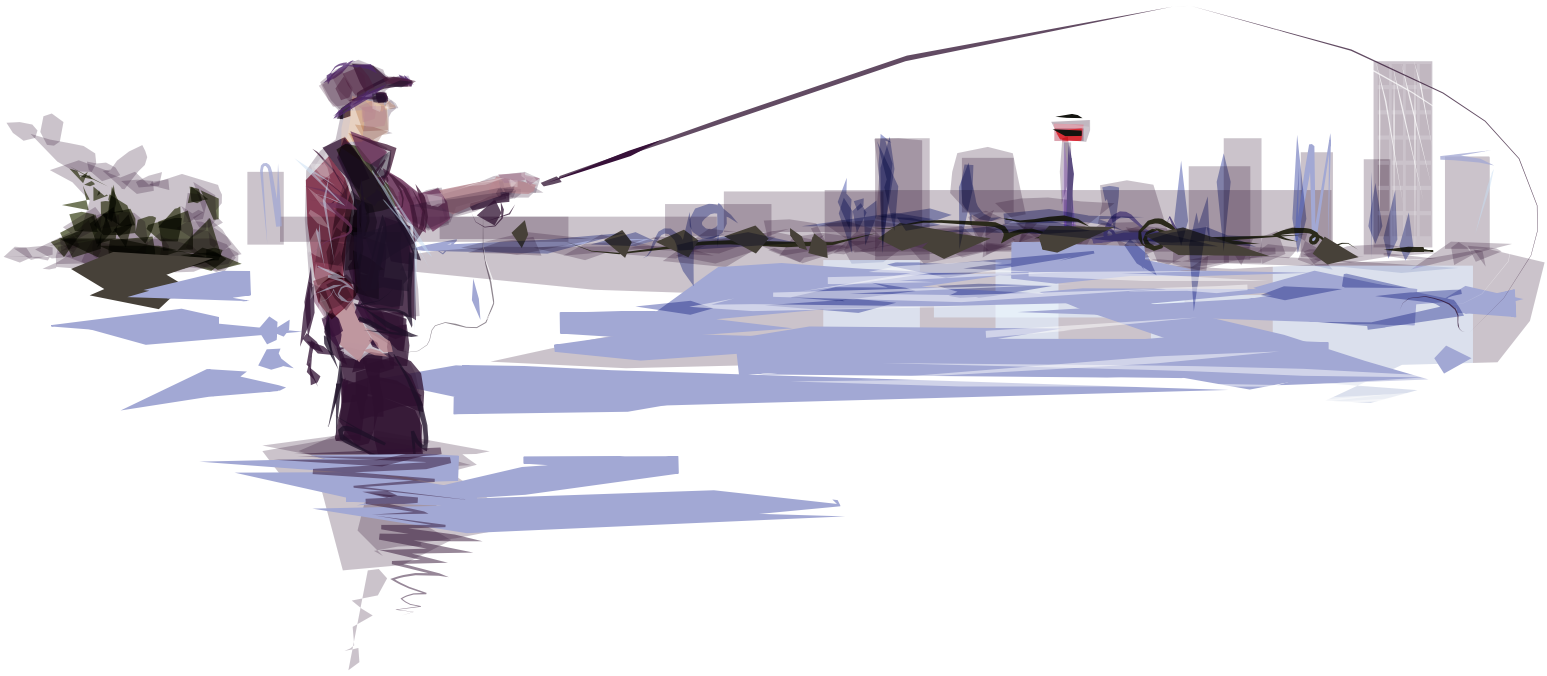
One Calgary One Water

A framework for Calgary's water secure future

January 2020



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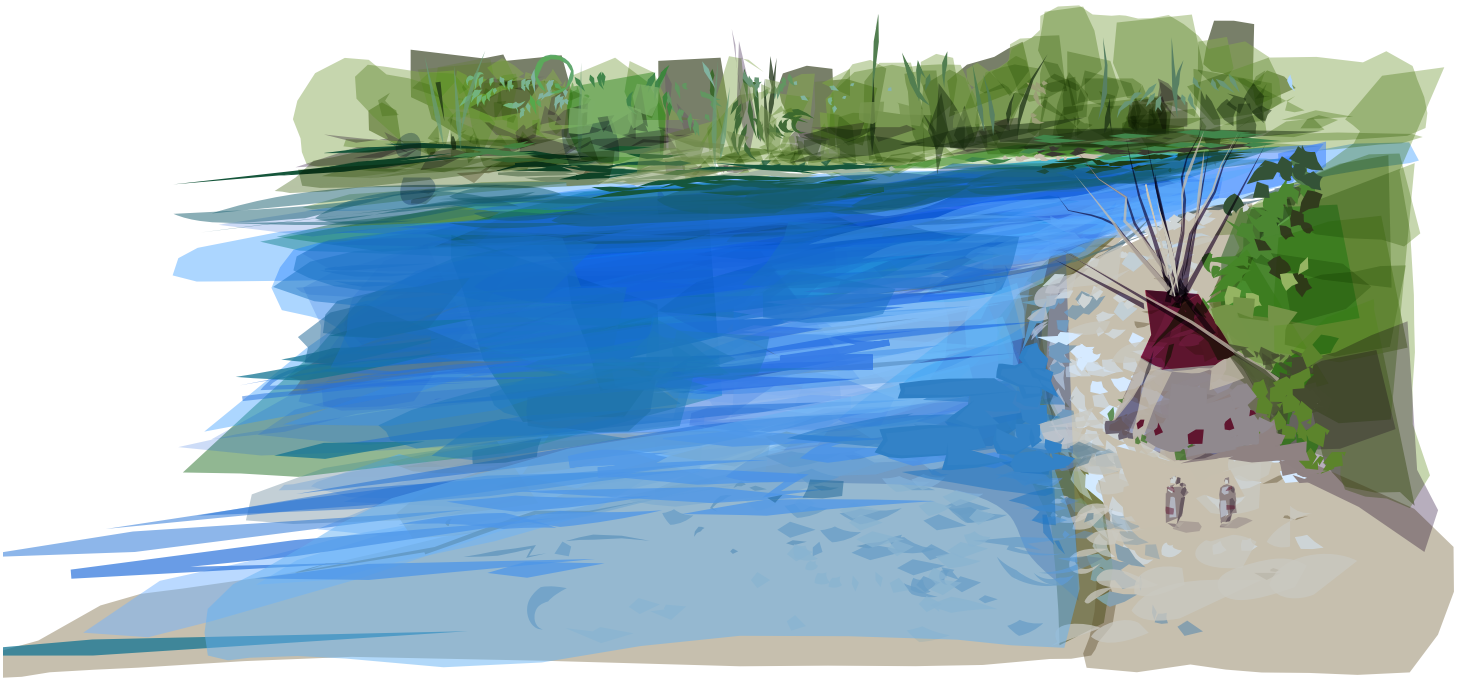


1 Shaping a water secure future

Calgary is a big city on a small river

For thousands of years, people have met at the confluence of the Bow and Elbow rivers. These rivers are the lifeblood of Calgary—they provide safe, clean drinking water, a reliable water source to support Calgary's economy and sustain our natural environment.

In other semi-arid regions where water shortages and declining water quality have already been experienced, the world is taking notice and international attention is increasing. The United Nations and governments, including Canada, are highlighting this critical global issue. In southern Alberta, water is already a limited resource and The City of Calgary is working on addressing water resource challenges.

Careful management of Calgary's water supply and demand, investing in efficiencies, and managing the operations of Calgary's water treatment and distribution systems ensures there is a secure water supply for Calgary's customers now and in the near future. The Water Utility continues to plan for long-term water security by addressing the critical question… **will there be enough water to meet the needs of customers, the environment and ensure a sustainable economy in the future?**

To answer this question, the Water Utility is taking an adaptive management approach to water security planning. Adaptive management allows for decisions in times of uncertainty. It improves long-term management outcomes by balancing the best short-term actions based on current knowledge with monitoring and feedback that improves learning and adjusts actions over time.

Our water supply is changing. River flows and water quality seen in the past will be very different in the future because of a changing climate. The City of Calgary is committed to better understanding the future changes to our rivers and will continue to manage emerging risks.

PURPOSE

This document is intended to create a high-level framework for addressing water security and articulates:

1. **Three top risks** that will have a significant influence on water security.
2. **Key initiatives** currently underway to manage water supply, demand and systems operations.
3. **Priority actions** to address the question of future water security.

This *Water Security Framework* aligns with The City's 2018 *Climate Adaptation Action Plan* and the 2019 *Resilient Calgary Strategy*. It supports the Water Utility's One Calgary customer commitments and the actions identified will inform and influence decisions at the municipal, regional and provincial orders of government.

One Calgary customer commitments

- Your access to drinking water is reliable and available.
- You have drinking water now and for generations to come.
- Your drinking water is of high quality and safe to drink.

What is water security?

Water security is a complex concept that can be framed at the global, national, provincial and local scale. In 2018, the United Nations launched the *Water Action Decade* to mobilize action on water security to address health, education, ecosystems, human rights and economic development.

The United Nations defines water security as: "*The capacity of a population to safeguard sustainable access to adequate quantities of an acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability.*"

Water security in Canada

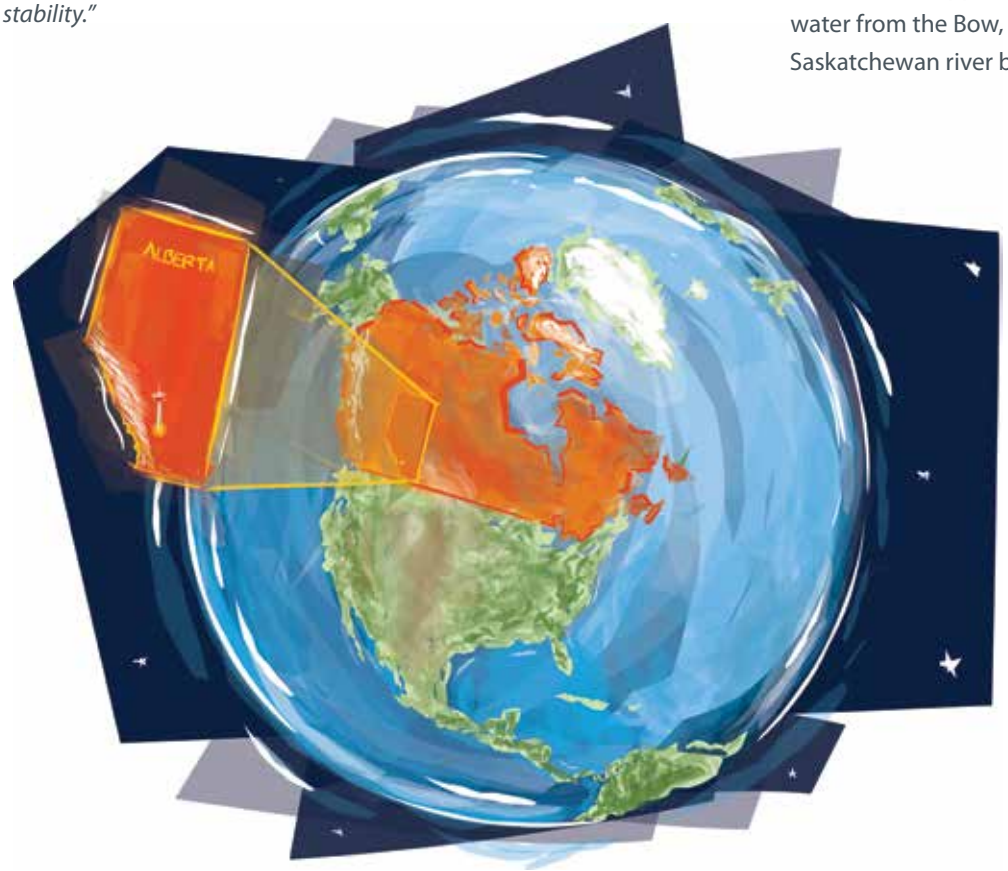
In positioning Canada as an international leader in global water security expertise, a national focus now includes creating a better, safer and a more water secure nation. In 2019, a collaboration of scientists and policy experts released the *Water Security for Canadians Initiative*[1] encouraging the federal government to exercise its jurisdiction to chart a path forward to ensure water security for all Canadians.

Water security in Alberta

The Government of Alberta's 2003 *Water for Life* strategy outlines commitments to managing Alberta's water resources by adopting the following goals:

- Safe, secure drinking water supply.
- Healthy aquatic ecosystems.
- Reliable, quality water supplies for a sustainable economy.

The 2006 *South Saskatchewan River Basin (SSRB) Water Management Plan* directed water management in southern Alberta to safeguard existing water users' supply and protect the aquatic environment. A key part of this plan is the Government of Alberta no longer accepts new surface water licence applications to withdraw water from the Bow, Oldman and South Saskatchewan river basins.



[1] Global Water Futures, Centre for Indigenous Environmental Resources, Forum for Leadership on Water, POLIS Water Sustainability Project, Centre for Global Studies, University of Victoria and United Nations University Institute for Water, Environment and Health

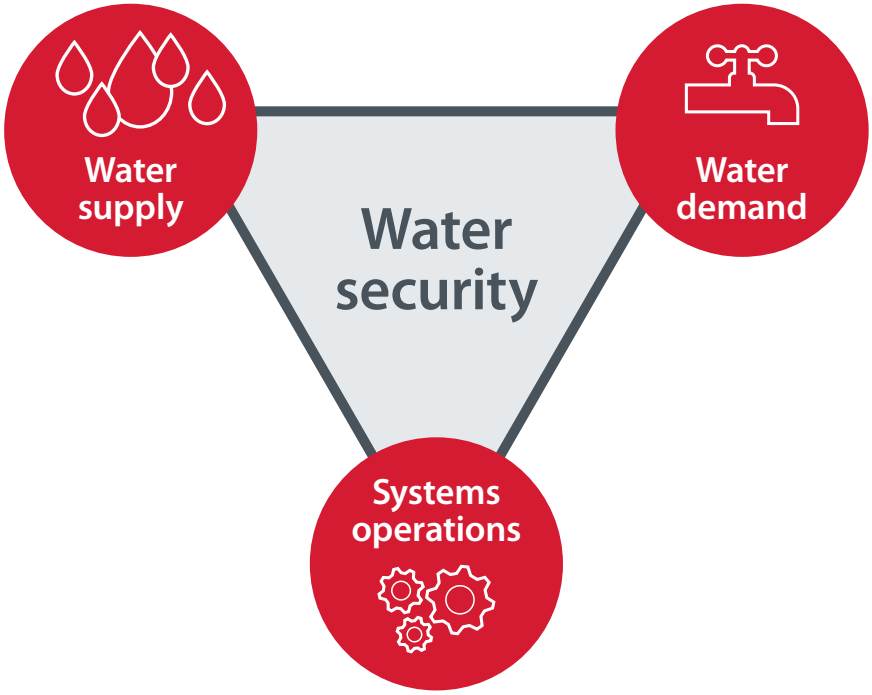
2 Water security in Calgary

Building on the United Nations and provincial goals, The City of Calgary defines water security as **having enough safe water for human well-being, ecosystem resilience and economic activities now and for future generations**.

The City of Calgary's water security system

The City of Calgary manages water security by having the right balance of activities across the following connected levers.

The availability and quality of water obtained from the source watershed.

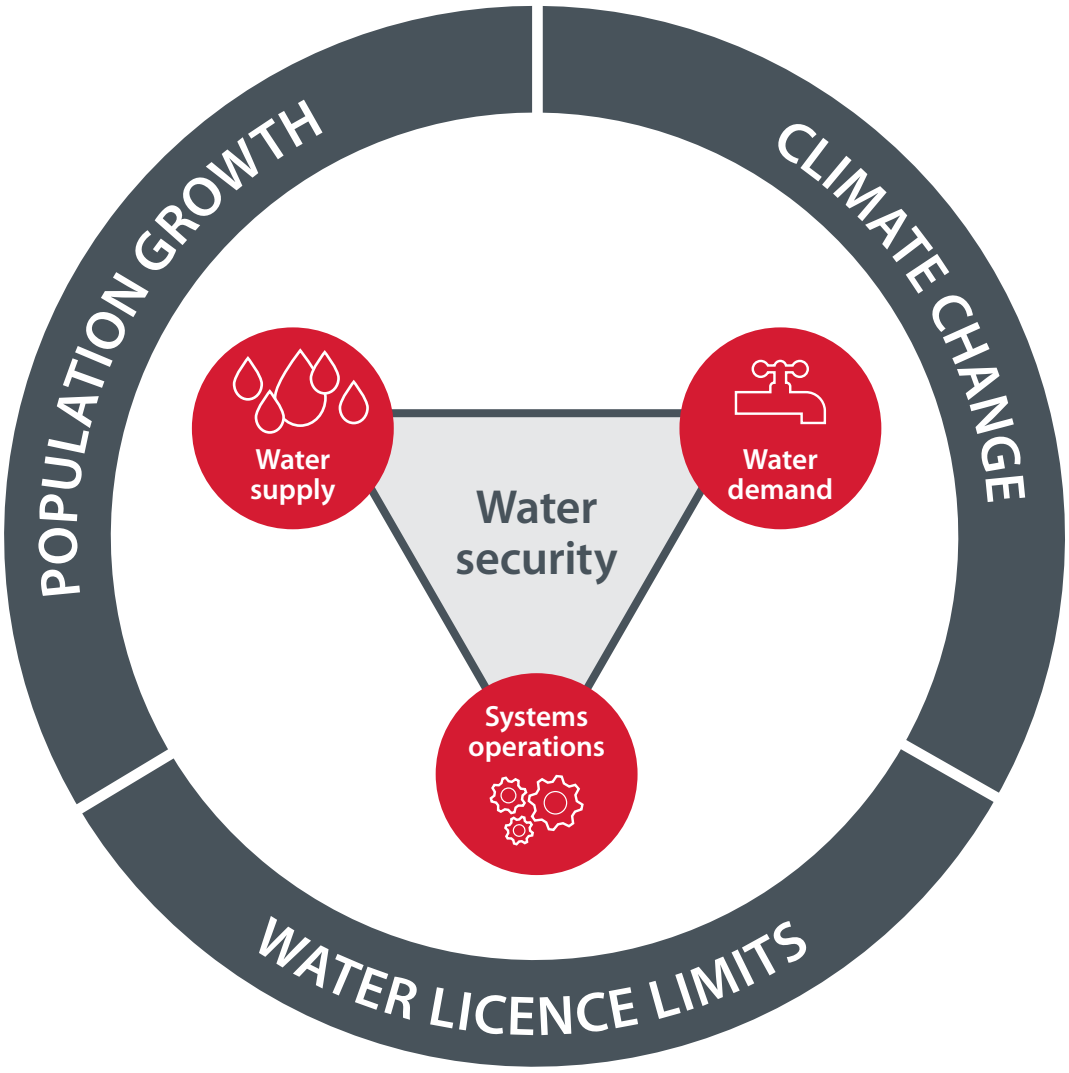


How, when and quantity of water used by customers.

How the Water Utility manages the infrastructure required to deliver the overall water service.

3 Calgary's water security risks

Calgary's water security is challenged by three main risks that must be managed in the short- and long-term: **climate change, water licence limits and population growth.** While additional social, economic and environmental risks do exist, these three main risks have the most significant impact to future water security.



1 | Climate change

Climate change is altering how and when precipitation falls in Calgary's watershed, affecting both water quantity and water quality. Climate impacts now and in the future are uncertain, but alterations in timing of river flows are expected:

- Mountain snowpack will melt earlier in the year.
- Precipitation will be more intense.
- Summers will be hotter, drier and longer.

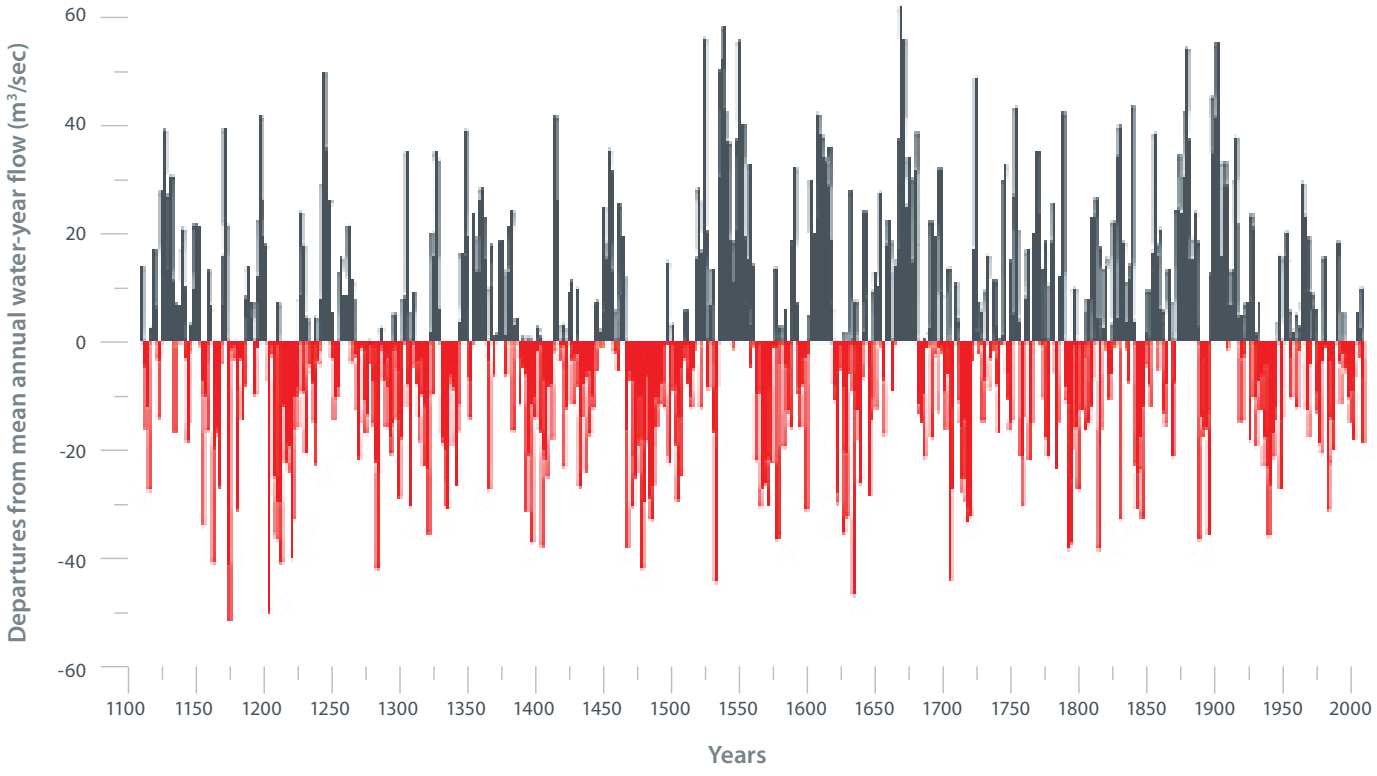
Rising temperatures will cause snow to melt earlier in the year, leading to a longer, hotter outdoor water use season, making it more difficult for our reservoirs to satisfy water demands.

Southern Alberta is an arid region, inherently susceptible to drought. Severe, multi-year droughts observed in the past include those between 1858-1872, 1930-1941 and dry conditions in the early 2000s. Tree ring evidence suggests that even more severe droughts hit the region in the 1400s, 1500s and 1700s (Figure 1).

Climate change is likely to make extreme weather, including severe drought, more common. According to The City of Calgary *Climate Adaptation Plan*, the average global temperature could increase by up to 5°C by the year 2080. Temperature increases for the Calgary region are projected to be higher than the rest of the globe. The risk of drought occurrence in summer or early fall in particular – when demand tends to peak – is likely to increase. Water management for both extreme flood and drought are priorities in adapting to the uncertainties of climate change as it relates to water security.

The City is supporting a number of additional studies to better understand water security risks from climate change. In 2018, The City participated in a countrywide expert panel that developed recommendations to the Government of Canada on Climate Change Adaptation and Resilience Results. There is also work underway with the Global Water Futures research program through the University of Saskatchewan, examining historical and future flow regimes on the Bow River. This study includes a climate change analysis to develop climate models to estimate future flows and flood

Figure 1. In 2015, the Water Utility partnered with the University of Regina to conduct tree ring analysis to analyze wet and dry conditions in the Bow River watershed over the past millennium. Decades long periods of drought (shown in red as deficits from the average annual flows) have occurred since 1100.

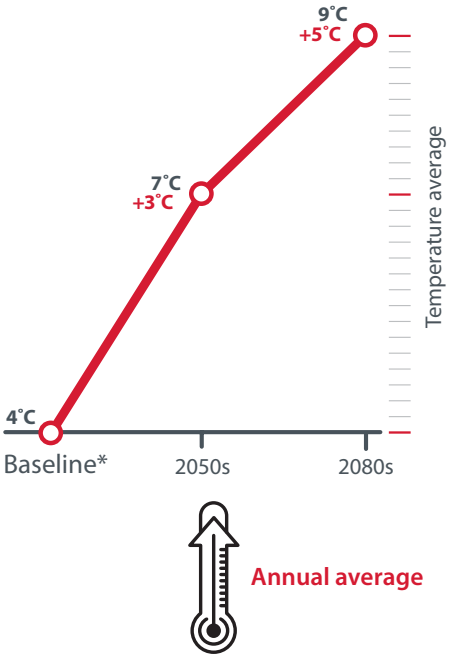


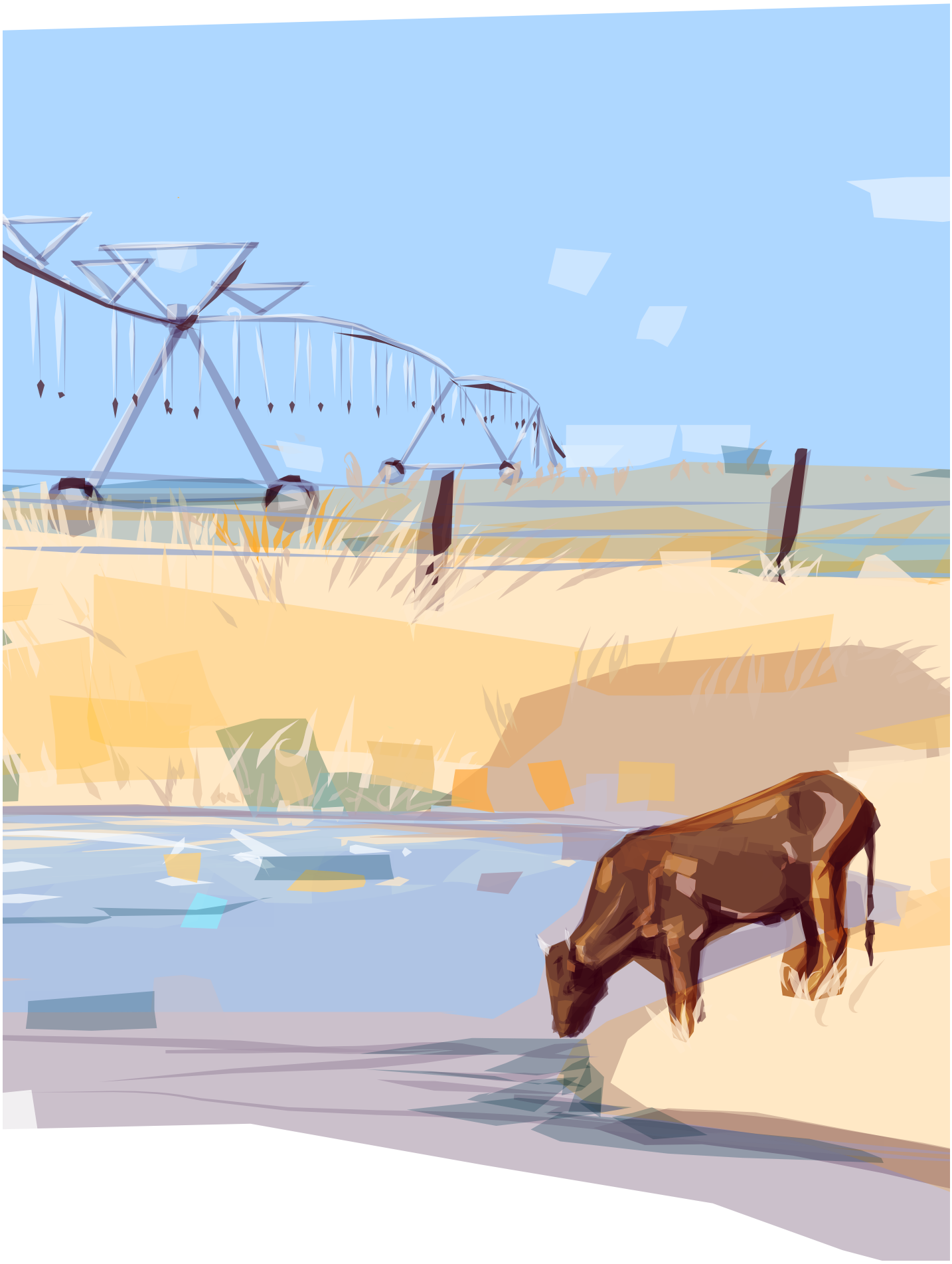
frequencies. The City is also working with the Government of Alberta on a new forecasting and modelling platform to examine river flows and improve accuracy of forecasting.

While climate change discussions often focus on water quantity, it is predicted that large, widespread wildfires are also likely to become more frequent in the future. Wildfires that impact source water quality have been identified as one of the highest risks in The City's *Source Water Protection Plan*.

After a wildfire, water chemistry from burned watersheds changes and includes higher concentrations of nutrients, sediment, metals, dissolved organic carbon and other organics, which can pose significant challenges for water treatment processes. To address this risk, The City completed a *Calgary Wildfire-Source Water Risk Strategy* to recommend new tactics and tools to reduce the impact of wildfires on water resources in our watershed.

Figure 2. Average temperature increases in the Calgary region are expected to be higher than other parts of the world. (Source: Calgary's Climate Resilience Strategy, 2018)





2 | Water licence limits

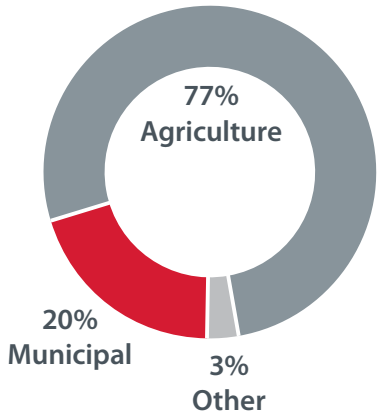
Regulatory requirements for water and watershed management are complex and challenging to navigate, particularly in a river basin closed to new surface water licences. The City's water licence allocations do not guarantee river water availability, and The City's licences have priority, daily and total allocation limits. One of the critical challenges identified within the next 20 years is the regulatory limitation on the maximum daily amount of water Calgary can withdraw from its water licences.

Calgary's water treatment plants carefully operate within the maximum day licence capacity, as indicated by the bottom line of Figure 4. With current projections of water demand from population growth, The City will not be able to provide the full amount of water demanded on a peak day by customers by the mid-2030s. To address this operational risk, The City will examine options to increase the maximum daily water diversion rate. This includes discussions with TransAlta, as the owners of the Bearspaw Reservoir, and the Government of Alberta and investigating infrastructure optimization opportunities.

The City's water licence priority is an important consideration during times of drought. Long-term water supply is fundamentally changing and there is a better understanding that the river flows seen in the past, on which current licence allocations are based, will be very different in the future. This creates uncertainty for all licence holders in the region. The City holds relatively large and senior licences compared with smaller municipalities on the Bow and Elbow rivers. But this licence priority is below other large water users in the basin, mainly the irrigation districts (Figure 3).

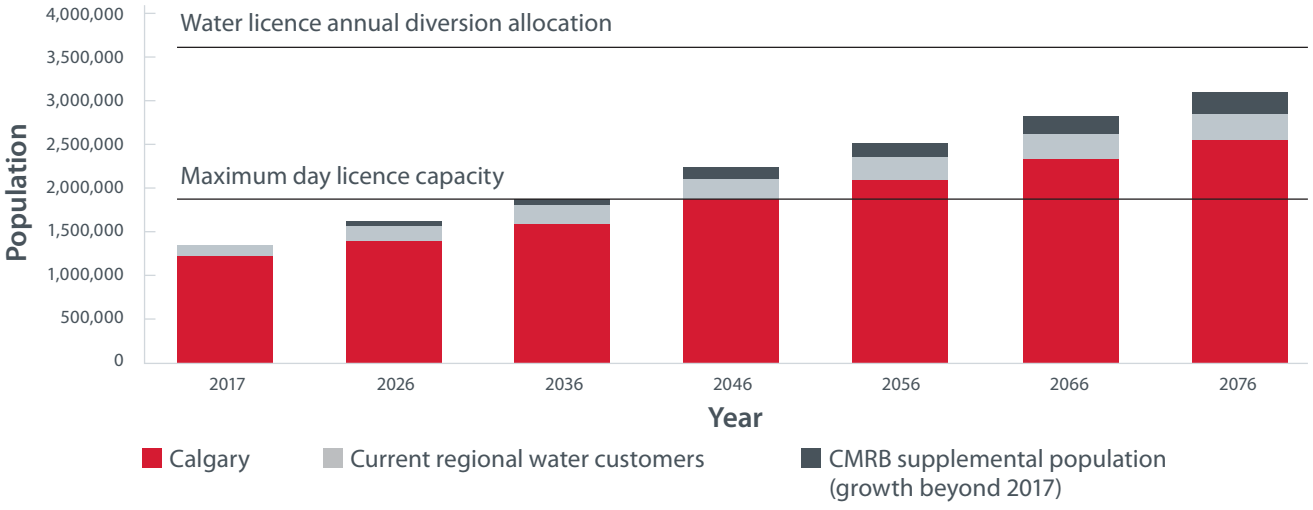
The total water licence annual diversion allocation (as indicated by the top line on Figure 4) is important to manage for The City's long-term growth. The City will continue to work with the Calgary Metropolitan Region Board (CMRB) to establish growth and servicing plans for the Calgary region. Upon completion, the Water Utility will assess how The City's total water licence allocation aligns to future growth.

Figure 3: Distribution of water licence allocations in the Bow River Basin.



Source: Government of Alberta, 2007.

Figure 4. City of Calgary water licence limits



WATER QUALITY AND STORMWATER MANAGEMENT

Growing communities in Calgary and the region will increase stormwater runoff, resulting in higher water supply contamination risks.

Recognizing a joint responsibility for stormwater management, The City is engaging with Calgary's urban development industry and other stakeholders to understand their needs and work towards stormwater quality improvement, which contributes to protecting water security.

This is especially important upstream of Calgary's water treatment plants.

3 | Population growth

Water security is a limiting factor to growth. Population and economic growth put pressure on Calgary's water supply, even as The City continues to invest significantly in infrastructure upgrades and water conservation programming. Multiple and growing water users and needs must be considered within the context of climate uncertainty, to ensure that demand does not exceed supply in the future.

A vibrant and diversified economy is dependent on the secure provision of water. A safe, affordable and reliable water supply is an advantage in attracting and retaining businesses, recreation and agricultural production in the region. In the future, growth in water intensive uses (e.g. food and energy production), climate change or an economic downturn may impact water security in terms of competition for water resources and ability to pay for water services.

The City's *Source Water Protection Plan* identifies stormwater runoff from current and future land development as one of the top risks to the quality of Calgary's water supply.

On Nov. 14, 2018, Council approved the One Calgary 2019-2022 Service Plans and Budgets, which included Council Directive on Integrated Watershed Management. City Council recognized the important relationship between land and water and adopted a Council Directive that *Calgary must develop our communities with a focus on achieving future water security and a sustainable water supply. Accordingly, watershed management must be integrated into our land use policies, plans and decisions… working collaboratively with other orders of government, adjacent municipalities, residents, landowners, developers, businesses and the First Nations.*

Ensuring land use decisions include water supply and water quality considerations will be critical to mitigate the impact of population and economic pressures to our water resources.

OUR RELATIONSHIP TO WATER

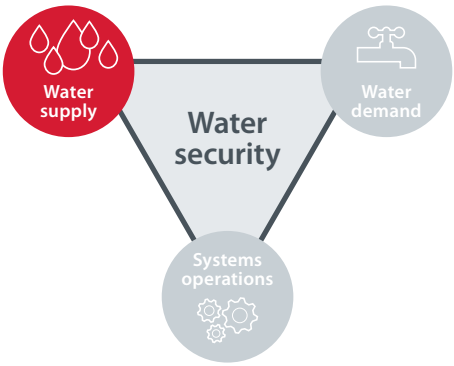
The City of Calgary has a secure water supply serving more than 1.3 million people. With a changing climate and a growing population, Calgary is not immune to water security challenges in the future.

Cities around the world that have experienced historic droughts have highlighted the need to have sustainable, reliable and diversified water security options. For example, Austin Water's 100-year plan shifts the way Austin thinks about its water resources by looking for new storage options and maximizing local water reuse opportunities.

4 Managing water security risks

Calgary's water services have become so reliable that it is easy to forget the level of effort required to deliver safe, clean drinking water to our customers. The City has made significant investments and implemented a range of programs, policies and operational processes to address each of these risks.

The following sections highlight current initiatives that manage risks through our water security system levers.



Understanding Calgary's water supply

Calgary's water supply is dependent on the quality and quantity of Calgary's source water upstream of its two water treatment plants, and the ability to withdraw source water to meet water demand and system operational requirements.

Despite being located in one of the driest regions of Canada, Calgary is fortunate that the Rocky Mountain headwaters are significantly wetter and cooler, helping to reliably provide clean water downstream to the Calgary region.

Water availability changes considerably during the year. Fall, winter and early spring are characterized by low flows in both the Bow and Elbow rivers. In contrast, river flows are high during the spring runoff period, which typically starts in May and ends in mid-July. A gradual tapering of river flows usually occurs during summer and early fall. However, climate change will create uncertainty for water supply leading to earlier and more snow melt; hotter and drier summers and higher intensity rainfall events.

Current initiatives

Source Water Protection Plan

Source water protection is the first line of defence to minimize the risk of drinking water contamination. The highest risks to Calgary's source water supply are wildfire and stormwater, which are tied to land management largely outside of Calgary's jurisdiction. A major wildfire in our forested headwaters and further land development with increased stormwater runoff will result in higher contamination risks to our water supply. Completed in 2018, The City's *Source Water Protection Plan* has 12 implementation actions to reduce source water risks in the Bow River watershed. These actions build resiliency in The City's operations and contribute to water security. The *Source Water Protection Plan and Policy* will be presented to City Council in 2020.

Water reuse

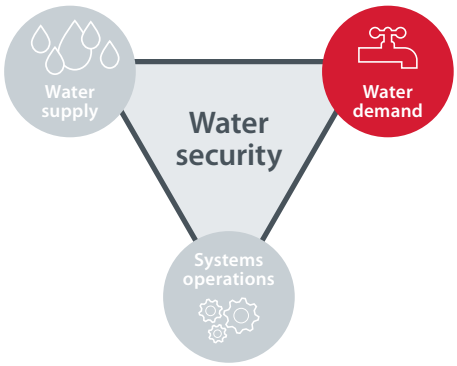
The Water Utility continues to work with our internal and external partners on rainwater and stormwater use for internal plumbing and irrigation, supporting water reuse projects to proceed in a safe and cost-effective manner and reducing risks associated with public health, the environmental, and cross contamination into the Water Utility's infrastructure. In January 2019, the Water Utility provided comments and input to the draft provincial *Water Reuse Guidelines*. Currently, the timing for a finalized provincial guideline is unknown.

WATER METERS

Water meters play an important role in conserving water and managing demand. Prompted by the *Water Efficiency Plan*, today nearly all Calgary homes and businesses have water meters installed as part of the Water Utility Bylaw.

WATER DEMAND DURING DROUGHT

A key component of drought management is a temporary reduction in water use to manage low water supply conditions. If necessary, The City can reduce water demand by restricting outdoor water use.



Understanding Calgary's water demand

Calgary's historically booming population and rapid economic growth placed heavy demands on Calgary's water supply. Since the late 1980s, The City has invested in infrastructure and programming to manage water demand (Figure 5).

A key component of water demand management is water conservation. In the mid-1980s, the Water Utility was planning the expansion of the Bearspaw Water Treatment Plant to produce more drinking water. At that time, water demand was 750 litres per capita per day and it became evident that the ability to provide service at that demand level was unsustainable.

This observation led to the development of the 2005 *Water Efficiency Plan*, which has guided water conservation efforts and demonstrated Calgarians' leadership in using water more efficiently. *The Water Efficiency Plan's* goal is to hold withdrawals from the river steady at 2003 levels, even with population growth. To do this, the *Water Efficiency Plan* charted a path of programs and initiatives to reduce water consumption by 30 per cent over 30 years, and Calgary is on track to meet this goal.

Significant investments have been made to reduce per capita demand through leak detection, main replacement, water metering, promotion of low flow toilets and faucets, educational programs and water treatment plant upgrades. These demand investments have allowed us to accommodate growth by deferring and better sequencing water treatment plant upgrades.

Current initiatives

Water Efficiency Plan update

The Water Utility continues to implement program recommendations through the 2016 update of the *Water Efficiency Plan*. This includes a shift in focus away from customer, or user, incentive-based programs to industrial, commercial and institutional customers. A focus on outdoor water conservation programming will also help manage peak day demand, which is the one day each year that Calgarians use the most water. Typically, this occurs in the summer months, as water demand spikes. Keeping this peak demand below current plant capacity ensures that The City can continue to meet water demands without requiring additional infrastructure. A renewed focus on peak day programming will continue to reduce overall water consumption and help achieve The City's 2033 water demand target.

Drought management

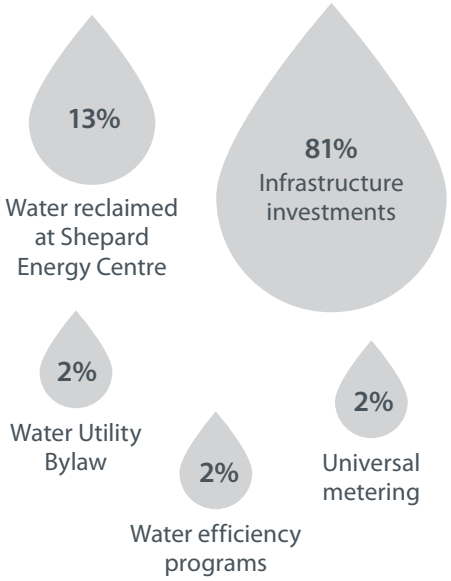
Planning and preparing for drought is an essential part of The City's integrated watershed management work. The Water Utility has established Drought Operational Guidelines to improve preparedness and decision-making during the summer months.

The Water Utility is also assessing future drought risks and vulnerabilities under changing climate scenarios to inform a final *Drought Management Plan*. This risk assessment will guide improved drought management strategies and stakeholder engagement over the next two years. The *Drought Management Plan* is anticipated to be finalized in 2022.

Demand forecast model

The Water Utility is updating its water demand forecast model, which considers all key drivers. The model will provide statistically based outlooks on city, regional and community-level water consumption. The model will also incorporate future climate change and economic scenarios to analyze and optimize future demand management programs.

Figure 5. Water demand in Calgary has decreased through various programs and investments over the years.

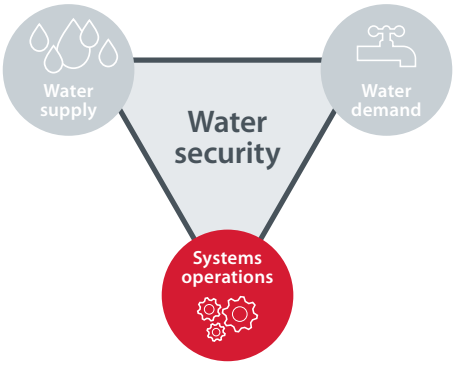


GLENMORE GATES

The Glenmore Reservoir is a critical component of Calgary's water supply operations. The City is installing new steel gates and an elevated hoist system on the Glenmore Dam crest, which will provide greater flexibility to manage reservoir storage during low flows in the winter and high flows in the spring. The new gates will also increase the operational efficiency of the Glenmore Water Treatment Plant and help build resiliency for Calgary.

PROTECTING WATER SUPPLY: 2013 FLOODS

As part of upgrades at the Glenmore Water Treatment Plant, the Actiflo filtration system allowed the Water Utility to continue to deliver clean drinking water to customers during the 2013 floods. This is remarkable given the rapid influx of sediment laden waters that entered the water treatment plant.



Understanding Calgary's systems operations

The City of Calgary owns and operates two drinking water treatment plants: the Bearspaw Water Treatment Plant and the Glenmore Water Treatment Plant. The City also owns and operates an extensive network of underground water supply pipes, treated water storage reservoirs and pumps. This infrastructure enables the delivery of reliable, high quality drinking water to customers every day.

The Bearspaw plant supplies treated Bow River water to north Calgary, while the Glenmore plant supplies treated water originating from the Elbow River to south Calgary.

The City has designed its operations to be resilient to ensure we continue to meet our customers' water needs. This is achieved through multiple approaches, including larger reservoirs to respond to seasonal water supply changes, building in-system storage and redundancy, and developing preparedness and response strategies to respond to an emergency.

The City recognizes that infrastructure needs to work in conjunction with the other users and their assets in the Bow River watershed. Extensive operational co-ordination exists between The City, the Government of Alberta, TransAlta and downstream irrigation districts to ensure adequate river flows for all users and the environment in the South Saskatchewan River Basin.

Current initiatives

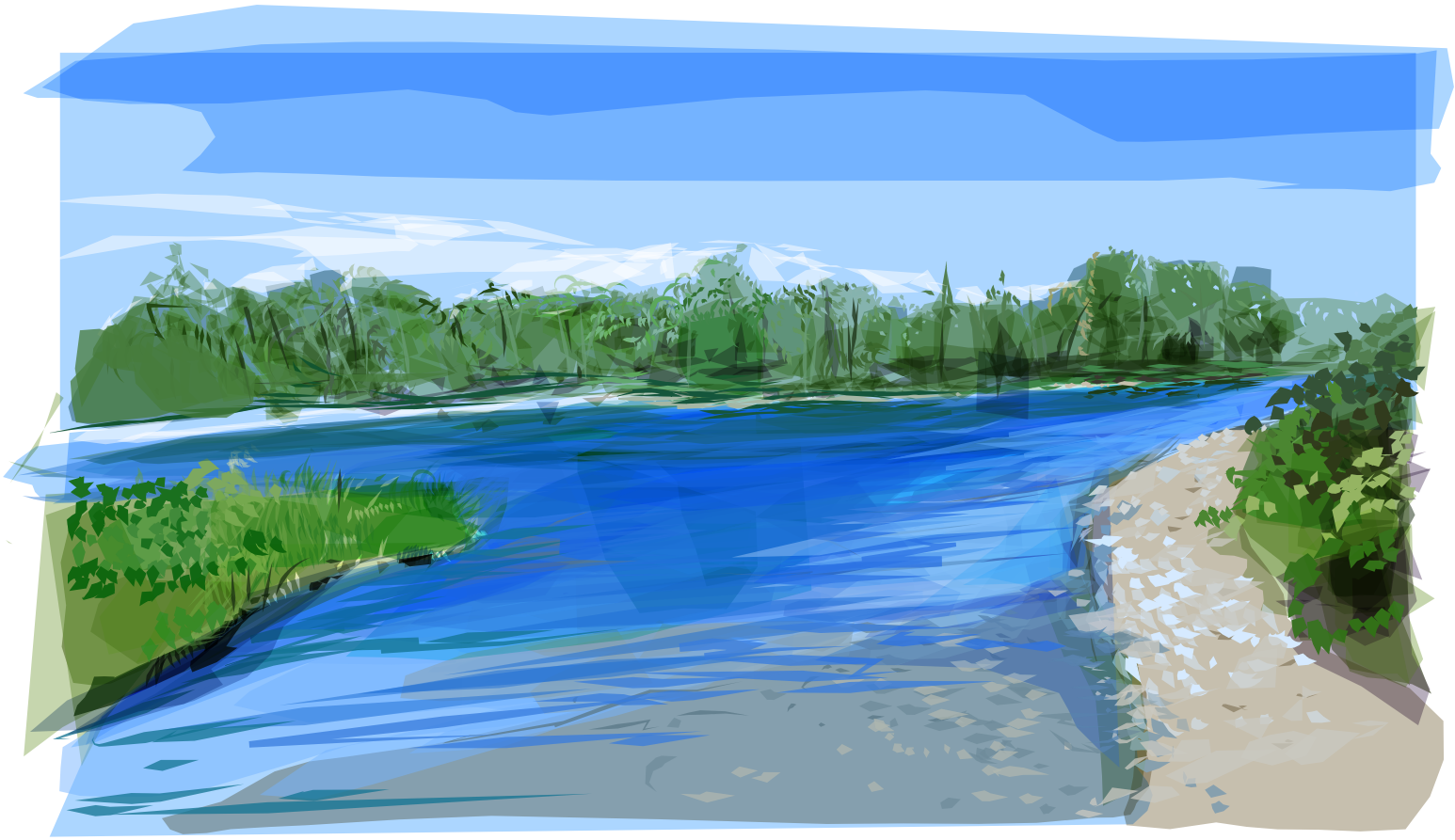
Water Long Range Plan

The City is currently updating the *Water Long Range Plan* (WLRP), which was last completed in 2011. The WLRP projects future water demands and, through a review of various supply strategies, identifies future water supply system requirements and associated capital investments. The WLRP looks at major infrastructure from source to tap including treatment plants, pump stations, reservoirs and transmission mains to ensure service levels are met.

Water Loss Strategy

The City conducts leak detection testing on water infrastructure as a critical part of a maintenance program to reduce water loss. Leaks identified are scheduled for repair, saving hundreds of thousands of litres of water daily.

As part of adaptive management and continual improvement, the Water Utility is developing a *Water Loss Strategy* to better understand the use of potable treated water within the Water Utility's infrastructure and minimize the volume of non-revenue water (i.e. water that is either used or "leaked" before being delivered to rate paying customers). Implementing these strategic changes will make better use of the existing water resources and infrastructure.



5 Water security priority actions

The City of Calgary is confident that its current actions and adaptive management approach will ensure a secure water supply now and help Calgary prepare for future water security. The following six priority actions will further support managing long-term risks to water security.

Priority actions

1. Develop future water supply scenarios

Effective long-term management of water security requires developing future water supply and demand planning scenarios. These scenarios must consider climate change impacts. The Water Utility will develop these scenarios together with options assessment criteria and continue to study how a changing climate affects water yields from the Bow River watershed. This understanding will guide servicing decisions, infrastructure investments, programming, and policies in a fiscally responsible manner leading into the next century.

2. Address water licence limits on high demand days

To accommodate projected population growth, The City will examine options to increase the maximum daily water diversion rate. This includes discussions with TransAlta and the Government of Alberta in 2020.

3. Collaborate on a regional solution for water security

Since many stakeholders contribute to water security in the Bow River watershed, The City will continue to work collaboratively with a variety of organizations, stakeholders and partners to build a shared understanding of water security issues. Through the development and implementation of the CMRB's Regional Growth and Servicing Plans, The City will work with the Government of Alberta, CMRB and other regional stakeholders to set a long-term adaptive water supply strategy for the region.

4. Advocate for a new upstream reservoir on the Bow River

Water management practices and storage capacity for both extreme flood and drought are priorities in adapting to the uncertainties of climate change. The City will continue to advocate for a new provincially owned upstream reservoir on the Bow River as a major component in flood mitigation and drought management for the Calgary region.

5. Finalize the Drought Management Plan

Managing for drought ensures Calgary can operate within water shortage shocks and stresses. The City is currently assessing drought risks and vulnerabilities under changing climate scenarios. This work will inform improved drought management adaptation strategies and stakeholder engagement that will be incorporated as part of The City's *Drought Management Plan*. This plan will be completed by 2022.

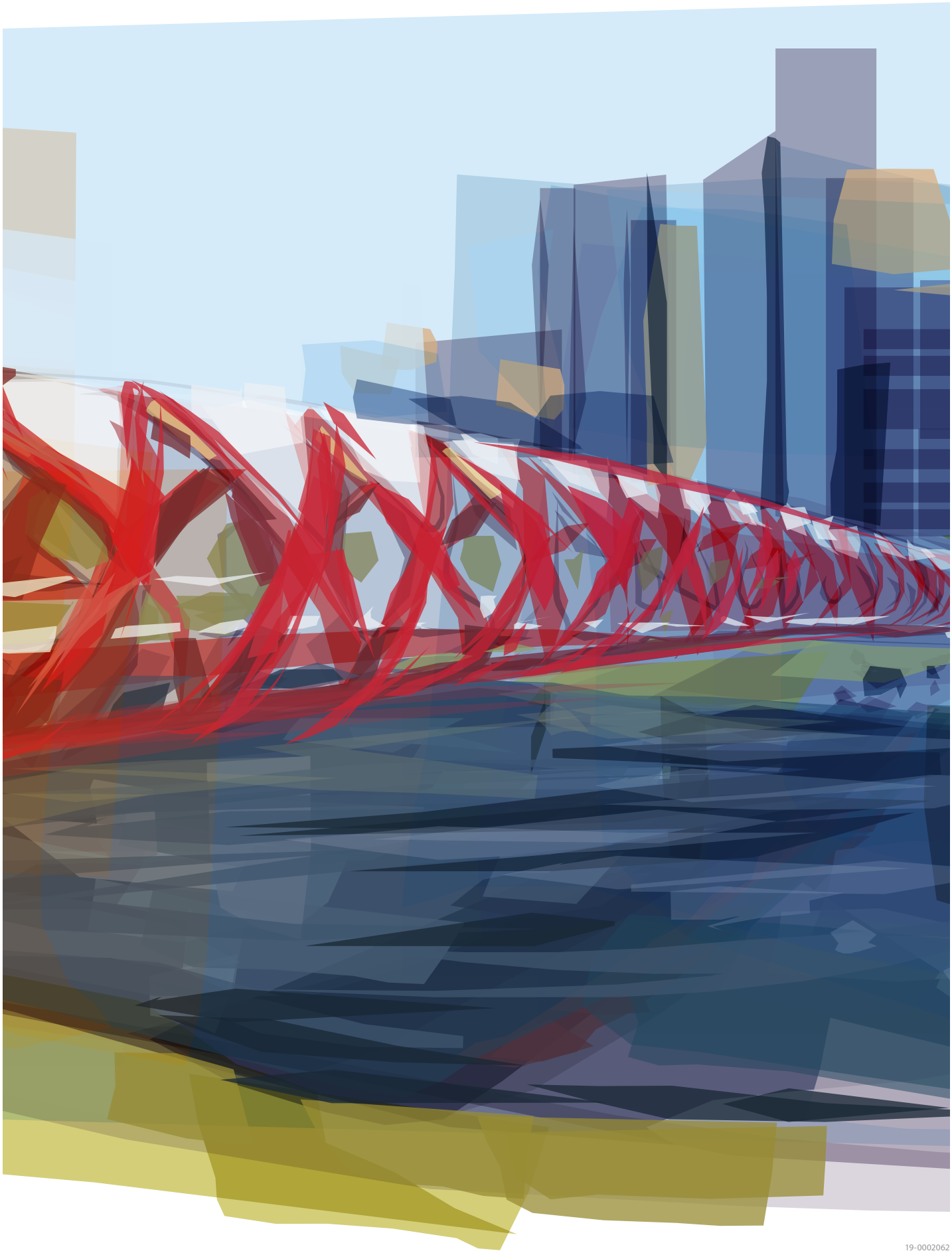
6. Finalize the Source Water Protection Plan and Policy

Source water protection is critical for water security. The City's *Source Water Protection Plan* identifies contamination from wildfires and stormwater runoff from land development as the top risks to the quality of Calgary's water supply. The Plan and Policy will be presented to City Council in 2020.

Looking ahead

Building a resilient future requires taking a long-term view of water security and embracing an adaptive management approach across the three water security levers of supply, demand and system operations. This approach requires The City to be comfortable with uncertainty and managing risks that are not fully understood today. New data, changing conditions, external influences and collaboration with stakeholders will continue to inform the path forward.

Actions taken today and over the long-term will ensure a water secure future for generations to come.



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