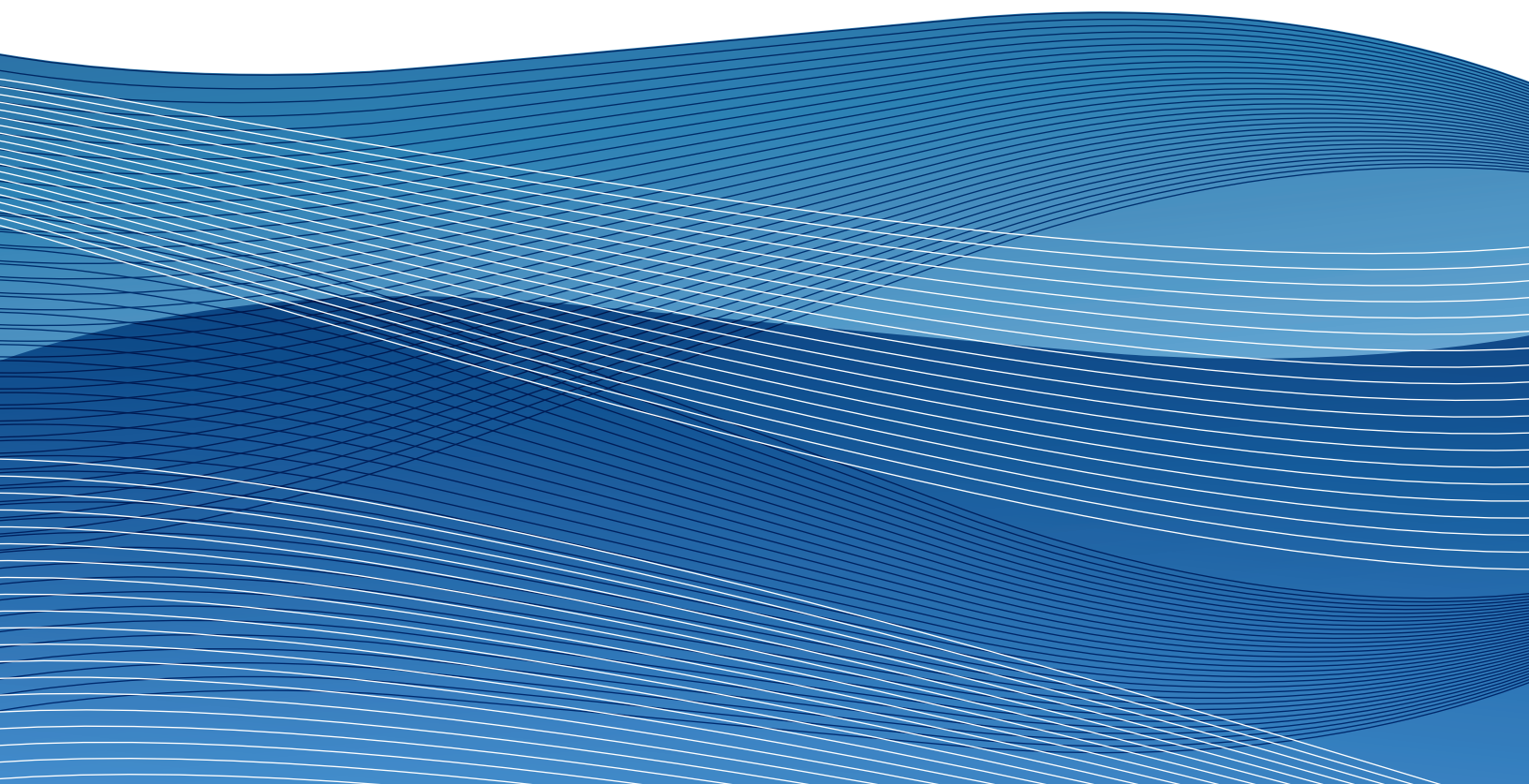


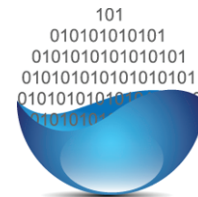
Bow River Project

Final Report

Prepared by | The Bow River Project Research Consortium

December 2010





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Alberta WaterSMART
Bow River Basin Council
Bow River Irrigation District
Calgary Regional Partnership
City of Calgary
County of Newell
Ducks Unlimited Canada
Eastern Irrigation District
HydroLogics Inc.
Rocky View County
Trout Unlimited Canada
Water and Environmental Hub
Western Irrigation District

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EXECUTIVE SUMMARY

The Bow River is one of Alberta's most historically, economically and environmentally significant waterways. It flows through the most populous river basin in the province where more than one-third of Alberta's residents live. A growing population, a thriving economy and the fact that the Bow River Basin is closed to new licence applications are all placing ever-increasing pressure on water supplies in the region.



Bow Glacier at Bow Lake

For the past 100 years, the flow of the Bow River has been controlled by dams and reservoirs and by the operating rules established by the owners of these facilities. Since 1911, TransAlta has been the main influence on the storage and release of water in the river and its tributaries. The fact that the timing and flow rate of the Bow River are already being managed offers a unique strategic opportunity to change the way decisions are made and make water available to more users when and where it is needed most.

In 2010, the Bow River Project Research Consortium was established to explore options for re-managing the river system from headwaters to confluence. Participants worked with an interactive, hydrologic simulation model to develop plausible and achievable scenarios for protecting the health of the river throughout the basin and meeting the needs of water users. The fully functioning, data-loaded Bow River Operational Model is a very significant output of this project that will be publicly available for further analysis of the Bow River System and can be adapted for other river systems in Alberta.

The key results of this project and the opportunities it identifies support the goals and principles of other major policy documents and approaches, including the *Water for Life* strategy, the Calgary Metropolitan Plan, and the South Saskatchewan Regional Plan being developed under the Land-use Framework. The Consortium's work shows that improvements in managing the Bow River System are realistic and doable with minimal economic impact on power generation revenues.

Five specific opportunities were identified for consideration by the Government of Alberta and others with a stake in the way the Bow River System is used and managed:

1. Manage the Bow River System in an integrated, adaptive, end-to-end manner, considering all users, interests and values
2. Pursue and support discussions between the Government of Alberta and TransAlta
3. Identify and consolidate the functions required to enable integrated, adaptive management of the Bow River System
4. Encourage and enable transparency and open data
5. Continue working toward an improved and integrated Bow River Management System.

The results of this project demonstrate that integrated management of the Bow River from headwaters to confluence could realize the following benefits:

- » Releases from upstream storage reservoirs can significantly improve flows downstream without negatively affecting water quality. Water quality below the Bassano Dam can be expected to improve.
- » Changes in management of the Kananaskis River have potential to greatly improve aquatic ecology and the existing fishery.
- » Stabilizing water levels in Lower Kananaskis Lake will greatly improve the fishery and create new and enhanced recreational and tourism experiences.
- » Long-term water demand forecasts for the City of Calgary, the Siksika First Nation, the Calgary Regional Partnership, Rocky View County and other surrounding municipalities can be accommodated.
- » Minimum flows through Calgary will continue to be met and may be able to improve dissolved oxygen levels at critical times of the year.
- » Modest irrigation expansion is expected to result from improvements in conservation and efficiency with no impact on the river.
- » Previous studies have shown that, with sufficient capital investment, the Spray Lakes Reservoir can be restored to its original design capacity. This would restore about 75,200 dam³ (61,000 acre feet) of storage, significantly enhancing total storage on the system and enabling most of the other benefits to be achieved. More immediately, there is an opportunity to create a water bank, which would utilize all the reservoirs in combination to achieve substantial overall benefits from the Bow System.

Areas for further work to flesh out and refine the proposed opportunities have also been identified.

Integrated management would optimize opportunities for licence holders, the environment and other users along the entire system. The collaborative approach used in this project and the resulting tool—the Bow River Operational Model—exemplify the importance and value of knowledgeable stakeholders working together, with access to agreed-upon data. The Consortium believes that successfully managing the Bow River System in an integrated fashion will require a shared approach involving the key water managers and users of this vital resource.

1. INTRODUCTION

Water has been the lifeblood of southern Alberta since the region was settled. This crucial resource has enabled the establishment of communities and supported a wide range of economic activities, to the benefit of the region and the province as a whole.

Although always recognized as a fundamental human need, water supplies in southern Alberta have become increasingly important in the face of existing and anticipated future pressures. For example, the Calgary region alone is expected to more than double its current population of 1.2 million to around 2.8 million in 60 to 70 years, adding about 800,000 new jobs in the process (Calgary Regional Partnership, 2009).

The challenge will be to accommodate this increase in population and economic activity while retaining the features that enhance the region's quality of life and define its character.



*Spray Lakes Reservoir
in Spray Valley above
Canmore*

Alberta's provincial water management strategy—*Water for Life: Alberta's Strategy for Sustainability*—has been the vehicle for managing Alberta's water resources since it was published in 2003. The strategy was renewed by the Province in 2008, reaffirming the commitment of the Government of Alberta "to the *Water for Life* approach for the wise management of Alberta's water quantity and quality for the benefit of Albertans now and in the future" (Government of Alberta, 2008, p.3). Southern Albertans understand the significance of water to the continued economic, environmental and social health of the region, and the challenges associated with sometimes conflicting needs.

These challenges, plus the realities that the Bow River Basin is closed to new licence applications and the percentage of municipal water licence use is increasing, have increased pressure to better manage the river system. The Bow River Project recognizes that water in the Bow River System is fully allocated and does not contemplate or suggest that water licence allocations will be re-opened. Many water users are already working on realistic, practical and innovative approaches to improve water management practices in the South Saskatchewan River Basin (SSRB). The Alberta Water Research Institute has played an important role in leading and supporting the development of new ideas and partnerships that will help solve these significant and growing water challenges.

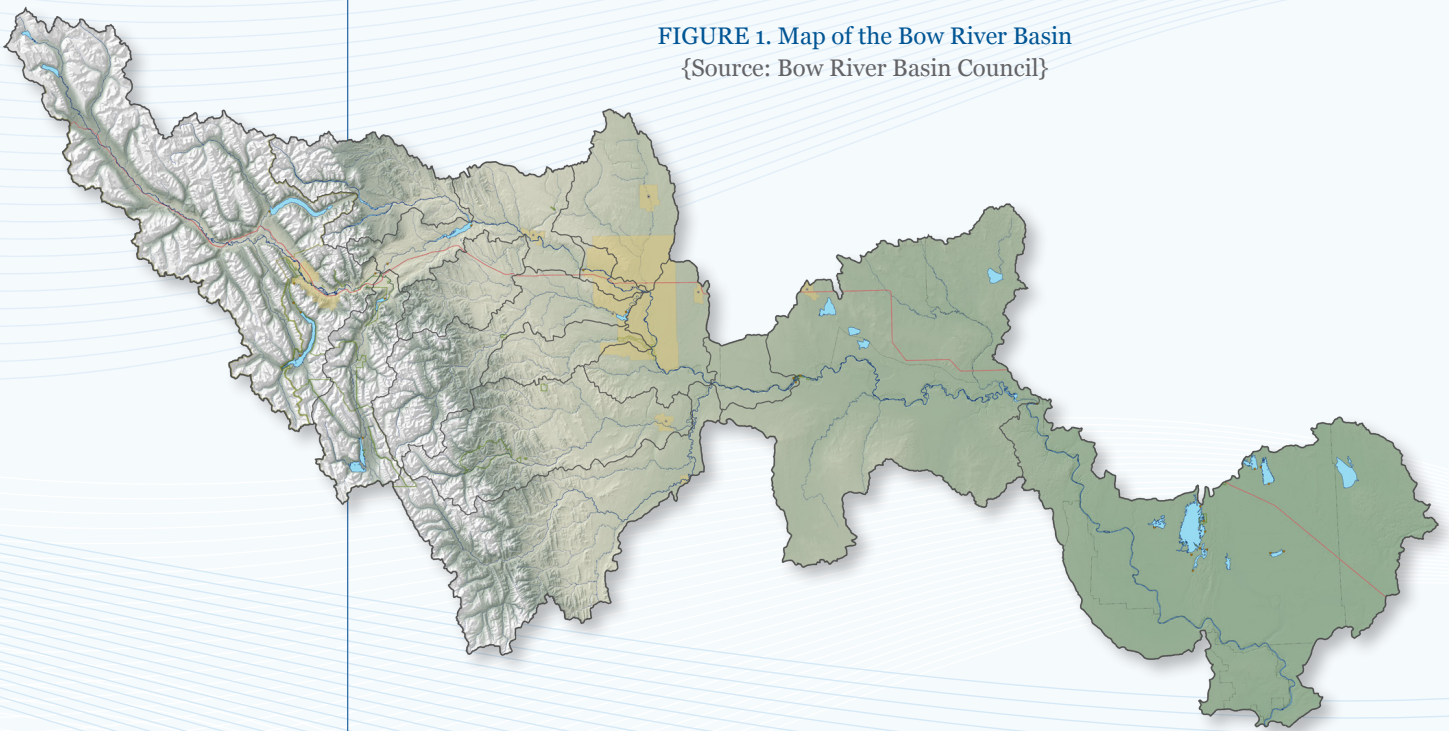
This report looks at new ways to manage water in the SSRB by focusing on improved management of the Bow River System as an integrated watershed. Taking advantage of the opportunities that emerged from this work could significantly improve water management and contribute to the long-term environmental health and economic growth of southern Alberta. All of the opportunities described in this report support the goals and key directions in *Water for Life*.

1.1 THE BOW RIVER SYSTEM AND ITS MANAGEMENT

Like most of Alberta's major river systems, the Bow River (the Bow) originates in the Rocky Mountains. On average, snowmelt from the mountains contributes about 80% of the river's total annual flow. This fact, combined with the high variability of snowfall from year to year, accounts for the extreme variability of annual flows in the river system. Although glacial meltwater contributes relatively little to the river's total annual flow, it plays an essential role in maintaining the health of the aquatic ecosystem in the headwaters during late summer, and in maintaining stream flow in low-flow periods and drought years.

The Bow passes through Calgary and, further downstream, joins the Oldman River to become the South Saskatchewan (see Figure 1). The Bow is approximately 645 km long and drains an area of nearly 25,000 square kilometres. The Bow Basin is home to 22 urban municipalities, including the City of Calgary, 12 rural or regional municipalities and three First Nations, making it the most populous river basin in Alberta (BRBC, 2010).

FIGURE 1. Map of the Bow River Basin
{Source: Bow River Basin Council}



The Bow and its tributaries provide water for drinking, irrigation, waste assimilation, electricity generation and wildlife, as well as for recreational activities including fishing, rafting, kayaking and canoeing. The river system and its shorelines also provide important aquatic habitat for many plant and animal species.

For the past 100 years, the flow in the Bow has been controlled by dams and reservoirs and by the operating rules established by the owners of these facilities. In 1911, TransAlta (then called Calgary Power) constructed the first of 11 hydroelectric stations on the Bow. Since that time, TransAlta has been the main influence on the storage and release of water in the river and its tributaries, and has played a major role in regional economic development. The locations of TransAlta's hydro facilities are shown on the map in Figure 2 and summarized in Table 1.

FIGURE 2. Map of TransAlta Facilities
{Source: TransAlta}

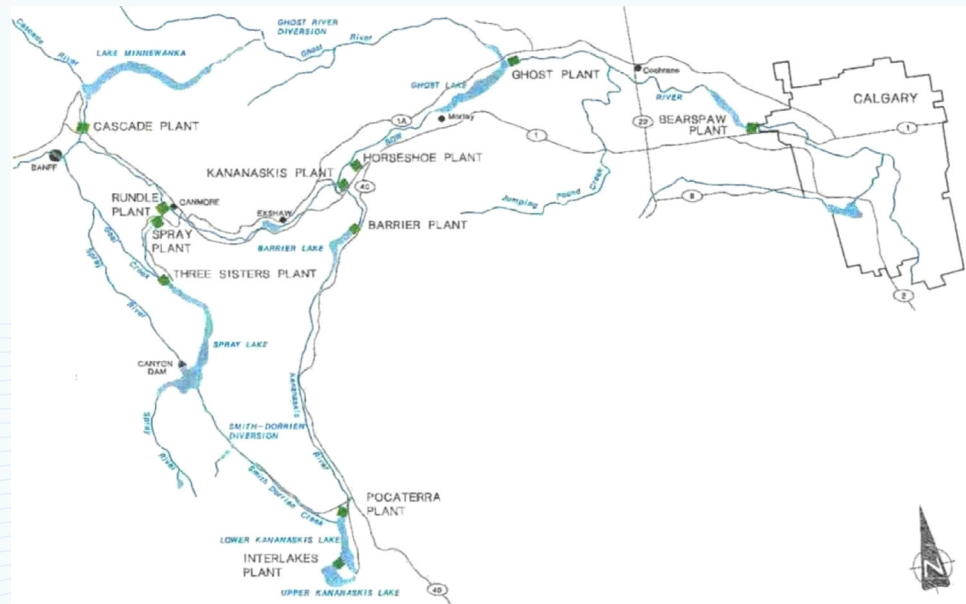


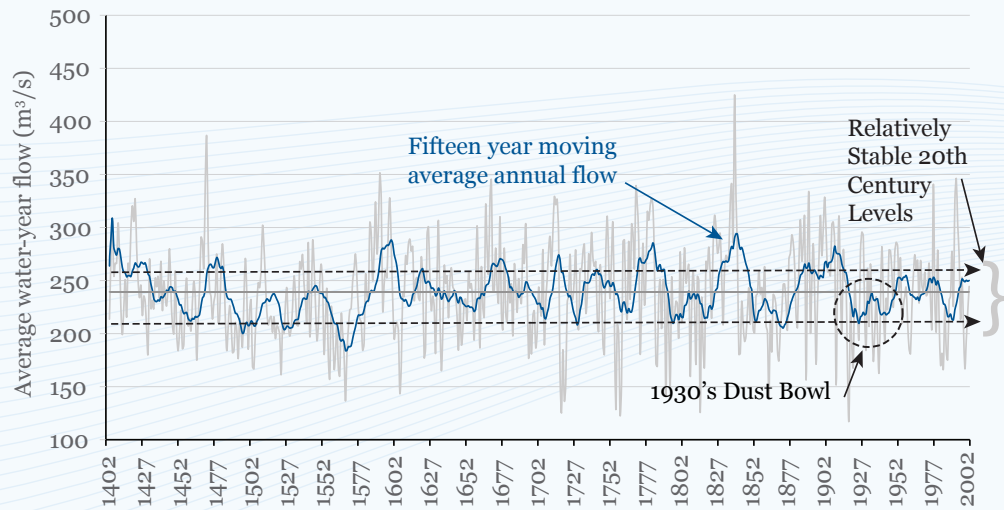
TABLE 1. Summary of TransAlta Hydro Facilities on the Bow River System
{Source: TransAlta}

Plant	Reservoir	Primary Reservoir Supply	Installed Capacity (MW)	Live Reservoir Storage (dam ³)
Cascade	Lake Minnewanka	Cascade, N. Ghost	34	221,900
Spray Group (Three Sisters, Spray, Rundle)	Spray Lake	Spray River	155	177,600
Interlakes	Upper Kananaskis Lake	Kananaskis River	5	124,500
Pocaterra	Lower Kananaskis Lake	Kananaskis River	15	63,100
Barrier	Barrier Lake	Kananaskis River	13	24,800
Kananaskis	fore bay	Bow River	19	-
Horseshoe	fore bay	Bow River	16	-
Ghost	Ghost Lake	Bow River	56	92,500
Bears paw	fore bay	Bow River	17	-
Bow Basin Total			330	704,400

For most of the year in most reaches of the Bow, the average annual flow is almost always adequate to meet environmental requirements and the demands of water licence holders. But there are exceptions during certain times of the year in certain reaches of the river, and in times of major drought.

Figure 3 shows the historic and prehistoric tree-ring calculated variation in flow associated with droughts and floods. As the chart shows, historic weather events have been more severe than in the more recent record, thus making drought and flood planning a prudent priority for all users of the river.

FIGURE 3. Historic Drought and Flood Record
 {Source: David Sauchyn, University of Regina}



The Bow’s hydro operations were designed over the past 100 years to maximize power production and revenue. Although economic circumstances and water usage have changed dramatically, little has changed in the technology or operation of the hydro system. The ability to almost instantly “spin up” its generators and produce electricity on demand allows TransAlta to balance the province’s constantly changing electricity loads. This enables TransAlta to provide ancillary services to the provincial electricity grid to help maintain stability in the power system. Hydro facilities are, for the most part, operated to generate power when electricity prices are at their highest, on both a daily and annual basis (known as “peak power” generation).

The fact that the timing and flow rate of the Bow are already being managed, offers a unique strategic opportunity to change management decisions and make water available to more users when and where it is needed most. Responding to the needs of multiple users in a more integrated fashion can be achieved by changing the way the river system is managed. The chart in Figure 4 reflects that the Bow is a managed river, with these managed flows varying considerably from natural flows.

In the fall of 2009, the Alberta Water Research Institute (AWRI) provided seed funding for an initiative to determine interest among key water stakeholders in the Bow River Basin to look at alternatives for managing water and water facilities within the basin. As a result of those discussions, carried out for the AWRI by Alberta WaterSMART, the Terms of Reference for a Bow River Operations Modelling Pilot Project were drafted, and funding for the initiative was obtained in May of 2010 from the AWRI, the Water and Environmental Hub, and from several water stakeholders in the Bow River Basin. The goal of the project was to explore options for improving management of the Bow and to demonstrate the environmental, economic and risk mitigation benefits and costs related to the proposed changes in operating policies and rules, including performance in meeting water conservation objectives within the Bow River Basin.