

Sante Enviro Health (SEH) Submission for the Troilus Mining Project

Adaptation and resilience strategies are most important when it relates to climate change impacts on mining infrastructure. Upgrades to mining infrastructure should include the design of facilities to withstand extreme weather and must plan and integrate climate projections. Essential also are monitoring of the impacts on an ongoing basis as well as managing risks using data to track environmental changes in real time and to adapt all aspects of operations.

The results of a study project published by an Ouranos consortium in 2022 review and summarize data important on the “regional climate portrait in reference and future climates to support the analysis of impacts and adaptation to climate change in the Eeyou Istchee Baie-James territory, northern Abitibi-Témiscamingue and Nunavik” (Paquin et al., 2022).

The results of this study are presented in PROJET MINIER MONT SORCIER - DESCRIPTION INITIALE DE PROJET prepared by WSP CANADA INC.

This type of approach could be useful and should be considered for the Troilus Mining Project.

PAQUIN D., A. MAILHOT, C. GUAY, C. MALENFANT, E. BRESSON, T. LOGAN, T. SMITH, G. TALBOT, 2022. Portrait climatique régional en climat de référence et futur en soutien à l'analyse des impacts et de l'adaptation aux changements climatiques sur le territoire Eeyou Istchee Baie-James, du nord de l'AbitibiTémiscamingue et du Nunavik. Rapport final présenté au Ministère des Transports. Ouranos et INRS. 77 p, annexe A 282 p., annexe B 181 p., annexe C 364 pages, total 904 p.

Wildfire risk

Wildfire science and calculations based on modeling can estimate how fast a raging wildfire can travel in an hour. Under severe burning conditions, meaning critically dry fuels and strong winds, a wildfire's forward rate of spread is approximately 10% of the prevailing wind speed. For example, a wind speed of 50 km/h would indicate that a wildfire could spread at a rate of ~5 km/h. This ratio is an estimation and ground and other conditions may alter the actual rate. However, this calculation must be taken into consideration when predicting the time needed to activate ERPs.

The factors that can also influence a wildfires spread include, terrain, vegetation type, fuel structure density of the forested areas and fuel moisture. Wildfires can last for any number of days and persist depending on multiple factors.

Peak fire risk occurs in summer with higher temperatures and after earlier higher spring temperatures, and a lack of rain. These conditions can contribute to longer duration of wildfires which can prolong wildfire risk. Lightning storms present an increased risk which is an unpredictable phenomenon, causing 93% of Canada's burned area in 2023.

Climate change amplification, due to areas of Canada warming twice as fast as the global average, is intensifying seasonal extremes and is a major concern. Wind dries out fuels ahead of the fire, supplies oxygen to intensify combustion and carries embers that can ignite spot fires kilometers away.

Global Forest Watch (GFW) is a tool that can aid in monitoring wildfires with the ability to view active fire data and thermal anomalies. Just as loss of tree cover can be observed using these tools it can be used to track where dry forest cover is present and indicate which areas are most at risk for future wildfires.

Tree cover loss data is a powerful mapping tool and has been widely used by governments, academia, private sector and civil society to identify and address deforestation. Tree cover loss data has changed over time due to adjustments in algorithms, improvement of satellite data due to improved sensitivity and satellite images becoming more available.

EOS Landviewer is also a powerful tool allowing comparison of satellite images from different dates using Sentinel-2 data and Landsat data to enable a visualization of Earth observation data over time. A download of high-resolution images is also possible.

These types of tools are invaluable in helping to predict areas of concern for wildfire risk in order to ensure the Troilus ERP incorporates this data into the ongoing risk analysis.

The shapefiles for the regional area indicate that the Troilus Mining Project sits in a zone that has not had wildfires for quite some time, since 2019, indicated by one shapefile.

From 1981 to 2001 the wildfires occurred on both flanks of the Troilus property. This distance is approximately 15 km.

See attached document: Troilus Mining Project Wildfire Corridor Map 1972-2022 – Final which contains an ArcGIS image of the 15 km (Foret Ouverte data on ArcGIS platform)

From 2002 to 2022 the wildfires occurred further away from the Troilus property. This leaves open the question as to what the condition of the forested areas is at the present time on both flanks of the property. Satellite imagery for the regional area of the Troilus Mining Project provides an insight into the forest structure and potential for wildfire events.

There are tools that can aid in predicting future wildfires. EOS Data Analytics provides the tools for investigating this risk potential.

Ouranos - Regional Climatology and Adaptation to Climate Change is “a collaborative innovation hub enabling Quebec society to better adapt to an evolving climate. The consortium brings together upwards of 450 researchers, experts, practitioners and decision-makers from an array of disciplines, collectively working on numerous applied research programs and projects.”

These tools are invaluable to contribute to the calculation of risk for both flooding events and wildfires.

Base de données des zones à risque d'inondation (BDZI) from the Open Source Quebec provincial database, also can be a part of this research, however at the moment the latest database available for public consumption is for June 2021. There has been a recent upgrade and access to that will be important.

Wildfires are very minimally addressed in the Troilus ESIA document Environmental and Social Impact Study for the Troilus Mine Project TECHNOLOGICAL RISK MANAGEMENT, a couple of paragraphs only. The only reference to wildfires in the document in chapter 28 of this ESIA document posted by Troilus is below.

“Forest fires pose a threat to the Troilus mining project, particularly during the summer season, because it is located in a forested area. Indeed, the site is located in the boreal forest, more specifically the continuous boreal forest. According to the interactive map of Open Forest (Quebec Data, 2025), the fires recorded in the provincial register near the site date from 1993, 1983, and 1985 and came within approximately 5 km of the site. Since 1990, 65% of forest fires in Quebec have been caused by human activity, 32% by lightning, and 3% are undetermined (National Forest Database [NFD], 2023).

Forestry activities near the site could influence the risks associated with forest fires. Reducing flammable biomass would reduce the risk of spread, while human presence and the use of heavy equipment increase the risk of accidental fire ignition. “

References to ‘fires’ in this document are mostly in the context of on-site fires and the risks that these types of fires would pose This is not seemingly from wildfires.

SEH recommends that wildfire scenarios must consider the getting in and out of the mine area as flights and roads in and out may be compromised. Also to consider, is the impact of smoke covering the mine area, and the difficulty of planning an exit for staff and personnel, if needed. Finally, if all have to exit the area, considerations for the stoppage of mechanization of pumping for areas of the mine, or infrastructure that may be at risk, which are usually surveilled on site, not remotely.

Canadian Wildland Fire Information System

The 2023 Wildfire Season contributed to increased research on effects of climate change on wildfires. Increasingly climate change can be linked to these events. Canada’s 2023 wildfire season was the most destructive ever recorded. In 2023, 15 million hectares of land were consumed by wildfires, as compared with the Canadian average of 2.5 million hectares.

Yan Boulanger, research scientist in forest ecology at Natural Resources Canada and Canadian Forest Services scientists, Jonathan Boucher and Sandy Erni, along with an international team of 16 scientists involved in a study by World Weather Attribution (WWA), focused on Quebec’s wildfire season. Their finding was that climate change more than doubled the likelihood of extreme fire weather conditions in Quebec.

The research looked at how the intensity and likelihood of an extreme weather event is linked to climate change. The WWA published results soon after the event, instead of waiting for a long review process, so they can provide context and lessons learned quickly after an extreme event.

Due to warm and dry conditions in early May, the 2023 wildfire season began early, and continued on into June and July. These researchers used Natural Resources Canada's Fire Weather Index (FWI), a metric combining temperature, wind speed, relative humidity and precipitation to estimate the level of fire danger. The scientists also calculated the Cumulative Daily Severity Rating from the FWI, to assess the effects and contribution of hot and dry weather conditions from January to July.

The conclusion was that extreme weather, record high temperatures and dry conditions caused by climate change intensified the 2023 wildfires. Researchers found "wildfire-prone weather conditions in Quebec were 50 percent more intense because of climate change caused by human activity, while the peak intensity recorded was 20 percent higher".

Weather data and computer model simulations are an important tool needed for the planning of mining projects, such as the Troilus Mining Project. Studies like the one here indicate that this data can assist and facilitate 'de-risking' a mining project, related to wildfires.

SEH recommends that long-term consequences of the increasing risk of wildfires warrants that mining companies must adapt and prepare for these changes, using a proactive approach and these changes must be included in any ESIA, including ERPs based on these increased risks.

<https://natural-resources.canada.ca/stories/simply-science/canada-s-record-breaking-wildfires-2023-fiery-wake-call>

The wildfires of June and July 2023, which came within approximately 50 km of the Troilus mine site, are a clear indication that this risk is of greater importance than the ESIA points out and demands larger scrutiny and much further adaptation to risk management strategies.

See attached document: **Sequence of wildfire maps May 1, 2023 -June 30, 2023 - Canadian Wildland Fire Information System**

The generation of risk management strategies, analysis and stratification of risk, resulting from extreme weather events, are very extensive for some other elements of risk for the project. However, the risk of wildfires is ever expanding and therefore SEH recommends this should comprise a greater part in the risk analysis and management strategies. Wildfire risk affects the construction, operation and closure phases of the Troilus Mining Project and must be more actively incorporated into the planning of all stages of this mining project.

Seismic risk

Seismic risk is seemingly less of a climate change related risk. However, it should be considered in the light of the implication that should a seismic event occur, impacts of climate change may already be affecting a project on an ongoing basis, and the cumulative effects will undoubtedly increase the overall risk.

Included in the ESIA document are Operational Control Measures, which describes mine design strategies, inspections, dewatering, wall scaling, and seismic monitoring. Also included are monitoring and response protocols, evacuation planning and field monitoring, essential for emergency preparedness. However, missing or incomplete is the definition of seismic hazard. Local seismic hazard or reference to seismic zone classification based on the latest Canadian hazard models should be included.

The probability of seismic event occurrence (e.g., 2% in 50 years) isn't specified. A geotechnical study on soil movement parameters for seismic risk assessment is provided, but there are no outputs relevant to seismic loading.

Seismic-specific standards and building codes such as National Building Code of Canada 2020, CAN/CSA-Z662 (for pipelines, as there may be pipelines needed for some aspects of the project) and CDA guidelines for tailings dams are not referenced. Performance-based seismic design principles could be used.

High-impact structure design considerations such as for critical infrastructure (e.g. tailings dams, explosive storage, shaft walls) are not specifically referenced for high-risk assets.

The ESIA addresses safety and monitoring protocols within a mining context, but SEH suggests it could be further expanded, with regard to potential cumulative effects.

Flooding risk

One of the largest issues related to flooding risk is the management of tailings pond management.

A major rainfall event that prompts flooding, with many millimeters of rain in a very short time period is of prime concern specifically for tailings ponds.

More scenarios than the 100 year flood should be addressed as shorter term flood events are becoming the norm. Predictions and analysis on much shorter time frames than 100 years for flooding are needed.

A summary of chemicals stored on site includes PAX Granulated powder, SPRI, Frothier, ZnSO₄, Na₂CS₃, Fe₂(SO₄)₃ Activated lime Powder. As well, 858,323 liters of propane will also be stored on the mine site. These elements would have severe consequences should a flooding event impact the mine area.

In the document “Desktop Assessment of Potential Failure of the Existing Tailing Storage Facility – Troilus Gold Mine Site” (page 48 of 144 pages) states:

“As part of the Environmental Impact Assessment, Troilus Gold Corp. seeks to obtain a preliminary assessment of the flooded area and consequences in the event of a breach of the existing TSF main dyke considering its future rising. It should be noted that a detailed TSF breach analysis will be conducted in subsequent phases of the project as the project engineering progresses.”

SEH recommends that this assessment should be done on the existing TSF main dyke as well as for other future infrastructure that could be affected by flooding events.

The conclusion for the Desktop Assessment of Potential Failure of the Existing Tailing Storage Facility (page 68 of 144 pages) states:

“A preliminary high-level assessment of the risk associated with a potential TSF breach was completed as part of this study. Three possible scenarios were evaluated, corresponding to the current TSF condition, the operational year 2, and the final operational stage. It was concluded that a breach TSF dyke considering the actual site condition could cause significant damage to mining infrastructure, as well as to nearby environmental and water bodies.”

The interpretations provided in the ESIA offer only a general insight, according to the authors in their conclusion, despite having provided a very detailed study of the parameters involved in a potential dam breach.

Specifically in the conclusion it is stated, *“Finally, as previously mentioned, this report provides only an approximate evaluation of the impacted area and should not be used to draw definitive conclusions or to make final decisions regarding the dam breach study or the TSF classification.”*

SEH questions when will definitive conclusions be drawn with regards to the actual risk of flooding potential?

Learnings from the Mount Polley disaster in 2014 are most important as they may be able to shed light on the built structure of a tailings impoundment, construction of where the waste rock piles will be situated and what measures can be taken to avoid major issues and failings of structures.

The Plan des Mesures Urgences (PMU) (Emergency Measures Plan) is extensive and extremely detailed. However, the main concerning issue with the PMU is that the risks have been determined mostly to be low to moderate. According to the list of what the delays might be with a lower risk event, the concern is minimized for events that occur more frequently or have fallout that lasts longer.

Impacts of wildfires and flooding on mining infrastructure are more immediate, so SEH recommends these effects must be planned as much as is possible, as early on in the planning process as possible.

Extreme weather risks will be escalating going forward, due to flooding and wildfires. SEH recommends that the risk analysis should be more inclusive of these specific risks. In other words, the risk analysis should go steps forward in that regard to be prepared for the inevitable events that may occur.

Troilus must take control over what aspects it can prepare for as there are multiple aspects, the most predominant being wildfires and flooding events, that no one has control over.

Attachments

Troilus Mining Project Wildfire Corridor Map 1972-2022 – Final

Sequence of wildfire maps May 1, 2023 -June 30, 2023 - Canadian Wildland Fire Information System

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