IRRB

THE
INTERNATIONAL
RED RIVER
WATERSHED BOARD

Twenty Second Annual
Progress Report
October 2021

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 Twenty Second Annual Progress Report to the International Joint Commission.

Respectfully submitted,

Patrick Cherneski
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 2020 Water Year (October 01, 2019 through September 30, 2020). In addition, this report describes the activities of the International Red River Board during the reporting period October 01, 2020 to September 30, 2021 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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1.01 Water Quantity and Water Quality

Streamflow for the Red River and most of its tributaries was at normal levels going into and during the 2020/2021 winter, with some locations even below normal (10-25 percentile). Winter was characterized by warmer than normal temperatures and less than normal precipitation. Snow water equivalent amounts were ranked in the lowest 25% and in the northern Red River Valley in the lowest 10% by January according to the National Weather Service (NWS) Office in Grand Forks, ND. These conditions extended into March with only a couple of weeks in mid-February of below normal temperatures, but precipitation still remained well below normal in the entire Valley. March 2021 marked the 5th warmest March on record, with Fargo setting record highs on March 8th, 9th, 20th and 29th. With little moisture to add to normal and below normal river flows, however, despite warm temperatures, the spring melt in March did not result in any significant spring events, with most of the river ice melting in place.

Peaks from the spring melt in the upper Red River (south of Fargo, ND) occurred in the second week of March and were followed by a slightly higher peak from a rain event in the first week of April. The April peak progressed downstream, with the crest passing into Canada on April 18-19, 2021. After the April rise, river levels from Grand Forks south, declined steadily with only a minor rise in mid-June. Current (mid-August) Red River Basin river conditions are mostly at the below normal (10-25 percentile), or much below normal (lowest-10 percentile) levels. The flow conditions since June have resulted in a need for the USGS lower USGS stage sensors and refine the lower end of the stage-discharge rating curves for sites on the Red River and its tributaries.

The Red River at Fargo (Figure 1) crested on April 11 with a provisional peak gage height of 16.76 ft. and streamflow of 2,940 cubic feet per second (cfs), providing the 75th highest peak, or the 45th lowest for the 120 years of peak flow record. The Red River at Grand Forks crested on April 14 with a provisional peak of 18.37 ft. and streamflow of 6,250 cfs, providing the 20th lowest peak for the 140 years of peak flow record.

The above normal temperatures combined with far below normal precipitation resulted in virtually no change in lake elevation from before ice-on to after ice-off for Devils Lake, with the lake having fallen steadily by approximately 1.10 ft from April to August 2021. A moderate rainfall event of 2.67 inches recorded at the Cando, ND NDAWN station has resulted in a slight rise in lake elevation, with the current stage (mid-August) around 47.43 ft. Pumping from Devils Lake outlets only resumed as of June 3rd, with only the West End outlet able to pump and only at reduced capacity of 140 cfs, due to reduced flow from the West Bay to Round Lake and water quality limiting output. Since July 16th, West End outlet flows have been reduced to only around 80 cfs. The East End outlet is still not currently being operated.

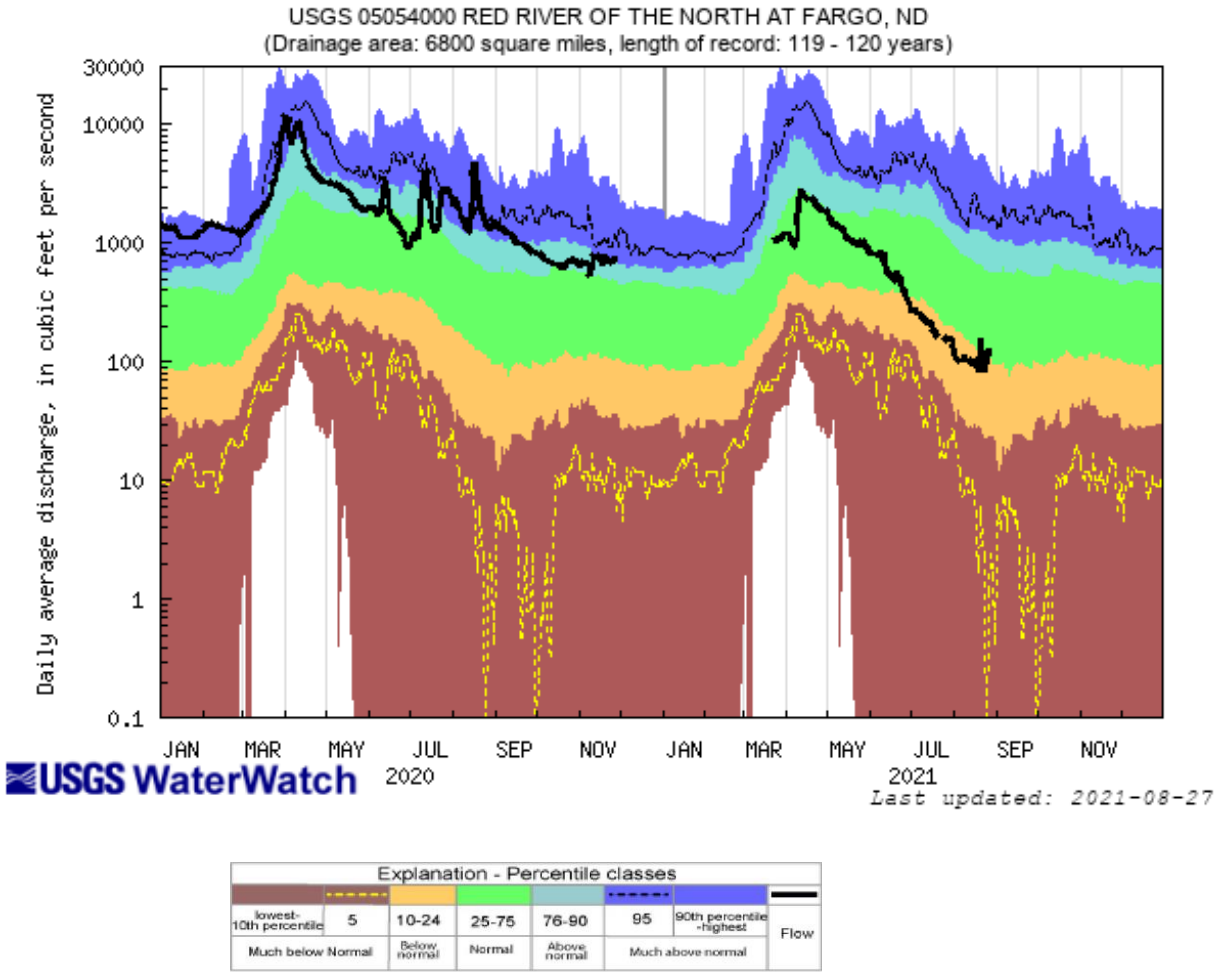

Figure 1: Red River at Fargo

In the Red River Basin, the USGS Dakota Water Science Center works in cooperation with:

- 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 Department of Water Resources,
- North Dakota Department of Health,
- U.S. Bureau of Indian Affairs, and
- 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.

Fall 2019/Winter 2020

Manitoba and the U.S. portions of the Red River and the Souris River basins received well above normal precipitation in the fall, due to near record high to record high precipitation in September and October. The first of three major storm systems struck the Red River Basin on September 20-21, with 2-4 inches of precipitation occurring across much of the basin. The second rainfall event occurred Sept 29-30, with another 2-3 inches of rain and a the third and final storm dropped another 2 inches between October 10-12. The first two storms helped set a new September precipitation record for Grand Forks, with a total of 9.07 inches of rain – a departure of +7.02 inches above normal.

The record September precipitation resulted in unusually high streamflows for October, November and December. The high streamflows on the Red River in October combined with the threat of the October 10-12 precipitation event necessitated the operation of the Red River Floodway under Rule 4 to mange river levels within the City of Winnipeg and reduce the risk of basement flooding due to sewer backup. The floodway gates were operated for 29 days, ending on November 7, 2019. This represents, by far, the latest in the year that the Floodway has ever been operated in its 50 years of existence.

The Red River at Grand Forks peaked on October 16, 2019, with a provisional peak gage height of 40.95 ft and a streamflow of 40,300 cfs, the 27th highest peak for the 137 years of peak flow record. The Red River at Winnipeg peaked at 17.2 ft on October 23rd, breaking the previous October water level record by 4 ft.

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. Manitoba's Hydrologic Forecasting Centre's Fall Conditions Report stated that heading into freeze-up soil moisture in most southern Manitoba basins was generally above normal to well above normal, with some areas showing record high soil moisture. All model results and various measurements confirmed that the Souris and Red River basins and the Whiteshell Lakes area were extremely wet, well above normal conditions.

At Emerson, flows remained at record levels throughout winter until the end of February (Figure 2). Streamflows for the Red River and its tributaries were at much above normal levels (>90 percentile) for the 2019/2020 winter, with some locations having record high winter streamflows. Winter was characterized by soil moisture levels that were much above normal, shallower frost depths, and snow water equivalent amounts that were near to above normal by March per the National Weather Service (NWS) Office in Grand Forks, ND. "Total precipitation (rain and snow-water) measured across the basin from September 1 through March 10 was 4-8 inches above the long-term normal for most of Red River Basin," (NWS March 12, 2020).

Winter snow fall was normal to above normal in the upper Red River basin, including significant late season snowfall in the Fargo area. The March Outlook published by Manitoba's Hydrologic Forecast Center estimated that the peak flow at Emerson would be similar to the flow seen in the spring of 2019 under favorable conditions, and exceed the 2006 flood under normal conditions. Under unfavorable conditions, the 2020 flow at Emerson was forecast to be greater than 2011.

Spring 2020

Snowmelt runoff began in late March progressing from south to north. Due to an unusually long and favourable thaw with minimal spring precipitation, flood peaks were lower than predicted in flood outlooks.

Peaks in the upper Red River occurred the second week of April and progressed downstream with the crest passing into Canada in mid-April. The Red River peaks at Fargo and Grand Forks were the 8th highest at both locations in over a hundred years of record and had an annual exceedance probability (AEP) for both locations of 0.04 or a "25-year recurrence interval".

- Provisional peak for the Red River at Fargo of 11,800 cfs at 28.23 ft. on April 1.
- Provisional peak for the Red River at Grand Forks of 73,800 cfs at 47.70 ft. on April 10.

The long and favourable thaw with minimal spring precipitation, resulted in peak at Emerson of approximately 69,600 cfs (1970 m3/s), and occurred over April 19 and 20. This is slightly lower than the peak flow observed at Emerson in 2006. The 2020 peak flow measured at Emerson equated to a 1:15 year flood. Due to the small contributions of tributaries in the Manitoba portion of the basin, the peak natural flood flow at James Avenue only equated to a 1-in-7 year flood. Red River Floodway operation began on April 10, and the gates were operated for 28 days ending on May 8. Approximately 757,300 acre-feet (934.1 million cubic meters) of water was diverted around the City of Winnipeg by the Red River Floodway, with a peak flow of 19,400 cfs (549.3 m3/s). Operation of the Red River Floodway, Portage Diversion, and Shellmouth Dam reduced the flood crest in the City of Winnipeg by 4.02 ft (1.22 m) at the peak natural flow. The recorded peak water level at James Avenue was 18.94 ft (5.77 m).

Summer 2020

Precipitation for the month of May was generally below normal. The month of June was a different story. In early June, a heavy rainfall event with amounts of 90 to 150 millimetres (3.5 to 6 inches) hit southeastern Manitoba. The event caused flooding in the Roseau River and Rat River watersheds with a record peak flood recorded at the Rat River near Sundown hydrometric gauge. The flooding caused the temporary evacuation of 93 homes.

The northwest portion of the Red River Valley in the US was plagued with numerous late June thunderstorms with heavy rainfall amounts. Harvey, ND (upper Sheyenne River) experienced a total of 8.80" of rainfall during the month of June, with 6.27" occurring on June 30. To the west Grand Forks accounts of 8-10" in the surrounding area were reported on June 30. On the other hand, in the south of the basin, precipitation at Fargo for June was 1.25" below normal. Regular rainfall events have kept Red River flows above the 75th percentile, or in the above normal to much above normal category, for the entire summer period.

Overall, drought conditions did not persist in the basin in summer 2020 although portions of the basin in Manitoba were drier than normal. USGS reported that generally speaking, there was an abundance of water in the US portion of the basin. Near the end of summer precipitation began to fall below normal with much of the western parts of the basin receiving less than half the normal amount of precipitation throughout August to October.

Fall/Winter 2020

Manitoba's Hydrologic Forecasting Centre's 2020 Fall Conditions Report stated that heading into freeze-up soil moisture in most of the basin was below normal, with some areas in the eastern part of the basin being normal to above normal.

Winter across the Red River Basin has been warm and dry. As of December 31st, snow water equivalent estimates ranged from less than 10 mm to 40 mm (0.5 to 1.5 inches) and were below the 20th percentile for much of the basin. At the end of 2020, the Canadian and United States Drought Monitors classified all of the basin in some degree of dryness.

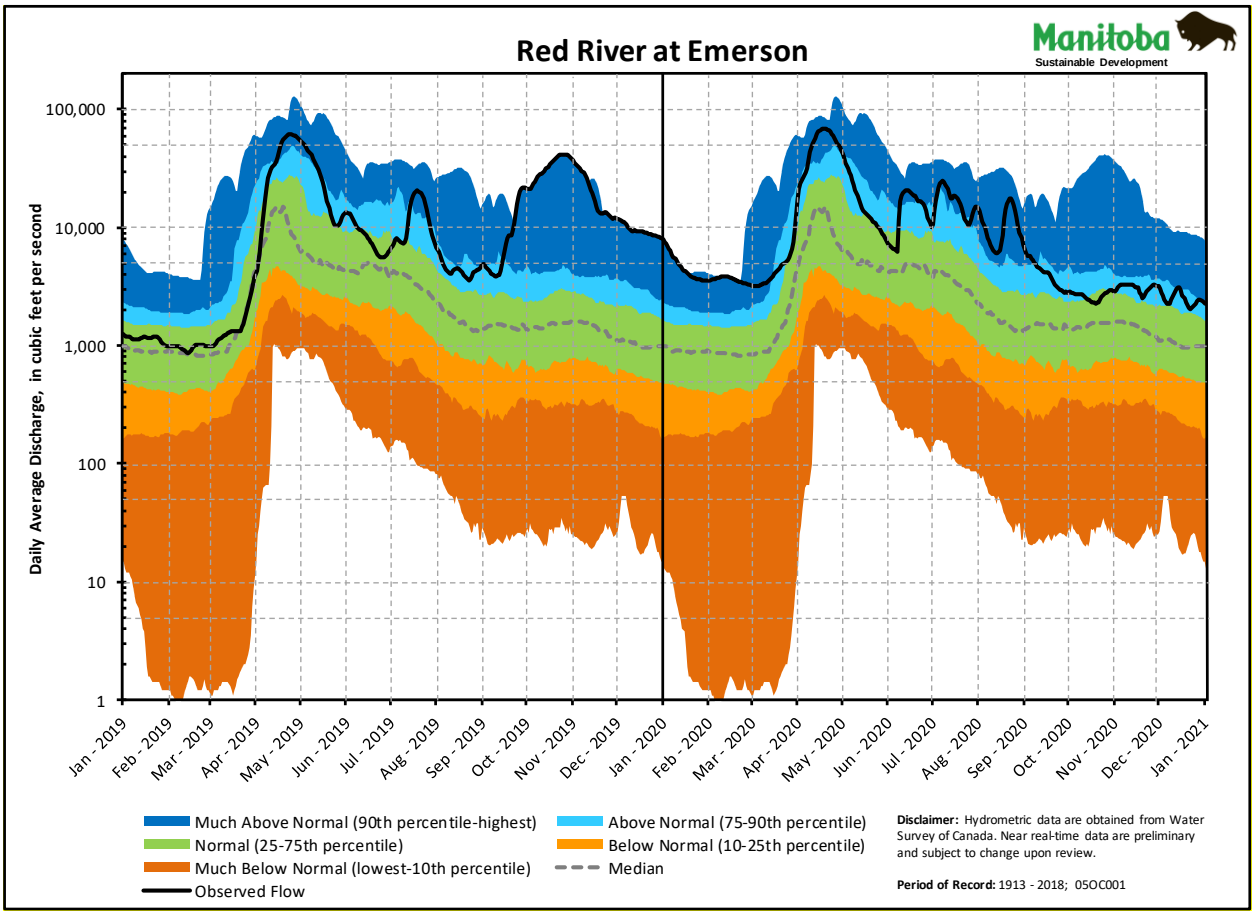

Figure 2. Average daily discharge in the Red River at Emerson for 2019 and 2020.

Water Quality

Water Quality Monitoring Program at Emerson in 2019-2020

Water quality monitoring of the Red River was interrupted by the COVID-19 pandemic during the 2019-2020 water year. As part of Environment and Climate Change Canada's Business Continuity Plan, the department focused on delivering its critical services, while prioritizing health and safety. Fieldwork and laboratory work that were deemed non-critical were temporarily suspended, including water quality monitoring. Monitoring was suspended after March 10, 2020 and resumed on August 27, 2020. When sampling recommenced, the ECCC National Laboratories for Environmental Testing came back online with a phased approach. Therefore, not all water quality analyses resumed at the same time, and not all parameters were measured from the initial water samples following the resumption of monitoring.

It is essential to recognize that the water quality data reported on in this document represents only a partial, or truncated, water year. A typical water year would comprise 40 to 45 sample; due to COVID-19 interruptions, the 2019-2020 water year saw up to 21 samples for certain parameters, and far fewer for other parameters. The frequency of monitoring, in a typical water year, consists of monthly sampling through the winter, weekly sampling during the open water season, and biweekly sampling during the spring freshet or other flood periods. In the 2019-2020 water year, no monitoring was conducted during the spring freshet, and very little of the summer period was captured. As a result, the reporting on the 2019-2020 partially monitored water year focuses heavily on the winter period and the unusual fall 2019 flood.

During the period in which ECCC temporarily suspended water quality monitoring at the international boundary, the Province of Manitoba sampled at the same location. It should be noted that MB measures similar water quality parameters to ECCC, but the two agencies use different laboratories, in some cases, different analytical chemistry techniques. A thorough interagency joint monitoring / data comparability study is currently underway to determine whether the ECCC and MB water quality datasets can be considered interchangeable. At this point, and until that study is complete, water quality data from the two agencies are not being pooled, analyzed or reported together. The water quality monitoring conducted by MB at Emerson while ECCC's monitoring was suspended is being presented in this report as a separate line of evidence. The seasonal patterns observed by Manitoba and the rates of exceedance they report are broadly similar to those which ECCC has reported. However, we need to wait until the interagency study is complete to determine whether the two datasets are comparable.

There are five water quality objectives established by the governments of Canada and the United States, herein called binational 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. In addition, the IJC has established a number of alert levels for a suite of pesticides, metals and toxic substances, and has proposed objectives for two nutrient parameters. The IRRB is responsible for monitoring and reporting on compliance with these objectives, proposed objectives, and alert levels.

Exceedances of the binational water quality objectives, and concentrations approaching the objective level for total dissolved solids (TDS) were observed at the international boundary during the October 1, 2019 - September 30, 2020 time period. Total Dissolved Solids (TDS) remained at or above the objective of 500 mg/L for most of the partially monitored 2019-2020 water year (87%). The highest observed value of TDS was 768 mg/L on December 3rd.

Furthermore, the Sulphate objective (250 mg/L) was exceeded in 33% of the samples collected during the same period. The highest recorded value was 317 mg/L on November 5th.

The bacteriological characteristics of the Red River are assessed on the basis of observed *Escherichia coli* bacteria for which an IJC objective (200 colonies per 100 mL) has been defined. The presence of *E. coli* in water is an indicator of impacts via human and/or animal wastes. During the partially monitored 2019-2020 water year, the *E. coli* bacteria objective of 200 colonies per 100 mL was not exceeded with a maximum count of 117 colonies per 100 mL on October 8th.

1.02 International Red River Watershed Board Activities

As noted in the Preface, this report also describes the activities of the International Red River Watershed Board (IRRWB) for the period October 01, 2020 - September 30, 2021, which succeeds the 2020 water year. The key activities are highlighted below:

In 2021, 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 IRRWB. 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 (COH) and completion of nutrient objectives by the Water Quality Committee (WQC) for the Red River at the International Boundary. Furthermore, the Aquatic Ecosystem (AEC) continues to work on its Fish Telemetry IWI Project in the Red River Basin. Other IWI projects either in progress or under development include the Sulphate Study that builds from the Trend Analysis work just completed, Nutrient Management Study through Workshops and Technical Assistance in the Red River Basin, and Drought Risk Analysis for the Red River Board (risk of extreme low flow events).

The IRRB coordinated two IJC public hearings – one in Fargo and another one in Winnipeg in 2020 held to seek public input on the recently completed nutrient objectives that the IRRB recommended to the IJC.

Aquatic Ecosystems Committee (AEC) - The AEC also continued its Fish Telemetry study in the Red River Basin. Aquatic Invasive Species and Habitat Mapping were put on hold due to resource limitations.

Lower Pembina Task Team (LPTT) - The LPTT was revived in 2019 to complete its modelling work and recommendations to the Premier of Manitoba and Governor of North Dakota. LPTT is expected to resume its activities in the near future. The Task Team has not met in-person due to COVID-19 travel restrictions.

Lake Winnipeg nutrient issues and the Fargo-Moorhead Diversion Project on the Red River continue to be topics of interest to the Board and were discussed at the Board meetings in 2020/2021.

The IRRB held its summer bi-annual meeting on August 25-26, 2020 virtually to address select issues in the basin. The winter bi-annual meeting was held on January 16, 2020 in Fargo, ND (the meeting on January 17, 2020 was later postponed to February 13, 2020 via conference call due to extreme winter weather conditions) for a more complete review of Board responsibilities, activities, and accomplishments. The meetings addressed water quality

monitoring and compliance with the bi - national water quality objectives and established alert levels and IRRB work plan priorities. The latter included actions to develop apportionment procedures and instream flow needs (IFN), prioritized flood mitigation plans, and biological monitoring.

In 2021, the IJC designated the IRRB as ***International Red River Watershed*** Board which was a major milestone. The IJC also issued a new and revised mandate to the Board (see Appendix E). The Board is currently engaged in discussions with its members and the IJC regarding inter-basin transfer of water such as the Red River Valley Water Supply Project (RRVWSP), Central North Dakota Water Supply Project (CNDWS), and the Eastern North Dakota Alternate Water Supply (ENDAWS) Project.

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

The Board reviewed and updated its three-year work plan in 2020 due to expire in September. Current priorities include:

- Reporting on Water Quality Objectives,
- Comprehensive Flood Mitigation Strategy,
- Water Quantity Apportionment & Instream Flow Needs (IFN) including Fish Telemetry Project,
- Next Steps to Address the Lower Pembina Flooding Issues,
- Follow-up of Nutrient Objectives recommended to the IJC,
- Outreach and Engagement including Engagement of Indigenous & Metis People, and
- IWI funded Projects.

The current three-year work plan covers the period from October 1, 2018 through September 30, 2021. A new work plan for the period October 1, 2021-September 30, 2024 was approved by the Board in August 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 Red River Basin is illustrated in Figure 3.

This report is the Twenty Second of the IRRB annual progress report to the IJC.

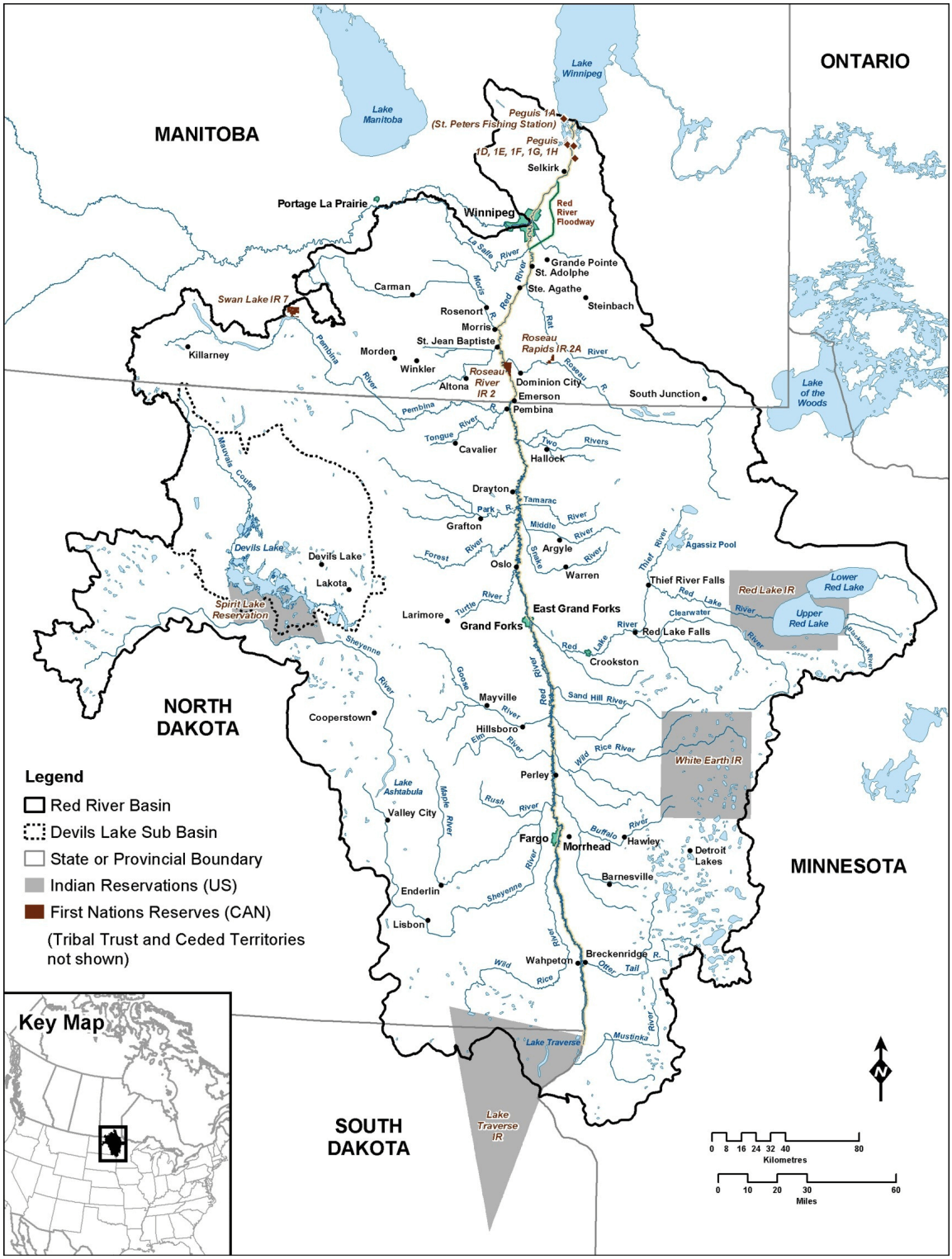

Figure 3: Red River and its Tributaries

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 Patrick Cherneski, 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 (retired)
Detroit Lakes Office
Minnesota Pollution Control Agency

David Glatt
Director, Division of Water Quality
North Dakota Department of Health

Randy Gjestvang
Red River Water Resources Engineer
North Dakota Department of
Water Resources

Brian Caruso
U.S Fish & Wildlife Service
Denver, Colorado

April E. Poitra-Walker
West Fargo Planning Commissioner
Chair, Cass Clay Community Land Trust

Benjamin Yawakie
Minnesota Environmental Quality Board
Citizen Member

Ayn Schmit
North Dakota Watershed Coordinator
U.S. EPA Region 8 (retired)

Mary Scherling
County Commissioner
Cass County, ND

Gregg Wiche
Emeritus
U.S. Geological Survey, Water Science Centre,
North Dakota

Nathan Kestner
A/Regional Manager
Minnesota, DNR Division of Ecological and
Water Resources

Theresa Haugen
Minnesota Pollution Control Agency

Jason Gildea
US Environmental Protection Agency

Dr. Rebecca Seal-Soileau - U.S. Secretary
St. Paul District IJC Specialist, Geologist
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Senior Engineering Advisor
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4.0 INTERNATIONAL RED RIVER BOARD ACTIVITIES

During the reporting period October 01, 2020 - September 30, 2021 the International Red River Board met virtually 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 25-26, 2020 to address select issues in the basin, and the winter bi-annual meeting on January 16, 2020 and February 13, 2020 for a more complete review of its responsibilities, activities, and accomplishments. The meetings addressed water quality monitoring and compliance with the binational 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 including the Fish Telemetry Project and recommendation of nutrient objectives to the IJC.

Except for short executive sessions during the August and January / February 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 was invited to share its views. The Board initiated its first public session in conjunction with the Red River Basin Commission's (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 its public sessions 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, 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-structured 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 a Water Quality Committee (WQC) in 2011 to report on water quality and nutrient management issues in the Red River Basin. The Board also created the Outreach and Engagement Committee (OEC) to improve communication between the Board and the various agencies that work with the IJC. In 2019, the OEC was active in seeking and encouraging Indigenous and Metis People engagement and participation in future Board meetings and activities.

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 Bi-national 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: Brian Caruso, US Fish and Wildlife Service

Current Committee members are:

Luther Aadland
Eva Enders (CAD)
Benjamin Holen (ND)
Nicholas Kludt (MN)
Jeff Long (MB)
Joshua Wert (ND)
Todd Caspers (ND)
Amanda Hillman (MN)
Geoff Klein (MB)
Aaron Larson (ND)
Doug Watkinson (CAD)

The AEC holds monthly phone calls except during the spring/summer field season. The group's discussion centers on 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. Phone calls will be resumed in the fall. Many of the field programs continue to be affected by COVID-19 restrictions.

The work of the committee continues to be focussed on developing items for the work plan, and an updated work plan was submitted to the Board earlier this year. The plan includes:

1. Fish Movement Study—current funding from IWI task expected to be finished by September 2021. Fish movement study to continue the larger project until 2022 at a minimum. The obtained information on habitat use and fish movement is crucial for Instream Flow Needs (IFN) predictions and will provide information on 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.

2. Species of Concern: The AEC in conjunction with federal, state and provincial authorities plan to continue to use the established array of sensors to develop a better understanding of different species of concern. Current tags are usable until 2022 and the hope is that the array will be used until 2026. This would provide valuable information on the impacts of the Fargo-Moorhead diversion. Construction is set to begin in the fall of 2022 on the Drayton Dam and the Red River structure in Fargo-Moorhead. Therefore the proposed work needs to begin before fall 2022 and as construction is scheduled to be completed late 2023-24, the study should carry on past completed construction.

3. Aquatic Invasive Species

   As discussed at the last meeting, we would like to still consider a workshop, but will put this on the back burner until we have a better understanding of what we can do while dealing with COVID restrictions. There are several other things to consider in deciding if we want to do a workshop, and what could be part of the workshop, including jurisdictional issues with AIS management, how science feeds into jurisdiction, and Asian Carp as one of the major concerns. We will be striking a sub-committee to determine the feasibility of such a workshop.

4. Habitat Evaluation

   The Committee on Hydrology (CoH) proposed doing work on the Red in this area, to which the AEC provided some suggestions.

   This work complements the fish movement study and the IFN study by the COH. If possible we suggest the additional surveys of some of the tributaries, with ADCP if depths are deep enough, or with alternate survey equipment appropriate to the depths being surveyed.

   The AEC participated on a call where the IRRB-Red River of the North bathymetry data collection was described.

   Some of the questions from the AEC on this project are:

   - What types of other work could be done at the same time? Substrate identification? Substrate composition (sand, cobble, clay, etc.)? Water surface elevation, water depths, and velocity data measurements?
   - When in the calendar year would be the best time to work on the river.
   - There is a need to scope out the work, especially on the Canadian side.
   - Is it possible to do some bathymetric work on some of the tributaries as well, and what would the additional costs be for that.
   - Is it possible to extend work for other different flow scenarios (mean and high flows)?
   - There is a need to obtain LIDAR data especially during the expected low flow scenario in Oct 2021.
   - How can we expedite the USACE boat crossing the border? Possibly need a request for authorization to do some scientific work in Canada. Canadian Coast Guard? Royal Canadian Navy?

Placeholders in the work plan:

- Roseau River Restoration: This project will rehabilitate and reconnect the historic river channel and re-establish the natural dimension, pattern and profile of the channel. Restoration of the stream to the historic meandering channel will provide better aquatic habitat diversity (pools and riffles) than the current ditch. There are 2 mussel species of special concern and 18 species of fish that will benefit from the restoration.

- Assessing species distribution abundance. Currently ND and MN do this on a periodic basis. MB and Canada do not. MN does this assessment once every five years timed with the descending limb of the spring hydrograph; they also use trap nets in the tributaries once every seven years. Longitudinal surveys conducted in MB with a boat electro-fisher provides information on species distribution and abundance, discover introduced species, but does not sample Channel Catfish effectively (target species in the MN surveys) .

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

The Water Quality Committee currently consists of the following members:

Jim Ziegler, Minnesota Pollution Control Agency (co-chair – retired July 6, 2021)
Nicole Armstrong, Manitoba Agriculture and Resource Development (co-chair)
Aaron Larsen, North Dakota State Department of Health
Ted Preister, Red River Basin Commission
Rochelle Nustad, U.S. Geological Survey
Iris Griffin, Environment and Climate Change Canada
Jason Vanrobaeys, Agriculture and Agri-Foods Canada
Elise Watchorn, Environment and Climate Change Canada
Paul Klawunn, Environment and Climate Change Canada
Keith Weston, Red River Retention Authority
Holiday Wirick, US Environmental Protection Agency
Josh Baker, US Environmental Protection Agency

The Committee last met in March 2021 and continues to focus on work related to the board's nutrient management strategy.

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

As a possible workplan item, the Committee is considering updating the compilation of actions, activities and plans for nutrient reductions. The last version of this document included actions, activities and plans from Minnesota, Manitoba, North Dakota and two federal governments.

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

The committee is awaiting a response from the two governments on the proposed nutrient load targets and concentration objectives. In the meantime, annual reporting to the IRRB includes some comparison to the proposed concentration objectives based on samples collected at the US/Canada border since April 2020.

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

International Watersheds Initiative – USGS Sulfate, Chloride and TDS Project

The USGS prepared a proposal for the IJC's International Watersheds Initiative (IWI) for a project titled "Evaluation of factors contributing to trends in sulfate, chloride and total dissolved solids in the Red River Basin: Statistical models". The WQC reviewed and provided comments on the proposal prior to submittal to IWI in late October 2020. The IWI reviewed the proposal and asked that the USGS respond to questions raised by IWI reviewers and resubmit the proposal. The proposal was resubmitted on January 6, 2021 and was approved for funding on February 18, 2021. Funding is anticipated to be in place by the end of August when USGS will begin working on the project.

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

International Watersheds Initiative – Supporting the IRRB's Nutrient Management Strategy through Workshops and Technical Assistance in the Red River Basin

The Environmental Protection Agency (EPA) with support from the Red River Basin Commission and others prepared a proposal to support the IRRB's Nutrient Management Strategy through voluntary performance improvement to reduce nutrient loading from wastewater facilities across the international Red River Basin. The WQC reviewed and provided comments on the proposal prior to EPA submittal to IWI in late October 2020. The IWI reviewed the proposal and asked that the EPA and Red River Basin Commission respond to questions raised by IWI reviewers and resubmit the proposal. The proposal was resubmitted on February 26, 2021 and was approved for funding on March 10, 2021. Work is now underway. The webinar for mechanical plants was held over six consecutive weeks in June/July 2021 with more than 120 participants in each weekly session. Scheduling of visits to plants has been complicated by ongoing COVID-19 challenges and plant calendar cycles but 5-6 (at least one in MB, MN, and ND) plants are online to have the expert out in April 2022. The in-person seminar for lagoon facilities has been scheduled for the week of September 20, 2021 with visits to four facilities associated with the seminar (two each in MN and ND). Uncertainty over COVID-19 has led to scheduling visits to Manitoba lagoons in April/May of 2022.

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, prompt interest in establishing set flow targets at the international boundary. The IRRB considers it prudent to consider establishment of such targets before they are needed.

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.

A meeting was held with IJC technical staff on May 14, 2020 to provide an update on the low flow frequencies project planning. Since then, several data pieces required for constructing the model have been gathered. Soils and land use data, dam/water retention structure data, and watershed boundaries information at the HUC-12 scale is being gathered. Hydrological and meteorological data to be used in the model are being evaluated. A literature search is being conducted for previous reports pertaining to streamflow and drought in the Basin.

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".

4.03-5 Outreach and Engagement Committee Update

Since the January 2021 Meeting, the Outreach and Engagement Committee has been working with new Board Members and Indigenous partners to submit a proposal through the IJC's International Watershed Initiative (IWI) during the spring intake period.
The proposal *Building the foundations for Indigenous collaboration in the International Red River Basin – Phase 1* was approved (with conditions) in June 2021. Funding is as follows:

- $49 K Can in IWI Funding
- $12 K Can in additional funding from Environment and Climate Change Canada

The project team has met twice since the proposal has been approved and efforts are underway to address the IWI conditions, determine oversight of the project and how the project will be administered (e.g. potential contract(s) with a non-government organization and/or the use of MOUs) and identifying a facilitator.
The project team has concluded that the formation of a task team would be the most effective means to provide the necessary oversight and ensure that the project will be implemented in an effective and timely manner.
Project Overview

- Phase I of this project (2021-2022) will focus on:
  - Establishing a state of current knowledge, perspectives and priorities amongst Indigenous Nations on both sides of the US-Canada border in the Red River Basin
  - Bridging existing knowledge gaps between the IRRWB and Indigenous Nations (Metis, First Nations and Tribes) in the International Red River Basin and informing future opportunities for Indigenous peoples and knowledge to be included in board activities and decision-making
- Series of meetings/working sessions will begin with identifying participants and establishing collective priorities
- A facilitator will assist in identifying priorities, gathering information and identifying opportunities for Indigenous knowledge to be integrated into IRRB activities
- Progress Report to be provided to IRRWB in Spring of 2022 and findings to be shared with IJC Indigenous Collaboration Team

Future phase will focus on Indigenous awareness training for IRRWB based on improved understanding of one another (including improved understanding of current status, Indigenous rights, water rights, governance for Canada and US Indigenous nations, barriers to fully engaging in watershed management activities and water-related decision making).

- enable integration and inclusion of Indigenous Nations in board activities
- Inform other IJC boards by sharing findings, lessons learned and best practices

Recommendations:

That the IJC International Red River Watershed Board (IRRWB) appoint a task team for this IWI project. Task Team to consist of:
April Walker, Board Member, US co-chair
Ute Holweger, O & E Committee, Canadian co-chair
Annette Trimbee, Board Member
Melissa Hotain, Board Member
Benjamin Yawakie, Board Member
Dimple Roy, Board Member, O & E Committee
Ted Preister, O & E Committee
Girma Sahlu, Canadian Secretary
Scott Jutila, US Secretary
Tina Keeper, Southern Chiefs Organization
Marci Riel, Manitoba Metis Federation*
Others?

There may be other board members or external partners that may have an interest in and wish to join the Task Team – for discussion at IRRWB meeting. IJC support provided by Robert Phillips, Mark Gabriel and Catherine Lee-Johnston. Decision requested at the August IRRB meeting.

Next Steps:

- If board approves, task team to provide oversight and guidance for project implementation
- Contract(s) and/or MOU to be finalized and signed
- Securing facilitator
- Initial Workshop with IRRB members in Fall 2021
- Additional working sessions to be held this fall/winter
- Progress Report to the IRRWB
- Phase 1 to be completed by March 31, 2022
- Planning for Phase 2 activities.

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 4). 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 Committee 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 raising of Hwy 18 near Neche, ND.
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

After the judge ruled that the Canadian Federal Court did not have jurisdiction to hear the 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.

Pembina River Basin Task Team

In June 2017, the Red River Basin Commission sent letters to North Dakota and Manitoba, requesting if there was interest in re-engaging the Pembina River Basin Task Team. Both responded favourably and scheduled a meeting to re-establish the work of the committee. Meetings were held in June 2019 in Gretna, MB, and in November 2019 in Pembina, ND. The Red River Basin Commission facilitated the meetings. 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.

Additional meetings of the Task Team were anticipated, but were delayed because of the border closure due to covid-19. It was felt that the discussion was at a critical stage, where face-to-face communication was essential. If the borders are able to open, it is expected that discussion for the next meeting will get underway. Because of the delay, an update to the membership may also be needed.

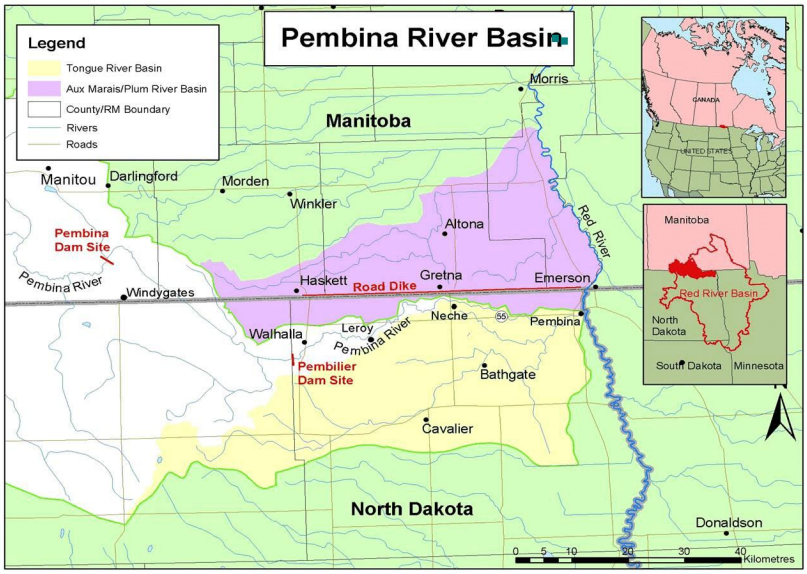


Figure 4: Pembina River Basin. The yellow and white areas comprise the Pembina River Basin.

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 2019-2020 water year (October 1, 2019 - September 30, 2020). The collected data are used to determine compliance with the binational water quality objectives, proposed nutrient 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, presented with contextual streamflow information, are discussed below for the corresponding time period. Two nutrient parameters for which the IJC has proposed objectives, as well as the suite of pesticides, metals and toxic substances which the IRRB uses as alert levels, are also discussed. 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 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.

Several exceedances of binational water quality objectives were observed during the 2019-2020 water year, as summarized in Table 1. 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 Boundary
Oct 1 2019 to Sept 30 2020 Partially Monitored Water Year

Parameter	Objective	Exceedances		
		Number (total # samples)	% samples exceeding	Maximum (Date)
Dissolved Oxygen	>5 mg/L	0 (21)	0%	5.99 ** (Aug 27th)
Total Dissolved Solids	500 mg/L	13 (15)	87%	768 (Dec 3rd)
Chloride	100 mg/L	0 (21)	0%	49.4 (Mar 10th)
Sulphate	250 mg/L	7 (21)	33%	317 (Nov 5th)
E. coli	<200 colonies /100 ml	0 (8)	0%	117 (Oct 8th)

***Minimum value for Dissolved Oxygen*

Dissolved Oxygen
Observed levels did not fall below the objective of 5 mg/L during the partially monitored 2019-2020 water year. The minimum observed value was 5.99 mg/L on Aug 27, 2020. Minimums often occur in summer, 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 unusually high water levels in October (Figure 4). Exceedances have been common over the last number of years: typically TDS values remain above the objective except where diluted by the higher flows of the spring freshet or other flooding. TDS exceedances were observed in 87% of the samples collected in the partially monitored 2019-2020 water year. The highest observed value of 768 mg/L occurred on Dec 3, 2019.

Chloride

The *chloride* objective (100 mg/L) was not exceeded during this reporting period. The maximum concentration was 49.4 mg/L on Mar 10, 2020.

Sulphate

The *sulphate* objective (250 mg/L) was exceeded in 33% of the samples collected in the 2019-2020 water year (Figure 5). The maximum value was 317 mg/L on Nov 5, 2019.

E. coli

Observed *E. coli* bacteria counts, as shown in Table 1, remained below the objective of 200 / 100 mL during the reporting period. The maximum concentration was 117 colonies / 100 mL on Oct 8, 2019.

Figure 5: Total Dissolved Solids (TDS) - Red River at the International Boundary

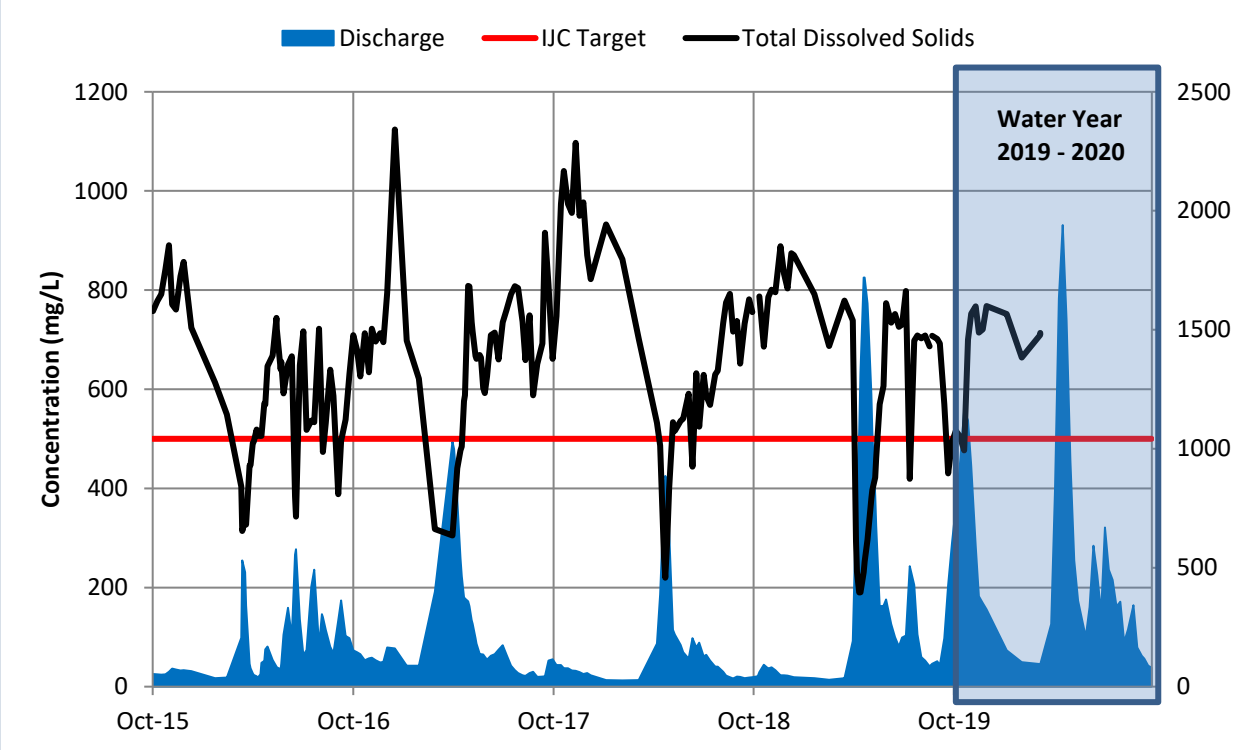


Figure 6: Sulphate Levels – Red River at the International Boundary

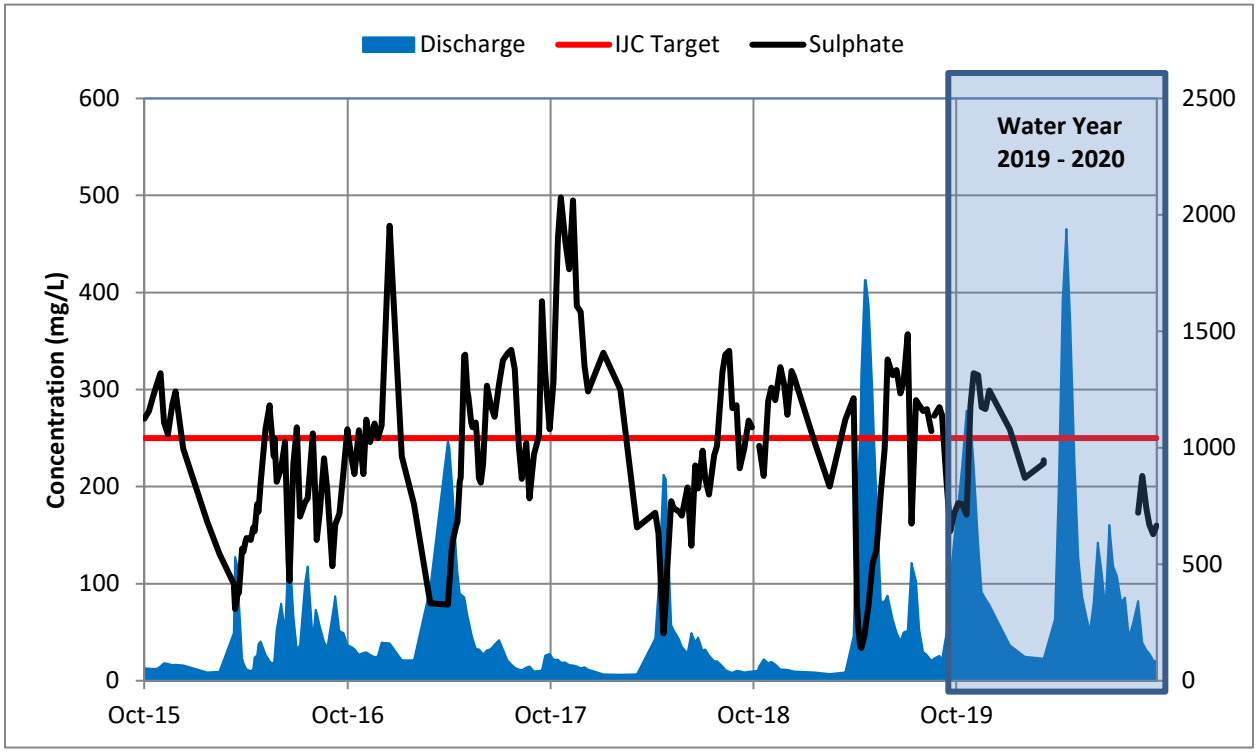
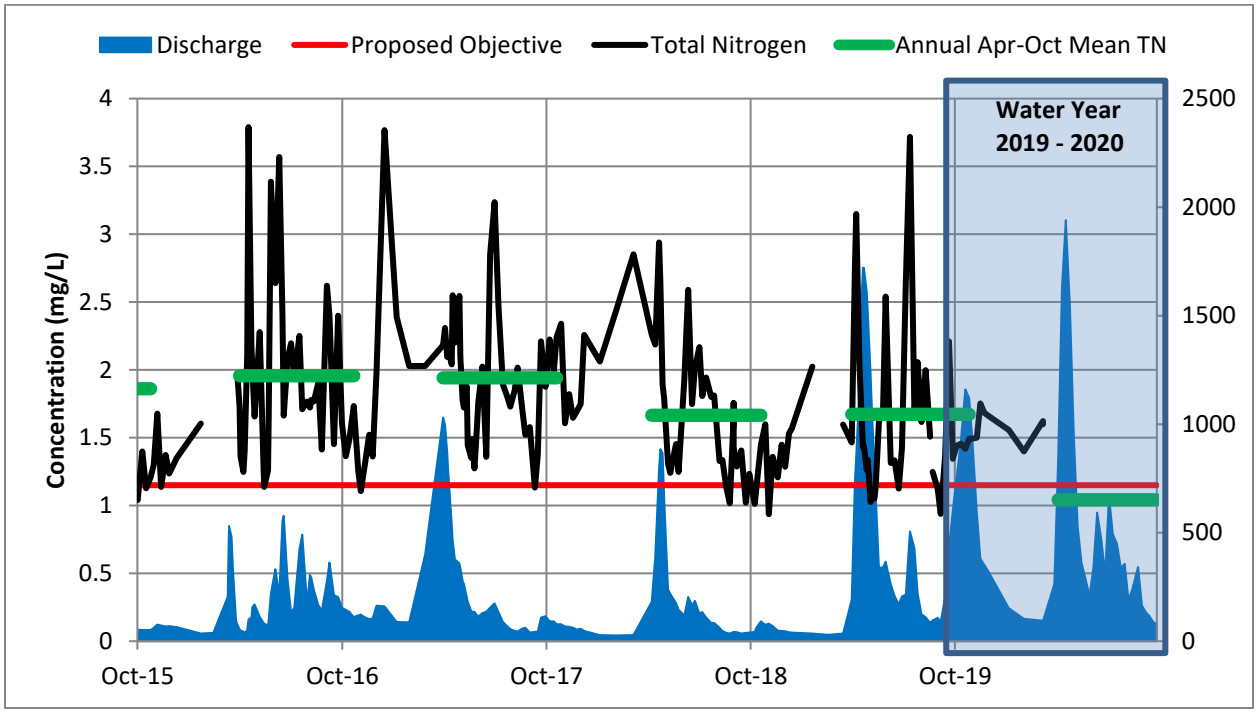


Figure 7: Nitrogen Levels – Red River at the International Boundary



5.02 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 eight water samples, 20 pesticides and metabolites with alert levels (greater than detection concentration) were monitored during the partially monitored 2019-2020 water year. Eight compounds (2,4-D, Atrazine, Clopyralid, Desethyl Atrazine, MCPA, MCPP, Metolachlor, Picloram) were detected in 75-100% of the samples. 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. No legacy contaminants were detected during this reporting period.

Environment and Climate Change Canada recently enhanced the pesticide analyses to assess current use pesticide concentrations during open water conditions (May to October). The analysis have been expanded to include a broader range of pesticides. These include insecticides (neonicotinoids), herbicides (sulfonyl urea) and fungicide pesticides. In 2019-20, detections included 4 of 14 insecticides, 9 of 19 herbicides and 10 of 14 fungicides. The pesticides with the highest frequency of detection 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 21 water samples were collected and analyzed for metals and toxic substances during the reporting period. The only parameters detected in exceedance of alert levels were cadmium, manganese and iron, each with an exceedance rate of 100%. The maximum values for cadmium, manganese and iron were detected in September 2020. Iron and manganese are components in natural soils; however, the detection of higher levels of cadmium may indicate anthropogenic sources. Higher metals concentrations tend to correspond to higher flow and higher particulate matter events. It should be noted that the spring freshet, when maximum values are typically measured, was not monitored during this water year.

Table 2 Exceedances of Alert Levels, Red River at International Boundary Oct 1 2019 to Sept 30 2020 Partially Monitored Water Year						
Parameter	**Units**	**Alert Level**	**Number of Samples**	**Number of Exceedances %**	**Maximum Exceedance Value (Month)**	**Canadian Environmental Quality Guideline**
Metals (total):						
Cadmium	µg/L	Detect	21	**21 (100%)**	0.131 (Sep)	0.37ug/L[1]
Chromium	µg/L	50	21	0	--	NG
Iron	µg/L	300	21	**21 (100%)**	3350 (Sep)	300 ug/l[1]
Manganese	µg/L	50	21	**21 (100%)**	320 (Sep)	200 ug/L[2]
Selenium	µg/L	10	21	0	--	1 ug/l[1]
Zinc	µg/L	47	21	**0**	--	30 ug/l[1]
Toxic Substances:						
Arsenic	ug/L	10	21	0	--	5 ug/l[1]
Boron	ug/L	500	21	0	--	29 mg/l[1]
Total PCB	ng/L	Detect	--	--	--	NG
Pesticides:						
2,4-D	ng/L	Detect	8	**8 (100%)**	169 (Oct)	4000 ng/l[1]
Bromoxynil	ng/L	Detect	8	**1 (12%)**	3.26 (Aug)	5000 ng/l[1]
Clopyralid	ng/L	Detect	8	**8 (100%)**	299 (Aug)	NG[5]
Dicamba	ng/L	Detect	8	**5 (62%)**	228 (Aug)	10000 ng/l[1]
Imazamethabenz-methyl a	ng/L	Detect	8	**0**	--	NG
Imazamethabenz-methyl b	ng/L	Detect	0	--	--	NG
MCPA	ng/L	Detect	8	**8 (100%)**	9.93 (Oct)	2600 ng/l[1]
Mecoprop (MCPP)	ng/L	Detect	8	**6 (75%)**	2.72 (Oct)	NG
Picloram	ng/L	Detect	8	**8 (100%)**	119 (Nov)	29000 ng/l[1]
Aldrin	ng/L	Detect	0	--	--	NG
g-Benzenehexachloride	ng/L	Detect	6	**0**	--	10 ug/l[1]
Pentachloroanisole	ng/L	Detect	0	--	--	NG
Atrazine	ng/L	Detect	7	**7 (100%)**	70.9 (Oct)	1800 ng/l[1]
Desethyl Atrazine	ng/L	Detect	4	**4 (100%)**	47.3 (Aug)	NG
Metolachlor	ng/L	Detect	7	**7 (100%)**	412 (Aug)	7800 ng/l[1]
P,P-DDE	ng/L	Detect	6	0	--	NG
Alpha-Endosulfan	ng/L	Detect	4	**0**	--	3 ng/l[1,4]
Beta-Endosulfan	ng/L	Detect	4	**0**	--	3 ng/l[1,4]
Heptachlor Epoxide	ng/L	Detect	0	--	--	NG
Metribuzin	ng/L	Detect	7	**4 (57%)**	21.3 (Oct)	1000 ng/l[1]

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 CaCO3) 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 Oct 1 2019 to Sept 30 2020 Partially Monitored Water Year					
Parameter	**Units**	**Number of Samples**	**Detections (%)**	**Maximum - Value (Month)**	**Canadian Environmental Quality Guideline[1,2]**
Fungicides					
Azoxystrobin	ng/L	4	100	15.2 (Aug)	NG[3]
Boscalid	ng/L	4	100	46.8 (Aug)	NG
Cyproconazole 1	ng/L	4	100	1.19 (Oct)	NG
Cyproconazole 2	ng/L	4	100	1.18 (Oct)	NG
Metconazole	ng/L	4	100	2.73 (Oct)	NG
Propiconazole	ng/L	4	100	37.8 (Aug)	NG
Pyraclostrobin	ng/L	4	100	5.12 (Oct)	NG
Tebuconazole	ng/L	4	100	60.4 (Aug)	NG
Tetraconazole	ng/L	4	100	10.5 (Aug)	NG
Trifloxystrobin	ng/L	4	50	0.0254 (Oct)	NG
Insecticides (Neonicotinoids)					
Chlorantraniliprole	ng/L	4	100	2.4 (Aug)	NG
Clothianidin	ng/L	4	100	33 (Oct)	NG
Imidacloprid	ng/L	4	100	11.1 (Oct)	230[1]
Thiamethoxam	ng/L	4	100	19 (Oct)	NG
Herbicides (Sulfonyl Ureas)					
Acifluorfen	ng/L	8	38	3.02 (Aug)	NG
Chlorsulfuron	ng/L	4	100	1.28 (Oct)	NG
Diuron	ng/L	4	100	19.6 (Aug)	NG
Flumetsulam	ng/L	4	100	21.6 (Oct)	NG
Fomesafen	ng/L	8	100	718 (Oct)	NG
Metsulfuron	ng/L	4	100	5.84 (Oct)	NG
Rimsulfuron	ng/L	4	25	0.245 (Oct)	NG
Thifensulfuron	ng/L	4	25	0.714 (Oct)	NG
Tribenuron	ng/L	4	100	0.965 (Oct)	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, 2020 to June 30, 2021

Watershed Restoration and Protection Strategy

There are 17 major tributaries to the Red River in Minnesota. The Minnesota Pollution Control Agency is developing watershed restoration and protection strategy (WRAPS) reports for each of these watersheds. Each WRAP consists of monitoring, stressor identification, modeling, public participation/input and a TMDL. The WRAPS have been completed on 15 watersheds, one report is drafted and under review, and the remaining report is under development.

Watershed Restoration and Protection Strategy reports:

Name	Status	Final WRAPS Approved
Bois De Sioux River	**Complete & Approved**	4/8/2020
Buffalo River	**Complete & Approved**	4/9/2016
Clearwater River	**Complete & Approved**	1/8/2021
Mustinka River	**Complete & Approved**	9/26/2016
Otter Tail River	Reports under Review	
Red Lake River	**Complete & Approved**	11/20/2019
Red R. - Grand Marais Creek	**Complete & Approved**	4/11/2019
Red R. - Marsh River	**Complete & Approved**	06/24/2021
Red R. - Sandhill River	**Complete & Approved**	4/13/2017
Red R. - Tamarac River	**Complete & Approved**	3/21/2019
Roseau River	**Complete & Approved**	12/3/2020
Snake River (Red R. Basin)	**Complete & Approved**	12/3/2020
Thief River	**Complete & Approved**	3/18/2019
Two Rivers	**Complete & Approved**	6/10/2019
Upper Red River	**Complete & Approved**	12/22/2017
Upper/Lower Red Lake	**Complete & Approved**	5/21/2021
Wild Rice River	Reports in Development	

Total Maximum Daily Load (TMDL)

TMDLs are currently being written for the Red River main stem and Wild Rice River and are expected to be complete near the end of this calendar year (2021). Assessment work has been completed on the Red River main stem and the status 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

TMDLs with WRAPS were completed for four (4) HUC 8 – Upper/Lower Red Lake, approved 6/22/2021; Clearwater River, 2/18/2021; Roseau River, 1/7/2021; and Snake River (Red R. Basin), 12/21/2020. Reports and further information can be viewed at https://www.pca.state.mn.us/water/total-maximum-daily-load-tmdl-projects#approved-6123248a ;

In the Upper/Lower Red Lake watershed, TMDLs address impaired aquatic recreation use due to excessive bacteria and excessive nutrients and impaired aquatic life use due to excessive sediment. TMDLs were written for 15 impairments of which included nine (9) bacteria TMDLs, five (5) nutrient TMDLs and one (1) sediment TMDL. Reports and further information can be viewed at https://www.pca.state.mn.us/water/watersheds/upper-lower-red-lake

In the Clearwater watershed, TMDLs address total suspended solids, phosphorus, and E. coli to address the impaired aquatic life use and aquatic recreation use. TMDLs were written for 24 impairments to address E. coli and total suspended solids. Reports and further information can be viewed at https://www.pca.state.mn.us/water/watersheds/clearwater-river

In the Roseau River watershed, TMDLs address Total Suspended Solids (TSS) and E. coli, and address impairments to Aquatic Life and Aquatic Recreation designated uses, respectively. TMDLs were written for two impairments of which included one (1) bacteria TMDLs and

one (1) sediment TMDL. Reports and further information can be viewed at https://www.pca.state.mn.us/sites/default/files/wq-iw5-18g.pdf

In the Snake River (Red R. Basin) watershed, TMDLs address impaired aquatic life and aquatic recreation use due to excessive bacteria and sediment. TMDLs were written for eight impairments: three (3) river/stream-reach aquatic recreation use impairments caused by elevated Escherichia E. coli (E. coli) levels and five (5) river/stream-reach aquatic life use impairments caused by turbidity, or too much suspended solids in the water (soil particles, etc.). Reports and further information can be viewed at https://www.pca.state.mn.us/water/watersheds/upper-lower-red-lake

National Pollutant Discharge Elimination System (NPDES)/State Discharge Elimination (SDS) wastewater permits

There were 31 National Pollutant Discharge Elimination System (NPDES)/State Discharge Elimination (SDS) permits issued. Fourteen of these were for industrial sites, one was a campground, the remainder were for wastewater treatment plants. There were 21 releases reported from NPDES permitted facilities.

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 Department of Water Resources (formerly State Water Commission) 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 8, 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 8, 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 8, 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.

As of October 2019, four (4) sites in the Fargo-Moorhead area are now being sampled by the USGS-GF. Previously, these four sites were sampled by the NDDEQ. These sites are being monitored as part of the Fargo Diversion Project in order to collect consistent water quality data pre-and-post construction of the Fargo Diversion channel in order to document any water quality changes associated with the project. All field measurements and analysis remain the same as noted above. These four sites are denoted with an asterisk (*) below.

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

USGS Site ID	NDDEQ Site ID	Site Name	Latitude	Longitude	Design Level	Responsible Agency
05051300	385055	Bois de Sioux River near Doran, MN	46.1522	-96.5789	1	NDDEQ
05051510	380083	Red River at Brushville, MN	46.3695	-96.6568	1	NDDEQ
05053000	380031	Wild Rice River near Abercrombie, ND	46.4680	-96.7837	1	USGS-GF*
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	NDDEQ
05058000	380153	Sheyenne River below Baldhill Dam, ND	47.0339	-98.0837	1	NDDEQ
05058700	385168	Sheyenne River at Lisbon, ND	46.4469	-97.6793	1	NDDEQ
05059000	385001	Sheyenne River near Kindred, ND	46.6316	-97.0006	1	USGS-GF*
05060100	384155	Maple River below Mapleton, ND	46.9052	-97.0526	1	USGS-GF*
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	NDDEQ 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	USGS-GF*
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	NDDEQ 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

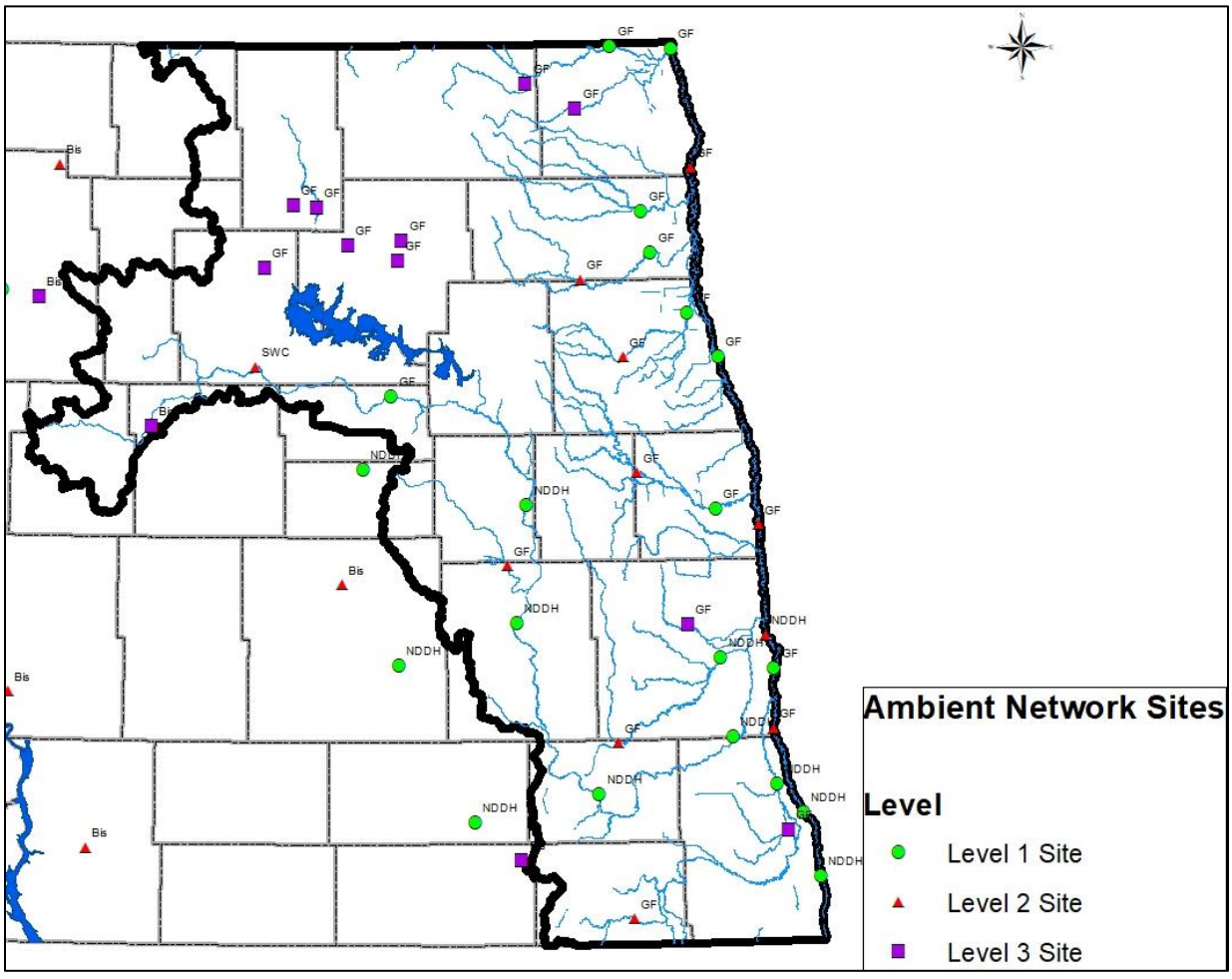


Figure 8. North Dakota Ambient Water Quality Monitoring Sites in the Red River Basin.

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.

Supplemental Monitoring Activities

Harmful algal blooms have become a concern in recent years due to their uninviting and potentially harmful nature due to cyanotoxin production. As of August 2021, the NDDEQ has posted four (4) water advisories on lakes/reservoirs and investigated another ten (10) lakes/reservoirs for potentially harmful algal blooms. Also, due to the extended drought conditions, the Department has also investigated potential blooms on the Red and Wild Rice rivers.

North Dakota Department of Agriculture Pesticide Monitoring Program

As a compliment to North Dakota's revised ambient water quality monitoring program, in 2019 the NDDEQ and the USGS cooperated with the North Dakota Department of Agriculture (NDDA) in a state pesticide monitoring program. The goals of the 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. A final report detailing the results of the monitoring program, including the results from samples collected in the Red River basin is available at https://www.nd.gov/ndda/sites/default/files/resource/2020%20SW%20Report%20WC2.pdf

6.03 Manitoba

Surface Water Quality Monitoring

During the 2019-2020 water year, Manitoba Agriculture and Resource Development continued its routine long-term monitoring of surface water quality within the Red River watershed. Sampling was conducted on a monthly frequency at two sites along the main stem of 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 9). Additionally, joint federal/provincial samples were collected at Selkirk and Emerson (only for October – December period) for quality control/quality assurance purposes to ensure the long-term consistency of comparability between federal and provincial datasets. Water quality parameters measured included physical parameters, general chemistry, suspended sediment, bacteria, industrial organics, trace elements, nutrients, and agricultural chemicals. Long-term variables monitored by Manitoba Agriculture and Resource Development are shown in Table 8. Benthic macroinvertebrates were also collected from the Red River at Emerson and Selkirk in September 2020.

As part of its regular Red River watershed monitoring, Manitoba Agriculture and Resource Development also conducted routine monitoring at seven sites on six tributary streams to the Red River (Figure 9) during the 2019-2020 water year. Tributary sites are typically monitored on a quarterly basis (October, January, April and July) throughout the water year; however, several tributary sites were not sampled during the April 2020 quarterly monitoring period due to temporary COVID-19 related impacts to monitoring activities. Tributary samples were analyzed for a wide range of variables including physical parameters, general chemistry, suspended sediment, bacteria, industrial organics, trace elements and nutrients. Long-term monitoring of tributary streams allows Manitoba Agriculture and Resource Development to identify potential

sources of pollution to the Red River and develop management strategies that address existing and emerging water quality issues within the Red River watershed.

Additionally, in response to the Canadian federal government's suspension of water quality monitoring at the US/Canada border (due to the COVID-19 pandemic), Manitoba Agriculture and Resource Development initiated a water quality monitoring program on the Red River at Emerson. Samples were collected monthly starting in April 2020 and analyzed for a wide range of variables including physical parameters, general chemistry, suspended sediment, bacteria, industrial organics, trace elements and nutrients.

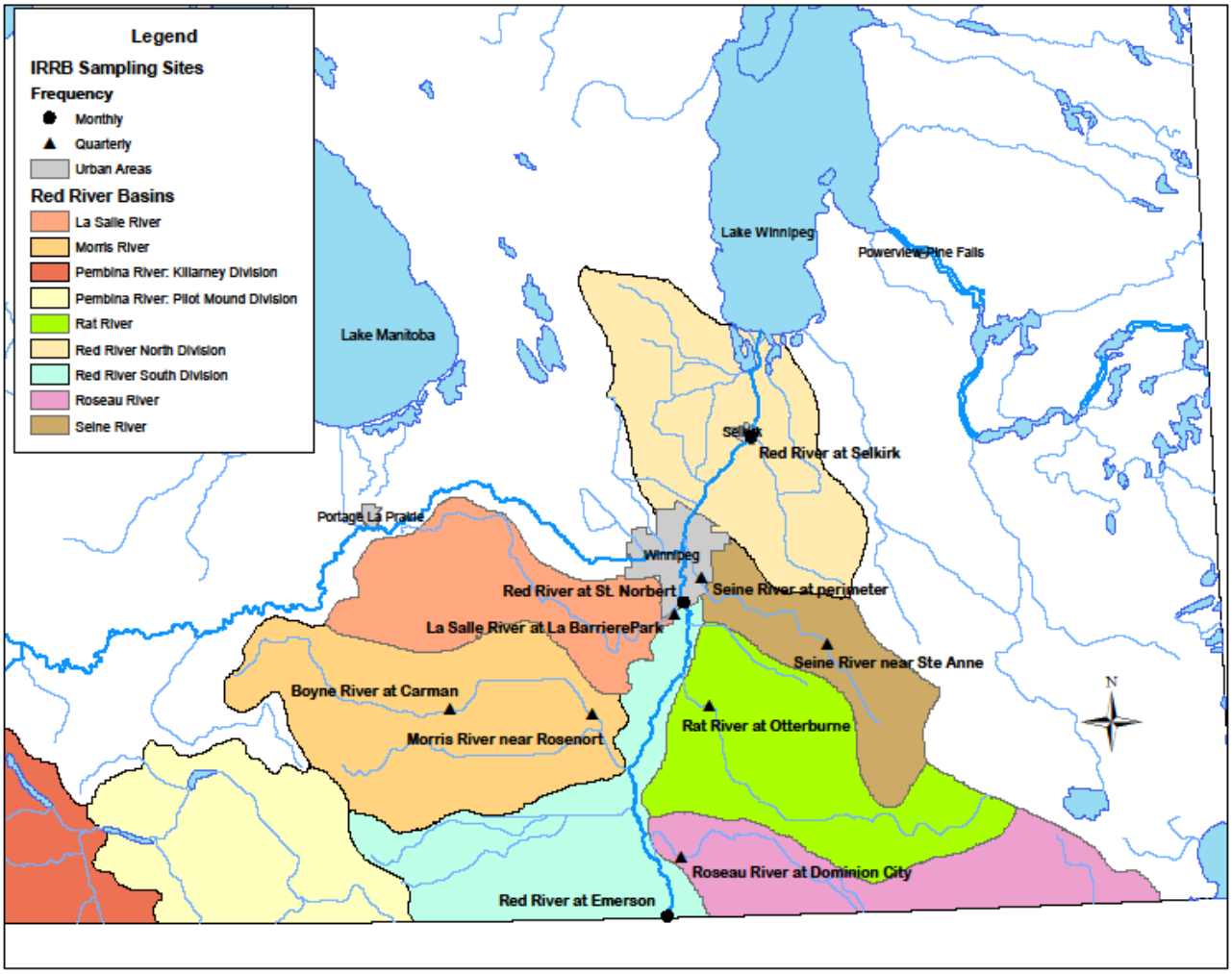


Figure 9. Location of water quality and benthic invertebrate sampling sites in the Red River watershed (Manitoba). Benthic invertebrates are collected 1x/year from the Red River at Emerson and Selkirk sites.

Table 8. Routine surface water quality monitoring variables monitored by Manitoba Agriculture and Resource Development on the Red River and tributary sites 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 @ 180^0 C
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

Red River – International Boundary at Emerson, MB

During the 2019-2020 reporting period, Manitoba Agriculture and Resource Development collected ten water samples from the Red River at the Canada-US International Boundary at Emerson, MB. All samples were analyzed for the five parameters (chloride, sulphate, total dissolved solids, dissolved oxygen, *Escherichia coli*) for which multi-national water quality objective have been established by both the governments of Canada and the United-States for the Red River at the International Boundary, as well as, for the two recently recommended additional parameters (2019: total phosphorus and total nitrogen). Water samples were also analyzed for the majority of parameters for which existing multi-national water quality alert levels have been established for the Red River at the International Boundary. However, pesticide analyses were not conducted on these samples.

Multi-National Water Quality Objectives

Overall, during the 2019-2020 water year, water quality exceedances were observed for all parameters with established or proposed multi-national water quality objectives, with the exception of chloride (Table 9). The highest observed measurement for total chloride was 46.7 mg/L, occurring during the August 2020 sampling period. The mean concentration of total chloride observed during the current water year was 33.6 mg/L, considerably lower that the 100 mg/L objective. Total sulphate concentrations exceeded the 250 mg/L objective in 50 % of samples, with a mean concentration of 225 mg/L for the current water year. Similar to total chloride, the highest total sulphate concentration of 318 mg/L occurred during the August 2020 sampling period. Total dissolved solids exceeded the water quality objective of 500 mg/L in nearly three quarters (70 %) of all samples collected during the current water year. The mean total dissolved solids concentration was 626 mg/L, with a maximum concentration of 856 mg/L occurring during the December 2019 sampling period.

Dissolved oxygen concentrations and *Escherichia coli* densities both met the established multi-national water quality objectives in 90 % (9 of 10) of samples collected. In general, dissolved oxygen concentrations in the Red River at the International Boundary were sufficient to support aquatic life and were relatively high with an average concentration of 8.40 mg/L. The lowest dissolved oxygen concentration observed occurred during the July 2020 period at 3.2 mg/L. While this minimum dissolved oxygen concentration represents a substantial departure from the >5 mg/L multi-national water quality objective, concentrations returned to acceptable levels by the August and September 2020 monitoring periods, with measured concentrations of 6.8 and 8.9 mg/L, respectively. The mean density of *Escherichia coli* (*E. coli*) bacteria was 50 organisms / 100 mL during the current reporting period, representing a substantially lower value than the 200 organisms / 100 mL multi-national objective. In particular, with the exception of the maximum density of 345 organisms / 100 mL observed during the June 2020 sampling period, only one additional sample collected exceeded an *E.coli* density of 28 organisms / 100 mL (57 organisms / 100 mL, October 2019) during the 2019-2020 water year.

Total nutrient concentrations observed at the International Boundary during the 2019-2020 water year were higher than the proposed multi-national water quality objectives for total phosphorus and total nitrogen concentrations of 0.15 mg/L and 1.15 mg/L, respectively. In particular, the proposed multi-national seasonal average objective (April 1 – October 30) for total phosphorus was exceeded by almost three-fold, with a mean concentration of 0.341 mg/L during the current reporting period. A maximum concentration of 0.751 mg/L was measured during the June 2020 monitoring period, representing a concentration five times greater than the proposed objective. Similar to total phosphorus, the seasonal mean (April 1 – October 30) total nitrogen concentration of 1.705 mg/L also exceeded the proposed seasonal average objective of 1.15 mg/L. A maximum total nitrogen concentration of 3.60 mg/L was observed during the June 2020 sampling period. Again, all individual samples collected exceeded the proposed water quality objective, with a minimum observed concentration of 1.32 mg/L total nitrogen.

Table 9. International Red River Board Water Quality Objectives
Summary of Exceedances - Red River at the International Boundary
October 2019 to September 2020 Water Year

Parameter	Units	Objective	Number of Samples	Number of Exceedances (%)	Min. (Month)	Mean	Max. (Month)
Total Chloride	mg/L	100	10	0 (0)	14.8	33.6	46.7 (August)
Total Sulphate	mg/L	250	10	5 (50)	102	225	318 (August)
Total Dissolved Solids [1]	mg/L	500	10	7 (70)	362	626	856 (December)
Dissolved Oxygen	mg/L	> 5	10	1 (10)	3.2 (July)	8.4	11.3
Escherichia coli	MPN/100 mL	200	10	1 (10)	1	50	345 (June)
Total Phosphorus *Seasonal Average* [2]	mg/L	0.15	*n/a*	*n/a*	0.222	0.341	0.751 (June)
Total Nitrogen *Seasonal Average* [2]	mg/L	1.15	*n/a*	*n/a*	1.320	1.705	3.6 (June)

[1]: At 180°C
[2]: Calculated based on seasonal period from April 1st to October 30th, 2020, per recommendation by International Red River Board (2019)

Multi-National Water Quality Alert Levels

Overall, water quality parameters with established multi-national water quality alert levels were exceeded for five of the eight parameters during the 2019-2020 water year (Table 10). In particular, total cadmium, total iron and total manganese exceeded the water quality alert levels in all ten samples collected. Maximum total concentrations observed for cadmium, iron and manganese were 0.641, 18900 and 944 µg/L, respectively, with all maximum concentrations occurring during the June 2020 sampling period. Total zinc and total arsenic concentrations each exceeded their respective alert levels for one of ten samples collected during the current water year. Similar to cadmium, iron and manganese, maximum concentrations for total zinc and total arsenic were observed during the June 2020 sampling period, with 77.9 and 10.1 µg/L, respectively. The remaining three parameters assessed against existing water quality alert levels did not exceed their respective alert levels at any time during the 2019-2020 water year. Maximum total concentrations for chromium, selenium and boron were 22, 2.01 and 146 µg/L, respectively, which are considerably lower than their established alert levels.

Table 10. International Red River Board Water Quality Alert Levels
Summary of Exceedances - Red River at the International Boundary
October 2019 to September 2020 Water Year

Parameter	Units	Alert Level	Number of Samples	Number of Exceedances (%)	Min.	Mean	Max. (Month)
Total Cadmium	µg/L	Detect	10	10 (100)	0.035	0.139	0.641 (June)
Total Chromium	µg/L	50	10	0 (0)	1.0	4.7	22 (June)
Total Iron	µg/L	300	10	10 (100)	702	3944	18900 (June)
Total Manganese	µg/L	50	10	10 (100)	59	260	944 (June)
Total Selenium	µg/L	10	10	0 (0)	0.7	1.2	2.01 (November)
Total Zinc	µg/L	47	10	1 (10)	5.1	17.6	77.9 (June)
Total Arsenic	µg/L	10	10	1 (10)	3.6	5.7	10.1 (June)
Total Boron	µg/L	500	10	0 (0)	39	85	146 (September)

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 8.83 mg/L upstream of the City of Winnipeg at St. Norbert and 9.26 mg/L downstream of the City of Winnipeg at Selkirk. The lowest dissolved oxygen concentrations observed occurred during the July 2020 period, with 4.2 mg/L at St. Norbert and 5.2 mg/L at Selkirk. With the exception of the July sample at St. Norbert, all dissolved oxygen concentrations observed were above the 5.0 mg/L threshold required for the protection of aquatic life. Furthermore, dissolved oxygen concentrations at St. Norbert had returned to acceptable levels by the August monitoring period, and remained above the water quality objective for the remainder of the water year.

Densities of *Escherichia coli* (*E. coli*) bacteria downstream of the City of Winnipeg were lower than the previous reporting period. The mean density downstream of the City of Winnipeg was 151 organisms / 100 mL, compared to 205 organisms / 100 mL in the previous reporting period. The mean density of *E. coli* bacteria in the upstream reach at St. Norbert was also lower than the previous reporting year with 31 organisms / 100 mL, compared to the previous 44 organisms / 100 mL. Densities of *E. coli* bacteria did 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 once during the current reporting period. The sole exceedance occurred during the October 2020 sampling period where the observed *E. coli* density was just slightly above the provincial objective with 201 organisms / 100 mL. *Escherichia coli* densities exceeded 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 October 2019, June 2020 and August 2020 sampling periods where *E. coli* densities were 1050, 291 and 210 organisms / 100 mL, respectively. In particular, *E. coli* densities were greater than five times higher than the recreational water quality guidelines during the October 2019 sampling period.

During this reporting period, twelve samples were analyzed for routine pesticide screening upstream of the City of Winnipeg on the Red River at St. Norbert. Of the 56 routinely monitored pesticides, eight were detected (14 per cent rate of detection) in the Red River at St. Norbert, which represents a slight decrease from the previous reporting period (16 per cent rate of detection). Dicamba, Glyphosate, and 2,4-D were the most commonly detected pesticides with twelve (100 per cent rate of detection), six (50 per cent rate of detection), and four detections (33 per cent rate of detection), respectively. AMPA and Atrazine were each detected on two occasions (17 per cent rate of detection) during the current reporting period, while Atrazine desethyl, Bromoxynil and Benomyl were each detected once (8 per cent rate of detection). Dicamba exceeded the irrigation guideline of 0.006 µg/L for all samples with detectable concentrations, ranging from 0.014 to 1.89 µg/L or nearly 2 to 300 times greater than the irrigation guideline. None of the other pesticides detected upstream of Winnipeg exceeded water quality guidelines (where available) for drinking water or protection of aquatic life, irrigation, or livestock uses.

Eleven samples were also collected from downstream of the City of Winnipeg at Selkirk during the current reporting period and analyzed for pesticides. Similar to the upstream site, eight pesticides out of the 56 monitored were detected downstream of the City of Winnipeg at Selkirk

(14 per cent rate of detection). This represented a slight increase in overall pesticide species detection versus the seven detections at this site in the previous reporting year. As with the upstream site, Dicamba was the most commonly detected pesticide in the Red River at Selkirk with eleven detections (100 per cent rate of detection), while Glyphosate was detected six times (55 percent detection rate) and 2,4-D was detected five times (45 percent detection rate). In particular, 2,4-D was detected nearly twice more often during the current reporting period compared to the previous period (three detections). Atrazine and AMPA were both detected twice (18 per cent rate of detection), while Bromoxynil, MCPA, and Benomyl were each detected once (9 percent rate of detection) during the current reporting year. Similar to the Red River at St. Norbert site, Dicamba exceeded the irrigation guideline (0.006 µg/L) for all samples at Selkirk with concentrations ranging from 0.015 to 1.25 µg/L or nearly 2.5 to 200 times greater than the irrigation guideline. None of the other pesticides detected downstream of Winnipeg exceeded water quality guidelines (where available) for drinking water or protection of aquatic life, irrigation, or livestock uses.

Red River - Tributary Streams

During this reporting period, seven sampling sites on six tributary rivers (Boyne, Rat, Roseau, Morris, La Salle Rivers and two sites on the Seine River) were each sampled at least three times, with three of the seven sites sampled four times (Boyne, La Salle and Seine River at Ste. Anne). In general, water quality parameters in these Red River tributaries remained comparable to past years. Mean dissolved oxygen concentrations among tributary sites were similar to previous reporting periods, ranging from 6.37 to 9.95 mg/L. Most notably, while the mean dissolved oxygen concentration observed for the Boyne River tributary site during the 2018-2019 reporting period was low (4.55 mg/L) in comparison to previous years, the observed mean concentration of 7.43 mg/L for the current reporting period represents a return to a more typical condition. Of the twenty-four samples analyzed for dissolved oxygen among tributary sites, only three samples (13 %) failed to meet the minimum provincial water quality objective of 5 mg/L. Two of the three occurred during the January 2020 sampling period at the La Salle and Seine River (at south Perimeter) sites, with 2.3 and 4.4 mg/L, respectively, while the third occurred at the Boyne River in July 2020, with a measured concentration of 3.0 mg/L. While it is not unusual to experience incidences of low dissolved oxygen concentrations at some of the tributary sites throughout the year, these are usually short-lived events, and levels sufficient to support aquatic life typically return relatively quickly.

The mean density of *Escherichia coli* (*E. coli*) bacteria observed among all the Red River tributary sites during the current reporting period was 54 organisms / 100 mL, with a range of 1 to 435 organisms / 100 mL. Only one sample, from the Rat River in January 2020, failed to meet Manitoba's recreational water quality objective of 200 organisms / 100 mL.

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

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. The City of Winnipeg reports annually on progress achieved regarding reductions in volumes of untreated effluent discharges originating from its municipal combined sewer system (https://winnipeg.ca/waterandwaste/sewage/annualResults/). 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, no intensive livestock proposals were proposed near the international border between October 2019 and September 2020.

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). Disinfection with ultraviolet light technology has been installed and is operational at the City of Winnipeg's South and North End Water Pollution Control Centres. In August 2004, the City of Winnipeg introduced a web-based system to inform the public whenever there is likely to be a sewer overflow into the Red or Assiniboine Rivers (http://winnipeg.ca/waterandwaste/sewage/overflow/previous24.stm). 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. Manitoba has developed draft nutrient concentration objectives for Lake Winnipeg and nutrient loading targets for the main tributary rivers flowing into Lake Winnipeg. Concentration objectives and loading targets complement the proposed multi-national water quality objectives for total phosphorus and total nitrogen concentrations developed through the IRRB. More information on the proposed objectives and targets is available at https://www.manitoba.ca/water/pubs/water/lakes-beaches-rivers/nutrient_targets_regulation_plain_language_summary_fall_2020.pdf.

The Sustainable Watersheds Act received royal assent on June 4, 2018 in Manitoba. The Act introduces a streamlined approach to drainage including stronger enforcement powers for illegal drainage, provisions to enable offset requirements for loss of significant wetlands, and changes to The Conservation Districts Act to shift to watershed-based boundaries and rename districts as Watershed Districts. The Act also enables the development of nutrient targets and establishes reporting requirements and this work is currently underway. The Act also 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 was based on the Alternate Land Use Services (ALUS) model. GROW supports ecological goods and services on the agricultural landscape and encourages 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. More than $200 million dollars has been invested in several trust funds (GROW Trust, GROW Wetlands Trust and the Conservation Trust) 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 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/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/water/lakes-beaches-rivers/guidelines/index.html) 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.

- Integrated Watershed Management Planning:

  - Work on integrated watershed management planning under The Water Protection Act continues in Manitoba. To date 30 plans have been initiated, of which 23 have been completed. Planning continues for six watersheds including four in the Red River basin, the Boyne-Morris River, Plum-Marais, Netley-Grassmere and Roseau River watersheds. The first integrated watershed management plan completed in Manitoba (for the East Souris River) is now being renewed as Manitoba's first second generation planning process under an expanded boundary for the Souris River watershed. In addition, a renewal process for the Netley-Grassmere and Willow Creek watershed management plans was initiated in 2020 under one new planning process.

  - 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 through the Watershed Management Regulation 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/water/watershed/iwmp/index.html).

7.03 Pollution Abatement and Advisories

North Dakota

Spills and Releases

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, Horace 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 311 stormwater permits for construction activity and 135 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 approximately 120 AFOs permitted by the NDDEQ in the Red River basin. Of these, there are 25 designated as large CAFOs.

Nonpoint 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 department 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 department 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 department is currently supporting six 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 10. Table 11 lists the best management practices (BMP) implemented with Section 319 funding by the active watershed projects in the Red River Basin. The following is a summary of the active watershed projects as of January 2021 in the Red River Basin.

- The Richland County SCD has been using Section 319 funding since 2011to 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 reaches of the Wild Rice River. 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 Cass County SCD was awarded Section 319 funding for the Maple River Watershed project in 2014 and 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 Wild Rice SCD has utilized Section 319 funding since 2010 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 currently 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, cross fencing, grazing management, no-till, cover crops, nutrient management, 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 funds were awarded in 2018 to support efforts in the expanded project area. The goal for the expanded project 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. In 2015 Outdoor Heritage Funds were also awarded to the project to increase support for BMP implementation. To further promote better soil management, the SCD, recently coordinated with the Walsh County "Natural Resources Team," to partner with General Mills to secure financial support for No Till/Strip Till Demonstrations in the county. Agency members on the Natural Resources Team include the SCD, Extension Service and NRCS.

- The Grand Forks County SCD was awarded Section 319 funding in 2016 and 2019 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 grazing management, fencing, tanks, pipeline, use exclusion, cover crops, and septic systems

- The Griggs County SCD was awarded Section 319 funding for the Griggs County Sheyenne River Riparian Corridor project in 2019. The goal of the project is to achieve "fully supporting status" for the recreational uses of the Sheyenne River in Griggs County. As a secondary goal, the practices that will be promoted and implemented by the project will also benefit aquatic life use in the Sheyenne River. To meet the project goals, the SCD is providing technical and financial assistance to producers to improve livestock manure management as well as grazing and cropland management in the watershed. Emphasis is being placed on installing BMPs on priority cropland and grazing areas along the riparian corridors. Practices that may be installed include fencing, off-site watering facilities, nutrient management, wells, filter strips, tanks, grassed waterways, manure management systems, pipelines, and cover crops.

Table 11. BMPs implemented with FY14-FY20 Section 319 funding in the active watershed project areas located in the Red River Basin, as of June 2021.

BMP Category/BMP Type	Amount Applied
Cropland	
Cover Crops	16,540 acres
Erosion Control	
Critical Area Plantings	5.0 acres
Grazing Manangement	
Livestock Fencing	57,912 linear feet
Pasture/Hayland Planting	1,170 acres
Pond	1 pond
Rural Water Hookup	1 hookups
Trough and Tanks	1 tanks
Wells (livestock watering only)	3 wells
Livestock Manure Management Systems	
Full Containment Manure Management System	8 systems *
Miscellaneous Practices	
Septic System Renovations	89 systems
Well Decommissioning	37 wells
Riparian Area Management	
Riparian Easements (Cropland)	187 acres
Riparian Foerst Buffer	118 acres
Riparian Herbaceous Cover	415 acres
Strembank and Shoreline Stabilization	5,200 linear feet
Tree Hand Plants	1,045 trees
Tree Plantings (machine)	1,020 linear feet

**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.*

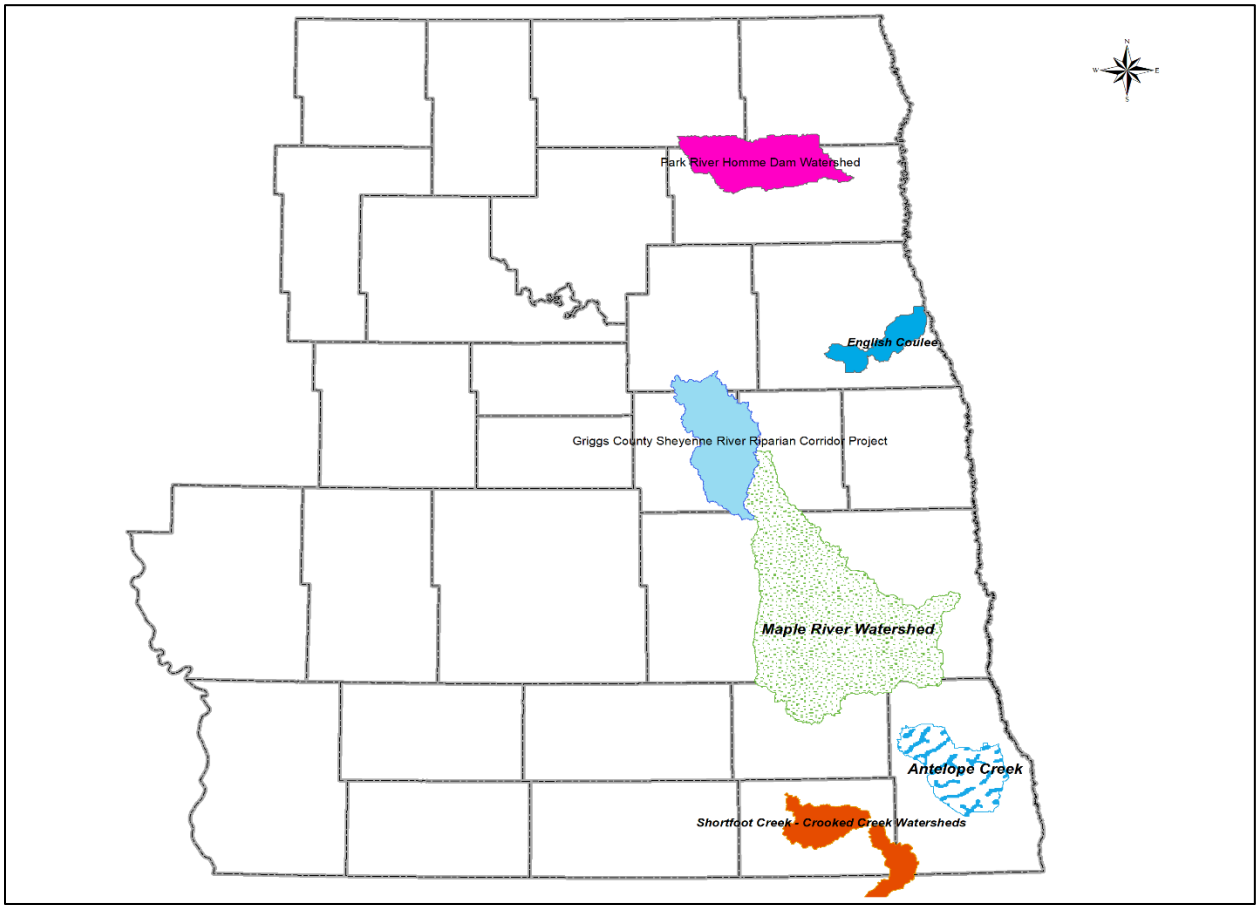


Figure 10. Active North Dakota Watershed Projects in the Red River Basin.

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 Basin. 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 12 lists the specific educational projects currently active in the Red River Basin.

Table 12. Educational projects supported by the NPS Program in the Red River Basin

Section 319 Funded Education Project	Section 319 Funded Education Project
Statewide ECO ED Program	Envirothon Program
Ranchers Mentoring and Outreach Program	Red River Basin River Watch and River of Dreams Program.
Project WET	Prairie Waters Education & Research Center
Soil Conservation and Watershed Leadership Academy	The Regional Environmental Education Series (TREES)
Nutrient Management Education & Support Program	

A third project category supported by the NPS Program includes projects that provide technical support to active NPS projects or address a specific priority resource concern. Collectively, these projects are identified as "support projects." The support projects are generally statewide or regional in scale. Four support projects are active in the Red River Basin. While the scope of the projects extends outside the Red River Basin, they have provided technical and/or financial support for BMP implementation in the basin. Active support projects are as follows:

- The ND Department of Agriculture has been awarded Section 319 funding since 2010 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 Basin.

- Section 319 funds have been used by the Stockmen's Association since 2001 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. To date, the Environmental Services Program has assisted with the implementation of one manure management system in the Red River Basin.

- Pheasants Forever, Inc. was awarded Section 319 funding in 2017 and 2020 to implement the Precision Ag Business Planning Support Program. The goal of the program is to utilize precision ag business planning technology delivered through several Return-on-Investment Platforms 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 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 Basin where the program is being implemented include Ransom, Sargent, Richland, and Barnes counties.

- The International Water Institute (IWI) was allocated Section 319 funding 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 for 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: 1) evaluate water quality benefits of different watershed improvement plans; 2) estimate the cost-effectiveness of potential practices for improving water quality; and 3) generate a report of "preferred" options to aid in developing watershed-based plans. Development of PTMApp has been completed for the Red River Basin in ND. The web address for the ND PTMApp is https://nd.ptmapp.iwinst.org/.

North Dakota's Nutrient Reduction Strategy for Surface Waters

Nutrients are essential components of aquatic ecosystems. However, when present in excess concentrations, these nutrients can result in water quality degradation. In order to address these concerns, the Department updated the nutrient reduction strategy in June of 2021 and the report is located at:
https://deq.nd.gov/publications/WQ/3_WM/NutrientStrategy/FINAL_NDNutrientStrategy_June_2_2021.pdf

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 2020: Emerson and Selkirk (Table 13). 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 channel. 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 13 Geographic coordinates for the benthic macroinvertebrates sampling stations at Emerson and Selkirk on the Red River, Manitoba in September 2020.

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

In 2020 at Emerson, 49 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 426 organisms/m^2 (Table 14). For the reporting period at Emerson in 2020, the organisms in greatest abundance were from the Order Trichoptera (Family Hydropsychidae). The second most abundant type of organisms present were from the Order Diptera (Family Chironomidae). Overall, fewer taxa and organisms were present for the current reporting period compared to the previous period. However, while the total number of organisms was less in the 2020 period compared to 2019, the total number of organisms observed in 2020 was similarly driven by two species of insect taxa, representing 69 per cent of all organisms collected.

In the Red River at Selkirk, 128 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 1114 organisms/m^2 (Table 15). For the 2020 reporting period at Selkirk, the organisms of greatest abundance were from the Order Oligochaeta (Family Tubificidae). The second most abundant type of organisms present were from the Order Trichoptera (Family Hydropsychidae). Similar to the trend observed at the Emerson site in 2020, the total number of benthic invertebrate organisms observed at Selkirk was less than the total organisms collected in 2019. However, the total number of taxa observed remained relatively similar to 2019 (17 taxa versus 22 taxa, respectively).

Overall in 2020, more species of benthic macroinvertebrates were found in the Red River at Selkirk than at the Red River near Emerson. The Red River near Selkirk had both a higher number of total organisms present, as well as, slightly more invertebrate taxa represented in the samples.

Table 14. Summary of benthic macroinvertebrates collected per transect and calculated total per metre squared in pooled Ponar © dredge samples from the Red River at Emerson, Manitoba in September 2020

Class	Order	Family	Genus	Species	Number of organisms
INSECTA	DIPTERA	CHIRONOMIDAE	Phaenopsectra	sp.	1
INSECTA	DIPTERA	CHIRONOMIDAE	Polypedilum	sp.	10
INSECTA	EPHEMEROPTERA	EPHEMERIDAE	Ephemera	sp.	1
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	Stenonema	sp.	1
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	unidentifed nymph	damaged	1
INSECTA	EPHEMEROPTERA	LEPTOHYPHIDAE	Tricorythodes	sp.	2
INSECTA	ODONATA - ANISOPTERA	GOMPHIDAE	unidentified	too young to ID	1
INSECTA	PLECOPTERA	PERLIDAE	Acroneuria	sp.	1
INSECTA	TRICHOPTERA	HYDROPSYCHIDAE	Hydropsyche	sp.	1
INSECTA	TRICHOPTERA	HYDROPSYCHIDAE	Potamyia	sp.	24
INSECTA	TRICHOPTERA	HYDROPTILIDAE	unidentified		1
INSECTA	TRICHOPTERA	LEPTOCERIDAE	Oecetis	sp.	2
PELECYPODA	VENEROIDA	DREISSENIDAE	Dreissena	polymorpha	1
PELECYPODA	VENEROIDA	PISIIDAE			1
PELECYPODA	VENEROIDA	PISIIDAE	unidentified	Too young to ID	1
				Total number of organisms	**49**
				Total number per square meter	**426**
				Total number of taxa	**15**

Table 15. Summary of benthic macroinvertebrates collected per transect and calculated total per metre squared in pooled Ponar © dredge samples from the Red River at Selkirk, Manitoba in September 2020

Class	Order	Family	Genus	Species	Number of organisms
ANNELIDA	OLIGOCHAETA	TUBIFICIDAE	Branchiura	sowerbyi	8
ANNELIDA	OLIGOCHAETA	TUBIFICIDAE	unidentified	with hair setae	18
ANNELIDA	OLIGOCHAETA	TUBIFICIDAE	unidentified	without hair setae	55
GASTROPO A			unidentified	damaged	1
INSECTA	COLEOPTERA	ELMIDAE	Stenelmis	sp.	6
INSECTA	DIPTERA	CERATOPOGONIDAE			2
INSECTA	DIPTERA	CHIRONOMIDAE	Polypedilum	sp.	2
INSECTA	DIPTERA	CHIRONOMIDAE	Thienemannimyia	sp.	1
INSECTA	DIPTERA	CHIRONOMIDAE	unidentified pupa		2
INSECTA	DIPTERA	PSYCHODIDAE	Psychoda	sp.	1
INSECTA	TRICHOPTERA	HYDROPSYCHIDAE	Hydropsyche	sp.	12
INSECTA	TRICHOPTERA	HYDROPSYCHIDAE	Potamyia	sp.	4
INSECTA	TRICHOPTERA	LEPTOCERIDAE	Oecetis	sp.	2
INSECTA	TRICHOPTERA	POLYCENTROPODIDAE	Polycentropus	sp.	1
NEMATODA					1
PELECYPODA	VENEROIDA	DREISSENIDAE	Dreissena	polymorpha	11
PELECYPODA	VENEROIDA	PISIIDAE	Pisidium	sp.	1
				Total number of organisms	**128**
				Total number per square meter	**1114**
				Total number of taxa	**17**

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.

$$D = 1 - \sum_{i=1}^{s} (p_i)^2$$

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 to high level of diversity. Calculated Diversity scores for Emerson and Selkirk were 0.72 and 0.78 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

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

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 0.022 and 0.005 for the Red River at Emerson and Selkirk respectively. The Evenness score for both sites was influenced by relatively small numbers of individuals from many 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) and 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 9 and Selkirk was 4. One individual from the pollution intolerant Order Plecoptera was found at Emerson, while none were found at Selkirk. Percent EPT is the total number of EPT individuals divided by the total number of individuals in the sample. Percent EPT was 69 percent for Emerson and 15 percent for Selkirk. Overall, relatively high numbers of EPT individuals were observed at Emerson, while relatively few numbers were observed at Selkirk during the 2019-2020 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 0.89 indicating that community compositions were different between sites.

In particular, there was a greater diversity of taxonomic families observed at Selkirk compared to Emerson (17 and 15 respectively), as well as, a much greater abundance of total organisms at Selkirk compared to Emerson (128 and 49 organisms collected respectively). Overall, five taxonomic groups were observed at both sites, while 10 groups and 12 groups were observed only at Emerson and Selkirk, respectively (Tables 14 and 15).

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

Manitoba monitored nineteen recreational beaches within the south basin of Lake Winnipeg for densities of *Escherichia coli* (*E. coli*) during 2020 (Figure 11). Sampling began mid-June and continued weekly until the beginning of September.

While some beaches occasionally exceeded Manitoba's recreational water quality guideline for fecal indicator bacteria in 2020, 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 2020 beach monitoring program, Manitoba Agriculture and Resource Development continued to monitor beaches on Lake Winnipeg for the presence of algal blooms. First level algal advisory signs are posted when the number of blue-green algal cells exceeds the Manitoba recreational water quality objective of 100,000 cells per mL. The 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. In 2020, there were no beaches on Lake Winnipeg posted with first level algal advisories. 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 2020, there were no beaches on Lake Winnipeg posted with second level algal advisory signs.

Figure 11. Map of beach monitoring locations on Lake Winnipeg as a part of the Clean Beaches Program.

8.04 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 16). Presently, Bigmouth Buffalo (*Ictiobus cyprinellus)* and Chestnut Lamprey (*Ichthyomyzon castaneus*) are designated as Special Concern under *The Species at Risk Act.* In 2005 and 2017, Lake Sturgeon (*Acipenser fulvescens)* was recommended for listing as Endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). A formal decision regarding Lake Sturgeon is expected within the next 2 years.

Known invasive species that have been introduced in the Manitoba portion of the Red River include the Common Carp (*Cyprinus carpio),* White Bass (*Morone chrysops),* Rainbow Smelt (*Osmerus mordax)* and Asian Carp Tapeworm (*Bothriocephalus acheilognathi)*. Other introductions into the Manitoba portion of the Red River include feral Goldfish (*Carassius auratus),* Smallmouth Bass *(Micropterus dolomieu)* and Largemouth Bass *(Micropterus salmoides).* Of these species, only Rainbow Smelt is listed formally as an Aquatic Invasive Species (AIS) in Manitoba. More significantly, 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. This was the first detection of adult Zebra Mussels in the entirety of the Red River. Subsequently, Zebra Mussel veligers were found throughout the length of the Manitoba portion of the Red River and the channel region and the north basin of Lake

Winnipeg. Zebra Mussel veligers were also found in Cedar Lake, Manitoba, a hydro-electric impoundment located immediately upstream from Lake Winnipeg on the Saskatchewan River system. In 2020, adult Zebra Mussels are found throughout Lake Winnipeg and in the Nelson River downstream as far as Limestone Generating Station – almost the entire length of the river. Zebra Mussels veligers have also been detected at Assean Lake – which is proximate to the Nelson River near Split Lake.

Manitoba has continued its efforts to minimize the spread of Zebra Mussels from Lake Winnipeg, the Red River and the Nelson River to other water bodies by operating six watercraft inspection stations, and continuing communication initiatives. Monitoring within Manitoba continues to determine the range and rate of spread of this species and other AIS.

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 $102M towards the overall economic value of angling in Manitoba (about $600M annually). A partial winter creel survey was conducted on Lake Winnipeg in winter 2018/19 and confirmed the continuing and rapid expansion of winter angling on the south basin of Lake Winnipeg during which an estimated 70,000 angler visits to the lake were reported.

The Red River fishery attracts nonresidents to trophy Walleye and Channel Catfish angling opportunities. 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.

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 Lockport downstream to Netley Creek, within the City of Winnipeg and along the shore of the south basin.

A commercial net fishery targeting primarily Walleye and Lake Whitefish has operated on Lake Winnipeg since the late 1800s. The Lake Winnipeg fishery comprises more than 50% of the value of all of Manitoba's commercial fisheries and is valued at approximately $50M annually.

Table 16. 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

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

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, consisting of 50 percent of North Dakota's population. 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 12 and Figure 13).

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 is $1.2 billion, for 165 cfs project capacity.

Legislative Mandate

The North Dakota Pollutant Discharge Elimination System (NDPDES) Discharge Permit was signed by the North Dakota Department of Environmental Quality on August 28, 2020.

The ND State Water Commission and ND Interim Water Topics Overview Committee determined in September 2020 that all criteria described in SB2020 from the 2019 legislative session had been met, allowing funding to be approved for construction of portions of the RRVWSP. In October 2020, the ND State Water Commission approved $5.75M to be released to fund the Missouri River Intake Pumping Station Wetwell construction south of Washburn, as well as $1.13M for property acquisition and project planning. Additional funding has also been approved for Phase 1 prioritized project features.

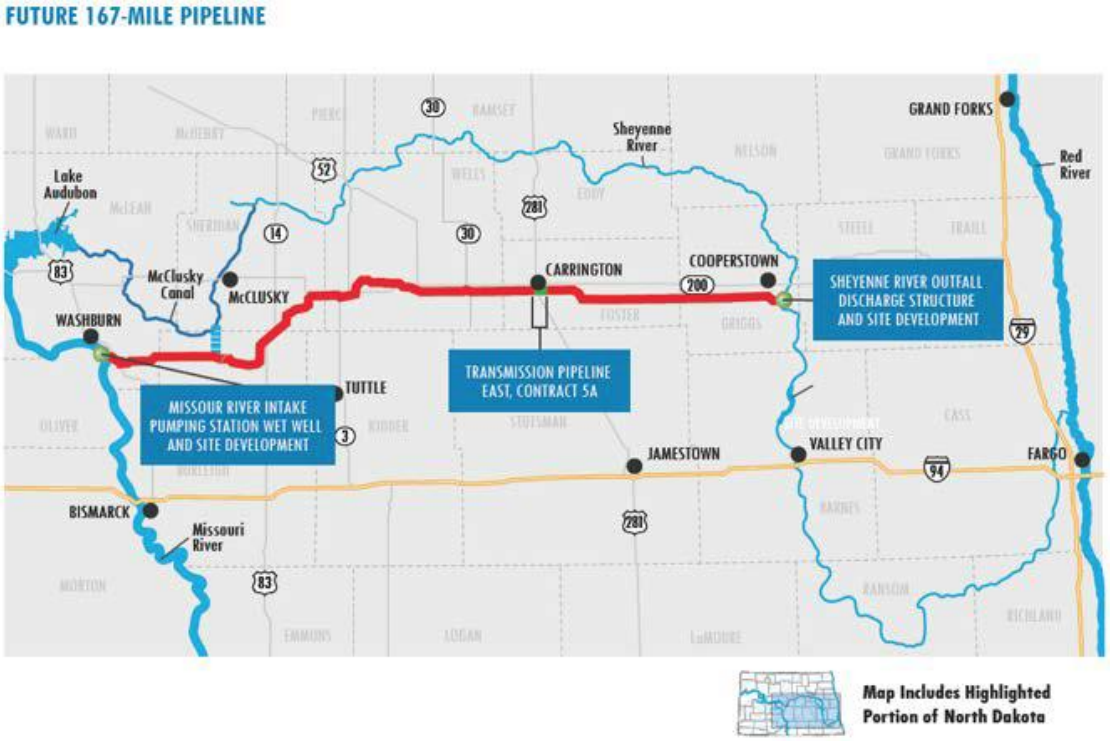


Figure 12: Proposed Route for the RRVWSP

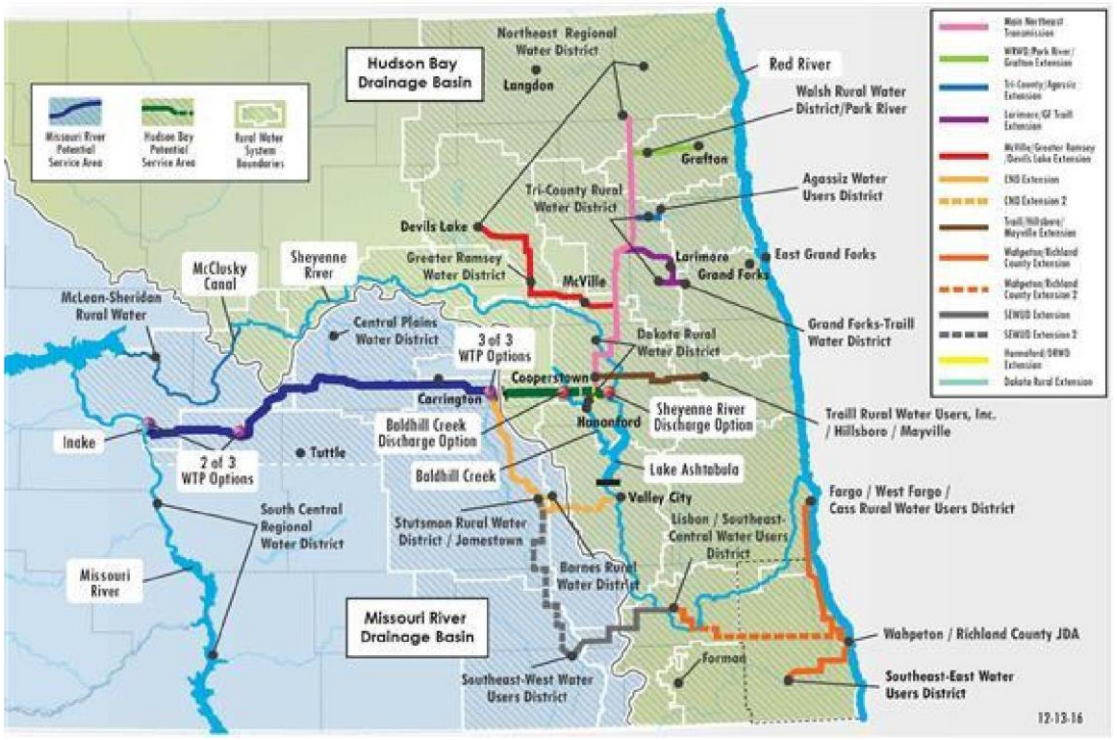


Figure 13: 35 Water Systems Shown That Have Signed Development Agreements

Design/Construction:
Construction began on the wet well for the intake on the Missouri River, near Washburn, N.D, near the end of 2020. Construction is also started in 2021 for installation of 1.2 miles of transmission pipe located near Carrington, ND. Work on the outlet structure on the Sheyenne River, near Cooperstown, is also underway.

The completion timeline of the project will depend on the pace of funding. The optimal construction period would be 10 years, based on a value engineering study.

Central North Dakota Water Supply Project
The project proposed to obtain a water service contract for 20 cfs from the McClusky Canal and to approve authorization of a preference power contract to Garrison Diversion (Figure 14). The water would serve industrial water needs in areas of Burleigh, Sheridan, Wells, Foster, Kidder, McLean, and Stutsman Counties within the Missouri River Basin, North Dakota. This proposal was analyzed through an Environmental Assessment, with a Finding of No Significant Impact issued in September 2018.

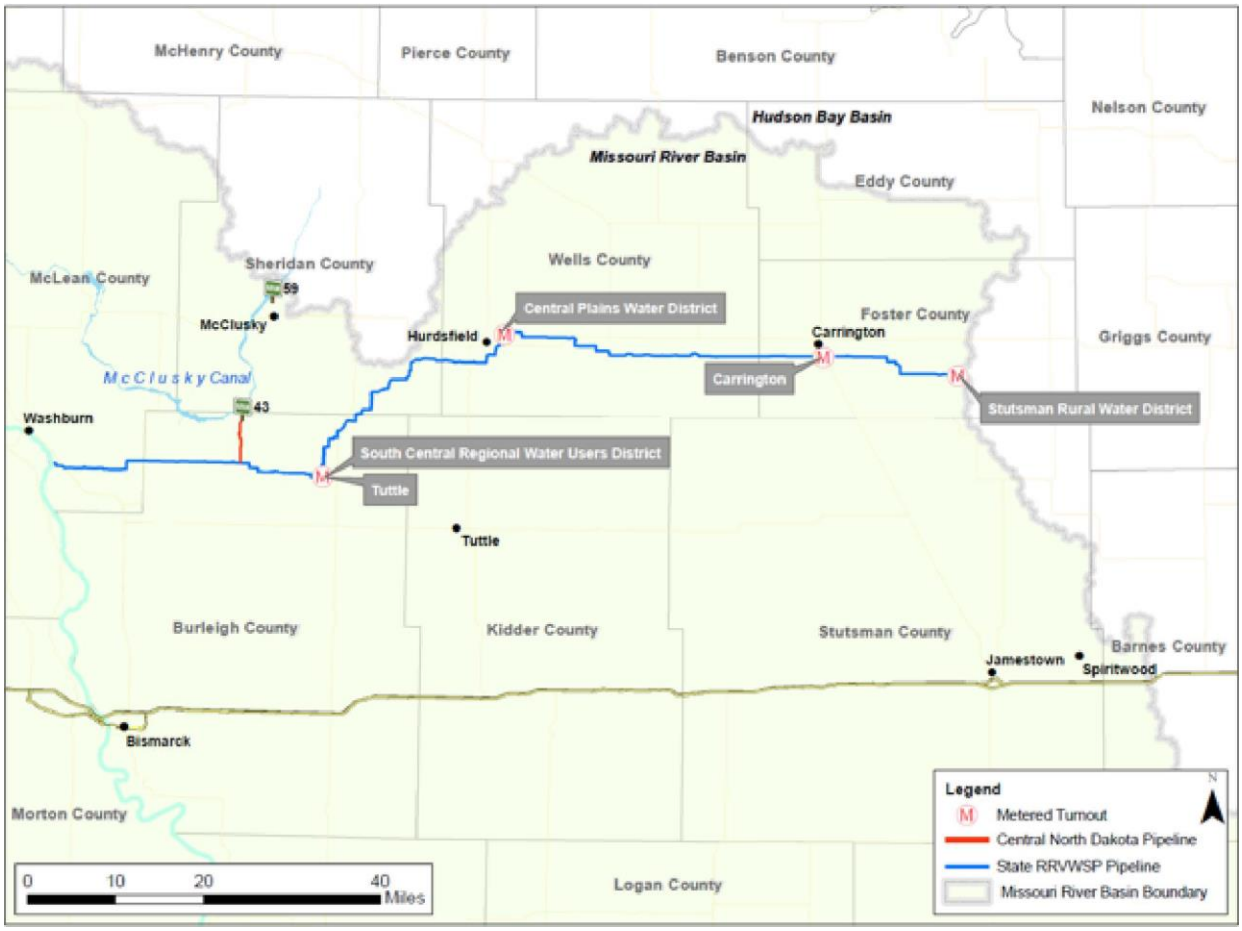


Figure 14: Overview of the Proposed Central North Dakota Pipeline Project and the State sponsored Red River Valley Water Supply Project.

Eastern North Dakota Alternate Water Supply Project (ENDAWS)

This proposal would deliver an alternate water supply for the Red River Valley Water Supply Project (RRVWS). This would include the use of the Snake Creek Pumping Plant, a portion of the McClusky Canal, and a bulk transmission pipeline to deliver water to the main transmission pipeline of the RRVWS (Figure 15). The request is for delivery of up to 145 cfs. It is estimated that using the McClusky Canal as an alternative water source could save millions of dollars in costs for construction, annual maintenance, and pumping.

The Bureau of Reclamation has prepared an Environmental Impact Statement (EIS) for the funding and construction of this proposed project. Reclamation is authorized to work with the State of North Dakota to plan, design and construct municipal, rural and industrial water supply projects. Reclamation's potential actions include construction of ENDAWS project features, issuance of a water repayment contract for Garrison Diversion Unit facilities, and issuance of permits to construct and maintain ENDAWS facilities on Reclamation rights-of-way.

Scoping meetings were held in October 2019. A notice of Intent was issued on November 13, 2019 and a draft EIS was released on May 22, 2020. A virtual public meeting was held on June 18, 2020, to receive comments on the draft EIS. The 45-day comment period for the draft EIS expired on July 6, 2020. The Final EIS was completed in November 2020. The EIS listed a preferred alternative, Alternative E - McClusky Canal and Missouri River North. The preferred alternative includes the Enhanced Disinfection Option as the Biota WTP option. This includes sand/grit removal, UV light irradiation followed by chlorine disinfection and chloramine formation. Following the 30-day comment period for the EIS, a Record of Decision was signed on January 15, 2021.

Reclamation's potential actions include construction of ENDAWS project features, issuance of a water repayment contract for Garrison Diversion Unit facilities, issuance of permits to construct and maintain ENDAWS facilities on Reclamation rights-of-way, and compliance with the Boundary Waters Treaty of 1909.

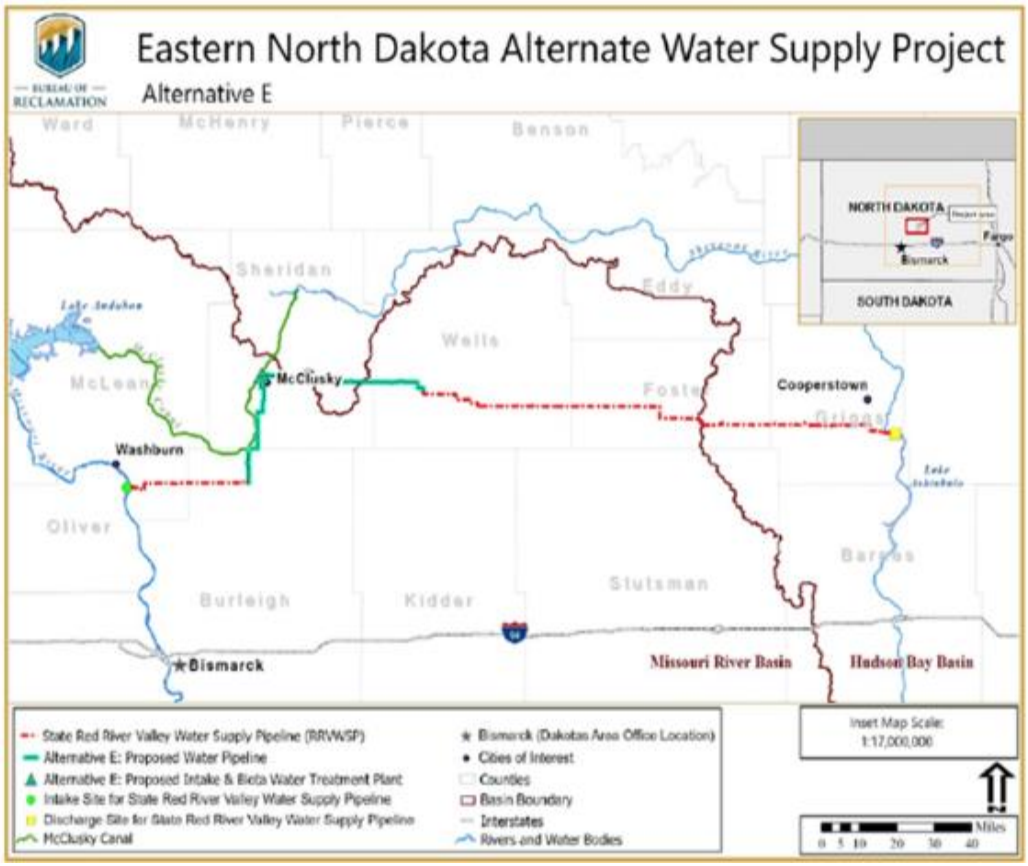


Figure 15: Proposed ENDAWS Route

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 16).

Current Design/Construction

Biota Water Treatment Plant

Bids were opened for construction of phase 1 of the Biota Water Treatment Plant on December 17, 2020. Estimated total cost for Phase I is roughly $64 million.

The contract includes construction of new concrete, steel, and precast Biota Water Treatment Plan, two Dissolved Air Floatation (DAF) basins with pre-procured DAF equipment, four dual-media filter, installation of two pre-procured ultraviolet (UV) disinfection reactors, clearwell, equalization basin, two freeze-thaw lagoons, chemical feed and storage, laboratory, break room, other

associated facilities, masonary, site piping, site work, BTWP shop, paving, landscaping, miscellaneous metalwork, doors, windows, flooring, and coatings; and other miscellaneous work. The contracts were awarded in February 2021 and the Notice to Proceed for the general and electrical construction were issued in March 2021. Site work including excavation and grading began in April 2021. Pile production for the deep foundation system began in May 2021.

Intake Modifications to Snake Creek Pumping Plant

Procurement documents for variable frequency drive (VFD) equipment, the air chamber for surge protection, and pumps and motors are being developed and should be ready to bid in mid-summer 2021. This facility will have to come on line at the same time as the completion and commissioning of the Biota Water Treatment Plant.

A draft facility use agreement with Reclamation is currently being reviewed. Meetings have also been held with Reclamation and the Corps of Engineers to discuss permit requirements for the intake pipeline and screen, work within the Snake Creek building, and the discharge pipeline through the U.S. Highway #83 embankment.

The 90 percent design documents are currently being reviewed. Bidding for the project is expected near the end of 2021.

Minot Water Treatment Plant

Minot WTP Phase II Improvements: The project mainly consists of construction of a new primary treatment building and replacement of aging softening basins, chemical storage and feed systems, laboratory, and IT facilities. Work is underway. Total Project cost is $31 million.

Westhope Corner to Souris Corner: This contract involves installation of roughly 15.25 miles of pipe and related appurtenances to extend the potable distribution system along Highway 5 from the Westhope corner to the Souris Corner. This contract includes a 5,230 foot long bore under the Souris River and the J. Clark Salyer Wildlife Refuge. The contract was awarded to Wagner Construction, lnc. April 27,2020 and contract documents were executed May 18,2020. A pre-construction conference was held May 26, 2020. Construction began in June, 2020. The project was substantially completed in July 2021.

Souris Corner to Bottineau: Bids were opened on November 10, 2020 for installation of roughly 14.25 miles of pipe and related appurtenances to extend the potable distribution system to the end of the project. The City of Bottinueau will be able to be serviced once the contract is completed. All bores have been completed. Pipe installation was scheduled to start in mid-July 2021. The substantial completion date is October 29, 2021. The total estimated project cost is $5.7 million.

Lansford Reservoir and Pump Station: This contract will involve a 4.3 million gallon reservoir and 2500 gallon per minute pump station on the potable distribution system north of the Minot Air Force Base. This facility will represent the only storage on the distribution system north of Minot and will allow additional user turnouts to be activated once more water is available from the City of Minot. Bids were opened September 23, 2020, with contracts awarded on October 8, 2020. The

subgrade work for the reservoir is completed. Excavation for the pump station is progressing. Forms for the pump trench were placed the week of May 17, 2021. The project cost is $11.7 million.

South Prairie Reservoir and Hydraulic Control Structure: This contract will involve a ten million-gallon (average day demand) reservoir roughly three miles north of Highway 23 on the NAWS raw water line and a hydraulic control structure 2 1/2 miles south of Highway 23 at the high point of the raw water pipeline. The 90 percent design review was held on May 6, 2021. Total estimated project cost is $18 million.

Souris and Bottineau Reservoirs and Booster Pump Stations: This contract(s) consists of a one million gallon ground storage reservoir and pump station at the intersection of State Highways 5 and 14 south of Souris and a two million gallon ground storage reservoir and pump station roughly four miles west of the connection to Bottineau. The final pipeline contract climbs roughly 300 feet in elevation from the location of the Souris Reservoir and Pump Station to the connection to Bottineau. The final design flows for both the City of Bottineau and All Seasons Water Users District northwest of Bottineau will require both storage and pumping to meet water demands. The project will be able to deliver water to the end of the pipeline but only in a limited quantity until additional facilities are constructed. The design of this contract is roughly 60 percent complete.

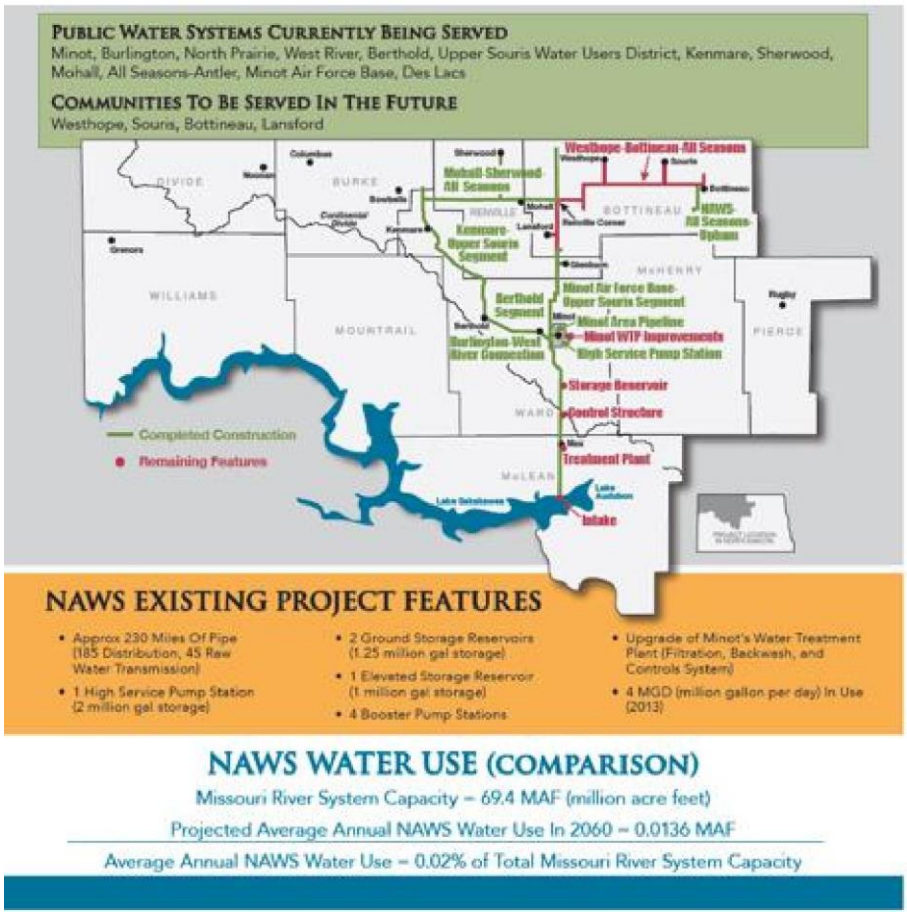


Figure 16: NAWS Project

Red River Retention Authority

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 Agriculture 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 is the lead partner for the projects (Figure 17). 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.

A local cooperation agreement was signed, for each of the studies, between the Natural Resource Conservation Service (NRCS) and the local sponsors. Public meetings were held with problems within the watersheds being identified. After development of a "purpose and need" statement, the task teams identified potentially feasible projects that would address these needs. Further analysis will be required for each potential project to determine if they have a benefit cost (B/C) ratio of at least 1 to be eligible for federal cost share for construction.

Project Status Update

There were originally 20 watershed studies that were approved for cost share. The NRCS agreement expired on May 20, 2021, after a 6 year commitment. At that time, two of the watershed plans were completed (North Branch Park River and Rush River Watersheds). The Upper Maple River Watershed is in the technical review stage while the Tongue River Watershed plan is being prepared for a NRCS technical review. The Roseau River WD has sent a draft watershed plan for the Whitney Lake Watershed initial technical review and comment by the Minnesota NRCS State Office.

At the conclusion of the agreement, there were still five active RCPP watershed planning cooperative agreements for Whitney Lake, JD 14, JD 19, Green Meadow and Upper Wild Rice River watersheds. These agreements are separate from the NRCS Agreement and are still ongoing in Minnesota due to COVID19 1-year extensions.

The watershed agreements for watershed plans for Klondike, Upper Sand Hill River, North Branch Antelope Creek, and Shortfoot Creek Watersheds were allowed to expire. The planning studies are still being pursued by the local sponsors.

Seven of the twenty watersheds have ceased planning and the sponsor requested to terminate the cooperative agreement with NRCS before the agreement expired. Those seven were:

Forest River
Swan Creek
Beltrami Island State Forest
Four Legged Lake
Pine Lake
Moccasin Creek
Bois de Sioux Direct

While these seven plans were not completed, the watershed sponsor and partners developed and will maintain much valuable resource inventory data. This data will likely be used in the future to address water resource concerns in the respective watershed districts.

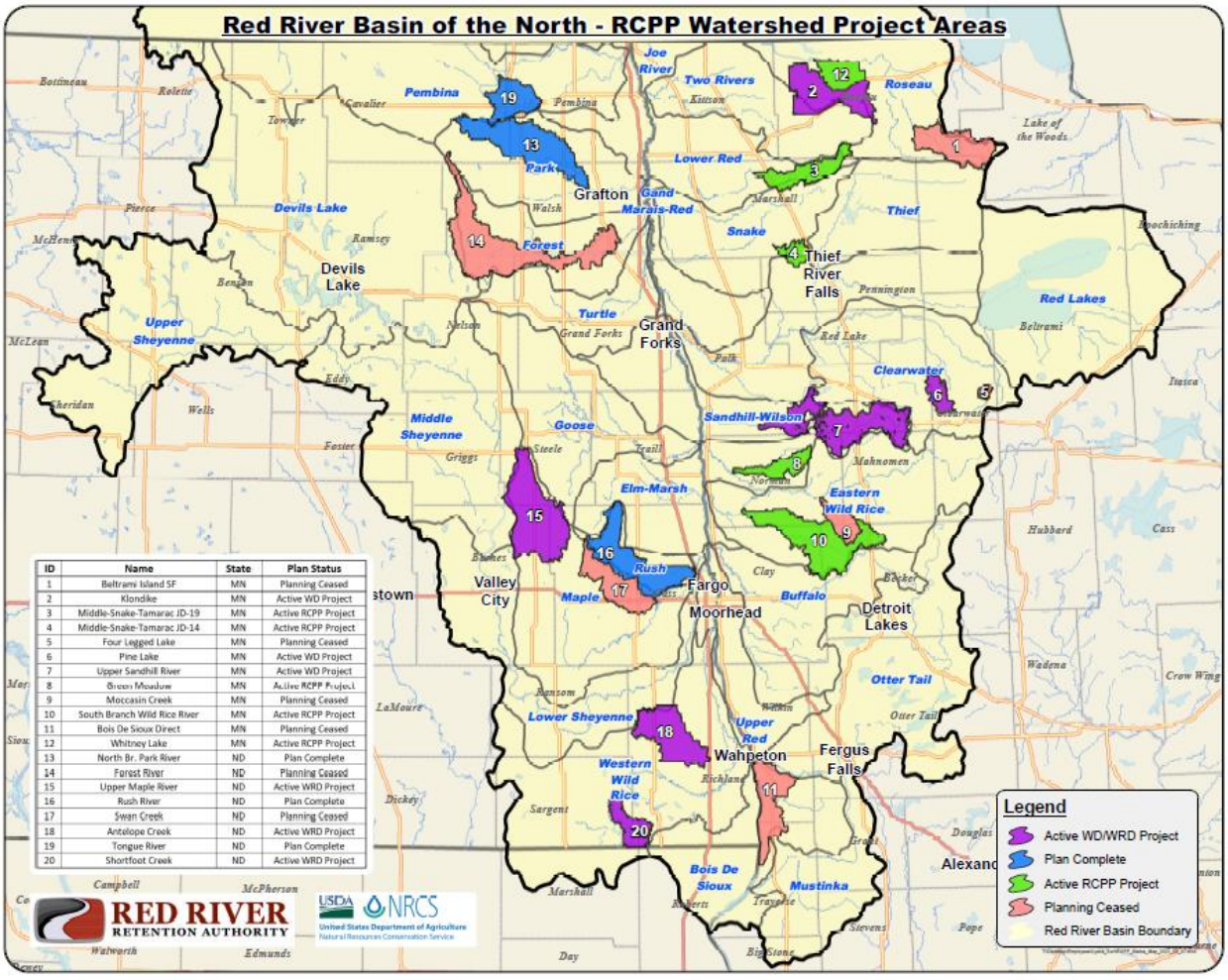
As a result of planning efforts and resource information gathered during the planning process there are two watershed projects (Pine Lake and JD19 watersheds) being planned by the Watershed Districts and partners. These two watershed projects are planned for implementation in 2022.

While flood damage reduction benefits are determined for each potential project, other benefits are also summarized for the projects. In some cases, operation plans are being explored that would maximize water quality benefits, such as the removal of nitrogen and phosphorous.

Future Project Funding

The remaining portion of the federal funds are being used to start the final design for a project in the Rush River watershed. After the North Branch Park River watershed plan is authorized, additional funds will be transferred to ND to complete the final design.

Additional federal funding may be available, through the NRCS PL-566 Watershed Program, for final design and construction of additional projects.



ID	Name	State	Plan Status
1	Beltrami Island SF	MN	Planning Ceased
2	Klondike	MN	Active WD Project
3	Middle-Snake-Tamarac JD-19	MN	Active RCPP Project
4	Middle-Snake-Tamarac JD-14	MN	Active RCPP Project
5	Four Legged Lake	MN	Planning Ceased
6	Pine Lake	MN	Active WD Project
7	Upper Sandhill River	MN	Active WD Project
8	Green Meadow	MN	Active RCPP Project
9	Moccasin Creek	MN	Planning Ceased
10	South Branch Wild Rice River	MN	Active RCPP Project
11	Bois De Sioux Direct	MN	Planning Ceased
12	Whitney Lake	MN	Active RCPP Project
13	North Br. Park River	ND	Plan Complete
14	Forest River	ND	Planning Ceased
15	Upper Maple River	ND	Active WRD Project
16	Rush River	ND	Plan Complete
17	Swan Creek	ND	Planning Ceased
18	Antelope Creek	ND	Active WRD Project
19	Tongue River	ND	Plan Complete
20	Shortfoot Creek	ND	Active WRD Project

Figure 17: Red River Conservation Partnership Program – Red River Basin

9.02 Devils Lake Sub-Basin

The water elevation on January 1, 2021 was 1448.5 msl, a decrease of about 1.4 feet from the 2020 high and about 0.4 feet lower than the water elevation at the beginning of 2020 (Figure 18).

With little snow pack, and nearly no additional spring runoff, the lake level remained flat during the early part of 2021, with a slow reduction extending to the middle of 2021. Based on provisional data, the highest water recorded so far in 2021 was 1458.54, during the period from the middle of March to the middle of April. The majority of the Devils Lake watershed is currently in an extreme drought (D3).

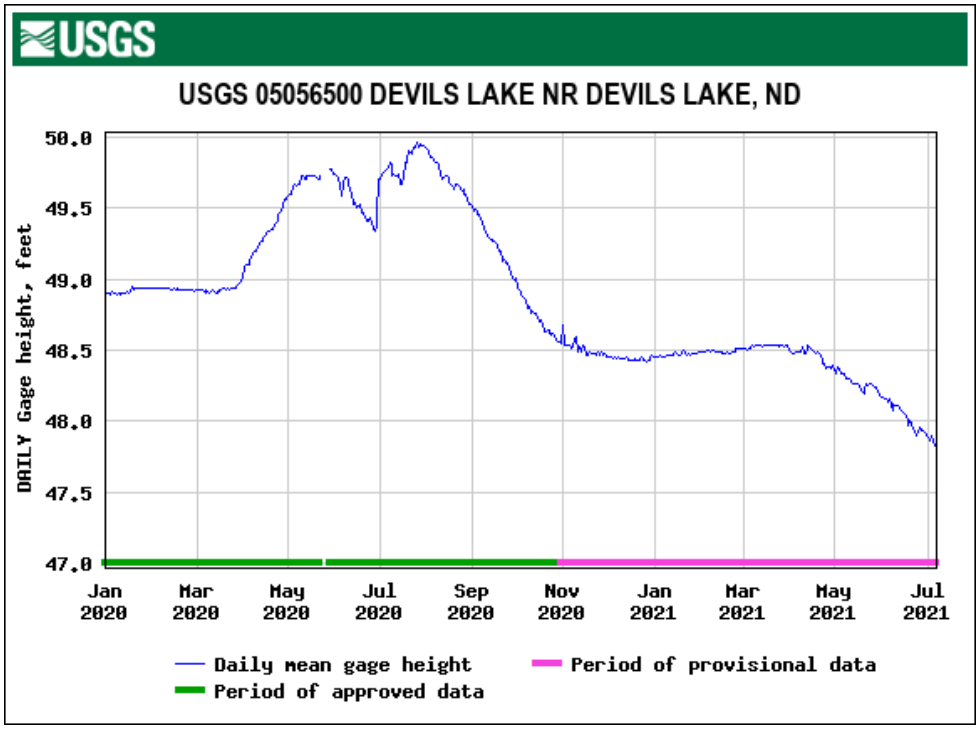


Figure 18: Devils Lake Elevation 2020 – 2021

Devils Lake Elevation 2008 – 2021 is shown in Figure 19 below.

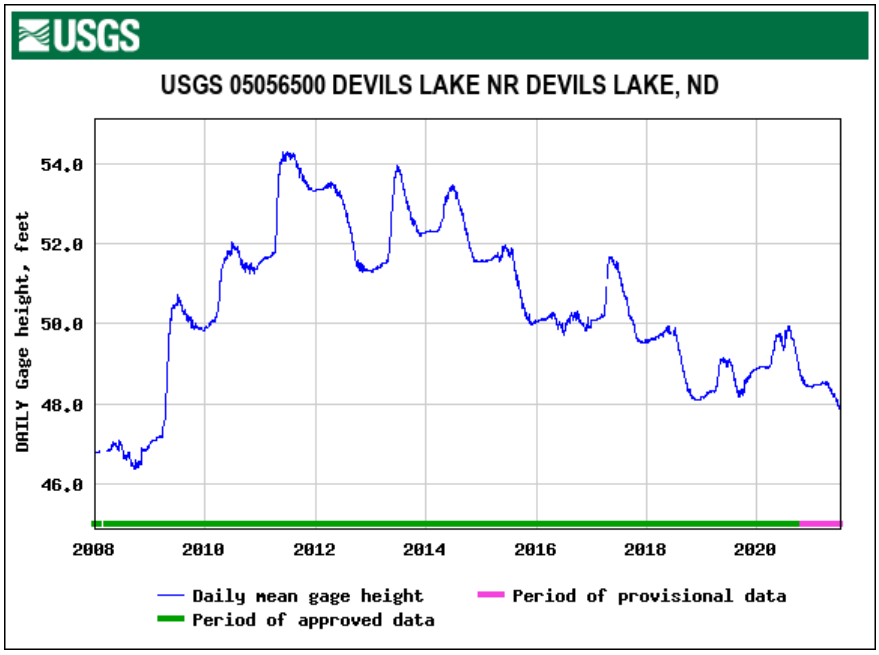


Figure 19: Devils Lake Elevation 2008 – 2021

Devils Lake period of record elevation is shown in Figure 20 below.

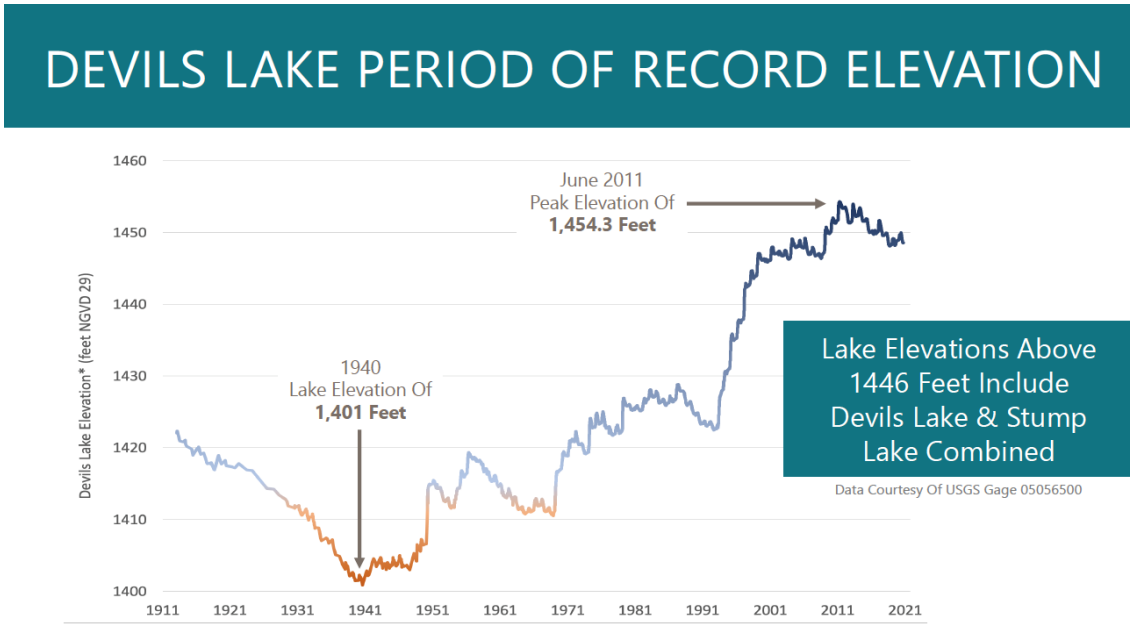


Figure 20: Devils Lake Period of Record Elevation

Devils Lake Estimated Inflows are shown in Figure 21 below.

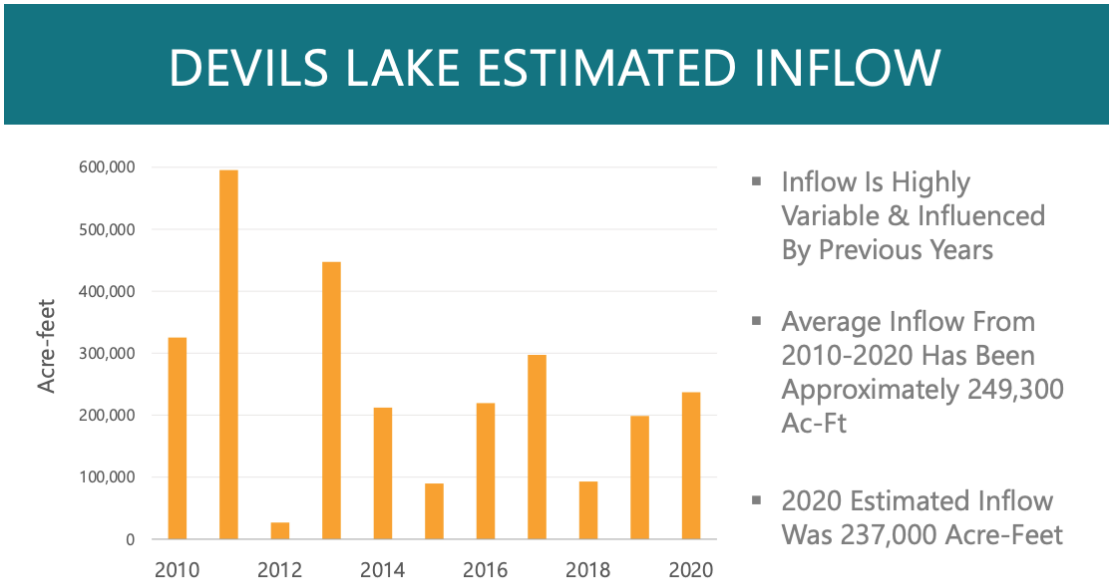


Figure 21: Devils Lake Estimated Inflows

State Emergency Outlets Project Update:

2020 Operation:

The west outlet started pumping on June 3, soon operating at about 160 cfs. Except for a couple of very short shutdowns, it has continued at that rate. A total of 14,176 acre-feet of water has been discharged through July. The east outlet has only operated for a few hours to test the pumping system.

The following graph shows the annual discharge for 2007 through 2020. A total volume of about 1.3 million acre-feet of water, about 5.5 feet of stage reduction, has been removed from the lake during that time.

Devils Lake Outlet discharge for the period 2007-2020 is shown in Figure 22 below.

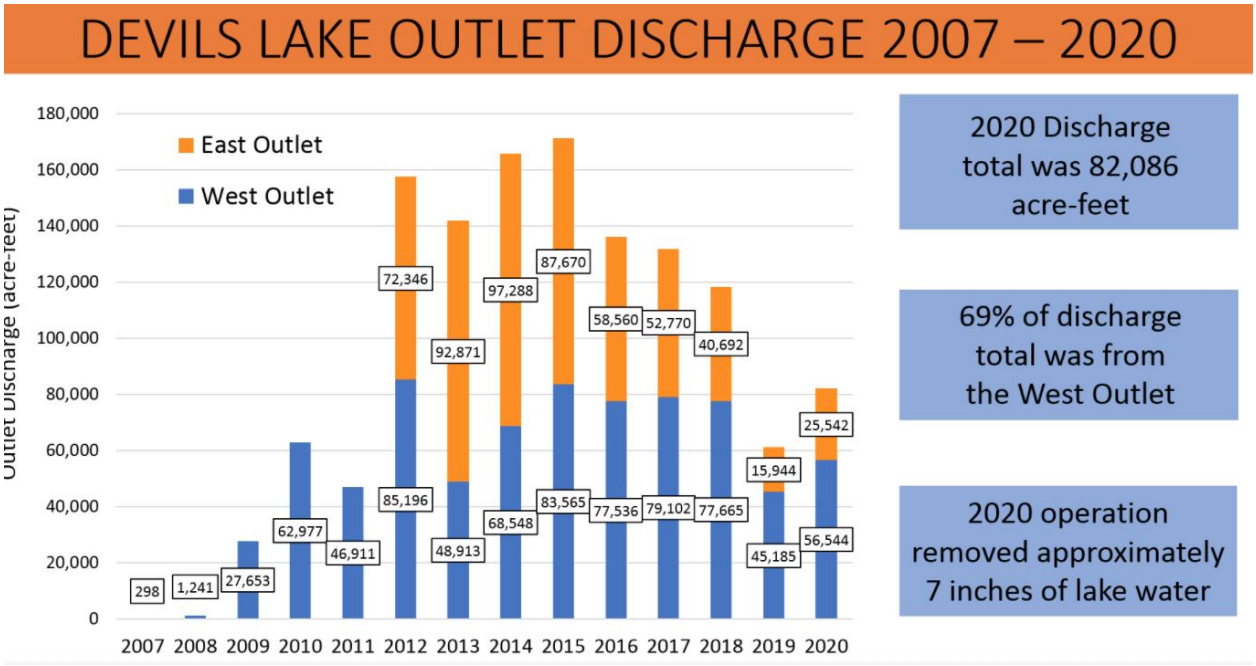


Figure 22: Devils Lake Discharge

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.

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, by webinar, on May 12, 2021. The Committee will likely schedule a meeting during in late spring of 2021. The majority recommendation was to continue pumping as long as the water quality conditions are met.

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

Introduction

The U.S. Army Corps of Engineers (Corps, USACE) 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. The Omaha District is responsible for part of the Red River of the North Basin in North Dakota. The St. Paul District is responsible for other areas of the basin in North Dakota and Minnesota.

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

Fargo-Moorhead Metropolitan Area Flood Risk Management Project

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.

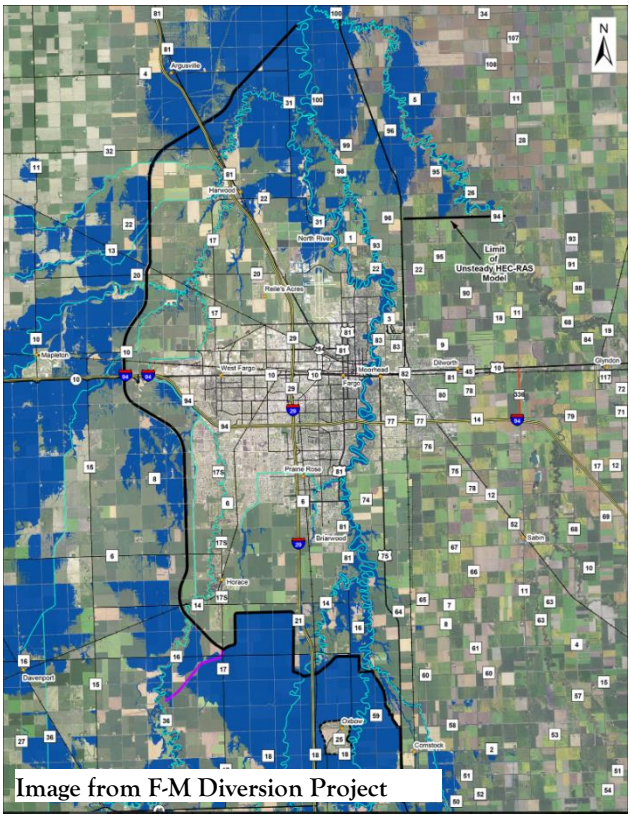


Image from F-M Diversion Project

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 spring 2017 with the diversion inlet structure and construction is also ongoing at the Wild Rice River Structure, the I-29 Raise, and Southern Embankment Reach SE-1. The sponsors selected their P3 developer, Red River Valley Alliance in June 2021 and construction of the diversion channel is anticipated to begin spring 2022. As of March 2021, all ongoing litigation has been resolved/dismissed.

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 will be concurrent with the Red River Control Structure, which is expected to begin in 2022.

Devils Lake Embankment Project
Devils Lake, North Dakota

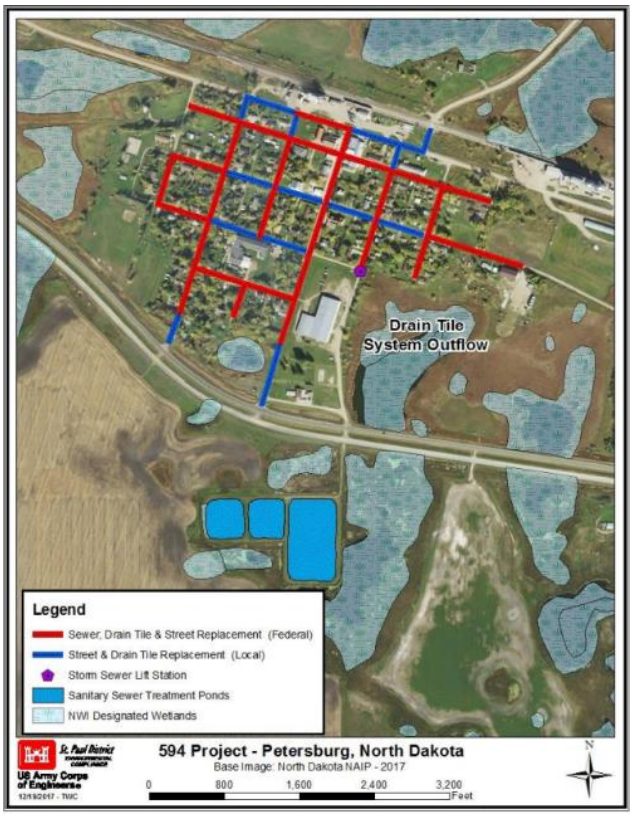
Devils Lake is a terminal lake in Devils Lake Basin, meaning water leaves Devils Lake through evapotranspiration or when its elevation is high enough to overflow the basin's boundary. Because Devils Lake typically does not have a natural outlet, it is subject to extreme variations in lake levels depending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


Image from USACE

As of August 18, 2021, the lake is at elevation 1447.3 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. All that remains to be completed is excavation of a ponding area and final project documentation, both of which are progressing.

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 has been completed and will be fiscally closed out by the end of fiscal year 2021.

City of Kindred Sanitary Sewer Service Improvement Project

During periods of wet conditions, heavy precipitation, and snowmelt events, the city's wastewater collection system experiences substantial increases in wastewater flows, and at times exceeds the capacity of the city's main wastewater pump station, resulting in pumping of untreated wastewater out of the system and onto the ground. The city of Kindred (the non-federal sponsor) requested assistance from the Corps; this Section 594 project includes the design and rehabilitation of the existing stabilization ponds, the expansion of two new cells, the rehabilitation of the main lift station, and the replacement of the force mains to the stabilization ponds. In fiscal year 2019, the Section 594 program received $2,950,000 for this project. The project partnership agreement was signed in June 2019. In fiscal year 2020, the Section 594 program received an additional $1,250,000 for Phase 2 of the Kindred project. The Corps continues to work closely with the city as they finalize their plans.

Current Studies

CAP 1135 – Lower Otter Tail River Restoration Project

Breckenridge, Minnesota

Under Section 1135 of the Water Resources Development Act of 1986, the Corps is authorized to study and implement ecosystem restoration projects at existing Corps projects. The Corps constructed a flood control project in the 1950s that 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 the 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 plan to complete the feasibility study in 2022, which will identify a plan for achieving the project goals. Construction would likely begin no earlier than 2023, subject to availability of federal and local funds. The maximum federal contribution is limited to $10 million.

CAP 14 – Sheldon Road Bridge

Sheldon, North Dakota

The purpose of this project is to evaluate alternatives and formulate a plan to stabilize the riverbank adjacent to Sheldon Road in order to protect the bridge from eroding into the Sheyenne River. The project is located where Sheldon Road crosses over the Sheyenne River approximately 4.75 miles south of Sheldon, North Dakota.

The bank of the Sheyenne River adjacent to the west side of the south abutment of the Sheldon Road Bridge, located on County Road 54, is being threatened by severe erosion. Surveys estimate that approximately 30 linear feet has eroded since 2006 with additional erosion happening since. The erosion is threatening the use of Sheldon Road Bridge, and without proper intervention, erosion could continue and potentially affect the integrity of both the bridge and the County Road 54 roadway.

Ransom County, the non-federal sponsor, submitted a request for assistance on February 12, 2018. The Corps worked closely with Ransom County on the federal interest determination which was approved July 13, 2020. The feasibility phase was completed the study report was approved June 2, 2021. Execution of a project partnership agreement between the Corps and Ransom County is expected in early fiscal year 2022.

The design and implementation phase of the project will be cost shared at 65 percent federal and 35 percent non-federal.

Planning Assistance to States and Tribes (Section 22)

Long Term Flood Solutions Plan
North Dakota and Minnesota

The Corps is currently working on a project for the Red River Basin Commission (RRBC). 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 and hydraulic models for the basin to assess the 1.0, 0.5, and 0.2 percent chance exceedance events and the possibility of flood risk reduction through possible upland storage impoundments for rarer flood events. Sensitivity to variations in precipitation will also be included. The Corps will update existing hydraulic models and the sponsor will provide basin-wide hydrology models of the tributaries to be used in the storage analysis. The Corps will also incorporate climate variability to evaluate potential impacts on future flood magnitudes. This project has a 50/50 cost share with the RRBC, with a federal contribution of $325,000. The project is expected to be complete in FY22.

Upper Red River Watershed Wetland Restoration Prioritization Study
Minnesota

The Corps and the Minnesota Board of Water and Soil Resources partnered 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 that have contributed to increased flooding, water quality impairments, and loss of habitat. Stakeholders had an increased interest in conservation and regulatory decisions that consider the condition and needs of the watershed.

Using a stakeholder informed, geospatial approach, the study developed a plan for prioritizing wetland restoration projects in the watershed. The final plan was accepted by the project sponsor in May 2021.The project had a 50/50 cost share with BWSR, with a federal contribution of $60,000.

Red River of the North Comprehensive Study/Downstream Storage Project
North Dakota and Minnesota

The Corps is currently working on a project with RRBC to develop a distributed storage analysis for the portion of the basin downstream of Halstad. This is to complement the existing storage model upstream of Halstad. Additional hydrology models were developed by RRBC consultants to provide the basin detail required for the analysis. All required hydraulic models are complete and ready to be used for the VTP (Virtual Thaw Progression) model runs. The Phase II report and appendices have been reviewed and are complete. This project has a 50/50 cost share with the RRBC, with a federal contribution of $312,500. The project is expected to be complete in FY22.

Red River of the North Main Stem Bathymetric Study
North Dakota and Minnesota

The Corps and RRBC are currently putting together a scope and work plan to obtain bathymetric data for the Red River of the North main stem from White Rock Dam to the Canadian border. This will provide up to data channel geometry for the entire main stem river in the United States. Additional phases to obtain the same data for the Canadian portion of the main stem and selected tributaries and also being developed, and

are being coordinated through the IJC. This project has a 50/50 cost share with the RRBC, with a USACE contribution of $75,000 for the first phase in the United States. Cost share funds for the Sponsor's part of the work will likely be provided from a FEMA mitigation grant.

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 was a project to update river gage datum to the current standard (NAVD 1988) and provide consistent elevations for the river stages across the basin that converted 34 river gages in 2017. There is strong interest to continue the conversion process for other gages, and funding will be sought for fiscal year 2021 under the Flood Plain Management Services (FPMS) program.

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 2021 the Flood Area Manager and Assistant Area Manager for the Red River of the North continues to meet with communities along the Red and Sheyenne rivers to better define roles and solidify relationships. The St. Paul District validated flood fight rostets and conducted training. The St. Paul District received no request for techiical or direct assistance. The Districts emergencey managemetn team is participating with the States of Minnesota and North Dakota drought teams.

City of Oslo FCCE Flood Damage Repair

The 2019 flood damage to the City of Oslo Levee has been repaired. The work was completed at 100% federal costs under PL84-99.

9.04 USGS Water Resource Investigations and Activities

Streamflow monitoring

Streamflow for the Red River and most of its tributaries was at normal levels going into and during the 2020/2021 winter, with some locations even below normal (10-25 percentile). Winter was characterized by warmer than normal temperatures and less than normal precipitation. Snow water equivalent amounts were ranked in the lowest 25% and in the northern Red River Valley in the lowest 10% by January according to the National Weather Service (NWS) Office in Grand Forks, ND. These conditions extended into March with only a couple of weeks in mid-February of below normal temperatures, but precipitation still remained well below normal in the entire Valley. March 2021 marked the 5th warmest March on record, with Fargo setting record highs on March 8th, 9th, 20th and 29th. With little moisture to add to normal and below normal river flows, however, despite warm temperatures, the spring melt in March did not result in any significant spring events, with most of the river ice melting in place.

Peaks from the spring melt in the upper Red River (south of Fargo, ND) occurred in the second week of March and were followed by a slightly higher peak from a rain event in the first week of April. The April peak progressed downstream, with the crest passing into Canada on April 18-19, 2021. After the April rise, river levels from Grand Forks south, declined steadily with only a minor rise in mid-June. Current (mid-August) Red River Basin river conditions are mostly at the below normal (10-25 percentile), or much below normal (lowest-10 percentile) levels. The flow conditions since June have resulted in a need for the USGS lower USGS stage sensors and refine the lower end of the stage-discharge rating curves for sites on the Red River and its tributaries.

The Red River at Fargo crested on April 11 with a provisional peak gage height of 16.76 ft. and streamflow of 2,940 cubic feet per second (cfs), providing the 75th highest peak, or the 45th lowest for the 120 years of peak flow record. The Red River at Grand Forks crested on April 14 with a provisional peak of 18.37 ft. and streamflow of 6,250 cfs, providing the 20th lowest peak for the 140 years of peak flow record.

The above normal temperatures combined with far below normal precipitation resulted in virtually no change in lake elevation from before ice-on to after ice-off for Devils Lake, with the lake having fallen steadily by approximately 1.10 ft from April to August 2021. A moderate rainfall event of 2.67 inches recorded at the Cando, ND NDAWN station has resulted in a slight rise in lake elevation, with the current stage (mid-August) around 47.43 ft. Pumping from Devils Lake outlets only resumed as of June 3rd, with only the West End outlet able to pump and only at reduced capacity of 140 cfs, due to reduced flow from the West Bay to Round Lake and water quality limiting output. Since July 16th, West End outlet flows have been reduced to only around 80 cfs. The East End outlet is still not currently being operated.

Fargo-Moorhead Diversion monitoring project

A monitoring program began in October 2019 in the Fargo-Moorhead area to detect any changes from the construction and operation of the various aspects of the Fargo-Moorhead Diversion project. The program was meant to provide consistent sampling methods and critical site locations to detect trends in water quality and to estimate constituent loads (mass per time) for understanding of how

water-quality constituents are transported and how that could change throughout the project. Continuous, real-time monitoring upstream and downstream of the project also provides information on changes in water-quality that might happened on a shorter timescale such as from rainfall-runoff events, spills, and channel disturbances. The current program was designed for sampling before, during and after construction of the Diversion and consists of:

- 10 Sampling Locations
    - Red River at Halstad, Georgetown, Harwood, Fargo, and Hickson.
    - Sheyenne River at Kindred and Harwood
    - Wild Rice River at Abercrombie and St. Benedict
    - Maple River below Mapleton.
- 8 scheduled samples per year - January, April (2 samples), May, June, July, August, October.
- Increased sampling during flood conditions.
- 3 continuous water quality monitors for (WT, SC, pH, DO, and Turbidity).
    - Red River at Georgetown, Fargo, and Hickson
- All sites operated for continuous discharge excluding Red River at Harwood.

A USGS Scientific Investigations Report will be published after September 2022 to describe the methods and data analysis of the monitoring during the pre-construction phase of the Fargo-Moorhead Diversion project.

Red River Low-flow Study

The Red River is susceptible to periods of dry conditions that have the potential to adversely impact ecological conditions and water supply. To understand the potential for drought conditions along the Red River, the USGS began a study in May 2020 to develop a water balance model and stochastic hydrometeorological data to derive a set of synthetic streamflows that would be used to statistically characterize the potential for periods of extreme low flows over the next 50 years. The objectives of this work are to: 1) Build knowledge of historical and potential future low flow conditions in the Red River Basin. 2) Estimate how much changes in land cover and land use have influenced low flow conditions. 3) Estimate how much hydro-climatic shifts and long-term persistence have influenced low flow conditions. 4) Quantify the influence of the Devils Lake outlet and major reservoir operations on low flow conditions. 5) Assess the degree of risk for extreme low flow conditions. Historical and static model inputs have been prepared for input to the water balance model. The historical water balance model has been run and is currently going through the calibration process. Validation of the water balance model will be completed following the model calibration, the stochastic model inputs will be generated, and stochastic streamflow will be simulated and analyzed. The final product is a USGS scientific investigation report that will be published in December 2022.

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APPENDIX A

DIRECTIVES TO THE INTERNATIONAL RED RIVER BOARD

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DIRECTIVE TO THE
INTERNATIONAL RED RIVER Board (to be replaced after October 1, 2021)

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
(Retired) (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

Jason Gildea - (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

Patrick Cherneski - (306) 564-4450 (office)
(306) 807-8563 (cell)

Environment and Climate Change Canada – Regina, SK

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

APPENDIX D

HYDROLOGY COMMITTEE, AQUATIC ECOSYSTEM COMMITTEE, WATER QUALITY COMMITTEE; AND OUTREACH AND ENGAGEMENT COMMITTEE MEMBERSHIP LIST

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International Red River Board
Hydrology Committee Membership:

Name	Agency	Address	Phone #	E-Mail
Mark Lee	Manitoba Agriculture and Resource Development	200 Saulteaux Cres. Winnipeg, MB R3J 3W3	(204) 945-5606 (o) (204) 391-1623 (c)	mark.lee@gov.mb.ca
Jason Vanrobaeys	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 Department of Water Resources	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 Department of Water Resources	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

International 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
Brian Caruso	US Fish and Wildlife Service	303-236-4304	Brian_caruso@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 Environmental Quality	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

lnternational Red River Watershed Board
Outreach and Engagement Committee Membership:

Name	Organization	Phone	Email
Ute Holweger	Environment and Climate Change Canada	204-983-5897	Ute.Holweger@canada.ca
Dimple Roy	International Institute for Sustainable Development	204 958 7700	droy@iisd.ca
Mary Scherling	Red River Basin Commission		ScherlingM@casscountynd.gov
Gavin van der Linde	Red River Basin Commission		gavin.vanderlinde@gmail.com
Ted Preister	Red River Basin Commission	701-356-3183	ted@redriverbasincommission.org
Sarah Lobrichon	International Joint Commission	613-992-5368	lobrichons@ottawa.ijc.org
Rebecca Seal-Soileau	US Army Corps of Engineers	651-290-5756	Rebecca.S.Soileau@usace.army.mil
Girma Sahlu	Environment and Climate Change Canada	306 564-4457	Girma.Sahlu@canada.ca

International Red River Watershed Board
Water Quality Committee
Membership:

Name	Organization	Phone	E-mail
Jim Ziegler, (Co-chair) (Retired)	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
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	Environment and Climate Change Canada	(431) 277-2907	Elaine.page@ec.gc.ca

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APPENDIX E

INTERNATIONAL RED RIVER WATERSHED BOARD (IRRWB)

DESIGNATION LETTER AND NEW DIRECTIVE- AUGUST 4, 2021

International Joint Commission
Canada and United States

Commission mixte internationale
Canada et États-Unis

August 4, 2021

Mr. Patrick Cherneski
Canadian Co-Chair
International Red River Board
patrick.cherneski@canada.ca

Col. Karl Jansen
US Co-Chair
International Red River Board
Karl.D.Jansen@usace.army.mil

Dear Mr. Cherneski and Col. Jansen,

IJC Commissioners would like to congratulate you and the Board for all of your efforts over the past decade in carrying out exceptional binational work as a pilot watershed board under the International Watersheds Initiative (IWI). As of today, we can formally recognize the International Red River Board (IRRB) as a watershed board and will refer to you henceforth as the International Red River Watershed Board (IRRWB).

We sincerely thank you for your continued patience over the years as the IJC and governments deliberated on the issue.

Along with this designation comes also the need to update the board name and its directive. Attached to this letter please find a revised directive to reflect the new designation as well as the Commission's decision of October 2015 removing reporting responsibilities for the Poplar and Big Muddy Rivers.

Should you wish to make recommendations for additional changes to the directive please forward these to us for Commission consideration. Please feel free to contact liaisons and IJC staff should you have any questions or concerns.

Once again, we thank you for your continued patience in this effort and for your commitment to healthy shared waters along the US-Canadian boundary. Congratulations!

Sincerely,

Pierre Béland
Chair, Canadian Section

Jane Corwin
Chair, U.S. Section

Enclosure: IRRWB Directive, August 4, 2021

cc: Michael Flores, Director, Office of Canadian Affairs, U.S. Department of State
Evelyne Coulombe, Executive Director, U.S. Transboundary Affairs, Global Affairs Canada

www.ijc.org

234 Laurier Avenue W., 22nd Floor
Ottawa, ON K1P 6K6
Phone: (613) 995-2984

100 Ouellette Avenue, 8th Floor
Windsor, ON N9A 6T3
Phone: (519) 257-6700
commission@ijc.org

1717 H St. NW. Suite 835
Washington, DC 20006
Phone: (202) 736-9000

August 4th, 2021.

Directive to the International Red River Watershed Board

1. Pursuant to the Boundary Waters Treaty of 1909, responsibilities have been conferred on the Commission under a 1948 Reference from the governments of Canada and the United States with respect to the use and apportionment of the waters along, across, or in the vicinity of the international boundary from the eastern boundary of the Milk River drainage basin on the west up to and including the drainage basin of the Red River on the east, and under the May 1969 authorization from the governments to establish continuous supervision over the quality of the waters crossing the boundary in the Red River and to recommend amendments or additions to the objectives when considered warranted by the International Joint Commission.
2. This directive replaces previous directives and instructions provided by the International Joint Commission to the International Red River Board on February 7th 2001 and previous directives to the International Souris-Red Rivers Engineering Board including the February 8, 1995 Directive to the International Red River Pollution Board. Whereas the February 7th 2001 Directive consolidated the functions of those two former boards into one board, known as the International Red River Board (IRRB) this updated 2021 Directive adds the word "Watershed "to the IRRB so that it is now the International Red River Watershed Board (IRRWB).
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:
    - 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.
    - Provide a continuing forum for the identification, discussion and resolution of existing and emerging water-related issues relevant to the Red River basin.

- Recommend appropriate strategies to the Commission concerning water quality, quantity and aquatic ecosystem health objectives in the basin.
- 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.
- Encourage the appropriate regulatory and enforcement agencies to take steps to ensure that agreed objectives are met.
- 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.
- Monitor and report on flood preparedness and mitigation activities in the Red River basin and their potential effects on the transboundary aquatic ecosystem, and encourage and facilitate the development and maintenance of flood-related data and information systems and flood forecasting and hydrodynamic models. In carrying out this responsibility, the Board shall:
    - Monitor progress by the governments (federal, state, provincial, municipal) in implementing the recommendations of the Commission's report on 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.
    - Encourage governments to develop and promote a culture of flood preparedness in the Red River valley.
    - Encourage government efforts to develop and implement a long-term strategy for flood mitigation and emergency preparedness.
    - 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.
    - 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.
    - Promote the application of innovative technologies for supporting flood modeling and mapping.

- 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.
- Monitor potential transboundary effects of flood mitigation and other works in the basin, and encourage cooperative studies necessary to examine these effects.
- Encourage governments to integrate floodplain management activities in watershed and basin management.
- Interact with all levels of government to help decision-makers become aware of transboundary flood-related and associated water management issues.
- Assist in facilitating a consultative process for resolution of the lower Pembina River flooding issue.

o 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.

o 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.

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

6. 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.
7. At the request of any member, 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.
8. 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 of activities undertaken by or on behalf of the Board, progress made, and any developments affecting such progress.

9. 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.
10. 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 or 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.
11. 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.
12. 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.
13. 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.
14. 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.
15. 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.
16. 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.
17. The Commission may amend existing instructions or issue new instructions to the Board at any time.

----------End of Document----------

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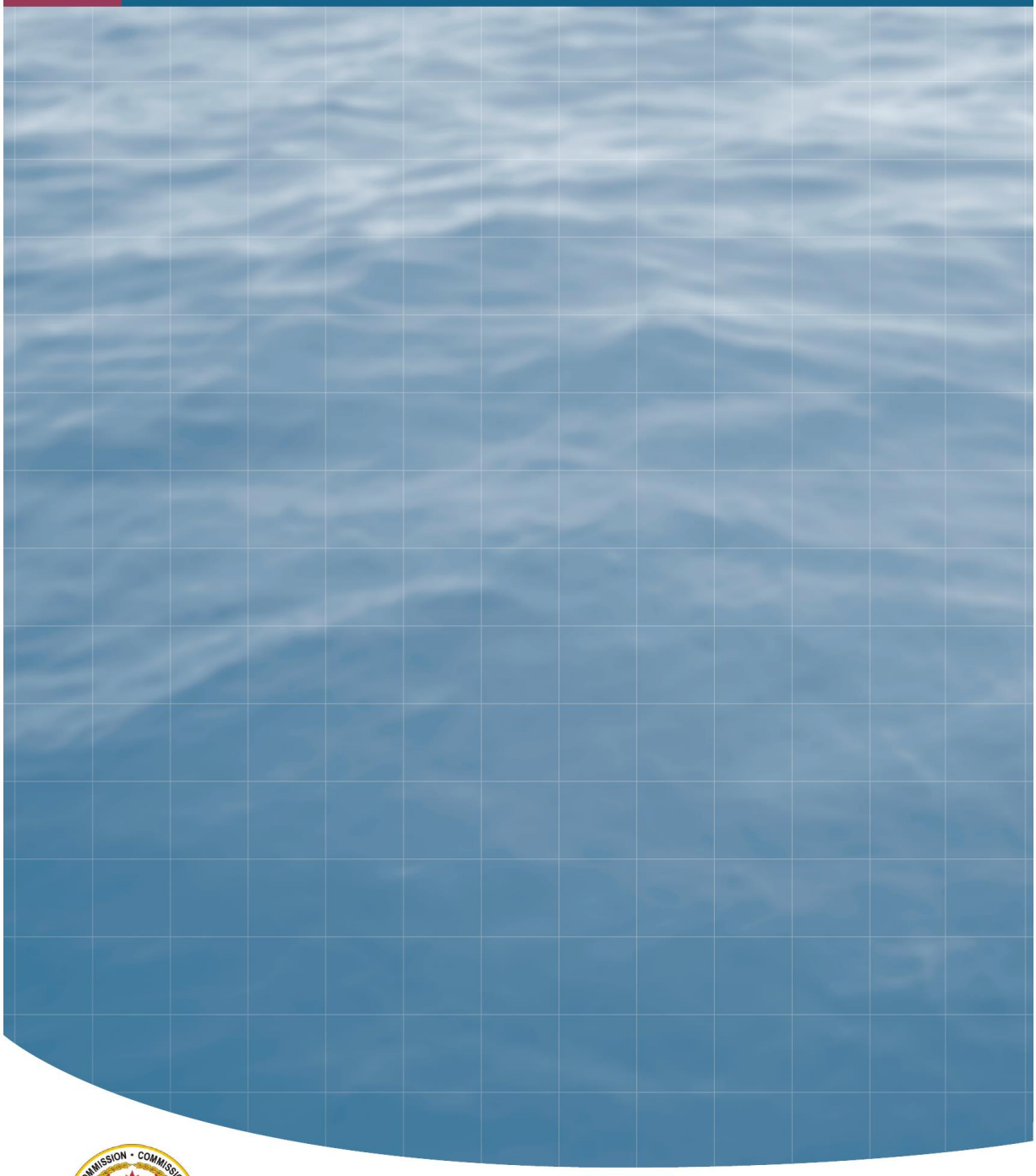


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