# Understanding Mining Policy Drivers and Barriers in the Context of Climate Change Impacts and Adaptation

*2014*

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**Please cite this document as:**

Rodgers, C., Sparling, E., Wiles, A., and Douglas, A. (2014): Understanding Mining Policy Drivers and Barriers in the Context of Climate Change Impacts and Adaptation, report submitted to Climate Change Impacts and Adaptation Division, Natural Resources Canada, 38p.

**With support from Natural Resources Canada through the Adaptation Platform.**

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# Table of Contents

# Glossary

**Barrier**: Refers to elements of policies or policy instruments that hinder, or act as a barrier to, climate change adaptation action.

**Driver**: Refers to elements of policies or policy instruments that support, or 'drive', climate change adaptation action.

**Policy**: A high-level statement of intent in response to defined conditions and in order to guide present and future decisions.

**Policy Instrument**: Mechanisms used to support implementation, and increase uptake, of policy.

**Policy Tools**: Refers to both policy and policy instruments.

**Public Policy**: Policy produced by governments in response to a specific public issue.

# 1.0 Executive Summary

Ontario's mining industry is increasingly threatened by changes in climate and subsequent impacts (Ford et al., 2010; Pearce et al., 2011). Such impacts can affect nearly all aspects of a mining project including health and safety of employees, infrastructure, equipment, natural systems and valued environmental components[1], with the potential to influence mine productivity and cause damage (Nelson and Schuchard, 2011). Vulnerability to these expected impacts is determined by the sensitivities specific to an individual mine site and operation (Pearce et al, 2011; IPCC, 2007). Given the evidence of climate change impacts in Ontario and the expectation that current climate risks will be exacerbated in the future (Lemmen et al., 2008; Chiotti and Lavendar, 2008; Report of the Expert Panel on Climate Change Adaptation, 2009); the potential for damage to the mine site; and the possibility of resultant environmental and health impacts for the surrounding area, adaptive action in the mining sector is increasingly urgent.

Policies and policy instruments (policy tools) affecting the mining sector (as well as those affecting supporting areas such as energy, water and transportation) provide the framework through which government can require that mining companies consider climate change and its impacts and risks. In this role, they may act as drivers or barriers to climate change adaptation. In Ontario, policy tools relevant to the mining sector are issued by a selection of government and industry sources.

The purpose of this study was to assess the ability (and potential) of existing mining policy tools to enable or support climate change adaptation action. Its specific focus was a subset of two policies and eight policy instruments relating to Tailings Design and Management, and Closure Planning for Ontario mines. The study's specific objectives were to:

- Identify aspects of selected policy tools that support or hinder climate change adaptation in the mining sector;
- Identify aspects of selected policy tools that promote activities that are mal-adaptive in nature; and
- Identify where mining policy tools have affected decision making within mining companies with regard to climate change adaptation.

The review and analysis generated several key findings on how policy tools influence climate change adaptation in the mining sector. Using these findings, the project team and advisors developed general and specific recommendations to increase the ability of mining policy tools to support climate change adaptation. A summary of selected general recommendations are presented below:

[1] Defined by the Canadian Environmental Assessment Agency as: The environmental element of an ecosystem that is identified as having scientific, social, cultural, economic, historical, archaeological or aesthetic importance (CEAA).

- Clear communication of environmental goals and the climate change implications that may impact them can improve the ability of a policy to promote and support climate change adaptation in the mining sector.
- To more effectively promote and support climate change adaptation in the mining sector, policy instruments (such as regulations and guidelines) should reflect standards and thresholds that consider climate change impacts.
- Clear consequences for inaction or inattention to climate change impacts can strengthen policy instruments and drive adaptive action.
- To help practitioners consider climate change impacts and adaptation within decision-making, new climate change guidance is required in a number of key areas including:
    - Climate change impacts;
    - Timeframes (of climate impacts);
    - Uncertainty (related to the use of climate data in decision-making);
    - The selection and use of climate scenarios; and
    - The monitoring of a wider set of environmental conditions (as indicators of climate change that could be relevant to the activity/facility).

# 2.0 Introduction

The impacts of the changing climate are already evident in all regions of Canada (Lemmen et al, 2008). The extent to which exposed systems are vulnerable will depend on their sensitivities and their ability to adapt or be adapted to both climate and non-climate-related stresses over time (Pearce et al, 2011; IPCC, 2007; Chiotti and Lavendar, 2008). Generally speaking, as the rate of climate change increases, so too does the urgency for adaptive action (Lemmen et al, 2008). For sectors like mining, which typically have long supply chains and rely on environmental services, there are many points of potential vulnerability and the length of mining project lifespans increases the probability of climate change impacts affecting the sector (Nelson and Schuchard, 2011). Methodical assessments of climate change-related vulnerabilities and opportunities, as well as the evaluation and management of related risks can help to protect mining stakeholders and prevent damage to the environment and communities in surrounding areas (Nelson and Schuchard, 2011).

To encourage key mining stakeholders to undertake these tasks government and industry groups must use existing policy tools. As policy tools stimulate and guide stakeholder action with regard to all aspects of mine planning and development, operation and closure, they can play a significant role in boosting the sector's adaptive capacity. This report examines the potential influence of policy tools[2] on the climate change adaptation behavior of mines operating in Ontario. It focuses on policy tools related to tailings facility design and management, and closure planning practices.

## 2.1 Background

**Policy**

A policy is a high-level statement of intent 'selected from alternatives in response to defined conditions and in order to guide present and future decisions' (Merriam-Webster). There are several types of policy including public policy[3], corporate policy and organizational policy, each governing decision-making in their respective arenas. Within this broad net there are different categories of policies that apply to specific issues faced by decision-makers. Public policy for instance can include distributive policies that focus on providing goods and services to user groups; regulatory policies that mandate certain types of action; economic policies that govern fiscal actions; and constituent policies that create executive powers (Clean Air Strategic Alliance). Corporate or organizational policies can include human resource, purchasing, privacy and reporting policies among others. This project considered two policies: *Towards Sustainable Mining: Mining Closure Framework* (Organizational Policy) and the *Toxic Substances Management Policy* (Public Policy – Federal level).

[2] Specifically those related to environmental and natural resource management policy domains.
[3] Produced by governments in response to a particular public issue.

Policy instruments are mechanisms used to support implementation and increase uptake of policy. Within this category there are hard and soft policy instruments. Hard policy instruments are prescriptive in nature, often setting expectations for how a stakeholder *must* meet policy terms, and are enforced uniformly. Examples include laws, permits, building codes and regulations (Zehavi, 2012). Soft policy instruments are designed to *encourage* policy compliance but do not enforce it. Examples include economic subsidies or incentives, guidelines and frameworks. A combination of both hard and soft policy instruments are often used to support policy compliance (Zehavi, 2012). For example, many policy instruments including Mining Metal Effluent Regulation, Ontario Environmental Protection Act and the Canadian Dam Safety Guidelines, among others, support the Toxic Substances Management Policy. Some instruments such as the regulations are legally binding and strongly enforced. Others such as the guidelines and any economic incentives help to guide action, but require buy in from proponents (Clean Air Strategic Alliance).

The policy instruments considered by this project are a mix of regulations, guidelines/frameworks and economic incentives. They include: *Ontario Focused Flow-Through Share Tax Credit, Metal Mining Effluent Regulations, Canadian Dam Safety Guidelines, Mine Development and Closure Regulation, Effluent Monitoring and Effluent Limits Regulation, Ontario Environmental Protection Act, National Orphaned or Abandoned Mine Initiative Policy Framework* and *Mine Environmental Neutral Drainage Program Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials*. Although many support the selected policies, all policy instruments were selected primarily for their relevance to the planning, design and operation of climate-sensitive elements of the mine relating to tailings facility design and management or closure planning practices.

**Climate Change**

Policy tools can be very effective at achieving wide-scale action to respond to and prepare for a 'global' threat. Climate change is just such a threat, affecting all regions of the world and all industries including mining. Warming temperatures, a changing precipitation regime, changing cryosphere conditions and extreme weather are increasingly causing damage and disruption to business operations, including supply and value chains, in many parts of the world (Nelson and Schuchard, 2011). These impacts will have significant implications for all phases of mine operations. The latest science from the Intergovernmental Panel in Climate Change (IPCC, 2013) suggests that these changes will continue into the future and likely to a larger extent. To address this type of dynamic and sweeping challenge, businesses, including mining companies, must take stock of climate risks and manage them in immediate and future terms. Adapting to the impacts of climate change will benefit mining stakeholders by helping to secure business continuity, safeguard company assets including people and property and maintain the competitiveness of the Canadian mining industry. Adaptive action in the mining sector will also benefit Canadians by protecting the environment and health of communities nearby to mine sites as well as the economic resources generated by the industry.

**Mining**

In Canada, mining remains one of the most important industries, contributing approximately $35B to the nation's GDP and employing over 320,000 employees in 2011 (MAC, 2012). Nationally, there are over 800 mines (MIHRC) that produce metals (aluminum, iron, gold, silver etc), minerals (zinc, lead, potash, diamonds, gypsum, magnesium, cobalt, uranium) and energy (oilsands, coal) (MAC) for domestic use, manufacturing and export. As one of the most appealing jurisdictions in which to mine (Canadian Mining Journal, 2013), Canada has a vested interest in both creating a business environment that is conducive to growth and prosperity while ensuring environmental quality and social health and safety.

Several factors affect the adaptive capacity of the mining sector with regard to climate change impacts. Reliance on surface infrastructure in operations, closure and post-closure phases (e.g. tailings ponds, water treatment plants and roads) (Nelson and Schuchard, 2011), implies a relatively high level of investment to design and build/retrofit key infrastructure to accommodate expected climate impacts. Although lower investment adaptation options exist (e.g. changes in maintenance practices etc.), they are most effective when undertaken in conjunction with infrastructural changes. The highly competitive nature of the mining sector discourages large investments of this kind, unless there is a high level of certainty that they are necessary to the operation of the project. Uncertainty related to the accuracy of climate data and the potential effects of future climate impacts, is viewed as a barrier to undertaking such a financial commitment. A lack of regulatory or legislative instruments that specifically require the consideration of climate change impacts and adaptation in the planning and management of a mine site exacerbates this issue. As mining companies are not uniformly required to take adaptive action, early adopters accept that any investments they make may reduce their ability to remain competitive with others that did not choose to undertake adaptation measures.

**Policy as an Adaptation Driver/Barrier**

Policy tools can be used both to drive proponents to take adaptation action, and to ensure that action taken will effectively address climate change in a fair and progressive manner. There are several ways that these tools can effect such change. First, policy instruments can mandate change or enforce standards. In both cases, a response from proponents is required. Secondly, policy tools can often contribute to the creation of an adaptive environment within a company or market. In particular, they can create opportunities for companies to act by effecting change politically, economically, legally, socially or operationally.

Unfortunately, policy tools can also act as a barrier to climate-sensitive adaptive management in several ways. In some cases they can block or hinder (either intentionally or unintentionally) adaptive behavior within companies. In addition, some policy tools can promote mal-adaptation[4] within industry sectors.

[4] The term 'maladaptation' refers to: Any changes in natural or human systems that inadvertently increase vulnerability to climatic stimuli; an adaptation that does not succeed in reducing vulnerability but increases it instead (IPCC, 2001).

Finally, policy tools may contribute to the creation of an environment where taking adaptive action unfairly hampers competitiveness.

## 2.2 Goal of the Project

Although the ability of policy to drive climate change adaptive action is well documented (Swart et al., 2009; Regen SW; Lemmen et al, 2008), the ability of Ontario's existing policy tools to achieve this goal is largely unexplored. This study seeks to fill the information gap by answering the question "Do Ontario policies and policy instruments act as drivers or barriers of climate change adaptation action"? The study emphasizes analysis of the selected policy tools to identify features of each tool that support or hinder adaptive action in the sector. It also brings together new research, policy analysis and stakeholder perspectives to develop an understanding of how existing policy tools influence decision making within the sector and identify opportunities to improve the level of support for adaptive action within each tool.

The remainder of the report is structured as follows:

- Section 3 provides detail on the selection of policy tools for analysis, development of the analytic criteria and the key stakeholder interview process;
- Section 4 provides the results of the policy tool analysis;
- Section 5 summarizes the findings from the key stakeholder interviews;
- Section 6 highlights general and policy-tool–specific recommendations; and
- Section 7 concludes the report with a summary of key findings and important next steps.

# 3.0 Methodology

This section presents the approach taken by the project team to complete this study. It provides details on the selection of the policy tools, development and use of the analysis criteria and the key stakeholder interviews that were conducted.

## 3.1 Policy Selection

From an original list of five[5] key mine performance issues, two were selected as the focus for policy analysis: 1) tailings facility design and management and 2) closure planning. The decision to focus on these issue areas was driven by a number of factors. Tailings facility design and management; and closure planning represent two long-term mining performance issues areas that must consider climate to ensure safety and health for the surrounding environment, and to prevent costly damage or liability concerns for the mine. Moreover, the vulnerability of these issue areas to climate change impacts is common to most of Ontario's mines regardless of location or type of mining. This implies that the findings and recommendations produced by the analysis may be widely relevant in the provincial mining sector. Finally, tailings facility and design management and closure planning were emphasized as key mining performance issues by the project advisory committee who felt that they would be ideal for assessment in this study.

Preliminary research to identify policy tools with direct bearing on tailings facility design and management and closure planning was confined to Provincial-level policy tools, and revealed fewer than anticipated. Through consultation with project advisors, the project team expanded the review to include Federal policies and those from industry groups. This decision helped to broaden the evaluation and allowed for a comparison between Federal and Provincial policy.

The project team selected ten policy tools for analysis primarily for their relevance to the planning, design and operation of climate-sensitive elements of the mine relating to tailings facility design and management or closure planning practices.

The 10 policy tools were:

*Policies*

1. Towards Sustainable Mining: Mining Closure Framework
2. Toxic Substances Management Policy

*Policy Instruments*

3. Ontario Mining Act (Regulation 240/00 Mine Development and Closure)

[5] Five mine performance issue areas listed in the project proposal were: Water usage, Transportation, Energy, Tailings Design and Management, Closure Planning

4. Ontario Focused Flow-Through Share Tax Credit
5. Metal Mining Effluent Regulations
6. Canadian Dam Safety Guidelines
7. Effluent Monitoring and Effluent Limits Regulation
8. National Orphaned or Abandoned Mine Initiative (NOAMI) Policy Framework
9. Mine Environmental Neutral Drainage Program (MEND) Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials
10. Ontario Environmental Protection Act

An Excel spreadsheet was populated with the assessment criteria (Section 2.1.1), which was then applied to each of the policy tools.

## 3.2 Analysis Criteria

The Project Team developed criteria to identify areas within a policy that support/hinder adaptation actions. Based on consultation with project advisors, the criteria (listed below Table 1 and 2) were refined for use in the policy analysis and transcribed into a spreadsheet to better facilitate the recording and presentation of analysis findings.

During the analysis process, it became clear that the provision of examples from within each policy tool in response to the criteria did not provide adequate context for the findings. For example, since few of the policy tools referenced climate change explicitly, much of the support or hindrance that they could offer adaptation efforts was indirect in nature. This level of complexity was not adequately addressed with a simple analysis. To accurately assess the policy tools, an additional 'weighting' evaluation component was devised. The following weighting criteria were applied:

- Active support/drive for climate change adaptation (noted by +1)
- Passive (or indirect) support/drive for climate change adaptation (noted by 0S)
- Passive (or indirect) hindrance of climate change adaptation (noted by 0B)
- Active hindrance of climate change adaptation (noted by -1)

**Driver Criteria**

*Primary question*: Does this policy support adaptation action? How?

Table 1: Driver Criteria and Indicators

| Criterion | Notes and Indicators |
|---|---|
| Presence of climate-related terminology | Yes/No |
| Creation of an adaptive environment within a company or market | |
| a. Politically | Refers to features that identify political action that could be taken to promote climate change adaptation in the mining sector OR features that build political support for climate change adaptation in the sector (e.g. policy from an industry association that emphasizes sustainability and adaptive action, which closely mirrors current political goals). |
| b. Economically | Refers to features that provide direct or indirect (statement of intent) to direct funding or investment to climate change research, guidance and adaptation measures; OR requires practitioners to commit funding to climate change adaptation related activities. |
| c. Legally | Refers to features that suggest a minimum standard or practice that must be met to avoid climate related liability. |
| d. Socially | Refers to features that encourage outreach or engagement of public by mining sector stakeholders to promote climate change adaptation in the community. |
| e. Operationally | Refers to features that provide tools and support to incorporate climate change adaptation into decision-making. |
| Encourages or mandates adaptive behavior change | Refers to features that encourage or mandate specific action by a mine. |
| Demonstrates flexibility with regard to changing climate trends | Refers to policy tools that promote standards that adjust (are adjusted) to accommodate changing environmental conditions or climate patterns (e.g. effluent regulations that set limits for deleterious material release based on water levels). |
| Makes taking adaptation action easier/less expensive/more efficient | Refers to actions that indirectly influence a mine's ability to undertake climate change adaptation action (e.g. provision of guidance material on adaptive action or climate impacts OR climate data resources etc.). |

**Barrier Criteria**

*Primary question*: Does this policy hinder adaptation action? How?

Table 2: Barrier Criteria and Indicators

| Criteria | Notes and Indicators |
|---|---|
| Blocks or hinders (intentionally or unintentionally) adaptive behavior or actions within a company. | E.g. restricts access to technology, equipment or information required to act; limits the ability of a company to act; encourages short-term action that may be challenged by subsequent governments etc. |
| Promotes mal-adaptation (actions or activities that increase risk or vulnerability of company or operations) | Refers to features that promote action that may increase the risk of climate change to mining operations (e.g. promotes standards based on historical weather trends). |
| Discourages adaptation | Refers to features that actively discourage adaptation action. |
| Creates an environment where taking adaptive action unfairly hampers competitiveness | Refers to features that impose prohibitive costs on adaptive measures OR requires adaptive action from some stakeholders and not others. |

Active support was defined as any feature of the policy that actively contributed to, encouraged or mandated either the consideration of climate change within planning/design phases or the introduction of adaptation action. Passive support for adaptation described any aspect of the policy that eased the introduction of climate change adaptation or created an environment where adaptation could occur, but did not encourage adaptation more actively (e.g. a policy that requires the use of risk assessment and management approaches when identifying deleterious substances. This feature does not directly require mine owners to consider climate impacts but encourages it indirectly as climate impacts will be raised during the risk assessment process). Similarly, active barrier/hindrance to climate change adaptation was defined as any policy feature that made it more difficult/expensive to undertake adaptation action. Passive barriers/hindrance was defined as policy features that made it possible for proponents to ignore climate change or practice mal-adaptation. For example, policies that allowed for the use of older building standards or historical climate data were included in this category.

## 3.3 Interviews

The project team conducted interviews with keys stakeholders in order to corroborate the results with real-life responses from mining companies considering and responding to climate change. Interview guides were developed to gauge the degree of company response to the policy in the area of climate

change impacts and adaptation. Results would define not only the degree of influence that policy has, but how the policy was interpreted by the company. Repeated attempts to gauge industry sentiment on the effectiveness of policy to drive attention to climate change impacts through adaptation met with minimal uptake. The project team conducted four interviews.

# 4.0 Policy Analysis Findings

This section will explore the findings from the analysis of selected policy tools. It will first focus on general findings and then discuss findings specific to each policy tool in greater detail.

## 4.1 General Findings

Analysis of the selected policy tools identified several general findings pertaining to the way climate change was considered (or not considered) within. First, it was noted that although several policy tools mentioned climate change as a factor affecting mine operations and monitoring programs [Mining Effluent Neutral Drainage (MEND) Acid Rock Drainage guide and the Canadian Dam Safety Guidelines], only one of the policy tools (Canadian Dam Safety Guidelines) directly and explicitly required proponents to consider climate change in the planning, design, operations, monitoring or closure phases of mining. Further, where climate change was referred to specifically, it was often termed an 'implied' risk, meaning that specific adaptation actions or measures were not suggested or required. This common feature gives mine owners and operators a significant level of freedom in deciding whether and how to consider climate change impacts and adaptation throughout the mining phases. Given the competitive nature of the industry (as discussed in Section 2.0), lack of specific direction and uniform application to all mines in policy tools, may result in minimal or inappropriate action, or in many cases, inaction.

Secondly, policy instruments such as guidelines or frameworks do not themselves provide the specific performance requirements to which proponents are asked to adhere. Rather, these instruments reference regulations and standards developed under key pieces of legislation; for example, the Canadian Dam Safety Guidelines reference standards derived from the Environmental Protection Act and the Ontario Mining Act. This subsequently places more emphasis on these standard-setting policy instruments as the ones ultimately responsible for incorporating climate change. Finally, where climate change references were present, climate uncertainty was strongly emphasized as a key consideration for decision makers, as it influences the reliability of climate data and therefore the adequacy of adaptation measures. These trends will be explored in greater detail during the policy-tool-specific analysis below.

## 4.2 Policies

Of the ten selected policy tools, two policies were reviewed: Towards Sustainable Mining: Mining Closure Framework and the Toxic Substances Management Policy. The following section examines the results of each analysis to highlight the characteristics or features that may support or hinder climate change adaptation in the mining sector.

### 4.2.1 Towards Sustainable Mining: Mining Closure Framework

In 2004, the Mining Association of Canada launched *Towards Sustainable Mining* as a set of principles for sustainability, to which MAC members must commit as a condition of membership. The MAC Mine Closure Framework is a part of that sustainability framework, and contains a set of commitments for the development of closure plans and conduct of post-closure activities for new and existing projects. While the framework in its current form does not reference climate change or contain related terminology, it does reveal significant potential as a driver of climate change adaptation through its complementary structure, themes and approach. First, it focuses on sustainability with an overarching goal of 'returning land to viable and diverse ecosystems that will serve the needs of post-mining use'. With its long-term focus, consideration of future impacts of climate change on mine sites could be incorporated into its purview.

In addition, the MAC Mine Closure Framework contains a commitment to incorporate community values into reclamation objectives. In recent years, the public has pressured mine owners to consider the impacts of climate change on a project and ensure that appropriate measures are taken[6]. Incorporating climate change adaptation into closure plans may well be a topic for consideration within this theme[7].

Under another theme, the Framework states that MAC members should establish financial assurance plans and work with communities to develop closure plans and strategies to mitigate the socio-economic impacts of the mine closure in accordance with local laws. Financial assurance plans require the owner of a mining company to set aside adequate funds to complete remediation of the mine site following the resource extraction phase of operation. Remediation measures suitable to the future climate context could feasibly be incorporated into the cost estimation process as a means of ensuring that the closure plan and rehabilitation process are completed in a sustainable and resilient manner.

The MAC Closure Framework is committed to a culture of research and innovation to improve closure processes, monitoring techniques and technologies. Under this theme MAC encourages continued awareness and adoption of new technologies; continued improvement and updating of closure plans during the mining life cycle; and robust, long-term monitoring programs implemented during reclamation, closure and post-closure phases to provide comprehensive information on reclamation progress and success. Already these themes imply an element of adaptive management and provide the proponent with additional opportunities to undertake climate change adaptation measures. Although the MAC Closure Framework does not currently address climate change impacts and adaptation explicitly, it retains significant potential to be a driver of climate change adaptation in mining closure plans.

[6] As evidenced by public consultation documents related to numerous mining environmental assessments (e.g. Joslyn North Mine, Galore Creek and Bellekeno Mine)
[7] As evidenced in public consultation materials relating to environmental assessments.

### 4.2.2 Toxic Substances Management Policy

The Toxic Substances Management Plan was enacted in June of 1995 and aims to achieve virtual elimination of toxic substances from the environment by preventing or minimizing their release into the environment (TSMP, 1995). As a federal level policy, the TSMP applies uniformly across the country and limits substances considered toxic by the Canadian Environment Protection Agency (CEPA), focusing on the sources of such substances. Careful assessment of the TSMP revealed that it contained passive support for climate change adaptation by encouraging/mandating behavioural change. In particular, the TSMP requires risk assessment and management approaches to be used to identify and manage track 2 substances[8]. Although climate change is not mentioned explicitly as a factor, this feature provides an opportunity for climate change to be considered in the management of these toxic substances through the risk management processes.

Another example that demonstrates the TSMP's passive support for climate change adaptation is the policy's adoption of a precautionary approach to substance management. In particular, the policy states that 'where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation'. This statement is very relevant with regard to climate change as it removes a key barrier to climate change adaptation action. In many cases, uncertainty associated with the output from global climate models is cited as a reason for inaction on climate change adaptation. In the face of multiple (and potentially conflicting) projections, it is difficult to know how to reasonably characterize and takes measures of uncertainty into account in decision-making. By allowing action in the face of scientific uncertainty, the policy encourages proponents to respond to the best of their ability using the information at hand. As climate change impacts can often impose threats of serious or irreversible damage, this clause can pertain to responses to climate changes without using explicit terminology.

Finally, the TSMP makes reference to policy tools with higher environmental standards. In a case where such tools are in conflict with the actions required to meet the objectives of the TSMP, the higher standard should be honoured. This feature allows provinces and territories to elect or adopt standards other than those specified in the Canadian Environmental Protection Act (CEPA) regulations, as long as those standards exceed the CEPA in strength. It provides a level of flexibility for provinces (and for mining companies) to operate under standards that are more appropriate given regional environmental, climate or other concerns.

## 4.3 Policy Instruments

Of the ten policy tools reviewed, eight can be classed as instruments: The Ontario Flow-Through Share Tax Credit; Canadian Dam Safety Guidelines; Metal Mining Effluent Regulation; Effluent Monitoring and Effluent Limits Regulation supporting the EPA; Mine Development and Closure Regulation of the Ontario

[8] Track 2 Substances refer to those that need to be managed but not strictly eliminated.

Mining Act; Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials (MEND Report); Policy Framework in Canada for Mine Closure; Management of Long-term Liabilities: A Guidance Document (NOAMI); and the Ontario Environmental Protection Act. This section reports findings related to the potential influence of each instrument on the climate change adaptation behavior of mining concerns operating in Ontario, especially with respect to tailings facility design, and management and closure planning practices.

### 4.3.1 Ontario Flow-Through Share Tax Credit

The Ontario Flow-Through Share Tax Credit (2006) was designed to stimulate mineral exploration in Ontario and improve access to capital for small mining exploration companies. Classed as an economic incentive, the Flow-Through Share Tax Credit provides eligible individual stakeholders with a refundable tax credit of 5% on select Ontario expenses relating to the production of output from the mines, operating and maintenance expenses incurred by the corporation. Therefore, this incentive acts to encourage investment into Ontario's mining sector.

At this time, the Ontario Flow-Through Share Tax Credit does not address climate change either explicitly or implicitly. There is potential however to amend the policy so that it can drive adaptation action. These opportunities will be explored in the Recommendations section of the report.

### 4.3.2 Canadian Dam Safety Guidelines

The Canadian Dam Safety Guidelines (2007) are the most recent[9] set of guiding materials for dam use and safety and as such they apply to dams used in mine tailings design and management as well as those that will remain in place during closure and post-closure phases. The guidelines are designed to protect the public and the environment from the effects of dam failure and the release of any fluids from behind a dam (Dam Safety Guidelines, 2007). The technical nature of dam design, operation and maintenance requires that guidance materials contain specific information about best practices, legal liability and due diligence. This document was therefore one of the most detailed documents assessed and gave the Project Team a better understanding of where climate change is considered and where it could be considered in greater detail for the mining sector.

**Enablers**

The Canadian Dam Safety Guidelines (CDSG) contain several references to climate change and promote careful consideration of climate parameters. Although the guidelines recognize that climate change *is* occurring, they note that there is a level of uncertainty surrounding where specific impacts will occur and the specific nature of those impacts. Despite this caveat, the document presents an opportunity for practitioners to consider the changing nature of climate and how it will affect dam safety.

[9] Revisions to these guidelines were developed in 2013, but are unavailable at present (CDA)

The CDSG contains many features that drive climate change adaptation action. They can be divided into two main categories: Creation of an adaptive environment legally and operationally; and Demonstrates flexibility with regard to climate change. These categories apply to both the Tailings Design and Management and Closure Planning focus areas.

*Creation of an Adaptive Environment - Legally*

The CDSG states that the onus for ensuring safe management of a dam under *any and all conditions* rests with the owner. Although this does not explicitly reference climate change, mine owners can understand that it may be considered a risk to the safe management of a dam. This basic tenet implies that the owner must exercise due diligence to understand the types of risks to their dam infrastructure, including climate risks, and address each appropriately according to its potential consequence. Failure to perform due diligence can result in damage to infrastructure, environment and human health. Although the owner can be held legally liable for the damage, it appears that what constitutes reasonable practice on how to address climate-change related risks is not yet spelled out in enough detail for negligence to be easily if at all proven.

*Creation of an Adaptive Environment - Operationally*

The CDSG both actively and passively support climate change adaptation in mine operations in a number of different ways. Examples of each are provided below:

*Tailings Design and Management*

Active support for climate change adaptation

- Identification of the need for maintenance of critical components (e.g. power supply) and stocking of spare parts as part of the emergency management plan (encourages resilience planning)
- Identification of preventative or adaptive actions and creation of a clear description of all climate events and adaptations on record
- Encouragement for regular flow control equipment design reviews which consider all available information and can lead the owner to revisit design if changing conditions present a threat

Passive support for climate change adaptation

- Recognition that operating procedures should consider flood forecasting information
- Recognition of external hazards (including flooding) and their inclusion in emergency preparedness/management plans.

*Closure*

Active support for climate change adaptation

- Regular updates of the closure plan in response to any emerging risks identified by dam safety reviews that occur throughout mine operation

Passive support for climate change adaptation

- An indication that long-term monitoring should be conducted post-closure to enable the site owner to address new risks

**Barriers**

Despite the information the CDSG provides to proponents to support climate change adaptation and ultimately build and maintain strong and resilient dams, the guidance document also presents some potential barriers for action. Primarily, there exist several caveats within the document. For example, although the CDSG states that owners have a responsibility to examine all possible risks to their dam and address them, it also states that safety reviews for a dam should be based on current knowledge and best practice. Knowing that climate change is not a strong component of the current 'best practice', and that the risks of climate change impacts are real and present, there is no strong impetus to drive adaptation.

The guidelines also suggest that the dam safety management system function within the context of public policies and the current owner's business objectives. If climate change risks are not considered in other public policies relevant to the mine (or as part of the current owner's business objectives), this feature of the CDSG may act as a barrier to climate change adaptation by offering mine owners an option to operate the dam safety management function by another standard.

Finally, although climate change risks and future projections are mentioned throughout, the CDSG uses current observations and historical climate data (only) to calculate Probable Maximum Precipitation and Probable Maximum Flood with regard to issues like spring thaw and seasonal variance. These calculations represent a standard that mines use when designing and constructing dams. If the calculations do not consider climate change, dams may not be designed to accommodate the types of floods or precipitation events that could occur in the future.

Although classed as 'guidelines', the Canadian Dam Safety Guidelines are referred to in several mining policies as industry standard. In effect this means that the CDSG are treated like policies/regulations and their guidance is not simply 'suggested' but can be enforced as an industry standard. This situation presents a significant opportunity for the CDSG to further enable adaptive behaviour in mining companies as it presents design standards for the mining sector and because it already considers climate change impacts and their potential impacts on dams. Opportunities are discussed further in the Recommendations section below.

### 4.3.3 Metal Mining Effluent Regulation

The Metal Mining Effluent Regulation was enacted in June of 2002 to regulate effluent storage and disposal in metal mining[10]. As a federal policy instrument, it applies to any mining facility (and recognized closed mine) exceeding an effluent rate of 50$m^3$/day. Though the policy does not include climate-related terminology, it appears to have several characteristics that could support climate change adaptation, as well as several that could hinder adaptive behavior.

Primarily concerned with fish health and habitat, the regulation supports adaptation in both active and passive ways. Active support for climate change adaptation is demonstrated by mandating the development of an emergency response plan that should anticipate any reasonable scenario where deleterious substances may be spilled. This clause makes a proponent legally responsible for identifying any risks that may reasonably be introduced or exacerbated (including those that result from climate changes), and that may then result in a spill. To meet the requirements of this regulation, proponents may need to evaluate climate change and extreme weather risks and incorporate such risks into their emergency management plan.[11] Though this clause does not require the proponent to actively prevent such emergencies, it could be argued that this clause requires the proponent to take the first step and consider climate change in their risk assessment.

An additional demonstration of active support for climate change adaptation is the regulation's requirement for proponents to develop an emergency response plan to reduce accidental/unintentional deposits of deleterious materials or to mitigate the effects of such a deposit. This requirement includes the identification of situations/scenarios that may reasonably result in damage to fish habitat. Again, though this clause does not require the proponent to act to reduce the possibility of such an accident, an effort to identify such scenarios will hopefully lead to adaptation actions as proponents seek to ensure that they meet their deleterious substance deposit limits set out in earlier parts of the regulation.

Other support for climate change adaptation within the regulation is more subtle. For example, requirements for comprehensive monitoring programs seek to contain certain threats and identify new risks as they emerge. As climate change is a long-term challenge, with many different potential impacts, this type of requirement may assist the proponent in recognizing emerging climate-related risks and managing them through an adaptive management strategy. However, since the connection between long-term monitoring programs and climate change adaptation was not made, it is unlikely that adaptive management efforts will address specific risks related to climate changes.

In addition to active and passive support, there were several features of the MMER that appeared to be active barriers to adaptation. For example, the policy does not require monitoring to continue past three

[10] And therefore has specific implications for tailings facility design and tailings management.
[11] There is Ontario-wide guidance available detailing how to factor climate change into municipal Emergency Management Plans. As yet, there is no such guidance specific to the mining sector.

years after the close of the mine. Cessation of monitoring would not allow recognition of the changes in local climate and impacts to the site, ultimately discouraging adaptive management of the site into the future. Another example of an apparent active barrier within the policy is the fact that the opportunity to consider climate change impacts is only mentioned with regard a mine's emergency response plan. This means that corporate investment into preventative adaptation measures is voluntary. In the mining sector's competitive markets, this characteristic makes it highly unlikely that proponents will assume that cost.

### 4.3.4 Effluent Monitoring and Effluent Limits Regulation

The Effluent Monitoring and Effluent Limits regulation for the Metal Mining Sector falls under the Environmental Protection Act and pertains specifically to tailings design and management components of a mine. This provincial-level regulation was consolidated in 2007 and applies to all mining operations since 1994. It aims to monitor and control the quality of effluent discharged from plants (E.g. water treatment plants) on mine sites. The assessment revealed several key findings. First, this policy instrument does not contain any explicit mention of climate change or related terminology, consistent with the other policies reviewed. Further, this policy has a combination of factors that could act as drivers of climate change adaptation as well as factors that could act as barriers.

There were two features in particular that bear mention as potential drivers of climate change adaptation. First, the policy requires a stormwater control study be undertaken by the owner/operator of the mine. This type of study is a key factor in understanding the risk that stormwater can pose to mining operations and determining appropriate adaptation measures to reduce the probability of stormwater contributing to an emergency situation. Though the policy does not require proponents to use the study's findings to identify adaptation measures, the Stormwater Control Study is an essential first step in understanding one potentially serious climate-related impact on a mine site.

Secondly, the policy states that the discharger must control and monitor effluent release to ensure that the pH value of any sample collected (from the water body into which the substance is released) is within the range of 6.0 to 9.5. This stipulation implies that mine owners/operators must control the level of effluent entering water bodies as water levels fluctuate due to weather/climate influences. In particular, this feature supports long-term monitoring and adaptive management throughout the life of the mine to maintain the levels governed by the policy. Aside from the costs of control structures, this type of standard does not interfere with the competitive nature of the business and is therefore more likely to be met. Despite the benefits of this approach for climate change adaptation, the development of a single standard does limit the adaptability of the policy itself. Climate projections and monitoring of local watersheds will be required to ensure that the standard is appropriate under changing climate conditions.

The policy analysis also revealed barriers to climate change adaptation. Primarily, the regulations surrounding the calculation of effluent loads solely consider the volume of effluent and water levels or quality of the receiving body. It appears that there is little consideration of the potential for historically

unknown lows or highs in water levels, temperatures etc. as a result of changing baseline conditions as well as greater variability in climate conditions and local weather. Failing to have the regulations recognize the changing nature of weather and climate may leave complying proponents more vulnerable and at risk for accidents.

### 4.3.5 Ontario Mining Act (Regulation 240/00 Mine Development and Closure)

The *Mine Development and Closure* regulation was developed in 1990 as a regulation supporting the Ontario Mining Act. The regulation defines the standards, procedures and requirements for closure plans. It also refers to several guidance documents for dam safety, crown pillars and acid rock drainage as resources that proponents should utilize when conducting closure planning. Additionally, the regulation refers to the Ontario Provincial Water Quality Objectives, as proponents are responsible for meeting the surface water monitoring objectives associated with this policy instrument.

Similar to the other policy tools considered in this report, this regulation of the Mining Act included characteristics that appeared to be enablers of climate change adaptation as well as those that appeared to act as barriers to action. On the enabling side, the Mine Development and Closure regulation was the only one in the selected policy tools that contained references to climate-related terminology including consideration of climatic conditions (mean daily temperature, frost free period, growing season, amount and timing of precipitation and prevailing wind). It also recognized factors like seasonal stream-flow patterns and ground water flow regime to be important considerations in closure planning. Despite these references, the changing nature of these conditions was not noted. Rather, they simply recognized the impact of climate factors on a mine site during the closure and post-closure phases.

As with many of the other policies reviewed, consideration of climate change impacts exceeds the requirements of the rehabilitation code and closure plan regulation. Implementing adaptation measures likely translates into increased costs for the proponent and could extend the duration of monitoring and responsibility for site conditions. Proponents would likely not undertake such burdens voluntarily, particularly if they were operating above and beyond the requirements of the Mining Act.

### 4.3.6 Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials (MEND Guidance Report)

The Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials, taken from the Mine Environment Neutral Drainage (MEND) Report on Abandoned Mines (2009) is a guidance manual that has been adopted as the required standard for the Mine Rehabilitation Code. The objective of this guide is to provide technical guidance on developing and conducting a prediction program for Acid Rock Drainage from mines in order to prevent environmental damage.

The technical guide could act as a significant driver of climate change adaptation in a number of ways. As a technical guide, the Prediction Manual makes several references to climate change and other

climate parameters (wind, precipitation, permafrost, snow depth etc.) as conditions that can influence Acid Rock Drainage. In addition to information on the types of influence certain climate impacts can have on acid-generating conditions, the guide warns practitioners that it is important to consider future climate warming, particularly with regard to parameters such as permafrost.

The guide also passively contributes to the creation of an adaptive environment within the mining industry. It achieves this in a number of ways: First, the guide stresses the idea that accurate prediction is essential for estimation and assurance of necessary resources for longer term monitoring and mitigation actions. This feature subtly encourages the use of climate change projections in closure planning activities, an action that may indirectly lead to the incorporation climate change adaptation measures into closure plans. In addition to efforts to predict conditions, the guide also stresses the need to plan for severe events that are not predictable, mentioning the increased unpredictability and intensity of large storms that may have an impact on considerations for the design of facilities. This feature passively encourages the incorporation of climate change adaptation in closure and rehabilitation plans.

Secondly, the guide describes requirements for long-term financial planning to ensure that responsibilities for long-term monitoring and maintenance of the site can be met. Cost estimates of long-term care of the site should be reviewed regularly and updated, and should include provisions for unplanned events, such as storm surges on tailing areas. This speaks indirectly to the need to utilize appropriate climate information in the development of ARD predictions within the closure plan.

Similar to the *Towards Sustainable Mining: Mining Closure Framework*, the technical guide raises the issue of stakeholder expectations as important factors in environmental decision-making on mine sites. This feature affords local stakeholders the opportunity to have input, notably suggestions for climate change adaptation, into the ARD predictions.

Finally, the technical guide stresses that ARD predictions may have errors that can be attributed to uncertain or incorrect data, an incomplete understanding of drainage chemistry and/or human error. In order to get the most accurate predictions of ARD (and thus avoid ARD), it is important to use robust climate information, local historical climate records and a long-term monitoring program. This combination will enable the proponent to make the most accurate predictions possible and more efficiently identify errors.

### 4.3.7 Policy Framework in Canada for Mine Closure and Management of Long-term Liabilities: A Guidance Document (NOAMI)

The National Orphaned/Abandoned Mines Initiative (NOAMI) developed *Policy Framework in Canada for Mine Closure and Management of Long-term Liabilities: A Guidance Document* in 2010. Analysis of this document revealed that it might act as an enabler to climate change adaptation action. The document makes frequent, explicit references to climate change and discusses environmental risks in the context of closure planning with an emphasis on water management. The document also provides many

resources for the proponent to demonstrate how climate change can be incorporated into closure plans, particularly in the case of Orphaned or Abandoned mines. These include:

- List of requirements for securing long-term funding and responsibilities for ongoing monitoring as well as future maintenance requirements;
- Outlines the need for mechanisms for the eventual reversion of property to the Crown;
- Outlines range of risks in mine closure planning including risk assessment, acid rock drainage, perpetual care, long-term monitoring and maintenance and relinquishment;
- Discussion on the challenge of planning for future severe events with focus on design considerations for water storage and management facilities; and
- Guidance on cost including – costs estimation, costs of financial assurance and types of instruments and risks.

The NOAMI guide acts as a climate change enabler by providing proponents with resources, recommendations and guidelines to achieve climate change adaptation within their own closure plans. The Project Team found no indication that any aspect of the guide acts as a barrier to climate change adaptation.

### 4.3.8 Ontario Environmental Protection Act

The Ontario Environmental Protection Act (EPA), 1990 (last updated in 2010) was designed to provide protection and conservation for the environment. As a provincial policy, the Environmental Protection Act bestows legal responsibility on proponents (owners/operators/managers) for the control and management of contaminant substances during the operation of a mine (MOE) and thus focuses on tailings design and management. The Environmental Protection Act plays an important overarching role and is referred to by many other mining-related policies/policy instruments. As such, the implications of this policy for the support of climate change adaptation are paramount as they reverberate through subsequent policy connections.

Though the EPA makes no explicit use of climate-related terminology or reference to climate change, it does contain both passive drivers and barriers for climate change adaptation. The policy demonstrates potential for more explicit incorporation of climate change consideration. The primary support for climate change adaptation relates to the requirement that proponents prevent spills of contaminants into the environment. This policy applies to mine sewage works, tailings facilities and waste generated from operations. Implicit in this requirement is the idea that proponents must take every reasonable precaution to prevent spills (including those which could potentially be caused by future extreme weather or climate impacts). It is implied that practitioners are expected to access climate projections and data relation to future hazard characteristics in cases where such information is available. Most importantly, by issuing a requirement that proponents prevent discharge of pollutants or contaminants into the environment, the EPA places liability for such events on the owners/operators of mines. Though this element of the Act could be related to climate change in a far more direct manner, support for adaptation action does exist within the policy.

Certain features of the legislation may limit the passive support for climate change adaptation and in some cases could present a barrier to adaptive actions. Specifically, though responsibility for the prevention of contamination rests with the owner/operator of a mine, there are certain caveats presented within the legislation that can temper the liability issue. For example, if it can be demonstrated that reasonable steps were taken to prevent discharge OR that the spill was 'wholly caused by a natural phenomenon of an exceptional, inevitable or irresistible character', mine owners/operators are not considered liable for the damage. The first part of this clause acts as a passive barrier to climate change adaptation by offering a caveat to the enacted liability. If a practitioner can demonstrate that their planning/design/maintenance (actions) are in line with current best practice or guidance (thus acting reasonably), they are relieved of liability. However, as best practices in planning/designing for climate change impacts are currently being developed; and as guidance materials do not yet provide specific guidance on where and how climate change should be considered in mine phases, the concept of 'reasonable' action may be an inadequate measure of potential liability.

The second part of the clause muddies the water with regard to the types of climate events that should be planned for, and the level of preparedness that may be expected with regard to these events. If climate change projections are not considered in planning, design or operation of a mine, it is conceivable that future extreme events may seem to be 'exceptional' and 'inevitable'. However, the Act is not intentionally encouraging lack of preparedness for future climate events as a way of reducing liability.

# 5.0 Industry Response to Policy

To verify results of the policy tool analyses, the Project Team conducted interviews with mining stakeholders to better understand if, and how, the climate-sensitive policy tools were interpreted and to seek examples where climate adaptation had taken place. Survey questions were designed to focus on the impacts of each policy on the decision-making process, operation and maintenance components of a mining project.

Despite an intensive effort to identify and engage appropriate stakeholders, the Project Team was able to secure only four interviews with stakeholders in Ontario's mining sector[12]. The first three interviews were with Sudbury Integrated Nickel Operations (SINO) staff: one high-level decision-maker and one technical specialist, as well as a consultant from Golder Associates that worked with SINO to develop appropriate climate change projections. Representatives of the SINO mine near Sudbury, Ontario were chosen for an interview due to existing relationships with key personnel at the company, but also because of SINO's advanced thinking and action on climate change impacts. The interviews revealed that there are several climate-related impacts that affect the current mining operations. These include extreme weather events (wind, precipitation, heat and cold) as well as flooding and an increase in freeze-thaw events. To cope with these events SINO has undertaken several adaptation measures. These include:

- Development of downscaled climate projections for the mine site;
- Development of a long-term climate change adaptation plan (to be implemented in 2014);
- Implementation of an adaptive management plan;
- Use of GoldSim Climate Generators and Water Management models to optimize existing water management structures; and
- Ongoing use of long and short term weather forecasts to obtain the most accurate climate information for decision-making.

SINO suggested that for policy tools to be truly effective in driving climate change adaptation action, they must set clear standards and expectations, be enforced, and specifically address climate change as a threat. The interviewees noted that while high-level provincial and federal policy did play a role in driving adaptation-centered decision-making at Glencore, much of the action taken responded to requirements set out in regulations, guidelines and other policy instruments. In particular, Glencore staff explained that policy instruments like the Canadian Dam Association guidelines were a major factor in design decisions as they provided the consulting engineers with clear standards for design. With respect to directly driving action, interviewees noted that in the cases where the risk of non-compliance with legislation was high, action was taken promptly and monitored closely. Finally, the interviewees noted that without specific reference to climate change, policies cannot act as effective drivers of adaptation action, as proponents are not obligated to consider climate impacts as long-term risks.

[12] See Methodology section for more detail on the engagement process.

The second interview was secured with the Environmental Manager of DeBeers Canada's Victor Diamond Mine near Attawapiskat in the Far North of Ontario. The interview revealed that actions to deal with changing weather and climate, including seasonal variability, are ongoing and distributed among different departments at the operations. At this point in time, inclusion of climate change in longer term planning was unnecessary given the limited remaining life of the mine and the relatively low probability of extreme weather events. DeBeers chose to manage climate risk through a combination of adaptive management, emergency management strategies and contingency planning. Though climate change was considered with regard to specific infrastructure (E.g. the stability of a critical winter road was questioned under potentially warmer climate), the corporation was under no obligation to pursue further adaptive action given the requirements of current policy tools. The use of historical climate information to determine design standards was consistent with current regulation, policy and policy instruments. Given these circumstances, DeBeers has not adapted to expected climate changes.

The interviews conducted proved to be inconclusive to draw general industry-wide conclusions about the influence of policy on adapting to climate change. It seems that at this point in time, adapting to changing climatic conditions is mostly driven by internal efforts and that although policies can further enable adaptation, at this stage they have yet to directly drive widespread adaptation efforts (Pearce et al., 2011, Ford et al., 2010). If practitioners wish to address climate change in their mine design and operations, there are several passively supportive aspects of most mining policies that can lend some support and guidance to decision-makers. There are few obligations to consider climate change impacts and incorporate adaptation into plans and designs however.

# 6.0 Recommendations

Several opportunities may exist for adjusting existing policies and policy instruments in ways that could create more direct and active support for climate change adaptation in the sector. This section makes two sets of recommendations; one with recommendations which are general in nature, relating to the mining policy regime as a whole; the other with recommendations which relate to specific policies or policy instruments.

## 6.1 General Recommendations

The analysis noted that very few policy tools directly addressed climate change as a real and current threat to mining tailings facility design and management or closure planning. The analysis demonstrated that this could result in future conditions under climate change not being considered, or in inadequate preparation for extreme events, which may carry increasing risk as the climate changes. The competitive nature of the mining industry and its markets suggest that stakeholders will very rarely undertake costly adaptation actions unless mandated or unless tangible, quantifiable financial benefits can be recognized. Clear communication of environmental goals and climate change implications that may impact them can improve the ability of a policy to promote and support climate change adaptation in the mining sector.

The analysis also demonstrated that there is significant potential to use prescriptive policy instruments (such as regulations or permits) to promote and support climate change adaptation in the mining sector. The high level of prescription in these instruments implies specific response from practitioners and is thus an ideal medium to aid the incorporation of climate change impacts and adaptation into mining phases. To most effectively promote and support climate change adaptation action, policy instruments (such as regulations and guidelines e.g. Canadian Dam Safety Guidelines) should reflect standards and thresholds that have considered climate change impacts. These tools may also benefit from the incorporation of clear consequences for inaction or inattention to climate change impacts.

The study findings also revealed that to help practitioners consider climate change impacts and adaptation within decision-making, new climate change guidance is required in a number of key areas including:

- Climate change impacts;
- Timeframes (of climate impacts);
- Uncertainties (related to the use of climate data in decision-making);
- The selection and use of climate scenarios; and
- The monitoring of a wider set of environmental conditions (as indicators of climate change that could be relevant to the activity/facility).

This guidance should be specific to mining and even to the specific region of operation (for example: could include threshold values of greatest consequence for key assets) and focus on how to evaluate climate change information and incorporate it into decision-making.

Finally, the review cast light on the potential for considering use of existing (and development of new) instruments to financially incent climate change adaptation in the mining sector. Interviews suggested that climate change adaptation is hampered by a number of factors, the largest of which is the perceived cost of action. To the sector, investing in adaptation may equate to significant investments in infrastructure, equipment or training. An economic incentive (such as the adapted Ontario Flow-Through Share Tax Credit) when combined with formal policy and other policy instruments, may be able to inspire greater levels of climate change adaptation in the sector.

## 6.2 Specific Recommendations

Recommendations for specific policy tools are captured in the list below.

- *Toxic Substances Management Policy* – Factor climate change explicitly into the risk management process to push proponents to actively consider climate change in the identification of Track 2 substances and respond appropriately to minimize the probability of a climate based disaster occurring.
- Ontario Flow-Through Share Tax Credit – There are several actions that could be taken to enable the Ontario Flow-Through Share Tax Credit to drive climate change adaptation:
    - Include climate change adaptation as one of the objectives within the Tax Credit. For example, the credit could be offered only to individuals who invest in corporations that have demonstrated climate change consideration in their planning and operations.
    - Be more inclusive or initiate phased introduction of the credit, a sliding scale of benefit could be designed whereby levels of climate change consideration receive different amounts of tax credit.
    - Introduce an alternative benefit structure to improve uptake. For example, instead of restricting credit benefits to investors, the development of a credit that corporations could access directly may help to encourage corporate adaptation. In particular, the current tax credit applies where select, eligible expenditures were made[13]. If these were expanded to include specific adaptive measures, the acquisition of select machinery or equipment, monitoring programs or the cost of obtaining relevant climate projections for a site, the credit could support climate change consideration in a very direct manner. Moreover, if this type of economic incentive was successful in the Ontario mining sector, a federal level incentive could help to give mining projects across the country a similar boost.

[13] These include geological/geochemical surveys; drilling by rotary; diamond, percussion or other methods of digging; trenching or digging test pits and preliminary sampling; contractors and consultant fees; supplies and equipment rental; indirect expenses

  - Create different return levels to reflect the challenges of adapting to climate change in select regions.
- Canadian Dam Safety Guidelines – Neutralize reference to climate data uncertainty by offering guidance on how to reasonably characterize and take measures of uncertainty into account in decision-making. Further support action in the face of climate change projection uncertainty by reinforcing legal onus to act.
- Mine Development and Closure Regulation – Revise financial assurance requirements to ensure that reclamation occurs in a sustainable and resilient manner and that the activities account for changing climatic conditions. Currently, the regulation only requires the proponent incorporate monitoring programs into their closure plans.
- ARD Prediction Manual
  - Provide references to additional guidance on monitoring biological conditions, to complement the provided resources that focus on geochemical monitoring
  - More explicit regulations requiring stakeholders to consult ARD predictions during the development of closure plans would provide greater support for climate change adaptation within the sector

# 7.0 Conclusions and Next Steps

In light of emerging climate-related threats for the mining industry in Canada, it is necessary for the sector to adapt. Policy tools are designed to guide and stimulate action according to a carefully selected goal and thus have an important role to play in helping the sector adapt to climate change. This project reviewed ten key mining policy tools to determine whether they currently act as drivers or barriers of climate change adaptation action.

Results revealed varying levels of support for climate change adaptation within mining policy tools overall. Some policy tools were stronger than others in their attention to, and inclusion of, climate change material, and their provision of examples or resources to encourage climate change adaptation action (e.g. Canadian Dam Safety Guidelines, NOAMI Framework). Moreover, the policy tools themselves often contained both driver and barrier characteristics. At this stage and given this policy environment, climate change adaptation requires significant independent commitment on the part of each mine.

The review successfully highlighted several opportunities to adjust existing policy and policy instruments to better address climate change impacts. It also highlighted some key next steps that can be undertaken to strengthen the existing policy regime for the mining sector. These include:

1. Identify and prioritize key policy tools that impact multiple critical industries/sectors in Ontario (e.g. energy, mining, forestry etc);
2. Conduct analysis on other existing policy tools pertaining to aspects of industrial planning and design (e.g. environmental assessment legislation, building codes or design standards and thresholds for cold weather engineering);
3. Consult with key sector stakeholders (through a survey or series of workshops) to develop a detailed understanding of their needs and perceived barriers with regard to climate change adaptation and policy tools;
4. Research and develop long-term economic incentives that can contribute to driving adaptive action in critical industries/sectors for Ontario, prioritizing industries where climate-related impacts can cause the most damage to the environment and health of Ontario's communities; and
5. Develop a framework that provides guidance for policymakers on effectively addressing climate change related risk through policy tools.

The findings and recommendations in this study are designed to contribute to efforts by policymakers to use available policy tools to foster a more adaptive environment within the mining sector and thus protect an important economic industry as well as environmental and social health and safety.

# Appendix A – Acknowledgments

OCCIAR and RSI would like to acknowledge the hard work and significant contribution of our expert Project Advisory Committee (PAC) in the development of the products associated with this project. The PAC comprises a group of key government, academic and industry stakeholders that specialize in climate change, environmental policy and the mining sector. The expertise provided by the group contributed to a comprehensive review of policies that apply to the mining sector and a rich understanding of the potential of government and industry policy tools to drive climate change adaptation action.

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