IRRB

THE

INTERNATIONAL RED RIVER BOARD

Twelfth Annual Progress Report

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PREFACE

This report documents water quality trends and exceedences of objectives, effluent releases, and control measures for the Red River basin for the 2009 Water Year (October 01, 2009 through September 30, 2010). In addition, this report describes the activities of the International Red River Board during the reporting period October 01, 2010 to September 30, 2011 and identifies several current and future water quality and water quantity issues in the basin.

The units of measure presented in this report are those of the respective agencies contributing to this report.

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1.0 SUMMARY

1.01 Water Quantity and Water Quality

Water Quantity

Average to above average precipitation in summer/ autumn of 2009 led to soil moisture that was above average at freeze-up in 2009 in the Red River Basin. The 2009/2010 winter precipitation was generally below average while the 2010 spring, summer and autumn precipitation was well above normal in southern Manitoba and the United States portions of the Red River Basin. Well above average precipitation led to high soil moisture levels at freeze-up time in 2010.

River flows were between the median and upper quartile range during the autumn 2009 and through winter 2009/2010. In May, extensive overland flooding occurred in many areas of southern Manitoba due to heavy rains falling on wet soils. Many small streams in areas that experienced heavy rainfall also experienced overbank flows in low lying areas and significant amounts of water flooded fields. The above normal precipitation between May and October 2010 resulted in flows greater than the upper decile in most parts of autumn 2010.

During the spring of 2010, floods resulted from above average soil moisture at freeze-up in 2009 combined with well above average snow cover in the United States portion of the Red River basin. Snow cover in the Manitoba portion of the basin was close to average. Spring rainfall was negligible in the Manitoba portion of the basin but a few rain events did occur within the United States portion of the basin.

Snowmelt runoff began before mid-March, aided by a 35 mm rain-on-snow event in the United States portion of the basin on March 9 to 12, 2010. Runoff from the Manitoba portion of the basin was delayed until late March but crests from Manitoba tributaries occurred before the arrival of the crest from the United States, resulting in little additional rise as the crest moved through Manitoba. The crest in Manitoba occurred on April 1, 2010 at Emerson.

The Red River crest at Winnipeg occurred on April 2 due to relatively high runoff from local tributaries including the Assiniboine River and due to the breaking of an ice jam in the St. Norbert area. The crest in the Selkirk area occurred on March 28 due to significant ice jamming. Ice jams produced the highest stages on record in the St. Peters Road area between Selkirk and Breezy Point and resulted in severe flood damages. Minor flooding occurred at Petersfield due to Red River ice jams backing water up Netley Creek.

As of 2010, the Red River Floodway has been operated in 28 of the 42 years since construction was completed in 1969, providing flood damage reduction in the order of $30 billion dollars. The floodway operated for 25 days in the spring of 2010 compared to 46 days in 2009. During the spring of 2010, the Red River Floodway gates were operated for 600 hours over 25 days beginning at 9:30 a.m. on March 28 and ending at 9:30 AM on April 22. During this period of operation, 47 discrete gate adjustments were made as required at various times throughout any 24 hour period. In the spring of 2010, 0.5 million acre-feet of water were diverted around the City of Winnipeg with a peak flow of 16,200 cubic feet per second (cfs).

In spring 2010, operation of the Red River Floodway was successful in protecting the City of Winnipeg while minimizing upstream impacts, through normal operation in accordance with Rule 1 of the Floodway Rules of

Operation, which requires the Department of Water Stewardship to maintain natural levels on the Red River at the Floodway inlet. In concert with operation of the Portage Diversion and Shellmouth Reservoir, operation of the floodway reduced the flood crest in the City of Winnipeg by 4.5 feet.

Due to unusually heavy rainfall events beginning late April and into summer 2010 in southern Manitoba, water levels in the Red and Assiniboine Rivers rose significantly. As a result, it became necessary to operate the floodway. Summer floodway operation commenced on May 30, 2010 under Rule 1, moved to Rule 4 on June 3, 2010, and ended on July 10, 2010. As in spring, the summer operation reduced flood crests in the city of Winnipeg, avoiding flood damage.

In 2010, there were two significant peaks in the Red River, spring and summer. The spring peak flow was 64,000 cfs followed by a lower summer peak flow of 35,000 cfs at Emerson. In Winnipeg, the respective peak flows were 56,000 and 54,000 cfs. The 2010 spring flood on the Red River basin was average with the exception of some areas near the United States boundary where it was above average. The flood at Emerson was the 8th largest and at St. Agathe, the 12th largest for the past 100 years of record. The 2010 natural spring peak stage at James Avenue in Winnipeg was the 24th largest flood since 1826. It was the 10th largest since operation of major flood control works began in 1969.

For the past 100 years, the flood at Emerson was the 8th largest on record, and at Ste. Agathe the 12th largest. During the 40 year period that major flood control works have been operated, the peak flow in the Red River Floodway was the 12th highest on record in 2010 and the peak stage of 18.6 feet in downtown Winnipeg, following the break of an ice jam in St. Norbert, was the 10 highest on record.

An average of 37,000 acres of agricultural land was flooded in the Red River valley in Manitoba in the spring of 2010, compared to 247,000 km^2 in 2009 and 455,000 km^2 in 1997. Without the operation of the Floodway the peak level in downtown Winnipeg would have been 22.6 feet. The actual peak was 18.6 feet. The four community ring dikes of Morris, Emerson, St Jean, and St Adolphe were partially closed but community access was maintained. Under the ice jam mitigation program in Manitoba, ice cutters cut 640 km of ice in 5 meter grids to weaken the ice. The Portage Diversion diverted a peak flow of 4600 cfs to control flooding on the Assiniboine River and reduced the peak Red River levels in downtown Winnipeg by 0.25 feet.

Water Quality

Some exceedences of the International Joint Commission (IJC) water quality objectives were observed at the international boundary during the 2009 water year. Dissolved oxygen generally remained well above the objective level of 5.0 mg/L. Exceedences of the International Joint Commission (IJC) water quality objectives, and concentrations approaching the objective level for total dissolved solids (TDS) were observed at the international boundary during the 2009 water year. The TDS objective of 500 mg/L was exceeded several times in the 2009 water year. The highest observed value of 778 mg/L was recorded in December 2009. The chloride objective (100 mg/L) was not exceeded. However, the sulphate objective of 250 mg/L was exceeded on four occasions during the water year. The fecal coliform and the new *Escherichia coli* objective (200 colonies/ 100 mL) were exceeded once on November 1, 2010.

1.02 International Red River Board Activities

As noted in the Preface, this report also describes the activities of the International Red River Board (IRRB) for the period October 01, 2010 - September 30, 2011 which succeeds the 2010 water year. The key activities are highlighted below.

In 2009, the IRRB created a new 3-year work plan to reflect the status of its activities, and to affirm consistency with the International Watersheds Initiative and the IJC Directive to the IRRB. The work plan priorities include a continued effort to expand the existing scientific knowledge of aquatic ecosystem dynamics and current conditions. The activities encompass assessment of fish and macro-invertebrate communities, distribution and abundance of exotic species, as well as plant community structures and trends. Key IRRB activities also include - development and implementation of apportionment/flow targets at the International Boundary; completion of the final year of the three-year Pathogen/Parasite Sampling Program; continuation of the development of Comprehensive Flood Mitigation Strategy (CFMS) as per the terms of reference of the Committee on Hydrology; LiDAR mapping and hydraulic modeling of the Lower Pembina River Basin; and setting nutrient objectives for the Red River at the International Boundary.

The IRRB held its sixth bi-annual meeting January 20-21, 2011 to address select issues in the basin, and the seventh bi-annual meeting September 7- 8, 2011 for a more complete review of its responsibilities, activities, and accomplishments. The meetings addressed water quality monitoring and compliance with IJC objectives and established alert levels, and IRRB work plan priorities. The latter included actions to develop and implement water quantity apportionment procedures, prioritized flood mitigation plans, and biological monitoring and nutrient management strategies for the basin. The Board also developed a draft white paper on Devils Lake for discussion and to make recommendations to the IJC to resolve outstanding issues related to water quantity/flooding, water quality, biota transfer, and operation of the Devils Lake Outlet structure. Various scenarios, including a potential natural spill from Devils Lake into the Sheyenne River are being examined by the Board.

Completion of a three-year sampling program for parasites and pathogens as a result of multi-agency negotiations led by the White House Council on Environmental Quality (CEQ) was a significant IRRB undertaking during the reporting period. The objective of the sampling program, which was initiated in September 2006, is to determine the presence and prevalence of fish parasites and pathogens in resident fish from Devils Lake, the Sheyenne River, Red River, and Lake Winnipeg, and to address the risks associated with transfer of such biota from the Devils Lake outlet to aquatic ecosystems downstream. A further objective is to use the comprehensive fish survey to support the overall framework for biological monitoring in the Red River basin as identified in the IRRB work plan.

The IRRB has completed its three year sampling program in 2008. Both Canadian and US analyses of fish samples collected over the three year period (2006-2008) have been completed. The US FWS is currently working on its analysis of fish samples collected in 2008 from the US portion of the Red River Basin.

The Aquatic Ecosystems Committee (AEC) conducted a workshop in March 2011 with a team of experts who reviewed the fish parasite, pathogen, and histopathology data collected from 2006 to 2008. The team discussed the issues and data, what these data mean and made recommendations for future monitoring in the basin, not just Devils Lake. The Final Synthesis Report is expected by the end of June 2011.

The Final Report will make recommendations on future monitoring for fish health and fish community stability. It will also make recommendations on the scope and direction for a final report on "risk assessment" that assess the potential for Devils Lake fish parasites and pathogens to have an adverse effect on the Red River and Lake Winnipeg ecosystems. The Report will have either Canada and USA co-authors; or a Canadian author and a USA editor; or a USA author and a Canadian editor. Final report will be peer-reviewed by a Canadian authority and USA authority on fish health. It is expected that the review process will take 6 months with a total cost of $85,000 that will include report preparation and peer-review.

1.03 International Red River Board Three-Year Work Plan (2009-2012)

A three-year work plan was approved by Board and its committee members at its September 2009 meeting held in Gimli, Manitoba. Priorities include:

- Report Water Quality Objectives,
- Completion of the Parasite/Pathogen Sampling Program,
- Comprehensive Flood Mitigation Strategy,
- Water Quantity Apportionment,
- Lower Pembina Flooding,
- Enhanced Bio Assessment,
- Nutrient Objectives, and
- IWI funded Projects.

2.0 INTRODUCTION

In April 2000, the International Joint Commission (IJC) formally merged its International Red River Pollution Board and International Souris-Red Rivers Engineering Board consolidating the water quality and water quantity responsibilities of the former boards, to form the International Red River Board (IRRB). This consolidation formalized the already emerging cooperative efforts of the former boards toward an integrated approach to transboundary water issues in the basin. Further, in its November 2000 report *Living with the Red*, the IJC recommended that the governments assign certain flood-related tasks to the IJC for implementation by its IRRB. In June 2001, Canada and the United States formally approved a new expanded directive for the IRRB. The directive is included in Appendix A.

In April 2003, the IJC requested further discussion with the IRRB on how to achieve a more ecosystem approach and a capacity to respond to the range of environmental and water-related challenges of the 21st century. In April 2004, the IJC adopted guiding principles aimed at broadening the partnership efforts of its international boards with other watershed entities for a more inclusive approach. The IJC refers to this effort as the International Watersheds Initiative. The various water management organizations in the Red River Basin appear receptive to the Initiative while at the same time recognizing the independent, impartial and objective role of the IJC and its boards in providing advice to governments. In June 2005, the IJC recommended that the governments of Canada and the United States confirm their support for the Initiative. The Red River basin is one of three pilot watersheds recommended by the IJC for implementation of the Initiative and for funding support.

In brief, the IRRB is responsible for assisting the IJC in avoiding and resolving transboundary disputes regarding the waters and aquatic ecosystems of the Red River and its tributaries and aquifers. This is accomplished through the application of best available science and knowledge of the aquatic ecosystems of the basin and an awareness of the needs, expectations and capabilities of residents of the basin. The geographic scope of the Board's mandate is the Red River basin, excluding the Assiniboine and Souris Rivers. The mandate presently includes the Poplar and Big Muddy River basins, previously the responsibility of the International Souris-Red Rivers Engineering Board. The Red River Basin is illustrated in Figure 1.

This report is the twelfth IRRB annual progress report to the IJC.

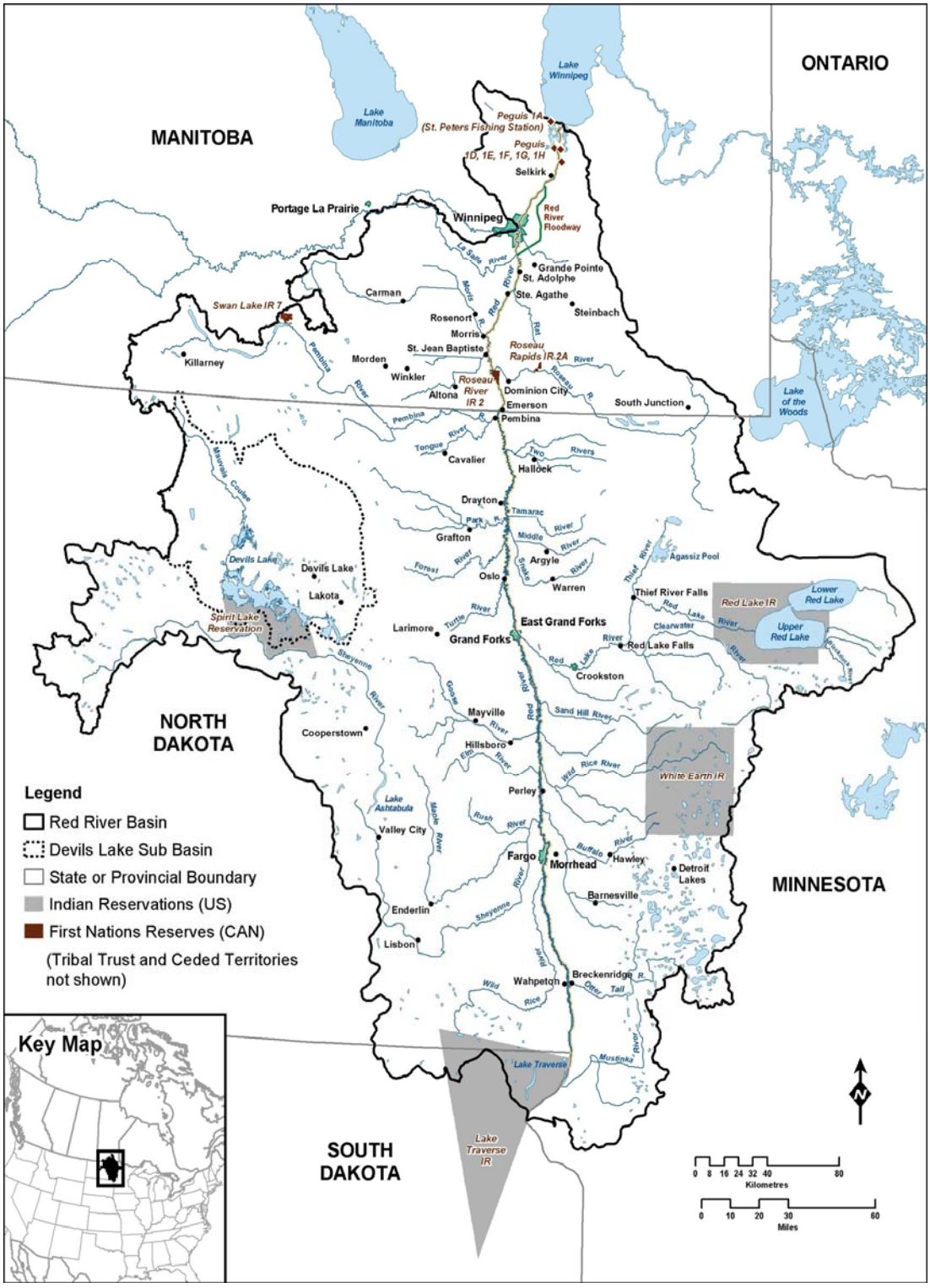

Figure 1 Red River and its Tributaries

3.0 INTERNATIONAL RED RIVER BOARD MEMBERSHIP

In its 1997 report *The IJC and the 21st Century*, the IJC proposed comprehensive international watershed boards as an improved mechanism for avoiding and resolving transboundary disputes. The intent was to broaden the scope of information upon which decisions relating to water and air are being made.

Through the continued integration of its water quality and water quantity responsibilities, and through efforts to increase stakeholder involvement, many of the goals of a comprehensive watersheds approach are being achieved by the International Red River Board. To facilitate these objectives, Board membership has been expanded to include non-government participation.

In 2010, Colonel Jonathan Christensen was replaced by Colonel Michael Price, U.S. Army Corps of Engineers, as U.S. Co-Chair. Kevin Cash, Environment Canada, has completed his term and is not seeking another term with the International Red River Board. Also, Scott Jutila has replaced Craig Evans from the U.S. Army Corps of Engineers as the U.S. Co-Secretary.

United States

Col. Michael Price – U.S. Chair
District Engineer, St. Paul District
U.S. Army Corps of Engineers

Will Haapala
Detroit Lakes Office
Minnesota Pollution Control Agency

Dennis Fewless
Director, Division of Water Quality
North Dakota Department of Health

Randy Gjestvang
Red River Water Resources Engineer
North Dakota State Water Commission

Dennis Breitzman
U.S. Bureau of Reclamation

Bert Garcia
Ecosystems Protection Program Director
Office of Ecosystems, Protection & Remediation
U.S. EPA Region 8

Daniel Wilkens
Administrator
Sand Hill River Watershed District, Minnesota
(Red River Basin Commission)

Gregg Wiche
Director, North Dakota
U.S. Geological Survey, Water Science Center

Robert Bezek
Regional Hydrologist
Minnesota Department of Natural Resources, Waters

Scott Jutila - U.S. Secretary
U.S. Army Corps of Engineers

Canada

Mike Renouf – Canadian Chair
Executive Director, Transboundary Waters Unit
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Dwight Williamson
ADM, Ecological Services Division
Manitoba Water Stewardship

Steven Topping
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Dr. L. Gordon Goldsborough
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Herm Martens
Red River Basin Commission

Vacant

Dr. Joseph O'Connor
Director, Fisheries Branch
Manitoba Water Stewardship

Dr. Susan Cosens
Manager, Environmental Science Division
Fisheries & Oceans Canada

Girma Sahlu - Canadian Secretary
Transboundary Waters Unit
Environment Canada

4.0 INTERNATIONAL RED RIVER BOARD ACTIVITIES

During the reporting period October 01, 2009 - September 30, 2010, the International Red River Board met with the IJC at the fall and spring semi-annual meetings at which Board priorities, activities and funding requirements were discussed. The Commissioners were apprised of basin developments and their potential transboundary implications.

4.01 Interim and Annual Board Meetings

The IRRB held its six bi-annual meeting January 20-21, 2011 to address select issues in the basin, and the seventh bi-annual meeting September 7- 8, 2011 for a more complete review of its responsibilities, activities, and accomplishments. The meetings addressed water quality monitoring and compliance with IJC objectives and established alert levels, and IRRB work plan priorities. The latter included actions to develop and implement water quantity apportionment procedures, prioritized flood mitigation plans, and biological monitoring and nutrient management strategies for the basin.

Except for half-day executive sessions during the January and September bi-annual meeting, both meetings were open to the public in a spirit of information sharing and collaboration. This was undertaken in recognition that there are many local, regional, state/provincial, federal and natural resource management entities operating in the basin with which connective links would be mutually beneficial. In addition to inviting presentations from interested groups, the public audience was invited to share its views.

4.02 IJC International Watersheds Initiative (IWI)

In 2004, the IJC adopted guiding principles aimed at broadening the partnership efforts of its international boards with other watershed entities for a more inclusive approach. The IJC refers to this effort as the 'International Watersheds Initiative'. The aim of the Initiative is to enhance the capabilities of existing IJC international boards while at the same time, strengthening cooperation among the various local entities. Building this capability includes[1]:

- employing a broader, systemic perspective of the watershed;
- expanding outreach and cooperation among organizations with local water-related interests and responsibilities;
- promoting the development of a common vision for the watershed;
- developing a better hydrologic understanding of the water-related resources; and
- creating the conditions for the resolution of specific watershed-related issues.

In 2010, the IJC funded a number of projects that were undertaken by the International Red River Board (IRRB) and its various committees. IRRB acknowledges and thanks the IJC for its continued financial support for initiatives carried out by the Board in the Red River Basin.

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1 *A Discussion Paper on the International Watersheds Initiative: Second Report to the governments of Canada and the United States under the Reference of November 19, 1998 with respect to International Watershed Boards, June 2005.*

There are many government, non-government, academic, private; and other entities with resource management responsibilities and interests in the Red River basin. Many have expressed support for a watershed approach. The present IRRB membership and Committee structures provide a linkage to key segments of this community with potential to expand the linkages as integrative approaches evolve.

In its June 2005 report to the governments of Canada and the United States[1], the IJC recommended that the governments confirm their support for the Initiative and that funds be made available commensurate with board work plans. The Red River watershed is one of three pilot watersheds recommended by the IJC for implementation of the Initiative and for funding support.

4.03 Improving the Information Base to Address Transboundary Issues

The IRRB monitors water quality at the international boundary; maintains awareness of development activities basin-wide; provides a forum for the identification and resolution of water-related transboundary issues; recommends strategies for water quality, water quantity, and ecosystem health objectives, and; monitors flood preparedness and mitigation activities.

To effectively address this mandate a focused effort through the application of best available science and knowledge of the hydrology and aquatic ecosystems of the basin is required. Hence, in 2001 the Board established two committees, a Committee on Hydrology (COH) and the Aquatic Ecosystem Committee (AEC) under which access to expertise could be consolidated with the capacity to undertake specific investigations and tasks. Specific activities assigned to the committees include establishing natural flow and water usage databases, evaluating current water quality monitoring and reporting protocols, developing biological monitoring strategies, and developing recommendations on an inter-jurisdictional drainage policy for the basin. These efforts are characterized by strengthened coordination with key water-oriented organizations in the watershed; and improved partnerships to develop a knowledge base and a shared understanding of water issues. Most frequently, the interests, objectives, and activities of the Committees intersect. Cross-membership also contributes to an integration of effort.

The Committee on Hydrology (COH) was re-established in 2006-2007 with a broader agency representation and new members.

4.03-1 Water Quality Monitoring at the International Boundary and Red River Basin

During the reporting period, Environment Canada continued to provide water quality monitoring at the international boundary, and provided reports on the status of compliance with established IJC water quality objectives. This was augmented with reports on the presence of pesticides, herbicides and other chemical constituents for which alert levels have been established (see reports summarized in Chapter 5).

IRRB Member agencies also reported on the status of water quality surveillance and water pollution control in their respective portions of the basin. The scope of this work and its significant contribution to the information base is described in Chapters 6 and 7.

4.03-2 Water Quality and Ecosystem Health

In 2003, the AEC prepared a conceptual framework to monitor the long-term aquatic ecosystem health of the watershed and an action plan outlining specific activities and resource requirements. The framework and action plan were endorsed by the Board and form the basis of the IRRB work plan. The overarching aquatic ecosystem health goal for the watershed, as articulated by the AEC, is to "assure that water resources of the Red River of the North basin support and maintain a balanced community of organisms with species composition, diversity and functional organization comparable to the natural habitats within the basin without regard to political boundaries".

Devils Lake Outlet Enhanced Monitoring

In early 2005, the North Dakota Devils Lake state outlet was completed and operation of the outlet was imminent. Operation of the outlet connects a closed basin in North Dakota, which is also part of the Hudson Bay drainage system, with the additional potential of transferring fish parasites and pathogens into the Hudson Bay watershed to the detriment of fish populations, especially to commercial and sport fish populations in the Red River and in Lake Winnipeg.

Given the transboundary implications of outlet operations and concerns to Manitoba and Canada regarding potential transfer of foreign organisms, multi-lateral negotiations were launched involving diplomatic levels, federal, state and provincial authorities, and the White House Council on Environmental Quality (CEQ). The negotiations resulted in the installation of a temporary gravel filter at the outlet to act as a barrier against the transfer of fish and some plants into the Red River system. The negotiations also resulted in a three-year sampling program to address issues related to the transfer of invasive species.

In summary, the objectives of the sampling program are to: determine the presence and prevalence of fish parasites and pathogens in resident fish from Devils Lake, the Sheyenne River, Red River, and Lake Winnipeg, and; to address the risks associated with transfer of such parasites and pathogens from the Devils Lake outlet to downstream aquatic ecosystems. A further objective is to use the comprehensive fish survey data to support the overall framework for biological monitoring in the Red River basin as identified in the IRRB work plan.

The three-year program comprising 7 sampling sites and 13 target fish species was initiated in September 2006. A report on the 2006 data collection was to provide the basis for any necessary refinement of the program for the following 2 years. Further, the results of the 3-year sampling program would be used to establish a focused long-term monitoring program for fish parasites and pathogens in the Red River basin, including select tributaries to the Red River and Lake Winnipeg.

The project plan assigns technical and financial responsibility to Canada for the collection and analysis of the biological data in the Canadian portion of the basin, and to the United States for like work carried out in the United States. Consistent methods, as confirmed in a workshop of experts in August 2006, are being applied to both streams of work. The project is being coordinated and managed by the Canadian and United States Co-Chairs of the AEC, with implementation and technical management of the project assigned to Fisheries & Oceans Canada and U.S. Fish & Wildlife Service. The project design allows for peer review of the interpretive reports. The three year sampling was completed in 2008.

The results from the 2006 -2008 Pathogen Survey of Devils Lake, the Red and Sheyenne Rivers indicate statistical confidence on six species from Devils Lake. There was no detection of viral agents, which was very significant. Some of the bacterial findings were not unusual for this type of aquatic environment; and

the results were repeatable from previous years. The initial sampling results were presented to governments via a conference call on March 10, 2009 (see also Section 1.02 of this report). For more information, please go to - http://www.ijc.org/conseil_board/red_river/en/irrb_home_accueil.htm, "*publications/other reports"*.

4.03-3 International Water Quality Objectives for Nutrients

In 2004, the AEC met to consider the Manitoba proposal to the IRRB that water quality objectives for nitrogen and phosphorus be established for the Red River at the international boundary. The Manitoba proposal reflects concerns about the continued eutrophication of Lake Winnipeg. One of the key AEC recommendations presented to the IRRB was the need for a joint effort on the part of the U.S. and Canada to protect and restore Lake Winnipeg's trophic status. Lake Winnipeg is the main ecological end point in the Red River system and an integrated analysis of the conditions in the watershed is required to identify the numerous factors that are contributing to the trophic status of the lake.

In 2008, the AEC recommended that the development of objectives for nutrients at the international boundary be delayed until Manitoba identified the target trophic status for Lake Winnipeg and numerical nutrient objectives for Lake Winnipeg.

In January 2010, the AEC met to further discuss options for setting water quality objectives. Three possible approaches were presented and discussed, including:

1. long term flow-weighted trends at the international boundary based on historical data,
2. exceedances of not more than some percentage of flow weighted samples taken at the international boundary, and
3. Lake Winnipeg objectives for nutrients as proposed by Manitoba.

After some discussion, AEC members agreed that the third option was the preferred one. Although it is likely to be politically challenging, setting objectives for Lake Winnipeg would be ecologically relevant. If Manitoba were to withdraw its request for nutrient objectives to be set for the international boundary, objectives instead would be set for Lake Winnipeg. Member agencies would continue monitoring and report on progress to reduce nutrients entering the Red River and associated tributaries. All agencies are equalized under this approach. Nutrient levels in Lake Winnipeg would be checked and progress monitored. Once we know what is going into Lake, agencies can set reduction targets throughout the drainage basin. Most of those data are now available.

Several ongoing research projects must be completed before Manitoba can set nutrient objectives for Lake Winnipeg. These include a paleolimnological assessment of historic nutrient levels, modeling of the relationships between nutrients and algae and modeling of the relationship between nutrients and food web characteristics. In addition, there are policy decisions to be made with regard to using historic nutrient levels as the goal.

Nine principles, outlined in the 2010 annual report, guide the development of ecologically based nutrient objectives for Lake Winnipeg.
The committee identified key items that need to be done or could be started to move the process forward.

1. Decide how trophic status will be measured. Complete paleolimnology and water quality modeling, catch rates from fishery and other science activities that are ongoing to define historical, present and future conditions. Main pieces should be completed by 2012. Nutrient objectives for Lake Winnipeg will be then set using the nine principles,
2. Ecosystem modeling exercises. Results would indicate what reductions in loading are needed to meet the nutrient objective,

3. Mass balances for nutrients entering the system and tributary estimates need to be updated regularly. This information will be available once models are completed. Update other sources. Need more information on atmospheric deposition (wet and dry),
4. Develop allocations for all nutrient sources. Principle 10 applies to this activity. This is already ongoing in Minnesota, some in North Dakota and also in Manitoba. Tributary loads are being estimated. SWAT modeling (soil and water assessment tool) is also being done in some areas,
5. These activities would be similar to those in Box 4 but scaled down from the watershed level to a specific point on a river,
6. Recommend nutrient objective at the international boundary to the IRRB. Member agencies should formally report, at the annual meeting, on what they have done to reduce nutrient loading in the Red River Basin,
7. Jurisdictional decisions regarding nutrient objectives are made. These decisions are up to agencies within those jurisdictions. Similar decisions would be made in Manitoba, and
8. Monitor, evaluate, review and refine. Once we define how monitoring is going to be done, the results would be reviewed and used to refine nutrient objectives.

In 2011, Four-Party discussions between the federal governments of the United States and Canada, the State government of North Dakota, and the Provincial government of Manitoba produced an agreement that, with the engagement of Minnesota and South Dakota, the parties would develop a basin-wide plan for the management of nutrients within the shared international Red River watershed. In conjunction with the January IRRB meeting, Manitoba participants organized a session to discuss a draft approach to developing a Basin-Wide Nutrient Management Strategy. Jurisdictions indicated that they are identifying nutrient sources and introducing management approaches.

4.03-4 Water Quantity Apportionment

As indicated by the historic streamflow records, water supply in the Red River basin is highly variable seasonally, annually, and over longer time periods. Recent forecasts of water demand based on population and economic growth projections further test the adequacy and reliability of these supplies. Scientific opinion with respect to climate change provides added caution regarding future hydrologic trends and the prospect of greater instability in water supply in the region.

The factors noted above and projected increases in water use causing larger departures from the natural regime to occur, prompt action to set flow targets at the international boundary. The IRRB considers it prudent to consider establishment of such targets before they are needed. In July 2006, the Committee on Hydrology (COH) was asked to prepare a detailed proposal to establish the 'process' for undertaking development and implementation of apportionment procedures. The proposal is to identify the project elements, participating agencies, related capacity issues, and timelines.

The COH presented a proposed framework on the development and implementation of flow apportionment on the Red River at the January 2008 meeting. The Committee noted the establishment of a process for the development and implementation of water quantity apportionment requires an understanding of the natural flow regime on the Red River. Any acceptance of an apportionment procedure will require agreement on the method of computing the natural flow in the Red River basin and understanding water uses in the Basin. The proposed framework plan developed is multi-year and will require involvement of many partners.

As part of the work on the development and implementation of a flow apportionment procedure for the Red River, the COH developed and submitted two IWI proposals to the IJC. The first proposal funded Dr. Rob de Loe, University of Guelph, to review apportionment governance procedures relevant to the Red River basin, and to recommend an appropriate model. Dr. de Loe's completed report titled, "Sharing

the Waters of the Red River Basin: A Review of options for Transboundary Water Governance" was approved by the IRRB at the September 2009 meeting.

The study was based on an extensive review of two main sources of information: (1) documents and reports relating to water management in the Red River Basin, and (2) the literature of transboundary water management. Two overseas and two International Canada/US case studies were analyzed in detail, with the goal of revealing insights into real-world problems and solutions of transboundary water governance. The overseas case studies were the Orange-Senqu River Basin in southern Africa and the Murray-Darling Basin, in Australia, The two Canada/US case studies were the St. Mary-Milk Rivers and the Souris River basins

The study recommends an apportionment model and approach to transboundary water governance in the Red River basin that includes the following major elements:

1. A prior appropriation to meet critical human and environmental needs.
2. Rules to apportion remaining natural flows between Canada and the United States based on the principle of equitable sharing.
3. Rules regarding waters that originate in the respective countries' portion of the basin but do not cross the boundary. This model represents a balanced approach that takes account of local circumstances (e.g., the role of the *Boundary Waters Treaty of 1909*, existing management relationships, climatic conditions and the nature of water uses).

The second IJC funded report, by R. Halliday & Associates; entitled "Determination of Natural Flow for Apportionment of the Red River" was completed, and dated May 30, 2010. This report established a process for the development and implementation of water quantity apportionment procedures. Various apportionment methodologies in the context of the Red River basin to assess natural flows were investigated and the Project Depletion Method is recommended. The report reviews the actual natural flow calculation and provides information on how the calculation can be accomplished. Gaps and concerns were discussed, particularly: hydrometric and meteorological networks, water allocation, water use, and instream flows. More detailed discussion on natural flow determination dealt with evaporation, minor projects, channel losses and travel times. Apportionment was addressed with regards to location(s), period, make-up water and dispute resolution.

There is also a need for in-stream flow needs (IFN) studies to make recommendations for apportionment. IFN is a multi-disciplinary issue involving biology, geomorphology, connectivity, water quality, and hydrology. The Board's Aquatic Ecosystem Committee and its Committee on Hydrology are working together to address IFN questions as part of the Board's ongoing water quantity apportionment efforts. A joint proposal for IWI funding to hire a contractor to collect available bathometric and hydrographic information for the Red River along with the following has been developed:

- Identification of representative fish species and life stages for the Red River,
- Data on distribution, habitat use and habitat availability of these representative fish species and life stages in the reference sites where bathymetric and flow data were recorded,
- Determination of biologically significant periods,
- Temperature preferences for the different fish species, and
- Any available reports on validating Habitat Suitability.
-

In January 2011, IRRB approved the joint IFN proposal and has submitted it the IJC for IWI funding in the new fiscal year starting April 1, 2011.

4.04 Invasive Species – Zebra Mussels

Zebra mussels, a nonnative invasive species, were discovered in the Red River basin for the first time in September 2009. The mussels were found in Pelican Lake in Otter Tail County, Minnesota, which is on the Otter Tail River. Native to Eastern Europe and Western Russia, zebra mussels were first discovered in the Great Lakes in 1988. They entered the Upper Mississippi River system from Lake Michigan via the Illinois River (Chicago Sanitary and Shipping Canal) and spread upriver into Minnesota and Wisconsin via recreation and commercial boat traffic. Heavy infestations can kill native mussels, impact fish populations, interfere with recreation, and increase costs for industry, including power and water supply facilities.

Zebra mussels are adapted to lentic (lakes/reservoir) habitat. They can survive in riverine habitat, but they require an upstream source of healthy zebra mussel populations to continually supply free floating larvae – typically from an upstream reservoir or lake. Zebra mussels are typically spread overland from infected lakes via transient recreational boat traffic and transfers of boat docks or lifts. It is probable that there is an established and reproducing population in Pelican Lake, as evidenced by small and large individuals observed. Based on previous experience on the Upper Mississippi River, it is likely that zebra mussels will colonize the reservoir immediately downstream (Orwell Reservoir) and larvae likely will drift down the Otter Tail River to the Red River. However, the higher energy and flashy nature of the Red River does not provide ideal zebra mussel habitat. Eventual Zebra mussel infestation of the Red River is possible, but surviving population levels are likely to be minimal.

The confluence of the Red River and the Otter Tail River is approximately 550 river miles from Lake Winnipeg. U.S. Army Corps of Engineers experience on the Upper Mississippi River indicates that larval drift ranges from approximately 75 to 125 miles before juveniles settle and attach to hard surfaces. It is highly unlikely that larval juveniles will drift from the Otter Tail to Lake Winnipeg. Infestation of Lake Winnipeg via the Red River would require the establishment of a viable population within closer proximity (a lake or a reservoir which is non-existent at this time). Over land transport by humans from infested waters appears to be a more likely vector for zebra mussels to become established in Lake Winnipeg.

There is little that can be done to address an existing infestation of zebra mussels. Natural resource agencies in the U.S. and Canada are focused on public awareness and education aimed at preventing transportation of mussels on boats, trailers, and docks. Actions include increased signage at infested lakes, watercraft inspections, and monitoring.

Because of the potential transfer of Zebra mussels and other species of concern downstream into the Red River system, IRRB has agreed to keep the topic of Invasive Species as a standing item on its Board agenda for future discussions.

4.05 Comprehensive Flood Mitigation Strategy

In its report *Living with the Red,* the IJC noted that there is no single solution to reduce, mitigate and prevent harm from future flooding, and that comprehensive, integrated, binational approaches must be pursued and implemented. The report follows with a list of recommendations to include, ” Governments immediately take steps, on a binational basis, to begin development of a comprehensive flood damage reduction plan for the Red River basin”.

In 2003, at the request of the IJC, the IRRB completed a basin-wide survey and analysis of actions taken by governments at all levels in implementing the recommendations contained in *Living with the Red*. The final survey report titled *Flood Preparedness and Mitigation in the Red River Basin - October 2003*,

indicated that while considerable progress had been made in increasing preparedness for major floods and in mitigating potential harm from future floods, there was a need for continued and concerted effort to address those IJC recommendations entailing multiple objectives and inter-jurisdictional cooperation. Further to this report, the IRRB indicated that a comprehensive flood mitigation plan as proposed by the IJC in January 2003 would provide an appropriate mechanism to mobilize the multi-jurisdictional co-operation necessary to assure cohesion on flood management and long-term resiliency in the basin.

In 2005 the document titled *Comprehensive Flood Mitigation Plan* (CFMP) was prepared by the IJC in consultation with the Red River Basin Commission (RRBC) and the IRRB, and advice regarding preferred options for advancing the document to the political level was sought from senior officials in the three jurisdictions (North Dakota, Minnesota, and Manitoba). The proposed CFMP is intended to build on the Memorandum of Understanding for Flood and Drought Mitigation on the Red River that was signed by the governors of North Dakota, Minnesota and South Dakota and the Premier of Manitoba in April 2004. Further, the Plan recognizes current efforts led by the RRBC to develop a Natural Resources Framework Plan (NRFP). The CFMP would contribute to and become an integral part of the NRFP.

Support for the CFMP was discussed further at the IRRB annual meeting in July 2006. It was concluded that while members do not all have the same interpretation of the priorities for flood mitigation in the basin or on follow-up approach, the components under a CFMP, or Flood Mitigation Strategy as the suggested name-change, need to be determined. Integral to this task is a [current] documentation of the accomplishments and the positive benefits that have accrued to the basin and communities. The latter represents an important communications document reflecting the actions and achievement of many agencies, including the IJC and IRRB. This undertaking would also provide insight into how the IRRB and others might support or influence continued preparedness and mitigation activities in the basin.

As agreed at the 2006 annual meeting, the IRRB Co-Chairs prepared a Terms-of-Reference for the Committee on Hydrology Committee (COH) to develop a detailed project proposal that outlines the scope of work required to document the flood mitigation accomplishments to date and to identify the remaining mitigation priorities for the basin. The individual and collective capacity of participating agencies, and options to engage Committee members, IRRB members, and/or independent consultants, to complete the task is to be explored.

The IRRB Co-Chairs reviewed the March 2007 letter they had sent to the COH regarding the IRRB's role in identifying priority flood mitigation activities for the basin. In their letter, the Co-Chairs asked the COH to continue providing a current inventory of improvements and deficiencies based on agency knowledge. The same letter was also discussed with the IJC Commissioners at the April 2007 meeting. Based on the discussion, the Commissioners clarified their position on the Comprehensive Flood Mitigation Strategy (CFMS), previously known as the Comprehensive Flood Mitigation Plan (CFMP), and it was agreed that the IRRB should continue with the development of the CFMS as per the terms of reference provided to the COH. The Co-Chairs have indicated that based on the discussion with the IJC, they would amend their direction to the COH.

Since the 1997 Red River Flood there has been a legacy of accomplishments in the areas of cooperation between jurisdictions, improvements in predictive tools, public involvement and changes in legislation and development of data dissemination tools. However, there are still challenges in improving the predictive tools, maintaining and improving databases, data collection and data dissemination, maintaining flood protection infrastructure and continued review of flood protection policy and legislation.

Based on these accomplishments and challenges the Board felt it was time to update the IJC report "Living with the Red". The COH was instructed to develop a project proposal under the IWI initiative for

the publication of a document entitled “How Are We Living with The Red?”. In 2008, the IJC approved funding for this project and the COH contracted Halliday & Associates to assess flood preparedness, mitigation and to identify gaps and tasks yet to be undertaken. The intent of the document is to inform the public of accomplishments and challenges regarding flood mitigation in the basin and to supplement IRRB information available via the IJC International Red River web page. The completed project was presented to the Board at its meeting on September 16, 2009 in Gimli, Manitoba.

The study found much has been accomplished, yet some unresolved issues remain.. While the communities of the Red River basin are unquestionably more flood resilient than in 1997, it will still take considerable effort to achieve the level of integration and cohesion on flood management that the IJC envisaged. Adoption of binational measures, however, will still be needed before the long-term resiliency of the basin can be assured. Some of the key achievements can be summarized under headings of policy, legislation and institutions; preparedness; mitigation; and environment as follows:

Policies, Legislation and Institutions

- Improvements in policy and legislation have been made in all jurisdictions.
- In 2008 Canada introduced its first national mitigation strategy. That strategy includes a number of priority actions, including an avenue for federal contributions to mitigation measures.
- Changes in data policies by the Canadian federal government and by the Manitoba government have led to much improved access to data.
- Manitoba has introduced a new designated flood area regulation. The associated elevation and inspection requirements for new structures will reduce future flood damages.
- Activities of the United States Army Corps of Engineers are aimed at a more integrated basin-wide consideration of mitigation projects.
- Both North Dakota and Minnesota have implemented new state building codes that include flood-proofing measures.
- Key institutional developments include the formation of the IJC's International Red River Basin Board, the Red River Basin Commission and the International Water Institute.

Preparedness

- All communities in the basin now have up-to date emergency response plans.
- Significant improvements have been made to flood forecasting in both Canada and the United States.

Mitigation

- Many structural measures aimed at protecting both rural and urban floodplain residents have been completed or are at advanced stages of development.
- Major levees such as those for Grand Forks and East Grand Forks are essentially complete.
- The increased capacity of the Red River Floodway at Winnipeg is now available although the project will not be complete until 2011.
- Flood protection measures for many other communities, large and small, are in place and thousands of rural residences have been moved, raised or diked.
- Several agencies are collaborating with the Red River Basin Commission and the International Water Institute on the development of complex hydraulic models for the basin.

Environment

- Measures have been introduced to avoid contamination of wells and to remove hazardous chemicals from the floodplain, or improve the storage facilities for chemicals.
- Programs are underway aimed at establishing riparian conservation reserves and developing a greenway on the Red River.

There are some causes for concern nonetheless. The less successful recommendations are those that involve multiple agencies and, perhaps, multiple objectives. These sorts of tasks could be deemed to be more difficult and could naturally be expected to take longer. It may be that public expectations for structural measures supercede all other post-flood pressures and that those expectations need to be met before proceeding with "softer" projects. As well, some structural measures in the upper basin have been delayed by other priorities and because of permitting issues.

4.06 Lower Pembina River Flooding

In 2003, the Pembina River Basin Advisory Board (PRBAB) formally requested the assistance of the IRRB to resolve the long-standing flooding/drainage issue along the lower Pembina River and the international boundary. Since then, the IRRB has taken several actions to facilitate discussion and develop a better understanding of the problems and opportunities in the Lower Pembina River basin.

The IRRB, at its January 2008 meeting, established the Lower Pembina River Flooding Task Team (LPRFTT). The mandate of this Task Team is to develop a science-based solution(s) to mitigate flooding in the lower Pembina River basin (Figure 2).

The LPRFTT is currently overseeing an International Watersheds Initiatives (IWI) study entitled "Refinement of the 2-Dimensional Model of the Lower Pembina River Flood Plains", a Phase 3 study being undertaken by the National Research Council's (NRC) Canadian Hydraulics Center. The two previous phases were also conducted by the Canadian Hydraulics Center with IWI funding.
Early in 2010, the USACE conducted the survey of Switzer Ridge area, which received significant erosion during the spring of 2009. The first report (Phase 1) was completed during July 2009; model details including model description, how it was applied to the Lower Pembina River flood plains, calibration, verification, etc. were presented at the IRRB September 2009 meeting by the NRC modeler, Thierry Faure; and the report was later approved by the IRRB at its January 2010 meeting and was to be forwarded to the IJC. Reviewers of the first phase thought that the model fairly accurately replicated what flooding occurred during the spring of 2006.

The second study (Phase 2) was completed during June 2010, expanded the model domain geographically and included more infrastructure, such as more roads and culverts. This was accomplished by provision of additional agency infrastructure data and by additional LiDAR information to the NRC. Based on consultations with a number of stakeholders, simulation scenarios such as removal of both County Road 55 and the border road dyke, and flattening of all roads; along with various flood mitigation scenarios including set-back dykes, various floodway alignments and various diversion alternatives, were simulated using the 2006 flood event. Stakeholders consulted included the Pembina River Basin Advisory Board, the Pembina County Water Resource District, the Red River Basin Commission, and the IRRB. Results of the study were presented to the IRRB September 2010 meeting by the LPRFTT. Modeled results were also presented to the Pembina River Basin Advisory Board and Pembina County Water Resource District and at the January 2011 Annual Red River Basin & Water International Summit Conference and at the June 2011 Canadian Water Resources Annual Conference.

The third phase of the study, "Refinement of the 2-Dimensional Model of the Lower Pembina River Flood Plains" refines the model along various rivers and coulees so that better representation of the flood extent along their courses can be simulated. The enhanced model will also be improved in terms of roads, bridges, and culverts, with the downstream boundary moved to Morris, Manitoba, to properly assess the confluence of Buffalo Creek with the Red River. Also included in this phase is a hydrologic study of the region, so that local runoff can be considered during the flood simulations. The model will assess USACE developed hydrographs at Walhalla along with local hydrographs for specific return periods. The report is scheduled for completion during September 2011.

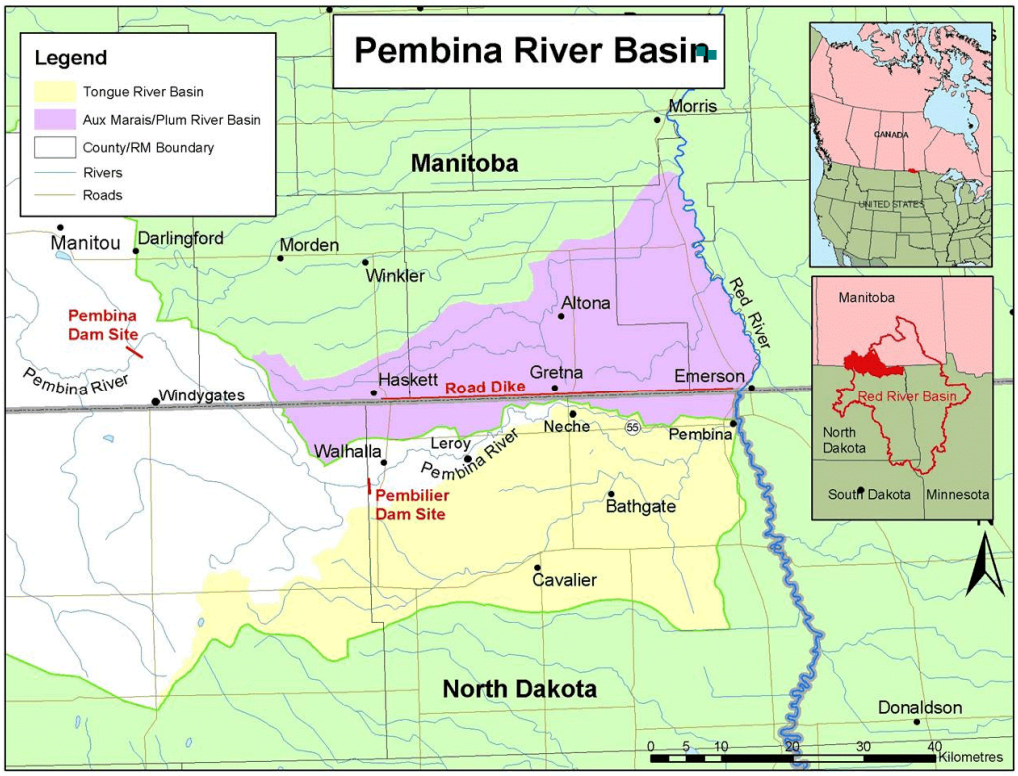

Figure 2 Pembina River Basin. The yellow and white areas comprise the Pembina River Basin.

4.07 Poplar River Basin

The Poplar River forms an international river basin shared by Saskatchewan and Montana. Although not geographically located within the Red River basin, the mandate of the IRRB includes the Poplar River, previously the responsibility of the International Souris-Red Rivers Engineering Board (ISRREB). This responsibility originates with the 1975 IJC instructions to the ISRREB to investigate equitable apportionment alternatives on the East Poplar River in consideration of the thermal power station and cooling reservoir that were being constructed by the Saskatchewan Power Corporation near Coronach, Saskatchewan. In 1976, the ISRREB recommended an apportionment formula to the IJC for the East Poplar River. Subsequently, in 1978, the IJC recommended an apportionment formula to the governments of Canada and the United States.

Environment Canada and the United States Geological Survey (USGS) have been collecting monthly water quality samples for nutrients, major ions and metals since July 1975. However, in 1977, the governments of Canada and the United States referred the issue of water quality to the IJC. The IJC Water Quality Task Force completed its report in 1981, which provided the basis for establishing flow-weighted objectives for numerous water quality parameters, including total dissolved solids (TDS) and boron. The International Air Pollution Advisory Board provided advice to the IJC regarding air pollution potential from the generating station. The Coronach Power Station began operation in 1981. Although Canada and Saskatchewan have not accepted the IJC apportionment formula and water quality objectives, both the formula and objectives have been followed by Saskatchewan throughout the intervening years.

Bilateral Monitoring Committee

The Poplar River Bilateral Monitoring Committee was established in 1980, and is composed of government representatives from Canada and the United States, Montana, and Saskatchewan, as well as one public ex-officio member from Canada and one from the United States. The Committee's main responsibility is to oversee monitoring programs designed to evaluate the potential for transboundary impacts from the generating station and its operations. The Committee's current mandate expires in 2012.

Under the Committee's purview, surface and ground water quality and quantity data, and air quality data are collected at or near the international boundary. These monitoring programs initially included a quarterly data exchange and an annual data review and report. In September 1991, the Committee agreed that the data exchange was no longer required and that an annual data review and report would suffice.

Compliance with Apportionment and Water Quality Objectives

The water quality report for boron and TDS for 2010 was derived from the daily specific conductance data collected on the East Poplar River at the international boundary. No exceedences of the water quality objectives were observed for the 2010 monitoring year.

Based on IJC recommendations, the United States was entitled to an on-demand release of 617 dam^3 (500 acre-feet) from Cookson Reservoir in 2010. A volume of 599 dam^3 (486 acre-feet) was delivered between May 1 and May 31, 2010. Further, in 2010, daily flows met or exceeded the minimum recommended by the IJC for most of the year except for January 1-12 when daily flows were below the recommended minimum due to ice conditions in the channel.

5.0 WATER QUALITY AT THE INTERNATIONAL BOUNDARY

The water quality of the Red River at the international boundary, as reported herein, is based on continuous monitoring and instantaneous grab samples obtained during the 2009 water year (October 1, 2009 - September 30, 2010). The collected data, carefully scrutinized, are used to determine compliance with established IJC water quality objectives at the international boundary and in meeting the provisions of the Boundary Waters Treaty of 1909. Detection of exceedences of the objectives serves as a trigger mechanism for agencies to take appropriate action to prevent or to mitigate potential problems, and to minimize the potential for reoccurrence. Environment Canada carries the responsibility for providing this monitoring service for the IRRB and maintains a permanent water quality and water quantity data collection site at Emerson, Manitoba.

The five parameters for which the IJC has approved objectives are discussed below along with streamflow and *pH* characteristics for a corresponding time period.

Water quality characteristics at other locations throughout the basin are referenced in subsequent chapters of this report to provide a more complete spatial representation of water quality and aquatic ecosystem conditions in the Red River basin.

***pH* and Temperature**

During the reporting period, the observed pH and temperature values for the Red River remained within the normal range.

5.01 Water Quality Objectives

As described in Appendix B, the IJC established objectives for a limited number of water quality variables for the Red River at the international boundary. These variables are dissolved oxygen, total dissolved solids, chloride, sulphate, and fecal coliform bacteria. The IRRB is responsible for monitoring and reporting on compliance with these objectives.

Dissolved Oxygen

Dissolved oxygen generally remained well above the objective level of 5.0 mg/L.

Total Dissolved Solids and Specific Conductance

Some exceedences of the International Joint Commission (IJC) water quality objectives, and concentrations approaching the objective level for total dissolved solids (TDS) were observed at the international boundary during the 2009 water year. The TDS objective of 500 mg/L was exceeded several times in the 2009 water year. The highest observed value of 778 mg/L was recorded in December 2009.

Chloride

The chloride objective (100 mg/L) was not exceeded during the reporting period. Other monthly values ranged from a high of 41 mg/L in December 2009 to a low of 1.5 mg/L in March 2010.

Sulphate

The sulphate objective (250 mg/L) was exceeded on four occasions during the water year – twice in November 2009, once in December 2009, and once in May 2010. Other monthly values ranged from a low of 55 mg/L in March 2010 to a high of 306 mg/L in December 2009.

Bacteriological Characteristics

The bacteriological characteristics of the Red River are assessed on the basis of observed fecal coliform bacteria for which an IJC objective (200 colonies per 100 ml) has been defined. During the 2009 water year, the fecal coliform bacteria objective of 200 colonies/100 ml was exceeded once on November 1, 2010. The newly established *Escherichia coli* objective of 200 colonies per 100 ml was also exceeded in November. The reason(s) for this sudden exceedance is being investigated by the North Dakota Department of Health.

New *Escherichia coli* Objective - In December 2009, the IRRB requested approval from the IJC to switch its bacterial indicator from fecal coliform to *Escherichia coli* to be consistent with other participating agencies. Subsequently, the IJC recommended to the Governments of Canada and United States endorsing the Board's request. In a letter sent to the IJC in July 2010, Canada and the United States supported the recommendation from the IJC and have agreed to amend the objective. The new *Escherichia coli* objective was effective starting October 1, 2010 (beginning of new water-year).

Although some exceedences of the IJC water quality objectives, and concentrations approaching the objective level for some parameters were observed during the reporting period, no intervention or action by the IRRB or participating agencies was required.

5.02 Alert Levels

Fifteen of the suite of pesticides, herbicides and metals for which alert levels were established by the former International Red River Pollution Board (Table 1) were detected during the reporting period. Based on a total of 12 water samples, 12 pesticides and/or herbicides with a total aggregate of 119 exceedences (greater than detection concentration) were recorded during the October 1, 2009 - September 30, 2010 reporting period. The number of exceedences may be higher because some of the later samples are still missing pesticide/herbicide data. The detection levels were below the Canadian Aquatic Guidelines. Given that the Red River basin is an agriculturally dominated region, the presence of pesticides and herbicides is expected.

The IRRB recognizes that there is very little scientific information available to assess the implications of long-term exposure to low concentrations of pesticides and herbicides by aquatic organisms and humans. The IRRB continues to closely monitor trends in these concentrations and their frequency of detection with the view to updating its assessment as new scientific information becomes available.

Table 1. Exceedences of Alert Levels, Red River at International Boundary
October 1, 2009 to September 30, 2010

Parameter	Units	Alert Level	Number of Exceedences	Exceedence Values		Canadian Aquatic Life Guidelines
				Min	Max	
pH		6-9	0			6-9
Chloride	mg/L	100	0			NG
TDS	mg/L	500	15	500.2	778.2	NG
Cadmium	ug/L	Detect	12	0.019	0.242	0.017ug/l
Manganese Total	ug/L	50	12	51.9	515	NG
Iron Total	ug/L	300	10	453	6800	300 ug/l
2,4-D	ng/L	Detect	9	17.5	89.8	4000 ng/l
Bromoxynil	ng/L	Detect	1	33.4	33.4	5000 ng/l
Clopyralid	ng/L	Detect	9	5.77	69	NG
Dicamba	ng/L	Detect	7	2.22	14.9	10000 ng/l
Imazamethabenz-methyl a	ng/L	Detect	0			NG
Imazamethabenz-methyl b	ng/L	Detect	0			NG
MCPA	ng/L	Detect	9	1.59	119	2600 ng/l
Mecoprop	ng/L	Detect	8	1.3	7.94	NG
Picloram	ng/L	Detect	2	25.5	41.8	29000 ng/l
Aldrin	ng/L	Detect	0			NG
g-Benzenehexachloride	ng/L	Detect	0			NG
Pentachloroanisole	ng/L	Detect	2	0.49	0.56	NG
Atrazine	ng/L	Detect	9	15.2	61.2	1800 ng/l
Desethyl Atrazine	ng/L	Detect	7	12.9	31.9	NG
Metolachlor	ng/L	Detect	9	2.2	70.1	7800 ng/l
P,P-DDE	ng/L	Detect	0			NG
Alpha-Endosulfan	ng/L	Detect	0			20 ng/l
Beta-Endosulfan	ng/L	Detect	0			20 ng/l
Heptachlor Epoxide	ng/L	Detect	0			10 ng/l
Metribuzin	ng/L	Detect	0			NG
Total PCB	ng/L	Detect	0			NG

*DL = Detection Level NG = No Guideline Established

6.0 WATER QUALITY SURVEILLANCE PROGRAMS

As described in Chapter 5, data collected at Emerson, Manitoba, are used to determine compliance with established IJC water quality objectives at the international boundary. Chapter 6 contains basin-wide data and information contributed by IRRB member agencies to provide a more complete spatial representation of water quality and aquatic ecosystem health conditions in the Red River basin.

U.S. Water Quality Standards Program

In the United States, the statutory basis for the current Water Quality Standards (WQS) program is the Clean Water Act. Under Section 303 of this Act, the Environmental Protection Agency (EPA) issued a Water Quality Standards Regulation (40 CFR Part 131). This regulation specifies the requirements and procedures for developing, reviewing, revising, and approving WQS by the States and Tribal Nations. EPA has approved WQS programs for the States of North Dakota, South Dakota, and Minnesota. No tribal programs in the Red River basin have yet been approved.

WQS define the water quality goals for a water body or portion thereof, by designating the use or uses to be made of the water, and implementation criteria for protecting each of those uses or areas. Additionally, a WQS program must include an anti-degradation policy to protect water quality that is already better than State standards. Designated uses for water bodies may include:

- Aquatic life - protection of fish and other aquatic organisms;
- Recreation - swimming, wading, boating, and incidental contact;
- Drinking water - protection for downstream public water supply intakes;
- Miscellaneous - industrial or agricultural uses, tribal religious use, etc.

Water quality standards are designed to protect the beneficial uses associated with the standards. Based on the assessment of the water quality data and other relevant information compared to the standards for a given pollutant or water quality characteristic, the use may be:

- Fully supported
- Partially supported
- Threatened
- Not supported

6.01 Minnesota

Water Quality Surveillance

In order to effectively sample streams throughout Minnesota, the Minnesota Pollution Control Agency (MPCA) has implemented an Intensive Watershed Monitoring Approach planning to assess and manage the aquatic health of the entire major watershed through intensive biological and water chemistry sampling and supporting assessment and action.

The Intensive Watershed Monitoring Strategy determines watershed condition through intensive monitoring of the state's major watersheds, known as 8HUCs, using a classification scheme developed by U.S. Geological Survey.

Intensive Watershed Monitoring utilizes a 'pour point' method of sampling which measures the

condition of the upstream watershed in an unbiased way. The intensive approach allows assessment of the watershed for aquatic life, aquatic recreation, and aquatic consumption use support of the state's streams in each of the state's 84 major watersheds on a rotating 10 year cycle. These uses are assessed to make sure that the goals of the Clean Water Act of "fishable, swimmable" waters are being met.

Biological Sampling

The majority of the sites in the watershed design are termed biological (signified by red dots). A single water chemistry sample is taken at each of these sites during the sampling season. Fish are sampled through electro-shocking, and invertebrates are sampled with dip nets. Sites are placed at the nearest road crossing to the end of each minor watershed throughout the larger watershed to be able to assess the watershed for biology. Sampling does not take place in a minor watershed if a lake, wetland, or larger stream is within one mile of the planned site location.

Water Chemistry Sampling

At the mouth of each minor watershed, a water chemistry site is placed (signified by green dots). These sites are sampled for biology, along with additional water chemistry parameters. Sites are sampled ten times throughout the summer, and depending on the watershed, may be sampled for nitrates-nitrites, ammonia, dissolved oxygen, pH, conductivity, temperature, total phosphorus, Kjeldahl nitrogen, chlorides, sulfates, calcium, magnesium, total suspended solids, total volatile solids, E. coli, chlorophyll-a, pheophytin, and transparency data. E. coli data makes it possible to assess the stream for aquatic recreation, and dissolved oxygen, transparency, and suspended solids data makes it possible to assess the stream for aquatic life.

Fish Contaminants Sampling

At the pour point of each of the major watersheds, fish are collected for the analysis of contaminants (mercury and PCBs) to assess whether or not the surface water is meeting the beneficial use of aquatic consumption. Additional stream reaches within the watershed may also be sampled and analyzed, such as collecting trout for mercury testing in coldwater reaches. Mercury and PCB analysis will be conducted on fish tissue. Top carnivore species are particularly important for mercury analysis while rough fish species are important for PCB analysis. Species preferences for top carnivores are: walleye, northern pike, smallmouth bass, channel catfish, and bluegill. Species preferences for rough fish are: common carp, redhorse sucker, and white sucker. It is important to collect an appropriate age/length range of these individuals, preferably of edible size. In general as the age/length increases so do the concentrations of these contaminants. An adequate distribution of size classes is critical to characterize or assess the contamination level of these parameters.

Watersheds Monitored

Monitoring has been completed in the Upper Red, Buffalo and Lower Red major watersheds. Assessment was in progress in Water year 2010.

Watershed monitoring has been initiated in the Thief River, Sandhill and Mustinka Watersheds.

Partners

MPCA continues to partner with the Minnesota Department of Agriculture (MDA) for monitoring of agricultural chemicals in the Red River Basin. MDA monitors ground water and surface water for detection of agricultural chemicals.

Acetochlor, atrazine and metolachlor were detected at one groundwater monitoring station in the Red River Basin. However, the amount detected did not exceed human health standards, values or limits.

Six surface water sites are monitored for agricultural chemicals in the Red River Basin. Three Tier One sites are located at the confluences of the Red River of the North and the Sandhill, Grand Marais and Tamarac Rivers. Acetochlor, atrazine and metolachlor were not detected at greater than aquatic life standards. Sites at the confluence of the Red and the Snake and Bois de Sioux Rivers were also sampled, and acetochlor, atrazine and metolachlor were not detected at greater than aquatic life standards.

The Buffalo River became a Tier Three site in 2009, after chlropryifos had been detected at low levels over several years. Chlropryifos was not detected at the Buffalo River site in 2010, but was detected at levels above aquatic life standards at two other Red River of the North sites.
In Water Year 2010, the two agencies entered into an agreement to house all water quality data in a single data base, maintained by MPCA.

6.02 North Dakota

Ambient Water Quality Monitoring Program

During the reporting period October 1, 2009 to September 30, 2010, the North Dakota Department of Health (department) conducted or contracted with the USGS for ambient chemical monitoring at 18 sites in the Red River basin (Table 2).

Table 2. North Dakota Department of Health Ambient Water Quality Monitoring Sites in the Red River Basin.

Station Number	Station Description
385055	Bois de Sioux near Doran, MN[1,5]
380083	Red River at Brushville, MN[4]
380031	Wild Rice River near Abercrombie[1,4]
385414	Red River at Fargo[1,2,4]
385040	Red River near Harwood[4]
380010	Sheyenne River at Warwick[1,4]
380009	Sheyenne River 3 mi E of Cooperstown[1,3]
380153	Sheyenne River below Baldhill Dam[1]
380007	Sheyenne River at Lisbon[3]
385001	Sheyenne River near Kindred[1,3]
384155	Maple River at Mapleton[1,4]
380156	Goose River at Hillsboro[1,2,4]
384156	Red River at Grand Forks[1,2,4]
380037	Turtle River at Manvel[2,4]
380039	Forest River at Minto[1,2,4]
380157	Park River at Grafton[1,2,4]
380158	Pembina River at Neche[1,2,5]
384157	Red River at Pembina[1,2,4]

[1]Site co-located with USGS flow gauging station.
[2] Site sampled by the USGS under cooperative agreement with the department.
[3] Sampled for pesticides in 2008, 2009 and 2010.
[4] Sampled for pesticides in 2009 and 2010
[5] Sampled for pesticides in 2010 only.

Sites were sampled during the open-water period at six-week intervals beginning in April and concluding in October. In addition, one sample was collected under ice in February 2010. This schedule resulted in seven samples collected at each site during the reporting period. Stations inaccessible due to flooding/road construction or sites with no flow were not sampled.

Samples collected by the department were analyzed for major cations, anions, trace elements, nutrients (total and dissolved), total suspended solids (TSS) and pathogens (Fecal coliform and E. coli bacteria) (Table 3). In addition, field measurements for temperature, pH, dissolved oxygen and specific conductance were taken during each site visit.

The department enters all of its water quality results in the Surface Water Quality Management Program's Sample Identification Database (SID). Each year, data are exported to the U.S. Environmental Protection Agency's (EPA) STOrage and RETreival (STORET) database.

Table 3. North Dakota Department of Health Water Quality Variables Analyzed.

Field Measurements	Laboratory Analysis			
	General Chemistry	**Trace Elements[1]**	**Nutrients[2]**	**Biological**
Temperature	Sodium	Aluminum	Ammonia	Fecal coliform
pH	Magnesium	Antimony	Nitrate-nitrite	E. coli
Dissolved Oxygen	Potassium	Arsenic	Total Kjeldahl Nitrogen	
Specific Conductance	Calcium	Barium	Total Nitrogen	
	Manganese	Beryllium	Total Phosphorus	
	Iron	Boron	Organic Carbon	
	Chloride	Cadmium		
	Sulfate	Chromium		
	Carbonate	Copper		
	Bicarbonate	Lead		
	Hydroxide	Nickel		
	Alkalinity	Silver		
	Hardness	Selenium		
	Total Dissolved Solids	Thallium		
	TSS	Zinc		

[1]Department samples are analyzed for total recoverable and dissolved metals. The USGS samples are analyzed only for dissolved metals.
[2]Nutrients are analyzed for both total and dissolved fractions.

Pesticide Monitoring Project

In 2008, the North Dakota Department of Agriculture's Pesticide Water Quality Program initiated a pesticide monitoring program for rivers and streams. The Department cooperated with the ND Department of Agriculture by collecting pesticide samples at three sites in the Red River basin located on the Sheyenne River. Two of the sites were ambient water quality monitoring sites, the Sheyenne River near Cooperstown (380009) and the Sheyenne River at Lisbon (380007) (Table 4). A third site was located on the Sheyenne River near Horace, ND. Samples were collected in 2008 during the weeks of April 21st, May 12th , June 2nd, June 23rd, July 14th, Aug 4th & 25th, Sept 15th, Oct 6th & Oct 27th.

In 2009, the North Dakota Department of Agriculture's Pesticide Water Quality Program was expanded to 15 sites in the Red River basin. (Table 4). Five sites on the mainstem Red River (380083, 385414, 385040, 384156, and 384157) and four sites on the Sheyenne River (380010, 380009, 380007, and 385001) were sampled for pesticides. Other tributary sites sampled included the Wild Rice River (380031), Maple River (384155), Goose River (380156), Turtle River (380037), Forest River (380039) and Park River (380157). Sampling in 2009 was concurrent with the North Dakota Department of Health's Ambient Water Quality Monitoring Program which collects samples every six weeks beginning with ice out. Five pesticides samples were collected at each site in 2009. Sampling occurred during the weeks of June 15th, July 27th, September 7th, October 19th, and November 30th.

In 2010, the Pesticide Water Quality Program was again expanded to 17 sites in the Red River basin with the addition of sites on the Bois de Sioux River (385055) and the Pembina River (380158). Sampling in 2010 was again concurrent with the North Dakota Department of Health's Ambient Water Quality Monitoring Program. Five pesticides samples were collected at each site in 2010. Sampling occurred during the weeks of April 26th, June 7th, July 19th, August 30th, and October 11th.

Samples were analyzed for 184 different pesticides and degradates in 2008 and 180 different pesticides and degradates in 2009 and 2010 (Table xx). All sample analysis was performed by Pacific Agricultural Laboratory (Portland, OR) using the EPA standard methods (Table xx).

The goals of the pesticide monitoring project were to:

- Determine the occurrence and concentration of pesticides in rivers;
- Determine whether any pesticides may be present at concentrations that could adversely affect human health, aquatic life, or fish-eating wildlife; and
- Determine the frequency of sampling needed to assess contamination, thereby helping to refine future pesticide monitoring design.

The ND Department of Agriculture will also use the monitoring data as part of its cooperative agreement with the US EPA. Under that agreement, the ND Department of Agriculture has committed to evaluate national and local pesticides of interest that may pose a risk to water quality. Furthermore, the Department is required to demonstrate that any risks are appropriately managed. In addition, the ND Department of Agriculture administers an Endangered Species Protection Program that is focused on ensuring that pesticides do not negatively impact threatened and endangered species in North Dakota. Since most of the seven listed species in the state are found in or near surface water, the ND Department of Agriculture will also use the results of the monitoring study to identify pesticides that may pose a risk to threatened and endangered species.

Four pesticides were detected in the samples collected from the three Sheyenne River sites in 2008. 2,4-D was detected at the Sheyenne River near Lisbon and Cooperstown sites in June and at the Sheyenne River near Horace site in October (Table 5). Atrazine, bentazon, and clopyralid were each detected once (Table 6).

The majority of the samples collected and analyzed in 2009 had no detectable pesticide residues. Only four pesticides were detected, all of which were herbicides. The pesticides detected in the Red River basin in North Dakota were atrazine, bentazon, dimethenamid and MCPA (Table 6). Atrazine and bentazon were detected four and three times, respectively, while dimethenamid and MCPA were both detected twice. All of the pesticides concentrations were less than 1 ppb.

Seven pesticides were detected in samples collected in 2010 (Table 7), all of which were herbicides. Bentazon was detected in 17 samples and was by far the most frequently detected pesticide in samples collected in the Red River basin in 2010. Bentazon is a postemergence herbicide used for broadleaf weed control and is used mostly on dry peas, dry beans and soybeans in North Dakota. Other pesticides detected in samples collected in 2010 include atrazine and metaolachlor (3 samples each), clopyralid (2 samples), and 2,4-D, bifenthrin and diuron (1 sample each).

For a complete description of the 2008, 2009 and 2010 Pesticide Water Quality Monitoring Project, including additional results and discussion, the reader is referred to the North Dakota Department of Agriculture's web site at http://www.agdepartment.com/ .

Table 4. North Dakota Department of Agriculture Pestiside Variables Analyzed.

Analyte	Trade name	Type	Reporting Limit
2,4,5-T	N/A	H	0.080 ug/liter (ppb)
2,4,5-TP (fenoprop)	Silvex	H	0.080 ug/liter (ppb)
2,4-D	2,4-D, Weed-B-Gon	H	0.20 ug/liter (ppb)
2,4-DB	Butryac, Butoxone	H	0.20 ug/liter (ppb)
3-Hydroxycarbofuran	Degradate	D	0.12 ug/liter (ppb)
Acetochlor	Surpass, Harnass	H	0.30 ug/liter (ppb)
Alachlor	Intrro, Lariat, Lasso	H	0.12 ug/liter (ppb)
Aldicarb	Temik	I	0.12 ug/liter (ppb)
Aldicarb sulfone	Degradate	D	0.12 ug/liter (ppb)
Aldicarb sulfoxide	Degradate	D	0.12 ug/liter (ppb)
Aldrin	Aldrex	I	0.12 ug/liter (ppb)
Ametryn	Evik, Gesapax	H	0.30 ug/liter (ppb)
Amitraz	Avartan, Triatox, Mitac	I	0.60 ug/liter (ppb)
Aspon	N/A	I	0.30 ug/liter (ppb)
Atrazine	Aatrex,	H	0.30 ug/liter (ppb)
Azinphos-methyl	Guthion, Bay	I	0.30 ug/liter (ppb)
Azoxystrobin	Quadris	F	0.30 ug/liter (ppb)
Bendiocarb	Dycarb, Niomil	I	0.12 ug/liter (ppb)
Benfluralin	Balan	H	0.12 ug/liter (ppb)
Bentazon	Basagran	H	0.08 ug/liter (ppb)
Bifenthrin	Talstar, Capture, Brigade	I	0.12 ug/liter (ppb)
Bolstar	Sulprofos	I	0.30 ug/liter (ppb)
Bromacil	Hyvar, Bromax	H	0.30 ug/liter (ppb)
Bromopropylate	Acarol, Folbex	I	0.60 ug/liter (ppb)
Captafol	Captafol, Sanspor	F	0.12 ug/liter (ppb)
Captan	Captanex, Orthocide	F	0.30 ug/liter (ppb)
Carbaryl	Sevin, Savit	I	0.12 ug/liter (ppb)
Carbophenothion	Trithion, Garrathion	I	0.30 ug/liter (ppb)
Carbofuran	Furadan, Carbodan	I	0.12 ug/liter (ppb)
Carfentrazone-ethyl	Aim	H	0.30 ug/liter (ppb)
Chlordane	Belt, Chlortox	I	1.2 ug/liter (ppb)
Chlorfenvinphos	N/A	I	0.30 ug/liter (ppb)
Chlorobenzilate	Akar, Acaraben	I	0.30 ug/liter (ppb)
Chloroneb	Terraneb	F	0.30 ug/liter (ppb)
Chlorothalonil	Bravo, Ole, Farben	F	0.12 ug/liter (ppb)
Chlorpropham	Furloe, Beet-kleen	H	0.30 ug/liter (ppb)
Chlorpyrifos	Lorsban, Dursban	I	0.30 ug/liter (ppb)
Chlorpyrifos-methyl	Reldan, Storcide	I	0.30 ug/liter (ppb)
Clopyralid	Stinger, Curtail	H	0.080 ug/liter (ppb)
Coumaphos	Resistox, Asuntol	I	0.30 ug/liter (ppb)
Cyanazine	Bladex	H	0.60 ug/liter (ppb)
Cyfluthrin	Tempo, Baythroid	I	1.2 ug/liter (ppb)
Cyhalothrin	Grenade, Karate	I	1.2 ug/liter (ppb)

Table 4 (cont). North Dakota Department of Agriculture Pestiside Variables Analyzed.

Analyte	Trade name	Type[1]	Reporting Limit
Cypermethrin	Ammo	I	1.2 ug/liter (ppb)
Dacthal	Dacthal	H	0.12 ug/liter (ppb)
DCPMU	Degradate	D	0.12 ug/liter (ppb)
Deltamethrin	Butox, K-Othrin	I	1.2 ug/liter (ppb)
Demeton-O	N/A	I	0.30 ug/liter (ppb)
Demeton-S (Metasystox)	N/A	I	0.30 ug/liter (ppb)
Diazinon	Knox Out, Diazol	I	0.30 ug/liter (ppb)
Dicamba	Banvel	H	0.080 ug/liter (ppb)
Dichlorfenthion	Mobilawn, Gro13	I	0.30 ug/liter (ppb)
Dichlorprop	Weedone, Strike, Envert	H	0.20 ug/liter (ppb)
Dichlorvos	Vapona, DDVP	I	0.30 ug/liter (ppb)
Diclofop-methyl	Hoelon	H	0.60 ug/liter (ppb)
Dicloran	Botran	F	0.12 ug/liter (ppb)
Dicrotophos	Bidrin	I	0.30 ug/liter (ppb)
Dieldrin	Dieldrex	I	0.12 ug/liter (ppb)
Dimethenamid	Outlook	H	0.30 ug/liter (ppb)
Dimethoate	Cygon, Roxion	I	0.30 ug/liter (ppb)
Dinoseb	Aretit, Dinitro	H	0.20 ug/liter (ppb)
Disulfoton	Disyston, Dithiosystox	I	0.30 ug/liter (ppb)
Diuron	Direx, Karmex	H	0.12 ug/liter (ppb)
Endosulfan I	Thionex, Thiodan	I	0.12 ug/liter (ppb)
Endosulfan II	Thionex	I	0.12 ug/liter (ppb)
Endosulfan sulfate	Degradate	D	0.12 ug/liter (ppb)
Endrin	Endrex	I	0.12 ug/liter (ppb)
Endrin aldehyde	Degradate	D	0.12 ug/liter (ppb)
EPN	N/A	I	0.30 ug/liter (ppb)
Esfenvalerate	Asana, Pydrin	I	0.12 ug/liter (ppb)
Ethalfluralin	Sonalan	H	0.12 ug/liter (ppb)
Ethion	Ethiol, Cethion	I	0.30 ug/liter (ppb)
Ethofumesate	Progress, Tramat	H	0.30 ug/liter (ppb)
Ethoprop	Mocap	I	0.30 ug/liter (ppb)
Famphur	N/A	I	0.30 ug/liter (ppb)
Fenarimol	Rubigan	F	0.12 ug/liter (ppb)
Fenbuconazole	Indar	F	0.60 ug/liter (ppb)
Fenhexamid	Elevate	F	0.12 ug/liter (ppb)
Fenitrothion	Cyfen, Folithion	I	0.30 ug/liter (ppb)
Fenobucarb	Folistar, Prostar, Moncut	F	0.12 ug/liter (ppb)
Fenoxaprop-ethyl	Puma, Option, Whip	H	0.60 ug/liter (ppb)
Fensulfothion	Terracur, Dasanit	I	0.30 ug/liter (ppb)
Fenthion	Baytex	I	0.30 ug/liter (ppb)
Fenuron	Dybar, PDU	H	0.30 ug/liter (ppb)
Fenvalerate	Pydrin	I	0.12 ug/liter (ppb)
Fipronil	Regent	I	0.60 ug/liter (ppb)

Table 4 (cont). North Dakota Department of Agriculture Pestiside Variables Analyzed.

Analyte	Trade name	Type	Reporting Limit
Fluazifop-P-butyl	Fusilade	H	0.60 ug/liter (ppb)
Fludioxanil	Maxim, Celest	F	0.30 ug/liter (ppb)
Flumioxazin	Sumisoya, Valor	H	0.30 ug/liter (ppb)
Fluometuron	Cortoran, Lanex	H	0.30 ug/liter (ppb)
Fluroxypyr-meptyl	Starane	H	0.30 ug/liter (ppb)
Flutolanil	Moncoat	F	1.2 ug/liter (ppb)
Folpet	Cosan, Fungitrol	F	0.30 ug/liter (ppb)
Heptachlor	Heptamule	I	0.12 ug/liter (ppb)
Heptachlor epoxide	Degradate	D	0.12 ug/liter (ppb)
Hexachlorobenzene	HCB	F	0.12 ug/liter (ppb)
Hexazinone	Velpar	H	0.30 ug/liter (ppb)
Imazamethabenz	Assert	H	0.02 ug/liter (ppb)
Imazamox[2]	Raptor	H	0.02 ug/liter (ppb)
Imazapyr[2]	Stalker	H	0.02 ug/liter (ppb)
Imazethapyr[2]	Pursuit	H	0.02 ug/liter (ppb)
Imidacloprid	Touchstone PF	I	0.30 ug/liter (ppb)
Iprodione	Rovral	F	0.12 ug/liter (ppb)
Isoxaben	Cent 7, Gallery	H	0.30 ug/liter (ppb)
Kelthane	Dicofol	I	0.30 ug/liter (ppb)
Linuron	Linex, Lorox	H	0.30 ug/liter (ppb)
Malathion	Malathion, Cythion	I	0.30 ug/liter (ppb)
MCPA	MCP	H	20 ug/liter (ppb)
MCPP	Encore, Trimec	H	20 ug/liter (ppb)
Mefenoxam	Apron, Dividend,Dynasty	F	0.30 ug/liter (ppb)
Metalaxyl	Hi-Yield, Ridomil	F	0.30 ug/liter (ppb)
Methidathion	Somonic, suprathion	I	0.30 ug/liter (ppb)
Methiocarb	Mesurol	I	0.12 ug/liter (ppb)
Methomyl	Lannate	I	0.12 ug/liter (ppb)
Methoxychlor	Methoxychlor	I	0.12 ug/liter (ppb)
Metolachlor	Dual, Magnum	H	0.30 ug/liter (ppb)
Metribuzin	Sencor, Lexone	H	0.60 ug/liter (ppb)
Mevinphos	Phosdrin	I	0.30 ug/liter (ppb)
Mirex	Ferriamicide, Dechlorane	I	0.12 ug/liter (ppb)
Monocrotophos	N/A	I	0.30 ug/liter (ppb)
Monuron	CMU, Telvar	I	0.12 ug/liter (ppb)
Myclobutanil	Rally	F	0.60 ug/liter (ppb)
Neburon	Kloben	H	0.12 ug/liter (ppb)
Norflurazon	Solicam	H	0.12 ug/liter (ppb)
Oryzalin	Surflan	H	0.30 ug/liter (ppb)
Ovex	Ovochlor, Ovotran	I	0.12 ug/liter (ppb)
Oxamyl	Vydate	I	0.12 ug/liter (ppb)
Oxyflorfen	Goal	H	0.12 ug/liter (ppb)
p,p'-DDD	N/A	I	0.12 ug/liter (ppb)
p,p'-DDE	Degradate	D	0.12 ug/liter (ppb)

Table 4 (cont). North Dakota Department of Agriculture Pestiside Variables Analyzed.

Analyte	Trade name	Type	Reporting Limit
p,p'-DDT	N/A	I	0.12 ug/liter (ppb)
Parathion	Parathion, Thiophos	I	0.30 ug/liter (ppb)
Parathion-methyl	Penncap-M, Folidol-M	I	0.30 ug/liter (ppb)
PCA	Degradate	D	0.12 ug/liter (ppb)
PCNB (quintozene)	Terraclor, Tritisan	F	0.12 ug/liter (ppb)
Pendimethalin	Prowl	H	0.30 ug/liter (ppb)
Pentachlorophenol	PCP	H	0.080 ug/liter (ppb)
Permethrin	Ambush, Pounce	I	1.2 ug/liter (ppb)
Phorate	Thimet	I	0.30 ug/liter (ppb)
Phosmet	Imidan	I	0.30 ug/liter (ppb)
Phosphamidon	Phosphamidon	I	0.30 ug/liter (ppb)
Picloram	Tordon	H	0.20 ug/liter (ppb)
Pirimicarb	Pirimor	I	0.30 ug/liter (ppb)
Pirimiphos-methyl	Tomahawk,Silosan	I	0.30 ug/liter (ppb)
Prodiamine	Barricade	H	0.12 ug/liter (ppb)
Prometon	Pramitol	H	0.60 ug/liter (ppb)
Prometryn	Caparol	H	0.30 ug/liter (ppb)
Pronamide	Kerb	H	0.12 ug/liter (ppb)
Propachlor	Ramrod	H	0.30 ug/liter (ppb)
Propanil	Stampede, Prop-Job	H	0.12 ug/liter (ppb)
Propargite	Comite, Omite	I	0.60 ug/liter (ppb)
Propazine	Milogard	F	0.30 ug/liter (ppb)
Propham	IPC	H	0.30 ug/liter (ppb)
Propiconazole	Banner, Tilt, Radar	F	0.30 ug/liter (ppb)
Propoxur	Baygon	I	0.12 ug/liter (ppb)
Pyraclostrobin	Cabrio, Headline	F	0.30 ug/liter (ppb)
Pyrethrins	Wilson, Mushroom House	I	1.2 ug/liter (ppb)
Pyridaben	Pyromite, Dynomite	I	0.60 ug/liter (ppb)
Quinclorac	Paramount	H	0.20 ug/liter (ppb)
Sethoxydim	Poast	H	6.0 ug/liter (ppb)
Siduron	Tupersan	H	0.12 ug/liter (ppb)
Simazine	Princep	H	0.60 ug/liter (ppb)
Simetryn	Gybon	H	0.30 ug/liter (ppb)
Sulfentrazone	Spartan	H	0.30 ug/liter (ppb)
Tebuconazole	Folicur	F	0.60 ug/liter (ppb)
Tebuthiuron	Spike	H	0.60 ug/liter (ppb)
Terbacil	Sinbar	H	0.12 ug/liter (ppb)
Terbufos	Counter	I	0.30 ug/liter (ppb)
Tetrachlorvinphos	Disvap	I	0.30 ug/liter (ppb)
Thiabendazole	Arbotect	F	0.30 ug/liter (ppb)
Thiobencarb	Bolero, Saturn, Abolish	H	0.30 ug/liter (ppb)
Toxaphene	Phenatox,Toxakil	I	6.0 ug/liter (ppb)
Triadimefon	Bayleton	F	0.60 ug/liter (ppb)
Trichlorfon	Dylox, Neguvon	I	0.60 ug/liter (ppb)

Table 4 (cont). North Dakota Department of Agriculture Pestiside Variables Analyzed.

Analyte	Trade name	Type	Reporting Limit
Triclopyr	Garlon	H	0.080 ug/liter (ppb)
Trifloxystrobin	Ronilan	F	0.12 ug/liter (ppb)
Triflumazole	Terraguard, Procure	F	0.12 ug/liter (ppb)
Trifluralin	Treflan, Trilin	H	0.12 ug/liter (ppb)
Vinclozalin	Ronilan	F	0.12 ug/liter (ppb)
α-BHC	Degradate	D	0.12 ug/liter (ppb)
β-BHC	Degradate	D	0.12 ug/liter (ppb)
γ-BHC (Lindane)	Gamma BHC	I	0.12 ug/liter (ppb)
δ-BHC	Degradate	D	0.12 ug/liter (ppb)

[1] H-Herbicide, F-Fungicide, I-Insecticide, D-Degradate
[2] Not sampled in 2009 or 2010.

Table 5. Description of Analytical Methods Used by Pacific Agricultural Labs (Portland, OR).

Pesticide Class	Method Description
Organochlorine pesticides	Modified EPA Method 608 (GC-ECD)
Organophosphorus pesticides	Modified EPA Method 614 (GC-FPD)
Organonitrogen pesticides	Modified EPA Method 625 (GC-MS)
Chlorinated pesticides	Modified EPA method 8321A (HPLC-MS)
Imidazolinone herbicides	American Cyanamid method (HPLC-MS)
Miscellaneous pesticides	Modified EPA Method 8321A (HPLC-MS)

Table 6. 2008 Pesticide Sampling Results.

Chemical	Concentration (ug/L)	Lowest EPA Aquatic Life Benchmark	Benchmark Organism	Sample Location	Date Collected
2,4-D	0.21	None	N/A	Sheyenne River near Lisbon	6/3/2008
2,4-D	0.21	None	N/A	Sheyenne River near Cooperstown	6/4/2008
2,4-D	0.25	None	N/A	Sheyenne River near Horace	10/7/2008
Atrazine	0.48	1	Non-vascular plants	Sheyenne River near Horace	6/23/2008
Bentazon	0.014	4,500	Acute-non-vascular plants	Sheyenne River near Lisbon	9/15/2008
Clopyralid	0.089	None	N/A	Sheyenne River near Horace	6/23/2008

Table 7. 2009 Pesticide Sampling Results.

Chemical	Concentration (ug/L)	Lowest EPA Aquatic Life Benchmark	Benchmark Organism	Sample Location	Date Collected
Atrazine	0.42	1	Non-vascular plants	Wild Rice River near Abercrombie	6/17/2009
Atrazine	0.46	1	Non-vascular plants	Red River near Brushville	6/17/2009
Atrazine	0.40	1	Non-vascular plants	Red River at Grand Forks	6/23/2009
Atrazine	0.45	1	Non-vascular plants	Wild Rice River nr Abercrombie	7/29/2009
Bentazon	0.38	4,500	Acute-vascular plants	Red River at Pembina	7/13/2009
Bentazon	0.54	4,500	Acute-vascular plants	Red River at Pembina	7/29/2009
Bentazon	0.70	4,500	Acute-vascular plants	Forest River near Minto	7/29/2009
dimethenamid	0.36	8.9	Acute-vascular plants	Red River near Brushville, MN	6/17/2009
dimethenamid	0.35	8.9	Acute-vascular plants	Wild Rice River nr Abercrombie	10/7/2009
MPCA	0.90	170	Acute-vascular plants	Wild Rice River nr Abercrombie	6/17/2009
MPCA	1.5	170	Acute-vascular plants	Red River near Brushville, MN	6/17/2009

Table 8. 2010 Pesticide Sampling Results.

Chemical	Concentration (ug/L)	Lowest EPA Aquatic Life Benchmark	Benchmark Organism	Sample Location	Date Collected
2,4-D	0.84	None	N/A	Turtle River nr Manvel	6/21/2010
Atrazine	0.34	1	Non-vascular plants	Red River at Fargo	6/23/2010
Atrazine	0.87	1	Non-vascular plants	Maple River at Mapleton	6/14/2010
Atrazine	0.42	1	Non-vascular plants	Red River at Grand Forks	6/21/2010
Bentazon	0.11	4,500	Acute-vascular plants	Turtle River nr Manvel	6/21/2010
Bentazon	0.57	4,500	Acute-vascular plants	Forest River nr Minto	6/21/2010
Bentazon	0.19	4,500	Acute-vascular plants	Park River at Grafton	6/21/2010
Bentazon	0.19	4,500	Acute-vascular plants	Red River at Grand Forks	7/26/2010
Bentazon	0.41	4,500	Acute-vascular plants	Goose River at Hillsboro	7/26/2010
Bentazon	0.96	4,500	Acute-vascular plants	Turtle River nr Manvel	7/27/2010
Bentazon	5.2	4,500	Acute-vascular plants	Forest River nr Minto	7/27/2010
Bentazon	3.2	4,500	Acute-vascular plants	Park River at Grafton	7/27/2010
Bentazon	0.39	4,500	Acute-vascular plants	Red River at Pembina	7/28/2010
Bentazon	0.5	4,500	Acute-vascular plants	Park River at Grafton	8/9/2010
Bentazon	0.15	4,500	Acute-vascular plants	Red River at Pembina	8/10/2010
Bentazon	0.13	4,500	Acute-vascular plants	Goose River at Hillsboro	8/10/2010
Bentazon	0.71	4,500	Acute-vascular plants	Turtle River nr Manvel	8/10/2010
Bentazon	3.1	4,500	Acute-vascular plants	Forest River nr Minto	8/10/2010
Bentazon	0.13	4,500	Acute-vascular plants	Park River at Grafton	10/4/2010
Bentazon	0.98	4,500	Acute-vascular plants	Forest River nr Minto	10/4/2010
Bentazon	0.23	4,500	Acute-vascular plants	Goose River at Hillsboro	10/5/2010
Bentazon	0.21	4,500	Acute-vascular plants	Turtle River nr Manvel	10/4/2010
Bifenthrin	0.13	None	N/A	Red River at Fargo	10/5/2010
Clopyralid	0.78	56,500	Acute-Non-vascular plants	Forest River nr Minto	6/21/2010
Clopyralid	0.41	56,500	Acute-Non-vascular plants	Park River at Grafton	6/21/2010
Diuron	0.19	2.4	Algae	Red River at Brushville, MN	6/15/2010

Table 8. 2010 Pesticide Sampling Results...cont.					
Metaolachlor	0.8	1	Chronic-invertebrate	Red River at Grand Forks	6/21/2010
Metaolachlor	0.39	1	Chronic-invertebrate	Red River at Brushville, MN	10/12/2010
Metaolachlor	0.7	1	Chronic-invertebrate	Red River at Pembina	7/28/2010

6.03 Manitoba

Surface Water Quality Monitoring

Water quality continues to be monitored monthly at two sites on the Red River within Manitoba by Manitoba Water Stewardship. These sites are located upstream and downstream of the City of Winnipeg (Floodway control structure and Selkirk, respectively). Variables measured include physical parameters, general chemistry, suspended sediment, bacteria, industrial organics, trace elements, plant nutrients, and agricultural chemicals. The City of Winnipeg normally monitors six sites on a bi-weekly basis. These sites are located upstream, within, and downstream of the City of Winnipeg. Variables monitored by the City of Winnipeg include general chemistry, plant nutrients, suspended sediment, bacteria, and chlorophyll *a*. Long-term variables and sampling frequency from October 2009 until September 30, 2010 are shown in Tables 9 and 10.

Routine monitoring is also conducted on five tributary streams to the Red River by Manitoba Water Stewardship. Samples are collected at minimum four times per year and analyzed for a wide range of variables including physical parameters, general chemistry, suspended sediment, bacteria, industrial organics, trace elements, plant nutrients, and agricultural chemicals. Locations and variables monitored are shown in Table 11. Benthic macroinvertebrates were collected from the Red River at Emerson and Selkirk in September 2010.

During the spring runoff in 2010, the frequency of water quality monitoring was increased in the Red River watershed. Samples were collected as often as twice a week in the main stem of the Red River during peak flows and weekly in the tributaries to the Red River. In addition, samples were collected on Red River tributaries in relation to heavy rainfall events in spring and summer 2010.

Manitoba continues to work to understand sources of nutrients to Lake Winnipeg, to monitor the impacts of excess nutrients and to reduce nutrient loading. On May 31, 2011, the Province of Manitoba released a report prepared by Dr. Peter Leavitt, Canada Research Chair in Environmental Change and Society (Department of Biology, University of Regina) and his colleagues Dr. Lynda Bunting and others on the paleolimnology of Lake Winnipeg. The report was commissioned by the province. The report (http://www.gov.mb.ca/waterstewardship/water_quality/lake_winnipeg/pdf/report_lake_wpg_paleolimnology_2011.pdf), one part of the research and monitoring underway on Lake Winnipeg through Manitoba Water Stewardship, Environment Canada and others, is a comprehensive report that identifies the historical water quality conditions that most likely existed in the south basin of Lake Winnipeg prior to the early 1800s, how the lake has changed up to the present time, and the likely causes of those changes. Dr. Leavitt's work has indicated that a 50 % reduction in phosphorus in Lake Winnipeg is required to reverse regular algae blooms and return the lake to a pre-1990 state.

On July 4, 2011, the Province of Manitoba and the Government of Canada released the State of Lake Winnipeg report. The report, led by Manitoba Water Stewardship and Environment Canada, is a collaborative effort by many researchers from government, universities, and non-governmental organizations and is the first comprehensive assessment of the physical, chemical, and biological characteristics of Lake Winnipeg since intensive lake monitoring began in late 1990s.

The State of Lake Winnipeg report serves as a reference to measure progress towards reducing nutrient loading, will help in the assessment of the overall health of the lake, and also provides key information to support current and future research on Lake Winnipeg. The report is available as both an extended technical report and a highlights report on the Manitoba Water Stewardship web site at http://www.gov.mb.ca/waterstewardship/water_quality/state_lk_winnipeg_report/index.html.

In September 2010, Canada and Manitoba signed the *Canada-Manitoba Memorandum of Understanding Respecting Lake Winnipeg and the Lake Winnipeg Basin* to facilitate a cooperative and coordinated approach in efforts to understand and protect the water quality and ecological health of Lake Winnipeg and the Lake Winnipeg Basin. A Steering Committee was formed under this Memorandum of Understanding and technical-secretariat support for the Committee is provided by the Department. The Memorandum of Understanding is available on the Manitoba Water Stewardship web site at http://www.gov.mb.ca/waterstewardship/water_quality/lake_winnipeg/index.html.

Action to reduce nutrient loading to Lake Winnipeg in Manitoba includes:

- In July 2011, Manitoba introduced a proposed regulation to enshrine the Manitoba Quality Standards, Objectives and Guidelines into a regulation under *The Water Protection Act.* The Water Quality Standards, Objectives and Guidelines are one of many tools used to protect, maintain and where necessary, rehabilitate water quality. The overall approach to environmental protection and the implementation of the water quality standards, objectives and guidelines remains unchanged from the draft November 22, 2002 document entitled Manitoba Water Quality Standards, Objectives, and Guidelines (Williamson 2002). Similarly, many of the numeric Water Quality Standards, Objectives and Guidelines proposed in the updated document also remain unchanged. However, a number of updates have been made to reflect new science and legislation. In particular, Water Quality Standards for Nutrients in wastewater effluent have been expanded to include new province-wide standards for phosphorus (1 mg/L) and where site-specific conditions warrant, nitrogen to 15 mg/L. To ensure that the approach is fair and equitable, water quality standards for phosphorus and nitrogen consider the size of the nutrient load and the receiving water body. Information on the proposed Manitoba Quality Standards, Objectives and Guidelines Regulation can be found on the Manitoba Water Stewardship web site at http://www.gov.mb.ca/waterstewardship/water_quality/quality/website_notice_mwqsog_2002.html.

- *The Phosphorus Reduction Act* (*Water Protection Act* amended) came into effect on July 1, 2010. The Act restricts the phosphorus content in household automatic dishwashing detergents that can be manufactured, sold, distributed or imported into Manitoba for use in Manitoba. Under the legislation, only those automatic dishwashing detergents that contain 0.5 % phosphorus or less can be sold or distributed throughout the province. Manitoba Water Stewardship worked with manufactures, retailers, and distributors of automatic dishwashing detergents to increase the availability of automatic dishwashing detergents with less than 0.5 % phosphorus.

- Work to implement the Nutrient Management Regulation which was enacted in March 2008 continues. Effective January 1, 2009, within urban and built up areas (Nutrient Management Zone N5), no one shall apply a fertilizer to turf containing more than 1 per cent phosphorus by weight, expressed as P_2O_5. An exception to this restriction includes newly established turf during the year of establishment as well as the year following establishment. Phosphorus-containing fertilizers can be applied provided that the soil test phosphorus level:
    - is less than 60 ppm on land used to grow grass for sale as sod,
    - is less than 30 ppm on land used as a sports facility, or

- is less than 18 ppm on land used neither to grow grass for sale as sod or as a sports facility

- Flowerbeds, gardens, trees and shrubs are excluded from the phosphorus restrictions. In addition, no one shall apply or allow the escape of a substance containing nitrogen or phosphorus onto a paved or other impervious surface within Nutrient Management Zone N5. Should this occur, the individual must immediately take all reasonable steps to remove the substance so that it does not drain into a storm or sewage drainage system. Manitoba Water Stewardship has been working with fertilizer retailers and the public to develop signage, brochures and ad campaigns to communicate the requirements of the regulation in urban areas. Through work with manufactures and retailers, the availability of lawn fertilizers containing less than one per cent phosphorus by weight was increased across the province.

- Also, as of January 1, 2009 under the Nutrient Management Regulation, golf courses in Manitoba are required to prepare annual Nutrient Management Plans to demonstrate how nutrients will be used on their golf courses to ensure that excess nutrients do not runoff into waterways. Manitoba Water Stewardship has developed templates for nutrient management planning for golf courses and is working to achieve compliance throughout the industry. In 2010, 45 Nutrient Management Plans were registered for golf courses across Manitoba.

- As of January 1, 2009, nutrients cannot be applied in the Nutrient Buffer Zone. The Nutrient Buffer Zone is a setback from waterways that varies in width depending on the type of waterway and if it is used as a drinking water source. Nutrient Buffer Zones apply to all nutrient applications including from livestock manure, inorganic fertilizer and municipal biosolids.

- More information on the *Nutrient Management Regulation* under *The Water Protection Act* is available at http://www.gov.mb.ca/waterstewardship/wqmz/index.html.

- Work on integrated watershed management planning under *The Water Protection Act* also continued and included plans in four Red River tributary watersheds: the Seine, La Salle, and Pembina Rivers and the Grassmere-Netley Creek watershed. Integrated watershed management plans are compiled by local water planning authorities with stakeholder input and are to be implemented, monitored and updated regularly (every ten years) by these authorities. Water planning authorities are designated under *The Water Protection Act* and the development of integrated watershed management planning is guided by specifications in *The Act*. Manitoba provides financial, planning and technical assistance to the process. The integrated watershed management plans include a report on current science knowledge of the watershed environment as well as initiatives to monitor, maintain and improve environmental conditions in the watershed.

- New financial incentives under the province's Wetland Restoration Incentive Program were announced in December 2008 to help restore the condition of wetlands, improve water quality and reduce greenhouse gas emissions. Landowners who sign a conservation agreement will be provided a one-time payment to ensure natural landscapes are protected over the long-term. An additional ecological goods and services payment will also be provided that recognizes the unique value of restored wetlands and helps offset operational costs incurred by the landowner in retaining the restored wetlands on their land.

- Continued support by Manitoba Water Stewardship to the South Basin Mayors and Reeves to develop and launch a program to help consumers better identify products that have proven to be the best choice for the environment. The Lake Friendly Label criteria are based on Environment

Canada's EcoLogo criteria. EcoLogo provides assurance that the products and services bearing the logo meet stringent standards of environmental leadership. The initial phase identifies hard surface cleaners, dish detergents (including dishwasher detergents) and laundry cleaners. These cleaners are all commonly used and can impact Lake Winnipeg. Lake Friendly Products are available at retailers throughout the south basin of Lake Winnipeg. The Lake Friendly initiative is gaining interest with municipalities and agencies across Manitoba and in north western Ontario.

Water Quality Status of Red River in Manitoba

During this reporting period, water quality in the Manitoba reach of the Red River main stem remained relatively good and comparable to previous years. Dissolved oxygen concentrations were relatively high with an average concentration of 7.1 mg/L upstream of the City of Winnipeg and 7.9 mg/L downstream of the City of Winnipeg. The lowest value recorded of 2.2 mg/L occurred in November of 2009 and May 2010 upstream of the City of Winnipeg.

Densities of *Escherichia coli* bacteria downstream of the City of Winnipeg were similar to the previous reporting period. Average density downstream of the City of Winnipeg was 61 organisms per 100 mL (geomean), compared to 77 organisms per 100 mL in the previous reporting period. In comparison, the average density of *Escherichia coli* bacteria in the upstream reach was 21 organisms per 100 mL (geomean), comparable to the previous year (18 organisms per 100 mL). Densities of *Escherichia coli* bacteria did not exceed the Manitoba Water Quality Objective for the protection of recreation of 200 organisms per 100 mL upstream of the City of Winnipeg. Meanwhile the exceedence rate of the Manitoba Water Quality Objectives for the protection of recreation was 18 % downstream of the City of Winnipeg.

During this reporting period, three samples were analyzed for pesticides upstream of the City of Winnipeg. Six pesticides out of the 63 monitored were detected. AMPA, atrazine, bromocil, 2,4-D, glyphosate and MCPA were each detected in July 2010. None of the detections of AMPA, atrazine, bromocil, 2,4-D, glyphosate and MCPA exceeded water quality guidelines (where available) for the protection of surface water used as sources of drinking water supply, habitat for aquatic life and wildlife, or livestock uses. However, concentration of MCPA exceeded the guidelines developed by the Canadian Council of Ministers of the Environment for protection of irrigation uses.

Ten pesticides out of the 63 monitored were detected downstream of the City of Winnipeg. A total of 8 samples were analyzed for pesticides. Ethalfluralin was detected once in November of 2009. Thifensulfuron-me, tribenuron-me, and MCPP were detected once in June 2010. Bromoxynil and MCPA were detected in June and July 2010. The pesticide 2,4-D was detected in October and November 2009, and in June, July, and September 2010. The pesticide AMPA was detected in November and December 2009 and June 2010. Dicamba was detected in November 2009, and in May, June, July and September 2010. Glyphosate was detected in December 2009 and in June, July, and September 2010.

None of the detections of pesticides exceeded water quality guidelines (where available) for the protection of surface water used as sources of drinking water supply, habitat for aquatic life and wildlife, or livestock uses. However, the concentrations of bromoxynil (June 2010), MCPA (June and July 2010) and Dicamba in (November 2009, May, June, July, and September 2010) exceeded the guidelines developed by the Canadian Council of Ministers of the Environment for protection of irrigation uses.

Table 9. Sampling frequency of routine surface water quality monitoring by Manitoba Water Stewardship on the Red River within Manitoba, Canada over the period October 1, 2009 to September 30, 2010.

Variables	Units	Red River at Selkirk	Red River at St. Norbert
2,4,5-TP	ug/L	8	3
2,4-DB	ug/L	8	3
2,4-D	ug/L	8	3
ALACHLOR	ug/L	8	3
ALKALINITY CO3	mg/L	8	8
ALKALINITY OH	mg/L	8	8
ALKALINITY TOTAL CACO3	mg/L	8	8
ALKALINITY TOTAL HCO3	mg/L	8	8
ALUMINUM DISSOLVED	mg/L	8	5
ALUMINUM TOTAL	mg/L	22	10
AMMONIA DISSOLVED	mg/L	22	11
AMPA(AMINOMETHYLPHOSPHONIC ACID)	ug/L	8	3
ANTIMONY TOTAL	mg/L	22	10
ARSENIC TOTAL	mg/L	22	10
ATRAZINE DESETHYL	ug/L	8	3
ATRAZINE	ug/L	8	3
AZINPHOS METHYL	ug/L	8	3
BARIUM TOTAL	mg/L	22	10
BENOMYL	ug/L	8	3
BERYLLIUM TOTAL	mg/L	22	10
BISMUTH TOTAL	mg/L	22	10
BORON TOTAL	mg/L	22	10
BROMACIL	ug/L	8	3
BROMOXYNIL	ug/L	8	3
CADMIUM TOTAL	mg/L	22	10
CALCIUM TOTAL	mg/L	22	10
CAPTAN	ug/L	8	3
CARBOFURAN	ug/L	8	3
CARBON TOTAL INORGANIC	mg/L	22	13
CARBON TOTAL ORGANIC (TOC)	mg/L	22	13
CARBON TOTAL	mg/L	22	13
CARBOXIN (CARBATHIN)	ug/L	8	3
CESIUM TOTAL	mg/L	22	10
CHLORDANE-CIS	ug/L	8	3
CHLORDANE-TRANS	ug/L	8	3
CHLORIDE DISSOLVED	mg/L	15	9
CHLOROPHYLL A	ug/L	22	13
CHLOROTHALONIL	ug/L	8	3
CHLORPYRIFOS-ETHYL (DURSBAN)	ug/L	8	3
CHROMIUM HEXAVALENT DISSOLVED	mg/L	8	5
CHROMIUM TOTAL (CR)	mg/L	22	10
COBALT TOTAL	mg/L	22	10
COLOUR TRUE	CU	8	8
CONDUCTIVITY (AT 25C)	uS/cm	22	13
COPPER TOTAL (CU)	mg/L	22	10
CYANAZINE	ug/L	8	3
DELTAMETHRIN	ug/L	8	3
DIAZINON	ug/L	8	3
DICAMBA (BANVEL)	ug/L	8	3
DICHLOROPROP(2,4-DP)	ug/L	8	3
DICLOFOP-METHYL	ug/L	8	3
DIMETHOATE (CYGON)	ug/L	8	3
DINOSEB	ug/L	8	3
DIURON (DCMBU)	ug/L	8	3

Table 9. Continued….

Variables	Units	Red River at Selkirk	Red River at St. Norbert
DIURON	ug/L	8	3
EPTAM	ug/L	8	3
ESCHERICHIA, COLI	CFU/100 mL	22	13
ETHALFLURALIN (EDGE)	ug/L	8	3
FENOXAPROP	ug/L	8	3
GAMMA-BENZENEHEXACHLORIDE (LINDANE)	ug/L	8	3
GLYPHOSATE (ROUNDUP)	ug/L	8	3
HARDNESS TOTAL CACO3	mg/L	22	10
IMAZAMETHABENZ-ME	ng/L	8	3
IMAZAMETHABENZ-METHYL	ug/L	8	3
IRON TOTAL (FE)	mg/L	22	10
LEAD TOTAL	mg/L	22	10
LITHIUM TOTAL	mg/L	22	10
MAGNESIUM TOTAL	mg/L	22	10
MALATHION	ug/L	8	3
MANGANESE TOTAL (MN)	mg/L	22	10
MCPA	ug/L	8	3
MCPP (MECOPROP)	ug/L	8	3
METASULFURON-ME	ng/L	8	3
METHOXYCHLOR (P,P'-METHOXYCHLOR)_	ug/L	8	3
METRIBUZIN	ug/L	8	3
METSULFURON-METHYL	ug/L	8	3
MOLYBDENUM TOTAL	mg/L	22	10
NICKEL TOTAL	mg/L	22	10
NITROGEN DISSOLVED NO3 & NO2	mg/L	22	13
NITROGEN TOTAL KJELDAHL (TKN)	mg/L	22	13
OXYGEN BIOCHEMICAL DEMAND	mg/L	22	13
OXYGEN DISSOLVED	mg/L	8	8
PARATHION ETHYL	ug/L	8	3
PARATHION METHYL	ug/L	8	3
PENTACHLOROPHENOL	ug/L	8	3
PHEOPHYTIN A	ug/L	22	13
PHOSPHOROUS-ACID HYDROLYZABLE	mg/L	22	13
PHOSPHOROUS-TOTAL-ORTHO	mg/L	22	13
PHOSPHORUS DISSOLVED ORTHO	mg/L	22	13
PHOSPHORUS PARTICULATE	mg/L	22	13
PHOSPHORUS TOTAL (METALS SCAN)	mg/L	22	13
PHOSPHORUS TOTAL (P)	mg/L	22	13
PHOSPHORUS TOTAL DISSOLVED	mg/L	22	13
PHOSPHORUS TOTAL INORGANIC	mg/L	22	13
pH	pH units	22	13
PICLORAM (TORDON)	ug/L	8	3
POTASSIUM TOTAL	mg/L	22	10
PROPACHLOR	ug/L	8	3
PROPANIL	ug/L	8	3
PROPOXUR	ug/L	8	3
QUIZALOFOP	ug/L	8	3
RUBIDIUM TOTAL	mg/L	22	10
SELENIUM TOTAL	mg/L	22	10
SETHOXYDIM	ug/L	8	3
SETHOXYDIM	ug/L	8	3
SILICON TOTAL	mg/L	22	10
SILVER TOTAL	mg/L	22	10
SIMAZINE	ug/L	8	3
SODIUM TOTAL	mg/L	18	10

Table 9. Continued….

Variables	Units	Red River at Selkirk	Red River at St. Norbert
SULPHATE DISSOLVED	mg/L	12	10
TEBUTHIURON	ug/L	8	3
TELLURIUM TOTAL	mg/L	22	10
TERBUFOS	ug/L	8	3
THALLIUM TOTAL	mg/L	22	10
THIFENSULFURON METHYL	ug/L	8	3
THIFENSULFURON-ME	ng/L	8	3
THORIUM TOTAL	mg/L	22	10
TIN TOTAL	mg/L	22	10
TITANIUM TOTAL	mg/L	22	10
TOTAL DISSOLVED SOLIDS	mg/L @180C	8	8
TOTAL SUSPENDED SOLIDS	mg/L	22	13
TRALKOXYDIM	ug/L	8	3
TRALKOXYDIM	ug/L	8	3
TRIALLATE (AVADEXBW)	ug/L	8	3
TRIBENURON	ng/L	8	3
TRICLOPYR	ug/L	8	3
TRIFLURALIN(TREFLAN)	ug/L	8	3
TUNGSTEN TOTAL	mg/L	22	10
TURBIDITY	NTU	8	8
URANIUM TOTAL	mg/L	22	10
VANADIUM TOTAL	mg/L	22	10
ZINC TOTAL (ZN)	mg/L	22	10
ZIRCONIUM TOTAL	mg/L	22	10

Table 10. Sampling frequency of routine surface water quality monitoring by City of Winnipeg on the Red River within Manitoba, Canada over the period October 1, 2009 to September 30, 2010.

Variables	Red River at Floodway Control	Red River at Fort Garry Bridge	Red River at Norwood Bridge	Red River at Redwood Bridge	Red River at Chief Peguis Bridge	Red River at Lockport
Chlorophyll a	14 times	14 times	14 times	14 times	14 times	14 times
Escherichia coli	14 times	14 times	14 times	14 times	14 times	14 times
Fecal Coliform	14 times	14 times	14 times	14 times	14 times	14 times
Dissolved Oxygen	14 times	14 times	14 times	14 times	14 times	14 times
Oxygen Saturation	14 times	14 times	14 times	14 times	14 times	14 times
pH	14 times	14 times	14 times	14 times	14 times	14 times
Soluble Phosphorus	14 times	14 times	14 times	14 times	14 times	14 times
Temperature	14 times	14 times	14 times	14 times	14 times	14 times
Total Kjeldahl Nitrogen	14 times	14 times	14 times	14 times	14 times	14 times
Total Nitrogen	14 times	14 times	14 times	14 times	14 times	14 times
Ammonia Nitrogen	14 times	14 times	14 times	14 times	14 times	14 times
Nitrate Nitrogen	14 times	14 times	14 times	14 times	14 times	14 times
Total Organic Carbon	14 times	14 times	14 times	14 times	14 times	14 times
Total Phosphorus	14 times	14 times	14 times	14 times	14 times	14 times
Total Solids	14 times	14 times	14 times	14 times	14 times	14 times
Total Suspended Solids	14 times	14 times	14 times	14 times	14 times	14 times
Turbidity	14 times	14 times	14 times	14 times	14 times	14 times

Table 11.Sampling frequency of surface water quality monitoring activities on tributaries to the Red River within Manitoba, Canada over the period October 1, 2009 to September 30, 2010.

Parameter	Units	Boyne River PTH 13, Carman	La Salle River At La Barriere Park Dam	La Salle River At town of La Salle	Rat River PR 303 near Otterborne	Roseau River PR 200, near Dominion City	Seine River PTH 100 (Perimeter Highway)	Seine River South East of Ste. Anne
2,4,5-TP	ug/L	3	2	1	3	3	3	3
2,4-DB	ug/L	3	2	1	3	3	3	3
2,4-D	ug/L	3	2	1	3	3	3	3
ALACHLOR	ug/L	3	2	1	3	3	3	3
ALKALINITY CO3	mg/L	3	2	1	3	3	3	3
ALKALINITY OH	mg/L	3	2	1	3	3	3	3
ALKALINITY TOTAL CACO3	mg/L	3	2	1	3	3	3	3
ALKALINITY TOTAL HCO3	mg/L	3	2	1	3	3	3	3
ALUMINUM DISSOLVED	mg/L	3	2	1	3	3	3	3
ALUMINUM TOTAL	mg/L	9	6	3	9	9	9	3
AMMONIA DISSOLVED	mg/L	9	6	3	9	9	9	3
AMPA(AMINOMETHYLPHOSPHONIC ACID)	ug/L	3	2	1	3	3	3	3
ANTIMONY TOTAL	mg/L	9	6	3	9	9	9	3
ARSENIC TOTAL	mg/L	9	6	3	9	9	9	3
ATRAZINE DESETHYL	ug/L	3	2	1	3	3	3	3
ATRAZINE	ug/L	3	2	1	3	3	3	3
AZINPHOS METHYL	ug/L	3	2	1	3	3	3	3
BARIUM TOTAL	mg/L	9	6	3	9	9	9	3
BENOMYL	ug/L							
BERYLLIUM TOTAL	mg/L	9	6	3	9	9	9	3
BISMUTH TOTAL	mg/L	9	6	3	9	9	9	3
BORON TOTAL	mg/L	9	6	3	9	9	9	3
BROMACIL	ug/L	3	2	1	3	3	3	3
BROMOXYNIL	ug/L	3	2	1	3	3	3	3
CADMIUM TOTAL	mg/L	9	6	3	9	9	9	3
CALCIUM TOTAL	mg/L	9	6	3	9	9	9	3
CAPTAN	ug/L	3	2	1	3	3	3	3
CARBOFURAN	ug/L	3	2	1	3	3	3	3
CARBON TOTAL INORGANIC	mg/L	9	6	3	9	9	9	3
CARBON TOTAL ORGANIC	mg/L	9	6	3	9	9	9	3
CARBON TOTAL ORGANIC (TOC)	mg/L	9	6	3	9	9	9	3
CARBON TOTAL	mg/L	9	6	3	9	9	9	3
CARBOXIN (CARBATHIN)	ug/L	3	2	1	3	3	3	3
CESIUM TOTAL	mg/L	9	6	3	9	9	9	3
CHLORDANE-CIS	ug/L	3	2	1	3	3	3	3
CHLORDANE-TRANS	ug/L	3	2	1	3	3	3	3
CHLORIDE DISSOLVED	mg/L							
CHLOROPHYLL A	ug/L	9	6	3	9	9	9	3
CHLOROTHALONIL	ug/L	3	2	1	3	3	3	3
CHLORPYRIFOS-ETHYL (DURSBAN)	ug/L	3	2	1	3	3	3	3
CHROMIUM HEXAVALENT DISSOLVED	mg/L							
CHROMIUM TOTAL (CR)	mg/L	9	6	3	9	9	9	3
COBALT TOTAL	mg/L	9	6	3	9	9	9	3
COLOUR TRUE	CU							
CONDUCTIVITY (AT 25C)	uS/cm	9	6	3	9	9	9	3
COPPER TOTAL (CU)	mg/L	9	6	3	9	9	9	3
CYANAZINE	ug/L	3	2	1	3	3	3	3

Table 11.Sampling frequency of surface water quality monitoring activities on tributaries to the Red River within Manitoba, Canada over the period October 1, 2009 to September 30, 2010 (continued…)

Parameter	Units	Boyne River PTH 13, Carman	La Salle River At La Barriere Park Dam	La Salle River At town of La Salle	Rat River PR 303 near Otterborne	Roseau River PR 200, near Dominion City	Seine River PTH 100 (Perimeter Highway)	Seine River South East of Ste. Anne
DELTAMETHRIN	ug/L	3	2	1	3	3	3	3
DIAZINON	ug/L	3	2	1	3	3	3	3
DICAMBA (BANVEL)	ug/L	3	2	1	3	3	3	3
DICHLOROPROP(2,4-DP)	ug/L	3	2	1	3	3	3	3
DICLOFOP-METHYL	ug/L	3	2	1	3	3	3	3
DIMETHOATE (CYGON)	ug/L	3	2	1	3	3	3	3
DINOSEB	ug/L	3	2	1	3	3	3	3
DIURON (DCMBU)	ug/L	3	2	1	3	3	3	3
DIURON	ug/L	3	2	1	3	3	3	3
EPTAM	ug/L	3	2	1	3	3	3	3
ESCHERICHIA, COLI	CFU/100 mL	12	5	7	13	13	12	4
ETHALFLURALIN (EDGE)	ug/L	3	2	1	3	3	3	3
FENOXAPROP	ug/L	3	2	1	3	3	3	3
GAMMA-BENZENEHEXACHLORIDE (LINDANE)	ug/L	3	2	1	3	3	3	3
GLYPHOSATE (ROUNDUP)	ug/L	3	2	1	3	3	3	3
HARDNESS TOTAL CACO3	mg/L	9	6	3	9	9	9	3
IMAZAMETHABENZ-ME	ng/L	3	2	1	3	3	3	3
IMAZAMETHABENZ-METHYL	ug/L	3	2	1	3	3	3	3
IRON TOTAL (FE)	mg/L	9	6	3	9	9	9	3
LEAD TOTAL	mg/L	9	6	3	9	9	9	3
LITHIUM TOTAL	mg/L	9	6	3	9	9	9	3
MAGNESIUM TOTAL	mg/L	9	6	3	9	9	9	3
MALATHION	ug/L	3	2	1	3	3	3	3
MANGANESE TOTAL (MN)	mg/L	9	6	3	9	9	9	3
MCPA	ug/L	3	2	1	3	3	3	3
MCPP (MECOPROP)	ug/L	3	2	1	3	3	3	3
METASULFURON-ME	ng/L	3	2	1	3	3	3	3
METHOXYCHLOR (P,P'-METHOXYCHLOR)_	ug/L	3	2	1	3	3	3	3
METRIBUZIN	ug/L	3	2	1	3	3	3	3
METSULFURON-METHYL	ug/L	3	2	1	3	3	3	3
MOLYBDENUM TOTAL	mg/L	9	6	3	9	9	9	3
NICKEL TOTAL	mg/L	9	6	3	9	9	9	3
NITROGEN DISSOLVED NO3 & NO2	mg/L	9	6	3	9	9	9	3
NITROGEN TOTAL KJELDAHL (TKN)	mg/L	9	6	3	9	9	9	3
OXYGEN BIOCHEMICAL DEMAND	mg/L	9	6	3	9	9	9	3
OXYGEN DISSOLVED	mg/L	3	2	1	3	3	3	3
PARATHION ETHYL	ug/L	3	2	1	3	3	3	3
PARATHION METHYL	ug/L	3	2	1	3	3	3	3
PENTACHLOROPHENOL	ug/L	3	2	1	3	3	3	3
PHEOPHYTIN A	ug/L	9	6	3	9	9	9	3
PHOSPHOROUS-ACID HYDROLYZABLE	mg/L	9	6	3	9	9	9	3
PHOSPHOROUS-TOTAL-ORTHO	mg/L	9	6	3	9	9	9	3
PHOSPHORUS DISSOLVED ORTHO	mg/L	9	6	3	9	9	9	3
PHOSPHORUS PARTICULATE	mg/L	9	6	3	9	9	9	3
PHOSPHORUS TOTAL (METALS SCAN)	mg/L	9	6	3	9	9	9	3
PHOSPHORUS TOTAL (P)	mg/L	9	6	3	9	9	9	3

Table 11.Sampling frequency of surface water quality monitoring activities on tributaries to the Red River within Manitoba, Canada over the period October 1, 2009 to September 30, 2010 (continued…)

Parameter	Units	Boyne River PTH 13, Carman	La Salle River At La Barriere Park Dam	La Salle River At town of La Salle	Rat River PR 303 near Otterborne	Roseau River PR 200, near Dominion City	Seine River PTH 100 (Perimeter Highway)	Seine River South East of Ste. Anne
PHOSPHORUS TOTAL DISSOLVED	mg/L	9	6	3	9	9	9	3
PHOSPHORUS TOTAL INORGANIC	mg/L	9	6	3	9	9	9	3
pH	pH units	9	6	3	9	9	9	3
PICLORAM (TORDON)	ug/L	3	2	1	3	3	3	3
POTASSIUM TOTAL	mg/L	9	6	3	9	9	9	3
PROPACHLOR	ug/L	3	2	1	3	3	3	3
PROPANIL	ug/L	3	2	1	3	3	3	3
PROPOXUR	ug/L	3	2	1	3	3	3	3
QUIZALOFOP	ug/L	3	2	1	3	3	3	3
RUBIDIUM TOTAL	mg/L	9	6	3	9	9	9	3
SELENIUM TOTAL	mg/L	9	6	3	9	9	9	3
SETHOXYDIM	ug/L	3	2	1	3	3	3	3
SILICON TOTAL	mg/L	9	6	3	9	9	9	3
SILVER TOTAL	mg/L	9	6	3	9	9	9	3
SIMAZINE	ug/L	3	2	1	3	3	3	3
SODIUM TOTAL	mg/L	9	6	3	9	9	9	3
STRONTIUM TOTAL	mg/L	9	6	3	9	9	9	3
SULPHATE DISSOLVED	mg/L	3	2	1	3	3	3	3
TEBUTHIURON	ug/L	3	2	1	3	3	3	3
TELLURIUM TOTAL	mg/L	9	6	3	9	9	9	3
TERBUFOS	ug/L	3	2	1	3	3	3	3
THALLIUM TOTAL	mg/L	9	6	3	9	9	9	3
THIFENSULFURON METHYL	ug/L	3	2	1	3	3	3	3
THIFENSULFURON-ME	ng/L	3	2	1	3	3	3	3
THORIUM TOTAL	mg/L	9	6	3	9	9	9	3
TIN TOTAL	mg/L	9	6	3	9	9	9	3
TITANIUM TOTAL	mg/L	9	6	3	9	9	9	3
TOTAL DISSOLVED SOLIDS	@180C	3	2	1	3	3	3	3
TOTAL SUSPENDED SOLIDS	mg/L	9	6	3	9	9	9	3
TRALKOXYDIM	ug/L	3	2	1	3	3	3	3
TRIALLATE (AVADEXBW)	ug/L	3	2	1	3	3	3	3
TRIBENURON METHYL	ug/L	3	2	1	3	3	3	3
TRIBENURON	ng/L	3	2	1	3	3	3	3
TRICLOPYR	ug/L	3	2	1	3	3	3	3
TRIFLURALIN(TREFLAN)	ug/L	3	2	1	3	3	3	3
TUNGSTEN TOTAL	mg/L	9	6	3	9	9	9	3
TURBIDITY	Ntu	9	6	3	9	9	9	3
URANIUM TOTAL	mg/L	9	6	3	9	9	9	3
VANADIUM TOTAL	mg/L	9	6	3	9	9	9	3
ZINC TOTAL (ZN)	mg/L	9	6	3	9	9	9	3
ZIRCONIUM TOTAL	mg/L	9	6	3	9	9	9	3

7.0 WATER POLLUTION CONTROL

7.01 Contingency Plan

In January 1981 a contingency plan was developed by the former International Red River Pollution Board. The purpose of the plan, which had been adopted by the IRRB, is to ensure that positive coordinated action is taken to minimize public health hazards and environmental damage in the event of a spill. This plan does not supersede any local or national contingency plans in existence but rather serves to coordinate these activities. The plan becomes effective wherever the discharge of a pollutant within the Red River basin has the potential to adversely impact the Red River. The plan also becomes effective at any time when exceedences of either water quality objectives or alert levels as described in Chapter 5 are observed at the international boundary. A current list of contacts and telephone numbers associated with the contingency plan is included in Appendix C.

The contingency plan, presently finalized, is available from the IRRB Secretariat.

7.02 Spills and Releases

Minnesota

Thirteen Minnesota wastewater treatment facilities reported 18 spills or bypasses in Water Year 2010. Of these releases, sixteen occurred at municipal wastewater treatment facilities, one major wastewater treatment and one industrial facility, during snowmelt or rain events in March, May and September. The remaining two spills were due to accidents. All cases were closed without enforcement action.

Feedlots

There are 2000 registered feedlots in the Red River Basin, of varying sizes and animal types. The greatest number is in Ottertail, Becker and Clay counties. Of these, ten facilities had permit actions in water year 2010. All cases are closed or moving towards closure.

Stormwater

For the water year 2010, 165 construction storm water permits were issued by MPCA for the 22 counties of northwestern Minnesota. These permits are required for any activity disturbing more than one acre of land.

North Dakota

The North Dakota Pollutant Discharge Elimination System (NDPDES) program requires all permitted facilities (industrial and municipal) to report wastewater spills and by-passes. During this reporting period (October 1, 2009 through September 30, 2010), there were 22 spills/releases reported to the department in the Red River basin in North Dakota. The spills/releases were related to pipe break/mechanical failure and lift station problems (overflows/bypasses) due to localized flooding and excessive precipitation. The facilities followed the reporting requirements of their permit. The spills/releases were followed up by department staff and all actions were resolved. Formal enforcement was not required based on the findings of the department.

Manitoba

Three municipalities with populations greater than 1,000 discharge treated effluents directly to the Red River within Manitoba. The Town of Morris discharges for a short period of time each spring and fall, while the City of Winnipeg's South End and North End Water Pollution Control Centres and the Town of Selkirk discharge continuously. Volumes and quality of effluent have not changed significantly from previous years. In addition to the two major wastewater treatment facilities within the City of Winnipeg, discharges also occur from 21 private wastewater treatment plants, 79 combined sewer outfalls, and 90 major land drainage outfalls. Most tributary streams also receive treated wastewater effluents from nearby communities.

Manitoba Water Stewardship tracks incidents that have the potential to impact water quality in Lake Winnipeg on the Department web site at www.manitoba.ca/lakewinnipeg. Five incidents occurred in the Red River watershed during the reporting period involving the discharge of partially treated wastewater effluent to the Red River or tributaries. All five incidents occurred within the City of Winnipeg. Three of the incidents involved water main breaks that caused a large volume of drinking water to drain to a combined sewer which subsequently overflowed to the Red River. The fourth incident involved a partial blockage in a sewer line that caused a combined sewage discharge into the Assiniboine River. The fifth incident involved a collapse in a portion of the sewer line that caused excess wastewater to be diverted to the Red River. In each incident, wastewater discharge rates were low and/or dilution with drinking water was high. No water quality impacts to the Red River were expected from these incidents.

7.03 Pollution Abatement and Advisories

North Dakota

Point Source Control Program

The department regulates the release of wastewater and stormwater from point sources into waters of the state through permits issued through the NDPDES Program. Permitted municipal and industrial point source dischargers must meet technology or water quality based effluent limits. In addition, all major municipal and industrial permittees must monitor their discharge for whole effluent toxicity (WET) on a regular basis.

Toxic pollutants in wastewater discharges are regulated through the industrial pretreatment program which is administered by the NDPDES Program. The cities of Grand Forks, Fargo, and West Fargo all have approved pretreatment programs within the Red River basin in North Dakota.

There are presently 154 facilities with a NDPDES Program permit in the Red River basin. Of these, there are 31 industrial wastewater permits and 123 domestic/municipal wastewater permits. A majority of the domestic/municipal wastewater permits are for small lagoon systems which typically discharge 2-3 times a year for a period of a few days to a few weeks.

Stormwater

The NDPDES Program permits stormwater discharges from industrial sites, construction sites and larger municipalities (termed MS4s). The cities of Grand Forks, Fargo, West Fargo and their urbanized area continue to implement their MS4 permits within the Red River basin in North Dakota.

A majority of the construction stormwater permitting in North Dakota is in the eastern part of the state which is part of the Red River basin. There are 584 stormwater permits for construction activity and 162 industrial stormwater permits in the Red River basin in North Dakota.

Animal Feeding Operations (AFOs)

The NDPDES Program continues to regulate animal feeding operations (AFOs) in the North Dakota. All large (>1000 animal units) permitted confined animal feeding operations (CAFOs) are inspected annually; whereas medium and small AFOs are inspected on an as-needed basis. There are 189 AFOs permitted by the department in the Red River basin. Of these, there are 27 designated as large CAFOs.

Nonpoint Source Pollution Management Program

The department's Division of Water Quality is responsible for administering the Clean Water Act Section 319 Nonpoint Source Pollution Management Program (NPS Program) in North Dakota. Section 319 of the Clean Water Act and guidance provided by EPA defines the scope of the NPS Program, while the department administers the program with input from the North Dakota Nonpoint Source Pollution Task Force. The task force is comprised of representatives from state and federal natural resource agencies, commodity/producer groups, tribal councils and private wildlife/natural resource organizations.

Each year, federal funds are appropriated by the U.S. Congress to EPA for NPS pollution management. These "Section 319 funds" are then made available to individual states based on an allocation formula. In North Dakota, funds are awarded to project sponsors (e.g., soil conservation districts, water resource boards, cities, state agencies, universities, resource conservation and development councils, non-profit organizations) to implement a variety of NPS pollution education, assessment and NPS pollution abatement projects. Approved local projects receive 60 percent federal funds with a 40 percent local match requirement.

Through the NPS Program, the department is currently cost-sharing a variety of NPS watershed assessment and NPS pollution abatement projects in the Red River basin. A map depicting the location of these projects in the Red River basin is provided in Figure 2. The following is a short summary of these projects.

- The Richland County SCD recently received Phase II funding for the Antelope Creek watershed implementation project. The primary goal of the project is to restore the recreational uses of the impaired reaches of Antelope Creek and the Wild Rice River to fully supporting status. As a secondary goal, the project will also protect and enhance the aquatic life use of Antelope Creek and the Wild Rice River through targeted implementation of best management practices (BMPs) within or immediately adjacent to the riparian corridor. These goals will be accomplished through comprehensive conservation planning, BMP implementation, and public education.

- The Barnes County SCD has recently received Phase II funding for a NPS pollution abatement project on the Sheyenne River below Baldhill Dam (Lake Ashtabula). The Barnes County Sheyenne River Watershed Phase II Project is designed to provide technical, financial and educational assistance to all agriculture producers and landowners with riparian acreage within the county. The goal of the project is to restore and maintain the recreational and aquatic uses of the Sheyenne River and its tributaries in Barnes County. Project sponsors intend to: 1) provide technical and financial assistance to producers and landowners within ½ mile of the Sheyenne River and its tributaries and to priority locations outside this corridor; 2) assist with BMPs that protect/enhance our riparian areas; 3) develop

educational programs to heighten public awareness of NPS pollution impacts and solutions; and 4) develop working partnerships in the local community to benefit natural resources.

- The Ransom County SCD is in the second year of a watershed restoration and NPS pollution abatement project for Dead Colt Creek Dam. The main goal of this project is to implement the nutrient, sediment and dissolved oxygen TMDLs for Dead Colt Creek Dam which were finalized in 2006. Implementation of these TMDLs will restore the recreational and aquatic uses of Dead Colt Creek Dam. The recreational and aquatic uses can be restored by reducing the sediment/nutrient loads from 12,614 acres of targeted crop, pasture and rangeland in the watershed. These goals will be accomplished by providing financial and technical assistance for conservation planning, BMP implementation and promoting a strong informational/educational (I/E) program. The I/E program will focus on providing farmers and ranchers information on the causes and effects of NPS pollution and ways to reduce or eliminate NPS pollution.

- The Cass County SCD has recently received Section 319 funding for a watershed implementation project for the Rush River and Brewer Lake watersheds. As part of the watershed implementation project, the Cass County SCD will promote the implementation of agricultural BMPs, which will result in the improvement of the designates uses of the Rush River and Brewer Lake, including fish and other aquatic biota, and recreation, while creating measurable reductions in the concentrations of known pollutants (nitrates, phosphorus, and fecal coliform bacteria) throughout the Rush River and Brewer Lake watersheds.

- The Cass County SCD has also received Section 319 funding for the Maple River watershed implementation project. The sponsors will promote the implementation of agricultural BMPs to improve of the designated uses of the Maple River, which includes fish and other aquatic biota, and recreation, while creating measurable reductions in the concentrations of known pollutants (nitrates, phosphorus, and fecal coliform bacteria) throughout the Maple River watershed. The project will provide technical and financial support for comprehensive conservation planning, BMP implementation, monitoring and assessment, and information and education programs in the highest priority sub-watersheds in terms of NPS pollution loadings to the Maple River.

- The Red River Riparian Project has recently received Section 319 funding for its Phase IV project aimed at stream and riparian area protection and restoration in the lower Red River basin. The first goal of this program will be to provide information and education for riparian management and restoration techniques to landowners, communities, water resource districts and soil conservation districts within targeted high priority watersheds in the Upper Red River basin in North Dakota. Financial assistance will be provided to landowners at selected sites to demonstrate effective riparian forest management in order to protect and sustain proper functioning condition and long-term measurable improvements in the health of the river system. In addition, trials will be established for riparian range/forestry management, and possible recommendations will be developed to enhance natural reforestation of riparian areas; there will be an outreach effort for proper management of riparian areas within an urban setting; and there will be an inventory of riparian forest to estimate the percentage of ash and predict the possible impacts from an Emerald Ash Borer infestation. The final three years will be implementation of riparian treatments including bio-engineering and management in targeted watersheds.

- The East and West Grand Forks County SCDs recently completed a two year water quality and watershed assessment project on the lower Turtle River in Grand Forks County and Larimore Dam. Based on this assessment, the project sponsors are now implementing the Turtle River/Larimore Dam Watershed Restoration Project. The primary goal of the project is the restoration of the recreational and aquatic life uses of the Turtle River and Larimore Dam reservoir through the implementation of BMPs. For priority areas within the Turtle River watershed, the project will focus on the implementation of BMP's that will reduce concentrations and loadings of phosphorus, nitrogen, and fecal coliform bacteria. Additional BMPs will also be implemented to improve riparian conditions along the Turtle River and its tributaries. As a secondary focus, BMPs which contribute to a reduction in the levels of cadmium, selenium, chloride, and arsenic, which occur naturally, will be given special consideration.

- The Wild Rice SCD in Sargent County continues to implement its Section 319 Watershed Restoration project on the upper Wild Rice River and its tributaries. The Wild Rice SCD's primary goal, through the course of the project is to promote and implement agricultural BMPs that will reduce or prevent sediment and nutrient loadings to the Wild Rice River and its tributaries. The watershed project will provide technical and financial support for comprehensive conservation planning and BMP implementation in three of the highest priority ranked tributaries in terms of NPS pollution loadings to the upper Wild Rice River and its tributaries.

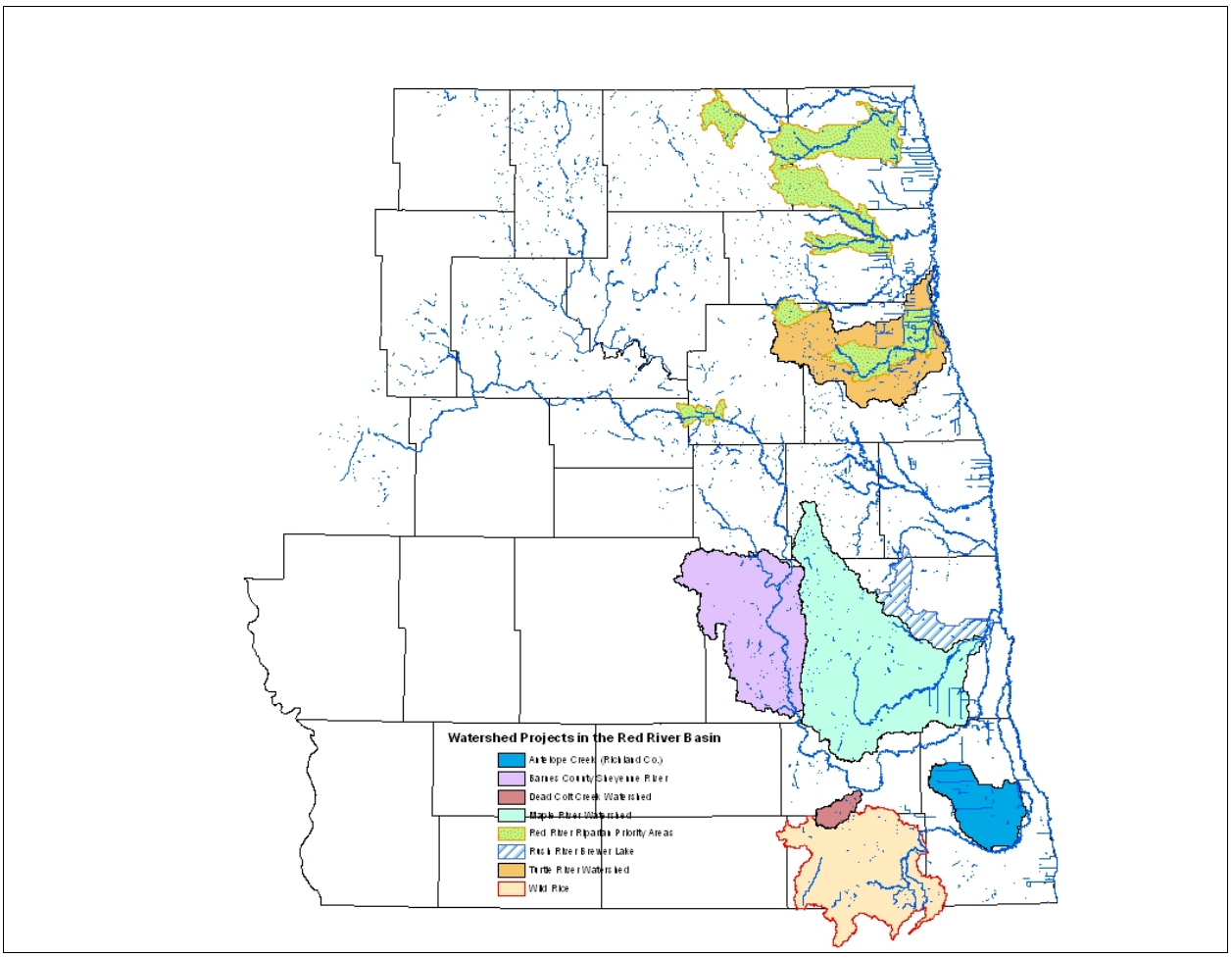

Figure 3 Watershed Restoration and Abatement Project in the Red River basin, North Dakota.

Manitoba

Manitoba Water Quality Standards, Objectives, and Guidelines are applicable to streams within the Red River basin. In addition, site-specific water quality objectives have been established for the Red River within and downstream of the City of Winnipeg. Water uses protected in the Red River include domestic water supply source, habitat for aquatic life and wildlife, industrial uses, irrigation, livestock watering, and water-related recreation. Manitoba intends to enshrine the Manitoba Water Quality Standards, Objectives, and Guidelines into legislation under *The Water Protection Act*.

Treated municipal effluents discharged to tributary streams within the Red River basin in Manitoba are licensed under Manitoba's *Environment Act*. Disinfection with ultra-violet light technology has been installed and is operational at the City of Winnipeg's South and North End Water Pollution Control Centres. In August 2004, the City of Winnipeg introduced a web-based system to inform the public whenever there is likely to be a sewer overflow into the Red or Assiniboine Rivers (http://winnipeg.ca/waterandwaste/sewage/overflow/previous24.stm).

Notification Regarding Intensive Livestock Operations

During the reporting period, Manitoba was not notified of any intensive livestock operations proposing to locate near the international border on the North Dakota or Minnesota side. Similarly, in Manitoba, no intensive livestock proposals were proposed near the international border.

8.0 BIOLOGICAL MONITORING IN THE RED RIVER BASIN

8.01 Fisheries of the Red River in Manitoba

Biological Information

A total of 67 fish species have been recorded in the Manitoba's portion of the Red River (Table 12). Presently, Bigmouth Buffalo (*Ictiobus cyprinellus)*, Chestnut Lamprey (*Ichtyomyzon unicuspis*) and Silver Chub (*Macrhboposis storeriana*) are designated as Special Concern under *The Species at Risk Act.* In 2005, Lake Sturgeon (*Acipenser fulvescens)* were recommended for listing as Endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). This species may be listed under the Species at Risk Act in 2011/2012.

Known aquatic invasive species that have been introduced in the Manitoba portion of the Red River include the Common Carp (*Cyprinus carpio)*, White Bass (*Morone chrysops)*, Rainbow Smelt (*Osmerus mordax)* and Asian Carp Tapeworm (*Bothriocephalus acheilognathi)*. Other recent introductions into the Manitoba portion of the Red River include Feral Gold Fish (*Carassius auratus)*, Smallmouth Bass *(Micropterus dolomieu)* and Largemouth Bass *(Micropterus salmoides).*

In June 2010, a zebra mussel veliger (*Dreissena polymorpha*) was confirmed from the Kidder Dam in the Red River near Wahpaton, North Dakota. This follows the discovery of zebra mussels in 2009 from Pelican Lake, Minnesota. Pelican Lake forms part of the upstream chain of connected waterways within the Red River watershed and this discovery was the first occurrence of this aquatic invader in the Red River watershed. Consequently, Manitoba Water Stewardship in cooperation with Environment Canada continued to collect weekly water samples during the spring and summer of 2010 for the presence of zebra mussel veligers (larval zebra mussels) in the Red River at Emerson. No veligers were found.

A number of new initiatives were put into place by the Aquatic Invasive Species Task Group under the Canada-Manitoba Fisheries Advisory Board with the goal of establishing collaborative programs for preventing aquatic invasive species from entering Manitoba. These preventative measures were aimed at popular fishing and boating destinations including the Red River corridor. Inspections of trailered watercraft at the international border crossings of Emerson and Sprague were conducted during 2010. Navigational buoys and supporting equipment deployed in the Red River were inspected for aquatic invasive species in the fall of 2010 with none being found.

In conjunction with expansion of the Red River Floodway, studies have been completed with regard to fish movements, fish passage, and fish abundance in the Red River upstream and downstream of the floodway inlet control structure. Under the direction of the Manitoba Floodway Authority, consultants under took an acoustic telemetry study of fish movements in relation to the floodway inlet control structure. Channel Catfish (*Ictalurus punctatus*), Northern Pike (*Esox lucius*), Walleye (*Sander vitreus*), and Sauger (*Sander canadensis*) were tagged with tracking devices. Study results at the floodway control structure indicates successful upstream passage of tagged fish during the spring, summer, fall and winter periods when the floodway control structure is not in operation. However, fish passage is impeded during the spring freshet and high summer flows when the control structure is in operation.

Large fish species collected at the floodway control structure for the abundance study have included Bigmouth Buffalo, Brown Bullhead (*Ameiurus nebulosus*), Common Carp, Freshwater Drum (*Aplodinotus grunniens*), Goldeye (*Hiodon alosoides*), Lake Sturgeon, Northern Pike, Quillback Sucker (*Carpiodes cyprinus*), Shorthead Redhorse Sucker (*Moxostoma macrolepidotum*), Silver Redhorse Sucker (*Moxostoma anisurum*), White Sucker (*Catostomus commersoni*), Stonecat (*Noturus flavus*), Walleye, Sauger, and Channel Catfish. Results showed that catches were greater downstream of the control structure than upstream of it however, this observation may have been related to seasonal changes in abundance. Condition factors of the fish collected appeared to be similar. Preliminary results from this study also suggest upstream movement of fish is blocked by operation of the gates during high water flows.

Work continues on a habitat compensation plan to mitigate harmful alteration and destruction to fish habitat due to the Red River Floodway expansion project. Some of the initial compensation projects being considered include fish habitat enhancement work on Red River tributaries (Seine River, La Salle River, Sturgeon Creek, and Normand Creek) which are in close proximity to the Red River Floodway.

An instream flow study has been undertaken on the Assiniboine River (a major tributary of the Red River). The objective of this study is to develop appropriate instream flow recommendations to ensure healthy and sustainable aquatic ecosystem functions. A draft report on the study was submitted for review in 2008 and a final report draft is expected in 2011/12.

The Instream Flow program within Manitoba Fisheries Branch continued coordination efforts on some of its activities with a committee from Fisheries and Oceans Canada. The intention of this collaboration was to seek intellectual partnerships that could promote the development of instream flow needs assessments within Manitoba. One project coming out of this collaboration concerned the International Joint Commission which had requested instream flow work to commence on the Red River through the International Red River Board. This request sought to understand the environmental impacts of apportionment agreements for the Red River. Up until this point, work had begun on the hydrology of the system but it had not been clear how these hydrological assessments would be linked to the environmental impact of the river's changed hydrology over time. As such, the Provincial Instream Flow Biologist was consulted to explain conceptual and methodological linkages between the hydrology and the other aspects of the instream flow needs approach as a method for determining "environmental flows". Currently, work on the Red River has remained focused on understanding its hydrology, after which it is proposed that linkages to other instream flow needs aspects will commence.

Recreational Angling - Value

The Manitoba portion of the Red River has become internationally known for the high quality of angling the fishery supports. Based on Manitoba's 2005 Angler Survey, Manitobans and visitors to the province fished a total of 2.6 million days of which 10% were spent on the Red River making it the most heavily fished area in the province. It is estimated that anglers fishing the Red River contribute $15-20 million annually on goods and services directly/indirectly related to angling. In 2010, Manitoba will again be participating in a National Recreational Angling Survey. These surveys remain the only source of harvest and economic information related to recreational fishing in Canada. The 2010 survey will provide vital information on recreational fishing activities on the Red River.

The fishery attracts nonresidents to trophy walleye and channel catfish angling opportunities. Furthermore, the diverse fish species composition appeals to residents of all ages. From an angling perspective, the fishery is managed to: 1) ensure sustainability of the recreational fishery for future generations, 2) encourage angler participation and development of the recreational fishing potential of the river, and 3) maximize economic returns to angling interests who rely on the fishery for their lively hood.

The majority of angling effort occurs between the floodway gate structure at St. Norbert to the mouth of the river at Lake Winnipeg during the open water season. Angling is especially concentrated from the dam at Lockport downstream to Netley Creek and within the City of Winnipeg.

Angling in Winnipeg has become more popular with anglers over the past 10 years due to the work conducted by Winnipeg's Urban Angling Partnership (UAP - private sector and government partnership). There are a number of issues that have affected users of this fishery and the UAP has been working towards addressing as many as possible. These include, but not restricted to, water quality concerns, fish consumption (i.e., safety) and access to the fishery due to fluctuating water levels particularly in within the City of Winnipeg.

Table 12. Fish species of the Red River in Manitoba.

Common Name	Genus	Species	Presence	Common Name	Genus	Species	Presence
Banded Killifish	Fundulus	diaphanus	Rare	Largemouth Bass +	Micropterus	salmoides	Uncommon
Bigmouth Buffalo *	Ictiobus	cyprinellus	Common	Logperch	Percina	caprodes	Common
Bigmouth Shiner	Notropis	dorsalis	Unknown	Longnose Dace	Rhinichthys	cataractae	Unknown
Black Bullhead	Ameiurus	melas	Common	Longnose Sucker	Catostomus	catostomus	Common
Black Crappie	Pomoxis	nigromaculatus	Common	Mimic Shiner	Notropis	volucellus	Unknown
Blackchin Shiner	Notropis	heterodon	Unknown	Mooneye	Hiodon	tergisus	Rare
Blacknose Shiner	Notropis	heterolepis	Unknown	Ninespine Stickleback	Pungitius	pungitius	Common
Blackside Darter	Percina	maculata	Unknown	Northern Pike	Esox	lucius	Common
Bluntnose Minnow	Pimephales	notatus	Unknown	Pearl Dace	Margariscus	margarita	Unknown
Brassy Minnow	Hybognathus	hankinsoni	Unknown	Quillback	Carpiodes	cyprinus	Uncommon
Brook Stickleback	Culaea	inconstans	Common	Rainbow Smelt +	Osmerus	mordax	Uncommon
Brown Bullhead	Ameiurus	nebulosus	Common	River Darter	Percina	shumardi	Common
Burbot	Lota	Lota	Common	River Shiner	Notropis	blennius	Unknown
Central Mudminnow	Umbra	Limi	Common	Rock Bass	Ambloplites	rupestris	Common
Channel Catfish	Ictalurus	punctatus	Common	Rosyface Shiner	Notropis	rubellus	Unknown
Chestnut Lamprey *	Ichthyomyzon	castaneus	Unknown	Sand Shiner	Notropis	stramineus	Uncommon
Cisco	Coregonus	artedi	Common	Sauger	Sander	canadensis	Common
Common Carp +	Cyprinus	carpio	Common	Shorthead Redhorse	Moxostoma	macrolepidotum	Common
Common Shiner	Luxilus	cornutus	Rare	Silver Chub *	Macrhybopsis	storeriana	Common
Creek Chub	Semotilus	atromaculatus	Unknown	Silver Lamprey	Ichthyomyzon	unicuspis	Unknown
Emerald Shiner	Notropis	atherinoides	Abundant	Silver Redhorse	Moxostoma	anisurum	Common
Fathead Minnow	Pimephales	promelas	Common	Smallmouth Bass +	Micropterus	dolomieu	Unknown
Flathead Chub	Platygobio	gracilis	Unknown	Spotfin Shiner	Cyprinella	spiloptera	Unknown
Freshwater Drum	Aplodinotus	grunniens	Abundant	Spottail Shiner	Notropis	hudsonius	Common
Golden Redhorse	Moxostoma	erythrurum	Rare	Stonecat	Noturus	flavus	Unknown
Golden Shiner	Notemigonus	crysoleucas	Unknown	Tadpole Madtom	Noturus	gyrinus	Common
Goldeye	Hiodon	alosoides	Common	Troutperch	Percopsis	omiscomaycus	Common
Goldfish +	Carassius	auratus	Unknown	Walleye	Sander	vitreus	Common
Hornyhead Chub	Nocomis	biguttatus	Unknown	Western Blacknose Dace	Rhinichthys	obtusus	Unknown
Iowa Darter	Etheostoma	exile	Common	White Bass +	Morone	chrysops	Common
Johnny Darter	Etheostoma	nigrum	Common	White Crappie	Pomoxis	annularis	Unknown
Lake Chub	Couesius	plumbeus	Rare	White Sucker	Catostomus	commersoni	Common
Lake Whitefish	Coregonus	clupeaformis	Uncommon	Yellow Perch	Perca	flavescens	Common
Lake Sturgeon *	Acipenser	fulvescens	Rare				

Note: * = indicates species at risk, + = indicates introduced species

8.02 Assessment of Red River Basin Tributary Streams

During this reporting period, most water quality parameters in the tributaries to the Red River main stem remained relatively comparable to past years. Average dissolved oxygen concentrations were notably lower for some tributaries and ranged from 2.7 to 7.0 mg/L. At six tributaries, dissolved oxygen concentrations dropped below the minimum instantaneous dissolved oxygen objective at least once during the reporting year. Dissolved oxygen concentrations for the Seine River south of the perimeter highway were consistently below the instantaneous objective during the reporting year. Densities of *Escherichia coli* bacteria occasionally exceeded the Manitoba Water Quality Objective for the protection of recreation at the following Red River tributaries: Seine River at South Perimeter Highway (May and July), Seine River South East of Ste. Anne (May), La Salle River at La Salle (July), La Salle River at La Barriere Park (July), Rat River (May and July), Roseau River (May).

Nine pesticides were detected in samples collected from the five main tributaries to the Red River within Manitoba including 2-4-D, AMPA, atrazene, MCPA, glyphosate, thifensulfuron methyl, tribenuron methyl, dicamba, and bromoxynil. AMPA and dicamba was detected in the Seine, the La Salle and the Boyne Rivers in July 2010. Concentrations of dicamba exceeded the guideline developed by the Canadian Council of Ministers of the Environment for protection of irrigation uses. 2,4-D was detected on two occasions for the Boyne and Seine Rivers (October 2009 and July 2010), and once in the La Salle River (October 2009). MCPA was also detected once each in the La Salle and Seine River in July 2010 and twice for in the Boyne River (October 2009 and July 2010). Glyphosate was detected in all the tributaries in July 2010 and was also detected in the Boyne and La Salle Rivers in January 2010. Atrazene, bromoxynil, and thifensulfuron-ME were detected once during the reporting period at the La Salle River at La Salle in July 2010. Tribenuron-ME was detected in the Boyne, the Roseau, and La Salle Rivers in July 2010.

Other Red River Water Quality / Biota Issues

Beach Monitoring in Lake Winnipeg

Manitoba monitored eighteen recreational beaches within the south basin of Lake Winnipeg for densities of *Escherichia coli* during 2010 (Table 13). Sampling began in early May and continued weekly until late August. Two beaches were monitored daily to provide sufficient data in support of developing a real-time predictive model for *E. coli* levels. Bathing water, sand, and sand water near the shoreline were collected for densities of *E. coli*.

While some beaches occasionally exceeded Manitoba's recreational water quality guideline for fecal indicator bacteria, in general recreational water quality is excellent at Lake Winnipeg beaches. All beaches have a blue coloured "Clean Beaches" sign that provides information to bathers about *E. coli* and identifies precautions on how the bathing public can reduce risk of exposure to pathogens. For beaches that had *E. coli* densities above the guideline and that have a history of elevated densities, additional yellow coloured "Beach Advisory" signs were posted. Results of the DNA ribotyping from 2002 to 2007 indicated that approximately 34 per cent of *E. coli* from all samples could be attributed to shorebirds and geese, while less than 5 per cent of the samples could be attributed to human sources. Thirty seven per cent of the *E. coli* samples could not be matched to a particular animal source.

As part of the 2010 beach monitoring program, Manitoba Water Stewardship continued to monitor beaches on Lake Winnipeg for the presence of algae blooms. Relatively warm summer weather during 2010 led to numerous algal blooms being reported from a number of Manitoba waterbodies. On Lake Winnipeg, algae blooms were reported at Victoria Beach, Victoria Beach at the Red Cross Dock, Lester Beach, West Grand Beach, East Grand Beach, Sunset Beach, and Hillside Beach. Seven beaches on Lake Winnipeg were posted with the first level of algae advisory indicating the number of blue-green algae cells exceeded the proposed recreational water quality guideline of 100,000 cells per mL. The first level of algae advisory informs bathers that algae blooms have been observed at the beach and provides some additional advice to reduce risk and contact with the water when algae blooms are present. The second level of advisory or the algae toxin advisory, is posted when the concentration of the algal toxin microcystin-LR exceeds the proposed recreational water quality guideline of 20 ug/L. The advisory indicates that drinking, swimming or other contact with the water is not recommended. No beaches on Lake Winnipeg were posted with the second level of algae advisory in 2010.

Table 13. Recreational beaches in Lake Winnipeg south basin monitored in 2010.

Locations	*E. coli* in bathing water	Sand and Sand water Samples
Victoria Beach (2 sites)	Weekly	
Hillside Beach	Weekly	
Albert Beach	Weekly	
Lester Beach	Weekly	
East Grand Beach	Weekly	
West Grand Beach	Daily	Daily
Sunset Beach	Weekly	
Patricia Beach	Weekly	
Gull Harbour	Weekly	
Black Point	Weekly	
Grindstone Beach	Weekly	
Sandy Bar Beach	Weekly	
Hnasau Park Beach	Weekly	
Spruce Sands Beach	Weekly	
Gimli Beach	Daily	Daily
Sandy Hook Beach	Weekly	
Winnipeg Beach	Weekly	
Matlock Beach	Weekly	

Macro-invertebrates of the Red River in Manitoba

Benthic macroinvertebrates were collected at two locations on the Red River in September 2010: Emerson and Selkirk. At each location, three transects of five ponar dredge grab samples were collected. Starting at the east bank, samples were collected at five equidistant sample sites across the width of the river. Each ponar dredge covered an area of 0.05 m^2. For each transect, 0.25 m^2 of sediment was collected. The dredge samples were washed through a 500 µm Nitex nylon net. River water was

used to remove organisms and sediment from the nylon net into a 500 µm mesh sieve. Samples were then sieved to remove macroinvertebrates from the sediment matrix. Remaining sediment and all organisms were then placed in labelled 500 mL glass jars with 70 % ethyl alcohol preservative. Macroinvertebrates were subsequently identified to the lowest possible taxonomic level, typically genus and species, by ALS Laboratory Group, Winnipeg, Manitoba.

In 2010 at Emerson, both Transect #2 and #3, failed to collect 200 organisms in the five grab samples. Moving from downstream to upstream, 249 organisms were collected at Transect #1, 122 organisms at Transect #2, and 48 organisms were collected at Transect #3. To calculate organisms per square metre, the number of organisms at each transect was multiplied by a factor of four. Transects #1, #2, and #3 yielded 996, 488, and 192 organisms/m^2 , respectively (Table 14). The majority of the organisms in Transect #1 and # 2 were Hydopsychidae (order Trichoptera) a relatively pollution-tolerant caddis fly larvae. Transect #3 had the lowest density of organisms (192 organisms/m^2) and the greatest sample diversity (18 taxa). The species of greatest abundance at Transect #3 were pollution-tolerant aquatic worms Tubificidae (order Oligochaeta). The coordinates for all three Emerson transects are listed in Table 15.

In the Red River at Selkirk, Manitoba, all three transects failed to collect 200 organisms from the five grab samples. The macroinvertebrates collected at this site yielded 49 organisms at Transect #1, 199 organisms at Transect #2, and 55 organisms were collected at Transect #3. To calculate organisms per square metre, the number of organisms at each transect was multiplied by a factor of four. Respectively, Transects #1, #2, and #3 yielded 198, 796, and 220 organisms/m^2 (Table 16). Aquatic worms formed a larger proportion of the benthic organisms collected at the Selkirk location. The species of greatest abundance in all three transects were aquatic worms Tubificidae (order Oligochaeta). The coordinates for all three Selkirk transects are listed in Table 17.

During 2010, the invertebrate data at the Emerson location had the greatest number of organisms while the Selkirk location had the greatest diversity. The species dominating the six transects along the Red River were the pollution-tolerant aquatic worms Tubificidae.

Table 14 Summary of Micro-invertebrates collected per square meter in pooled Ponar @ dredge samples from three transects on the Red River at Emerson, Manitoba in September 2010.

Class	Order	Family	Genus	Species	Transect 1 Numbers / m^2	Transect 2 Numbers / m^2	Transect 3 Numbers / m^2
Annelida	Oligochaeta	Lumbriculidae			12	0	0
Annelida	Oligochaeta	Tubificidae	unidentified		100	16	84
Annelida	Oligochaeta	Lumbriculidae	*Lumbriculus*	sp.	0	0	4
Gastropoda			unidentified		4	0	0
Gastropoda	Basommatophora	Lymnaeidae	unidentified		0	0	4
Insecta	Coleoptera	Elmidae	*Stenelmis*	sp.	0	16	0
Insecta	Diptera	Chironomidae	*Polypedilum*	sp.	8	0	4
Insecta	Diptera	Chironomidae	*Orthocladinae*		0	0	4
Insecta	Diptera	Chironomidae	*Corynoneura*	sp.	0	0	4
Insecta	Diptera	Chironomidae	*Thienemannimyia*	sp.	0	0	4
Insecta	Diptera	Dolichopodidae			0	0	4
Insecta	Diptera	Empididae			4	0	0
Insecta	Diptera	Tipulidae	unidentifed		0	0	4
Insecta	Ephemeroptera		unidentified		0	4	4
Insecta	Ephemeroptera	*Caenidae*	*Caenis*	sp.	8	0	4
Insecta	Ephemeroptera	Heptageniidae	unidentifed		4	0	0
Insecta	Ephemeroptera	Heptageniidae	*Stenonema*	sp.	0	0	16
Insecta	Ephemeroptera	Baetidae	*Baetis*	sp.	0	0	4
Insecta	Ephemeroptera	Leptohyphidae	*Tricorythodes*	sp.	0	0	12
Insecta	Ephemeroptera	Polymitarcyidae	*Ephoron*	sp.	0	0	4
Insecta	Lepidoptera		unidentified		8	0	0
Insecta	Trichoptera	Hydropsychidae	unidentified		4	0	0
Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche*	sp.	380	88	0
Insecta	Trichoptera	Hydropsychidae	*Hydropsyche*	sp.	36	36	4
Insecta	Trichoptera	Hydropsychidae	*Potamyia*	*flava*	408	304	0
Insecta	Trichoptera	Leptoceridae	unidentified		0	4	0
Insecta	Trichoptera	Leptoceridae	*Nectopsyche*	sp.	0	0	16
Pelecypoda	Veneroida	Pisiidae	*Sphaerium*	sp.	0	16	0
Pelecypoda	Veneroida	Pisiidae	unidentified		20	0	12
Nematoda			unidentified		0	4	0
Total Number of Organisms / m2 :					**996**	**488**	**192**
Total Number of Taxa :					**12**	**10**	**18**

Table 15. Geographic coordinates for the three transects where benthic macroinvertebrates were sampled at Emerson, Manitoba in September 2010

Transect	Latitude	Longitude
1	49°00'23.4"	97°13'03.2"
2	49°00'13.6"	97°13'16.2"
3	49°00'01.2"	97°13'41.8"

Table 16. Summary of macro-invertebrates collected per square meter in pooled Ponar © dredge samples from three transects on the Red River at Selkirk, Manitoba in September 2010.

Class	Order	Family	Genus	Species	Transect 1 Numbers / m^2	Transect 2 Numbers / m^2	Transect 3 Numbers / m^2
Annelida	Oligochaeta	Tubificidae	unidentified		160	476	64
Annelida	Oligochaeta	Tubificidae	*Branchiura*	*sowerbyi*	0	12	8
Crustacea	Amphipoda	Hyalellidae	*Hyalella*	*azteca*	0	24	0
Crustacea	Copepoda	Calanoida			0	4	0
Crustacea	Ostracoda				0	8	4
Gastropoda			unidentified		0	8	4
Gastropoda	Neotaenioglossa	Hydrobiidae	*Amnicola*	*limosa*	0	16	4
Gastropoda	Prosobranchia	Valvatidae	*Valvata*	*sincera*	0	4	0
Insecta	Coleoptera		unidentified		0	4	0
Insecta	Coleoptera	Scirtidae	*Cyphon*	sp.	0	4	0
Insecta	Diptera	Ceratopogonidae			4	44	0
Insecta	Diptera	Chaoboridae	*Chaoborus*	sp.	0	4	0
Insecta	Diptera	Chironomidae			4	4	0
Insecta	Diptera	Chironomidae	*Ceolotanypus*	sp.	0	4	0
Insecta	Diptera	Chironomidae	*Cryptochironomus*	sp.	0	20	0
Insecta	Diptera	Chironomidae	*Demicryptochironomus*	sp.	0	4	0
Insecta	Ephemeroptera		*unidentified*		0	4	4
Insecta	Ephemeroptera	Caenidae	*Caenis*	sp.	0	8	4
Insecta	Ephemeroptera	Ephemeridae	*Hexagenia*	*limbata*	0	16	4
Insecta	Ephemeroptera	Ephemeridae	*Hexagenia*	sp.	4	0	0
Insecta	Ephemeroptera	Heptageniidae	*Stenonema*	sp.	0	4	8
Insecta	Ephemeroptera	Heptageniidae			0	4	12
Insecta	Ephemeroptera	Palingeniidae	*Pentagenia*	*vittegera*	4	0	0
Insecta	Hemiptera	Corixidae	unidentified		4	4	0
Insecta	Hemiptera	Corixidae	*Sigara*	*lineata*	0	16	0
Insecta	Anisoptera	Gomphidae	*Gomphus*	sp.	0	4	0
Insecta	Trichoptera	Hydropsychidae	*Cheumatopsyche*	sp.	4	0	36
Insecta	Trichoptera	Hydropsychidae	*Hydropsyche*	sp.	4	0	0
Insecta	Trichoptera	Hydropsychidae	*Potamyia*	sp.	0	0	36
Nematoda			unidentified		0	4	0
Pelecypoda			unidentified		0	0	4
Pelecypoda	Veneroida	Pisiidae	unidentified		0	4	0
Pelecypoda	Veneroida	Pisiidae	*Pisidium*	sp.	0	24	0
Pelecypoda	Veneroida	Pisiidae	*Sphaerium*	sp.	8	64	28
Total Number of Organisms / m2 :					**196**	**796**	**220**
Total Number of Taxa :					**9**	**28**	**14**

Table 17. Geographic coordinates for the three transects where benthic macroinvertebrates were sampled at Selkirk, Manitoba in September 2010.

Transect	Latitude	Longitude
1	50°09'10.7"	96°51'10.2"
2	50°08'55.7"	96°51'24.8"
3	50°08'37.2"	96°51'59.7"

Biological Sampling and Water Quality Sampling in Minnesota

The majority of the sites in the watershed design are termed biological (signified by red dots). A single water chemistry sample is taken at each of these sites during the sampling season. Fish are sampled through electro-shocking, and invertebrates are sampled with dip nets. Sites are placed at the nearest road crossing to the end of each minor watershed throughout the larger watershed to be able to assess the watershed for biology. Sampling does not take place in a minor watershed if a lake, wetland, or larger stream is within one mile of the planned site location.

Water Chemistry Sampling

At the mouth of each minor watershed, a water chemistry site is placed (signified by green dots). These sites are sampled for biology, along with additional water chemistry parameters. Sites are sampled ten times throughout the summer, and depending on the watershed, may be sampled for nitrates-nitrites, ammonia, dissolved oxygen, pH, conductivity, temperature, total phosphorus, Kjeldahl nitrogen, chlorides, sulfates, calcium, magnesium, total suspended solids, total volatile solids, E. coli, chlorophyll-a, pheophytin, and transparency data. E. coli data makes it possible to assess the stream for aquatic recreation, and dissolved oxygen, transparency, and suspended solids data makes it possible to assess the stream for aquatic life.

Fish Contaminants Sampling

At the pour point of each of the major watersheds, fish are collected for the analysis of contaminants (mercury and PCBs) to assess whether or not the surface water is meeting the beneficial use of aquatic consumption. Additional stream reaches within the watershed may also be sampled and analyzed, such as collecting trout for mercury testing in coldwater reaches. Mercury and PCB analysis will be conducted on fish tissue. Top carnivore species are particularly important for mercury analysis while rough fish species are important for PCB analysis. Species preferences for top carnivores are: walleye, northern pike, smallmouth bass, channel catfish, and bluegill. Species preferences for rough fish are: common carp, redhorse sucker, and white sucker. It is important to collect an appropriate age/length range of these individuals, preferably of edible size. In general as the age/length increases so do the concentrations of these contaminants. An adequate distribution of size classes is critical to characterize or assess the contamination level of these parameters.

Preliminary Report on Upper Red River and Lower Red River Watershed Monitoring

In Summer 2008, low water in the north and high water in the south challenged monitoring crews conducting the basin's first Intensive Watershed Monitoring in the Upper Red River Watershed, which includes Wolverton Creek, and Whisky Creek, and the Lower Red River Watershed, which includes the Two Rivers and Joe River watersheds. In the Upper Red watershed, three sites were assessed for biological conditions. Generally, the monitoring team found that conditions at those sites were acceptable. However, monitoring for water chemistry found that pollutant levels exceeded state standards in many locations. Further monitoring will be planned to diagnose the water chemistry exceedances.

For the Lower Red River Watershed, 44 biological monitoring sites were identified, but of these, 25 sites had no visits due to low water (determined when less than 50 percent of reach has water). Nineteen sites had visits but 11 were channelized, therefore could not be assessed. Of these, two sites were considered impaired for fish.

Water chemistry exceeded standards at those monitoring sites. Follow-up monitoring in Water Year 2009 will address the limitations for fish and the water chemistry exceedances.

8.03 Red River Mainstem Biological Assessment Project

In August of 2010, the North Dakota Department of Health in conjunction with the Midwest Biodiversity Institute (Columbus, OH), conducted sampling for the Red River Mainstem Biological Assessment Project. The goals of this project are to:1) provide an ecological assessment of the Red River of the North mainstem in the U.S.; 2) to complement existing and future biological assessment efforts which have, and will be, conducted on Red River tributaries in North Dakota and Minnesota; and 3) demonstrate and train biologists and water quality specialists in the basin on procedures to sample large non-wadable rivers like the Red River of the North. A total of 54 sites were sampled from August 18, 2010 through September 1, 2010, including 52 sites on the mainstem Red River and one site each on the Bois de Sioux and Ottertail Rivers (Figure 4). All sites were sampled for fish, macroinvertebrates and water quality. In addition, a qualitative habitat assessment was conducted at each site.

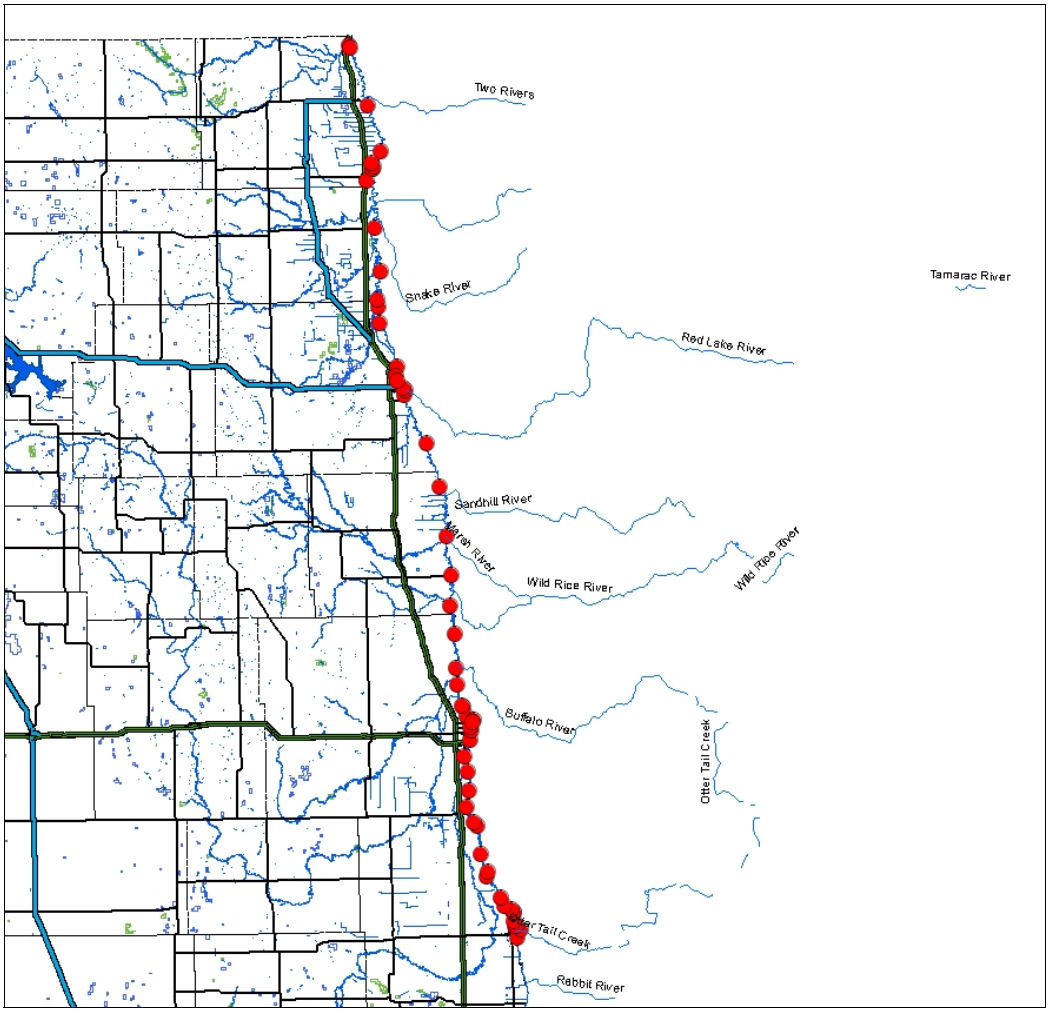

Figure 4 Location of Red River Mainstem Biological Assessment Project Sites in ND

9.0 ADDITIONAL ACTIVITIES IN THE RED RIVER BASIN

As outlined in Appendix A – International Red Rive Board Directive, the duties of the Board include maintaining an awareness of other agencies in the basin, of developments and conditions that may effect water levels and flows, water quality and ecosystem health of the Red River and its transboundary tributaries, and activities that contribute to a better understanding of the aquatic ecosystems. Chapter 9 provides and overview of a number of relevant activities and developments in the basin.

9.01 Garrison Diversion Project - Dakota Water Resources Act

The Dakota Water Resources Act (DWRA) of December 2000 amended authorizing legislation for the Garrison Diversion Project. The legislation outlines a program to meet Indian and non-Indian water supply needs in North Dakota and authorizes water uses including municipal, rural and industrial, fish and wildlife, recreation, irrigation, flood control, stream flow augmentation, and ground water recharge.

Red River Valley Water Supply Project

In December 2007 a final Environmental Impact Statement (EIS) was completed which identified a preferred alternative for delivery of Missouri River water, via existing and new facilities, to meet both short- and long-term water needs in the Red River Valley in North Dakota and Minnesota. The Bureau of Reclamation has completed the DWRA required NEPA analyses.

Secretary of the Interior Kempthorne signed a formal determination on January 13, 2009, finding that the EIS' proposed water treatment for the importation of Missouri River water for the Red River Valley project was adequate under applicable federal law and treaty provisions. The selected approach to water treatment was developed in close consultation with U.S. EPA and the U.S. Department of State, as required by DWRA. The preferred biota treatment alternative identified in the final EIS meets or exceeds treatment goals proposed by the Province of Manitoba.

Secretary Kempthorne deferred signing a Record of Decision (ROD) concluding it would be more appropriate to defer a ROD until Congress has authorized construction of the project features identified in the EIS. If and when authorized by subsequent legislation, as DWRA requires for such an importation project, the Department of the Interior would then review the authorized project to determine whether any additional National Environmental Policy Act (NEPA) is required or appropriate.

Northwest Area Water Supply Project

In March 2006, Reclamation initiated preparation of an environmental impact statement (EIS) to evaluate water treatment techniques to further reduce the risks of transfer of non-native species from the Missouri River Basin into the Hudson Bay Basin. The final EIS was released to the public in December 2008. Reclamation signed a Record of Decision (ROD) for the EIS on January 15, 2009. In February 2009, the Department of Justice notified the U.S. District Court that Reclamation had completed the final EIS and ROD. Shortly thereafter the Province of Manitoba filed a Supplemental Complaint arguing that the final EIS was insufficient. A day later the State of Missouri filed a complaint against the Department of the Interior and the U.S. Army Corps of Engineers in the same District Court in Washington D.C. In March 2009, the court combined the Missouri suit with the Manitoba suit. Numerous briefs from all parties involved in the litigation were filed with the court throughout 2009. On March 5, 2010, the District Court remanded the case to Reclamation for further analysis. Reclamation has decided to prepare a supplemental EIS. A notice of intent was published in the Federal Register on August 12, 2010. Public scoping meetings are scheduled for September 13-16, 2010, in four locations throughout the project service area. Reclamation will address the areas of concern identified by the court as well as other issues identified during public scoping.

9.02 Devils Lake Sub-Basin

DEVILS LAKE UPDATE

Devils Lake

Hydrology:

The water surface elevation on September 1, 2011 was 1454.0 msl. This is only down slightly from the new record high of 1454.30 msl set on June 27, 2011. The previous record (set on June 28, 2010) of 1452.05 ft-msl was eclipsed on April 11, 2011. The water surface elevation of Devils Lake rose 2.6 feet from its January 1, 2011 elevation of 1451.7 ft-msl to June 27, 2011. The 2009 spring rise was 3.5 feet, with an inflow of 540,000 ac.-ft and the 2010 spring rise was 1.8 feet with an inflow of 312,000 ac.-ft. The total storage of Devils Lake (including Stump Lake) is now 4.11 million ac-ft., covering an area of 204,800 acres. This is an increase of 450,000 ac. ft. of storage and 26,200 acres in surface area from the beginning of this year. The data above was collected from the stage/storage table which is found on the State Water Commission website.

Date	Elevation (msl)	Area (acres)	Volume (acre-feet)
Jan. 16, 2010	1449.92	162,100	3.36 million
June 27, 2010	1452.05	182,800	3.73 million
Nov. 20, 2010	1451.26	175,000	3.59 million
Jan. 16, 2011	1451.65	178,600	3.66 million
June 27, 2011	1454.30	208,500	4.19 million
September 1, 2011	1454.00	204,800	4.11 million

State Emergency Outlet Project Update:

Operation:

The releases of Devils Lake water from the outlet into the Sheyenne River (Tables 18 and 19) began on May 26, 2011 at 150 cfs. The flow near Bremen on the Sheyenne River was at approximately 400 cfs, the flow at Cooperstown was 780 cfs and was expected to drop below channel constraints prior to the outlet water reaching that location. This year's starting date is similar to the last two years, the 2009 start was on May 22nd and 2010 start was May 21st. The sulfate concentration below Bald Hill Dam from March 29, 2011 was found to be 357 mg/L and will not constrain releases due to sulfate concentrations. Flow was increased to 250 cfs on June 8, 2011. Releases were stopped for some time in August due to high flow conditions occurring downstream. Two pumps are also being repaired. The current discharge is 75 cfs.

Table 18 - Summary of the extent of discharge from the outlet for a portion of 2011

Month	Days Discharge Occurred	Average Discharge (cfs)	Monthly Volume (acre-feet)
May 2011	6	140	1,672
June	30	211	12,549
July	31	215	13,283

Table 19 - Summary of the volume and inches of water removed from the lake since pumping was started in 2005:

Year	Volume Removed (acre-feet)	Inches Removed (inches)
2005	38	0.00
2006	0	0.00
2007	298	0.02
2008	1,241	0.09
2009	27,653	2.04
2010	62,969	4.30
TOTAL	92,199	6.45

Construction:

West Devils Lake Outlet:

Construction was completed in 2010, increasing the capacity of the pumped outlet from 100 cfs to 250 cfs. Two additional 75 cfs pumps were installed at the Round Lake pump site and at the Josephine pump site. A gravel filter/transition structure was also installed.

East Devils Lake Outlet:

In March 2011, the Governor of North Dakota announced the selection of a project plan to build a second water outlet at Devils Lake. The project calls for constructing an underground pipeline from East Devils Lake to the downstream side of Tolna Coulee. The pump-flow pipeline will be capable of transferring between 250 cubic feet per second (cfs) and 350 cfs from Devils Lake into the Sheyenne River. From East Devils Lake, the pipeline will run about five miles southeast to Tolna Coulee. The outlet and pipeline design will allow for winter construction. The project is scheduled for completion in June 2012, and is expected to cost between $62 million and $90 million.

Tolna Coulee Control Structure:

The Tolna Coulee control structure project consists of a combination of sheet pile, embankment, and a steel stop log weir structure. The purpose of this project is to allow the natural erosion of the divide between Stump Lake and the Tolna Coulee, while protecting downstream communities from an uncontrolled release of the water in Stump Lake. To this end, this structure is designed to allow flow in the Tolna Coulee to cause erosion the same as would occur naturally while providing the ability to lower the lake elevation in a controlled manner as the divide erodes. It is not the purpose of this project to impound water in Stump Lake above the natural outlet elevation, as it exists now or what it may become in the future. This project is a cooperative effort between the State Water Commission and the US Army Corps of Engineers.

The Corps continues to work on the design of the project, which is at the 60% review phase. As part of their design effort, the Corps is developing a cost estimate for the project. Negotiation of the agreement between the Army Corps of Engineers and the North Dakota State Water Commission for the design and construction of the proposed control structure is ongoing.

Emergency Gravity Water Transfer Channel:

A gravity flow channel is also being pursued. The proposed channel would provide an outlet from Stump Lake and extending south to Tolna Coulee. The control elevation at the bottom of the channel is proposed at 1452 msl. The channel would include stop logs to control releases based on downstream conditions. The channel would have a capacity of 100 cfs when Stump Lake is at an elevation of 1454 msl, if the stop logs were not in place. The channel would be operated to maintain downstream water quality uses. An operating committee is being proposed for the project. Completion of the project is expected to occur in June 2012.

Upstream Storage:

The State Water Commission (SWC) is committed to a three-pronged approach to flooding in the Devils Lake basin, of which upper basin water management is an integral part. Several programs exist to store water, including the Extended Storage Acreage Program (ESAP), and projects by the ND Natural Resources Trust (Trust), and the U.S. Fish and Wildlife Service. The new Devils Lake Executive Committee action plan has reinforced and placed emphasis on the need to increase upper basin storage where possible.

The Trust is pursuing a plan to acquire privately held land for a multipurpose, multi-wetland restoration project in northeastern Ramsey County. SWC staff has estimated that this project will store approximately 631 acre-feet of additional water over existing conditions. The project requires commitments from multiple funding sources, including the Wetland Reserve Program (WRP), the North American Wetlands Conservation Act, ND Game and Fish, and the Trust. The project will put the land under a 30-year WRP easement with the ND Game and Fish taking title to the land for use as a public access wildlife conservation area. Total project cost is estimated at $2,048,000, and would result in long term water storage on land available for public use. The Trust has requested water storage funding from the SWC in the amount of $125,000. If approved, the SWC will develop a seven-year contract for water storage at the Johnson Farms site. Annual inspections will be conducted to ensure water storage at the site for the duration of the agreement. This expenditure equates to about $30.00/acre-foot per year of storage for the duration of the contract, which is comparable to the rates paid for existing ESAP temporary storage easements. The acquisition plan developed by the Trust involves several

Outlet Mitigation Plan:

Beginning in 1993, as Devils Lake began its historically unprecedented rise, the State Water Commission (SWC) has been at the forefront of efforts to combat flooding in the basin. The lake level has now risen 30 feet (Figure 5), expanding from about 49,000 acres to over 200,000 acres (Figure 6). At its overflow elevation of 1458 feet msl, where it naturally spills into the Sheyenne River, Devils Lake will cover more than 261,000 acres. To combat the growing flooding problem, local, state, and federal authorities adopted a three-pronged approach in the mid 1990s: infrastructure protection for roads, levees, and relocations; upper basin water management, including water storage in the upper basin; and discharge of flood water through an emergency west-end outlet to the Sheyenne River. This approach was designed with the interests of both Devils Lake basin and downstream residents in mind. The principal concept has been to manage water and flood damage within the Devils Lake basin, while attempting to prevent a potentially catastrophic natural overflow through Tolna Coulee to the Sheyenne River.

The 2011 Devils Lake Outlet Mitigation plan being developed by SWC staff with input from stakeholders, including the Devils Lake Outlet Advisory Committee, provides important direction in addressing problems that could arise downstream from emergency measures taken at Devils Lake to protect the safety and general welfare of both basin and downstream residents. The draft plan has two key components; construction of emergency outlets to remove floodwater from Devils Lake and a course of action to address downstream issues along the Sheyenne River that may result from operating the emergency outlet projects.

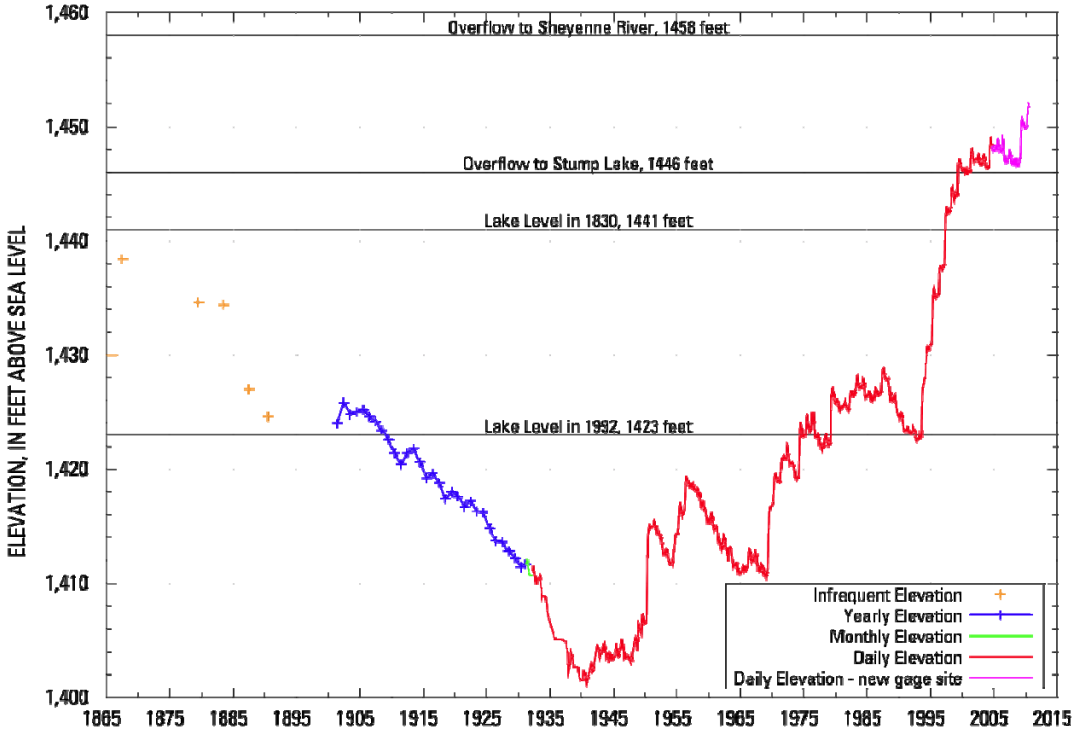

Figure 5 Devils Lake Historic Water Levels

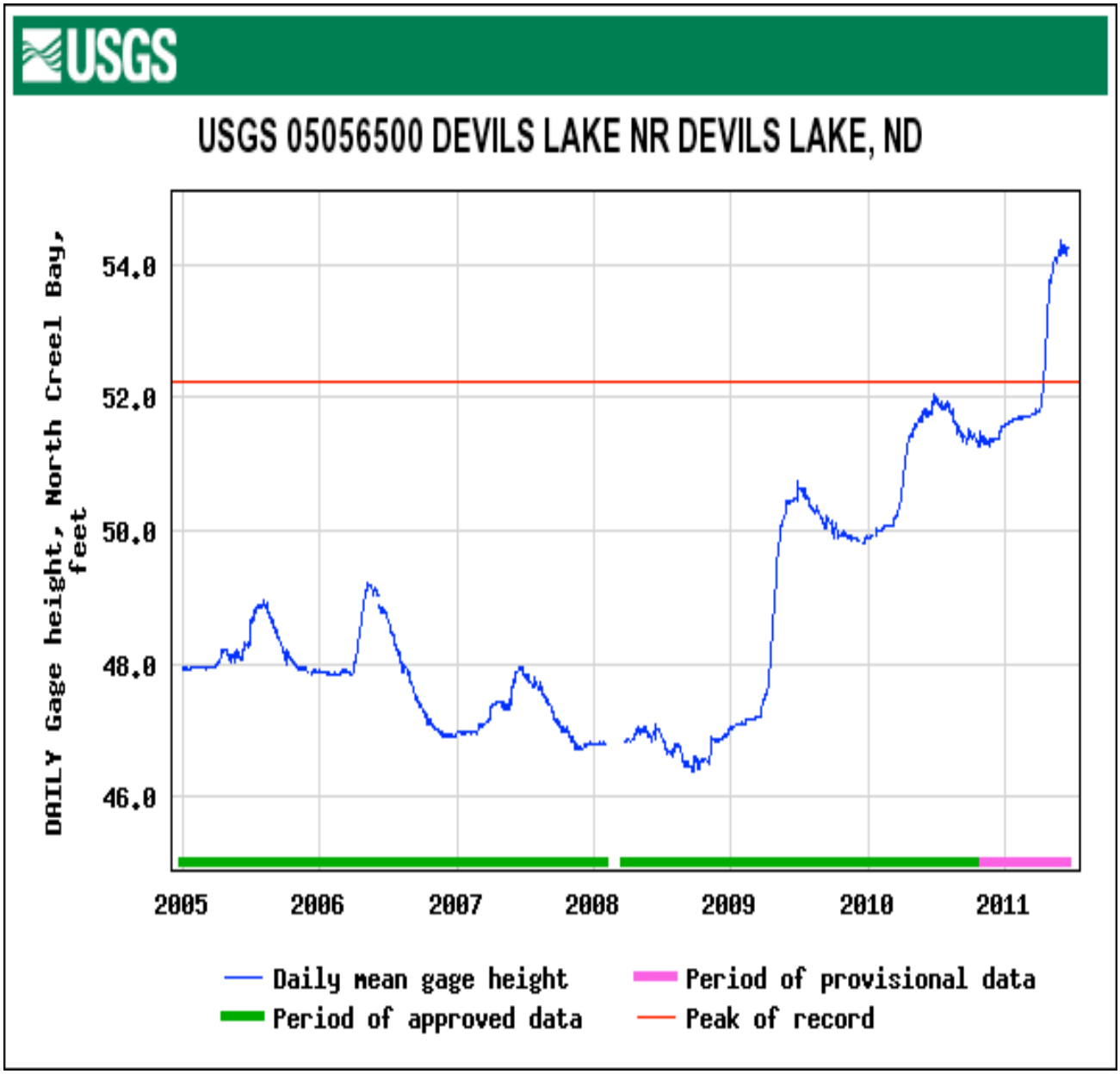

Figure 6 Devils Lake Water Levels (2005-2011)

Red River Retention Authority

The Red River Joint Water Resource District (RRJWRD) of ND and the Red River Water Management Board (RRWWB) of MN formed the Red River Retention Authority in August 2010. The Authority will provide the two entities with a better opportunity to jointly coordinate aggressive pursuit of retention projects within the watershed. The Red River Retention Authority will prioritize retention projects; facilitate interaction with federal agencies; provide assistance to member districts in obtaining regulatory approvals; seek federal, state, and other cost-share assistance; develop long-term watershed goals; and otherwise seek reduction of peak flows on the Red River.

9.03 U.S. Army Corps of Engineers Flood Control Activities

Introduction

The Corps of Engineers has a long history of involvement in water resource issues in the Red River of the North basin. Current Corps activities in the basin include operating flood control and multipurpose reservoirs, conducting flood risk management and ecosystem restoration studies, constructing flood risk management and ecosystem restoration projects, conducting and participating in special studies and initiatives, regulating work in navigable waters and other waters of the United States, and providing emergency assistance and disaster response. The Corps cooperates and collaborates with other Federal and State agencies, local watershed districts, environmental groups, and local communities to address water resource problems and opportunities in the basin.

Construction Projects

Breckenridge, Minnesota, and Wahpeton, North Dakota

Wahpeton and Breckenridge are at the confluence of the Bois de Sioux and Otter Tail Rivers, the beginning of the Red River of the North. The flood risk management projects for these cities are treated as two separate, but dependent, projects. The levee portions of both projects must be initiated together to avoid adverse impact on the city on the other side of the river.

The Breckenridge project consists of a high-flow diversion channel north of the Otter Tail River and two separable permanent levee reaches that would protect all of Breckenridge. Construction of the diversion was completed in 2005. The first two of four stages of levee construction were awarded in April 2009. The total estimated cost for the Breckenridge project is $41.1 million. Stage 2b3 construction began in spring 2010, and Stage 2a was awarded in fall 2010. The project was reauthorized at a higher cost in the 2010 Energy and Water Appropriation Act.

The Wahpeton project, authorized under the Corps' Section 205 Continuing Authority, consists of a permanent levee system and flood easements. Construction of the Wahpeton project began in 2003 with interior flood control features, which are now complete. The first of three stages of levee construction began in June 2008. The second stage began in June 2009. Stage 3b, the third and final in-town levee reach, will be ready for a construction start in 2011. Additional work on existing levees will be incorporated as needed for compliance with levee standards. The total estimated cost for the Wahpeton project is $20 million.

Crookston, Minnesota

Construction of a flood risk management project for the Thorndale, Woods, and Downtown/Riverside neighborhoods was essentially completed in November 2004. Two rock berms protecting the upstream side of two cutoff channels were damaged from ice flows in April 2005. Construction would be completed approximately 6 months after project award.

Devils Lake Embankment, North Dakota

Devils Lake flooding continues. This spring the lake rose nearly 3 feet and is currently at an elevation of 1454.2. The embankments are being raised in four phases to protect the city of Devils Lake. Phase 1 was awarded in October 2009, and construction is nearing completion. Phase 2 was split into two contracts to allow for additional time to address geotechnical challenges with the design. Phase 2a was awarded in November 2010 and will be completed in November 2011. Phase 3 was awarded in April 2011, and Phase 2b was awarded in May 2011. All phases are scheduled to be completed by November 2012. Once construction is complete, the city will be protected from the maximum lake elevation that could occur; no additional embankment raises will be required. The embankments will increase in length from 8 miles to 12 miles. The cost to complete the raise to elevation 1465 is approximately $150 million.

The Devils Lake Executive Committee (DLEC) was formed by Major General Michael Walsh at the direction of Lieutenant General Robert Van Antwerp. Members of the committee include senior working staff from Federal, tribal, State, and local governments; the International Joint Commission (IJC) (observer status); Canada (observer status); and nongovernmental organizations (NGOs) (observer status). The initial meeting of the DLEC was held on March 7, 2011, in Bismarck, North Dakota. The DLEC is a forum for all agencies that have responsibilities and authorities related to proposals and recommendations on projects, plans and ongoing actions affecting the Devils Lake watershed and those downstream. The formal committee provides continuity for an interagency approach to planning and implementing measures to reduce the risks associated with flooding in the Devils Lake basin and vicinity.

Emergency Operations

The spring flood of 2011 reached near-record stages in many communities in the Red River basin. The Corps' St. Paul District provided emergency assistance as part of a large force made up of local, State and Federal responders and thousands of volunteers who worked together for more than 2 months to prevent flood damages throughout the basin. By the end of the fight, the district had distributed approximately 84,000 sandbags, 175 rolls of plastic, and 18 pumps; awarded 21 contracts to build temporary levees; and spent more than $15 million. More than 80 Corps personnel were on the ground in the Red River Valley throughout the fight, and more supported the flood fight from the district's headquarters in St. Paul, Minnesota. In addition to the Red River flood fight, the district also assisted with a flood fight in the adjacent Souris River basin. That effort started in mid-March and is expected to continue into July.

Fargo, North Dakota (Ridgewood Addition)

Construction of the Section 205 Fargo Ridgewood flood control project is complete. The project consists of a levee, floodwall and pump station for the Department of Veterans Affairs Medical Center and levees, floodwalls, pump station, and stop-log closure for the Fargo Ridgewood area. The project will reduce flood risk for the Department of Veterans Affairs hospital and the portion of Fargo between 15th Avenue North and 22nd Avenue North. Levees and floodwalls required for the line of protection were completed in December 2009 when the Elm Street closure was completed. All construction work was completed in September 2010.

Grand Forks, North Dakota, and East Grand Forks, Minnesota

Construction of the flood risk management project for the cities of Grand Forks and East Grand Forks is essentially complete. The project has been certified as providing a 100-year level of flood protection in accordance with the Federal Emergency Management Agency's national flood insurance program. The levee construction has now been completed to a 250-year level of protection. Project close out and miscellaneous repairs remain to be completed. The project consists of 30 miles of levees and 3 miles of floodwall set back from the river. The levees and floodwalls form rings around the communities. The project also includes stabilization of an existing dam; removal of a former railroad bridge; and construction of interior flood control features, 24 pump stations, numerous road and railroad closures, and two diversion channels. The project was also authorized to provide recreation features including 24 miles of trails and seven trailheads constructed in the new river greenway. The design level of protection is equivalent to the peak discharge experienced during the 1997 flood. Total estimated project cost is $409,300,000.

North Dakota Environmental Infrastructure Program (Section 594)

The Corps is assisting communities and rural areas in North Dakota under the North Dakota Environmental Infrastructure Program. The program authorizes the Corps to provide assistance to North Dakota public entities in the form of "design and construction assistance for water-related environmental infrastructure and resource protection and development projects in North Dakota, including projects for wastewater treatment and related facilities; combined sewer overflow; water supply, storage, treatment, and related facilities; environmental restoration; and surface water resource protection and development." The program was authorized in the Consolidated Appropriations Act (CAA) of 2008, which amended Section 594 of the Water Resources Act of 1999 and established a program authorization of $100,000,000 for North Dakota. In 2008 and 2009, funds were appropriated for projects at the cities of Devils Lake and Parshall, North Dakota. In 2009, American Recovery and Reinvestment Act (ARRA) funds allowed for new projects with the Southeast Water Users District, the Cass Rural Water Users, and Valley City in the St. Paul District and with Zeeland, North Central Rural Water Consortium (two projects), State Line Water Coop, and the McKenzie County Water Resource District in the Omaha District. In 2010, eight new rural water supply projects were funded including the Barnes, Langdon, North Prairie, Greater Ramsey, Minnewaukan and Traill Rural Water Districts in the St. Paul District and the North Central and Williams Rural Water Districts in Omaha District. No funds were appropriated in 2011, and no new projects were initiated this fiscal year.

Minnewaukan Project Information Report

In February 2011, the State of North Dakota requested Public Law 84-99 Advance Measures Assistance to construct a temporary embankment to protect the Minnewaukan public school, water tower, and other critical public infrastructure from the rising waters of Devils Lake. This temporary protection would allow time for the construction of a new school at the city's proposed new subdivision approximately 2 miles northwest of the existing city on high ground. The Project Information Report was approved by Corps Headquarters on April 15, 2011, and construction started May 9. The project is scheduled to be complete in July 2011.

Roseau, Minnesota

A flood risk management project for the city of Roseau, Minnesota, was authorized in the Water Resources Development Act of 2007. The project will include a diversion channel with associated recreation features. The current estimated project cost is $39.2 million. As part of the project, the city completed the construction of two highway bridges in 2010. The Corps' initial construction contract will be completed in summer 2011. The

second construction contract is scheduled to be awarded in September 2011. The Corps is completing plans and specifications for the remaining portion of the project to be ready for construction in spring 2012.

Sheyenne River, West Fargo, North Dakota
Construction of the West Fargo project was essentially completed in 1994. Construction to repair 6,000 feet of the diversion channel that was damaged by erosion and sloughing in 2005 was scheduled to be completed in December 2009. Continued wet conditions have led to long durations of high water in the channel, which have delayed construction progress.

Studies

Ada, Minnesota
The Section 205 flood risk management feasibility study is on hold. The city of Ada is pursuing a State-funded project to construct a wastewater pumping station, an upgraded levee system and a diversion of Judicial Ditch 51.

Drayton Dam, Drayton, North Dakota
A Section 206 aquatic ecosystem restoration feasibility study of the Drayton Dam began in July 2008. The study is assessing ways to provide fish passage and eliminate dangerous hydraulic conditions at the dam while maintaining the pool for water supply and bank stability. The project is under consideration as mitigation for potential impacts to fish passage associated with a flood damage reduction project at Fargo, North Dakota.

Fargo-Moorhead Metropolitan Area, North Dakota and Minnesota
A feasibility study of flood risk management measures for the entire Fargo-Moorhead metropolitan area began in September 2008. The primary goal is to develop a regional system to reduce flood risk in the entire metropolitan and surrounding area and assess the feasibility of Federal implementation. An array of potential alternatives was considered, including nonstructural flood proofing, diversion channels, levee/floodwall systems, and flood storage. Only the diversion channel concept survived initial screening. A draft feasibility report and environmental impact statement was released for review in May 2010. A supplemental draft feasibility report and environmental impact statement was released for review in May 2011. The tentatively selected plan is the North Dakota 20k cubic feet per second (cfs) diversion with upstream staging and storage. The Report of the Chief of Engineers is expected to be signed in December 2011.

Fargo-Moorhead and Upstream Area, North Dakota, South Dakota and Minnesota
This feasibility study is looking for opportunities to reduce flood damages and restore aquatic ecosystems in the entire watershed upstream of Fargo-Moorhead. The study began in August 2004. Phase 1a was completed in June 2005. It concluded that a system of impoundments could reduce the 1-percent-chance flood stage in Fargo-Moorhead up to 1.6 feet, but the system is not likely to be economically justified based on economic benefits alone. Phase 1b began in April 2008 to develop hydrologic and hydraulic models of the Wild Rice River in North Dakota to assess specific potential storage sites. Scoping for Phase 2 of the study is underway; Phase 2 will include more detailed investigations of environmental benefits and site-specific economic benefits.

Fort Abercrombie, North Dakota
A Section 14 Emergency Streambank Protection study began in September 2008. Erosion along the Red River of the North is threatening the historic Fort Abercrombie site. A Federal interest has been determined, and the

feasibility study is scheduled to be completed in July 2011. Final design and implementation could begin immediately following feasibility approval.

Red River Basin-Wide Feasibility Study

Hydraulic modeling of the entire Red River will be completed in 2012. The Red River Basin Commission will issue a report to State and Federal officials on a comprehensive plan for long-term flood solutions in summer or fall 2011; that report will be the basis for future feasibility study requests. The Red River Basin Decision Information Network is being updated, and a draft version will be available in 2011. The University of Minnesota is conducting a drainage study; it will be available in late 2011.

Red River Unsteady Flow Model, North Dakota

The Corps and the State of North Dakota began a study of the Pembina River in August 2008 under the Section 22 Planning Assistance to States program. The study will develop an HEC-RAS unsteady flow model of the lower Pembina River and the Red River of the North from Drayton, North Dakota, to the international border.

A reconnaissance study of the Pembina River basin is underway, but it is on hold pending identification of a non-Federal sponsor for the feasibility phase of study. The reconnaissance study began in April 2006. The draft report identified flooding in the lower Pembina valley from Walhalla, North Dakota, to Pembina, North Dakota, as the primary problem in the study area. An existing road/dike along the international border is the subject of ongoing litigation; uncertainty regarding the future of that dispute has complicated the study efforts. The Corps reconnaissance study focuses on potential solutions that lie within the United States, but it appears that more creative and beneficial solutions to flooding in the lower Pembina River basin would be possible with a cooperative United States-Canadian planning effort.

A HEC-RAS Unsteady Flow model has been developed for the Red River from Halstad, Minnesota, to Pembina. The model has been calibrated and verified to the 2006 and 2009 floods. The North Dakota State Water Commission has developed a separate HEC-RAS Unsteady Flow model of the 2006 flood on the Pembina River from Walhalla to Pembina. The two models will be combined during 2011.

Red River Basin Watershed Study

The Corps began a basin-wide watershed study in June 2008. The first phase of study will use LIDAR to collect detailed topographic information and develop a digital elevation model of the entire watershed in cooperation with the International Water Institute. Subsequent phases are planned to build and refine basin-wide hydraulic and hydrologic models, develop a decision support system, and prepare a Comprehensive Watershed Management Plan.

Sheyenne River Reconnaissance Study

2011 efforts include the building of an economic model, which will be used to quantify the benefits that can be derived from several theoretical retention projects on the Sheyenne River. If appropriate, a Federal interest report will be prepared in 2012.

Valley City, North Dakota Reconnaissance Study

A Federal interest study is being conducted, and a draft report is expected for local review in summer 2011. If a Federal interest is determined and a non-Federal sponsor is identified, a feasibility study would be started in 2012.

Wild Rice River Basin, Minnesota

A feasibility study for flood risk management and ecosystem restoration in the Wild Rice River watershed is being terminated at the request of the non-Federal sponsor. The request for termination is based on the anticipated costs to complete the study and differing priorities in the watershed.

Operations

The Corps of Engineers maintains several stream gages and operates five reservoir projects within the Red River basin: Homme Dam and Lake, Baldhill Dam, Orwell Dam, Lake Traverse, and Red Lake Dam.

Stream Gaging

The Corps provides funding to support stream gaging in the Red River and Souris River watersheds. The Corps maintains gages at several locations including Wahpeton, Valley City and Minot, North Dakota. These gages provide critical information related to reservoir operation, flood forecasting, drought management and the overall health of the watersheds.

Homme Dam and Lake

Homme Dam and Lake is on the South Branch of the Park River 2 miles west of the city of Park River, North Dakota, on North Dakota State Highway 17. Homme Dam was built for flood control and water supply purposes.

Baldhill Dam (Lake Ashtabula)

Baldhill Dam is in eastern North Dakota 60 miles west of Fargo and 9 miles northwest of Valley City, North Dakota. The dam is on the Sheyenne River, 271 river miles upstream from its confluence with the Red River of the North. The dam provides flood protection for urban areas along the Sheyenne River. It also provides substantial water supply and pollution abatement for the Sheyenne River and the Red River of the North.

Orwell Dam

Orwell Dam is on the Otter Tail River, 6 miles southwest of Fergus Falls, Minnesota, on County Road 15. Project purposes are flood control, water supply, and pollution abatement. During periods of low flow in the Red River basin, discharges from Orwell Dam comprise the majority of the stream flows in the Red River. The Minnesota Department of Natural Resources leases 1,985 acres of the project for wildlife management purposes, of which 660 acres are a wildlife sanctuary. Hunting and fishing are permitted in some project areas, but not in the wildlife sanctuary.

Lake Traverse

Lake Traverse is located at the border between north-eastern South Dakota and western Minnesota. The primary purposes of the project are flood control along the Bois de Sioux River and in the lower Red River Valley and water conservation for frequent periods of drought. The project includes two dams, two lakes, and the Browns Valley dike at the southern end of the project. The Browns Valley dike lies directly on the continental divide. White Rock Dam, which forms Mud Lake, is at the extreme north end of the project and controls water flowing north on the Bois de Sioux River. Reservation Dam controls the pool level at Lake Traverse and the water flow north into Mud Lake; it also serves as a levee that separates the two lakes.

Red Lake Dam

Red Lake Dam is on the Red Lake River at the outlet of Lower Red Lake. The project is operated for water supply, pollution abatement, flood reduction, water conservation, recreation, and fish and wildlife enhancement. Construction of a fish passage structure at the dam began in 2007 and is scheduled to be completed in May 2011.

Regulatory Programs

The Corps of Engineers Regulatory Programs include permitting authorities under Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the Clean Water Act. The St. Paul District has jurisdiction in Minnesota; Omaha District has jurisdiction in North Dakota and South Dakota. Under Section 10, a Corps permit is required to do any work in, over or under a navigable water of the United States. Water bodies have been designated as navigable waters of the United States based on their past, present, or potential use for transportation for interstate commerce. Under Section 404, a Corps permit is required for the discharge of dredged or fill material into waters of the United States.

Contact Person

The St. Paul District, Corps of Engineers, point-of-contact for planning and studies in North Dakota is Craig Evans, Senior Planner, Project Management Branch. Telephone: (651) 290-5594
Email: **craig.o.evans@usace.army.mil**

Project information sheets with details on all St. Paul District projects can be found on the St. Paul District, Corps of Engineers, Internet homepage at: **www.mvp.usace.army.mil**

9.04 USGS Water Resource Investigations and Activities

Monitoring activities related to the 2011 flooding

Flooding on the Red River in the spring of 2011 was significant. The 2011 Spring flood equals or exceeds the volumes that were seen in 2009 in a number of locations. The peak flows along the main stem Red River passed through later than what has been experienced over the last 5 years (see Figure 7 below).

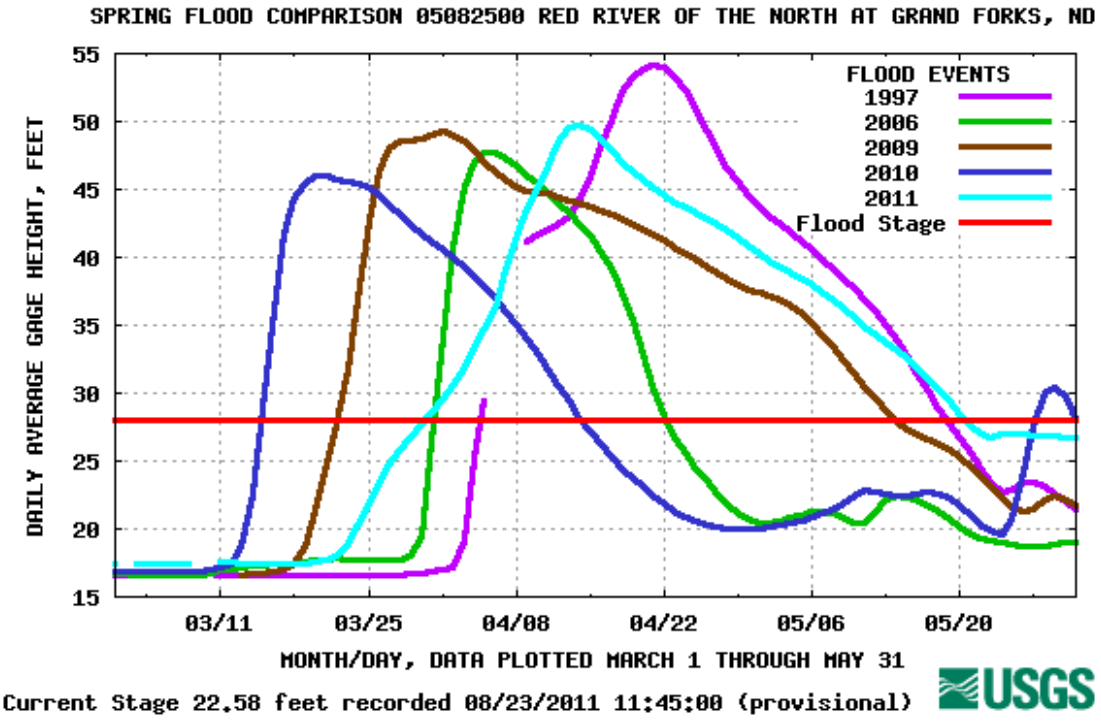

Figure 7. Spring Flood Comparison - Red River at Grand Forks, North Dakota

The Red River at Fargo crested on April 9 with a discharge of 27,500 cfs, the third highest peak in 110 years. Two of the three highest peaks in the Fargo record have occurred in the last three years. The preliminary exceedence probability is in the .02 to .01 range.

The Red River at Grand Forks crested with a peak discharge of 86,700 cfs, on April 14 - the second highest recorded peak discharge in 129 years of record. The preliminary exceedence probability is in the .04 to .02 range. (see Table 20).

Table 20. Comparison of Red River Flood Peaks at Selected Locations in the U.S.

Peak Discharges for Selected Years on the Red River at Fargo, ND

	*2011	2010	2009	2006	2001	1997
Discharge (cfs)	27,500	21,300	29,500	19,900	20,300	28,000
Elevation (ft)	38.77	36.99	40.84	37.13	36.69	39.57

Peak Discharges for Selected Years on the Red River at Grand Forks, ND

	*2011	2010	2009	2006	2001	1997
Discharge (cfs)	86,700	61,400	76,700	72,800	57,800	137,000
Elevation (ft)	49.87	46.06	49.33	47.93	44.87	52.04

*Provisional, subject to revision.

Flows in the upper Sheyenne River basin exceeded the peak-of-record record flows of 2009. Record snowfall totals, along with a later than normal melt increased the flows to levels greater than previously seen. All gaging stations on the upper Sheyenne River (above Lake Ashtabula) recorded a peak of record discharge except for the Sheyenne River at Harvey.

The Sheyenne River at Warwick (6o years of record) crested on April 12, at 7,560 cfs, well over the previous peak of record discharge of 4,930 cfs. The preliminary exceedence probability is in the .01 to .005 range. The Sheyenne River at Cooperstown (66 years of record) crested on April 14 at 8,400 cfs, exceeding the previous peak of record set in 1950. The preliminary exceedence probability is in the .02 to .01 range.

Flows on the lower Sheyenne River approached peaks-of-record as a result of the record high releases from Baldhill Dam. The Sheyenne River at Lisbon (54 years of record) recorded the 2nd highest peak of record on April 20 at 8,240 cfs. The preliminary exceedence probability for the peak is in the .02 to .01 range

In the Red River Basin, the USGS North Dakota Water Science Center works in cooperation with the U.S. Army Corps of Engineers; U.S. Bureau of Reclamation; International Joint Commission of the U.S. State Department; Manitoba Provincial Government; National Weather Service; North-Central River Forecast Center; Minnesota Department of Natural Resources; North Dakota State Water Commission; North Dakota Department of Health; U.S. Bureau of Indian Affairs; several water resource boards and districts; and other Federal, State and local water resources managers. Data and information shared among the agencies and offices during the time of flooding helped to mitigate loss of life and damages to property in the Red River Basin during the 2009 and 2010 spring floods.

Simulation of the Effects of the Devils Lake Outlet on Hydrodynamics and Water Quality in Lake Ashtabula, North Dakota, 2006-10 (http://pubs.usgs.gov/sir/2010/5234/)

This USGS report, in cooperation with the North Dakota State Water Commission, was published in February 2011. The purpose of the study was to simulate the hydrodynamics and water quality in Lake Ashtabula to provide a better understanding of how discharge from the Devils Lake State Outlet upstream in the Sheyenne River may affect the hydrology and water quality in Lake Ashtabula. Hydrodynamics and water-quality characteristics in Lake Ashtabula were simulated using the U.S. Army Corps of Engineers CE-QUAL-W2 modeling software. The laterally averaged, two-dimensional model was calibrated using ambient data collected from June 2006 through June 2010 when measured water-quality data were available in the reservoir. Scenarios also were conducted using the Lake Ashtabula model to simulate the possible effects of the current Devils Lake outlet operation, possible future changes to the outlet, and additional outlets from Devils Lake on the water quality in Lake Ashtabula.

Simulation of the Effects of the Devils Lake Outlet Alternatives on Future Lake Levels and Downstream Water Quality in the Sheyenne River and the Red River of the North (http://pubs.usgs.gov/sir/2011/5050/)

This USGS report, in cooperation with the North Dakota Department of Health, was published in June 2011. The purpose of the study was to evaluate new Devils Lake outlet options being considered, such as expanding the capacity of the existing west-end outlet or constructing an additional outlet from East Devils Lake, with respect to their effect on downstream water quality and their ability to control future lake levels. A Devils Lake stochastic simulation model developed in previous studies was combined with a downstream stochastic routing model developed for this study to simulate future (2011-30) Devils Lake levels and water quality, outlet discharges, and downstream flows and water quality for key locations along the Sheyenne and Red Rivers, including the Red River at Halstad, Minnesota and at Emerson, Manitoba. Results show that a 350 cubic feet per second outlet from East Devils Lake, in addition to the existing 250 cubic feet per second outlet from West Bay, would substantially reduce, but not eliminate, the chance of a spill from Stump Lake in future years. The east-end outlet expansion also would be highly effective in speeding drawdown of Devils Lake. The effect of the expanded outlet on downstream water quality depended on the constraints assumed for sulfate concentration of the outflow from Baldhill Dam. For a 750 milligram per liter constraint on sulfate concentration below Baldhill Dam, sulfate concentration in the Red River at Emerson peaked at about 450-500 milligrams per liter during 2013-15 and declined to about 250 milligrams per liter by 2025. For a 650 milligram per liter constraint on sulfate concentration below Baldhill Dam, sulfate concentration at Emerson peaked at about 350 milligrams per liter during 2013-17 and declined to about 275 milligrams per liter by 2025.

Determination of the Distribution, Transport, and Load of Sediment in the Red River of the North and its Tributaries near Fargo

Natural resource agencies are concerned about possible geomorphic impacts of proposed diversion projects in the Fargo-Moorhead area. Site-specific information available on sediment transport and riverine geomorphic processes is very limited and prohibits accurate geomorphic modeling to address the concerns. The existing Horace-West Fargo diversion represents a good field scale example of what could happen to the sediment transport and distribution if the proposed ND Diversion Channel is constructed. The 2010 and 2011 spring breakup events provided a unique opportunity to sample sites during high-flow conditions when most sediment generally is transported. The USGS, in cooperation with the US Army Corps of Engineers, collected suspended-sediment, bedload, and 63 bed-sediment samples at 9 sites on the Red River, Sheyenne River, Maple River, and Wild Rice River in the Fargo area during the 2010 and 2011 spring high-flow periods from March through May. The data will provide information to describe the distribution and transport of sediment near the Fargo-Moorhead area. The methods and results of the 2010 data collection were compiled in a USGS Scientific Investigations Report (http://pubs.usgs.gov/sir/2011/5064/) and the 2011 results will be compiled in a report to be published in September 2011.

APPENDICES A-D

APPENDIX A

DIRECTIVES TO THE INTERNATIONAL RED RIVER BOARD

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DIRECTIVE TO THE
INTERNATIONAL RED RIVER BOARD

1. Pursuant to the Boundary Waters Treaty of 1909, responsibilities have been conferred on the Commission under a 1948 Reference from the governments of Canada and the United States with respect to the use and apportionment of the waters along, across, or in the vicinity of the international boundary from the eastern boundary of the Milk River drainage basin on the west up to and including the drainage basin of the Red River on the east, and under the May 1969 authorization from the governments to establish continuous supervision over the quality of the waters crossing the boundary in the Red River and to recommend amendments or additions to the objectives when considered warranted by the International Joint Commission.

2. This directive replaces previous directives and instructions provided by the International Joint Commission to the International Souris-Red Rivers Engineering Board, and in the February 8, 1995 Directive to the International Red River Pollution Board. This Directive consolidates the functions of those two former boards into one board, to be known as the International Red River Board (Board).

3. The Board's mandate is to assist the Commission in preventing and resolving transboundary disputes regarding the waters and aquatic ecosystem of the Red River and its tributaries and aquifers. This will be accomplished through the application of best available science and knowledge of the aquatic ecosystem of the basin and an awareness of the needs, expectations and capabilities of residents of the Red River basin.

4. The geographical scope of the Board's mandate shall be the Red River basin, excluding the Assiniboine and Souris Rivers. The Board's activities shall focus on those factors which affect the Red River's water quality, water quantity, levels and aquatic ecological integrity.

5. The Board's duties shall be to:

   A. Maintain an awareness of basin-wide development activities and conditions that may affect water levels and flows, water quality and the ecosystem health of the Red River and its transboundary tributaries and inform the Commission about transboundary issues.

   B. Provide a continuing forum for the identification, discussion and resolution of existing and water-related issues relevant to the Red River basin.

   C. Recommend appropriate strategies to the Commission concerning water quality, quantity and aquatic ecosystem health objectives in the basin.

   D. Maintain continuing surveillance and perform inspections, evaluations and assessments, as necessary, to Determine compliance with objectives agreed to by governments for water quality, levels and quantity in the Red River basin.

   E. Encourage the appropriate regulatory and enforcement agencies to take steps to ensure that agreed objectives are met.

   F. Encourage the appropriate authorities, such as resource and emergency planning agencies, to establish and maintain contingency plans, including early warning procedures, for

appropriate reporting and action on accidental discharges or spills, floods and droughts.

G. Monitor and report on flood preparedness and mitigation activities in the Red River basin and their potential effects on the transboundary aquatic ecosystems, and encourage and facilitate the development and maintenance of flood-related data information systems and flood forecasting and hydrodynamic models. In carrying out this responsibility, the Board shall:

   i. Monitor progress by the governments (federal, state, provincial, municipal) in implementing the recommendations of the Commission's report on the Red River basin flooding, and in maintaining and advancing the work of the Task Force's legacy projects, and to this end provide opportunities for the public to comment on the adequacy of such progress.

   ii. Encourage governments to develop and promote a culture of flood preparedness in the Red River valley.

   iii. Encourage government efforts to develop and implement a long-term strategy for flood mitigation emergency preparedness.

   iv. Encourage the sharing of accurate and timely transboundary information to support the development of improved flood forecasting techniques and procedures for early flood warnings and to improve communication of flood forecasts.

   v. Provide through the activities of the Board a forum for the exchange of best practices and for other flood-related information on preparedness, mitigation, response and recovery to assist in transboundary problem solving.

   vi. Promote the application of innovative technologies for supporting flood modeling and mapping.

   vii. Monitor the adequacy of data and information collection networks (meteorological, hydrometric, water quality) for flood preparedness, forecasting and mitigation, within the larger context of overall water management needs in the basin.

   viii. Monitor potential transboundary effects of flood mitigation and other works in the basin, and encourage cooperative studies necessary to examine these effects.

   ix. Encourage governments to integrate floodplain management activities in watershed and basin management.

   x. Interact with all levels of government to help decision-makers become aware of transboundary flood-related and associated water management issues.

   xi. Assist in facilitating a consultative process for resolution of the lower Pembina River Flooding issue.

H. Involve the public in the work of the Board, facilitate provision of timely and 'pertinent information within the basin in the most appropriate manner', including electronic

information networks; and conduct an annual public meeting in the Red River basin.

I. Provide an annual report to the Commission, plus other reports as the Commission may request or the Board may feel appropriate in keeping with this Directive.

J. Maintain an awareness of the activities of other agencies and institutions, in the Red River basin.

6. The Board shall continue to report on the non-Red River geographic areas under the responsibility of the former International Souris-Red Rivers Engineering Board, including the Popular and Big Muddy basins, but excluding the Souris River basin until the Commission determines otherwise.

7. The Board shall have an equal number of members from each country. The Commission shall normally appoint each member for a three-year term. Members may serve for more than one term. Members shall act in their personal and professional capacity, and not as representatives of their countries, agencies or institutions. The Commission shall appoint one member from each country to serve as co-chairs of the Board. An alternate member may not act as a co-chair.

8. At the request of any members, the Commission may appoint an alternate member to act in the place of such member whenever the said member, for any reason, is not available to perform such duties as are required of the member.
9. The co-chairs of the Board shall be responsible for maintaining proper liaison between the Board and the Commission, and among the Board members. Chairs shall ensure that all members of the Board are informed of all instructions, inquiries, and authorizations received from the Commission and also activities undertaken by or on behalf of the Board, progress made, and any developments affecting such progress.

10. Each chair, after consulting the members of the Board, may appoint a secretary. Under the general supervision of the chair(s), the secretary(ies) shall carry out such duties as are assigned by the chairs or the Board as a whole.

11. The Board may establish such committees and working groups as may be required to discharge its responsibilities effectively. The Commission shall be kept informed of the duties and composition of any committee of working group. Unless other arrangements are made, members of the Board, committees or working groups will make their own arrangements for reimbursement of necessary expenditures.

12. The Commission should also be informed of the Board's plans and progress and of any developments or cost impediments, actual or anticipated, which are likely to affect carrying out the Board's responsibilities.

13. The Commission shall be informed, in advance, of plans for any public meetings or public involvement in the Board deliberations. The Board shall report in a timely manner, to the Commission on these meetings, including representations made to the board.

14. The Board shall provide the text of media releases and other public information materials to the Secretaries of the Commission for review by the Commission's Public Information Officers, prior to their release.

15. Reports, including annual reports and correspondence of the Board shall, normally, remain privileged and be available only to the Commission and to members of the Board and its

committees until their release has been authorized by the Commission.

16. If, in the opinion of the Board or of any member, any instruction, directive, or authorization received from the Commission lacks clarity or precision, the matter shall be referred promptly to the Commission for appropriate action.

17. In the event of any unresolved disagreement among the members of the Board, the Board shall refer the matter forthwith to the Commission for decision.

18. The Commission may amend existing instructions or issue new instruction to the Board at any time.

APPENDIX B

B.1 WATER QUALITY OBJECTIVES

B.2 WATER QUALITY ALERT LEVELS

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B.1 WATER QUALITY OBJECTIVES

The purpose of the water quality objectives and alert levels is to restore and maintain the chemical, physical, and biological integrity of the waters of the Red River. Five specific objectives were adopted for the Red River at the international boundary by the IJC in 1969.

Water quality objectives are used when necessary to secure government commitment to pollution abatement action. Compliance with the objectives is the primary means by which the International Red River Board identifies major water quality issues to the IJC.

The term 'exceedence' is used to describe a situation where an objective is not met. A situation is classified as an exceedence if an individual instantaneous sample, obtained from the continuous auto-monitor, or through a grab sample, is equal to or greater than the corresponding water quality objective (except for dissolved oxygen, which must be observed to be equal to or less than the objective). The five specific parameters and corresponding objective are listed below.

E. Coli	200 colonies/100 ml
Chloride	100 mg/L
Sulphate	250 mg/L
Total Dissolved Solids	500 mg/L
Dissolved Oxygen	5 mg/L

B.2 WATER QUALITY ALERT LEVELS

Water quality alert levels are used to complement water quality objectives. If exceeded, alert levels will trigger investigative action on the part of the IRRB or its representatives. The exceedence is addressed in terms of its magnitude, implications to water uses and possible resolutions. On the basis of alert level exceedances and subsequent investigations, the IRRB may advance proposals for additional objectives.

Water quality alert levels, for a wide range of parameters, in addition to the five specific parameters noted above, were developed by a working group in 1985. These alert levels were approved by the predecessor International Red River Pollution Board in January 1986. The alert levels that are currently in effect are listed in the following table. Further, the table provides a comparison of alert levels with the North Dakota and Minnesota Water Quality Standards, and with the Manitoba Water Quality Objectives as of 1990. The table has not been updated to reflect recent state and provincial revisions. The IRRB Aquatic Ecosystem Committee established by the IRRB in June 2001 will be reviewing the issue of objectives and alert levels with respect to monitoring requirements, analytical methodologies, and reporting protocols.

COMPARISON OF WATER QUALITY ALERT LEVEL STANDARDS AND OBJECTIVES - August 20, 1990

Parameter	Minnesota Standards	North Dakota Standards	Manitoba Objectives	Red River Pollution Board Objectives	Origin/ Rational
Fecal Coliform	200/100 ml geometric mean 10% of samples not to exceed 2,000 based on a minimum of 5 samples in a 30 day period from Mar. 1 – Oct. 31. HH*	200 fecal coliforms per 100 ml. This standard shall apply only during the recreation season, May 1 to September 30. HH	100/100 ml. At least 90% of samples in any consecutive 30 day period should have a fecal coliform density of less than 100 per 100 ml. HH	200/100 ml geometric mean with 10% of samples not to exceed 400 based on min. 5 samples – 30 day period – May 1 – Oct. 31 and for the balance of year not to exceed 1000/100 ml. Current IJC objective.	Minnesota and North Dakota based on primary body contact recreation.
Chloride	100 mg/l (total) ID	100 mg/l (total) ID	100 mg/l (soluble) ID	100 mg/l (dissolved) Current IJC Objective	All agencies based on industrial consumption.
Sulfate	250 mg/l (total) DW	250 mg/l (total) DW	250 mg/l (dissolved) DW	250 mg/l (total) Current IJC Objective	All agencies based on domestic consumption.
TDS	500 mg/l DW	None	500 mg/l DW	500 mg/l Current IJC Objective	All agencies, excluding North Dakota based on domestic consumption.
Dissolved Oxygen	5 mg/l (minimum)	5 mg/l (minimum)	47% saturation or more.	5 mg/l (minimum) Current IJC Objective	All agencies for the protection of aquatic life.
Chemical Characteristics					
pH	6.5 - 9.0 AL	7.0 - 9.0 AL	6.5 – 9.0 AL	6.5 - 9.0	All agencies based on protection of aquatic life.

- DW – Drinking Water
- HH – Human Health
- AL – Aquatic Life
- ID – Industrial Consumption
- IR - Irrigation

Parameter	Minnesota Standards	North Dakota Standards	Manitoba Objectives	Red River Pollution Board Objectives	Origin/ Rational
Dissolved Gas					
Ammonia-N	.04 mg/l as N unionized (warm water) Al	Unionized as N (dissolved). Calculation from standards. See page 8-10. AL	Variable, ranging from 0.0184 to 0.050 mg/l ammonia as NH_3.*		Minnesota and North Dakota for the protection of aquatic life.
Metals (Total)					
Aluminum	Total 125 µg/l AL	None	None	None	Minnesota for the protection of aquatic life.
Cadmium	Total The chronic standard shall not exceed: $_e$ [0.7852 {ln (total hardness mg/l)} – 3.49]. For hardness values greater than 400 mg/l, 400 mg/l shall be used in the calculation of the standard. Cadmium standards in µg/l at various hardness values: 50 mg/l hardness = 0.66 µg/l, 100 mg/l hardness = 1.1 µg/l, 200 mg/l hardness = 2.0 µg/l AL	Total The one-hour average, concentration in µg/l cannot exceed the numerical value given by $_e$ [1.128{ln(hardness as mg/l)} –3.828] more than once every 3 years on the average. AL The four day average concentration in µg/l cannot exceed the numerical value given by $_e$ [.7852{ln(hardness as mg/l)} –3.490] more than once every 3 years on the average.	$_e$ [0.7852 {ln(hardness as mg/l)} –3.49], where hardness is expressed in mg/l $CaCO_3$ and the resultant objective is expressed in µg/l. (e.g.) 50 mg/l $CaCO_3$ = 0.66 µg/l, 100 mg/l $CaCO_3$ = 1.1µg/l, 200 mg/l $CaCO_3$ = 2.0 µg/l. AL	Less than detection.	Minnesota and Manitoba for the protection of aquatic life and wildlife.
Chromium	None	Total 50 µg/l DW	$_e$ [0.8190 {ln (hardness)} +1.561], where hardness is expressed in mg/l $CaCO_3$ and the resultant objectives is expressed in µg/l.	50 µg/l	North Dakota based on domestic consumption.

Parameter	Minnesota Standards	North Dakota Standards	Manitoba Objectives	Red River Pollution Board Objectives	Origin/ Rational
			(e.g.) 50 mg/l $CaCO_3$ = 120 µg/l, 100 mg/l $CaCO_3$ = 210 µg/l, 200 mg/l $CaCO_3$ = 370 µg/l.		
Chromium, Trivalent	Total The chronic standard shall not exceed: exp. [0.819{ln (total hardness mg/l}+ 1.561]. For hardness values greater than 400 mg/l, 400 mg/l shall be used in the calculation of the standard. Chromium +3 standards in µg/l at various hardness values: 50 mg/l hardness = 117 µg/l, 100 mg/l hardness = 207 µg/l, 200 mg/l hardness = 365 µg/l. AL	None	$_e$ [0.8190 {ln (hardness)} +1.561], where hardness is expressed in mg/l $CaCO_3$ and the resultant objectives is expressed in µg/l. (e.g.) 50 mg/l $CaCO_3$ = 120 µg/l, 100 mg/l $CaCO_3$ = 210 µg/l, 200 mg/l $CaCO_3$ = 370 µg/l.. AL	None	Manitoba and Minnesota for the protection of aquatic life.
Chromium, Hexavalent	Total The chronic standard is 11 µg/l AL	None	11 µg/l AL	None	Manitoba and Minnesota for the protection of aquatic life.

Parameter	Minnesota Standards	North Dakota Standards	Manitoba Objectives	Red River Pollution Board Objectives	Origin/ Rational
Copper	Total The chronic standard shall not exceed: exp. [0.62 {ln (total hardness mg/l}) -0.57]. For hardness values greater than 400 mg/l, 400 mg/l shall be used in the calculation of the standard. Copper standards in µg/l at various harness values: 50 mg/l hardness = 6.4 µg/l, 100 mg/l hardness = 9.8 µg/l, 200 mg/l hardness = 15 µg/l . AL	Total The one-hour average concentration in µg/l cannot exceed the numerical value given by $_e$[.9422{1n (hardness as mg/l})-1.464] more than once every 3 years on the average. The four-day average concentration in µg/l cannot exceed the numerical value given by $_e$ [8545{ln (hardness as mg/l)} –1.465] more than once every 3 years on the average. AL	$_e$[0.8545{ln(hardness)}-1.465], where hardness is expressed in mg/l $CaCO_3$ and the resultant objective is expressed in µg/l. (e.g.) 50 mg/l $CaCO_3$ = 6.5 µg/l., 100 mg/l $CaCO_3$ = 12 µg/l, 200 mg/l $CaCO_3$ = 21 µg/l.		Minnesota and Manitoba for the protection of aquatic life.
Iron	300 µg/l DW	None	300 µg/l DW	300 µg/l	Minnesota, Manitoba based on domestic consumption.
Lead	Total The chronic standard shall not exceed: exp. [1.273{ln (total hardness mg/l)}-4.705]. For hardness values greater than 400 mg/l, 400 mg/l shall be used in the calculation of the standard. Lead standards in µg/l at various hardness values: 50 mg/l hardness = 1.3 µg/l 100 mg/l hardness = 3.2 µg/l 200 mg/l hardness = 7.7 µg/l AL	Total The one-hour average concentration in µg/l cannot exceed the numerical value given by $_e$ [1.266{In (hardness as mg/l) - 1.416] more than once every 3 years on the average. The four-day average concentration in µg/l cannot exceed the numerical value given by $_e$ (1.266{ln (hardness as mg/l) - 4.661) more than once every 3 years on the average. AL	$_e$ [1.273{ln (hardness)} - 4.705], where hardness is expressed in µg/l $CaCO_3$ and the resultant objective is expressed in µg/l. (e.g.) 50 mg/l $CaCO_3$ = 1.3 µg/l, 100 mg/l $CaCO_3$ = 3.2 µg/l, 200 mg/l $CaCO_3$ = 7.7 µg/l,		Manitoba, Minnesota and North Dakota for the protection of aquatic life and wildlife.
Manganese	50 µg/l DW	None	50 µg/l DW	50 µg/l	Minnesota and Manitoba based on domestic consumption.

Parameter	Minnesota Standards	North Dakota Standards	Manitoba Objectives	Red River Pollution Board Objectives	Origin/ Rational
Mercury	Total 0.0069 µg/l AL	Total Acute 2.4 µg/l Chronic 0.012 µg/l AL	Acid soluble mercury 0.006 µg/l	Less than detection in water. 0.5 micrograms per gram in fish fillets.	Minnesota, North Dakota and Manitoba for protection of aquatic life, animal life and humans as a result of bioconcentrations in tissue in the food chain.
Nickel	Total The chronic standard (CS) shall not exceed the human health-based criterion of 88 µg/l. For waters with total hardness values less than 50 mg/l, the CS shall not exceed: exp. [0.846{ln(total hardness mg/l)} + 1.1645]. AL and HH	None	$_e$ [0.76{ln(hardness)} None +1.06], where hardness is expressed in mg/l) $CaCO_3$ and the resultant objective is expressed in µg/l (e.g.) 50 mg/l $CaCO_3$ = 56 µg/l, 100 mg/l $CaCO_3$ = 96 µg/l, 200 mg/l $CaCO_3$ = 160 µg/l, AL	None	Minnesota for the protection of aquatic life and human health. Manitoba for the protection of aquatic life.
Selenium	Total 5 µg/l AL	10 µg/l DW	10 µg/l DW	10 µg/l	Manitoba and North Dakota based on domestic consumption. Minnesota for the protection of aquatic life.
Silver	Total The chronic standard shall not exceed 1.0 µg/l. AL	The one-hour average concentration in µg/l cannot exceed the numerical value given by $_e$ [1.72{ln(hardness)} as mg/l)}-6.52] more than once every three years on the average. AL	0.1 µg/l AL	None	Manitoba, Minnesota and North Dakota for protection of aquatic life.

Parameter	Minnesota Standards	North Dakota Standards	Manitoba Objectives	Red River Pollution Board Objectives	Origin/ Rational
Zinc	Total The chronic standard shall not exceed: exp. [0.8473{ln(total hardness mg/l)} + 0.7615], For hardness values greater than 400 mg/l, 400 mg/l shall be used in the calculation of the standard. Zinc standards in µg/l at various hardness values: 50 mg/l hardness = 59 µg/l 100 mg/l hardness = 106 µg/l 200 mg/l hardness = 191 µg/l AL	Total The one-hour average concentration in µg/l cannot exceed the numerical value given by e [.8473{ln(hardness as mg/l)} +.8604] more than one every 3 years on the average. The four-day average concentration in µg/l cannot exceed the numerical value given by e [.8473 {ln(hardness as mg/l})+.7614] more than once every 3 years on the average. AL	47 µg/l AL	47 µg/l	Minnesota, North Dakota and Manitoba for the protection of aquatic life.
Nutrients					
Nitrates (N)	Total 10 mg/l DW	Dissolved 1.0 mg/l DW	Total 10 mg/l DW	Total 10 mg/l	Minnesota and Manitoba based on domestic consumption.
Toxic Substances					
Arsenic	Total 50 µg/l DW and AL	Total 50 µg/l DW	Acid soluble arsenic 50 µg/l DW	Total 10 µg/l (under review)	Minnesota based on domestic consumption and for protection of aquatic life.
Boron	500 µg/l IR	750 µg/l IR	500 µg/l IR	Total 500 µg/l	Minnesota, Manitoba based on irrigation water.
Chlorine	Total residual 6 µg/l	None	None	None	Minnesota for protection of aquatic life.
Cyanide	Free cyanide	Total	Free cyanide	Total	Minnesota and North

Parameter	Minnesota Standards	North Dakota Standards	Manitoba Objectives	Red River Pollution Board Objectives	Origin/ Rational
	5.2 µg/l AL	5 µg/l AL	5.2 µg/l cyanide AL	5 µg/l	Dakota for protection of aquatic life.
Dioxin	None	None	None	Not detectable in any media analyzing to parts per trillion.	Task Force
PCBs	Total 0.000029 µg/l AL and HH	Total Acute 2.0 µg/l Chronic 0.014 µg/l AL	.014 µg/l AL	Not detectable in water, in fish total PCBs not exceeding 2 micrograms per gram in fillets.	Body burden: Manitoba, North Dakota and Minnesota for protection of aquatic life, animal life and human life.
Phenolics	None	None	1 µg/l DW	10 µg/l	North Dakota to protect against taste and odor in water and fish.
Phenol	123 µg/l AL	Total 10 µg/l DW	1.0 µg/l 2.0 AL	None	North Dakota to protect against taste and odor in water and fish.
Pentachlorophenol	The chronic standard shall not exceed: exp.[1.005{pH} – 5 .290]. Pentachlorophenol standards in µg/l at, various pH values: pH 7.0 = 5.7 µg/l, pH 7.5 = 9.5 µg/l, pH 8.0 = 16 µg/l. AL	Acute 20.0 µg/l Chronic 13.0 µg/l AL	0.06 mg/l DW	None	Minnesota and North Dakota for the protection of aquatic life. Manitoba based on domestic consumption.
Pesticides and Volatile Hydrocarbons	Acenapthene 12 µg/l Acrylonitrile 0.38 µg/l Anthracene 0.029 µg/l	Aldrin (total) Acute 3.0 µg/l Chlordane (total)	Aldicarb 0.009 mg/l Aldrin + Dieldrin	Not detectable in water**	All agencies for the protection of aquatic life, animal life domestic

** Limits in fish tissue are being researched by the Task Force.
Tissue samples have been collected by North Dakota and Manitoba.

Parameter	Minnesota Standards	North Dakota Standards	Manitoba Objectives	Red River Pollution Board Objectives	Origin/ Rational
	Benzene 6.9 µg/l Bromoform 128 µg/l Carbon Tetrachloride 1.9 µg/l Chlordane 0.00029 µg/l Chlorobenzene 10 µg/l Chloroform 55 µg/l Chlorpyrifos 0.041 µg/l DDT 0.0017 µg/l 1,2-Dichloroethane 3.8 µg/l Dieldrin 0.000026 µg/l Di-2-Ethylhexyl phthalate 1.9 µg/l Di-n-Octyl phthalate 30 µg/l Endosulfan 0.15 µg/l Endrin 0.016 µg/l Ethylbenzene 68 µg/l Fluoranthene 4.1 µg/l Heptachlor 0.00039 µg/l Heptachlor epoxide 0.00048 µg/l Hexachlorobenzene 0.00022 µg/l Lindane 0.032 µg/l Methylene chloride 46 µg/l Parathion 0.013 µg/l Phenanthrene 2.1 µg/l 1,1,2,2-Tetrachloroethane 1.54 µg/l Tetrachloroethylene 3.8 µg/l 1,1,1-Trichloroethane 263µg/l 1,1,2-Trichloroethylene25µg/l 2,4,6-Trichlorophenol 2.0µg/l	Acute 2.4 µg/l Chronic 0.0043 µg/l Dieldrin (total) Acute 2.5 µg/l Chronic .002 µg/l Endosulfan (total) Acute .22 µg/l Chronic .06 µg/l (continued) Endrin (total) Acute .18 µg/l Chronic .0023 µg/l Heptachlor (total) Acute .52 µg/l Chronic .004 µg/l Lindane (Hexachlorocyclohexane) Acute 2.0 µg/l Chronic .06 µg/l Toxaphene (total) Acute .73 µg/l Chronic .0002 µg/l AL	0.0007 mg/l Atrazine 0.06 mg/l Azinphos-methyl 0.02 mg/l Bendiocarb 0.04 mg/l Benzene 0.005 mg/l Benzo (a) pyrene 0.00001 mg/l Bromoxynil 0.005 mg/l Carbaryl 0.09 mg/l Carbofuran 0.09 mg/l Carbon tetrachloride 0.005 mg/l Chlordane 0.0043 µg/l Chlorpyrifos 0.09 mg/l Cyanazine 0.01 mg/l Diazinon 0.02 mg/l Dicamba 0.12 mg/l 1,2-Dichlorobenzene 0.2 mg/l 1,4-Dichlorobenzene 0.005 mg/l DDT and metabolites		consumption and human health.

Parameter	Minnesota Standards	North Dakota Standards	Manitoba Objectives	Red River Pollution Board Objectives	Origin/ Rational
	Toluene 253 µg/l Toxaphene 0.0013 µg/l Vinyl Chloride 0.15 µg/l Xylene(total m, p and o) 166 µg/l		0.001 µg/l 1,2-Dichloroethane 0.005 mg/l Dichloromethane 0.05 mg/l 2,4-Dichlorophenol 0.9 mg/l 2,4-D – 0.9 mg/l (continued) Diclofop-methyl 0.009 mg/l Dieldrin – 0.0019 µg/l Dimethoate – 0.02 mg/l Diquat – 0.07 mg/l Diuron – 0.15 mg/l Endosulfan – 0.056 µg/l Endrin – 0.0023 µg/l Glyphosate – 0.18 mg/l Heptachlor and heptachlor epoxides – 0.0038 µg/l Hexachlorobutadiene 0.1 µg/l Lindane – 0.080 µg/l Malathion – 0.19 mg/l Methoxychlor – 0.9 mg/l Metribuzin – 0.08 mg/l Monochlorobenzene 0.08 mg/l Nitrilotriacetic acid 0.05 mg/l Paraquat – 0.01 mg/l Parathion – 0.05 mg/l Phthalic acid esters: Dibutylphthalate–4.0 µg/l Dii-(2-ethylhexyl) phthalate 0.6 µg/l other phthalates –0.2 µg/l Phorate – 0.002 mg/l Picloram – 0.19 mg/l		

Parameter	Minnesota Standards	North Dakota Standards	Manitoba Objectives	Red River Pollution Board Objectives	Origin/ Rational
			Polychlorinated biphenyls 0.014 µg/l Simazine – 0.01 mg/l Temephos – 0.28 mg/l Terbufos – 0.001 mg/l (continued) 2,3,4,6-Tetrachlorophenol 0.1mg/l Toxaphene – 0.013 µg/l Triallate – 0.23 mg/l Trichloroethylene 0.05 mg/l 2,4,6-Trichlorophenol 0.005 mg/l 2,4,5-T – 0.28 mg/l Trifluralin – 0.045 mg/l Trihalomethanes 0.35 mg/l DW and AL		
Oil and Grease	500 µg/l HH	No visible film or sheen upon the waters.	Free from oil and grease residues which cause a visible film or sheen upon the waters or any discolouration of the surface of adjoining shorelines, or cause a sludge or emulsion to be deposited beneath the surface of the water or upon adjoining shorelines.	No visible sheen on the surface.	All agencies based on aesthetics, taste and odor in water and fish, and bathing.

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APPENDIX C

WATER POLLUTION CONTROL CONTINGENCY

PLAN LIST OF CONTACTS

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Notification List
For D.O. Depletions, Non-toxic, Oil, and Toxic Spills

United States:

Minnesota Pollution Control Agency – Detroit Lakes, MN

Will Haapala
(218) 856-0730 office
(218) 846-0719 Fax
1-800-422-0798 (24hr)

Molly MacGregor
(218) 846-0494 office
(218) 846-0719 Fax
1-800-422-0798

Minnesota Department of Natural Resources – Bemiji, MN (Fisheries)

Henry Drews
(208) 755-3959 office
1-800- 422-0798 (24hr)

North Dakota Health Department – Bismark, ND

Dennis Fewless
(701) 328-5210 office
(701) 328-5200 fax
1-800-472-2121 (24hr in-state-ask for REACT Officer)
(701) 328-9921 (24hr out-of-state – ask for REACT Officer)

Environmental Protection Agency – Denver, CO

Bert Garcia
(303) 312-6670 office
(303) 312-7206 fax
1-800-424- 8802 (24hr National Response Center)

Canada:

Manitoba Water Stewardship – Winnipeg, MB

Dwight Williamson
(204) 945-7030 office
(204) 948-2357 fax
(204) 256-3706 res.
(204) 944-4888 (24hr telephone service emergency number)

Environment Canada – Regina, SK

David Donald
(306) 780-6723 office
(306) 780-5311
(306) 586-1468 res.

Girma A. Sahlu
(306) 780-6425 office
(306) 780-5311fax
(306) 757-2892 res.

APPENDIX D

HYDROLOGY COMMITTEE & AQUATIC ECOSYSTEM COMMITTEE
MEMBERSHIP LIST

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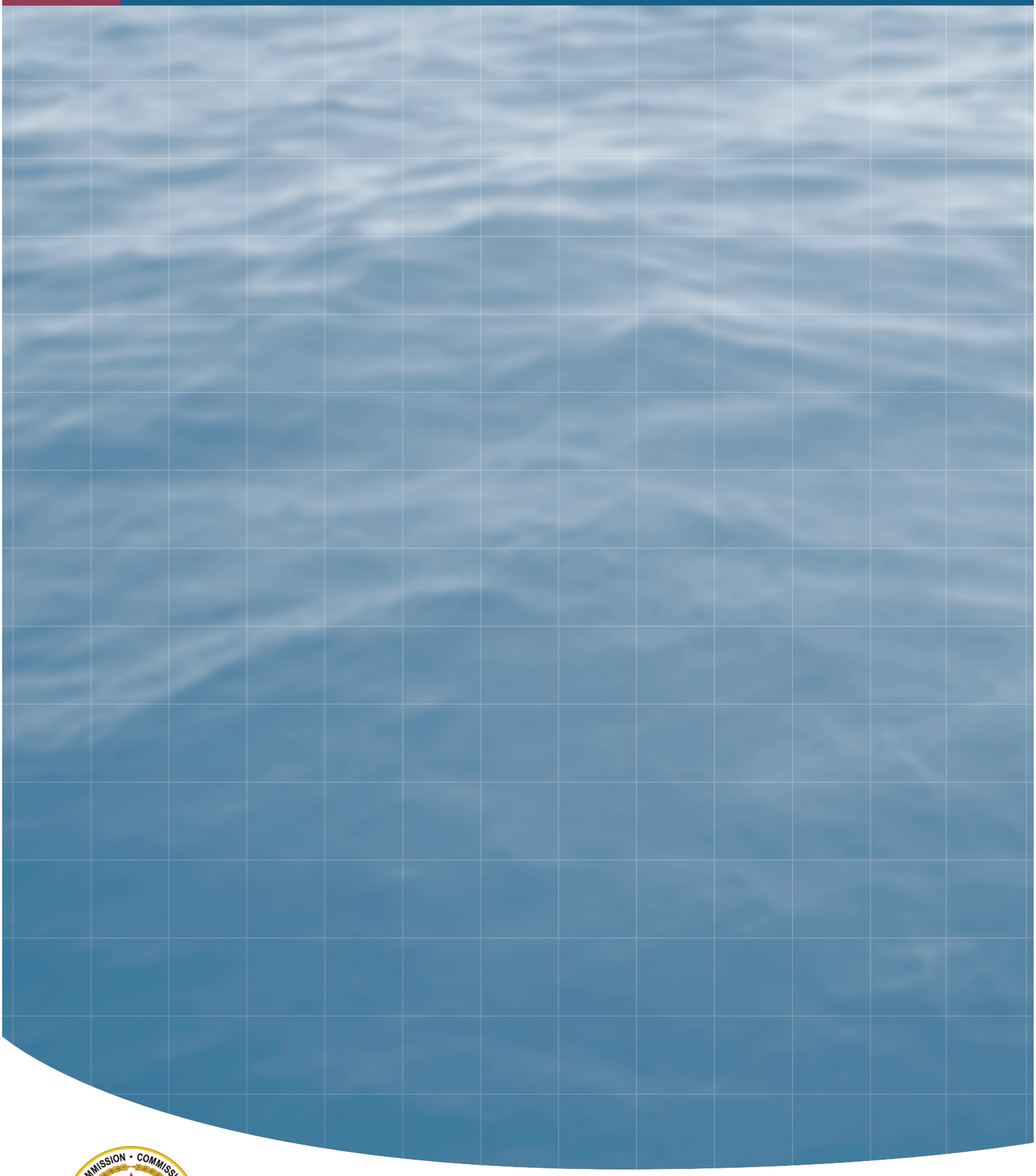
International Red River Board
Hydrology Committee
Membership:

Name	Organization	Phone	E-mail
Bob Harrison (Chair) Steve Topping (Alt.)	Manitoba Water Stewardship, Winnipeg	 (204) 945-7411 (204) 945-6398	 Bob.Harrison@gov.mb.ca stopping@gov.mb.ca
Steve Robinson (Chair) Gregg Wiche (Alt.)	USGS, Bismark	(701) 775-7221 (701) 250-7400	Smrobins@usgs.gov gjwiche@usgs.gov
Girma A. Sahlu	Environment Canada, Secretary IRRB, Regina, SK	(306) 780-6425	Girma.Sahlu@EC.GC.CA
Scott Jutila	Corps of Engineers, Secretary IRRB, St. Paul, MN	(651) 290-5631	Scott.A.Jutila@usace.army.mil
Randy Gjestvang	N.D. State Water Commission, West Fargo	(701) 282-2318	rgjest@water.swc.state.nd.us
Chuck Fritz	International Water Institute, Fargo	(701) 231-9747	charles.fritz@ndsu.nodak.edu
Al Kean	Minnesota Board of Water and Soil Resources,	(651) 297-2907	Al.kean@bwsr.state.mn.us
Haitham Ghamry	Dept. of Fisheries & Oceans Canada	(204)	Ghamry,Haitham K: DFO XCA
Vacant	Minnesota DNR, Bemidji		
Kip Gjerde Amy Ambuehl (Alt.)	U.S. Bureau of Reclamation, Billings	(406) 247-7813 (701) 250-4242 ext. 3615	jgjerde@gp.usbr.gov aambuehl@gp.usbr.gov

International Red River Board
Aquatic Ecosystem Committee
Membership:

Name	Organization	Phone	E-mail
David Rathke (Sec.)	EPA/Denver	(303) 312-6016	rathke.david@epa.gov
Mike Sauer	NDHD/Bismarck	(701) 328-5237	msauer@state.nd.us
Mike Ell	NDHD/Bismarck	(701) 328-5214	mell@state.nd.us
Rick Nelson (Chair)	USBR/Bismarck	(701) 250-4242	rnelson@gp.usbr.gov
Wayne Berkas	USGS/Bismarck	(701) 250-7429	wrberkas@usgs.gov
Molly MacGregor	MPCA/Detroit Lakes	(218) 846-0494	molly.macgregor@ pca.state.mn.us
Lance Yohe	RRBC/Moorhead	(218) 291-0422	lancer2b2@corpcomm.net
Chuck Fritz	Int'l Water Institute, Fargo	(701) 231-9747	charles.fritz@ndsu.nodak.edu
Bethany Kurz	EERC, Grand Forks	(701) 777-5050	bkurz@undeerc.org
Susan Cosens (Chair)	Fisheries and Oceans Canada	(204) 983-8838	susan.cosens@dfo-mpo.gc.ca
David Donald	Environment Canada, Regina	(306) 780-6723	david.donald@ec.gc.ca
Dwight Williamson	Manitoba Water Stewardship, Winnipeg	(204) 945-7030	dwilliamso@gov.mb.ca
Joe O'Connor	Manitoba Water Stewardship, Winnipeg	(204) 945-7814	joconnor@gov.mb.ca
Terry Shortt	DFO/Winnipeg	(204) 983-5062	shorttt@dfo-mpo.gc.ca
Pat McGarry	PFRA/Winnipeg	(204) 983-4832	mcgarryp@em.agr.ca

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