Calgary

UCS2021-0841
Attachment 3

Calgary Today: Environment Background Study

Environmental Approaches, Information, and Ideas

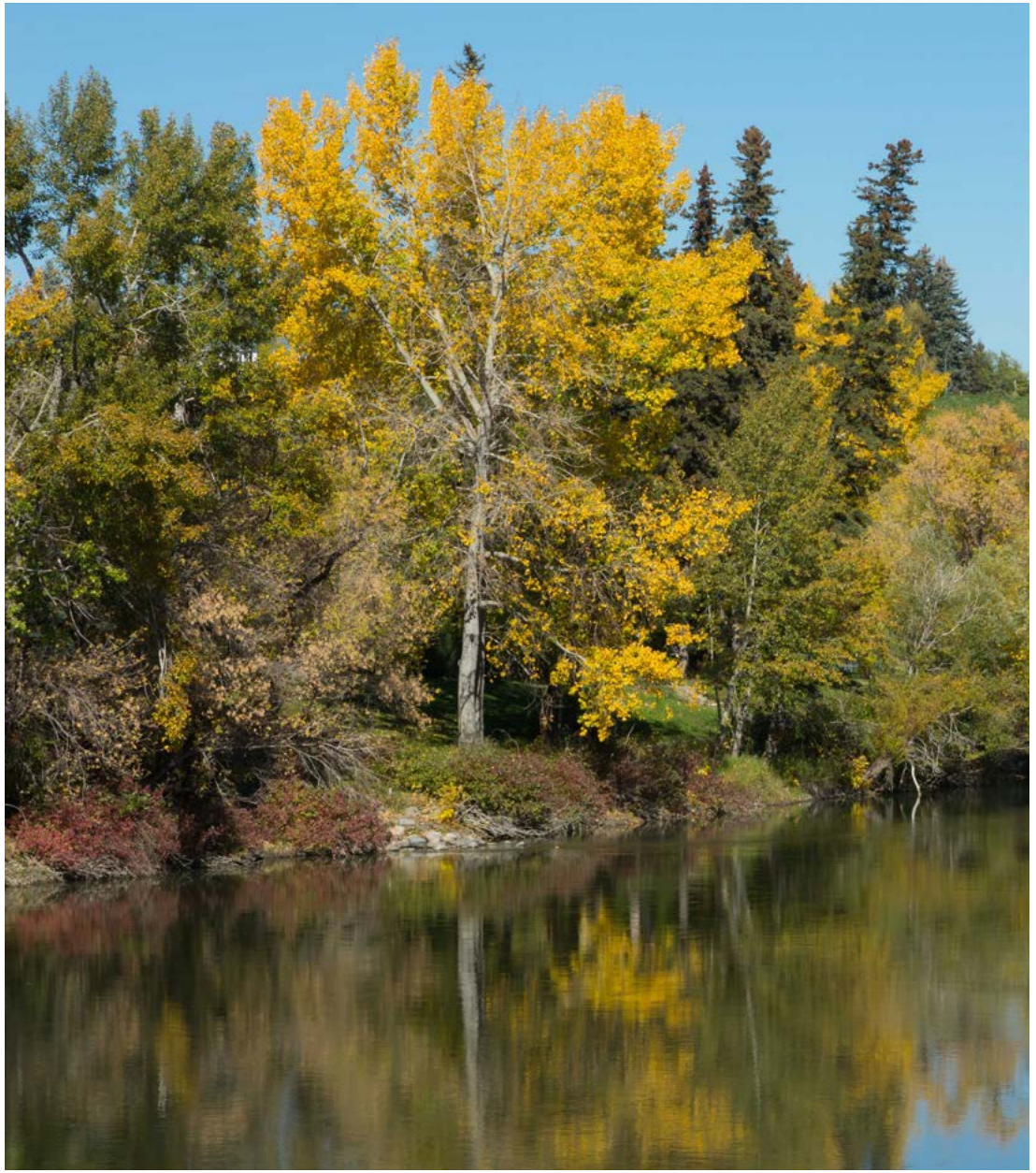
May 2021

Land Acknowledgement

In the Blackfoot language, Calgary is Moh'kin'stis; in Stoney Nakoda, Wiçispa Oyade; in Tsuut'ina, Gu'tsi'tsi and in Métis, it is Otoskwunee. For each of these Indigenous languages, the words translate to 'Elbow,' representing the confluence of the Bow and Elbow Rivers. This is where the story of Calgary begins as the confluence has been a trading hub for Indigenous peoples for millennia and the site where they celebrated natural abundance, ceremony, culture, and partnerships.

This plan acknowledges the traditional lands of the Treaty Seven Nations – the Blackfoot confederacy, (Siksika, Kainai, Piikani), the Tsuut'ina, the Îyâxe Nakoda Nations (Bearspaw, Chiniki, Wesley), the Métis Nation of Alberta, Region 3, and all people who have made Calgary their home. This plan honours their long history and deep connections to this land.

The strength and energy of Calgary comes from the land it was built on, as well as the Indigenous people and newcomers whose footsteps have marked this territory.



Calgary Today: Environment Background Study

Calgary and its environment are intertwined. How people live directly impacts the health of the environment and the environment directly impacts the well-being of individuals and the community. Calgary has access to fresh air, clean water, and abundant natural areas. This enables Calgarians to reap the benefits of the city's setting while remaining appreciative and good stewards of this rich environment. To maintain a healthy relationship with the environment, Calgary needs to strive to become a healthy and green city that focuses on maintaining and improving its performance in the following areas: biodiversity and ecosystems, water, air, waste, climate change mitigation and adaptation.

This report provides a high-level overview of Calgary's performance in each of the environmental focus areas using the latest available data. It also ties each of these areas together into Calgary's environmental story and contextualizes Calgary within a global environmental context.

The report is extensive, but the intent is that it can be read as one document or broken up into component modules focused on a specific area or concept. This modular approach will enable specific content to be updated, removed, or added as new information becomes available allowing this Environment Background Study to remain current and up to date.

Most of the information and photos in this report come from the City of Calgary. When external sources and photos are used, they have been noted.

Environmental Focus Areas

- Biodiversity + Ecosystems
- Water
- Air
- Waste
- Climate Change Mitigation
- Climate Change Adaptation

A Healthy and Green City

Healthy and Green Cities

When Calgary sets a priority of becoming a "healthy and green city," what does it hope to achieve? A healthy and green city is an urban environment that features well-connected natural spaces throughout the city. These natural spaces not only provide wildlife habitat, biodiversity, and ecosystem health, but they also create opportunities for people to connect with nature in their own backyard. A healthy and green city's natural assets also deliver many services to the community, including water filtration, cleaner air, and sinks for greenhouse gases.

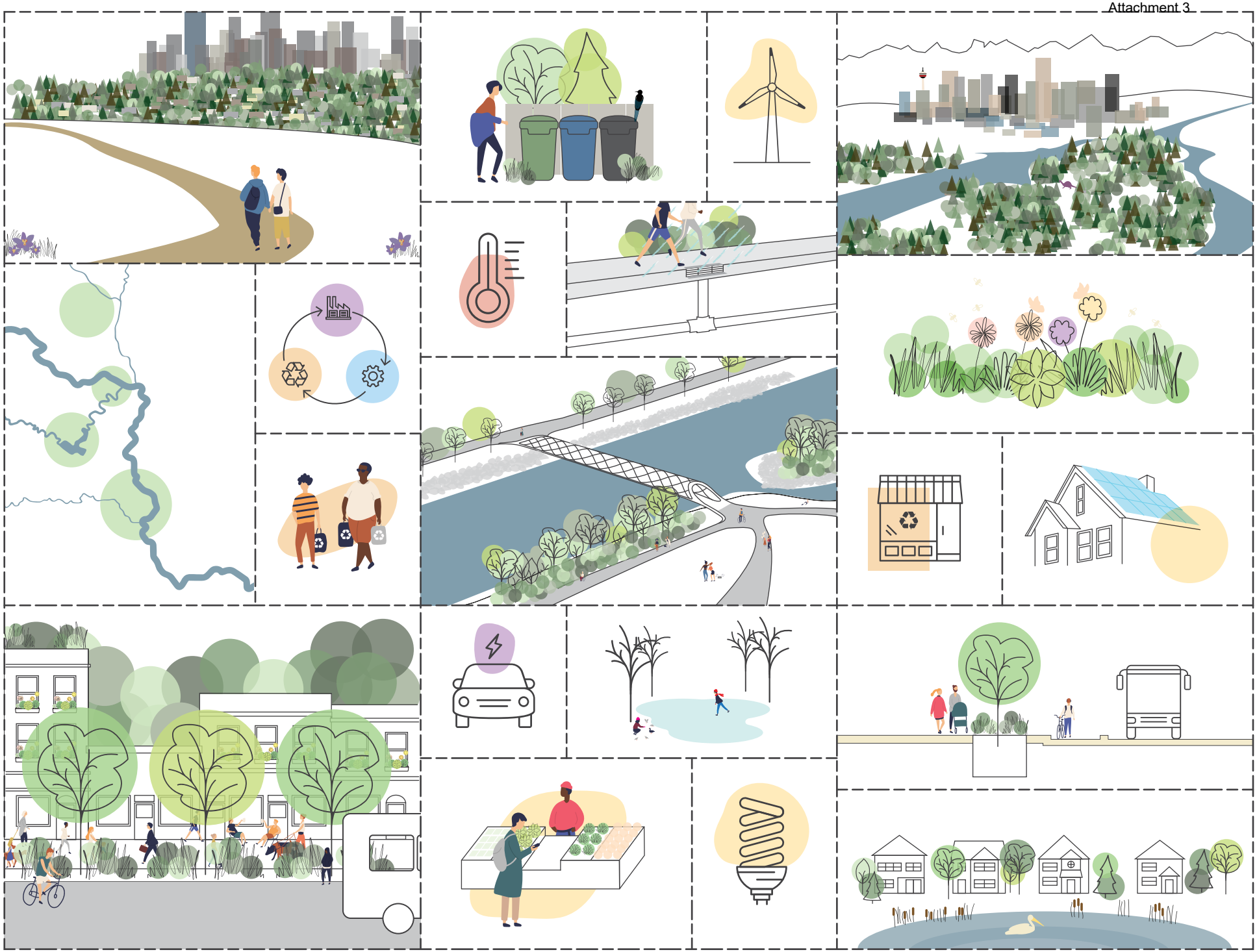
Healthy and green cities use land efficiently, both to protect natural areas and to concentrate development and services, improving the efficiency of operations for the entire city. More efficient land use reduces habitat loss and fragmentation, saves money, and enables healthy lifestyles. Weaving trees, greenery, and other open spaces through every community beautifies and enriches residential neighbourhoods and main streets alike, while also filtering pollution, absorbing stormwater, reducing flooding, and providing habitat for wildlife.

Efficient land use also means locating housing near or within areas for shopping, working, and playing, which provides people with greater choice in how they go about their daily activities and requiring less travel. This freedom of movement supports a healthy and green city by allowing more people to walk, ride bicycles or take transit, further reducing emissions and improving air quality.

Building a healthy and green city involves constructing and servicing buildings to further support a healthy environment. Increased building efficiency can reduce greenhouse gas emissions, produce cost savings, improve water conservation, and create more comfortable homes and workplaces. Using renewable energy can reduce emissions even further.

Waste reduction and reuse initiatives can provide raw materials and a second life for goods while reducing pollution, requiring fewer new resources, and redirecting waste away from landfills.

A healthy and green city does not just protect the environment for future generations. It makes urban life better today. Everyone benefits from clean air and water and the improved quality of life that comes with easy access to nature. There is also time and money to be saved by having more choices in how to live and move around the city. An enhanced natural environment also helps cities to weather storms and droughts, creates more beautiful communities, and increases leisure opportunities.



Calgary's Vision for a Healthy and Green City

Calgary's City Council is committed to creating a Healthy and Green City. Here is how it has been defined:

"Calgary is a leader in caring about the health of the environment and promotes resilient neighbourhoods where residents connect with one another and can live active, healthy lifestyles."

Source: Calgary 2019-2022 Service Plan

Citizen Satisfaction Survey, Environmental Highlights

Calgarians feel a deep connection to their natural environment and value The City's environmental stewardship.

A 2020 Citizen Satisfaction Survey (conducted from August 17 to September 6) asked 2,500 Calgarians aged 18 years and older how they feel about municipal services. The survey indicated very high levels of satisfaction with The City's stewardship to date. Here are the results of questions related directly to The City's record on environmental management:

95%
are satisfied with drinking water

93%
are satisfied with Calgary's parks, playgrounds, and other open spaces

92%
are satisfied with the residential Blue Cart recycling program

93%
are satisfied with residential garbage collection service

93%
are satisfied with protection from river flooding

Environmental Challenges Facing Calgary Today

The world is currently facing significant global environmental challenges, including climate change, the biodiversity crisis, pollution, and resource depletion. Calgary has already begun to feel the impacts of environmental challenges on people's lives and livelihoods. These include three major natural disasters in the last ten years:

- In June 2020, a ferocious hailstorm inflicted more than $1.2 billion in property damage in Calgary in a few short hours—the fourth most expensive natural disaster in Canadian history.[1]
- The summer of 2018 was the smokiest on record in Calgary, with over 322 hours of dangerous smoke haze from major wildfires in British Columbia filling the city's skies.[2]
- In 2013, Calgary endured its largest flood since 1932, leading to mass evacuation of most inner city neighbourhoods and $3.5 billion in property damage.

These recent disasters have proven to Calgary that global environmental challenges, like the increase in frequency and severity of extreme weather events due to climate change, have harmful local impacts in the near term, obliging the city to change and adapt. The complexity and scale of these challenges require an examination of how local actions that cause pollution and other environmental harms deepen the problem, as well as how the negative consequences affect populations here in Calgary and beyond unequally. Given the interconnection of all environmental systems, these challenges can only be addressed by understanding how actions have ripple effects on the planet, people's health, and the economy.

What Cities like Calgary can do to Address these Challenges[3]

They can accelerate action to keep pace with the ongoing "great acceleration" in both environmental impacts and technological innovations. They can limit impacts by becoming better stewards of urban natural areas and apply ecological thinking, recognizing that all living systems are connected and ensuring a holistic, environmentally sound approach is taken to managing challenges. Cities can grow more sustainably using principles of sustainable urbanism such as concentrating development, locating amenities closer together, and using land more efficiently. Cities can think creatively, breaking from established patterns to integrate environmentally beneficial systems.

[1] Hailstorm damage in Calgary tops $1.2B, making it 4th costliest natural disaster ever in Canada https://calgary.ctvnews.ca/hailstorm-damage-in-calgary-tops-1-2b-making-it-4th-costliest-natural-disaster-ever-in-canada-1.5016161#:~:text=The%20most%20expensive%20natural%20catastrophe,caused%20%241.49%20billion%20in%20damage.

[2] 322 hours of smoke makes 2018 Calgary's smokiest year on record https://www.cbc.ca/news/canada/calgary/calgary-smokiest-year-2018-forest-fires-1.4791785

[3] People and nature in an urban world (https://theecologist.org/2020/feb/26/people-and-nature-urban-world)

"All the cities of the world are going to expand. We need to have a better understanding of what makes good urban habitat for people. We have an obligation to make the new places more livable, more sustainable, more healthy. We have the tools."

— Jan Gehl

Calgary Today

Calgary aspires to be a healthy and green city; how is it doing? Here is a quick look at how Calgary is performing in biodiversity and ecosystems, water, air, waste, climate mitigation and climate adaptation, .

[1] *CRAZ Air Quality Management Planning Committee and the CRAZ Engagement Committee. (2020). Health Impacts of Air Pollution in the CRAZ Region*

[2] *Calgary Region Airshed Zone. (2019). Calgary Region Airshed Zone Air Quality Management Plan.*

WHAT TO DO	CITY DIRECTION	WHAT DOES THIS MEAN FOR CALGARIANS?	TRENDS
BIODIVERSITY + ECOSYSTEMS 	The City set out targets for 2025 in its Our BiodiverCity Strategy to restore 20 per cent of Calgary's current open space to support the conservation of biodiversity. The Riparian Action Program is also an important contributer to protecting Calgary's biodiversity.	Biodiversity loss impacts community and economic health due to the loss of important ecosystem services. Replicating the water storage and filtration services of wetlands alone has cost Calgary millions of dollars. The City of Calgary has undertaken significant restoration work, especially around waterways, but there is still a lot of work to do to protect and restore natural areas.	Calgary has seen declines in plant and animal species diversity in recent years. Outward growth of the city has encroached on natural spaces, leading to habitat loss, fragmentation, and an increase in the spread of invasive species.
WATER 	By 2033, Calgary is aiming to reduce water consumption to 350 litres per capita per day.	Single-family residential demand was estimated to be 197 litres per capita per day in 2019, the lowest on record for this customer group. This shows that customers are doing their part, and The City's water conservation programs are working.	In 2019, Calgary's overall water use, including all residential, business and municipal demand, was 356 litres per capita per day—on track to meet The City's 350 litres per capita per day target.
AIR 	Calgary is part of the Calgary Region Airshed Zone, which has its own Air Quality Management Plan. The City must also meet the air quality objectives of the South Saskatchewan Regional Plan (SSRP), including targets for particulate matter, ozone, and nitrogen dioxide.	Human caused air pollution in the Calgary Region contributes to higher occurrences of respiratory diseases, such as asthma and approximately 377 premature deaths annually. In addition to this, Calgary sees about three restricted activity days per year per person.[1] Reducing air pollution to background levels in the region would save many lives and $161 million dollars a year by reducing the economic impact of restricted activity days and reducing healthcare costs.	Though the Calgary Region is meeting the overall air quality standards in the regional plan, the city has exceeded some proactive air quality triggers. Calgary should investigate these trends further and determine mitigating actions to ensure that air quality does not worsen.[2] Thresholds will also be lowering, meaning Calgary needs to be proactive in managing the airshed to meet the lower limits coming in the future.

WHAT TO DO	CITY DIRECTION	WHAT DOES THIS MEAN FOR CALGARIANS?	TRENDS
WASTE	Calgary's target is the diversion of 70 per cent of waste from landfills by 2025. The City's overall long term goal is zero waste, where all discarded materials become resources that can be reused (recycled, composted, repurposed, etc.), and no garbage is sent to landfills.	Although Calgarians have made great strides, the city still sent 545,000 tonnes of garbage to City of Calgary landfills in 2020. One of the next steps for Calgary is to reduce the contamination of recyclable and organic materials collected.	Calgarians have supported waste diversion and have been recycling and composting. The City has implemented Blue Cart recycling (2009) and Green Cart food and yard waste collection (2017), which significantly reduced the amount of garbage ending up in landfills.
CLIMATE MITIGATION	The City is aiming for an 80 percent reduction in city-wide emissions from 2005 levels by 2050.	Calgary has one of the highest per-capita GHG emissions of any major city in Canada. About two thirds of greenhouse gas emission come from energy use in buildings, about one third from fuel use in vehicles, and one percent from landfills and wastewater treatment facilities. To meet the GHG reduction targets, Calgary needs to significantly reduce emissions across all sectors.	Prior to 2020, Calgary's emissions had been trending up; however, the impacts of the COVID pandemic have resulted in a reduction of emissions to slightly above 2005 levels.
CLIMATE ADAPTATION	The City is working to reduce its vulnerabilities and exposure to severe weather and long-term climate effects as part of its Climate Resilience Strategy. The City has identified 175 adaptation actions that should be initiated within the first 5 years of the Strategy (2018-2022) by The City's business units, related to people, infrastructure, natural infrastructure, water management, and governance.	Calgary can expect to see more frequent and severe weather events in the future due to climate change. Proactive disaster management and resilience planning will be essential to ensure that individuals, communities, and the city as a whole are prepared. The city also needs to consistently improve resilience as it recovers from natural disasters.	First steps have been completed in developing a Calgary-specific framework for climate adaptation and performance monitoring. The TAMD (Tracking Adaptation and Measuring Development) Scorecard is the first indicator developed under the framework which evaluates how far and how well climate risk is being managed. The City's cumulative progress score for 2020 was 36/80.

Transforming Recovery into Resilience

Transforming Recovery into Resilience

All over the world, 2020 was a year of great and unexpected change. The COVID-19 global pandemic has left irrevocable marks on every society, including a devastating loss of life, social upheaval, and economic turbulence. Canada and the rest of the world will be recovering, socially and economically, for many years to come. This immense recovery process is already underway as global leaders strive to resolve the impacts of COVID-19 and parallel environmental challenges related to climate change. Cities remain at the centre of recovery efforts to balance both economic and environmental challenges. In addition to the COVID-19 recovery, cities need to build ecological resilience and minimize the impacts of human activity to reduce additional stressors on ecological health.

To recover from the pandemic, there are ways to make cities and economies more resilient, sustainable, and future-proof. This idea of using recovery as a catalyst for much needed environmental and social change is a growing movement across Canada and around the world. It involves strategic investments in new green technologies, sustainable development, and better solutions for the natural environment. In the face of disaster, cities can choose to launch a much better era.

The pandemic has already begun to point the way in how to address the climate crises and environmental challenges. One of the lessons relearned in the pandemic lockdowns has been the value of outdoor space and nature for individual and civic health and well-being. Since the start of the pandemic, researchers have noticed a large increase in the numbers of visitors to urban forests and parks.[1]

The forced shutdowns of large portions of the global economy have also shown how quickly air quality improves when emissions are reduced at wide scale. Measurements from the European Space Agency's Sentinel-5P satellite showed decreased levels of nitrogen dioxide (NO_2) from the 2019 levels by as much as 40 per cent over cities in Asia and Europe from late January and early February 2020.[1] Throughout 2020, Calgary also saw a decrease in its overall greenhouse gas emissions compared to 2019, with the overall effects on air quality not yet known. The return of clear skies and clean air in much of the world was a welcome improvement in the midst of the devastating pandemic and a glimpse of the sort of positive transformation that strong action can bring.

[1] *Cities and pandemics: towards a more just, green and healthy future* https://unhabitat.org/sites/default/files/2021/03/cities_and_pandemics-towards_a_more_just_green_and_healthy_future_un-habitat_2021.pdf

[2] *Here's how lockdowns have improved air quality around the world* https://www.weforum.org/agenda/2020/04/coronavirus-lockdowns-air-pollution

Recovery to Resilience in Canada

The Canadian government, both through its COVID recovery task force and its new climate plan, is endorsing large investments in clean energy, energy efficiency, electric vehicles, mass transit, and stronger environmental stewardship. The Independent Task Force for a Resilient Recovery has recommended that Canada follow the lead of the European Union, which has pledged more than $1 trillion in recovery funds with an emphasis on climate-friendly solutions.

These bold recovery plans could mean big opportunities for Calgary. Greener, healthier cities are better prepared to weather the intensifying storms of climate change and thrive in the emerging low-carbon economy. The expenses that come with a shift in this new direction are far outweighed by the risks of failing to act and the opportunities for economic growth in new technological sectors. Enhancing environmental stewardship and taking stronger action on climate change represents some of the best ways for cities to recover after the pandemic and enhance their resilience.

Canada Healthy Communities Initiative[1]

About $31 million in existing federal funding is being provided through The Canada Healthy Communities Initiative (CHCI). Funding for this initiative is being repurposed to support communities in dealing with the challenges posed by COVID-19. The Canada Healthy Communities Initiative supports projects under three main themes:

1. Creating safe and vibrant public spaces

The focus of this theme is to support projects that encourage safe physical and cultural activities through new or adapted parks, main streets and indoor spaces.

2. Improving mobility options

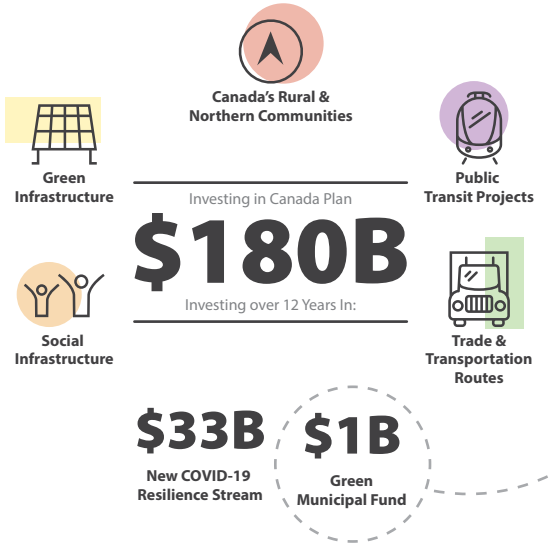
Projects that permit physical distancing through permanent or temporary changes that make it easier for people to get around in their communities, whether by walking, biking, accessing public and private transit, or using other modes of transportation.

3. Digital solutions

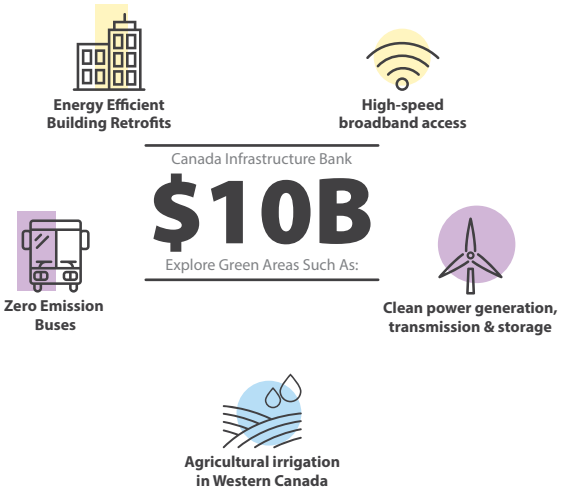
Innovative digital projects that address changing community needs using data and connected technologies.

[1] *https://www.infrastructure.gc.ca/chci-iccs/index-eng.html*

FEDERAL GOVERNMENT INVESTMENT THAT SUPPORTS BUILDING BACK BETTER:



source: infrastructure.gc.ca



source: bloomberquint.com

GREEN MUNICIPAL FUND IS INVESTING IN TWO CITY OF CALGARY PROJECTS:

$500,000

Pilot Project: Electric & Hybrid Waste Collection Trucks

Will determine if electric vehicles could replace other heavy duty vehicles (ex. dump trucks & plows)

$321,050

Reduce Energy Consumption Operating Costs of Calgary's LRT by $500,000

By testing track switch heaters with a snow detection system and rail thermostats

source: canada.ca/en/office-infrastructure

International Environmental Commitments

International Environmental Commitments

Canada has committed to a wide range of international agreements, conventions, treaties, plans, and protocols in pursuit of better environmental stewardship. This list highlights a selection of important agreements in the areas most relevant to this environmental assessment.

FOCUS AREA	COMMITMENTS	
BIODIVERSITY + ECOSYSTEMS 	**United Nations Convention on Biological Diversity**	This convention focused on: ▪ Expanding terrestrial and marine protected areas. ▪ Enhancing protection for species at risk. ▪ Adopting an ecosystem approach with an emphasis on precaution. ▪ Exchanging information, technology, and capacity building in developing countries. ▪ Mobilizing significant resources for conservation and sustainable use. ▪ Promoting the fair and equitable sharing of genetic resources. ▪ Adopting two protocols – the Cartagena Protocol on Biosafety and the Nagoya Protocol on Access and Benefit Sharing.
	Biodiversity and Ecosystem Services: Intergovernmental Platform	In 2019, the Platform released a biodiversity ecosystem services assessment with a rolling work programme up to 2030. The assessment provides evidence that worldwide, natural systems are deteriorating rapidly as a result of human activities. This affects economic health, food security, public health, and quality of life. The report stresses that it is not too late to reverse this trend by addressing the root causes of nature deterioration.
WATER 	**Canada-US Boundary Waters Treaty**	This treaty identifies more than 100 boundary water issues to address through control boards, pollution boards, watershed boards, advisory boards, and study boards.

FOCUS AREA	COMMITMENTS	
AIR	**Gothenburg Protocol to Reduce Transboundary Air Pollution**	To fulfill its commitments to this protocol, Canada has implemented a comprehensive approach for reducing air pollution called the Air Quality Management System (AQMS). The number of Canadians living in areas that meet the Canadian Ambient Air Quality Standards under this protocol increased from 60 per cent in 2007 to 70 per cent in 2017.
	Montreal Protocol on Ozone Layer Depletion	As a result of countries fulfilling their obligations under this protocol, the ozone layer is expected to recover fully over most of the globe – by mid-century in the Arctic and mid-latitudes and a little later for the Antarctic hole. The ozone layer is 2 per cent below the 1980 benchmark on the global scale and about 3.5 per cent below the benchmark over the north mid-latitudes, which includes most of Canada.
	Canada-US Air Quality Agreement	This agreement commits both countries to reduce their transboundary air pollution. In areas covered by the agreement: ▪ Sulphur dioxide has decreased by 63 per cent from 1990 to 2014. ▪ Nitrogen dioxide has decreased by 53 per cent from 2000 to 2014.
WASTE	**Canadian Government Plastic Waste Action Plan**	The Government of Canada created a plastic waste action plan in June 2019. This plan includes six priority areas and actions that governments can consider when reducing plastic waste. They are: ▪ Extended producer responsibility. ▪ Single-use and disposable plastic products. ▪ National performance requirements and standards. ▪ Incentives for a circular economy. ▪ Infrastructure and innovation investments. ▪ Public procurement and green operations.
CLIMATE MITIGATION	**Paris Agreement United Nations Convention on Climate Change**	The Pan-Canadian Framework on Clean Growth and Climate is Canada's plan to meet the national emissions reduction target for the Paris Agreement of 40-45 per cent below 2005 levels by 2030 and net zero by 2050. The Framework has four pillars: pricing carbon pollution; complementary actions to reduce emissions; adaptation and climate resilience; and clean technology, innovation, and jobs.

In addition to these international commitments, there are several other international standards to help support ecologically healthy cities, including:

EcoCity Standards offer a framework for transforming cities from an unhealthy status quo to an ecocity. The framework includes 18 standards, such as access to amenities within walking distance, safe and affordable housing, environmentally friendly transportation, green building, air/water/soil health, energy, and food.

UN Sustainable Development Goals were adopted by all UN member states in 2015 and tie together health, education, quality of life, and economic growth with climate change, ocean and forest protection.

100 Resilient Cities is a Rockefeller Institute Initiative focused on creating and implementing urban resilience strategies. Calgary was selected as a 100R City in 2016.

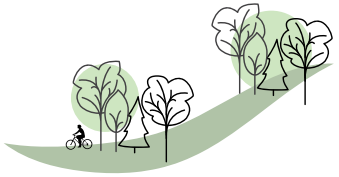
The C40 cities climate leadership group is a group of 97 cities committed to taking climate action and together have achieved the following:

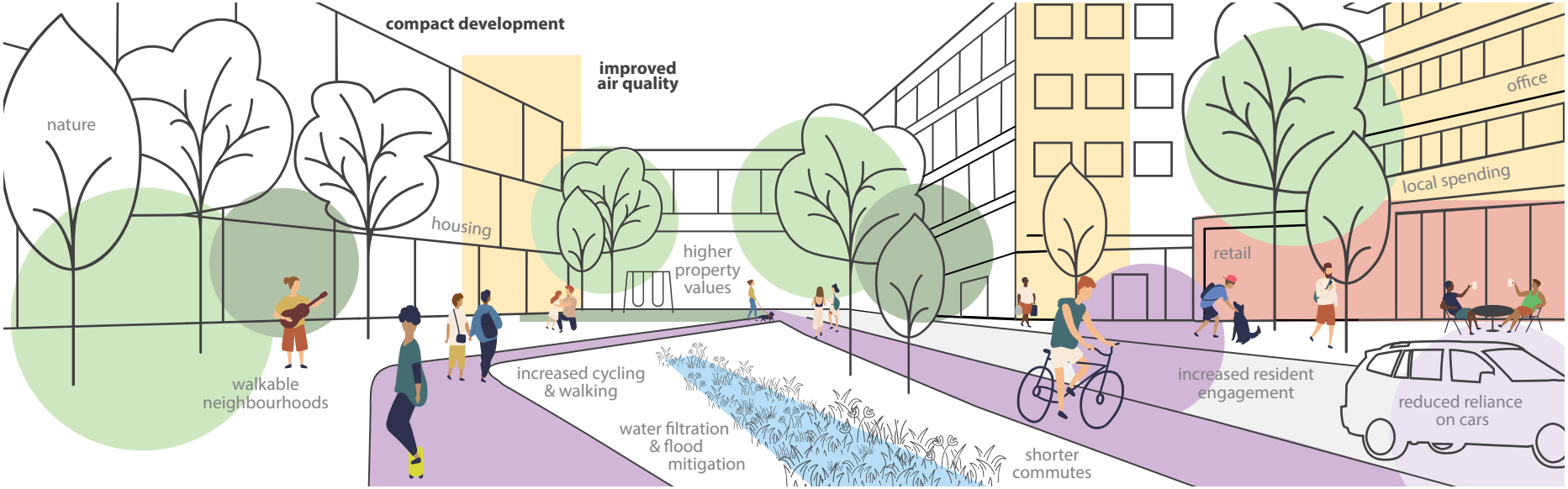
- 53 have reached or are expected to reach their peak emissions by the end of 2020.
- 18 have banned or restricted single-use, non-recyclable plastics.
- 17 have restrictions on high-polluting vehicles.
- 82 have implemented cycle hires.

Cities and Environmental Stewardship

City Building and the Environment

To grow in harmony with the natural environment, cities can encourage urban forms and provide services that support environmental objectives:

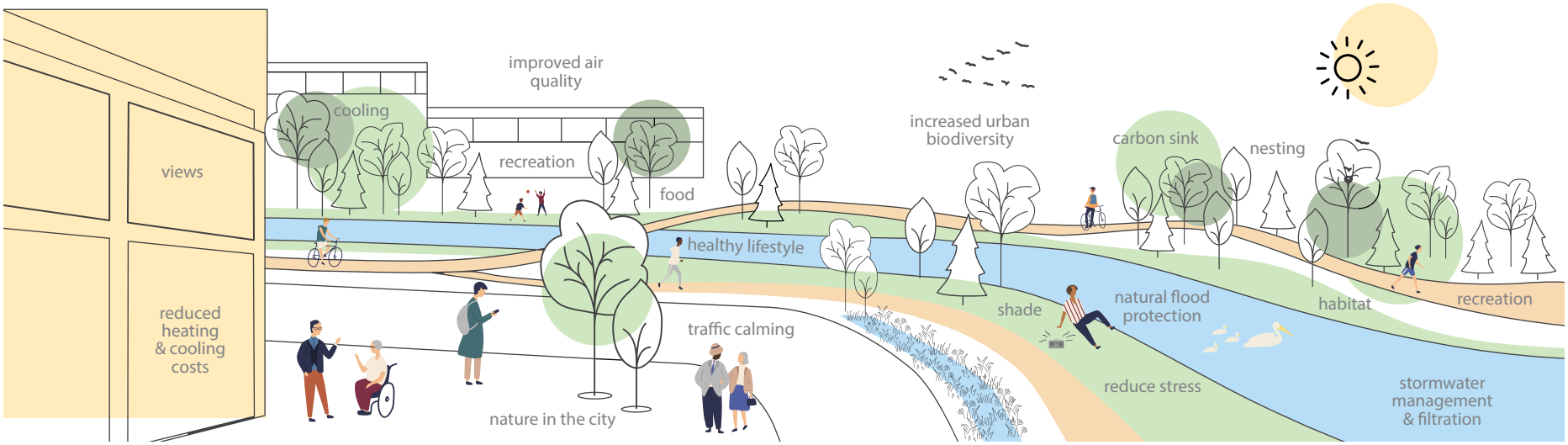
WHAT TO DO	HOW DOES THIS HELP THE ENVIRONMENT?	RELATED FOCUS AREAS
 **Directing growth to already built out areas**	▪ Protects natural areas and farmland at the city's borders. ▪ Concentrates uses and increases density to protect more green spaces.	
 **Mixing land uses and amenities**	▪ Allows more people to choose transit, walking, or cycling, lowering emissions. ▪ Improves access to parks and recreational opportunities.	
 **Connecting open spaces, parks, natural areas, and natural infrastructure**	▪ Improves air and water filtration. ▪ Improves food production. ▪ Creates healthier ecosystems. ▪ Improves wildlife movement and habitat. ▪ Improves flood resilience.	
 **Improve the efficiency of servicing and waste collection**	▪ Reduces litter and other contaminants that end up in the environment, harming human and wildlife health. ▪ Reduces greenhouse gases. ▪ Improves water quality. ▪ Reduces pollution. ▪ Reduces waste.	



Community Design and the Environment

The design of Calgary's communities can provide better options for how Calgarians spend their time and move around the city, while connecting people more closely with the environment. A more walkable community design, integrating a mix of uses, facilitates walking and wheeling, which can improve physical and mental health and result in better air quality.

Benefits of natural and green infrastructure in the city

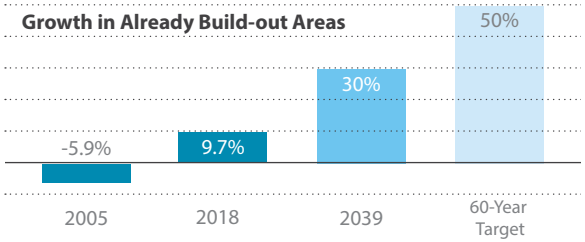


Nature within the City

Calgary is an impressively green city, with plentiful parks, natural areas and trees citywide. Weaving natural elements and features into every community has many benefits for health and wellbeing, while also lowering heating and cooling costs and reducing the amount the municipal government needs to spend on infrastructure to replace the functions that nature provides for free.

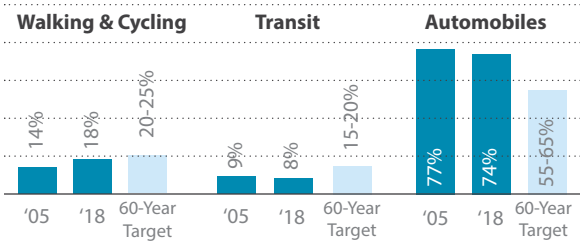
Calgary's Municipal Development Plan Targets

Calgary's Municipal Development Plan (MDP) identifies 14 core indicators to measure progress toward a more sustainable city that meets the needs of Calgary's diverse population. Here are the five indicators most relevant to environmental goals:



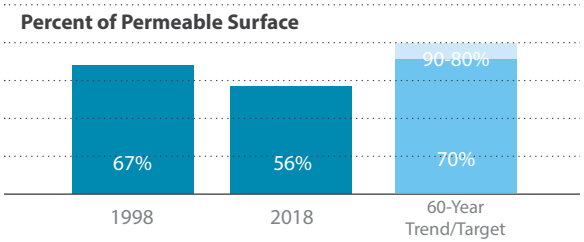
Urban Expansion

Calgary's population within existing developed lands is no longer declining (as it was in the middle 2000s), however, the population growth in the developed areas is not occurring fast enough to meet the 60-year MDP target of 50 per cent growth. Greenfield development continues to make up most of Calgary's growth.



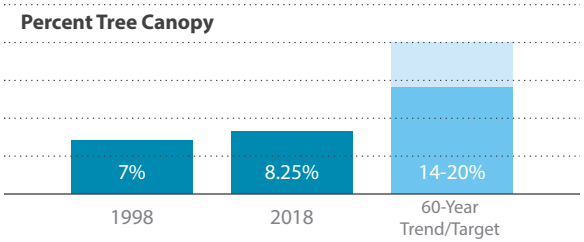
Transportation Modal Split

Though walking, cycling, and driving are trending toward their targets under the MDP, transit's share of total transportation is not growing, which creates challenges for reducing emissions and air pollution and meeting the 15-20 per cent target for that mode.



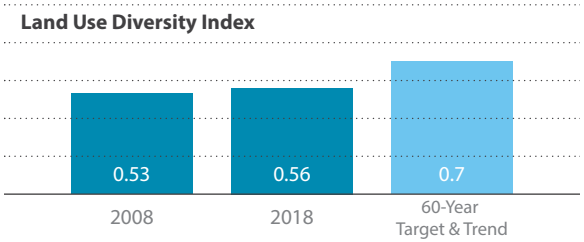
Watershed Health

The area of Calgary covered by permeable surfaces is trending away from the MDP target. Less permeable surfaces mean that less stormwater is absorbed and filtered by the land, instead collecting pollutants from urban surfaces and depositing them into the city's waterbodies, resulting in negative impacts on the health of these ecosystems and reduced water quality.



Urban Forest

Calgary is trending toward the lower end of the 60-year MDP target. Trees can provide enormous value for urban life by regulating urban temperatures, improving air quality, improving water quality, providing habitat, and sequestering carbon.



Land Use Mix

As with urban expansion, Calgary's land use mix has begun to increase, though not fast enough at present to meet the MDP's 60-year target. Diverse land uses within a community provide people with more transportation options, favouring lower emissions modes such as walking, cycling and transit.

Calgary's Growth

Calgary is a relatively young city that has seen rapid growth in a short period of time. This growth has ebbed and flowed along with the boom and bust cycles of the provincial economy. Through ongoing growth, Calgary has an opportunity to better align growth and development outcomes with environmental outcomes.

Calgary's Size

The City of Calgary comprises a large amount of land area for a city its size, consisting primarily of low-density residential development. Because Calgary is surrounded by rural municipalities, farmland and natural areas across a relatively flat topography, greenfield development is relatively straightforward. But this expansion comes at the cost of losing natural areas and farmland around the city and an increasing dependence on cars for travel within the city, which increases greenhouse gas emissions and impacts air quality, water quality, biodiversity, and ecosystem health.

Calgary's Population

Calgary's population has grown rapidly over the last few decades and continues to increase even though the economy has slowed. Population growth can stress existing built and natural systems through increased use. While Calgary grows, it is important to account properly for environmental impacts to ensure Calgary remains resilient and welcoming, with a high quality of life.

Calgary's Economy

Calgary's economy has been one of the primary engines of Canadian prosperity in recent years, but it is subject to wrenching boom and bust cycles. Diversification will help stabilize Calgary's economy and help foster a more holistic view in which a healthy environment and a strong economy are no longer viewed as competing objectives but instead as mutually supporting goals. Sustainable practices are increasingly seen as important for global competitiveness, and Calgary is well-positioned with considerable access to natural resources, capital, skills, and expertise to thrive in this new clean economy.

PHYSICAL SIZE

2005
772km² → 2020 **848**km²
Calgary — Calgary

432km² Montreal
630km² Toronto
784km² New York

POPULATION

2005-2020
329,633 Population Growth → 2021-2035 **314,589** Forecasted Growth

2005 **956,078**
2019 **1,285,711**
2035 **1,600,300**

DWELLINGS

2005 **395,779** → 2019 **521,257**

JOBS

2005 **608,000** → 2016 **685,000**

Calgary's Environment

Calgary's Natural Environment

Calgary and its surrounding natural landscape consists of a unique, irreplaceable mix of prairie grassland, aspen forests, wetlands, riparian areas, and riverine ecosystems. Despite generations of residential, industrial, and agricultural development in the region, these ecosystems continue to support diverse natural habitats and make important contributions to the ecological, cultural, and economic health of southern Alberta.

Calgary's Climate

Calgary has a prairie steppe climate, with abundant sunshine, even in winter, and the region is prone to drought and flooding. These summer rains are vital for agriculture and water supply. Summers also include periodic violent hailstorms, causing property and crop damage. Calgary's sunny, dry climate is prone to rapid and unpredictable weather changes. It is also characterized by strong winds, owing to its prairie surroundings with few natural barriers. Warm, westerly Chinook winds out of the Rocky Mountains, capable of raising the temperature as much as 30°C in a few hours, make southern Alberta weather highly variable in winter.

Calgary's Watersheds

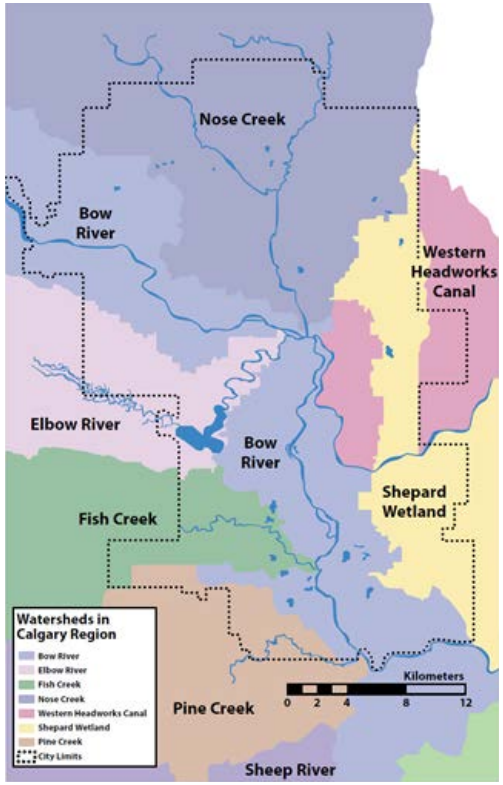
Watersheds are areas consisting of a single river basin fed by multiple waterways. They are catchment areas that collect and direct water from precipitation. Calgary lies within the South Saskatchewan watershed and is located at the confluence of several smaller sub-watersheds: the Bow River, the Elbow River, Nose Creek, Fish Creek, the Shepard Wetlands, and Pine Creek.

Maintaining a healthy watershed is vital to the survival of all plant and animal species. Watersheds support ecosystems and wildlife as well as providing the following services:

- Supplying drinking water.
- Providing habitat.
- Providing critical inputs for agriculture, including water to irrigate crops, feed livestock, and maintain operations.
- Supporting industrial activity by supplying water for production, cooling, and cleaning.
- Providing natural beauty and space for recreational activities such as fishing, boating, and swimming.

Calgary's creeks and rivers together comprise a defining feature of the city's character, giving a strong sense of place and creating abundant opportunities to access nature within the city limits.

Calgary's watersheds are urban. An urban watershed differs from a natural watershed because there is less vegetation and more hard, impermeable surfaces. In a natural watershed, a significant amount of water infiltrates into the ground rather than flowing directly into water



bodies. In urban watersheds, there is more surface runoff, meaning, in some cases, more than twice as much water flows overland and directly into stormwater systems and water bodies than into the ground. This also means that water does not benefit from the filtering effects of vegetation, resulting in more pollutants and sediment entering water bodies directly.

The Bow River

The Bow River sub-watershed covers more than 25,000 square kilometres and makes up about 23 per cent of the South Saskatchewan River watershed. The Bow River's path begins in the Rocky Mountains at Bow Lake, flowing through Banff National Park, the foothills, several dams, and the City of Calgary before joining the Oldman River to form the South Saskatchewan River. Primarily fed by snow melt, glacial melt and rain, the Bow River's flow varies significantly throughout the year, with high river flows in the spring and summer and reduced flows in the fall and winter. At times of reduced flow, groundwater supplements the supply, but it contributes only about 20 percent of the river's annual flow.

The Bow River is the most populated and regulated river in Alberta. Access to its water is a significant resource issue that requires balancing environmental management with regional economic development. The City of Calgary is the largest municipal water user of the river, and ensuring a sufficient supply of clean water will pose a major challenge in the future as the city and the region grow.

The Elbow River

From its headwaters in the front range of the Rocky Mountains, the Elbow River sub-watershed, which is over 1,235 kilometres squared, extends eastward to where it joins with the Bow River in Calgary.

The Elbow River has provided drinking water since 1909. Today, the river supplies water to nearly half a million people, making it a unique example of a small river supporting such a large population. Although it is one-tenth the size of the Bow River, the Elbow provides drinking water to one in six Albertans. The river's core challenges include source water protection, flooding, drought, recreational impacts, and a growing population.

Nose Creek

The Nose Creek sub-watershed extends north from the centre of Calgary to Crossfield, passing through northern Calgary, Airdrie, and Rockyview County. The cumulative effects of increased residential and commercial development, industrial growth, stormwater discharge, agricultural activity and channelization are placing increased pressure on Nose Creek.

Image Source: Dawn from Flickr

Fish Creek

Fish Creek runs through Fish Creek Provincial Park, one of the largest urban parks in North America, stretching 19 kilometres from east to west. The park is bordered on all sides by human settlement—including the new Ring Road and the territory of the Tsuu T'ina First Nation. Fish Creek is home to abundant wildlife, including elk, deer, moose, bear, coyote, cougar, squirrel, porcupine, beaver, blue herons, snakes, amphibians, and fish.

Many Calgarians use Fish Creek Park for recreation, including educational programs, bird watching, mountain biking and running. Managing this heavy use, as well as agricultural and stormwater runoff, is critical to the park and creek's health. To manage stormwater, Fish Creek Provincial Park contains one of Canada's largest networks of engineered wetlands, which help to improve the quality of the stormwater runoff into the creek.

The Shepard Wetlands

The Shepard Wetlands in eastern Calgary are home to a wide range of birds, plants, and animals. The wetlands were formed by groundwater feeding into "kettle" depressions and draining very slowly. As a result, most of the water evaporates, leaving the groundwater's mineral salts behind and creating a unique habitat. As Calgary has expanded eastward, many of these wetlands have been incorporated into urban development, with water draining into Calgary's stormwater infrastructure and then flowing into Ralph Klein Park's water treatment wetland and then on into the Bow River.

Pine Creek

Pine Creek originates in the forested lands west of Calgary and flows east through the largely rural areas of the Municipal District of Foothills before entering Calgary. Pine Creek eventually drains into the Bow River just east of Heritage Pointe.

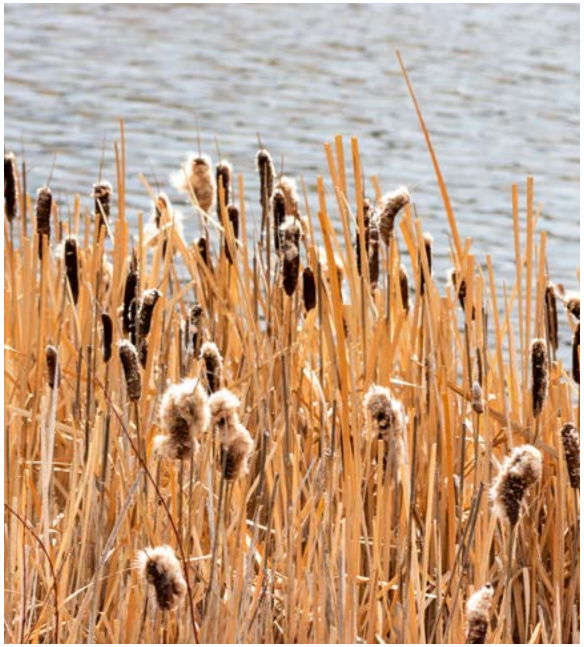
The Pine Creek corridor is a steep ravine and remains largely undeveloped at present, with a large portion of the corridor retained as open space during the development of the Legacy subdivision.

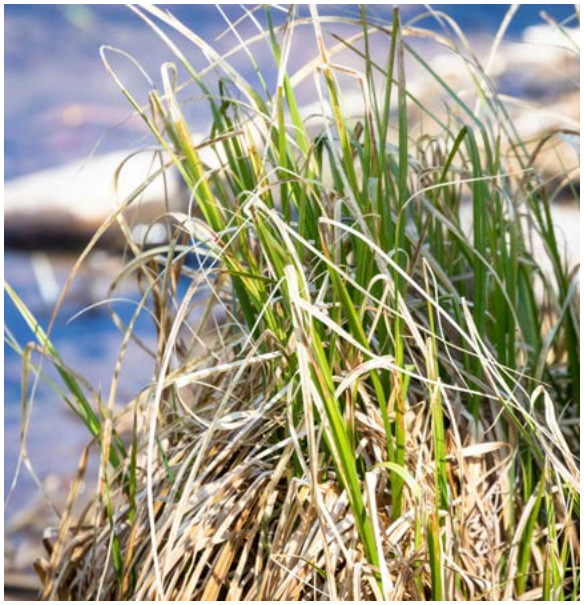
Calgary's Natural Features

Natural areas and open spaces are a defining feature of Calgary as a city, providing a strong sense of place and myriad opportunities for recreation, tourism, and education, as well as moments of quiet solitude in areas of natural beauty. Calgary's scenic waterways, mountain views, and prairie grasslands invite reflection, admiration, and wonder at the beauty of the environment.

Wetlands

Healthy wetlands slow water flow during floods, are vital to protecting Calgary's natural areas, and supplying ecosystem services that would otherwise require costly infrastructure. They also hold water during droughts and replenish the water in the atmosphere through evaporation. Additionally, they are natural filters, removing sediment and pollutants such as bacteria, fertilizers, pesticides, vehicle fluids, metals, and road salt. Wetlands are vital habitats for a diverse range of plants and animal. For example, more than 46 species of birds have been identified at Ralph Klein Park alone. All of this emphasizes the value of wetlands in Calgary justifying their retention as important community and city-wide assets.





Riparian Areas

Riparian areas—the lands that border creeks and rivers—function as natural filters. They improve water quality by trapping and storing sediment and filtering contaminants and nutrients from upland areas, helping to provide Calgary and downstream communities with fresh, clean drinking water. Riparian lands also store water and recharge aquifers through the slow release of water.

Riparian areas are among the most biologically diverse and productive ecosystems on the planet. Their nutrient-rich soils nurture plant communities that store water and support a lush diversity of life, providing critical urban habitats for fish and animal populations and functioning as important wildlife corridors for yearly migrations.

Healthy riparian areas provide Calgarians with recreation and education opportunities, enhance quality of life, and improve public health. They also help communities adapt to the impacts climate change by reducing the impact (and costs) of floods and droughts. Keeping riparian lands healthy reduces the need for intervention and investment in water quality improvement, stormwater management, erosion protection, and other infrastructure.

Prairie Grasslands

Fescue prairie grasslands are one of North America's most endangered ecosystems, and Alberta is the only place on the continent that is home to all three types of rough fescue (plains, foothills, and northern). These grasslands support biodiversity and provide critical habitat to the many species-at-risk in southern Alberta, where 80 percent of the province's endangered and threatened species reside. Many prairie species require large grassland areas to survive, one example being the swift fox.

Healthy fescue grasslands are also vital for the ranching industry and play important roles in Alberta's culture, heritage, and economy. In addition to protecting air, soil and water, grasslands, provide sustainable livelihoods for Alberta ranchers, allow visitors to experience nature through low-impact recreation (including hiking, hunting, and photography), and serve as iconic settings for Alberta's film industry.

More than half of Alberta's unique grasslands have already been lost. Once native prairie has been converted into cropland, it is exceedingly difficult to restore. But grasslands remain underrepresented within the province's protected area network. Preserving and restoring these lands is crucial for enhancing biodiversity.

The Foothills

The foothills region, west of Calgary, is a transitional ecosystem, beginning at the eastern edge of the Rocky Mountains and fading northward into the boreal forest. This region is characterized by both steeply sloping and gently undulating hills. Southern Alberta's foothills are home to the largest populations of moose in North America and also provide habitat for snowshoe hare, beaver, muskrat, wolf and black bear.

Calgary's Environment Today and into the Future

Improving Calgary's Environmental Outcomes

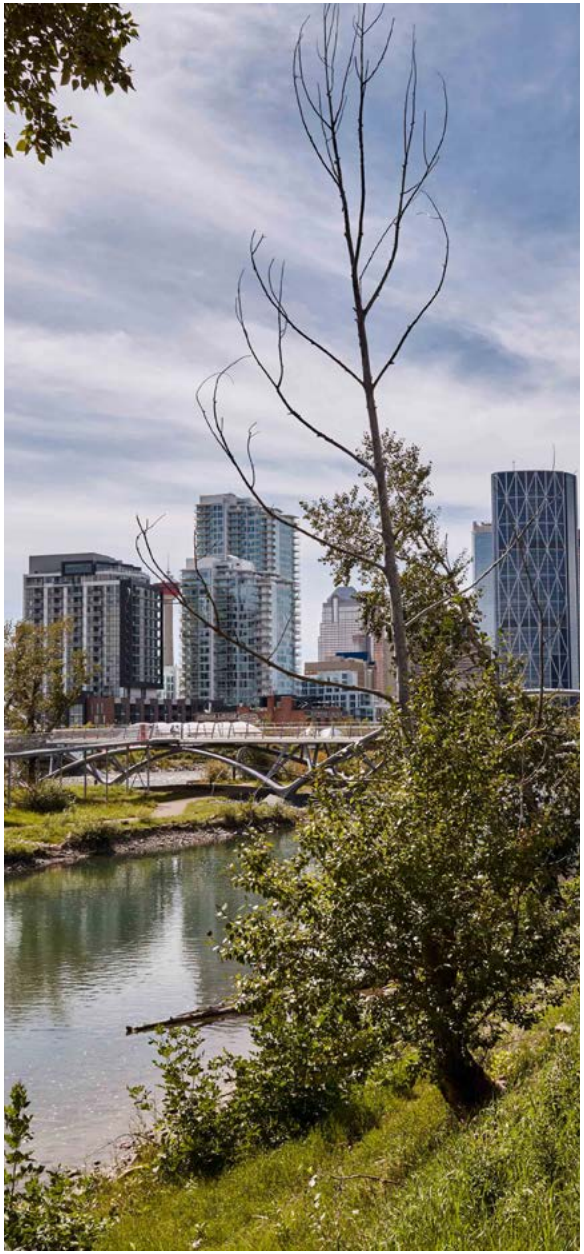
The staggering complexity of environmental systems can make wise stewardship seem daunting. Restoring nature while meeting Calgary's current needs requires a bold vision that ties together the many facets of the environment—climate, air, water, waste, biodiversity—with how the city grows and meets its needs. The preservation of nature and the reduction of damage to the natural world should be a priority for all decision makers, not just specialized conservation organizations.

The '4 Rs' provide a framework to focus decision-making processes on addressing environmental needs:

1. **Refrain:** Avoid negative impacts on nature.
2. **Reduce:** Minimize the harm caused by any unavoidable impacts.
3. **Restore:** Act to quickly counteract any harm caused to nature.
4. **Renew:** Work to improve damaged ecosystems.[1]

The City of Calgary has many options for contributing to individual stewardship efforts, from public outreach and education to direct infrastructure improvements and supportive grant programs. In addition to financial contributions, City-led initiatives can encourage wise individual actions by providing information and decision-support tools. Supporting these efforts makes good economic sense because they reduce long-term maintenance costs, build stronger and more resilient communities, support locally-owned businesses, and reduce the consequence of natural hazards by maintaining healthy natural areas.

Source(s):
[1]Four steps for the Earth: mainstreaming the post-2020 global biodiversity framework https://linkinghub.elsevier.com/retrieve/pii/S2590332220306576



Calgary's Economy and the Environment

Calgary's recurring boom-and-bust cycle, driven by the oil and gas industry, can put added pressure on the city's natural assets during a boom cycle and make new investments harder to access in a bust. But the current bust highlights the need to for enhancing stability and diversity in Calgary's economy, and the environmental sector in Alberta presents opportunities to do so. The environmental sector is expected to grow rapidly in the coming decade, expanding by 14 per cent overall and resulting in 14,400 new jobs to 2029.[1] This job growth will be driven by investment in clean technologies, emissions reduction, and renewable energy.[2]

Transforming Calgary into a renewable energy hub and centre for innovative clean technologies is perfectly suited to the city's population and the phenomenal renewable energy resources available in Alberta.

[1] *From Recession to Recovery: Environmental Labour Demand Outlook* https://www.eco.ca/research/report/environmental-labour-demand-outlook/

[2] *Environmental sector jobs to see growth in spite of pandemic, report says* https://esemag.com/news/environmental-sector-jobs-growth-report/

Traverse Solar Project, Vulcan County, AB

- Secured via a **$500-million investment.**
- Upon its completion in 2021, it will be the **largest solar farm in Canada.**
- The project will consist of **1.5 million solar panels,** and will generate approximately **800 million kWh per year,** enough to **power more than 100,000 homes.**

The Environmental Strategy

The Calgary Environment Strategy (Strategy) provides a comprehensive overview of the natural processes, emerging challenges, and unique opportunities facing Calgary and its residents. The Strategy will highlight what Calgary must preserve, improve, and celebrate to ensure that the city remains healthy and green. Calgarians are facing complex environmental challenges in the coming decades, and this strategy will help tie together The City of Calgary's strategic efforts to manage the biodiversity, water, air, waste and climate resources in a much more integrated way.

Without an overarching environmental strategy, it can be hard for a city and its residents to understand the cumulative impacts of their decisions, increasing the risk of irreparable damage to the natural landscapes of the region. The Calgary Environment Strategy is a roadmap and long-term commitment to protect and steward the environment as follows:

"The Environment Strategy and Action Plan (the Strategy) will renew and strengthen this commitment to the legacy of sustainability and improving quality of life and health in our communities and city. The strategy will set out a clear vision for improving Calgary's environment for all Calgarians."

The Strategy is drawing on extensive public input, expert advice, and research into best practices from cities around the world to preserve and showcase Calgary's unique natural assets. These irreplaceable elements make Calgary what it is, and the actions Calgarians take today will have a lasting influence on tomorrow's environmental health. Practically speaking, this means developing policies and plans to maintain and improve the natural conditions of the city and region, including:

- Clean air and water.
- Healthy soil.
- Responsible use of resources and materials.
- Expanded use of clean and renewable energy.

The Strategy will also support social and cultural amenities to improve community well-being, enhance quality of life, and foster a culture of sustainability citywide.

As Calgary has grown in recent decades, a number of smart decisions have helped preserve many of its most valuable natural features. A wide range of community groups and individual Calgarians have enhanced the city's quality of life by acting to protect its green spaces and river valleys.

The new Strategy reframes and unites these efforts, and it also brings together the wide range of strategic plans created in recent years under a single banner of sustainability. These ongoing efforts are now focused on three linked corporate values:

1. A healthy environment.
2. A strong and vital economy.
3. Livable, inclusive communities.

These three values are consistent with the United Nations Environment Programme's description of a sustainable city as one that is "low-carbon, resource-efficient and socially just." It puts those values at the centre of Calgary's decision-making. In the age of climate change awareness, this will require a robust action plan to reduce the city's carbon footprint and build climate resilience and adaptation into every aspect of daily life.

By building on its legacy of stewardship with this Strategy, Calgary will continue to be a beautiful and inviting place that supports long-term economic growth and attracts visitors and new residents alike. The Strategy will help bring the city together as a thriving, vibrant, and sustainable home for all in the decades to come.

The Benefits of a Healthy Environment

The Benefits of a Healthy Environment

A healthy, resilient, and thriving natural environment is a valuable objective on its own —a way to maintain biodiversity, minimize pollution, manage waste and protect wildlife. But Calgarians also benefit directly from a healthy environment in many other ways, summarized here.

INDIVIDUAL AND PUBLIC BENEFITS

Allow future generations to meet their needs and enjoy enhanced quality of life

- Ensure reliable and clean water for drinking, fishing, and recreation.
- Support traditional use of land.
- Reduce infectious diseases (e.g. Lyme disease).
- Improve physical and mental health.
- Maintain clean air.
- Provide opportunities for Calgarians to enjoy nature in the city.
- Protect Calgarians from harmful substances.
- Support child development.
- Enable healthier homes and energy efficiency.
- Avoid premature deaths due to emissions and pollution.

CITY BENEFITS

Create resilient and green cities that exist in harmony with the natural environment

- Reduce the frequency and intensity of environmental emergencies.
- Reduce flood risk (for both river and stormwater flooding).
- Improve food security.
- Store carbon.
- Build resilient infrastructure.
- Improve adaptability to climate change.
- Integrate green spaces and natural infrastructure throughout the city.
- Decrease greenhouse gas emissions.
- Create low-carbon, climate-resilient buildings and communities.
- Reduce waste.

ECONOMIC BENEFITS

Ensure Calgary is competitive in innovative clean energy and cleantech sectors

- Attract talent and firms.
- Stimulate local innovation, entrepreneurship, and diversification.
- Capitalize on existing energy infrastructure and skills.
- Save money and time (individually and collectively).
- Increase global economic competitiveness.
- Transition to a low-carbon economy.
- Increase productivity.
- Add green jobs.
- Improve housing and transportation affordability.
- Enhance Calgary's national and international brand.

The Environment and the Economy

The cities that will thrive in the twenty-first century will be the ones that take bold action now to prepare for it—by weaving sustainable practices, low-carbon technologies, and climate resilience measures into everything they do. Cities can also encourage economic diversity and technological innovation by attracting investment in the work of building an equitable and green pandemic recovery.

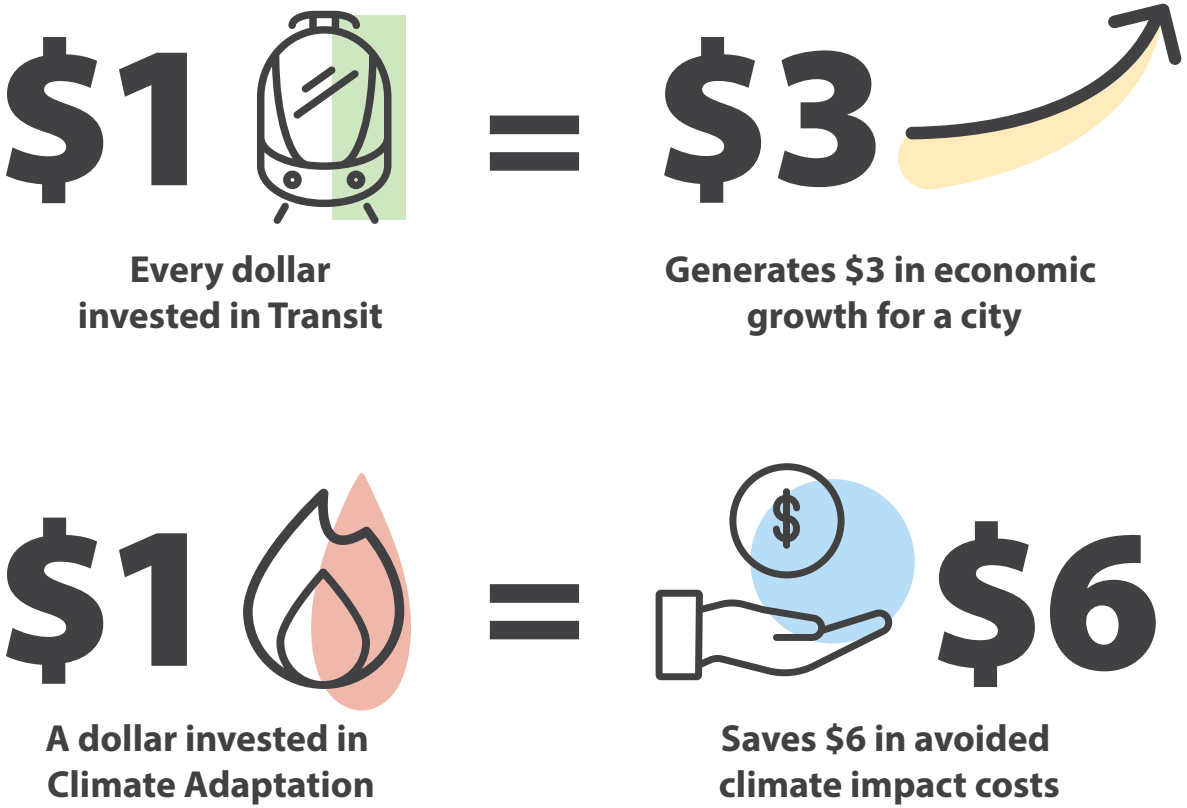
Caring for the environment can also help reduce costs for government and residents alike. A federal government study found that simply maintaining and enhancing wetlands in an urban setting can reduce disaster costs by 38 per cent.[1] The environmental sector is also a high growth sector. The cleantech industry is already a trillion-dollar business sector worldwide, and further growth in investment, new business activities, and jobs in clean technology is expected to accelerate in the years to come likely exceeding $2.5 trillion by next year.[2]

Natural systems and the environment also provide significant value to communities. Policies and initiatives to expand green space and nurture biodiversity are not just about a healthy environment—they add enormous value through a range of ecosystem services, from reducing the impacts of floods to helping keep cities cool in the warmest months.

Sustainability is simply good business and an excellent investment in Calgary's quality of life.

[1] *When the big storms hit https://www.intactcentreclimateadaptation.ca/wp-content/uploads/2017/07/When-the-Big-Storms-Hit.pdf*

[2] *Accelerating clean innovation in Canada https://institute.smartprosperity.ca/cleaninnovation*



Source: Federation of Canadian Municipalities

Calgary's Role in Achieving a Healthy Environment

There is a tendency to think of environmental challenges as mostly distant from daily urban life. When many people think of "the environment," they imagine outdoor scenes in untouched nature far away from the city, defining it by the absence of urban amenities. With the challenges the world now faces—the climate crisis paramount among them—cities must come to be understood as the main engines of environmental stewardship and climate action.

The tools of urban sustainability all reinforce healthy lifestyles, enhance quality of life, and create new economic opportunities in every community. By reframing environmental challenges to address individual choices and the local context in Calgary, the ability to create lasting change and shift markets becomes much closer at hand.

Expert analysis around the world confirms that many of the most vital tools for climate action and are also the tools of **urban sustainability**. These include:

- Reducing food waste.
- Improving walkability and cycling networks.
- Expanding transit.
- Building new net zero buildings.
- Retrofitting existing buildings for improved efficiency.

As individuals, Calgarians can choose to use the tools of urban sustainability and demand their improvement so that choosing them becomes second nature. Examples include:

- Reducing food waste and composting organic household waste.
- Walking or using the cycling network.
- Riding public transit.
- Seeking out net zero buildings when buying a home and making these standards important market selling features.
- Retrofitting homes to improve heating or cooling costs.
- Supporting businesses who are choosing to follow sustainable practices.
- Demanding changes to make it easier for all Calgarians to choose sustainable options.

Green Success and Innovation

The past decade has seen the development of cost-effective tools to reduce impacts on the planet's natural systems. The cost of clean energy technologies such as wind and solar power has plummeted to a point where they are the cheapest sources of power in much of the world. Entirely electric cars are fast becoming a mainstream option, while mass transit and active transportation have seen renewed investment and enthusiasm. Enormous gains have been made in energy efficiency, green building design, electrified transport, and many other fields. Advances in waste management are facilitating a shift to a more "circular economy," where the ongoing repair, reuse, and recycling of commercial products avoids the inevitability of the landfill.

Although a clear path has now emerged toward a more sustainable way of life, much of the world (and much of Calgary) remains dependent on outdated technologies and established infrastructure. The increasing support for sustainable options in Calgary represents an opportunity to accelerate the transition to cleaner technology, while encouraging more efficient and sustainable ways of living. The City of Calgary can assist in helping individuals and organizations understand the costs and benefits of the range of available innovations.

Electric car market share growth

Calgary is part of the Peaks to Prairies Network, which will establish a network of 20 fast charging stations along with back-up "level 2" stations across southern Alberta. This will improve electric vehicle transportation northward to Edmonton and westward into the BC interior, linking up with other networks like the Accelerate Kootenays charging network.

Fun Fact: Ford anticipates electric vehicles will outsell fossil-fuel powered ones at some point in the next decade.[1]

Image Source: Lynn Dombrowski from Flickr

Circular economy

Calgary has set a long-term goal of zero waste (in which all goods and services are designed for perpetual reuse in a closed loop) through recycling, composting and diversion programs. Some circular initiatives are already in place. These include:

- Recycling for packaging and paper products.
- Potable water re-use projects.
- Sustainable building policies.
- Tool- and appliance-sharing platforms, repair shops, and zero-waste retailers.
- Antique shops, thrift stores, consignment, and on-line platforms.

Fun Fact: Alberta has the highest participation rate in the second-hand economy in Canada, with a total second-hand spending of $4.4 billion in 2017. The second-hand economy also supports 46,000 jobs in Alberta.[2]

Image Source: Steve Snodgrass from Flickr

[1] *Governments unveil details of $590M investment to help Ford Oakville plant make electric cars* https://www.cbc.ca/news/business/ford-oakville-government-1.5754974#:~:text=Business-,Governments%20unveil%20details%20of%20%24590M%20investment%20to%20help%20Ford,to%20start%20making%20electric%20vehicles.

[2] *City of Calgary Roadmap Summary* https://recycle.ab.ca/city-of-calgary-circular-cities-roadmap/

Utility-scale renewable energy

Alberta's deregulated electricity market and the provincial government's commitment to phase out coal for power generation combine to create an outstanding opportunity for renewable energy. The Calgary area is in one of the sunniest regions in Canada, boasts abundant wind resources, and has excellent geology for geothermal energy. Pair these natural resources with a well-established service sector and a reputation as an energy leader, and Calgary is poised to lead in the renewable energy sector.

Fun Fact: Currently, Calgary has 241 renewable energy companies and 108 energy storage companies.[3]

Cleantech

Clean technology—often called simply "cleantech"—is a broad industrial category comprising companies and technologies that improve environmental sustainability. The field includes both companies that develop new technologies and those focused on reducing the negative impact of existing technologies and industrial processes.

Fun Fact: Calgary was ranked one of the world's top 15 cleantech ecosystems in 2019 with more than 70 per cent of Alberta's cleantech head offices located in Calgary. Many of these companies focus on oil and gas, electricity generation, and food and agriculture.[4]

Image Source: Kate Field from Flickr

Green building design

The City of Calgary's Sustainable Building Policy ensures that all City-owned and City-financed facility planning, design, construction, management, renovation, operation and demolition is carried out in a sustainable manner and takes triple bottom line impacts into account. The policy enhances The City of Calgary's reputation as a fiscally responsible municipal government and addresses the health and well-being of the people who use and occupy the buildings.

In addition to greening its facilities, The City of Calgary is also committed to sustainable infrastructure. Various Low Impact Development (LID) and water saving features, such as rain gardens, are being incorporated into City projects.

Fun Fact: As of 2018, 390 buildings in Calgary have achieved LEED certification, with more than 90 of those certified as LEED Gold.

Image Source: NNECAPA from Flickr

[3] *Alberta could lead Canada in wind and solar power by 2025, expert says https://www.cbc.ca/news/business/alberta-wind-and-solar-future-1.5728757*

[4] *Cleantech https://calgaryeconomicdevelopment.com/sectors/focus-areas/energy/cleantech/*

Key Concepts and Approaches to Environmental Sustainability

Living within the Limits of the Environment

The concept of "ecological limits" is vital for understanding many of the environmental challenges Calgary is facing today. Living within the ecological limits requires working to decrease ecological footprints and promote ecological integrity.

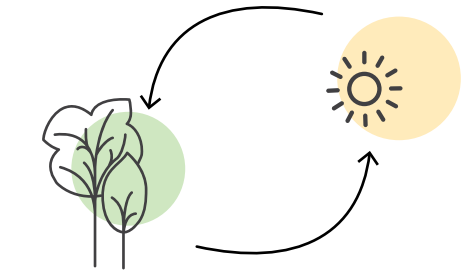
[1] *Carrying Capacity* https://worldpopulationhistory.org/carrying-capacity/

[2] *Ecologic al Footprint* https://www.footprintnetwork.org/our-work/ecological-footprint/

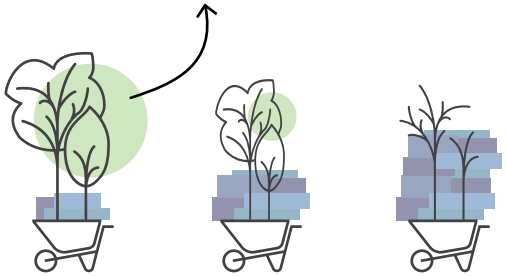
Ecological integrity refers to the ability for an ecosystem to support healthy habitats and maintain ecological processes. Though there are many "renewable" resources on the planet, these can only regenerate as long as their overall ecological integrity remains intact. When resources are over-harvested, such as fish or forests, it can destroy this integrity and cause ecological collapse. This means that the system is depleted past the point where it can recover. The same is true of the amount of waste or pollution a system can absorb before it is detrimentally affected.

The overall limits of the planet are often referred to as **carrying capacity**. Carrying capacity is the maximum population of a species that can be sustained in a specific environment without compromising its ecological integrity. There are over 7.8 billion people living on the planet, and that figure is expected to grow to 9.5 billion by 2050.[1] This large and growing population brings with it a very large ecological footprint.

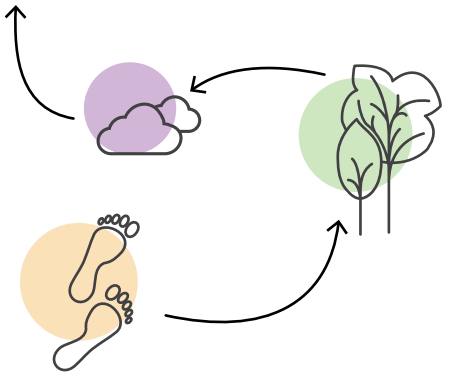
An **ecological footprint** is a measure of the human demand on natural capital or "biocapacity." That demand includes the amount of land needed, the resources consumed, and the waste generated. Compared to the overall capacity of the planet, humanity is using more than the Earth can give. In fact, together humanity is using about 1.75 Earths of capacity annually.[2] This means that the Earth takes a year and eight months to regenerate what everyone consumes globally in a year.



Ecological Integrity
Ability to support and maintain natural ecological processes



Carrying Capacity
Overall limits of the planet



Ecological Footprint
A measure of human demand on natural capital

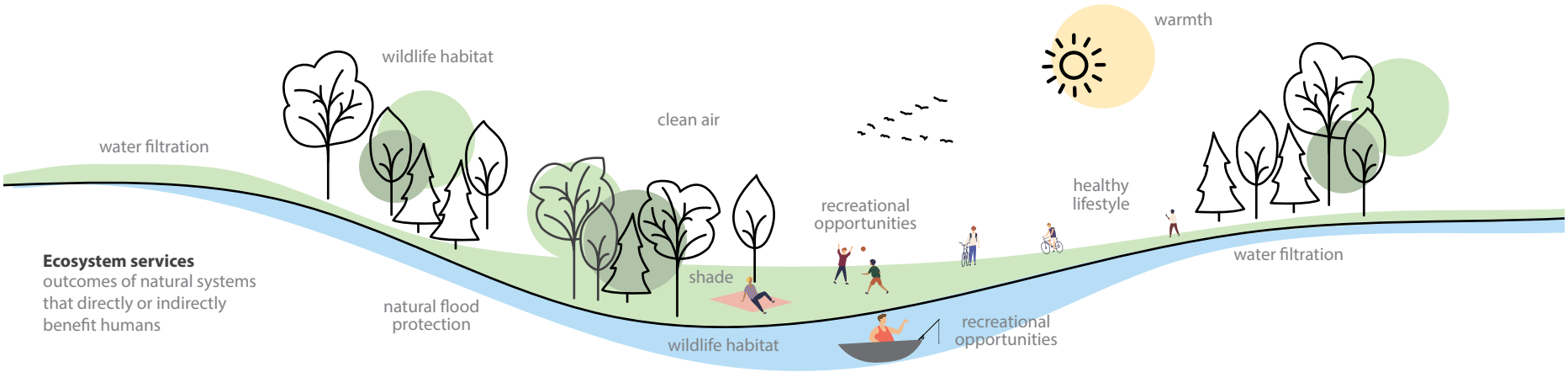
Natural Systems and Services

To learn to live within ecological limits, cities must focus on the services supplied by natural systems and find ways to integrate these functions into all decision-making processes. The multitude of natural systems that urban populations rely on for health and wellbeing can easily be taken for granted, in part because it can be hard to quantify their value against other economic and social priorities. Ecosystem services and natural capital are two frameworks for quantifying the value of natural systems so that they are factored properly into the decisions organizations and governments make.

Ecosystem services are the services, outputs and processes of natural systems that directly or indirectly benefit human populations.

Natural capital measures the economic value of natural systems and the ecosystem services they provide. Calculating natural capital requires taking inventories of natural assets and their functions and then estimating the cost of the infrastructure required to match those services.

In addition to determining the value of natural assets as infrastructure, cities can also develop ways to measure the social and cultural value of natural systems as part of their natural capital accounting. Spending time in nature is beneficial for physical and mental health, and parks and open spaces are significant sources of tourism and recreation revenue. Proximity to nature and its aesthetic value should also be considered. By considering all these factors, natural capital measures the total economic and social value of a city's natural infrastructure and assets.



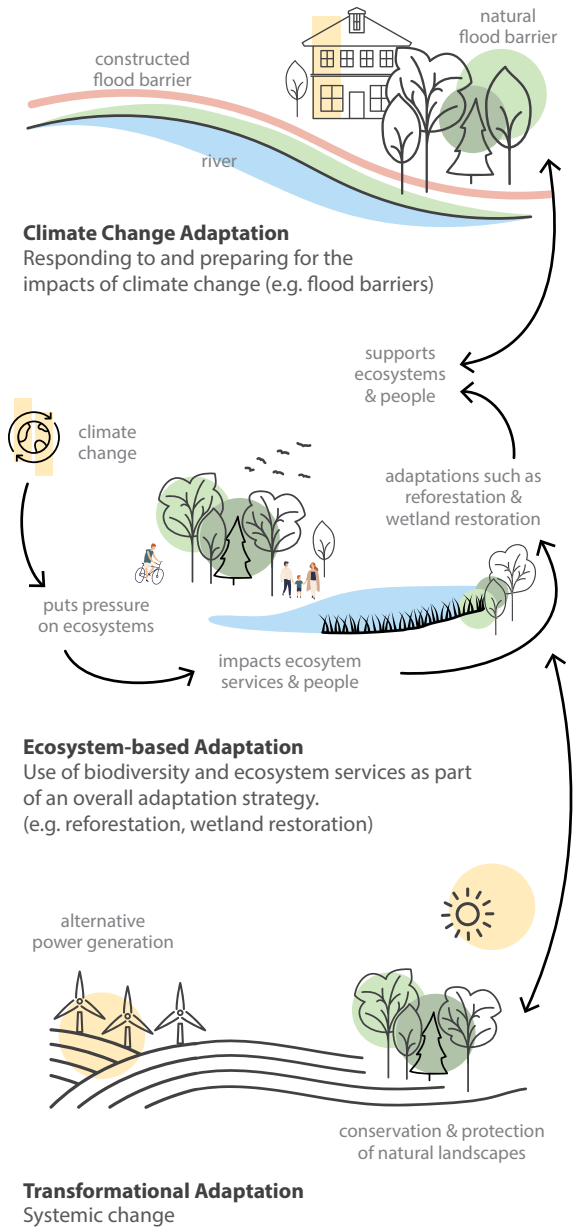
Environmental and Climate Change Adaptation

Communities have been adapting to climate variability for centuries, but today their established coping mechanisms are being outpaced by the rapidly changing climate. Climate change is happening at a faster pace and scale than has ever been seen before, due to the magnitude of human emitted greenhouse gases in the atmosphere. The impacts of climate change, including more frequent extreme weather events, loss of biodiversity, and environmental disasters, are only likely to magnify, with serious near-term implications for health, well-being, and livability in every city.

Calgary must begin preparing today for a significantly altered climate, building resilience and adaptation into both human and natural urban systems so they are ready for the challenges created by dramatic changes in climate, weather, social patterns, and economic trends. The approaches to adaptation to be considered include:

- **Climate Change Adaptation,** referring to the process of responding to and preparing for the impacts of climate change (e.g. flood protection).
- **Transformational Adaptation,** a deeper level of adaptation that results in the systemic change of social, economic, and ecological systems to safeguard people and infrastructure.
- **Ecosystem-based Adaptation,** which involves enhancing ecosystem services (through conservation, management and restoration) and nature-based solutions to reduce a community's vulnerability and increase its resistance to climate change (e.g. better forest management to reduce the risk of wildfires).[1]

[1] *Ecosystem-based Adaptation* *https://www.iucn.org/resources/issues-briefs/ecosystem-based-adaptation*



Nature and Natural Systems within Cities

"Nature-based systems"—the process of harnessing nature's assets to meet the needs of urban populations—is a vital response to climate change pressures in cities. An ecosystem-based adaptation approach involves recognizing and capitalizing on natural systems to work with nature rather than against it and build a healthier environment.

To design in harmony with nature is to become a **biophilic city**—a nature-loving city where planning and design incorporates the natural world into the daily lives of residents.[1]

Natural infrastructure involves harnessing natural landscapes, such as wetlands and riparian areas, to minimize flood damages, treat and store stormwater, and reduce urban stormwater runoff through naturally occurring ecological processes or engineered infrastructure intended to mimic a natural process. In addition to stormwater management, natural infrastructure can support biodiversity, protect habitats, facilitate climate change adaptation, and sequester carbon.

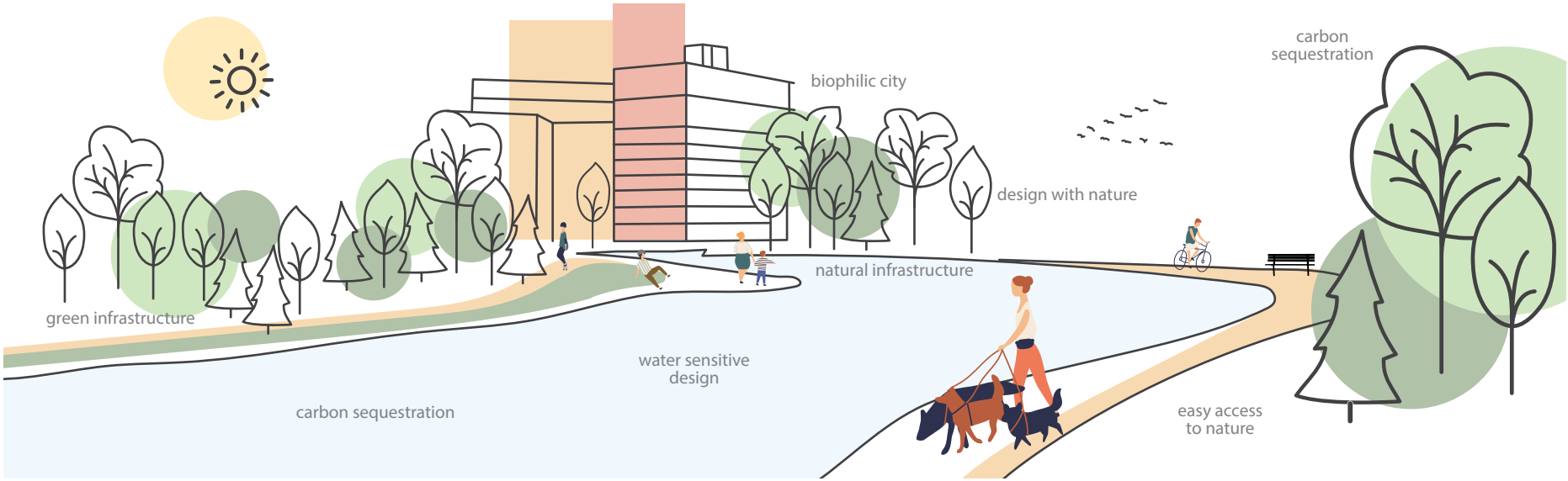
Carbon sequestering is a process of carbon dioxide removal (CO2) from the atmosphere through techniques such as carbon capture, re-forestation (replacing lost trees) and afforestation (adding trees where they didn't exist before).

Green infrastructure uses vegetation, soil, and other elements to restore natural water management processes by filtering and absorbing stormwater. This includes small interventions such as rain gardens and bioswales as well as preserving larger natural areas. In addition to cleaning water, green infrastructure offers flood protection, provides habitat, and improves air quality.

Water-sensitive urban design integrates stormwater, groundwater, wastewater and water supply into land-use planning, engineering, and urban design to minimize environmental degradation and beautify the urban environment.

Integrated watershed management includes co-ordinated water and land management that achieves economic and social benefits without compromising ecosystem sustainability.

[1] *The rise of biophilic – or nature friendly – cities* https://thehill.com/changing-america/resilience/smart-cities/482752-the-rise-of-biophilic-or-nature-friendly-cities



Economic Opportunities through Environmental Sustainability

Research confirms that some of the biggest strides toward Calgary's climate goals can be met in ways that also strengthen the city's economy—generating clean energy, radically enhancing energy efficiency, embracing green economies, reducing waste, and adopting the principles of a circular economy.

A **green economy** is an economy based on reducing environmental risks and supporting sustainable development. It also accounts for the economic value natural capital and ecosystem services. Investing in and expanding the development of the green economy will introduce more employment opportunities for Calgary that have a direct, positive impact on the environment. A green economy also creates **green jobs**, which includes work related to renewable energy, energy efficiency, and environmental management.

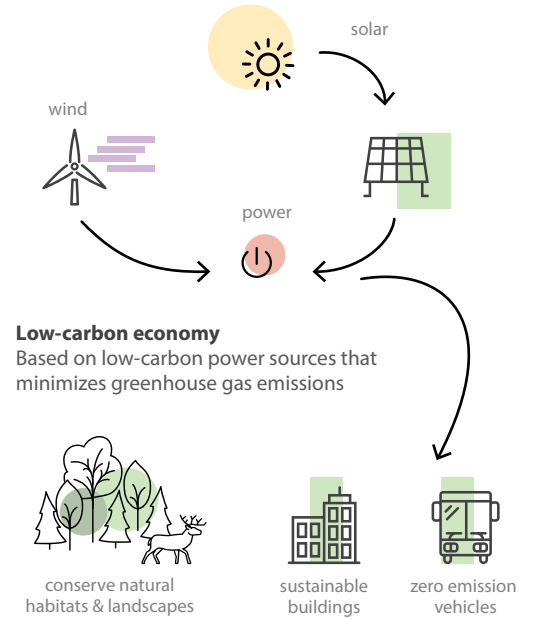
The **low-carbon economy** is an approach to developing a green economy based on low-carbon power sources that minimizes greenhouse gas emissions, with a focus on power generation and distribution tools such as renewable energy and smart-grids.

A **smart grid** is an electrical grid that incorporates operational and monitoring technology such as smart meters, smart appliances, renewable energy resources, and energy efficient resources to allow for much more precision and efficiency in the production and distribution of electricity.

Full-cost accounting determines the complete end-to-end cost of producing products and services. This type of accounting can help ensure informed decision making.

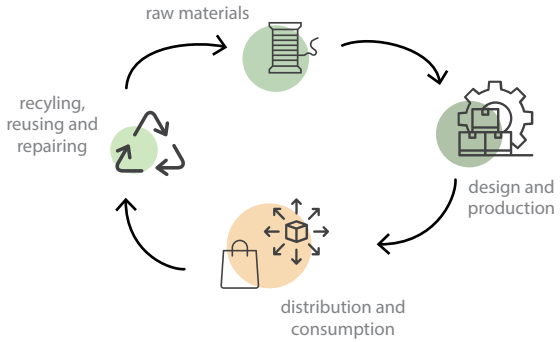
The principles of the **circular economy** shift manufacturing processes away from the current linear model of raw materials (input) to consumption to waste (output), by adopting a circular model where materials, products, and components are designed with perpetual reuse and recycling in mind. This can help the city work towards **zero waste**.

The cities that will thrive in the twenty-first century are the ones that are taking bold action now to prepare for change by weaving sustainable practices, low-carbon technologies, the circular economy, and climate resilience measures into everything they do.



Low-carbon economy
Based on low-carbon power sources that minimizes greenhouse gas emissions

Green economy
Based on reducing environmental risks and supporting sustainable development



Circular economy
Materials, products, and components are designed to be useful for as long as possible, mimicking the natural circle of life

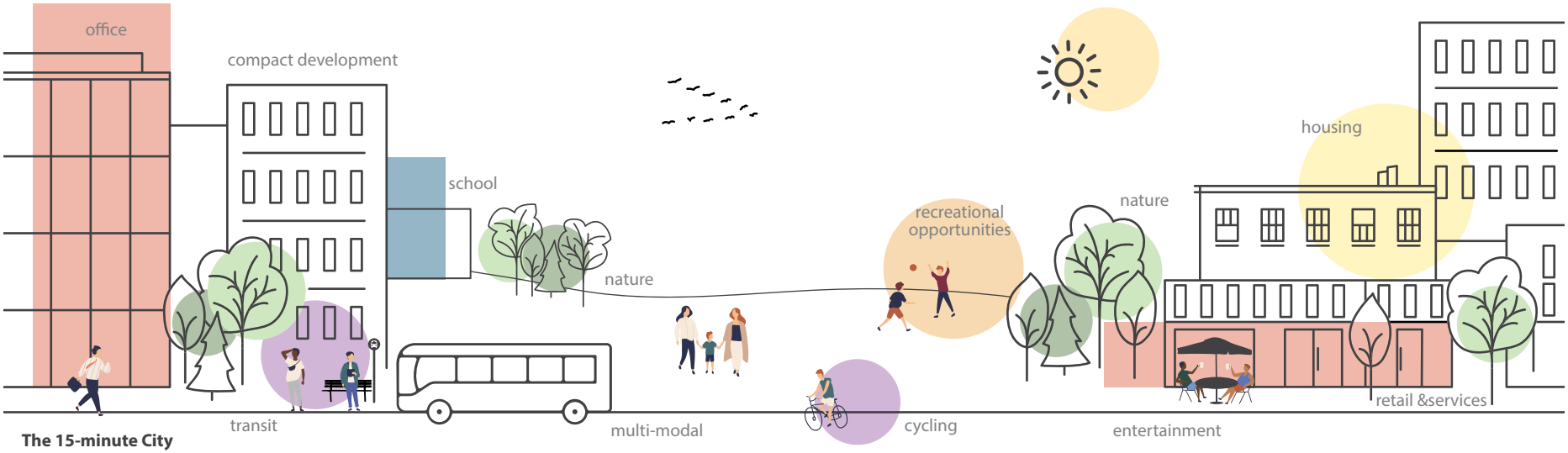
Livable, Inclusive Communities

The infrastructure of cities—parks and green spaces, utilities, streetscapes and neighbourhood designs—can enhance resilience, better preparing cities for the impacts of climate change even while this infrastructure improves quality of life by creating healthier communities, better public spaces, and reduced pollution. Expert analysis around the world confirms that many of the most vital tools for climate action and are also the tools of urban sustainability.

Urban sustainability leaders have recently integrated these livable-city tools into a holistic approach called the "**15-minute city**"—the concept of building a city where every resident is never more than fifteen minutes from all the necessities of life, from work to shopping to school. This concept, also known as a **complete community**, echoes longstanding urban sustainability principles regarding the value of complete streets, walkability, public spaces, and mixed-use buildings. The value of complete communities was emphasized by the hardships endured during the pandemic, particularly the increased demand for nearby public spaces and parks.

Integral to the establishment of a 15-minute city is compact development and the provision of multi-modal mobility options. **Multi-modal transportation systems** emphasize improving walkability and cycling networks, expanding transit, and providing multiple mobility options in a safe, comfortable, and seamless manner.

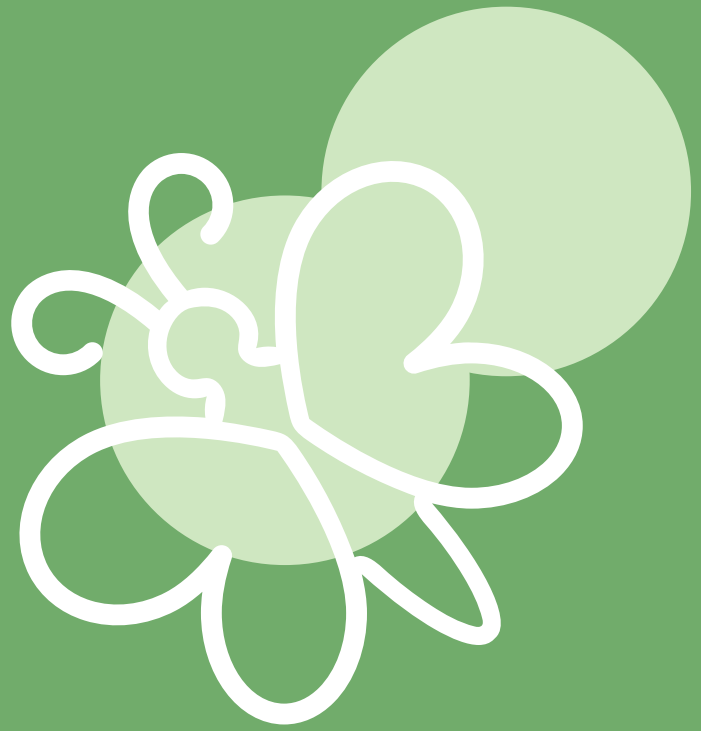
Compact development focuses on efficient land use through higher density development, infills, clustered development, mixed land uses, and brownfield development. This maximizes the use of existing infrastructure and reduces maintenance and operations costs for municipalities, helping cities better use scarce resources.



The 15-minute City

Environmental Focus Areas

Biodiversity + Ecosystems



Biodiversity and Ecosystems Overview

Natural systems are an essential component of healthy and thriving human environments.

Over the years, natural systems have been altered as Calgary has developed and urban areas expanded. Though some natural areas have been retained and protected, some have been modified greatly from their original functions. Others have been entirely lost to development. In general, habitat has become fragmented, resulting in less connectivity between natural areas, making it harder for wildlife to move from one place to another, and leading to greater human and wildlife conflicts.

Balancing the conservation of natural systems with development priorities is a challenge facing all cities. In addition to development pressures, Calgary's natural areas face pressures from climate change, recreational activities, and invasive species, which also alter their function and ability to adapt.

Recognizing the importance of these areas to the health and wellbeing of Calgarians, The City has been working to repair many of these natural spaces through stream restorations, riparian buffer plantings, living shoreline projects, habitat restorations, and the care of urban forests. The protection and restoration of natural areas will continue to be a significant priority in the future in response to climate change and a growing need for strengthened natural infrastructure.

Measuring Biodiversity

One of the primary ways to assess the overall health of natural systems in Calgary is to examine biodiversity. Biodiversity is the variability among the species of animals, plants, and habitats on land and in waterways. The more diversity there is within and between species and ecosystems, the healthier and more resilient a natural system is.

Calgary measures its biodiversity in a variety of ways. An important measurement is the quality and quantity of natural areas and open space. Calgary has both natural areas and parks, which serve different functions. Natural areas are habitats that have been conserved or protected from development to retain their original ecosystem functions. Parks, though they may contain natural habitats, have been modified to provide recreation and other amenities and, as a result, do not provide the same quality of habitats as natural areas do.

Biodiversity

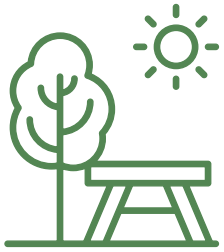
the variability among living organisms

Natural Areas

habitats conserved or protected from development to retain original ecosystem functions

Parks

has natural habitats, but have been modified to provide recreation and other amenities



Natural areas are more biodiverse and provide greater ecosystem services than parks because there has been less disturbance to the landscape. Disturbance affects the quality of habitat, reflecting the level of change from the original ecosystem and its functions. Disturbances can be from human actions, severe weather events, or the spread of invasive species.

Disturbance can be counteracted through restoration, which is when work is conducted to help restore a landscape to a more natural state to support biodiversity and ecosystem functions. The City of Calgary tracks how much habitat has been restored as one of the indicators of ecological health.

In some cases, there are also opportunities to further naturalize the city's parks. This means returning some areas to a more natural state through tactics such as establishing wild grasses rather than mowing or manicuring spaces. These naturalized spaces will still not achieve the same ecological functionality as the original or restored natural areas, but they will provide greater ecological functionality than a more formalized park. Though parks are more disturbed landscapes, they still provide valuable ecosystem services as green spaces, including stormwater management, carbon sequestration, air filtration and passive recreation opportunities.

Disturbance

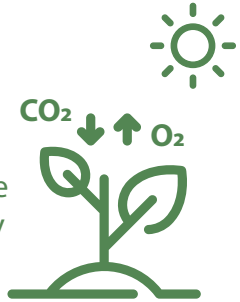
affects quality of habitat, reflecting level of change from the original ecosystem

Restoration

when work is conducted to help restore a landscape to a natural state

Naturalize

returning areas to a natural state through tactics to provide greater ecological functionality (e.g. carbon sequestration, air filtration)



Another indicator of ecological health is the percentage of impervious surfaces in Calgary. Impervious surfaces include asphalt and other paved surfaces that do not allow water to soak through into the ground, which can cause increased stormwater runoff and send higher volumes of pollutants flowing into creeks and rivers.

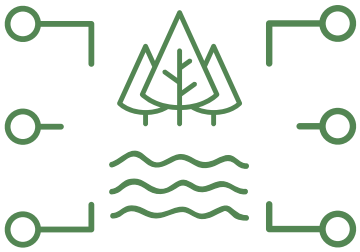
When there are a lot of impervious surfaces, they can also contribute to the urban heat island effect, which is when the ground retains heat and increases local temperatures. The more impervious surfaces inside the city, the less vegetated surfaces and potential habitat available.

Tree canopy is another important measure of ecological health. Trees provide a range of habitat functions as well as ecosystem services that benefit people, including reduced air pollution, cooling and shade, and improved aesthetics.

Finally, it is essential to analyze the ecological connectivity of Calgary's natural areas. This involves assessing natural areas as part of an overall interconnected system. High connectivity supports greater biodiversity by providing a larger land area in which species can mix and travel. In contrast, fragmented habitats become islands within the city, making it difficult for species to travel and reducing the amount of genetic variability in a species. This fragmentation can be compounded by other infrastructure barriers which often lead to human-wildlife conflicts, such as vehicle and animal collisions.

Ecological Connectivity

viewing our natural areas as a part of an overall interconnected system

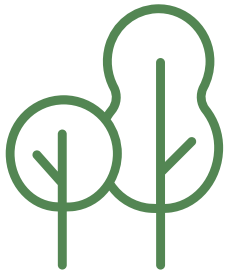


Impervious

surfaces that do not enable water to infiltrate into the ground

Urban Heat Island Effect

when ground retains more heat and results in a local increase in temperature



Tree Canopy

provides a range of habitat functions as well as ecosystem services that benefit people (e.g. shade)

Targets | **City Targets**

GOALS	TARGETS
One of the goals of Calgary's Municipal Development Plan (MDP) is to: *Conserve, protect and restore the natural environment.* The MDP sets out the following objective to fulfill this goal: *Maintain biodiversity and landscape diversity, integrate and connect ecological networks throughout the city.*	The MDP sets out a series of Core Indicators. These include the following long term (60 year) targets: ▪ Reduce total city impervious surface to 10-20 per cent. ▪ Increase tree canopy to 16 per cent. ▪ Direct 50 per cent of population of growth to within developed areas.

In addition to the MDP, The City prepared a 10-year biodiversity strategy in 2015 called Our BiodiverCity. This strategy directs:

- Restoring 20 per cent of Calgary's current open space to increase biodiversity by 2025.
- Establishing of conservation targets for ecological cores and corridors.
- The development of strategies for the management of invasive species.

Fact Sheet | **Trends**

Though Calgary has been continuously adding land to its parks system each year with new development, the rate of population growth means that over time, the amount of park space available per person has declined, decreasing by four per cent from 2013 to 2019. In 2019, the average park area per person was 67 square metres.

Approximately 642 hectares has been added to the parks system between 2013 and 2019. About 34 per cent of this was maintained or manicured park and the other 66 per cent was natural area

Calgary has been gradually increasing its tree canopy in recent years. In 1998, the city had a seven per cent tree canopy coverage, which increased to eight per cent by 2019. This one per cent increase over 20 years indicates The City has a way to go to meet its long range target of a 16 per cent tree canopy.

Calgary is not on track to meet its target for the percentage of impervious surfaces in the city. The City's long-term goal is to reduce impervious surfaces to 10 to 20 percent of total land area, while increasing the amount of vegetated spaces. In 1998, 33 per cent of Calgary was covered by impervious surfaces, and this has increased to 44 per cent by 2016. Significant additional effort will be needed to reverse this trend.

↓ **4%**

decrease in parkland available per 100,000 people from 2013 to 2019

approximately

642 ha

added to the parks system between 2013 and 2019

34%

was maintained or manicured parkland

66%

was natural parkland

in 2019, the city had an

8%

tree canopy coverage

in 1998, the city's coverage was **7%**

by 2016, the city's impervious surfaces have increased to

44%

in 1998, impervious surfaces were at **33%**

Fact Sheet | **Park Space and Tree Canopy Trends**

INDICATOR	TREND	AMOUNT OF CHANGE	CURRENT LEVEL	TARGET
Total Maintained Park Area	↑	+427 hectares since 2008		N/A
Maintained Park Area Added Annually	→	-0.5 hectares since 2008	61.52 hectares added in 2019	N/A
Total Natural Park Area	↑	+857 hectares since 2008		N/A
Natural Park Area Added Annually	↓	-22.09 hectares per year since 2008	39.57 hectares added in 2019	N/A
Total Amount of Parks (Natural, Maintained and Other)	↑	+1320 hectares since 2008	8554 hectares	N/A
Total Park Area per Person	↓	-28 hectares per 100,000 people since 2013 (-4 per cent)	665 hectares per 100,000 people in 2019	N/A
Tree Canopy	↑	+1.2 per cent since 1998	8.2 per cent in 2019	16 per cent
Trees Planted Annually			25,000 planted in 2019	N/A
Impervious Surface	↑	+12 per cent since 1998	44 per cent in 2018	10-20 per cent

Fact Sheet | **Park Space Provision**

8554 ha

total managed park space in 2020

2299 ha

total site area with high potential for naturalization

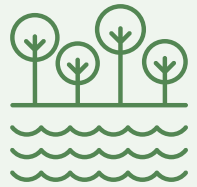
99.8%

citizens within a 450 m walk of a park space in 2020

Total percent of parkland in 2019

44%
manicured

56%
natural



Fact Sheet | **Biodiversity Cores and Ecological Network Connectivity**

Within the ecological network, there are two main types of habitats: core habitats and stepping stones. Core habitats are larger areas of natural or semi-natural habitat greater than 30 hectares in size. These areas provide temporary or permanent resources for breeding, feeding, shelter, and movement for a variety of species. Core habitats are primarily City-owned land, with the exception of Fish Creek Provincial Park. All other core habitats are classified as Natural Environment Parks.

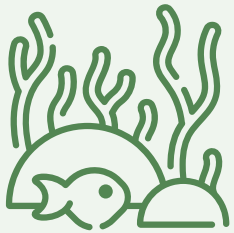
Stepping stones are smaller natural areas, usually five to 30 hectares in size. These areas are used by species to seek shelter, find food, or rest. These form the backbone of the secondary corridors (described later). All stepping stones are City-owned natural areas.

In Calgary, the most significant ecological network corridors are the region's rivers. These are classified as primary corridors. They provide the greatest level of contiguous ecological connection through the city to the region, and although fragmented by development in places, the primary corridors provide opportunities for wildlife movement and connected habitats.

Secondary corridors are relatively linear stretches of landscape elements connecting core habitats to each other or core habitats to the primary corridors (rivers and creeks). Secondary corridors offer some potential for safe journeys from one core area to another, but high fragmentation can reduce corridor integrity. Both types of corridors contain lands from a mix of ownership.

Stepping Stones

small, natural area nodes that are more fragmented, usually 5 to 30 hectares in size



Core Habitats

larger areas of natural or semi-natural habitat greater than 30 hectares in size

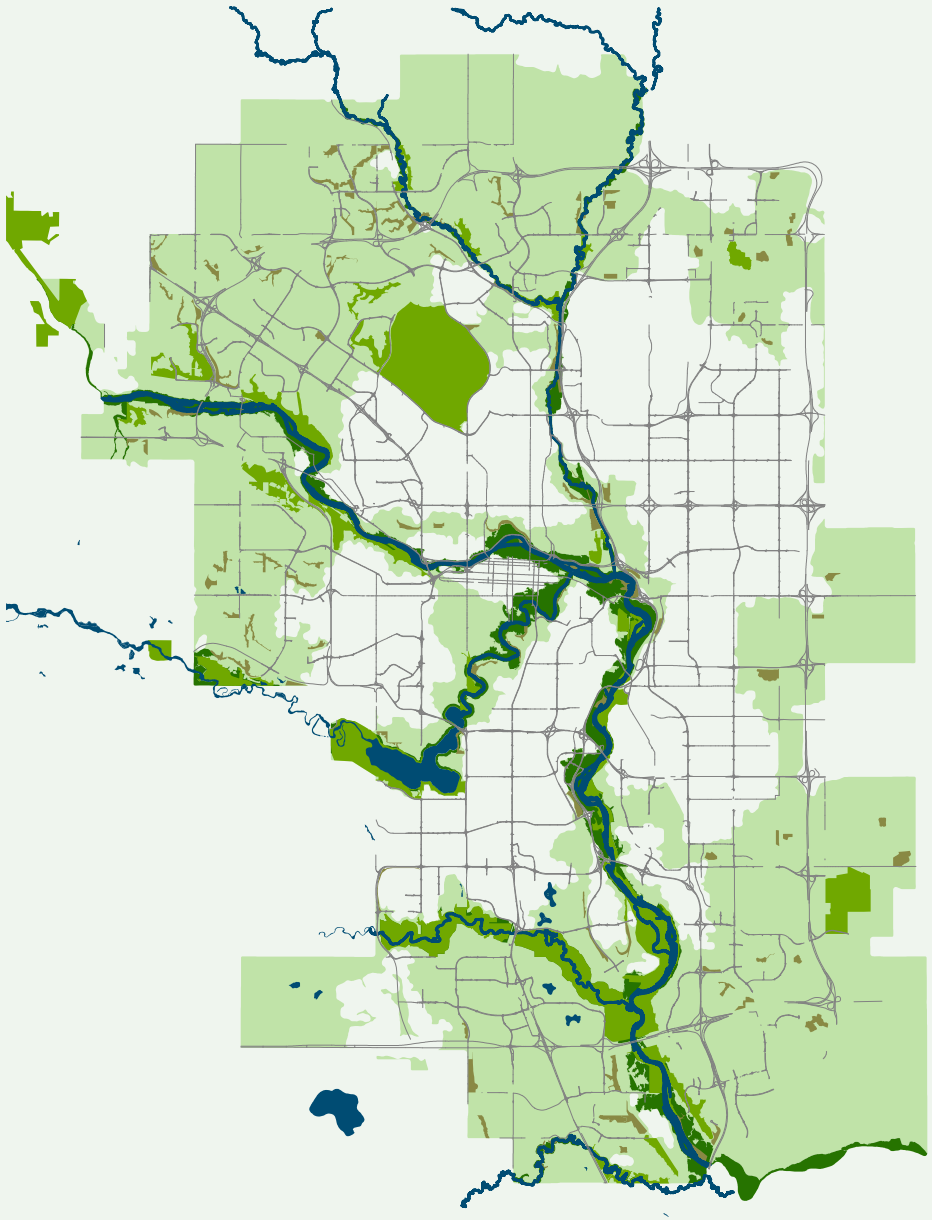
Primary Corridors

provide the greatest level of movement for wildlife and provide the most connected habitat (i.e. rivers and creeks)

Secondary Corridors

linear stretches of landscape elements connecting core habitats to each other or core habitats to primary corridors

CALGARY'S HABITATS AND CORRIDORS



Legend

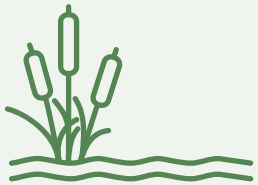
- Road
- Open Water
- Core Habitat
- Stepping Stone
- Primary Corridor
- Secondary Corridor
  (linear stretches of parks and private lands)

Fact Sheet | **Impacts of Biodiversity**

Connecting with nature is scientifically proven to be beneficial to overall health and wellness. Access to good quality green space and living in neighbourhoods with abundant trees and vegetation can have a big impact on quality of life. Calgary's natural areas, parks, and open spaces are places where Calgarians can exercise, meet, socialize, and relax. Connecting with nature also helps develop a greater understanding of natural systems and the need to conserve them.

In addition to directly influencing individual mental health and the beauty of Calgary, natural systems also clean the air, soil, and water. The ecological processes that occur in natural areas benefit other species and wildlife, while at the same time providing ecosystem services that take some of the pressure off of city infrastructure. For example, healthy riparian areas and wetlands help to store rainwater and mitigate flooding. Trees and vegetated spaces help to reduce overall heating costs, provide shade and retain moisture. In many ways, natural areas can be thought of as natural infrastructure.

In the future, natural infrastructure will be critically important to help Calgary adapt to climate change. Healthy and biodiverse ecosystems are the most resilient to change. Loss of these important systems, and their replacement with engineered solutions make the city less able to adapt to the increasing frequency and severity of weather events, rising temperatures, and other impacts of climate change. Engineered infrastructure also often costs more, because this infrastructure requires more frequent replacement and repair than a natural system which sustains itself.



Natural Infrastructure

natural areas that provide habitat, flood protection, cleaner air and water (e.g. wetlands)

A natural system is self-sustaining

natural infrastructure takes pressure off of engineered infrastructure and costs less

Healthy riparian areas

mitigate flooding

store and filter rainwater

when an ecosystem is healthy and biodiverse, they are the most resilient to change

Fact Sheet | **Overall Diversity**

SPECIES IN CALGARY (2015)

INDICATOR	TOTAL	NON-NATIVE	STATUS
Mammals	52	2	100
Birds	365	8	71
Reptiles	4		4
Amphibians	6		3
Fish	22	2	1
Vascular Plants	845	148	53
Non-vascular Plants	101		7

Bird Friendly City

In the last 50 years, bird populations in North America have dropped by a quarter. This means approximately three billion birds have disappeared during this time. Much of this can be attributed to human causes, such as domestic house cat ownership, significant habitat loss, and collisions with building windows and vehicles. To combat this alarming trend, Nature Canada created a new certification called 'Bird Friendly Cities' to encourage and recognize the efforts that municipalities are undertaking to make cities safer for birds.

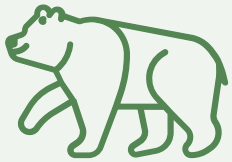
Calgary was recognized as a Bird Friendly City in 2021 by Nature Canada. The criteria that earned Calgary's is designation were its efforts towards:

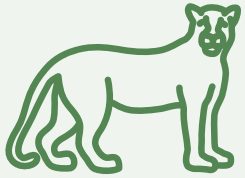
- Reducing human-related threats to birds
- Habitat protection, restoration, and climate resiliency
- Community outreach/education

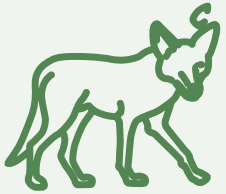
Source: https://naturecanada.ca/bfc/https://naturecanada.ca/bfc/

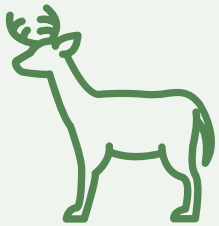
Fact Sheet | **Wildlife Conflicts**

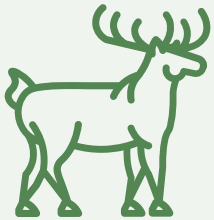
17,405 animals killed on Calgary roadways between 2015-2019 including:


1 Bear


1 Cougar


398 Coyotes


1631 Deer


18 Moose

$45,376,600 estimated financial cost of collisions

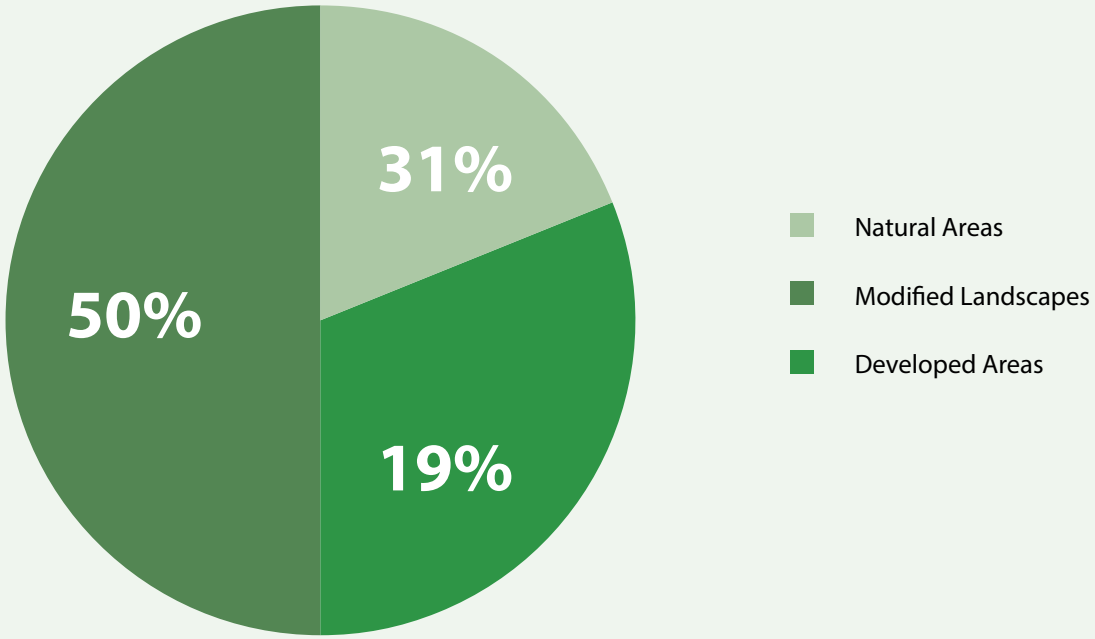
Fact Sheet | **Restoration Projects**

LEVEL OF COMPLETION	COUNT (#)	PER CENT OF TOTAL COUNT	AREA (HECTARES)	PER CENT OF TOTAL AREA
Active	159	42.6 per cent	234.8	35.2 per cent
Complete	82	22.0 per cent	88.3	13.2 per cent
Identified	110	29.5 per cent	321.1	48.1 per cent
On Hold	22	5.29 per cent	23.8	3.6 per cent
TOTAL	373		667.9	

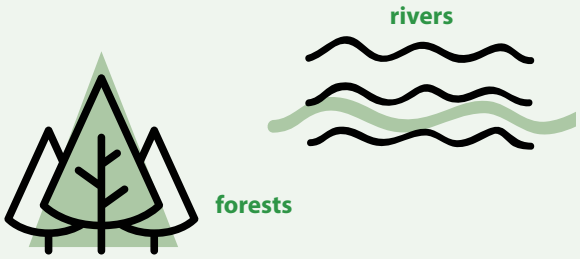
Fact Sheet | **Natural Areas Land Coverage**

Natural areas make up 19 per cent of Calgary's total area. These natural areas include forests, grasslands, natural wetlands, shrub lands, streams, and rivers. Developed areas, including paved surfaces and buildings, represent 31per cent of Calgary's total land cover. The remaining 50 per cent of Calgary's area is made up of modified landscapes, which include agricultural areas, bare land, golf courses, anthropogenic (man-made) wetlands and water features, and other manicured or modified lands.

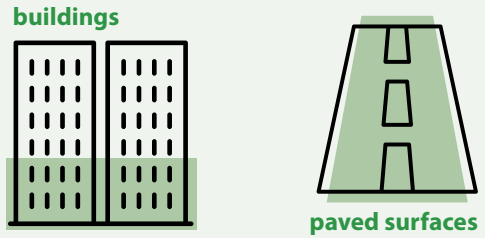
LAND COVER TYPE IN CALGARY



Natural infrastructures include



Developed areas include



Modified landscapes include

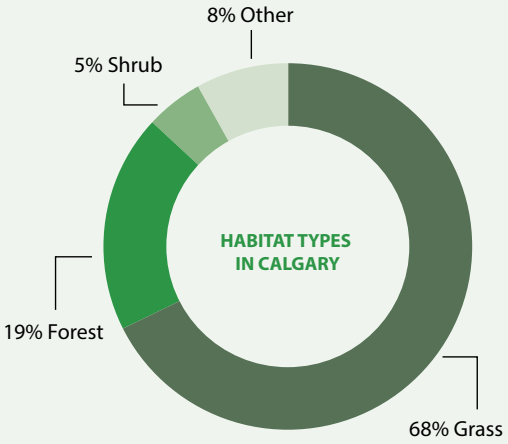
Fact Sheet | **Habitat in Parks**

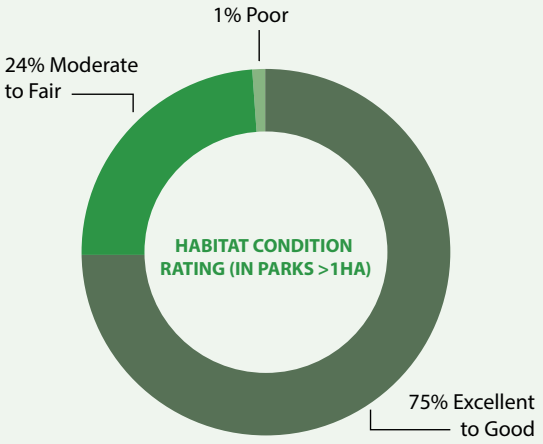
Calgary's parks contain a range of habitat types. The majority of habitat in parks is grass (68 per cent) with the next greatest area being forest (19 per cent). Shrub makes up only 5 per cent.

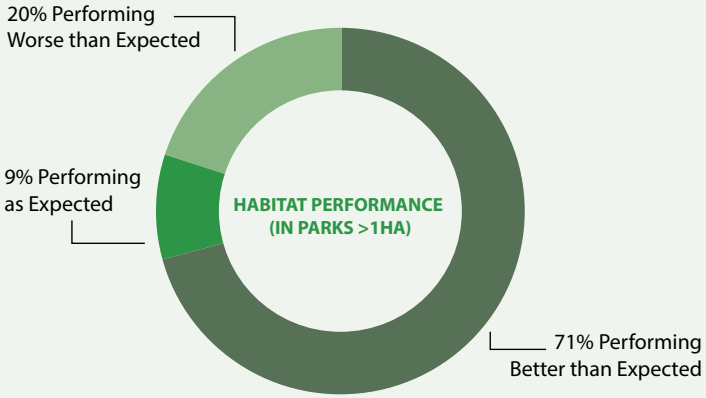
The City of Calgary measures both Habitat Condition Rating and Habitat Performance in all parks larger than one hectare in size. In 2020, 75 per cent of habitat in large parks was in excellent to good condition, with only 24 per cent in moderate to fair condition and 1 per cent in poor condition.

Habitat condition is generally higher when there is a lower level of disturbance to habitat. Using habitat disturbance information, The City can estimate what condition it thinks habitat should be in certain areas. When this estimate is compared to the actual assessment of habitat condition rating, this determines its habitat performance.

Overall, 71 per cent of park habitat is performing better than expected and nine per cent as expected. Approximately 20 per cent are performing worse than expected.







Targets | **International Commitments**

In 2011, Calgary formally joined Local Action for Biodiversity (LAB), a global urban biodiversity program coordinated by Local Governments for Sustainability (previously International Council for Local Environmental Initiatives).

In 2016, Calgary signed the Durban Commitment: Local Governments for Biodiversity.[1] By signing the Durban Commitment, The City acknowledges its accountability and responsibility for the health and well-being of Calgary neighbourhoods through protecting, sustainably using, and managing biodiversity while recognizing biodiversity's role as the foundation to a healthy community. The LAB program prescribes the following five-step process to create and act upon biodiversity protection:

1. Develop a biodiversity report documenting the current state of biodiversity and its management in Calgary.
2. Ensure long-term commitment by Council to sustainable biodiversity management through formally signing a local government biodiversity declaration.
3. Develop a 10-year biodiversity strategic action plan and framework that includes commitments to biodiversity implementation plans and integration within broader city plans.
4. Have Council formally accept the 10-year biodiversity strategic action plan and framework.
5. Implement three new on-the-ground biodiversity initiatives by the end of the 10-year program.

These steps are included in The City's Our Biodiversity Strategy. Calgary has completed the first four steps in the process, and it in the midst of implementing stage 5.

[1] *ICLEI. (2016). Mayor of Calgary Signs Durban Commitment, available: https://cbc.iclei.org/mayor-calgary-signs-durban-commitment/`*

Benchmarking | **How Calgary Compares**

When compared to several cities in Canada, Calgary has one of the higher provisions of total park area per total city area (10.1 per cent), with only Toronto (12.8 per cent) and Montreal (10.2 per cent) having more in 2019.[1]

When comparing the area of parks per population, Calgary falls just below the average of 770 acres at 665 acres per 100,000 people; however, it has more park area per population than seven of the 11 cities compared. Calgary had more natural park area per 100,000 people at 367 acres than all other municipalities surveyed in 2019, except for Sudbury (1617 acres), Thunder Bay (1484 acres), and London (416 acres).

Maintained park area includes hectares where the municipality is responsible for the direct and non-recoverable costs to maintain the space that are available for public use. This could include hectares owned by the municipality or school boards (if a reciprocal agreement is in place) and/or those leased from other third parties (through a formal lease agreement) as long as they are made available for public use.

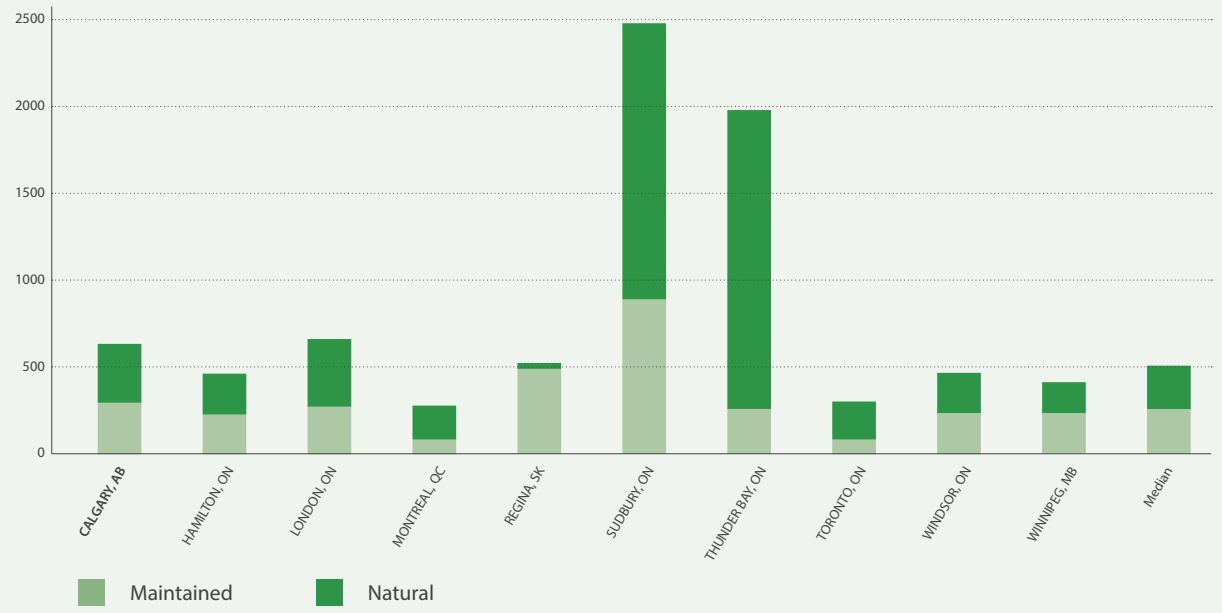
Natural park area includes forests, meadows, stormwater management buffer areas above the waterline (unless they are maintained to a high standard). These include the land surrounding ponds and rivers if these areas are part of the trail system or open space system and are available for public use.

In many cases, there is little to no change in the number of hectares reported year over year, therefore only 2019 data is presented.

External Sources:

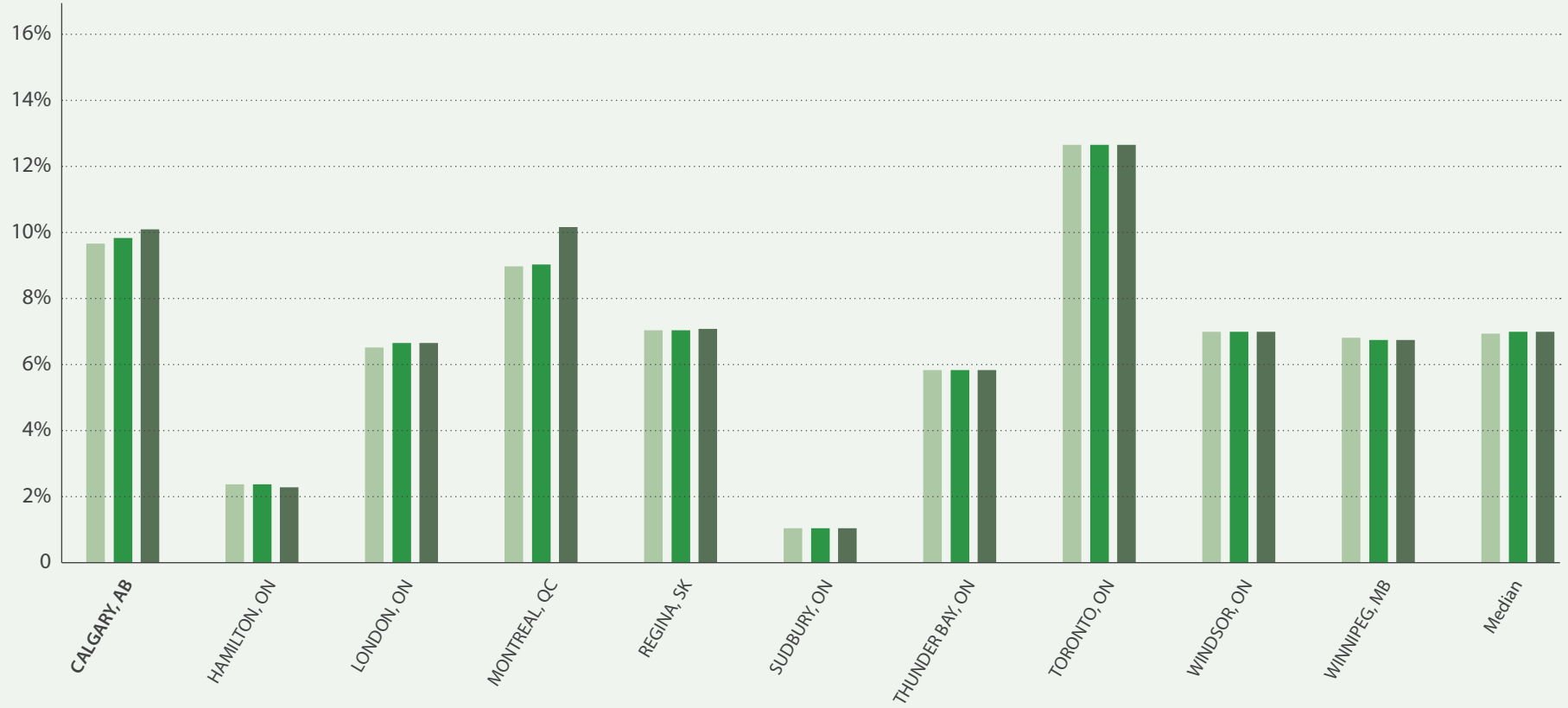
[1] *MBNCanada Performance Measurement Report* http://mbncanada.ca/app/uploads/2021/03/2019-Performance-Report-full-mar-19-2021.pdf

HECTARES OF MAINTAINED AND NATURAL PARKLAND IN MUNICIPALITY PER 100,000 POPULATION



	CALGARY	HAMILTON	LONDON	MONTREAL	REGINA	SUDBURY	THUNDER BAY	TORONTO	WINDSOR	WINNIPEG	MEDIAN
MAINTAINED	298	235	290	148	491	867	257	149	243	250	253
NATURAL	367	214	416	118	65	1617	1484	124	192	142	203
TOTAL	665	449	706	266	556	2484	1741	273	435	392	503

ALL PARKLAND IN MUNICIPALITY AS A PERCENT OF TOTAL AREA OF MUNICIPALITY



	CALGARY	HAMILTON	LONDON	MONTREAL	REGINA	SUDBURY	THUNDER BAY	TORONTO	WINDSOR	WINNIPEG	MEDIAN
2017	9.6%	2.4%	6.5%	8.9%	7.2%	1.1%	5.7%	12.8%	6.7%	6.4%	6.6%
2018	9.9%	2.4%	6.6%	9.0%	7.2%	1.1%	5.7%	12.8%	6.7%	6.3%	6.7%
2019	10.1%	2.3%	6.6%	10.2%	7.3%	1.1%	5.7%	12.8%	6.7%	6.3%	6.7%

Water

Water Overview

Calgarians value healthy river areas, reliable safe drinking water, and the management of their wastewater. Calgary strives to be a city that maintains high quality drinking water, uses water efficiently, builds resiliency to flooding and protects watershed health.

The Calgary area has been inhabited for at least 11,000 years and is sustained by the Bow and Elbow rivers that join together here and continue on into the prairie. Calgary is in the heart of traditional Blackfoot territory, on land called Moh'kínsstsis in the Blackfoot language. The word translates to "elbow," in reference to this meeting of the Elbow and Bow Rivers.

In 1787, cartographer David Thompson spent the winter with a band of Peigan encamped along the Bow River, the first recorded European to visit the area. Since then, the Calgary area has seen a constant influx of new people who have made their homes along the banks of the Bow and Elbow rivers. Over time, the city has grown outwards, creating a significant impact on the natural flow of water through this area.

Calgary lies near the headwaters of a vast watershed stretching east across the prairies. As a large part of the waters flow out of the glaciers of the Rocky Mountain's Eastern Slopes, the supply of fresh water has been instrumental in shaping Calgary's communities. The peaks and lows of this flow has sustained the city, while also periodically bringing challenging droughts and flood events.

As the climate changes, the routines Calgarians have become accustomed to change with it, requiring a more diligent and effective approach to managing the use and development of Calgary's waterways. The city shares the water with many users upstream and downstream, which means that solutions must be developed in cooperation and coordination with other municipalities, industries, and jurisdictions.

City of Calgary Lines of Service

Water treatment & supply

Treatment and delivery of drinking water, ensuring public health and long-term sustainability of a precious resource.

Wastewater collection & treatment

Collection and treament of Calgary's wastewater; protects public health, property, and the environment.

Stormwater management

Collection and management of rain and snow/ice melt, protecting you, your property and our environment.

Water Security

Water security is having enough safe water for human well-being, ecosystem resilience, and economic activities now and in the future. Water security also ensures a suitable supply of water that exceeds demand.

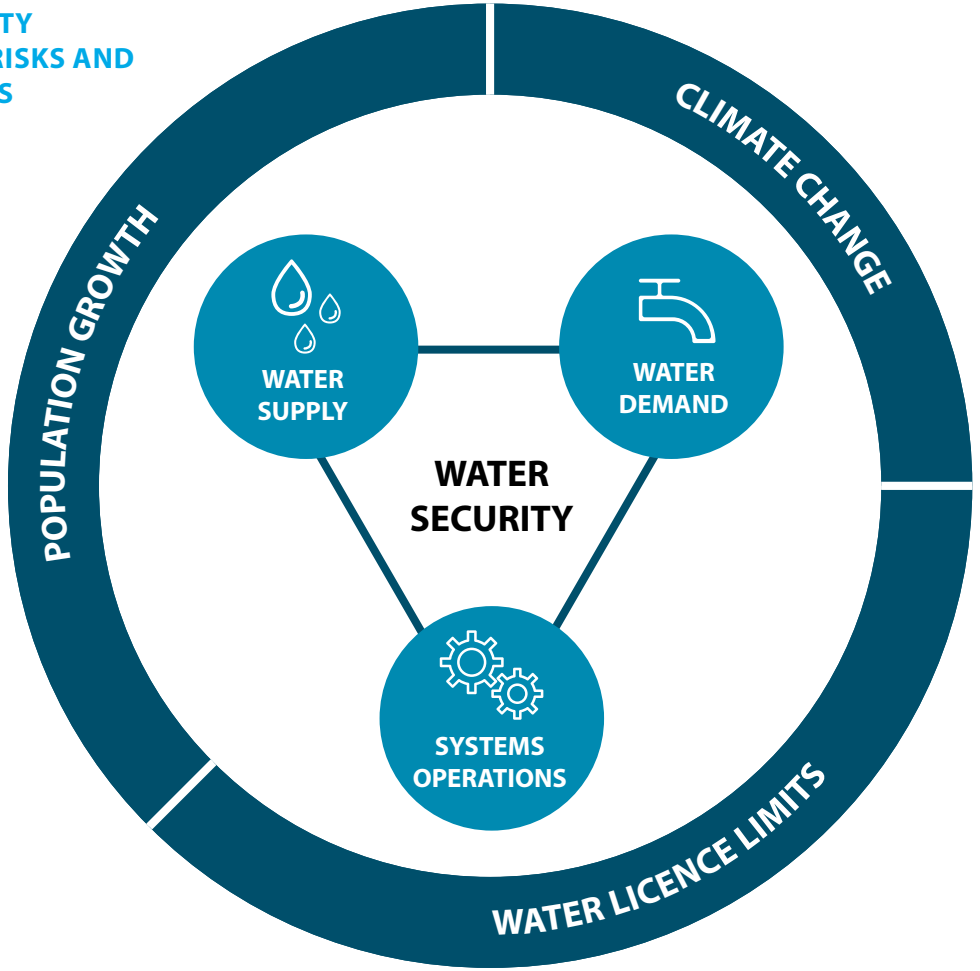
Today, The City has a secure water supply serving 1.3 million people daily. The security of this service is achieved by managing Calgary's source water supply, managing demand through water conservation and investing in operational efficiencies in the water treatment and distribution systems. Calgary's future water security outlook will deteriorate if it does not respond to three key risks:

- A changing climate.
- Water licence limits.
- Population and economic growth pressures.

The One Calgary One Water framework provides guidance around the critical question of water security: will there be enough safe clean water to meet the needs of Calgarians while preserving the environment and ensuring a sustainable economy in the future? The framework outlines six priority actions to address these risks to ensure water security is maintained into the future:

1. Develop future water supply scenarios.
2. Address water licence limits on high demand days.
3. Ensure collaboration on a regional solution for water security.
4. Advocate for a new upstream reservoir on the Bow River.
5. Finalize the Drought Management Plan.
6. Implement the Source Water Protection Plan and Policy.

WATER SECURITY FRAMEWORK RISKS AND ACTION LEVERS

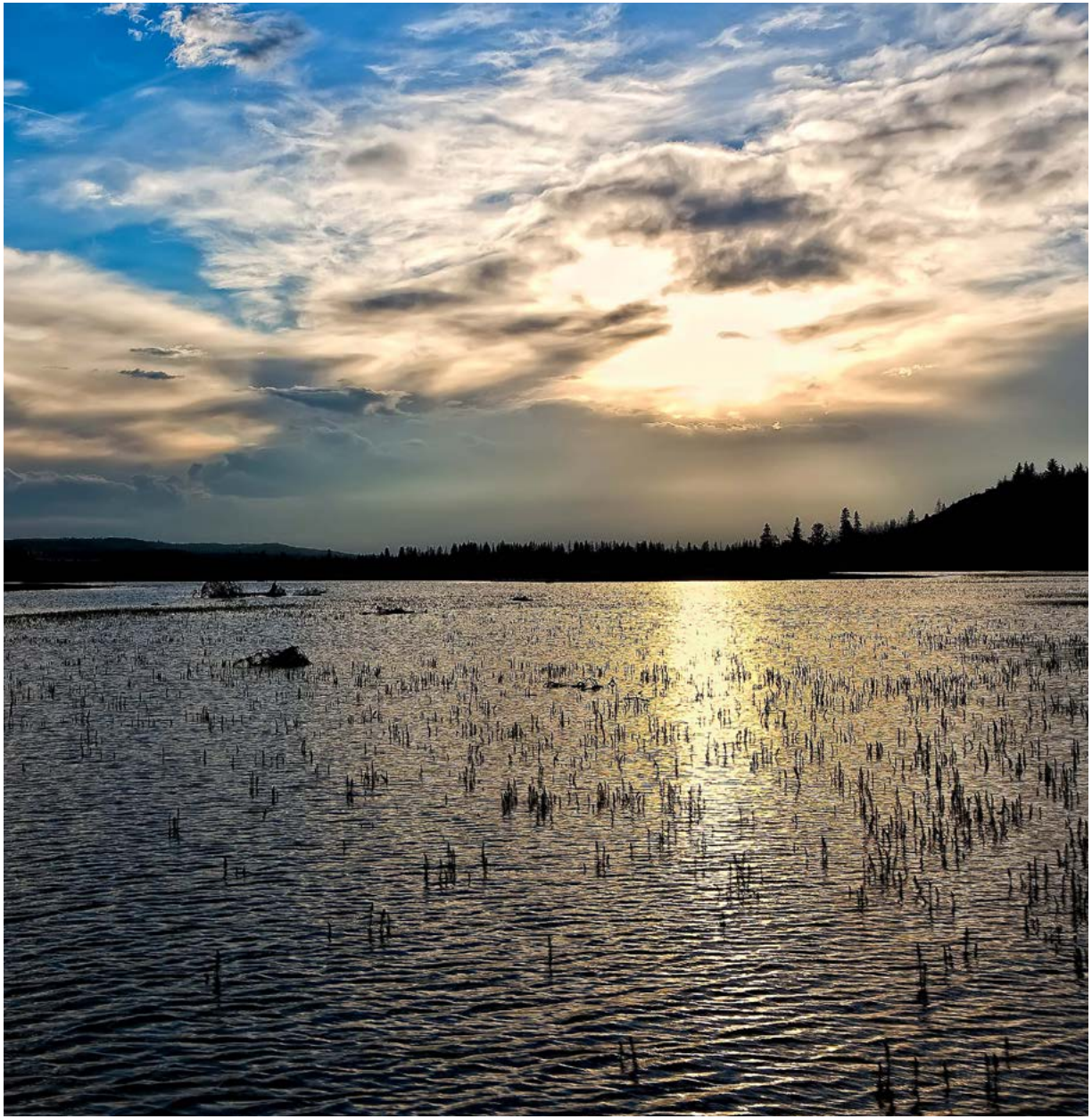


Protecting the Water Supply

Calgary's water supply is dependent on the quality and quantity of the source water upstream of its two water treatment plants, and the ability to withdraw source water to meet water demand. Calgary has two sources of drinking water. The Bow River supplies the Bearspaw Water Treatment Plant and the Elbow River, which flows into the Glenmore Reservoir, supplies the Glenmore Water Treatment Plant.

Our water supply is fundamentally changing. River flows and water quality seen in the past will be different in the future because of a changing climate. Population and economic growth also put pressure on Calgary's water supply, so we need to ensure growth, land use and other decisions include water supply and water quality considerations.

Calgary's Source Water Protection Plan vision is that "Our source watershed continues to provide clean, high quality water to the region, through proactive stewardship and management". As Calgary's population continues to grow, so does the demand and impacts on the rivers.



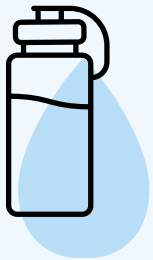
Targets | **City Targets**

GOAL	OUTCOMES	TARGETS
Protect our water supply.	Risks to our source water are reduced so that our source watershed continues to provide clean, high quality water to the region. Water security ensures enough safe water for human well-being, ecosystem resilience and economic activities now and in the future.	▪ Maintain Federal Water Quality Index (WQI) at `Good' or `Excellent' in Calgary's source water. ▪ Future targets to be developed.
Use water wisely.	Effective water efficiency and conservation programing enables The City to continue to supply all Calgarians with the water they need, even as the population increases over time.	▪ Reduce per capita water consumption by 30 per cent from 2003 levels, to 350 litres per capita per day, by 2033. ▪ Keep The City's total water withdrawals from the Bow and Elbow rivers below the 2003 benchmark of 212,500 megalitres per day.
Build resiliency to flooding.	Public and private lands are protected from overland flood damage, and the risks and potential impacts of flood events are clearly understood by residents.	▪ Zero properties at risk of overland flood damage in a 1:100 flood by 2032.
Keep rivers healthy.	Healthy riparian and aquatic ecosystems are commonplace throughout Calgary's river valleys. Urban development and human activity has negligible impact to the health of the rivers.	▪ Average Riparian Health Score of 72 per cent by 2026. ▪ Keep Total Suspended Solids (TSS) loadings below Provincial loading objectives (remain below 52,920 kilograms per day in the Bow River from stormwater and treated wastewater). ▪ Keep total phosphorus loadings from The City below 340 kilograms per day.

Fact Sheet | **Calgary's Drinking Water**

97 per cent of Calgarians are satisfied with their drinking water quality. The City works hard to ensure all Calgarians have a safe and reliable supply of drinking water through Calgary's water treatment plants that operate 24 hours a day, 365 days a year.

As water travels from the mountains and foothills, through the water treatment plants, across the city through the distribution system and to customer taps, Calgary's water is tested at every step to ensure its quality is maintained and meets or exceeds the Guidelines for Canadian Drinking Water Quality.



97%

of Calgarians are satisfied with drinking water quality

Fact Sheet | **Water Usage**

In the mid 1980s, The City was planning its expansion of the Bearspaw Water Treatment Plant to produce more drinking water. At that time, demand was 750 litres per capita per day. It was clear that the ability to service at that demand level was unsustainable. Since that turning point, The City has invested over $700 million to improve efficiencies through water treatment plant upgrades, water metering, leak detection, main replacement, and educational programs. These actions have helped ensure Calgary's water security despite population growth and a changing climate and today the per capita target is 350 litres per capita per day.

In 2020, Calgary's per capita water demand was 354 litres per capita per day, keeping Calgary well on track to meet the 2033 target.

The one day in a year that customers use the most water is referred to as the peak day demand. This typically occurs in the summer months, as water demand can spike from outdoor watering activities and cooling. In 2020, Calgary's peak day water demand was 655 megalitres which occurred on August 17. This amount remains below the 950 megalitres threshold which is the current capacity of Calgary's water treatment plants. This means Calgary can continue to provide water for 1.46 million people on a peak day.

Per capita water consumption target

350L/Day by 2033

Calgary is on track to meet the target with the per capita water demand reaching

354L/Day in 2020

Calgary has invested

$700 million +

over the last several decades

Peak Day Demand

usually happens in the summer

Calgary's water treatment plants can produce a maximum of:

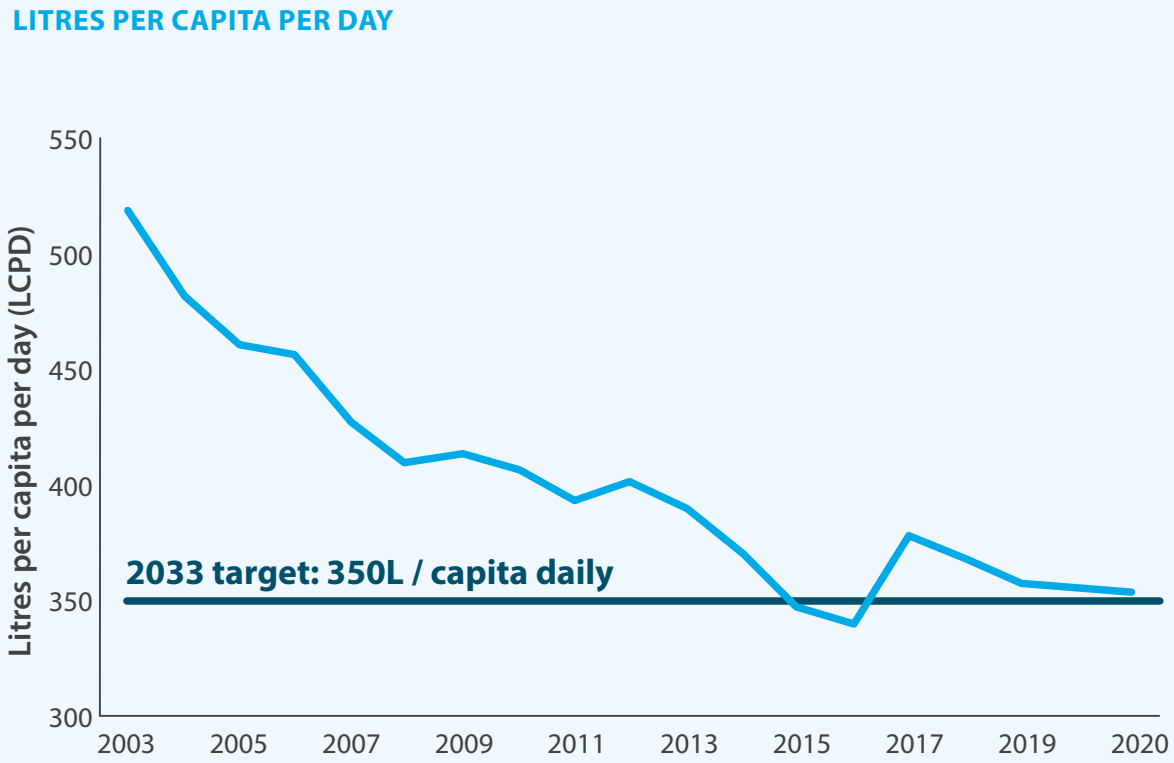
950 mega litres/day

Meaning, Calgary can provide water for

1.46 million

people on a peak day

Fact Sheet | **Water Usage**



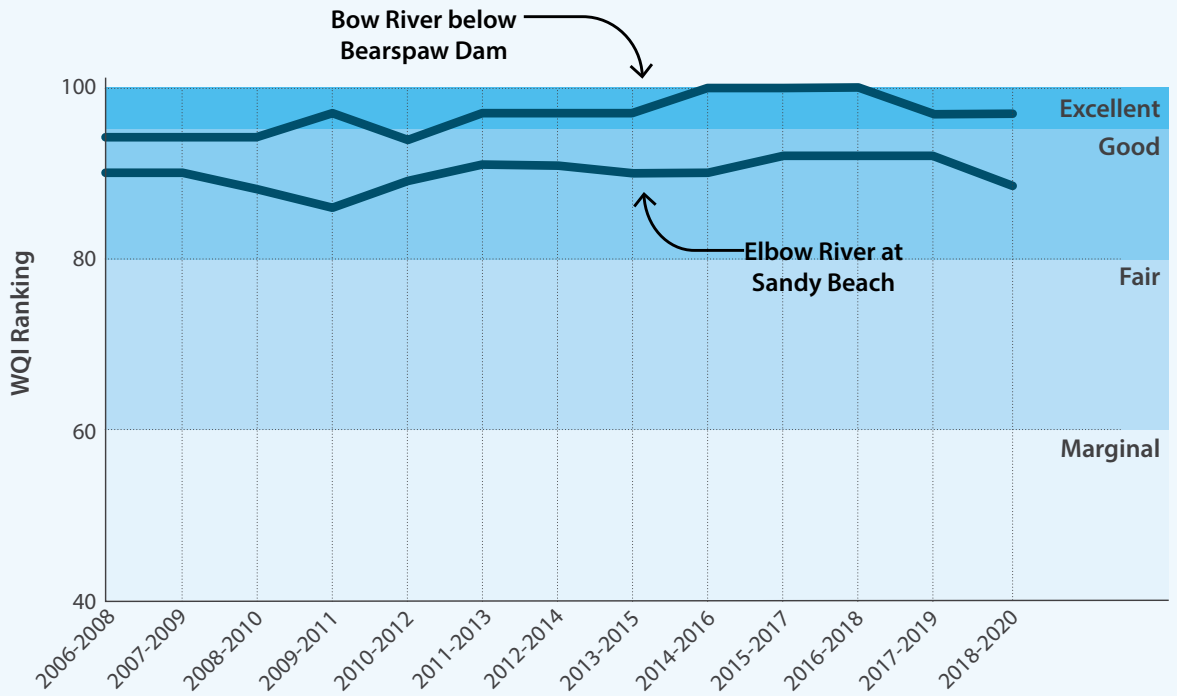
Fact Sheet | **Water Quality Management**

Calgary's Source Water Quality

The federal Water Quality Index (WQI) translates data from multiple water quality parameters into a single score. The WQI measures dissolved oxygen, pH, conductivity, total nitrogen, and total phosphorus. Both the Bow River near the Bearspaw Dam and the Elbow River near the Glenmore Reservoir provide a very high-quality water supply to The City's water treatment plants.

The Bow River typically has 'Excellent' water quality, while the Elbow River typically has 'Good' water quality. The lower flow rates of the smaller Elbow River result in higher sensitivity to water quality conditions, so guidelines are more often exceeded. Over the last decade, consistently high WQI ratings have been observed near The City's water treatment plants. This means the water is easier to treat before it goes to customer taps.

WATER QUALITY INDEX RANKING



Fact Sheet | **Stormwater Management**

The city's expansion creates a huge catchment area for stormwater falling within the city's borders. The Water Utility manages water from rain or snow/ice melt by either collecting, storing, or moving it into the nearest river or creek through storm drains, pipes, and ponds. Parts of Calgary's stormwater system are designed to limit the sediment going into the river, ensuring healthy rivers and riverbanks and allowing the quality of the rivers to be maintained for Calgarians and downstream users. Stormwater management is a key component in the design of vibrant, safe, and resilient communities.

Calgary's stormwater drainage system contains over 300 wet and dry storage ponds. These ponds reduce the amount of sediment and other pollutants entering the rivers. They also provide some localized flood mitigation by holding stormwater during high rainfalls, releasing it slowly back into The City's stormwater system.

The City's Stormwater Pollution Prevention program ensures customers and City staff plan, implement, and monitor effective practices to reduce stormwater pollutant loadings from construction activity and ensure regulatory compliance. Construction activity in Calgary exposes highly erosive subsoil, which is easily transported by wind and water. Ongoing management and monitoring is necessary to protect the watershed and infrastructure from the impacts of construction site sediment.

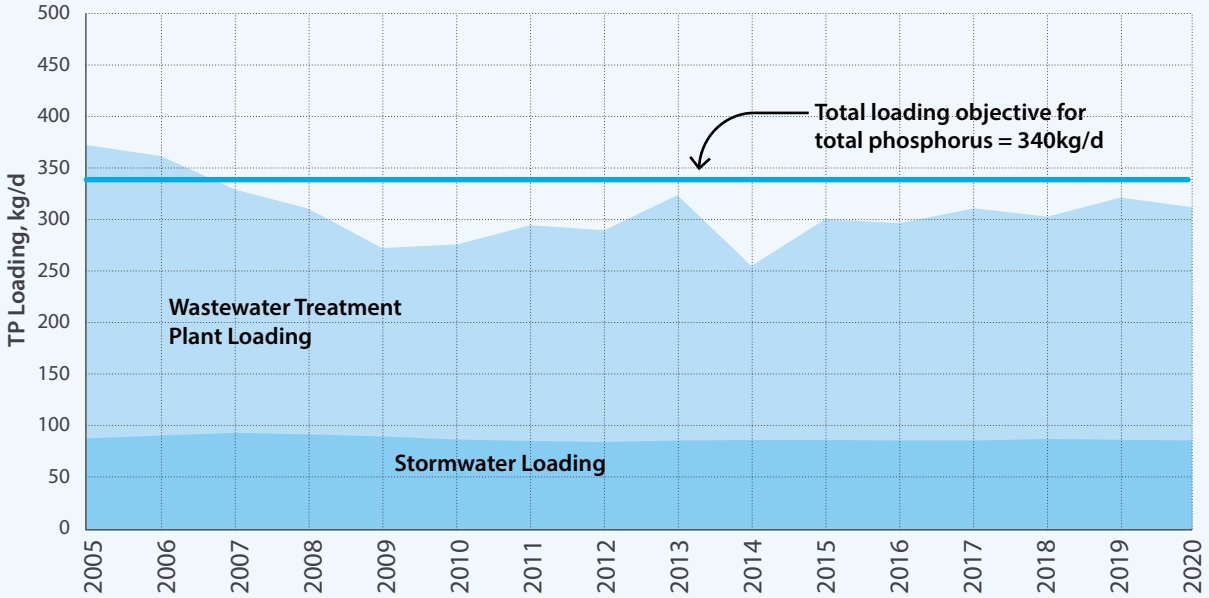
The City constructs stormwater quality retrofit projects such as wet ponds or constructed wetlands to improve water quality by removing solids and other pollutants before it enters our rivers. These projects help improve stormwater management in established communities.

Fact Sheet | **Total Phosphorus Loading**

Phosphorus is an essential element for plant life, but when there is too much of it in water, it can over stimulate algae growth in water bodies. Algae blooms can use up available oxygen supplies, threatening the survival of fish and other aquatic organisms.

The primary source of phosphorus entering the Bow River in Calgary is from treated wastewater effluent, with the remaining amount contributed by stormwater. In 2020, the Total Phosphorus (TP) entering the river from both stormwater and wastewater remained below the Provincial objectives, demonstrating that Calgary's wastewater treatment continues to be effective. Treated wastewater contributes more than double the amount of phosphorus to the Bow River compared to stormwater, and The City's wastewater treatment plants ensure phosphorus loading into the rivers is limited.

TOTAL PHOSPHORUS LOADINGS FROM THE CITY

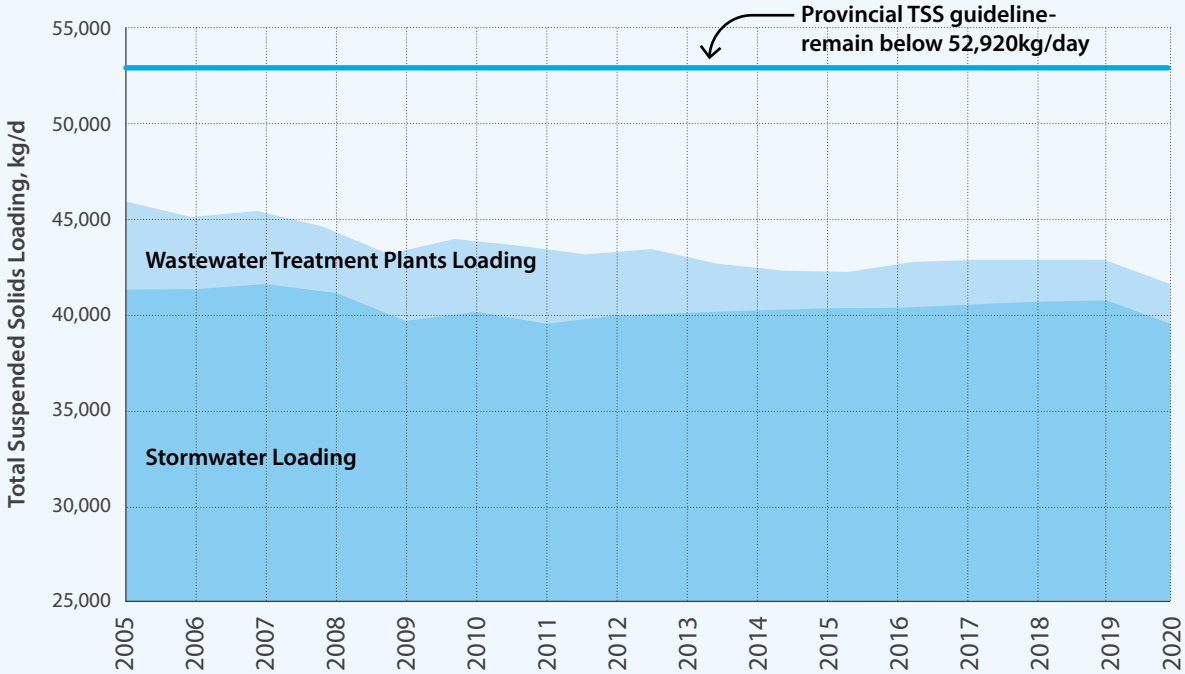


Fact Sheet | **Total Suspended Solids**

Stormwater and treated wastewater contain total suspended solids (TSS), which include organic and inorganic materials, specifically, anything drifting or floating in the water, from sediment, silt, and sand to plankton and algae. Total suspended solids are a significant factor in the clarity of water. The more solids present in the water, the less clear it is. Murky water can impact fish habitat, and reduce the beauty of the rivers.

Urban runoff from stormwater contributes a significantly higher proportion of total suspended solids to the Bow River compared to wastewater effluent. In 2020, estimated TSS loadings from stormwater to the Bow River were 39,471 kilograms a day, which is below The City's 2005 benchmark. This demonstrates the effectiveness of The City's stormwater quality investments and pollution prevention programming, especially accounting for the pressures placed on the stormwater system from growth and urban expansion.

TOTAL SUSPENDED SOLIDS LOADING



Fact Sheet | **Riparian Area Health**

Riparian areas are the areas along the edges of creeks, rivers and other water bodies. They are transitional areas between the land and aquatic systems. The City's Riparian Action Program is a comprehensive and coordinated approach to protect riparian areas in Calgary. Healthy riparian areas mitigate flood impacts, and provide a buffer that helps with water quality by trapping sediment, reducing erosion, and filtering or absorbing nutrients and contaminants before they reach the rivers.

Riparian areas are also important wildlife corridors and storehouses of biodiversity, especially within an urban context. The riverfront parks in Calgary are cherished places where people can relax, play, and commute. By ensuring riparian areas are well-managed and well-maintained, these natural areas will continue to provide valuable ecosystem benefits to all Calgarians.

Riparian restoration projects lead to more resilient natural infrastructure that provides protection against floods and erosion and improves water quality. The City continually works to improve riparian health and restore riparian areas through bioengineering and riparian planting projects. Bioengineering is an approach to riverbank engineering that incorporates living plants with natural and synthetic support materials to stabilize slopes and reduce erosion. Riparian planting projects use native vegetation with deep-rooted plants that stabilize riparian areas.

The City also monitors changes in city-wide riparian health conditions along the Bow River, Elbow River, Nose Creek and West Nose Creek. The City uses the Cows and Fish Riparian Health Inventory methodology which draws on vegetation, soil, and waterway inventories to produce a single score for key riparian areas.

2020 marked the third year of The City's 5-year Riparian Monitoring Program. The City tracks progress towards its 2026 riparian health restoration target and prioritizes future restoration and conservation efforts as part of an adaptive management approach. Over 100 sites are being monitored to evaluate riparian health trends. The 2020 analysis showed an improvement in riparian health compared to baseline (2007-2010) conditions. These results demonstrate that the restoration investments made by The City are improving the health of the waterways.

65%
Average riparian health score

72%
Target riparian health score by 2026

Fact Sheet | **Flood Resiliency**

The City's Flood Resilience Plan relies on a combination of upstream, community, and property-level flood mitigation measures to ensure that Calgary becomes more resilient to river flooding, despite climate uncertainty and continued urban development. The activities in the Plan include both actions by The City and major projects upstream of Calgary by the Government of Alberta to mitigate the risk of flooding to at least a 2013-level flood throughout Calgary. The Plan aims to balance the safety and resilience of river communities while ensuring they remain great places to live.

Since 2013, significant progress has been made to reduce flood risk in Calgary by approximately 50 per cent. The installation of the new gates at the Glenmore Dam was completed in 2020, doubling the water storage capacity and reducing flood risk on the Elbow River. Also on the Elbow River, the Province anticipates that the Springbank Reservoir will be completed in three years. This will provide significant flood protection to Elbow River communities and the downtown. The City continues to support the Province's work towards an upstream reservoir on the Bow River.

The City continues to focus on implementing community mitigation in areas with the highest flood risk. In addition to completing the Heritage Drive Flood Barrier in 2020, progress continues on the Downtown Flood Barrier which will protect the downtown to a 1:200 flood level, and construction is anticipated to start in 2021 on the Sunnyside Flood Barrier. These are just a selection of the initiatives implemented to improve the flood resiliency of Calgary and its river communities.

In addition to river flooding, The City continues to reduce the risk of stormwater flooding in communities through its Community Drainage Improvements program and smaller Local Drainage Improvement projects. The City's investments in stormwater retrofits, Drainage Improvement Programs, and green stormwater infrastructure help manage the impacts of climate change and a growing city as well as reducing the impacts of localized and river flooding on residents and businesses.

Targets | **International Commitments**

The UNESCO 2030 Agenda and Sustainable Development Goals (SDGs) bring water quality issues to the forefront of international action by setting Goal 6 specifically aiming to:

"Ensure availability and sustainable management of water and sanitation for all".

Water quality is also addressed under other SDGs such as the goals on health, poverty reduction, ecosystems and sustainable consumption and production, recognizing the links between water quality and the key environmental, socioeconomic and development issues (Goals 1, 3, 12, 15 and Targets 1.4, 3.3, 3.9, 12.4, 15.1). The clear focus on water quality in the SDGs demonstrates growing attention on the urgent need to improve water quality worldwide.

Benchmarking | **How Calgary Compares**

The Municipal Benchmarking Network Canada provides an overview of comparable municipalities in the 2019 MBN Canada Performance Measurement Report. This report focuses on infrastructure spending per capita, scaled by the number of treatment facilities. Comparisons are made to municipalities that have full responsibility for all water activities including treatment, transmission, storage and local distribution.

Overall, Calgary spends less on its water treatment and distribution than the median cost for other municipalities in Canada.

	TOTAL COST FOR CALGARY	MEDIAN COST FOR COMPARABLE CANADIAN MUNICIPALITIES
Treatment and Distribution / Transmission of drinking water treated	**$824**	**$1,120**
Distribution / Transmission of drinking water per kilometer of water distribution pipe relative to the number of water pumping stations operated	**$17,465**	**$20,999**

Air

Air Overview

The City of Calgary protects and improves air quality.

Clean air, though often taken for granted, is essential to human health and functioning ecosystems. Calgary is fortunate to have relatively good air quality most of the time; however, there are some poor air quality days throughout the year that can result in adverse health impacts.

Every Calgarian contributes air pollution as a byproduct of their day-to-day lives. The amount of air pollution Calgarians generate is influenced by the design of the city and the choices made about how to get around, how to heat and power the city's homes and buildings, and what products to buy.

Calgarians have experienced the consequences of air pollution firsthand in recent years when blankets of smoke from wildfires have settled over the city, making it hard to see and breathe and limiting the ability to participate in outdoor activities. But there are also less visible impacts of air pollution—day-to-day levels of harmful airborne particles and emissions that cause respiratory problems, particularly for children and seniors. This section will discuss, in greater detail, the air quality trends affecting Calgary and what can be done to improve air quality and health in the coming years.

Measuring Air Quality

There are several ways for cities to measure air quality. The first is monitoring ambient air quality. This involves continuously monitoring the levels of particles and gases in the air that are bad for human health. The ones most commonly measured are: fine particulate matter ($PM_{2.5}$), ozone (O_3), nitrogen dioxide (NO_2), and sulphur dioxide (SO_2). The government of Canada sets Canadian Ambient Air Quality Standards which determine the acceptable limits and triggers for each indicator based on impacts to human health and the environment.[1]

[1] *Canadian Ambient Air Quality Standards* https://www.alberta.ca/canadian-ambient-air-quality-standards.aspx

4 main particles and gases measured to determine air quality

Ozone
O_3

Sulphur Dioxide
SO_2

Nitrogen Dioxide
NO_2

Fine Particulate Matter
$PM_{2.5}$

To help jurisdictions manage air quality, Canada also established a national air quality management system. This system uses the limits and triggers from the Canadian Ambient Air Quality standards to identify four management levels of action required when an indicator surpasses a threshold. This serves as a warning system, identifying air quality issues early so that actions can be implemented to resolve them. Red, or Level 4, is the most serious level, meaning that a limit has been exceeded. These levels are used in the management plan for the South Saskatchewan Region, which includes Calgary.[1]

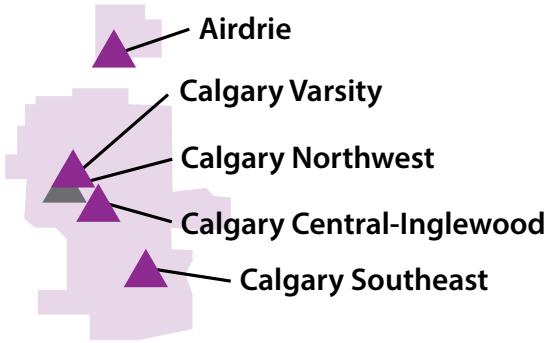
Environment Canada's Air Quality Health Index is the most familiar measurement to the general public, as it is widely reported when wildfire smoke impacts the city.[2] This is an additional tool providing real-time measurements of ambient air pollution, as well as offering health guidance in the event of elevated air quality risks. The index provides a scale of lowest to highest risk from 1 to 10.

Calgary is in the Calgary Region Airshed Zone (CRAZ), which monitors Calgary's air continuously at three stations: Central/Inglewood, Southeast, and Varsity (which just replaced the former Northwest station in 2018).

AIR QUALITY HEALTH INDEX

MANAGEMENT LEVEL	AIR QUALITY OBJECTIVE
Green	To maintain good air quality through proactive air management measures to keep areas clean.
Yellow	To improve air quality using early and ongoing actions for continuous improvement.
Orange	To improve air quality through active air management and prevent exceedance of the CAAQS.
Red	To reduce pollutant levels below the CAAQS through advanced air management actions.

MONITORING STATIONS IN THE CALGARY REGION



[1] *South Saskatchewan Regional Plan* https://open.alberta.ca/publications/9781460139417

[2] *Air Quality Health Index Messages* https://weather.gc.ca/air_quality/healthmessage_e.html

Health Impacts of Poor Air Quality

In 2019, Health Canada conducted a study of overall health impacts from poor air quality across the country. The study showed that reducing ambient air pollution in Calgary and the surrounding area could save lives and an estimated $2.94 billion in economic losses and healthcare costs. On average, 377 people die prematurely each year in the Calgary region from the impacts of air pollution. Poor air quality also intensifies chronic respiratory diseases such as asthma and bronchitis, which affects almost one in ten Canadians (or roughly 147,000 people in the Calgary region). People suffering from respiratory diseases will experience an average of nine symptomatic days per year due to human caused air pollution, costing the regional healthcare system $21.7 million per year to address.

Even people free from chronic respiratory conditions are still affected by air pollution. Calgarians experience an average of three restricted activity days per year due to human-caused air pollution. This costs the economy approximately $28.3 million per year.

Reducing air pollution in the region would result in fewer restricted activity days and decreases in respiratory and asthma symptom days, bronchitis cases, hospital visits, and premature deaths.

370+

die prematurely from impacts of air pollution

Reduce ambient air pollution

saves lives & money

Estimated $2.94 billion in economic losses and healthcare costs

Approximately

9%

of Canadians suffer from respiratory diseases, and experience an average of 9 symptom days/ year from air pollution

9 symptom days costs the healthcare system

$21.7 million/year

approximately

The average Calgarian experiences 3 restricted activity days per year from air pollution, resulting in

$28.3 million/year

in economic losses

Targets | **City Targets**

GOAL	OUTCOMES	TARGETS
Calgarians recognize the importance of air quality to their health and wellbeing and are working collaboratively to protect the airshed (2020 Sustainability Direction).	Air quality is maintained and protected, and it sustains healthy ecosystems. Calgarians value the quality of clean air, have access to relevant air quality information, and are made aware of any related health risks.	▪ Calgary's air quality meets or surpasses national and provincial air quality standards objectives, and guidelines. ▪ Calgary's air quality is consistently measured as "low risk" to human health, using the Air Quality Health Index (AQHI). ▪ Air contaminates from City of Calgary operations are reduced.

Calgary is part of the **South Saskatchewan Regional Plan,** which sets out targets and management levels for air quality. Currently, the overall air quality objectives and limits identified in the South Saskatchewan Regional Plan are being met. However, Calgary is exceeding some of the proactive triggers, meaning that **action is required to maintain concentrations below the limits.**

Fact Sheet | **Air Quality**

Ambient Air Quality Sources and Trends

The following table provides a summary of recent trends in air quality in Calgary. The trends are influenced by meteorological changes and changes to monitoring standards, and are not a statistically significant indication of trends over time.

MEASURE	MAIN SOURCES	STATIONS	ANNUAL TREND (2014-2018)	MANAGEMENT LEVEL
Fine Particulate Matter (PM2.5)	Construction and Transportation	Central / Inglewood	↑	No data
		NW	↑	**Level 3 (2013)**
		Varsity	No data	Opened June 2018 (no data)
		SE	↑	No data
Ozone (O3)	This is not directly emitted, but forms as a result of chemical reactions between sunlight, NO2, and Volatile Organic Compounds.	Central / Inglewood	↓	**Level 2 (2018)**
		NW	↑	**Level 2 (2018)**
		Varsity	No data	Opened June 2018 (no data)
		SE	↓	**Level 2 (2018)**
Nitrogen Dioxide (NO2)	Combustion sources including Transportation and Upstream Oil and Gas (such as power generation)	Central / Inglewood	↑	**Level 3 (2013)**
		NW	↑	Decommissioned May 2018 (no data)
		Varsity	No data	Opened June 2018 (no data)
		SE	↑	**Level 2 (2018)**
Sulphur Dioxide (SO2)	Primarily industrial sources and Upstream Oil and Gas	Central / Inglewood	No data	(no limit set)
		NW	No data	
		Varsity	No data	
		SE	↑	

Fact Sheet | **Trends**

Trends from 2014 to 2018 indicate that although the region did not exceed any air quality limits, there were increases in particulate matter and nitrogen dioxide. The sources of this pollution are emissions generated from transportation, construction, and heavy industry/burning of combustibles. It is important to note that changes in levels for these indicators are also influenced by meteorology and changes to the standards.

Particulate matter (PM) concentrations from 2015 to 2017 earned a Level 3 (orange) rating in one of the stations within Calgary (NW Calgary), meaning the levels approached the trigger and proactive action was needed to prevent further increases.[1]

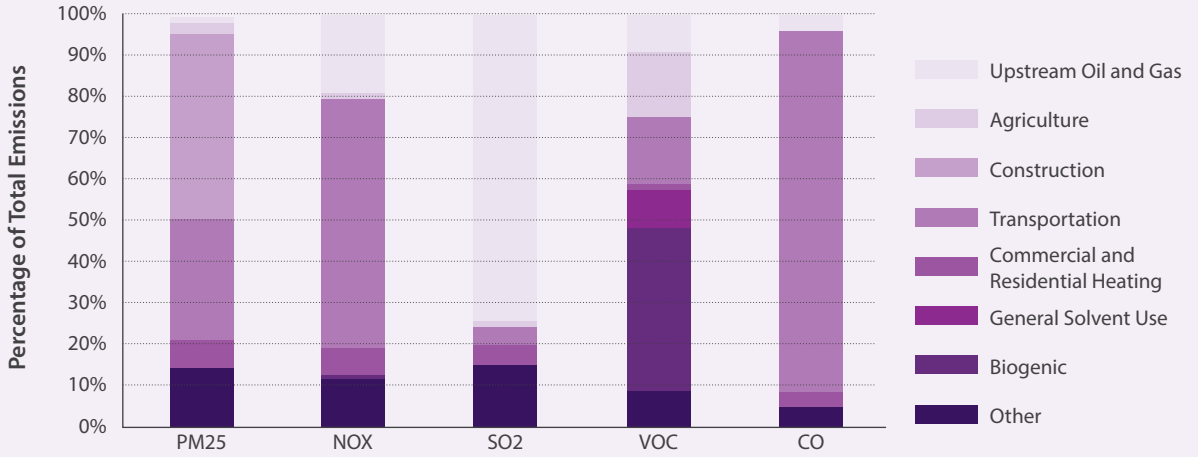
All three stations in Calgary, Central/Inglewood, Southeast, and Northwest (before it was replaced by Varsity), also received a Level 2 (yellow) management level for Ozone (O3) from 2015 to 2017 indicating that additional knowledge and understanding of these trends is needed.[2] Further action may be required to ensure that levels do not rise. Management levels for particulate matter and ozone are not yet available for 2016 to 2018.

Calgary's monitoring station at Central-Inglewood measured ambient concentrations of nitrogen dioxide (NO2) above the upper range trigger for management Level 3 (orange) in 2018. This indicates that action is needed to prevent exceeding the limit.[3] Calgary Southeast Station, meanwhile, surpassed Level 2 (yellow) for nitrogen dioxide, an early warning that concentrations are rising and action is needed.[4]

Currently there is only one station monitoring sulphur dioxide (SO2) concentrations - the Southeast Calgary station, and there has not been a threshold established. Data from that station between 2014 and 2018, however, indicates this measure has also been increasing since 2016.[5]

The Air Quality Health Index indicates that Calgary sees reduced air quality events most often from May to August. Significantly reduced air quality was seen during this period in 2015, 2017, and 2018.

EMISSION SOURCES IN THE CRAZ REGION (2008)



[1] Alberta Air Zones Report 2015-2017 https://open.alberta.ca/publications/9781460145692

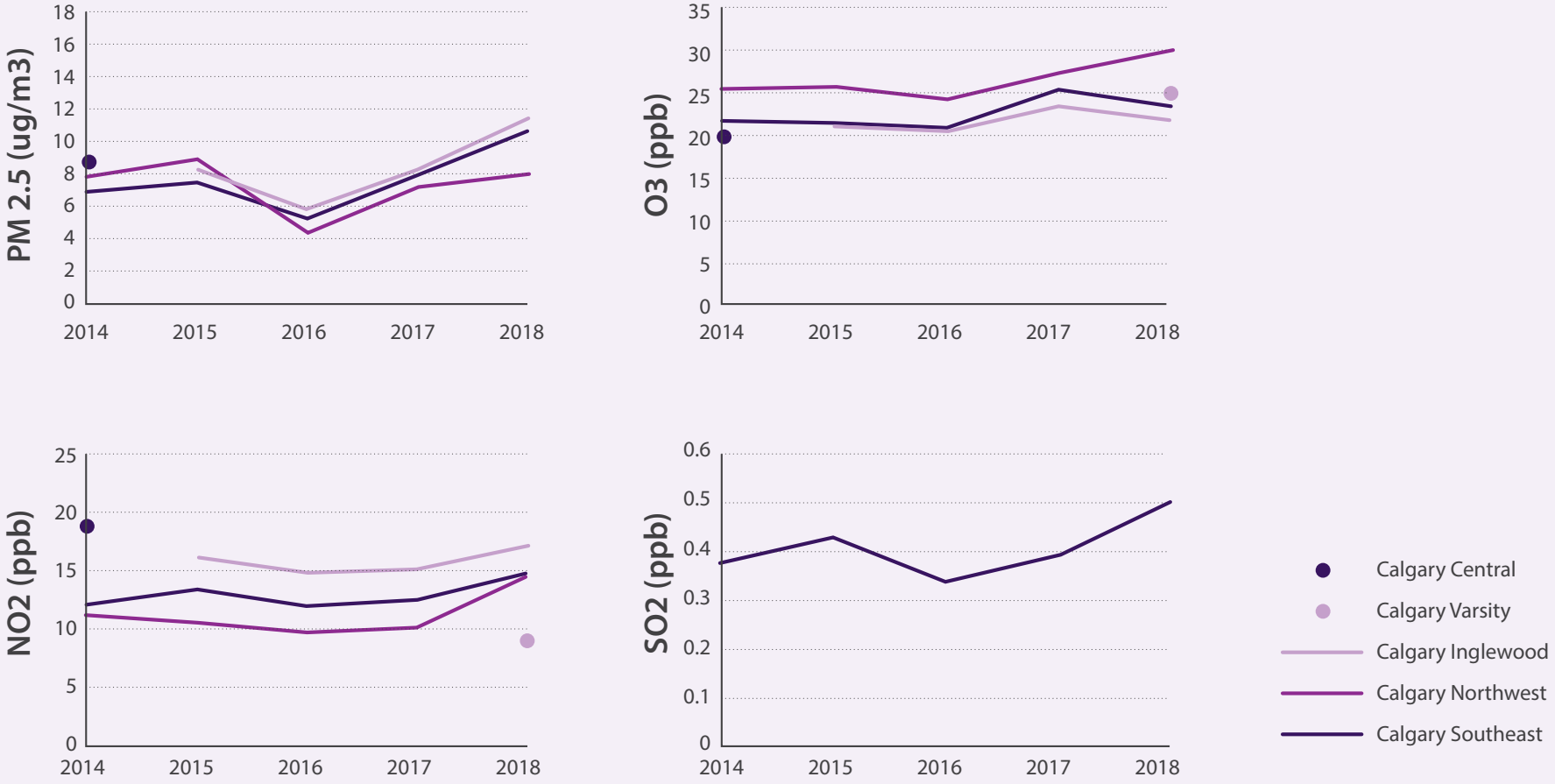
[2] Alberta Air Zones Report 2015-2017 https://open.alberta.ca/publications/9781460145692

[3] Alberta Environment and Parks (2020). 2018 Status of Air Quality South Saskatchewan Region.

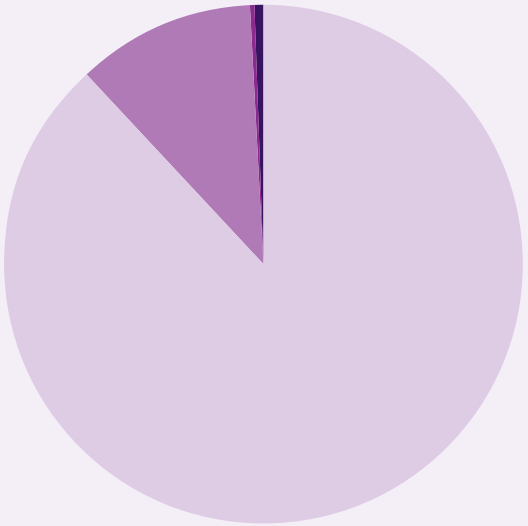
[4] Alberta Environment and Parks (2020). 2018 Status of Air Quality South Saskatchewan Region.

[5] Calgary Region Airshed Zone. (2019). Calgary Region Airshed Zone Air Quality Management Plan.

MONITORING TRENDS (2014-2018)



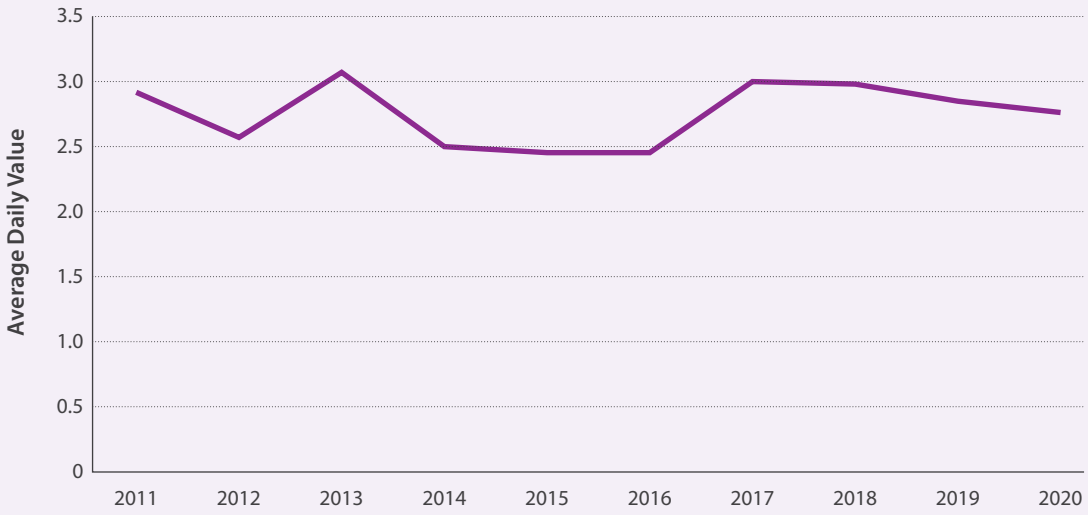
As mentioned earlier, an air quality level between 1.0 and 3.0 is low risk and the graph below shows that Calgary's air quality largely falls within that risk category. Looking at 2019, the pie chart to the right, there is a small percentage of time that air quality exceeds the low risk category.



2019 PERCENT OF DAYS PER RISK LEVEL

- 0.3% High/Very High
- 0.2% Very High
- 0.1% High
- 11.1% Moderate
- 88.3% Low

AIR QUALITY HEALTH INDEX OVER TIME



Targets | **International Commitments**

The City of Calgary is a party to a number of international commitments to protect air quality, both on its own and as part of larger federal pledges.

The City has signed the **World Energy Cities Partnership Calgary Climate Change Accord**, committing Calgary to support actions that will reduce municipal greenhouse gas emissions to 20 per cent below 2005 levels by 2020.

Canada is party to the **Gothenburg Protocol to Reduce Transboundary Air Pollution**, which has involved implementing a comprehensive approach to reducing air pollution, the Air Quality Management System (AQMS). The AQMS has established standards for fine particulate matter, ozone, nitrogen dioxide and sulphur dioxide and informed regulatory changes for air quality management in Canada.

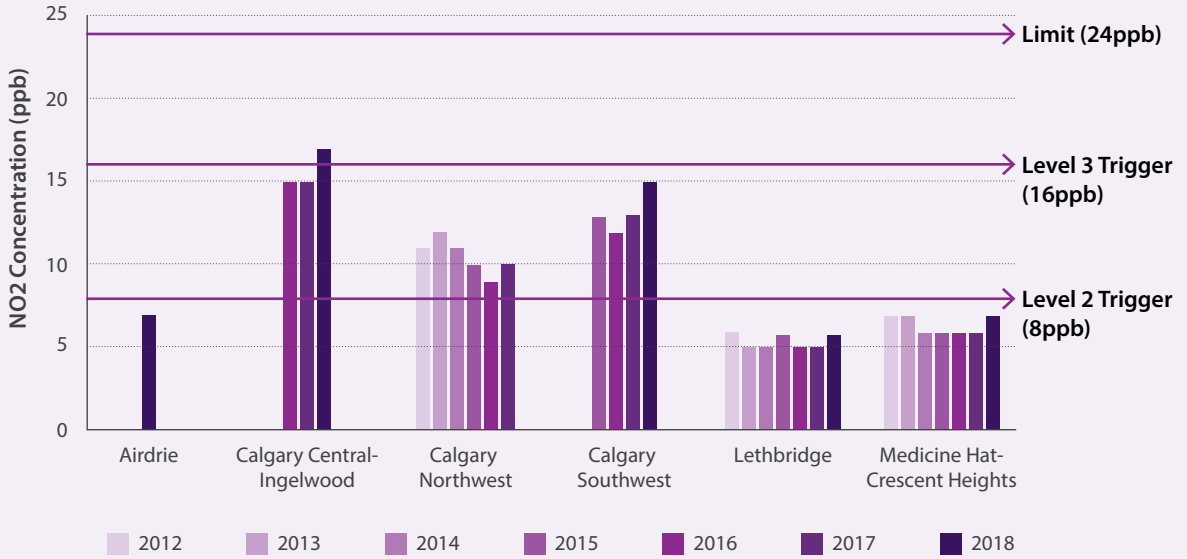
The **Canada-US Air Quality Agreement** is a commitment to reduce transboundary air pollution. Under the agreement, sulphur dioxide pollution has decreased 63 per cent from 1990 to 2014, and nitrogen dioxide has decreased 53 per cent from 2000 to 2014.

Canada is a lead signatory of the **Montreal Protocol on Ozone Layer Depletion**, an international commitment to reduce the use of ozone-depleting chemicals called chlorofluorocarbons (CFCs). As a result of the Montreal Protocol, the ozone layer is expected to recover over most of the globe—by mid-century for the Arctic and mid-latitudes and a little later for the Antarctic region. The ozone layer is two per cent below the pre-1980 benchmark (indicating a minimum recovery threshold) on the global scale and about 3.5 per cent below the benchmark over the north mid-latitudes which includes most of Canada.

Benchmarking | **How Calgary Compares**

Air quality at Calgary's three air monitoring stations saw the highest levels of nitrogen dioxide in the South Saskatchewan Region, compared to measurements in Airdrie, Lethbridge, and Medicine Hat.

ANNUAL AVERAGE OF THE HOURLY DATA (2012-2018) FROM AIR MONITORING STATIONS IN THE SOUTH SASKATCHEWAN REGION FOR NO2



Waste

Waste Overview

The City of Calgary is committed to a long-term target of zero waste and works collaboratively with customers and partners in the community in pursuit of that goal.

Alberta generates and disposes of more waste per capita than any other province in Canada. In 2020, Calgary disposed of 417 kilograms of waste per capita.

When waste ends up in landfills or in the environment, it takes up land and creates pollution. Lands remain contaminated for many years as it takes a long time for garbage to break down. Landfills also release greenhouse gases, including methane, which is a significant contributor to climate change. Additionally, water passing through landfills creates leachate, a harmful liquid garbage that must be contained and treated. Calgary is better able to contain this contamination and cap landfills so that they can be used for other purposes, but constant monitoring is still required to ensure they are not impacting surrounding areas and natural systems.

The City has made significant progress on reducing the amount of waste sent to its landfills. The City introduced household recycling collection with its Blue Cart program in 2009 and expanded into household compostable waste pickup with its Green Cart program in 2017. Through these two initiatives and other programs to encourage waste reduction, Calgary has decreased the amount household waste going to landfills by 46% per cent from 2014 to 2019—a significant step forward for waste reduction. Commercial and industrial waste have also been trending downward. Much work remains, however, to meet The City's ambitious long-term goals of becoming a zero waste city and shifting to a circular economy.

Waste per capita

417kg

Calgary, 2020*

*does not include waste disposed in private landfills

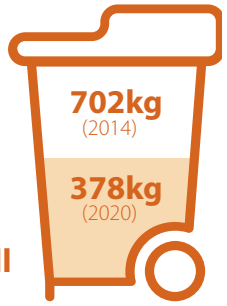
Blue Cart → 2009

Green Cart → 2017

Resulted in a

46%

reduction in household waste going to the landfill



Measuring Waste

When looking at waste and its environmental impacts, it is important to understand the waste management hierarchy. The waste management hierarchy prioritizes management actions by their ability to minimize the impact of the waste.

First, products and systems can be redesigned to generate less waste. Next, The City is looking to reduce the overall amount of waste created. The City can track this by monitoring how much waste is disposed of in Calgary each year. Ultimately, this is the starting place for lowering the city's environmental footprint. The less waste the city produces, the less space and resources needed for waste facilities and the less pollution generated.

Total waste is measured in tonnes, and can be looked at from a city-wide perspective, or as an average amount per person. The City also tracks waste generation by sector to understand which activities create the most waste. Different sectors produce different types of waste, such as household waste, commercial waste, construction waste, and industrial waste. It is often difficult to measure non-household waste, however, because it is not directly collected by The City and may sometimes be disposed of in private landfills or diverted to private processors of recyclables and organics.

The next levels on the waste management hierarchy are reuse and recycling/composting. To measure these, The City monitors how much waste diverted from the landfill by tracking where it is going instead. Specifically, The City tracks how much waste is going to City recycling and composting programs. One challenge with measuring diverted waste is that it is difficult to track how much of the diverted waste is contaminated. Often the recycling and compost collected in Green and Blue Carts have items that should not be in them, and this can sometimes lead to entire batches of waste being unable to be recycled or composted. This waste ends up having to go to the landfill anyways.

Finally, The City tracks how much waste falls into the last management category: recover/dispose. This means the amount of waste in The City's landfills or the energy able to be recovered. Landfills can only hold so much waste before they must be capped and a new landfill created. When all of the other actions on the management hierarchy are prioritized, it can prolong the lifespan of existing landfills.

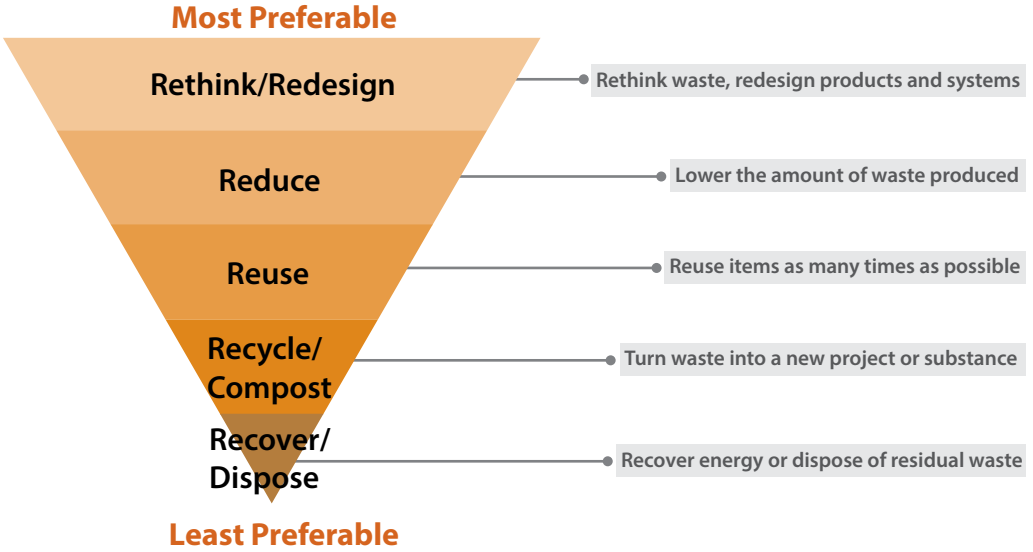
What goes into the landfill?

household waste

commercial / mixed-use waste

construction waste

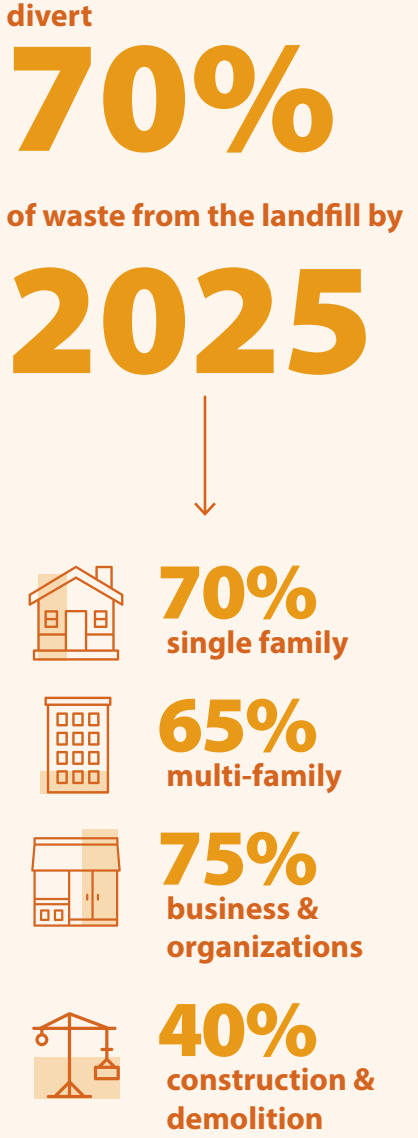
industrial waste



Targets | **City Targets**

GOALS	TARGETS
Reduce waste and increase diversion. ▪ Provide programs and education to help Calgarians reduce and divert their waste. ▪ Work with partners in the community to help Calgarians reduce and divert their waste. ▪ Advocate for government policy and legislation that support and enable waste reduction and diversion. ▪ Manage waste and waste management facilities to protect public health and the environment.	Divert 70 per cent of waste from landfill by 2025 (Citywide) ▪ Single family – 70 per cent. ▪ Multi-family – 65 per cent. ▪ Business and organizations (Industrial, Commercial and Institutional) – 75 per cent. ▪ Construction and demolition – 40 per cent.

The City's **Sustainable Building Policy** guides all City-owned and City-financed facility planning, designing, constructing, managing, renovating, operating, and demolishing and includes a requirement for **diverting at least 80 per cent** of non-hazardous construction and demolition waste from landfill.



Fact Sheet | **Waste Management**

	TREND	TOTAL CHANGE	CURRENT AMOUNT
Total municipal waste to landfill	↓	Down 27 per cent since 2010	545,000 tonnes (2020)
Black cart waste per household to landfill	↓	Down 46 per cent since 2014	378 kg/household (2020)
Total household collected waste (Blue, Green, and Black Carts)	↑	Up 13 per cent since 2010	284,000 tonnes (2020)
Compostable waste left in Black Carts			45 per cent of total Black Cart waste (2019)
Recyclable waste left in Black Carts			16% Blue Cart recyclables 11% other recyclables (electronics, paint, textiles, etc.)
Landfill gas captured	↑	Up 534 per cent since 2010	8,600,000 cubic metres (2020)

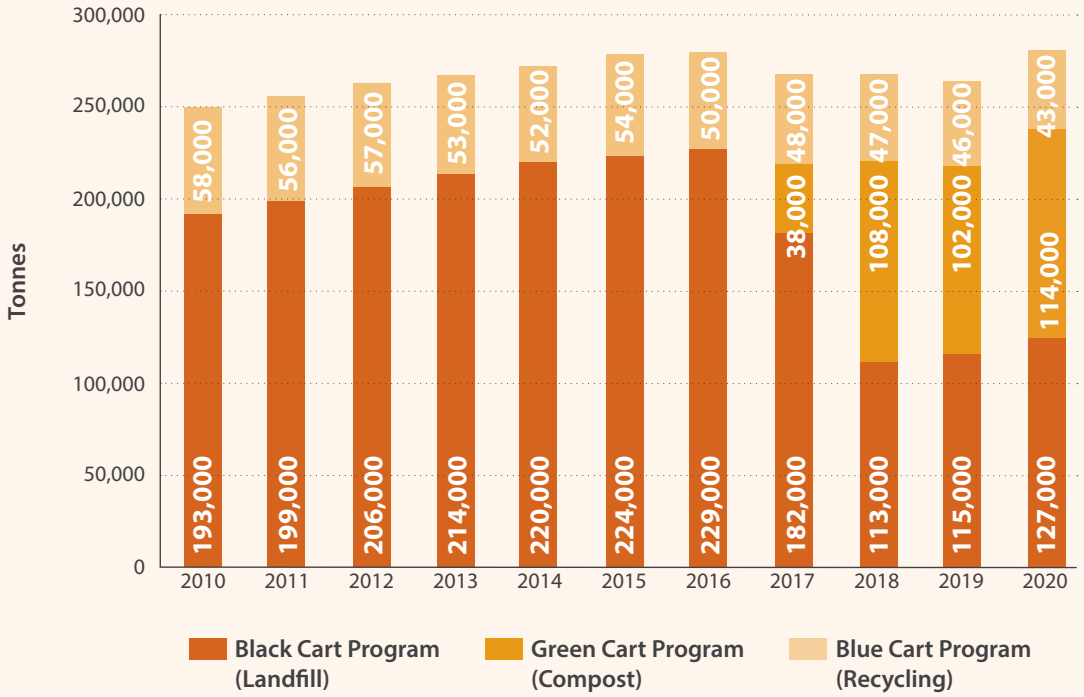
Fact Sheet | **Household Waste**

Although Calgary's growing population has increased the overall amount of waste, the portion going to landfills has declined by 46 per cent per household from 2014 to 2020. This is an encouraging trend towards a more circular economy, with more of the household waste the city produces being repurposed into recycled products or compost rather than ending up in the landfill.

From 2010 to 2016, overall household waste collected through the curbside pickup of the Black, Blue, and Green Carts increased. In 2016, the amount of household waste collected peaked at 279,000 tonnes. Approximately 50,000 tonnes of that household waste was diverted as recycling with 229,000 tonnes going to the landfill that year.

From 2016 to 2019, curbside household waste was decreasing; however, it increased again in 2020. However, a much greater percentage of waste is being diverted to Blue and Green Cart programs. The amount of household waste going to the landfill in 2020 was 34 per cent less than it was in 2010. Note that these trends do not account for waste that households took to the landfill themselves.

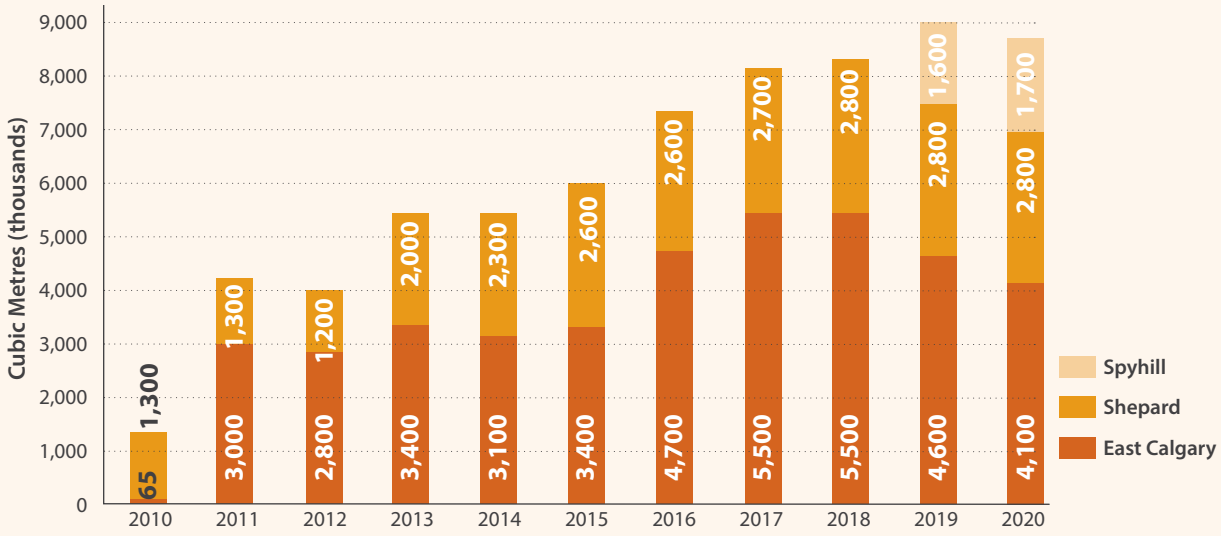
WASTE COLLECTED BY RESIDENTIAL COLLECTION CREWS

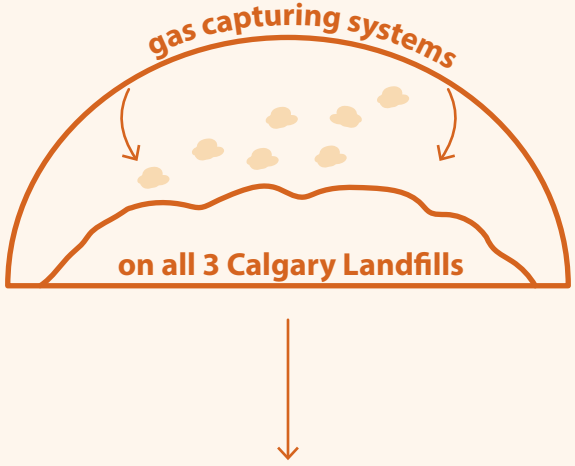


Fact Sheet | **Landfill Gas**

Through advances in technology, Calgary is becoming more efficient at gas capture and conversion systems. The City now has gas capturing systems on all three of its landfills, which reduce greenhouse gas emissions by approximately 70,000 tonnes of carbon dioxide equivalent (CO_2e) annually.

LANDFILL GAS COLLECTED IN CALGARY





Reduces greenhouse gas emissions by

70,000 tonnes

of CO2 equivalent / year

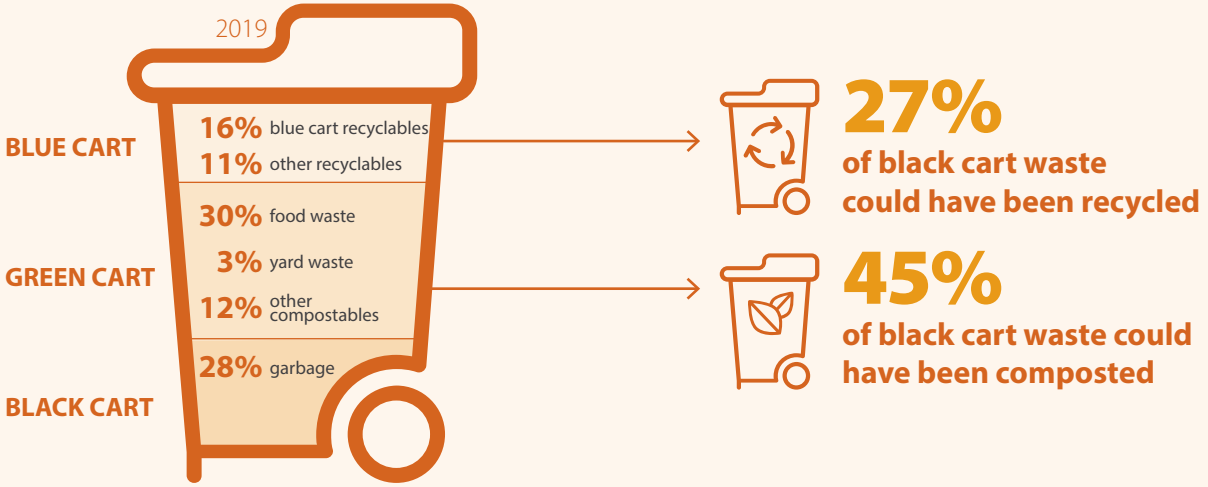
Fact Sheet | **Recycling and Composting**

Two of the most significant challenges Calgary faces in pursuit of its zero-waste target are reducing the amount of recyclable and compostable materials that are still sent to landfills and reducing the contamination of recycled and composted waste.

In 2019, approximately 27 per cent of the household waste sent to landfills could have been recycled, and 45 per cent could have gone in Green Carts. Most of the compostable material that ended up in Black Carts was food waste. There are also increasing amounts of non-recyclable and non-compostable waste ending up in Blue and Green Carts, which can contaminate a significant amount of properly sorted material and result in it ending up in the landfill.

Both challenges result from improper sorting and increasingly challenging packaging materials. Greater awareness and education on waste streams would help to further reduce the amount of Calgary's landfill waste.

The City continues to advocate for the Government of Alberta to enable an Extended Producer Responsibility (EPR) framework, in which producers fund and manage recycling programs for the packaging and paper products they supply into the marketplace. This EPR regulation would reduce Blue Cart program costs, potentially eliminating Blue Cart fees for single-family households. Following from this advocacy work, the Government of Alberta is conducting stakeholder engagement in 2021 to inform regulations that will enable EPR.



Targets | **National Commitments**

The Government of Canada created a plastic waste action plan in June 2019. This plan includes six priority areas and actions that governments can consider when reducing plastic waste. They are:

1. Extended producer responsibility.
2. Single-use and disposable plastic products.
3. National performance requirements and standards.
4. Incentives for a circular economy.
5. Infrastructure and innovation investments.
6. Public procurement and green operations.

Phase 2 (2020) focuses on:

7. Improving consumer, business and institutional awareness
8. Reducing waste and pollution from aquatic activities
9. Advancing science
10. Capturing and cleaning-up debris in the environment.
11. Contributing to global action

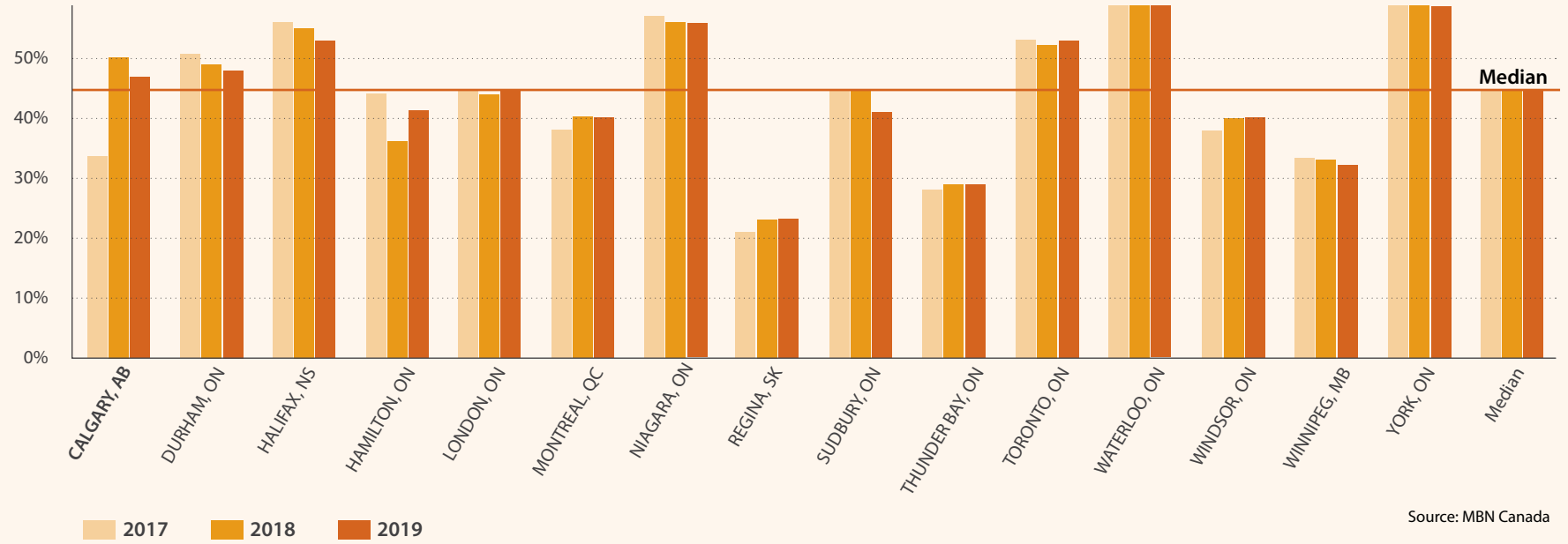
Source: https://www.canada.ca/en/treasury-board-secretariat/services/innovation/greening-government/guidance-reduction-plastic-waste-meetings-events.html

Benchmarking | **How Calgary Compares**

Calgary started its Green Cart program in 2017. Because of this, it saw the greatest change in its waste diversion rates out of all of the municipalities surveyed from 2017-2019 as part of the Municipal Benchmarking Initiative. It is still behind several communities for waste diversion, including Toronto, Waterloo, and Hamilton, but has recently pulled ahead of the median.

PERCENT OF RESIDENTIAL SOLID WASTE DIVERTED

This measure demonstrates the percent of residential waste diverted away from landfills and incineration through programs such as organics, blue box, leaf and yard, municipal hazardous or special waste and other recyclable materials (e.g. wood, metal, tires).



Source: MBN Canada

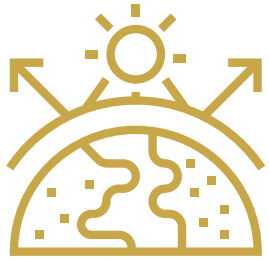
Climate Change Mitigation

Climate Change Mitigation Overview

The planet's climate is changing. There is a protective layer of greenhouse gases in the Earth's atmosphere that acts as an insulator, trapping incoming heat from the sun. This "greenhouse effect" is an important natural process that keeps the planet livable, but it has been amplified dramatically by human-produced emissions of greenhouse gases, particularly the burning of fossil fuels.

Before 1880, concentrations of greenhouse gases remained relatively constant at around 280 parts per million of CO_2e - for 10,000 years.[1] With the dawn of the Industrial Revolution in the 1800s, human emissions began to increase the CO_2e concentration significantly through the burning of fossil fuels, such as coal and petroleum, and the industrialization of agricultural activities.

In addition to increased emissions, land-use changes removed many natural systems that take carbon from the air and store it, such as forests and wetlands. The result has been a dramatic increase in greenhouse gas concentrations in the earth's atmosphere, causing a rise in global temperature of approximately 1°C since 1880. Most of this warming has occurred in the last 50 years, which coincide with the highest concentrations of greenhouse gases in the atmosphere.[2] In 2017, the total concentration of greenhouse gases in the earth's atmosphere reached 454 parts per million CO_2e.



Before 1880, concentrations of greenhouse gases remained relatively constant around

280 ppm of CO_2e

for ten thousand years

in 2017, the total concentration of greenhouse gases in the atmosphere has reached

454 ppm of CO_2e

[1] CO^2 is carbon dioxide gas and CO^2e stands for carbon dioxide equivalents and is a measure of the greenhouse gas effect by converting various greenhouse gases into their equivalent amount of carbon dioxide.

[2] Atmospheric greenhouse gas concentrations https://www.eea.europa.eu/data-and-maps/indicators/atmospheric-greenhouse-gas-concentrations-6

The temperature change associated with the 1°C global increase has been more severe in some parts of the world, including Canada. Alberta has already warmed by approximately 1.4°C since 1880, with warming expected to increase at approximately twice the global average.[1] Globally, a warming of 4°C above pre-industrial levels (1880) is expected by 2100 unless dramatic reductions in human generated emissions are implemented.[2]

Though this may not seem like a significant change on a household thermostat, a global increase of this magnitude has far-reaching consequences for both natural and human environments.

Climate change is both a local and a global issue, presenting the most challenging and complex environmental, social and economic problem of today. Action on climate change will be twofold:

1. **Mitigating** how much the climate will change by reducing emissions and thereby avoiding the most catastrophic impacts of climate change.

2. **Adapting** infrastructure and cities to respond to changes in climate that are already occurring and will continue to occur.

Understanding how the climate is changing and how human populations are contributing to those changes enhances efforts to mitigate climate change. Mitigation involves changing activities and practices to reduce emissions and to store or remove carbon from the atmosphere to slow the pace of climate change. This section will focus on The City of Calgary's efforts to mitigate climate change.

Measuring Emissions

The main greenhouse gases emitted by human activities are carbon dioxide (CO_2) and methane (CH_4). Both the level of emissions being generated and the activities generating the most emissions can be tracked. Usually this is calculated as carbon dioxide equivalent (CO_2e), which measures all greenhouse gases and then translates them into the amount of CO_2 that would create the same amount of atmospheric warming.

Another way to report emissions is per capita. This measure accounts for the size of the population emitting greenhouse gases and then calculates the average emissions produced per person.

Since 1880, the global temperature has risen by 1˚C

Alberta has already warmed up by approximately **1.4˚C**

A warming of 4˚C is expected by 2100

unless dramatic reductions in human generated emissions are implemented

Warming is expected to increase in Alberta at 2x the global average
approximately

[1] *Alberta's climate future: final report 2019 https://open.alberta.ca/publications/albertas-climate-future-final-report-2019*

[2] *Climate Change 2014 Synthesis Report :https://www.ipcc.ch/site/assets/uploads/2018/05/SYR_AR5_FINAL_full_wcover.pdf*

Targets | **City Targets**

GOALS	TARGETS
▪ Improve energy efficiency and reduce GHG emissions. ▪ Support the low-carbon economy.	▪ 80 per cent reduction in city-wide emissions below 2005 levels by 2050.

The **Calgary Climate Change Mitigation Plan** is Calgary's action plan for reducing city-wide greenhouse gas emissions in line with the 2050 target. It identifies actions in five theme areas: Buildings and Energy Systems; Land-use and Transportation; Consumption and Waste; Natural Infrastructure - Carbon Sinks; and Leadership.

Targets | **The Impact of Reducing Greenhouse Gases**

Reducing greenhouse gas emissions will have significant benefits in the long run in addition to mitigating the severity of climate change and its consequences. Changing how people heat their homes, travel, produce food, and design cities will also have significant economic, social, and health benefits by making systems more efficient, less wasteful, and more comfortable.

For example, The City of Calgary has, since 2008, made a priority of increasing the energy efficiency of municipal buildings. In 2018, The City saw cumulative savings of more than $1.6 million through this effort, which included pursuing LEED (Leadership in Energy and Environmental Design) certification for 31 buildings.[1] The amount of energy saved through Calgary's energy efficiency efforts was enough to supply more than 3,700 houses, and the amount of greenhouse gas emissions avoided was equal to taking more than 1,800 vehicles off the road.

Reducing emissions and switching to cleaner energy sources is also better for public health as it will reduce air pollution. Harnessing the capacity of ecosystem services, through the integration of natural systems through natural infrastructure, will help Calgary to realize its low carbon future while also making the city a more attractive place to live.

The City of Calgary saw cumulative savings of

$1.6 million

by increasing the energy efficiency in municipal buildings from 2008-2018

31

Leadership in Energy and Environmental Design (LEED) certified buildings included in this effort

The amount of energy saved through The City of Calgary's focus on energy efficiency was the equivalent of:

powering

3720 houses

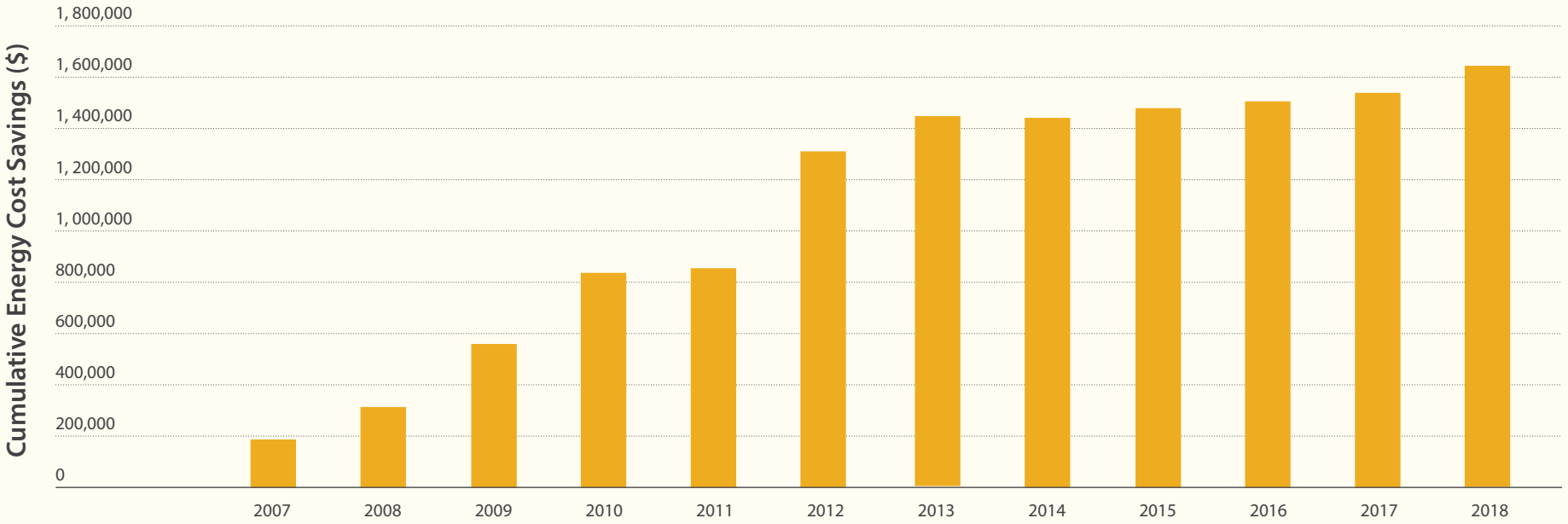
taking

1842 vehicles

off the road

[1] *LEED certification is an internationally recognized green building certification program that rates buildings for their environmental sustainability.*

Fact Sheet | **Cumulative Energy Cost Savings 2008-2018 for City of Calgary Buildings**



Notes: The avoided cost each year is converted into the present value of 2018 based on a 3 per cent escalation rate.

Greenhouse gas (GHG) emission factors for natural gas and electricity includes upstream (extraction, processing) emissions as per the Carbon Offset Emission Factors Handbook published by Government of Alberta in 2015.

Cumulative avoided cost/energy/GHG are aggregated based on a total of 31 City of Calgary LEED New Construction projects certified between 2008 to 2018.

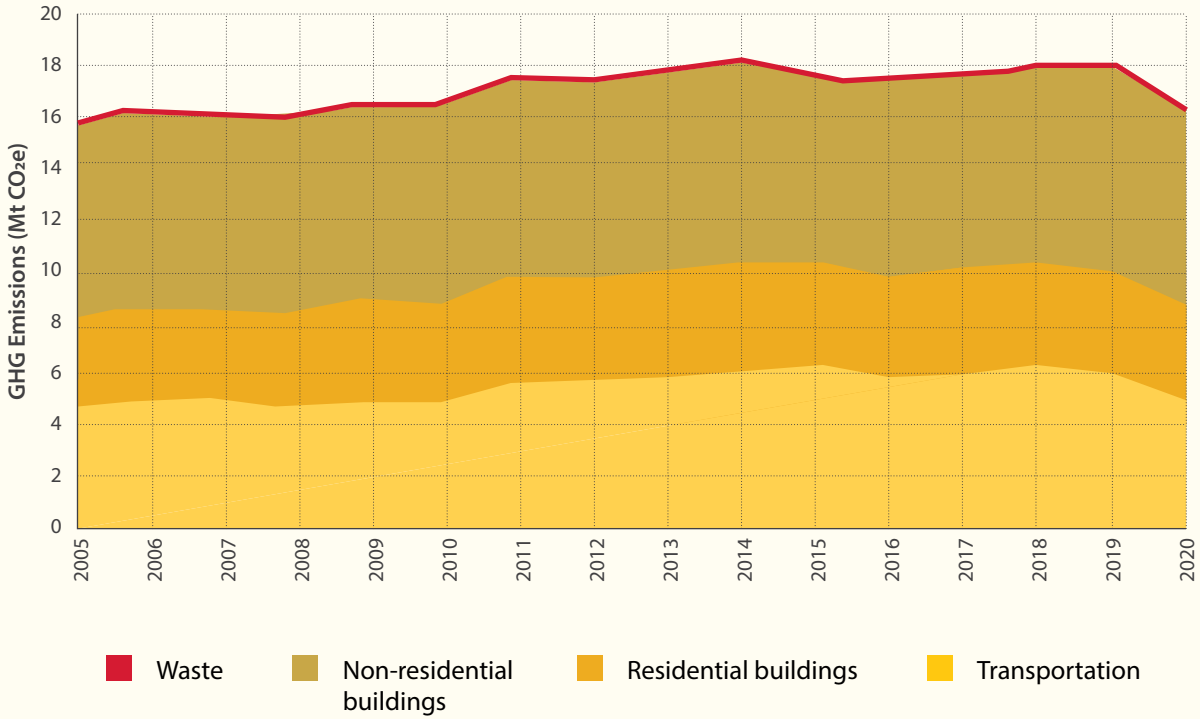
https://www.calgary.ca/cs/iis/green-building/ghg-emisisionsavings.html

Fact Sheet | **Trends**

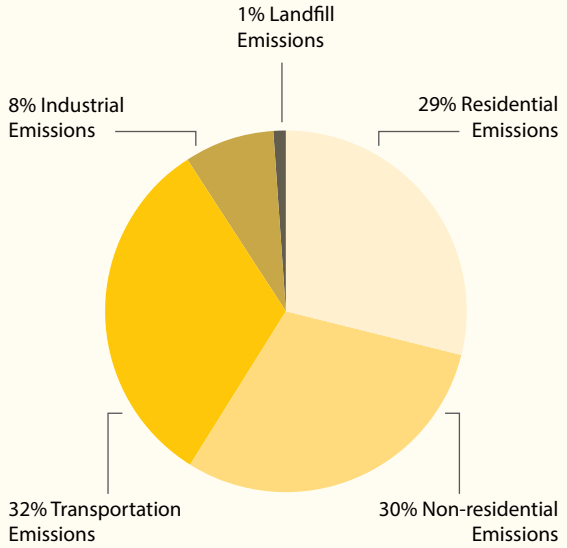
	TREND	TOTAL CHANGE (2005 -2020)	CURRENT AMOUNT (2020)	PER CENT OF TOTAL EMISSIONS
Total Emissions	→	No change (0.4 percent below 2005 emission in 2020)	15.8 megatonnes	(100 per cent)
Residential Emissions	↑	Increased 0.6 mega tonnes (+15 per cent)	4.6 megatonnes	29 per cent
Non-residential Emissions	↓	Decreased 1.2 mega tonnes (-17 per cent)	6.0 megatonnes	38 per cent
Transportation Emissions	↑	Increased 0.5 mega tonnes (+13 per cent)	5.1 megatonnes	32 per cent
Landfill Emissions	→	No change	0.1 megatonnes	1 per cent
Per Capita Emissions	↓	Down 4.52 tonnes per person (-27 per cent)	12 tonnes per person in 2020, down from 16.52 in 2005	

Fact Sheet | **Overall Greenhouse Gas Emissions**

CALGARY COMMUNITY-WIDE GHG EMISSIONS



TOTAL EMISSIONS BY SECTOR IN 2020

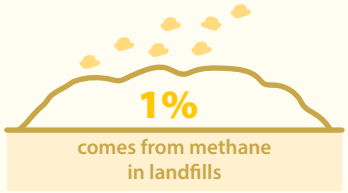


Fact Sheet | **Reducing Greenhouse Gas Emissions**

Approximately two-thirds of the total greenhouse gas emission in Calgary are caused by heating, lighting, and power demands in buildings. The other third of emissions are due to transportation emissions (gasoline and diesel usage) and the remaining one percent of emissions in Calgary come from methane from landfills and wastewater treatment facilities. City of Calgary operations (city-owned buildings, infrastructure, fleet, landfills and facilities) represent only four per cent of Calgary's overall emissions.

approximately

2/3 of total greenhouse gas emissions in Calgary are caused by heating, lighting and power demands in buildings



4% of total emissions are represented by these City of Calgary operations


buildings


facilities


fleet


landfills

Fact Sheet | **Reducing Greenhouse Gas Emissions**

From 2005 to 2020, total emissions in Calgary rose to a peak of 19 megatonnes in 2014, but have since returned to just below 2005 levels of 15.73 megatonnes in 2020. Calgary's emissions decreased by 14 per cent in 2020, an unprecedented change. COVID-19 restrictions impacted energy use across all sectors in 2020, the provincial electricity supply became cleaner, and warm weather reduced the demand for heating. This resulted in a notable departure from the long-term trend in Calgary.

Though Calgary's population has been increasing, per capita emissions have decreased to 12 tonnes per person, a change of 27 per cent since 2005.

Calgary has a long way to go to reduce emissions by 80 per cent below 2005 levels by 2050, and that gap may grow if the city's emissions start increasing again, as they were before the COVID-19 pandemic. Strategic action is needed now to begin reducing these emissions to the 2050 target, and eventually to transition to net zero, where Calgary's economy and urban systems generate no net CO_2 emissions. The Calgary Climate Mitigation Plan outlines The City's key priorities for action.

–0.4%

emissions declined slightly from 2005 levels

Emissions peaked in 2014, but decreased in 2020 with the COVID-19 pandemic

Since 2005,

↓ **decrease in emissions from non-residential sectors**

– **no change to emissions from landfills**

despite population growth, per capita emissions are trending downward

Targets | **International Commitments**

The **Paris Accord** is an international agreement with the goal of limiting global warming to well below 2°C, ideally 1.5°C, compared to pre-industrial levels. Canada signed the agreement in 2015, committing the country to reducing greenhouse gas emissions and working towards a low-carbon future.

As part of this agreement, **Canada's Mid-Century Long-Term Low-Greenhouse Gas Development Strategy** was formulated in 2016. The strategy establishes an emissions abatement pathway for reducing net emissions to 80 per cent below 2005 levels by 2050. This target was chosen with the understanding that it was consistent with the Paris Agreement's 2°C to 1.5°C temperature goal.

Some analyses, however, indicate that the current global emissions targets set by countries that have signed the Paris Agreement will still result in a global temperature rise of 2.7°C by 2100, and the current trajectory could lead to global temperatures temporarily exceeding 1.5°C above pre-industrial levels by 2024.

To strengthen its climate strategy, the Canadian government introduced the **Canadian Net-Zero Emissions Accountability Act** in November 2020, setting a goal of achieving net-zero emissions by 2050. The Act creates a legislative requirement for Canada to meet this target. This is in line with more than 120 countries who have also pledged to achieve net zero by 2050.[1]

The Canadian Net-Zero Emissions Accountability Act was introduced to achieve

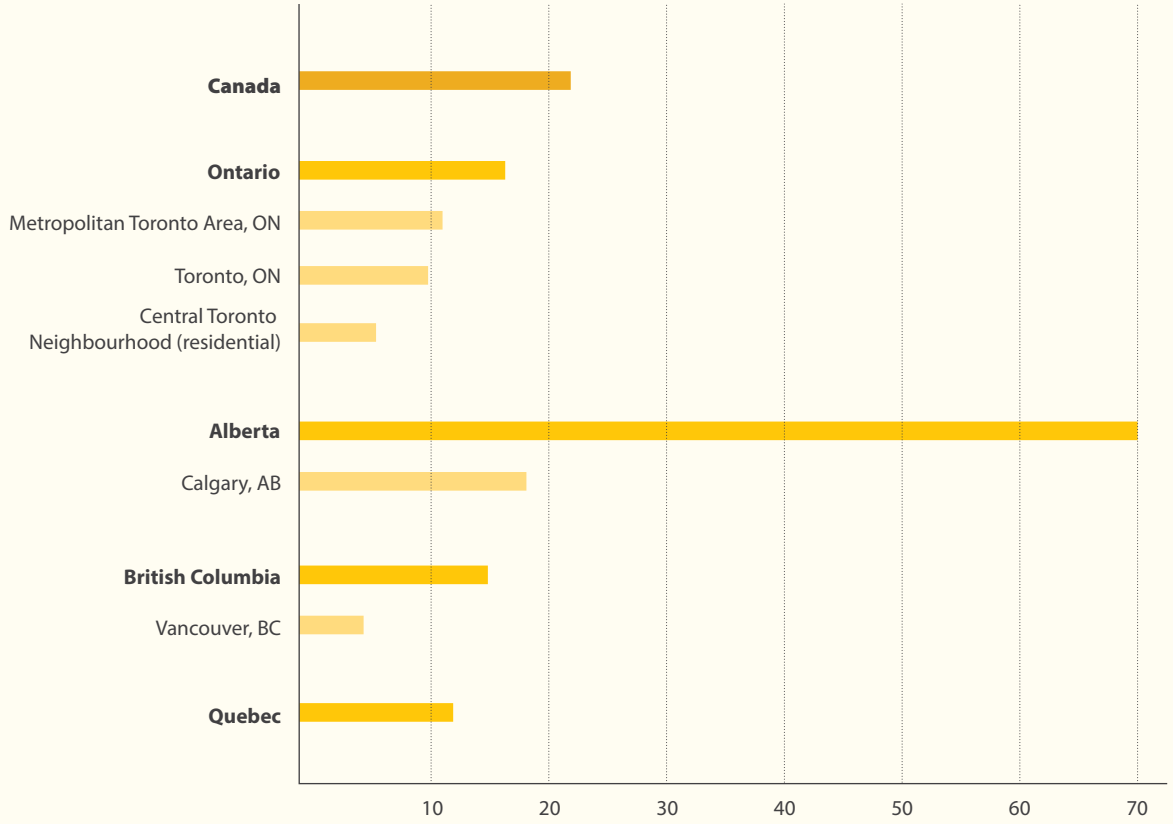
net-zero emissions by 2050

More than 120 countries have pledged to do the same

[1] *Global update: Paris Agreement Turning Point* https://climateactiontracker.org/publications/global-update-paris-agreement-turning-point/

Benchmarking | **How Calgary Compares**

Calgarians have a large per capita carbon footprint compared to many cities across Canada and around the world. In 2010, Calgary had the fifth highest emissions per capita compared to 50 other C40 Cities[1]. Alberta and Calgary also have higher per capita emissions than the rest of Canada. The main reason for this is that most of Calgary's electricity is generated by fossil fuels, whereas provinces like BC and Ontario have a greater proportion of hydroelectricity. The phasing out of coal power is anticipated to help lower Alberta and Calgary's emissions.



In 2010, Calgary ranked

5th highest per capita

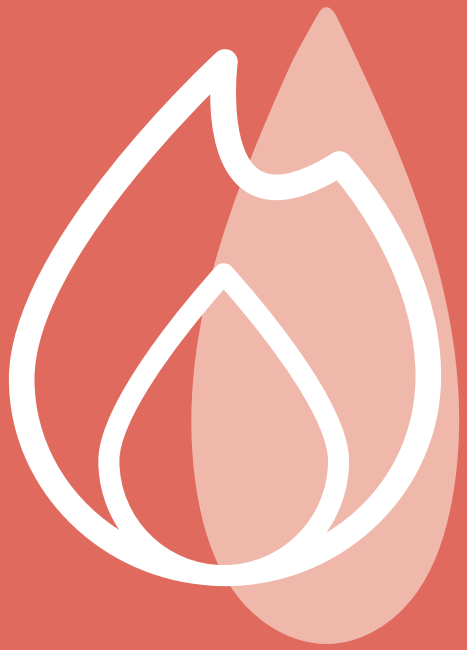
for greenhouse gas emissions when compared to 50 other C40 cities

Alberta and Calgary heavily rely on fossil fuels for power, making the province and city's per capita GHG emissions higher than the rest of Canada

other provinces like BC and Ontario have lower per capita GHG emissions because they have a greater proportion of hydroelectricity

[1] *C40 Cities: a leadership group of 97 cities committed to taking climate action*

Climate Change Adaptation



Climate Change Adaptation Overview

Calgary has already experienced the impacts of climate change, particularly the increasing frequency and severity of extreme weather events.

Calgarians saw firsthand the devastating impact of flooding in 2013 across southern Alberta, caused by heavy rainfall on melting snow pack in the Rocky Mountains. The flood cost $3.5 billion in insured damage, with a total of $409 million in damages to City of Calgary infrastructure alone. Other local costs included $55 million to cover the emergency response and $323 million in recovery costs.

More recently, Calgary experienced the fourth costliest insured natural disaster in Canadian history when a hailstorm in June 2020 resulted in significant damage and an estimated $1.3 billion in insurance claims. Golf-ball sized hail damaged buildings, shattered windows, cracked or shattered windshields, and damaged vehicles. Street flooding and blackouts impacted several areas of the city. More vehicles were written off due to this one event than are bought in all of Alberta in an entire year.

The impact of the 2013 flood across southern Alberta

$3.5 billion in insured damage

$409 million in damages to City of Calgary infrastructure

other Calgary costs include

$55 million to cover the emergency response

$323 million in recovery costs

On June 13, 2020 Calgary experienced the

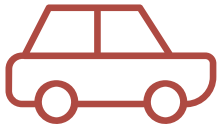
4th costliest natural disaster in Canada's history

the impact of the 2020 hailstorm in NE Calgary had an estimated

$1.3 billion in insurance claims

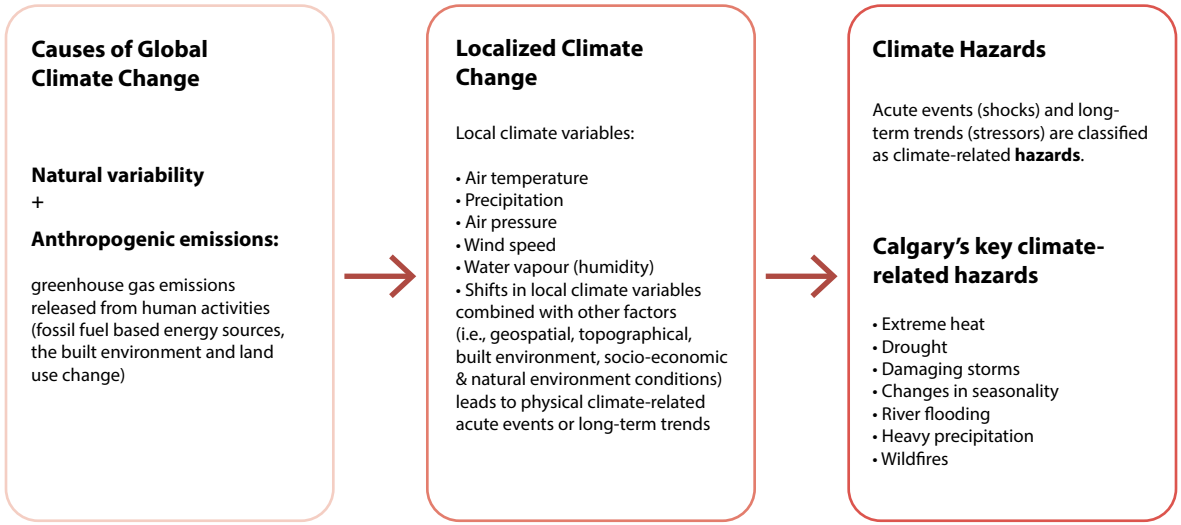
golf-ball sized hail damaged buildings, shattered windows and damaged vehicles

more vehicles were written off due to this one event than are bought in all of Alberta in an entire year



These extreme weather events are anticipated to increase in the future because of climate change and global temperature increases. Calgary's climate-related hazards include higher temperatures in every season, an increase in the frequency and magnitude of river and stormwater flooding, higher likelihood of drought, and an overall shift in seasonal patterns of heat and precipitation.

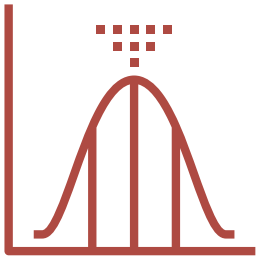
Though mitigation efforts and emissions reductions are critical to reduce the magnitude of climate change consequences, it is essential to acknowledge that the climate is still going to change in the foreseeable future, and Calgary must prepare for this change. Adapting to climate change risk requires targeted interventions and strategies to make infrastructure, services, the environment, and the economy more resilient.



Modeling Climate Change, Risk, and Vulnerability

Climate refers to the average weather conditions of a region over a long period of time. The main weather conditions that make up climate are temperature, precipitation, and wind. Usually, these weather conditions are observed over a period of 30 years to determine averages and extremes.[1] Overall climate trends are related to the weather experienced day-to-day but are determined by a much longer range of patterns.

Scientists can predict climate change through modelling. This modelling accounts for trends in the levels of greenhouse gases emissions and historical climate patterns to predict future climate variations. Climate modelling looks at several of the same weather conditions over time, including mean (average) annual precipitation and mean (average) annual temperature, as well as the impact of changes these patterns have on soil moisture and natural ecosystems.



Climate is the average of weather conditions in a region over a long period of time

The main weather conditions that make up climate are

temperature

precipitation

wind

To determine averages and extremes, weather conditions are observed for

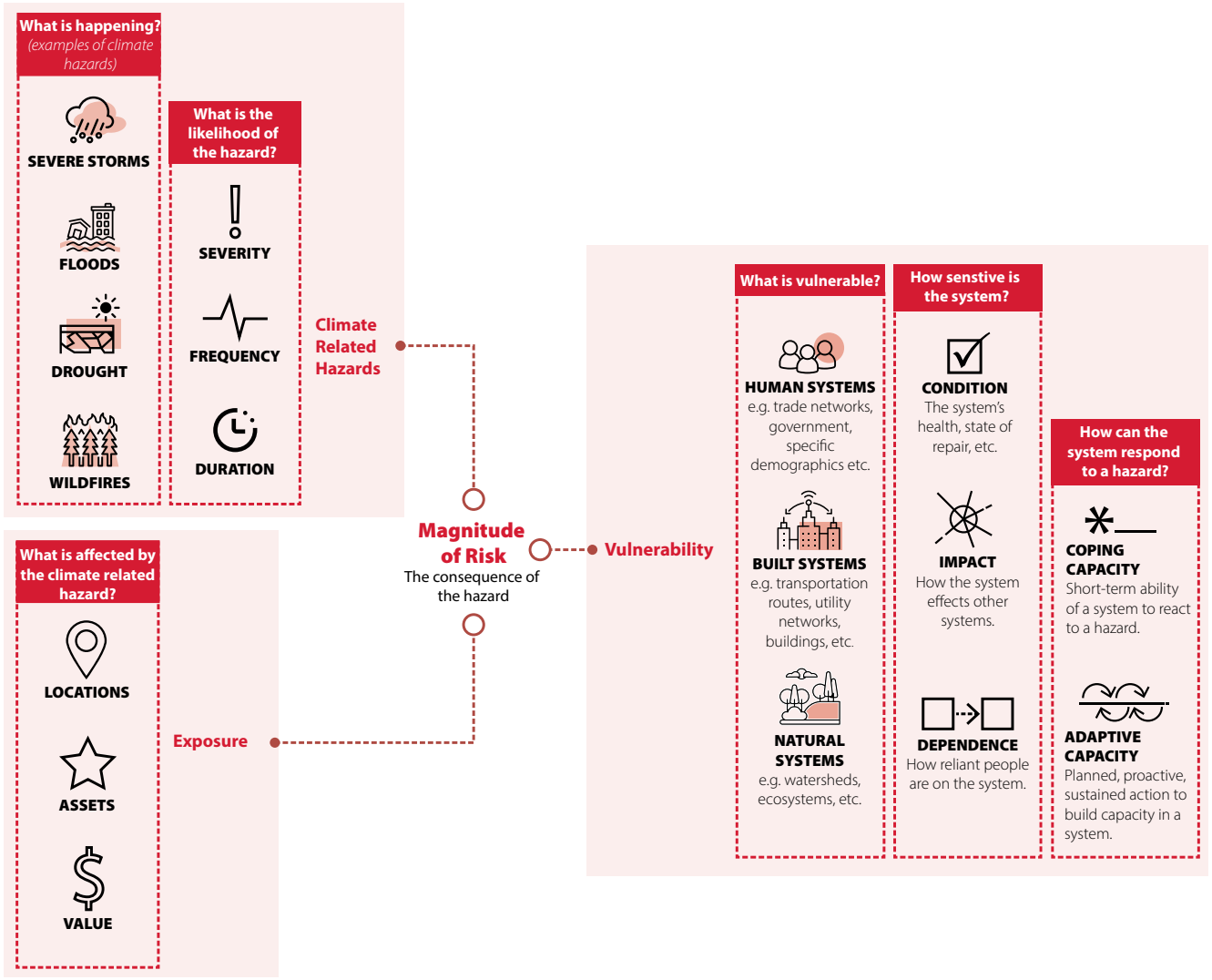
30 years

our overall climate is related to the weather we experience day-to-day but looks at a longer range of trends

[1] *Definition of Terms Used Within the DDC Pages https://www.ipcc-data.org/guidelines/pages/glossary/glossary_r.html*

Climate change modelling enables the identification and assessment of future climate risks and opportunities. It is important to estimate the magnitude of both risks and opportunities, as well as their likelihood of occurring. But because climate hazards are so complex, there are often downstream effects to systems beyond the initial event. For example, the hailstorm in Northeast Calgary not only caused damage from the physical ice pellets, it also clogged storm drains, leading to local flooding.

Part of this risk assessment involves looking at existing systems and their vulnerability. Vulnerability refers to the degree to which a system may be adversely affected by an external force, its level of susceptibility to harm and its capacity to respond. The more resilient or adaptive something is, the less vulnerable it is to the negative consequences of change. This is a key concept in planning for climate adaptation.



Targets | **City Targets**

GOALS

- Reduce exposure and vulnerability to severe weather and long-term climate effects.

While Calgary has made progress in implementing the Climate Resilience Strategy since it was approved in June 2018, much work remains to implement the actions identified in the Climate Mitigation and Adaptation Action Plans. Ensuring Calgary is a climate resilient community will require not only the successful achievement of the Climate Resilience Strategy but the integration climate-related risk into standard City and community practice. Improving resilience will also require collaboration with other levels of government, industry, academia, environmental organizations, and communities.

Calgary's **Climate Resilience Strategy** outlines The City's strategies and actions to:

1. Reduce the contributions to climate change by improving energy management and reducing greenhouse gas emissions.
2. Respond to a changing climate by implementing risk management measures to reduce the impact of extreme weather events and climatic changes on infrastructure and services.

Improving city resilience will require collaboration with

other levels of government

environmental organizations

industry

academia

citizens

Fact Sheet | **The Impacts of Climate Change**

Climate change has significant impacts on public health and wellbeing. While there are several potential positive outcomes of a warmer climate, such as longer growing seasons, these benefits are outweighed by the costs of the climate hazards that Calgary is already facing. This includes the increased risk of injury and loss of life from severe weather events such as hailstorms, heat waves, floods and wildfires. In addition to the physical harm these climate events cause, they have significant economic consequences given the costs associated with the response and recovery from disasters. Lastly, climate events are detrimental to mental health.

With temperatures increasing in Alberta, so are the ranges of various diseases. Examples of these are Lyme disease from ticks and the West Nile virus carried by mosquitoes. Changing conditions will also impact both local and global food systems, with more frequent flood and drought events that damage crops and can disrupt supply chains.

Climate change is a tough problem to fix because it is so far reaching and complex. However, there are many things to reduce the harm it will have on Calgary's communities. The objective is to create resilience in The City's infrastructure and systems, enabling Calgarians to adapt to change as it occurs. This can be done by ensuring that land use planning considers increasing flood risk and other hazards, redundant/back up systems are in place, and natural systems are integrated into infrastructure planning and design. Embedding greater resilience within Calgary's communities will enable the city to bounce back more quickly when disaster does strike.

POTENTIAL POSITIVE IMPACTS OF CLIMATE CHANGE IN CALGARY

Warmer seasonal temperatures

- Reduced cold-related injuries and illnesses.
- Increased recreational, active-transportation and tourism opportunities.
- Decreased demand for space heating in winter.
- Shift in viable plant species and agricultural opportunity.
- Extended construction season.
- Extended growing season.
- Decrease in frost events and lengthened frost-free season.

Increased precipitation in spring, fall and winter:

- Shift in snow-related tourism opportunities.
- Earlier spring growing season

ONGOING NEGATIVE IMPACTS OF CLIMATE CHANGE IN CALGARY

Extreme heat - Calgary will experience increasingly hot summers with heat waves (a heat wave is three days in which a daytime high reaches above 29°C) occurring more often and for longer periods of time.

Drought - Drought is a lack of adequate precipitation over an extended period of time, resulting in a water shortage. Increased summer temperatures and decreased summer precipitation indicate that meteorological drought conditions may become more common, prolonged, and widespread.

Shifting Seasonality (higher average temperatures) - Calgary is experiencing and will continue to experience higher average annual temperatures which affects the length of the seasons. Winters are getting shorter, spring is arriving earlier, summers are longer and fall is arriving later.

Wildfire - Wildfire risks will continue to intensify as climate change makes the fire season longer and drier leading to more frequent, larger, and intense wildfires.

Heavy Precipitation - The nature of individual storm events are changing, with more precipitation falling as short-duration, high-intensity storms, which can lead to overland flooding.

Winter Storms - This includes a greater risk of damage associated with heavy snow, blizzard conditions and freezing rain.

Damaging Storms - This includes hail, high wind events and tornadoes, often accompanied by rain and lightning.

River Flooding - Climate change is exacerbating the conditions that lead to river flooding, continuing to influence the likelihood of Calgary experiencing major flooding on a reoccurring basis.

Fact Sheet | **Climate Change Modelling**

CLIMATE INDICATOR (ANNUAL)	TREND	1981-2010 NORMALS	2050S MEAN CHANGE (2041-2070)	2080S MEAN CHANGE (2071-2100)
Temperature	↑	4.4°C	7.4 C (+3°C)	9.3°C (+4.9°C)
Mean Daily Maximum Temperature	↑	9.9°C	12.9°C (+3°C)	14.9°C (+5°C)
Mean Daily Minimum Temperature	↑	-1.5°C	1.7°C (+3.2°C)	3.8°C (+5.3°C)
Maximum Temperature	↑	31.8°C	36.3°C (+4.5°C)	38.9°C (+7.1°C)
Days Above 29 (°C) threshold for heat wave	↑	6 days	27.5 days (+21.5 days)	48.7 days (+42.7 days)
Precipitation	↑	416 millimetres	444 mm (+28 millimetres)	455 mm (+39milimetres)
Snowfall	↓	100 centimetres	72 cm (-28 centimetres)	59 cm (-41 centimetres)

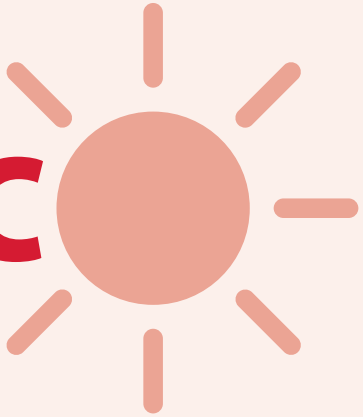
Fact Sheet | **Trends**

Historic climate trends in Calgary indicate that local temperatures have steadily increased over the past century, and projections strongly indicate that regional warming is expected to continue at an accelerated rate over the next century. More warming is expected during the cooler seasons (winter, late autumn and early spring) and in nighttime temperatures throughout the year. Changes in temperature extremes (e.g. heat waves and high heat days) are significantly more pronounced than seasonal or annual averages.

Currently, Calgary experiences approximately six days of heat greater than 29°C per year. By the 2050s, it's projected that there will be 18.9 to 38.2 additional days warmer than 29°C. By 2080, projections indicate that there will be between 30.9 to 68.9 additional days that reach temperatures greater than 29°C.

Calgary currently experiences 6 days above 29°C

approximately



Changes in temperature extremes (i.e heat waves and high heat days) are significantly more pronounced than seasonal or annual averages

It is projected that by 2050, there's an additional

18.9 - 38.2 **days greater than 29˚C**

and

30.9 - 68.9

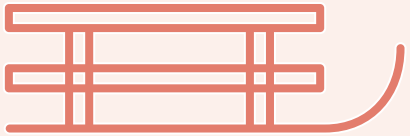
days by 2080

Average winter temperatures are projected to increase but remain below 0°C. Calgary's climate will remain cold enough to be subject to snowfall events, and these warmer winter temperatures in combination with the projected increases in winter precipitation may result in increased snow events during the winter months.

The winter season itself will be shorter, as "shoulder season" temperatures in the spring and fall will more often be above 0°C. Freeze-thaw cycles are expected to decrease as more of the year, especially during the spring and fall, will see temperatures above 0°C.

Despite increasing average winter temperatures, they are projected to remain below

0°C



warmer winter temperatures in combination with increases in winter precipitation may result in increased snow events

Winter itself will be shorter as 'shoulder season' temperatures in the spring and fall will be above 0˚C

freeze-thaw cycles are expected to decrease as more of the year, especially during the spring and fall, will be spent at temperatures above 0˚C

Warmer air holds about seven per cent more water for every degree of temperature increase. This means that as temperatures rise, there is potential for increased precipitation in Calgary. Warming can affect both increases in extreme rainfall during warm season storms and lead to greater volumes of precipitation in the form of snow during the colder seasons.

Precipitation is based on several factors, so, although a slight annual increase in precipitation is projected for Calgary, seasonal precipitation will be affected by climate change in different ways.

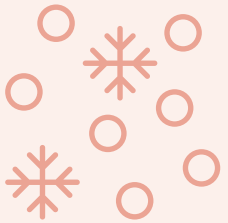
warmer air holds about

7%

more water for every degree of temperature increase

increased precipitation in Calgary is likely as temperatures rise

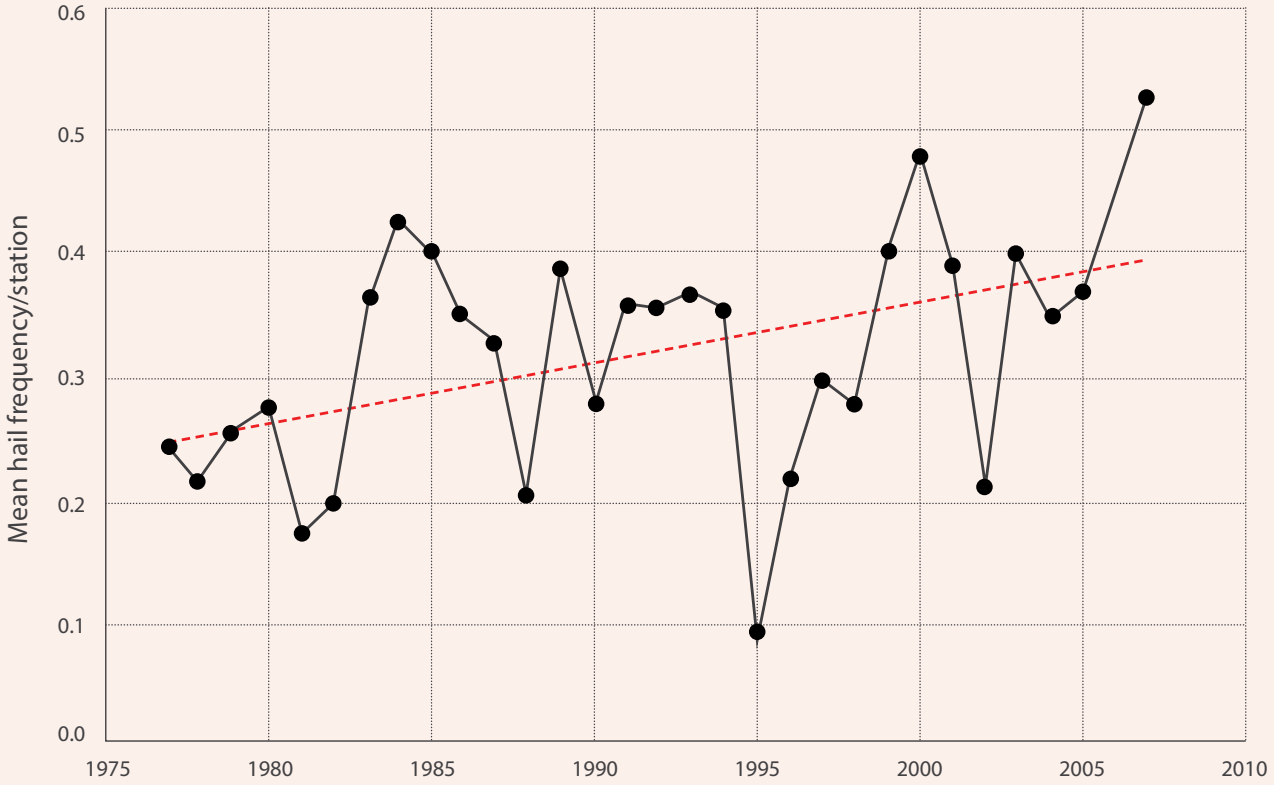
warming affects both increases in extreme rainfall during warm seasons and leads to greater volumes of precipitation in the form of snow during cold seasons



There is an increasing trend in hail events in Alberta from 1975 to 2010. Although climate projections for hail cannot be definitively determined, it is expected that the upward trend will continue based on the increase in temperature, severe precipitation, and increasing atmospheric energy. Additionally, the increasing duration of the "hail season" or convective storm season will likely contribute to Calgary experiencing more hail events, and buildings will experience greater impacts.

In general, Calgary will continue to see increased climate-related hazards, including higher temperatures across all seasons, an increase in the frequency and magnitude of river and stormwater flooding, a higher likelihood of drought, and an overall shift in seasonal patterns of heat and precipitation.

TRENDS IN ALBERTA HAIL FREQUENCY (MAY-SEP)



Targets | **International Commitments**

Part of the **Paris Accord** agreement, signed by Canada and 195 other countries, involves resilience building and adaptation strategies. Canada created the **Pan-Canadian Framework on Clean Growth and Climate Change**, which sets out direction for adaptation in the following areas:

- Translating scientific information and Traditional Knowledge into action.
- Building climate resilience through infrastructure.
- Protecting and improving human health and well-being.
- Supporting particularly vulnerable regions.
- Reducing climate-related hazards and disaster risks.

This report was created in collaboration with O2 Planning and Design, Chris Turner and The City of Calgary.

Given the modular style of the report, as new information becomes available, sections can be removed and updated as needed. This will ensure that the *Calgary's Environment Report* remains a resource for The City and the public on an ongoing basis.