DILLON CONSULTING

BRACE PROGRAM: MANITOBA CLIMATE RESILIENCE TRAINING PROJECT

Deliverable B8: Case Study- Northern Manitoba Business Sector

MANITOBA CLIMATE RESILIENCE TRAINING

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1.0 MCRT Project Background

The Province of Manitoba (the Province) recently launched a new project known as the Manitoba Climate Resilience Training Project (MCRT) to develop customized training and capacity development for the Northern Manitoba Business sector under Natural Resources Canada's Building Regional Adaptation Capacity and Expertise (BRACE) program.

The MCRT project aligns with the Province's Climate and Green Plan adaptation pillars to:

- Build knowledge and capacity to take action
- Weave climate adaptation planning into all decision-making.

Dillon Consulting Limited (Dillon) was retained by the Province to develop customized training and capacity development specifically for the Northern Manitoba Business sector.

Table 1: MB-BRACE Project Overview

MB BRACE Component	Key Partner/Service Provider
Project Coordination and Community of Practice Development	ICLEI Canada
Climate Resiliency Planning Training for Professional Planners	University of Winnipeg, Prairie Climate Centre
Infrastructure Resilience Training and Capacity Building	Engineers and Geoscientists Manitoba
Northern Business Climate Readiness Training and Capacity Building	**Dillon Consulting Limited**
Indigenous Climate Readiness Training and Capacity Building	Prairie Climate Centre, Turtle Lodge

The overall objective of this project is to build capacities for Northern Manitoba Business sector decision-makers. The capacities and training offered to participants will assist northern Manitoba businesses in integrating climate risk into their financial planning, operations, supply chains, continuity planning and other key decisions. The training aims to help northern businesses:

- Adapt to these emerging climate change impacts, conditions
- Increase capacity to weave climate resilience into all Manitoba's economic sectors
- Equip business with knowledge and tools to cope with climate-induced disruption
- Build capacity for Manitoba business to be "Climate Ready"
- Anticipate, plan, and take steps to add climate resilience.

1.1 MCRT Northern Business Sector

The Province's Request for Proposal identifies the natural resources sector (including the mining and forestry industries), tourism and indigenous organizations as key stakeholder groups in the business community of northern Manitoba. Other stakeholder groups include transportation supply chains and logistics providers, the healthcare sector, chambers of commerce and industry organizations as well as educational institutions.

2.0 Case Study Introduction

A hypothetical case study was developed and designed on the climate risks and/or opportunities for the Northern Manitoba Business sector. The case study was based upon real assets in Manitoba that served important roles in the shipment of resupply cargo to remote communities in northern Manitoba. "**BuildIt Project Partners (BPP)**" is a medium-sized business (with less than 500 employees) providing construction management and operations and maintenance (O&M) services including contract administration services for infrastructure and building construction projects. BPP's business specialises in delivering these projects to remote communities in northeast Manitoba. Since BPP's business caters specifically to the ongoing infrastructure development needs of these remote northern communities in northeast Manitoba, BPP has established a transmodal shipping hub in Thompson, Manitoba. **(Figure 1)**.

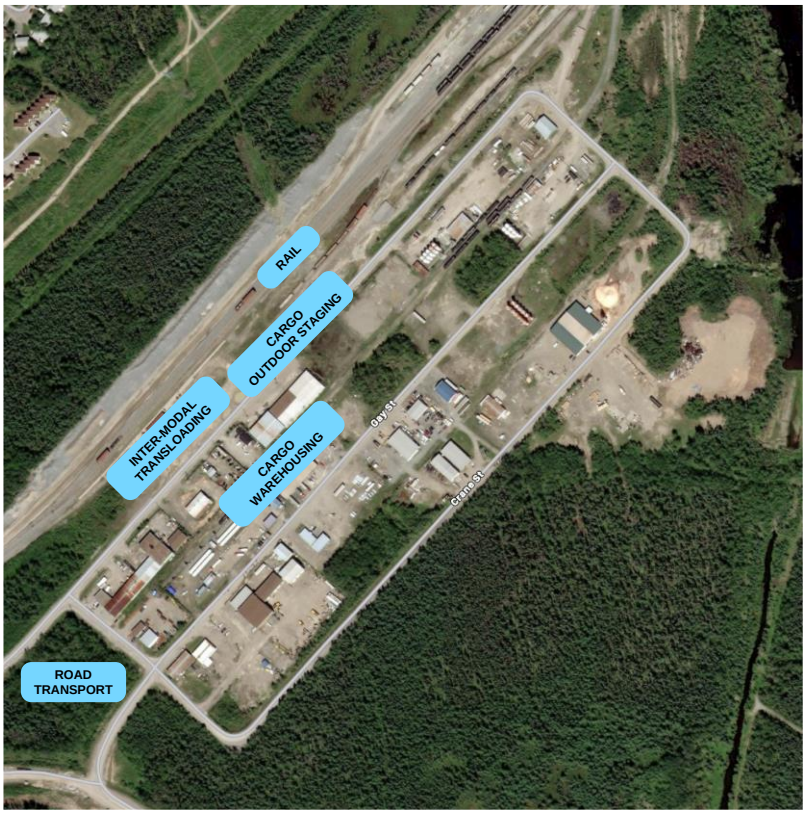


Figure 1: BuildIt Project Partners Transmodal Shipping Hub in Thompson, MB

The purpose of BPP's Thompson transmodal shipping hub is to establish a northern Manitoba hub for receiving, processing, and transferring materials, supplies, equipment, and work crews before they are shipped to remote communities via winter roads and air to support BPP's multiple major projects each year in remote communities within northern Manitoba. Examples of communities served by winter roads in this area include: God's Narrows First Nation, Garden Hill First Nation, Wasagamack First Nation, Shammatawa, Island Lake, St. Theresa Point, Wasagamack, Berens River, Poplar River First Nation, Red Sucker Lake, and other North Western Ontario Nations.

The BPP Thompson Hub lists assets such as buildings, vehicles, and equipment, and they store and transport construction materials, replacement parts and components, perishable foods and medical supplies, feedstocks, and critical supplies. The BPP facility sees clients, staff and suppliers arrive on the premises, and both goods and people arrive at the facility by multiple modes: Provincial Highway and winter road network, rail service, and Thompson Airport.

2.1 Objective

This document responds to an MCRT Project objective to develop and design a case study on the climate risks and/or opportunities for the Manitoba Northern Business sector. The case study will serve as a supporting resource for both integrated training and/or sector specific courses. As a collective, Manitoba intends for the four case studies developed across the MCRT sectors to present a high-level picture of climate risks across Manitoba. The four sectors represented in the MCRT project are Indigenous, Planning, Infrastructure, and Manitoba Northern Business. This document represents the Case Study developed for the business sector that serves Northern Manitoba regions.

3.0 Climatic Changes – Overview

This case study scenario for the Northern Manitoba Business sector is sited within Manitoba's North Boreal Shield ecozone. The Prairie Climate Centre (PCC) has prepared ecozone-specific climate data summaries in products they refer to as "Climate Report Cards" [2].

The Prairie Climate Centre published an undated "Manitoba Report" that includes a summary of projected climate changes for several Manitoba communities, an overview of important regional and local impacts across Manitoba.

In this PCC report, significant changes are anticipated for Manitoba's north, including:

- 43 fewer days reaching -30 °C each year for Manitoba northern regions.
- For the Flin Flon/Thompson region: 42 fewer days obtaining temperatures less than 0 °C per year.
- For communities such as Flin Flon, Thompson and Churchill, the average hottest temperature of each year is projected to increase on average by 12% under our current global levels of GHG emissions to atmosphere.
- For these same communities, the average number of days per year that reach +25 °C will increase by an average of 2.4 times.
- The average length of the frost-free season will grow on average for these communities, by an average of 35%

According to the PCC's report, many northern locations will have to start coping with significant heat for the first time, which will have serious consequences for communities, ecosystems and infrastructure. These climatic changes will also affect seasonal experiences of place, identity, and community, as well as our built environment, governance, and economy.

The PCC also cautions that in the coming decades, northern Manitoba is projected to experience a dramatic reduction in the number of cold days. As an example, the PCC indicates that Churchill could lose virtually all of its -30 °C days by the end of this century under a scenario that reflects current global GHG emission loadings (High Carbon Scenario). This represents a loss of six weeks of -30 °C weather for the region.

Also, since many remote communities in Manitoba rely on winter road networks for the resupply delivery of food, fuel, construction equipment and supplies, as well as other components too large, heavy or costly to fly in. Ongoing losses in cold weather conditions will decrease the reliability and viability of these winter road networks.

In **Figure 2** shown below, climate variables for the North Boreal Shield ecozone are presented for baseline (historical) climate conditions (expressed as the 1981-2010 historical baseline), and two future time horizons. These datasets are, expressed in 30-year records, defined by the ranges of 2021-2050 and 2051-2080, respectively.

In this figure, a High Carbon Emissions scenario (RCP 8.5) is highlighted as this scenario most closely aligns with current trends in global GHG emissions. Considering Manitoba's contributions to global GHG emissions, Manitoba set a goal to cut GHG emissions by a cumulative 1 megatonne in the five-year period between 2018 and 2022. This reduction target over this 5-year period represents 4.4 per cent of the 22.6 megatonnes Manitoba emitted in 2019. Emissions data currently indicate that GHG emissions

are not decreasing globally, and for Manitoba, the province's GHG emissions in 2019 were 9.8% higher than 2005 levels [3].

Prairie Climate Centre
From Risk to Resilience

Manitoba North Boreal Shield

High Carbon Emissions (RCP8.5)

Climate Variable	Season	1981–2010 (Baseline)	2021–2050 L	2021–2050 M	2021–2050 H	2051–2080 L	2051–2080 M	2051–2080 H
			Projections			Projections		
Mean Temperature	Annual	-2.3 °C	-0.8 °C	-0.2 °C	0.6 °C	1.1 °C	2.2 °C	3.6 °C
	Summer	15.0 °C	16.1 °C	16.7 °C	17.3 °C	17.8 °C	18.8 °C	19.8 °C
	Winter	-21.4 °C	-19.6 °C	-18.3 °C	-17.0 °C	-16.7 °C	-15.2 °C	-13.6 °C
Precipitation	Annual	463.0 mm	466.5 mm	492.1 mm	516.6 mm	483.5 mm	511.7 mm	543.9 mm
	Summer	187.0 mm	173.1 mm	188.1 mm	204.6 mm	172.9 mm	188.4 mm	204.7 mm
	Winter	69.4 mm	68.7 mm	76.0 mm	84.6 mm	75.5 mm	84.4 mm	94.2 mm
Days ≥ 30 °C	Annual	1.3 days	1.6 days	4.7 days	8.2 days	8.7 days	13.2 days	18.8 days
Nights ≥ 20 °C	Annual	0.1 days	0.0 days	0.4 days	1.1 days	1.0 days	3.2 days	5.9 days
Days ≤ -30 °C	Annual	34.7 days	11.7 days	19.7 days	27.1 days	3.1 days	8.4 days	13.4 days
Frost-Free Period	Annual	108.3 days	110.1 days	125.9 days	142.9 days	125.9 days	141.4 days	157.7 days
5 °C Degree Days	Annual	1146.1	1327.7	1402.8	1497.9	1594.8	1741.1	1946.4
10 °C Degree Days	Annual	538.4	662.7	722.8	799.1	860.6	975.7	1125.1
Freeze-Thaw Cycles	Annual	56.5 cycles	44.6 cycles	52.7 cycles	61.3 cycles	39.2 cycles	48.7 cycles	57.4 cycles
Max 1-day Precip Total	Annual	39.1 mm	31.0 mm	45.1 mm	61.3 mm	30.9 mm	42.2 mm	54.7 mm
Max 3-day Precip Total	Annual	85.8 mm	68.4 mm	97.4 mm	130.7 mm	69.5 mm	93.1 mm	120.4 mm

L = Low Projection (10th Percentile) M = Mean Projection H = High Projection (90th Percentile)

Figure 2: Prairie Climate Centre Climate Data Summary for Manitoba North Boreal Shield Ecozone

4.0 Summary of Climate Impacts and Opportunities to Northern Manitoba Business Sector

Impacts in the context of this report refer to the ***negative consequences of climate change*** with potential impacts to business assets, staff, or operations. Climate change impacts include conditions such as higher temperatures, resulting in indirect impacts such as shorter winter road seasons (higher urgency to concentrate remote community resupply within a shorter winter road season window), increasing water scarcity (impacts to business' staff, processes), and increasing frequency and severity of extreme weather (impacts to supply chains, transport/logistics, health, and safety for businesses).

Opportunities in the context of this report refer to the consequences of climate change that ***could present a positive benefit to a business***. An example of a business opportunity arising from a climate change impact would be a longer tourism season due to a longer period of warmer weather and longer sea shipping seasons due to the reduced formation of sea ice expected under warmer temperatures.

The climate change **impacts** anticipated for the BuildIt Project Partners' business operation include:

- **Supply Chain impacts** - Shortened and less reliable winter road season creating impacts such as food insecurity and food affordability. Impacts reducing winter road seasons can be very costly for northern businesses and the communities reliant on a safe, predictable winter road network. Over 33,000 clients in the region rely on winter roads for access to food and materials.
- **Cargo/Shipment Stranding** - As demand for resupply programs grows in remote communities, some cargo/equipment could be stranded under a shortened winter road season.
- **Extended Operating Seasons for some aspects of the business** - Potential business opportunity in lengthening of tourism seasons but could also see higher cancellations due to increasing trends in extreme weather.
- **Access to Critical Care Services** - Winter road shortened season also impacts "at risk" patients needing access to regional hub healthcare services – from a public health or employee/staff health perspective.
- **Added Cost Burden** - Continued increases in "doing business in the north" due to an expectation that climate change could offer more accessibility for development in remote regions.

The climate change **risks** to the company's assets and operations include:

- **Less reliability for shipments** required for community resupply programs. Reduced winter road seasons for reliable winter roads are a growing concern in Manitoba's supply chain.
- **Disruption to supply chains** relied on to deliver affordable food supplies, and the corresponding increase in food insecurity as winter road seasons become less reliable.

- **Degraded access to healthcare**: impacts to the timing and availability of affordable transport for at-risk patients. These stakeholders have significant health care needs, require reliable access to regional health hubs for ongoing treatments, resulting in potential for increased costs to access medical services.
- **Increased costs to service infrastructure, housing, and community development** projects.
- **Continued and increasing disruption to transport loads** of heavy equipment and materials required to support progress in remote projects, including major northern Manitoba projects.

Table 2 below, summarizes several key climate change-related impacts **across the business sector within specific sub-sectors in Manitoba** and where identified; potential opportunities across northern Manitoba for business sector stakeholders.

Table 2: Compiled Impacts and Opportunities to Various Business Sectors

Sector	Phase	Impacts	Opportunities
Transportation and Logistics	Sea Shipping	• Sea level rise: potential permanent inundation of coastal infrastructure [4]. • Losses due to delays, higher costs [4]	• Shifts in sea ice formation could potentially extend shipping season [4] [5] • New shipping routes, lower fuel costs [4].
	Winter Roads	• Availability of winter roads is rapidly changing, impacting communities reliant on them [6] [7].	
Agribusiness	Processing	• Extreme weather events may cause disruption to supplies, labor availability, and infrastructure [8].	
	Distribution	• Changing weather can compromise the integrity of all forms of transport infrastructure [8]. • Extreme weather events can cause physical damage in all aspects of distribution [8].	
Tourism	Ecotourism (Churchill)	• Polar bears are a main driver of ecotourism; reduced sea ice from climate change would have a significant impact on this [10] [11].	• A longer warmer season could mean a longer primary tourism season, as mentioned during stakeholder sessions.
Forestry	Resource Availability and Extraction	• Potential for the expansion of endemic pest species with warmer conditions [12] [14] [15]. • Projected strong declines in overall above-ground biomass due to mortality [13].	• Forest composition may shift, favouring tree species best able to adapt to new climate conditions and altered disturbance regimes [12] [14].

Sector	Phase	Impacts	Opportunities
Mining	Resource Extraction	• More droughts and floods may alter water supply, disrupting operations [16] [17] [18]. • Winter road deterioration [6] [7].	• Adoption of green vehicles will increase demands for Nickel, Copper and rare earths [18].
Construction	Resource Availability and Construction	• Extreme temperatures and precipitation can impact health, can cause project delays, and can reduce durability of building material, permafrost degradation causing infrastructure damages [22]. • Extreme wind events could increase chances for damage to construction sites [22].	• An extended warm season could mean an extended construction season
Fishing	Resource Availability	• Changes in the temperature and pH of water can impact fishing seasons/locations	

5.0 Summary of Risk: Likelihood and Potential Consequences

The following section describes the core considerations and sequence of tasks undertaken by BuildIt Project Partners (BPP) to assess their business operations for climate risks. BPP operates a business with assets and operations catering to the ongoing infrastructure development needs of remote northern communities in Manitoba, handling community cargo transport and logistics. BPP has established a transmodal shipping hub in Thompson, Manitoba. The set of worksheets referred to in this assessment is provided in **Appendix A**.

5.1 Risk Assessment Framework

For this Manitoba Business Case Study Example, a basic, qualitative (Tier 1) Climate Change Risk Assessment was applied, consistent with the principles outlined in ISO 31000: A Practical Guide to Risk Management [23]. ISO 31000 provides a basic, five-step process for risk management, including the steps needed for risk assessment. **Figure 3** illustrates this process and the 3 key steps required to complete the risk assessment.

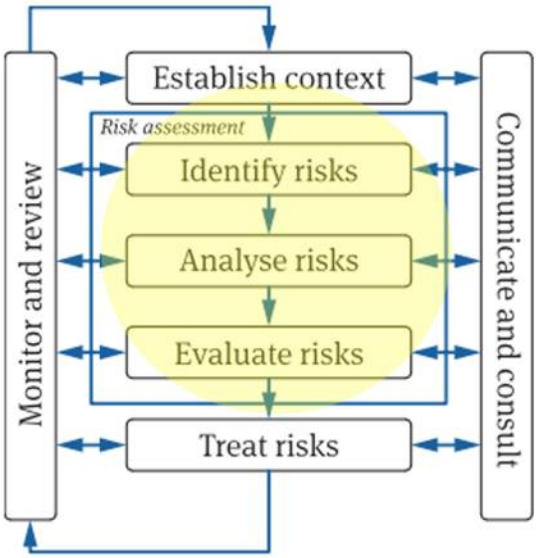


Image: ISO 31000

Figure 3: Five Step Risk Assessment Process under ISO 31000 [23]

5.2 Identifying Climate Risks for BuildIt Project Partners

For this case study example, the process began with a review of past climate impacts for the region of operations for the business. In this early step, the BuildIt Project Partners (BPP) team looked at prior significant weather events in the region(s) where the business operates and developed an understanding through discussion about how these prior weather events historically impacted the business and/or its operations. For this task, the BPP team used **WORKSHEET 1** to map out past climate and extreme events for the company's sites. In this activity, the company consulted staff, long-term residents and news archives to look back to years that precede their staff's experience operating the business at their location.

Following this activity, BuildIt Project Partners began to review these past climate extreme events and map out how these climate hazards and extreme events impacted their business, and in what areas of the business these impacts occurred. To document their findings, BPP's team used **WORKSHEET 2** to capture these details on business impacts. In **WORKSHEET 2**, past climate hazards are indicated as having "no impact", "minor impact" and "significant impact". For each climate hazard listed, BPP's team also documented a short description of the impacts triggered by each climate hazard.

After mapping out past climate risks, BuildIt Project Partners began using **WORKSHEET 3** to document their current climate risks, asking the question: "Where do climate risks currently reside in our business?" In this worksheet, BPP's team completed its inputs to describe:

- Climate risks currently known to exist in their business;
- Any corporate action taken by BPP to reduce these risks in the past and;
- When these steps to reduce risk were taken by BPP, how successful were they?

As a final step in the risk identification process, BPP's team then considered future climate conditions for the region with a goal of identifying how anticipated future climate conditions could trigger business impacts in key areas such as:

- **Physical Changes**: how changes in their regional setting can alter the business' operating environment.
- **Economic Changes**: how fluctuations in costs for securing supplies, transport and asset management can impact the business.
- **Social Changes**: how emerging future climate conditions may alter the business' customer base and its buying patterns, staff wellness and community sustainability.

BuildIt Project Partners reviewed the Prairie Climate Centre's (PCC) climate summary statistics on baseline and projected future climate for the region to establish a narrative that describes how climate change is expected to impact regions in northern Manitoba. The information told BPP's team that the most concerning emerging climate hazards in Manitoba for them include events such as:

- Extreme Heat
- Wildfire
- Extreme Precipitation
- Extreme Snowfall
- Freezing Rain Events
- High Wind Events

- Drought
- Changes in seasonality

BPP's team then began to work with **WORKSHEET 4** to identify those climate hazards with potential to impact their business in the future. This evaluation was also informed by how BPP responded to historical and current climate impacts, leveraging the inputs BPP's team added to **WORKSHEETS 1, 2,** and **3.**

After BPP's team completed **WORKSHEET 4** to indicate which future climate hazards had the potential to impact their business, they began work on **WORKSHEET 5** where they developed deeper detail on each relevant climate hazard for their business. In this step, BPP gathered an assessment team, including members of BPP's staff. As a team, they reviewed each listed climate hazard and they determined if the hazard posed "No Impact", "Minor Impact", or "Substantial Impact". The BPP team also added an impact description statement to each climate hazard and indicated which area(s) of BPP's business are impacted by the hazard.

5.3 Determining Risk Levels

Since BPP was following the ISO 31000 process, they worked with an equation for risk defined as

Risk Level= L x S,

where: **L**= the likelihood of the climate hazard and

S= the severity of the consequence when the hazard occurs.

The approach to determine the L and S values for the Risk Level equation above is discussed in the next sections.

5.4 Defining Likelihood for Climate Hazards Events

BuildIt Project Partners needed to establish likelihood scores for climate hazard events for its business assets and operations. The business was aware that it had *not* collected detailed numerical data to allow them to conduct a statistical analysis of the climate hazards for assessing for impacts to their operations. BPP's team did understand that despite a lack of detailed statistics about climate hazards in the region, Tier 1 Climate Change Risk Assessments (CCRA) can also rely on **qualitative, or subjective descriptions** on the frequency of future climate hazards. They understood that by using a consistent scoring approach to assign scale factor scores for the Likelihood of Climate Hazard Events in a structured way, they could assign a scale factor score for each climate hazard's likelihood.

To consistently work through this step, **BuildIt Project Partners** used a qualitative, 5-point scale to describe different degrees of likelihood **(Figure 4)**. In their application of this Likelihood Scale, the BPP assessment team reviewed the past (historical) climate hazard events they mapped out in **WORKSHEET 1**, and then considered how often each hazard occurred historically. This allowed BPP's team to determine a likelihood score for hazards they experienced in the ***historical climate***. They then looked at projected climate trends for the future and considered if the climate hazard would increase or

decrease in likelihood, and by how much. Using this process, they evaluated projected trends in each hazard and selected a likelihood scale score that accounted for that projected change.

Figure 4: Five Point Likelihood Scale under Tier 1, ISO-31000 [23]

5.5 Defining Consequence Severity for Impacts

BuildIt Project Partners then needed to determine Consequence Severity scores for each hazard to describe "How bad would the impact be for our business activities/movements?" when the climate hazard occurs. It is important to note that for this consideration, the business assumes that the impact *has taken place*, and when this "happened", the Consequence Severity score reflects how severe the consequences are when the hazard takes place and the impact does occur.

In this process, **BuildIt Project Partners** applied a general purpose, 5-point rating scale to describe consequence severity, ranging from a lowest score of "1" for negligible consequences (minimal damage or long-term effect) to a highest score of "5" to represent catastrophic consequences (extensive damage, long-term impacts). **Figure 5** presents the 5-point rating scale applied to the consequence severity assessment. BPP's team completed this assessment of Consequence Severity for each one of their climate hazards under consideration, documenting their results in worksheets.

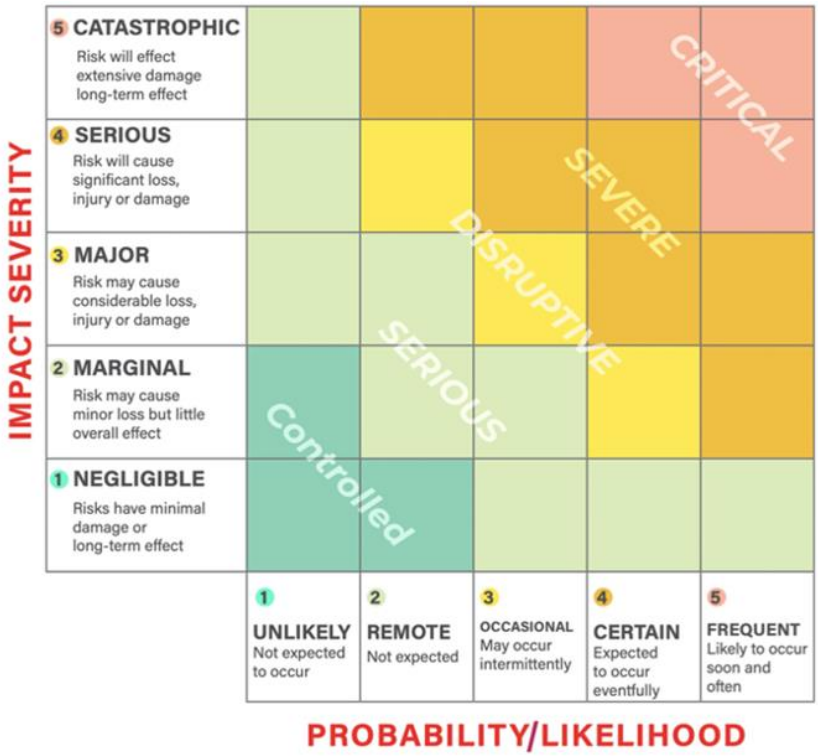
Figure 5: Five Point Consequence Severity Scale, ISO-31000 [23]

5.6 BuildIt Project Partners Case Study Risk Assessment and Results - Risk Matrix and Prioritisation

At this stage of the process, **BuildIt Project Partners** completed the assembly of the **climate hazards**, the **likelihood scores** for these climate hazards, and the **consequence severity scores**. They also identified from their team discussions which area of their business was affected by specific climate hazards. BPP's team focussed on 4 key areas:

1. Staff/Customer Health/Safety
2. Business Premises
3. Supply Chains
4. Business Continuity

With all this information assembled, BPP's team then applied a risk matrix, a standard tool for considering likelihood and impact severity to assess risk. **Figure 6** shows the risk matrix they applied, with each risk level assigned a different colour in the matrix. Each defined risk level has a corresponding response (action level) assigned to it, which is also shown in the figure.



SCORE	RISK LEVEL	RESPONSE
1-2	CONTROLLED	Limited Monitoring Only
3-6	SERIOUS	Active Monitoring
8-9	DISRUPTIVE	Investigation Needed
10-16	SEVERE	Rapid Action Required
20-25	CRITICAL	Immediate, Crucial Priority

Figure 6: Risk Matrix with Defined Risk Levels and Responses, ISO-31000 [23]

BuildIt Project Partners' assessment team completed several tasks to get them to the point where they could apply the Risk Matrix. First, they identified their past and emerging climate hazards. Then, they assembled information on the likelihood of these hazards going forward in time, informed by the climate projections for the region, and then they assessed the impact severity for each hazard across four impact areas of their business, should those hazards occur.

BPP' team then used a simple table to develop a summary of these values, allowing them to calculate a Risk Level score using the equation for risk:

Risk Level= L x S,
where: **L**= the likelihood of the climate hazard and
S= the severity of the consequence when the hazard occurs.

Keeping in mind that each Risk Level has an assigned risk response associated with it, BPP's team then used the "sort" function of their spreadsheet software to sort the Risk Level scores from highest to lowest values. This allowed BPP's team to review the impacts associated with each Risk Level and let them identify which risks are highest priority (requiring immediate attention) and which risks are low enough to simply monitor for future changes. BuildIt Project Partners' final, sorted inventory of risks for identified climate hazards is shown in **Figure 7**.

INVENTORY OF RISKS FOR IDENTIFIED CLIMATE HAZARDS

Name: BuildIT Project Partners Date: 21-Nov-21

Climate Hazard	(P) Likelihood/Probability Scale Factor	(S) Impact Severity Scale Factor	(R) RISK LEVEL SCORE	Area of Impact	Impact Desscriptions
Wilfire Events	5	4	20	Staff/Customer Health, Safety	Air Quality, Respiratory Impacts, Eyes, throat, lungs
Wilfire Events	5	4	20	Business Premises	Wildfire encroaching sites
Wilfire Events	5	4	20	Supply Chains	Smoke/Visibility delays in transprot
Wilfire Events	5	4	20	Business Continuity	Staff and movements curtailed due to heavy smoke
Drought Events	5	4	20	Business Premises	Marginal impact to water supply - conservation policies
Changes in Seasonal Patterns	5	4	20	Supply Chains	Shorter winter road system season
Changes in Seasonal Patterns	5	4	20	Business Continuity	Equipment stranding in remote communities
Extreme Heat Events	4	4	16	Staff/Customer Health, Safety	Extreme Heat health impacts
Extreme Precipitation Events	4	4	16	Supply Chains	Culvert failures on surface roads
Drought Events	5	3	15	Supply Chains	Supply chains impacted by wildfire events from drought
Changes in Seasonal Patterns	5	3	15	Business Premises	Bldg HVAC system operations
Extreme Heat Events	4	3	12	Business Continuity	Reduction in some activities due to high heat
Extreme Precipitation Events	4	3	12	Business Premises	Site Drainage
Extreme Precipitation Events	4	3	12	Business Continuity	Impacts due to road washouts, culvert failures
Drought Events	5	2	10	Staff/Customer Health, Safety	Minor impact to staff
Drought Events	5	2	10	Business Continuity	Some impacts but manageable
Changes in Seasonal Patterns	5	2	10	Staff/Customer Health, Safety	Low impact to staff
Extreme Snowfall Events	3	3	9	Business Premises	Snow management on sites
Extreme Snowfall Events	3	3	9	Supply Chains	Delays until snow clearing completed
Extreme Snowfall Events	3	3	9	Business Continuity	Some delays due to excess snowfall
Freezing Rain Events	3	3	9	Staff/Customer Health, Safety	Slip and fall hazards
Freezing Rain Events	3	3	9	Business Premises	Ice accretion on bldgs, components, outdoor storage
Freezing Rain Events	3	3	9	Supply Chains	Short-term transport delays
Freezing Rain Events	3	3	9	Business Continuity	Gaps in supplies due to transport delays
Extreme Heat Events	4	2	8	Business Premises	HVAC and occupancy conditions
Extreme Heat Events	4	2	8	Supply Chains	Some tasks suspended due to high heat
Extreme Precipitation Events	4	2	8	Staff/Customer Health, Safety	Transportation risks - potential washouts
High Wind Events	4	2	8	Staff/Customer Health, Safety	Staff follow high wind event procedures
High Wind Events	4	2	8	Business Premises	Procedures in place for materials stored outdoors
High Wind Events	4	2	8	Supply Chains	Impacts to aircraft schedules
High Wind Events	4	2	8	Business Continuity	Minor impacts, delays
Extreme Snowfall Events	3	2	6	Staff/Customer Health, Safety	Temprorary mobility challenges to worksite

Figure 7: Sorted Risks for Identified Climate Hazards

6.0 Summary of Current Adaptive Actions

A summary of current adaptive actions responding to climate hazards within specific business sectors was developed using existing literature, input from stakeholder engagements, and training needs/gap analysis specific to the Northern Manitoba business sector.

Table 3, below summarizes several current high-level adaptive actions that may be applicable to the northern Manitoba business sectors divided into sub-sectors including Transportation/Logistics, Tourism, Forestry, Mining, Construction, and general business considerations.

Table 3: Compiled Existing Adaptive Actions

Sector	Adaptation Options to Respond to CC Impacts
Transportation Logistics	• Invest in the development of electric vehicle fleets, infrastructure, and safety standards [23]. • Develop dialogues with stakeholders on potential impacts associated with the roll-out of new technology [23]. • Develop, test and scale economically viable business models supporting circularity in the automotive industry, while developing and adopting guidelines for the roll-out of sustainable transport infrastructure [23].
Tourism	• Focus on four-season opportunities and activities to reduce the dependence on season-specific activities [24].
Agribusiness	• Advance water-smart solutions to support operations in the context of growing water scarcity [19]. • Utilize climate-informed modelling of future timber supply to better anticipate future trends and impacts [25].
Forestry	• Advance water-smart solutions to support operations in the context of growing water scarcity for water-intensive industries such agriculture, mining, and forestry [19] [26]. • Develop regional and site-level scientific modeling to quantify and integrate risks and opportunities [19].
Mining	• Develop circular business models to maintain the value of materials and resources throughout the lifetime of built structures. Innovate to make circular options more cost-competitive, convenient and dependable [21]. • Future-proof buildings and infrastructure to withstand environmental, social and health-related shocks through urban planning, performance standards and construction practices [21]. • Integrate nature-based solutions into design and construction efforts such as passive heating/cooling [21].
Construction	• Develop new business models to ensure product life cycles are extended for as long as possible, prioritizing maintenance and refurbishment where appropriate [23]. • Integrate circularity and next-life use into all aspects of business strategy. Map and identify value chain gaps in capabilities related to closing circular loops, and work to address them internally and with partners [23].

Sector	Adaptation Options to Respond to CC Impacts
	• Invest in the innovation and adoption of sustainable and circular biological products that store carbon and substitute non-renewable and fossil-based materials, while also setting science-informed goals [23].
Business	• Develop new business models to ensure product life cycles are extended for as long as possible, prioritizing maintenance and refurbishment where appropriate [23]. • Account for the true value of products and materials by factoring in natural, social and human capital costs. • Businesses should seek out suitable sustainable financial instruments to fund their ambitions and objectives.

7.0 Best Practices from Other Jurisdictions

Businesses in northern Manitoba can look to other jurisdictions for direction on best practices to respond to climate hazards or impacts they may face. While businesses in other regions of Canada may not experience the same climate hazards as the northern Manitoba business sector due to geographical, social, or political reasons, many adaptive actions are broad and can be applied across the country.

Table 4 below summarizes best practices from other jurisdictions in Canada across business sectors including Transportation/Logistics, Tourism, Forestry, Mining, Construction, and general business. This table provides a foundation for businesses serving northern Manitoba to develop their own best practices.

Table 4: Adaptive Actions for Business Sub Sectors from Other Jurisdictions

Sector	Adaptive Action Best Practices Responding to Climate Impacts
Agribusiness	• Precision agriculture, proactive mater management, and other types of water reduction methods are used to conserve water, while maintaining harvest yields [20] • Use climate data and projections from climate models in combination with soil information to assess the agricultural potential of a region and plan for a change in the range and types of crops grown.
Tourism	• Services and opportunities for tourists developed by locals living in Arctic regions [20]. • A focus on four-season opportunities and activities to reduce the dependence on season-specific activities [20].
Forestry	• Climate-informed modelling of future timber supply [20]. • Adjust planting strategies for a diversity of species, trial seed from a variety of provenances and keep a mix of age classes to spread risk [20].
Mining	• Develop regional and site-level scientific modeling to identify and quantify physical risks and opportunities [19]. • Integrating climate-related risks and mitigation measures into business decisions throughout the project lifecycle [19].
Construction	• Increase design and construction standards and invest in energy efficiency opportunities [24]. • Preparations for extreme rainfall events - flood defense measures, effective stormwater management [24]. • Whether a project is being tendered to address a specific climate-related concern or an unrelated infrastructure need, the project scoping must deliberately make room for climate resiliency considerations [24].
Business	• Keep social and environmental goals and outcomes top-of-mind throughout the innovation [23]. • Open innovation up to make entire supply chains, industries and systems more sustainable and resilient [23]. • Establish effective technology governance mechanisms [23]. • Upskilling people to work with new technologies [23].

Sector	Adaptive Action Best Practices Responding to Climate Impacts
	• Understanding, developing, and utilizing sustainable funding opportunities
Fisheries	• Collaboration between fishers and government scientists to report new species and predict biodiversity changes; assess infrastructure risks; and improve key fisheries infrastructure to enhance resilience [20]. • Reduced quotas and regional fisheries closures are used to manage and support declining fish stocks [20].

8.0 Recommendations

The case study presented in Section 2.0 is a designed and developed exercise based upon hazards, impacts, and considerations derived from literature research, prior project experience on northern assets and operations, and reported impacts from the northern Manitoba business sector and its stakeholders.

Based on the researched results presented for this illustrative case study, several recommendations are presented below to assist the northern Manitoba business sector. The recommendations are intended to support efforts and programs needed to help the Manitoba business sector prioritise the initiation and completion of their own corporate climate risk assessments. While it is recognised that business sectors worldwide have been severely impacted by disruption due to COVID-19 and have been highly focused on meeting that continuing challenge, there is the strong potential for repeated, ongoing and intensifying disruption to the business sector if it does not identify its climate risks and develop plans to adapt to them.

Recommendation 1: All businesses operating in Manitoba, and in particular, businesses serving northern regions of Manitoba, regardless of their size, should commit to and complete a simple climate risk screening process to identify, assess and plan to respond to current and emerging climate change impacts. The most important task in the process is committing to it and following through to start it.

Recommendation 2: Businesses servicing northern Manitoba need to grow capacities in their companies to identify climate risks and plan measures to reduce them to acceptable levels. Climate risks will accelerate more rapidly in northern regions, in response to higher temperature increases projected for northern regions of Canada. Course modules offered through the MCRT BRACE project provide foundational training in climate change. Accessible guidance on processes to complete simplified climate risk assessments for business is now readily available in Manitoba. MCRT courses can be leveraged to build the corporate capacities needed to begin meaningful discussions to prepare for climate risk assessment and risk reduction planning.

Recommendation 3: For those that do not yet do so, businesses should assemble information about the historical climate impacts they have faced in the past to generate an understanding of their business' current resilience to climate hazards. Based on an assessment of past impacts and resilience levels, businesses should apply a basic ISO 31000 Tier 1 process to identify their present climate risks and prioritize them for risk reduction planning. The worksheets included in Appendix A, based on the results provided in this case study can assist with this process.

Recommendation 4: Businesses should make efforts to revisit their findings at regular intervals, such as every five years, to weave in emerging data as they operate in the years ahead. Revisiting their results from earlier climate risk assessments is an opportunity for a business to sharpen its understanding of how emerging climate hazards impact them and where risk reduction investments need to be

prioritised. Revisiting prior results will also help in assessing if prior risk reductions actions taken have resulted in a positive impact.

Recommendation 5: Businesses are urged to work towards mainstreaming climate resilience (i.e., becoming "Climate Ready") into their strategic business planning.

Recommendation 6: Businesses in Manitoba would benefit from future development of programs promoting the advantages of climate preparedness and the importance of understanding the extent of climate vulnerability for the business sector.

It is recommended that the Manitoba government develop and promote the programs critical to direct a business focus towards managing the emerging and dynamic climate risks that are growing in Manitoba.

Historically and at present, the Province of Manitoba's messaging on climate change has focussed almost exclusively on GHG emission reduction and carbon footprint management. While this attention to mitigate the emissions that drive climate change is essential, the Manitoba business sector has yet to receive provincial government messaging that conveys how important climate resilience will be in the decades ahead for their economic viability. A full response to the challenge of climate change requires both a response to the causes and effects of climate change.

9.0 High Level Summary: Frontier North Adventures: Manitoba Case Story Call Out

This content is intended for a "call out" panel in a merged cross-sectoral document that will be desktop published by ICLEI (Sector Coordinator for the MCRT Project)

Manitoba's Business Sector, like Manitoba's government itself, has yet to complete a coordinated assessment of climate change impacts and the resulting risks to its assets, operations and staff.

Historically in Manitoba, most of the climate change messaging to the business sector has focused on mitigating the greenhouse gas (GHG) emissions that drive global warming and result in climate change. As a result, most Manitoba businesses with significant emissions associated with their operations are very familiar with developing GHG emission inventories, tracking increases and decreases in their GHG emissions, and are fluent with reporting their GHG emissions to regulatory agencies and shareholders. In addition, managing GHG emissions is considered an integral part of overall Environmental, Social and Governance (ESG) approaches to doing business. ESG constitutes three broad areas of interest for what are described as "socially responsible investors". Socially responsible investors place an emphasis on the importance of incorporating their values and concerns into their selection of investments instead of simply using potential profitability and investment risk as drivers of their selection [27] [28].

Within the environmental component of ESG, an emphasis is placed on efforts to preserve our natural world and requires attention to considerations including climate change, carbon emission reduction, water pollution and water scarcity, air pollution and deforestation. For Manitoba's business sector, larger companies and operations with reportable emissions are tracking and managing their carbon emissions and are developing strategies to reduce those emissions. In terms of undertaking a process to identify climate hazards, assessing climate impacts and risks to business, and developing strategies to reduce business risks from climate change impacts, very few Manitoba businesses have completed the needed work to prepare for climate adaptation strategy development.

One business that has recognised the challenges that climate change presents to its operations is **Frontier North Adventures** (FNA) [29]. FNA is a family business with a 30-year history of operating in northern Canada, delivering services to travellers looking for unique experiences in Manitoba's North. FNA's tourism services are highly reliant on the polar bear population along the coast of the Hudson Bay near Churchill, Manitoba. The hunting, eating and mating activities of polar bears all require a stable, reliable extent of sea ice. Higher temperatures caused by climate change have led to an increase in annual ice-free days in Hudson Bay and have led to changes in the timing and duration of sea ice, creating serious risk to the polar bear population. When the ice-free period extends beyond historical ranges, this creates difficulties for polar bears who rely on the presence of ice to hunt and feed, causing polar bears to lose weight, and sometimes preventing female bears from reaching the critical body mass needed to reproduce.

For FNA's business operations, when polar bear populations are impacted in the region, then additional measures to help manage this subpopulation of polar bears are anticipated by the company. Those measures could bring changes to how it conducts its operations and when it will be permitted to do so. If the Western Hudson Bay subpopulation were devastated by the loss of sea ice, this would have a significant impact on FNA's revenues, tourist satisfaction, and return on investments going forward. After considering these factors, FNA opted for a proactive approach to manage their climate risks by developing an adaptation strategy.

FNA's Adaptation Strategy Approach

FNA's Adaptation Strategy was focussed on two components: 1) optimising current operations, and 2) exploring future opportunities. Their strategy prioritized cash flow management and forecasting as key to their liquidity and business viability. The adaptation strategy considered infrastructure investment planning, delivery planning, supply chain planning and forecasting.

Infrastructure investment planning was important as FNA's fleet of tundra-capable vehicles was aging, requiring informed decisions about future investments in new company infrastructure. Lower polar bear populations create the risk of fewer tourist clients, which would be expected to make the payback period on new infrastructure investments unattractive. FNA worked with professionals to consider the operational and financial risks facing the company if key FNA assets were compromised due to climate impact events, and to also estimate the likelihood of occurrences for these events. This process allowed FNA's team to complete qualitative (descriptive) and quantitative (numerical data-based) analyses to identify recommended options to reduce FNA's risks to acceptable levels.

FNA implemented delivery planning to consider physical constraints in delivering their services. One key metric was thickness of sea ice, particularly in areas where FNA's vehicles need to travel. FNA's operations involve tests to measure ice thickness along their planned routes. Supply chain planning for FNA was also examined due to the relative isolation of their base community, Churchill, Manitoba, where they receive their materials and equipment. FNA understood that disruption to rail freight service would require them to pivot to much more expensive barge or air cargo shipments.

FNA's forecasting of future climate conditions involved collaboration with researchers, scientists and non-profit organisations. FNA had an interest in understanding potential changes in the time periods that polar bears gather on land. Understanding how timing of ice formation changes in the future was important as FNA wanted to avoid scheduling trips after ice had formed and the bears had left the coast.

FNA's planning identified adaptation measures that included:

1. Scenario planning to explore different outcomes in infrastructure investment planning.
2. Examining scenarios involving the ability of their vehicles to travel over the ice under different ice thickness conditions.
3. Strengthened relationships for alternate modes of cargo transport to aid in partnering with local suppliers who bring in shipments by barge, leveraging surplus capacity in the community.
4. Anticipating future conditions through forecasting techniques.

The following is an excerpt from an article published by Red River College Polytech on one of the results of FNA's adaptation planning [30].

Going electric in the sub-Arctic: RRC and Frontiers North unveil EV Tundra Buggy

August 24, 2021

Today, Frontiers North Adventures and Red River College unveiled a new zero-emission vehicle technology initiative. The Electric Vehicle Tundra Buggy® is a collaborative, proof-of-concept project that oversaw the conversion of a Tundra Buggy in Frontiers North's touring fleet from diesel-powered to battery electric.

The EV Tundra Buggy was made possible through the province's new Conservation and Climate Fund, and the Vehicle Technology Centre (VTCI) – a non-profit organization dedicated to supporting Manitoba's heavy vehicle manufacturing sector – and through in-kind support and technical services from RRC's Vehicle Technology & Energy Centre (VTEC).

Figure 8: Red River College News Item on FNA's EV Tundra Buggy

References

[1] Local Governments for Sustainability. (2022). Guide on Connecting Green Recovery and Resilience in Cities - ReCAP 2021. [Online]. Available from https://www.iclei.org/en/publication/-guide-on-connecting-green-recovery-and-resilience-in-cities-recap21

[2] Prairie Climate Centre. (2022). Climate Change Report Cards. [Online]. Available from https://prairieclimatecentre.ca/videos-downloads/climate-change-report-cards/

[3] Froese, I. (2021, April 22). Manitoba's premier pans PM's pledge to slash greenhouse gas emissions. *CBC*. [Online]. Available from https://www.cbc.ca/news/canada/manitoba/manitoba-premier-emissions-reduction-target-1.5998854

[4] United Nations Conference on Trade and Development. (2020). Transport and Trade Facilitation Series No. 12, Climate Change Impacts and Adaptation for Coastal Transport Infrastructure: A Compilation of Policies and Practices. [Online]. Available from https://unctad.org/system/files/official-document/dtltlb2019d1_en.pdf

[5] Manitoba Chambers of Commerce. (2020). Climate Change: A primer for Manitoba business. [Online]. Available from https://mbchamber.mb.ca/wp-content/uploads/2020/08/climate-change-primer-manitoba-business6.pdf

[6] Sauchyn, D., Davidson, D., and Johnston, M. (2020). Prairie Provinces; Chapter 4 in Canada in a Changing Climate: Regional Perspectives Report. [Online]. Available from https://changingclimate.ca/site/assets/uploads/sites/4/2020/12/Prairie-Provinces-Chapter-%E2%80%93-Regional-Perspectives-Report-1.pdf

[7] Taylor, S., Parry, J. (2020). Enhancing the Resilience of Manitoba's Winter Roads System. [Online]. Available from https://www.iisd.org/system/files/publications/winter_roads.pdf

[8] Climate Atlas of Canada. (2021). Agriculture and Climate Change. [Online]. Available from https://climateatlas.ca/agriculture-and-climate-change

[9] Schnitter, R., and Berry, P. (2019). The Climate Change, Food Security and Human Health Nexus in Canada: A Framework to Protect Population Health. [Online]. Available from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6678521/

[10] Dacey, E. (2020). Travel Manitoba not considering risks like climate change that could affect tourism: Auditor General. [Online]. Available from https://globalnews.ca/news/6452694/travel-manitoba-risks-climate-change-ag/

[11] Churchill Polar Bears. (2021). Climate Change and Polar Bears. [Online]. Available from https://churchillpolarbears.org/climate-change-and-polar-bears/

[12] Government of Canada. (2020). Climate Change Impacts on Forests. [Online]. Available from https://www.nrcan.gc.ca/climate-change/impacts-adaptations/climate-change-impacts-forests/impacts/13095

[13] Brecka, A., Boulanger, Y., Searle, E., Taylor, A., Price, D., Zhu, Y., Shahi, C., Chen, H. (2020). Sustainability of Canada's forestry sector may be compromised by impending climate change. [Online]. Available from https://www.sciencedirect.com/science/article/abs/pii/S037811272031121X

[14] Price, D. T., Alfaro, R. J., Brown, K. J., Flannigan, M. D., Fleming, R. A., Hogg, E. H., … Vernier, L. A. (2013). Anticipating the consequences of climate change for Canada's boreal forest ecosystems. [Online]. Available from https://cdnsciencepub.com/doi/10.1139/er-2013-0042

[15] The Canadian Press. (2018, December 28). The changing nature of Canada's forest supply as fires, bugs, and climate bite. [Online]. Available from https://www.cbc.ca/news/business/canada-forest-fire-bugs-climate-change-1.4961044

[16] Delevingne, L., Glazener, W., Gregoir, L., and Henderson, K. (2020). Climate risk and decarbonisation: What every mining CEO needs to know. [Online]. Available from https://www.mckinsey.com/business-functions/sustainability/our-insights/climate-risk-and-decarbonization-what-every-mining-ceo-needs-to-know#

[17] Northey et al. (2017). The exposure of global base metal resources to water criticality, scarcity, and climate change. Global Environmental Change, 44, 109-124. Available from https://www.sciencedirect.com/science/article/abs/pii/S0959378016303545

[18] Manitoba. (2020). Manitoba Mineral Sector Profile. [Online]. Available from https://www.gov.mb.ca/iem/industry/sector/mines.html

[19] Business for Social Responsibility. (2021). Adapting to Climate Change: A Guide for the Mining Industry. [Online]. Available from https://www.bsr.org/reports/BSR_Climate_Adaptation_Issue_Brief_Mining.pdf

[20] Vodden, K. and Cunsolo, A. (2021). Rural and Remote Communities; Chapter 3 in Canada in a Changing Climate: National Issues Report. [Online]. Available from https://changingclimate.ca/site/assets/uploads/sites/3/2021/01/Chapter-3_Rural-and-Remote-Communities_Final_EN-1.pdf

[21] Canadian Construction Association. (2021). Canada's construction sector recommendations on adapting to climate change. [Online]. Available from https://www.cca-acc.com/wp-content/uploads/2021/03/Strength-resilience-sustainability-Full-Report-Final.pdf

[22] Schuldt et al. (2021). Weather-Related Construction Delays in a Changing Climate: A Systematic State-of-the-Art Review. [Online]. Available: https://www.mdpi.com/2071-1050/13/5/2861/pdf

[23] International Organization for Standardization. (2018, 02). ISO 31000: A Practical Guide to Risk Management (2nd ed.). Available from https://www.iso.org/standard/65694.html

[24] World Business Council for Sustainable Development. (2021). Vision 2050: Time to Transform: How Businesses Can Lead The Transformations The World Needs. [Online]. Available from https://timetotransform.biz/wp-content/uploads/2021/03/WBCSD_Vision_2050_Time-To-Transform.pdf

[25] Travel Manitoba. (2021). Provincial Tourism Strategy for Manitoba. [Online]. Available from https://www.travelmanitoba.com/tourism-industry/industry-resources/provincial-tourism-strategy/

[26] Aaheim et al. (2010). Integrated Modelling Approaches to Analysis of Climate Change Impacts on Forests and Forest Management. [Online]. Available from https://link.springer.com/article/10.1007/s11027-010-9254-x

[27] Moats, M. C., deNicola, P. (2021, December 15). The Corporate Director's Guide to ESG. *The Harvard Law School Forum on Corporate Governance*. Available from https://corpgov.law.harvard.edu/2021/12/15/the-corporate-directors-guide-to-esg/

[28] Corporate Finance Institute. (2021). ESG (Environmental, Social and Governance) - Overview and Framework. Available from https://corporatefinanceinstitute.com/resources/knowledge/other/esg-environmental-social-governance/

[29] Chartered Professional Accountants of Canada. (2015). Adaptation Case Study #1: Frontiers North Adventures, Tourism Sector, Churchill, Manitoba. Available from https://www.cpacanada.ca/en/business-and-accounting-resources/other-general-business-topics/sustainability/publications/frontiers-north-adventures-long-case-study-1

[30] Red River College. (2021, August 24). Going electric in the sub-Arctic: RRC and Frontiers North unveil EV Tundra Buggy. Available from https://www.rrc.ca/news/2021/08/24/going-electric-in-the-sub-arctic-rrc -and-frontiers-north-unveil-ev-tundra-buggy

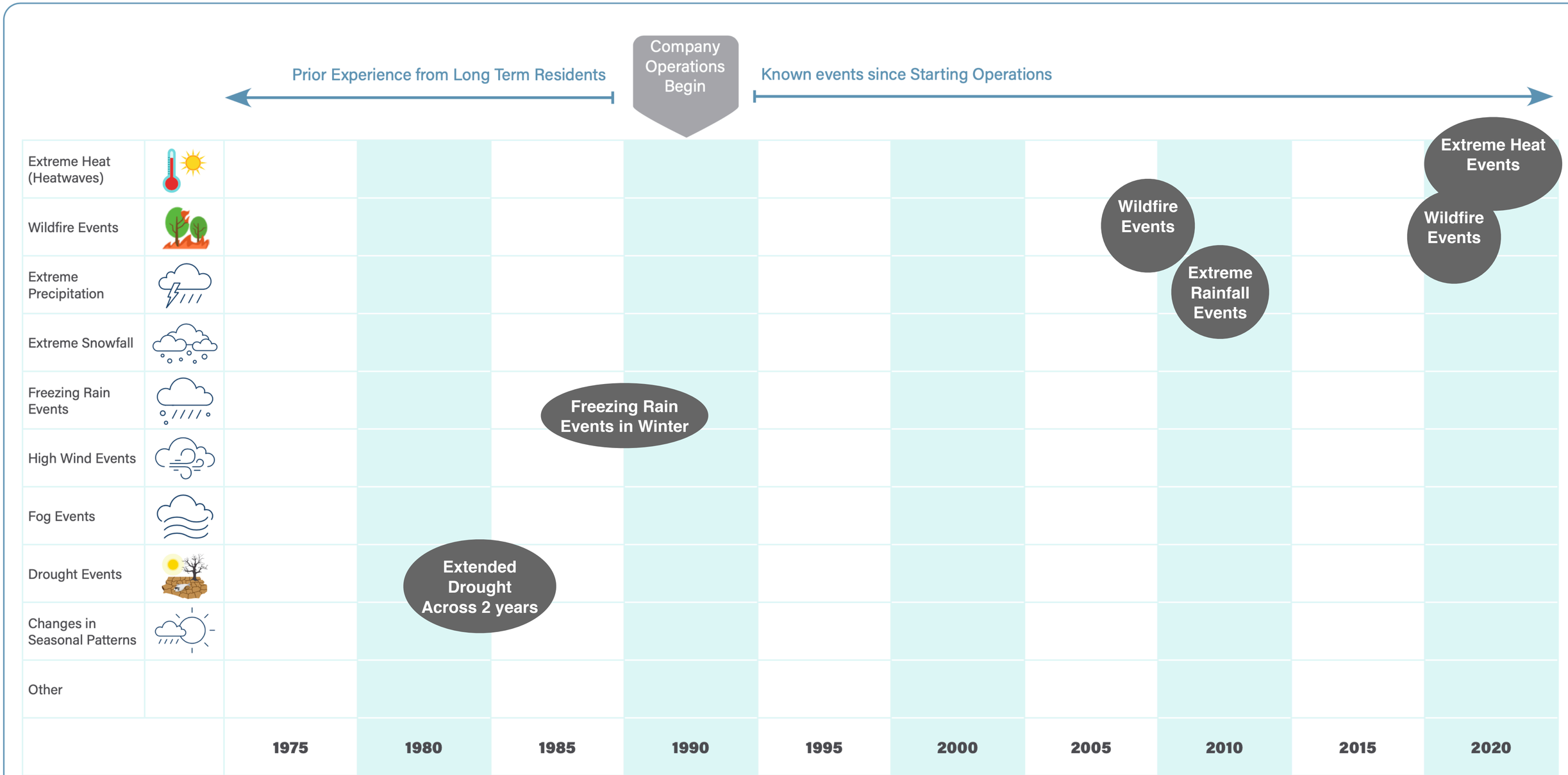
[31]The Manitoba Report from https://climateatlas.ca/sites/default/files/Manitoba-Report_FINAL_EN.pdf

Appendix A

Case Study Worksheet

WORKSHEET 1: PAST CLIMATE EXTREME EVENTS

Documenting Past Climate Extremes in your Operating Region



WORKSHEET 2:
PAST CLIMATE IMPACTS FOR YOUR BUSINESS: DETAILS ON HOW YOUR BUSINESS WAS AFFECTED.

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If any of the above answers are YES, then indicate details on HOW it impacted your business.

PART B

	NO IMPACT	MINOR IMPACT	SIGNIFICANT IMPACT	WRITE DESCRIPTION OF THE IMPACT(S)
Extreme Heat (Heatwaves)	☐	☑	☐	Lack of Air Conditioning meant staff had to bring fans, suspend some activities
Wildfire Events	☐	☐	☑	Minor health impacts to some staff due to wildfire smoke - breathing issues, eye irritation.
Extreme Precipitation	☐	☐	☑	Seepage from overland flow and site runoff caused some damage in goods stored in yard.
Extreme Snowfall	☐	☑	☐	Site snow clearing and snow storage considerations
Freezing Rain Events	☐	☑	☐	Temporary and intermittent loss of power
High Wind Events	☐	☑	☐	Minor damage to a storage building -roof elements
Fog Events	☐	☐	☐	
Drought Events	☐	☐	☑	Water supply issues, also periods of reduced activity due to increased wildfire restrictions
Changes in Seasonal Patterns	☐	☐	☑	Shorter, less reliable winter road season
Other	☐	☐	☐	

WORKSHEET 3: CURRENT CLIMATE RISKS

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During the time since your region and your business were exposed to the weather events listed in **WORKSHEET 1**, has your business made any adjustments or taken any steps to minimize future impacts to your business?

YES ☑ NO ☐

If your answer above is YES, please list any actions you have taken to cope with these weather events below:

After recent extreme heat events, we defined a set of Extreme Heat Event Operating Procedures for our staff who work in tasks with exposure to high heat conditions

Determine current climate-related risks to your business. Place a checkmark to respond to the questions of right:

☑ **YES,** there are existing climate-related risks to my business.

☐ **NO,** there are no existing climate-related risks to my business.

If you think there are existing climate-related risks to your business, which of the following aspects of your business are currently at risk due to those impacts?

☑ **HEALTH AND SAFETY OF STAFF AND CUSTOMERS**

☑ **BUSINESS PREMISES**

☑ **BUSINESS SUPPLY CHAIN**

☑ **BUSINESS CONTINUITY**

Have the actions that were taken in the past to reduce your climate risks worked?

- **Yes** - Established procedures for staff working under Extreme Heat conditions
- **Promising** - Looked at lot grading improvements to improve site drainage
- **Unproven** - Set up working policy for conditions of wildfire smoke and low visibility after 2021 fire season

Are any adjustments required to reduce present day climate risks?

Need to look at vegetation management near our property, evaluate layouts of equipment and materials in storage yard for improved fire resistance

WORKSHEET 4: FUTURE CLIMATE CHANGE OUTLOOK

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Review the climate hazards below and consider how climate change can influence this hazard. Document key points on how climate change can influence this hazard, and place checkmarks beside the hazards that are relevant to you.

HAZARDS	HOW CLIMATE CHANGE CAN INFLUENCE THIS HAZARD IN MANITOBA	PLACE A CHECKMARK BESIDE HAZARDS RELEVANT TO YOU
Extreme Heat (Heatwaves) 	In general, increases in average temperature are likely to increase the number of hot days and nights, and the duration of heatwaves.	☑
Wildfire Events 	Increased average temperatures, combined with dry conditions, electrical storms and high winds increase the potential for wildfire events.	☑
Extreme Precipitation 	For every 1 degree of temperature increase in the atmosphere, that atmosphere can hold 7% more water, leading to potential for increases in short duration, high intensity rainfall events.	☑
Extreme Snowfall 	Warmer temperatures can cause a reduction in the amount of precipitation that falls as snow. At the same time, the potential for large, heavy, wet snowfall events has increased for some regions.	☑
Freezing Rain Events 	Increases in average winter temperatures have resulted in increases of winter precipitation falling as rain and more rain on snow events.	☑
High Wind Events 	Changes in winds are not easy to model for climate change. Ranges of extreme winds are expected to increase as the potential for increased extreme weather activity grows with a warming climate. Winds can cause damages to forests, power lines, and buildings. Wind can also increase the spread of wildfires.	☑
Fog Events 	Fog events create visibility concerns for transportation by motor vehicle, boat and aircraft. Prolonged fog events can disrupt modes of transportation and cause delays due to transportation safety concerns	☐
Drought Events 	In Manitoba, climate change means there is potential for increased periods of drought. At the same time, short duration high intensity rainfall events are expected to increase. This creates the potential for drought and localized flooding in the same year.	☑
Changes in Seasonal Patterns 	Climate change, particularly increases in average temperature can affect the timing of seasons. This is expected to result in shorter winter seasons and an extension of the annual "shoulder" seasons in autumn and spring.	☑
Other		☐

WORKSHEET 5: FUTURE CLIMATE IMPACTS

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Using the information you entered in WORKSHEET 4 for Future Climate Change, consider how future hazards May impact your business and its operations. Be sure to think of all aspects of your business: staff, buildings, supply chain, business continuity, etc. Place a checkmark in the proper circle below to indicate No Impact, Minor Impact, or Significant Impact.

HAZARDS	NO IMPACT	MINOR IMPACT	SIGNIFICANT IMPACT
Extreme Heat (Heatwaves)	☐	☐	✓
Wildfire Events	☐	☐	✓
Extreme Precipitation	☐	☐	✓
Extreme Snowfall	☐	✓	☐
Freezing Rain Events	☐	☐	✓
High Wind Events	☐	✓	☐
Fog Events	✓	☐	☐
Drought Events	☐	☐	✓
Changes in Seasonal Patterns	☐	✓	☐
Other	☐	☐	☐

For ONLY the Hazards that you have checked off as MINOR or SIGNIFICANT IMPACT, Document potential impacts for your business. All hazards indicated as "No Impact" are dropped from consideration.

Check those that apply, add brief description of each impact

Staff/Customer Health & Safety	✓ Heat exhaustion, fatigue in staff
Business Premises	✓ Indoor air quality, occupational comfort
Business Supply Chains	☐
Business Continuity Planning	✓ Temporary staff absences from work
Staff/Customer Health & Safety	✓ Bad Air quality, eye and airway irritation
Business Premises	✓ Threat of building damage from fire
Business Supply Chains	✓ Flight disruption due to heavy smoke
Business Continuity Planning	✓ Some interruptions in staffing and services
Staff/Customer Health & Safe	✓ Risk of injury, mould growth
Business Premis	✓ Seepage resulting in need to remove some drywall
Business Supply Chair	✓ Road and rail washouts
Business Continuity Plannin	✓ Delays in arrival of incoming shipments
Staff/Customer Health & Safety	☐
Business Premises	✓ Roof clearing to reduce load on roof
Business Supply Chains	✓ Delays in transporting shipments
Business Continuity Planning	✓ Disruption lead to parts shortages
Staff/Customer Health & Safety	✓ Downed power lines, slip accidents
Business Premises	☐
Business Supply Chains	✓ Loss of power, air and road transport disruption
Business Continuity Planning	✓ Transport delays, power outages
Staff/Customer Health & Safety	✓ Wind-borne debris - safety of staff
Business Premises	✓ Airborne particulate, dust, debris damages
Business Supply Chains	☐
Business Continuity Planning	✓ Outdoor activities can close during high wind events
Staff/Customer Health & Safety	☐
Business Premises	☐
Business Supply Chains	☐
Business Continuity Planning	☐
Staff/Customer Health & Safet	✓ Water supply constraints, elevated risk of wildfire
Business Premise	✓ Constraints to available water supply
Business Supply Chains	☐
Business Continuity Planning	☐
Staff/Customer Health & Safety	☐
Business Premises	✓ Changes to "shoulder season" operations on site
Business Supply Chains	✓ Reduced winter road network viability
Business Continuity Planning	✓ Delayed shipments due to degraded winter roads
Staff/Customer Health & Safety	☐
Business Premises	☐
Business Supply Chains	☐
Business Continuity Planning	☐

WORKSHEET 6: IMPACT ASSESSMENT

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Climate Hazard	Likelihood Score		Impact Severity: Minor	Impact Severity: Significant	Impact Areas: Staff/Customer Health & Safety	Impact Areas: Business Premises	Impact Areas: Supply Chains	Impact Areas: Business Continuity	Comments
Extreme Heat (Heatwaves)	4			✓	4	2	2	3	Impacts to operations from tasks suspended during extreme heat
Wildfire Events	5			✓	4	5	4	4	Smoke/Visibility, Wildfire encroaches site
Extreme Precipitation	4			✓	2	3	4	3	Potential for road washouts
Extreme Snowfall	3		✓		2	3	3	3	Short term disruption likely
Freezing Rain Events	3			✓	3	3	3	3	Slip and Fall Hazards for staff Ice accretion on premises Short-term transport delays
High Wind Events	4		✓		2	2	2	2	Procedures in place for high wind events Some, but minimal impact on operations, assets
Fog Events	4								
Drought Events	5			✓	2	4	3	2	Marginal impact on local water source - conservation Drought and soils, vegetation, foundation damage
Changes in Seasonal Patterns	5		✓		2	3	4	4	Marginal impact to staff Bldg HVAC Shorter Winter Road Network season. Equipment stranding
Other									
Other									

Impact Severity: 1 Negligible 2 Marginal 3 Major 4 Serious 5 Catastrophic