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Municipal Adaptation to Climate Change and Severe Weather Events in Alberta

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1.0 Purpose

This paper provides information to Alberta's small urban and rural municipal councils and administrators about climate change adaptation and resiliency planning processes. The information will hopefully help them develop municipal climate change adaptation and resiliency plans (CARP). The general public might find the information useful during community consultation for CARP development.

Climate change is a global issue, with severe weather events (multi-year drought, flooding, severe heat and cold, severe rain and hail storms, and wildfires) (SWE) becoming more common and less predictable around the world,[1] and notably in Alberta.[2] SWE are negatively impacting the landscape and people at both the local and regional scales[3] where municipalities govern.

In Alberta, two of the five purposes of municipal governance are to 'foster the well-being of the environment,' and 'to develop and maintain safe and viable communities.'[4] Some ecologists have found that, in the face of climate change, a healthy local environment is critical to sustaining the health and welfare of citizens, and the safety and viability of communities.[5] These findings corroborate the Supreme Court of Canada's (SCC) early recognition (1997) of the correlation between healthy local environments and community viability. The SCC noted that municipalities govern at the local scale, responding directly to people where they live, work, and play, and therefore, they necessarily play a significant role in local environmental management.[6]

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[1] S.I. Seneviratne, et al., 'Weather and Climate Extreme Events in a Changing Climate,' (2021*). Climate Change 2021: The Physical Science Basis*. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, V. Masson-Delmotte, et al., (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1513–1766, doi:10.1017/9781009157896.013.

[2] Mary Ellen Tyler, "Climate Risk Assessment and Adaptation Considerations for Municipal Governance", Volume 15:43 (2023), online (pdf): *University of Calgary School of Public Policy, Future of Municipal Government Series* https://www.policyschool.ca/wp-content/uploads/2023/03/AUMA-UP44 ResearchPaper.ClimateRiskAssessment.Tyler_.pdf [Tyler].

[3] Fünfgeld, H., Fila, D., & Dahlmann, H. 'Upscaling climate change adaptation in small-and medium-sized municipalities: current barriers and future potentials,' (2023) *Current Opinion in Environmental Sustainability,* 61, 101263 [Funfgeld et al.]. See also Hyung-Il Eum, et al. 'Potential changes in climate indices in Alberta under projected global warming of 1.5–5 °C,' *Journal of Hydrology*: *Regional Studies,*(2023) 47-101390, at 101390, online: https://doi.org/10.1016/j.ejrh.2023.101390. [Eum, et al.]

[4] *Municipal Government Act*, RSA 2000, c M-26 [MGA], s 3.

[5] Tyler, *supra* note 2.

[6] *Ibid.* See also: *114957 Canada Ltée (Spraytech, Société d'arrosage) v Hudson (Town*), 2001 SCC 40, [*Spraytech*] at para 2: 'The case arises in an era in which matters of governance are often examined through the lens of the principle of subsidiarity. This is the proposition that law-making and implementation are often best achieved at a level of government that is not only effective, but also closest to the citizens affected and thus most responsive to their needs, to local distinctiveness, and to population diversity. La Forest J wrote for the majority in R v Hydro-Québec, [1997] 3 SCR 213, that "the protection of the environment is a major challenge of our time. It is an international problem, one that requires action by governments at all levels" (at para 127). His reasons in that case also quoted with approval a passage from Our Common Future, the report produced in 1987 by the United Nations' World Commission on the Environment and Development. The so-called "Brundtland Commission" recommended that "local governments [should be] empowered to exceed, but not to lower, national norms" (at para 220).'

Alberta's municipalities are tasked with emergency preparedness and operations when local states of emergency are declared under the provincial *Emergency Management Act*.[7] Over the past 10 years, several Alberta municipalities have declared local states of emergency due to SWE.

Many municipalities are developing CARP to assess local climate vulnerabilities and adapt to increased risks to society and the ecosystem associated with warming temperatures and SWE. However, like small urban and rural municipalities around the world,[8] many Alberta communities do not have CARP in place. As a result, there are few policies and programs in these communities to help citizens and businesses mitigate or adapt to climate change at the personal or sectoral scales. These communities may not be prepared to respond to the impacts of SWE that may threaten lives, property and livelihoods during declared states of emergency.

Recently, climate researchers identified several barriers that prevent small urban and rural municipalities from developing CARP, including the lack of: awareness; trained personnel; financial resources; and the scientific knowledge and data necessary to assess local vulnerabilities and risks.[9] These researchers also say that councils and administrators need champions for CARP development, and may not be aware of the various policy tools, programs, funding opportunities, and processes currently available to help them develop CARP.

Since 2018, new research, federal and provincial policy and legislative change, funding, and institutional arrangements have emerged in Alberta to assist municipalities develop CARP. However, in its current disorganized state, finding and assessing this information for local relevancy and usefulness might be daunting for smaller urban and rural municipalities. This paper organizes the most relevant of these resources, highlighting policy, legislation, research, technical, and funding tools, as well as examples of innovative municipal CARP processes to help municipalities develop CARP with their citizens and stakeholders.

To develop CARP, small and rural municipalities need:

- ***leadership and champions;***
- ***awareness;***
- ***trained personnel;***
- ***financial resources; and***
- ***scientific knowledge and data to assess local vulnerabilities and risk.***

[7] *Emergency Management Act,* RSA 2000, c E-6.8 [EMA]. See s.11: 'A local authority (a) shall, at all times, be responsible for the direction and control of the local authority's emergency response unless section 19(5.1) applies or except to the extent provided in an order made under section 24(1.01) or (1.011); (b) shall approve emergency plans and programs, subject to the regulations; (c) may enter into agreements with and make payments or grants, or both, to persons or organizations for the provision of services in the development or implementation of emergency plans or programs.' Municipalities also have powers, duties and functions described in s.5 of the MGA: A municipality (a) has the powers given to it by this and other enactments, (b) has the duties that are imposed on it by this and other enactments and those that the municipality imposes on itself as a matter of policy, and (c) has the functions that are described in this and other enactments. See also *Local Authority Emergency Management Regulation*, Alberta Regulation 203/2018.

[8] Funfgeld et al. *supra* note 3, at 1.

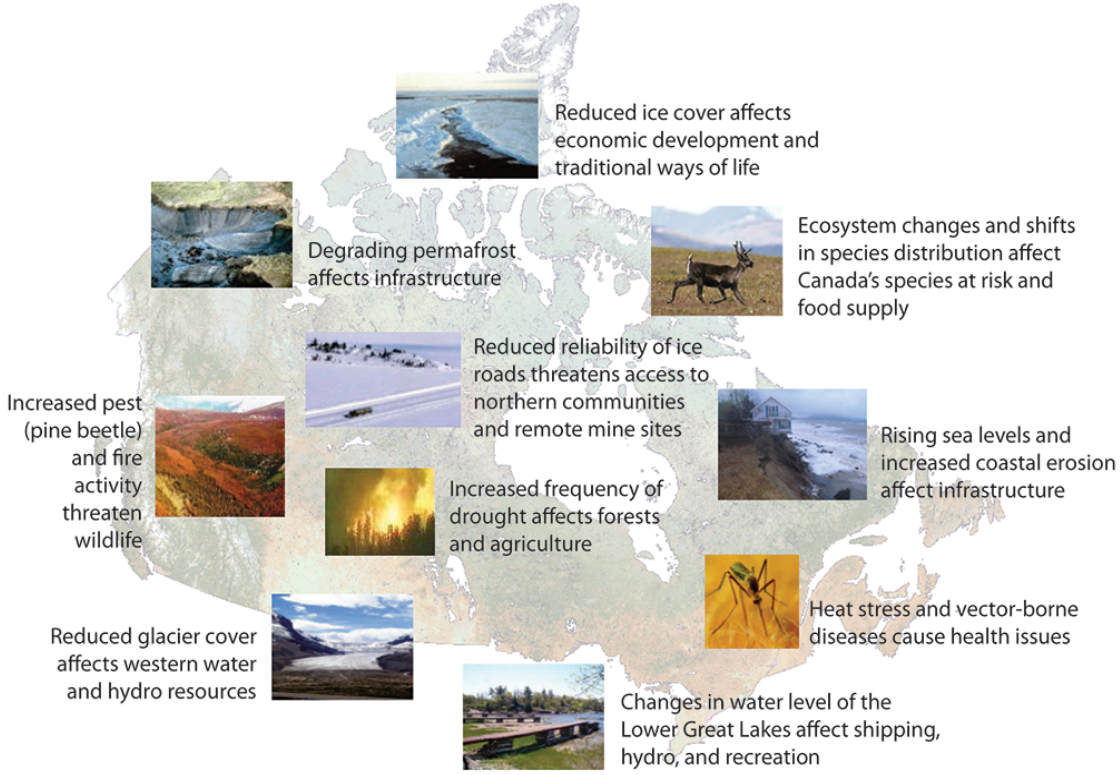
[9] Tyler, *supra* note 2 at 29-30.

2.0 What is climate change and what are some known impacts?

According to the Canadian government, climate change is 'a long-term shift in weather conditions identified by changes in temperature, precipitation, winds, and other indicators. Climate change can involve both changes in average conditions and changes in variability, including, for example, extreme events.'[10]

The impacts of climate change and associated SWE are different in different bioregions in Canada. While water scarcity and wildfires are becoming more common across the country, Alberta has experienced warmer temperatures, less precipitation, and more wildfires and droughts than other bioregions. Within Alberta, different bioregions have been impacted more severely than others: for example, wildfires plague the northern boreal forest, while southern Alberta suffers from both flooding and multi-year drought conditions. Figure 1 shows different climate change impacts across Canada.

Figure 1: Climate change impacts are felt across Canada



Source: Government of Canada, *2017 Fall Reports of the Commissioner of the Environment and Sustainable Development to the Parliament of Canada: Report 2—Adapting to the Impacts of Climate Change* (2017).[11]

[10] Government of Canada, 'Causes of Climate Change' (2024) (pdf) online: https://www.canada.ca/en/environment-climate-change/services/climate-change/causes.html. [Canada webpage]. The information on the webpage was modified as recently as July 10, 2023.

[11] Government of Canada, *2017 Fall Reports of the Commissioner of the Environment and Sustainable Development to the Parliament of Canada: Report 2—Adapting to the Impacts of Climate Change*, (2017), online: https://www.oag-bvg.gc.ca/internet/english/parl_cesd_201710_02_e_42490.html [Canada Report 2].

In 2019, in *Canada's Changing Climate Report*,[12] Bush and Lemmen made several "headline statements" emerging from their research that was commissioned by Environment and Climate Change Canada (ECCC), as follows:

- Canada's climate has warmed and will warm further in the future, driven by human influence.
- Both past and future warming in Canada is, on average, about double the magnitude of global warming.
- Oceans surrounding Canada have warmed, become more acidic, and less oxygenated, consistent with observed global ocean changes over the past century.
- The effects of widespread warming are evident in many parts of Canada and are projected to intensify in the future.
- Precipitation is projected to increase for most of Canada, on average, although summer rainfall may decrease in some areas.
- The seasonal availability of freshwater is changing, with an increased risk of water supply shortages in summer.
- A warmer climate will intensify some weather extremes in the future.
- Canadian areas of the Arctic and Atlantic Oceans have experienced longer and more widespread sea-ice-free conditions.
- Coastal flooding is expected to increase in many areas of Canada due to local sea level rise.
- The rate and magnitude of climate change under high versus low emission scenarios project two very different futures for Canada. (Explanations and page numbers from report omitted.)(Emphasis added.)[13]

These are startling statements; especially that future warming in Canada is on average double the magnitude of global warming. Also in 2019, while acknowledging Bush and Lemmen's study, Hayhoe and Stoner[14] reported to Alberta Environment and Parks (as it was then):

> Alberta's climate is changing. Since 1950, winter temperatures have increased by +0.5 to +1 degree C per decade across the province, and the frequency of cold days, heating degree-days, and the proportion of winter precipitation falling as snow rather than rain have all decreased. Across much of the province, summer temperatures have increased by +0.1 to +0.3 [degree] C per decade, and some regions have also seen significant increases in the frequency of warm days over 25 and 30 [degree] C. Even greater changes are projected to occur over the rest of this century. Many climate indicators for Alberta are projected to increase nearly linearly as global average temperature increases, though at a greater rate of change than the global average. Per degree of global mean temperature increase, projected changes for Alberta include:
>
> - A 2 [degree] C increase in average winter and 1.5 [degree] C increase in average summer temperature.
> - An increase of about 3 degree C in the temperature of the coldest day of the year and an increase of about 2 [degree] C in the temperature of the warmest day of the year.
> - A two-week lengthening of the frost-free season, and between a two to four-week lengthening of the growing season, with greater changes for more southern locations.
> - A 5-10% increase in Sept-Apr precipitation, with between 5-10% more falling as rain compared to snow.
> - A 50% increase in the number of very wet days (more than 25mm in 24 hours) and a 20% increase the amount of precipitation on the wettest day of the year.
> - Proportional decreases in heating degree-days and increases in growing degree-days and other cumulative heating indices.[15] (Emphasis added.)

[12] E. Bush and D.S. Lemmen, (eds,) *Canada's Changing Climate Report,* (2019) Government of Canada, Ottawa, ON, online: https://publications.gc.ca/collections/collection_2019/eccc/En4-368-2019-eng.pdf [Bush and Lemmen]
[13] *Ibid.* See 'Headline Statements' online: https://changingclimate.ca/CCCR2019/.
[14] Hayhoe, K., Stoner, A., & ATMOS Research & Consulting. (2019). *Alberta's Climate Future*. Alberta Environment and Parks [Hayhoe and Stoner] at 2.
[15] *Ibid.* Executive Summary.

However, like our knowledge about our changing weather patterns, what we know about average annual temperatures in Canada in 2025 has changed dramatically since 2019. As drought conditions loomed in different parts of Alberta in early 2024,[16] climate change experts were noticing the general trend toward hotter and drier conditions in different bioregions all across the country, not just in Alberta. The federal government's most recent research into changes in Canadian average annual temperature (AAT) from 1948 to 2022 provided three key findings:[17]

- In Canada, the national average temperature for the year 2022 was 1.2 degrees Celsius (°C) above the 1961 to 1990 reference value, making it the 16th warmest year since 1948.
- From 1948 to 2022, there is a trend in annual average temperature departures, showing 1.9°C of warming over that period.
- Annual average temperatures were consistently above or equal to the reference value from 1997 onward.[18]

Alberta's weather in southern bioregions has always been notoriously unpredictable and difficult to prepare for, especially in the winter and spring months when Chinook winds and sudden weather changes are commonplace. Alberta's singer/songwriter Ian Tyson captured these notoriously unpredictable weather variabilities in a song.[19] However, the impact of a 1.9 to 2 degree C increase in temperature has already had different impacts throughout Alberta's various bioregions due to SWE.

How the changing climate and SWE will impact small urban and rural communities remains largely unknown and unexplored. However, some of these municipalities are assessing local social, economic, and ecological vulnerabilities and risks and putting municipal policies, plans and programs in place to adapt to those risks and what may come.

- **2 degrees C warmer average winter temperature**
- **1.5 degrees C increase average summer temperature**
- **3 degree C increase in the coldest day/ 2 degree C increase the hottest day**
- **Frost-free season 2 weeks longer/ 2 to 4 week longer growing season**
- **5-10% increase in Sept-Apr precipitation, with between 5-10% more falling as rain compared to snow.**
- **50% increase in the number of very wet days (more than 25mm in 24 hours)**
- **20% increase the amount of precipitation on the wettest day of the year**
- **Proportional decreases in heating degree-days and increases in growing degree-days and other cumulative heating indices.**

[16] CBC News, Joel Dryden & Carla Turner, 'Water is in short supply in southern Alberta. Is a massive expansion of irrigation possible?' (2024) Posted: Apr 09, 2024 5:00 AM PDT | Last Updated: April 9, online: https://www.cbc.ca/news/canada/calgary/michel-camps-irrigation-st-mary-irrigation-alberta-1.7167015.
[17] Government of Canada, 'Temperature Change in Canada,' (pdf), online: https://www.canada.ca/en/environment-climate-change/services/environmental-indicators/temperature-change.html [Canada Temperature Indicators].
[18] *Ibid.*
[19] Ian Tyson, 'Springtime in Alberta,' (1991, Track 4 on *I Stood There Amazed*, 'Just like springtime in Alberta Warm sunny days endless skies of blue, Then, without a warning. Another winter storm comes raging through…'

3.0 What is the difference between mitigation and adaptation?

Municipal policies, plans and programs put in place to address **climate change mitigation** or **climate change adaptation** are necessarily different. However, they are inextricably connected as municipalities attempt to reduce greenhouse gas emissions and respond locally to changing weather patterns and the impacts of SWE. By adapting their facilities, operations and programs to mitigate climate change, while also adapting to cope with the impacts of SWE, municipalities are becoming more **resilient.**

3.1 Mitigation

Mitigation includes deliberate and purposeful human activities that prevent or reduce greenhouse gas emissions into the atmosphere. For example, the City of Calgary defines ***'mitigation' as 'the actions intended to reduce and prevent greenhouse gas emissions from going into the atmosphere, or those activities that remove these greenhouse gases from the atmosphere through natural or technological means.'***[20] Some typical municipal mitigation activities include increasing renewable energy development policies; using alternative energy supplies in municipal buildings and fleets; providing cleaner transportation systems and community transit; and increasing urban forests to absorb emissions.

3.2 Adaptation

Adaptation includes deliberate and purposeful human activities to adjust to current and future effects of a changing climate, such as preparing to respond to the impacts of SWE. The City of Calgary's definition of ***adaptation*** is ***'the actions, policies, programs, tools and strategies intended to reduce the negative impacts of climate change on our city's infrastructure, natural assets, economy, and people.'***[21] Some typical municipal adaptation activities include creating water conservation programs and technology; conserving and restoring critical natural infrastructure; and promoting land use practices that minimize the impacts of SWE, such as low impact development.

3.3 Resiliency

The City of Calgary defines ***'urban resiliency"*** as: ***'The capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow despite chronic stresses (e.g. water shortages) and acute shocks they experience (e.g. floods)'***[22]

CARP

While some municipalities, such as Calgary and Edmonton are putting *climate change mitigation policies and plans* in place, this paper primarily addresses *municipal climate change adaptation and resiliency* through CARP development and implementation.

[20] City of Calgary, *Calgary Climate Strategy: Pathways to 2050*, (2022), online: https://www.calgary.ca/environment/policies/climate-strategy.html [Calgary Climate Strategy] at 88.
[21] *Ibid.*
[22] City of Calgary, *Calgary Resilience Strategy: Mitigation and Adaptation Action Plans* (2018), online: https://www-prd.calgary.ca/environment/policies/climate-action-plans.html [Calgary Climate Resiliency Plan] at v.

4.0 Policy, legislative and regulatory change

4.1 Policy frameworks for climate change adaptation

Recognizing the severity of potential impacts of changing weather patterns, the Government of Canada adopted the *Federal Adaptation Policy Framework* (Federal Adaptation Framework) in 2011.[23] The Federal Adaptation Framework established the climate change vision, objectives, roles of the federal government, and provided criteria for setting priorities for federal action. The Federal Adaptation Framework, as amended from time to time, informs all federal departments and programs and Canada's international climate change adaptation policies.[24]

In 2002, long before the Federal Adaptation Framework was adopted, the Alberta government introduced climate mitigation policies and programs through *Albertans and Climate Change: Taking Action* (Climate Change Taking Action).[25]

> In October 2002, Alberta released Canada's first comprehensive action plan to deal with climate change. *Albertans and Climate Change: Taking Action* set out key directions aimed at helping governments, industry, and individual Albertans take realistic, tangible actions to reduce greenhouse gases. Alberta's Taking Action plan focused on four main areas: • better emissions management; • enhancing technology to control industrial emissions; • improving energy efficiency; and, • developing renewable energy sources."[26]

In 2003, the Alberta government enacted the *Emissions Management and Climate Resilience Act*[27] to implement the Climate Change Taking Action policies and programs.

In 2010, the Alberta government adopted a *Climate Change Adaptation Framework Manual* (Alberta's Adaptation Manual).[28] Alberta's Adaptation Framework is considered an evidence-based decision support tool. It 'provides a consistent yet flexible approach to understanding where an organization may be vulnerable to climate change impacts, analyze the risks to achieving objectives and identifying options to adapt and building organizational capacity to respond.' [29] The Alberta Adaptation Manual is a must-read document for municipal councils and administrators.

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[23] Government of Canada (2011), *Federal Adaptation Policy Framework*, Environment Canada, Gatineau, QC, (pdf) online: https://open.alberta.ca/dataset/5d919e22-15bf-4e59-b9ec-949c9676ccf4/resource/c58bb3eb-da11-4ab7-a518-4609e03a9fc6/download/2012-climate-change-risk-assessment-ministry-of-transportation-2012-06.pdf [Federal Adaptation Framework].

[24] *Ibid.*

[25] Government of Alberta, *Albertans and Climate Change: Taking Action*, (2002), (pdf) online: https://open.alberta.ca/publications/077852423x. [Alberta Mitigation Policy].

[26] *Ibid*, at 1

[27] *Emissions Management and Climate Resiliency Act,* SA 2003 c. E- 7.8 {EMCRA]. 'The Act addresses carbon dioxide, methane and other specified gas emissions that contribute to climate change. The Act enables regulation-making authority to govern specified gas emissions, mandates reporting requirements for any person who releases specified gases in Alberta, and establishes the Technology Innovation and Emissions Reduction Fund to support initiatives that either reduce specified gas emissions or improve Alberta's ability to adapt to climate change. It also describes authorities and measures to ensure compliance with the legislation.'

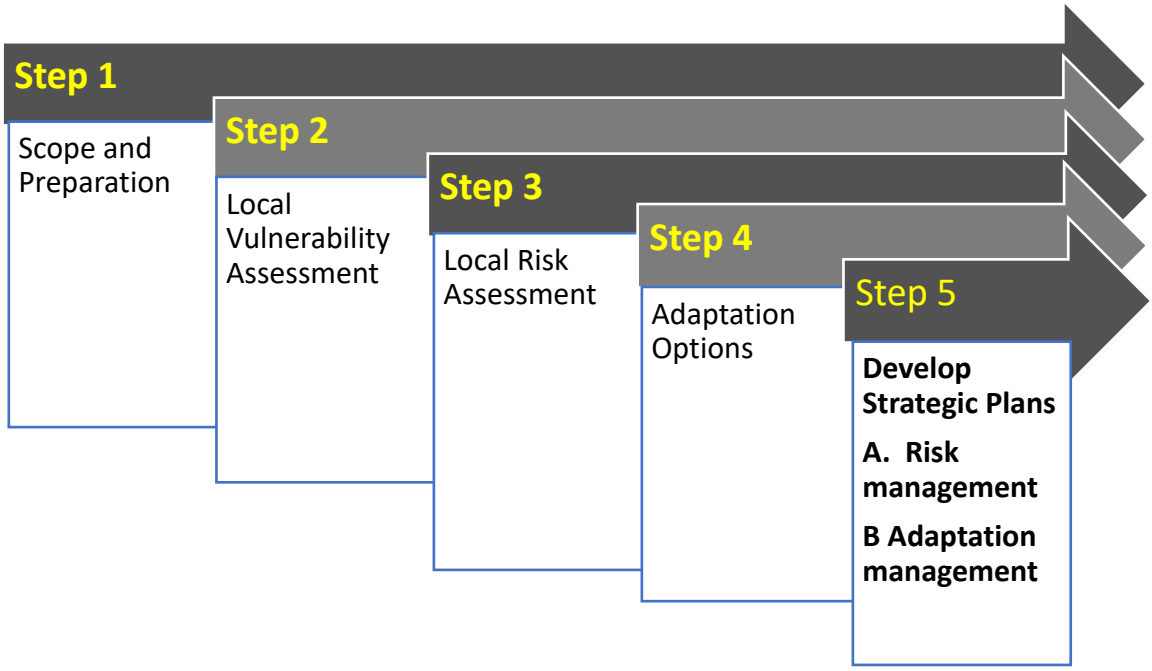
[28] Government of Alberta*, Climate Change Adaptation Framework Manual (*2010), (pdf) online: https://open.alberta.ca/publications/climate-change-adaptation-framework-manual [Alberta Adaptation Manual].

[29] *Ibid.* Executive Summary.

The Alberta Adaptation Manual was designed to help organizations assess and manage risks associated with a changing climate. It provides a step-by-step approach that municipalities might use to prepare CARP. This step-wise approach leads to the development of specific strategies to address identified vulnerabilities and risks, and potential impacts that the organization may face.

> The Climate Change Adaptation Framework Manual (the "Alberta Adaptation Manual") is intended to help organizations address climate change risks in a comprehensive and consistent manner. It integrates the key elements for robust climate change adaptation: integration with strategic planning standardized processes, continuity and stakeholder involvement. The users of this manual can be any individual or group responsible for managing or understanding climate change adaptation risks; and may include elected or senior officials, division leaders, or technical staff.[30]

Figure 2: Steps to Developing a Municipal Climate Change Adaptation Framework[31]



The planning processes are iterative, and CARP are meant to be updated and amended as new local scientific knowledge and data arise. **Stakeholder involvement is the key to successful implementation.**

4.2 Municipal legislative and regulatory change

In 2015, the Alberta government amended the *Municipal Government Act* 'to authorize the establishment of city charters to address the evolving needs, responsibilities and capabilities of cities in a manner that best meets the needs of their communities.' Only Calgary and Edmonton became charter cities.[32] A 'charter governs all matters related to the administration and governance of the charter city, including, without limitation, the powers, duties and functions of the charter city and any other matter that the Lieutenant Governor in Council considers desirable.'[33]

[30] Alberta Adaptation Manual, *supra* note 28.
[31] *Ibid.* This figure is adapted from the information and schematics provided in the Alberta Adaptation Manual.
[32] MGA, *supra* note 4, Part 4, s 141.2.
[33] MGA, *supra* note 4, Part 4, s 141.2. See also s 141.5.

In 2018, both the *Edmonton City Charter Regulation*[34] and the *Calgary City Charter Regulation*[35] were enacted. In two important aspects, the regulations were significant with respect to environmental management and specifically climate change mitigation and adaptation.

First, section 7 of the MGA, which provides all Alberta municipalities with general jurisdiction to pass bylaws for a number of listed municipal matters, is amended for the cities adding subsection 7(1)(h.1).[36] The new subsection in both charter regulations authorizes charter cities (Edmonton and Calgary) to pass and enforce bylaws for 'the well-being of the environment, including bylaws providing for the creation, implementation and management of programs respecting … climate change adaptation and greenhouse gas emission reduction,' among a list of other emergent environmental matters.[37]

Through both city charter regulations, section 8.1 is added to the MGA. This section clarifies that a charter city council may pass a bylaw for any municipal purpose set out in section 3: one of the stated municipal purposes is 'to foster the well-being of the environment.'[38]

Through both charter regulations, **Part 17: Planning and Development, section 617 of the MGA** is amended. The purpose of land use planning and development in these cities is clarified through subsection 617(b) to include environmental sustainability and stewardship, as follows: 'to maintain and improve the quality of the physical environment within which patterns of human settlement are situated within the boundaries of the City, including the promotion of environmental sustainability and stewardship,'[39] (Emphasis added.)

Most relevant to developing CARP, through both charter regulations, **Part 16.1** is added to the MGA **mandating that charter cities 'establish a plan for the purpose of addressing and mitigating the effects of climate change'**[40] The two charter cities were required to establish both a climate change mitigation plan and a climate change adaptation plan on or before December 31, 2020.[41]

The new charter regulation provisions in sections 615.5(3) and (4) describe what the two cities must include in their respective mandated climate change mitigation plan and climate change adaptation plan, as follows:

615.5

(3) A climate change adaptation plan must

(a) be based on an assessment of the exposure, risk and vulnerability of systems within the City to effects of climate change over the short, medium and long term,

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[34] *City of Edmonton Charter, 2018 Regulation,* Alta Reg 39/2018 [Edmonton Charter Regulation].
[35] *City of Calgary Charter, 2018 Regulation,* Alta Reg 40/2018 [Calgary Charter Regulation].
[36] *Ibid.*
[37] *Ibid.*
[38] MGA, *supra* note 4 s 3(a.1).
[39] MGA, *supra* note 4, s 617(b). See s 617 of the MGA: Purpose of this Part that directs all municipalities except charter cities. 's 617 The purpose of this Part and the regulations and bylaws under this Part is to provide means whereby plans and related matters may be prepared and adopted (a) to achieve the orderly, economical and beneficial development, use of land and patterns of human settlement, and (b) to maintain and improve the quality of the physical environment within which patterns of human settlement are situated in Alberta, without infringing on the rights of individuals for any public interest except to the extent that is necessary for the overall greater public interest.' (Emphasis added.)
[40] MGA, *supra* note 4, s 615.04.
[41] See, for example Edmonton Charter Regulation, *supra* note 34, s 615.5(11).

(b) set out or summarize the assessment referred to in clause (a), and
(c) identify actions that will be taken to address the effects referred to in clause (a).

(4) Actions identified under subsection (3) (c) may include actions to be taken respecting
(a) asset management,
(b) use of climate-resilient infrastructure,
(c) stormwater management,
(d) flood preparedness,
(e) City-owned and City-operated energy and utility cables,
(f) water and sanitation,
(g) public safety,
(h) health and social resilience,
(i) biodiversity management,
(j) invasive species, or
(k) any other matter the council considers appropriate.

In 2018, Calgary adopted the *Climate Resilience Strategy: Mitigation and Adaptation Action Plans (*Calgary Resilience Strategy),[42], and Edmonton adopted the *Climate Resilient Edmonton: Adaptation Strategy and Action Plan.* [43] Both charter cities followed iterative processes with extensive public involvement to develop climate action plans. For example, in June 22, following extensive public education and consultation, Calgary released the *Calgary Climate Strategy: Pathways to 2050*,[44] to integrate climate mitigation and adaptation action throughout the municipality. The intent is stated to become climate resilient.

In both charter cities, climate strategies and action plans are updated regularly, with new programs introduced as needed to affect climate adaptation.

Other large and small urban and rural municipalities in Alberta do not have the same legislative authority or responsibility to develop CARP as the charter cities. However, with major changes to the MGA that occurred between January 2015 and January 2025,[45] many municipalities are developing CARP using new-found authority in the MGA, the EMA and other provincial and federal enactments, such as *An Act to Enable Clean Energy Improvements.*[46] A Table of municipal CARP in Alberta is provided in Chapter 7.0.

Chapter 7.0 also presents the complex CARP processes developed in Calgary, Edmonton, St. Albert, Okotoks, Canmore, Beaver County, and Brazeau County. These examples may help smaller urban and rural municipalities to develop and implement local CARP with their own citizens and stakeholders.

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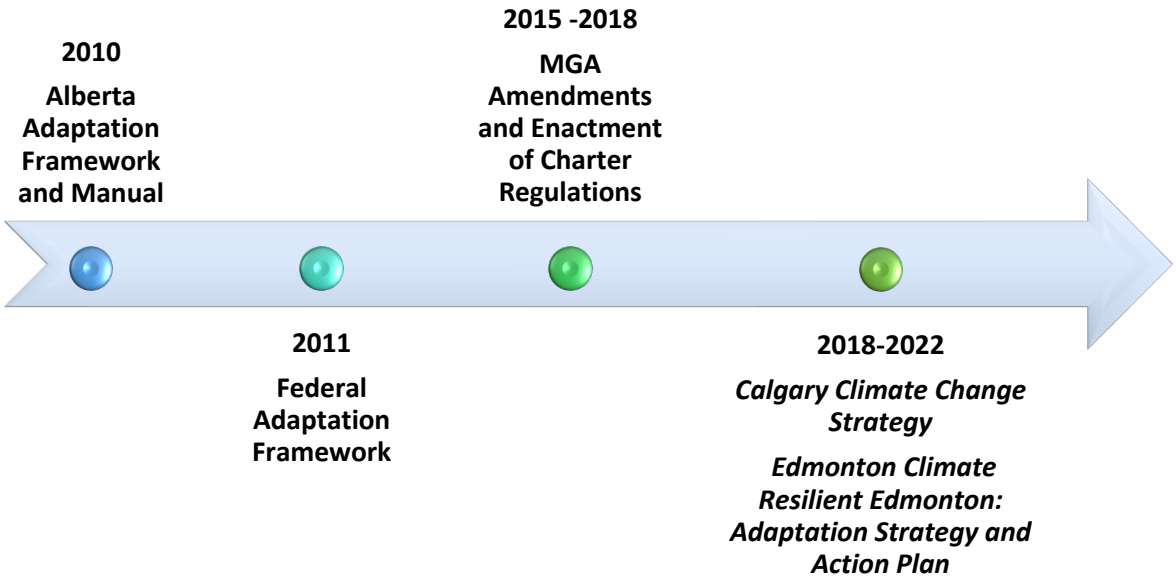
[42] Climate Resilience Strategy , *supra* note 22.
[43] City of Edmonton, *Climate Resilient Edmonton: Adaptation Strategy and Action Plan*, (2018), (pdf) online: https://www.edmonton.ca/sites/default/files/public-files/assets/Climate_Resilient_Edmonton.pdf?cb=1717178476 [Climate Resilient Edmonton].
[44] Calgary Climate Strategy, *supra* note 22.
[45] Judy Stewart, 'A Guide to the Basics and What's New in Alberta's Municipal Legislation for Environmental Management.,' (2023), Canadian Institute of Resources Law, Occasional Paper #80. Also see Judy Stewart, 'A Guide to Alberta's Municipal Environmental Bylaws: Overview and Examples', (2024), Canadian Institute of Resources Law, Occasional Paper #83.
[46] *An Act to Enable Clean Energy Improvements*, SA 2018, c 6.

Figure 3: Relevant Climate Change Policy, Legislative, and Regulatory Change Since 2010



5.0 Recent research on municipalities and climate change

In 2023, three different climate change studies in Alberta found that global warming has greater effects on the climate at regional or local bio-geopolitical scales. [47] These research papers are summarized below, and are followed up by some more recent articles from 2024 that applied the earlier findings. Academic and scientific research about climate change and municipal CARP continues to emerge in 2025 as a rapidly changing scientific inquiry.

5.1 Eum et al.

First, in 2023 Eum et al.[48] modelled temperature changes in Canada from 1948 using latest technology. The researchers explained that 'the annual average temperature on land in Canada warmed by 1.7◦ C since 1948 especially with a stronger warming trend in the north and west parts of Canada.'[49] Eum, et al. summarized their main findings as follows:

> Main finding of this study is that a significant warming trend in annual mean temperature was projected from all of the selected CMIP6 climate projections in Alberta while there was no distinct trend in annual precipitation. Under the GMT [Global Mean Temperatures] changes from + 1.5 ◦ C to + 5 ◦ C, extreme cold temperature indices were warming at a larger rate in response to the GMT warming. In particular, the warming rate of the annual coldest minimum temperature in Alberta was 2.5 times faster than GMT warming. In addition, a potential decrease in summer precipitation was projected under the GMT warming, leading to a drier and warmer summer in the central and southern parts of Alberta. Furthermore, more extreme drought conditions were projected in Alberta under the GMT warming, indicating that the extreme drought conditions are likely to become more common in Alberta along with the GMT warming.[50]

[47] Eum et al., *supra* note 3; Funfgeld et al., *supra* note 3; Tyler, *supra* note 2.
[48] Eum et al., *supra* note 3
[49] *Ibid* at 101389.
[50] Eum et al., *supra* note 3. Abstract.

Eum et al. also found that changes in global mean temperatures were expected to continue to rise exponentially over time.[51]

Applying Eum et al.'s earlier findings, in 2024 Yang et.al,[52] studied the impacts of climate change on urban stormwater runoff quantity and quality in a cold region (Alberta). Some of Yang et al.'s critical and startling findings are summarized below:

> The peak inflow rate and maximum flooding duration are projected to increase from historical to future climate scenarios. Notably, the 5-year peak inflow rate shows the most substantial rise, with 1-h, 4-h, and 24-h peak inflow rates increasing by 74.3% (170.7%), 89.2% (158.4%), and 64.1% (102.8%) in the 2050s (2080s). In addition, the flooding duration of the 5-year 24-h storm event is projected to increase by 86.7% (133.3%) in the 2050s (2080s). These projections suggest that the current stormwater infrastructure could overload under climate change.
>
> The application of representative years (dry, average, and wet years) is effective in predicting long-term changes in runoff quantity and quality. Concerning runoff quantity, the average year is anticipated to experience the most substantial increase, with 10.2% and 17.5% in the 2050s and 2080s, respectively. Regarding pollutant loadings, both typical dry and average years are expected to have greater increases than the wet year, with TSS [total suspended solids] having the largest surge among all pollutants. Consequently, stormwater quality is likely to deteriorate under the impact of climate change, and additional efforts, such as LID [low impact development] practices, will be necessary to support sustainable stormwater management in urban environments. (Emphasis added.)[53]

Yang et al.'s study puts Alberta municipalities on notice that current stormwater management infrastructure in cold regions may be overloaded during SWE that significantly increase stormwater flows. Alberta municipalities might want to implement adaptation strategies such as low impact development to address surges in stormwater runoff with increased loads of total suspended solids during SWE that will affect water quality. Small urban and rural municipalities that identify high vulnerabilities and risks associated with overland runoff or storm drainage collection and treatment facilities may wish to read Yang et al.'s paper and several of the earlier articles referenced by these researchers.

5.2 Funfgeld et al.

Of particular relevance to Alberta municipalities, in 2023 Funfgeld et al. studied climate change adaptation in small-and medium-sized municipalities around the world, noting current barriers to adaptation and future potentials.[54] Funfgeld et al. found that:

> … tangible progress with climate change adaptation at the municipal scale is mostly limited to metropolises and large cities. The majority of small- and medium-sized municipalities (SMMs) are either stalling at the stage of developing adaptation plans or are not yet engaged in adaptation at all.[55]

Funfgeld et al. reviewed available academic literature about known barriers and opportunities available in different geopolitical regions around the world, taking into consideration constraining

[51] *Ibid.* Conclusion.
[52] Yang Yang, David Z. Zhu, Mark R. Loewen, Wenming Zhang, Bert van Duin, and Khizar Mahmood. "Impacts of climate change on urban stormwater runoff quantity and quality in a cold region." *Science of The Total Environment* (2024): 176439. https://www.sciencedirect.com/science/article/pii/S0048969724065951 [Yang et al.].
[53] *Ibid.* Conclusion.
[54] Funfgeld et al., *supra* note 3.
[55] Funfgeld et al., *supra* note 3. Abstract.

factors arising from these different bio-geopolitical factors. They discovered that smaller municipalities that had successfully developed and implemented adaptation plans had 'champions' or individuals who provided the necessary leadership for adaptation planning,

Funfgeld et al. also confirmed that small urban and rural municipalities around the world faced both structural and political obstacles to adaptation. These municipalities struggled with limited legislative authority, personnel and technical capacity, and lack of financial and other resources necessary to effectively develop and implement adaptation plans.

During 2024, several other researchers continued the discourse about the barriers and opportunities for CARP development and implementation as identified by Funfgeld et al., again focusing on small urban and rural municipalities. These include three noteworthy studies that expand on previous research:

- Olazabal, et al.[56] studied what is limiting how we imagine climate change adaptation. Among other key findings, Olazabal et al. emphasized the 'importance of engaging with the specificities of local contexts, considering and integrating multiple forms of knowledge along adaptation processes, and experimenting and learning in the practice of adapting.'[57]

- Nils Riacha and Glaser Rüdiger,[58] studied local climate services and whether 'municipal climate profiles' (vulnerability and risk assessments) help improve climate adaptation in municipalities in Baden-Wuerttemberg, Germany. Some of their key findings (paraphrased) include that:

  - adaptation is less practiced than mitigation at the local level.
  - guidelines for dealing with climate extremes should be provided: few risk management strategies are in place for heavy precipitation and even fewer for heat
  - legal requirements have an impact on widespread adaptation: the high level of adaptation measures against flooding shows that government regulations lead to comprehensive management and thus other hazards such as heat, heavy precipitation or storms should be included in future legislation.
  - developing adaptation strategies is an outcome of municipal awareness or commitment to government-mandated tasks.[59]

These findings are particularly relevant in Alberta where municipalities are responsible for implementing provincial policy and regulations regarding floodplains and building setbacks from provincially owned beds and shores. As found by Yang et al., current storm drainage collection and treatment facilities in cold regions such as Alberta may be overloaded during SWE.

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[56] Olazabal, et al., 'What is limiting how we imagine climate change adaptation?.' *Current Opinion in Environmental Sustainability* 71 (2024): 101476; online: https://doi.org/10.1016/j.cosust.2024.101476 (Olazabal et al.).
[57] *Ibid*. See Conclusion.
[58] Nils Riach and Glaser Rüdiger. 'Local climate services. Can municipal climate profiles help improve climate literacy?' Climate Services 34 (2024): 100449; online: https://www.sciencedirect.com/science/article/pii/S2405880724000049 (Riach and Rudiger).
[59] *Ibid.* Conclusion.

- Selseng and Arild[60] studied what drives sustainable climate change adaptation at the local level. They reviewed three knowledge gaps in their study of Norwegian municipalities. Their findings echo several of Funfgeld et al.'s discoveries. However, in Norway, the earlier identified barrier of limited municipal resources was not problematic. As well, they stated that how a municipality conceptualizes climate change adaptation is critical to CARP development.

> This research paper critically examines three underexplored areas in CCA [climate change adaptation] research: the influence of multilevel governance, the unique challenges faced by small and medium-sized municipalities, and the drivers of transformative and sustainable CCA efforts. Drawing on data from three surveys of Norwegian municipalities and counties, this study provides a nuanced understanding of CCA dynamics by statistically assessing the drivers and barriers of local holistic CCA. The study reveals several key findings.
>
> First, factors such as political awareness, network participation, risk perception, stakeholder collaboration, municipality size, and updated climate and energy plans significantly enhance CCA efforts. But the results are contingent on the conceptualization of CCA….
>
> Second, the study finds no direct connection between municipal resources and CCA efforts, when controlled for other relevant factors. This challenges the conventional notion that increased resources directly translate into better adaptation outcomes…
>
> Third, we find that regional support is crucial for the CCA efforts in smaller municipalities, while the effect on larger municipalities is minimal. We find that the effectiveness of regional support for local governments hinges more on the degree of engagement than the format or forum of the support…
>
> Finally, the study underscores the need for greater scrutiny of "what is CCA?" in large-N studies, as the outcomes are highly sensitive to the conceptualization of CCA. (Emphasis added.)[61]

While Selseng and Arild's study took place in Norway with different bio-geopolitical and legislative factors in play, their main findings are important and relevant to Alberta municipalities.

In Alberta, smaller urban and rural municipalities that cannot conceptualize climate change adaptation may not understand why it is necessary to adapt to the potential impacts of warmer temperatures and SWE on existing local social, economic and ecological systems. They are unlikely to be prepared for the impacts of SWE, and their business communities and citizens may likewise not be prepared.

5.3 Dr. Mary Ellen Tyler

Finally, in 2023 Dr. Mary Ellen Tyler (Tyler) was commissioned by the Alberta Urban Municipalities Association (now AMA), the Rural Municipalities Association, (RMA) and the School of Public Policy at University of Calgary to address climate risk assessment and adaptation considerations for municipal governance in Alberta.[62] Tyler highlighted her major findings as follows:

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[60] Torbjorn Selseng and Gjertsen Arild. 'What drives sustainable climate change adaptation at the local level? Approaching three knowledge gaps.' *Sustainable Development* (2024); online: https://onlinelibrary.wiley.com/doi/pdf/10.1002/sd.3043 (Selseng and Arild)
[61] *Ibid*, at 13.
[62] Tyler**,** *supra* note 2.

> Climate risk and adaptation need to be integrated into municipal plans, infrastructure maintenance, capital budgets and asset management to strengthen local resilience. Municipalities in Alberta have a provincial statutory framework that can address climate risk assessment and adaptation. Eight opportunities are identified that can be used within Alberta's municipal government model to increase municipal effectiveness including: greater use of Intermunicipal Collaboration Frameworks (ICFs) and development of a Climate Adaptation Research and Decision Support (CARDS) network to provide multi- disciplinary decision support to local government decision-makers in different geographic areas of Alberta.[63]

Tyler reviewed the policy and legislative framework for municipal CARP development, concluding that necessary federal and provincial guidance tools were already in place. Using the federal and provincial policy and legislative climate adaptation frameworks, Tyler recommended that the province set up a Climate Adaption Research and Decision Support network (CARDS) with the three major universities in Edmonton, Calgary and Lethbridge. Each of the CARDS would be strategically located to provide the necessary bio-geographic knowledge and data from the institution closest to the municipalities developing CARP.

CARDS would provide scientific knowledge and data at the regional scale. These centers would be available to help small urban and rural municipalities in their respective regions understand local and regional vulnerabilities and risks associated with changing weather patterns and SWE. Figure 17 in Tyler's paper illustrates how CARDS would fit within Alberta's existing municipal policy and regulatory land use management frameworks.

> The Climate Adaptation and Research Decision Support concept or CARDS is based on establishing collaborative networks (online and/or physical) among provincial agencies, municipal associations, Alberta universities involved in climate risk and adaptation and collaborative organizations in the private and public sectors with expertise and resources related to community climate risk and adaptation planning. CARDS networks/centres would have the outreach capacity to broker and interpret expert knowledge and expertise at regional and locally relevant scales in the southern, central and northern thirds of the province.[64]

The CARDS network would perform bridging functions,[65] bringing together resources from within each bio-geopolitical region to assist smaller municipalities with CARP development. Tyler's work offers a viable solution to helping small urban and rural municipalities develop CARP using reliable scientific knowledge about local climate vulnerabilities and risks. CARDS would operate at much reduced costs when compared to each municipality having to hire consultants to provide these resources from already limited municipal budgets.

In 2024, Blomme,[66] as part of his Masters of Arts thesis at the University of Windsor, Ontario, studied small and medium municipalities in Ontario to discover those that had developed CARP and prepared for SWE. Blomme referred to previous researchers in this field, including Tyler. His concluding remarks echo some of Tyler's findings and recommendations, especially when justifying the costs of developing CARP. The costs of not developing CARP will be higher.

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[63] *Ibid.* Abstract
[64] *Ibid* at 35.
[65] Judy Stewart and Mary Ellen Tyler. "Bridging organizations and strategic bridging functions in environmental governance and management." *International Journal of Water Resources Development* 35, no. 1 (2019): 71-94 online: https://www.tandfonline.com/doi/abs/10.1080/07900627.2017.1389697 [Stewart and Tyler].
[66] Zachary Blomme, "Climate Adaptation Plans in Ontario: Small and Medium Municipalities Preparedness for Extreme Weather" (2024). Major Papers. 293, online: https://scholar.uwindsor.ca/major-papers/293 [Blomme].

> The federal and Ontario provincial government have largely failed in their attempts to implement effective climate change policy. Additionally, the impacts of climate change will be mainly felt at the municipal level through extreme weather events. As a result, the responsibility of enacting climate change policy should fall to municipalities in the form of climate adaptation plans to mitigate the impact of extreme weather events such as catastrophic fires and flooding. The results of this paper clearly show that the implementation of a climate adaptation plan for both catastrophic fire and flooding results in cost savings for Ontario SMMs. Thus, SMMs should take advantage of this opportunity to develop and implement climate adaptation plans in order to combat the impact of extreme weather events. While, the initial costs of climate adaptation are high many opportunities for assistance have been made available to municipalities from both government and non-profit organizations. This should aid in lowering costs for implementation and alleviate some of the burden of high initial costs. The high initial costs of implementation may be especially difficult for SMMs causing hesitancy in adaptation and these opportunities should help ease this issue. However, even without this funding the cost benefit analyses in this paper suggest that Ontario SMMs would significantly benefit from developing climate adaptation plans.[67] (Emphasis added.)

Chapter 6.0 below in this paper provides a snapshot of some emergent institutional, scientific and technical, and funding tools that also may help Alberta's small urban and rural municipalities develop CARP.

6.0 Institutional, scientific and technical, and funding tools

6.1 Institutional Tools

Alberta Municipal Climate Change Action Center (MCCAC)[68]

In 2009, the MCCAC was established by Alberta Municipalities Association (AMA), RMA and the Government of Alberta to design and deliver programs to address Alberta's changing climate. The non-profit organization has a comprehensive online presence and delivers funding, technical assistance, and education to municipalities and others to improve climate resilience. Several programs help municipalities and other organizations develop climate mitigation plans to reduce greenhouse gas emissions and lower the costs of energy consumption.[69]

As well, the MCCAC assists with development of CARP and keeps a database of municipal adaptation plans as adopted and released by Alberta municipalities. These plans outline regional climate trends and projected environmental changes specific to a local context.

Adaptation planning typically takes local governments through the following iterative process:

- Defining the context and scope of local climate change impacts.
- Assessing risks and opportunities, based on the likelihood and consequences of climate change impacts.
- Formulating adaptation actions to increase resilience to these risks and maximize opportunities.
- Preparing to implement adaptation actions and monitor progress.

> The **Database of Municipal Climate Adaptation Plans** summarizes the current state of municipal climate adaptation planning in Alberta and makes these publicly available plans accessible to local governments and adaptation practitioners, enabling others to learn how peer or neighbouring municipalities are approaching

[67] *Ibid.*
[68] Municipal Climate Change Action Center, online: https://mccac.ca/ [MCCAC].
[69] *Ibid*. About Us. (pdf), online: https://mccac.ca/about/.

> climate adaptation planning. The database provides a snapshot of the following aspects of these adaptation plans.[70]

MCCAC is invaluable. Small urban and rural municipalities have benefitted by accessing resources and tools from the center. Initially invested with $2 million from the Alberta government to achieve their objectives, the MCCAC has emerged as the hub for all Alberta municipalities to access and share climate change mitigation and adaptation information. The MCCAC is referred to throughout the remaining chapters of this paper, and it is highly recommended to small urban and rural municipalities as the go-to resource to get started when developing CARP.

Prairie Climate Center (PCC)[71]

Like the MCCAC, the PCC is an online resource system that brings an 'evidence-based perspective to communicating the science, impacts, and risks of climate change through maps, documentary video, research reports, and plain-language language training, writing, and outreach.'[72] While not specific to municipalities as in the case of the MCCAC, the goal of the PCC is stated as follows:

> Inspire citizen participation, support communities in making meaningful adaptation and mitigation decisions, and help Canadians move from risk to resilience… The Prairie Climate Centre is committed to making climate change meaningful and relevant to Canadians of all walks of life. [73]

The mission of the PCC is 'to carry out evidence based science and communications designed to propel innovative climate change solutions in and by communities.'[74] The PCC provides climate and data information including data reporting, reporting and guidance; knowledge mobilization and translation including mapping and visualization; and collaboration for action including vulnerability and risk assessment and adaptation planning.

The 'Prairie Climate Atlas'[75] and the 'Building a Climate Resilient City'[76] research series are just two of the excellent resources that the PCC offers to small urban and rural municipalities that are looking at developing CARP. Calgary and Edmonton refer to both the MCCAC and the PCC programs and resources in their webpages about CARP processes.

All One Sky Foundation[77]

This non-profit organization also has a strong online presence providing communities with resources to plan for climate change impacts and build resilience; build capacity to better

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[70] MCCAC, *supra* note 68: Database of Municipal Climate Adaptation Plans, (pdf), online: https://mccac.ca/municipal-climate-adaptation-plans/ [Database].
[71] Prairie Climate Centre: From Risk to Resilience, online: https://prairieclimatecentre.ca/ [PCC].
[72] *Ibid.*
[73] *Ibid.*
[74] *Ibid.* 'Our Work'.
[75] *Ibid.* 'Prairie Climate Atlas.'
[76] *Ibid.* 'Building a Climate Resilient City.' See links to Building a Climate-Resilient City: Economics and finance; Building a Climate-Resilient City: Agriculture and food security; Building a Climate-Resilient City: Urban ecosystems;
Building a Climate-Resilient City: Transformational adaptation; Building a Climate-Resilient City: Transportation infrastructure; Building a Climate-Resilient City: Water supply and sanitation systems; Building a Climate-Resilient City: Electricity and information and communication technology infrastructure; Building a Climate-Resilient City: The built environment; and Building a Climate-Resilient City: Disaster preparedness and emergency management
[77] All One Sky Foundation: online: https://www.allonesky.ca/climate-adaptation-resilience [All One Sky].

understand changes, vulnerabilities risks and actions; and conduct research on climate impacts and adaptation. The website offers research materials and resources that have been used by Edmonton and several other communities during CARP development and programming.

Quest Canada[78]

A Canadian registered charity since 2007, Quest supports municipalities across the country to achieve net-zero emission goals. The organization works with municipalities to develop and implement mitigation programs. However, Quest also provides a series of resources to assist with development of CARP, programs and actions; for example, Okotoks is an Alberta municipality that participated in Quest's programming when developing the municipal CARP.

***Tamarack Institute* (Tamarack)**[79]

Like the other non-profits and charities listed above, Tamarack is a Canadian charity that provides a resource hub to municipalities developing CARP. In 2024, Laura Schnurr of Tamarack published a paper entitled *Canadian Cities Leading on Climate Action - 2024 Edition*.[80] At that time, Schnurr identified Calgary, Edmonton, Lethbridge and Banff as noteworthy leaders. Several other Alberta communities have emerged as climate leaders since Schnurr's work and are presented in Chapter 7.0 of this paper.

Tamarack's online resource hub and publications are easily accessible to Alberta municipalities engaged in CARP development.

Canadian climate change non-profits and charities such as those listed above continue to emerge in Alberta in 2025, providing excellent resources to small urban and rural municipalities.

6.2 Scientific and Technical Tools

CARDS networks

Tyler[81] noted that two major barriers to small urban and rural municipalities developing CARP were the lack of trained personnel to provide scientific and technical support, and the lack of sufficient municipal funding. Both of these barriers are difficult to overcome, especially when municipal budgets are already strained.

To alleviate these two significant barriers, Tyler recommended that the provincial government work with cities and other municipal partners, the AMA, and the RMA to create three CARDs

[78] Quest Canada, 'About Us', (pdf) online: https://questcanada.org/. 'Canada is a registered Canadian charity that supports communities in Canada on their pathway to net-zero. Since 2007, we've been facilitating connections, empowering community champions and advising decision-makers to implement energy use and emissions reduction solutions that best meet community needs and maximize local opportunities. We develop tools and resources, convene stakeholders and rights holders, and advise decision-makers — all with the goal of encouraging, assisting and enabling communities to contribute to Canada's net-zero goal.'

[79] Tamarack Institute, online: https://www.tamarackcommunity.ca/adaptive-and-resilient-communities-cohort [Tamarack].

[80] *Ibid.*

[81] Tyler, *supra* note 2.

(climate adaptation research and decision support networks) to provide scientific, technical and funding support at a bio-geopolitical regional scale. As noted in Chapter 5.0, CARDs would ideally be centralized with the University of Alberta in the northern –geopolitical region, the University of Calgary in the central bio-geopolitical region, and the University of Lethbridge in the southern bio-geopolitical region of the province.

Acting as bridging organizations, the CARDS would connect municipalities with a range of institutions and partners, including scientists, climate experts, and other organizations in a position to provide funding, such as MCCAC, the Alberta Ecotrust Foundation, and Alberta's watershed planning and advisory councils (WPACs). The provincial and federal governments already invest heavily in many non-profit organizations such as WPACs, the MCCAC and the PCC.

The development of CARP would necessarily remain a local process, engaging citizens and stakeholders, but would be supported by the CARD network in the relevant bio-geopolitical region. The CARD network would become the storehouse of climate information, data and data analysis necessary for vulnerability and risk assessment and local CARP development.

Unfortunately, at the time of publication of this paper, there has been no effort by the AMA, the RMA or the Alberta government to form CARDs networks. As pointed out by several researchers, a major barrier to developing CARP continues to be lack of political will, leadership, and project champions, and this remains particularly problematic in small urban and rural municipalities Alberta where resources are already strained.

6.3 Funding Tools

MCCAC

The MCCAC has a wealth of information about emergent technical and funding opportunities for development and implementation of CARP. In the MCCAC 'Alberta Climate Funding Guide[82] addressing 'climate adaptation,' the MCCAC lists three funding programs[83] that were available in 2024 to help municipalities with different aspects of climate adaptation.

- The Flood Hazard Identification And Mapping Program (FHIMP) – Indigenous Traditional Knowledge (Federal Government);
- The Alberta Ecotrust Foundation, (Alberta Non-profit Organization); and
- The Natural Infrastructure Fund (Federal Government).

Each of these funding sources is described with appropriate levels of detail, contact information, and website links to make applying for funds relatively straightforward. For example, the Alberta Ecotrust Foundation has a dedicated 'Climate Innovation Fund.'[84]

[82] MCCAC, *supra* note 68, 'Alberta Climate Funding Guide', (pdf), online: https://mccac.ca/funding-guide/?fwp_grant_categories=climate-adaptation [Alberta Climate Funding Guide].
[83] MCCAC, *supra* note 68.
[84] Alberta Ecotrust Foundation, 'Climate Innovation Fund,' (pdf) online: https://albertaecotrust.com/climate-innovation-fund.

In addition to funding information, the MCCAC provides a "Community Climate Resilience Self-Assessment Tool."[85] The self-assessment is done online at no cost to the community user.

> The assessment is based on the Climate Adaptation Competency Framework, part of the Adaptation Learning Network project funded by Natural Resources Canada: Building Regional Adaptation Capacity & Expertise (BRACE), The BC Ministry of Environment and Climate Change Strategy, and Royal Roads University. The survey looks at five aspects of climate adaptation and asks communities to rank their capacity in aspects of each.

The MCCAC also has an active program called the 'Climate Resilience Capacity Building Program.'[86] The MCCAC provides a 'Guidebook' to help municipalities learn about funding opportunities and eligibility requirements to participate in the program. The program is now run as a community of practice, with regular quarterly meetings that allow municipalities to share their capacity building processes. 'Climate Resilience Capacity Building Community of Practice' meetings take place quarterly and are published in the center's events calendar. MCCAC advises that any community interested in participating may email contact@mccac.ca for further details.

6.4 Institutional, Scientific and Technical, and Funding Tools

The Federal Climate Change Adaptation Program (Federal CCA Program)[87]

The Federal CCA Program is supported by Natural Resources Canada and funded through federal general revenues. The program has three goals: to support decision-makers in identifying and implementing adaptation actions; enhance adaptation knowledge and skills among Canada's workforce; and increase access to climate change adaptation tools and resources.[88]

The program co-funds projects that address climate adaptation, for example to develop climate skills and capacity building; address local emerging issues and economic impacts; and to assist with planning in the natural resource sector (forestry, mining and energy). Interested communities can contact Natural Resources Canada at adaptation@nrcan-rncan.gc.ca.
Links to the program and platforms developed by Natural Resource Canada to December, 2025 are provided below:

- Climate-Resilient Coastal Communities (CRCC) Program
- Canada's Climate Change Adaptation Platform
- Building Regional Adaptation Capacity and Expertise Program
- Canada in a Changing Climate: National Assessment Process
- Canada's National Adaptation Strategy

7.0 Examples of Innovative Municipal CARP Processes

[85] MCCAC, *supra* note 66. See 'Community Climate Resilience Self-Assessment Tool', (pdf), online: https://mccac.ca/tools/community-climate-resilience-self-assessment/ [MCCAC Self-Assessment Tool].
[86] *Ibid.* Climate Resilience Capacity Building Program' (pdf), online: https://mccac.ca/programs/climate-resilience-capacity-building-program/ [MCCAC Climate Resilience Capacity Building].
[87] Government of Canada, 'Climate Change Adaptation Program' (pdf), online: https://natural-resources.canada.ca/climate-change/climate-change-adaptation-program/25115. [Federal CCA Program].
[88] *Ibid.*

Table 1 below is adapted from the MCCAC 'Database of Municipal Climate Adaption Plans' (Database)[89]. The Table provides a quick overview of the all the climate vulnerability and risk assessments and CARP that Alberta municipalities have adopted and released to MCCAC. The Database is a living online system and much more comprehensive than Table 1, providing links and other information about each plan. As such, the Database is worth reviewing by municipalities of all sizes wherever located in Alberta.

Two usage issues need to be addressed upfront. First, CARP developed in small urban centers and those developed in rural municipalities will necessarily be very different, because they have different bio-geopolitical considerations to deal with. In small urban centers, there are many people living on relatively small landscapes in typical commercial centers and residential subdivisions. In rural areas, a small number of people live and work on large tracts of land. In small urban centers while human safety is a major issue, in rural areas, crops, animals and other assets necessary to sustain rural livelihoods are also at risk. Second, CARP are specific to the community landscape and the people who develop them. It is neither suitable nor wise for small urban and rural municipalities to attempt to emulate CARP developed in large cities.

Table 1; Municipalities that have developed CARP since 2014[90]

Municipality	Name of CARP	Year
Athabasca	Climate Change Risk and Vulnerability Assessment and Adaptation Planning Report	2024
Banff	Banff Climate Resilience Action Plan	2016
Beaver County	Beaver County Climate resilience Action Plan	2018
Big Lakes County	Big Lakes County Climate Resilience Action Plan	2018
Bighorn	Climate Adaptation and Resilience Plan	2024
Bondiss	Summer Village of Bondiss Climate Adaptation Plan	2023
Brazeau County	Brazeau County Climate Resilience Action Plan	2018
Bruderheim	Bruderheim Climate Resilience Action Plan	2016
Calgary	Climate Resilience Strategy Mitigation and Adaptation Action Plans	2018
Calgary	Calgary Climate Strategy – Pathways to 2050	2022
Calgary	2023-2026 Climate Implementation Plan	2022
Canmore	Climate Change Adaptation Background Report and Resilience Plan	2016
Canmore	Adapting to the Risks of Extreme Heat and Wildfire Smoke in Canmore – Final Report	2023
Canmore	Climate Emergency Action Plan	2024
Devon	Climate Risk Assessment and Adaptation Plan	2024
Diamond Valley	Black Diamond and Turner Valley Climate Resilience Action Plan	2016
Edmonton	Climate Resilient Edmonton – Adaptation Strategy and Action Plan	2018

[89] Database, *supra* note 70.
[90] *Ibid.* This Table is adapted from the MCCAC Database of Municipal Climate Adaptation Plans.

Edmonton	**Edmonton City Plan Scenarios – Climate Vulnerability Cost Assessment**	**2019**
Edson	**Climate Change Vulnerability and Risk Assessment**	**2023**
Ghost Lake	**Summer Village of Ghost Lake Climate Resilience and Adaptation Plan**	**2022**
Ghost Lake	**Summer Village of Ghost Lake Climate Resilient Groundwater Implementation Plan**	**2023**
High River	**Climate Change Adaptation Action Plan**	**2023**
Hinton	**Climate Risk Assessment Report**	**2024**
Island Lake	**Climate Adaptation and Resilience Plan**	**2024**
Jasper	**Climate Risk Assessment Report**	**2024**
Lacombe County	**Lacombe County Climate resilience Action Plan**	**2018**
Leduc	**Weather and Climate Readiness Plan**	**2014**
Lethbridge	**Climate Vulnerability and Risk Assessment**	**2020**
Lethbridge	**Climate Adaptation Strategy and Action Plan**	**2024**
Mackenzie County	**Mackenzie County Climate Resilience Action Plan**	**2018**
Okotoks	**Okotoks Climate Resilience Action Plan**	**2016**
Okotoks	**Resilient Okotoks – Climate Action Plan 2021-2033**	**2021**
Onoway	**Climate Vulnerability and Risk Assessment**	**2024**
Pincher Creek	**Climate Risk Assessment and Adaptation Plan**	**2023**
Red Deer	**Climate Change Adaptation Plan –Part 1**	**2014**
Red Deer	**Climate Adaptation Strategy**	**2024**
Slave Lake	**Climate Change Risk and Vulnerability Assessment**	**2024**
Spruce Grove	**Spruce Grove Climate Change Resilience Action Plan**	**2018**
Spruce Grove	**Spruce Grove Climate Change Action Plan**	**2022**
St. Albert	**A Climate of Resilience- St. Albert Climate Adaptation Plan**	**2022**
Strathcona County	**Astotin Creek Resiliency Action Plan**	**2022**
Sturgeon County	**Sturgeon County Climate Adaptation Action Plan**	**2022**
Sylvan Lake	**Sylvan Lake Climate Resilience Action Plan**	**2018**

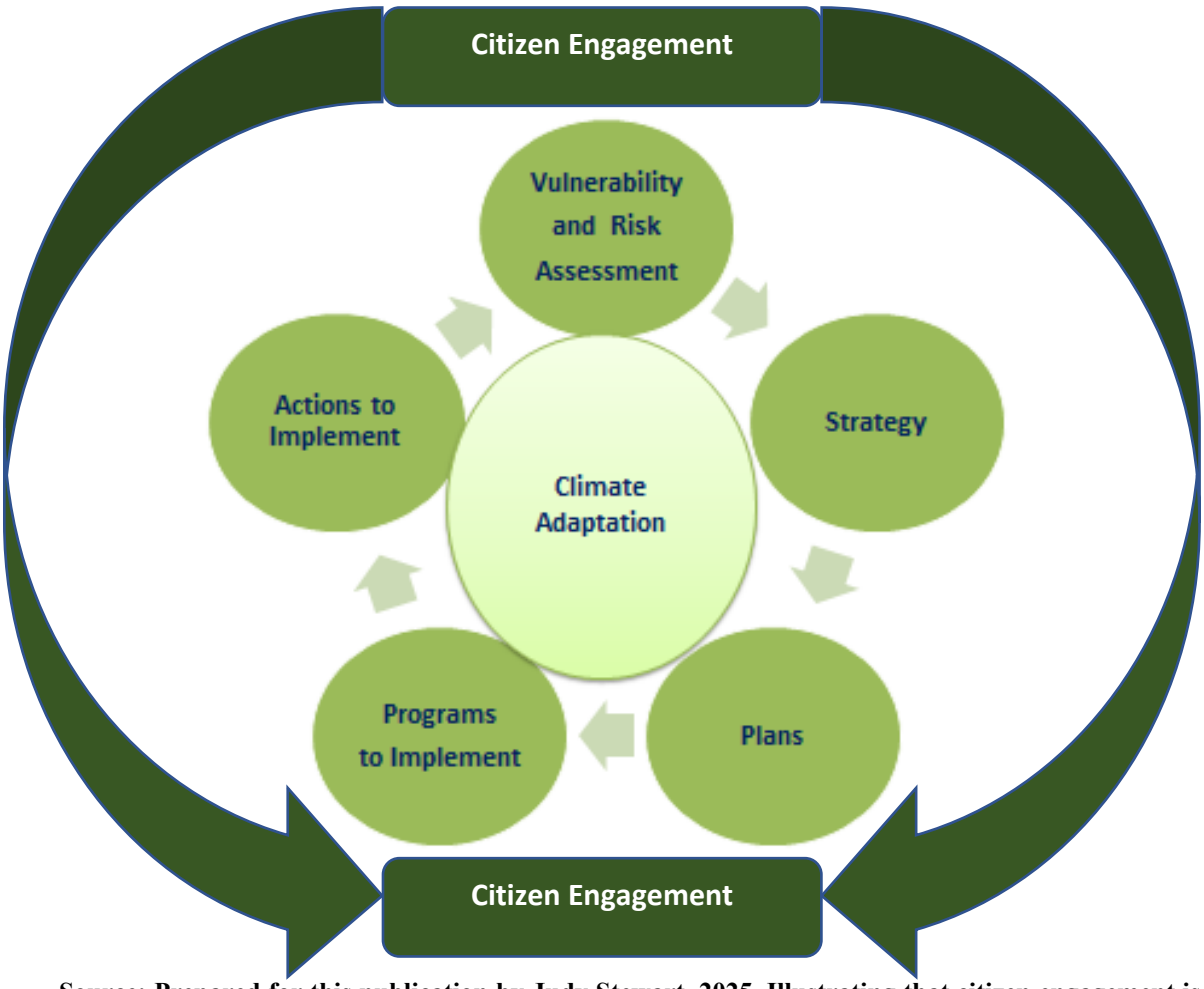
It is noteworthy that the smaller urban centers of Banff, Bruderheim, Canmore, Leduc, Okotoks, and Red Deer all adopted CARP before 2018, with Leduc and Red Deer leading the way in 2014.

Six examples of these complex municipal CARP development and implementation processes (CARP Processes) are presented below in detail: those of Calgary, Edmonton, St. Albert, Okotoks, Canmore, Beaver County, and Brazeau County. These are innovative and unique to the community, the bio-geopolitical climate vulnerabilities and risks, and the people.

7.1 Calgary's Complex CARP Processes[91]

Calgary is Alberta's largest city with a population of 1,491,900 on April 1, 2024, growing 6% in 2023.[92] In the discussion below, some components of Calgary's climate mitigation program are also represented illustrating the significant overlap between mitigation and adaptation programs.

Figure 4: Calgary's Complex CARP Processes



Source: Prepared for this publication by Judy Stewart, 2025. Illustrating that citizen engagement is a key component to development and implementation of CARP.

The information below is an overview of Calgary's CARP Processes documents adopted by city council since 2017. This lengthy overview it is not comprehensive. Calgary's CARP Processes are iterative, with regular document review and updates.

Policies, Assessments, and Strategies in Calgary's Complex CARP Processes

[91] City of Calgary, 'Climate Change Program", (pdf), online: https://www.calgary.ca/environment/policies/climate-change-program.html

[92] Robson Fletcher, 'Calgary population surges by staggering 6%, Edmonton by 4.2% in latest StatsCan estimates,' (May 22, 2024), CBC News, online: https://www.cbc.ca/news/canada/calgary/calgary-edmonton-cmas-july-2023-population-estimates-2024-data-release-1.7210191 [CBC May 2024 Report].

2017 Building a Climate-Resilient City Research Series
2018 Calgary Climate Strategy (Initial)
2018 Climate Resilience Strategy: Mitigation and Adaptation Action Plans
Climate Resilient City
2021 Declaration of Climate Emergency
2021 Climate Adaptation Best Practices White Paper
2021 Climate Risk Assessment Framework (Original)
2022 Citizen Perspectives Survey Report Climate Change (3rd Ed.)
2022 Calgary's Climate Profile
2022 Climate Hazards 2022 Year in Review (1993-Present)
2022 Climate Strategy Update /Public Consultation
2022 Climate Strategy - Pathways to 2050
2022 Climate Implementation Plan
2022 Funding Climate Action Report
2022 Reconciliation and the Intersections of Indigenous Peoples and Climate Change — Literature Review and Recommendations
2023 Climate Progress Report
2023 Recommendations for Climate Adaptation Planning
2023-2026 Climate Implementation Plan
2024 Climate Projections for Calgary 2024
2024 Climate Risk Assessment Framework and Process Guide (4th ed)

The Climate Risk Assessment Framework and Process Guide is separated into two sections: 1) the Climate Risk Assessment Framework, which is made up of the Climate Risk and Resilience Assessment (CRRA) and the Climate Risk Screening Assessment (CRSA) processes and 2) Calgary's Climate Profile (climate profile).The first part of this document outlines the framework and associated CRRA and CRSA processes, which will inform resilience and adaptation measures for infrastructure projects as a full assessment and scaled down assessment approach, respectively. The second part of this document highlights the projected changes to Calgary's climate.[93]

Calgary Climate Change Mitigation and Adaptation Programs and Actions

The city has identified nine main climate hazards that are of concern to Calgarians:

- Extreme Heat
- Higher Average Temperatures
- Drought
- Short Duration High Intensity Rainfall (SDHI)
- Severe Storms
- High Winds
- River Flooding
- Heavy Snowfall, and
- Wildfire.'[94]

[93] City of Calgary, 'Climate Risk Assessment Framework and Process Guide', (4th Version), 2024), online;
[94] City of Calgary, Climate Hazards 2022 Year in Review (1993-Present), (2022), online:

Since 2018, Calgary's Climate Strategy has been implemented through a series of innovative mitigation and adaptation programs and actions. To understand the complexity of these programs and actions, some are captured in the lists below. This illustrates what can be done to address climate mitigation generally, and adapt to identified climate vulnerabilities and risks (such as water scarcity, droughts, floods, and wildfires).

Mitigation

- Climate Advisory Committee
- Bonnybrook Wastewater Treatment Plant Upgrades
- BenchmarkYYC
- Clean Energy Improvement Program (CEIP)
- Commercial and Institutional Building Energy Benchmarking Program
- Cycling Strategy
- Pedestrian Strategy
- Renewable Energy Non-Residential Tax Incentive Bylaw
- Solar Energy & Photovoltaic Systems
- Electric Vehicle (EV) Strategy
- Energy efficiency tip sheet
- Green Buildings
- Green Buildings Priority Stream Program
- Green Line
- Pedestrian Strategy
- Residential Solar Calculator
- Solar Information
- Sustainable Building Policy
- Actions you can take to help limit climate change
- Home Energy Label Program
- Greenhouse Gas Emissions Technical Reference
- 2021 Emissions Modelling Reference Document
- Climate equity
- Affordable housing
- About Energy Advisors (CACEA)
- Air Quality
- Installed rooftop solar capacity
- Insulation
- Electric vehicles in Calgary
- Cost calculator to operate and maintain an electric vehicle
- Plugshare: Find an electric vehicle charging station near you
- Zero Carbon Building Standards

Adaptation

- Calgary's Environment Strategy
- Calgary's Environmental, Health and Safety Scorecard
- Climate Ready Home Guide
- Disaster Risk Explorer
- Calgary's River Flood Story
- Flood Planning
- Calgary's Flood Resilience Plan
- Bonnybrook Wastewater Treatment Plant Upgrades
- Green Roofs
- Naturalization Program
- Peaks to Prairies Network
- Leave grass clippings on the lawn
- Branching Out Tree Program
- Biodiversity Policy
- Stormwater Management Strategy
- 30 by 30 Water Efficiency Plan
- Homeowner Water Guide
- Rain Barrel Grogram
- Water Saving Tips
- Drought resilience plan
- Brownfield Tax Incentive Program
- 211 Distress Centre
- Crisis Intervention Fund
- Measuring Calgary's climate action
- A Benchmarking Primer
- Climate Ready Home Guide with Handouts [95]
- Calgary Composting Facility
- Calgary's Environment Strategy
- Calgary's Environmental, Health and Safety Scorecard

Calgary's CARP Processes continue in 2025, with ongoing public engagement. New programs, actions and guidebooks continue to emerge to help Calgary's citizens and stakeholders adapt to warming temperatures and SWE.

Small urban and rural municipalities might wish to work with their own citizens and businesses in a review of Calgary's research, plans, programs and actions to discover if any of the materials could be implemented locally.

[95] City of Calgary, 'Calgary Ready Home Guide', online: https://www.calgary.ca/environment/resources/climate-ready-home-guide.html [Home Guide]. This webpage comes with handouts to help citizens and homeowners prepare for SWE. See these hyper- linked documents on the webpage: How to prepare your home for extreme heat; How to prepare for wildfire and smoke; How to protect your home from flood and heavy rain; How to prepare your home and yard for drought; How to prepare your home and yard for hail and high wind [SWE Guidebooks].

7.2 Edmonton's Complex CARP Processes

Edmonton's is Alberta's second largest city, with an unofficial population of 1,140,000 on November 1, 2024. Edmonton grew 4.2% in 2023, and is projected to grow by 3% over the next 3 years.[96] More people mean more climate vulnerabilities and risks to address over time.

Based on climate models, Edmonton predicts that all four seasons in Edmonton will not resemble the past.[97] City council recognizes that climate adaptation is critical to resilience. In 2010, Edmonton released two important studies about the potential specific climate vulnerabilities and risks the city would face moving forward. These two documents frame Edmonton's CARP Processes since 2010.

- 2010 Resilient Edmonton – Why and How?[98]
- 2010 Climate Change Projections and Implications for Edmonton[99]

Basically, Edmonton's complex CARP Processes mirror those of Calgary as depicted in Figure 4 above, with public engagement considered a critical component. Like Calgary, Edmonton has developed complex CARP Processes with various plans, strategies, assessments, strategies, plans, programs and actions for both climate mitigation and adaptation.

Much of Edmonton's climate mitigation programming can be found under the city's *Enviso: Edmonton's Environmental Management System*.[100] Through policies and programs such as those listed below, Edmonton is a recognized leader in climate mitigation in Alberta.[101] However, this section focuses only on Edmonton's CARP processes only, and does not discuss the complex climate mitigation strategy, plans, programs and actions such as those listed below:

- Contractor Environmental Responsibilities
- Environmental Construction Operations (ECO) Plans
- Phase 1 Environmental Site Assessments - Property Inquiries
- Low Carbon Cities Canada
- City of Edmonton's Environmental Policy (C512)
- Environmental Management System Policy (C505)
- International Organization for Standardization (ISO)

As was noted in Calgary, Edmonton's mitigation programs and adaptation programs are inextricably connected. For example, Edmonton's 'Environmental Actions'[102] webpage includes

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[96] CBC May 22, 2024 Report, *supra* note 90.
[97] City of Edmonton, 'Climate Change Adaptation,' (pdf), online: https://www.edmonton.ca/city_government/environmental_stewardship/climate-change-adaptation.
[98] Craig Applegath and Jonathan Yazer, *Resilient Edmonton – Why and How?* (2010), (pdf), online: https://www.edmonton.ca/city_government/city_vision_and_strategic_plan/climate-change-discussion-papers.
[99] Dr. Debra J. Davidson, *2010 Climate Change Projections and Implications for Edmonton* (2010), (pdf), online: https://www.edmonton.ca/city_government/city_vision_and_strategic_plan/climate-change-discussion-papers.
[100] City of Edmonton, 'Enviso: Edmonton's Environmental Management System,' online:
[101] See Tamarack, supra note 80.
[102] City of Edmonton, 'Environmental Actions', online: https://www.edmonton.ca/programs_services/environmental/actions-what-you-can-do [Edmonton Environmental Actions]. The list is fairly comprehensive, providing homeowner and business owners with practical tips for a number of climate mitigation and adaptation actions.

many recommended mitigation strategies and actions that are also important adaptation strategies and actions. See **Appendix A** for a list of practical environmental actions all municipalities might share with their citizens and other stakeholders. **Appendix A** is adapted from Edmonton's Environmental Actions webpage.

In 2018, Edmonton adopted *Climate Resilient Edmonton: Adaptation Strategy and Action Plan.*[103] The documents listed below have all emerged from that plan.

A few more recent of Edmonton's climate adaptation documents
2018 Climate Resilient Edmonton: Adaptation Strategy and Action Plan
2020 High-Resolution Climate Change Projections for the City of Edmonton
2021 High-Resolution Climate Change Projections for the City of Edmonton - Final Report
2021 Climate Change, Older Adults and Immigrants: Exploring Community Vulnerability and Resilience - Project Summary
2023 Change Habits For Climate Guide
2023 Climate Data Workshop Summary Report
2023 Assessment of Wildland-Urban Interface Fire Risks and Hazards for City Buildings/Infrastructure (Crowdsensing Framework) - Final Report
2024 Resilience Hubs and Evacuations: Preparing Edmonton for Extreme Events and Climate Change - Final Report

The documents listed above are the 'tip of an iceberg' of information that can be found on Edmonton's webpage entitled 'Environment and Climate Resilience.' [104] The webpage provides links to CARP programs and actions grouped under nine headings, as follows:

- Air Quality
- Climate Change Adaptation
- Contaminated Site Management Program
- Edmonton's Energy Transition
- Enviso: Edmonton's Environmental Management System
- Land and Ecosystems
- Mobility Choices
- Green Education Resources
- Videos

On the webpage, each of the headings is further linked to specific CARP programs and actions. Linked resources under four of the headings above are provided below for ease of reference: air quality; climate change adaptation; and land and ecosystems for your ease of reference. All the headings on Edmonton's 'Environment and Climate Resilience' webpage are relevant and useful, but these selections are most relevant to small urban and rural communities that may be thinking of starting up something similar.

Air Quality

[103] Climate Resilient Edmonton, *supra* note 43.
[104] City of Edmonton, 'Environment and Climate Resilience,' online: https://www.edmonton.ca/city_government/environmental-stewardship [Edmonton Resilience].

- Be Idle Free
- Alberta Capital Airshed
- West Central Airshed Society
- Heartland Air Monitoring Partnership
- Connect(ED)monton
- Air Quality Health Index
- Air Quality Health Index - Map
- Promoting the AQHI
- Particulate matter and ozone management plan guidance
- Live Air Data Map
- Radon: About
- Evict Radon
- Canadian National Radon Proficiency Program
- Radon Mitigation Rough-in
- Root for Trees
- Mobility Choices
- Wildfire Prevention and Education
- Healthy Home Tour
- Alberta Environment and Parks' Information About Air
- Environment Canada's Information About Air

Climate Change Adaptation

- Climate Change Adaptation and Resilience Strategy
- Climate Change Adaptation: Discussion Papers
- Climate Resilient Edmonton: Adaptation Strategy and Action Plan
- Change Homes for Climate Guide
- Climate Resilient Home
- Climate Resilient Home Guide
- Neighbouring For Climate
- Preparing for Climate Change
- Installing a Rain Garden
- Residential Lot Grading
- Homeowner’s Guide to Lot Grading and Drainage
- Climate Resilient Business
- Edmonton's Climate Change Almanac
- Climate Conversations Teachers Guide
- Green Leagues: Adapting to Climate Change
- Flood Prevention Homeowner Programs
- Climate Innovation Fund
- Cities IPCC Legacy Research Grant
- Edmonton’s Community Energy Transition Strategy & Action Plan
- Regional Climate Adaptation Collaborative
- Edmonton Ecoroof and Climate Change Resiliency Initiative Jurisdictional Review
- PCC Building a Climate-Resilient City series (See Chapter 6-note 76)

Land and Ecosystems

- Edmonton's Global Conservation Commitments and Partnerships
- Natural Areas, Parks and Urban Biodiversity
- Naturalization
- Integrated Pest Management
- Pest Management Policy
- Pest Management
- Turf Operations
- Natural Private Property
- Eco-Landscaping
- Partners in Parks
- About Breathe
- River Valley Planning Modernization Project

Some of Edmonton's Most Innovative Programs and Actions

- Change For Climate Lunchbox Series
- Changing for Climate Video Series
- A Tiny Explanation Series –explains how to take action on climate change
- Renewable Series - Includes videos about urban forests[105]
- Neighbouring For Climate
- Green Education Resources

7.3 Okotoks Complex CARP Processes

Okotoks is a small urban center with a population of 31,270 as of November 30, 2024. Nevertheless, Okotoks has impressive CARP Processes that provide useful and relevant information that other small urban municipalities might want to review.

After extensive public consultation between 2016 and 2018, CARP Processes began in earnest in 2018 when town council adopted the *Environmental Master Plan.*[106] In 2021, Okotoks adopted *Resilient Okotoks-Climate Action Plan 2021-2033* [Okotoks CARP][107] that is the cornerstone to Okotoks climate adaptation programs and actions. Okotoks CARP is a climate mitigation and adaptation action plan whereby the municipality and its citizens will work together to achieve carbon neutrality by 2050 and ensure that the local citizens and businesses 'are informed, connected, and prepared to respond and recover in the face of future climate challenges.'[108]

Okotoks CARP includes an overview of the deliberative processes and documents that informed CARP development and implementation as follows:

2016 Community Sustainability Plan[109]
2018 Climate Resilience Express Action Plan

[105] All the four video series can be found at Edmonton Resilience, *supra* note 104: Videos.
[106] Town of Okotoks, 'Environmental Master Plan', (2018), online: https://www.okotoks.ca/your-community/living-okotoks/participate-okotoks/archived-public-participation/environmental.[Okotoks EMP].
[107] Town of Okotoks, 'Climate Resilient Okotoks, Climate Action Plan 2021-2033,' (2021), online**:** https://www.okotoks.ca/your-community/green-living/climate-action [Okotoks CARP].
[108] *Ibid.* at vii
[109] Town of Okotoks, 'Community Sustainability Plan', (2016), online: https//www.okotoks.ca.

2019 Climate Risk and Resilience Assessment and associated Recommendations Report[110]
2021 Climate Action Plan Report 2021-2033
2021 - 2022 Okotoks Municipal Development Plan[111]
2021 Okotoks Water Supply and Resiliency Presentation
2023 Financial Sustainability Plan

Okotoks implements the CARP through a number of adaptation programs and actions under the "Green Living'[112] umbrella. There are several linked program categories, including Rebates and Incentives; Green Living Events; Green Living Programs and Tools; Living in Okotoks; and Environmental Research Center. These programs include a number of environmental actions that citizens and businesses might engage in while adapting to warmer temperatures and SWE.

Rebates and Incentives

- Water Smart Business Grant
- Water Conservation Rebate
- Clean Energy Improvement Program (CEIP)
- LEED® Building Incentive Program

Green Living Events

- Green Living Programs & Tools
- Growing Greener Together
- Environmental Education Centre
- Corporate Sustainability

Green Living Programs and Tools

- Irrigation Assessment
- Eco-Education Programs
- Do-It-Yourself Home Energy Audit Kit

Growing Greener Together

- Local Wildlife and Nature
- Our Water
- Our Energy
- Our Air
- Our Waste
- Growing Greener Together Guide

Environmental Research Center

- Environmental Resources
- Climate Action

[110] Town of Okotoks, 'Climate Risk and Resilience Assessment, (2019), (pdf) online:
[111] Town of Okotoks, 'Uniquely Okotoks: Municipal Development Plan', Bylaw 02-21 as amended by Bylaw 19-22, (2022), online: https://www.okotoks.ca/your-government/plans-and-projects/community-planning/planning-bylaws-and-guiding-documents [Uniquely Okotoks].
[112] Town of Okotoks, 'Green Living', online: https://www.okotoks.ca/your-community/green-living

- Corporate Sustainability

Living in Okotoks

- Community Event Calendar
- Community Engagement
- Volunteering
- Community Initiatives
- Shared e-Scooters
- Community Gardens
- Schools
- Maps

Okotoks has a number of new policies, programs and strategies to address emergent environmental issues arising from warming temperatures. Some of these are listed under 'Corporate Sustainability,' [113] as follows:

- Okotoks is a Bee City
- Living Soils Filtration Project
- Drake Landing Solar Community
- Conservation Educator Program
- Sustainable Facilities

Some Innovative and Unique Climate Adaptation Programs and Actions in Okotoks

2021 Climate Action Plan Infographics Timeline[114]
2020 Affordable Housing Strategy + Action Plan
2022-2025 Okotoks Urban Deer Management Strategy & Action Plan
Weed and Pest Management[115]
Natural Areas[116]

7.4 St. Albert's Complex CARP Processes

St. Albert is a mid-sized city adjacent to Edmonton, with a population 72,316 as of November 2024. In May 2022, the city adopted the document entitled *A Climate of Resilience: St. Albert Climate Adaptation Plan* [117] (St. Albert's CARP**).**

[113] Town of Okotoks, 'Corporate Sustainability', online: https://www.okotoks.ca/your-community/green-living/corporate-sustainability.
[114] Town of Okotoks, 'Climate Action Plan Report 2021-2033', (2021), online: https://www.okotoks.ca/your-community/green-living/climate-action.
[115] Town of Okotoks, 'Weed and Pest Management', online: https://www.okotoks.ca/your-services/maintenance/weed-pest-management.
[116] Town of Okotoks, 'Natural Areas', online: https://www.okotoks.ca/your-services/maintenance/weed-pest-management.
[117] City of St. Albert, 'A Climate of Resilience: St. Alberta Climate Adaptation Plan,' (2022), online: https://stalbert.ca/city/environment/reports/climate-adaptation-plan/. [St. Albert's CARP].

St. Albert's CARP development began in 2014 with the city's adoption of the *Environmental Master Plan* (EMP).[118] In 2019, the city adopted the Environmental *Sustainability Policy*. [119] In 2021, *Flourish: Growing to 100K - City of St. Albert Municipal Development Plan (*Flourish) incorporated several climate adaptation policies objectives and strategic actions.

St. Albert reviews and updates adaptation to strategic actions through annual 'Community Report on the Environment' [120] documents, with the latest issued in 2022 when St. Albert's CARP was adopted.

St. Albert's CARP followed extensive public engagement in the 'Climate Adaptation Challenge' (CAC)[121] that is an *All One Sky* program. St. Albert's staff and environmental advisory committee partnered with MCCAC and *All One Sky* to develop the 'Climate Change Vulnerability and Risk Assessment,'[122] identifying six priority climate risks and two priority opportunities, and actions to address them, as follows:

- heat waves;
- freezing rain;
- wildfire smoke;
- changes in energy demand for heating;
- ventilation and air cooling (HVAC);
- wildland fire;
- invasive species; and
- seasonal drought.

St. Albert's identified climate vulnerabilities and risks mirror those listed in Edmonton's CARP, which makes sense given their proximity to one another. There are some similarities with Calgary. The plan reflects climate adaptation strategies under 4 pillars:

- Built Environment;
- Natural Environment;
- Public Health and Safety; and
- Water Management.

Adaptation principles and objectives are provided under each pillar, along with strategic actions.

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[118] City of St. Albert , *Environmental Master Plan,(*2014) online: https://stalbert.ca/city/environment/reports/environmental-master-plan/#:~:text=Plan%20Summary,future%20environmental%20plans%20and%20initiatives.&text=In%20May%202014%2C%20St.,(EAC)%20and%20City%20staff [St Albert EMP].
[119] City of St. Albert, *Environmental Sustainability Policy*, (2019), online: https://stalbert.ca/city/environment/reports/environmental-policy/.
[120] St. Albert's EMP*, supra* note 118.'
[121] MCCAC, supra note 68, "Climate Adaptation Challenge', online: https://mccac.ca/programs/climate-adaptation-challenge/. [Climate Adaptation Challenge].
[122] City of St. Albert, Climate Change Vulnerability and Risk Assessment, (2022), online: https://mccac.ca/programs/climate-adaptation-challenge/.

Strategic actions under Natural Environment and Water Management are most relevant to small urban and rural municipalities engaged in CARP development, and links to these as actions are provided below.

Natural Environment

- Natural Areas
- Weeds
- Urban Tree Cover
- City Wildlife
- Goldfish Management Program

Water Management

- Water Conservation Bylaw
- Indoor Water Saving Tips
- Outdoor Water Saving Tips
- Rain Barrels
- Discover the Sturgeon River

For an example of strategic actions under each of these pillars, under 'Discover the Sturgeon River' the city lists a number of programs and resources to assist citizens and businesses to take adaptation actions, as follows:

- Sturgeon River Watershed
- Natural State of the River
- River Critters
- What Can You Do for the River
- Water Monitoring
- Alberta Regulations: Alberta Guide to Sportfishing Regulations

St. Albert also has a robust climate mitigation plan and strategic actions to reduce carbon and greenhouse gas emissions. Like Calgary, St. Albert recognizes and promotes climate adaptation programs that are inextricably connected to climate mitigation programs.

7.5 Canmore's Complex CARP Processes

The Town of Canmore is a small urban center adjacent to Banff National Park in the Rocky Mountains, with a population of 15,990 in 2021. Tourism increases Canmore's population significantly in the summer and winter months and the town has unique environmental management issues.

In 2019, Canmore declared a climate emergency, and in April, 2024 adopted the *Town of Canmore Climate Emergency Plan* (Canmore's CARP).[123] The town considers the plan to be a strategic-level plan, outlining what is necessary to achieve a low-carbon, climate resilient future for Canmore. Like St. Albert and Calgary, Canmore connects programs for climate mitigation

[123] Town of Canmore, *Town of Canmore Climate Emergency Plan* (2024), (pdf), online: https://www.canmore.ca/your-community/environmentandclimate/climatechange.

with those for climate adaptation. Public engagement was critical in developing Canmore's CARP.

Canmore has a number of unique climate adaption strategies and actions that may be suitable for small urban centers, especially those located near tourist attractions and natural amenities such as mountainous and foothills bioregions and national parks. Some of these are listed below for consideration by other municipalities with similar climate vulnerabilities and risks.

- Incentive programs
- Waste diversion
- Sustainable transportation
- Flood mitigation
- The Bow Valley Community Fireguard Project
- Hazard monitoring

An example of an incentive program is the 'Fruit Tree Removal Incentive Program' provided in order to discourage bears and other wildlife from looking for food within town boundaries. Many other communities are looking for ways to eliminate this growing environmental vulnerability and risk that has become a health and safety issue.

Under 'Hazard Monitoring', the town monitors the overall risk to the community posed by wildfire threats, flooding and drought. This information is kept current and provides levels of risk and actions those citizens and businesses can do to limit hazards to themselves and their property.

Canmore's 'Document' webpage 'Climate Emergency Action Plan'[124] provides links to the vulnerability and risk assessment, the public engagement summary, and several other important research documents that informed the development of Canmore's CARP.

7.6 Beaver County Complex CARP Processes

Beaver County was incorporated in 1958, and includes approximately 120 kilometers of rural landscape in central Alberta. The county's population in 2021 was 5,868. As a typical rural landscape, climate change impacts a small population and large tracts of agricultural and industrial land.

In 2017, the county participated in a Climate Resilience Express project with the MCCAC and the *All One Sky Foundation.* Starting in 2017, various community stakeholders participated in a workshop to identify climate vulnerabilities and risks, and opportunities to prepare for climate resilience actions and implementation through CARP development. Participants identified 13 climate risks: and created an action plan to address the three top priorities: reduced water availability; wildland fires; and impacts of freeze-thaw cycles.

[124] Town of Canmore, *Climate Emergency Action Plan* website, online: https://www.mycanmore.ca/climateaction

To ensure that the county remained resilient the county identified several actions that could be taken, and the *Climate Resilience Express Action Plan* (Beaver County's CARP) [125] was developed and adopted in 2018. It is reviewed periodically and updated as required. The plan combines cultural, economic, science, technology, and ecosystem considerations to ensure that the actions will be implemented.

The county used a typical All One Sky Foundation four-step approach to developing the plan, as follows:

Step 1: Establish the local context for climate resilience action planning;
Step 2: Assess potential climate-related risks and opportunities to establish priorities for action;
Step 3: Formulate actions to manage priority risks and opportunities; and
Step 4: Prepare and implement an Action Plan, review progress, and update the Plan to account for new information and developments.[126]

Under each of the three identified risk priorities, a list of implementable actions was provided, along with a cost, timeframe for implementation, and lead. For example, under the risk 'wildland fires,' the following actions were set out:

- Implement a County-wide FireSmart Program, at moderate cost in the short term with Beaver Emergency Services Commission (BESC) as the lead;
- Develop a fire risk communication system, including through social media at moderate cost in the short-term with BESC / Beaver County as the leads.
- Upgrade firefighting equipment, with emphasis on equipment for wildland fires at very high costs, in the short-term with BESC / Beaver County as the leads; and finally
- Conduct a regional water planning process to identify future water supply needs at very high costs, in the very long-term with BESC / Highway 14 Regional Water Services Commission as the lead.[127]

In addition, continuing the expansion and improvement of the Emergency Response Plan was identified as a priority action.

Under the county's 'Sustainable Agriculture" webpage,[128] the following resources that they used when preparing the CARP are described. Links are provided for ease of reference as follows;

- Government of Alberta: Sustainable Canadian Agricultural Partnership in Alberta
- Alberta Environmental Farm Plan
- Results Driven Agriculture Research (RDAR): On-Farm Climate Action Fund (OFCAF)
- Government of Alberta: Resilient Agricultural Landscape Program

Beaver County CARP processes and action plan provide good examples of what can be done by rural municipalities to develop CARP with their stakeholders using available resources, such as

[125] Beaver County, *Climate Resilience Express Action Plan*, (2018), (pdf) online: https://www.beaver.ab.ca/government/plans-projects/climate-resilience-plan [Beaver County CARP].
[126] *Ibid,* at 3.
[127] *Ibid*, at 30.
[128] Beaver County, 'Sustainable Agriculture', online: https://www.beaver.ab.ca/on-line-services/agricultural-services/sustainable-agriculture.

the MCCAC and *All One Sky Foundation*, and provincial government resources and funding opportunities.

7.7 Brazeau County Complex CARP Processes

Brazeau County has a rural population of 7,179 as of December 10, 2024. It is located in central Alberta with Drayton Valley acting as a central hub. Brazeau County lands are about 135 kilometers from Edmonton. The landscape hugs both sides of Highway 22. A typical rural geopolitical landscape is present: a large rural area with a very small population, with climate vulnerabilities and risks that could impact the land, the business community, and the people.

In 2018, the county developed and adopted the *Climate Resilience Express Action Plan*.[129] The county worked with its stakeholders in a similar process through the Climate Resilience Express project with financial support from the MCCAC, the Calgary Foundation, Natural Resources Canada, *All One Sky Foundation*, and Alberta Ecotrust.[130] The exact same four-step process was used as was done in Beaver County.

The county identified the following observed climate vulnerabilities and risks:

- Wildfires, with evacuations and impacts on the economy (oil and gas), health and livestock
- Excessive dry conditions, water supply concerns
- Excessive wet conditions, water surcharging
- Freezing rain
- Impacts on forests and agriculture from insects (grasshoppers, pine beetle, etc.)
- Improvements to quality of life from warmer weather
- Flooding of rivers and creeks
- Snow and storms increase snow removal costs
- Climate affects wildlife habitat (populations, migration, behaviour, etc.)
- Health / psychological impacts related to storms and severe weather
- Tornadoes and wind storms – damage to property
- Summer storms – impacts on lake-based and river-based recreation
- Water quality issues from heavy rains and runoff [131]

Several opportunities and benefits of the warming climate and increased precipitation forecasted through modeling were also observed and presented, for example increased water levels in wetlands and a longer growing season.

Four priorities were selected for action planning:

- Overland flooding;
- Water supply shortage / drought;
- Forest fire; and
- Increased growing season (opportunity).

[129] Brazeau County, *Climate Resilience Express Action Plan*, (2018) (pdf) online: Brazeau.ab.ca [Brazeau's CARP].
[130] *Ibid.*
[131] *Ibid,* at 6.

In the same way as in Beaver County, Brazeau's CARP provides actions under each priority with costs, timeframe for implementation, and the lead actor. The actions under the heading 'Overland Flooding'[132] are a good example of how the county chose to adapt and become more resilient.

- Develop an inventory of local wetlands that could be used for stormwater management at high costs in the short-term with Brazeau County Planning and Development as the lead;
- Enhance development regulations to prohibit development in high-risk flooding zones at moderate cost in the short-term with Brazeau County Planning and Development as the lead;
- Separate stormwater and sewer water systems where they are currently combined at very high costs in the long-term with Public Works and Infrastructure as the lead, and
- Install bioswales and green infrastructure to manage rainwater at very high costs as an ongoing action with the county as lead.[133]

While the CARP development process and the plan is similar in many ways to the one developed for Beaver County, it is unique in its details, identified climate vulnerabilities, risks an opportunities, and in the actions that the county will implement in the short, medium and long term. Brazeau's CARP Processes continue to emerge, and provide some good starting points for other rural communities interested in CARP development.

7.0 Concluding Remarks

All Alberta municipalities, whether comprised of large cities, small urban centers, summer villages, or large rural landscapes have already been impacted by a warming climate trend and SWE. Much has been written about municipalities and CARP development, and academic and scientific research, public policy, online resources, (such as MCAAC and *All One Sky*,) and technology continue to emerge to help municipalities develop CARP with their citizens and stakeholders. Public participation in CARP development is the key to successful implementation of plans that reflect local bio-geopolitical conditions.

This paper is offered to municipal councils and administrators in an attempt to organize the most recent and emerging climate change information to address four identified barriers to CARP development. Each of the chapters within addresses one of these barriers, providing information and resources to overcome the lack of:

- Climate change awareness;
- Trained personnel and consultants;
- Financial resources; and
- The scientific knowledge and data necessary to assess local vulnerabilities and risks.

Background scientific information, along with the most current government policy and legislation about climate adaptation are provided upfront as the context for why municipal CARP are critical. One chapter addresses the most recent academic literature about municipal CARP,

[132] Ibid, at 31.
[133] Ibid, at 31.

and one is dedicated to identifying institutional, scientific and technical, and funding tools that are currently available to address lack of resources.

Finally, examples of innovative CARP from Edmonton, Okotoks, St. Albert, Canmore, Beaver County and Brazeau County are presented as examples of what can be done to develop CARP and strategic implementable action plans. From each of these municipal CARP, unique and noteworthy actions, programs and projects are identified with hyperlinks.

An Appendix of 'Practical Environmental Actions for Citizens and Businesses' based on Edmonton's CARP is attached.

While there is no one-size-fits-all in CARP development and implementation, it is hoped that this paper will help Alberta's small urban and rural municipalities to take steps to develop CARP with their citizens and stakeholders. Without a CARP in place the community will be vulnerable and at risk to the warming climate and SWE.

8.0 Appendix A: *Practical Environmental Actions for Citizens and Businesses*

This list is adapted from the City of Edmonton and is not meant to be comprehensive. Many of the actions may not be achievable in all communities. Each community might amend it to address local climate vulnerabilities and risks.

Reduce GHG Emissions and Improve Air Quality

- Don't idle your vehicle
- Turn off lights when not in the room
- Buy green power
- Install high-efficiency furnace
- Set thermometer at 17-21 degree C
- Use high-efficiency washers and dryers
- Wash in cold water
- Hang clothes out to dry
- Replace stove with induction stovetop
- Use toaster oven for small meals
- Invest in renewable energy – install solar panels on your roof
- Weatherproof your home
- Upgrade roof insulation
- Upgrade basement insulation
- Insulate walls and attics
- Install energy efficient windows
- Retrofit building envelope
- Open and close blinds seasonally
- Use fans not AC
- Use LED bulbs
- Use toaster oven for small meals
- Commute sustainably whenever you can
- Work and play close to where you live
- Vacation locally

Water Conservation

- Use rain barrels
- Retrofit drains with DWHR units
- Use a tankless water heater
- Replace your showerhead and faucets – use low-flow
- Use low-flow fixtures, especially toilets
- Use only full loads
- Use plants and flowers that don't need a lot of water

Transportation

- Drive an electric vehicle
- Install high-efficiency furnace

- Use high-efficiency washers and dryers
- Hang clothes out to dry
- Work and play close to where you live
- Car-share as much as possible
- Drive smarter-slow down – use less gas and electricity
- Maintain correct tire pressure

Consumerism

- Shop locally
- Reduce what you buy
- Reuse/recycle/repurpose
- Learn online
- Mend clothes instead of buying new
- Use gently used clothes and materials

Food and local sources

- Reduce food waste – eat what you buy – reduce what you buy
- Have a garden - grow your own food
- Eat less meat
- Shop locally and at farmers markets
- Keep bees
- Compost at home

Natural Landscapes

- Practice eco-landscaping
- Use low impact development technology and practices
- Protect against floods
- Plant some trees
- Cut lawn with a push mower
- Leave grass clippings on the lawn
- Leave 18 inches topsoil in garden
- Compost
- Plant flowers, food and crops that attract bees