



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

ENVIRONMENTAL AND SOCIAL
MONITORING AND FOLLOW-UP
PROGRAM

Environmental and Social Impact Assessment for the Troilus Mine Project

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Acronyms and abbreviations

Ag	Silver
Al	Aluminum
As	Arsenic
B	Boron
Ba	Barium
Be	Beryllium
Bi	Bismuth
Ca	Calcium
Cd	Cadmium
CEAEQ	Center d'expertise en analyse environnementale du Québec
CN	Cyanide
Co	Cobalt
Cr	Chromium
Cu	Copper
D019	Directive 019
DFO	Department of Fisheries and Oceans
ECCC	Environment and Climate Change Canada
EEM	Environmental Effects Monitoring
ESIA	Environmental and Social Impact Assessment
Fe	Iron
GHG	Greenhouse gas
GHGRP	Greenhouse Gas Emissions Reporting Program
GPS	Global Positioning System
Hg	Mercury
IEA	International Energy Agency
IES	Invasive exotic species
ISO	International Organization for Standardization
K	Potassium
km ²	Square kilometer
Li	Lithium
LSA	Local Study Area
MDMER	Metal and Diamond Mining Effluent Regulations
MELCCFP	Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs (Ministry of the Environment, the Fight against Climate Change, Wildlife and Parks)
Mg	Magnesium
Mn	Manganese
Mo	Molybdenum
MRNF	Ministère des Ressources naturelles et des Forêts (Ministry of Natural Resources and Forests)
Na	Sodium

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Ni	Nickel
OER	Environmental discharge objectives (objectifs environnementaux de rejet)
P	Phosphorus
PDA	Project Development Area
Pb	Lead
pH	Hydrogen Potential
PM10	Airborne particles less than or equal to 10 micrometers (μm) in diameter.
RAA	Clean Air Regulation (Règlement sur l'assainissement de l'atmosphère)
RDOCECA	Regulation respecting mandatory reporting of certain emissions of contaminants into the atmosphere (Règlement sur la déclaration obligatoire de certaines émissions de contaminants dans l'atmosphère)
S	Sulfur
Sb	Antimony
Sc	Scandium
Se	Selenium
Si	Silicon
Sn	Tin
Sr	Strontium
SS	Suspended solids
SSSE	Health, safety, security and environment
Ti	Titanium
Tl	Thallium
TSP	Total suspended particules
U	Uranium
$\mu\text{g/l}$	Microgram per liter
V	Vanadium
VC	Valued Components
Zn	Zinc

30. Environmental and social monitoring program

30.1 Environmental monitoring program

30.1.1 Objectives

The purpose of environmental monitoring will be to ensure implementation of:

- The requirements of relevant laws and regulations;
- Measures proposed in the environmental and social impact assessment (ESIA), including mitigation or compensation measures;
- Established environmental procedures;
- Commitments set out in ministerial authorizations;
- Conditions set out in the ministerial authorizations.

The monitoring program will enable Troilus Gold Corp (Troilus) to verify the proper operation of the work, equipment and facilities, and to monitor any environmental disturbance caused by the construction, operation, closure or dismantling of the project. This program will make it possible, if necessary, to redirect the work and possibly improve the progress of construction and installation of the various project components.

30.1.2 Application and project phases

The environmental monitoring program will be applied by Troilus from the start of the project's pre-construction phase and will be continued during the construction, operation and restoration phases.

30.1.2.1 Pre-construction

The pre-construction phase consists of planning activities prior to construction work. These activities include :

- Permit applications: these involve requests for authorization to clear land, prepare the site and build the various project structures. These permits will be issued by the various provincial and federal ministries concerned;
- Detailed engineering: this stage involves issuing plans and specifications for tendering and construction;
- Preparation of tender documents (including checking compliance and adding specific mitigation measures to the follow-up plan) and awarding of contracts.

30.1.2.2 Construction

There is a great deal of work to be carried out during the construction phase, necessitating increased environmental monitoring.

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The main activities associated with the construction phase are as follows:

- Deforestation;
- Site preparation: excavation, backfilling, rock blasting for earthworks;
- Construction of access roads;
- Installation of water supply facilities;
- Modifications to electrical distribution network installations;
- Construction of ore processing infrastructure;
- Construction of service buildings;
- Development of the fuel farm;
- Construction of the explosives warehouse;
- Installation of wastewater and drinking water treatment systems;
- Water management structures;
- Excavation of extraction pits;
- Expansion of the tailings facility;
- Installation of tailings lines.

The main environmental concerns in this phase concern water management, air quality including dust emissions, protection of fish and fish habitat, protection of wildlife and wildlife habitat, protection of wetlands and water bodies, and user safety on the access road. Noise is also a concern that will be assessed.

30.1.2.3 Operation and maintenance

The operation and maintenance phase is the mining activity itself: ore extraction, ore processing, concentrate transportation, tailings management, final effluent treatment and discharge.

The main environmental issues associated with operation and maintenance activities are tailings management and mine wastewater management. To these must be added issues related to dust and noise management, which are likely to be generated as much by extraction activities (drilling and blasting) as by transportation activities.

30.1.2.4 Restoration

The end of mining operations will mark the start of the infrastructure dismantling and site restoration phase. It should be noted that Troilus will carry out progressive reclamation during the operation and maintenance phase, particularly for the tailing's storage facility.

The objective of the restoration phase is to return the mine site to a satisfactory state, i.e.:

- Eliminating unacceptable risks to human health and safety;



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- Limit the production and spread of substances likely to harm the receiving environment and, in the long term, aim to eliminate all forms of maintenance and monitoring;
- To restore the site to a condition that is visually acceptable to the land users and communities;
- Restore the infrastructure site to a condition compatible with future land use.

The restoration phase is divided into two periods: post-operation and post-restoration.

Post-operational activities involve dismantling and demobilizing infrastructure and equipment on the property, rehabilitating accumulation areas and affected surfaces, securing exposed openings, and revegetating affected areas. The main environmental issues are similar to those described for the construction phase.

Post-restoration monitoring will include monitoring of the integrity of the mining infrastructure, re-vegetation and the environmental monitoring of effluents and the surrounding receiving environment. During this period, the main environmental issues during this phase are water quality and dust management.

30.1.2.5 Monitoring

In the pre-construction phase, environmental monitoring will cover the following aspects:

- Verify that the necessary authorizations and permits are obtained before the start of construction activities;
- Ensure that all site personnel are aware of environmental concerns, environmental protection measures and emergency measures;
- Establish the role and authority of each person, based on a hierarchical system, to deal with unforeseen situations or non-compliances, and implement appropriate preventive and corrective measures;
- Establish the measures that contractors will have to apply to protect the environment, according to their respective activities;

Prior to any construction, a team of experienced supervisors will be formed to adequately monitor the execution of the work.

Together with the main contractor, site and environmental managers will oversee site meetings, the first of which will take place at the very start of construction. The purpose of these meetings will be to inform and raise awareness among site personnel of the environmental and safety rules and provisions to be observed throughout the construction period, and of the general operation of monitoring activities.

Environmental site monitoring will make it possible to document and monitor construction activities, to take decisions where necessary on the resolution of non-compliance situations, and to implement corrective actions or preventive measures to ensure that these non-compliances are not reproduced.

In general, the person in charge of environmental monitoring will have to make regular visits to the work areas, take note of the compliance checklists performed by those involved with the various commitments,

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obligations, measures and other requirements, evaluate the quality and effectiveness of the measures applied, and note any non-conformities observed. He will then report his observations to the site manager, so that appropriate corrective measures can be taken as soon as possible.

All the environmental monitor's observations will be recorded on follow-up sheets for each project component. Photographs will be attached to facilitate understanding of any measures not implemented and corrective actions taken.

Contractors will be required to comply with Troilus' instructions and procedures regarding scheduled site activities and the protection of the environment and surrounding communities. Contractors will also comply with Troilus policies on the employment of Cree workers, the code of conduct and respect for cultural differences.

During the operation and maintenance phase, environmental monitoring will consist of verifying the integration of mitigation measures into the project, and the implementation of the environmental monitoring program in compliance with regulatory requirements and Troilus' commitments.

More specifically, the environmental monitoring team will ensure compliance with mitigation measures, as well as the maintenance of data banks and controls to support studies and other follow-up required in correlation with these same mitigation measures.

This continuous monitoring will be integrated into operations management so that specific mitigation measures can be applied when required. The use of continuous monitoring will make it possible to identify when or for how long the implementation of measures based on modulation or interruption of activities on the mine site (reduction of activities in a sector, avoidance of a sector at a given period, use of equipment with specific characteristics, etc.) will be required.

Site restoration will involve dismantling facilities and infrastructure. Environmental monitoring procedures applicable during the restoration phase will be similar to those planned for the construction phase. They will be used to ensure that the work is proceeding smoothly, and to intervene in the event of a particular situation.

The monitoring team will also be responsible for implementing the environmental monitoring program for the post-operational period, which will be similar to that for the operation and maintenance phase, as well as the post-restoration monitoring program.

Monitoring and follow-up during the restoration phase will make it possible to verify the apprehended impacts and to ensure the smooth running and success of the restoration plan implemented.

30.1.3 Adaptive and change management

Troilus will rigorously monitor the implementation of the environmental monitoring program to ensure compliance with the standards that will govern its activities on the mine site. This ongoing monitoring will be integrated into operations management so that specific mitigation measures can be applied when required.

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Should circumstances change, the site manager will ensure that the program is revised so that it remains appropriate to the impacts and risks associated with the site and activities carried out. Changes will be documented, communicated to the relevant authorities, communities and organizations, and approved prior to implementation. The monitoring plan will also be revised in the event of adverse events or incidents, to ensure that appropriate measures are taken to prevent recurrence. Conversely, Troilus may ask to withdraw or modify the application of certain measures after demonstrating to federal and provincial authorities that they are no longer necessary to achieve environmental protection objectives. The division of responsibilities will be kept up to date as the project develops.

It should be noted that all documents and files concerning environmental issues will be kept in an appropriate information management system to ensure a clear history of procedures and interventions.

In addition, Troilus will promote environmental awareness training for personnel and will strive to employ resources with the skills and experience required to perform environmental functions.

An adaptive management plan may be justified in addition to a monitoring program if it meets each of the following criteria:

1. There is considerable uncertainty as to the effectiveness of mitigation measures or predicted impacts;
2. It is necessary or advantageous to reduce uncertainties through an adaptive management plan;
3. Adaptive management is technically feasible.

Based on the information provided in the Valued Component-specific assessments presented in Chapter 25 of the ESIA, although the concept of adaptive management has been integrated into the monitoring programs, no adaptive management plan is proposed.

Depending on the observations resulting from the follow-up program, adaptive management will be integrated into this program so that the results of impact verification and the evaluation of mitigation measures can be used to improve the avoidance, reduction, restoration or compensation of impacts.

30.2 Environmental and social monitoring program

30.2.1 Objectives

The follow-up program aims to:

- Ensure compliance with regulatory and legal requirements and conditions applicable to future mine site activities as determined by the responsible authority;
- Monitor the environmental impacts identified in the environmental assessment;
- Verify the effectiveness of mitigation measures in view of modifying them or implementing new measures, if necessary;
- Establish measurement methods, execution plan, quality control plan and sampling schedule to obtain relevant data that will be published to reassure communities of interest. The data obtained will make it possible to assess the effectiveness of the design and mitigation measures implemented, and to adjust where necessary;

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- Encourage the implementation of adaptive management measures to deal with unforeseen adverse environmental impacts.

Land users will be involved as much as possible in environmental and social monitoring activities. They will also be involved in discussions and interventions involving wildlife resources in the mining project area.

The environmental and social follow-up program will be completed later, following project authorization.

30.2.2 Air quality monitoring

Objective

The objective of this monitoring program is to measure the impact of mining activities on air quality, and to ensure compliance with applicable standards and criteria (*Normes et critères québécois de qualité de l'atmosphère* of the Ministry of Environment, the Fight Against Climate Change, Wildlife and Parks [MELCCFP]). This program, developed by WSP Canada, aims to characterize the concentrations of pollutants of interest in the area of the Troilus facilities.

Study area

The study area for the air quality monitoring program corresponds to the Project Development Area (PDA). Depending on feedback from land users during operations, additional stations may be added.

Monitoring activities

The project's air quality monitoring program is based on the installation of two air sampling stations on the project site.

The stations will be positioned to optimize, as far as possible, compliance with the following good practice criteria:

- Located at least 100 m from a major watercourse or basin;
- Located at least twice the height of windbreaks;
- Located so that sampling nozzles or collection points are at least 2 m above ground level;
- Located at least 10 m from a road;
- Located at least 30 m from a non-vegetated surface likely to emit dust;
- Located at least 20 m from the footprint of tree foliage.

The ambient air quality monitoring program is a dynamic tool that can be adapted to operating conditions. Consequently, the location of the station may evolve according to operating conditions or the conditions of the receiving environment. Any changes to the monitoring station location required during the operating phase will be submitted to the MELCCFP for approval. A brief description of the station location is

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presented in Table 30.1. The proposed coordinates are indicative and may be modified according to technical constraints, including access to electrical power.

Table 30.1 Air quality monitoring station

Designation	Description of location	UTM zone 18 coordinates	
		X (m)	Y (m)
Troilus-air1	Northeast boundary	539088 m E	5652421 m N
Troilus-air2	Southern limit	535364 m E	5648305 m N

Whenever possible, sampling station sites will be set up in accordance with the Guidelines for Air Quality Monitoring Network Stations (Centre d'expertise en analyse environnementale du Québec [CEAEQ], 2013).

If a sound climate measurement station is located near an ambient air sampling station, the noise emitted by the latter's instruments must not interfere with sound climate monitoring.

Breathable particles PM10 will not be sampled during the initial characterization; particle characterization will be based on sampling of total particles and PM2.5. PM10 sampling may be added during project operation. Metals for which the standard or criterion is based on PM10 respirable particles will be assessed by conservatively comparing the concentrations of these metals in total particles with the value of the standard or criterion established for PM10 particles.

Equipment will be calibrated according to the manufacturer's recommendations. Certificates of analysis from approved laboratories and proof of equipment calibration will be kept.

In compliance with section 201 of the Clean Air Regulation (RAA), the analyses required to ensure the application of this by-law must be performed by a laboratory approved by the MELCCFP under section 118.6 of the LQE. Where there is no such accredited laboratory for the analysis of a targeted substance, the samples taken will be sent to a laboratory that meets the ISO/CEI 17025 standard.

Table 30.2 Methodology by substance

Substance	Designation	Sampling method	Frequency	Duration	Reference method
Total suspended particules	TSP	Sequential, high air flow	Every 6 days	24 hours	Environment Canada EPS 1-AP-73-2 method
Metals	Per metal element	Sequential, high air flow	Every 6 days	24 hours	Combined with sequential TSP sampling
Crystalline silica	Silica	Sequential, low air flow, PM4 selective head	Every 12 days	96 hours	Modified CARB method; NIOSH 7500 analysis
Fine particles PM2.5	PM2.5	Sequential, low air flow, PM2.5 selective head	Every 6 days	24 hours	Method RFPS-1014-219 or equivalent

In addition to the installation and operation of air quality sampling stations, Troilus' monitoring will also include meteorological data collection, dust deposition and dust collector emission measurements.

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Air quality sampling results will be compiled and compared with both Quebec standards and Canadian air quality objectives.

To complement this program, a sampling specification will be drawn up based on the equipment selected and the installation configurations at the station sites. This estimate will include operating and maintenance procedures based on the equipment selected and manufacturers' recommendations.

Implementation schedule

Air quality monitoring will be carried out during the construction and operation phases of the project.

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30.2.3 Greenhouse gas emissions monitoring

In order to accurately quantify actual greenhouse gas (GHG) emissions generated by project activities, Troilus will implement a structured GHG monitoring program that complies with regulatory requirements and international best practices. This program will aim to document both direct and indirect emissions.

Implementation of the monitoring program will include:

- Consolidation, by Valued Component (VC), of the mitigation measures and commitments described in the ESIA;
- Integration of additional mitigation measures and commitments resulting from public consultations conducted by the provincial and federal governments;
- Development of a follow-up schedule for critical construction and operation periods, based on the schedule established during the detailed engineering phase;
- Preparation of a monitoring booklet describing the data collection process, quality control and management system;
- The design of monitoring sheets and reports adapted to the collection of GHG data.

Troilus will collect data on fuel consumption and energy sources associated with equipment and processes. Data collection will continue monthly. Fuels and other energy sources identified during the design phase of the project are listed below.

- Stationary combustion
 - Diesel combustion from equipment such as lighting systems
 - Propane combustion for heating numerous areas of the mine
- Mobile combustion
 - Diesel combustion for off-road and road vehicles
- Use of explosives
 - Consumption of fossil fuels used in explosives
- Indirect emissions linked to electricity consumption
 - Electricity consumption from various infrastructures and processes.

These data will be used with recognized emission factors, including those published by the Regulation respecting mandatory reporting of certain emissions of contaminants into the atmosphere (RDOCECA; RLRQ, Q-2, r. 15) and Environment and Climate Change Canada (ECCC), to ensure an accurate and reproducible calculation of GHG emissions. Troilus will estimate annual GHG emissions to determine whether the facility meets the reporting thresholds of RDOCECA and ECCC's Greenhouse Gas Emissions Reporting Program (GHGRP).

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This monitoring program will be enhanced when all project elements are better defined. It will be completed, if necessary, following project authorization.

30.2.4 Geotechnical monitoring

A geotechnical monitoring program will be established for the tailings facility.

The purpose of the monitoring program is to confirm assumptions made regarding geological interpretations, and to detect unexpected conditions early enough for corrective action to be taken.

As operations continue and more data become available, assumptions can be checked and recommendations can be verified and possibly modified to reflect actual field conditions.

The effectiveness of the monitoring program relies on the efforts of team members to review data, understand potential instability mechanisms within the tailings facility, and be attentive and responsive to any changes in data trends.

The team will be responsible for:

- Planning safe access routes for data collection;
- Ensuring that access roads are maintained and that slope conditions are respected;
- Ensure compliance with health, safety, security and environmental (HSSE) guidelines;
- Monitor instrumentation and verify that results meet expectations;
- Carry out monthly inspections, identify anomalies, document them, inform the parties concerned and carry out the necessary work;
- Update the operations, maintenance, and monitoring manual on a monthly/annual basis.

A responsible person must be appointed to manage the monitoring program, the methods and frequency of data collection, and to ensure that data is properly recorded.

The monitoring program, including alarm response plans, will be complemented by a regular visual inspection program and will be described in a detailed operation, maintenance and monitoring manual. This program will be prepared before the plant is commissioned.

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30.2.4.1 Instrumentation

The following instrumentation is proposed to confirm the stability of structures associated with the tailings facility:

- Six to eight inclinometers will be progressively installed in the tailings facility embankments, particularly in the vicinity of the pits. The inclinometers are an integral part of designated slope monitoring and provide an angle or deflection measurement. Data will need to be collected from each instrument every two weeks if it is not connected to a wireless acquisition system;
- Fifteen to twenty survey markers will be progressively installed on the dikes to monitor vertical deformations. The markers are to be placed on the crest, at mid-slope and near the base of the dikes. Small, gradual settlements are expected in the first few months after construction. The site team should determine reasonable settlement criteria, taking into account settlement rate and time of year (e.g. thawing during spring freshet) and, if necessary, an investigation to determine the reason for settlement. Benchmarks should be checked every two weeks.
- Ten to twelve vibrating-wire piezometers should be progressively installed in the dikes and tailings to monitor pore pressures and their variations.

The piezometers will monitor the water table inside the stored tailings and dike foundations. Piezometers may indicate that drainage systems are not functioning as intended, destabilizing earthworks inside the tailings facility.

Vibrating wire piezometers should be checked every two weeks, if not connected to a wireless data acquisition system:

- Eight to ten thermistors should be installed progressively to measure the tailings temperature profile. Thermistors should be checked once a month, if not connected to a wireless data acquisition system.

30.2.5 Geochemical characterization of mine tailings

30.2.5.1 Objective

No geochemical characterization is planned during operations. Instead, the plan is to continue column tests on waste rock already in place at the mine site. The purpose of this follow-up is to continue acquiring knowledge about the impact of mine waste rock on the water that comes into contact with it, and to confirm the predictions made upstream of the project regarding water quality around the mine site. The results of this follow-up will also be used to confirm waste rock management methods, appropriate mitigation measures, reclamation methods for accumulation areas and associated costs.

30.2.5.2 Monitoring activities

Monitoring of column tests, which have been ongoing at the mine site since 2022, will continue for the duration of operations. This involves different mixtures of mine waste rock from drill core samples carefully selected on a geostatistical basis of sulphur distribution in the main geological units and their

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spatial distributions, for which a monthly sample of rainwater passing through the rock is collected. The program consists of 15 barren rock samples (columns). The parameters analyzed are as follows:

- Field: measurements taken in the field with a multi-parameter probe (pH, conductivity, oxidation-reduction potential, temperature and dissolved oxygen);
- Laboratory: 35 dissolved metals (Ag, Al, As, B, Ba, Be, Bi, Ca, Cd, Co, Cr, Cu, Fe, Hg, K, Li, Mg, Mn, Mo, Na, Ni, P, Pb, S, Sb, Sc, Se, Si, Sn, Sr, Ti, Tl, U, V, Zn), acidity, alkalinity, chlorides, fluorides and sulfates.

Water quality monitoring at effluent STP-9 (exfiltration water from the J4 pit waste rock pile) will also be continued monthly, analyzing the same parameters as the above-mentioned column tests.

30.2.5.3 Implementation schedule

Analysis of water samples from on-site column tests is already underway. Samples are analyzed monthly from May to October, during frost-free periods. This monitoring will continue for the duration of the operation.

30.2.6 Hydrological regime

30.2.6.1 Objective

Certain activities taking place during the construction, operation and closure phases of the project are likely to modify the hydrological regime in the mining project area.

To validate the assessment of the project's impacts on the site's hydrological regime and verify the effectiveness of the mitigation measures implemented, water levels and flows will be monitored.

30.2.6.2 Study area

The area to be monitored includes Lac Amont, Bibou Creek and Lac A (including its outlet).

30.2.6.3 Monitoring activities

Water levels and flows will be monitored at specific stations located:

- In the tributary of Lac Amont;
- In the outlet of lac Amont (beginning of ruisseau Bibou);
- In Ruisseau Bibou, upstream of the southwestern pit;
- In Ruisseau Bibou, downstream of the southwest pit;
- In Bibou Creek, downstream of pits 87 and J4;
- Near the junction of Bibou Creek with Lake A;
- In the outlet of Lake A.

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Water levels and discharge will be measured during monthly visits to monitoring stations during ice-free periods. In this way, changes in peak flow during spring freshet can be measured, as well as changes in low-flow.

Water levels in a number of lakes near the pits will also be monitored, to measure the impact of dewatering and keeping the pits dry on water levels in lakes around the pits.

The results of this monitoring will be used to identify and implement appropriate mitigation measures for the project, as required.

Monitoring stations will be reviewed regularly during the project. As operations progress, monitoring stations may be added or removed from the monitoring program, depending on their usefulness for monitoring the project's impacts on the site.

30.2.6.4 Implementation schedule

Monitoring of water levels and flow measurements will begin during the construction phase and continue throughout the duration of operations. The need for continued monitoring will be reassessed after site restoration:

30.2.7 Surface water monitoring

Water quality will be monitored to comply with the federal Metal and Diamond Mining Effluent Regulation (MDMER; SOR/2002-222) and provincial Directive 019 (D019). In addition, an environmental discharge objective (OER) monitoring program will be defined. Monitoring will be carried out during the construction, operation and post-operation phases.

The final effluents planned for the mining project are as follows: SP-01 to SP-04 and WTP.

30.2.7.1 Metal and Diamond Mining Effluent Regulations

The general objective of mine effluent monitoring is to track effluent quality to ensure compliance at all times with the discharge standards set by the MDMER.

Regular monitoring involves taking a grab sample and analyzing the parameters listed in Table 30.3 below, at the frequencies indicated. The frequency of monitoring of certain parameters may be adjusted according to the results obtained and the terms and conditions stipulated by MDMER.

Table 30.3 Regular monitoring of final effluent according to the MDMER

MDMER analysis parameters	Frequency
Flow pH Temperature	Continuous
Suspended solids (SS) Extractable arsenic (As) Extractable copper (Cu) Extractable iron (Fe)	1 per week

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MDMER analysis parameters	Frequency
Extractable nickel (Ni) Extractable lead (Pb) Extractable zinc (Zn) Total cyanides (CN tot) Radium 226 Ammoniacal nitrogen	
Acute toxicity (rainbow trout and daphnia)	1 per month

It should be noted that the final effluent will also be monitored as required by D019 on the mining industry. The two types of monitoring will be harmonized to avoid duplicating certain activities, particularly those related to water sampling and analysis, since many analytical parameters are identical.

30.2.7.2 Environmental effects monitoring studies

Under the Fisheries Act, the MDMER also provides for monitoring of water quality and fish habitat by tracking benthic invertebrate and fish communities in the final effluent receiving environment, in order to assess whether discharge standards are sufficient to protect aquatic resources downstream of the discharge point.

The study area covered by the Environmental Effects Monitoring (EEM) study will include a monitoring station in the reference zone (without influence from the mine site), a station in the exposed zone, in the final effluent receiving environment, and the final effluent.

Initially, water quality (environment and effluent) will be monitored. This monitoring comprises three distinct activities:

- Effluent characterization;
- Sublethal toxicity testing of the effluent at the final discharge point on a fish species, an invertebrate species, a plant species and an algal species;
- Water quality monitoring in the exposed zone around the effluent's point of entry at the final discharge point, in reference zones and in sampling zones selected as part of the biological monitoring study.

The following activities will be undertaken to monitor the biological environment:

- **Fish population monitoring:** The objectives of this monitoring are to measure fish population health indicators in the exposure zone and in the reference zone, in order to determine whether mine effluent is having an effect on fish. This study will be required if the effluent concentration in the exposed zone is greater than 1% at 250 m from the final discharge point ;
- **Benthic invertebrate community monitoring:** The purpose of this monitoring is to determine whether effluent has an effect on fish habitat by sampling benthic organisms in the exposed zone and in the reference zone. This study will be required if the effluent concentration in the exposed zone is greater than 1% at 100 m from the final discharge point;
- **Fish tissue monitoring :** A fish tissue mercury study, if the effluent concentration reveals an annual average total mercury concentration equal to or greater than 0.10 µg/l for a given calendar year. Also,

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a fish tissue selenium study if effluent characterization reveals a total selenium concentration equal to or greater than 10 µg/l, or if effluent characterization reveals an annual average total selenium concentration equal to or greater than 5 µg/l for a given calendar year.

The EEM procedure is as follows: effluent characterization will be carried out four times per calendar year, at least one month apart. The first characterization will be performed no later than six months following the date on which the mine becomes subject to MDMER. Sublethal toxicity testing is performed twice per calendar year for three years. Thereafter, the frequency and type of testing are modified according to the results obtained during the first three years of monitoring.

Water quality monitoring is carried out no later than six months following the date on which the mine becomes subject to MDMER. Monitoring is carried out four times per calendar year, at least one month apart.

A study plan must be prepared and submitted to ECCC no later than 12 months after the date on which the mine becomes subject to Section 7 of the MDMER, i.e., when the effluent flow exceeds 50 m³ per day or when the effluent discharges a deleterious substance. The first biological monitoring study will begin no earlier than 6 months after the date on which the study plan was submitted to ECCC.

30.2.7.3 Mining Directive 019

Mining effluent quality monitoring is required in the context of Directive 019 on the mining industry (MELCCFP, 2025).

Regular monitoring involves taking a grab sample and analyzing the parameters listed in Table 30.4 below, at the frequencies indicated. These frequencies are to be maintained until mining activities cease.

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Table 30.4 Regular monitoring of final effluent as per Directive 019

Analysis parameters as per Directive 019 ¹	Frequency
Flow Temperature pH	Continuous ²
Suspended solids and pH	3 times per week
Extractable arsenic (As) Extractable copper (Cu) Extractable iron (Fe) Extractable nickel (Ni) Extractable lead (Pb) Extractable zinc (Zn) Total cyanides (CN tot) Ammoniacal nitrogen	1 per week
Acute toxicity (rainbow trout and daphnia)	1 per month

¹Refer to tables 3.1 and 3.3 of Directive 019 on mining industry (MELCCFP, 2025).

²If effluent volume exceeds 1,000 m³/d.

Quarterly monitoring includes analysis and measurement of all parameters listed in Table 30.5 below, in addition to regular monitoring parameters. Sampling and measurements for annual monitoring must be carried out on the same day.

Table 30.5 Quarterly monitoring of final effluent as per Directive 019

Standard parameters	Nutrients	Ore or metallic elements	Cyanide family	Sulfide family	Biological parameters
Chlorides Conductivity Hardness Fluorides Petroleum hydrocarbons C10-C50 Dissolved solids Total solids Sulfates	Nitrates Nitrites Total phosphorus	Cadmium Calcium Chromium Magnesium Manganese Mercury Potassium Radium 226 Selenium Sodium	Cyanates Thiocyanates	Sulfides Thiosulfates	Chronic toxicity invertebrates (Ceriodaphnia dubia) and algae (Raphidocelis subcapitata)

Refer to tables 3.5 of Directive 019 on mining industry (MELCCFP, 2025).

A monitoring program for the surface waters of the receiving environment will be developed with the MELCCFP later.

30.2.7.4 Environmental discharge objectives

The OERs are designed to identify the most problematic substances, seek substitutes, use more advanced treatment technologies, promote better control at source, and implement clean technologies aimed at reducing flow and pollutant loads.

Troilus will monitor the OER, which will be defined by MELCCFP later. This program will include:



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- Monitoring of physico-chemical parameters subject to OERs, as well as chronic toxicity, on a quarterly basis over the discharge period. Acute toxicity will be monitored on a monthly basis;
- The presentation of OER exceedances, if any, as well as the cause of these exceedances and the means the proponent intends to put in place to meet or come as close as possible to OERs. This exercise can also be used to identify contaminants that do not pose a risk to the environment, thereby reducing the list of contaminants to be monitored.

An analysis report on effluent quality monitoring data will be submitted to the MELCCFP after three years of operation, and every five years thereafter. This report will contain a comparison between OERs and effluent results based on the principles of the document *Lignes directrices pour l'utilisation des objectifs environnementaux de rejet relatifs aux rejets industriels dans le milieu aquatique* (Ministère du Développement durable, de l'Environnement et des Parcs [MDDEP], 2008) and its addendum *Comparaison entre les concentrations mesurées à l'effluent et les objectifs environnementaux de rejet (OER)* (MDDELCC, 2017c) for existing businesses.

30.2.7.5 Mechanism in the event of environmental degradation

In the event of non-compliance following receipt of analytical results for final effluent, the MELCCFP and ECCC will be notified without delay. Steps will be taken to identify the source of the problem, implement mitigation measures if required, and correct the problem. However, no effluent will be discharged unless the treated water complies with D019 or MDMER standards and criteria:

30.2.8 Groundwater monitoring

30.2.8.1 Objective

The general objective of groundwater monitoring is to track changes in groundwater quality and levels to measure the actual impact of the project. Monitoring will be carried out during the operational, closure and post-closure phases.

This monitoring aims to achieve the following specific objectives:

- Monitor groundwater levels and quality in the vicinity of mining infrastructures considered to be at-risk developments in accordance with Directive 019 (MELCCFP, 2025);
- Measure the impacts of groundwater drawdown around open pits on groundwater levels and quality.

30.2.8.2 Study area

The location of the wells to be sampled is shown in the groundwater monitoring program presented in Appendix 30.1 of this chapter.

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30.2.8.3 Monitoring activities

Groundwater level monitoring

Water level readings will be taken during sampling campaigns (spring/summer) in all available wells. Piezometric maps will be produced for each period. Water level surveys are necessary to establish groundwater flow direction and hydraulic gradients.

Continuous monitoring of piezometric variation will be carried out in wells adjacent to the pits, using levellogger probes. A barologger probe will also be installed out of the water in one of the pits to measure atmospheric pressure.

These probes will monitor the influence of pit dewatering on water level rise in the vicinity of surface watercourses.

Particular attention will be paid to the influence of the Bibou Creek deviation on groundwater level changes, in order to validate the results of groundwater modelling.

30.2.8.4 Project schedule

Some of the wells proposed in the monitoring program are already in place; others will have to be installed and sampled before construction of the mining project begins. Installation and sampling of these new wells is scheduled in part for 2025 and will be completed in 2026.

Sampling campaigns will be carried out twice a year, in spring and summer, from the start of operations. The program may be re-evaluated during the closure period, depending on the results obtained and in collaboration with the MELCCFP.

For infrastructure considered to be at risk, the groundwater monitoring program during the closure period (post-operation) and during the post-restoration period will continue with the same frequency as during operation, i.e. twice a year.

In the post-restoration period, monitoring will be maintained for a minimum of five years at the accumulation areas (tailings pond and waste rock pile). Thereafter, monitoring may be discontinued upon approval by the MELCCFP if groundwater quality meets groundwater protection criteria during the last five years of monitoring. For the explosives storage area and the mill area, post-restoration monitoring must be continued for a minimum of 10 years in the event of the presence of sulphides, and for a minimum of five years in the event of the presence of any other contaminant.

30.2.9 Monitoring of sediment physico-chemistry

30.2.9.1 Objective

The physico-chemical quality of sediments will be monitored as part of the project, since this component is an integral part of fish habitat. A sediment monitoring program will be developed in accordance with the *Guide de caractérisation physico-chimique de l'état initial du milieu aquatique avant l'implantation d'un projet industriel*.

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30.2.9.2 Study area

The program will be coordinated with water quality monitoring, and sampling stations will be defined to represent the area upstream of the project (control zone) and the area impacted by the project (receiving environment).

30.2.9.3 Monitoring activities

The parameters analyzed will be the same as those used to establish the initial status of the aquatic environment, to compare the physico-chemistry of sediments before and during mining. Comparisons will also be made between results from stations in the area exposed and unexposed to the mining project. The detailed program will be prepared in collaboration with the MELCCFP later.

30.2.9.4 Implementation schedule

Sampling will begin during the operating phase and will be repeated at intervals to be determined with the MELCCFP. In terms of federal requirements, sediment monitoring must be planned as part of the EEM study.

30.2.10 Monitoring of vegetation and wetlands

30.2.10.1 Objective

Development of the site and planned infrastructures will have indirect impacts on the vegetation that will remain in place, in addition to the areas directly affected by the work. The composition of terrestrial and wetland plant communities adjacent to mining infrastructures may be altered by project construction. Also, since natural drainage patterns will be altered by the construction of the infrastructures, changes in the hydrology of certain wetlands could be observed.

The proposed follow-up will confirm the anticipated changes in plant community types and wetlands and assess the indirect impacts of the project on these environments.

A follow-up report will be produced after each inventory, and if necessary, enhanced mitigation measures will be proposed.

30.2.10.2 Study area

The proposed follow-up consists in conducting vegetation inventories in plots located along transects within a 100 m band around the mining infrastructures, with the aim of identifying a potential disturbance gradient.

30.2.10.3 Monitoring activities

Monitoring will be used to document the following:

- Characterization of vegetation in plant communities adjacent to mining infrastructures;

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- Comparison with original vegetation composition of plant communities;
- Characterization of wetland hydrology (hydrological and soil indicators) adjacent to the PDA;
- Comparison with baseline hydrological and pedological indicators;
- Identification of changes in composition and/or hydrology.

30.2.10.4 Implementation schedule

The first inventory will be carried out during site construction, and monitoring will continue over a 5-year period, in years 1, 3 and 5 of the operation phase.

30.2.11 Monitoring invasive exotic species

30.2.11.1 Objective

The objective of this monitoring program is to check for the introduction of invasive exotic plant species (IES) on the mining project site, which could occur during the construction and operation phases of the project.

30.2.11.2 Study area

All areas where work will be carried out, as well as all traffic areas on the mining project site.

30.2.11.3 Monitoring activities

The first stage of monitoring will be carried out by surveying all areas of site equipment traffic (heavy equipment and vans) and areas where work has been carried out. The plant growth period will be targeted for this monitoring (mainly July and August). Any IES identified during these checks will be noted. Any colonies detected will be delimited using a *Global Positioning System* (GPS) and characterized. Depending on the species found, appropriate control and eradication methods will be applied. Soil and residues contaminated by these species will then be managed to prevent recontamination of the site. Monitoring of a colony and its eradication may be required for 3 years.

30.2.11.4 Implementation schedule

Monitoring of the introduction and spread of IESs will take place annually during the construction, operation and reclamation phases of the mining project. At the end of the reclamation phase, a final check will be carried out. Items identified will be included in the annual monitoring report. In the event of significant problems being observed in connection with the presence of IESs, additional mitigation measures will be applied.

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30.2.12 Wildlife monitoring

30.2.12.1 Fish and fish habitat monitoring

Under the Fisheries Act, the MDMER also provides for monitoring of water quality and fish habitat by tracking benthic invertebrate and fish communities in the final effluent receiving environment, to assess whether discharge standards are sufficient to protect aquatic resources downstream of the discharge point. Details of this monitoring are provided in the *Surface Water Monitoring* section.

30.2.12.2 Bibou Creek deviation

Objective

The deviation of Bibou Creek will significantly alter fish habitat in this area. During construction of the new watercourse, special measures will be taken to maintain fish habitat. Monitoring of Ruisseau Bibou will be necessary to verify that all measures in place to maintain quality fish habitat are still present and effective. This monitoring will enable us to detect any problems with the habitat or living conditions of the fish, so that we can intervene quickly in the event of deterioration.

Monitoring activities

Monitoring of Bibou Creek will include:

- Measuring water levels on certain segments of the creek, to ensure free passage of fish. The watercourse will be designed to ensure a minimum water level of between 0.1 and 0.2 m to ensure year-round fish passage. Increased monitoring will be carried out during summer low-water periods;
- Flow velocity measurements on certain critical segments, to ensure that the flow does not exceed the maximum swimming capacity of the fish. The elements to be considered will be the maximum water velocity, as well as the distance over which this velocity is measured;
- Fish passage monitoring will be carried out during spring freshet to confirm that all designed fish passage structures are in place and functioning as intended.
- Observing (opportunistically) the presence of fish in the watercourse. Observations and comments will be collected from land users.

Implementation schedule

Monitoring of these elements in Bibou Creek will be carried out as soon as the new watercourse has been connected between Lac Amont and Lac A, during the construction period. Monitoring will be carried out throughout operations, during the months when the stream is ice-free. The frequency of inspections will be monthly, but weekly during spring freshet. Checks will also continue during the restoration and post-restoration periods.

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30.2.12.3 Monitoring of species at risk

A list of wildlife species with special status that have been identified in the study area, or that could potentially be present, is presented in Chapters 17 and 18. Various follow-up programs may be developed to monitor the impacts on wildlife species with precarious status. This list includes chiropterans, birds and woodland caribou.

Chiroptera

The presence of three chiropteran species of special concern was confirmed during inventories carried out in the Local Study Area (LSA). These are the little brown myotis, the silver-haired bat and the hoary bat. Eastern Red Bat and Northern Myotis have a potential presence in the study area but were not formally identified during inventories.

In order to document the impacts of the project on the presence of chiropterans with special designation in the project area, at various stages of mine operation through to reclamation follow-up, five-year inventories are proposed, starting in the first year of mine operation and continuing until the fifth year following final closure. These inventories will also be used to assess the effectiveness of the mitigation measures implemented as part of the mining project, as well as to document the impact of the natural restoration of habitats affected by forest fires on these mammals.

The protocol to be used could be the same as that used for the fixed-station acoustic inventory carried out in 2022. Surveys will be carried out during the breeding (early June to late July) and migration (mid-August to mid-October) periods. Locations surveyed in 2022, but rendered unsuitable by mine operations, would be replaced by an adjacent site with similar habitat.

Avian species with special designation

The objective of the follow-up program for bird species with special designation is to confirm the ESIA predictions and assess the effectiveness of actions taken to reduce the adverse impacts of the project on these species. Its main purpose is to verify the presence and numbers of local bird populations, analyze changes in these populations over time and, if necessary, adjust or implement additional actions to minimize the impact of any residual impacts noted.

The monitoring program will focus in particular on status species whose habitat is present in the study area, but also in favourable habitats that will recover from construction work on the mining project. The presence of 8 avian species with special status, either provincially or federally, was confirmed during inventories carried out between 2019 and 2024. They are: Common Nighthawk, short-eared owl, rusty blackbird, olive-sided flycatcher, lesser yellowlegs, bald eagle, evening grosbeak and bank swallow. In addition, four status avian species are likely to be found in study area habitats, but their presence was not confirmed during the inventories. These are Barrow's goldeneye (eastern population), Canada warbler, harlequin duck (eastern population) and red-necked phalarope. These species will be specifically monitored, without ruling out the possibility that new species may be granted special status during the monitoring period. Accordingly, inventory stations will be set up in habitats favorable to each of these species.

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Inventory efforts, timing and techniques will be comparable to those used to define the pre-project baseline by Wachihi and FauneNord, namely the listening station method for terrestrial breeders and ground station inventory for nesting waterfowl and waterbirds. More targeted protocols will be used for Common Nighthawk and short-eared owls. Where possible, stations used during previous surveys will be reused if they are still accessible.

The follow-up plan proposes a period of avian inventories every five years following the start of the operational phase, until the fifth year following mine site closure. If necessary, the five-year monitoring plan can be modified progressively. In this way, it will be possible to monitor the progress of local populations of endangered bird species and then adapt mitigation measures if necessary. These inventories will also be used to document the impact of the progressive restoration of borrow pits, quarries and stockpiles.

If issues related to a particular bird species are identified, suggested actions will be detailed in the follow-up reports and may be discussed in collaboration with the monitoring committee and the relevant authorities.

30.2.12.4 Monitoring woodland caribou populations

Objective

In order to confirm the anticipated impacts of the mining project on population distribution, monitoring of land use by woodland caribou and habitat conditions for this species will be set up in collaboration with the MELCCFP and land users. This follow-up will also enable us to verify whether the mitigation measures implemented will reduce the impact on woodland caribou populations, and to adjust them if necessary.

Study area

The analysis will be carried out on information corresponding to the area bounded by a circle with a radius of 50 km from the center of the mine. This zone represents an area of 7,850 km².

Monitoring activities

The monitoring program has several components. The first is the creation of a discussion group on woodland caribou with land users, in particular tallymen. This follow-up will provide a more accurate picture of past and planned caribou use on traplines. It will also enable the gathering of indigenous knowledge concerning the fragmentation of caribou habitat. These discussions will enable the development of additional appropriate measures to mitigate the possible impacts of mine activities, based on the proposals of current and future land users. This will also enable the transmission of knowledge about caribou in the communities and its "sensitive" status, in order to promote good Cree practices and the preservation of the resource for future generations, which could include a growing number of young hunters.

The second component consists in repeating the analysis of the distribution of woodland caribou populations using MELCCFP telemetry data, as carried out as part of the present ESIA, in order to

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determine the baseline status. As part of this follow-up, several sources of geomatic data will be gathered and analyzed. These will mainly come from the ecoforestry map, habitat quality models and telemetry data collected by the MELCCFP. In addition, photo-interpretation work will be carried out to complete the disturbance data, particularly for new, unmapped forest roads.

A module on woodland caribou will be incorporated into the training of mine employees and subcontractors, with the aim of raising awareness of the precarious nature of caribou, developing their ability to distinguish possible signs of their presence, and informing them of the monitoring system and action plan in the event of their presence. All employees and subcontractors will be made aware of the importance of reporting any sightings of caribou or signs of their presence, on site or on the access road. Where appropriate, these sightings will be recorded in a wildlife register. The wildlife register will also include observations of the presence or signs of caribou predators (wolves and bears).

The annual environmental monitoring report will include the following:

- A general summary of the annual focus group meeting;
- Elements of Cree families' indigenous knowledge of caribou;
- The number of workers and subcontractors who have received the training module;
- A summary of general information gathered from the wildlife registry;
- Changes in land use by woodland caribou based on observations by land users, including telemetry points in years when this analysis will be carried out;
- Recommendations for adjusting the monitoring and surveillance program.

Implementation schedule

The monitoring program will be implemented on an ongoing, annual basis, until mine closure. The caribou focus group meeting with land users will take place once a year, but additional meetings may be held as needed, depending on the findings. This annual meeting will take place in June or July of each year, to cover the last winter and calving periods of the woodland caribou.

The results of the monitoring of woodland caribou populations will be included in the annual monitoring and follow-up report.

The first analysis of woodland caribou population distribution using telemetry data from MELCCFP monitoring will be carried out during the final year of construction. The second analysis will be carried out in year 5 of operations. Depending on the results of this second follow-up, the relevance of continuing this analysis will be reassessed.

30.2.13 Monitoring the effectiveness of fish and wetland habitat compensation projects

Proposed and future fish habitat and wetland compensation projects will include habitat development/restoration. Specific monitoring programs will be drawn up for each project that is authorized, so that the achievement of objectives can be properly assessed over time. The effectiveness

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of the compensation projects, in the short and medium term, can be assessed during the various monitoring programs. Approval of the projects and their respective follow-ups will have to be validated in advance by the Department of Fisheries and Oceans (DFO) and the MELCCFP. Chapter 26 presents a summary of the compensation measures proposed for the Troilus mining project.

30.2.14 Human environment monitoring

30.2.14.1 Socio-economic environment monitoring

Objective

The Troilus mining project will have a positive impact on the economy of neighboring communities, particularly Mistissini, as well as on training and employment. The monitoring program for this component will enable us to quantify and qualify the economic spinoffs, assess the effectiveness of the policies and measures put in place, and evaluate whether the expectations of these communities have been met.

Monitoring activities

Socio-economic conditions will be monitored through documentary research, as well as meetings and interviews with community organizations and workers. Available statistical data will be used to support this follow-up. Elements to be covered include

- Assessment of training-hiring-retention measures for workers;
- Assessment of contracts with regional Cree and non-Native businesses;
- Description of problems and solutions related to the integration of Cree and Jamesian workers into advancement opportunities, employee retention and discrimination (where applicable);
- Comparison of the populations of the four communities affected by the project (Mistissini, Chibougamau, Chapais, Oujé-Bougoumou);
- Unemployment rates, employment rates and workforce availability (data from Institut de la statistique du Québec, Statistics Canada, etc.);
- Pressure on health and social services, particularly in relation to increased demand generated by mining activity and migrant labour;
- Potential impacts of the project on the social determinants of health, including access to housing, food security, access to health care and social cohesion.

Surveys will be conducted among Cree workers at the Troilus mining project, to document their appreciation and employment experience.

Implementation schedule

Monitoring will be carried out on an annual basis. The data collected will be presented in the annual environmental monitoring report. An in-depth analysis of this data will be carried out every 5 years, and a specific study report will be presented.

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30.2.14.2 Monitoring current use of land and resources for traditional purposes

Objective

During the construction and operation phases of the mining project, a portion of the land will be withdrawn from traditional activities and the exploitation of natural resources by land users. The installation of infrastructure on the mine site and the noise caused by mining operations could cause some animals to move away from the site. The hunting and trapping habits of some users will have to be modified, and they will have to use other areas for these activities. Increased use of the access road to the site will most likely cause disturbance to occupants of camps located near this road.

The proposed follow-up program is designed to document and assess the impacts of the project on the traditional activities of the tallymen and their families living on the lands where the mining project is planned. The follow-up will also verify the effectiveness of the mitigation measures implemented. In addition, tallymen are always informed of upcoming work or special situations related to operations on the mining project site. They are always welcome at the camp, and Troilus team members are always open to their comments, concerns or questions. Operations can also be adjusted/modified to ensure that mine activities do not interfere with those of land users. The communities of Mistissini and Oujé-Bougoumou will also be involved in monitoring traffic management and access to camps and trails.

Study area

The area covered by this follow-up corresponds to the LSA shown on Map 19.1 in Chapter 19 (Land and Resource Use) of the ESIA.

Monitoring activities

As a first step, a list of all mitigation measures put in place to minimize the project's impacts on the current use of land and resources for traditional purposes will be compiled. Information will be gathered through discussions and interviews with tallymen and members of their families, which will enable us to verify the effectiveness of these mitigation measures, and if not, to identify other solutions for avoiding or mitigating the impacts of the mining project on these activities.

The elements to be covered in this part of the follow-up will update the data collected during the ESIA and subsequent years on hunting, fishing and trapping activities. Topics covered will include

- Camp use and the addition/movement of other camps on the trapline (attendance, number of users, location);
- Perception of the effectiveness of measures implemented to reduce noise and dust for camp users;
- Access to the territory (use of secondary forest roads, hunting and trapping routes and snowmobile trails);
- Hunting success for large animals, trapping success for small fur-bearing animals, fishing and gathering activities;

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- Perception of the evolution of animal populations and the state of wildlife habitats since the start of the mining project;
- Perception of the evolution and level of practice of cultural and traditional activities on the trapline;
- Satisfaction with specific measures put in place at work sites to enable Cree workers to stay in touch with their culture (for family members employed by Troilus).

Implementation schedule

This follow-up will be carried out annually, from construction to project closure. The annual environmental and social monitoring report will be presented to the families affected, as well as on the Troilus website. It is important to note that only information to which impacted families have given their consent will be disclosed.

30.2.14.3 Monitoring quality of life and well-being

Objective

Quality of life and well-being in Cree and non-native communities is a major concern that will need to be monitored to ensure that the measures put in place are effective.

Monitoring activities

Monitoring will focus on :

- Perception of quality of life in affected communities
- Tensions between the Cree population and mine workers;
- Social problems linked in particular to alcohol and drug consumption, and compulsive gambling;
- Sexual harassment;
- Feelings of loss and loss of cultural identity;
- Decreased sense of safety for Route du Nord users;
- Pressure on the health and social services system.

This follow-up component is based on two integration and follow-up committees that will be set up with stakeholders from the Indigenous non-Indigenous communities, to enable the population to express its views on these aspects of the project.

The composition of the committee is designed to represent the diversity of viewpoints of the communities of interest concerned by the project, and to bring together the expertise and knowledge needed to develop the project, while ensuring that information sharing between members is effective and that the committee's work can be carried out in a conducive and convivial atmosphere.

Potential members of the Jamesian communities monitoring committee could include

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- Citizens of the towns of Chibougamau and Chapais;
- One person designated by each of the municipalities of Chibougamau and Chapais;
- One or two people from the following fields:
 - Environment;
 - Community and social services
 - Community and social services;
 - Training and employment;
 - Land use;
- A flying seat (a flexible seat for a person interested in the project, but who does not fit into the themes of the other seats).

Individuals from environmental, community, economic, training and employment, land use organizations, as well as the Cree Board of Health and Social Services of James Bay, who could sit on the Indigenous Monitoring Committee, will be defined in collaboration with the Cree Nation of Mistissini and the Cree Nation of Mistissini Government.

That said, a number of organizations have already been identified, including :

- The Council of the Cree First Nation of Mistissini;
- Cree Board of Health and Social Services of James Bay;
- Cree Women's Association of Eeyou Istchee;
- Nibiischii Corporation;
- Mistissini Elders Council;
- Apatsiwin Skills Development.

Implementation schedule

Monitoring activities will be carried out according to the following schedule:

- The committees will meet at least once a year during the construction phase;
- During the second year of the operating period, and every 5 years thereafter until the end of operations;
- One year after mine reclamation.

30.2.14.4 Noise monitoring for users

Objective

In order to verify the conformity of the noise climate during each phase of the project, acoustic monitoring will be carried out from the start of construction and maintained throughout the operating phase. This



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monitoring will make it possible to verify the project's compliance with the regulations applicable to the noise climate, in accordance with the methodology of Directive 019 and the requirements of MELCCFP NI 98-01 and Health Canada's noise criteria, which are contained in the document "Guidelines for Human Health Effects Assessment in Impact Assessment: Noise" (Health Canada, 2023). . If authorized levels are exceeded, additional mitigation measures may be implemented to limit the impact of noise emissions.

Monitoring activities

Noise measurements will be carried out at a minimum of two stations: at the new location of the Awashish family camp (to be moved a few kilometers northeast of the project) (R1) and at the Petawabano family camp (also corresponding to the Square Tail Lodge outfitting facilities) (P3), the two residences closest to the mining project. The locations of the measurement points are shown in Table 30.6.

Table 3.03 Location of measurement points during noise climate monitoring

Description	Identification in the sound climate study	Description	UTM 18 coordinates	
			X (m)	Y (m)
Point 1	R1	Main camp site	To be determined	To be determined
Point 3	P3	Main camp site and outfitter	526 931	5 640 239

Measuring stations consist mainly of a sound level meter (including a microphone) and an audio recorder, placed at a height of between 1.2 m and 1.5 m above ground level. Each sound level meter must be capable of continuously recording the surrounding noise level in one-third octave frequency bands. Sound level meters must also record the audio signal, enabling sound events to be logged. Measurements will be taken continuously over a period of at least 24 h, during weather conditions that are conducive to environmental noise measurements.

An active communication link exists and will be maintained between Troilus and land users for the duration of the project. Users will be able to notify the proponent at any time of an excessively noisy event, or of a situation of discomfort related to the noise environment resulting from the mining project.

Implementation schedule

Sampling at each of the measurement points will be carried out twice, spread over the duration of the construction work, i.e. during the noisiest construction activities. Noise monitoring measurements will also be carried out during the operating phase, at the rate of one measurement campaign per year.

In the event of a noise complaint, an acoustic compliance measurement will be carried out on the complainant to verify the justification for the complaint.

Noise levels measured in the reference state (before the start of the project), during the construction phase and in operation will be compared and reported annually.

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30.2.15 Vibration and air overpressure

Section 3.4.3.1 of Directive 019 requires the implementation of a vibration and air overpressure monitoring program when the blast is located within one km of dwellings. Since the nearest sensitive receptors are located outside the area potentially affected by blasting, a request for exemption will be submitted to the Ministry.

30.2.16 Cumulative impact monitoring

The purpose of cumulative impact monitoring is to validate the environmental and social predictions made during the analysis, and to assess the actual effectiveness of the proposed mitigation measures. This step is essential to ensure adaptive management of the Troilus project, and to enable real-time adjustments if cumulative impacts turn out to be greater than anticipated.

Unlike a standard monitoring program, a cumulative impact monitoring program must:

- Focus on VCs, targeted by the combined impacts of several concrete projects or activities.
- Be designed on a broader, sometimes regional, scale, going beyond the immediate limits of the project.
- Be based on indicators that are sensitive to the accumulation of pressures, whether environmental (e.g. surface water quality, habitat integrity) or social (e.g. access to land, quality of life in indigenous communities).

The cumulative impact monitoring program will include the following elements:

- Measurable indicators clearly linked to affected VCs and anticipated cumulative impacts.
- Sufficient frequency of measurement to detect trends or gradual deterioration.
- Accountability mechanisms, including public reporting, local community participation, and transparency in the interpretation of results.
- An adaptive management approach, enabling mitigation measures to be revised, project practices to be modified or compensatory mechanisms to be activated if necessary.

30.2.17 Post-restoration monitoring program

30.2.17.1 Water quality

Monitoring of mine water, final effluent and groundwater quality will continue throughout the decommissioning and closure phase (1-2 years) and will comply with the requirements of D019. During this phase, the frequency of effluent and mine wastewater quality monitoring will comply with provincial requirements as described in chapter 3.10 of D019. During this period, groundwater levels and quality will be monitored twice a year (summer and fall), and compliance criteria will be validated with those of D019.

Once remediation work is complete (post-remediation period), monitoring of the quality of final effluent and remaining mine wastewater, as well as groundwater, will continue for a minimum period of 5 years,

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as recommended by D019. During this period, groundwater levels and quality will be monitored twice a year (summer and fall), and compliance criteria will be validated with those of D019. The quality of remaining mine effluent and wastewater will be monitored 6 times a year over the 5-year period.

Monitoring of water levels and flow measurements in Bibou Creek and surrounding lakes (hydrological regime) will continue for a few years during the reclamation period. Measurement stations will be the same as during the operating period.

Environmental monitoring results will be forwarded to the Ministry of Natural Resources and Forests (MRNF) and the MELCCFP each year in the form of an annual environmental monitoring report. Monitoring results will remain public, and interested parties will have access to them.

30.2.17.2 Geotechnical

Following closure and reclamation work, geotechnical monitoring must continue to validate the stability of the infrastructures left in place. The integrity of the waste rock piles, tailings dams and civil engineering works will be checked for erosion, movement, settlement and cracking. For the first five years after reclamation is complete, annual inspections will be carried out by an engineer, then periodically for 10 years at a frequency recommended by the engineer.

30.2.17.3 Revegetation

Post-closure monitoring of vegetation recovery on restored surfaces is required. The purpose of this follow-up is to ensure that site reclamation activities have established an adequate density of vegetation to protect against erosion, and that areas disturbed by mining activities have been adequately revegetated. Monitoring will include characterization of vegetation cover, plant species composition in reclaimed areas and identification of signs of erosion. Monitoring is to be carried out over a 5-year period.

30.2.18 Response mechanism in the event of unforeseen impact or degradation

If unforeseen degradation is observed in any of the environmental monitoring components, or if a problem is detected in relation to the effectiveness of a mitigation measure, the following steps must be taken:

- Inform the environmental coordinator and, if necessary, the relevant authorities (MELCCFP, ECCC, MRNF, etc.);
- Identify the source of the problem by verifying the effectiveness of mitigation measures;
- Identify corrective measures and/or work to be carried out, and notify the environmental coordinator and, if necessary, the relevant authorities;
- If necessary, additional follow-up work may be carried out to confirm that the measures taken have indeed achieved the objectives set.

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30.2.19 Dissemination of information and transparency of monitoring results

To address the concerns of communities of interest, this monitoring program outlines the methods for assessing and monitoring the various environmental variables that will ensure close monitoring and, consequently, the maintenance of the local ecosystem. What's more, all monitoring reports will be made public: either published on the website or presented to the various monitoring committees.

30.2.19.1 Advisory committee

At the moment, a committee is in place for the Troilus project. It includes members of the Mistissini and Oujé-Bougoumou communities, the Cree Nation Government, families affected by the project, and organizations and land users in the vicinity of the project.

30.2.19.2 Families affected

Occasional meetings are also held with families affected by the project to discuss the issues at stake for them. These meetings will continue throughout the project.

30.2.19.3 Monitoring committee

As required by the Mining Act, Troilus will set up a follow-up committee to encourage the communities concerned to get involved in the project. This committee will be set up prior to the construction of the mining project, and will be maintained throughout the project's lifespan, until the work set out in the mine site rehabilitation plan has been completed.

The follow-up committee will be a global exchange committee that includes representatives from the four communities affected by the Troilus mining project (Mistissini, Chibougamau, Oujé-Bougoumou and Chapais). This committee will meet quarterly. Additional meetings may be added according to the needs and questions of committee members. The committee's mandate will be to exchange information, identify problems and concerns, find common solutions, and communicate with the public about changes or additions to Troilus projects in the region. The mandate of the representatives will be to ask questions of stakeholders, identify the issues, concerns and suggestions of the community they represent, and pass them on to the committee.

Troilus undertakes to make all follow-up reports publicly available. In addition, if a land user observes certain anomalies related to the local ecosystem, he or she may contact Troilus at any time, either in person or through the register of concerns that will be available to the general public.

The environmental and social monitoring report will be submitted no later than March 31 of each year for the previous calendar year's activities and will be presented to the monitoring committee.

30.3 Environmental management plan

Troilus will implement a series of environmental management plans to ensure rigorous, structured management consistent with the priority issues identified in this ESIA. These plans are intended to meet current regulatory requirements and support the implementation of mitigation measures associated with

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the project's VCs. They will specify actions to be taken, assigned responsibilities, updating procedures, and monitoring and reporting mechanisms. Each plan will be drawn up prior to the start of construction and/or operation, depending on the needs of the project. Table 30.7 shows the plans to be drawn up for this purpose.

Table .304 Environmental management plans

Environmental management plan	Objective
Environmental protection plan for the construction phase	<ul style="list-style-type: none"> – This comprehensive plan will oversee the implementation of measures to reduce environmental impacts during construction. It will summarize mitigation measures related to dust, noise, vibration, water, waste, wildlife, vegetation and sediment management.
Soil management and rehabilitation plan	<ul style="list-style-type: none"> – This plan will define mitigation measures for soil handling and storage, including the use of excavated soil for progressive rehabilitation or storage for decommissioning.
Waste management plan	<ul style="list-style-type: none"> – This will establish procedures for managing residual materials in accordance with applicable provincial legislation and the company's internal policies.
Air quality management plan	<ul style="list-style-type: none"> – This plan will set out air emission control measures and regulatory monitoring requirements for ambient air quality.
Explosives management plan	<ul style="list-style-type: none"> – This plan will describe safe practices related to the use and storage of explosives, and associated mitigation measures.
Vegetation management plan	<ul style="list-style-type: none"> – This plan will define approaches to reducing impacts on vegetation and will include a summary of studies planned as part of the closure plan.
Erosion and sediment control plan	<ul style="list-style-type: none"> – This plan will specify best practices for limiting erosive processes and preventing sedimentation of nearby watercourses.
Wildlife management plan	<ul style="list-style-type: none"> – This plan will set out measures to reduce impacts on wildlife, including migratory birds and special-status species, and their habitats. – It will describe the project's bird-specific monitoring activities to frame risk management in accordance with ECCC guidelines. – Identify sensitive periods for clearing and site preparation, according to species-specific requirements or permit/authorization conditions. – Provide a protocol for managing wildlife encounters, including caribou and bird nest discovery, and for handling animals during rescue and relocation activities. – Summarize the wildlife studies planned as part of the closure plan.
Fish rescue plan	<ul style="list-style-type: none"> – This plan will provide guidelines for fish rescue by a qualified biologist, in compliance with applicable permits.
Noise and vibration management plan	<ul style="list-style-type: none"> – This plan will specify how noise and vibration sources will be managed during construction and operation, as well as communication and complaint handling protocols.

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Environmental management plan	Objective
Spill prevention and response plan	<ul style="list-style-type: none"> – This plan will define the internal procedures to be activated in the event of a spill of hydrocarbons and hazardous materials, the steps to be followed, emergency contacts, and the response and clean-up equipment available on site.
Protocol for the accidental discovery of heritage resources	<ul style="list-style-type: none"> – This protocol will provide a framework for the procedures to be followed in the event of the accidental discovery of archaeological resources during construction work. – These procedures will be the subject of consultations with indigenous nations.
Archaeological resource protection plan	<ul style="list-style-type: none"> – This plan will specify measures for the identification, analysis, mitigation and management of archaeological resources. – Develop and implement a training and awareness program for workers on how to recognize archaeological artifacts in the event of an accidental discovery (e.g. objects from indigenous material culture).
Acid drainage and metal leaching management plan	<ul style="list-style-type: none"> – This plan will define measures to prevent, detect and manage acid drainage and metal leaching risks associated with waste rock, ore and tailings. – It will also provide a framework for emergency preparedness, spill management and response to incidents involving hazardous substances, medical emergencies, explosions or fires. – The plan will also specify responsibilities, training needs, required equipment and communication procedures, in line with regulatory requirements and internal policies.
Emergency preparedness and response plan	<ul style="list-style-type: none"> – This plan will establish a structured framework for emergency preparedness and management, including spill prevention and corrective action, in compliance with federal and provincial legislative requirements and internal company policies. – It will describe response protocols in the event of accidents involving hazardous substances, medical emergencies, explosions or fires. – It will also specify planning procedures, responder responsibilities, training requirements, required cleaning equipment, materials to be used, and communication and reporting procedures.
Integrated water management plan	<ul style="list-style-type: none"> – This plan will define the water management strategy for all phases of the project, including design criteria for hydraulic infrastructures.
Traffic management plan	<ul style="list-style-type: none"> – This plan will establish the measures and strategies needed to reduce travel delays during construction and improve user safety.
Accommodation management plan	<ul style="list-style-type: none"> – This plan will specify workforce accommodation requirements and the measures planned to alleviate pressure on the local housing stock.
Health and medical services plan	<ul style="list-style-type: none"> – This plan will describe the approach to managing occupational and non-occupational injuries and illnesses, as well as procedures for managing communicable diseases and access to the employee and family assistance program.

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ANNEXE 30.1 Groundwater monitoring program e



TECHNICAL MEMORANDUM

DATE 12 mai 2025

N° de référence 109-CA0033368.9269-MT-Rev0

TO Mathieu Michaud, Coordonnateur en environnement
Troilus Gold Corp.

CC Josee De Launiere

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TROILUS – PROGRAMME DU SUIVI DE L'EAU SOUTERRAINE

1.0 MISE EN CONTEXTE

Troilus Corp. a mandaté WSP Canada pour la préparation d'un programme de suivi de l'eau souterraine à son site minier Troilus. Le programme de suivi est destiné au suivi de la qualité et du niveau de l'eau souterraine tout au long de la durée de l'exploitation du site minier et après sa fermeture. Le programme de suivi a été préparé selon les exigences de la Directive 019 sur l'industrie minière (D019, MELCCFP (2025)).

2.0 LOCALISATION DU SITE

Le site minier Troilus est situé à 175 km au nord de la ville de Chibougamau (Figure 1). Le site a été en exploitation avec deux fosses à ciel ouvert entre 1996 et 2010. Le site fait actuellement l'objet d'un programme de suivi de l'eau souterraine dans le cadre de sa fermeture.

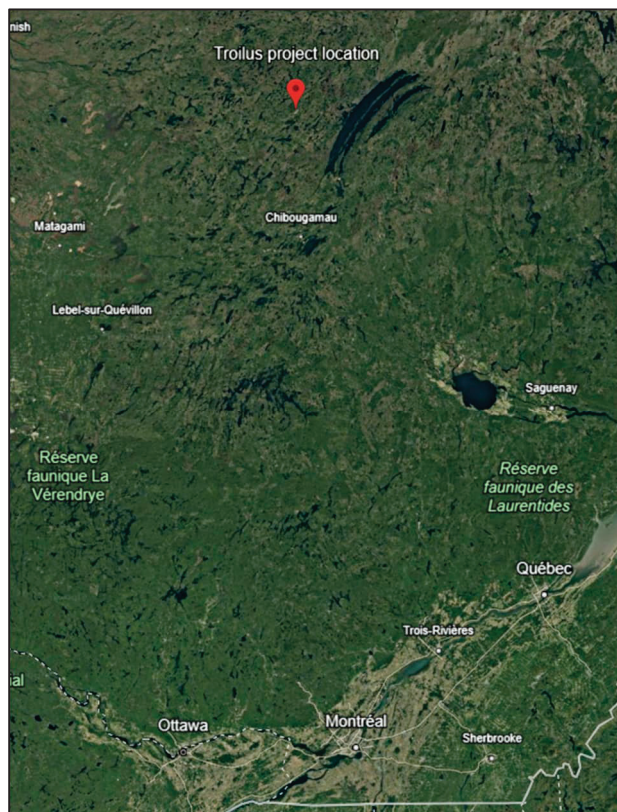


Figure 1: Localisation du site minier Troilus.

2.1 Infrastructures minières planifiées

Le redéveloppement du site prévoit l'agrandissement des deux fosses existantes J4 et 87 et le développement de deux nouvelles fosses SW et X22 (la fosse X22 est incluse dans la zone grise identifiée comme « fosse projetée »). La Figure 2 montre la localisation des infrastructures minières à la fermeture du site minier. On y distingue les fosses 87, J4, X22, les haldes à stériles, la halde à minerai, les haldes à mort-terrain, le parc à résidus miniers et le secteur de traitement du minerai. La fosse SW sera recouverte par une halde à stériles durant l'exploitation.

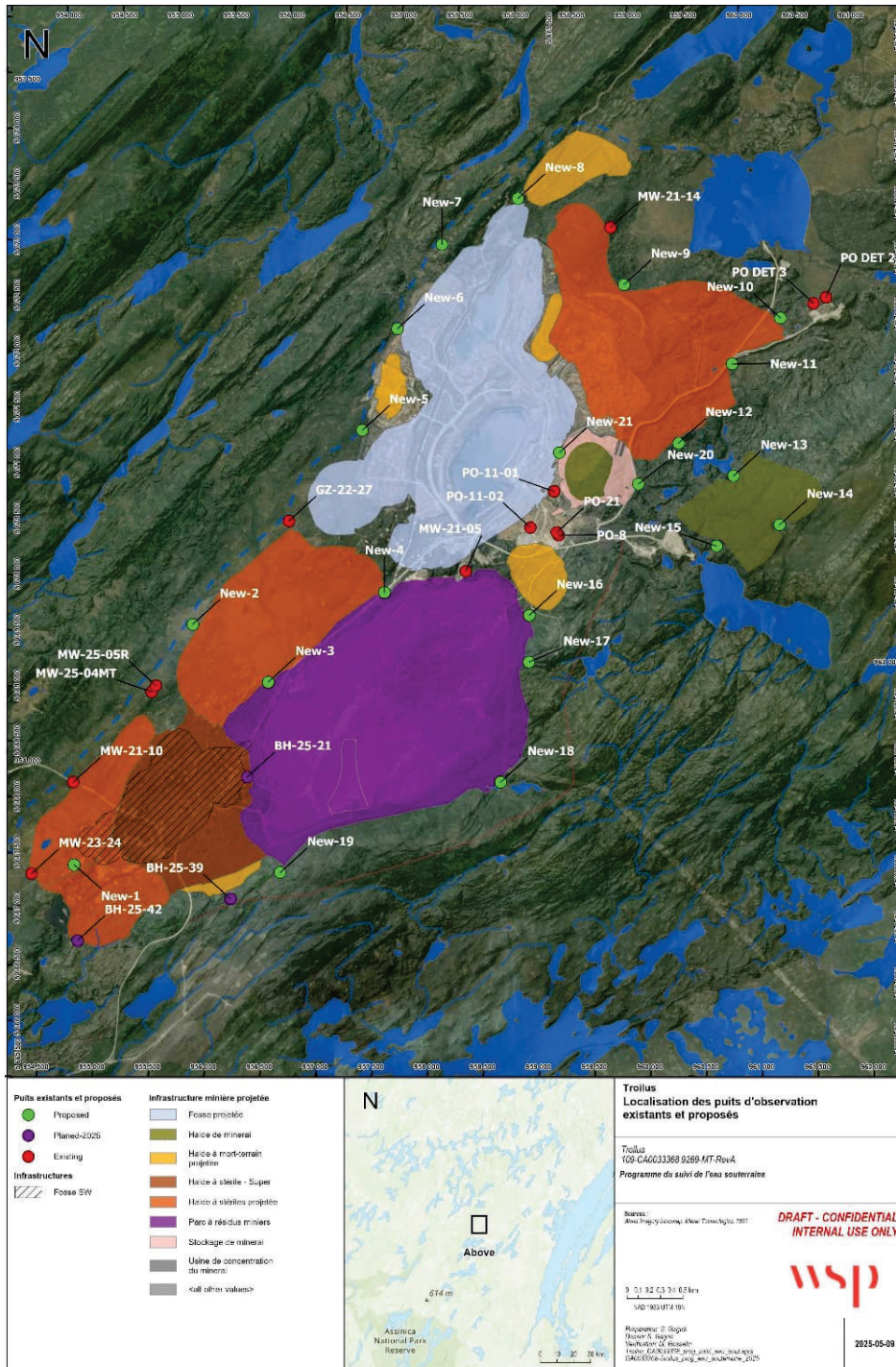


Figure 2: Localisation des infrastructures minières projetées et des puits d'observation sélectionnés pour le programme de suivi. Se référer au Tableau 2 pour les détails des puits d'observation.

3.0 TENEURS DE FOND DE L'EAU SOUTERRAINE

Les teneurs de fond naturelles des métaux dissous présents dans l'eau souterraine des dépôts meubles et de l'eau souterraine sont présentées au Tableau 1. Les résultats indiquent des concentrations naturelles dans l'eau souterraine circulant dans les dépôts meubles, au-dessus des critères de résurgence de l'eau souterraine (critère RES, MELCC, 2021) pour le Cuivre (Cu), le Mercure (Hg) et le Zinc (Zn). Les concentrations naturelles de l'eau souterraine des dépôts meubles dépassent le critère d'eau de consommation (EC) de l'aluminium (Al), le cuivre (Cu) et le manganèse (Mn), tandis qu'un dépassement en manganèse (Mn) est mesuré pour l'eau souterraine dans le roc.

Tableau 1: Teneur de fond des métaux dissous présents dans l'eau souterraine pour les dépôts meubles et le roc. Les valeurs en rouge indiquent les éléments pour lesquels un dépassement de la norme RES* ou EC est identifié.**

Paramètres	Unités lithologiques / Teneurs de fond (mg/L)		Critères (mg/L)	
	Dépôts meubles	Roc	Limite RES*	Limite EC**
Aluminium	0,12	0,0175	NA	0,1
Arsenic	0,0004	0,0025	0,34	0,0003
Bore	0,01	0,14	28	5
Cadmium	0,0001	0,0001	0,0011	0,005
Calcium	76	162		
Chrome	0,0004	0,0003		0,5
Cobalt	0,0046	0,0121	0,37	
Cuivre	0,0088	0,0049	0,0073	1
Fer	1,693	1,705		
Lithium	0,005	0,005		
Magnésium	7,42	6,06		
Manganèse	0,2305	0,2585	2,3	0,05
Mercure	0,0000119	0,0000915	0,0000013	0,001
Molybdène	0,0003	0,0091	29	40
Nickel	0,0035	0,0057	0,26	0,07
Plomb	0,00006	0,00005	0,034	0,005
Potassium	14,049	14,713		

Paramètres	Unités lithologiques / Teneurs de fond (mg/L)		Critères (mg/L)	
	Dépôts meubles	Roc	Limite RES*	Limite EC**
Silicium	11,6	15,9		
Sodium	14,213	19,491		200
Zinc	0,1019	0,0513	0,067	5
*Critère de résurgence de l'eau souterraine. **Critère d'eau de consommation				

4.0 RÉSEAU DE PUIITS D'OBSERVATION

Le programme actuel de suivi de l'eau souterraine du site en fermeture comporte 10 puits d'observation. Parmi ces puits, huit sont installés dans les dépôts meubles et deux dans le roc. Les puits PM-3, PM-5, PO-08 et PO-21 servent au suivi général du site. Les puits PZ-1, PZ-2 et PZ-3 servent au suivi au pourtour du parc à résidus minier. Les puits PO-DE 1, PO-DET 2, et PO-DET 3 servent au suivi près du dépôt en tranchées et en périphérie.

Plus d'une trentaine de puits supplémentaires ont été installés historiquement sur le site pour permettre d'établir les conditions initiales et répondre à des objectifs géotechniques.

Le programme proposé de suivi de l'eau souterraine est développé selon les infrastructures minières qui seront présentes à la fin des opérations. La stratégie est d'éviter des localisations de puits qui seront détruits durant les opérations par le développement des infrastructures telles que les fosses, les haldes et le parc à résidus.

4.1 Puits d'observation existants

Les puits existants sélectionnés sont présentés à la Figure 2. Au total, 19 puits existants ou planifiés d'être mis en place en 2025 ont été sélectionnés. Une grande majorité des puits existants ont été écartée de la sélection puisqu'ils seront détruits par le développement des infrastructures.

4.2 Puits d'observation à ajouter au réseau de suivi

À la suite de la sélection des puits faite à la section 4.1, des puits additionnels ont été ajoutés au réseau de suivi afin de respecter les exigences de la directive 019. Un total de 38 puits supplémentaires a ainsi été ajouté au réseau actuel (Figure 2).

4.3 Sommaire des puits proposés pour le réseau de suivi

Le Tableau 2 présente un sommaire des puits d'observation qui sont proposés pour le réseau de suivi de l'eau souterraine. Au total, 57 puits sont proposés dont 26 dans les dépôts meubles et 31 dans le roc. Ce réseau de puits permettra de suivre la qualité et le niveau de l'eau souterraine à proximité des infrastructures à risque tel que les haldes à stérile et le parc à résidus miniers tel qu'exigé par la D019, en plus de permettre le suivi du niveau de l'eau souterraine pendant et après le dénoyage des fosses à ciel ouvert. Tous les puits sont situés à moins de 150 m des infrastructures. Des puits d'observation ont aussi été ajoutés au nord de la fosse 87, afin de suivre le niveau et la qualité de l'eau souterraine entre les fosses et la dérivation du ruisseau Bibou.

Tableau 2: Détails des puits d'observation sélectionnés pour le programme de suivi de l'eau souterraine.

Statut	Nom	Y	X	Infrastructure minière visée	Unité géologique	Nombre de puits
Planifié: 2025	BH-25-21	5648322	535224	Aval parc à résidus	Roc/Dépôts	2
Planifié: 2025	BH-25-39	5647230	535074	Amont halde à mort terrain sud-ouest	Roc/Dépôts	2
Planifié: 2025	BH-25-42	5646859	533704	Amont halde à mort terrain sud-ouest	Roc/Dépôts	2
Existant	GZ-22-27	5650625	535596	Halde à stériles Ouest	Roc	1
Existant	MW-21-05	5650176	537182	Pied digue parc résidus	Roc	1
Existant	MW-21-10	5648275	533663	Pied halde stériles SW	Roc	1
Existant	MW-21-14	5653259	538480	Pied halde stériles 87	Dépôts	1
Existant	MW-23-24	5647456	533291	Pied halde stériles SW	Roc	1
Existant	MW-25-04MT	5649092	534367	Halde à stériles ouest/Fosse SW	Dépôts	1
Existant	MW-25-05R	5649148	534406	Halde à stériles ouest/Fosse SW	Roc	1
Existant	PO DET 2	5652632	540409	Site enfouissement	Dépôts	1
Existant	PO DET 3	5652579	540298	Site enfouissement	Dépôts	1
Existant	PO-11-01	5650891	537975	Fosse/stockage de minerai aval	Dépôts	1
Existant	PO-11-02	5650567	537761	Fosse/Usine/halde mort terrain	Dépôts	1
Existant	PO-21	5650523	537996	Halde mort terrain/Usine	Roc	1
Existant	PO-8	5650498	538015	Halde mort terrain/Usine	Roc	1
Planifié	New-01	5647536	533672	Aval/Fosse SW	Roc/Dépôts	2
Planifié	New-02	5649698	534734	Halde à stériles Ouest/Dérivation Bibou	Roc/Dépôts	2
Planifié	New-03	5649181	535411	Aval parc à résidus	Roc/Dépôts	2
Planifié	New-04	5649984	536453	Aval parc à résidus	Roc/Dépôts	2

Statut	Nom	Y	X	Infrastructure minière visée	Unité géologique	Nombre de puits
Planifié	New-05	5651440	536255	Dérivation Bibou/Fosse	Roc/Dépôts	2
Planifié	New-06	5652350	536569	Dérivation Bibou/Fosse	Roc/Dépôts	2
Planifié	New-07	5653106	536969	Dérivation Bibou/Fosse	Roc/Dépôts	2
Planifié	New-08	5653519	537650	Fosse/Dérivation Bibou	Roc/Dépôts	2
Planifié	New-09	5652746	538599	Aval halde stériles 87	Roc/Dépôts	2
Planifié	New-10	5652446	540001	Aval halde stériles 87	Roc/Dépôts	2
Planifié	New-11	5652035	539569	Amont halde stériles 87	Roc/Dépôts	2
Planifié	New-12	5651324	539089	Aval halde stériles 87	Roc/Dépôts	2
Planifié	New-13	5651031	539581	Aval halde à minerais	Roc/Dépôts	2
Planifié	New-14	5650591	539994	Amont halde à minerais	Roc/Dépôts	2
Planifié	New-15	5650400	539429	Aval halde à minerais	Roc/Dépôts	2
Planifié	New-16	5649779	537752	Amont parc à résidus	Roc	1
Planifié	New-17	5649360	537749	Amont parc à résidus	Roc	1
Planifié	New-18	5648274	537493	Amont parc à résidus	Roc	1
Planifié	New-19	5647466	535519	Amont parc à résidus	Roc	1
Planifié	New-20	5650957	538729	Stockage de minerai amont	Roc/Dépôts	2
Planifié	New-21	5651239	538020	Stockage de minerai aval	Roc/Dépôts	2

À chacun des nouveaux sites où des puits d'observation sont prévus d'être installés, une évaluation sur la nécessité d'installer un puits dans les dépôts meubles devra être faite. Dans le cas où une épaisseur de dépôts meubles supérieure à trois mètres et ayant une profondeur de nappe phréatique inférieure à un mètre, un puits d'observation dans les dépôts meubles devra être installé en plus du puits d'observation installé dans le roc.

5.0 PARAMÈTRES GÉOCHIMIQUES À ANALYSER

Les paramètres géochimiques qui doivent être suivis dans le cadre du programme de suivi sont dictés par la D019 et le Guide de caractérisation des terrains (MELCCFP, 2024). En plus des paramètres géochimiques de base, le Guide de caractérisation des terrains dicte une liste de paramètre additionnel à analyser pour les sites

d'extraction de minerais d'or et d'argent. Le Tableau 3 indique les paramètres qui être analysés dans le cadre du programme de suivi de la qualité de l'eau souterraine.

Tableau 3: Paramètres géochimiques identifiés pour le suivi de la qualité de l'eau souterraine.

Cations (dissous)	Anions et composés organiques
Calcium, Potassium, Magnésium, Sodium	Bicarbonates, Sulfate
Arsenic	Cyanure
Béryllium	CNBC
Cadmium	Chlorures
Chrome	Bromures
Cobalt	Sulfures
Cuivre	Nitrates
Mercure	Phosphore
Manganèse	Hydrocarbures pétroliers (C ₁₀ -C ₅₀)
Molybdène	Composés phénoliques
Nickel	
Plomb	Conductivité électrique
Zinc	pH

6.0 MÉTHODOLOGIE ET FRÉQUENCE D'ÉCHANTILLONNAGE

6.1 Relevés piézométriques

Les mesures de niveaux d'eau souterraine seront prises dans les puits énumérés au Tableau 2. Les mesures du niveau de l'eau souterraine seront prises à l'aide d'une sonde d'interface. Les mesures piézométriques doivent être faites minimalement deux fois par année, au printemps (période de crue) et à la fin de l'été (étiage). Pour les mesures en période d'étiage, et dans la mesure du possible, il est recommandé de ne pas procéder à la prise de mesure dans les cinq jours suivant un événement de pluie important.

6.2 Échantillonnage de l'eau souterraine

Les puits seront échantillonnés à l'aide d'une pompe. Une pompe de type péristaltique sera utilisée pour les puits ayant des niveaux d'eau dont la profondeur est inférieure à 7 m (des profondeurs supérieures à 7 m pourraient être rencontrées à proximité des fosses durant les premières années suivant l'arrêt du dénoyage). Une pompe hydrolift de type Waterra sera prise pour les puits avec un niveau d'eau plus profond. Il est recommandé que les opérations de purge soient réalisées par la méthode de purge à faible débit et à faible rabattement décrite dans le

Guide d'échantillonna à des fins d'analyses environnementales (Guide) (MDDELCC, 2019). Les mesures in situ des paramètres physico-chimiques (conductivité électrique, le pH, la température, et le potentiel d'oxydo-réduction) seront réalisées à l'aide d'une sonde multiparamétrique.

La procédure simplifiée d'échantillonnage est la suivante :

- 1) pomper avec un débit minimum (0,1 à 0,5 l/min) de manière à effectuer une micropurge;
- 2) stabiliser le rabattement et le maintenir, si possible, à une valeur inférieure à 10 cm;
- 3) mesurer in situ les paramètres physico-chimiques toutes les cinq minutes;
- 4) procéder à l'échantillonnage de l'eau souterraine lorsque la stabilisation des paramètres et du rabattement est atteinte, c'est-à-dire lorsque les écarts entre chaque lecture sont inférieurs aux valeurs indiquées dans le Guide pour trois lectures consécutives.

Si la colonne d'eau au niveau du puits échantillonné est faible (< 1 m), la méthode de purge minimale est alors recommandée dans ce cas, conformément au Guide.

7.0 CONSERVATION ET ACHEMINEMENT AU LABORATOIRE

L'eau souterraine sera versée dans des contenants préparés par le laboratoire d'analyse ayant les agents de conservation appropriés, lorsque requis. Les échantillons doivent être conservés au frais puis acheminés au laboratoire d'analyse dans les meilleurs délais. Le prélèvement, la conservation et le transport des échantillons doivent être effectués conformément au Guide d'échantillonnage à des fins d'analyses environnementales (MDDELCC, 2019). À noter qu'en fonction de la date d'échantillonnage et du transport vers le laboratoire, certains paramètres pourraient être à délais dépassés, tels que le pH (24 h) ainsi que les nitrites et nitrates séparés (48 h).

8.0 ANALYSE DES RÉSULTATS

8.1 Résultats géochimiques

Les résultats géochimiques devront être analysés conformément à la méthodologie décrite dans la D019. Les principales étapes de l'analyse sont présentées ci-dessous. La Figure 3 présente le cheminement type. Les résultats de l'analyse des résultats géochimiques doivent être présentés dans le rapport annuel présenté au Ministère.

- 1) Comparer les résultats d'analyse aux critères prescrits par le Guide d'intervention (MELCC, 2021)
- 2) Comparer les résultats aux teneurs de fonds
- 3) Dès que 10 données de suivi sont disponibles pour un puits, procéder à une analyse de tendance (Guide technique de suivi de la qualité des eaux souterraines (MDDELCC, 2017).

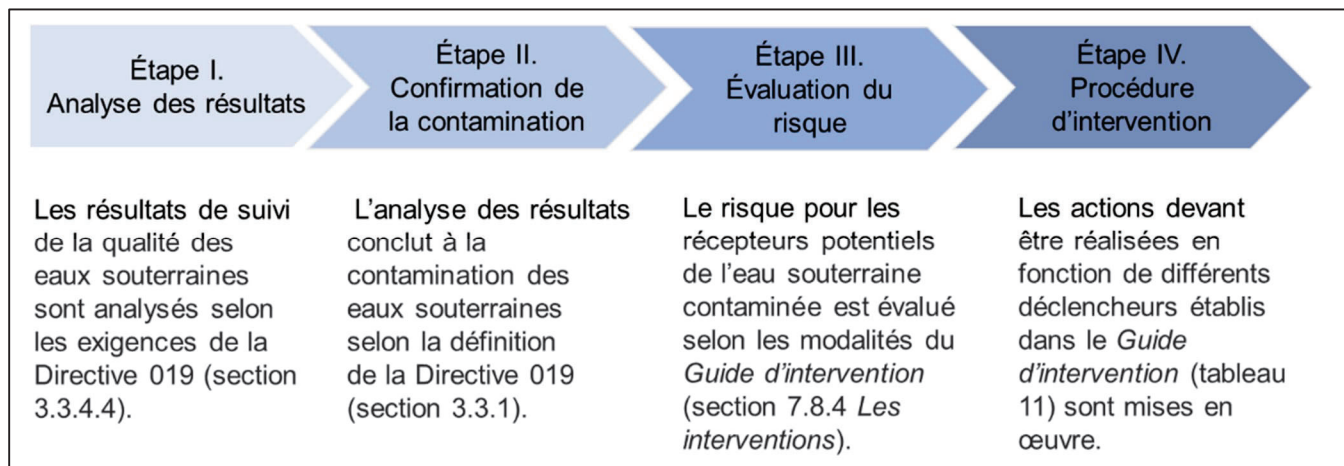


Figure 3: Étapes pour la réalisation de l'analyse des résultats de suivi de la qualité de l'eau souterraine.
Tiré de : Directive 019, MELCCFP (2025).

8.2 Résultats piézométriques

Les résultats du suivi piézométrique doivent être compilés et détaillés dans le rapport annuel présenté au Ministère.

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