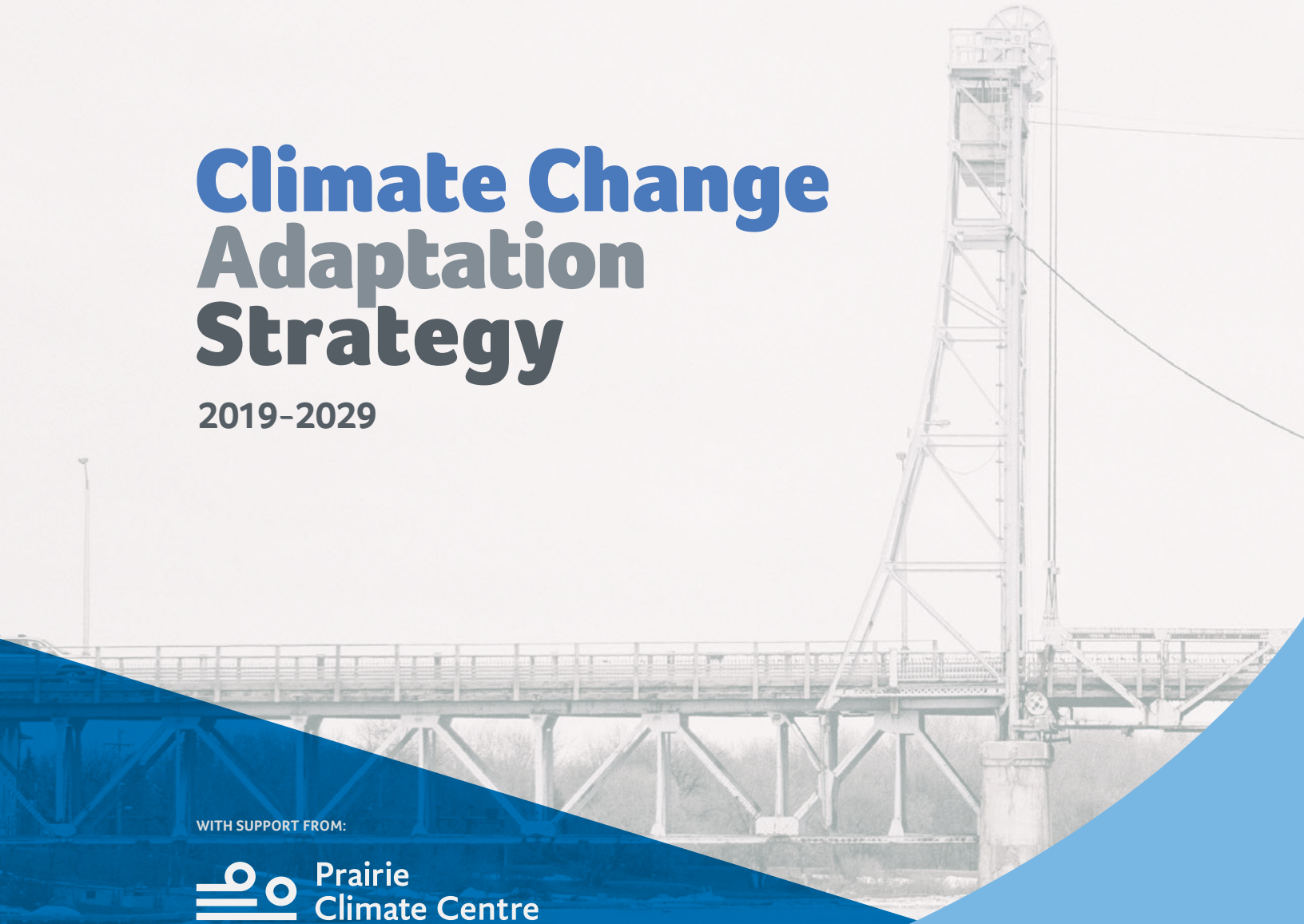
CITY OF Selkirk

Where it all comes together

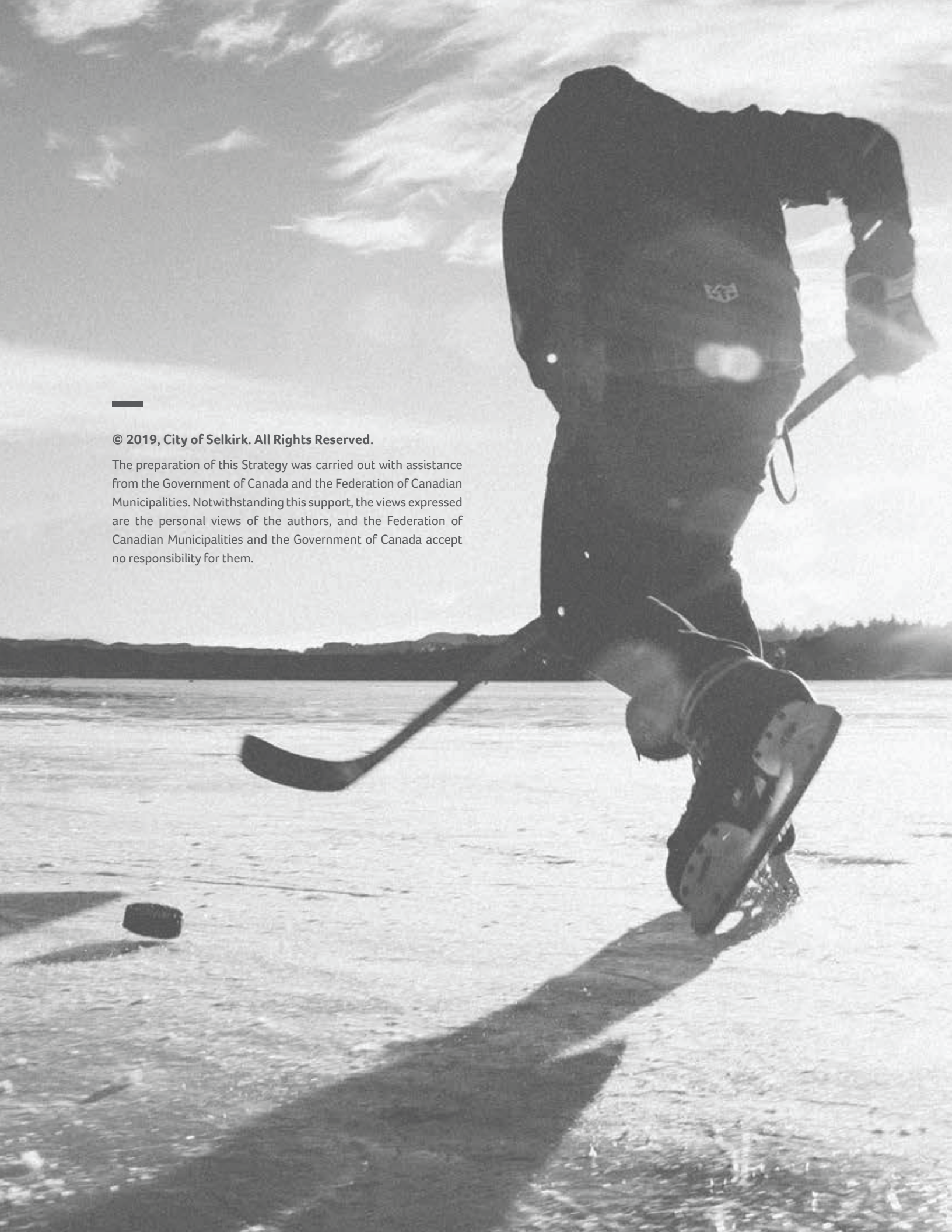
Climate Change Adaptation Strategy

2019-2029



WITH SUPPORT FROM:

Prairie Climate Centre



The preparation of this Strategy was carried out with assistance from the Government of Canada and the Federation of Canadian Municipalities. Notwithstanding this support, the views expressed are the personal views of the authors, and the Federation of Canadian Municipalities and the Government of Canada accept no responsibility for them.

Table of Contents

Vision

> *"A city government that, using high-quality data and leading practices, is thoughtfully engaged in the adaptation of municipal infrastructure and services to mitigate the negative impacts of a changing climate on its citizens."*

Objectives

Through the development and implementation of this strategy, the City seeks to achieve the following objectives which will help it deliver on its vision:

1) **Gain**
a better understanding of the impacts climate change is expected to have on Selkirk and district region;

2) **Identify**
the consequences climate change impacts will have on the delivery of municipal services;

3) **Prepare**
and prioritize a list of adaptation actions the city can undertake to improve its climate change preparedness;

4) **Develop**
the city's internal capacity to anticipate climate change impacts when planning and implementing new municipal services or reviewing existing services;

5) **Imbed**
climate change adaptation into the city's Capital Asset Management Program and annual business planning processes;

6) **Demonstrate**
leadership within Manitoba on the adaptation of municipal services to address and mitigate the impacts of climate change; and

7) **Establish**
and build strong relationships with climate change experts to ensure Selkirk has access to high-quality climate data and insight into leading adaptation practices.

Guiding Principles

As the City implements this strategy it will encounter situations it did not anticipate and will be forced to make decisions that it did not contemplate. When faced with these unexpected "forks in the road", the city will depend on the following principles to help guide its path:

1) Municipal infrastructure must facilitate and deliver municipal services that meet the needs and reasonable expectations of citizens;

2) Leading climate change data, and industry standards shall form the basis for all policies and procedures that come from the tactics listed in this strategy;

3) The absence of full scientific understanding shall not be used as a reason to postpone adaptation action when there is the potential of serious irreversible complications; and

4) Priority will be given to tactics that deliver both climate change adaptation and mitigation.

Introduction

The old saying of "climate is what you expect, weather is what you get" nicely summarizes the difference between climate and weather. In Selkirk, as is common across Canada, the weather is remarkably variable from day to day, month to month and even year to year. However, over a longer period of time, a predictable pattern called climate emerges that describes the average, or typical, range of weather conditions for a location.

Due to human activities - specifically the combustion of fossil fuels that is increasing the production of greenhouse gases – the climate is now warming and changing in important ways. The United Nations led Intergovernmental Panel on Climate Change (IPCC) has shown that the globe has already warmed approximately 1°C and has concluded that this change in the climate system is unequivocal and unprecedented.[i] While this may not seem like much of a change, scientists from around the world have warned that warming above 1.5°C will have widespread economic, environmental and health impacts, and that the burning of fossil fuels must cease by 2050 if the globe is to meet the Paris Accord and limit warming to below 2°C globally.[ii]

According to recent studies, Canada has been warming at roughly double the global average over the last six decades.[iii] Temperature records indicate that Selkirk's climate warmed by 1.8°C between 1948 and 2016.[iv] This warming is very likely altering precipitation patterns, and impacting the frequency, intensity, and duration of extreme weather events.[v] Worryingly, climate models indicate that an increase of just 2°C globally may translate into a temperature increase of 3-4°C for southern Manitoba,[vi] which means that cities like Selkirk are in a global "hot spot."

> *"climate is what you expect, weather is what you get"*

Climate action and communities

It is not an exaggeration to say that climate change is one of the paramount issues of our time. Recently, the Federal and Provincial Auditor Generals of Canada echoed this sentiment when they issued a report saying the "impacts of a warming climate and extreme weather events are already being felt in Canada and are forecast to become more severe and more frequent." These auditors concluded that most governments have not fully assessed climate change risks nor developed detailed adaptation plans.[vii]

In general, it is the responsibility of municipal governments to ensure that service delivery going forward is environmentally, economically, and socially sustainable, and that is why it is important to consider asset management in the context of a changing climate. Climate change will have a significant and long-term impact on infrastructure, therefore many suggest that it's strategically beneficial for asset managers to incorporate climate change - including its modelled likelihood and associated uncertainties - into short-term operational planning.[viii] The goal of a long-term sustainable asset management strategy is to ensure that municipal systems are able to deliver services in a way that does not compromise the needs of future generations.[ix]

There are two main ways of dealing with the threat of climate change:

▶ 1. Mitigation

Mitigation seeks to limit the magnitude or the rate of long-term climate change by reducing contributing factors. Municipalities can mitigate climate change by introducing policies, regulations, and mitigation projects that decrease fossil fuel-reliance and GHG emissions to the atmosphere.

However, even with concerted efforts to mitigate climate change, some climate changes are now all but unavoidable. Therefore, municipalities across Canada and the world must prepare for and manage the impacts and risks of a changing climate.

▶ 2. Adaptation

Adaptation seeks to identify ways of increasing resilience and building capacity for dealing with the impacts of climate change. Adaptation actions help ensure municipal service delivery is maintained as the climate continues to change, while also seeking potential benefits and opportunities that might arise as a result of the changing climate. Adaptation planning is about being smart, recognizing that climate change is happening, planning for the future, and acting accordingly to ensure the reliable delivery of services.

At present, Canadian insurers suggest that claims on natural disasters - such as floods, forest fires, and other extreme weather events - are conservatively approximated at about $1 billion per year and increasing.[x] Economic studies suggest that, by 2050 in Canada, the climate change costs may range between $21-$43 billion per year and possibly higher if mitigation and adaptation planning is not undertaken.[xi] Given the impacts and associated costs associated with climate change, many are suggesting that Canada must develop a whole-of-society "culture of climate resilience,"[xii] and that means together, communities across the country must be taking bold climate action.

The City of Selkirk Joins FCM's *"Climate and Asset Management Network"*

To address the increasing needs of municipalities in a changing climate, the Federation of Canadian Municipalities (FCM) launched their "Climate and Asset Management Network," which is a national peer-learning network that supports communities with funding, training, and knowledge exchange opportunities.[xiii] The City of Selkirk was one of 19 communities from across Canada to successfully apply to this program, it was also the smallest city selected, and the only one located in Manitoba.[xiv] In the first phase of this two-year program, participating cities were encouraged to "develop or refresh an asset management policy, strategy and governance framework." This report is the outcome of the City of Selkirk's work over the past two years and overall involvement in this FCM-funded program.

The City of Selkirk's Climate Change Adaptation Strategy *(CCAS)*

This Climate Change Adaptation Strategy (CCAS) identifies some of the likely impacts climate change will have on municipal service delivery for the City of Selkirk. This plan was developed by City of Selkirk staff, in close collaboration with the Prairie Climate Centre (PCC), which helped ensure that the CCAS was based on a combination of community knowledge regarding municipal services along with leading science, policy, and adaptation planning processes.

By systematically assessing how Selkirk's municipality and service delivery will likely be affected by climate change, the CCAS and associated adaptation actions have a factual basis, clear goals, appropriate policy responses, and can be monitored and evaluated. These criteria ensure that the adaptation plan is following best practices regarding climate change planning within a Canadian context.[xv]

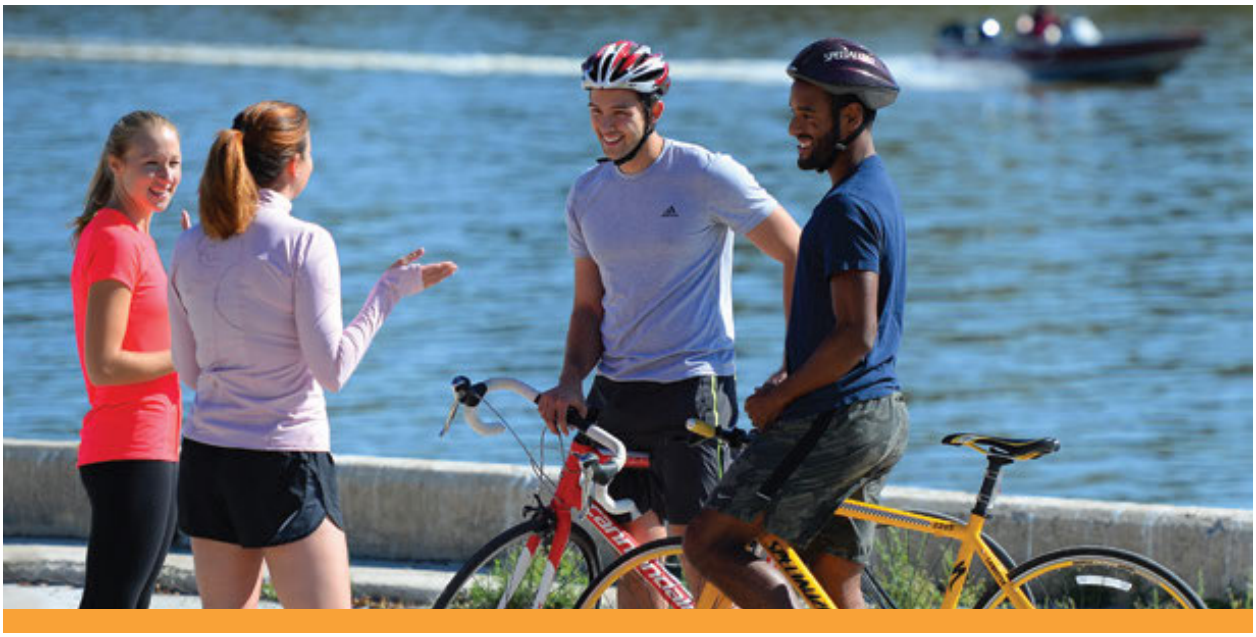
An adaptation action is any project or initiative that seeks to reduce the vulnerability of social, ecological, physical and economic systems to changing climate conditions over the long term. Thus, CCAS adaptation actions are designed to reduce the vulnerability of the City of Selkirk's delivery of municipal services and its assets; ensure overall viability of the City's operations; and increase or maintain the long-term safety and well-being of Selkirk's citizens.

> ***"Adaptation is how we as a community respond to changes. What are those impacts going to be, and how does it impact our municipal services? How do we prepare for that? Because preparing now is a lot more cost effective, and less harmful socially, and environmentally if we start now and develop those strategies."***
>
> ***- CCAS Project Team Member***

Community Profile

Established in 1882, the City of Selkirk is a vibrant community with a population of approximately 10,278 (as of 2016), a land area of 24.82 square kilometers, which is located adjacent to the Red River.[xvi] Given its central location, the City is also a regional hub to over 70,000 people, and is a gateway to the Interlake being surrounded by three different routes to cottage country. Selkirk is the largest commercial centre in the Interlake Region, making it a go-to destination for shopping and services.

The City offers all of the types of municipal services generally expected of a progressive urban centre, including a new hospital (that is the largest and best equipped in the region) and a new state-of-the-art wastewater treatment facility (that will come online in the year 2020). The City's infrastructure and services are managed and delivered by its dedicated and professional employees through innovative partnerships. With a growing population both in Selkirk and the surrounding communities, the City is facing increased demands on its aging infrastructure and assets, which requires forward-thinking and long-term planning for renewal and expansion. These plans are helping prepare the City for new residential and commercial growth for years to come, while also factoring in a changing climate.



Capital Asset Management Program *(CAMP)*

In 2014, Council established the City of Selkirk's Strategic Plan, which identified a number of important priorities for the City that focused on continuing to build a vibrant and efficient community and economy while also practicing environmental stewardship and development of safe and sustainable infrastructure.[xvii] As part of this planning exercise, Council prioritized more active management of capital assets, and one of the key activities of the Capital Asset Management Program (CAMP) was to establish baseline levels of service that the City is expected to achieve into the future.

CAMP brings together the data, technology, policies, procedures, human resources and financial practices needed to actively manage and maintain Selkirk's infrastructure, so that the City can continue to deliver municipal services that meet our community's expectations. It is a comprehensive, integrated, evolving, and robust program. Given that climate change will likely have a significant impact on municipal services and infrastructure, it's critical that the best available data, policy, and associated recommendations from the CCAS process dovetail and integrate into the City's ongoing CAMP activities.

This CCAS is a key component to the evolution of the city's CAMP, as it will ensure that adequate thought and foresight goes into planning for the future of the City, and that previously defined performance targets for municipal services are monitored and maintained despite a changing climate and the impacts that may occur. The CCAS demonstrates that Selkirk is at the cutting edge of climate change preparation at the municipal level and, as a result, risks to delivery of current and future municipal services will be minimized.

Selkirk's Project Team

The City of Selkirk assembled a multidisciplinary team of CAMP members and City service experts in a series of meetings and workshops to discuss and generate potential adaptation actions for future climate change decision making and policy implementation. It was the responsibility of this team to partner with climate change experts to collaboratively explore the potential "climate scenarios" for Selkirk and construct the final CCAS based on both community and scientific knowledge. Table 1 lists the participating members of the City of Selkirk staff, as well as their roles within the organization and their contributions to the CCAS.

Selkirk's Project Team

Table 1: Selkirk's Climate Change Adaptation Strategy (CCAS) Project Team

Name	*Job Title*	*Role in Climate Change Adaptation Plan Development*
Duane Nicol	*Chief Administrative Officer*	*CAMP Member*
Kevin Richter	*Director of Finance*	*CAMP Member*
Dan McDermid	*Director of Operations*	*CAMP Member*
Megan Jakilazek	*GIS/Survey Technician*	*CAMP Member, Document Developer*
Susan Hnatiuk	*Operations Clerk*	*CAMP Member*
Youssef Mouzahem	*Project Administrator*	*CAMP Member*
David Atkins	*Draftsman*	*Workshop Participant*
Dale Scott	*Manager of Water and Wastewater*	*Workshop Participant*
Dennis Whall	*Manager of Public Works* (Former)	*Workshop Participant*
Ryan Sicinski	*Manager of Public Works* (Current)	*Workshop Participant*
Brent Scherza	*Public Works Chargehand*	*Workshop Participant*
Scott Blanco	*Manager of Buildings and Fleet*	*Workshop Participant*
Brady Clark	*Manage of Cultural & Recreation Programs*	*Workshop Participant*
Jason Soltys	*By-Law Officer*	*Workshop Participant*
John Duff	*Director of Protective Services*	*Workshop Participant*

Selkirk Municipal Service Areas

At the onset, Selkirk's project team wanted to take a pragmatic approach to climate change adaptation planning, which was appropriate for the size and structure of their operations and as a city. Selkirk's municipal services are divided into eight so-called "service areas" which largely represent the governance structure for how services are delivered and who is responsible for them. When designing the CCAS, Selkirk's team decided that for climate change adaptation to be effective and "mainstreamed" throughout city operations, then adaptation actions would have to fit within these service areas. This ensures that service areas – and their associated staff – will be responsible for planning, initiating, and monitoring the adaptation actions proposed. It also allows for the City to better understand the specific financial and staffing requirements moving forward with climate change planning.

Table 2: City of Selkirk Municipal Service Area Legend

Climate Change Adaptation Planning Process

To develop the Climate Change Adaptation Strategy (CCAS), the City of Selkirk partnered with local climatologists and climate change adaptation experts at the University of Winnipeg's Prairie Climate Centre (PCC). The PCC is a leading climate change research group with a team of climate scientists, social and health science researchers, and communication specialists that seek to move society "from risk to resilience" (prairieclimatecentre.ca). The PCC's evidence-based approach - combining climate data, community-based research, and digital storytelling - follows the best practices in climate adaptation and communications. The PCC is well known for having developed the *Climate Atlas of Canada* (www.climateatlas.ca), which is the first tool to visualize climate data, maps, and stories for the entire country.

Prairie Climate Centre

For this project, the PCC was responsible for developing and facilitating a series of workshops, which brought together the local knowledge of the City's staff with that of climate experts to develop a robust and collaborative understanding of how climate change will likely affect Selkirk's municipal service delivery. After striking the partnership between the City of Selkirk and PCC, a series of workshops and planning activities led to the development of the CCAS according to the following timeline:

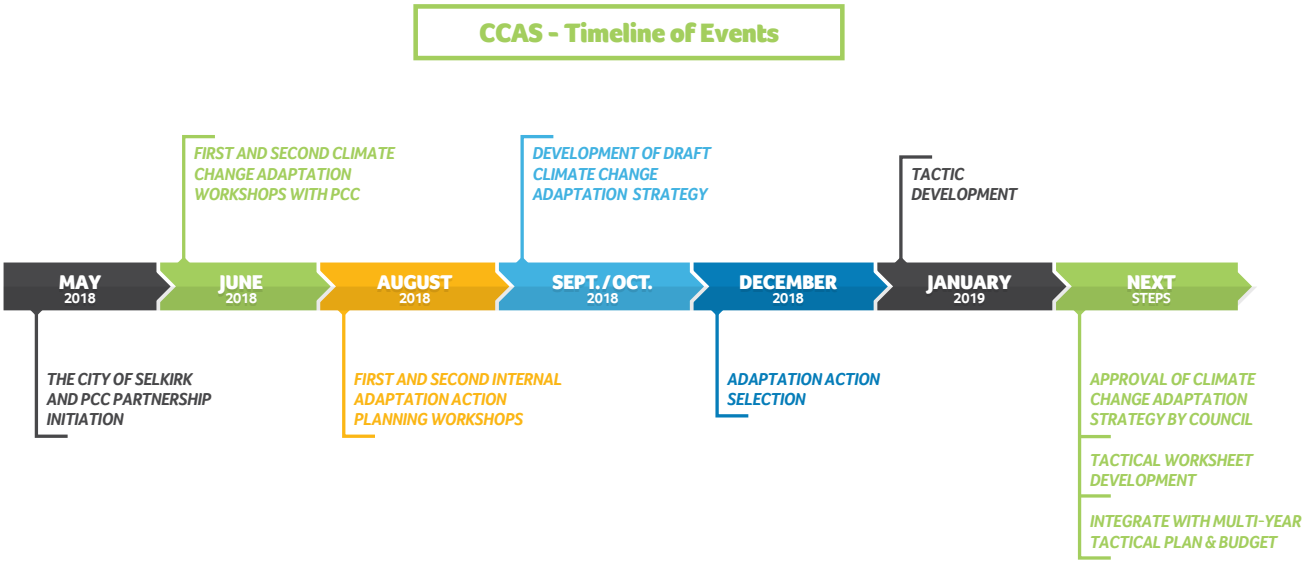


Figure 1: Timeline of CCAS planning process.
A more detailed explanation of the process steps can be found in table 11 in Appendix I

The PCC developed its own workshop approach based on an extensive literature review of adaptation planning processes, pre-existing city adaptation plans cross Canada, and the recently launched Infrastructure Canada ***Climate Lens*** program.[xviii] The workshop was a multi-day event, split into two sessions with a 2-week space between them. In between workshops, the PCC produced a summary of the outcomes from the first session, conducted additional research on specific issues raised by the City of Selkirk, and returned to the second workshop with additional evidence for consideration by the team. The PCC filmed the workshops as a way to document and communicate the outcomes of the planning process.

The framework was largely consistent with approaches developed by the Canadian Institute of Planners,[xix] ICLEI-BARC,[xx] and the United Nations Framework Convention on Climate Change (UNFCCC).[xxi] These approaches represent some of the best practices in climate change adaptation planning for municipalities and therefore it was important to build from the well-established processes while adjusting them to the local context.

Through this collaborative process, the City and PCC teams identified and ranked a representative range of climate change impacts that will likely affect Selkirk's assets and infrastructure, and linked these impacts with specific service areas within the City. From there, it was much easier to discuss applied adaptation actions and priorities, given that CAMP members and relevant service area experts were all contributing to the workshops and its outcomes.

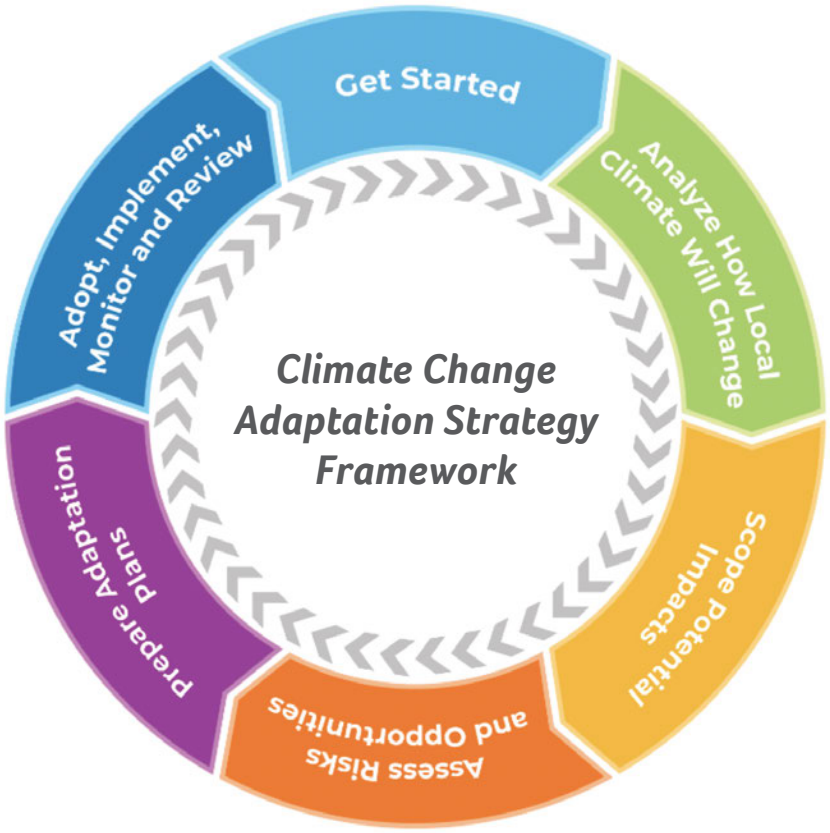
The PCC helped Selkirk develop a scoring approach to assess and prioritize possible adaptation actions. Ultimately, it was the responsibility of the Selkirk team to come up with the final list of adaptation actions and bring them to Council for approval.

This community-based and collaborative approach to the CCAS was innovative on a number of levels. Firstly, the City recognized the importance of bringing together climate experts with their front-line municipal workers to create a holistic yet grounded understanding of the real-world impacts that are likely to be expected with climate change. Conversations about global climate model data were quickly translated into discussions about local consequences, associated costs, and how the community could best respond. The City of Selkirk has developed a philosophy of increasing knowledge and educational capacity in-house, as opposed to simply having a plan developed by a third party, and this is yet another example of the success of that approach. Importantly, it is Selkirk's contention that involving front-line workers also increases the degree of 'buy-in,' and therefore ultimately the success of the CCAS.

The following sections detail the process that Selkirk used to develop its CCAS. It concludes with a list of specific climate change actions proposed by the team for consideration by council.

Step 1:
▸ Getting Started

The first step in the development of Selkirk's CCAS was to get the necessary support and funding from council. The CAMP team was established as the CCAS's project team. Experts from the City's service areas were also included to ensure that all of the experience and knowledge of frontline staff was captured. Once in the workshop, the team began to familiarize itself with the climate change adaptation planning framework proposed by the Canadian Institute of Planners.



Get Started › Analyze How Local Climate Will Change › Scope Potential Impacts ›
Assess Risks and Opportunities › Prepare Final Adaptation Actions ›
Adopt, Implement, Monitor and Review

Figure 2: The six steps of the climate change adaptation strategy framework

Step 2:
Analyze How Local Climate Will Change

In this second step in the CCAS, City staff with the support of the PCC, gathered locally-relevant climate change projections for Selkirk, and discussed the potential implications in the workshop. This step co-generated knowledge, between informed City staff who are also community residents, and supporting climate researchers. The goals of this step were to identify how changes in global climate can lead to meaningful changes in the frequency, intensity and duration of extreme weather events in the Selkirk area and to begin to translate this knowledge into a list of likely climate change consequences.

Since climate change data can be complex and abstract, it was vital to begin a discussion about future climate change by talking about the differences between climate and weather and differentiating between climate variability (the seemingly 'random' year to year variation in weather patterns) and climate change. Many of Selkirk's team have lived and worked in the community their whole lives. These individuals have a unique perspective on local climate and weather and were instrumental in helping to identify long-term climate changes already taking place in the region. Through an open discussion, team members identified local climate changes they have observed over their lives and careers. This information provided an important link for the rest of the team—particularly the younger members—between global-scale climate change and local-scale impacts. This was a key step in incorporating the thoughts and experiences of frontline staff in the development of the City's CCPA.

Climate change trends observed

by City of Selkirk team members:

- More wind year round
- Increased number of extremely hot days
- Less winter precipitation in the form of snow
- Mild winters with extreme cold snaps
- Snow coming later in the year
- More intense rain events, rainfall more frequently coming as downpours
- Deeper frost because less snow as insulator
- Warmer summers with higher levels of humidity
- Consistently lower river levels – especially when it comes to freezing time
- Increased short-term temperature variations

> *"I see the heat and the penetration of the heat around me. The cracking in the land. I haven't seen that before. Just how penetrating it is and you can feel the heat on your body and on the climate."*
>
> *- CCAS Project Team Member*

Analyze How Local Climate Will Change

This discussion was followed up by a presentation on the PCC's ***Climate Atlas of Canada*** (www.climateatlas.ca), which presents and connects climate model data and community-based stories that are visualized for all regions of the country through maps, graphs, videos, and downloadable datafiles. PCC began with a general introduction of the tool, and then zeroed in on Manitoba – and specifically the City of Selkirk – to identify anticipated changes in climate averages and extremes. A summary of the changes discussed in the workshop are presented below.

Figure 3: These data from the Climate Atlas of Canada show the projected change in the mean number of +30 °C days for the Municipality of Selkirk, in a high carbon scenario. The historical mean from 1976-2005 is 9.1 +30 °C days in a given year. For the time period 2051-2080 this is projected to increase to 42.7 days in a given year, an increase of 33.5 days.

Projected Climate Changes for the City of Selkirk

The projections made by the climate models presented in the Climate Atlas are summarized over the short-term (2021-2050) as well as the long-term (2051-2080). In the workshop, the PCC also discussed two future climate scenarios, differentiated by the projected amount of global warming by the end of this century.

The climate projections used in the workshop focus on long term projections under a "high carbon" scenario (RCP8.5) – or more simply a "business as usual" scenario. This scenario was selected based on the planning perspective of "preparing for the worst, hoping for the best". These models project that Selkirk will become warmer throughout the year, with an increase in precipitation in late fall, winter and spring, but a decrease in the summer. Figure 3 shows the temperature and weather predictions for the 2051-2080 period, compared to historical values (1976-2005).

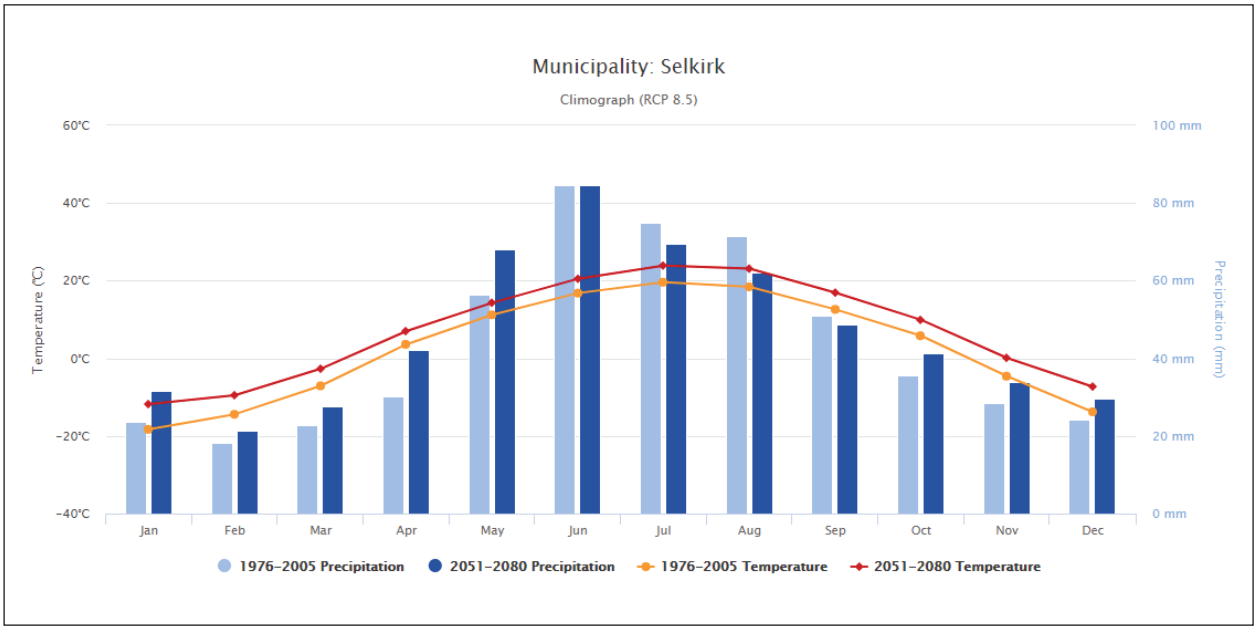


Figure 4: City of Selkirk 2051-2080 Temperature Predictions

The following sections break down the projected seasonal climatic changes along with associated consequences and the services areas likely impacted by the change.

A) Spring & Fall

Table 3: Seasonal Climate Change Impacts for the City of Selkirk

Climate Variable	Description	1976-2005 Average	2021-2050 High Carbon Scenario	2051-2080 High Carbon Scenario	Importance	Service Area
Spring Precipitation	Average total Mar, Apr, and May rain and snow	109 mm	121 mm (up 11%)	138 mm (up 26%)	Affects seeding and planting of crops, spring flood risk, etc.	
Fall Precipitation	Average total Sep, Oct, and Nov rain and snow	115 mm	126 mm (up 9%)	124 mm (up 8%)	Impacts water availability	
Date of Last Spring Frost	Marks the approx. beginning of growing season	May 22	May 11 (11 days sooner)	Apr 30 (21 days sooner)	Announces growing season and the return of summer, and is likely to come earlier	
Date of First Fall Frost	Marks the approximate end of growing season	Sep 26	Oct 6 (9 days later)	Oct 11 (14 days later)	Affects plant, animal, and human well-being/experience of seasons	

Projected Climate Changes for the City of Selkirk

The spring and fall seasons, also known as shoulder seasons, are anticipated to become warmer and wetter, receiving a 26% and 8% increase in precipitation respectively. Map and data outputs from the Climate Atlas helped create greater understanding regarding predicted changes in precipitation in the shoulder seasons.

With shoulder seasons predicted to become warmer and wetter Selkirk will be faced with new risks, including:

Extended and possibly more severe storm season

With the summer season stretching out longer into the traditional spring and fall seasons, there is an increased risk of summer-like storm development. Associated with these storms is high winds, increased heavy rainfall with the potential of hail, as well as lightning. If Selkirk begins to receive these heavy rainfall events in the spring months, when they already face the threat of Red River flooding, rainfall amounts could exceed the capacity of the storm sewer, resulting in increased sewer backups into residential properties.

Very hot temperatures

Increased temperatures in the spring and fall months can emphasize fire risk, as well as increase health issues, and contribute to increasing and potentially problematic wildlife interactions.

Polar vortex 'cold snap' events

Although the overall trend is temperature warming, there is potential for cold snaps to occur in the early spring or late fall months. Large temperature swings due to a changing jet stream can cause several issues including challenges to maintaining building temperature and increased stress of roadways.

B) Summer

Table 4: Summer Climate Change Impacts for the City of Selkirk

Climate Variable	Description	1976-2005 Average	2021-2050 High Carbon Scenario	2051-2080 High Carbon Scenario	Importance	Service Area
Very hot days	Days when the temperature rises to at least 30°C	9	23 (up 14 days)	43 (up 34 days)	Indicates severity of summer heat, affects health, recreation, ecosystems, water supply, etc.	
Warmest Maximum Temperature	The highest temperature of the year	33.9 °C	36.0 °C (up 2.1 °C)	38.5 °C (up 4.7 °C)	Heat extremes affect many social and ecological systems	
Tropical Nights	When the lowest temperature of the day does not go below 20°C	1	5 Up 4 nights)	15 (up 14 nights)	Psychological stress, heat stroke, A/C usage, energy consumption, etc.	
Summer Precipitation	Average total Jun, Jul, and Aug rain	231 mm	227 mm (down 2%)	216 mm (down 6%)	Affects water availability, risk of drought	

Projected Climate Changes for the City of Selkirk

Selkirk's summer season is expected to become warmer and somewhat drier. While total precipitation is likely to decrease, climate models indicate that Selkirk will also experience an increase in intense rainfall events punctuated by longer and more persistent droughts. According to climate models, the number of very hot days, which is defined as a day of 30°C or higher, is anticipated to increase from 9 annually in the recent past (1976-2005) to up to 43 a year (on average) in the near future (2051-2080). In addition to very hot days, the nights will be warmer as well. Tropical nights are defined as nights when the lowest temperature does not go below 20°C, and according to climate model predictions, this number will increase from 1 a year in the recent past, up to 15 per year (on average) in the near future (2051-2080). The amount of summer precipitation is anticipated to decrease slightly by 6%, but the patterns of rainfall will change significantly. Instead of receiving equal amounts of rain throughout the season, it is likely that more rainfall will come in a shorter period – resulting in lengthy periods without any precipitation at all. Warmer temperatures can have several advantages including increased growing period, and a longer construction seasons, but may also have several negative consequences including:

Heat waves

Heat wave events are defined as three or more consecutive days that are 32°C or higher. Currently this is rare in Selkirk, but it is likely going to become more frequent. This can have significant health implications on the public, especially the elderly and the disadvantaged – putting large strain on health services. In addition, these heat waves heighten the risk of grass and urban fires.

Longer, more persistent droughts

Longer periods without water can pose risk to the City's water source, and the aquifer may reach critical levels. With longer droughts people use more water, and Selkirk may need to implement water rationing – something that has never been done in the past.

Heavier rainfall events

Even with persistent droughts, the risk of intense rain events will increase due to the hot temperatures. Intense rainfalls can lead to temporary overland flooding, increased debris on roadways, and damage to trees and property.

C) Winter

Table 5: Winter Climate Change Impacts for the City of Selkirk

Climate Variable	Description	1976-2005 Average	2021-2050 High Carbon Scenario	2051-2080 High Carbon Scenario	Importance	Service Area
Coldest Minimum Temperature	The coldest temperature of the year	-36.7 °C	-33.8 °C (up 2.9 °C)	-30.5 °C (up 6.2 °C)	Affects safety, recreation, buildings, transportation use, energy use, etc.	
Heat Degree Days	Annual accumulated degrees Celsius below 18 °C	5,796	5,076 (down 720)	4,472 (down 1,324)	An indication of how much heating will be required in a given year	
Frost Days	Number of days in a given year with below-freezing temperatures	188	167 (down 21)	148 (down 40 days)	Measure of cold affecting snow/ice accumulation and energy use	
Winter Precipitation	Average total Dec, Jan, and Feb rain and snow.	65 mm	75 mm (up 15%)	83 mm (up 26%)	Affects snowpack, spring flooding, ground insulation	

According to the climate experts of the Prairie Climate Centre, and the data presented by the Climate Atlas of Canada, Selkirk is projected to have shorter, warmer, and wetter winters. Historically, the City of Selkirk has seen an average coldest minimum temperature of -36.7°C and this is anticipated to rise to approximately -30.5°C by the 2051-2080 time-frame. In addition, Selkirk has historically received 188 frost days annually, but this is also anticipated to decrease to 148 frost days (on average) a year by the 2051-2080 time period. As a result of these warmer conditions, Selkirk will experience a change in precipitation type as well as patterns. The Climate Atlas of Canada projects an increase in winter precipitation up to 26%. This precipitation will come as a heavier wet snowfall compared to what has been seen in the recent past (1976-2005). This precipitation will also come in a more concentrated amount of time as the date of first fall frost is pushed later into the year, and the date of last spring frost occurs earlier. Negative consequences that this may have include:

Heavier, wet snowfalls

People will need to work harder to remove this type of snow, which can be harmful to human health and dangerous for some sub-populations. City snow removal operations will also become more challenging, as the equipment will have to work harder to remove this type of snow, leading to increased operational costs associated with time and maintenance issues.

Freezing rain events

When surface temperatures hover around the 0°C mark, precipitation will come in the form of freezing rain which can have huge safety complications. Icy roadways and sidewalks will increase safety issues city wide.

Rain on snow events

Rain on snow can create problems similar to freezing rain events, primarily safety issues on roadways and sidewalks.

Winter thaw events

Extended periods of above freezing temperatures mid-winter can have significant impact on snow cover, and lead to several issues. When snow melts then refreezes, Selkirk can begin to run into issues of frozen land drainage pipes or mains. In addition, increased freeze/thaw cycles can lead to other kinds of thermal distress on the built environment such as frost heaves in pavement.

Loss of insulating snow

In addition to rain on snow, above zero temperatures and a decrease in annual snowfall ultimately does a poorer job of insulating the ground from frost, leading to deeper frost which can damage subterranean water and sewer mains. In addition, less insulating snow on major waterbodies will lead to the development of thicker ice which can lead to spring ice breakup challenges.

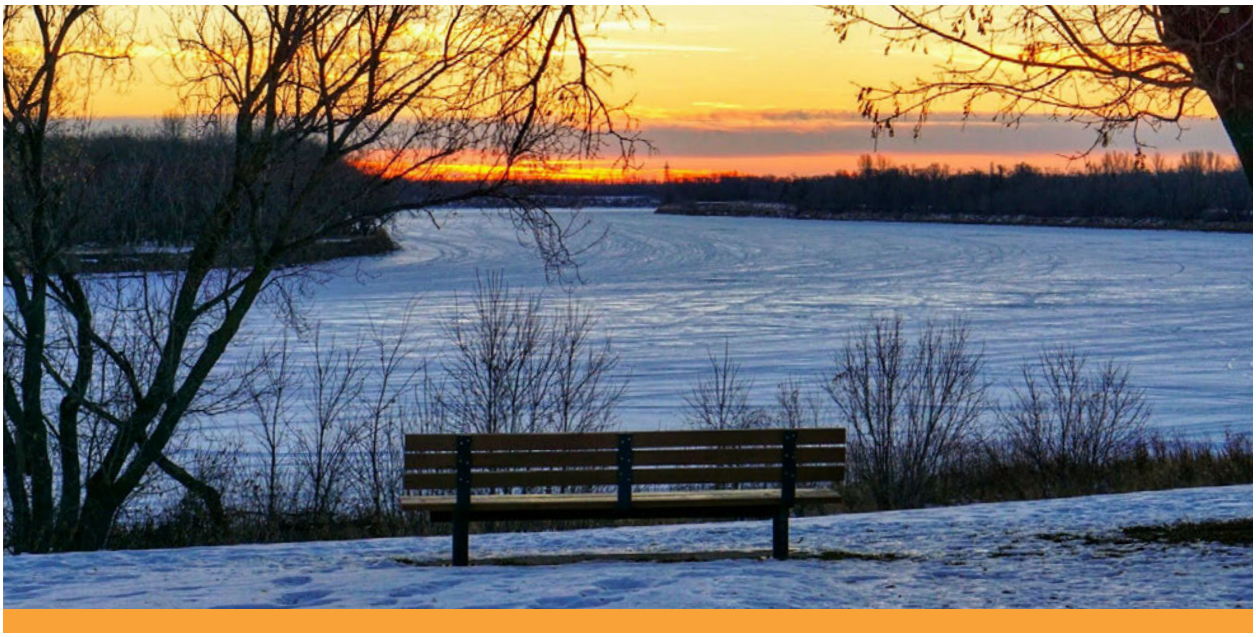
Using the Climate Atlas as a foundation for discussion, the workshop pivoted to focus on the experiences of City staff and what they might expect based on future climate projections. Dozens of potential climate changes were identified and discussed during this step in the workshop. It was clear during the roundtable discussion that certain climate changes pose more of a threat to Selkirk than others. It was also identified that climate models are more certain about some climate change variables than others. For example, projections show that there's going to be an increased likelihood of heavy precipitation as well as overall increased spring precipitation within the region, how and when this exactly occurs in Selkirk and the associated likelihood of increasing river flooding is highly uncertain. Determining the magnitude of spring river flooding in Selkirk is difficult because it depends on many different factors, such as the timing of spring melt, the depth of river ice freeze, and the degree of ice-jamming. In contrast, climate models are much more certain that the number of heat waves will increase substantially in the near future. Therefore, to help focus discussions during Steps 3-5, a climate change 'shortlist' was developed, which included the following four likely outcomes:

1) **More frequent and intense heat waves**

2) **Warmer winters**

3) **More intense rainstorms capable of causing flooding, and**

4) **Shoulder season (spring and fall) cold snaps**

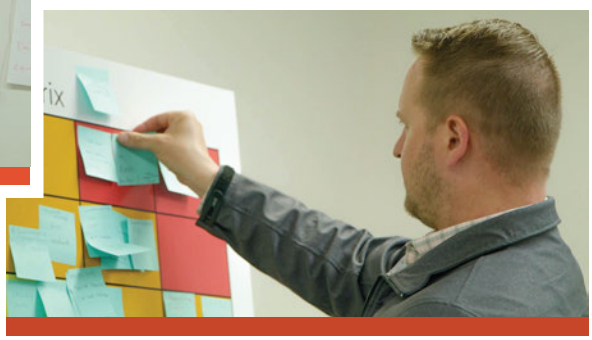


Step 3:
▸ Scope Potential Impacts

After the climate projections were presented in Step 2, the City of Selkirk staff and PCC experts went through each of the four identified climate change outcomes and discussed the implications that each may have on the delivery of municipal services. It became clear as the workshop continued that many of the identified climate changes in Selkirk's future are seasonal and, therefore, impact municipal service delivery differently throughout the year.

This process resulted in a list of potential impacts and opportunities (hereafter simply called 'consequences') that each of the four climatic change outcomes may have on the City of Selkirk. This list was used to complete Step 4, involving the computation of risk associated with each of these consequences.

> *"The lack of snow cover in the winter creates deeper frost levels. So that creates pressure on our pipes, that creates pressure on our road systems, so then we have more water main breaks, we have more potholes and alligator cracking in our roads."*
>
> *- CCAS Project Team Member*



Step 4:
Assess Risks and Opportunities

The City of Selkirk staff participated in a "risk evaluation matrix" activity where the climate change consequences identified in Step 3 were evaluated to determine their level of community defined risk. During this exercise, the team went through the list of consequences and scored each one individually based on its expected likelihood of occurring and its expected magnitude. Consequences with very high likelihood include those that are anticipated to occur multiple times per year, and consequences with very high magnitude include those that put human lives at risk. On the other end of the risk spectrum, consequences that may occur only once in a decade and pose no risk to human health and municipal finances are deemed to have very low likelihood and magnitude ratings. The tables used to define the likelihood and magnitude of consequence can be found in Appendix II.

In the workshop, Selkirk staff collectively decided how to rank the consequence and magnitude for each risk identified, and this was done by placing sticky notes on a large risk evaluation matrix in the room. The risk matrix board was divided into five colour-coded sections, ranging from extreme risk (which includes consequences that have high likelihood and magnitude ratings; red colours) to negligible risk (with low likelihood and magnitude ratings; blue colours). Once all consequences were added to the matrix, a 'risk rating' of 1 to 5 was applied to each consequence, with 5 being the highest (extreme risk) and 1 being the lowest (negligible risk).

For the purpose of this report, adaptation actions were only developed for climate change consequences with a high or extreme risk level. Once each consequence was scored on the risk matrix, the participants discussed the assessment, with PCC support to consider the climate science underlying each risk. In some instances, there was a general and quick consensus that the impact was accurately scored, whereas others had more complex considerations and lengthier discussion. In cases with a large amount of scoring variability among participants, a decision by consensus was made that reflected the diversity of perspectives.

The following four subsections detail the risk activity exercises carried out during the workshop, one for each identified climate change scenario.

a) Increase in the Frequency/Intensity of Heat Waves

As demonstrated by the PCC during Step 2, it is projected that summers in Selkirk will become a lot warmer in the near future (2051-2080). As a result, the City could begin to experience more frequent and intense heat waves. Heatwaves have numerous impacts on City operations and its citizens. Physical heat stress puts vulnerable populations, specifically the elderly and low-income, at greater risk. The City of Selkirk has an older population, and relative to provincial averages, has a higher percentage of residents living in social housing. Heat wave events are especially problematic for these populations because many of them do not have access to air conditioning and, therefore, struggle to stay cool.

City staff who are working outside may also struggle when a heat wave event occurs. Parks and recreation staff often work outside for long hours, cutting grass, or working at the City's pool, and may suffer from physical heat stress if exposed to heat for an extended period of time.

Another concerning consequence of increased frequency and intensity of heat waves is the dry condition of the natural environment. If the heat waves coincide with fewer rainfall events, urban and grass fires have a greater likelihood of starting. Lightning strikes coincide with hot and dry spells may also lead to more fires.

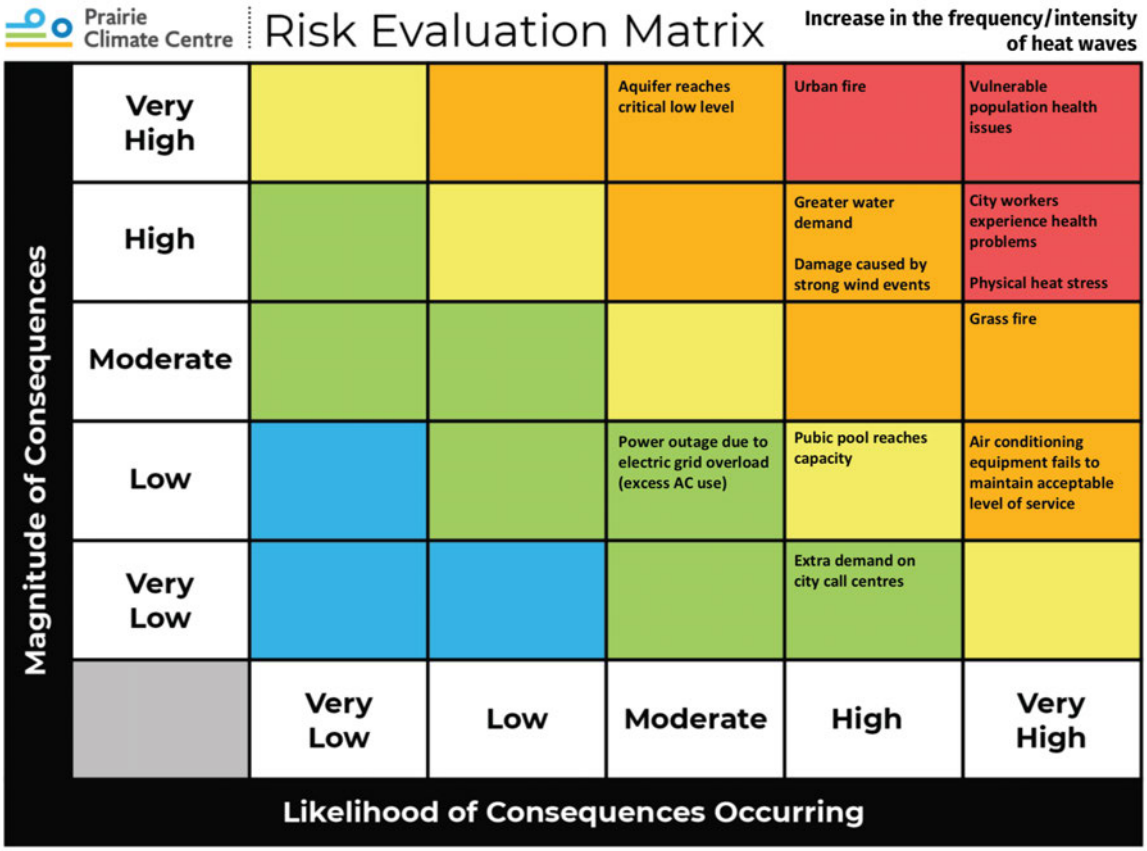


Figure 5: Risks associated with an increase in the frequency and/or intensity of summer heatwaves.

Assess Risks and Opportunities

b) Increase in the Frequency/Intensity of Flooding Rains

Climate science foretells an increase in extreme precipitation events as a result of atmospheric warming. Selkirk is vulnerable to short-term overland flooding, which has historically resulted in sewer backup issues. Overland flooding may lead to additional problems, including uncontrolled release of sewage into the river, road closures, and debris on roads.

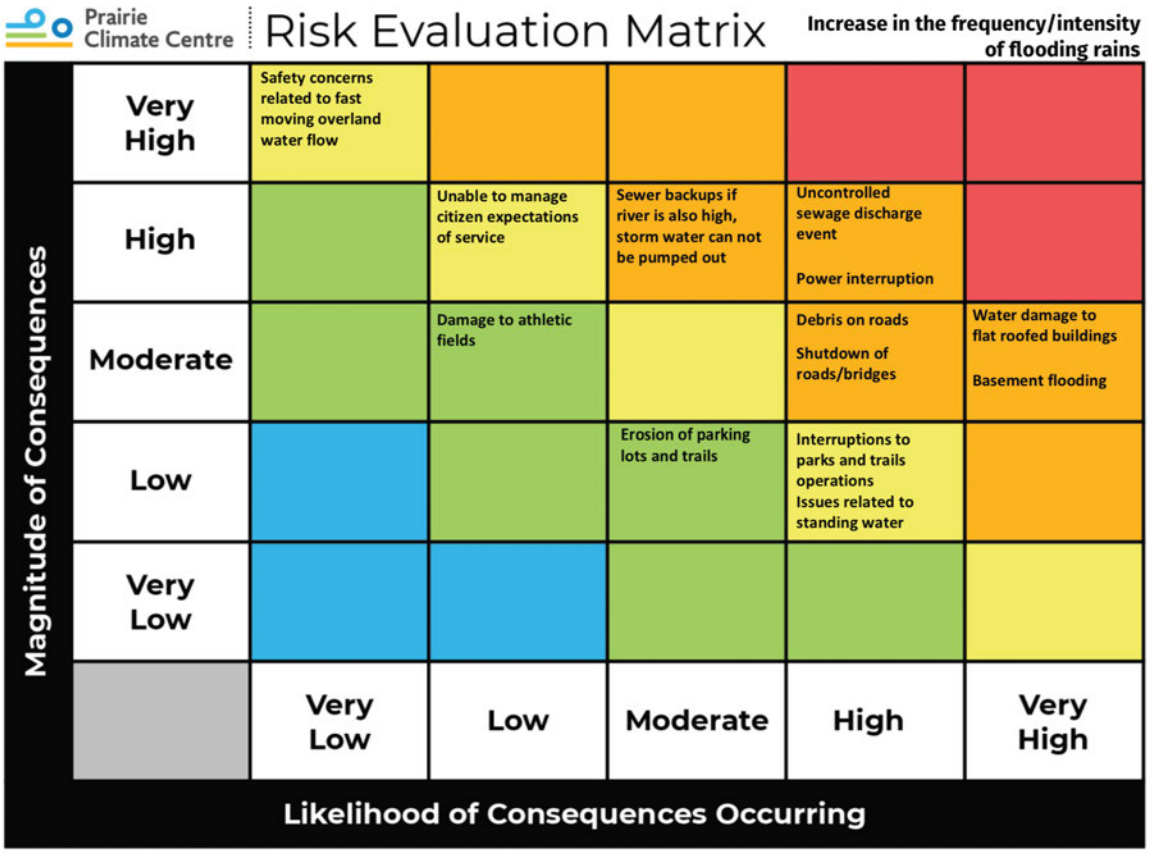


Figure 6: Risks associated with an increase in the frequency and/or intensity of heavy precipitation events capable of producing overland flooding

c) Warmer Winters

Warmer winter temperatures can result in much heavier and wetter snowfalls. The physical activity to shovel these snowfalls can be dangerous for many citizens. City machinery will also have to work harder to remove heavy snowfalls and may lead to an increase in down-time of snow removal equipment due to increased breakdowns.

Precipitation may also fall more frequently as freezing rain or rain. As surface temperatures begin to warm, the chance of freezing rain increases, which can have serious impacts if it accumulates on powerlines, roadways or sidewalks.

With warmer winter temperatures, the number of winter thaw events that occur each year will increase, causing significant problems for land drainage systems. Once snow melts and begins to flow, it often pools in half-frozen culverts and storm mains, and partially or fully block these important drainage systems.

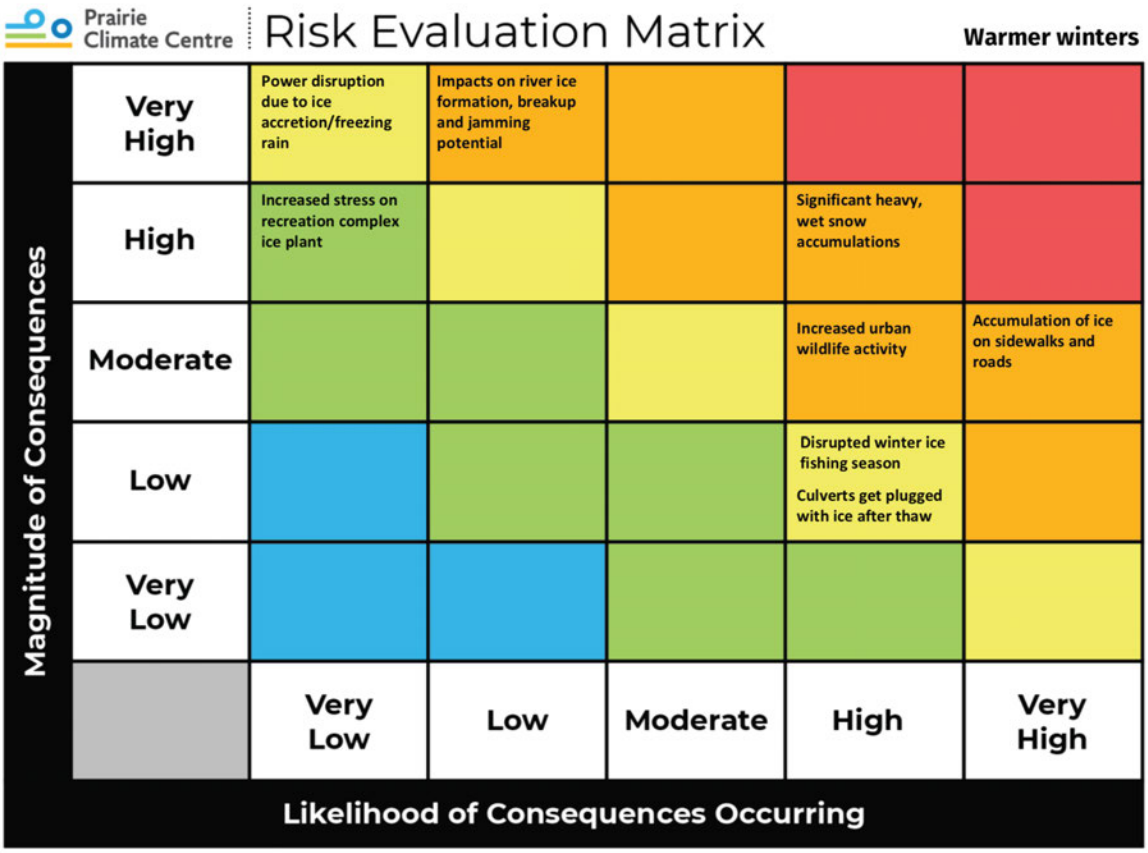


Figure 7: Risks associated with warmer winter temperatures

d) Cold Snaps (Polar Vortex Outbreaks)

Although winters are predicted to get warmer overall, the City of Selkirk is still at risk of increased cold snaps, or polar vortex outbreaks. One of the consequences of these events is the increased stress placed on furnaces and heating systems in buildings, as well as snow removal equipment, resulting in higher maintenance requirements. These extreme cold snaps will also threaten the reliability of fire hydrants; if water accumulates and freezes during a polar vortex outbreak it may leave the hydrant temporarily unusable or cause long-term damage.

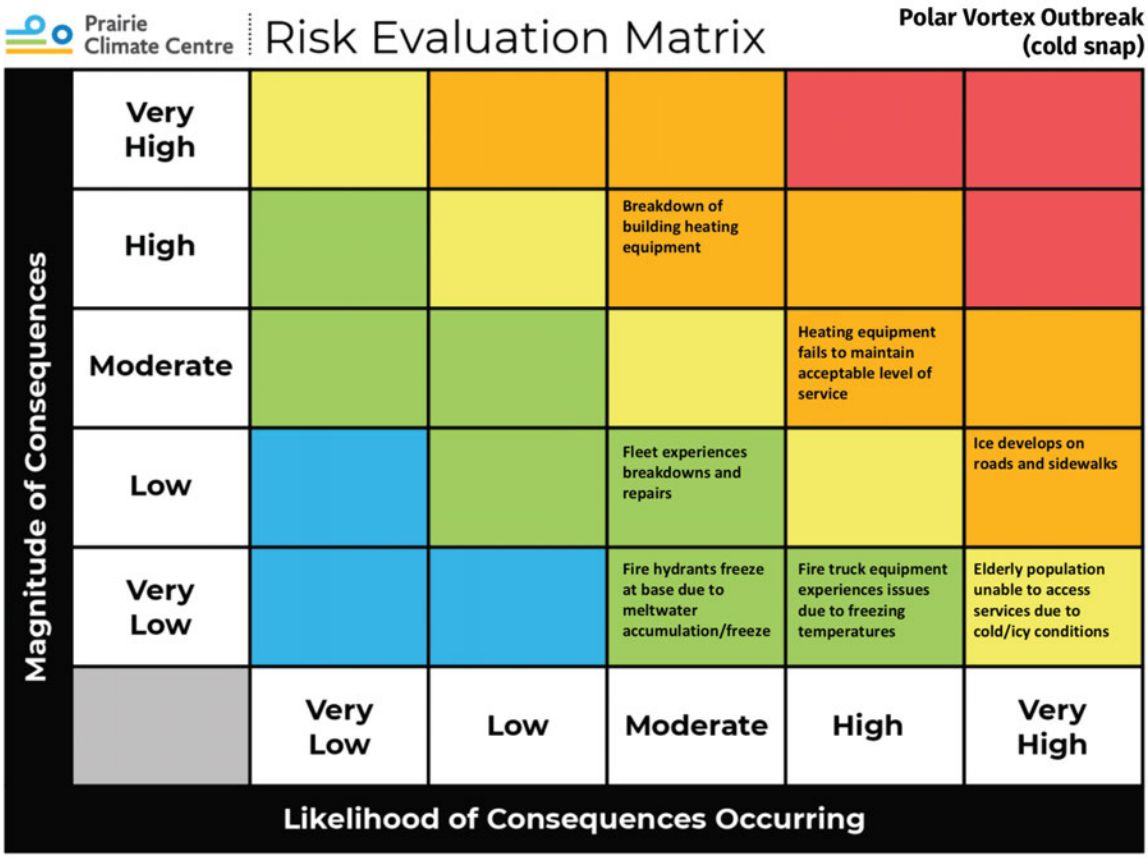


Figure 8: Risks associated with polar-vortex outbreak events during shoulder seasons

> *There will be higher impacts on heat sensitive citizens, so older community, that might live in apartments that don't have air conditioning. That will increase the demand for city buildings that have air conditioning for the times of high heat waves.*

- CCAS Project Team Member

> *I'm concerned about summer storms because of the high rain events. Every time there's a lightning crack and a hard rain, I'm constantly checking the loading of the water on the street. I know when it gets beyond a certain point in front of the house, that we're going to have problems throughout the city.*

- CCAS Project Team Member

> *I find extreme temperatures really hard on our equipment, both hot and cold. We're having a lot more breakdowns with emissions and things like that. It's hard on customers too, trying to keep them either cool or warm. Extreme temperatures are really affecting us.*

- CCAS Project Team Member

Evaluating Risks

At the conclusion of the risk activity exercise, all ranked consequences were compiled into a master list, ordered by risk rating. The risk matrix had five colour codes associated with increasing risk levels to the City of Selkirk, and these colour codes were used to group together impacts with similar risk ratings. The risk codes were:

- **Blue – Negligible Risk**
  No adaptation actions required. *Note: None of the identified consequences fell into this category.*

- **Green – Slight Risk**
  No adaptation actions required at this time; however, ongoing monitoring is required.

- **Yellow – Moderate Risk**
  Adaptation actions should consider addressing these risks.

- **Orange – High Risk**
  Adaptation actions will need to address these risks.

- **Red – Extreme Risk**
  Adaptation actions must address these risks.

After the matrix exercise was completed, all the consequences were ranked by their relative risk evaluations to create a priority table, whereby impacted service areas were identified. This was a critical step, linking City staff, programs, and potentially budget lines to potential climate change impacts and their associated costs.

It is unrealistic to think that upon the completion of the City's first CCAS that adaptation actions will be developed and implemented for each identified consequence; therefore, this list can act as a checklist of high priorities during ongoing adaptation planning process.

Table 6: The final prioritized climate change risks and consequences table. This list helps inform what adaptation actions will have the greatest impact and which service areas will be responsible for implementation.

Risk	Consequence	Municipal Service Area							
●	Physical heat stress			■	■				■
●	Vulnerable population health issues	■			■				■
●	City workers and firefighters experience health problems							■	■
●	Urban fire				■			■	■
●	Breakdown of building heating equipment								■
●	Heating equipment fails to maintain acceptable levels of service								■
●	Ice develops on roads and sidewalks	■	■	■					
●	Aquifer reaches critical low level				■			■	■
●	Greater water demand				■				
●	Air conditioning equipment fails to maintain acceptable level of service	■							■
●	Grass and brush fire			■				■	■
●	Sewer backups if river is also high, storm water must be pumped out					■	■		■
●	Uncontrolled sewage discharge event					■			■
●	Power interruption				■	■			■
●	Debris on roads	■	■				■		
●	Water damage to flat roofed buildings								■
●	Basement flooding					■	■		■
●	Impacts on river ice formation, breakup and jamming potential								■
●	Significant heavy, wet snow accumulation on ground	■	■	■					■
●	Significant heavy, wet snow accumulation on roofs								■
●	Increased urban wildlife activity			■					■
●	Shutdown of roads		■				■		■
●	Damage caused by high winds		■	■					■
●	Elderly population unable to access services due to cold/icy conditions	■	■						■
●	Shutdown of bridge								■
●	Public pool reaches capacity			■					
●	Safety concerns related to fast moving overland water flow						■		■
●	Unable to manage citizen expectations of services								■
●	Interruptions to parks and trails operations			■					
●	Issues related to standing water						■		
●	Power disruption due to ice accretion/freezing rain								■
●	Disrupted winter ice fishing season								■
●	Culverts get plugged with ice after thaw						■		
●	Fire hydrants freeze at base due to melt water accumulation/freeze				■			■	
●	Fleet experiences breakdowns and repairs	■						■	■
●	Firetruck equipment experiences issues due to freezing temperatures							■	■
●	Power outage due to electric grid overload (excess AC use)			■					■
●	Extra demand on city call centres								■
●	Damage to athletic fields			■					
●	Erosion of parking lots and trails		■	■					
●	Increased stress on recreation complex ice plant				■				■

Step 5:
▸ Prepare Final Adaptation Actions

Moving "from risk to resilience" requires creative thinking and leadership. There is no 'right' answer when it comes to developing climate change solutions; however, some solutions are ultimately much more realistic and feasible than others. The next step in the adaptation planning process was to identify and prioritize adaptation actions. The City of Selkirk decided to focus on those consequences that were given high or extreme risk scores during the risk activity exercise.

To ensure the team considered all possible actions, each project team member was asked to complete the "Adaptation Action Planning Worksheets". A sample of these worksheets can be found in Appendix III. Selkirk's team was encouraged to think broadly about the adaptation actions and were informed that the types of action may include (but are not limited to) changes to policy, the introduction of new programs, or public education campaigns.

Given the reality of limited municipal resources, it was critical to screen, rank, and prioritize adaptation actions to identify which were the most realistic to implement. To do this, Selkirk's team came together in a series of workshops to rank each brainstormed adaptation action for each identified climate change consequence. Each adaptation action was evaluated on a scale of 1 to 4, in six different categories. Proposed adaptation actions were scored based on:

1) **Effectiveness**
2) **Affordability**
3) **Feasibility**
4) **Acceptability**
5) **Equitability**
6) **Flexibility**

Table 7 shows the decision-making criteria that each adaptation action was evaluated against.

Prepare Final Adaptation Actions

Table 7: Evaluation Criteria for Prioritizing Climate Change Adaptation Actions.

Criteria	Score 1	Score 2	Score 3	Score 4
Effectiveness	Minor Contribution to effective management of risk			Vital to effective management of risk and achievement of objectives
Affordability	Requires significant additional budget for implementation			Can be completed within planned budgets
Feasibility	Lack of human, legal knowledge, technical, or administrative capacity to implement			Sufficient human, legal, knowledge, technical and administrative capacity to implement
Acceptability	Significant pushback likely from specific stakeholders, elected officials			Supported by majority of stakeholders, elected officials
Equitability	Has unintended or undesirable distributional effects			Costs and benefit equally shared across community
Flexibility	Difficult to reverse, inflexible			Easy to scale up or down, flexible, no regret

Once each adaptation action was scored based on the six evaluation criteria, the sum of the scores was calculated and this became the assessment score of the adaptation action. The idea behind the assessment score is that the higher the value, the higher priority that action should have.

The project team also scored adaptation strategies in terms of decision-making factors (table 8):

1) Investment costs **2) Annual recurring costs** **3) Implementation timeframe**

The criteria and scale in table 8 was used to gauge the overall cost of selecting a specific adaptation action – including implementation and operating costs – as well as the timeframe it would take to implement. This table allowed for the comparison of different adaptation actions for each climate change consequence. As a result, individual actions can be selected based on not only on criteria, but also the cost and length of time required to implement the action.

Table 8: Key Information to Support Decision-making during Climate Change Adaptation Planning.

Criteria	*Score 1*	*Score 2*	*Score 3*	*Score 4*
Investment Cost *(Implementation)*	$ (<$25,000)	$$ ($25,000-$74,999)	$$$ ($75,000 - $199,999)	$$$$ (> $200,000)
Annual Cost *(Recurring)*	$ (<$5,000)	$$ ($5,000 - $19,999)	$$$ ($20,000 - $49,999)	$$$$ (> $50,000)
Timeframe *(to have action implemented by)*	Short Term (< 3 Years)	Medium Term (3-6 Years)	Long Term (> 6 Years)	On Going

The specific outcomes of these workshops – which matched climate consequences with possible climate adaptation actions – are displayed in Table 9. Each of the adaptation actions that had a high or extreme risk rating were given a score. The scores were derived as a group and agreed upon during a workshop with all of Selkirk's team members.

This type of ranking approach shows that the higher the cumulative assessment score, the more preferred the action. The evaluation of each adaptation action against investment and recurring costs will help prioritize climate adaptation actions for the City of Selkirk. Once all actions are evaluated, a priority action list ranked from highest to lowest assessment score will help to generate a portfolio of 'preferred actions' for consideration later in the CCAS.

The list of climate change adaptation actions that is presented below is a checklist for senior management to consider when evaluating potential adaptation actions. When finalizing this list, many adaptation actions were eliminated from consideration if they failed to align with overall City strategic prioroties; there was overlap or redudancy with alternative climate change adaptation actions; and if adaptation action assessment scores were simply too low.

Table 9: Climate consequences and corresponding adaptation actions with assessment score

Climate Consequence	Adaptation Action	Assessment Score
1. *Physical heat stress due to more frequent and intense heatwaves*	***1.1*** *Develop a community plan that sees public buildings, such as the recreation complex, open as emergency cooling sites.*	***22***
	1.2 *Develop a public awareness campaign to provide education on being safe during a heat event, and how to recognize early symptoms of heat exhaustion.*	***18***
	1.3 *Develop a street tree program to increase shade and decrease urban heat island effect in order to mitigate the impact of more frequent and intense heatwaves.*	***17***
2. *City workers and firefighters to experience health problems due to more frequent and intense heatwaves*	***2.1*** *Review policy and procedures for outdoor workers - complete a thorough review of existing policies and procedures on working outdoors in extreme temperatures. Revise policy as necessary, while taking into consideration climate change and the predicted increased number of +30° C days.*	***24***
	2.2 *Develop a training program for staff to manage heat stress. This program will assist staff in identifying warning signs of heat stress, how to appropriately dress for extreme head, as well as how to change behaviours thorough the workday during a heatwave.*	***23***
	2.3 *Supply heat-smart, lightweight clothing and personal protective equipment to staff working outdoors.*	***21***
	2.4 *Add cabs or sunshades to equipment. Increasing shade cover or cabs that allow airflow on equipment such as grass cutting equipment will help employees deal with heat stress during heatwaves.*	***21***
	2.5 *Shift regular work hours for staff working outside in summer heat. Shifting regular work hours for staff members working outside during intense heatwaves to avoid exposure during peak sun hours.*	***19***

Table 9: Climate consequences and corresponding adaptation actions with assessment score

Climate Consequence	Adaptation Action	Assessment Score
3. *Increase in urban fire/grass fire due to more frequent and intense heatwaves.*	***3.1*** *Do a study on what would be required to be recognized as a FireSmart City by FireSmart Canada.*	***21***
	3.2 *Develop a fire-ban by-law that outlines what it means to implement a fire ban as well as when the City finds it suitable to enforce.*	***20***
	3.3 *Develop a fire suppression incentive for property owners in the downtown area, or in old buildings so that in the case of a fire, it is contained to one property and does not spread rapidly.*	***18***
4. *Breakdown of building heat equipment due to cold snaps, or polar vortex outbreaks.*	***4.1*** *Develop a Check-In with your Neighbor program that encourages community relationship building. The idea behind this is that in times of major cold snaps, or polar vortex outbreaks that may lead to the breakdown of heating equipment, vulnerable populations will have someone checking in on them to ensure their safety.*	***21***
	4.2 *Develop a power outage plan that includes education for people so that they know what to do in the case of a long-term power outage, where building heating equipment has the potential to breakdown.*	***21***
5. *Heating Equipment fails to maintain acceptable levels of service for City offices due to cold snaps and polar vortex outbreaks.*	***5.1*** *Continue to develop the Capital Asset Management program; specifically by extending the program to include building components and specialized building equipment into the program.*	***23***
	5.2 *Develop a facility strategy that requires the consideration of passive heating systems in all new city builds.*	***21***
	5.3 *Establish a flexible work arrangement, or work from home program/policy that allow staff whose jobs can be successfully completed off-site to do so.*	***19***

Table 9: Climate consequences and corresponding adaptation actions with assessment score

Climate Consequence	Adaptation Action	Assessment Score
6. *Ice develops on roads and sidewalks due to cold snaps and polar vortex outbreaks.*	***6.1*** *Expand the Capital Asset Management Program to include fleet, as well as develop a fleet management strategy to ensure machinery and equipment is sized according to needs and that the City has the best equipment required for the task.*	***23***
	6.2 *Conduct a pilot program that uses a pre-wetting brine solution before salting or sanding roads. This will prevent snow and ice from adhering to concrete which ultimately would decrease the difficulty of removing snow.*	***20***
	6.3 *Replace traditional salt and sand mixtures (which are only effective to a certain temperature) for traction control, with new traction mixtures such as fine granite chips.*	***17***
7. *Aquifer reaches critically low level due to frequent and intense heatwaves.*	***7.1*** *Develop a policy that reduces water pressure during the summer months to assist in reducing water consumption during times when aquifer recharge may be less.*	***21***
	7.2 *Use the scata system to actively monitor aquifer levels during the summer months to ensure adequate notice if the aquifer does unfact reach a critically low level.*	***21***
	7.3 *Develop a low water plan to be implemented at high risk time. This would include the review of existing plans and developing a policy for this type of emergency.*	***20***
	7.4 *Explore a progressive water pricing system. This system would see the unit cost of water increasing with use in hopes of deterring excess water use.*	***17***
8. *Greater water demand due to frequent and intense heatwaves*	***8.1*** *Develop a water conservation rebate program throughout the summer months to assist in water preservation.*	***19***
	8.2 *Develop a rain barrel program and encourage use for gardens/grass/recreation during the summer months.*	***19***

Table 9: Climate consequences and corresponding adaptation actions with assessment score

Climate Consequence	Adaptation Action	Assessment Score
8. *Greater water demand due to frequent and intense heatwaves*	***8.3*** *Explore a progressive water pricing system. This system would see the unit cost of water increasing with use in hopes of deterring excess water use.*	***17***
	8.4 *Explore increasing the price of water when weather is warmer and there is greater demand/consumption due to grass cutting, filling of pools etc.*	***17***
	8.5 *Introduce drought tolerant landscaping on public and private properties to be better prepared for drier summers.*	***15***
9. *Air conditioning equipment fails to maintain acceptable levels of service due to more frequent and intense heatwaves.*	***9.1*** *Continue to develop the City's Capital Asset Management Program and extend the program to include building components and specialized building equipment. This will ensure that buildings, and their components, are appropriately decommissioned at the end of their useful lives.*	***23***
	9.2 *Establish a flexible work arrangement policy, or work from home program that will allow staff who to work off-site, if their work allows.*	***19***
	9.3 *Develop a street tree program to increase shade and decrease urban heat island effect to mitigate the impact of more frequent and intense heatwaves.*	***17***
10. *Due to more frequent and intense rainfalls, sewers may back up if river is also high during a storm event. This will require storm water to be pumped out to prevent basement flooding.*	***10.1*** *Conduct a study on the capacity of the storm water system. This study shall include a cost/benefit analysis on increasing the capacity of storm water pipes to determined if current practice is of large enough capacity to handle predicted increase in precipitation that is to come from intense storm events.*	***20***
	10.2 *Develop a street tree program to increase the amount of storm water that is used, and ultimately redirected from the combined storm sewer network.*	***17***
	10.3 *Depending on the outcome of a study conducted (10.1), redesign and construct outfalls with lift and pump capabilities.*	***16***
	10.4 *Incorporate storm sewer separation program into the Capital Asset Management Program renewal plan.*	***14***

Table 9: Climate consequences and corresponding adaptation actions with assessment score

Climate Consequence	Adaptation Action	Assessment Score
11. *Uncontrolled sewage discharge due to more frequent and intense rainfall events.*	***11.1*** *Develop a street tree program to increase the amount of storm water that is used before it makes its way to the combined sewer system.*	***17***
12. *Power interruptions due to ice accretion or freezing rain events due to warmer winter temperatures.*	***12.1*** *Develop a community plan that sees public buildings such as the recreation complex open as emergency warming sites.*	***22***
	12.2 *Install natural gas generators as public buildings to use in emergency situations.*	***19***
	12.3 *Use city buses as stationary working refuges outside of multi-family dwellings during a power interruption, or extreme heatwaves.*	***14***
13. *Debris on road due to more frequent and intense rain events*	***13.1*** *Develop a policy and protocol to manage clean-up after storm events. Identifying the process to be followed if a storm occurs outside of usual business hours is critical.*	***23***
	13.2 *Develop a street tree program to increase shade and decrease heat island effect to mitigate the impact of more frequent and intense heatwaves. Street tree program will also include a maintenance program that will ensure trees are healthy, making them more resilient to storm events.*	***17***
14. *Water damage to flat roofed buildings due to more frequent and intense rain events.*	***14.1*** *Expand CAMP by Developing individual facility maintenance plans for all City owned Facilities. Assess all buildings and components to gauge current condition and prioritize capital projects.*	***22***
15. *Basement flooding due to more frequent and intense rain events.*	***15.1*** *Develop a street tree program to increase the amount of storm water that is diverted from the combined sewer system*	***17***
	15.2 *Develop an incentive program to encourage the installation of backwater valves and sump pumps in residential buildings.*	***17***

Table 9: Climate consequences and corresponding adaptation actions with assessment score

Climate Consequence	Adaptation Action	Assessment Score
15. *Basement flooding due to more frequent and intense rain events.*	***15.3*** *Develop policy incentives that encourage porous driveways, and less impermeable surfaces to allow for the proper drainage of water and management of storm water. This may also include planting trees or shrubs that use a lot of water and may decrease the risk of basement flooding.*	***17***
16. *Impacts of river ice formation, breakup and jamming potential due to warmer winters.*	***16.1*** *Develop a community plan that sees public buildings being open as emergency sites when overland flooding is occurring due to ice jams and seasonal melt.*	***22***
17. *Significant heavy, wet snow accumulation on ground due to warmer winters.*	***17.1*** *Develop a fleet management strategy as a part of the Capital Asset Management Program to ensure that machinery and equipment is sized according to needs and that the City has the best equipment required to complete the task.*	***23***
18. *Significant heavy, wet snow accumulation on roofs due to warmer winters.*	***18.1*** *Continue the development of the City's CAMP; specifically extending the program to include building components and specialized building equipment. This involves routine inspections of all facilities and their components, such as roof integrity.*	***23***
	18.2 *Develop a program that has snow accumulation removed from flat roofs of City owned buildings.*	***18***
	18.3 *Conduct a simple snow load risk assessment of municipal facilities to determine high risk facilities and help to prioritize now clearing and maintenance operations.*	***18***
19. *Increased urban wildlife activity due to warmer winters.*	***19.1*** *Develop a public education program on the dangers of feeding wild animals, detailing how less attraction and early reporting can quickly lessen risk.*	***18***
	19.2 *Increase the number of staff trained to deal with the higher frequency of wildlife activity.*	***18***

Table 9: Climate consequences and corresponding adaptation actions with assessment score

Climate Consequence	Adaptation Action	Assessment Score
20. *Shut down of roads due to more frequent and intense rainfall events.*	***20.1*** *Develop a street tree program to increase the amount of water that is diverted from the combined sewer system.*	***17***
	20.2 *Based on the conclusions of a storm sewer capacity study, increase the capacity of the storm drainage system so that it can manage the levels of precipitation that will come as extreme rainfall events increase in capacity as well as frequency.*	***13***
21. *Damage caused by high winds due to more frequency and intense heatwaves*	***21.1*** *Develop a street tree program that includes maintenance schedules which ultimately would improve the health of the trees and increase resilience to high winds.*	***17***
22. *Elderly population unable to access services due to cold/icy conditions due to cold snaps or polar vortex outbreaks.*	***22.1*** *Develop a policy that allows for increase service of Selkirk Mobility during extreme weather events. This would add additional mobility buses or increase service hours to ensure the elderly population is not without access to services when conditions are extremely cold. This would require a service agreements to ensure seniors are contacted during polar vortex outbreaks.*	***14***

A draft of the Climate Change Adaptation Implementation Strategy – including risk prioritization and association adaptation actions and cost ranking – was presented to Selkirk's senior management and front-line workers to identify any improvements to be made prior to the document being presented to council. This iterative and inclusive approach ensures that the CCAS is robust and supported by the City of Selkirk and its citizens.

Step 6:
Adopt, Implement, Monitor and Review

It will be important to implement the adaptation actions and monitor their effectiveness. One of the most important characteristics of a CCAS is the ability to revisit, review and update the plan as necessary. The CCAS is a dynamic strategy and it provides multiple viable options for how the City can alter current service delivery to adapt to climate change. Importantly, the CCAS is in line and strongly supports prioritized outlined in the City of Selkirk 2014 Strategic Plan.

To be a vibrant, safe, and healthy community.

Each adaptation action identified by this strategy contributes to the Strategic Plan's first priority, which is to be a vibrant, safe, and healthy community. Our city should be a community of choice for people of all ages and backgrounds who want to pursue fulfilling, promising, healthy lives. It should be a place where everyone feels empowered to help shape the city's future. By the continued development of Selkirk's natural features and outdoor spaces, we encourage our citizens to partake in an abundance of opportunities for healthy outdoor activities year around. The development of the City's street tree program is an adaptation action that will reduce risks to multiple consequences of climate change, but it will also contribute to the continued development of Selkirk's natural features and outdoor spaces over the long term.

Ensure safe and sustainable infrastructure.

To assure citizens of long-term reliability and affordability, the city needs a forward-looking plan that is fiscally responsible and aligned with expectations for new development, as well as addresses risk presented by a constantly changing climate. Recognizing climate change, and specifically the consequences it will have on future service delivery, is a crucial consideration when addressing sustainability. This CCAS will assist to enhance or maintain the long-term reliability of municipal services and infrastructure.

Maximum value from community resources.

The people of Selkirk deserve the best return from municipal investments and operations. To deliver on that promise, the city government must continue to strike the right balance of efficiency, effectiveness and long-term affordability in all of its plans and programs. The approval of this CCAS and the development of the associated implementation strategy commits the City to improving management of assets and expenditures based on capital asset management best practices, while also ensuring that strong consideration is given to the future challenges under a changing climate.

Environmental Stewardship

The City of Selkirk is committed to environmental sustainability and protecting the natural features and resources that are important to the community. With the CCAS, The City has further enhanced its dedication to environmental stewardship, and is now in a position to strategically approach the issue of climate change in a manner that reduces risks and improves City practices and services and ensures the safety of its staff and citizens now and in the future.

Next Steps: Business Planning Process

One of the challenges to successful implementation of adaptation plans is the how these efforts are "mainstreamed" into pre-existing business and governance systems. Once the climate change adaptation strategy receives the approval of council, it will be moved to officially become part of the City of Selkirk's long-term business planning process. To achieve this, the adaptation actions highlighted (table 9) have been converted into tactics (table 10). In this form, the tactics will then be placed in tactical worksheets, which is the City's process by which strategic plans get aligned and integrated into annual budgets, timelines and associated project implementation. Critically, these tactical worksheets are linked the City's capital asset management program, which tracks and accounts for both the immediate and longer-term financial implications of initiatives such as climate change adaptation planning. In this way, Senior management can understand and manage the financial lifecycle of a multi-year tactical plan across projects. This demonstrates Selkirk's long term commitment to adaptation and how budgeting, planning, and governance fit together to ensure that proposed climate adaptation actions gets completed.

Becoming resilient to climate change is not a static process, and therefore it is crucial that the City develop a schedule in which the CCAS is reviewed and updated. To ensure that the City's adaptation actions remain relevant and successful – for current and future climate change – the CCAS should be reviewed and updated regularly. These updates should reflect on lessons learned, incorporate the latest climate projection data, and continue to match with the ongoing strategic priority setting of the City.

> ***"We don't know what's going to happen so we're sort of fearful of that, but if we're a little more aware of what the impacts are actually going to be, and we actually have a plan... This whole effort is to make it manageable."***
>
> ***- CCAS Project Team Member***

Table 10: Table of Tactics for incorporation into Selkirk's business planning process, including related adaptation actions and timeframe of expected implementation.

Tactic	Related Adaptation Action	City of Selkirk's Strategic Plan #s	2019	2020	2021	MEDIUM TERM 2022-2025	LONG TERM 2026-2029
Establish a Street Tree Program *Program would include policies, procedures and budget allocations to guide and facilitate the planting and maintenance of trees along municipal rights-of-way.*	*1.3, 9.3, 10.2, 11.1, 13.2, 15.1, 20.1*	*1A, 5B*	✓				
Implement Street Tree Program *Begin the strategic planting of street trees as determined by the established street tree program.*	*1.3*	*1A, 5B*		✓	✓	✓	✓
Establish a Tree Inventory *Leveraging the Province of Manitoba's pilot project, conduct a survey of trees on city property and establish a detailed inventory within the City's GIS system.*	*1.3*	*1A, 4A*	✓	✓	✓		
Establish an Urban Forest Program *Program would include policies, procedures, tools and budget allocations necessary to ensure the city has the capacity to proactively manage and ensure the health of its urban forest (street trees, park trees)*	*1.3, 13.1, 13.2, 21.1*	*1A, 5A*			✓		
Establish an Aquifer Monitoring Program *Program would include policies, procedures, tools and budget allocation necessary to measure, track and report on the capacity and health of the aquifer upon which the city's potable water supply depends.*	*7.2*	*3A, 4A*			✓		
Prepare an updated Water Master Plan using climate change projection *Undertake a review of the City's potable water master plan to ensure the impacts of climate change are considered in the demand and supply projections and determinations of the system's capacity.*	*7.2*	*3A*				✓	
Create a policy and protocol for responding to water shortage events *Develop and implement policies that guide the city's response to short and long-term potable water shortages.*	*7.2, 7.3, 7.4, 8.1, 8.2, 8.4, 8.5*	*3A, 5C*				✓	

Table 10: Table of Tactics for incorporation into Selkirk's business planning process, including related adaptation actions and timeframe of expected implementation.

Tactic	Related Adaptation Action	City of Selkirk's Strategic Plan #s	2019	2020	2021	MEDIUM TERM 2022-2025	LONG TERM 2026-2029
Include extreme heat & cold respite services as objectives in the recreation facilities feasibility studies *When the City undertakes feasibility studies for the replacement of the Selkirk Arena and Memorial Hall, include an evaluation of the potential for providing extreme heat & cold respite in the new facilities.*	***1.1, 4.2, 5.2, 12.1***	***1A, 5B***	✓				
Create a policy and protocol for municipal service delivery during extreme heat and cold events *Develop and implement policies that guide the delivery of municipal services during extreme heat and cold events. The policy would guide how the city manages internal resources to mitigate risk to staff and assets, and the type and level of services (including communication) the city would provide to mitigate impacts on citizens.*	***1.1, 1.2, 2.1, 2.3, 2.5, 4.1, 4.2, 5.3, 9.2, 12.1, 12.3, 16.1, 22.1***	***1A, 5B***		✓			
Amend Asset Management Risk Policy to give greater priority to wastewater renewal projects that include storm sewer separation *Enhance the AM Risk Policy to make storm-sewer separation projects more critical in the annual evaluation and prioritization of infrastructure projects.*	***10.4***	***1A, 4A***	✓				
Conduct Land Drainage Improvement Study *Using incident reporting and other data, identify existing land-drainage problem areas, and areas anticipated to be problematic under climate change scenarios, and proposal improvements to the systems to reduce or eliminate drainage problems.*	***1.3, 13.1, 13.2, 21.1***	***1A, 5A***			✓		
Implement Land Drainage Improvement Study *Amend Asset Management Risk Policy to give greater priority to storm water renewal projects that support the implementation of the Land Drainage Improvement Study.*	***10.1, 10.3, 20.2***	***3A, 4A***				✓	✓

Conclusion

The City of Selkirk is taking a proactive approach and is committed to becoming a leader in climate change adaptation. This strategy shows the commitment of council and city administration to building a more resilient and livable community. By mainstreaming the outcomes of this strategy and incorporating adaptation actions into regular business planning processes, the city is committed to ensuring that climate adaptation action is real and that the CCAS and associated report is not an initiative that simply sits on a shelf.

The city recognizes that this document is only the beginning of its climate change adaptation journey, and that this is a living document that will require consistent review and updates based on lessons learned. With new data, comes new solutions and the city is dedicated to maintaining the currency of this document. We are confident that together this document paired with the Climate Change Local Action Plan will support future generations with successfully navigating the complexities of climate change.[xxii]

As a testament to the efforts put into the City of Selkirk's Climate Change Adaptation Strategy, Catherine McKenna – Federal Minister of the Environment and Climate Change – made a special visit to Selkirk in August 2018. Minister McKenna met members of Selkirk's CAMP team along with the Selkirk Council to discuss the development and progress of the Climate Change Adaptation Strategy.

> ***"It's great to come to Selkirk and see you are doing this and thinking longer term. I like the fact that you're thinking about systems change. It's a made in MB solution."***
>
> ***- Minister Catherine McKenna***
> ***Environment and Climate Change Canada***

As one of the few cities in Canada developing a climate adaptation asset management plan, Selkirk is on the frontlines of preparedness, which should reassure citizens that the City is focused on continued sustainability and affordability of the services it provides. In this way, the City of Selkirk is acting locally while thinking globally about climate change.

Glossary

Adaptation Action
Any initiative or action that seeks to reduce the vulnerability of social, ecological, physical and economic systems to changing climate conditions over the long term.

Climate Change Consequence
The result or effect that each climate change impact has on municipal service delivery.

Climate Change Impact
The weather-related changes that occur as a result of our changing climate.

Coldest Minimum Temperatures
The very coldest temperature of the year.

Cooling Degree Days
Equal to the number of degrees Celsius a given day's mean temperature is above 18°C. For example, if the daily mean temperature is 21°C, the CDD value for that day is equal to 3°C. If the daily mean temperature is below 18°C, the CDD value for that day is set to zero.

Freeze-Thaw Cycles
A count of days when the air temperature fluctuates between freezing and non-freezing temperatures. Under these conditions, it is likely that some water at the surface is both liquid and ice at some point during the 24- hour period.

Freezing Degree Days
These days begin to accumulate when the daily mean temperature drops below freezing: if a day's mean temperature is -21°C, it increases the annual FDD value by 21. Days when the mean temperature is 0°C or warmer do not contribute to the annual sum.

Frost Days
A frost day is one on which the coldest temperature of the day is lower than 0°C. Under these conditions frost might form at ground level or on colder surfaces. The number of frost days is an indicator of the length and severity of the winter season.

Greenhouse Gases
These are gases that can absorb and emit thermal infrared (heat) energy. The most important greenhouse gases in the atmosphere include water vapor, carbon dioxide, methane, nitrous oxide and ozone. Without any greenhouse gases in its atmosphere, earth would be too cold to support life as we know it. However, too high a concentration of greenhouse gases in the atmosphere can result in a dangerous level of planetary warming.

Heating Degree Days
Equal to the number of degrees Celsius a given day's mean temperature is below 18°C. For example, if the daily mean temperature is 12°C, the HDD value for that day is equal to 6°C. If the daily mean temperature is above 18°C, the HDD value for that day is set to zero.

Icing Days
A day on which the air temperature does not go above freezing (0°C)

Mean Temperature
The average temperature (e.g. single day, annual, spring, fall, summer, or winter).

Maximum Temperature
The highest temperature achieved in a day, season, or annually.

Minimum Temperature
The lowest temperature reached in a day, season, or annually.

Summer Days
Is when the temperature rises to at least 25°C.

Tropical Nights
When the lowest temperature of the day does not go below 20°C.

Very Cold Days (-30)
A day when the temperature drops to at least -30°C.

Very Hot Days (+30)
When the temperature rises above 30°C.

Warmest Maximum Temperature
The highest temperature of the year. When temperatures are very hot, people are much more likely to suffer from heat exhaustion and heat stroke.

Appendix I
Timeline of CCAS Development Process

Table 11: Detailed explanation of CCAS planning process timeline

Date	Activity
	Partnership Initiation *Discussion between PCC and City of Selkirk about potential collaboration on the development of the Climate Change Adaptation Plan begin.*
June 8, 2018	***Summary of Climate Changes Selkirk can anticipate.*** *PCC provided Selkirk with a summary of projected climate changes that are to be expected in the future in the City, based on the information sourced from the Climate Atlas. City staff were to review before first workshop in order to get a basic understanding of trends that are to be expected.*
	Pre-workshop Questionnaire *Questionnaire regarding each participant experience with climate change in the past is completed by all City of Selkirk Staff that participated in the Climate Adaptation workshops.*
June 11, 2018	***First Climate Change Adaptation Workshop with PCC*** *This workshop began with a roundtable conversation between PCC and CoS staff discussing past weather and climate trends staff have observed, and specifically relating it back to how it has impacted them in their positions.* *This was followed by a presentation that introduced how the Climate Atlas works and a tour that demonstrated how to extract data on how climate is projected to change in both the City of Selkirk, and on a regional scale.* *Based on the climate projections for the City of Selkirk, participants then identified future climate risk and opportunity events, as well as the consequences that these changes may have on each of the different service areas that Selkirk is responsible for. The consequences that were brainstormed this activity were then used in a Risk Matrix Activity, where participants scored each of the consequences based on the Likelihood of Occurrence, and the Magnitude of consequence. The objective of this exercise was to develop a ranked priority list that could be used for decision making and determining priorities for action planning.* *This prioritization list of consequences to be addressed was the main deliverable from workshop one and is key for the work that is to be done in workshop 2.* *PCC developed a report that summarized the outcomes of this initial workshop.*

Appendix I
Timeline of CCAS Development Process

Table 11: Detailed explanation of CCAS planning process timeline

Date	Activity
June 27, 2018	***Second Climate Change Adaptation Workshop with PCC*** *The second workshop with Prairie Climate Centre summarized the work that was done in the first workshop. Prairie Climate Centre went through the prioritized list of climates consequences and identified which service areas would be impacted by each consequence. From this list, the group participated in an activity that assisted in understanding the process to be used in identifying potential adaptation actions. A few examples were worked through as a group – but the generation of potential adaptation actions for climate change consequence was assigned to the group as a take home activity. The "Adaptation Action Planning Handout" worksheet found in Appendix III was used to brainstorm adaptation actions for each prioritized consequence.*
August 16, 2019	***Completion of Adaptation Action Planning Handouts*** *Participants to return "Adaptation Action Planning Handouts" to Megan. Each participant completed worksheet shall have 3 adaptation actions for each climate change consequence that has been identified as a priority.*
August 24, 2018	***First Adaptation Action Planning Workshop*** *This workshop collected all of the potential adaptation actions that could be taken by the City of Selkirk to address climate change consequences that were of the greatest risk to the City, and evaluated them in terms of likelihood of implementation, cost and time required to implement.*
August 28, 2018	***Second Adaptation Action Planning Workshop*** *Continuation of the First Adaptation Action Planning Workshop. The deliverable at the end of this step was a list of adaptation actions that could potentially be included in the final climate change adaptation strategy.*
September/October, 2018	***Development of Draft Climate Change Adaptation Strategy*** *Several drafts of the Climate Change Adaptation Strategy were developed by City of Selkirk staff, and the final draft was sent off to PCC for their review.*
December 12, 2018	***Adaptation Action Selection*** *Based on the scores each adaptation action received in the Adaptation Action Planning workshops, the most likely actions were selected and compiled into a master list.*

Appendix I
Timeline of CCAS Development Process

Table 11: Detailed explanation of CCAS planning process timeline

Date	Activity
January 25, 2019	***Tactic Development*** *Climate Change Adaptation Strategy Tactics were developed, and each tactic identifies which if the prioritized adaptation actions would be addressed by the tactic.*
Next Steps:	***Approval of Climate Change Adaptation Strategy by Council*** ***Tactical Worksheet Development*** ***Integrate with Multi-Year Tactical Plan & budget***

Appendix II
Magnitude of Consequence

Table 12: Table provided to participants to gauge the magnitude of identified consequence

Magnitude Rank	Explanation*
Very Low	*Temporary disruption to normal operations*
Low	*Minor damage to asset, resulting in short term disruption of services*
Medium	*Damage to asset, resulting in medium term disruption to services and/or environmental impacts*
High	*Widespread damage to asset, resulting in long-term disruption to services/has a major impact on municipal finances/impacts human livelihood*
Very High	*Complete loss of asset and/or loss of human life*

** The City's adaptive capacity was also factored into the magnitude calculation (a high adaptive capacity led to a lower score than it may have otherwise received).*

Appendix II
Magnitude of Consequence

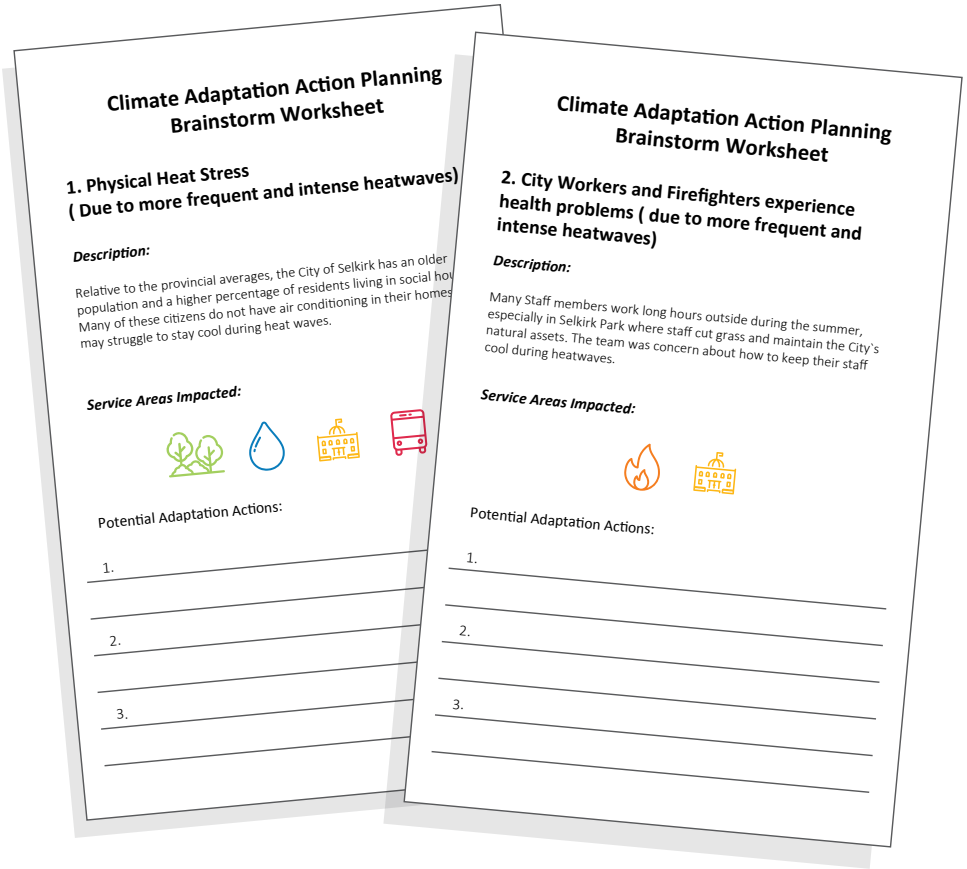
Table 13: Table provided to participants to gauge the likelihood of identified consequence

Very Low	*Low*	*Medium*	*High*	*Very High*
Occurs once per lifetime	*Occurs once every decade or so*	*Occurs once every few years*	*Occurs once per year*	*Occurs multiple times per year*

Note: the likelihood calculation considered future climate risks where possible. For example, if the present-day likelihood of a heat-wave related consequence was low, then future risk was shifted higher on the scale.

Appendix III
Adaptation Action Planning Worksheet

Samples



Sources

[i] IPCC. (2015). Climate Change 2014: Synthesis Report of the IPCC Fifth Assessment Report. Retrieved from: *https://www.ipcc.ch/report/ar5/syr/*

[ii] IPCC. (2018). Special Report: Global Warming of 1.5 °C. Retrieved from: *https://www.ipcc.ch/sr15/*

[iii] Government of Canada. (2015). The Science of Climate Change. Retrieved from: *https://www.canada.ca/en/environment-climate-change/services/climate-change/science-research-data/science.html*

[iv] Government of Canada. (2019). Environment and Climate Change Canada: Climate Data Viewer. Retrieved from: *https://climate-viewer.canada.ca*

[v] City of Barrie. (2017). Climate Change Adaptation Strategy. Retrieved from: *https://www.barrie.ca/Living/Environment/Conservation/Pages/Climate-Change.aspx*

[vi] Prairie Climate Centre. (2018). The Climate Atlas of Canada. Retrieved from: *http://climateatlas.ca*

[vii] Office of the Auditor General of Canada. (March 2018). Perspectives on Climate Change Action in Canada – A Collaborative Report from Auditors General – March 2018. Retrieved from: *http://www.oag-bvg.gc.ca/internet/English/parl_otp_201803_e_42883.html*

[viii] Bhamidipati, S. (2015). Simulation framework for asset management in climate change adaptation and transportation infrastructure. Transportation Research Procedia, 8, 17-28.

[ix] Asset Management BC. (2018). Climate Change and Asset Management: A Sustainable Service Delivery Primer. Retrieved from: *https://www.assetmanagementbc.ca/wp-content/uploads/The-BC-Framework_Primer-on-Climate-Change-and-Asset-Management.pdf*

[x] Hodgson, G. (May 15, 2018). The costs of climate change are rising. The Globe and Mail. Retrieved from: *https://www.theglobeandmail.com/business/commentary/article-the-costs-of-climate-change-are-rising*

[xi] National Roundtable on the Environment and Economy. (2011). Paying the Price: The Economic Impacts for Climate Change in Canada. Retrieved from: *www.nrt-trn.ca/wp-content/uploads/2011/09/paying-the-price.pdf*

[xii] Gambrill, D. (2018). Canada starting to build a "culture of climate resilience," insurers say. Canadian Underwriter. Retrieved from: *https://www.canadianunderwriter.ca/insurance/canada-starting-build-culture-climate-resilience-insurers-say-1004126411/*

[xiii] Federation of Canadian Municipalities. (2019). Climate and Asset Management Network. Retrieved from: *https://fcm.ca/en/programs/municipalities-climate-innovation-program/climate-asset-management-network*

[xiv] City of Selkirk. (2017). Selkirk only Manitoba municipality selected for Climate and Asset Management Network. Retrieved from: *https://www.myselkirk.ca/blog/2017/12/22/selkirk-manitoba-municipality-selected-climate-asset-management-network/*

[xv] Guyadeen, D., Thistlethwaite, J., and Henstra, D. (2018). Evaluating the quality of municipal climate change plans in Canada. Climatic Change. *https://doi.org/10.1007/s10584-018-2312-1*

[xvi] City of Selkirk. *https://www.myselkirk.ca*

[xvii] City of Selkirk. (2014). The Path to a Brighter Future. The City of Selkirk Strategic Plan. Retrieved from: *https://www.myselkirk.ca/wp-content/uploads/2015/02/Final-Report-Public-Document-2014-04-24.pdf*

[xviii] Infrastructure Canada. (2018) Climate Lens. Retrieved from: *https://www.infrastructure.gc.ca/pub/other-autre/cl-occ-eng.html*

[xix] Canadian Institute of Planners. (2011) Climate Change Adaptation Planning: A Handbook for Small Canadian Communities. Retrieved from: *https://www.cip-icu.ca/Files/Resources/RURAL-HANDBOOK-FINAL-COPY*

[xx] Local Governments for Sustainability – Building Adaptive and Resilient Communities (ICLEI-BARC). *http://www.icleicanada.org/programs/adaptation/barc*

[xxi] United Nations Framework on Climate Change Conference. *https://unfccc.int*

[xxii] City of Selkirk (2016) Acting Today to Change Tomorrow.

Credits

CITY OF Selkirk

200 Eaton Avenue
Selkirk, Manitoba, Canada
R1A 0W6

Phone: 204.785.4900
Email: CitizenSupport@Cityofselkirk.com

www.myselkirk.ca

Prairie Climate Centre

The Prairie Climate Centre, based at the University of Winnipeg, is generously supported by the Government of Manitoba, Environment and Climate Change Canada, and the Social Sciences and Humanities Research Council.

For more information contact Dr. Ian Mauro

Phone: 204.258.2921
Email: i.mauro@uwinnipeg.ca

prairieclimatecentre.ca