



**Environmental and Social Impact
Assessment for the Troilus Mine Project**

CLIMATE (GREENHOUSE GAS
EMISSIONS)

Environmental and Social Impact Assessment for the Troilus Mine Project

CLIMATE (GREENHOUSE GAS EMISSIONS)

TABLE OF CONTENTS

10.	CLIMATE (GREENHOUSE GAS EMISSIONS)	10.1
10.1	SCOPE OF ASSESSMENT	10.1
10.1.1	Regulatory and policy setting	10.2
10.1.2	Influence of consultation and engagement.....	10.3
10.1.3	Potential impacts, pathways and measurable parameters	10.3
10.1.4	Boundaries	10.4
10.1.5	Residual impacts characterization.....	10.4
10.1.6	Significance definition.....	10.5
10.2	EXISTING CONDITIONS	10.6
10.2.1	Overview.....	10.6
10.3	PROJECT INTERACTIONS WITH CLIMATE	10.6
10.4	ASSESSMENT OF RESIDUAL IMPACT ON CLIMATE	10.7
10.4.1	Change in GHG emission releases	10.8
10.4.2	Contribution to Provincial GHG Emissions	10.10
10.4.3	Summary of project residual impacts	10.10
10.4.4	Summary of adverse impact.....	10.11
10.5	CLIMATE RESILIENCE	10.12
10.6	PREDICTION CONFIDENCE	10.15
10.7	REFERENCES.....	10.16

LIST OF TABLES

Table 10.1	Potential impacts, impacts, pathways and measurable parameters for climate	10.3
Table 10.2	Characterization of residual impacts on climate change	10.4
Table 10.3	Project Interactions with Climate Change.....	10.6
Table 10.4	Summary of peak annual GHG emissions during construction (Year -1).....	10.9
Table 10.5	Summary of peak annual GHG emissions during operation (Year 13)	10.10
Table 10.6	Project residual impacts on climate	10.11
Table 10.7	Summary of potential impacts and possible adaptation measures	10.13

Environmental and Social Impact Assessment for the Troilus Mine Project

CLIMATE (GREENHOUSE GAS EMISSIONS)

Acronyms and abbreviations

Ag	Silver
Au	Gold
BAT	Best available technology
BEP	Best Environmental Practices
CCRA	Climate Change Resilience Assessment
CH ₄	Methane
CO ₂	Carbon Dioxide
Cu	Copper
ECCC	Environment and Climate Change Canada
ESIA	Environmental and Social Impact Assessment
GHG	Greenhouse Gas
IPCC	Intergovernmental Panel on Climate Change
MELCC	Ministère de L'Environnement et de la Lutte Contre les Changements Climatiques
MELCCFP	Ministère de L'Environnement et de la Lutte Contre les Changements Climatiques, de la Faune et des Parcs (Ministry of Environment, the Fight Against Climate Change, Wildlife and Parks)
N ₂ O	Nitrous Oxide
NIR	National Inventory Report
RDOCECA	Règlement sur la déclaration obligatoire de certaines émissions de contaminants dans l'atmosphère (Regulation respecting mandatory reporting of certain emissions of contaminants into the atmosphere)
TDR	Technical Data Report
the Guide	Les Changements Climatique et L'Évaluation Environnementale: Guide à l'intention de l'initiateur de projet
the Project	the Troilus Gold Mining Project
the Quantification Document	Guide de quantification des émissions de gaz à effet de serre
VC	Valued component
LQE	Loi sur la qualité de l'environnement (Environmental Quality Act)
PDA	Project Development Area
LSA	Local Study Area
RSA	Regional Study Area

10. Climate (Greenhouse Gas Emissions)

The Troilus Gold Corporation (Troilus) Mine project (the Project) is a mining operation that will take place in Eeyou Istchee James Bay territory, at the site of a former mine. The mine will primarily produce gold (Au), along with copper (Cu) and silver (Ag). As part of the environmental and social impact assessment (ESIA), a greenhouse gas (GHG) emissions assessment was conducted to evaluate the Project's impact on climate change.

10.1 Scope of assessment

As per the Directive sur l'évaluation environnementale du projet Troilus (MELCC, 2022), the Project must identify and quantify annual GHG emissions from Project activities during its lifetime. In accordance with the *Directive*, the project must identify and quantify its annual GHG emissions resulting from its activities throughout its entire lifecycle. The GHG emissions must be quantified considering the best available technology (BAT) and best environmental practices (BEP) for the reduction of GHG emissions.

A GHG is any gas in the atmosphere that absorbs and re-emits infrared radiation, which acts to warm the lower levels of the atmosphere. GHGs can be released from both natural and anthropogenic (human activity) sources (IPCC, 2014). Typical GHG emission sources include volcanoes and fossil fuel combustion.

In Canada, GHGs are estimated and reported annually both on a provincial and federal basis in the National Inventory Report (NIR) published by Environment and Climate Change Canada (ECCC). The national GHG inventory includes the following gases: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), perfluorocarbons, hydrofluorocarbons, sulphur hexafluoride, and nitrogen trifluoride (ECCC, 2025a). This assessment is considering the same set of GHGs as the NIR. For this assessment, the GHGs that may be released during Project activities include mainly CO₂, CH₄, and N₂O. Other GHGs (e.g., hydrofluorocarbons) are not expected to be emitted by the Project in more than negligible quantities. These GHGs are, therefore, excluded from further consideration in this assessment.

The emissions of each of the included GHGs are multiplied by their 100-year global warming potential as determined by the Intergovernmental Panel on Climate Change (IPCC) and are reported as carbon dioxide equivalent (CO₂e). The global warming potential of these GHGs align with the ones applied in the 2025 NIR (ECCC, 2025a):

- CO₂ = 1
- CH₄ = 28
- N₂O = 265

The total mass of CO₂e for the Project is calculated as:

$$CO_2e = (mass\ CO_2 \times 1) + (mass\ CH_4 \times 28) + (mass\ N_2O \times 265)$$

Environmental and Social Impact Assessment for the Troilus Mine Project

CLIMATE (GREENHOUSE GAS EMISSIONS)

CO₂ that is generated from the combustion or decomposition of biomass is part of the carbon cycle; however, this CO₂, when emitted from a facility, is reported separately from CO₂ from fossil fuel combustion.

10.1.1 Regulatory and policy setting

10.1.1.1 Federal

Canada has established legislation, policies, and guidance documents related to GHG emissions. These include:

- Pan Canadian Framework on Clean Growth and Climate Change (ECCC, 2016), which identifies the goal to reduce GHG emissions 30% below 2005 by 2030;
- Greenhouse Gas Reporting Program (ECCC, 2025b), which is a mandatory reporting program for facilities that emit greater than 10,000 tonnes CO₂e annually in Canada;
- Strategic Assessment of Climate Change (ECCC, 2020), which is a framework for assessing whether a Project will hinder or contribute to Canada's emissions reduction targets. Three guidance documents related to GHG emissions quantification, carbon sink impact, net-zero plans, upstream GHG emissions, climate resilience, and best-in-class performance for oil and gas projects;
- Canadian Net Zero Emissions Accountability Act (ECCC, 2021), which establishes national emission reduction targets for 2030, 2035, 2040, and 2045.

10.1.1.2 Provincial

Quebec enacted legislation for the reporting of GHG emissions in 2007 with the Règlement sur la déclaration obligatoire de certaines émissions de contaminants dans l'atmosphère (RDOCECA)¹, under the Loi sur la qualité de l'environnement² (LQE) and the Loi sur certaines mesures permettant d'appliquer les lois en matière d'environnement et de sécurité des barrages. The RDOCECA sets up the reporting of GHG emissions by large industrial emitters in Quebec. The Regulation identifies the GHG emissions reporting threshold as 10 000 t CO₂e per year and the required information to report, including GHG emissions, production amounts, fuel amounts, raw materials, equipment, and processes. The reports are submitted to the Ministère de L'Environnement et de la Lutte Contre les Changements Climatiques, de la Faune et des Parcs (MELCCFP).

Québec published in 2020 the Plan pour une économie verte 2030 (Gouvernement du Québec, 2020). This plan provides a roadmap for Quebec to reach its 2030 target of reducing the provincial GHG emissions by 37.5% compared to the emission levels from 1990. Quebec's 1990 GHG emissions as presented in the 2025 National Inventory Report are 83 590 kt CO₂e; in 2023, Quebec's GHG emissions have decreased by approximately 6% from the 1990 emissions.

¹ Regulation respecting mandatory reporting of certain emissions of contaminants into the atmosphere

² Environmental Quality Act

Environmental and Social Impact Assessment for the Troilus Mine Project

CLIMATE (GREENHOUSE GAS EMISSIONS)

The following guidance documents were used to quantify the GHG emissions and assess the Project's residual impact on climate change, as prescribed by the environmental impact directive for the Troilus Project:

- Les changements climatiques et l'évaluation environnementale: Guide à l'intention de l'initiateur de projet (the Guide) (MELCCFP, 2021) : This guide describes how climate change should be considered as part of the Project's environmental impact assessment;
- Guide de quantification des émissions de gaz à effet de serre (the Quantification Document) (MELCCFP, 2025): This guide presents the methodologies to quantify GHG emissions from the Project.

The contribution of Project annual GHG emissions were compared to the latest available Quebec annual GHG emission total from the National Inventory Report (NIR), published by Environment and Climate Change Canada (ECCC, 2025a), to quantify its contribution relative to the provincial total annual emissions.

10.1.2 Influence of consultation and engagement

Troilus has engaged with the potentially affected Cree and Jamesian communities, regulatory authorities, the public, and others stakeholders. The concerns raised during these consultations did not directly relate to GHG emissions and climate change. Instead, concerns were more frequently related to air quality and disturbances to land users, particularly due to noise and vibration disturbance. Additionally, some concerns about the increased traffic of heavy vehicles on the roads were expressed. Details of the consultation and communication process are presented in Chapter 4 of the ESIA, as well as in Appendix E. Finally, Chapter 8 of the ESIA (Atmospheric Conditions) also provides detailed information on air quality.

This information were considered in evaluating whether the mitigation and enhancement measures proposed by Troilus are sufficient to address the identified potential interactions, or whether additional or refined mitigation measures are needed.

10.1.3 Potential impacts, pathways and measurable parameters

The potential impacts, pathways, and measurable parameters that are relevant to GHG emissions are presented in table 10.1.

Table 10.1 Potential impacts, impacts, pathways and measurable parameters for climate

Potential Impact	Impact Pathway	Measurable Parameters and Units of Measurement
Release of GHGs into the atmosphere	Fossil fuel combustion, third-party electricity production for use at the Project	Emissions of CO ₂ , CH ₄ , and N ₂ O in tonnes, aggregated as tonnes CO ₂ e
Loss of carbon sink capacity	Removal of forest and wetlands	Loss of carbon sink capacity in tonnes carbon.

Environmental and Social Impact Assessment for the Troilus Mine Project

CLIMATE (GREENHOUSE GAS EMISSIONS)

10.1.4 Boundaries

10.1.4.1 Spatial boundaries

Because the GHGs released by the Project will disperse and mix with other GHGs in the global atmosphere, the spatial boundary for potential impacts is global. With respect to Project sources, GHG emissions from activities at the Project itself or at a location that generates electricity for use at the Project are within the spatial boundary for the quantification of GHG emissions.

10.1.4.2 Temporal boundaries

The temporal boundary of the assessment includes the Project phases from the start of construction through to the end of closure. Based on the current Project schedule, the Project phases include:

- Construction (Year -3 to Year -1)
- Operations
 - Operations phase 1 (Year 1 to Year 21): milling with ore extraction
 - Operations phase 2 (Year 22): milling with no ore extraction
- Decommissioning and closure
 - Active closure (Year 22 to Year 24)
 - Passive closure (Year 24+)

Refer to Chapter 3 of the EIES (Project Description) for a detailed description of the activities anticipated to occur during each phase.

10.1.5 Residual impacts characterization

Characteristics that provide context to the Project's residual effects on climate change are presented in Table 10.2.

Table 10.2 Characterization of residual impacts on climate change

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The long-term trend of the residual impact	Positive – a residual impact that moves measurable parameters in a direction beneficial relative to baseline. Adverse – a residual impact that moves measurable parameters in a direction detrimental relative to baseline.
Magnitude	The amount of change in measurable parameters or the VC relative to existing conditions	No Measurable Change – no measurable change in the measurable parameter expected. Low – a measurable change in GHG emissions that does not exceed 1% of Quebec's reported GHG emissions.

Environmental and Social Impact Assessment for the Troilus Mine Project

CLIMATE (GREENHOUSE GAS EMISSIONS)

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
		<p>Moderate – measurable change in GHG emissions that is between 1% to 5% of Quebec's reported GHG emissions.</p> <p>High – measurable change of in GHG emissions that exceed 5% of Quebec's reported GHG emissions.</p>
Geographic Extent	The geographic area in which a residual impact occurs	<p>PDA – residual Impacts are restricted to the PDA</p> <p>LSA – residual Impacts extend into the LSA</p> <p>RSA – residual Impacts extend into the RSA</p> <p>Global – residual Impacts contribute globally</p>
Timing	Considers when the residual impact is expected to occur, where relevant to the VC.	<p>No sensitivity - Impact does not occur during critical life stage (e.g., outside fish spawning or elk calving periods or cultural activity times) or timing does not affect the VC.</p> <p>Moderate sensitivity - Impact may occur during a lower sensitive period of a critical life stage; for many species this is the start (e.g., several days prior to nesting for birds) or end (e.g., periods when birds have fledged but remain in proximity to their nest) of the critical period.</p> <p>High sensitivity - Impact occurs during a critical life stage (e.g., fish spawning or bird nesting periods) or culturally important activities (e.g., plant harvesting or festival time).</p>
Duration	The time required until the measurable parameter or the VC returns to its existing condition, or the residual impact can no longer be measured or otherwise perceived	<p>Short-term – the residual impact is restricted to the Project phase duration that it occurs in</p> <p>Medium-term –the residual impact extends through the Project lifetime</p> <p>Long-term – the residual impact extends beyond the life of the project</p>
Frequency	Identifies how often the residual impact occurs and how often during the project or in a specific phase	<p>Single event</p> <p>Multiple irregular event – occurs at no set schedule</p> <p>Multiple regular event – occurs at regular intervals</p> <p>Continuous – occurs continuously</p>
Reversibility	Pertains to whether a measurable parameter or the VC can return to its existing condition after the project activity ceases	<p>Reversible – the residual impact is likely to be reversed after activity completion and reclamation</p> <p>Irreversible – the residual impact is unlikely to be reversed</p>

10.1.6 Significance definition

Because climate change impacts are global, resulting from many years of GHG emissions, the impact to climate change from a single Project is considered negligible. Nonetheless, the release of GHG emissions is used as a proxy of a Project's contribution to climate change and it is well understood that GHG emissions need to be managed proactively on a global scale. Therefore, the significance of a

Environmental and Social Impact Assessment for the Troilus Mine Project

CLIMATE (GREENHOUSE GAS EMISSIONS)

change in GHG emissions and climate change is stated as the relative contribution of the Project's GHG emissions to 2023 provincial GHG emissions (the latest year of publicly available information) (ECCC, 2025a).

10.2 Existing conditions

10.2.1 Overview

The existing GHG emissions from sources in Quebec were obtained from Environment and Climate Change's NIR for comparison to the Project's GHG emissions. The 2025 NIR presents GHG emissions for the year 2023, which is the last year with published information (ECCC, 2025a). In 2023, Quebec's GHG emissions were 78 931 kilotonnes (kt) CO₂e. Most of these emissions are from the Energy category, including stationary and mobile combustion sources.

10.3 Project interactions with climate

Table 10.3 identifies the physical activities for each potential impact that might interact with the VC and result in the identified impact. These interactions are indicated by a check mark (potential interaction) or a dash (no interaction) and are discussed in detail in Section 10.4 in the context of impacts pathways, standard and project-specific mitigation/enhancement, and residual impacts.

The project activities for each phase are described in the Project Description (Chapter 3 of the impact study). The Project GHG emissions are detailed in the GHG Technical Data Report (TDR) (Appendix H.3 of the impact study).

The potential interactions between Project activities and the environment have been considered for the construction, operation, decommissioning, and closure phases. The identification of project activities and their potential interactions are based on stakeholder engagement, the professional judgment of technical specialists, and the review of existing conditions. The selection of interactions was also guided by potential effects and impact pathways for each VC.

Table 10.3 Project Interactions with climate change

Physical Activities	Impacts GHGs
Construction	
Labour, equipment and materials transport to the site.	–
Vehicles and equipment operation and maintenance within the PDA.	√
Tree cutting, vegetation clearing, soil stripping and earthworks.	√
Handling and use of explosives, including blasting	√
Construction of temporary and permanent buildings, including wastewater treatment system and drinking water collection and distribution system.	√
Construction of mining infrastructures such as stockpiles, pits and the raising of tailings management facility.	√
Construction of roads and preparation of construction surfaces including the crushing of material used for construction. Relocation of a section of the access road and the power line.	√

Environmental and Social Impact Assessment for the Troilus Mine Project

CLIMATE (GREENHOUSE GAS EMISSIONS)

Physical Activities	Impacts GHGs
Construction of water management systems including ditches, diversion channel, sedimentation ponds and the water treatment plant.	√
Dewatering of natural water bodies and pits, lowering water level in tailings management facility and management of contact water.	√
Diversion of Bibou Creek (CE2).	√
Management of waste materials, including hazardous waste.	√
Purchases of goods and services	–
Employment	–
Operation	
Labour, equipment and materials transport to the site.	√
Vehicles and equipment operation and maintenance within the PDA.	√
Handling and use of explosives, including blasting	√
Ore extraction from pits including drilling and hauling of waste rock.	√
Ore, waste rock and tailings storage.	√
Ore processing including conveyor, crushing, loading and hauling on site.	√
Transportation of concentrate to a smelter or a wharf.	√
Management and treatment of water on the mine site and to the environment, including drainage and contact water.	√
Progressive reclamation of disturbed areas.	√
Management of waste materials, including hazardous waste.	√
Purchases of goods and services	–
Employment	–
Decommissioning and Closure	
Labour, equipment and materials transport to the site.	√
Vehicles and equipment operation and maintenance within the PDA.	√
Decommissioning, dismantling and disposal of buildings and equipment.	√
Pits flooding, surface and groundwater management.	√
Reclamation of disturbed areas, including earthworks, placement of overburden and revegetation.	√
Management of waste materials, including hazardous waste.	√
Purchases of goods and services	–
Employment	–

Notes:

√ = Potential interaction

– = No interaction

10.4 Assessment of residual impact on climate

This section describes the techniques and methods used to assess the GHG emissions. Appendix H.3 of the impact study, the GHG TDR, provides further details on the GHG assessment.

The impact of the Project on Climate Change was assessed using GHG emission releases from Project activities as a proxy. A GHG emissions inventory was developed to characterize the GHG emissions from each Project interaction identified in Table 10.3.

Environmental and Social Impact Assessment for the Troilus Mine Project

CLIMATE (GREENHOUSE GAS EMISSIONS)

10.4.1 Change in GHG emission releases

10.4.1.1 Project Pathways

The GHG emissions from the various Project activities are released to the atmosphere thereby impacting the climate change, albeit in a negligible way. The GHG sources from the Project activities are categorized into stationary fuel combustion (e.g., propane-fueled heating processes), transportation (e.g., diesel off-road vehicles), other emissions from blasting and indirect electricity generation, and land-use change (e.g., removal of vegetation). These sources are described below for each Project phase.

Construction

During construction, heavy construction equipment, such as bulldozers, cranes, and excavators will be used to conduct site preparation activities, including land clearing and grading, as well as road and infrastructure development. Blasting using emulsion as explosive is planned to assist with pit development. The combustion of fossil fuels, including in the explosives will release GHG emissions (CO₂, CH₄, N₂O) into the atmosphere.

In addition, the removal of vegetation, which contains carbon, can result in CO₂, CH₄, and N₂O emissions which vary depending on how the vegetation is disposed of (e.g., burning, stockpiling). Although vegetation clearing will continue into the operation phase, the assessment assumed that the Project area will be completely cleared of vegetation during the construction phase as a worse case.

Operation

Heavy mobile mining equipment, such as excavators, will be used to move blasted rock to the processing plant. Blasting will continue into operation to break apart ore-containing rock. Various equipment, including conveyors, the processing facility, and the crusher will be powered by low GHG emitting electricity from the Quebec grid which is mainly from hydroelectric dams. Site maintenance activities such as road grading and stockpile management will also consume fossil fuels. Fossil fuel combustion generates CO₂, CH₄, and N₂O GHG emissions while electricity use generates very few GHGs. Both types of GHGs are estimated and considered in the assessment.

Decommissioning and Closure

During the restoration and closure phase, certain GHG emissions may be released by equipment similar to that used during the construction phase. However, as these activities are scheduled to occur after 22 years of mining operations, it is possible that technologies with lower GHG emissions than diesel—or even zero-emission technologies such as renewable electricity—could be employed.

10.4.1.2 Mitigation and Enhancement Measures

Troilus has proposed mitigation measures to prevent or reduce the project's GHG emissions, as summarized below. These mitigation measures have been incorporated into the emissions estimates used in the GHG assessment. Details of the assumptions related to these measures, their effectiveness

Environmental and Social Impact Assessment for the Troilus Mine Project

CLIMATE (GREENHOUSE GAS EMISSIONS)

in reducing GHG emissions, and how they were applied in the emissions estimation are outlined in Section 4.7 of the GHG TDR (appendix H.3).

Troilus will implement the following GHG mitigation measures:

- Optimization of blasting practices (e.g., type, timing sequence, and blasting patterns);
- Limit speed on secondary roads to 50 km/h;
- Vehicle maintenance to improve energy efficiency;
- Acquire mobile equipment that meets Transport Canada’s off-road vehicle emission requirements (Tier 4 emission standards), where possible;
- Implement effective and timely vehicle maintenance to keep equipment in good working condition;
- Implement an idling policy on-site for mobile equipment and vehicles;
- Road network design and operational scheduling to reduce transport distances;
- Connect the mine to Quebec electricity grid;
- Use diesel with biodiesel blend.

10.4.1.3 Project residual impact

GHG emissions from construction activities in Year-1 are presented in Tableau 10.4. Year -1 emissions are presented because fuel use during this year is anticipated to be the highest during construction. The full amount of GHG emissions from land-use change over the lifetime of the Project have been conservatively assumed to occur during Year -1.

Table 10.4 Summary of peak annual GHG emissions during construction (Year -1)

Source Category	CO ₂ (t CO ₂ e)	CH ₄ (t CO ₂ e)	N ₂ O (t CO ₂ e)	CO ₂ e (t CO ₂ e)
Stationary Fuel Combustion	2,690	1.4	44	2,735
Transportation	63,754	52	188	63,994
Other Emissions	2,206	-	-	2,271
Blasting	2,206	-	-	2,206
Electricity	-	-	-	64
CO ₂ Emissions from Biomass	1,997,954	-	-	1,997,954
Biodiesel	3,590	-	-	3,590
Land-Use Change	1,994,364	-	-	1,994,364
Total Excluding Biomass	68,650	54	232	69,000

Notes:

Totals may not add up due to rounding, “-“ means not applicable

The Project peak annual GHG emissions during construction, excluding CO₂ emissions from biomass, are expected to be 69,000 t CO₂e.

Environmental and Social Impact Assessment for the Troilus Mine Project

CLIMATE (GREENHOUSE GAS EMISSIONS)

GHG emissions from operation activities in Year 13 are presented in table 10.5. Year 13 emissions are presented because fuel use is anticipated to be the highest in this year over the operation period.

Table 10.5 Summary of peak annual GHG emissions during operation (Year 13)

Source Category	CO ₂ (t CO ₂ e)	CH ₄ (t CO ₂ e)	N ₂ O (t CO ₂ e)	CO ₂ e (t CO ₂ e)
Stationary Fuel Combustion	18,362	8.3	340	18,710
Transportation	133,509	109	348	133,965
Other Emissions	4,549	-	-	5,737
Blasting	4,549	-	-	4,549
Electricity (indirect)	-	-	-	1,187
CO ₂ Emissions from Biomass (Biodiesel)	7,494	-	-	7,494
Total Excluding Biomass	156,420	117	688	158,412

Notes :

Totals may not add up due to rounding

“-“ means not applicable

The Project peak annual GHG emissions during operation, excluding CO₂ emissions from biomass, are expected to be 158,412 t CO₂e.

During decommissioning and closure, some GHG emissions may be released by similar equipment as during construction. However, because decommissioning and closure are expected to take place after 22 years of mine operation, technologies that generate fewer GHG emissions than diesel or that generate no GHG emissions (such as renewable electricity) may be used. As a conservative estimate, GHG emissions during decommissioning and closure are assumed to be no more than those from construction emissions, excluding emissions from land-use change and blasting which would not occur during decommissioning.

Detailed on how the GHG emissions were calculated can be found in Section 5 of the GHG TDR (appendix H.3).

10.4.2 Contribution to provincial GHG emissions

Quebec's estimated GHG emissions as published in the 1990–2023 National Inventory Report are 78 931 kt CO₂e in 2023 (ECCC, 2025a). The peak annual GHG emissions associated with the Project's construction period (represented by Year -1) represent approximately 0,09% of Quebec's 2023 GHG emissions. The peak annual GHG emissions associated with the Project's operation period (represented by Year 13) represent approximately 0,20% of Quebec's 2023 GHG emissions.

The Project will release GHG emissions during 2030 and 2050. However, based on the Project's small contribution to the Quebec provincial GHG emissions, the Project is not a substantive barrier to Quebec meeting its 2030 emission reduction target.

10.4.3 Summary of project residual impacts

Table 10.6 summarizes project residual impacts on Climate.

Environmental and Social Impact Assessment for the Troilus Mine Project

CLIMATE (GREENHOUSE GAS EMISSIONS)

Table 10.6 Project residual impacts on climate

Residual Impact	Residual Impact Characterization							
	Project Phase	Direction	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
GHGs	C	A	L	G	NS	LT	C	I
	O	A	L	G	NS	LT	C	I
	D	A	L	G	NS	LT	C	I

KEY

See Table 10.2 for detailed definitions

Project Phase

C: Construction

O: Operation

D: Decommissioning and closure

Direction:

P: Positive

A: Adverse

Magnitude:

NMC: No Measurable Change

L: Low

M: Moderate

H: High

Geographic Extent:

PDA: Project Development Area

LSA: Local Study Area

RSA: Regional Study Area

G: Global

Timing

NS: No sensitivity

MS: Moderate sensitivity

HS: High sensitivity

Duration:

ST: Short-term

MT: Medium-term

LT: Long-term

N/A: Not applicable

Frequency:

S: Single event

IR: Irregular event

R: Regular event

C: Continuous

Reversibility:

R: Reversible

I: Irreversible

In addition to the residual effects from GHG emissions, a conservative estimate of the Project’s impact on carbon sinks was made. Because of the Project’s removal of forest land and potential removal of wetlands, approximately 132,976 t CO₂ may not be removed from the atmosphere from the growth of trees and wetland sequestration. This estimate assumed that the sequestration would take place over 100 years; however, this is likely overestimating the amount of time needed for the forest land to return to same condition as it was before the Project. Details on the carbon sink impact assessment can be found in Section 6.1 of the GHG TDR (Appendix H.3).

10.4.4 Summary of adverse impact

The Project residual impact on climate change is not significant. With the proposed mitigation measures integrated into the Project, the relative contribution of the Project’s GHG emissions to provincial GHG emissions are expected to be low in magnitude for all project phases and does not hinder the ability of Quebec to achieve their GHG reduction targets for 2030 and 2050.

10.5 Climate resilience

Local meteorology, extreme weather events, and applicable environmental protection and design measures were considered in Chapter 3 (project Description), Sections 3.16 et 3.17.

Climate change resilience is the ability of a system (built, natural, social or economic) to anticipate, withstand, recover, adapt to and transform in response to climate-related hazards (ECCC, 2020). Climate change may alter the likelihood or magnitude of sudden weather events such as extreme precipitation that can contribute to flooding, as well as contribute to longer-term changes such as sea level rise, permafrost thaw and changes to migration patterns. If not properly considered, such changes may cause issues such as equipment failures that can threaten the environment, human health and safety, interrupt essential services, disrupt economic activity, and require high costs for recovery and replacement. A climate change resilience assessment (CCRA) was conducted to assess risks to the Project due to climate change and to identify adaptation options to mitigate those risks. The CCRA identifies the climate risks to the Project at a broad systems-level based on a future climate scenario and provides a discussion of the potential climate impacts on the Project over its construction and operation life. The assessment is intended to inform the design and project management team of projected changes in climate and associated risks to consider at the Project's detailed design stage, and to highlight climate change impacts on the Project operation throughout the life of the Project.

Climate hazards are the climate variables that can impact the Project infrastructure components. The climate hazards used for the resilience assessment were chosen based on experience with previous climate resilience studies for similar types of Project infrastructure, as well as information provided as part of the Impact Assessment process and from Project designers. The climate hazards included in the CCRA include:

- Higher air temperature, which can lead to increased maintenance requirements of infrastructure components and increased discomfort for personnel;
- Increase in winter thawing frequency, which can increase maintenance requirements for walkways, roadways, and can increase slip and fall risks for personnel;
- More frequent and intense rains, which can cause local flooding, can lead to structural damage of the infrastructure components, and can result in increased maintenance requirements;
- More significant wildfires, which can lead to the structural damages to the Project or reduce facility operation or Site access;
- Changes in the hydrologic regime, which can reduce water availability for the Project as well as the environment;

A summary of the assessed hazards, the impact on the Project and on the environment, as well as possible adaptation measures are presented in table 10.7

Environmental and Social Impact Assessment for the Troilus Mine Project

CLIMATE (GREENHOUSE GAS EMISSIONS)

Table 10.7 Summary of potential impacts and possible adaptation measures

Potential Hazard Affecting the Project or Its Environment	Further details on the climate hazard, if applicable	Category of Project Assets / Processes Potentially Affected by the Hazard	Potential Impacts		Possible Adaptation Measures
			Potential consequences on specific project components		
			Effect of the Climate on the Project	Effect of the project on the environment	
More frequent and Intense Heavy Precipitation	Heavy Precipitation	Excavation and Construction Activities	<ul style="list-style-type: none"> • Collapse of storage piles; • Localized flooding on site; • Increased erosion of roads and storage piles; • Increased water in pits, increased need for dewatering; • Failure of pit walls. 	<ul style="list-style-type: none"> • Increased suspended solids in streams and watercourses • Soil saturation leading to landslides or ground movement. 	<ul style="list-style-type: none"> • Analysis and adjustments to the water management plan based on projected rainfall increases (+20 mm in spring to +45 mm in autumn); • Adjustment of recent climate projection data for HEC-HMS modeling; • More frequent inspections of road and infrastructure conditions; • Consideration of a greater-than-anticipated need for stockpile management and preparing the stockpile in the event of heavy rainfall; • Development and implementation of an erosion and sediment control plan to minimize the environmental impact of intense precipitation; • Planning for the progressive rehabilitation of the tailings facility to reduce runoff and erosion during extreme rainfall events.
		Transport and Handling	<ul style="list-style-type: none"> • Water runoff on roads • Additional grading and maintenance required 	<ul style="list-style-type: none"> • Accumulation and movement of sediment in the environment from roads. 	
		Processing and Handling	<ul style="list-style-type: none"> • Increased load on the water management system (diversion systems and collection ponds) 	<ul style="list-style-type: none"> • System capacity exceedance, leading to the discharge of untreated water into the environment 	
	Heavy Snowfall	Transport	<ul style="list-style-type: none"> • Road closure, slowdown in workers and resources transportation • Increased risk of road accidents 		
		Processing and Handling	<ul style="list-style-type: none"> • Increased resource requirements for the dewatering system (time and energy): snow accumulating in the pits to be removed with the excavated materials or left to melt and be drained toward the mine sump 	<ul style="list-style-type: none"> • Potential discharge and release of contaminated snow into the environment 	
		Built environment	<ul style="list-style-type: none"> • Increased load on rooftops, raising the risk of roof failure. 		
	Freezing Rain	Processing and Handling	<ul style="list-style-type: none"> • Reduced efficiency of water management system • Increased risk of damage to power transmission lines and power outages 		
Change in Hydrological Regime		Processing and Handling	<ul style="list-style-type: none"> • Increased surface water during melt periods, causing localized flooding on site" • Variation in water availability and quality during prolonged droughts or extreme precipitation 	<ul style="list-style-type: none"> • Exceedance of collection basin capacity during rapid snowmelt in the spring freshet , potentially leading to overflows and environmental discharges. 	<ul style="list-style-type: none"> • Consider the most recent climate change projections and conduct monitoring of site-specific hydrological behavior to prevent potential impacts.
More frequent winter thaws	Ice formation	Processing and Handling	<ul style="list-style-type: none"> • Freeze-thaw events can result in inefficient drainage system the 		<ul style="list-style-type: none"> • Schedule regular inspections to ensure proper drainage (when frost is expected)
	Deep freeze-thaw cycles	Transport	<ul style="list-style-type: none"> • Freeze-thaw cycles can affect road and outdoor infrastructures, reducing their service life 		<ul style="list-style-type: none"> • Schedule regular inspections to ensure road conditions are maintained.

Environmental and Social Impact Assessment for the Troilus Mine Project

CLIMATE (GREENHOUSE GAS EMISSIONS)

Potential Hazard Affecting the Project or Its Environment	Further details on the climate hazard, if applicable	Category of Project Assets / Processes Potentially Affected by the Hazard	Potential Impacts		Possible Adaptation Measures
			Potential consequences on specific project components		
			Effect of the Climate on the Project	Effect of the project on the environment	
	Cycles de gel-dégel profond combiné avec le phénomène de carbonatation	Built environment	<ul style="list-style-type: none"> Freeze-thaw cycles may affect concrete infrastructures and reduce their service life 		<ul style="list-style-type: none"> Cure the concrete in properly for greater durability against climatic consequences; Plan regular inspections every five years to assess the condition of concrete surfaces (buildings); Select high cement content in concrete to improve material durability (400 to 420 kg of cement/m³ [35 MPa]) and reduce the water/cement ratio (target maximum of 0.40). Concrete permeability and exposure to corrosive agents can be slowed down by bitumen in a simple, cost-effective way 50\$/5 gal US – covers 635 ft² for an approximative service life of 10–20 years).
Higher air temperature		Processing and Handling	<ul style="list-style-type: none"> Increased maintenance needs and risk of failure; Increased evapotranspiration, potentially accelerating the reduction of water levels in collection ponds and decreasing the volume of water requiring treatment before being discharged into the environment 	<ul style="list-style-type: none"> Increase in flying dust emissions due to higher evaporation rates, negatively impacting air quality. 	<ul style="list-style-type: none"> Adjust recent climate projection data and consider the increase in heatwaves across the region (+12 days above 30 °C) in the design of energy requirements at all levels of the process and throughout the built environment.
		Built environment	<ul style="list-style-type: none"> Increased demand for cooling Heating, Ventilating, and Air Conditioning (HVAC) systems in building, which may result in insufficient cooling capacity to consistently maintain building setpoints and ensure adequate comfort levels for personnel Increased risk of wildfires 		
More frequent wildfires		Processing, Transport and Handling	<ul style="list-style-type: none"> Evacuation of the mine and suspension of operation; Road closures; High levels of particulates posing a risk to workers and potentially affecting mine operations and productivity. 		<ul style="list-style-type: none"> Require mandatory safety orientation for all new employees. Training should include fuel handling, equipment maintenance, and fire prevention and response measures; Maintain on-site fire prevention and suppression systems, including water reserves, sprinklers, fire extinguishers and other firefighting equipment. Flammable materials (such as fuels and explosives) must be carefully managed on site. Maintain sufficient water levels for on-site firefighting. Explore the possibility of establishing on-demand forest fires suppression capacity (City of Chapais's experience during the 2023 wildfires).

10.6 Prediction confidence

The prediction confidence for residual impact on climate change from GHG emissions are based on the accuracy of the project design information and emission factors. The project information is well documented, the emissions factors come from established references from provincial and federal GHG programs, and the calculations use conservative assumptions. Also, as GHG emissions influence climate change on a global scale and Canada as a whole is a small contributor globally with Quebec being a small contributor to national emissions (approximately 11% of national emissions), the confidence in the overall prediction on the significance of the effects of the project on climate change is high.

Environmental and Social Impact Assessment for the Troilus Mine Project

CLIMATE (GREENHOUSE GAS EMISSIONS)

10.7 References

- BluMetric – Stantec. 2025. Projet minier Troilus – Évaluation des effets potentiels des changements climatiques sur le projet; May 30, 2025.
- ECCC (Environment and Climate Change Canada). 2016. PAN-CANADIAN FRAMEWORK. on Clean Growth and Climate Change. 2016. Available at: https://publications.gc.ca/collections/collection_2017/eccc/En4-294-2016-eng.pdf. Accessed June 2025.
- ECCC. 2020. Strategic Assessment of Climate Change. Available at : <https://www.strategicasessmentclimatechange.ca/>. Accessed Juin 2025.
- ECCC. 2021. Canadian Net-Zero Emissions Accountability Act. S.C. 2021, C. 22. Assented to 2021-06-29. Available at: <https://laws-lois.justice.gc.ca/eng/acts/c-19.3/fulltext.html>. Accessed Juin 2025.
- ECCC. 2025a. National Inventory Report 1990–2023: Greenhouse Gas Sources and Sinks in Canada. 2025. Available at: https://publications.gc.ca/collections/collection_2025/eccc/En81-4-2023-1-eng.pdf. Accessed Juin 2025.
- ECCC. 2025b. Reporting greenhouse gas emissions. Available at : <https://www.canada.ca/en/environment-climate-change/services/climate-change/greenhouse-gas-emissions/facility-reporting/reporting.html>. Accessed Juin 2025.
- Gouvernement du Québec. 2020. Plan pour une économie verte 2030. Available at: <https://cdn-contenu.quebec.ca/cdn-contenu/adm/min/environnement/publications-adm/plan-economie-verte/plan-economie-verte-2030.pdf>. Accessed June 2025.
- IPCC (Intergovernmental Panel on Climate Change). 2014. In: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyers (eds.)]. IPCC, Switzerland, 151 pp. Available online at: [AR5 Synthesis Report - Climate Change 2014](#). Accessed June 2025.
- MELCC (Ministère de L'Environnement et de la Lutte Contre les Changements Climatiques). 2021. Les Changements Climatique et L'Évaluation Environnementale: Guide à l'intention de l'initiateur de projet. Available online at : <https://www.environnement.gouv.qc.ca/evaluations/directive-etude-impact/guide-intention-initiateur-projet.pdf>. Accessed June 2025.
- MELCC. 2022. Direction générale de l'évaluation environnementale et stratégique. August 2022. N/Réf : 3214-14-025.
- MELCCFP. 2025. Guide de quantification des émissions de gaz à effet de serre. Available online at : <https://www.environnement.gouv.qc.ca/changements/ges/guide-quantification/guide-quantification-ges.pdf>. Accessed June 2025.