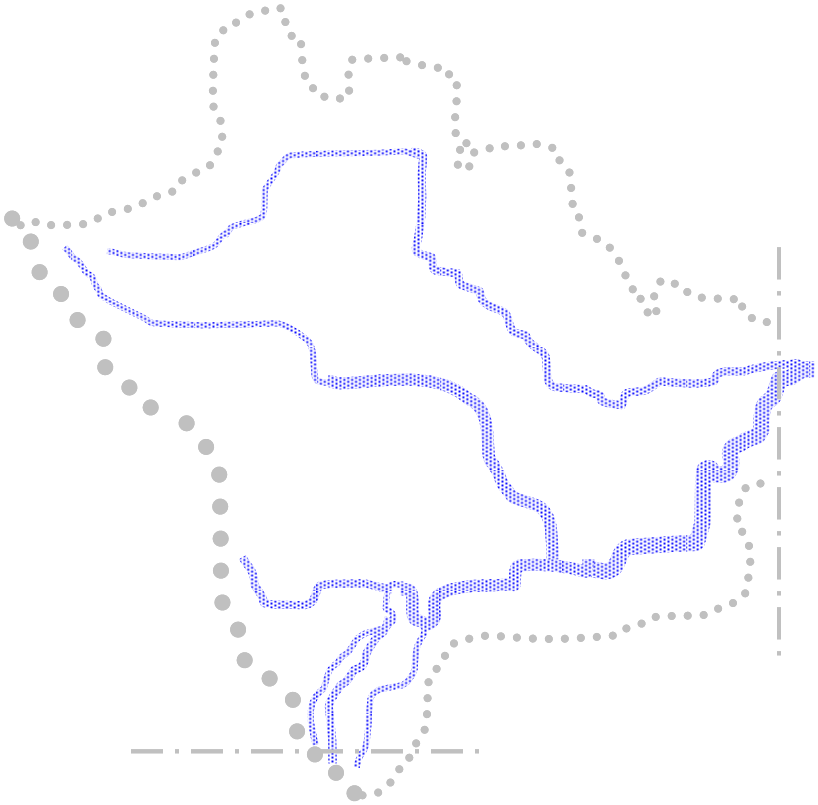
Apportionment Operations Plan

for the

South Saskatchewan River Basin

(Alberta)



South Saskatchewan River Basin
Intrabasin Water Coordinating Committee (Alberta)

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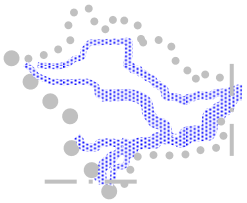


Introduction

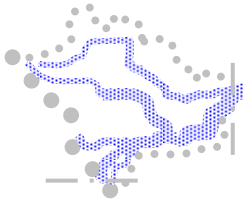
The purpose of this Apportionment Operations Plan (the plan) is to describe the means by which the Intrabasin Water Coordinating Committee (IWCC) will gather and consider information and provide advice to Alberta Environment on how the South Saskatchewan River Basin (SSRB) in Alberta can meet the terms of the *Master Agreement on Apportionment* (MAA). This advice will usually be for situations arising in any given year.

The Terms of Reference for the IWCC can be found in Appendix 'A' of this document. The committee comprises representatives from each of the four watershed planning and advisory councils in the SSRB:

- Red Deer River Watershed Alliance
- Bow River Basin Council
- Oldman Watershed Council
- South East Alberta Watershed Alliance.

Alberta Environment provides secretariat and technical services to the committee.

This plan is expected to evolve over time and will be amended as deemed necessary by the committee.



Mandate

The mandate for managing the apportionment requirements of the SSRB and of the Intrabasin Water Coordinating Committee is stated in the Approved SSRB Water Management Plan:

> *To promote coordination between the sub-basins on matters of common interest, an Int*[ra]*basin Water Coordinating Committee will be established. It will have representation from the Watershed Planning and Advisory Councils in the SSRB and from the South Saskatchewan River Sub-basin. Alberta Environment will also have membership.*
>
> *This committee will provide advice to Alberta Environment on managing water during periods of water shortage in any or all of the sub-basins. This committee is to meet at least annually or on as frequent a basis as necessary to review and address matters regarding water shortage situations and how to best meet the requirements of the Master Agreement on Apportionment. The Director will make any applicable decisions.* (p. 10, Alberta Environment 2006)

- *All of the sub-basins of the SSRB continue to be managed as a single entity in order to meet the requirements of the Master Agreement on Apportionment.*
- *An apportionment operations plan be developed to identify criteria for decisions on how Alberta will meet its flow obligations to Saskatchewan. A key principle is to achieve fair and equitable sharing of water between the sub-basins, such that during times of shortage the licence holders of one sub-basin do not carry an excessive burden for the benefit of licence holders in other sub-basins.*
- *It is recognized that in strict legal terms, a senior licence could call priority in one sub-basin, but because of insufficient junior licences, insufficient water storage, and apportionment issues in that sub-basin, this could result in a more junior licence in another sub-basin being negatively affected. However, the likelihood of this occurring is very remote, as other options, such as calling on stored water in the Oldman River Dam reservoir, will usually be available. With some foresight, the committee should easily be able to avoid a strict priority situation.*
- *The principle of sharing water during shortages should take precedence, so licences in the water-short basin(s) are affected first. The proportion of contribution should consider the following in each sub-basin:*
    - *Amount of storage capacity and amount of water in storage*
    - *Location of storage*
    - *Snow pack*
    - *Volume of licences affected*
    - *Sub-basin natural flows.*
- *The Alberta Government will consider the advice of the SSRB Int*[ra]*basin Water Coordinating Committee to meet apportionment obligations under the Master Agreement on Apportionment.*
- *The public should be provided with information on a regular basis as to the committee's recommendations. AENV should submit an annual report to the public on its activities with respect to meeting apportionment.*

<u>Rationale</u>
Under the 1990 SSRB Water Management Policy, the basin has operated as a single unit to meet requirements of the Master Agreement on Apportionment. This permits flexibility in drawing on the sub-basins in response to annual variations in water supply and demand, while striving to achieve balance and equity in the contribution of the sub-basins.

It is recognized that options are limited in the Bow River sub-basin due to the absence of government-owned storage and in the Red Deer River sub-basin due to limited flexibility of available storage. (pp. 10-11, Alberta Environment 2006)

Background

General Overview of the Hydrology of the SSRB and Water Management

The rivers of the SSRB have their headwaters in the Rocky Mountains along the western margin of the basin. Snowmelt from the mountains is the source of the majority the annual discharge. Approximately 60% of this occurs in a two and one half month period from early May to mid-July. There is a great deal of variation in seasonal and annual river flows (Figures 1 and 3).

The Red Deer River typically discharges about half the annual volume of either the Bow or Oldman Rivers (Figure 2). The flow of the South Saskatchewan River comprises what it receives from the Bow and Oldman Rivers. There is very little surface water contribution to flow from its watershed.

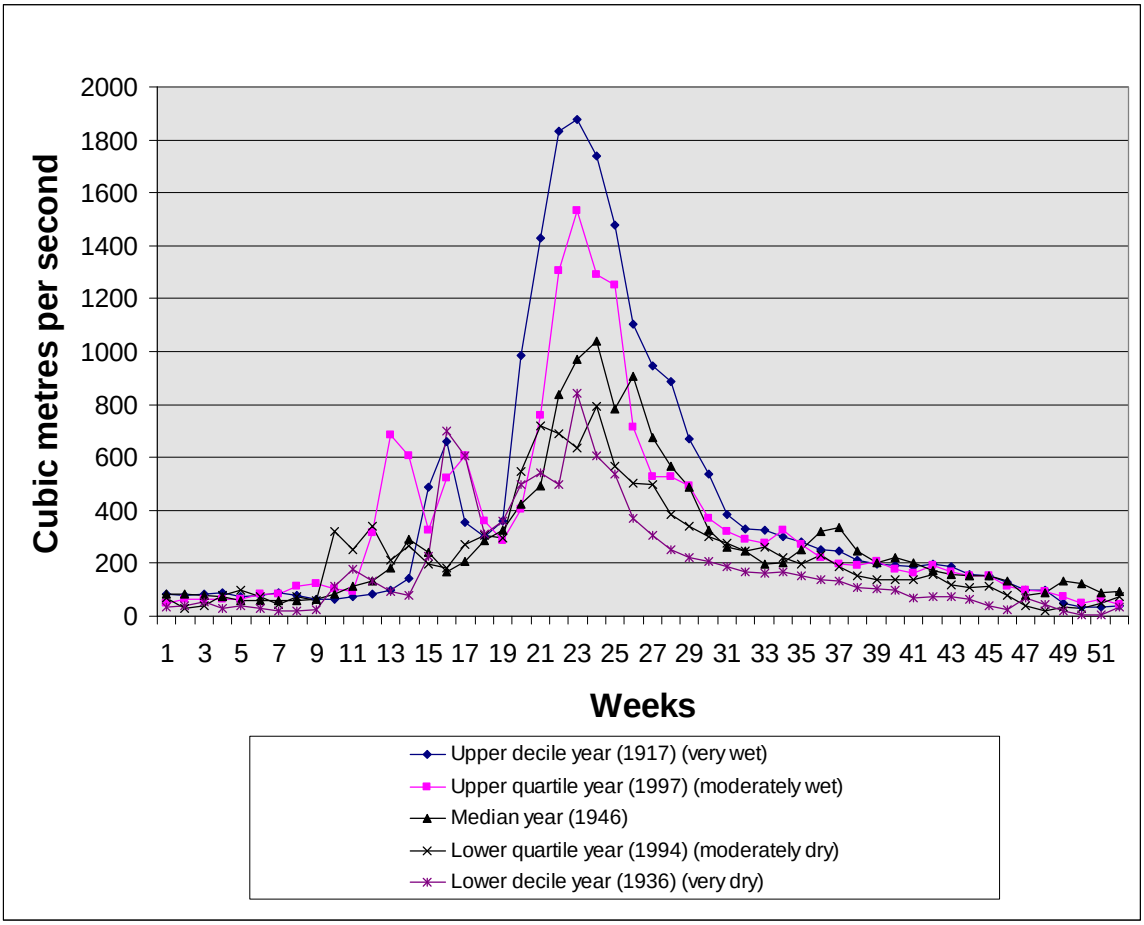


Figure 1. SSRB Representative Hydrographs (natural rate of flow at Saskatchewan border)

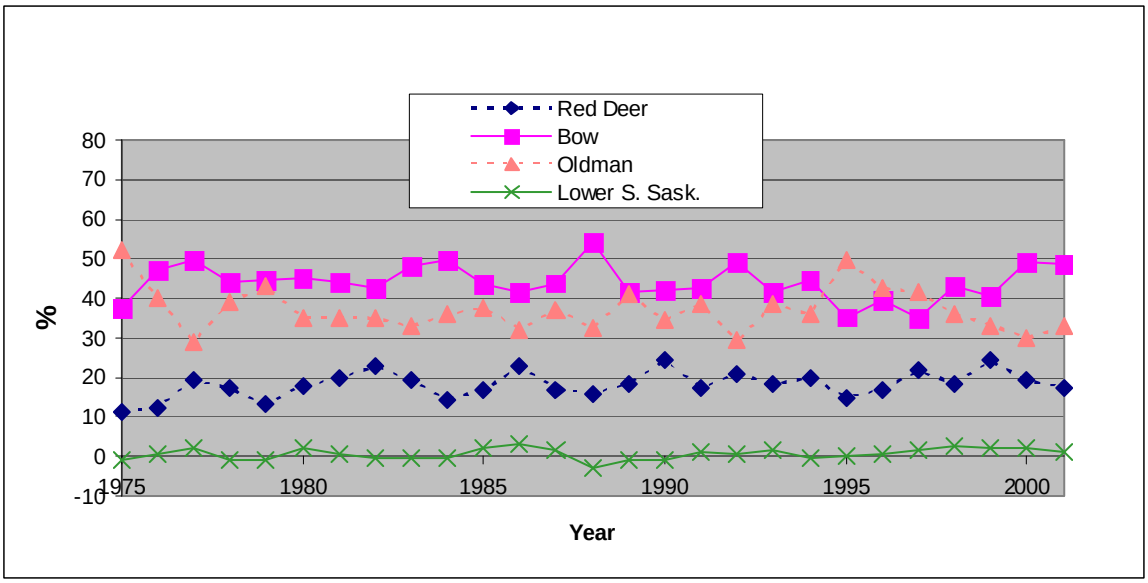


Figure 2. Annual sub-basin contribution (in %) to the South Saskatchewan River natural flow (Source: Alberta Environment 2003)

Water has been steadily allocated from the SSRB, using a priority system based on the date of application, since the late 1800s. The total allocation is now at the point where it can be greater than Alberta's share of the flow under the Master Agreement on Apportionment in drier years (Figure 3). Some of this allocation was made in anticipation of population growth and irrigation development and is not yet being fully utilized.

Licences for allocations have the following key elements: name of holder, priority, volume, diversion rate, purpose, and location of diversion. There is also a requirement to maintain records of the amount of water used. Operating licences for dams have similar elements, including priority, which means reservoirs cannot be filled unless the water needs of higher priority licences are being satisfied, and volume, which includes the amount of water lost to evaporation and seepage.

Approximately 74 percent of the volume of water allocated in the SSRB is allocated for irrigation in the sub-basins of the Bow and Oldman Rivers. The degree of allocation to irrigation is significant to apportionment because irrigation consumes most of the water diverted. Approximately 80-85% of the water diverted by large urban municipalities returns on a continuous basis to the source river after it has been used and treated. Water diverted to regional systems and water co-operatives usually has as its final destination sewage lagoons or septic fields. Much of this water is lost to evaporation or discharged only once per year and usually not back to the source river.

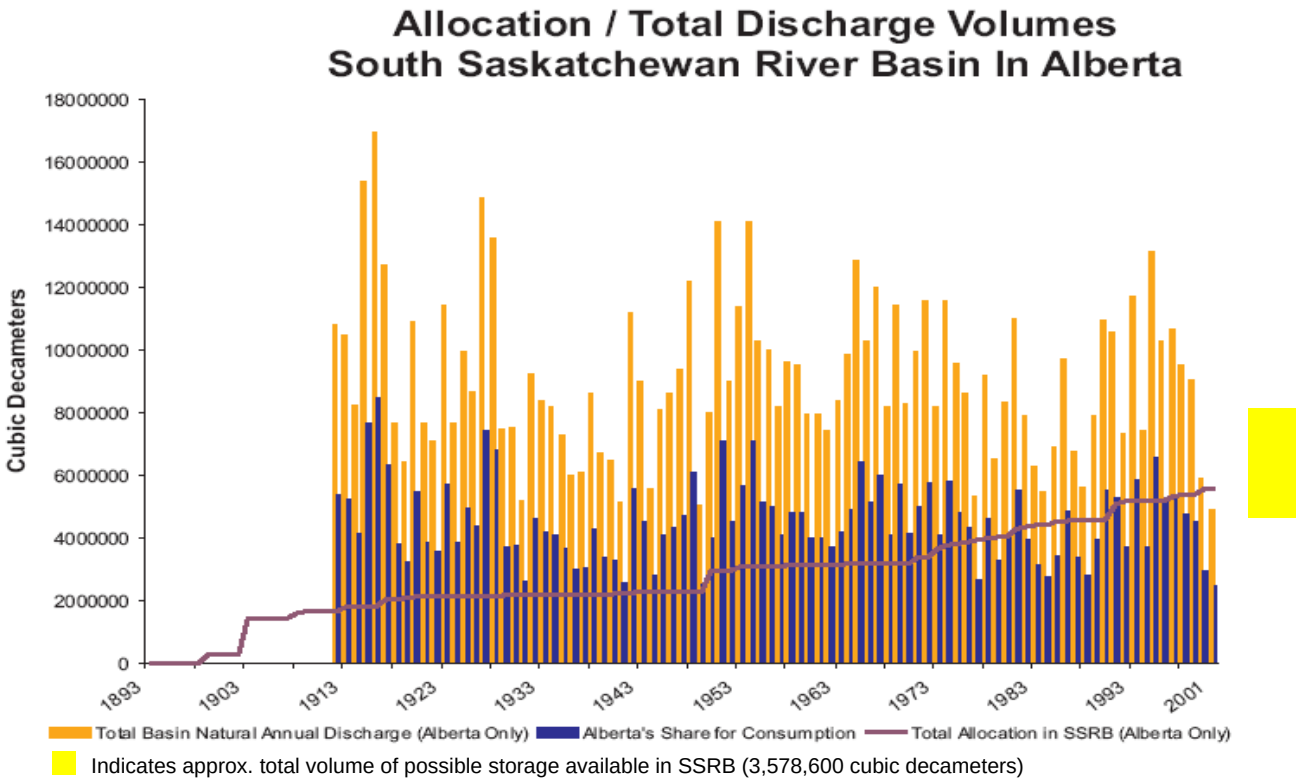


Figure 3. Annual Naturalized Flow Volumes and Allocation Trend, South Saskatchewan River Basin in Alberta

Master Agreement on Apportionment (MAA)

The MAA is between Alberta, Saskatchewan, Manitoba and Canada and is administered by the Prairie Provinces Water Board (PPWB).

The major points of the agreement for the SSRB in Alberta are:

1. The apportionment point for the South Saskatchewan River and Red Deer River is located in Saskatchewan immediately below the confluence of the two rivers. In general, on an annual basis, Alberta is required to pass to Saskatchewan 50% of the combined “apportionable” flow of the Red Deer River and South Saskatchewan River. At its discretion, Alberta can deliver Saskatchewan’s entitlements entirely from the Red Deer River, entirely from the South Saskatchewan River or any combination thereof. The annual apportionable flow is computed as the annual natural flow of the South Saskatchewan River below its confluence with the Red Deer River less any U.S. diversions from the St. Mary River under the 1909 International Boundary Waters Treaty. In a dry year the U.S. share can be up to approximately four per cent of the natural discharge of the SSRB, and in a wet year this can be less than one per cent.

2. Because natural flows no longer occur, due to water storage and diversions, the natural and apportionable discharge must be calculated. The apportionable flow and each province's entitlement are calculated by the PPWB on a quarterly basis during average and above average years, on a monthly basis during dry years and more frequently upon the request of any party to the Agreement. The natural and apportionable flow is calculated using a PPWB methodology.

3. In recognition of the degree of allocation that existed in Alberta when the agreement was made, Alberta is entitled to consume no less than 2,591,500 cubic decameters (2,100,000 acre feet) even though this depletion may be more than 50% of the apportionable flow; provided it maintains a minimum flow of 1,500 cfs at the confluence of the Red Deer and South Saskatchewan Rivers at all times throughout the year.

4. On an instantaneous basis, Alberta must maintain a rate of flow just downstream of the confluence of the Red Deer and South Saskatchewan Rivers of 42.5 cubic meters per second (1,500 cubic feet per second) or 50 percent of the natural rate of flow, whichever is less.

5. There are also requirements for water quality.

Alberta manages the SSRB as a single entity for purposes of meeting apportionment. That is, there is no set contribution required from each sub-basin. The sub-basins may contribute differently from year to year depending on water supply and demand conditions in each.

On average, Alberta has passed on to Saskatchewan approximately 75 percent of the annual natural discharge. In wet years more has been passed and in dry years less. In 2001, the driest year on record, the amount passed was reported to be 57 percent. Alberta has never failed to meet the terms of the agreement in terms of water quantity. On only one occasion has active management been required to ensure the agreement was met. This was in 2001, when water was released from the Dickson Dam for a few days in October to maintain the required rate of flow.

As a general practice Alberta Environment (AENV) attempts to maintain a rate of flow of 42.5 cubic meters per second at Medicine Hat. This by itself has usually been sufficient to meet the instantaneous flow requirements of the MAA.

More than 50 percent of the annual natural flow of the Red Deer River passes to Saskatchewan in almost all years. This is due to low consumption of Red Deer River water and not due to any requirement to compensate for consumption in the Bow and Oldman basins.

In only one year (1988) has more than 50 percent of the Red Deer River's annual natural discharge been required to meet apportionment. In that year 53 per cent of the natural flow of the Red Deer was required to meet apportionment, although a much higher percentage of the flow of the Red Deer River was actually passed due to non consumption. In most years to date little or none of the discharge of the Red Deer River has been required to meet apportionment. In other words, in most years all apportionment requirements would have been met with the flow being passed in the Bow and Oldman Rivers.

The contributions of the four sub-basins to apportionment is described in greater detail in the report *1996-2001 Update to South Saskatchewan River Sub-basin Contributions to International and Interprovincial Water-sharing Agreements* (Alberta Environment 2002 and 2003).

Major Operational Considerations for the Sub-basins

Red Deer River Sub-basin

The one major reservoir in the Red Deer River sub-basin is Glennifer Lake, which is created by the Dickson Dam. The reservoir fills mostly in the spring with a final top up in the fall. The dam releases a steady flow throughout the winter months that exceeds natural flows. The enhanced winter flow serves several purposes, including: to provide water supplies to communities downstream, waste water assimilation, and prevention of ice jams.

Major diversions are to municipalities (including regional systems), petrochemical industries, Buffalo Lake stabilization, and to the Sheerness generating plant.

Bow River Sub-basin

In the headwaters of the Bow River there is a system of eleven dams, reservoirs and canals for generation of hydroelectricity. Except for evaporation from reservoirs, this is a non-consumptive use of water, so the water can contribute to apportionment.

The hydroelectric reservoirs fill during the spring and summer and release water during the winter. Assimilation of waste water from Calgary is an incidental benefit.

Major diversions are to municipalities (particularly the City of Calgary) and to three large irrigation districts. Some of the water diverted from the Bow River by the Western and Eastern Irrigation Districts is conveyed into the Red Deer River. Water from the Highwood River is diverted into the Oldman River sub-basin, largely for irrigation.

Oldman River Sub-basin

Most of the water storage capability in the SSRB is found in the Oldman River sub-basin. This consists of a number of on-stream reservoirs, as well as storages within irrigation districts.

The reservoirs are filled during the spring and early summer, primarily to support irrigation. The major diversions in the sub-basin are to seven irrigation districts and to municipalities. Some municipalities receive their water through irrigation canals.

The instream objectives set for the Oldman River require a higher than natural flow to be released from the Oldman River Dam during the winter months. The instream objectives were established to protect the aquatic environment by maintaining acceptable dissolved oxygen levels and temperatures, which could be adversely affected by reduced river flows and wastewater discharge.

The relatively recently constructed Oldman River Dam is the only government owned and operated water storage in the SSRB with the capability to provide significant storage and flexibility for ensuring the Master Agreement on Apportionment is met. It is the only structure that has an operating licence that specifically includes apportionment. During some springs in the Oldman River sub-basin 50 percent of annual water demand can be in storage and 50 percent in the mountains as snow.

South Saskatchewan River Sub-basin

The major diversions in this sub-basin are to the City of Medicine Hat, including to its power plant, which discharges warm water back to the river.

Overall Considerations

The diversions to irrigation in the Bow and Oldman Rivers can have the result in many years of flows in the lower reaches being much below natural in the late summer.

The artificially high winter flows (which would naturally be very low) contribute to apportionment, and approximately to the same degree each year. This is in contrast to the spring and summer runoff, which has a high degree of variability.

Although man has altered the river flows in the SSRB to a considerable extent, large floods can still occur below the reservoirs, which are not large enough to capture large floods. These are typically the result of heavy rainfall combined with peak snowmelt in the mountains in June. As it is impossible to capture or manage large floods almost all of this water contributes to apportionment.

A Typical Year in the SSRB in Meeting the Master Agreement on Apportionment

The following describes the typical patterns in SSRB river flows and water usage over the course of the year. At times Alberta can be in either a surplus or deficit position relative to apportionment requirements, but by the end of the year the requirements are always met.

- January to April – Actual flows at the Alberta-Saskatchewan boundary (flows delivered to Saskatchewan) exceed natural flows due to releases of stored water from the Oldman and Dickson Dams to meet instream flow requirements and releases from hydroelectric dams in the headwaters of the Bow River during the course of power generation. During this period Alberta generally accumulates a surplus in the delivery of apportionment requirements.
- April to May – With the start of warmer spring weather, the relatively low levels of plains snow-melt runoff are generally insufficient to meet the irrigation diversion requirements and apportionment. This, combined with a reduction in power releases, can pose a challenge to meeting the 42.5 cms (1500 cfs) minimum flow requirements of the apportionment agreement without significant coordination of water operations. Volumetrically, during this period Alberta is generally delivering less than 50 percent of the natural flow and as a result experiences a reduction in the surplus deliveries it had accumulated during the January- April period.
- June to August - While the high-elevation snow melt which occurs during this period generates large quantities of water, irrigation diversions, combined with the replenishing of storage for both irrigation and power, generally result in

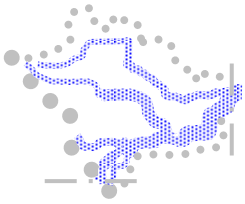
Alberta passing less than 50% of the runoff volume to Saskatchewan in average to below average years. As Alberta is generally using and/or storing more than 50 percent of the natural runoff in this period, in June, July and August Alberta generally experiences a further reduction in the surplus deliveries it had accumulated during the January-April period, although generally Alberta continues to maintain a cumulative surplus. During above average years large volumes of water, much in excess of requirements, are passed to Saskatchewan, even though water is being stored for use later in summer

- September to October - The rapid decline in stream flow due to the depletion of high elevation snow melt and glacier contributions, combined with ongoing irrigation diversions to replenish internal irrigation storage at a time when power releases from hydroelectric dams is still minimal can pose a challenge to meeting the 42.5 cms (1500 cfs) minimum flow requirements of the apportionment agreement without coordination of reservoir releases and operations. Volumetrically, during this period the 42.5 cms (1500 cfs) minimum flow passed to Saskatchewan is generally reasonably close to 50 percent of the natural runoff volume generated during this period and as such Alberta's volume balance does not change significantly.
- Late October to December - Actual flows at the Alberta-Saskatchewan boundary exceed natural flows due to releases of stored water from the Oldman and Dickson Dams to meet instream flow requirements and releases from hydroelectric dams in the headwaters of the Bow River to meet power requirements. During this period Alberta generally increases its accumulated surplus delivery to meet or exceed the volume requirements of its apportionment obligations.

The Approved Water Management Plan for the South Saskatchewan River Basin

The Water Management Plan for the SSRB (approved in 2006) provided the following direction concerning apportionment:

1. All the sub-basins of the SSRB will continue to be managed as a single entity in order meet apportionment.
2. The Interbasin (later re-termed Intrabasin) Water Coordinating Committee be created to give advice to AENV on managing water during periods of water shortage in any or all of the sub-basins.
3. This Apportionment Operations Plan be prepared to identify criteria for decisions on how Alberta will meet apportionment.
4. The key principle is to achieve fair and equitable sharing of water between the sub-basins, such that during times of shortage the licence holders in one sub-basin do not carry an excessive burden for the benefit of licence holders in other sub-basins.



Issues

The main issues are:

1. Meeting apportionment in the future will be increasingly challenging due to increased water consumption and potential decreases in the natural water supply, whether the result of natural climate cycles or human activities.
2. Meeting apportionment may, at times, require more recently issued licences (i.e., lowest priority) to reduce or stop diversions. In future, the lowest priority licences may be in the Red Deer River sub-basin.
3. While the priority system of licenses is the legal backstop, strict enforcement of it may not be the best or only way to meet the challenges of apportionment.

Meeting Apportionment in the Future

Meeting apportionment requirements to date has required little management input by AENV. A number of factors made this possible:

1. Man-made greater than natural winter flows,
2. Irrigation return flows,
3. Under-utilized allocations,
4. A limited degree of allocation in the Red Deer River sub-basin

However, this is likely to change due to:

1. Increased utilization of existing allocations.
2. Projected large increase in population and economic growth (if there are insufficient conservation measures to offset growth).
3. Reduced return flows from irrigation districts as diverted water is utilized more completely due to more efficient practices and possible expansion.
4. Additional allocations in the Red Deer River sub-basin.
5. Additional allocations to First Nations.

Each and all of the above mean that more water will be consumed in Alberta, and Alberta's safety margin for meeting apportionment will be reduced. Computer simulations show that Alberta could be delivering 50 to 60 percent of the apportionable flow of the SSRB in half of future years (Fig. 4). The simulations are structured to always meet apportionment, so this can mean that lower priority licences could be required to reduce or stop diversions in half of future years.

Potential Impacts on Lower Priority Licences

Water allocations are still being granted in the Red Deer River Sub-basin, and will be granted in the other sub-basins only under the terms of the Bow, Oldman and South Saskatchewan River Basin Water Allocation Order. This means that in a future water shortage affecting the entire SSRB or the three southern sub-basins, the lowest priority licences are likely to be in the Red Deer River sub-basin. From a strict legal

perspective, this could lead to these licences being required to reduce or stop their diversions to ensure apportionment requirements are being met. (The MAA is considered by Alberta to have the equivalent of a priority of 1969.)

With cooperation among water users in the sub-basins, and advance planning, the situation described above could be forestalled or avoided.

Water Quality

The MAA contains water quality standards that are to be met for water being passed from Alberta to Saskatchewan. While the IWCC's focus will be mainly on water quantity, the committee will be mindful of water quality requirements. However, for the foreseeable future, the IWCC will not be asked for advice on water quality.

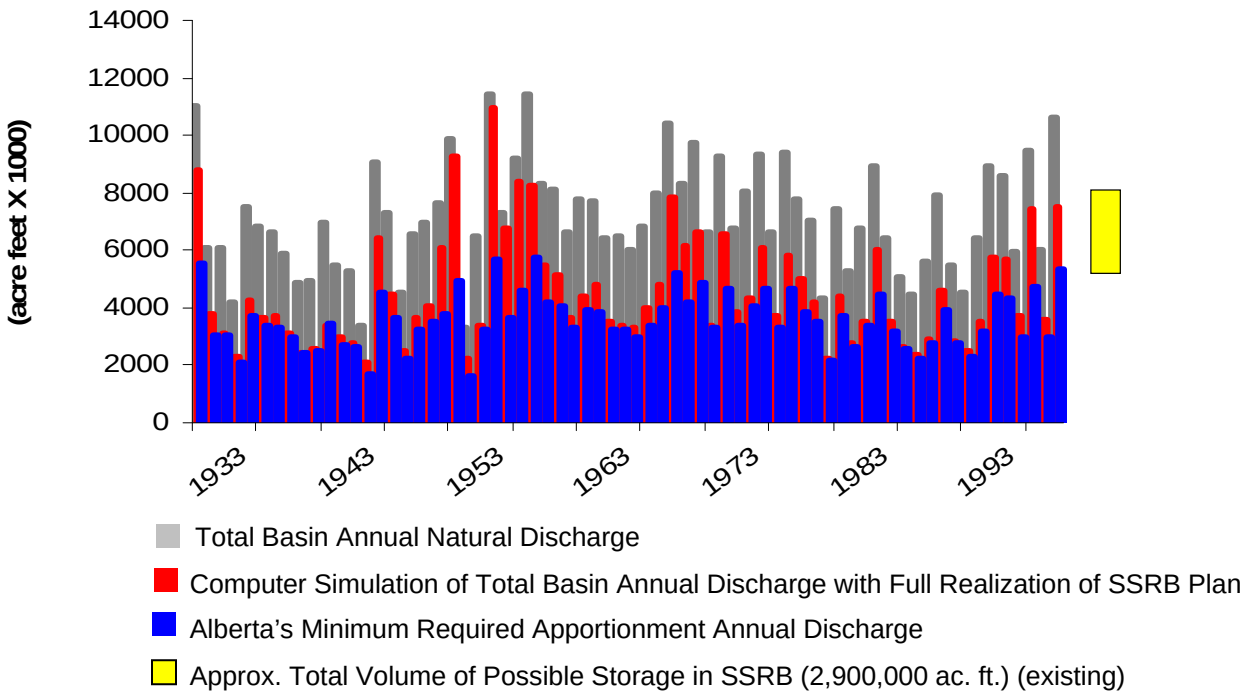


Figure 4. Predicted Basin Annual Discharges Relative to Apportionment Requirements. Predicted Future Demand and Historical Water Supply. South Saskatchewan River Basin.

The PPWB routinely monitors water quality at the border to ensure site specific objectives for an agreed to suite of water quality parameters is met. Alberta Environment has the responsibility to take any necessary actions required to ensure the MAA water quality objectives are met.

Other Considerations

Several other matters concerning apportionment have been identified that must be considered:

1. Aquatic environment

There a number of specific flow requirements for protection of the aquatic environment and these may also have implications for meeting apportionment. Some of these flow requirements need occur only at multi-year intervals, and depend on a specific set of conditions coinciding.

a) Periodic high flows for channel maintenance, flushing and cottonwood poplar seeding.
b) Ramping down of high flows to foster regeneration of cottonwood poplar in the right conditions.
c) Minimum flows to maintain riparian vegetation and fish and other aquatic species (maintenance of water table, temperature and dissolved oxygen).

2. Operation of Existing Reservoirs and Diversions

The existing methods and purposes of operation of reservoirs and diversions may have a bearing on meeting apportionment. Over time it may become apparent that adjustments to operations may be necessary in order to meet apportionment.

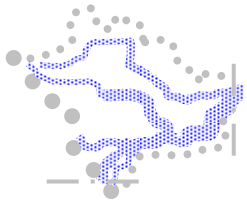
- Dickson Dam on the Red Deer River
- TransAlta Utilities hydroelectric dams in the Bow River headwaters.
- Oldman River Dam
- St. Mary-Waterton Headworks
- Diversions to irrigation districts, cities and large industries.

3. Water Supply and Demand Management

The challenge of meeting apportionment in the future can be reduced by generally decreasing water use per capita and increasing water use efficiency. Steps by water consumers to reduce long-term demand could have the benefit of water users not having to experience the inconvenience or cost of unplanned for water shortages. Some water users have already taken steps in this regard but there is much remaining opportunity. Water users may also consider drought management plans that would enable them to reduce demand in an orderly fashion during water shortages.

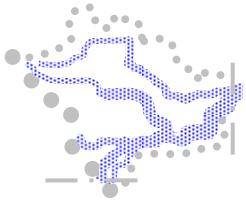
Water users may also consider improving the reliability of their water supply in order to lessen the impact of water shortages. This can include:

- securing long-term higher priority water allocations through the water allocations transfer market,
- arranging water assignments in advance that can be activated during a shortage.
- Storage infrastructure.



Objectives of the Apportionment Operations Plan

1. The MAA is always met.
2. The water supply and demand situation is carefully monitored during each year so that any necessary reductions in consumption can be made in an orderly, timely and effective manner, in a planned way that minimizes inconvenience, hardship or financial loss.
3. During water short years when the amount of water Alberta is entitled to consume is less than licenced allocations or the rate of actual consumption and water consumption must be reduced, the reduction is equitably shared between sub-basins.
4. The river flows required to meet apportionment will coincide as much as possible with flows that are beneficial for the aquatic environment.
5. The WPACs in the SSRB are informed each year, or as often as necessary, of the issues and decisions concerning the MAA.
6. Good information is prepared to support effective communication and this information is made available as required.



Procedures and Deliverables

The IWCC will review and consider the information available concerning water supply and demand over the course of each year and provide advice to AENV about how to best meet the MAA. Depending on circumstances, this advice could range from “no action required,” to very specific actions.

1. The operational decision making procedure of AENV is shown in Appendix C.
2. AENV will make decisions on how to best meet apportionment after considering available information and advice, particularly that of the IWCC.
3. The IWCC will consider matters affecting how the MAA will be met in any given year. AENV will attend to day-to-day operations.
4. The IWCC will meet as follows:
   a) Twice during March to June to consider the water supply and demand situation for the upcoming season and to make recommendations.
   b) In the winter to review the water management for apportionment of the previous year and to make recommendations and also to formulate an annual report.
   c) At other times as necessary.

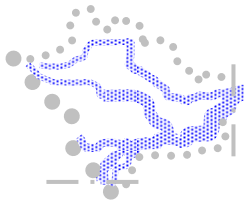
5. AENV will provide at least the following information to the IWCC:

a) Prior to its spring meetings:
    i. Snow pack information and predictions for water supply (may be provided on a continuous basis during the year).
    ii. Status of water storage.
    iii. Other matters such as soil moisture status that may affect runoff.
    iv. Long-range weather forecasts
    v. Status of large licence holders and projected demand.
    vi. A summary report of key facts from the above for distribution to the WPACs.
b) Prior to any summer meetings, if held,:
    i. Current information on the water supply and demand situation as it has evolved.
    ii. Apportionment status to that point.
c) Prior to the winter meeting:
    i. Apportionment results as provided by the PPWB.
    ii. Generalized water use data and degree to which licence demand was met or not in the previous year.
    iii. Performance in meeting instream objectives and water conservation objectives.
    iv. A summary report on apportionment for the previous year for distribution to the WPACs.
d) Secretarial and writing services to prepare an annual and other reports for the IWCC.
e) Logistical, organizational and administrative services.
f) Resource staff, particularly for modeling assistance.
g) Information and presentations from third parties, if requested.
h) Information and presentations for third parties, such as other WPACs.
i) An opportunity to meet with a member of AENV executive and/or the Minister of Environment in years with serious water shortages.

6. The IWCC will provide the following to AENV:
    a) After its spring meetings:
        i. Advice to AENV as to how to best meet apportionment during the upcoming year.
        ii. Suggestions as to if or when additional meetings should be held.
        iii. Advice and information the IWCC will be giving the WPACs and licence holders.
    b) After summer meetings, if held,:
        i. Revised, if necessary, advice concerning how to best meet apportionment.
        ii. Revised, if necessary, advice and information the IWCC will be giving the WPACs and licence holders.
    c) After its winter meeting:
        i. Advice to AENV about how the procedures could be improved.

7. The IWCC members will become familiar with the operations plans for dams and rule curves for reservoirs.
8. The WPAC representatives on the IWCC will communicate with their respective WPACs to ensure the advice provided is understood by the WPACs.
9. A work plan will be prepared every year to describe specific tasks to be accomplished and by whom.

10. Through their respective WPACs, the members of the IWCC will attempt to increase public awareness of the MAA, the challenges faced, and its recommendations to AENV.



IWCC Responses to AENV Water Shortage Procedures

AENV has adopted a set of procedures for use by its staff during water shortages entitled: *AENV Water Shortage Procedures for the SSRB* (AENV 2007). Procedures are described for each of four stages of increasing severity of drought. The following outlines how the IWCC intends to respond to each of the stages.

Stage 1 Water Shortage Management

As stated in the water shortage procedures (AENV 2007, page 8):

Stage 1 Water Shortage Management occurs when one or more of the following conditions apply:

- *The rate of flow and potential for water storage, at any place, is less than median in the water management area;*
- *The water supply outlook from Flow Forecasting indicates there may be potential water shortages in an affected water management area;*
- *Water users are able to divert, however, there is an elevated risk of a priority call or risk of failure to meet apportionment requirements.*

<u>Responses:</u>

- AENV:
  - Provide IWCC with relevant information.
  - Inform IWCC on a regular basis as the situation evolves, particularly if any possible implications for apportionment become apparent.
  - Receive advice provided by IWCC

- IWCC:
  - Monitor the situation,
  - May request additional reports and information to supplement the water supply and demand information ordinarily provided by AENV, and
  - May provide advice to AENV.

Stage 2 Water Shortage Management

Stage 2 Water Shortage Management occurs when conditions degrade in the affected water management area from Stage 1. The criteria that may trigger the Department to commence Stage 2 operations are:

- *The Department received a priority call from a licensee, traditional agricultural users and/or household users.*

The receipt of a priority call may require the Department to administer priority to a portion or all of a water management area. A priority call can occur when household users, licensees or traditional agricultural users are not able to receive their full allocation allotted under the Water Act. (AENV 2007, page 10)

Responses:

- AENV:
  - Provide IWCC with relevant information.
  - Inform IWCC on a regular basis as the situation evolves, particularly if any possible implications for apportionment become apparent.
  - Receive advice provided by IWCC

- IWCC:
  - Monitor the situation,
  - May request additional reports and information to supplement the water supply and demand information ordinarily provided by AENV, and
  - May provide advice to AENV.

Stage 3 Water Shortage Management

Stage 3 Water Shortage Management occurs when conditions in the water management area(s) degrade to a point where:

- *the water shortage impacts multiple water management areas;*
- *the majority of licensees/traditional agricultural users/household users in the water management areas are impacted and are unable to divert water;*
- *the water shortage persists or is projected to persist.*

b) …the Water Shortage Information Section meets with WPACs and water user groups in the affected water management areas to discuss issues, provide information on water availability, advice on water conservation practices, and consider apportionment issues and water sharing from department owned storage when possible, if applicable.

c) The Water Shortage Command Committee seeks advice from the SSRB Intrabasin Water Coordinating Committee on water shortage management strategies specific to the South Saskatchewan River Basin, and the department considers the advice in the development of an implementation plan.

f) If water shortage persists or is projected to persist, the Water Shortage planning section will develop long-term water shortage strategies. These strategies will be developed with input and support from Water Shortage Compliance, Water Management Operations, Water Shortage Information Team, Trans-Boundary Water Policy Section and SSRB Intrabasin Water Coordinating Committee. (AENV 2007, pages 15-16)

Responses:

- AENV:
  - Will provide the IWCC with briefings and all necessary information.
  - Will seek the advice of the IWCC.

- IWCC:
  - May request additional briefings from AENV as the situation develops to Stage 3.
  - Will consider the matter of fairness and equity between the sub-basins in formulating advice for AENV. This could include considerations such as:
    - Past contributions of sub-basins to apportionment,
    - Number and types of licences in each sub-basin that could be required to modify or cease diversions,
    - Previous requirements to modify or cease diversions due to apportionment
  - May consider making recommendations, such as:
    - Increasing water storage as a precaution
    - Water conservation and storage strategies.

Stage 4 Water Shortage Management

Stage 4 Water Shortage Management is considered and implemented when there are unforeseen circumstances, such as:

- *Elevated risk to human health and safety due to insufficient water supply;*
- *Elevated risk to human health and safety due to water quality degradation as a result of insufficient flow to dilute effluent releases to a water body;*
- *Elevated stress on the health of the aquatic environment to a point where fish mortality occurs;*
- *Municipality(ies), water user(s) and Alberta government departments have been unable to address the extent and magnitude of the water shortage;*
- *Licensees have implemented Water Shortage Response Plans and, if available, Sector Water Use Standards; and*
- *The issues can be solved or improved by such a declaration and issuing of orders, which may suspend licences or registrations and designate water use.*

a) If the water shortage meets the criteria as outlined above, the Water Shortage Command Committee will consult with WPACs and the SSRB Intrabasin Water Coordinating Committee.

b) The Water Shortage Command Committee will consider recommending to the Lieutenant Governor in Council that an emergency be declared under the Water Act. (AENV 2007, page 17)

Responses:

- AENV:
  - Will provide the IWCC with briefings and all necessary information.
  - Will seek the advice of the IWCC.

- IWCC:
  - May request additional briefings from AENV as the situation develops to Stage 4.
  - Will consider the matter of fairness and equity between the sub-basins in formulating advice for AENV. This could include considerations such as:
    - Past contributions of sub-basins to apportionment,
    - Number and types of licences in each sub-basin that could be required to modify or cease diversions,
    - Previous requirements to modify or cease diversions due to apportionment
  - Will consider measures that could be included in the emergency declaration for the purpose of achieving an equitable outcome for the sub-basins.
  - May consider making additional recommendations, such as:
    - Increasing water storage as a precaution
    - Water conservation and storage strategies.

References

Alberta Environment, 2002. *South Saskatchewan River Sub-basin Contributions to International and Interprovincial Water-sharing Agreements.* Edmonton, Alberta. 28 pp. + App.

Alberta Environment, 2003. *1996-2001 Update to South Saskatchewan River Sub-basins Contributions to International and Interprovincial Water-sharing Agreements.* Edmonton, Alberta. 22 pp.

Alberta Environment, 2007. *Draft AENV Water Shortage Procedures for the South Saskatchewan River Basin (for internal use by staff of Alberta Environment).* Calgary, Alberta.

Government of Alberta, 2006. *Water Management Plan for the South Saskatchewan River Basin.* (O.C. 409/2006) Pub. No: I/011. Edmonton, Alberta. 18 pp.

Government of Alberta, 1999. *Water Act.* Edmonton, Alberta.

Prairie Provinces Water Board, 1969. *Master Agreement on Apportionment*.

Glossary

Aquatic environment – from the *Water Act*:

…the components of the earth related to, living in or located in or on water or the beds or shores of a water body, including but not limited to

(i) all organic and inorganic matter, and
(ii) living organisms and their habitat, including fish habitat,

and their interacting natural systems.

Instream objective

Regulated flows that should remain in the river via dam operations or as a restriction on licences. Below dams, Instream Objectives are in place in throughout the SSRB, although some offer only limited protection of the aquatic environment. Instream Objectives have usually been set in response to fish habitat instream needs (the Fish Rule Curve) and/or water quality.

Water conservation objective – from the *Water Act*:

…the amount and quality of water established by the Director under Part 2, based on information available to the Director, to be necessary for the

(i) protection of a natural water body or its aquatic environment, or any part of them;

(ii) protection of tourism, recreational, transportation or waste assimilation uses of water; or

(iii) management of fish or wildlife,

and may include water necessary for the rate of flow of water or water level requirements.

A licence may be issued by the Director to the Government of Alberta for the purpose of implementing a Water Conservation Objective.

Rule curve

A reservoir rule curve is a line plotted on a graph, which has water elevation as its vertical axis and time of year as its horizontal axis. The curve represents the desired elevation of the water in the reservoir over the course of a year and is used by the staff who operate dams to guide their decisions about storing and releasing water.

Median

As used in this document, the median rate of flow is the rate of flow which, at any given point in time, has in the period of record an equal number of greater and lesser recorded values.

Water management area – from the *Water Act*:

The Director may establish water management areas for the purposes of

(a) administering priority to divert water,

(b) groundwater management,

(c) temporarily assigning water under section 33,

(d) directing that the diversion of water for household purposes cease,

(e) directing that applications for licences are not to be accepted, and

(f) any other matter specified in the regulations.

It should be noted that at section 10 the *Water Act* also identifies that *Water Management Planning Areas* can be established by the Minister.

Priority call

A priority call occurs when a licence holder indicates to Alberta Environment that he/she cannot divert water to the extent permitted by his/her licence due to water withdrawals upstream by holders of licences with lower priority. When this occurs Alberta Environment communicates to the holders of lower priority licences upstream that they must reduce or cease withdrawals.

Appendices

Appendix A

Terms of Reference for the South Saskatchewan River Basin Intrabasin Water Coordinating Committee

Overview

The Approved Water Management Plan for the South Saskatchewan River Basin (Alberta) (Order-In-Council 409/2006) calls for the creation of an Interbasin* Water Coordinating Committee (IWCC). As stated in the plan (p. 10, Alberta Environment 2006):

> *To promote coordination between the sub-basins on matters of common interest, an Interbasin Water Coordinating Committee will be established. It will have representation from the Watershed Planning and Advisory Councils in the SSRB and from the South Saskatchewan River Sub-basin. Alberta Environment will also have membership.*
>
> *This committee will provide advice to Alberta Environment on managing water during periods of water shortage in any or all of the sub-basins. This committee is to meet at least annually or on as frequent a basis as necessary to review and address matters regarding water shortage situations and how to best meet the requirements of the Master Agreement on Apportionment. The Director will make any applicable decisions.*

The committee will be the main source of advice to Alberta Environment (AENV) concerning actions that should be taken to ensure the *Master Agreement on Apportionment* (MAA) is met. The MAA governs the quantity, rate of flow and quality of water that Alberta must pass on to Saskatchewan.

The four sub-basins of the South Saskatchewan River Basin (SSRB) are those of the Red Deer, Bow, Oldman and South Saskatchewan Rivers (see Map 1).

The plan calls for preparation of an apportionment operations plan to identify criteria for decisions on how Alberta will meet its obligations to Saskatchewan for flows from the SSRB.

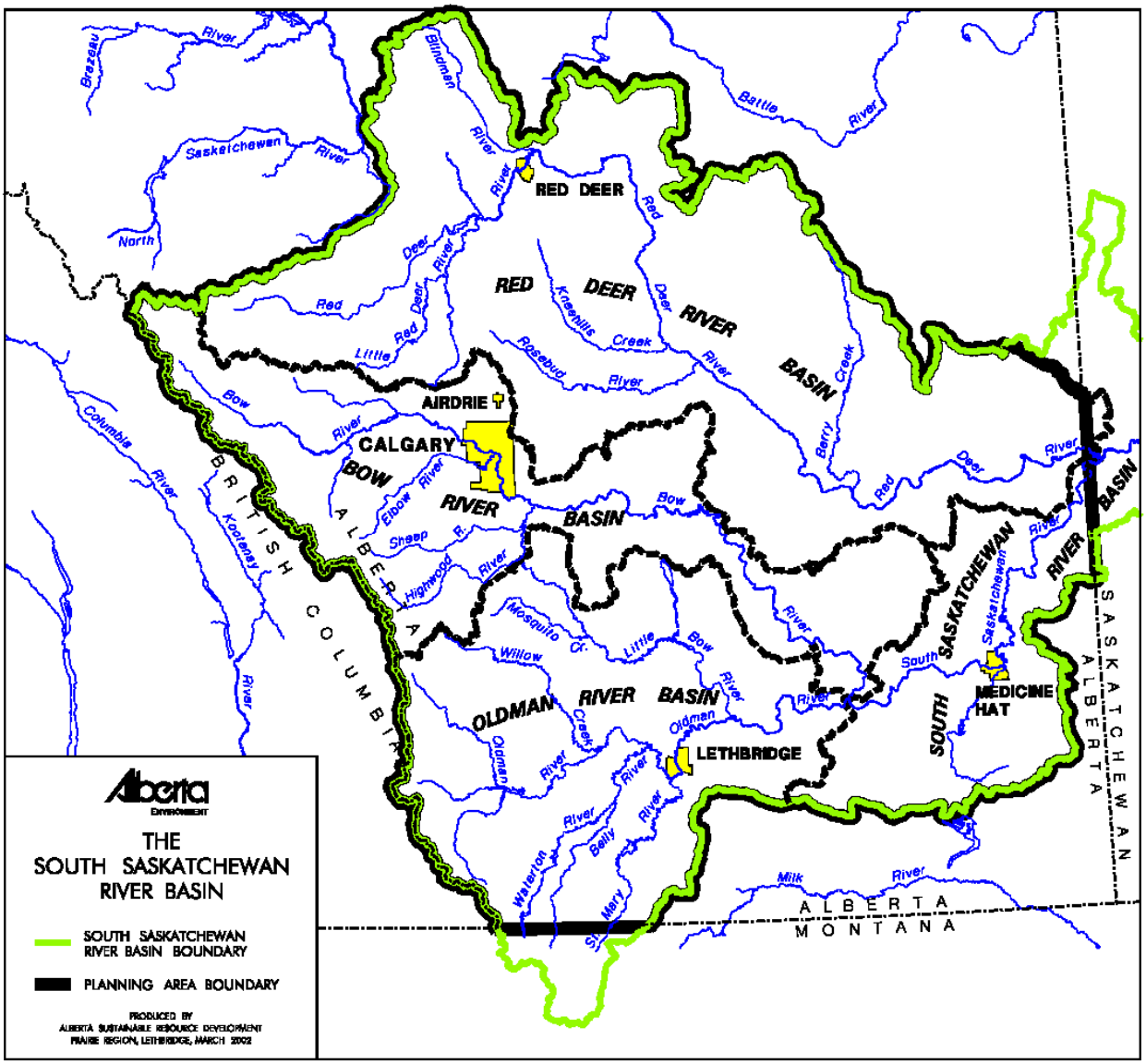
Background

The SSRB is managed by AENV as a single unit for purposes of meeting the requirements of the *Master Agreement on Apportionment.* This permits flexibility in drawing on the sub-basins in response to annual variations in water supply and demand.

To date, Alberta has been able to meet apportionment with little special effort other than in 1988 and 2001. However, this is expected to change in the future as the result of

* The committee's name has subsequently been revised to become the Intrabasin Water Coordinating Committee to avoid confusion around the word "interbasin." In Alberta this word has come to usually mean some connection between any of the seven major basins identified in the *Water Act.*

existing allocations being utilized more completely, allocations to First Nations and new allocations in the Red Deer River sub-basin.



Map 1 The South Saskatchewan River Basin

- The parts of the basin that lie in Montana and Saskatchewan are not in the water management plan area.
- The water management plan applies to all projects that use water diverted within the SSRB.

Purpose of IWCC

The overarching purpose of the IWCC is to have in place a committee of respected individuals representing the SSRB Watershed Planning and Advisory Councils[1] (WPACs) who will be capable of providing to Alberta Environment advice as to how best meet the MAA under any particular set of circumstances. These individuals will have a good understanding of the MAA, SSRB water management opportunities and limitations, and the water supply and demand situation at any point in time.

- The committee shall prepare and maintain an apportionment operations plan to guide water management for purposes of meeting the requirements of the MAA.
- The committee shall provide to AENV water managers on-going situational advice as needed, for meeting the requirements of the MAA in unusual conditions.
- The committee may provide a coordination function for the WPACs within the SSRB for water operational and administration matters of common interest to the WPACs.

Key Tasks

- Prepare an apportionment operations plan.
- Provide advice to AENV as requested during the course of the year on how to best meet apportionment during water shortages in any or all sub-basins, bearing in mind legal and physical constraints and possibilities.
- During periods of water shortage, provide regular communication to the public and water users about the situation, and recommendations and decisions.
- Provide oversight for preparation by AENV of an annual report to the public concerning apportionment. This report would generally be prepared after February, when all data for the preceding season is available.
- Prepare a communications plan, which should include annual and operational reports, as well as communications during shortages.
- The communications provided are to be in plain English and user-friendly.
- Provide to AENV on-going review of information and performance.
- Review normal operations plans for dams, weirs and diversions and, if considered necessary, make recommendations on possible changes.

Guiding Principles

- The Approved Water Management Plan for the SSRB provides the guiding principles for the committee, particularly the following sections, which are quoted from the plan (pp. 10-11, Alberta Environment 2006):
    - *All of the sub-basins of the SSRB will continue to be managed as a single entity in order to meet the requirements of the Master Agreement on Apportionment.*
    - *An apportionment operations plan be developed to identify criteria for decisions how Alberta will meet its flow obligations to Saskatchewan. A key principle is to achieve fair and equitable sharing of water between the*

[1] Red Deer River Watershed Alliance, Bow River Basin Council, Oldman Watershed Council, South East Alberta Watershed Alliance

sub-basins, such that during times of shortage the licence holders of one sub-basin do not carry an excessive burden for the benefit of licence holders in other sub-basins.

- *It is recognized that in strict legal terms, a senior licence could call priority in one sub-basin, but because of insufficient junior licences, insufficient water storage, and apportionment issues in that sub-basin, this could result in a more junior licence in another sub-basin being negatively affected. However, the likelihood of this occurring is very remote, as other options, such as calling on stored water in the Oldman River Dam reservoir, will usually be available. With some foresight, the committee should easily be able to avoid a strict priority situation.*
- *The principle of sharing water during shortages should take precedence, so licences in the water-short basin(s) are affected first. The proportion of contribution should consider the following in each sub-basin:*
  - *Amount of storage capacity and amount of water in storage*
  - *Location of storage*
  - *Snow pack*
  - *Volume of licences affected*
  - *Sub-basin natural flows.*
- *The Alberta Government will consider the advice of the IWCC to meet apportionment obligations under the Master Agreement on Apportionment.*
- *The public should be provided with information on a regular basis as to the committee's recommendations. AENV should submit an annual report to the public on its activities with respect to meeting apportionment.*

Constraints

- The *Water Act* of Alberta and related regulations
- The terms of the Master Agreement on Apportionment (administered by the Prairie Provinces Water Board)
- The policies and direction provided by *Water For Life, Alberta's Strategy for Sustainability*, particularly those pertaining to water conservation standards.
- Licences and associated operations plans for dams, weirs and reservoirs.

Duration

- The IWCC is anticipated to be an on-going committee.

Committee Operations

- The committee will strive to reach consensus on its recommendations to AENV.
- If consensus cannot be achieved, then the committee will provide to AENV the majority and minority opinions and their rationale.
- AENV will send any matters requiring a recommendation from the IWCC at least one week prior to the meeting at which the matter is to be considered.
- Quorum will be reached if one representative from each of the WPACs is in attendance.
- Until the committee decides otherwise, the meetings will be chaired by Dave McGee, AENV.

- While the Apportionment Operations Plan is being prepared, the committee will strive to meet monthly. After the plan is in place, the committee will meet at least three times per year. This will include a meeting in the spring to consider the water supply and demand situation and possible actions that may be required to meet apportionment. A meeting will also be held in the fall to review the year's operations. The committee may be requested to meet more frequently in years when special management is required to meet apportionment.
- Members or alternates are expected to attend meetings in person, unless there are extenuating circumstances. This is to help achieve the best possible communication and understanding.
- Guests may attend meetings as observers if there are no objections from committee members, on a case-by-case basis. Requests to have a guest attend must be sent to the recording secretary, who will forward the request to the membership, along with the agenda. Guests may speak if permission is requested and received from the Chair. The committee may hold parts of meetings at which guests are present *in camera.*

Membership

- Each of the four WPACs in the SSRB can send up to three representatives. The Councils can determine alternates who can attend IWCC meetings in the event of a member being unavailable.
- Each of the WPACs will set the terms for their respective representatives.
- AENV can send up to three representatives to assist the committee and to receive advice. The AENV representatives will be non-voting.

Roles/Responsibilities

- The WPAC representatives are to communicate with the membership and boards of their WPAC to ensure the views and interests of their WPAC are conveyed to the IWCC.
- The representatives from AENV are to provide information to the committee and to hear and receive advice.
- AENV will provide secretariat services including all logistical, organizing, and administrative services required.
- AENV will make resource staff available as required, particularly for modeling assistance.

Administrative Matters

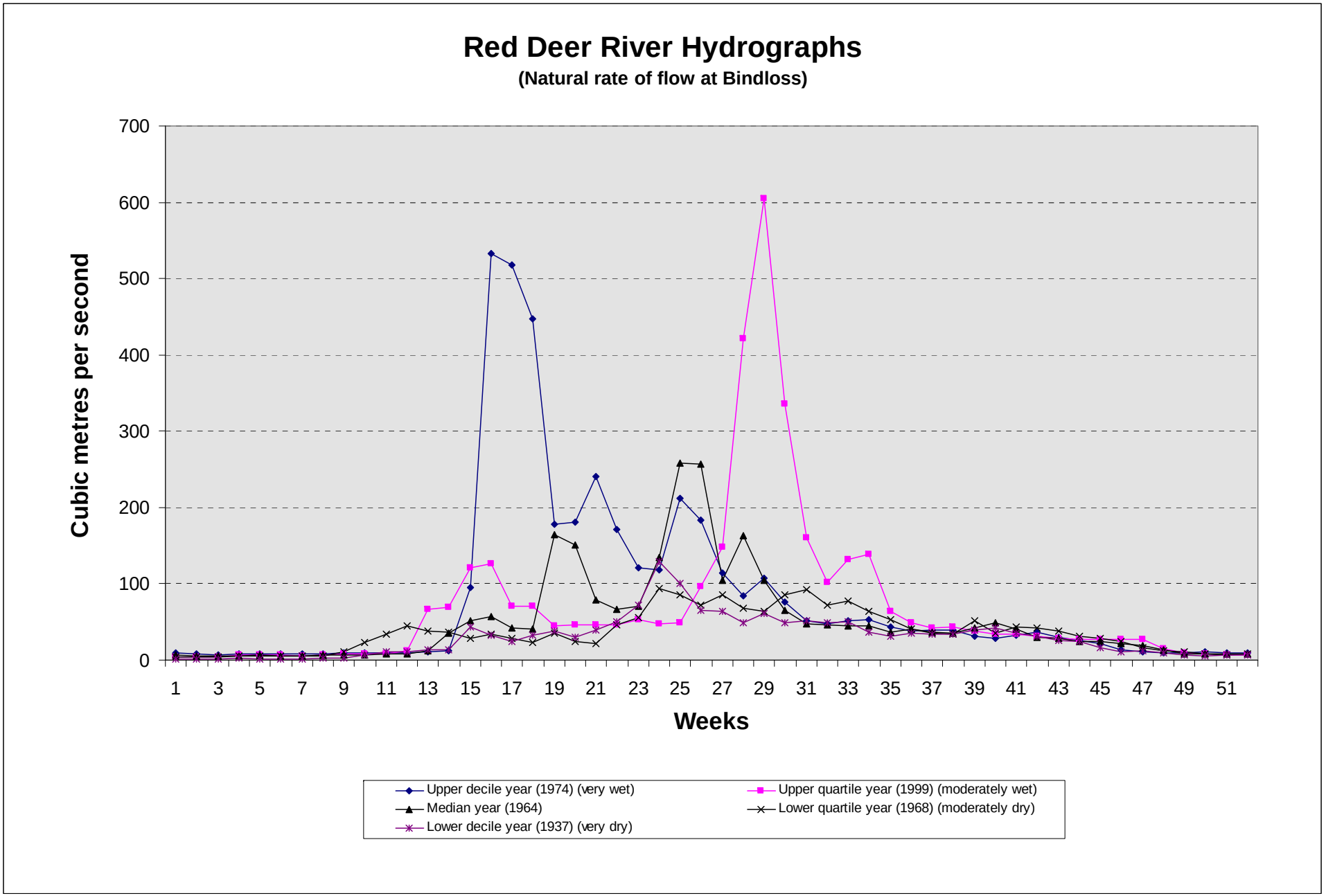
- Locations and frequency of meetings to be determined on an on-going basis.
- It is anticipated that much business can be conducted by conference calls and e-mail.
- If any individual member so requests, AENV will reimburse that member for reasonable expenses incurred in attending committee meetings. This will ordinarily be limited to mileage and meals.

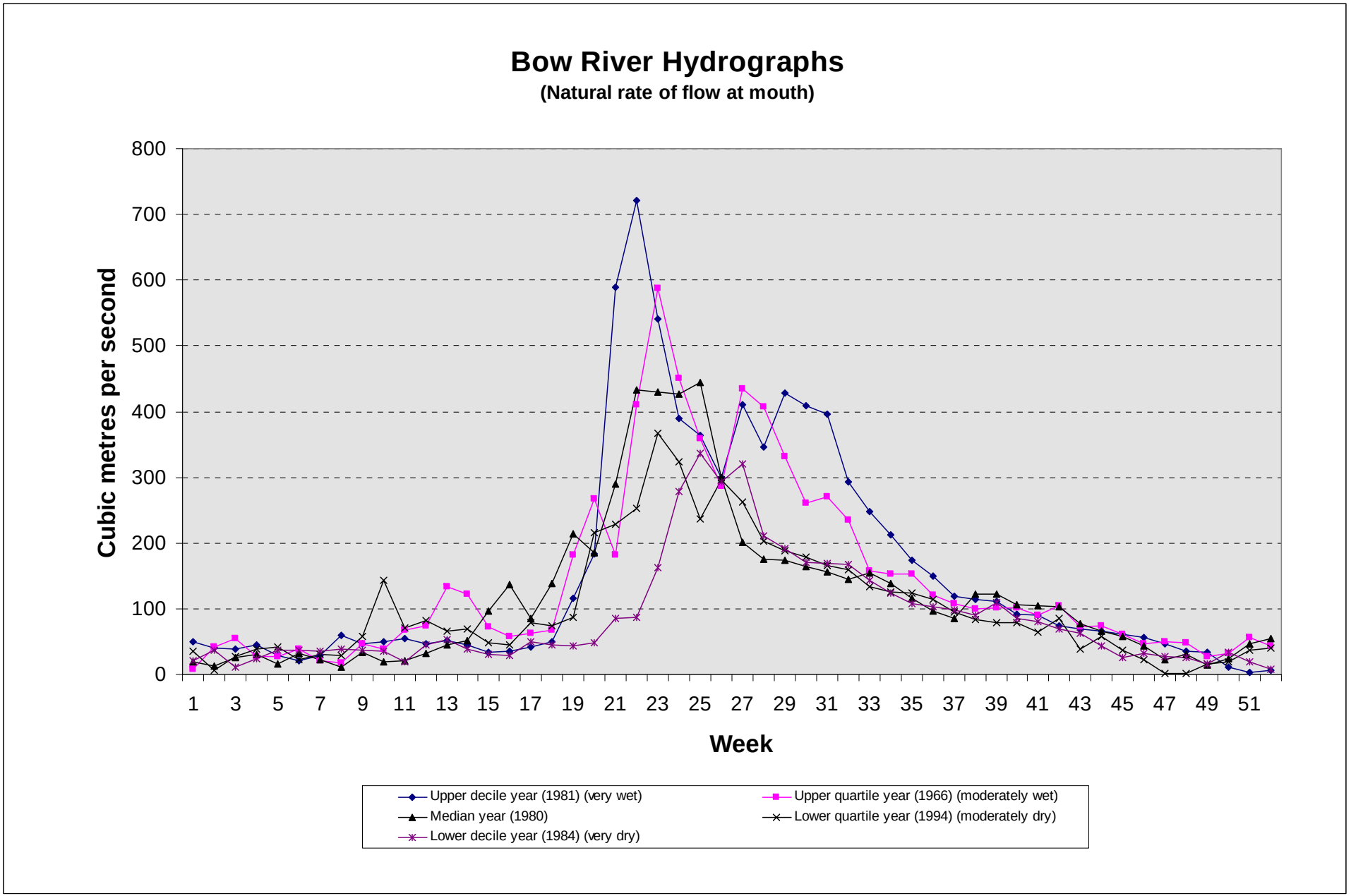
References

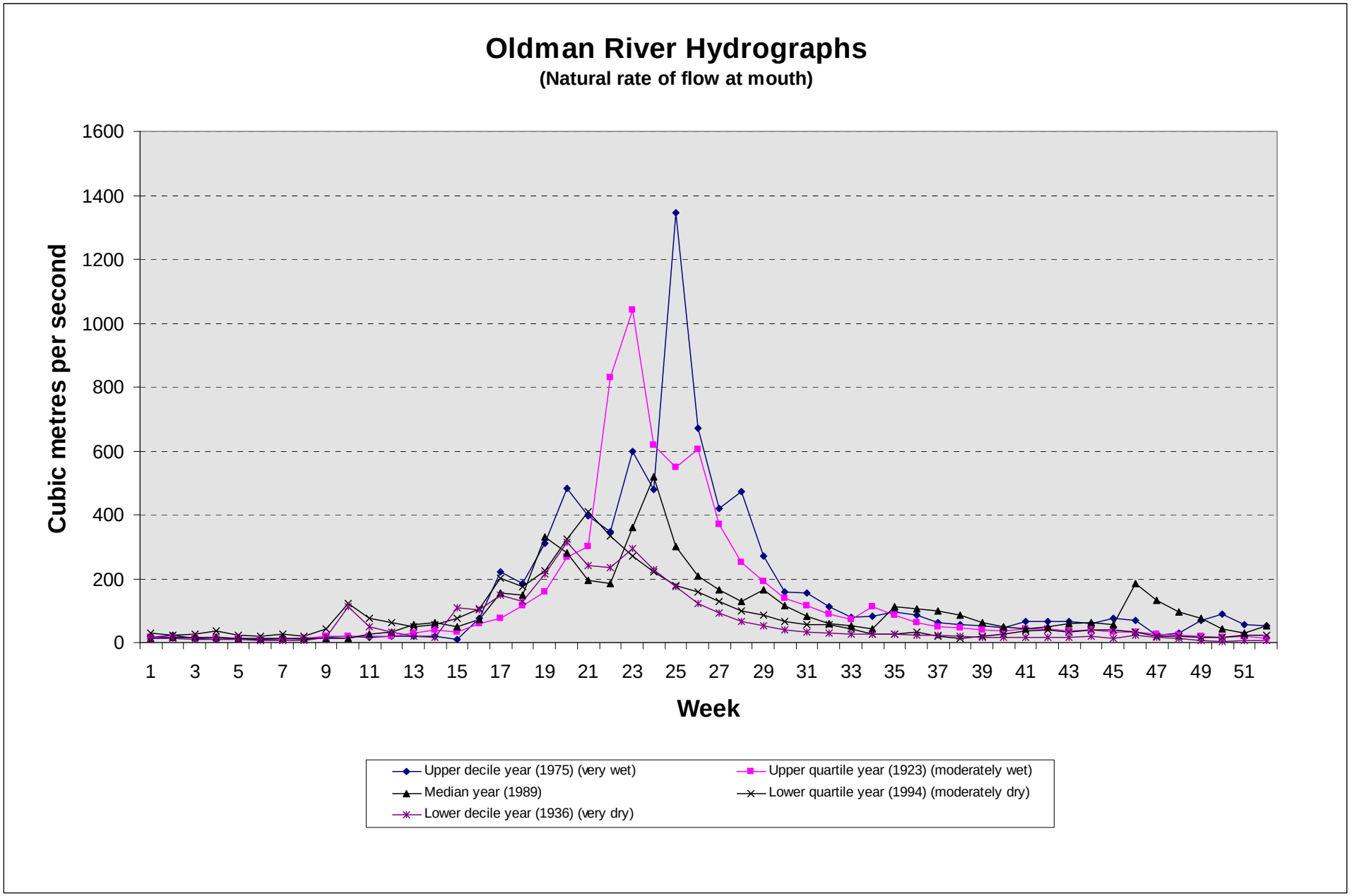
Alberta Environment. 2006. Approved Water Management Plan for the South Saskatchewan River Basin (Alberta). Edmonton, Alberta.

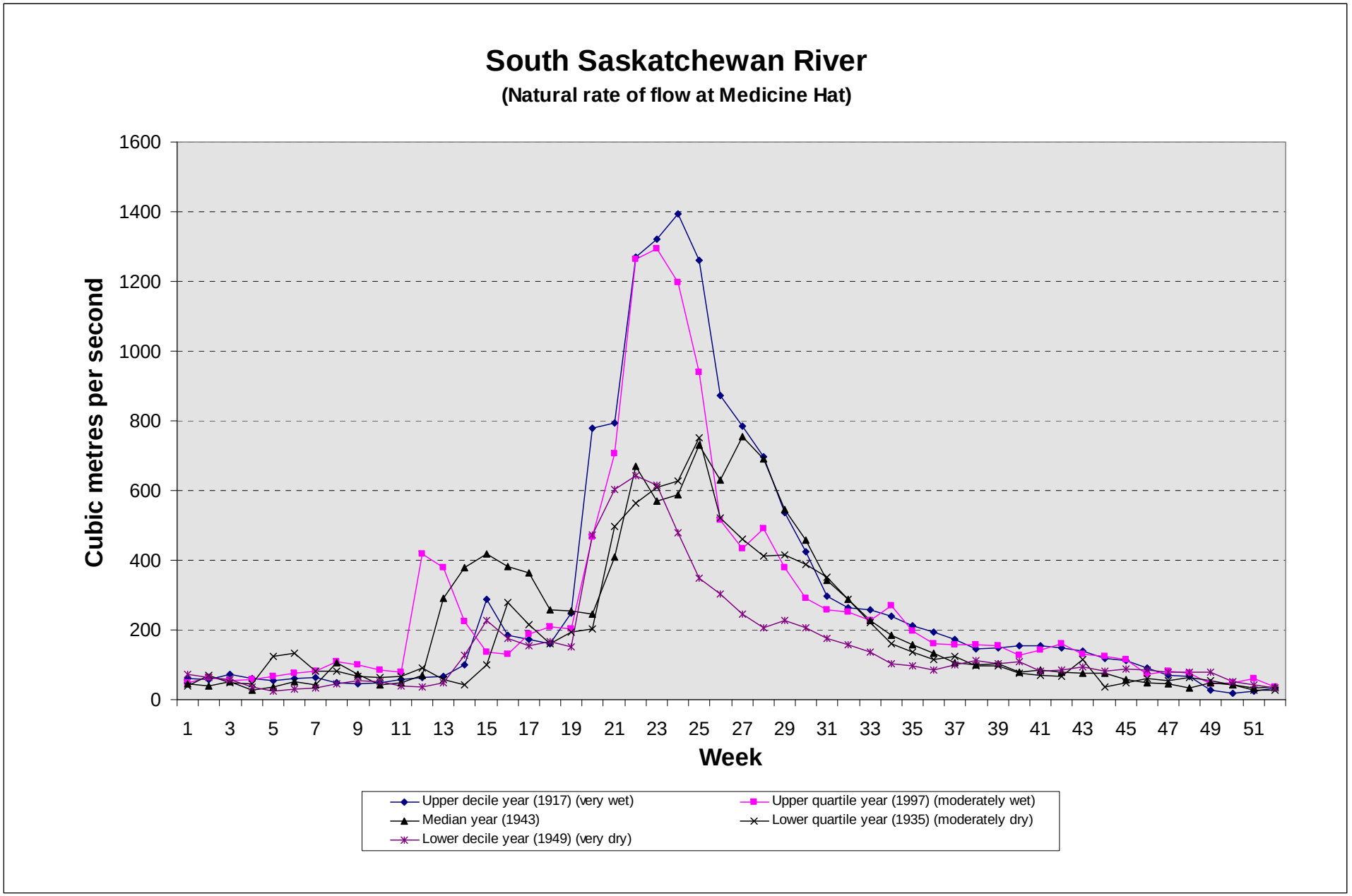
Appendix B

Representative SSRB Hydrographs


Red Deer River Hydrographs
(Natural rate of flow at Bindloss)
Cubic metres per second
700
600
500
400
300
200
100
0
1
3
5
7
9
11
13
15
17
19
21
23
25
27
29
31
33
35
37
39
41
43
45
47
49
51
Weeks
Upper decile year (1974) (very wet)
Upper quartile year (1999) (moderately wet)
Median year (1964)
Lower quartile year (1968) (moderately dry)
Lower decile year (1937) (very dry)


Bow River Hydrographs
(Natural rate of flow at mouth)
Cubic metres per second
800
700
600
500
400
300
200
100
0
1
3
5
7
9
11
13
15
17
19
21
23
25
27
29
31
33
35
37
39
41
43
45
47
49
51
Week
Upper decile year (1981) (very wet)
Upper quartile year (1966) (moderately wet)
Median year (1980)
Lower quartile year (1994) (moderately dry)
Lower decile year (1984) (very dry)


Oldman River Hydrographs
(Natural rate of flow at mouth)
Cubic metres per second
1600
1400
1200
1000
800
600
400
200
0
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49 51
Week
Upper decile year (1975) (very wet)
Upper quartile year (1923) (moderately wet)
Median year (1989)
Lower quartile year (1994) (moderately dry)
Lower decile year (1936) (very dry)


South Saskatchewan River
(Natural rate of flow at Medicine Hat)
Cubic metres per second
1600
1400
1200
1000
800
600
400
200
0
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49 51
Week
Upper decile year (1917) (very wet)
Upper quartile year (1997) (moderately wet)
Median year (1943)
Lower quartile year (1935) (moderately dry)
Lower decile year (1949) (very dry)

Appendix C - Apportionment Decisions Feedback Loop

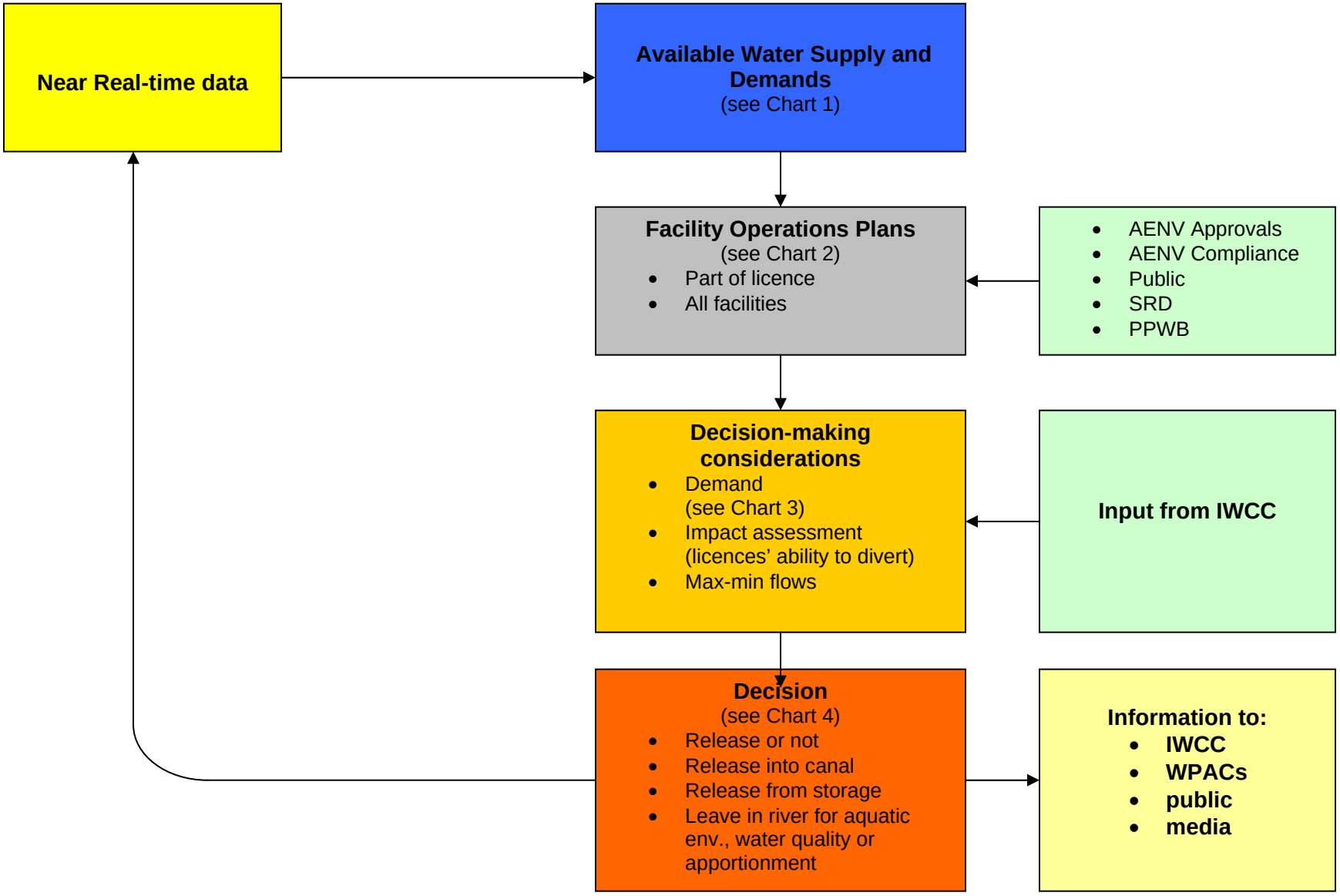


Chart 1
Demands on Supply

Supply

Licenced allocations & Statutory rights

Instream:
- Water conservation objectives
- Apportionment
- Unallocated

Chart 2
Facility Operations Plans

Facility Licences

Operating Scheme Rules

Maximum physically-possible release

Minimum legal release

Chart 3
Influences & Controls on Demand

Water Mastering
(Administration of priority system)
- Legal given

Alternatives to Priority:
- **Conservation**
- **Assignments**
- **Sharing**
  (between basins)
- **Allocation transfers**
- **Emergency Declaration**
  (by Cabinet)

Chart 4
Options for Decisions

Managed distribution of apportionment contributions between sub-basins
- Norms: Bow: 11.3 cms / S. Sask at Med. Hat: 42.5 cms / Red Deer River at Dickson Dam: 16 cms
- Management options: Within one sub-basin / Between two sub-basins / Among all sub-basins,
- Degree of contribution

Sub-basin independence
Sub-basins should operate independently as much as possible, but managed distribution of apportionment contributions is an option.

Appendix D

Master Agreement on Apportionment
(sections relevant to Alberta)

THIS AGREEMENT is made in quadruplicate this THIRTIETH day of OCTOBER, 1969, A.D.

BETWEEN:

Government of Canada, represented herein by the Minister of Energy, Mines and Resources (Hereinafter called "Canada")

- and -

Government of Alberta, represented herein by the Minister in charge of Water Resources for Alberta (Hereinafter called "Alberta")

- and -

Government of Saskatchewan, represented herein by the Minister in charge of The Water Resources Commission Act of the said Province (Hereinafter called "Saskatchewan")

- and -

Government of Manitoba, represented herein by the Minister in charge of The Water Control and Conservation Branch Act of the said Province (Hereinafter called "Manitoba")

WHEREAS under natural conditions the waters of the watercourses hereinafter referred to arising in or flowing through the Province of Alberta would flow into the Province of Saskatchewan and under the said conditions the waters of some of the said watercourses arising in or flowing through the Province of Saskatchewan would flow into the Province of Manitoba;

AND WHEREAS the Governor-in-Council has authorized Canada to enter into this agreement by Order-in-Council P.C. 1969-8/2051 dated October 29, 1969, and the Lieutenant Governors-in-Council for Alberta, Manitoba and Saskatchewan, respectively, have authorized them to enter into this agreement by the following Orders-in-Council:

- Alberta - O.C. 2053-69
- Manitoba - O.C. 1359/69
- Saskatchewan - O.C. 1612/69

AND WHEREAS the parties hereto deem it to be in their mutual interest that an agreement be reached among the four parties as to the apportionment as described in the schedules attached hereto of such interprovincial waters among the three Provinces;

AND WHEREAS Alberta and Saskatchewan have entered into an agreement, which agreement is attached to this agreement as Schedule A, that permits the Province of Alberta to make a net depletion of one-half the natural flow of water arising in or flowing through the Province of Alberta and that permits the remaining one-half of the natural flow of each such watercourse to flow into the Province of Saskatchewan, subject to certain exceptions as are set forth in the said agreement;

AND WHEREAS Saskatchewan and Manitoba have entered into an agreement which agreement is attached to this agreement as Schedule B, that permits the Province of Saskatchewan to make a net depletion of one-half the natural flow of water arising in, and one-half of the water flowing into the Province of Saskatchewan, and that

permits the remaining one-half of the flow of each such watercourse to flow into the Province of Manitoba, subject to such conditions and agreements as therein contained;

AND WHEREAS the parties are desirous that the Prairie Provinces Water Board (referred to herein as the Board), reconstituted by this agreement will be responsible for the administration of this agreement;

AND WHEREAS the parties hereto recognize the continuing need for consultation and co-operation as between themselves with respect to the matters herein referred to so that the interests of all the parties are best served;

NOW THEREFORE, THIS AGREEMENT (hereinafter known as the Master Agreement) witnesseth that each party agrees as follows:

Interprovincial Agreements

1. Alberta and Saskatchewan agree that the agreement between them (hereinafter called the First Agreement), a copy of which is set out in Schedule A to the Master Agreement, will become binding upon them upon the date that the Master Agreement is executed.

2. Saskatchewan and Manitoba agree that the agreement between them (Hereinafter called the Second Agreement), a copy of which is set out in Schedule B to the Master Agreement, will become binding upon them upon the date that the Master Agreement is executed.

3. The parties agree to the apportionment of water between Alberta and Saskatchewan and Manitoba as provided in the First and Second Agreements and each party agrees to be bound by the said agreements as they relate to apportionment as if it were a party thereto.

4. The parties agree that the First or Second Agreement, or both, may be altered by an agreement in writing among the four parties to the Master Agreement, but not otherwise.

5. The parties agree that the First and Second Agreements will continue in force and effect until cancelled by an agreement in writing among the four parties to the Master Agreement.

Water Quality

6. The parties mutually agree to consider water quality problems; to refer such problems to the Board; and to consider recommendations of the Board thereon.

Groundwater

6.1 The parties mutually agree to consider groundwater matters that have implications affecting transboundary surface and groundwater, to refer such matters to the Board, and to consider recommendations of the Board thereon.

Monitoring

7. The parties agree that the monitoring of the quantity and quality of waters as specified in the First and Second Agreements, the collection, compilation and publication of water quantity and quality data required for the implementation and maintenance of the provisions of this agreement shall be conducted by Canada, subject to provision of funds being voted by the Parliament of Canada.

Administration

8. The parties agree, subject to Clause 9 of this agreement that if at any time, any dispute, difference or question arises between the parties with respect to this agreement or the construction, meaning and effect thereof, or

anything therein, or the rights and liabilities of the parties thereunder or otherwise in respect thereto, then every such dispute, difference or question will be referred for determination to the Federal Court of Canada, Trial Division, under the provisions of the Federal Court Act of Canada and each of the parties hereto agrees to maintain or enact the necessary legislation to provide the Federal Court of Canada with jurisdiction to determine any such dispute, difference, or question in the manner provided under the Federal Court Act of Canada.

9. The parties also agree that the Board, with the consent of the parties in dispute, may cause to be prepared, a factual report of the dispute for consideration by the parties hereto prior to the referral of the dispute to the Federal Court of Canada.

10. The parties agree that the Prairie Provinces Water Board shall monitor and report on the apportionment of waters as set out in the provisions of the First and Second Agreements and ratified by this Master Agreement.

11. The parties agree to revoke the agreement dated July 28, 1948, establishing the Prairie Provinces Water Board and to reconstitute the Prairie Provinces Water Board in the form of Schedule C hereto and the said Schedule shall form and become part of this Master Agreement.

12. Because the Orders-in-Council referred to in Schedule D hereto will become redundant upon the execution of this Master Agreement, the parties agree to take steps to have them revoked.

13.The parties agree for the future application of the provisions of the Master Agreement (and the First and Second Agreements thereunder), to work together and to co-operate to the fullest extent each with the other for the integrated development and use of water and related resources to support economic growth according to selected social goals and priorities and to participate in the formulation and implementation of comprehensive planning and development programs according to their national, regional and provincial interest and importance.

14. No Member of the Parliament of Canada or Member of the Legislative Assemblies of the Provinces party to this agreement shall hold, enjoy, or be admitted to any share or part of any contract, agreement, commission or benefit arising out of this agreement.

IN WITNESS HEREOF Canada has caused its presents to be executed by its Minister of Energy, Mines and Resources, and Alberta has caused its presents to be executed by its Minister in charge of Water Resources, and Saskatchewan has caused its presents to be executed by its Minister in charge of The Water Resources Commission Act, and Manitoba has caused its presents to be executed by its Minister in charge of The Water Control and Conservation Branch Act of the day and year first mentioned above.

A. Davidson
Witness to the signature of the Minister (Energy, Mines and Resources) for Canada
J.J. Greene
Minister (Energy, Mines and Resources) for Canada

October 30, 1969

R.E. Bailey
Witness to the signature of the Minister in charge of Water Resources for Alberta
Henry A. Ruste
Minister in charge of Water Resources for Alberta

October 30, 1969

Harold W. Pope
Witness to the signature of the Minister in charge of The Water Resources Commission Act for Saskatchewan
Allan R. Guy

Minister in charge of The Water Resources Commission Act for Saskatchewan

October 30, 1969

Thomas E. Weber
Witness to the signature of the Minister in charge of The Water Control and Conservation Branch Act for Manitoba
Leonard S. Evans
Minister in charge of The Water Control and Conservation Branch Act for Manitoba

October 30, 1969

4th Recital Clause amended on July 5, 1984
Description of the parties amended April 2, 1992

Section 6.1 amended on April 2, 1992

Schedule A to the Master Agreement on Apportionment

(Apportionment agreement between Alberta and Saskatchewan)

(The following text reflects 1999 amendments)

THIS AGREEMENT is made in quadruplicate this THIRTIETH day of OCTOBER, 1969, A.D.

BETWEEN:

HER Majesty, the Queen, in right of Alberta, represented herein by the Minister in charge of Water Resources for Alberta (Hereinafter called "Alberta")

- and -

HER Majesty, the Queen, in right of Saskatchewan, represented herein by the Minister in charge of The Water Resources Commission Act of the said Province (Hereinafter called "Saskatchewan")

WHEREAS under natural conditions the waters of the watercourses hereinafter referred to arising in or flowing through the Province of Alberta would flow into the Province of Saskatchewan and under the said conditions the waters of some of the said watercourses arising in or flowing through the Province of Saskatchewan would flow into the Province of Manitoba;

AND WHEREAS the parties hereto deem it to be in their mutual interest and in the interest of Manitoba that an agreement in principle be reached among the said three Provinces as to the apportionment of such interprovincial waters among them;

AND WHEREAS the parties hereto are of the opinion that an equitable apportionment of such waters as between the adjoining Provinces of Alberta and Saskatchewan would be to permit the Province of Alberta to make a net depletion of one-half the natural flow of water arising in or flowing through the Province of Alberta and to permit the remaining one-half of the natural flow of water of each such watercourse to flow into the Province of Saskatchewan, subject to certain prior rights as are hereinafter set forth or may hereafter be mutually agreed upon in writing;

AND WHEREAS on the basis of the foregoing apportionment as between the Provinces of Alberta and Saskatchewan the parties hereto are of the opinion that in a similar manner, an equitable apportionment of the remainder of the natural flow of the said watercourses that flow into the Province of Manitoba after permitting the

Province of Alberta to make its depletion of one-half thereof would be to permit the Province of Saskatchewan to make a net depletion of one-half of the said remainder and to permit the other one-half thereof to flow into the Province of Manitoba; and that the natural flow of any tributaries to the said watercourses which tributaries join the said watercourses in the Province of Saskatchewan without arising in or first flowing through the Province of Alberta could be apportioned one-half to the Province of Saskatchewan and one-half to the Province of Manitoba in a manner similar to the apportionment of waters as between the Provinces of Alberta and Saskatchewan, in all cases subject to such prior rights as may be mutually acknowledged by the said Provinces of Manitoba and Saskatchewan;

AND WHEREAS the parties hereto recognize the continuing need for consultation and cooperation as between themselves and with Manitoba with respect to the matters herein referred to so that the best and most beneficial use of the said waters may be made and the interests of all said provinces best served:

NOW THIS AGREEMENT witnesseth as follows:

1. IN THIS AGREEMENT:

(a) "Natural flow" means the quantity of water which would naturally flow in any watercourse had the flow not been affected by human interference or human intervention, excluding any water which is part of the natural flow in Alberta but is not available for the use of Alberta because of the provisions of any international treaty which is binding on Alberta.

(b) “Watercourse” means any river, stream, creek, inter-provincial lake, or other natural channel which, from time to time, carries a flowing body of water from the Province of Alberta to the Province of Saskatchewan, and includes all tributaries of each such river, stream, creek, inter-provincial lake, or other natural channel which do not themselves cross the common boundary between the Provinces of Alberta and Saskatchewan. Such tributaries as do themselves cross the common boundary between the Provinces of Alberta and Saskatchewan shall be deemed to be “watercourses” for the purpose of this agreement.

(c) “Inter-provincial lake” means any lake that is situated on or intersected by the common boundary between the Provinces of Alberta and Saskatchewan which either has no outlet or, if it does have an outlet, drains from time to time into a river, stream, creek, lake, or other natural channel situated in the Province of Saskatchewan, or into a river, stream, creek, lake, or other natural channel situated in Alberta and which carries a flowing body of water from the Province of Alberta to the Province of Saskatchewan.

2.

(a) The parties hereto shall mutually establish a method by which to determine the natural flow of each watercourse flowing across their said common boundary.

(b) For the purpose of this agreement, the said natural flow shall be determined at a point as near as reasonably may be to their said common boundary.

(c) Notwithstanding sub-paragraph (b) the point of which the natural flow of the watercourses known as the South Saskatchewan and Red Deer Rivers is to be determined may be, at the option of Alberta, a point at or as near as reasonably may be below the confluence of the said two rivers.

3.

Alberta shall permit a quantity of water equal to one-half the natural flow of each watercourse to flow into the Province of Saskatchewan, and the actual flow shall be adjusted from time to time on an equitable basis during each calendar year, but this shall not restrict or prohibit Alberta from diverting or consuming any quantity of water from any watercourse provided that Alberta diverts water to which it is entitled of comparable quality from other streams or rivers into such watercourse to meet its commitments to Saskatchewan with respect to each

watercourse.

4.

Notwithstanding paragraph 3 hereof, the following special provisions shall apply as between the parties hereto with respect to the watercourse known as the South Saskatchewan River.

(a) Alberta shall be entitled in each year to consume, or to divert or store for its consumptive use a minimum of 2,100,000 acre-feet net depletion out of the flow of the watercourse known as the South Saskatchewan River even though its share for the said year, as calculated under paragraph 3 hereof, would be less than 2,100,000 acre-feet net depletion, provided however Alberta shall not be entitled to so consume or divert, or store for its consumptive use, more than one-half the natural flow of the said South Saskatchewan watercourse if the effect thereof at any time would be to reduce the actual flow of the said watercourse at the common boundary of the said Provinces of Saskatchewan and Alberta to less than 1,500 cubic feet per second.

(b) The consumption or diversion by Alberta provided for under the preceding sub-paragraph shall be made equitably during each year, depending on the actual flow of water in the said watercourse and the requirements of each Province, from time to time.

5.

The parties hereto shall work together and co-operate to the fullest extent, each with the other, for the most effective, economical and beneficial use of waters flowing from the Province of Alberta into the Province of Saskatchewan, including the construction and operation of approved projects of mutual advantage to our Provinces on a cost-share basis proportionate to the benefits derived therefrom by each Province, (the approval of which projects shall not be unreasonably withheld by either of the parties hereto) and shall enter into such other arrangements, agreements or accords with each other, and with the Governments of Canada and other Provinces to best achieve the principles herein agreed upon.

6.

Notwithstanding paragraph 3 hereof, with respect to each of the three watercourses known as Battle Creek, Lodge Creek, and Middle Creek, the annual flow shall be apportioned such that, in each of the said watercourses, Alberta permits a quantity of water equal to 75 percent of the natural flow to pass the interprovincial boundary from Alberta to Saskatchewan.

7.

If at any time any dispute, difference or question shall arise between the par-ties or their representatives touching this agreement or the construction, meaning and effect thereof, or anything therein, or the rights or liabilities, of the parties or their representatives thereunder or otherwise in respect thereto then every such dispute, difference or question shall be referred for determination to the Federal Court of Canada under the provisions of the Federal Court Act of Canada, and each of the parties hereto agrees to enact the necessary legislation to provide the Federal Court of Canada with jurisdiction to determine any such dispute, difference or question in the manner provided under the Federal Court Act of Canada.

8.

This agreement shall become effective upon the execution of an agreement by Canada, Alberta, Manitoba and Saskatchewan relative to the apportionment of waters referred to in this agreement.

IN WITNESS WHEREOF Alberta has caused these presents to be executed on its behalf by its Minister in charge of Water Resources, and Saskatchewan has caused these presents to be executed by its Minister in charge of The Water Resources Commission Act, both on the day and year first above mentioned.

R.E. Bailey
Witness to the signature of the Minister in charge of Water Resources for Alberta

Henry A. Ruste
Minister in charge of Water Resources for Alberta

Harold W. Pope
Witness to the signature of the Minister in charge of The Water Resources Commission Act

Allan R. Guy
Minister in charge of The Water Resources Commission Act

Section 6 amended on July 5, 1984.

Section 1(b), 1(c) and 7 amended on October 1, 1999.

Note: Schedule B, an apportionment agreement between Saskatchewan and Manitoba is not included here.

Schedule C to the Master Agreement on Apportionment

Prairie Provinces Water Board Agreement describing the composition, functions and duties of the Board.

(The following text reflects 1992 and 1999 amendments)

Prairie Provinces Water Board Agreement

THIS AGREEMENT is made in quadruplicate this THIRTIETH day of OCTOBER, 1969, A.D.

BETWEEN:

THE GOVERNMENT OF CANADA, (hereinafter called "Canada")

- and -

THE GOVERNMENT OF MANITOBA, (hereinafter called "Manitoba")

- and -

THE GOVERNMENT OF SASKATCHEWAN, (hereinafter called "Saskatchewan")

- and -

THE GOVERNMENT OF ALBERTA, (hereinafter called "Alberta")

1.

Manitoba, Saskatchewan, Alberta and Canada agree to establish and there is hereby established a Board to be known as the Prairie Provinces Water Board to consist of five members to be appointed as follows:

(a) two members to be appointed by the Governor General in Council, one of whom shall be Chairman of the Board, on the recommendation of the Minister of Energy, Mines and Resources,

(b) one member to be appointed by the Lieutenant Governor in Council of each of the Provinces of Manitoba, Saskatchewan and Alberta.

2. Functions

The Board shall oversee and report on the Master Agreement (including the First and Second Agreements thereunder) executed by Canada, Alberta, Manitoba and Saskatchewan for the apportionment of waters flowing from one province into another province; shall take under consideration, comprehensive planning, water quality management including the mandate in respect of interprovincial management of water quality described in paragraph 2 of Schedule "E" and other questions pertaining to water resource management referred to it by the parties hereto; shall recommend appropriate action to investigate such matters and shall submit recommendations for their resolution to the parties hereto.

3. Composition of Board

The members of the Board shall be chosen from those engaged in the administration of water resources or related duties for Manitoba, Saskatchewan, Alberta or Canada, as the case may be, and shall serve as members of the Board in addition to their other duties.

4. Duties of the Board

In accordance with its functions, the duties of the Board shall be as follows:

(a) to review, collate, and analyze streamflow data and prepare reports and recommendations on the apportionment of water,

(b) to review water quality problems, particularly such problems located at the interprovincial boundaries, and to recommend to the parties hereto, appropriate management approaches for their resolution including the establishment of new institutional arrangements,

(c) to develop recommendations on other water matters, in addition to problems on water quality, referred to the Board by any party hereto including the review and analysis of existing information and the requesting of additional studies and assistance by appropriate governmental agencies to provide information for formulating its recommendations,

(d) to promote through consultation and the exchange of information the integrated development of water resources of interprovincial streams,

(e) to cause to be prepared with the consent of the parties involved factual reports on disputes arising out of the water apportionment for consideration by the parties hereto,

(f) to ensure the co-ordination of such technical programs as water quantity and quality monitoring and streamflow forecasting required for the effective apportionment of water,

(g) to comply with the list of duties described in paragraph 8 of Schedule E concerning its water quality mandate.

5. Confirmation of the Board's Recommendations

A recommendation of the Board with respect to any matters referred to it under Section 2 shall, subject to the Master Agreement for the apportionment of water, become effective when adopted by Orders-in-Council passed by Canada and each of the Provinces.

6. Authority of Board

The Board shall have authority to correspond with all Governmental organizations and other sources of information in Canada or abroad concerned with the administration of water resources, and such other authority as may be conferred on the Board from time to time by agreement between the parties hereto; all agencies of the four governments having to do with the water and associated resources in the area covered by the Agreement shall be required to supply the Board with all data in their possession requested by the Board.

7. Records

The records relating to the water resources of the three provinces collected and compiled by the Prairie Farm Rehabilitation Administration organization at Regina shall be made available to the Board.

8. Meetings of the Board

The Board shall meet at the call of the Chairman and meetings shall be called at least twice annually; the expenses of the members shall be borne by their respective governments.

9. Reports

The Board shall submit an annual progress report outlining work done and work contemplated in the agreed program to each of the responsible Ministers of the parties hereto and such other reports as may be requested by any one of such Ministers.

10. Operation of the Board

The Executive Director for the Board and such other technical and clerical staff as may be required, shall be Federal or Provincial public servants with office headquarters located in a city within one of the prairie provinces as designated from time to time by the Board. The cost of administration, excluding the cost of monitoring as described in Section 7 of the Master Agreement, but including staff, accommodation, supplies and incidental expenses of the Board, shall be borne by the parties hereto on the basis of one-half by Canada and one-sixth by each of the Provinces. The Board shall prepare, for the approval of the parties hereto, work program, staff requirements, annual budgets and 5 year forecasts and such other reports as may be required for the operation of the Board.

11.

Any water development project already constructed or to be constructed by any one of the parties shall be so operated as to maintain the apportionment of water as set out in the Master Agreement (and the First and Second Agreements thereunder) for the apportionment of waters of interprovincial streams.

Sections 2 and 4(g) amended April 2, 1992

Section 10 amended on October 1, 1999

Schedule D to the Master Agreement on Apportionment

Previous allocations of Interprovincial Waters Approved by Orders-in-Council by the Governments of Canada, Alberta, Manitoba, and Saskatchewan *

Allocation of water for specific projects in Alberta

Order-in-Council			
Canada	Alberta	Saskatchewan	Manitoba
4030/49	857/49	1307/51	1121/49

Allocation of water for specific projects in Saskatchewan

Order-in-Council			
Canada	Alberta	Saskatchewan	Manitoba
1874/51	1091/51	1310/51	1264/51

Allocation of water for South Saskatchewan River Project in Saskatchewan

Order-in-Council			
Canada	Alberta	Saskatchewan	Manitoba
973/53	991/53	1271/53	924/53

* Master Agreement on Apportionment

12. Because the Orders-in-Council referred to in Schedule D hereto will become redundant upon the execution of this Master Agreement, the parties agree to take steps to have them revoked.

Schedule E to the Master Agreement on Apportionment

|Attachment "A" to Schedule E |

Agreement on Water Quality

THIS AGREEMENT made this SECOND day of APRIL, A.D. 1992.

BETWEEN:

The Government of Canada, as represented by the Minister of the Environment, (hereinafter called "Canada")

- and -

The Government of Alberta, as represented by the Minister of the Environment and by the Minister of Federal and Intergovernmental Affairs, (hereinafter called "Alberta")

- and -

The Government of Manitoba, as represented by the Minister of Natural Resources, (hereinafter called "Manitoba")

- and -

The Government of Saskatchewan, as represented by the Minister for the Saskatchewan Water Corporation, (hereinafter called "Saskatchewan").

WHEREAS under natural conditions the waters of the watercourses hereinafter referred to arising in or flowing through the Province of Alberta would flow into the Province of Saskatchewan and under the said conditions the waters of some of the said watercourses arising in or flowing through the Province of Saskatchewan would flow into the Province of Manitoba;

AND WHEREAS the water quality of the said watercourses is important to the social and economic development as well as the environmental and public protection of all of the parties to this Agreement;

AND WHEREAS the parties entered into an agreement dated October 30, 1969, and an Amending Agreement on April 30, 1984, collectively referred to herein as the "Master Agreement", providing for the apportionment of water in watercourses arising in or flowing through the Provinces of Alberta, Saskatchewan, and Manitoba and providing for the reconstitution of the Prairie Provinces Water Board, hereinafter referred to as the "Board", which is responsible for the administration of the Master Agreement;

AND WHEREAS the parties have in paragraph 6 of the Master Agreement agreed to consider water quality problems, to refer such problems to the Board, and to consider recommendations of the Board thereon;

AND WHEREAS, in furtherance of the provisions of paragraph 6 of the Master Agreement, and on the recommendation of the Board, the parties consider it is in their mutual interest that an agreement be entered into on certain water quality objectives for the water in the said watercourses;

AND WHEREAS the parties intend to define the mandate of the Board in respect of interprovincial management of water quality of the said watercourses;

NOW THEREFORE THIS AGREEMENT witnesseth that the parties mutually agree as follows:

DEFINITIONS

1. IN THIS AGREEMENT:

(a) "aquatic environment" means water and the environment containing all living things upon or in water including all bottom substrates and physical, chemical and biological constituents;

(b) "ecosystem" means a system made up of a community of animals, plants and microbes and its interrelated physical and chemical environment;

(c) "interprovincial water quality management" means management of the water in accordance with the water quality objectives agreed to herein by the parties as set out in the Tables referred to in Attachment "A";

(d) "monitoring" means the process of developing plans for the collection of samples from the aquatic environment, conducting analyses and interpretation of data that is provided by Canada pursuant to paragraph 7 of the Master Agreement;

(e) "objective" means a numerical concentration or narrative statement of limit or limits, to a chemical, physical or biological variable within a river reach, that will support and protect uses of water, as such limit or limits are more particularly specified in each of the Tables referred to in Attachment A annexed hereto and forming a part hereof;

(f) "river reach" means each section of a river of a predetermined length that is identified in Attachment A;

(g) "watercourse" means any river, stream, creek, or other natural channel which from time to time carries a flowing body of water from the Province of Alberta to the Province of Saskatchewan, or from the Province of Saskatchewan to the Province of Manitoba, and includes all tributaries of each such river, stream, creek or natural channel which do not themselves cross the common boundary between the Provinces of Alberta, Saskatchewan, and Manitoba. Such tributaries as do themselves cross the said common boundaries between the Provinces of Alberta, Saskatchewan, and Manitoba shall be deemed to be "watercourses" for the purpose of this Agreement.

WATER QUALITY MANDATE

2. The mandate of the Board with respect to water quality in the watercourses shall be to foster and facilitate interprovincial water quality management among the parties that encourages the protection and restoration of the aquatic environment.

WATER QUALITY OBJECTIVES

3. The objectives specified in the Tables that are referred to in Attachment A are considered by the parties to be appropriate and acceptable water quality objectives in each river reach.

4. If the concentration of a chemical, physical or biological variable in a river reach, as a result of human activities, is not within the acceptable limit or limits when compared to the agreed objective for that chemical, physical or biological variable, reasonable and practical measures will be taken by the party in whose jurisdiction the chemical, physical or biological variable originates so that the quality of the water in the river reach is within the acceptable limit or limits.

5. If the concentration of a chemical, physical or biological variable in a river reach is within the acceptable limit or limits when compared to the agreed objective for that chemical, physical or biological variable, and if trend analysis or an assessment of the impact of a proposed development indicates that water quality has been or may be significantly altered within the acceptable limit or limits, the parties shall agree as to the reasonable and practical measures that will be taken by the party in whose jurisdiction the chemical, physical or biological variable originates to endeavour to maintain the water quality in the river reach.

6. The objectives for each river reach should be reviewed on a periodic basis of at least every five (5) years.

7. Attachment "A" hereto and the numbered Tables may be amended, from time to time, by the written agreement of all the Ministers, which amendment shall be effective on the date and year of execution by the Minister last signing.

WATER QUALITY DUTIES OF THE BOARD

8. The duties of the Board with respect to its water quality mandate shall be as follows:

(a) monitoring the quality of the aquatic environment in the river reaches and making comparisons with the objectives established herein;

(b) providing a written report to the parties annually, and from time to time as the Board considers necessary, on the quality of the water in the river reaches, and providing such other reports or information as may be requested by any of the parties to this Agreement;

(c) reviewing the appropriateness of the objectives and making recommendations to the parties based on available water quality data and scientific information;

(d) promoting through consultation and the exchange of information the establishment by the parties of compatible water quality objectives in the Provinces of Alberta, Saskatchewan and Manitoba;

(e) promoting through consultation and the exchange of information a preventive and proactive ecosystem approach to interprovincial water quality management; and

(f) promoting through consultation and the exchange of information the recognition of the interdependence of quality and quantity of water in the management of the watercourses.

9. This Agreement shall take effect on the date and year of execution by the party last signing, and shall continue in full force and effect until termination of the Master Agreement, or upon any of the parties giving one years notice to the other parties of their intention to withdraw from this Agreement.

10. The headings used in this Agreement are for convenience only and are not to be considered a part of this Agreement and do not in any way limit or amplify the terms and provisions of this Agreement.

11. No member of the Parliament of Canada or Member of the Legislative Assemblies of the Provinces party to this Agreement shall hold, enjoy, or be admitted to any share or part of any contract, agreement, commission or benefit arising out of this Agreement.

IN WITNESS WHEREOF Alberta has caused these presents to be executed by the Minister of the Environment and the Minister of Federal and Intergovernmental Affairs, and Manitoba has caused these presents to be executed by the Minister of Natural Resources, and Saskatchewan has caused these presents to be executed by the Minister responsible for the Saskatchewan Water Corporation, and Canada has caused these presents to be executed by the Minister of the Environment, on the day and year first mentioned above.

THE GOVERNMENT OF CANADA

T. Price, Witness per: Jean J. Charest, Minister of the Environment January 23, 1992

THE GOVERNMENT OF ALBERTA

S. Burns, Witness per: Ralph Klein, Minister of the Environment February 21, 1992
Approved Pursuant to the Alberta Department of Federal and Intergovernmental Affairs Act

James D. Horsman, Minister of Federal and Intergovernmental Affairs March 11, 1992

THE GOVERNMENT OF SASKATCHEWAN

J. Samuelson, Witness per: Darrel Cunningham Minister responsible for the Saskatchewan Water Corporation
March 25, 1992

THE GOVERNMENT OF MANITOBA

L.J. Whitney, Witness per: Harry Enns Minister of Natural Resources
April 2, 1992 Date

Attachment "A" To Schedule E

Listing of River Reaches and Reference to Tables of Water Quality Objectives

Table listing Water Quality Reach Objectives			
For River		**Predetermined Length**	**River Reach**
Beaver River		Beaver Crossing to the Border	1
North Saskatchewan River		Lea Park to Lloydminster Ferry	2
Red Deer River A/S		Bindloss to Confluence with the South Saskatchewan River	3
South Saskatchewan River		Highway #41 to Confluence with Red Deer River	4
Battle River		Blackfoot Creek to Unwin	5
Churchill River		Island Falls to Pukatawagan Lake	6
Saskatchewan River		Outlet of Cumberland Lake to Mouth of Carrot river	7
Carrot River		Turnberry to Mouth of Carrot River	8
Red Deer S/M		Etomami River to Red Deer Lake	9
Assiniboine River		Whitesand River to Outlet of Shellmouth Reservoir	10
Qu'Appelle River		Kaposvar Creek to Assiniboine River	11

Water Quality Monitoring Locations and Objectives

Water Quality Objectives

Red Deer River Alberta/Saskatchewan Reach: Bindloss to Confluence with the South Saskatchewan River	
Chemical, Physical or Biological Variable	**Acceptable Limit or Limits**
Arsenic (diss.)	0.05
Barium (total)	1.0
Boron (diss.)	5.0
Cadmium (total)	0.001
Chromium (total)	0.011
Copper (total)	0.004
Fecal Coliform	100/100ml
Fluoride (diss.)	1.5
Iron (diss.)	0.3
Lead (total)	0.007
Manganese (diss.)	0.05
Nickel (total)	0.025
NO_2+NO_3 (as N)	10.0
Selenium (diss.)	0.001
Sulphate (diss.)	500.
Zinc (total)	0.03
Cobalt	1.0
Sar	3.0
Total Diss. Solids	500
Vanadium	0.1
Ammonia (total)	Total Ammonia Nitrogen

Red Deer River Alberta/Saskatchewan Reach: Bindloss to Confluence with the South Saskatchewan River	
Chemical, Physical or Biological Variable	**Acceptable Limit or Limits**
Lindane	0.0001
2,4-D	0.004
2,4,5-TP	0.01
Chlorophenols (total)	0.001
Cyanide (free)	0.005
Mercury in Fish (ug/g)	0.5
PCB in Fish (ug/g)	2.0

Symbols:

- all units are in mg/L unless otherwise noted.

South Saskatchewant River Reach: Highway #41 to confluence with Red Deer River	
Chemical, Physical or Biological Variable	**Acceptable Limit or Limits**
Arsenic (diss.)	0.05
Barium (total)	1.0
Boron (diss.)	5.0
Cadmium (total)	0.001
Chromium (total)	0.011
Copper (total)	0.01
Fecal Coliform	100/100ml
Fluoride (diss.)	1.5
Iron (diss.)	1.0
Lead (total)	0.02
Manganese (diss.)	0.05
Nickel (total)	0.025
NO_2+NO_3 (as N)	10.0
Selenium (diss.)	0.002
Sulphate (diss.)	500.
Zinc (total)	0.05
Cobalt	1.0
Sar	3.0
Total Diss. Solids	500
Vanadium (total)	0.1
Ammonia (total)	Total Ammonia Nitrogen
Lindane	0.0001
2,4-D	0.004

South Saskatchewant River Reach: Highway #41 to confluence with Red Deer River	
Chemical, Physical or Biological Variable	**Acceptable Limit or Limits**
2,4,5-TP	0.01
Chlorophenols (total)	0.001
Cyanide (free)	0.005
Mercury in Fish (ug/g)	0.5
PCB in Fish (ug/g)	2.0

Symbols:

- all units are in mg/L unless otherwise noted.