Information Bulletin

River Flows, Lake Levels, Groundwater Levels and Climate Patterns in the Sturgeon River Watershed

The purpose of this Bulletin is to briefly highlight current water supply and demand conditions in the Sturgeon River basin. The Sturgeon River is fed mainly from spring runoff, precipitation events in the summer and groundwater inputs. Water levels tend to be low during the summer months, and in recent years river flow has ceased in certain reaches.

Similar conditions were evident during the late 1980s and 1990s. In 1995, Alberta Environment undertook an analysis of water supply and demand for the Sturgeon River with the intention of developing water allocation guidelines for the basin. Further work was undertaken in the early 2000s, but unfortunately water management recommendations were not fully developed or implemented. The assessment of instream flow needs for the basin also remains incomplete. The Sturgeon River Watershed Alliance is advocating for a new assessment of water supply and demand in the basin.

Flows are monitored by the Water Survey of Canada at 4 locations along the Sturgeon River. Annual flow volumes are illustrated below for the Sturgeon River at Magnolia (Figure 1), at Villeneuve (Figure 2) and at its confluence with the North Saskatchewan River, near Fort Saskatchewan (Figure 3). The five year running averages reveal a general decline in flow volumes over the past few decades, with evidence of limited recovery since 2011.

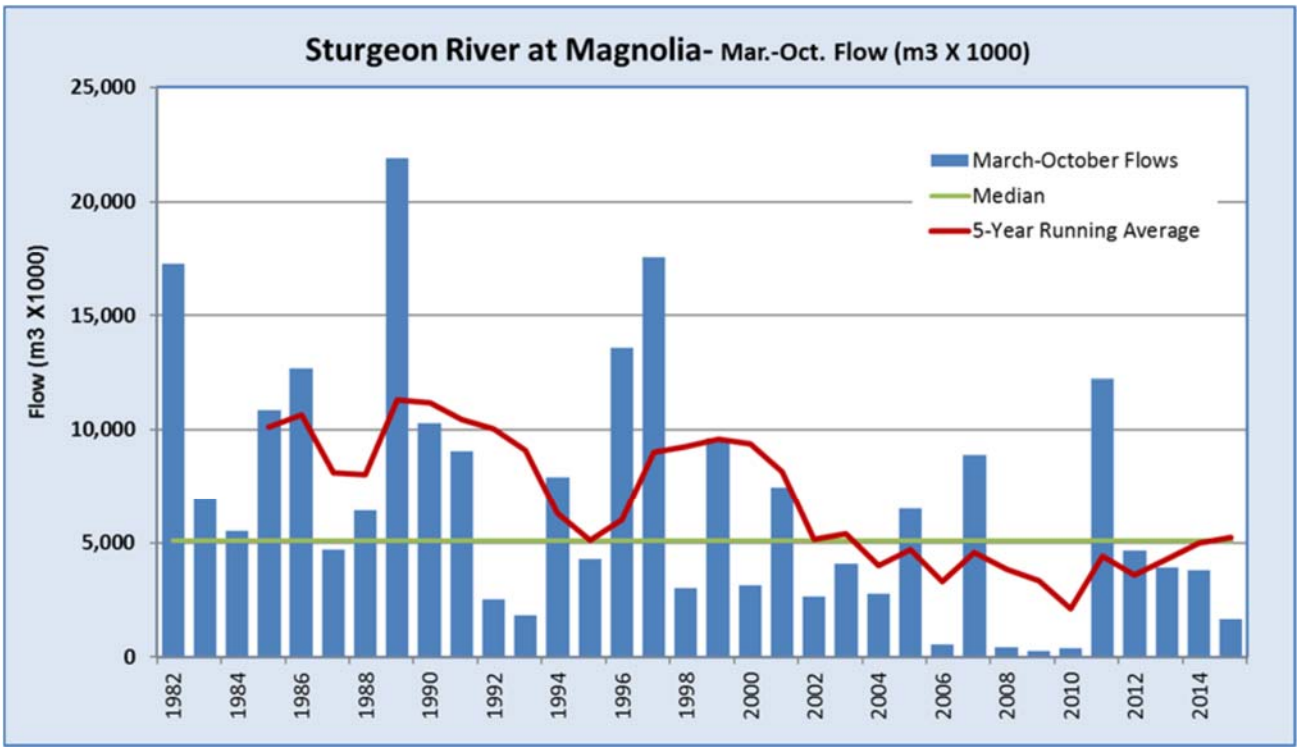

Figure 1. Annual flow volumes at the Sturgeon River at Magnolia. Data from Alberta Environment and Parks.

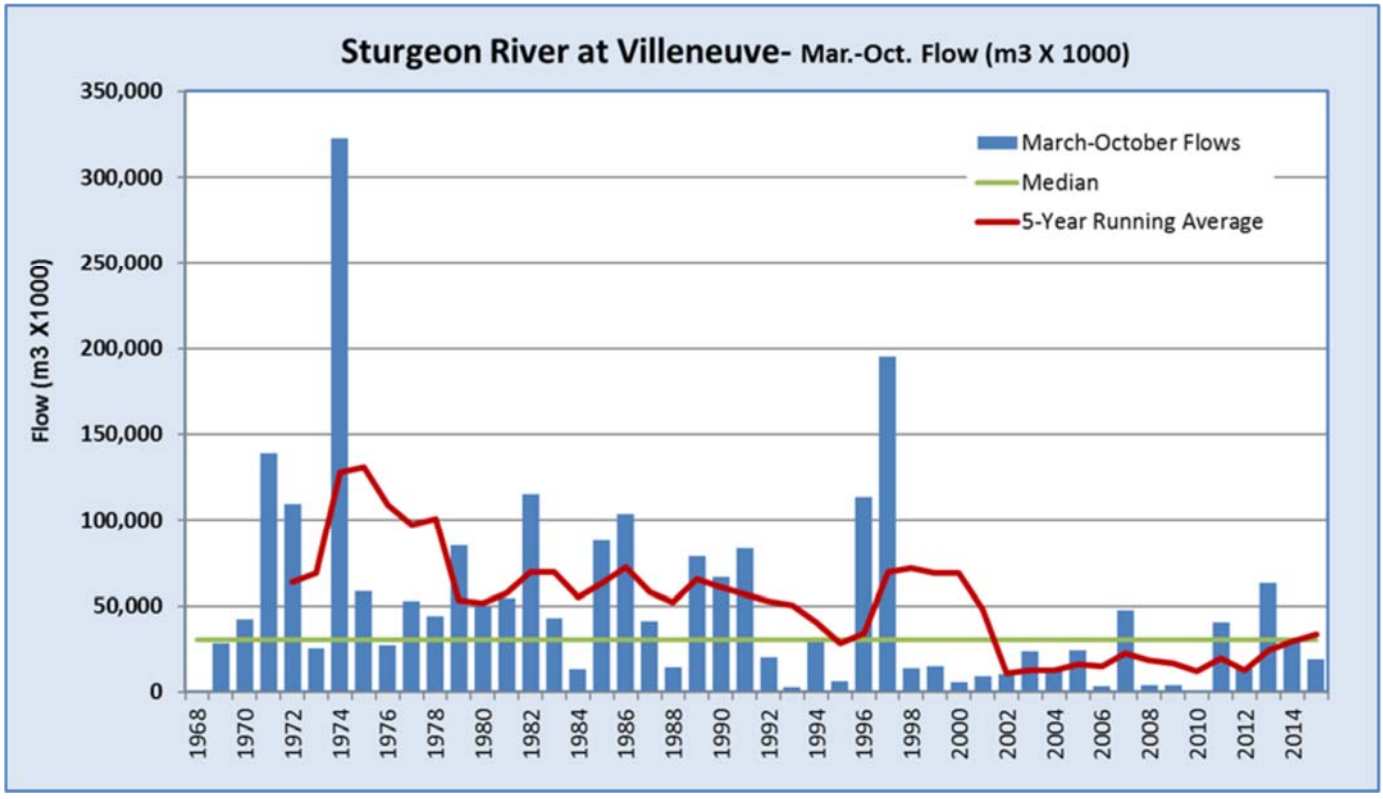

Figure 2. Annual flow volumes at Villeneuve, in the central region of the Sturgeon River watershed. Data from Alberta Environment and Parks.

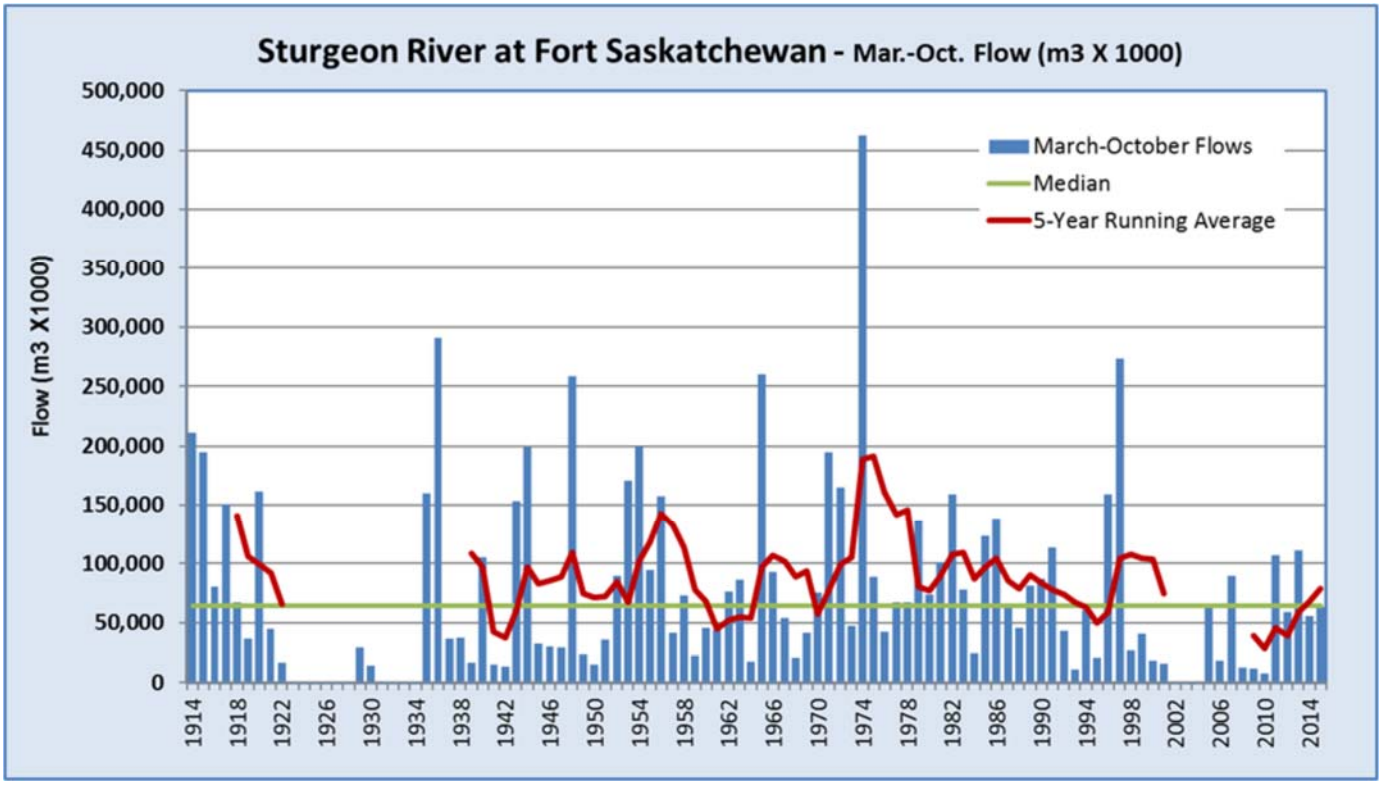

Figure 3. Annual flow volumes at the mouth of the Sturgeon River, near Fort Saskatchewan. Data from Alberta Environment and Parks.

Water levels are also declining in small lakes in the Sturgeon River watershed, and in other lakes in central Alberta. A composite graph of water levels for eight small pothole lakes west of Stony Plain is presented in Figure 4. A decline in lake levels has occurred since the early 1990s, with evidence of limited recovery since 2011. Declining water levels have implications with respect to recreation, water quality, ecological health and fish populations. Winterkill risk in pothole lakes increases as mean depth decreases. Jackfish Lake experienced a significant winterkill in 2016 (Figure 5).

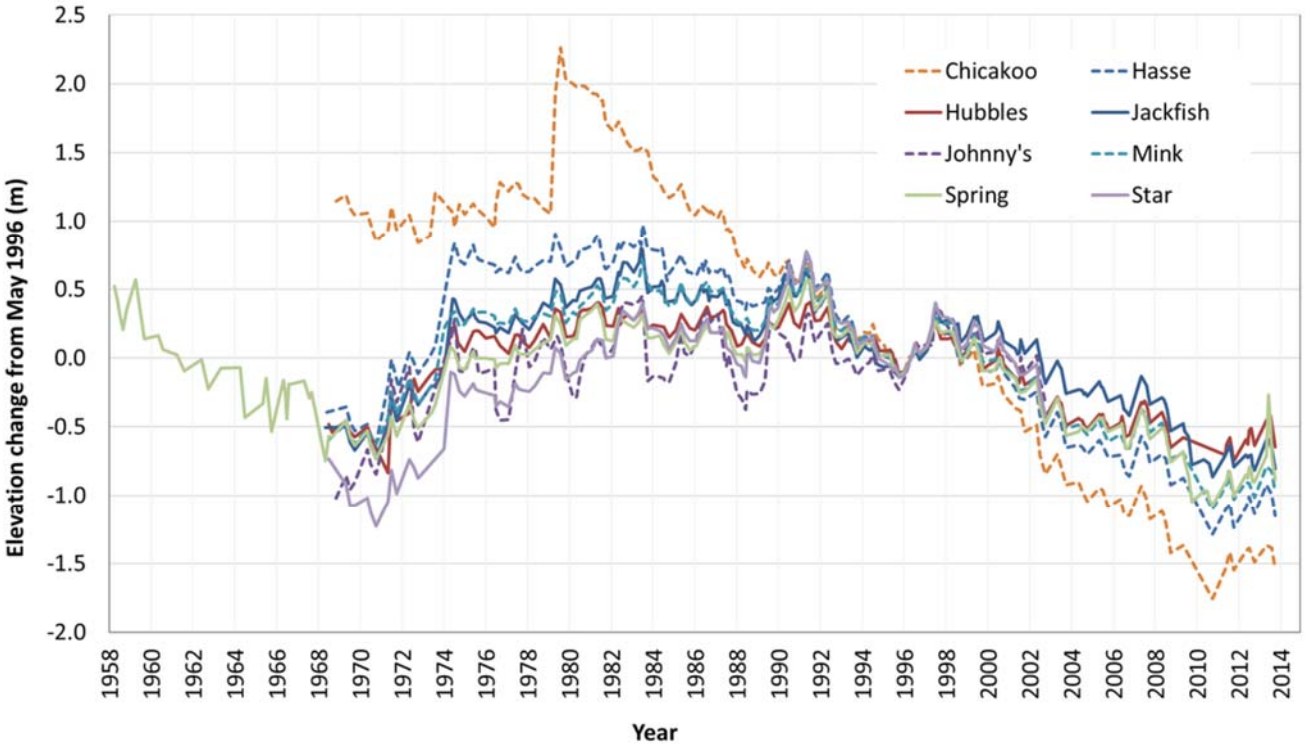

Figure 4. Regional decline of small lakes west of Stony Plain. Levels are graphed relative to May 1996 elevation. (Data from Alberta Environment and Parks).

Figure 5. Evidence of recent winterkill in Jackfish Lake (Uhryn[1], 2016).

[1].M. Uhryn, 2016. Pers.comm.

Groundwater level data for the Beverly Channel at Hubbles Lake (depth 74.7 m) are presented in Figure 6. A steady decline in elevation over the past two decades is evident in this graph. All sites in the Groundwater Observation Well Network (GOWN) in Parkland County have shown similar declines over this period.

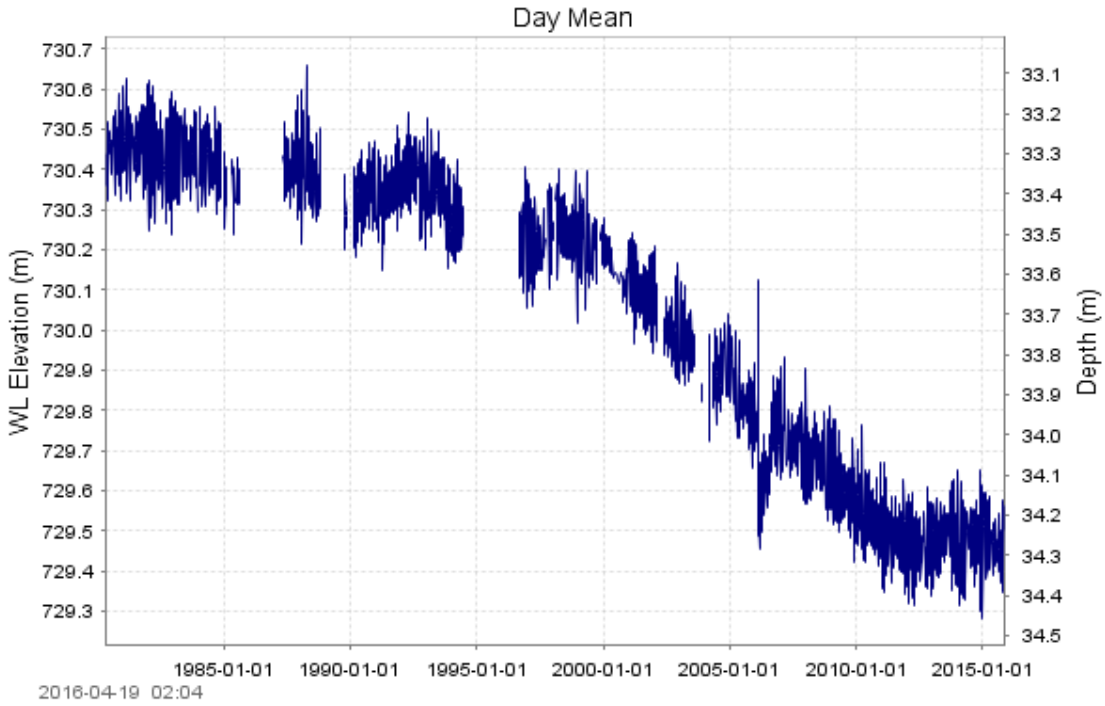

Figure 6. Groundwater levels in the Beverly Channel at Hubbles Lake (Data from Alberta Environment and Parks).

Annual deviations from long-term precipitation and average temperature conditions are presented in Figure 7. The data were collected at the Environment Canada weather station near Stony Plain, and clearly reveal that local weather patterns have been warmer and drier for the past two decades. These weather conditions are well correlated with observed declines in stream flows, lake levels and groundwater levels, and suggest that the Sturgeon River watershed has been undergoing prolonged drought.

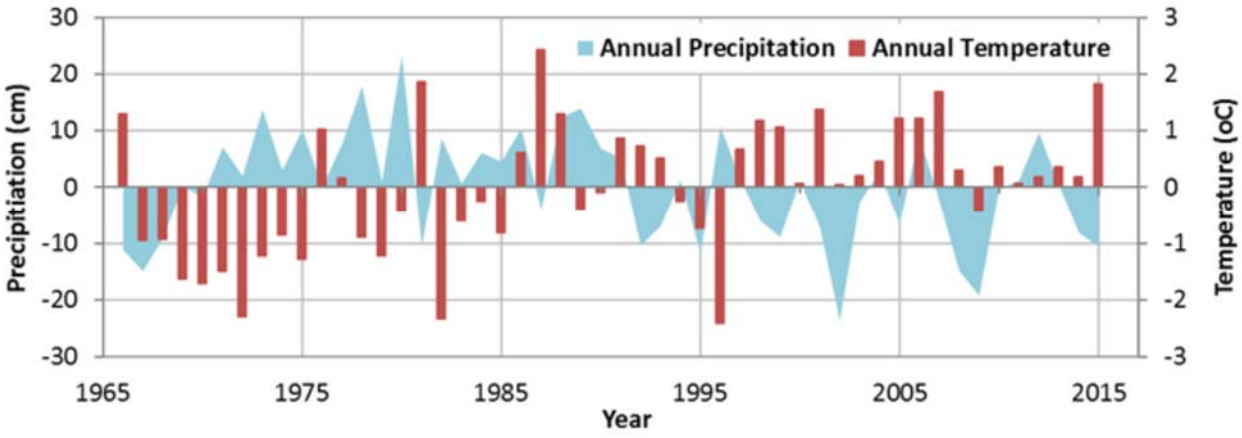

Figure 7. Annual precipitation and temperature deviations relative to the 1966-2015 average at the Stony Plain Weather station (Data from Environment Canada).

The Sturgeon River has many licenced surface water withdrawals (Figure 8), mainly for irrigation, stock watering, municipal and commercial use. The demand for this water is highest in the summer months (Table 8, red box; data from S. Figliuzzi and Associates, 2016[2]), which is typically when the water levels are the lowest in the river. This demand puts further strain on the water supply and ecological health of the river. There are also a number of groundwater licences issued in the basin for gravel extraction, municipal use, drainage and livestock watering. The effects of these uses on regional groundwater levels are unknown.

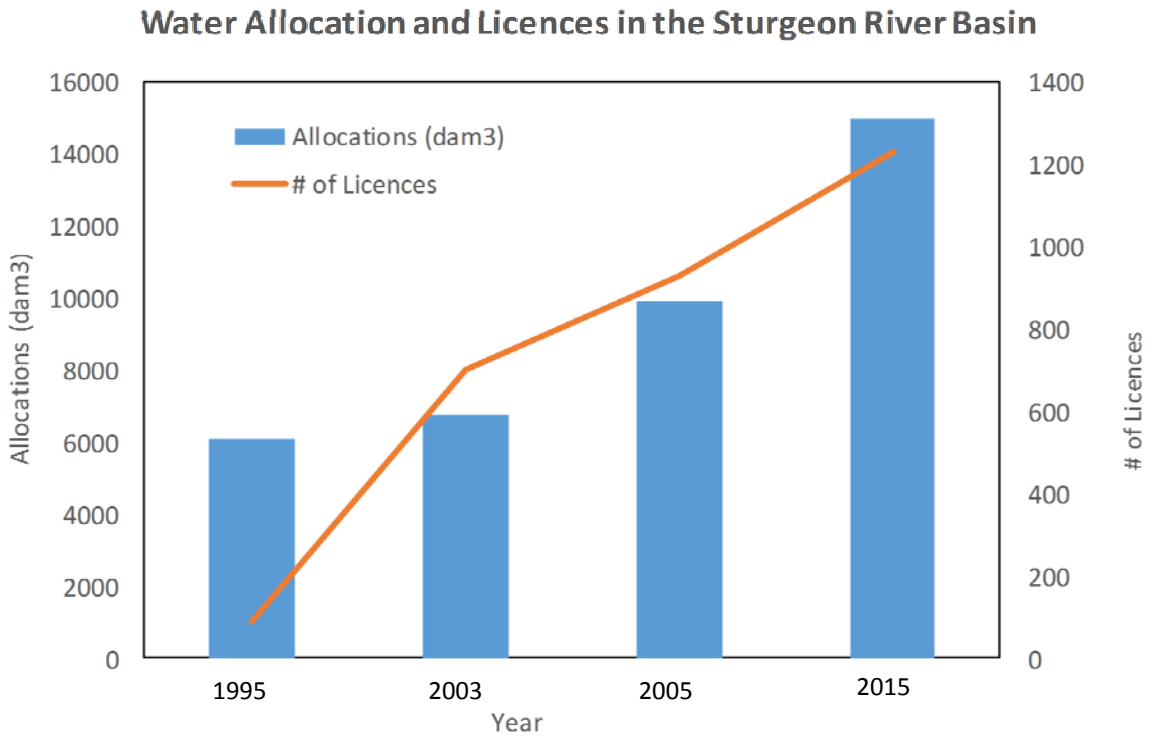

Figure 8. Surface water allocation volumes and licences issued in the Sturgeon River Watershed from 1995 to 2015.

Table 8 - Monthly Surface Water Use Estimates from 2004 "Sturgeon River Basin - Current Consumptive Use Estimates - Final Report"

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Rate (m3/s)	0.0116	0.0127	0.0116	0.6273	0.4293	0.352	0.5667	0.2755	0.0825	0.0409	0.012	0.0116	
Volume (dam3)	31	31	31	1626	1150	912	1518	738	214	110	31	31	6422

An important consideration in the regulation of water use in Alberta is the volume of return flow, or the amount that gets returned "unused" to the river by the licenced user. A new online website has been created by AEP in order for licencees to easily report their annual water withdrawal and return flow. This information has not been reported consistently to the government on an annual basis by all users. At this time it is difficult to determine the net consumption of water in the Sturgeon River watershed.

[2] Figliuzzi, S. 2016. *Assessment of the Existing Water Supply and Demand Data for the Sturgeon River Basin*. Prepared for the North Saskatchewan Watershed Alliance, Edmonton, AB.

This synopsis of water supply and demand information, when considered in light of recent climate trends, points to the need for a review of water resources management approaches in the Sturgeon River watershed. The Sturgeon River Watershed Alliance, working in conjunction with the North Saskatchewan Watershed Alliance, advocates for the development of a Water Management Plan (*Water Act*) or a Water Management Framework (*Alberta Land Stewardship Act*) to provide the necessary future guidance.

The following technical analyses should be undertaken to support the planning work:

- Develop an updated, weekly water balance for Lake Isle and Lac Ste Anne, located in the upper Sturgeon River watershed
- Reconstruct historic flows throughout the basin, at key locations
- Refine estimates of historic and current water demand for all important sectors in the basin
- Develop a water resources management model for the basin
- Reconstruct historic and current natural flows in the Sturgeon River
- Calculate ecological instream flow needs and set water conservation objectives
- Complete a water management plan for the basin

The Sturgeon River watershed presents a complex array of water management issues. Aside from regulatory information needs, the influences of several broad scale environmental factors must be addressed and better understood in this watershed: the interactions between surface water and groundwater; the relative influences of climate cycling versus climate change; the influence of broad scale landscape changes in the basin; urbanization and stormwater management; and the impacts of overall population growth on water use, recreation and quality.

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