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PRAIRIE PROVINCES WATER BOARD

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Prairie Provinces Water Board Apportionment Monitoring Assessment Procedure

Prepared for the Prairie Provinces Water Board

By the Committee on Hydrology

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Prairie Provinces Water Board

Apportionment Monitoring Assessment Procedure

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Version Control

This table summarises the changes over the life of this procedure document.

Version	Date	Initiator	Description of Change
V0_?	2016-Feb-xx	COH	COH sub-committee drafted AMAP to be applied during Basin Reviews. Board instructs COH to complete AMAP edits.
V0_??	2018-03-14	COH	AMAP applied as test case to North Saskatchewan River (Appendix A) and Battle River (Appendix B). Board approved the AMAP for application during future basin reviews. Board suggests application of AMAP to a small stream. (COH selected Gainsborough Creek)
V0_J	2024-05-07	COH	Text edits to procedure and appendix to make Appendix C read like Appendices A and B. Appendix C generalized to “test case”. Preliminary analytics posted to unique letter report.
	2024-09-19	COH	Appendix C edits resolved and approved by COH.
	2024-11-XX	Secretariat	Appendix C edits presented to Board.
	2024-11-XX	Board	Board approved AMAP and Appendices

PPWB Apportionment Monitoring Assessment Procedure

Background

Under the Schedule C of the Master Agreement on Apportionment (MAA), the Prairie Provinces Water Board (PPWB) is tasked with overseeing and reporting on the apportionment of transboundary waters that are subject to the MAA. Apportionment monitoring and reporting commenced in its present format in 1970 with results for the South Saskatchewan River published in the PPWB Annual Report. Additional basins have been added since that time, with apportionment for twelve basins currently being reported in the PPWB Annual Report. In addition to annual reporting, three of those basins are also subject to interim apportionment monitoring each year, which is reported for the internal information of the Board. There is one additional basin for which a special apportionment monitoring structure has been established that does not include apportionable flow calculations. For all remaining interprovincial transboundary basins, there is no regular monitoring, reporting or apportionment oversight.

The PPWB Committee on Hydrology (COH) is responsible for making recommendations to the Board regarding apportionment monitoring and apportionable flow calculation procedures, as well as ongoing completion of the apportionment calculations according to the approved methods and schedules. Over time, there have been efforts by the COH and Board to document a rationale or decision-making process to support which transboundary basins should be apportioned or how frequently existing apportioned basins should be monitored. However, due to the combination of technical and non-technical rationale, there has been limited success in this process, and the current level of oversight has been established at the discretion of the Board.

While in theory there could be justification to monitor and report apportionment for all transboundary basins under the terms of the MAA, in practicality the decision to monitor apportionment must be made in the context of costs related to data collection and availability of resources, which are under ongoing pressure. It is proposed that basins will normally be evaluated using the PPWB Apportionment Monitoring Assessment Procedure (the Procedure) as part of the basin review process. However, the Procedure could be applied at any time, and a final classification approved by the Board under a separate internal report. The purpose of this Procedure is to formalize a classification system to evaluate current and potential apportionment monitoring and reporting and support decisions regarding changes in the future. Additionally, the appendices outline three applications of the procedure, serving as illustrative examples.

Classes of Apportionment Monitoring

Apportionment monitoring by the PPWB is categorized into the following five classes:

Class One: No Active Apportionment Monitoring by PPWB

(Currently: Battle River, Big Gully Creek, Eyehill Creek, Beaver River, Antler River, Gainsborough Creek, Gopher/Bosshill Creeks, Graham Creek, Jackson Creek, Stony Creek, Birch River, Swan River, Woody River, Overflowing River, Elm Creek, Carrot River)

- Apportionable flow calculations are not completed by the Secretariat.
- There is limited to no water use or development in the upstream province, or the downstream province has determined apportionment of the basin to be of low concern.
- Apportionable flow calculation procedures, if they do exist for a basin, are not regularly updated.
- The need for apportionment monitoring, and the calculation procedures used, are reviewed if there are significant changes in conditions in the upstream or downstream province.
- Due to previous points, the monitoring data required to complete apportionable flow calculations is not a priority for the PPWB and is not included on the monitoring lists. However, hydrometric data for locations on the interprovincial boundary may be maintained on the hydrometric monitoring list at the request of the PPWB Committee on Water Quality for use in monitoring against PPWB water quality objectives.

Class Two: Monitoring on a Periodic Basis with no External Reporting

(Currently: none)

- Apportionable flow calculations are not routinely completed by the Secretariat.
- From time to time, on a schedule approved by the Board, the COH/Secretariat review conditions in the basin and/or complete an audit of apportionable flow calculations for one or more select years.
- The results of the monitoring review are provided for the information of the Board, but not published externally.
- Apportionable flow calculation procedures are updated on an as needed basis, based on the results of an apportionable flow audit, or at the discretion of the COH based on a change in conditions in the basin.
- The hydrometric stations required to complete the apportionable flow monitoring for these basins are maintained on the PPWB monitoring lists, but with flexibility in terms of the requirement for this data (i.e. in terms of priority relative to other stations and timelines for data availability).

- The number of hydrometric stations and other data points required to complete the Board approved apportionable flow calculation procedures is kept to the minimum required to complete a basic audit of apportionment. Thus, the accuracy of the apportionment calculations may be less than that of a class three or four basin.

Class Three: Monitoring and Reporting on an Annual Basis

(Currently: North Saskatchewan River, Saskatchewan River, Qu'Appelle River, Assiniboine River, Battle Creek, Pipestone Creek, Churchill River, Red Deer River)

- Apportionable flow calculations are completed by the Secretariat on an annual basis.
- Annual apportionment results are approved by the Board and published in the PPWB Annual Report.
- Apportionable flow calculation procedures are updated on a 10-year target review cycle.
- Because the monitoring data required to complete the apportionable flow monitoring for these basins are of high priority on the PPWB monitoring lists, they must be maintained by federal and provincial governments unless exceptions are approved by Board.
- The number of hydrometric stations and other data points required to complete the Board approved apportionable flow calculation is commensurate with the level of accuracy required for each basin but is likely higher than for class two basins.

Class Four: Monitoring and Reporting at Intervals Less than One Year as Approved by the Board

(Currently: South Saskatchewan River, Cold Lake, Lodge Creek, Middle Creek)

- Apportionable flow calculations are completed by the Secretariat at intervals less than one year, as approved by the Board (for example, quarterly, biannually, monthly, etc.).
- Apportionment monitoring results are distributed to the COH as calculations are completed and to the Board either as part of the quarterly report, or more frequently at the discretion of the Board.
- Annual apportionment monitoring results are approved by the Board and published in the PPWB Annual Report.
- Apportionable flow calculation procedures are updated on a 10-year target review cycle, or more frequently at the discretion of the COH due to changes in conditions in the basin.
- The hydrometric stations and weather data required to complete the apportionable flow calculation for these basins is the highest priority on the PPWB monitoring list and must be maintained by federal and provincial governments unless exceptions are approved by the Board.
- The number of hydrometric stations and other data required to complete the Board approved apportionable flow calculation is commensurate with the level of accuracy

required for each basin. The data requirements are likely to be the highest among PPWB monitored basins.

Special Cases: Monitoring as Directed by PPWB/COH for Unique Watersheds

(Currently: Boxelder Creek)

- Apportionable flow monitoring for these basins does not fit into the class one to four apportionment monitoring classification system.
- Due to special situations in these basins, the Board, at the suggestion of the COH, has reached agreement that apportionment will be handled according to special terms. These special terms may relate to how monitoring is handled (e.g., not via traditional apportionable flow calculation), or other special conditions.
- Depending on the agreed upon plan, monitoring data may be required and, if so, those requirements will be included on the PPWB monitoring lists with the same importance as a class two, three or four basins, depending on the specifics of the situation.

Basin Classification Criteria

To ensure both upstream and downstream perspectives are considered when determining the appropriate apportionment monitoring class at the provincial boundary, the assessment process is divided into two components as follows:

Upstream Component

The upstream component consists of quantitative categories that use available data to identify the likelihood that the upstream province could potentially not meet its apportionment obligations under the MAA. If it appears there is a high potential that the upstream province could either not deliver its apportionable flow obligation, or only narrowly deliver its apportionable flow obligation, the basin will then be assigned to one of the two highest classes, class three or four. Basins where the possibility for this to occur is more remote would be assigned class one or two.

The evaluation categories listed in Table 1 will be used to determine which class a basin will be assigned through the upstream assessment. Each basin must be evaluated in each category. The basin will be assigned to the highest class evaluated for any one category. For example, if a basin receives a class three ranking in one category, but only a class two ranking in the remaining categories, it will be assigned an Upstream Classification of class three.

Table 1: Evaluation categories to be applied for the assessment of apportionment classification based on conditions in the upstream province.

	Evaluation Category			
Class	**Level of Use**	**Apportionment History**	**Non-Discretionary Consumptive Use**	**Capacity to Alter Flows**
Four	Annual water use[I] in upstream province exceeds 75% of mean annual entitlement over the period of apportionment record.	In the apportionment record there are instances where the upstream province used 90% or more of entitlement during the apportionment period.	Non-discretionary consumptive use[II] in the upstream province exceeds 25% of mean annual entitlement over the period of apportionment record.	Storage capacity in the upstream province is greater than 80% of mean annual entitlement over the period of apportionment record.
Three	Annual water use[I] in upstream province is 50-75% of mean annual entitlement over the period of apportionment record.	In the apportionment record there are instances where the upstream province used 60-90% of entitlement during the apportionment period.	Non-discretionary consumptive use[II] in the upstream province is 15-25% of mean annual entitlement over the period of apportionment record.	Storage capacity in the upstream province is 70-80% of mean annual entitlement over the period of apportionment record.
Two	Annual water use[I] in upstream province is 25-50% of mean annual entitlement over the period of apportionment record.	In the apportionment record there are instances where the upstream province used 30-60% of entitlement during the apportionment period.	Non-discretionary consumptive use[II] in the upstream province is 5-15% of mean annual entitlement over the period of apportionment record.	Storage capacity in the upstream province is 50-70% of mean annual entitlement over the period of apportionment record.
One	Annual water use[I] in upstream province is less than 25% of mean annual entitlement over the period of apportionment record.	In the apportionment record the upstream province has never used more than 30% of entitlement during the apportionment period.	Non-discretionary consumptive use[II] in the upstream province is less than 5% of mean annual entitlement over the period of apportionment record.	Storage capacity in the upstream province is less than 50% of mean annual entitlement over the period of apportionment record.

[I] Annual water use means the total net depletion licensed by the upstream province in the effective drainage area of the basin. Licensed water use associated with significant storage projects will not be included. Licensed water use associated with small storage projects, such as on farm storage or wildlife projects, will be included.

[II] Non-discretionary consumptive use means the net depletion licensed by the upstream province in the effective drainage area of the basin associated with essential purposes, which may include domestic licences, and unavoidable purposes, essentially evaporation from water bodies.

Downstream Component

The downstream component of the assessment includes both quantitative and qualitative categories. The quantitative portion assesses the current level of use that is supplied directly from the river (on-stream use) in the downstream province. This quantitative assessment is used as a measure of how critical it is for the upstream province to adhere to its obligations under the MAA in order to allow the downstream province to meet its water supply needs.

Additionally, the type of use and sensitivity to changes in the timing of water delivery caused by storage in the upstream province are also considered.

The qualitative portion of the downstream assessment evaluates the importance of a basin in terms of several non-quantifiable, or difficult to quantify, aspects such as the basin significance, level of public/governmental concern, the population that depends on water supply from that basin, and the perception of water availability. Although subjective, the rationale behind the assessment of the qualitative criteria in the downstream assessment shall be documented and subject to the scrutiny of all the PPWB member agencies.

The evaluation categories listed in Table 2 will be used to determine which class a basin will be assigned through the downstream assessment. Each basin must be evaluated in each category. The basin will be assigned to the highest class evaluated for any one category. For example, if a basin receives a class three ranking in one category, but only a class two ranking in the remaining categories, it will be assigned a Downstream Classification of class three.

Table 2: Evaluation categories to be applied for the assessment of apportionment classification based on conditions in the downstream province.

	Evaluation Category				
Class	**Level of Use**	**Non-Discretionary Consumptive Use**	**Timing of Water Availability**	**Significance of Basin**	**Public Perception of Water Availability**
Four	Annual water use[III] in downstream province exceeds 75% of mean annual entitlement over the period of apportionment record.	Non-discretionary consumptive use[IV] in the downstream province exceeds 25% of mean annual entitlement over the period of apportionment record.	Storage or use of water in the upstream province disrupts the flow regime such that it conflicts with the requirements for water in the downstream province.	The basin is very significant[V] to the downstream province.	There has been/is very significant public concern that water use in the upstream province affects water availability in the downstream province.
Three	Annual water use[III] in downstream province is 50-75% of mean annual entitlement over the period of apportionment record.	Non-discretionary consumptive use[IV] in the downstream province is 15-25% of mean annual entitlement over the period of apportionment record.	Storage or use of water in the upstream province has some potential to conflict with the requirements for water in the downstream province.	The basin is significant[V] to the downstream province.	There has been/is some public concern that water use in the upstream province affects water availability in the downstream province.
Two	Annual water use[III] in downstream province is 25-50% of mean annual entitlement over the period of apportionment record.	Non-discretionary consumptive use[IV] in the downstream province is 5-15% of mean annual entitlement over the period of apportionment record.	Storage or use of water in the upstream province has low potential to conflict with the requirements for water in the downstream province.	The basin is moderately significant[V] to the downstream province.	There has been/is very little public concern that water use in the upstream province affects water availability in the downstream province.
One	Annual water use[III] in downstream province is less than 25% of mean annual entitlement over the period of apportionment record.	Non-discretionary consumptive use[IV] in the downstream province is less than 5% of mean annual entitlement over the period of apportionment record.	There is no present or foreseeable conflict between storage or use of water in the upstream province and requirements for water in the downstream province.	The basin is of lesser significance[V] to the downstream province.	There has been/is no public concern that water use in the upstream province affects water availability in the downstream province.

[III] Annual water use means the total on-stream gross depletion licensed in the downstream province. This assumes that the entire gross diversion must be available, in order for the downstream province to utilize its consumptive use (gross diversion minus return flow).

[IV]Non-discretionary consumptive use means the total on-stream gross diversion licensed by the downstream province associated with essential and non-avoidable purposes.

[IV] Significance could be demonstrated by one or more of the following:

- Population in the downstream province depending on the water supply.
- Geographic area in the downstream province that is significantly impacted by water use in the upstream province.
- Contribution of local inflow between the boundary and the downstream confluence relative to inflow from the upstream province.
- Significant associated economic value either current or potential (e.g., irrigation, industry, recreation).
- Significant aquatic habitat values (e.g., species at risk, Ramsar, etc.).

Classification Procedure

Step 1 & 2 - Upstream and Downstream Assessment and Classification

The COH conducts assessments of evaluation categories and determines the Upstream and Downstream Classifications.

Step 3 – Resulting Classification and COH Recommendation to Board

The COH will assign the higher of the two classifications determined in Step 1 & 2 to the basin. This preliminary classification will be considered the COH Classification. The potential designation of a basin into the Special Case classification is also determined in Step 3.

Step 4 -Final Review by Downstream Provincial Board Member ("Final Review by D/S.." in Figure 1)

The Board member for the downstream province will review the COH Classification. The downstream province may choose to recommend the COH Classification to the Board for approval.

The province, at their sole discretion, may also decrease the COH Classification (i.e., recommend the basin be classified as Class 1 instead of Class 4), but cannot increase it. The application of this decision would apply in a situation where one of the evaluation categories in the upstream assessment, or one of the quantitative categories in the downstream assessment, cause a basin to receive a higher classification than what is warranted given the specific circumstances of that basin. This final review step ensures reasonable classification results for each specific situation. If the classification resulting from the downstream province review is changed from the COH Classification, the classification will be considered the Downstream Province Classification.

The downstream province recommends either the COH Classification or the Downstream Province Classification to the Board for approval.

Step 5 – Final Review by Board ("Final Basin Classification 1-4" in Figure 1)

The Board reviews the COH classification and the downstream province recommendation and provides final approval of basin classification. This review step ensures reasonable classification results for each specific situation.

Step 6 – Approval of Calculation Procedures and Schedule

The Board approves the apportionable flow calculation procedures and reporting.

Figure 1 illustrates the assessment process. Through the assessment process, it may be determined that a basin should be designated into the Special Case classification. Assignment to this class must be agreed upon by both the upstream and downstream provinces.

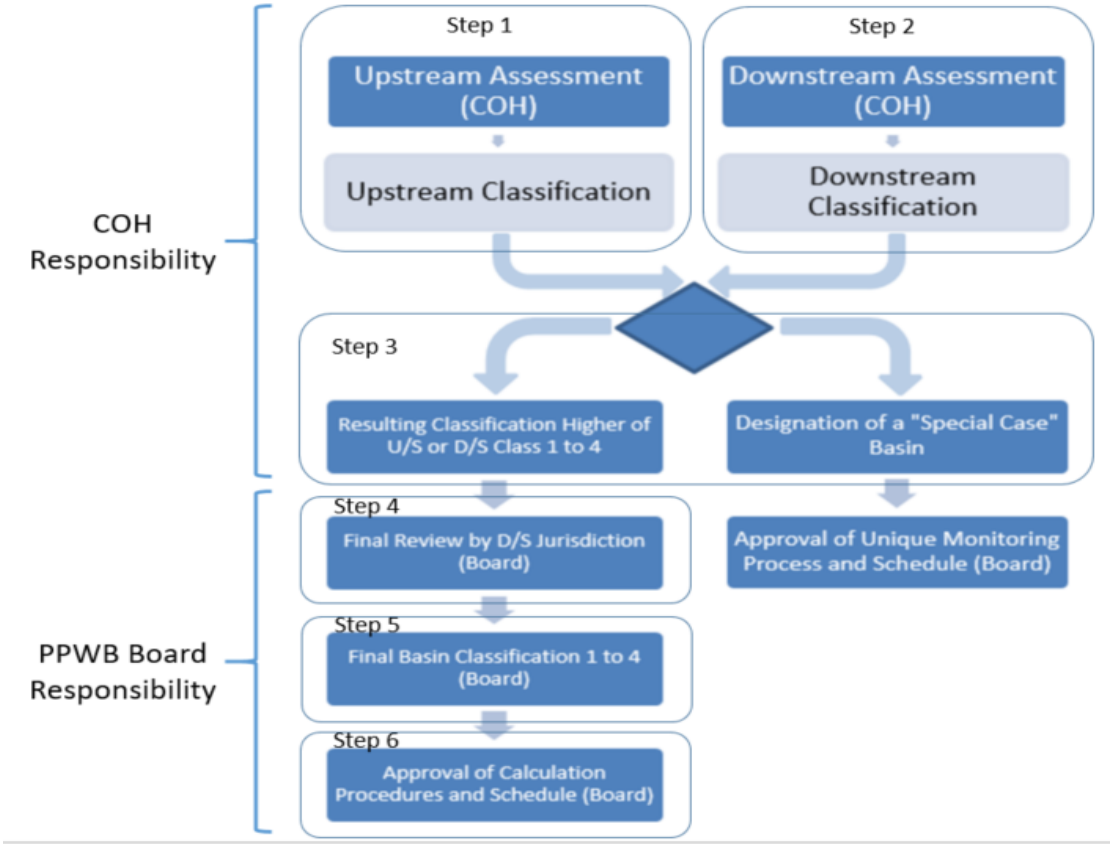


Figure 1: Flow chart showing basin classification procedure. Text left of brackets indicates level of responsibility for each task.

Consideration of Anticipated Future Development

The assessment of categories in Table 1 and 2 will be completed in terms of present conditions within the basin and the current Board approved apportionable flow calculation procedures. However, as part of the assessment process consideration may be given to anticipated future development in both the upstream and downstream provinces. The potential for development will be evaluated by each province based on their knowledge of development activities occurring in the basin and the impact those developments will likely have in terms of the assessment criteria, and this will be documented as part of the assessment process. For example, if a downstream province is aware of a proposed development that could be affected by water availability this may be considered within their assessment of the Significance of Basin category.

The reasonableness of such considerations will be confirmed by the COH as part of their assessment in Step 1 and Step 2. If the proposed development is expected to occur further in the future the COH may recommend to the Board that the basin be re-evaluated should the development proceed.

Limitations Due to Data Availability

In some situations, the information required to complete the assessment of one or more of the categories in Table 1 or 2 may not be available or may be dated. In such situations, the COH will have discretion to modify an assessment category, while in their judgement maintaining the intent of that category, based on the information that is available. Alternatively, the COH may elect to omit a category from either of the assessments. Such change to the above noted procedures must be approved by the COH and documented in the minutes of the Committee. The rationale to support any adjustment to the assessment process will be provided in the documentation of the assessment.

Documentation of Basin Classification

The assessment process for each basin will be documented in a short report, which provides the details for each of the evaluation categories for the upstream and downstream components. The report will also provide the dates on which the resulting assessment was recommended to the Board for approval by the COH and when it was approved by the Board, including reference to the minute documenting each decision. The final classification document will be maintained by the Secretariat in the records of the Board for internal use by the members of the PPWB and included as a component of the published basin review reports for each river basin.

Assignment of Responsibilities

The COH is responsible for overseeing completion of the upstream and downstream components of the classification assessment. Official motions of the COH will be required to recommend the results of the assessment to the Board for approval. The upstream and downstream provinces are responsible for providing any information needed to accurately complete the assessment.

The Board is responsible to assign the final review to the Board member for the downstream province to complete based on internal consultations within their province. Once the downstream province has completed their review, the Board will provide final approval of the basin classification.

The Board also approves the apportionable flow calculation procedures and reporting schedule for each basin.

The Apportionment Monitoring Assessment Procedure will be reviewed and updated concurrent with the Basin Review cycle or at any time at the discretion of the Board.

Appendix A

PPWB Apportionment Monitoring Assessment Test Application for the North Saskatchewan River at the Alberta/Saskatchewan Boundary (2017)

The purpose of this appendix is to demonstrate the application of the proposed PPWB Apportionment Monitoring Assessment Procedure to the North Saskatchewan River at the Alberta/Saskatchewan boundary (as measured at the hydrometric station near Deer Creek, SK).

In order to complete the evaluation as laid out in the PPWB Apportionment Monitoring Assessment Procedure information about the historical apportionable and recorded flows and current water use must be considered. Apportionment for the North Saskatchewan River is currently monitored on an annual basis. The calculation procedures used are those set out in PPWB Report #172 *Basin Review Calculation of Apportionable Flow for the North Saskatchewan River at the Alberta/Saskatchewan Interprovincial Boundary* dated December 2015. The apportionable flow record for the North Saskatchewan River is shown in Table 3 below. On an annual basis Alberta has historically delivered close to, or greater than, one hundred percent of the apportionable flow since apportionment monitoring began. The Apportionment Monitoring Assessment Procedure uses the mean annual apportionable flow to evaluate several of the categories. The mean annual apportionable flow for the North Saskatchewan River for the apportionment period of record from 1979 to 2016 is 6,740,000 dam^3. The annual flow varies through the record with a minimum and maximum annual apportionable flow of 4,580,000 dam^3 and 9,520,000 dam^3, respectively.

Assessment Step 1: Upstream Assessment and Classification

The following categories were assessed based on conditions in the North Saskatchewan River basin in Alberta, following the PPWB Apportionment Monitoring Assessment Procedure.

Level of Use

The Level of Use category compares the annual water use in the upstream province to that province's mean entitlement over the period of record, in this case is 50% of 6,740,000 dam^3 or 3,370,000 dam^3. Annual water use is defined as the sum of net depletions licensed by the province, not including licences associated with large storage projects.

As part of the 2015 North Saskatchewan River basin review study the licensed consumptive uses in the basin were reviewed to determine how they should be incorporated into the apportionable flow calculation. At the time of that review there were 15,653 licences issued in the North Saskatchewan basin in Alberta, with 14,854 of those having an associated consumptive use (i.e., allocation minus losses and return). The total licensed consumptive use at that time was 295,991 dam^3. The licences for Brazeau Reservoir and Lake Abraham are both assigned zero consumptive use.

Calculation:

Level of Use = 295,991 dam^3/3,370,000 dam^3 = 9%

Assessment:

Class 1: The annual water use in the upstream province is less than 25% of that province's entitlement in an average year.

Apportionment History

The Apportionment History category uses the apportionment record to determine how close the upstream province has been in the past to utilizing its share of the apportionable flow (Mean Entitlement). The apportionment period of record for the North Saskatchewan River at the Alberta/Saskatchewan boundary is shown in Table 4 below. The lowest percent of apportionable flow delivered from 1979 to 2016 was in 2015 when 5,700,000 dam^3 of the 6,000,000 dam^3 apportionable flow was delivered. This was also the first year the new calculation procedures were implemented. Until 2015 only the two reservoir storage projects were included in the apportionable flow calculation, so the delivery each year varied only by the storage carry over from year to year.

Calculation:

Maximum Historical Use = 300,000 dam^3/3,000,000 dam^3 = 10% of entitlement

Assessment:

Class 1: In the apportionment record the upstream province has never consumed more than 30% of its entitlement.

Non-Discretionary Consumptive Use

The Non-Discretionary Consumptive Use category considers the essential (e.g., domestic) and unavoidable (e.g., evaporation) water uses in the upstream province against its mean entitlement over the period of apportionment record. In the case of the North Saskatchewan River, non-discretionary use in Alberta has been assumed to include evaporation from Brazeau Reservoir and Lake Abraham, municipal consumption, registry licences, as well as cooling water, stock watering, feedlot, wetland, wildlife, and fishery licences, as well as licences associated with lake stabilization where there is no outflow control. This results in 14,516 licences with a total net licensed volume of 204,195 dam^3 being considered, most of which are Registry licences (13,941). The average estimated total reservoir evaporation from 1979 to 2016 from the two reservoirs is 5300 dam^3 per year as shown in Table 1 below.

Table 1 Non-Discretionary Consumptive Use

Licence Category	Number of Licences	Net Licensed Volume, dam^3
Cooling	23	154,356
Community Water Supply + Other Municipal	12	57
Urban Water Supply	25	42,719
Feedlot	2	136
Fishery	17	251
Stock watering	415	2154
Wetlands	80	5446
Wildlife	4	26
Stabilization	49	11,444
Registry	13,941	4312
Reservoir Evaporation	-	5300
Total	14,568	226,200

Calculation:

Non-Discretionary Consumptive Use = 226,200 dam^3/3,370,000 dam^3 = 7%

Assessment:

Class 2: Non-Discretionary consumptive use is between 5% and 15% of the upstream provinces mean annual entitlement for the period of record.

Capacity to Alter Flows

The Capacity to Alter Flows category is intended to measure the ability of the upstream province to store water, which may contribute significantly to their ability to consume their apportioned share of flow or alter the timing of delivery to the downstream province (equitability of apportionment). This is measured as the storage in the upstream province divided by the mean upstream entitlement for the period of apportionment record available.

In the case of the North Saskatchewan River basin there are two reservoirs located within the basin in Alberta, Lake Abraham and Brazeau Reservoir. The storage capacity of the reservoirs is 1,409,900 dam^3 and 486,300 dam^3, respectively, giving a total storage capacity of 1,896,200 dam^3.

Typically, water is stored in Lake Abraham from June to September and then gradually released through the remainder of the year. The maximum volume stored during the apportionment record was 1,250,000 dam^3 in 1999, however the net storage change in that same year was less than 20,000 dam^3. Similarly, for Brazeau Reservoir water is typically stored from April to September each year. The

maximum stored volume in one year during the apportionment record was 472,000 dam^3 in 1986, however in this same year the total net change in storage was less than 100,000 dam^3. Storage operations in the North Saskatchewan normally follow this pattern, however the purpose of this category is to measure the capacity or maximum potential, not the typical operation.

Calculation:

Capacity to Alter Flow = 1,896,200 dam^3/3,370,000 dam^3 = 56%

Assessment:

Class 2: Storage capacity in the upstream province is between 50-70% of that province's mean annual entitlement over the period of record.

Assessment Step 2: Downstream Assessment and Classification

The following categories were assessed based on conditions in the North Saskatchewan River basin in Saskatchewan, following the PPWB Apportionment Monitoring Assessment Procedure:

Level of Use

Similar to the upstream category, the downstream Level of Use category compares the annual water use in the downstream province to that province's mean entitlement for the period of apportionment record available. Annual water use in this case is defined as the on-stream gross diversion licensed by the downstream province.

In 2017 the PPWB completed a basin review for the Saskatchewan River at the Saskatchewan/Manitoba boundary. The basin review analyzed licensed consumptive use in the Saskatchewan River basin to determine how these uses should be accounted for in the apportionable flow calculation. At that time Saskatchewan had issued 607 licences in the effective drainage area of the North Saskatchewan River basin, with 47 of those licences described as using the North Saskatchewan River as their source. The total gross diversion associated with these licences is 62,500 dam^3.

Calculation:

Level of Use = 62,500 dam^3/3,370,000 dam^3 = 2%

Assessment:

Class 1: The typical annual water use in the downstream province is less than 30% of mean entitlement over the period of record.

Non-Discretionary Consumptive Use

The Non-Discretionary Consumptive Use category considers the essential (e.g., domestic) and unavoidable (e.g., evaporation) water uses in the downstream province against the provinces mean annual entitlement over the period of record. In this case, the water use is defined as the on-stream total licensed gross diversion volume.

Of the 47 licences mentioned in the Downstream Level of Use category that list their source as the North Saskatchewan River the following nine could be considered as non-discretionary demands: six municipal (20,200 dam^3), two domestic (188 dam^3), and one livestock watering (231 dam^3). The remaining licences are related primarily to irrigation.

Calculation:

Non-Discretionary Consumptive Use = 20,600 dam^3/3,370,000 dam^3 = 0.6%

Assessment:

Class 1: Non-discretionary consumptive use is less than 5% of the downstream province's mean annual entitlement over the period of record.

Timing of Water Availability

The Timing of Water Availability category evaluates whether the pattern of storage or use of water in the upstream province has negative implications in the downstream province. For example, if the upstream province stores or uses more water at a time when the downstream province needs or wants it for their own purposes. Although they may be receiving their share of the apportioned water over the year, the pattern of delivery from the upstream province impedes their use of the resource.

The 2015 Basin Review report notes that when examined on a monthly basis there have been a few instances in the historical record where upstream storage has caused the flow delivered to be close to or just under 50% of the apportionable flow on a monthly basis. On average however, the percentages of apportionable flow delivered are greater than 50%, including for the months where storage is occurring upstream, as shown in Table 3. Even with the addition of other consumptive uses that were previously ignored in the calculation procedure, Saskatchewan would still have likely received its full entitlement on a monthly basis almost all the time. Currently Saskatchewan has limited development in the North Saskatchewan River Basin and there are no existing or proposed water demands that are restricted by the timing of water availability.

Assessment:

Class 2: Storage or use of water in the upstream province has low potential to conflict with the requirements for water in the downstream province. *(Note: As this is a test case, the assessment reasoning was assumed and SK was NOT consulted)*

Significance of Basin

The Significance of Basin category is meant to be a qualitative assessment of the importance of the water supply in the basin to the downstream province. The North Saskatchewan River is the second largest inflow into Saskatchewan. Although it is located in a relatively sparsely populated part of the province and its use so far been relatively limited, it is of great significance to the province and contributes to hydropower generation and ecological services on the Saskatchewan River below its confluence with the South Saskatchewan River.

Assessment:

Class 4: The basin is very significant to the downstream province in terms of water supply and development. (*Note: As this is a test case only, this assessment was assumed, and SK was NOT consulted)*

Public Perception of Water Availability

This purpose of the Public Perception of Water Availability category is to account for any present, or historic concerns of the public, local or provincial government, or other interest groups with respect to the upstream province negatively affecting the availability of water in the downstream province. The category accounts for the fact that there may be other reasons to actively monitor apportionment in a basin, such as public transparency and accountability that are not captured in the other needs-based assessment categories.

The Saskatchewan Water Security Agency rarely, if ever, receives complaints or inquiries about water availability from the North Saskatchewan River related to water use in Alberta affecting users in Saskatchewan. There are no other indications of public concern.

Assessment:

Class 2: There has been/is very little public concern that water use in the upstream province affects water availability in the downstream province. *(Note: As this is a test case only, this assessment was assumed, and SK was NOT consulted)*

Assessment Step 3: Resulting Classification and COH Recommendation to Board

The following table summarizes the results of the assessment for the North Saskatchewan River at the Alberta/Saskatchewan boundary:

Table 2 Classification Assessment

Upstream Assessment					
Assessment Category	Level of Use	Apportionment History	Non-Discretionary Consumptive Use	Capacity to Alter Flow	
Result	Class 1	Class 1	Class 2	Class 2	
Downstream Assessment					
Assessment Category	Level of Use	Non-Discretionary Consumptive Use	Timing of Water Availability	Significance of Basin	Public Perception of Water Availability
Result	Class 1	Class 1	Class 2	Class 4	Class 2

The highest classification obtained through the assessment process is a Class 4 ranking, resulting in a preliminary classification for the North Saskatchewan River of Class 4.

Saskatchewan, as the downstream Province, reviews the COH Classification and recommends a Downstream Province Classification based on current conditions of the basin. For example, in this test case, Saskatchewan could determine that the North Saskatchewan River should be decreased to a Class 3 ranking. (*Note: As this is a test case only, SK was NOT consulted*)

The COH reviews the apportionment classification results for the North Saskatchewan River at their meeting XX and recommends the results for approval by the Board. This is documented in meeting minutes (i.e., COH Minute XX-XX).

(Note: As this is a test case, the COH has not yet discussed this assessment nor recommended it for approval.)

Assessment Step 4: Final Review by Downstream Provincial Board Member

The PPWB Board Member reviews the COH Classification results for the North Saskatchewan River and recommends the results for approval by the Board. This recommendation is noted in Board meeting minutes (i.e., PPWB Minute XX-XX).

(Note: As this is a test case, the Board member has not reviewed nor recommended it for approval.)

Assessment Step 5: Final Review by Board

The PPWB Board reviews the apportionment classification results and jurisdiction recommendation for the North Saskatchewan River. This discussion is documented in Board meeting minutes (i.e., PPWB Minute XX-XX).

(Note: As this is a test case, the Board has not reviewed nor recommended it for approval.)

Assessment Step 6: Board Approval

The PPWB approves the assessment of the North Saskatchewan River as Class 3 according to the terms of the PPWB Apportionment Monitoring Assessment Procedure. Monitoring and reporting of apportionment for this basin will be completed on an annual basis (i.e., PPWB Minute XX-XX).

(Note: As this is a test case, the Board has not yet approved this assessment, nor outlined a monitoring schedule.)??

Table 3 Historical annual recorded and apportionable flows for the North Saskatchewan River

Year	Recorded Flow, dam^3	Apportionable Flow, dam^3	% Apportionable Flow Delivered
1979	5,520,000	5,440,000	101%
1980	8,370,000	8,230,000	102%
1981	7,720,000	7,800,000	99%
1982	7,310,000	7,470,000	98%
1983	5,830,000	5,640,000	103%
1984	5,020,000	4,960,000	101%
1985	5,890,000	5,750,000	102%
1986	8,940,000	8,930,000	100%
1987	5,410,000	5,360,000	101%
1988	4,790,000	4,710,000	102%
1989	7,190,000	7,290,000	99%
1990	8,950,000	8,950,000	100%
1991	8,400,000	8,320,000	101%
1992	5,590,000	5,480,000	102%
1993	6,300,000	6,360,000	99%
1994	5,990,000	5,930,000	101%
1995	7,270,000	7,430,000	98%
1996	6,860,000	6,910,000	99%
1997	6,980,000	7,090,000	98%
1998	7,660,000	7,650,000	100%
1999	8,360,000	8,280,000	101%
2000	5,710,000	5,750,000	99%
2001	4,880,000	4,710,000	104%
2002	4,840,000	4,840,000	100%
2003	6,100,000	6,030,000	101%
2004	5,620,000	5,780,000	97%
2005	9,520,000	9,520,000	100%
2006	5,630,000	5,490,000	103%
2007	7,650,000	7,680,000	100%
2008	7,020,000	6,910,000	102%
2009	4,700,000	4,580,000	103%
2010	5,820,000	5,990,000	97%
2011	8,450,000	8,450,000	100%
2012	7,960,000	7,860,000	101%
2013	8,190,000	8,210,000	100%
2014	7,400,000	7,450,000	99%
2015	5,700,000	6,000,000	95%
2016	6,820,000	7,000,000	97%
Average	6,750,000	6,740,000	100%

Table 4 Evaporation estimates for reservoirs in the North Saskatchewan River basin based on long term average gross evaporation and recorded annual precipitation.

Year	Annual Total Evaporation Brazeau, dam^3	Annual Total Evaporation Abraham, dam^3	Annual Total Evaporation, dam^3
1979	6265	9273	15539
1980	-1644	-1377	-3021
1981	-519	-2721	-3241
1982	-2246	1960	-286
1983	4390	6424	10815
1984	1632	3103	4735
1985	-2342	1015	-1327
1986	-3887	1189	-2698
1987	3158	2095	5253
1988	2993	6081	9074
1989	-1844	681	-1162
1990	197	-212	-15
1991	-688	-1408	-2096
1992	2712	2104	4817
1993	1332	-2958	-1625
1994	3577	4424	8000
1995	-1360	-2468	-3828
1996	3763	7410	11172
1997	2570	6144	8714
1998	150	2953	3103
1999	3314	1843	5157
2000	2739	7243	9982
2001	4915	5310	10225
2002	5810	-1200	4610
2003	5654	6880	12534
2004	-1499	-262	-1761
2005	-1617	-3342	-4959
2006	-834	3125	2291
2007	2122	6822	8944
2008	5409	4666	10075
2009	4316	7197	11513
2010	2332	6307	8638
2011	2788	8413	11202
2012	4136	7174	11311
2013	4676	3116	7791
2014	5636	10187	15824
2015	3233	6225	9458
2016	446	6763	7209
		Average	5315

Table 5 Average and minimum percent of monthly apportionable flow delivered based 1979 to 2016

Month	Average	Minimum
Jan	514%	222%
Feb	394%	215%
Mar	278%	152%
Apr	140%	114%
May	98%	72%
Jun	71%	50%
Jul	65%	48%
Aug	62%	48%
Sep	75%	62%
Oct	108%	87%
Nov	184%	132%
Dec	375%	198%

Appendix B

PPWB Apportionment Monitoring Assessment Test Application for the Battle River at the Alberta/Saskatchewan Boundary (2017)

The purpose of this appendix is to demonstrate the application of the proposed PPWB Apportionment Monitoring Assessment Procedure to Battle River at the Alberta/Saskatchewan boundary.

In order to complete the evaluation as laid out in the PPWB Apportionment Monitoring Assessment Procedure information about the historical apportionable and recorded flows and current water use must be considered. The Battle River is not currently subject to apportionment monitoring, however, the PPWB has published two reports studying the basin. The first, PPWB technical report number 64 *Battle River at Alberta-Saskatchewan Boundary Natural Flow* was published in 1982 and contains annual naturalized flows for the period from 1912 to 1979. The second, PPWB technical report number 168, *Battle River at Saskatchewan/Alberta Boundary Natural Flow Update 1980 to 2004,* was published in 2008. This report contains annual naturalized flows for the period from 1980 to 2004. In 2011 Alberta Environment and Parks extended the natural flow series for the period from 2005 to 2009, however this report was done independent of the PPWB. The combined natural flow record for the Battle River is shown in Table 3.

The reports cited above use the term "natural flow" to describe the flow that would have existed prior to storage development and diversions. Since the date of these reports, the PPWB has adopted the convention of using "apportionable flow" to **represent** natural flow. Apportionable flow is calculated based on methodology accepted by the PPWB for use in interprovincial apportionment.

On an annual basis Alberta has historically delivered more than fifty percent of the apportionable flow volume to Saskatchewan. The lowest percent delivery was in 2002 when 54% of the apportionable flow was passed to Saskatchewan. The Apportionment Monitoring Assessment Procedure uses the mean annual apportionable flow to evaluate several of the categories. The mean annual apportionable flow for the Battle River for the period from 1912 to 2009 is 266,000 dam^3. The annual flow varies widely through the record with a minimum and maximum annual apportionable flow of 43,300 dam^3 and 1,283,000 dam^3, respectively.

Assessment Step 1: Upstream Classification

The following categories were assessed based on conditions in the Battle River basin in Alberta, as per the PPWB Apportionment Monitoring Assessment Procedure:

Level of Use

The Level of Use category compares the annual water use in the upstream jurisdiction to that province's mean entitlement over the period of record, which in the case of the Battle River is 133,000 dam^3. Annual water use is defined as the sum of net depletions licensed by the province, not including licences associated with large storage projects.

Alberta reviewed their database and determined that there are currently 6135 water use licences in the effective drainage area of the Battle River with a total licensed net consumptive use of 45,870 dam^3. In the Alberta portion of the Battle River basin there are several water bodies with some form of outlet control. Three of these, Driedmeat Lake, Ribstone Lake and Pigeon Lake are not considered in the apportionable flow calculation as the control structures have not increased the water surface area and their impact on the natural flow of the river (either because of the type of structure or the way they are operated), have been deemed insignificant. The Atco Power Reservoir (also known as Forestburg Reservoir, or Battle River Reservoir) and Coal Lake (located on Pipestone Creek) are specifically addressed in the apportionable flow calculations.

Calculation:

Level of Use = 45,870 dam^3/133,000 dam^3 = 34%

Assessment:

Class 2: The typical annual water use in the upstream jurisdiction is between 25% and 50% of that province's entitlement in an average year.

Apportionment History

The Apportionment History category uses the apportionment record to determine how close the upstream jurisdiction has been in the past to utilizing its share of the apportionable flow. The apportionment record for the Battle River at the Alberta/Saskatchewan boundary is shown in Table 3. The lowest percent of apportionable flow delivered from 1912 to 2009 was in 2002 when 43,700 dam^3 of the 80,900 dam^3 apportionable flow was delivered.

Calculation:

Maximum Historical Use = 37,200 dam^3/40,450 dam^3 = 92% of entitlement

Assessment:

Class 4: In the apportionment record there are instances where the upstream jurisdiction used 90% or more of its entitlement during the apportionment period.

Non-Discretionary Consumptive Use

The Non-Discretionary Consumptive Use category considers the essential (e.g., domestic) and unavoidable (e.g., evaporation) water uses in the upstream province against its mean entitlement over the period of apportionment record. In the case of the Battle River non-discretionary use in Alberta has been assumed to include urban use, community water use, cooling water, feedlot, stock watering, wetlands, wildlife, registry, and fishery licences, as well as licences associated with lake stabilization. Reservoir evaporation losses are included in the apportionable flow calculation for Atco Reservoir and Coal Lake, and those would also be included in the non-discretionary consumptive use estimate (*Note: not yet included in this test case*).

Table 1 Non-Discretionary Consumptive Use

Licence Category	Number of Licences	Net Licensed Volume, dam^3
Cooling	3	13,741
Community Water Supply + Other Municipal	4	968
Urban Water Supply	9	2127
Feedlot	4	201
Fishery	9	157
Stock watering	408	1982
Wetlands	53	5569
Wildlife	3	376
Registry	5309	1602
Lake Stabilization	15	5100
Reservoir Evaporation	?	?
Total	5817	31,823

Calculation:

Non-Discretionary Consumptive Use = 31,823 dam^3/133,000 dam^3 = 24% of entitlement

Assessment:

Class 3: Non-Discretionary Consumptive use in the upstream province is 15-25% of that province's mean entitlement over the period of apportionment record.

Capacity to Alter Flows

The Capacity to Alter Flows category is intended to measure the ability of the upstream jurisdiction to store water, which may contribute significantly to their ability to consume their apportioned share of flow or alter the timing of delivery to the downstream jurisdiction (equitability of apportionment). The proposed measure is the total storage in the upstream jurisdiction divided by the mean upstream entitlement for the period of apportionment record available.

In the case of the Battle River basin there are two reservoirs located within the basin in Alberta which are considered to affect the natural flow of the river: Coal Lake, located on Pipestone Creek, and the Atco Power Reservoir. The storage capacities of the reservoirs are 42,700 dam^3 and 10,500 dam^3, respectively, giving a total storage capacity of 53,200 dam^3. (*Note: volumes are rough estimates for this test case.*)

Calculation:

Capacity to Alter Flow = 53,200 dam^3/133,000 dam^3 = 40%

Assessment:

Class 1: Storage capacity in the upstream jurisdiction is less than 50% of its mean entitlement over the period of record.

Assessment Step 2: Downstream Classification

The following categories were assessed based on conditions in the Battle River basin in Saskatchewan, as per the PPWB Apportionment Monitoring Assessment Procedure:

Level of Use

Similar to the upstream category, the downstream Level of Use category compares the annual water use in the downstream jurisdiction to that jurisdiction's mean annual entitlement. Annual water use in this case is defined as the on-stream gross diversion licensed by the downstream province.

In 2017 the PPWB completed a basin review for the Saskatchewan River at the Saskatchewan/Manitoba boundary and reviewed the database of water use licences to determine how these water uses should be accounted for in the apportionable flow calculation. At that time Saskatchewan had 123 licences in their database that were in the effective drainage area of the Battle River basin, of those 14 were listed as using the Battle River as their source. There were a further five licences with a supply listed as 'Watercourse' but no supply name. One of these licences had the same location and licensee name as two of the licences sourced from the Battle River, so it was assumed the supply was also directly from the Battle River. The other four licences with unnamed supply were for small volumes which for conservatism will also be assumed to be sourced directly from the Battle River. Of these 19 licences 13 were listed with a purpose of irrigation, one industrial (oil recovery) and five domestic users. The total licensed gross diversion was 2,892 dam^3.

Calculation:

Level of Use = 2,892 dam^3/133,000 dam^3= 2%

Assessment:

Class 1: The typical annual water use in the downstream jurisdiction is less than 30% of the mean annual entitlement.

Non-Discretionary Consumptive Use

The Non-Discretionary Consumptive Use category considers the essential (e.g., domestic) and unavoidable (e.g., evaporation) water uses in the downstream province against the province's mean annual entitlement over the period of record. In this case, the water use is defined as the on-stream total licensed gross diversion volume.

Of the licences noted in the Level of Use category, the only water uses considered non-discretionary are associated with the five domestic licences, which have a total allocated gross diversion allocation of 61 dam^3.

Calculation:

Non-Discretionary Consumptive Use =61 dam^3/133,000 dam^3= <1%

Assessment:

Class 1: The non-discretionary consumptive use is less than 5% of the downstream provinces mean annual entitlement over the period of record.

Timing of Water Availability

The Timing of Water Availability category evaluates whether the pattern of storage or use of water in the upstream jurisdiction has negative implications in the downstream jurisdiction. For example, if the upstream jurisdiction stores or uses more water at a time when the downstream jurisdiction needs or wants it for their own purposes. Although they may be receiving their share of the apportioned water over the long term, the pattern of delivery from the upstream province impedes their use of the resource.

For the 2005-2009 Natural Flow Study done by AEP the apportionable flows were calculated on a weekly basis, this allows examination of the distribution of the apportionable flow through the year. In 2009, the annual delivery was 61% of the apportionable flow. On a weekly basis there were 19 weeks that year when the delivery was less than 50%, with the lowest weekly percent delivery being 23%. However, in terms of cumulative apportionment delivery, there were only four weeks where the cumulative balance to Saskatchewan was less than 50%. In the other years from 2005-2009 the apportionment balance was positive for all weeks.

There is little development in the Battle River basin in Saskatchewan with only a few licensed users relying on the river for their water supply.

Assessment:

Class 2: Storage or use of water in the upstream jurisdiction has low potential to conflict with the requirements for water in the downstream jurisdiction.

Significance of Basin

The Significance of Basin category is meant to be a qualitative assessment of the importance of the water supply in the basin to the downstream province. The gross drainage area of the Battle River at the Saskatchewan Boundary is 25,032 km^2. The gross drainage area of the Battle River at the confluence with the North Saskatchewan River is 45,522 km^2. This gives a gross drainage area of the Battle River in Saskatchewan of 20,490 km^2. Because of its close proximity to the North Saskatchewan River (which serves as a key water supply), the Battle River is not a key water supply source for Saskatchewan and there is limited potential for development within the Saskatchewan portion of the basin.

Assessment:

Class 1: The basin is of lesser significance to the downstream jurisdiction.

(*Note: As this is a test case only, this assessment was assumed, and SK was NOT consulted*)

Public Perception of Water Availability

This purpose of the Public Perception of Water Availability category is to account for any present or historical concerns of the general population with respect to the upstream jurisdiction negatively affecting the availability of water in the downstream jurisdiction. The category accounts for the fact that there may be other reasons to actively monitor apportionment in a basin, such as public transparency and accountability, which are not captured in the other assessment categories.

Assessment:

Class 1: There has been/is no public concern that water use in the upstream jurisdiction affects water availability in the downstream jurisdiction.

(*Note: As this is a test case only, this assessment was assumed, and SK was NOT consulted*)

Assessment Step 3: Resulting Classification and COH Recommendation to Board

The following table summarizes the results of the assessment for the Battle River at the Alberta/Saskatchewan boundary:

Table 6 Classification Assessment

Upstream Assessment				
Assessment Category	Level of Use	Apportionment History	Non-Discretionary Consumptive Use	Capacity to Alter Flow
Rank	Class 2	Class 4	Class 3	Class 1

Downstream Assessment					
Assessment Category	Level of Use	Non-Discretionary Consumptive Use	Timing of Water Availability	Significance of Basin	Public Perception of Water Availability
Rank	Class 1	Class 1	Class 2	Class 1	Class 1

The highest classification obtained is a Class 4 ranking, resulting in a classification for the Battle River basin of Class 4.

Saskatchewan, as the downstream province, reviews the COH Classification and determines an appropriate classification based on current conditions of the basin. For example, in this test case, Saskatchewan could determine that the Battle River should be downgraded to a Class 1 ranking.

(*Note: As this is a test case only, SK was NOT consulted*)

The COH reviews the apportionment classification results for the Battle River at their bi-annual meeting and recommends the results for approval by the Board. This is documented in meeting minutes (i.e., COH Minute XX-XX).

(Note: As this is a test case, the COH has not yet discussed this assessment nor recommended it for approval.)

Assessment Step 4: Final Review by Downstream Provincial Board Member

The PPWB Board Member reviews the apportionment classification results for the Battle River and recommends the results for approval by the Board. This recommendation is noted in Board meeting minutes (i.e., PPWB Minute XX-XX).

(Note: As this is a test case, the Board member has not reviewed nor recommended it for approval.)

Assessment Step 5: Final Review by Board

The PPWB Board reviews the apportionment classification results and jurisdiction recommendation for the Battle River. This discussion is documented in board meeting minutes (i.e., PPWB Minute XX-XX).

(Note: As this is a test case, the Board has not reviewed the classification results of the assessment.)

Assessment Step 6: Board Approval

The PPWB Board approves the assessment of the Battle River as Class XX according to the terms of the PPWB Apportionment Monitoring Assessment Procedure. Monitoring and reporting of apportionment for this basin is not required at present (i.e., PPWB Minute XX-XX).

(Note: As this is a test case, the Board has not yet approved this assessment, nor outlined a monitoring schedule.)

Table 3: Historical annual recorded and apportionable flows for the Battle River.

Year	Recorded Flow, dam^3	Apportionable Flow, dam^3	% Apportionable Delivered	Year	Recorded Flow, dam^3	Apportionable Flow, dam^3	% Apportionable Delivered
1912	525,000	540,000	97%	1961	34,400	53,300	65%
1913	423,000	439,000	96%	1962	121,000	136,000	89%
1914	488,000	503,000	97%	1963	279,000	297,000	94%
1915	550,000	565,000	97%	1964	50,000	67,100	75%
1916	919,000	933,000	98%	1965	578,000	591,000	98%
1917	602,000	619,000	97%	1966	153,000	170,000	90%
1918	121,000	139,000	87%	1967	141,000	157,000	90%
1919	93,400	110,000	85%	1968	95,200	113,000	84%
1920	519,000	534,000	97%	1969	315,000	332,000	95%
1921	284,000	301,000	94%	1970	352,000	369,000	95%
1922	76,400	94,500	81%	1971	371,000	389,000	95%
1923	76,000	90,800	84%	1972	203,000	220,000	92%
1924	68,500	83,800	82%	1973	385,000	401,000	96%
1925	210,000	224,000	94%	1974	1,267,000	1,283,000	99%
1926	261,000	276,000	95%	1975	292,000	308,000	95%
1927	686,000	702,000	98%	1976	146,000	163,000	90%
1928	254,000	270,000	94%	1977	60,700	78,800	77%
1929	59,500	77,500	77%	1978	123,000	139,000	88%
1930	33,500	50,700	66%	1979	185,000	201,000	92%
1931	52,500	68,800	76%	1980	232,000	255,000	91%
1932	143,000	160,000	89%	1981	210,000	238,000	88%
1933	180,000	197,000	91%	1982	391,000	409,000	96%
1934	132,000	149,000	89%	1983	359,000	388,000	93%
1935	138,000	153,000	90%	1984	104,000	133,000	78%
1936	368,000	386,000	95%	1985	285,000	302,000	94%
1937	45,000	61,600	73%	1986	262,000	286,000	92%
1938	59,800	77,000	78%	1987	215,000	245,000	88%
1939	47,600	64,000	74%	1988	63,900	90,600	71%
1940	236,000	252,000	94%	1989	135,000	168,000	80%
1941	26,300	43,300	61%	1990	431,000	459,000	94%
1942	39,200	56,000	70%	1991	234,000	264,000	89%
1943	399,000	416,000	96%	1992	160,000	191,000	84%
1944	174,000	191,000	91%	1993	180,000	213,000	85%
1945	64,800	82,400	79%	1994	146,000	178,000	82%
1946	143,000	159,000	90%	1995	88,400	118,000	75%
1947	203,000	220,000	92%	1996	253,000	283,000	89%
1948	909,000	923,000	98%	1997	338,000	372,000	91%
1949	81,200	97,400	83%	1998	79,300	119,000	67%
1950	87,600	107,000	82%	1999	295,000	333,000	89%
1951	385,000	400,000	96%	2000	148,000	178,000	83%
1952	397,000	414,000	96%	2001	49,400	78,000	63%
1953	265,000	281,000	94%	2002	43,700	80,900	54%
1954	518,000	533,000	97%	2003	123,000	163,000	75%
1955	465,000	481,000	97%	2004	34,700	62,100	56%
1956	513,000	529,000	97%	2005	369,000	419,000	88%
1957	192,000	210,000	91%	2006	184,000	214,000	86%
1958	192,000	210,000	91%	2007	479,000	507,000	94%
1959	45,500	63,000	72%	2008	94,000	119,000	79%
1960	106,000	123,000	86%	2009	39,000	64,000	61%

Appendix C

PPWB Apportionment Monitoring Assessment Test Application for Gainsborough Creek at the Saskatchewan/Manitoba Boundary (2019)

The purpose of this appendix is to illustrate how the proposed PPWB Apportionment Monitoring Assessment Procedure is applied to Gainsborough Creek at the Saskatchewan-Manitoba boundary.

Background

Gainsborough Creek is a small intermittent stream located in the southeast corner of Saskatchewan. Gainsborough Creek crosses into Manitoba about 10 km north of the international boundary and flows into the Souris River about 30 km downstream of the apportionment point at the interprovincial boundary. The hydrometric station used for apportionment is Gainsborough Creek near Lyleton, Manitoba (05NF007) which is located approximately 13 km downstream of the apportionment point. The gross and effective drainage areas of the basin at the hydrometric station are 1129 and 556 km^2, respectively. Recorded flow at Lyleton is transferred to the apportionment point by applying a factor of 0.933, based on the effective drainage area ratio between the interprovincial boundary and the hydrometric station location. Licensed water use in the basin is limited to domestic, municipal and wildlife uses. The most significant feature in the basin in Saskatchewan is the Gainsborough Community Project which is located 3 km upstream of the boundary and has a total storage capacity of 1120 dam^3. The total annual flow volume over the historical record for station 05NF007 is shown in Figure 1 below. Flow in the creek is highly variable from year to year with many years experiencing little to no recorded flow, while other years have significant flow. With this being the case, any water use in Saskatchewan can have a significant impact on the delivery of apportionment in a dry year. A map of the Gainsborough Creek basin is shown as Figure 2.

Gainsborough Creek is not subject to active apportionment monitoring by the PPWB. Apportionable flow calculation procedures for this basin were approved by the Board under PPWB Report #63, *Gainsborough Creek at Saskatchewan-Manitoba Boundary Natural Flow*, dated July 1987. In that report recorded and apportionable flows were estimated for the period from 1912 to 1979. Additionally, the report looked at the apportionable flow results for the entire record based on the 1979 level of use. Those results are shown in Table 3. It was found that under the 1979 use scenario, there would have been 22 years in the 67-year record where there would have been a deficit in delivery at the year end. Further, in 15 of the 22 years of deficit it was estimated that Saskatchewan would have used more than 95% of the apportionable flow of Gainsborough Creek.

For the purposes of this apportionment monitoring assessment, the apportionable flow history was updated to include the period from 1980 to 2017 using an existing FORTRAN model developed in the mid 1990's based on the approved procedures from PPWB Report #63. The model was taken "as is" and was not verified as part of this study. The apportionable flow history from 1980 to 2017 is shown in Table 4. The model was run using current (2019) licensed water use information obtained from Saskatchewan for the entire period. In the case of this basin, licensed water use has decreased over time. However, due

to the great fluctuation in water availability in the Gainsborough Creek basin and small volume available, the assumptions on water use volumes have little impact on the apportionment results.

The mean annual apportionable flow varies depending on which data set is used. For the purposes of this assessment, the mean value from the 1912 to 2017 data set will be used in its entirety. The median values for each of the data sets is also presented for comparison.

Mean Annual Apportionable Flow 1912 to 1979 = 8,420 dam^3 (SK/MB entitlement = 4,208 dam^3)
Mean Annual Apportionable Flow 1980 to 2017 = 15,400 dam^3 (SK/MB entitlement = 7,700 dam^3)
Mean Annual Apportionable Flow 1912 to 2017 = 10,948 dam^3 (SK/MB entitlement = 5,474 dam^3)

Median Annual Apportionable Flow 1912 to 1979 = 3,479 dam^3
Median Annual Apportionable Flow 1980 to 2017 = 5,161 dam^3
Median Annual Apportionable Flow 1912 to 2017 = 3,706 dam^3

Assessment Step 1: Upstream Classification

The following categories were assessed based on conditions in the Gainsborough Creek basin in Saskatchewan, following the procedures laid out in the PPWB Apportionment Monitoring Assessment Procedure document.

Level of Use

The Level of Use category compares the annual water use in the upstream province to that province's mean entitlement over the period of apportionment record. Annual water use is defined as the sum of net depletions licensed by the province in the effective drainage area, not including licences associated with large storage projects.

Based on the current Saskatchewan Water Security Agency database there are 12 water use licences in the effective drainage area (listed in Table 5). The licences fall into the domestic, municipal (tank load) and wildlife water use categories. The total allocation volume of the 12 licences is only 29 dam^3, which is spread amongst the domestic category licences. The licensed evaporation losses are 357 dam^3 of which the bulk (220 dam^3) is associated with the municipal (tank load) licence from the Gainsborough Community Use Project. Assuming a return flow factor of 0.2 for the allocations associated with the domestic licences, the total net water use in the effective drainage area is 381 dam^3. It is unclear whether the municipal licence is referring to evaporation from the storage project, or evaporation associated with the water use; there are no other water use licences at that location. The licence also notes a reservoir capacity of 1,110 dam^3, which corresponds with the storage capacity of the reservoir. The 1987 Natural Flow study refers to average evaporation losses of 336 dam^3 from the reservoir. The apportionable flow calculation program reports calculated net depletions from the reservoir based on gross evaporation and precipitation measured at Broadview, SK. The average net depletion from the reservoir for the period from 1980 to 2017 was 572 dam^3.

Calculation:

Without a detailed investigation into the water use licensing, natural flow calculations and Fortran programming, it is difficult to determine this calculation. For the basin to be assessed as a Class 2 the licensed net depletion must be more than 25% of Saskatchewan's average entitlement.

Licensed net depletion required to be assessed as a Class 2 basin = 0.25 x 5474 dam^3 = 1368 dam^3

Based on the preliminary numbers presented above it appears that the licensed net depletion is less than that required for a Class 2 basin.

Assessment:

Class 1: The annual water use in the upstream province is less than 25% of that province's entitlement in an average year.

Apportionment History

The Apportionment History category uses the apportionment record to determine how close the upstream province has been in the past to utilizing its share of the apportionable flow. The apportionment record for Gainsborough Creek at the Saskatchewan/Manitoba boundary is shown in Table 3 (1912 to 1979) and Table 4 (1980 to 2017). Although actual depletions in the basin would vary from year to year based on water availability, the apportionable flow calculations are based on consistent water use from year to year. This results in a slight overestimate of apportionable flow and therefore underestimate of delivery in low flow years.

Calculation:

Maximum Historical Use = 200% of entitlement (100% of apportionable flow)

Assessment:

Class 4: In the apportionment record there are instances where the upstream province used 90% or more of its entitlement during the apportionment period.

Non-Discretionary Consumptive Use

The Non-Discretionary Consumptive Use category considers the essential (e.g. domestic) and unavoidable (e.g. evaporation) water uses in the upstream province against its mean entitlement over the period of record. In the case of Gainsborough Creek, unavoidable use in Saskatchewan has been assumed to include evaporation losses from the Gainsborough Community Project and the three wildlife projects. Essential uses have been identified as the domestic water use licences (this comprises all the licensed water use with the exception of the municipal tank load licence). According to the 1987 PPWB Natural Flow Study, typical annual evaporation losses (based on 1964 to 1978) are 336 dam^3. The average annual gross evaporation at Broadview is 822 mm (1981-2010) and the long-term average annual precipitation is 429 mm (1981-2010) resulting in an average annual net evaporation of 393 mm. The typical operating range for the Gainsborough Community Project appears to be 472 – 475 m, with an elevation of 475 m associated with a surface area of about 72 ha. This roughly supports the evaporative loss volume noted in

the Natural Flow Study. The total domestic allocation in the basin is 29 dam^3 with an assumed return flow factor of 0.2.

Table 7 Non-Discretionary Consumptive Use

Licence Category	Estimated Use, dam^3
Domestic Allocation	23
Licensed Evaporation Losses	137
Evaporation from Gainsborough Reservoir (from 1987 Natural Flow Study)	336
Total	496

Calculation:

Non-Discretionary Consumptive Use = 496 dam^3/5474 dam^3 = 9%

Assessment:

Class 2: Non-Discretionary consumptive use is between 5% and 15% of the upstream province's mean annual entitlement for the period of record.

Capacity to Alter Flows

The Capacity to Alter Flows category is intended to measure the ability of the upstream province to store water, which may contribute significantly to its ability to consume its apportioned share of flow or alter the timing of delivery to the downstream province (equitability of apportionment). This is measured as the storage in the upstream province divided by the mean upstream entitlement for the period of apportionment record available.

The Gainsborough Community Project is the only significant reservoir in the Gainsborough Creek basin with a capacity of 1120 dam^3 according to the 1987 Natural Flow Study. The study also notes reservoir capacities associated with two Ducks Unlimited Projects (122 dam^3 total) as well as the capacities of all the small domestic and industrial storage projects (306.9 dam^3). The 1987 study notes a total reservoir capacity of 1549 dam^3. The current water use licence database (Table 5 below) notes a total reservoir capacity of 1514 dam^3.

Calculation:

Capacity to Alter Flow = 1549 dam^3/5474 dam^3 = 28%

Assessment:

Class 1: Storage capacity in the upstream province is less than 50% of that province's mean annual entitlement over the period of record.

Assessment Step 2: Downstream Classification

Level of Use

Manitoba has indicated that there may be a few small unlicensed water users (cattle producers), but that at present there is no licensed water use in the Manitoba portion of the Gainsborough Creek basin.

Assessment:

Class 1: Annual water use in the downstream province is less than 25% of mean entitlement over the period of record.

Non-Discretionary Consumptive Use

As noted above, there are no licensed water uses in the Manitoba portion of the basin.

Assessment:

Class 1: Non-discretionary consumptive use in the downstream province is less than 5% of mean annual entitlement over the period of record.

Timing of Water Availability

The few cattle producers that may be using the creek seem to have adjusted to the intermittent nature of water availability in the basin. There are no other indications that water use in Saskatchewan is affecting the timing of water availability such that the public is concerned about it.

Assessment:

Class 1: There is no present or foreseeable conflict between storage and use of water in the upstream province and requirements for water in the downstream province.

Significance of Basin

The Significance of Basin category is meant to be a qualitative assessment of the importance of the water supply in the basin to the downstream province. In the case of Gainsborough Creek, the residents and unlicensed water users in the basin appear to be accustomed to the intermittent, highly variable flow of the creek. Although officials from the rural municipality note that it is a problem for local cattle producers, it has not been raised to the province previously or pursued through water use licensing.

Assessment:

Class 1: The basin is of lesser significance to the downstream province.

Public Perception of Water Availability

The Public Perception of Water Availability category accounts for any current or historical concerns of the public, local or provincial government, or other interest groups with respect to the upstream province negatively affecting the availability of water in the downstream province. The category accounts for the

fact that there may be other reasons to actively monitor apportionment in a basin, such as transparency and accountability that are not captured in the other needs-based assessment categories.

There seems to be no indication that any interested parties perceive that water shortages in the Manitoba portion of the Gainsborough Creek basin are caused by water use in Saskatchewan.

Assessment:

Class 1: There has been/is no public concern that water use in the upstream province affects water availability in the downstream province.

Assessment Step 3: Resulting Classification and COH Recommendation to Board

The following table summarizes the results of the assessment for Gainsborough Creek at the Saskatchewan/Manitoba boundary:

Table 8 Classification Assessment

Upstream Assessment				
Assessment Category	Level of Use	Apportionment History	Non-Discretionary Consumptive Use	Capacity to Alter Flow
Result	Class 1	Class 4	Class 2	Class 1

Downstream Assessment					
Assessment Category	Level of Use	Non-Discretionary Consumptive Use	Timing of Water Availability	Significance of Basin	Public Perception of Water Availability
Result	Class 1	Class 1	Class 1	Class 1	Class 1

The highest classification obtained through the assessment process is a Class 4 ranking, resulting in a classification of Class 4 for Gainsborough Creek.

Assessment Step 4: Final Review by Downstream Provincial Board Member

The PPWB Board Member reviews the classification results for Gainsborough Creek and recommends the results for approval by the Board. This recommendation is noted in board meeting minutes (i.e., PPWB Minute XX-XX).

(Note: As this is a test case, the Board member has not reviewed nor recommended it for approval.)

Assessment Step 5: Final Review by Board

The PPWB Board reviews the apportionment classification results and jurisdiction recommendation for Gainsborough Creek. This discussion is documented in board meeting minutes (i.e., PPWB Minute XX-XX).

(Note: As this is a test case, the Board has not reviewed the classification results of the assessment.)

Assessment Step 6: Board Approval

The PPWB approves the assessment of Gainsborough Creek as Class XX according to the terms of the PPWB Apportionment Monitoring Assessment Procedure. Monitoring and reporting of apportionment for this basin is not required at present (i.e., PPWB Minute XX-XX).

(Note: As this is a test case, the Board has not yet approved this assessment, nor outlined a monitoring schedule.)

Figure 1: Annual Flow at hydrometric station 05NF007 Gainsborough Creek near Lyleton, MB.

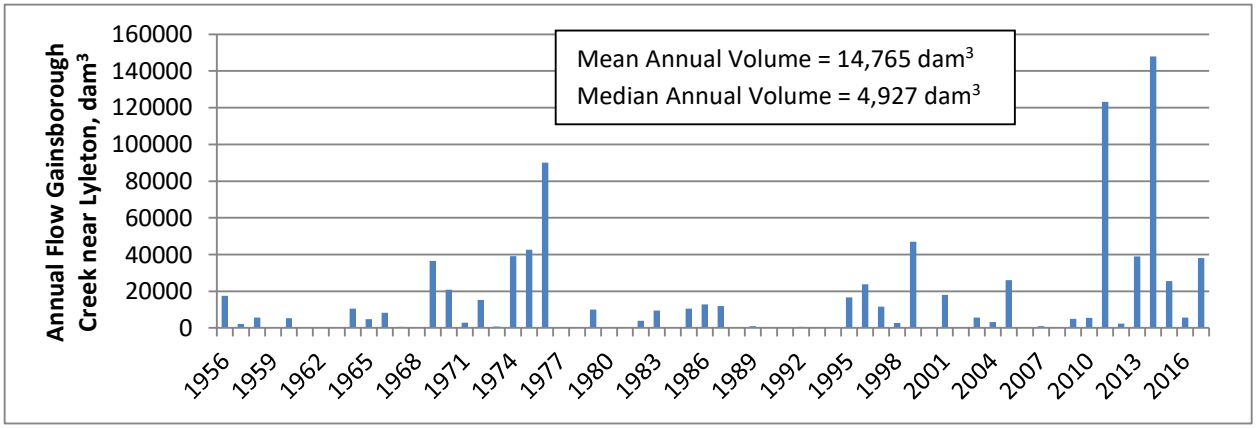
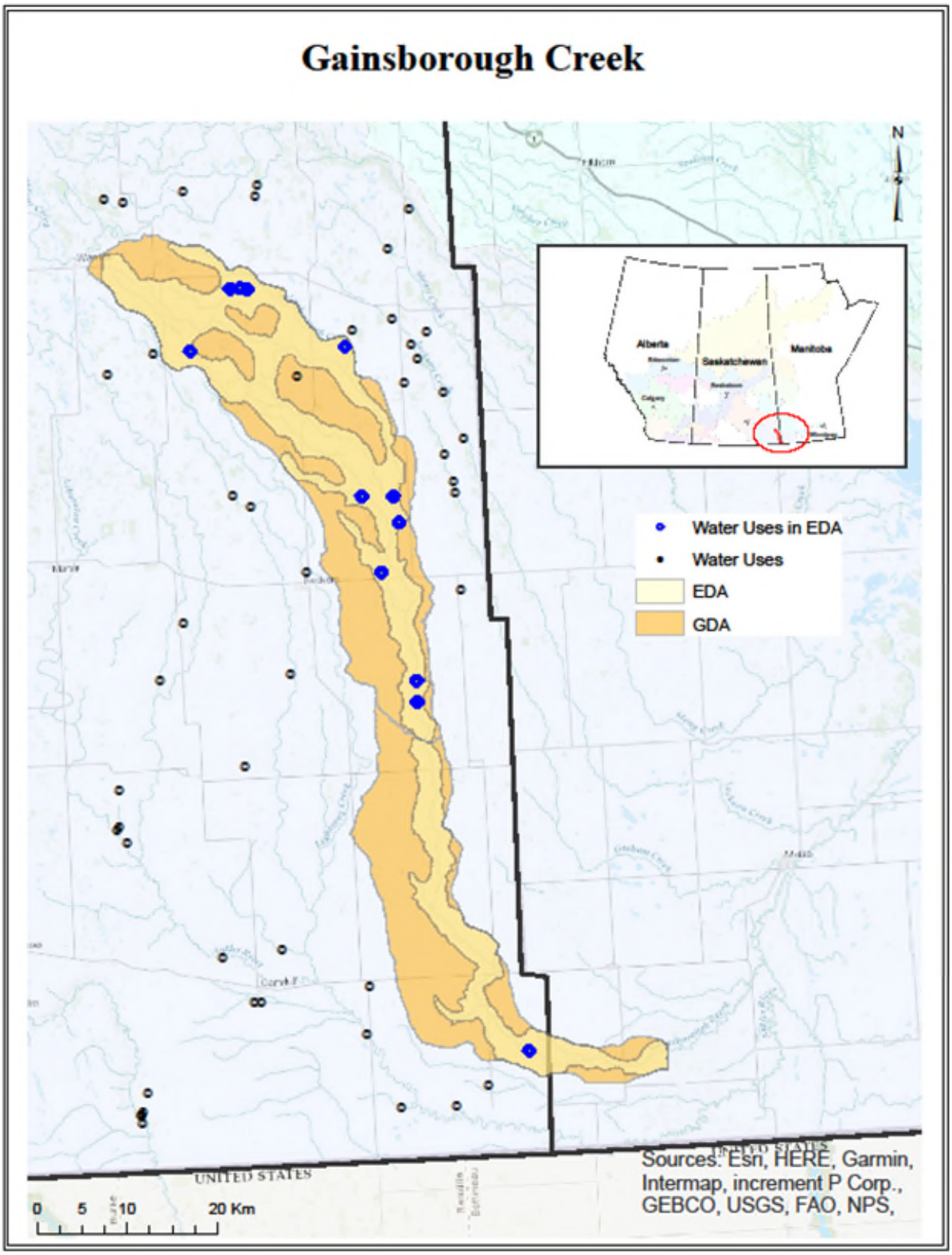


Figure 2: Gainsborough Creek basin map showing current water use licences in Saskatchewan.



EDA – Effective Drainage Area
GDA – Gross Drainage Area

Table 3: Historical Apportionable Flow based on 1979 Level of Use as reported in PPWB Report #63.

Year	to	Year	Apportionable Flow* dam^3	Balance of Flow** dam^3	Recorded Flow*** dam^3	% Delivery
1912	-	1913	3673	1285	3122	85%
1913	-	1914	2320	551	1711	74%
1914	-	1915	3993	1590	3587	90%
1915	-	1916	242	-119	2	1%
1916	-	1917	7150	2807	6382	89%
1917	-	1918	4278	1276	3415	80%
1918	-	1919	568	33	317	56%
1919	-	1920	4173	1462	3549	85%
1920	-	1921	3479	980	2720	78%
1921	-	1922	1848	246	1170	63%
1922	-	1923	6900	3047	6497	94%
1923	-	1924	8271	3407	7543	91%
1924	-	1925	1376	19	707	51%
1925	-	1926	17036	7895	16413	96%
1926	-	1927	1348	-162	512	38%
1927	-	1928	12028	5515	11529	96%
1928	-	1929	11066	5273	10806	98%
1929	-	1930	686	-337	6	1%
1930	-	1931	1307	178	832	64%
1931	-	1932	71	-35	1	1%
1932	-	1933	414	-204	3	1%
1933	-	1934	534	-262	5	1%
1934	-	1935	139	-69	1	0%
1935	-	1936	345	-170	3	1%
1936	-	1937	1521	-489	272	18%
1937	-	1938	666	-328	5	1%
1938	-	1939	1165	-329	254	22%
1939	-	1940	969	-11	474	49%
1940	-	1941	55	-27	1	1%
1941	-	1942	423	-208	4	1%
1942	-	1943	1913	121	1078	56%
1943	-	1944	12588	5785	12079	96%
1944	-	1945	1337	-112	557	42%
1945	-	1946	2244	311	1433	64%
1946	-	1947	6267	2980	6114	98%
1947	-	1948	11460	4944	10674	93%
1948	-	1949	25264	11970	24602	97%
1949	-	1950	15132	7091	14657	97%
1950	-	1951	26605	12676	25979	98%
1951	-	1952	34877	16865	34304	98%
1952	-	1953	3706	1479	3332	90%
1953	-	1954	2398	618	1817	76%
1954	-	1955	7467	3114	6848	92%
1955	-	1956	21618	10321	21130	98%
1956	-	1957	16955	7685	16163	95%
1957	-	1958	2873	790	2227	77%
1958	-	1959	4506	1829	4082	91%
1959	-	1960	192	-94	2	1%
1960	-	1961	5082	1681	4222	83%
1961	-	1962	0	0	0	0%
1962	-	1963	2	-1	0	0%
1963	-	1964	2	-1	0	0%
1964	-	1965	11430	3844	9559	84%
1965	-	1966	6058	2179	5208	86%
1966	-	1967	7777	3247	7136	92%
1967	-	1968	1010	-12	493	49%
1968	-	1969	367	-181	3	1%
1969	-	1970	34824	16220	33632	97%
1970	-	1971	20034	9269	19286	96%
1971	-	1972	8881	3536	7977	90%
1972	-	1973	9238	3835	8454	92%
1973	-	1974	1053	24	551	52%
1974	-	1975	37227	17722	36336	98%
1975	-	1976	41216	19788	40396	98%
1976	-	1977	83366	40889	82572	99%
1977	-	1978	283	-25	117	41%
1978	-	1979	665	-318	15	2%

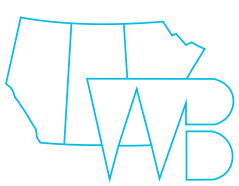
*Table B-4 from 1987 Natural Flow report; **Table B-6 from 1987 Natural Flow report
***Inferred based on Tables B-4 and B-6 from 1987 Natural Flow report

Table 4: Annual recorded and apportionable flows for Gainsborough Creek at the Saskatchewan/Manitoba Boundary from 1980 to 2017 (based on 2019 licensed water use).

	Apportionable Flow, dam^3	Recorded Flow, dam^3	% Delivery
1980	964	68	7%
1981	52	0	0%
1982	**4951**	**3761**	**76%**
1983	**9717**	**8835**	**91%**
1984	963	284	29%
1985	**10862**	**9846**	**91%**
1986	**12753**	**12066**	**95%**
1987	**11825**	**11196**	**95%**
1988	147	7	5%
1989	**1997**	**1014**	**51%**
1990	52	0	0%
1991	52	0	0%
1992	**1882**	**630**	**33%**
1993	52	0	0%
1994	1262	184	15%
1995	**16335**	**15535**	**95%**
1996	**22921**	**22261**	**97%**
1997	**11540**	**10936**	**95%**
1998	**3249**	**2503**	**77%**
1999	**44444**	**43809**	**99%**
2000	712	212	30%
2001	**17956**	**16856**	**94%**
2002	1000	258	26%
2003	**6112**	**5357**	**88%**
2004	**3876**	**3053**	**79%**
2005	**24963**	**24359**	**98%**
2006	**795**	**427**	**54%**
2007	**1884**	**982**	**52%**
2008	399	41	10%
2009	**5371**	**4673**	**87%**
2010	**5878**	**5242**	**89%**
2011	**115430**	**114798**	**99%**
2012	**2813**	**2270**	**81%**
2013	**37105**	**36301**	**98%**
2014	**138512**	**137942**	**100%**
2015	**24697**	**23929**	**97%**
2016	**5817**	**5300**	**91%**
2017	**36238**	**35576**	**98%**
Average 1980-2017	**15410**	**14750**	

Table 5: Current (2017) water use licences in the Gainsborough Creek effective drainage area.

WSA_File	ClientName	cprojname	Status	Alloc_ Dm3	Return Flow Factor	EvapL oss_D	Net Water Use	cpurpose	ctype1	SupplyType	SupplyName	Res_Cap _Dm	Res_Area _H
9501	ARGYLE RM OF		ATO	0		220	220	Municipal	Tankload	Watercourse	Gainsborough Creek	1,110.10	70.8
16337	[redacted]		ATO	3	0.2	6	6.6	Domestic		Watercourse	Gainsborough Creek	20.4	2.1
16900	[redacted]		APP	0		0	0	Domestic		Reservoir	on Gainsborough Creek	0	0
15881	[redacted]		ATO	1	0.2	10	10.2	Domestic		Reservoir		24.2	5.5
2940	ANTLER RM OF		ATO	20	0.2	30	34	Domestic		Watercourse	Gainsborough Creek	98.7	7.6
3675	REDVERS AGRICULTURAL & SUPPLY LTD		ATO	1	0.2	4	4.2	Domestic		Reservoir		6.2	1
11730	[redacted]		ATO	2	0.2	4	4.4	Domestic		Reservoir	on Gainsborough Creek	8.9	1.3
13580	DUCKS UNLIMITED CANADA	EISLER PROJECT	ATO	0		32	32	Other	Wildlife	Reservoir		93.6	11.2
13693	[redacted]		ATO	1	0.2	3	3.2	Domestic		Watercourse	Gainsborough Creek	6.5	1.2
12321	DUCKS UNLIMITED CANADA	MELENCHUK-DEROO PROJECT	ATO	0		15	15	Other	Wildlife	Reservoir		25.2	5.3
3646	[redacted]		ATO	1	0.2	6	6.2	Domestic		Reservoir		23.4	4.6
12087	DUCKS UNLIMITED CANADA	MELENCHUK PROJECT	ATO	0		27	27	Other	Wildlife	Reservoir		97.2	10.9



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