CLIMATE CHANGE CONSIDERATIONS FOR DESIGNATED PROJECTS UNDER THE IMPACT ASSESSMENT ACT

RESEARCH OVERVIEW REPORT

CLIMATE RISK INSTITUTE

Climate Change Considerations for Designated Projects under the Impact Assessment Act

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Contents

Acronyms

IAA - *Impact Assessment Act*

VCs - Valued Components

IA - Impact Assessment

IAAC - Impact Assessment Agency of Canada

CRT - Companion Resource Tool

CEAA – Canadian Environmental Assessment Act

CIDs - Climatic Impact Drivers

IPCC - Intergovernmental Panel on Climate Change

EA - Environmental Assessment

Section 1: Introduction

1.1 Background

The rapidly changing climate may present significant challenges to designated projects in Canada.

This report presents a research project that synthesized knowledge and developed a tool (tailored database) to help understand and characterize how climate change, variability, and extreme weather events may interact with the activities of designated projects and their effects on Valued Components (VCs)[1] (environmental, health, social, and economic), as well as the broader landscape in which these projects are planned and assessed. In so doing, the project supports efforts to assess the effects of climate change for the purpose of conducting impact assessments under the *Impact Assessment Act* (IAA).

To inform this work, a conceptual framework (see Appendix A for the full framework) was developed to support the integration of climate change considerations across each phase of the IA process. This framework also served as the logic model for the design of the Companion Resource Tool (CRT), a searchable database created to facilitate access to information relevant to the consideration of the effects of climate change on designated projects and VCs and the broader contextual landscape.

This research focused primarily on the mining and nuclear power sectors. Findings were derived from peer-reviewed and grey literature, as well as an analysis of 18 federal assessments of designated mining and nuclear projects in Canada. These assessments were conducted under the 1992 *Canadian Environmental Assessment Act* (CEAA 1992) or the *Canadian Environmental Assessment Act, 2012* (CEAA 2012), both of which offered limited direction on incorporating climate change. At the time of this research, no full assessment reports for mining or nuclear power projects were yet available based on assessments carried out under the IAA. This context shaped the nature and depth of climate-related information observed in the review.

This report is divided into five main sections:

Section 1 provides an overview of the conceptual framework (Appendix A) developed to support the consideration of the effects of climate change.

[1] Valued components (VCs) refer to elements of the human and natural environment that are important to participants in an impact assessment process. Valued components are identified by Indigenous communities, the public, federal authorities or proponents. They may have scientific, biological, social, cultural, economic, historical, archaeological or aesthetic importance, and may be intricately related to community health and well-being.

Section 2 outlines the general nature and intensity of climate change and its impacts across different regions of Canada, focusing particularly on the mining and nuclear power sectors.

Section 3 uses the structure of the conceptual framework to explore the effects of climate change on the contextual landscape, physical components across all project phases, and associated VCs of mining and nuclear power projects. It provides specific examples of these effects and potential adaptation interventions.

Section 4 addresses how the effects of climate change on projects and VCs may impact Indigenous Peoples. It also describes the role of Indigenous Knowledge in understanding and mitigating the effects of climate change on VCs.

Section 5 identifies research gaps, proposes areas for further research, and concludes the report.

1.2 Overview of Climate Change Considerations within the Conceptual Framework

This section provides an overview of a conceptual framework (see Appendix A for full framework) developed to offer a structured and holistic perspective on the key pathways through which climate change - via changes in average climate conditions, climate variability, and the increasing frequency and intensity of extreme events - interacts with the project landscape, project components across various phases, associated VCs, and Indigenous communities (knowledge, culture, and rights).

1.2.1 Changes to the Designated Project Contextual Landscape

Climate change has the potential to fundamentally alter the environmental, economic, social, health, regulatory, policy, and legal landscapes in which designated projects are proposed, constructed, and operated, ultimately leading to changes in the needs, requirements, demands, prioritization, and locations of projects. Proponents may need to account for these evolving conditions when making project decisions, even before entering the impact assessment (IA) process, as climate change can shift the broader context in which projects are planned and developed.

For instance, climate-driven changes in environmental conditions may influence where resources can be found and extracted (e.g., melting Arctic sea ice, driven by warming temperatures, may make new areas accessible for resource extraction). Meanwhile, changes to regulatory and/or economic conditions can affect demand for less carbon-intensive forms of energy (e.g., hydro, nuclear), and for the raw materials required to help electrify specific sectors (e.g., battery materials for electric vehicles) [1].

1.2.2 Impacts on Designated Projects: Physical Activities and Activities

In addition to contextual landscape changes, climate change may impact the physical activities and works of projects. In relation to designated projects, physical activities include tasks or actions that involve a degree of physical effort, such as construction, modification, operation, expansion, abandonment, and decommissioning [2]. On the other hand, physical works include structures that have been built by humans and that have a defined area and fixed location [2].

The potential for and character of interactions between climate change and physical activities and works is largely a function of the climate and project contexts, as summarized in Table 1.

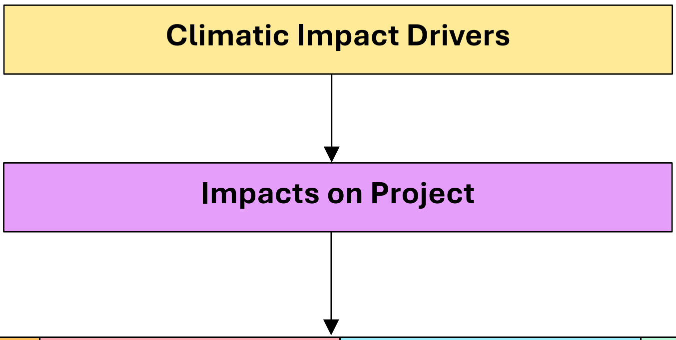
Table 1: *Climate and Project Context Considerations and Examples*

Category	Considerations	Examples
Climate Context	Historical climate data (past climate patterns and trends)	Past temperature, precipitation records
	Future climate projections (climate scenarios tied to greenhouse gas (GHG) emission pathways)	Emission scenarios (e.g., high emissions vs. moderate emissions)
	Project time horizons	Short-term (20 years) vs. long-term (100 years)
	Indigenous Knowledge on climate change patterns and trends	Observation of patterns and trends by Indigenous communities
Project Context	Geographic location (site-specific climatic risks)	Coastal locations (flooding, storms, sea-level rise), northern permafrost (thaw risk), inland lakes (water availability)
	Type of project	Nuclear facilities, mining operations (open pit or underground)

Understanding climate change impacts on physical activities and works is an essential step towards identifying appropriate adaptation measures to manage or eliminate potential adverse climate-related consequences on projects. This, in turn, may help to avoid potential effects to the environment, or to health, social, and economic conditions that would result from climate-driven accidents and malfunctions.

1.2.3 Adaptation Interventions

Adaptation interventions are measures implemented to manage or eliminate the adverse effects of climate change on a project and enhance its resilience. Effective adaptation interventions reduce a project's vulnerability to climate impacts and enhance its resilience, ultimately minimizing adverse effects on VCs. As shown in Figure 1, in the presence of effective adaptation interventions, project vulnerability is decreased, resilience is increased, and impacts on VCs are lessened. Conversely, in the absence of effective adaptation interventions, project vulnerability is increased, resilience is decreased, and impacts on VCs are amplified.



Adaptation Interventions (Yes/No)	Project Vulnerability	Project Resilience	Impacts on Valued Components
Yes	Decreased	Increased	Lessened
No	Increased	Decreased	Amplified

Figure 1: *Relationship Between Adaptation Interventions, Project Vulnerability, Project Resilience, and Valued Components*

Adaptation interventions can include policy and regulation, grey infrastructure (i.e., modifications to the materials and designs used for the physical components of energy, transport, communications, water and sanitation, solid waste management systems, among others), blue infrastructure (i.e., water bodies, watercourses, and storm drainage systems that enhance resilience by improving stormwater management, reducing flood risks, and regulating water flow), green infrastructure (i.e., natural and constructed ecological systems and landscape features that improve air and water purification, temperature management, floodwater management, or coastal defence), technological interventions, financing and incentives, and management and planning measures.

When considering climate adaptation interventions, it is important to consider which are most:

- ***Suitable***, based on the type of impact and location
- ***Effective***, given the desired outcome
- ***Feasible***, relative to the available technology
- ***Economical***, relative to the cost of the impact (e.g., costs of infrastructure upgrades and maintenance versus the costs of service disruptions,

infrastructure failures, resultant impacts to valued components, and related remediation)

After considering the Impact Assessment Report and the implementation of appropriate mitigation measures, the Minister or Governor-in-Council must determine whether the project's significant adverse federal effects are justified in the public interest. The Decision Statement includes the reasons for the decision and may include conditions established under the IAA. The Post-decision phase may also provide opportunities to implement adaptation interventions by way of Post-decision activities (Phase 5), such as follow-up programs and adaptive management plans.

It is important to clarify that within the IA context, "mitigation measures" are actions or project design features intended to eliminate, reduce, control, or offset the adverse federal effects of a project and can include restitution for damage in the form of restoration, replacement, compensation, etc. While "adaptation interventions" can be included as mitigation measures, not all mitigation measures are adaptation interventions. For example, treating discharge water from a mine would be considered a mitigation measure but not an adaptation intervention; however, the implementation of a bioswale at a project site could serve an adaptive function in the form of stormwater management while also increasing habitat as a mitigation measure.

1.2.4 Direct, Indirect, and Cumulative Impacts on Valued Components

The impacts of climate change on projects may also have implications for environmental, health, social, and economic VCs in the form of direct, indirect, or cumulative effects.

- **Direct effects** occur when climate change affects project infrastructure or operations, which in turn results in impacts on valued components. For example, intense rainfall or flooding may damage a tailings impoundment, leading to the release of contaminants into nearby rivers and causing acute effects on fish and aquatic habitat.
- **Indirect effects** occur when climate change alters conditions in ways that amplify the effects of a project on VCs. For instance, if a project withdraws water from a lake that is already experiencing reduced water levels due to prolonged drought, the combined stress may result in greater impacts on fish habitat than anticipated.
- **Cumulative effects** occur when the residual effects[2] of a designated project interact with the effects of other past, present, or reasonably foreseeable physical activities, with climate change further compounding these impacts. For example, a mining project's water withdrawals may contribute to regional water

[2] A residual effect is the effect of a project that remains, or is predicted to remain, even after mitigation measures have been implemented.

stress when combined with withdrawals from other projects, particularly under drought conditions intensified by climate change. These combined pressures can place additional stress on fish habitat.

Understanding these pathways is critical because project activities do not occur in isolation - they take place in environmental, social, health, and economic contexts that may already be affected by climate change and other stressors. In many cases, components within these contexts that may be identified as VCs during an assessment could already be in a vulnerable state. Figure 2 illustrates the pathways through which climate change and designated projects interact with VCs, leading to direct, indirect, and cumulative effects.

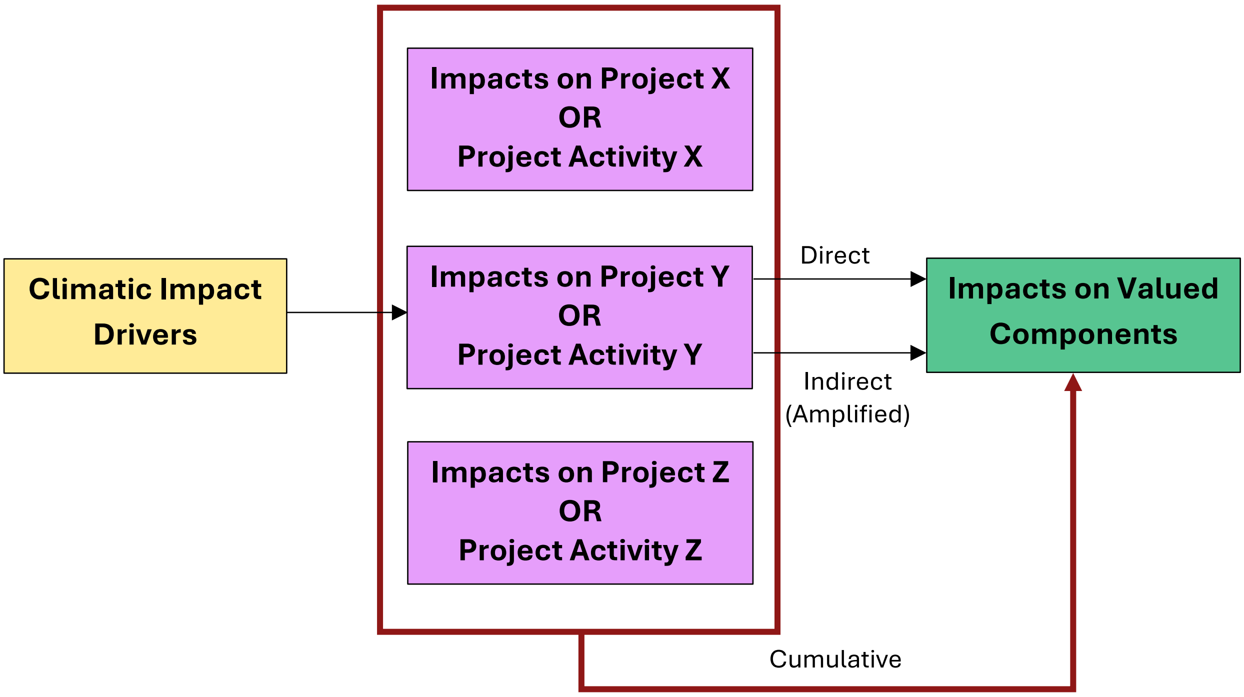


Figure 2: *Interactions Between Climate Change, Projects, and Valued Components*

1.2.5 Indigenous Knowledge and Communities

Climate change is already having profound effects on Indigenous communities, knowledge systems, and cultural practices. These include impacts on physical, mental, and spiritual health, as well as risks to food security (Appendix A). Project activities may exacerbate these challenges or, in some cases, help to mitigate them. For instance, infrastructure development can improve access to essential goods and services in communities affected by climate change, but it may also lead to increased pressure on traditional lands, disrupted harvesting patterns, or other effects on food systems and culturally significant practices.

Indigenous Knowledge is a body of knowledge built up by Indigenous Peoples through generations of living in close contact with the land. In an IA, it can provide evidence and understanding related to the biophysical environment; to social, cultural, economic, and health issues; as well as to Indigenous governance, traditional laws, customs, and resource use. Incorporating Indigenous Knowledge into the IA process is essential for understanding how climate change has affected, is affecting, and may affect the exercise of Aboriginal and/or treaty rights by Indigenous Peoples. It also helps validate and complement the information and analysis provided by other participants in the assessment process.

Section 2: State of Climate Change Impacts

2.1 Regional Climate Impact Trends Across Canada

Canada is exposed to a wide range of climate impacts and has experienced an increase in hazards, including storm surges, floods, and winter storms, in recent decades [3]. Average temperatures have risen by 1.7°C nationwide and 2.3°C in Northern Canada between 1948 and 2016 [4]. Figure 3 provides examples of climate trends across provinces and territories, which have been categorized into Northern, Atlantic, Central, and Western Canada based on geographic and climatic similarities.

Regional Impact Trends Across Canada

- Longer sea-ice-free periods enhance shipping and resource extraction [8].
- Offshore activities benefit from increased Arctic access due to reduced sea ice [9].
- Marine shipping opportunities arise but thawing permafrost and ice road loss hinder transportation [8].
- Shortened operation, exploration, and transportation season due to rapid rates of warming [8][10].
- Changing streamflows may benefit certain areas, but erratic free-floating ice increases navigation hazards despite ice loss [10].

- Sea level rise, storm surges, and coastal flooding threaten infrastructure and industries [7][8].
- Overland flooding in spring and winter affects public safety and infrastructure systems [10][11].
- More extreme heat events and reduced summer precipitation are expected, increasing droughts and water shortages [11].

Northern

Northwest Territories
Nunavut
Yukon

Atlantic

New Brunswick
Nova Scotia
Prince Edward Island
Newfoundland & Labrador

Alberta
British Columbia
Manitoba
Saskatchewan

Western

Ontario
Quebec

Central

- Flooding and sea-level rise along the British Columbia coast are major concerns, while the central and southern regions face increasing drought risks [8].
- Increased streamflow may overwhelm water bodies and drainage systems, while reduced precipitation will worsen drought conditions in inland areas [8][10].
- Forests in Western Canada are getting increasingly vulnerable to wildfires, pest outbreaks, and water stress [8].

- Warmer winters, reduced snowfall, and increased rainfall have been recorded, with more severe summer storms projected [8].
- New areas such as Ontario's 'Ring of Fire' mining have become more accessible [8].
- Rising temperatures increase risks of forest fires, extreme weather, and water stress, leading to socioeconomic stress [12].
- Warmer winters affect winter roads, airstrips, and essential supplies for remote communities [8].

Figure 3: *Example Climate Impact Trends by Region in Canada*

2.2 Sectoral Climate Impact Trends Across Canada

Furthermore, climate change poses a significant risk to all natural resource sectors in Canada [1]. In general, impacts can affect the condition, performance, and longevity of project sites, infrastructure, the surrounding environment, and the sensitivity of that environment to the effects of project activities [6]. It can also affect supply chains [10].

For instance, there are concerns about the reliability of hydroelectricity generation in certain regions of Canada, as many Canadian watersheds already face diminished summer and spring water levels and increasing winter flows. Similarly, shortened and milder winter seasons are leading to less stable ground conditions and fewer days with reliable ice roads, reducing the timeframe for resource exploration and the transportation of supplies to remote mining and industrial sites [9][10]. Meanwhile, heat events are expected to become more frequent and severe, potentially affecting all sectors requiring outdoor workforces [11]. Increased wildfire activity, driven by rising temperatures and drier conditions, also poses risks to project infrastructure and operations, and worker safety [10][11].

Climate Impact Trends in the Mining and Nuclear Power Sectors Across Canada. The most recent natural resource project plan of Natural Resources Canada (NRCan), Natural Resources: Major Projects Planned or Under Construction 2023 to 2033, indicates that between 2023 and 2033, the majority of major projects will take place in the energy and mining sectors[3] (Figure 3) [13].

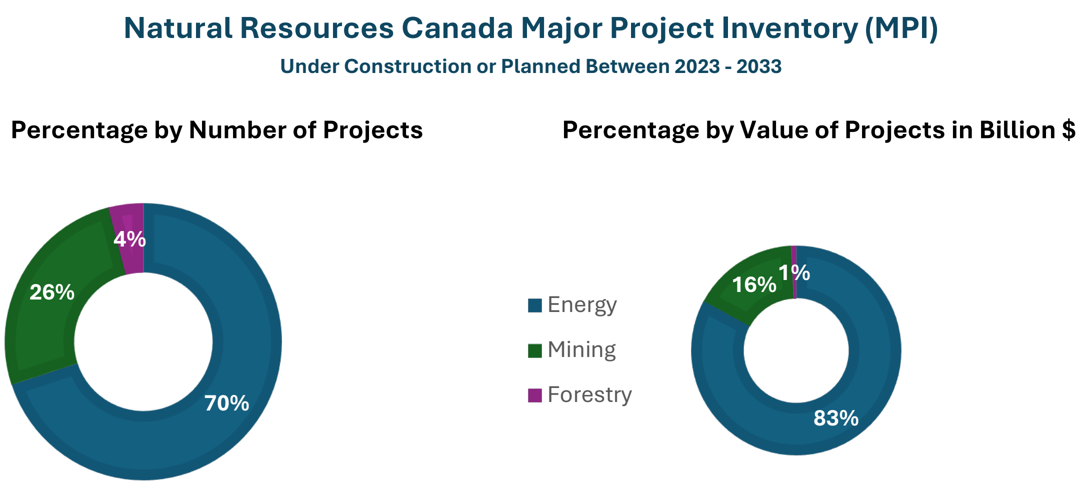


Figure 4: *Percentage and value of sector-based major projects within the Natural Resources Canada Major Project Inventory (MPI) under construction or planned between 2023-2033 in Canada [13]*

[3] While forestry projects are included in NRCan's Major Projects Inventory, they are not designated under the IAA. Other project types that are designated under the IAA, such as ports, interprovincial pipelines, railways, and electricity transmission lines, were not included in the scope of this review.

As of May 2023, 493 major projects are under construction or planned until 2033. Between 2022 and 2023, 92 new energy projects and 23 new mining projects valued at $103B and $11.7B, respectively, entered the “Major Project Inventory” [13]. This represents an increase of 10% in both the overall project count and capital value. Approximately 65% of the energy sector projects are classified as “clean technology” [13], which includes nuclear power generation. Given the majority of new and proposed projects fall within the energy and mining sectors, the following sections focus on their sector-specific climate impacts.

Mining Sector: Climate change may affect all stages of mine development, including exploration, extraction, processing, transportation, and reclamation, and could bring both challenges and opportunities [10]. In Canada’s far northern regions, reductions in sea ice driven by rising air temperatures are creating new exploration opportunities. However, mining operations in general can be vulnerable to extreme weather events such as rainfall-induced flooding, which can affect the stability, management, and overall performance of critical infrastructure systems [8][9].

Most mining infrastructure - including tailings management facilities, water treatment plants, and storage ponds - have historically been designed based on past climate conditions, with assets engineered to withstand previous averages or extreme events. The Mining Association of Canada’s Climate Change Adaptation Guide highlights the importance of incorporating climate projections into decision-making to better prepare for future conditions. It emphasizes that adaptation planning should account for evolving climate hazards, such as changes in precipitation patterns and extreme weather events, to support the long-term resilience of mining infrastructure [14].

Nuclear Power Sector: Canada is anticipating an increase in nuclear development as an emissions-free energy source to support electrification. However, nuclear power generation can be vulnerable to climate change due to rising air and water temperatures, shifts in water availability, and the increasing frequency of extreme events [9].

For instance, higher air and water temperatures can reduce the efficiency of cooling systems in nuclear power plants, potentially impacting power generation capacity [10]. Additionally, reduced water availability, whether from droughts or changing precipitation patterns, can further limit cooling efficiency and increase operational challenges [5]. Meanwhile, extreme events such as flooding can damage transmission and distribution lines, leading to power outages and significant repair costs [5].

Section 3: Understanding Interactions Between Climate Change and Designated Mining and Nuclear Power Projects Using the Conceptual Framework

This section uses the Conceptual Framework described above (Section 1.2), and provided in full in Appendix A, to illustrate the effects of climate change on mining and nuclear power projects and their relevance for the IA of designated projects. Figure 5 depicts the main components of the Conceptual Framework and the corresponding sections of the current Report. All content is drawn from a selection of 18 Environmental Assessment (EA) reports recently prepared for designated mining and nuclear power projects in Canada (see Appendix B for full list).

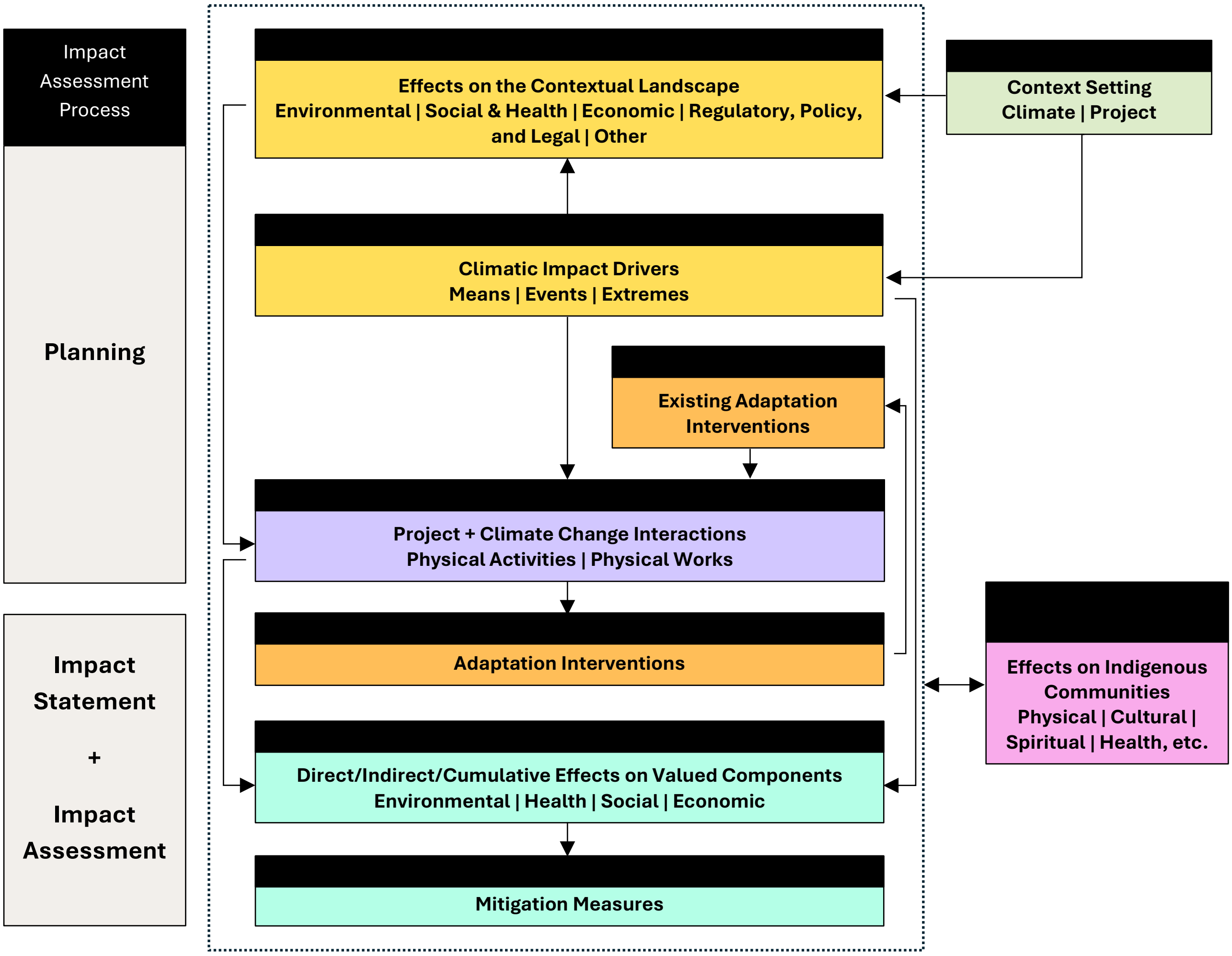


Figure 5: *Components of the Conceptual Framework and Related Sections of the Report*

3.1 Context Setting

EAs typically begin with a description of the project's environmental and geographic setting to support the identification and evaluation of potential effects. This includes baseline information about environmental features that may influence or be influenced by the project. While these context-setting sections may acknowledge environmental effects on the project (e.g., flooding, permafrost, or erosion), they generally lack explicit consideration of future climate projections or how climate change may alter these environmental features over time. To support a more integrated approach, this section elaborates on and distinguishes between the climate context (Section 3.1.1) and the project context (Section 3.1.2).

3.1.1. Climate Context

This section introduces the climate context to support the understanding of the effects of climate change on designated projects. As previously noted (Table 1), climate context includes considering historical climate normals to understand baseline conditions and using future climate projections to explore potential changes in these conditions based on different greenhouse gas emissions scenarios (e.g., RCP8.5 - high emissions vs. RCP4.5 - moderate emissions) [16].

A project's time horizon is another key factor, as climate conditions will evolve differently over short-term (e.g., 20 years) vs. long-term (e.g., 100 years) timeframes [16]. Multi-model climate projections, which use an ensemble of models to show the range of possible climate futures, help compare historical baseline conditions with future (e.g., mid-century, end-century) climate change scenarios [16].

While uncertainties remain in long-term projections and in integrating related risks into shorter-term project phases, acknowledging a range of possible futures is essential for building resilience into project design. In practice, establishing the climate context also requires selecting the most relevant climate variables and indices based on factors such as the project type and location. This may include indices such as changes in extreme precipitation (e.g., intensity-duration-frequency curves), heatwaves (e.g., number of days above 30°C), freeze–thaw cycles, or drought duration, depending on the project. Additionally, Indigenous Knowledge provides valuable context by offering insights into climate trends and the associated risks [17].

In several cases, supplemental documents cited within the EA Reports, such as Environmental Impact Statements (EISs) or technical studies, indicated the incorporation of historical and projected climate data under multiple emissions scenarios, using global climate models or other existing analyses to assess future climate risks. These documents identified how factors such as temperature fluctuations, changes in precipitation, and increases in extreme events like wildfires and storms could affect project operations and the integrity of infrastructure. Climate projections were also used to support evaluations of the effects of climate change on infrastructure to inform design considerations. In accordance with the requirements of the IAA, proponents also acknowledged the importance of involving Indigenous Peoples and Traditional Knowledge in understanding baseline conditions and potential climate-related effects.

3.1.2. Project Context

Understanding the project context is critical for assessing the effects of climate change on designated projects. This includes key characteristics such as the project's location, setting, lifecycle, type, and design elements, all of which may shape exposure and vulnerability to climate hazards [16].

Certain geographical characteristics play a central role in shaping these vulnerabilities. For instance, coastal areas may face risks from sea-level rise, storm surges, and related flooding; ice-rich permafrost zones may be affected by the instability of the thawing ground over time; and drought-prone regions may experience prolonged water scarcity [16].

Climate risks should be evaluated across all phases of a project, as exposure and vulnerability can vary significantly depending on the phase. For example, tailings facilities that require water cover post-operations may be more affected by dry conditions during the closure phase than during active operations [16].

In addition, climate change introduces evolving risks over time. Even if the same types of climate hazards, such as drought, flooding, or extreme heat, remain relevant throughout the project's lifecycle, the underlying factors that drive these hazards, such as precipitation intensity, temperature extremes, or seasonal variability, may change over time. These shifts can lead to future vulnerabilities that may not have been apparent during early project planning based on historical baselines [16].

Project type and design elements further shape climate risk considerations. For instance, particular elements of nuclear facilities may be vulnerable to flooding, as demonstrated by the 1999 storm surge event at the Le Blayais Nuclear Power Plant in France, where high tides and strong winds generated waves that breached protective dykes, resulting in overland flooding that damaged electrical systems and compromised cooling mechanisms [19]. In contrast, mining projects exposed to similar hazards may face slope instability or an increased risk of tailings facility failure [20].

The EA Reports reviewed include a dedicated section that provides an overview of the project, covering the project's location, lifecycle phases, and key infrastructure components. Project descriptions also reference geographic coordinates or regional landmarks and identify nearby communities, transportation corridors, and ecological features (e.g., proximity to lakes, rivers, or sensitive habitats). In many cases, the project's location is also described in relation to Indigenous territories or traditional use areas. The lifecycle of designated projects is generally outlined across phases, including construction, operation, and decommissioning & abandonment, with each phase associated with distinct sets of activities. EA Reports also provide information on various project components, including main facilities, tailings management facilities, or reactor cores, as well as supporting infrastructure like roads, pipelines, and power supply systems. However, information related specifically to climate change or future climate projections is typically lacking in relation to these project contextual factors.

3.2 Changes to Designated Project Landscape as a Result of Climate Change

As stated in Section 1.2.1, climate change can alter the broader project landscape and may require proponents to account for evolving environmental, economic, social, health, regulatory, policy, and legal conditions when making project decisions, even before entering the IA process.

3.2.1 Changes in Environmental Conditions

Climate change is fundamentally altering environmental conditions, affecting factors such as ecosystem health and resource availability, and reshaping the biophysical conditions in which projects are proposed, developed, and operated. The environmental landscape into which projects are being, or will be, introduced is already undergoing significant changes. These shifts may affect project activities and increase the difficulty and risk of project planning, implementation, and long-term operations.

The evolving environmental conditions associated with climate change and weather extremes can compromise the structural integrity of both existing and residual infrastructure. Many project components, particularly those constructed under historical climate norms, were not designed to accommodate current or future climate conditions [9]. For example, frozen-core tailings dams and other waste containment systems may be vulnerable to thawing permafrost, which can result in unanticipated erosion and further release of contaminants into surrounding environments [10]. As these conditions continue to shift, terrain instability caused by permafrost thaw, projected to reduce permafrost extent by 16% to 20% by 2090, can affect the reliability of infrastructure foundations and access routes, in northern regions [7]. In coastal and remote areas, the loss of sea ice may further limit seasonal access and increase the risk of damage to project infrastructure, complicating construction logistics, material transport, and long-term operations [7][10][22].

Climate change is also reshaping ecological baselines through shifts in species distributions and migration patterns. For example, the northward migration of wildlife and plant species may increase ecological sensitivity in areas once considered low risk [23], influencing site selection and increasing the complexity of baseline assessments. Landscape connectivity, critical for maintaining healthy ecosystems and biodiversity, can be compromised by various climate-related factors such as intensified wildfires, glacial retreat, drought, and extreme precipitation. These events can physically alter habitats, create barriers to species movement, and disrupt ecological corridors, leading to increased habitat fragmentation [24]. These changes, when combined with project activities, may amplify ecological fragmentation and require additional mitigation measures.

Additionally, shifting seasonal conditions, such as earlier snowmelt and shorter periods of ice cover, can constrain the timing and feasibility of construction and transportation activities. This is particularly relevant in northern and remote regions where winter roads are critical for accessing sites [8]. These constraints may shorten operational windows, increase costs, and require contingency strategies for maintaining timelines and regulatory compliance.

3.2.2 Changes to Economic Conditions

Climate change can introduce significant financial challenges to projects by causing infrastructure damage, disrupting transportation and supply, affecting resource availability, and increasing operational costs. In Canada, for example, mining operations are particularly exposed to climate-related impacts due to the location of many sites in northern or remote areas and their reliance on climate-sensitive infrastructure, such as winter roads and long-lived tailings containment systems. These factors can lead to disruptions in operations and supply chains, which may result in higher costs and logistical challenges over the course of a project's life cycle [9].

Climate change is also contributing to wider economic shifts that influence the viability and planning of designated projects. Macroeconomic trends, such as rising global demand for critical minerals like lithium and rare earth elements to support low-carbon technologies, are reshaping resource markets and long-term project strategies [26]. In Canada, the economic viability of resource development projects is being reshaped not only by physical climate risks but also by broader market and policy trends. As global demand for critical minerals accelerates, Canada, recognized for its abundance of these resources, low-emission electricity, and established regulatory frameworks, is increasingly viewed as a secure and sustainable supplier of choice, with regions like Northern Ontario's Ring of Fire attracting renewed interest for their long-term strategic potential [40][41]. As a result, projects that may have previously faced economic or logistical barriers are now receiving renewed attention, as global demand and policy incentives improve their long-term viability.

Carbon pricing mechanisms and border carbon adjustments are also emerging in jurisdictions worldwide, with implications for export competitiveness and regulatory compliance [27][28]. Financial markets and insurers are also factoring in climate-related risks, leading to higher insurance premiums and more stringent lending criteria for high-risk projects [29]. In parallel, environmental, social, and governance (ESG) expectations are becoming more central to investor and public scrutiny. Proponents are increasingly expected to demonstrate how they are managing climate risks, aligning with broader sustainability goals [30]. These evolving expectations and economic pressures form part of a rapidly changing economic landscape that the mining sector as a whole and individual project proponents must take into account.

3.2.3 Changes to Health and Social Conditions

Climate change is altering social and health conditions in ways that can influence how designated projects are planned and managed. In many regions, the increasing frequency and severity of heat waves have contributed to more intense wildfires, leading to degraded air quality and heightened health risks. These, along with more frequent extreme weather events such as floods and severe storms, pose significant challenges for both the public and workers, especially in remote areas where emergency response systems and healthcare services may already be limited [11][12][14]. As these risks escalate, they can shape how projects are designed (e.g., heat safety measures), evaluated (e.g., community health impacts), and perceived by communities and approval bodies.

In regions such as Northern Ontario’s Ring of Fire, where new mining projects are being proposed, climate-related changes may intersect with social and cultural dynamics. Warming temperatures, shifting ice conditions, and altered precipitation patterns, when combined with industrial development in previously less disturbed areas, may intensify concerns around land use, displacement of traditional activities, and added pressures on already limited local services [17][31].

As health and social conditions continue to evolve under climate change, designated projects will increasingly need to respond to these intersecting risks. This includes planning for health and safety protocols, understanding local health vulnerabilities, and engaging with communities to address emerging social concerns.

3.2.4 Changes to Regulatory, Policy, and Legal Conditions

In recent years, Canada has taken a leading role in climate regulations and emissions reduction policies. Projects that fail to adapt to evolving conditions may face economic and regulatory consequences, such as higher compliance costs, fines for excessive emissions, or public opposition [32].

Carbon-intensive industries in particular, such as mining, are expected to face increasing regulatory pressures, with stricter climate policies and emissions regulations leading to delays or complications in approvals and expansions, reduced profitability, and employment impacts for projects that are unprepared [33].

Climate policies and regulatory changes also shape project development in Indigenous territories. Stricter environmental policies may require greater consultation with Indigenous communities in project approvals and influence how projects are planned and managed. Hence, Indigenous governance systems may play a greater role in decision-making, offering alternative approaches to protecting natural areas and managing resources, which can complement or improve upon state-led methods [17][25].

Alongside shifts in climate policy and emissions regulations, evolving professional standards and regulatory expectations are shaping how physical climate risks are addressed in project design and assessment. In Canada, various organizations have advanced sector-relevant guidance and standards to support climate resilience. For example, the Mining Association of Canada's Climate Change Adaptation Planning Guidance (2023) helps mine operators assess and manage climate risks across the project life cycle. In the nuclear sector, the Canadian Nuclear Safety Commission's REGDOC-1.1.1 (2022) requires proponents to evaluate site-specific climate risks, including flooding and extreme weather, during site selection and design. More broadly, Engineers Canada's Principles of Climate Adaptation and Mitigation for Engineers (2018) promote the integration of climate risk into engineering practice. These examples illustrate how emerging guidance is raising the duty of care in project development and shaping expectations within assessments.

3.2.5 Effects of Climate Change on Resource Access and Industrial Development

Climate change is opening new opportunities for resource extraction in previously inaccessible regions of Canada [8]. For instance, a longer warm season could allow more time for mapping and transportation of materials, potentially driving growth in industries such as mining [9].

However, shifting climate conditions also introduce challenges for resource accessibility and industrial expansion. For example, thawing permafrost can destabilize terrain, making transportation routes less reliable and extraction activities more difficult and costly [9]. Climate-driven increases in wildfire activity across northern and forested regions are also affecting resource access and development. Wildfires have the potential to damage infrastructure, delay exploration and construction activities, and restrict access to remote sites, posing risks to safety and operations [9]. Additionally, increased industrial activity in sensitive northern ecosystems could exacerbate environmental and social impacts, requiring careful planning to balance development with ecosystem protection [8][34].

Hence, projects will need to plan proactively, not only to take advantage of emerging opportunities but also to adapt to climate-related risks.

3.3 Climatic Impact Drivers

As defined by the Intergovernmental Panel on Climate Change (IPCC), a Climatic Impact Driver (CID) is a climate condition that directly affects ecosystems or society. CIDs are categorized into three types: Means, Events (Common Events), and Extremes (Extreme Events) (see Table 2 for examples) [15]. Understanding CIDs plays is important to assessing how climate change influences projects and associated VCs, and for developing effective adaptation measures.

Table 2: *CIDs Overview with Examples*

CID	Description	Examples
Means	Long-term shifts in average climate conditions	Increasing temperatures and longer heat seasons
		Changes in precipitation patterns, such as drier summers and wetter winters
		Declining snow and ice cover, including glacier retreat and permafrost thaw
Events	Short-term, discrete climate-related hazards	Floods, severe windstorms, and wildfires disrupting ecosystems and infrastructure
		Heavy rainfall & storms causing landslides and erosion
		Droughts reducing water availability
Extremes	Severe climate conditions that exceed historical norms	Extreme heat waves impacting human health and infrastructure
		Extreme cold snaps causing energy supply disruptions
		High winds and storm surges increasing coastal risks

3.4 Interactions Between Climate Change and Designated Projects

Climate change can directly affect designated projects throughout different phases of their physical activities, including construction, operation, and decommissioning & abandonment, by increasing the risk and severity of disruptions. The effects of CIDs on project activities can be both indirect and direct. Indirect effects occur when climate-related events damage physical works, such as roads, pipelines, or containment structures, thereby disrupting project activities. Direct effects can occur even when physical works remain intact. For example, low water levels due to drought may reduce water availability for mining operations, requiring temporary intake reductions to protect fish habitat [Rainy River Project]. Smoke from wildfires can pose health risks to workers, prompting work stoppages or delays in monitoring [36]. Frozen pipelines can halt water treatment activities [37], and snow-blocked roads may delay critical inspections [38].

In addition, off-site climate-related impacts, such as damaged ice roads or disrupted transportation and supply chains, may restrict site access, delay the delivery of materials and equipment, or hinder emergency response. While these disruptions may not involve direct damage to on-site infrastructure, they can significantly impair a project's ability to manage risks, meet regulatory requirements, and protect associated VCs.

Understanding these effects is critical since the type, extent, and severity of related risks must be considered. based on factors such as project location, duration, design, and regional climatic conditions, as discussed in Sections 3.1.1 and 3.1.2. Identifying and assessing these risks can help proponents select and rationalize ways to mitigate potentially adverse effects not only on project infrastructure and activities but also on the VCs associated with the project, as further discussed in Section 3.5.

Table 3 provides examples of the potential effects of CIDs specifically on physical works across the construction, operation, and decommissioning phases of mining and nuclear projects, based on statements made within the reviewed set of 18 EAs.

***Table 3**: Effects of CIDs on Physical Works Across Physical Activities*

Infrastructure Type	Impacts	Project Phases	Reports Referenced
Mining			
Main Infrastructure Main Buildings, Tailings Management	Floods, storms, and wildfires may damage structures, restrict access, or cause roof and wall collapse.	Construction, Operation	• **Akasaba West Copper – Gold** • **Brucejack Gold** • **Donkin Export Coking Coal**
	Erosion and flooding can weaken dikes, shafts, and foundation earthworks.	Construction, Operation,	

Facilities, Water Management Facilities, Storage Facilities		Decommissioning & Abandonment	• Dumont Nickel • Hardrock Gold • James Bay Lithium • Magino Gold • Murray River Coal • Red Mountain Gold • Rose Lithium – Tantalum • Valentine Gold • Whabouchi Lithium Surface Mine Underground Mine
	Altered water balances may destabilize tailings facilities, degrade containment covers, and compromise material integrity.	Operation, Decommissioning & Abandonment	
	Excess runoff may overwhelm water systems, reducing treatment efficiency and increasing overflow risk.	Operation	
Accessory Infrastructure Accessory Buildings, Roads, Water Networks, Landing Strips	Flooding and storms may compromise foundations and roofs; temperature extremes reduce material flexibility.	Construction, Operation	
	Wildfires pose explosion and safety risks to storage sheds, fuel tanks, or vehicle areas.	Construction, Operation	
	Flooding, erosion, and snow buildup can degrade or block roads, increasing maintenance and delaying access.	Construction, Operation, Decommissioning & Abandonment	
	Storms or unstable ground may damage access roads or delay transport.	Construction, Operation	
Utility Infrastructure Power Stations, Transmission and Energy Systems	Flooding, wildfires, wind, and ice storms may disable heating, power, or communications systems.	Construction, Operation	
	Freeze–thaw cycles can damage pipelines and destabilize power lines.	Operation, Decommissioning & Abandonment	
	Erosion may undermine transmission tower foundations or cause structural failures.	Operation, Decommissioning & Abandonment	
	Ice buildup or shoreline damage can obstruct landing strips and barge docks critical to logistics.	Operation	
Energy			
Main Infrastructure Reactor Buildings, Deep Geological Repositories	Flooding, storm surge, and extreme precipitation may compromise structural integrity, requiring climate-resilient siting and design.	Construction, Operation	• **Darlington Nuclear** • **Deep Geologic Repository**
	Wildfires pose a direct risk to core safety systems and containment areas.	Operation	
	Long-term climate shifts (glacial cycles, permafrost) may increase structural stress on repositories, affecting waste isolation.	Decommissioning & Abandonment	
Accessory Infrastructure Accessory Buildings, Water Networks, Landing Strips	Flooding, storms, and snow may damage smaller buildings or restrict access to remote infrastructure.	Construction, Operation, Decommissioning & Abandonment	
	Drought and reduced precipitation may limit water availability for fire protection, utilities, or maintenance functions.	Operation	
Utility Infrastructure	Flooding, storm surge, ice storms, freeze-thaw cycles, and wildfires can damage power systems and lead to grid disruptions.	Construction, Operation,	

Power Blocks, Transmission and Energy Systems		Decommissioning & Abandonment	
	Drought can reduce water supply critical for cooling systems and energy intake.	Operation	

3.5 Impacts on Valued Components

VCs are elements of the human and natural environment that are important to participants in an IA process and serve as the foundation for the assessment of effects [39]. These VCs can be grouped into four broad categories: environmental, health, social, and economic. Table 4 below lists the types of VCs identified across the EAs we reviewed and how many of the 18 EA reports addressed each VC.

***Table 4**: List of VCs Identified in EAs and How Commonly they are Addressed*

Valued Components	Category	Number of Projects Identifying VC
Air Quality	Environmental	5
Aquatic Environment	Environmental	6
Current Indigenous Land Use	Social	6
Fish and Fish Habitat	Environmental	15
GHGs and Transboundary Effects	Environmental	7
Geology and Soils	Environmental	3
Human Health	Health	4
Indigenous Health and Socio-economic Conditions	Health, Social, Economic	6
Indigenous Interests	Social	2
Indigenous Physical and Cultural Heritage	Social	10
Land Use	Social	3
Migratory Birds	Environmental	13
Noise	Environmental	1
Population and Demographics	Social	1
Public Safety	Health	1
Radiation and Radioactivity	Environmental, Health	2
Recreation and Commercial Use	Social	1
Socio-economic Conditions (other than those provided for in section 5 of CEAA 2012)[4]	Social, Economic	4
Species at Risk	Environmental	9
Surface Water and Hydrology	Environmental	4
Terrestrial Environment	Environmental	2
Traffic and Transportation	Social	1
Vegetation and Habitat	Environmental	3
Visual Quality and Aesthetics	Environmental	2
Wetlands	Environmental	4
Wildlife	Environmental	3

[4] Economic and social effects on the general population, or those not directly tied to environmental change, and not specific to Indigenous communities.

A wide range of environmental VCs are quite commonly addressed across the 18 EAs; few of the health, social, and economic VCs are as commonly addressed. Of the 26 VCs summarized in Table 4, only seven were explicitly identified in any of the reviewed EAs as potentially affected by a clear climate hazard-project interaction: Aquatic Environment, Fish and Fish Habitat, Geology and Soils, Human Health, Indigenous Health and Socio-economic Conditions, Surface Water and Hydrology, and Vegetation and Habitat.

While most EAs examine how projects may affect VCs, they do not generally link these effects to climate change. For example, although cumulative effects assessments in the reviewed projects evaluate interactions between a project's residual effects and those of other past, present, or reasonably foreseeable projects or activities, there is limited consideration of how climate change may intensify these effects on VCs. In one instance, the residual effects of water withdrawal on aquatic habitat were considered minimal under current conditions, but the potential for increased water stress due to prolonged drought combined with other physical activities was not accounted for, potentially underestimating cumulative pressures over time.

Nevertheless, some examples from the reviewed EAs, as well as peer-reviewed and grey literature, do offer insights into how climate-related impacts on VCs across the four categories occur through direct, indirect, and cumulative pathways. These examples are presented in Table 5. To maintain consistency, "Affected VCs" in Table 5 have been aligned with VCs identified in the EAs.

Table 5: *Prominent Direct, Indirect, and Cumulative Effects of CIDs on Environmental, Health, Social, and Economic VCs as Identified through the reviewed EAs and Peer-Reviewed Literature, by Sector*

(M) = Mining | (N) = Nuclear | (B) = Applies to both

Pathway	Example	VC Categories	Affected VCs
Direct	Thawing permafrost destabilizes tailings management facilities, increasing the risk of contaminant release into surrounding soil and water. **(M)**	Environmental	Geology and Soils, Aquatic Environment
	Intense rainfall and related overland flooding overwhelm containment systems, leading to sedimentation in aquatic environments. **(B)**	Environmental	Aquatic Environment
	Wildfires degrade aboveground containment structures, such as liners, piping, or access control systems, through heat exposure or combustion of	Environmental	Geology and Soils, Aquatic Environment

Pathway	Example	VC Categories	Affected VCs
	surrounding infrastructure, increasing the risk of chemical releases. **(M)**		
	Extreme wind and storms damage containment and storage facilities by dislodging infrastructure components or causing debris impacts, leading to potential chemical spills. **(B)**	Environmental	Geology and Soils, Aquatic Environment
Indirect	Warmer ambient water temperatures reduce the assimilative capacity of receiving waters, increasing the thermal stress on aquatic species from the effluents of nuclear plant cooling. **(N)**	Environmental	Aquatic Environment, Fish and Fish Habitat
	Dust and wildfire ash from project areas are carried by wind or rain into nearby ecosystems, degrading vegetation, aquatic quality, and human health. **(M)**	Environmental	Vegetation and Habitat, Aquatic Environment, Human Health
	During drought, reduced streamflow limits dilution capacity for effluent discharges, resulting in higher contaminant concentrations in receiving waters and increased risks to fish habitat. **(B)**	Environmental	Aquatic Environment, Fish and Fish Habitat
	Warming air temperatures and shifting seasons expand the range of disease vectors; ongoing project activity increases community exposure to Lyme disease and West Nile virus. **(B)**	Health, Social	Human Health, Indigenous Health and Socio-economic Conditions
Cumulative	Thawing permafrost in a region with several adjacent resource projects destabilizes multiple waste storage sites, resulting in cumulative contamination of local water and soil. **(M)**	Environmental	Geology and Soils, Aquatic Environment
	Coastal erosion, combined with shoreline alteration from multiple projects, leads to impacts on marine habitat. **(B)**	Environmental	Aquatic Environment, Terrestrial Environment

Pathway	Example	VC Categories	Affected VCs
	Prolonged exposure to airborne contaminants from multiple projects and recurring wildfires over time contributes to chronic respiratory illness and long-term health degradation in nearby communities. **(M)**	Environmental, Health	Air Quality, Human Health
	Loss of biodiversity or prey due to the combined effects of climate change (e.g., increased water temperatures) and effluent discharges from multiple nearby projects, for instance, reduced Arctic char populations affecting polar bears and Indigenous harvesting. **(B)**	Environmental, Social, Economic	Fish and Fish Habitat, Indigenous Interests, Indigenous Health and Socio-economic Conditions

Among the pathways considered, direct climate-related effects on VCs are most frequently identified in the reviewed materials. In contrast, information on indirect and cumulative effects on VCs is comparatively limited. Several examples presented in Table 5, such as contaminant release from infrastructure failure or thermal impacts on aquatic ecosystems, are repeatedly more commonly cited and primarily focus on environmental VCs.

3.6 Adaptation Interventions to Reduce the Vulnerability of Projects and VCs

The EAs reviewed document a variety of adaptation measures intended to mitigate the climate-related effects on projects and the associated VCs. These measures have been categorized into five broad types: infrastructure design, operational procedures, management procedures, nature-based solutions, and emergency preparedness. Table 6 summarizes the frequency with which each type of measure is referenced across the EAs, representative examples, and whether climate change considerations were explicitly referenced in their design or justification.

Table 6: *Summary of Adaptation Measures from Reviewed EAs*

Measure Type	Number of Projects	Total Instances	Representative Examples	Climate Change-Informed Instances	CID Examples
Infrastructure Design	13	25	Drainage control systems, improved discharge diffuser designs, shoreline protection works, engineered covers	6	Increased discharge capacity for future runoff, shoreline stabilization to withstand erosion, covers designed for freeze–thaw cycles
Operational Procedures	8	12	Adjusting vessel speed near marine terminals, stormwater management plans, lighting design to reduce heat/light impacts	3	Water intake design considering increased water temperatures; lighting adjusted to reduce glare under intense sun conditions
Management Procedures	9	16	Groundwater and surface water monitoring, emergency management plans, adaptive project layout planning	2	Hydrological monitoring to capture climate-driven flow variability; adaptive site planning for water level changes
Nature-Based Solutions	4	9	Riparian vegetation protection, wetland avoidance and compensation, wildlife habitat maintenance	0	NA
Emergency Preparedness	6	10	Emergency response plans for floods or spills, contingency planning for marine accidents	1	One plan referenced storm intensity increases as a driver for enhanced response protocols

Most adaptation measures identified focus on infrastructure design, with fewer examples falling under operational or management procedures. While these interventions can enhance resilience to climate-related stressors, only a small proportion explicitly references projected climate change. Nature-based and emergency preparedness measures are also documented but typically lack a clear climate-specific context.

Case studies from the mining sector[5] (see full list in Appendix C) provide additional insight into adaptation practices, as well as common barriers and enabling conditions, some of which complement the patterns observed in the EA review. For instance, frequently implemented adaptation measures include stabilizing tailings dams, installing permafrost monitoring equipment, and upgrading water treatment infrastructure, many of which fall under infrastructure design, operational procedures, or management practices.

Barriers to effective climate adaptation include the limited availability of localized climate data, uncertainties associated with long-term climate projections, high adaptation costs, and the absence of sector-specific regulatory frameworks that account for future climate conditions.

In contrast, initiatives that successfully integrated adaptation measures often featured early incorporation of climate risks into project planning, strong leadership commitment and technical expertise, Indigenous collaboration, and structured risk assessment processes.

Overall, while current adaptation practices substantially reduce project-level risks, there is comparatively limited focus on adaptation pathways that explicitly address climate-related risks to VCs. Expanding adaptation planning to explicitly consider how climate change, mediated by project activities, affects VCs could strengthen long-term outcomes. The economic case for proactive adaptation remains strong, with benefits such as avoided damage costs and improved operational resilience often exceeding the initial costs of intervention [34].

[5] These case studies were originally compiled through the Adaptation Implementation Insights Project. Further information, including access to a Practitioner Network, is available through CanAdapt's Adaptation Implementation Practitioner Network.

Section 4: Impacts on Indigenous Peoples from Climate Change Effects on Designated Projects

Climate change is already altering the conditions under which Indigenous communities in Canada engage in traditional practices such as hunting, fishing, gathering, spiritual activities, and land stewardship [17]. These changes affect the availability, accessibility, and quality of traditional resources and landscapes. At the same time, designated projects introduce additional environmental stressors, such as water contamination and biodiversity loss, which may affect the well-being, cultural practices, and rights of Indigenous communities. These impacts are likely to be further amplified by climate change [11][17][25].

The EAs reviewed identified a range of pathways through which climate change and project-related impacts may intersect to affect Indigenous Peoples. While nearly all VC categories assessed in EAs can have implications for Indigenous communities, some were explicitly focused on Indigenous-specific impacts:

- Current Indigenous Land Use (6 reports)
- Indigenous Health and Socio-economic Conditions (6 reports)
- Indigenous Interests (2 reports)
- Indigenous Physical and Cultural Heritage (10 reports)

However, these categories do not consistently include climate change considerations. Nonetheless, several projects have documented concerns raised by Indigenous communities regarding the effects of climate change during the engagement process. Some examples include water quality degradation linked to both project discharges and tailings seepage due to extreme events, particularly in relation to fish health, consumption safety, and access to clean water [37]. Communities have also routinely identified risks to wetland ecosystems, plant harvesting areas, and wildlife habitats due to project activities, which may be amplified by the effects of climate change, especially where vegetation may not regenerate to support species of traditional importance. In some cases, Indigenous communities have also explicitly emphasized broader concerns about climate change, including shifting seasonal patterns, reduced availability of traditional food sources, and long-term ecosystem health.

Across the reviewed EAs, several common themes emerged in how Indigenous communities engage with proponents and assess project risks:

- A strong desire to be involved early and meaningfully in developing key documents such as Adaptive Management Plans, Environmental Management Plans, and Emergency Preparedness Plans.

- Support for community-based monitoring, including establishing advisory committees to oversee and interpret monitoring results.
- Calls for clear, plain-language communication about environmental risks, climate change impacts, and how proposed adaptation and mitigation measures will work in practice.
- Requests for restoration and monitoring approaches that reflect Indigenous Knowledge, priorities, and practices.

Overall, the findings highlight the essential role that Indigenous Peoples continue to play in identifying risks and shaping adaptation responses. Strengthening the integration of Indigenous perspectives in relation to the effects of climate change risks on projects and the associated VCs is important for ensuring more equitable assessments and for building resilient and informed project outcomes.

Section 5: Conclusion

This report discusses the conceptual framework, which considers the multiple pathways through which climate change affects projects, VCs, and Indigenous Communities. Insights from the literature reviewed indicate that climate change is already impacting designated projects and VCs. The components and linkages in the framework provide a foundation for evaluating potential future risks and considering adaptation strategies to mitigate the effects of climate change.

As noted earlier, the EA reports reviewed were completed under CEAA 1992 or CEAA 2012, both of which may have offered limited direction on incorporating climate change. This context influenced the extent and focus of climate-related content in the assessments.

Despite the growing body of knowledge on climate change and its implications for projects and VCs, several key gaps may remain:

- Incomplete Linkages Between Climate Change and VCs: Most assessments emphasize how climate affects infrastructure but offer limited analysis of how these changes cascade through project activities to affect VCs.
- Uneven Coverage of VCs: Environmental VCs receive the most attention, while health, social, and economic VCs, particularly those tied to cultural practices, livelihoods, and land use, are less frequently addressed.
- Limited Integration of Indigenous Knowledge: Although projects engage with Indigenous communities, the incorporation of Indigenous Knowledge in climate risk assessment and adaptation planning is inconsistent.
- Climate Change and Resource Development: While literature notes that warming may “open up” new opportunities for resource extraction, such discussions tend to be broad and speculative. Targeted research is needed on how climate-driven changes influence the viability and long-term sustainability of extracting resources like rare earth elements.
- Cumulative Effects and Residual Risks: EAs include cumulative effects assessments, yet few fully consider how climate change may intensify the residual impacts of projects. For example, residual water withdrawal impacts may appear minimal in isolation but could become significant under future drought conditions. Better tools and guidance are needed to evaluate how climate change interacts with legacy and ongoing project impacts.

Addressing these gaps will be critical for advancing IA practices that are climate-informed, socially inclusive, and future-oriented. This includes formalizing climate change impact assessment practices and refining the integration of climate change considerations throughout IA processes. Continued collaboration will be necessary to strengthen conceptual frameworks, improve data availability and use, and support more adaptive and resilient decision-making. These efforts can draw on a growing body of national and international standards related to climate risk assessment and adaptation planning.

Consideration could be given to tools that compile organized examples of the effects of climate change on designated projects and associated VCs across different sectors and contexts from IA documents, and peer-reviewed and grey literature. Such tools can assist proponents and IA practitioners in identifying project-related risks, relevant mitigation and adaptation measures, and in promoting the integration of climate change considerations across all phases of the IA process. They may also support more consistent and evidence-based analysis in future assessments.

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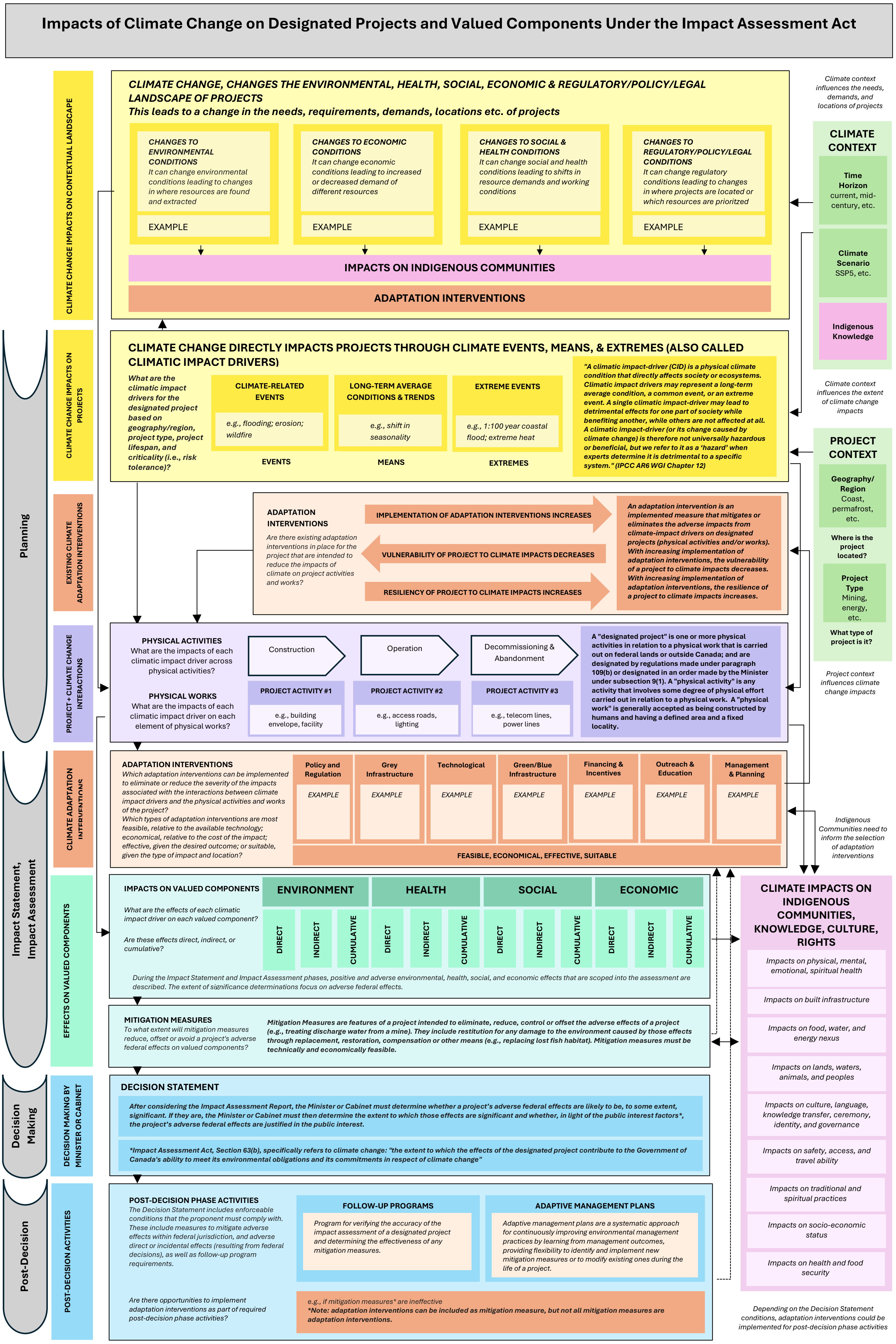
Appendix A: Conceptual Framework for Considering Climate Change within the Canadian Impact Assessment Process



Appendix B: List of EAs Reviewed

Project Name	Project Type	Project Sub-Type	Location
Akasaba West Copper - Gold Mine Project	Mining	Surface	Quebec
Brucejack Gold Mine Project	Mining	Underground	British Columbia
Darlington New Nuclear Power Plant Project	Nuclear	Nuclear Power Generation	Ontario
Deep Geologic Repository Project for Low and Intermediate Level Radioactive Waste	Nuclear	Nuclear Waste Management	Ontario
Donkin Export Coking Coal Project	Mining	Underground	Nova Scotia
Dumont Nickel Mine Project	Mining	Surface	Quebec
Grassy Mountain Coal Project	Mining	Surface	Alberta
Hardrock Gold Mine Project	Mining	Surface	Ontario
Howse Property Iron Mine Project	Mining	Surface	Newfoundland and Labrador
James Bay Lithium Mine Project	Mining	Surface	Quebec
Magino Gold Project	Mining	Surface	Ontario
Murray River Coal Project	Mining	Underground	British Columbia
Rainy River Project	Mining	Surface & Underground	Ontario
Red Mountain Underground Gold Project	Mining	Underground	British Columbia
Rose Lithium - Tantalum Mining Project	Mining	Surface	Quebec
Sukuna Coal Mine Project	Mining	Surface	British Columbia
Valentine Gold Project	Mining	Surface	Newfoundland and Labrador
Whabouchi Mining Project	Mining	Surface	Quebec

Appendix C: Adaptation Case Study List

Project	Type	Location
Kam Kotia Mine	Copper-Zinc Mine	Ontario
Yukon Mining Sector Study	Mixed Mining	Yukon
Faro Mine	Zinc Mine	Yukon
Minto Mine	Copper-Gold Mine	Yukon
Eagle Gold Project	Gold Mine	Yukon
Klondike Mine	Placer Gold Mining	Yukon
Diavik Diamond Mine	Diamond Mine	Northwest Territories
Myra Falls Mine	Zinc-Copper Mine	British Columbia
Galore Creek Project	Gold-Copper-Silver Mine	British Columbia
Glencore Sudbury Operations	Nickel-Copper Mine	Ontario