Environment Canada / Environnement Canada

RETURN BIDS TO:
RETOURNER LES SOUMISSIONS À:

Bid Receiving - Environment Canada / Réception des soumissions – Environnement Canada

BID SOLICITATION
DEMANDE DE SOUMISSONS

PROPOSAL TO: ENVIRONMENT CANADA

We offer to perform or provide to Canada the services detailed in the document including any attachments and annexes, in accordance with the terms and conditions set out or referred to in the document, at the price(s) provided.

SOUMISSION À: ENVIRONNEMENT CANADA

Nous offrons d'effectuer ou de fournir au Canada, aux conditions énoncées ou incluses par référence dans le document incluant toutes pièces jointes et annexes, les services détaillés dans le document, au(x) prix indiqué(s).

Title – Titre **Procedures for Calculating Apportionable Flow for the Qu'Appelle River at the Saskatchewan/Manitoba Boundary**

EC Bid Solicitation No. /SAP No. – N° de la demande de soumissions EC / N° SAP K4E21-16-2000

Date of Bid solicitation (2016-06-27) – Date de la demande de soumissions (2016-06-27)

Bid Solicitation Closes (2016-08-09) - La demande de soumissions prend fin (2016-08-09) **at – à 2:00 P.M.** **on – le**	**Time Zone – Fuseau horaire** *Mountain*

F.O.B – F.A.B Regina, Saskatchewan

Address Enquiries to - Adresser toutes questions à
Environment and Climate Change Canada,
Attention: Carl Bathgate
Regional Manager, Contracting & Finance Directorate,
9250 – 49 Street NW
Edmonton, Alberta T6B 1K5

Telephone No. – N° de téléphone	**Fax No. – N° de Fax**
780-951-8659	780-495-5097

Delivery Required (2017-12-1) – Livraison exigée (2017-12-1)

Destination - of Services / Destination des services
Environment & Climate Change Canada,
Senior Engineering Advisor, Transboundary Waters Unit
Associate Regional Director General Office, West & North
Room 300, 2365 Albert Street, Regina, Saskatchewan S4P 4K1

Security / Sécurité: Not Applicable

Vendor/Firm Name and Address - Raison sociale et adresse du fournisseur/de l'entrepreneur

Telephone No. – N° de téléphone	**Fax No. – N° de Fax**

	Name and title of person authorized to sign on behalf of Vendor/Firm: (type or print) / **Nom et titre de la personne autorisée à signer au nom du fournisseur/de l'entrepreneur (taper ou écrire en caractères d'imprimerie)** **Signature** **Date**

The purpose of this Request for Proposal is to:

Obtain the services of a consultant to review and update the apportionable flow calculation procedures used by the Prairie Provinces Water Board for the Qu'Appelle River at the Saskatchewan/Manitoba interprovincial boundary.

Proposals will be accepted in English only.

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PART 1 – GENERAL INFORMATION

1. Security Requirement

1.1 There is no security requirement associated with this requirement.

2. Statement of Work

The Contractor must perform the Work as follows: See Annex A

3. Debriefings

Bidders may request a debriefing on the results of the bid solicitation process. Bidders should make the request to the Contracting Authority within 15 working days of receipt of the results of the bid solicitation process. The debriefing may be in writing, by telephone or in person.

PART 2 – BIDDER INSTRUCTIONS

1. Standard Instructions, Clauses and Conditions

All instructions, clauses and conditions identified in the bid solicitation by number, date and title are set out in the PWGSC *Standard Acquisition Clauses and Conditions Manual* (https://buyandsell.gc.ca/policy-and-guidelines/standard-acquisition-clauses-and-conditions-manual) issued by Public Works and Government Services Canada.
Bidders who submit a bid agree to be bound by the instructions, clauses and conditions of the bid solicitation and accept the clauses and conditions of the resulting contract.

The 2003 Standard Instructions - Goods or Services - Competitive Requirements, are incorporated by reference into and form part of the bid solicitation.

The standard instructions 2003 are modified as follows:

Under "Text" at 02:
Delete: "Procurement Business Number"
Insert: "Deleted"

At Section 02 Procurement Business Number
Delete: In its entirety
Insert: "Deleted"

At Section 05 Submission of Bids, Subsection 05 (2d):
Delete: In its entirety
Insert: "send its bid only to Environment Canada (EC) as specified on page 1 of the bid solicitation or to the address specified in the bid solicitation;"
At Section 06 Late Bids:
Delete: "PWGSC"
Insert: "Environment Canada"

At Section 07 Delayed Bids:
Delete: "PWGSC"
Insert: "Environment Canada"

At Section 08 Transmission by Facsimile, Subsection 08 (1):
Delete: In its entirety
Insert: "Bids may be submitted by facsimile if specified in the bid solicitation."

At Section 12 Rejection of Bid, Subsection 12 (1) a. and b.:
Delete: In their entirety
Insert: "Deleted"

At Section 17 Joint Venture, Subsection 17 (1) b.:
Delete: "the Procurement Business Number of each member of the joint venture,"
Insert: "Deleted"

At Section 20 Further Information, Subsection 20 (2):
Delete: In its entirety
Insert: "Deleted"

2. Submission of Bids

2.1 Bids must be submitted to the Contracting Authority at the address indicated on page 1 of the bid solicitation by 9 August 2016, 14:00 Mountain.

2.2 Bids may be transmitted by facsimile to Carl Bathgate at: 780-495-5097.

3. Former Public Servant – Competitive Bid

Contracts awarded to former public servants (FPS) in receipt of a pension or of a lump sum payment must bear the closest public scrutiny, and reflect fairness in the spending of public funds. In order to comply with Treasury Board policies and directives on contracts awarded to FPS, bidders must provide the information required below before contract award. If the answer to the questions and, as applicable the information required have not been received by the time the evaluation of bids is completed, Canada will inform the Bidder of a time frame within which to provide the information. Failure to comply with Canada's request and meet the requirement within the prescribed time frame will render the bid non-responsive.

Definitions

For the purposes of this clause, "former public servant" is any former member of a department as defined in the *Financial Administration Act*, R.S., 1985, c. F-11, a former member of the Canadian Armed Forces or a former member of the Royal Canadian Mounted Police. A former public servant may be:

a. an individual;

b. an individual who has incorporated;

c. a partnership made of former public servants; or

d. a sole proprietorship or entity where the affected individual has a controlling or major interest in the entity.

"lump sum payment period" means the period measured in weeks of salary, for which payment has been made to facilitate the transition to retirement or to other employment as a result of the implementation of various programs to reduce the size of the Public Service. The lump sum payment period does not include the period of severance pay, which is measured in a like manner.

"pension" means a pension or annual allowance paid under the *Public Service Superannuation Act* (PSSA), R.S., 1985, c.P-36, and any increases paid pursuant to the *Supplementary Retirement Benefits Act*, R.S., 1985, c.S-24 as it affects the PSSA. It does not include pensions payable pursuant to the *Canadian Forces Superannuation Act*, R.S., 1985, c.C-17, the *Defence Services Pension Continuation Act*, 1970, c.D-3, the *Royal Canadian Mounted Police Pension Continuation Act* , 1970, c.R-10, and the *Royal Canadian Mounted Police Superannuation Act*, R.S., 1985, c.R-11, the *Members of Parliament Retiring Allowances Act* , R.S., 1985, c.M-5, and that portion of pension payable to the *Canada Pension Plan Act*, R.S., 1985, c.C-8.

Former Public Servant in Receipt of a Pension

As per the above definitions, is the Bidder a FPS in receipt of a pension? **Yes** ( ) **No** ( )

If so, the Bidder must provide the following information, for all FPS in receipt of a pension, as applicable:

a. name of former public servant;

b. date of termination of employment or retirement from the Public Service.

By providing this information, Bidders agree that the successful Bidder's status, with respect to being a former public servant in receipt of a pension, will be reported on departmental websites as part of the published proactive disclosure reports in accordance with Contracting Policy Notice: 2012-2 and the Guidelines on the Proactive Disclosure of Contracts.

Work Force Adjustment Directive

Is the Bidder a FPS who received a lump sum payment pursuant to the terms of the Work Force Adjustment Directive? **Yes** ( ) **No** ( )

If so, the Bidder must provide the following information:

a. name of former public servant;

b. conditions of the lump sum payment incentive;

c. date of termination of employment;

d. amount of lump sum payment;

e. rate of pay on which lump sum payment is based;

f. period of lump sum payment including start date, end date and number of weeks;

g. number and amount (professional fees) of other contracts subject to the restrictions of a work force adjustment program.

For all contracts awarded during the lump sum payment period, the total amount of fees that may be paid to a FPS who received a lump sum payment is $5,000, including Applicable Taxes.

4. Enquiries - Bid Solicitation

All enquiries must be submitted in writing to the Contracting Authority no later than 7 calendar days before the bid closing date. Enquiries received after that time may not be answered.

Bidders should reference as accurately as possible the numbered item of the bid solicitation to which the enquiry relates. Care should be taken by bidders to explain each question in sufficient detail in order to enable Canada to provide an accurate answer. Technical enquiries that are of a proprietary nature must be clearly marked "proprietary" at each relevant item. Items identified as "proprietary" will be treated as such except where Canada determines that the enquiry is not of a proprietary nature. Canada may edit the question(s) or may request that the Bidder do so, so that the proprietary nature of the question(s) is eliminated and the enquiry can be answered to all bidders. Enquiries not submitted in a form that can be distributed to all bidders may not be answered by Canada.

5. Applicable Laws

Any resulting contract must be interpreted and governed, and the relations between the parties determined, by the laws in force in Saskatchewan.

Bidders may, at their discretion, substitute the applicable laws of a Canadian province or territory of their choice without affecting the validity of their bid, by deleting the name of the Canadian province or territory specified and inserting the name of the Canadian province or territory of their choice. If no change is made, it acknowledges that the applicable laws specified are acceptable to the bidders.

6. Basis for Canada's Ownership of Intellectual Property

Environment Canada has determined that any intellectual property rights arising from the performance of the Work under the resulting contract will belong to Canada, on the following grounds:

(6.4.1) the main purpose of the contract, or of the deliverables contracted for, is to generate knowledge and information for public dissemination;

PART 3 – BID PREPARATION INSTRUCTIONS

Proposals will be accepted in English only.

1. Bid Preparation Instructions

Canada requests that bidders provide their bid in separately bound sections as follows:

Section I: Technical Bid 1 hard copy or 1 soft copy in PDF format, *such as CD, DVD*

Section II: Financial Bid 1 hard copies or 1 soft copy in PDF format, *such as CD, DVD*

Section III: Certifications (1 hard copy)

If there is a discrepancy between the wording of the soft copy and the hard copy, the wording of the hard copy will have priority over the wording of the soft copy.

Prices must appear in the financial bid only. No prices must be indicated in any other section of the bid.

Canada requests that bidders follow the format instructions described below in the preparation of their bid:

(a) use 8.5 x 11 inch (216 mm x 279 mm) paper;
(b) use a numbering system that corresponds to the bid solicitation.

In April 2006, Canada issued a policy directing federal departments and agencies to take the necessary steps to incorporate environmental considerations into the procurement process Policy on Green Procurement (http://www.tpsgc-pwgsc.gc.ca/ecologisation-greening/achats-procurement/politique-policy-eng.html). To assist Canada in reaching its objectives, bidders should:

1) use 8.5 x 11 inch (216 mm x 279 mm) paper containing fibre certified as originating from a sustainably-managed forest and containing minimum 30% recycled content; and

2) use an environmentally-preferable format including black and white printing instead of colour printing, printing double sided/duplex, using staples or clips instead of cerlox, duotangs or binders; and

(3) print on both sides of the paper.

Section I: Technical Bid

In their technical bid, bidders should demonstrate their understanding of the requirements contained in the bid solicitation and explain how they will carry out the Work

Section II: Financial Bid

1. Bidders must submit their financial bid in accordance in accordance with the Basis of Payment in Annex **B**. The total amount of Applicable Taxes must be shown separately.

1.1 Price Breakdown

In their financial bid, the bidders are requested to provide a detailed breakdown of the price for the following elements *for phases of the work, travel if required,* of the Work, as applicable:

(a) Professional fees: For each individual and (or) labour category to be assigned to the Work, the bidders should indicate: i) the firm hourly rate or the firm daily rate, inclusive of overhead and profit; and ii) the estimated number of hours or days, as applicable. The bidders should indicate the number of hours in one working day.

"The professional fees must include the total estimated cost of all travel and living expenses that may need to be incurred for:

(i) all travel between the successful bidder's place of business and the Regina office if required.

to satisfy the terms of any resulting contract. These expenses cannot be charged directly and separately from the professional fees to any contract that may result from the bid solicitation.)

(b) Materials and Supplies (if applicable): The bidders should identify each category of materials and supplies required to complete the Work and provide the pricing basis. The Bidder should indicate, on a per category basis, whether the items are likely to be consumed during the performance of any resulting contract.

(c) Travel and Living Expenses (if applicable): The bidders should indicate the number of trips and the number of days for each trip, the cost, destination and purpose of each journey, together with the basis of these costs without exceeding the meal, private vehicle and incidental expenses provided in Appendices B, C and D of the *National Joint Council Travel Directive* and with the other provisions of the directive referring to "travellers", rather than those referring to "employees".

(d) Subcontracts (if applicable): The bidders should identify all of the proposed subcontractors and provide in their financial bid for each one a price breakdown.

(e) Other Direct Charges (if applicable): The bidders should identify all of the categories of other direct charges anticipated, such as long distance communications and rentals, providing the pricing basis for each and explaining the relevance to the work described in the resultant contract in part 6 of the bid solicitation.

(f) Applicable Taxes: The bidders should indicate the Applicable Taxes separately.

1.2 Bidders should include the following information in their financial bid:

(a) Their legal name; and

(b) The name of the contact person (including this person's mailing address, phone and facsimile numbers and email address) authorized by the Bidder to enter into

communications with Canada with regards to their bid; and any contract that may result from their bid.

PART 4 - EVALUATION PROCEDURES AND BASIS OF SELECTION

Proposals will be accepted in English only.

1. Evaluation Procedures

Bids will be assessed in accordance with the entire requirement of the bid solicitation including the technical and financial evaluation criteria.

Information to be included in the bid:

For Technical Proposal:

1. Project Schedule.
2. Technical Proposal.
3. References / Resumes.
4. The Mandatory Criteria Table found in the Evaluation Criteria section must be completed and included in the bid.

For Financial Proposal:
In Separate Envelope: Financial Bid

Note that all proposals MUST include Technical Evaluation responses in a SEPARATE envelope from the Financial Bid.

Proposals with financial bid totals greater than $75,000 (exclusive of travel expenses and GST) will be automatically disqualified.

1.1 Technical Evaluation

Except where expressly provided otherwise, the experience described in the bid must be the experience of the Bidder itself (which includes the experience of any companies that formed the Bidder by way of a merger but does not include any experience acquired through a purchase of assets or an assignment of contract). The experience of the Bidder's affiliates (i.e. parent, subsidiary or sister corporations), subcontractors, or suppliers will not be considered.

All bidders should consider the information in the following tables as part of their proposal when preparing information to answer and comply with the technical evaluation portion of their submission.

1.2 Technical Evaluation

1.2.1. Mandatory Technical Criteria: Bidders must meet these criteria in order to be further considered. Failure to meet mandatory criteria will result in being eliminated

from further consideration. Each mandatory requirement must be checked off "Yes". Failure to meet any mandatory requirement will result in the elimination of bid from the competition.

Attention Bidders: Write beside each of the criteria the relevant page number(s) from your proposal which addresses the requirement identified in the criteria.			
Criteria	**Page #**	**Yes**	**No**
The Proponent must demonstrate knowledge of natural flow calculation procedures and knowledge of the hydrology of the Canadian Prairie Provinces. The Proponent must demonstrate this by listing previous work experience, relevant projects completed, or otherwise explaining where they have obtained this knowledge.			
The Proponent must demonstrate familiarity with the Master Agreement on Apportionment and interprovincial apportionment of waters. The Proponent must provide a written summary of their exposure to this topic within their proposal.			
The Proponent must provide professional résumés of all project staff (including subcontractors) that clearly state their experience and expertise relevant to the project subject matter and objectives.			

1.2.2 Point Rated Technical Criteria: The Project Steering Committee will review each proposal and determine a rating for each criterion based on the 0-4 rating system listed in the table header and defined in the 'Assignment of Points (Rating)' table found at the end of this document. The rating will be determined based on a review of the Proponent's proposal package including the Technical Proposal and appendices and proposed project schedule. Each rating will then be multiplied by the weight (column in the point rated technical criteria table) to determine the score for each requirement.

Each point rated requirement section (A2.1, A2.2, A2.3) must achieve a minimum point score in order for the proposal to receive further consideration. A proposal that receives less than the minimum score for any section will be eliminated from the competition.

The scores for all the requirements will then be tallied to determine the Total Points Awarded. This score will be combined with the Cost Score to determine the successful Proponent as described below in the section 'Basis of Awarding Contract'.

A.2.0	**POINT RATED TECHNICAL CRITERIA:** (Rating: 4=excellent, 3=very good, 2=acceptable, 1=poor, 0=unsatisfactory)			
A.2.1	**STUDY STRATEGY**	**WEIGHT**	**RATING**	**SCORE**
a)	Demonstrated understanding of the scope and importance of the study and the Statement of Work as set out in the	30		

	RFP. The proposal must illustrate the Proponent's knowledge regarding the role of the Prairie Provinces Water Board and apportionment. The proposal must speak to the work described in the RFP text and Scope of Work section, and all deliverables that are required under this project.			
b)	Breakdown of project into logical tasks; planning and detail of tasks illustrates that proponent has full appreciation of project.	25		
c)	Proposal provides a detailed schedule and timelines for completion of each aspect of the project. Schedule is realistic and achievable and demonstrates that the Proponent understands project requirements.	10		
d)	Proposal describes realistic and achievable approaches to completing the tasks in the Statement of Work. Important tasks noted in the RFP are identified in the proposal and appropriate resources and time are allocated to these items.	10		
e)	Adequacy and availability of personnel to carry out the project tasks appears reasonable. The resources assigned to the project appear to be sufficient to achieve the proposed schedule. The distribution of work amongst the project team is described.	5		
	Maximum points available			320
	Minimum points acceptable			208
	Points awarded			
A.2.2.	**TRAINING & EXPERIENCE**	**WEIGHT**	**RATING**	**SCORE**
a)	Demonstrated experience in projects of this nature. Examples of projects relating to the estimation of natural/apportionable flows are provided and the Proponent shows work experience that indicates knowledge of the hydrology of the Canadian Prairie provinces. Sample projects are of a similar size and complexity to project being proposed.			
b)	Suitability of academic backgrounds of personnel assigned. Proponent resumes show that resources assigned to the project have post-secondary training in fields relevant to the project.	15		
c)	Specialized training and experience in hydrology, hydraulics and naturalizing streamflow. Where relevant this should be summarized in the proposal and backed up by the Proponent staff resumes.	20		
d)	Relevant experience of personnel assigned to the project. Resources assigned to the various project tasks have experience completing projects of a similar nature, scope and complexity relative to their contribution to the project.	20		
	Maximum points available			320
	Minimum points acceptable			208
	Points awarded			
A.2.3	**PROJECT ORGANIZATION**	**WEIGHT**	**RATING**	**SCORE**
a)	Study team organization. Proposed internal and external reporting structure is specified in the proposal and clearly shows accountability for each facet of the project and for	10		

	overall project results.			
b)	Allocation of manpower for efficient use of personnel. Project work is distributed amongst Proponent team according to each individual's strengths and reflects that the project has been well thought through.	12		
c)	Overall organization of the project. The proposal lays out a clear and well organized strategy for completion of the project. Tasks are itemized and broken down with realistic timelines for completion of each part.	10		
d)	Performance references of three different clients for whom projects of equal scope and complexity have been completed in the last 5 years.	8		
	Maximum points available			160
	Minimum points acceptable			104
	Points awarded			
	MAXIMUM TOTAL POINTS AVAILABLE			800
	MINIMUM TOTAL POINTS ACCEPTABLE			520
	TOTAL POINTS AWARDED			

Assignment of Points (Rating)

	CATEGORIES	MAXIMUM SCORE	4
QUALIFIED	EXCELLENT:	Exceptional. Proposal demonstrates that the Proponent exceeds the requirement, or describes an approach to the requirement that will be more than satisfactory for the project. Should ensure extremely effective performance.	4
	VERY GOOD:	Above average and more than adequate for effective performance. Proposal demonstrates that the Proponent clearly meets the requirement, or describes an approach to the requirement that is appropriate for the project.	3
	ACCEPTABLE:	Average and should be adequate for effective performance. Proposal demonstrates that the Proponent meets the requirement, or describes an approach to the requirement that will be acceptable for the project.	2
	POOR:	Just acceptable and should meet minimum performance requirements. Proposal demonstrates that the Proponent marginally meets the requirement, or describes an approach to the requirement that will be just enough for the project.	1

UNQUALIFIED	UNSATISFACTORY:	Unacceptable. Insufficient for performance requirements.	0

***Note: Assignment of points will not be limited to integer values. Partial points (e.g. down to 0.1 of a point) may be awarded at the discretion of the evaluators. Partial points will be used where proposal responses are deemed to fall somewhere between the categories listed above, and to differentiate between the varying degrees of quality of responses in multiple proposals, if required.**

1.3 Financial Evaluation

Note that all proposals submitted by mail MUST include Technical Evaluation responses in a SEPARATE envelope from Financial Bid Proposal. The Financial Proposal MUST have a value less than $75,000 (exclusive of travel expenses and GST).

PRICING	

2. Basis of Selection

Basis of Awarding Contract:

The Basis of Selection to issue the resulting Contract is:
Highest Compliant Combined Rating of Technical Merit and Price:

To qualify, bidders **must** meet all mandatory requirements as well as the minimum score identified for each of the point-rated technical criteria. The contract will be awarded based on a determination of best value taking into account both the technical merit of the proposals and the price evaluations.

For the purpose of ranking all technically acceptable proposals, the following ratio will factor the technical and the price component to establish a total score:

Technical Score = total of points in evaluation section (A2.1 + A2.2 + A2.3)

Cost Score = $\frac{\text{Lowest Proposal Cost*}}{\text{Cost on this Proposal*}}$ **x** 90 points

*For the purposes of this calculation the proposal costs will include travel expenses.

Total Score = Technical Score + Cost Score

The contract will be awarded to **the highest Total Score**

The responsive bid with the lowest evaluated price will be recommended for award of a contract.

1 Integrity Provisions - Associated Information

By submitting a bid, the Bidder certifies that the Bidder and its Affiliates are in compliance with the provisions as stated in Section 01 Integrity Provisions - Bid of Standard Instructions 2003. The associated information required within the Integrity Provisions will assist Canada in confirming that the certifications are true.

1.2 Federal Contractors Program for Employment Equity - Bid Certification

By submitting a bid, the Bidder certifies that the Bidder, and any of the Bidder's members if the Bidder is a Joint Venture, is not named on the Federal Contractors Program (FCP) for employment equity "FCP Limited Eligibility to Bid" list (http://www.labour.gc.ca/eng/standards_equity/eq/emp/fcp/list/inelig.shtml) available from Employment and Social Development Canada (ESDC) - Labour's website.

Canada will have the right to declare a bid non-responsive if the Bidder, or any member of the Bidder if the Bidder is a Joint Venture, appears on the "FCP Limited Eligibility to Bid "list at the time of contract award.

2. Additional Certifications Required Precedent to Contract Award

The certifications listed below should be completed and submitted with the bid but may be submitted afterwards. If any of these required certifications is not completed and submitted as requested, the Contracting Authority will inform the Bidder of a time frame within which to provide the information. Failure to comply with the request of the Contracting Authority and to provide the certifications within the time frame provided will render the bid non-responsive.

2.1 Status and Availability of Resources

The Bidder certifies that, should it be awarded a contract as a result of the bid solicitation, every individual proposed in its bid will be available to perform the Work as required by Canada's representatives and at the time specified in the bid solicitation or agreed to with Canada's representatives. If for reasons beyond its control, the Bidder is unable to provide the services of an individual named in its bid, the Bidder may propose a substitute with similar qualifications and experience. The Bidder must advise the Contracting Authority of the reason for the substitution and provide the name, qualifications and experience of the proposed replacement. For the purposes of this clause, only the following reasons will be considered as beyond the control of the Bidder: death, sickness, maternity and parental leave, retirement, resignation, dismissal for cause or termination of an agreement for default.

If the Bidder has proposed any individual who is not an employee of the Bidder, the Bidder certifies that it has the permission from that individual to propose his/her services in relation to the Work to be performed and to submit his/her résumé to Canada. The Bidder must, upon request from the Contracting Authority, provide a written confirmation, signed by the individual, of the permission given to the Bidder and of his/her availability. Failure to comply with the request may result in the bid being declared non-responsive.

2.3 Rate or Price Certification

3. Certifications Required with the Bid

Bidders must submit the following duly completed certifications as part of their bid.

PART 6 - RESULTING CONTRACT

The following clauses and conditions apply to and form part of any contract resulting from the bid solicitation.

Title: Procedures for Calculating Apportionable Flow for the Qu'Appelle River at the Saskatchewan/Manitoba Boundary

1. Security Requirement

1.1 There is no security requirement applicable to this Contract.

2. Statement of Work

The Contractor must perform the Work in accordance with the Statement of Work at Annex "**A**".

3. Standard Clauses and Conditions

All clauses and conditions identified in the Contract by number, date and title are set out in the PWGSC *Standard Acquisition Clauses and Conditions Manual* (https://buyandsell.gc.ca/policy-and-guidelines/standard-acquisition-clauses-and-conditions-manual) issued by Public Works and Government Services Canada.

3.1 General Conditions

2010B, General Conditions - Professional Services (Medium Complexity), as modified below, apply to and form part of the Contract.

General conditions 2010B is modified as follows:

At Section 12 Transportation Costs
Delete: In its entirety
Insert: "Deleted"

At Section 13 Transportation Carriers" Liability
Delete: In its entirety.
Insert: "Deleted"

At Section 18, Confidentiality:
Delete: In its entirety
Insert: "Deleted"

Insert Subsection: "35 Liability"
"The Contractor is liable for any damage caused by the Contractor, its employees, subcontractors, or agents to Canada or any third party. Canada is liable for any damage caused by Canada, its employees or agents to the Contractor or any third party. The Parties

agree that no limitation of liability or indemnity provision applies to the Contract unless it is specifically incorporated in full text in the Articles of Agreement. Damage includes any injury to persons (including injury resulting in death) or loss of or damage to property (including real property) caused as a result of or during the performance of the Contract."

A. For professional services requirements where the deliverables are copyrightable works:

Canada to own Intellectual Property rights in Copyright
At Section 19 Copyright

1. In this section:
   "Material" means anything that is created or developed by the Contractor as part of the Work under the Contract, and in which copyright subsists.
   "Background Information" means all Intellectual Property that is not Foreground Information that is incorporated into the Work or necessary for the performance of the Work and that is proprietary to or the confidential information of the Contractor, its subcontractors or any other third party;
   "Foreground Information" means all Intellectual Property first conceived, developed, produced or reduced to practice as part of the Work under the Contract;
2. Material that is created or developed by the Contractor as part of the Work under the Contract belongs to Canada. The Contractor must incorporate the copyright symbol and either of the following notices, as appropriate: © Her Majesty the Queen in right of Canada (year) or © Sa Majesté la Reine du chef du Canada (année).
3. At the request of the Contracting Authority, the Contractor must provide to Canada, at the completion of the Work or at such other time as the Contracting Authority may require, a written permanent waiver of moral rights as defined in the *Copyright Act*, R.S., 1985, c. C-42, in a form acceptable to the Contracting Authority, from every author that contributed to the Work. If the Contractor is an author, the Contractor permanently waives the Contractor's moral rights.
4. All Intellectual Property Rights in the Material belongs to Canada as soon as they come into existence. The Contractor has no right in or to any such Intellectual Property except any right that may be granted in writing by Canada.
5. The Contractor also grants to Canada a non-exclusive, perpetual, irrevocable, worldwide, fully-paid and royalty-free license to use the Background Information to the extent that this information is required by Canada to exercise its rights to use the Material. This license cannot be restricted in any way by the Contractor providing any form of notice to the contrary, including the wording on any shrink-wrapped license attached to any deliverable.

4. Term of Contract

4.1 Period of the Contract

The period of the Contract is from date of Contract to December 1, 2017 inclusive.

5. Authorities

5.1 Contracting Authority

The Contracting Authority for the Contract is:

Name: Carl Bathgate
Title: Regional Manager
Environment Canada
Procurement and Contracting
Address: 9250 – 49 Street, NW
Edmonton, Alberta T6B 1K5

Telephone: 780-951-8659
Facsimile: 780-495-5097
E-mail address: carl.bathgate@canada.ca

The Contracting Authority is responsible for the management of the Contract and any changes to the Contract must be authorized in writing by the Contracting Authority. The Contractor must not perform work in excess of or outside the scope of the Contract based on verbal or written requests or instructions from anybody other than the Contracting Authority.

6. Proactive Disclosure of Contracts with Former Public Servants

By providing information on its status, with respect to being a former public servant in receipt of a Public Service Superannuation Act (PSSA) pension, the Contractor has agreed that this information will be reported on departmental websites as part of the published proactive disclosure reports, in accordance with Contracting Policy Notice: 2012-2 of the Treasury Board Secretariat of Canada.

7. Payment

7.1 Basis of Payment

Estimate as supplied: **Basic proposed dollar amount, plus GST**

Contract is to be paid by benchmark, upon acceptance of all specified deliverables. Departmental Representative must review and approve deliverables prior to any compensation.

Up to 4 benchmarks (as describe in Project Reporting Structure Section) will be considered as follows:

1. Following completion of activities outlined in Benchmark #1. (15%)
2. Following completion of activities outlined in Benchmark #2. (40%)
3. Following completion of activities outlined in Benchmark #3. (15%)
4. Following submission of the Final Basin Review Report and all deliverables associated with the project. (30%)

Travel expenses related to attendance at meetings as described in the section 'Project Reporting Structure' shall be included as a separate item within the bid price. Payment for these expenses will be payable after attendance at these meetings.

The Departmental Representative will serve as point of contact for the Contractor and verify satisfactory work completion in accordance with the Statement of Work. Following review, receipt of completed work, and acceptance of the final invoice, payment shall be made within 30 days.

11. Priority of Documents

If there is a discrepancy between the wording of any documents that appear on the list, the wording of the document that first appears on the list has priority over the wording of any document that subsequently appears on the list.

(a) the Articles of Agreement;
(b) Modified 2010B General Conditions
(c) Annex A, Statement of Work;
(d) Annex B, Basis of Payment;

ANNEX A

STATEMENT OF WORK

Title: Procedures for Calculating Apportionable Flow: Qu'Appelle River at the Saskatchewan/Manitoba Boundary

Duration of Contract:

Start Date : **Date of Signing**
Termination Date : **October 2, 2017**

Background: The Prairie Provinces Water Board (PPWB) is the body that oversees the administration of the Master Agreement on Apportionment (MAA). Signed in 1969, the MAA is an agreement in place between Canada and the provinces of Alberta, Saskatchewan and Manitoba relating to the sharing of water in transboundary basins. The PPWB consists of representatives from Alberta, Saskatchewan, and Manitoba, as well as Environment and Climate Change Canada and Agriculture and Agri-Food Canada.

In order to facilitate collaboration on water sharing issues, the PPWB utilizes special committees related to various aspects of the MAA. The Committee on Hydrology (COH) is the committee that directly oversees aspects of the MAA related to water quantity, including the calculation of apportionable flows at the Alberta/Saskatchewan and Saskatchewan/Manitoba interprovincial boundaries.

Apportionable flow is the term used to describe the volume of water available at the boundary that is to be shared under the terms of the MAA. Apportionable flows are similar to naturalized flows in that they are an estimate of the volume of water that would have passed the

interprovincial boundary under undeveloped conditions. They are, however, distinguished from natural flow in that they are calculated based on specific procedures that have been approved by the PPWB. These procedures are selected based on considerations such as data cost and availability, and the required level of accuracy for each basin. In striking this balance apportionable flow calculations may therefore not represent the same level of rigour that might normally be associated with a true natural flow estimate. Apportionable flow calculations, based on the PPWB approved calculation procedures, are completed by the PPWB Secretariat which is housed within the Transboundary Waters Unit of Environment and Climate Change Canada. Deviations from the approved apportionable flow calculation procedures are not permitted without approval of the Board.

The project depletion method is the name given to the apportionable flow calculation methodology that has been adopted by the PPWB for use in apportionment monitoring for most of the interprovincial basins. Project depletion method calculations are typically completed on a monthly time step. The method is based on adjusting the recorded flow at the apportionment point by adding and subtracting measured or estimated water inputs or withdrawals that have occurred within the basin. These include such things as: water put into or released from storage, evaporation losses from stored water, licensed water use, agricultural land drainage activities and inter basin diversions. All these items may also have routing adjustments applied to them to account for travel time between the location of their occurrence and the apportionment point.

Apportionment procedures for most basins were documented during the 1970s in a series of reports published by the PPWB. Some, but not all, basins have had additional studies. The apportionable flow calculations were subsequently moved into FORTRAN programs specific to each basin, which often resulted in modifications to the calculation procedures. An Excel workbook has been developed to complete the apportionable flow calculations for the Qu'Appelle River. The calculations in this workbook mirror the calculation procedures carried out by the former FORTRAN program.

In 2011 the PPWB COH embarked on a process of reviewing the apportionable flow calculation procedures for each of the basins subject to apportionment under the MAA. The COH's target is that each basin will be reviewed approximately every ten years. The purpose of this review process is to ensure regular evaluation and improvement to the apportionable flow calculation procedures. Reviews for the North Saskatchewan River and Cold Lake at the Alberta/Saskatchewan boundary are complete and a review for the Saskatchewan River at the Saskatchewan/Manitoba boundary is underway. The Qu'Appelle River will be the fourth basin to undergo review.

The PPWB has recently begun utilizing a custom apportionable flow program called River Basin Assessment Tools (RBAT). The apportionable flow procedures recommended through this basin review will be implemented in the RBAT program. The Consultant completing the basin review will not be responsible for setting up the basin in RBAT, or require any knowledge in the use of this program, however, it is important to recognize that the use of this software may factor into the decision making process of the COH.

Qu'Appelle River Apportionment

Basin Description and Features

The Qu'Appelle River basin is approximately 52,000 km^2 in area, extending approximately 400 km from east to west. A map of the basin is shown in Figure 1. The main river channel extends from the Qu'Appelle Dam on Lake Diefenbaker in Saskatchewan to its confluence with the Assiniboine River near St. Lazare, Manitoba. The river is incised into the Qu'Appelle Valley, one of the most predominant geographic features of southern Saskatchewan. The valley, which was shaped to its present form during the glacial retreat, varies from approximately 10 to 90 m in depth and up to 3 km in width, although it is estimated that it was once approximately 45 m deeper than present. At the end of the glacial period the South Saskatchewan River followed a course from near the town of Elbow through the Qu'Appelle Valley, before migrating to its current course

The present headwaters of the Qu'Appelle River lie at the southeast end of Lake Diefenbaker at the Qu'Appelle Valley Dam. The portion of the river from Lake Diefenbaker to Buffalo Pound Lake consists of a constructed channel to allow the diversion of water from the South Saskatchewan River to feed the municipal and industrial demands out of Buffalo Pound Lake. The channel was constructed to bypass Eyebrow Lake, although facilities exist to divert water from the channel into the lake if desired to support waterfowl habitat.

The Qu'Appelle River has about ten major tributaries, the most significant of which are the Moose Jaw River and Wascana Creek. The smaller tributary streams are often intermittent with the predominant runoff volume occurring as a result of snowmelt, and in many years little or no flow in the summer. As mentioned above, the water supply in the Qu'Appelle River is augmented by diversions from Lake Diefenbaker via the Qu'Appelle Dam (Elbow Diversion Channel). Diversions into the basin are typically managed to balance or sometimes exceed water consumed, such that in a typical year Saskatchewan may deliver a significant portion of the apportionable flow to Manitoba. To help explain the dynamics of this system the flow composition of the Qu'Appelle River near Lumsden from 1989 to 2001 is shown in Figure 2.

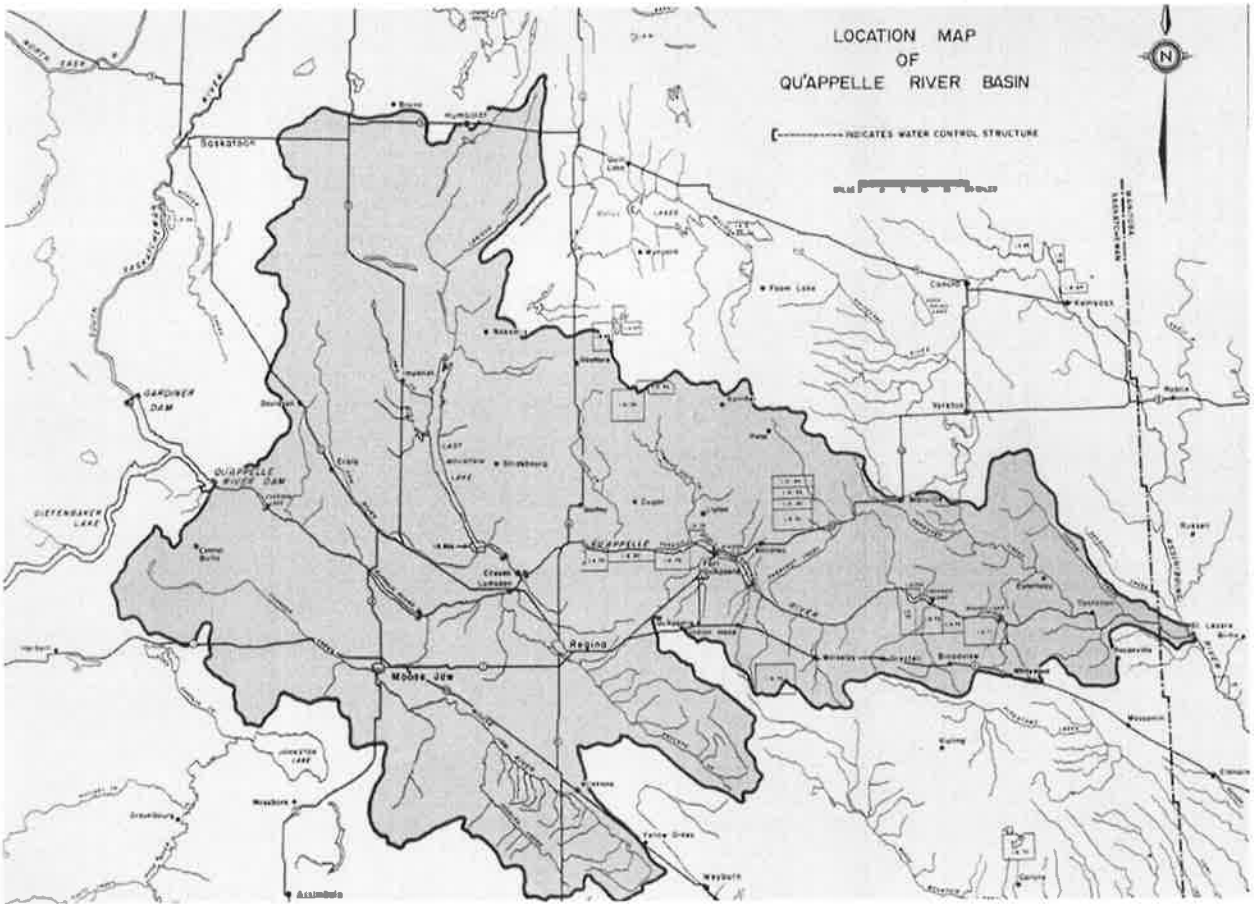

Figure 1: Qu'Appleel River Basin

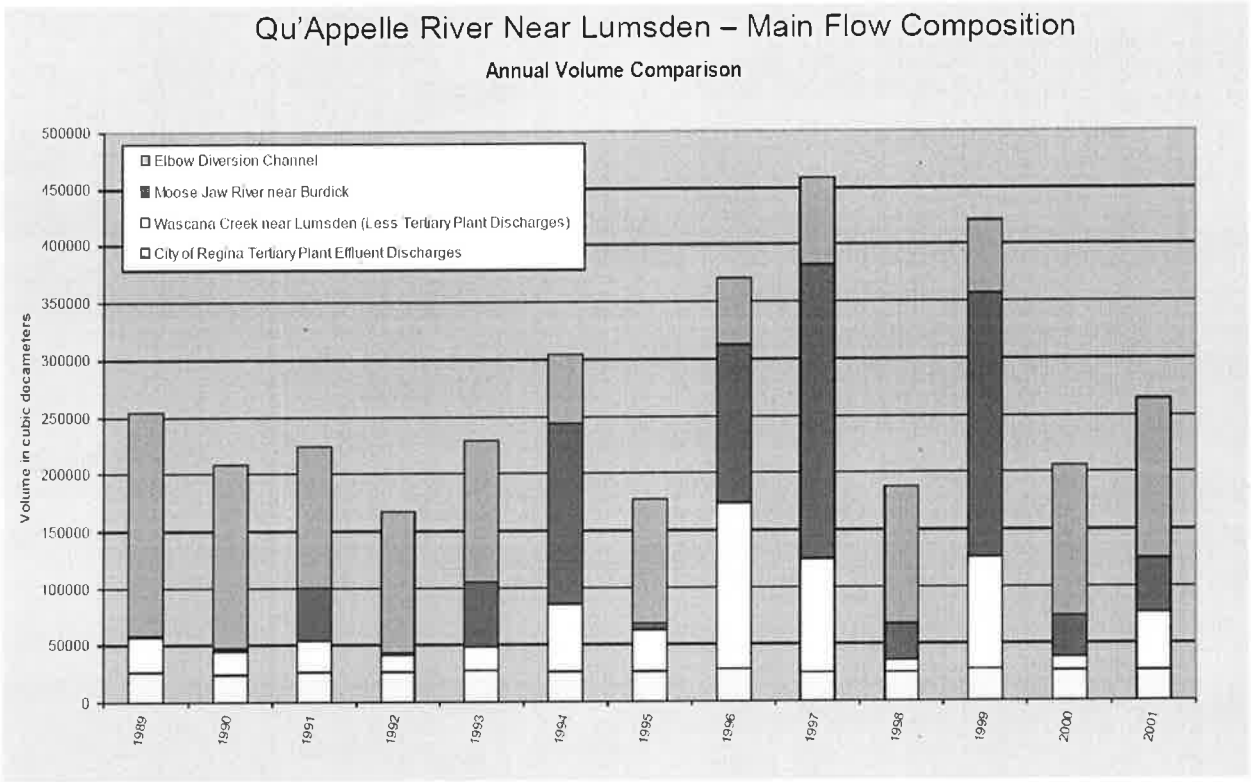

Figure 2: Flow composition of the Qu'Appelle River near Lumsden.

Along the Qu'Appelle River there are several significant natural bodies of water including Buffalo Pound Lake, Pasqua Lake, Echo Lake, Mission Lake, Katepwa Lake, Crooked Lake and Round Lake. Buffalo Pound Lake, as well as the group of lakes known as the Fishing Lakes (Pasqua, Echo, Mission and Katepwa) were created by alluvial fans, deposits of sand and gravel conveyed by the meltwater from the retreating glacier that accumulated at tributary confluences. The largest lake in the basin, Last Mountain Lake, is connected to the Qu'Appelle River by Last Mountain Creek near the town of Craven, Saskatchewan.

The Qu'Appelle River is highly regulated, with some form of control structure present at the outlet of every lake. The structures were constructed to stabilize water supplies, enhance recreation and cottage development opportunities, improve navigation, help develop fish habitat and, in some cases, to help control flow in the river. Further details on the structures can be found in the supporting documentation that will be provided to the successful Consultant (see list of Reference Documents). The structures are as wide as the channel, such that when wide open there is little impact to the natural condition and they do not restrict flow during flood periods. A summary of the control structures is provided in Table 1.

Table 1: Summary of Control Structures on the Qu'Appelle River

Structure	Type	Purpose	Typical Operation

Qu'Appelle Dam	Reinforced concrete drop chute structure with slide gate.	Operated to supplement flows in the Qu'Appelle River with water from Lake Diefenbaker.	Structure operation adjusted several times throughout the year. Small winter flow maintained. Spring and summer diversions are adjusted based on need and channel capacity.
Eyebrow Lake Control Structure	Reinforced concrete structure with five stoplog bays.	Operated to allow diversion (via upstream culverts) into Eyebrow Lake for habitat purposes.	Operated by Ducks Unlimited.
Buffalo Pound Lake Control Structure	Reinforced concrete structure with three main and one riparian slide gates, and a fishway.	Operated to control water levels on Buffalo Pound Lake.	Low flow fall and winter releases. During spring and summer operations are adjusted to maintain lake level within operating range based on inflow and to meet downstream needs.
Valeport Control Structure	Eight bay timber structure with stoplogs.	Operated to control water level on Last Mountain Lake	Typically left open. Has not been operated in at least 10 years.
Craven Control Structure	Reinforced concrete structure with four main slide gates, one small riparian slide gate, and a fishway.	Operated to direct Qu'Appelle River flow into Last Mountain Lake, to manage Last Mountain Lake levels, and to control outflows and regulate downstream Qu'Appelle River flows	Actively operated in medium and low flow conditions. Fully opened during high flows.
Echo Lake Control	Reinforced concrete	To regulate water	Typically opened in

Structure	structure with eight stoplog bays and a riparian gate.	levels on Echo and Pasqua Lakes.	the fall and left wide open over winter. Operated as necessary to bring lake levels into spring and summer operating range.
Katepwa Lake Control Structure and Weir	Reinforced concrete structure with two radial gates and a riparian slide gate. Timber weir is located to the side of main structure.	Operated to stabilize lake levels on Mission and Katepwa Lakes.	Typically structure is left closed except under high runoff events. Lake level is passively controlled by outflow over the weir.
Crooked Lake Control Structure	Nine bay reinforced concrete structure. Six bays have a concrete weir crest that can be augmented with stoplogs. The remaining three bays are standard stoplog controlled.	Operated to maintain water levels on Crooked Lake.	Structure is typically wide open over the winter and spring and may be gradually closed as the lake level recedes into the operating range, then operated to maintain lake level throughout the season.
Round Lake Control Structure	Nine bay reinforced concreted structure similar to Crooked Lake structure.	Operated to maintain water levels on Round Lake.	Operated in similar manner to Crooked Lake structure.

In years of high runoff in the Moose Jaw River flow from that basin naturally backed up into Buffalo Pound Lake during peak flow periods. A dyke and control structure at the east end of the lake now controls outflow from the lake, however at very high flow rates on the Moose Jaw River, flow will still back up into Buffalo Pound Lake over the dyke. The relationship between Buffalo Pound Lake water level and Moose Jaw Creek flow versus overflow into Buffalo Pound Lake under natural conditions is provided graphically in the PPWB report entitled Qu'Appelle River Natural Flow (PPWB, 1975). As the flow rate in the river drops outflow from the lake increases, such that on an annual basis the effect of this feature of the basin on the apportionable flow is moot. However, on a monthly basis there would be some impact.

The hydraulic connection between the Qu'Appelle River and Last Mountain Lake is similarly complex. Naturally, flow on the Qu'Appelle would either have bypassed Last Mountain Lake (Last Mountain Creek), or split with a portion flowing up the creek and surcharging into the lake and portion continuing downstream. How much, or if, water from the Qu'Appelle River entered Last Mountain Lake being dependent on the level of Last Mountain Lake relative to the water level in the Qu'Appelle River. Once the flood crest had passed and the water level in the Qu'Appelle River receded, Last Mountain Lake would then gradually drain back into the river depending again on the water level of the lake relative to the river. The Valeport control structure, at the south end of Last Mountain Lake, and Craven control structure, located on the Qu'Appelle River just downstream from Last Mountain Creek, now allow for some manipulation of this natural connection, by making it possible to either limit or increase flow from the Qu'Appelle River into Last Mountain Lake and to subsequently control the outflow from Last Mountain Lake to the Qu'Appelle River. General practice has been to leave both structures open and allow for a natural split in flows during the spring and early summer. After that the structures may be operated to control the Last Mountain Lake level and flow in the Qu'Appelle River downstream of Craven through to fall.

The 1975 PPWB Natural Flow report contains curves created by PFRA to document the relationship between the Qu'Appelle River and Last Mountain Lake. As the report states these curves are assumed to represent a natural condition, or one where Craven and Valeport dams are wide open. The original version of these curves is also available from the PFRA archives and the notes indicate that they were created based on conditions in 1955 and 1956. A different presentation of curves is also contained in Figure II-10 of The Qu'Appelle River Conveyance Study Handbook of Hydraulics (Saskatchewan Department of Environment, 1975) for which the note also indicates that the curves apply when the control structures at Craven and Valeport are wide open. Some additional modelling work regarding the relationship between the Qu'Appelle River and Last Mountain Lake has recently been conducted by the Saskatchewan WSA. Information on this study will be made available to the Consultant prior to the start of the study.

Tables 2 and 3 are taken from the Environmental Assessment Screening Report for the Replacement of the Craven Control Structure (AAFC, 2002) and are provided for context. Table 2 shows the 1968 to 1999 average monthly and annual releases from Lake Diefenbaker into the Qu'Appelle River, as well as flows of the Qu'Appelle River above and below the Craven control structure and the corresponding flows in Last Mountain Creek. Studies have indicated that in extreme flood events, up to 70% of the peak flow and half of the flood volume at Craven may be diverted into Last Mountain Lake. This is illustrated by the scenarios shown in Table 3.

Table 2: Craven Control Structure – 1968 to 1999 Average Monthly and Annual Flows (from PFRA, 2002).

Month	Average Monthly Flow (m^3/s)			
	Lake Diefenbaker Release to Qu'Appelle River	Qu'Appelle River above Craven Control Structure	Last Mountain Creek[1]	Qu'Appelle River below Craven Control Structure
January	1.62	1.43	0.99	2.42
February	1.20	1.65	0.46	2.11
March	0.86	5.80	-1.76	4.04
April	1.62	33.1	-17.4	15.7
May	3.95	17.8	-6.60	11.2
June	4.62	7.37	-0.01	7.36
July	4.65	6.36	0.12	6.48
August	4.23	3.45	1.80	5.25
September	3.04	2.47	1.97	4.44
October	1.91	1.78	2.94	4.72
November	2.01	1.42	2.95	4.37
December	1.65	1.33	1.96	3.29
Annual (dam^3)	82 600	220 400	-32 500	187 900

Note: 1- Negative values indicate diversions from the Qu'Appelle River into Last Mountain Lake and positive values indicate outflows from Last Mountain Lake to the Qu'Appelle River.

Table 3: Craven Control Structure – Flood Potential (from PFRA, 2002).

Flood Event	Qu'Appelle River above Craven Control Structure		Last Mountain Creek to Last Mountain Lake		Qu'Appelle River below Craven Control Structure	
	Peak Flow (m^3/s)	90-Day Volume (dam^3)	Peak Flow (m^3/s)	90-Day Volume (dam^3)	Peak Flow (m^3/s)	90-Day Volume (dam^3)
1:2	21	50 000	5	25 000	16	25 000
1:5	62	130 000	31	55 000	31	75 000
1:10	102	210 000	51	100 000	51	110 000
1:25	173	320 000	92	150 000	81	170 000
1:50	244	410 000	143	200 000	101	210 000
1:100	335	500 000	213	250 000	122	250 000
1:500	558	700 000	386	350 000	172	350 000

In addition to the Last Mountain Lake curves noted above, the Qu'Appelle Hydraulics Handbook (Saskatchewan Department of Environment, 1975) contains area/capacity curves for all the lakes along the Qu'Appelle River, inflow-outflow curves for Buffalo Pound Lake, outflow curves for Pasqua, Echo, Mission, Katepwa, Crooked and Round Lakes, stage discharge curves for many locations along the river, as well as time of travel estimates for three reaches of the river from the confluence with the Moose Jaw River to Crooked Lake. It is important to note however, that more recent information may be available which will need to be gathered from various agencies as part of this basin review study.

There are many users that consume water from the Qu'Appelle River system, including municipal water supply for Regina and Moose Jaw, agricultural operations, and various commercial/industrial applications. In future there is significant potential for increased industrial usage. The province of Saskatchewan issues various types of water use licenses in order to control and track the amount of water being utilized. The majority of the water use in the Qu'Appelle basin is currently withdrawn from Buffalo Pound Lake, with only a small component occurring from the other lakes, directly from the river, or from off stream sources. The 1996 report entitled PPWB Monitoring Network Interim Report (Water Resources Consultants Ltd., 1996) lists 1430 licensed projects in the Qu'Appelle basin at that time; this

number will have no doubt increased today. Information on current licensed use will be provided by the Saskatchewan WSA for use in this basin review study.

Qu'Appelle River Apportionable Flow Calculations

Apportionable flow calculations for the Qu'Appelle River have undergone significant evolution over the time since annual reporting for this basin began in 1977. The Qu'Appelle River Natural Flow study was published as PPWB Report #45 in 1975. The report provides significant background on the features of the basin and describes the development of a SSARR model, of which further details are provided in a User Manual volume.

Concurrent to that study, the PPWB also published a report called 'Determination of Natural Flow for Apportionment Purposes' (PPWB Report #48, 1976). The report describes options for the calculation of apportionable flow and documents the recommendation of the PPWB to implement the Project Depletion calculation method for apportionable flow calculations. The report also includes recommendations for the application of the project depletion method to five sample basins, including the Qu'Appelle River. The report documents the adoption of the apportionment point for the Qu'Appelle River as the hydrometric station at Welby, which has been carried forward since that time. The Qu'Appelle River is not the only basin for which apportionment is calculated at a hydrometric station and not at the boundary. However, recently the COH has been revisiting these situations and assessing whether reporting should instead be referenced to the boundary, typically by making adjustments within the calculation, or by recommending relocation of the hydrometric station. The location of the apportionment point at Welby shall be reviewed as part of this basin review contract.

Initially, as documented in the 1975 Natural Flow study, calculations were completed on a daily time step using a SSARR model and reported as monthly volumes. The SSARR model for Qu'Appelle River apportionment calculated two simulations: one under natural conditions, and one based on recorded conditions. The model required data from 22 hydrometric stations and was much more complex than almost all other apportionable flow calculations carried out by the PPWB. The SSARR model was adopted because it was felt that the operation of the lakes, most notably Last Mountain Lake, was too complex for other methods of calculating apportionable flow.

The SSARR model divided the river into six reaches: Lake Diefenbaker to Moose Jaw River, Moose Jaw River to Craven, Craven to Loon Creek, Loon Creek to Katepwa Lake outlet, Katepwa Lake outlet to Hyde, and Hyde to Welby. In addition to the effects of the lake regulation and storage in Last Mountain Lake, the SSARR model was also set up to include the overflow into Buffalo Pound Lake, return flow from the SSEWS system, storage in small reservoirs, licensed water use, backwater effects from Indianhead and Ekapo Creeks on outflow from Katepwa and Crooked Lakes, and routing effects. Land drainage projects were not considered.

The 1975 Natural Flow study describes that evaporation was considered in the SSARR model for all the lakes in the Qu'Appelle system. Evaporation from Eyebrow Lake and Buffalo Pound Lake was calculated based on the entire surface area of the water body. Evaporation from Last Mountain Lake was not calculated as a separate item, but was considered lumped together with other components as a net inflow residual. For Pasqua, Echo, Mission, Katepwa, Crooked and Round Lakes evaporation was also calculated indirectly as the net inflow residual, however adjustments were calculated based on Diefenbaker net evaporation to account for the incremental increase in gross evaporation for smaller, shallower water bodies. The gross evaporation depth used in the calculation was estimated as the net evaporation at Lake Diefenbaker multiplied by a factor of 1.1.

Over time, problems and issues were encountered with the Qu'Appelle SSARR model related to both the complexity and construction of the model itself, as well as data availability. In the mid 1990's a decision was made to investigate alternatives to the SSARR model. The Saskatchewan Water Security Agency (then Sask Water) was contracted to complete a review of the Qu'Appelle River apportionable flow calculation procedures which was summarized in a report entitled Qu'Appelle River Apportionment Review (Sask Water, 1996). The report recommends the use of an annual water balance method for the Qu'Appelle River apportionable flow calculations. The annual water balance method described in this report was implemented in 1995 via a FORTRAN program which has been in use since that time. In order to facilitate easy understanding of the current calculation procedures by the Consultant, an Excel Workbook illustrating the application of this water balance methodology for the period from 1995 to 2014 has been created. The Consultant awarded this contract is not expected to interface with the FORTRAN program at all.

The annual water balance method is much more simplified than the SSARR method, requiring hydrometric data from only 12 hydrometric stations. The method estimates annual flow in the river based on recorded annual volumes for the Qu'Appelle River near Lumsden and on the tributaries throughout the basin. The recorded volumes are adjusted using the recorded flow for the Elbow Diversion (subtracted from recorded flow), as well as annual diversions by licensed projects throughout the basin (added to the recorded flow). The calculation can be summarized as follows:

$$\textit{Apportionable Flow at Welby} =$$
$$\tfrac{2}{3}\ (\text{Recorded Flow of the Qu'Appelle River near Lumsden} +$$
$$\text{Diversions by Licensed Projects upstream of Lumsden} - \text{Recorded Elbow Diversion} +$$
$$\text{Local Inflow from Lumsden to Craven} +$$
$$\text{Diversion by Licensed Projects Lumsden to Craven)} + \text{Local Inflow Craven to Welby} +$$
$$\text{Diversion by Licensed Projects Craven to Welby} - \text{Lake Evaporation}$$

The licensed water use is divided into two categories. The first category are uses withdrawing water directly from the river (18,356 dam^3) and the second category are licenses that withdraw water from other locations in the basin (43,880 dam^3). The licenses obtaining water from the river are assumed to utilize 100% of their licensed allocation each year. The licences obtaining water from elsewhere in the basin are assumed to obtain a portion of their allocation which is

estimated using the ratio of the annual tributary flow volume to the 70% annual tributary flow volume (i.e. if the annual volume exceeds the 70% flow volume then the licenses will receive their full allocation, if not it will be prorated). The licensed water use is assumed to be distributed evenly throughout the basin, such that the total allocation is distributed based on the effective drainage area of a particular sub basin vs. the total effective drainage area at Welby, SK.

The calculations of tributary inflow and licensed water use are divided into the following sub basins: above Lumsden, Lumsden to Craven, Craven to Pasqua Lake, Pasqua Lake to Echo Lake, Echo Lake to Indianhead Creek, Indianhead Creek to Crooked Lake, Crooked Lake to Round Lake, and Round Lake to Welby. In past years data from some of the tributary hydrometric stations has not been available, in which case data from neighbouring stations has been used in its place with the appropriate adjustments in drainage area ratio. These instances are shown in the Excel spreadsheet.

The annual water balance method handles the impact of Last Mountain Lake by assuming that one third of the natural flow in the Qu'Appelle River at Craven flows into Last Mountain Lake. The method inherently assumes that there is no outflow from Last Mountain Lake and justifies this by the assertion that only in high flow years would there be appreciable outflow, and in those years apportionment is not an issue. It is assumed that in the remaining years evaporation and licensed use from the lake would totally consume all inflow into the lake from the Qu'Appelle River and there would be no outflow. This is a considerable simplification which leads to a systematic under reporting bias to the apportionable flow at Welby. Other details such as the overflow into Buffalo Pound Lake, return flow from the SSEWS system, and Eyebrow Lake are not considered in the annual water balance method.

In the annual water balance calculations, evaporation is calculated based on derived net evaporation at Regina multiplied by the estimated natural surface area of the six lakes downstream of Craven. In the current calculation procedures this evaporation volume is subtracted in the calculation of apportionable flow at Welby as documented in the 1996 SaskWater report. Evaporation from Buffalo Pound Lake is included in the calculation by default as it is accounted for in the recorded flow near Lumsden, however because there is an incremental increase in evaporation due to a larger surface area, evaporation losses for that incremental area are added back into the calculated apportionable flow. Evaporation from Last Mountain Lake is considered in the model, in so far as it is included in the rationale to support not considering outflow from the lake.

At the same time that the Qu'Appelle River Apportionment Review study was being completed by Sask Water, Environment Canada contracted out another study to look at simplifications for the calculation of Qu'Appelle River apportionable flows. That study was wrapped up in 1996 and is documented in a report entitled Qu'Appelle River PPWB Monitoring Network Interim Report (Water Resource Consultants Ltd., 1996). The study proposed various alternatives for simple apportionable flow accounting for the Qu'Appelle River, including an option which required data from only five hydrometric stations and included consideration of Last Mountain Lake which was reported to provide very reasonable results. No further action was taken by the

PPWB as a result of the recommendations of this study. At some point in time the Saskatchewan Water Security Agency did develop their own internal WRMM model, which has been updated as recently as 2013, however no such model was ever adopted by the PPWB.

The percent delivery Saskatchewan made to Manitoba over the period of apportionment monitoring is shown in Table 4. In the years from 1981 to 1995 apportionment was calculated based on the water year (April to March). As mentioned previously, the transition from the SSARR model to the Water Balance model occurred in 1995. It should be noted when looking at this table that it is acknowledged by the COH that one of the downfalls of the Qu'Appelle apportionable flow calculations to date is that the apportionable flow has likely been systematically underestimated, leading to overestimates of percent delivery by Saskatchewan, due to simplifying assumptions in the calculation models used.

Although Saskatchewan generally offsets all of its water use with water diverted from the South Saskatchewan River, and delivers well in excess of the required 50% of the apportionable flow to Manitoba, apportionment monitoring is continued at the discretion of the Board.

Table 4: Historical Apportionable Flow Summary

Year	Recorded Flow, dam^3	Apportionable Flow, dam^3	% Apportionable Delivered
1977	72150	73330	98%
1978	64700	69200	93%
1979	361000	299000	121%
1980	114000	63000	181%
1981	67560	41780	162%
1981/82	59500	29700	200%
1982/83	295000	194000	152%
1983/84	327000	246000	133%
1984/85	64900	39200	166%
1985/86	270000	170000	159%
1986/87	108300	112700	96%
1987/88	68440	34870	196%
1988/89	20280	5091	398%
1989/90	71315	9640	740%
1990/91	160010	82169	195%
1991/92	179440	69826	257%
1992/93	149010	89851	166%
1993/94	179940	52555	342%
1994/95	430810	349675	123%
1995	441000	430000	103%
1996	718000	530000	135%
1997	597000	471000	127%
1998	199000	96500	206%
1999	677000	471000	144%

2000	163000	76480	213%
2001	338460	318610	106%
2002	83110	18200	457%
2003	285310	161980	176%
2004	176490	76600	230%
2005	443280	333133	133%
2006	441700	277101	159%
2007	436000	264959	165%
2008	128000	44800	286%
2009	173000	139000	124%
2010	757000	438172	173%
2011	2270000	1810000	125%
2012	529000	437000	121%
2013	716000	509000	141%
2014	1640000	1670000	98%

Key Considerations for the Qu'Appelle River Basin Review Study

The basin review will examine each aspect of the apportionable flow calculation for potential improvement as described in the Outline of Study Steps and Generic Table of Contents that are included in this RFP.

The study is expected to review all aspects of the apportionable flow calculation as described in the following sections, however, some areas that are anticipated to require special attention for the Qu'Appelle basin will include:

- Exploration of alternative calculation methodology options for determining the apportionable flow of the Qu'Appelle River at the Saskatchewan/Manitoba boundary, including use of the Project Depletion method.
- Examination of the manner in which tributary inflow is estimated, should the Project Depletion method not be adopted.
- Exploration of options for accounting for the connection between Last Mountain Lake and the Qu'Appelle River within the apportionable flow calculation.
- Completion of a review of current licensed water use in the Qu'Appelle basin and determination of options to include this water use in the apportionable flow calculation.
- Consideration of the manner in which evaporation from regulated lakes in the Qu'Appelle basin should be included.
- Consideration of the location of the apportionment point at the hydrometric station at Welby vs. the interprovincial boundary.

Outline of Study Steps:
The following steps outline the general study process:

i. Research and compile information regarding the hydrology of the basin.
ii. Investigate current basin characteristics and features as they relate to the estimation of apportionable flow.
iii. Review historical written documentation regarding the apportionable flow calculation procedures for this basin provided by the COH.
iv. Review the current calculation procedures (will be provided in an Excel workbook).
v. Determine options for an alternative apportionable flow calculation methodology to the method currently in use. One option that must be investigated will be a project depletion method based calculation, as this is in keeping with most other basins apportioned by the PPWB.
vi. Critically examine the various components (e.g. diversions into the basin, licensed consumptive use, evaporation, routing, etc.) that are considered in the calculation of apportionable flow in order to:
    a. Understand the impact of the assumptions made in the current calculation procedure on the apportionable flow calculations.
    b. Assess whether the assumptions accurately represent the current conditions in the basin and if they can be expected to remain valid for application in the future.
    c. Determine what options are available to account for each component (e.g. what calculation methods are available, or, if insignificant, should the item be left out of the calculation).
    d. Quantify the significance of the various options for the revised calculation procedures on the apportionable flow results.
    e. Identify other considerations relating to changes to the procedures (e.g. data availability, monitoring program implications, accuracy of data).
vii. Consider the impact of the changes to the calculation procedures as a whole in comparison to the current calculation methodology.
viii. Summarize the data requirements for the proposed new calculation procedures.
ix. Set up the new apportionable flow calculation procedures in an Excel workbook.
x. Determine what the impact of anticipated future changes in the basin may be on apportionable flows and provide recommendations regarding future review and potential need for further revision to the apportionable flow procedures (beyond the regular review cycle that is proposed).
xi. Document the study process and findings in a comprehensive and detailed written report. The report must be suitable for publication as a PPWB approved technical report.

The successful Consultant will complete all analysis and background work and present options for the calculation methodology (item v) and calculation of each component of apportionable flow to the PPWB COH (item vi). The COH will determine which options will be carried forward to form the revised apportionable flow calculation methodology. The Consultant will use the decisions of the COH to inform their work on items vii) through xi) above.

A generic annotated basin review table of contents is included as a guideline for completion of this study.

Documentation and Information Available to Support the Qu'Appelle River Basin Review

The following documents and information may be used by the Consultant to assist in conducting the basin review and in preparation of the report:

1. PPWB Report #48, Determination of Natural Flow for Apportionment Purposes, 1976.
2. PPWB Report #45, Qu'Appelle River at Saskatchewan Manitoba Boundary, Natural Flow, 1975.
3. PPWB Report #45 (Part 2), Qu'Appelle River at Saskatchewan Manitoba Boundary, Natural Flow, User Manual, 1975.
4. Excel workbook documenting current apportionable flow calculation procedures for the Qu'Appelle River.
5. PFRA Hydrology Report #104, The Determination of Gross and Effective Drainage Areas in the Prairie Provinces, 1983 and Addendum #8, 2001.
6. PFRA Watershed Project, http://www.agr.gc.ca/watersheddelineation.
7. Report of the Qu'Appelle River Basin Study Board, 1972
8. Qu'Appelle River System and Operation Technical Document, Environment Saskatchewan, 1977.
9. Qu'Appelle Conveyance Study Handbook of Hydraulics Appendix 1, Saskatchewan Department of the Environment, 1975.
10. PFRA Plans 41826 and 41831, Qu'Appelle River Inflow to Last Mountain Lake and Qu'Appelle River Outflow from Last Mountain Lake (PFRA, 1956 and 1957).
11. Qu'Appelle River PPWB Monitoring Network Interim Report, Water Resource Consultants Ltd., 1996.
12. Environmental Assessment Screening Report, PFRA Craven Control Structure: Replacement and Decommissioning, Agriculture and Agri-Food Canada, 2002.
13. Qu'Appelle River Apportionment Review, Water Management Division, Sask Water, 1996.
14. PPWB Report #172 Calculation of Apportionable Flow for the North Saskatchewan River at the Alberta/Saskatchewan Interprovincial Boundary, 2015.

Client Participation

The COH will act as the oversight body for this project. The following support can be anticipated from COH members and the PPWB Secretariat:

- The COH will provide the Consultant with any available information that is relevant to the project, including the reports and files listed in the Documentation section above.

- The COH will review and provide comments on the Consultant's deliverables in a timely manner.
- Available consumptive use licensing information and associated data will be provided by the appropriate provincial jurisdiction.
- Various other information will also be provided by the appropriate provincial or federal agencies as required. This may include items such as reservoir information, details of water control structures, operating plans, etc.
- The COH will attend scheduled meetings with the Consultant in order to keep informed of the Consultant's progress, as well as to answer any questions and provide information to the Consultant as requested.
- The Consultant will provide options for calculation of apportionable flow to the COH. It will be the responsibility of the COH to determine which of the options presented will be used for the new apportionable flow calculations.

Contractor Responsibilities:

Responsibilities of the Consultant

The Consultant will be responsible to make whatever contacts are necessary to obtain the information and data necessary to complete the basin review. This will include contact with provincial and federal agencies (possibly through COH members). In some cases the Consultant may also be required to contact outside parties to request information pertaining to the basin review. The project is anticipated to consist of a desktop review only and no field work component is envisioned. The Consultant will keep the COH informed of progress on the study and proactively seek input on any issues that are encountered during the course of completing the work.

Project Reporting Structure

The Consultant will have a single point of contact within the PPWB Secretariat through which all communication regarding the project will be channeled. All communication regarding the project will be in English.

The following tasks outline the structure of the basin review assignment:

Project Start Up Meeting (Benchmark #1)
The Consultant shall attend a project start up meeting with the COH. The Consultant shall attend the meeting in person at the PPWB office in Regina, although some members of the COH may participate by teleconference. The cost of any required travel or related expenses for the Consultant to attend this meeting must be included as a separate item in the bid price. At this meeting the project requirements and deliverables will be reviewed and any outstanding issues pertaining to the Consultant's proposal will be resolved. Prior to the meeting the Consultant will have reviewed the supporting documentation provided by the PPWB and come to the meeting prepared with any questions they may have regarding that material, as well as a list of other

information that they anticipate requiring for the study. The Consultant must be familiar with the current apportionable flow calculation method to enable a useful discussion with the COH regarding the project.

Submission of First Draft of Report (Benchmark #2)
A face to face meeting will be held at the PPWB office in Regina after submission of the first draft of the Basin Review Report. The cost of any required travel or related expenses for the Consultant to attend this meeting must be included as a separate item in the bid price. The first draft of the report will present options for the revised apportionable flow calculation procedure as described in the sixth bullet of the Client Participation section above. This report will be incomplete in that it will not include any recommendations, only options. Based on the analysis and options presented by the Consultant, the COH will determine what changes will be made to the apportionable flow calculation. The COH will be allowed at least six weeks to make these decisions and respond to the Consultant. The Second Draft Basin Review Report will reflect the outcome of this meeting and the decisions of the COH.

Submission of Second Draft of Report (Benchmark #3)
Once a Second Draft version of the Basin Review Report is complete it shall be submitted to the COH for review. This version of the report will be complete and reflect the decisions of the COH with regards to what will be included in the revised apportionable flow calculation. The Second Draft Report shall be submitted in MS Word format to facilitate the insertion of review comments by the COH in Track Changes mode. The minimum review period allowed to the COH will be four weeks. Comments will be provided in writing to the Consultant as they become available. Following the COH review period the Consultant will take action to address the comments received from the COH on the Second Draft Basin Review Report.

Submission of Final Draft of Report
A Final Draft Report shall be submitted for review by the COH in MS Word format to facilitate the insertion of review comments in Track Changes mode. The purpose of this submission is to allow the COH the opportunity to confirm that any issues and concerns previously raised have been addressed to their satisfaction. The COH will be allowed a period of four weeks in which to complete their review and provide any remaining feedback in writing.

Submission of Final Report (Benchmark #4)
Once any remaining issues have been resolved, the Consultant will issue the final version of the Basin Review Report.

Deliverables:

All interim in and final project deliverables must be submitted in English.

The final project deliverables will consist of the Basin Review Report documenting the review process and detailing the options available for apportionable flow calculation procedures. The revised calculation procedures will be set up in an Excel workbook which will also be provided.

The submission of the final document will consist of an electronic copy of the report in both MS Word and PDF formats. The Consultant will also submit one copy of all supporting documentation and files collected in the course of the assignment in electronic format.

IMPORTANT NOTE: This contract may be cancelled at any time should the Contractor be unable or unwilling to fulfill the conditions of any Benchmark. The Crown will pay all completed work up to the point of unfulfilled Benchmark conditions.

Generic Annotated Table of Contents for PPWB Basin Review

(Note: The annotations are meant only as a guide as to what type of content was intended for each section. They are not meant to be a comprehensive account of the information required in the report. **It should be expected that other report sections and sub sections will likely be required based on the specific situations in each basin.** Similarly some sections listed here may not apply to all basins.)

Executive Summary
Table of Contents

1. Introduction
   1.1 Study Background
      Description of basin review concept, procedures, how this document fits in the broader context.
   1.2 Report Overview
      Description of how the report is laid out to help guide the reader.

2. Basin Overview
   2.1 Basin Geography
      Description of location, size, terrain, significant features, land use, etc.
   2.2 Basin Hydrology
      Description of basin hydrology and related statistics.

3. Apportionable Flow Calculation Background
   3.1 Apportionment Details
      Location of apportionment point, details of apportionment obligations (% delivery to downstream jurisdictions), historical apportionable vs recorded flow, calculation interval, apportionment period, etc.
   3.2 Documented Apportionable Flow Calculations
      Summary of apportionable flow calculation procedures documented in various reports provided by PPWB.
   3.3 Current Apportionable Flow Calculations
      Describe current calculation procedures determined from review of Excel workbook. Comment on obvious problems noted in these procedures.
   3.4 Comparison of Apportionable Flow Results from Documented Method vs. Current Procedures

Highlight differences between current vs. documented calculation procedures and what difference that makes to the apportionable flow results.

3.5 Discussion of Other Models Available for Basin

For some basins provincial agencies maintain their own models. Does such a model exist for this basin? How do naturalized flows from that model compare with PPWB apportionable flow results?

3.6 Summary

4. Apportionable Flow Calculation Methodology

4.1 Current Calculation Methodology

Describe current methodology, outline problems or advantages of current methodology.

4.2 Options for Apportionable Flow Calculation Methodology

Describe other options for method used to calculate apportionable flow, including project depletion method based calculation, pros and cons of each option.

4.3 Summary of Option Selected by COH

5. Consumptive Use *(including, but not limited to, commercial/industrial, municipal and agricultural uses)*

5.1 Consumptive Use in Current Apportionable Flow Calculations

How is consumptive use accounted for under current procedures? Which licenses are included in the calculation?

5.2 Availability of Consumptive Use Data

What data regarding consumptive use is available, what are the limitations of that data (availability, accuracy, etc.)?

5.3 Analysis of Consumptive Use Data

What can be determined from the available consumptive use data? Where are consumptive uses located in the basin? What kinds of uses are present? How is water use distributed within the year?

5.4 Consumptive Use Returns

Of the total consumptive use volume how much is actually consumed? How will water returned to the system be estimated (i.e. agricultural return flows, municipal effluent)?

5.5 Significance of Consumptive Use Relative to Apportionable Flow

Quantify the significance of consumptive use in the basin and the impact it would have on the estimation of apportionable flow.

5.6 Procedures for Incorporating Consumptive Use in Apportionable Flow Calculations

Present options for including consumptive use in the apportionable flow procedures (i.e. do not include, various estimation methods). What projects would be included and how would the volumes be estimated? What data is required? Demonstrate the options with sample calculations. Highlight the pros and cons of each option.

5.7 Changes to Consumptive Use Over Time

Note any anticipated projects that would have a significant impact on consumptive use or any trends in consumptive use in the basin. Estimate the impact of future increase in consumptive use on apportionable flows (e.g. if consumptive use increased by 15% how that would impact apportionable flow). Outline options for updating consumptive use in apportionable flow procedures if appropriate.

5.8 Summary of Option Selected by COH

(including procedures for updating consumptive use data, if applicable)

6. Impact of Land Use Changes
   6.1 Agricultural Drainage
   Does the basin contain a significant amount of agricultural land that has drainage projects in place? Where are the projects located? What is the estimated impact of that drainage on flow at the apportionment point? Are more drainage projects being considered?
   6.2 Other Land Use Changes
   Are there other land use changes in the basin that impact the flow at the apportionment point (e.g. urban development, resource development, etc.)?
   6.3 Procedures for Incorporating Impact of Land Use Changes in Apportionable Flow Calculations
   Present options for including land use changes in the apportionable flow procedures (i.e. do not include, various estimation methods). What data is required? Demonstrate the options with sample calculations. Highlight the pros and cons of each option.
   6.4 Summary of Option Selected by COH

7. Channel Loss
   7.1 Channel Loss in Current Apportionable Flow Calculations
   Is channel loss considered in current calculation procedures?
   7.2 Significance of Channel Loss Relative to Consumptive Use and to Apportionable Flow
   Is channel loss significant in the context of this basin? (If not the entire channel loss section can likely be omitted)
   7.3 Procedures for Incorporating Channel Loss in Apportionable Flow Calculations
   What options are available to estimate channel loss? What data is required? Demonstrate the options with sample calculations. Highlight the pros and cons of each option.
   7.4 Summary of Option Selected by COH

8. Reservoir Evaporation
   8.1 Evaporation in Current Apportionable Flow Calculations
   Is evaporation from reservoirs considered in current calculation procedures?
   8.2 Available Methods for Estimating Evaporation
   For the locations in question are evaporation estimates already available? What data is available to calculate evaporation? How to evaluate these methods?
   8.3 Significance of Reservoir Evaporation Relative to Apportionable Flow
   Is reservoir evaporation significant in the context of apportionable flow in this basin? How does reservoir evaporation compare to other water uses?
   8.4 Procedures for Incorporating Reservoir Evaporation in Apportionable Flow Calculations
   Present options for including reservoir evaporation in the apportionable flow procedures (i.e. do not include, various estimation methods). What data is required? Consider data availability and expense vs. required accuracy, and methods used by the PPWB in other basins. Demonstrate the options with sample calculations. Highlight the pros and cons of each option.
   8.5 Summary of Option Selected by COH

9. Routing Adjustments for Consumptive Use Projects
   9.1 Routing Adjustments in Current Apportionable Flow Calculations
   How is routing of the various apportionable flow adjustments accounted for in the current calculation procedures?
   9.2 Significance of Routing Relative to Apportionable Flow
   What items in the apportionable flow calculations may require routing to the apportionment point (e.g. consumptive uses, reservoir storage changes). Do the volumes, distances and patterns of use warrant routing?
   9.3 Procedures for Routing in Apportionable Flow Calculations
   Provide options for routing calculations along with supporting information. What data is required? Demonstrate the options with sample calculations. Highlight the pros and cons of each option.
   9.4 Summary of Option Selected by COH

10. Overall Impact of Proposed Calculation Changes
   Quantify and discuss the impact of the proposed changes to the apportionable flow calculation method relative to the current procedures and documented procedures.

11. Hydrometric Data Required for Apportionable Flow Calculations
   Summarize what hydrometric data will be required to complete the apportionable flow calculations as proposed. How does this compare to current data requirements?

12. Meteorological Data Required for Apportionable Flow Calculations
   Summarize what meteorological data will be required to complete the apportionable flow calculations as proposed. How does this compare to current data requirements? Does the meteorological monitoring network provide adequate information for apportionable flow calculation? (e.g. precipitation observation...)

13. Other Data Required for Apportionable Flow Calculations
   Summarize any other data that will be required to complete the apportionable flow calculations as proposed. How does this compare to current data requirements?

14. Future Action Regarding Apportionment Calculation Procedures
   Based on the information presented in the report note any future actions that will be required in order to keep the apportionment calculations valid. Is anything beyond the proposed 10 year review cycle required for this basin?

15. Conclusions and Recommendations
Provide an overall summary of the study and the recommended apportionable flow calculation procedures.