EXECUTIVE SUMMARY

Bow River Water Management Project

Advice to Government on Water Management in the Bow River Basin

Submitted to:
Hon. Shannon Phillips
Minister
Environment and Parks
Government of Alberta

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The Bow River system is fundamental to the daily life of people in the watershed and downstream, providing water for drinking, irrigation, livestock, waste assimilation, electricity generation, wildlife and recreation.

Historical records and estimates for the Bow River show dramatic variation in volume from year to year as well as within years. The need to adapt to an ever-changing environment and often rapidly changing weather conditions is a simple reality of life in the basin. The flow in the Bow River is heavily influenced by water management infrastructure. The water from snowmelt and spring rains, partially captured by upstream and downstream reservoirs, has allowed for sufficient flows, in most years, for environmental protection, municipal purposes, power production and irrigation.

A less predictable water supply and an increasing demand for water as well as changing climate and demand patterns mean that careful water management will be critical to success in our economic, community, recreational, and environmental future. A fundamental principle of this work is that floods and droughts cannot be prevented, but we can be better prepared.

The 2005 and 2013 floods surpassed any observed on the Bow River since 1932 and illustrate the risks to public safety and infrastructure associated with populations and developments in the floodplain.

Droughts pose a risk to providing a reliable supply of clean water for municipal, residential, commercial, and agriculture needs. Droughts also place stress on environmental conditions in the watershed, and present significant economic risks.

Flood or drought mitigation cannot be assessed in isolation—they must be considered as part of a water management system that values watershed health.

Water management cannot be looked at in isolation because it ties directly to many other government priorities, including climate change mitigation and adaptation, regional land-use planning, economic development, and recreation and tourism. Thus, this complex river system requires careful water management leadership and operations to balance environmental, social and economic values in the region.

PROJECT OBJECTIVES AND REPORT OVERVIEW

The Bow River Water Management Project, announced in October 2015 by Alberta Environment and Parks (AEP) and jointly chaired with the City of Calgary, is one of many water management projects and investments initiated in the Bow River Basin since the floods in 2013.

Specifically, the project had objectives to:

- 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).

The Bow River Basin is fortunate to have a strong history of collaborative exploration of water management challenges and opportunities. This project benefited from a similar collaborative effort, involving water users, water managers, and other stakeholders from across the basin. This process did not seek consensus; rather, it was designed to explore practical mitigation strategies and scenarios informed by the best available data and knowledge in the basin. The project was governed through three groups: the Advisory Committee, the Bow River Working Group (BRWG), and community groups.

This project focused on the water quantity impacts (peak flow rate and volume, storage, shortages) of a range of potential flood and drought mitigation schemes and drew on the expertise and knowledge of participants to comment on their perspectives on associated socio-economic, environmental, and design and operational considerations. The work was a screening assessment the contributors recognized as an essential first step, and one that must be followed with further analysis based on a prioritized set of schemes .

The Bow River Operational Model (BROM) provided the analysis required for the BRWG to consider a range of flood and drought events, assess the effect of individual mitigation schemes, and assess the cumulative effect of multiple mitigation schemes combined into mitigation scenarios. The BROM is a comprehensive, mass balance model of the Bow River system developed using 86 years of Government of Alberta water data broken into daily flows, combined with the latest data from TransAlta and the Water Survey of Canada for hourly flows during the 2005 and 2013 flood periods.

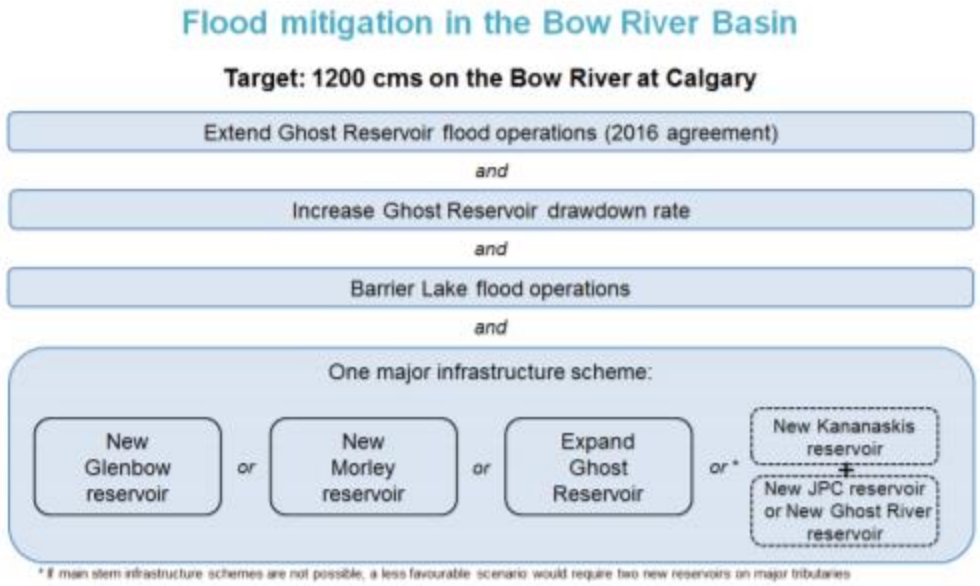
This report summarizes the findings of the project and offers it as advice to the Minister of Alberta Environment and Parks in developing a robust, strategic plan for water management in the Bow River Basin, from the headwaters to the confluence with the Oldman River and continuing through Medicine Hat. This advice focuses on screening structural flood and drought mitigation opportunities in the basin, assessing the resulting flow impacts downstream through the entire basin, and considering the associated effects on watershed health.

FLOOD MITIGATION RESULTS

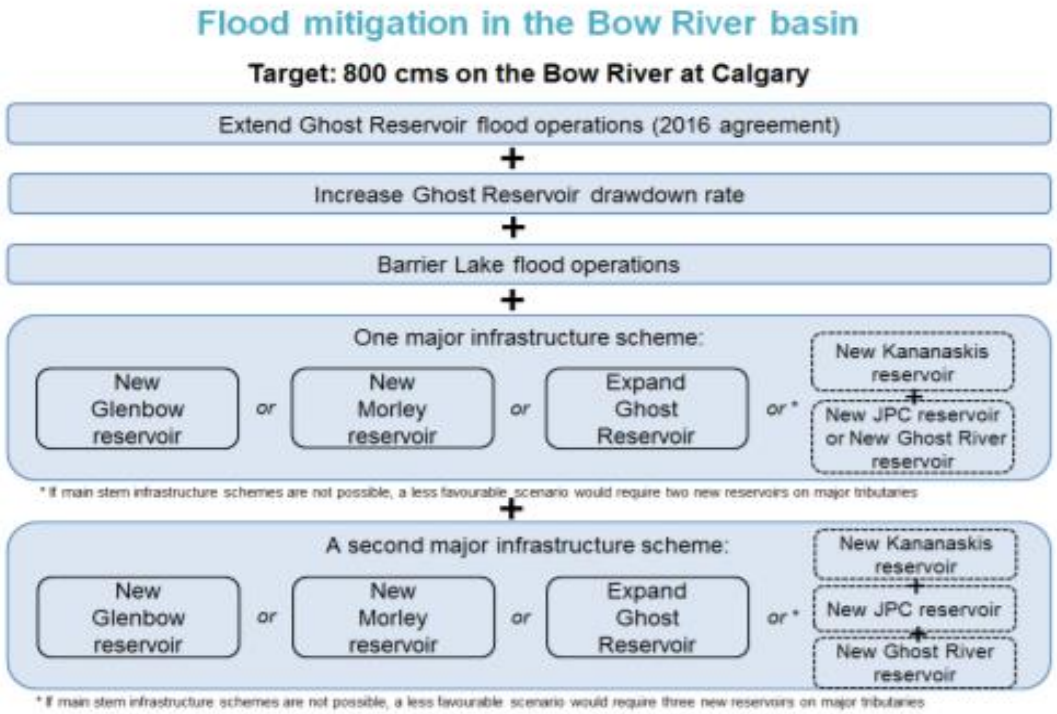
Four synthesized flood events, based on data from the actual 2005 and 2013 floods, were chosen to test and assess potential flood mitigation schemes. These flood events exhibited different characteristics, with 2005 having high volume and two peaks, and 2013 having less volume but a single, higher peak. The peak flow at Calgary was used to establish the baseline, but flow rates at many other locations throughout the Bow River system were also considered in the assessment of mitigation schemes.

Early in the process, discussion focused on whether 400 cms is a realistic flood mitigation target—given many schemes would be required to mitigate to that level and there would be potential for detrimental effects on the natural functions of the river and floodplain. Given these concerns of the BRWG and results of preliminary modelling, the Advisory Committee confirmed in August 2016 that flood mitigation scenarios should be developed for the 1,200 and 800 cms targets only.

Fifteen flood mitigation schemes were assessed by the BRWG. These schemes were located across the Bow River Basin upstream of Calgary. The most promising schemes were grouped into scenarios to achieve the flow target. Four scenarios were developed for the 1,200 cms flow target and three scenarios were developed for the 800 cms target.



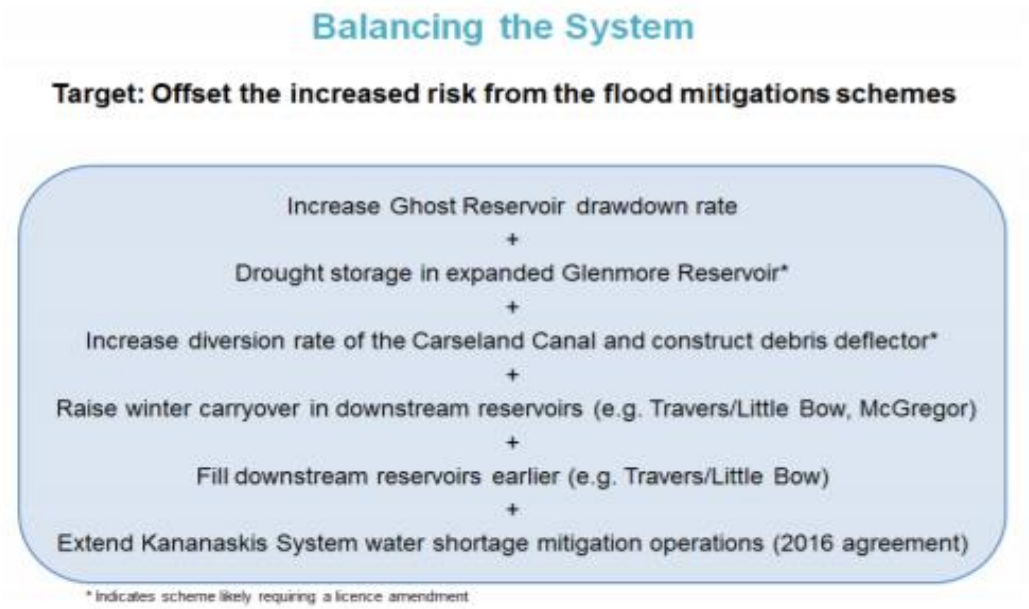
Executive Summary Figure 1: Flood mitigation scenarios for target 1,200 cms on the Bow River at Calgary



Executive Summary Figure 2: Flood mitigation scenarios for target 800 cms on the Bow River at Calgary

The Bow River Basin is a complex, regulated, interconnected system. Implementing flood mitigation schemes and scenarios upstream of Calgary will change the historically managed flow regime the system has grown and adapted into. Changes to improve flood mitigation have already and could further reduce drought resiliency, which could result in more water shortages to licensed water users and impact watershed health.

Thus, early in this project, project participants emphasized the importance of balancing the system. To address this, six relatively minor schemes were identified as most promising and combined into a scenario to balance the system.



Executive Summary Figure 3: Scenario to balance the system

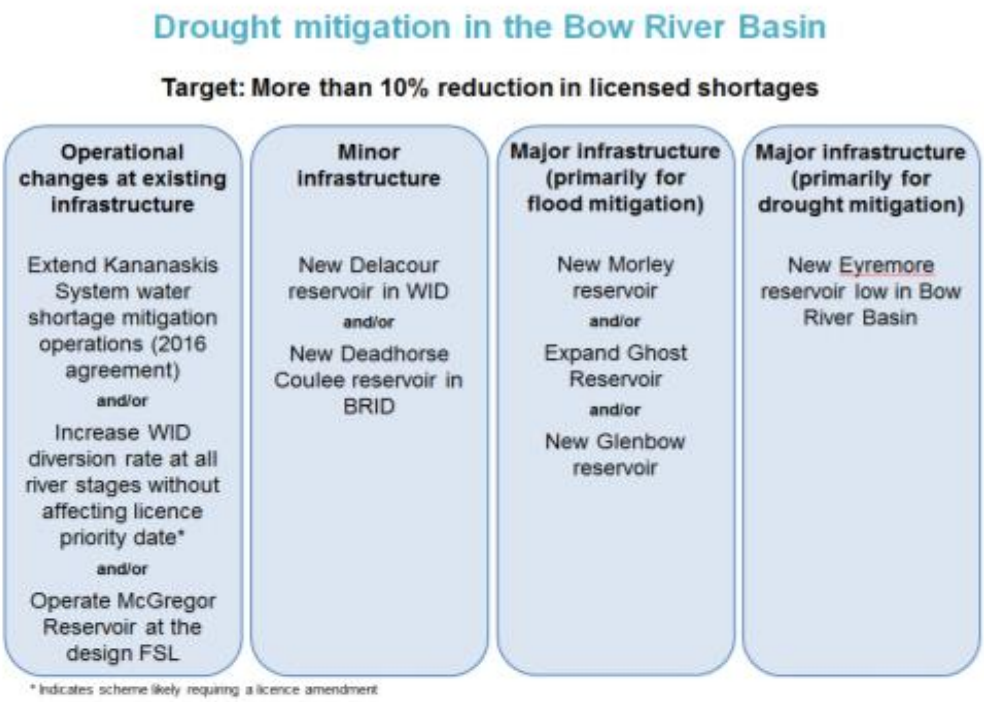
DROUGHT MITIGATION RESULTS

The historical record and two synthesized drought events (developed to simulate inflow time series that stress the Bow River system beyond what has been observed in the historical record and reflect potential impacts of climate change) were used to assess drought mitigation schemes.

Twelve drought mitigation schemes across the Bow River Basin were assessed by the BRWG. These were over and above the six schemes already covered in the balancing the system scenario.

The BRWG was assigned a drought mitigation objective that early modelling found to be quite conservative. Many of the individual drought mitigation schemes alone could achieve the 5% to 10% reduction in licence shortages without violating apportionment requirements and ecosystem health.

The nature of the BRWG discussion evolved from "How do we achieve the objective?" to "What are the most promising schemes for adding drought mitigation capacity to the Bow River Basin?" The most promising schemes fell into four types: operational changes, minor infrastructure projects, major infrastructure projects primarily for flood mitigation, and major infrastructure projects primarily for drought mitigation.



Executive Summary Figure 4: Drought mitigation in the Bow River Basin; in addition to the six schemes already identified to balance the system

WATER MANAGEMENT ADVICE

Participants in the BRWG were adamant that a flexible, resilient, and adaptive water management strategy is needed for the Bow River. During this project, the BRWG identified and assessed multiple potential structural flood and drought mitigation schemes and combined them into scenarios. As presented in this report, in a system as complex as this one, there are a number of promising scenarios that could be pursued following further study.

No single scenario can, at this point, be put forward as the ideal solution. Nor can a single combination of flood and drought mitigation schemes be put forward as the ideal strategy for the Bow River Basin. Instead, this project has reduced the number of potential schemes to a short list of those that appear most promising.

Water management in the Bow River Basin

Target: Balancing flood mitigation and drought mitigation

	Flood mitigation	Balancing the system	Drought mitigation
Operational changes	• Extend Ghost Reservoir flood operations (2016 agreement)* • Barrier Lake flood operations	• Drought storage in expanded Glenmore • Raise winter carryover in existing reservoirs • Fill downstream reservoirs earlier • Extend Kan. 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
Minor infrastructure projects	• Increase Ghost Reservoir drawdown rate	• Increase Carseland diversion and construct debris deflector	• New Delacour reservoir in WID • New Deadhorse Coulee reservoir in BRID
Major infrastructure projects**	• New Glenbow reservoir • New Morley reservoir • Expand Ghost Reservoir		• 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.

Executive Summary Figure 5: Most promising water management schemes for the Bow River Basin

The varying scale of the potential schemes means many of the operational and minor infrastructure projects could be implemented relatively quickly, while larger infrastructure projects would typically require a longer assessment, design, and construction process.

Recognizing this, the BRWG offers the following next steps for a strategy to improve water management in the Bow River Basin:

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

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.

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.

Most importantly, a coordinated and integrated approach to watershed management throughout the Bow watershed is essential to reduce risks from floods and droughts, minimize costs for mitigation options, and provide for a safe, clean, and healthy river system over the long term.

Much work has already been done, however, given the need for new and costly schemes to achieve flood and drought protection goals, a more formalized collaborative governance process may be needed to select the most effective and affordable options for implementation and to retain public confidence in the expenditures and expected results.

Participants in this project have indicated they are willing and eager to continue to provide their expertise and energy to the next several phases of this long-term, public interest project.