Crawford Nickel Project
Impact Statement

Chapter 30 Assessment of Potential Effects of the Environment on the Project

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Table of Contents

List of Tables

List of Figures

Acronyms and Abbreviations

CCRA	Climate Change Resilience Assessment
ECCC	Environment and Climate Change Canada
GCM	Global Climate Models
ISO	International Organization of Standardization
LOM	life of the mine
O&M	operation and maintenance
PA	Project Area
SOP	Standard Operating Procedure
TMF	Tailings Management Facility

30 Assessment of Potential Effects of the Environment on the Project

An assessment of the effects of the environment on the Crawford Nickel Project (‘the Project’) has been included as environmental conditions, including natural hazards and external events, could adversely affect the Project and, in turn, result in effects to the environment, health, social, and economic conditions. These interactions may include naturally occurring events related to climate (including weather and its variables), climate change, forest fires (e.g., wildfires), and geologic hazards (e.g., seismic activity, erosion, and landslides).

If effects of the environment on the Project are not managed effectively, adverse changes may occur to Project components and infrastructure, construction schedule (including site preparation, physical construction and equipment installation, and commissioning), and operational performance. Typically, these potential effects are addressed through Project design, scheduling, applying industry standards and best management practices, and operational procedures that are implemented in consideration of gradual changes (e.g., continuing increase in atmospheric temperature) as well as more sudden and/or extreme environmental conditions (e.g., short-term intense rain events that cause flooding).

30.1 Scope of the Assessment

30.1.1 Approach

Weather conditions and events are assessed under different likelihoods of occurrence (e.g., 5-year flood versus 100-year flood) to determine how these events could change under a range of potential future climate scenarios. Credible weather conditions and external events that have a reasonable likelihood of occurrence and for which the resulting environmental effects could be impactful without careful management are considered.

The Climate Change Resilience Assessment (CCRA) methodology aligns with the requirements of the Technical Guide Related to the Strategic Assessment of Climate Change (ECCC, 2022) and uses a similar risk assessment approach as the Institute for Catastrophic Loss Reduction (ICLR) Public Infrastructure Engineering Vulnerability Committee Protocol and Infrastructure Canada’s Climate Lens General Guidance (Latest Edition). The methodology also aligns with the following international standards:

- International Organization of Standardization (ISO) 31000:2018 – Risk Management – Principles and Guidelines
- ISO 14090:2019 – Adaptation to Climate Change — Principles, requirements, and guidelines
- ISO 14091:2021 – Adaptation to Climate Change — Guidelines on vulnerability, impacts and risk assessment

A detailed CCRA has been completed to assess the risks to Project infrastructure and assets (built and natural) from climate change and extreme weather events (see Appendix N of the Impact Statement). The CCRA assessed how Project infrastructure, assets, and operations will respond when exposed to selected climate hazards and extreme weather events, under current and future climate conditions over the Life of the Mine (LOM). The CCRA assessment process used for the Project generally follows the framework outlined in the Strategic Assessment of Climate Change: Assessing Climate Change Resilience document (ECCC 2022) as illustrated in Figure 30.1.

A review of regional and site-specific climate change conditions was completed to determine the climate hazards the Project assets and infrastructure might be exposed to over the LOM. Historical climate data collected from available weather stations in the Project Area have been used to establish the climate baseline (1981-2010 and 1991-2020).

Future climate projections using downscaled Global Climate Models (GCMs) for the 2020s (2011-2040), 2050s (2041-2070), and 2080s (2071-2100) (to align with the LOM including closure and post closure monitoring requirements) were used to determine the future likelihood of occurrence of the climate hazards.

The impacts from climate change and extreme weather were assessed using two Shared Socioeconomic Pathways (SSP), to determine how climate risks to the Project may change depending on the global socio-economic response to reducing greenhouse gas emissions. SSP-8.5 and SSP2-4.5 scenarios were selected to represent the high and more middle of the road emissions scenarios, respectively. To provide a risk averse conservative estimate of projected climate change and extreme weather impacts, risks and the recommended controls, adaptation and resilience measures have been developed using the GHG emissions scenario SSP5-8.5.

A list of built and natural assets and related infrastructure components considered as part of the CCRA was established based on the Feasibility Study (Ausenco 2023) in conjunction with the Project Description (Chapter 3 of the Impact Statement). Each asset was reviewed, and potential impacts identified were reviewed and for all climate hazard-asset exposures. Using the impacts as a guide, consequence scores were assigned for each climate hazard-asset/infrastructure component exposure. Using the likelihood of the climate hazard occurring and the consequence score assigned to the interaction, the climate risk to each asset was determined for the baseline climate and the 2020s, 2050s, and 2080s time periods. For all medium, high, and extreme risks identified, climate adaptation and mitigation measures were suggested. The findings in this chapter are supported by the CCRA completed for the Project. A copy of the CCRA report, with further details on the methodology and assessment completed, is included in Appendix N of the Impact Statement.

30.1.2 The Influence of Consultation and Engagement on the Assessment

Canada Nickel Company (Canada Nickel) has engaged with potentially affected Indigenous Nations, regulators, the public, and stakeholders. Table 30.1 provides a summary of the topics, key information including Indigenous knowledge, and concerns that Canada Nickel identified through their engagement efforts that relate to climate change, as well as a summary of the influence that the outcomes of this engagement had on the assessment.

Comments received and additional information collected during on-going engagement are documented and catalogued and proposed actions to address the comments and concerns are provided. The comments received through the engagement process have been reviewed and considered in the development of the assessment of the effects of the environment on the Project.

Table 30.1 Summary of Key Information, Indigenous Knowledge, and Concerns for the Project Related to Effects of the Environment on the Project

Topic	Key Information, Indigenous Knowledge, and Concerns	Influence on the Assessment	Where Information is Addressed in the Impact Statement
GHG Emissions and Carbon Sinks	• NRCan commented about the validity of Canada Nickel's Carbon Storage Plan and expressed that a Best Available Technologies/Best Environmental Practices (BAT/BEP) assessment be prepared, alongside a credible net-zero plan that uses and builds off the BAT/BEP determination to describe mitigation measures that will be taken to minimize GHG emissions. • Members of the public, stakeholder groups and Apitipi Anicinapek Nation, Mattagami First Nation and Métis Nation of Ontario – Region 3 expressed support for increased carbon capture/storage opportunities and commented about the Project's ability to store carbon through the mineral carbonation of tailings and the potential effectiveness of this novel technology in reducing greenhouse gas emissions and the Project's ability to reach carbon neutral/net-zero by 2050. • Members of the public and other stakeholders expressed concern regarding: • impacts of the Project on climate change (i.e., GHG emissions) • use of diesel-fired generation during various mine phases • how the Project will be carbon neutral and how the In-Process Tailings (IPT) Carbonation works • Stakeholder groups, Taykwa Tagamou Nation, Apitipi Anicinapek Nation, Flying Post First Nation, Matachewan First Nation, Mattagami First Nation, and Métis Nation of Ontario (Region 3) expressed concern regarding potential changes to wetlands and muskeg function for carbon sequestration within the PA. • The Impact Assessment Agency of Canada and Taykwa Tagamou Nation expressed concern regarding carbon sequestration, specifically whether the overburden that will be removed are accounted in climate change modelling. • Flying Post First Nation, Matachewan First Nation, Mattagami First Nation, Métis Nation of Ontario - Region 3, and Taykwa Tagamou Nation expressed concern over the effects from changes to waste management because of mineral carbonization techniques.	• Informed the assessment of GHG emissions and carbon sinks in Chapter 20 (Assessment of Potential Effects on Climate Change). The assessment was completed in accordance with the SACC. This includes: • a BAT/BEP determination to identify ways to reduce the Project's GHG emissions • an assessment of the potential for carbon sequestration including the IPT Carbonation process • calculation of net GHG emissions by year for each phase of the Project • description of the Project's main sources of GHG emissions with description of diesel-fired generation limited to construction phase and emergency use during operations phase • a quantification of direct GHG emissions as a result of land-use change – part of which includes the assessment of GHG emissions from overburden removal • a quantification of changes to carbon sinks, including impacts of changes to wetlands and impacts of overburden removal • a net-zero plan for the Project to achieve net-zero by 2050 and description of carbon sinks including IPT Carbonation process • Informed the assessment of potential effects on vegetation, riparian and wetland environments in Chapter 16, including an assessment of potential changes in wetland form and function (Assessment of Potential Effects on Vegetation, Riparian and Wetland Environments) • Informed the assessment on Indigenous interests in Chapters 25 to 28 of the Impact Statement (Assessment of Potential Effects on Indigenous Interests).	• Chapter 20 (Assessment of Potential Effects on Climate Change) • Appendix C.6 (Greenhouse Gases Following the Strategic Assessment of Climate Change), Sections 2, 4, 5, 6, 9 • Chapter 16 (Assessment of Potential Effects on Vegetation, Riparian and Wetland Environments) • Chapters 25 to 28 (Assessment of Effects on Indigenous Interests)
Forest Fires	• Members of the public and other stakeholders are concerned about how forest fire risk will be incorporated into the Impact Assessment.	• An assessment of potential wildfires and their potential effect on the Project was considered. • The potential for the Project to cause an accidental fire and associated forest fire risk has been evaluated as part of the Accidents and Malfunctions assessment.	• Chapter 30 (Assessment of Potential Effects of the Environment on the Project), Section 30.2.5 • Chapter 31 (Accidents and Malfunctions)
Climate Risk and Design	• Apitipi Anicinapek Nation and Taykwa Tagamou Nation expressed concern regarding the Project's contribution to climate change. • Taykwa Tagamou Nation expressed concern regarding the effects of climate change on all aspects of the Project, with an emphasis on water management infrastructure and water dependent design components such as waterbodies or waterways that the Project will collect water from. • Matachewan First Nation and Mattagami First Nation expressed concern regarding climate change, increased wind, and the potential for interactions with the tailings, including dust dispersal and affects on harvested resources and the environment. • Taykwa Tagamou Nation recommended Canada Nickel provide up-to-date climatological information and demonstrate how extreme conditions due to climate change will be incorporated into both baseline conditions and future predictions.	• The assessment of the Project's contribution to climate change was completed in accordance with the SACC in Chapter 20 (Assessment of Potential Effects on Climate Change). • Climate change scenarios related to water were considered when assessing effects of the Project and when determining design criteria for water management infrastructure. • An air quality assessment was conducted, including an assessment of particulate matter effects. • Informed the assessment on Indigenous interests in Chapters 25 to 28 of the Impact Statement (Assessment of Potential Effects on Indigenous Interests). • Canada Nickel's responses to mitigation recommendations made by the Indigenous nations are provided in Chapters 25 to 28 of the Impact Statement (Assessment of Potential Effects on Indigenous Interests).	• Chapter 12 (Assessment of Potential Effects on the Atmospheric Environment) • Chapter 15 (Assessment of Potential Effects on Surface Water) • Surface Water Resources Assessment (Appendix C.5 of the Impact Statement) • Chapter 20 (Assessment of Potential Effects on Climate Change) • Appendix C.6 (Greenhouse Gases Following the Strategic Assessment of Climate Change) • CCRA (Appendix N of the Impact Statement) • Chapters 25 to 28 (Assessment of Effects on Indigenous Interests)

Where made available by Indigenous nations through engagement, information gathering, and voluntary information sharing, Indigenous knowledge has been considered and incorporated into the Impact Statement, as applicable. Refer to the Description of Engagement with Indigenous Peoples (Chapter 7 of the Impact Statement) for detailed methods regarding the incorporation of Indigenous knowledge to the Impact Statement.

30.1.3 Boundaries

30.1.3.1 Spatial Boundaries

The spatial boundary for effects of the environment on the Project is limited to the area having Project related infrastructure within it, or the **Project Area (PA)**. As part of the assessment, historical climate data from four Environment and Climate Change Canada (ECCC) weather stations in the Timmins region were used as a proxy to determine baseline climate for the PA.

30.1.3.2 Temporal Boundaries

The effects of climate change and the environment on the Project have been evaluated over the LOM, from construction and development, through active mining operations and maintenance, to closure, decommissioning, and post closure monitoring and maintenance.

30.2 Existing Conditions

A summary of climate trends and projections for the Project region is presented in the following subsections. Detailed historical climate data and future climate projections (including charts and graphs displaying the data) for the region are presented in the CRRA (Appendix N of the Impact Statement). SSP5-8.5 was used for the CCRA as it a conservative method of assessing potential future climate conditions, which is industry practice for CCRA. Other disciplines (e.g., surface water) use different climate scenarios, which are accepted industry/regulatory guidelines/standards for those disciplines.

30.2.1 Air Temperature

The Project region has experienced (and is projected to continue experiencing) temperature increases for annual mean daily temperature, annual mean daily minimum temperature, and annual mean daily maximum temperature for all seasons. By the 2080s, the average annual maximum daily temperature is projected to increase by 3.9°C and 6.5°C above baseline climate under SSP2-4.5 and SSP5-8.5, respectively.

The number of extreme heat temperature events – i.e., days with temperatures equal to or greater than 30°C – has averaged around 7.5 days/year for the 1981 to 2010 period. By the 2080s, the number of days over 30°C is projected to increase to 31.9 and 55.7 days/year under SSP2-4.5 and SSP5-8.5, respectively. An increase in the frequency of heat waves (based on a 30°C threshold) is also expected, which can translate into an increase in operation and maintenance costs and increased potential for heat related illnesses for workers on the Project.

The number of cold temperature days – i.e., days equal to or below -30°C – is expected to decline from 15.5 days/year (1981-2010) to 2.6 and 0.4 days/year by the 2080s under SSP2-4.5 and SSP5-8.5, respectively. A decline in the number of heating degree days (based on an 18°C threshold) is also expected, which will result in a decrease in heating needs in the region.

The number of freeze-thaw cycles is expected to decrease from 78.9 cycles/year in the baseline climate to 62.1 and 59.9 cycles/year by the 2080s under SSP2-4.5 and SSP5-8.5, respectively.

30.2.2 Precipitation

Total annual precipitation in the region is projected to increase by 10.8% and 18.3% under SSP2-4.5 and SSP5-8.5, respectively, for the 2080s from the 1981-2010 baseline. Seasonal precipitation (winter, spring, summer, and fall) is projected to increase in the region, with the largest percentage changes (+22.5% [SSP2-4.5], +37.2% [SSP5-8.5] in the 2080s) in winter, while summer precipitation is projected to remain relatively constant (+0.4% [SSP2-4.5], +0.1% [SSP5-8.5] in the 2080s).

Heavy precipitation events are projected to become 31.6% and 58.9% more intense by the 2080s under SSP2-4.5 and SSP5-8.5, respectively, for all design storms ranging from 5-minute to 24-hour duration and 2 to 100-year return frequency when compared to historical Intensity-Duration-Frequency curves. This translates to increased potential for localized and overland flooding due to both rapid and long-term accumulations with the potential to overwhelm Project water management systems.

The frequency of heavy snow events – i.e., with snowfall greater than 25 cm – is expected to remain similar to the historic frequency at 0.3 days/year due to cold air outbreaks and storm tracks. However, the type of winter precipitation is expected to change under a warming climate, as snowfall in this region is more likely to occur as rain. This will likely translate into an increase in the percentage of mixed winter precipitation in the future.

Under a warming climate, research has shown that projected temperature changes may increase the likelihood of freezing rain events by the 2050s and 2080s. Freezing rain events in winter months (December, January, and February) could increase by about 40 to 100% in frequency in the PA for the 2050s and 2080s. For the warmer months (November, March, and April), future freezing rain events are projected to increase in frequency by 10 to 40% (Cheng 2011). However, other studies using different freezing rain simulation methods and GCM ensembles have suggested that total annual freezing rain hours may decrease under warming temperatures while extreme events remain possible (McCray 2022). Therefore, it is difficult to determine how freezing rain events will impact the Project region in the future due to limited supporting data and high uncertainty.

30.2.3 High Winds and Wind Gusts

High winds are defined as straight-line winds (to differentiate from tornadoes) including thunderstorm-associated winds (downbursts, microbursts) and winds from large-scale low-pressure systems, of sufficient strength to cause damage to exposed vegetation, buildings, and infrastructure.

Historical wind gusts of ≥70 kilometres per hour (km/h) and >90 km/h have occurred on average 3.41 days/year and 0.29 days/year in the Project region, respectively. The effects of climate change with respect to wind are not as well understood as other variables such as temperature. Projected wind gust trends are based on peer reviewed published results of statistically downscaled future wind gusts above the 90 km/h threshold (Cheng, et al. 2014). Using the ensemble of eight GCM simulations, the modeled results indicated that the frequencies of the wind gust events could increase in Canada under a warming climate.

The study also showed a consistent pattern of greater increases in gust frequency for successively higher thresholds. Hence, gusts above the 110 km/h threshold are expected to increase at least by the same magnitude if not more than the 90 km/h threshold under climate change. The percentage increases in future daily wind gust events of ≥90 km/h and ≥110 km/h from the current baseline could be 10% to 20% in most of the regions across Canada (Cheng 2014). A similar trend for winds is expected for the Project region under future climate.

30.2.4 Lightning

More than 45 million cloud-to-ground (CG) lightning flashes were recorded by the Canadian Lightning Detection Network for the years 1999–2018 (Kochtubajda and Burrows 2020). Lightning activity in Canada is greatest in the summer. Winter lightning is rare, usually occurring in extreme southern Ontario and the Atlantic Provinces as well as over offshore regions west of Vancouver Island (British Columbia) and the coastal waters off Nova Scotia. Preliminary analysis suggests the majority of western and northern Canada has experienced more lightning days during the 2009–2018 period, whereas much of eastern Canada has experienced fewer lightning days. These numbers vary from a low of 1.57 million flashes in 2009 to a high of 2.97 million flashes in 2005 in Canada during the study period.

Within 25 km of Timmins, Canadian lightning activity statistics recorded 13,679 CG lightning flashes from 1999 to 2018, with an annual average of 25.7 days with lightning (ECCC 2019). Under climate change, a proxy model based on precipitation rates and air circulation in the atmosphere has estimated that, for roughly every 1°C increase in global average air temperature, there is a 12% (±5%) increase in lightning frequency due to higher moisture content in the atmosphere (Romps 2014).

30.2.5 Wildfires

Using the Canadian Wildland Fire Information System (NRCan 2017), 36 separate large (≥ 200 ha) wildfires were observed within a 100 km radius of the Project site during the 1950-2020 period. Under the RCP8.5 climate change projections, the area burnt by wildfires is expected to increase gradually from 2020 to 2050 and exponentially from 2050 to 2100 (Balshi, 2008). Due to the predicted warmer temperatures, change in precipitation, and intensification of drought events, fire occurrences caused by lightning are expected to increase by an estimated 24% by 2040 and by 90% by 2090 in Ontario based on fire weather and fuel moisture scenarios from GCM climate projections and the LEOPARDS protection analysis system (Wotton, Logan, & McAlpine 2005).

Due to the projected warmer temperatures, changes in precipitation, and intensification of drought events, the frequency of wildfire occurrence is expected to increase by an estimated 24% by 2040 and by 90% by 2090 in Ontario (Wotton, Logan, & McAlpine 2005). However, this result is subject to a moderate amount of uncertainty due to the complex nature of wildfires, available wildfire fuel type, and possible future fire management adaptation plans.

A small (<5 ha) wildfire occurred on the Project site in June 2023 (Figure 30.2). The fire was identified and quickly extinguished resulting in no substantive damage to workers or equipment on site. This event illustrates the susceptibility of the Project site to the physical risks from wildfires.

Smoke from wildfires is a concern, as the air quality in the Project Area could be impacted by wildfire smoke from hundreds to thousands of kilometers away. Wildfire smoke can be a health and safety concern to Project workers, potentially impacting operations as steps may be necessary to reduce exposure to wildfire smoke and associated airborne particulate matter.

30.2.6 Inversions

Weather generally occurs in the lowest part of the earth’s atmosphere, the troposphere, which can extend to heights of 16 km above the earth’s surface. Air temperature in the troposphere typically decreases with elevation. In an inversion layer, the atmosphere warms as it increases in elevation. This often happens in areas of high pressure, where the air aloft dries out and warms up as it descends towards the ground. The layer of warm air can act as a barrier to vertical air movement, trapping cooler (and denser) air near the surface, creating an inversion.

A study of long-term changes in extreme air pollution meteorology has shown a warming climate is expected to increase evapotranspiration, releasing more latent heat in the upper troposphere (Hou & Wu 2016). Consequently, atmospheric stability is generally expected to increase with climate change, leading to more temperature inversions. Additionally, the trends in temperature inversion event frequencies over non-polar continental regions in the Northern Hemisphere show clear seasonal variation, with the strongest increase (+17.4%) in summer and little change in winter.

Surface temperature inversions can have an impact on air quality, especially during winter when the inversions have the strongest effects. This phenomenon can severely restrict the vertical movement of trapped air particles. Cooling frequently occurs in low places such as valleys and open pit mines, which are sheltered from winds. Pollutants from mining equipment and blasting operations can be trapped near the surface of open pits during an inversion, leading to poor air quality, and creating a health and safety risk. Additionally, when the temperature drops below the dewpoint temperature, fog may form in the surface layer, reducing visibility and hindering the movement of mine equipment, impacting operations, and creating an increased operational safety risk. As inversions would primarily occur within the open pit, the effect on the Project is expected to be nominal, with the inversions primarily affecting the Project operations.

30.3 Potential Effects of the Environment on the Project

The environmental factors that could potentially affect the Project include precipitation (short and long duration rainfall, snow, freezing rain, drought), changes in air temperature (extreme heat/heat waves, extreme cold), high winds and wind gust, wildfires (including wildfire smoke) and lightning. The effects of climate change and extreme weather has the potential to affect the Project by causing disruptions and impact to the project's assets and infrastructure and operations, and potentially impact the environment over the LOM. The potential effects of these events are discussed in the relevant sections below, and further supported by the CCRA completed to assess the resilience of the Project to the impacts of climate change and extreme weather (see the Appendix N of the Impact Statement).

30.3.1 Air Temperature

Extreme heat and heat waves can impact the Project in the following ways:

- Increases the cooling demand on building heating, ventilation, and air conditioning systems, which may result in insufficient cooling to consistently maintain building set points to provide a proper comfort level for staff. Air conditioning units will produce less cooling as ambient air temperatures rise.
- Increases the risk of heat-related illnesses (e.g., increased risk of heat fatigue and heat stress) to workers who need to be outside and in the buildings like garages or maintenance shop bays that are not air conditioned.
- Higher equipment operating temperatures can lead to increased maintenance requirements and risk of failure.
- Increases evaporation can lead to an increase in fugitive dust impacting air quality.
- Increased potential for forest fires.
- Increase evapotranspiration can accelerated reduction in the water levels in collection ponds and decreases the volume of water needed to be treated before being released to the environment.

Extreme cold temperatures can impact the Project in the following ways:

- Extreme cold can freeze pumps and pipes in the water management system (transportation/distribution pipes and valves), which can increase maintenance costs and potentially cause a reduction in production throughput.
- Extreme cold can freeze stockpiles, which can increase rehandling costs, impacting the processing of ore.
- Extreme cold can cause frost bite or hypothermia to workers.
- Extreme cold may impact revegetation by increasing the risks of morbidity of plants and ground cover.
- Cold temperatures may be beneficial during stripping operations by reducing the amount of surface water.

30.3.2 Precipitation

Short duration high intensity and long duration rainfall events can impact the Project in the following ways:

- Rainfall can saturate soils and lead to potential landslides/earth movement, slumping of stockpiles, rockslides, and may increase the risk of pit wall failure.
- Runoff on roads can washout material and require additional grading and maintenance.
- Long duration rainfall increases the water in the open pit, thus increasing the need for dewatering.
- High rainfall increases the loading of the water management system, including contact and non-contact diversion systems and collection ponds, which may exceed the system capacity resulting in a release of untreated water to the environment.
- High rainfall produces large volumes of water and fine-grained materials from erosion and runoff during construction (e.g., stripping of overburden), which can potentially lead to increased suspended solids in local creeks and waterways if not contained on site.
- Excess precipitation in the form of short and long duration rainfall events have the potential to result in localized flooding at the mine site, water levels in the open and increased erosion to roads and stockpiles.
- Increased precipitation can reduce the free board on the Tailings Management Facility (TMF) potentially increasing the potential for over topping, and the release of contaminated water to the environment.

Heavy snowfall can impact the Project in the following ways:

- Heavy snow can impact roads and bridges, increasing the potential for accidents, resulting in road closures, slowing the transport of workers and resources to and from the Project site.
- Heavy snowfall can increase the load on roofs, increasing the potential for roof collapse or failure.
- Large accumulations of snow can lead to increased surface water during periods of melting, causing localized flooding. Rapid melts during spring freshet may cause collection ponds to exceed capacity.
- Snow in the Open Pit will either be removed with the excavated materials or allowed to melt and drained towards the pit sump for removal by the dewatering system.

Freezing rain can impact the Project in the following ways:

- Ice accumulation on trolley wires may impact the operation and functionality of the trolley assist system. The weight of accumulated ice on the trolley can cause sagging or breakage of trolley wires or may cause physically damage support towers.
- Ice accumulation can damage power transmission lines leading to power outages, impacting site-wide operations.

Drought was evaluated using the using the Standardized Precipitation Evapotranspiration Index (see Appendix B in the CCRA [Appendix N of the Impact Statement]), which assesses metrics like precipitation, runoff rates, evapotranspiration, and soil water content over an extended time to analyze and identify drought characteristics in the context of climate change. Based on the 12-month Standardized Precipitation Evapotranspiration Index, wet periods become exceedingly rare after the 2050s, suggesting a prolonged period of dry conditions with occasional droughts. The timing of possible drought periods coincides with the closure and post closure period of the mine, which may increase the risk of morbidity to restorative vegetation.

30.3.3 High Winds and Wind Gusts

High winds and wind gusts can impact the Project in the following ways:

- potential for structural damages to buildings; high winds can damage roof and building envelope, windows, and doors
- health and safety hazards to workers from flying debris and increased fugitive dust
- increase erosion of sand, clay, till, and ore stockpiles resulting in material losses
- falling trees can damage site power supply and third-party distribution systems (e.g., transmission poles and wires), leading to power outages

30.3.4 Lightning

Lightning can have several significant impacts on mining operations:

- Lightning strikes can pose a serious safety risk to the safety of miners. Direct strikes or nearby strikes can cause electrical surges, potentially leading to injuries or fatalities. A lightning strike on a moving vehicle may introduce other hazards to workers, including:
    - short-circuiting batteries, tires, and flammable material, resulting in burns
    - arc strike causing temporary blindness, resulting in a loss of vehicle control
    - failure of electric assisted braking and steering, resulting in a loss of vehicle control
    - tire rupture or explosion causes by a substantial increase in tire pressure, resulting in damage to the vehicle and potential harm to the operator or workers nearby
- Lightning can damage electrical and electronic equipment impacting the drilling machines, communication systems, and monitoring devices, leading to costly repairs and downtime.
- Lightning is a potential ignition source leading to possible wildfires and fires to mine infrastructure and equipment.
- Lightning strikes can cause power outages, disrupting mining operations. Dewatering equipment and water management systems can be impacted.

- Lightning-induced power surges or electrical interference can damage control systems, data storage devices, and communication networks, which can impact operations and compromise operational efficiency and regulatory compliance requirements.

30.3.5 Wildfires

Wildfires can impact the Project by physically damaging the Project assets and infrastructure and cause health risks and concerns from smoke from the fires as:

- wildfire can spread to directly damage mine assets and infrastructure, potentially resulting in evacuation of the mine and the potential shut down of mine operations.
- wildfire smoke contains elevated levels of particulate, which is a health hazard for workers, which could affect mine operations and productivity.
- wildfires can result in road closures which can affect access to the mine.

30.3.6 Projection Confidence

Some climate variables can be projected into the future with more confidence than others. The level of confidence in climate projections is dependent on the understanding of the processes involved in the climate phenomena, ability of climate models to simulate the phenomena, degree of agreement among the climate models (e.g., range of uncertainty), and the supporting evidence (e.g., theory, specialized literature, expert judgement). Projections based on GCMs, and downscaling of such models are considered to have high confidence for general temperature and precipitation projections, moderate confidence for extreme parameters, and low confidence for combined or complex events.

Combined or complex climate events are normally inferred from other climate variables and result in lower confidence in projections. For example, freezing rain is a complex process and the projected prevalence of freezing rain events under future climate conditions is not as well understood as other variables. Confidence may also refer to whether other specialized studies have been done assessing climate event projections in the geographical area.

The confidence levels used for the climate projections are described in Table 30.2. A 3-level standard scale of low, moderate, and high has been applied but, depending on the climate parameter, intermediate levels (e.g., low to moderate) may be used to define the confidence in the climate data (Cannon et al 2020).

Table 30.2 Confidence Levels in Climate Projections

Confidence Level in Climate Projections	Description
High	High level of confidence in projected changes of the climate variable based on an in-depth knowledge of the processes involved with the climate phenomenon and a broad body of evidence, including on a local or regional level. Relevant data are available in large quantities and are of high quality. Projections and studies are very consistent and relevant.
Moderate	Moderate level of confidence in projected changes of the climate variable based on considerable knowledge of the process involved with the climate phenomenon and a body of evidence on a regional or larger scale. Relevant data are available and of good quality. Projections and studies are consistent and relevant. Level of confidence attributed is justified by literature.
Low	Low level of confidence in projected changes of the climate variable based on a limited body of knowledge about the climate phenomenon and limited body of evidence (phenomenon has not be widely studied in published literature). There is some relevant data of quality and lower level of consistency among specialized studies. Further study necessary to increase confidence level in projected changes.

Despite low levels of confidence in some climate projection values, the general projected trend in frequency can provide valuable information for planning purposes (e.g., adaptation strategies). For climate parameters with low confidence levels in the projections, additional studies (e.g., sensitivity analyses) can provide further insight into the potential impacts of climate change on infrastructure reliability in different warming and load combination scenarios. Variability of future climate change projections and confidence levels in the climate data are considered in the methodology when determining the likelihood ratings for the climate hazards (See the CCRA, Appendix N of the Impact Statement for more detail).

30.4 Summary of Commitments

30.4.1 Common Mitigation Measures

Climate risks and impacts are important considerations during the full life of the Project, from early planning and design through operations through to closure and post closure activities and monitoring. Risk management strategies form a continuum from reactive actions, which focus on reducing the consequences associated with risks, to proactive actions, which involve planning to avoid or reduce the occurrence of the risk. The preferred approach is to eliminate or develop adaptation and/or risk avoidance measures where possible to reduce the risks to acceptable levels, supported by organizational policies and procedures to manage the risks and develop risk response strategies to reduce the consequences.

Resilient design must be an integral part of the project planning process, to assess risks to the Project from climate hazards in the context of the project’s purpose, asset type, site location, and finances, and then determine the appropriate climate adaptation and mitigation strategies to meet the resiliency objectives of the project.

Mitigation strategies to reduce (or eliminate) the risks can range from proactive adaptation and active operations and maintenance (O&M) management to reactive responses and emergency response planning. Generally, the objective is to adapt where possible, but where this is not feasible, risks will need to be mitigated through management and/or purpose-based response strategies.

A CCRA (Appendix N of the Impact Statement) was completed to determine the highest risks from extreme weather and climate change to the Project over the LOM. The intent of the CCRA was to find the optimum balance between mitigation and resilience by completing two main objectives:

1. Identify current and future climate-related risks to the Project assets, infrastructure, and operations.
2. Develop climate adaptation and resilience measures that can be considered by Canada Nickel to reduce the physical impacts of climate change to the Project, and in doing so, reduce the impacts to the environment.

Recommended adaptations and planned controls to address the possible impacts of climate on the Project are discussed in the following sections. The measures provided are not exhaustive and should be used as a guide to develop further Project site and infrastructure-specific adaptations during detailed design to reduce the risks associated with the identified climate hazards over the LOM.

In addition to the adaptation strategies and controls provided, it should be noted many risks can be efficiently and effectively addressed and reduced through O&M policy considerations and the development of Standard Operating Procedures (SOPs). The suggested O&M policies and SOPs presented should be reviewed and revised on a regular basis to address current and future impacts to mine assets and personnel under a changing climate.

30.4.2 Specific Climate Adaptation and Mitigation Measures

Impacts from selected climate hazards and proposed controls, adaptation, and mitigation measures to address the identified impacts are discussed in the following subsections.

30.4.2.1 Air Temperature

The following controls and adaptation and mitigation measures are considered to address the impacts from extreme temperatures on the Project:

- Mine designs will consider the use of climate adjusted design criteria to develop an elevated level of resilience to extreme temperatures.
- A Health and Safety policy will be developed to reduce the potential impacts of extreme temperatures (i.e., extreme heat and cold) on workers. Training for workers will be part of the policy to promote prevention, early detection, and First Aid treatment.

30.4.2.2 Precipitation

The following controls, adaptation and mitigation measures may be considered to address the impacts from short and long duration rainfall events to the Project:

- Develop and implement a Site-Wide Water Management Plan (Appendix J of the Impact Statement). This system will be designed to manage the 100-year return period, 24-hour duration storm event adjusted for climate change through the use of collection ponds and the Open Pit.
- Implement water treatment through the use of a water treatment plant to receive discharge from the TMF, collection ponds and will use proven processes to treat the water to meet regulatory effluent criteria prior to discharge to the environment.
- The current design and sequence of the Open Pit allows for in-pit impoundment of tailings, reducing the size of a TMF and associated environmental impacts. This sequence allows in-pit deposition of tailings to commence after the Main Zone is depleted in Year 18, reducing the footprint required water management associated with a larger TMF footprint.
- Progressive rehabilitation of the Impoundment Facility will commence during operations at various intervals as Project development allows. This will limit runoff and erosion during extreme precipitation events. During the first five years of active closure, final overburden cover will be applied to the Impoundment Facility slopes and appropriate vegetation will be established. Performance will be monitored throughout the progressive rehabilitation trials and adjustments will be made to the design, as necessary.

The following controls, adaptation and mitigation measures may be considered to address the impacts from heavy snow on the Project:

- Move and store snow on site so that the melt waters do not cause flooding. Collect and treat potentially contaminated meltwaters as required before releasing to the environment.
- Consider providing bus service to and from the Project sites for workers to reduce the risks of harm and limit the number of vehicles traveling to site during a heavy snow event.

The following adaptation and mitigation measures may be considered to address the impacts from freezing rain on the Project:

- Consider the impacts of loading from freezing rain accumulation on the design of transmission and trolley system wires and supporting infrastructure.
- Consider implementing O&M policies to clear ice from trolley wires in the event of freezing rain or ice storms.
- Have sufficient generator power for critical systems to limit negative affects to the Project and the environment during extended power outages.

To offset the potential impacts of drought during active closure and post-closure phases of the mine, native vegetation will be considered for restorative cover which will be monitored and maintained as required to reduce morbidity.

30.4.2.3 High Winds and Wind Gusts

The following controls, adaptation and mitigation measures may be considered to address the impacts from high winds and wind gusts on the Project:

- Implement emissions and dust control measures as described in Chapter 12 of the Impact Statement. An Air Quality Management Plan will be developed and implemented.
- Consider implementing house keeping practices that focus on reducing loose objects and materials on site (e.g., place small and loose materials in covered storage bins).
- Reduce drop heights during material handling to the extent feasible to reduce dust generation.
- Revegetate areas that are no longer in use to reduce the potential sources of dust.

30.4.2.4 Lightning

The following controls, adaptation and mitigation measures may be considered to address the impacts from lightning strikes:

- Design and install electrical ground structures for lightning protection as required, in accordance with applicable engineering standards.
- Develop a site-wide health and safety policy for working during electrical storms.

30.4.2.5 Wildfires

Wildfire can impact the Project by physically damaging the Project assets and infrastructure and cause health risks and concerns from smoke from the fires. As smoke from wildfires can travel thousands of kilometres, smoke-related impacts can be experienced on the Project site but may not be directly related to fires proximal to the Project.

The following controls, adaptation and mitigation measures may be considered to address the impacts from wildfires:

- Develop an Emergency Preparedness Response Plan which could include emergency response planning, training, responsibilities, cleanup equipment, and materials, and contact and reporting procedures.
- Require mandatory safety orientations for new employees. Training will include fuel handling, equipment maintenance, and fire prevention and response measures.
- Maintain on-site fire prevention and suppression systems, including water supplies, sprinklers, fire extinguishers, and other firefighting equipment. Flammable material (such as fuels and explosives) will be carefully managed at the Project.
- Maintain sufficient levels of water for fire fighting on site. Investigate opportunities to establish on-demand forest fire suppression capabilities.

- Remove combustible material along the portion of the rail spur right-of-way under the care and control of Canada Nickel. Maintain Canada Nickel's rail equipment, if applicable, to reduce the potential for sparks from rolling stock as a source of ignition for wildfires.

30.5 Follow-up and Monitoring

Canada Nickel will implement follow-up and monitoring programs to verify the accuracy of effects and to evaluate the effectiveness of mitigation measures, the results of which will be used to identify and implement adaptive management measures, as appropriate. As it relates the impacts from climate change and extreme weather, Canada Nickel will develop a follow-up and monitoring program to monitor the physical stability of project infrastructure and success of revegetation efforts during reclamation. Monitoring data will be used to verify and confirm the predicted effects identified in Section 30.3 and to meet regulatory requirements related to specific permits or conditions of approval. See Chapter 34 of the Impact Statement for additional information on Follow-up Programs.

30.6 References

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30.7 Figures

Figure 30.1 Climate Change Resilience Assessment Process Flow (ECCC, 2022)

Figure 30.2 Location of Cochrane 009 Fire