Resilient Regina

City of Regina's Corporate Climate Adaptation Strategy

July 2025

REGINA

Contents

Foreword

The City of Regina has developed this Corporate Climate Adaptation Strategy (CCAS) through a collaborative approach with its various departments, employees and the Prairie Adaptation Research Collaborative research center at the University of Regina. As with many other frameworks and policies within the City of Regina's portfolio, the CCAS has been developed in the spirit of reflecting the City's values and commitments to truth and reconciliation. To this end, the CCAS includes and incorporates Indigenous knowledge and worldview. The CCAS will guide the City in taking proactive actions on potential climate change impacts, thereby preparing future generations to live together on the land in a harmonious way.

Studies have shown that human activities, principally through emissions of greenhouse gases (GHGs), have caused global warming. Changes to weather and climate extremes are already evident and have led to widespread adverse impacts and related damage as well as losses to people and the environment. Despite efforts to limit GHG emissions, climate change researchers predict that the global temperature will continue to increase over the next 20 years because of cumulative emissions. It is likely that continued warming will intensify climate impacts, thereby increasing risks to health and wellbeing, nature and biodiversity, infrastructure and the economy.

Climate change is increasing the frequency and intensity of extreme events such as fires, flooding, droughts and air quality. These events do not affect all groups equally. Therefore, preparing for climate change, especially for those who are more vulnerable to its impacts, is paramount. While efforts to limit the extent of climate change through climate mitigation efforts are more important than ever, increasing climate impacts make climate adaptation imperative.

The CCAS integrates adaptation and mitigation strategies to promote sustainable development for all residents. The City of Regina recognizes that identifying the hazards, risks and vulnerability to its assets, as well as implementing sustained mitigation and accelerated implementation of adaptation actions, will reduce future losses and damages related to climate change. Adaptation refers to actions taken to prepare for and respond to the impacts of climate change – both by reducing risk to climate changes and enhancing resilience to withstand them. According to the Government of Canada National Adaptation Strategy (2023):

"Adaptation is finding new ways of making decisions, building communities and businesses, and protecting each other and the places we value in anticipation of climate change. It means ensuring that we are all better able to prevent, prepare, respond, and recover from climate impacts today and in years to come. Taking ambitious and collective action to adapt in ways that are equitable and inclusive will help us ensure that everyone's lives and welfare are protected from the impacts of a changing climate".[1]

Climate adaptation recognizes that despite our best efforts on mitigation, changes to climate are inevitable. The City of Regina is already witnessing several of those changes. Taking actions to improve resilience and reduce risks created by climate hazards will have added benefits of making Regina a more livable city with a thriving economy and robust natural systems. From an economic perspective, being proactive in climate action now will avoid significant costs in the future.

The City of Regina is committed to developing adaptation measures in an inclusive and holistic way that also respects Indigenous values and principles. This approach will ensure the best possible outcomes for the future. As such, adaptation measures will be developed through guidance from scientists, engineers and Indigenous Elders and knowledge keepers.

Indigenous knowledge, sometimes referred to as traditional ecological knowledge, is knowledge that was developed over millennia of observation and cultural teachings. Indigenous knowledge comes from a life-long process of learning that entails experiential, tangible, intangible, spiritual and generational influences. It is based on a strong sense of interconnection and interdependence, ethics and relationships that have been built on reciprocity and obligations towards stewardship of the land and environment. Indigenous knowledge focuses on the web of relationships between humans, animals, plants, natural forces, spirits and landforms. A set of moral principles and ethics are deeply embedded within the Indigenous knowledge system that guide behavior within its paradigm. Indigenous peoples of the world have used their knowledge system to establish complex management and conservation approaches to steward local environments. The Government of Canada (2022)

1 Canada's National Adaptation Strategy. Retrieved on June 3, 2025, from: https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/national-adaptation-strategy/full-strategy.html

states, "Indigenous Knowledge has made, and continues to make, valuable contributions to environmental, regulatory, and other processes across the country".[2] And according to the Mackenzie Valley Review Board, Indigenous knowledge can cover a substantial time-period and if properly documented, it can add an important historical perspective and understanding of the variability and extent of biophysical, social, and cultural phenomena. As well, Indigenous knowledge holders are often able to identify links between seemingly unrelated components of the environment.[3]

The City of Regina is committed to including Indigenous knowledge and considering multiple viewpoints to help reveal a more complete picture of reality as it relates to climate change adaptation. The purpose of including Indigenous knowledge in the CCAS is to provide the city with greater knowledge and understanding of the environment in which we live and must adapt to.

Our approach will not only help to develop robust and effective climate change adaptation and mitigation measures, but also help to develop a more meaningful and respectful relationship with the Indigenous community in the City of Regina.

2 Indigenous Knowledge Policy Framework (p. 4/12). Retrieved on June 8, 2025, from: https://www.canada.ca/content/dam/iaac-acei/documents/programs/indigenous-knowledge-policy-framework.pdf

3 Guidelines for Incorporating Traditional Knowledge in Environmental Impact Assessment, July 2005. Retrieved on June 8, 2025 from: https://reviewboard.ca/upload/ref_library/1247177561_MVReviewBoard_Traditional_Knowledge_Guidelines.pdf

Glossary

Climate Adaptation	Actions that reduce the vulnerability of natural and human systems to the actual or expected impacts of climate change, and take advantage of potential new opportunities, thereby increasing resilience to a changing climate.
Climate Mitigation	Actions that slow the rate and magnitude of climate change, such as reducing greenhouse gas (GHG) emissions and enhancing activities that remove these gases from the atmosphere.
Climate Resilience	The capacity of a community, business, or natural environment to prevent, withstand, respond to, and recover from climate related events.
Climate Hazard	A climatic condition or event with the potential to cause harm to natural systems or society.
Indigenous Knowledge	A set of complex knowledge systems based on the worldviews of Indigenous Peoples that reflect the unique cultures, languages, values, histories, governance and legal systems of Indigenous Peoples. It is place-based, cumulative and dynamic. Indigenous Knowledge systems involve living well with, and being in relationship with, the natural world. Indigenous Knowledge systems build upon the experiences of earlier generations, inform the practice of current generations, and evolve in the context of contemporary society.
Climate Risk and Vulnerability Assessment (CRVA)	A process used to understand the potential negative impacts of climate change on a specific area, system, or population, as well as their susceptibility to those impacts.
Energy & Sustainability Framework (ESF)	Energy and Sustainability Framework, the City of Regina's climate mitigation plan to achieve net-zero emissions by 2050.

Green Infrastructure	The natural vegetative systems and green technologies that collectively provide society with a multitude of economic, environmental, health, and social benefits.
International Council for Local Environmental Issues (ICLEI)	Local Governments for Sustainability - a global network working with more than 2500 local and regional governments committed to sustainable urban development.
Intensity-Duration-Frequency (IDF) curve	A graphical representation that shows the relationship between rainfall intensity, duration, and frequency (or return period) for a specific location.
Intergovernmental Pane of Climate Change (IPCC)	The United Nations body that assesses the science related to climate change.
kâ-nâsihtikawin	The City of Regina's Indigenous framework, which guides how the City can incorporate Indigenous worldview into every aspect of our work.
Prairie Adaptation Research Collaborative (PARC)	A climate change research center at the University of Regina.
Representative Concentration Pathway (RCP)	A set of scenarios used to model future climate change, representing different trajectories of greenhouse gas concentrations in the atmosphere.

Units

Temperature, T

Degrees C or ^{o}C – degrees Celsius

Precipitation, P

mm= millimeters

Growing Degree Days (Base 5^{o} C)

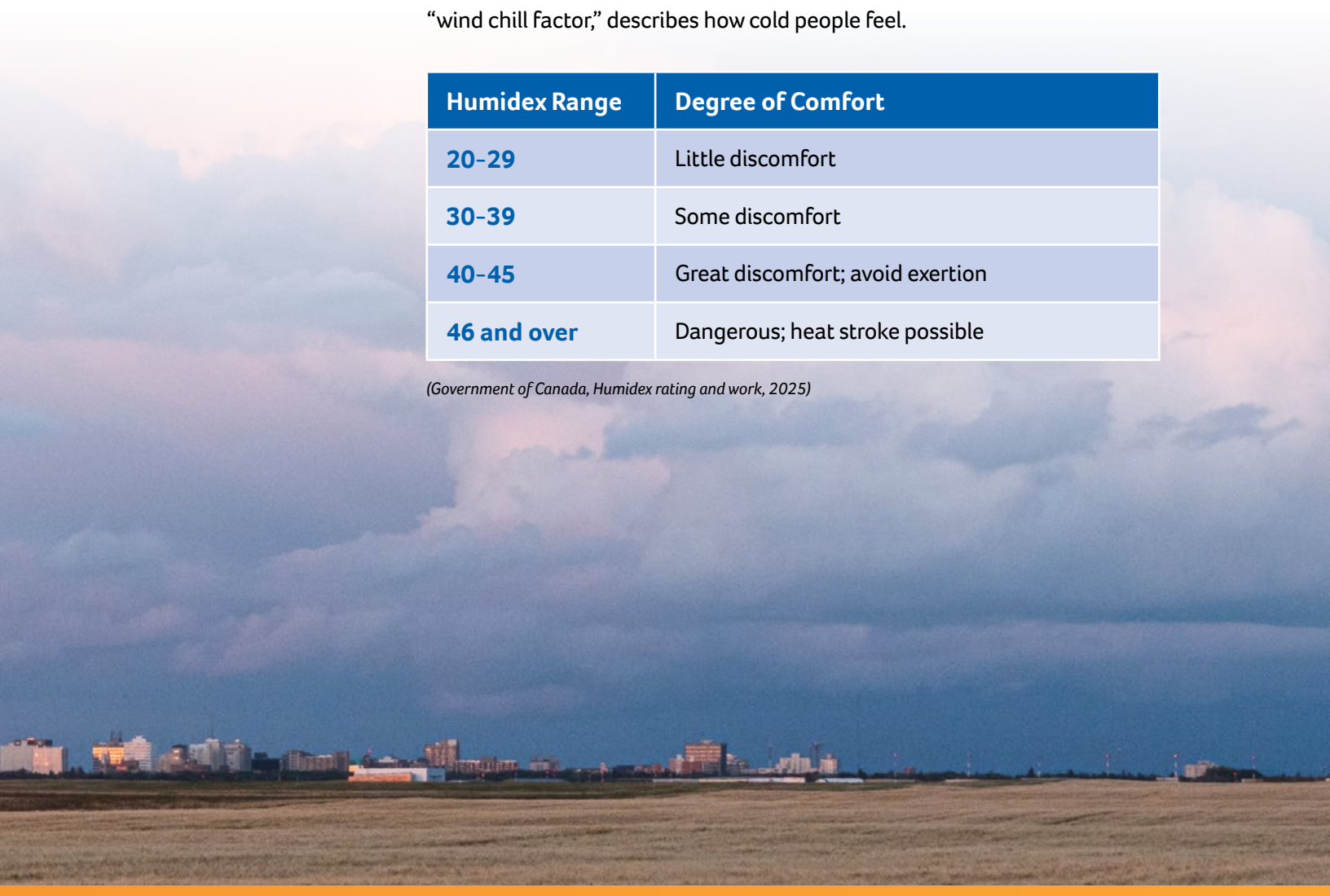
Provide an index of the amount of heat available for the growth and maturation of plants and insects. Annual sum of the number of degrees Celsius that each day's mean temperature is above 5^{o}C.

Humidex

Humidex measures how hot we feel in hot, humid weather. It is a parameter intended for the general public to express how the combined effects of warm temperatures and humidity are perceived. It provides a number that describes how hot people feel, much in the same way the equivalent chill temperature, or "wind chill factor," describes how cold people feel.

Humidex Range	Degree of Comfort
20-29	Little discomfort
30-39	Some discomfort
40-45	Great discomfort; avoid exertion
46 and over	Dangerous; heat stroke possible

(Government of Canada, Humidex rating and work, 2025)



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Why we are here

Introduction

The climate of Regina has always required resilience and adaptation. From hot, dry summers to freezing winters, the extreme conditions of the Canadian prairies have profoundly shaped how the City is designed, built and operated.

For generations, the Indigenous Peoples of this land developed knowledge systems and ways of living in balance and respect with local ecosystems. Early settlers also faced the challenges of adapting to Regina's local climate and lands they sought to develop. Today, newcomers continue to adapt to Regina's climate, language and culture when they arrive at their new home. Rooted in this diversity, strength and resiliency, Regina has developed into a vibrant community and is, in many ways, already well positioned to adapt to the changes brought on by climate change.

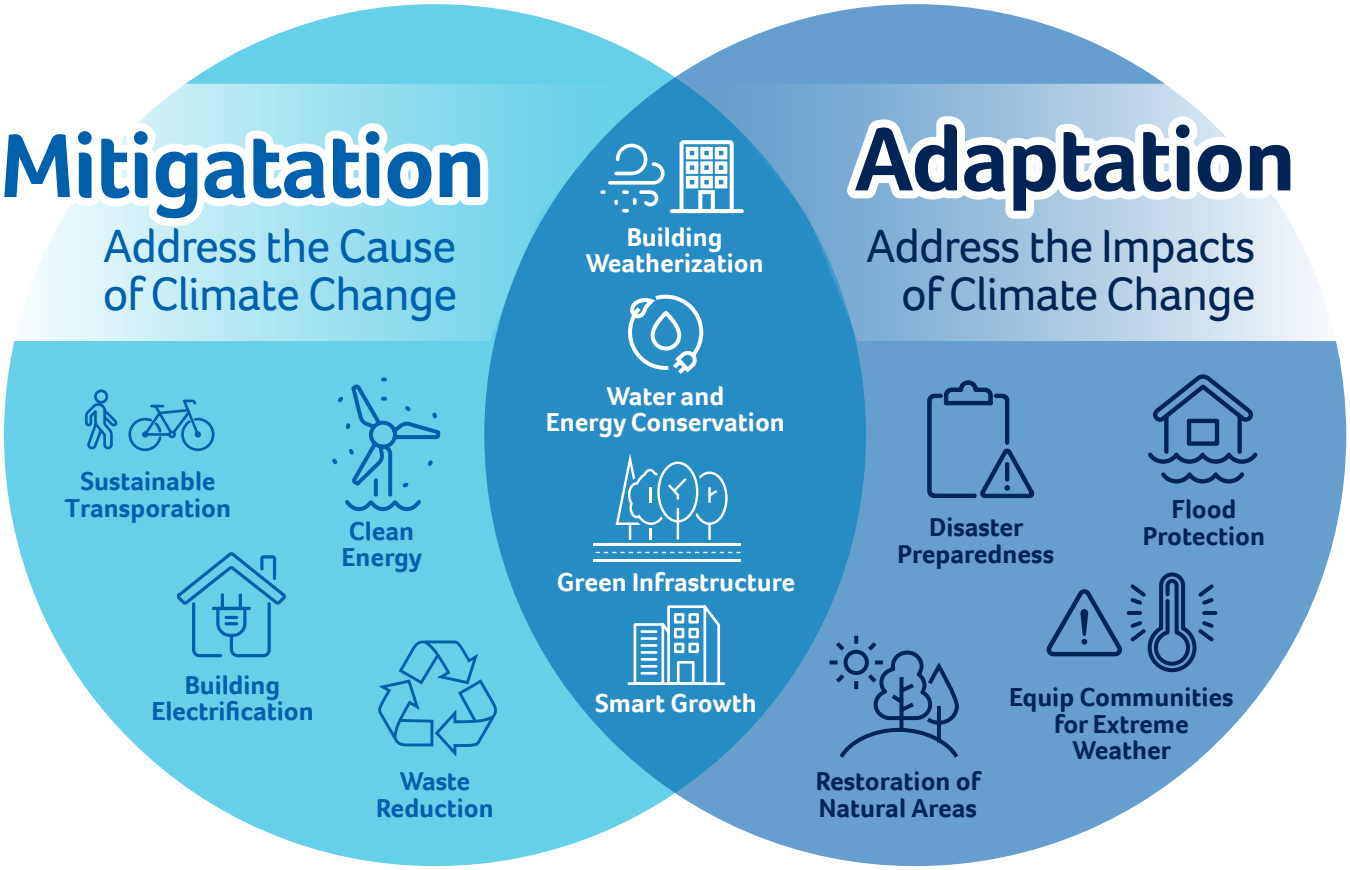
To continue to build a vibrant and resilient community, it is critical to incorporate climate adaptation principles into the City's planning and service delivery. This work must be grounded in a collaborative approach, one that brings together Indigenous knowledge and Western science, to better understand the current and future impacts of climate change on our city and to guide the actions needed to effectively adapt.

As climate change accelerates the environmental challenges we face, the Corporate Climate Adaptation Strategy will support the City of Regina in delivering a cohesive and aligned approach to addressing climate risks.

Action on Climate Change

The impacts of climate change are being felt across Canada and the world. From more frequent extreme weather events to changing precipitation patterns and increased risk of drought, climate action has become an integral part of municipal planning and service delivery. To meaningfully address the challenge of climate change, the City of Regina must:

- Take an active role in climate action by addressing climate mitigation through dedicated efforts to reduce greenhouse gas (GHG) emissions.
- Take an active role in climate adaptation by addressing localized climate hazards and risks.



Climate Mitigation

Climate change mitigation involves actions to reduce greenhouse gas (GHG) emissions that cause climate change. In October 2020, City Council tasked City staff with the development of a community-wide Energy and Sustainability Framework (ESF) to lay the groundwork for the transition to renewables, while decreasing GHG emissions to net-zero by 2050. This pathway aligns with the Intergovernmental Panel for Climate Change's (IPCC) recommendations to help slow global climate change to below 1.5 degrees warming in order to avoid the worst impacts of climate change.

While the City is making efforts towards addressing the root causes of climate change with the ESF, a plan for addressing climate adaptation is also needed.

Climate Adaptation

Climate change adaptation involves initiatives and measures to reduce the vulnerability of natural and human systems to the actual or expected impacts of climate change. Key drivers for the development of the CCAS include the recognition that climate change is already occurring, the need to prepare for and respond to the impacts of climate change, and to understand emerging risks or new opportunities presented by Regina's changing climate.

Climate Resilience

There are several areas where climate mitigation and adaptation overlap. For example, managing our urban forest stores carbon and reduces emissions (mitigation), while the tree canopy provides shade protection and slows stormwater drainage rates (adaptation). Being a climate resilient city means both reducing GHG emissions and preparing for the impacts of a changing climate, and finding interconnections between this work to better serve our community in a changing climate.

Cost of Inaction

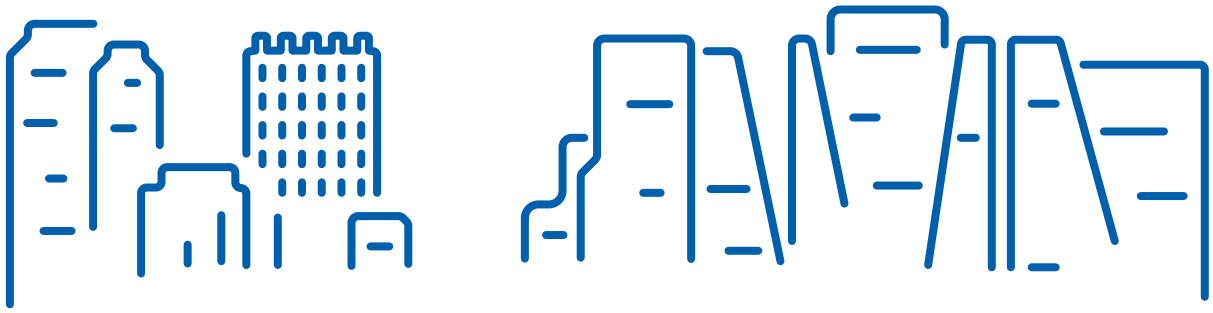
Regina is not immune to the impacts of climate change. Under future climate scenarios, the current infrastructure and other assets used to deliver services to residents may experience conditions that exceed their original design parameters. This could result in increased operating, maintenance and renewal costs, or lower levels of service. Residents and businesses within the community will face these same conditions, potentially incurring additional costs to either mitigate or respond to the impacts of climate change.

Additional costs may be indirectly incurred, including lost time from physical and mental health impacts and damage to ecosystems. These indirect costs may also increase due to service delivery disruptions, increased commute times, rising insurance premiums, long term physical and mental impacts and the loss of revenue to businesses that work with impacted industries.[1]

Economically, the community impact of climate change is commonly measured through the Gross Domestic Product (GDP). The impact of climate change results in a drag on GDP growth.

However, GDP is not considered to be the perfect measure of climate change impacts, and so it should be augmented by other impacts. Across Canada, it is estimated that by the middle of the century, the cost of climate change compared with a climate stable scenario will be between $78 to $101 billion in lost GDP.[2] By mid-century, direct costs in the prairie provinces including GDP losses are projected to be as a high as $15.7 billion, with Saskatchewan alone accounting for roughly $3.1 billion of that estimate.[3]

Various communities across Canada have undertaken their own analysis on the cost of inaction[4] using a tool kit created by ICLEI – Local Governments for Sustainability. On the other hand, investing in climate adaptation can yield $12 to $15 for every $1 invested[5]. As the City moves forward in our climate adaptation journey, understanding the potential financial impacts of climate change in Regina will be an important part of understanding the true benefits of taking action.



1 The Cost of Doing Nothing: Primer Document for Building a Local Business Case for Adaptation, ICLEI – Local Governments for Sustainability
2 Sawyer, Dave, Ryan Ness, Caroline Lee, and Sarah Miller. 2022. Damage Control: Reducing the costs of climate impacts in Canada. Canadian Climate Institute. https://climateinstitute.ca/reports/ damage-control/
3 Boyd, R., 2023. Costs of Climate Change on the Prairies. Prepared by All One Sky Foundation for ClimateWest
4 Climate Change Impacts in Windsor: A Technical Analysis, 2019
5 Damage Control: Reducing the Costs of Climate Impacts in Canada. Canadian Climate Institute. 2022.

The City of Regina's Corporate Climate Adaptation Strategy

As the effects of climate change are becoming more apparent, the City of Regina must consider what is required to adapt and what it means to become a more resilient city. Climate change adaptation involves initiatives and measures to reduce the vulnerability of natural and human systems against actual or anticipated impacts of climate change. While mitigation is necessary to reduce the rate and magnitude of climate change, adaptation is essential to address the impacts from climate change that cannot be avoided.

Vision

The CCAS lays out a vision of strategically improving the City's understanding of climate change, understanding its impacts, and identifying opportunities to proactively adapt and build resilience across all City services. Adaptation is an investment that both protects the City and the wider environment, while reducing the risks from climate change. The CCAS aligns with the City of Regina's vision of being "Canada's most vibrant, inclusive, attractive, sustainable community, where people live in harmony and thrive in opportunity."

Objectives

The City of Regina's CCAS aims to:

1. Increase the City's resiliency and reduce its vulnerability to the impacts of a changing climate.
2. Optimize the City's allocation of financial and natural resources to balance the fiscal realities of the present with the climate impacts of the future.
3. Bridge gaps in City plans, strategies and frameworks to ensure a cohesive and aligned approach to understanding and managing climate change risks.
4. Incorporate Indigenous perspectives into climate adaptation and resilience planning within City services and operations.

Guiding Principles

The City of Regina's CCAS has been developed through careful review of data, analysis of impacts to the City's work and engagement with internal and external stakeholders. To ensure the CCAS reflects the City's values and aligns with expectations, the guiding principles for this strategy include:

Using science and evidence to inform decisions

The City's approach to climate adaptation must consider the climate data and science available to support decision-making, while also considering evidence of climate change that cannot be modelled.

Incorporating and reflecting the Indigenous knowledge and Indigenous worldview

Indigenous people have been stewards of the land for generations and their approach to living on the land in harmony with the environment and all living things must be reflected in climate adaptation work.

Considering equity and inclusion

Climate change can have a disproportional impact on different groups based on their exposure to different hazards. It is important for the City to consider how various groups, like frontline staff, outdoor workers and vulnerable populations, are affected by climate hazards and the actions we take.

Considering our local context

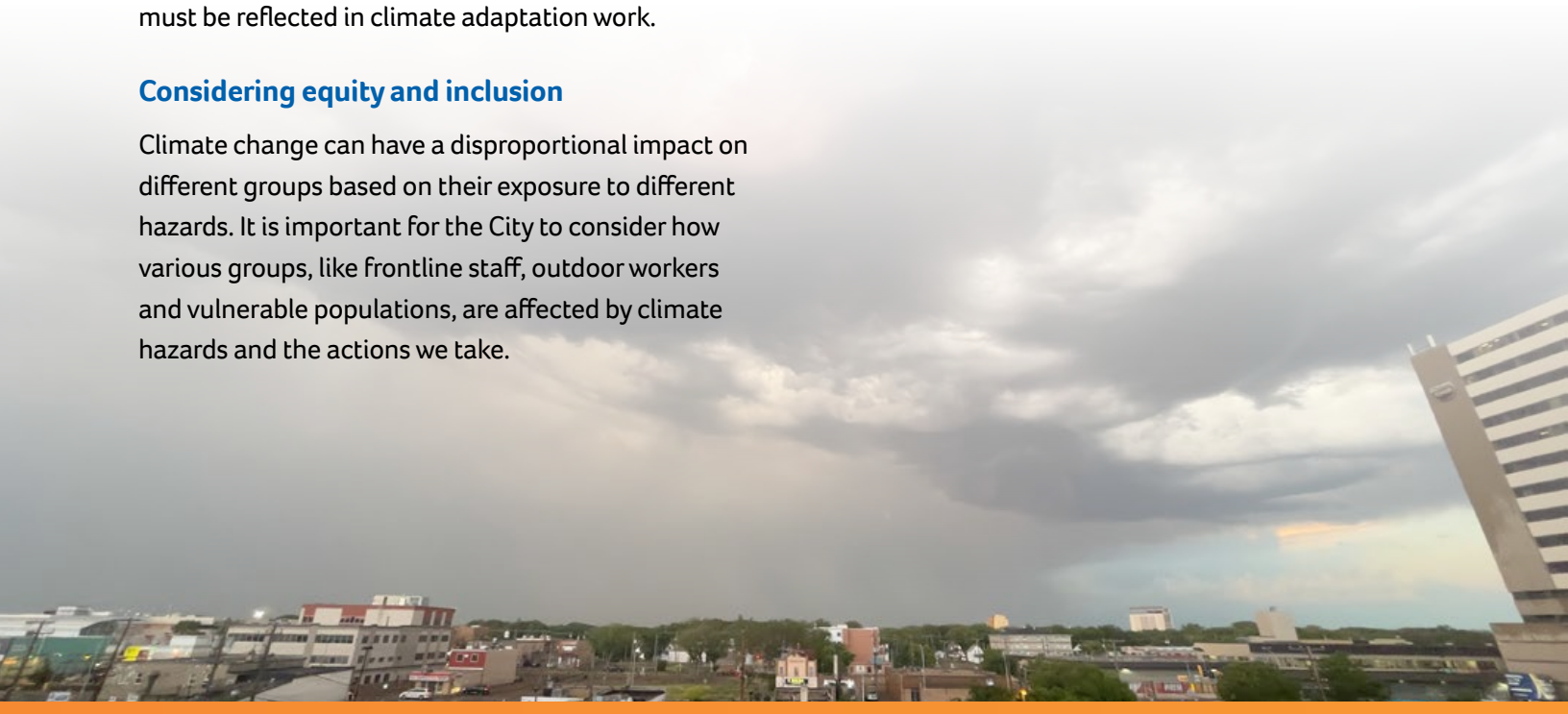
The CCAS is a 'made in Regina strategy' that clearly understands our local context in the overall picture of climate change on a national and global scale and considers what adaptation means for Regina.

Being practical and action oriented

It is important that the actions the City takes around climate change make sense in the context of all the work the City is aiming to accomplish. The strategy lays a clear path for deliberate actions that build climate resilience and align with organizational needs.

Being collaborative and cross-functional

Successfully facing the challenge of climate change will require collaboration across departments and with key partners to manage risks and embrace new ideas.



Incorporating an Indigenous Worldview

The City of Regina is located on Treaty 4 territory, the traditional lands of the Cree, Saulteaux, Dakota, Nakota and Lakota peoples and the homeland of the Métis/Michif Nation. Indigenous people on the prairies have long held deep, reciprocal relationships with the land, water, plants and animals. They have also had to adapt to many changes to their ways of life and rapid changes to the environment around them. Development of the CCAS comes at a time when the City of Regina is truly reflecting on the holistic worldview held by the Indigenous people of this land. We need to embrace two-eyed seeing with both the Western and Indigenous worldviews as we embark on a journey of adapting to a new world brought on by climate change as equal partners and collaborators.

One of the City's first steps towards acknowledging the importance of bringing the Indigenous worldview to our work began with the adoption of kâ-nâsihtikawin, the City's Indigenous Framework.

kâ-nâsihtikawin

On August 26, 2024, a Pipe Ceremony was held in Henry Baker Hall at City Hall. This ceremony was to name an Indigenous Framework that guides the City in its ongoing commitment to intertwining policy, procedures and administration with Indigenous worldviews. During the ceremony, Elder Larry Oakes, from Nekaneet First Nation, lifted the men's pipe, smoking it in unity with various First Nations Elders and Métis Old Ones from across Treaty 4 Territory and the homeland of the Métis. The woman's pipe was simultaneously lifted by Elder Diane Kaiswatum, from Piapot First Nation, symbolizing a harmonious balance and the inclusion of all voices in this sacred act. Elder Larry Oakes led the gathering in a song, a heartfelt plea to the grandfathers, asking them to provide a name for the Framework. Upon the completion of the prayers and the song, a name was revealed in the Cree language: kâ-nâsihtikawin (kah-nah-see-tik-a-win) – which means "to go out and attain" — representing the purpose of seeking and incorporating ceremony and guidance.

Regina City Council adopted kâ-nâsihtikawin – the Indigenous Framework – on April 9, 2025. The Framework guides and informs every aspect of municipal work, from day-to-day operations to ongoing engagement with First Nations, Métis, and Inuit people. kâ-nâsihtikawin says: "By centering its processes and policies in First Nations, Métis, and Inuit ways of knowing and being, the City of Regina is laying the groundwork for a renewed relationship with all communities within Treaty 4 Territory and in the homeland of Métis Nation."

Environmental sustainability and stewardship of the land is central to Indigenous worldviews. kânâsihtikawin will inform and guide future engagement and inclusion of Indigenous perspectives in advancing the City's environmental sustainability initiatives.

Treaty Principles & Reconciliation

The Treaty Principle that most closely aligns with the purpose and intent of the CCAS is **wîtaskêwin (WEE-tah-skay-win)**, living together on the land, in harmony; though all Treaty Principles should be considered in the implementation of actions related to the Climate Adaptation Strategy. The principle of wîtaskêwin is clear in identifying the strong connection between Indigenous peoples and the land, and the importance of creating balance between the human-centered environment and the natural systems all around us.

Reconciliation is a long-term endeavour spanning generations. By taking climate action now, we are placing gifts for the future: we may not see the results of our work today, but those coming after us will benefit from our efforts. This approach reflects Indigenous ways of knowing and being, which focus on stewardship of the land to preserve it for future generations. The City's vision is that of a future in which Indigenous culture and people are equally represented, included, celebrated, and supported. To realize this vision, the City must infuse Indigenous ways of knowing and being into its decision-making, policies, and procedures by adopting principles of equity and inclusivity.

Ensuring that the Treaty Principles inform the City's approach to environmental sustainability supports greater connection between work across land, air, water, energy use, people, and climate change.

Treaty Principles

Treaty Principle	Relationship to Climate Adaptation
miyo-wîcêhtowin *Getting along well with others; good relations; expanding the circle*	• Incorporate principles of good relations like clear and transparent communication channels into project planning and action outcomes. • Include Indigenous worldview in planning initiatives. • Advocate for Indigenous inclusion across government partnerships. • Take care of employees and residents vulnerable to the impacts of climate hazards.
tâpwêwin *Speaking the truth or speaking with precision and accuracy.*	• Engage in culturally competent environmental learning and training. • Incorporate opportunities for Indigenous art and culture in adaptation projects.
miskâsowin *Finding one's sense of origin and belonging; finding "one's self"; finding "one's centre.*	• Include Indigenous worldview in planning and projects centered around protecting and taking care of the land. • Incorporate Indigenous knowledge into City projects and work.
wîtaskêwin *Living together on the land in harmony.*	• Consider how actions prepare our land for future generations. • Integrate environmental stewardship and caretaking into long term decision making and planning. • Take care of plants and animals which all have spirits and uplift the value of the natural environment. • Protect water resources both upstream and downstream of city limits. • Support the health and wellbeing of employees, residents, and all people.
pimâcihowin *Making a living.*	• Identify actions that encourage or support economic activities that benefit Indigenous people and communities, such as hiring Indigenous consultants and contractors. • Consider climate resilience in urban reserve strategy.

Incorporating Equity

Climate change can often have a greater impact on vulnerable members of society who are more exposed to climate hazards. Those with less resources are often positioned in living situations that don't meet their needs for adequate heating or cooling systems during times of extreme heat or cold. Those without consistent shelter will face challenges during extreme or unpredictable weather that can exacerbate health conditions and add to already difficult circumstances.

The CCAS will aim to incorporate equity considerations into the Climate Risk and Vulnerability Assessment (CRVA) process, as well as in reviewing actions that will be delivered as part of climate resilience.

Methodology

The City of Regina's Corporate Climate Adaptation Strategy was prepared using similar methods to most other municipal climate adaptation strategies in Canada. The process included:

- ✔ Reviewing municipal climate adaptation strategies and approaches
- ✔ Working with Indigenous advisors to understand concepts around Indigenous knowledge and Indigenous worldview on environment
- ✔ Gathering and analyzing climate data
- ✔ Identifying climate hazards
- ✔ Engaging with internal and external stakeholders
- ✔ Conducting a workshop of internal subject matter experts on climate impacts
- ✔ Developing a CRVA
- ✔ Evaluating risks
- ✔ Identifying and validating actions
- ✔ Developing an implementation approach

This strategy describes the City of Regina's first step towards formally addressing climate change adaptation as an organization and as a city. While this is an important step, there is still more work to be done towards fully identifying and understanding the breadth and scope of potential impacts of climate change on the City and the opportunities available to address those risks.

Climate Data & Hazards

Climate models and data tables were prepared by PARC, a research collective based out of the University of Regina. PARC are the local experts on climate change in the prairies and have provided support on many climate adaptation strategies across North America. A list of key climate indices were selected for modelling based on feedback from the City and a discussion around what climate variables were most likely to affect our work.

Accurate, prairie-specific climate models formed the basis of the data being considered for the development of the CRVA and the CCAS.

Incorporating Indigenous Worldview

In alignment with the Indigenous Framework, the Project Team and consultants worked with Elder Harry Francis from Piapot First Nation and Bryce Jardine-Pelletier, P.Eng of the Métis Nation to learn more about Indigenous ways of knowing and Indigenous knowledge. Their advice and insight helped shape the CCAS to better reflect Indigenous perspectives and will continue to guide future work on incorporating Indigenous knowledge into City projects and work.

Stakeholder Engagement

In addition to the climate modeling data, the CCAS incorporated inputs from internal and external stakeholders to add context to the climate data. This process identified additional climate hazards that are not fully represented in climate models, like wind and smoke, as well as the impacts of climate hazards on the City and our partners.

Extensive internal stakeholder engagement was undertaken to understand how climate change impacts areas where the City holds significant responsibility or influence. Internal engagement activities included:

- A webinar attended by over 200 staff to learn about the CCAS project and to share the climate data presented by PARC.
- A survey completed by 343 City staff to understand the importance of adapting to climate change and identify potential barriers to incorporating climate resilience.
- A workshop with 70 employees, representing almost every branch in the City, to identify, discuss, and assess climate impacts on service areas and the City's work.
- Focused meetings with key departments to review the impacts identified, the risk scores assigned, and actions and next steps for implementing the CCAS.

To better understand and strengthen the City's capacity to respond to climate change, several meetings were also held with external stakeholders. These discussions explored how the actions, priorities and constraints of partner organizations influence the City's climate adaptation efforts and how, in turn, the City's strategies impact those stakeholders. These discussions focused on identifying intersections and opportunities for collaboration, with the shared goal of enhancing adaptive capacity across Regina.

Key stakeholders consulted in the strategy development included:

- SaskPower
- The Provincial Capital Commission
- Ministry of Environment
- Buffalo Pound Water Treatment Plant
- EPCOR
- Members of the Extreme Weather Committee

Climate Risk and Vulnerability Assessment

The CRVA was conducted by synthesizing the impacts identified during the climate risk workshops using the climate data. A series of risk statements were then developed to describe the impacts and consequences associated with the climate hazards identified. The risk statements were evaluated by subject matter experts from across the organization and validated through consultation with impacted departments.

Action and Implementation Planning

The final phase of developing the CCAS involved identifying actions necessary to mitigate risks identified in the CRVA and to increase the City's climate resilience. Actions were identified based on the primary consequences of risks and vulnerabilities in the CRVA. City employees brought forward ideas for how to prepare for those risks and incorporate climate adaptation into their work. Through these discussions, eight themes emerged along with six areas of focus for implementation, forming the basis for how the City will approach implementing climate adaptation.

What we know about climate change in Regina

Understanding climate change involves considering a variety of perspectives, including technical models, historical data, traditional knowledge, and careful local observations. The effects of climate change are already being felt in Regina, and are expected to intensify in the coming decades

As a prairie city with a semi-arid climate, Regina is particularly vulnerable to changes in temperature, precipitation patterns, and extreme weather events. These shifts are already putting pressure on infrastructure, natural systems, health, social and recreation opportunities, and will continue to challenge how we plan, build, and live in our community.

The CCAS is based on what we know today about climate risks in Regina, drawing from scientific data, practitioner expertise, and the lived experiences of those on the frontlines of climate response. Together, this information forms the evidence base for the actions and priorities identified throughout the CCAS.

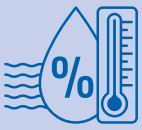
Western Science

Climate Modelling & Data

PARC prepared future climate scenarios from advanced climate models. These outputs serve as the foundation to assess physical climate hazards and risks facing the City of Regina's services, assets and operations.

PARC provided climate projections using simulations from 11 Regional Climate Models (RCMs) at 25km spatial resolution. RCMs downscale global climate models to gather more detailed data and are especially helpful in places where localized weather events like thunderstorms are important. They are also better suited for analyzing local climate hazards and planning for resilience. Using these methods, PARC simulated future climate conditions for the City of Regina and surrounding region under three global warming time horizons: 1.5 °C, 2 °C, and 3 °C above pre-industrial levels. These future warming levels were based on a high-emissions scenario[1], which assumes no efforts to restrain anthropogenic (human-caused) factors contributing to climate change. This represents what many scientists see as the worst-case scenario for climate change.

The results provide important data about climate change factors in Regina:

	**Increasing precipitation**	• Annual average precipitation is expected to increase by up to 20 per cent a year in Regina.
	**Hotter summers**	• 3 times increase in days over 30 ˚C. • 9 times increase in days over 35 ˚C. • New potential for Tropical Nights (>20˚C overnight).
	**Increased humidity**	• 2 times increase in days with Humidex >30. • New potential for Humidex >40.
	**Warmer winters**	• 55 per cent decrease in cold and very cold days. • Longer frost-free season (+54 days).

1 i.e., Representative Concentration Pathway 8.5

The table below describes the climate projections modelled by PARC. The first column indicates the climate variable of interest (e.g., 'annual temperature'). The second column indicates average conditions for that variable during the selected historical baseline period (1976-2005). The remaining three columns present the projected change in each variable from the historical baseline (column two) at three time horizons when the global temperature is projected to reach 1.5 °C, 2 °C, and 3 °C of warming globally. The midpoint year in which the warming scenario is expected to be reached globally is provided in parentheses and is based on the average of all 11 RCPs modelled.

	Historical	1.5 °C	2 °C	3 °C
	1976-2005	Short-Term (2035)	Medium-Term (2048)	Long-Term (2070)
Annual Temperature, T	3.6	+2.5	+3.2	+4.7
# Hot Days daily max. T ≥ 30 °C	16	+19	+22	+32
# Very Hot Days daily max. T ≥ 35 °C	1	+5	+7	+11
# Cold Days daily max. T ≤ -15 °C	65	-16	-24	-36
# Cold Days daily max. T ≤ -30 °C	9	-7	-8	-9
Spring min. T	3.6	+3.0	+3.5	+4.6
Spring max. T	17.7	+2.5	+2.8	+3.6
Summer min. T	9.5	+2.0	+2.7	+4.3
Summer max. T	24.1	+2.3	+2.8	+4.2
Fall min. T	-8.9	+2.2	+3.1	+5.0
Fall max. T	2.3	+1.9	+2.6	+4.1
Winter min. T	-15.3	+3.3	+4.7	+6.7

	Historical	1.5 °C	2 °C	3 °C
	1976-2005	Short-Term (2035)	Medium-Term (2048)	Long-Term (2070)
Winter max. T	-4.8	+2.6	+3.5	+4.7
Frost-free Season	169	+32	+39	+54
Frost Days	196	-32	-39	-54
Annual Precipitation, P	394	+44	+51	+70
# Wet Days, 5 mm daily P ≥ 5 mm	24	+3	+4	+5
# Wet Days, 10 mm daily P ≥ 10 mm	9	+2	+2	+3
# Very Wet Days, 20 mm daily P ≥ 20 mm	2	+1	+1	+1
Wettest Day, mm	30	+4	+5	+5
# Dry Days daily P ≤ 1 mm	294	-6	-6	-7
Standardized Precipitation Evapotranspiration Index, summer	2.0	-0.4	-0.4	-0.3
Spring P, seasonal avg.	140	+26	+31	+45
Summer P, seasonal avg.	152	+4	+5	+8
Fall P, seasonal avg.	52	+6	+7	+7
Winter P, seasonal avg.	42	+7	+7	+9
Growing Degree Days, base 5 Sum of °C > 10 °C [(max. daily T + min. daily T)/2] - 5 °C	1720	385	482	711
Growing Degree Days, base 10 sum of °C > 10 °C [(max. daily T + min. daily T)/2] - 10 °C	951	334	417	619

Indigenous Knowledge

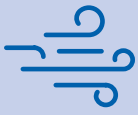
Indigenous knowledge tells a story of climate adaptation and resilience from the very beginning. Elders and knowledge keepers take the lessons from those who came before them and pass them on to those that come after them, sharing valuable knowledge about the land, water, plant and animal relations. Indigenous peoples have always known what western science is now trying to understand – that living in harmony on the land requires balance with Mother Earth and all her relations.

The City is on a journey to better understand Indigenous knowledge and how to honour and incorporate this knowledge into City planning, programs and projects. This journey begins with unpacking assumptions about science and knowledge and who can hold it, learning what Indigenous knowledge tells us about climate change, and acknowledging the value of Indigenous ways of knowing.

Future plans to advance Indigenous science within the City of Regina include training staff on Indigenous knowledge and how to incorporate this into City projects, as well as sharing environmental teachings offered by our elder advisor.

Climate Hazards

Based on the climate data and outcomes of engagement with City staff and key stakeholders, the following hazards were identified as impacting Regina. These climate hazards form the basis of understanding the risks that the City needs to plan for and adapt:

	**Drought**	• Warm and dry conditions – combined with the lack of a major waterway in Regina – increase the potential for drought, impacting Regina's water supply for irrigation, industry and potentially consumption.
	**Flooding**	• Increased spring and annual precipitation create an increased risk of overland flooding.
	**Extreme Weather**	• Warmer temperatures and increased humidity, combined with prairie winds, indicate the potential for increased extreme storm events.
	**Freeze-Thaw Cycles**	• The frequency of daily freeze-thaw cycles is decreasing, but these cycles may be more sporadic throughout the year or occur during different seasons. • Warmer temperatures increase the likelihood of major thaws throughout the winter, which can increase icy conditions and degrade infrastructure.
	**Wildfires and Smoke**	• The combination of higher temperatures, dry conditions and extreme weather creates an increased risk of wildfires in and around Regina, as well as in the northern forests which create spreading smoke hazards.
	**Increased Seasonal Variability**	• Warmer temperatures in all seasons combined with overall unpredictability indicate longer and more variable shoulder seasons with less of a consistent "deep freeze" in the winter. • A longer frost-free season may mean more time for construction and recreation activities between spring and fall.
	**Wind**	• Wind persists as a major climate hazard on the prairies; however, it is difficult to model accurately using climate models.

What climate change means for the City of Regina

Climate change is already affecting how the City of Regina delivers services, manages infrastructure and protects the well-being of residents. Many of the climate hazards identified through the CRVA are hazards that have long presented challenges for those who have lived here to overcome.

An intentional approach to managing climate risks ensures the City can be prepared to adapt to changing climate hazards alongside existing and more familiar hazards, and to understand what these changes mean for the environment. It is important to consider when old and familiar assumptions no longer hold true, and what work planning and processes need to be updated to reflect changing conditions, while building on existing knowledge and processes.

What We Heard

Understanding what climate change means for the City of Regina is more than just looking at climate models and data. It is also about listening to employees and partners to learn how things are already changing, what barriers we face to implementing climate adaptation, and how our values and priorities should inform this work. By uplifting the values of respect, collaboration and accountability, the CCAS can effectively bring people along on the City's climate adaptation journey and ensure adaptation can be meaningfully integrated across departments and stakeholders.

Results of the engagement with internal stakeholders from across the organization were incorporated into the strategy at multiple key milestones, particularly contributing to the CRVA and actions development. However, additional important insights were gathered through the internal employee survey.

- The majority of employees participating in the survey indicated it is either very important or extremely important for the City to have a climate adaptation strategy.
- Many employees feel at least somewhat knowledgeable about climate change, but do not feel they currently have enough information about climate change or what actions need to be taken.

Results of consultation with external partners was also incorporated into the CCAS. Several important themes were identified through this process, as described below.

- Infrastructure resilience is key; power consumption during periods of peak demand that overlap with extreme weather events puts the greatest stress on grid infrastructure. The City can support electrical grid resilience by ensuring accessibility for emergency repair crews during times of extreme weather.
- The water that runs through Regina in creeks and Wascana lake are an important natural asset to the community The City should ensure these ecosystems are resilient to climate change and valued for the climate adaptation benefits they bring.
- Regulations for environmental protection are informed by environmental conditions of the present and future. Environmental regulations should ensure new industrial and residential developments will minimize environmental damage by being prepared for climate change.
- The upgrades to the water treatment plant are expected to improve the plant's ability to treat water through various hazardous environmental conditions like algal blooms brought on by hotter temperatures, large temperature swings, or lower water levels. These improvements will ensure safe and clean drinking water through changing climate conditions.
- Minimizing inflow and infiltration into the sewer system will prevent the wastewater treatment plant from becoming overwhelmed during wet weather events. Increasing back-up power capacity can further improve resilience.
- Extreme cold continues to have a significant impact on the health and safety of vulnerable residents in Regina. Protection against all inclement weather conditions, especially for vulnerable populations, should be prioritized.

Climate Risk and Vulnerability Assessment

The CRVA examines the impacts that the climate hazards identified can have on the City of Regina. A wide range of potential impacts were identified through the climate hazard and impact workshop with City staff. These impacts were then synthesized into a series of risk statements that describe the nature of each risk, the climate hazards that could trigger it, and the potential consequences if it occurs. The results of the CRVA were organized into five main categories:

- Infrastructure & Other Assets
- Water & Environment
- Recreation & Outdoor Spaces
- Work & Operations
- People & Safety

While the CRVA is primarily corporately focused, efforts were made to understand where significant impacts to the community could emerge, especially as it relates to areas where the City has a responsibility to mitigate impacts to residents, businesses and vulnerable populations.

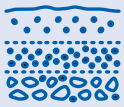
The CRVA considers all climate hazards affecting Regina, not just those newly emerging due to climate change. This recognizes that increasing risks related to climate change must be understood within the broader context of existing climate challenges. These hazards were also examined alongside existing community vulnerabilities to better understand baseline conditions that increase exposure to climate risks in Regina.

Vulnerabilities

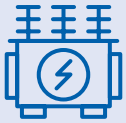
An important layer of the CRVA is identifying the vulnerabilities that exist already and that can amplify the impacts of climate change on the City. The key vulnerabilities identified through the CRVA are shown here.

Semi-arid climate – the naturally dry conditions in Regina make it difficult to manage various systems that are dry most of the year with periods of extreme precipitation.

Aging infrastructure – as City infrastructure ages, it will either need replacement or renewal to support service delivery. Deterioration may be further accelerated by climate hazards shortening the useful life.



Soil conditions – the clay soil underlying the majority of Regina is prone to cracking and shifting when dry.



Power grid infrastructure – Regina is reliant on SaskPower's grid infrastructure to supply power across the community and to operate critical services like water treatment and delivery.

Topography - Regina's flat terrain makes discharging water from the environment during wet weather events challenging and leads to significant costs for pumping and transporting water and sewage.

Goods Movement by Rail – there are several operational rail lines running through the city. Rail operations create a spark risk that can be a fire hazard when combined with prolonged dry conditions.

Inflow and infiltration (I&I) - cross connections, manholes, and other connection points between the stormwater and wastewater collection systems create risk of overflows at lift stations and the Wastewater Treatment Plant (WWTP).

Employee mental health – workers are likely to be negatively impacted by climate hazards like wildfire smoke or extreme weather, impacting their abilities at work and their overall health and wellbeing.

Stormwater system capacity – the minor storm system comprised of underground pipe infrastructure can become quickly overwhelmed during larger precipitation events.

Organizational financial health and reserves – reserves and budgeting processes don't currently consider increased risks from climate change which may impact capacity to respond to climate related events or opportunities.

Landscaping expectations – expectations for landscaping styles that rely on intensive maintenance practices will become increasingly challenging to meet, especially as drought conditions increase in likelihood.

Bylaw enforcement capacity – while the City already has some regulations or bylaws in place for mitigating environmental impacts of development, the current enforcement capacity is not sufficient to effectively address every instance.

Fireflow capacity – increased risk of wildfires means the City will need sufficient equipment and waterflow to respond to a variety of potential fire situations, both urban and on the city outskirts.

Vulnerable populations in community – those in the community who face additional vulnerability to climate change because they are houseless, elderly or have health conditions will require increased support to manage increased climate risks.

Risk Log

A detailed risk log was generated as part of the CRVA. Using the outputs from the first workshop, risk statements were prepared and validated by a team of subject matter experts from different sectors across the organization.

Climate risks consider the various hazards associated with each event and the consequences of the risk materializing.

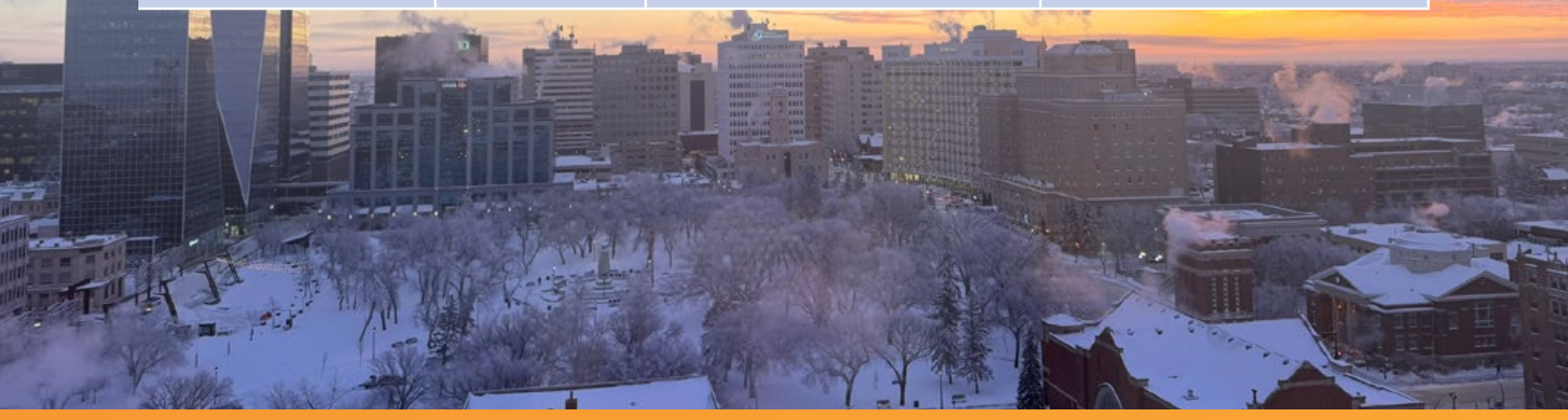
Infrastructure & Other Assets

Building, operating, maintaining, and repairing infrastructure and other assets make up a significant portion of the City's responsibilities and liabilities. Roads, bridges, underground water and wastewater pipes and storm channels are what typically come to mind when thinking of municipal infrastructure. However, many other important assets are impacted including large assets like the wastewater treatment plant, landfill, municipal facilities, vehicles, and equipment, and smaller assets like waste carts and tools.

Infrastructure and other City owned assets are exposed to both physical damage from acute climate hazards like extreme weather events, as well as accelerated physical degradation from long-term effects of climate change like more winter thaw events and hotter temperatures.

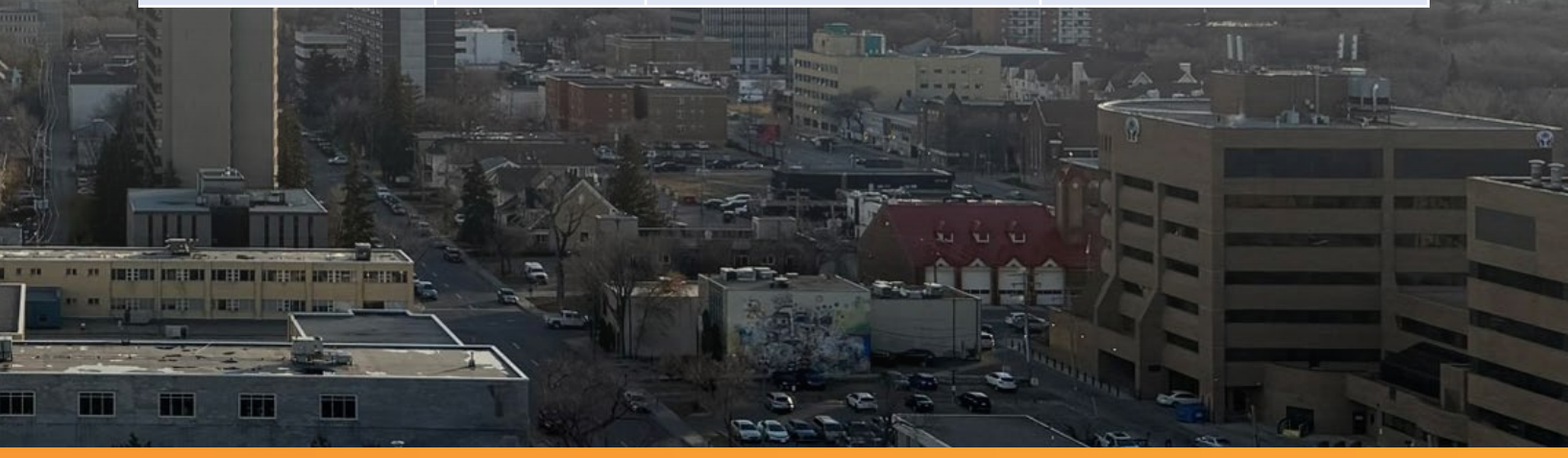
Impacts of climate change on infrastructure also lead to consequences on service levels by causing transportation impacts, restricting opportunities for future development, or reducing useability of infrastructure.

Risk Statement	Hazard(s)	Hazard Contributors	Consequences
Damage to critical infrastructure and utilities Extreme weather events cause significant damage to infrastructure (roads, bridges, sidewalks, water lines) and utilities (water, power, telecoms, gas) that lead to immediate service disruptions.	■ Flood ■ Major frost event ■ Wildfire ■ Freeze/Thaw ■ Warmer temperatures ■ Prolonged extreme temperatures	• Increased likelihood of extreme weather - flood, storms, fires • Hoar frost can collect on power lines and cause damage • Extreme heat/cold accelerate degradation of concrete and asphalt • Freeze/thaw causes moisture in asphalt, concrete and soil to expand and contract	• Loss of major assets requiring repair • Disrupted logistics and communications • Disrupted emergency services and repairs • Disrupted travel and commuting across the city



Risk Statement	Hazard(s)	Hazard Contributors	Consequences
Long-term degradation of City infrastructure Increased environmental strains on roads and underground infrastructure causes damage, reduces the overall lifespan of assets and increases repair requirements.	■ Rain/Flood ■ Freezing Rain Freeze/Thaw Snowstorms ■ Drought ■ Warmer Temperatures	• Increased precipitation • Warmer temperatures • Increased risk of drought affects soil moisture conditions • Freeze-thaw cycle negatively impacts soil conditions • Warmer temperatures cause moisture to evaporate from concrete • Increased ground temperature affects asphalt and concrete • High temperatures can cause road surfaces to soften and deform, damage electronic systems and strain cooling systems in buildings and machinery	• Increased infrastructure repair • Increased maintenance requirements • Increased resource requirements for future builds and expansions • Reduced asset lifespan • Requires capacity expansions to be planned for the future • Increased utility rates or property taxes • Lower serviceability
Transportation network disruptions Transportation network is disrupted by flooded roads and underpasses, snow drifts, or icy conditions that impede travellers, workers, and emergency services from getting where they need to be.	■ Rain/Flood ■ Freezing Rain ■ Snowstorm	• Increased precipitation • Warmer temperatures • Increased risk of extreme weather - flood, storm, fire	• Reduces level of service in the roadway network • Residents' concerns - cannot commute or travel as desired • Employee staffing - employees cannot get to work • Emergency services cannot respond as required • Repair crews cannot get out and do work as required • Disrupts operational services • Disrupts utility repair crews • Increases calls to Service Regina • Disproportionate impacts on more marginalized residents
Asset and Equipment damage and losses Damage to building, utility lines, and outdoor equipment occurs from environmental hazards.	■ Rain/Flood ■ Freezing Rain ■ Hail ■ Cold Temperatures ■ Wind	• Flooding causes damage to vehicles or Equipment in the flood path • Freezing rain or frost damage overhead lines • Wind gusts cause physical damage to assets	• Repairs are required • Work is delayed or cancelled • Service disruptions for residents and stakeholders • Increased maintenance or repair costs • Damage to shingles, HVAC, windows and fencing from wind

Risk Statement	Hazard(s)	Hazard Contributors	Consequences
Pipe breakages Underground water infrastructure breaks from shifting soil conditions.	■ Freeze/Thaw ■ Drought ■ Warm Winter Temperatures ■ Deep Frost penetration	• Freeze/thaw cycles • Drought causes dry soil that is prone to shifting • Cold temperatures cause freezing or burst pipes	• Increased risk of sinkholes • Repair and replacement of broken pipe is costly • Requires emergency repairs
Drainage infrastructure challenges Drainage infrastructure (storm pipes, parks, ponds, etc.) becomes damaged or blocked and is unable to functionally discharge stormwater from city streets leading to standing water in neighbourhoods and overflows into the sanitary system.	■ Rain/Flood ■ Warmer Temperatures ■ Drought ■ Wind	• Increased precipitation • Flooding from snowmelt • Vegetation grows blocking channels • Wind blows debris into storm channels	• Water cannot drain and causes ponding or flooding • Parks cannot be used for recreation (sports, activities) • Resident concerns • Increased mosquitos
Small asset Inventory damage and losses Loss of product inventory at the materials yard or other City locations.	■ Wind ■ Hail ■ Freezing rain	• Wind blows away sand and gravel piles • Hail damages assets like garbage carts	• Lost revenue and product • Assets need to be replaced • Lack of supplies available when needed • Damage to signs, traffic lights, poles, garbage carts
Residential property damage Residential property damage such as flooded basements, sewer back-ups, and cracked foundations occurs from environmental hazards.	■ Rain/Flood ■ Cold temperatures ■ Freeze/thaw ■ Drought ■ Wind	• Increased precipitation • Flooding from snowmelt • High volume of precipitation during dry weather • Drought causes clay soil to dry and crack, leading to foundation shifting • Strong wind gusts damage fences, shingles and siding	• Reduced level of service • Potential claims • Loss of property • Resident concerns • Pressure for improved regulations or standards • Disproportionate impacts on more marginalized residents



Water & Environment

The importance of responsible management of the natural environment is paramount in the face of climate change. Water is an especially critical natural resource for sustaining human, animal and plant life. At the same time, it can also lead to significant hazards or damage materializing with freezing rain, snowstorms or floods. Balancing the needs of the City for development, recreation and green spaces with the needs of the natural environment and ecosystems is a key component of climate adaptation and will be critical to sustaining the City into the future.

Ensuring clean and safe water quality downstream is something the City has already taken steps to improve. It is very important to maintain good relations with the communities and Indigenous groups downstream of the City that rely on those water resources. Environmental stewardship and responsible use of resources is a key principle in Indigenous knowledge and should be appropriately reflected in the City's approach to building climate resilience.

Risk Statement	Hazard(s)	Hazard Contributors	Consequences
Lack of Water Supply Reduced or limited potable water supply and availability from the WTP or wells to meet corporate, community and industry water needs.	■ Drought ■ Warmer temperatures ■ Wind ■ Extreme Weather	• Drought leads to lack of water in Buffalo Pound Lake • Warm temperatures impact water quality leading to reduced treatment • Wind stirs up lake creating turbidity and quality issues • Extreme weather - flood, fire, storm causes major outage at the Buffalo Pound Water Treatment Plant	• Reduced firefighting capacity • Emergent vegetation can take over in ponds with low water levels • Water restrictions and limitations can come into effect • Reduced or paused irrigation which results in loss of natural assets • Water conservation measures will need to be implemented in City facilities • Community recreation can be limited by closure of pools or spray pads • Puts pressure on groundwater resources and potential depletion • Resident concerns • Negative impacts on plant and animal relatives and interconnected ecosystems • Political challenges around water prioritization

Risk Statement	Hazard(s)	Hazard Contributors	Consequences
Drinking water quality Worsening water quality going into the Buffalo Pound Water Treatment Plant.	■ Rain/Flood ■ Wind ■ Warmer temperatures	• Drought leads to lack of dilution of water supply • Warm temperatures lead to increased algae growth • Wind creates turbidity and temperature differentials • Rain and flood increase suspended solids	• Water is more difficult/ expensive to treat • Water restrictions need to be put in place • Lack of drinking water availability becomes a concern for residents • Taste and odour concerns
Environmental water quality Decreased water quality upstream, downstream and within City limits, including in creeks, ponds, and Wascana Lake.	■ Wind ■ Drought ■ Warmer temperatures	• Wind stirs up lake creating turbidity, suspended solids and affecting the water temperature • Drought can reduce overall water quality • Wind can blow debris and litter into waterways • Inflow and infiltration during storm events cause overflows and bypasses in the wastewater system or at the WWTP	• Regulatory issues from unplanned discharges from the wastewater system • Potential damage to environment and natural assets • Potential implications for downstream water quality or quantity which could impact relationships with downstream users • Wastewater/stormwater system will need to be designed or expanded to withstand heavy rains • Inflow and Infiltration (I&I) will need to be minimized • Commercial and residential development is limited by wastewater service • Negative impacts on plant and animal relatives and interconnected ecosystems • Resident concerns • Emergent vegetation can take over in ponds with low water levels • Clay liners for ponds can crack • Odour complaints
Odour issues Increased odours in the community create public concern and limit access to outdoor spaces.	■ Warm temperatures ■ Variable seasons	• Heat accelerates decomposition of organic matter creating odors • Heat leads to plant growth in waterways	• Resident concerns • Public spaces are underutilized or unavailable • Regulatory requirements are not met • Operational mitigation measures required at the compost site or WWTP

Recreation & Outdoor Spaces

Residents rely on the City to create a beautiful, fun, livable community with parks, spray pads, pools, tennis courts, ice rinks and programming that meet their needs. A large portion of City seasonal staff include lifeguards, recreation programmers and maintenance workers who deliver these valuable services to the community, supporting entertainment, recreation and vital access to warming or cooling spaces in times of extreme heat or cold. Climate change impacts the viability of some of these activities and requires the City to consider new approaches to planning and delivering these services. From outdoor ice rinks melting multiple times each winter, to drought threatening the City's parks and trees, this category represents some of the areas where climate hazards like hotter temperatures and increased risk of drought will have the most impact.

Risk Statement	Hazard(s)	Hazard Contributors	Consequences
Loss of the urban forest and tree canopy Increased tree disease, mortality or destruction due to environmental conditions.	■ Wind ■ Flood ■ Wildfire ■ Drought ■ Freezing rain	• Strong winds cause branches to snap and break and kills young trees • Wildfire destroys trees and vegetation • Flood and high volumes of standing water damage trees • Drought leads to tree death from lack of water • Freezing rain can lead to ice build-up on trees that can cause damage	• Loss of valuable and difficult to replace assets • Loss of canopy and neighbourhood shade • Requires clean-up • Incremental loss of carbon sequestration • Impacts to plant and animal relatives and interconnected species/ ecosystems • Impacts to sense of place and cultural services
Loss of plant life and vegetation throughout the city Reduced plant life and vegetation throughout the City from lack of moisture and other unfavourable conditions.	■ Drought ■ Wind ■ Higher temperatures ■ Cold temperatures	• Lack of moisture from drought or extreme heat • Wind damages plant branches and stems • Extreme heat and cold stress plant life • New pest species	• Resident concerns • Dry dusty environment • Increased irrigation costs • Impacts to plant and animal relatives and interconnected species/ ecosystems • Impacts to sense of place and cultural services
Public need for safe and accessible outdoor spaces Increase in reliance on City services, like parks, rec centres, and spray pads by the community to mitigate climate impacts.	■ Hot temperatures	• Heat waves and tropical nights creating unmanageably warm indoor temperatures • Extreme and prolonged heat affects those without air conditioning	• Increased operational costs • Increased public demand for services

Risk Statement	Hazard(s)	Hazard Contributors	Consequences
Parks are unusable or inaccessible Environmental conditions cause damage to parks or create situations where they are inaccessible to the public.	■ Flood ■ Drought	• High rains or flooding leads to standing water in parks • Drought kills off vegetation and makes parks too dry to be useable • Increased mosquitoes and insects	• Resident concerns • Loss of public recreation spaces to escape indoor heat • Loss of natural assets • Impacts to sense of place and cultural services
Event planning and success Environmental conditions affect event attendance/outdoor events or prevent events from occurring.	■ Rain/Flood ■ Freezing Rain ■ Warm Temperatures ■ Cold Temperatures ■ Wildfires ■ Variable and unpredictable weather	• Increased precipitation prevents people from attending outdoor events • Standing water and heat attracts mosquitoes • Unpredictable and extreme weather makes it difficult to plan activities appropriately	• Difficult to plan events • Lower revenues • Increased costs • Reduced economic impact of large events • Reduced overall usage of recreation/entertainment infrastructure

Work & Operations

Unpredictability and variability are some of the main concerns associated with climate change and its effect on municipal operations. Weather related events can cause significant disruptions to construction, maintenance or operational activities that can escalate costs or extend project timelines. Climate hazards like flooding or storms can also create emergency situations that divert attention away from planned work activities and can be costly to address with emergency interventions. Emergency response and management is often more challenging and expensive than proactive planning and preparations.

Climate adaptation planning presents an opportunity to review existing work and identify long term improvements that can effectively build resilience. Identifying opportunities to adjust work processes and objectives to align with changing circumstances allows the City to continue delivering services that meet service level expectations of residents into the future.

Risk Statement	Hazard(s)	Hazard Contributors	Consequences
New and updated operational needs for buildings Outdoor temperature conditions and air quality require new processes for building operation and maintenance.	■ Wildfires ■ Extreme Heat ■ Cold temperatures	• Warmer temperatures increase indoor cooling requirements • Wildfires create outdoor air quality issues that force people indoors • Cold temperatures increase indoor heating requirements • Need for warming/cooling spaces	• Low air quality increases filter replacement requirements and costs • Increased temperatures impact equipment and cooling systems required to cool buildings • Increased costs for operating cooling systems • Increased costs for operating heating systems
Supply chain disruptions Extreme weather events or conditions can disrupt supply chains of goods/services/supplies the City needs.	■ Extreme Weather ■ Flood ■ Wildfire ■ Drought	• Floods/wildfire restrict road accesses for the travel of goods • Drought/wildfire impacts agricultural and industrial activities	• Increased costs for critical supplies • Increased costs overall • Lack of availability of critical supplies
Increased demand for Emergency Planning & Response Resources will need to be allocated to wildfire response, emergency mapping, or public safety communications, impacting regular operations and workflows.	■ Rain/Flood ■ Wildfire ■ Wind ■ Freezing Rain	• Increased frequency or occurrence of flooding • Increased likelihood of extreme weather	• Impacts insurance requirements • Increased emergency response requirements • Disruption of regular work • Reduced level of service • Emergency purchase requirements like sandbags, generators, pumps, etc. • Resident concerns

Risk Statement	Hazard(s)	Hazard Contributors	Consequences
Unpredictable operations Operational requirements and work increase or decrease to adjust to changing or unpredictable conditions.	■ Freezing Rain ■ Warmer Temperatures ■ Colder Temperatures ■ Wind	• Warm weather increases irrigation requirements and building cooling requirements • Freeze/thaw cycles lead to pipe breaks and potholes • Increased wind blowing dirt on roads • Reduced labour productivity • Increased market demand for workers with lower per capita productivity	• Increased building operational costs • Increased salt/sand requirements • Increased building/site cleaning requirements • Increases street cleaning requirements • Resident concerns and increased service requests • Cost overruns • Budget challenges • Potential for increased work stress for employees with more reactive or emergent work
Construction delays Construction activities are delayed due to reduced productivity or work stoppages.	■ Rain/Flood ■ Wind ■ Drought (water bans) Wildfire ■ Smoke ■ Warm temperatures	• Smoke, fire, and extreme temperatures reduce the time workers can spend outside and lowers their productivity	• Lower worker productivity • Work may not be completed on schedule • Contributes to rising infrastructure deficit if projects start to fall behind or take significantly longer
Road and sidewalk clearing and cleaning requirements Adjustments to road cleaning and snow clearing requirements are required to maintain accessible roads with variable seasons.	■ Wind ■ Variable Seasons ■ Warmer Temperatures	• Wind blows dust into the streets and causes leaves to fall from trees • Snowfall during shoulder seasons • Increased salt/sand for icy conditions needs to be cleaned	• Increased street cleaning requirements • Resident concerns and increased service requests

People & Safety

The impact of climate change on people and their wellbeing cannot be understated. Hazards like hotter temperatures and wildfire smoke can worsen health conditions and prevent people from spending time outdoors for work or recreation. Although extreme cold is projected to become less frequent, even occasional cold snaps have serious impacts on those with prolonged exposure to these extreme conditions.

The City has the responsibility to support the wellbeing of employees with effective safe work policies and personal protective equipment that mitigates the impacts of challenging weather conditions. Work cannot happen without the people committed to delivering the services residents rely on every day. Conditions that negatively impact people have the potential to negatively impact service delivery.

The City also has a responsibility to create a safe environment that meets residents' needs for accessibility and transportation. Certain climate hazards like icy or flooded roads and sidewalks can have major impacts on the safe movement of people and goods around the City and limit people's ability to get to work safely, access services or participate in activities.

Risk Statement	Hazard(s)	Hazard Contributors	Consequences
Amplified Stress on vulnerable populations requiring City supports Safety and wellbeing of vulnerable populations in our community, especially vulnerable groups such as the houseless community and those with accessibility needs.	■ Wildfires/ smoke ■ Dry dusty conditions ■ Extreme heat ■ Extreme cold	• Poor air quality aggravating health conditions • Warm temperatures and lack of moisture increase dust in the environment • Extreme heat creates risk of heat stress • Extreme cold creates risk of frost bite • Warmer temperatures alter the effects of drugs on individual drug-users and increase risks of overdose and unpredictable behaviour • Heat amplifies concrete/ pavement temperatures creating urban heat islanding effects	• Increased mobilization required for community response and support mechanisms • Increased costs for supports • Resident concerns • Heat stress and frost bite • Stress on emergency response • Overload on hospitals and health care systems • Reduced community wellbeing and vibrancy
Employee physical health risks Employees are at risk of heat stress, smoke inhalation, asthma, or frostbite as a direct results of work conditions.	■ Wildfires/ smoke ■ Dry dusty conditions ■ Extreme heat ■ Extreme cold	• Reduced air quality • Wildfire smoke • Extreme heat creating risk of heat stroke • Extreme cold creating risk of frostbite	• Increased sick leave • Reduced outdoor activities • Limitations on field work and disrupted operations • Reduced hours and shift changes • Project schedule delays • Reduced employee wellbeing

Risk Statement	Hazard(s)	Hazard Contributors	Consequences
Employee mental health Employees are at risk of heat stress, smoke inhalation, asthma, or frostbite as a direct results of work conditions.	■ Wildfires/ smoke ■ Dry dusty conditions ■ Extreme heat ■ Extreme cold	• Smoke or prolonged cold temperatures prevent people from going outdoors • Personal property is damaged from extreme weather • Worsening health conditions	• Increased workplace stress • Operational and construction challenges with lack of staff to complete work • Reduced employee wellbeing, possibly personal or community relationships
Evacuation shelter needs The City may need to house evacuees from Regina neighbourhoods or other areas suffering from extreme weather.	■ Wildfires ■ Floods	• Extreme weather requires people to evacuate from their homes	• Increased demand for staff and resources • Disrupts other services
Wind gusts and blowing debris Flying debris creates safety hazards for residents and employees.	■ Wind	• High speed wind gusts	• Safety risks to employees working outdoors • Increasing the potential for falling debris, making certain operations unsafe or delayed • Creates litter and challenges waste collection
Unsafe sidewalk and surface conditions Icy conditions creating sidewalk accessibility issues.	■ Freezing rain ■ Cold temperatures ■ Freeze thaw	• Icy and snow-covered sidewalks	• Safety risks for employees • Safety risks for residents, especially vulnerable groups • People cannot get where they need to go • Employee and resident concerns • Increased snow/ice removal and prevention requirements • Disproportionate impacts on elderly, families and persons with mobility challenges
Motor vehicle accidents Increased vehicle accidents for city fleet, transit and the public.	■ Blowing snow ■ Freezing Rain ■ Cold temperatures ■ Snow ■ Freeze thaw ■ Flood	• Icy road conditions • Blowing snow • Snow drifts and accumulation on roads • Overland flooding and standing water	• Safety risks for employees • Potential lost time injuries • Increased insurance claims • Increased budget for repairs • Delays in deliveries • Restricted mobility for field operations • Increased towing costs • Increased snow/ice removal and prevention requirements • Increased emergency response requirements • Increased risk to emergency responders

Evaluating Risks

Evaluating and prioritizing the risks associated with climate change is important to ensure that the risks that are likely to cause the most significant impacts are well understood and planned for.

The risk statements presented in the log were evaluated based on the criteria below to identify which risks pose the greatest concern to the City. A key component of reflecting Indigenous worldview in the evaluations was highlighting the importance of natural ecosystems and interconnections, including plant and animal life and water resources.

Evaluation Criteria

Consequence Severity

4 Critical	Critical impacts to business areas or service delivery. Impacts would require significant staff and cost interventions for correction.
	Critical impacts to plant and animal life or natural systems. Impacts would require significant time, cost, or effort to remediate and result in critical loss of natural ecosystems.
	Critical impacts to the community, including residents, homeowners, business owners, and vulnerable groups. Impacts would cause significant property damage and/or harm to people's health or wellbeing.
3 Major	Major impacts to plant and animal life or natural systems. Impacts would require increased time, cost, or effort to remediate and result in major damage to natural ecosystems.
	Major impacts to plant and animal life or natural systems. Impacts would require increased time, cost, or effort to remediate and result in major damage to natural ecosystems.
	Major impacts to the community, including residents, homeowners, business owners, and vulnerable groups. Impacts would cause major property damage and/or harm to people's health or wellbeing.
2 Moderate	Moderate impacts to business areas or service delivery. Impacts would require moderate staff and cost interventions for correction.
	Moderate impacts to plant and animal life or natural systems. Impacts would require moderate time, cost, or effort to remediate or rectify and result in moderate damage to natural ecosystems.
	Moderate impacts to the community, including residents, homeowners, business owners, and vulnerable groups. Impacts would cause moderate property damage and/or harm to people's health or wellbeing.
1 Minor	Minor impacts to business areas or service delivery. Impacts would require minimal staff and cost interventions for correction.
	Minor impacts to plant and animal life or natural systems. Impacts would require little to no time, cost, or effort to remediate or rectify and result in minor damage to natural ecosystems.
	Minor impacts to the community, including residents, homeowners, business owners, and vulnerable groups. Impacts would cause minor property damage and/or harm to people's health or wellbeing.

Likelihood of Impact Occurring

Likelihood Rating
5 – Very likely
4 - Likely
3 – Moderate/realistic probability
2 – Unlikely
1 – Low/very unlikely

Risk Matrix

Based on the evaluation rankings, climate risks were plotted on a matrix based on their likelihood and severity ratings.

Overall Risk Rating	Categorization	Response
Green (1 – 4)	Minor	• Review and update operational processes as required.
Yellow (5 – 9)	Moderate	• Review and update operational processes. • Identify risk mitigation opportunities and implement where cost-effective.
Orange (10 – 14)	Major	• Review and update operational processes. • Identify risk mitigation opportunities and implement best available risk mitigation opportunities.
Red (15 – 20)	Critical	• Review and update operational processes. • Develop and implement risk mitigation opportunities as a top priority.

		Likelihood				
		1 - Low/very unlikely	**2 - Unlikely**	**3 - Moderate/ realistic possibility**	**4 - Likely**	**5 - Very likely**
Severity	**4 - Critical**	4	8	12	16	20
	3 - Major	3	6	9	12	15
	2 - Moderate	2	4	6	8	10
	1 - Minor	1	2	3	4	5

Probability						
Severity		1 - Low/ very unlikely	2 - Unlikely	3 - Moderate/ realistic possibility	4 - Likely	5 - Very likely
	4 - Critical			• Damage to critical infrastructure and utilities • Lack of Water Supply		
	3 - Major			• Environmental water quality • Increased demand for Emergency Planning & Response • Supply chain disruptions • Evacuation Shelter needs	• Long-term degradation of City infrastructure • Transportation network disruptions • Asset and Equipment damage and losses • Residential property damage • Drinking water quality • New and updated operational needs for buildings • Amplified stress on vulnerable populations requiring City supports • Loss of the urban forest and tree canopy • Loss of plant life and vegetations throughout the city • Public need for safe and accessible outdoor spaces	
	2 - Moderate			• Small asset inventory damage and losses • Construction delays • Road and Sidewalk clearing and cleaning requirements • Employee mental health • Parks are unusable or inaccessible	• Drainage infrastructure challenges • Underground pipe breakages • Operational disruptions • Employee physical health risks • Wind gusts and blowing debris • Motor vehicle accidents • Event planning and success	
	1 - Minor			• Odor issues		

What we are going to do

Understanding the climate risks ahead of us is the first step in adapting to climate change. The City must also actively manage these risks, prepare for the changes already underway and build resilience into systems that support the city and its residents. Avoiding the impacts of climate change is not an option because these changes are already taking place. Although the City has already been working to build resilience in many ways, projected climate changes bring increased risks that require a responsible and aligned approach to reducing these risks within our community and doing our part to advance climate action.

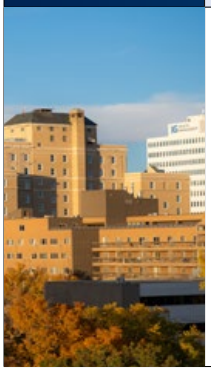
Advancing adaptation actions requires coordination across many departments and teams within the City, as well as close collaboration with key partners and stakeholders. All areas of the City – from asset management and planning, to project delivery, to operations, to community services – have a role to play in building a resilient Regina.

Action Areas

Eight thematic areas emerged around key actions that can address the climate risks identified in the CRVA. Identifying and aligning work across these action areas will allow the City effectively target investments and coordinate actions critical for improving climate resilience.

1 Infrastructure Resilience

Planning, designing, maintaining and updating municipal assets to be resilient to the impacts of climate change will enable consistent delivery of service level expectations.



Goals:

- **Ensure City infrastructure is designed to withstand new and changing climate hazards.**
  - Example – update design standards to incorporate climate change projections
- **Monitor and inspect infrastructure to maintain resilience.**
  - Example – review and update infrastructure maintenance processes
- **Investigate opportunities for innovative project and material types.**
  - Example – review research and studies on improving infrastructure

2 Drought Preparedness

Increasing water conservation and water supply management is critical to addressing anticipated impacts of increased drought.

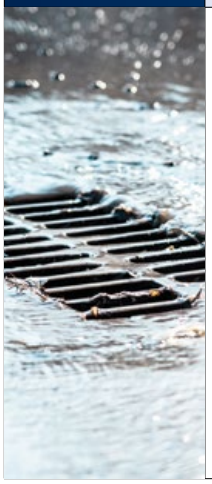
Goals:

- **Implement water conservation programs in City facilities.**
  - Example – retrofit City facilities with water re-use systems.
- **Promote water conservation in the community.**
  - Example – develop education and outreach campaigns for water conservation.
  - Example – develop guidelines for water conservation for new developments.
- **Plan and design for long term water supply requirements**
  - Example – develop plan for long term water security.

Conserving water will lead to increased energy efficiency and align with action 8.1 for Water and Wastewater Improvements in the ESF.

3 Stormwater Management

Ensuring both minor and major stormwater systems have sufficient capacity to meet stormwater management needs is necessary to prevent damage from flooding.



Goals:

- **Expand stormwater management system capacity.**
  - Example – update drainage master plan to identify projects that improve stormwater management capacity.
- **Reduce inflow and infiltration into the wastewater collection system.**
  - Example – develop a program to coordinate efforts across departments to manage I&I.
- **Design and implement enhancements to the stormwater systems to mitigate impacts of flooding on the community.**
  - Example – upgrade drainage systems in flood-prone neighbourhoods.
- **Leverage natural assets for stormwater management.**
  - Example – develop a plan for incorporating green infrastructure into drainage projects.

4 Environmental Water Quality

Monitoring and improving water quality is important for protecting the water needs of residents and downstream communities as increased temperatures, drought and flood can impact water quality.

Goals:

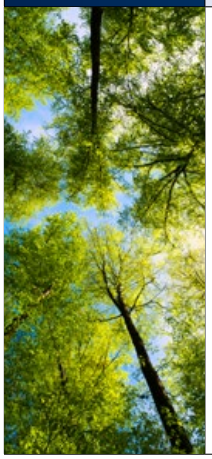
- **Protect water quality throughout the city's water systems.**
  - Example – study opportunities for water quality improvements from the storm system.
- **Collaborate with institutional and operational partners to monitor and assess source water quality.**
  - Example – track climate conditions and associated impacts that may affect water treatment.
- **Mitigate negative impacts to downstream user water quality from the city.**
  - Example – ensure the wastewater system has sufficient capacity to avoid discharging wastewater into the environment.

Protecting water and nature resources aligns with the Treaty Principal wîtaskêwin, living together on the land in harmony.

Balancing the natural and built environments advance opportunities for economic opportunities into the future.

5 Trees and Nature

Enhancing and safeguarding the natural environment offers crucial protection against climate change impacts such as extreme heat, flooding, and drought.



Goals:

- **Protect and expand the urban tree canopy.**
  - Example – incorporate climate resilience in Urban Forest Master Plan and the importance of the tree canopy for combating the heat island effect.
- **Reduce irrigation and intensive maintenance through planting native and drought resilient plant species.**
  - Example - Follow recommendations in Parks Master Plan for planting native and drought resilient plants.
- **Improve soil health in green spaces.**
  - Example - Identify opportunities for adding compost and mulch to reduce erosion and restore soil health.

6 Building Operations

Incorporating climate resilience into municipal facility operations protects against the impacts of extreme weather, hotter temperatures, windy conditions and drought.

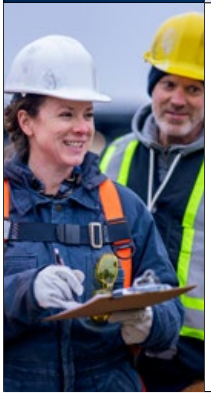
Goals:

- **Review and update requirements for heating and cooling in City facilities.**
  - Example - Conduct a needs assessment for City-owned buildings and how they can be leveraged to maximize community benefits during extreme temperatures.
- **Identify opportunities to improve climate resilience of City facilities.**
  - Example - Carry out an assessment of building systems and identify opportunities for improved climate resilience.

Climate resilience retrofits can be coordinated with energy-efficiency retrofits to align with Big Move #1 – Building Retrofits in the ESF.

7 Safety and Emergency Response

Proactively planning for the impacts of extreme weather and changing conditions protects the safety of workers and the public.



Goals:

- **Incorporate climate change risks into emergency response planning.**
  - Example – Incorporate CRVA into community-wide Hazard Risk and Vulnerability Assessment and Emergency Response Plan.
- **Incorporate climate risks into safe work plans.**
  - Example – Update branch safe operating procedures (SOPs) to reflect climate change hazards.
- **Support vulnerable residents in times of extreme weather.**
  - Example – Increase operational hours of extreme weather shelters.

8 Proactive Seasonal Service Delivery

Planning for increased variability of seasonal conditions and overall higher temperatures proactively supports the City in delivering the level of services the community expects.

Goals:

- **Adjust seasonal recreation programs to adapt to new climate hazards.**
  - Example – Review climate impacts on recreation infrastructure like outdoor ice rinks and spray pads.
- **Update operational processes to align with changing seasonal conditions.**
  - Example – Review processes and timing for key seasonal operations like winter snow removal and street sweeping.

Providing safe and reliable service as part of climate adaptation supports the employees and the community, while aligning with the health and wellbeing considerations of wîtaskêwin.

Implementing a Climate Resilient Approach

A well-established, consistent and supported approach to implementing the CCAS is essential to ensuring the City of Regina can continue to deliver reliable, cost-effective and equitable municipal services in the face of a changing climate. Proactively addressing climate change through adaptation and resilience building will mitigate the growing financial, operational and reputational risks the City faces. Many of the risks identified affect multiple departments, systems or stakeholders and require coordinated efforts and clear objectives to meaningfully address.

Implementing a climate resilient approach is also an opportunity to reflect on the treaty principles informing our relationship to the land and each other. It is important to ensure that the values of good relations, expanding the circle, speaking the truth, operating from one's place of self and living together on the land in harmony are reflected in our approach to building climate resilience.

The implementation approach outlines how the vision, objectives and guiding principles of the strategy will be integrated to increase resiliency and reduce vulnerability of the City to the impacts of a changing climate.

Implementation Approach

Utilize Data, Research and Indigeous Knowledge

- Incorporate Indigenous knowledge into planning and decision making.
- Support and advance research on climate hazards and their potential impacts on the prairies.
- Leverage climate data for more informed project planning and decision making.

Improve Planning

- Update Master Plans.
- Update Asset Management Plans.
- Update Emergency Response Plans.
- Update and develop new strategies or plans.

Develop Competencies

- Establish employee training and education programs and resources.
- Establish internal governance structures.
- Coordinate, monitor and evaluate progress on climate related work.
- Update financial policies and processes.
- Regularly review progress and update strategy on a five-year cycle.

Integrate Processes

- Integrate climate resilience into the budget process.
- Integrate climate resilience into the business planning process.
- Integrate climate resilience in business continuity planning and Emergency Operations Centre (EOC).
- Integrate climate resilience in the Safety Matrix and OH&S policies.

Build Resilient Infrastructure

- Update design standards and guidelines.
- Update bylaws.
- Update zoning requirements.
- Increase bylaw review and enforcement.
- Add or improve back-up power solutions.

Deliver Public Education and Outreach

- Incorporate climate adaptation into education on emergency preparedness.
- Incorporate climate adaptation into education on fire safety and prevention.
- Develop public education and outreach on water conservation.
- Deliver public education and outreach on importance of nature and trees in their communities.

Evaluating and Prioritizing Actions

To ensure that any initiatives advanced through the CCAS can be effectively prioritized and coordinated, specific actions will be evaluated using the following criteria developed based on the Low Carbon Resilience Planning Handbook.[1]

Criteria	Low	Medium	High
Adaptation/ Resilience	Strengthens adaptation or builds resilience little to not at all.	Moderately strengthens adaptation or builds resilience.	Significantly strengthens adaptation or builds resilience.
Cost	Cost is high relative to cost of inaction.	Cost is moderate relative to cost of inaction.	Cost is low relative to cost of inaction.
Co-benefits	Responds to only a few climate impacts and contributes little or not at all to other City priorities.	Responds to several climate impacts and contributes moderately to other City priorities.	Responds to many climate impacts and contributes significantly to other City priorities.
Urgency	Consequences of inaction are likely to occur in the long-term.	Consequences of inaction are likely to occur in the near- to medium-term.	Consequences of inaction are already occurring.
Regret	Little or no benefit if climate change doesn't occur.	Some benefits regardless of climate change.	Significant benefits regardless of climate change.

1 ACT, 2021. *LCR Planning Handbook: Integrating Low Carbon Resilience in Local Government,* Action on Climate Team, Simon Fraser University. Canada

Immediate Actions and Next Steps

There are several actions the City plans to undertake immediately as part of the next steps and implementation approach for the CCAS.

1	Work with Elders to share Indigenous environmental and ecological teachings across the organization.
2	Incorporate climate resilience into a community-wide Hazard Risk and Vulnerability Assessment (HRVA) and Emergency Response Plan (ERP).
3	Develop an implementation plan for advancing climate resilience actions in alignment with climate mitigation principles identified in the ESF.
4	Begin training employees on climate adaptation and leveraging existing sustainability frameworks, championed by organizations such as Envision Canada and the Public Infrastructure Engineering Vulnerable Committee.
5	Review and adopt updated technical requirements for development and design standards that incorporate future climate change projections.

Appendix - Climate Data Tables

Wet Days

Historical			
	Min	Mean	Max
Wet days >5 mm	23.0	**23.9**	24.9
Wet days >10 mm	8.6	**9.2**	9.8
Wet days >20 mm	1.7	**2.0**	2.3
Wettest day (mm)	28.2	**30.5**	32.7
Annual precipitation (mm)	384.1	**393.8**	408.1
1.5 ° Celsius of Global Warming in 2035			
	Min	Mean	Max
Wet days >5 mm	24.4	**27.0**	30.5
Wet days >10 mm	9.6	**11.0**	12.6
Wet days >20 mm	2.1	**2.7**	3.3
Wettest day (mm)	31.3	**34.5**	39.0
Annual precipitation (mm)	411.0	**437.3**	468.6
2.0 ° Celsius of Global Warming in 2048			
	Min	Mean	Max
Wet days >5 mm	24.4	**27.0**	30.5
Wet days >10 mm	9.6	**11.0**	12.6
Wet days >20 mm	2.1	**2.7**	3.3
Wettest day (mm)	31.3	**34.5**	39.0
Annual precipitation (mm)	411.0	**437.3**	468.6
3.0 ° Celsius of Global Warming in 2070			
	Min	Mean	Max
Wet days >5 mm	25.5	**29.0**	32.5
Wet days >10 mm	10.6	**12.1**	14.3
Wet days >20 mm	2.3	**3.2**	4.0
Wettest day (mm)	32.9	**36.0**	44.2
Annual precipitation (mm)	420.1	**464.2**	498.9

Hot Days

Historical			
	Min	Mean	Max
Hot Days > 30° C	14.1	**16.1**	18.3
Very Hot Days > 35° C	0.8	**1.3**	1.6
Dry Days (<1 mm)	290.4	**293.5**	296.2
1.5 ° Celsius of Global Warming in 2035			
	Min	Mean	Max
Hot Days > 30° C	24.4	**27.0**	30.5
Very Hot Days > 35° C	9.6	**11.0**	12.6
Dry Days (<1 mm)	281.1	**287.4**	291.9
2.0 ° Celsius of Global Warming in 2048			
	Min	Mean	Max
Hot Days > 30° C	23.7	**38.6**	
Very Hot Days > 35° C	2.8	**8.1**	14.0
Dry Days (<1 mm)	281.6	**287.2**	290.7
3.0 ° Celsius of Global Warming in 2070			
	Min	Mean	Max
Hot Days > 30° C	34.7	**48.3**	57.1
Very Hot Days > 35° C	5.9	**12.5**	21.0
Dry Days (<1 mm)	2.3	**3.2**	4.0

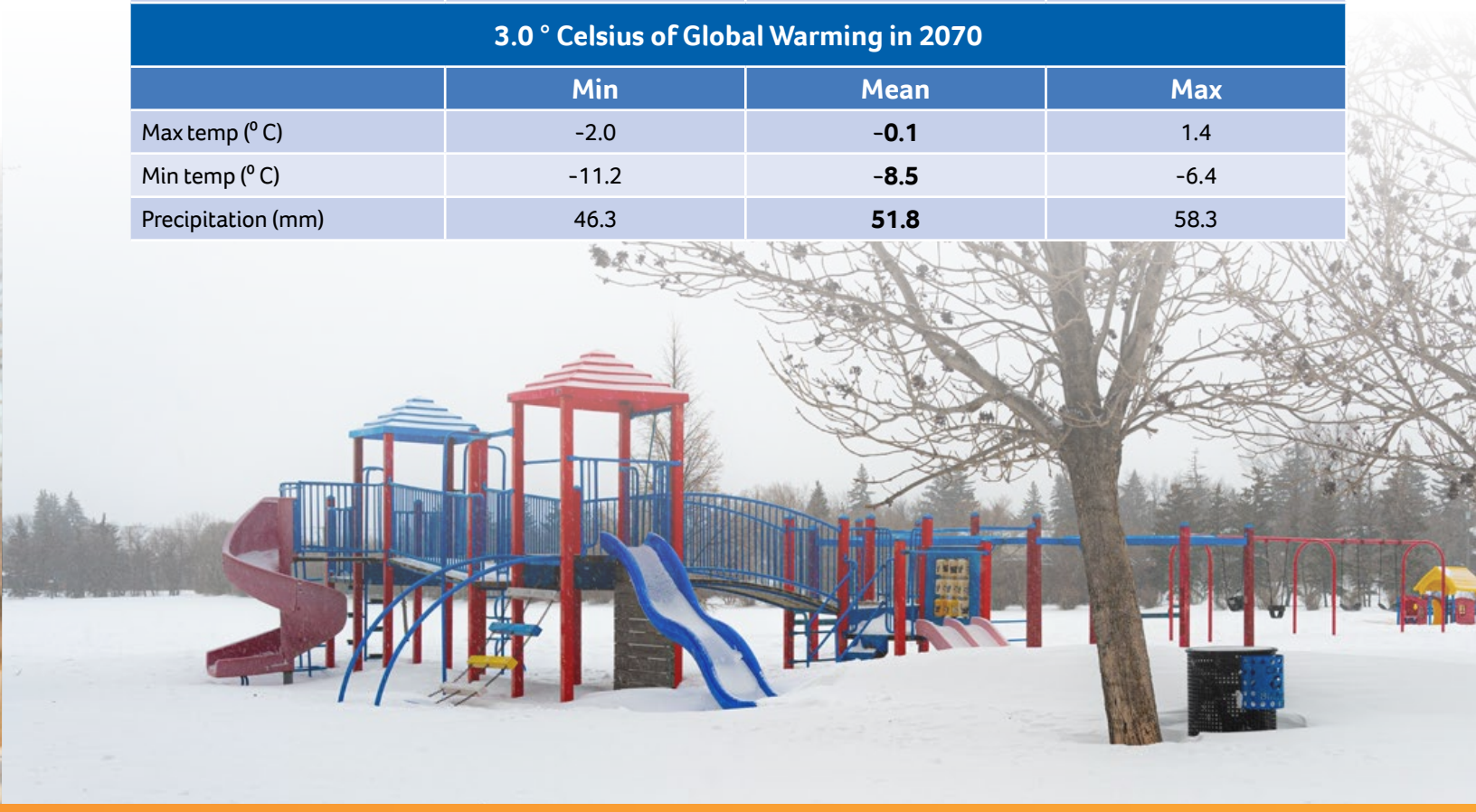
Cold Days

Historical			
	Min	Mean	Max
Cold Days < 15° C	8.1	**9.4**	11.4
Very Cold Days <30° C	63.1	**65.3**	67.1
Frost Free Season	166.1	**169.2**	171.3
Frost Days	193.7	**195.8**	198.9
1.5 ° Celsius of Global Warming in 2035			
	Min	Mean	Max
Very Cold Days <30° C	1.5	**2.8**	4.4
Cold Days < 15° C	42.5	**49.1**	58.3
Frost Free Season	183.7	**201.2**	211.9
Frost Free Days	153.1	**163.8**	181.4
2.0 ° Celsius of Global Warming in 2048			
	Min	Mean	Max
Very Cold Days <30° C	0.9	**1.8**	3.1
Cold Days < 15° C	34.7	**41.7**	54.0
Frost Free Season	187.9	**208.5**	219.6
Frost Free Days	145.5	**156.5**	177.1
3.0 ° Celsius of Global Warming in 2070			
	Min	Mean	Max
Very Cold Days <30° C	0.2	**0.7**	1.8
Cold Days < 15° C	23.4	**29.3**	43.2
Frost Free Season	204.7	**223.3**	238.2
Frost Free Days	126.8	**141.7**	160.3

Winter Seasonal Data

Note: Meteorological winter is from December, January, and February

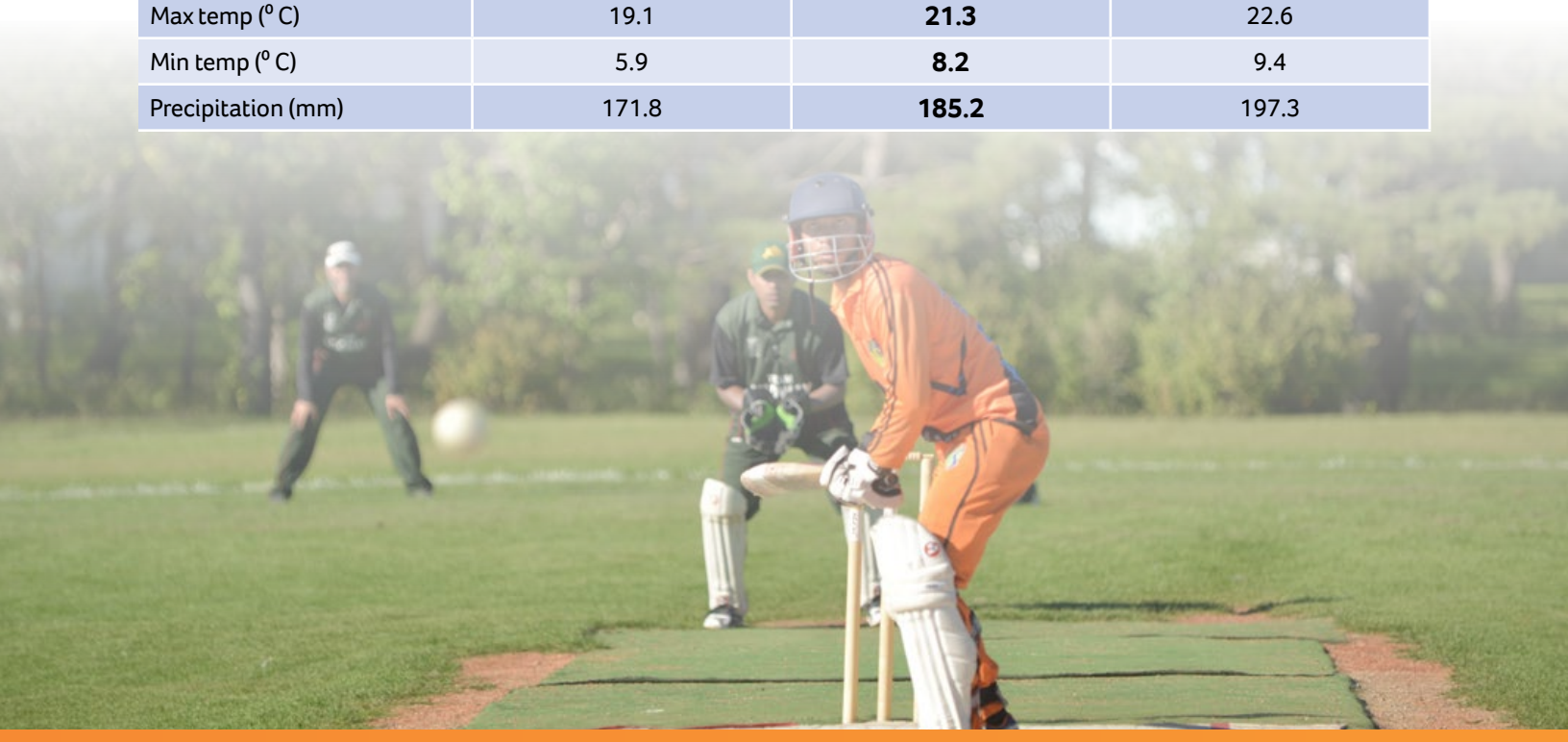
Historical			
	Min	Mean	Max
Max temp (° C)	-5.7	**-4.8**	-4.3
Min temp (° C)	-16.0	**-15.3**	-14.8
Precipitation (mm)	40.1	**42.5**	44.6
1.5 ° Celsius of Global Warming in 2035			
	Min	Mean	Max
Max temp (° C)	-3.7	**-2.3**	-1.3
Min temp (° C)	-13.9	**-11.9**	-10.7
Precipitation (mm)	44.0	**49.3**	53.2
2.0 ° Celsius of Global Warming in 2048			
	Min	Mean	Max
Max temp (° C)	-3.1	**-1.4**	0.0
Min temp (° C)	-13.1	**-10.6**	-9.0
Precipitation (mm)	44.1	**49.3**	54.0
3.0 ° Celsius of Global Warming in 2070			
	Min	Mean	Max
Max temp (° C)	-2.0	**-0.1**	1.4
Min temp (° C)	-11.2	**-8.5**	-6.4
Precipitation (mm)	46.3	**51.8**	58.3



Spring Seasonal Data

Note: Meteorological spring is March, April and May

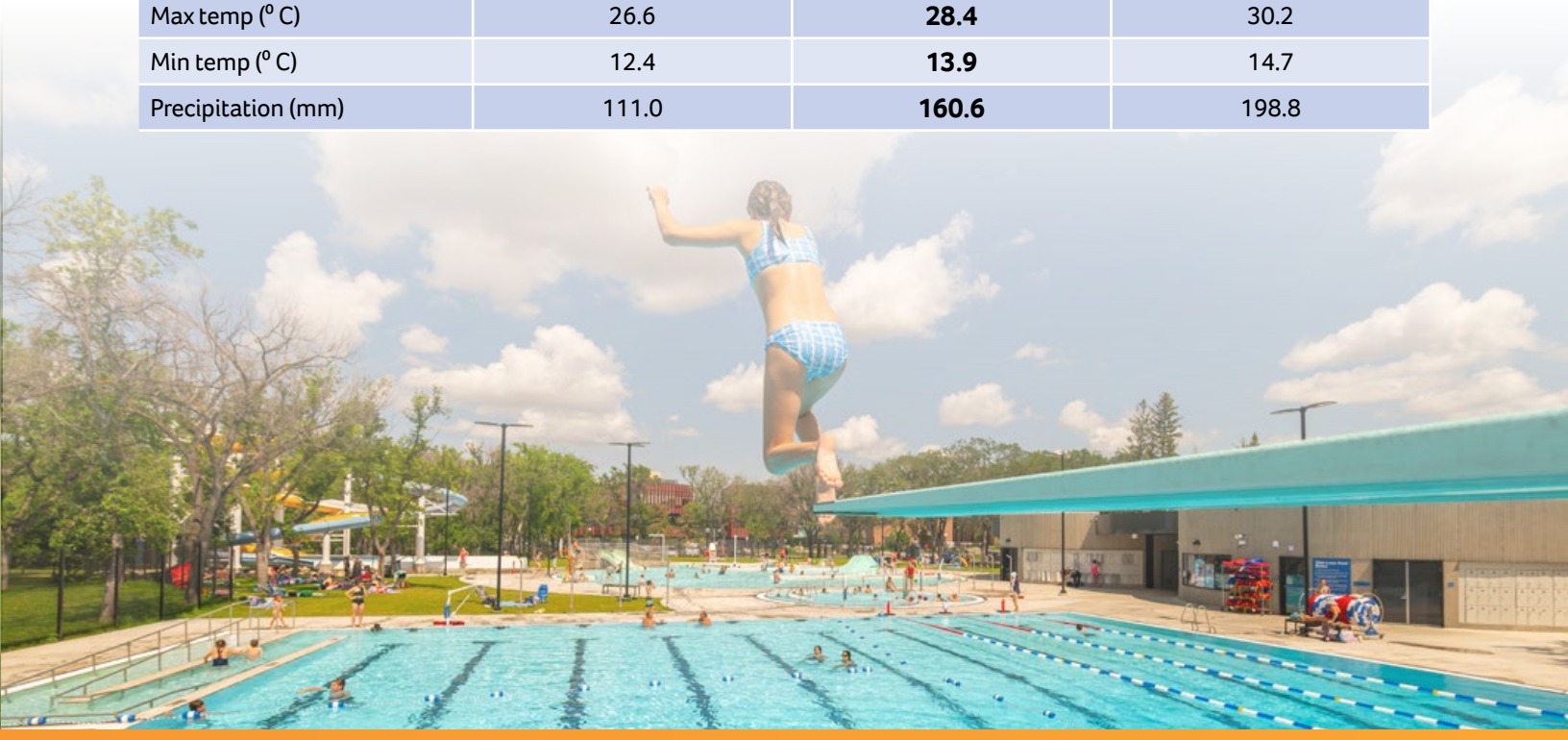
Historical			
	Min	Mean	Max
Max temp (° C)	17.3	**17.7**	18.2
Min temp (° C)	3.1	**3.6**	3.9
Precipitation (mm)	132.3	**140.0**	152.5
1.5 ° Celsiuss of Global Warming in 2035			
	Min	Mean	Max
Max temp (° C)	17.9	**20.2**	21.8
Min temp (° C)	4.5	**6.5**	7.8
Precipitation (mm)	142.7	**165.7**	180.0
2.0 ° Celsius of Global Warming in 2048			
	Min	Mean	Max
Max temp (° C)	18.0	**20.6**	21.9
Min temp (° C)	4.8	**7.1**	8.3
Precipitation (mm)	153.7	**171.5**	189.2
3.0 ° Celsius of Global Warming in 2070			
	Min	Mean	Max
Max temp (° C)	19.1	**21.3**	22.6
Min temp (° C)	5.9	**8.2**	9.4
Precipitation (mm)	171.8	**185.2**	197.3



Summer Seasonal Data

Note: Meteorological summer is June, July, and August

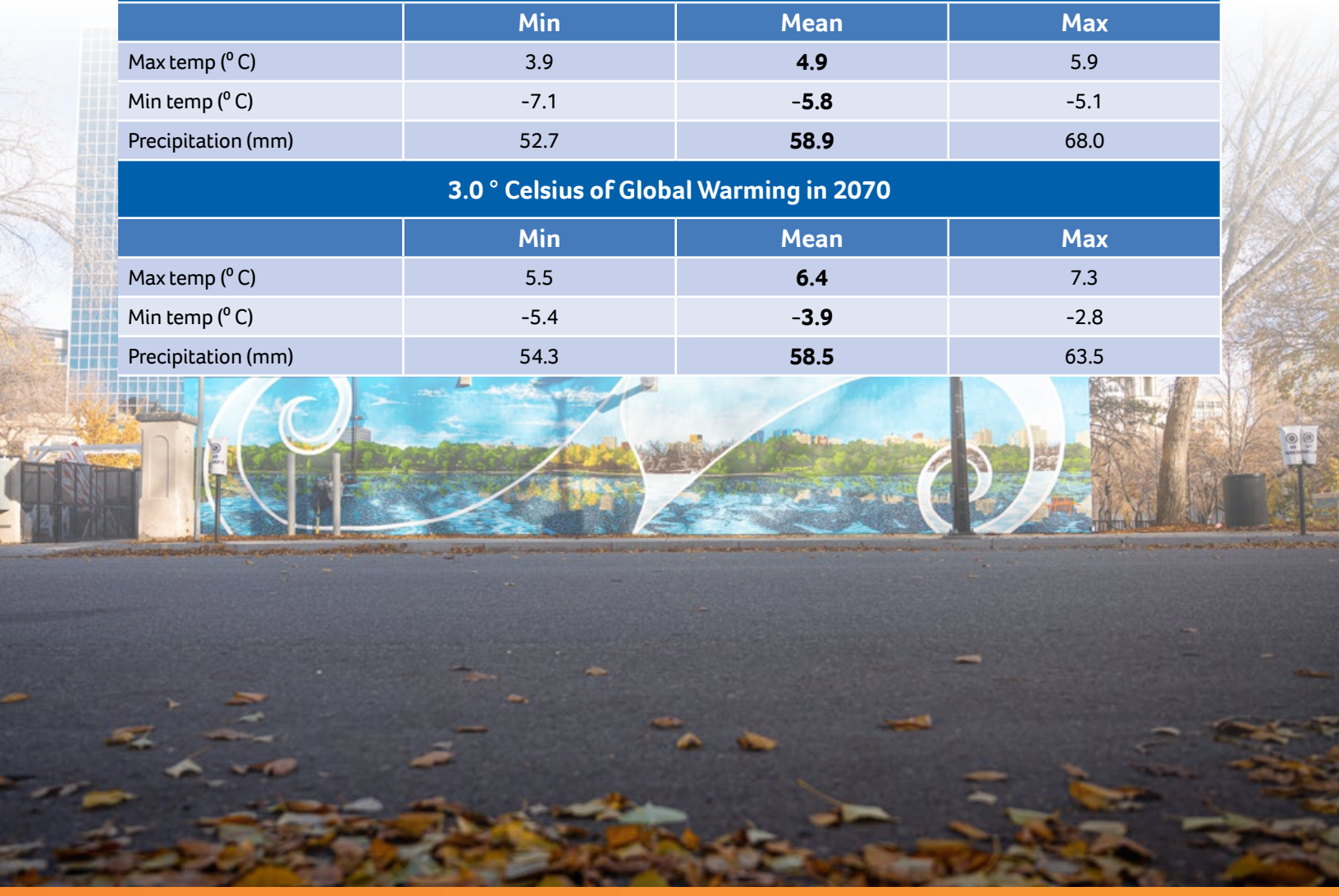
Historical			
	Min	Mean	Max
Max temp (° C)	23.8	**24.1**	24.6
Min temp (° C)	9.3	**9.5**	9.7
Precipitation (mm)	142.5	**152.4**	159.6
1.5 ° Celsius of Global Warming in 2035			
	Min	Mean	Max
Max temp (° C)	24.4	**26.5**	28.5
Min temp (° C)	10.2	**11.5**	12.5
Precipitation (mm)	118.9	**156.6**	194.5
2.0 ° Celsius of Global Warming in 2048			
	Min	Mean	Max
Max temp (° C)	24.7	**27.0**	28.5
Min temp (° C)	10.7	**12.2**	13.2
Precipitation (mm)	118.5	**157.3**	198.4
3.0 ° Celsius of Global Warming in 2070			
	Min	Mean	Max
Max temp (° C)	26.6	**28.4**	30.2
Min temp (° C)	12.4	**13.9**	14.7
Precipitation (mm)	111.0	**160.6**	198.8



Fall Seasonal Data

Note: Meteorological summer is September, October, and November

Historical			
	Min	Mean	Max
Max temp (° C)	1.9	**2.3**	2.9
Min temp (° C)	-9.2	**-8.9**	-8.6
Precipitation (mm)	47.9	**52.0**	55.2
1.5 ° Celsius of Global Warming in 2035			
	Min	Mean	Max
Max temp (° C)	3.3	**4.3**	5.2
Min temp (° C)	-7.6	**-6.7**	-6.1
Precipitation (mm)	52.6	**57.9**	72.4
2.0 ° Celsius of Global Warming in 2048			
	Min	Mean	Max
Max temp (° C)	3.9	**4.9**	5.9
Min temp (° C)	-7.1	**-5.8**	-5.1
Precipitation (mm)	52.7	**58.9**	68.0
3.0 ° Celsius of Global Warming in 2070			
	Min	Mean	Max
Max temp (° C)	5.5	**6.4**	7.3
Min temp (° C)	-5.4	**-3.9**	-2.8
Precipitation (mm)	54.3	**58.5**	63.5




Mosaic

REGINA