PRAIRIE PROVINCES WATER BOARD

WATER QUALITY PROCEDURES MANUAL

OCTOBER 1991
PPWB REPORT NO. 110

SUMMARY

This document outlines procedures adopted by the Prairie Provinces Water Board to facilitate the carrying out of the Board's interprovincial water quality management responsibilities in accordance with the 1969 Prairie Provinces Water Board Master Agreement on Apportionment. The need for the manual is a result of the growing importance and complexity of interprovincial water quality management and the need to more clearly define the role of the PPWB and its member agencies in carrying out the Board's water quality mandate.

In addition to providing the goal and objectives of the PPWB water quality program the manual outlines the responsibilities and activities to be carried out by both the parties to the Master Agreement and the Board to meet these objectives. The manual describes how water quality objectives were developed, how they are used and the procedures for amending them.

The PPWB water quality monitoring program is also discussed in this document. The monitoring program goals and objectives are defined along with reporting and updating procedures. The last part of the manual describes how the Board identifies and resolves potential water quality issues by reviewing development proposals and implementing the PPWB Water Quality Contingency Plan.

Most of the manual's content is based on the September 1989 Committee on Water Quality Policy report "Proposed Water Quality Strategy for the Prairie Provinces Water Board", and the November 1983 "Prairie Provinces Water Board Water Quality Administrative Procedures - PPWB Report No. 66".

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CHAPTER 1

INTRODUCTION

Since the signing of the Master Agreement on Apportionment in 1969, the Prairie Provinces Water Board (PPWB) has been involved in interjurisdictional water quality management. In recognition of the growing importance of water quality to social and economic development as well as environmental and public protection, a new schedule on water quality was added to the Master Agreement in 1991. That schedule specifically defines the mandate of the PPWB in interprovincial water quality management and the role of the parties and the Board in carrying out that mandate. A copy of Schedule E (Agreement on Water Quality) is shown in Appendix I.

Because of the complexity and dynamics of water quality management the PPWB identified the need to prepare this document on water quality procedures for use by the Board and its Committee on Water Quality (COWQ). This Water Quality Procedures Manual was therefore prepared by the PPWB Secretariat and approved for use by the Board at its October 1991 meeting.

This manual contains five chapters including the Introduction. Chapter 2 provides the goal and objectives of the PPWB water quality program. Chapter 3 describes how the PPWB Water Quality Objectives were developed, the procedures used to renew and amend the objectives and how excursions to the objectives are reported. Chapter 4 describes the goals and objectives of the PPWB water quality monitoring program and how the results of that program are reported. Chapter 5 sets out the procedures on how interprovincial water quality issues are identified and resolved.

The manual has four appendices. Appendix I contains the Schedule E to the Master Agreement on Apportionment. Appendix II lists the most recent PPWB Water Quality Objectives and Appendix III shows the PPWB Water Quality River Reaches. Appendix IV contains a summary report of excursions to the PPWB Objectives.

The document is bound in loose-leaf form to facilitate future amendments or additions.

CHAPTER 2

PPWB WATER QUALITY PROGRAM

2.1 PRAIRIE PROVINCES WATER BOARD AGREEMENTS

On July 28, 1948 Canada, Alberta, Saskatchewan and Manitoba signed the Prairie Provinces Water Board Agreement. The agreement created an advisory Board whose duties were to make recommendations on the best use of interprovincial waters and allocations of water between the provinces.

In 1969, to reflect changes in water management philosophies, the Master Agreement on Apportionment was signed. This agreement established a formula for apportionment of interprovincial waters, gave recognition to the problem of water quality and provided the Board authority to study and consider water quality problems related to interprovincial waters.

While the Master Agreement stated that interprovincial water quality matters were within the mandate of the Board, it did not provide the same degree of specificity accorded to water quantity apportionment. Consequently, in 1989 the Board established the Committee on Water Quality Policy to clarify the Board's role in water quality management. As a result of the Committee's recommendations, a new Schedule E to the Master Agreement was prepared which more clearly defined the Board's mandate in the management of the quality of water in interprovincial streams.

2.2 WATER QUALITY PROGRAM GOAL AND OBJECTIVES

2.2.1 Goal

Schedule E to the Master Agreement states that the goal (Mandate) of the PPWB water quality program is "**to foster and facilitate interprovincial water quality management among the parties that encourages the protection and restoration of the aquatic environment.**"

2.2.2 Objectives

The objectives of the PPWB Water Quality Program are to:

1. **Promote a preventative and proactive approach to interprovincial water quality management.**

   The Board will undertake activities which will be consistent with preventing the pollution and degradation of interjurisdictional waters. It will carry out its activities with a vision of the future by keeping informed about regional environmental, social and economic trends to anticipate and deal with water quality issues.

2. **Promote the protection and restoration of the aquatic environment.**

   The Board will attempt to anticipate and respond to potential issues as well as react to present issues. Water quality management should not only facilitate and ensure the protection of the aquatic environment but work towards the restoration of the aquatic environment where improvement is beneficial to various interjurisdictional water uses.

3. **Promote an ecosystem approach to the management of interprovincial waters.**

   The Board recognizes that the aquatic ecosystem is composed of closely linked elements. Management of one element, or changes in one element, will induce changes in another and so on. Therefore, water quality management needs to consider the ecosystem as a whole to be effective.

4. **Recognize the effect of quantity on the quality of water for the effective management of interprovincial waters.**

   The management of interjurisdictional water quality requires recognition of the relationship of flow versus water quality. Flow augmentation, withdrawal and regulation on the prairies have a pronounced effect on the quality of water.

5. **Promote compatible water quality objectives for the effective management of interprovincial waters.**

   The Board will encourage the development of consistent water quality guidelines (eg. CCME) to be used by the parties in establishing water quality objectives. A cooperative negotiating process is the key to developing compatible water quality objectives.

2.3 RESPONSIBILITIES AND ACTIVITIES

To achieve the goal and objectives of the Prairie Provinces Water Board in the area of water quality there are a number of responsibilities and activities which need to be carried out. These have been divided into those which are primarily the responsibility

of the parties to the Master Agreement and those which are the responsibility of the Board.

2.3.1 Parties

To carry out the goal and objectives of the PPWB water quality program, the parties shall:

1. ***Promote a compatible approach to the protection and restoration of interprovincial waters by:***

   a) adopting the PPWB Water Quality Objectives and designated uses shown in Appendix II;

   b) implementing all reasonable and practical measures to meet the PPWB Water Quality Objectives;

   c) agreeing, where existing water quality is better than the agreed upon objective, reasonable and practical measures will be taken to maintain the quality and where the agreed upon objective is better than the existing water quality because of human activities, reasonable and practical measures will be taken to improve the quality to meet the objective;

   d) ensuring compatibility of agency sampling and analytical protocols;

   e) promoting compatible water pollution control programs.

2. ***Promote public awareness and understanding of the importance of water quality management and the Board's role in interprovincial water quality by:***

   a) consulting with the public;

   b) handling media inquiries;

   c) issuing news releases.

2.3.2 Board

To meet the goal and objectives of the PPWB water quality program, the Board shall:

1. ***Plan, coordinate and direct transboundary water quality monitoring and assessment by:***

   a) planning and directing water quality monitoring of eastward flowing interprovincial streams, near the boundaries, to ensure the PPWB objectives are being met on the interjurisdictional river reaches;

   b) coordinating and/or directing synoptic surveys as required;

   c) identifying monitoring needs which may include but not necessarily be limited to the collection of water, biological, sediment and toxicity data (see Chapter 4);

   d) promoting a long-term monitoring network to meet the goals of the Board;

   e) interpreting water quality data through assessment by modelling, statistical analysis, trend analysis and other means;

   f) publishing reports to the parties annually or from time to time as the Board considers necessary, on the quality of the water in the watercourses;

   g) maintaining and operating a computerized water quality data base.

2. ***Assess the effectiveness of water quality management and control programs, identify and investigate problems, and recommend remedial or preventative measures by:***

   a) reviewing water quality data and scientific information on a periodic basis, no less frequent than every five years, and make recommendations to the parties on the revision and development of PPWB objectives in Appendix II;

   b) ensuring that the PPWB objectives are compatible with the provincial objectives and/or CCME Guidelines and that the scientific basis for the objectives is agreed to by all parties;

   c) recommending to the parties appropriate remedial action to resolve concerns identified by comparison to the objectives;

d) keeping informed of water quality management strategies and control programs and observing the quality of interprovincial waters;

e) ensuring that sampling and analytical protocols are established for each water quality objective;

f) identifying and evaluating trends and changes in water quality and their causes;

g) reviewing the PPWB water quality monitoring program, surveys and studies and updating them as appropriate.

3. ***Promote a compatible approach to the protection and restoration of interprovincial waters by:***

a) ensuring compatibility of agency sampling and analytical protocols;

b) promoting the use of compatible water quality guidelines and objectives;

c) promoting compatible water pollution control programs;

d) exchanging and disseminating information.

4. ***Facilitate the resolution of interprovincial water quality disputes by:***

a) reviewing and investigating interprovincial concerns regarding water quality brought to or identified by the Board;

b) making recommendations to the parties for the resolution of issues and subsequent evaluation of corrective measures.

5. ***Promote the development and use of state of the art procedures for the evaluation, assessment and management of interprovincial waters by:***

a) reviewing scientific advances in water quality management including, sample design and collection programs, analysis, guidelines and objectives and data management and interpretation;

b) promoting the development of procedures and methods of assessment applicable to the prairie region;

c) promoting the development of procedures for modelling and statistical analyses;

d) promoting the efficient and effective use of water.

6. ***Assess the implications of any activity which may significantly alter the quality of interprovincial waters by:***

a) coordinating a contingency plan to facilitate an information exchange on spills and unusual water quality conditions;

b) reviewing impact assessments on proposed projects that may have interprovincial water quality implications;

c) identifying water quality concerns related to the proposed development in interprovincial basins;

d) advising the parties on measures to reduce or prevent adverse project impacts;

e) considering, where appropriate, the impacts of activities outside the prairie provinces on the prairie watercourses (eg. global warming, toxic rain and long range transport of air pollutants).

7. ***Identify and promote research on water quality management pertinent to the prairie region by:***

a) identifying research to assist in the monitoring and assessment of water quality of interprovincial waters;

b) promoting research and development on water quality problems and management approaches pertinent to the prairie region.

8. ***Promote integrated and joint planning of interprovincial waters on a basin-wide basis by:***

a) promoting effective water quality management practices;

b) promoting, coordinating and where appropriate, participating in joint water quality basin studies on interprovincial waters and disseminating information to the appropriate agencies;

c) promoting cooperative and compatible approaches to interprovincial water quality management.

9. ***Promote public awareness and understanding of the importance of water quality management and the Board's role in interprovincial water quality by:***

   a) preparing brochures and fact sheets;

   b) making presentations at conferences, and other public meetings;

   c) handling media inquiries;

   d) issuing news releases.

CHAPTER 3

PPWB WATER QUALITY OBJECTIVES

3.1 HISTORY OF WATER QUALITY OBJECTIVES

Water quality objectives are commonly used for defining and assessing acceptable water quality and for protecting water uses. In order to identify desirable levels of water quality on eastward flowing interprovincial streams at provincial boundaries the Board in March 1973 adopted the PPWB Water Quality Objectives. These objectives were jointly developed by Canada and the Provinces of Alberta, Saskatchewan, and Manitoba and recommended by the PPWB Task Force on Water Quality.

The 1973 objectives were based on a "universal user" concept and did not take into consideration the characteristics of individual streams. Subsequent advances in technical knowledge, and greater familiarity with existing water quality characteristics of streams indicated inadequacies in the 1973 objectives.

In 1986 the Committee on Water Quality recommended the development of site-specific water quality objectives (Indicators) at the PPWB interprovincial stations. These proposed objectives were developed by considering the natural water quality characteristics at the site, and by identifying uses in the basins and the variables and criteria necessary to protect those uses. This approach attempted to equitably apportion the quality of water among the jurisdictions.

In 1989 the Board decided not to use the proposed site-specific water quality objectives because, in part, the objectives relied on an apportionment approach which could be perceived as encouraging the degradation of water quality. Following the recommendations from the Committee on Water Quality Policy, the Board directed that new reach specific water quality objectives be developed that would be compatible with provincial water quality objectives.

In 1990 the Committee on Water Quality developed new PPWB objectives to be applied at interprovincial river reaches. They were developed using provincial objectives or, where available, basin specific objectives. If provincial basin objectives

were not available CCME Surface Water Quality Guidelines were used. The reach concept facilitated the formulation of objectives based on scientific considerations rather than political boundaries or site characteristics. The objectives in a reach were deliberately linked to the quality requirements and the upstream and downstream water uses. This approach minimized the differences across jurisdictions in regard to management strategies, water quality objectives, and monitoring in the spirit of interjurisdictional water quality management.

In 1990 the new PPWB Water Quality Objectives were agreed to by the Board and subsequently incorporated into Schedule E of the Master Agreement on Apportionment.

3.2 DEVELOPMENT OF WATER QUALITY OBJECTIVES

The following procedures were used to formulate the PPWB Water Quality Objectives:

1. The provinces agreed to interprovincial river reaches at which the PPWB objectives will apply.

2. The provinces identified sensitive water uses they wish to protect on the interprovincial streams.

3. The provinces identified the necessary list of variables (constituents) for which objectives will be established.

4. The provinces reviewed all provincial surface water quality objectives including basin specific objectives and the CCME Surface Water Quality Guidelines.

5. The provinces agreed to an objective for each constituent based on the most sensitive use in the river system and the most restrictive of the provincial objectives. If a provincial objective was not available then the CCME guideline was used to establish the objective. If basin specific objectives were available then these objectives were used instead of a provincial surface water objective or CCME Guideline.

6. The PPWB Committee on Water Quality reviewed, discussed and modified the objectives and recommended they be used by the Board.

7. The parties to the Board agreed that the objectives are appropriate and acceptable limits of water quality in each river reach.

8. The parties agreed that if the concentration of a chemical or a physical or biological variable in a river reach, as a result of human activities is not within the acceptable limits, reasonable and practical measures will be taken by the

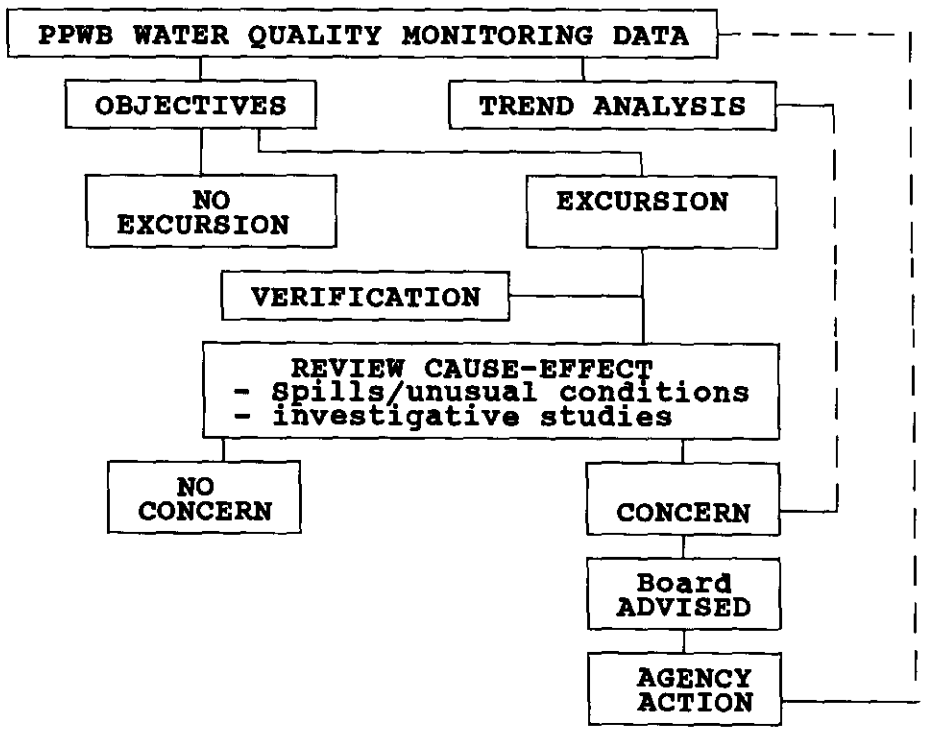
party in whose jurisdiction the chemical or physical or biological variable originates so that the quality of the water in the river reach is within the acceptable limit or limits.

9. The parties agreed that if the concentration of a chemical or a physical or biological variable in a river reach is within the acceptable limit or limits, and if trend analysis or an assessment of the impact of a proposed development indicates that water quality may be significantly altered the parties will agree as to the reasonable and practical measures that will be taken by the party in whose jurisdiction the chemical or physical or biological variable originates in order to preserve the water quality.

The PPWB Water Quality Objectives and river reaches developed using the above procedures were approved by the Board and are shown in Appendix II and III respectively.

3.3 EXCURSIONS TO THE WATER QUALITY OBJECTIVES

Reviewing excursions to the objectives is one part of the overall process to identify potential interprovincial water quality concerns. Other processes used by the Board include trend analysis and spill reporting. The following diagram shows how water quality objectives are used to identify potential concerns.



The following procedures are used to inform the Board and member agencies of any excursions to the PPWB Water Quality Objectives:

1. Environment Canada collects, verifies and provides the Secretariat with data from the PPWB monitoring sites. Environment Canada informs the Secretariat of any highly unusual water quality conditions.

2. The Secretariat regularly tests the data for excursions to the PPWB objectives and advises the COWQ members of any excursions to the objectives.

3. When objectives are exceeded the COWQ prepares a report to the Board, with an explanation, and a recommended course of action. The degree of detail in the report to the Board depends both on the severity of the excursion and on its frequency.

4. The Board makes recommendations to the parties on how to resolve any problems and the agencies of the parties take the appropriate action to mitigate the situation. Member agencies are also responsible for identifying to the Board any problems caused by the excursions.

5. The COWQ submits to the Board a summary report of excursions to the objectives on an annual basis (see Appendix IV).

3.4 REVIEW AND REVISIONS TO WATER QUALITY OBJECTIVES

Modifications to the PPWB Water Quality Objectives are needed from time to time to ensure that they reflect current uses, and priorities of member agencies and the latest technical information. It is anticipated that the necessity for such amendments will occur approximately every five years.

The following procedure will be used to amend the objectives:

1. The province informs the COWQ of any changes in water uses or in provincial water quality objectives, and the Committee determines whether these changes necessitate a revision to the objectives. If so, the Committee informs the Board of the required revisions.

2. The COWQ regularly compares the PPWB Water Quality Objectives with monitoring data supplied by Environment Canada and new scientific information. As a result of this comparison the Committee determines the suitability of the objectives, and informs the Board of any necessary revisions.

3. The Secretariat regularly reviews and updates the scientific information base pertaining to the formulation of the water quality objectives, and advises the COWQ accordingly.

4. The Parties, through a Board member, may request a review of the PPWB Water Quality Objectives citing reasons why a variable should be revised, added, or deleted. At the direction of the Board, the COWQ reviews the objective for which a change has been requested and makes recommendations to the Board.

5. The Board reviews the recommendations made by the COWQ. Where the Board agrees that a change to the objectives is required, Board members arrange for Order-In-Councils.

CHAPTER 4

PPWB WATER QUALITY MONITORING

4.1 MONITORING PROGRAM

The purpose of the PPWB Water Quality Monitoring Program is to determine if water quality objectives are being met and to identify, resolve, and avoid interprovincial water quality problems. The Board has identified interprovincial rivers where, on its behalf, systematic measurements by Environment Canada of selected water quality characteristics are conducted at transboundary locations. A monthly sampling program has been conducted since April, 1974 and provides a description of conditions against which future quality can be compared. The results obtained not only contribute to the formulation of water quality objectives, and serve notice when excursions to the objectives occur but also are used to identify significant trends in water quality.

The provinces also conduct intraprovincial water sampling at numerous locations. To maximize the usefulness of these sampling programs the Board recommended to its member agencies, a minimum water quality network comprising approximately 60 stations ("First Order Long Term Water Quality Network, PPWB Report No. 51"). The member agencies agreed to use the network as a guideline in developing their monitoring programs.

Interpreting and reporting the monitoring results at the interprovincial stations is one of the duties of the COWQ. These data constitute the basis for interprovincial water quality assessments and must be reported expeditiously to the member agencies for use in their water management programs. The PPWB monitoring program must be assessed annually to determine if its objectives are being efficiently met.

4.2 GOAL OF THE PPWB WATER QUALITY MONITORING PROGRAM

The goal of the PPWB monitoring program is to provide data and information to the PPWB and member agencies that would:

- characterize the state of the aquatic ecosystem as well as the current water quality of the interprovincial rivers;

- provide water quality data to identify potential issues and to assist in averting/resolving interprovincial water quality conflicts;

- assess the suitability of existing water quality relative to existing and foreseeable water uses by comparison with water quality objectives.

4.3 OBJECTIVES OF THE PPWB WATER QUALITY MONITORING PROGRAM

The monitoring program objectives of the PPWB are a subset of the larger water quality program objectives of the Board as identified in Chapter 2. The objectives of the PPWB water quality monitoring program are:

1. To describe the quality of the aquatic ecosystems at the interprovincial boundary and to identify potential water quality issues in terms of their physical, chemical and biological attributes, by:

    a) establishing ambient conditions and describing the seasonal and annual variations including the presence, absence and abundance of toxic substances, and other physical, chemical and biological attributes of transboundary waters;

    b) estimating the mass loading of selected constituents (e.g. nutrients) and establishing relationships which improve these estimates (e.g. relationships to flow);

    c) interpreting water quality data and related information and articulating potential issues, causes and solutions.

2. To provide evidence of changes and trends in the concentration of chemical and physical substances, and in the biological integrity of the aquatic ecosytem, by:

    a) reporting periodically to the Board on trends and changes in aquatic quality and the possible causes;

    b) providing an early warning of potential water quality problems;

c) maintaining an ongoing water quality awareness of transboundary water quality and of factors affecting water quality, addressing water quality concerns of priority.

3. To assess the achievement of water quality objectives, other water quality indicators and other water quality management goals, by:

   a) directing monitoring, surveys or studies to establish water quality objectives and to determine the state of water quality relative to the established objectives;

   b) reporting periodically to the PPWB on the state of transboundary water quality in terms of maintaining downstream water uses.

4. To maintain a scientifically credible data and information base on the quality of transboundary waters, by:

   a) testing, reviewing and revising monitoring requirements and protocols in accordance with findings from research and monitoring and up-to-date basin specific information (e.g. new pollution sources);

   b) maintaining a current and accessible (by member agencies) data base of validated and screened PPWB water quality data;

   c) adopting approved (standard) field and laboratory procedures and quality control guidelines, and harmonizing these with federal and provincial methods;

   d) reporting water quality data to member agencies according to a monitoring schedule and a publication plan.

4.4 REPORTING OF PPWB MONITORING RESULTS

The reporting procedures described below will be used to inform member agencies of the analytical results at the locations monitored for the PPWB.

1. The preliminary sampling results are verified by Environment Canada and any unusual results are immediately reported to the Secretariat and affected member agencies.

2. The analytical results of monitoring at the PPWB stations are reported by Canada to the PPWB and to member agencies within 90 days of sample collection.

3. Excursions are reported to member agencies by the Secretariat and reviewed by the Committee on Water Quality. These procedures are outlined in section 3.3.

4. The analytical results of monitoring at the PPWB stations are published from time to time complete with graphical and statistical interpretations.

5. The analytical results from PPWB stations are stored on NAQUADAT, a data storage and retrieval system operated by Environment Canada. They are also stored on micro computers in the office of the Secretariat and updated on a quarterly basis. These data are available to the PPWB agencies in various formats (i.e. RS1, Lotus 1-2-3, and SAS) upon request.

4.5 UPDATING THE PPWB WATER QUALITY MONITORING PROGRAM

The monitoring requirements of the Board must be updated periodically to reflect changes in provincial designated water uses, provincial priorities, new environmental legislation, and advances in monitoring technology. The COWQ reviews its monitoring needs in the context of such changes on an annual basis or as requested, as follows:

1. The COWQ annually reviews the monitoring results and the scope and strategy of the existing sampling programs, recommending their continuation or modification to the Board.

2. The Board, upon acceptance of the Committee's recommendations, requests Environment Canada to implement the strategies for the coming year.

3. Any member agency may indicate to the Board additional interprovincial rivers where it would be desirable to have the Board coordinate water quality measurement and assessment programs.

4. The Board considers such requests and may direct the COWQ to design the appropriate water quality measurement and assessment strategies.

CHAPTER 5

IDENTIFYING, MINIMIZING AND RESOLVING INTERPROVINCIAL WATER QUALITY ISSUES

5.1 PROCEDURES TO IDENTIFY AND RESOLVE PROBLEMS

Reviewing excursions to the PPWB objectives and testing for trends are but two ways the Board identifies interprovincial water quality issues. Other potential concerns are brought to the attention of the PPWB by Board members and the implementation of the PPWB Interprovincial Water Quality Contingency Plan.

To help fulfil the PPWB's role of identifying, resolving and minimizing water quality problems the Board also implements procedures to review proposed developments and environmental emergencies. These procedures are summarized below.

5.2 REVIEW OF PROJECTS OR PROPOSED DEVELOPMENTS

The following procedures are used in reviewing projects or proposed developments that have a potential to effect the quality of interprovincial waters:

1. PPWB member agencies inform the Board of the potential impact the said projects are expected to have on the water quality at interprovincial boundaries.

2. The Board reviews the interprovincial implications of the project proposal with advice and assistance from the COWQ and other Board Committees.

3. The Board provides a written evaluation of the project proposal with recommendations to the parties to the agreement.

4. Member agencies advise the Board on steps taken to mitigate the potential water quality impacts.

5. The Board may request the COWQ to provide a post-project statement (audit) concerning water quality impacts.

5.3 ENVIRONMENTAL EMERGENCIES, SPILLS AND UNUSUAL WATER QUALITY CONDITIONS

To handle the reporting of environmental emergencies, spills or unusual water quality conditions that may have an impact on interprovincial water quality or be of public concern, the PPWB established in 1984 an interprovincial contingency plan. The PPWB Interprovincial Water Quality Contingency Plan ensures that downstream water quality management agencies are promptly notified of any unusual water quality conditions.

The Contingency Plan ensures that the following procedures are followed in the event of a spill or unusual water quality condition on an interprovincial stream.

1. The province in which a spill occurs or from which a pollutant originates is named the lead agency.

2. When a spill occurs, the lead agency immediately informs the appropriate downstream agency and the PPWB Secretariat.

3. The Secretariat contacts all other member agencies and updates them on the situation.

4. Downstream agencies then take any action they decide is necessary to minimize environmental impact and protect and inform the public.

5. The lead agency keeps the PPWB and the Committee on Water Quality updated on the situation.

6. The Committee on Water Quality informs the Board of these events and, if required, advises them on measures which may be used to prevent such events from occurring again.

APPENDIX I

SCHEDULE E
TO THE
MASTER AGREEMENT ON APPORTIONMENT

SCHEDULE E

AGREEMENT ON WATER QUALITY

THIS AGREEMENT made this day of , A.D. 1991.

BETWEEN:

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

-and-

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

-and-

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

- and -

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

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

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

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

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

AND WHEREAS, in furtherance of the provisions of paragraph 6 of the Master Agreement, and on the recommendation of the Board, the parties consider it is in their mutual interest that an agreement be entered into on

certain water quality objectives for the water in the said watercourses;

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

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

DEFINITIONS

1. IN THIS AGREEMENT:

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

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

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

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

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

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

(g) "watercourse" means any river, stream, creek, or other natural channel which from time to time carries a flowing body of water from the Province of Alberta to the Province of Saskatchewan, or from the Province of Saskatchewan to the Province of Manitoba, and includes all tributaries of each such river, stream, creek or natural channel which do not

themselves cross the common boundary between the Provinces of Alberta, Saskatchewan, and Manitoba. Such tributaries as do themselves cross the said common boundaries between the Provinces of Alberta, Saskatchewan, and Manitoba shall be deemed to be "watercourses" for the purpose of this Agreement.

WATER QUALITY MANDATE

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

WATER QUALITY OBJECTIVES

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

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

so that the quality of the water in the river reach is within the acceptable limit or limits.

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

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

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

WATER QUALITY DUTIES OF THE BOARD

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

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

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

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

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

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

(f) promoting through consultation and the exchange of information the recognition of the

interdependence of quality and quantity of water in the management of the watercourses.

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

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

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

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

the Environment, on the day and year first mentioned above.

THE GOVERNMENT OF CANADA

_____
Witness

per: _____
Minister of the Environment

_____
Date

THE GOVERNMENT OF ALBERTA

_____
Witness

per: _____
Minister of the Environment

_____
Date

Approved Pursuant to the Alberta Department of Federal and Intergovernmental Affairs Act

_____
Minister of Federal and Intergovernmental Affairs

_____
Date

THE GOVERNMENT OF SASKATCHEWAN

_____
Witness

per: _____
Minister responsible
for the Saskatchewan
Water Corporation

_____
Date

THE GOVERNMENT OF MANITOBA

_____
Witness

per: _____
Minister of Natural
Resources

_____
Date

ATTACHMENT "A"

To Schedule E

(LISTING OF RIVER REACHES AND
REFERENCE TO TABLES OF WATER QUALITY OBJECTIVES)

RIVER	REACH (predetermined length)	TABLE LISTING WATER QUALITY OBJECTIVES (FOR RIVER REACH)
Beaver River	Beaver Crossing to the Border	1
North Saskatchewan River	Lea Park to Lloydminster Ferry	2
Red Deer River A/S	Bindloss to Confluence with the South Saskatchewan River	3
South Saskatchewan River	Highway #41 to Confluence with Red Deer River	4
Battle River	Blackfoot Creek to Unwin	5
Churchill River	Island Falls to Pukatawagan Lake	6
Saskatchewan River	Outlet of Cumberland Lake to Mouth of Carrot River	7
Carrot River	Turnberry to Mouth of Carrot River	8
Red Deer S/M	Etomami River to Red Deer Lake	9
Assiniboine River	Whitesand River to Outlet of Shellmouth Reservoir	10
Qu'Appelle River	Kaposvar Creek to Assiniboine River	11

NOTE: Objectives are part of Agreement but are shown in Appendix II.

APPENDIX II

1990 PPWB WATER QUALITY OBJECTIVES

TABLE 1

WATER QUALITY OBJECTIVES

BEAVER RIVER REACH: BEAVER CROSSING TO THE BORDER

CHEMICAL, PHYSICAL OR BIOLOGICAL VARIABLE	ACCEPTABLE LIMIT OR LIMITS
ARSENIC (diss)	0.05
BARIUM (total)	1.0
BORON (diss)	5.0
CADMIUM (total)	0.001
CHLORIDE (diss.)	100.
CHROMIUM (total)	0.011
COPPER (total)	0.004
FECAL COLIFORM	100/100ml
FLUORIDE (diss)	1.5
IRON (diss)	1.0
LEAD (total)	0.007
MANGANESE (diss)	0.2
NICKEL (total)	0.1
NO_2+NO_3 (as N)	10.0
SELENIUM (diss)	0.001
SODIUM (diss)	100.
SULPHATE (diss)	500.
URANIUM	0.02
ZINC (total)	0.03
AMMONIA (total)	TABLE BACK SIDE
OXYGEN (diss)	OW 6.0
pH (pH units)	6.5-9.0
LINDANE	0.0001
2,4-D	0.004
2,4,5-TP	0.01
CHLOROPHENOLS (total)	0.001
CHLORINE	0.002
CYANIDE (free)	0.005
SILVER (total)	0.0001
PCP	0.0005
MERCURY IN FISH (ug/g)	0.5
PCB IN FISH (ug/g)	2.0

SYMBOLS:
- all units are in mg/L unless otherwise noted.
- OW - open water objective only.

Total Ammonia Nitrogen (mg/L)

NOTE: The toxicity of ammonia relates primarily to the unionized form (NH_3). The concentration of unionized ammonia present in water increases with pH and temperature. The values below represent total ammonia-nitrogen concentrations (at various temperatures and pH levels) above which accompanying NH_3 concentrations may be harmful to aquatic life.

Total Ammonia (NH_3 + NH_4+)
(maximum levels expressed as N at various pH/temperature conditions)

pH (pH units)	Water Temperature (°C) 0	5	10	15	20	25	30
6.50	2.06	1.97	1.81	1.81	1.22	0.85	0.60
6.75	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.00	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.25	2.06	1.97	1.81	1.81	1.23	0.86	0.61
7.50	2.06	1.97	1.81	1.81	1.23	0.87	0.62
7.75	1.89	1.81	1.73	1.64	1.15	0.81	0.58
8.00	1.26	1.18	1.13	1.09	0.76	0.54	0.39
8.25	0.72	0.67	0.64	0.62	0.44	0.32	0.23
8.50	0.40	0.39	0.37	0.37	0.26	0.19	0.15
8.75	0.23	0.22	0.21	0.22	0.16	0.12	0.09
9.00	0.13	0.13	0.13	0.13	0.11	0.08	0.06

TABLE 2

WATER QUALITY OBJECTIVES

NORTH SASK. R. REACH: LEA PARK TO LLOYDMINSTER FERRY

CHEMICAL, PHYSICAL OR BIOLOGICAL VARIABLE	ACCEPTABLE LIMIT OR LIMITS
ARSENIC (diss)	0.05
BARIUM (total)	1.0
BORON (diss)	5.0
CADMIUM (total)	0.001
CHLORIDE	100
CHROMIUM (total)	0.011
COPPER (total)	0.004
FECAL COLIFORM	100/100ml
FLUORIDE (diss)	1.5
IRON (diss)	0.3
LEAD (total)	0.007
MANGANESE (diss)	0.05
NICKEL (total)	0.1
NO_2+NO_3 (as N)	10.0
SELENIUM (diss)	0.001
SODIUM	100
SULPHATE (diss)	500.
URANIUM	0.02
ZINC (total)	0.03
ALUMINUM (total)	5.0
COBALT	0.05
TOTAL DISS. SOLIDS	500
VANADIUM (TOTAL)	0.1
AMMONIA (total)	TABLE BACK SIDE
OXYGEN	6.5
pH (pH UNITS)	6.5-9.0
LINDANE	0.0001
2,4-D	0.004
2,4,5-TP	0.01
CHLOROPHENOLS (total)	0.001
CHLORINE	0.002
CYANIDE (free)	0.005
PCP	0.0005
MERCURY IN FISH (ug/g)	0.5
PCB IN FISH (ug/g)	2.0

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

Total Ammonia Nitrogen (mg/L)

NOTE: The toxicity of ammonia relates primarily to the unionized form (NH_3). The concentration of unionized ammonia present in water increases with pH and temperature. The values below represent total ammonia-nitrogen concentrations (at various temperatures and pH levels) above which accompanying NH_3 concentrations may be harmful to aquatic life.

Total Ammonia (NH_3 + NH_4+)
(maximum levels expressed as N at various pH/temperature conditions)

pH (pH units)	Water Temperature (°C) 0	5	10	15	20	25	30
6.50	2.06	1.97	1.81	1.81	1.22	0.85	0.60
6.75	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.00	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.25	2.06	1.97	1.81	1.81	1.23	0.86	0.61
7.50	2.06	1.97	1.81	1.81	1.23	0.87	0.62
7.75	1.89	1.81	1.73	1.64	1.15	0.81	0.58
8.00	1.26	1.18	1.13	1.09	0.76	0.54	0.39
8.25	0.72	0.67	0.64	0.62	0.44	0.32	0.23
8.50	0.40	0.39	0.37	0.37	0.26	0.19	0.15
8.75	0.23	0.22	0.21	0.22	0.16	0.12	0.09
9.00	0.13	0.13	0.13	0.13	0.11	0.08	0.06

TABLE 3

WATER QUALITY OBJECTIVES	
RED DEER RIVER A/S REACH: BINDLOSS TO CONFLUENCE WITH THE S. SASK. R.	
CHEMICAL, PHYSICAL OR BIOLOGICAL VARIABLE	ACCEPTABLE LIMIT OR LIMITS
ARSENIC (diss)	0.05
BARIUM (total)	1.0
BORON (diss)	5.0
CADMIUM (total)	0.001
CHROMIUM (total)	0.011
COPPER (total)	0.004
FECAL COLIFORM	100/100ml
FLUORIDE (diss)	1.5
IRON (diss)	0.3
LEAD (total)	0.007
MANGANESE (diss)	0.05
NICKEL (total)	0.025
NO_2+NO_3 (as N)	10.0
SELENIUM (diss)	0.001
SULPHATE (diss)	500.
ZINC (total)	0.03
COBALT	1.0
SAR	3.0
TOTAL DISS. SOLIDS	500
VANADIUM	0.1
AMMONIA (total)	TABLE BACK SIDE
LINDANE	0.0001
2,4-D	0.004
2,4,5-TP	0.01
CHLOROPHENOLS (total)	0.001
CYANIDE (free)	0.005
MERCURY IN FISH (ug/g)	0.5
PCB IN FISH (ug/g)	2.0

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

Total Ammonia Nitrogen (mg/L)

NOTE: The toxicity of ammonia relates primarily to the unionized form (NH_3). The concentration of unionized ammonia present in water increases with pH and temperature. The values below represent total ammonia-nitrogen concentrations (at various temperatures and pH levels) above which accompanying NH_3 concentrations may be harmful to aquatic life.

Total Ammonia (NH_3 + NH_4+)
(maximum levels expressed as N at various pH/temperature conditions)

	Water Temperature (°C)						
pH (pH units)	0	5	10	15	20	25	30
6.50	2.06	1.97	1.81	1.81	1.22	0.85	0.60
6.75	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.00	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.25	2.06	1.97	1.81	1.81	1.23	0.86	0.61
7.50	2.06	1.97	1.81	1.81	1.23	0.87	0.62
7.75	1.89	1.81	1.73	1.64	1.15	0.81	0.58
8.00	1.26	1.18	1.13	1.09	0.76	0.54	0.39
8.25	0.72	0.67	0.64	0.62	0.44	0.32	0.23
8.50	0.40	0.39	0.37	0.37	0.26	0.19	0.15
8.75	0.23	0.22	0.21	0.22	0.16	0.12	0.09
9.00	0.13	0.13	0.13	0.13	0.11	0.08	0.06

TABLE 4

WATER QUALITY OBJECTIVES	
SOUTH SASK. R. REACH: HIGHWAY #41 TO CONFLUENCE WITH RED DEER RIVER	
CHEMICAL, PHYSICAL OR BIOLOGICAL VARIABLE	ACCEPTABLE LIMIT OR LIMITS
ARSENIC (diss)	0.05
BARIUM (total)	1.0
BORON (diss)	5.0
CADMIUM (total)	0.001
CHROMIUM (total)	0.011
COPPER (total)	0.01
FECAL COLIFORM	100/100ml
FLUORIDE (diss)	1.5
IRON (diss)	1.0
LEAD (total)	0.02
MANGANESE (diss)	0.05
NICKEL (total)	0.025
NO_2+NO_3 (as N)	10.0
SELENIUM (diss)	0.002
SULPHATE (diss)	500.
ZINC (total)	0.05
COBALT	1.0
SAR	3.0
TOTAL DISS. SOLIDS	500
VANADIUM (TOTAL)	0.1
AMMONIA (total)	TABLE BACK SIDE
LINDANE	0.0001
2,4-D	0.004
2,4,5-TP	0.01
CHLOROPHENOLS (total)	0.001
CYANIDE (free)	0.005
MERCURY IN FISH (ug/g)	0.5
PCB IN FISH (ug/g)	2.0

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

Total Ammonia Nitrogen (mg/L)

NOTE: The toxicity of ammonia relates primarily to the unionized form (NH_3). The concentration of unionized ammonia present in water increases with pH and temperature. The values below represent total ammonia-nitrogen concentrations (at various temperatures and pH levels) above which accompanying NH_3 concentrations may be harmful to aquatic life.

Total Ammonia (NH_3 + NH_4+)
(maximum levels expressed as N at various pH/temperature conditions)

	Water Temperature (°C)						
pH (pH units)	0	5	10	15	20	25	30
6.50	2.06	1.97	1.81	1.81	1.22	0.85	0.60
6.75	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.00	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.25	2.06	1.97	1.81	1.81	1.23	0.86	0.61
7.50	2.06	1.97	1.81	1.81	1.23	0.87	0.62
7.75	1.89	1.81	1.73	1.64	1.15	0.81	0.58
8.00	1.26	1.18	1.13	1.09	0.76	0.54	0.39
8.25	0.72	0.67	0.64	0.62	0.44	0.32	0.23
8.50	0.40	0.39	0.37	0.37	0.26	0.19	0.15
8.75	0.23	0.22	0.21	0.22	0.16	0.12	0.09
9.00	0.13	0.13	0.13	0.13	0.11	0.08	0.06

TABLE 5

WATER QUALITY OBJECTIVES

BATTLE RIVER REACH: BLACKFOOT CREEK TO UNWIN

CHEMICAL, PHYSICAL OR BIOLOGICAL VARIABLE	ACCEPTABLE LIMIT OR LIMITS
ARSENIC (diss)	0.05
BARIUM (total)	1.0
BORON (diss)	5.0
CADMIUM (total)	0.001
CHLORIDE	100
CHROMIUM (total)	0.011
COPPER (total)	0.004
FECAL COLIFORM	100/100ml
FLUORIDE (diss)	1.5
IRON (diss)	0.3
LEAD (total)	0.007
MANGANESE (diss)	0.05
NICKEL (total)	0.1
NO_2+NO_3 (as N)	10.0
SELENIUM (diss)	0.001
SODIUM	100
SULPHATE (diss)	500.
URANIUM	0.02
ZINC (total)	0.03
ALUMINUM (total)	5.0
COBALT	0.05
TOTAL DISS. SOLIDS	500
VANADIUM	0.1
AMMONIA (total)	TABLE BACK SIDE
OXYGEN	OW 6.0
pH (pH UNITS)	6.5-9.0
LINDANE	0.0001
2,4-D	0.004
2,4,5-TP	0.01
CHLOROPHENOLS (total)	0.001
CHLORINE	0.002
CYANIDE (free)	0.005
PCP	0.0005
MERCURY IN FISH (ug/g)	0.5
PCB IN FISH (ug/g)	2.0

SYMBOLS:
- all units are in mg/L unless otherwise noted.
- OW - indicates open water period.

Total Ammonia Nitrogen (mg/L)

NOTE: The toxicity of ammonia relates primarily to the unionized form (NH_3). The concentration of unionized ammonia present in water increases with pH and temperature. The values below represent total ammonia-nitrogen concentrations (at various temperatures and pH levels) above which accompanying NH_3 concentrations may be harmful to aquatic life.

Total Ammonia (NH_3 + NH_4+)
(maximum levels expressed as N at various pH/temperature conditions)

pH (pH units)	Water Temperature (°C) 0	5	10	15	20	25	30
6.50	2.06	1.97	1.81	1.81	1.22	0.85	0.60
6.75	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.00	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.25	2.06	1.97	1.81	1.81	1.23	0.86	0.61
7.50	2.06	1.97	1.81	1.81	1.23	0.87	0.62
7.75	1.89	1.81	1.73	1.64	1.15	0.81	0.58
8.00	1.26	1.18	1.13	1.09	0.76	0.54	0.39
8.25	0.72	0.67	0.64	0.62	0.44	0.32	0.23
8.50	0.40	0.39	0.37	0.37	0.26	0.19	0.15
8.75	0.23	0.22	0.21	0.22	0.16	0.12	0.09
9.00	0.13	0.13	0.13	0.13	0.11	0.08	0.06

TABLE 6

WATER QUALITY OBJECTIVES

CHURCHILL RIVER REACH: ISLAND FALLS TO PUKATAWAGAN LAKE

CHEMICAL, PHYSICAL OR BIOLOGICAL VARIABLE	ACCEPTABLE LIMIT OR LIMITS
ARSENIC (diss)	0.05
BARIUM (total)	1.0
BORON (diss)	5.0
CADMIUM (total)	0.00058
CHLORIDE (diss.)	250.
CHROMIUM (total)	0.011
COPPER (total)	0.0057
FECAL COLIFORM	200/100ml
FLUORIDE (diss)	1.5
IRON (diss)	0.3
LEAD (total)	0.011
MANGANESE (diss)	0.05
NICKEL (total)	0.025
NO_2+NO_3 (as N)	10.0
SELENIUM (diss)	0.01
SODIUM (diss)	300.
SULPHATE (diss)	500.
URANIUM	0.02
ZINC (total)	0.047
PHOSPHORUS (total)	0.05
AMMONIA (total)	TABLE BACK SIDE
OXYGEN (diss)	6.5
pH (pH units)	6.5-9.0
LINDANE	0.00008
2,4-D	0.004
2,4,5-TP	0.01
CHLOROPHENOLS (total)	0.001
CHLORINE	0.002
CYANIDE (free)	0.005
PCP	0.0005
CESIUM-137 (Bq/L)	50.
IODINE-131 (Bq/L)	10.
RADIUM-226 (Bq/L)	1.0
STRONTIUM-90 (Bq/L)	10.
TRITIUM (Bq/L)	40000.
MERCURY IN FISH (ug/g)	0.2
PCB in Fish (ug/g)	2.0

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

Total Ammonia Nitrogen (mg/L)

NOTE: The toxicity of ammonia relates primarily to the unionized form (NH_3). The concentration of unionized ammonia present in water increases with pH and temperature. The values below represent total ammonia-nitrogen concentrations (at various temperatures and pH levels) above which accompanying NH_3 concentrations may be harmful to aquatic life.

Total Ammonia (NH_3 + NH_4+)
(maximum levels expressed as N at various pH/temperature conditions)

	Water Temperature (°C)						
pH (pH units)	0	5	10	15	20	25	30
6.50	2.06	1.97	1.81	1.81	1.22	0.85	0.60
6.75	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.00	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.25	2.06	1.97	1.81	1.81	1.23	0.86	0.61
7.50	2.06	1.97	1.81	1.81	1.23	0.87	0.62
7.75	1.89	1.81	1.73	1.64	1.15	0.81	0.58
8.00	1.26	1.18	1.13	1.09	0.76	0.54	0.39
8.25	0.72	0.67	0.64	0.62	0.44	0.32	0.23
8.50	0.40	0.39	0.37	0.37	0.26	0.19	0.15
8.75	0.23	0.22	0.21	0.22	0.16	0.12	0.09
9.00	0.13	0.13	0.13	0.13	0.11	0.08	0.06

TABLE 7

WATER QUALITY OBJECTIVES	
SASKATCHEWAN RIVER REACH: OUTLET OF CUMBERLAND LAKE TO MOUTH OF CARROT RIVER	
CHEMICAL, PHYSICAL OR BIOLOGICAL VARIABLE	ACCEPTALBE LIMIT OR LIMITS
ARSENIC (diss)	0.05
BARIUM (total)	1.0
BORON (diss)	0.5
CADMIUM (total)	0.001
CHLORIDE (diss.)	68.
CHROMIUM (total)	0.011
COPPER (total)	0.01
FECAL COLIFORM	200/100ml
FLUORIDE (diss)	1.0
IRON (diss)	0.3
LEAD (total)	0.0061
MANGANESE (diss)	0.05
NICKEL (total)	0.10
NO_2+NO_3 (as N)	10.0
SELENIUM (diss)	0.01
SODIUM (diss)	100.
SULPHATE (diss)	250.
URANIUM	0.02
ZINC (total)	0.047
PHOSPHORUS (total)	0.05
AMMONIA (total)	TABLE BACK SIDE
OXYGEN (diss)	6.5
pH (pH units)	6.5-9.0
LINDANE	0.00008
2,4-D	0.004
2,4,5-TP	0.01
CHLOROPHENOLS (total)	0.001
CHLORINE	0.002
CYANIDE (free)	0.005
PCP	0.0005
CESIUM-137 (Bq/L)	50.
IODINE-131 (Bq/L)	10.
RADIUM-226 (Bq/L)	1.0
STRONTIUM-90 (Bq/L)	10.
TRITIUM (Bq/L)	40000.
MERCURY IN FISH (ug/g)	0.2
PCB in Fish (ug/g)	2.0

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

Total Ammonia Nitrogen (mg/L)

NOTE: The toxicity of ammonia relates primarily to the unionized form (NH_3). The concentration of unionized ammonia present in water increases with pH and temperature. The values below represent total ammonia-nitrogen concentrations (at various temperatures and pH levels) above which accompanying NH_3 concentrations may be harmful to aquatic life.

Total Ammonia (NH_3 + NH_4+)
(maximum levels expressed as N at various pH/temperature conditions)

	Water Temperature (°C)						
pH (pH units)	0	5	10	15	20	25	30
6.50	2.06	1.97	1.81	1.81	1.22	0.85	0.60
6.75	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.00	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.25	2.06	1.97	1.81	1.81	1.23	0.86	0.61
7.50	2.06	1.97	1.81	1.81	1.23	0.87	0.62
7.75	1.89	1.81	1.73	1.64	1.15	0.81	0.58
8.00	1.26	1.18	1.13	1.09	0.76	0.54	0.39
8.25	0.72	0.67	0.64	0.62	0.44	0.32	0.23
8.50	0.40	0.39	0.37	0.37	0.26	0.19	0.15
8.75	0.23	0.22	0.21	0.22	0.16	0.12	0.09
9.00	0.13	0.13	0.13	0.13	0.11	0.08	0.06

TABLE 8

WATER QUALITY OBJECTIVES	
CARROT RIVER REACH: TURNBERRY TO MOUTH OF CARROT RIVER	
CHEMICAL, PHYSICAL OR BIOLOGICAL VARIABLE	ACCEPTABLE LIMIT OR LIMITS
ARSENIC (diss)	0.05
BARIUM (total)	1.0
BORON (diss)	2.0
CADMIUM (total)	0.001
CHLORIDE (diss.)	100.
CHROMIUM (total)	0.011
COPPER (total)	0.01
FECAL COLIFORM	200/100ml
FLUORIDE (diss)	1.0
IRON (diss)	0.3
LEAD (total)	0.015
MANGANESE (diss)	0.05
NICKEL (total)	0.10
NO_2+NO_3 (as N)	10.0
SELENIUM (diss)	0.01
SODIUM (diss)	100.
SULPHATE (diss)	500.
URANIUM	0.02
ZINC (total)	0.047
PHOSPHORUS (total)	0.05
AMMONIA (total)	TABLE BACK SIDE
OXYGEN (diss)	OW 6.5
pH (pH units)	6.5-9.0
LINDANE	0.00008
2,4-D	0.004
2,4,5-TP	0.01
CHLOROPHENOLS (total)	0.001
CHLORINE	0.002
CYANIDE (free)	0.005
PCP	0.0005
CESIUM-137 (Bq/L)	50.
IODINE-131 (Bq/L)	10.
RADIUM-226 (Bq/L)	1.0
STRONTIUM-90 (Bq/L)	10.
TRITIUM (Bq/L)	40000.
MERCURY IN FISH (ug/g)	0.5
PCB in Fish (ug/g)	2.0

SYMBOLS:
- all units are in mg/L unless otherwise noted.
- OW - indicates open water period.

Total Ammonia Nitrogen (mg/L)

NOTE: The toxicity of ammonia relates primarily to the unionized form (NH_3). The concentration of unionized ammonia present in water increases with pH and temperature. The values below represent total ammonia-nitrogen concentrations (at various temperatures and pH levels) above which accompanying NH_3 concentrations may be harmful to aquatic life.

Total Ammonia (NH_3 + NH_4+)
(maximum levels expressed as N at various pH/temperature conditions)

	Water Temperature (°C)						
pH (pH units)	0	5	10	15	20	25	30
6.50	2.06	1.97	1.81	1.81	1.22	0.85	0.60
6.75	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.00	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.25	2.06	1.97	1.81	1.81	1.23	0.86	0.61
7.50	2.06	1.97	1.81	1.81	1.23	0.87	0.62
7.75	1.89	1.81	1.73	1.64	1.15	0.81	0.58
8.00	1.26	1.18	1.13	1.09	0.76	0.54	0.39
8.25	0.72	0.67	0.64	0.62	0.44	0.32	0.23
8.50	0.40	0.39	0.37	0.37	0.26	0.19	0.15
8.75	0.23	0.22	0.21	0.22	0.16	0.12	0.09
9.00	0.13	0.13	0.13	0.13	0.11	0.08	0.06

TABLE 9

WATER QUALITY OBJECTIVES

RED DEER RIVER S/M REACH: ETOMAMI RIVER TO RED DEER LAKE

CHEMICAL, PHYSICAL OR BIOLOGICAL VARIABLE	ACCEPTABLE LIMIT OR LIMITS
ARSENIC (diss)	0.05
BARIUM (total)	1.0
BORON (diss)	5.0
CADMIUM (total)	0.00058
CHLORIDE (diss.)	100.
CHROMIUM (total)	0.011
COPPER (total)	0.01
FECAL COLIFORM	200/100ml
FLUORIDE (diss)	1.0
IRON (diss)	0.3
LEAD (total)	0.0118
MANGANESE (diss)	0.05
NICKEL (total)	0.10
NO_2+NO_3 (as N)	10.0
SELENIUM (diss)	0.01
SODIUM (diss)	100.
SULPHATE (diss)	500.
URANIUM	0.02
ZINC (total)	0.047
PHOSPHORUS (total)	0.05
AMMONIA (total)	TABLE BACK SIDE
OXYGEN (diss)	6.0
pH (pH units)	6.5-9.0
LINDANE	0.00008
2,4-D	0.004
2,4,5-TP	0.01
CHLOROPHENOLS (total)	0.001
CHLORINE	0.002
CYANIDE (free)	0.005
PCP	0.0005
CESIUM-137 (Bq/L)	50.
IODINE-131 (Bq/L)	10.
RADIUM-226 (Bq/L)	1.0
STRONTIUM-90 (Bq/L)	10.
TRITIUM (Bq/L)	40000.
MERCURY IN FISH (ug/g)	0.5
PCB in Fish (ug/g)	2.0

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

Total Ammonia Nitrogen (mg/L)

NOTE: The toxicity of ammonia relates primarily to the unionized form (NH_3). The concentration of unionized ammonia present in water increases with pH and temperature. The values below represent total ammonia-nitrogen concentrations (at various temperatures and pH levels) above which accompanying NH_3 concentrations may be harmful to aquatic life.

Total Ammonia (NH_3 + NH_4+)
(maximum levels expressed as N at various pH/temperature conditions)

pH (pH units)	Water Temperature (°C) 0	5	10	15	20	25	30
6.50	2.06	1.97	1.81	1.81	1.22	0.85	0.60
6.75	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.00	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.25	2.06	1.97	1.81	1.81	1.23	0.86	0.61
7.50	2.06	1.97	1.81	1.81	1.23	0.87	0.62
7.75	1.89	1.81	1.73	1.64	1.15	0.81	0.58
8.00	1.26	1.18	1.13	1.09	0.76	0.54	0.39
8.25	0.72	0.67	0.64	0.62	0.44	0.32	0.23
8.50	0.40	0.39	0.37	0.37	0.26	0.19	0.15
8.75	0.23	0.22	0.21	0.22	0.16	0.12	0.09
9.00	0.13	0.13	0.13	0.13	0.11	0.08	0.06

TABLE 10

WATER QUALITY OBJECTIVES	
ASSINIBOINE RIVER REACH: WHITESAND RIVER TO OUTLET OF SHELLMOUTH RESERVOIR	
CHEMICAL, PHYSICAL OR BIOLOGICAL VARIABLE	ACCEPTABLE LIMIT OR LIMITS
ARSENIC (diss)	0.05
BARIUM (total)	1.0
BORON (diss)	2.0
CADMIUM (total)	0.001
CHLORIDE (diss.)	100.
CHROMIUM (total)	0.011
COPPER (total)	0.01
FECAL COLIFORM	200/100ml
FLUORIDE (diss)	1.0
IRON (diss)	0.3
LEAD (total)	0.02
MANGANESE (diss)	0.05
NICKEL (total)	0.10
NO_2+NO_3 (as N)	10.0
SELENIUM (diss)	0.01
SODIUM (diss)	100.
SULPHATE (diss)	500.
URANIUM	0.02
ZINC (total)	0.047
PHOSPHORUS (total)	0.05
AMMONIA (total)	TABLE BACK SIDE
OXYGEN (diss)	6.0
pH (pH units)	6.5-9.0
LINDANE	0.00008
2,4-D	0.004
2,4,5-TP	0.01
CHLOROPHENOLS (total)	0.001
CHLORINE	0.002
CYANIDE (free)	0.005
PCP	0.0005
CESIUM-137 (Bq/L)	50.
IODINE-131 (Bq/L)	10.
RADIUM-226 (Bq/L)	1.0
STRONTIUM-90 (Bq/L)	10.
TRITIUM (Bq/L)	40000.
MERCURY IN FISH (ug/g)	0.5
PCB in Fish (ug/g)	2.0

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

Total Ammonia Nitrogen (mg/L)

NOTE: The toxicity of ammonia relates primarily to the unionized form (NH_3). The concentration of unionized ammonia present in water increases with pH and temperature. The values below represent total ammonia-nitrogen concentrations (at various temperatures and pH levels) above which accompanying NH_3 concentrations may be harmful to aquatic life.

Total Ammonia (NH_3 + NH_4+)
(maximum levels expressed as N at various pH/temperature conditions)

pH (pH units)	Water Temperature (°C) 0	5	10	15	20	25	30
6.50	2.06	1.97	1.81	1.81	1.22	0.85	0.60
6.75	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.00	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.25	2.06	1.97	1.81	1.81	1.23	0.86	0.61
7.50	2.06	1.97	1.81	1.81	1.23	0.87	0.62
7.75	1.89	1.81	1.73	1.64	1.15	0.81	0.58
8.00	1.26	1.18	1.13	1.09	0.76	0.54	0.39
8.25	0.72	0.67	0.64	0.62	0.44	0.32	0.23
8.50	0.40	0.39	0.37	0.37	0.26	0.19	0.15
8.75	0.23	0.22	0.21	0.22	0.16	0.12	0.09
9.00	0.13	0.13	0.13	0.13	0.11	0.08	0.06

TABLE 11

WATER QUALITY OBJECTIVES

QU'APPELLE RIVER REACH: KAPOSVAR CREEK TO ASSINIBOINE RIVER

CHEMICAL, PHYSICAL OR BIOLOGICAL VARIABLE	ACCEPTABLE LIMIT OR LIMITS
ARSENIC (diss)	0.05
BARIUM (total)	1.0
BORON (diss)	2.
CADMIUM (total)	0.001
CHLORIDE (diss.)	100.
CHROMIUM (total)	0.011
COPPER (total)	0.01
FECAL COLIFORM	100/100ml
FLUORIDE (diss)	1.0
IRON (diss)	0.3
LEAD (total)	0.02
MANGANESE (diss)	0.05
MERCURY (total) (ug/L)	0.006
NICKEL (total)	0.10
NO_2+NO_3 (as N)	10.0
SELENIUM (diss)	0.01
SODIUM (diss)	100.
SULPHATE (diss)	500.
URANIUM	0.02
ZINC (total)	0.047
PHOSPHORUS (total)	0.05
AMMONIA (total)	TABLE BACK SIDE
OXYGEN (diss)	6.0
pH (pH units)	6.5-9.0
LINDANE	0.00008
2,4-D	0.004
2,4,5-TP	0.01
CHLOROPHENOLS (total)	0.001
CHLORINE	0.002
CYANIDE (free)	0.005
PCP	0.0005
CESIUM-137 (Bq/L)	50.
IODINE-131 (Bq/L)	10.
RADIUM-226 (Bq/L)	1.0
STRONTIUM-90 (Bq/L)	10.
TRITIUM (Bq/L)	40000.
MERCURY IN FISH (ug/g)	0.5
PCB in Fish (ug/g)	2.0

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

Total Ammonia Nitrogen (mg/L)

NOTE: The toxicity of ammonia relates primarily to the unionized form (NH_3). The concentration of unionized ammonia present in water increases with pH and temperature. The values below represent total ammonia-nitrogen concentrations (at various temperatures and pH levels) above which accompanying NH_3 concentrations may be harmful to aquatic life.

Total Ammonia (NH_3 + NH_4+)
(maximum levels expressed as N at various pH/temperature conditions)

	Water Temperature (°C)						
pH (pH units)	0	5	10	15	20	25	30
6.50	2.06	1.97	1.81	1.81	1.22	0.85	0.60
6.75	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.00	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.25	2.06	1.97	1.81	1.81	1.23	0.86	0.61
7.50	2.06	1.97	1.81	1.81	1.23	0.87	0.62
7.75	1.89	1.81	1.73	1.64	1.15	0.81	0.58
8.00	1.26	1.18	1.13	1.09	0.76	0.54	0.39
8.25	0.72	0.67	0.64	0.62	0.44	0.32	0.23
8.50	0.40	0.39	0.37	0.37	0.26	0.19	0.15
8.75	0.23	0.22	0.21	0.22	0.16	0.12	0.09
9.00	0.13	0.13	0.13	0.13	0.11	0.08	0.06

APPENDIX III

PPWB WATER QUALITY RIVER REACHES

APPENDIX IV

SUMMARY REPORT OF EXCURSIONS TO PPWB OBJECTIVES

1990 PPWB WATER QUALITY OBJECTIVES					
RIVER: QU'APPELLE RIVER			REACH: KAPOSVAR CREEK TO ASSINIBOINE RIVER		
WATER QUALITY PARAMETER/CONDITION	MOST SENSITIVE USE	PPWB OBJECTIVE	POTENTIAL ACTION COMMENTS	STATE OF WATER QUALITY	
				Change over Time	Values Beyond Objectives (1990)
ARSENIC (diss)	FISHERIES	0.05		NA	0
BARIUM (total)	DRINKING	1.0		NA	0
BORON (diss)	IRRIGATION	2.		NA	0
CADMIUM (total)	FISHERIES	0.001		NA	0
CHLORIDE (diss)	IRRIGATION	100.	SK, STUDY 1992 @	NA	2
CHROMIUM (total)	FISHERIES	0.011		NA	1
COPPER (total)	FISHERIES	0.01		NA	0
FECAL COLIFORM	IRRIGATION	100/100ml		NA	0
FLUORIDE (diss)	IRRIGATION	1.0		NA	0
IRON (diss)	DRINKING	0.3		NA	0
LEAD (total)	FISHERIES	0.02		NA	0
MANGANESE (diss)	DRINKING	0.05	SK, STUDY 1992 @	NA	6
MERCURY (total) (ug/L)	FISH CONSUMPTION	0.006	SK, STUDY 1992 @	NA	1
NICKEL (total)	FISHERIES	0.10		NA	0
NO_2+NO_3 (as N)	DRINKING	10.0		NA	0
SELENIUM (diss)	FISHERIES	0.01		NA	0
SODIUM (diss)	IRRIGATION	100.	SK, STUDY 1992 @	NA	12
SULPHATE (diss)	DRINKING	500.	SK, STUDY 1992 @	NA	2
URANIUM	DRINKING	0.02	MONITOR	NA	-
ZINC (total)	FISHERIES	0.047		NA	0
PHOSPHORUS (total)	RECREATION	0.05	SK, STUDY 1992 @	NA	12
AMMONIA (total)	FISHERIES	TABLE BACK SIDE		NA	0
OXYGEN (diss)	FISHERIES	6.0		NA	0
pH (pH units)	FISHERIES	6.5-9.0		NA	0
LINDANE	FISHERIES	0.00008		NA	0
2,4-D	FISHERIES	0.004		NA	0
2,4,5-TP	DRINKING	0.01		NA	0
CHLOROPHENOLS (total)	FISHERIES	0.001	MONITOR	NA	-
CHLORINE	FISHERIES	0.002	MONITOR	NA	-
CYANIDE (free)	FISHERIES	0.005	MONITOR	NA	-
PCP	FISHERIES	0.0005	MONITOR	NA	-
CESIUM-137 (Bq/L)	DRINKING	50.	MONITOR	NA	-
IODINE-131 (BQ/L)	DRINKING	10.	MONITOR	NA	-
RADIUM-226 (Bq/L)	DRINKING	1.0	MONITOR	NA	-
STRONTIUM-90 (Bq/L)	DRINKING	10.	MONITOR	NA	-
TRITIUM (Bq/L)	DRINKING	40000.	MONITOR	NA	-
MERCURY IN FISH (ug/g)	FISH CONSUMPTION	0.5	MONITOR	NA	-
PCB in Fish (ug/g)	FISH CONSUMPTION	2.0	MONITOR	NA	-

AUGUST/91

SYMBOLS:
- all units are in mg/L unless otherwise noted.
- NA - trend not yet analyzed.
- shading indicates a potential issue.
- @ - provincial data review

Total Ammonia Nitrogen (mg/L)

NOTE: The toxicity of ammonia relates primarily to the unionized form (NH_3). The concentration of unionized ammonia present in water increases with pH and temperature. The values below represent total ammonia-nitrogen concentrations (at various temperatures and pH levels) above which accompanying NH_3 concentrations may be harmful to aquatic life.

Total Ammonia (NH_3 + NH_4+)
(maximum levels expressed as N at various pH/temperature conditions)

	Water Temperature (°C)						
pH (pH units)	0	5	10	15	20	25	30
6.50	2.06	1.97	1.81	1.81	1.22	0.85	0.60
6.75	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.00	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.25	2.06	1.97	1.81	1.81	1.23	0.86	0.61
7.50	2.06	1.97	1.81	1.81	1.23	0.87	0.62
7.75	1.89	1.81	1.73	1.64	1.15	0.81	0.58
8.00	1.26	1.18	1.13	1.09	0.76	0.54	0.39
8.25	0.72	0.67	0.64	0.62	0.44	0.32	0.23
8.50	0.40	0.39	0.37	0.37	0.26	0.19	0.15
8.75	0.23	0.22	0.21	0.22	0.16	0.12	0.09
9.00	0.13	0.13	0.13	0.13	0.11	0.08	0.06

1990 PPWB WATER QUALITY OBJECTIVES

RIVER: RED DEER S/M — REACH: ETOMAMI RIVER TO RED DEER LAKE

WATER QUALITY PARAMETER/CONDITION	MOST SENSITIVE USE	PPWB OBJECTIVE	POTENTIAL ACTION COMMENTS	STATE OF WATER QUALITY	
				Change over Time	Values Beyond Objectives (1990)
ARSENIC (diss)	FISHERIES	0.05		NA	0
BARIUM (total)	DRINKING	1.0		NA	0
BORON (diss)	DRINKING	5.0		NA	0
CADMIUM (total)	FISHERIES	0.00058		NA	0
CHLORIDE (diss.)	IRRIGATION	100.		NA	0
CHROMIUM (total)	FISHERIES	0.011		NA	0
COPPER (total)	FISHERIES	0.01		NA	0
FECAL COLIFORM	CONTACT RECREATION	200/100ml		NA	0
FLUORIDE (diss)	IRRIGATION	1.0		NA	0
IRON (diss)	DRINKING	0.3		NA	0
LEAD (total)	FISHERIES	0.0118		NA	0
MANGANESE (diss)	DRINKING	0.05		NA	0
NICKEL (total)	FISHERIES	0.10		NA	0
NO_2+NO_3 (as N)	DRINKING	10.0		NA	0
SELENIUM (diss)	FISHERIES	0.01		NA	0
SODIUM (diss)	IRRIGATION	100.		NA	0
SULPHATE (diss)	DRINKING	500.		NA	0
URANIUM	DRINKING	0.02	MONITOR	NA	0
ZINC (total)	FISHERIES	0.047		NA	0
PHOSPHORUS (total)	RECREATION	0.05	SK. STUDY 1994 @	NA	1
AMMONIA (total)	FISHERIES	TABLE BACK SIDE		NA	0
OXYGEN (diss)	FISHERIES	6.0		NA	0
pH (pH units)	FISHERIES	6.5-9.0		NA	0
LINDANE	FISHERIES	0.00008		NA	0
2,4-D	FISHERIES	0.004		NA	0
2,4,5-TP	DRINKING	0.01		NA	0
CHLOROPHENOLS (total)	FISHERIES	0.001	MONITOR	NA	-
CHLORINE	FISHERIES	0.002	MONITOR	NA	-
CYANIDE (free)	FISHERIES	0.005	MONITOR	NA	-
PCP	FISHERIES	0.0005	MONITOR	NA	-
CESIUM-137 (Bq/L)	DRINKING	50.	MONITOR	NA	-
IODINE-131 (BQ/L)	DRINKING	10.	MONITOR	NA	-
RADIUM-226 (Bq/L)	DRINKING	1.0	MONITOR	NA	-
STRONTIUM-90 (Bq/L)	DRINKING	10.	MONITOR	NA	-
TRITIUM (Bq/L)	DRINKING	40000.	MONITOR	NA	-
MERCURY IN FISH (ug/g)	FISH CONSUMPTION	0.5	MONITOR	NA	-
PCB in Fish (ug/g)	FISH CONSUMPTION	2.0	MONITOR	NA	-

AUGUST/91

SYMBOLS:
- all units are in mg/L unless otherwise noted.
- NA - trend not yet analyzed.
- shading indicates a potential issue.
- @ - provincial data review

EXCERPT FROM THE "SURFACE WATER QUALITY OBJECTIVES", WATER QUALITY BRANCH SASKATCHEWAN ENVIRONMENT AND PUBLIC SAFETY, NOVEMBER, 1988 (WQ 110)

Total Ammonia Nitrogen (mg/L)

NOTE: The toxicity of ammonia relates primarily to the unionized form (NH_3). The concentration of unionized ammonia present in water increases with pH and temperature. The values below represent total ammonia-nitrogen concentrations (at various temperatures and pH levels) above which accompanying NH_3 concentrations may be harmful to aquatic life.

Total Ammonia (NH_3 + NH_4+)
(maximum levels expressed as N at various pH/temperature conditions)

	Water Temperature (°C)						
pH (pH units)	0	5	10	15	20	25	30
6.50	2.06	1.97	1.81	1.81	1.22	0.85	0.60
6.75	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.00	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.25	2.06	1.97	1.81	1.81	1.23	0.86	0.61
7.50	2.06	1.97	1.81	1.81	1.23	0.87	0.62
7.75	1.89	1.81	1.73	1.64	1.15	0.81	0.58
8.00	1.26	1.18	1.13	1.09	0.76	0.54	0.39
8.25	0.72	0.67	0.64	0.62	0.44	0.32	0.23
8.50	0.40	0.39	0.37	0.37	0.26	0.19	0.15
8.75	0.23	0.22	0.21	0.22	0.16	0.12	0.09
9.00	0.13	0.13	0.13	0.13	0.11	0.08	0.06

1990 PPWB WATER QUALITY OBJECTIVES

RIVER: CHURCHILL RIVER — REACH: ISLAND FALLS TO PUKATAWAGAN LAKE

WATER QUALITY PARAMETER/CONDITION	MOST SENSITIVE USE	PPWB OBJECTIVE	POTENTIAL ACTION COMMENTS	STATE OF WATER QUALITY	
				Change over Time	Values Beyond Objectives (1990)
ARSENIC (diss)	FISHERIES	0.05		NA	0
BARIUM (total)	DRINKING	1.0		NA	0
BORON (diss)	DRINKING	5.0		NA	0
CADMIUM (total)	FISHERIES	0.00058		NA	0
CHLORIDE (diss.)	DRINKING	250.		NA	0
CHROMIUM (total)	FISHERIES	0.011		NA	1
COPPER (total)	FISHERIES	0.0057		NA	0
FECAL COLIFORM	CONTACT RECREATION	200/100ml		NA	0
FLUORIDE (diss)	DRINKING	1.5		NA	0
IRON (diss)	DRINKING	0.3		NA	0
LEAD (total)	FISHERIES	0.011		NA	0
MANGANESE (diss)	DRINKING	0.05		NA	0
NICKEL (total)	FISHERIES	0.025		NA	0
NO_2+NO_3 (as N)	DRINKING	10.0		NA	0
SELENIUM (diss)	FISHERIES	0.01		NA	0
SODIUM (diss)	DRINKING	300.		NA	0
SULPHATE (diss)	DRINKING	500.		NA	0
URANIUM	DRINKING	0.02	MONITOR	NA	-
ZINC (total)	FISHERIES	0.047		NA	0
PHOSPHORUS (total)	RECREATION	0.05		NA	0
AMMONIA (total)	FISHERIES	TABLE BACK SIDE		NA	0
OXYGEN (diss)	FISHERIES	6.5		NA	0
pH (pH units)	FISHERIES	6.5-9.0		NA	0
LINDANE	FISHERIES	0.00008		NA	0
2,4-D	FISHERIES	0.004		NA	0
2,4,5-TP	DRINKING	0.01		NA	0
CHLOROPHENOLS (total)	FISHERIES	0.001	MONITOR	NA	-
CHLORINE	FISHERIES	0.002	MONITOR	NA	-
CYANIDE (free)	FISHERIES	0.005	MONITOR	NA	-
PCP	FISHERIES	0.0005	MONITOR	NA	-
CESIUM-137 (Bq/L)	DRINKING	50.	MONITOR	NA	-
IODINE-131 (BQ/L)	DRINKING	10.	MONITOR	NA	-
RADIUM-226 (Bq/L)	DRINKING	1.0	MONITOR	NA	-
STRONTIUM-90 (Bq/L)	DRINKING	10.	MONITOR	NA	-
TRITIUM (Bq/L)	DRINKING	40000.	MONITOR	NA	-
MERCURY IN FISH (ug/g)	FISH CONSUMPTION	0.2	MONITOR	NA	-
PCB in Fish (ug/g)	FISH CONSUMPTION	2.0	MONITOR	NA	-

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SYMBOLS:
- all units are in mg/L unless otherwise noted.
- NA - trend not yet analyzed.

Total Ammonia Nitrogen (mg/L)

NOTE: The toxicity of ammonia relates primarily to the unionized form (NH_3). The concentration of unionized ammonia present in water increases with pH and temperature. The values below represent total ammonia-nitrogen concentrations (at various temperatures and pH levels) above which accompanying NH_3 concentrations may be harmful to aquatic life.

Total Ammonia (NH_3 + NH_4+)
(maximum levels expressed as N at various pH/temperature conditions)

	Water Temperature (°C)						
pH (pH units)	0	5	10	15	20	25	30
6.50	2.06	1.97	1.81	1.81	1.22	0.85	0.60
6.75	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.00	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.25	2.06	1.97	1.81	1.81	1.23	0.86	0.61
7.50	2.06	1.97	1.81	1.81	1.23	0.87	0.62
7.75	1.89	1.81	1.73	1.64	1.15	0.81	0.58
8.00	1.26	1.18	1.13	1.09	0.76	0.54	0.39
8.25	0.72	0.67	0.64	0.62	0.44	0.32	0.23
8.50	0.40	0.39	0.37	0.37	0.26	0.19	0.15
8.75	0.23	0.22	0.21	0.22	0.16	0.12	0.09
9.00	0.13	0.13	0.13	0.13	0.11	0.08	0.06

1990 PPWB WATER QUALITY OBJECTIVES

RIVER: ASSINIBOINE RIVER — REACH: WHITESAND RIVER TO OUTLET OF SHELLMOUTH RESERVOIR

WATER QUALITY PARAMETER/CONDITION	MOST SENSITIVE USE	PPWB OBJECTIVE	POTENTIAL ACTION COMMENTS	STATE OF WATER QUALITY	
				Change over Time	Values Beyond Objectives (1990)
ARSENIC (diss)	FISHERIES	0.05		NA	0
BARIUM (total)	DRINKING	1.0		NA	0
BORON (diss)	IRRIGATION	2.0		NA	0
CADMIUM (total)	FISHERIES	0.001		NA	0
CHLORIDE (diss.)	IRRIGATION	100.		NA	1
CHROMIUM (total)	FISHERIES	0.011		NA	1
COPPER (total)	FISHERIES	0.01		NA	0
FECAL COLIFORM	CONTACT RECREATION	200/100ml		NA	0
FLUORIDE (diss)	IRRIGATION	1.0		NA	0
IRON (diss)	DRINKING	0.3		NA	0
LEAD (total)	FISHERIES	0.02		NA	0
MANGANESE (diss)	DRINKING	0.05	PPWB STUDY 1991	NA	5
NICKEL (total)	FISHERIES	0.10		NA	0
NO_2+NO_3 (as N)	DRINKING	10.0		NA	0
SELENIUM (diss)	FISHERIES	0.01		NA	0
SODIUM (diss)	IRRIGATION	100.		NA	1
SULPHATE (diss)	DRINKING	500.		NA	1
URANIUM	DRINKING	0.02	MONITOR	NA	-
ZINC (total)	FISHERIES	0.047		NA	0
PHOSPHORUS (total)	RECREATION	0.05	PPWB STUDY 1991	NA	9
AMMONIA (total)	FISHERIES	TABLE BACK SIDE		NA	0
OXYGEN (diss)	FISHERIES	6.0	PPWB STUDY 1991	NA	3
pH (pH units)	FISHERIES	6.5-9.0		NA	0
LINDANE	FISHERIES	0.00008		NA	0
2,4-D	FISHERIES	0.004		NA	0
2,4,5-TP	DRINKING	0.01		NA	0
CHLOROPHENOLS (total)	FISHERIES	0.001	MONITOR	NA	-
CHLORINE	FISHERIES	0.002	MONITOR	NA	-
CYANIDE (free)	FISHERIES	0.005	MONITOR	NA	-
PCP	FISHERIES	0.0005	MONITOR	NA	-
CESIUM-137 (Bq/L)	DRINKING	50.	MONITOR	NA	-
IODINE-131 (BQ/L)	DRINKING	10.	MONITOR	NA	-
RADIUM-226 (Bq/L)	DRINKING	1.0	MONITOR	NA	-
STRONTIUM-90 (Bq/L)	DRINKING	10.	MONITOR	NA	-
TRITIUM (Bq/L)	DRINKING	40000.	MONITOR	NA	-
MERCURY IN FISH (ug/g)	FISH CONSUMPTION	0.5	MONITOR	NA	-
PCB in Fish (ug/g)	FISH CONSUMPTION	2.0	MONITOR	NA	-

AUGUST/91

SYMBOLS:
- all units are in mg/L unless otherwise noted.
- NA - trend not yet analyzed.
- shading indicates potential issue.

Total Ammonia Nitrogen (mg/L)

NOTE: The toxicity of ammonia relates primarily to the unionized form (NH_3). The concentration of unionized ammonia present in water increases with pH and temperature. The values below represent total ammonia-nitrogen concentrations (at various temperatures and pH levels) above which accompanying NH_3 concentrations may be harmful to aquatic life.

Total Ammonia (NH_3 + NH_4+)
(maximum levels expressed as N at various pH/temperature conditions)

	Water Temperature (°C)						
pH (pH units)	0	5	10	15	20	25	30
6.50	2.06	1.97	1.81	1.81	1.22	0.85	0.60
6.75	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.00	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.25	2.06	1.97	1.81	1.81	1.23	0.86	0.61
7.50	2.06	1.97	1.81	1.81	1.23	0.87	0.62
7.75	1.89	1.81	1.73	1.64	1.15	0.81	0.58
8.00	1.26	1.18	1.13	1.09	0.76	0.54	0.39
8.25	0.72	0.67	0.64	0.62	0.44	0.32	0.23
8.50	0.40	0.39	0.37	0.37	0.26	0.19	0.15
8.75	0.23	0.22	0.21	0.22	0.16	0.12	0.09
9.00	0.13	0.13	0.13	0.13	0.11	0.08	0.06

1990 PPWB WATER QUALITY OBJECTIVES

RIVER: CARROT RIVER — REACH: TURNBERRY TO MOUTH OF CARROT RIVER

WATER QUALITY PARAMETER/CONDITION	MOST SENSITIVE USE	PPWB OBJECTIVE	POTENTIAL ACTION COMMENTS	STATE OF WATER QUALITY	
				Change over Time	Values Beyond Objectives (1990)
ARSENIC (diss)	FISHERIES	0.05		NA	0
BARIUM (total)	DRINKING	1.0		NA	0
BORON (diss)	IRRIGATION	2.0		NA	0
CADMIUM (total)	FISHERIES	0.001		NA	0
CHLORIDE (diss.)	IRRIGATION	100.	NATURAL GDW	NA	4
CHROMIUM (total)	FISHERIES	0.011		NA	0
COPPER (total)	FISHERIES	0.01		NA	0
FECAL COLIFORM	CONTACT RECREATION	200/100ml		NA	0
FLUORIDE (diss)	IRRIGATION	1.0		NA	0
IRON (diss)	DRINKING	0.3	NATURAL GDW	NA	2
LEAD (total)	FISHERIES	0.015		NA	0
MANGANESE (diss)	DRINKING	0.05	NATURAL GDW	NA	4
NICKEL (total)	FISHERIES	0.10		NA	0
NO_2+NO_3 (as N)	DRINKING	10.0		NA	0
SELENIUM (diss)	FISHERIES	0.01		NA	0
SODIUM (diss)	IRRIGATION	100.	NATURAL GDW	NA	4
SULPHATE (diss)	DRINKING	500.		NA	0
URANIUM	DRINKING	0.02	MONITOR	NA	-
ZINC (total)	FISHERIES	0.047		NA	0
PHOSPHORUS (total)	RECREATION	0.05	SK STUDY 1993 @	NA	7
AMMONIA (total)	FISHERIES	TABLE BACK SIDE		NA	0
OXYGEN (diss)	FISHERIES	OW 6.5		NA	0
pH (pH units)	FISHERIES	6.5-9.0		NA	0
LINDANE	FISHERIES	0.00008		NA	0
2,4-D	FISHERIES	0.004		NA	0
2,4,5-TP	DRINKING	0.01		NA	0
CHLOROPHENOLS (total)	FISHERIES	0.001	MONITOR	NA	-
CHLORINE	FISHERIES	0.002	MONITOR	NA	-
CYANIDE (free)	FISHERIES	0.005	MONITOR	NA	-
PCP	FISHERIES	0.0005	MONITOR	NA	-
CESIUM-137 (Bq/L)	DRINKING	50.	MONITOR	NA	-
IODINE-131 (BQ/L)	DRINKING	10.	MONITOR	NA	-
RADIUM-226 (Bq/L)	DRINKING	1.0	MONITOR	NA	-
STRONTIUM-90 (Bq/L)	DRINKING	10.	MONITOR	NA	-
TRITIUM (Bq/L)	DRINKING	40000.	MONITOR	NA	-
MERCURY IN FISH (ug/g)	FISH CONSUMPTION	0.5	MONITOR	NA	-
PCB in Fish (ug/g)	FISH CONSUMPTION	2.0	MONITOR	NA	-

AUGUST/91

SYMBOLS:
- all units are in mg/L unless otherwise noted.
- NA - trend not yet analyzed.
- GDW - indicates groundwater input to the system.
- OW - indicates open water period.
- shading indicates a potential issue.
- @ - provincial data review

Total Ammonia Nitrogen (mg/L)

NOTE: The toxicity of ammonia relates primarily to the unionized form (NH_3). The concentration of unionized ammonia present in water increases with pH and temperature. The values below represent total ammonia-nitrogen concentrations (at various temperatures and pH levels) above which accompanying NH_3 concentrations may be harmful to aquatic life.

Total Ammonia (NH_3 + NH_4+)
(maximum levels expressed as N at various pH/temperature conditions)

	Water Temperature (°C)						
pH (pH units)	0	5	10	15	20	25	30
6.50	2.06	1.97	1.81	1.81	1.22	0.85	0.60
6.75	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.00	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.25	2.06	1.97	1.81	1.81	1.23	0.86	0.61
7.50	2.06	1.97	1.81	1.81	1.23	0.87	0.62
7.75	1.89	1.81	1.73	1.64	1.15	0.81	0.58
8.00	1.26	1.18	1.13	1.09	0.76	0.54	0.39
8.25	0.72	0.67	0.64	0.62	0.44	0.32	0.23
8.50	0.40	0.39	0.37	0.37	0.26	0.19	0.15
8.75	0.23	0.22	0.21	0.22	0.16	0.12	0.09
9.00	0.13	0.13	0.13	0.13	0.11	0.08	0.06

1990 PPWB WATER QUALITY OBJECTIVES

RIVER: SOUTH SASK. R. REACH: HIGHWAY #41 TO CONFLUENCE WITH RED DEER RIVER

WATER QUALITY PARAMETER/CONDITION	MOST SENSITIVE USE	PPWB OBJECTIVE	POTENTIAL ACTION COMMENTS	STATE OF WATER QUALITY	
				Change over Time	Values Beyond Objectives (1990)
ARSENIC (diss)	FISHERIES	0.05		NA	0
BARIUM (total)	DRINKING	1.0		NA	0
BORON (diss)	IRRIGATION	5.0		NA	0
CADMIUM (total)	FISHERIES	0.001		NA	0
CHROMIUM (total)	FISHERIES	0.011		NA	2
COPPER (total)	FISHERIES	0.01		NA	1
FECAL COLIFORM	IRRIGATION	100/100ml		NA	1
FLUORIDE (diss)	DRINKING	1.5		NA	0
IRON (diss)	DRINKING	1.0		NA	0
LEAD (total)	FISHERIES	0.02		NA	0
MANGANESE (diss)	DRINKING	0.05		NA	0
NICKEL (total)	FISHERIES	0.025		NA	0
NO_2+NO_3 (as N)	DRINKING	10.0		NA	0
SELENIUM (diss)	FISHERIES	0.002		NA	0
SULPHATE (diss)	DRINKING	500.		NA	0
ZINC (total)	FISHERIES	0.05		NA	0
COBALT	LIVESTOCK	1.0		NA	0
SAR	IRRIGATION	3.0		NA	-
TOTAL DISS. SOLIDS	DRINKING	500		NA	0
VANADIUM (TOTAL)	LIVESTOCK	0.1		NA	0
AMMONIA (total)	FISHERIES	TABLE BACK SIDE		NA	0
LINDANE	FISHERIES	0.0001		NA	0
2,4-D	FISHERIES	0.004		NA	0
2,4,5-TP	DRINKING	0.01		NA	0
CHLOROPHENOLS (total)	FISHERIES	0.001	MONITOR	NA	-
CYANIDE (free)	FISHERIES	0.005	MONITOR	NA	-
MERCURY IN FISH (ug/g)	FISH CONSUMPTION	0.5	MONITOR	NA	-
PCB IN FISH (ug/g)	FISH CONSUMPTION	2.0	MONITOR	NA	-

AUGUST/91

SYMBOLS:
- all units are in mg/L unless otherwise noted.
- NA - trend not yet analyzed.

Total Ammonia Nitrogen (mg/L)

NOTE: The toxicity of ammonia relates primarily to the unionized form (NH_3). The concentration of unionized ammonia present in water increases with pH and temperature. The values below represent total ammonia-nitrogen concentrations (at various temperatures and pH levels) above which accompanying NH_3 concentrations may be harmful to aquatic life.

Total Ammonia (NH_3 + NH_4+)
(maximum levels expressed as N at various pH/temperature conditions)

	Water Temperature (°C)						
pH (pH units)	0	5	10	15	20	25	30
6.50	2.06	1.97	1.81	1.81	1.22	0.85	0.60
6.75	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.00	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.25	2.06	1.97	1.81	1.81	1.23	0.86	0.61
7.50	2.06	1.97	1.81	1.81	1.23	0.87	0.62
7.75	1.89	1.81	1.73	1.64	1.15	0.81	0.58
8.00	1.26	1.18	1.13	1.09	0.76	0.54	0.39
8.25	0.72	0.67	0.64	0.62	0.44	0.32	0.23
8.50	0.40	0.39	0.37	0.37	0.26	0.19	0.15
8.75	0.23	0.22	0.21	0.22	0.16	0.12	0.09
9.00	0.13	0.13	0.13	0.13	0.11	0.08	0.06

1990 PPWB WATER QUALITY OBJECTIVES

RIVER: RED DEER RIVER A/S — REACH: BINDLOSS TO CONFLUENCE WITH THE S. SASK. R.

WATER QUALITY PARAMETER/CONDITION	MOST SENSITIVE USE	PPWB OBJECTIVE	POTENTIAL ACTION COMMENTS	STATE OF WATER QUALITY	
				Change over Time	Values Beyond Objectives (1990)
ARSENIC (diss)	FISHERIES	0.05		NA	0
BARIUM (total)	DRINKING	1.0		NA	0
BORON (diss)	IRRIGATION	5.0		NA	0
CADMIUM (total)	FISHERIES	0.001		NA	0
CHROMIUM (total)	FISHERIES	0.011		NA	0
COPPER (total)	FISHERIES	0.004	AB, STUDY 1992	NA	4
FECAL COLIFORM	IRRIGATION	100/100ml	AB, STUDY 1992	NA	3
FLUORIDE (diss)	DRINKING	1.5		NA	0
IRON (diss)	DRINKING	0.3	AB, STUDY 1992	NA	1
LEAD (total)	FISHERIES	0.007	AB, STUDY 1992 *	NA	1
MANGANESE (diss)	DRINKING	0.05		NA	0
NICKEL (total)	FISHERIES	0.025		NA	0
NO_2+NO_3 (as N)	DRINKING	10.0		NA	0
SELENIUM (diss)	FISHERIES	0.001		NA	0
SULPHATE (diss)	DRINKING	500.		NA	0
ZINC (total)	FISHERIES	0.03	AB, STUDY 1992 *	NA	1
COBALT	LIVESTOCK	1.0		NA	0
SAR	IRRIGATION	3.0		NA	-
TOTAL DISS. SOLIDS	DRINKING	500		NA	0
VANADIUM	LIVESTOCK	0.1		NA	0
AMMONIA (total)	FISHERIES	TABLE BACK SIDE		NA	0
LINDANE	FISHERIES	0.0001		NA	0
2,4-D	FISHERIES	0.004		NA	0
2,4,5-TP	DRINKING	0.01		NA	0
CHLOROPHENOLS (total)	FISHERIES	0.001	MONITOR	NA	-
CYANIDE (free)	FISHERIES	0.005	MONITOR	NA	-
MERCURY IN FISH (ug/g)	FISH CONSUMPTION	0.5	MONITOR	NA	-
PCB IN FISH (ug/g)	FISH CONSUMPTION	2.0	MONITOR	NA	-

AUGUST/91

SYMBOLS:
- all units are in mg/L unless otherwise noted.
- NA - trend not yet analyzed.
- shading indicates a potential issue.
- * - some excursions to the objective occurred in previous years.

Total Ammonia Nitrogen (mg/L)

NOTE: The toxicity of ammonia relates primarily to the unionized form (NH_3). The concentration of unionized ammonia present in water increases with pH and temperature. The values below represent total ammonia-nitrogen concentrations (at various temperatures and pH levels) above which accompanying NH_3 concentrations may be harmful to aquatic life.

Total Ammonia (NH_3 + NH_4+)
(maximum levels expressed as N at various pH/temperature conditions)

	Water Temperature (°C)						
pH (pH units)	0	5	10	15	20	25	30
6.50	2.06	1.97	1.81	1.81	1.22	0.85	0.60
6.75	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.00	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.25	2.06	1.97	1.81	1.81	1.23	0.86	0.61
7.50	2.06	1.97	1.81	1.81	1.23	0.87	0.62
7.75	1.89	1.81	1.73	1.64	1.15	0.81	0.58
8.00	1.26	1.18	1.13	1.09	0.76	0.54	0.39
8.25	0.72	0.67	0.64	0.62	0.44	0.32	0.23
8.50	0.40	0.39	0.37	0.37	0.26	0.19	0.15
8.75	0.23	0.22	0.21	0.22	0.16	0.12	0.09
9.00	0.13	0.13	0.13	0.13	0.11	0.08	0.06

1990 PPWB WATER QUALITY OBJECTIVES

RIVER: SASKATCHEWAN RIVER REACH: OUTLET OF CUMBERLAND LAKE TO MOUTH OF CARROT RIVER

WATER QUALITY PARAMETER/CONDITION	MOST SENSITIVE USE	PPWB OBJECTIVE	POTENTIAL ACTION COMMENTS	STATE OF WATER QUALITY	
				Change over Time	Values Beyond Objectives (1990)
ARSENIC (diss)	FISHERIES	0.05		NA	0
BARIUM (total)	DRINKING	1.0		NA	0
BORON (diss)	IRRIGATION	0.5		NA	0
CADMIUM (total)	FISHERIES	0.001		NA	0
CHLORIDE (diss.)	IRRIGATION	68.	SPILL	NA	1
CHROMIUM (total)	FISHERIES	0.011		NA	1
COPPER (total)	FISHERIES	0.01		NA	0
FECAL COLIFORM	CONTACT RECREATION	200/100ml		NA	0
FLUORIDE (diss)	IRRIGATION	1.0		NA	0
IRON (diss)	DRINKING	0.3		NA	0
LEAD (total)	FISHERIES	0.0061		NA	0
MANGANESE (diss)	DRINKING	0.05		NA	0
NICKEL (total)	FISHERIES	0.10		NA	0
NO_2+NO_3 (as N)	DRINKING	10.0		NA	0
SELENIUM (diss)	FISHERIES	0.01		NA	0
SODIUM (diss)	IRRIGATION	100.	SPILL	NA	1
SULPHATE (diss)	IRRIGATION	250.		NA	0
URANIUM	DRINKING	0.02	MONITOR	NA	-
ZINC (total)	FISHERIES	0.047		NA	0
PHOSPHORUS (total)	RECREATION	0.05	SK STUDY 1993 @	NA	6
AMMONIA (total)	FISHERIES	TABLE BACK SIDE		NA	0
OXYGEN (diss)	FISHERIES	6.5		NA	0
pH (pH units)	FISHERIES	6.5-9.0		NA	0
LINDANE	FISHERIES	0.00008		NA	0
2,4-D	FISHERIES	0.004		NA	0
2,4,5-TP	DRINKING	0.01		NA	0
CHLOROPHENOLS (total)	FISHERIES	0.001	MONITOR	NA	-
CHLORINE	FISHERIES	0.002	MONITOR	NA	-
CYANIDE (free)	FISHERIES	0.005	MONITOR	NA	-
PCP	FISHERIES	0.0005	MONITOR	NA	-
CESIUM-137 (Bq/L)	DRINKING	50.	MONITOR	NA	-
IODINE-131 (BQ/L)	DRINKING	10.	MONITOR	NA	-
RADIUM-226 (Bq/L)	DRINKING	1.0	MONITOR	NA	-
STRONTIUM-90 (Bq/L)	DRINKING	10.	MONITOR	NA	-
TRITIUM (Bq/L)	DRINKING	40000.	MONITOR	NA	-
MERCURY IN FISH (ug/g)	FISH CONSUMPTION	0.2	MONITOR	NA	-
PCB in Fish (ug/g)	FISH CONSUMPTION	2.0	MONITOR	NA	-

AUGUST/91

SYMBOLS:
- all units are in mg/L unless otherwise noted.
- NA - trend not yet analyzed.
- shading indicates a potential issue.
- @ - provincial data review

Total Ammonia Nitrogen (mg/L)

NOTE: The toxicity of ammonia relates primarily to the unionized form (NH_3). The concentration of unionized ammonia present in water increases with pH and temperature. The values below represent total ammonia-nitrogen concentrations (at various temperatures and pH levels) above which accompanying NH_3 concentrations may be harmful to aquatic life.

Total Ammonia (NH_3 + NH_4+)
(maximum levels expressed as N at various pH/temperature conditions)

	Water Temperature (°C)						
pH (pH units)	0	5	10	15	20	25	30
6.50	2.06	1.97	1.81	1.81	1.22	0.85	0.60
6.75	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.00	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.25	2.06	1.97	1.81	1.81	1.23	0.86	0.61
7.50	2.06	1.97	1.81	1.81	1.23	0.87	0.62
7.75	1.89	1.81	1.73	1.64	1.15	0.81	0.58
8.00	1.26	1.18	1.13	1.09	0.76	0.54	0.39
8.25	0.72	0.67	0.64	0.62	0.44	0.32	0.23
8.50	0.40	0.39	0.37	0.37	0.26	0.19	0.15
8.75	0.23	0.22	0.21	0.22	0.16	0.12	0.09
9.00	0.13	0.13	0.13	0.13	0.11	0.08	0.06

1990 PPWB WATER QUALITY OBJECTIVES

RIVER: BATTLE RIVER — REACH: BLACKFOOT CREEK TO UNWIN

WATER QUALITY PARAMETER/CONDITION	MOST SENSITIVE USE	PPWB OBJECTIVE	POTENTIAL ACTION COMMENTS	STATE OF WATER QUALITY	
				Change over Time	Values Beyond Objectives (1990)
ARSENIC (diss)	FISHERIES	0.05		NA	0
BARIUM (total)	DRINKING	1.0		NA	0
BORON (diss)	IRRIGATION	5.0		NA	0
CADMIUM (total)	FISHERIES	0.001		NA	0
CHLORIDE	IRRIGATION	100		NA	0
CHROMIUM (total)	FISHERIES	0.011	AB. STUDY 1991	NA	2
COPPER (total)	FISHERIES	0.004	AB. STUDY 1991	NA	4
FECAL COLIFORM	IRRIGATION	100/100ml		NA	1
FLUORIDE (diss)	DRINKING	1.5		NA	0
IRON (diss)	DRINKING	0.3	AB. STUDY 1991	NA	2
LEAD (total)	FISHERIES	0.007		NA	1
MANGANESE (diss)	DRINKING	0.05	AB. STUDY 1991	NA	4
NICKEL (total)	FISHERIES	0.1		NA	0
NO_2+NO_3 (as N)	DRINKING	10.0		NA	0
SELENIUM (diss)	FISHERIES	0.001		NA	0
SODIUM	IRRIGATION	100	AB. STUDY 1991	NA	5
SULPHATE (diss)	DRINKING	500.		NA	0
URANIUM	DRINKING	0.02	MONITOR	NA	-
ZINC (total)	FISHERIES	0.03	AB. STUDY 1991	NA	1
ALUMINUM (total)	LIVESTOCK	5.0	MONITOR	NA	-
COBALT	IRRIGATION	0.05		NA	0
TOTAL DISS. SOLIDS	DRINKING	500	AB. STUDY 1991	NA	5
VANADIUM	LIVESTOCK	0.1		NA	0
AMMONIA (total)	FISHERIES	TABLE BACK SIDE		NA	0
OXYGEN	FISHERIES	OW 8.0		NA	0
pH (pH UNITS)	FISHERIES	6.5-9.0		NA	0
LINDANE	FISHERIES	0.0001		NA	0
2,4-D	FISHERIES	0.004		NA	0
2,4,5-TP	DRINKING	0.01		NA	0
CHLOROPHENOLS (total)	FISHERIES	0.001	MONITOR	NA	-
CHLORINE	FISHERIES	0.002	MONITOR	NA	-
CYANIDE (free)	FISHERIES	0.005	MONITOR	NA	-
PCP	FISHERIES	0.0005	MONITOR	NA	-
MERCURY IN FISH (ug/g)	FISH CONSUMPTION	0.5	MONITOR	NA	-
PCB IN FISH (ug/g)	FISH CONSUMPTION	2.0	MONITOR	NA	-

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SYMBOLS:
- all units are in mg/L unless otherwise noted.
- NA - trend not yet analyzed.
- OW - indicates open water period.
- shading indicates a potential issue.

Total Ammonia Nitrogen (mg/L)

NOTE: The toxicity of ammonia relates primarily to the unionized form (NH_3). The concentration of unionized ammonia present in water increases with pH and temperature. The values below represent total ammonia-nitrogen concentrations (at various temperatures and pH levels) above which accompanying NH_3 concentrations may be harmful to aquatic life.

Total Ammonia (NH_3 + NH_4+)
(maximum levels expressed as N at various pH/temperature conditions)

	Water Temperature (°C)						
pH (pH units)	0	5	10	15	20	25	30
6.50	2.06	1.97	1.81	1.81	1.22	0.85	0.60
6.75	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.00	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.25	2.06	1.97	1.81	1.81	1.23	0.86	0.61
7.50	2.06	1.97	1.81	1.81	1.23	0.87	0.62
7.75	1.89	1.81	1.73	1.64	1.15	0.81	0.58
8.00	1.26	1.18	1.13	1.09	0.76	0.54	0.39
8.25	0.72	0.67	0.64	0.62	0.44	0.32	0.23
8.50	0.40	0.39	0.37	0.37	0.26	0.19	0.15
8.75	0.23	0.22	0.21	0.22	0.16	0.12	0.09
9.00	0.13	0.13	0.13	0.13	0.11	0.08	0.06

1990 PPWB WATER QUALITY OBJECTIVES

RIVER: NORTH SASK. R. REACH: LEA PARK TO LLOYDMINSTER FERRY

WATER QUALITY PARAMETER/CONDITION	MOST SENSITIVE USE	PPWB OBJECTIVE	POTENTIAL ACTION COMMENTS	STATE OF WATER QUALITY	
				Change over Time	Values Beyond Objectives (1990)
ARSENIC (diss)	FISHERIES	0.05		NA	0
BARIUM (total)	DRINKING	1.0		NA	0
BORON (diss)	IRRIGATION	5.0		NA	0
CADMIUM (total)	FISHERIES	0.001		NA	0
CHLORIDE	IRRIGATION	100		NA	0
CHROMIUM (total)	FISHERIES	0.011		NA	1
COPPER (total)	FISHERIES	0.004	AB. STUDY 1991	NA	3
FECAL COLIFORM	CONTACT RECREATION	100/100ml	AB. STUDY 1991	NA	3
FLUORIDE (diss)	DRINKING	1.5		NA	0
IRON (diss)	DRINKING	0.3		NA	0
LEAD (total)	FISHERIES	0.007	AB. STUDY 1991	NA	2
MANGANESE (diss)	DRINKING	0.05		NA	0
NICKEL (total)	FISHERIES	0.1		NA	0
NO_2+NO_3 (as N)	DRINKING	10.0		NA	0
SELENIUM (diss)	FISHERIES	0.001		NA	0
SODIUM	IRRIGATION	100		NA	0
SULPHATE (diss)	DRINKING	500.		NA	0
URANIUM	DRINKING	0.02	MONITOR	NA	-
ZINC (total)	FISHERIES	0.03	AB. STUDY 1991	NA	2
ALUMINUM (total)	LIVESTOCK	5.0	MONITOR	NA	-
COBALT	IRRIGATION	0.05		NA	0
TOTAL DISS. SOLIDS	DRINKING	500		NA	0
VANADIUM (TOTAL)	LIVESTOCK	0.1		NA	0
AMMONIA (total)	FISHERIES	TABLE BACK SIDE		NA	0
OXYGEN	FISHERIES	6.5		NA	0
pH (pH UNITS)	FISHERIES	6.5-9.0		NA	0
LINDANE	FISHERIES	0.0001		NA	0
2,4-D	FISHERIES	0.004		NA	0
2,4,5-TP	DRINKING	0.01		NA	0
CHLOROPHENOLS (total)	FISHERIES	0.001	MONITOR	NA	-
CHLORINE	FISHERIES	0.002	MONITOR	NA	-
CYANIDE (free)	FISHERIES	0.005	MONITOR	NA	-
PCP	FISHERIES	0.0005	MONITOR	NA	-
MERCURY IN FISH (ug/g)	FISH CONSUMPTION	0.5	MONITOR	NA	-
PCB IN FISH (ug/g)	FISH CONSUMPTION	2.0	MONITOR	NA	-

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SYMBOLS:
- all units are in mg/L unless otherwise noted.
- NA - trend not yet analyzed.
- shading indicates a potential issue.

Total Ammonia Nitrogen (mg/L)

NOTE: The toxicity of ammonia relates primarily to the unionized form (NH_3). The concentration of unionized ammonia present in water increases with pH and temperature. The values below represent total ammonia-nitrogen concentrations (at various temperatures and pH levels) above which accompanying NH_3 concentrations may be harmful to aquatic life.

Total Ammonia (NH_3 + NH_4+)
(maximum levels expressed as N at various pH/temperature conditions)

	Water Temperature (°C)						
pH (pH units)	0	5	10	15	20	25	30
6.50	2.06	1.97	1.81	1.81	1.22	0.85	0.60
6.75	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.00	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.25	2.06	1.97	1.81	1.81	1.23	0.86	0.61
7.50	2.06	1.97	1.81	1.81	1.23	0.87	0.62
7.75	1.89	1.81	1.73	1.64	1.15	0.81	0.58
8.00	1.26	1.18	1.13	1.09	0.76	0.54	0.39
8.25	0.72	0.67	0.64	0.62	0.44	0.32	0.23
8.50	0.40	0.39	0.37	0.37	0.26	0.19	0.15
8.75	0.23	0.22	0.21	0.22	0.16	0.12	0.09
9.00	0.13	0.13	0.13	0.13	0.11	0.08	0.06

1990 PPWB WATER QUALITY OBJECTIVES

RIVER: BEAVER RIVER — REACH: BEAVER CROSSING TO THE BORDER

WATER QUALITY PARAMETER/CONDITION	MOST SENSITIVE USE	PPWB OBJECTIVE	POTENTIAL ACTION COMMENTS	STATE OF WATER QUALITY	
				Change over Time	Values Beyond Objectives (1990)
ARSENIC (diss)	FISHERIES	0.05		NA	0
BARIUM (total)	DRINKING	1.0		NA	0
BORON (diss)	IRRIGATION	5.0		NA	0
CADMIUM (total)	FISHERIES	0.001		NA	0
CHLORIDE (diss.)	IRRIGATION	100.		NA	0
CHROMIUM (total)	FISHERIES	0.011		NA	1
COPPER (total)	FISHERIES	0.004		NA	0
FECAL COLIFORM	IRRIGATION	100/100ml	AB. STUDY 1991 *	NA	0
FLUORIDE (diss)	DRINKING	1.5		NA	0
IRON (diss)	AQUATIC LIFE	1.0		NA	0
LEAD (total)	FISHERIES	0.007		NA	0
MANGANESE (diss)	IRRIGATION	0.2	NATURAL COND.	NA	3
NICKEL (total)	FISHERIES	0.1		NA	0
NO_2+NO_3 (as N)	DRINKING	10.0		NA	0
SELENIUM (diss)	FISHERIES	0.001		NA	0
SODIUM (diss)	IRRIGATION	100.		NA	0
SULPHATE (diss)	DRINKING	500.		NA	0
URANIUM	DRINKING	0.02	MONITOR	NA	-
ZINC (total)	FISHERIES	0.03		NA	0
AMMONIA (total)	FISHERIES	TABLE BACK SIDE		NA	0
OXYGEN (diss)	FISHERIES	OW 6.0		NA	0
pH (pH units)	FISHERIES	6.5-9.0		NA	0
LINDANE	FISHERIES	0.0001		NA	0
2,4-D	FISHERIES	0.004		NA	0
2,4,5-TP	DRINKING	0.01		NA	0
CHLOROPHENOLS (total)	FISHERIES	0.001	MONITOR	NA	-
CHLORINE	FISHERIES	0.002	MONITOR	NA	-
CYANIDE (free)	FISHERIES	0.005	MONITOR	NA	-
PCP	FISHERIES	0.0005	MONITOR	NA	-
MERCURY IN FISH (ug/g)	FISH CONSUMPTION	0.5	MONITOR	NA	-
PCB IN FISH (ug/g)	FISH CONSUMPTION	2.0	MONITOR	NA	-

AUGUST/91

SYMBOLS:
- all units are in mg/L unless otherwise noted.
- NA - trend not yet analyzed.
- OW - open water objective only.
- shading indicates a potential issue.
- * - some excursions to objectives occurred in previous years.

Total Ammonia Nitrogen (mg/L)

NOTE: The toxicity of ammonia relates primarily to the unionized form (NH_3). The concentration of unionized ammonia present in water increases with pH and temperature. The values below represent total ammonia-nitrogen concentrations (at various temperatures and pH levels) above which accompanying NH_3 concentrations may be harmful to aquatic life.

Total Ammonia (NH_3 + NH_4+)
(maximum levels expressed as N at various pH/temperature conditions)

	Water Temperature (°C)						
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6.75	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.00	2.06	1.97	1.81	1.81	1.22	0.85	0.61
7.25	2.06	1.97	1.81	1.81	1.23	0.86	0.61
7.50	2.06	1.97	1.81	1.81	1.23	0.87	0.62
7.75	1.89	1.81	1.73	1.64	1.15	0.81	0.58
8.00	1.26	1.18	1.13	1.09	0.76	0.54	0.39
8.25	0.72	0.67	0.64	0.62	0.44	0.32	0.23
8.50	0.40	0.39	0.37	0.37	0.26	0.19	0.15
8.75	0.23	0.22	0.21	0.22	0.16	0.12	0.09
9.00	0.13	0.13	0.13	0.13	0.11	0.08	0.06