

GENERAL OVERVIEW



The South Saskatchewan River Basin (SSRB) consists of four sub-basins: those of the Red Deer, Bow, Oldman and South Saskatchewan Rivers. Most of the flow of these rivers typically originates from snowmelt in the Rocky Mountains in the spring. Rainfall (mainly in May and June) can also be significant. Glacial melt water makes a small contribution to flows in the Bow River in the late summer.

The water management planning process

With the aid of a number of background studies, four Basin Advisory Committees (BACs) will be making recommendations on water management in the SSRB, particularly concerning the amount of water that should remain in the rivers for the aquatic environment. The BACs have been asked to find an acceptable balance between water consumption and environmental protection, while considering economic and social values and ecological requirements.

The background studies, and other information, can be found on the Alberta Environment web site at:

<http://www3.gov.ab.ca/env/water/regions/ssrb/index.asp>

- *A licence not in good standing:
- Licence under suspension
- Being considered for cancellation
- Subject to an investigation, water management order or an enforcement order
- Outstanding complaint that may result in compliance or enforcement action
- Subject to a prosecution, administrative penalty, civil matter or FAB appeal
- Not in compliance with the terms and

A pre-condition of the SSRB water management planning process is that existing water allocation licences in good standing* will be respected.

The challenge

Overall, the SSRB faces a dilemma:

- The rivers are highly allocated, with the exception of the Red Deer River.
- Large increases in municipal, industrial and stockwatering water demands are predicted, even when an expected decrease in per capita use is considered. It has been forecasted that demand for non-irrigation consumptive use could increase between 35% and 67% by 2021 (assuming the water is available). Irrigation will continue to be the major consumer of water in the basin.
- There is a significant gap between typical existing flows in the Bow, Oldman, St. Mary, Belly and Waterton Rivers below the major diversions and the flows required to maintain a healthy aquatic ecosystem over the long-term.

We have difficult decisions to make about the use of water, retaining water in the rivers, and maintaining a sustainable aquatic ecosystem. It is not possible to have, in any given river reach, both a high degree of consumptive water use and a near-natural aquatic ecosystem over the long-term.

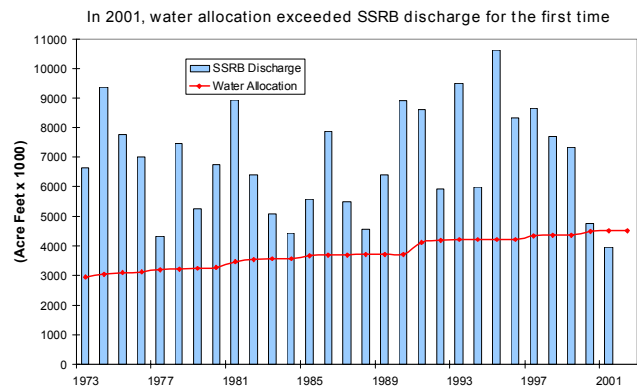
The main questions concerning water allocation in the SSRB are:

- 1) How much water should be allocated from the Red Deer River, and under what conditions?
- 2) Should more water be allocated from the Bow and Oldman Rivers and their tributaries?
 - a) If yes, how much more and under what conditions?
 - b) If no, should attempts be made to restore flows, at least to some reaches, and under what conditions?

How much water is available?

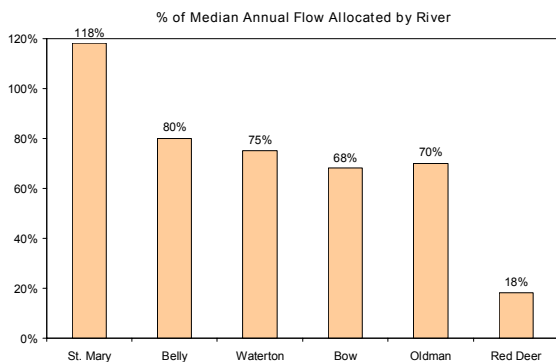
In the Bow and Oldman River sub-basins any new water allocation will risk water deficits in drier years. This is due to the existing degree of allocation and the in-stream objectives¹.

For the first time, in 2001, the natural discharge (i.e. the discharge that would have occurred in the absence of any withdrawals) of the SSRB was less than the total amount of water allocated. This was the least discharge ever recorded. In that very dry year, about 54% of the natural



discharge was passed to Saskatchewan, and water stored in the basin was depleted. Water shortages occurred in the Oldman River sub-basin. However, the impacts were mitigated to a large extent by senior licence holders (irrigation districts) sharing water with more junior licence holders such as towns, villages and private irrigators.

The Bow and Oldman Rivers each have approximately the same discharge, while the Red Deer River discharge is about 50% less.



¹ This is the river flow for the benefit of the aquatic environment that dam operators strive to meet by water releases as much as possible. Can also be a condition on licences restricting withdrawals to when the river flow is greater than the in-stream objective. Some are for variable flows, others are for steady-state flows. This term is being replaced by the term "water conservation objective."

A significant part of the flow of the Bow and Oldman Rivers is allocated: about 68% and 70% of the median annual flow, respectively. The southern tributaries of the Oldman River (Waterton, Belly and St. Mary Rivers) are highly allocated (75% to 118% of the median annual flow). Applications for new allocations are not being accepted in the basins of the southern tributaries. About 18% of the median annual flow of the Red Deer River is presently allocated.

Research is underway into possible changes to water supply and demand in the SSRB that may result from climate change.

Where has the water been allocated?

Most allocated water is for irrigation (about 75% of the licensed allocations in the SSRB). However, irrigation demand is variable depending on precipitation during the growing season. In wet years, less water is diverted for irrigation, whereas a greater portion of the licensed allocation is diverted for irrigation in dry years. Other major water users are municipalities, although they return about 80% of their withdrawals to the rivers. Under existing practices, the irrigation districts typically return 20 to 30% of their withdrawals. However, this return rate is expected to decrease in the future.

Consumption of water is a significant contributor to the provincial economy. Benefits include crop and livestock production, food processing industries, petrochemical industries, municipal uses and recreation on reservoirs.

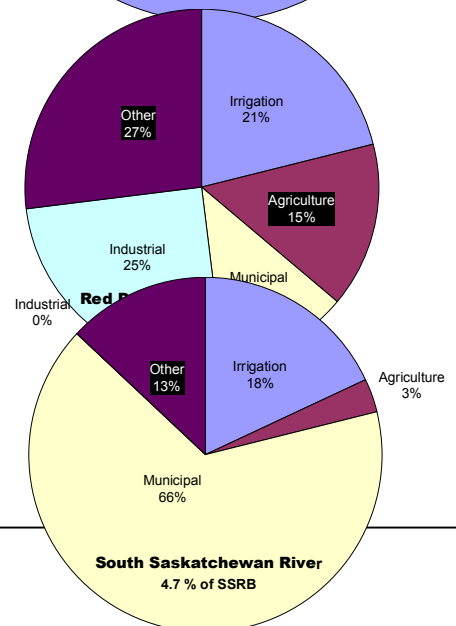
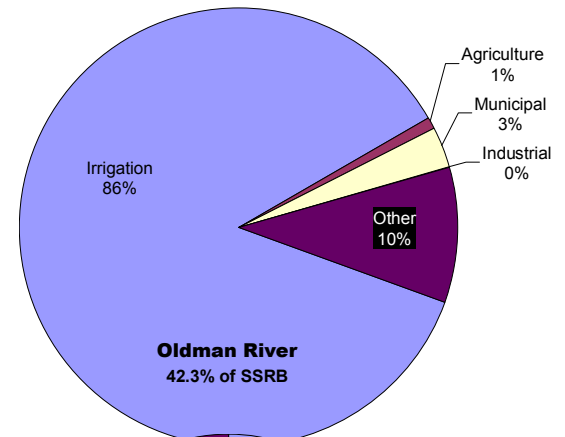
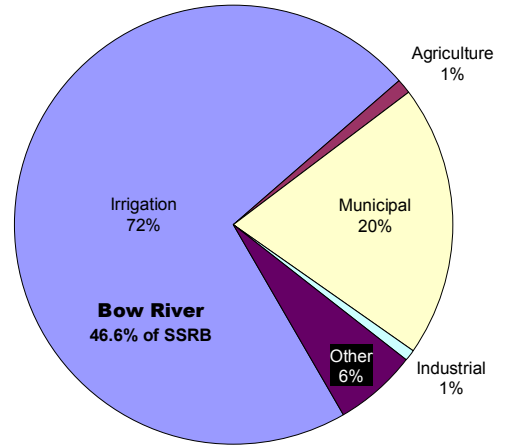
The 4% of cultivated land in Alberta that is irrigated produces almost 20% of the agri-food gross domestic product for the province. Studies predict significant increases in water demand in the SSRB, particularly from industries and municipalities, as the region continues to grow and develop.

In Alberta, as with many other jurisdictions around the world, water is allocated from rivers under a priority system. Water users who were granted licences first have priority of use over licences granted at a later time. Licences granted in recent years have a condition on them restricting withdrawals when river flows are less than a stipulated amount (the "in-stream objective") in order to leave water in the river for the aquatic environment.

How much water do we pass to Saskatchewan?

Alberta is a party to the Master Agreement on Apportionment between the prairie provinces and the federal government. In general terms, this agreement requires Alberta to pass 50% of the natural annual discharge from the SSRB to Saskatchewan. Also, Alberta must never let the rate of flow of the South Saskatchewan River (just below the confluence with the Red Deer River) fall below 42.8 cubic meters per second (1,500 cubic feet per second), except when the natural rate of flow would be less. Alberta has never failed to meet apportionment and typically has passed about 75% of the annual discharge of the SSRB to Saskatchewan. The Red Deer River has not been required to contribute more than 50% of its natural flow to apportionment, with the exception of two years in which the contribution was slightly over 50%. Flows

Allocation by Sub-Basin



remaining in the river for the aquatic environment have the incidental benefit of serving as apportionment flows.

At the present time, flows from the Bow and Oldman Rivers meet the requirements of apportionment, with the assistance of stored water released from the Oldman River Dam Reservoir. However, as the utilization of the existing licences in these basins increases, there will be an increasing requirement for contributions from the Red Deer River.

Will there be future demand for irrigation?

In 1991, in view of limitations on available water, a regulation was approved that placed a “cap” on irrigation development (irrigation districts, private irrigation outside the districts, and a number of “named projects”). In the Bow and Oldman River basins, between current irrigation development and applications in process, the “cap” has almost been reached. The only significant undeveloped named project in these two basins is irrigation expansion in the Siksika First Nation. Under the Irrigation Districts Act, irrigation districts may expand their irrigated areas with the water available from their licensed allocations. Studies have shown that with present licences (and with increased efficiency), the irrigated areas in irrigation districts have the potential to expand by up to about 10% and 20% in the Oldman and Bow River basins, respectively. There is potential supply for additional irrigation in the Red Deer River basin.

What is the role of dams, canals and reservoirs?

Dams, canals and reservoirs play a major role in water management in the SSRB. The Dickson Dam on the Red Deer River, owned by Alberta Environment, is operated as a multi-purpose facility but its principal purpose is to provide a reliable source of water for downstream communities in the winter. The Oldman River Dam, owned by Alberta Environment, is also a multi-purpose facility. It releases stored water to help licensed water users avoid shortages, to help meet apportionment, and to maintain flows for the aquatic environment.

TransAlta Utilities owns and operates several dams in the upper part of the Bow River. These reservoirs are filled during the summer and water is released during the winter for power generation. These winter flows prevent ice damming and help to dilute the wastewater from Calgary. However, reservoir filling in late summer can contribute to low water flow at that time.

The Bassano Dam on the Bow River is owned and operated by the Eastern Irrigation District to divert water into the district. Other major diversions are the Western Irrigation District weir located in Calgary, the Carseland weir which diverts water for the Bow River Irrigation District and the Lethbridge Northern Irrigation District weir located on the Oldman River near Bocket. The series of dams, weirs and canals comprising the St. Mary River Project collects water from the Waterton, Belly and St. Mary Rivers for the irrigation districts south of the Oldman River, the largest of which is the St. Mary River Irrigation District. Several of the irrigation districts have significant off-stream storage.

What impact have we had on the aquatic environment?

The aquatic environment includes both the life in the river water and the river valley (riparian) vegetation. The river valley vegetation provides important wildlife habitat even although it occupies a relatively small land area in the grasslands. Healthy riparian areas provide a number of benefits: They help limit erosion, recharge groundwater, improve water quality and contribute to biodiversity.

The diversion of water from the rivers has had effects on the aquatic environment to varying degrees. A study has been carried out to determine the necessary river flows to maintain a healthy aquatic environment over the long-

term. These flows are referred to as “in-stream flow needs” (IFN). They include flows required to maintain riparian vegetation, fish habitat, channel maintenance processes and water quality. This study suggested we need to focus on maintaining:

- Variable flows to maintain habitat for fish and permit cottonwoods to reseed and replenish.
- Sufficient flow to support water quality needs (temperature and dissolved oxygen) for fish and to assimilate wastewater from cities and industries to acceptable standards. At times this requires more than the natural rate of flow.

With the existing level of water allocation there are insufficient flows in the Bow and Oldman Rivers to meet the IFN. Even if water consumption was reduced by 20%, river flows would still be substantially below IFN. Nonetheless, there may be opportunities in the SSRB to mitigate impacts on the aquatic environment, whether they be the result of water quantity, quality or land use issues.

In all rivers of the SSRB, there are presently “in-stream objectives” that determine the amount of water to remain in the river for the aquatic environment and, coincidentally, for apportionment. These were established using the knowledge available and reflect the priorities for water management at the time. None assure complete protection of the aquatic environment, and some provide minimal protection. At the present time, in most rivers of the SSRB the water supply provides flows above the in-stream objectives for at least part of the year. However, in dry years river flows may be reduced to or below the in-stream objectives. As more water is allocated or existing allocations are used more completely, the rivers will run closer to the in-stream objectives.

A study based on the expert opinions of biologists² and others familiar with the aquatic environments of the SSRB was carried out. This study indicated the aquatic environment has been affected to varying degrees by altered flow regimes, land-uses and pollution. Most river reaches in the SSRB were considered to be “moderately impacted” but some were rated as “heavily impacted” or “degraded.” This expert opinion study is being followed up by a more objective scientific study. Recent monitoring on the Bow River reinforced the concerns raised by these experts regarding dissolved oxygen in the stream.

Although it has been possible to determine the flow requirements for a healthy aquatic ecosystem, at present science is not able to predict either the benefits to the aquatic environment that would result from an increment of flow restoration, or the adverse impacts of an increment of withdrawal.

If Alberta typically passes 75% of the natural flow (total annual volume) of the SSRB to Saskatchewan each year, why is the aquatic environment under stress in the Bow and Oldman River basins? This is because the pattern of flows (frequency, magnitude and duration) is more important to ecosystem health than total annual volumes. The pattern of flows in the Bow and Oldman Rivers has been altered in two particularly significant ways:

- 1) the high spring flows make up much of the flows required for apportionment, but flows lower than natural for long periods in the summer due to water withdrawals place stress on the aquatic environment.
- 2) Due to hydropower generation on the Bow River, considerable water is passed to Saskatchewan during the winter, when the flows have limited benefit for the aquatic environment (although they have the incidental benefit of diluting the wastewater from Calgary).

Conclusions

With the aid of computer simulations, a number of key conclusions have been reached concerning the status of water management in the SSRB. These are summarized below.

² SORAC – Strategic Overview of Riparian and Aquatic Conditions of the SSRB. Golder and Associates, Calgary, 2003.

In the following, for purposes of the simulations, deficits are defined as:

- For irrigation – water demand is not met by a depth of 100 mm in a year. (Crop water requirements can typically range from 400 mm to 700 mm for a year.)
- For other allocations – the allocation receives less than 90% of the allocation.

With the existing allocations:

- In the Red Deer River and Oldman River/South Saskatchewan River mainstems, there are a few consumptive use deficits, and existing in-stream objectives are always met.
- In the Bow River sub-basin, junior allocations have frequent, substantial deficits. Existing in-stream objectives are frequently not met above Bassano. They are always met below Bassano, but in-stream flows are frequently at the in-stream objective value of 11.33 m³/s (400 ft³/sec).
- In the Oldman River's Southern Tributaries, junior allocations have frequent, substantial deficits. These rivers flow at the minimum flows stipulated by the South Saskatchewan Basin Water Allocation Regulation most of the time.

With certain future increases in allocations:

- In the Red Deer River sub-basin, junior allocations have infrequent, small deficits. The Special Areas Water Supply Project has some deficits that need further evaluation.
- In the Bow River sub-basin, the Western Irrigation District has applied for further allocation to reduce the potential for deficits in supply. Current in-stream objectives would limit the volume that the Western Irrigation District could divert.
- In the Oldman River/South Saskatchewan River mainstem (where most of the non-district expansion occurs), deficits to junior allocations increase since the consumptive demand relying on the Oldman Reservoir storage is increased.
- In the Oldman River's Southern Tributaries (where the expansion is limited to non-district irrigation applications received), junior allocations have frequent, substantial deficits.

With full possible water use by irrigation districts and 50-year projected non-irrigation increases in water demands:

- There will be substantial negative impact on junior licences.
- The 50-year projected non-irrigation water use will have very frequent, large deficits.
- The state of the aquatic environment will be further impacted.

Other conclusions:

- Applying IFN as a condition on existing and future junior licences would render them substantially unusable.
- A fixed 50% of natural flow from the Red Deer River sub-basin to apportionment would enable substantial development in the Red Deer River basin. However, this would result in frequent large deficits to junior allocations in the Oldman River/South Saskatchewan River mainstems because water availability from the Red Deer River to help meet apportionment would be reduced.
- In the Red Deer River sub-basin, there is potential to increase the in-stream objectives above existing levels and provide for additional allocation. However, the ability to increase in-stream objectives or to issue additional allocations in the Bow River and Oldman River sub-basins is limited, unless the risk of deficits to existing licences is increased, or the amount of water allocated is reduced.

Glossary

Consumptive use:

- Refers to water withdrawn from the river and used and not returned to the river.

Junior licence:

- In the Red Deer River basin, a licence issued after the Dickson Dam was licensed in 1977.
- In the Bow River basin, a licence issued since 1992, when the fish rule curve in-stream objective started to be applied as a licence condition.
- In the Oldman River basin, a licence issued after the Oldman Dam was licensed in 1988.
- In the Southern Tributaries of the Oldman River, a licence issued after 1950, when the Waterton-St. Mary Headworks were licensed.

Median annual flow:

- For a given number of years, this is the amount of water that flowed down a river in the year for which half the number of years each had more annual flow and half had less.