li)	Uranium (U)
Beryllium (Be)	Manganese (Mn)	Vanadium (V)
Boron (B)	Mercury (Hg)	Zinc (Zn)
Cadmium (Cd)	Molybdenum (Mo)	
Chromium (Cr)	Nickel (Ni)	

Applicable criteria and quality control

If a significant increase in concentrations is detected in a monitored individual, all samples from that individual will be reanalyzed to ensure that the increase is not due to external contamination or a laboratory artifact. The tissue samples will be stored for six months after collection. The term “significant increase” is used here to refer to any increase in contamination levels in snowshoe hare tissue that could pose a risk to human health.

If the confirmed results exceed the environmental assessment’s projections, PMET will implement all modified or additional mitigation measures based on the results obtained.

Frequency and duration of follow-up

A survey of potentially concerning contaminants in the tissues of the snowshoe hare will be conducted in the winter of 2027 prior to the project’s construction. Follow-up on potentially concerning contaminants in game tissue will be conducted during the mine’s construction and operations phases as follows:

- winter 2027 (baseline level);
- construction phase (Year 1);
- operations phase (Years 1, 5, 10, 15, 20, 25).

The frequency of monitoring may be revised, subject to the results obtained during the operations phase, if those results show that there has been no significant increase in metal concentrations compared to baseline levels.

Follow-up report

A follow-up report will be prepared once the laboratory results are received. This report will include the methodology (trapping method, capture locations, and a brief description of the individual animals). In addition, the results will be interpreted in terms of potential risks to human health, and recommendations will be issued as appropriate. Since the samples will be collected in the winter, the follow-up report will be included in the following year's annual report.

Historical and cultural heritage, and significant sites and features

Interaction with the land and the various sites of importance to the Cree community representatives living near the mine site is a sensitive issue that must be preserved. PMET will hold an annual meeting with them to identify the changes caused by mining activities on this interaction with the land. When required, an assessment will be conducted to determine whether changes can be made to mining operations to mitigate the reported impacts.

In the event of the accidental discovery of an unlisted heritage or cultural site during construction work or exploration activities that will continue throughout the various phases of the project, the associated work will be interrupted, the site will be assessed, and meetings will be organized with representatives of the affected Cree communities to determine the steps to be taken to protect or relocate the site.

13.2.4.2 Public infrastructure and utilities

Traffic and road safety

PMET will develop a traffic management plan prior to the start of construction, in coordination with the local land users, Cree communities and regional stakeholders (SDBJ, Town of Matagami, etc). This plan will be implemented throughout the project and include the following elements:

- Protocol on the use of radio communication systems in transport trucks.
- Monitoring the daily flow of heavy vehicles and employee shuttle services, depending on the day and time of day.
- Monitoring of incidents involving project vehicles on the Trans-Taiga Road.
- Communication plan for local residents regarding ongoing activities and management of a complaint registry.
- Evaluation of potentially reducing traffic during hunting seasons.
- Evaluation of potentially implementing blasting and traffic restrictions during goose hunting season.
- Road safety awareness campaigns, with particular attention paid to hunting periods.
- Implementation of speed limits and appropriate road maintenance on the site.
- Analysis of opportunities to increase the use of electric vehicles on site.
- Prohibition of the use of engine braking when possible.
- Training in eco-driving and energy conservation.
- Raising awareness about wildlife and species of special concern.
- Watering haulage roads to reduce dust and using dust suppressants as needed.

- Identification of available rest areas in case of emergency.

The collected data will be systematically cross-referenced with daily traffic flows of vehicles entering and leaving the site, as well as with recorded complaints. Any substantiated complaint or proven environmental impact will result in the development and implementation of appropriate mitigation measures.

Monitoring during the operations phase is the responsibility of PMET's Environment Department. The results of this monitoring will be included in the annual environmental and social monitoring report and presented at meetings with the various follow-up committees.

Collisions with large wildlife

PMET will establish a registry of wildlife collisions. This initiative will make it possible to assess the impacts on local species and develop appropriate corrective measures. By incorporating this data, PMET will be able to implement targeted protection strategies, particularly during critical periods or on road sections identified as high-risk. The goal is to minimize the impact on biodiversity while ensuring road safety.

13.2.4.3 Archaeology

In the event of the chance discovery of a significant archaeological site, two options will be considered: either conducting a supplementary inventory or carrying out a targeted excavation to sample the site before it is destroyed by construction work. The main users of the land will be consulted on the approach to be adopted.

In any case, the areas with archaeological potential that had been identified during the initial assessment in 2024 within the project area were inventoried in 2025. In most of the areas inventoried as part of this project, no archaeological remains were found. The impact risk in these areas is therefore very low. Only one area (FjFl-2 [Area 126]) has been identified as having potential additional artifacts, however it is outside the planned development area. Should any development or activities be planned within this area, it would be subject to a specific management plan which could include further surveys and removal of discovered artifacts (Appendix 8-2).

If archaeological remains are accidentally uncovered during construction, site supervisors will immediately contact the environmental superintendent and the chance discovery procedure will be followed. Any discovery related to First Nations heritage will also be shared with the CH39 tallyman, the Cree Nation of Chisasibi and the Cree Nation Government.

13.2.4.4 Landscape

No follow-up is planned regarding the landscape component of the project.

13.2.4.5 Follow-up committee

PMET will establish a follow-up committee to ensure the ongoing participation of stakeholders in the project's implementation and follow-up. Once established, the committee will be responsible for establishing its operating procedures, including the principles of ethics, independence, and confidentiality applicable to its members. It will also define its mandate, objectives, and expected outcomes, as well as the responsibilities of each member, both with respect to the committee and to the organizations they represent, if applicable. The procedures for external communications and feedback will also be defined through consultation.

The committee's mandate will be developed collectively by its members and will reflect the issues, expectations, concerns, and challenges identified by the local community, as well as the project's current status.

At least once a year, during the follow-up committee's regular meetings, a detailed report on the complaints received—including their nature, number, and the steps taken to resolve them—will be presented to the members. The specific procedures for reviewing, processing, and presenting complaints will be established collectively by the committee members.

With regard to the Cree community, a dedicated follow-up committee—the terms and conditions of which will be specified in the Impact and Benefit Agreement (IBA)—will be established to facilitate the discussion, review, and resolution of issues that may arise during the various phases of the mining project. This committee will provide a structured and ongoing mechanism for collaboration between PMET and Cree representatives.

13.2.5 Other follow-ups

13.2.5.1 Wetland and water body compensation

The program is presented in Chapter 14. The projects associated with this program are currently being developed, and once the details are finalized, the proposed follow-up plan will be presented to government authorities for approval. Follow-ups are typically conducted in years 1, 3, and 5 after project completion.

13.2.5.2 Fish habitat compensation

The fish habitat compensation plan described in Chapter 14 details the planned activities. Follow-up assessments would be conducted in years 1, 3, and 5 following the completion of the work to confirm that the work has been carried out properly and to ensure that the objectives have been met. The physical characteristics of the structures and the conditions for the free passage of fish will be assessed based on the following parameters:

- a description of the overall condition of the structures (signs of instability, erosion, sand encroachment, scouring, etc.);
- condition of the riparian zone and rock-filled embankments;
- photographs (view upstream, view downstream, view of the banks, etc.) for comparison with the reference state;
- description and dimensions of the installed culvert:
  - wet area in the culvert;
  - reconstituted bed substrate;
  - watertightness of the reconstructed bed (signs of infiltration);
  - drop height;
  - type of flow at the outlet of the culvert, if any;
  - water depth at the upstream and downstream ends;
  - velocity of the current in the culvert;
  - description of the downstream ditch (depth, velocity of the current);
- use by fish fauna, if possible (visual observations).

These measurements will be taken at each follow-up visit to allow for comparisons. The effectiveness of the improvements will also be assessed through visual inspections. The results will be presented in a report following each follow-up.

13.2.6 Annual monitoring and follow-up report

The annual report, as required by D019 (MELCCFP, 2025b), serves as a key tool for environmental accountability for all mining operators in Quebec. It is intended to provide the Ministère with a comprehensive, transparent, and up-to-date overview of mining activities, their environmental management, and the measures taken to ensure regulatory compliance. This report serves not only to demonstrate compliance with legal requirements, but also to document efforts toward continuous improvement and the responsible management of environmental impacts associated with mining operations.

The report provides a summary of the mining activities carried out during the year. This summary must include the tonnage mined and processed, the number of production days, and any periods of temporary suspension of operations. It is also essential to report any incidents or problems that have occurred and that could have an impact on the environment, such as accidental spills, specifying the corrective measures taken to address them. This section provides an overview of operations and highlights proactive environmental risk management.

The report must detail any changes made to the accidental spill response plan, as well as the measures taken to strengthen incident prevention and management. Finally, the report must include a summary of the restoration work carried out during the year, including progressive restoration efforts, the locations and areas restored, as well as the follow-up measures put in place. This section demonstrates the operator’s commitment to rehabilitating mining sites.

The content of the annual report is organized around several key themes, each of which addresses specific requirements of D019 (MELCCFP, 2025b).

13.2.6.1 Calculation of annual loads and flow measurements

The report presents the calculation of annual loads for each parameter in the routine follow-up of the final effluent, in accordance with the methods detailed in D019 (MELCCFP, 2025b). The monthly loads are added together to calculate the annual load (expressed in kg/year) for each monitored parameter, such as arsenic, copper, iron, nickel, lead, zinc, cyanides, suspended solids, and radium-226.

The report must include the initial or annual verification report on the accuracy of flow measurement systems, as required by D019 (MELCCFP, 2025b). This report must include recommendations and an action plan for corrective measures, if necessary, as well as a follow-up on the implementation of those measures. This requirement ensures that loads are calculated with greater accuracy.

13.2.6.2 Tailings management

The annual report must include the annual quantity, in metric tonnes, of all tailings produced, as well as a breakdown by management method (backfilling, disposal in stockpiles, reuse, etc.). The area, in hectares, affected by tailings storage facilities and treatment ponds must also be specified. This information can be used to assess the environmental footprint of operations and the effectiveness of waste management.

The report also includes the annual physical stability inspection report for tailings storage facilities and associated structures, as well as the recommended corrective actions and their state of progress. The follow-up on corrective actions taken following the safety review must be detailed, including a timeline for implementing the corrective measures. This requirement is to ensure that recommendations resulting from inspections and safety reviews are effectively implemented.

13.2.6.3 Piezometric and groundwater quality follow-up

The report includes a section specifically dedicated to groundwater quality monitoring, covering the results of tests, an analysis of trends, and a description of any corrective or mitigation measures implemented, where applicable. Analysis certificates must be kept in an accessible log and made available upon request. This requirement is intended to ensure the protection of water resources and prevent any contamination resulting from mining activities.

The piezometric follow-up, that is, the measurement of groundwater levels, must also be included in the annual report. Measurements must be taken at locations where observation wells have been installed, at least twice a year, typically in the spring and summer. The report must present the results of these measurements and their interpretation.

13.2.6.4 Water report

The report provides a detailed overview of water used and discharged at the mine site, including the mine wastewater utilization rate and the mine wastewater utilization efficiency rate, calculated using the prescribed formulas. All data required for these calculations—such as the annual volume of reused mine wastewater, the annual volume of fresh water used, and the annual volume of final effluent—must be provided. This assessment is used to evaluate the effectiveness of water management and efforts to reduce fresh water consumption.

For each tailings storage facility on the site, the report must include the results of the percolation rate calculation, as well as all data necessary for that calculation. This requirement is intended to ensure that waste management facilities do not pose a risk of contamination to groundwater.

13.2.6.5 Submission and retention procedures

The annual report must be submitted to the Ministère by June 1 of each year, until the end of the transition period leading to the site's full restoration. All reports submitted, along with the documents, information, and data required to produce them, will be retained by PMET throughout the duration of the activities and until the post-restoration follow-up program is discontinued.

13.2.6.6 Annual report and follow-up

The annual report must demonstrate compliance with requirements. It is a key tool for environmental management and accountability. It will help the MELCCFP verify the compliance of PMET's activities and monitor changes in environmental impacts. In addition to the content presented above, the follow-up reports to be prepared during the year will be included as an appendix. Thus, all commitments made for a given year will be reported according to the follow-up schedule presented in the following chapter.

13.2.7 Follow-up program calendar

Appendix 13-1 provides a timeline for all follow-up activities planned as part of the environmental monitoring program throughout the various phases of the project.

14 Preliminary compensation program

14.1 Summary of loss of fish habitat, wetlands, and aquatic environments

Table 14-1 summarizes the anticipated direct loss of fish habitat, wetlands, and aquatic environments associated with the project.

Table14-1 Summary of estimated direct loss of fish habitat, wetlands, and aquatic environments

Environment	Category	Type of environment	Total (ha)
Aquatic	**Fish habitat**		
	Littoral	Watercourse	0.78
		Bodies of water	56.35
		Wetland below the littoral zone	0.05
		Sub-total fish habitat aquatic environments	**57.18**
	Not a fish habitat		
	Littoral	Watercourse	0.00
		Body of water	0.03
		Wetland below the littoral zone	4.93
		Sub-total not a fish habitat littoral	**4.97**
	Riverbank	Wetland	3.63
		Forested	6.09
		Non-forested	0.82
		Sub-total riverbank	**10.53**
		Sub-total not a fish habitat aquatic environments	**15.50**
Wetland		**Wetlands outside littoral or riverbank**	**104.68**
Total of estimated direct loss of fish habitat, wetlands, and aquatic environments			**120.19**

14.2 Fish habitat compensation plan

14.2.1 Context and losses to be compensated

As part of the project, spodumene will be extracted using a hybrid approach combining open pit and underground mining, so as to reduce the direct impact on fish habitat. Despite these efforts, the infrastructure development will result in the direct loss of approximately 57.18 ha of aquatic habitat, mainly due to the partial draining of Lake L01.

These habitats are mainly populated by white sucker (*Catostomus commersonii*) and northern pike (*Esox lucius*), with a lesser presence of lake trout (*Salvelinus namaycush*). Brook trout (*Salvelinus fontinalis*) have also been observed in the lake outlet, which offers good potential for feeding and spawning for lithophilic species, but poor potential for phytophilic species.

Mitigation measures are planned, including fish relocation and the creation of a diversion channel modelled on a natural watercourse to maintain connectivity (Appendix 14-1). However, residual impacts remain and require the implementation of a compensation plan aimed at restoring or improving equivalent habitats, in accordance with regulatory requirements, in consultation with the Cree community and government authorities (Appendix 14-2).

14.2.2 Compensation project identification

The identification of compensation projects relied on two complementary components. First, consultations were held with land users, regional organizations, and government agencies to identify priority issues and gather compensation project ideas. Next, a photo interpretation analysis was undertaken of the identified sites, disturbed areas and areas with restoration potential, such as altered watercourses, obsolete culverts, borrow pits, and abandoned mine sites.

The consultation effort revealed several major concerns relating to aquatic environments, including mercury contamination in fish flesh, which remains a significant issue for the Chisasibi community; the presence of invasive species, exacerbated by fishing tournaments and the arrival of tourists with their boats; and the degraded quality of water in some watercourses, which tallymen consider to be a cause for concern.

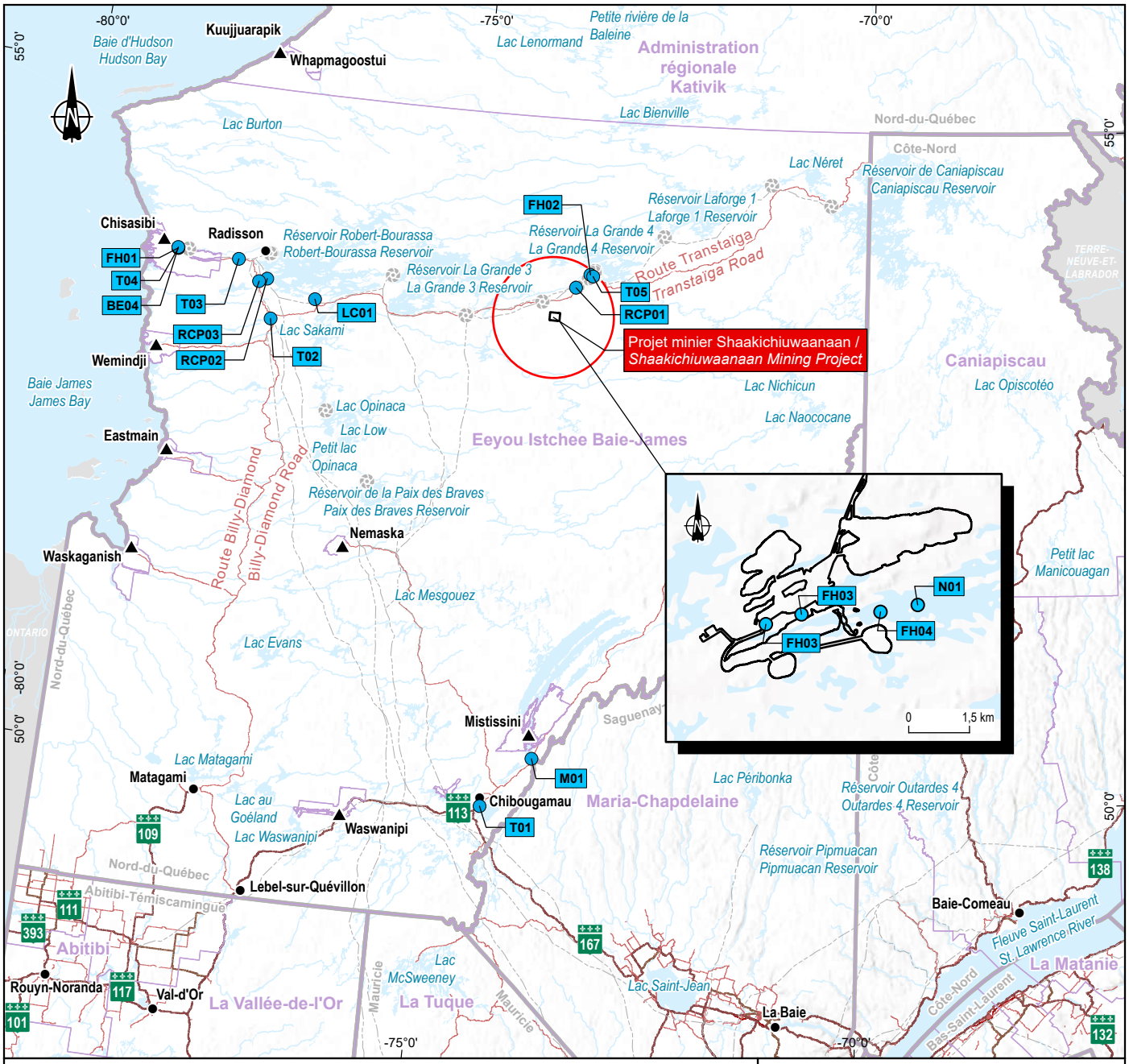
A list of potential aquatic habitat compensation projects has been developed in accordance with the principles of the Policy for applying measures to offset harmful impacts to fish and fish habitat (DFO, 2025), while incorporating the cultural values and fisheries management priorities of local Indigenous communities.

14.2.3 Identified projects

The identified compensation projects fall into different categories:

- Water level increase
- Restoration of watercourses and water bodies
- Development of spawning grounds and grass beds
- Improved fish passages (migratory pass)
- Rehabilitation of culverts
- Restoration of disturbed sites (borrow pits, abandoned mine sites)
- Measures targeting invasive species and contaminants

Some identified projects were rejected because they did not meet the compensation criteria or presented major constraints. Other projects are currently being analyzed and will be presented in detail at a later date. The projects presented below are considered “active” and have been identified as having the potential to compensate for fish habitat loss from the project. Map 14-1 shows the location of identified fish habitat compensation projects.



Zones d'étude / *Study Areas*

- Projet / *Project*
- Biophysique - Régionale / *Regional - Biophysical*

Site de compensation / *Compensation Site*

- Habitat du poisson / *Fish habitat*

Repères géographiques / *Geographical Landmarks*

- Communauté crie dans la zone d'étude du milieu humain / *Cree community in the human environment study area*
- Municipalité / *Municipality*

Infrastructures / *Infrastructure*

- Centrale hydroélectrique / *Hydroelectric generating station*
- Ligne de transport d'énergie / *Electric power transmission line*

Réseau routier / *Road Network*

- Autoroute / *Highway*
- Route nationale / *National road*
- Route régionale / *Regional road*
- Autre / *Other*

Limites / *Boundaries*

- Région administrative / *Administrative Region*
- Municipalité régionale de comté (MRC) et Territoires autochtones / *Regional County Municipality (RCM) and First Nations Territories*

Projet minier Shaakichiuwaanaan / *Shaakichiuwaanaan Mining Project*

Étude d'impact sur l'environnement / *Environmental Impact Assessment*

Carte 14-1 / *Map 14-1*
Localisation des pistes de compensation de l'habitat du poisson / *Location of Fish Habitat Compensation Options*

Sources :
SDA, 1/20 000, MRNF, 2024-02
Canvec, 1/250 000, 1/5 000 000 et 1/15 000 000, RNCan, 2019
BDGA, 1/1 000 000, MRN Québec, 2014
BDGA, 1/5 000 000, MRNF Québec, 2010
AQréseau+, réseau routier, MERN, 2024-03-01
RNCan, Frontières géopolitiques, 2002

0 50 100 km

NAD 1983 Quebec Lambert

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14.2.4 Summary

Several fish habitat compensation projects were identified and selected to move forward based on their relevance and feasibility. The table below provides a summary of these projects, indicating the issue identified needing improvement, the work planned to address identified issues, the anticipated gain in surface area, and the potential challenges to be considered.

Table 14-2 Summary of potential fish habitat compensation projects

Project name	Issues	Planned work	Anticipated gain (ha)	Potential challenges
Raising the water level of Lake L01 (N01)	Partial drying up of Lake L01 and significant loss of fish habitat. Habitats suitable for northern pike spawning are very rare (<1% of riverbanks) and aquatic vegetation is scarce.	Raise the water level of Lake L01 using the dam planned for the mine site to increase the area and volume of fish habitat. This measure will also allow spring flooding of the riverbanks, promoting northern pike spawning and improving ecological functions (fry rearing, shelter, feeding).	2.15 to 20.71 (depending on the level-raising scenario: +10 cm to +60 cm).	Proximity to mining infrastructure and issues related to site closure. Confirmation of the volume of water retained by the dam to determine the type of structure (high or low capacity).
Development of multi-species spawning grounds at the mine site (FH03)	Scarcity of habitats suitable for spawning lithophilic species in Watercourses CE8 and CE11 at the site.	Develop multi-species spawning grounds at the crossings of Watercourses CE8 and CE11 by preserving the natural riverbed, adding suitable substrate, and installing sills to ensure favourable water conditions for lithophilic species to spawn.	Between 0.05 and 0.1 ha (exact gain to be confirmed according to the development plan).	To be determined (related to the design of the crossings and water conditions).
Development of grass beds in Lake L01 (FH04)	Lack of spawning habitats for northern pike due to the scarcity of aquatic vegetation and steep banks.	Reshape some riverbanks to create or enlarge flood plain areas during the spawning season, then replant with suitable vegetation to ensure the rapid establishment of grass beds conducive to northern pike reproduction.	2.5 ha (six preliminary sites identified, possibility of increasing the surface area).	To be determined (related to site selection and topographical constraints).
Watercourse near airport LG-4 (RCP01)	Past impacts: three crossings and the presence of an embankment disrupting the watercourse.	Restore the banks at the former crossing points and develop a water body in the embankment area, including depressions to reach the water table, gentle slopes to promote grass beds, topsoil spreading, and revegetation work (seeding, reforestation, transplantation).	0.41 ha (fish habitat).	Proximity to the runway and ownership of the land.
Watercourse (north) at Lac Desaulniers (RCP02)	Decreased quality of the fishing site (spread of willow trees) and uncertain water quality; free passage of fish not documented.	Restore the spawning ground and banks overgrown with willow, improve water quality, and take action to ensure the free passage of fish if necessary.	To be determined	To be determined

Project name	Issues	Planned work	Anticipated gain (ha)	Potential challenges
Watercourse (west) at Lac Desaulniers (RCP03)	Problematic water quality (rusty colour), possible contamination linked to a nearby landfill site.	Implement corrective measures to treat the contamination responsible for the discolouration and improve the quality of the water environment.	To be determined	To be determined
Restoration of a brook trout spawning ground (FH01)	Brook trout spawning ground near the Chisasibi public beach.	Implement measures to restore the spawning ground, including site characterization and measures to improve habitat quality and functionality.	To be determined	To be determined
Restoration of a walleye spawning ground (FH02)	Walleye spawning ground near the LG-4 power plant; spawning site unsuitable since the removal of a bridge or culvert.	Restore the spawning ground by improving habitat quality and functionality, and implement corrective measures related to the removal of the bridge or culvert.	To be determined	To be determined
Restoration of a fish pass (LC01)	Damaged pass preventing the free passage of fish between the water bodies and the Robert-Bourassa reservoir.	Reconfigure the fish pass to restore connectivity and enable species migration between watercourses and the reservoir.	Up to 124 ha (upstream water bodies).	Ownership of the dam and the pass by Hydro-Québec; legal obligations and willingness to carry out the work.
Culvert at Lac Yasinski (T02)	Issue of free passage of fish; little use of the developed spawning ground; risk of eggs being washed away on the jetty.	Rehabilitate the culvert to restore connectivity and optimize the existing spawning ground by improving hydraulic conditions and correcting the jetty (uniform level, removal of the insulating fabric, adjustment of the protective arm) to reduce the risk of eggs being washed away.	Up to 137.9 ha (water bodies) and 0.169 ha (spawning grounds).	Complex logistics (Billy-Diamond Highway, single North-Radisson route) and preserving the integrity of the existing spawning grounds.
Culverts at km 77 of the Chisasibi Road (T03)	Culverts in poor condition hindering the free passage of fish; risk of complete deterioration.	Replace culverts with a permanent structure (e.g., arch culvert) that ensures free passage at all times and preserves a natural flow bed.	Up to 36.17 km of watercourses and 183.18 ha of water bodies.	Complex logistics (single road to Chisasibi); maintaining traffic flow during construction.
Culvert at the entrance to Chisasibi borrow pit 1 (T04)	Issue of free passage for fish; accumulation of water upstream of the culvert; presence of a brook trout spawning ground upstream.	Implement appropriate measures to restore connectivity, including technical characterization of the culvert and design of a structure that facilitates the free passage of fish.	To be determined	Keep traffic flowing if the borrow pit is still in use.
Culverts near LG-4 (T05)	Crossings and culverts that may interfere with the free passage of fish and the quality of the habitat.	Implement appropriate measures to restore connectivity, including the characterization of culverts and the design of structures that facilitate the free passage of fish.	To be determined	Ownership of the rights-of-way (possibly Hydro-Québec).

Project name	Issues	Planned work	Anticipated gain (ha)	Potential challenges
Chisasibi borrow pit 1 (BE04)	Deteriorated environment; crossings hindering traffic; presence of excavated water.	Restore the borrow pit by removing residual material, apply the “rough and loose” method, enlarge the excavated water body, and develop a juxtaposed wetland (gentle slopes, drainage channels, topsoil, vegetation). Replace or adapt culverts to restore the free passage of fish.	2.5183 ha (fish habitat) + additional water and wetland environments.	Project compromised if the borrow pit is still active (access for heavy machinery).
Culvert in Chibougamau (T01)	Heavily damaged culvert hindering the free passage of fish; rising water levels upstream.	Replace the culvert with a suitable structure to restore connectivity between the two bodies of water and ensure free passage for fish at all times.	Up to 26.05 km of watercourses and 683.5 ha of water bodies.	To be determined (ownership, technical and logistical constraints).
Icon Sullivan (M01)	Homogeneous channel with no sinuosity; steep banks; contamination by tailings; old road on the riverbank.	Create a diversion channel with a basin from the existing channel; stabilize the banks at strategic locations to limit runoff; renaturalize an old road northeast of the site.	1,168 ha (fish habitat: 0.7003 ha; riverbanks: 0.4677 ha.	Presence of contaminants and instability in several areas.
Boat washing station (EEE01)	Risk of introducing invasive alien species due to fishing tournaments and the growing number of tourists arriving from the south with boats.	Set up a mobile washing station that can be moved as needed (tournaments, critical periods) and/or a fixed station at a strategic location to intercept boats coming from the south.	N/A	Ensure that the mobile station is present at the right water bodies at the right time; approve sites for a fixed station.
Environmental contaminants – traditional food (R01)	Presence of mercury in freshwater fish flesh, concerns for the health and food safety of the Chisasibi community.	Identify environmental contaminants (particularly mercury) in traditional foods; conduct sampling and analysis; disclose results and raise public awareness.	N/A	To be determined (related to methodology, sampling sites, and reporting of results).

References: (Niigaan. 2025) (DFO, 2025)

14.3 Wetland and aquatic environment compensation plan

14.3.1 Context and losses to be compensated

The planned development will result in the loss of 120.19 ha of wetlands and aquatic environments. Table 14-1 describes the type of environment per hectare in further detail.

The local project study area encompasses a total of 285 wetlands. The vast majority of these wetlands (89%) are part of a wetland complex, while 92% have an identified water connection (direct or indirect). Identified wetlands include a shallow water area, a pond, four marshes, 43 treed swamps, 17 shrubby swamps, eight forested fens, 45 open fens, 66 forested ombrotrophic bogs, and 100 open ombrotrophic bogs.

14.3.2 Project search

Due to the abundance of wetlands and aquatic environments in the region, and the limited number of disturbed environments requiring restoration, the search for compensation options could not be based solely on achieving gains comparable to losses in surface area. Particular attention was paid to identifying projects that could offset losses of affected ecological functions. However, this approach complexifies the quantification of gains, as they are not based on a direct comparison of surface areas for a given type of environment, but on enhancements to ecological functions, the equivalence of which cannot be expressed solely on an area basis..

Consultations with communities potentially affected by the project were also a central part of the process to identify compensation projects. The selected projects must meet the expectations of land users who know and use the area and who could be directly affected by the project. The main concerns expressed throughout land user consultation efforts were related to fish habitat. However, tallymen are also concerned about the increased presence of invasive species, a phenomenon exacerbated by fishing tournaments and the influx of tourists with their boats. Concerns about water quality in some watercourses were also expressed.

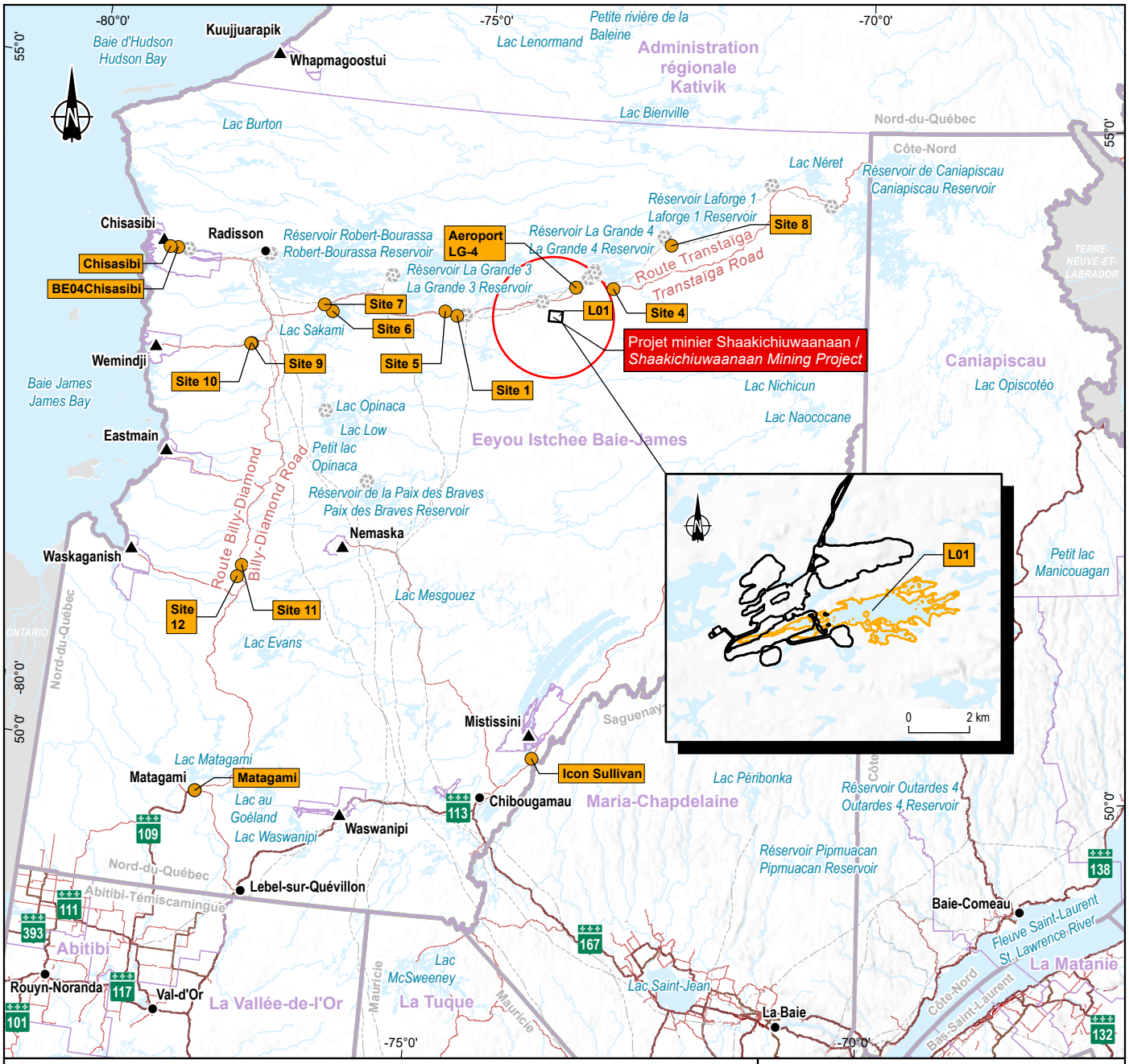
Moreover, some traditional activities practiced by land users are closely tied to wetlands and aquatic environments. The conservation of hunting of geese, ducks, and bears, may be among other measures that could be explored within wetland and water management plans.

14.3.3 Selected projects

Four main areas have been identified for wetland and water compensation projects in the project region (Appendix 14-3):

- Indirect gains from fish habitat compensation projects
- Development of former borrow bits
- Restoration of contaminated sites
- Research focus: a path forward with carbon sequestration in peatlands

The projects selected to date are considered active and offer potential for offsetting the loss of wetlands and aquatic environments. Map 14-2 shows the location of potential wetland and aquatic environment compensation projects.



Zones d'étude / *Study Areas*

- Projet / *Project*
- Biophysique - Régionale / *Regional - Biophysical*

Site de compensation / *Compensation Site*

- Milieux humides et hydriques / *Wetland and hydrous environment*

Repères géographiques / *Geographical Landmarks*

- Communauté crie dans la zone d'étude du milieu humain / *Cree community in the human environment study area*
- Municipalité / *Municipality*

Infrastructures / *Infrastructure*

- Centrale hydroélectrique / *Hydroelectric generating station*
- Ligne de transport d'énergie / *Electric power transmission line*

Réseau routier / *Road Network*

- Autoroute / *Highway*
- Route nationale / *National road*
- Route régionale / *Regional road*
- Autre / *Other*

Limites / *Boundaries*

- Région administrative / *Administrative Region*
- Municipalité régionale de comté (MRC) et Territoires autochtones / *Regional County Municipality (RCM) and First Nations Territories*

Projet minier Shaakichiuwaanaan / *Shaakichiuwaanaan Mining Project*

Étude d'impact sur l'environnement / *Environmental Impact Assessment*

Carte 14-2 / *Map 14-2*
Localisation des pistes de compensation des milieux humides et hydriques / *Location of Wetland and Hydrous Environment Compensation Options*

Sources :
SDA, 1/20 000, MRNF, 2024-02
Canvec, 1/250 000, 1/5 000 000 et 1/15 000 000, RNCan, 2019
BDGA, 1/1 000 000, MRN Québec, 2014
BDGA, 1/5 000 000, MRNF Québec, 2010
AQréseau+, réseau routier, MERN, 2024-03-01
RNCan, Frontières géopolitiques, 2002

0 50 100 km

NAD 1983 Quebec Lambert

2026-03-27

Préparation / Preparation : F. Gagnon
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Approbation / Approval : F. Gagnon
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14.3.4 Summary

The following table provides an overview of the various potential projects selected, highlighting the targeted issues for each identified project, the planned work to be undertaken, the expected gains in hectares, and the potential challenges to be considered.

Table 14-3 Summary of potential wetland and aquatic environment compensation projects

Project name	Issues	Planned work	Anticipated gain (ha)	Potential challenges
Raising the water level of Lake L01 (N01)	Partial drying up of Lake L01 and significant loss of fish habitat. Habitats suitable for northern pike spawning are very rare (<1% of riverbanks) and aquatic vegetation is scarce.	Raise the water level of Lake L01 using the dam planned for the mine site to increase the area and volume of fish habitat. This measure will also allow spring flooding of the riverbanks, promoting northern pike spawning and improving ecological functions (fry rearing, shelter, feeding).	2.15 to 20.71.	Proximity to mining infrastructure and issues related to site closure. Confirmation of the volume of water retained by the dam to determine the type of structure (high or low capacity).
Development of grass beds in Lake L01 (FH04)	Lack of spawning habitats for northern pike due to the scarcity of aquatic vegetation and steep banks.	Reshape some riverbanks to create or enlarge flood plain areas during the spawning season, then replant with suitable vegetation to ensure the rapid establishment of grass beds conducive to northern pike reproduction.	2.5 (six preliminary sites identified, possibility of increasing the surface area).	To be determined (related to site selection and topographical constraints).
Watercourse near airport LG-4 (RCP01)	Past impacts: three crossings and the presence of an embankment disrupting the watercourse.	Restore the banks at the former crossing points and develop a water body in the embankment area, including depressions to reach the water table, gentle slopes to promote grass beds, topsoil spreading, and revegetation work (seeding, reforestation, transplantation).	Riverbanks: 0.28; wetlands: 0.44.	Proximity to the runway and ownership of the land.
Watercourse (north) at Lac Desaulniers (RCP02)	Decreased quality of the fishing site (spread of willow trees) and uncertain water quality; free passage of fish not documented.	Restore the spawning ground and banks overgrown with willow, improve water quality, and take action to ensure the free passage of fish if necessary.	To be determined	To be determined

Project name	Issues	Planned work	Anticipated gain (ha)	Potential challenges
Chisasibi borrow pit 1 (BE04)	Deteriorated environment; crossings hindering traffic; presence of excavated water.	Restore the borrow pit by removing residual material, apply the “rough and loose” method, enlarge the excavated water body, and develop a juxtaposed wetland (gentle slopes, drainage channels, topsoil, vegetation). Replace or adapt culverts to restore the free passage of fish.	Riverbanks: 0.81; wetlands: 1.23.	Project compromised if the borrow pit is still active (access for heavy machinery).
Icon Sullivan (M01)	Homogeneous channel with no sinuosity; steep banks; contamination by tailings; old road on the riverbank.	Create a diversion channel with a basin from the existing channel; stabilize the banks at strategic locations to limit runoff; renaturalize an old road northeast of the site.	Riverbanks: 0.4677.	Presence of contaminants and instability in several areas.
Site 4	Borrow pit open under certain conditions, environment damaged by removal of material, creation of access roads, and machinery traffic.	Restoration of the site by creating wetlands through the removal of material, reshaping the landscape, revegetation, and development of floodplains.	2.84.	To be determined
Site 5 -33G06-1	Gravel borrow pit open under certain conditions, environment damaged by removal of material, creation of access roads, and machinery traffic.	Restoration of the site by creating wetlands through the removal of material, reshaping the landscape, revegetation, and development of floodplains.	2.32.	To be determined
Site 7 -33F07-1	Crushed stone borrow pit open under certain conditions, environment damaged by removal of material, creation of access roads, and machinery traffic.	Restoration of the site by creating wetlands through the removal of material, reshaping the landscape, revegetation, and development of floodplains.	4.56.	To be determined
Site 8 – 33I02-12	Closed sand borrow pit, environment damaged by removal of material, creation of access roads, and machinery traffic.	Restoration of the site by creating wetlands through the removal of material, reshaping the landscape, revegetation, and development of floodplains.	2.40.	To be determined

Project name	Issues	Planned work	Anticipated gain (ha)	Potential challenges
Site 9 – 33F04-1	Closed sand borrow pit, environment damaged by removal of material, creation of access roads, and machinery traffic.	Restoration of the site by creating wetlands through the removal of material, reshaping the landscape, revegetation, and development of floodplains.	1.98.	To be determined
Site 10 – 33F04-0	Closed gravel borrow pit, environment damaged by removal of material, creation of access roads, and machinery traffic.	Restoration of the site by creating wetlands through the removal of material, reshaping the landscape, revegetation, and development of floodplains.	8.26.	To be determined
Site 11 – 32N06-1	Closed sand borrow pit, environment damaged by removal of material, creation of access roads, and machinery traffic.	Restoration of the site by creating wetlands through the removal of material, reshaping the landscape, revegetation, and development of floodplains.	11.50.	To be determined
Site 12 – 32N06-5	Closed gravel borrow pit, environment damaged by removal of material, creation of access roads, and machinery traffic.	Restoration of the site by creating wetlands through the removal of material, reshaping the landscape, revegetation, and development of floodplains.	8.10.	To be determined
Site 1 - WJ/6-054	Contaminated site: environment damaged by soil disturbance, machinery traffic, and probable soil contamination.	Site restoration through soil decontamination, land reshaping, and wetland development.	To be determined	To be determined
Site 6 - WJ/6-028	Contaminated site: : environment damaged by soil disturbance, machinery traffic, and probable soil contamination.	Site restoration through soil decontamination, land reshaping, and wetland development.	To be determined	No access road, in the middle of a wetland complex, near the river.
Site 7 – Former dumping ground	Former illegal dumping ground containing around fifteen abandoned cars, old fuel tanks, and various other types of waste.	Site restoration through soil decontamination, land reshaping, and wetland development.	4.0.	In the middle of a wetland complex (machinery traffic).

Project name	Issues	Planned work	Anticipated gain (ha)	Potential challenges
Research Focus				
Creation of conservation areas (AMCE—Other efficient conservation measures)	Project carried out in a peatland complex.	A specialized study on carbon would be conducted, including the MELCCFP's method for quantifying carbon stocks.	To be determined	Determine site location in agreement with all stakeholders.
Knowledge acquisition	Acquire knowledge on the impact of creating a mining project (with an underground component) on the ecological functions and ecosystem services of wetlands in general, and peatlands in particular.	Mapping of plant communities, review of peatland studies, field campaigns for characterization, installation of monitoring devices, hydrological and physicochemical measurements, carbon and groundwater modelling.	To be determined	To be determined

References: (Niigaan. 2025); (MPO, 2025); (Megnan, 2024)

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