Water Services

Flood Resiliency and Mitigation

November 2017

Springbank Off-Stream Reservoir (SR1)

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In 2013, Calgary experienced its largest flood since 1932 which resulted in approximately $5 billion in damages across Alberta, and over $400 million in damages to the City of Calgary's infrastructure. Many homes and businesses in Calgary's most established neighbourhoods experienced devastating damage from river and stormwater flooding.

Since the 2013 floods, the City of Calgary has made flood resiliency a priority and placed considerable attention on mitigation to reduce the risk of future flood damage. In addition to technical studies to better understand flood risk, and identification of structural and non-structural flood mitigation measures, the City of Calgary and the Province have committed over $150 million for various projects to build long-term flood resilience throughout Calgary.

River flooding affects us all

Calgary was established at the confluence of the Bow and Elbow Rivers. The short, steep distance the rivers travel from the mountains to Calgary means that intense flooding can happen quickly, and with little warning. There will always be a risk of flooding in Calgary.

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Now home to over 1 million people, with the downtown core and historic neighbourhoods located along the river, building resilience to flooding is a top priority for the City of Calgary.

Springbank Off-Stream Reservoir (SR1)

In 2015, the Province committed to SR1 on the Elbow River. It will be located approximately 18.5 kilometres upstream of the Glenmore Dam, near Springbank Road, north of the Elbow River and mostly east of Highway 22. The reservoir will store water temporarily during a flood and release the water slowly back into the Elbow River afterwards.

SR1 is critical to building flood resiliency for Calgary, and for ensuring flood mitigation on the Elbow River. That said, since SR1 will be located outside of The City's jurisdiction, the location, design, and construction of the reservoir is the responsibility of the Province of Alberta. (For project details, please visit the Province's webpage.)

The Province of Alberta submitted their SR1 Environmental Impact Statement to the Canadian Environmental Assessment Agency, and Alberta's Natural Resources Conservation Board in mid-October 2017, as required for the environmental assessment review of the project.

For more information about the project, visit the Province's Springbank Off-Stream Reservoir project webpage.

Flood Mitigation Measures Assessment

In 2016, The City hired IBI Group and Golder Associates to update the Provincial Flood Damage Assessment study for Calgary, and to assess and recommend future resiliency and mitigation measures. The assessment included a technical study, a sustainability analysis and community engagement.

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The high level findings of the assessment were:

- Without any mitigation in place, the annual flood damage costs in Calgary would average $170 million per year.
- Investments in flood mitigation to date have decreased the flood damage risk by approximately 30 per cent to $115 million per year.
- The Province of Alberta's Springbank Off-Stream Reservoir and The City's upgraded Glenmore Dam gates will protect Calgary from Elbow River flood waters to an event similar to the 2013 flood.
- The Province's multi-year agreement with TransAlta to modify operations at the Ghost Reservoir for flood mitigation purposes provides significant flood mitigation for Calgary.
- A new upstream reservoir, in combination with ongoing TransAlta operations and complementary flood barriers in communities along the Bow River, will protect against a flood event similar to 2013.
- A barrier implementation plan must be adaptable to Provincial policy decisions and include community engagement. Any future policy changes must align with Provincial flood hazard regulations, Federal guidelines, and structural mitigation that is put in place.
- Property level mitigation undertaken by private property owners can significantly the reduce risk of flood damage.

Calgary's Flood Resiliency Plan

The City is committed to integrated watershed management that provides a high level of flood resilience for our communities, while protecting the natural river valley, enhancing water quality, water supply and the environmental function of the watershed. To reduce Calgary's flood risk, a combination of watershed, community, and property level mitigation solutions, as well as floodplain policy is necessary. Calgary's approach provides flexible and adaptable strategies to reduce flood risk for a large city.

The plan was developed considering The City's principles and priorities regarding flood resiliency: public safety, sustainable watershed management, cost beneficial investments, adaptability and flexibility, equitable protection on both rivers, community receptivity, and shared responsibility. The City's strategy is a holistic, adaptable and multi-faceted approach. It incorporates policy and regulation, structural and non-structural mitigation measures, and public and private resiliency measures.

Elbow River Mitigation

The Flood Mitigation Measures Assessment confirmed the Springbank Off-Stream Reservoir (SR1) combined with the installation of upgraded gates at the Glenmore Dam will mitigate a flood similar to the 2013 flood. It is estimated that flood risk will be reduced approximately 25 per cent by the new gates on the Glenmore Dam, and 75 per cent by SR1.

The Assessment concluded that the mitigation provided by SR1 for the Elbow River communities cannot be achieved through fortification by barriers alone. Barriers are not considered viable because of the size and scale required, and their associated implications:

- Barriers would need to be built on private property.
- They would significantly disrupt community function and aesthetics.
- They would need to be built along both sides of the Elbow River for almost the entire length of the river below the Glenmore Dam (over 14 kilometers in length).
- Barriers would average in height between 1.6 and 3 meters. In some areas, the maximum height would be between 5 and 6 meters.
- Barriers would disrupt riparian and river ecosystems, and disconnect the community from the river.
- Ultimately, they would cost more to build than the damages they would protect against, and would cost more than SR1.

For more information on The City's flood mitigation actions, please visit **calgary.ca/floodinfo**

Frequently Asked Questions

The following Frequently Asked Questions have been prepared in response to citizen enquiries about the role of SR1 in The City's Flood Resiliency and Mitigation Plan.

What is The City's role in the building of SR1?

The City continues to support SR1 as it is a critical piece of infrastructure to help control river flows on the Elbow River. The City also values a healthy and resilient watershed that will continue to provide reliable, clean water and ecosystem services for current and future generations.

As a stakeholder, The City meets regularly with the Government of Alberta project team to discuss the design and operations of SR1.

How is The City participating in the Environmental Review Process?
The Canadian Environmental Assessment Agency (CEAA) and Alberta's Natural Resources Conservation Board (NRCB) are conducting an environmental review of SR1.

While SR1 is a critical piece of flood mitigation for Calgary, The City also supports a thorough environmental review of the project to minimize environmental impacts while achieving the highest possible reduction of flood risk.

Along with other key stakeholders, The City is participating on CEAA's Technical Working Group. The City will also participate as an intervener during the public input phases of the process. As a government entity, The City is not eligible for intervener funding nor receives special status within the process.

For more information on how the public can participate in the process, please visit the CEAA and NRCB websites.

What level of protection does SR1 provide to Calgary?
The combination of SR1 and the upgraded gates on the Glenmore Dam will provide protection against floods on the Elbow River similar in size to the 2013 flood event. It is estimated that SR1 will provide 75 per cent and the Glenmore Reservoir will provide 25 per cent of the storage needed to mitigate against a large event.

Can the Glenmore Dam prevent Elbow River flooding on its own?
No. The Glenmore Reservoir and Dam were constructed over 85 years ago to provide Calgarians with a safe and sufficient supply of drinking water. The reservoir and dam are managed to store an adequate supply for drinking water, reduce the impact of small to intermediate sized floods, sustain the environmental health of the river, and provide recreational opportunities.

Currently, the reservoir is not large enough to hold the flows from a flood event the size experienced in 2013. Infrastructure at the Glenmore Dam is currently being upgraded. One part of this upgrade involves installing new, automatic steel gates that will improve the operational efficiency of the dam, helping to better manage high flows in the spring, and low flows in the winter. This will provide approximately 25 per cent of the needed protection against a flood equivalent in size to the 2013 flood. The remaining 75 per cent of the storage volume would be provided by SR1.

The water level in the Glenmore Reservoir is constantly monitored so that operators can respond to sudden changes in river flows, as well as control the flow coming out of the reservoir to minimize impacts downstream.

Will SR1 and Glenmore Gates protect downtown Calgary?
In addition to residential communities along the Elbow River, commercial areas on the eastern and southern side of the downtown core will benefit from the protection provided by SR1 and the Glenmore Gates. This includes areas such as 4th Street in Mission, Beltline, Victoria Park, East Village, and parts of Inglewood.

Lower flows entering the Bow River from the Elbow River will also provide protection to areas downstream of where the rivers meet.

Why doesn't The City build barriers along the Elbow River instead of relying on SR1?
The barrier fortification of the Elbow River is not a viable option. Barriers would be needed along the entire length of the Elbow River below the Glenmore Dam. This would require costly private land acquisition, dramatically disrupt community function and aesthetics, and significantly impact the riparian and fish habitat of the river. The fortification of the Elbow River with barriers ranked poorly in the sustainability analysis, and was viewed unfavorably during community engagement.

What measures are in place until SR1 and the Glenmore Gate Upgrades are completed and operating?
The City of Calgary's priorities when planning for, and responding to, flooding are public safety, protection of critical infrastructure and maintenance of vital community services, and protection of large areas to minimize the social and economic impacts on the city.

The City has a Flood Emergency Response Plan that is activated if required. The City undertakes a number of activities each year to prepare for potential emergencies. These include:

- Annual revision to The City's Flood Emergency Response Plans.
- Field readiness to monitor and operate stormwater outfall gates, lift station plans, pre-positioning of pumps and other emergency supplies.
- Training and exercises for Water Utility employees on equipment deployment and emergency response.
- Monitoring of meteorological and river conditions in partnership with Alberta Environment and Parks.

What other measures is Calgary taking to protect citizens?
The City is exploring additional policy and regulatory changes and property level mitigation programs that could increase flood resiliency and reduce future flood risk and future flood damages.

The Municipal Development Plan was updated in 2014 with top priorities related to flood resiliency. In addition, amendments to The City's Land Use Bylaw in 2014 included:

- In the floodway, no new development is allowed beyond the existing building footprint. All floodway redevelopment is discretionary.
- In the flood fringe and overland flow areas, main floors and mechanical/electrical systems must be set above the designated flood elevation. Development in flood fringe and overland flow areas must follow these rules regardless of parcel history (i.e. no "grandfathering"). Post 2013 flood inundation elevations are also provided by The City as an advisory.
- In the flood fringe, building setbacks apply (30m/60m depending on which creek/river, or 6m from the floodway, depending on parcel history).
- New and redeveloped properties in the flood hazard area require back flow prevention valves.
- A "sliding-scale" approach is employed to determine which mitigation measures are required based on the size of the redevelopment. Small building alterations require minimal mitigation measures and large alterations require more robust flood mitigation measures.
- Restrictions and advisory conditions on what is allowed to be stored on a parcel in the flood hazard area, to mitigate against environmental contamination and river debris.

What measures are not being pursued?
The following measures have previously been researched and set aside as they were not technically, economically, environmentally, or socially practical:

- Dredging of the Glenmore Reservoir, Elbow River or Bow River.
- Elbow River tunnel from Glenmore Reservoir to Bow River.
- Full barrier fortification of the Elbow and Bow Rivers.

Could SR1 impact water quality in the Elbow River, and how will that affect Calgary's drinking water?
The Elbow River is the source of water for the Glenmore Water Treatment Plant and provides drinking water for about half of Calgary's population.

The City of Calgary works hard to ensure a safe, clean and reliable supply of drinking water. Our world-class water treatment and testing facilities continue to meet or perform better than all federal and provincial health guidelines. The City closely monitors drinking water daily throughout the system from the river, to our treatment plants and throughout the distribution system that delivers water to homes and businesses, and conducts more than 150,000 tests annually.

The City and the Province are working together to understand and address the potential impacts to Calgary's drinking water from SR1.

Is my property at risk of flooding?
There are a number of maps that are available on The City's website that can help citizens determine their flood risk. For more information, visit Calgary.ca/floodinfo to see whether your property is located in the flood hazard area.

What can citizens do to protect their property?
Flooding can happen at any time in Calgary. The period between May 15 and July 15 is when we are most likely to experience flooding since historically this is when we receive our largest rainfalls.

To make sure you and your family are as prepared as possible in the event a flood occurs, follow the steps below:

- Read The City's Flood Readiness Guide
- Create a 72 hour kit
- Get the latest alerts and notices from Alberta Emergency Alert and Alberta Rivers apps
- Create an evacuation plan
- Visit Calgary.ca/floodinfo for more information.

Why is The City not buying out properties at risk of flooding?
Based on property values alone, it is cost prohibitive to purchase all properties in the current flood hazard area. The buy-out costs have been estimated to be up to five times greater than the cost of SR1. In addition, there would be the costs associated with building demolition, conversion of the land to parkland, and incentives to assist homeowners to relocate.

How will SR1 change land-use regulations?
The Province is currently updating designated flood hazard maps. The impact of SR1 and any flood mapping changes are unknown at this time. The City will align any of its future land use for Calgary with the new provincial flood maps and policy changes once they are released by the Province.

Glossary

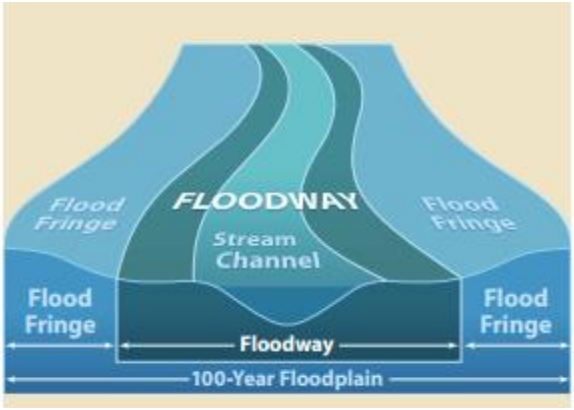
Design Flood – The size of flood that flood-related policies and structures are designed to protect against. In Alberta, flood-related policies, such as Calgary bylaws, are based on a 1:100 year flood. The design flood for structural design depends on the structure, but it is often the 1:100 year flood.

Flood mitigation – Includes policies or structures that reduce the risk of floods to a community, either by preventing floodwater from entering the community or by reducing the potential damages or threats to public safety when flooding does occur.

Flood barrier – An earthen embankment (known as a berm or a dyke), flood wall, or a temporary wall constructed of sand bags or other materials built to provide protection from floods.

Flood hazard mapping – Flood hazard mapping shows flood hazard areas along streams and rivers.

Flood Hazard Area – In Alberta, the flood hazard area is the area that would be flooded in a 1:100 year flood. It is typically divided into two zones: floodway and flood fringe. In some areas, such as Calgary, there may also be a third zone, called the overland flow zone, which is considered a special part of the flood fringe.



Floodway – The floodway includes the channel of a river and, in some places, the land next to the river. The floodway carries the bulk of the floodwater downstream. Flow is usually fastest and deepest in the floodway.
Floodplain - The area next to a river which can flood when river flows are high. The floodway and flood fringe are within the floodplain.

Flood fringe – The area outside of the floodway that is flooded in a 1:100 year event, but where flows are not as deep or fast as in the floodway.

Flow Rate – Flow is a measure of the amount of water traveling past a point in a given amount of time. In rivers, the flow of water is typically reported in cubic metres per second (m^3/s). A cubic meter is the volume of water contained in a cube of one metre high, one meter wide, and one metre deep. It is equivalent to 1000 litres of water and weighs a metric tonne. Typical flow rates on the Elbow River are $25m^3/s$ in spring and $3m^3/s$ in winter.

Non-structural mitigation measures – Knowledge, practice, or agreements to reduce risk and improve resiliency. These measures include policies, land use planning, development regulations, emergency response and public training and awareness.

Structural mitigation measures – Keep river flood water out of communities to a specified water level, reduce property damage and increase public safety. Examples of physical structures are dams and reservoirs, as well as barriers.

- **Upstream physical measures** such as dams and reservoirs are built to control or slow the flow of the river to reduce the risk of flooding to a community as a whole.
- **Local physical barriers**, such as dykes and barriers are placed where the river banks need to be raised to prevent flooding at specific locations and providing protection to specific communities/areas.

Watershed – The entire land area that drains to a river. The Elbow River watershed extends up into the Rocky Mountains beyond Bragg Creek. Calgary gets its water from both the Elbow River and Bow River watersheds.

1 in 100 year flood – A large flood that has a one per cent chance of occurring in any given year. It can also be called a 1 per cent flood or a 100-year flood, and is often written as “1:100 year flood”. Although called a “1 in 100 year flood” there will not necessarily be one every 100 years. It is even possible to have more than one 1 in 100 year flood in the same year. On the Elbow River, the estimated flow rate coming into the Glenmore Reservoir in a 1:100 year flood is about 950 m^3/s.