

Calgary's Flood Resiliency Plan

Updated January 2019

Introduction

Flood mitigation is one of The City of Calgary's top strategic priorities. The City's River Flood Resiliency Plan is built on several technical and social studies conducted since 2013, including the *Flood Mitigation Measures Assessment (FMMA)* that City Council approved in 2017. The Plan relies on a multi-faceted approach with watershed, community, and property-level components working together to manage flood damage risks in Calgary. Our strategy aims to provide timely, cost effective, and practical flood risk management while respecting community values and staying adaptable to future uncertainties. The Plan is designed so that every dollar spent on flood investments since the 2013 flood will return approximately \$10 in avoided flood damage once projects are completed.

Figure 1 shows the key investments and actions that make up our Plan.



FIGURE 1 CALGARY'S PLAN RELIES ON UPSTREAM AND COMMUNITY INVESTMENTS, OPERATIONS, PROPERTY PROTECTION AND FLOODPLAIN POLICY

Building flood resiliency is a shared responsibility of all orders of government as well as Calgarians. The City has developed strong relationships with the Province, TransAlta, businesses, and community leaders as it works to make Calgary more prepared for future floods.

The City's principles for building flood mitigation include:

- Ensuring public safety
- Maintaining operation of critical infrastructure, such as roads and utilities
- Maximizing value for money
- Maintaining climate adaptability and flexibility in flood mitigation design
- Providing an equitable level of protection on both rivers wherever possible
- Working with communities to build understanding on flood mitigation and shared responsibility; and
- Balancing sustainable water management opportunities with flood mitigation investments

What we've done so far

With support from the Province and Federal government, completed infrastructure investments have reduced Calgary's overall flood risk by as much as 30 per cent. Once projects such as the Springbank reservoir and the improvements to the Glenmore dam's gates are completed, most of Calgary's remaining flood risk will be on the Bow River. The City is actively working to address this. The City has started work on some community flood mitigation projects such as the Downtown Barrier, however more work is needed to reduce flooding on the Bow River.

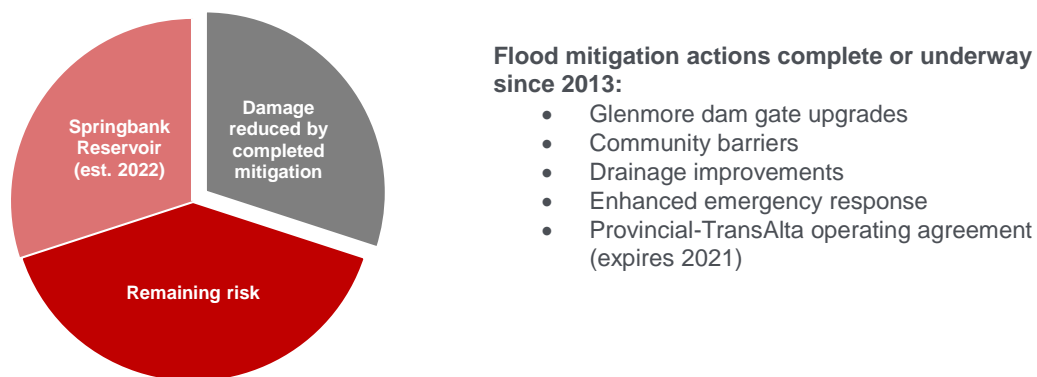


FIGURE 2 FLOOD MITIGATION PROGRESS TO DATE

Upstream mitigation is the cornerstone to our Plan

Floods larger than what happened in 2013 are not unprecedented. Had the rainfall pattern in 2013 shifted slightly flooding would have been much worse, causing even greater damage to communities and the downtown core. In fact, two floods larger than the 2013 flood have occurred in Calgary since we started recording this information just over a hundred years ago. The City's *Flood Mitigation Measures Assessment* clearly shows there is no way to mitigate floods bigger than 2013 without multiple lines of defense. This includes upstream flood mitigation – the Province's planned Springbank reservoir on the Elbow River, a future reservoir on the Bow River, and modified operation of existing reservoirs on the Bow River. Even with upstream mitigation, Calgary is still at risk of a flood. The City's Plan includes municipal mitigation efforts to complement upstream infrastructure.

Watershed level mitigation – Elbow River

The Springbank off-stream storage reservoir planned by the Province will be located about 18 km upstream of Calgary's Glenmore dam and is designed to store water during a flood, releasing it slowly back into the Elbow River. Once completed, the Springbank reservoir, operated in tandem with improvements to The City's Glenmore dam, will provide flood mitigation on the Elbow River for a flood event similar to 2013, with Springbank providing the majority of mitigation.

As of January 2019, the Province is working with the Federal government to complete the Environmental Impact Assessment process for the Springbank reservoir. Upgrades of the Glenmore dam's gates are underway with completion slated for the end of 2020. These upgrades will increase the dam's storage, helping with flood mitigation, and will work with the Springbank reservoir when it is completed.

Community flood barriers are not part of The City's recommended actions on the Elbow River, due to the substantial length, breadth and height of barriers that would be required throughout all communities downstream of the Glenmore dam, significant community disruption, and land acquisition costs.

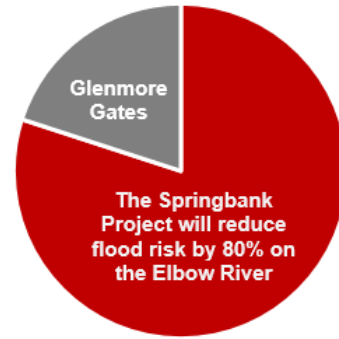


FIGURE 3 ACTIVE MITIGATION PROJECTS TO PROTECT ELBOW RIVER COMMUNITIES AND DOWNTOWN

Watershed level mitigation – Bow River

The City participated in the Bow River Working Group, which released a report in 2017 outlining short, medium, and long term operational and infrastructure improvements to improve flood mitigation and water supply on the Bow River. The City participated in the process and endorses the report's recommendations of a future reservoir upstream of Calgary, as well as modifications to the operations of existing reservoirs.

TransAlta operations play a critical role in flood mitigation for Calgary. Key actions from the report include negotiation of a long term watershed agreement between the Province and TransAlta, and also extending the Ghost Reservoir flood operations agreement and drawdown rate. Operating upstream reservoirs during high waters significantly reduces flood damages in Calgary, and enhancing these operational efficiencies is crucial. Optimized TransAlta operations will also enhance the effectiveness of Calgary's community barriers by helping control the flow of water through Calgary.

The Province has begun work on the report's short term mitigation recommendations, including a study to investigate the feasibility of drawing down the Ghost Reservoir more quickly. The Province has also initiated an in-depth technical feasibility study of three potential locations for a new reservoir, and a renewed Bow River Working Group will be reconvened to advise on the process.

Climate change is likely to increase the frequency and magnitude of flooding and drought in the Calgary region. An upstream reservoir on the Bow River is critical to Calgary's flood resilience, and has the potential to address water supply and drought risks in the face of climate uncertainty, working as a holistic water management solution that goes beyond flood mitigation.

The role of community flood barriers

The City's *Flood Mitigation Measures Assessment* and *Permanent Flood Barrier Protection Assessment* identified that community-level flood barriers on the Bow River play a crucial role in combination with upstream measures to mitigate a flood event similar to 2013.

Calgary's Plan includes a recommendation for four new community barriers in high risk locations:

- Downtown from Jaipur bridge to Reconciliation bridge
- Sunnyside-Hillhurst, from the Peace bridge to the existing community flood barrier
- Bowness, behind Bow Crescent; and
- In Pearce Estate Park near the community of Inglewood.

These proposed community barriers are intended to:

- Mitigate frequently occurring, lower magnitude flood events in the most vulnerable communities, and provide flood protection to a 1:200 level flood event downtown
- Enhance optimization of TransAlta operations by helping control the flow of water through Calgary
- Work in combination with a future upstream reservoir, so that no Bow River communities in Calgary will be flooded during a 1:200 flood event, and downtown will be protected to a 1:1000 event, and
- Be flexible, so that barriers can be modified in the future to address future climate uncertainty.

The Province approved funding to construct the Downtown Barrier in 2018. The City continues to work with the Province to negotiate funding for the remaining barriers. Preliminary planning and design for barriers in the communities of Sunnyside-Hillhurst, Bowness, and Pearce Estate-Ingleswood has started.

The Downtown Barrier is critical to Calgary's flood resilience as nearly half of the downtown is at risk should a significant flood event occur. Once complete, it will connect to existing flood barriers at West Eau Claire and Centre Street Bridge as single piece of infrastructure and mitigate up to a 1:200 year flood event.

Performance of the proposed Bowness and Sunnyside barriers will be enhanced by TransAlta's existing operating agreement with the Province. Performance of the barriers will be further improved if TransAlta operations are enhanced as recommended by the 2017 Bow River Working Group Report.



THE DOWNTOWN BARRIER IS PART OF THE CITY'S EAU CLAIRE PUBLIC REALM PROJECT AND WILL BE INTEGRATED WITH THE EXISTING PARK. IT IS A CRITICAL COMPONENT TO PROTECTING DOWNTOWN.

Groundwater and sewer backup can account for as much as 30-50 per cent of damage during overland river flooding according to recent City and independent studies. Managing river flows through upstream operations reduces groundwater levels by decreasing overland flooding and slowing the seepage from the river into the ground nearby. Barriers can help reduce groundwater flooding and sewer backups even further by keeping water from flowing overland from the river into storm and sewer systems and basements.

Barrier designs must reflect community considerations

The City recognizes that building flood protection must strike a balance with community values and be accepted by residents. The City examined a number of scenarios with extensive input from Calgarians before landing on its Flood Mitigation Plan. Buying out properties in Calgary's historic communities is extremely costly financially and socially. The City's preferred solution is to protect these communities as they exist now.

Careful consideration was given to the fact that the Bowness project is mostly on private property. The proposed Bowness barrier protects more than 350 private properties as well as municipal infrastructure. The Sunnyside barrier will include groundwater protection and its performance will be enhanced by the Upper Plateau stormwater improvement project underway, protecting the community, critical water infrastructure and a major road (Memorial Drive).

Community engagement

The City is committed to ensuring flood mitigation projects provide value to citizens and are well managed. We undertook public engagement throughout 2016 to gather input on different flood mitigation scenarios and to

inform the development of our Flood Mitigation Plan. Engagement included a Community Advisory Group, a phone survey, community workshops, open houses and online engagement. The City continues to engage with flood affected communities to ensure community barriers are understood and supported by residents. Engagement on the downtown barrier was completed as part of the Eau Claire public realm improvements, and we are reaching out in several ways to citizens in 2018 as part of the preliminary design work on the Sunnyside and Bowness barriers. The City is offering riverfront residents in Bowness one-on-one site visits between fall 2018 and spring 2019.

Floodplain policy and property protection

Property-level and flood policy measures, such as changes to building codes and types of development permitted in flood prone areas, are an important part of The City's Plan. These measures take time to achieve a substantive reduction in flood damages experienced by communities. However, when combined with the structural measures proposed, they can effectively increase the resiliency of existing communities and reduce new flood risk caused by growth and development.

In 2014, The City made changes to its Municipal Development Plan and Land Use Bylaw to provide guidance and better regulate development within the Flood Hazard Area. In 2017 we started to explore potential changes to The City's existing land use and building regulations to further increase Calgary's flood resilience. Examining restriction of land uses and occupancy types in the floodplain, such as care facilities and schools, are part of this investigation.

Provincial Flood Hazard Area (FHA) maps are from 1983 and continue to regulate Calgary's land use planning. The City continues to advocate for the Province to release its updated FHA maps and floodplain policy because there are implications on Calgary's mitigation project designs, municipal land use policy and development, and eligibility for disaster relief.

The City offers a number of flood preparedness resources including a Flood Readiness Guide, seasonal newsletter, and web resources to encourage property and personal flood preparedness. The City has also begun exploring additional education and property protection initiatives for Calgarians.

Benefits of investing in flood protection

Investments made since the 2013 flood combined with the Provincial-TransAlta agreement have reduced Calgary's flood risk by almost 30 per cent compared to 2013. Still, Calgary's risk exposure remains at \$115 million per year in annual average flood damages. The new barriers, Glenmore upgrades, and Springbank project will further reduce this risk exposure to about \$45 million per year. Every dollar spent on flood investments since the 2013 flood will return approximately \$10 in avoided flood damage once projects are completed. A future reservoir on the Bow River will provide additional flood protection equivalent to at least the 2013 flood throughout Calgary.

Calgary's combined approach of upstream and community investments maximizes investments in flood mitigation and is intended to enhance Calgary's ability to prepare for future climate uncertainty. As we continually improve our capacity to manage flood risk, together we are building flood resilience for future generations of Calgarians.