IRRB

THE

INTERNATIONAL RED RIVER BOARD

Twentieth Annual

Progress Report

October 2019

INTERNATIONAL
RED RIVER BOARD

CONSEIL INTERNATIONAL
DE LA RIVIERE ROUGE

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Commissioners:

The International Red River Board is pleased to submit its Twentieth Annual Progress Report to the International Joint Commission.

Respectfully submitted,

Mike Renouf
Co-Chair, Canadian Section

COL. Karl Jansen
Co-Chair, United States Section

PREFACE

This report documents water quality trends and exceedances of objectives, effluent releases, and control measures for the Red River basin for the 2017 Water Year (October 01, 2017 through September 30, 2018). In addition, this report describes the activities of the International Red River Board during the reporting period October 01, 2018 to September 30, 2019 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

In North Dakota, streamflows for the Red River were at normal levels (25-75 percentile) for the 2018/2019 winter. Winter was characterized by soil moisture levels at near normal levels, deeper than normal frost depths, and snow water equivalent amounts that were above to much above normal by March per the National Weather Service (NWS) Office in Grand Forks, ND. "Total precipitation (rain and snow-water) from October 1 - March 15 ranged from 2-4 inches above the long-term normal for most of the central and southern Red River Basin," NWS 2019 Spring Flood Outlook on March 15. Snowmelt runoff began in late March progressing from south to north. Peaks in the upper Red River occurred the second week of April and progressed downstream with the crest passing into Canada on about April 25. A wet summer has resulted in current Red River streamflows that are above normal (76-90percentile) levels.

The Red River at Fargo crested on April 8 with a provisional peak gage height of 35.03 ft. and a streamflow of 19,400 cfs, providing the 8th highest peak for the 118 years of streamflow record. The Red River at Grand Forks crested on April 11 with a provisional peak of 46.98 ft. and a streamflow of 66,500 cfs, providing the 8th highest peak for the 137 years of peak flow record. The annual exceedance probability (AEP) for both locations was 0.04 or a "25-year recurrence interval". Spring runoff into Devils Lake caused a rise of approximately 0.75 ft. with the current stage (August 6, 2019) around 48.63 ft. Pumping from Devils Lake began on June 5 from the West End Outlet and on June 11 from the East End Outlet.

In the Red River Basin, the USGS 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 helps in flood mitigation, water regulation, and water resource planning.

In Manitoba in fall 2017/winter 2018, the Antecedent Precipitation Index (API) and soil moisture measurements indicated moisture conditions were normal to above normal throughout the Red River Basin heading into freeze up The API reflects the soil moisture, or the amount of May to October precipitation that is within the soil that has not yet contributed to runoff. The 2017 API was generally below normal in the northern portion of the basin and normal in the southern portion of the basin.

Above freezing temperatures during mid-January 2018, resulted in some melting of the snowpack. Along the main stem, streamflow was normal (between the 25th to 75th percentile) over the winter months.

Despite a Colorado low weather system in early March that brought heavy snow to parts of the basin, the March flood outlook produced by the Manitoba Flow Forecasting Centre reported normal to well below normal snow accumulation, resulting in a low risk of major flooding. The forecasted levels were expected to be below flood protection levels even under unfavorable weather conditions.

Spring 2018

Flows on the Red River were in the normal range except for a short period in late April to early May 2018 when the flows reached the above normal category as a result of snowmelt runoff.

The Red River at Fargo crested on April 19th at 18.65 ft., with a peak discharge of 4,740 cfs (134 cms) (54th highest peak for the 118 years of daily record). The exceedance probability for the spring peak was in the 0.20 to 0.10 range (5 - 10 year). The Red River at Grand Forks crested on April 24th at 34.99 ft with a peak discharge of 28,000 cfs (793 cms) (43rd highest peak for the 136 years of peak flow record). The exceedance probability for the peak was in the 0.50 to 0.20 range (2 – 5 year).

Emerson peaked April 29th at a flow of approximately 32,500 cfs (920 cms). This corresponds to an approximately 1 in 3-year event. The Red River peaked in Winnipeg on May 1st at 15.7 ft (flood stage is 18 ft). The Red River Floodway was not operated in 2018. The Portage Diversion was operated for ice management on the Assiniboine River.

Summer 2018

After the spring freshet the weather was generally dry. Flows over the summer months generally followed the historical median quite closely remaining in the normal range (25th – 75th percentile range). Much of the Red River Basin experienced some degree of dryness or drought conditions in the summer of 2018. The Canadian portion of the basin experienced slightly drier conditions than the US portion of the basin.

Fall 2018

Rainfall in September and October increased flows on the main stem into the "above normal" range for a short period but they receded back into the normal range by mid-November 2018/

The Antecedent Precipitation Index is a model that indicates the amount of summer and fall rain (May to October) that remains in the soil layer and has yet to contribute to runoff. It is a model that indicates the degree of saturation in the soil and is used in Manitoba's flood forecasts. Heading into freeze-up the Antecedent Precipitation Index for the Red River Basin was generally normal to below normal. Soil moisture surveys showed soil moisture was generally normal for most of the basin and slightly above normal for the southern portion. Despite the drier summer weather, it seems the fall precipitation was sufficient to increase soil moisture to normal levels in most areas. The figure below (Figure 1) shows the streamflow trend for the calendar year 2017 and 2018 on the Red River at Emerson, Manitoba.

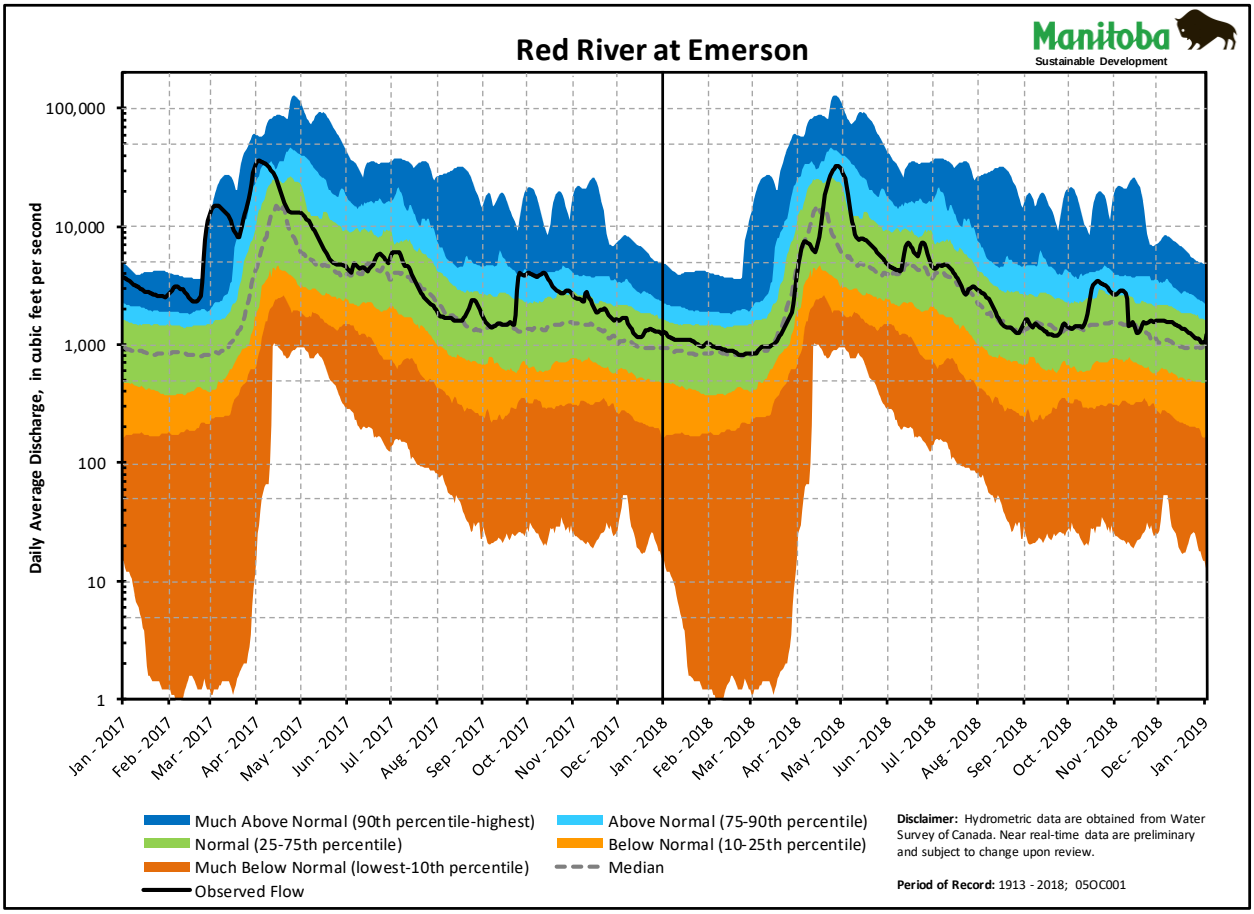

Figure 1. Average daily discharge in the Red River at Emerson for 2017 and 2018.

Water Quality

There are five binational water quality objectives established by the governments of Canada and the United States, herein called multi-national water quality objectives, for the Red River at the International Boundary. These parameters are - Total Dissolved Solids (TDS), Dissolved Oxygen (DO), Chloride (Cl), Sulphate (SO_4), and E. coli. Exceedances of the water quality objectives, and concentrations approaching the objective level for total dissolved solids (TDS) were observed at the international boundary during the October 1, 2017 - September 30, 2018 time period. Total Dissolved Solids (TDS) remained at or above the objective of 500 mg/L for most of the 2018 water year (86 %). The highest observed value of TDS was 1,097 mg/L on November 14th.

Furthermore, the Sulphate objective (250 mg/L) was exceeded in 50% of the samples collected during the same period. The highest recorded value was 498 mg/L on October 23rd.

The bacteriological characteristics of the Red River are assessed on the basis of observed *Escherichia coli* bacteria for which a Binational Objective (200 colonies per 100 ml) has been defined. The presence of *Escherichia coli* in water is an indicator of impacts via human and/or animal wastes. During the 2017-2018 water year, the *Escherichia coli* bacteria objective of 200 colonies per 100 ml was not exceeded with a maximum count of 150 colonies per 100 ml on October 10, 2018.

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, 2018 - September 30, 2019, which succeeds the 2018 water year. The key activities are highlighted below:

In 2019, the IRRB further revised its 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. Key IRRB activities also include - development of apportionment/flow targets at the International Boundary including instream flow needs (IFN), continuation of the development of Comprehensive Flood Mitigation Strategy (CFMS) as per the terms of reference of the Committee on Hydrology, and development of nutrient objectives for the Red River at the International Boundary.

In 2019, the IJC contracted independent peer reviewers of the 2016 RESPEC report to develop a stressor response for the Red River. Results of the peer review were received in spring 2019. Overall, the reviewers found that the study was adequately designed and conducted and the analytical methods were appropriate.

Aquatic Ecosystems Committee (AEC) - The AEC also received additional IWI funds and extension to continue its Fish Telemetry study in the Red River Basin. Aquatic Invasive Species and Habitat Mapping are also included in the study.

Lower Pembina Task Team (LPTT) - The LPTT was revived again in 2019 to complete its modelling work and recommendations to the Premier of Manitoba and Governor of North Dakota. LPTT held its first meeting in June 2019 in Gretna, Manitoba.

The IRRB held its summer bi-annual meeting on August 28-29, 2018 in Detroit Lakes, MN to address select issues in the basin, and the winter bi-annual meeting on January 17-18, 2019 in Grand Forks, ND for a more complete review of its responsibilities, activities, and accomplishments. The meetings addressed water quality monitoring and compliance with the binational water quality objectives and established alert levels and IRRB work plan priorities. The latter included actions to develop water quantity apportionment procedures / instream flow needs (IFN), prioritized flood mitigation plans, and biological monitoring and nutrient management strategies for the basin.

1.03 International Red River Board Three-Year Work Plan (2018-2021)

The Board reviewed and updated its three-year work plan in August 2018. Current priorities include:

- Reporting on Water Quality Objectives,
- Comprehensive Flood Mitigation Strategy,
- Water Quantity Apportionment & Instream Flow Needs (IFN),
- Next Steps to Address the Lower Pembina Flooding Issues,
- Strategies to Develop Nutrient Management Objectives,
- Outreach and Engagement, and
- IWI funded Projects.

The current three-year work plan covers the period from October 1, 2018 through September 30, 2021.

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 Poplar and Big Muddy basins were removed after consultation with the IJC. The Red River Basin is illustrated in Figure 2.

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

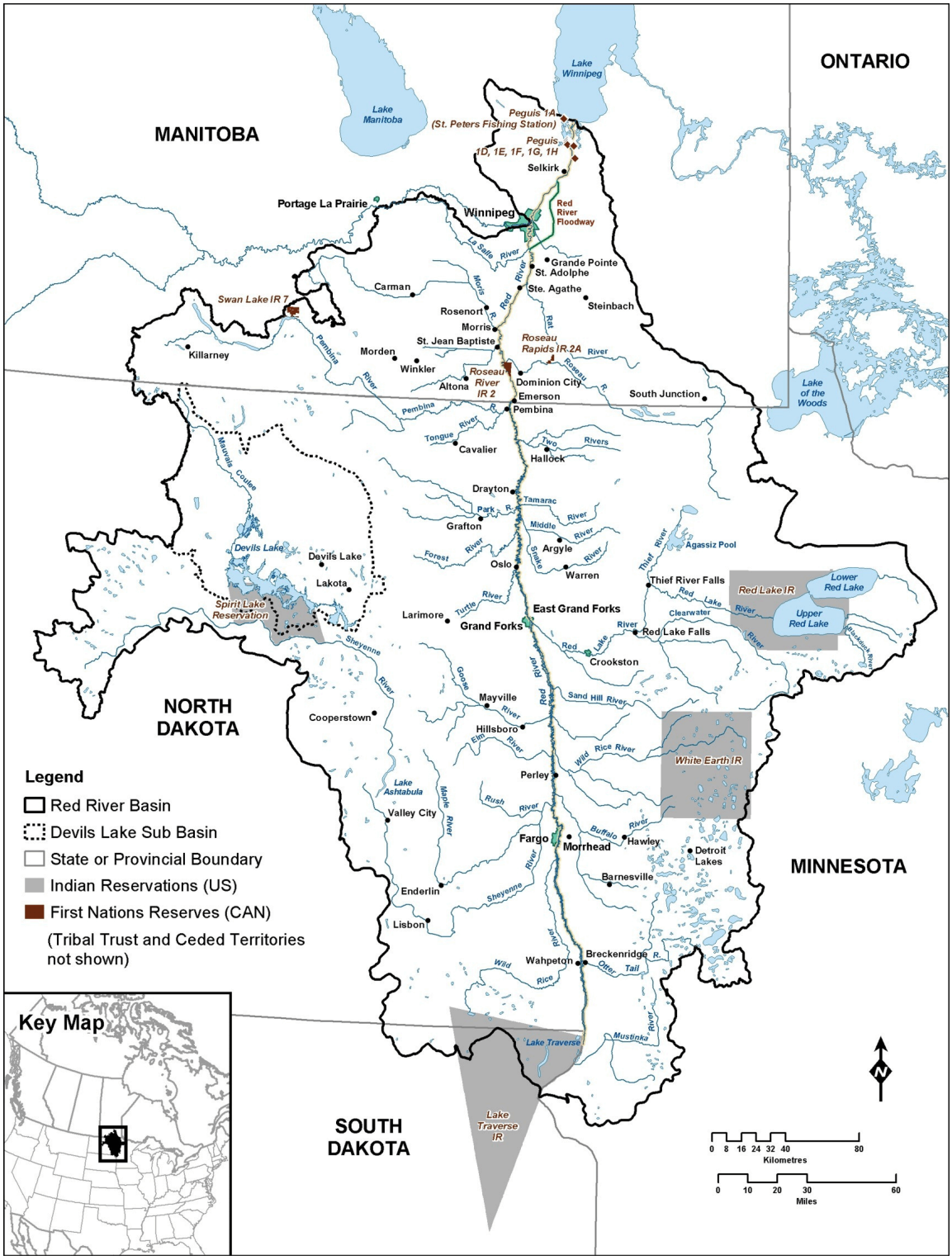

Figure 2: Red River and its Tributaries

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.

COL Karl Jansen, U.S. Army Corps of Engineers and Mike Renouf, Environment and Climate Change Canada, are the current Co-Chairs of the Board, respectively. Rebecca Seal-Soileau, US Army Corps of Engineers and Girma Sahlu, Environment and Climate Change Canada, provide secretarial, technical and engineering support to the Board.

United States

COL Karl Jansen – U.S. Chair
District Engineer, St. Paul District
U.S. Army Corps of Engineers

Jim Ziegler
Detroit Lakes Office
Minnesota Pollution Control Agency

David Glatt
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North Dakota Department of Health

Randy Gjestvang
Red River Water Resources Engineer
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4.0 INTERNATIONAL RED RIVER BOARD ACTIVITIES

During the reporting period October 01, 2018 - September 30, 2019, the International Red River Board met with the IJC at the fall semi-annual meeting 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 summer bi-annual meeting on August 28-29, 2018 to address select issues in the basin, and the winter bi-annual meeting on January 17-18, 2019 for a more complete review of its responsibilities, activities, and accomplishments. The meetings addressed water quality monitoring and compliance with the multi-national objectives and established alert levels, and IRRB work plan priorities. The latter included actions to develop water quantity apportionment procedures, instream flow needs, prioritized flood mitigation plans, and biological monitoring and developing nutrient management strategies for the Red River Basin.

Except for short executive sessions during the August and January 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. The Board initiated its first public session in conjunction with the Red River Basin Commission (RRBC) Annual Conference in January 2015. RRBC provided a session in its conference agenda for IRRB co-chairs and IJC Commissioners to answer questions and receive input from conference attendees. IRRB will continue to coordinate the public session with RRBC for future public meetings. This would allow the IRRB to reach a larger public audience than it would during its regular open house held at the end of its meetings.

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.

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.

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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.*

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 five 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.

The COH was re-established in 2006-2007 with a broader agency representation and new members. 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. Furthermore, the Board established the Water Quality Committee (WQC) in 2011 to report on water quality and nutrient management issues in the Red River Basin.

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

During the reporting period, Environment and Climate Change Canada continued to provide water quality monitoring at the international boundary and reported on the status of compliance with established Binational 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 (reports summarized in Chapter 5).

IRRB also received information from agencies monitoring 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 Aquatic Ecosystem Committee

In 2003, the Aquatic Ecosystem Committee (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 "assist in assuring 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".

In January 2016, the AEC was expanded to include several new members at the state, provincial and federal level. The committee members are:

Canadian Co-Chair: Patricia Ramlal, Fisheries & Oceans Canada
US Co-Chair: Joanne Grady, U.S. Fish & Wildlife Service

Current Committee members are:

Luther Aadland (MN)
Todd Caspers (ND)
Eva Enders (CAD)
Amanda Hillman (MN)
Jessica Howell (ND)
Geoff Klein (MB)
Aaron Larson (ND)
Jeff Long (MB)
Doug Watkinson (CAD)

The AEC holds monthly phone calls except during the spring/summer field season. The group's discussion centers on how current work being done in the basin, linkages between ongoing programs and how the various programs could collaborate to get a better picture of the entire basin.

The AEC continues to flag the main issues of concern to the committee as those related to: (1) fish movement within the basin including instream flow needs (IFN); (2) aquatic invasive species (AIS); and (3) communication.

Fish Telemetry Study in the Red River Basin conducted by the AEC

A large scale hydro-acoustic telemetry study is currently conducted in the Red River and the adjunct Lake Winnipeg Basin to study habitat use and movement of a number of fish species including Lake Sturgeon (*Acipenser fulvescens*), Bigmouth Buffalo (*Ictiobus cyprinellus*), Channel Catfish (*Ictalurus punctatus*), Walleye (*Sander vitreus*), and Common Carp (*Cyprinus carpio*). Funding provided through a proposal accepted by the IWI is consistent with the International Red River Board (IRRB)'s existing mandate to establish Instream Flow Needs Recommendations for the Red River as outlined in work plan.

The obtained information on habitat use and fish movement is crucial for Instream Flow Needs predictions and will provide previously unknown aspects of the lives of fishes in the Red River such as where certain fish spawn and when fish move to and from spawning grounds or overwintering areas. Additionally, we will better understand the population structure and movement of fish between the United States (US) and Canada in the Red River Basin.

The Aquatic Ecosystem Committee proposed a three-year work plan to the IRRB that met with their approval. AEC will be applying for IWI funds to support some of these activities. The three components of that plan are as follows:

1. Continuation of the Fish Movement Study: The large scale hydroacoustic telemetry study is currently conducted in the Red River and the adjunct Lake Winnipeg Basin to study habitat use and movement of a number of fish species. We have successfully solicited funds for the next three years, until 2022. Two manuscripts on the Channel Catfish and Bigmouth Buffalo movement have been submitted to peer-reviewed journals. Follow-on tasks are reporting in form of a communication report and final report.

2. Aquatic Invasive Species: Evaluation of current and projected AIS in the Red River. Joanne Grady has indicated that the FWS had received internal funding from Congress to fund a GIS Biologist in Bismarck who will be looking at the transfer of Asian carp across the border. It was agreed that the AEC should have a workshop as described in the work plan and will try to solicit funds to help with that. We will want to pull information from other agencies together before that workshop happens.

3. Habitat Evaluation in the Red River: Survey the riverine habitat in the Red River by conducting velocity and depth measurements along transects positioned at every hydroacoustic receiver site in the Red River using an ADCP (Acoustic Doppler Current Profiler). In addition, depth and substrate will be assessed using a BioSonics MX Aquatic Habitat Echosounder throughout the entire the length of the Red River. This study would be conducted by both countries (US and Canada) and would require approximately four weeks of field work and two months of data analysis. This work complements the fish movement study and the IFN study by the COH. Possibly add surveys of some of the tributaries, with ADCP if depths are deep enough, or with alternate survey equipment appropriate to the depths being surveyed. NOTE: This study has been postponed until fiscal 2020/21 due to the heavy workload of the participants. We expect to submit a proposal to the IWI for ~$30K CDN to assist in this study.

4.03-3 Water Quality Committee - Nutrient Management Strategy for the Red River Watershed

The formation of the Water Quality Committee was approved at the September 2011 International Red River Board meeting. The Committee is developing a Nutrient Management Strategy as endorsed by the Board.

The Water Quality Committee currently consists of the following members:

Jim Ziegler, Minnesota Pollution Control Agency (co-chair)
Nicole Armstrong, Manitoba Sustainable Development (co-chair)
Mike Ell, North Dakota State Department of Health (retired April 2019)
Ted Preister, Red River Basin Commission
Rochelle Nustad, U.S. Geological Survey
Eric Steinhaus, U.S. Environmental Protection Agency (retired September 2018)
Kris Jensen, U.S. Environmental Protection Agency
Mike Vavricka, Minnesota Pollution Control Agency
Iris Griffin, Environment and Climate Change Canada
Brian Parker, Manitoba Sustainable Development
Jason Vanrobaeys, Agriculture and Agri-Foods Canada
Michelle Harland, Environment and Climate Change Canada
Paul Klawunn, Environment Canada
James Noren, US Army Corps of Engineers
Elaine Page, Manitoba Sustainable Development

The Committee last met in April 2019.

Component One - Develop Nutrient Management Study
Complete

Component Two - Develop a Shared Understanding of Jurisdictions' Nutrient Regulatory Frameworks and Identify Current Nutrient Reduction Actions, Activities and Plans for the Red River Watershed

Members of the committee and partners including the Red River Basin Commission hosted a Red River Basin/Cold Climate Agricultural Nutrients BMP workshop in Crookston, Minnesota in April 2019. Implementing agricultural beneficial management practices is critical to reducing nutrient runoff and improving water quality. Recent research suggests that the effectiveness of some BMPs in cold climates might differ from observations from areas south of the Red River Basin. The workshop included a review and exploration of available research on BMP effectiveness in northern climates to develop a consensus recommendation on BMP effectiveness. The workshop was well attended and a report is expected later in 2019.

Component Three - Recommend and Implement Nutrient Load Allocation and/or Water Quality Targets for Nutrients

The Water Quality Committee presented a draft report recommending nutrient objectives and targets for the Red River at the US-Canada border to the IRRB at the August 2018 meeting. During winter 2019, the IJC contracted a peer review of the 2016 RESPEC report commissioned by the board to develop a stressor response for the Red River. Results of the peer review were received in spring 2019. The committee will present an updated report recommending nutrient objectives and targets for the Red River at the US-

Canada border at the September 2019 board meeting.

Component Four – Monitor and Report on Progress towards Meeting Water Quality Targets and Nutrient Load Allocations

International Watersheds Initiative – USGS Trend Analysis Project

With funding from the International Watersheds Initiative, the USGS is conducting a basin-wide, water quality trend analysis for approximately 40 sites (including the binational site at Emerson, MB). The trend analysis is being performed by the USGS using QWTREND, a statistical time-series model for analyzing complex flow-related variability and trends in constituent concentrations and loads (Vecchia, 2000, 2003, 2005, 2019 in draft). Constituents included in the trend analysis are nutrients, total suspended solids, total dissolved solids, sulfate and chloride and the time period is from 1980-2015. The trend analysis will fill a critical need to identify changes in water-quality across the Red River Basin while accounting for changes in streamflow.

Preliminary results for the Red River at Emerson from 1970-2017 generally indicate the flow-averaged trend of TP concentrations has increased and the flow-averaged trend in TN concentrations overall has decreased for the same period. Rochelle Nustad will present an update on the project at the September 2019 board meeting. A USGS publication and companion story map to be hosted on IJC website is expected to be completed by late 2019.

Component Five - Facilitate ongoing technical, scientific and methodological dialogue and information sharing

This work is ongoing.

Component Six - Adapt the nutrient management strategy based on progress and ongoing evaluation.

This work is ongoing.

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 Hydrology Committee was asked to prepare a detailed proposal to establish the 'process' for undertaking development and implementation of apportionment procedures. The proposal was to identify the project elements, participating agencies, related capacity issues, and timelines.

The Hydrology Committee's work on apportionment and international drought contingency planning is continuing and focussing on two components: 1) quantifying water usage and low flow vulnerabilities (municipal and other licensed water use, ecosystem instream flow needs, wastewater assimilation, etc.), and 2) quantifying low flow frequencies and the ability of U.S. reservoirs to deliver water during a drought to satisfy U.S. water demand and a potential low flow criteria at the border. The result of the study will be a better understanding of the risks the Basin faces from various Red River Drought scenarios and how a drought contingency plan or minimum flow criteria for the Red River could reduce these risks.

In January 2017, the Hydrology Committee presented work the committee has been undertaking internally to develop a fish habitat model from Emerson, MB to Morris, MB. The purpose of this model development is to have a tool to assess habitat availability for various fish species at various low flows. The committee continues to work on the model development and refinement, is determining the next steps in the model application to support low flow and drought planning.

The Hydrology Committee has updated its work plan with projects focused on obtaining more information of water usage and low flow frequencies. Two potential projects to be completed in the next two to three years include "Red River Low-Flow Frequency Analysis for Evaluation of Future Instream Flow Needs" and "Water Use in the Red River of the North Basin, United States and Canada, 1985-2015".

4.04 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".

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 Hydrology Committee 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 Hydrology Committee 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 Hydrology Committee will also ensure the Board stays engaged about future plans and activities of the Red River Basin Commission as they update their Long Term Flooding Solutions (LTFS) document.

4.05 Lower Pembina River Flooding

The IRRB at its January 2008 meeting established the Lower Pembina Task Team (LPTT). The mandate of this Task Team was to develop a science-based solution(s) to mitigate flooding in the lower Pembina River Basin (Figure 3).

A significant milestone for the IRRB was the completion of the LPTT Report. The LPTT has overseen the completion of a three- phased International Watersheds Initiatives (IWI) study report entitled, "Simulation of Flood Scenarios on the Lower Pembina River Flood Plains with the Telemac 2D Hydrodynamic Model". All three phases of the study were conducted by the National Research Council (NRC). Based on the results of the modelling effort, the LPTT developed a document titled, "An exploratory analysis of mitigation measures for the lower Pembina River basin". These LPTT reports from the three phases were then presented to the Board and subsequently accepted by the IJC. The reports, the model and animations have also been made public.

One of the recommendations provided by the IJC to Governments was to establish a Task Team to work towards a binational solution to help manage the flooding issues in the Pembina Basin. Based on this recommendation, the Governor of ND and the Premier of Manitoba have each assigned 5 members and have created the Pembina River Task Team. IRRB Co-chairs have also been included as members of the Task Team in addition to the 10 Task Team members. The Committee was active from 2013 to 2015 and its meetings were facilitated by the Red River Basin Commission. The committee was working on recommendations to provide to the Governor and Premier but the work has halted when the court case surrounding Pembina River flooding went to trial in the Federal Court of Canada.

Two additional phases of the Telemac 2D were completed to support the committee work. The additional modelling provided additional scenarios key to the committees work and to investigate culvert configurations for the potential raining on Hwy 18 near Neche, ND.

After the judge ruled that the Canadian Federal Court did not have jurisdiction to hear the lawsuit, in June 2017 the Red River Basin Commission sent letters to North Dakota and Manitoba, requesting if there was interest in re-engaging the Lower Pembina River Flooding Task Team. Both have responded favourably and a meeting to re-establish the work of the committee was held in June 2019 in Gretna, MB.

The National Hydraulics Centre has developed a Pembina Interactive Visualization Tool in 2016/2017 to assist in viewing flood inundation areas for various scenarios modeled with the Telemac 2D model for the Lower Pembina River area. Various scenarios are shown and can be compared using a split screen visualization. The tool is available at: http: //pyla.canadacentral.cloudapp.azure.com:8080/

Border Dike Lawsuit

An application for leave to appeal was submitted to the Supreme Court of Canada in August 2017. The applicants are requesting to appeal the Canadian Federal Court and the Canadian Federal Court of Appeal concerning the determination that the Federal Courts do not have any jurisdiction to hear the issues concerning the border dike located near the Lower Pembina River. In December 2017, the Supreme Court of Canada dismissed the leave application for appeal of the Federal judge decision concerning whether the border dike lawsuit could be heard in Federal court.

A newly appointed Lower Pembina River Advisory Team/Task Team held their first meeting in Gretna, Manitoba on June 24, 2019. The Red River Basin Commission facilitated the meeting. A summary of the history of the issues along the border, previous studies completed to analyze the problems and potential solutions, and the progress from the previous task team were presented. A short field tour of a portion of the border dike was provided. The Team discussed the possibility of meeting again later in 2019.

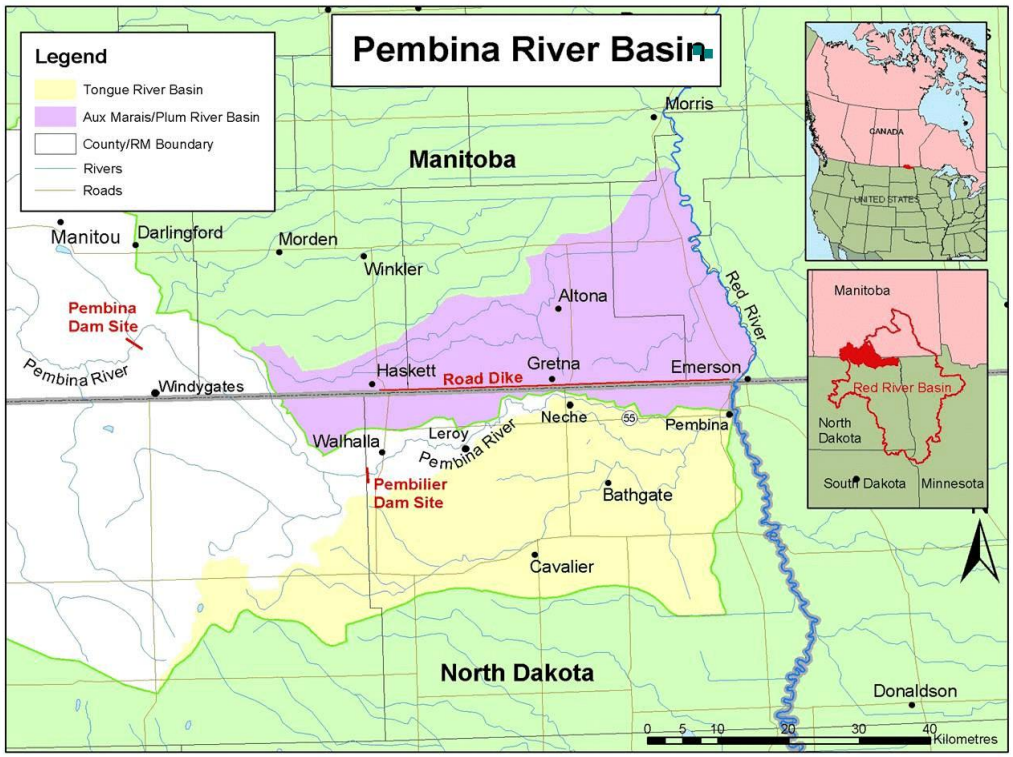


Figure 3: Pembina River Basin. The yellow and white areas comprise the Pembina River Basin.

5.0 WATER QUALITY AT THE INTERNATIONAL BOUNDARY

The water quality of the Red River at the Canada-US boundary, as reported herein, is based on continuous monitoring and instantaneous grab samples obtained during the 2017-2018 water year (October 1, 2017 - September 30, 2018). The collected data are used to determine compliance with the binational water quality objectives and alert levels at the boundary. Detection of exceedances of the objectives and alert levels serves as a trigger mechanism for the Board to report to the IJC and for the IJC to report to governments and also may lead agencies to take appropriate action to prevent or to mitigate potential problems, and to minimize the potential for reoccurrence. Environment and Climate Change Canada provides 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 governments have approved objectives, as well as the suite of pesticides, metals and toxic substances which the Board uses as alert levels, are discussed below along with streamflow and pH 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.

5.01 Binational Water Quality Objectives for the Red River at the International Boundary

The IJC recommended the establishment of water quality objectives for a limited number of variables at the International Boundary on April 11, 1968, and the recommendation was approved by governments of Canada and the United States on May 4, 1969. These variables include: dissolved oxygen, total dissolved solids, chloride, sulphate, and Fecal coliform bacteria. E. coli replaced Fecal coliform as a water quality objective October 1, 2010. In addition, the governments of Canada and the United States established a number of alert levels for a suite of pesticides, metals and toxic substances. The IRRB is responsible for monitoring and reporting on compliance with these objectives and alert levels.

Several exceedances were observed during the 2017-2018 water year, as summarized in Table 1, below. Additional detail on each parameter is provided in the following sections.

Table 1 International Red River Board Water Quality Objectives Summary of Exceedances Red River at the International Border 2017-2018 Water Year

Parameter	Objective	Exceedances		
		Number (total # samples)	% samples exceeding	Maximum (Date)
Dissolved Oxygen	>5 mg/L	0 (42)	0	6.41 (Jun 27)**
Total Dissolved Solids	500 mg/L	37 (43)	86	1097 (Nov 14)
Chloride	100 mg/L	0 (44)	0	87.5 (Mar 9)
Sulphate	250 mg/L	22 (44)	50	498 (Oct 23)
E. coli	<200 colonies /100 ml	0 (12)	0	150 (Oct 10)

***Minimum value for Dissolved Oxygen*

Dissolved Oxygen

Observed levels did not fall below the objective of 5 mg/L during the 2017-2018 water year. The lowest concentration was measured in the fall. Minimums often occur when discharge increases following significant rain events.

Total Dissolved Solids
Total Dissolved Solids (TDS) remained at or above the objective (500 mg/L) for most of the reporting period, with the exception of during the spring (Figure 4). This pattern has been consistent over the last number of years, with higher flows resulting in additional dilution. Exceedances were observed in 86% of the samples collected in the 2017-2018 water year. The highest observed value of 1097 mg/L occurred on Nov. 14, 2017.

Chloride
The *chloride* objective (100 mg/L) was not exceeded during this reporting period. The maximum concentration was 88 mg/L on March 9, 2018.

Sulphate
The *sulphate* objective (250 mg/L) was exceeded in 50% of the samples collected in the 2017-2018 water year. (Figure 5).

E. coli
Observed *E. coli* bacteria counts, as shown in Table 1, remained below the objective of 200 / 100 mL during the reporting period.

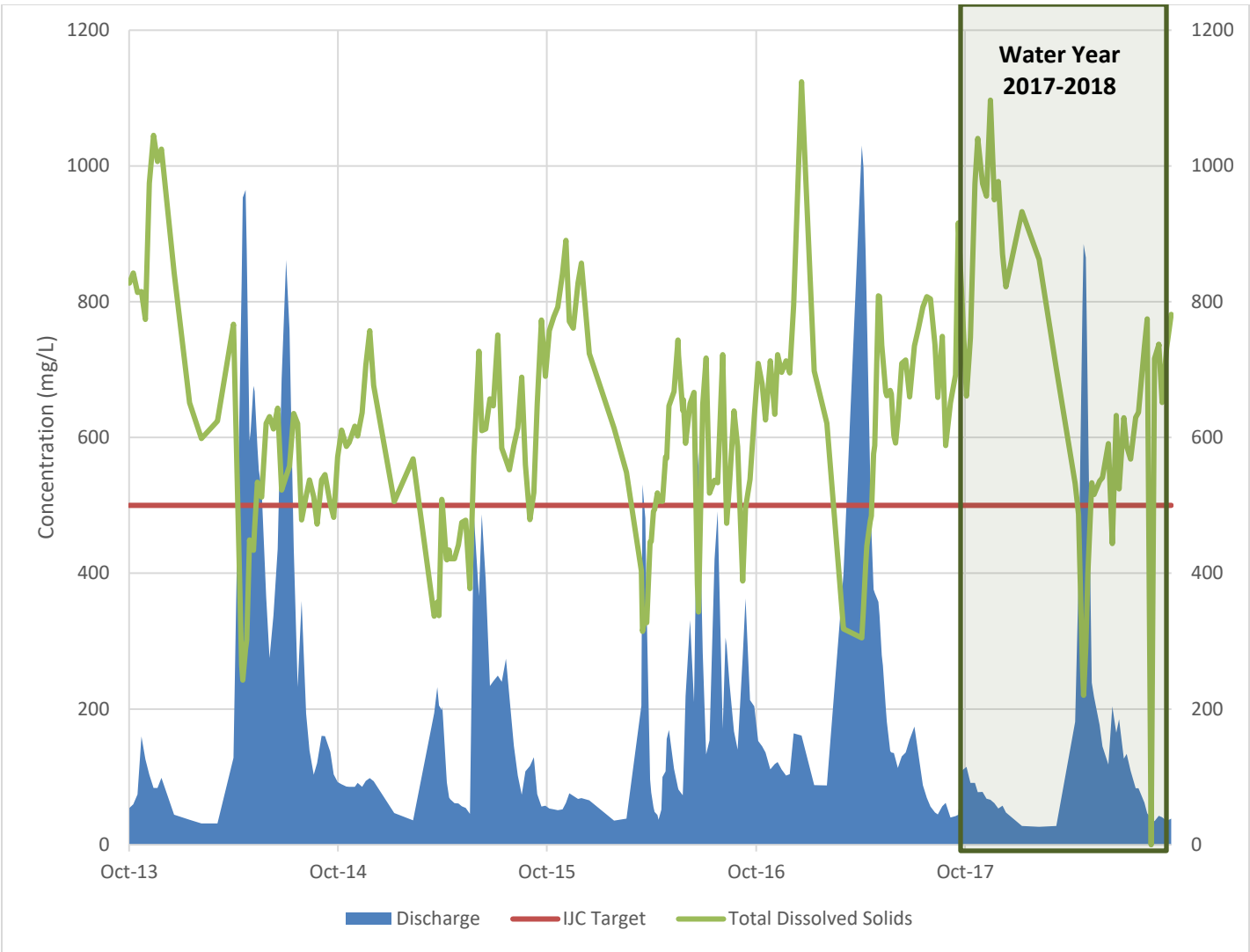


Figure 4: Total Dissolved Solids (TDS) - Red River at the International Boundary

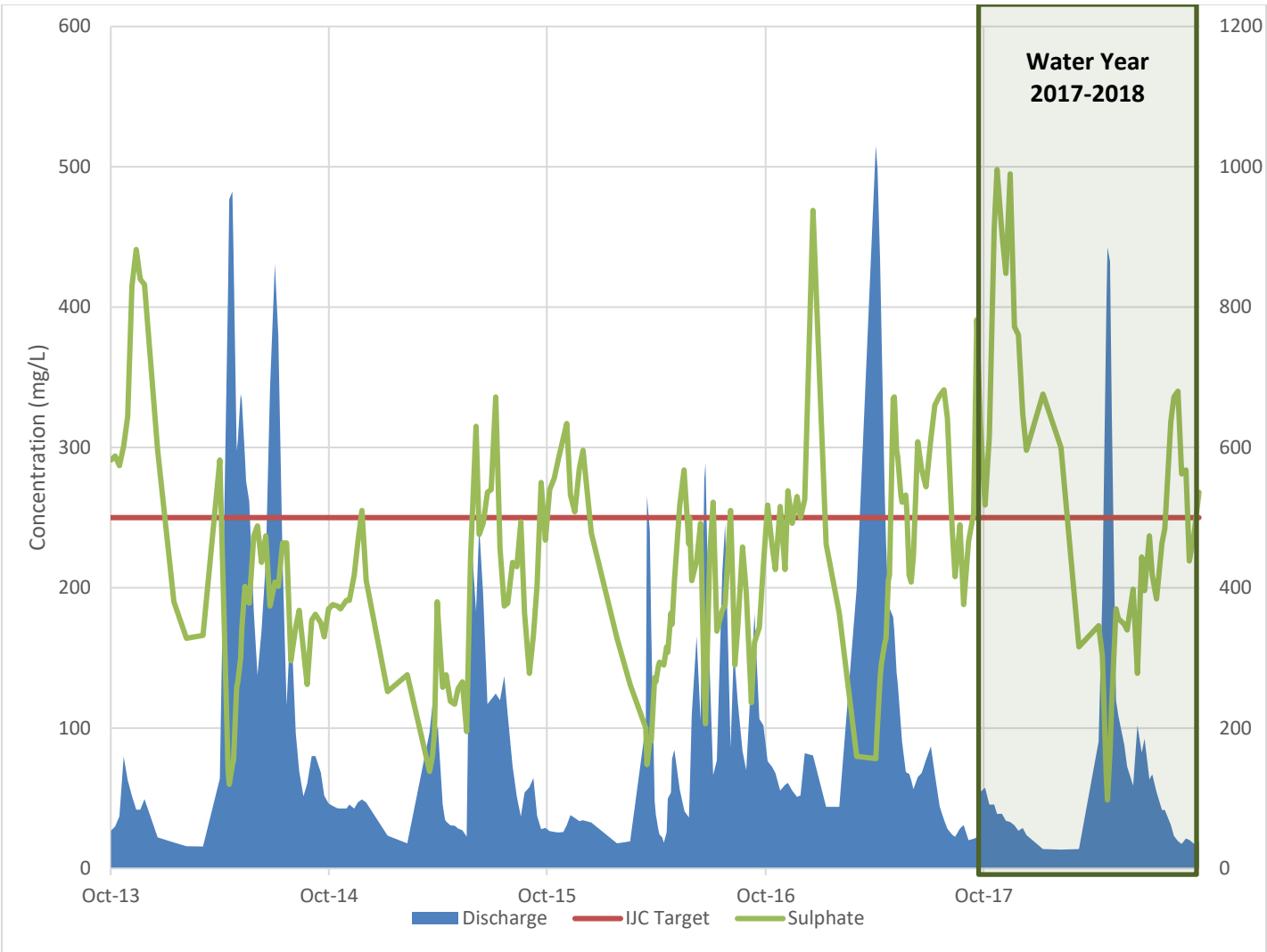


Figure 5: Sulphate Levels – Red River at the International Boundary

Alert Levels

The former International Red River Pollution Board established alert levels for suites of pesticides, metals and toxic substances in 1986. For pesticides, the alert level is described as "not detectable in water", while specific metals have concentration values for alert levels. The following table details the number of "alerts" detected by Environment and Climate Change Canada (Water Quality Monitoring and Surveillance Division) during the reporting period (Table 2).

Pesticides

Based on a total of up to 12 water samples, twenty-one (21) pesticides and metabolites with alert levels (greater than detection concentration) were monitored during the October 1, 2017 - September 30, 2018 reporting period. Five (5) compounds (Atrazine, 2,4-D, Clopyralid, Picloram, Metolachlor) were detected in all samples analyzed. The detection levels for all compounds were all below the Canadian Guidelines

for the Protection of Aquatic Life. Given that the Red River basin is an agriculturally dominated region, the presence of pesticides is expected. The detection of banned pesticides (legacy contaminants) is not unusual given the slow bio-degradation rate of these chemicals. A breakdown product of DDT and endosulfan were detected in one sample during this reporting period.

Environment and Climate Change Canada recently added additional pesticide analyses to assess current use pesticide concentrations during open water conditions (May to October). These include neonicotinoids, sulfonyl urea and carbamate pesticides. In 2017-18, detections included 3 of 8 neonicotinoid insecticides, 5 of 19 sulfonyl urea herbicides and 1 of 7 carbamate fungicides. These results are summarized in Table 3.

The IRRB continues to closely monitor trends in these concentrations and their frequency of detection with the intention to update its assessment as new scientific information becomes available. 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.

Metals

A total of 44 water samples were collected and analyzed for metals and toxic substances during the reporting period. The highest numbers of exceedances were detected for cadmium, manganese and iron, with exceedances exceedance rates ranging from 86-100%. The maximum values for cadmium, manganese and iron were detected in April 2018. Zinc also exceeded the alert level for a few samples this year. It should be noted that the maximum measured concentration for all metals, with the exception of selenium, occurred on the same date during the spring freshet. Higher metals concentrations tend to correspond to higher flow and higher particulate matter events. Iron and manganese are components in natural soils; however, the detection of higher levels of cadmium may indicate anthropogenic sources.

Water Quality Monitoring Program at Emerson in 2017-2018

Following North Dakota's decision to increase releases from Devils Lake, Environment and Climate Change Canada increased the frequency of water quality monitoring on the Red River at Emerson, which continued into the 2017-18 Water Year. During the spring freshet, a minimum of two samples per week were collected. Weekly samples were collected for the remainder of the open water season. Monthly sampling resumed during the winter.

A similar monitoring program is planned for 2018-2019.

Table 2 Exceedances of Alert Levels, Red River at International Boundary October 1, 2017 to September 30, 2018						
Parameter	**Units**	**Alert Level**	**Number of Samples**	**Number of Exceedences (%)**	**Maximum Value (Month)**	**Canadian Environmental Quality Guideline**
Metals:						
Cadmium	ug/L	Detect	44	**44 (100%)**	0.5 (Apr 24)	0. 074 ug/l[1,3]
Chromium	ug/L	50	44	0	15.6 (Apr 24)	NG
Iron Total	ug/L	300	44	**38 (86%)**	14,800 (Apr 24)	300 ug/l[1]
Manganese Total	ug/L	50	44	**39 (89%)**	985 (Apr 24)	200 ug/L[2]
Selenium	ug/L	10	44	0	2.3 (Oct 23)	1 ug/l[1]
Zinc	ug/L	47	44	**3 (7%)**	64.3 (Apr 24)	30 ug/l[1]
Toxic Substances:						
Arsenic (total)	ug/L	10	44	0	8.9 (Jun 27)	5 ug/l[1]
Boron (total)	ug/L	500	44	0	160 (Sep 26)	29 mg/l[1]
Total PCB (Not tested)	ng/L	Detect	0	--	--	NG
Pesticides:						
2,4-D	ng/L	Detect	12	**12 (100%)**	193 (Sep 10)	4000 ng/l[1]
Bromoxynil	ng/L	Detect	12	**6 (50%)**	51.9 (Jun 27)	5000 ng/l[1]
Clopyralid	ng/L	Detect	12	**12 (100%)**	254 (Mar 9)	NG[5]
Dicamba	ng/L	Detect	12	**9 (75%)**	653 (Jun 27)	10000 ng/l[1]
Imazamethabenz-methyl (A)	ng/L	Detect	12	0	-	NG
MCPA	ng/L	Detect	12	**12 (100%)**	75.3 (Jun 27)	2600 ng/l[1]
Mecoprop (MCPP)	ng/L	Detect	12	**12 (100%)**	23.4 (Sep 10)	NG
Picloram	ng/L	Detect	12	**12 (100%)**	69.3 (Apr 11)	29000 ng/l[1]
g-Benzenehexachloride	ng/L	Detect	10	0	-	NG
Atrazine	ng/L	Detect	10	**10 (100%)**	1220 (Jun 27)	1800 ng/l[1]
Desethyl Atrazine	ng/L	Detect	10	**9 (90%)**	164 (Jun 27)	NG
Metolachlor	ng/L	Detect	10	**10 (100%)**	2270 (Jun 27)	7800 ng/l[1]
P,P-DDE	ng/L	Detect	10	**1 (10%)**	1.71 (May 3)	NG
Alpha-Endosulfan	ng/L	Detect	10	**1 (10%)**	0.8 (May 3)	3 ng/l[1,4]
Beta-Endosulfan	ng/L	Detect	10	0	-	3 ng/l[1,4]
Metribuzin	ng/L	Detect	10	**1 (10%)**	263 (Jun 27)	1000 ng/l[1]
Simazine D-ethyl	ng/L	Detect	12	0	-	NG
Endosulfan sulfate	ng/L	Detect	12	0	-	NG
Mirex	ng/L	Detect	12	0	-	NG
p,p-DDT	ng/L	Detect	12	0	-	1 ng/L
Pentachlorobenzene	ng/L	Detect	12	0	-	6.0 ug/l[1]

Notes:
1. Canadian Water Quality Guidelines for the Protection of Aquatic Life (http://st-ts. ccme. ca/)
2. Canadian Water Quality Guidelines for the Protection of Agriculture (http://st-ts. ccme. ca/)
3. Guideline value corrected for minimum value for hardness (mg/L $CaCO_3$) in the reporting period (http://st-ts. ccme. ca/?lang=en&factsheet=93)
4. Guideline value is for technical grade Endosulfan, which is a mixture of the two biologically active isomers (α and β)
5. NG = No guideline established

Table 3 Detections of Current Use Pesticides, Red River at International Boundary October 1, 2017 to September 30, 2018					
Parameter	**Units**	**Number of Samples**	**Detections (%)**	**Maximum - Value (Month)**	**Canadian Environmental Quality Guideline[1,2]**
Carbamates (Fungicides)					
Metalaxyl	*(ng/L)*	7	100	5.0 (Oct 10)	NG
Neonicotinoids (Insecticides)					
Imidacloprid	*(ng/L)*	7	86	11.3 (May 3)	NG
Clothianidin	*(ng/L)*	7	100	31.7 (Apr 11)	NG
Thiomethoxam	*(ng/L)*	7	100	17.8 (May 3)	NG
Sulfonyl Ureas (Herbicides)					
Acifluorfen	*(ng/L)*	7	57	42.9 (Aug 15)	NG
Chlorsulfuron	*(ng/L)*	7	14	1.53 (Jul 17)	NG
Diuron	*(ng/L)*	7	86	20.1 (Jun 27)	NG
Fomesafen	*(ng/L)*	7	86	440 (Aug 15)	NG
Flumetsulam	*(ng/L)*	7	86	14.2 (Aug 15)	NG

1. Canadian Water Quality Guidelines for the Protection of Aquatic Life (http://st-ts. ccme. ca/)
2. Canadian Water Quality Guidelines for the Protection of Agriculture (http://st-ts. ccme. ca/)

3. 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 Binational Water Quality Objectives at the international boundary. Chapter 6 contains basin-wide data and information contributed by federal, state and provincial 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 uses, 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

This information in this report is from July 1, 2018 to June 30, 2019

Watershed Restoration and Protection Projects

There are 17 major tributaries to the Red River in Minnesota. The Minnesota Pollution Control Agency is developing watershed restoration and protection plans for each of these watersheds. Each project consists of monitoring, stressor identification, modeling, public participation/input and a TMDL. The WRAPs have been completed on eight watersheds, one is on public notice, we are responding to comments from the public notice on one, reports are being developed for three and fieldwork is underway in four watersheds.

Watershed Restoration and Protection Project

Name	Status	Final WRAPS Approved
Bois De Sioux River	Responding to Comment	
Buffalo River	Complete	8/9/2016
Clearwater River	Reports in Development	
Mustinka River	Complete	9/26/2016
Otter Tail River	In Progress	
Red Lake River	On Public Notice	
Red R. - Grand Marais Creek	Approved	4/11/2019
Red R. - Marsh River	In Progress	
Red R. - Sandhill River	Complete	4/13/2017
Red R. - Tamarac River	Complete	3/21/2019
Roseau River	In Progress	
Snake River (Red R. Basin)	Reports in Development	
Thief River	Complete	3/18/2019
Two Rivers	Approved	6/10/2019
Upper Red River	Complete	12/22/2017
Upper/Lower Red Lake	Reports in Development	
Wild Rice River	In Progress	

Work has been completed on the Red River main stem and the report was released in January of 2019. The report can be viewed at https://www.pca.state.mn.us/water/red-river-north-evaluating-its-health

Total Maximum Daily Loads

Seven TMDL's where completed during this reporting period.

TMDL Project Name	WID	Waterbody Name	Pollutant	Approval Date
Red R. - Grand Marais Creek WRAPS/TMDL	09020306-515	County Ditch 2	Escherichia coli	5/14/2019
Red R. - Grand Marais Creek WRAPS/TMDL	09020306-519	Judicial Ditch 1	Escherichia coli	5/14/2019
Red R. - Grand Marais Creek WRAPS/TMDL	09020306-520	Judicial Ditch 75	Escherichia coli	5/14/2019
Red R. - Tamarac River WRAPS 2008	09020311-503	Tamarac River	Solids, Total Suspended (TSS)	4/16/2019
Red R. - Tamarac River WRAPS 2008	09020311-503	Tamarac River	Solids, Total Suspended (TSS)	4/16/2019
Thief River WRAPS 2011	09020304-501	Thief River	Solids, Total Suspended (TSS)	3/28/2019
Thief River WRAPS 2011	09020304-507	Mud River	Escherichia coli	3/28/2019

6.02 North Dakota

Ambient Water Quality Monitoring Program

In May 2019, the North Dakota Department of Health's (NDDoH) Environmental Health Section transitioned to its own cabinet agency within the state. The Environmental Health Section separated from the NDDoH and became known as the North Dakota Department of Environmental Quality (NDDEQ). Within the NDDEQ, the Watershed Management Program is responsible for ambient surface water quality monitoring.

In 2012, the USGS North Dakota Water Science Center completed an analysis of the state's ambient water quality monitoring network, including the North Dakota Department of Environmental Quality's (NDDEQ) fixed station ambient monitoring network and the ND State Water Commission's (SWC's) High/Low flow network. In addition to evaluating trends, providing loading estimates and providing a spatial comparison of sites, the report, entitled "Evaluation of Water-Quality Characteristics and Sampling Design for Streams in North Dakota, 1970-2008" (http://pubs.usgs.gov/sir/2012/5216/), provided recommendations for a revised water quality monitoring network for rivers and streams in the state. These recommendations were made to ensure adequate coverage, both spatially and temporally, which is necessary to estimate trends, estimate loads and provide for general water quality characterization in rivers and streams across the state.

Beginning on January 1, 2013 and based on the recommendations provided in the USGS report, the NDDEQ, in cooperation with the USGS and the SWC, implemented a revised ambient water quality monitoring network for rivers and streams. The highest level of sites, design level 1, consist of a network of 32 basin integrator sites located across the state with 16 level 1 sites located in the Red River basin (Figure 6, Table 4). These sites are sampled 8 times per year, twice in April, once each in May, June, July, August, and October, and one time in the winter (January) under ice. The next level, design level 2, consists of 25 sites with 12 level 2 sites located in the Red River basin (Figure 6, Table 5). These sites are sampled 6 times per year, once each in April, May, June, August and October and once under ice during the winter (January). The lowest level of sites, design level 3, consists of 25 sites. There are 12 level 3 sites located in the Red River basin (Figure 6, Table 6). These sites are only sampled 4 times per year, once each in April, June, August and October. Under the current design, the USGS samples all of the design level 2 sites (with the exception of the Red River at Harwood which is sampled by the NDDEQ) and all the design level 3 sites. In the Red River basin, the NDDEQ samples 8 level 1 sites, while the USGS samples 8 sites.

At all level 1, 2 and 3 sites field measurements are taken for temperature, dissolved oxygen, pH and specific conductance. Sampling and analysis at all level 1, 2 and 3 sites consist of general chemistry, dissolved trace elements, and total and dissolved nutrients (Table 7). In addition to these water quality parameters, total organic carbon (TOC), dissolved organic carbon (DOC), total suspended solids (TSS), and E. coli bacteria are sampled and analyzed for at all level 1 sites (Table 7). E. coli bacteria are only sampled during the recreation season (May-September). In addition to sampling for these analytes, the Red River at Fargo, the Red River at Grand Forks, and the Red River at Pembina are sampled for total suspended sediment. The analysis of the total suspended sediment samples is conducted by the USGS Iowa Sediment Laboratory. All chemical analysis of samples is performed by the NDDEQ's Laboratory Services Division.

Table 4: Level 1 North Dakota Ambient Water Quality Monitoring Sites in the Red River Basin.

USGS Site ID	NDDoH Site ID	Site Name	Latitude	Longitude	Design Level	Responsible Agency
05051300	385055	Bois de Sioux River near Doran, MN	46.1522	-96.5789	1	NDDH
05051510	380083	Red River at Brushville, MN	46.3695	-96.6568	1	NDDH
05053000	380031	Wild Rice River near Abercrombie, ND	46.4680	-96.7837	1	NDDH
05054000	385414	Red River at Fargo, ND	46.8611	-96.7837	1	USGS-GF
05057000	380009	Sheyenne River near Cooperstown, ND	47.4328	-98.0276	1	NDDH
05058000	380153	Sheyenne River below Baldhill Dam, ND	47.0339	-98.0837	1	NDDH
05058700	385168	Sheyenne River at Lisbon, ND	46.4469	-97.6793	1	NDDH
05059000	385001	Sheyenne River near Kindred, ND	46.6316	-97.0006	1	NDDH
05060100	384155	Maple River below Mapleton, ND	46.9052	-97.0526	1	NDDH
05066500	380156	Goose River at Hillsboro, ND	47.4094	-97.0612	1	USGS-GF
05082500	384156	Red River at Grand Forks, ND	47.9275	-97.0281	1	USGS-GF
05083000	380037	Turtle River at Manvel, ND	48.0786	-97.1845	1	USGS-GF
05085000	380039	Forest River at Minto, ND	48.2858	-97.3681	1	USGS-GF
05090000	380157	Park River at Grafton, ND	48.4247	-97.4120	1	USGS-GF
05100000	380158	Pembina River at Neche, ND	48.9897	-97.5570	1	USGS-GF
05102490	384157	Red River at Pembina, ND	48.9769	-97.2376	1	USGS-GF

Table 5: Level 2 North Dakota Ambient Water Quality Monitoring Sites in the Red River Basin.

USGS Site ID	NDDoH Site ID	Site Name	Latitude	Longitude	Design Level	Responsible Agency
05051522	NA	Red River at Hickson, ND	46.6597	-96.7959	2	USGS-GF
05051600	385573	Wild Rice River near Rutland, ND	46.0222	-97.5115	2	USGS-GF
05054200	385040	Red River at Harwood, ND	46.9770	-96.8203	2	NDDH
05055300	385505	Sheyenne R above DL Outlet nr Flora, ND	47.9078	-99.4162	2	SWC
05056000	385345	Sheyenne River near Warwick, ND	47.8056	-98.7162	2	USGS-GF
05057200	384126	Baldhill Creek near Dazey, ND	47.2292	-98.1248	2	USGS-GF
05059700	385351	Maple River near Enderlin, ND	46.6216	-97.5740	2	USGS-GF
05064500	NA	Red River at Halstad, MN	47.3519	-96.8437	2	USGS-GF
05065500	NA	Goose River nr Portland, ND	47.5389	-97.4556	2	USGS-GF
05082625	385370	Turtle River at State Park near Arvilla, ND	47.9319	-97.5145	2	USGS-GF
05084000	NA	Forest River near Fordville, ND	48.1972	-97.7306	2	USGS-GF
05092000	380004	Red River at Drayton, ND	48.5722	-97.1476	2	USGS-GF

Table 6: Level 3 North Dakota Ambient Water Quality Monitoring Sites in the Red River Basin

USGS Site ID	NDDoH Site ID	Site Name	Latitude	Longitude	Design Level	Responsible Agency
05052500	385232	Antelope Creek at Dwight, ND	46.3113	-96.7345	3	USGS-GF
05054500	380135	Sheyenne River above Harvey, ND	47.7028	-99.9490	3	USGS-Bis
05056060	385089	Mauvais Coulee Trib #3 nr Cando, ND	48.4575	-99.2243	3	USGS-GF
05056100	380207	Mauvais Coulee nr Cando	48.4481	-99.1026	3	USGS-GF
05056200	385092	Edmore Coulee nr Edmore	48.3367	-98.6604	3	USGS-GF
05056215	385093	Edmore Coulee Trib nr Webster	48.2664	-98.6809	3	USGS-GF
05056239	385091	Starkweather Coulee nr Webster, ND	48.3206	-98.9407	3	USGS-GF
05056340	380213	Little Coulee nr Leeds, ND	48.2433	-99.3729	3	USGS-GF
05060500	385302	Rush River at Amenia, ND	47.0166	-97.2143	3	USGS-GF
05099400	385287	Little South Pembina near Walhalla, ND	48.8653	-98.0059	3	USGS-GF
05101000	381279	Tongue River at Akra, ND	48.7783	-97.7468	3	USGS-GF

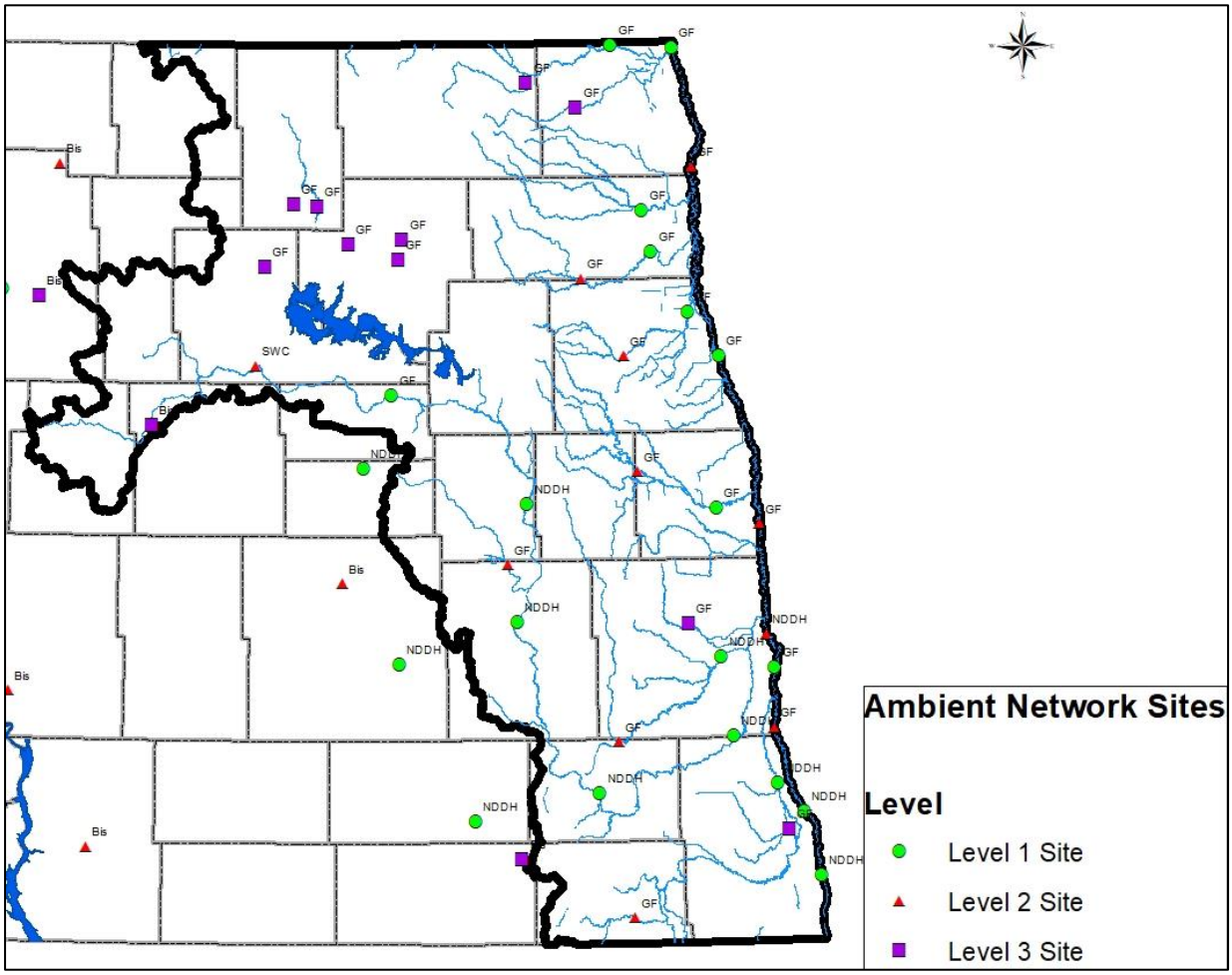


Figure 6: North Dakota Ambient Water Quality Monitoring Sites in the Red River Basin.

Table 7: North Dakota Ambient Water Quality Monitoring Parameters

Field Measurements	**Laboratory Analysis**			
	General Chemistry	**Trace Elements**	**Nutrients**	**Biological**
Temperature	Sodium[1,2]	Aluminum[1,2]	Ammonia (Total) [2]	E. coli[3]
pH	Magnesium[1,2]	Antimony[1,2]	Nitrate-nitrite (Total) [2]	
Dissolved Oxygen	Potassium[1,2]	Arsenic[1,2]	Total Kjeldahl Nitrogen[2]	
Specific Conductance	Calcium[1,2]	Barium[1,2]	Total Nitrogen[2]	
	Manganese[1,2]	Beryllium[1,2]	Total Phosphorus[2]	
	Iron[1,2]	Boron[1,2]	Total Organic Carbon[3]	
	Chloride[1,2]	Cadmium[1,2]	Ammonia (Dissolved) [2]	
	Fluoride[1,2]	Chromium[1,2]	Nitrate-nitrite (Dissolved) [2]	
	Sulfate[1,2]	Copper[1,2]	Total Kjeldahl Nitrogen (Dissolved) [2]	
	Carbonate[2]	Lead[1,2]	Total Nitrogen (Dissolved) [2]	
	Bicarbonate[2]	Nickel[1,2]	Total Phosphorus (Dissolved) [2]	
	Hydroxide[2]	Silica[1,2]	Dissolved Organic Carbon[3]	
	Alkalinity[2]	Silver[1,2]		
	Hardness[2]	Selenium[1,2]		
	Total Dissolved Solids[3]	Thallium[1,2]		
	Total Suspended Solids[1]	Zinc[1,2]		

[1]Analyzed as dissolved.
[2]Sampled and analyzed at level 1, 2 and 3 sites.
[3]Sampled and analyzed at level 1 sites.

North Dakota Department of Agriculture Pesticide Monitoring Program

As a compliment to North Dakota's revised ambient water quality monitoring program, in 2018 the NDDEQ and the USGS cooperated with the North Dakota Department of Agriculture (NDDA) in a state pesticide monitoring program. The goals of the 2018 monitoring program were to: 1) determine the occurrence and concentration of pesticides in North Dakota rivers and streams; 2) identify trends in pesticide contamination to guide regulatory activities; 3) determine whether any pesticides may be present at concentrations that could adversely affect human health, aquatic life, or wildlife dependent on aquatic life; and 4) evaluate levels of certain neonicotinoid insecticides in North Dakota's rivers and streams.

Through this cooperative pesticide monitoring program, the NDDEQ and the USGS collected pesticide samples April through August and in October at all of the level 1 water quality monitoring sites in the state, while the NDDA provided sample analysis through a contract with Montana State University's Agriculture Experiment Station Analytical Laboratory. Through this program six (6) samples were collected at each site in 2018. A final report detailing the results of the 2018 monitoring program, including the results from samples collected in the Red River basin is available at https://www.nd.gov/ndda/publications/reports/reports/pesticide-monitoring-report-2018.

6.03 Manitoba

Surface Water Quality Monitoring

During the water year, Manitoba Sustainable Development continued to monitor water quality on a monthly basis at two sites on the Red River within Manitoba. These sites are located upstream of the City of Winnipeg at the Floodway control structure at St. Norbert and downstream of the City of Winnipeg at Selkirk (Figure 7). Additionally, joint federal/provincial samples are collected at Emerson and Selkirk for quality control/quality assurance purposes to ensure the long-term consistency among federal and provincial datasets. Variables measured include physical parameters, general chemistry, suspended sediment, bacteria, industrial organics, trace elements, nutrients, and agricultural chemicals. Long-term variables monitored by Manitoba Sustainable Development are shown in Table 8. Benthic macroinvertebrates were also collected from the Red River at Emerson and Selkirk in September 2018.

Manitoba Sustainable Development also conducts routine monitoring at seven sites on six tributary streams to the Red River (Figure 7). Samples were collected three times throughout the open water season (October, April and July) and analyzed for a wide range of variables including physical parameters, general chemistry, suspended sediment, bacteria, industrial organics, trace elements and nutrients. Long-term monitoring allows Manitoba Sustainable Development to identify potential sources of pollution on the Red River and develop management strategies to address water quality issues.

Red River – Main Stem

During this reporting period, water quality in the Manitoba reach of the Red River main stem remained similar to previous years. Overall, dissolved oxygen concentrations in the Red River were sufficient to support aquatic life and were relatively high with an average concentration of 9.41 mg/L upstream of the City of Winnipeg at St. Norbert and 9.36 mg/L downstream of the City of Winnipeg at Selkirk. The lowest dissolved oxygen concentrations were sufficient for the protection of aquatic life and occurred in July and August 2018 (6.8 mg/L) at sites upstream and downstream of the City of Winnipeg.

Densities of *Escherichia coli* (*E. coli*) bacteria downstream of the City of Winnipeg were higher than the previous reporting period. The geometric mean density downstream of the City of Winnipeg was 92

organisms / 100 mL, compared to 68 organisms / 100 mL in the previous reporting period. The geometric mean density of *E. coli* bacteria in the upstream reach at St. Norbert was consistent with the previous reporting year with 6 organisms / 100 mL. Densities of *E. coli* bacteria did not exceed the recreational water quality objective of 200 organisms / 100 mL (Manitoba Water Quality Standards, Objectives, and Guidelines, 2011) upstream of the City of Winnipeg at St. Norbert during the current reporting period. However, *E. coli* densities did exceed the recreational water quality objective in samples downstream of the City of Winnipeg on three occasions during the current reporting period. Exceedances occurred during the December 2017 and February 2018 sampling periods where *E. coli* densities were 276 and 214 organisms / 100 mL, respectively. The exceedance during the March 2018 sampling period was approximately 2 times the recreational water quality guideline with an *E. coli* density of 435 organisms / 100 mL.

During this reporting period, eleven samples were analyzed for routine pesticide screening upstream of the City of Winnipeg on the Red River at St. Norbert. Of the 53 routinely monitored pesticides, twelve were detected (23 per cent rate of detection) in the Red River at St. Norbert, which was consistent with the previous reporting period. Dicamba, AMPA, 2,4-D, Glyphosate and Atrazine were the most commonly detected pesticides with nine (82 per cent rate of detection), seven (64 per cent rate of detection), six (55 per cent rate of detection), five (45 per cent rate of detection) and four (36 per cent rate of detection) detections, respectively. Triclopyr was detected on three occasions (27 per cent rate of detection). Atrazine desethyl, Diuron, MCPA and Thifensulfuron methyl were each detected twice (18 per cent rate of detection), while Bromoxynil and Ethalflurin were both detected once (9 per cent rate of detection) during the current reporting period. Dicamba exceeded the irrigation guideline of 0.006 µg/L for all samples with detections (October and December 2017, January and April-September 2018) with concentrations ranging from 0.010 to 0.748 µg/L or nearly 2 to 120 fold greater than the irrigation guideline. None of the other pesticides detected upstream of Winnipeg exceeded water quality guidelines (where available) for the protection of surface water used as sources of drinking water supply, protection of aquatic life, or livestock uses.

A total of eleven samples were also collected from downstream of the City of Winnipeg at Selkirk during the reporting period and analyzed for pesticides. Similar to the Red River at St. Norbert site upstream, eleven pesticides out of the 53 monitored were detected downstream of the City of Winnipeg at Selkirk (21 per cent rate of detection), versus thirteen detections at this site in the previous reporting year. As with the upstream site, Dicamba, 2,4-D, AMPA, Glyphosate and Atrazine were the most commonly detected pesticides in the Red River at Selkirk, with eight (73 per cent rate of detection), six (55 per cent rate of detection), five (45 per cent rate of detection), five (45 per cent rate of detection) and three (27 per cent rate of detection) detections, respectively. Diuron, MCPA, Thifensulfuron methyl, and Triclopyr were each detected twice (18 per cent rate of detection), while Ethalflurin and Atrazine desethyl were both detected once (9 per cent rate of detection) during the current reporting period. Similar to the Red River at St. Norbert site, Dicamba exceeded the irrigation guideline (0.006 µg/L) for all samples with detections (October and December 2017, January and April-August 2018) at Selkirk with concentrations ranging from 0.013 to 0.174 µg/L or nearly 2 to 30 fold greater than the irrigation guideline. None of the other pesticide species detected downstream of Winnipeg exceeded water quality guidelines (where available) for the protection of surface water used as sources of drinking water supply or livestock uses.

Red River - Tributary Streams

During this reporting period, seven sampling stations on six tributary rivers (Boyne, Rat, Roseau, Morris, La Salle rivers and two sites on the Seine River) were each sampled three times. Most water quality parameters in these Red River tributaries remained comparable to past years. Average dissolved oxygen concentrations in the Roseau, Rat, Morris, Seine and La Salle rivers were similar to the previous reporting period, ranging from 8.40 to 10.77 mg/L. However, dissolved oxygen concentrations in the Boyne River were low in comparison to past years, with an average dissolved oxygen concentration of 6.33 mg/L and

lower concentrations of 2.30 and 4.40 mg/L observed during the October 2017 and July 2018 sampling periods, respectively. With the exception of these two sampling periods on the Boyne River, dissolved oxygen concentrations were sufficient to support aquatic life and above the Manitoba Water Quality Objective in the Red River tributaries.

Average densities of *E. coli* bacteria for the Red River tributaries ranged from 15 to 116 organisms / 100 mL for the current reporting period. All samples were below the recreational water quality objective for *E. coli* (200 organisms / 100 mL) during the current reporting period.

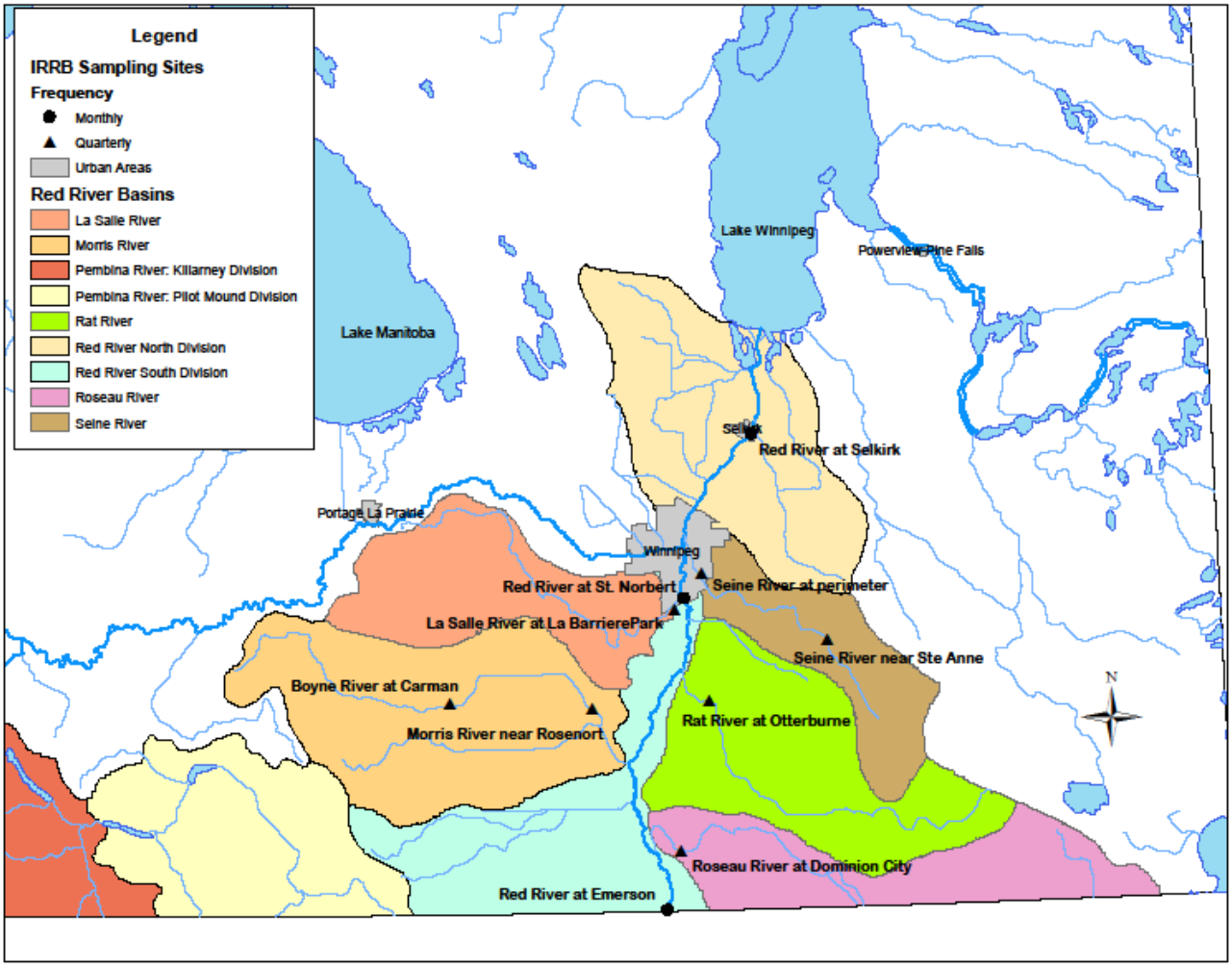


Figure 7: Location of water quality and benthic invertebrate sampling sites in the Red River watershed (Manitoba). Benthic invertebrates are collected 1x/year from the Red River at Emerson and Selkirk sites.

Table 8. Routine surface water quality monitoring variables monitored by Manitoba Sustainable Development on the Red River and tributaries within Manitoba, Canada.

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

Table 8. Continued….

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

Table 8. Continued….

Variables	Units
SULPHATE DISSOLVED	mg/L
TELLURIUM TOTAL	mg/L
TERBUFOS	ug/L
THALLIUM TOTAL	mg/L
THIFENSULFURON-ME	ng/L
THORIUM TOTAL	mg/L
TIN TOTAL	mg/L
TITANIUM TOTAL	mg/L
TOTAL DISSOLVED SOLIDS	mg/L @180C
TOTAL SUSPENDED SOLIDS	mg/L
TRALKOXYDIM	ug/L
TRIALLATE (AVADEXBW)	ug/L
TRIBENURON	ug/L
TRICLOPYR	ug/L
TRIFLURALIN(TREFLAN)	ug/L
TUNGSTEN TOTAL	mg/L
TURBIDITY	NTU
URANIUM TOTAL	mg/L
VANADIUM TOTAL	mg/L
ZINC TOTAL (ZN)	mg/L
ZIRCONIUM TOTAL	mg/L

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 has 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 exceedances 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.

7.02 Spills and Releases

Minnesota

There were 33 Municipal NPDES permits issued and 7 Industrial NPDES permits issued in the Red Basin.

Ada WWTP	12/26/2018
Alvarado WWTP	12/26/2018
Argyle WWTP	12/26/2018
Audubon WWTP	12/26/2018
BNSF Dilworth Yard	04/01/2019
Border States Paving/Marvin/Gordon Pits	05/01/2019
Clearbrook WWTP	12/26/2018
Comstock WWTP	12/26/2018
Donnelly WTP	07/01/2018
Elizabeth WWTP	12/26/2018
Fosston Industrial Facility	05/10/2019
Gary WWTP	12/26/2018
Georgetown WWTP	12/26/2018
Goodridge WWTP	12/26/2018
Grygla WWTP	02/21/2019
Hawkes Co Inc - Peat Harvesting	11/01/2018
Hendrum WWTP	12/26/2018
Hitterdal WWTP	12/26/2018
Kelliher WWTP	12/26/2018
Kittson-Marshall WTP	07/01/2018
Lake Park WWTP	12/26/2018
Marshall & Polk Rural Water System	07/01/2018
McIntosh WWTP	12/26/2018
New York Mills WTP	07/01/2018
Newfolden WWTP	12/26/2018
Oklee WWTP	12/26/2018
Perley WWTP	12/26/2018
Plummer WWTP	12/26/2018

Polaris Industries Inc - Roseau	04/01/2019
Red Lake Falls WWTP	12/26/2018
Rothsay WWTP	12/26/2018
Saint Hilaire WWTP	12/26/2018
Shelly WWTP	12/26/2018
Strata Corp	11/01/2018
Thumper Pond WWTP	09/01/2018
Twin Valley WWTP	12/26/2018
Ulen WWTP	12/26/2018
Vergas WTP	07/01/2018
Warren WWTP	12/26/2018
Wheaton WTP	07/01/2018

There were 29 spills reported.

Date	Source
7/10/2018	Middle River WWTP
8/16/2018	Red Lake Falls WWTP
8/21/2018	Detroit Lakes WWTP
8/23/2018	Detroit Lakes WWTP
8/26/2018	American Crystal Sugar - Crookston
9/17/2018	American Crystal Sugar - Moorhead
10/9/2018	Detroit Lakes WWTP
10/16/2018	Blackduck WWTP
11/6/2018	Greenbush WWTP
12/7/2018	American Crystal Sugar - Crookston
12/7/2018	American Crystal Sugar - Crookston
12/18/2018	Comstock WWTP
12/26/2018	American Crystal Sugar - Crookston
12/26/2018	American Crystal Sugar - Crookston
1/18/2019	Kelliher WWTP
1/23/2019	American Crystal Sugar - Crookston
1/23/2019	American Crystal Sugar - Crookston
2/15/2019	American Crystal Sugar - Crookston
2/18/2019	American Crystal Sugar - Moorhead
3/30/2019	Glyndon WWTP
4/8/2019	Donnelly WWTP
4/8/2019	Barnesville WWTP
4/10/2019	Crookston WWTP
4/17/2019	Erskine WWTP
4/17/2019	Campbell WWTP
4/22/2019	American Crystal Sugar - Crookston
5/2/2019	Detroit Lakes WWTP
5/4/2019	American Crystal Sugar - Crookston
7/3/2019	Bongards' Creameries - Perham

Manitoba

Pollution Sources

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 76 combined sewer outfalls and 90 major land drainage outfalls. Most tributary streams also receive treated wastewater effluents from nearby communities.

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. In Manitoba, four intensive livestock operations (new or expansion) were proposed near the international border between October 2017 and September 2018. All four proposals were reviewed by North Dakota and no concerns were identified.

Pollution Abatement

Manitoba Water Quality Standards, Objectives, and Guidelines are applicable to streams within the Red River basin. Water uses protected in the Red River basin include domestic water supply source, protection of aquatic life, industrial uses, irrigation, livestock watering, and water-related recreation.

Treated municipal effluents discharged to the Red River and tributary streams in Manitoba are licensed under The Environment Act (Manitoba). The City of Winnipeg has 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). The City of Winnipeg also provides annual summaries of combined sewer overflows events, volumes and rainfall information (https://winnipeg.ca/waterandwaste/sewage/annualResults/default.stm).

Manitoba continues to work to understand sources of nutrients to Lake Winnipeg, to monitor the impacts of excess nutrients and to reduce nutrient loading to achieve a 50 % reduction in phosphorus in Lake Winnipeg. Specific nutrient concentration and loading targets for major tributaries to Lake Winnipeg are currently being developed in partnership with neighbouring jurisdictions.

The Sustainable Watersheds Act received royal assent on June 4, 2018 in Manitoba. The Act enables a streamlined approach to drainage, stronger enforcement powers for illegal drainage, a no-net-loss of wetland benefits framework, and changes to The Conservation Districts Act to shift to watershed-based boundaries. The Act also enables the development of nutrient targets and establishes reporting requirements, supports mandate commitments to implement watershed-based planning for drainage and water resource management, and also provides a foundation to implement a province-wide ecological goods and service program called Growing Outcomes in Watersheds or GROW.

GROW is a homegrown approach to ecological goods and services programming that is based on the Alternate Land Use Services (ALUS) model. GROW will create ecological goods and services on the agricultural landscape and encourage beneficial management practices like water retention, grassland restoration, wetland restoration or improved riparian area management by incenting farmers to create new environmental improvements on the landscape. The expected outcomes of GROW are reduced flooding, improved water quality, improved on-farm management of nutrients, enhanced resiliency to the impacts of

climate change, improved biodiversity, enhanced carbon storage, enhanced sustainable food production and improved groundwater quality and recharge. The Manitoba government consulted with Manitobans on GROW in 2017 and just recently announced the GROW Trust, a $52 million endowment that is intended to support practices that will reduce flooding, improve water quality and nutrient management, and support the overall goals of the made-in-Manitoba Climate and Green Plan. In addition, Manitoba also recently announced a $102 million Conservation Trust intended support the work of conservation districts, including for watershed planning and projects.

In addition, Manitoba continues to implement a series of key water protection initiatives aimed at reducing nutrient loading to waterways including regulations restricting nutrient applications to land, requirements for advanced wastewater treatment to remove nutrients and improving surface water retention and management through integrated watershed management planning:

- Nutrient Management Regulation:
    - Manitoba is continuing to implement the Nutrient Management Regulation (https://www.gov.mb.ca/sd/water/lakes-beaches-rivers/nutrient_management/index.html). The Nutrient Management Regulation addresses the application of nutrients to land from all sources, including livestock manure, inorganic fertilizer, cosmetic fertilizers, and biosolids/sludge.
    - Under the Nutrient Management Regulation, nutrients (regardless of the source) cannot be applied to land between November 10th and April 10th.
- Wastewater Treatment:
    - The Manitoba Water Quality Standards, Objectives and Guidelines Regulation (https://www.gov.mb.ca/sd/pubs/water/mb_water_quality_standard_final.pdf) includes province-wide standards for phosphorus in wastewater effluent (1 mg/L) and, where site-specific conditions warrant, nitrogen (15 mg/L). Under the province-wide nutrient standards, a 1 mg/L phosphorus limit applies to all new, expanding or modified wastewater treatment facilities. Small wastewater treatment facilities discharging more than 820 kilograms of phosphorus per year (serving less than 2,000 people or equivalent) have the option of implementing a demonstrated nutrient reduction strategy (for example, a constructed wetland, effluent irrigation, etc.) or the 1 mg/L phosphorus limit. Some facilities in Manitoba have received an extension for implementing the 1 mg/L phosphorus standard through an approved phosphorus compliance plan that outlines the actions they have taken and propose to take along with timelines.
- Integrated Watershed Management Planning:
    - Work on integrated watershed management planning under The Water Protection Act continues in Manitoba. To date 27 plans have been initiated, of which 23 have been completed, five of which are within the Red River Basin. Planning continues for four watersheds including two in the Red River, the Boyne-Morris River and Roseau River watersheds.
    - Integrated watershed management plans are compiled by local water planning authorities with stakeholder input. Plans are 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 plans is guided by specifications in the Act. Manitoba provides financial, planning and technical assistance throughout the process. The integrated watershed management plans include a report on current science and traditional knowledge of the watershed as well as actions to monitor, maintain, and improve environmental conditions in the watershed (https://www.gov.mb.ca/sd/water/watershed/iwmp/index.html).

North Dakota

Spills and Releases

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, 2017 through September 30, 2018), there were 11 releases reported to the department in the Red River basin in North Dakota. The 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 required for one facility based on the findings of the department.

7.03 Pollution Abatement and Advisories

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 151 facilities with a NDPDES Program permit in the Red River basin. Of these, there are 36 industrial wastewater permits and 115 domestic/municipal wastewater permits. Most 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 or Municipal Separate Storm Sewer Systems (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 now in the western part of the state. There are approximately 890 stormwater permits for construction activity and 120 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 126 AFOs permitted by the NDDEQ in the Red River basin. Of these, there are 24 designated as large CAFOs.

Non-point Source Pollution Management Program

The 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 NDDEQ administers the program with input from the North Dakota Nonpoint Source Pollution Task Force (Task Force). The Task Force is comprised of representatives from state and federal natural resource agencies, commodity/producer groups and private wildlife/natural resource organizations.

Each year, Section 319 funds are appropriated to EPA by the U.S. Congress for nonpoint source pollution (NPS pollution) management. The amount of Section 319 funding available to each state is based on an allocation formula and variable from year to year. In North Dakota, approximately 80% (i.e., $3,000,000) of the annual Section 319 grant award is allocated to various organizations (e.g., soil conservation districts, water resource boards, state agencies, universities, and nonprofit organizations) to implement NPS pollution education, assessment and/or abatement projects. The balance of funds awarded to the state are used to support NDDEQ staff and laboratory services. Section 319 funds awarded to the state and approved projects require a 40 percent non-federal match.

Through the NPS Program, the NDDEQ is currently supporting several watershed projects in the Red River basin that are focused on nonpoint source pollution abatement. In most cases, these projects are addressing NPS pollution associated with agricultural activities. A map depicting the location of these projects is provided in Figure 8. Best management practices (BMP) implemented by the active watershed projects in the Red River Valley using FY14-18 Section 319 funding are listed in Table 9. The following is a summary of the active watershed projects as of June 2019 in the Red River Valley.

- The Richland County SCD was awarded Section 319 funding in 2014, 2015 and 2018 to support the implementation of the Antelope Creek Watershed and Wild Rice Riparian Corridor project. The SCD was also awarded Outdoor Heritage Funds in 2014 to supplement the Section 319 funds committed for the implementation of BMPs. The Outdoor Heritage Funds are state funds generated through oil tax revenues. The primary goal of the project is to restore the recreational uses of the impaired reaches of Antelope Creek and the Wild Rice River in Richland County. As a secondary goal, the project will protect and enhance aquatic life uses of Antelope Creek and the Wild Rice River through targeted implementation of BMPs within or immediately adjacent to the riparian corridor. These goals are being accomplished through one-on-one conservation planning; implementation of agricultural BMPs; septic system renovation; and public education. Through these efforts the project has reported declining E. coli bacteria concentrations in some stream reaches of the Wild Rice River in the project area. For one of these reaches, E. coli concentrations are now being maintained below state water quality standards criteria, indicating recreational uses have been fully restored. The water quality improvements in this reach are described in an Environmental Protection Agency (EPA) "Success Story." The web address for the EPA Success Story is https://www.epa.gov/sites/production/files/2015-11/documents/nd_wildrice.pdf.

- The Ransom County SCD was awarded Section 319 funding in 2015 to support the

implementation of the Timber Coulee Watershed project. Outdoor Heritage Funds were also allocated to the SCD to cost share the implementation of BMPs throughout the county, including Timber Coulee Watershed. The primary goal of the project is to restore the recreational uses of Timber Coulee, which is a tributary to the Sheyenne River near Lisbon ND. This is being accomplished by providing financial and technical assistance to producers to improve livestock management along the riparian corridor of Timber Coulee. Specific emphasis is being placed on improving manure management on three animal feeding operations and addressing livestock grazing in the riparian corridor. Practices being promoted and installed include cover crops; cross fencing, vegetative buffers, watering facilities, prescribed grazing and manure management systems.

- The Cass County SCD was awarded Section 319 funding for the Maple River Watershed project in 2018. The long-term goal of the project is to restore the recreational uses of the Maple River in Cass County. As a secondary goal, the project is also promoting the implementation of best management practices (BMP) that improve soil health and reduce nutrient and sediment delivery to the Maple River. To achieve these goals, the project sponsors initiated a watershed-wide educational program and are also providing financial and technical assistance to implement BMPs. Emphasis is being placed on installing BMPs in priority cropland areas and along riparian corridors. Practices that may be installed include septic systems, cross-fencing, off-site watering facilities, nutrient management, water wells, cover crops, riparian buffers and grass waterways.

- The Red River Regional Council was allocated Section 319 funding in 2014 and 2018 to support the implementation of the Red River Riparian Project. Outdoor Heritage Funds were also awarded to the project in 2014 and 2017 to support the installation of BMPs identified in the project implementation plan. The goal of the project is to provide financial and technical assistance to landowners to restore degraded riparian areas within priority watersheds in the Red River Basin. Current priority watersheds include the Forest, Goose, Lower Pembina, Middle Sheyenne, Park and Turtle River watersheds. Landowners are being provided riparian management planning assistance to identify and install BMPs that restore and protect the proper functioning condition of the riparian corridor. Proposed practices include prescribed grazing, exclusion fencing, tree plantings, bank stabilization practices, vegetative buffers, and off-site watering facilities. The project also conducts public outreach events to disseminate information on riparian management and restoration techniques. The target audience for the educational efforts includes the public and landowners as well as staff and supervisors from local communities, water resource districts, and soil conservation districts.

- The Wild Rice SCD received Section 319 funding in 2014, 2016 and 2018 to implement the Wild Rice River Restoration and Riparian project. The project was also allocated Outdoor Heritage funds in 2014 to support BMPs implemented in the project area. The project is focusing on the watersheds for Shortfoot and Crooked Creek as well as the riparian corridor along the main stem of the Wild Rice River in Sargent County. The goal of the project is to improve aquatic life use in the Wild Rice River, Shortfoot Creek and Crooked Creek. This is being accomplished by providing financial and technical assistance to agricultural producers to implement BMPs that reduce livestock impacts, restore riparian habitat and improve the buffering capabilities of riparian areas and adjacent lands. Practices being promoted and installed include manure management systems (i.e., diversions, dikes, holding ponds; etc.) cross fencing, off-site watering facilities, cover crops, riparian easements, grassed waterways, filter strips, and tree plantings. Because of these efforts, the project sponsors have reported declining trends in E. coli bacteria concentrations for one stream reach located in the Shortfoot Creek watershed.

- The Walsh County Three Rivers SCD was initially awarded Section 319 funding for the Homme Dam watershed project in 2014. That project area was expanded in 2018 to include the entire Park River watershed upstream of Grafton. Additional Section 319 funding was awarded in 2018 to support efforts in the expanded project area. Outdoor Heritage Funds were also awarded to the project in 2015. The goal for the expanded project area is to improve the recreational and aquatic life uses of the Park River and Homme Dam reservoir. E. coli bacteria, phosphorus and nitrogen are the primary NPS pollutants being addressed by the project. To achieve the long-term goal, technical and financial assistance is being provided to agricultural producers to implement BMPs that protect or enhance riparian areas as well as improve grazing and woodland management along the Park River, upstream and downstream from Homme Dam reservoir. Practices being promoted and implemented include fencing, off-site watering facilities, water wells, cover crops, grassed waterways, riparian tree plantings; grass buffers/filters and windbreaks.

- The Wells County SCD was awarded Section 319 funding for the Middle Sheyenne River watershed project in 2016. The project area includes a one-mile corridor along both sides of the Sheyenne River from Harvey Dam downstream to the Eddy County line. The SCD is using the 319 funding to implement BMPs that restore the recreational and aquatic life uses of the Middle Sheyenne River. To achieve the goal, the SCD is offering technical and financial assistance to agricultural producers for conservation planning and BMP installation. The project is also conducting information/education activities focused on practices that reduce livestock impacts within the riparian corridor. Priority BMPs being promoted and installed include prescribed grazing systems, fencing, watering facilities, cover crops, septic systems and manure management systems.

- The Grand Forks County SCD was awarded Section 319 funding in 2014 and 2016 to support the implementation of the English Coulee watershed project. The main goal for the project is to achieve an improving trend in the recreational and aquatic life uses of English Coulee. A secondary goal of the project is to educate the public on the relationship between healthy soils and water quality through education and BMP demonstrations. To accomplish these goals, the SCD is offering technical and financial assistance to producers for riparian grazing management, fencing, tanks, pipeline, use exclusion, cover crops, and septic systems

Table 9: BMPs implemented with FY14-FY18 Section 319 funding in the active watershed project areas located in the Red River Valley, as of June 2019

BMP Category/BMP Type	Amount Applied
Cropland	
Cover Crops	6,672 acres
Erosion Control	
Critical Area Plantings	23 acres
Grazing Manangement	
Livestock Fencing	108,324 linear feet
Pasture/Hayland Planting	548 acres
Pipelines	2,386 linear feet
Pond	1 pond
Rural Water Hookup	3 hookups
Trough and Tanks	11 tanks
Wells (livestock watering only)	3 wells
Livestock Manure Management Systems	
Full Containment Manure Management System	8 systems *
Portable Windbreaks	1,424 linear feet
Waste Utilization	2,020 tons
Miscellaneous Practices	
Septic System Renovations	50 systems
Well Decommissioning	34 wells
Riparian Area Management	
Riparian Easements (Cropland)	62 acres
Riparian Herbaceous Cover	270 acres
Strembank and Shoreline Stabilization	5,450 linear feet
Tree Hand Plants	1,045 trees

**Systems implemented with Section 319 funds allocated to the statewide manure management programs administered by the ND Stockmen's Association and ND Department of Agriculture.*

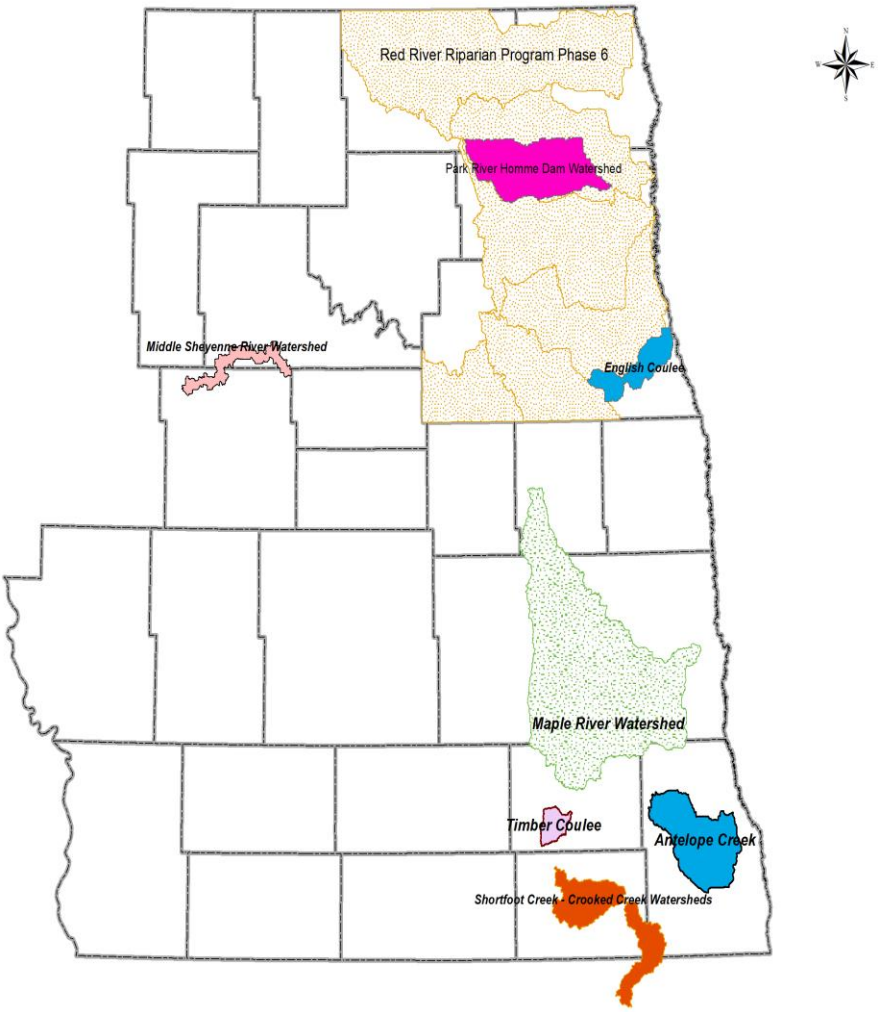


Figure 8: Active North Dakota Watershed Projects in the Red River Basin.

In addition to the watershed projects, the NPS Program also provides Section 319 financial support to several educational projects conducting outreach efforts in the Red River Valley. In general, these educational projects are disseminating information on NPS pollution impacts as well as the solutions to those impacts. The target audiences for these educational events range from K-12 students to the public at large. However, given the extent of the agricultural industry in the state, agricultural producers are typically the primary target audience for most NPS Program educational efforts. Table 10 lists the specific educational projects currently active, to some degree, in the Red River Valley.

Table 10: Educational projects supported by the NPS Program in the Red River Valley

Section 319 Funded Education Project	**Section 319 Funded Education Project**
Statewide ECO ED Program	Envirothon Program
Ranchers Mentoring and Outreach Program	Eastern ND Soil Salinity Demonstration
Project WET	Prairie Waters Education & Research Center
Riparian Ecological Site Description Development	The Regional Environmental Education Series (TREES)
Nutrient Management Education & Support Program	Watershed Leadership Academy

A third category of projects supported by the NPS Program includes projects that are providing technical support to other NPS projects or focusing on a specific priority resource concern. Collectively, these projects are identified as "support projects." The support projects are generally statewide or regional in scale. To date, four support projects have been awarded Section 319 funding through the NPS Program. While the scope of these projects extends beyond the Red River Valley, they have implemented BMPs in the Red River Valley. Summaries of the support projects currently funded by the NPS Program are as follows:

- The ND Department of Agriculture has been awarded Section 319 funding in 2010-2018 to support the Livestock Pollution Prevention Program (LP3). The goal of the program is to deliver a statewide program that will reduce water quality impairments associated with concentrated livestock feeding areas. This is being accomplished by providing planning assistance to livestock producers to design and install manure management systems. Some of the practices being installed include diversions, dikes, fencing, holding ponds, vegetative buffers, and settling basins. Since 2010 the LP3 has provided financial and technical assistance to implement seven full containment livestock manure management systems in the Red River Valley.

- Section 319 funds were awarded to the Stockmen's Association in 2010, 2011, 2013, 2016 and 2017 to support the ND Stockmen's Association Environmental Services Program. The program goal is to deliver a statewide program that addresses water quality impairments associated with concentrated livestock feeding areas. To meet this goal, financial and technical assistance is provided to livestock producers to design and install full containment manure management systems. Assistance is also being provided to develop manure utilization plans for each feeding system. Practices that may be installed include diversions, dikes, fencing, holding ponds, vegetative buffers, and settling basins. The Environmental Services Program assisted with the implementation of one full containment manure management system in the Red River Valley, since 2017.

- Pheasants Forever, Inc. was awarded Section 319 funding in 2017 to implement the Precision Ag Business Planning Support Program. The goal of the program is to utilize precision ag business planning technology, delivered through Profit Zone Manager (PZM) or an equivalent Return on Investment Platform, to improve water quality and wildlife habitat while maximizing farm profits and minimizing risks for participating producers. This is being accomplished by providing technical assistance to producers to utilize PZM or an alternative to evaluate their fields and identify areas of low or negative profits. Using this information, project staff coordinate with local SCD and/or NRCS staff to assist producers in determining alternative uses for the revenue negative acres. The management objective for the targeted acres is to implement practices that will improve producer profits; eliminate unnecessary nutrient and/or pesticide inputs; protect the soil resource; and reduce potential water quality impacts. Typically, the management adjustments on the revenue negative acres include enrollment in the Conservation Reserve Program or, for more short-term practices, planting annual cover crops, perennial forage crops or native grasses. Counties in the Red River Valley where the program is being implemented include Ransom and Sargent counties.

- The International Water Institute (IWI) was allocated Section 319 funding in 2017 and 2018 to support the development and management of the Prioritize, Target and Measure Application (PTMApp) for the Red River Valley in ND. The NRCS has also contributed significant funding to support the development of the PTMApp in the state. The PTMApp provides the means to develop water quality geo-spatial data products at very fine scales. Using the web-based PTMApp, these data can be used by local resource managers and landowners to establish

watershed and field scale priorities; identify specific fields for BMP implementation; and estimate nutrient and sediment load reductions delivered to downstream lakes, reservoirs, rivers and streams. The tool provides a readily available means to evaluate the water quality benefits of different watershed improvement plans; estimate the cost-effectiveness of potential practices for improving water quality; and generate a report of the "preferred" option to aid in soliciting funding for project implementation. Development of PTMApp has been completed for the Wild Rice, Park, and Maple River watersheds in the Red River Valley in ND. The long-term goal is to have PTMApp completed for all the ND watersheds in the Red River Valley. The web address for the ND PTMApp is https://iwinst.org/mesmerize/watershed-research/.

8.0 BIOLOGICAL MONITORING IN THE RED RIVER BASIN

8.01 Macorinvertebrates of the Red River in Manitoba

Benthic macroinvertebrates were collected at two locations on the Red River in September 2018: Emerson and Selkirk (Table 11). At each location, one transect of five dredge grab samples were collected with a petit Ponar dredge. 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 0.023 m^2. For each transect, 0.115 m^2 of sediment was collected. The dredge samples were washed through 500 µm Nitex nylon nets. River water was used to remove organisms and sediment from the nylon net into a 500 µm mesh sieve. Remaining sediment and all organisms were then placed in labelled 500 mL jars with 70 % ethyl alcohol preservative. Macroinvertebrates were subsequently identified to the lowest possible taxonomic level, typically genus and species, by ALS Environmental in Winnipeg, Manitoba. Data were screened for terrestrial species which were removed from the data subsequently reported.

Table 11: Geographic coordinates for the benthic macroinvertebrates sampling stations at Emerson and Selkirk on the Red River, Manitoba in September 2018.

Transect	Latitude	Longitude
Emerson	49°00'13.6"	97°13'16.2"
Selkirk	50°08'55.7"	96°51'24.8"

In 2018 at Emerson, 48 organisms were collected. To calculate organisms per square metre, the number of organisms at each transect was multiplied by a factor of 8.70, yielding 418 organisms/m^2 (Table 12). For the reporting period at Emerson in 2018, the organisms in greatest abundance were from the Order Trichoptera (Family Hydropsychidae).

In the Red River at Selkirk, 345 organisms were collected. To calculate organisms per square metre, the number of organisms at each transect was multiplied by a factor of 8.70, yielding 3002 organisms/m^2 (Table 13). For the 2018 reporting period at Selkirk, the organisms of greatest abundance were from the Order Oligochaeta. The second most abundant type of organisms present were from the Class Insecta (Order Diptera and Ephemeroptera).

Overall, the Red River at Selkirk had a much greater species richness of benthic macroinvertebrates in 2018 than did the portion of the Red River near Emerson. The Red River near Selkirk had both a substantially higher number of total organisms present, as well as, approximately double the amount of different invertebrates taxa represented in the samples.

Table 12. Summary of macroinvertebrates collected per transect and calculated total per metre squared in pooled Ponar © dredge samples from the Red River at Emerson, Manitoba in September 2018.

Class	Order	Family	Genus	Species	Number per transect
ANNELIDA	OLIGOCHAETA	TUBIFICIDAE	*unidentified*	*without hair setae*	2
GASTROPODA	BASOMMATOPHORA	ANCYLIDAE	*Ferrissia*	*rivularis*	1
INSECTA	COLEOPTERA	ELMIDAE	*Stenelmis*	*sp.*	2
INSECTA	DIPTERA	CHIRONOMIDAE	*Harnischia*	*sp.*	2
INSECTA	EPHEMEROPTERA	EPHEMERIDAE	*Ephemera*	*sp.*	6
INSECTA	ODONATA - ANISOPTERA	GOMPHIDAE	*unidentified*	*too young to ID*	1
INSECTA	TRICHOPTERA	HYDROPSYCHIDAE	*Cheumatopsyche*	*sp.*	3
INSECTA	TRICHOPTERA	HYDROPSYCHIDAE	*Potamyia*	*sp.*	26
INSECTA	TRICHOPTERA	LEPTOCERIDAE	*Oecetis*	*sp.*	1
PELECYPODA	VENEROIDA	PISIIDAE	*Sphaerium*	*sp.*	4
				Total number of organisms	**48**
				Total number per square meter	**418**
				Total number of taxa	**10**

Table 13. Summary of macroinvertebrates collected per transect and calculated total per metre squared in pooled Ponar © dredge samples from the Red River at Selkirk, Manitoba in September 2018.

Class	Order	Family	Genus	Species	Number per transect
ANNELIDA	OLIGOCHAETA	NAIDIDAE	*Nais*	*sp.*	6
ANNELIDA	OLIGOCHAETA	TUBIFICIDAE	*Branchiura*	*sowerbyi*	5
ANNELIDA	OLIGOCHAETA	TUBIFICIDAE	*unidentified*	*with hair setae*	39
ANNELIDA	OLIGOCHAETA	TUBIFICIDAE	*unidentified*	*without hair setae*	117
CRUSTACEA	AMPHIPODA	HYALELLIDAE	*Hyalella*	*azteca*	1
CRUSTACEA	COPEPODA	CALANOIDA			2
CRUSTACEA	COPEPODA	CYCLOPOIDA			1
CRUSTACEA	DECAPODA	CAMBARIDAE	*Orconectes*	*sp.*	1
CRUSTACEA	OSTRACODA				4
GASTROPODA	NEOTAENIOGLOSSA	HYDROBIIDAE	*Amnicola*	*limosa*	6
GASTROPODA			*unidentified*	*too young to ID*	2
INSECTA	COLEOPTERA	ELMIDAE	*Dubiraphia*	*sp.*	2
INSECTA	DIPTERA	CERATOPOGONIDAE			4
INSECTA	DIPTERA	CHIRONOMIDAE	*Axarus*	*sp.*	7
INSECTA	DIPTERA	CHIRONOMIDAE	*Chironomus*	*sp.*	18
INSECTA	DIPTERA	CHIRONOMIDAE	*Ceolotanypus*	*sp.*	4
INSECTA	DIPTERA	CHIRONOMIDAE	*Cryptochironomus*	*sp.*	8
INSECTA	DIPTERA	CHIRONOMIDAE	*Polypedilum*	*sp.*	5
INSECTA	DIPTERA	CHIRONOMIDAE	*Procladius*	*sp.*	5
INSECTA	EPHEMEROPTERA	EPHEMERIDAE	*Hexagenia*	*limbata*	43
INSECTA	TRICHOPTERA	HYDROPSYCHIDAE	*Potamyia*	*sp.*	1
INSECTA	TRICHOPTERA	LEPTOCERIDAE	*Oecetis*	*sp.*	4
PELECYPODA	VENEROIDA	PISIIDAE	*Pisidium*	*sp.*	1
PELECYPODA	VENEROIDA	PISIIDAE	*Sphaerium*	*sp.*	58
PELECYPODA	VENEROIDA	PISIIDAE	*unidentified*	*Too young to ID*	1
				Total number of organisms	**345**
				Total number per square meter	**3002**
				Total number of taxa	**25**

8.02 Benthic Invertebrate Indices: Simpsons Evenness, EPT taxa, and Bray-Curtis Dissimilarity Index.

Simpsons Diversity Index (D) (Krebs, 1994) places little weight on rare taxa and more weight on common species and is calculated.

$$\mathbf{D} = 1 - \sum_{i=1}^{s} (\mathbf{p}_i)^2$$

Where S total number of species in the community (richness), pi proportion of S made up of the ith species. D ranges from zero to one, indicating a low level of diversity. Calculated Diversity scores for Emerson and Selkirk were 0.83 and 0.71 respectively.

Simpsons equitability or Evenness (E) indicates if taxa are evenly represented within a given sample. Evenness varies from a score of zero to one. A score of one represents a sample in which all the taxa are equally abundant (Smith and Wilson 1996). Evenness is calculated by

$$E_D = \frac{D}{D_{max}} = \frac{1}{\sum_{i=1}^{s} p_i^2} \times \frac{1}{S}$$

where:
E = evenness
pi = the proportion of the ith taxon at the station
S = the total number of taxa at the station

Simpsons Evenness scores were 0.21 and 0.2 for the Red River at Emerson and Selkirk respectively. The Evenness score for both sites was influenced by relatively large numbers of individuals from relatively few taxa.

The EPT Index is named for three orders of aquatic insects that are common in the benthic macroinvertebrate community including pollution intolerant Ephemeroptera (mayflies), Plecoptera (stoneflies), and generally pollution tolerant order Trichoptera (caddisflies). EPT taxa richness will decrease with decreasing water quality. The EPT score is the sum of the number of species from within these groups. The EPT score for Emerson was 4 and Selkirk was 1. No individuals from the pollution intolerant Order Plecoptera were found at Emerson or Selkirk. Percent EPT is the total number of EPT individuals divided by the total number of individuals in the sample. Percent EPT was 4 percent for Emerson and 0.63 percent for Selkirk. Overall, very low numbers of EPT individuals were observed at either sites during the 2016-2017 report period.

The Bray-Curtis Index compares the community composition of two sites where the co-efficient reaches a maximum of 1 for two sites that are entirely different and a minimum score of 0 for sites that possess identical composition (Legendre and Legendre, 1983). The calculated Bray-Curtis Dissimilarity Index was 0.76 indicating that community compositions were considerably different between sites. In particular, there was a much greater diversity of taxonomic families observed at Emerson compared to Selkirk (28 and 17 respectively), whereas, overall abundance of organisms was much greater at Selkirk compared to Emerson (315 and 115 organisms collected respectively). Overall, 13 taxonomic groups were observed at both sites, while 15 groups and 4 groups were only observed at Emerson and Selkirk, respectively (Tables 12 and 13).

References:

Krebs, C.J. 1994 Ecology: The Experimental Analysis of Distribution and Abundance, 4th Ed. Harper Collins, New York. P. 705-706.

Legendre, L., and P. Legendre. 1983. Numerical ecology. Elsevier, Amsterdam.

Smith, B. and J. Wilson. 1996. A consumer's guide to evenness indices. - Oikos. 76: 70-82.

8.03 *Escherichia coli* and Algal Bloom Monitoring in Lake Winnipeg

Manitoba monitored nineteen recreational beaches within the south basin of Lake Winnipeg for levels of *Escherichia coli* during 2018 (Figure 9). Sampling began at the beginning of June and continued weekly until the beginning of September.

While some beaches occasionally exceeded Manitoba's recreational water quality guideline for fecal indicator bacteria, typically 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 DNA ribotyping from 2002 to 2006 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 2018 beach monitoring program, Manitoba Sustainable Development continued to monitor beaches on Lake Winnipeg for the presence of algal blooms. On Lake Winnipeg, East Grand Beach, West Grand Beach, Hillside Beach, and Victoria Beach (at two beaches) were posted with first level algal advisories indicating the number of blue-green algae cells exceeded the Manitoba recreational water quality objective of 100,000 cells per mL. The first level algal advisory informs bathers that algal blooms have been observed at the beach and provides some additional advice regarding avoiding contact with the water when algal blooms are present. The second level algal toxin advisory is posted when the concentration of microcystin exceeds the Manitoba recreational water quality objective of 20 µg/L. The advisory indicates that drinking, swimming or other contact with the water is not recommended. In 2018, there were no beaches on Lake Winnipeg posted with second level algal advisory signs.

Figure 9: Map of beach monitoring locations on Lake Winnipeg as a part of the Clean Beaches Program.

8.4 Fisheries of the Red River in Manitoba

Biological Information

A total of 67 fish species have been recorded in the Manitoba portion of the Red River (Table 14). Presently, Bigmouth Buffalo (*Ictiobus cyprinellus)* and Chestnut Lamprey (*Ichthyomyzon castaneus*) are designated as Special Concern under *The Species at Risk Act.* In 2005, Lake Sturgeon (*Acipenser fulvescens)* was recommended for listing as Endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

Aquatic invasive species that are known to exist 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 introductions into the Manitoba portion of the Red River include feral Goldfish (*Carassius auratus)*, Smallmouth Bass *(Micropterus dolomieu)* and Largemouth Bass *(Micropterus salmoides).*

Zebra Mussel (*Dreissena polymorpha*) veligers were detected in the Manitoba portion of the Red River for the first time in samples collected on June 9th, 2015 at Emerson and a second sampling location at Selkirk. Zebra Mussel veligers were subsequently found in the U.S.A. portion of the Red River. In early May 2015, adult Zebra Mussels were reported from a dock located in an offshoot of the Red River near Selkirk Park. Zebra Mussels are now well established in the Red River and downstream in Lake Winnipeg. Manitoba has increased its efforts to minimize the spread of Zebra Mussels from Lake Winnipeg and the Red River to other water bodies through work in five main areas - Legislation; Prevention (including the Watercraft Inspection, Public Engagement and Partnership programs); Monitoring; Early Detection and Rapid Response; and Management and Control.

Recreational Angling - Value

The Manitoba portion of the Red River is internationally known for the high quality of angling the fishery supports. Based on a 2010 Angler Survey, Manitobans and visitors to the province fished a total of 2 million days, of which 11% were spent on the Red River, and 8% on Lake Winnipeg, making these the most heavily fished water bodies in the province. It is estimated that anglers fishing the Red River and Lake Winnipeg contributed approximately $70M towards the overall economic value of angling in Manitoba ($407M annually based on the 2012 Travel Manitoba report "Economic Evaluation of Manitoba's Hunting and Fishing Industry"). A partial winter creel survey was conducted on Lake Winnipeg in winter 2017 and confirmed the continuing and rapid expansion of angling on the south basin of Lake Winnipeg. Between January 23 and February 23, 2017 more than 66,000 angler visits to the lake were reported. Additional creel survey work was conducted during the winter of 2018-2019.

The Red River fishery attracts non-residents primarily to trophy Channel Catfish and Walleye 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 livelihood. A commercial net fishery targeting primarily Walleye, Sauger and Lake Whitefish has operated on Lake Winnipeg since the late 1800s.

The majority of angling effort occurs between the floodway gate structure at St. Norbert and the north end of the south basin of Lake Winnipeg. Angling is especially concentrated from the dam at Lockport downstream to the Red River delta, within the City of Winnipeg and along the southern shore of the south basin.

Manitoba Sustainable Development, Wildlife and Fisheries Branch, has been collaborating with researchers from the University of Nebraska and the Canadian Department of Fisheries and Oceans on a series of projects to understand the movement and improve the management of Channel Catfish, Bigmouth Buffalo, Walleye and Lake Sturgeon.

Table 14: 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*	*Maculate*	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

9.0 ADDITIONAL ACTIVITIES IN THE RED RIVER BASIN

As outlined in Appendix A – International Red River Board Directive, the duties of the Board include maintaining an awareness of agencies in the basin, of developments and conditions that may affect 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 an 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 (RRVWSP)

The Garrison Diversion Conservancy District (GDCD) is the project's state sponsor, while the Lake Agassiz Water Authority (LAWA) represents the local users. The project is designed to provide a supplemental water supply during times of water scarcity to central and eastern North Dakota. The project, as envisioned by the GDCD, will also supply additional water to support industrial development as well as provide an environmental benefit by augmenting natural stream flows (Figure 10).

Thirty-five cities and water systems have committed to help fund the development portion of the project. A capacity of about 159 cfs would be needed to service these interests. The current estimated cost of the project ranges from $947 million to $1.174 billion, for 150 cfs and 180 cfs project capacity (Figure 11).

Legislative Mandate

SB 2020, passed during the 2019 ND Legislative session, directs the ND State Water Commission (ND SWC) to provide, in the form of a grant, up to $30 million for the project, with a cost share requirement of 75 percent state and 25 percent local. SB 2020 also includes $13 million carryover grant funds from the 2017-19 budget for the project. Up to $13 million is to initiate construction of phase one prioritized project features to the Garrison Diversion Conservancy District for the Red River Valley Water Supply Project, for the biennium beginning the effective date in 2019 and ending June 30, 2021. The bill also established the following requirements for this funding.

1. Any funding received for the completion of the planning and permitting process of the Red River valley water supply (RRVWS) project must result in the following accomplishments:
    a. The completed RRVWS project plan document that will be the basis and justification for project construction and must include alternative selection, water supply needs, projected project costs, easement acquisitions, environmental regulation compliance to include issuance of a final national pollutant discharge elimination system permit, and acquisition of all state and federal permits required for the construction of any project features intended to be constructed with funding provided during the 2019-21 biennium;
    b. A signed Bureau of Reclamation water service contract agreeing to a minimum of one hundred sixty-five cubic feet per second over a minimum of forty years or equivalent to ensure an adequate water source for the project's needs;
    c. Prioritized project features for phase one construction; and
    d. A recommendation for funding options for all phases of the RRVWS project.

2. Any funding received to initiate construction of phase one prioritized project features identified in subsection 1 may be spent and construction of phase one may begin only after the budget section receives and approves certification from the state water commission and the state engineer that all items listed in subsection 1 have been accomplished.
3. Quarterly progress reports on the RRWVS project from the Garrison Diversion Conservancy District to the water topics overview committee of the legislative management, during the 2019-21 interim.

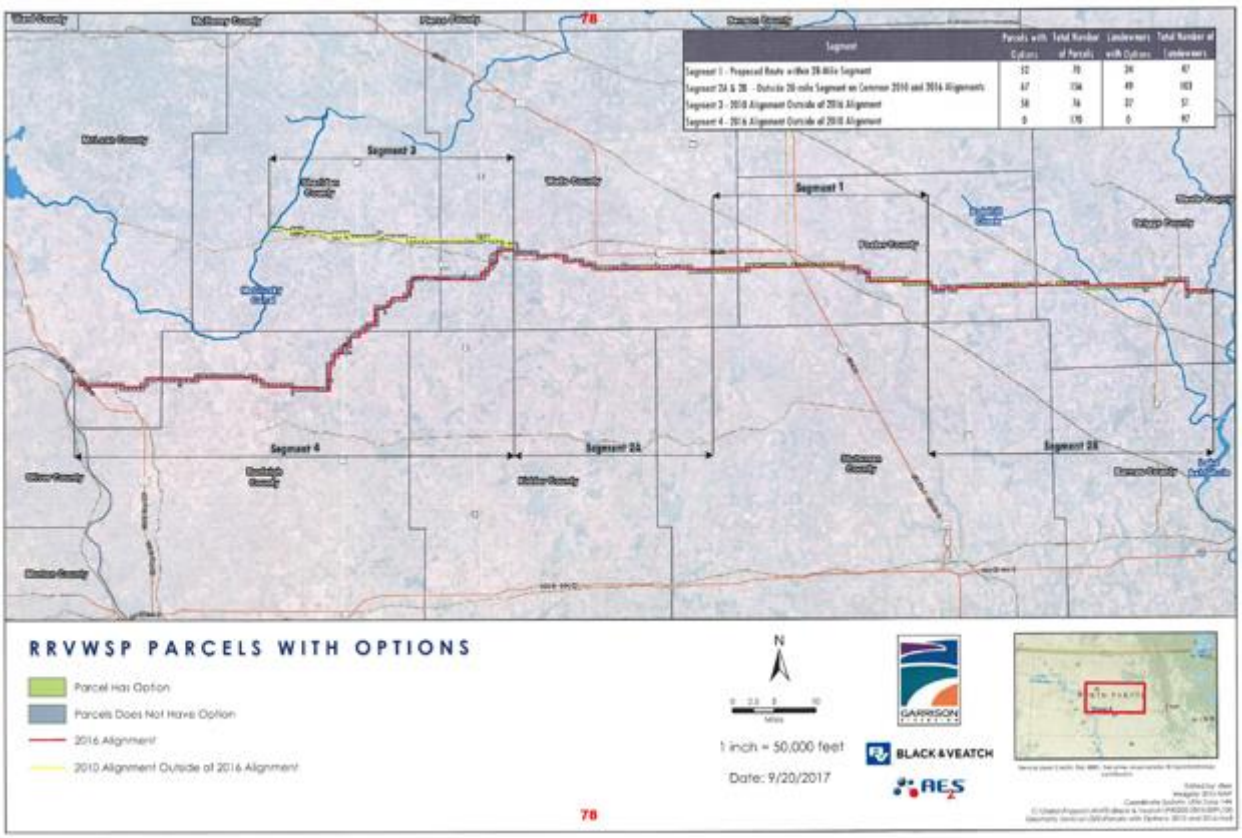


Figure 10: Proposed Route - RRVWSP

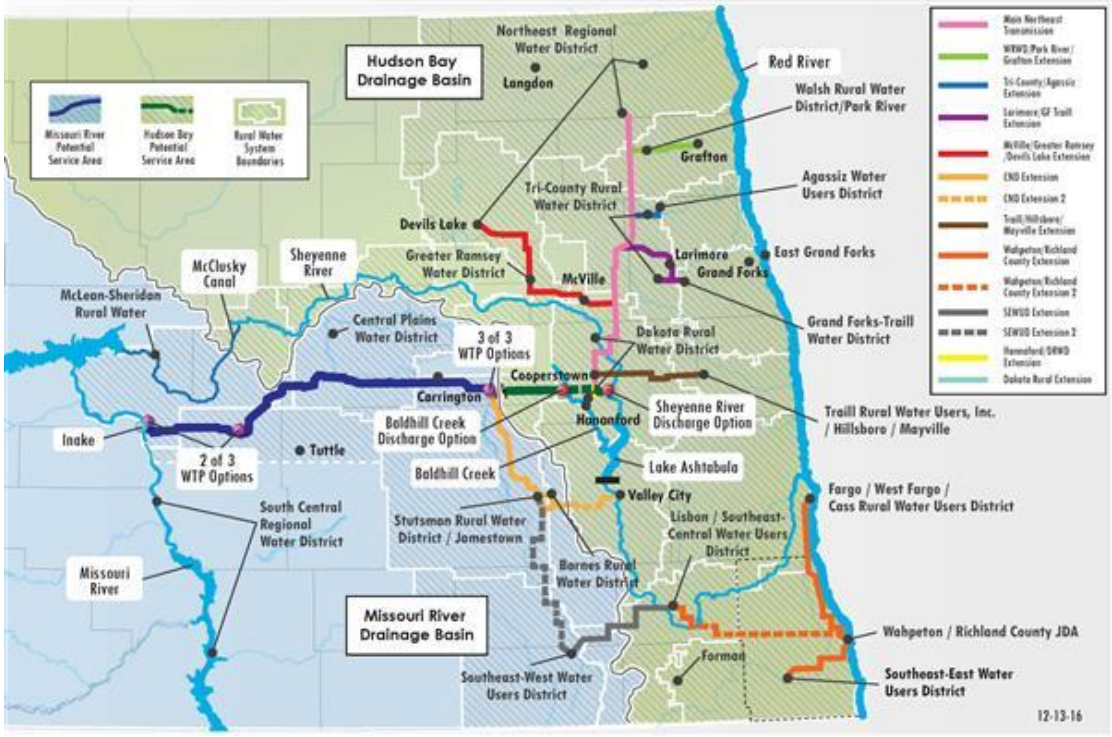


Figure 11: 35 Water Systems Shown That Have Signed Development Agreements

Design/Construction:
The conceptual plan was completed and is summarized in a September 2016 report.

The draft preliminary design was released in October 2017.

Phased final design is underway. Priority items for the phased final design and construction are the discharge structure, trenchless crossings, and portions of the intake.

Other priorities for 2017 to 2019 include: exercise existing options, acquire remaining easement options, acquire state and federal permits, secure water source, complete the final design of strategic lengths of the pipeline for construction, complete final design for the Missouri River intake and discharge structures, and start construction of key components.

The first segment of pipeline to be designed and prepared for construction is a 28-mile length located on the Missouri River side of the divide. The phased design of the trenchless crossings will also be located within this 28-mile section.

The majority of the remaining project work is planned to be bid and constructed from 2019 to 2027. Major components of the design and construction include: Pipeline alignment McClusky to the split; Missouri River Conventional Intake/COE Permit; Financial Modeling; Pipeline alignment Washburn to McClusky; Pipeline alignment split to Baldhill Creek; Main Pumping Station, Pre-Treatment, Break Tank, Control Valve Structure, Hydraulics and Tansient – Preliminary Engineering; Aerial Photography and LIDAR Services; StateMod Water Supply Model; Pipeline Extensions; and Discharge Structure Design.

A FONSI was obtained for the delivery of 20 cfs from the McClusky canal pipeline system. There has also been further discussion about the outlet being located further upstream on the Sheyenne River. The RRBC has facilitated meetings for further discussion on water treatment plant proposals.

At the April 9, 2019 meeting, the ND SWC approved 120,000 acre-feet per year at a rate of 165 cubic feet per second from SWC Water Permit #1416A be assigned to the GDCD for the purpose of supplying water to the RRVWSP from the Missouri River.

Northwest Area Water Supply (NAWS)

An August 2015 Record of Decision (ROD) addressed invasive species and inter-basin water transfer concerns. The ROD identified the use of Missouri River water with subsequent advanced water treatment before it crosses the basin divide. This water treatment will provide flexibility in addressing long-term Safe Drinking Water Act standards to provide a safe and reliable drinking water supply to this region, while providing additional benefits for biota treatment (Figure 12).

Manitoba & Missouri Lawsuit

Summary judgement was granted to North Dakota on August 10, 2017. Both plaintiffs filed appeals in October and initial filings were due November 27, 2017. The court issued a briefing schedule January 3, 2018 with appellant's briefs due February 12, 2018, appellee's briefs due March 14, 2018, and appellant's reply briefs due March 28, 2018. A joint motion was filed and approved by the court to hold the case in abeyance for 90 days to allow settlement negotiations between appellant Manitoba and the appellees. Another joint motion was filed and approved by the Court to extend the abeyance further to allow further discussions. A joint motion by North Dakota, Department of Interior, and Province of Manitoba moving to dismiss Manitoba's appeal was filed June 22nd, 2018 and granted by the Circuit Court the following week. The State of Missouri continued their appeal of the Court's decision briefing only on the issue of their standing in the case. Oral arguments were held on November 8, 2018 in the District of Columbus Circuit Court of Appeals. On May 3, 2019, the Circuit Court affirmed the District Court's August 2017 ruling, ending sixteen years an seven months of litigation on the project.

Biota Water Treatment Plant Design

A value planning workshop was held July 30, 2018 through August 2, 2018 for this project. The 30 percent design kickoff workshop was held October 3, 2018 through October 5, 2018. An internal 30 percent design review was held the week of March 18, 2019. A 60 percent design review meeting was scheduled for the week of June 24, 2019. Equipment procurement contracts will be issued for the ultraviolet (UV) disinfection equipment and the dissolved air floatation (DAF) equipment. The UV and DAF equipment will be procured ahead of time with design and delivery phases. Information obtained from the design phase will be used to complete the overall design for the facility. The project should be ready to bid early 2020.

NAWS Contract 7-1B

NAWS Contract 7-1B was awarded by the State Water Commission at its February 8, 2018 meeting to PKG Contracting and generally consists of construction of a new primary treatment building at the Minot water treatment facility to replace the aging softening basins, chemical storage and feed systems, a new laboratory, break room, and IT facilities. The notice to proceed was signed on March 21, 2018. A preconstruction conference was held that same day in Minot. Work on this project is currently underway. The substantial completion date for this contract is December 20, 2019.

NAWS Contract 2-2A-2 - 19th Ave Vault Relocation
NAWS Contract 2-2A-2 was awarded to PKG Contracting, Inc. in the amount of $515,695. Work performed under this contract was substantially complete in November 2018. Final reclamation work is currently taking place.

NAWS Contract 2-4A - Renville Corner to Westhope
This contract will involve roughly 16 miles of pipe and related appurtenances to extend the potable distribution system from the corner of US Highway 83 and State Highway 5 to south of Westhope.

Bids were opened on February 28, 2019. Kemper Construction of Minot, ND was the low bidder at $4,274,260.50. The contract was awarded to Kemper Construction on March 21, 2019. A preconstruction conference was held in Minot on May 8, 2019. Contract documents were executed and the Notice to Proceed was issued on May 16, 2019. The substantial completion date is October 31, 2019, and the final completion date is June 1, 2020.

NAWS Contract 2-3C - Lansford to Renville Corner
This contract will involve roughly 18 miles of pipe and related appurtenances to extend the potable distribution system north of Minot, near Lansford, to tie into the existing pipeline along Highway #5. Bids were opened June 18, 2019. This contract will complete the 'looped' nature of the distribution pipeline, greatly expanding the hydraulic capacity and flexibility to serve customers as well as adding redundancy to the system. Everything north o Booster Pump Station 4 is currently served out of Reservoir 3 near Kenmare and is basically at the limit of what can hydraulically serve in the current configuration. The Contract 2-3C pipeline will enable the system to serve Mohall and All Seasons directly from the High Service Pump Station. This will free up capacity to serve currently unused turnouts further west.

NAWS Contract 6-lA - Intake Modifications to Snake Creek Pumping Plant
The design kickoff meeting for Contract 6-1A was held October 3-5 in Denver. A 30 percent design review was held in June 2019, with a value engineering workshop to be held in late June 2019. The procurement contract for the variable frequency drive (VFD) equipment will be beneficial due to the incoming voltage and power rating of the motors. This facility will have to come on line coincident with the completion and commissioning of the Biota Water
Treatment Plant.

Remaining Project Components
Preliminary design has begun for the two remaining pipeline contracts to Bottineau. A 30 percent route alignment review was held for the Contract 2-4B on April 25, 2019. Design has
also been initiated for other critical project components necessary to deliver water to Bottineau and deliver water from Lake Sakakawea to Minot. Hydraulic analyses, water allocations, and water needs are all being performed to maximize benefit to citizens.

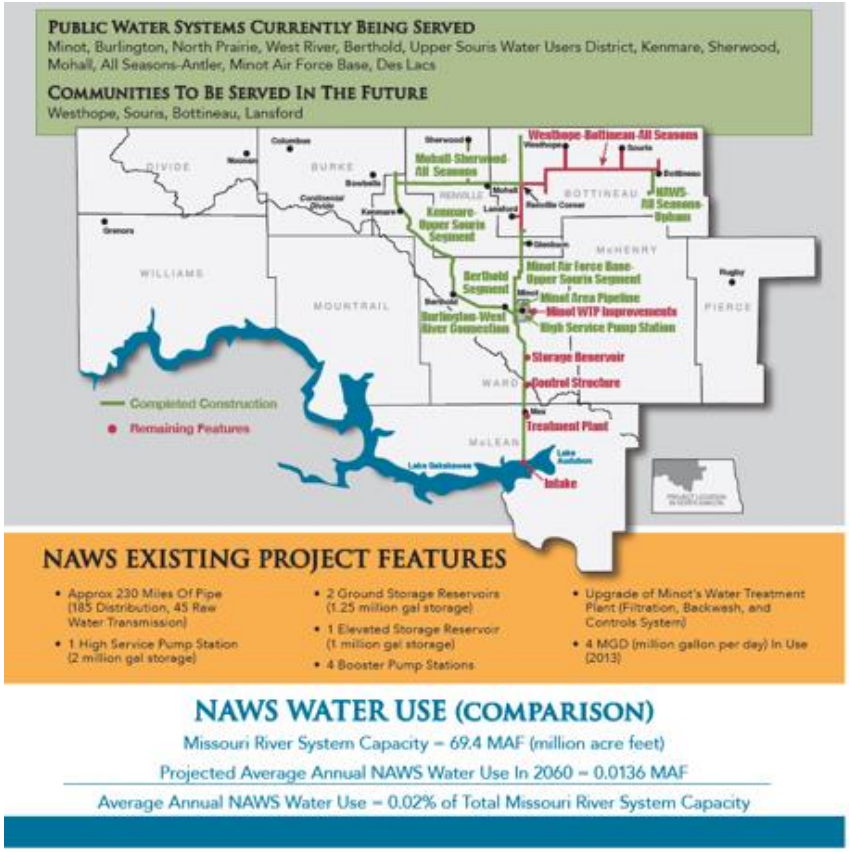


Figure 12: Northwest Area Water Supply (NAWS) Project

<u>Red River Retention Authority</u>

The Red River Retention Authority (RRRA), formed in 2010, is comprised of members of the Red River Joint Water Resource District, a North Dakota political subdivision, and the Red River Watershed Management Board, a Minnesota political subdivision. The primary objective of the Red River Retention Authority is to ensure joint, comprehensive, and strategic coordination of retention projects in the Red River of the North watershed and facilitating implementation and construction of temporary retention in the Red River Watershed for the purpose of flood damage reduction. Several entities are involved as partners in this process.

The main goal of the RRRA is to reduce the severe flood damage within the Red River watershed. While the majority of the benefit from an individual project will be in the sub-watershed where it is located, a combination of several detention projects would also be expected to reduce peak flows on the Red River mainstem.

Regional Conservation Partnership Program (RCPP):

The Secretary of Agricultural announced on January 14, 2015 that up to $12 million was included in the 2014 farm bill for the Red River Basin of the North Flood Prevention Plan through the NRCS-Regional Conservation Partnership Program (RCPP). The Red River Retention Authority will be the lead partner for the projects. These funds will be used to plan PL-566 like projects to achieve the main goal of reducing flood damages. They will be leveraged with state and local funds.

There were originally 20 watershed studies that were approved for cost share (Figure 13). The Swan Creek Watershed previously ceased watershed planning. A final technical report was provided to the North Dakota NRCS. The Bois de Sioux Watershed District and the Red Lake Watershed District have requested to cease watershed planning. A draft final technical report is being prepared for each watershed. There are now 17 watershed protection studies approved by the RRRA that are underway. A local cooperation agreement has now been signed, for each of these studies, between the Natural Resource Conservation Service (NRCS) and the local sponsors. Public meetings have been held for each study area. Problems within the watersheds have been identified and a "purpose and need" statement has been developed for the majority of the studies. The task teams for many of the study areas have identified potentially feasible projects that would accomplish the goals set by the sponsors. Further analysis will be required for each potential project to determine if they have a B/C ratio of at least 1 to be eligible for federal cost share for construction.

An extension has been approved for the completion of most of these studies. If approved the completion date for most of these studies would be in the fall of 2020.

While the main purpose of the projects is for flood damage reduction, water quality and natural resource benefits may also be obtained. Staff of the NRCS have met with project sponsors to discuss methods to account for the natural resource benefits. This may be necessary in order to develop potential projects that may be eligible for federal cost share.

The procedure, and information obtained, for the study would be adequate to pursue any necessary permits for the identified projects. Additional federal funding may eventually be requested to construct any projects found to be feasible. Other projects may be able to proceed without federal cost share for construction.

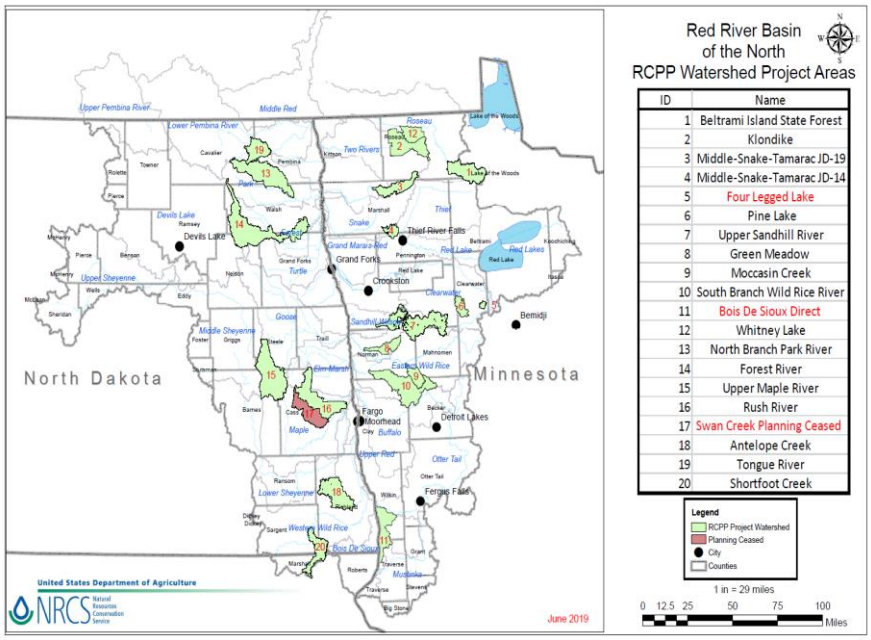


Figure 13: Red River Conservation Partnership Program – Red River Basin

9.02 Devils Lake Sub-Basin

The water elevation of Devils Lake was 1449.7 on January 1, 2018. The water elevation experienced very little rise from the spring runoff and remained fairly level from late May through early July. The highest water level currently experienced in 2018 was about 1450.2 msl on July 4. The water elevation for Devils Lake was 1448.2 msl on January 1, 2019, about 1.5 feet lower than the lake level one year prior to that date.

A fairly high snow pack, and water equivalent, developed during the 2018-19 winter. The March 7, 2019 probabilistic forecast estimated that there was a 50% chance of the lake level to rise about 1.5 feet, to 1449.8 msl as a result of the 2019 spring runoff. Due to a slow snow melt conditions, and minimal spring precipitation, the lake rise was limited to about 1 foot. The apparent peak 2019 water elevation of about 1449.2 msl occurred for various days in May and June of 2019. This is about 1 foot below the peak 2018 elevation. The water elevation on July 22, 2019 was 1448.9 msl. The following table (Table 15) shows Devils Lake elevation, area and volume of water removed.

Table 15: Devils Lake – Elevation, Area and Volume Removed

Date	Elevation (msl)	Area (acres)	Volume (acre-feet)
June 27, 2011	1454.30	208,500	4.19 Million
Jan. 1, 2014	1452.3	185,000	3.77 million
June 29, 2014	1453.5	198,881	4.01 million
Jan. 1, 2015	1451.6	178,100	3.65 million
June 9, 2015	1452.0	182,244	3.72 million
January 1, 2016	1450.0	163,000	3.38 million
April 25, 2016	1450.3	165,566	3.42 million
January 1, 2017	1450.1	163,025	3.39 million
May 4, 2017	1451.7	179,138	3.67 million
January 1, 2018	1449.7	160,191	3.32 million
July 4, 2018	1450.2	164,652	3.41 million
January 1, 2019	1448.2	147,838	3.10 million
June 2019	1449.2	155,907	3.25 million

State Emergency Outlets Project Update:

2018 Operation:
The west end outlet started operation on May 9, discharging at 125 cfs. It was shut down from May 15 to May 18 for a planned electrical preventive maintenance service. The west end outlet was at full capacity (250 cfs) on May 22. It continued operating at full capacity until June 21 when an electrical conduit was damaged on a construction site unrelated to the outlet. The resulting power interruption led to failure of a transformer at the Josephine pump station. This forced the west end outlet to operate at a reduced capacity (about 165 cfs) for several weeks. The final repairs were made during the week of July 16 while the outlet was shut down to perform seasonal canal maintenance. Operation of the west outlet returned to 250 cfs discharge on July 21 and continued near that rate until shut down for the year on October 31.

Repair of the erosion on the downstream end of the east outlet terminal structure was completed on May 22. Discharge started on May 24, at 150 cfs. The east end outlet discharge varied between 80 cfs and 250 cfs throughout June and July, with an average of about 160 cfs. Operation of the east outlet was stopped on August 2 because of erosion damage at the outfall to the Tolna Coulee. It resumed operation on August 22,

at 165 cfs. The average discharge of the east outlet for the months of September and October was 130 cfs and 113 cfs. Discharge from the east outlet was limited for much of the year, due to water quality constraints on the Sheyenne River.

The flow volumes from the east outlet have been managed, to mix with the discharge from the west outlet, to prevent exceedances of downstream water quality limitations.

2019 Operation:
The start of the discharge from the outlets was delayed due to high flows on the Sheyenne River and Red River.

The west outlet started operating on June 5, with a flow of 125 cfs. The discharge rate was slowly increased to 250 cfs on June 10. Except for being shut down for a few days for maintenance, starting on July 15. Discharge resumed at 125 cfs on July 18. High flows on the Sheyenne River limited the flow rate that was allowed from the west outlet.

The east outlet started operation on June 11, with a flow of 75 cfs. The discharge was increased to 145 cfs after the first week. It was reduced to 80 cfs on June 24, due to high flows on the Sheyenne River. It was increased to 145 cfs on June 28. The discharge was again reduced to 80 cfs, due to high flows on the Sheyenne River. The following table (Table 16) summarizes the extent of discharge from the outlets for the 2019 calendar year:

Table 16: Summary of Extent of Discharge from the Outlets in 2019

Month	Days Discharged		Average Discharge (cfs)		Monthly Volume (acre-feet)	
	West	East	West	East	West	East
May	0	0	0	0	0	0
June	26	20	230	113	11,860	4,468
July						
August						
Sept.						
Oct.						
Nov. 2019						
TOTAL						

The following figure (Figure 14) is a summary of the volume and inches of water removed from the lake since pumping was started in 2005 (based on the volume at the peak yearly elevation).

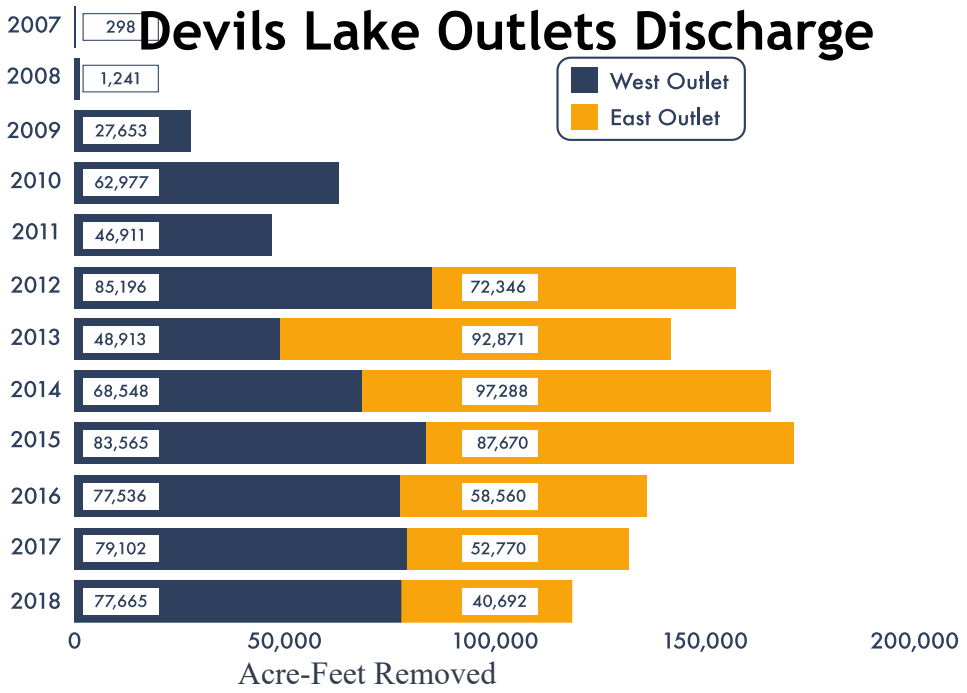
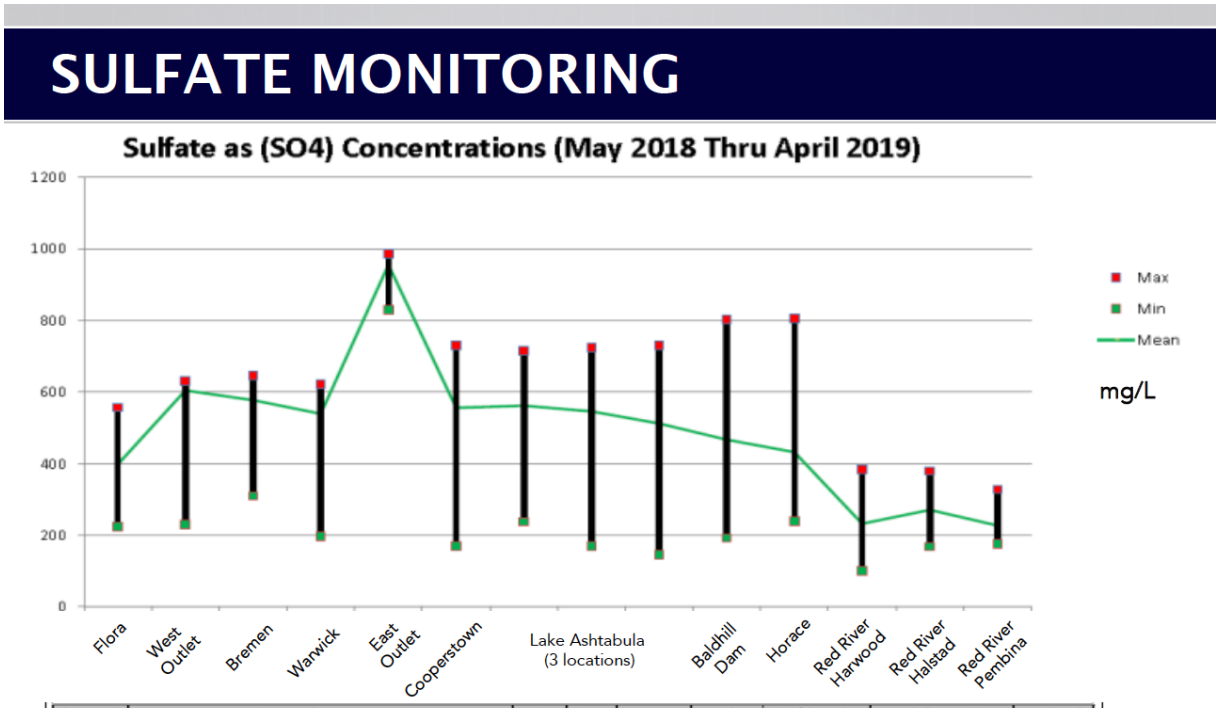


Figure 14: Summary of Devils Lake Outlets Discharge

Water Quality:

Samples are collected from a total of 20 sites ranging from the Sheyenne River above the West Outlet discharge location, throughout the Sheyenne and Red Rivers, to the final sample location near Pembina. These samples are collaboratively collected by staff from the SWC, Garrison Diversion Conservancy District, and the USGS. The samples are tested by the ND Department of Health Chemistry Lab, and the results are used to adaptively manage the outlet operations within their permitted parameters.

The 2018 sulfate monitoring results are shown at various sites in the figure (Figure 15) below.



StationID	Station Description	Max	Min	Mean	Median	# Of Samples	LastCollectionDate	LastResult
31816	Sheyenne River Near Flora	557	224	398.14	399	49	07-Nov-18	399
31848	Devils Lake State Outlet	631	231	604.32	614.5	44	30-Oct-18	628
31817	Sheyenne River Near Bremen	647	310	577.53	602	49	07-Nov-18	597
5389	Sheyenne River Near Warwick	623	198	539.38	581	26	07-Nov-18	548
128224	East End Outlet at County Road 4	986	830	955.53	962	38	30-Oct-18	944
24750	Sheyenne River Near Cooperstown	731	171	555.67	621	30	27-Mar-19	171
126171	Lake Ashtabula East Of Hannaford	716	238	562.11	617	18	07-Nov-18	600
126172	Lake Ashtabula At Sibley Crossing Bridge	724	171	545.78	618	18	07-Nov-18	670
126173	Lake Ashtabula Downstream Location At Ashtabula	730	146	512.44	594.5	18	07-Nov-18	648
24563	Sheyenne River Below Baldhill Dam	802	193	467.07	510.5	30	27-Mar-19	802
16280	Sheyenne River Near Horace	806	239	431.97	455	29	27-Mar-19	608
31834	Red River Near Harwood	383	100	232.35	216	17	27-Mar-19	374
966	Red River Near Halstad Mn	390	169	271.12	268	17	27-Mar-19	373
29102	Red River At Pembina	328	177	227.19	208	16	21-Mar-19	270

Figure 15: Summary of Ranges of Sulfate Monitoring Results from the Sheyenne and Red River

Additional water quality information is available on the ND State Water Commission website and on the U.S. Geological Services website.

Devils Lake Outlet Management Advisory Committee:

The Devils Lake Outlets Management Advisory Committee met on May 9, 2019 in Carrington, North Dakota. A presentation was provided to summarize the current situation in the basin and included the outlet operations and water quality monitoring.

Testimony was provided by citizens and committee members with agricultural interests who would like the outlets to operate at their maximum allowable capacities to lower the lake to 1446 msl as soon as possible. They stated that the outlets continue to be crucial because of the potential for the lake to rise several feet in a single year and the desire to provide a buffer for the land that is gradually returning to production after years of inundation.

There were also several comments provided by citizens who focused on the recreational benefits of the lake with higher water levels. They are concerned that continuing to remove water through the outlets will diminish the fishery, reduce lake accessibility, and eliminate the benefits to their growing communities. Comments from committee members also included the continued concerns of water quality reduction in the Sheyenne and Red Rivers.

The final committee recommendation was that the outlets should continue to operate within their specified limitations on downstream water quality and quantity to a target lake elevation of 1448.0 msl. The Committee would then meet to develop a plan of operation for the outlets, after reaching 1448.0 msl. In addition, the committee requested additional information before the next meeting to enable them to make a more informed recommendation for how the outlets should be managed in the future.

The following figure (Figure 16) shows the Devils Lake water surface elevations in 2019.

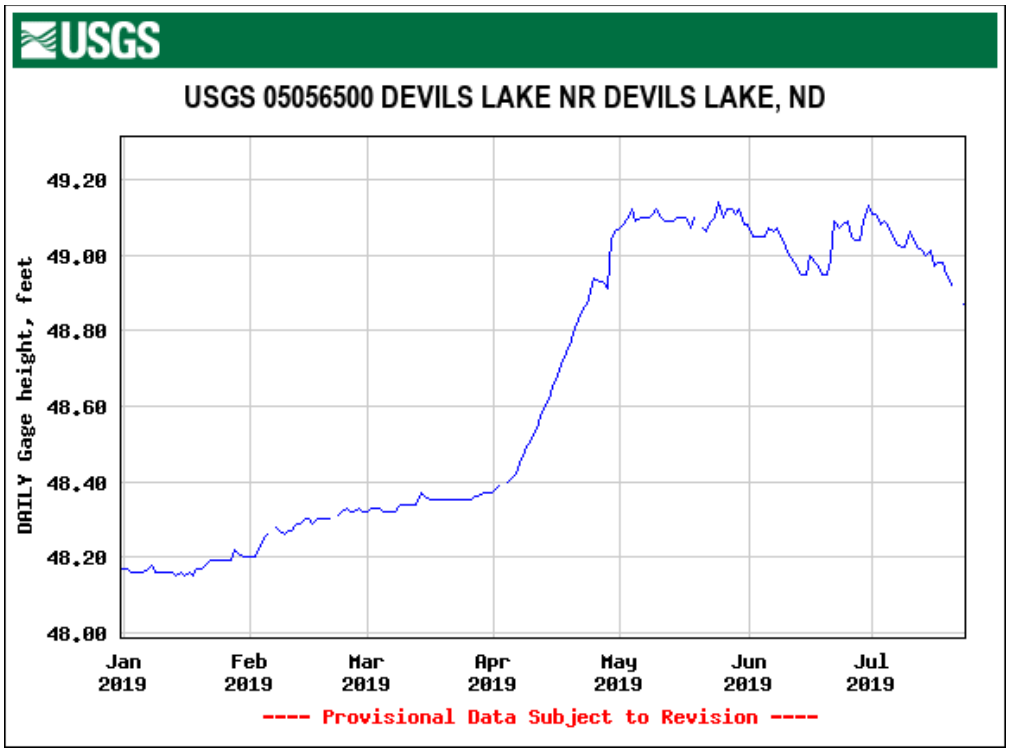


Figure 16: Devils Lake Water Surface Elevations – 2019

Devils Lake water surface elevations for the period 2009 to 2018 are shown in Figure 17.

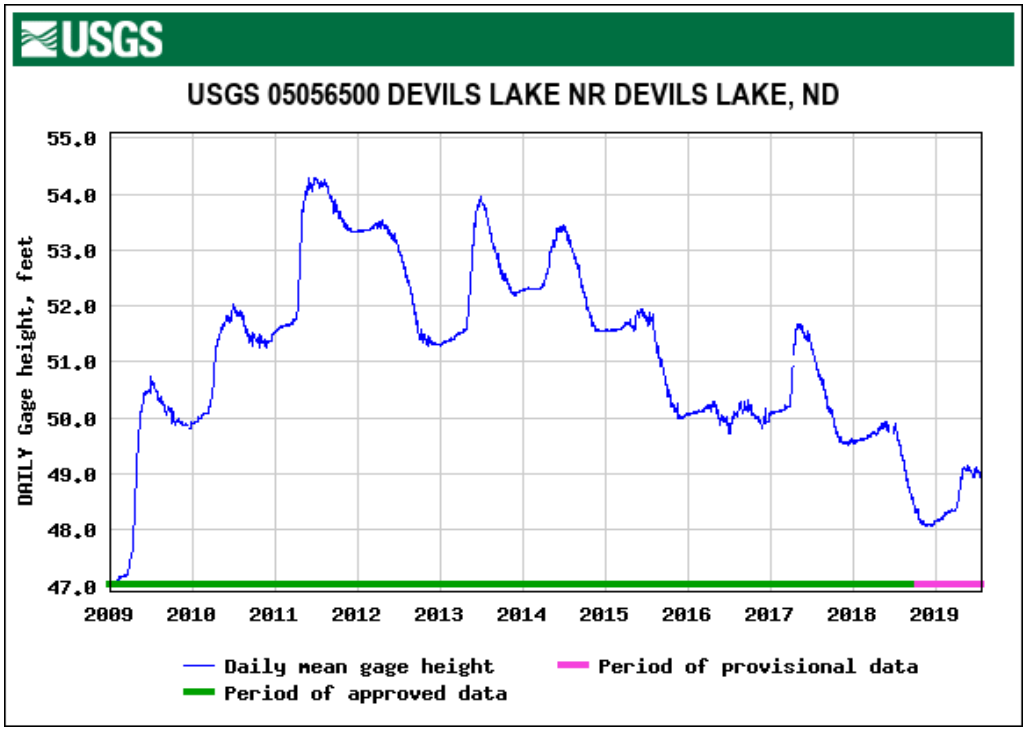


Figure 17: Devils Lake Water Surface Elevations - 2009-2018

Devils Lake historic water surface elevations are shown in Figure 18.

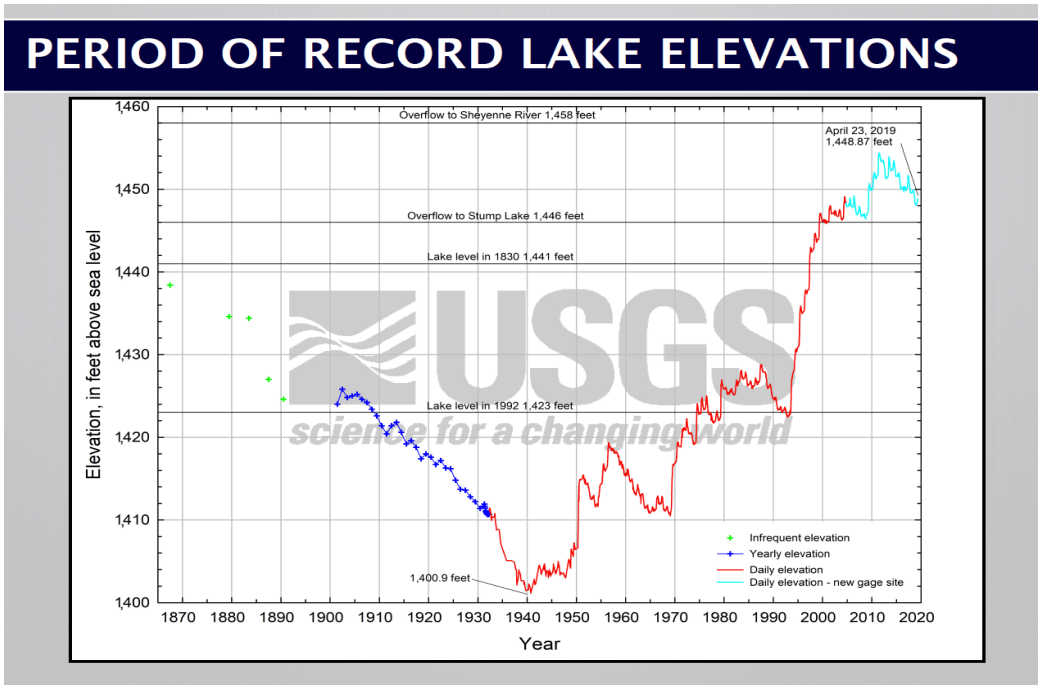


Figure 18: Devils Lake Historic Water Surface Elevations

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

Introduction

The U.S. Army Corps of Engineers (Corps) St. Paul District has a long history of involvement in water resource issues in the Red River of the North basin. The St. Paul District operates reservoirs for flood control, recreation, and environmental purposes.

The Corps works with other federal and state agencies, municipalities, local watershed districts, environmental groups, and local communities to address water resource problems and opportunities in the basin. The Corps also regulates work in navigable waters and other waters of the United States through the Omaha and St. Paul Districts for North Dakota and Minnesota respectively.

Currently, Corps activities in the basin include conducting flood risk management and ecosystem restoration studies, constructing flood risk management and ecosystem restoration projects, and providing emergency assistance and disaster response.

Current Construction Projects

<u>Fargo-Moorhead Metropolitan Area Flood Risk Management Project</u>

Fargo, North Dakota; Moorhead, Minnesota

The project was authorized in the Water Resources Reform and Development Act of 2014 and funded to begin construction in 2016. It includes building a 20,000 cubic feet per second diversion to the west of Fargo with upstream staging and storage. Once construction is complete, the diversion would operate for events larger than a 20-year flood event. The project will provide permanent flood protection to a metropolitan area of 230,000 people.

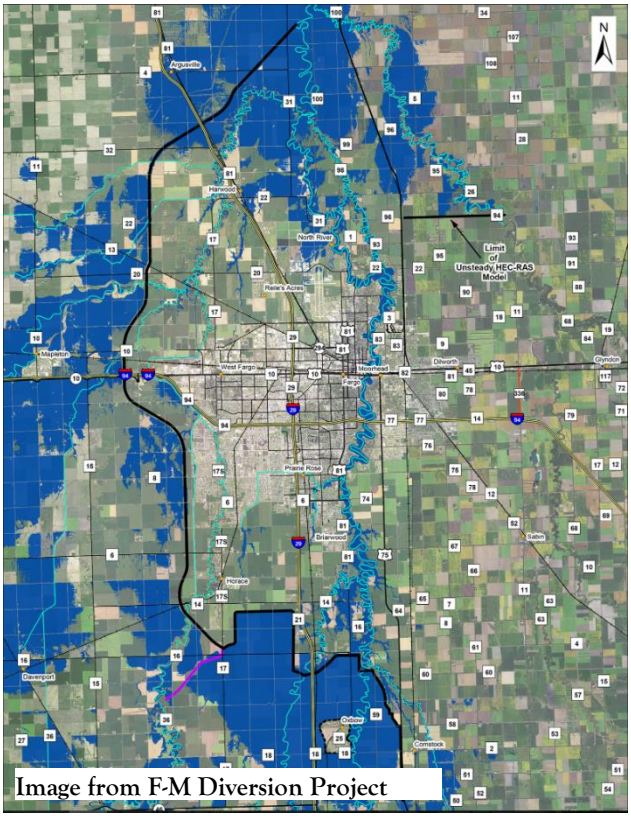


Image from F-M Diversion Project

The project is being implemented using a split delivery plan. Under this plan, the local sponsor constructs the diversion channel using a public-private partnership, and the Corps constructs the Southern Embankment or "dam" portion of the project. Federal construction began in the spring of 2017 with the diversion inlet structure. The sponsors issued a request for proposals in December 2016 for their portion of the project, and discussions were initiated with the three shortlisted teams.

Construction of the diversion inlet structure and negotiations for the diversion channel were suspended after a federal judge issued a temporary injunction on the project in September 2017. A revised plan, called "Plan B," was developed as a result of a Governors' Task Force and the MnDNR issued a dam safety and public waters permit in December 2018. A supplemental environmental assessment was completed for Plan B by the Corps in February 2019. In April 2019, the federal judge issued an order modifying the injunction to allow for certain construction in North Dakota. Construction resumed on the Diversion Inlet Structure in April 2019 and proposals are due 5 September 2019 for construction of the Wild Rice River Structure. The sponsors plan to resume the P3 procurement for the diversion channel in August 2019.

Drayton Dam Fish Passage Mitigation Project
Drayton, North Dakota

This aquatic ecosystem restoration project will provide fish passage and eliminate dangerous hydraulic conditions at Drayton Dam while maintaining the pool for water supply and bank stability. Construction plans involve replacing the existing dam and creating rock riffles. The project is being included as mitigation for the Fargo-Moorhead Metropolitan Area Flood Risk Management Project. Construction could begin in 2021.

Sand Hill River Fish Passage Project
Fertile, Minnesota

Between 1955 and 1958, the Corps completed a flood control project that straightened 18 miles of the Sand Hill River and installed four concrete drop structures. Although the project reduced the flood profile along the lower portion of the river, the drop structures left the river impassable for spawning fish and isolated the upper portion of the watershed.


Image from Houston Engineering,

Recently, at the request of the Sand Hill River Watershed District, the St. Paul District addressed fish passage on the Sand Hill River by completing a Section 1135 ecosystem restoration project. The four drop structures were replaced with rock slopes that allow fish migration. Construction was completed in the fall of 2017.

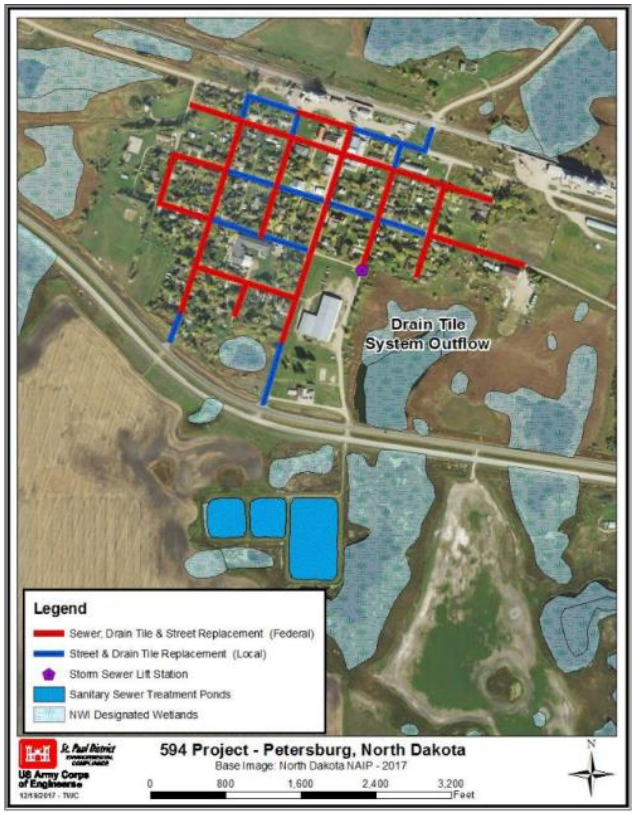
Devils Lake Embankment Project
Devils Lake, North Dakota

Devils Lake is a terminal lake in Devils Lake Basin, meaning water leaves Devils Lake through evapotranspiration or when its elevation is high enough to overflow the basin's boundary. Because Devils Lake typically does not have a natural outlet, it is subject to extreme variations in lake levels depending on changes in climate.

As of August 19, 2019, the lake is at elevation 1448.4 feet, down from its record elevation of 1454.30 feet in June 2011. The embankment construction is complete to a minimum elevation of 1466.00. The project was transitioned to the City of Devils Lake, North Dakota, on July 17, 2018. Final project documentation is being completed.

North Dakota Environmental Infrastructure Program (Section 594)

The Corps is authorized to assist communities and rural areas in North Dakota under this program. The Corps provides design and construction assistance 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.



Section 594 of the Water Resources Development Act of 1999, Public Law 106-53, as amended, authorizes the following sanitary sewer systems where the work is performed by the non-federal sponsor.

City of Petersburg Sanitary Sewer Service Replacement Project

The 1950s era sewer has significant deterioration, and the city could not afford the rehabilitation alone. Removing the current sanitary sewer could cause potential flooding. The city requested assistance from the Corps, which selected the city as the non-federal sponsor. New pipes, a lift station, and a drain tile system will be installed. In fiscal year 2017, the Section 594 program received $2,765,000 for this project. Construction of this project is ongoing.

Current Studies

Red River Basin-wide Feasibility Study

The study began in June 2008. The North Dakota Joint Water Resource District and the Minnesota Red River Watershed Management Board are the local sponsors. Products of the study include planning, data collection, hydrologic and hydraulic modeling, and development of a comprehensive watershed management plan (CWMP). The Corps, the Red River Basin Commission (RRBC), and local stakeholders and experts, including representatives from both the U.S and Canada, cooperatively developed the CWMP.

Building on the RRBC's 2005 Natural Resources Framework Plan, the CWMP contains recommendations for action in flood risk management and hydrology, aquatic and riparian ecosystem restoration, water quality, water supply and drought management, recreation, and soil health. These actions can be implemented by the Corps, the RRBC, and federal, state, and local stakeholders.

The RRBC provided a letter of support in June 2017 for the federally-implementable actions, which include de-authorization of two existing Corps channel projects. All elements of the basin-wide study will be completed in 2019, following a final meeting with the Red River Basin technical advisory committee to discuss the hydraulic models developed by the Corps.

Lower Otter Tail River Restoration Project

Breckenridge, Minnesota

Under the authority of Section 1135 of the Water Resources Development Act of 1986, the Corps is able to study and implement ecosystem restoration projects at existing Corps projects. In this case, the Corps constructed a flood control project in the 1950s which straightened and enlarged a portion of the Lower Otter Tail River between Orwell Dam and the city of Breckenridge, Minnesota. This reach of the Lower Otter Tail River is characterized by unstable banks, excessive sediment loading, and degraded in-stream and riparian habitats.


Image from USACE

The St. Paul District and the Buffalo-Red River Watershed District (BRRWD) are currently completing a feasibility study on improving these environmental conditions of the Lower Otter Tail River while maintaining the originally authorized purpose of protecting adjacent lands from flood damages. Potential alternatives include constructing rock riffle structures to create diversified river pools and reconnecting river meanders that were cut off.

The Corps and the BRRWD should complete the feasibility study in 2020, which will identify a plan for achieving the project goals. Construction would likely begin no early than 2021, subject to availability of federal and local funds. The maximum federal contribution is limited to $10 million.

<u>Upper Red River Watershed Wetland Restoration Prioritization Study</u>
Minnesota

The Corps and the Minnesota Board of Water and Soil Resources are partnering to develop a comprehensive water resources plan which will identity and prioritize wetland restoration opportunities in the Upper Red River Watershed within Minnesota. The study is being conducted under the authority of Section 22 of the Water Resources Development Act of 1974 (Planning Assistance to States and Tribes).

The watershed faces significant natural resources challenges, including major losses of historic wetlands and stream alterations which have contributed to increased flooding, water quality impairments, and loss of habitat. Stakeholders have increased interest in conservation and regulatory decisions that consider the condition and needs of the watershed.

Using a stakeholder informed, geospatial approach, the study will develop a plan for prioritizing wetland restoration projects in the watershed. A series of stakeholder meetings are being planned for 2019 through 2020. A final plan is anticipated to be completed in 2020.

Ongoing Programs

Silver Jackets

The Corps has worked with the U.S. National Weather Service, the U.S. Geological Survey, and others on the placement of soil moisture and temperature instrument packages around the basin to provide detailed hydrologic parameters to improve spring flood forecasts. There is a project to update river gage datum to the current standard (NAVD 1988) and provide consistent elevations for the river stages across the basin.

The Corps is currently working on a Planning Assistance to States and Tribes Project for the Red River Basin Commission. The project consists of developing a basin-wide, long term flood plan for the Red River watershed within Minnesota and North Dakota. Specifically, the Corps is developing an updated hydrologic model for the basin to assess 0.5 to 0.2% chance exceedance events and the possibility of flood risk reduction through possible upland storage impoundments for rarer flood events.

Emergency Operations

During flood events in the Red River basin, the St. Paul District provides emergency assistance in support of the locally-led flood response. The St. Paul District becomes part of a large force made

up of local, state, and federal responders as well as volunteers.
In 2019 the Flood Area Manager and Assistant Area Manager for the Red River of the North met with communities along the Red and Sheyenne Rivers. At the meetings they discussed the community flood response and emergency action plans. Areas where support from the St. Paul District may have been needed were indentified and potential actions noted so we could be prepared.

The 2019 melt was ideal, with moderately warm days and below freezing nights. This weather extended the melt's duration, reducing its damaging effects. Spring rains following the melt fell at regular intervals, extending the high stages further and causing some damage. Many flood risk management features required maintenance following the 2019 event.

Prior to the flood season and since the fall of 2017, the St. Paul District has had sandbags leftover from 2009 available for pick up at Orwell Dam. If communities are interested in these they can contact the St. Paul District office at 651-290-5210 to discuss quantities needed. Generally we only distribute bags during flooding or to preposition for an impending flood. These bags are being rotated out before they age out.

9.04 USGS Water Resource Investigations and Activities

Red River Basin conditions that existed from Oct. 1, 2018 to current.

Streamflows for the Red River were at normal levels (25-75 percentile) for the 2018/2019 winter. Winter was characterized by soil moisture levels at near normal levels, deeper than normal frost depths, and snow water equivalent amounts that were above to much above normal by March per the National Weather Service (NWS) Office in Grand Forks, ND. "Total precipitation (rain and snow-water) from October 1 - March 15 ranged from 2-4 inches above the long-term normal for most of the central and southern Red River Basin," NWS 2019 Spring Flood Outlook on March 15. Snowmelt runoff began in late March progressing from south to north. Peaks in the upper Red River occurred the second week of April and progressed downstream with the crest passing into Canada on about April 25. A wet summer has resulted in current Red River streamflows that are above normal (76-90percentile) levels.

The Red River at Fargo crested on April 8 with a provisional peak gage height of 35.03 ft. and a streamflow of 19,400 cfs, providing the 8th highest peak for the 118 years of streamflow record. The Red River at Grand Forks crested on April 11 with a provisional peak of 46.98 ft. and a streamflow of 66,500 cfs, providing the 8th highest peak for the 137 years of peak flow record. The annual exceedance probability (AEP) for both locations was 0.04 or a "25-year recurrence interval". Spring runoff into Devils Lake caused a rise of approximately 0.75 ft. with the current stage (August 6, 2019) around 48.63 ft. Pumping from Devils Lake began on June 5 from the West End Outlet and on June 11 from the East End Outlet.

In the Red River Basin, the USGS Dakota Water Science Center works in cooperation with the U.S. Army Corps of Engineers, U.S. Bureau of Reclamation, International Joint Commission, 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 helps in flood mitigation, water regulation, and water resource planning.

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APPENDIX A

DIRECTIVES TO THE INTERNATIONAL RED RIVER BOARD

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DIRECTIVE TO THE
INTERNATIONAL RED RIVER (Currently Under Review)

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

On October 1, 1964, the Governments of Canada and the United States submitted a reference to the IJC requesting an investigation of pollution in the waters crossing the International Boundary in the Red River pursuant to the provisions of Article IV of the Boundary Waters Treaty of 1909. Following receipt of the reference, the Commission established the International Red River Water Pollution Board on December 2, 1964, and appointed technical experts to the Board from both countries. The Commission provided detailed instructions to the Board in the form of a directive which asked that all relevant water quality information be examined, pollution sources identified and remedial measures determined. The International Red River Water Pollution Board conducted investigations from 1965 to 1966 and submitted a report to IJC in October 1967. 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 Binational water quality objectives were adopted for the Red River at the international boundary in 1969.

The IJC conducted public hearings on April 11, 1968 and reported to the Governments on their findings, recommendations and conclusions. The key recommendation was that WQOs, as defined in the IJC report, be accepted by Governments. In letters dated May 13 and 14, 1967, the Governments informed the Commission that the recommendations contained in the Commission's report to Governments were accepted and approved. The two Governments specifically authorized the Commission to establish continuous supervision over the quality of waters in the Red River crossing the International Boundary and to recommend amendments or additions to the objectives when warranted by the Commission. IJC recommended the establishment of WQOs for a limited number of variables at the boundary on April 11, 1968 and the recommendation was approved by governments on May 4, 1969. Shortly after, the Commission established the International Red River Pollution Board on June 10, 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 “exceedance” is used to describe a situation where an objective is not met. A situation is classified as an exceedance 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 exceedance 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.

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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

Jim Ziegler - (218) 856-0730 (office) State Duty officer
(218) 846-0719 Fax
1-800-422-0798 (24-hr) State Duty officer

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

Marilyn Danks - (651) 259-5087 (office – primary contact Central Office St. Paul)
Henry Drewes - (218) 308 -2633 (office – secondary contact Bemidji office)
1-800- 422-0798 (24-hr National Response Center)

North Dakota Health Department – Bismarck, ND

David Glatt - (701) 328-5210 (office)
Aaron Lason - (701) 328 -5214 (office)
(701) 328-5200 fax
1-800-472-2121 (24-hr in-state-ask for REACT Officer)
(701) 328-9921 (24-hr out-of-state - ask for REACT Officer)

Environmental Protection Agency – Denver, CO

Johanna Miller - (303) 312-6670 office
-(303) 312 -8637 (office-alternate contact)
-(303) 312-7206 fax
1-800-424- 8802 (24-hr National Response Center)

Canada:

Manitoba Sustainable Development – Winnipeg, MB

Spills - (204) 944-4888 (24-hr telephone service emergency number)

Exceedance - Nicole Armstrong – nicole.armstrong@gov.mb.ca

Environment and Climate Change Canada – Winnipeg, MB

Ute Holweger - (204) 983 – 9832 (office)
(204) 984 – 6683 (fax)
(204) 294 – 5128 (cell)

Environment and Climate Change Canada – Regina, SK

Girma Sahlu - (306) 564 – 4457(office)

APPENDIX D

HYDROLOGY COMMITTEE, AQUATIC ECOSYSTEM COMMITTEE, AND WATER QUALITY MEMBERSHIP LIST

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International Red River Board
Hydrology Committee Membership:

NAME	AGENCY	ADDRESS	PHONE #	E-MAIL
Mark Lee	Manitoba Sustainable Development	200 Saulteaux Cres. Winnipeg, MB R3J 3W3	(204) 945-5606 (o) (204) 391-1623 (c)	mark.lee@gov.mb.ca
Vacant	Agriculture and Agri-Food Canada	2701 Grand Valley Road, P.O. Box 1000A R.R. #3 Brandon, MB R7A 5Y3	(204) 578-6637	
Dr. Haitham Ghamry	Fisheries and Oceans Canada	501 University Crescent Winnipeg, Manitoba R3T 2N6	(204) 983-5206	Haitham.Ghamry@dfo-mpo.gc.ca
Bruce Davison	National Hydrological Services Environment and Climate Change Canada	11 Innovation Blvd Saskatoon, Saskatchewan S7N 3H5	(306) 975-5788	bruce.davison@canada.ca
Steven M. Robinson	U. S. Geological Survey	821 East Interstate Avenue Bismarck, ND 58503	(701) 250-7404 (o) (701) 595-9153 (c)	smrobins@usgs.gov
Vacant	North Dakota State Water Commission	900 E Boulevard Avenue Bismarck, ND 58505	(701) 328-2756	
Dan Thul	Minnesota Dept of Natural Resources	2532 Hanna Ave. Box, 9 Bemidji, MN 56601	(218) 308-2463	dan.thul@state.mn.us
Randy Gjestvang	North Dakota State Water Commission	1120 28th Avenue N., Suite C Fargo, ND 58102	(701) 282-2318 (o) (701) 390-3578 (c)	rgjestvang@nd.gov
Rebecca Seal-Soileau	US Army Corps of Engineers	180 East Fifth Street, Suite 700 Saint Paul, MN, 55101	(651) 290-5631	Rebecca.s.soileau@usace.army.mil

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lnternational Red River Board
Aquatic Ecosystem Committee Membership:

Name	Organization	Phone	Email
Patricia Ramlal	Fisheries and Oceans Canada	204-983-5173	Patricia.Ramlal@dfo-mpo.gc.ca
Maureen Gallagher	US Fish and Wildlife Service	303-236-4304	maureen_gallagher@fws.gov
Luther Aadland	Minnesota Department of Natural Resources	218-739-7576 ext. 235	luther.aadland@state.mn.us
Todd Caspers	North Dakota Game and Fish Department	701-739-6869	tcaspers@nd.gov
Eva Enders	Fisheries and Oceans Canada	204 984-4653	Eva.Enders@dfo-mpo.gc.ca
Amanda Hillman	Minnesota Department of Natural Resources	218-739-7576 x 276	amanda.hillman@state.mn.us
Geoff Klein	Manitoba Sustainable Development, Fisheries Branch	204-945-5206	Geoff.Klein@gov.mb.ca
Aaron Larsen	North Dakota Department of Health, Environmental Health Section	701-328-5230	allarsen@nd.gov
Jeff Long	Manitoba Sustainable Development, Fisheries Branch	204 945-7801	Jeff.Long@gov.mb.ca
Doug Watkinson	Fisheries and Oceans Canada	204-983-3610	Doug.WatkinsonWdfo-mpo.gc.ca
Jamieson Wendel	Minnesota Department of Natural Resources	218-846-8340	jamison.wendel@state.mn.us

International Red River Board
Water Quality Committee
Membership:

Name	Organization	Phone	E-mail
Jim Ziegler, (Co-chair)	Minnesota Pollution Control Agency	(218) 846-8102	Jim.Ziegler@state.mn.us
Nicole Armstrong, (Co-Chair)	Manitoba Sustainable Development	(204) 945-3991	nicole.armstrong@gov.mb.ca
Aaron Larson	North Dakota Department of Environmental Quality	701-328-5230	alarsen@nd.gov
Mike Vavricka	MPCA/Detroit Lakes	(218) 846-8137	michael.vavricka@state.mn.us
Ted Preister	RRBC/Moorhead	(218) 291-0422	ted@redriverbasincommission.org
Rochelle Nustad	US EPA	(303) 312-6837	Steinhaus.Eric@epa.gov
Iris Griffin	Environment and Climate Change Canada	(204)-984-5694	iris.griffin@canada.ca
Jim Noreen	US Army Corps of Engineers (CWMP)		James.B.Noren@usace.army.mil
Paul Klawunn	Environment and Climate Change Canada	(905) 336-4965	Paul.klawunn@canada.ca
Michelle Harland	Environment and Climate Change Canada	(204) 983-1816	Michelle.harland@canada.ca
Brian Parker	Manitoba Sustainable Development	(204) **945-7792**	Brian.Parker@gov.mb.ca
Jason Vanrobaeys	Agriculture and Agri-Food Canada		Jason.Vanrobaeys@AGR.GC.CA
Kris Jensen	US EPA	(313) 312-6237	jensen.kris@epa.gov
Elaine Page	Manitoba Sustainable Development	(204) 945-5344	Elaine.Page@gove.mb.ca

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IRRB