

# **Bow River Water Management Project**

## **Panel Discussion Land Use 2018**

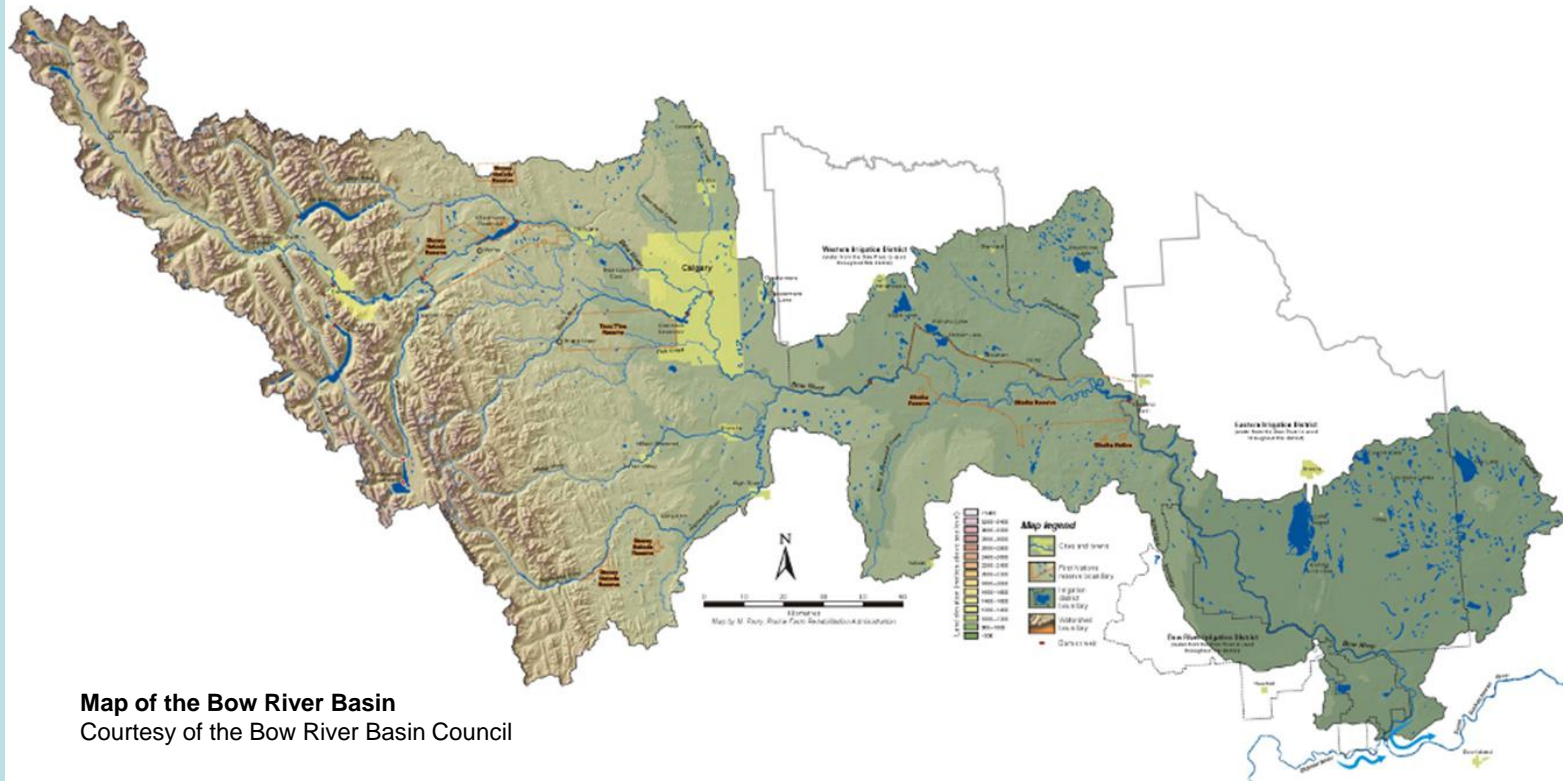
**Megan Van Ham, Alberta WaterSMART**

**Carolyn Bowen, City of Calgary**

**Erik Butters, MD of Bighorn**

**Mark Comerford, Alberta Environment & Parks**

# The Bow River system: Fundamental to people in the watershed and downstream



Vision: To have a robust, strategic plan for water management in the Bow River Basin, from the headwaters to the confluence with the Oldman River and continuing through Medicine Hat

# Objectives: Inform a Bow River Basin water management strategy

Flood mitigation	Balancing the system	Drought mitigation
Develop scenarios of potential operational and infrastructure flood mitigation opportunities in the upper Bow River Basin (above Calgary) to reduce peak flow during a defined range of synthesized flood events to approximately 1,200, 800, and 400 cms measured on the Bow River above the confluence with the Elbow River, and assess how these scenarios affect flow thresholds along other reaches of the Bow River	Identify schemes required to offset any increased water management risk in the basin created by the flood mitigation scenarios upstream	Develop scenarios of potential operational and infrastructure drought mitigation opportunities to reduce the volume of licence shortages by at least 5% to 10%, while continuing to meet apportionment requirements, and with improvement, or at minimum no reduction, in ecosystem health (all relative to current operations in the same time period)

**Advice to GoA on a water management strategy for the Bow River Basin**

# The Bow River Water Management Project

Announced October 2015

Co-chaired by AEP and the City of Calgary

Completed work between January 2016 and April 2017

4 Advisory Committee sessions

7 Bow River Working Group (BRWG) sessions

3 Community group sessions

Sub committees as needed (Data, Drought)

Broad representation of water users, managers and stakeholders, including:

- 10 municipalities
- 2 First Nations
- 6 reservoir operators
- 3 watershed groups
- 2 Environmental Non-Governmental Organizations
- 2 government ministries

This presentation and corresponding report summarize the findings of the Bow River Water Management Project and offers it as advice to the Minister of AEP in developing a robust, strategic plan for water management in the Bow River Basin

# Context: Water and water management in the Bow River Basin

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- Home to 22 urban municipalities, 12 rural or regional municipalities, and 3 First Nations
- Provides water for drinking, irrigation, livestock, waste assimilation, electricity generation, wildlife and recreation
- Experiences extreme variability in annual flows
- Prone to flooding, typically between May and July
- Prone to drought, both single and multi-year
- Directly and significantly impacted by climate variability and change
- The flow in the Bow is heavily influenced by 11 hydro facilities, irrigation diversions and municipal diversions
- Since the 2013 flood, the Province and municipalities have invested in many flood mitigation projects, studies, and community programs
- Flood or drought mitigation should be looked at in combination
- Water management must be adaptable to current and future conditions

# Flood mitigation: objective, schemes and synthesized events

Develop scenarios of potential operational and infrastructure flood mitigation opportunities in the upper Bow River basin to reduce peak flow during a defined range of synthesized flood events to 1200, 800 and 400 cms measured on the Bow River at Calgary and other reaches. And the scenarios will include additional measures required to offset any detriment to drought mitigation and watershed health.

15 potential schemes from 2 prior studies and from participants

4 synthesized events:

- (Event 1) the 2013 flood event of 2,400 cms naturalized peak hourly streamflow for the Bow River at Calgary (above the Elbow River)
- (Event 2) the 2005 flood event of 1,250 cms naturalized peak flow scaled to approximately 2,000 cms peak hourly streamflow for the Bow River at Calgary (above the Elbow River)
- (Event 3) the 2005 flood event scaled to approximately 2,400 cms peak hourly streamflow for the Bow River at Calgary (above Elbow River), and
- (Event 4) the 2013 flood event scaled to approximately 3,300 cms peak hourly streamflow for the Bow River at Calgary (above the Elbow River).

# Project and participants recognized importance of layers in mitigation



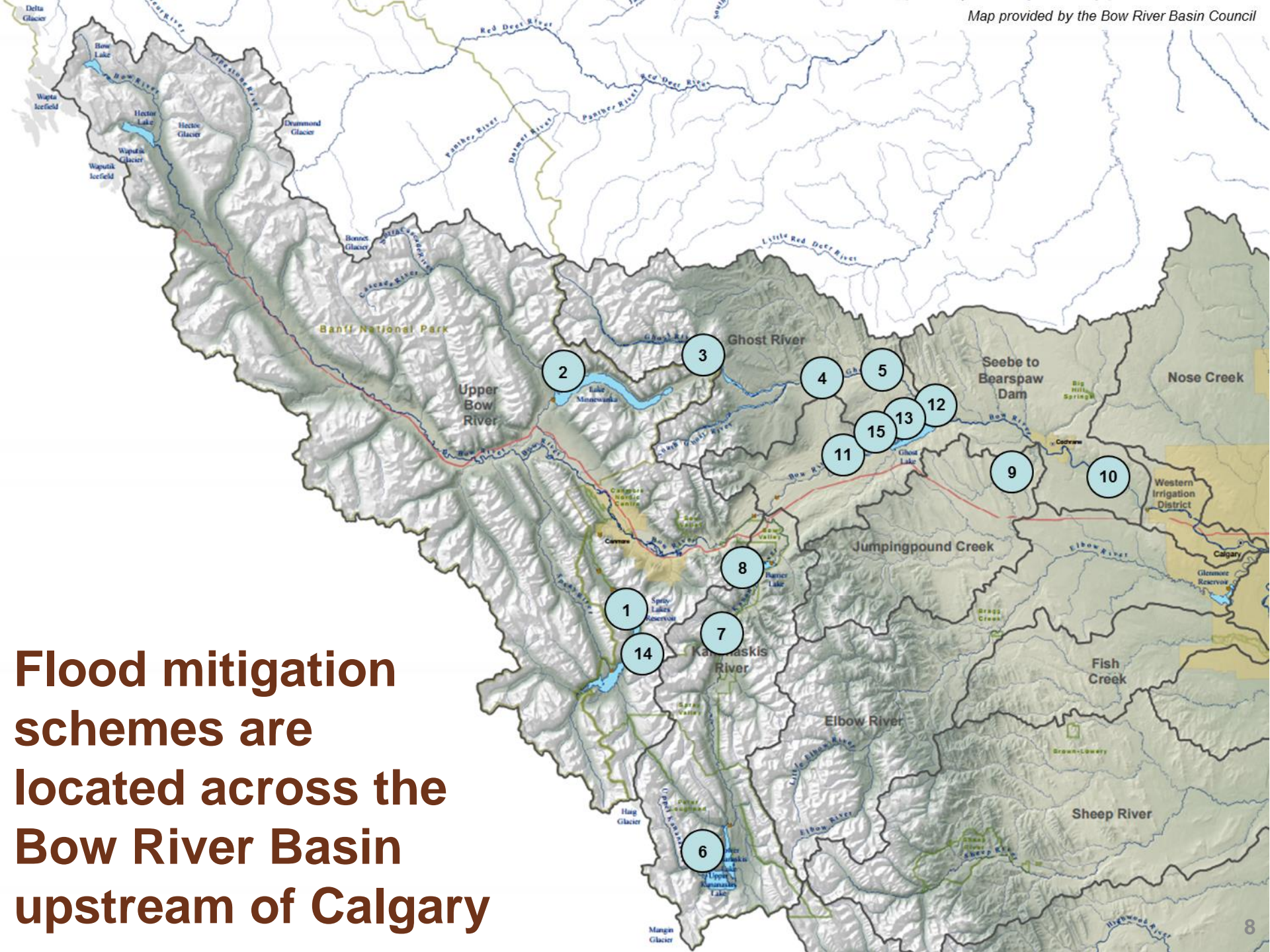
"Seven key elements will guide our approach to mitigation: watershed management, flood modelling and warning systems, risk management policies, water management and mitigation infrastructure, erosion control, local initiatives, and individual initiatives."



"Building resilience to flooding requires action across many disciplines and organizations. From forecasting and monitoring weather, to engineering design standards and emergency preparedness, there are many planning processes and activities that are all critical for improving flood resilience."

**This project focused on engineered infrastructure  
Reiterated importance of all layers**



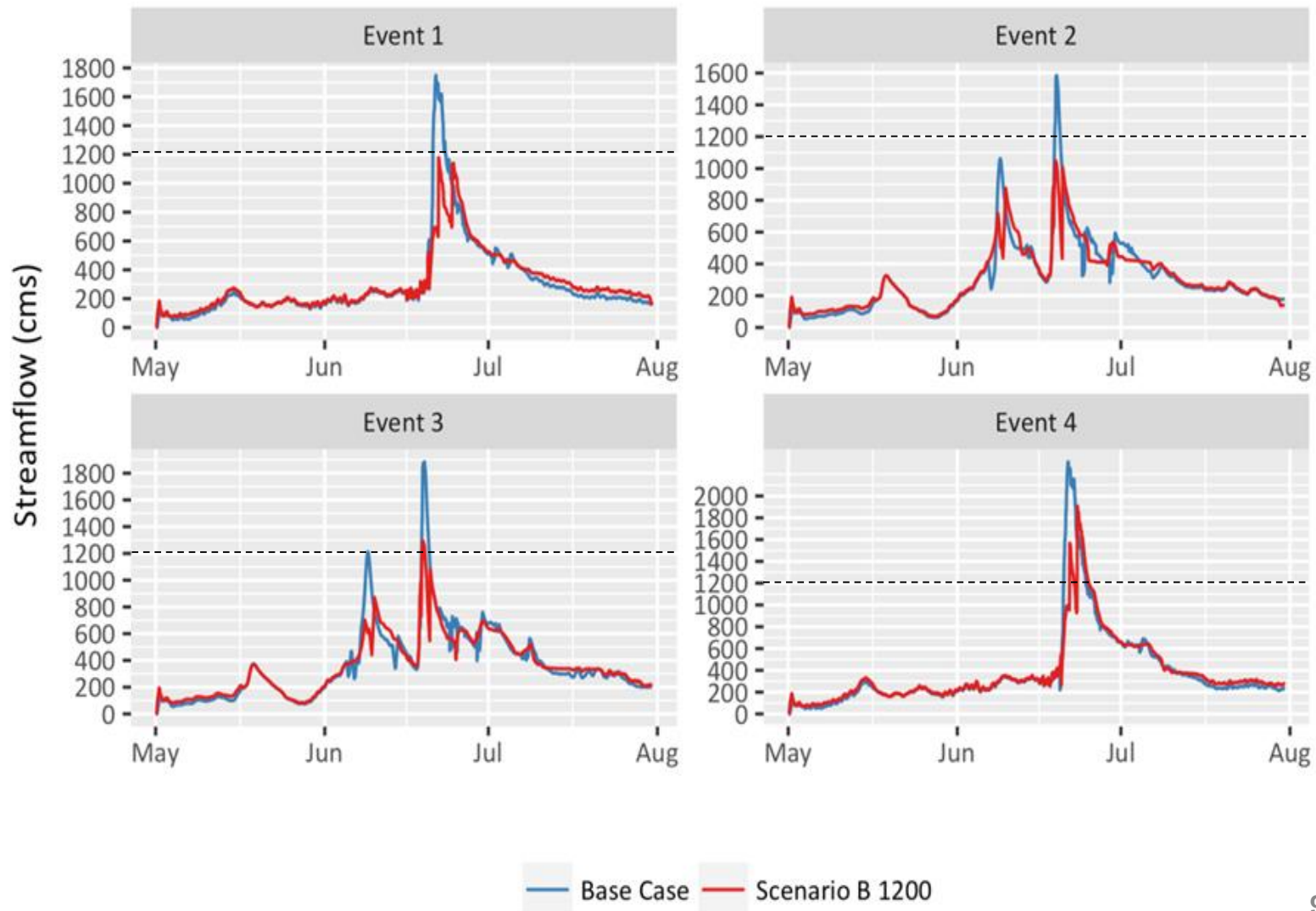


**Flood mitigation schemes are located across the Bow River Basin upstream of Calgary**



# 1200 cms Scenario B (ops + Morley)

*Met the target in Events 1 and 2; nearly in Event 3; substantial reduction in Event 4*



# Flood mitigation in the Bow River Basin

**Target: 1200 cms on the Bow River at Calgary**

Extend Ghost Reservoir flood operations (2016 agreement)

*and*

Increase Ghost Reservoir drawdown rate

*and*

Barrier Lake flood operations

*and*

One major infrastructure scheme:

New  
Glenbow  
reservoir

*or*

New  
Morley  
reservoir

*or*

Expand  
Ghost  
Reservoir

*or* \*

New Kananaskis  
reservoir

+

New JPC reservoir  
or New Ghost River  
reservoir

\* If main stem infrastructure schemes are not possible, a less favourable scenario would require two new reservoirs on major tributaries

# Bow River Water Management Project: Flood mitigation findings

The 1200 cms flood mitigation objective can be met in many flood events using a combination of operational changes and one major project.

There may be opportunity to push these same schemes to achieve close to the 800 cms objective; otherwise a second major project would be required.

The operational changes include:

- Extend the 2016 agreement for flood operations at Ghost Reservoir.
- Increase the Ghost Reservoir drawdown rate.
- Flood operations at Barrier Dam.

The most attractive major projects are located low on the main stem of the Bow River, not on the tributaries:

- A new Glenbow reservoir on Bow River upstream of Bearspaw.
- A new Morley reservoir on Bow River upstream of Ghost Reservoir.
- Expansion of the existing Ghost reservoir through raising full supply level and/or installing a low-level outlet.

# Balancing the system: objective, schemes and synthesized events

Identify schemes required to offset any increased water management risk in the basin created by the flood mitigation scenarios upstream.

38 (long list) reduced to 20 (short list) potential schemes from multiple prior studies.

1 synthesized event:

- Historic record from 1928 to 2009

# Balancing the System

**Target: Offset the increased risk from the flood mitigations schemes**

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Increase Ghost Reservoir drawdown rate

+

Drought storage in expanded Glenmore Reservoir\*

+

Increase diversion rate of the Carseland Canal and construct debris deflector\*

+

Raise winter carryover in downstream reservoirs (e.g. Travers/Little Bow, McGregor)

+

Fill downstream reservoirs earlier (e.g. Travers/Little Bow)

+

Extend Kananaskis System water shortage mitigation operations (2016 agreement)

\* Indicates scheme likely requiring a licence amendment



# Drought mitigation: Objective, schemes and synthesized events

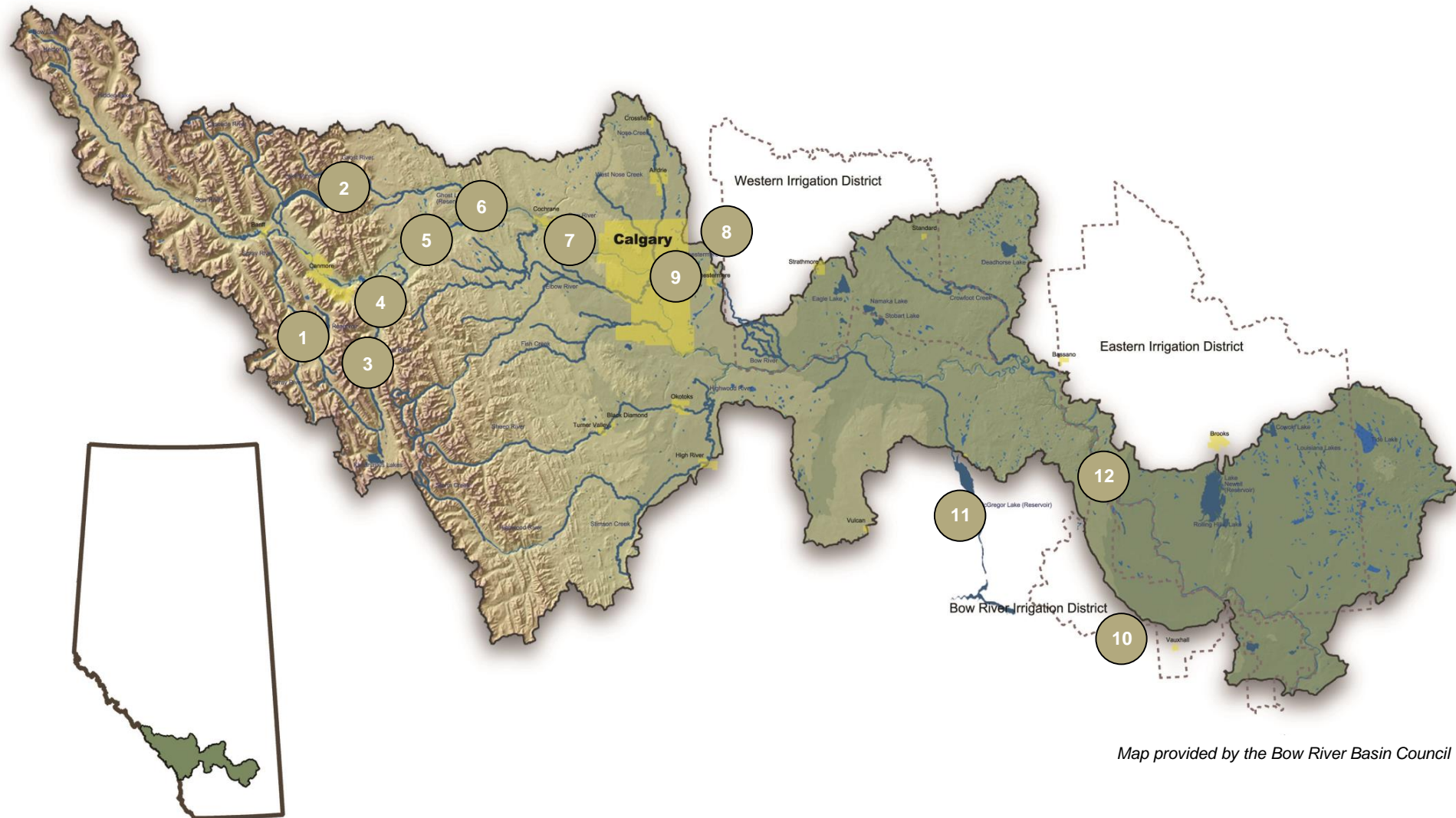
Reduce volume of licence shortages by at least 5% to 10%, while maintaining the same apportionment contribution, and with improvement, or at minimum no reduction, in ecosystem health, all relative to current operations in the same time period.

38 (long list) reduced to 20 (short list) potential schemes from multiple prior studies; 5 schemes used to balance the system.

3 synthesized events:

- Historic record from 1928 to 2009
- Drought 1: The period 1935 - 1945 with 1936 inflows repeated three times and 1941 inflows repeated two times
- Drought 2: The same time series scaled monthly using climate change scenario data

# Drought mitigation schemes are located across the Bow River Basin



# Drought mitigation in the Bow River Basin

**Target: More than 10% reduction in licensed shortages**

## **Operational changes at existing infrastructure**

Extend Kananaskis  
System water shortage  
mitigation operations  
(2016 agreement)

**and/or**

Increase WID diversion  
rate at all river stages  
without affecting licence  
priority date\*

**and/or**

Operate McGregor  
Reservoir at the design  
FSL

## **Minor infrastructure**

New Delacour  
reservoir in WID  
**and/or**

New Deadhorse  
Coulee reservoir in  
BRID

## **Major infrastructure (primarily for flood mitigation)**

New Morley  
reservoir  
**and/or**

Expand Ghost  
Reservoir  
**and/or**

New Glenbow  
reservoir

## **Major infrastructure (primarily for drought mitigation)**

New Eyremore  
reservoir low in Bow  
River Basin

\* Indicates scheme likely requiring a licence amendment

# Water management schemes for the Bow River Basin

**Target: Balancing flood mitigation and drought mitigation**

	Flood mitigation	Balancing the system	Drought mitigation
<b>Operational changes</b>	<ul style="list-style-type: none"> <li>Extend Ghost Reservoir flood operations (2016 agreement)*</li> <li>Barrier Lake flood operations</li> </ul>	<ul style="list-style-type: none"> <li>Drought storage in expanded Glenmore</li> <li>Raise winter carryover in existing reservoirs</li> <li>Fill downstream reservoirs earlier</li> <li>Extend Kan. System water shortage mitigation operations (2016 agreement)*</li> </ul>	<ul style="list-style-type: none"> <li>Increase WID diversion rate at all river stages without affecting licence priority date</li> <li>Operate McGregor Reservoir at the design FSL</li> </ul>
<b>Minor infrastructure projects</b>	<ul style="list-style-type: none"> <li>Increase Ghost Reservoir drawdown rate</li> </ul>	<ul style="list-style-type: none"> <li>Increase Carseland diversion and construct debris deflector</li> </ul>	<ul style="list-style-type: none"> <li>New Delacour reservoir in WID</li> <li>New Deadhorse Coulee reservoir in BRID</li> </ul>
<b>Major infrastructure projects**</b>	<ul style="list-style-type: none"> <li>New Glenbow reservoir</li> <li>New Morley reservoir</li> <li>Expand Ghost Reservoir</li> </ul>		<ul style="list-style-type: none"> <li>New Eyremore reservoir low in Bow River Basin</li> </ul>

\*Ghost Reservoir flood operations and Kananaskis System water shortage mitigation operations are currently in place until 2021.

\*\*One major infrastructure project would be required to meet the 1200cms flood mitigation target at Calgary. Two major infrastructure projects would be required to meet the 800cms flood mitigation target at Calgary.

# Next steps for flood and drought mitigation in the Bow River Basin (I)

1. Build on the 2016 GoA Modified Operations Agreement with TransAlta to put in place the prerequisite needed in the upper Bow system: a long-term flexible watershed agreement between the Province and TransAlta.
2. Implement the relatively quick wins, which can be completed while larger projects are assessed.
  - Extend Ghost Reservoir flood operations (2016 agreement) \*
  - Barrier Lake flood operations
  - Drought storage in expanded Glenmore Reservoir \*\*
  - Increase diversion rate of the Carseland Canal and construct debris deflector \*\*
  - Raise winter carryover in downstream reservoirs (e.g., Travers, McGregor)
  - Fill downstream reservoirs earlier (e.g., Travers/Little Bow)
  - Extend Kananaskis System water shortage mitigation operations (2016 agreement) \*
  - Increase WID diversion rate at all river stages without affecting licence priority date \*\*
  - Operate McGregor Reservoir at the design FSL

\* indicates scheme already in place or underway  
\*\* indicates scheme likely requiring a licence amendment
3. Complete conceptual assessments and feasibility studies of the minor infrastructure schemes within 1 year.
  - Increase Ghost Reservoir drawdown rate
  - Increase diversion rate of the Carseland Canal and construct debris deflector
  - New Delacour reservoir in WID
  - New Deadhorse Coulee reservoir in BRID



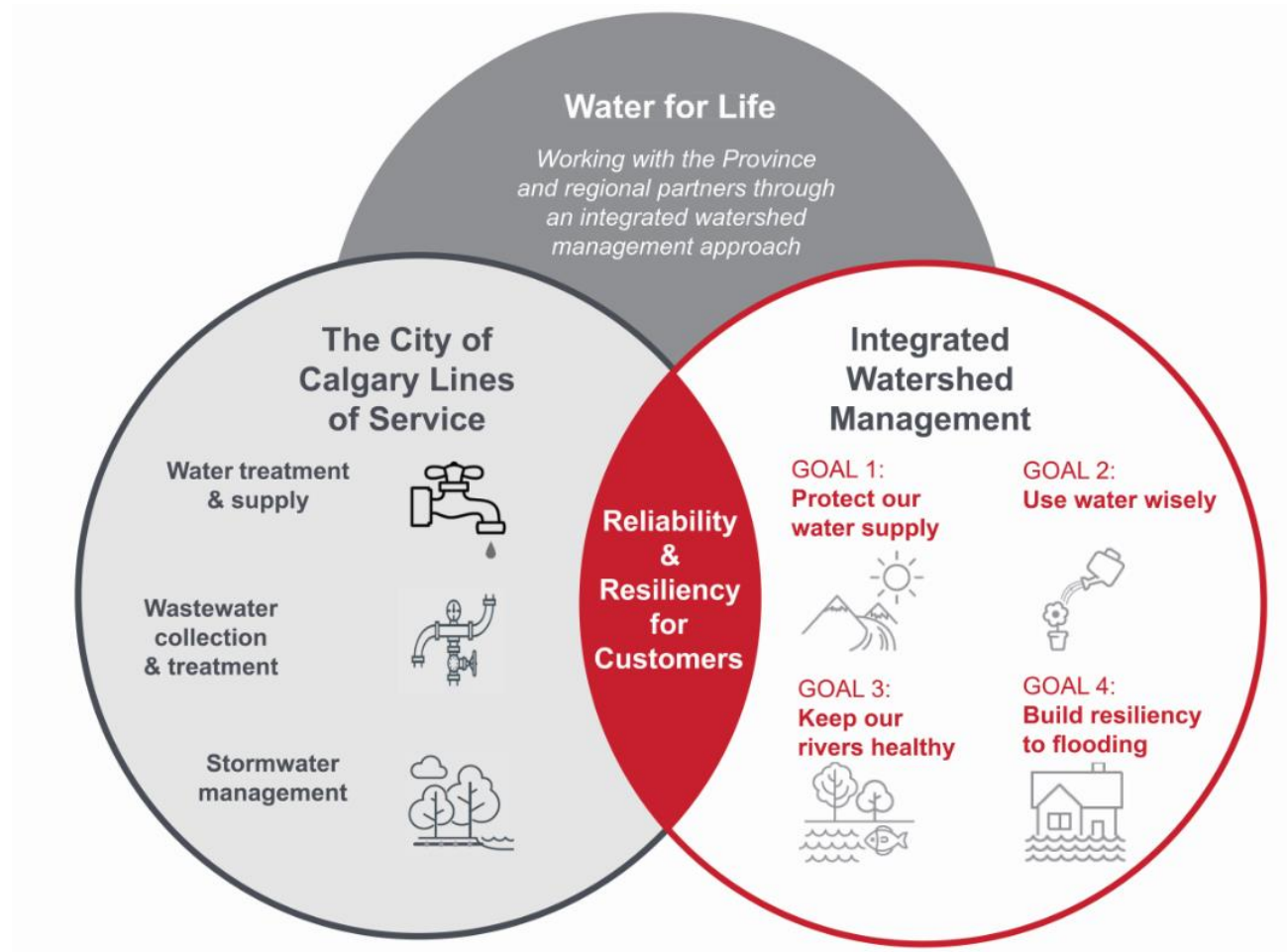
# Next steps for flood and drought mitigation in the Bow River Basin (II)

4. Complete conceptual assessments of the 3 major infrastructure flood schemes within 2 years to determine which to advance to feasibility study.
  - New Glenbow reservoir
  - New Morley reservoir
  - Expand Ghost Reservoir
5. Complete conceptual assessment for Eyremore scheme.
6. Ensure full risk management, feasibility, cost–benefit, and triple bottom line assessments are completed in subsequent steps as the schemes and scenarios are advanced.
7. Balance the system to mitigate the increased drought risk from the 2016 GoA Modified Operations Agreement with TransAlta and do not implement further flood mitigation schemes without implementing the accompanying schemes to balance the system and improve its adaptive capacity.

# Next steps for flood and drought mitigation in the Bow River Basin (III)

8. Establish a process to set and achieve drought mitigation objectives for the Bow River Basin given that the most promising drought mitigation schemes assessed in this project can achieve far more than the original 5 to 10% objective.
9. Increase resourcing and support for precipitation monitoring and forecasting, flow monitoring, flood forecasting and drought forecasting to enhance the effectiveness and adaptability of water management operations.
10. Continue to invest in natural watershed functions, floodplain protection and local mitigation.
11. Commit to a continual collaborative process with stakeholders and policy makers for advancing and implementing these schemes as part of the water management strategy in the Bow River Basin.
12. Review and strengthen where possible the current water management operational protocols of both public and private operators.

# The City of Calgary's integrated approach to watershed management



# Our Flood Resilience Strategy

## Watershed

### BOW RIVER

New Reservoir  
+  
TransAlta operations

### ELBOW RIVER

Springbank Reservoir  
+  
Glenmore Gates

## Community

Complementary  
Bow River  
Barriers

Stormwater  
improvements

Emergency  
response

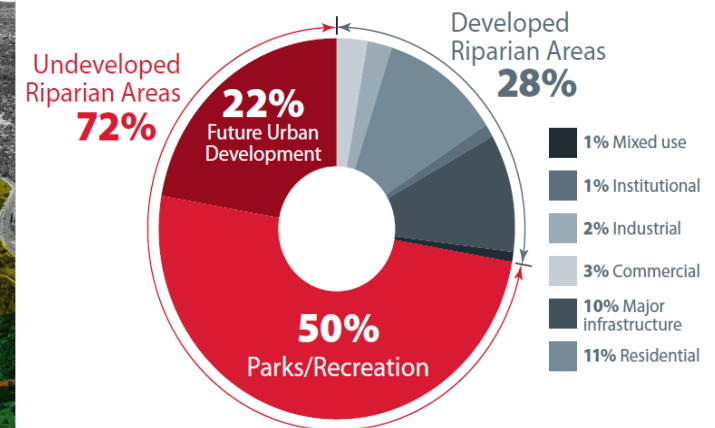
- Gravel bar reshaping
- Riparian Action Program
- Environmental Reserve
- Green Stormwater Infrastructure
- Wetlands conservation

## Property

- Land use and building policy
- New Federal and Provincial policy

- Citizen education and engagement
- Property protection

# Calgary's Riparian Action Program



## Program area

## Outcome

Land use planning

Further loss of riparian areas is minimized

Health restoration

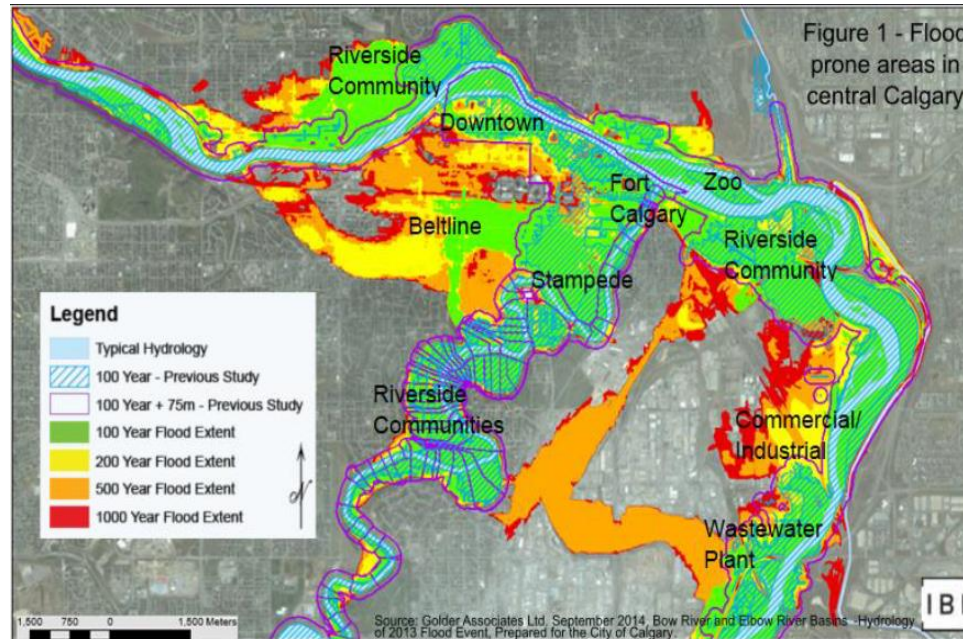
City-wide riparian health is improved

Education and outreach

Stakeholders and citizens value riparian areas



# Economic and social impacts of flooding



- 50,000 Calgarians live in the 1:100 flood zone.
- 140,000 downtown workers
- A 1:100 flood has a 1% chance of happening in any given year

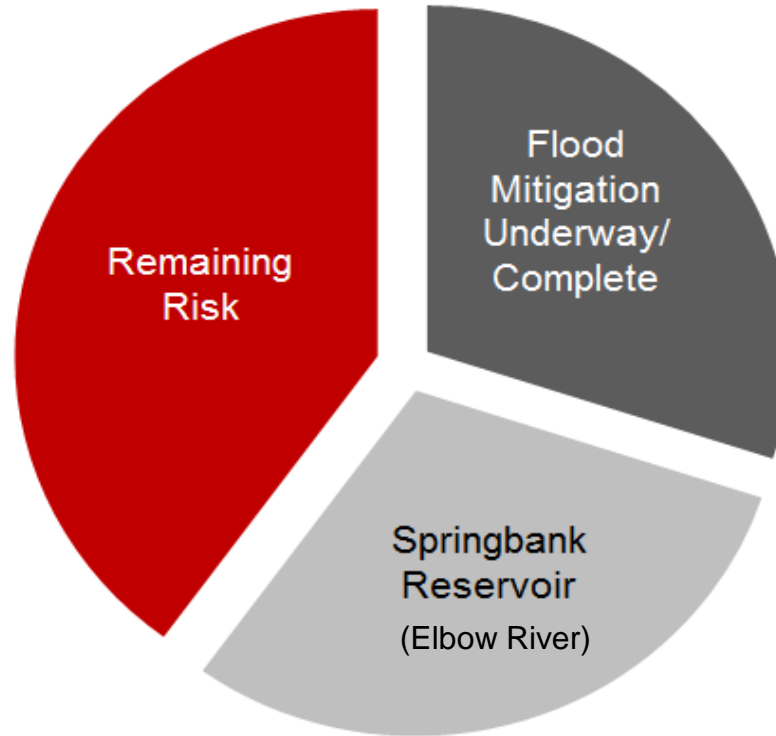
## 1:100 flood scenario (unmitigated):

Residential flood damages = \$1.1 billion

Non-residential damages = \$399 million

City infrastructure damages = \$549 million

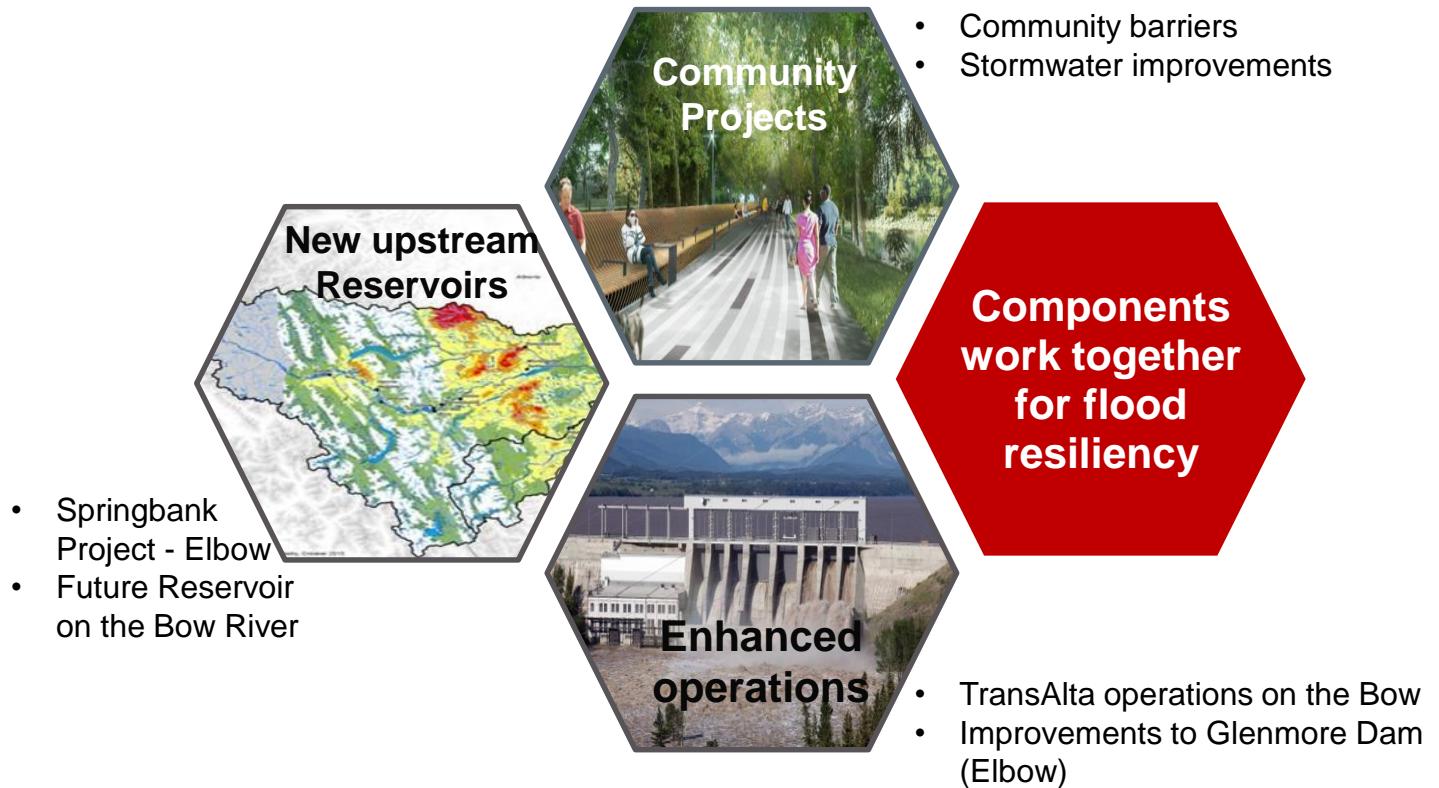
## Flood mitigation since 2013



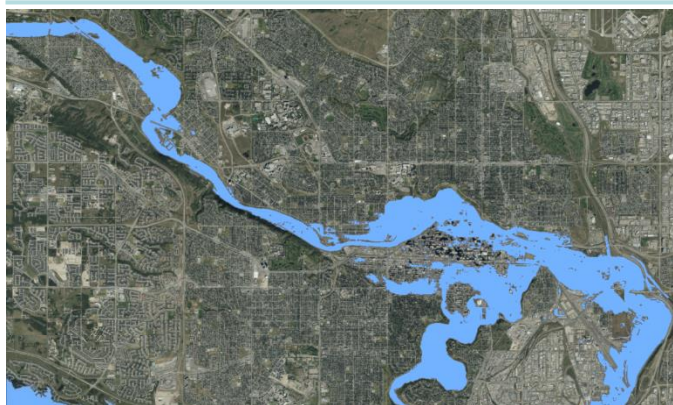
Remaining risk is primarily on the Bow River, to be addressed by:

- A future upstream reservoir on the Bow River
- Permanent TransAlta agreement
- 4 new community barriers

# Key flood mitigation investments

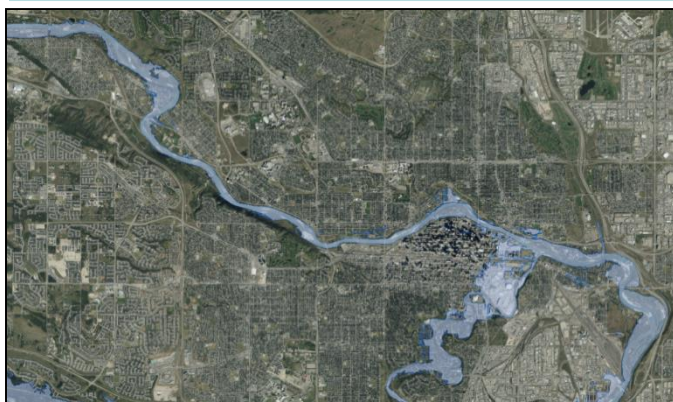


# Progression of flood mitigation in Calgary



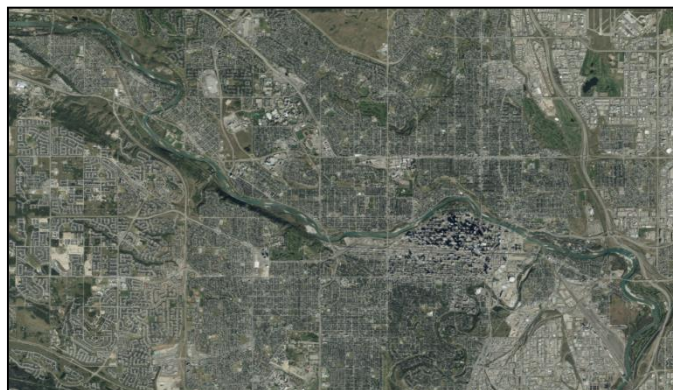
## 2013 flood unmitigated

(what would have happened if  
no action was taken)



## 2013 FLOOD ACTUAL

(City and TransAlta operations,  
emergency response)



## 2013 flood with full strategy implemented

(New upstream reservoirs, enhanced  
operations, community barriers,  
emergency response)



# Role of the Government of Alberta

- Invited the Bow River Working Group (BRWG) to reconvene
  - Strong history of collaborative exploration
  - Project did not seek consensus; rather, it was informed by best available data and knowledge in the Basin.
- Established an Advisory Committee to oversee work
  - Co-chaired with the City of Calgary
- Provided funding, resources and support.
- Government used a hands off approach.



# Update on flood and drought mitigation in the Bow River Basin

- Drought storage in expanded Glenmore Reservoir
  - Spillway gate upgrades that will increase the overall capacity of the reservoir
- Carseland Canal debris deflector
  - Conceptual studies complete
  - Preferred option is to install a floating trash boom
- Operation of provincially owned water management infrastructure

# Update on flood and drought mitigation in the Bow River Basin

- Ghost Rapid Drawdown Rate Study
  - Phase 1: Initial Data Review - underway
  - Phase 2: Site Investigation and Design
  - Phase 3: Construction
- Flood Mitigation Infrastructure on the Bow River
  - Phase 1: Conceptual Assessment
  - Phase 2: Feasibility Study
  - Phase 3: Detailed Design and Engineering
  - Phase 4: Construction
- Phase 1: Conceptual Assessment – Approved and underway
  - Hydrology study
  - Conceptual engineering design
  - High-level geotechnical investigation
  - Table top environmental scan
  - Stakeholder overview and pre-engagement

A scenic view of a river with rapids, a bridge in the distance, and a rocky shoreline in the foreground. The river flows from the left towards the right, with white water rapids visible. The left bank is covered in dense green trees and shrubs. In the foreground, dark, jagged rocks are visible on the left. A large, dark, rocky island or point of land is situated in the middle of the river. In the background, a bridge spans the river, and a small building with a red roof is visible on the far bank. The sky is clear and blue.

**Thank you**