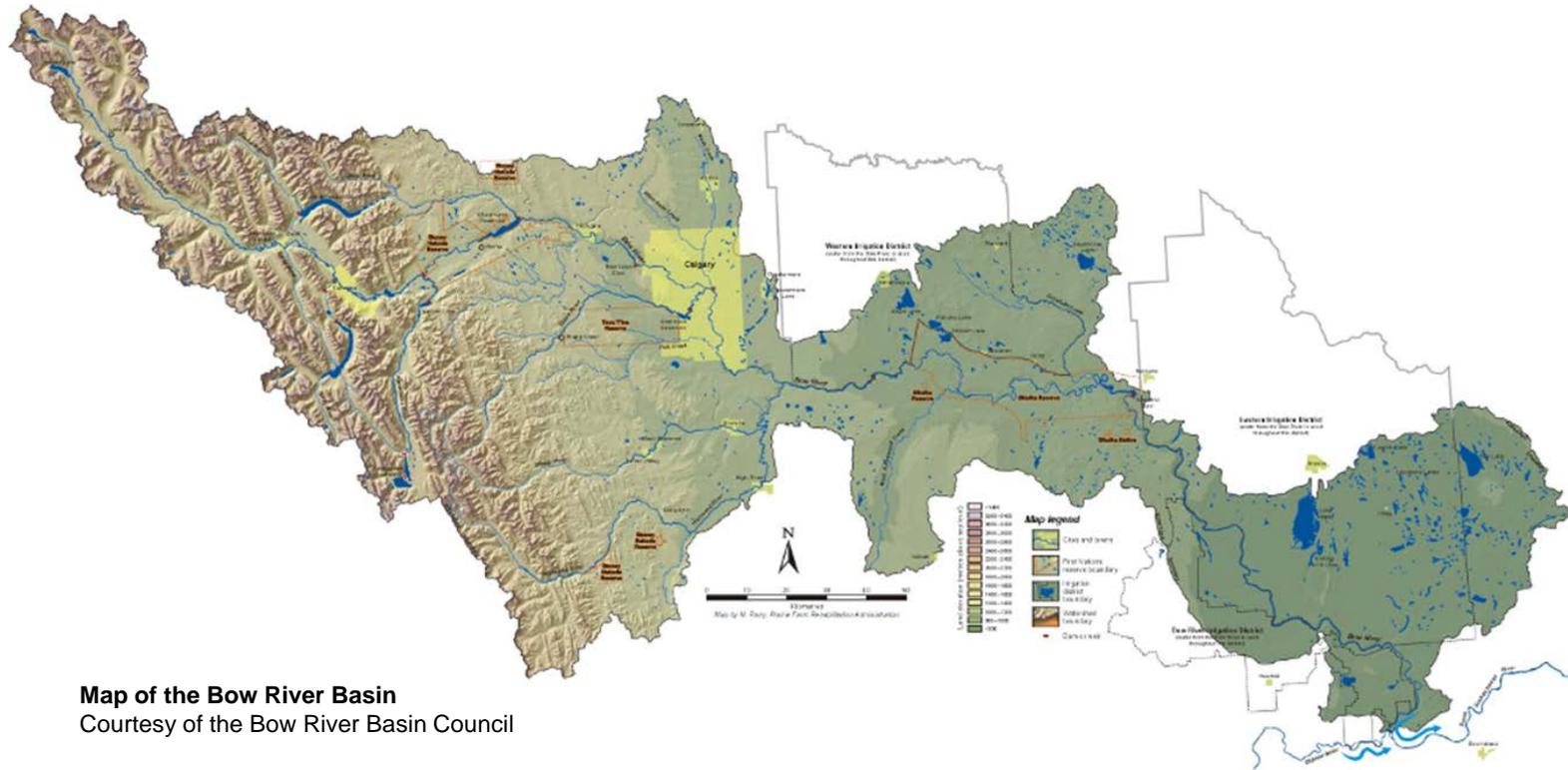


Bow River Water Management Project

Executive Summary

May 2017

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

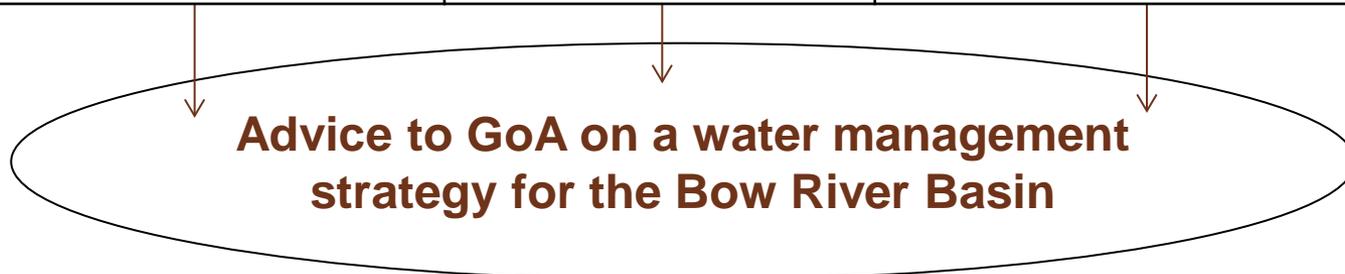


Map of the Bow River Basin
 Courtesy of the Bow River Basin Council

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
<p>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</p>	<p>Identify schemes required to offset any increased water management risk in the basin created by the flood mitigation scenarios upstream</p>	<p>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)</p>



The Bow River Water Management Project

Announced October 2105

Co-chaired by Environment and Parks, and the City of Calgary

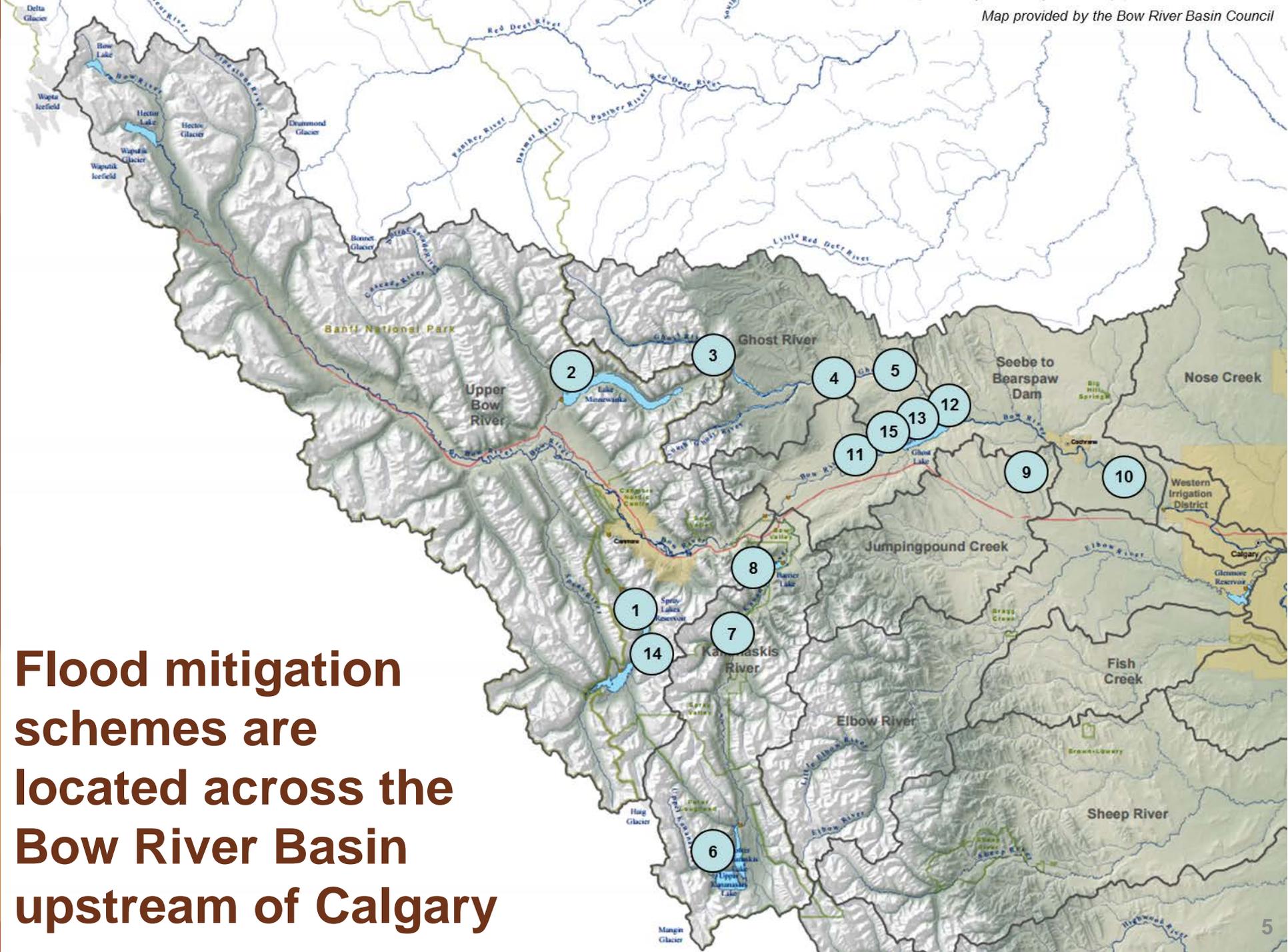
Completed work between January 2016 and April 2017

- 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.



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

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.

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

Flood mitigation in the Bow River basin

Target: 800 cms on the Bow River at Calgary

Extend Ghost Reservoir flood operations (2016 agreement)

+

Increase Ghost Reservoir drawdown rate

+

Barrier Lake flood operations

+

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

+

A second major infrastructure scheme:

New
Glenbow
reservoir

or

New
Morley
reservoir

or

Expand
Ghost
Reservoir

or*

New Kananaskis
reservoir

+

New JPC reservoir

+

New Ghost River
reservoir

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

Balancing the System

Target: Offset the increased risk from the flood mitigations schemes

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)

+

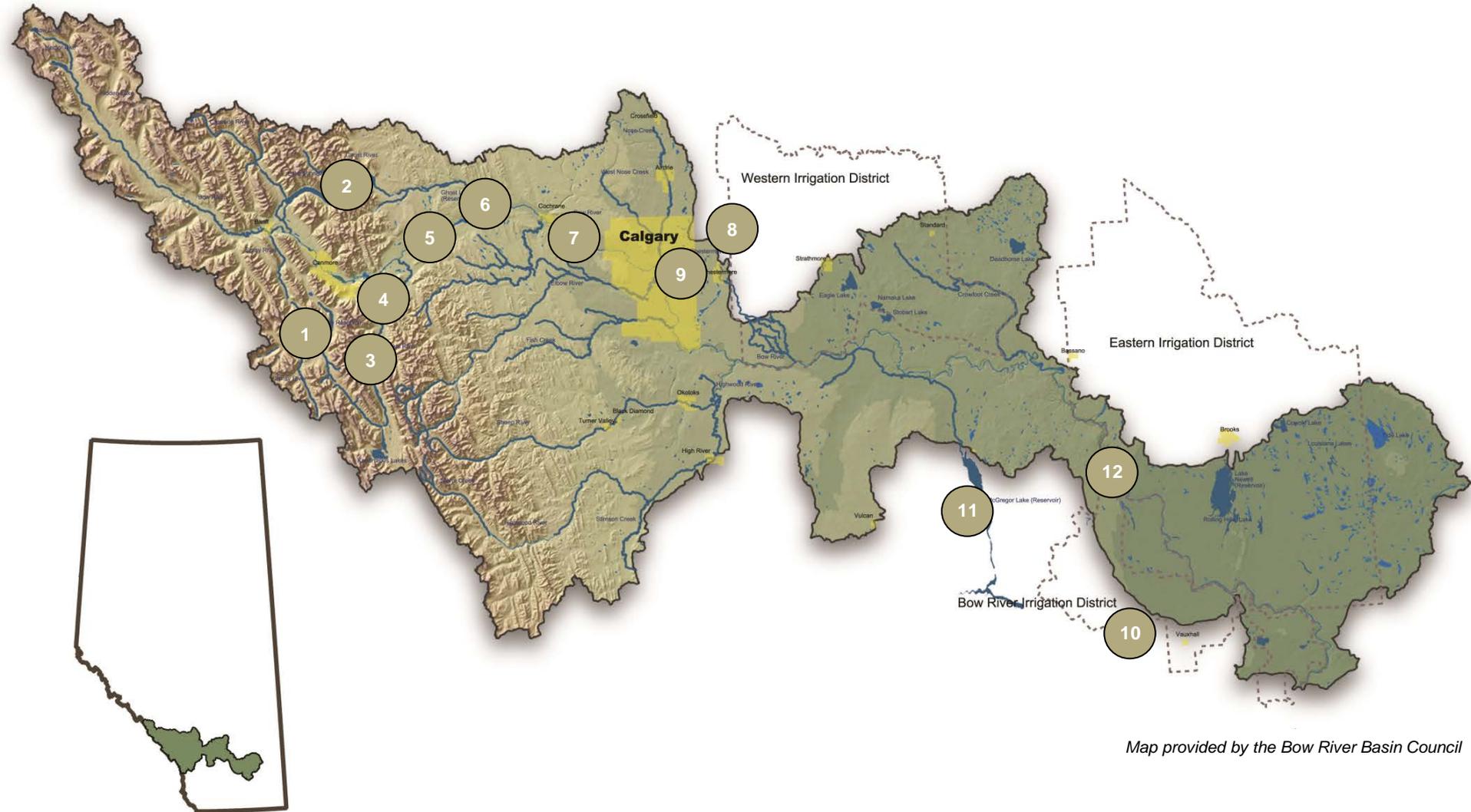
Fill downstream reservoirs earlier (e.g. Travers/Little Bow)

+

Extend Kananaskis System water shortage mitigation operations (2016 agreement)

* Indicates scheme likely requiring a licence amendment

Drought mitigation schemes are located across the Bow River Basin



Map provided by the Bow River Basin Council

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

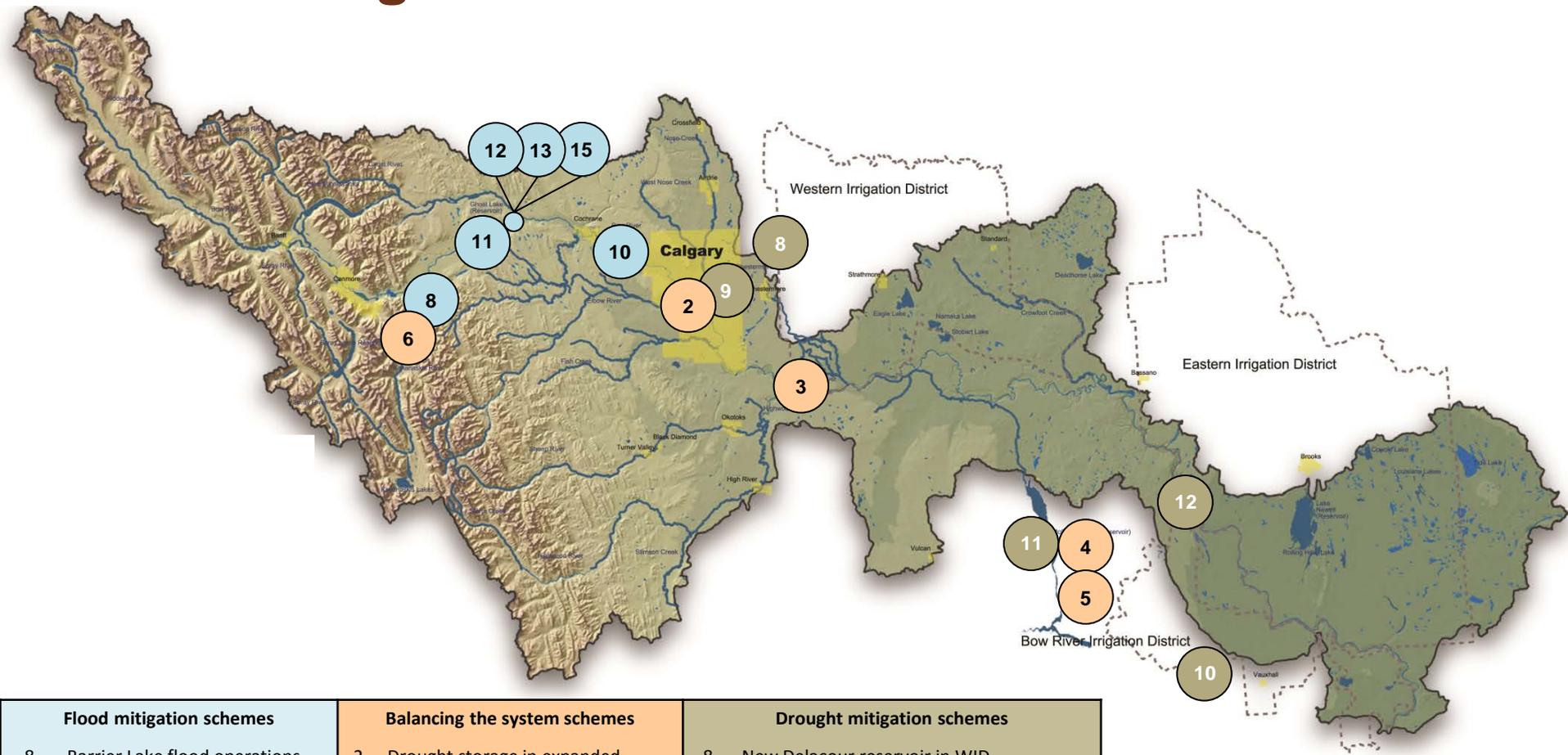
Target: Balancing flood mitigation and drought mitigation

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

*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.

Water management schemes for the Bow River Basin



Map provided by the Bow River Basin Council

Flood mitigation schemes		Balancing the system schemes		Drought mitigation schemes	
8	Barrier Lake flood operations	2	Drought storage in expanded Glenmore	8	New Delacour reservoir in WID
10	New Glenbow reservoir	3	Increase Carseland diversion and construct debris deflector	9	Increase WID diversion at all river stages without affecting licence priority date
11	New Morley reservoir	4	Raise winter carryover in existing reservoirs	10	New Deadhorse Coulee reservoir in BRID
12	Extend Ghost Reservoir flood operations (2016 agreement)	5	Fill downstream reservoirs earlier	11	Operate McGregor Reservoir at the design FSL
13	Expand Ghost Reservoir	6	Extend Kananaskis system water shortage mitigation operations (2016 agreement)	12	New Eyremore reservoir low in the Bow River Basin
15	Increase Ghost Reservoir drawdown rate				

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

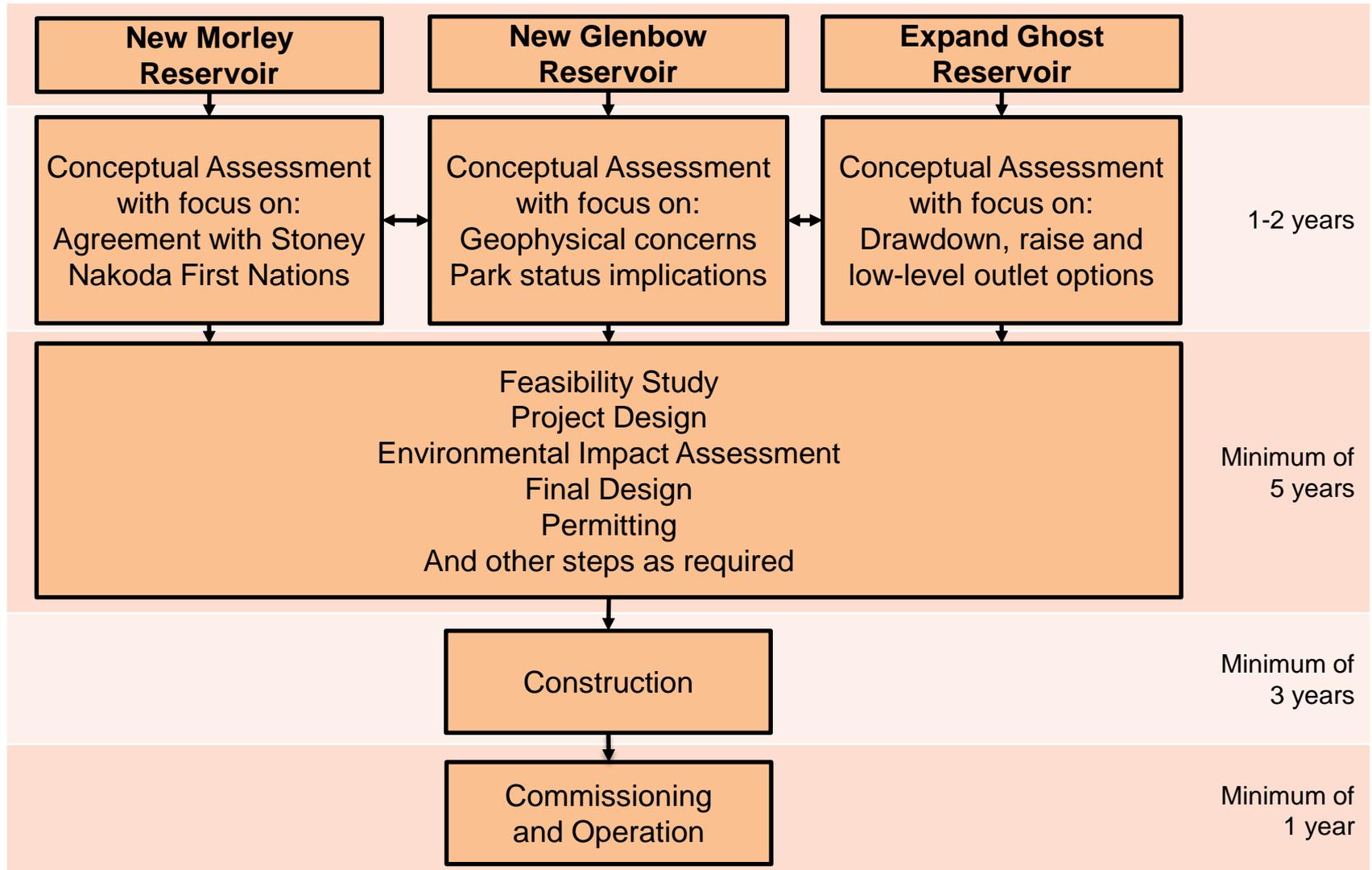
* indicates scheme already in place or underway
 ** indicates scheme likely requiring a licence amendment

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.

Project life cycle: Conceptual assessments within 2 years



Note: Timing of these projects are resource dependent

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.