International Red River Watershed Board

25th Annual
Progress Report
October 2024

INTERNATIONAL
RED RIVER WATERSHED
BOARD

CONSEIL INTERNATIONAL
DE LA RIVIERE BASSIN
VERSANT ROUGE

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Commissioners:

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

Respectfully submitted,

Patrick Cherneski
Co-Chair, Canadian Section

Karl Jansen
Alternate 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 2023 Water Year (October 01, 2022, through September 30, 2023). In addition, this report describes the activities of the International Red River Watershed Board during the reporting period October 01, 2023, to September 30, 2024, 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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Appendices for International Red River Watershed Board's 2023 Annual Report

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 Directive for the IRRB.

In April 2003, the IJC requested further discussion with the IRRB on how to achieve a more ecosystem-based approach and what capacity would be required 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 was one of three pilot watersheds recommended by the IJC for implementation of the Initiative and for funding support.

In August 2021, the IJC elevated the IRRB to full Watershed Board status under the International Watersheds Initiative (IWI). This change included significantly expanding the responsibilities of the Board in the Red River Basin, formally dropping the Poplar River from the mandate, and resulting in a name change to, 'International Red River Watershed Board (IRRWB)'. In 2023, the Board returned to in-person meetings for the first time since Covid-19 restrictions were implemented in early 2020, and the winter Board meeting was hosted in-person in Winnipeg in January 2023 and in Fargo, ND in January 2024, each in conjunction with the Red River Basin Commission conference. The Board began to align its work plan with the IWI and the updated IJC Directive. The updated Directive is included in Appendix A.

In October 2022, the governments of Canada and the United States approved four additional water quality objectives for the watershed as part of a broader nutrient management strategy. The approval was confirmation of eleven years of work by jurisdictions, the Board and its Water Quality Committee. Shortly thereafter, the Board began reporting on nutrient concentration objectives and load targets for nitrogen and phosphorus.

Another milestone was the work of the Indigenous Task Team with support of the Outreach and Engagement Committee to complete Phase I of a two-phase IWI project on ways to increase Indigenous collaboration. In 2021, the IJC appointed four Indigenous Members (two each from Canada and the United States) to the Board, and all Indigenous members co-lead or participate in the Task Team which was created later in 2021. In November 2022, although not specifically a Board activity, the two Board Co-Chairs were invited by the governments of North Dakota and Manitoba to participate in a renewed Pembina River Task Team. The team convened its first meeting in January 2023.

The IRRWB is responsible for assisting the IJC in avoiding and resolving transboundary disputes regarding the waters and aquatic ecosystems of the Red River, 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 1.

This report is the Twenty Fifth of the IRRWB annual progress report to the IJC.

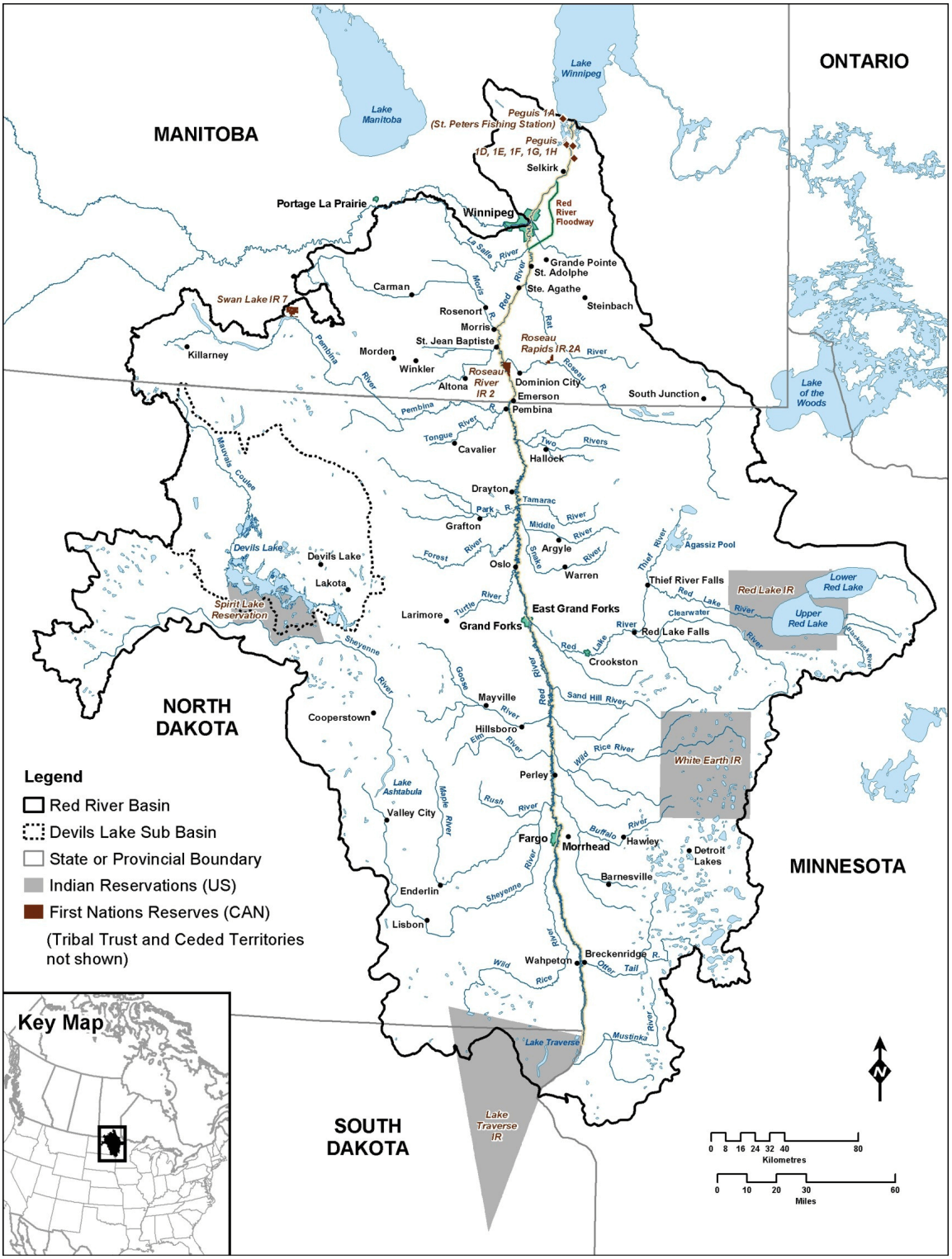

Figure 1. Red River and its Tributaries

2.0 BOARD MEMBERSHIP (suggest adding an 'as of' date for clarity)

Canadian Section

Patrick Cherneski, Canadian Chair,
Environment & Climate Change Canada

Melissa Hotain,
Director of Intergovernmental Affairs,
Sioux Valley Dakota Nation, MB

Dr. Annette Trimbee,
Métis President and Vice-chancellor
MacEwan University

Nicole Armstrong,
Manitoba Environment, Climate and Parks
WQC Co-lead

Mark Lee,
Manitoba Environment, Climate and Parks
COH Co-lead

Chris Propp,
Manitoba Infrastructure

Jason Vanrobaeys,
Agriculture and Agri-Food Canada

Dimple Roy,
International Institute
for Sustainable Development

Gavin van der Linde,
Public Member – Citizen of Basin

Malcolm Conly,
Environment & Climate Change Canada

Dr. Patricia Ramlal,
Fisheries & Oceans Canada; AEH co-lead

Girma Sahlu,
Canadian Secretary,
Environment & Climate Change Canada

United States Section

Colonel Eric Swenson, U.S. Chair,
U.S. Army Corps of Engineers

April E. Poitra-Walker,
Civil Engineering Consultant,
Member of the Turtle Mountain
Band of Chippewa Indians,
ITT Co-lead

Vacant, Minnesota Indigenous member

Theresa Haugen,
Minnesota Pollution Control Agency

Dave Glatt,
North Dakota Department of
Environmental Quality

Andrea Travnicek,
North Dakota Department of
Water Resources

Brian Caruso,
US Fish and Wildlife Service,
AEH Co-lead

Jason Gildea,
U. S. Environmental
Protection Agency

Brian Holmer
Red River Basin Commission,
O&EC Co-lead

Gregg Wiche,
U.S. Geological Survey

Nathan Kestner,
Minnesota Department of
Natural Resources

Rebecca Seal-Soileau,
U.S. Secretary, U.S. Army
Corps of Engineers

Collin Smith,
Action Officer, USACE

3.0 BOARD ACTIVITIES

The IRRWB held in-person meetings August 30-31, 2023 in Detroit Lakes, MN; and an in-person/hybrid meeting January 18-19, 2024 in Fargo, ND. In addition to these regular meetings, the Board also held a virtual special meeting on May 8, 2024. The January meeting was held in conjunction with the Red River Basin Commission's (RRBC) Annual Conference. As in the past, IRRWB co-chairs provided a brief presentation about the IJC and activities of the IRRWB to conference attendees as part of board public engagement activities. IJC liaisons also presented an overview of the IJC and the Boundary Waters Treaty of 1909. Questions were submitted by the public in writing on forms provided by the Secretariat and handed to the Co-Chairs for reading. Five comments were submitted. There were questions about the impacts of climate change in the Red River basin, nutrient management, and overall health of the aquatic ecosystem in the Red River including fisheries. The five Municipalities of Minnesota which included the cities of Breckenridge, Moorhead, Thief River Falls, Roseau and Warroad were also invited to attend the board meeting because of their interest in nutrient management in the Red River Basin.

Strategic Planning Workshop[1] – The IRRWB held an in-person facilitated strategic planning session August 28-30, 2023 in Detroit Lakes, Minnesota. The session was well-attended. All Board and Committee members who participated were sent a pre-workshop survey to gather input. The Strategic Planning Session participants included members of the watershed Board and external members with key roles in the Board's various committees. The desired outcomes of the session were to:

- Help establish strategic alignment of the IRRWB's work with the IJC's 2022 Directive to the Board, including its new components (e.g. climate change, drought, and Indigenous engagement); and
- Advance IRRWB strategic work planning approaches as the Board develops its next three-year work planning priorities.

The key information summarized in the strategic work planning report is the structured format used by the IRRWB to set strategic priorities and develop its 2023-2026 work plan by:

- Using the IRRWB Strategic Directions Diagram (2023-2026), four areas of activities were synthesized from the May 26, 2022 Directive and its ten responsibilities:
    - Maintain Awareness of the Condition of the Watershed,
    - Provide a Forum for Discussion and Resolution of Issues,
    - Influence all Order of Governments, and
    - Recommend and Report.
- Identifying "what does success looks like?" as results-based goals for each activity,
- Setting "Strategic Objectives" for each Area of Activity,
- Establishing "Deliverables" for each Strategic Objective,
- Developing Strategic Directions Work Plan using structured work planning templates,
- Creating a SWOT list that identified Strengths, Weaknesses, Opportunities and Threats for the IRRWB and its Committees to guide current and future work planning,
- Considering the Indigenous Collaboration Task Teams recommendations for Indigenous Nations' roles as Board or Committee members, and discussing approaches on how Indigenous Nations participation many be improved and incorporated in the IRRWB activities,
- Prioritizing Integrated Watershed Initiative (IWI) projects, and reviewing these through an initial basic set of criteria, and
- Discussing a structured process to maintain currency of work plan and incorporate adaptive management.

1- *Strategic Work Planning Report (2023)*

Other activities of the Board included:

- Development of an internal process for nominating and approving vacant Committee co-chair positions,
- Addition of new Nutrient Objectives to the exiting bi-national water quality objectives – Board to discuss implementation,
- Inviting university students and professors to attend the Board meeting in January 2024 for a high-level information session so students can see what projects they could work on. Furthermore, it is expected faculties could offer space to set-up lectures and presentations for high visibility,
- Indigenous Task Team (ITT) effort which resulted in an Indigenous Nations Roundtable that was held in Winnipeg, Manitoba January 16-17, 2023. The purpose of the Roundtable was to provide an opportunity for First Nations, Red River Métis and Tribal Nations whose territories are located in the Red River Watershed Basin to come together to discuss their priorities related to the IRRWB, and the IJC; and how traditional knowledge could be incorporated into future Board activities; and
- Special virtual meeting with the Board in May 2023 to review and discuss initial results of the Team.

The Roundtable concluded that water is important to everything in life and connected to many rights issues. Water also carries unique spiritual significance for many Indigenous Peoples. Indigenous water knowledge , as well as Indigenous Peoples relationships to water have not historically been reflected in Canadian or US water governance, and instead have actively been harmed and supressed. Indigenous Peoples have specific responsibilities as well as rights when it comes to water that also need to be recognized and respected. For example, the role of women as water protectors must be upheld[2]. The Roundtable made thirteen recommendations to the IRRWB; out of which four were approved by the Board and the remaining nine were sent back to the ICCT for further clarification and review.

Another highlight of the ICCT that occurred in August 2023 was the invitation to the White Earth Nation in Minnesota to observe Wild Rice harvesting and parching operations. Wild Rice is a part of the aquatic ecosystem in the Red River Basin, and it is very dependent on both water quantity and quality. It is an economic driver to the White Earth Nation as well as many Anishinaabe Peoples. The interaction is expected to foster relationships through continued engagement with events led by Indigenous People.

Additional activities included:

- Completion of the Strategic Planning and Submittal of the Work Plan to the IJC
- IWI Projects
  - Aquatic Ecosystem Health Committee –
    - Fish Tracking – Big Mouth Buffalo
    - Proposal to continue Fish Tracking Telemetry
  - Water Quality Committee
    - IWI Proposal on investigating pathways of exceedance on other parameters
  - Indigenous Collaboration Task Team – Phase II
- Indigenous Round Table Recommendations and Special Board Meeting
  - 15 December 2023
- Flag Flying Ceremony – 10 April 2024 in Washington D.C.in recognition of the work of ICCT
- 2024 January Board Meeting in Fargo, ND
  - Public Session at Red River Basin Commission annual meeting
- SharePoint Training for Board Members and Committee Chairs
- Orientation of new Board Members (onboarding)
- Canadian Water Resources Association webinar January 2024 presented by IRRWB Co-Chairs.

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2 – Indigenous Nations Roundtable (Jan 16-13, 2023)

Source: Rebecca Seal-Soileau – IRRWB – White Earth Nation, MN - August 2023

The second highlight of the ICCT was the flag flying ceremony on the Capitol Hill in Washington D.C. in April 2024 to honour the collaborative work the IRRWC/IJC do with Indigenous Peoples in the Red River Basin.

Insert flag here in the box.

The Aquatic Ecosystem Health Committee (AEHC) holds monthly phone calls during the fall and winter, while spring and summer are reserved mainly for field work. Discussions this year have focused on planning and activities in the basin. Research and monitoring proposals have been an additional topic of interest, including a new International Watersheds Initiative (IWI) proposal and collaborative opportunity to study flows or "e-flows" under the partner-driven Canadian National Science and Engineering Council (NSERC) Alliance Advantage Program. The latter opportunity has been brought to the attention of both the AEHC and Committee on Hydrology (CoH) who are currently in talks to determine how the committees might mutually benefit from partnering (i.e., financial commitment) or collaborating (i.e., no financial commitment). As discussed in the AEHC's June 2023 update and with the help of supporting documents provided by the International Red River Watershed

Board (IRRWB), the AEHC is drafting a Terms of Reference based on the revised Directive from the IJC to the IRRWB.

AEHC members have been in discussions with the Seine-Rat-Roseau Watershed District to evaluate funding opportunities (e.g., IWI, Manitoba Fish and Wildlife Enhancement Fund) for carrying out restoration activities related to Lake Sturgeon and aquatic connectivity on the Roseau River. Seine-Rat-Roseau staff have discussed sturgeon restoration with the Roseau River Anishinabe First Nation, and reports indicate support for restoration work. As previously noted, agency partners and stakeholders continue to benefit from the free exchange of information, ideas, and plans for field work facilitated by the AEHC.

IWI proposal – Submitted January 1, 2024

The AEHC is backing an IWI project proposal titled "Assessing Outcomes of Dam Modification to Facilitate Fish Passage in the Red River Watershed". With the help of federal (US and Canada), state, and provincial partners, the current receiver network of underwater acoustic telemetry receivers focuses on the mainstem of the Red River and Lake Winnipeg. Prior IWI funding (IRRB-02-2021) provided support to expand the array into the Otter Tail and Red Lake rivers, important tributaries of the Red River. Despite impressive overall receiver coverage in the system, the network is too broadly spaced to accurately determine habitat use and passage success at barriers. Direct evaluation of fish passage improvements is a major informational need, with extensions to management and restoration of culturally and commercially valuable species. If funded, the most recently submitted IWI proposal will expand the array around the former Drayton Dam, which in 2023 was converted into a rock-arch-rapids structure designed to effectively pass fish. Funding will support the field work (e.g., travel), additional fish tagging efforts (Lake Sturgeon and Walleye), and hiring a highly-qualified technician.

Red River Telemetry Studies

Telemetry studies in the Red River basin have been supported by IWI proposals through the IRRWB, as well as partnerships with federal (US and Canada), state (Minnesota and North Dakota), and provincial (Manitoba) agencies. If funded, the most recent IWI proposal will provide support to extend the study to 2027. Data collected on habitat use and fish movement are valuable input information for Instream Flow Needs (IFN) predictions of the CoH and provide detailed biological information on fishes in the basin, e.g., migration routes, spawning sites and timing, and overwintering areas. Additionally, data have revealed previously unknown characteristics of population structure and transboundary movement of fish between the US and Canada.

The Lake Winnipeg Fish Movement Program continued in its 8th year. The Red River basin contains a number of ecologically important yet understudied species. For instance, little to no information exists on the movement ecology and barrier passage effectiveness of Freshwater Drum or Silver Redhorse. In an effort to fill knowledge gaps and bolster sample sizes, Fisheries and Oceans Canada tagged Sauger (n = 42, Fig. 1), Silver Redhorse (n = 40), and Bigmouth Buffalo (n = 40) downstream of St. Andrews Lock and Dam in 2024. Through previous IWI funding, an additional 19 Bigmouth Buffalo, 13

Freshwater Drum, 14 Walleye, and 12 Lake Sturgeon were tagged by the University of Nebraska. This brings the total to 1,141 fish, representing 10 species[3].

Fish Passage IWI Project

Funding for the IWI proposal "Integrating fish passage considerations into cultural and ecological connectivity in the Red River watershed" was received in Fall of 2022. A graduate student started field work on the project in spring/summer of 2023. Specifically, the objectives are to: 1) monitor target species movements; (2) evaluate timing of movements; and (3) use these data to inform management decisions on future water management in the context of ecologically and culturally important species.

Ongoing water management efforts that mitigate extreme flows to reduce flooding impacts on infrastructure throughout the Red River watershed have led to concerns about fish passage over existing dams as well through, or around, current and pending water diversion projects. Many of these species are both ecologically and culturally significant. Lake Sturgeon recovery and reintroduction efforts accentuate the linkage between ecology and culture. This species is viewed as a sentinel indicator of a properly functioning ecosystem because they typically need long reaches of river to complete their life cycle. Lake Sturgeon are also regarded as spiritual keepers of the fishery in the Ojibwe culture. Here we are assessing movement of Lake Sturgeon, as well as several other native species of concern (e.g., Bigmouth Buffalo, Walleye, etc.), to ensure there is sufficient connectivity in the Red River Watershed to allow complete life-cycles.

The specific objectives of the study are to: (1) monitor target species movements; (2) evaluate timing of movements; and (3) use these data to inform management decisions on future water management in the context of ecologically and culturally important species. The telemetry network, consisting of ~ 250 listening stations, spans nearly the entirety of the Red River and extends into the Assiniboine River and Lake Winnipeg to ensure movements are captured adequately (Figure 1). Target species being tracked in the Red River include primarily Lake Sturgeon, Walleye, Bigmouth Buffalo, Channel Catfish, and Freshwater Drum, but additional species are being monitored and will be included in analyses when they are present in the Red River (Table 1). These species are culturally, ecologically, and economically important throughout the basin. They also represent a range of movement strategies that will help us better understand fish movements, especially through fish-passage mitigation projects currently under construction or consideration.

This project advances our knowledge by specifically assessing movements of these fish species in and around current development projects to ensure fish passage is either enhanced or not impacted. Substantial work among a partnership of state, provincial, federal, Tribal, and First Nations partners to establish a propagation and reintroduction effort for Lake Sturgeon has been ongoing. A clear next step is to monitor those fish released to ensure they are viable and able to contribute to the population in a meaningful way. Ensuring the Lake Sturgeon can move within the basin is a good start to that understanding. Specifically, the Red River Lake Sturgeon re-introduction and re-establishment program has been ongoing since 1997.

3- AEC Annual IWI Report for 2023 / 2024

Source: Marshall Stuart and Mark Pegg – Integrating Fish Passage considerations - IWI Project 2023/2024

Red River Valley Water Supply Projects, and the Fargo-Moorhead Diversion Project in the Red River continue to be topics of interest to the Board and were discussed at the Board meetings in August 2023 and January 2024. Furthermore, the two meetings addressed water quality monitoring and compliance with the bi - national water quality objectives and established alert levels and IRRWB work plan priorities.

Implementation of the new nutrient objectives for Nitrogen and Phosphorus that have been approved by the Governments of Canada and the United States - The board is expected to start the discussion among its members on how to implement the new nutrient objectives.

Work plan – the Board held a co-facilitated Strategic Planning Session in August 2023. The session defined seven long-term strategic objectives and helped align the new three-year work plan to the updated IJC Directive and its ten responsibilities for the Board. The Board is expected to finalize and begin implementation of the new three-year work plan at the August 2024 meeting.

Development of Terms of Reference (TOR) for all the committees is in-progress and most of the committees have a draft. This is an important item to ensure alignment with the new strategic plan and clarify committee roles and responsibilities so there is no duplication or gaps.

4. BOARD PRIORITIES

- Completion of Strategic Plan for Implementing the Work Plan – the Board had invested a significant amount of time and effort to complete the strategic plan session with the full engagement of committee members based on the cross-walk exercise completed recently.
- Final review to ensure the Strategic Objectives fully reflect the responsibilities in the Directive, and then approval.
- 'How do we get there' discussion (i.e. Board structure and capacity). The Board needs to assess its current structure and capacity (financial and human resources) to ensure these are sufficient to address the new requirements of the IJC Directive.
- IWI project selection criteria and process for approval. This is intended to be directly connected to the Strategic Plan. This will help ensure a standardized approach going forward.
- Development of Committee TORs (mandatory components to be completed yet).
- Highlighting Board membership vacancies with IJC, with the goal of filling vacancies
- Advancing Indigenous Recommendation,
    - Thirteen recommendations were made following the Indigenous Round Table. Four were approved by the Board at the Aug 2023 meeting, and the remaining nine were sent back to the ITT for further review and clarification. Additional recommendations are expected to be brought to the Board at future meetings.
- Developing Talking Points and work plan activities around Climate Change.
- Evaluating Water Quality Objectives. The current water quality objectives were set several decades ago and need timely review and evaluation to ensure whether they are still applicable or need updating.
- Ongoing Monitoring, Reporting, Public Engagement
    - Use Work Plan Graphic
    - New IWI projects Pending
    - Strategic Planning Work
- Monitoring basin conditions – The Red River Basin is known for its extreme hydrologic and climatic variations going from extreme floods within a short period of time. Timely reporting and actions are required to address impacts.
- Monitoring Inter-basin transfer water projects – Ongoing discussions and exchange of timely information are required to address issues arising from moving water from one basin into another basin due to potential transfer of invasive aquatic species.
- Pembina River Task Team – Ongoing discussions
- Advancing Phase II of the Indigenous Collaboration Task Team IWI Project

5. HYDROLOGIC CONDITIONS

Fall/Winter 2022/2023

The Antecedent Precipitation Index is a model that indicates the amount of summer and fall (May to October) rain 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. Generally soil moisture levels decreased in the basin from north to south. Manitoba's Hydrologic Forecasting Centre's 2022 Fall Conditions Report stated that heading into freeze-up soil moisture in the Red River basin was normal to above normal in southern Manitoba, and below normal in the U.S. portion of the basin, as shown in Figure 2 below.

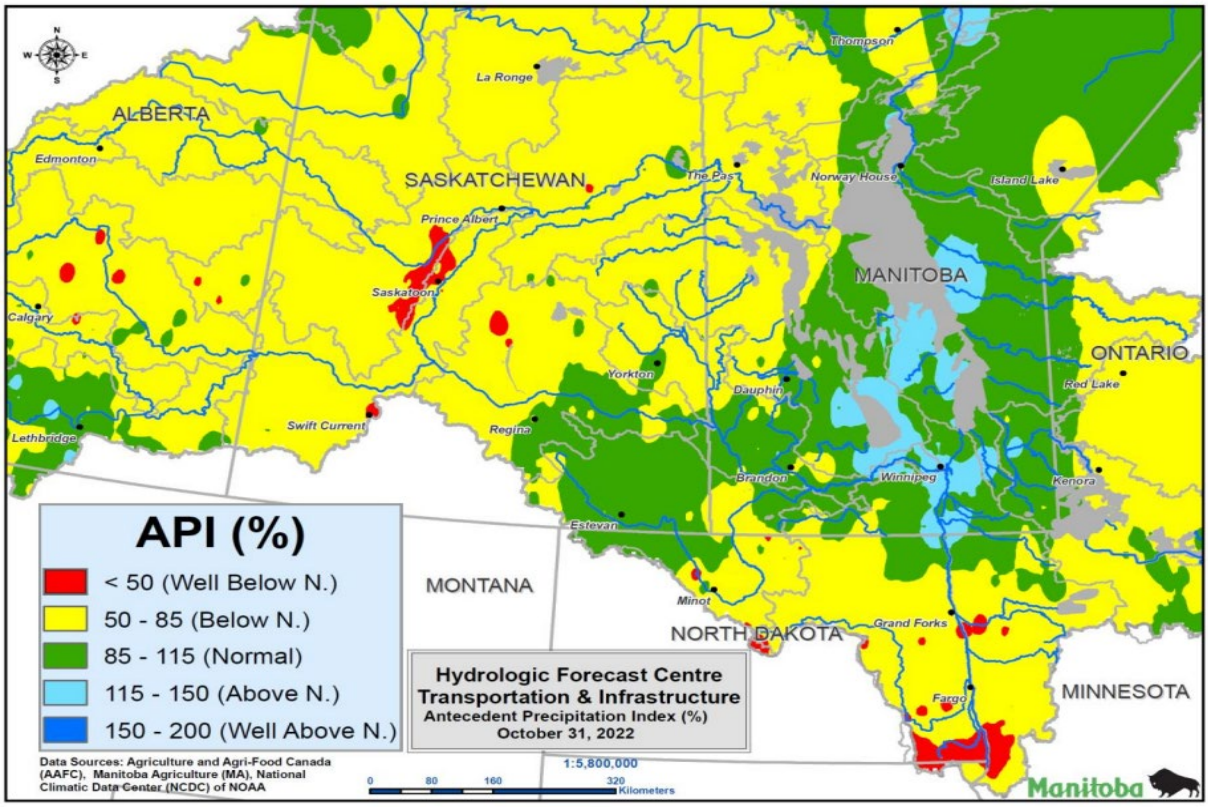


Figure 2. Antecedent Precipitation Index (API) (%) for fall 2022

Going into the winter ice period, almost all of the mainstem Red River gauging stations showed flow in the middle of the normal range, the Sheyenne River flows were above normal from the Devils Lake outlet pumps pumping through October, the Goose River was on the high end of normal, the Red Lake River on the low end of above normal, the Forest River at above normal, and the Pembina River flows at the low end of above normal.

Mid-winter the Canadian and United States Drought Monitors classified most of the basin, particularly the U.S. portion, in some degree of dryness as detailed on the map below (Figure 3). The Canadian basin was classified as normal with some areas of abnormally dry (D0) in the western portion of the basin. The US portion of the basin is classified as abnormally dry (D0) to severe drought (D2).

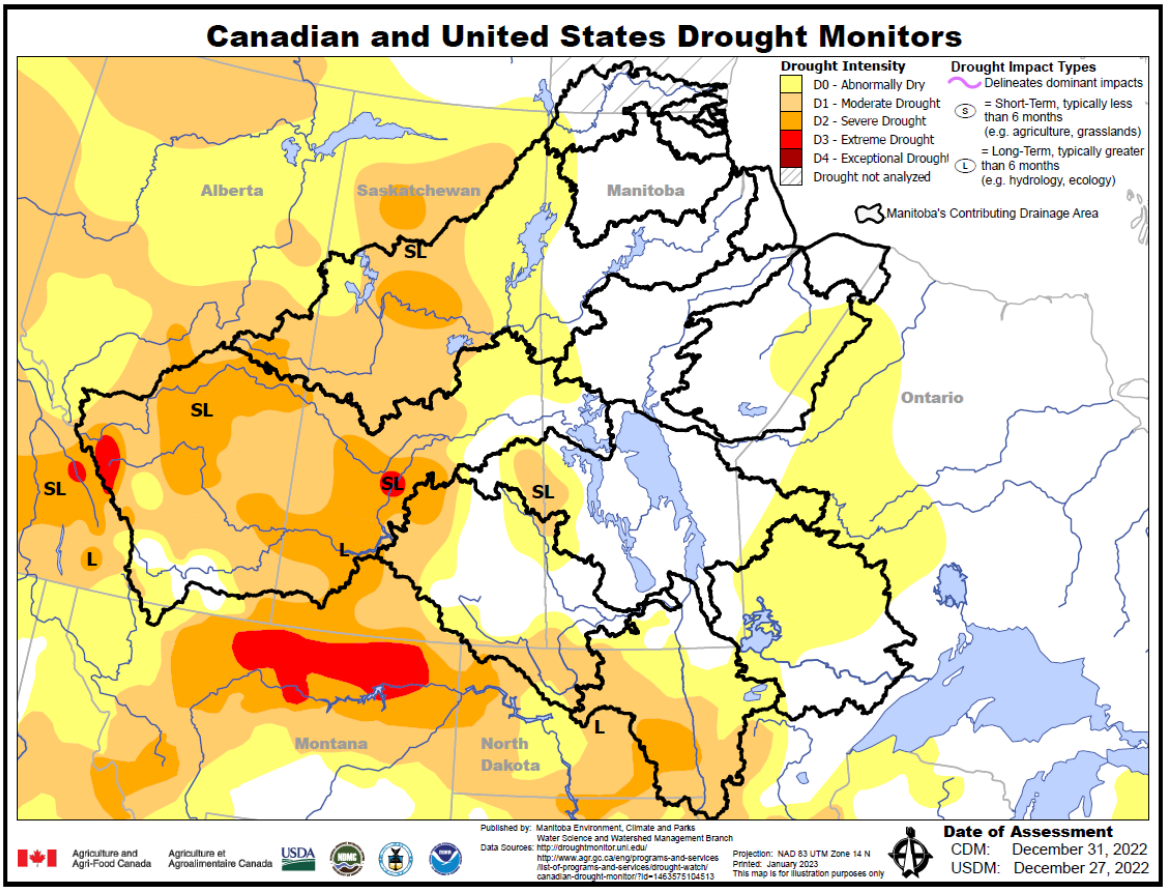


Figure 3. Canadian and US Drought Monitor Data for Dec 2022

The basin received heavy snowfall in December to start the winter season. According to the National Weather Service, Grand Forks received over 24 inches of snow in December 2022. Fargo-Moorhead recorded 22.8 inches of snow, the 6th highest monthly snow amount. The map below shows the snow depth on March 14, 2023, compared to normal amount for the time of year. Much of the US portion of the basin had normal to above normal snow accumulation, while Manitoba had below normal snow accumulation (Figure 4).

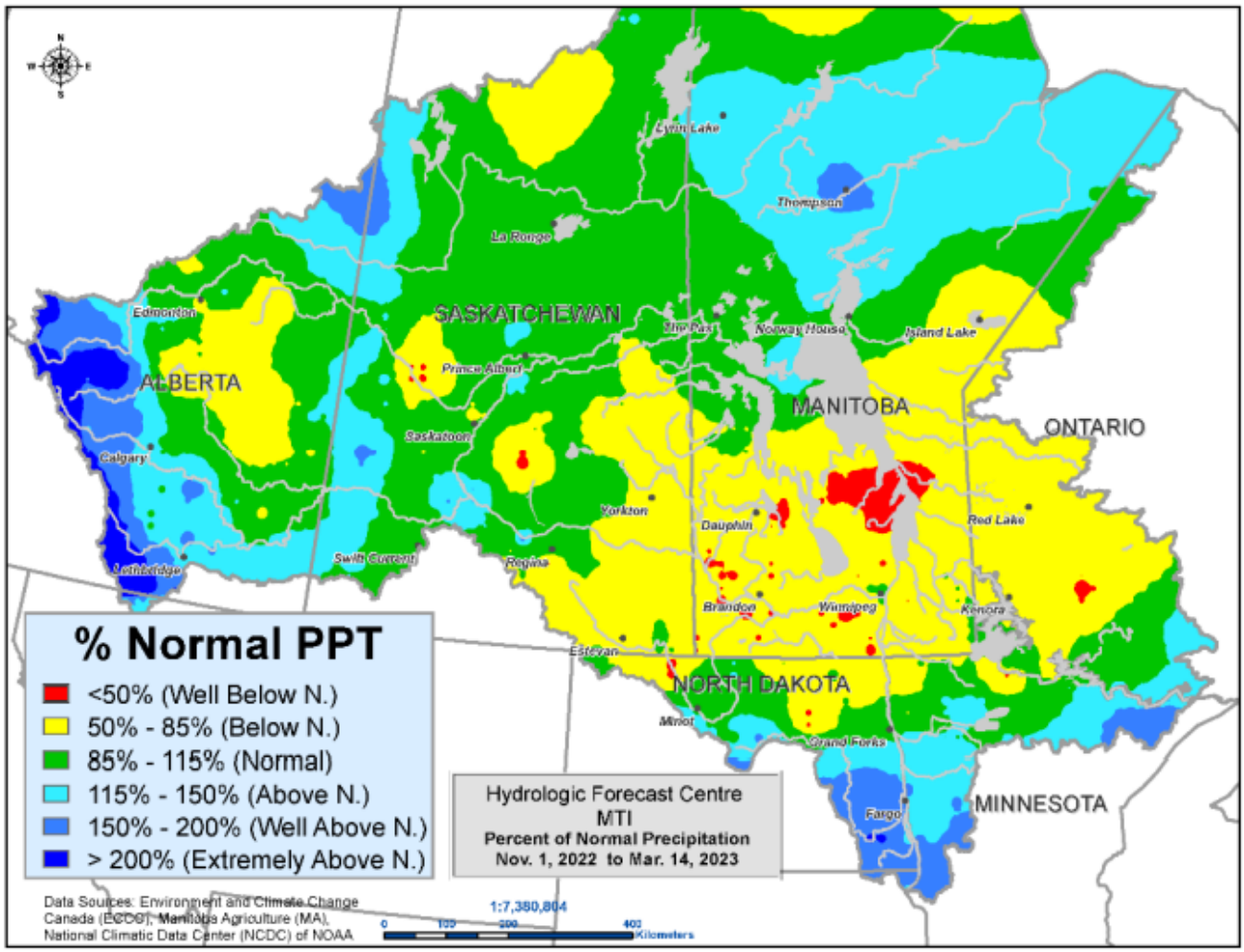


Figure 4**.** Percent of normal snow depth on from November 1st, 2022 to March 14th, 2023

Spring 2023

Soil Moisture conditions at freeze-up generally had normal to above normal conditions in Canadian portion of the basin and below normal conditions in the USA. Manitoba Transportation and Infrastructure's Hydrologic Forecast Centre's March Flood Outlook (March 21, 2023) described a major risk of significant spring flooding along the main stem of the Red River. This was due to well above normal winter precipitation in the U.S. portion of the basin. Other tributaries in Manitoba had lower flood risk due to near normal soil moisture and below normal snow in the Manitoba portion of the basin.

The spring melt began in early April, a few weeks later than normal. Due to an early melt of the local tributaries and near normal spring precipitation, the observed peak at Emerson for the 2023 spring flood was approximately 50,145 cfs (1420 cms) and occurred on May 4. This is slightly higher than the peak forecast for favourable melt conditions published in the March Outlook. The 2023 peak flow measured at Emerson equated to a 1:7 year flood.

Red River Floodway operation began on April 20th, and the gates were operated for 29 days ending on May 18. During the spring 2023 period of operation approximately 429,000 acre-feet (529 million m^3) of water was diverted around the City of Winnipeg by the Red River Floodway, with a peak flow of 10,710 cfs (303.3 cms). In concert with the operation of the Portage Diversion and Shellmouth Dam, the operation of the floodway reduced the flood crest in the City of Winnipeg by 3.75 ft (1.14 m) at the natural flow crest. The recorded peak water level at James Avenue was 17.89 ft (5.45 m), just below Winnipeg's flood stage of 18 ft (5.5 m).

Although most of the mainstem Red River south of the U.S./Canada border, as well as the Red Lake River, lower Sheyenne River, and most of the other tributaries to the Red in the U.S. reached "major" flood stage, no peak of record (POR) flows were recorded this spring (U.S. Geological Survey, 2023). Flooding conditions in the Red River Basin lasted approximately 3 weeks. The Red River had a provisional peak of 43,100 cfs at 40.83 ft on April 24, 2023 of the North at Grand Forks, ND; not a top 10 peak. Fargo, ND recorded a provisional peak of 11,900 cfs at 29.76 ft on April 22, 2023; not a top 10 peak.

Summer 2023

After the spring freshet the Red River receded gradually into the normal range. After some improvement in the spring, drought conditions intensified over the summer. Parts of the basin were extremely dry over the open water period. However, timely rains and cooler temperatures compared to 2021 prevented as intense of drought conditions from developing in 2023.

Stream flow was in the normal range throughout the summer at Emerson. Despite the dry conditions water supplies were not a major concern (Figure 5). The U.S. Drought Monitor showed drought conditions for the region south of the US/Canada border decreasing in coverage from August to January, mostly receding from the southern Basin, but increasing in severity in the northern Basin, especially in the northwestern portion (U.S. Drought Monitor, 2024).

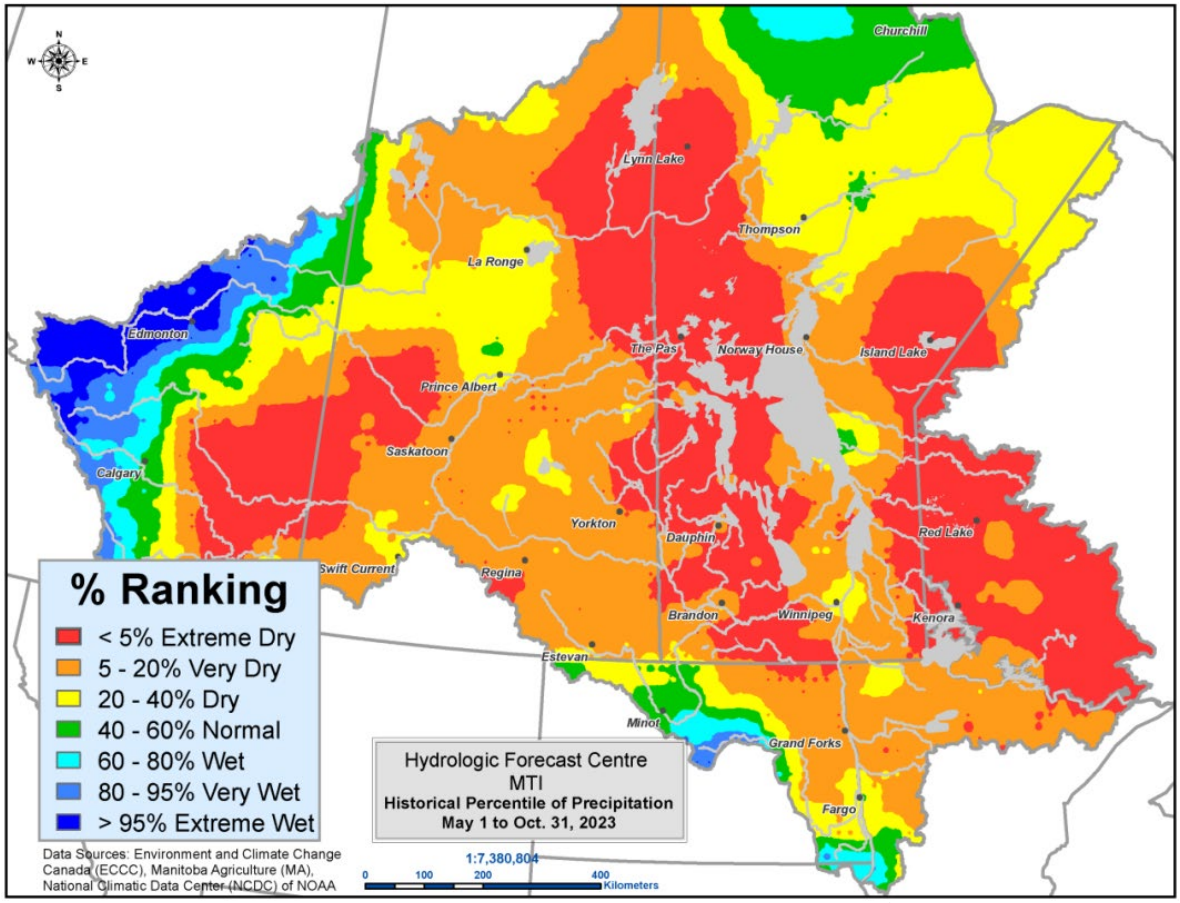


Figure 5**.** Precipitation from May 1st to November 30th, 2023

Fall/Winter 2023/2024

The Antecedent Precipitation Index is a model that indicates the amount of summer and fall (May to October) rain 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. Generally soil moisture levels decreased in the basin from north to south. Manitoba's Hydrologic Forecasting Centre's 2023 Fall Conditions Report stated that heading into freeze-up soil moisture in the Red River basin was below normal to normal with the southern tip of the basin above normal (Figure 6).

Most of the basin is classified between abnormally dry (D0) and extreme drought (D2). The driest areas are in the Pembina and Roseau River Basins. The very southern and western portions of the basin are not classified as having dry or drought conditions (Figure 7).

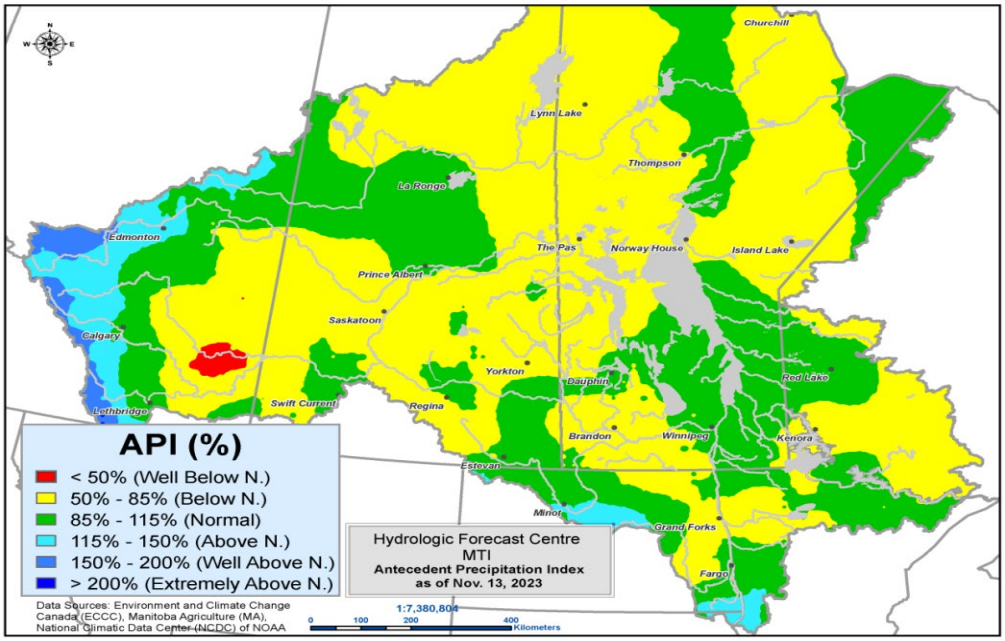


Figure 6**.** Antecedent Precipitation Index (API) (%) for fall 2023

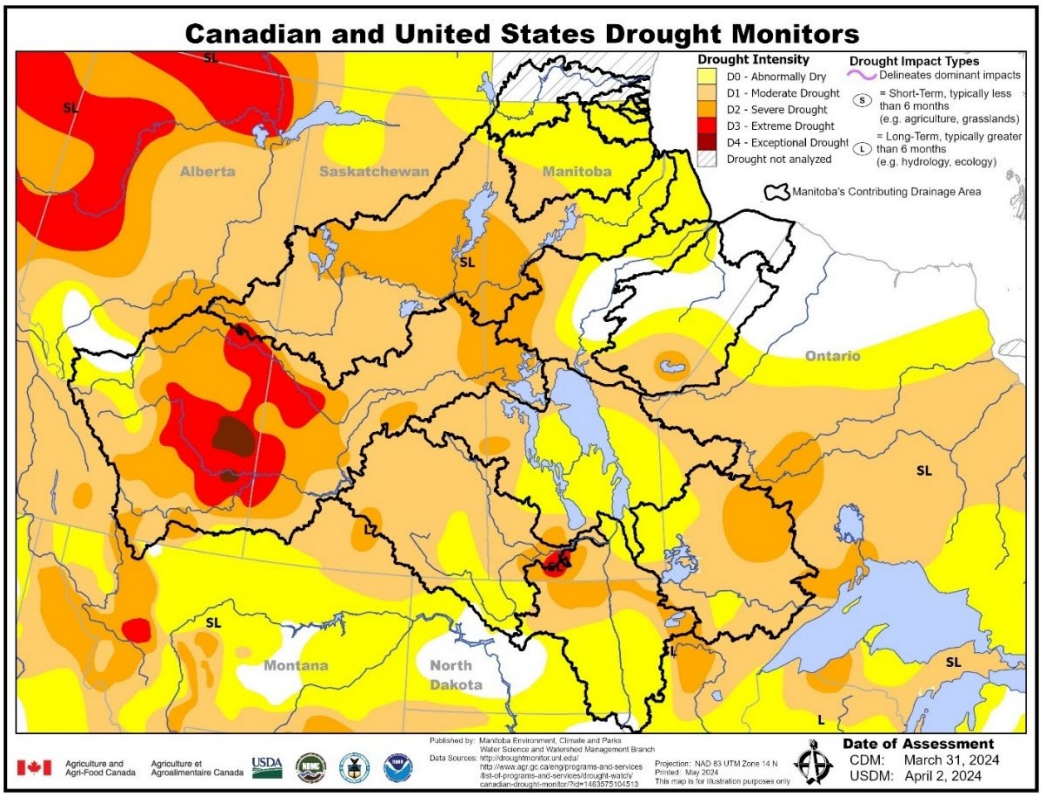


Figure 7**.** Candian and US Drought Monitor maps for end of March 2023

A rainfall event with a maximum total of approximately 2.4 inches of precipitation recorded at Sonora, ND, occurred in the headwaters of the Red River from Dec 25-27 (North Dakota Agricultural Weather Network, 2024) caused a substantial rise in flow on the mainstem Red River and the Wild Rice River and the resulting streamflow exceeded the "much above normal" (90th-highest percentile) streamflow for the Wild Rice River and reached the 95th percentile of flow for the Red River for this time of year (U.S. Geological Survey, 2024). Both the USGS streamgage on the Wild Rice River near Abercrombie, ND (05053000) and the Red River at Fargo, ND (05054000) briefly exceeded their respective flood stages and the flow at the Red River at Grand Forks, ND streamgage (05082500) was measured at 5590 cfs on January 3rd, at the peak of the event (provisional, U.S. Geological Survey, 2024).

Flow at the Emerson gauge peaked January 6th at a flow of 6460 cfs (183 cms). The wave of flow caused the level to rise 2.1 m at the Emerson gauge (Figure 9). This caused the ice to rise and open water to form along the river edges. Warnings were released to ice fishers and other recreational users to not use the river. Flows have been receding since the peak and are currently 3100 cfs (88 cms), which is much above normal and near the historical record maximum for the time of year.

Winter precipitation was below normal to near normal. The well above normal temperatures and rainfall have melted earlier winter snow and snow accumulation was well below normal.
Spring/Summer 2024

The spring melt was earlier than usual and peak flows were below normal and did not cause any flood concerns. Drought concerns were increasing, however above normal rain in April, May and June increased soil moisture and water levels to above normal across the basin. The Red River peaked at Emerson in early July well above the spring peak and has remained above normal to well above normal for the summer of 2024. There were no drought conditions in the Red River basin reported in the end of June drought monitor assessments.

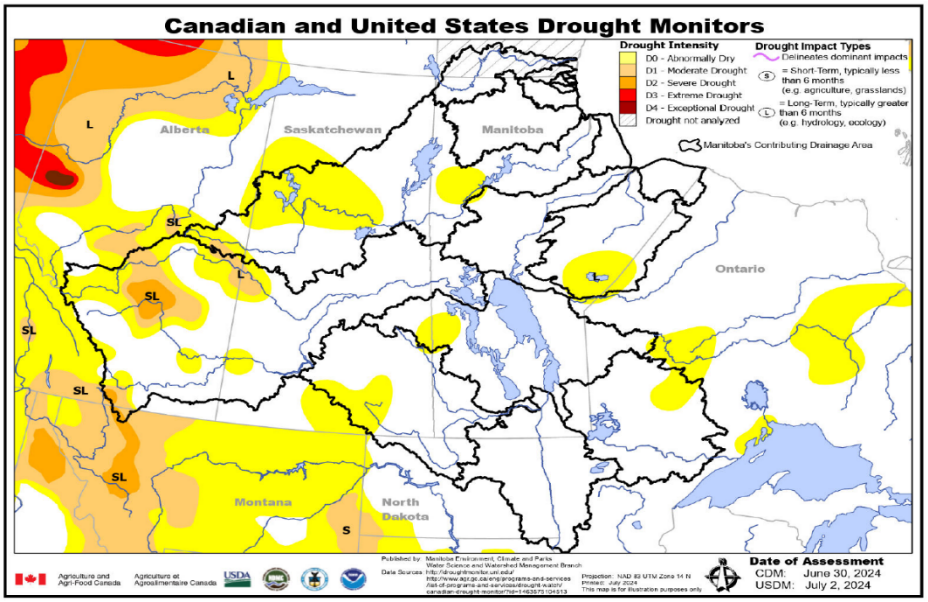


Figure 8. Candian and US Drought Monitor maps for end of June 2024

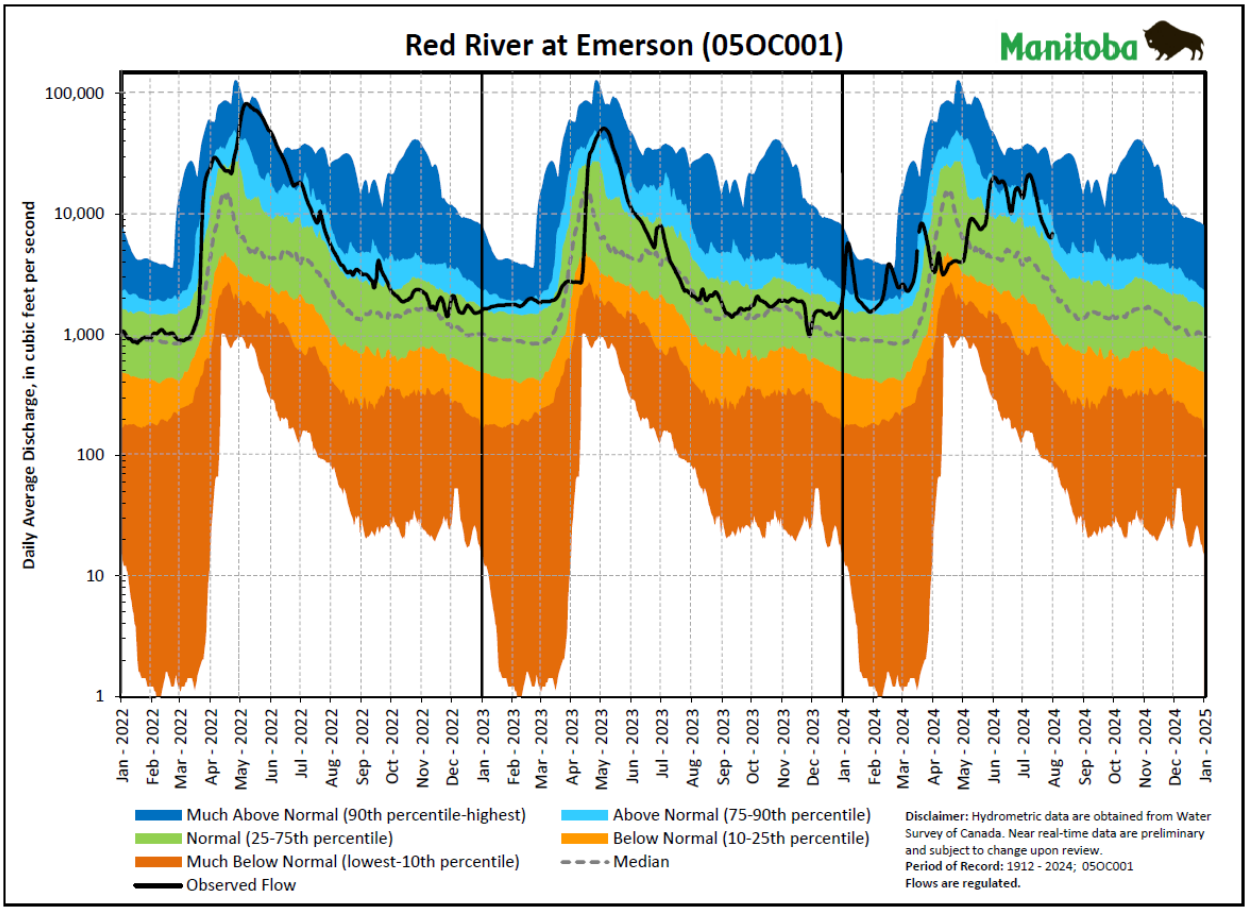


Figure 9. Average daily discharge in the Red River at Emerson from January 2022 to July 2024.

In the US portion of the Basin, the 2023-2024 winter season (Dec-Jan-Feb) can mostly be characterized as warm and wet for the Red River Basin, with the Fargo-Moorhead weather station recording the warmest ever winter season at an average temperature of 26.5 degrees Fahrenheit (F) and the second wettest at 3.83 inches of precipitation (NWS Grand Forks Forecast Office, 2024b). The January average temperatures were 5-10 degrees F above normal for all National Weather Service (NWS) weather stations in the Red River Basin. The NWS Grand Forks weather station recorded 12 days of temperatures below normal in the middle of January, while the rest of the days were well above average for that location (NWS Grand Forks Forecast Office, 2024a). The span of colder days in mid-January allowed for the formation of a deeper frost layer of 20-30 inches for most of the Basin (NWS Grand Forks Forecast Office, and NWS North Central River Forecast Center, 2024a). Snow cover by January 31st was minimal for most of the Basin, except for the northwest corner of MN (NWS Grand Forks Forecast Office, 2024a). Except for the last 3 days of the month, February was another month with average daily temperatures around 20 degrees F above normal as measured at the NWS Grand Forks weather station. Average monthly temperatures were 12-18 degrees F above normal for all NWS weather stations in the Basin. This was the warmest February on record for the Fargo-Moorhead NWS weather station with an average of 30.9 degrees F recorded (NWS Grand Forks Forecast Office, 2024b). There was also no snowfall for the month of February until February 27,

when a blizzard brought 6 inches of snow to a small region in the center, and 2-4 inches for much of the remainder, of the Basin (NWS Grand Forks Forecast Office, 2024b). Drought conditions at the end of December showed Abnormally Dry conditions for a majority of the Basin, except for the area at the international border, which showed Severe Drought. This intensified throughout the winter season to Abnormally Dry for more portions of the southern Basin and an increased area of Moderate and Severe Drought in the north, by the end of February (U.S. Drought Monitor, 2024a).

Streamflow conditions at the time of freeze-up were in the normal range for the Red River and most of the major tributaries, with the exception of the Sheyenne, the Wild Rice, and the Goose Rivers, which were all flowing at above normal going into the winter season (U.S. Geological Survey, 2024b). A rain event occurred in the headwaters of the Red River from Dec 25-27, with a maximum total of approximately 2.4 inches of precipitation recorded at Sonora, ND, (North Dakota Agricultural Weather Network, 2024a). This rain event caused a substantial rise in flow on the mainstem Red River, the Maple River and the Wild Rice River resulting in streamflow for all three to exceed the 95th percentile, or "much above normal", streamflow for this time of year (U.S. Geological Survey, 2024b). All other streams in the Red River Basin mostly remained unaffected from this precipitation event. This increase in flow, coupled with mild temperatures, prevented formation of good ice at many USGS streamgage locations until much later in the winter season, preventing the collection of streamflow measurements until February or March, in most cases (U.S. Geological Survey, 2024a). Streamflow remained at or just above normal for the remainder of the winter season, with the exception of a rise into "much above normal" for a short period in mid-February, due to a precipitation event that resulted in 0.5-0.75 inches of precipitation for a significant portion of the central Basin, from Fargo up to Baudette and 0.25-0.4 inches for the remainder of the Basin, excluding only the Devils Lake subbasin (NOAA National Water Prediction Service, 2024a).

The National Weather Service (NWS) Grand Forks Forecast Office held the first Spring Flood Outlook webinar of 2024 on January 25, at which time the outlook showed a low risk for significant (moderate or higher) flooding in the Basin, due to relatively normal frost depths, much below normal snowfall and below to near normal soil moisture and precipitation (NWS Grand Forks Forecast Office, and NWS North Central River Forecast Center, 2024a). Subsequent outlooks were provided on February 15, February 29 and lastly on March 14, each progressively reducing the risk of significant flooding. The outlook on March 14 stated the risk for significant flooding was very low and that the risk would primarily be from rainfall, as the soil moisture remained below normal and snowpack had melted away across the Basin, by this time (NWS Grand Forks Forecast Office, and NWS North Central River Forecast Center, 2024b).

Average daily temperatures in March remained cool, delaying ice-off until early April (North Dakota Agricultural Weather Network, 2024c). Due to the relatively dry conditions at time of freeze-up and the lack of snowpack accumulation during the winter, ice-off did not result in any significant increase in flows and there were no streamgages in the Red River Basin that reached flood stage from ice-out (U.S. Geological Survey, 2024a). Flow at most streamgages in the Red River Basin was "below normal" at the beginning of April but rose well into the "normal" range throughout the month, as up to 3.5 inches of rain fell in the southern Basin, reducing to 2.5 in the middle and down to 1.5-2 inches in the north (NOAA National Water Prediction Service, 2024b). Both May and June were wetter months with 4-7 inches falling throughout the Basin during the month of May and an additional 4-7

inches falling in the month of June, with the majority of the Basin receiving 10-11 inches of rain in May and June combined (NOAA National Water Prediction Service, 2024c, NOAA National Water Prediction Service, 2024d). The month of July added another 3 inches, on average, of rain to the Basin, while August added on average another 4 inches (NOAA National Water Prediction Service, 2024e, NOAA National Water Prediction Service, 2024f). This resulted in drought conditions to reduce from Abnormally Dry in the middle of the Basin and Moderate to Severe Drought from Grand Forks north to the international border at the end of April, to no drought at all for the entire Basin by the end of May and remaining that way through August (U.S. Drought Monitor, 2024b). Streamflow on the mainstem Red River and most major tributaries also increased to "much above normal" flows by the end of May, remaining there or at the "above normal" flows through August. The only exceptions were the Sheyenne River and the Pembina River, which remained in the 76-90th percentile, or at "above normal" in May, not rising to "much above normal" until July but remaining there through August for the Sheyenne River and receding back to "normal" flows by the end of July for the Pembina River, as seen in figures 4 and 6 below (U.S. Geological Survey, 2024b). Most of the 2024 Water Year peaks occurred in May so far, with some streamgages, including the Red Lake River at Crookston, MN, having reached their peak in June from continued precipitation since May (U.S. Geological Survey, 2024a). Some provisional peaks as of June 20, 2024, for stations with at least 70 years of data are shown below.

05054000, Red River of the North at Fargo, ND

Provisional peak of 6,960 cfs at 22.16 ft on May 27, 2024; not a top 10 peak (U.S. Geological Survey, 2024).

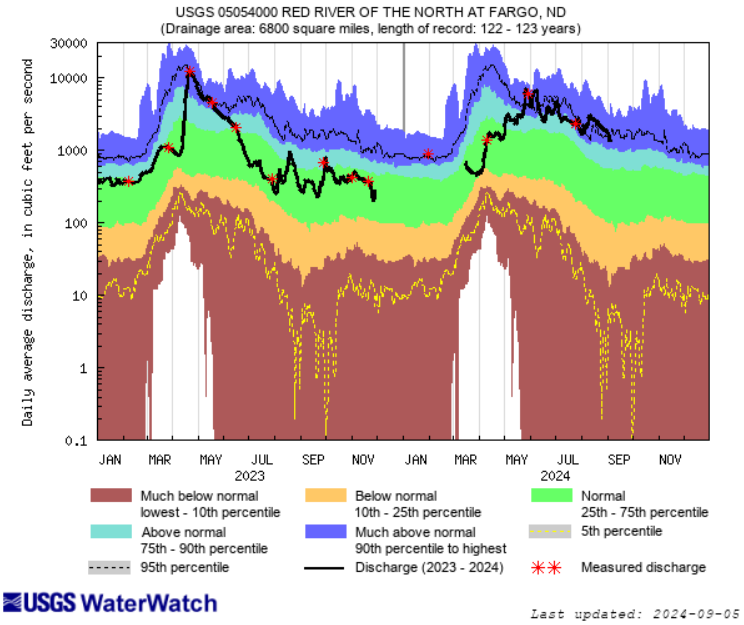


Figure 10: Streamflow at the Red River of the North at Fargo, ND January 1, 2023-September 5, 2024 (https://waterwatch.usgs.gov/index.php?id=wwchart_sitedur).

The Devils Lake Basin was subject to same mild temperatures and meager snowfall in the 2023-2024 winter season, as the rest of the Basin. Lake levels therefore did not rise until the first rain event on April 16 of just under 0.90 inches. An additional 1.16 inches of rain fell April 26-27 and another 0.49 inches April 29-30 (North Dakota Agricultural Weather Network, 2024b). In total, the month of May saw an average of approximately 5 inches of rain fall in the entire Devils Lake region, with a total of 3.09 inches recorded by the Cando, ND NDAWN station over May 23-24 (NOAA National Water Prediction Service, 2024c, North Dakota Agricultural Weather Network, 2024b). Additionally, another 6.12 inches of rain have been recorded at the Cando, ND, NDAWN station for the month of June, 2.33 inches for the month of July, and 4.18 inches for the month of August (North Dakota Agricultural Weather Network, 2024b). All this combined for a provisional rise of 0.89 ft in the Devils Lake level from April 16 to July 23, with a provisional peak of 50.17 ft on July 23 (U.S. Geological Survey, 2024c). Pumping resumed out of the west-end outlet on May 6 and out of the east-end outlet on May 14 (North Dakota Department of Water Resources, written commun(s)., May 6 and May 14, 2024).

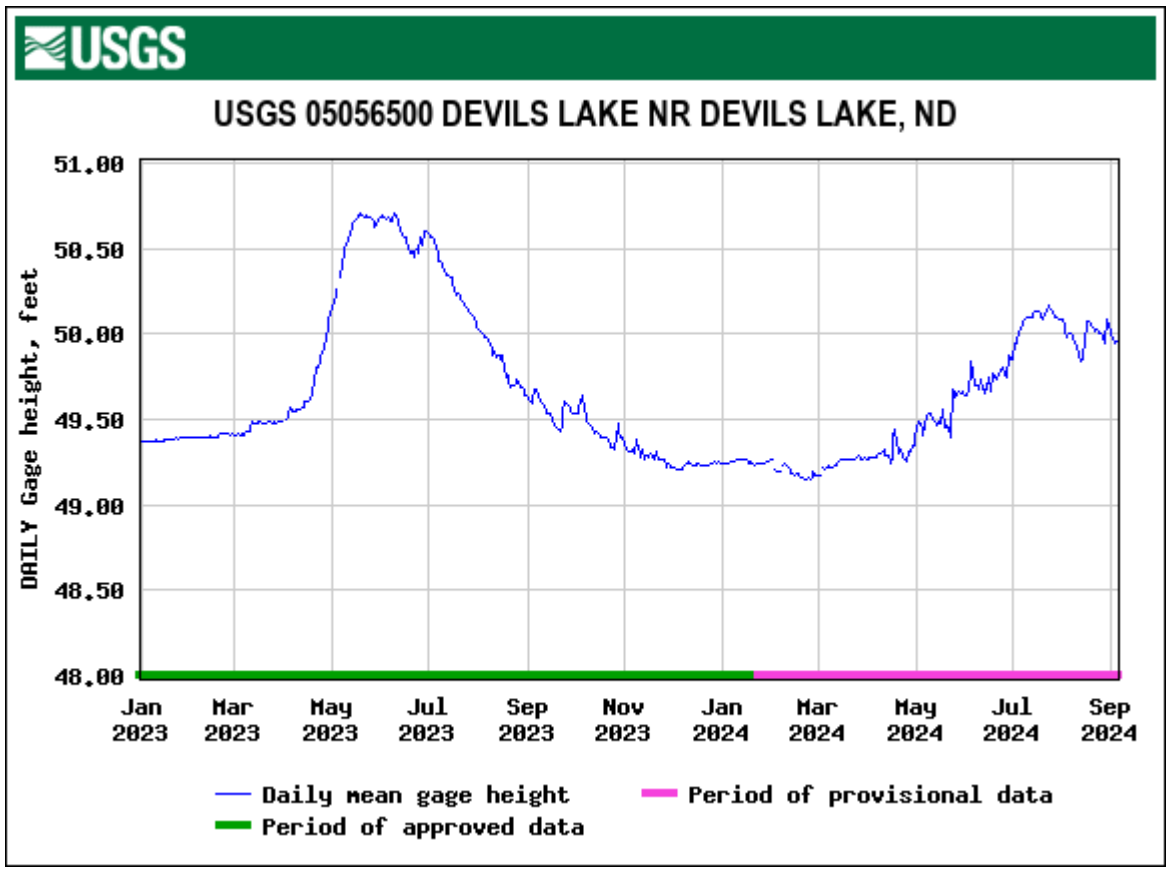


Figure 11: Devils Lake Gage Height January 1, 2023–September 5, 2024
(https://waterdata.usgs.gov/nwis/dv?cb_00065=on&cb_00065=on&format=gif_default&site_no=05056500&legacy=&referred_module=sw&period=&begin_date=2023-01-01&end_date=2024-09-05).

6. WATER QUANTITY MONITORNIG

The Hydrology Committee monitors conditions in the basin and provides an overview of flow conditions and forecasts for board meetings, IJC semi-annual board appearances, the annual report and whenever else requested by the board or IJC. The reporting ensures the board and IJC are aware of the hydrologic conditions in the Basin.

Red River Low-Flow Frequency Study:

The Hydrology Committee received IWI funds to quantifying low flow frequencies to better understand potential low flow management 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 inform how a drought contingency plan or minimum flow criteria for the Red River could reduce these risks.
The water-balance model (WBM) has been calibrated and verified and the stochastically generated weather data has been derived. Future streamflows have been simulated and from these simulations, low-flow frequency curves have been derived for the Wahpeton, Halstad, Grand Forks and Emerson locations on the Red River. Results will be published in a USGS Scientific Investigation Report, in the coming months.

Red River Instream Flow Analysis:

This work supports the board's desired outcome of assessing and recommending a process for the development and implementation of minimum flow management for the Red River at the International Boundary. Discussion paper presented to IRRWB at January 2019 Board meeting summarizing past work and future work required. Future work in the near term was to gather key data and improve and extend past modelling work to better understand the complexity of the Red River's aquatic ecosystem and make more informed low flow management decisions. The Hydrology Committee recommended that a complete homogeneous bathymetric survey would be fundamental to instream flow assessment and other work.

MTI completed bathymetry from near the border to just downstream on the Red River Floodway Inlet Control Structure in the summer and fall of 2022. Data includes 50 m of aerial LiDAR to cover the shoreline. USACE has collected the US portion of the Red River in summer 2024. USACE will to merge the two surveys together. MTI is planning to extend its bathymetry from the Red River Floodway Inlet Control Structure to Lake Winnipeg. It is expected a homogeneous bathymetric survey from the headwaters to Lake Winnipeg will be available in 2025.

7.0 WATER QUALITY MONITORING AT THE INTERNATIONAL BOUNDARY

Monitoring the water quality of the Red River at the Canada-US boundary is conducted by Environment & Climate Change Canada (ECCC). ECCC maintains a permanent water quality station on the Red River at Emerson, Manitoba. Monitoring of the Red River takes place monthly during the ice cover season, weekly during the open water season, and twice weekly during the spring freshet or other periods of flood. The water quality data for the 2022-2023 water year, included in this report, are based on instantaneous grab samples collected between October 1st, 2022 - September 30th, 2023.

These collected water quality data are used to determine compliance with the binational water quality objectives, nutrient objectives and targets, and alert levels at the international 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.

Water quality characteristics at other locations throughout the basin are referenced elsewhere in this report to provide a more complete spatial representation of water quality and aquatic ecosystem conditions in the Red River basin (see Appendix B).

Water quality monitoring on the Red River at the Canada-US boundary by Environment & Climate Change Canada.

7.1 Water Quality Objectives

The IJC recommended the establishment of water quality objectives for a limited number of variables at the International Boundary in April 1968, and the recommendation was approved by governments in May 1969. These variables with binational objectives included dissolved oxygen, total dissolved solids, chloride, sulphate, and fecal coliform bacteria. *E. coli* replaced fecal coliform as a water quality objective in October 2010. Several exceedances of binational water quality objectives were observed during the 2022-2023 water year, as summarized in Table 1. Additional detail on each parameter is provided.

Table 1 International Red River Board Water Quality Objectives
Summary of Exceedances Red River at the International Boundary
Oct 1 2022 to Sept 30 2023 Water Year

Parameter	Objective	Exceedances		
		Number (total # samples)	% samples exceeding	Maximum (Date)
Dissolved Oxygen	>5 mg/L	0 (44)	0%	6.13 ** (Jun 28)
Total Dissolved Solids	500 mg/L	28 (44)	64%	700 (Jul 13th)
Chloride	100 mg/L	0 (44)	0%	65.5 (Oct 20th)
Sulphate	250 mg/L	3 (44)	7%	263 (Jul 13th)
E. coli	<200 colonies /100 ml	0 (13)	0%	160 (Apr 24th)

***Minimum value for Dissolved Oxygen*

Dissolved Oxygen
Observed levels of *dissolved oxygen* did not fall below the objective of 5 mg/L during the 2022-2023 water year. The minimum observed value was 6.13 mg/L on June 28th, 2023. Minimums often occur in summer, when discharge increases following significant rain events.

Total Dissolved Solids
Total Dissolved Solids (TDS) exceeded the objective of 500 mg/L in 64% of samples (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. The highest observed value of TDS was 700 mg/L on July 13th, 2023.

Chloride
Observed levels of *chloride* did not exceed the objective (100 mg/L) during this reporting period. The maximum concentration was 65.5 mg/L on October 20th, 2022. In recent years, chloride has occasionally exceeded the objective at low frequencies.

Sulphate
S*ulphate* exceeded the objective of 250 mg/L in 7% of samples during the 2022-2023 water year (Figure 5). Sulphate exceedances have been common over the last number of years: often exceeding the objective even more frequently than during this reporting period. The maximum value measured was 263 mg/L on July 13th, 2022.

E. coli

The bacteriological characteristics of the Red River are assessed on the basis of observed *Escherichia coli* bacteria. The presence of *E. coli* in water is an indicator of impacts via human and/or animal wastes. During the 2022-2023 water year, *E. coli* bacteria counts did not exceed the objective of 200 colony forming units per 100 mL.

7.2 Water Quality Objectives and Targets for Phosphorus and Nitrogen

In May 2020, the IJC recommended the adoption of nutrient objectives and targets at the International Boundary, and in October 2022, the recommendation was approved by governments. The parameters total nitrogen and total phosphorus are each evaluated against ***concentration objectives*** as well as ***loading targets***. Nutrient concentrations and nutrient loads are reported in Table 2.

Table 2 Nutrient Concentrations and Loads, Red River at International Boundary

Parameter	Nutrient Concentration Objective	2023 Open Water Season Mean Concentration	Meets or Exceeds
Total Phosphorus	0.15 (mg/L)	0.37	Exceeds
Total Nitrogen	1.15 (mg/L)	2.29	Exceeds
Parameter	**Nutrient Load Target**	**2018-2022 Average Load**	**Meets or Exceeds**
Total Phosphorus	1400 (tonnes / year)	2,952	Exceeds
Total Nitrogen	9,525 (tonnes / year)	16,204	Exceeds

Nutrient Concentration Objectives

An open water season mean concentration is calculated as the average concentration in all samples collected between April 1st and October 30th in a given year. The open water season mean is compared against the concentration objective to determine compliance.

Total Phosphorus

The Apr-Oct mean total phosphorus concentration for the 2023 open water season was 0.37 mg/L, which exceeded the objective of 0.15 mg/L (Figure 3). Total phosphorus has consistently exceeded the concentration objective value for several decades.

Total Nitrogen

The Apr-Oct mean total nitrogen concentration for the 2023 open water season was 2.29 mg/L, which significantly exceeded the proposed objective of 1.15 mg/L (Figure 4). Total nitrogen has consistently exceeded the concentration objective value for several decades.

Pesticides

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

8. WATER QUALITY AND BIOLOGICAL MONITORING PROGRAMS

Manitoba During the 2022-2023 water year, Manitoba Environment and Climate Change continued its routine long-term monitoring of surface water quality within the Red River watershed. Sampling was conducted on a monthly frequency at three sites along the main stem of the Red River within Manitoba. These sites were located at Emerson, MB; upstream of the City of Winnipeg at the Floodway inlet control structure at St. Norbert, MB; and downstream of the City of Winnipeg at Selkirk, MB. Additionally, joint federal/provincial paired samples were collected at the Selkirk monitoring location 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, trace elements, nutrients, and agricultural chemicals. Long-term water quality parameters monitored by Manitoba Environment and Climate Change are shown in Appendix C-1. Benthic macroinvertebrates were also collected from the Red River at Emerson and Selkirk in September 2023.

As part of its regular Red River watershed monitoring, Manitoba Environment and Climate Change also conducted routine monitoring at nine sites on seven tributary streams to the Red River during the 2022-2023 water year. Tributary sites are typically monitored on a quarterly basis (October, December/January, April, and July) throughout the water year. Tributary samples were analyzed for a wide range of variables including physical parameters, general chemistry, suspended sediment, bacteria, trace elements, nutrients, and agricultural chemicals. Long-term monitoring of tributary streams allows Manitoba Environment and Climate Change 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.

Biological Monitoring - Benthic macroinvertebrates were collected at two locations, Emerson, MB and Selkirk, MB, on the Red River in September 2023. At each location, one transect of five dredge grab samples were collected with a petit Ponar dredge. Starting at the east bank, samples were collected at five equidistant sample sites across the width of the river 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 per cent 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.

Pollution Control - 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. Upgrades are underway to the City of Winnipeg's South End and North End Water Pollution Control Centres including to add biological nutrient removal to meet 1 mg/L total phosphorus and 15 mg/L total nitrogen limits. 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.

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 2021 and September 2023.

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 per cent reduction in phosphorus in Lake Winnipeg. Manitoba has developed 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 IRRWB. 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. 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:

North Dakota - Ambient Water Quality Monitoring Program
North Dakota Department of Environmental Quality (NDDEQ) in partnership with US Geological Survey (USGS) maintains thirty-one (31) river monitoring stations in the Red River Basin. There are 16 level one sites, 12 level two sites, and 4 level three sites. Field data includes temperature, dissolved oxygen, pH and specific conductance. Laboratory analysis consists of general chemistry, dissolved trace elements, total and dissolved nutrients, total organic carbon, dissolved organic carbon, total suspended solids, and E. coli bacteria, and total suspended sediment at select sites (Appendix C-2).

North Dakota Department of Agriculture Pesticide Monitoring Program
As a complement to North Dakota's revised ambient water quality monitoring program, the NDDEQ and the USGS collaborated with the North Dakota Department of Agriculture (NDDA) in a pesticide monitoring program. The program goals are: 1) determine the occurrence and concentration of pesticides in rivers and streams, 2) identify trends in pesticide contamination, 3) determine if any pesticides may be present at concentrations that could adversely affect human health or aquatic life, and 4) evaluate levels of selected neonicotinoid insecticides in North Dakota's rivers and streams.

Through this cooperative pesticide monitoring program, the NDDEQ and the USGS collected samples April through October at level one water quality monitoring sites in the Red River Basin. A final report will detail 2023 monitoring results (pending). The 2022 final report is available at: https://www.ndda.nd.gov/sites/www/files/documents/files/2022%20Pesticide%20Surface%20Water%20Monitoring%20Report.pdf

Pollution Abatement and Advisories

Point Source Control Program: The NDDEQ regulates the release of wastewater and stormwater from point sources through permits issued by the North Dakota Pollutant Discharge Elimination System program (NDPDES). Permitted municipal and industrial point source dischargers must meet technology or water quality based effluent limits. The cities of Grand Forks, Fargo, and West Fargo all have approved pretreatment programs within the Red River basin in North Dakota.

In addition, all major municipal and industrial permittees must monitor their discharge for whole effluent toxicity (WET) on a regular basis. There are presently 151 municipal or industrial facilities with an NDPDES Program permit in the Red River basin. Of these, 36 are industrial wastewater permittees and 115 are domestic/municipal wastewater permittees.

Stormwater: The NDPDES Program permits stormwater discharges from industrial sites, construction sites and larger municipalities or Municipal Separate Storm Sewer Systems (MS4s). There are 311 stormwater permits for construction activity, 135 industrial stormwater permits in the Red River basin in North Dakota, and 4 MS4s.

Animal Feeding Operations (AFOs): The NDPDES Program regulates animal feeding operations (AFOs) in North Dakota. All large (>1000 animal units) confined animal feeding operations (CAFOs) are inspected annually. 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, 25 are designated as large CAFOs.

Nonpoint Source Pollution Management (NPS) Program: The NPS Program is currently supporting nine watershed projects in the Red River Basin that are focused on nonpoint source pollution mitigation. Additionally, there are two statewide watershed projects that provide technical/financial assistance in the Red River Basin. In most cases, these projects are addressing NPS pollution associated with agricultural activities.

North Dakota's Nutrient Reduction Strategy for Surface Waters

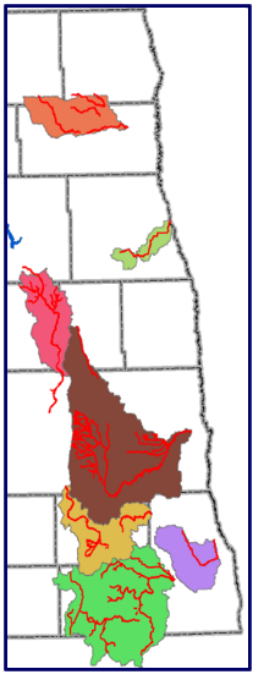
Nutrients are essential components of aquatic ecosystems but when present in excess concentrations, they can result in water quality degradation. To address these concerns, the NDDEQ developed a nutrient reduction strategy in May 2021. The strategy may be viewed at: https://deq.nd.gov/publications/WQ/3_WM/NutrientStrategy/FINAL_NDNutrientStrategy_June_2_2021.pdf

Other work underway - North Dakota

Nutrient Reduction Strategy

1) Criteria Development 2) Setting Targets, 3) Identifying Priorities, 4) Implementing Strategies

Nine Projects in 2023	N lbs/yr	P lbs/yr
Antelope Creek & Wild Rice	246.8	49.3
English Coulee	24.7	5.5
Griggs Co. Sheyenne River Riparian	23.4	1.5
Livestock Pollution Prevention	7578	3694
Maple River Watershed	2209.4	1041.5
Park River Watershed	135.6	20.9
Stockmen's Ass. Environmental Services	13512.6	6488
Wild Rice River PTMApp	300.5	37.2
Sheyenne River Ransom Co PTMApp	NC	NC
Total	24,031	11,337.9



Minnesota - There are 17 major tributaries to the Red River in Minnesota. The Minnesota Pollution Control Agency has developed Watershed Restoration and Protection Strategy (WRAPS) reports for each of these watersheds. Each WRAPS consists of monitoring, stressor identification, modeling, public participation/input and any associated TMDLs. The WRAPS and all associated Total Maximum

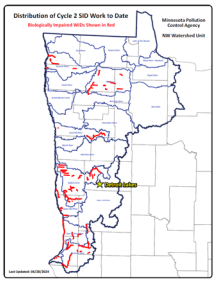
Daily Load (TMDL) studies have been completed on all 17 watersheds, in the Red River Basin, as indicated below (Appendix C-3). This completes cycle 1 of the watershed approach for the Red River Basin.

The second cycle of monitoring has begun which will result in WRAPS Updates, as needed, for each watershed with any necessary TMDLs. Most of the watersheds in the Red River Basin are set to be sampled starting in 2023 through 2026 with a few that began in 2022. For the summer of 2024 the MPCA is monitoring (fish, macroinvertebrate, and discrete water quality) the following watersheds in the Red River Basin Monitoring is expected to be completed by the end of September (monitoring is done for two years in each watershed):

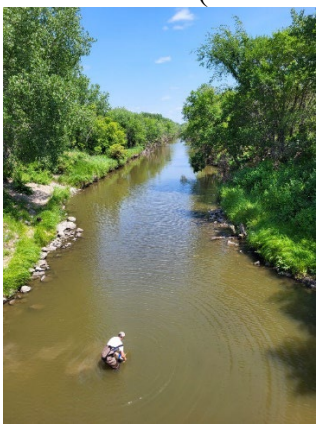
- Snake River (1st year)
- Tamarac/Joe River (1st year)
- Two Rivers (1st year)
- Red Lake River Watershed (2nd year)
- Grand Marais Creek Watershed (2nd year)

This next sampling cycle (Update Cycle) will create more recent monitoring data to inform the WRAPS and implementation work being done by local government partners.

Stressor ID (SID) Monitoring continues following the IWM schedule above. Below you will see a map of the work that has been done in the basin to date for the Update Cycle and the WIDs that include impairments for fish/inverts. WQ monitoring has been completed on each of these WIDs.



Photos of staff (Mike Sharp and Betsy Nebgen, SID Staff) at monitoring sites in the basin.



Total Maximum Daily Load (TMDL)

TMDLs with completed WRAPS in the Red River Basin can be found at the following website, along with additional information: https://www.pca.state.mn.us/water/total-maximum-daily-load-tmdl-projects#approved-6123248a ;

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

There were 7 individual National Pollutant Discharge Elimination System (NPDES)/State Discharge Elimination (SDS) permits issued of which 5 were for domestic wastewater treatment plants and 2 were for industrial facilities. There were also 60 general NPDES/SDS permits reissued of which 5 were to sand and gravel facilities, 52 to a municipal wastewater treatment pond system, 1 for municipal pesticide application, and 2 to water treatment plants. There were 5 wastewater related incidents/releases of which two were noted as spills and the remaining 3 being releases or bypasses (all from municipal wastewater treatment plants).

Other

The MPCA has helped support the Red River Basin Flood Damage Reduction Work Group's (FDRWG) five-year monitoring program by providing technical support and monitoring equipment (5 sondes and calibration solution). Discrete and continuous water quality monitoring of sites began in 2024. The MPCA is committed to continuing its support of this effort until its completion in June 2028.

9. INDIGENOUS ENGAGEMENT

The International Joint Commission (IJC) has instructed the International Red River Board Watershed Board to include Indigenous People in its membership and as such has appointed four new Indigenous members to join the Board in 2021. The addition is expected to provide a traditional knowledge perspective that would enrich the knowledge base for the protection of the ecology of the Red River Basin (Appendix E-7).

The Indigenous Collaboration Task Team held its first Roundtable meeting from January 16-17, 2023 in Winnipeg, Manitoba. The purpose of the Indigenous Nations Roundtable was to provide an opportunity for First Nations, Red River Métis and Tribal Nations whose territories are located in the Red River Watershed Basin to come together to discuss their priorities related to the IRRWB, and the IJC more broadly.

The Indigenous Collaboration Task Team (ICTT) continues to focus on meeting the intent of the IJC Directives for providing a continuous and inclusive forum using science and traditional knowledge. Our work seeks to advance foundational efforts to bridge existing knowledge gaps between the IRRWB and Indigenous Nations. This work is necessary to inform future approaches and opportunities that support integration and inclusion of Indigenous peoples and knowledge in board activities and decision-making. For the betterment of the basin, we strive to bring Traditional Knowledge to the Board's Activities.

Through deliberate and concentrated efforts in 2023, ICCT was able to provide thirteen (13) recommendations resulting from information gathered at the 2023 Indigenous Nations Roundtable. The recommendations are intended for both the International Red River Watershed Board and the International Joint Commission in alignment with their scope and authorities. The IRRWB has begun the process of adopting and implementing recommendations and as of August of 2023, the IRRWB adopted the following recommendations:

- ✓ Make room for Ceremony (Acknowledge and Respect)
- ✓ Participate in events led by Indigenous Peoples (Opportunities are being identified)
- ✓ Partner with Indigenous Peoples (Studies, Data Collection, Knowledge Identification)
- ✓ Enable Indigenous Representation at the Committee Level

In December of 2023, the IRRWB held a special board meeting to consider the remaining recommendations, allowing for additional conversation to take place. The board noted that the previously approved recommendations may require funding which could present an obstacle to implementation. Through a facilitated process they expressed support for Six (6) of the remaining Nine (9) recommendations as follows:

- ➢ Find way for representation to be chosen by Indigenous communities (at committee level)
- ➢ Find a way to have an intergenerational approach. Engage with and include Tribal/First Nations Elected Leaders and youth.
- ➢ Support Binational Indigenous Collaboration (between the United States and Canada)
- ➢ Develop a Data Practices Act
- ➢ Foster Relationships (Continue engagement)
- ➢ Consider framing studies with the 7 teachings: Love, Respect, Bravery, Truth, Honesty, Humility, and Wisdom. This is intended to help to preserve the meaning of Traditional Knowledge by providing and including some Cultural context.

The remaining three (3) recommendations garnered a great deal of discussion. It was suggested that additional clarification and guidance was needed by the board to aid their considerations. Some members acknowledged that they don't know the content of the treaties and/or the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP). There may also be differences between the framework in Canada and the framework in the United States that could lead to confusion. This feedback was provided to the ICTT to help identify knowledge gaps or other challenges moving forward. The work of 2024 is largely about creating opportunities for expanding understandings of and identifying how we can meet the intent and spirit of the recommendations within the scope of the board's authority. The items still under consideration are as follows:

- Meaningful Inclusion and Engagement-(Commit to uphold Consultation and Consent requirements)
- Respect Indigenous Knowledge- Create, Adopt, Develop and be accountable for new approaches
- Reference UNDRIP and Treaty Promises in the work of the Board. Support the inherent rights of Indigenous People to their traditional territories.

The ICTT has determined that it is necessary to provide additional context to the board to enable a common understanding through the aid of subject matter experts. The ICTT will continue to work to identify subject matter experts who can provide Cultural Competency Training for the IRRWB. The ICTT will seek IWI support to host an event in 2024.
The ICTT has endeavored to align the work plan to the updated directive by integrating Indigenous collaboration with three priorities in mind:

1) Including Indigenous representation at the committee level. This effort may allow us to progress two goals, one for greater Indigenous participation at the committee level, as well as working with the elected leadership of the Indigenous Nation to bring forth individuals supported by their community.

2) Identifying opportunities for the board members to participate in Indigenous-Led Events. A list of mostly recurring events is being compiled and placed on the IRRWB's SharePoint site to allow for member collaboration on the expansion of this list. Upcoming events will be included in future reports to the board to create a greater awareness of opportunities to participate at Indigenous-led events that can inform the priorities of Indigenous communities.

3) Creation of a Data Policy. The IRRWB would like to continue to engage and collaborate with Indigenous people in the Basin. It is necessary to provide a framework for this engagement to demonstrate a commitment to respect Traditional Knowledge. The ICTT and IRRWB recognize that while this is a high priority that is essential to provide a foundation for future collaborations, it is also essential that we carry out this work in an informed manner. Therefore, we have delayed the scoping and drafting of a policy until the critical conversations, facilitated by subject matter experts, can take place as described above. Following the fall meeting, the ICTT will determine the best path forward for the drafting and implementation of a policy. It is anticipated that this effort will require an IWI proposal and funding to provide for resources to carry out the drafting.

10. 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:

- 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.

The Seven Principles of the International Watershed Initiatives (IWI)

The IWI program supports activities that strengthen the capacity of IJC boards to deliver on their mandates through building partnerships and promoting sound water stewardship. The following principles guide the IWI:

1. Integrated Ecosystem Approach
2. Binational Collaboration
3. Involvement of local expertise
4. Public engagement
5. Balanced and inclusive board representation
6. Open and respectful dialogue
7. Adaptive management perspective

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 IRRWB membership and Committee structures provide a linkage to key segments of this community with potential to expand the linkages as integrative approaches evolve.

In its June 2005 report to the governments of Canada and the United States[1], the IJC recommended that the governments confirm their support for the Initiative and that funds be made available commensurate with board work plans.

Currently, the IRRWB has six IWI projects underway with some to be completed in the near future.

- Fish Telemetry Study by AEHC (initially funded in 2016 extended sampling to battery life –to 2022).
- Fish Passage and Connectivity AEHC-submitted Spring 2022, approved Fall 2022. Dovetails with the Fish Telemetry Project to answer newly emerging questions.
- Drought Risk Analysis for the Red River Basin (Funded May 2020 - ongoing).
- Evaluation of Factors contributing to Sulfate Trends in the Red River Basin. (Funded late FY2021 Est Completion Late 2023).
- Nutrient Water Quality Training - Supporting the IRRWB's Nutrient Management Strategy

through Workshops and Technical Assistance in the Red River Basin (Accepted Feb 26, 2021- ongoing).
- Phase I - Building the foundations for Indigenous collaboration in the International Red River Basin (Funded Sept 2021).

The following are projects in development.

- Habitat Mapping
  - Complements AEC fish movement study and the Instream Flow Needs study (Completing in 2023)
- Review & Update Water Quality Objectives at the Border
- N-RFC CoCoRaHS Kits for Indigenous Collaboration
  - 2 IWI Phases: Purchasing; Distribution and Education
  - Collateral support from SWCD, N-FRC, Others
- Focus on Ecosystem Integrity: WQC - Assess nutrient metrics relative to biological measures –
  - Expand data set through monitoring (phytoplankton, periphyton, and others)

The following IWI project was approved in July 2024

- Indigenous Collaboration – Phase II

The following IWI Projects were completed recently:

- Indigenous Collaboration Phase I
- Water Quality Trend Analysis

With the leadership of IJC liaisons, several other projects have been identified at the January 2023 Board meeting in Winnipeg as potential IWI projects.

Appendices for International Red River Watershed Board's 2023 Annual Report

Appendix A

Directive to the International Red River Watershed Board (2022)

DIRECTIVE TO THE
INTERNATIONAL RED RIVER WATERSHED (May 26, 2022)

History of Directive

Pursuant to the Boundary Waters Treaty of 1909, wherein Canada and the United States agree to certain provisions including regarding the maintenance of navigation, water levels, flows, and water quality of boundary waters, 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.

The directive from the International Joint Commission dated February 7th 2001 consolidated the functions of two former boards created pursuant to the above responsibilities, the International Red River Pollution Board and the International Souris-Red Rivers Engineering Board, into one board, known as the International Red River Board (IRRB). This Directive replaces the February 7th 2001 directive given that on [date] the International Joint Commission designated the IRRB an International Watershed Board, which shall now be named the International Red River Watershed Board (IRRWB), requiring it to operate pursuant to International Watershed Initiative principles and approaches.

Definitions

"Aquatic Ecosystem of the Red River Basin" means the structure, function and interacting components of water, land, air, and living organisms that relate to the Water Resources of the Red River Basin.

"Aquatic Ecosystem Integrity" means that the Aquatic Ecosystem of the Red River Basin can support and maintain a community of organisms that has species composition, diversity, functional organization, supporting processes, and rates of change comparable to those of natural habitats within the Red River Basin.

"Red River Basin" means the Red River excluding the Assiniboine and Souris Rivers.

"Water Resources of the Red River Basin" means the Red River and any order tributary to the Red River including deltas, tributaries of deltas, wetlands, and lakes which contribute water to the Red River, whether in liquid or frozen state and includes groundwater and aquifers.

Objective

The objective of the IRRWB is to support the Aquatic Ecosystem Integrity of the Red River Basin pursuant to this Directive.

Direction

The IRRWB operates under the authority of the Commission as set out in this Directive.

Commission's direction to the IRRWB is to achieve the Objective by assisting the Commission in preventing and resolving disputes relating to the Aquatic Ecosystem of the Red River Basin through implementation of its responsibilities under this Directive in accordance with the seven operating principles of an International Watershed Board (attached as Schedule A).

Responsibilities

To fulfil this Directive, the IRRWB shall:

1. Focus on all aspects of Aquatic Ecosystem Integrity which includes but is not limited to ground and surface water quality, quantity, levels, flows, and biological elements.
2. Maintain an awareness of current and emerging land use and development and socio-economic activities and conditions and the potential or existing impact of these activities and conditions on the Aquatic Ecosystem Integrity of the Red River Basin, including through maintaining an awareness of the activities of other governments (federal, provincial, state, municipal and/or Indigenous as relevant) and their agencies and institutions;
3. Provide a continuing and inclusive forum for the identification, discussion and resolution of relevant existing and emerging issues, science and traditional knowledge, and the sharing of information and best practices;
4. Develop an approach, maintain and report on the state of the Aquatic Ecosystem of the Red River Basin;
5. Recommend to the Commission objectives for Aquatic Ecosystem Integrity, including objectives related to the watershed and the component parts of the Red River Basin, and where objectives have been agreed to by governments of the Red River Basin:
    - Maintain continuing surveillance and perform inspections, evaluations and assessments, as necessary, to determine compliance with the objectives;
    - Encourage the responsible governments (federal, provincial, state, municipal and/or Indigenous as relevant), including their regulatory and enforcement agencies and the Commission to take steps to ensure that the objectives are met;
    - Review and update if necessary the objectives every five years or more frequently if circumstance so require;
    - Report yearly to the Commission on this provision, unless circumstances require more frequent reporting.
6. Encourage the responsible governments (federal, provincial, state, municipal and/or Indigenous as relevant) and their appropriate authorities, such as resource and emergency planning agencies, to develop and promote a culture of climate change adaptation and resilience, including flood, drought, and wildfire mitigation, management and preparedness and associated land management and conservation approaches.
7. Develop and promote a culture of climate change adaptation and resilience, including flood, drought, and wildfire mitigation, management and preparedness and associated land management and conservation approaches, and their effects on the Aquatic Ecosystem by:

- Monitoring and reporting on the adequacy of mitigation, management and preparedness activities, procedures, data and information collection networks, and warnings;
- Encouraging and facilitating adaptive management and the development, maintenance and sharing of collaborative and innovative data and information systems and forecasting and hydrodynamic techniques, mapping and models;
- Encouraging governments to develop improved procedures for emergency warnings and to improve communication of emergency forecasts;
- Interacting with all levels of government to help decision-makers become aware of these issues;
- Monitor potential effects of flood, drought, and wildfire mitigation, management and preparedness and associated land management and conservation approaches and other works in the Red River Basin, and encourage cooperative studies necessary to examine these effects;

8. Encourage governments to establish and maintain contingency plans, including early warning and coordination procedures, for appropriate reporting and action on emergency matters that may impact Aquatic Ecosystem Integrity including accidental discharges or spills, floods, droughts and wildfires and associated land management and conservation approaches.
9. Monitor and report on progress by relevant governments (federal, provincial, state, municipal and/or Indigenous as relevant) in implementing the IRRWB and Commission recommendations;
10. Involve the public in the work of the IRRWB, facilitate provision of timely, pertinent, and public-friendly (in terms of readability and accessibility) information and knowledge translation in the most appropriate manner including electronic information networks, and conduct an annual public meeting.

Accountability and Reporting

The IRRWB is accountable to the Commission and therefore shall:

1. Provide an annual report to the Commission on the state of the Red River Basin, progress made towards fulfillment of the Objective and the responsibilities set out in this Directive, plus other reports as the Commission may request or the IRRWB may feel appropriate in keeping with this Directive;
2. Provide a tri-annual assessment of progress to the Commission evaluating the effectiveness in achieving the Objective and any recommendations to improve effectiveness;
3. Ensure adequate opportunities are provided for the public to comment on the IRRWB's activities including on the adequacy of progress towards the Objective and effectiveness of fulfilment of this Directive;
4. Inform the Commission, in advance, of plans for any public meetings or public involvement in the IRRWB deliberations. The IRRWB shall report, in a timely manner, to the Commission on these meetings, including the representations made;
5. Provide the text of media releases and other public information materials to the Secretaries of the Commission for review and approval by the Commission's Public Information Officers, prior to their release;

6. Inform the Commission of any developments or cost impediments, actual or anticipated, which are likely to affect fulfilment of the IRRWB's responsibilities or attainment of the objective of this Directive, and provide the IRRWB's proposed plan to address fulfilment of its responsibilities under the circumstances.

Membership

1. The IRRWB shall have an equal number of members from each country.
2. The IRRWB shall be comprised of members representing a wide range, if not all interests in the Red River Basin to include, but not limited to, Indigenous, conservation, and municipal members.
3. The Commission shall normally appoint each member for a three-year term. Members may serve for more than one term.
4. Members shall act in their personal and professional capacity to uphold and achieve the objective and fulfil this Directive, and not as representatives of their countries, agencies, institutions or communities.
5. The Commission shall appoint one member from each country to serve as co-chairs of the IRRWB.
6. 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. An alternate member may not act as a co-chair.
7. The co-chairs of the IRRWB shall be responsible for maintaining proper liaison between the IRRWB and the Commission, and among the IRRWB members. Chairs shall ensure that all members of the IRRWB are informed of all instructions, inquiries, and authorizations received from the Commission and also of activities undertaken by or on behalf of the IRRWB, progress made, and any developments affecting such progress.
8. Each chair, after consulting the members of the IRRWB, 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 as decided by the IRRWB.
9. The IRRWB may establish such committees and working groups as may be required to discharge its responsibilities effectively. All committees established by the IRRWB must be established in accordance with the terms of this Directive and operate according to Terms of Reference approved by the Commission. The Commission shall be kept informed of the duties and composition of any committee or working group.

Meetings, Management and Administration

1. The IRRWB shall conduct its work by consensus as per the Commission's Guidance on Board Consensus Document dated March 20, 2020.
2. In the event of any unresolved disagreement among the members of the IRRWB, the IRRWB shall refer the matter forthwith to the Commission for decision.
3. If, in the opinion of the IRRWB 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 timely and appropriate action shall be promptly communicated to the IRRWB.

4. Ordinarily, members of the IRRWB, committees, or working groups will make their own arrangements for reimbursement of necessary expenditures.
5. Reports, including annual reports, and correspondence of the IRRWB shall, normally, remain privileged and be available only to the Commission and to members of the IRRWB and its committees until their release has been authorized by the Commission.

Duration of Directive

1. This Directive continues until amended or discontinued by the Commission.
2. The Commission may amend this Directive and/or existing instructions or issue a new Directive and/or instructions to the IRRWB at any time.

Appendix B

Water Quality Monitoring at the International Boundary - ECCC

Water Quality Objectives and Water Quality Alert Levels

7.0 WATER QUALITY MONITORING AT THE INTERNATIONAL BOUNDARY

Monitoring the water quality of the Red River at the Canada-US boundary is conducted by Environment & Climate Change Canada (ECCC). ECCC maintains a permanent water quality station on the Red River at Emerson, Manitoba. Monitoring of the Red River takes place monthly during the ice cover season, weekly during the open water season, and twice weekly during the spring freshet or other periods of flood. The water quality data for the 2022-2023 water year, included in this report, are based on instantaneous grab samples collected between October 1st, 2022 - September 30th, 2023.

These collected water quality data are used to determine compliance with the binational water quality objectives, nutrient objectives and targets, and alert levels at the international 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.

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

Water quality monitoring on the Red River at the Canada-US boundary by Environment & Climate Change Canada.

7.1 Water Quality Objectives

The IJC recommended the establishment of water quality objectives for a limited number of variables at the International Boundary in April 1968, and the recommendation was approved by governments in May 1969. These variables with binational objectives included dissolved oxygen, total dissolved solids, chloride, sulphate, and fecal coliform bacteria. *E. coli* replaced fecal coliform as a water quality objective in October 2010.

Several exceedances of binational water quality objectives were observed during the 2022-2023 water year, as summarized in Table 1. Additional detail on each parameter is provided.

Table 1 International Red River Board Water Quality Objectives
Summary of Exceedances Red River at the International Boundary
Oct 1 2022 to Sept 30 2023 Water Year

Parameter	Objective	Exceedances		
		Number (total # samples)	% samples exceeding	Maximum (Date)
Dissolved Oxygen	>5 mg/L	0 (44)	0%	6.13 ** (Jun 28)
Total Dissolved Solids	500 mg/L	28 (44)	64%	700 (Jul 13th)
Chloride	100 mg/L	0 (44)	0%	65.5 (Oct 20th)
Sulphate	250 mg/L	3 (44)	7%	263 (Jul 13th)
E. coli	<200 colonies /100 ml	0 (13)	0%	160 (Apr 24th)

***Minimum value for Dissolved Oxygen*

Dissolved Oxygen
Observed levels of *dissolved oxygen* did not fall below the objective of 5 mg/L during the 2022-2023 water year. The minimum observed value was 6.13 mg/L on June 28th, 2023. Minimums often occur in summer, when discharge increases following significant rain events.

Total Dissolved Solids
Total Dissolved Solids (TDS) exceeded the objective of 500 mg/L in 64% of samples (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. The highest observed value of TDS was 700 mg/L on July 13th, 2023.

Chloride
Observed levels of *chloride* did not exceed the objective (100 mg/L) during this reporting period. The maximum concentration was 65.5 mg/L on October 20th, 2022. In recent years, chloride has occasionally exceeded the objective at low frequencies.

Sulphate
S*ulphate* exceeded the objective of 250 mg/L in 7% of samples during the 2022-2023 water year (Figure 5). Sulphate exceedances have been common over the last number of years: often exceeding the objective even more frequently than during this reporting period. The maximum value measured was 263 mg/L on July 13th, 2022.

E. coli

The bacteriological characteristics of the Red River are assessed on the basis of observed *Escherichia coli* bacteria. The presence of *E. coli* in water is an indicator of impacts via human and/or animal wastes. During the 2022-2023 water year, *E. coli* bacteria counts did not exceed the objective of 200 colony forming units per 100 mL.

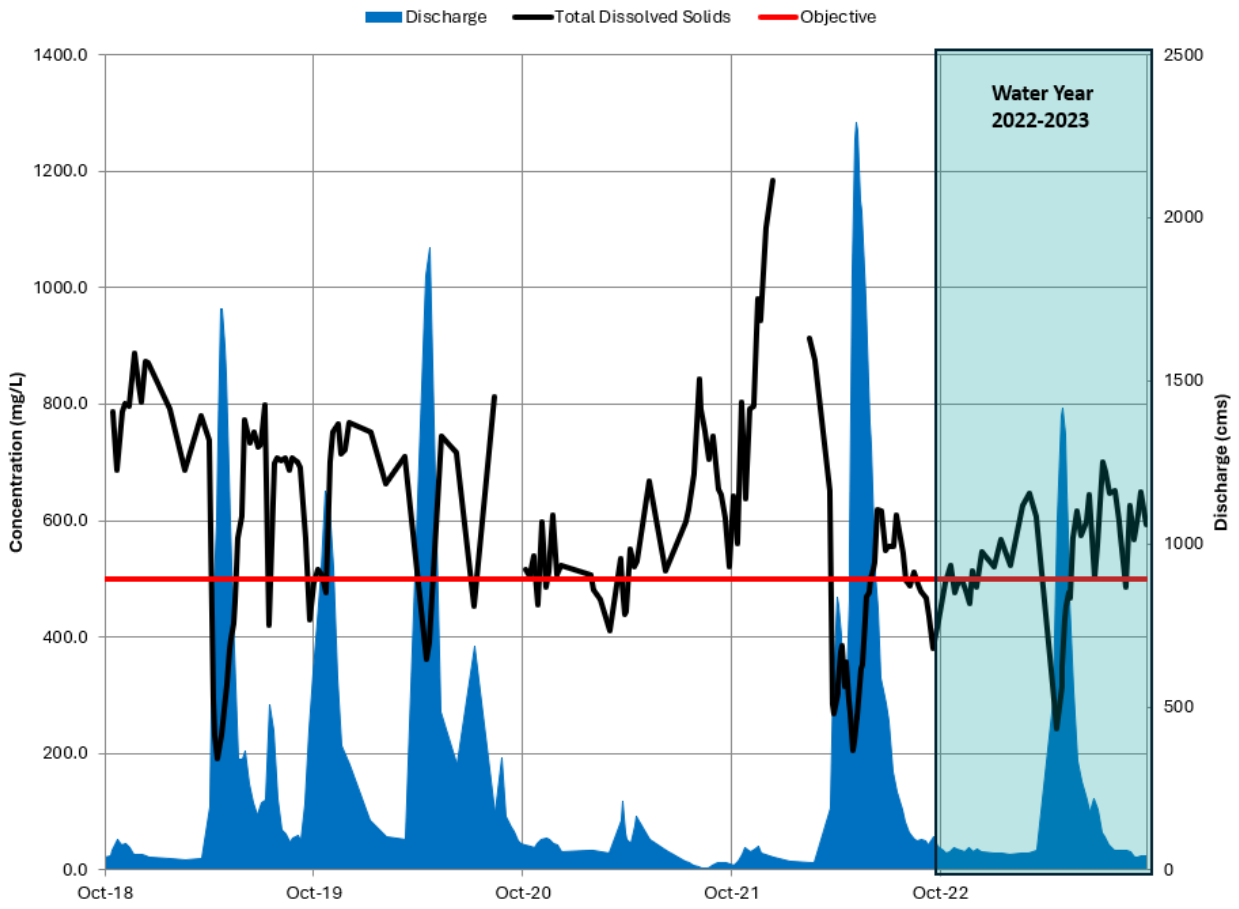


Figure 1: Total Dissolved Solids (TDS) - Red River at the International Boundary

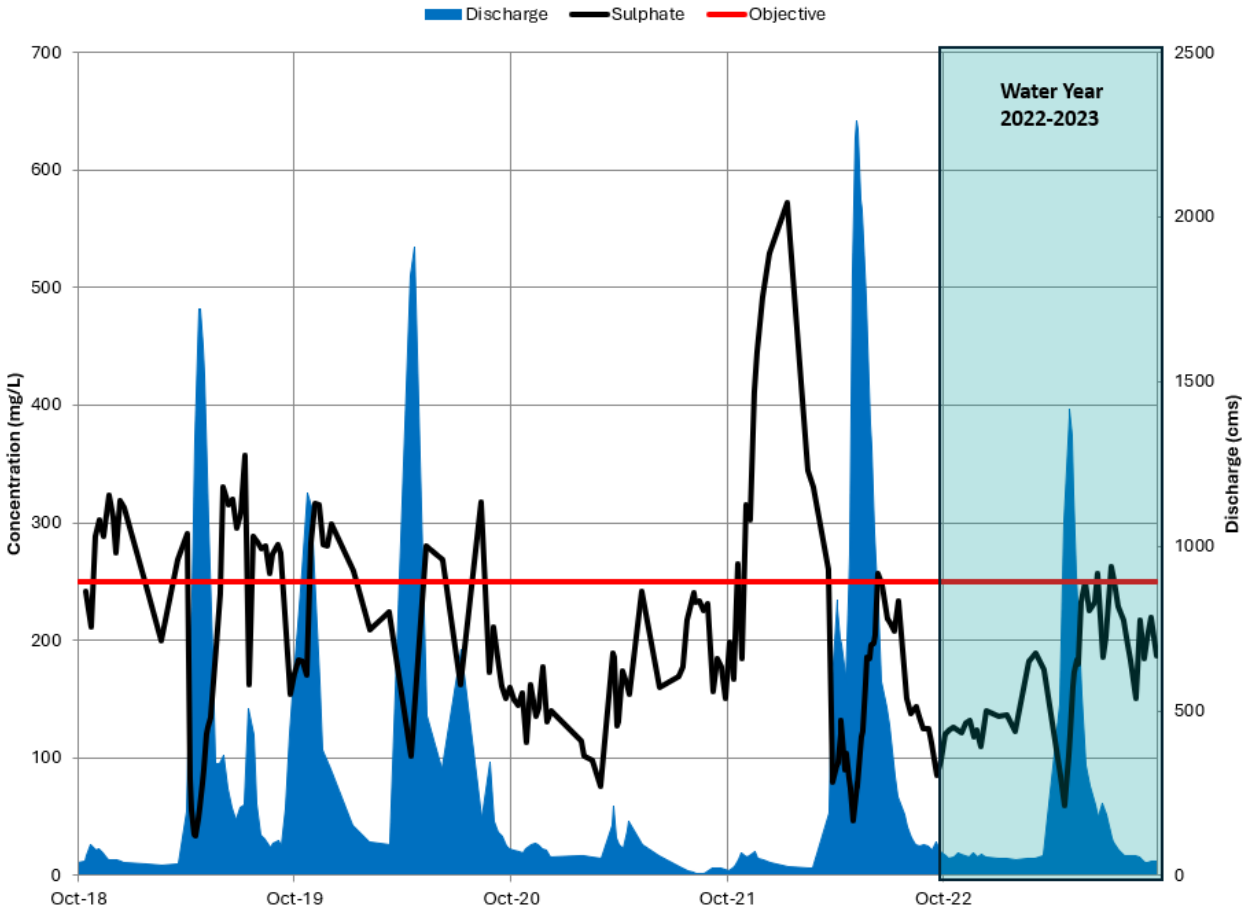


Figure 2: Sulphate Levels – Red River at the International Boundary

7.2 Water Quality Objectives and Targets for Phosphorus and Nitrogen

In May 2020, the IJC recommended the adoption of nutrient objectives and targets at the International Boundary, and in October 2022, the recommendation was approved by governments. The parameters total nitrogen and total phosphorus are each evaluated against ***concentration objectives*** as well as ***loading targets***. Nutrient concentrations and nutrient loads are reported in Table 3.

Table 3 Nutrient Concentrations and Loads, Red River at International Boundary

Parameter	Nutrient Concentration Objective	2023 Open Water Season Mean Concentration	Meets or Exceeds
Total Phosphorus	0.15 (mg/L)	0.37	Exceeds
Total Nitrogen	1.15 (mg/L)	2.29	Exceeds
Parameter	**Nutrient Load Target**	**2018-2022 Average Load**	**Meets or Exceeds**
Total Phosphorus	1400 (tonnes / year)	2,952	Exceeds
Total Nitrogen	9,525 (tonnes / year)	16,204	Exceeds

Nutrient Concentration Objectives

An open water season mean concentration is calculated as the average concentration in all samples collected between April 1st and October 30th in a given year. The open water season mean is compared against the concentration objective to determine compliance.

Total Phosphorus

The Apr-Oct mean total phosphorus concentration for the 2023 open water season was 0.37 mg/L, which exceeded the objective of 0.15 mg/L (Figure 3). Total phosphorus has consistently exceeded the concentration objective value for several decades.

Total Nitrogen

The Apr-Oct mean total nitrogen concentration for the 2023 open water season was 2.29 mg/L, which significantly exceeded the proposed objective of 1.15 mg/L (Figure 4). Total nitrogen has consistently exceeded the concentration objective value for several decades.

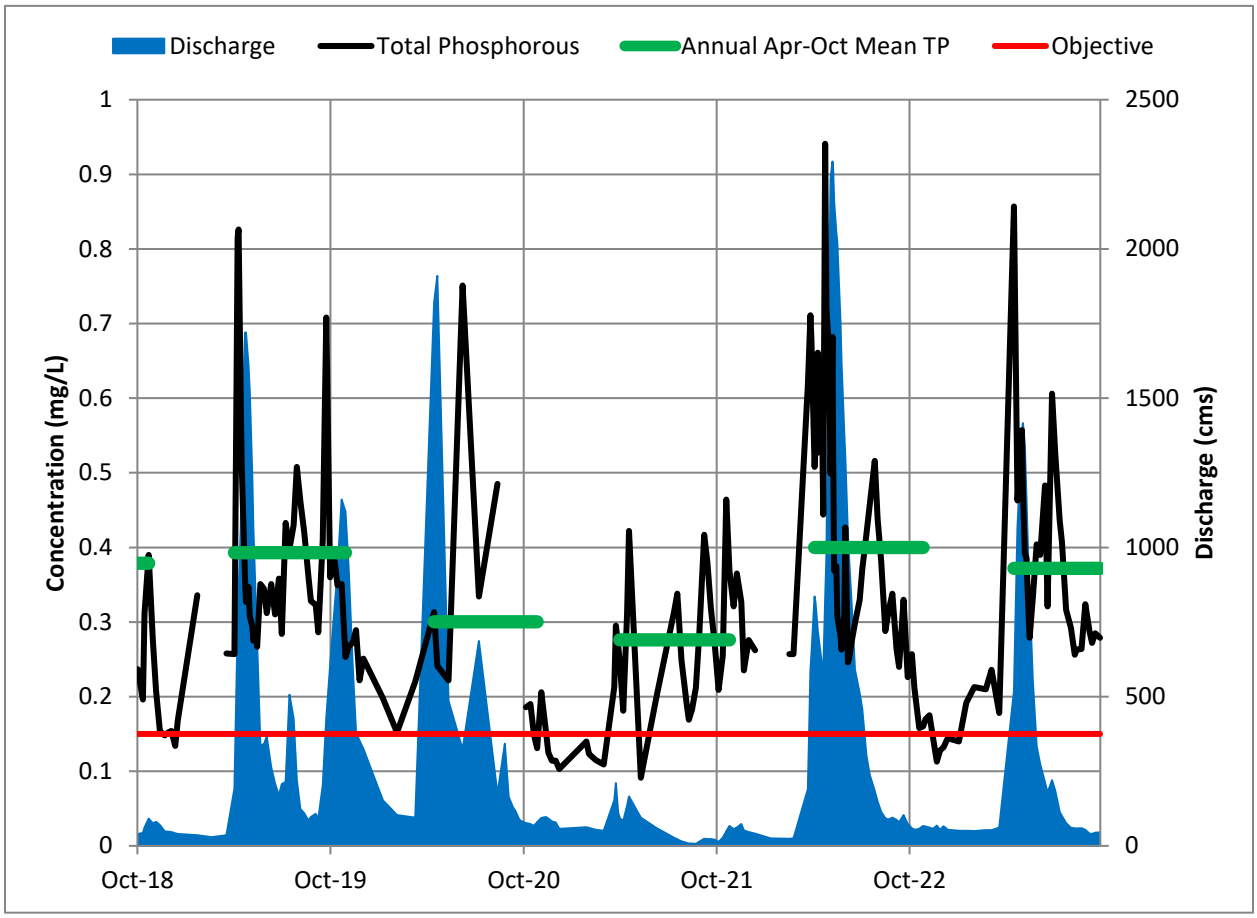


Figure 3: Total Phosphorus Concentrations – Red River at the International Boundary

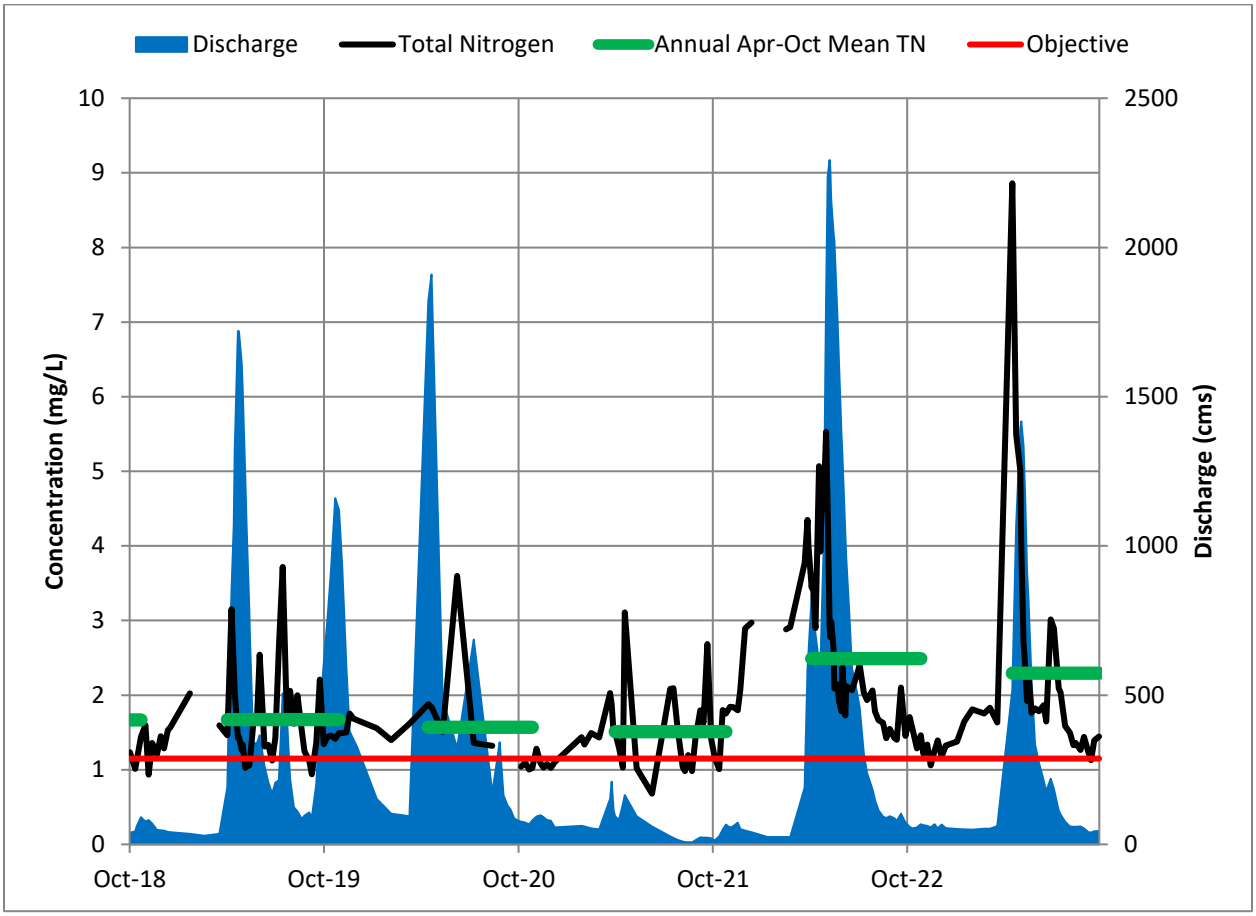


Figure 4: Total Nitrogen Concentrations – Red River at the International Boundary

Nutrient Loading Targets

Nutrient loads are calculated by calendar year based on concentrations and river flows. The nutrient loading target is applied to the five-year rolling average load to determine compliance.

Total Phosphorus

The total phosphorus load for the five-year period ending in 2022 was 2,952 tonnes per year, exceeding the loading target of 1,400 tonnes per year. Phosphorus loads have consistently exceeded the target for several decades, and the 2022 phosphorus load was one of the highest on record.

Total Nitrogen

The total nitrogen load for the five-year period ending in 2022 was 16,204 tonnes per year, exceeding the loading target of 9,525 tonnes per year. Nitrogen loads have consistently exceeded the target for several decades, and the 2022 nitrogen load was one of the highest on record.

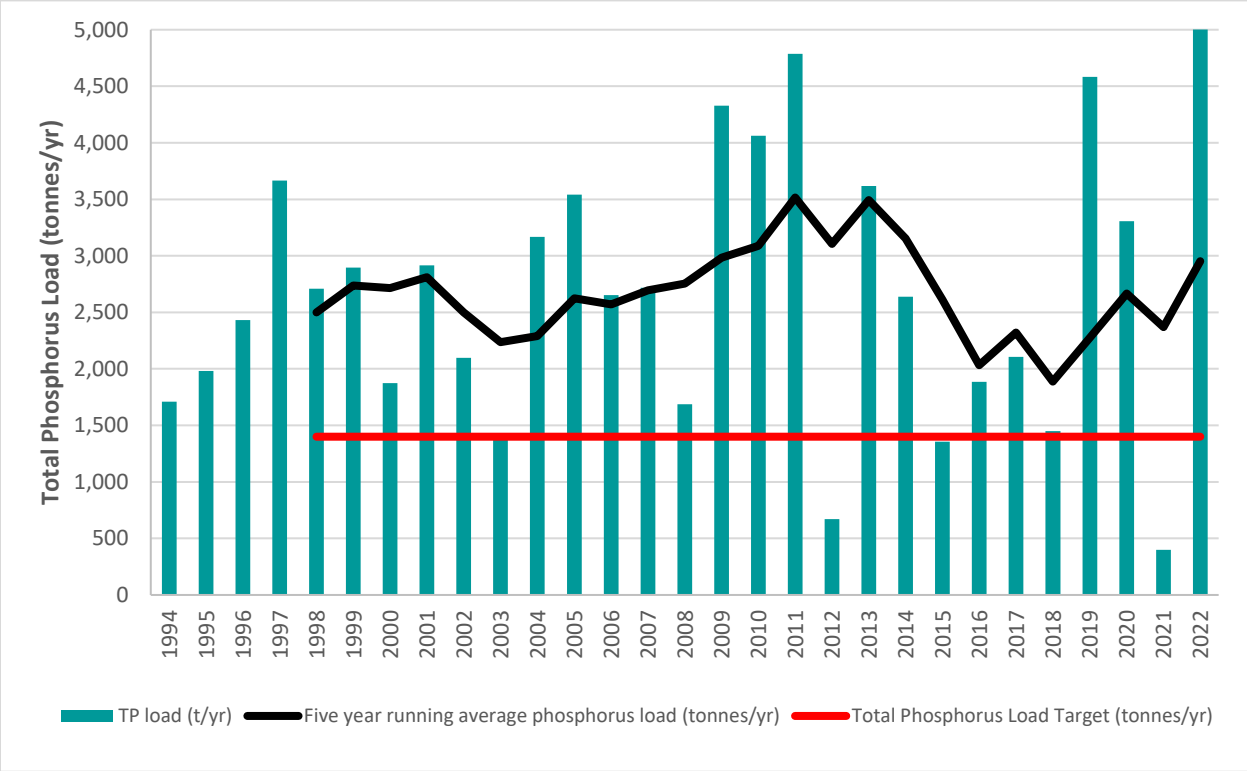


Figure 5: Total Phosphorus Loads – Red River at the International Boundary

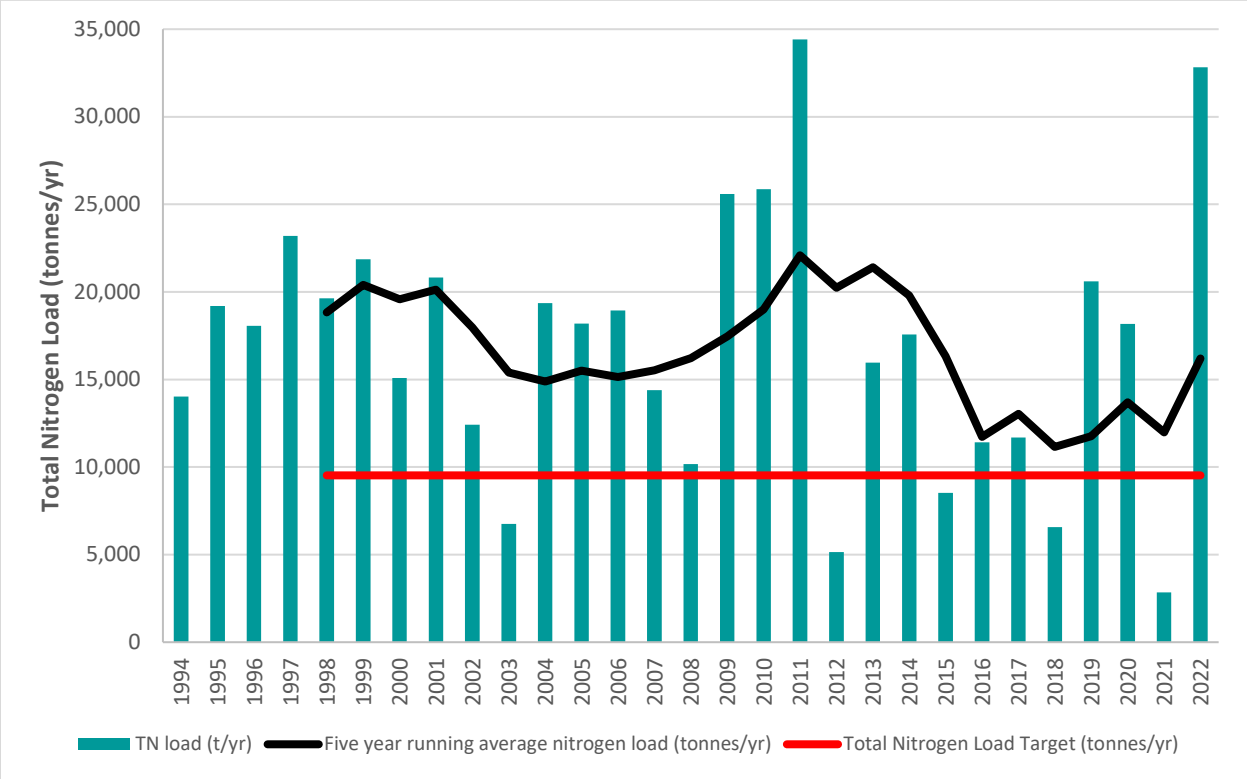


Figure 6: Total Nitrogen Loads – Red River at the International Boundary

APPENDIX B – Water Quality 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 & Climate Change Canada (Water Quality Monitoring and Surveillance Division) during the reporting period (Table B1).

Metals

A total of 53 water samples were collected and analyzed for metals and toxic substances during the reporting period (Table B1). Four metals were detected in exceedance of alert levels. Cadmium, manganese and iron each had exceedance rates of 75-100%, with maximum values detected in April to June 2023. 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. The exceedance rates seen this water year are consistent with rates in recent years for these metals.

Zinc exceeded the alert level in one sample. The toxic substance arsenic also exceeded the alert level in one sample. Until recently, arsenic exceedances were rare, but a single arsenic exceedance has been observed in each of the last four water years.

Table B1 Exceedances of Alert Levels, Red River at International Boundary

October 1, 2022 to September 30, 2023

Parameter	Units	Alert Level	Number of Samples	Number of Exceedences %	Maximum Exceedence Value (Month)	Canadian Environmental Quality Guideline
Metals (total):						
Cadmium	µg/L	Detect	44	**44 (100%)**	0.748 (Apr)	0.37ug/L[1]
Chromium	µg/L	50	44	0	--	NG
Iron	µg/L	300	44	**33 (75%)**	10700 (Jun)	300 ug/l[1]
Manganese	µg/L	50	44	**36 (82%)**	1180 (Apr)	200 ug/L[2]
Selenium	µg/L	10	44	0	--	1 ug/l[1]
Zinc	µg/L	47	44	1 (2%)	56.3 (Apr)	30 ug/l[1]
Toxic Substances:						
Arsenic	µg/L	10	44	1 (2%)	10.2 (Jun)	5 ug/l[1]
Boron	µg/L	500	44	0	--	29 mg/l[1]
Total PCB	ng/L	Detect	--	--	--	NG
Pesticides:						
2,4-D	ng/L	Detect	18	**18 (100%)**	260 (Apr)	4000 ng/l[1]
Bromoxynil	ng/L	Detect	18	**12 (67%)**	69.9 (Jul)	5000 ng/l[1]
Clopyralid	ng/L	Detect	18	**10 (56%)**	94 (Jul)	NG[5]
Dicamba	ng/L	Detect	18	**13 (72%)**	898 (Jul)	10000 ng/l[1]
Imazamethabenz-methyl a	ng/L	Detect	18	**2 (11%)**	2.82 (Apr)	NG
Imazamethabenz-methyl b	ng/L	Detect	0	--	--	NG
MCPA	ng/L	Detect	18	**18 (100%)**	23.6 (Jul)	2600 ng/l[1]
Mecoprop (MCPP)	ng/L	Detect	18	**17 (94%)**	26.2 (Dec)	NG
Picloram	ng/L	Detect	18	**3 (17%)**	47.8 (Jul)	29000 ng/l[1]
Aldrin	ng/L	Detect	0	--	--	NG
g-Benzenehexachloride	ng/L	Detect	18	0	--	10 ug/l[1]
Pentachloroanisole	ng/L	Detect	0	--	--	NG
Atrazine	ng/L	Detect	18	**18 (100%)**	857 (Jul)	1800 ng/l[1]
Desethyl Atrazine	ng/L	Detect	18	**18 (100%)**	114 (Jul)	NG
Metolachlor	ng/L	Detect	18	**18 (100%)**	1680 (Jul)	7800 ng/l[1]
P,P-DDE	ng/L	Detect	18	0	--	NG
Alpha-Endosulfan	ng/L	Detect	18	0	--	3 ng/l[1,4]
Beta-Endosulfan	ng/L	Detect	18	0	--	3 ng/l[1,4]
Heptachlor Epoxide	ng/L	Detect	0	--	--	NG
Metribuzin	ng/L	Detect	18	**13 (72%)**	82.3 (Jul)	1000 ng/l[1]

Notes:

1. Canadian Water Quality Guidelines for the Protection of Aquatic Life (http://st-ts. ccme. ca/)
2. Canadian Water Quality Guidelines for the Protection of Agriculture (http://st-ts. ccme. ca/)
3. Guideline value corrected for minimum value for hardness (mg/L 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

Pesticides

Based on a total of up to 18 water samples, 12 pesticides and metabolites with alert levels (greater than detection concentration) were monitored during the 2022-2023 water year (Table B1). Five compounds (2,4-D, Atrazine, Desethyl Atrazine, MCPA, and Metolachlor) were detected in 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 analyses have been expanded to include a broader range of pesticides. These include insecticides (neonicotinoids), herbicides (sulfonyl ureas) and fungicides (including carbamates) pesticides. In 2022-23, detections included 9 of 14 insecticides, 10 of 17 herbicides and 15 of 21 fungicides. The pesticides with the highest frequency of detection are summarized in Table B2.

The IRRWB 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 IRRWB 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.

APPENDIX C

Jurisdictional Monitoring in the Red River Basin in 2022

C-1 Manitoba

2024
MANITOBA STATUS REPORT
TO
THE INTERNATIONAL RED RIVER WATERSHED BOARD (IRRWB)
FOR THE
WATER YEAR OCTOBER 1, 2022 TO SEPTEMBER 30, 2023

1. Surface Water Quality Monitoring Program

During the 2022-2023 water year, Manitoba Environment and Climate Change continued its routine long-term monitoring of surface water quality within the Red River watershed. Sampling was conducted on a monthly frequency at three sites along the main stem of the Red River within Manitoba. These sites were located at Emerson, MB; upstream of the City of Winnipeg at the Floodway inlet control structure at St. Norbert, MB; and downstream of the City of Winnipeg at Selkirk, MB (Figure 1). Additionally, joint federal/provincial paired samples were collected at the Selkirk monitoring location 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, trace elements, nutrients, and agricultural chemicals. Long-term water quality parameters monitored by Manitoba Environment and Climate Change are shown in Table 1. Benthic macroinvertebrates were also collected from the Red River at Emerson and Selkirk in September 2023.

As part of its regular Red River watershed monitoring, Manitoba Environment and Climate Change also conducted routine monitoring at nine sites on seven tributary streams to the Red River (Figure 1) during the 2022-2023 water year. Tributary sites are typically monitored on a quarterly basis (October, December/January, April, and July) throughout the water year. Tributary samples were analyzed for a wide range of variables including physical parameters, general chemistry, suspended sediment, bacteria, trace elements, nutrients, and agricultural chemicals. Long-term monitoring of tributary streams allows Manitoba Environment and Climate Change 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.

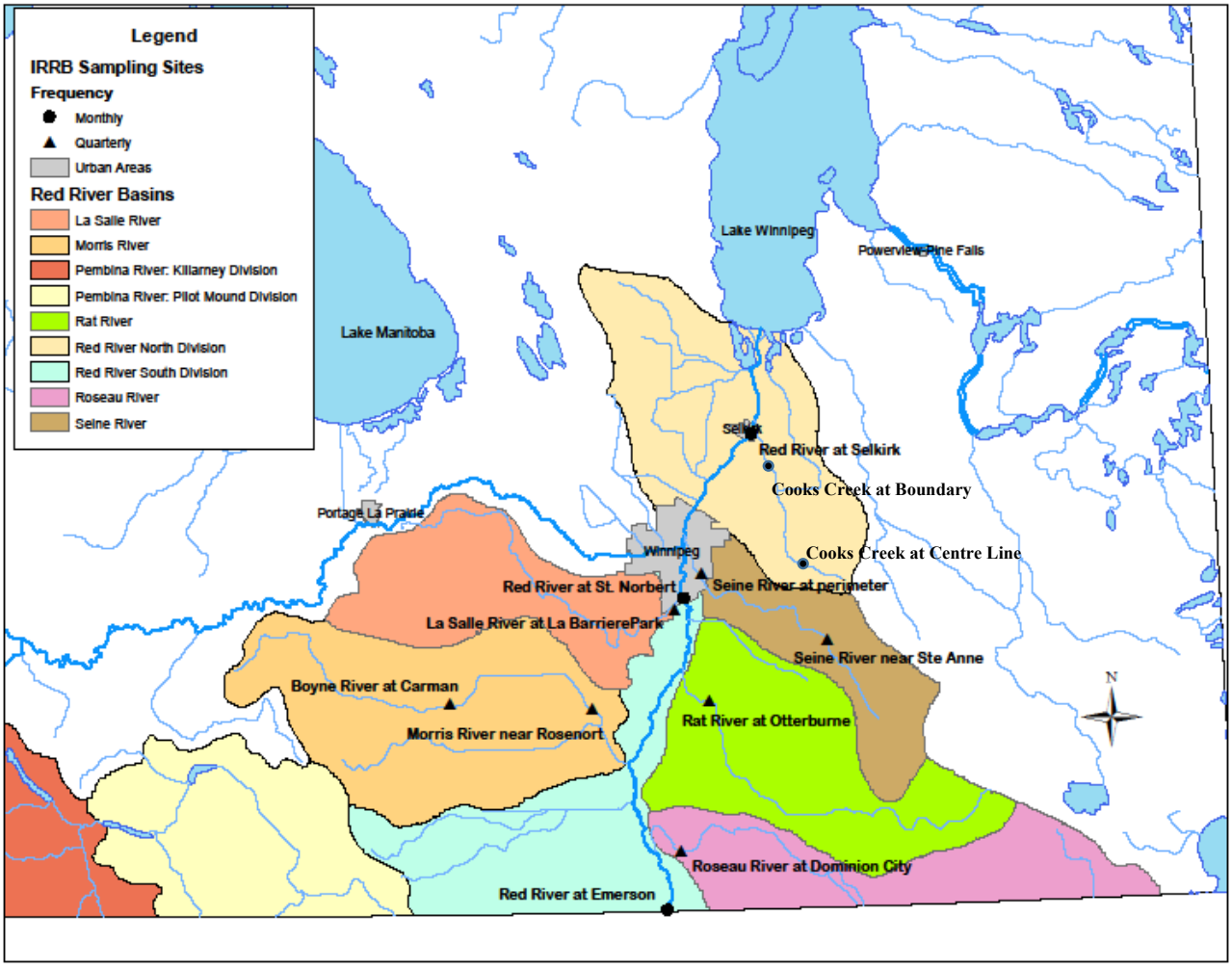


Figure 1. Location of water quality and benthic macroinvertebrate sampling sites in the Red River watershed (Manitoba). Benthic macroinvertebrates are collected once per year from the Red River at Emerson, MB and Selkirk, MB sites.

Table 1. Routine surface water quality parameters monitored by Manitoba Environment and Climate Change on the Red River and tributary sites within Manitoba, Canada.

Parameter	MDL [1]	Units
Physical		
Colour, True	5	CU
Turbidity	0.1	NTU
Temperature		°C
Total Suspended Solids	1	mg/L
Total Dissolved Solids	4	mg/L
Specific Conductivity	1	umhos/cm
Biological		
Escherichia coli (*E. coli*)	1	MPN/100 mL
Chemical		
General Chemistry		
pH	0.1	pH units
Hardness (as CaCO3)	0.2	mg/L
Dissolved Oxygen	0.1	mg/L
Biochemical Oxygen Demand	1	mg/L
Total Alkalinity (as CaCO3)	1	mg/L
Carbonate (CO3)	0.6	mg/L
Bicarbonate (HCO3)	1.2	mg/L
Hydroxide (OH)	0.34	mg/L
Chloride (Cl)	0.1	mg/L
Sulfate (SO4)	0.3	mg/L
Total Carbon	1	mg/L
Total Inorganic Carbon	0.5	mg/L
Total Organic Carbon	0.5	mg/L
Chlorophyll a	0.1	ug/L
Phaeophytin a	0.1	ug/L
Anion Sum	0.1	
Cation Sum	0.1	
Cation - Anion Balance	-100	
Nutrients		
Total Ammonia (as N)	0.01	mg/L
Total Nitrogen	0.2	mg/L
Total Kjeldahl Nitrogen	0.2	mg/L
Nitrate and Nitrite (as N)	0.005	mg/L
Nitrite (as N)	0.001	mg/L
Nitrate (as N)	0.005	mg/L
Total Phosphorus	0.003	mg/L
Total Dissolved Phosphorus	0.003	mg/L
Total Particulate Phosphorus	0.0042	mg/L
Total Inorganic Phosphorus	0.003	mg/L
Total Acid-Hydrolyzable Phosphorus	0.0042	mg/L
Total Reactive Phosphorus	0.003	mg/L

Parameter	MDL [1]	Units
Chemical - cont'd		
Total Metals		
Aluminum	3	ug/L
Antimony	0.1	ug/L
Arsenic	0.1	ug/L
Barium	0.1	ug/L
Beryllium	0.1	ug/L
Bismuth	0.05	ug/L
Boron	10	ug/L
Cadmium	0.005	ug/L
Calcium	50	ug/L
Cesium	0.01	ug/L
Chromium	0.1	ug/L
Chromium Hexavalent	0.5	ug/L
Cobalt	0.1	ug/L
Copper	0.5	ug/L
Iron	10	ug/L
Lead	0.05	ug/L
Lithium	1	ug/L
Magnesium	5	ug/L
Manganese	0.1	ug/L
Molybdenum	0.05	ug/L
Nickel	0.5	ug/L
Potassium	50	ug/L
Rubidium	0.2	ug/L
Selenium	0.05	ug/L
Silicon	100	ug/L
Silver	0.01	ug/L
Sodium	50	ug/L
Strontium	0.2	ug/L
Tellurium	0.2	ug/L
Thallium	0.01	ug/L
Thorium	0.1	ug/L
Tin	0.1	ug/L
Titanium	0.3	ug/L
Tungsten	0.1	ug/L
Uranium	0.01	ug/L
Vanadium	0.5	ug/L
Zinc (Zn)	3	ug/L
Zirconium	0.2	ug/L
Mercury	0.005	ug/L
Dissolved Metals		
Aluminum	1	ug/L

Parameter	MDL [1]	Units
Chemical - cont'd		
Pesticides		
Chlorothalonil	0.05	ug/L
Triclopyr	0.05	ug/L
AMPA	0.5	ug/L
Glyphosate	0.2	ug/L
Pentachlorophenol	0.02	ug/L
2,4-D	0.05	ug/L
2,4-DB	0.05	ug/L
2,4-DP	0.05	ug/L
Bromoxynil	0.02	ug/L
Dinoseb	0.05	ug/L
MCPA	0.025	ug/L
Mecoprop	0.05	ug/L
Picloram	0.2	ug/L
Dicamba	0.006	ug/L
Alachlor	0.1	ug/L
Atrazine	0.1	ug/L
Atrazine-desethyl	0.05	ug/L
Azinphos-methyl	0.1	ug/L
Carbofuran	0.2	ug/L
Chlorpyrifos	0.02	ug/L
Cyanazine	0.1	ug/L
Diazinon	0.03	ug/L
Diclofop-methyl	0.1	ug/L
Dimethoate	0.1	ug/L
Malathion	0.1	ug/L
Methyl Parathion	0.1	ug/L
Metribuzin	0.2	ug/L
Parathion	0.1	ug/L
Simazine	0.1	ug/L
Terbufos	0.1	ug/L
Triallate	0.1	ug/L
Trifluralin	0.03	ug/L
a-chlordane	0.008	ug/L
gamma-hexachlorocyclohexane	0.008	ug/L
g-chlordane	0.008	ug/L
Methoxychlor	0.008	ug/L
Carboxin	0.1	ug/L
Diuron	0.018	ug/L
Eptam	0.2	ug/L
Fenoxaprop	0.1	ug/L
Imazamethabenz-methyl	0.01	ug/L
Metsulfuron-methyl	0.01	ug/L
Propanil	0.2	ug/L
Propoxur	0.2	ug/L
Quizalofop	0.1	ug/L
Sethoxydim	0.1	ug/L
Thifensulfuron-methyl	0.01	ug/L
Tralkoxydim	0.1	ug/L
Benomyl	0.1	ug/L
Deltamethrin	0.04	ug/L
Tribenuron-methyl	0.01	ug/L
Ethalfluralin	0.02	ug/L
Bromacil	0.1	ug/L

[1]: Minimum detection limit of analytical method

1.1 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 for most parameters monitored. In general, dissolved oxygen concentrations in the Red River were sufficient to support aquatic life and were within the historical range with a mean concentration of 8.78 mg/L upstream of the City of Winnipeg at St. Norbert and 9.38 mg/L downstream of the City of Winnipeg at Selkirk (Figure 2). The lowest dissolved oxygen concentrations observed during the current reporting period were 6.1 mg/L in June 2023 at St. Norbert, and 6.5 mg/L in August 2023 at Selkirk. All dissolved oxygen concentrations observed were above the 5.0 mg/L threshold required for the protection of aquatic life (Manitoba Water Quality Standards, Objectives, and Guidelines, 2011).

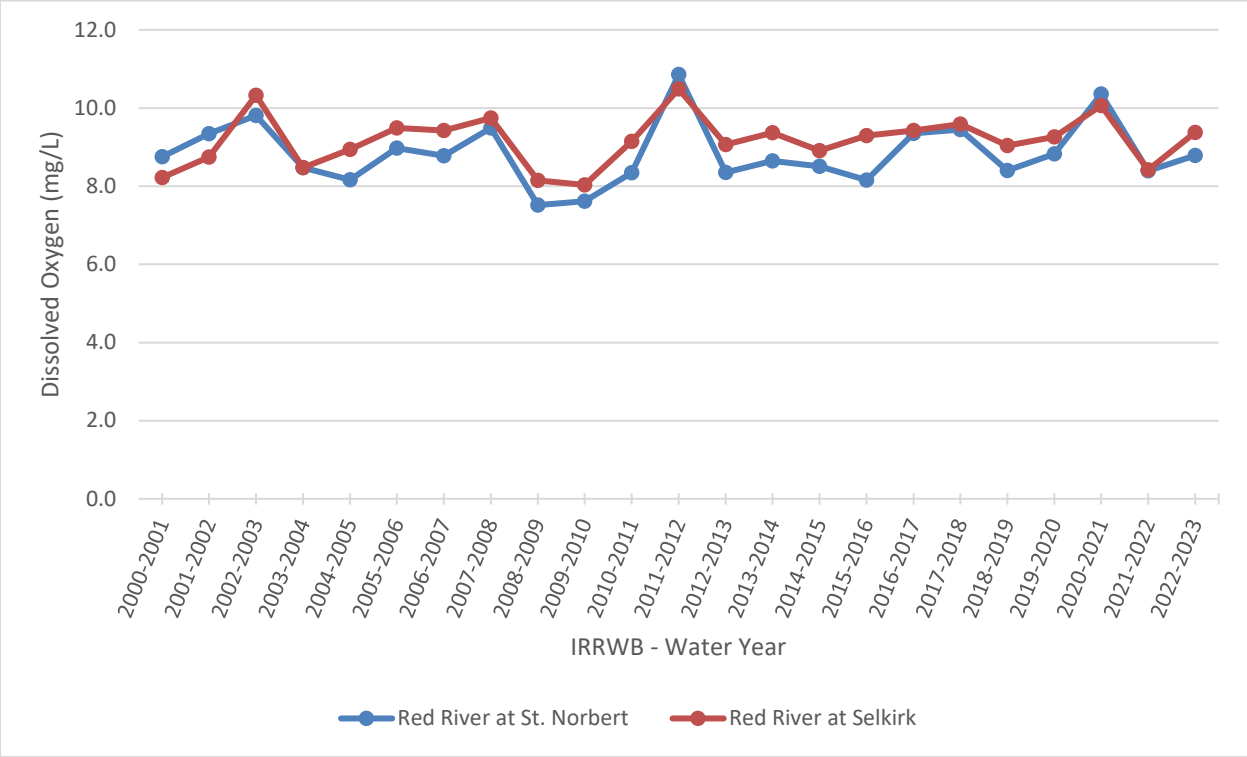


Figure 1: Mean annual (water year) dissolved oxygen (mg/L) for the Red River at St. Norbert and Selkirk, MB from 2000 to 2023.

Densities of *Escherichia coli* (*E. coli*) bacteria observed downstream of the City of Winnipeg at Selkirk during the current water year were similar to levels typically observed throughout the historical record and represent a substantially lower mean density than what was observed the previous reporting period (Figure 3). The mean density downstream of the City of Winnipeg at Selkirk was 238 organisms per 100 mL, compared to 675 organisms per 100 mL during the previous reporting period. Four of the 13 samples collected from this site had measured *E. coli* densities greater than the Manitoba recreational water quality objective of 200 organisms per 100 mL (Manitoba Water Quality Standards, Objectives, and Guidelines, 2011). The maximum *E. coli* density observed at Selkirk was 1,050 organisms per 100 mL during the January 2023 sampling period, while the lowest measurement was observed in May 2023 at 1 organism per 100 mL. All four of the samples with measured densities above the recreational guideline occurred in

the period between November 2022 and April 2023 (7 total samples collected during this period). In contrast, all but one sample collected from the upstream reach of the Red River at St. Norbert were measured below the Manitoba recreational water quality objective, with a mean *E. coli* density of 39 organisms per 100 mL (Figure 3). The maximum *E. coli* density observed at St. Norbert was 214 organisms per 100 mL during the October 2022 sampling period, while the lowest measurements were observed in May 2023 at 2 and 4 organisms per 100 mL.

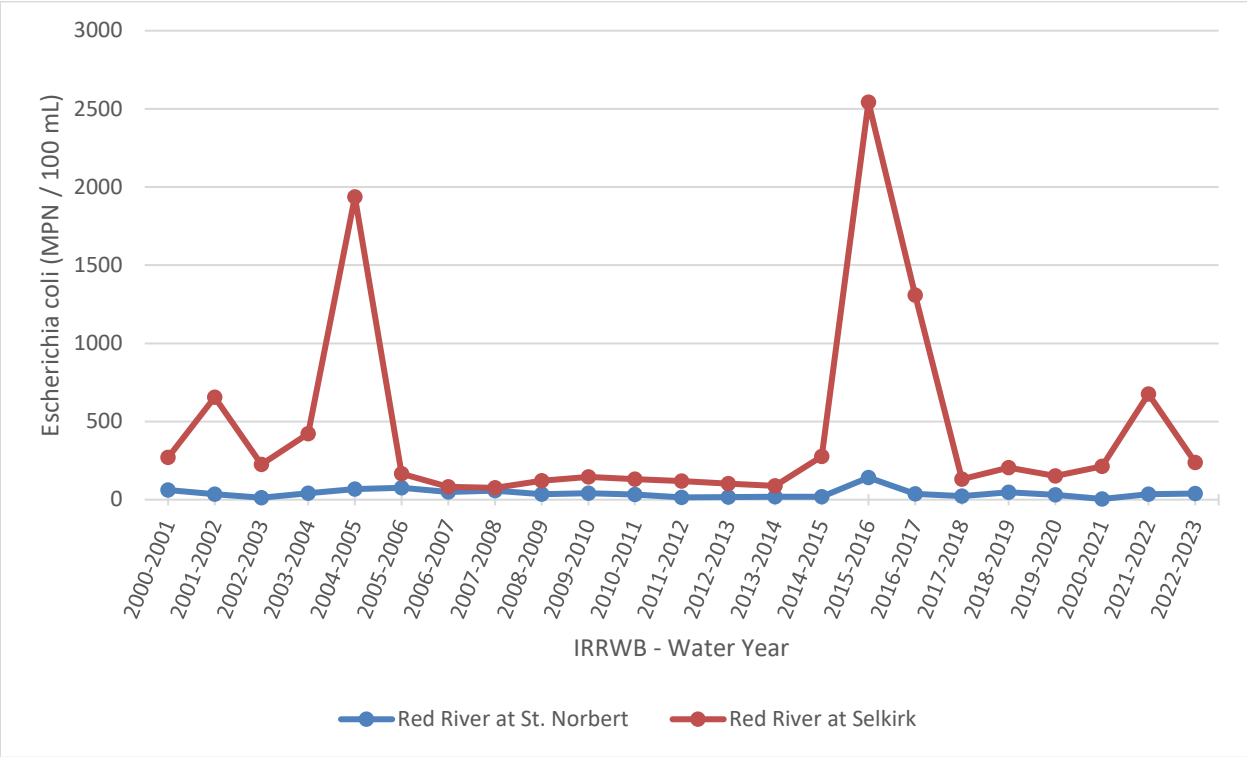


Figure 2: Mean annual (water year) *Escherichia coli* densities (organisms/100 mL) for the Red River at St. Norbert and Selkirk, MB from 2000 to 2023.

During the 2022-2023 water year, concentrations of total chloride, total sulphate and total dissolved solids were similar to previous reporting periods. The mean total chloride concentrations observed were 39.2 mg/L at St. Norbert and 40.3 mg/L at Selkirk (Figure 4). The highest measurements for total chloride were 68.4 mg/L at St. Norbert and 63.8 mg/L at Selkirk. Minimum total chloride concentrations occurred during the May 2022 sampling period at both locations, with 15.8 mg/L and 16.3 mg/L at St. Norbert and Selkirk, respectively. Mean total sulphate concentrations observed were 139.7 mg/L at St. Norbert and 165.7 mg/L at Selkirk (Figure 5). The highest concentration of total sulphate was 241 mg/L at St. Norbert and 245 mg/L at Selkirk, occurring during the July 2023 and August 2023 sampling periods, respectively. Minimum total sulphate concentrations occurred during April 2023 at both locations, with 57.3 mg/L and 72.4 mg/L at St. Norbert and Selkirk, respectively. Like total chloride and total sulphate concentrations, total dissolved solids concentrations were very similar between the two Red River sites, as well as, between the previous water year for each of the respective sites (Figure 6). The mean total dissolved solids concentrations observed were 492 mg/L at St. Norbert and 532 mg/L at Selkirk. The highest measurements for total dissolved solids were 652 mg/L at St. Norbert in August 2023,

and 669 mg/L at Selkirk in December 2022. Minimum total dissolved solids concentrations occurred during the April 2023 period at both locations, with 293 mg/L at St. Norbert and 331 mg/L at Selkirk.

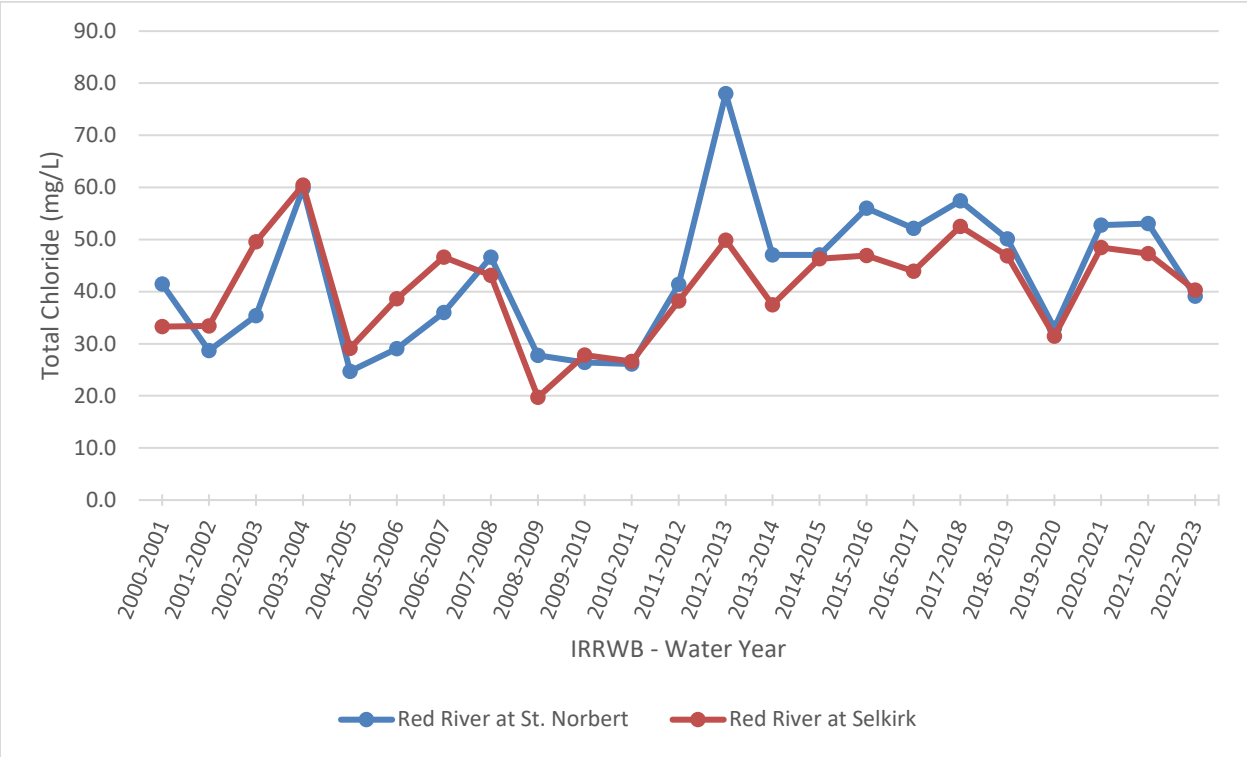


Figure 3: Mean annual (water year) total chloride (mg/L) for the Red River at St. Norbert and Selkirk, MB from 2000 to 2023.

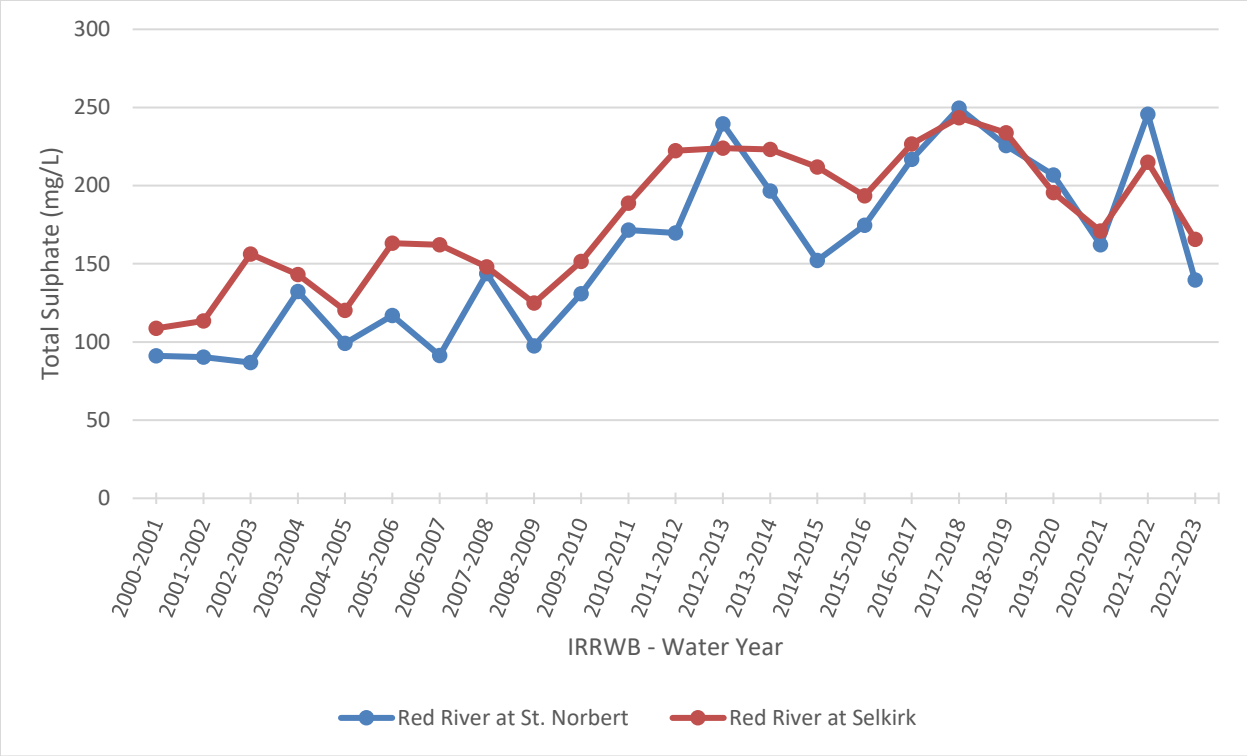


Figure 4: Mean annual (water year) total sulphate (mg/L) for the Red River at St. Norbert and Selkirk, MB from 2000 to 2023.

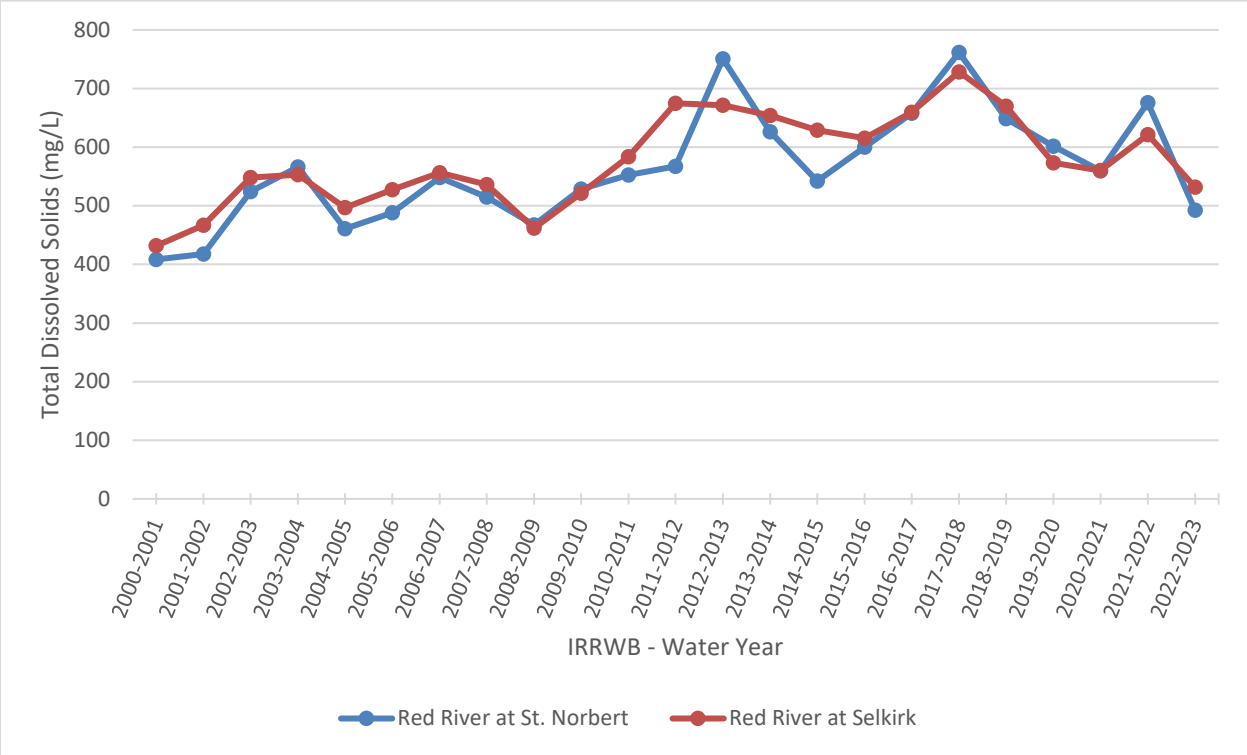


Figure 5: Mean annual (water year) total dissolved solids (mg/L) for the Red River at St. Norbert and Selkirk, MB from 2000 to 2023.

Similar to previous reporting periods, total nutrient concentrations observed along Manitoba's Red River main stem monitoring sites continued to be high during the 2022-2023 water year. Mean concentrations of total phosphorus at St. Norbert and Selkirk were 0.395 and 0.380 mg/L, respectively (Figure 7). Maximum concentrations of total phosphorus were observed during the April 2023 period for both monitoring locations, with observed maximum concentrations of 1.01 mg/L at both St. Norbert and Selkirk. Minimum concentrations of total phosphorus observed at both main stem sites were also relatively high, with 0.142 and 0.176 mg/L measured at St. Norbert and Selkirk, respectively. Mean concentrations of total nitrogen at St. Norbert and Selkirk were 2.73 and 3.08 mg/L, respectively (Figure 8). Similar to the pattern observed with total phosphorous concentrations, maximum concentrations of total nitrogen at both locations were observed during April 2023 period, with 7.72 mg/L at St. Norbert and 6.91 mg/L at Selkirk. Minimum concentrations of total nitrogen observed were 1.08 mg/L and 1.97 mg/L at St. Norbert and Selkirk, respectively.

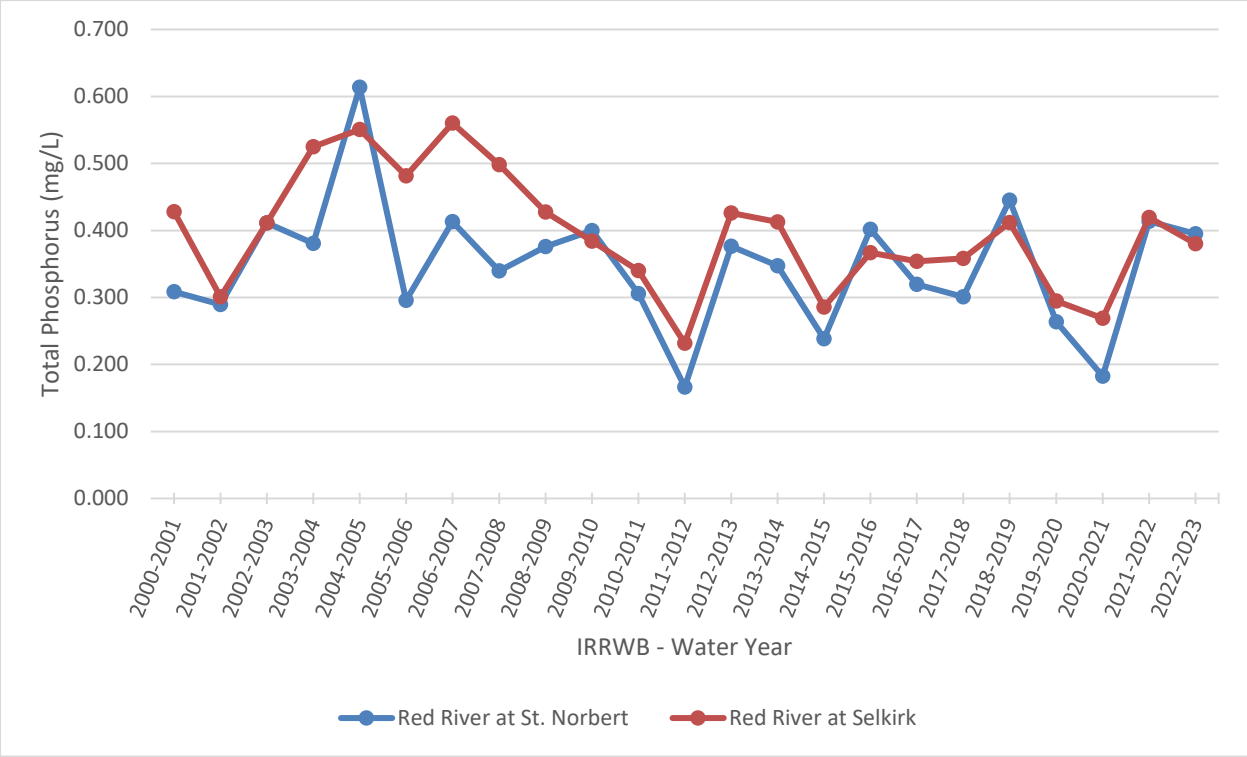


Figure 6: Mean annual (water year) total phosphorus (mg/L) for Red River at St. Norbert and Selkirk, MB from 2000 to 2023.

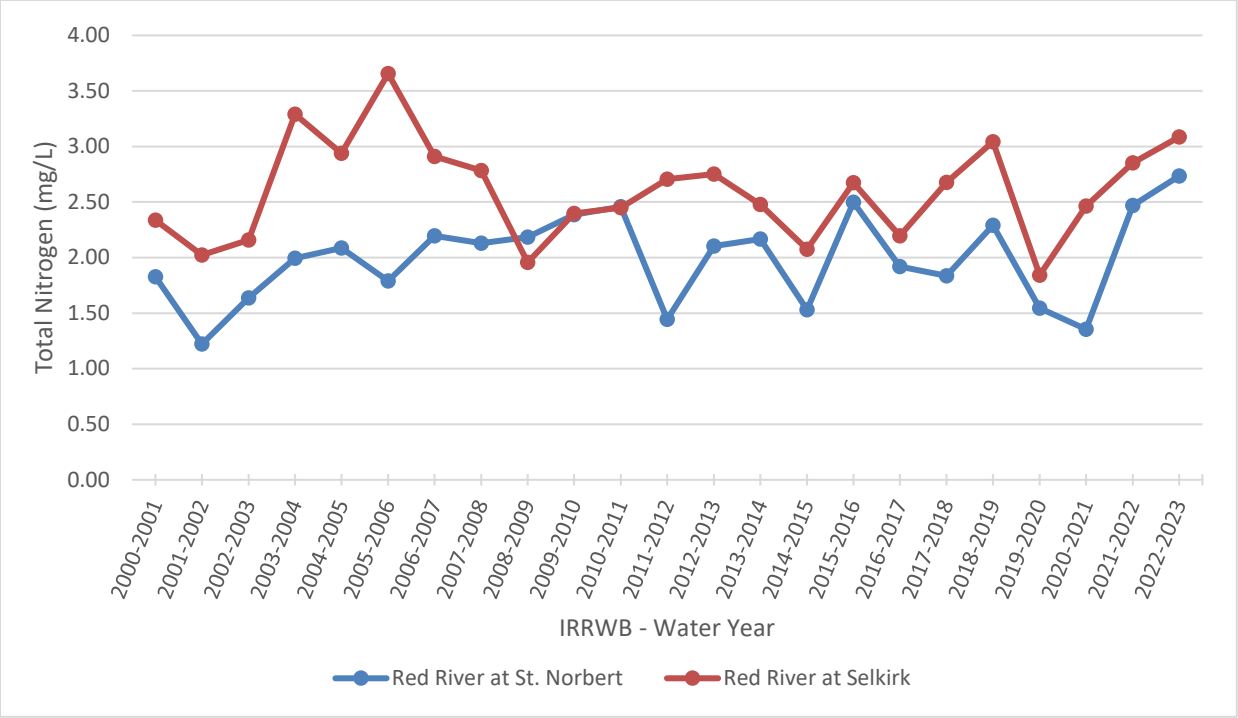


Figure 7: Mean annual (water year) total nitrogen (mg/L) for Red River at St. Norbert and Selkirk, MB from 2000 to 2023.

During this reporting period, 13 samples were analyzed for routine pesticide screening upstream of the City of Winnipeg on the Red River at St. Norbert. Of the 53 routinely monitored pesticides, six were detected (11 per cent rate of detection) in the Red River at St. Norbert, which represents a modest decrease from the previous reporting period (17 per cent rate of detection). Atrazine and Glyphosate were the most detected pesticides with five (38 per cent rate of detection) detections, respectively. 2,4-D and AMPA were each detected on three occasions (23 per cent rate of detection) during the current reporting period, while Dicamba was detected twice (15 per cent rate of detection) and Atrazine Desethyl was detected once (8 per cent rate of detection). Dicamba exceeded the irrigation guideline of 0.006 µg/L for both samples with detections, with measured concentrations of 0.43 µg/L in April 2023 and 1.3 µg/L in July 2023. Measured concentrations of Dicamba during the current reporting period were higher than those detected concentrations during the previous water year (0.0354 to 0.048 µg/L), representing a 10 to 25 times increase. None of the other pesticides detected upstream of Winnipeg exceeded water quality guidelines (where available) for drinking water, protection of aquatic life, irrigation, or livestock uses.

Thirteen samples were also collected from downstream of the City of Winnipeg at Selkirk during the current reporting period and analyzed for pesticides. Nine of the 53 routinely monitored pesticide species were detected (17 per cent detection rate) during the current reporting period. This represents a similar number of pesticides detected during the current water year compared to the previous reporting year. As with the upstream site, Glyphosate and 2,4-D were among the most detected pesticides in the Red River at Selkirk, with five (38 per cent rate of detection) and four detections (31 per cent rate of detection), respectively. Atrazine and AMPA were each detected three times (23 percent detection rate), while Dicamba, Atrazine Desethyl, MCPA, Pentachlorophenol and Thifensulfuron Methyl were each detected once (8 percent detection rate).

Similar to the Red River at St. Norbert site, Dicamba exceeded the irrigation guideline (0.006 µg/L) and had a measured concentration of 0.64 µg/L (April 2023) which represents a greater than two-fold increase in measured concentration compared to the previous reporting period. None of the other pesticides detected downstream of Winnipeg exceeded water quality guidelines (where available) for drinking water, protection of aquatic life, irrigation, or livestock uses.

1.2 Red River - Tributary Streams

During this reporting period, nine sampling sites on seven tributary rivers (Boyne, Rat, Roseau, Morris, La Salle, and Seine (two sites) rivers and Cooks Creek (two sites)) were each monitored four times, during October, December/January, April, and July. In general, water quality parameters in these Red River tributaries remained comparable to previous years for most of the samples collected. Of the thirty-five samples analyzed for dissolved oxygen among tributary sites (Cooks Creek at Millbrook site was not analyzed during the July 2023 period), only three samples (nine per cent) failed to meet the minimum water quality objective of 5 mg/L, compared to 28 per cent of samples (ten samples) failing to meet the objective in the previous reporting period. In particular, of the three samples that failed to meet the objective, two samples were measured below 3.5 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, as was the case during the current reporting period.

The mean density of *E. coli* bacteria observed among all the Red River tributary sites during the current reporting period was 54 organisms per 100 mL, with a range of three to 440 organisms per 100 mL. Only one of the 27 samples collected from the Red River tributary sites failed to meet Manitoba's recreational water quality objective of 200 organisms per 100 mL during the current reporting period. The only sample with an observed exceedance occurred during the October 2022 sampling period at the Seine River at South Perimeter site (440 organisms per 100 mL).

During the 2022-2023 water year, concentrations of total chloride, total sulphate and total dissolved solids were similar to previous reporting periods. The mean total chloride concentration observed among all tributary sites was 29.5 mg/L. Similarly to previous reporting periods, the highest measurements for total chloride occurred at the La Salle River during the October 2022, January 2023, and July 2023 sampling periods, with 104 mg/L, 183 mg/L and 95.7 mg/L, respectively. All other samples analyzed for total chloride among the tributary sites had concentrations below 55 mg/L. The mean total sulphate concentration for all tributary sites was 39.9 mg/L. The highest total sulphate concentrations observed occurred at the La Salle, Boyne, and Morris River locations, and ranged between 101 and 130 mg/L. The majority of elevated total sulphate measurements (> 100 mg/L) were recorded during the January and July 2023 monitoring periods (one elevated measurement was observed during the October 2022 period at the Morris River site). All other total sulphate measurements were less than 72.7 mg/L. The mean total dissolved solids concentration was 370 mg/L for all the tributary sites monitored during the current water year. The highest measurements for total dissolved solids were observed at the Morris, Boyne, and La Salle River locations, with annual water year means of 449 mg/L, 453 mg/L and 500 mg/L, respectively. Maximum total dissolved solids concentrations occurred during the January monitoring period for all sites.

Similar to the provincial main stem Red River monitoring sites, total nutrient concentrations observed at the tributary sites were relatively high during the 2022-2023 water year. However, overall measured concentrations did represent a substantial decrease from the previous reporting period, especially for total phosphorus concentrations. The mean concentration of total phosphorus among all tributary sites was 0.287 mg/L, down from 0.436 mg/L during the previous water year, with a maximum concentration of 1.64 mg/L observed at the la Salle River during the October 2022 monitoring period. No other tributary samples had measured total phosphorus concentrations above 1.0 mg/L. However, only four of the 36 samples analyzed for total phosphorus among the tributary sites during the 2022-2023 water year were observed below Manitoba's narrative water quality guideline of 0.05 mg/L. Total nitrogen concentrations observed among all tributary sites ranged between 0.49 mg/L and 8.02 mg/L, with a mean concentration of 1.97 mg/L. Similar to the previous reporting period, for all tributary sites, the highest total nitrogen concentrations measured typically occurred during the winter (December/January) and spring (April) quarterly monitoring periods.

2. 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. Upgrades are underway to the City of Winnipeg's South End and North End Water Pollution Control Centres including to add biological nutrient removal to meet 1 mg/L total phosphorus and 15 mg/L total nitrogen limits. 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.

3. 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 2022 and September 2023.

4. 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 (https://www.winnipeg.ca/services-programs/water-wastewater/sewage/reports-untreated-sewage). The City of Winnipeg also provides annual summaries of combined sewer overflows events, volumes and rainfall information (https://legacy.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 per cent reduction in phosphorus in Lake Winnipeg. Manitoba has developed 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 IRRWB. 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.

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 10 and April 10.
- 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.

- Compliance with the requirement to remove phosphorus to 1 mg/L is at 87 % for facilities across Manitoba for 2023. Compliance remains similar to 2022 (78 %). Work is underway to further improve compliance. Work is also underway to accelerate improvements at the City of Winnipeg's North End Water Pollution Control Centre and the South End Water Pollution Control Centre, in response to failure to meet timelines outlined in their Environment Act licenses and The Water Protection Act.

- Watershed Districts and Integrated Watershed Management Planning:

  - Manitoba's Watershed Districts Program is a voluntary partnership between the province and local municipalities to protect, restore and manage water resources on a watershed basis. Watershed districts are also responsible for integrated Watershed Management Planning under The Water Protection Act. Manitoba's 14 watershed districts offer programs to reduce the impacts of flooding and drought, improve land and water management practices, improve water quality, and protect drinking water. In particular, watershed districts in the Red River Basin (East Interlake, Northeast Red, Pembina Valley, Redboine, and Seine Rat Roseau) offer surface water retention, erosion control, and riparian management programs to reduce nutrient runoff and loading to Red River tributaries.

  - In 2022/23, watershed districts supported operations and programming in water quality, surface water management, drinking water protection, water retention, soil conservation, wildlife habitat and public education programs promoting improvements to watershed health and resiliency. Watershed Districts established 710 cubic decametres of water storage capacity, installed 28.1 kilometres of riparian area fencing limiting more than 2200 head of cattle from waterways, sealed 108 abandoned wells, and hosted 55 demonstration and project tours with 5,300 participants.

  - More information on the specific outcomes of watershed district programming is available in the annual report for the program - gov.mb.ca/sd/pubs/water/watershed/2022-23-cd-annual-report.pdf

  - Work on integrated watershed management planning under The Water Protection Act continues in Manitoba. To date 24 first-generation watershed management plans have been completed. Planning continues for 10 watersheds including four in the Red River basin, the Pembina, Boyne-Morris River, Plum-Marais, and Netley-Grassmere-Willow watersheds. Souris River, Shell River, Northwest Interlake, Brokenhead, Willow Creek, and Lower Assiniboine River watershed management plans are also in development. Several of these planning processes are renewals of first-generation plans: Souris River, Netley-Grassmere-Willow, and the Shell River watersheds.

- Integrated watershed management plans are compiled by local water planning authorities with input from government, Indigenous communities, non-government organizations and public. Plans are implemented, monitored, and renewed regularly (every 10-15 years) by these water planning authorities. Designated under The Water Protection Act as water planning authorities, Manitoba's 14 watershed districts have been charged with the development of integrated watershed management plans guided by specifications in the Act. Manitoba provides financial, planning, and technical assistance throughout the process. Integrated watershed management plans include an overview of current science and traditional knowledge of the watershed as well as actions to monitor, maintain, and improve watershed health (https://www.gov.mb.ca/sd/water/watershed/iwmp/index.html).

- Growing Outcomes in Watersheds (GROW):

  - Growing Outcomes in Watersheds (GROW) is a made-in-Manitoba approach that supports the delivery of ecological goods and services (EG&S) in Manitoba. Identified under the Water Pillar in Manitoba's Climate and Green Plan, GROW outcomes include 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 agricultural production, and improved biodiversity and habitat. GROW is delivered by Manitoba's watershed districts, as they are ideally positioned to support actions identified in their integrated watershed management plans that meet local and provincial priorities.

  - More than $200 million dollars has been invested by the Manitoba Government 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 spring 2023, $7.5M in GROW Trust funding was dedicated to GROW-related activities delivered by watershed districts. In spring 2024, $9.8M in Trust funding was dedicated to GROW-related activities delivered by watershed districts. Local GROW programs delivered by watershed districts in 2023-24 included upland area conservation, wetland conservation, enhancement and restoration, riparian area conservation, tree planting, water retention, soil health project, and livestock programming. riparian and erosion control, riparian and wetland conservation, water retention, and livestock programming.

    Since the program's inception, over $35M in Trust funding has been dedicated to GROW activities ($5.6M in 2020, $5.5M in 2021, $7.5M in 2022, $7.5M in 2023, and $9.8M in 2024)

5. Biological Monitoring in the Red River Basin

5.1 Macroinvertebrates of the Red River in Manitoba

Benthic macroinvertebrates were collected at two locations, Emerson, MB and Selkirk, MB (Figure 1, Table 2), on the Red River in September 2023. At each location, one transect of five dredge grab samples were collected with a petit Ponar dredge. Starting at the east bank, samples were collected at five equidistant sample sites across the width of the river 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 per cent 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 2. Geographic coordinates for the benthic macroinvertebrates sampling stations at Emerson and Selkirk on the Red River, Manitoba in September 2022.

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

In 2023 at Emerson, 98 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 853 organisms per m^2 (Table 3). For the current reporting period at Emerson, the organisms in greatest abundance were from the Order Diptera (Family Chironomidae). The second most abundant type of organisms present were from the Order Trichoptera (Family Hydropsychidae). Overall, a decrease in total organisms were observed for the current reporting period compared to the previous period, with 98 total organisms in 2023 versus 122 organisms in 2022. However, this still represented a much greater abundance in total organisms compared to the 29 and 49 total organisms collected in 2021 and 2020, respectively. The total number of taxa represented in the sampled population for the current period was similar to the previous reporting period, with 26 taxa represented in 2023, compared to the 25 taxa collected during the 2022 sampling period. Similarly to the 2022 sample population, the overall composition was driven by very few taxa. Three Orders of insect taxa, Trichoptera, Diptera and Hemiptera represented approximately 72 per cent of the individuals in the total population.

In the Red River at Selkirk, 240 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 2,088 organisms per m^2 (Table 4). For the current reporting period, the organisms of greatest abundance were from the Order Oligochaeta (Family Naididae), which was similar to the previous reporting

period. The second most abundant type of organisms present were from the Order Diptera (Family Chironomidae). In contrast to the trend observed at Emerson in 2023, the total number of benthic macroinvertebrate organisms observed at Selkirk during the current water year increased by approximately 26 per cent, compared to the total organisms collected in the previous water year (190 organisms in September 2022). The total number of taxa observed increased by approximately 22 per cent between 2022 and 2023 sampling periods, 22 taxa versus 27 taxa, respectively. Following successive years of decreases in total taxa observed within the population dating back to the 2017-2018 reporting period, the 2022-2023 water year represents the second consecutive reporting period with increases in invertebrate species richness at Selkirk.

Overall, in 2023, a much greater number of total organisms of benthic macroinvertebrates were found in the Red River at Selkirk than at the Red River near Emerson. However, both monitoring locations had approximately the same amounts of invertebrate taxa represented in their sample populations.

Table 3. 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 2023.

Class	Order	Family	Genus	Species	Number of organisms
ANNELIDA	OLIGOCHAETA	NAIDIDAE	Dero	sp.	1
ANNELIDA	OLIGOCHAETA	NAIDIDAE	unidentified	without hair setae	5
BIVALVIA	VENEROIDA	SPHAERIIDAE	Sphaerium	sp.	4
BIVALVIA	VENEROIDA	SPHAERIIDAE	unidentified	Too young to ID	3
EUCHELICERAT	TROMBIDIFORMES	HYGROBATIDAE	Hygrobates	sp.	1
GASTROPODA			unidentified	damaged	1
GASTROPODA	NEOTAENIOGLOSSA	AMNICOLIDAE	Amnicola	limosus	2
GASTROPODA	PROSOBRANCHIA	VALVATIDAE	unidentified	too young to ID	2
INSECTA	COLEOPTERA	ELMIDAE	Stenelmis	sp.	2
INSECTA	DIPTERA	ATHERICIDAE	Atherix	sp.	1
INSECTA	DIPTERA	CERATOPOGONIDAE			1
INSECTA	DIPTERA	CHIRONOMIDAE	Ablabesmyia	sp.	1
INSECTA	DIPTERA	CHIRONOMIDAE	Axarus	sp.	6
INSECTA	DIPTERA	CHIRONOMIDAE	Chironomus	sp.	4
INSECTA	DIPTERA	CHIRONOMIDAE	Procladius	sp.	2
INSECTA	DIPTERA	CHIRONOMIDAE	Tanytarsus	sp.	1
INSECTA	DIPTERA	CHIRONOMIDAE	unidentified pupa		6
INSECTA	DIPTERA	EMPIDIDAE	Hemerodromia	sp.	1
INSECTA	EPHEMEROPTERA	LEPTOHYPHIDAE	Tricorythodes	sp.	1
INSECTA	HEMIPTERA	CORIXIDAE	Sigara	lineata	1
INSECTA	HEMIPTERA	CORIXIDAE	unidentified nymph		17
INSECTA	ODONATA - ANISOPTE	GOMPHIDAE	unidentified	too young to ID	3
INSECTA	TRICHOPTERA	HYDROPSYCHIDAE	Potamyia	flava	19
INSECTA	TRICHOPTERA	LEPTOCERIDAE	Nectopsyche	sp.	1
INSECTA	TRICHOPTERA	LEPTOCERIDAE	Oecetis	sp.	10
NEMATODA			unidentified		2
			Total number of organisms		**98**
			Total number per square meter		**853**
			Total number of taxa		**26**

Table 4. 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 2023.

Class	Order	Family	Genus	Species	Number of organisms
ANNELIDA	OLIGOCHAETA		unidentified	in egg sacks	1
ANNELIDA	OLIGOCHAETA	NAIDIDAE	Branchiura	sowerbyi	13
ANNELIDA	OLIGOCHAETA	NAIDIDAE	Dero	sp.	3
ANNELIDA	OLIGOCHAETA	NAIDIDAE	Nais	sp.	1
ANNELIDA	OLIGOCHAETA	NAIDIDAE	Uncinais	uncinata	2
ANNELIDA	OLIGOCHAETA	NAIDIDAE	unidentified	with hair setae	52
ANNELIDA	OLIGOCHAETA	NAIDIDAE	unidentified	without hair setae	20
BIVALVIA	VENEROIDA	SPHAERIIDAE	damaged		4
BIVALVIA	VENEROIDA	SPHAERIIDAE	Pisidium	sp.	4
BIVALVIA	VENEROIDA	SPHAERIIDAE	unidentified	Too young to ID	9
CRUSTACEA	AMPHIPODA	HYALELLIDAE	Hyalella	azteca	1
CRUSTACEA	COPEPODA	CYCLOPOIDA			1
GASTROPODA			unidentified	damaged	1
GASTROPODA	NEOTAENIOGLOSSA	AMNICOLIDAE	Amnicola	limosus	11
GASTROPODA	NEOTAENIOGLOSSA	HYDROBIIDAE	Probythinella	emarginata	13
INSECTA	DIPTERA	CERATOPOGONIDAE			13
INSECTA	DIPTERA	CHIRONOMIDAE	Ablabesmyia	sp.	5
INSECTA	DIPTERA	CHIRONOMIDAE	Chironomus	sp.	31
INSECTA	DIPTERA	CHIRONOMIDAE	Coelotanypus	sp.	2
INSECTA	DIPTERA	CHIRONOMIDAE	Cryptochironomus	sp.	2
INSECTA	DIPTERA	CHIRONOMIDAE	Polypedilum	sp.	12
INSECTA	DIPTERA	CHIRONOMIDAE	unidentified pupa		2
INSECTA	EPHEMEROPTERA	CAENIDAE	Caenis	sp.	1
INSECTA	EPHEMEROPTERA	EPHEMERIDAE	Hexagenia	sp.	26
INSECTA	MEGALOPTERA	SIALIDAE	Sialis	sp.	1
INSECTA	TRICHOPTERA	LEPTOCERIDAE	Oecetis	sp.	6
NEMATODA			unidentified		3
			Total number of organisms		**240**
			Total number per square meter		**2088**
			Total number of taxa		**27**

5.2 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 i^{th} species. D ranges from zero to one, indicating a low to high level of diversity. Calculated Diversity scores for Emerson and Selkirk were 0.95 and 0.91 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 i^{th} taxon at the station
S = the total number of taxa at the station

Simpsons Evenness scores were 0.046 and 0.005 for the Red River at Emerson and Selkirk respectively. Relatively small numbers of individuals from many taxa influenced the Evenness score for both sites.

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 4 and Selkirk was 3. No individuals from the pollution intolerant Order Plecoptera were found at either the Emerson or the Selkirk sites. Per cent EPT is the total number of EPT individuals divided by the total number of individuals in the sample. Per cent EPT was 32 per cent for Emerson and 14 per cent for Selkirk. Overall, EPT individuals were greater in numbers at Emerson than for Selkirk during the 2022-2023 water year.

The Bray-Curtis Index compares the community composition of two sites where the co-efficient reaches a maximum of one for two sites that are entirely different and a minimum score of zero for sites that possess identical composition (Legendre and Legendre, 1983). The calculated Bray-Curtis Dissimilarity Index was 0.83 indicating that community compositions were different between sites. In particular, while both sites had somewhat similar numbers of total individuals (98 and 240 at Emerson and Selkirk, respectively) and diversity of taxonomic families represented at Emerson and

Selkirk (26 and 27, respectively) during this reporting period compared to 2021-2022 water year, only 26 percent of taxonomic groups were identified at both locations. Overall, 11 taxonomic groups were observed at both sites, while 15 groups and 16 groups were observed only at Emerson and Selkirk, respectively (Tables 3 and 4).
References:

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

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

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

5.3 *E. coli* and Algal Bloom Monitoring in Lake Winnipeg

Manitoba monitored nineteen recreational beaches within the south basin of Lake Winnipeg for densities of *E. coli* during 2023 (Figure 9). Sampling began late May and continued weekly until the beginning of September.

While some beaches occasionally exceeded Manitoba's recreational water quality guideline for fecal indicator bacteria in 2023, typically recreational water quality is excellent at Lake Winnipeg beaches. In 2023, there were 51 incidents of Lake Winnipeg beaches showing elevated *E. coli* concentrations above the recreational water quality objective. 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 five 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 2023 beach monitoring program, the department 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 2023, there were six 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 2023, Sunset Beach on Lake Winnipeg was briefly posted with second level algal advisory signs. Algal toxin concentrations quickly returned below recreational objectives at Sunset Beach and the algal toxin advisory was rescinded a day later.

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

5.4 Fisheries of the Red River in Manitoba

Biological Information

A total of 67 fish species have been recorded in the Manitoba portion of the Red River (Table 6). 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).

Known invasive fish species that have been introduced in the Manitoba portion of the Red River include the Common Carp (*Cyprinus carpio),* White Bass (*Morone chrysops)*, and Rainbow Smelt (*Osmerus mordax).* 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. As of 2024, adult Zebra Mussels are found throughout the Red River, Lake Winnipeg, and the entire extent of the Nelson River.

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 through five main pillars of work including Legislation; Prevention (including the Watercraft Inspection, Public Engagement and Partnership programs); Monitoring; Early Detection and Rapid Response (EDRR); and Management and Adaptation. Manitoba operated eight watercraft inspection stations in 2023 and conducted more than 16,000 inspections and 2,743 decontaminations. Watercraft inspection station placement is determined primarily as a containment approach with units being situated between invaded and uninvaded waters. Manitoba released an Aquatic Invasive Species Prevention and Response Plan in July 2024. More information is available here - https://www.manitoba.ca/stopais .

Recreational Angling - Value

The Manitoba portion of the Red River is internationally known for its high-quality recreational angling fishery. The Red River fishery attracts non-residents 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.

Based on a 2015 angler survey, Manitobans and visitors to the province fished a total of 2.5 million days, of which 8.4% were spent on the Red River, and 7.3% 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 over $100M annually 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. A subsequent partial winter creel survey was conducted between January 6 and April 3, 2022, on the south basin of Lake Winnipeg. The estimated angler visits in this survey declined to just over 25,000. The decline is largely attributable to the inclement weather. During the months of January and February 2022, 17 days experienced windchills of -24°C or colder with 10 days at or below -30°C. The month of March typically sees milder temperatures, however the first 2 weeks of March 2022 generally had windchills at or below -24°C.

The majority of angling effort on the Red River 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. In 2023, Manitoba enacted its most significant changes to angling regulations in decades. Generally, the new regulations increase opportunities to fish while enhancing protection of Manitoba's recreational fish populations. New regulations lower the limit of certain species, such as Walleye/Sauger and Northern Pike, and introduce new size restrictions to protect large spawning fish, moving to species-specific seasons, and closing some sensitive areas to all fishing during spring. Particularly, the Walleye/Sauger closed season will run from the first Monday in April to the second Friday in May. However, the lower Red River is closed to all fishing activity for the same time period given it is home to important spawning grounds for walleye and is subject to high pressure from anglers. The Walleye/Sauger season on Lake Winnipeg is closed from the first Monday in April to the third Friday in May. This provides one additional week of protection on Lake Winnipeg.

Manitoba's Fisheries Branch conducts spawn testing on Lake Winnipeg each spring. The 30-year data set shows that walleye spawning on Lake Winnipeg continues later into the spring than it does within the tributaries due to cooler water temperatures in the lake as ice cover melts.

A commercial net fishery targeting primarily Walleye, Sauger 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 $80M annually.

Table 5. 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

C-2 North Dakota

WATER QUALITY PROGRAMS
NORTH DAKOTA DEPARTMENT OF ENVIRONMENTAL QUALITY

Ambient Water Quality Monitoring Program

The North Dakota Department of Environmental Quality (NDDEQ) Watershed Management Program is responsible for tracking the ambient water quality conditions within the State of North Dakota. The NDDEQ maintains a monitoring network to evaluate trends, estimate loads and compare variations between sites in the Red River Watershed. The network coordinates with the US Geological Survey (USGS) and the North Dakota Department of Water Resources (DWR) water quality monitoring networks.

The monitoring design includes 3 levels of sampling frequency (Figure 1). Level 1 sites are sampled 8 times per year (Twice in April, once each in May, June, July, August, and October, and one time under ice), level 2 sites are sampled 6 times per year (April, May, June, August, and October and once under ice, and level 3 sites are sampled 4 times per year (April, June, August, and October). There are 16 level 1 sites, 12 level 2 sites, and level 3 sites. Under the current design, the NDDEQ samples 5 level 1 sites, the Department of Water Resources samples 1 level 2 site, and the USGS samples all the rest (Tables 1 through 3).

Field measurements are taken for temperature, dissolved oxygen, pH and specific conductance. Sampling and analysis consist of general chemistry, dissolved trace elements, and total and dissolved nutrients (Table 4). In addition, total organic carbon, dissolved organic carbon, total suspended solids, and E. coli bacteria are sampled and analyzed for at level 1 sites (Table 4). E. coli bacteria are only sampled during the recreation season (May-September). Additionally, the Red River at Fargo, the Red River at Grand Forks, and the Red River at Pembina are sampled for total suspended sediment. All chemical analysis except total suspended solids is performed by the NDDEQ's Laboratory Services Division. Total suspended solids analysis is conducted by the USGS Iowa Sediment Laboratory.

Table 1. 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 2. 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

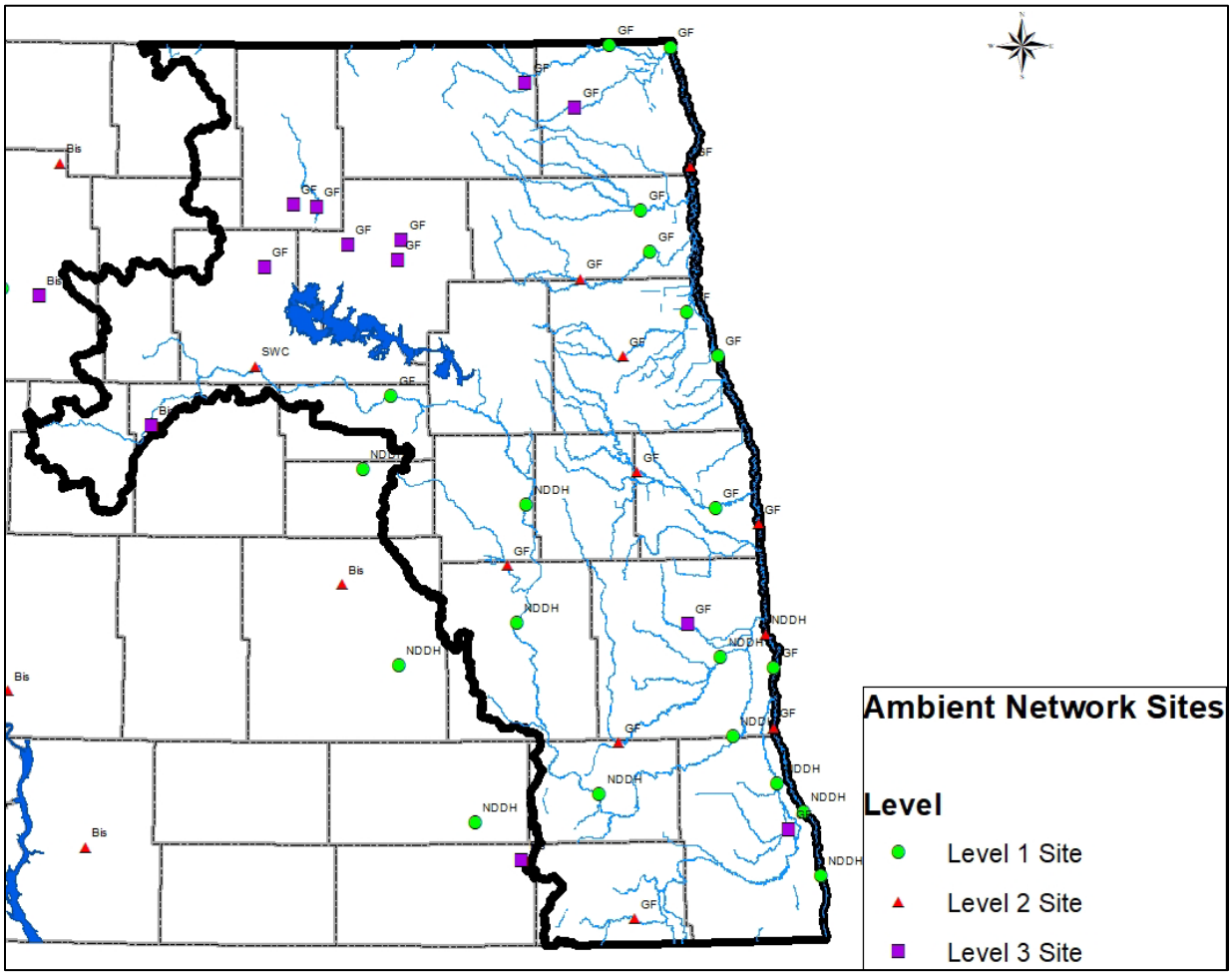


Figure 1. North Dakota Ambient Water Quality Monitoring Sites in the Red River Basin.

Table 3. 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

Table 4. North Dakota Ambient Water Quality Monitoring Parameters

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

[1]Analyzed as dissolved.

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

[3]Sampled and analyzed at level 1 sites.

North Dakota Department of Agriculture Pesticide Monitoring Program

As a compliment to North Dakota's revised ambient water quality monitoring program the NDDEQ and the USGS collaborates 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 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.ndda.nd.gov/sites/www/files/documents/files/2022%20Pesticide%20Surface%20Water%20Monitoring%20Report.pdf

WATER POLLUTION CONTROL

Pollution Abatement and Advisories

Point Source Control Program

The department regulates the release of wastewater and stormwater from point sources through permits issued by the North Dakota Pollution Discharge Elimination System program (NDPDES). 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. 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 regulates animal feeding operations (AFOs) in North Dakota. All large (>1000 animal units) confined animal feeding operations (CAFOs) are inspected annually. 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,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. The NPS Program is administered 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.

Through the NPS Program, the department is currently supporting eight watershed projects in the Red River Basin that are focused on nonpoint source pollution mitigation. Additionally, there are two statewide watershed projects that provide technical/financial assistance in the Red River Basin. 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 2. Table 5 lists the best management practices (BMP) implemented with Section 319 funding through these projects. The following is a summary of the active watershed projects as of July 2023 in the Red River Basin.

- The Richland County Soil Conservation District (SCD) has been using Section 319 funding since 2011 to support the implementation of the Antelope Creek Watershed and Wild Rice Riparian Corridor project. The primary goal of the project is to restore the recreational uses of the impaired reaches of Antelope Creek and the Wild Rice River 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 consistently within state water quality standards limitation, indicating recreational uses have been fully restored.

- 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 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 is currently focusing on utilizing PTMApp to find priority areas for implementing BMP. The goal of the project is to improve aquatic life use in the Wild Rice River through focused project work in the sub-watersheds adjacent to the Wild Rice River including 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 and upstream and downstream from Homme Dam reservoir. Practices being promoted and implemented include fencing, off-site watering facilities, water wells, cover crops, grassed waterways, riparian tree plantings, grass buffers/filters, and windbreaks.

- The Grand Forks County SCD was awarded Section 319 funding in 2022 to pursue implementation work in the Turtle River/Larimore Dam Watershed following the successful English Coulee watershed project. The main goal for the project is to achieve an improving trend in the recreational and aquatic life uses of the Turtle River and mitigate nutrient and sediment loading in Larimore Dam. A secondary goal of the project is to educate the public on the relationship between healthy soil 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.

- The Ransom County SCD was awarded Section 319 funding for the Sheyenne River PTMApp project in 2021. The Ransom County SCD will provide financial and technical assistance for conservation planning and provide increased emphasis on NPS Pollution in their I/E program. The goals of this project are to 1) Reduce the sediment and nutrient inputs from farm fields and pasture/rangeland shown as major contributors by the PTMApp program, 2) Reduce the pathogen/nutrient inputs from 10 or more faulty septic systems within close proximity to the Sheyenne River, and 3) Increase public awareness to the causes, effects and solutions to NPS pollution. Data collected as part of this project will be used for future TMDL development as the segment of the Sheyenne being addressed through this project has a high priority.

- The Sheyenne River Joint Board, in collaboration with BARR Engineering was awarded Section 319 funding for the Upper Sheyenne River Watershed Pilot project in 2022. The primary goal of the Upper Sheyenne River Watershed Pilot Project is to identify and implement channel stability measures in eighteen (18) select areas of high priority across the Upper Sheyenne River, from the headwaters in Sheridan County to Lake Ashtabula. Potential applicable measures to improve channel stability include changes to riparian vegetation, changes to grazing practices, replacement of road crossing culverts, and targeted bank stabilization measures. These measures will directly benefit in improving Sheyenne River water quality by reduction in sediment loading. Out of eighteen sites identified, the Joint Board selected seven (7) sites for the Project by working collaboratively with multiple stakeholders. Of these seven (7), two (2) will be funded through the 319 program.

Table 5. BMPs implemented with FY16-FY22 Section 319 funding in the active watershed project areas located in the Red River Basin, as of July 2023.

BMP Category/BMP Type	Amount Applied
Cropland	
Cover Crops	15,400 acres
Erosion Control	
Critical Area Plantings	5.0 acres
Grazing Manangement	
Livestock Fencing	37,088 linear feet
Pasture/Hayland Planting	1,233 acres
Pond	1 pond
Rural Water Hookup	1 hookups
Trough and Tanks	6 tanks
Wells (livestock watering only)	9 wells
Alternative Power Source (Livestock watering only)	5 sources
Livestock Manure Management Systems	
Full Containment Manure Management System	8 systems *
Miscellaneous Practices	
Septic System Renovations	97 systems
Well Decommissioning	43 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

**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.*

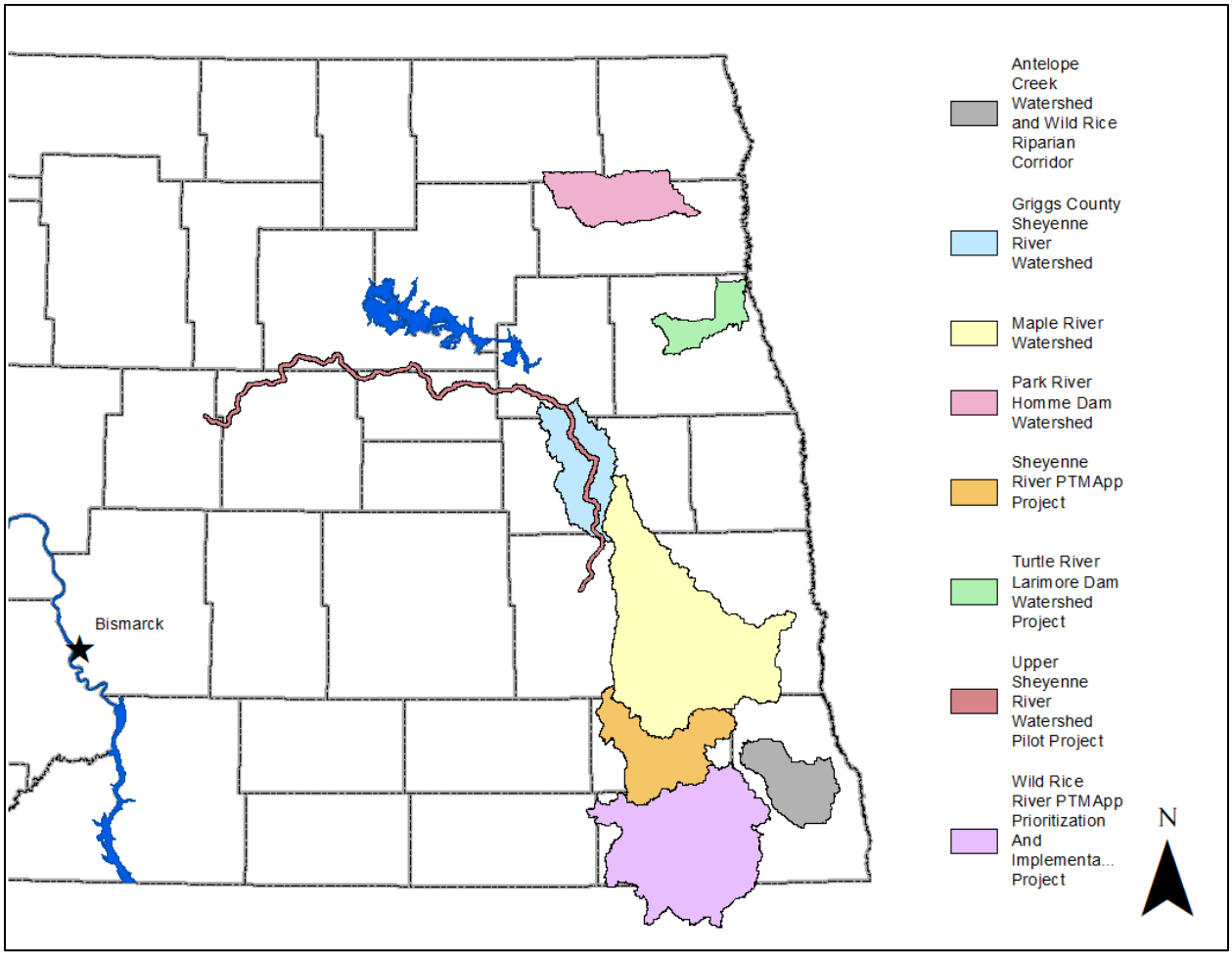


Figure 2. Active North Dakota Watershed Projects in the Red River Basin.

The statewide watershed projects that have supported work in the Red River Basin are:

- 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.

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

Table 6. 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/ND Water Education	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:

- 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/.

- The International Water Institute (IWI) was allocated Section 319 funding to support the need and potential success of a Pay-for-Progress (PfP) program in North Dakota. IWI will complete a review of PfP/outcomes/progress programs proposed or being used in other U.S. regions, develop a conceptual framework for the PfP. The IWI will solicit from a ND farmer-focus group, ND commodity groups, ND DEQ Staff, and the public, and 3 corporations with sustainability programs actively doing business in ND. A Pay-for-Progress report and recommendations for implementation will be submitted for use by the DEQ to deliver a functioning framework to deliver more cost-effective WQ improvements.

- The Ransom County SCD has received 319 funding since 2012 to assist with the engineering cost of Best Management Practices in 319 Watershed areas across the state through the NPS BMP Team. In addition to 319 funds, the NPS BMP Team also receives State Water Commission funds in support of this work.

Currently, the Nonpoint Source Pollution Management Program is in the process of awarding eight projects which received FY23 funding and soliciting applications for FY24 funding due November 1, 2023.

North Dakota's Nutrient Reduction Strategy for Surface Waters

Nutrients are essential components of aquatic ecosystems but when present in excess concentrations, they can result in water quality degradation. To address these concerns, the Department completed a reduction strategy in June of 2021. The strategy may be viewed at: https://deq.nd.gov/publications/WQ/3_WM/NutrientStrategy/FINAL_NDNutrientStrategy_June_2_2021.pdf

C-3 Minnesota

Minnesota

This information in this report is from July 1, 2023 to June 30, 2024

Watershed Restoration and Protection Strategy

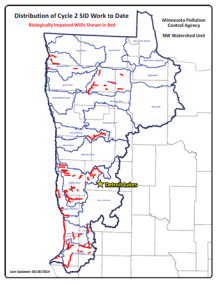
There are 17 major tributaries to the Red River in Minnesota. The Minnesota Pollution Control Agency has developed Watershed Restoration and Protection Strategy (WRAPS) reports for each of these watersheds. Each WRAPS consists of monitoring, stressor identification, modeling, public participation/input and any associated TMDLs. The WRAPS and all associated Total Maximum Daily Load (TMDL) studies have been completed on all 17 watersheds, in the Red River Basin, as indicated below. This completes cycle 1 of the watershed approach for the Red River Basin.

The second cycle of monitoring has begun which will result in WRAPS Updates, as needed, for each watershed with any necessary TMDLs. Most of the watersheds in the Red River Basin are set to be sampled starting in 2023 through 2026 with a few that began in 2022. For the summer of 2024 the MPCA is monitoring (fish, macroinvertebrate, and discrete water quality) the following watersheds in the Red River Basin Monitoring is expected to be completed by the end of September (monitoring is done for two years in each watershed):

- Snake River (1st year)
- Tamarac/Joe River (1st year)
- Two Rivers (1st year)
- Red Lake River Watershed (2nd year)
- Grand Marais Creek Watershed (2nd year)

This next sampling cycle (Update Cycle) will create more recent monitoring data to inform the WRAPS and implementation work being done by local government partners.

Stressor ID (SID) Monitoring continues following the IWM schedule above. Below you will see a map of the work that has been done in the basin to date for the Update Cycle and the WIDs that include impairments for fish/inverts. WQ monitoring has been completed on each of these WIDs.



Photos of staff (Mike Sharp and Betsy Nebgen, SID Staff) at monitoring sites in the basin.

Watershed Restoration and Protection Strategy reports and their Update schedule:

Name	Status	Final WRAPS	Update Complete/ Started
Bois De Sioux River	**Complete & Approved**	4/8/2020	S
Buffalo River	**Complete & Approved**	4/9/2016	S
Clearwater River	**Complete & Approved**	1/8/2021	S
Mustinka River	**Complete & Approved**	9/26/2016	
Otter Tail River	**Complete & Approved**	10/14/2021	
Red Lake River	**Complete & Approved**	11/20/2019	S
Red R. - Grand Marais Creek	**Complete & Approved**	4/11/2019	S
Red R. - Marsh River	**Complete & Approved**	6/24/2021	S
Red R. - Sandhill River	**Complete & Approved**	4/13/2017	S
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	S
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	S
Wild Rice River	**Complete & Approved**	06/29/2022	

Total Maximum Daily Load (TMDL)

TMDLs with completed WRAPS in the Red River Basin can be found at the following website, along with additional information: https://www.pca.state.mn.us/water/total-maximum-daily-load-tmdl-projects#approved-6123248a ;

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

There were 7 individual National Pollutant Discharge Elimination System (NPDES)/State Discharge Elimination (SDS) permits issued of which 5 were for domestic wastewater treatment plants and 2 were for industrial facilities. There were also 60 general NPDES/SDS permits reissued of which 5 were to sand and gravel facilities, 52 to a municipal wastewater treatment pond system, 1 for municipal pesticide application, and 2 to water treatment plants. There were 5 wastewater related incidents/releases of which two were noted as spills and the remaining 3 being releases or bypasses (all from municipal wastewater treatment plants).

Other

The MPCA has helped support the Red River Basin Flood Damage Reduction Work Group's (FDRWG) five-year monitoring program by providing technical support and monitoring equipment (5 sondes and calibration solution). Discrete and continuous water quality monitoring of sites began in 2024. The MPCA is committed to continuing its support of this effort until its completion in June 2028.

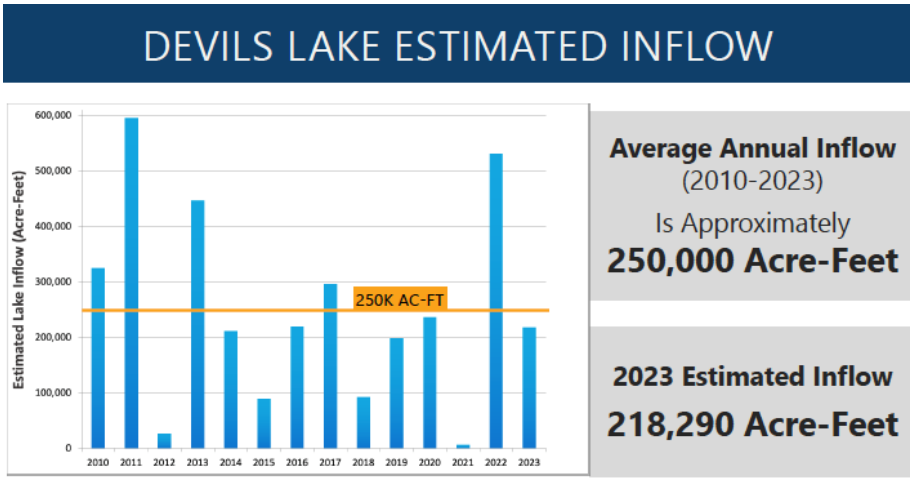
Appendix D

Additional Activities in the Red River Basin

D-1 Devils Lake Sub-basin

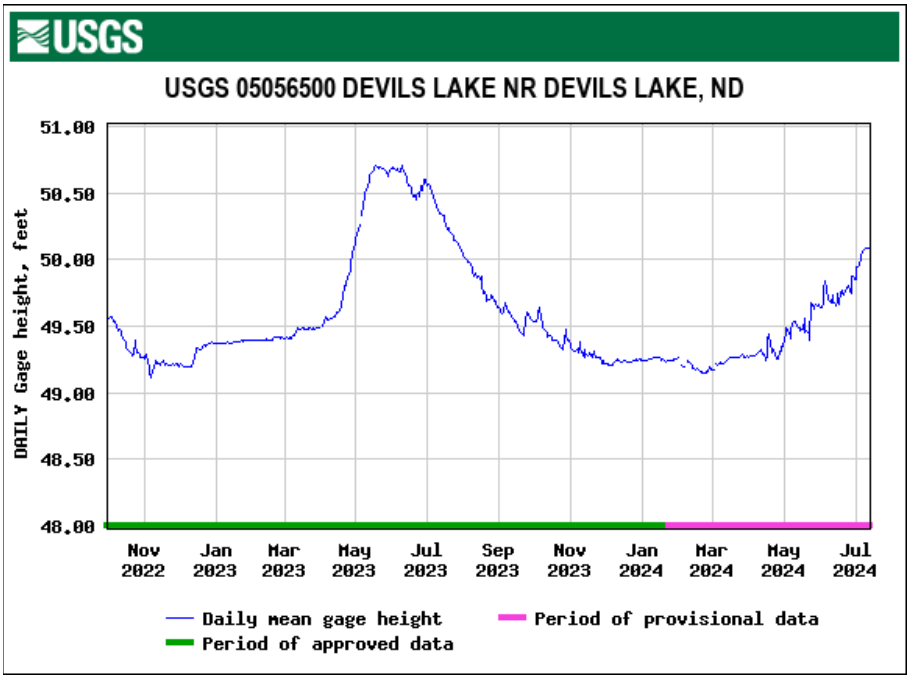
Devils Lake Sub-Basin

The 2023 Devils Lake inflow of 218,290 acre-feet was slightly below the average annual inflow experienced since 2010. The total estimated precipitation of about 20 inches nearly matched the average precipitation calculated since 2010. Nearly half of the precipitation occurred before July 1.



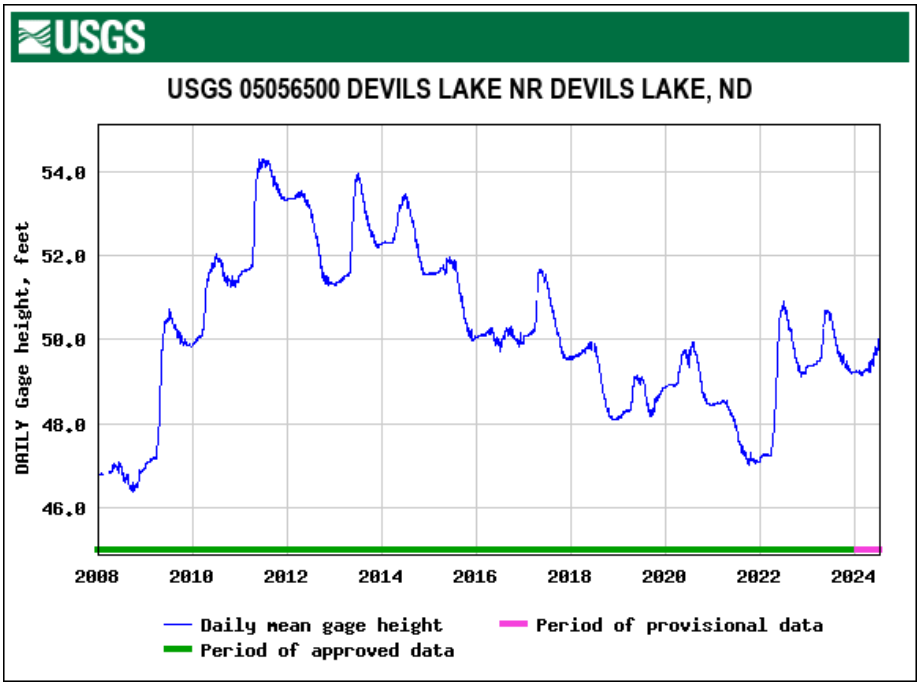
Annual Inflow to Devils Lake

The water level of Devils Lake started 2023 at 49.4 feet. The 2023 spring runoff caused the lake level to increase by approximately 1.3 feet to 50.7 feet by the end of May 2023. It remained near that level into early June, before slowly receding to 49.2 feet by the end of 2023.



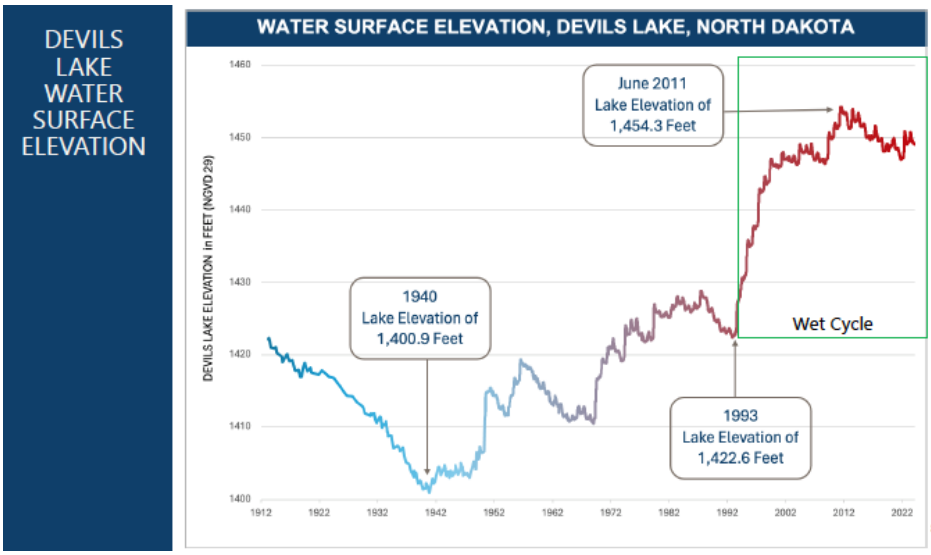
Devils Lake water stage: From Oct. 2022 through July 12, 2024 (Figure courtesy of USGS.)

The water elevation of Devils Lake has experienced an annual increase of more than 2 feet several times in recent history. The figure below shows the large increases in water elevation due to the 2009 and 2011 runoff. The highest elevation in recent history was recorded in June 2011 at 1454.3 feet. The natural outlet is at an elevation of 1458.0 feet.

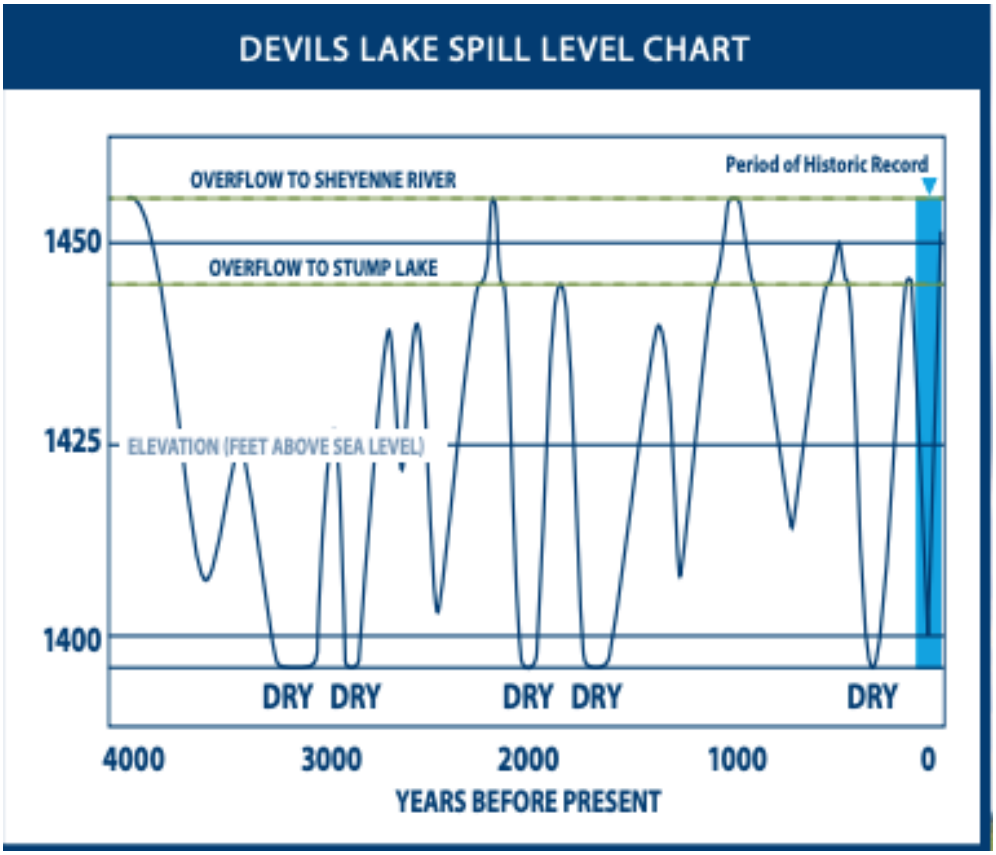


Devils Lake water stage: From 2008 through July 12, 2024. (Figure courtesy of USGS.)

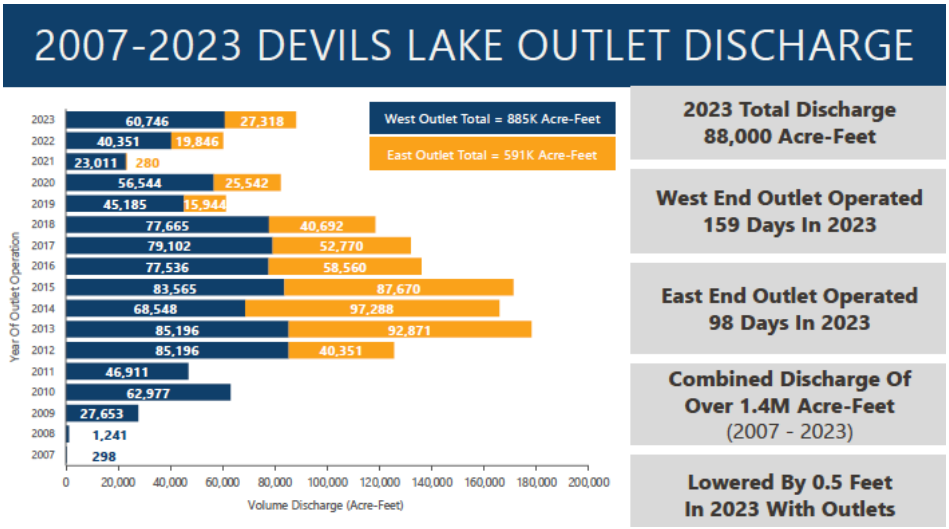
The figure below shows the Devils Lake water elevation since 1912. The impact to the water elevation due to the wet cycle that started around 1993 is evident on the right side of the figure.



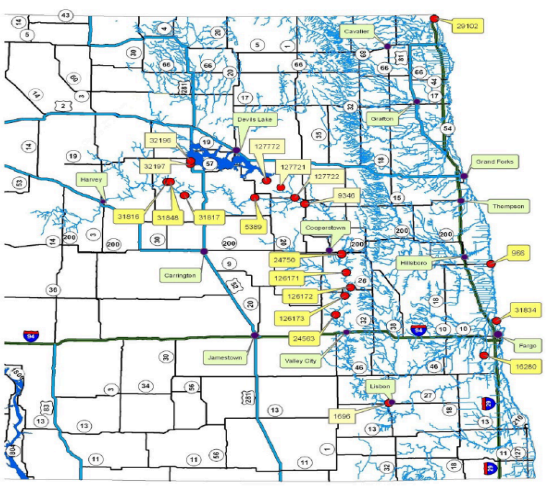
Devils Lake Historical Water Elevations (1929 datum)
Historical evidence obtained from various studies indicates that the water elevation has exceeded the elevation of the natural outlet several years.



The state of North Dakota owns and operates two outlets: West End and East End outlets. A summary of the annual outlet discharge is provided in the following graph. The West End outlet started the 2023 discharge on May 15. Discharge continued until October 24, with some short disruptions due to minor maintenance requirements. The East End outlet started operation on June 6. Water quality thresholds limited the capacity of the East End outlet. It was shut down for the year on September 15.



Water quantity and quality thresholds are in place for operating the outlets. The locations of the monitoring sites are shown in the following map.



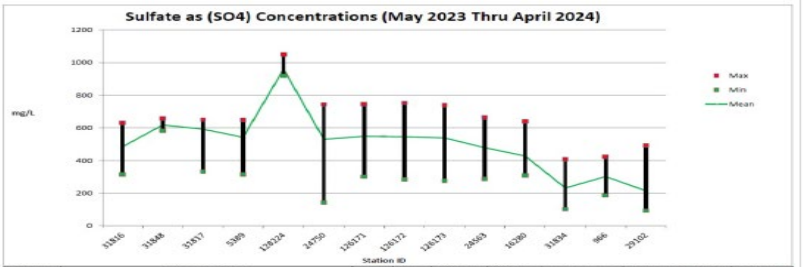
DEVILS LAKE OUTLET MONITORING SITES

381816	Sheyenne River Near Flora
32196	Devils Lake West Bay - South Of Minnewauken
32197	Round Lake Portion Of Devils Lake
31848	Devils Lake State Outlet
31817	Sheyenne River Near Bremen
5389	Sheyenne River Near Warwick
127772	East Devils Lake - East End Outlet Intake
127721	Devils Lake, East End Outlet
127722	Tolna Coulee at Tolna Dam
9346	Sheyenne River South of Pekin
24750	Sheyenne River Near Cooperstown
126171	Lake Ashtabula East Of Hannaford
126172	Lake Ashtabula At Sibley Crossing Bridge
126173	Lake Ashtabula Downstream Location At Ashtabula Crossing
24563	Sheyenne River Below Baldhill Dam
1696	Sheyenne River, North Side of Lisbon, ND
16280	Sheyenne River Near Horace
31834	Red River Near Harwood
966	Red River Near Halstad Mn
29102	Red River At Pembina

Outlet Monitoring Sites

The following tables shows the range of sulfate levels measured at various locations, from May 2023 through April 2024.

SULFATE ON THE SHEYENNE & RED RIVERS



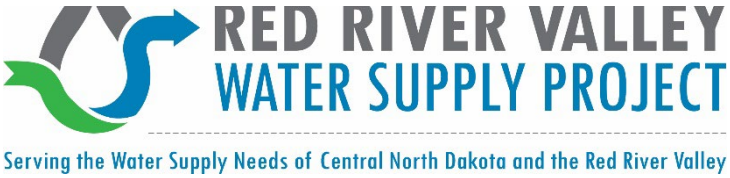
StationID	Station Description	Max	Min	Mean	Median	# Of Samples	LastCollectionDate	LastResult
31816	Sheyenne River Near Flora	631	314	484.12	479	43	24-Oct-23	467
31848	Devils Lake State Outlet	658	582	617.88	616	41	24-Oct-23	619
31817	Sheyenne River Near Bremen	651	333	592.12	604	43	24-Oct-23	615
5389	Sheyenne River Near Warwick	648	314	542.36	568.5	22	24-Oct-23	571
128224	East End Outlet at County Road 4	1050	919	959.67	949	27	15-Sep-23	1000
24750	Sheyenne River Near Cooperstown	744	143	530.00	537	27	19-Mar-24	143
126171	Lake Ashtabula East Of Hannaford	746	301	548.17	550.5	12	17-Oct-23	523
126172	Lake Ashtabula At Sibley Crossing Bridge	753	285	545.25	584.5	12	17-Oct-23	557
126173	Lake Ashtabula Downstream Location At Ashtabula	739	275	538.75	597	12	17-Oct-23	645
24563	Sheyenne River Below Baldhill Dam	664	288	478.85	480	27	19-Mar-24	598
16280	Sheyenne River Near Horace	640	309	427.93	419	27	19-Mar-24	334
31834	Red River Near Harwood	408	102	231.76	239	17	19-Mar-24	215
966	Red River Near Halstad Mn	424	187	301.06	301	17	19-Mar-24	187
29102	Red River At Pembina	492	93.3	215.02	199.5	18	12-Mar-24	197

The Devils Lake Outlets Management Advisory Committee met in Devils Lake on April 16, 2024. The Committee members stated that an emergency condition exists, and that pumping should continue at the maximum amount allowable.

The West End outlet started the 2024 operation on May 6 while the East Outlet started discharge on May 14. Discharge rates have varied due to water quality and quantity constraints. Excessive rainfall has occurred during the months of May and June, causing the lake level to increase to about 50.1 as of July 12, 2024. Based on North Dakota Agricultural Weather Network measurements taken near the town of Devils Lake, precipitation was about 204 percent and 170 percent above normal for those two months.

Note: All elevations provided are based on the 1929 datum.
Stage + 1400 feet = Elevation in 1929 datum
Stage + 1401.33 feet = Elevation in 1988 datum

D-2 Red River Water Supply Projects



Red River Valley Water Supply Project (RRVWSP)

The Red River Valley Water Supply Project (RRVWSP) is a drought resiliency project and economic development initiative that will deliver treated Missouri River water to central and eastern North Dakota through a buried pipeline.

An emergency water supply will be delivered to communities and rural water systems during moderate to severe droughts. The water will also provide opportunities for industrial development, as a current lack of industrial water supply has driven industries to obtain water through less desirable means and/or relocation out of North Dakota.

Upon completion, the RRVWSP will benefit about half of North Dakota's population. Over 30 cities and water systems committed early on to help fund the development portion of the project, where a capacity of about 159 cfs would be needed to service these interests.

The project's state sponsor is the Garrison Diversion Conservancy District (Garrison Diversion) while the local sponsor is the Lake Agassiz Water Authority (LAWA) for the project.

Project leaders have recently spent several months attending countless meetings with rural water systems and city leaders within the regional project area, to further determine commitments to the RRVWSP.

The current estimated cost of the project is $1.24 billion, for 165 cfs project capacity.

Figure 1 - Red River Valley Water Supply Project

D-3 US Army Corps of Engineers Flood Control Activities

MVP Red River Basin Activity Summary

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, updates to USACE water control manuals, 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 risk management to a metropolitan area of nearly 260,000 people.
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 (P3), and the Corps constructs the Southern Embankment or "dam" portion of the project. Federal construction began in spring 2017 and is ongoing for the Diversion Inlet Structure, Wild Rice River Structure, Red River Structure, I-29 Grade Raise, Drayton Dam Fish Passage Mitigation (see below) and Southern Embankment Reaches SE-1B, SE-2A, SE-2B and SE-4. Construction of the Southern Embankment Reach SE-1 and the Drain 27 Wetland Restoration are complete. The sponsors selected their P3 developer, Red River Valley Alliance, in June 2021 and construction of the diversion channel began fall 2022. The Project is scheduled to be operational in time for a Spring 2027 flood event. The federal work was funded to completion in the Infrastructure Investment and Jobs Act, Nov. 2021 (Public Law 117-58).

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 removing and replacing the existing dam and creating an arched-rapid fishway, which creates rock riffles for fish movement. The project is included as mitigation for the Fargo-Moorhead Metropolitan Area Flood Risk Management Project. A construction contract was awarded in May 2022 and work was completed in the fall of 2023. The old low-head dam was removed, and boulders were placed to create an arched-rapid fishway passage. In total, approximately 1,100 boulders were placed. The contractor will complete riverbank vegetative establishment in 2024.

Devils Lake Embankment Project

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

As of July 27, 2024, the lake elevation is 1451.31 feet, down from its record elevation of 1454.30 feet in June 2011. The embankment construction is complete with a minimum elevation of 1466.00 feet. With all final components of the project complete, (construction and excavation) the project was transitioned to the city of Devils Lake, North Dakota, on July 17, 2018). USACE has provided all project documentation (Operation and maintenance manuals and project as-build drawing) to the city of Devils Lake. USACE continues to provide FEMA and State of North Dakota with project information in support of the National Flood Insurance Program with the project in place.

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 Aneta Water and Sanitary Sewer Replacement Project

The City of Aneta's sanitary sewer and water infrastructure, originally installed around 1960, is aging and creating problems for the community. The city has been proactive with portions of their infrastructure, recently replacing their water tower, several fire hydrants and 3 blocks of

emergency water main replacement project. However, the sewer mains, a majority of the water mains and services have not been updated. The proposed project consists of replacing all of the above noted sanitary sewer and water mains. Also included in the scope of work is replacement of manholes, service lines, hydrants, valves, street repairs, curb and gutter, sidewalk, and American with Disabilities Act ramp improvements. In fiscal year 2022, the city of Aneta received $4,887,500 for this project. The Corps executed a project partnership agreement with the city in November 2023 and the project is anticipated to be complete in fiscal year 2026.

City of Cando Water and Sanitary Sewer Replacement Project

Approximately two-thirds of the city of Cando's sanitary sewer system is older vitrified clay pipe (VCP). The exact age of the pipe is unknown, but it is estimated that this pipe has been in the ground for 65 years or more. These clay sewer mains are at the end of their service life and are starting to deteriorate. The purpose of this project is to replace and rehabilitate the deteriorating sanitary sewer system and water mains throughout the city of Cando. This project will help prevent possible health and safety hazards by addressing system deficiencies and reducing the possibility of a sewer collapse and backup into homes and businesses. In fiscal year 2022, the city of Cando received $3,275,000 for this project. The Corps executed a project partnership agreement with the city in March 2024 and the project is anticipated to be complete in fiscal year 2026.

City of Enderlin Drinking Water and Water Treatment Plant Improvement Project

The city of Enderlin's is currently working to identify what their environmental infrastructure funding will be put towards, and they've hired a consultant to assist in this effort. In fiscal year 2022, the City of Enderlin received $3,800,000 for this project. Once the city's priorities are determined Corps will work with the community to execute a project partnership agreement for construction.

Current Studies

CAP 1135 – Lower Otter Tail River Restoration Project

Breckenridge, Minnesota

Under Continuing Authorities Project (CAP) 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.

The St. Paul District and the Buffalo-Red River Watershed District (BRRWD) has completed the 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.

Following discussions with USACE regarding land acquisition requirements and the inability to utilize Reinvest in Minnesota (RIM) Easement dollars for acquisition, the BRRWD has decided that they will pursue this project on their own utilizing existing funds they have and requested that the CAP 1135 project be terminated.

CAP 14 – Sheldon Road Bridge

Sheldon, North Dakota

The purpose of the Continuing Authorities Program (CAP) 14 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 and continues to erode today. The erosion is threatening the use of Sheldon Road Bridge. 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. Following the completion of the feasibility phase, the study report was approved June 2, 2021. A project partnership agreement between the Corps and Ransom County was executed March 22, 2023.

The design and implementation phase of the project will be cost shared at 65% federal and 35% non-federal and will utilize a design/build multiple award task order contract (MATOC). During the spring of 2024, the Corps learned that Ransom County was replacing the Sheldon Road Bridge in the summer of 2024. The Corps MATOC is now being updated to incorporate the new bridge design and location. The Corps anticipates construction of the Sheldon Road CAP 14 riverbank stabilization to begin during the 2025 construction season.

Tribal Partnership Program (TPP)

Red Lake River fish passage and the Zah Gheeng Marsh Restoration, Red Lake River, Minnesota
The Tribal Partnership Program (TPP) will address the degradation of culturally significant habitat faced by the Red Lake Nation on their tribal lands along the Red Lake River and the Zah Gheeng Marsh. The study will assess and make recommendations related to fish passage through a low-head dam and wetland restoration opportunities along the Red Lake River. The Red Lake River is the only outlet to Lower Red Lake, which is completely within the boundaries of the Red Lake Nation in Red Lake, Minnesota. The Zah Gheeng Marsh is adjacent to the Red Lake River, immediately downstream of Lower Red Lake. The Red Lake River is a tributary to the Red River of the North.

The Zah Gheeng Marsh has not been functioning as it did before construction of the Red Lake Dam and channelization of the Red Lake River. Previous efforts to restore marsh function include construction of the low-head dam and inlet structures which pass flows into the marsh directly from Red Lake. The Red Lake Dam, channelization, low-head dam, and inlet structures are USACE projects. The purpose of the feasibility study is to examine the hydrologic restoration of the Zah Gheeng Marsh as it relates to waterfowl and fur-bearing mammal habitat and a low-head dam on the Red Lake River in conjunction with wetland hydrology and fish passage.

A feasibility cost-share agreement between the Corps and the Red Lake Nation was signed on June 16, 2021. The study includes gathering information, formulating alternatives, analyzing costs, benefits, and environmental impacts, and recommending a plan on how to address hydrologic restoration and fish passage. Significant hydraulic modeling is currently underway. The Corps is drafting a feasibility study report with an integrated environmental assessment in coordination with the Red Lake Nation Tribal Council. In Winter 2025, a public meeting and review will be held. The final report is scheduled for Fall 2026.

Sustainable Rivers Program (SRP)

Mud Lake, Wheaton, Minnesota
In 2023, under the Sustainable Rivers Program (SRP), St. Paul District completed an environmental assessment (EA) of the effects of a drawdown, fall flooding, and minimum releases at Mud Lake via the White Rock Dam to provide shorebird and waterfowl habitat. Water releases would discharge into the Bois de Sioux River. The SRP is an Army Corps of Engineers and The Nature Conservancy partnership that focuses on modifying operations at Corps dams to enhance habitat conditions for the plants and animals that depend on downstream river flows.
In 2020 and 2021, scoping opportunities and constraints to modify discharges from Mud Lake occurred, including coordination with agency partners. During scoping there was general agreement from agencies that it would be possible to operate the dam in a way that would benefit both shorebirds and fisheries by identifying minimum flows and managing ramping rates. The Corps' EA evaluated how operating the White Rock Dam to drawdown and flood Mud Lake will affect the hydrologic regime in the Bois de Sioux River and the organisms it supports, as well as other effects to the surrounding environment. A drawdown was performed in September of 2023. While successful, the shorebird response was limited. Another drawdown is planned for

September 2024. The current water control manual update is considering including this type of draw down permanently. More information regarding the project can be found here: https://www.mvp.usace.army.mil/SustainableRiversProgram/MudLake_SRP/.

Updates to Water Control Manuals at USACE Projects

Fiscal Year 2023

In fiscal year 2023 the following USACE projects received funding to begin a Water Control Manual (WCM) update:

Lake Traverse (Reservation Dam)/Mud Lake (White Rock Dam)

- The update is expected to take three years (at a minimum – assuming future appropriations)
- In Feb of 2023 USACE conducted a public meeting to gain input from the public and stakeholder on the proposed update.
- In May of 2023 USACE conducted an internal workshop to create building blocks for modeling based on the public and stakeholder input (delayed due to spring flooding)
- In Jun-Aug of 2023 USACE modeled building blocks
- In Sep of 2023 USACE will review results of the building block runs and combine building blocks into alternatives for phase 2 modeling.

Fiscal Year 2024 (Year 1)

- In fiscal year 2024 USACE the following USACE projects received funding for Water Control Manual updates.

Fiscal Year 2025 (Year 2)

- Year 2 is funded.
- Year 2 includes phase 2 modeling, results from phase 2 given to public and stakeholders for input on phase 3 modeling, phase 3 modeling and the draft decision document complete.

Lake Ashtabula (Baldhill Dam)

- Update is expected to take two years as it is assumed the manual is more up to date and it is assumed less phases of modeling will be required (at a minimum – assuming future appropriations).
- Year 1 includes initial public/stakeholder meetings, phase 1 modeling, mid-point public/stakeholder meetings, phase 2 modeling.

Red Lake (Red Lake Dam)

- Update has been paused; when resumed, it is expected to take three years (at a minimum – assuming funding)

- The pause came after a public meeting with the Red Lake Nation, and MVP decided additional Tribal Consultation was necessary before advancing with the update.
- Year 1 includes initial preliminary H&H work and data gathering which will support eventual modeling.

Planning Assistance to States and Tribes (Section 22)

Long Term Flood Solutions Plan

North Dakota and Minnesota - The Planning Assistance to States and Tribes (PAS) project, sponsored by the Red River Basin Commission (RRBC), the Corps the study consisted of development of a basin-wide, long-term flood risk reduction plan for the Red River watershed within Minnesota and North Dakota. The Corps developed an updated hydrologic and hydraulic model for the basin to assess the 1.0, 0.5, and 0.2% chance exceedance events and the possibility of flood risk reduction through potential upland storage impoundments for rarer flood events. Sensitivity to variations in precipitation and snow melt patterns were also evaluated. The Corps updated hydraulic models and the sponsor provided basin-wide hydrology models of the tributaries to be used in the storage analysis. The Corps also evaluated climate variability and the potential impacts on future flood magnitudes. The project has a 50/50 cost share with the RRBC, with a federal contribution of $325,000. The Final Report is complete, and the agreement is in the final stages of fiscal close out.

Red River of the North Comprehensive Study/Downstream Storage Project

North Dakota and Minnesota
The Planning Assistance to States and Tribes (PAS) project, sponsored by the RRBC, have developed a distributed storage analysis for the portion of the basin downstream of Halstad, Minnesota. This study compliments the existing storage model upstream of Halstad. Hydrology models developed by RRBC consultants provided basin details required for the analysis. All hydraulic models are complete and ready for use 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 2024 and is a companion study to the Long-Term Flood Solutions Plan PAS project.

Red River of the North Main Stem Bathymetric Study

North Dakota and Minnesota
The Planning Assistance to States and Tribes (PAS) project, sponsored by the North Dakota Department of Water Resources, with support from the RRBC, revised executed a project partnership agreement to obtain bathymetric data, or channel geometry, for 444 river miles of the Red River of the North main stem from White Rock Dam to the Canadian border in May 2024. Additionally, Corps coordinated with the IJC to obtain the same data for the Canadian

portion of the main stem and selected tributaries (separately funded). This project has a 50/50 cost share with the North Dakota Department of Water Resources, with a USACE contribution of $242,500. Engineering Research and Development Center survey team has completed approximately 70% of the survey. An estimated 2.5 weeks to complete survey data gathering is forecasted. Following survey completion, data will be post-processed and provided to MVP district GIS specialists to integrate with LiDAR data creating a seamless "topobathy" data layer. Final product is estimated to be complete in fall of 2024. This project represents the largest continuous data set collected in a single season on a riverine system within the contiguous United States.

Thief River Falls Raw Water Intake

Minnesota

The Thief River Falls Raw Water Intake is a Planning Assistance to States and Tribes (PAS) project, sponsored by the city of Thief River Falls, MN. The goal of the study is to provide technical assistance to assist the city evaluate the current state of sedimentation in the river from the existing raw water intake to approximately 1 mile upstream near Centennial Park. The resulting technical assistance will be used as baseline information towards studies and design efforts involving the installation of a new raw water intake and screen in the area upstream of Thief and Red Lake River. Site suitability will be, in part, assessed through water depth variability, sediment depth and deposition patterns and presence of standard HTRW contaminants in the vicinity of the preferred site location. Field data collection has been completed. Remaining project tasks include evaluation of the data and report development. This project has a 50/50 cost share with the City of Thief River Falls, with a USACE contribution of $91,500.00. Project is scheduled for completion in December 2024.

Northern Red River Flood Study (NRRFS)

North Dakota and Minnesota

The Northern Red River Flood Study (NRRFS) Planning Assistance to States and Tribes (PAS) project, co-sponsored by the North Dakota Department of Transportation and Minnesota Department of Transportation. The overall objective of this study is to identify and prioritize feasible alternatives that reduce the frequency and duration of Interstate and State Highway closures due to flooding of the Red River of the North. The Interstate and State Highway closures caused by flooding have had a substantial effect on both transportation agencies and users, forcing travelers to follow lengthy detours, limiting access across the region, and requiring roadway monitoring, cleanup, and repairs. By identifying and prioritizing feasible alternatives to reduce flood-related Interstate and State Highway closures, the resources needed to respond to flood events and the regional impact of flooding can be mitigated. This project has a 50/50 cost share with the North Dakota Department of Transportation and Minnesota Department of Transportation, with a USACE contribution of $514,948.00. The study is projected to be completed in FY 2026.

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.
The Red River of the North Basin Gage Datum Update Project initiated in 2017, to update river gage datum to the current standard (NAVD 1988) and provide consistent elevations for the river stages across the basin. During phase 1 of the project, USACE converted 34 river gages. Phase 2 of the project, USACE completed an additional 62 gages. Remaining gages were completed by the three regional Watershed Districts: Bois de Sioux, Two Rivers, and the Red Lake River Watershed District. A total of 204 gages were updated as a result of this coordinated effort. These gages are critical during flood fighting periods to provide greater fidelity to the stream monitoring network. This gage datum conversion project has received a total of $150,000. The final report was completed in January 2024. The project is in the final stages of fiscal close out.
Emergency Operations

Emergency Operations

During flood events in the St Paul Districts area of responsibility, the St. Paul District provides emergency assistance in support of the locally led flood response. The St. Paul District becomes part of a larger force made up of local, state, and federal responders as well as volunteers.
In 2024 the St. Paul District provided both technical and direct assistance in multiple communities due to spring flooding. The flood area manager and assistant area managers continue to better define roles and solidify relationships with communities in the affected basins to continually improve our support. The district's emergency management team is also prepared to provide water assistance due to drought.

PL84-99 Rehabilitation Assistance PL84-99 Rehabilitation Assistance

Fiscal Year 2022 Red River Basin Requests

In the spring of 2022, the following projects were damage by flood event and the associated local project local sponsors submitted requests for PL84-99 assistance to repair the flood related damages:
Oslo, MN – Due to high water the project experience erosion along approximate 4,000ft of the levee toe. USACE completed a project implementation report (PIR) in October of 2023. Currently, USACE is the process of completing all final permitting and compliance and intends to award a construction contract to complete the repairs in the summer of 2024.

Pembina, ND - The Pembina levee system experienced damage due to debris flow on the Red River and wave action caused by high winds. The debris flow had displaced and damaged a 35 linear foot section of sheet pile wall on the outlet of the pump station. USACE completed a project implementation report (PIR) in October of 2023. Currently, USACE is the process of

completing all final permitting and compliance and intends to award a contract to remove the displaced sheet pile in the 2024 construction season.

St. Vincent, MN - Due to high water the project experience erosion along approximate 2,000ft of the levee toe. USACE completed a project implementation report (PIR) in October of 2023. Following the event, the local sponsor (St. Vincent) made repairs to the erosion area. After a site visit and review, USACE has determined the repairs are sufficient and no additional work is required.

Noyes, MN - Due to high water the project experienced significant erosion along the levee. The levee system at Noyes is currently inactive in the Public Law 84-99 rehabilitation assistance program due to unacceptable deficiencies from encroachments and flood damage that dates back to 2009. USACE is pursuing the possibility to return the levee to active status pursuant to Section 120(2) of WRDA 2020. Repairs due to flood damage from both the 2009 and 2022 floods would be performed by USACE at 100% federal expense. USACE has drafted and is currently reviewing a project cooperation agreement that will accompany the Section 120(2) request. This request requires ASA(CW) approval. Pending Section 120(2) and funding USACE would repair the existing flood damages, and the non-federal sponsor is required to address any other project deficiencies that would affect the projects eligibility under the PL84-99 program.

Fiscal Year 2023 Red River Basin Requests

Grand Forks, ND - Due to high water during the 2023 high water event on the Red River of the North, the streamflow velocity of flood waters going through the English Coulee exceeded the designed protection of the channel slopes and scoured topsoil and foundation material of the system. Total damaged areas exceed 4,600 linear feet worth of damage that is sporadic along two miles of channel. USACE completed a project implementation report (PIR) in July of 2024. USACE is currently coordinating with the city and planning for the repair work. USACE plans to execute a construction contract to repair the damage in fall of 2024.

D-4 USGS Water Resources Investigation and Activities

ADDITIONAL ACTIVITIES IN THE RED RIVER BASIN

USGS Water Resource Investigations and Activities

Streamflow Conditions January-August 2024

The 2023-2024 winter season (Dec-Jan-Feb) can mostly be characterized as warm and wet for the Red River Basin, with the Fargo-Moorhead weather station recording the warmest ever winter season at an average temperature of 26.5 degrees Fahrenheit (F) and the second wettest at 3.83 inches of precipitation (NWS Grand Forks Forecast Office, 2024b). The January average temperatures were 5-10 degrees F above normal for all National Weather Service (NWS) weather stations in the Red River Basin. The NWS Grand Forks weather station recorded 12 days of temperatures below normal in the middle of January, while the rest of the days were well above average for that location (NWS Grand Forks Forecast Office, 2024a). The span of colder days in mid-January allowed for the formation of a deeper frost layer of 20-30 inches for most of the Basin (NWS Grand Forks Forecast Office, and NWS North Central River Forecast Center, 2024a). Snow cover by January 31st was minimal for most of the Basin, except for the northwest corner of MN (NWS Grand Forks Forecast Office, 2024a). Except for the last 3 days of the month, February was another month with average daily temperatures around 20 degrees F above normal as measured at the NWS Grand Forks weather station. Average monthly temperatures were 12-18 degrees F above normal for all NWS weather stations in the Basin. This was the warmest February on record for the Fargo-Moorhead NWS weather station with an average of 30.9 degrees F recorded (NWS Grand Forks Forecast Office, 2024b). There was also no snowfall for the month of February until February 27, when a blizzard brought 6 inches of snow to a small region in the center, and 2-4 inches for much of the remainder, of the Basin (NWS Grand Forks Forecast Office, 2024b). Drought conditions at the end of December showed Abnormally Dry conditions for a majority of the Basin, except for the area at the international border, which showed Severe Drought. This intensified throughout the winter season to Abnormally Dry for more portions of the southern Basin and an increased area of Moderate and Severe Drought in the north, by the end of February (U.S. Drought Monitor, 2024a).

Streamflow conditions at the time of freeze-up were in the normal range for the Red River and most of the major tributaries, with the exception of the Sheyenne, the Wild Rice, and the Goose Rivers, which were all flowing at above normal going into the winter season (U.S. Geological Survey, 2024b). A rain event occurred in the headwaters of the Red River from Dec 25-27, with a maximum total of approximately 2.4 inches of precipitation recorded at Sonora, ND, (North Dakota Agricultural Weather Network, 2024a). This rain event caused a substantial rise in flow on the mainstem Red River, the Maple River and the Wild Rice River resulting in streamflow for all three to exceed the 95th percentile, or "much above normal", streamflow for this time of year (U.S. Geological Survey, 2024b). All other streams in the Red River Basin mostly remained unaffected from this precipitation event. This increase in flow, coupled with mild temperatures, prevented formation of good ice at many USGS streamgage locations until much later in the winter season, preventing the collection of streamflow measurements until February or March, in most cases (U.S. Geological Survey, 2024a). Streamflow remained at or just above normal for the remainder of the winter season, with the exception of a rise into "much above

normal" for a short period in mid-February, due to a precipitation event that resulted in 0.5-0.75 inches of precipitation for a significant portion of the central Basin, from Fargo up to Baudette and 0.25-0.4 inches for the remainder of the Basin, excluding only the Devils Lake subbasin (NOAA National Water Prediction Service, 2024a).

The National Weather Service (NWS) Grand Forks Forecast Office held the first Spring Flood Outlook webinar of 2024 on January 25, at which time the outlook showed a low risk for significant (moderate or higher) flooding in the Basin, due to relatively normal frost depths, much below normal snowfall and below to near normal soil moisture and precipitation (NWS Grand Forks Forecast Office, and NWS North Central River Forecast Center, 2024a). Subsequent outlooks were provided on February 15, February 29 and lastly on March 14, each progressively reducing the risk of significant flooding. The outlook on March 14 stated the risk for significant flooding was very low and that the risk would primarily be from rainfall, as the soil moisture remained below normal and snowpack had melted away across the Basin, by this time (NWS Grand Forks Forecast Office, and NWS North Central River Forecast Center, 2024b).

Average daily temperatures in March remained cool, delaying ice-off until early April (North Dakota Agricultural Weather Network, 2024c). Due to the relatively dry conditions at time of freeze-up and the lack of snowpack accumulation during the winter, ice-off did not result in any significant increase in flows and there were no streamgages in the Red River Basin that reached flood stage from ice-out (U.S. Geological Survey, 2024a). Flow at most streamgages in the Red River Basin was "below normal" at the beginning of April but rose well into the "normal" range throughout the month, as up to 3.5 inches of rain fell in the southern Basin, reducing to 2.5 in the middle and down to 1.5-2 inches in the north (NOAA National Water Prediction Service, 2024b). Both May and June were wetter months with 4-7 inches falling throughout the Basin during the month of May and an additional 4-7 inches falling in the month of June, with the majority of the Basin receiving 10-11 inches of rain in May and June combined (NOAA National Water Prediction Service, 2024c, NOAA National Water Prediction Service, 2024d). The month of July added another 3 inches, on average, of rain to the Basin, while August added on average another 4 inches (NOAA National Water Prediction Service, 2024e, NOAA National Water Prediction Service, 2024f). This resulted in drought conditions to reduce from Abnormally Dry in the middle of the Basin and Moderate to Severe Drought from Grand Forks north to the international border at the end of April, to no drought at all for the entire Basin by the end of May and remaining that way through August (U.S. Drought Monitor, 2024b). Streamflow on the mainstem Red River and most major tributaries also increased to "much above normal" flows by the end of May, remaining there or at the "above normal" flows through August. The only exceptions were the Sheyenne River and the Pembina River, which remained in the 76-90th percentile, or at "above normal" in May, not rising to "much above normal" until July but remaining there through August for the Sheyenne River and receding back to "normal" flows by the end of July for the Pembina River, as seen in figures 4 and 6 below (U.S. Geological Survey, 2024b). Most of the 2024 Water Year peaks occurred in May so far, with some streamgages, including the Red Lake River at Crookston, MN, having reached their peak in June from continued precipitation since May (U.S. Geological Survey, 2024a). Some provisional peaks as of June 20, 2024, for stations with at least 70 years of data are shown below.

05054000, Red River of the North at Fargo, ND

Provisional peak of 6,960 cfs at 22.16 ft on May 27, 2024; not a top 10 peak (U.S. Geological Survey, 2024).

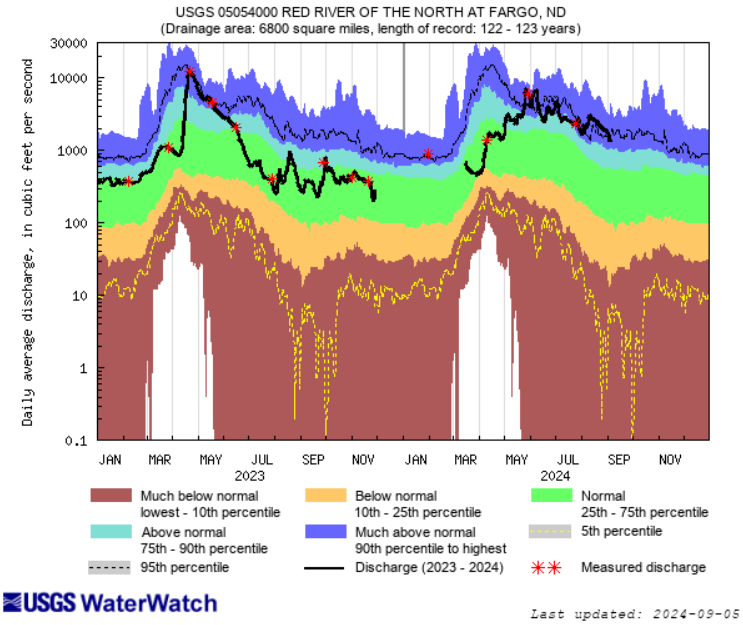


Figure 1: Streamflow at the Red River of the North at Fargo, ND January 1, 2023-September 5, 2024 (https://waterwatch.usgs.gov/index.php?id=wwchart_sitedur).

05082500, Red River of the North at Grand Forks, ND

Provisional peak of 19,400 cfs at 27.34 ft on May 29, 2024; not a top 10 peak (U.S. Geological Survey, 2024).

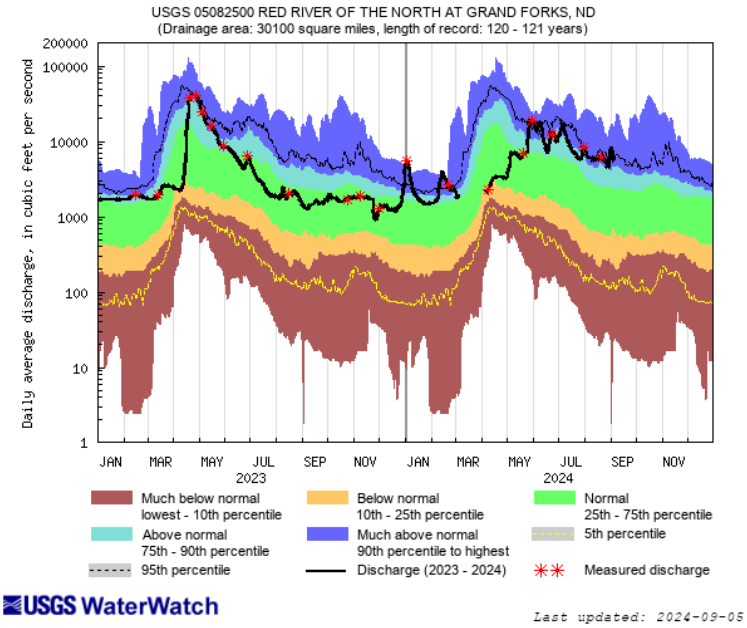


Figure 2: Streamflow at the Red River of the North at Grand Forks, ND January 1, 2023-

September 5, 2024 (https://waterwatch.usgs.gov/index.php?id=wwchart_sitedur).

05053000, Wild Rice River nr Abercrombie, ND

Provisional peak of 1,980 cfs (est) at 19.46 ft on June 29, 2024; not a top 10 peak (U.S. Geological Survey, 2024).

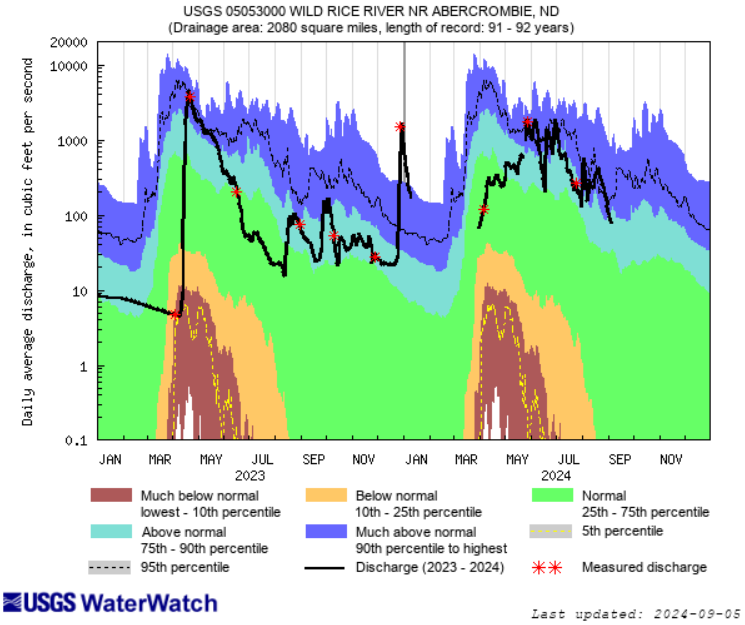


Figure 3: Streamflow at the Wild Rice River nr Abercrombie, ND January 1, 2023-September 5, 2024 (https://waterwatch.usgs.gov/index.php?id=wwchart_sitedur).

05059000, Sheyenne River nr Kindred, ND

Provisional peak of 1,620 cfs at 10.25 ft on June 26, 2024; not a top 10 peak (U.S. Geological Survey, 2024).

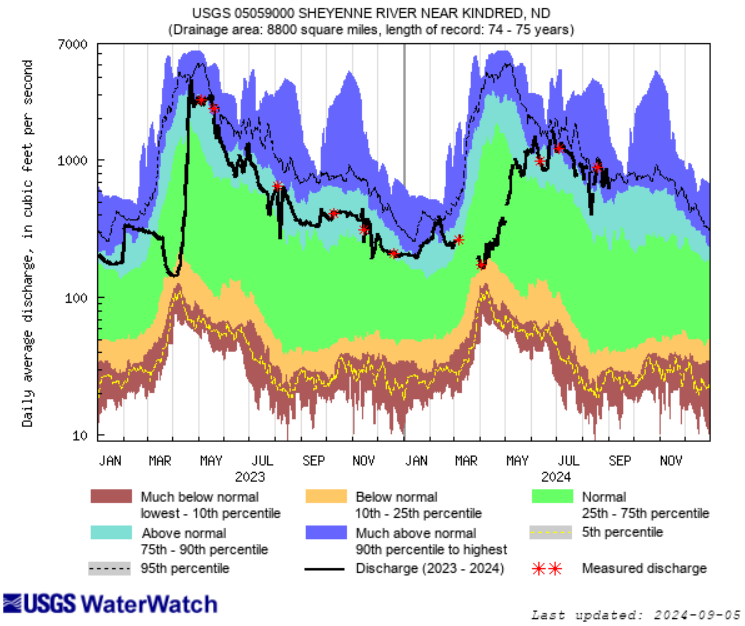


Figure 4: Streamflow at the Sheyenne River nr Kindred, ND January 1, 2023-September 5, 2024 (https://waterwatch.usgs.gov/index.php?id=wwchart_sitedur).

05079000, Red Lake River at Crookston, MN

Provisional peak of 9,270 cfs at 15.65 ft on July 3, 2024; not a top 10 peak (U.S. Geological Survey, 2024).

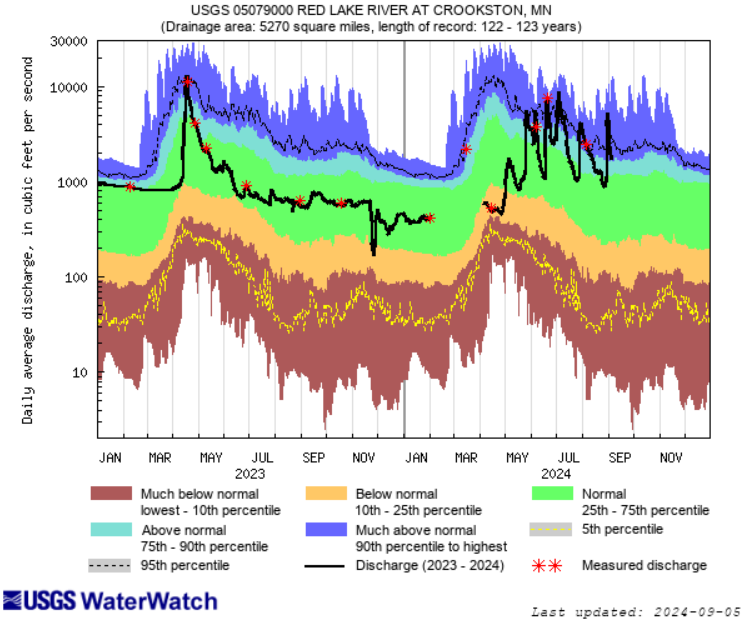


Figure 5: Streamflow at the Red Lake River at Crookston, MN January 1, 2023-September 5, 2024 (https://waterwatch.usgs.gov/index.php?id=wwchart_sitedur).

05100000, Pembina River at Neche, ND

Provisional peak of 3,100 cfs at 14.31 ft on July 3, 2024; not a top 10 peak (U.S. Geological Survey, 2024).

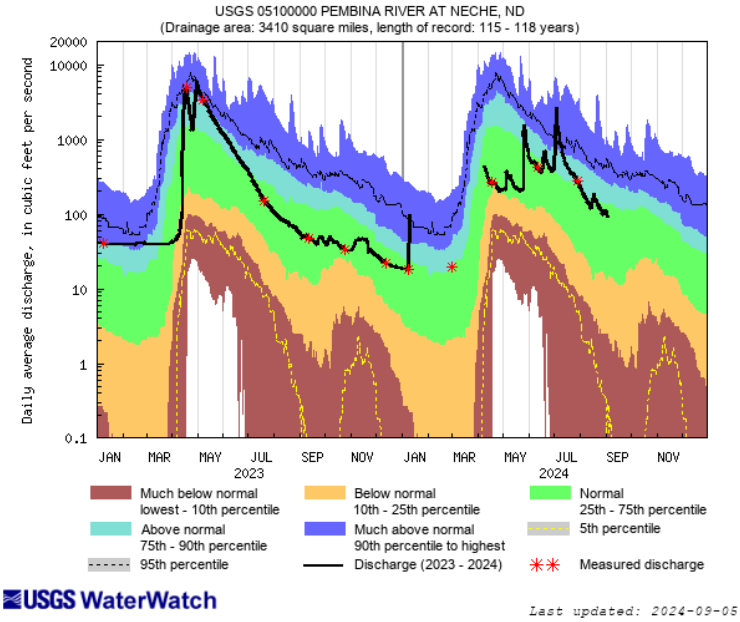


Figure 6: Streamflow at the Pembina River at Neche, ND January 1, 2023-September 5, 2024 (https://waterwatch.usgs.gov/index.php?id=wwchart_sitedur).

The Devils Lake Basin was subject to same mild temperatures and meager snowfall in the 2023-2024 winter season, as the rest of the Basin. Lake levels therefore did not rise until the first rain event on April 16 of just under 0.90 inches. An additional 1.16 inches of rain fell April 26-27 and another 0.49 inches April 29-30 (North Dakota Agricultural Weather Network, 2024b). In total, the month of May saw an average of approximately 5 inches of rain fall in the entire Devils Lake region, with a total of 3.09 inches recorded by the Cando, ND NDAWN station over May 23-24 (NOAA National Water Prediction Service, 2024c, North Dakota Agricultural Weather Network, 2024b). Additionally, another 6.12 inches of rain have been recorded at the Cando, ND, NDAWN station for the month of June, 2.33 inches for the month of July, and 4.18 inches for the month of August (North Dakota Agricultural Weather Network, 2024b). All this combined for a provisional rise of 0.89 ft in the Devils Lake level from April 16 to July 23, with a provisional peak of 50.17 ft on July 23 (U.S. Geological Survey, 2024c). Pumping resumed out of the west-end outlet on May 6 and out of the east-end outlet on May 14 (North Dakota Department of Water Resources, written commun(s)., May 6 and May 14, 2024).

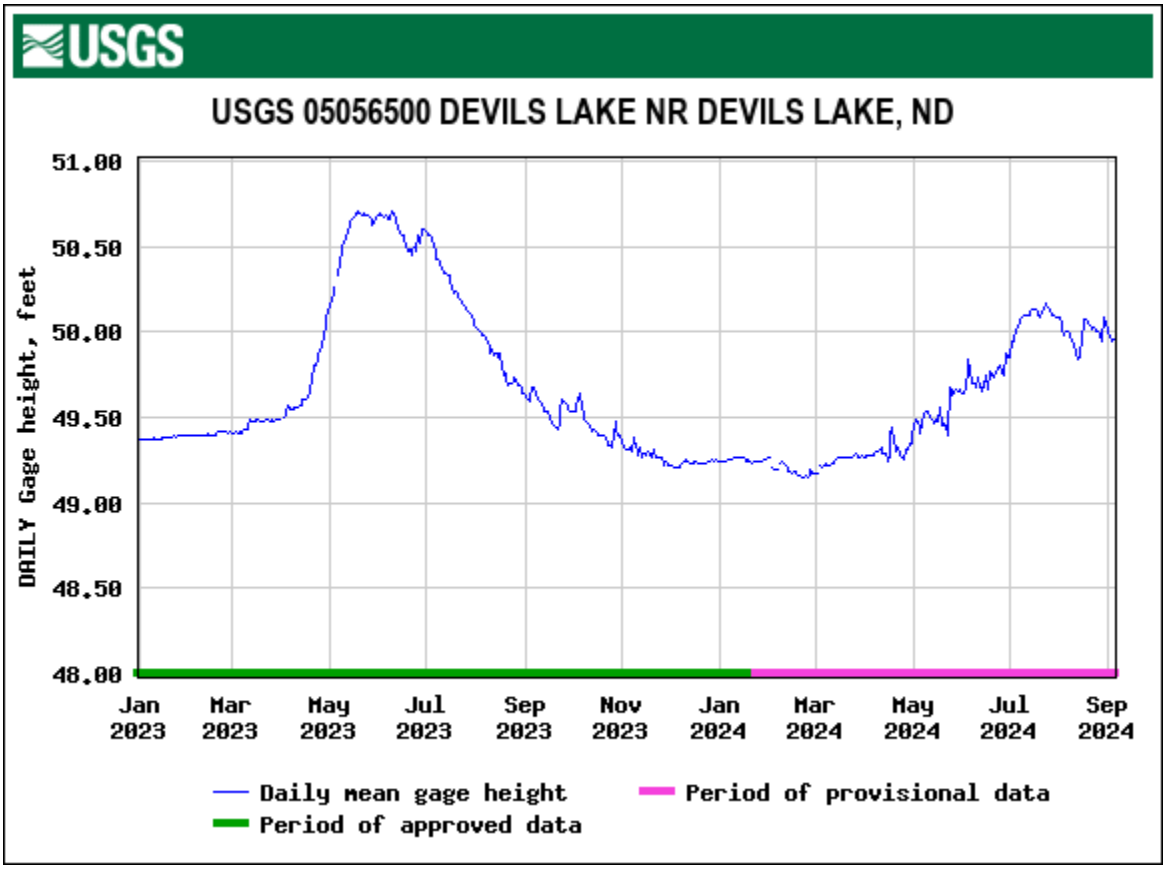


Figure 5: Devils Lake Gage Height January 1, 2023–September 5, 2024 (https://waterdata.usgs.gov/nwis/dv?cb_00065=on&cb_00065=on&format=gif_default&site_no=05056500&legacy=&referred_module=sw&period=&begin_date=2023-01-01&end_date=2024-09-05).

USGS Scientific Investigations Update

Fargo-Moorhead Diversion Monitoring

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 is 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 is 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 (water temperature, specific conductance, pH, dissolved oxygen, and turbidity).
    - Red River at Georgetown, Fargo, and Hickson
- All sites operated for continuous discharge, excluding Red River at Harwood.

Data collection for the first phase, pre-construction, is complete and a report has been published (Galloway and others, 2024). The second phase of data collection, during construction, began fall 2022 and continues through fall 2027.

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 (WBM) of the Red River Basin upstream of Emerson 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 WBM has been calibrated and verified and the stochastically generated weather data has been derived. Using the calibrated WBM and 100 50-year traces of stochastic weather data, future streamflows have been simulated. From the future streamflow simulations, low-flow frequency curves have been derived for Wahpeton, Halstad, Grand Forks and Emerson.

Red River Sulfate Study

The Red River sulfate study is a follow up to the Red River trend analysis and is dependent upon output from the Red River low-flow study. This project was set up to develop trend attribution models for the Red River at Emerson and the Red River at Selkirk. Two categories of explanatory variables will be evaluated for this project: natural or hydroclimatic variables and anthropogenic variables. Natural/hydroclimatic variables will be considered first and then anthropogenic sources. Based on the large and consistent increases in sulfate occurring about the same time as the onset of the wetter conditions in the basin, we expect that the natural/hydroclimatic variables such as shallow groundwater flow or runoff from saturated soil will explain a large component of the trends. Output from the Red River low-flow water balance model (WBM) that represent the components of runoff will be used for natural/hydroclimatic variables. Output from the Red River low-flow model has recently become available so work will soon begin on the trend attribution model for the Red River at Emerson. An

additional piece planned for this project is to extend the Red River low-flow WBM from Emerson to Selkirk. Once the low-flow WBM is extended, a trend attribution model for Selkirk will be developed.

Galloway, J.M., Nustad, R.A., and Wheeling, S., 2024, Water-quality characteristics of the Red River of the North and tributaries in the Fargo-Moorhead metropolitan area, North Dakota, 2019–22: U.S. Geological Survey Scientific Investigations Report 2023–5136, 76 p., accessed June 21, 2024, at https://doi.org/10.3133/sir20235136.

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Appendix E

Committee, Task Team and Agency Reports

E-1 Water Quality Committee

August 2024 Water Quality Committee Report to the IRRWB

The Water Quality Committee currently consists of the following members:

Nicole Armstrong, Manitoba Environment and Climate Change (co-chair)
Theresa Haugen, Minnesota Pollution Control Agency (co-chair to May 2024)
Ted Preister, Red River Basin Commission
Rochelle Nustad, U.S. Geological Survey
Iris Griffin, Environment and Climate Change Canada
Pete Wax, North Dakota Department of Environmental Quality
Jason Vanrobaeys, Health Canada
Shanwei Xu, Agriculture and Agri-Foods Canada
Elise Watchorn, Environment and Climate Change Canada
Brian Fuder, Red River Retention Authority
Micah Bennett, US Environmental Protection Agency
Dan Rheault, Manitoba Environment and Climate Change
James Noren, US Army Corps of Engineers

The committee has not met since the January 2024 board meeting.

Much of the work of the committee continues to focus on the board's nutrient management strategy, on which the committee was originally established. The committee (through Environment and Climate Change Canada) is now reporting regularly on compliance with the approved nutrient concentration objectives and load targets, and continues to consider opportunities to reduce nutrient loading to the Red River and its watershed. This work includes sharing information on best practices across the jurisdictions.

The committee has developed a draft terms of reference to share with the board for discussion at the January 2024 meeting. Key questions for discussion with the board include how the committee members and co-chairs are appointed.

The committee worked to support the board in developing its new draft three-year work plan as part of the new directive that was approved in May 2022. Much of this work was done in August 2023 as part of a work plan strategic workshop.

The committee is looking forward to welcoming Indigenous members to the committee and expects to work with the board and other committees on this over the next year.

The committee also expects to support the board and other committees over the next year to report on the state of the basin including with respect to water quality indicators.

The committee recognizes the need to review and update the water quality objectives for the Red River at the US/Canada border and has prepared an IWI proposal that was submitted to the board in January 2024.

To support the objectives review, an IWI project is underway to evaluate factors contributing to trends in sulfate, chloride and total dissolved solids in the Red River Basin. When complete, the project will provide critical information on the factors contributing to trends in concentrations of sulfate, chloride and total dissolved solids, and inform water quality objective review for these three parameters.

E-2 Aquatic Ecosystem Committee

Aquatic Ecosystem Health Committee-IRRWB
August 2024

Canadian Co-Chair: Lee Gutowsky, Fisheries & Oceans Canada
US Co-Chair: Nicholas Kludt, Minnesota Department of Natural Resources

As of August 2024 committee members are:

Todd Caspers (ND)
Brian Mason (MN)
Benjamin Holen (ND)
Geoff Klein (MB)
Jeff Long (MB)
Doug Watkinson (CAN)

Summary of Activities

The Aquatic Ecosystem Health Committee (AEHC) holds monthly phone calls during the fall and winter, while spring and summer are reserved mainly for field work. Discussions this year have focused on planning and activities in the basin. Research and monitoring proposals have been an additional topic of interest, including a new International Watersheds Initiative (IWI) proposal and collaborative opportunity to study flows or "e-flows" under the partner-driven Canadian National Science and Engineering Council (NSERC) Alliance Advantage Program. The latter opportunity has been brought to the attention of both the AEHC and Committee on Hydrology (CoH) who are currently in talks to determine how the committees might mutually benefit from partnering (i.e., financial commitment) or collaborating (i.e., no financial commitment). As discussed in the AEHC's June 2023 update and with the help of supporting documents provided by the International Red River Watershed Board (IRRWB), the AEHC is drafting a Terms of Reference based on the revised Directive from the IJC to the IRRWB. AEHC members have been in discussions with the Seine-Rat-Roseau Watershed District to evaluate funding opportunities (e.g., IWI, Manitoba Fish and Wildlife Enhancement Fund) for carrying out restoration activities related to Lake Sturgeon and aquatic connectivity on the Roseau River. Seine-Rat-Roseau staff have discussed sturgeon restoration with the Roseau River Anishinabe First Nation, and reports indicate support for restoration work. As previously noted, agency partners and stakeholders continue to benefit from the free exchange of information, ideas, and plans for field work facilitated by the AEHC.

IWI proposal – Submitted January 1, 2024

The AEHC is backing an IWI project proposal titled "Assessing Outcomes of Dam Modification to Facilitate Fish Passage in the Red River Watershed". With the help of federal (US and Canada), state, and provincial partners, the current receiver network of underwater acoustic telemetry receivers focuses on the mainstem of the Red River and Lake Winnipeg. Prior IWI funding (IRRB-02-2021) provided support to expand the array into the Otter Tail and Red Lake rivers, important tributaries of the Red River. Despite impressive overall receiver coverage in the

system, the network is too broadly spaced to accurately determine habitat use and passage success at barriers. Direct evaluation of fish passage improvements is a major informational need, with extensions to management and restoration of culturally and commercially valuable species. If funded, the most recently submitted IWI proposal will expand the array around the former Drayton Dam, which in 2023 was converted into a rock-arch-rapids structure designed to effectively pass fish. Funding will support the field work (e.g., travel), additional fish tagging efforts (Lake Sturgeon and Walleye), and hiring a highly-qualified technician.

Red River Telemetry Studies

Telemetry studies in the Red River basin have been supported by IWI proposals through the IRRWB, as well as partnerships with federal (US and Canada), state (Minnesota and North Dakota), and provincial (Manitoba) agencies. If funded, the most recent IWI proposal will provide support to extend the study to 2027. Data collected on habitat use and fish movement are valuable input information for Instream Flow Needs (IFN) predictions of the CoH and provide detailed biological information on fishes in the basin, e.g., migration routes, spawning sites and timing, and overwintering areas. Additionally, data have revealed previously unknown characteristics of population structure and transboundary movement of fish between the US and Canada.

The Lake Winnipeg Fish Movement Program continued in its 8th year. The Red River basin contains a number of ecologically important yet understudied species. For instance, little to no information exists on the movement ecology and barrier passage effectiveness of Freshwater Drum or Silver Redhorse. In an effort to fill knowledge gaps and bolster sample sizes, Fisheries and Oceans Canada tagged Sauger (n = 42, Fig. 1), Silver Redhorse (n = 40), and Bigmouth Buffalo (n = 40) downstream of St. Andrews Lock and Dam in 2024. Through previous IWI funding, an additional 19 Bigmouth Buffalo, 13 Freshwater Drum, 14 Walleye, and 12 Lake Sturgeon were tagged by the University of Nebraska. This brings the total to 1,141 fish, representing 10 species.

Fig. 1 - Surgical tagging and release of Sauger at St. Andrews Lock and Dam, Winnipeg.

Receiver downloads in Lake Winnipeg (~220) occurred as scheduled during spring and summer. Downloads in the Red River were delayed until late spring/early summer due to higher than average flows. All downloads were completed August 7, 2024. An additional six receivers (3 above and 3 below) were deployed at the newly constructed rock-arch-ramp structure at Drayton, ND. These receivers are intended to facilitate a finer-scale assessment of fish passage in the former Drayton Dam area.

New data related to a VEMCO Positioning System (VPS), first deployed in Lake Winnipeg in

2021, have been acquired from Innovasea. Common Carp (n = 1), Freshwater Drum (n = 6), Lake Whitefish (n = 10), and Walleye (n = 42) swam through the VPS array between June 2021 and July 2022 (Fig. 2). Preliminary results indicate seasonality in habitat occupancy. Walleye were most abundant in the array, followed by Freshwater Drum. The array was devoid of activity during winter. Lake Whitefish only occupied the array from May to June, 2023 (Fig. 3). Data logged in 2022-2023 are expected from Innovasea this year. Results from this work will provide a high level of detail about fish movement behavior, habitat use, and inform movement path models for the broader telemetry network.

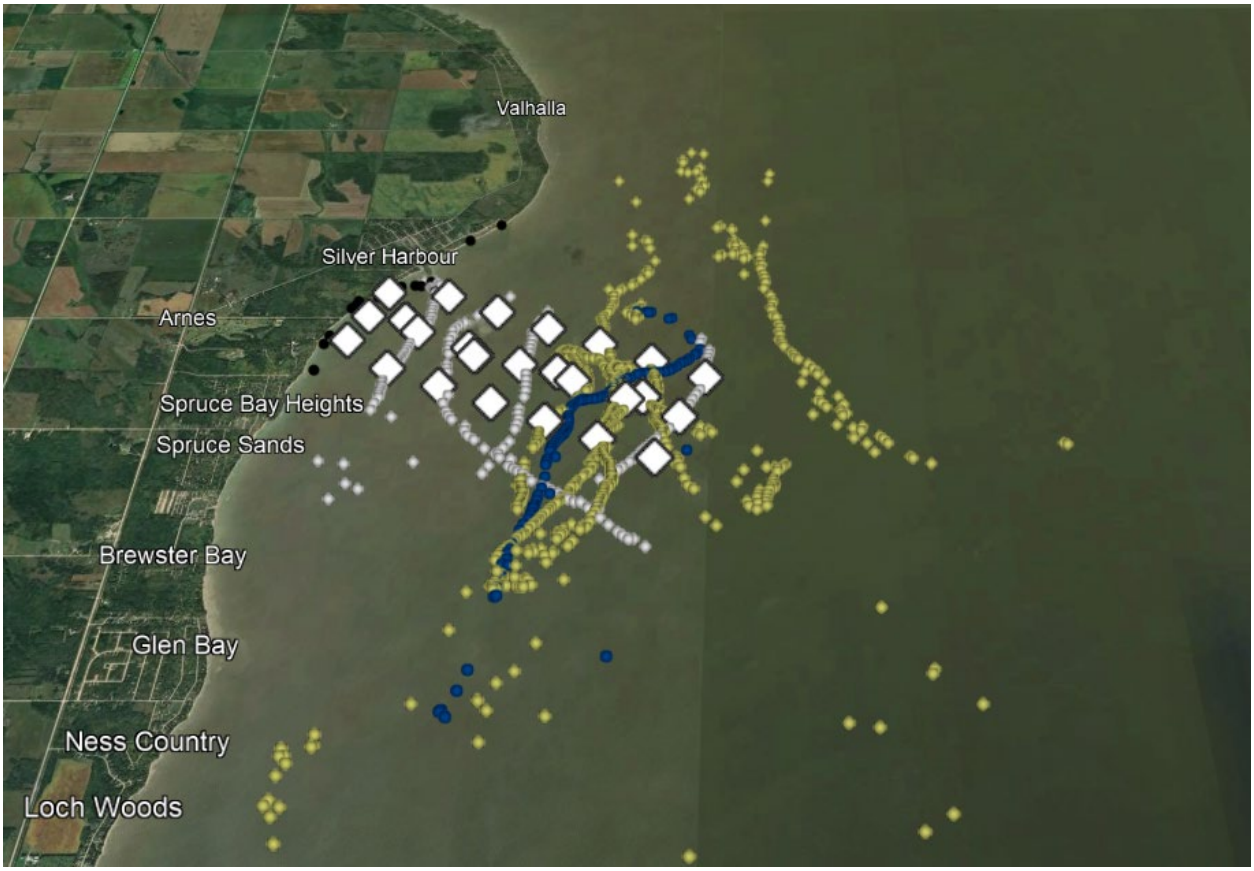

Fig. 2 – Movement paths by select individual Common Carp (black circles), Walleye (gold circles), Freshwater Drum (blue circles), and Lake Whitefish (silver circles) in the VPS array (white diamonds) on Lake Winnipeg.

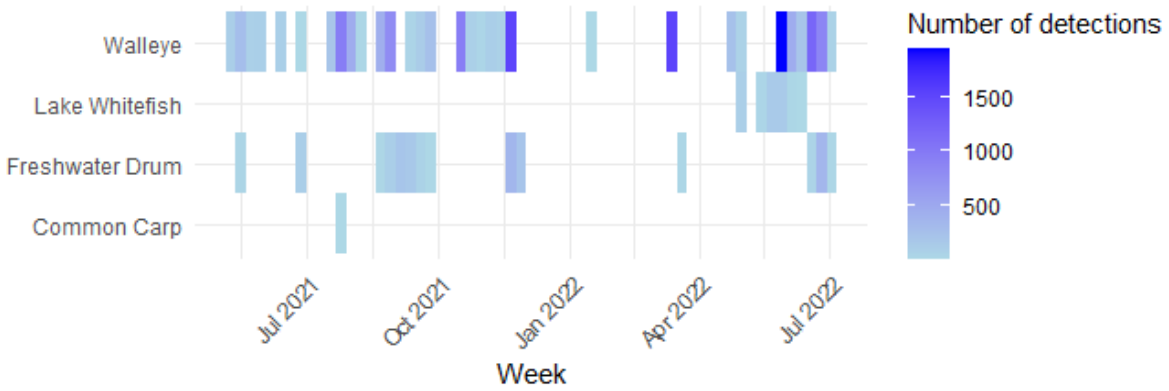

Fig. 3 – Number of detections by species for each week of the year. Results courtesy of Amanda Caskenette.

All telemetry data acquired from the Lake Winnipeg Basin Fish Movement Program were transferred to the new Fathom database hosted by Innovasea, which will facilitate data-sharing between user groups. Since being funded in August of 2022, the IWI project on "Integrating fish passage considerations into cultural and ecological connectivity in the Red River watershed" has made considerable progress. Dr. Mark Pegg's (University of Nebraska) graduate student has begun their Masters of Science thesis titled "Examining the Spatial Ecology of Fish in the Red River of the North". A primary research paper acknowledging the IJC has been published in the journal FACETS (Gutowsky et al. 2024). Here the authors demonstrate how barriers restrict the movement of Bigmouth Buffalo as they migrate seasonally between Canada and the US. Another primary research paper on the movement ecology of Freshwater Drum in the basin is currently under peer-review (Glowa et al. In Review). Relevant to the AEHC's objectives in the Red River watershed, Dr. Gutowsky recently reviewed the best available science and knowledge on the challenges and solutions of aquatic connectivity in a changing climate (Franklin et al. 2024).

The continued telemetry work will dovetail into the existing telemetry network within the Red River-Lake Winnipeg basin to answer newly emerging questions. Specifically, the objectives are to: 1) monitor target species movements; (2) evaluate timing of movements; and (3) use these data to inform management decisions on future water management in the context of ecologically and culturally important species. This work is particularly relevant as barriers on the Red River and its tributaries continue to be removed or modified to facilitate fish passage (Fig. 4).

Fig. 4 – The newly constructed rock-arch-rapids at the former Drayton Dam site, ND.

2024 Workplan

The committee continually reviews and updates their work plan, most recently done in December 2023, with the goal to further update following full Board strategic planning sessions in late August 2023. The most recent workplan includes:

Continuation of the Fish Movement Study: The large scale hydroacoustic telemetry study in the Red River and the adjunct Lake Winnipeg Basin will be used to study habitat use and movement of a number of fish species. New work for 2024 proposes to examine aquatic connectivity and the consequences of fish passage in the Red River. Tagging and tracking will be focused on Lake Sturgeon, Walleye, Sauger, Bigmouth Buffalo, Freshwater Drum, and Silver Redhorse.

Species of Concern: The AEC in conjunction with federal, state and provincial authorities plan to continue to use the established array to better understanding species of concern. The array is expected to remain in tact until at least 2026. This would provide valuable information on the impacts of the Fargo-Moorhead diversion on fish movement. Drayton Dam has now been decommissioned (2023) and theoretically should pass all species, including Bigmouth Buffalo which is designated as special concern under schedule 1 of the Canadian Federal Species at Risk Act (SARA). To understand passage effectiveness, the proposed work should including monitoring through to 2026.

To understand species distribution and abundance in the city of Winnipeg, DFO is currently undertaking a brail sampling survey for Mapleleaf mussel (*Quadrula quadrula*). The species is currently listed as threatened under SARA. This survey is being conducted near riverbanks impacted by armoring, which has the potential to destroy mussel habitat in the Red River. Surveys are underway and will conclude in the summer of 2024.

Aquatic Invasive Species: Evaluation of current and projected AIS in the Red River.

Roseau River Restoration: This project will rehabilitate and reconnect the historic river channel and reestablish 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 two mussel species of special concern and 18 species of fish that will benefit from the restoration. The AEHC has been in discussions with agency partners (e.g., Seine-Rat-Roseau Watershed District) to evaluate funding opportunities (e.g., IWI, Manitoba Fish and Wildlife Enhancement Fund) for carrying out this activity in partnership with the AEHC.

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E2 -1 Integrating Fish Passage Considerations into Cultural and Ecological Connectivity in the Red River Watershed

PREFACE

[Document subtitle]

by
Marshall Stuart and Mark Pegg
University of Nebraska-Lincoln

Fish Passage Project

Background

Ongoing water management efforts that mitigate extreme flows to reduce flooding impacts on infrastructure throughout the Red River watershed have led to concerns about fish passage over existing dams as well through, or around, current and pending water diversion projects. Many of these species are both ecologically and culturally significant. Lake Sturgeon recovery and reintroduction efforts accentuate the linkage between ecology and culture. This species is viewed as a sentinel indicator of a properly functioning ecosystem because they typically need long reaches of river to complete their life cycle. Lake Sturgeon are also regarded as spiritual keepers of the fishery in the Ojibwe culture. Here we are assessing movement of Lake Sturgeon, as well as several other native species of concern (e.g., Bigmouth Buffalo, Walleye, etc.), to ensure there is sufficient connectivity in the Red River Watershed to allow complete life-cycles.

Project Description

This effort dovetails with an existing telemetry network within the Red River-Lake Winnipeg watershed (Figure 1). The existing telemetry network was initiated by Fisheries and Oceans Canada (D. Watkinson and E. Enders) and University of Nebraska-Lincoln (M. Pegg) in 2016 and has been financially supported by funds secured from a number of sources (e.g., Manitoba Fisheries and Wildlife Enhancement Fund, Minnesota Department of Natural Resources, Manitoba Agriculture and Resource Development, University of Nebraska-Lincoln) in addition to IWI support in 2016 (DFO MOU – PF1700112) and currently (IRRB-02-2021) to leverage an unprecedented breadth of spatial coverage and species being studied in freshwater systems.

The specific objectives of our study are to: (1) monitor target species movements; (2) evaluate timing of movements; and (3) use these data to inform management decisions on future water management in the context of ecologically and culturally important species. The telemetry network, consisting of ~ 250 listening stations, spans nearly the entirety of the Red River and extends into the Assiniboine River and Lake Winnipeg to ensure movements are captured adequately (Figure 1). Target species being tracked in the Red River include primarily Lake Sturgeon, Walleye, Bigmouth Buffalo, Channel Catfish, and Freshwater Drum, but additional species are being monitored and will be included in analyses when they are present in the Red River (Table 1). These species are culturally, ecologically, and economically important throughout the basin. They also represent a range of movement strategies that will help us better understand fish movements, especially through fish-passage mitigation projects currently under construction or consideration.

This project advances our knowledge by specifically assessing movements of these fish species in and around current development projects to ensure fish passage is either enhanced or not impacted. Substantial work among a partnership of state, provincial, federal, Tribal, and First Nations partners to establish a propagation and reintroduction effort for Lake Sturgeon has been ongoing. A clear next step is to monitor those fish released to ensure they are viable and able to contribute to the population in a meaningful way. Ensuring the Lake Sturgeon can move within the basin is a good start to that understanding. Specifically, the Red River Lake Sturgeon re-introduction and re-establishment program has been ongoing since 1997. In addition to stocking, connectivity restoration has been a major focus for re-establishing the natural recruitment of

Lake Sturgeon populations in the Red River Basin. Access to critical spawning habitat was eliminated due to dam construction in the late 1800s. The current program has enjoyed success, with 40 of 77 major barriers removed or modified for fish passage. Movement data will help Lake Sturgeon managers evaluate two major program goals. First, 37 barriers remain unaddressed in the Red River of the North tributaries in Minnesota. The telemetry project will help identify key blockages, which can be used to help prioritize project sequencing. We also intend to evaluate timing of movements to develop a standard monitoring program for Lake Sturgeon. A monitoring program that is effective and reliable is a critical goal of the recovery program.

Bigmouth Buffalo are a large bodied riverine fish native to the Red River that historically has been understudied. Movement data are needed to further understand how management paradigms may or may not benefit Bigmouth Buffalo populations. In un-impounded reaches of the Red River, they are known to have mean annual home ranges in excess of 130 km with some individual movements surpassing 300 km. Concurrent regional research has also highlighted apparent Bigmouth Buffalo recruitment failures in reservoir and fragmented river reaches – presumably due to a lack of connectivity that allows completion of their life-cycle. This telemetry project is examining Bigmouth Buffalo movement over the course of river modifications that may allow further fish passage. These results will facilitate prioritizing the sequence of additional fish passage projects (e.g., dam removals) to aid river fish populations.

Achievements June 2023 – June 2024

Fish Tagging

Our goal for the fall of 2023 was to implant 15 transmitters into both Bigmouth Buffalo and Freshwater Drum. We were able to exceed our tagging goal for Bigmouth Buffalo (19 individuals tagged) and nearly met our goal for Freshwater Drum (13 individuals tagged). Tagging efforts were focused around the Drayton Dam area and will provide insight into the success of modification efforts converting the low head dam into a rock arch rapid structure that may influence connectivity and movement patterns.

Sampling efforts in the fall of 2023 for Lake Surgeon were also successful. Trotlines proved to be the most effective method, capturing 4 Lake Surgeon before falling temperatures caused us to conclude sampling. Interestingly one of the Lake Sturgeon was recaptured on a trotline only 300 meters away from where it was tagged the previous day. Lake Sturgeon captured on trotlines ranged in length from 890-660 mm. No visible signs of sexual maturity during tagging suggests some individuals were juveniles, allowing us insight into the movement behaviors as some individuals approach sexual maturity.

In the spring of 2024 tagging efforts targeted Lake Sturgeon and Walleye in the Red Lake and Otter Tail rivers. We were able to tag six new Lake Sturgeon in the Otter Tail River below Orwell Dam and recapture an individual that was tagged in the spring of 2023 at the same location. We tagged one Lake Sturgeon in the Red Lake River. Walleye were tagged in the Red Lake River from Thief River Falls, MN downstream to East Grand Forks, MN. We tagged at total of 13 Walleye with acoustic transmitters in the spring of 2024. Eight acoustic transmitters

are still available for Lake Sturgeon. Future tagging efforts will be completed in the fall as water temperatures rose above the handling window before tagging efforts could continue this spring.

Receiver Deployments

A total of 67,634 transmissions from 47 unique fish were detected on the array for the 2022-2023 deployment period. All the receivers deployed in 2022 on the United States portion of the receiver array were retrieved in 2023. An internal clock error caused the receiver deployed in the Sheyenne River to fail so this receiver was replaced. The additional receivers installed in the Red Lake and Otter Tail rivers have provided additional insight into the movements of tagged fish. No receivers have been lost in the Red Lake and Otter Tail Rivers which are deployed in bridge mounted PVC pipes. Corroding cables on these receivers were replaced with new plastic coated cable that will be more resistant to rust.

Data Summarization

Fish Passage

The acoustic telemetry array has provided insight into passage and large-scale connectivity of the system. Drayton Dam has the most passage events of all the permanent, in-stream anthropogenic structures with over 250 recorded passage events (Figure 2). Bigmouth Buffalo accounted for 93% of the passage events with 120 upstream and 115 downstream events recorded at Drayton Dam. St. Andrews Lock and Dam is the second most passed structure within the array with 124 passage events (Figure 2). St. Andrews Lock and Dam is also the only structure to have an upstream passage event by all the study species. The area below St. Andrews Lock and Dam also has the highest number of tagged individuals which could be inflating the passage numbers compared to other structures.

The species with the most passage events at anthropogenic structures is Bigmouth Buffalo, highlighting their tendency to travel vast distances that require passage over structures. Lake Sturgeon have the second highest number of passage events, although most of these movements have been in the downstream direction to date.

The Red River Floodway Inlet Control Structure upstream of the city of Winnipeg appears to be an impassible barrier when the structure is diverting flow into the floodway as there were no recorded upstream passage events when in operation. This structure only operates when flooding poses a risk to the city of Winnipeg and has been operated infrequently, typically during spring flooding. This structure has had Bigmouth Buffalo, Freshwater Drum, Channel Catfish, and Lake Sturgeon pass upstream when the structure was not operating (Figure 2).

Bigmouth Buffalo

Analysis of the Bigmouth Buffalo dataset revealed that movement patterns varied between river sections between in-stream anthropogenic structures. Migratory movements that were over a distance greater than 90 river kilometers (RKM) were observed in the longest unimpeded section of the Red River between St. Andrews Lock and Dam and Drayton Dam. These migratory movements occurred in the spring and fall, appearing to coincide with warming and falling temperatures. Some cyclical behaviors in movement were observed in other sections of the study area but these movements were less consistent and over a smaller distance than the migratory

patterns observed between Drayton Dam and St. Andrews. Across all sections, winter home ranges averaged 23.5 RKM and summer home ranges averaged 48.9 RKM.

Spring movements from overwinter to spawning/summer ranges typically began near Drayton Dam and concluded near the La Salle River. Upstream migration movements in the fall typically started near the city of Winnipeg and ended below Drayton Dam. Notable exceptions to this pattern occurred in 2019 and 2022 when directed movements concluded upstream of Drayton Dam. Water levels were elevated during the fall in 2019 and 2022 compared to other years likely improving passage over Drayton Dam, which was still a low head dam at the time. Repeatability analysis revealed that individuals were most consistent in the location that they migrated to on the downstream (spring) migration (Table 2). The second most repeatable behavior was the temperature that individual left their overwinter range (temperature at downstream departure; Table 2). Bigmouth Buffalo were more consistent in the locations that they migrated too rather than the day of year that they migrated (Table 2).

Lake Sturgeon

A total of 34 Lake Sturgeon have been tagged in the Red River and headwater tributaries from 2016 to 2024. Ten of the tagged individuals have not been detected since they were released but all except two of these individuals were from recent tagging events in 2023 and 2024. Several of the individuals tagged in the Otter Tail River have made downstream movements into Canada with three individuals moving into Lake Winnipeg (Figure 3). Linear home range estimates for Lake Sturgeon are as high as 907 river kilometers (RKM) and average 467 RKM (SD = 368 RKM). Most of the long-distance movements have been downstream in direction with four individuals only moving downstream. Fish tagged in the Otter Tail River have the highest number of use days in the section of river from Wahpeton, ND to Fargo, ND followed by the section between Drayton Dam and St. Andrews Lock and Dam (Figures 1 & 4). Individuals tagged below St. Andrews have been detected passing upstream but residence patterns are typically below the dam or into Lake Winnipeg (Figure 4).

Walleye

Most of the Walleye were previously tagged in Lake Winnipeg within the telemetry array. Only one of these individuals was detected moving above St. Andrews Lock and Dam and most movements of Walleye have been within Lake Winnipeg. To evaluate movement of Walleye within the flowing waters of the array we have tagged a total of 13 individuals with acoustic transmitters in the Red Lake River. One of the individuals tagged in 2023 was detected at a receiver 1 km downstream of the tagging location but has not been detected at any other receiver in the system. A Walleye tagged with a t-bar tag downstream of the East Grand Forks Dam was reported caught and released by an angler 2 months later 2 kilometers downstream on the Red River. Twelve individuals were tagged in the spring of 2024 so movement information will not be available until the next receiver data download.

Meetings/Presentations

Red River Steering Committee Meeting; East Grand Forks, ND, United States (August 2023)- Telemetry tagging update with state and provincial biologists. Presentation- Seasonal Movements of Bigmouth Buffalo in the Red River of the North

Midwest Fish and Wildlife Conference; Sioux Falls, SD, United States (January 2024)- Presentation - Long Term Acoustic Telemetry Reveals Interjurisdictional Migratory Behavior of Bigmouth Buffalo (*Ictiobus cyprinellus*)

Nebraska Chapter, American Fisheries Society Annual Meeting; Aurora, NE, United States (February 2024)-

Presentation - Long Term Acoustic Telemetry Reveals Interjurisdictional Migratory Behavior of Bigmouth Buffalo (*Ictiobus cyprinellus*)

Great Plains Fisheries Workers Association Annual Meeting; Hecla, MB, Canada (March 2024)- A Transboundary Traverse: Exploring Bigmouth Buffalo (*Ictiobus cyprinellus*) Migratory Patterns and Connectivity Challenges in the Lake Winnipeg Watershed through Acoustic Telemetry

Manuscript Submissions

Journal: *FACETS* the official journal of the Royal Society of Canada's Academy of Science
Manuscript ID: facets-2024-0003
Title: Bigmouth Buffalo (*Ictiobus cyprinellus*) migratory behavior and seasonal home range overlap are functions of geographic space in a fragmented river scape
Contributing Authors: Gutowsky, Lee F.G.; Stuart, Marshall; Caskenette, Amanda; Jarvis, Lauren; Watkinson, Doug; Kovachik, Colin; Leroux, Douglas; Kludt, Nicholas; Pegg, Mark; Enders, Eva.

Work Plan for June 2024 – December 2024

Receiver Downloads

Receiver data downloads and battery replacement will be conducted on all the receivers in the Red River and tributaries. Aging rope and mooring material will be replaced if necessary. Additional receivers have been provided by collaborators at Fisheries and Oceans Canada to increase the resolution of the array downstream of the Riverside Rock Arch Rapid. This will result in finer resolution movement data with receivers placed every 15 RKM instead of the current resolution of every 30 RKM. New R1 model receivers will also be placed above and below the Drayton Rock Arch Rapid (formally a low head dam), to improve estimates of passage and residence directly below and above the dam.

Data Summarization

Analysis of the detection dataset will continue as new information is downloaded from receivers. Detections will need to be vetted to ensure erroneous or false detections are not present. Movements and home ranges of tagged individuals will be estimated, and timing and conditions of passage events will be determined using logged information from receivers and from available

hydrologic monitoring stations that are located throughout the receiver array. Movement patterns will be synthesized so that collaborators can prioritize dam removal or modification projects and aid in development of sampling plans. Information on sampling efforts for Lake Sturgeon will be particularly useful as our efforts to capture individuals for tagging are the most extensive sampling conducted in flowing waters connected to the Red River within the United States. Final reports to the International Joint Commission and collaborators will be delivered.

Tables

Table 1. Fish species in the telemetry network. Included is number originally tagged, predominant system of use, year(s) of tagging, and approximate amount of remaining battery life (years). Grey shaded species are the target set for analysis in this proposal but other species will be included as appropriate. Additional tagging efforts are planned for 2023.

Species	Number	System	Year(s) tagged	Remaining life
Lake Sturgeon	44	Lake Winnipeg	2016-2017	~1
Lake Sturgeon	19	Red River headwaters	2021	~4-5
Lake Sturgeon	12	Red River headwaters	2023-2024	~5
Bigmouth Buffalo	80	Red River	2016-2017	~1
Bigmouth Buffalo	19	Red River	2023	~5
Channel Catfish	161	Red River	2016-2017	~1
Freshwater Drum	80	Lake Winnipeg/Red River	2018	~2
Freshwater Drum	13	Red River	2023	~5
Burbot	40	Lake Winnipeg	2019-2020	~0-3
Walleye	357	Lake Winnipeg	2017-2018	~0-3
Walleye	60	Lake Winnipeg	2022	~2-10
Walleye	13	Red Lake River	2023-2024	~5
Common Carp	40	Lake Winnipeg	2016	~1
Lake Whitefish	80	Lake Winnipeg	2021	~2

Table 2. Repeatability estimates (ranges from 0 -1) for migration events across years for Bigmouth Buffalo with two or more years of observations. Sample sizes are denoted by superscripts ([a] = 30 individuals, 108 observations; [b] = 29 individuals, 105 observations). Upstream departure = leaving summer range; Upstream destination = arriving at winter range; Downstream departure = leaving winter range; Downstream destination = arriving at spawning/summer range.

Metric	Event	Repeatability	SE	p
Julian Day	Upstream Departure[a]	0.011	0.056	0.498
	Upstream Destination[a]	0.136	0.097	0.072
	Downstream Departure[b]	0.060	0.075	0.295
	Downstream Destination[b]	0.000	0.052	1.000
Distance	Upstream[a]	0.000	0.050	1.000
	Downstream[b]	0.149	0.096	0.057
Temperature	Upstream Departure[a]	0.000	0.050	1.000
	Upstream Destination[a]	0.129	0.091	0.078
	Downstream Departure[b]	0.328	0.109	0.002
	Downstream Destination[b]	0.000	0.050	1.000
Latitude	Upstream Departure[a]	0.215	0.103	0.015
	Upstream Destination[a]	0.085	0.081	0.184
	Downstream Departure[b]	0.222	0.104	0.008
	Downstream Destination[b]	0.548	0.099	<0.001

Figures

Figure 1. Map of the Lake Winnipeg watershed (inset map) and focal area with receiver arrays. Anthropogenic structures (lock and dam, floodway control structure, low-head dam, and rock arch rapid [RAR]) are defined by black rectangles. Receiver arrays are colored based on river section from home range overlap analysis (Wahpeton, ND to Fargo, ND (W-F); Fargo North RAR to Riverside RAR (F-R); Riverside RAR to Drayton Dam (R-D); Drayton Dam to St. Andrews Lock and Dam, MB (D-S); St. Andrews Lock and Dam to Lake Winnipeg, MB (S-L); and Lake Winnipeg, MB (LW)).

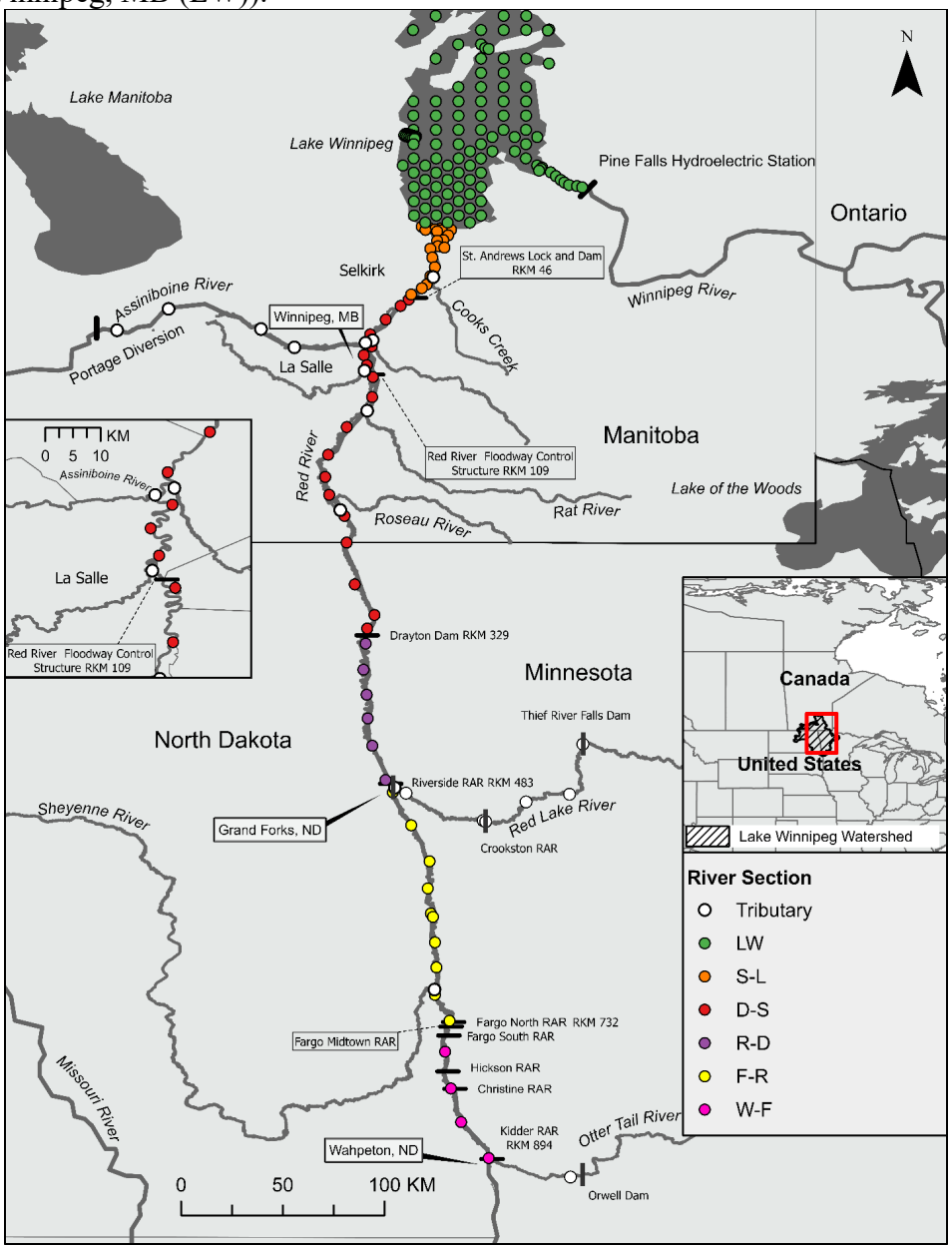


Figure 2. Map of anthropogenic structures with tables of passage numbers by species and direction.

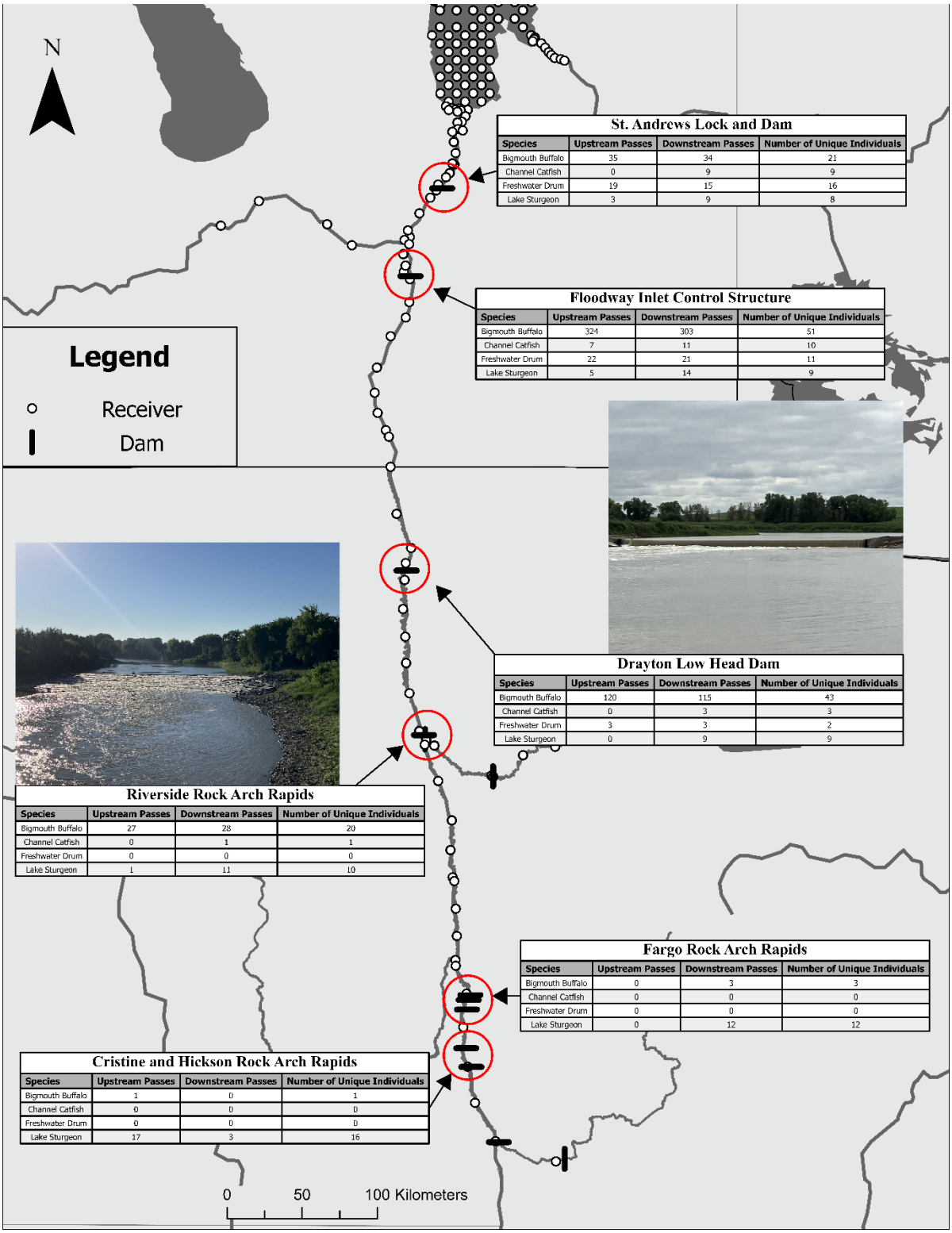


Figure 3. Example movements of Lake Sturgeon in the Red River receiver array. Position is defined by latitude and dashed horizontal lines are locations of anthropogenic structures that may pose restriction to movement.

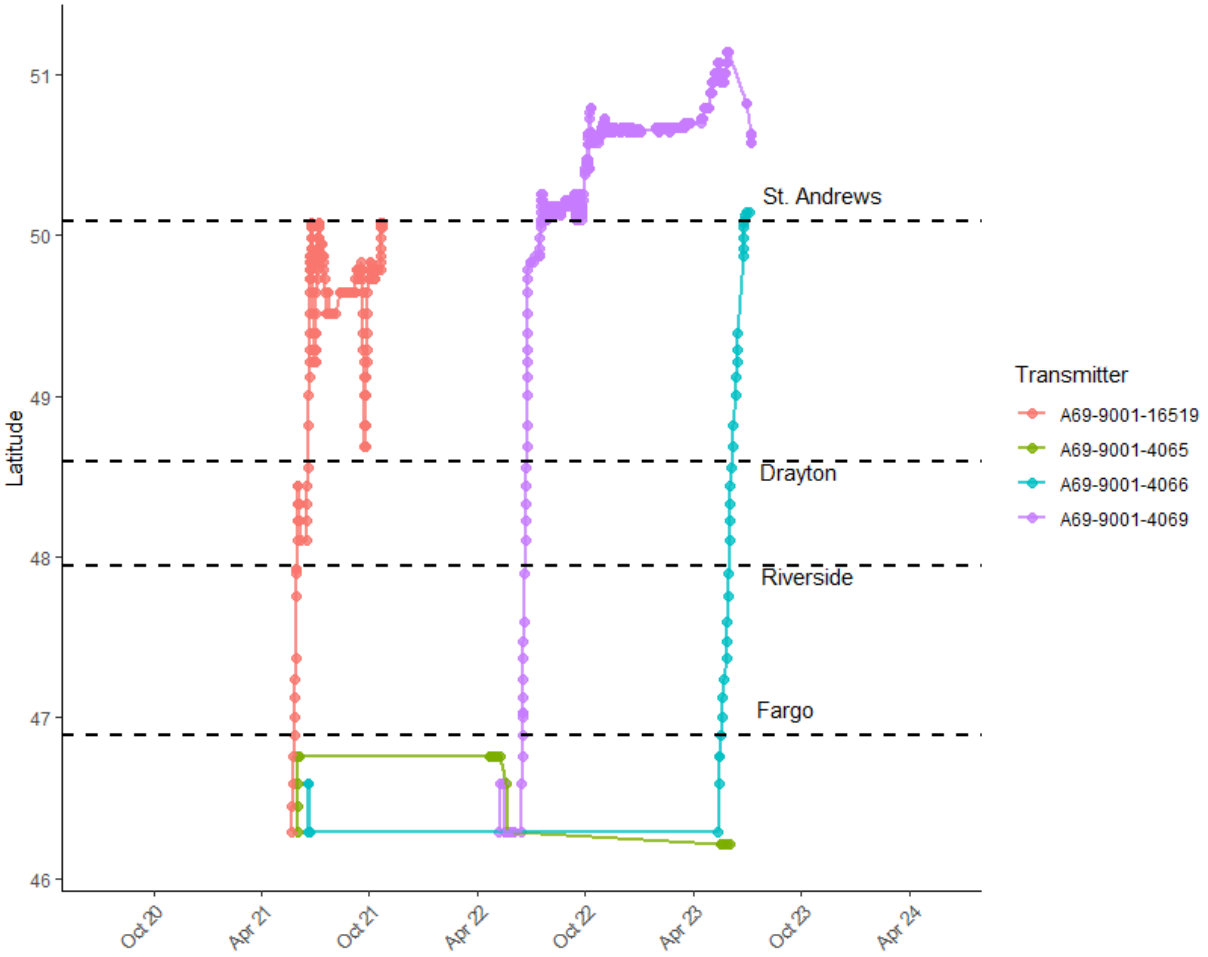
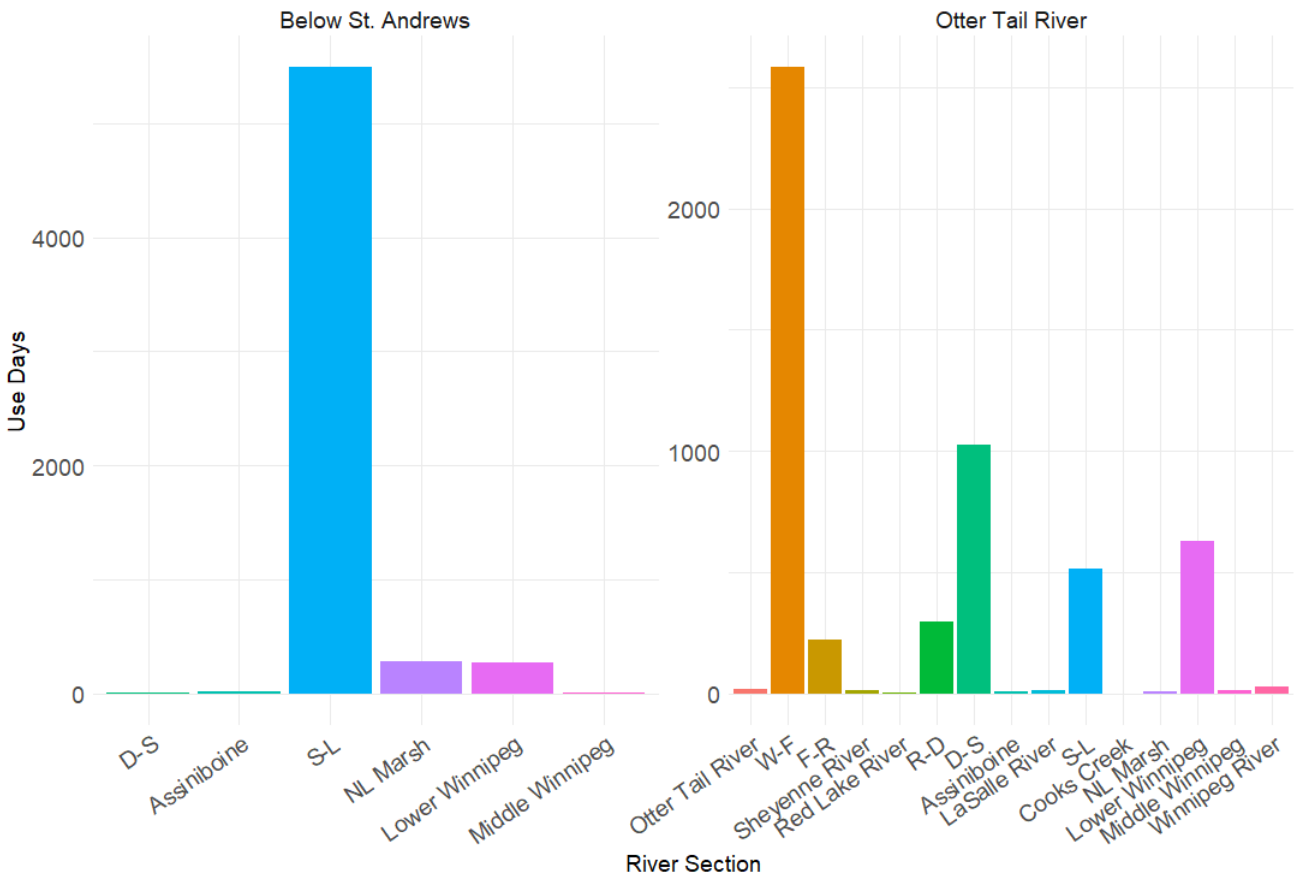


Figure 4. Number of use days in river sections (defined in Figure 1) by Lake Sturgeon tagged below St. Andrews Lock and Dam and in the Otter Tail River. Fish tagged in the Red Lake River are not shown as they were tagged after annual downloads were completed. Lake Sturgeon movement including Red Lake River will be available following data downloads in 2024.


Below St. Andrews
Otter Tail River
Use Days
4000
2000
0
2000
1000
0
D-S
Assiniboine
S-L
NL Marsh
Lower Winnipeg
Middle Winnipeg
Otter Tail River
W-F
F-R
Sheyenne River
Red Lake River
R-D
D-S
Assiniboine
LaSalle River
S-L
Cooks Creek
NL Marsh
Lower Winnipeg
Middle Winnipeg
Winnipeg River
River Section

E-3 Hydrology Committee

Monitoring
The Hydrology Committee monitors conditions in the basin and provides an overview of flow conditions and forecasts for board meetings, IJC semi-annual board appearances, the annual report and whenever else requested by the board or IJC. The reporting ensures the board and IJC are aware of the hydrologic conditions in the Basin.

Red River Low-Flow Frequency Study:

The Hydrology Committee received IWI funds to quantifying low flow frequencies to better understand potential low flow management 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 inform how a drought contingency plan or minimum flow criteria for the Red River could reduce these risks.

The water-balance model (WBM) has been calibrated and verified and the stochastically generated weather data has been derived. Future streamflows have been simulated and from these simulations, low-flow frequency curves have been derived for the Wahpeton, Halstad, Grand Forks and Emerson locations on the Red River. Results will be published in a USGS Scientific Investigation Report, in the coming months.

Red River Instream Flow Analysis:

This work supports the board's desired outcome of assessing and recommending a process for the development and implementation of minimum flow management for the Red River at the International Boundary. Discussion paper presented to IRRWB at January 2019 Board meeting summarizing past work and future work required. Future work in the near term was to gather key data and improve and extend past modelling work to better understand the complexity of the Red River's aquatic ecosystem and make more informed low flow management decisions. The Hydrology Committee recommended that a complete homogeneous bathymetric survey would be fundamental to instream flow assessment and other work.

MTI completed bathymetry from near the border to just downstream on the Red River Floodway Inlet Control Structure in the summer and fall of 2022. Data includes 50 m of aerial LiDAR to cover the shoreline. USACE has collected the US portion of the Red River in summer 2024. USACE will to merge the two surveys together. MTI is planning to extend its bathymetry from the Red River Floodway Inlet Control Structure to Lake Winnipeg. It is expected a homogeneous bathymetric survey from the headwaters to Lake Winnipeg will be available in 2025.

Hydrologic Conditions

Fall/Winter 2022/2023
The Antecedent Precipitation Index is a model that indicates the amount of summer and fall (May to October) rain 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. Generally soil moisture levels decreased in the basin from north to south. Manitoba's Hydrologic

Forecasting Centre's 2022 Fall Conditions Report stated that heading into freeze-up soil moisture in the Red River basin was normal to above normal in southern Manitoba, and below normal in the U.S. portion of the basin, as shown on the figure below.

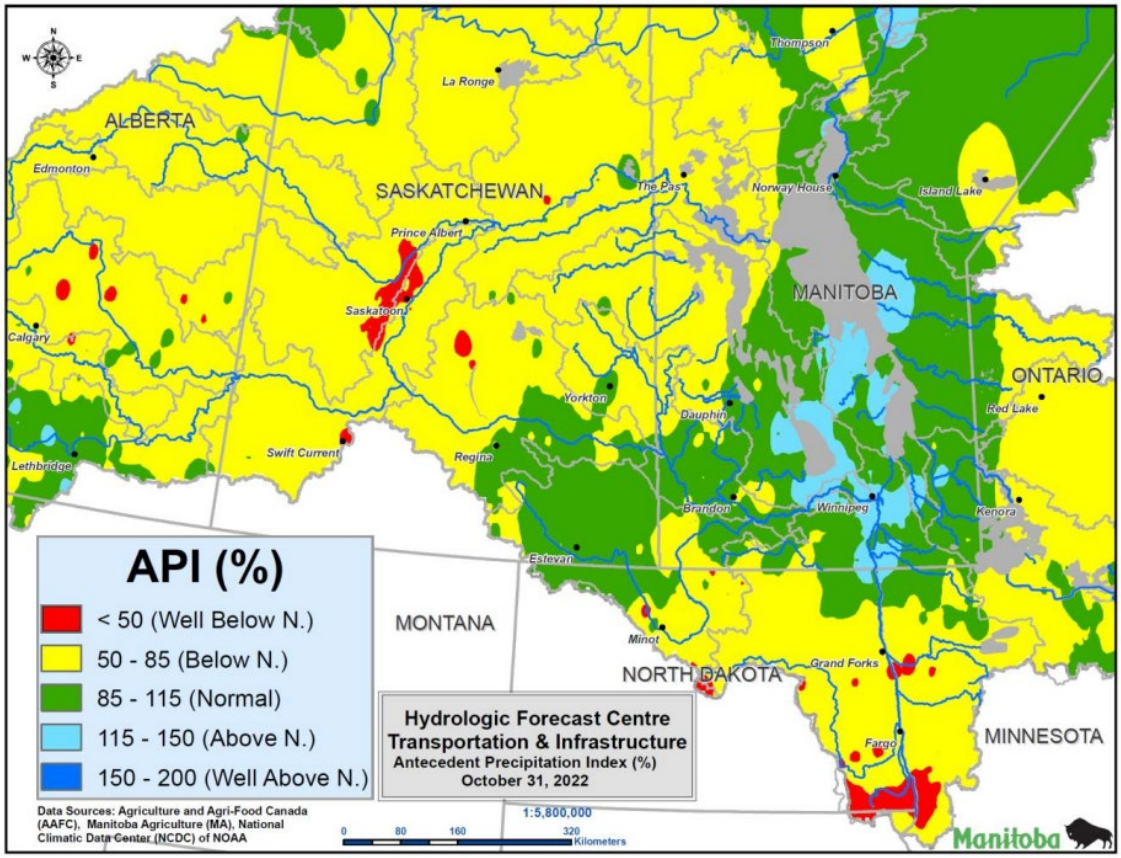


Figure 1. Antecedent Precipitation Index (API) (%) for fall 2022

Going into the winter ice period, almost all of the mainstem Red River gauging stations showed flow in the middle of the normal range, the Sheyenne River flows were above normal from the Devils Lake outlet pumps pumping through October, the Goose River was on the high end of normal, the Red Lake River on the low end of above normal, the Forest River at above normal, and the Pembina River flows at the low end of above normal.

Mid-winter the Canadian and United States Drought Monitors classified most of the basin, particularly the U.S. portion, in some degree of dryness as detailed on the map below. The Canadian basin was classified as normal with some areas of abnormally dry (D0) in the western portion of the basin. The US portion of the basin is classified as abnormally dry (D0) to severe drought (D2).

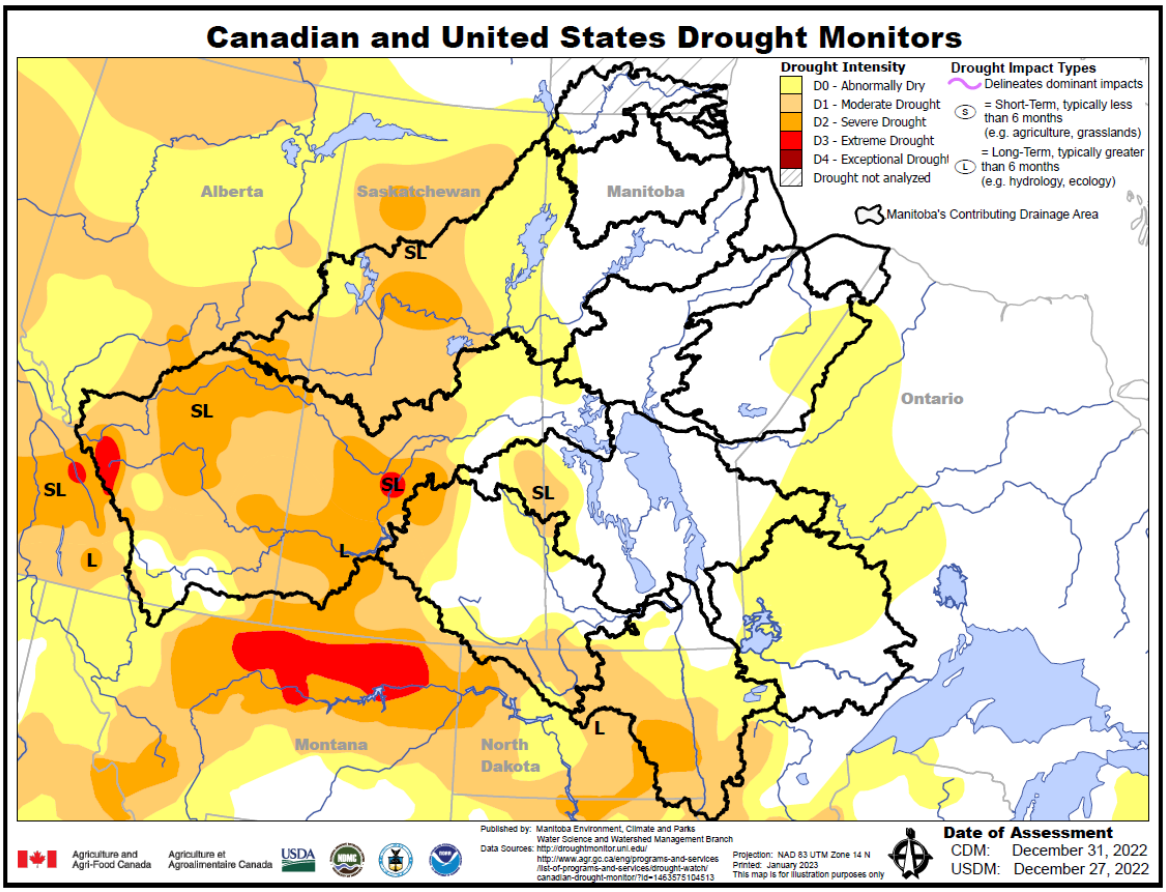


Figure 2. Canadian and US Drought Monitor Data for Dec 2022

The basin received heavy snowfall in December to start the winter season. According to the National Weather Service, Grand Forks received over 24 inches of snow in December 2022. Fargo-Moorhead recorded 22.8 inches of snow, the 6th highest monthly snow amount. The map below shows the snow depth on March 14 2023 compared to normal amount for the time of year. Much of the US portion of the basin had normal to above normal snow accumulation, while Manitoba had below normal snow accumulation.

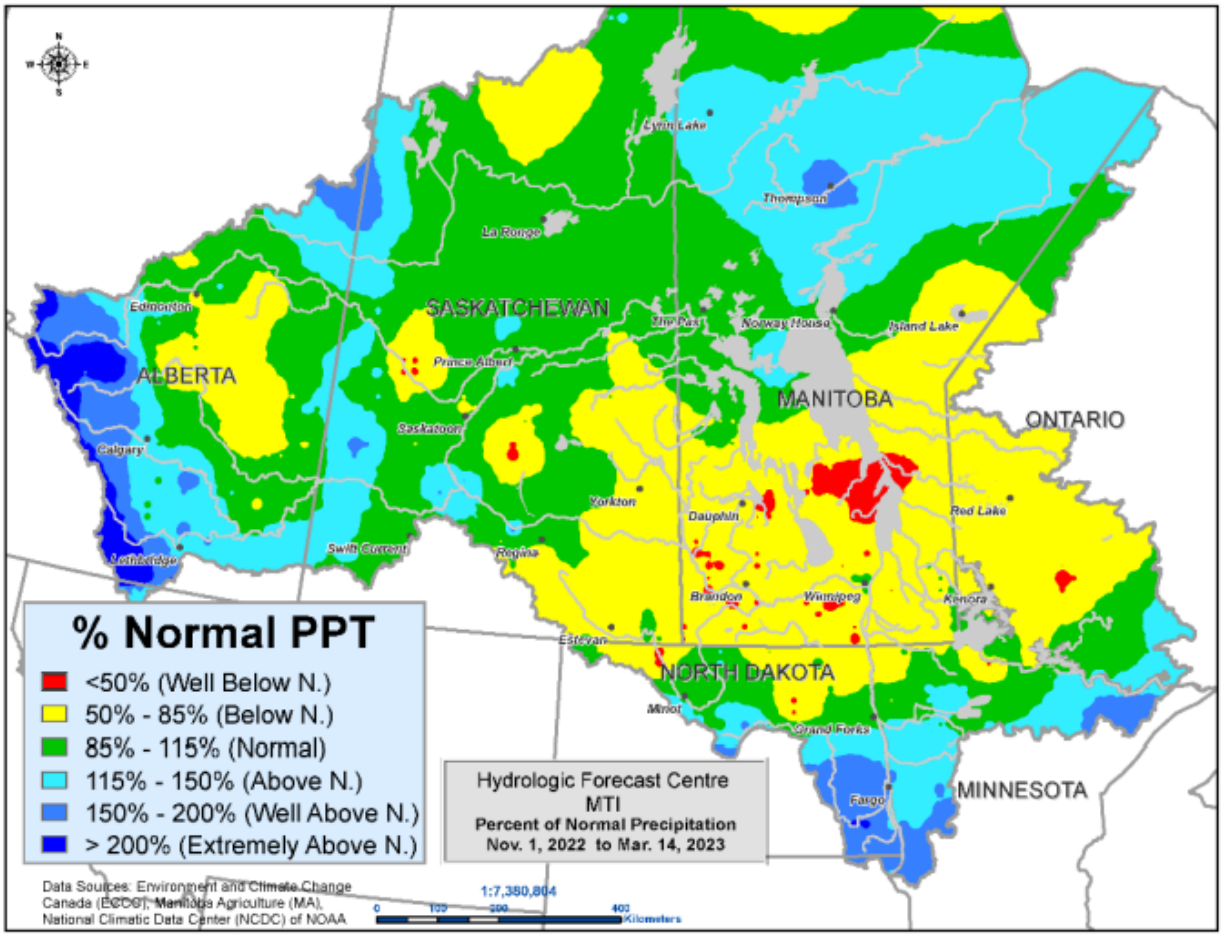


Figure 3. Percent of normal snow depth on from November 1st, 2022 to March 14th, 2023

Spring 2023

Soil Moisture conditions at freeze-up generally had normal to above normal conditions in Canadian portion of the basin and below normal conditions in the USA. Manitoba Transportation and Infrastructure's Hydrologic Forecast Centre's March Flood Outlook (March 21, 2023) described a major risk of significant spring flooding along the main stem of the Red River. This was due to well above normal winter precipitation in the U.S. portion of the basin. Other tributaries in Manitoba had lower flood risk due to near normal soil moisture and below normal snow in the Manitoba portion of the basin.

The spring melt began in early April, a few weeks later than normal. Due to an early melt of the local tributaries and near normal spring precipitation, the observed peak at Emerson for the 2023 spring flood was approximately 50,145 cfs (1420 cms) and occurred on May 4. This is slightly higher than the peak forecast for favourable melt conditions published in the March Outlook. The 2023 peak flow measured at Emerson equated to a 1:7 year flood.

Red River Floodway operation began on April 20th, and the gates were operated for 29 days ending on May 18. During the spring 2023 period of operation approximately 429,000 acre-feet (529 million m^3) of water was diverted around the City of Winnipeg by the Red River Floodway, with a peak flow of 10,710 cfs (303.3 cms). In concert with the operation of the Portage

Diversion and Shellmouth Dam, the operation of the floodway reduced the flood crest in the City of Winnipeg by 3.75 ft (1.14 m) at the natural flow crest. The recorded peak water level at James Avenue was 17.89 ft (5.45 m), just below Winnipeg's flood stage of 18 ft (5.5 m).
Although most of the mainstem Red River south of the U.S./Canada border, as well as the Red Lake River, lower Sheyenne River, and most of the other tributaries to the Red in the U.S. reached "major" flood stage, no peak of record (POR) flows were recorded this spring (U.S. Geological Survey, 2023). Flooding conditions in the Red River Basin lasted approximately 3 weeks. The Red River had a provisional peak of 43,100 cfs at 40.83 ft on April 24, 2023 of the North at Grand Forks, ND; not a top 10 peak. Fargo, ND recorded a provisional peak of 11,900 cfs at 29.76 ft on April 22, 2023; not a top 10 peak.

Summer 2023

After the spring freshet the Red River receded gradually into the normal range. After some improvement in the spring, drought conditions intensified over the summer. Parts of the basin were extremely dry over the open water period. However, timely rains and cooler temperatures compared to 2021 prevented as intense of drought conditions from developing in 2023.
Stream flow was in the normal range throughout the summer at Emerson. Despite the dry conditions water supplies were not a major concern. The U.S. Drought Monitor showed drought conditions for the region south of the US/Canada border decreasing in coverage from August to January, mostly receding from the southern Basin, but increasing in severity in the northern Basin, especially in the northwestern portion (U.S. Drought Monitor, 2024).

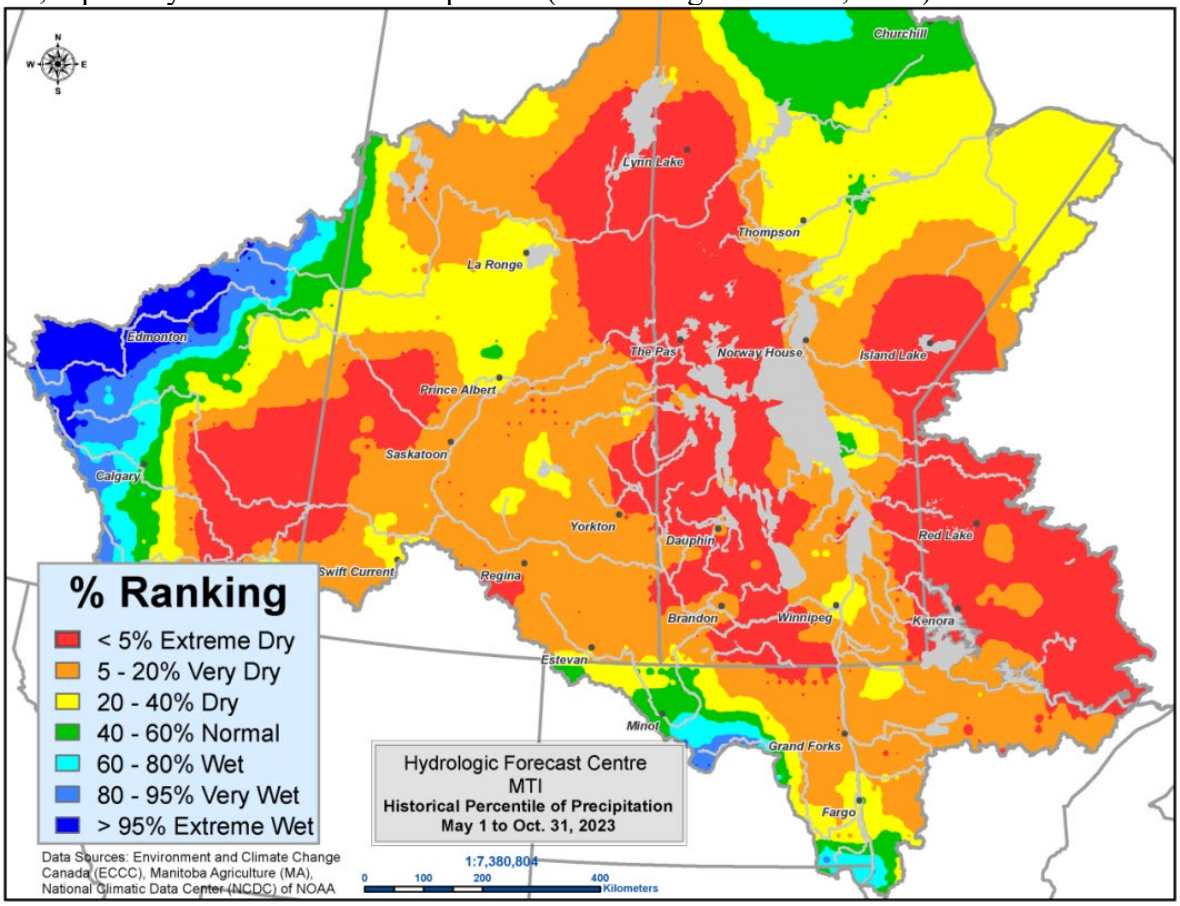


Figure 4. Precipitation from May 1st to November 30th, 2023

Fall/Winter 2023/2024

The Antecedent Precipitation Index is a model that indicates the amount of summer and fall (May to October) rain 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. Generally soil moisture levels decreased in the basin from north to south. Manitoba's Hydrologic Forecasting Centre's 2023 Fall Conditions Report stated that heading into freeze-up soil moisture in the Red River basin was below normal to normal with the southern tip of the basin above normal.

Most of the basin is classified between abnormally dry (D0) and extreme drought (D2). The driest areas are in the Pembina and Roseau River Basins. The very southern and western portions of the basin are not classified as having dry or drought conditions.

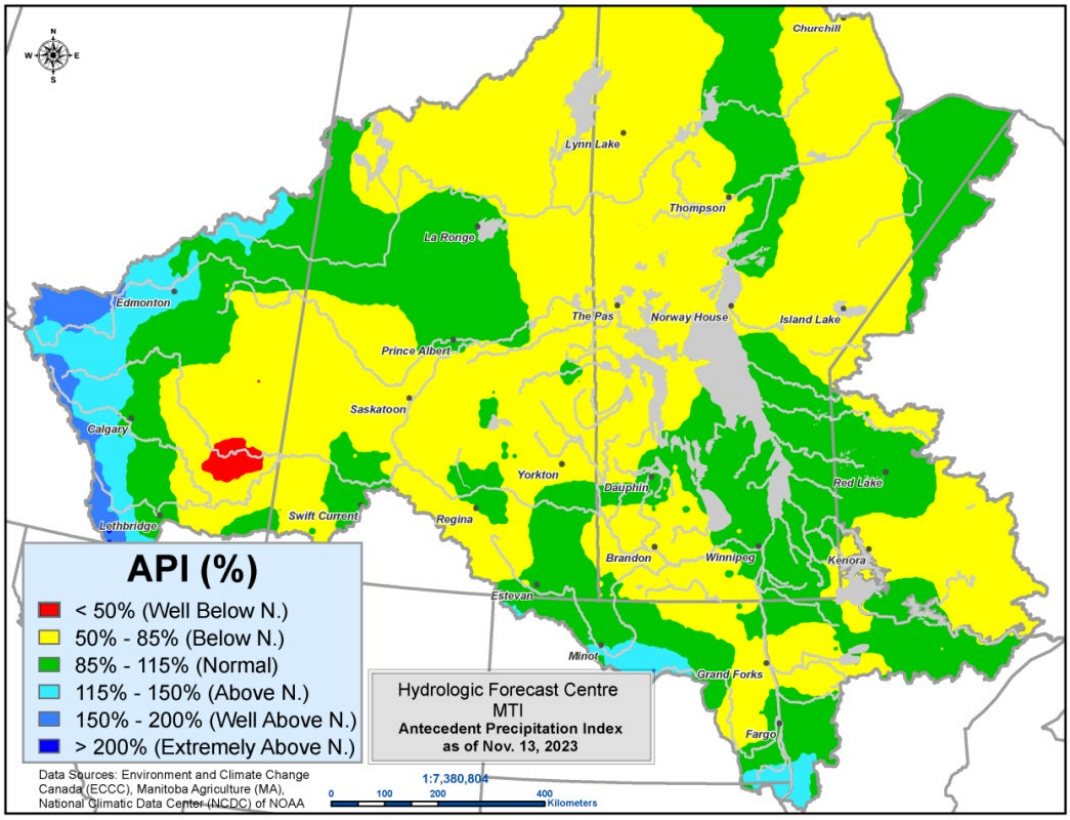


Figure 5. Antecedent Precipitation Index (API) (%) for fall 2023

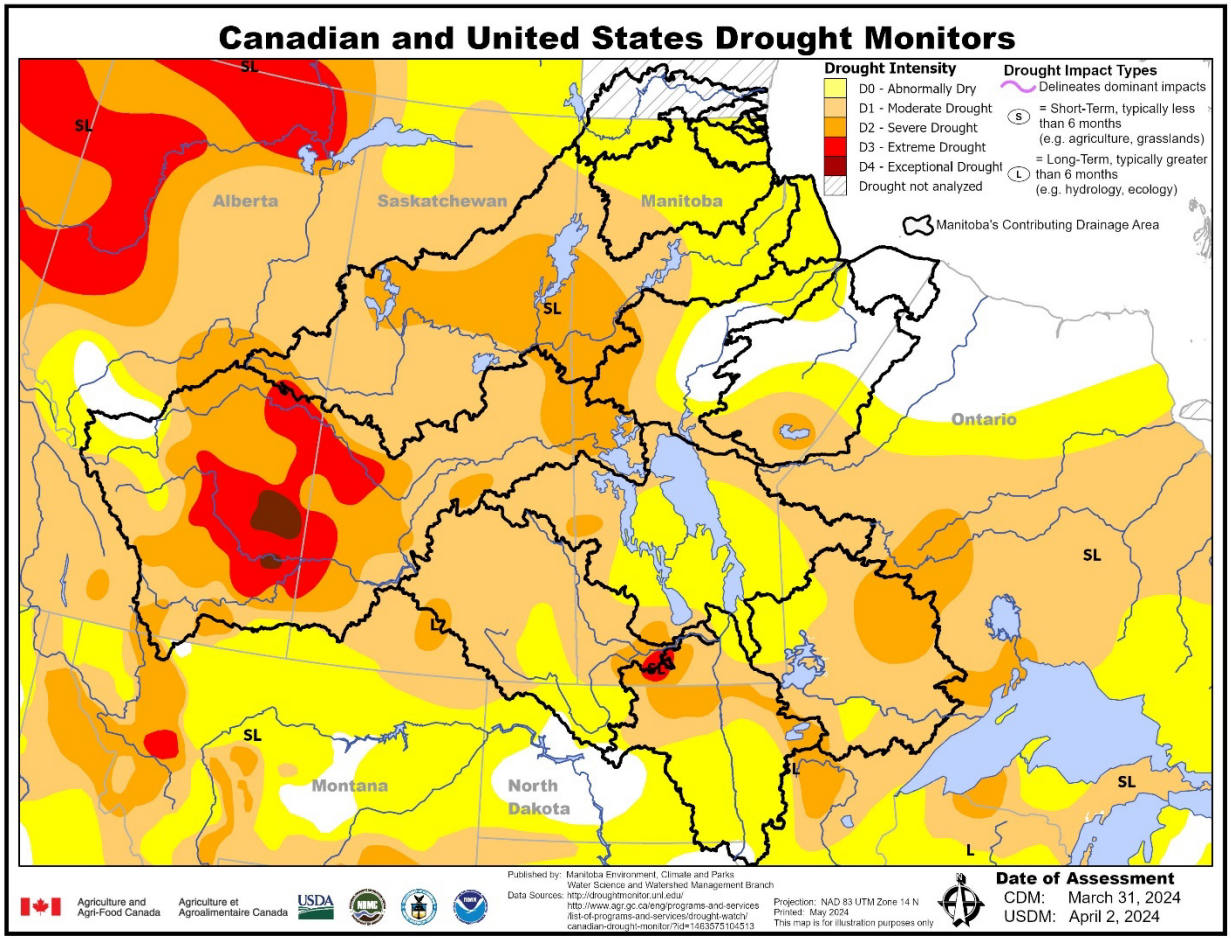


Figure 6. Candian and US Drought Monitor maps for end of March 2023

A rainfall event with a maximum total of approximately 2.4 inches of precipitation recorded at Sonora, ND, occurred in the headwaters of the Red River from Dec 25-27 (North Dakota Agricultural Weather Network, 2024) caused a substantial rise in flow on the mainstem Red River and the Wild Rice River and the resulting streamflow exceeded the "much above normal" (90th-highest percentile) streamflow for the Wild Rice River and reached the 95th percentile of flow for the Red River for this time of year (U.S. Geological Survey, 2024). Both the USGS streamgage on the Wild Rice River near Abercrombie, ND (05053000) and the Red River at Fargo, ND (05054000) briefly exceeded their respective flood stages and the flow at the Red River at Grand Forks, ND streamgage (05082500) was measured at 5590 cfs on January 3rd, at the peak of the event (provisional, U.S. Geological Survey, 2024).

Flow at the Emerson gauge peaked January 6th at a flow of 6460 cfs (183 cms). The wave of flow caused the level to rise 2.1 m at the Emerson gauge. This caused the ice to rise and open water to form along the river edges. Warnings were released to ice fishers and other recreational users to not use the river. Flows have been receding since the peak and are currently 3100 cfs (88 cms), which is much above normal and near the historical record maximum for the time of year. Winter precipitation was below normal to near normal. The well above normal temperatures and rainfall have melted earlier winter snow and snow accumulation was well below normal. Spring/Summer 2024.

The spring melt was earlier than usual and peak flows were below normal and did not cause any flood concerns. Drought concerns were increasing, however above normal rain in April, May and June alleviated increased soil moisture and water levels to above normal across the basin. The Red River peaked at Emerson in early July well above the spring peak and has remained above normal to well above normal for the summer of 2024. There were no drought conditions in the Red River basin reported in the end of June drought monitor assessments.

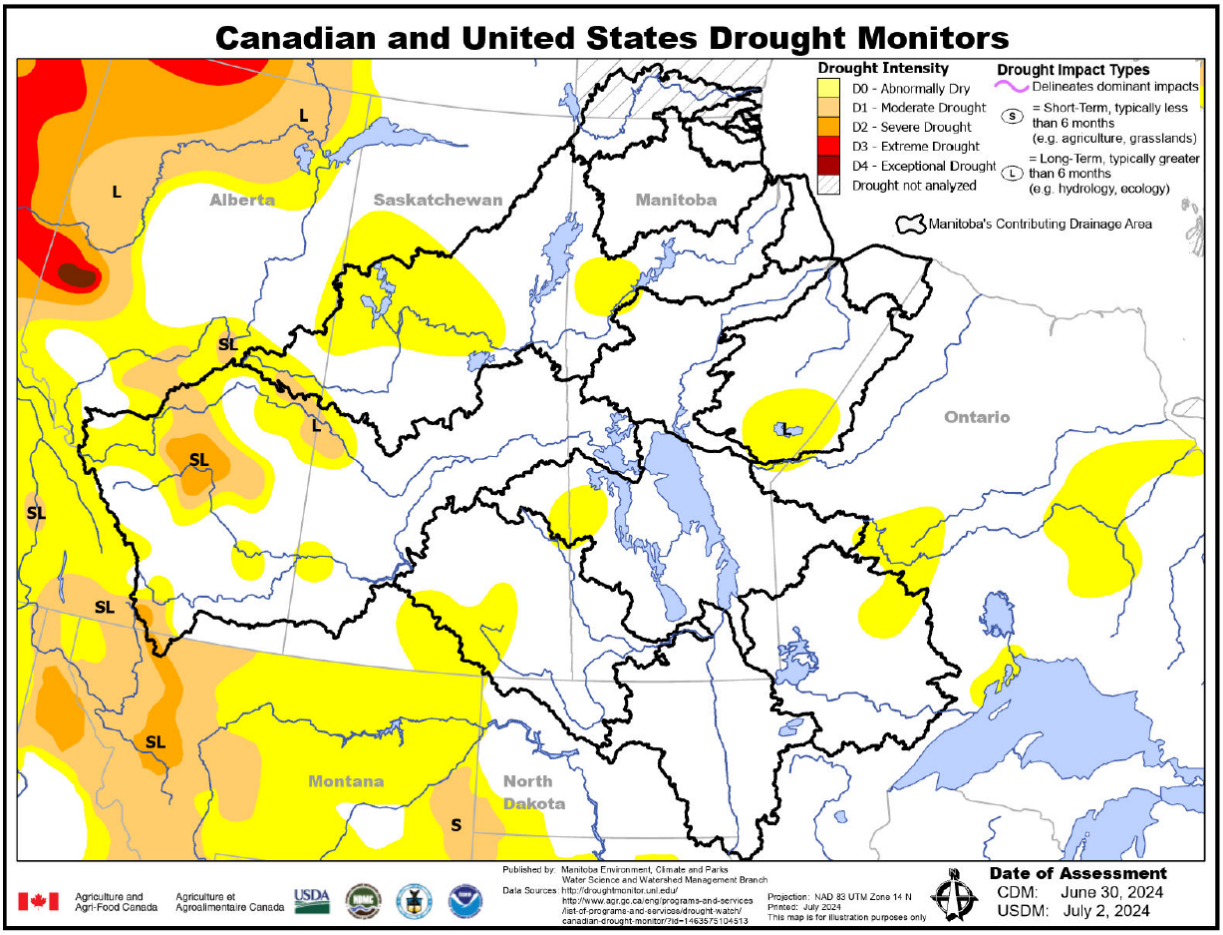


Figure 7. Candian and US Drought Monitor maps for end of June 2024

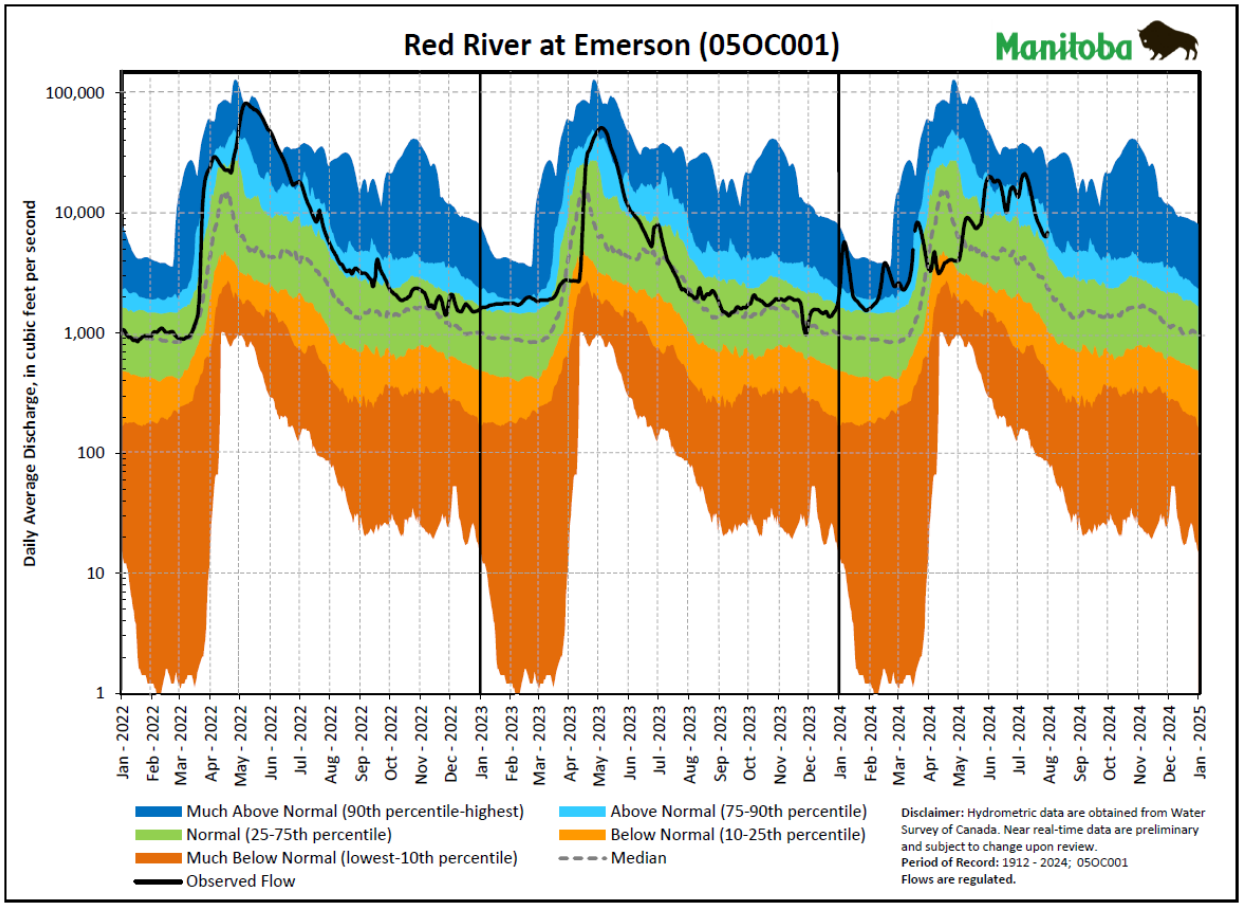


Figure 8. Average daily discharge in the Red River at Emerson from January 2022 to July 2024.

E-4 Environment and Climate Change Canada

Environment and Climate Change Canada (ECCC) Update on Canada Water Agency and Freshwater Action Plan: Lake Winnipeg Basin Program as of September 05, 2023

Budget 2023 Freshwater Funding

Budget 2023 announced significant investment in fresh water in Canada, including:

- $650M over ten years, starting in 2023-24, to support monitoring, assessment, and restoration work in the Great Lakes, Lake Winnipeg, Lake of the Woods, St. Lawrence River, Fraser River, Saint John River, Mackenzie River, and Lake Simcoe (Note that this amount includes the $420M announced by the Prime Minister for the Great Lakes).
- $22.6 million over three years, starting in 2023-24, to support better coordination of efforts to protect fresh water across Canada.
- $85.1 million over five years, starting in 2023-24, and $21 million ongoing thereafter to support the creation of a Canada Water Agency

Through Budget 2023, Canada also committed to the involvement of Indigenous Peoples in the implementation of the Freshwater Action Plan, through greater engagement, and seeking Indigenous advisory expertise, especially from women who are the traditional "water carriers" in Indigenous communities.

Canada Water Agency (CWA)

- The CWA was established as Branch within Environment and Climate Change Canada (ECCC) in June 2023. By the end of 2023, the government will introduce legislation that will fully establish the CWA as a standalone Agency.
- The CWA will advance freshwater protection and management in Canada by providing leadership for federal action on water and facilitating effective federal collaboration, and improving coordination and collaboration with provinces, territories, and Indigenous Peoples, and others to proactively address national, and regional transboundary, freshwater challenges and opportunities.
- Headquartered in Winnipeg, the Agency will be regionally responsive, including advancing delivery of Freshwater Ecosystems Initiatives in Lake Winnipeg, other waterbodies of national significance across the country.

Lake Winnipeg Basin Program

Grants and Contribution Funding

- In 2022/23, the Lake Winnipeg Basin Program invested almost $1.6 million in 25 partner-led projects to accelerate nutrient reduction, advance collaborative governance, and enhance Indigenous engagement and leadership in freshwater management. Since 2017, Canada has invested over $10 million in stakeholder led action. The next call for proposals is anticipated in winter/spring 2023/2024.

Ongoing Collaborative Arrangements with other Government Departments

ECCC support is ongoing for:

- Canada-Manitoba MOU Respecting Lake Winnipeg and its Basin (2021-2026) – Collaborative efforts through the MOU are coordinated through the Canada-Manitoba MOU Steering Committee.
- A Science Subsidiary Arrangement to the MOU is being developed to identify priorities for science and help coordinate comprehensive reporting, monitoring, research, and communication activities, thereby maximizing synergies and avoiding duplication.
- Indigenous engagement is a priority for the Canada-Manitoba MOU Steering Committee, with an initial engagement session was held March 2023 with several Indigenous organizations to help inform future approaches and opportunities that inclusion of Indigenous peoples and knowledge in the committee's work. Further engagement opportunities are being explored.

Lake Winnipeg Science Plan

- The LWBP Science Plan includes four priority areas:
    - reporting on progress towards restoring a healthy Lake Winnipeg
    - monitoring to assess status and track changes
    - research on nutrient sources and transport pathways to the lake
    - research on lake ecosystem components to achieve a sustainable nutrient balance
- In 2022/23, ECCC collected nutrient concentration and load data during spring runoff and summer rainfall events at five sites in Lake Winnipeg Basin. These sites were decommissioned in fall 2022 with a total of 80 site-years of data collected. The data set includes extremes of flood and drought and a range of fertilizer and manure management practices. Initial analyses show that hydrological drivers have a greater influence on downstream nutrient loading than fertilizer management, but poorly timed or excessive nutrient applications can result in increased off target transport. Management of ditch vegetation may provide an opportunity to reduce downstream losses.
- Collaborative research with the Universities of Manitoba and Saskatchewan on potential of variable rates of manure and phosphorus fertilizer to reduce nutrient losses in runoff is continuing in 2023/2024. The first stage of this research is to determine drivers of soil phosphorus distribution in the landscape. Phosphorus hotspots in hydrologically active areas could then be prescribed a lower rate of fertilizer application.
- The development of binational Bayesian SPAtially Referenced Regressions on Watershed attributes (SPARROW) model for the Red-Assiniboine River Basin is ongoing.
- Researchers updated critical sources areas and main tributary nutrient loadings in the Red River Basin (RRB) and assessed a suite of BMP scenarios with the updated Red River Basin

Soil and Water Assessment Tool (SWAT) model. The Assiniboine River Basin (ARB) SWAT model was recalibrated and validation of the model based on extended climate data (1988-2017) and observed flow and water quality data at monitoring stations is complete.

- Researchers assessed the impact of climate change on flow, sediment, and nutrient loadings from the Red and Assiniboine River Basin to the Lake of Winnipeg based on the calibrated RRB and ARB SWAT models with seven long-term GCM climate change scenarios (1950-2100).
- Researchers evaluated long-term nutrient (Total Phosphorus, Total Nitrogen) and suspended solids (TSS) concentrations, loads, and yields in the Canadian portion of the Lake Winnipeg Basin.
- Sediment cores were collected for analysis of phosphorus and its fractions as a nutrient source along a gradient of nutrient-producing activities, such as agricultural and sewage effluent (this data is being analyzed).
- Remotely sensed algal bloom products continue to be delivered by ECCC's EOLakewatch through a near-real-time web portal, weekly email bulletins, and annual summary reports. The bloom of 2022 peaked at a spatial extent of 10,700 km2 (43% of lake area) with a maximum severity observed on August 25. The 2023 bloom began in the North Basin around July 23rd and as of August 13th has reached a spatial extent of 10,345km 2, tracking above the long-term median for the time of year. Field campaigns were conducted in August 2023 to validate satellite bloom retrievals and contribute to new bloom community composition algorithm development. Work is ongoing to complete a large-scale validation of retrievals using historical provincial monitoring data and investigate nutrient loading responses, in order to update the analysis being carried out by Binding et al. (2018) which covered the period 2002-2011.
- Remotely sensed Secchi disk depth retrievals have been validated and used to report on long term changes in water clarity on Lake Winnipeg since 1998. Results capture a marked increase in water clarity since 2012 (manuscript in prep).
- A high-resolution 3D hydrodynamic-ecological model (AEM3D) for the lake is under development. The year-round simulation of hydrodynamics is complete and ECCC has started to conduct multi-year modelling with the ecological modelling integrated. The inputs from different sources including monitoring data, outputs from watershed model, data-driven models, and remote sensing tools are gathered to drive the model. The calibration and validation of tempo-spatial variability of ice, dissolved oxygen (DO), nutrients (e.g., Total Phosphorus, Total Nitrogen), total suspended solid (TSS), and chlorophyll a is ongoing.

Water Quality Monitoring

- International long-term monitoring is ongoing at 4 sites (Red River at Emerson, Pembina River at Windygates, Souris River at Westhope, North Dakota and at Sherwood, North Dakota)
- Red River Emerson Automated Station
    - Continuously monitored, hourly water quality data is now available for public access on the federal open data portal: Automated Fresh Water Quality Monitoring and Surveillance Data. Data files for the Red River are those with station ID MA05OC0001.

    - The portal has been updated with Red River data from 2018-2021. Historic data dating back to 1971 is also available.
- Lake Winnipeg Nearshore Monitoring
    - Two water quality monitoring surveys were successfully completed in spring and summer 2023 with a fall survey planned. Surveys visited the north and south basin, and Netley-Libau Marsh.
    - The backlog of biological samples has been analyzed by contract laboratories; data interpretation is underway.
- Lake Winnipeg Eastern Tributary Monitoring
    - Monitoring of four rivers (Manigotagan, Bloodvein, Pigeon, and Berens) was conducted between 2017-2023.
- Ongoing collaborations on Lake Winnipeg-related work include:
    - Manitoba Environment, Climate and Parks (Morison) – ECCC partnered with Manitoba to carry out under-ice winter water quality sampling. Helicopter surveys in the North & South Basin were carried out in Feb/March 2023.
    - ECCC-led research (Binding) – WQMS conducts ground truthing of remotely sensed harmful algal blooms.
    - ECCC-led research (Zastepa) – Toxin and taxonomic samples are collected by WQMS when cyanobacterial blooms are encountered.
    - Manitoba Environment and Climate (Morison) – samples for cyanobacterial cell count and microcystin analysis collected when blooms encountered.
    - University of Manitoba (Goldsborough) and Red River Basin Commission – Netley-Libau Marsh channel measurements and incidental biological samples provided to inform wetland restoration plans.
    - Lake Winnipeg Foundation / Lake Winnipeg Research Consortium (Stainton) – WQMS has provided in-kind support in the form of a decommissioned nutrient autoanalyzer. LWF is investigating whether this device can be rehabilitated / repurposed for installation aboard the MV Namao, which would allow for real time continuous nutrient monitoring during cruises of Lake Winnipeg.

E-5 Agriculture and Agri-Food Canada

IRRWB Annual Report 2023-2024

Activity Report: Agriculture and Agri-Food Canada

1. Sustainable Canadian Agricultural Partnership 2023-2028

- Priorities for the Sustainable Canadian Agricultural Partnership (2023-2028) can be read in the Guelph Statement, available online.
- The Sustainable Canadian Agricultural Partnership and the new AgriScience Program began April 1, 2023, and are set to run until 2028. The Minister has announced the Beef, Canola, Agronomy, Pulse, Dairy, Wheat, Cropping Systems, Swine, Grape & Wine, Biomass and Horticulture Clusters. The AgriScience Projects Stream has a continuous intake process, which is currently open.

2. Research, Development and Technology Transfer Activities

- AAFC (Agriculture and Agri Food Canada) research activities are ongoing. With collaborative applied research, knowledge and information transfer occurring on the effectiveness of various beneficial management practices (BMPs) in reducing potential risks to surface water.
- Science and Technology Branch (STB) also issues an internal project proposal process that supports activities across the RDT continuum.
- AAFC released a 10-year Science Strategic Plan in fall 2022. More details on the plan can be found at the link.
- Active research projects with activities in Manitoba with potential relevance to the health of Red River watershed and Lake Winnipeg, include:
    - Comparative current-use pesticide dynamics in three priority basins of Canada
    - Evaluating how climate change, land use and on-farm management practices influence the hydrological characteristics of a wetland and its ability to capture and store carbon.
    - Advancing phosphorus management in Canadian manured soils using ecosystem approach to improve use efficiency and ensure one health.
    - A multidisciplinary approach to improve phosphorus management in Canadian agro-ecosystems
    - SCAP-ASC-13 Organic Cluster Activity #7 - Optimizing the environmental and agronomic co-benefits of recycled phosphorus inputs for organic field crops
    - AAFC Hydrologist in Brandon was involved in discussions with the province of Manitoba, potato producers and the University of Manitoba in an effort to identify solutions in addressing the potato industry's water needs for expansion.
- AAFC continues to work with Environment and Climate Change Canada to respond to recommendations for enhanced AAFC-ECCC collaboration in the Lake Winnipeg Basin from the Commissioner of the Environment and Sustainable Development (CESD) 2021 Audit Report on Scientific Activities in Select Water Basins.
- Activities arising from the AAFC-ECCC interdepartmental discussions include a short-term Letter of Agreement in fiscal year 2023-24 with ECCC enabled a scientist at AAFC Morden RDC to build on a previous project looking at the application of phosphorus sorbing materials with vegetated buffer strips as a BMP to treat phosphorus in agricultural runoff water. As well, AAFC and ECCC researchers working on water quality issues in the Lake Winnipeg Basin participated in a second 1.5 day Lake Winnipeg Basin Science Workshop in March 2024 to understand current science activities and capacity, identify common science

priorities and explore opportunities for further coordination or collaboration amongst researchers.

3. Agricultural Climate Solutions

- Agricultural Climate Solutions (ACS) is a $185 million, 10-year program that will help develop and implement farming practices to tackle climate change. Through agricultural practices such as shelterbelts or cover crops, farmland can trap and store carbon and reduce greenhouse gases. ACS will develop regional collaboration hubs on farms, known as "Living Labs". Farmers and farm groups will be at the centre of decision making, innovation and on-farm activities at each hub. ACS includes transferring knowledge to other farmers so that they can deploy solutions that are tailored to their region and promote environmental sustainability and resiliency in the agriculture sector.
- Projects are selected based on the potential to store carbon and/or reduce greenhouse gases. Projects also contribute to environmental co-benefits, such as finding ways to conserve clean water.
- Applicants must form a large network of partnerships within a province, including with agricultural non-profits, Indigenous organizations and environmental groups.
- A new Manitoba Living Lab was announced November 15, 2023. The lead partner is the Manitoba Association of Watersheds, who previously led Living Lab – Eastern Prairies under the former Living Laboratories Initiative, which ended in 2023.
- Researchers are finishing up laboratory and statistical analysis from the previous Living Lab research. Upon completion of analysis, researchers will provide reports to producers on the work done on their farm as well as generalized project reports for distribution to a broader audience.
- The new living lab will develop and test BMPs for nutrient management, natural and agricultural landscapes, water retention, agroforestry, crop and livestock integration, grazing management, rhizome microbiome, soil organic matter growth and soil health, as well as facilitating better use of resources. A key focus of these activities will be to bridge the gap between understanding and implementation. In collaboration with partner organizations within the living lab, the Manitoba Association of Watersheds also encourages knowledge transfer and exchange between local producers, federal and provincial researchers, Indigenous communities, and other partners.
- A manuscript describing predictors of P loss from perennial forages and resulting from collaboration between AAFC and ECCC researchers, initiated through Living Labs is currently under review. Results to date suggest that P losses will not be elevated should increased land area be planted to perennial crops to increase carbon sequestration if soil P fertility is carefully managed.
- Co-development on AAFC led projects is moving forward with individual producers and should be finalized in the next few months. Projects involving natural landscapes, pastures and perennial forages will begin this summer. Projects focused on annual crop land will start in the fall and with site characterization and possibly seeding of cover crops. Next spring will be the first year for most studies focused on crop land.
- The external lead partner has established teams for the different activities. Some projects have been initiated.

4. **Canada-Manitoba Lake Winnipeg MOU Steering Committee, and Joint AAFC-ECCC Watershed Science Coordination Committees**
    - AAFC continues to participate on the CA-MB Lake Winnipeg MOU committee as a standing member (Dr. Felicitas Katepa-Mupondwa; delegates: Dr. Eric Liu, Dr. Alison Nelson) and its reinstated Science Coordination Subcommittee (Dr. Henry Wilson), and provide expertise related to water issues that impact agriculture in the region.
    - As part of the broader inter-departmental MOU between AAFC-ECCC on science collaboration signed in February 2017, four joint regional watershed Committees were formed to share activities related to water quality and quantity on regional watersheds including Lake Winnipeg.
    - The re-established joint AAFC-ECCC Watershed Science Coordination Committee for Lake Winnipeg has held two meetings March 3 and December 1, 2023.
    - Drs. Eric Liu (AAFC) and Ram Yerubandi (ECCC) are co-chairs for the Winnipeg Watershed Science Committee. Other AAFC members include Dr. Henry Wilson, Dr. Shanwei Xu, Dr. Taras Lychuk and Dr. Alison Nelson.

5. **Contribution to inter-jurisdictional organizations and boards**
    - AAFC continues to participate on the Prairie Provinces Water Board (PPWB) and its technical committees which undertake work that contributes to the goals and objectives of the Lake Winnipeg initiative. AAFC has representation on the Board (Dr. Eric Liu, Mr. Ron Woodvine), on the Committee on Hydrology (Mr. Ron Woodvine), the Committee on Water Quality (Dr. Henry Wilson), the Committee on Groundwater (Dr. Kayla Moore), and the Committee on Flow Forecasting (Mr. Trevor Hadwen).
    - AAFC continues to participate on the International Joint Commission (IJC) - International Red River Watershed Board (IRRWB) as a standing board member (Dr. Eric Liu). AAFC representatives provides scientific input and professional expertise for establishing water quality targets and developing a nutrient management strategy for the Red River Basin through its participation in the Water Quality Committee (Dr. Henry Wilson) and Hydrology Committee (Dr. Kayla Moore) of the IJC-IRRWB.

E-6 Lower Pembina Task Team

The IRRWB, 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 1). 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.

After the subsidence of the extensive spring flooding in 2022, both ND and MB executive offices sought to re-energize the discussion. The RRBC was able to confirm interest from both the Pembina County Commission and the Pembina Water Board to have representation on the Task Team. It is anticipated that appointments by the Premier and Governor can be completed in time for a meeting in the late fall of 2022.

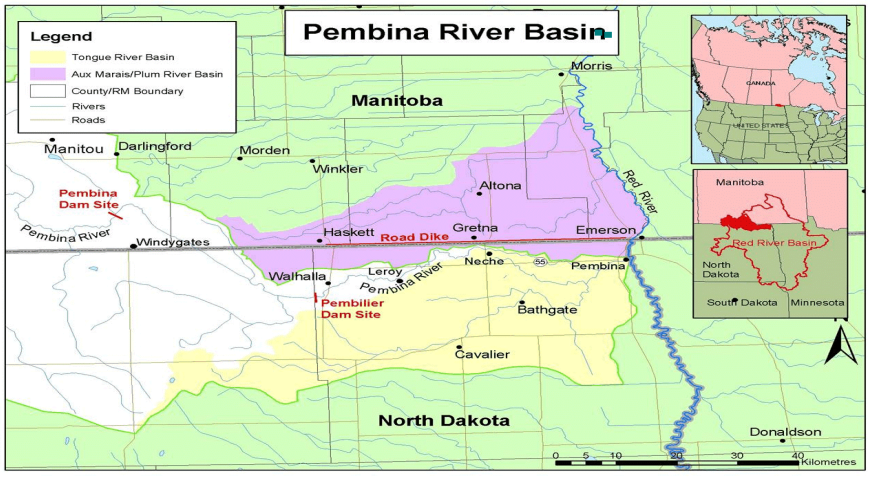


Figure 1. Pembina River Basin. The yellow and white areas comprise the Pembina River Basin.

The current Pembina River Task Team (reconstituted in late 2022) does not report to the IRRWB. It was created by and reports to Govts (ND and MB). The current chair is Red River Basin Commission (Ted Priester). So too was the previous iteration, the pre-Covid one that did a draft report. The Task team reconvened officially in late 2022 (includes IRRWB Co-Chairs) and met early January 2023.

Prior to both these iterations, there was an even earlier one – the Lower Pembina River Flood Task Force was created by the IRRB to do a hydrologic study/modeling of flooding in the Pembina watershed for the Board. Most if not all of the IRRB COH members were on the team. The IRRB gave the results to the IJC. IJC passed them on to govts. Ultimately, this led to the creation of the above-mentioned Pembina River Task Team. The Task Team has not met recently and is expected to reconvene its work soon.

E-7 Indigenous Collaboration Task team

Indigenous Collaboration Task Team 2023 Progress
ICTT Members and Collaborators
Co-Chairs Ute Holwegar and April Walker

Dr. Anette Trimbee	Melissa Hotain	Dimple Roy	Ted Priester
Brian Holmer	Tina Keeper	Marci Riel	Phoenix Combe
Celeste McKay	Cliff Crowell	Geoff Reimer	Aidan O'Hara,
Gima Sahlu	Rebecca Seal Soileau	Vanessa Alberto	Catherine Lee-Johnston
Jo Werba	Avni Solanki	Lynne Sabourin	

The Indigenous Collaboration Task Team (ICTT) continues to focus on meeting the intent of the IJC Directives for providing a continuous and inclusive forum using science and traditional knowledge. Our work seeks to advance foundational efforts to bridge existing knowledge gaps between the IRRWB and Indigenous Nations. This work is necessary to inform future approaches and opportunities that support integration and inclusion of Indigenous peoples and knowledge in board activities and decision-making. For the betterment of the basin, we strive to bring Traditional Knowledge to the Board's Activities.

Through deliberate and concentrated efforts in 2023, we were able to provide thirteen (13) recommendations resulting from information gathered at the 2023 Indigenous Nations Roundtable. The recommendations are intended for both the International Red River Watershed Board and the International Joint Commission in alignment with their scope and authorities. The IRRWB has begun the process of adopting and implementing recommendations and as of August of 2023, the IRRWB adopted the following recommendations:

- ✓ Make room for Ceremony (Acknowledge and Respect)
- ✓ Participate in events led by Indigenous Peoples (Opportunities are being identified)
- ✓ Partner with Indigenous Peoples (Studies, Data Collection, Knowledge Identification)
- ✓ Enable Indigenous Representation at the Committee Level

In December of 2023, the IRRWB held a special board meeting to consider the remaining recommendations, allowing for additional conversation to take place. The board noted that the previously approved recommendations may require funding which could present an obstacle to implementation. Through a facilitated process they expressed support for Six (6) of the remaining Nine (9) recommendations as follows:

- ➢ Find way for representation to be chosen by Indigenous communities (at committee level)
- ➢ Find a way to have an intergenerational approach. Engage with and include Tribal/First Nations Elected Leaders and youth.
- ➢ Support Binational Indigenous Collaboration (between the United States and Canada)
- ➢ Develop a Data Practices Act
- ➢ Foster Relationships (Continue engagement)
- ➢ Consider framing studies with the 7 teachings: Love, Respect, Bravery, Truth, Honesty, Humility, and Wisdom. This is intended to help to preserve the meaning of Traditional Knowledge by providing and including some Cultural context.

The remaining three (3) recommendations garnered a great deal of discussion. It was suggested that additional clarification and guidance was needed by the board to aid their considerations. Some members acknowledged that they don't know the content of the treaties and/or the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP). There may also be differences between the framework in Canada and the framework in the United States that could lead to confusion. This feedback was provided to the ICTT to help identify knowledge gaps or other challenges moving forward. The work of 2024 is largely about creating opportunities for expanding understandings of and identifying how we can meet the intent and spirit of the recommendations within the scope of the board's authority. The items still under consideration are as follows:

- Meaningful Inclusion and Engagement-(Commit to uphold Consultation and Consent requirements)
- Respect Indigenous Knowledge- Create, Adopt, Develop and be accountable for new approaches
- Reference UNDRIP and Treaty Promises in the work of the Board. Support the inherent rights of Indigenous People to their traditional territories.

The ICTT has determined that it is necessary to provide additional context to the board to enable a common understanding through the aid of subject matter experts. The ICTT will continue to work to identify subject matter experts who can provide Cultural Competency Training for the IRRWB. The ICTT will seek IWI support to host an event in 2024.
The ICTT has endeavored to align the work plan to the updated directive by integrating Indigenous collaboration with three priorities in mind:

4) Including Indigenous representation at the committee level. This effort may allow us to progress two goals, one for greater Indigenous participation at the committee level, as well as working with the elected leadership of the Indigenous Nation to bring forth individuals supported by their community.

5) Identifying opportunities for the board members to participate in Indigenous-Led Events. A list of mostly recurring events is being compiled and placed on the IRRWB's SharePoint site to allow for member collaboration on the expansion of this list. Upcoming events will be included in future reports to the board to create a greater awareness of opportunities to participate at Indigenous-led events that can inform the priorities of Indigenous communities.

6) Creation of a Data Policy. The IRRWB would like to continue to engage and collaborate with Indigenous people in the Basin. It is necessary to provide a framework for this engagement to demonstrate a commitment to respect Traditional Knowledge. The ICTT and IRRWB recognize that while this is a high priority that is essential to provide a foundation for future collaborations, it is also essential that we carry out this work in an informed manner. Therefore, we have delayed the scoping and drafting of a policy until the critical conversations, facilitated by subject matter experts, can take place as described above. Following the fall meeting, the ICTT will determine the best path forward for the drafting and implementation of a policy. It

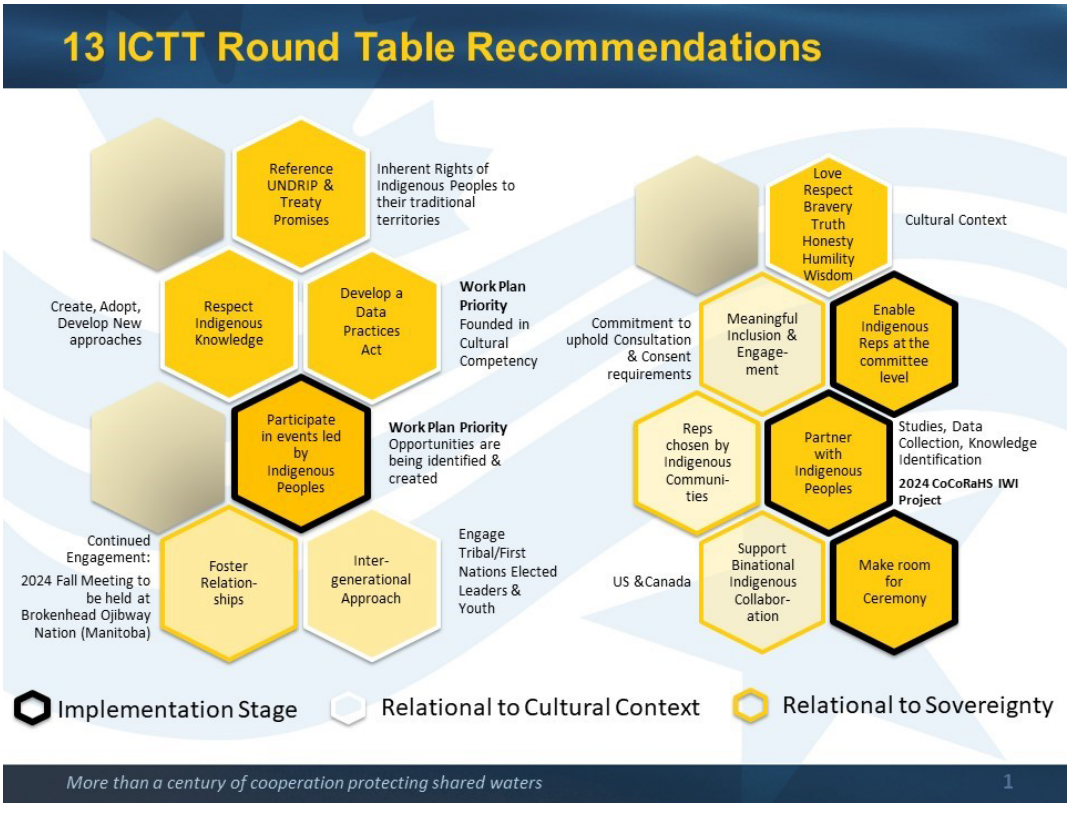
is anticipated that this effort will require an IWI proposal and funding to provide for resources to carry out the drafting.

In addition, several Community Collaborative Rain Hail and Snow (CoCoRaHS) kits will soon be available to the ICTT. We intend to prepare an IWI proposal to facilitate the distribution and implementation of the kits in Indigenous communities within the basin.

The ICTT has also been working toward a discussion with Indigenous members of the Souris River Basin Board. The ICTT would like to understand what successes the Souris Team may have celebrated that we can learn from.

As you can see, throughout 2023, the ICTT has focused on meeting the IJC Directives' intent for providing a continuous inclusive forum using science and traditional knowledge. These efforts will continue to be advanced in 2024.

Diagram 1 – Indigenous Round Table Recommendations



Flag Flying Ceremony at the Capitol Hill, Washington D.C. in April 2024 in Recognition of the Collaborative Work of the IRRWB/IJC with Indigenous Peoples in the Red River Basin

E-8 Outreach and Engagement Committee

Outreach and Engagement Committee input to the 2023 International Red River Watershed Report Annual Report

Respectfully submitted in July 2024

Members of the Outreach and Engagement Committee include Ute Holweger, Environment and Climate Change Canada (Canadian co-chair), Brian Holmer, Mayor Thief River Falls (US Co-chair), Ted Preister, Red River Basin Commission, Dimple Roy, International Institute for Sustainable Development, Gavin van der Linde, Red River Basin Commission, Rebecca Seal-Soileau, US Army Corps of Engineers and Girma Sahlu, Environment and Climate Change Canada. The committee is also well supported by IJC Communications staff including Kevin Bunch and Christina Chiasson. The Committee would like to thank Gavin van der Linde, whose term on the board ended in January 2024, for the support he provided to the committee over the years.

The committee met several times throughout the year, with the aim to meet monthly, to advance its priorities and workplan activities. The committee has discussed opportunities for increased collaboration/coordination with the other committees of the board and feels that the outcome of the strategic planning session and the updated workplan (e.g. State of Ecosystem Health Reporting) should be able to facilitate greater collaboration/coordination across committees.

The key priority of the Outreach and Engagement Committee in 2023 was the development of a communications and outreach plan to help guide the work of both the committee and the board more broadly. The plan identifies key priorities over the coming years including the following:

- State of Basin Reporting
- Accessible Plain Language Information
- Public Meetings and Tours
- Science Communication Training

It also includes a communications calendar, methods and tools for communications and outreach, as well as the development of key messages to help support the board's efforts in advancing these priorities.

In support of the identified priorities, the committee has initiated the development of key messages (likely to be designed/formatted as an infographic) and initiated foundational efforts related to advancing ecosystem health reporting with a proposal for a Master student at the University of Manitoba's Natural Resources Institute to develop recommendations for the advancement of an ecosystem health reporting system for the Red River Basin submitted to the board in the Spring of 2024 for consideration.

The committee also developed a poster on *Binational collaboration on Water – What's new with the International Red River Watershed Board* for the Canadian Water Resources Association Annual Conference which was held in Halifax, Nova Scotia in June 2023.

A summer tour to engage with White Earth Nation and see a wild rice harvesting demonstration was held in conjunction with the August 2023 board meeting and strategic planning session held in Minnesota. The tour was very informative and enabled relationship building.

Appendix F

IRRWB Work Plan (2023-2026) Placemat


Draft International Red River Watershed Board 2023 to 2026 Work Plan
Objective: Support the Aquatic Ecosystem Integrity (AEI) of the Red River Basin
10 Responsibilities
1- Aquatic Ecosystem Integrity (AEI)
2- Awareness of Land Use, Socio-Econ impacts on AEI
3- Forum for Issue resolution
4- Report on State of AEI
5- Recommend AEI Objectives to IJC
6- Gov'ts Establish & Maintain Contingency Plans
7- Culture of Climate Change Adaptation
8- Climate Resilience & Impacts on AEI
9- Monitor & Report
10- Involve Public
Strategic Objectives
Work Plan Items
Lead
Resources
Metrics of Success:
Document the current state the watershed, changing trends, and key knowledge gaps.
Establish a Process to identify, understand, and address emerging watershed issues,
All peoples in the watershed are well-informed and have meaningful opportunities to engage and dialogue with the IRRWB and governments, on issues
Their input is valued by the IRRWB, and reflected in public opinion polls and the annual IRRWB workplans and reports.
All orders of Government in the IRRW understand the role, scope, and mandate of the IRRWB, and are actively engaged with the IRRWB.
Reports annually on the State of the Basin, including key aquatic ecosystem indicators, changing trends in the IRRW, and climate change management and preparedness
Recommends actions to improve Aquatic Ecosystem integrity, and to anticipate and address emerging issues.
State of the Basin Report & SOP for addressing Issues linked to Continued agency monitoring and reporting of WQual, WQ, AEH COH,OEC, USGS,NDP#1
IRRWB & Indigenous people partner on data , studies, and knowledge ID COH #3
Provide Scientific Support to address Pembina Flooding Issues COH #2
Finish the low flow study underway, report on drought frequency on the Red COH #3
Species of concern ecology and fish passage management evaluation AEC #1, USGS #3
Bathymetry Mapping and Habitat Evaluation AEC #1, COH &NDDWR #4
Review & update WQ Objectives @Border – (Connects to ID KPIs) WQC #1, USGS #2
Extend Indigenous Representation to the Committees ICTT #1 & WQC #1 & NDDWR#2
Develop Innovative Public Engagement tools EPA & OEC #2
IRRWB & IJC Participate in Indigenous led events. ICTT #2
Engage public in IRRWB work including hosting tours and/or public meetings OEC #3
Develop Government Focused Communication Procedures NDDWR #3
Creation of Data Practices Policy ICTT #3
Develop plain language information for awareness of IRRWB activities/ mission/outcomes. OEC #2
Identify Key Performance Indicators (KPIs) EPA #1, COH #2, WQC#4
Identify nutrient reduction actions to achieve targets WQC #2
Provide recommendations & objectives. Regularly EPA #3
Work Group with Reps from Committees &ICTT
ICTT & Sec, Com Co-Chairs
COH and IRRWB Co-Chairs
AEC, FOC, MNDNR
AEC , USACE
WQC, SubCom, IRRWB
ICTT & Sec, All Committee Co-Chairs
OEC, Committees
ICTT & Sec, IJC & Co-Chairs
OEC, IJC Comms Advisors, ICTT
Secretariat with ICTT
Committees with IRRWB
Committees – WQC, COH, AEH, OEC
WQC
IRRWB, IJC to Gov't, WQC and AEC
IJC Staff, Facilitators
IWI & AM Funding, Travel to Indigenous
IWI for feasibility of alternatives
IWI , F&OC, MNDNR
IWI Funds
IWI Funded Contractor
Time, $$ for ICTT,
IJC Staff support,
Ceremonial tobacco, IJC Staff support
IWI $$, IJC Comm staff
IWI funded Consultant, Committee Co-Chairs
IWI funding, IJC Com
KPI Experts, Survey Experts, IWI $$
Tech experts in jurisdictions, IWI $$ for report
IRWWB, IJC
*Current conditions and emerging trends in State of basin report & SOP for issues...
0%
100%
*Water is a top-of-mind public issue; the public is water literate, cares & participates...
0%
100%
*All orders of government have contingency plans, implement recommendations & protecting Red River AEI
0%
100%
*Forward-looking objectives and recommendations are developed...reports are used by partners...
0%
100%
Meaningful Indigenous Inclusion
FOUNDATIONAL COMPONENTS of IJC's 2022 DIRECTIVE
Mainstreaming Climate Change
1909 Boundary Waters Treaty - to prevent and resolve disputes of trans-boundary waters shared by United States and Canada

Appendix G

Contingency Plan Contact List

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

United States:

Minnesota Pollution Control Agency – Detroit Lakes, MN

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

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

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

North Dakota Health Department – Bismarck, ND

David Glatt - (701) 328-5210 (office)
Peter Wax - (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 Environment, Climate and Parks – 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) 807-8563 (office and cell)

Environment and Climate Change Canada – Regina, SK

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

Appendix H

Committee Membership List

HYDROLOGY COMMITTEE, AQUATIC ECOSYSTEM COMMITTEE, WATER QUALITY COMMITTEE, INDIGENOUS TASK TEAM, AND OUTREACH & ENGAGEMENT COMMITTEE MEMBERSHIP LIST

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International Red River Watershed Board
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International Red River Watershed Board
Aquatic Ecosystem Committee Membership:

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International Red River Watershed Board
Water Quality Committee
Membership:

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Appendix I

INTERNATIONAL RED RIVER WATERSHED BOARD (IRRWB)

DESIGNATION LETTER 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

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IRRB