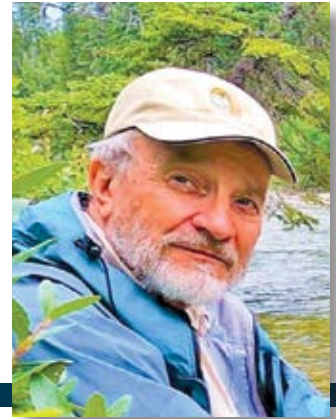


Are Prairie Rivers at Risk?

Irrigation and the Future of Southern Alberta's Rivers



By Lorne Fitch, *P. Biol.*

The pathway to degraded rivers

The heat dome and severe low flows of 2021 had me reflecting on the recent scheme by southern Alberta's irrigation sector to massively expand irrigated acreage. In response, I thought of the old hymn, "Shall we gather at the river". Some of you with church experiences might remember the refrain: "Yes, we'll gather at the river/The beautiful, the beautiful river..."

The details of this irrigation expansion, spun as a "modernization" project, are vague. Ten of the 13 Irrigation Districts with funding support from the Province of Alberta and the Canada Infrastructure Bank propose to "modernize" 86 components of irrigation infrastructure and construct (or expand) four off-stream reservoirs. Through increases in irrigation efficiency and water storage, the goal is to save sufficient water to increase the acreage under irrigation by 230,000 acres (+15 percent). This will be the single largest irrigation expansion in Alberta's history.

Irrigation Districts now hold licenses to withdraw roughly half of the average natural annual flow from the Bow and Oldman rivers and their major tributaries. This doesn't leave much room for providing water for uses outside of Irrigation Districts since half of the average natural flow in the South Saskatchewan River basin must be passed on to Saskatchewan according to a 1969 intergovernmental agreement. On average Irrigation Districts withdraw two thirds of their allocation each year. But in dry years essentially all the licenced amount is removed. Summer is the most critical period since demand for other uses of our rivers peaks then.

Evidence from government reports shows that southern Alberta rivers below major irrigation dams and diversions are stressed. Some are significantly degraded and the prognosis is for a continual decline in river health. That is the inescapable reality.

The proposed irrigation expansion, in the context of this reality, begs investigation. What are the implications of these irrigation ambitions?

Historical context—Why increase irrigation acreage?

We need historical context to see how the past influences the future. Irrigation Districts (or their precursors) have been diverting water from southern Alberta's rivers for well over a century. They have erected an extensive network of dams, diversions, reservoirs and irrigation canals. By now they divert, store and deliver water on demand to more than half a million hectares in a semi-arid landscape. Taxpayers largely paid for this marvel of engineering.

The history of water allocations to irrigation illustrates a rigid adherence to tradition and captured regulators. Water diversions started under the Northwest Irrigation Act of 1894. As David Percy noted in 1977, this federal law "was designed with irrigation in mind." When it came to allocating water, this Act established a system of seniority for water users that still exists in Alberta's Water Act. Known as "first in time, first in right" (FITFIR) it means that those with the oldest allocation licences are first in line for receiving water. Under FITFIR, water licences to Irrigation Districts are among those with the highest seniority and the largest volume.

The irrigation focus was encouraged by the fact that key officials in the new department of Alberta Environment came from Agriculture.

They saw their water stewardship role through an irrigation-favourable lens. Alberta Agriculture was an accessory, rubber stamping the irrigation sector's expansion demands for decades. Whenever Irrigation Districts exceeded their allocation, instead of being held to account, they were allocated more water. When other interests, especially those concerned about fish, questioned the wisdom of increasing diversions, these concerns were ignored and additional allocations were passed out.

Despite evidence from the 1970s that southern Alberta rivers were already in peril, additional licenses were issued in the early 1990s to accommodate the Irrigation Districts' expansion limits established by the South Saskatchewan Basin Water Allocation Regulation of 1991. Amendments to the Irrigation Districts Act in 2002 allowed each Irrigation District to establish its own new expansion limit, beyond the 1991 allocation regulation, provided the total water demand does not exceed their licenced amount.

It wasn't until 2006 that the Alberta Government finally closed the Bow, Oldman and South Saskatchewan sub-basins to further allocation. Many believe that this action was "too little, too late."

Instream Flow Needs How much water does a river need?

Summer flows (May–August) in the Bow and Oldman rivers below impoundments and large-scale water diversions are now 40 to 60 percent below historical values. This is also when there is peak demand for irrigation withdrawals. Demands for ample flow in rivers are also greatest at this time as fish, cottonwoods, canoeists, swimmers and gardeners need the water too.



Irrigation demands in summer create extremely low river flows, below ecological limits, risking aquatic life, fish and riparian habitats. Photo © L.Fitch

Dr. Stewart Rood, Emeritus Professor at University of Lethbridge observed that, “Water budgeting that we based the allocation on was in the beginning of the 1900s which was naturally a very wet interval.” All evidence suggests the future will not reflect the past, even though the past was used to allocate the water of tomorrow.

One way of managing the issues associated with intensifying irrigation withdrawals combined with declining river flows is to establish limits, real ecological limits, not arbitrary ones that can be stepped over when they impede expansion plans. An instream flow need (IFN) is a rigorous, science-based recommendation for the amount of water that should flow at any particular time to meet the objectives of river health.

Allan Locke, retired Provincial IFN Specialist, points out IFN recommendations are based on the natural variability in flow, since native biodiversity and ecological functions of rivers in southern Alberta have evolved under seasonal flow patterns. As an example, spring floods are essential to reset the ecological clock, providing new sediment bars for the seeds of cottonwood trees to establish themselves. Substrates of gravel are cleansed of sediment and new pools are created which are mandatory for aquatic life. Robust summer flows are required to

buffer against higher water temperatures and maintain dissolved oxygen levels.

Unfortunately for southern Alberta rivers, when considering actual river flows under current allocations and commitments, there isn't enough water left to meet ecologically-derived IFN values. Healthy rivers should have been the goal in the first place, but while many waited for the answer from proper IFN research, water managers in the government of Alberta were busy giving away the water that would have assured a measure of ecological integrity.

Our rivers, especially those in southern Alberta show the strain of over a century of careless development. Fisheries biologists had been pointing this out for decades but water managers seemed oblivious until a massive fish kill occurred on the Highwood River in 1977, caused by high water temperatures and exacerbated by excessive diversions. This incident (and others) should be putting irrigation diversions and inadequate instream flows into the broader public consciousness.

Still, there was very little action to limit irrigation diversions over the next 30 years. As an example of the foot-dragging, a retired fisheries biologist recalls bureaucrats not wanting the term “over-allocation” to be used in reports and presentations. Work on IFN

evaluations was not greeted with much enthusiasm by provincial water managers since it would not only provide a sense of limits, it would expose the fact that limits had already been exceeded.

The government of Alberta finally acknowledged in a 2006 report that the lower reaches of the Bow, Oldman and South Saskatchewan rivers were at least moderately impacted, some heavily impacted and a few degraded by water diversions (*Approved Water Management Plan for the South Saskatchewan River Basin [Alberta]*). All rivers impacted by irrigation withdrawals have aquatic environments believed to be in “a state of long-term declining health.”

This 2006 plan recommended a water conservation objective (WCO) to protect river health of approximately 45 percent of natural flow. This was not based on IFN science but was all that might reasonably be achieved given high levels of water allocation. Recent analysis using historical flow records shows this inadequate target is seldom met 100 percent of the time in any given year for reaches below major irrigation dams and diversions and less than 70 percent of the time in drier than average years.

More disturbing is that 45 years of river flow records from the South Saskatchewan

River at Medicine Hat show the WCO is met only 40 percent to 70 percent of the time in the summer months (May to September). Because of liberal allocations of water to irrigation, actual flows are well below natural flows and the WCOs are rarely achieved.

When you've exceeded ecological limits with reckless water allocations and can't meet an IFN amount, all that's left are some administrative band-aids like water conservation objectives and instream objectives (IO) to give the impression our rivers are being managed to avoid ecosystem failure. These WCOs and IOs will not restore health to degraded rivers. In stark terms southern Alberta rivers are on life support, without enough water to guarantee a healthy, functioning ecosystem.

As a headwaters province Alberta also has responsibilities and legal agreements to allow enough water to pass our eastern border to Saskatchewan. This can provide an administrative ceiling on allocations within Alberta but as these become red-lined and exceeded for the Bow and Oldman watersheds, there is an increased reliance on the Red Deer River to make up the difference.

This exacerbates river health issues on the Bow and Oldman systems.

Governments, both federal and provincial have failed in their stewardship responsibilities to manage the quantity and quality of waters under their jurisdictions for both current and future generations. Fundamental to that responsibility is ensuring sufficient water is retained in rivers, for all seasons, to sustain fish populations, riparian areas and overall riverine health and function.

Climate change – Are we paying attention?

Climate change scenarios suggest declines in natural annual flow will continue due to decreased snow accumulation, increased air temperatures and greater evaporation and evapotranspiration. This will lead to a decline in the glaciers that feed the headwaters of the Bow River. According to Dr. John Pomeroy, Canada Research Chair in Water Resources and Climate Change at the University of Saskatchewan, about 80 percent of flow in the Saskatchewan River basin comes from the Eastern Slopes, mostly from snowpack, making southern Alberta's rivers "very vulnerable to climate change."

Pomeroy reflects it is "important to look at the whole thing before expanding irrigation in one part or managing it differently in another part, and we're going to have to do that always with an eye to the mountains." Lessons from south of the border backstop this and need to be heeded. Over-allocation of water, coupled with drought in the Colorado River basin has led US governments to severely curtail water use by irrigators.

Recent modelling, using historical drought scenarios for water volume in the Oldman River at Lethbridge, suggests water needs would exceed supply. Water deficits for more than two years could not be mitigated by water stored in reservoirs, and provision of environmental instream flows would be further challenged. This demonstrates that building more reservoirs is, at best, a questionable adaptive strategy. Every bit of plumbing promises us we are ever closer to re-engineering our world into something it is not, and never will be—a place of abundant water. We kid ourselves if we think we can outwit nature instead of adapting to its realities.

Climate change, with greater frequency and duration of droughts cannot be mitigated with irrigation reservoir storage. Photo ©L. Fitch

