

# FLOOD RESILIENCE AND MITIGATION



S

2022 Update Report

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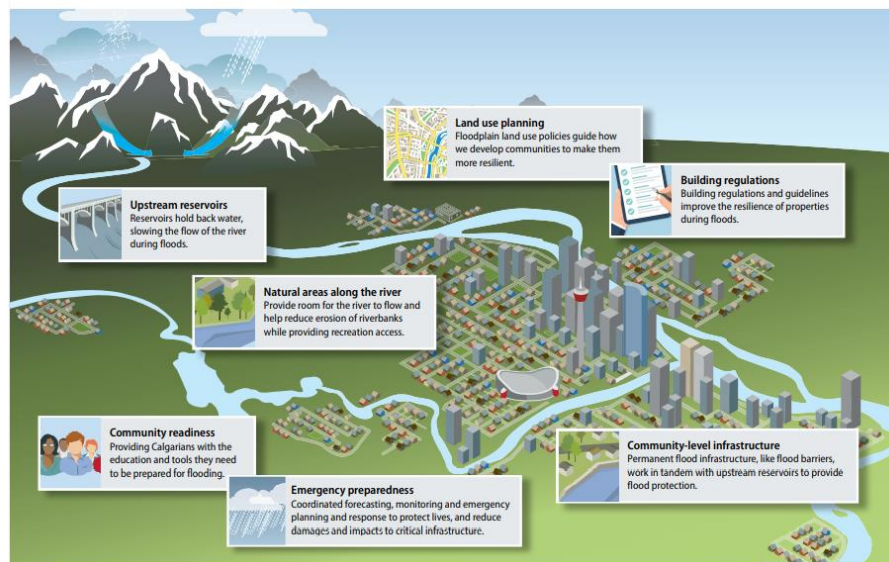
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## 1. OVERVIEW: THE CITY'S FLOOD RESILIENCE PROGRAM

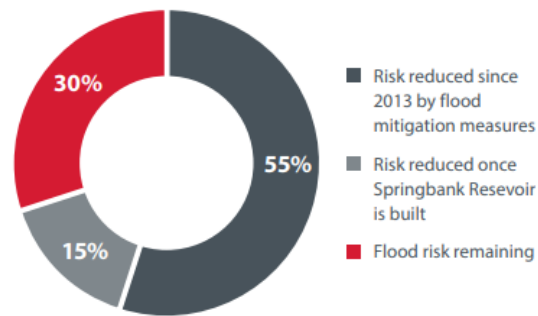
The 2013 southern Alberta floods were the costliest disaster in Canadian history until it was surpassed by the 2016 Fort McMurray wildfires. Shortly after the 2013 floods, The City of Calgary formed the Expert Management Panel on River Flood Mitigation. The City also undertook comprehensive city-wide engagement and used citizen feedback to inform the development of the Flood Resilience Plan.

Following recommendations from the 2014 Expert Management Panel report, a permanent flood resilience team was established to oversee and develop the Flood Resilience Program. The flood resilience team was to coordinate implementation of the Expert Management Panel recommendations, develop the long-term flood strategy for The City and implement associated actions, through timely, cost-effective, and practical flood risk management, while respecting community values and staying adaptable to future uncertainties. The program has advanced resilience measures in seven areas (see illustration below).



This June, it will be 10 years since the devastating 2013 flood. We will mark the anniversary by acknowledging the flood's impact and our City's resiliency through recovery, highlighting the progress we've made in flood resilience over the past decade, and recognizing The City's leadership in crisis management.

The City of Calgary, with financial assistance from the Government of Alberta (GoA) and the Government of Canada, has invested or committed approximately \$1B in flood mitigation infrastructure for Calgary, including the GoA's Springbank Offstream Reservoir (SR1) project. Since 2013, approximately 55% of Calgary's flood damage exposure has been eliminated, or over \$90M in average annualized damages (2015 damage assessment basis). By 2025 when SR1 is fully operational, an additional 15% of damage exposure will be averted. The remaining will be mostly in Bow River communities.



River flooding is one of the eight climate hazards of the greatest concern in Calgary’s 2022 Climate Strategy and falls under the adaptation theme of Water. The City continues to reduce the exposure to this changing hazard in a shifting climate, guided by Calgary’s Climate Strategy: Pathways to 2050. More information on The City’s Flood Resilience Program, its background, and the progress that’s been made by The City since 2015 can be found at [Calgary's Flood Resilience Plan](#).

## 2. SUMMARY: 2022 HIGHLIGHTS

- Completed construction of the Downtown Flood Barrier
- Continued progress on the Upper Plateau Separation project
- Progressed design on the Sunnyside Flood Barrier project as part of the Memorial Parkway Program
- Participated in operational and land use steering committees for the GoA’s SR1 project (under construction).
- GoA progressed Phase 2 feasibility study of the Bow River Reservoir Options Study
- The GoA – TransAlta operating agreements remained in force (until 2026).
- High rainfall event in June, which exercised City response plans, resulting in plan refinements and underscored the importance of reliable permanent flood mitigation infrastructure.
- Progressed Calgary’s regulatory review of draft provincial flood hazard maps and planning of flood resilience policy modernization in the river valleys into 2023, while advancing a parallel process of Indigenous engagement.
- Community readiness, engagement and awareness building, including continuation of outreach programs contributing to equity and inclusion.

This Update outlines the progress made in 2022 and forecast actions in 2023 under the Flood Resilience Program. These actions form the multi-layered approach that combines upstream, community-level, and property-level mitigation measures working together to manage Calgary’s flood risk.

## 3. COMMUNITY MITIGATION MEASURES

Mitigation measures at the community scale have included flood barrier, gravel bar, erosion/bank stability and drainage improvement infrastructure directly tied to river flood resilience.

On the Bow River, community flood barriers along downtown and in Sunnyside will protect the safety of the community and critical infrastructure. The Bowness flood barrier project was paused in 2021 as the result of community response. In addition to advocating for advancing an upstream Bow reservoir option by the GoA, The City continues to work with Ward 1 and the community of Bowness through 2023 and beyond to improve community preparedness and resilience to flooding.

### **3.1 DOWNTOWN FLOOD BARRIER**

The Downtown Flood Barrier is situated on the south bank of the Bow River, extending between Jaipur Bridge and Reconciliation Bridge through several public realm spaces including the Eau Claire Plaza, Sein Lok Park, and Calgary Municipal Land Corporation's (CMLC) Riverwalk. Design and construction has been integrated through the multi-departmental program "Eau Claire Area Improvements" that encompasses flood protection amongst upgrades to the Eau Claire Plaza, replacement of Jaipur Bridge, and early infrastructure work supporting the future GreenLine Eau Claire station. By connecting to flood defences constructed as part of the West Eau Claire project in 2018, it will complete a contiguous flood barrier for Downtown Calgary, protecting critical assets vital to Calgary's economic wellbeing.

#### **Action for 2023:**

The Downtown Flood Barrier will be operational for flood season 2023 and final landscaping works will be completed later in the year. The project has been constructed with funding assistance from the GoA's Alberta Community Resilience Program and Infrastructure Canada's Investing in Canada Infrastructure Program.

### **3.2 SUNNYSIDE FLOOD BARRIER AND MEMORIAL PARKWAY PROGRAM**

The Sunnyside flood barrier project was approved by City Council in 2020 to protect the community from overbank river flooding up to a 1:100 flood. In response to community feedback, the flood barrier was integrated into the larger Memorial Parkway Program that was presented to and approved by City Council in February 2022, to coordinate barrier design and construction with public space improvements. The Sunnyside Flood Barrier project is anticipated to be completed in 2025 and will occur in parallel with other MPP elements. The barrier will stretch from 14 Street Northwest to Centre Street North and avert an estimated \$270 million in flood damages over the next 100 years, or, an average, approximately \$2.7 million annually.

The Memorial Parkway Program delivers a comprehensive vision for the area that combines flood mitigation with new spaces for commemoration, public spaces and opportunities for a reimagined Memorial Drive with enhanced mobility options. By taking an integrated approach, we can achieve the best outcome for the area.

Feedback gathered during engagement in summer and fall 2022 helped scope plans and priorities for future enhancements along the parkway. The engagement ultimately ranked the following elements as top priorities: Peace Bridge north shore; Prince's Island pedestrian bridge / river access; Poppy Plaza; 7

Street N.W. lookout; Calgary Soldiers Memorial. Using public feedback, the team is working on designing improvements for these areas.

A permanent flood barrier is critical to help protect people, homes and businesses in Sunnyside/Hillhurst from river flooding. We remain committed to delivering a 1:100 level flood barrier with limited delay. We are continuing to finalize the design of the Sunnyside flood barrier. Construction is expected to begin in 2023 with estimated completion in 2025.

Construction impacts include tree removals for the construction of the flood barrier. Trees we will be salvage for reuse. The program team is committed to preserving, protecting and replanting new trees along Memorial Drive, and beyond our project site.

**Action for 2023:**

The program team will be providing updates to the community in spring 2023 once the construction schedule and work plan has been confirmed; the team will continue outreach to keep progressing the project.

Throughout 2023, The City of Calgary will be refining detailed design for the flood barrier and ensuring consistency with the Memorial Parkway Public Realm Master Plan's vision and design guidelines. The flood barrier, once completed, will work with other completed infrastructure in Sunnyside and other mitigation measures to increase flood resilience in the Bow River communities.

### 3.3 UPPER PLATEAU SEPARATION



**THE UPPER PLATEAU SEPARATION WILL PROVIDE AN EXPRESS ROUTE TO MOVE STORMWATER FROM THE COMMUNITIES ON TOP OF THE HILL DIRECTLY TO THE RIVER, BYPASSING SUNNYSIDE AND HELPING**

In addition to Sunnyside pump station 1 & 2 (completed), Upper Plateau Separation is another project directly tied to Sunnyside and Hillhurst communities' overall flood resilience including river and stormwater flooding risks and compound effects. This is in part due to communities located on the hill above sharing a stormwater system. The Upper Plateau Separation project is intended to separate the stormwater system of the hill communities from Hillhurst and Sunnyside's stormwater system, both reducing the volume of water in the system and increasing the system's capacity to minimize the likelihood of rainfall overwhelming infrastructure and causing localized flooding.

**Action for 2023:**

Construction of the Upper Plateau Separation project began in November 2021, with anticipated completion in Q4 2023. As well, stormwater system upgrades in Sunnyside and Hillhurst are taking place during this time. More information about these projects can be found in the Community (and local) Stormwater Drainage Improvements (CDI) Appendix below.

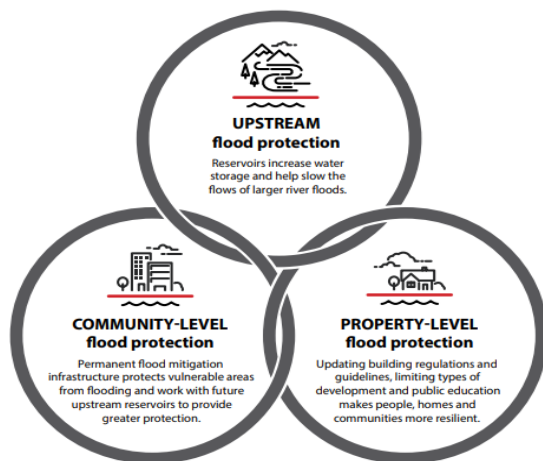
### 3.4 BONNYBROOK WWTP FLOOD MITIGATION

The Bonnybrook Wastewater Treatment Plant (WWTP) Flood Mitigation Project, with contribution from the Government of Canada and the GoA, was well underway as of 2022. Flood Protection Phase 2 and revamped outfall infrastructure is in place. A revised Water Act application for completion of the remaining portion of the berm was submitted and subsequently approved on May 8, 2020 (previously expired in June 2018). The City is currently fulfilling its commitment with First Nations to monitor construction activities, anticipating completion in late 2023.

## 4. UPSTREAM MITIGATION

Upstream reservoirs on the Bow and Elbow Rivers remain a key component of The City’s long-term flood resilience strategy. Reservoirs provide benefits over community mitigation structures like barriers since they can store flood water, releasing it slowly over time after the initial event has passed. In some cases, reservoirs can provide additional water supply storage and drought mitigation benefits.

Upstream mitigation remains primarily the responsibility of the GoA. The City of Calgary is a key stakeholder in upstream mitigation initiatives and closely monitors progress on these items.



The City’s critical upstream mitigation priorities include:

- The completion of SR1 on the Elbow River;
- The GOA’s seasonal operating agreement with TransAlta on operations of the Ghost Reservoir and Kananaskis Reservoir system from May to July each year, renewed until 2026; and
- The construction of a new reservoir upstream of Calgary on the Bow River.

THE CITY CONTINUES TO UTILIZE A LAYERED STRATEGIC APPROACH TO FLOOD MITIGATION THAT RELIES ON A COMBINATION OF UPSTREAM, COMMUNITY-LEVEL, AND PROPERTY-LEVEL MITIGATION ACTIONS TO REDUCE FLOOD RISK.

### 4.1 SPRINGBANK OFFSTREAM RESERVOIR

The SR1 project was initially announced by the GoA in 2014, to mitigate flood risk on the Elbow River following the 2013 flood. The project, located 18 kilometres upstream of Calgary, will divert and store water during a high flow event and slowly release it back into the Elbow River after flows subside. Working together with new storage gates installed at the Glenmore Reservoir in 2020, a 2013-level flood can be fully mitigated on the Elbow River once SR1 is in operation.

Following a public hearing on the environmental impact of SR1, The Natural Resources Conservation Board approved the project in June 2021, announcing that it believed the project was in the public interest. Following its regulatory approval, the GOA announced that it had acquired all of the land necessary, and construction began in early 2022.

The Province commits to functional operation (to 1:100 flood) after the second year of construction (2024) and full operation after the third year of construction (2025).

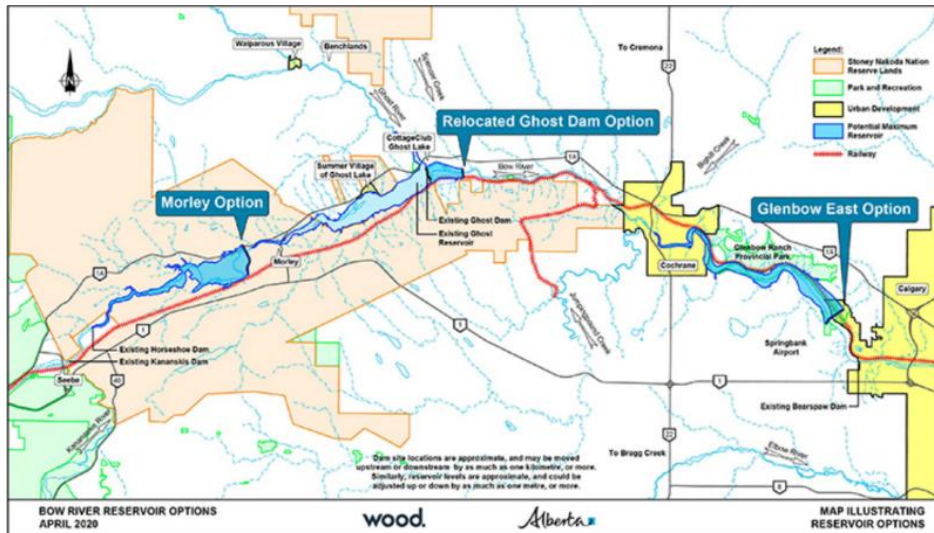
**Action for 2023:**

The City of Calgary will remain in close contact with the GOA regarding SR1 as construction continues and operating plans are developed in 2023. The City is a member of the project's various committees and regularly meets with its counterparts at the GoA. The City will continue to attend technical operations committee and land use advisory committee meetings throughout 2023 and is working to ensure that any potential concerns are adequately considered by the GoA. Key areas of City interest are: reservoir operation during high-flow events, maintenance requirements, downstream water quality in the Glenmore Reservoir, and flood hazard mapping implications on the lower Elbow below Glenmore Dam.

## **4.2 BOW RIVER RESERVOIR OPTIONS STUDY**

The Phase 1 conceptual study of the Bow River Reservoir Options (BRRO) project was completed in Spring 2020 and identified three potential sites for further study (see figure below). Phase 2 of the study was announced by the GOA in 2020 to evaluate the relative feasibility of the three possible sites, including Morley, Relocated Ghost Dam and Glenbow East options. The GoA will potentially recommend one to undergo detailed design and regulatory approvals, progressed in 2022.





THE BOW RIVER RESERVOIR OPTIONS STUDY IS EVALUATING THE RELATIVE FEASIBILITY OF THREE POTENTIAL SITES FOR A NEW RESERVOIR ON THE BOW RIVER UPSTREAM OF CALGARY (CREDIT: GOVERNMENT OF ALBERTA)

Specifically,

- Field, engineering and environmental work was completed in 2022 on the Glenbow East and Relocated Ghost Dam options, while Morley option discussions continued.
- Water balance modelling demonstrated impact of Glenbow East and Relocated Ghost options on flood and drought scenarios. The Province began evaluating water driven economic benefits, including both drought and flood resilience, and a water security lens for future growth and development

The BRRO Phase 2 study is scheduled to complete in 2023, including two public engagement sessions, with the final report anticipated in 2024. If approved, the Project would proceed to Phase 3 of detailed engineering and regulatory approval for the selected option.

City staff maintained regular direct contact with the GoA's Phase 2 project team and consultant through 2022 and participated in the Bow River Working Group providing advisory input to the Phase 2 work. The GoA's work on upstream Bow River reservoir options remains a critical component to Calgary's flood resilience. The GoA has stated that a new reservoir on the Bow River is estimated at \$1 billion or more and at least a dozen years away from operations. The Phase 2 work so far had noted significant land and water licensing aspects, environmental, recreational and operational complexity.

### **Action for 2023:**

In 2023, The City of Calgary will continue to monitor the progress of the BRRO Phase 2 study. Key activities include participating and supporting the GoA's public engagement, and contributing to three planned BRWG sessions, and advocating for progress to Phase 3 as desired.

Parallel to the BRRO Phase 2 study and as a Federal Government requirement, the GoA is expected to start the Bow River Alternative Mitigations Initiative in 2023 assessing the merits of potential alternatives to a new reservoir.

## 5. Emergency Preparedness, Forecasting and Response

The readiness of first responders, City staff and Calgarians is an integral part of flood resilience, and forms a key ongoing component of The City's flood resilience.

The City of Calgary reviews and updates its flood emergency response plans annually, and refines and improves its modelling and forecasting capabilities. In 2022, response plans were updated to reflect new inundation mapping available from the GoA and new permanent flood mitigation infrastructure, such as the Downtown Flood Barrier.

During the 2022 flood season, The City's flood response plans were activated during a high rainfall event in June 2022. This critical but relatively small potential flood event provided valuable testing of City plans and processes and experience for those involved in response.

### *June 2022 High Rainfall Event*

The 2022 season started with above average snowpack in the eastern slopes of the Bow and Elbow river basins. Because a high snowpack alone does not create flood risk in Calgary, early messaging was circulated to the public to relieve potential anxieties around the amount of snow this year. By mid-May, the Glenmore Reservoir was drawn down in anticipation of the up coming flood season. TransAlta's Ghost Reservoir was also brought down to the lowest level.

On June 9<sup>th</sup>, City forecasters observed forecasts indicating the potential for a significant precipitation event. In close contact with GoA and Government of Canada partners, the Glenmore Reservoir was further drawn down to its lowest level to ensure that The City could provide maximum mitigation along the Elbow if required. In anticipation of rain in Calgary while the river was high, select stormwater outfalls were closed to prevent river backup into communities, and pumps were deployed to strategic locations to enable stormwater to be pumped to the river. Alberta Environment began issuing flood advisories, and the precipitation began falling on June 13<sup>th</sup>. Guidance from Environment Canada indicated precipitation in the range of 150 mm, but with the potential for locally higher amounts beyond 200 mm. For context, the 2013 event had precipitation in the range of 200 mm with locally higher amounts in the range of 250+ mm. Using The City's flood forecasting models, it was determined that the upgraded Glenmore Gates would be able to handle flows on the Elbow. For the Bow, it was determined that the worst-case scenario would require a barrier across Memorial Drive to protect the community of Sunnyside. Calgary Emergency Management Agency (CEMA) (now Emergency Management Operations (EMO)) activated the Emergency Operations Center (EOC), a state of local emergency was declared, and the barrier across Memorial Drive was completed on June 14<sup>th</sup>.



**Flood barrier being built across Memorial Drive in Sunnyside, along with deployed pumps.**

By the end of the event, precipitation amounts in the Bow basin averaged in the range of 70-90 mm, and 110 mm on the Elbow. In addition, up to 65 mm of precipitation in the upper elevations fell as snow instead of the rain forecasted, which lowered runoff amounts and peak river flows. Glenmore operations held Elbow flows downstream at safe levels. TransAlta's reservoirs were also able to use its storage to mitigate flows through Calgary to approximately a 1:2 flood only impacting parks and low-lying pathways. While evacuations plans were prepared for the most vulnerable communities that would be affected by the forecast peak flow (primarily Bowness and Sunnyside), as conditions downgraded those plans were called off.

The June event was an invaluable exercise for staff in forecasting, communication and response. It demonstrated the value of emergency response measures working with reservoir mitigation and operations. Lessons learned in these areas have been actioned and will be applied in future events.

**Action for 2023:**

For 2023, we are updating our flood emergency response plan with field observations made during the 2022 event, and finalizing the transformation of our flood reference manual into a digital platform and tracking tool. We also continue to update and improve our flood forecasting capabilities which includes our hydrologic forecast model and the Flood Forecasting Platform that we jointly built with Alberta Environment and Protected Areas.

## **6. LAND USE PLANNING, BUILDING REGULATIONS AND FLOOD RESILIENCE**

The amount and type of development in the floodplain has a significant impact on Calgary's vulnerability to flood events. As our understanding of flood risk in Calgary's floodplains has improved over time, we have evolved our guidance for safer land use, building and development practices. Coupled with investments in upstream and community mitigation infrastructure, Calgary has continued to support safe, flood resilient communities.

As our city continues to grow, and the information available about flood risk evolves and improves, it is important that The City continue to revisit floodplain land use policies and building regulations to guide how we plan and develop in river communities to make them more resilient.

This is why we are undertaking a floodplain policy modernization project, aligned to GoA updates to Calgary's regulatory Flood Hazard Area (FHA) map.

### *New Flood Hazard Mapping in Calgary*

The City is working closely with the GOA on new FHA maps being developed for Calgary to understand what impacts new maps and classification changes could have in Calgary. New maps will reflect the latest understanding of how a 1:100 flood would impact Calgary and will introduce some changes to flood hazard classifications. The new maps will show some Calgary communities with increased flood hazard areas and others with decreased flood hazard areas. These changes are reflective of the two new types of flood hazard zones introduced by the GoA, including **High Hazard Flood Fringe**, which are areas of the flood fringe where the flood water is deep and/or flowing fast, and **Protected Flood Fringe**, which are areas protected by a permanent flood barrier or upstream reservoir. The City of Calgary has been working with the GoA to ensure the map accurately represents Calgary's flood risk before it is released publicly in 2023, and to coordinate City and Provincial communications about the new map. The GoA will not be releasing regulatory standards or engaging on the regulatory implications of the map, which will be left to Municipalities.

### *Calgary's approach to integrating new FHA mapping*

We are undertaking the Calgary river valleys project, which will direct how we develop and regulate in the floodplain. The project will respond to new GoA Flood Hazard Maps, consolidate floodplain policy, and guide updates to the Land Use Bylaw, Municipal Development Plan, and other plans and regulations. This work will explore the relationship between structural measures and land use policy direction, and may introduce updated development and redevelopment regulations that better reflect and manage the risk in our flood hazard areas.

This process will fulfill the direction in the Council-approved Flood Resilience Plan to conduct a policy review to ensure land use planning is a tool that works alongside structural mitigation and emergency response to build flood resilience in Calgary.

### **Action for 2023:**

Engagement on city-wide floodplain policy and regulatory options, especially with residents and businesses in flood risk communities, will be an important part of flood resilience policy update.

Early engagement will launch in Spring 2023, focused on clarifying priorities and values for our river valley communities. Subsequent phases of engagement will be aligned with the public release of the draft FHA map for Calgary, focused on how we can implement and achieve those values through the development process. In lockstep with this engagement, Administration will continue efforts to advance the river valleys project including associated policies and regulations. Any City policy and regulatory revisions cannot occur until the GoA finalizes the map after their public engagement process.

While this work is underway, development applications will continue to be assessed according to existing regulations. Administration has established a process for reviewing development applications that considers and makes available updated information from the map, as directed by Law. As always, applicants may draw on additional information in support of their applications.

Administration is also advancing a parallel process of Indigenous engagement, rooted in respect, relationship building and ethical-space. A series of gatherings to convene Elders, Knowledge Keepers and members of Treaty 7 Nations, Metis Nation of Alberta Region 3 and urban Indigenous Calgarians are taking place in 2023. River valleys are sacred spaces, and all planning activities must be rooted in an understanding of settler-colonial relations, Treaty history and Indigenous rights.

## 7. COMMUNITY READINESS, ENGAGEMENT AND AWARENESS

Annual public communications about river flood conditions and seasonal risk began as usual in March /



**A NEW FLOOD DIAL TOOL WAS INTRODUCED IN 2021 TO HELP PROVIDE CALGARIANS WITH A QUICK SNAPSHOT OF DAILY RIVER CONDITIONS**

April 2022 preceding flood season. In addition to annual campaign tactics such as social media posts and targeted ads, the flood dial tool was again utilized via [calgary.ca/floodinfo](http://calgary.ca/floodinfo) to provide Calgarians with a quick snapshot of the daily river conditions to help them understand current river flows and flood risk. The dial was updated on [calgary.ca/floodinfo](http://calgary.ca/floodinfo) every weekday along with details about the anticipated forecast, snowmelt, effect on river flows, how The City is responding to conditions, and what citizens should be doing to be prepared.

Responding to requests from Calgarians to have better access to this information, the frequency for sending our Flood Readiness E-newsletters was modified to have the dial and forecast information sent out every week on Fridays, as well as at critical times when citizens most sought updates, such as when rain was forecast. The e-newsletter also contained brief articles on relevant content such as updates on flood mitigation projects, flood preparedness tips and how to sign up for notifications and emergency alert apps. As we continue to encourage signing up for the e-newsletter as an effective way for Calgarians to receive information, the distribution has risen to over 1,300 recipients.

To assist Councillors and Community Associations supporting Calgarians in preparing for flood season and understanding river flood risk, digital toolkits with key messages, images for social media and links for more information were provided by The City. As every year, presentations were offered to all river valley communities to discuss flood preparedness: what to expect in a flood, how to prepare and how to stay informed. In 2022, presentations were requested and delivered to the community of Discovery Ridge.

As part of our flood readiness education program, this year in partnership with CEMA (now EMO), workshops were held for multi-family building managers, and targeted multi-lingual information cards were delivered in Spring 2022, to help vulnerable residents in flood risk communities understand their flood risk and assist them in the completion of personal evacuation plans. In addition, Chinese language radio spots were aired to reach residents in Chinatown.

During the June 2022 high rainfall event, updates to the flood dial/forecast online were made as information became available, and the flood e-newsletter was utilized to communicate with Calgarians, sent at least daily with updated information. Once the EOC was activated, communications were directed by and through the EOC.

### **Action for 2023:**

The City continues to enhance its annual flood awareness campaign and education programming, targeting high risk and vulnerable communities. The river conditions dial was positively received and will continue to be used in 2023. In partnership with CEMA (now EMO), training for building managers overseeing multi-family buildings with vulnerable Calgarians in flood risk communities will be delivered to more buildings managers. These sessions are intended to give managers the tools and skills to assist these residents in understanding their flood risk and with completion of personal evacuation plans. 2023 will continue the focus on community connections among building residents with the intent of strengthening their resiliency in the event of flood and other disaster scenarios.

As 2023 marks 10 years since the 2013 flood, messaging around this will be integrated with all flood resilience and preparedness communications in 2023.

## **8. THE YEAR AHEAD AND BEYOND**

The Program team and ongoing operations continue to work together toward optimal flood risk resilience for Calgarians. The 2013 flood reshaped Calgary, and over the past decade, the Flood Resilience Program has been an indispensable part of our city building. Looking ahead, the Flood Program will evolve as an integral component of the Administration's planning efforts and processes, as well as integration with overall climate adaptation efforts.

The Program team continues to advance the remaining actions outlined in the Plan:

- Completion of SR1: Anticipated to come onstream in 2024, fully operational by 2025
- Construction of a new upstream Bow River reservoir: Administration is actively involved in the GoA studies and are looking for its progression to Phase 3 in 2024.
- River valleys planning for flood resilience: Early communications and engagement planned for 2023 in advance of Provincial FHA Maps release, and integration with City planning.
- Remaining community flood barriers: Completing the Sunnyside flood barrier through the Memorial Parkway Program by 2025 and monitoring the need for a Bowness flood barrier, paused in 2021 in response to community concerns.
- CDI projects tied to river flood mitigation: Completing the Upper Plateau Separation project.

- Assessing and advancing additional municipal opportunities to support flood readiness and recovery for residents, communities and public assets.

This work is implemented by an existing, multi-disciplinary team. As external work evolves beyond Calgary's jurisdiction and outside of Calgary's Flood Resilience Program/Plan, the team continues to monitor, influence and shape from a Calgary perspective.

2022 was a dynamic year for The City's Flood Resilience Program and reducing Calgary's long-term flood risk. In addition to the major activities identified for 2023, The City of Calgary continues to advise on redevelopment applications to minimize flood risk to new buildings, and identify opportunities to advance Calgary and citizens' flood resilience. As the organization continues its Adjust and Assess stage of the Realignment, integration and alignment with broader climate resilience and adaptation (including reporting) evolves along with emerging opportunities and risks.

Climate change is shifting precipitation patterns and increasing the intensity of storms. Combined with Calgary's continued growth and development, The City of Calgary's Flood Resilience Program continues to ensure flood resilience remains a high priority, and that the risk of flooding is reduced now and remains low in the future.

## APPENDIX 1: COMMUNITY AND LOCAL STORMWATER DRAINAGE IMPROVEMENTS

In addition to Sunnyside pump station 1 & 2 and Upper Plateau Separation which are directly tied to river flood resilience updated above, other community and local drainage projects continued to progress. The City's Community Drainage Improvements (CDI) Program invests in Calgary's stormwater management infrastructure to reduce the risk of localized flooding from intense rainfalls, primarily in established neighborhoods built before 1988. Stormwater flooding in communities close to the Bow and Elbow Rivers can also be compounded by river flooding. The City also invests in site-specific local drainage improvements (LDI) to reduce localized flooding.

In 2022, The City invested approximately \$58.4 million in CDI projects, including the underground tunnel construction completed for the Upper Plateau Separation project. As well, Consultant procurement selection was completed for the new CDI Phase 3 projects (see the prioritization list below).



FROM L TO R: UPPER PLATEAU SEPARATION, NWIC LOCAL IMPROVEMENTS ON SUNNYHILL LANE, TUXEDO PARK DRY POND.

An additional \$748K in local drainage improvements was also completed in 2022, including Northwest Inner-City, Tuxedo, and Macleod Community Drainage Improvement study areas.

### **Action for 2023:**

The following progress is anticipated in 2023:

- Majority of construction completed for remaining NorthWest Inner City Community Drainage Improvement in the Kensington area;
- Construction completion for Tuxedo Community Drainage Improvements Centre St storm trunk portion;
- Progress in design, engagement, and Phase 3 projects.

The City continues to develop the data and tools to better identify and quantify existing local stormwater flood risks in established areas. This work was primarily advanced through the *Community-Scale Localized Flood Risk Mapping and Hydrologic Modelling* (City-wide Stormwater Modelling Project). The first two phases of this work is complete. Phase Three, likely the final phase, has commenced in 2022 and will continue through all of 2023. This work is part of The City's efforts to modernize its



approach to stormwater management and commitment to continual improvement of our service delivery to citizens.

The City also continues to support Corporate and regional planning initiatives to facilitate development, mitigate flood risks, and meet regulatory and environmental requirements. In 2022 this included:

1. Continuing work on the East Calgary Regional Drainage Study;
2. Completion of the Belvedere Master Drainage Plan, including submission to and engagement with Alberta Environment and Protected Areas (AEPA);
3. Continuing support of the Cooperative Stormwater Management Initiative, including construction of the first infrastructure stages in 2021. Comprised of three municipalities and one irrigation district, the Initiative will accommodate stormwater from developments in three municipalities; and
4. Enhancing stormwater management strategies in support of Corporate planning initiatives such as Main Streets, Local Area Planning, the Industrial Growth Strategy, and the Established Areas Growth and Change Strategy. This work ensures that opportunities to improve stormwater management, address risks to existing customers, enhance the use of stormwater in the public realm, and support growth are identified and integrated into future development throughout Calgary.

Enhancing stormwater management strategies in support of Corporate planning initiatives such as Main Streets, Local Area Planning, the Industrial Growth Strategy, and the Established Areas Growth and Change Strategy. This work ensures that opportunities to improve stormwater management, address risks to existing customers, enhance the use of stormwater in the public realm, and support growth are identified and integrated into future development throughout Calgary.

Table. Community Drainage Improvement Program Prioritization List

February 2023

	<b>Project Name</b>	<b>Cost Estimate<sup>1</sup> (\$'000's)</b>	<b>Project Status<sup>8</sup></b>	<b>Construction Date<sup>2</sup></b>
<b>CDI Delivery Phase 1</b>	Woodlands/Woodbine - Braeside Dry Pond	\$6,247	Completed	2018-2019
	Woodlands/Woodbine - Bebo Grove Wet Pond & 24th Street SW Diversion	\$20,842	Completed	2018-2020
	Woodlands/Woodbine - Local Improvements	\$3,645	Completed	2018-2022
	North West Inner-City - Pump Station #1 – Sunnyside <sup>3</sup>	\$12,961	Completed	2019-2021
	North West Inner-City - Pump Station #2 – Sunnyside <sup>4</sup>	\$10,917	Completed	2018-2020
	North West Inner-City - Upper Plateau Separation <sup>4,5,6</sup>	\$49,132	Partially Completed	2021-2023
<b>CDI Delivery Phase 2</b>	North West Inner-City - 19 St, 7th Avenue, 1st Avenue, Sunnyside Lane <sup>5,7</sup>	\$20,919	Completed	2021-2022
	North West Inner-City - 10th Street NW <sup>5,7</sup>	\$14,052	Partially Completed	2021-2023
	North West Inner-City - Kensington <sup>5,7</sup>	\$20,476	Partially Completed, In Design	2021-2024
	Tuxedo - High Point Diversion and Local Improvements <sup>7</sup>	\$2,903	Completed	2021-2022
	Tuxedo - 35 Ave NE Trunk <sup>7</sup>	\$3,302	Completed	2021-2022
	Tuxedo – Tuxedo Dry Pond and Trunk Upgrades <sup>7</sup>	\$22,059	Partially Completed	2021-2023
<b>CDI Delivery Phase 3</b>	Pineridge Dry Pond B & Storage Duct <sup>9</sup>	\$11,082	In Conceptual Design	2025-2026
	North West Inner-City - Hillhurst Storm Lift Station 4 & Upgrades <sup>5,9</sup>	\$24,678	In Conceptual Design	2025-2026
	North West Inner-City - 14 St NW <sup>5,9</sup>	\$12,274	In Conceptual Design	2025-2026
	North West Inner-City - Capitol Hill Dry Pond/ 17 St & 23rd Ave NW <sup>5,9</sup>	\$5,716	In Conceptual Design	2025-2026
	Palliser Oakridge <sup>9</sup>	\$49,500	Consultant Procurement	2026-2029
	Macleod Tr Meadowview Park <sup>9</sup>	\$3,850	Consultant Procurement	2025-2026
	R.T. Alderman Dry Pond <sup>9</sup>	\$7,200	Consultant Procurement	2027-2028
	Deer Ridge Storm Trunk Diversion <sup>9</sup>	\$7,400	Consultant Procurement	2027-2028
	Bow Bottom Trail Storage <sup>9</sup>	\$10,050	Consultant Procurement	2027-2028
		<b>\$319,205</b>	<b>TOTAL</b>	

1 -- Cost Estimates are based on the current project stage

2 -- Schedules subject to change based on external funding availability, new studies, and dependencies on other projects

3 -- With funding from Alberta Community Resilience Program (ACRP) and the New Building Canada Fund (NBCF)

4 -- With funding from ACRP

5 -- These projects are linked via dependency to projects within the area

6 -- With funding from Investing in Canada Infrastructure Program (ICIP)

7 -- With funding from Municipal Stimulus Program (MSP)

8 -- Projects marked as Completed are in-service

9 -- Cost estimates provided are Class 5 and grant funding application is planned for Disaster Mitigation and Adaptation Fund (DMAF)

## APPENDIX 2. 55% RISK MITIGATED: MAJOR FLOOD MITIGATION AND INFRASTRUCTURE COMPLETION

### 2014

- Deane House barrier

### 2017

- 12 St. SE Bridge Rehabilitation and Raising
- Christie Park Upgrades and Sarcee Trail

### 2019

- Centre Street Bridge Lower Deck Flood Barrier

### 2021

- Sunnyside Pump Station 2
- Mission bridge (gravel Bar)
- GOA-TA agreement (until 2026)

### 2023

- Upper Plateau Separation
- Bonnybrook WWTP Flood Mitigation

### 2016

- Municipal Complex Site Drainage Program

### 2018

- W. Eau Claire barrier
- Zoo Flood Mitigation
- Sunnyside Sanitary LS
- Roxboro Sanitary LS Resiliency and Sanitary Lining
- Western Headworks Diversion Site Improvements (Harvie Passage)

### 2020

- Glenmore new gates
- Heritage Drive Flood Barrier
- Sunnyside Pump Station 1
- Montgomery barrier

### 2022

- Downtown barrier
- 9th Ave Bridge Raising & Bank Stabilization
- Centre St. Bridge Gravel Bar
- Crowchild Trail Gravel Bar
- Scollen Bridge Gravel Bar
- Outfall improvements

- Stream Health / Bank Protection