



Red River Basin Water Quality Offset Plan



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List of Acronyms

Benefits Estimator And Summary Tool	BEAST
Best Management Practice	BMP
Board of Water and Soil Resources	BWSR
BWSR Water Erosion Pollution Reduction Estimator	BWSR Calculator
Environmental Protection Agency	EPA
Hydrologic Unit Code	HUC
Hydrologic Simulation Program FORTRAN – Scenario Application Manager	HSPF-SAM
Minimal Impact Design Standards	MIDS
Minnesota Agricultural Water Quality Certification Program	MAWQCP
Minnesota Agricultural Water Resources Center	MAWRC
Minnesota Department of Agriculture	MDA
Minnesota	MN
Minnesota Pollution Control Agency	MPCA
Municipal Separate Storm Sewer System	MS4
North Dakota	ND
National Pollutant Discharge Elimination System	NPDES
Natural Resources Conservation Service	NRCS
Non-Governmental Organizations	NGO
Phosphorus Reduction Offset Calculator	P-ROC
Pollution Load Estimator Tool	PLET
Prioritize, Target, and Measure Application	PTMApp
Red River Basin Commission	RRBC
South Dakota	SD
Soil and Water Conservation Districts	SWCDs
Spatially Referenced Regression on Watershed attributes	SPARROW
Total Maximum Daily Load	TMDL
Total Nitrogen	TN
Total Phosphorus	TP
United States Geological Survey	USGS
Waste Water Treatment Plant	WWTP
Water and Sediment Control Basin	WASCOB
Water Quality Offset Plan	WQOP
Watershed Pollutant Load Reduction Calculator Tool	WPLRCT
Wetland Restoration Effectiveness Tool	WRET

Introduction and Purpose

There has been an international effort to define nutrient reduction goals for Lake Winnipeg. Associated with these goals, phosphorus limit targets have been set for the U.S. portion of watersheds contributing nutrients to Lake Winnipeg. Stakeholders in the Red River Basin (hereafter referred to as The Basin) are interested in encouraging phosphorus offsets as part of a collaborative effort to improve water quality in The Basin and make progress towards targets set for Lake Winnipeg.



The Red River Basin Commission (RRBC) and partnering stakeholders are interested in encouraging offsets within The Basin (and, if within Minnesota jurisdiction, aligning with Minnesota Pollution Control Agency (MPCA) permitting requirements) to reduce nutrient loading within The Basin, at the border, and eventually to Lake Winnipeg. A major driver for this focus is National Pollutant Discharge Elimination System (NPDES) permit requirements that point sources in The Basin are facing for phosphorus

Purpose

To develop an Offset Plan that supports stakeholders with certainty in achieving effective and efficient phosphorus reductions in the United States portion of the Red River Basin.

reductions. The intent is for this plan to serve as a means for implementing a water quality offset that could be used for a water quality trade through the MPCA. This approach will protect the Red River of the North and downstream uses as well as facilitate collaboration with the RRBC to develop a basin-wide phosphorus management plan, hereafter referred to as the Water Quality Offset Plan (WQOP).

As part of permit requirements, five wastewater facilities in Minnesota agreed to an alternative permitting process. **This plan, in part, is meant to**

satisfy portions of the permitting requirements of multiple municipalities in the Minnesota portion of The Basin. The goal of this plan, in part, is to address the total phosphorus section of the permits for five wastewater treatment facilities in MN by developing a basin-wide phosphorus management plan, hereafter called the WQOP. The WQOP identifies point and nonpoint source phosphorus contributors, estimates or calculates known phosphorus loads from each source, and identifies an allocation of reductions from each contributor throughout The Basin.

The MPCA trading program provides detail on the permitting requirements and process, but there is a gap between the Minnesota trading program and the basin-specific phosphorus loading data needed for the actual planning and implementation of effective offsets that could result in an executed trade. This plan is also intended to serve as a guide that could be used in other parts of The Basin or Minnesota.

At this time, **the WQOP is only focused on phosphorus**. The WQOP identifies point and nonpoint source loads at the watershed scale generated and delivered to the United States border. This WQOP will be used to implement pilot offsets within the United States portion of The Basin. Because the Red River of the North is not presently impaired for nutrients based on Minnesota River Eutrophication Standards, permitted entities in Minnesota would allocate phosphorus reductions generated from offset projects to the Minnesota portion of the United States phosphorus load goal at the border (700 metric tons/year). The Basin-wide target is 1,400 metric tons/year, split evenly between Minnesota and North Dakota. If provided offsets in The Basin are successful, entities within The Basin may also target offsets for nitrogen or total suspended solids (TSS) reduction. Implementation of phosphorus offset projects and practices will have a secondary benefit of also meeting Basin objectives of resiliency to flooding, water storage, habitat, and water quality improvement.

In addition to providing guidance for effective and efficient offsets, this WQOP provides an opportunity to bring together various stakeholders in The Basin including the MPCA, farmers, and cities to partner for offset implementation. The Stakeholder Engagement and Outreach section discusses the role of various stakeholders in developing this WQOP and their continued involvement in the pilot phase implementation. RRBC is interested in supporting an offset program to spur permitted entities and landowners to partner for offset projects, providing an additional pathway toward reducing basin-wide nutrient loading. This WQOP will empower permitted facilities to readily understand opportunities to offset permit requirements through projects that address sources of phosphorus in The Basin. It creates an innovative basin-scale plan that enables resources to be invested into the construction of projects and practices that drive reductions in phosphorus within The Basin.

Parallel to this planning effort, a simple spreadsheet calculator tool called the Phosphorus Reduction Offset Calculator (P-ROC) was delivered to the RRBC, providing a degree of certainty towards the impact of potential offset projects and practices. P-ROC was developed using the U.S. Geological Survey (USGS) SPAtially-Referenced Regression On Watershed attributes (SPARROW) model to assess Basin subwatershed phosphorus loading, provide specific basins that can be targeted for offsets, and model the load of phosphorus at the border from a given subwatershed where a project could occur. The P-ROC tool, discussed in detail in the Approach for Calculating Offsets section, allows stakeholders to input a Natural Resources Conservation Service (NRCS) practice at a specific subwatershed and receive an estimated load reduction in total phosphorus (TP) at The Basin border. Briefly, the following appendices were developed in support of the WQOP:

- Appendix A – Small watershed maps showing hotspots for total phosphorus loading to Canada
- Appendix B – list of permitted facilities connected to the WQOP
- Appendix C – Examples of practice types that could provide water quality offsets
- Appendix D – Example projects that could be used for a water quality offset
- Appendix E – guidebook for conducting a water quality offset

Background

Excess nutrients are an ongoing focus of efforts to improve water quality in The Basin and Lake Winnipeg. Excess nutrients can lead to eutrophication of waterbodies and make algae blooms more likely. Algae blooms are unsightly, impede aquatic recreation, and can harm aquatic life through blocking sunlight and lowering dissolved oxygen. In some cases, algae blooms can produce toxins. Lake Winnipeg has had a large increase in the presence of algae blooms in the past few decades, making it an international priority for improvements.



Algae blooms along the coast of Lake Winnipeg.

Load reductions in The Basin can have a disproportionate effect on Lake Winnipeg, as the Red River of the North contributes about 16% of the flow to Lake Winnipeg (Environment Canada and Manitoba

Water Stewardship, 2011). However, modeling places its nutrient loading contribution at 68% of the lake phosphorus load and 34% of the lake nitrogen load (Environment Canada and Manitoba Water Stewardship, 2011). In 2019, Canada proposed Water Quality Objectives at the United States border for phosphorus (1,400 metric tons/year) and nitrogen (9,525 metric tons/year) to improve water quality from Minnesota and North Dakota (Nustad, 2020). The WQOP is focused on providing pathways to make progress towards

What is an offset?

Offsets allow a point source discharge facility to partner with an outside party to implement a TP reduction project at another location in a watershed. The resulting reduction at the watershed outlet is claimed by the point source discharger.

phosphorus improvements in The Basin.

Offsets to satisfy legal requirements are allowed through the Clean Water Act and are described in the Environmental Protection Agency (EPA) update to the 2003 Water Quality Trading Policy, now encouraging market-based principles and watershed-scale implementation in the memo 'Water Quality Trading Policy to Promote Market-Based Mechanisms for Improving Water Quality' (EPA, 2019). Minnesota statutes § 115.03, subdivision 10 and Minn. R. ch. 7050.0250 through 7050.0280 authorize the use of pollutant offsets in water quality permits for surface water discharge and antidegradation analyses. In some cases, meeting the permitted load may be challenging or prohibitively expensive. MPCA is allowed to amend or issue permits for a water quality trade that offsets a permit requirement, where there is a net decrease in pollutant loading to a receiving water. In Minnesota, further detail on trading can be found at:

<https://www.pca.state.mn.us/business-with-us/water-quality-trading>

The Basin WQOP was developed to initially support phosphorus offsets in the Minnesota portion of The Basin. This initial focus was driven by the availability of guidance from the MPCA and permitting requirements that have been set forth to point discharge locations around the state.

***Disclaimer* – This plan does not provide any explicit or implied regulatory oversight for the approval of a water quality trade connected to permitting requirements. It is simply intended to provide efficiencies in developing offset information that could be used to execute a water quality trade. All efforts to transact a water quality trade are subject to the regulatory review of the appropriate permitting authorities.**

Stakeholder Engagement and Outreach

There are two levels of stakeholder engagement and outreach: one describing how stakeholders were engaged during the development of this WQOP, and the other describing how stakeholders will be engaged during implementation.

Plan Development

Three different stakeholder groups were formed to help guide the development of this Offset Plan: the Steering Committee, Technical Team, and Advisory Committee. The role of each of these stakeholder groups is described below. The RRBC and the plan development vendor, Houston Engineering, Inc., facilitated gathering feedback from each of the stakeholder groups. The RRBC relied heavily on the feedback of each of these stakeholder groups in drafting and finalizing this WQOP.

Steering Committee

The Steering Committee was made up of representatives from the cities and agricultural community. The cities in the Minnesota portion of The Basin facing NPDES permit changes connected to phosphorus included Breckenridge, Moorhead, Roseau, Thief River Falls, and Warroad.

The agricultural community will likely be engaged by cities or other permitted facilities to discuss opportunities for offsets. The agricultural representatives included the Minnesota Agricultural Water Resources Center (MAWRC) and Minnesota Department of Agriculture's (MDA) Minnesota Agricultural Water Quality Certification Program (MAWQCP).



An aerial of the Fargo-Moorhead area.

Members of the Steering Committee have been engaged in supporting the development of this Offset Plan since 2020. Prior to the planning

process beginning, the Steering Committee committed time and effort to help shape the direction of this planning process. They also stayed engaged throughout the planning process by providing critical feedback on the overall structure of the WQOP and its applicability in supporting the implementation of water quality offsets within the Minnesota portion of The Basin.

Technical Team

The Technical Team consisted of representatives from the MPCA with administrative authority for implementing water quality trades in Minnesota. This authority is provided to the MPCA through the EPA under the Clean Water Act and authorized in Minnesota, statutes § 115.03, subdivision 10 and Minn. R. ch. 7050.0250 through 7050.0280 for the purpose of achieving compliance with water quality standards.

The Technical Team was engaged through virtual and in-person meetings and provided opportunities to submit verbal and written feedback on this plan. The goal of engaging the feedback of the technical team was to provide alignment between this WQOP as well as the processes and procedures for executing water quality trades in The Basin with an initial focus on Minnesota and phosphorus.

Advisory Panel

The Advisory Panel consisted of the Steering Committee, Technical Team, and a broader stakeholder group connected to efforts to improve water quality within The Basin. The broader stakeholder group included representatives from the Steering Committee, the Technical Team, and the Red River Watershed Management Board.

The Advisory Panel was first convened to review the preliminary framework outline for this WQOP. They were asked to provide feedback on content that is needed to make this effort successful for stakeholders in The Basin and support the possibility of being adapted to other geographies and water quality constituents (e.g., nitrogen). The Advisory Panel was then convened again to review the full WQOP prior to implementation. The feedback from the Advisory Panel was instrumental in ensuring that this Offset Plan meets the needs of stakeholders in The Basin and has the potential to be applied within other major river basins and to other water quality constituents.

Plan Implementation

The RRBC plans to perform example offset calculations utilizing the methods described in this WQOP for a few pilot projects. After completing those assessments, the RRBC intends to engage all three stakeholder groups for feedback on the results. The lessons learned from that process will be used to develop a simplified guidebook for performing water quality offset assessments in The Basin for phosphorus (see Appendix E for an example of a completed guidebook). After the completion of the example assessments and the guidebook, the RRBC intends to continue to engage stakeholders in supporting water quality offsets within The Basin.

Stakeholders not on the committee described above will also be important supporters for implementation and outreach. For example, farmer groups, Soil and Water Conservation Districts

(SWCDs), cities, universities, counties, and Non-Governmental Organizations (NGOs) can be a valuable source of resources and enhance buy-in through connecting interested landowners with RRBC.

Definitions of Eligible Organizations

Eligible Entities and Scenarios

Within The Basin, there are numerous facilities that could be interested in offsets to meet TP load allocations. Of facilities authorized for surface water discharge and therefore eligible for offsets, there are 82 domestic wastewater treatment facilities, 4 tribal facilities, and 39 industrial facilities with NPDES permits in the Minnesota portion of The Basin (MPCA, 2025). A full list that includes the Rainy River Basin is included in Appendix B.

Any individual or organization aiming to reduce phosphorus load at the U.S. border that will eventually benefit Lake Winnipeg may be eligible to participate (see Eligible Locations subsection below for further discussion). Specific wastewater treatment facilities in Minnesota have expressed difficulty in meeting proposed performance based effluent limits. These wastewater treatment plants (WWTPs) would be ideal entities to engage in the offset process.

Offsets are only available for projects not otherwise required by law (i.e., installing stream buffers as required by MN law would not be an applicable practice for offset credit generation). However, components of projects that provide benefits beyond regulatory requirements could be eligible for an offset.

This plan focuses on phosphorus reduction but acknowledges that as of 2025, MPCA allows for multiple pollutant credits to be generated from one BMP. Eligible pollutants include TP, TN, TSS, salinity, and oxygen-depleting pollutants. For example, a water and sediment control basin (WASCOB) reduces TSS as well as phosphorus. The ability to receive credits for more than one pollutant provides further incentive for BMP installation.

Eligible Locations

Anywhere in the U.S. portion of The Basin that contributes phosphorus to Lake Winnipeg is eligible for an offset project. However, deference to the respective state agency rules and programs is needed. If a practice is installed in North Dakota with the intent to be used to offset a phosphorus load in Minnesota, discussion with the MPCA would be needed on case-by-case basis for using out-of-state projects to apply offsets to Minnesota permits. It is unlikely that MPCA will allow projects outside of Minnesota to generate credits for permits within Minnesota.

The P-ROC tool and this Plan are intended for RRBC use. However, the RRBC acknowledges that the neighboring Rainy River Basin also contributes phosphorus to Lake Winnipeg. The Rainy River Basin does not drain into the Red River Basin. Additionally, many waterbodies in the Rainy River Basin have a long residence time, meaning load reductions may not impact Lake Winnipeg until far in the future and practices have a low cost to benefit ratio. Given these characteristics and the complications with

implementing and inspecting a practice in another jurisdiction, the RRBC will not actively seek projects within the Rainy River Basin. However, the P-ROC tool is built to model reductions within the Rainy River Basin if projects arise within this area.

The remainder of this plan defines the pathways for how the offset quantity is calculated relative to the individual(s) or organization(s) participating in the offset exchange. Once an offset project is started, the project or practice should be operated and maintained according to appropriate standards. For example, the NRCS maintains a list of standards for conservation practices that typically contain operation and maintenance guidance on each practice Standard Document:

<https://www.nrcs.usda.gov/resources/guides-and-instructions/conservation-practice-standards>. As another example, operation and maintenance procedures could also be detailed for a specific project by a licensed professional.

Phosphorus Source Assessment

This Plan describes several levels of a watershed- Hydrologic Unit Code (HUC) 4 is a basin scale, HUC8 is a major watershed scale (i.e., larger area of the landscape), and HUC12 is a minor watershed scale (i.e., smaller area of the landscape as compared to a HUC8 watershed). An explanation of HUCs can be found online: <https://nas.er.usgs.gov/hucs.aspx>. This section identifies point and nonpoint source contributions of phosphorus to the Canadian border by HUC 8 watersheds utilizing information contained in USGS SPARROW model. In order for a water quality offset to be converted into an approved water quality trade, the current condition of the water body must first be understood through a Total Maximum Daily Load (TMDL) study or other similar watershed analysis (Bosch et al., 2022). **Figure 1** shows a map of phosphorus loads contributed from HUC 8 watersheds to the Canadian board based upon USGS SPARROW model outputs. **Table 1** utilizes this same source of information to provide point and nonpoint source loads and allocations by HUC 8 watershed in a watershed analysis manner like a TMDL.

The USGS SPARROW model was selected as it is the only known calibrated model that can provide consistent load and load routing estimates across The Basin. The USGS SPARROW model also has a history of being used and accepted for water quality offsets and water quality trades. More details on the recommended use of the USGS SPARROW model for generating offsets is provided in subsequent sections of this plan.

SPARROW point source and non-point source loads were adjusted based on readily available loading data from a number of sources. Long-term (most recent ~10 years) annual total phosphorus loads were obtained from the Minnesota watershed pollutant load monitoring network to update overall loading at the HUC 8 scale. On the North Dakota side of the Red River, annual HUC 8 loads were updated using data from Galloway et. al, 2024.

Point source loads from permitted facilities in Minnesota were obtained from the Minnesota Pollution Control Agency. Annual total phosphorus discharges from permitted facilities within each HUC 8 were individually averaged over the most recent five-year period and aggregated for all facilities within each

HUC 8. These annual loads were applied as the point source load within each individual HUC 8, with the non-point source load assumed to account for the remainder of the total phosphorus load within each HUC 8.

The Basin has an annual loading goal of no more than 1,400 metric tons of TP reaching the Canadian border per year. [Table 1](#) provides the annual loading from point and nonpoint sources within each of the contributing HUC 8 watersheds in The Basin, as well as the portioned nonpoint source load reductions necessary to meet the 1,400 metric ton loading target, accounting for an optional 10% margin of safety in the load reduction calculations.

Table 1. Watershed analysis results of point and nonpoint source load characterization for phosphorus delivery to the U.S. border by HUC 8 watershed. This data is intended to provide an understanding of the current condition of the water body (i.e., Lake Winnipeg)

HUC 8	HUC8 Location (primary state)	HUC 8 Name	HUC 8 Area (ha)	Point Source, (kg/year)*	Nonpoint source, (kg/year)†	Nonpoint source yield, kg/ha/year‡	Proportion of Total load to Canada (%)	Nonpoint source Load reduction target (kg/yr)#
09020101	MN	Bois De Sioux	287,504	24	73,736	0.26	3.0	44,755
09020102	MN	Mustinka	222,751	696	65,496	0.29	2.7	40,428
09020103	MN	Otter Tail	494,361	1,448	47,275	0.10	2.0	30,127
09020104	MN	Upper Red	169,555	10,585	90,830	0.54	4.1	65,686
09020105	ND	Western Wild Rice	579,314	1,918	138,635	0.24	5.7	59,248
09020106	MN	Buffalo	292,807	6,574	62,540	0.21	2.8	44,099
09020107	ND	Elm-Marsh	283,825	459	132,220	0.47	5.4	55,177
09020108	MN	Eastern Wild Rice	423,520	431	94,432	0.22	3.9	57,705
09020109	ND	Goose	327,677	1,927	98,945	0.30	4.1	42,844
09020201	ND	Devils Lake	994,538	0	18,102	0.02	0.7	7,486
09020202	ND	Upper Sheyenne	487,728	322	40,939	0.08	1.7	17,252
09020203	ND	Middle Sheyenne	522,907	49	97,813	0.19	4.0	40,498
09020204	ND	Lower Sheyenne	446,269	5,054	249,589	0.56	10.4	108,266
09020205	ND	Maple	408,897	744	165,818	0.41	6.8	69,315
09020301	MN	Sandhill-Wilson	304,956	685	28,926	0.09	1.2	18,385
09020302	MN	Red Lakes	502,677	24	94	0.0002	0.0	78
09020303	MN	Red Lake	346,814	3,355	146,212	0.42	6.1	91,839
09020304	MN	Thief	271,498	59	27,241	0.10	1.1	16,586
09020305	MN	Clearwater	351,788	703	44,369	0.13	1.8	27,589
09020306	MN	Grand Marais-Red	164,417	2	41,169	0.25	1.7	25,033

HUC 8	HUC8 Location (primary state)	HUC 8 Name	HUC 8 Area (ha)	Point Source, (kg/year)*	Nonpoint source, (kg/year)†	Nonpoint source yield, kg/ha/year‡	Proportion of Total load to Canada (%)	Nonpoint source Load reduction target (kg/yr)#
09020307	ND	Turtle	176,975	4,668	75,636	0.43	3.3	35,946
09020308	ND	Forest	242,511	0	80,586	0.33	3.3	33,325
09020309	MN	Snake	201,585	555	69,523	0.34	2.9	42,735
09020310	ND	Park	247,220	1,171	65,354	0.26	2.7	28,197
09020311	MN	Middle Red	637,762	171	156,122	0.24	6.4	65,226
09020312	MN	Two Rivers	282,221	415	74,788	0.26	3.1	45,765
09020313‡	ND	Pembina River	1,014,075	1,794	180,217	0.18	7.4	76,319
09020314	MN	Roseau	534,677	632	46,744	0.09	1.9	29,120
09030003	MN	Rainy Lake	1,273,219	0	18,733	0.01	NA	NA
09030007	MN	Rapid	244,466	0	17,170	0.07	NA	NA
09030008	MN	Lower Rainy	397,544	17,725	-9,604	-0.02	NA	NA
09030009	MN	Lake of the Woods	1,374,043	36	39,957	0.03	NA	NA
TOTAL:				62,226	2,479,569		100	1,219,028

* Wastewater treatment plant TP contributions

† Fertilizer, Manure, Natural, and Urban TP contributions

‡ The SPARROW model used for this plan assigns several catchments to the 09020313 HUC8. Current USGS HUC8 Boundaries divide 09020313 into two separate HUC8s (09020315 and 09020316)

Load reduction needed (plus 10% margin of safety) to meet the 1,400 MT/year load target at the Canadian Border

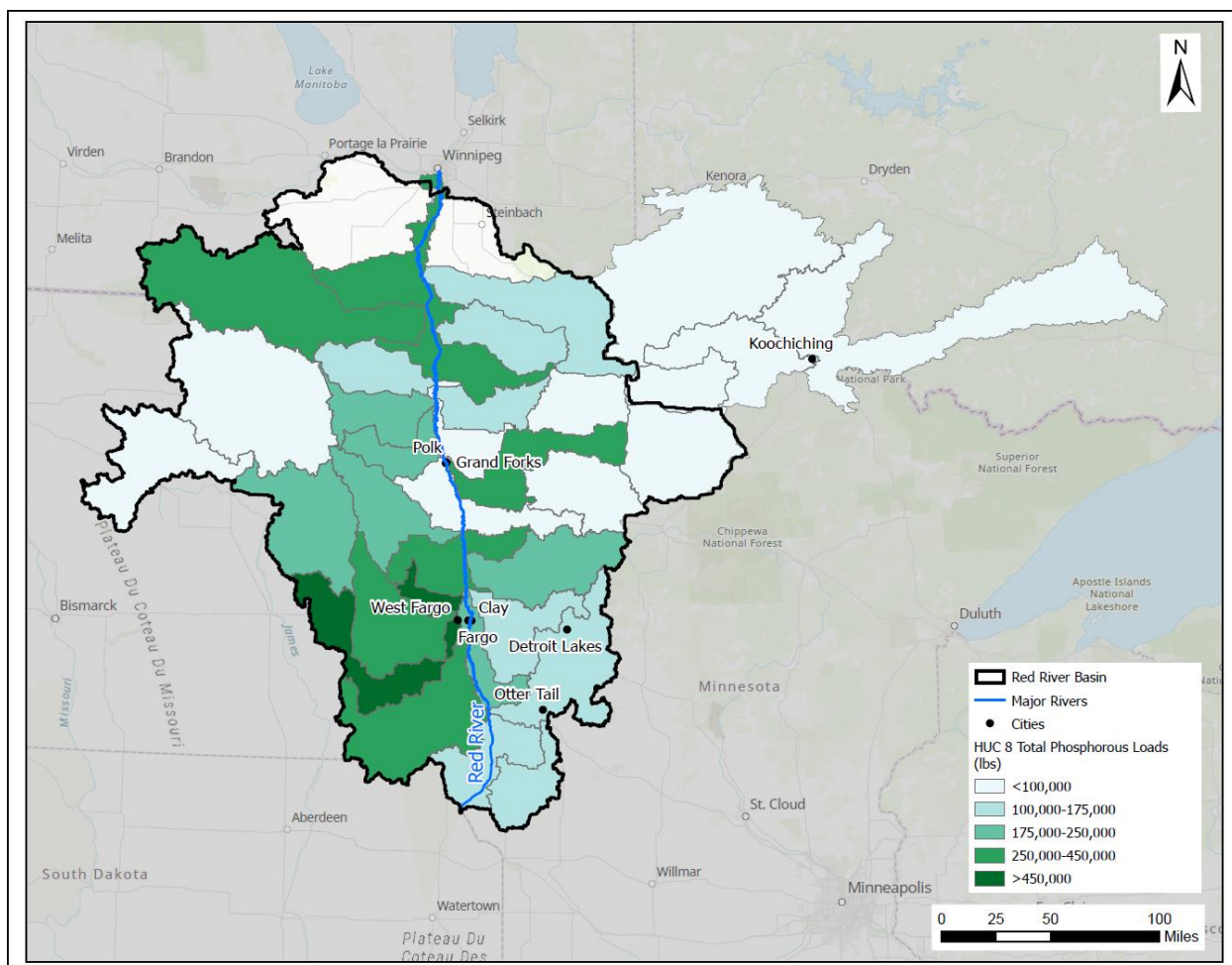


Figure 1. Annual TP loads (to Canada) from HUC8 watersheds within the Red River Basin.

Table 2 presents the TP loading information in a format that is consistent with categories used for establishing total maximum daily loads for surface waters. Existing annual TP loads from SPARROW and ancillary data sources were used to create an allocated annual TP load reduction assuming that each HUC 8 watershed would be responsible for a portion of the 1,400 metric ton per year load goal that is proportional to the existing annual TP load from that watershed. Methods used to derive the existing load are consistent with the approach used to derive **Table 1**. The annual load capacity is then the existing annual TP load minus the allocated annual TP load reduction. Consistent with TMDL approaches, a 10% margin of safety was taken from the annual load capacity and the balance applied to the annual load allocation available for each HUC 8 watershed. This allocation is exclusive to nonpoint sources and removes the additional mass from calculated point source additions. A wasteload allocation for permitted point-sources was not included at this time as permitted limits are still under negotiation for facilities in the Minnesota portion of The Basin. Existing loads from **Table 2** are utilized in the implementation section (see **Table 5**) for allocating load reductions to collaborating cities.

Table 2. Nonpoint source load characterization for phosphorus delivery to HUC 8s derived from SPARROW data that has been amended with recent monitoring data from the MPCA consistent with methods describe in generating **Table 1**.

HUC 8	HUC 8 Name	HUC08 Primary State	Existing Annual TP Load (kg)*	Allocated Annual TP Load Reduction (kg)†	Annual Load Capacity (kg)	10% MOS (kg)	Annual Load Allocation (kg)
09020101	Bois De Sioux	MN	73,760	41,522	32,238	3,224	29,005
09020102	Mustinka	MN	66,192	37,261	28,931	2,893	25,764
09020103	Otter Tail	MN	48,723	27,428	21,295	2,130	18,596
09020104	Upper Red	MN	101,415	57,090	44,325	4,433	35,729
09020105	Western Wild Rice	ND	140,553	48,964	91,589	9,159	81,305
09020106	Buffalo	MN	69,114	38,906	30,208	3,021	25,015
09020107	Elm-Marsh	ND	132,679	46,221	86,458	8,646	77,502
09020108	Eastern Wild Rice	MN	94,863	53,401	41,462	4,146	37,158
09020109	Goose	ND	100,872	35,140	65,732	6,573	58,028
09020201	Devils Lake	ND	18,102	6,306	11,796	1,180	10,616
09020202	Upper Sheyenne	ND	41,261	14,374	26,887	2,689	24,009
09020203	Middle Sheyenne	ND	97,862	34,092	63,770	6,377	57,364
09020204	Lower Sheyenne	ND	254,643	88,709	165,934	16,593	146,377
09020205	Maple	ND	166,562	58,025	108,537	10,854	97,247
09020301	Sandhill-Wilson	MN	29,611	16,669	12,942	1,294	11,226
09020302	Red Lakes	MN	118	66	52	5	40
09020303	Red Lake	MN	149,567	84,196	65,371	6,537	57,728
09020304	Thief	MN	27,300	15,368	11,932	1,193	10,714
09020305	Clearwater	MN	45,072	25,372	19,700	1,970	17,483
09020306	Grand Marais-Red	MN	41,171	23,176	17,995	1,799	16,138
09020307	Turtle	ND	80,304	27,975	52,329	5,233	44,358
09020308	Forest	ND	80,586	28,073	52,513	5,251	47,261
09020309	Snake	MN	70,078	39,449	30,629	3,063	27,343
09020310	Park	ND	66,525	23,175	43,350	4,335	38,328
09020311	Middle Red	ND	156,293	54,447	101,846	10,185	91,067
09020312	Two Rivers	MN	75,203	42,334	32,869	3,287	29,438
09020313†	Pembina River	ND	182,011	63,406	118,605	11,860	105,692
09020314	Roseau	MN	47,376	26,669	20,707	2,071	18,256
09030003	Rainy Lake	Not included	18,733				
09030007	Rapid	Not included	17,170				
09030008	Lower Rainy	Not included	8,121				
09030009	Lake of the Woods	Not included	39,993				
TOTAL:					1,400,000 (1,400 MT)		

† The SPARROW model used for this plan assigns several catchments to the 09020313 HUC8. Current USGS HUC8 Boundaries divide 09020313 into two separate HUC8s (09020315 and 09020316)

* Does not include load from Canadian catchments

† To meet 1,400 Metric Ton load limit target

Approach for Calculating Offsets

General Overview of Offset Calculations

Water quality offsets for organizations, individuals, or other entities within The Basin can be calculated using the site-specific assessment of the BMP load reduction in combination with a custom-designed phosphorus reduction offset calculator (P-ROC) tool. P-ROC provides estimates of TP loads from subwatersheds within The basin alongside estimated TP load reductions from implemented best management and conservation practices (BMPs), as estimated at the Canadian border. The remainder of this section provides an overview of the recommended technical approach for generating a phosphorus offset calculation.

Phosphorus Loads in The Basin

Data from the most recent USGS SPARROW model for The Basin will be used to estimate the source, fate, and transport of TP within the entire basin. At the time of developing The Basin WQOP, the SPARROW model was developed with a base year of 2012 and published in 2019.

Water quality data used in the calibration of the SPARROW TP model covers a 15-year period between 2000 and 2014. Data was normalized (detrended) to a selected base year (2012). This means that the estimated phosphorus loads calculated by SPARROW represent the loads that would have been measured if the factors or variables causing trends in loads had remained constant to their values during that base year. This approach increases comparability among individual collected datasets that may have different collection timeframes, sample sizes, or hydrologic conditions (Robertson and Saad, 2019).

Initial SPARROW outputs show the measured HUC 8 loading of TP to the Canadian border ([Figure 1](#)). In other words, offset practices in the HUC8 watershed(s) that contribute the most TP to the Canadian border are more likely to provide potential for a greater measurable impact. Higher resolution maps showing the annual TP load at the HUC12 watershed scale, along with the point-source TP loading at that same HUC12 scale are presented in Appendix A.

HUC12-scale BMP Load Reduction Estimates

In order to assess the load reduction from a BMP project site, measured or modeled data will need to be reviewed. In short, any individual(s) or organization looking to calculate a phosphorus offset will first need to assess the phosphorus load reduction benefit at the practice location. This section describes several approaches for assessing the site-specific phosphorus load reduction benefits of an implemented practice.

Below are several widely accepted water quality models and tools that can provide measurable TP load reduction benefits (lbs/yr) at the HUC12 or spatially finer scale (e.g. field edge). Models or tools that provide edge-of-field load reduction estimates should be able to route the estimated load reduction to the primary HUC12 outlet, accounting for natural in-stream attenuation and biological, chemical, and/or

physical losses. If not, a generalized HUC12 routing process has been included in the custom-designed P-ROC tool.

Example models or tools (and typical use scenarios) include, but may not be limited to:

- **In-field practices**

- Hydrologic Simulation Program FORTRAN – Scenario Application Manager (HSPF-SAM)
 - <https://www.respec.com/product/modeling-optimization/scenario-application-manager/>
- Watershed Pollutant Load Reduction Calculator Tool (WPLRCT)
 - <https://data.pca.state.mn.us/views/Watershedpollutantloadreductioncalculator/WatershedPollutantLoadReductionCalculator?%3Aembed=y&%3AisGuestRedirectFromVizportal=y>
- Prioritize, Target, and Measure Application (PTMApp)
 - <https://bwsr.state.mn.us/ptmapp>
- Benefits Estimator And Summary Tool (BEAST)
 - <https://www.houstoneng.com/services/environmental/>
- Pollution Load Estimator Tool (PLET – formerly STEPL)
 - <https://www.epa.gov/nps/plet>
- Engineer’s Assessment

- **Edge-of-field practices**

- Hydrologic Simulation Program FORTRAN – Scenario Application Manager (HSPF-SAM)
 - <https://www.respec.com/product/modeling-optimization/scenario-application-manager/>
- Watershed Pollutant Load Reduction Calculator Tool (WPLRCT)
 - <https://data.pca.state.mn.us/views/Watershedpollutantloadreductioncalculator/WatershedPollutantLoadReductionCalculator?%3Aembed=y&%3AisGuestRedirectFromVizportal=y>
- Prioritize, Target, and Measure Application (PTMApp)
 - <https://bwsr.state.mn.us/ptmapp>
- Benefits Estimator And Summary Tool (BEAST)
 - <https://www.houstoneng.com/services/environmental/>
- Pollution Load Estimator Tool (PLET – formerly STEPL)
 - <https://www.epa.gov/nps/plet>
- Wetland Restoration Effectiveness Tool (WRET)
 - <https://bbe.umn.edu/wret>
- Engineer’s Assessment

- **Near Channel and in-channel practices**

- BWSR Water Erosion Pollution Reduction Estimator (aka BWSR Calculator)
 - <https://bwsr.state.mn.us/water-quality-tools-and-models>
- Wetland Restoration Effectiveness Tool (WRET)

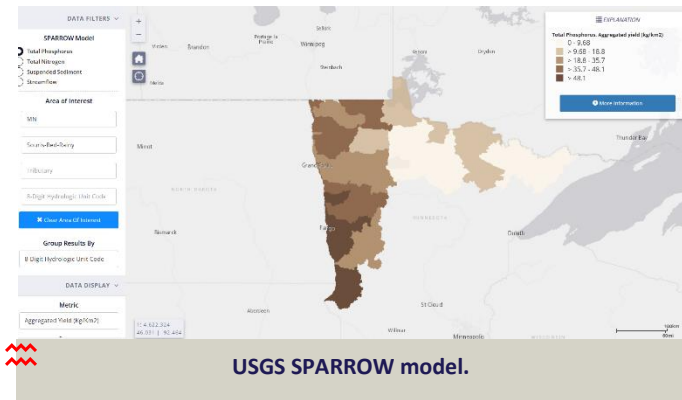
- <https://bbe.umn.edu/wret>
 - Engineer's Assessment
- **Urban practices**
 - Minimal Impact Design Standards (MIDS) Calculator
 - [https://stormwater.pca.state.mn.us/index.php/Overview_of_Minimal_Impact_Design_Standards_\(MIDS\)](https://stormwater.pca.state.mn.us/index.php/Overview_of_Minimal_Impact_Design_Standards_(MIDS))
 - Engineer's Assessment

For use within the custom-designed P-ROC tool, reporting of local load reductions will be done on an annual basis (lbs/yr), as measured at the nearest HUC12 outlet.

BMPs considered for this water quality offset program will include any NRCS-defined, engineer-assessed, or other federally approved practices that have been shown to be capable of reducing downstream TP loads as a result of implementing the practice. See Appendix C for example BMPs. The overall goal of implementing these practices will be to reduce the amount of TP contributed from upstream portions of The Basin as measured at the Canadian border and serve as a potential offset practice for point sources that contribute TP to The Basin.

Routing Load Reductions Downstream to Canadian Border

The USGS SPARROW model for The Basin will be used to route the locally measured load reduction estimates downstream through the local flow paths and river systems to the Canadian border or to the most downstream (terminus) HUC12 within the United States. SPARROW calculates the delivery of TP for each of the individual SPARROW catchments. The routed annual load is decreased using a first order decay coefficient along with the



travel time of water within the stream between the point of origin and the Canadian border or terminus HUC12. The applied decay coefficient accounts for any natural in-stream attenuation and biological, chemical, and/or physical losses to the TP load on an annual basis. Some fraction of TP leaving the landscape remains within The Basin in a given year as it is incorporated into living organisms, converted from soluble to insoluble forms, adsorbed into soil particles and redeposited, or any number of other scenarios which prevent downstream movement of TP. The measurable delivered load fraction from a SPARROW catchment to the Canadian border or HUC12 terminus will also be applied to the measured or modeled load reduction from implementing a BMP on the landscape. Not only will annual loads of TP be routed downstream and “measured” at the Canadian border or HUC12 terminus, but TP load reductions from implemented BMPs will also be routed and “measured” similarly.

SPARROW makes the assumption based on analysis of all of the model calibration data, regression analysis, and comparison of model outputs to real world measurements that there is no statistically

significant decay of TP in streams with mean discharge of greater than or equal to 80 cubic feet per second. For phosphorus in particular, this lack of relationship is likely due to the flow volume, depth, width, and velocity of the river under higher flow conditions preventing the uptake or deposition of TP due to decreased opportunity for chemical or biological interaction and physical attenuation.

The SPARROW model divides the landscape within The Basin at a much smaller scale than a HUC12. On average, there are roughly 15 to 45 SPARROW catchments within a single HUC12 ([Table 2](#)).

Table 2. SPARROW catchment vs. HUC12 spatial scale within the Red River Basin

Catchment	Count*	Median area (km ²)	Mean area (km ²)
SPARROW	16,180	2.09	6.54
HUC12	1,016	96.73	101.93

* Within the USA portion of the Red River Basin

Each individual SPARROW catchment has a TP load delivery fraction associated with it, which provides the measurable fraction of TP load generated within that catchment that will be measurable on an annual basis at the Canadian border or HUC12 terminus. TP delivery fractions from the SPARROW catchments were spatially weighted and aggregated up to the HUC12 scale. The HUC12 delivery fraction (annual mass and project load reduction) thus represents the spatially weighted average of all SPARROW catchment delivery fractions within the HUC12. Users of the custom-designed P-ROC tool will be required to determine the HUC12 watershed where an offset BMP will be implemented. All annual BMP TP load reduction estimates are expected to be calculated or estimated as measurable at the edge-of-field, or just downstream of the location of the BMP. From there, the custom-designed P-ROC tool will route the measurable load reduction downstream to the Canadian border or HUC12 terminus using the spatially weighted TP delivery fraction for that HUC12.

As described, each HUC12 watershed is made up of multiple SPARROW model catchments. This means that within a HUC12 watershed there is variation in how much load will be delivered to the U.S. border. The P-ROC tool is designed to default to a weighted average (as described in the paragraph above). However, users have the option to adjust the default average based upon the statistical variation of the catchments within the HUC12 watershed. An option is provided to use the minimum, 25th percentile, median, 75th percentile, and maximum based upon local knowledge of the project location.

The spatially weighted mean value is preferred for all custom-designed P-ROC tool calculations unless local knowledge specific to the area where a BMP is implemented supersedes default values from the custom-designed P-ROC tool. Users that know a BMP is close to the outlet of the HUC12 may opt to use the 75th percentile or maximum delivery fraction instead of the spatially weighted mean. Conversely, users who know a BMP is far from the outlet of the HUC12 may opt to use the 25th percentile or minimum delivery fraction instead of the spatially weighted mean, taking into account the additional travel time. Not only will the five-number summary function as optional user-operated quality control within the custom-designed P-ROC tool, but it can also serve as a tool for sensitivity analysis.

Given that the modeled travel times from all locations within The Basin to the terminus at the Canadian border are less than one year ([Table 3](#)), it is not anticipated that additional lag time for the benefits of any BMP needs to be estimated.

Table 3. Travel time of water and total phosphorus delivery fraction from the outlet of each listed HUC08 to the Canadian border.

Watershed	HUC08	Travel Time to Canadian Border (days)	Travel Time to Canadian Border (hours)	Mean HUC08 Total Phosphorus delivery fraction
Lower Red	09020311	0.00	0.00	0.73
Pembina	09020313 [‡]	0.08	1.92	0.62
Two Rivers	09020312	1.04	24.96	0.84
Grand Marais-Red	09020306	3.39	81.36	0.81
Park	09020310	3.39	81.36	0.33
Snake	09020309	3.67	88.08	0.63
Forest	09020308	4.11	98.64	0.55
Turtle	09020307	4.24	101.76	0.60
Sandhill-Wilson	09020301	5.78	138.72	0.72
Red Lake	09020303	5.92	142.08	0.83
Elm-Marsh	09020107	9.00	216.00	0.58
Goose	09020109	9.05	217.20	0.46
Clearwater	09020305	9.32	223.68	0.64
Eastern Wild Rice	09020108	10.04	240.96	0.70
Thief	09020304	10.75	258.00	0.50
Upper Red	09020104	12.15	291.60	0.80
Buffalo	09020106	12.15	291.60	0.70
Lower Sheyenne	09020204	12.45	298.80	0.75
Maple	09020205	13.21	317.04	0.42
Red Lakes	09020302	14.26	342.24	0.01
Western Wild Rice	09020105	15.76	378.24	0.62
Bois De Sioux	09020101	19.90	477.60	0.54
Otter Tail	09020103	19.90	477.60	0.33
Mustinka	09020102	22.63	543.12	0.27
Middle Sheyenne	09020203	23.01	552.24	0.68
Upper Sheyenne	09020202	32.55	781.20	0.41
Devils Lake	09020201	0.00	0.00	0.08
Rainy Lake	09030003	0.00	0.00	0.52
Rapid	09030007	0.00	0.00	0.64
Lower Rainy	09030008	0.00	0.00	0.60
Lake of the Woods	09030009	0.00	0.00	0.71

[‡] The SPARROW model used for this plan assigns several catchments to the 09020313 HUC8. Current USGS HUC8 Boundaries divide 09020313 into two separate HUC8s (09020315 and 09020316)

Interannual Variability

The results from the custom-designed P-ROC Tool provide an annual average reduction in TP resulting from implementation of a BMP, as measurable at the Canadian border. It is assumed that this annual average is representative of the loading that would continue to occur if the BMP was not implemented. While interannual variability was not considered explicitly as part of the calculation, it is reasonable to assume that the majority of loading at the site of a BMP would occur during larger runoff events between April and October.

Planning Your Offset Requirement

In addition to providing load reductions at the border, the P-ROC tool has also been designed to aid in planning where BMPs may be most beneficial for offsets. The planning option allows users to take a known load reduction goal (mass of TP reduced) within one of the United States HUC12s, route that load reduction goal to the Canadian border. Next, the planning option allows the user to identify the amount of load that would need to be reduced within an upstream HUC12 to achieve the goal at the border.

Organizations, individuals, or other entities within The Basin needing to calculate offset potential can enter their TP offset needs at their location and have the necessary mass load reduction be routed to the Canadian border. From there, the routed offset mass can be mathematically pushed back upstream to any HUC12 to determine the necessary load reduction within that specified HUC12 to meet the requirements of the entity requiring the phosphorus offset.

Two Options for Using the Tool:

- 1) Start with a selected HUC12 for project implementation, know project load reduction, and use the Tool to identify the measurable load reduction at the Canadian border
- 2) Start with the needed load reduction in a HUC12, use the Tool to determine the measurable load reduction at the border and at an upstream HUC12 for offset implementation

Offset Ratios

The ability to determine a trade ratio has also been built into the custom-designed P-ROC tool. In permitted trades, a trade ratio is required to be applied after calculation of the load delivered to the border. The trade ratio can be implemented for a number of reasons, including incorporating a margin of safety in the estimation of an offset or encouraging additional water quality improvement as a result of the offset. For example, a 2.6x trade ratio means that the load reduction of the offset BMP has to be 2.6x higher than the phosphorus load being offset by the trade. For example, if one party needs to reduce phosphorus by 10 lbs per year and a 2.6x trade ratio is applied, the offsetting BMP would need to provide a reduction of 26 lbs per year.

Implementation: Permitted Load Reductions

Offsets may be of interest to permitted entities in The Basin that need to meet MPCA load reduction requirements. The MPCA and the five participating WWTPs discussed pathways for establishing performance-based standards at each participating facility, while also providing a flexible offset pathway for achieving standards when in exceedance of defined phosphorus limits. This plan section describes the option of a 20% annual load reduction approach for permitted facilities to achieve phosphorus-based limits, when current (five-year average) loading is in exceedance of those limits. This aligns with permit requirements for meeting a facilities final phosphorus effluent limits no later than January 1, 2031. An average annual load reduction of approximately 20% is applied over a five-year period.

This percent load reduction approach sets a reduction percentage based on a pace of progress intended to provide a time window that allows for permitted facilities to plan and execute the necessary improvements. The participating permitted facilities that are in excess of their permitted effluent limits (Moorhead and Thief River Falls at the time of this report) would be responsible for reducing annual effluent phosphorus load by 20% of the excess amount annually, tracked with a 5-year moving average no later than the end of their next permitting cycle, whichever occurs first. All facilities will have load limits, but only those facilities that are not currently meeting those limits will be required to make improvements. Current facility loads would be calculated as the “typical” average annual effluent load from the facility during years with average or near-average precipitation. From the recent available data for these facilities, this would include annual loads from 2015, 2020, 2022, 2023, and 2024. These years were selected as representative of typical precipitation years, as many of the other years within the previous decade were considerably wetter or drier than average within The Basin. Years with typical precipitation are favored as they will correlate with typical discharge volumes from permitted treatment facilities.

Collaborating cities will commit to matching their point source reductions to the specified reduction percentage based on their typical annual effluent load exceedance. [Table 5](#) shows the existing performance-based standards. The intent is for cities currently not meeting limits to achieve approximately 20% load reduction annually (re-evaluated every five years, and on a five-year rolling average) until the MPCA performance-based load reduction target is met. The cities that are currently meeting limits based on data analysis, Breckenridge, Warroad and Roseau, will receive limits in their next permit to be effective at reissuance. For example, if it is identified that a city is exceeding their standard by 1,000 kg/year, they would ideally need to reduce 200 kg (i.e., 20% X 1,000 kg/year) of phosphorus per year until the standard was achieved. The annual increase in load reduction can fluctuate from year to year as long as the standard is eventually achieved by the end of the five-year period. Given that larger projects for reducing phosphorus may take multiple years to plan and implement, this reduction would be managed on a 5-year rolling average. In other words, in this example the facility would need to record at least 1,000 kg of cumulative phosphorus reduction over any five-year period while still in exceedance of their permit limit. Any permittee whose loads are lower than MPCA proposed standards will not be held to the load reduction target. Instead permitted facilities will receive limits with their next permit reissuance.

For comparison against the proposed point source reduction targets, nonpoint source load reductions within The Basin were also reviewed. Voluntary conservation efforts are documented by the MPCA on the Healthier Watershed tracking webpage. MPCA staff developed an HSPF-based tool to estimate the TP load reductions enacted through these voluntary nonpoint source conservation efforts, which should be inclusive of all conservation supported with state or federal resources. The nonpoint source load reduction data show voluntary conservation efforts have achieved a 1.85% annual TP load reduction throughout The Basin based on conservation practices implemented during the five years across which the participating permitted point source loads were calculated. The rate at which nonpoint source conservation efforts reduce phosphorus in the Red River Basin will almost certainly vary over time but are currently considerably less than the proposed point source percent load reduction targets.

Table 5. *Proposed performance-based limits for the five participating facilities along with the proposed annual reduction percentage.*

City	HUC 08	MPCA proposed performance-based standards (kg/yr)	TP Load Reduction
Moorhead WWTP	09020104	5,861*	20%
Breckenridge WWTP	09020104	1,382	
Thief River Falls WWTP	09020303	1,403*	
Roseau WWTP	09020314	1,865	
Warroad WWTP	09020314	1,020	

*Annual performance standard based on a concentration limit of 1 mg/l and typical discharge during 2015, 2020, 2022, 2023, and 2024

Implementation: Processes and Procedures for Offsets

This section describes the processes and procedures for utilizing the offset calculations in alignment with guidance for water quality trades developed by the MPCA (Bosch et al., 2022). It is intended to provide a clear pathway for integrating the offset calculations described in The Basin WQOP with processes and procedures that would allow stakeholders to transition an offset project into an approved water quality trade.

Process and Procedures

The steps below were adapted from MPCA water quality trade guidance to fit the calculation procedures specified in this plan. If a water quality trade will be generated through the offset project, it is recommended that the MPCA water quality trading staff be engaged early in the offset project's planning process.

1. **Establish or Consider Minimum Control Levels** – Any facility or entity wishing to offset phosphorus loads must first meet minimum control levels set for the individual facility or entity.

This is to ensure that the offset will supplement pollution controls, not replace them. The MPCA will work with facilities or entities to establish these concentration limits if none currently exists.

2. **Establish the Parameter of Concern** - The organization initiated the offset needs to identify the amount of phosphorus that they need to offset. The organizations mass of phosphorus contribution can be inserted into the Calculator Tool's Planning functionality to derive this information.
3. **Identify Offset Practice and Location** – the entity seeking an offset should collaborate with stakeholders to select a project and project location. The P-ROC tool's Planning functionality can be used to aid in selecting locations in The Basin with the largest potential for providing an offset. The entity pursuing the offset should be aware of local permit obligations that may impact decisions on where to place the project. If a trade will be pursued, the entity pursuing the offset should also confirm that the type of practice is eligible for a trade with the MPCA.
4. **Establish Baseline Site Conditions** – Document the current condition of the proposed project site and waterbody through site visit(s) and assessment.
5. **Confirm Site Assessment** – A list of commonly used tools and models for performing the project load reduction assessment at the project site are provided above. The organization pursuing the offset will need to perform this assessment for use in later steps in finalizing the offset potential of the project.
6. **Calculate Offset** – Utilize the site assessment information from the previous step to calculate the offset potential of the project with the P-ROC tool. If offset will be utilized for a trade, determine trade ratio.
7. **Develop Operation, Maintenance, and Monitoring Plan** – Every project has a defined life cycle and likely will have standards for operating and maintaining the project in a manner consistent with initial design and construction. In addition, if an offset developed through The Basin WQOP will be utilized for a trade, annual inspections and maintenance will be required.
8. **Establish Trade Ratio** – At this stage, the entity pursuing the offset should have sufficient information to establish a trade ratio. The default ratio for a point to nonpoint offset is 2.6:1.0. Depending on the specific practice, offset potential, operation, maintenance, and monitoring plan, the entity pursuing the offset may be able to establish an improved trade ratio. The MPCA will have final authority over the trade ratio for the offset. If an adjusted trade ratio is utilized, the offset calculation from Step 6 will need to be updated in the P-ROC tool.

If the entities collaborating on an offset choose to pursue a water quality trade, they should be prepared to discuss the following items *prior to implementing the project*. These items were taken directly from MPCA trading guidance (Bosch et al., 2022).

- MPCA staff will likely inspect the BMP site(s) early in the planning stage, long before construction begins.
- Some BMPs may require a Professional Engineer (PE) signature. In the past, these were BMPs that included a structural component.

- The Permittee shall retain an independent auditor to certify project completion. The auditor shall be a PE for engineered projects designed by a PE. For other BMPs, the auditor can be a PE or other professional with demonstrated expertise in the field.
- Temporary impacts during construction.
- Regular maintenance will be required, just like at a WWTP.
- Minnesota Department of Natural Resources, the USACE, and other federal, state, or local authorities may have restrictions that will have to be considered.
- Some BMPs can lose their effectiveness over time. Some may become more effective. This may depend on the type of BMP, its location, and pollutant of concern.
- A legally binding contract between the Permittee and the landowner will have to be developed to clarify the details of the BMP. The contract will need to be submitted to the MPCA for review prior to signing by the Permittee and the landowner.
- Construction plans should be submitted to the MPCA for review prior to bidding.
- The NPDES permit must be reissued with trading language and trading attachments prior to approval of any trading credits. The NPDES permit will contain, at a minimum, a requirement for submittal of an annual report to provide the MPCA with an update on the status of the trades.
- Project cost and pollutant reduction cost in \$/kg per BMP must be reported to MPCA on an annual basis. Metric units are shown here in alignment with MPCA guidance.

In addition, the entities collaborating on the offset should plan to develop and retain the following records about the project in case a water quality trade is pursued. These items were taken directly from MPCA trading guidance (Bosch et al., 2022).

1. Site name
2. Site location
3. Identification of major and minor watersheds and map(s)
4. Presence of downstream lakes or wetlands
5. Landowner
6. Past five years of land use and vegetative cover type
7. Proposed legal agreement
8. Plan view
9. Plans and specifications (as needed)
10. Operation and maintenance plans
11. Vegetation establishment and maintenance criteria
12. Cost
13. Pollutant of concern reduction estimates

Pathways to Generate Offsets

Offset projects are any BMP or conservation practice that has been shown to reduce phosphorus in surface water. To be eligible for a water quality trade, the BMP or conservation practice type will need to be approved by the MPCA. These can be in-field management practices, structural practices, or capital improvement projects. Successful implementation is more likely with projects that have demonstrated success in The Basin. Minnesota tracks implemented BMPs statewide through the

eLINK system. The most popular BMPs that reduce phosphorus, as tracked through eLINK within The Basin, include riparian herbaceous cover, cover crops, residue and tillage management, filter strips, WASCObS, grade stabilizations, and streambank and shoreline protection. It is likely to be easier to receive support for a project already familiar to a landowner and that has been previously implemented in the watershed. When considering a BMP, the performance of BMPs for reducing TP in the cold climate of The Basin should be taken into account. Descriptions of potential in-field, edge-of-field, near-channel, and urban practices that could be implemented are included in Appendix C.



An example of a BMP: streambank stabilization.

The annual loading from each SPARROW catchment delivered to the Canadian border was aggregated up to the HUC12 scale and presented as a fraction of the overall loading to the border (Appendix A). Higher priority could be given to BMPs that are located in areas with the greatest delivery potential as they will have the greatest impact in reducing TP loading to the outlet of The Basin at the Canadian border. BMPs could also be prioritized from the HUC12 catchments that have the highest delivery fraction, as those measurable load reductions will be transferred through The Basin with the least amount of natural attenuation or reduction.

Post-Implementation

MPCA will serve as the external oversight authority for any pilot offset projects that are ramped into a water quality trade. The operation and maintenance of BMPs that are part of a TP offset are intended to continue throughout the lifespan of the practice determined in the Operations and Maintenance Plan. With this in mind, BMPs need to be operated and maintained to ensure effective TP load reduction. An operation, maintenance, and inspection plan will be part of the design, permitting, and construction of the project, as described in the steps above for establishing an offset project.

If a project is not maintained or the landowner wishes to remove it, the offset associated with the project would be lost. Long-term legal agreements with the project site landowner are recommended to avoid losing the offset before the lifespan of the project is reached.

Future Growth

The adoption of TP offsets can be a starting point for future growth in the nutrient reduction sector. While the focus of this WQOP and local efforts is typically on phosphorus reductions, nitrogen is a pollutant of concern as well. As this WQOP is used, entities and landowners will form relationships and can be potential future partners in similar projects to offset nitrogen loading.

Additionally, **successful implementation of the pilot offsets can attract private funding for practices**, accelerating nutrient load reductions with multiple environmental benefits. Demonstration of the implementation of offset projects can encourage private capital and philanthropic contributions for projects that not only reduce phosphorus, but align with RRBC initiatives of protection against flooding, habitat improvement, and climate-smart practices.

This WQOP was designed to provide efficient and effective opportunities to offset phosphorus contributions in the Red River Basin. However, the framework used for establishing this plan should be transferable to other major basins in Minnesota and beyond.

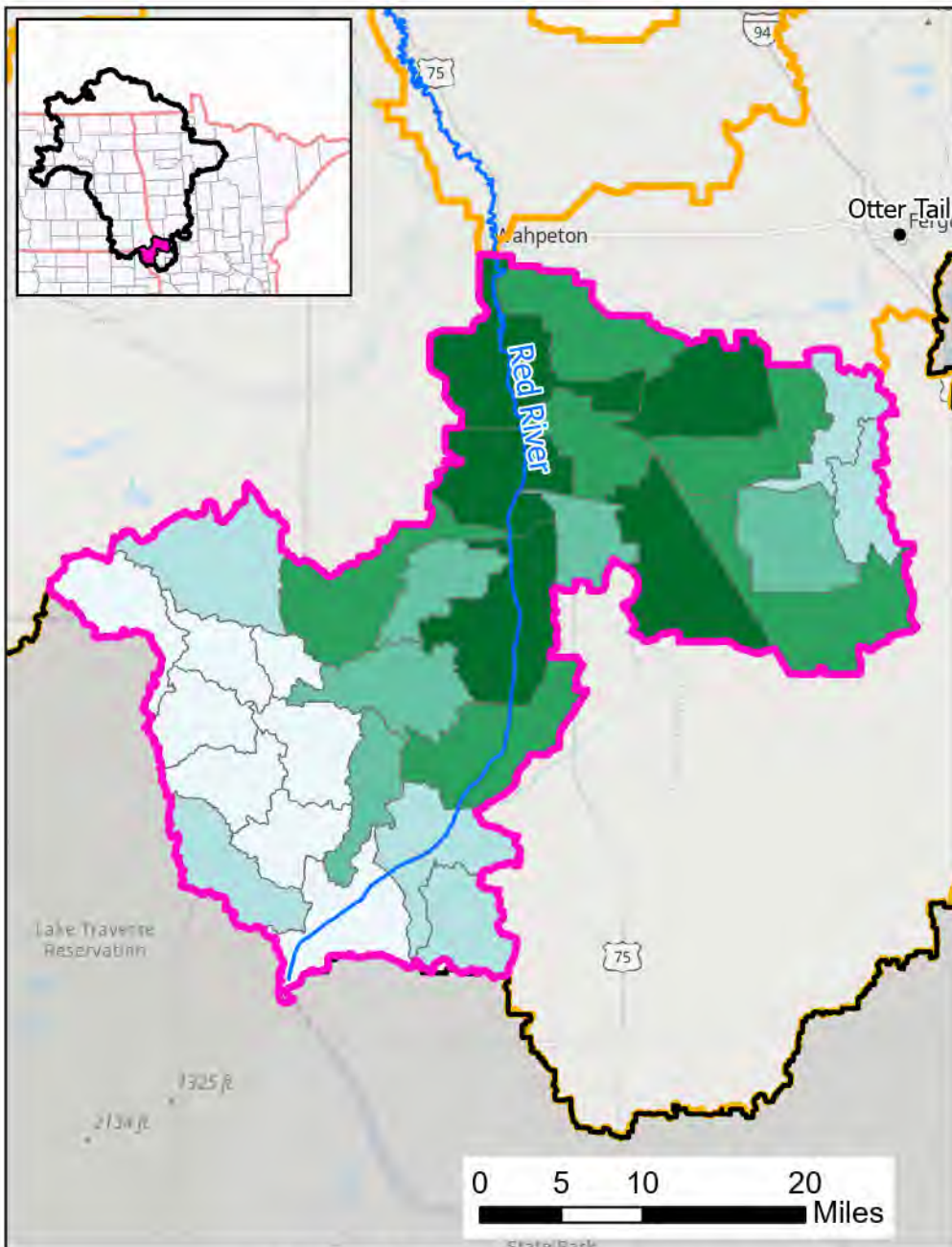
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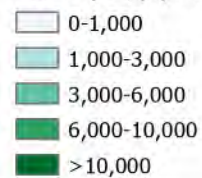
Appendix A - HUC12 SPARROW TP Loads to Canada

This appendix contains a series of maps for each HUC8 watershed with the US contributing areas to Lake Winnipeg. Each map shows the annual TP load and annual TP point source load delivered to the US border for the HUC 12 watershed within the HUC8 watershed based upon SPARROW model results.

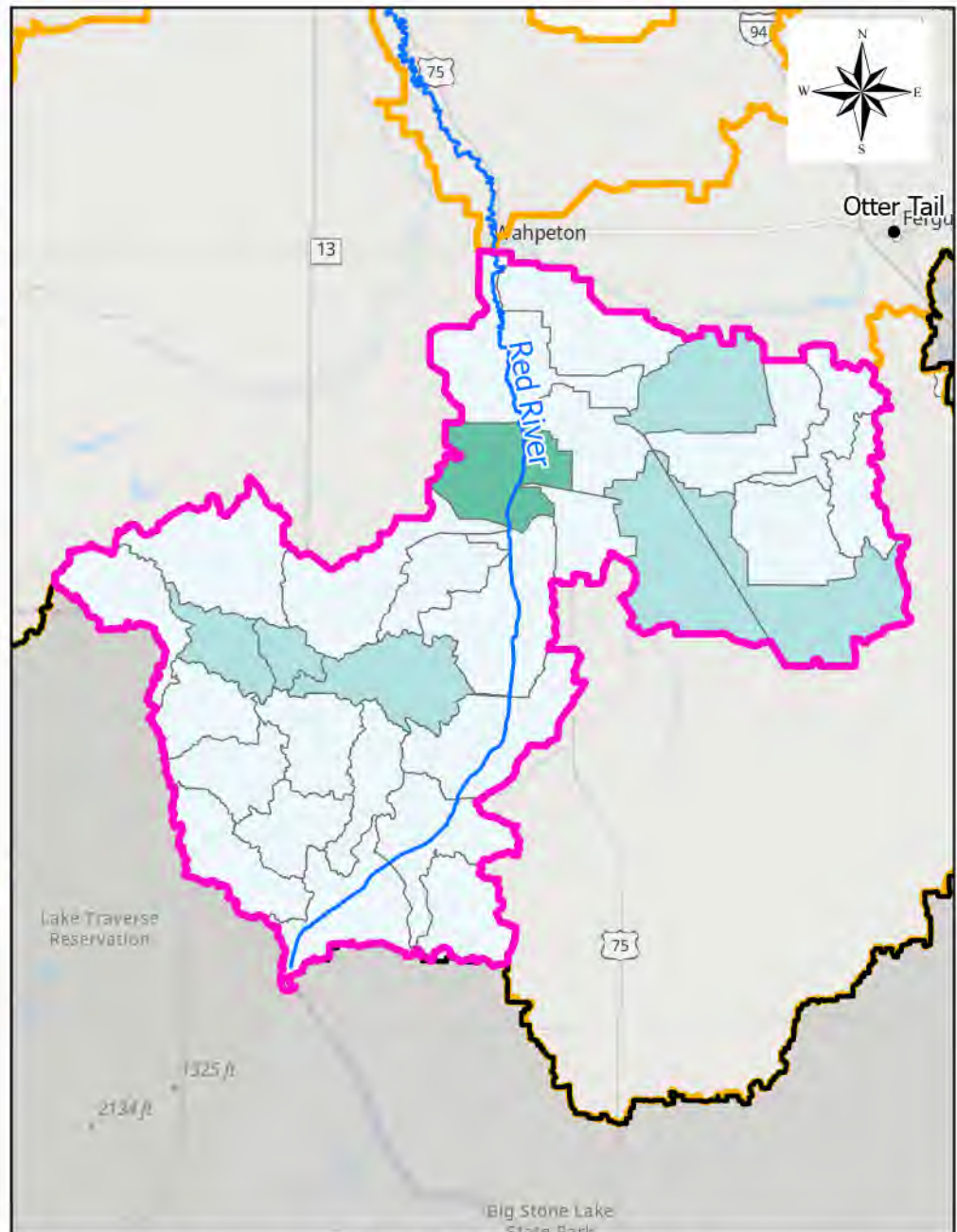
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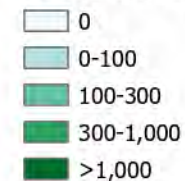
HUC 12 Total Phosphorous
Loads (lbs/yr) to Canada

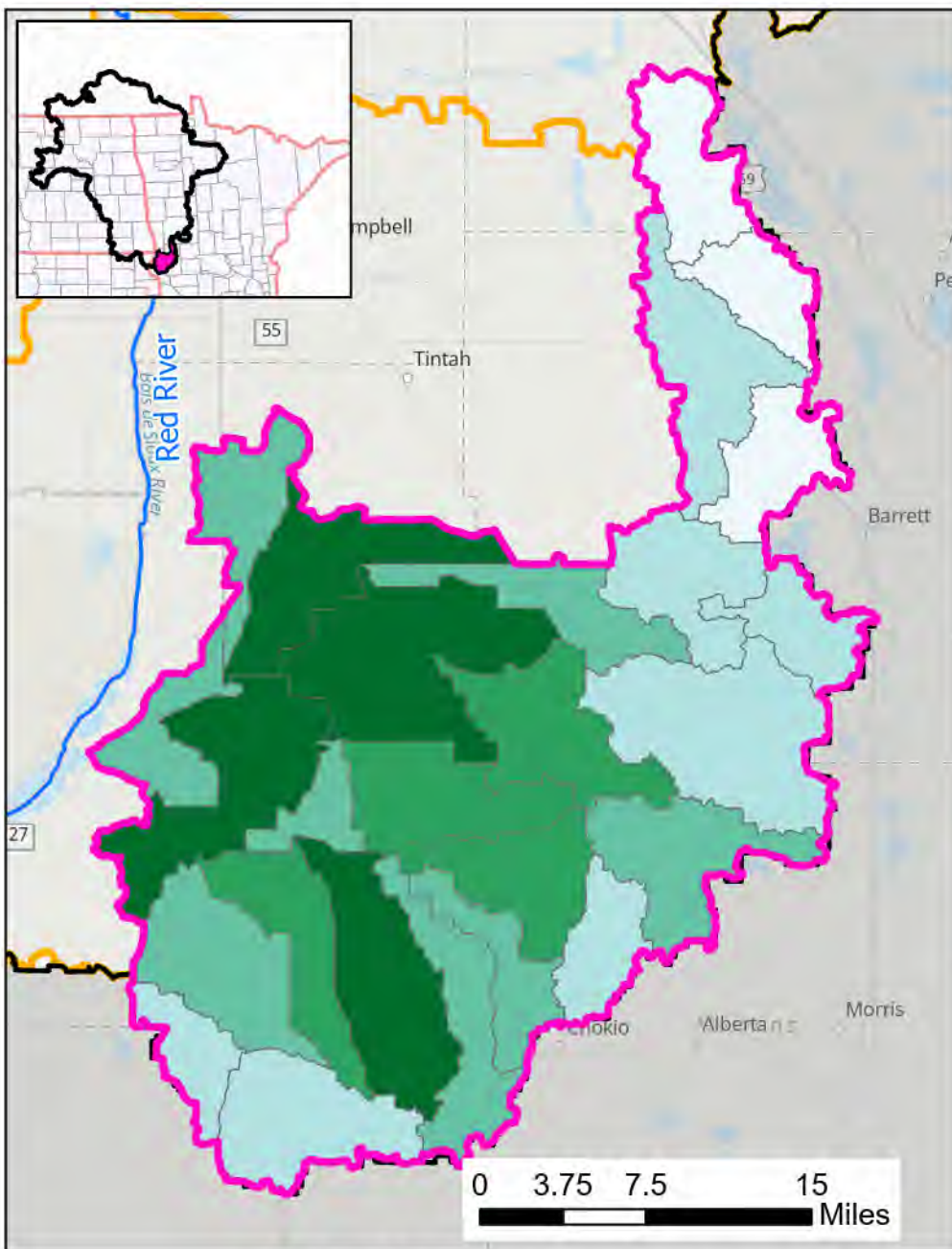


Total and Point Source Phosphorus loads from HUC 12 watersheds within the 09020101 HUC 8 Bois De Sioux

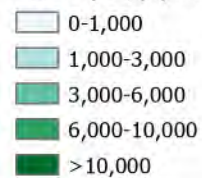


HUC 12 Total Phosphorus Point
Source Loads (lbs/yr) to Canada

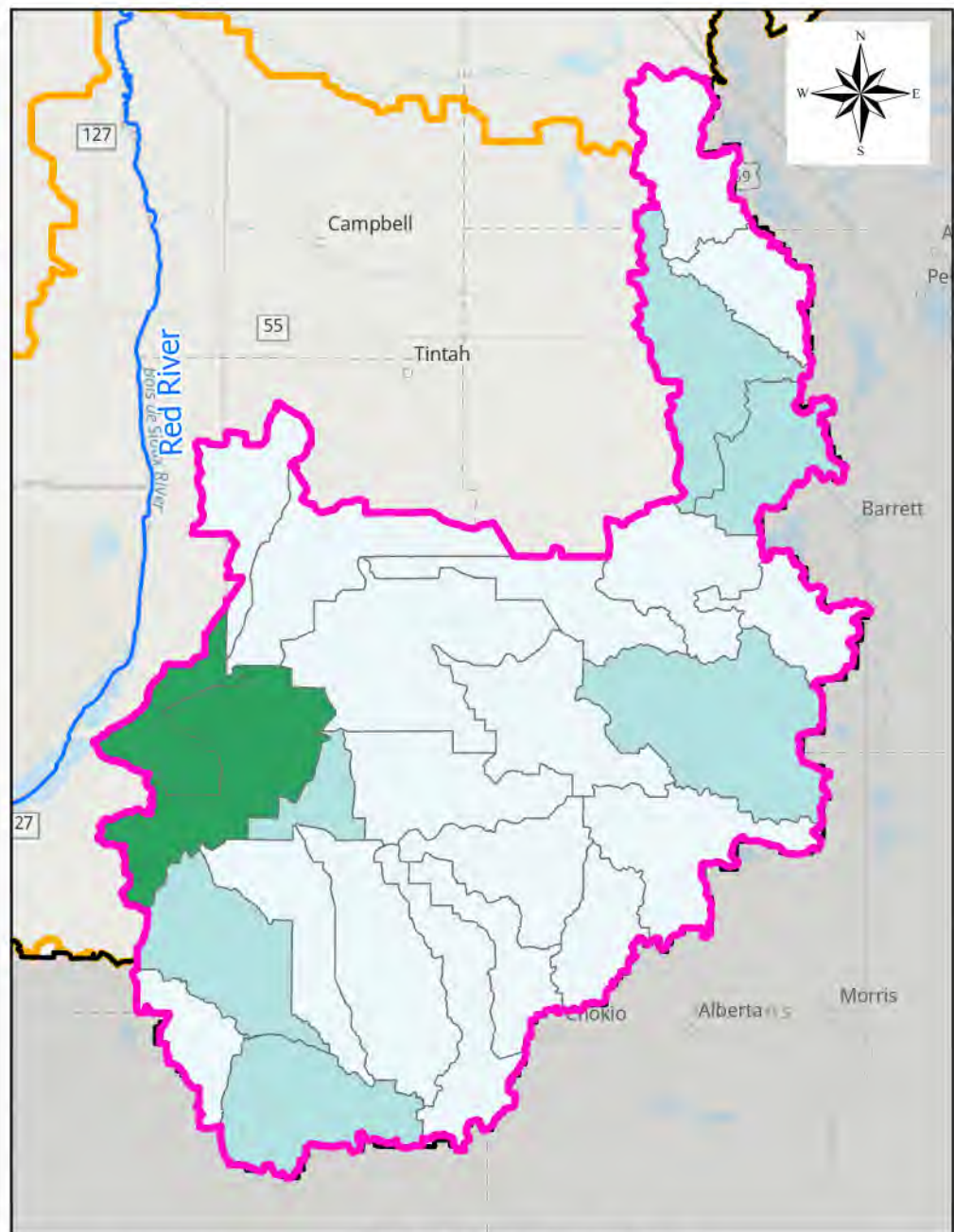




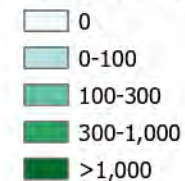
HUC 12 Total Phosphorous
Loads (lbs/yr) to Canada

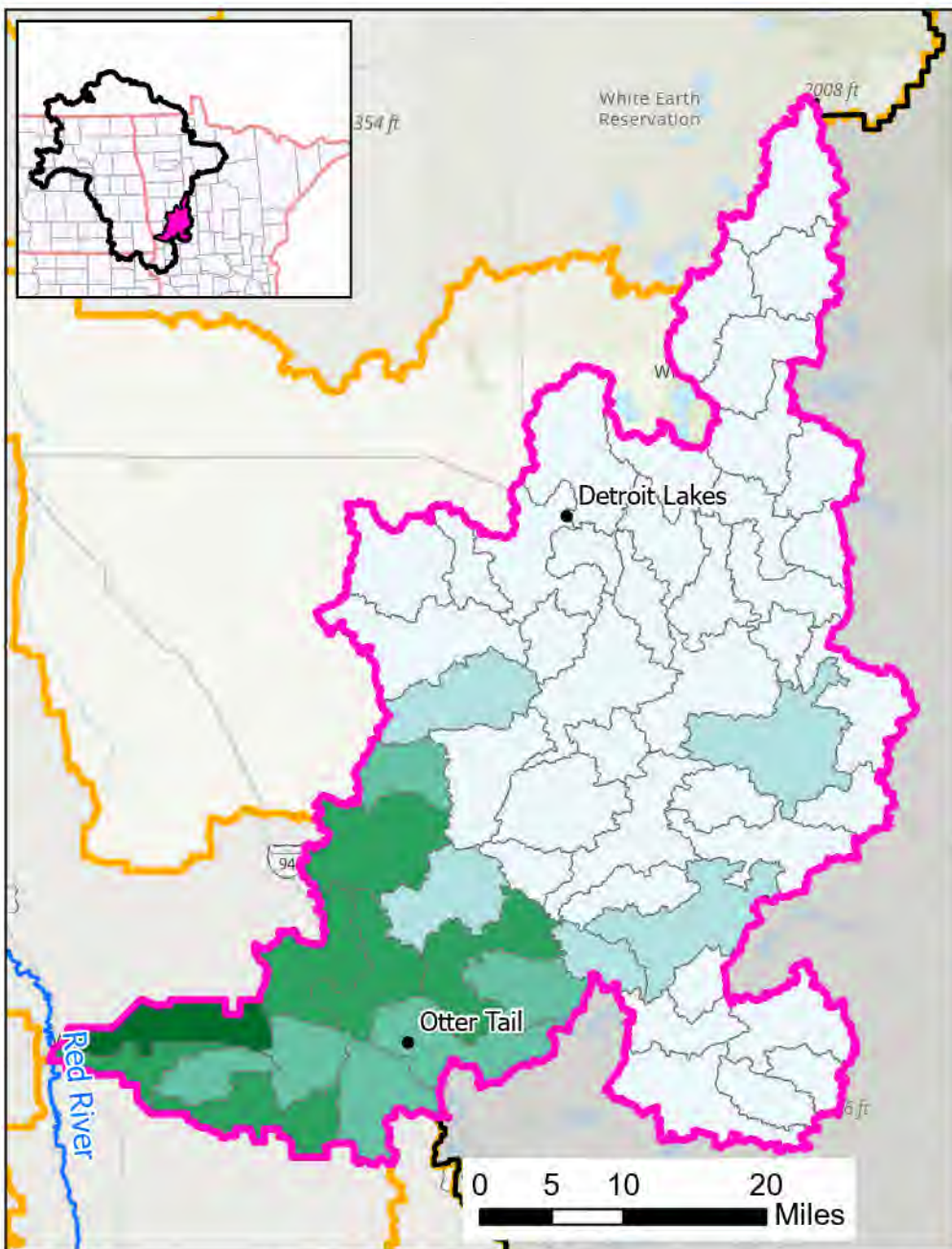


Total and Point Source Phosphorus loads from HUC 12 watersheds within the 09020102 HUC 8 Mustinka

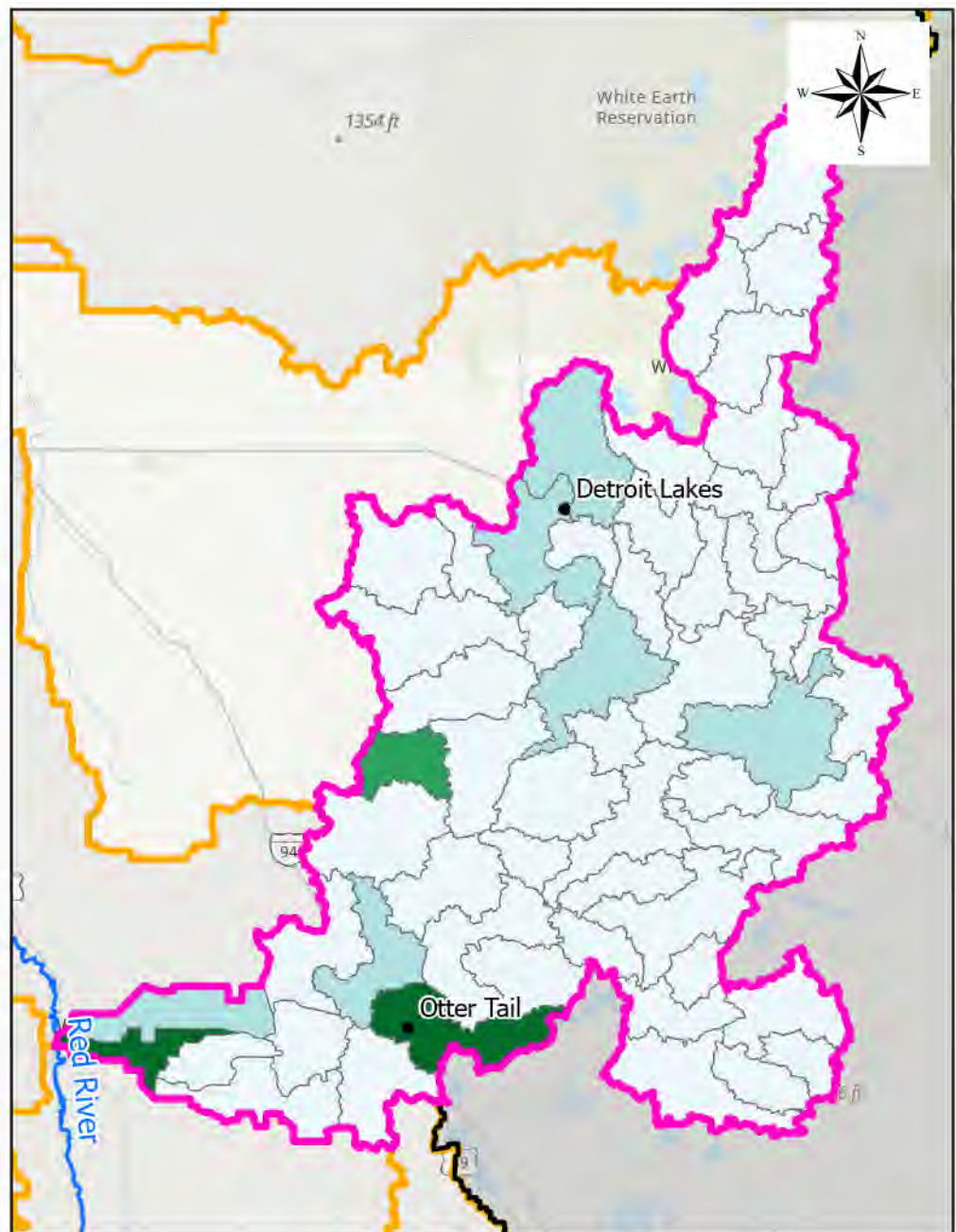


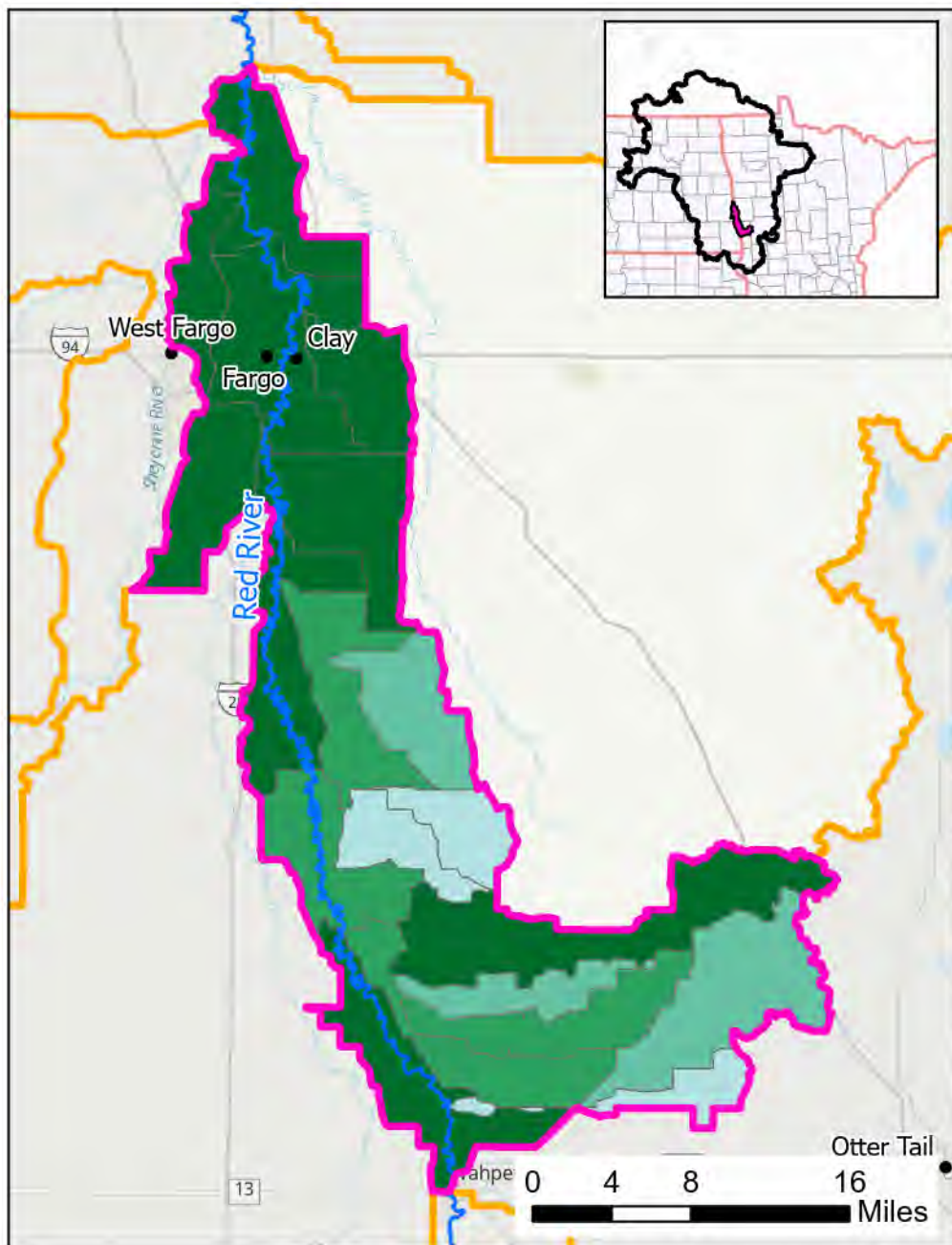
HUC 12 Total Phosphorus Point
Source Loads (lbs/yr) to Canada



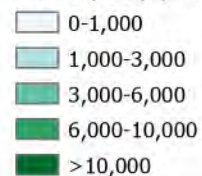


Total and Point Source Phosphorus loads from HUC 12 watersheds within the 09020103 HUC 8 Otter Tail

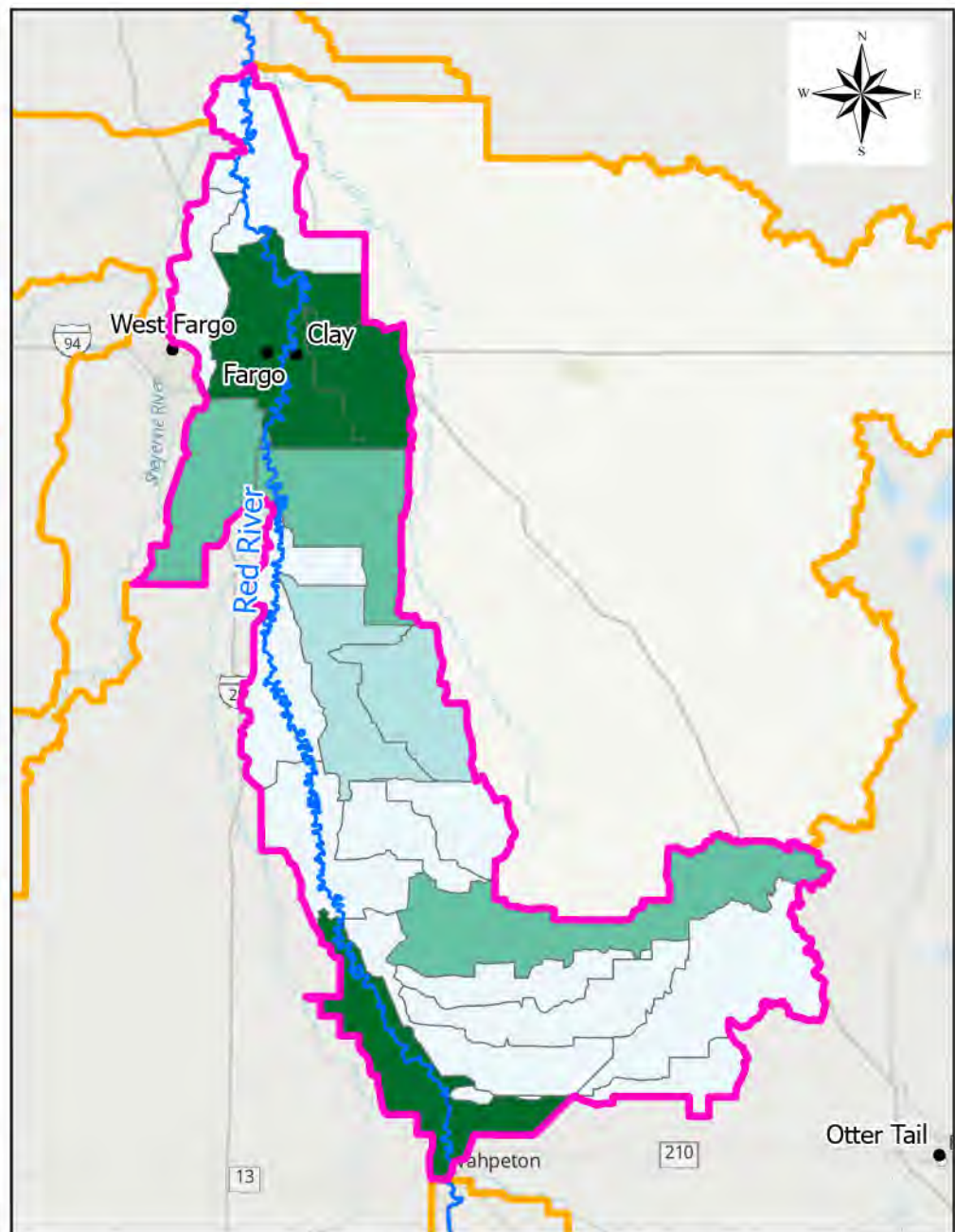




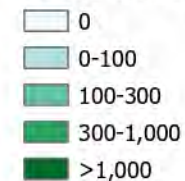
HUC 12 Total Phosphorous Loads (lbs/yr) to Canada

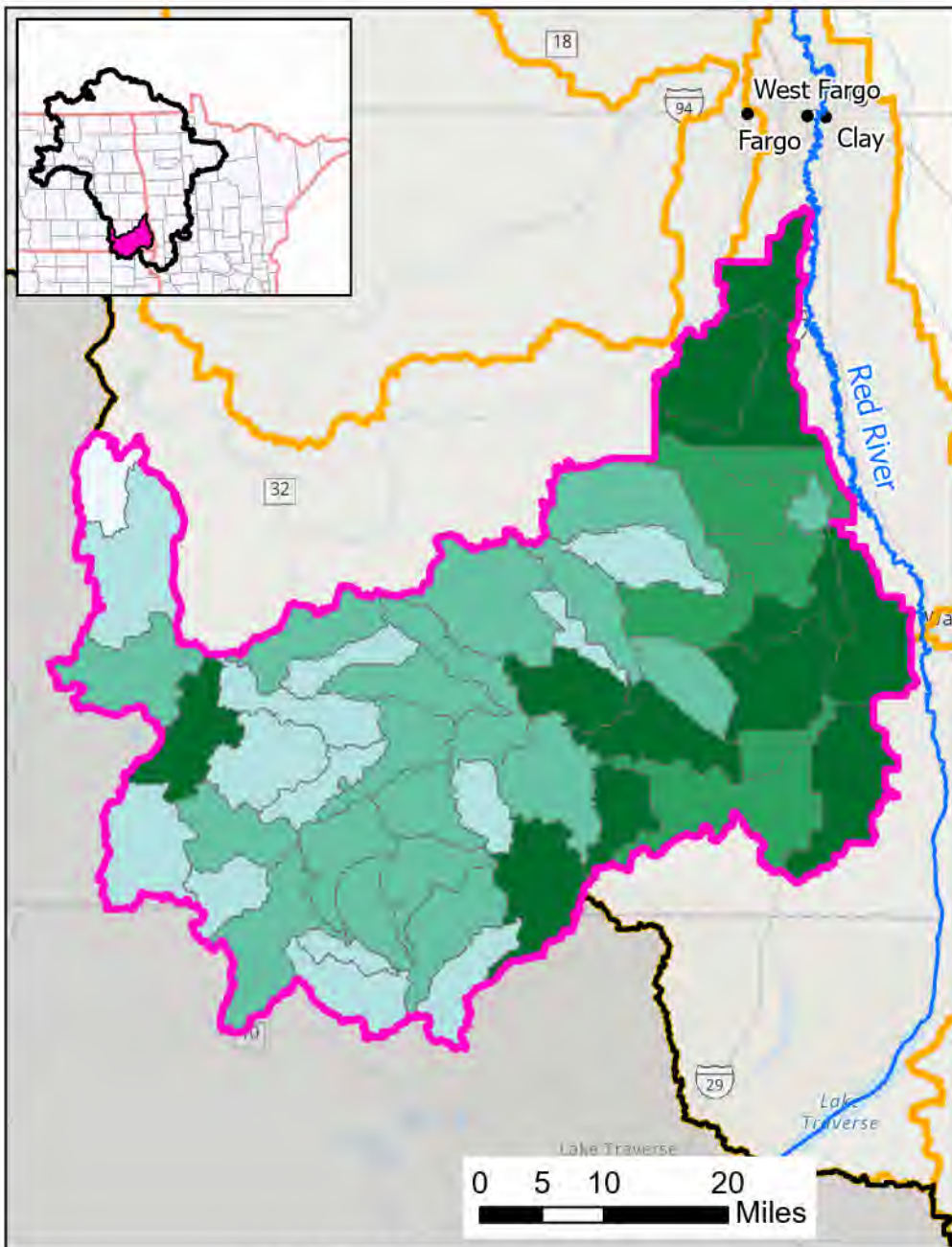


Total and Point Source Phosphorus loads from HUC 12 watersheds within the 09020104 HUC 8 Upper Red

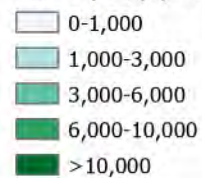


HUC 12 Total Phosphorus Point Source Loads (lbs/yr) to Canada

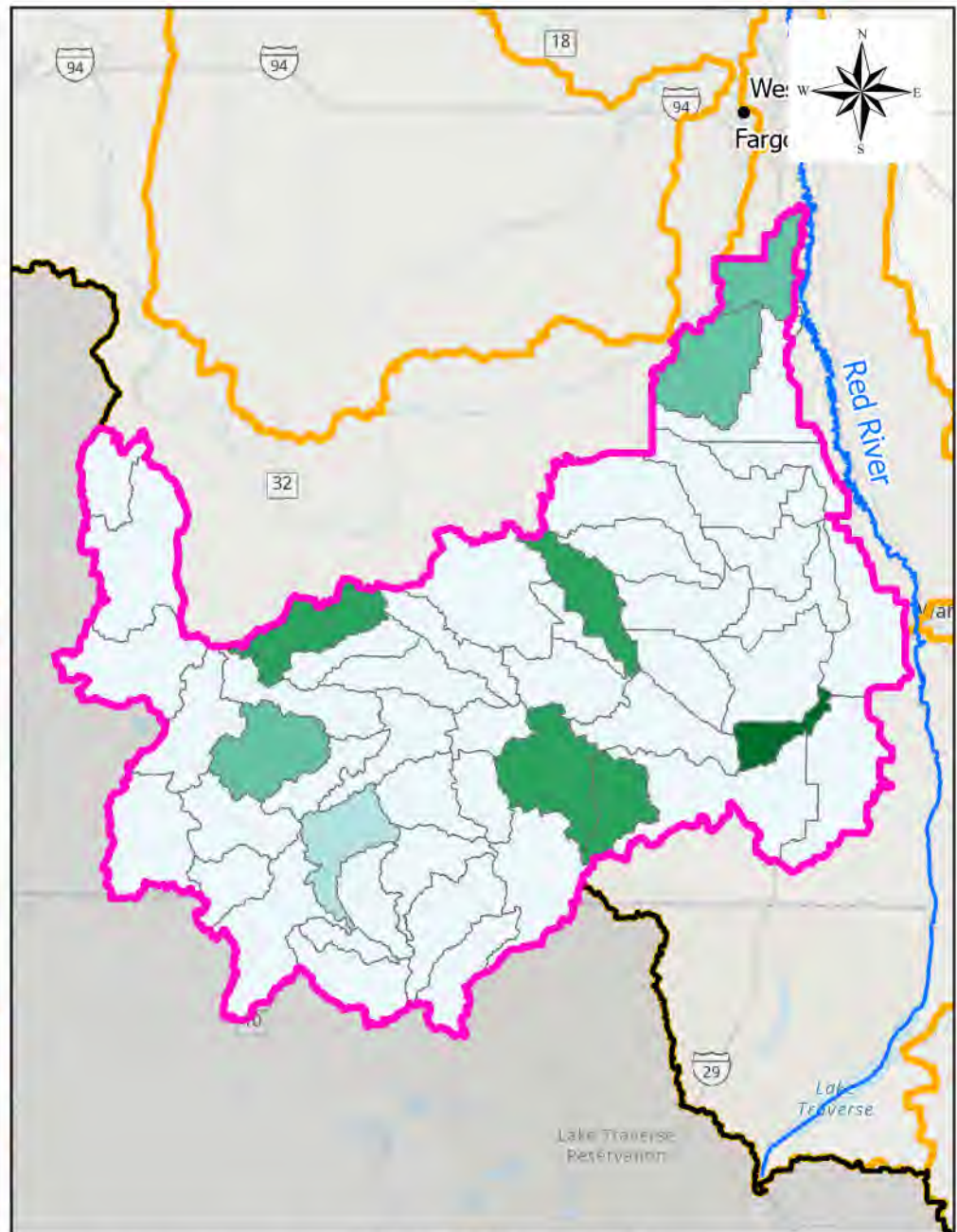




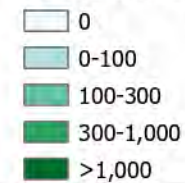
HUC 12 Total Phosphorous Loads (lbs/yr) to Canada

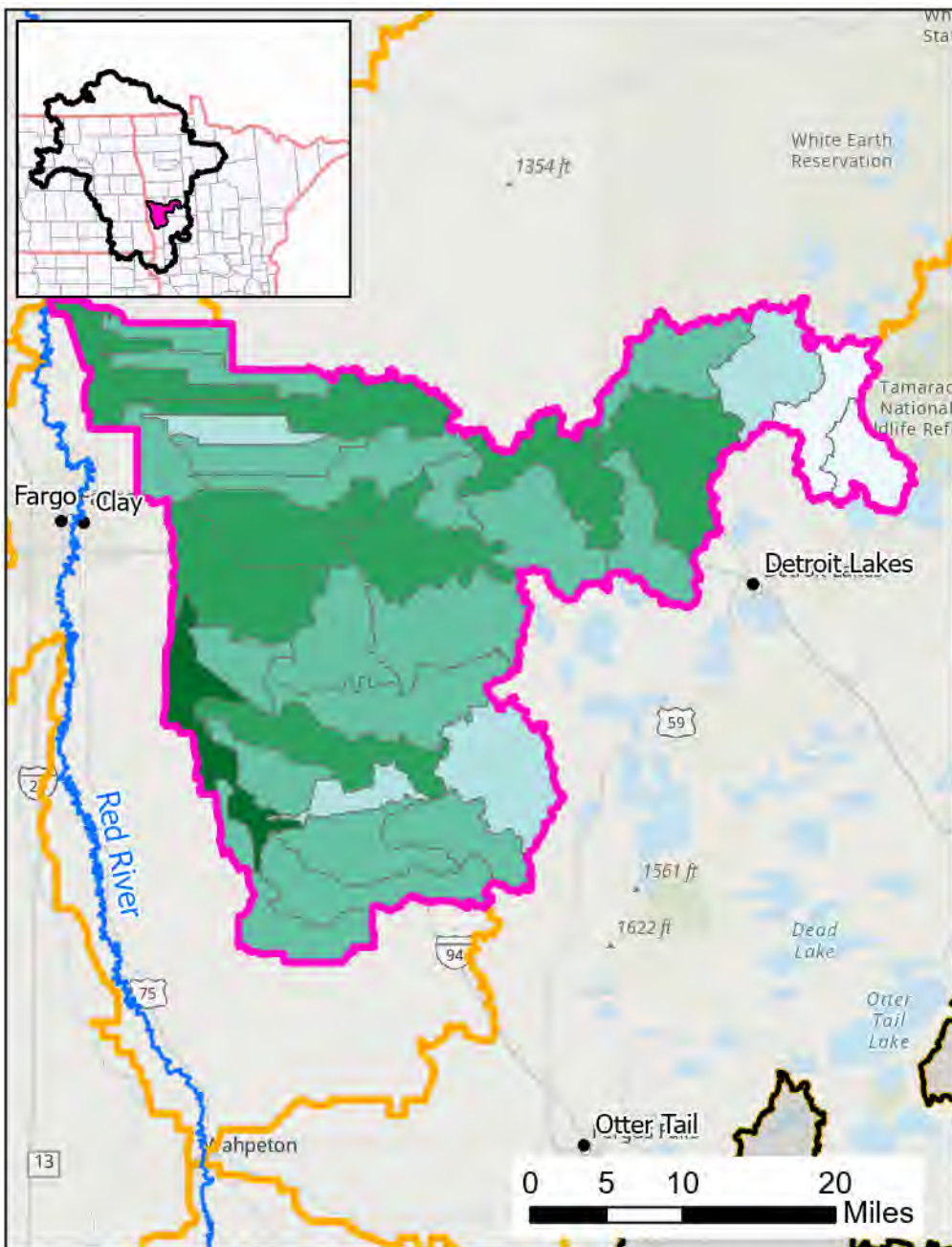


Total and Point Source Phosphorus loads from HUC 12 watersheds within the 09020105 HUC 8 Western Wild Rice

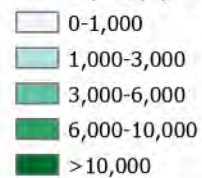


HUC 12 Total Phosphorus Point Source Loads (lbs/yr) to Canada

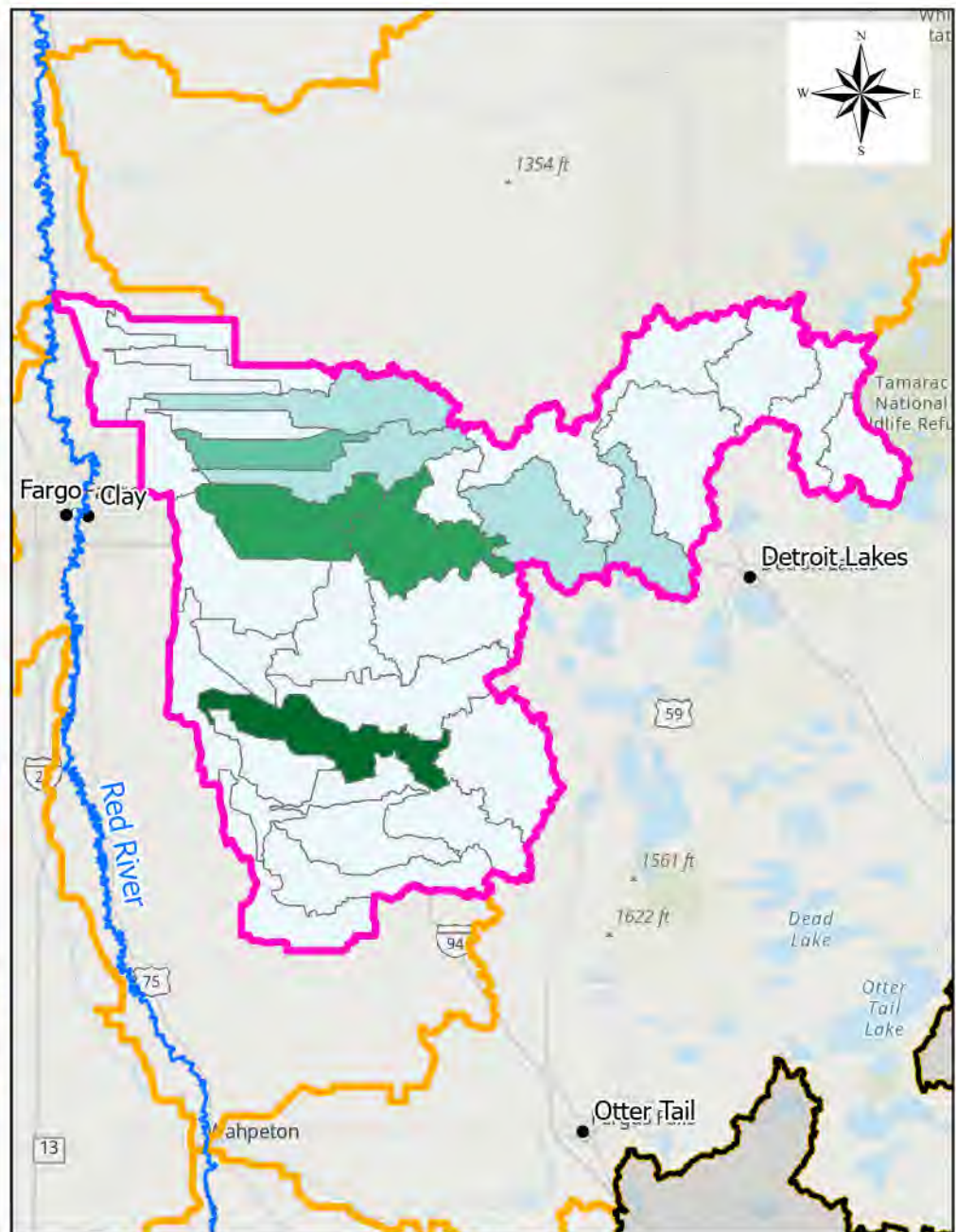




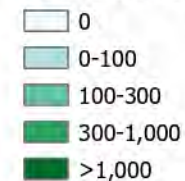
HUC 12 Total Phosphorous Loads (lbs/yr) to Canada

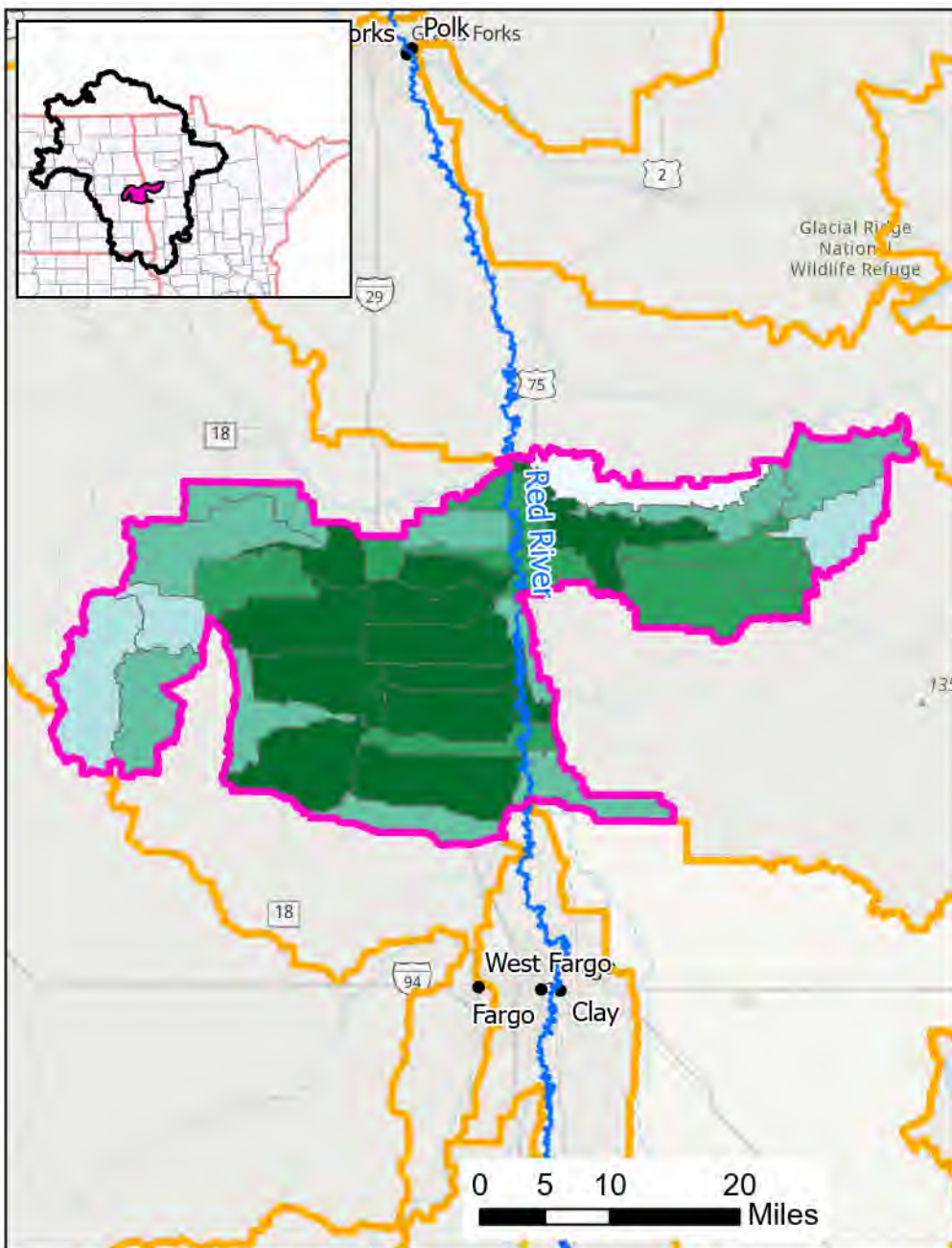


Total and Point Source Phosphorus loads from HUC 12 watersheds within the 09020106 HUC 8 Buffalo

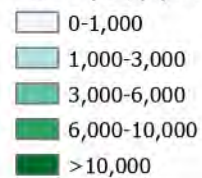


HUC 12 Total Phosphorus Point Source Loads (lbs/yr) to Canada

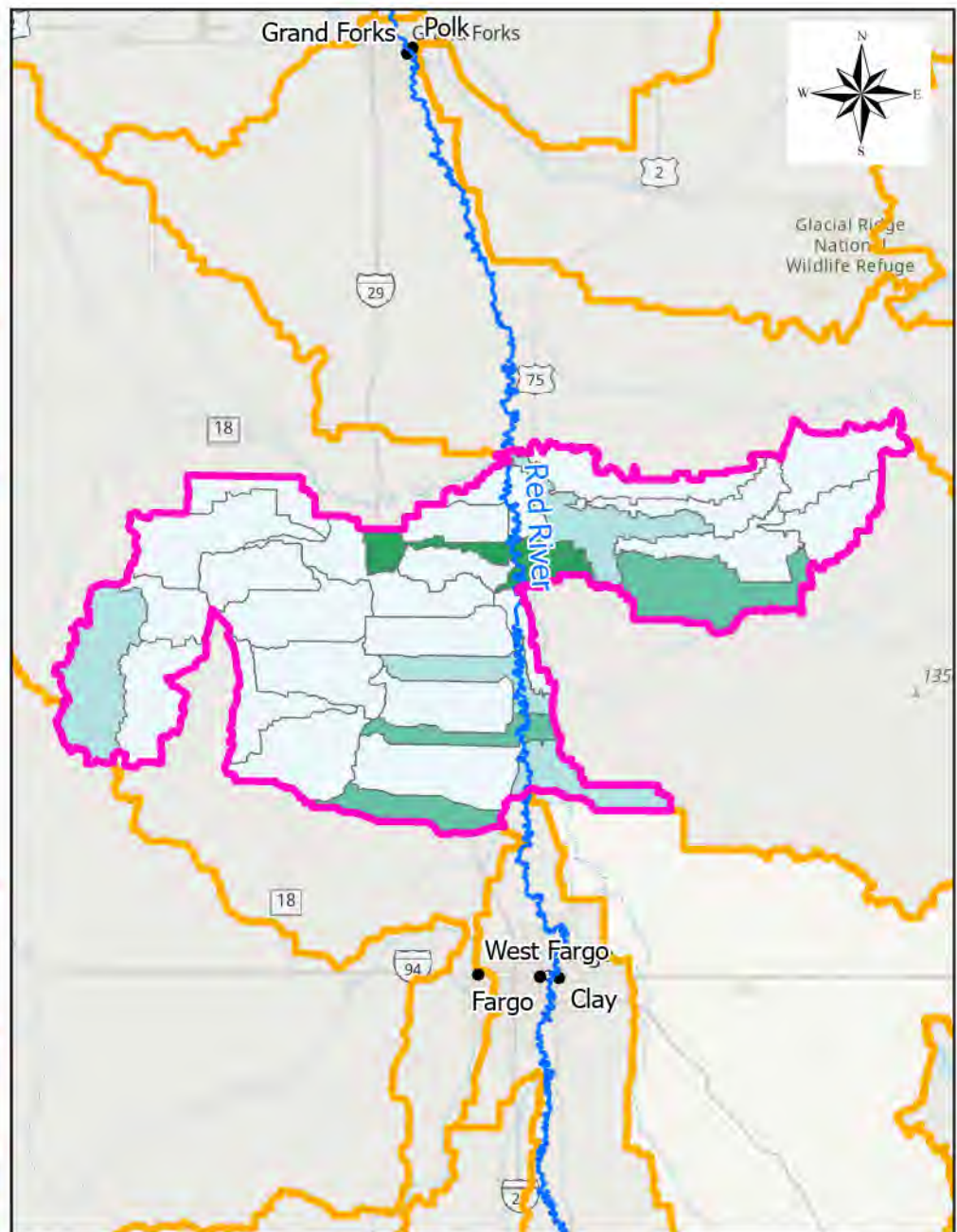




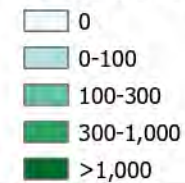
HUC 12 Total Phosphorous
Loads (lbs/yr) to Canada

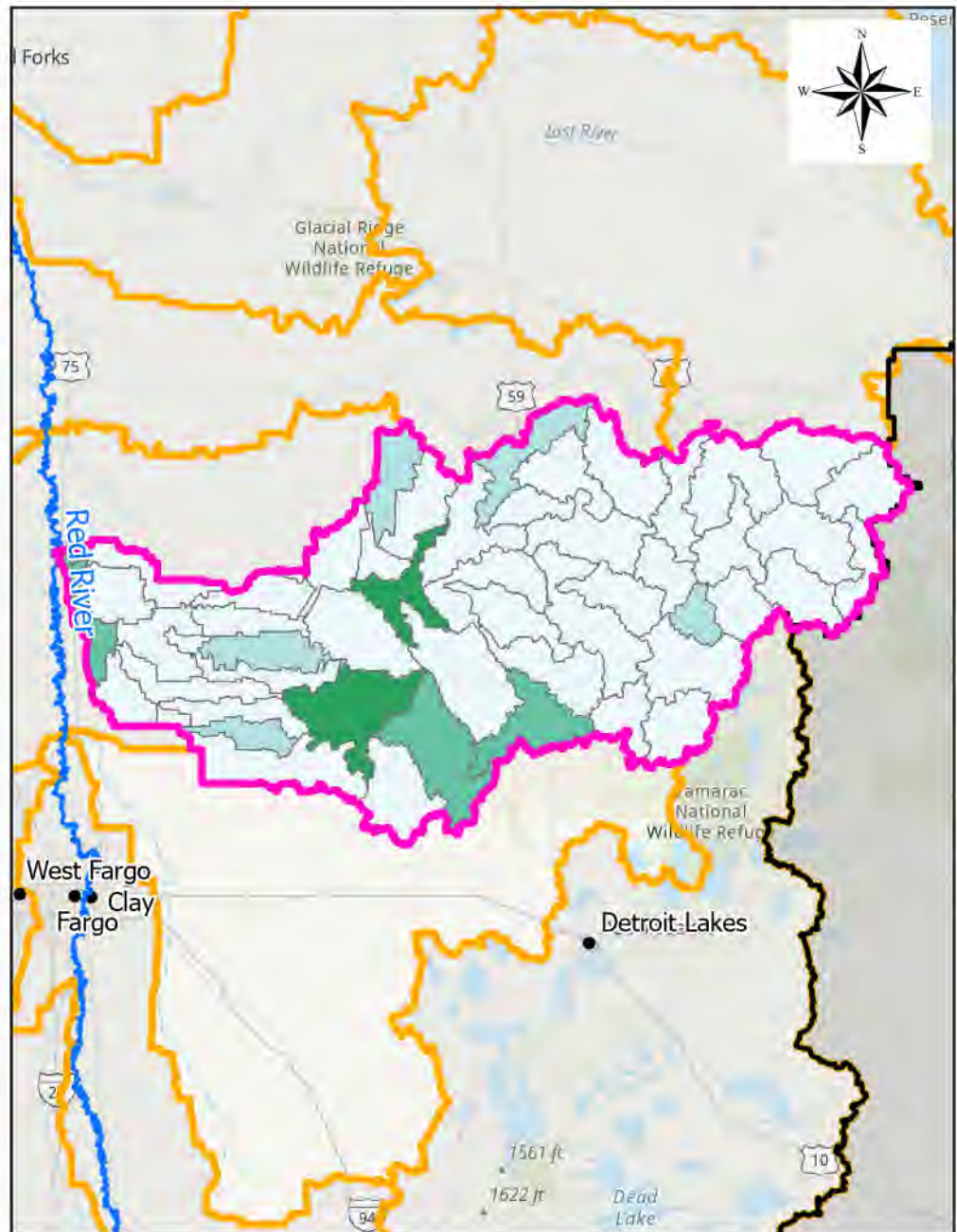
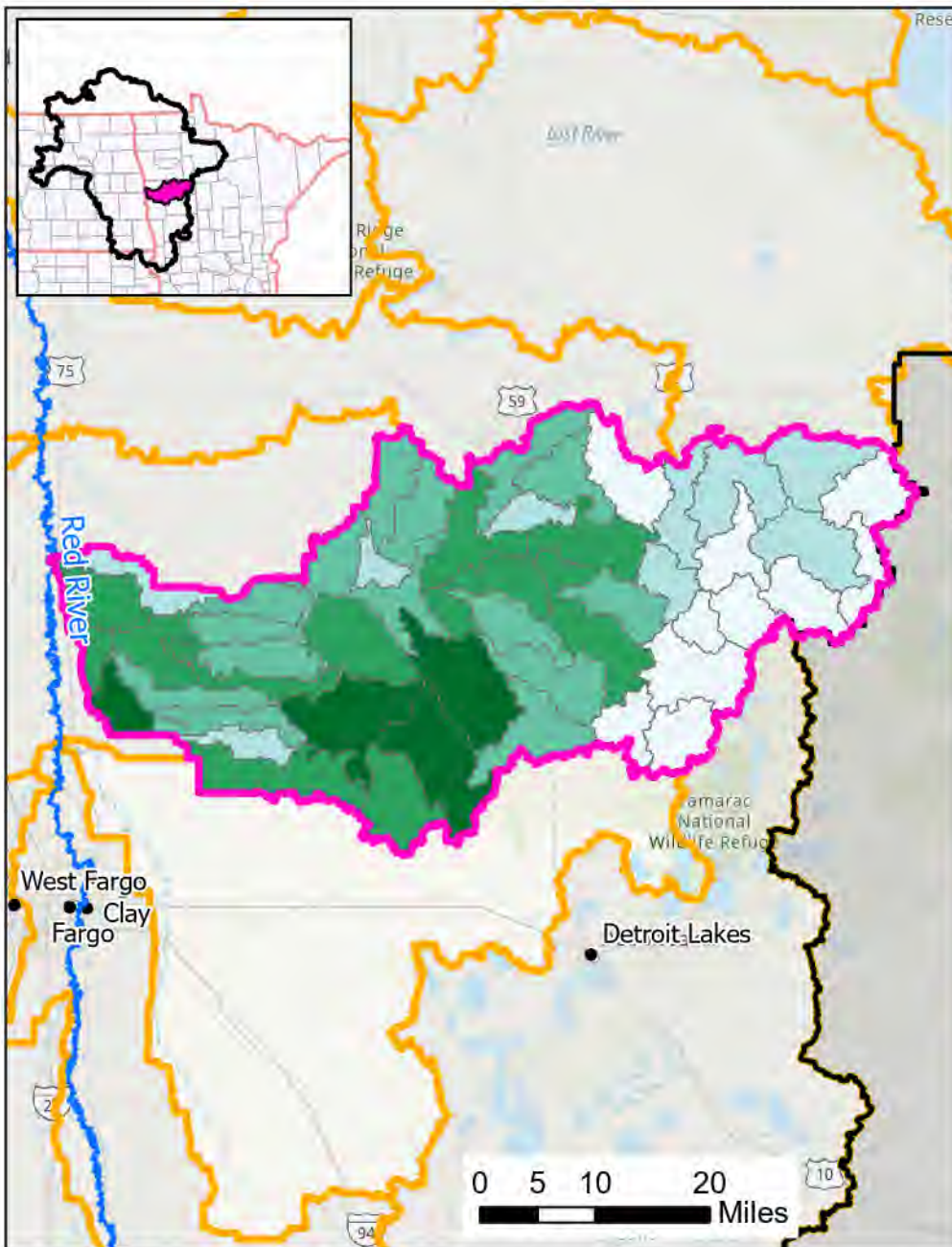


Total and Point Source Phosphorus loads from HUC 12 watersheds within the 09020107 HUC 8 Elm-Marsh

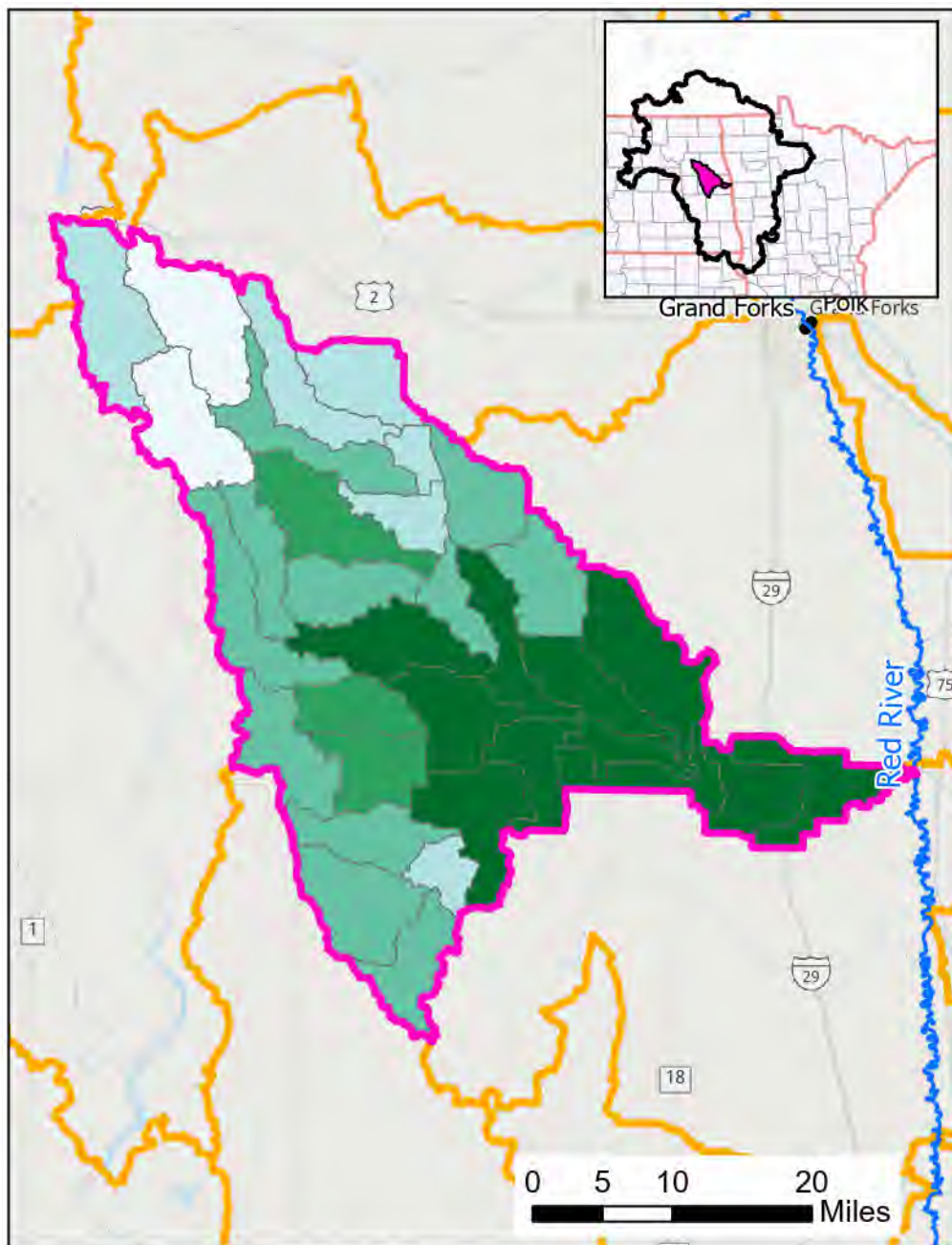


HUC 12 Total Phosphorus Point
Source Loads (lbs/yr) to Canada

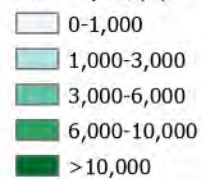




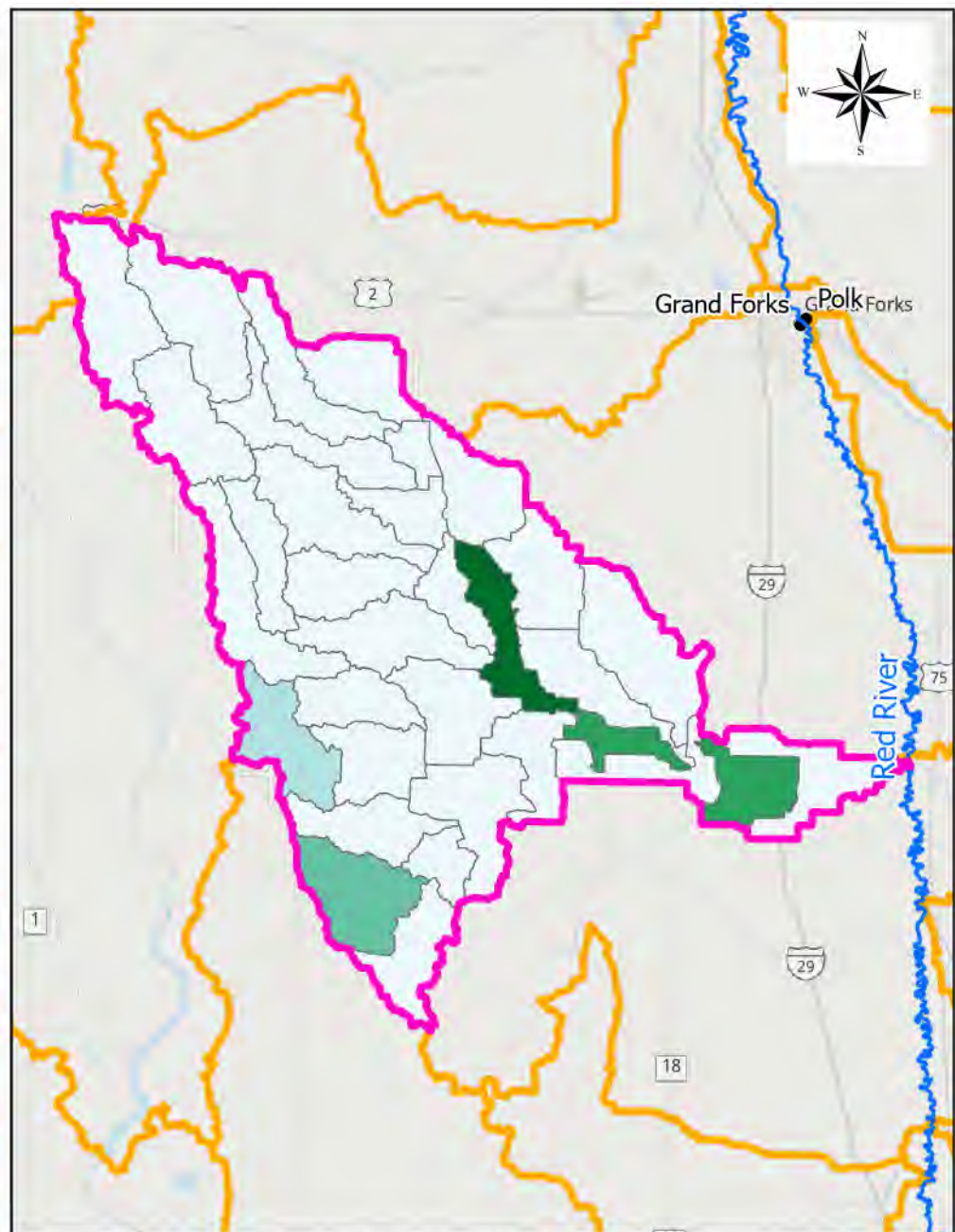
**Total and Point Source Phosphorus
loads from HUC 12 watersheds
within the 09020108 HUC 8
Eastern Wild Rice**



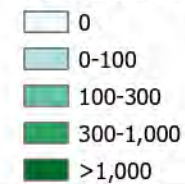
HUC 12 Total Phosphorous
Loads (lbs/yr) to Canada

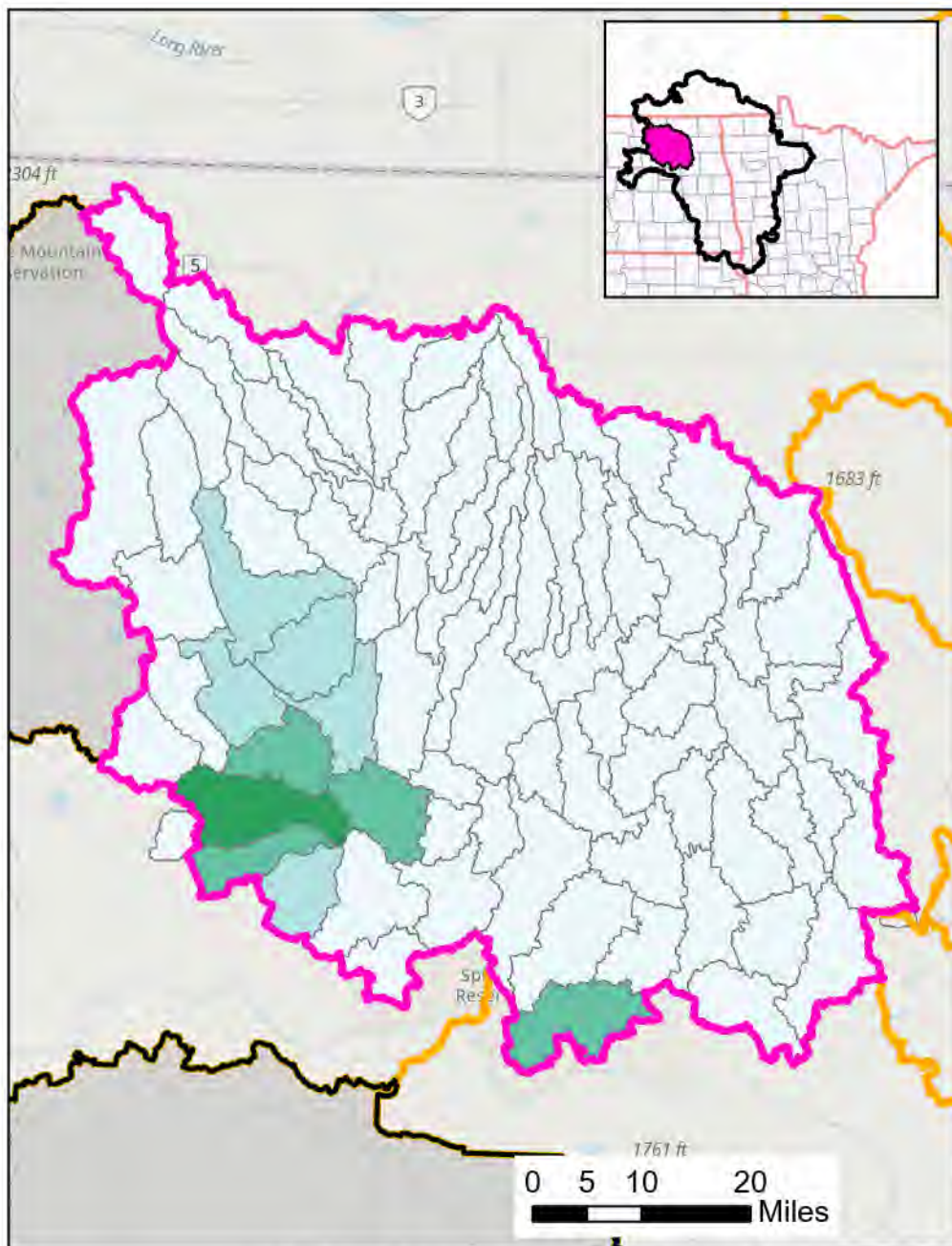


Total and Point Source Phosphorus loads from HUC 12 watersheds within the 09020109 HUC 8 Goose



HUC 12 Total Phosphorus Point
Source Loads (lbs/yr) to Canada

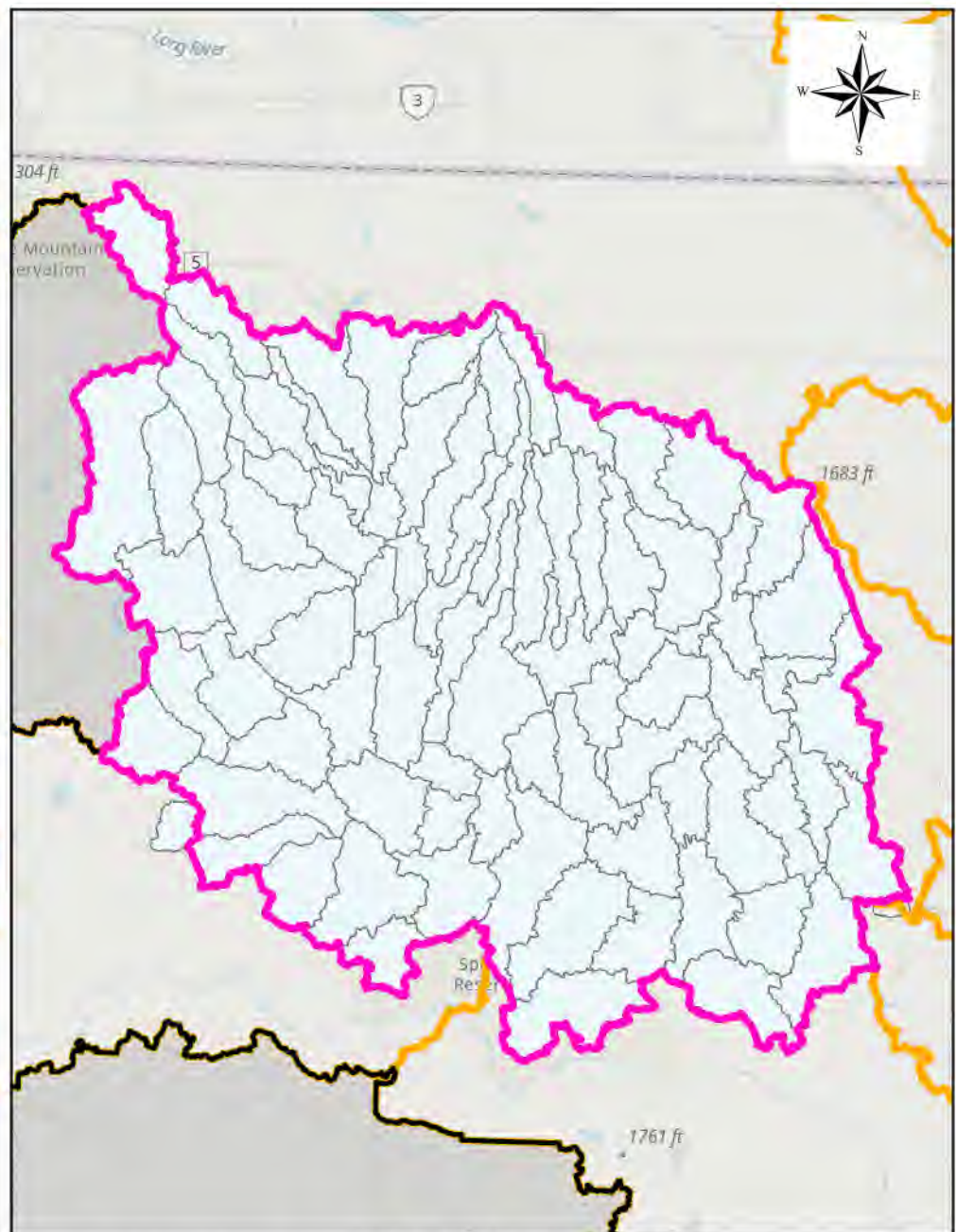




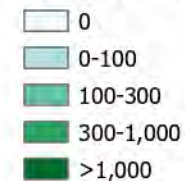
HUC 12 Total Phosphorous Loads (lbs/yr) to Canada

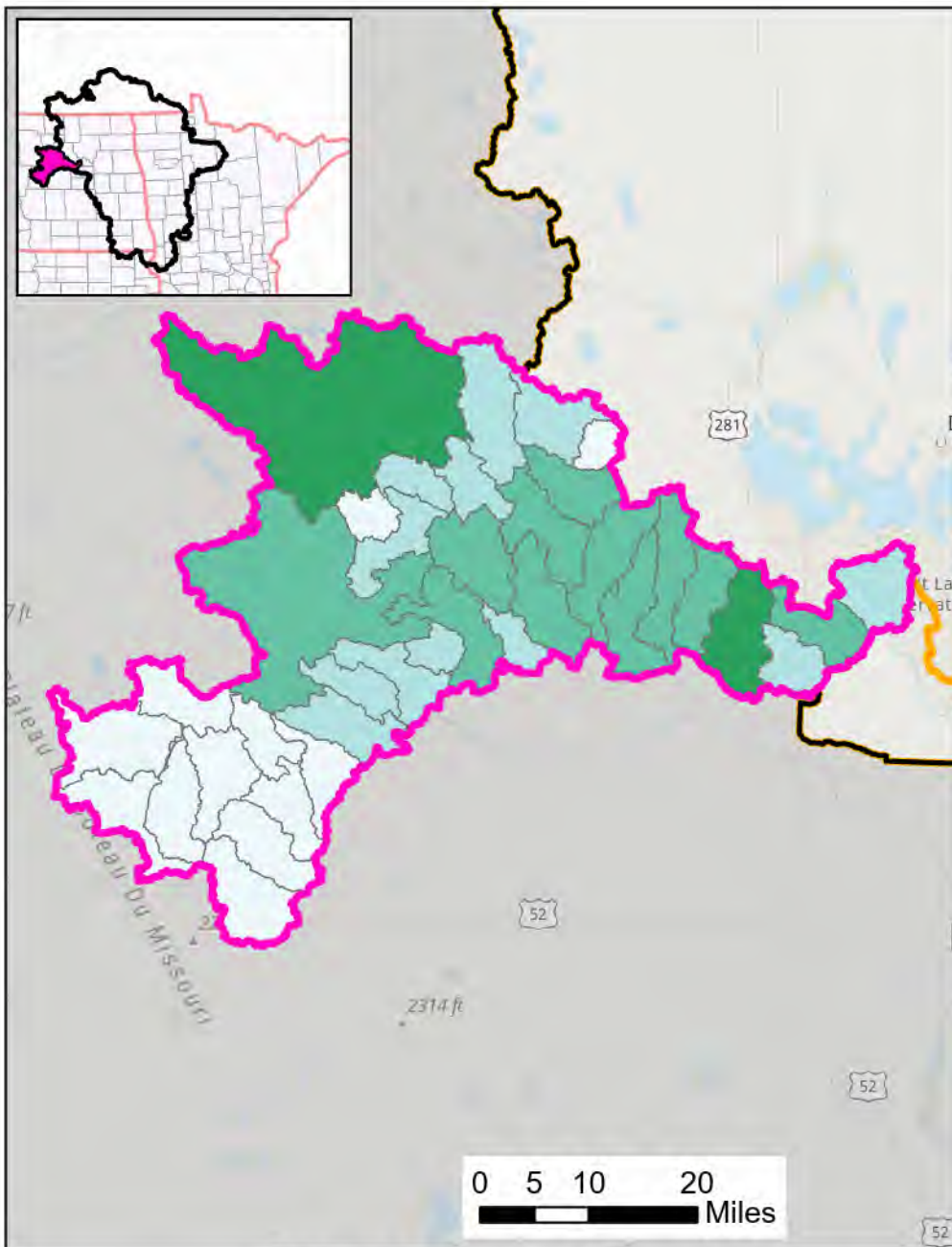


Total and Point Source Phosphorus loads from HUC 12 watersheds within the 09020201 HUC 8 Devils Lake

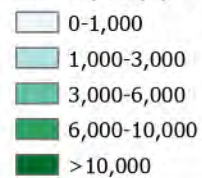


HUC 12 Total Phosphorus Point Source Loads (lbs/yr) to Canada

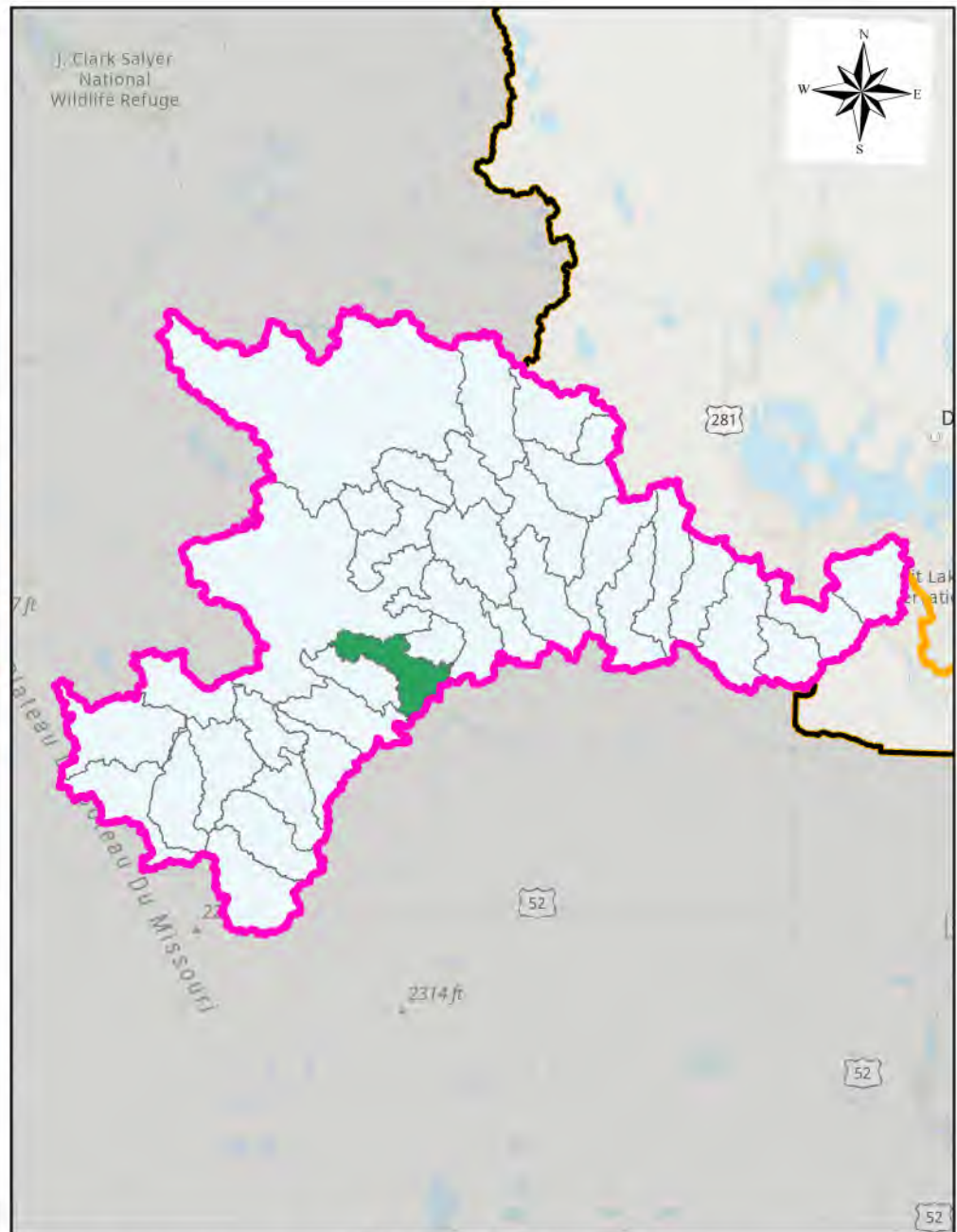




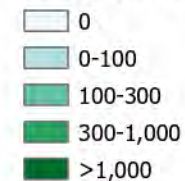
HUC 12 Total Phosphorous
Loads (lbs/yr) to Canada

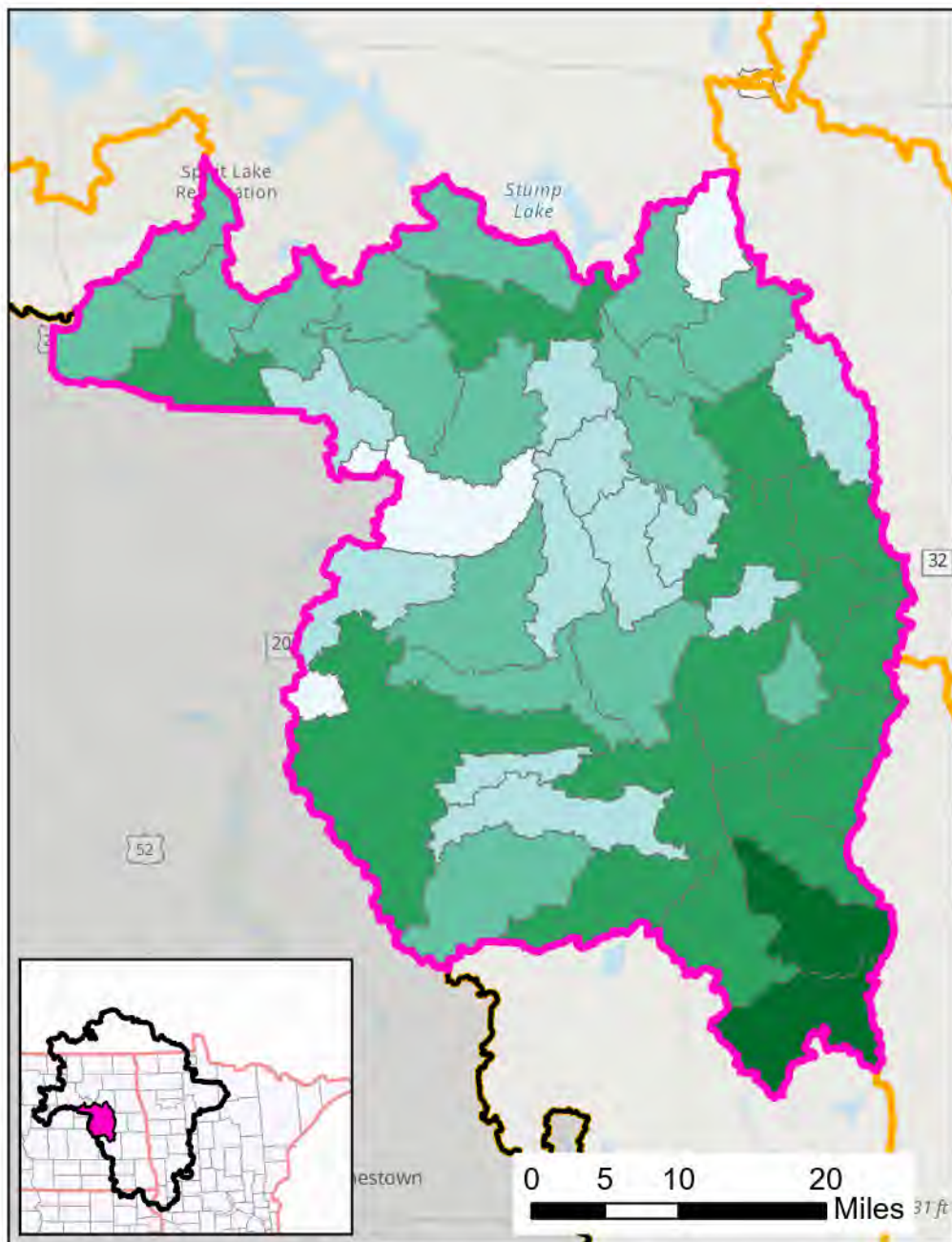


Total and Point Source Phosphorus loads from HUC 12 watersheds within the 09020202 HUC 8 Upper Sheyenne

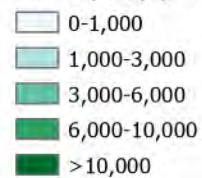


HUC 12 Total Phosphorus Point
Source Loads (lbs/yr) to Canada

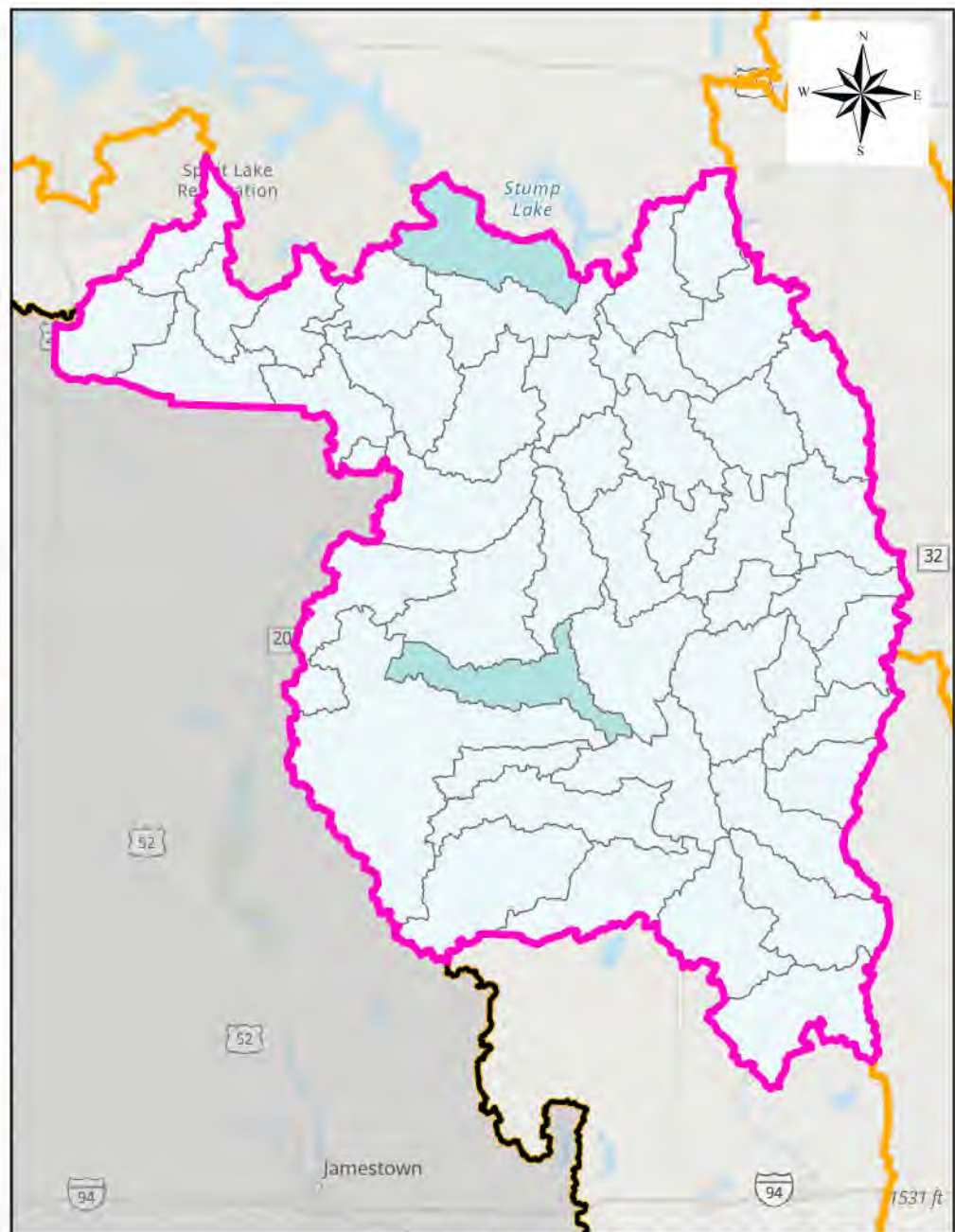




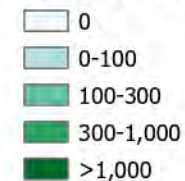
HUC 12 Total Phosphorous
Loads (lbs/yr) to Canada

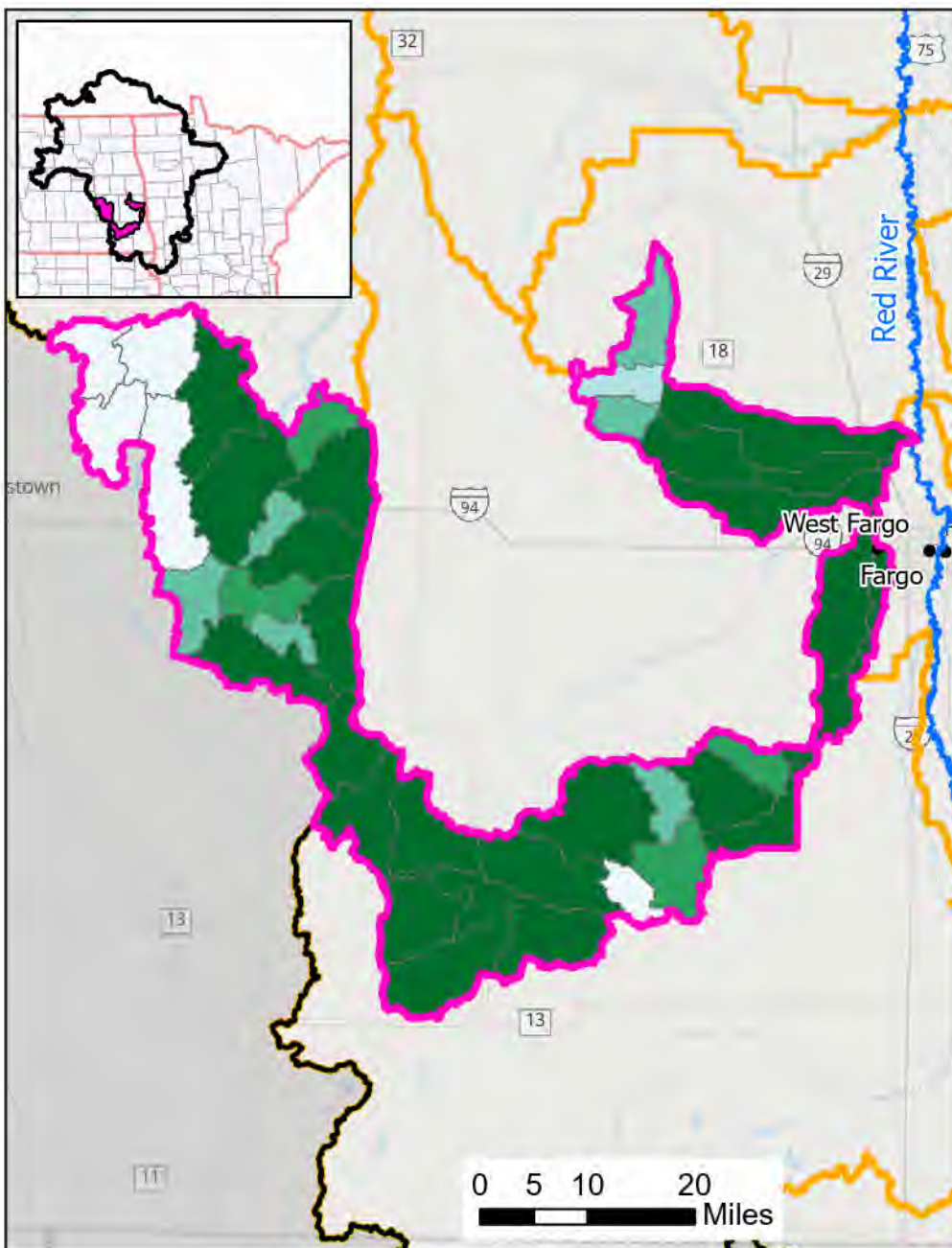


Total and Point Source Phosphorus loads from HUC 12 watersheds within the 09020203 HUC 8 Middle Sheyenne

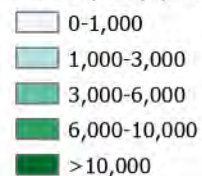


HUC 12 Total Phosphorus Point
Source Loads (lbs/yr) to Canada

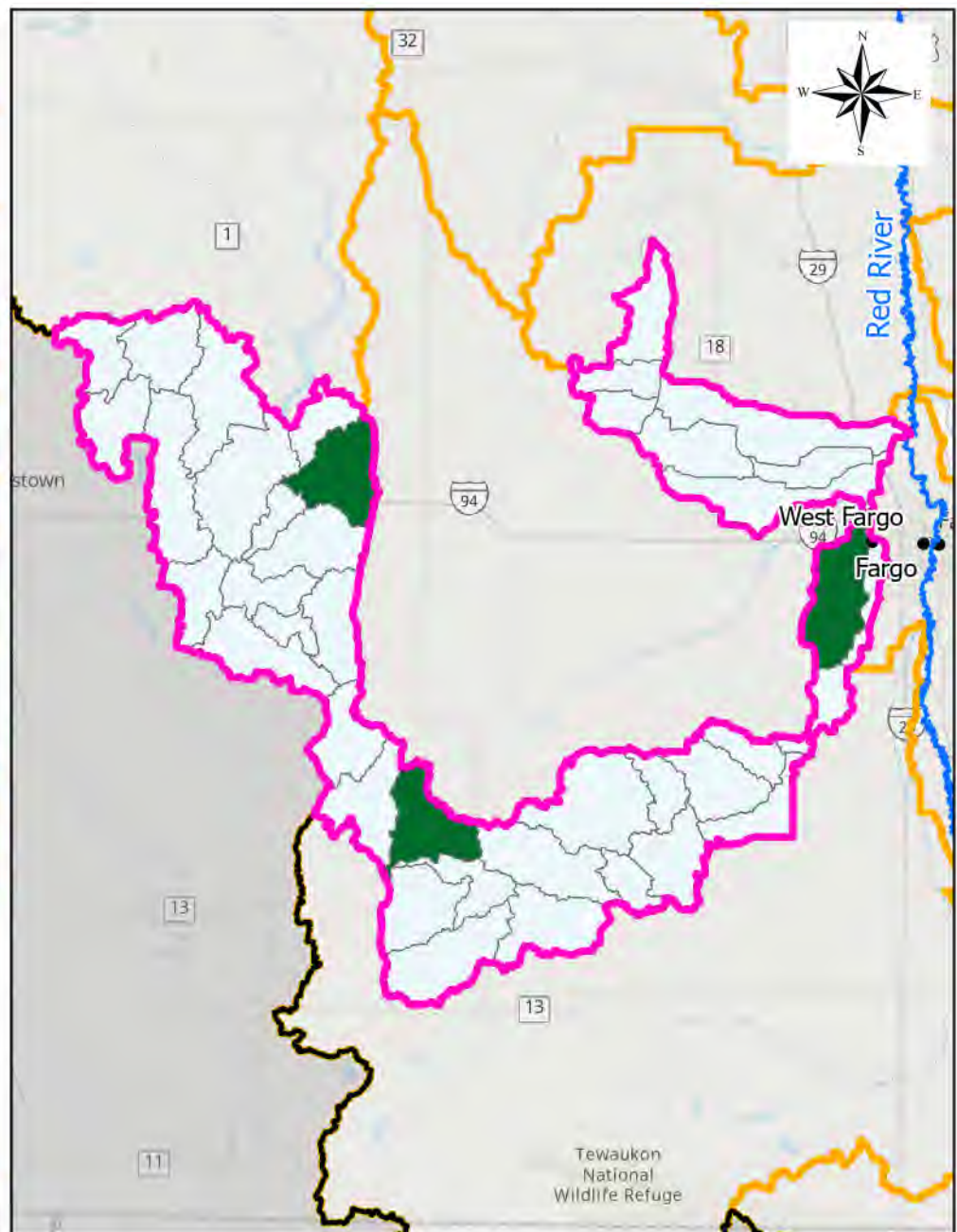




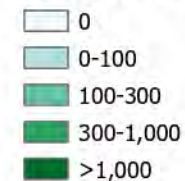
HUC 12 Total Phosphorous
Loads (lbs/yr) to Canada

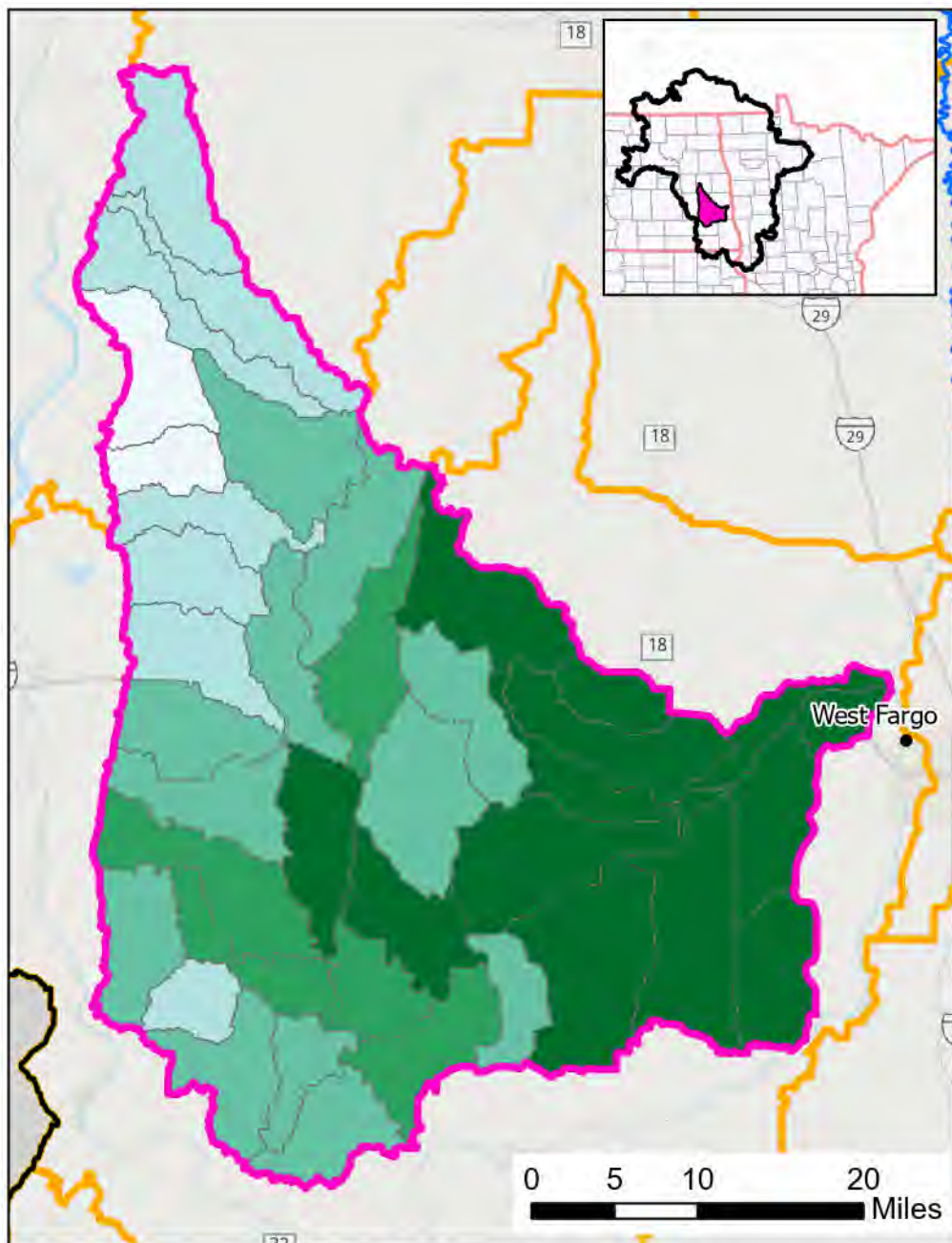


Total and Point Source Phosphorus loads from HUC 12 watersheds within the 09020204 HUC 8 Lower Sheyenne

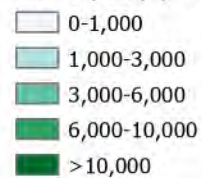


HUC 12 Total Phosphorus Point
Source Loads (lbs/yr) to Canada

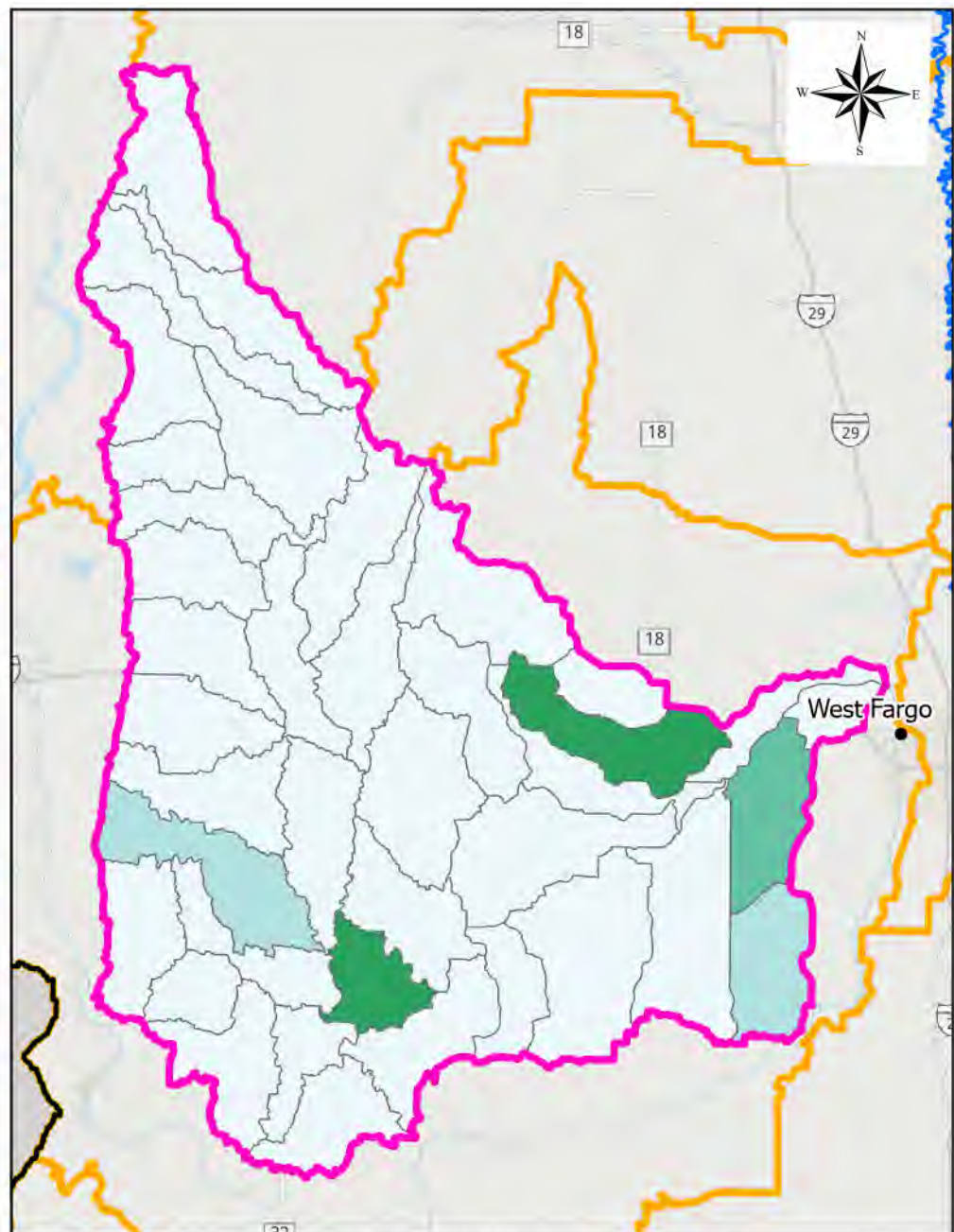




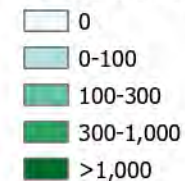
HUC 12 Total Phosphorous Loads (lbs/yr) to Canada

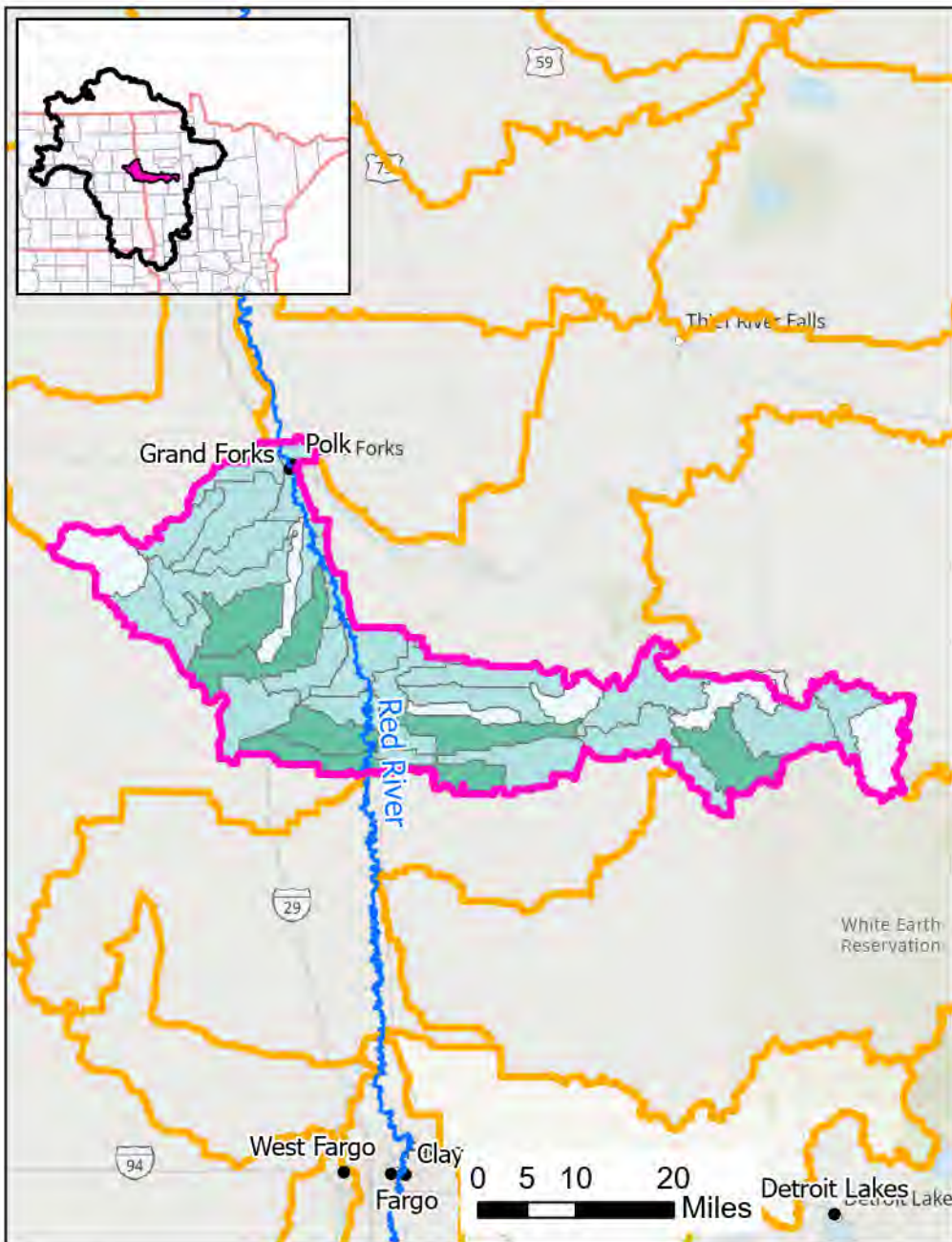


Total and Point Source Phosphorus loads from HUC 12 watersheds within the 09020205 HUC 8 Maple

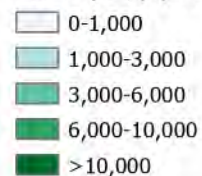


HUC 12 Total Phosphorus Point Source Loads (lbs/yr) to Canada

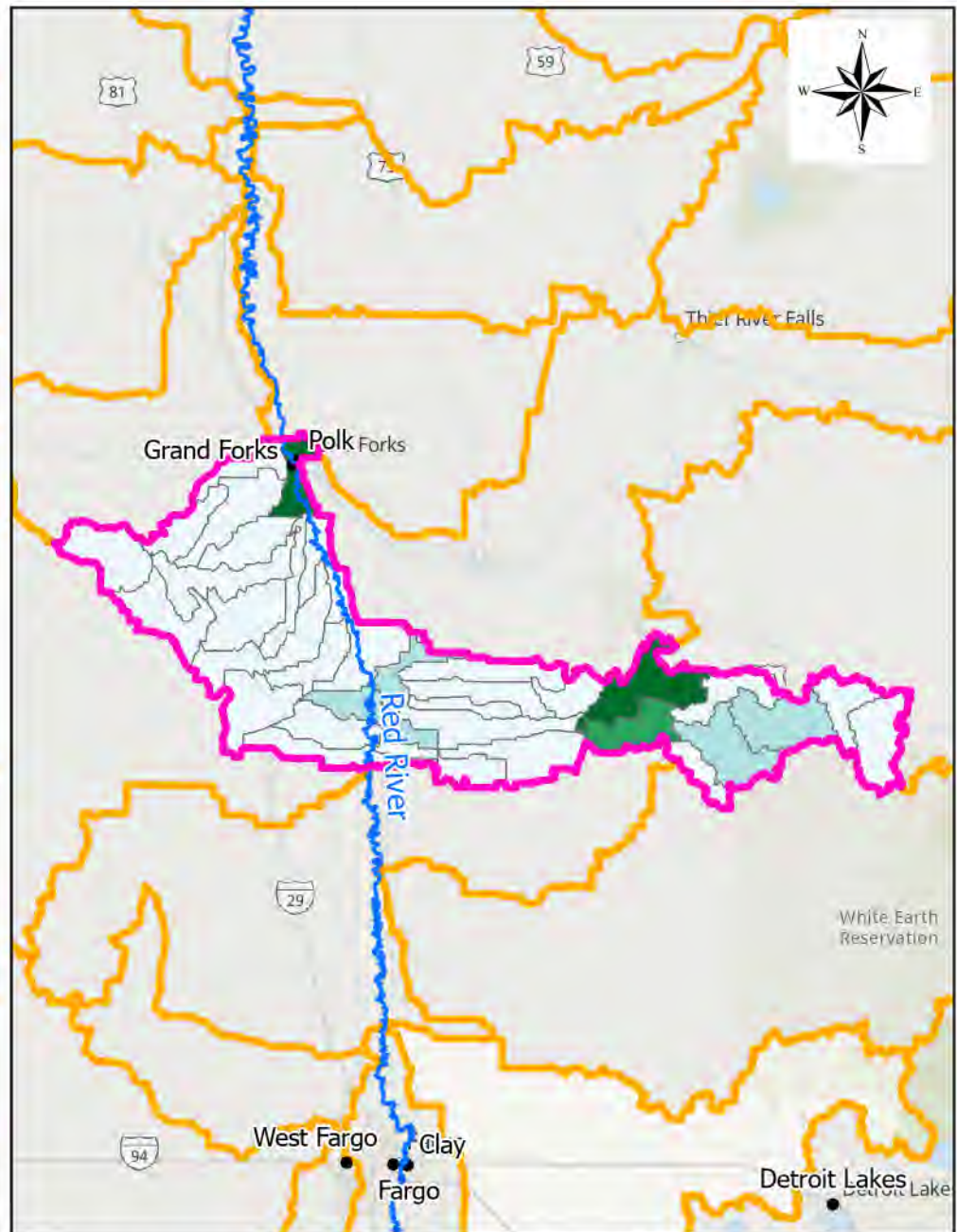




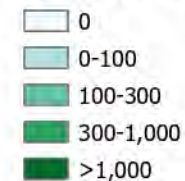
HUC 12 Total Phosphorous
Loads (lbs/yr) to Canada

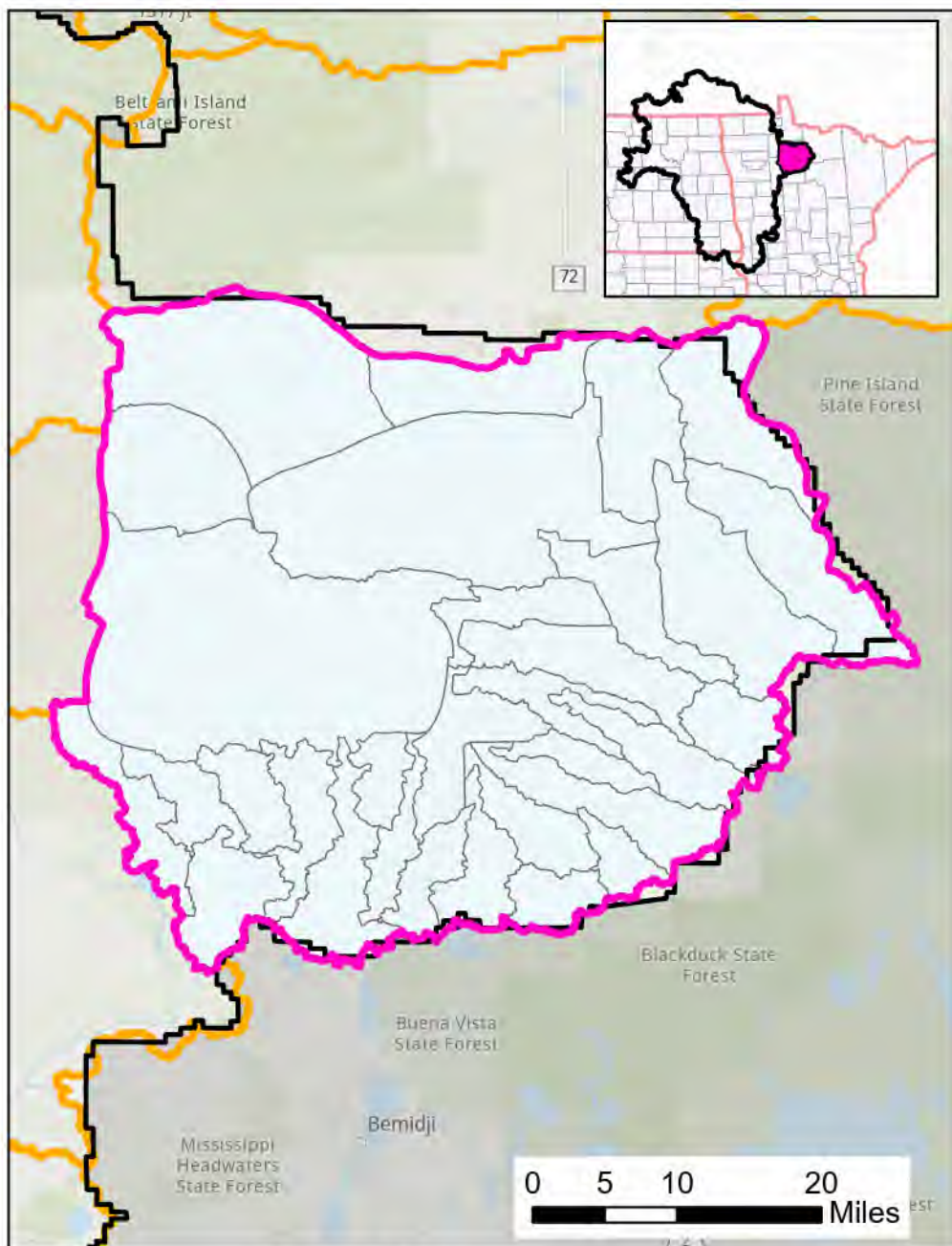


Total and Point Source Phosphorus loads from HUC 12 watersheds within the 09020301 HUC 8 Sandhill-Wilson

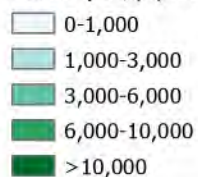


HUC 12 Total Phosphorus Point
Source Loads (lbs/yr) to Canada

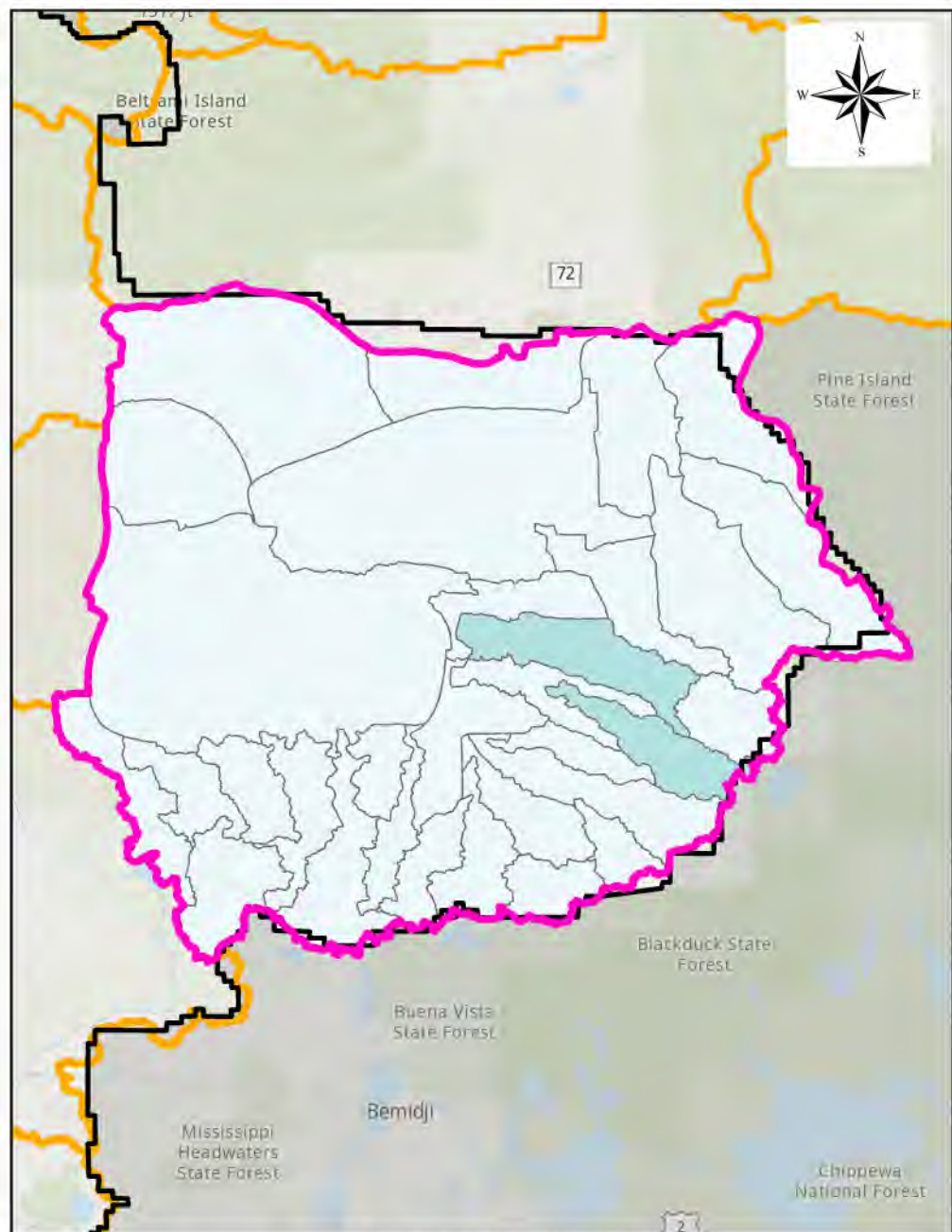




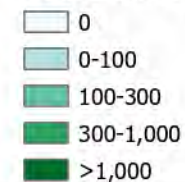
HUC 12 Total Phosphorous
Loads (lbs/yr) to Canada

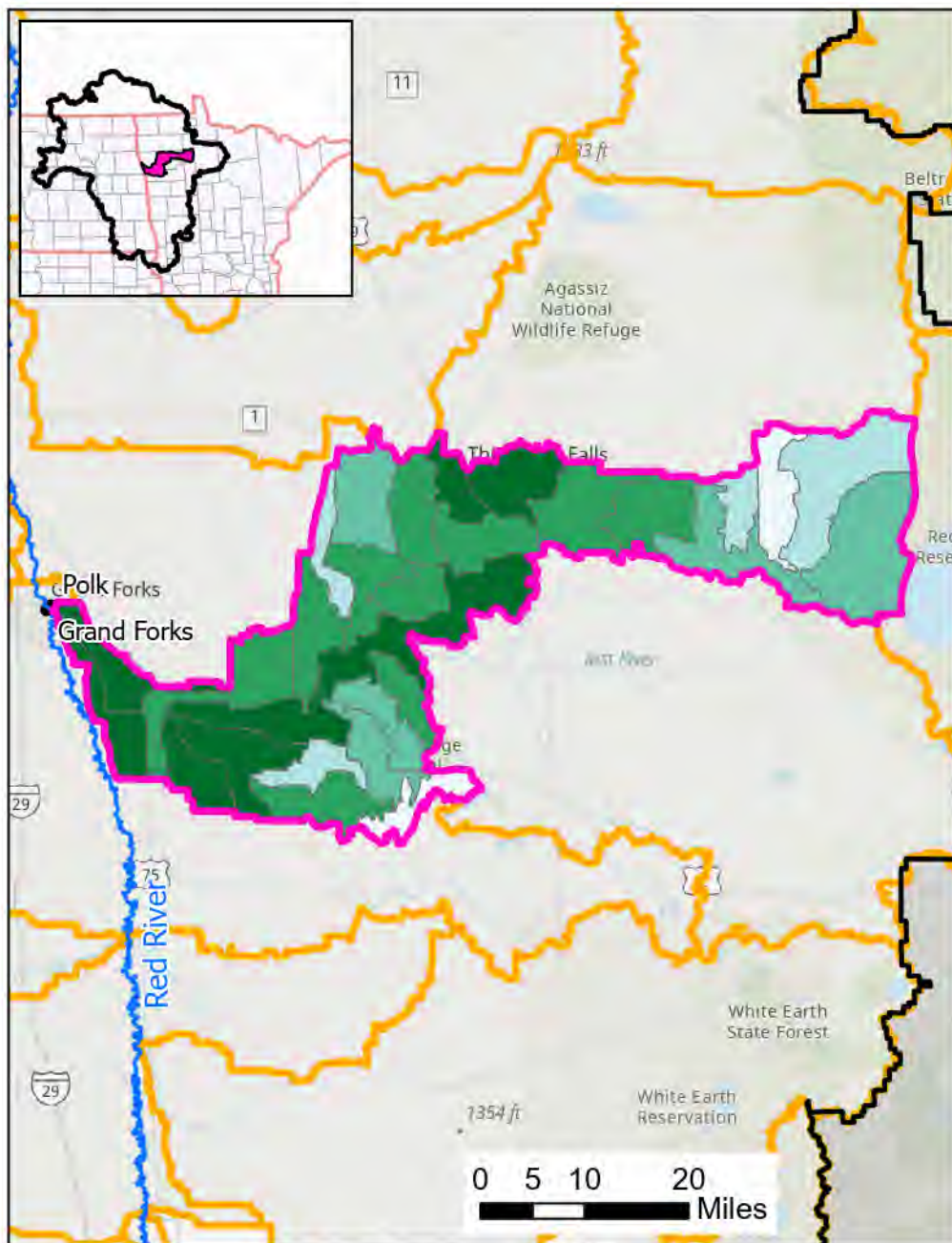


Total and Point Source Phosphorus loads from HUC 12 watersheds within the 09020302 HUC 8 Red Lakes

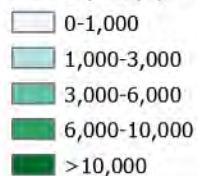


HUC 12 Total Phosphorus Point
Source Loads (lbs/yr) to Canada

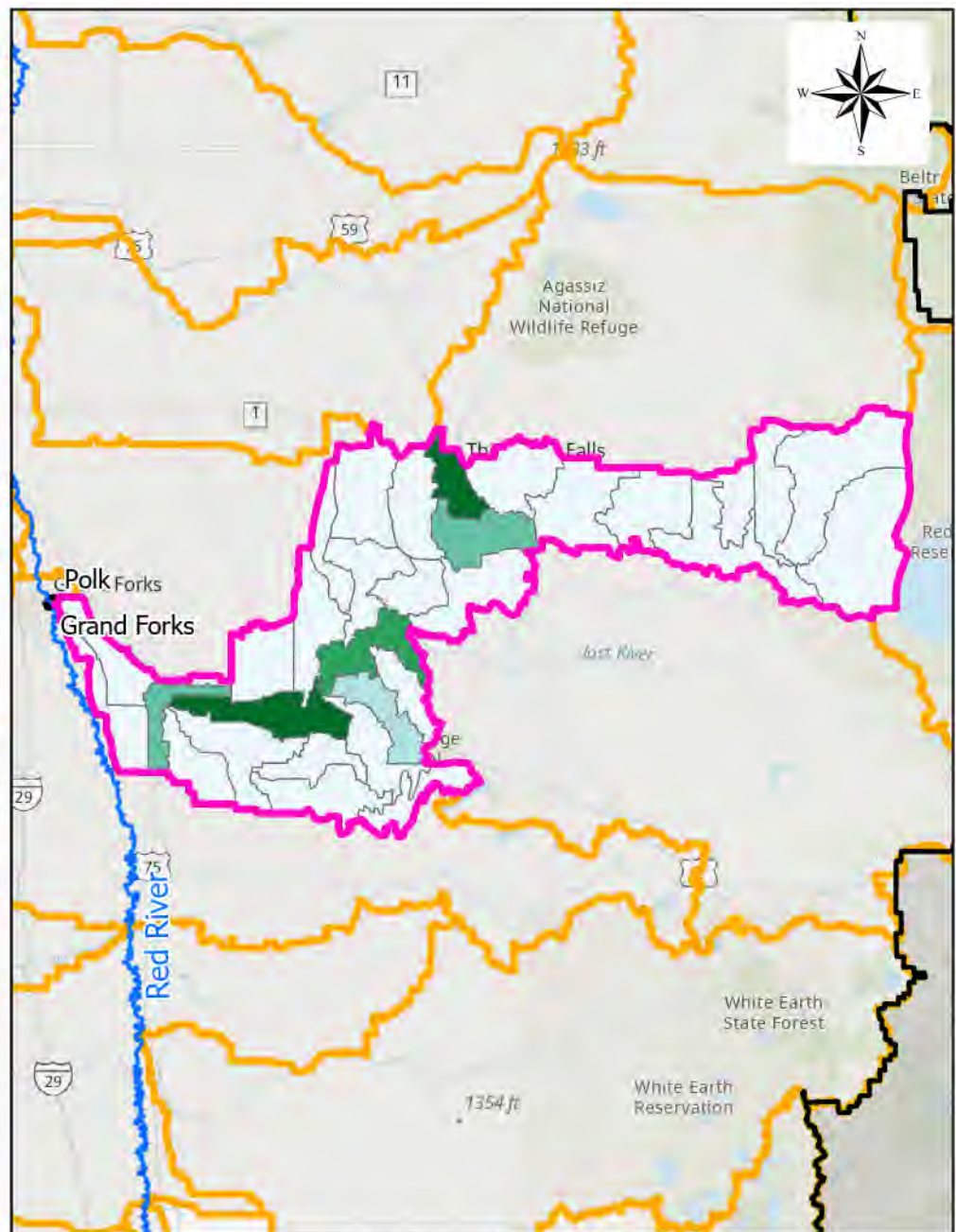




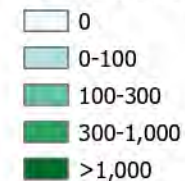
HUC 12 Total Phosphorous
Loads (lbs/yr) to Canada

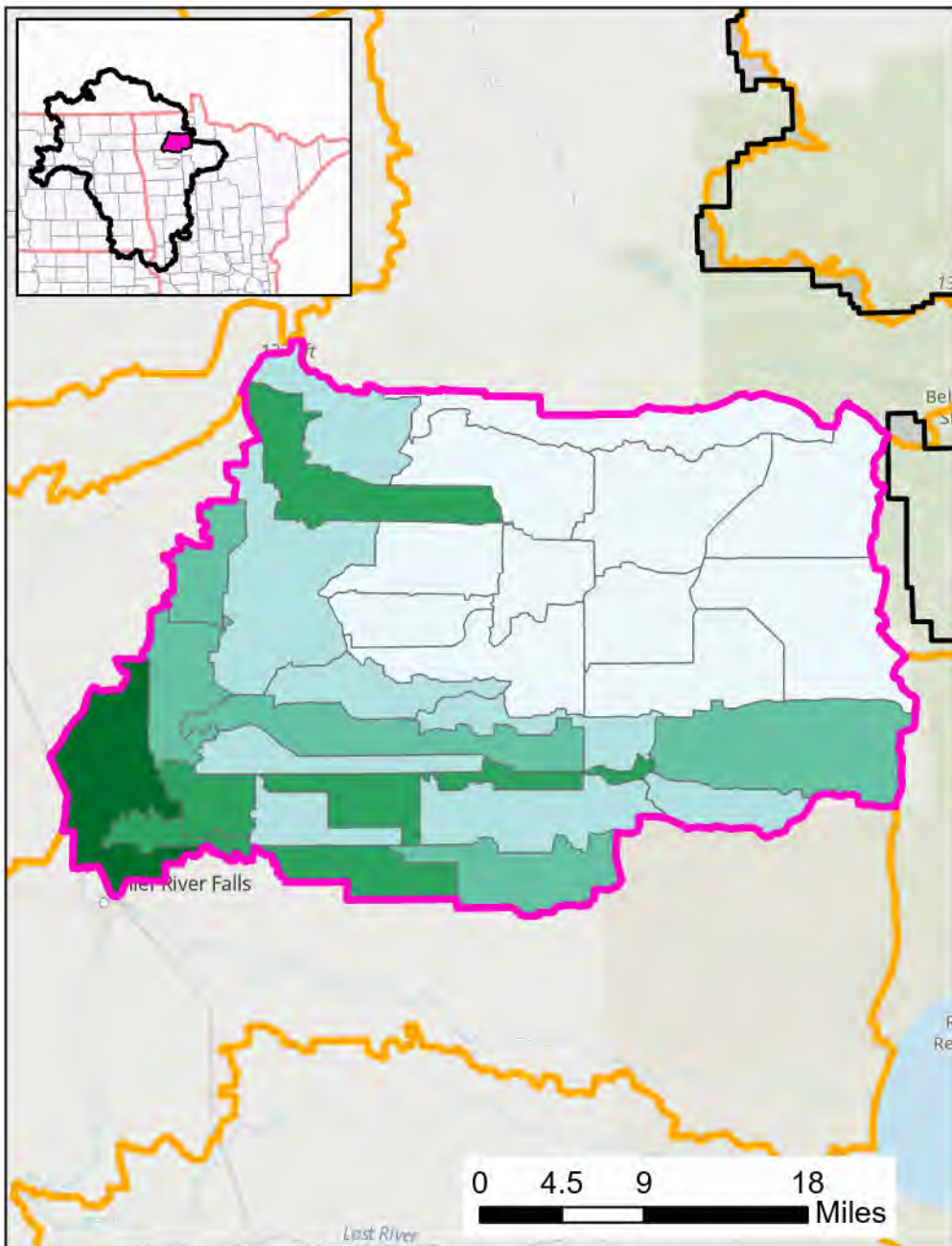


Total and Point Source Phosphorus loads from HUC 12 watersheds within the 09020303 HUC 8 Red Lake

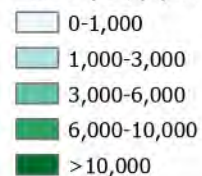


HUC 12 Total Phosphorus Point
Source Loads (lbs/yr) to Canada

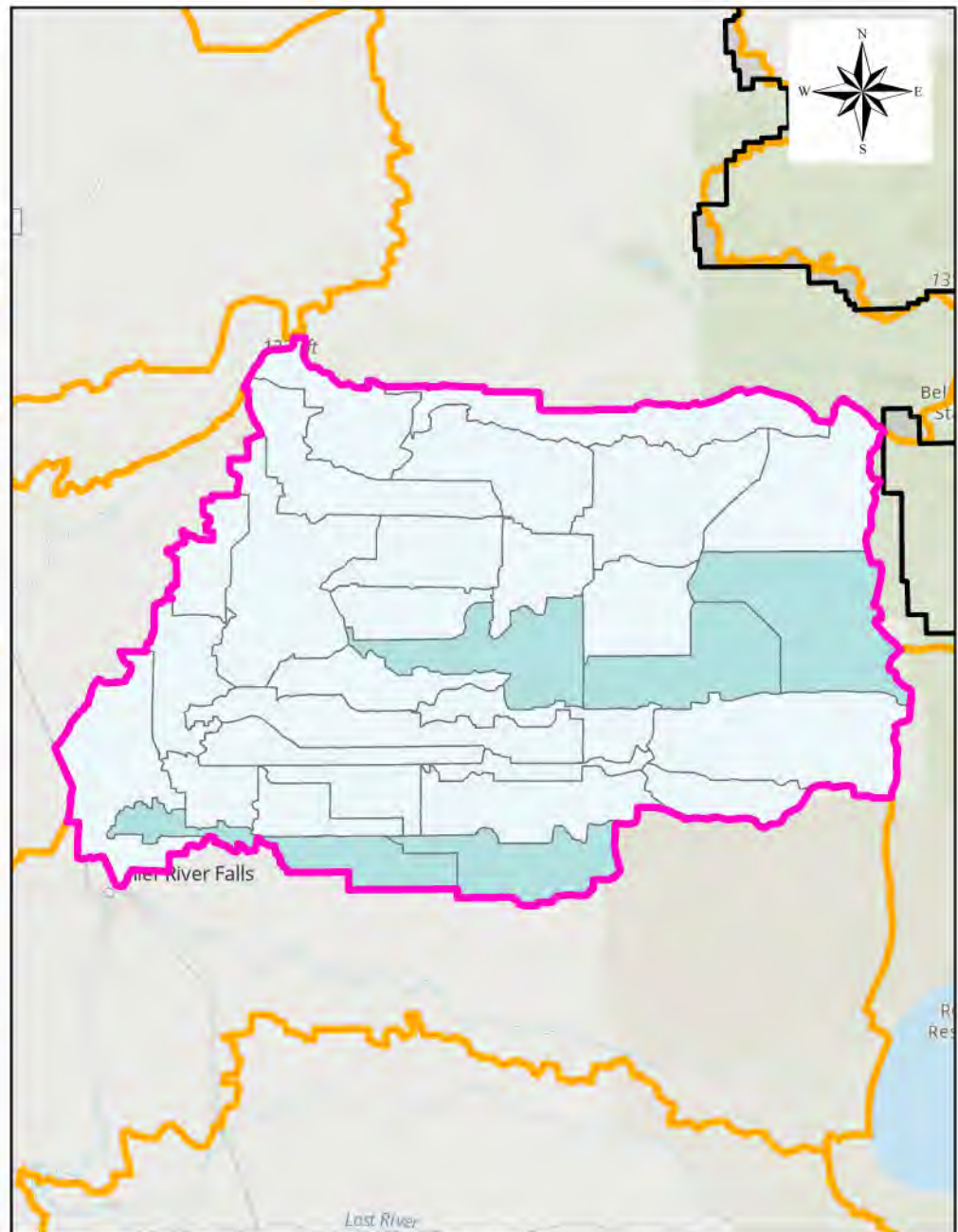




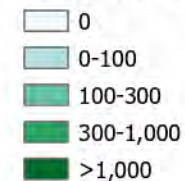
HUC 12 Total Phosphorous Loads (lbs/yr) to Canada

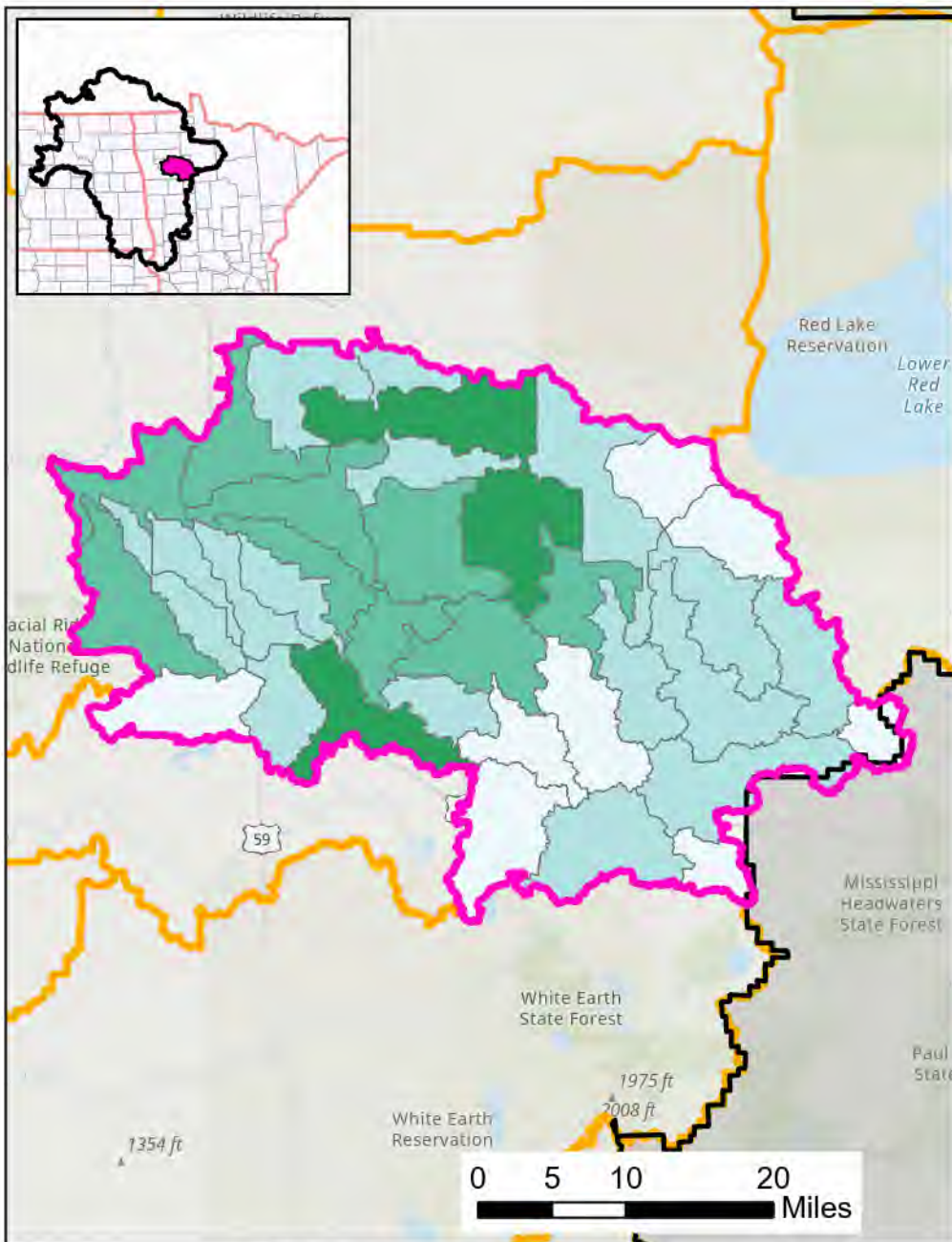


Total and Point Source Phosphorus loads from HUC 12 watersheds within the 09020304 HUC 8 Thief

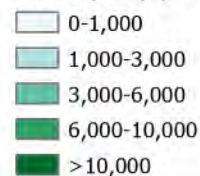


HUC 12 Total Phosphorus Point Source Loads (lbs/yr) to Canada

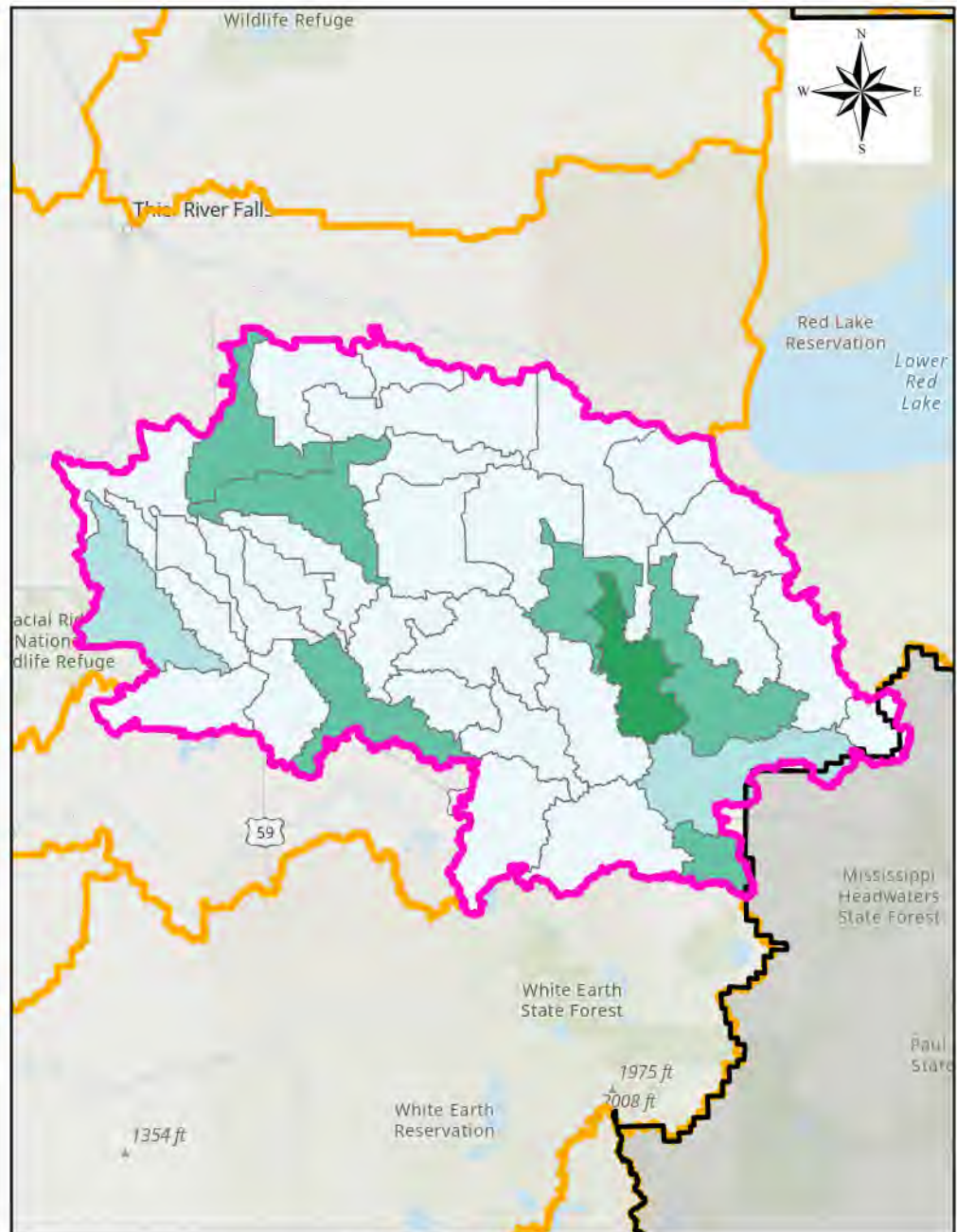




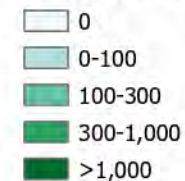
HUC 12 Total Phosphorous Loads (lbs/yr) to Canada

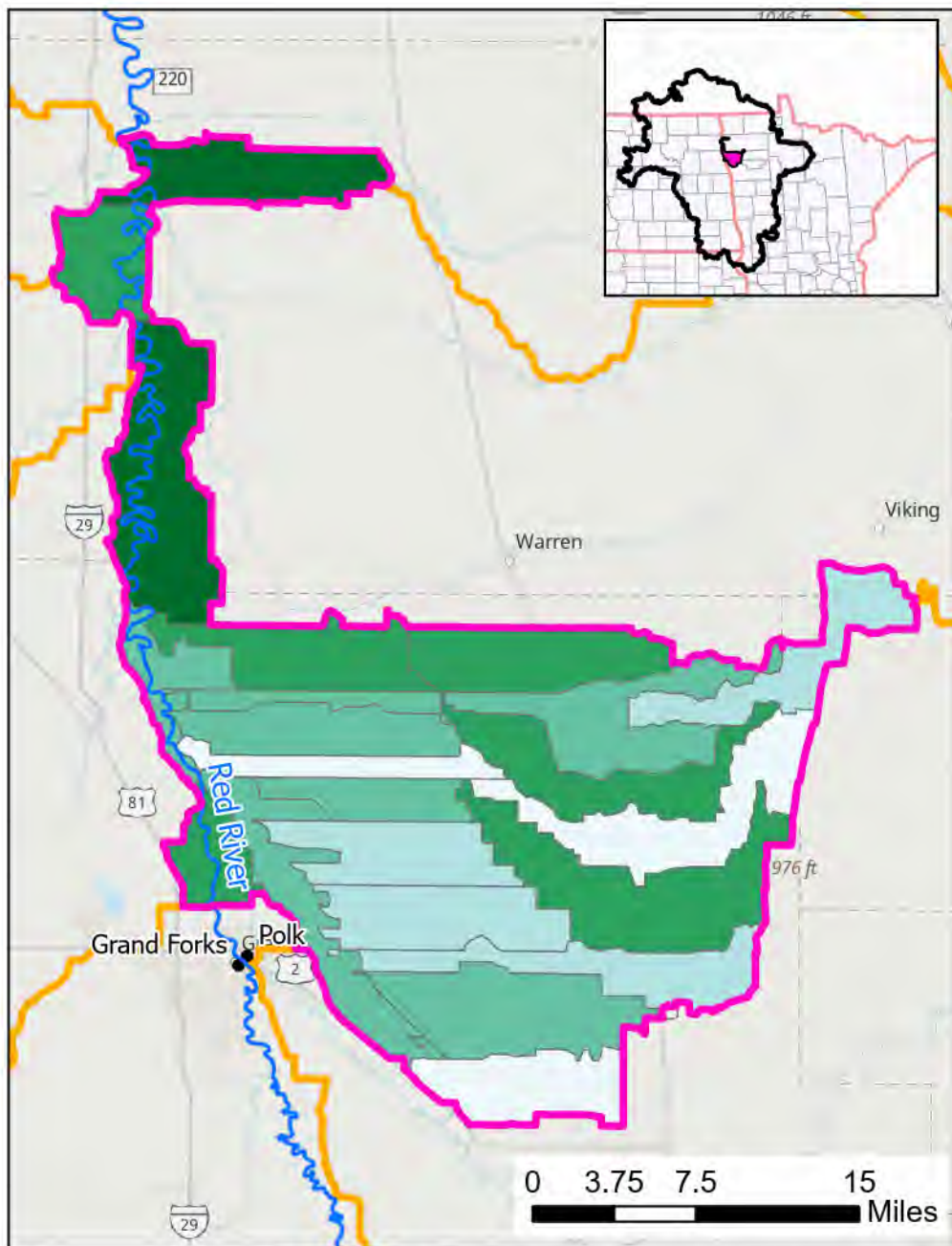


Total and Point Source Phosphorus loads from HUC 12 watersheds within the 09020305 HUC 8 Clearwater

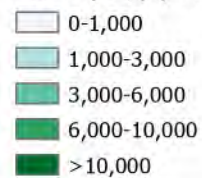


HUC 12 Total Phosphorus Point Source Loads (lbs/yr) to Canada

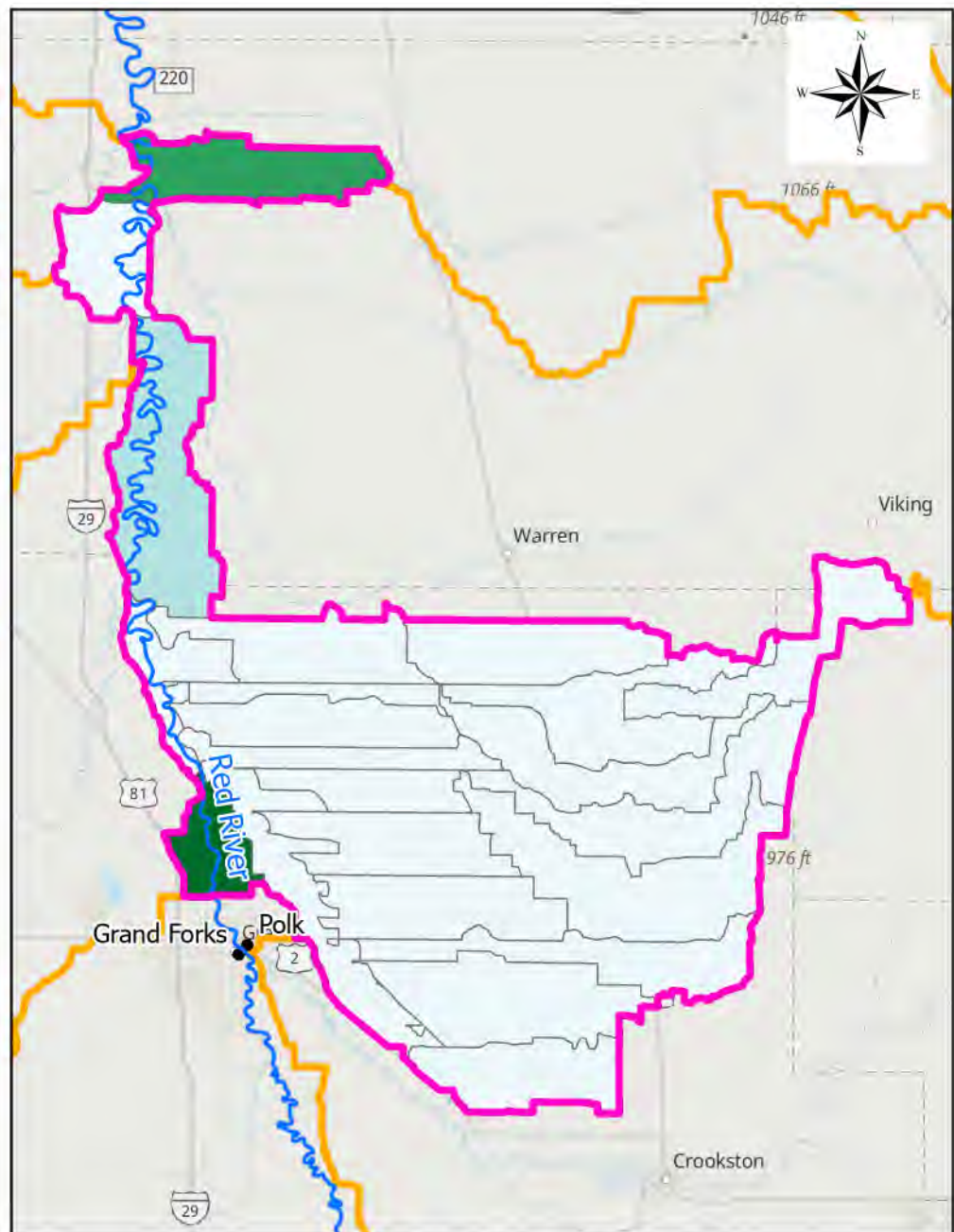




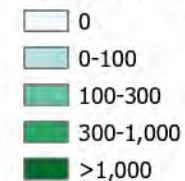
HUC 12 Total Phosphorous
Loads (lbs/yr) to Canada

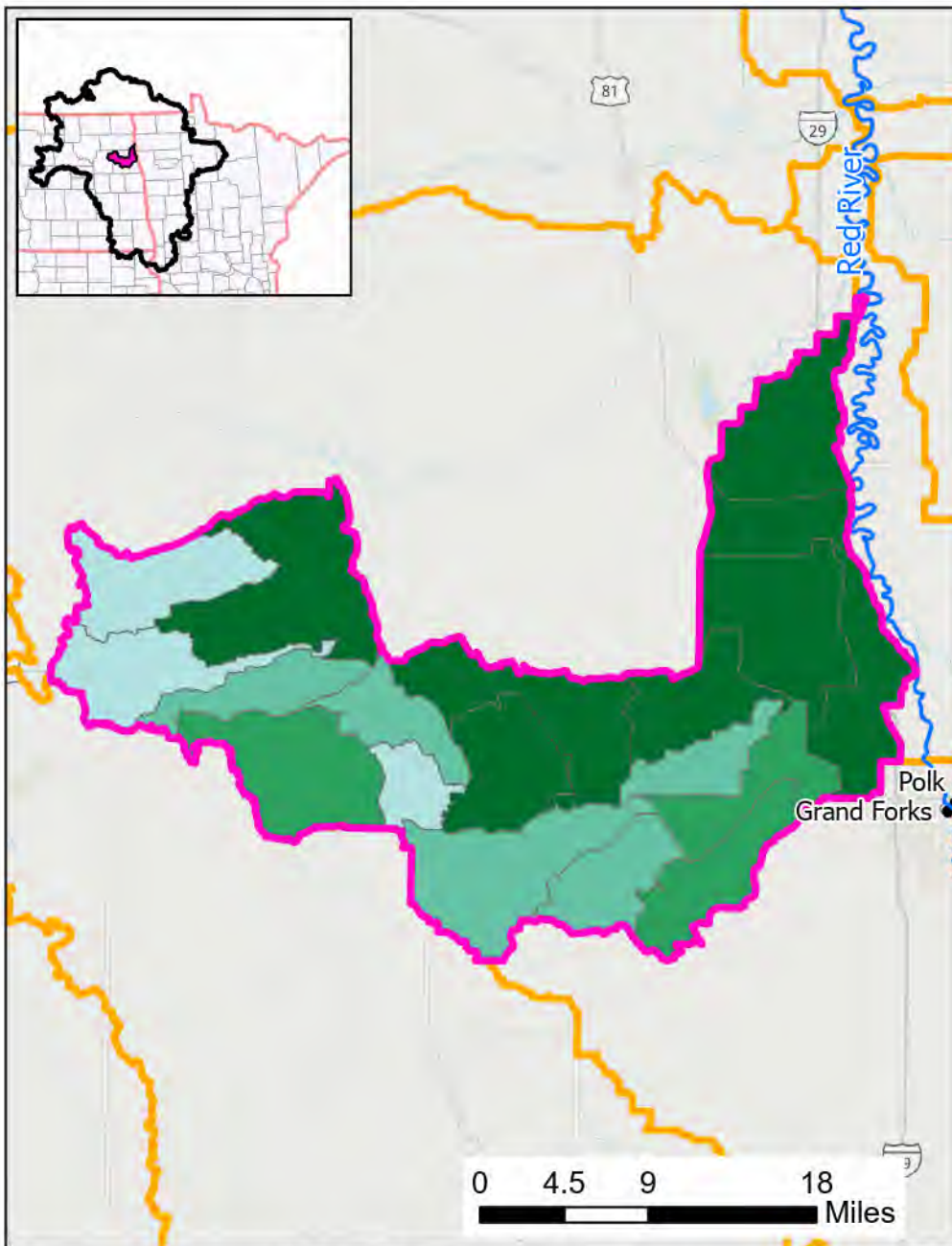


Total and Point Source Phosphorus loads from HUC 12 watersheds within the 09020306 HUC 8 Grand Marais-Red

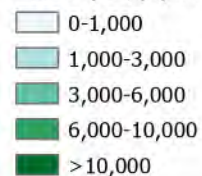


HUC 12 Total Phosphorus Point
Source Loads (lbs/yr) to Canada

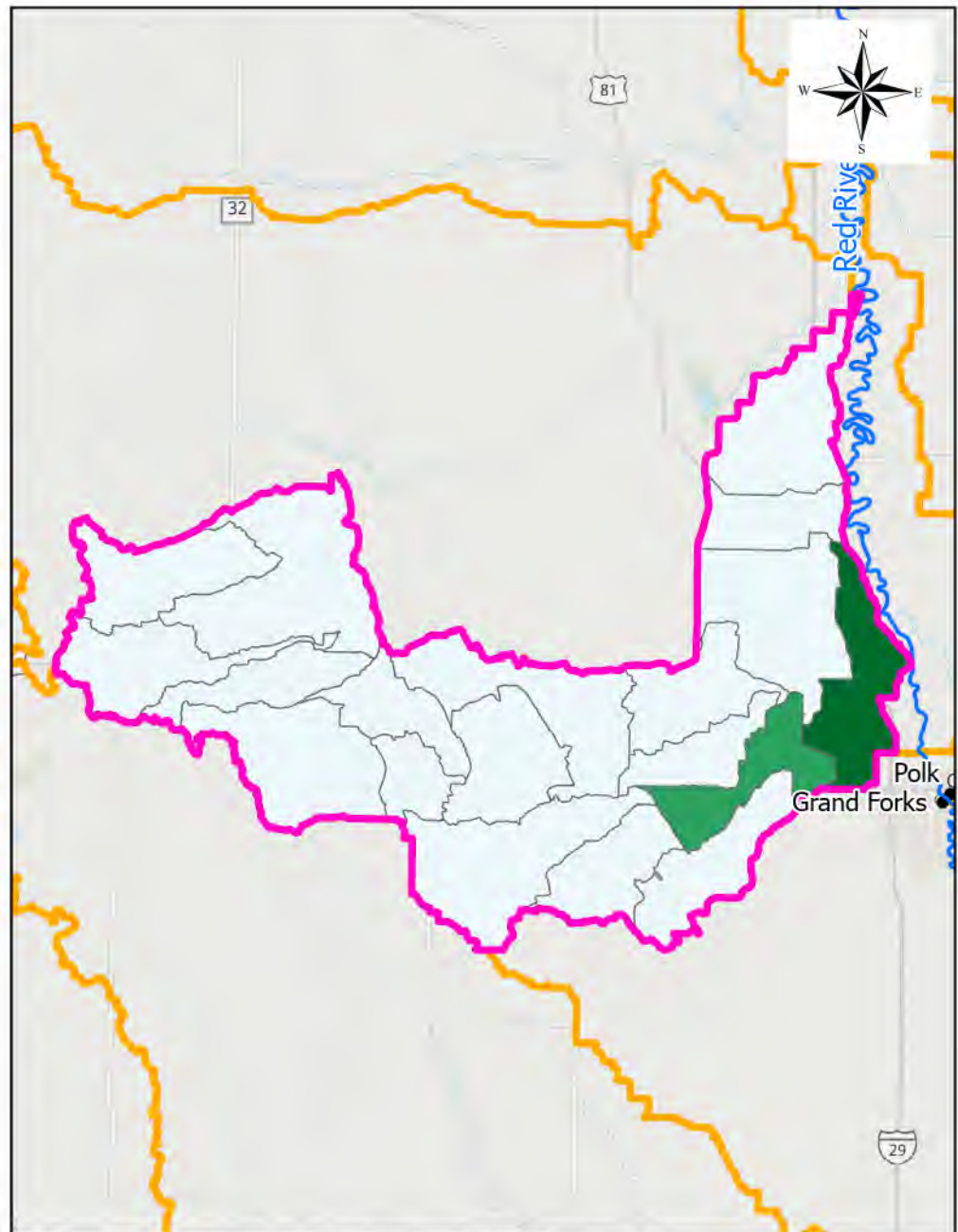




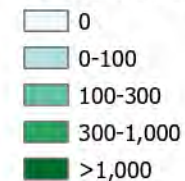
HUC 12 Total Phosphorous
Loads (lbs/yr) to Canada

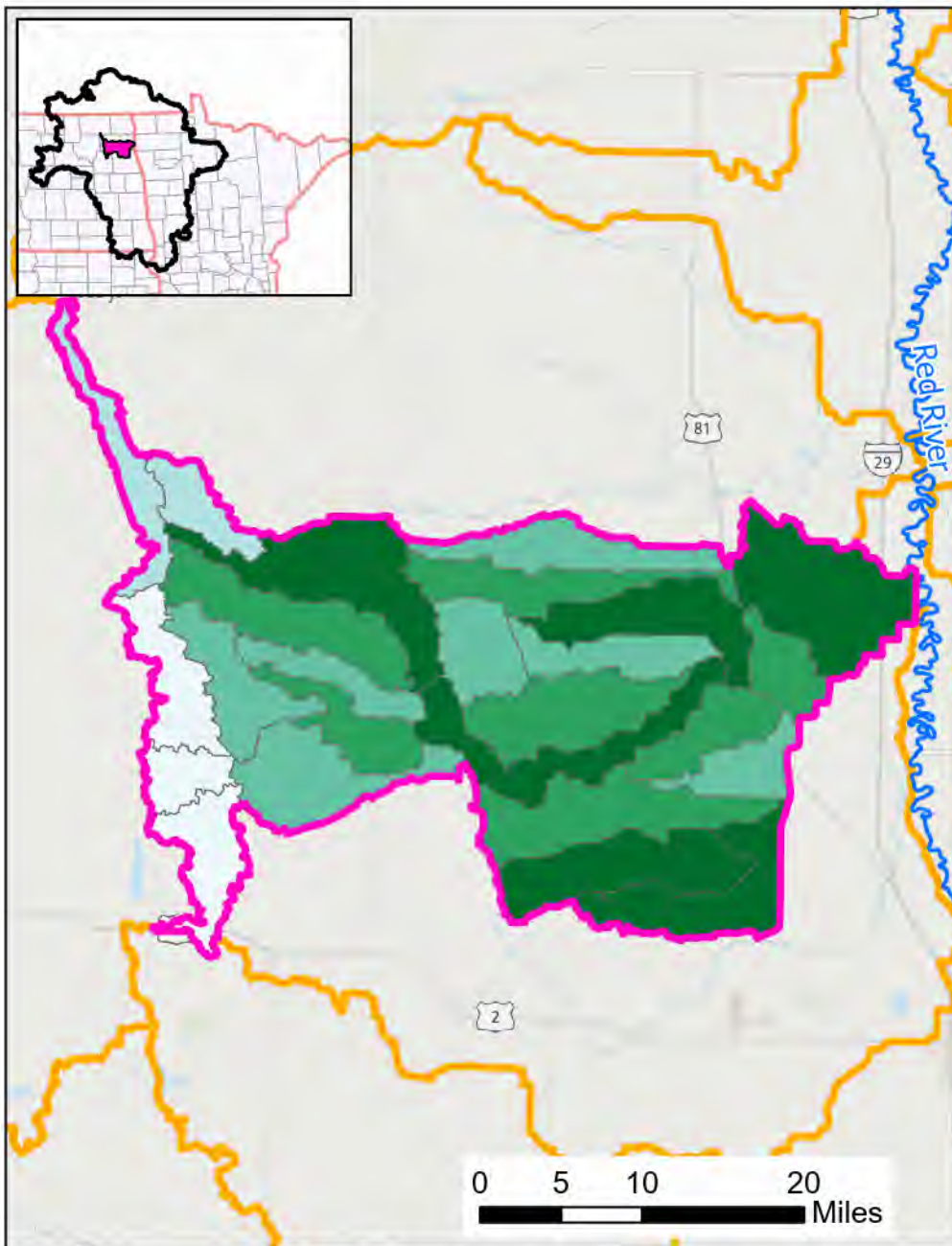


Total and Point Source Phosphorus loads from HUC 12 watersheds within the 09020307 HUC 8 Turtle

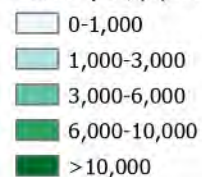


HUC 12 Total Phosphorus Point
Source Loads (lbs/yr) to Canada

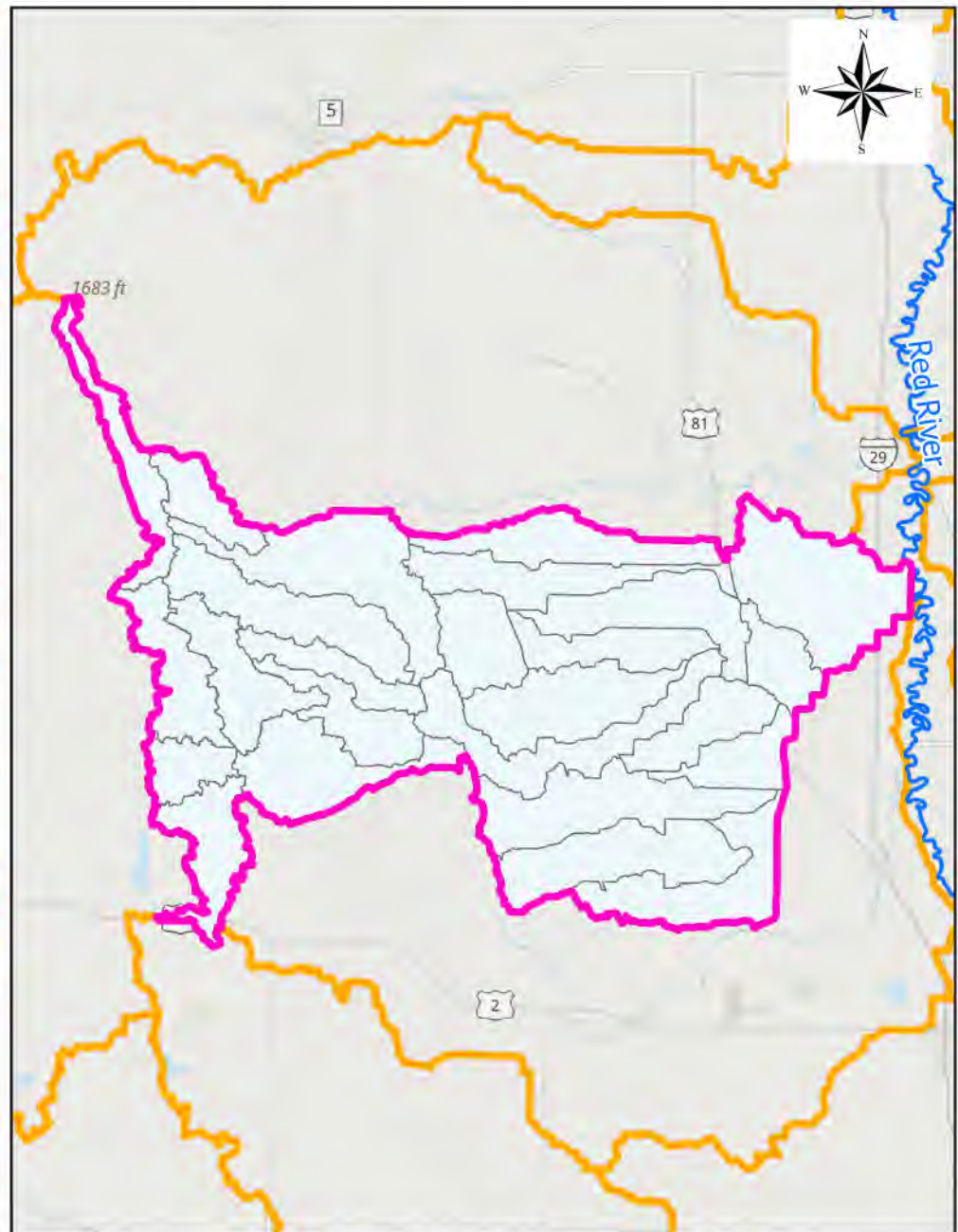




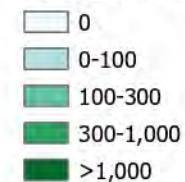
HUC 12 Total Phosphorous
Loads (lbs/yr) to Canada

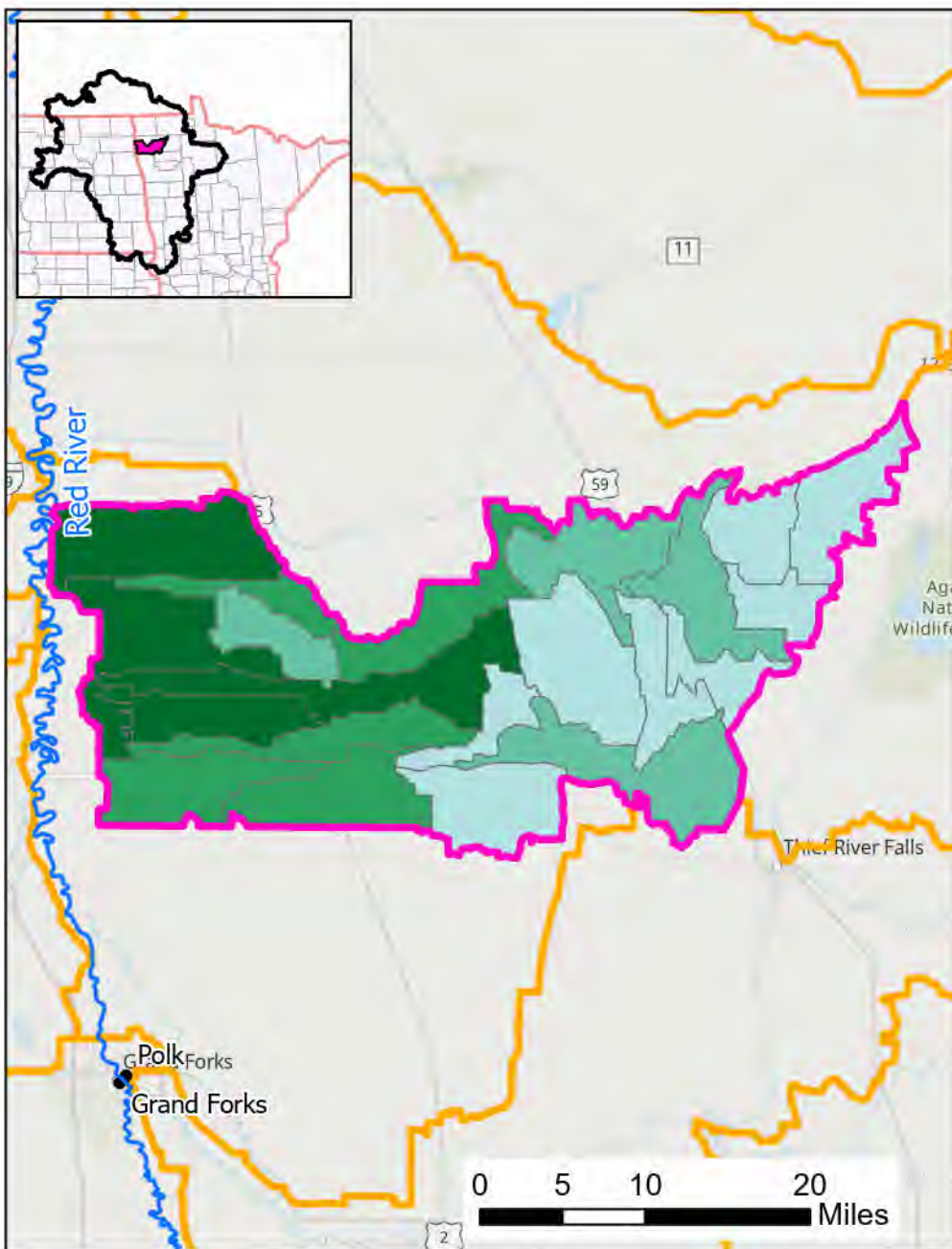


Total and Point Source Phosphorus loads from HUC 12 watersheds within the 09020308 HUC 8 Forest

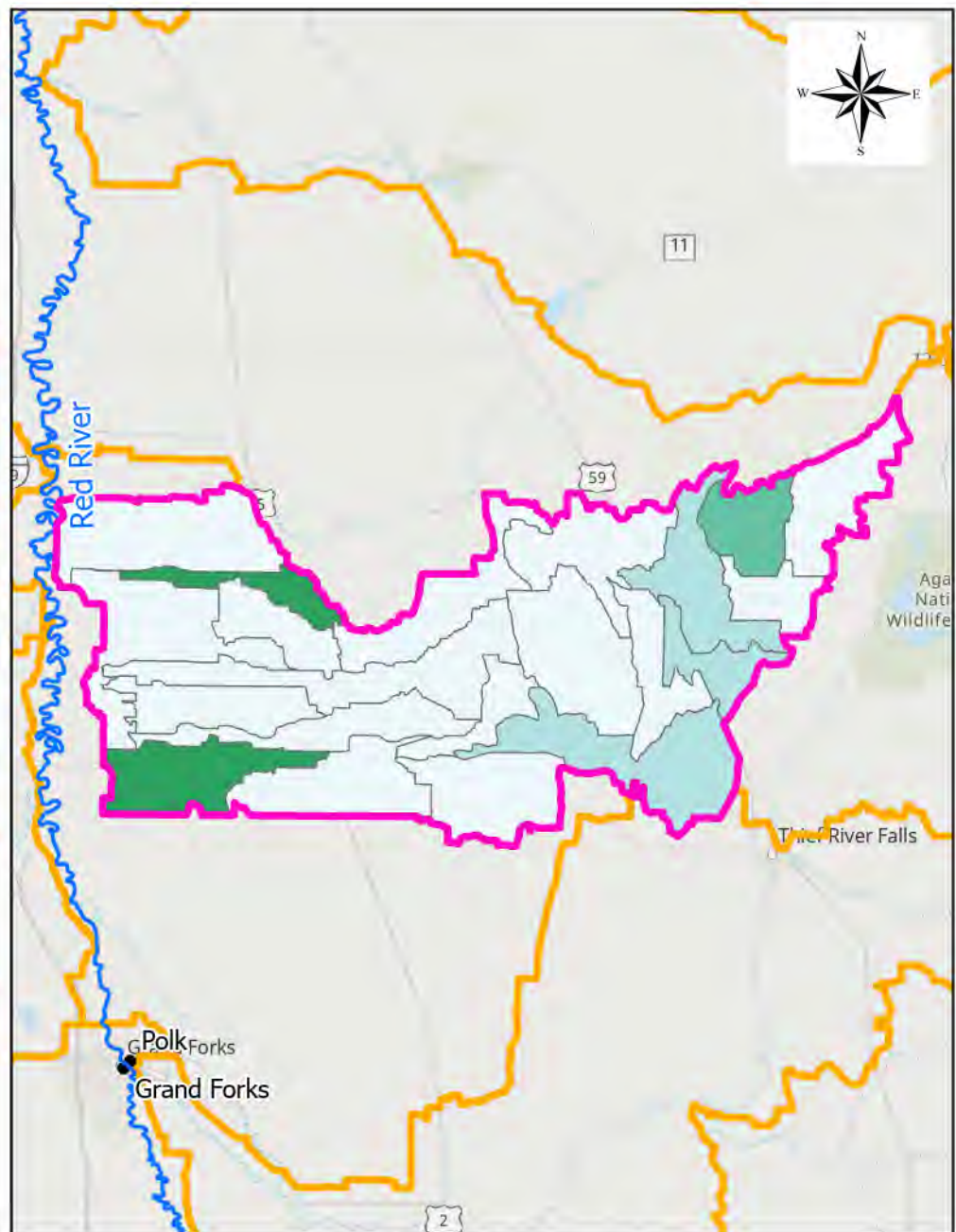


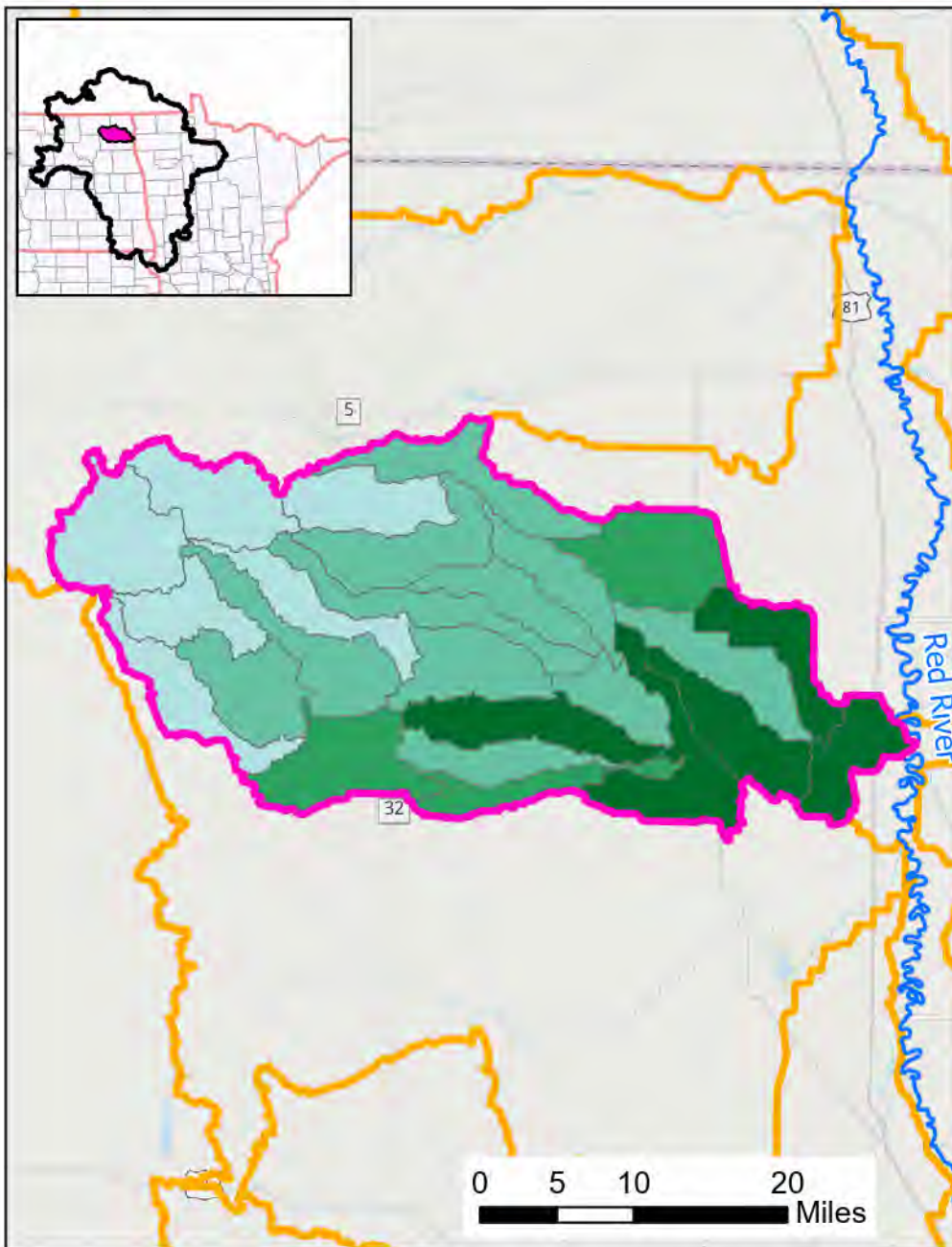
HUC 12 Total Phosphorus Point
Source Loads (lbs/yr) to Canada



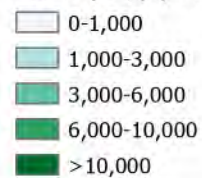


Total and Point Source Phosphorus loads from HUC 12 watersheds within the 09020309 HUC 8 Snake

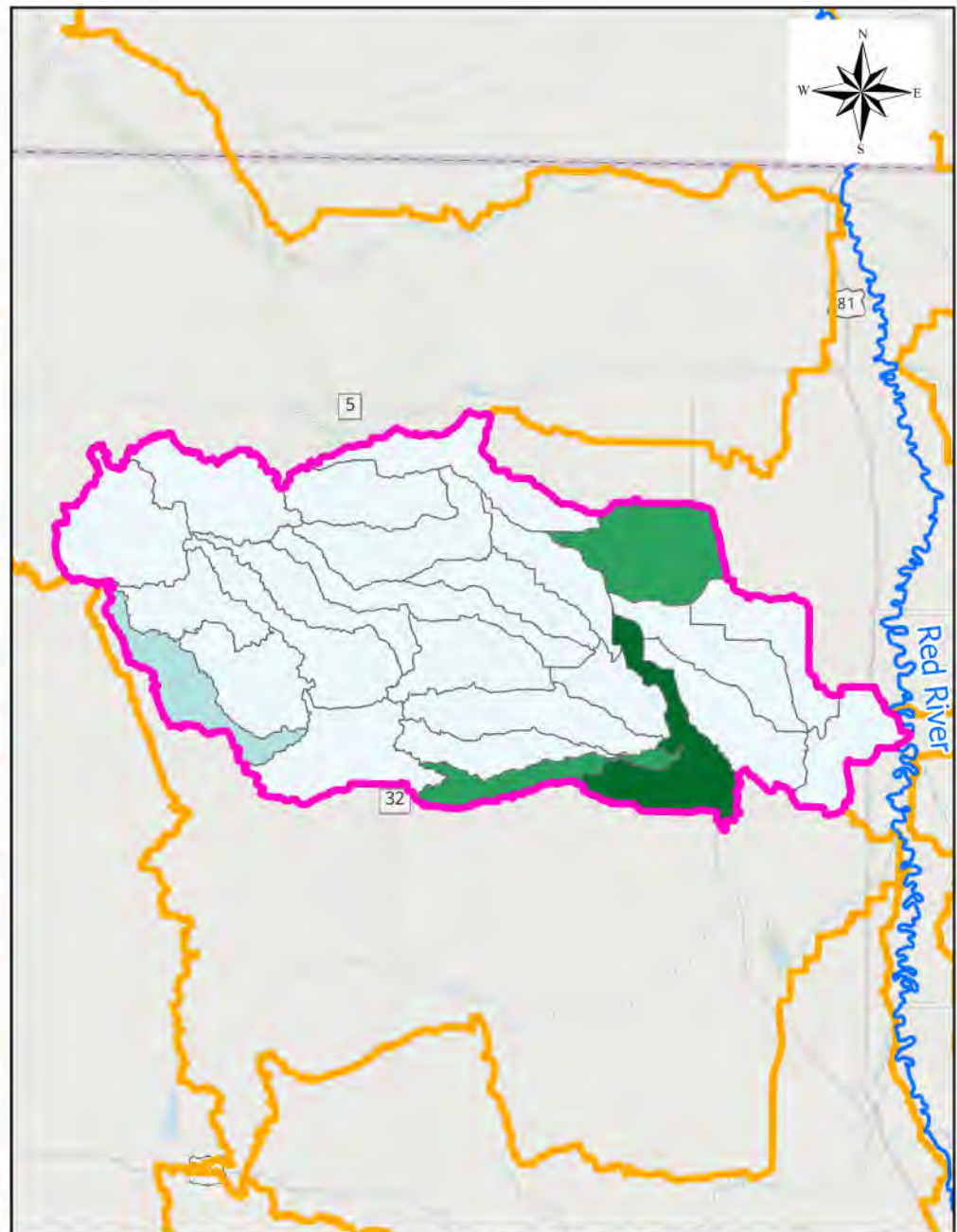




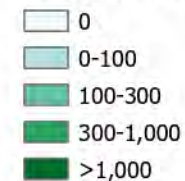
HUC 12 Total Phosphorous
Loads (lbs/yr) to Canada

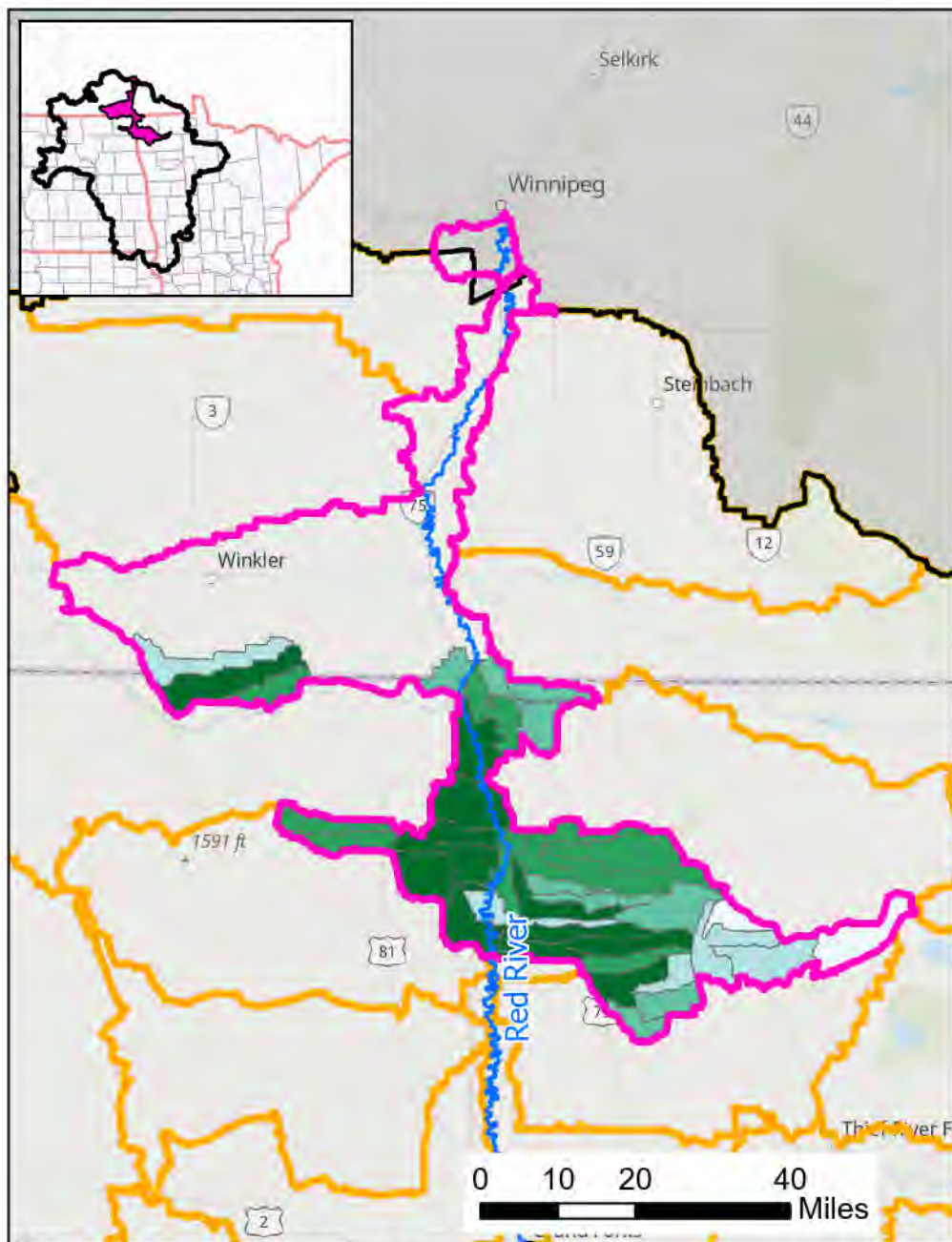


Total and Point Source Phosphorus loads from HUC 12 watersheds within the 09020310 HUC 8 Park

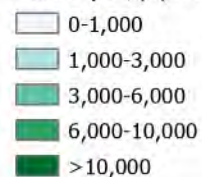


HUC 12 Total Phosphorus Point
Source Loads (lbs/yr) to Canada

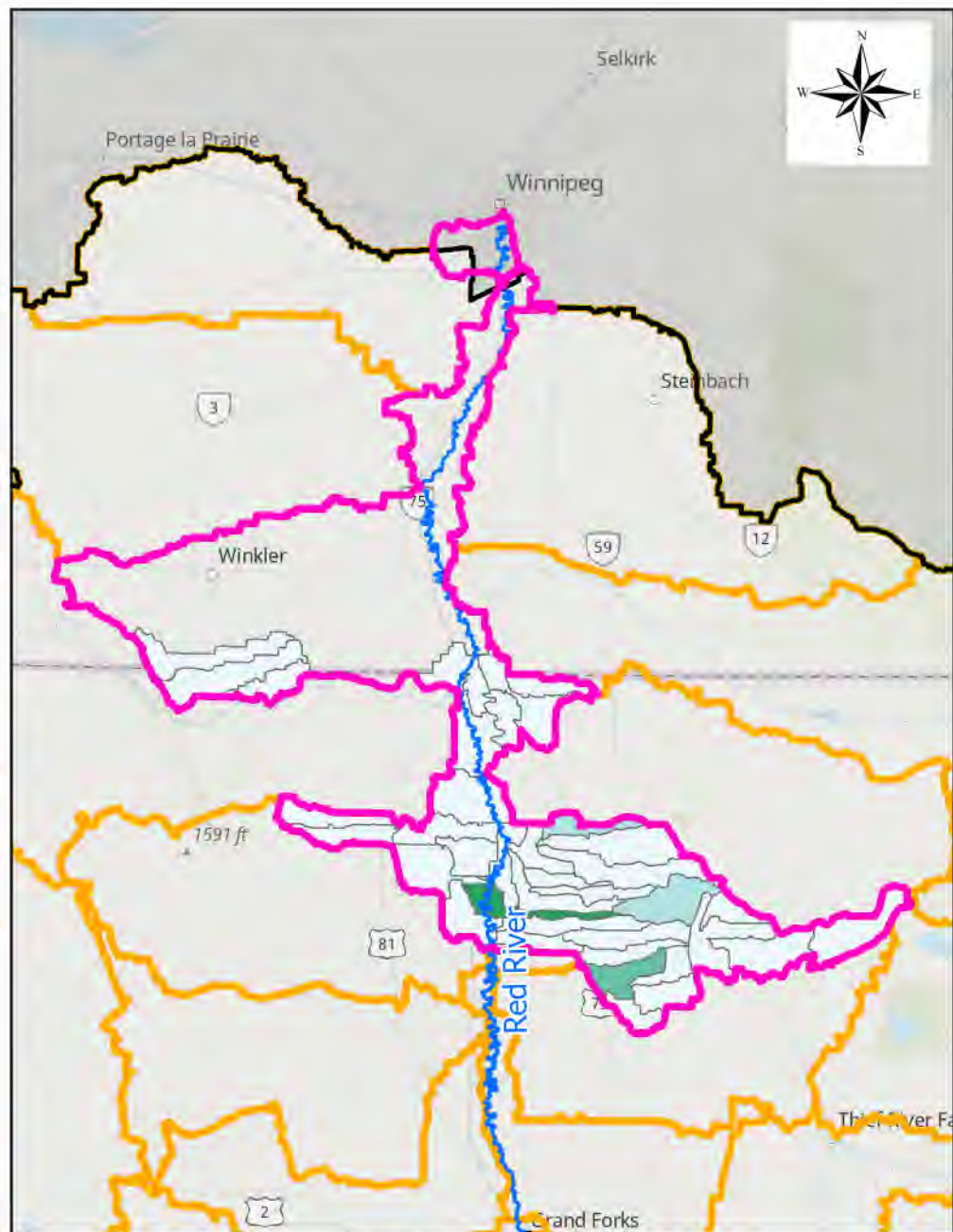




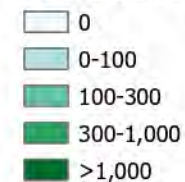
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Loads (lbs/yr) to Canada

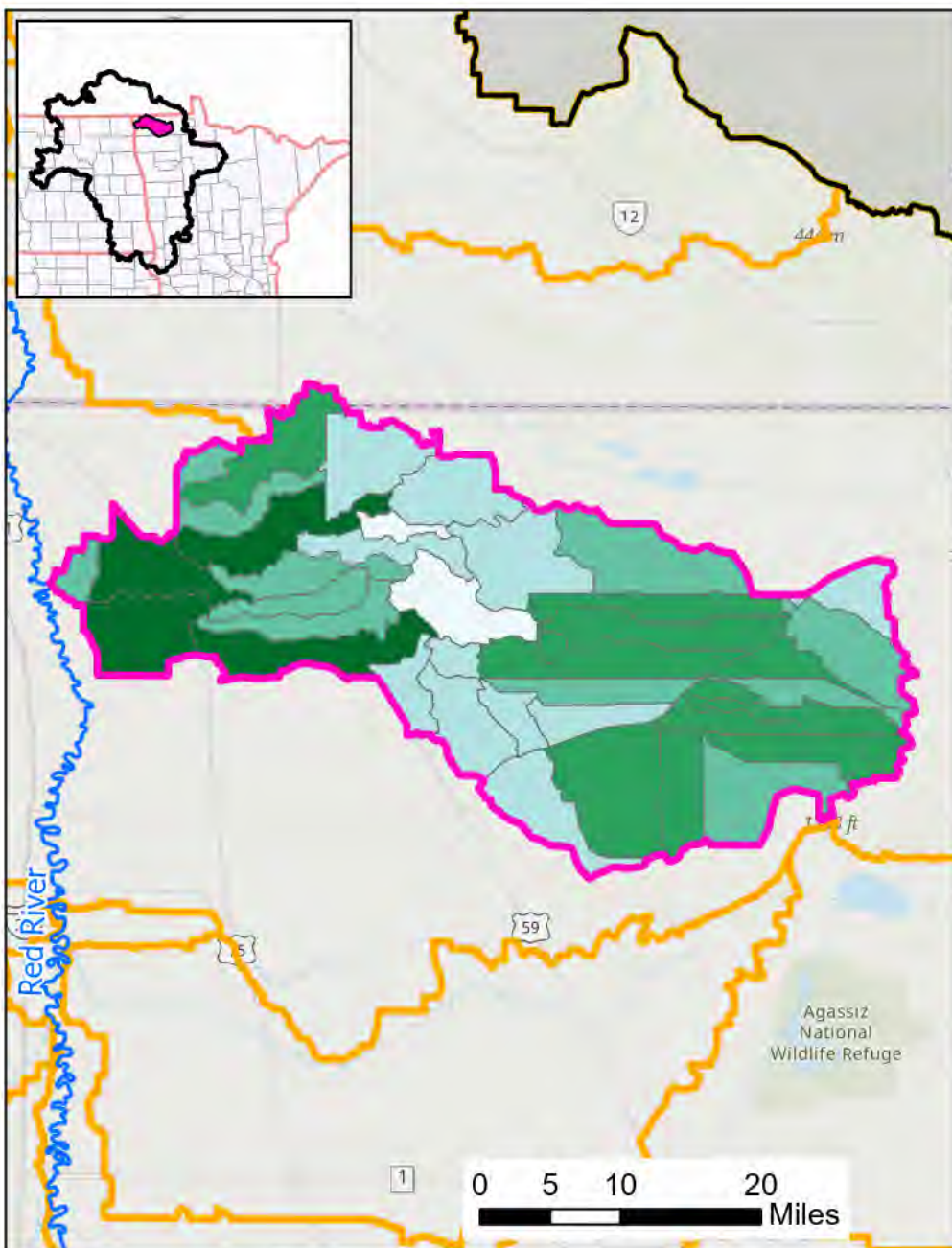


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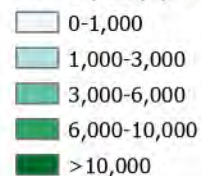


HUC 12 Total Phosphorus Point
Source Loads (lbs/yr) to Canada

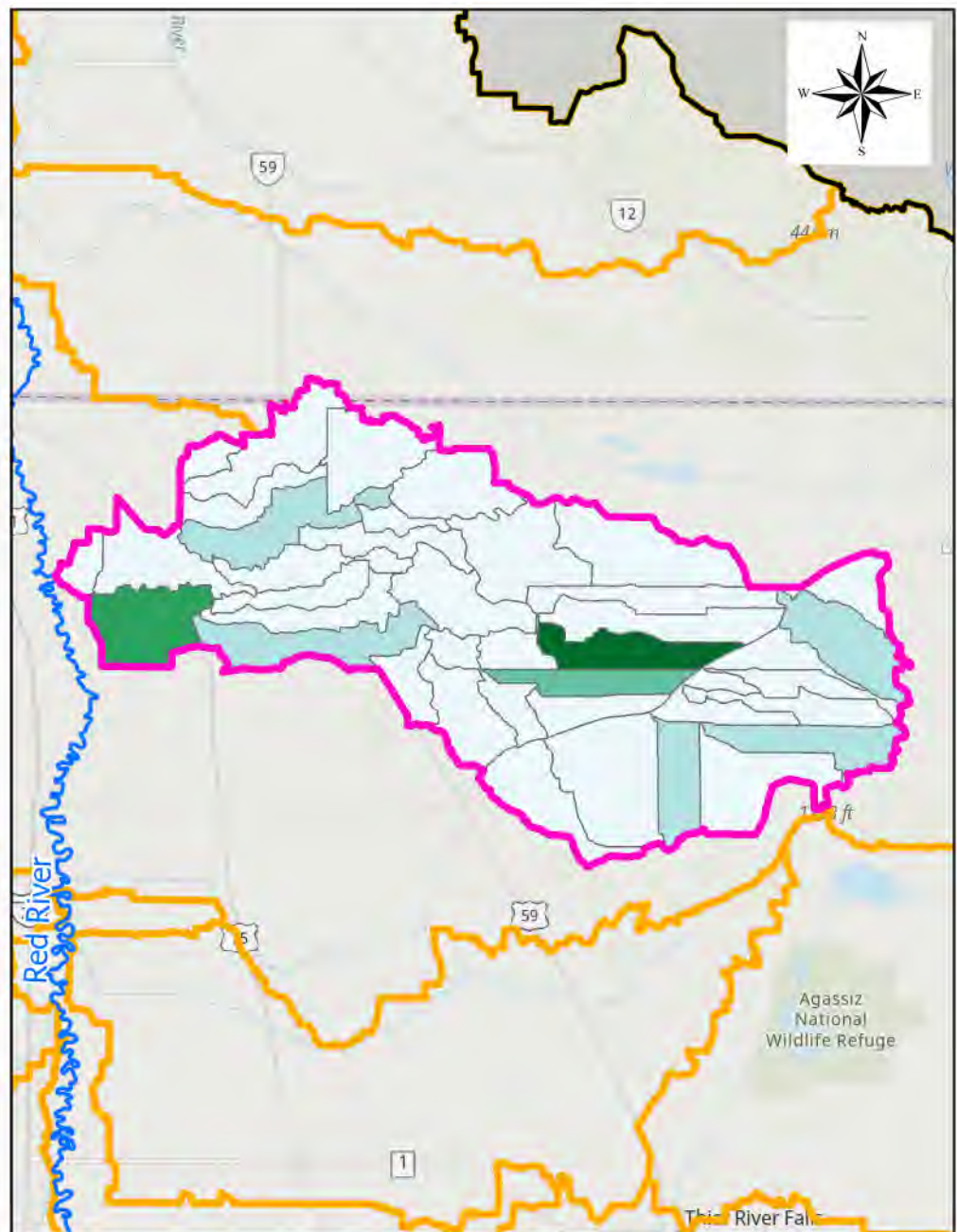




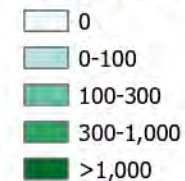
HUC 12 Total Phosphorous
Loads (lbs/yr) to Canada

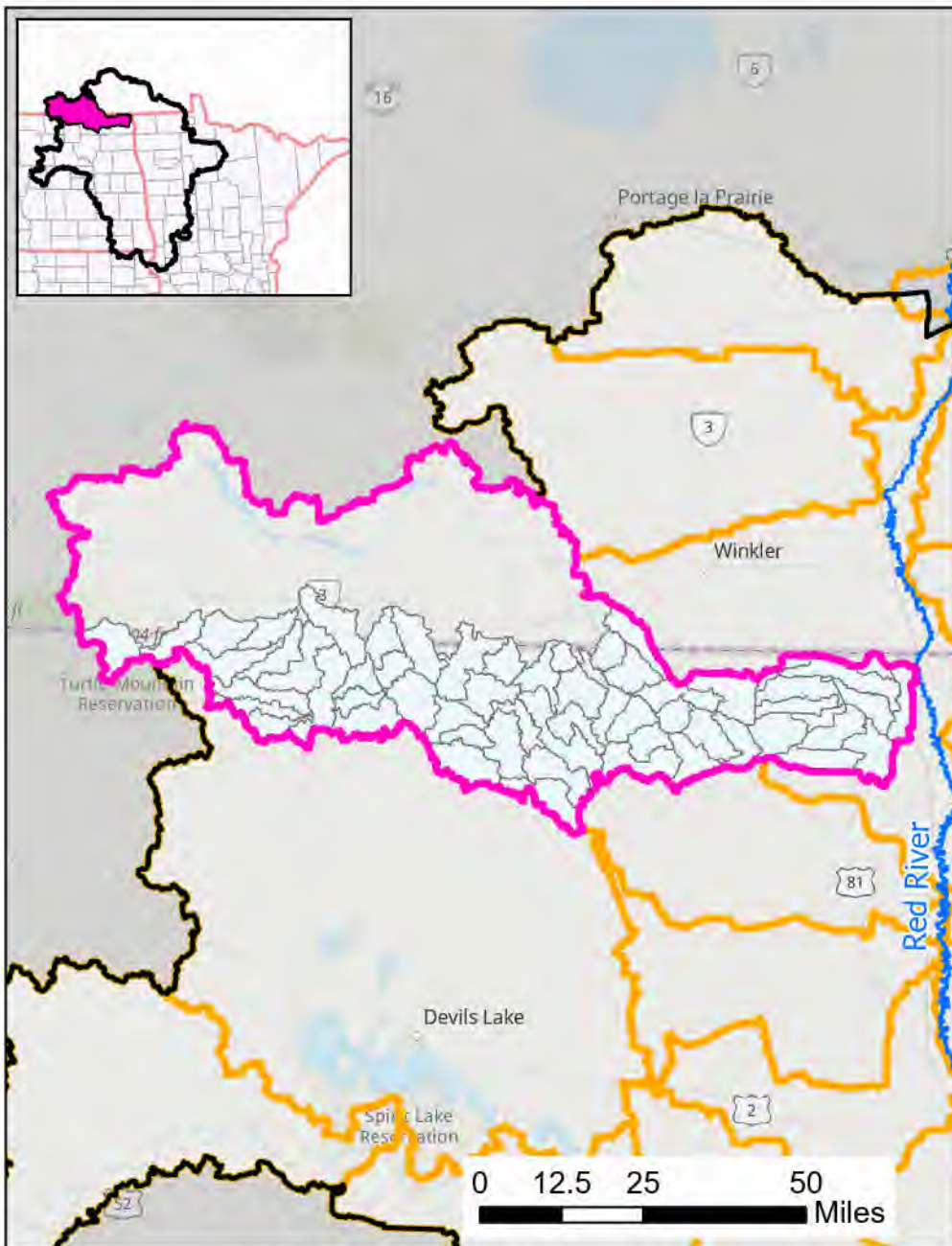


Total and Point Source Phosphorus loads from HUC 12 watersheds within the 09020312 HUC 8 Two Rivers

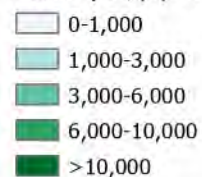


HUC 12 Total Phosphorus Point
Source Loads (lbs/yr) to Canada

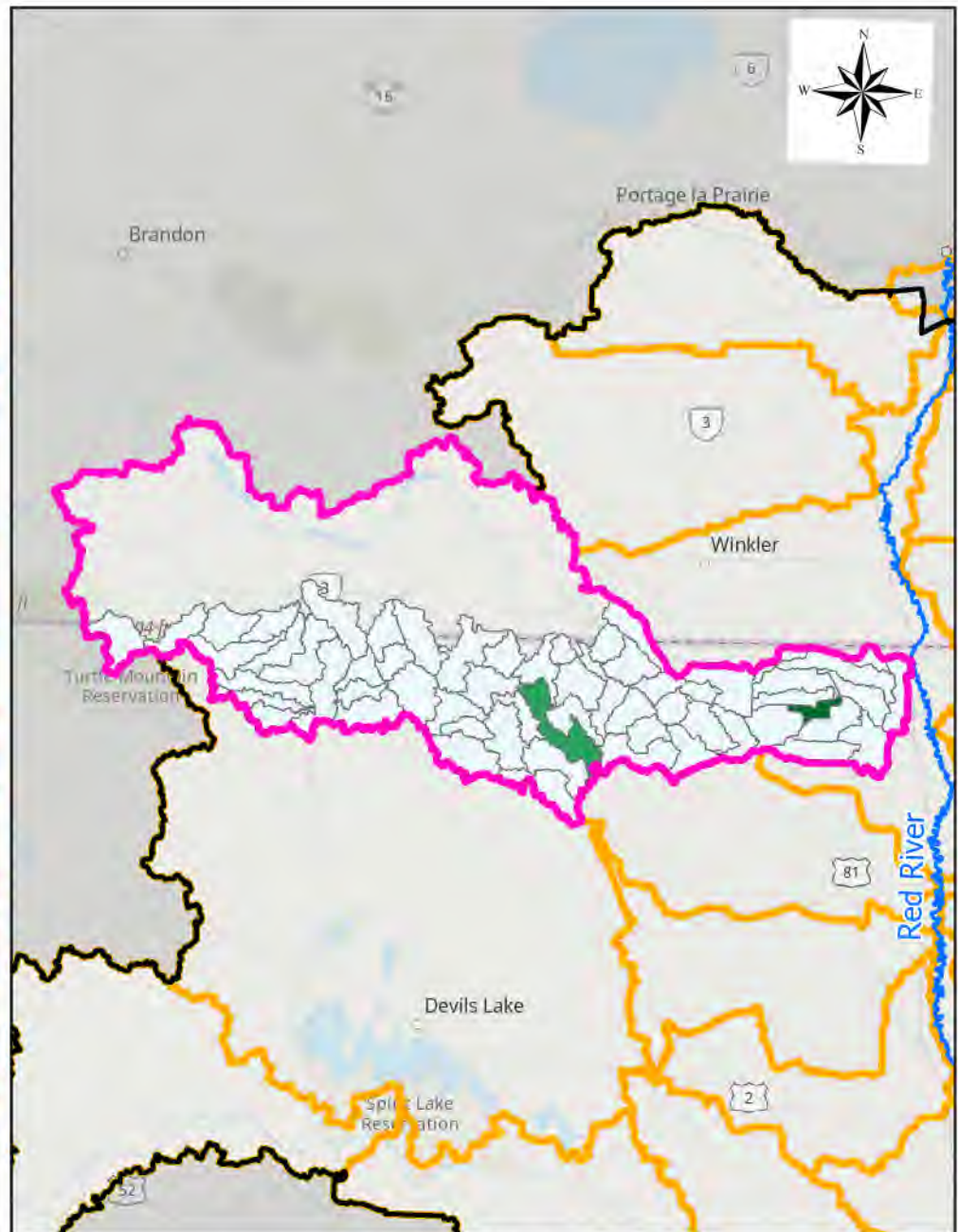




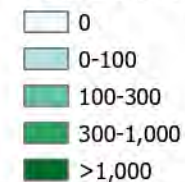
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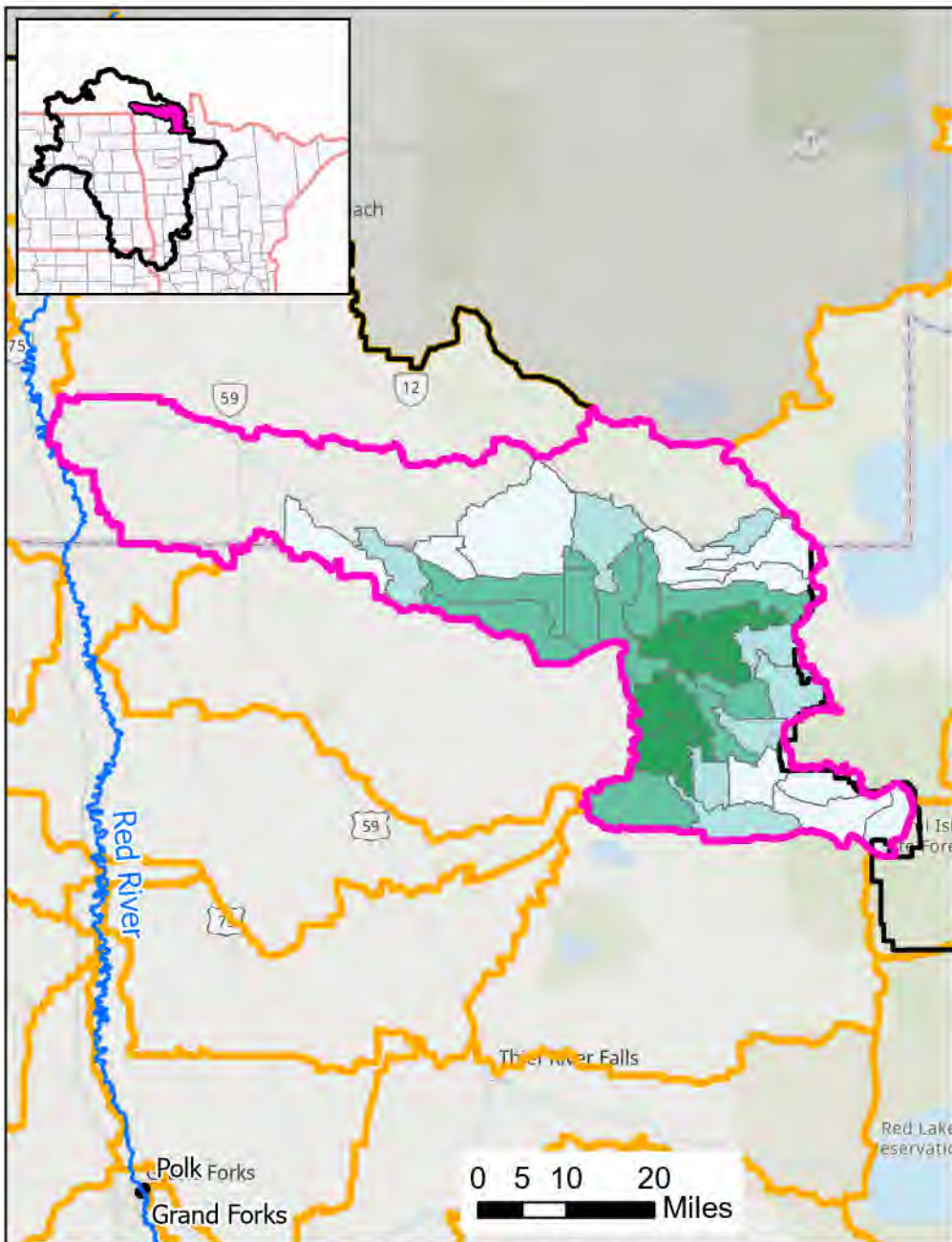


Total and Point Source Phosphorus loads from HUC 12 watersheds within the 09020313 HUC 8 Pembina River



HUC 12 Total Phosphorus Point
Source Loads (lbs/yr) to Canada

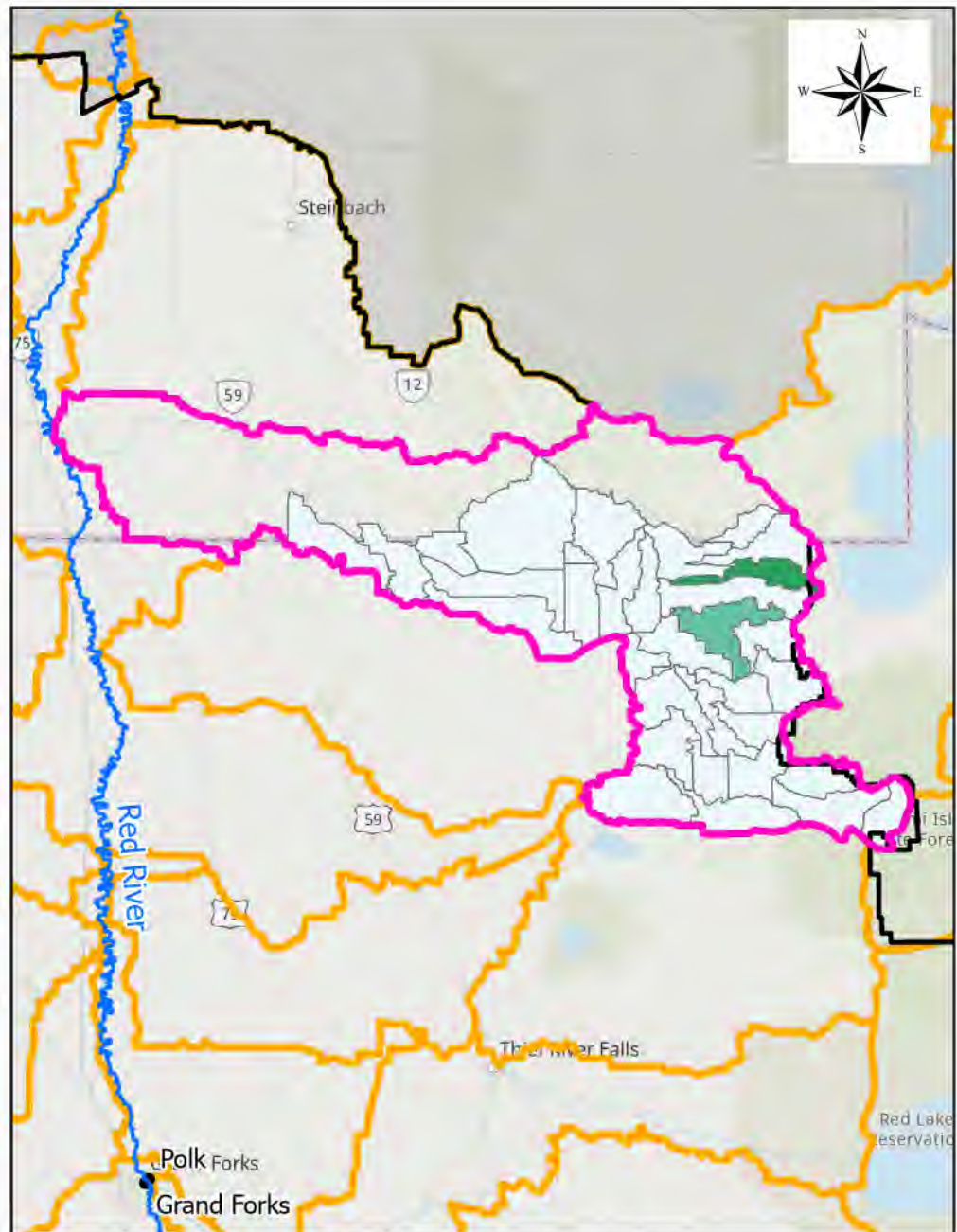




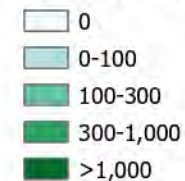
HUC 12 Total Phosphorous
Loads (lbs/yr) to Canada

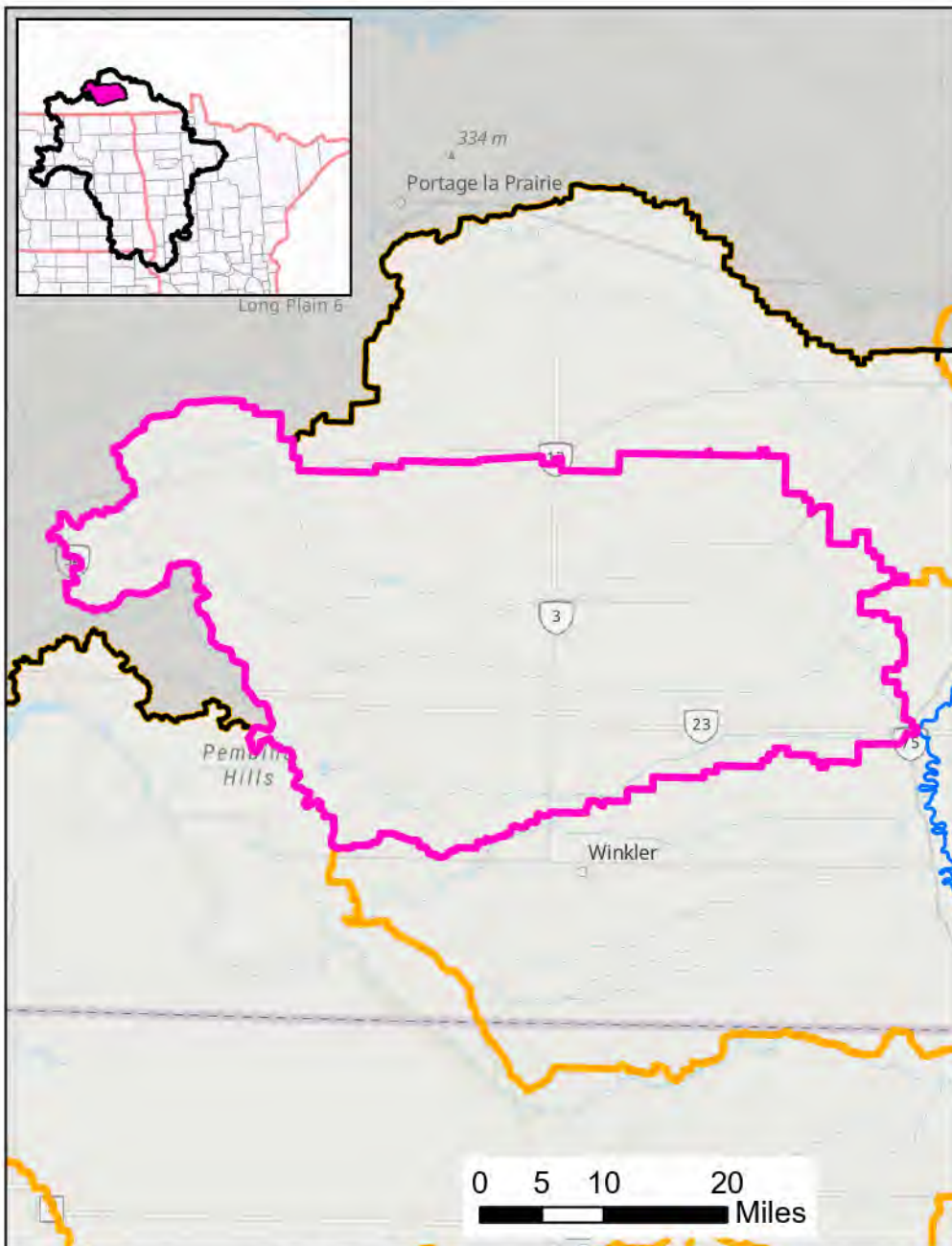


Total and Point Source Phosphorus loads from HUC 12 watersheds within the 09020314 HUC 8 Roseau

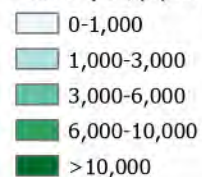


HUC 12 Total Phosphorus Point
Source Loads (lbs/yr) to Canada

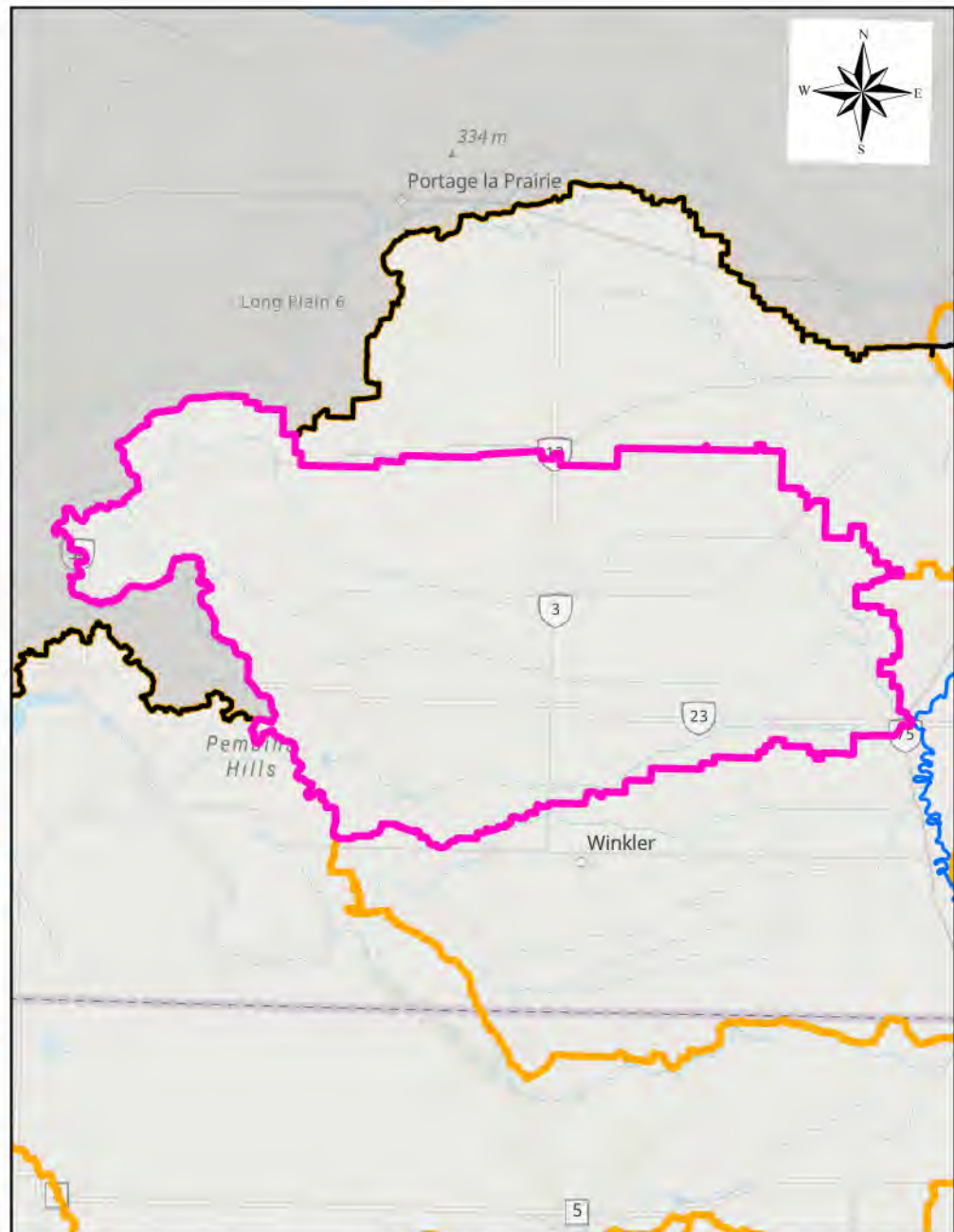




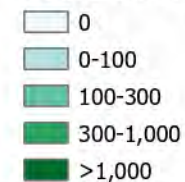
HUC 12 Total Phosphorous
Loads (lbs/yr) to Canada

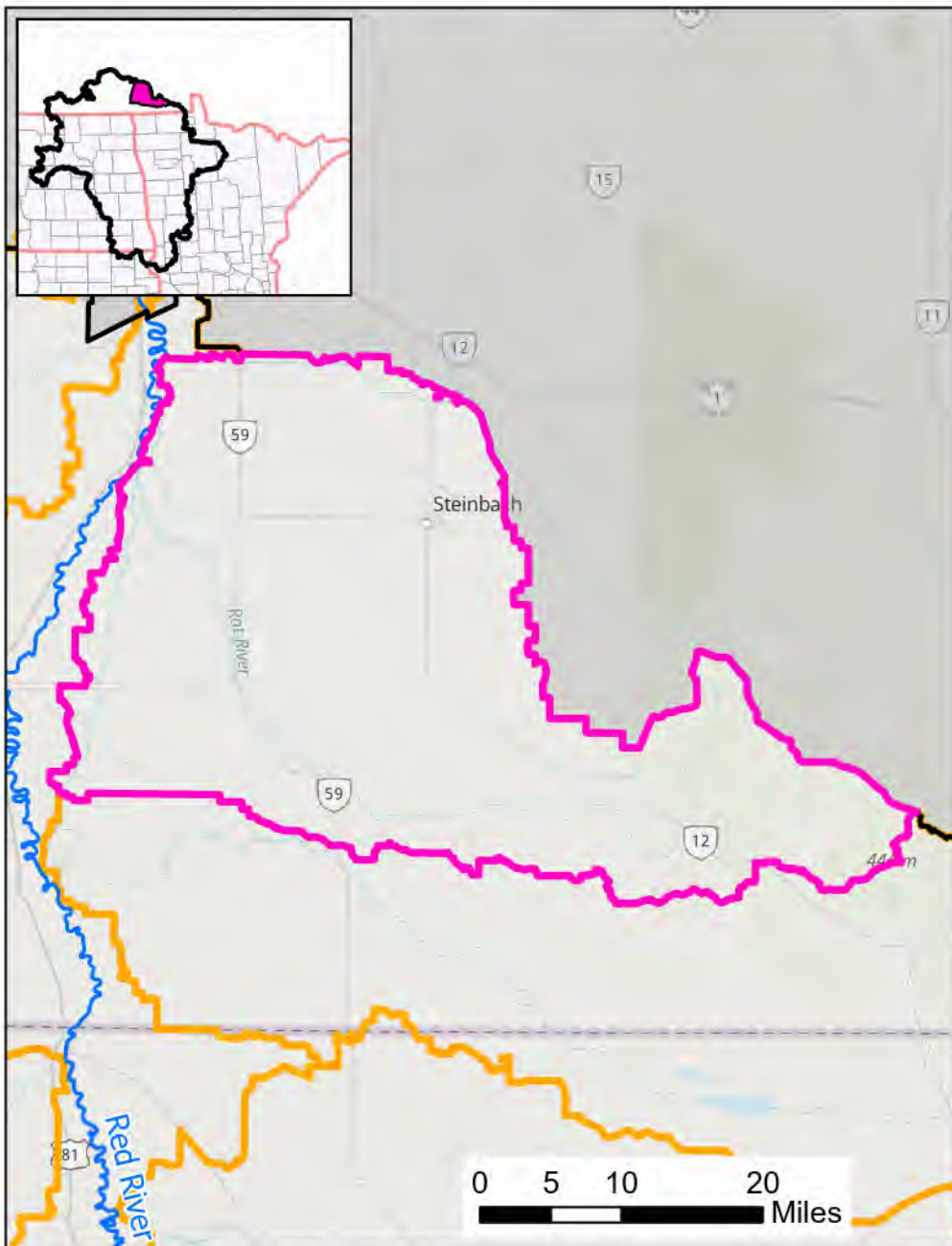


Total and Point Source Phosphorus loads from HUC 12 watersheds within the 09020317 HUC 8 Morris River

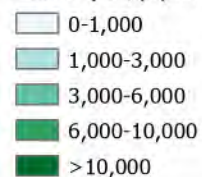


HUC 12 Total Phosphorus Point
Source Loads (lbs/yr) to Canada

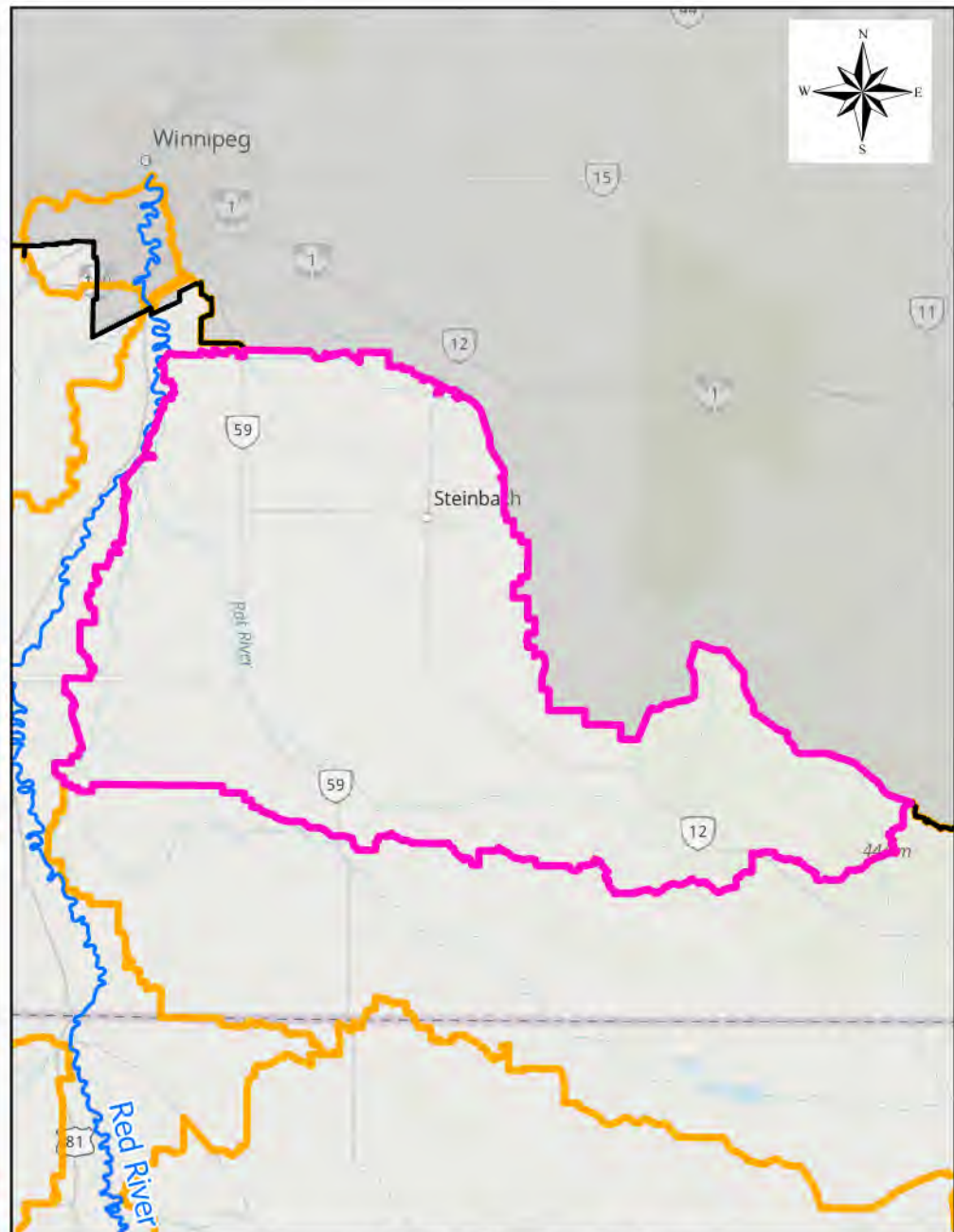




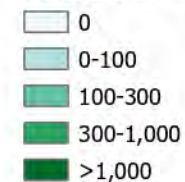
HUC 12 Total Phosphorous
Loads (lbs/yr) to Canada

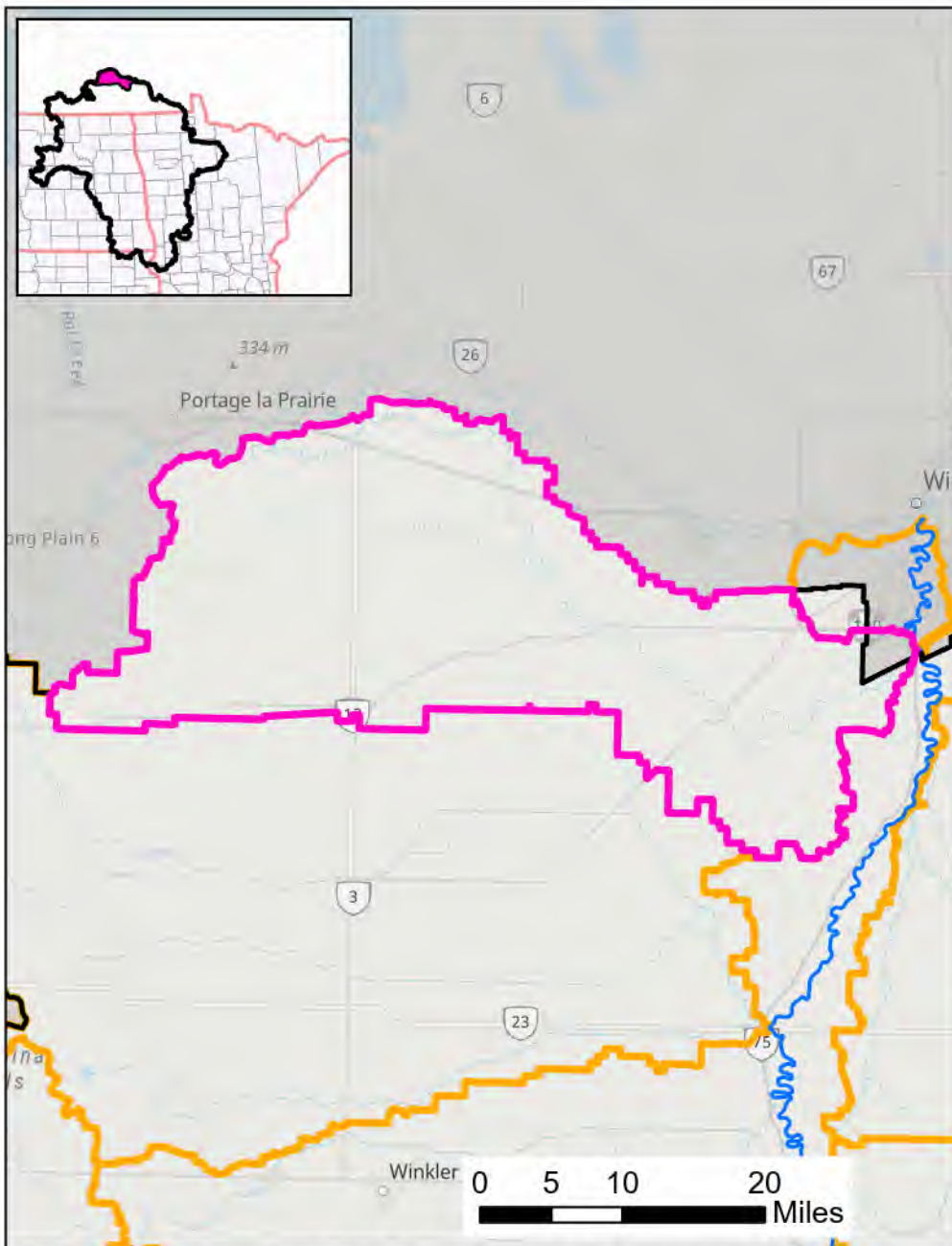


Total and Point Source Phosphorus loads from HUC 12 watersheds within the 09020318 HUC 8 Rat River-Tourond Creek

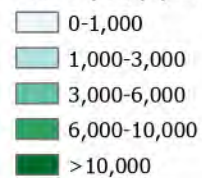


HUC 12 Total Phosphorus Point
Source Loads (lbs/yr) to Canada

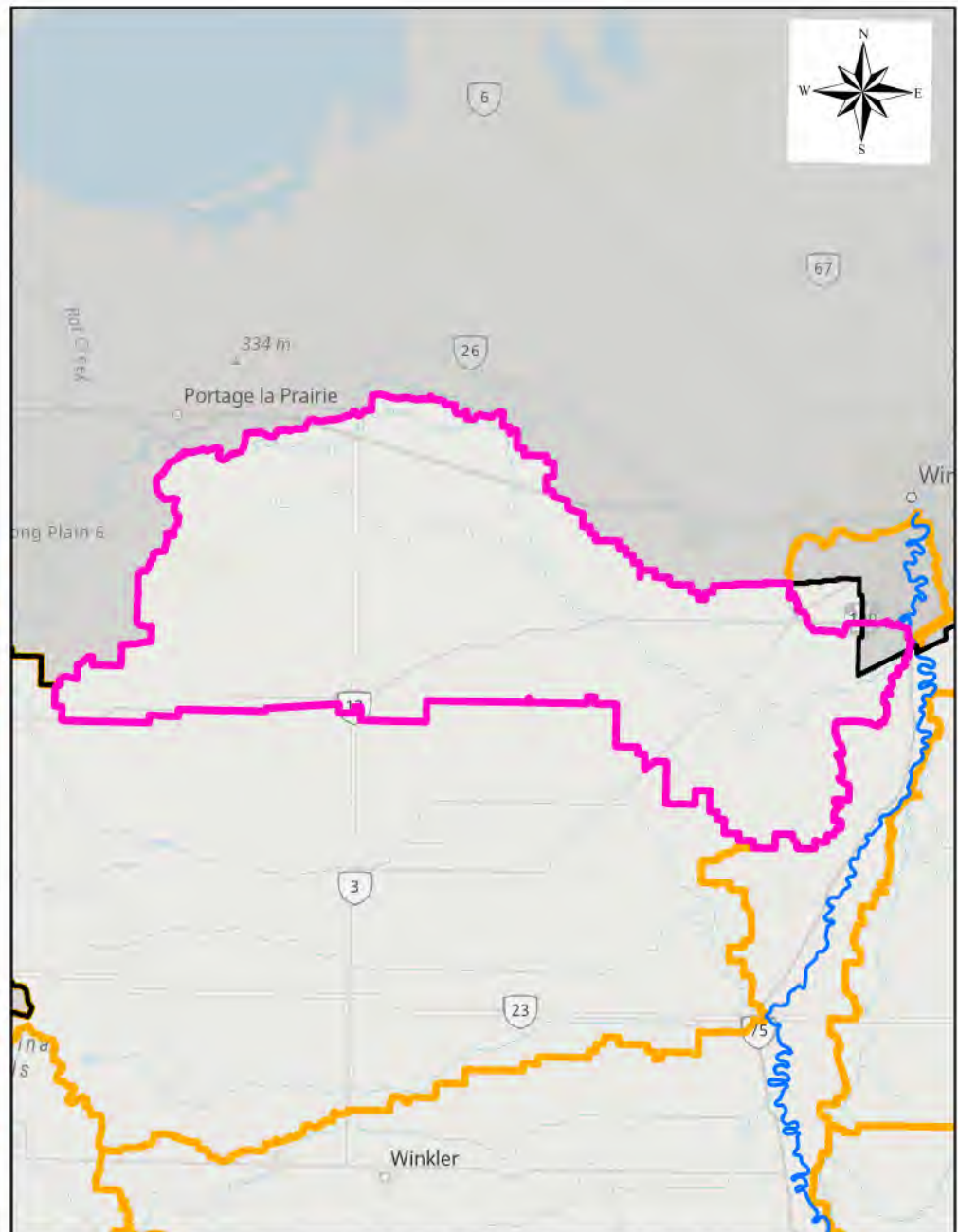




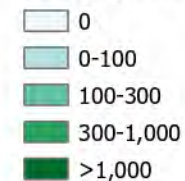
HUC 12 Total Phosphorous
Loads (lbs/yr) to Canada

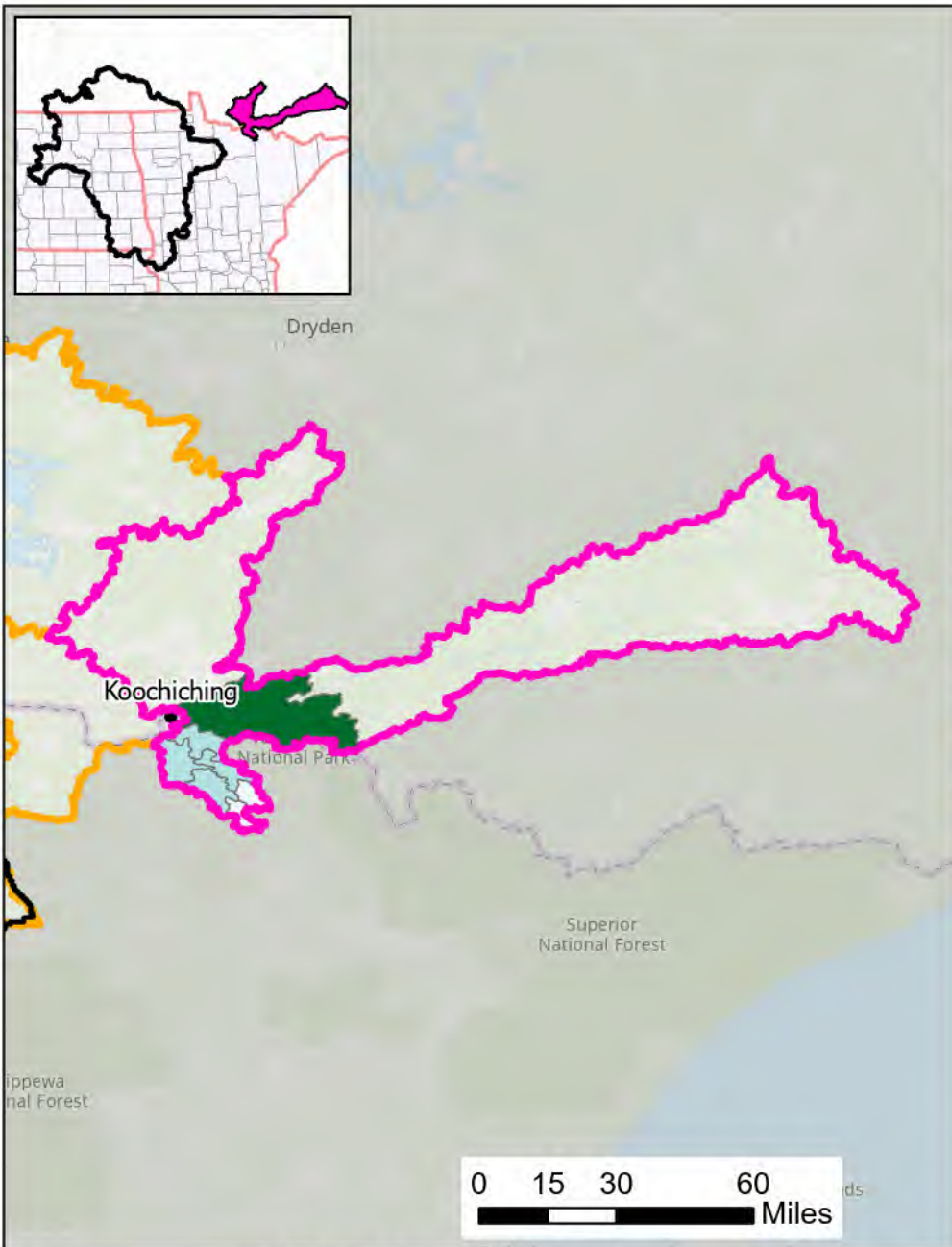


Total and Point Source Phosphorus loads from HUC 12 watersheds within the 09020319 HUC 8 La Salle River

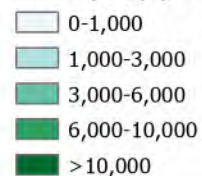


HUC 12 Total Phosphorus Point
Source Loads (lbs/yr) to Canada





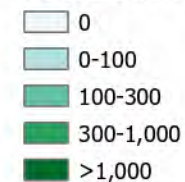
HUC 12 Total Phosphorous Loads (lbs/yr) to Canada

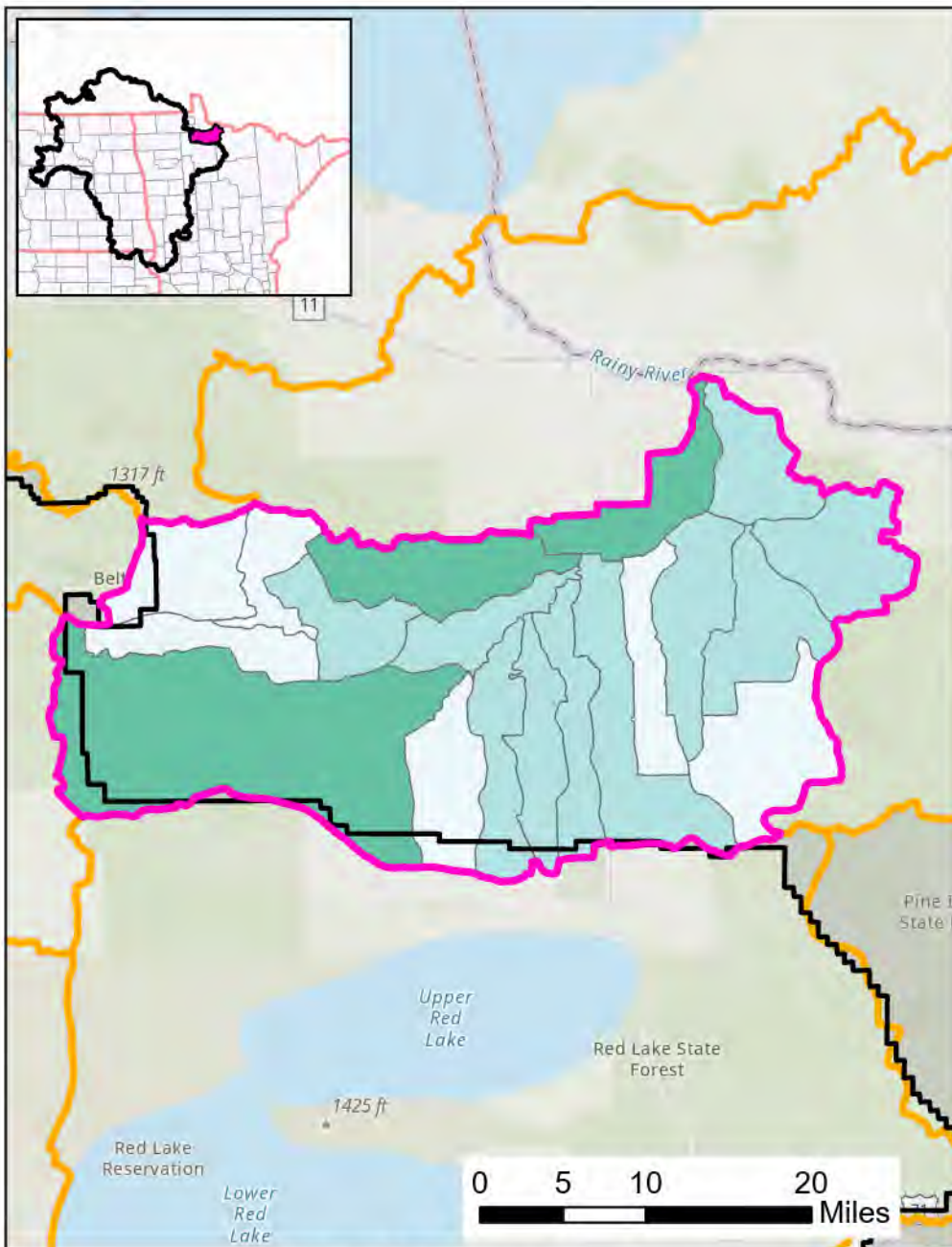


Total and Point Source Phosphorus loads from HUC 12 watersheds within the 09030003 HUC 8 Rainy Lake

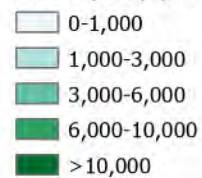


HUC 12 Total Phosphorus Point Source Loads (lbs/yr) to Canada

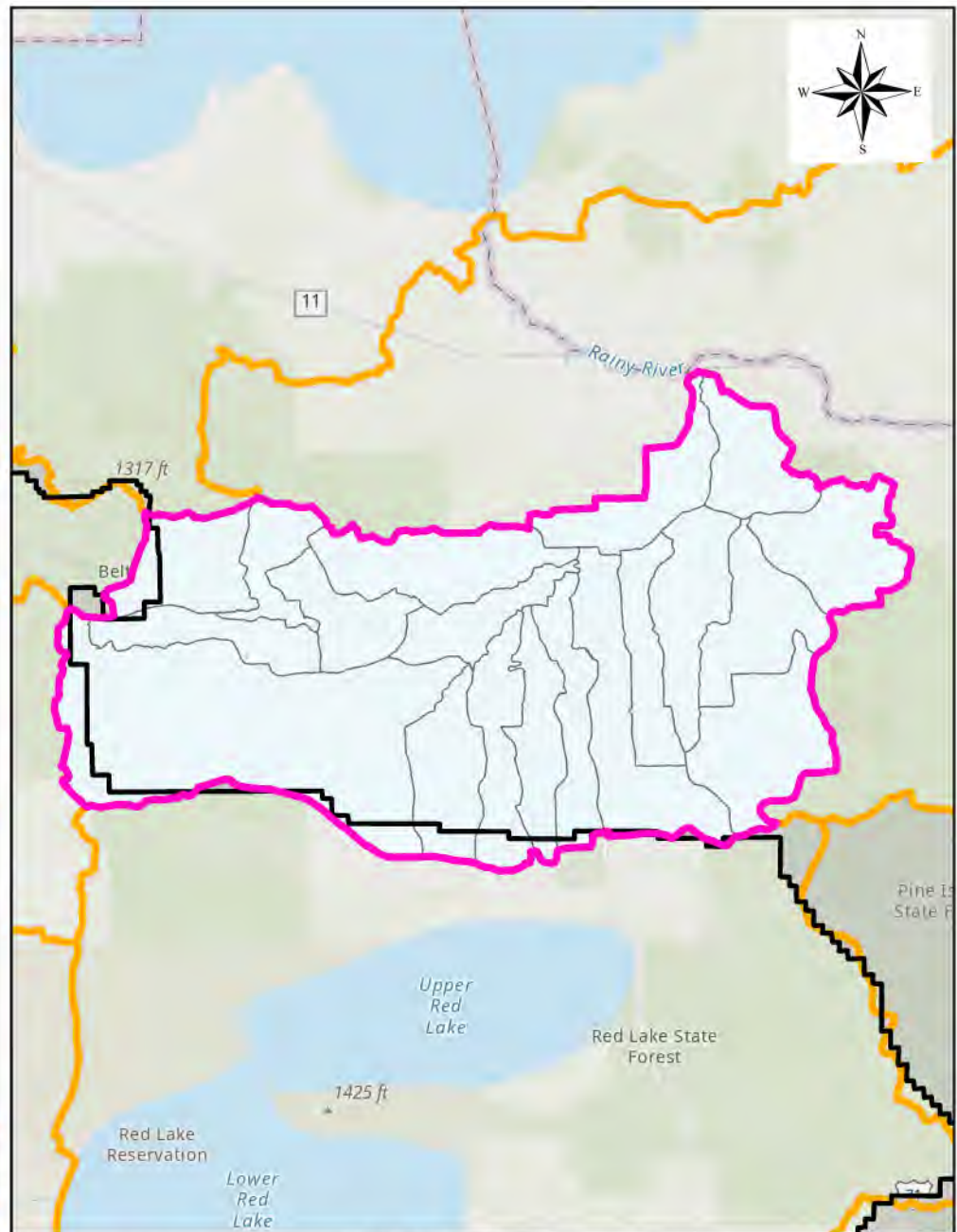




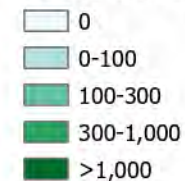
HUC 12 Total Phosphorous
Loads (lbs/yr) to Canada

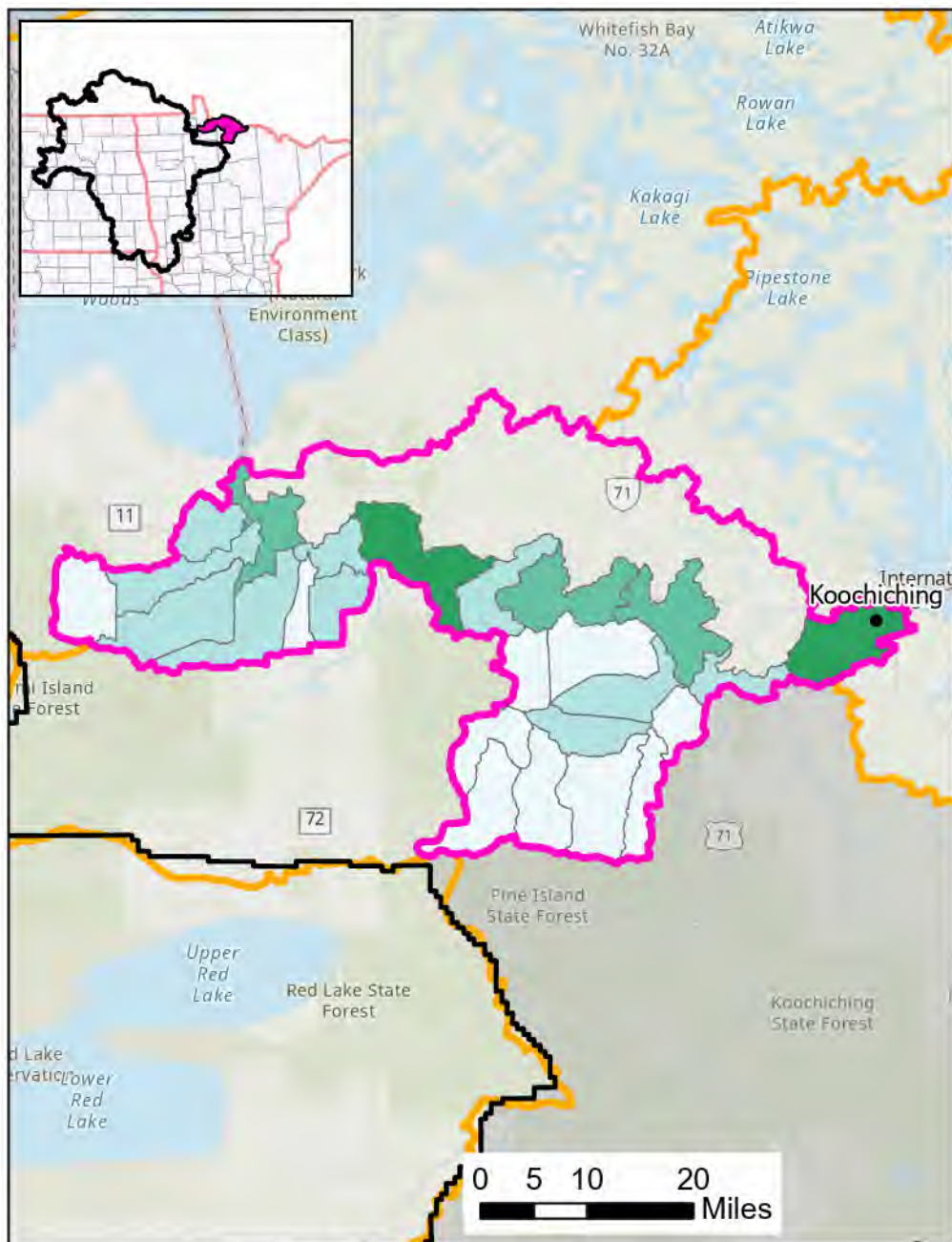


Total and Point Source Phosphorus loads from HUC 12 watersheds within the 09030007 HUC 8 Rapid

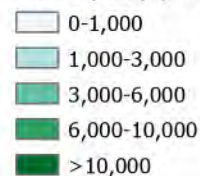


HUC 12 Total Phosphorus Point
Source Loads (lbs/yr) to Canada

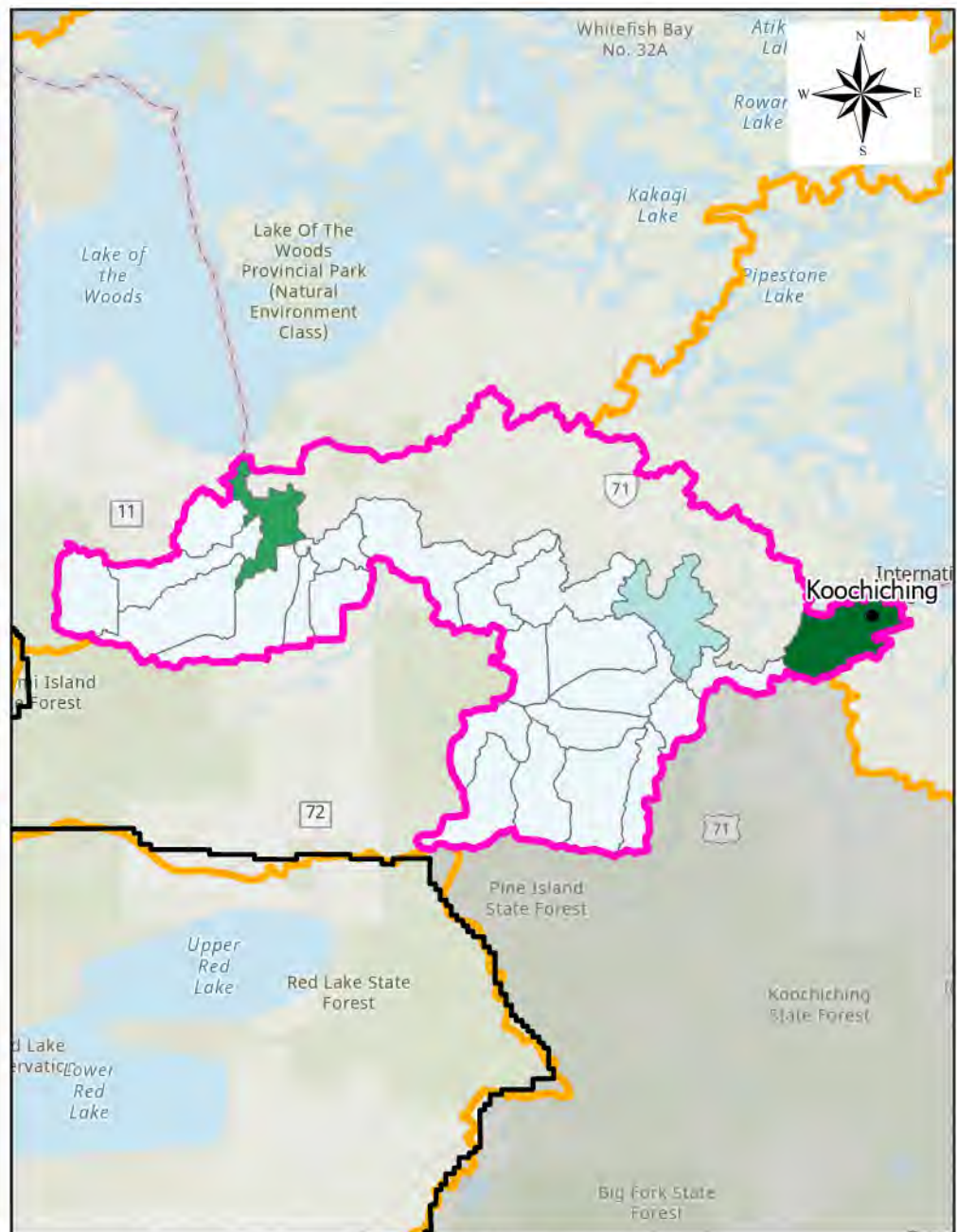




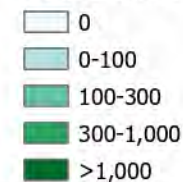
HUC 12 Total Phosphorous
Loads (lbs/yr) to Canada

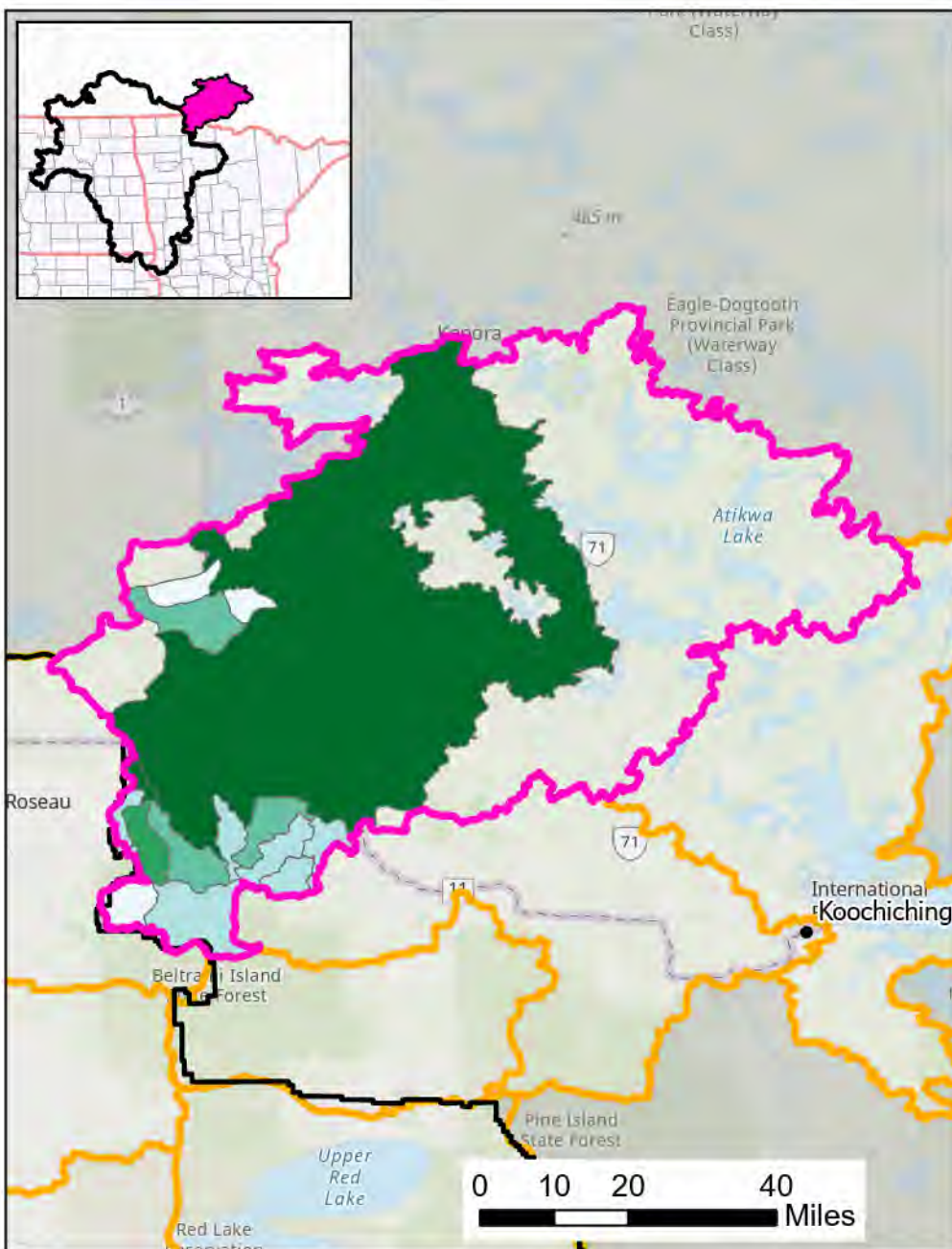


Total and Point Source Phosphorus loads from HUC 12 watersheds within the 09030008 HUC 8 Lower Rainy

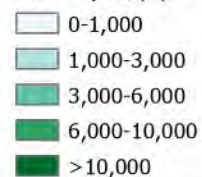


HUC 12 Total Phosphorus Point
Source Loads (lbs/yr) to Canada

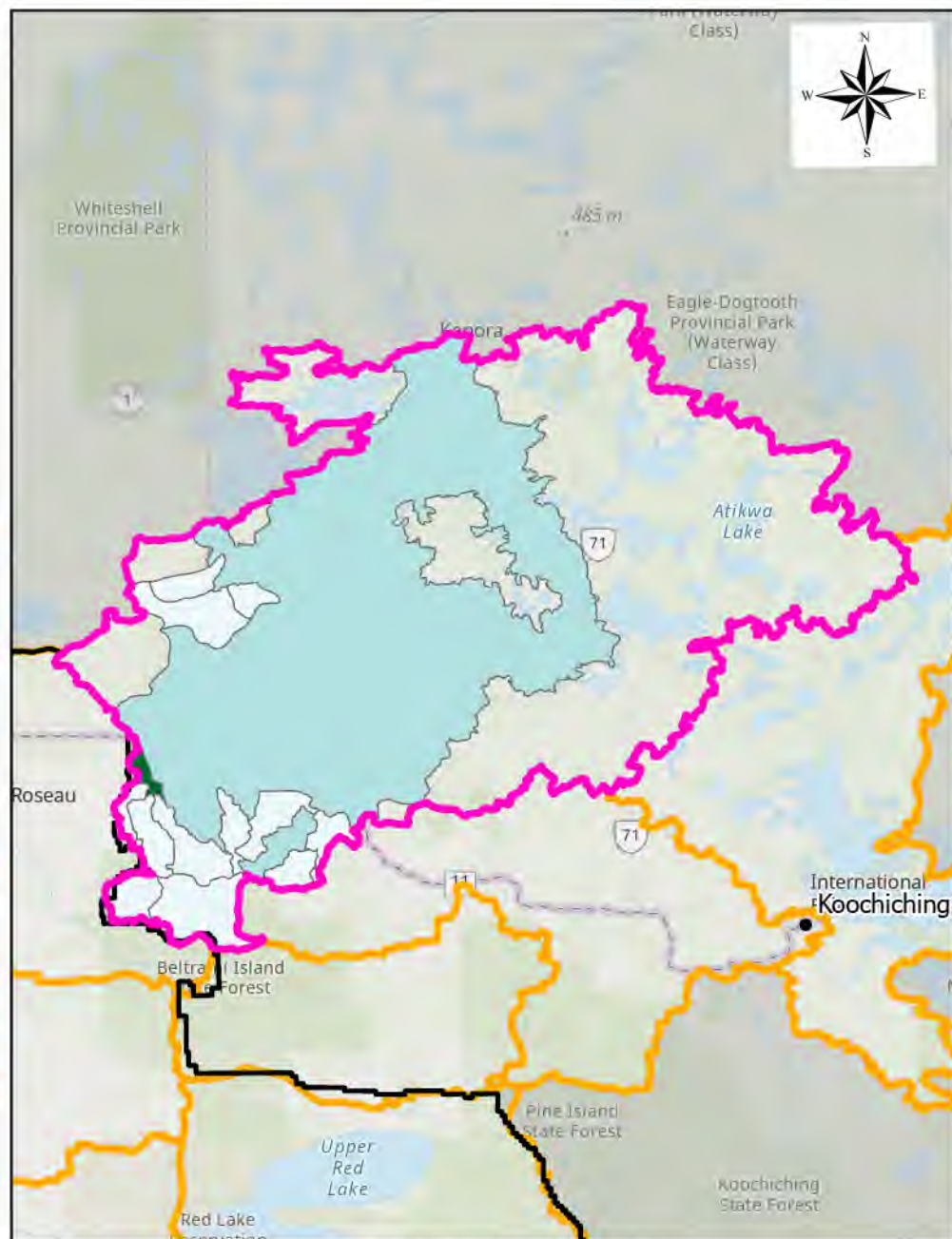




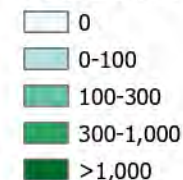
HUC 12 Total Phosphorous Loads (lbs/yr) to Canada



Total and Point Source Phosphorus loads from HUC 12 watersheds within the 09030009 HUC 8 Lake of the Woods



HUC 12 Total Phosphorus Point Source Loads (lbs/yr) to Canada



Appendix B – List of Permitted Facilities

List of permitted Minnesota Facilities in Red River Basin and Rainy River Basin. Provided by MPCA (MPCA, 2025).

HUC8	HUC Name	Facility Name
09030006	Big Fork River	Big Falls WWTP
09030006	Big Fork River	Bigfork WWTP
09030006	Big Fork River	Effie WWTP
09030006	Big Fork River	MDNR Scenic State Park
09030006	Big Fork River	Michalek Excavating
09030006	Big Fork River	Northome WWTP
09030006	Big Fork River	Shot Rock - Margie Quarry
09020106	Buffalo River	Aggregate Industries Pit 21
09020106	Buffalo River	Audubon WWTP
09020106	Buffalo River	Barnesville WWTP
09020106	Buffalo River	Glyndon WWTP
09020106	Buffalo River	Hawley WWTP
09020106	Buffalo River	Hitterdal WWTP
09020106	Buffalo River	Holcim - Pit 21
09020106	Buffalo River	Lake Park WWTP
09020106	Buffalo River	Spring Prairie Colony
09020106	Buffalo River	Spring Prairie Colony - Hawley
09020305	Clearwater River	Bagley WWTP
09020305	Clearwater River	Clearbrook WWTP
09020305	Clearwater River	Fosston WWTP
09020305	Clearwater River	Gonvick WWTP
09020305	Clearwater River	McIntosh WWTP
09020305	Clearwater River	Oklee WWTP
09020305	Clearwater River	Plummer WWTP
09030009	Lake of the Woods	Marvin Windows & Doors
09030009	Lake of the Woods	Marvin Windows and Doors
09030009	Lake of the Woods	Northstar Materials Inc dba Knife River Materials
09030009	Lake of the Woods	Springsteel Island Sanitary District
09030009	Lake of the Woods	Williams WWTP
09030005	Little Fork River	Cook WWTP
09030005	Little Fork River	Hibbing Taconite Co - Tails Basin Area
09030005	Little Fork River	ISD 2142 Pre-Kindergarten to Grade 12 N School
09030005	Little Fork River	Littlefork WWTP
09030005	Little Fork River	US Steel - Minntac Tailings Basin Area
09030005	Little Fork River	US Steel Corp - MN Ore Operations - Minntac Tailings Basin
09020102	Mustinka River	Big Stone Co Hutterite Colony Graceville
09020102	Mustinka River	Big Stone Hutterite Colony

09020102	Mustinka River	Dumont WWTP
09020102	Mustinka River	Elbow Lake WWTP
09020102	Mustinka River	Graceville WWTP
09020102	Mustinka River	Herman WWTP
09020102	Mustinka River	Wendell WWTP
09020102	Mustinka River	Wheaton WWTP
09020103	Otter Tail River	Becker County Sanitary Landfill - Closed
09020103	Otter Tail River	Bongards' Creameries - Perham
09020103	Otter Tail River	Detroit Lakes Water Reclamation Facility
09020103	Otter Tail River	Detroit Lakes WWTP
09020103	Otter Tail River	Elizabeth WWTP
09020103	Otter Tail River	Fergus Falls WWTP
09020103	Otter Tail River	Forest Hills Golf & RV Resort WWTP
09020103	Otter Tail River	Green Plains Otter Tail LLC
09020103	Otter Tail River	Otter Tail Power Co - General Office
09020103	Otter Tail River	Otter Tail Power Co - Hoot Lake Plant
09020103	Otter Tail River	Pelican Rapids WWTP
09020103	Otter Tail River	Perham Resource Recovery Facility
09020103	Otter Tail River	Vergas WTP
09020103	Otter Tail River	Vergas WWTP
09030008	Rainy River - Baudette	Anchor Bay Mobile Home Park
09030008	Rainy River - Baudette	Baudette WWTP
09030008	Rainy River - Baudette	Boise White Paper LLC
09030008	Rainy River - Baudette	Boise White Paper LLC - Intl Falls
09030008	Rainy River - Baudette	ISD 363 - Indus School
09030008	Rainy River - Baudette	NKASD WWTP
09030001	Rainy River - Headwaters	Cliffs - Dunka Mining Area
09030001	Rainy River - Headwaters	Cold Spring Granite Co
09030001	Rainy River - Headwaters	Ely WTP
09030001	Rainy River - Headwaters	Ely WWTP
09030001	Rainy River - Headwaters	Kasota Stone Fabricators Inc - L231
09030001	Rainy River - Headwaters	Northshore Mining Co - Babbitt
09030001	Rainy River - Headwaters	UofM NOvA Far Detector Bldg Water Treatment System
09030001	Rainy River - Headwaters	Winton WWTP
09020303	Red Lake River	7-Clans Casino WWTP
09020303	Red Lake River	American Crystal Sugar - Crookston
09020303	Red Lake River	Crookston WWTP
09020303	Red Lake River	Fisher WWTP
09020303	Red Lake River	Red Lake Falls WWTP
09020303	Red Lake River	RJ Zavoral and Sons Inc
09020303	Red Lake River	Saint Hilaire WWTP
09020303	Red Lake River	Strata Corp
09020303	Red Lake River	Thief River Falls Power Plant
09020303	Red Lake River	Thief River Falls WWTP
09020306	Red River of the North - Grand Marais Creek	East Grand Forks WWTP

09020306	Red River of the North - Grand Marais Creek	Oslo WWTP
09020107	Red River of the North - Marsh River	ACSC - East Grand Forks MN
09020107	Red River of the North - Marsh River	Ada WWTP
09020107	Red River of the North - Marsh River	Georgetown WWTP
09020107	Red River of the North - Marsh River	Halstad WWTP
09020107	Red River of the North - Marsh River	Perley WWTP
09020107	Red River of the North - Marsh River	Shelly WWTP
09020301	Red River of the North - Sandhill River	American Crystal Sugar - East Grand Forks
09020301	Red River of the North - Sandhill River	Climax WWTP
09020301	Red River of the North - Sandhill River	Fertile WWTP
09020301	Red River of the North - Sandhill River	JC and J Trucking
09020301	Red River of the North - Sandhill River	Nielsville WWTP
09020301	Red River of the North - Sandhill River	Spokely Farms
09020301	Red River of the North - Sandhill River	Winger WWTP
09020311	Red River of the North - Tamarac River	CHS
09020311	Red River of the North - Tamarac River	Enbridge Line 3
09020311	Red River of the North - Tamarac River	Great Lakes Gas Transmission - Station 1
09020311	Red River of the North - Tamarac River	Karlstad WWTP
09020311	Red River of the North - Tamarac River	Kennedy WWTP
09020311	Red River of the North - Tamarac River	Stephen WWTP
09020314	Roseau River	Roseau WWTP
09020314	Roseau River	Warroad WWTP
09020309	Snake River	Alvarado WWTP
09020309	Snake River	Argyle WWTP
09020309	Snake River	Hawkes Co Inc - Peat Harvesting
09020309	Snake River	Middle River WWTP
09020309	Snake River	Newfolden WWTP

09020309	Snake River	Viking WWTP
09020309	Snake River	Warren WWTP
09020304	Thief River	Goodridge WWTP
09020304	Thief River	Grygla WWTP
09020312	Two Rivers	Badger WWTP
09020312	Two Rivers	Central Boiler Inc
09020312	Two Rivers	Central Boiler, Inc
09020312	Two Rivers	Greenbush School ISD 2683
09020312	Two Rivers	Greenbush WWTP
09020312	Two Rivers	Hallock WWTP
09020312	Two Rivers	Lake Bronson WWTP
09020312	Two Rivers	Lancaster WWTP
09020104	Upper Red River of the North	American Crystal Sugar - Moorhead
09020104	Upper Red River of the North	Breckenridge WWTP
09020104	Upper Red River of the North	Comstock WWTP
09020104	Upper Red River of the North	Minn-Dak Farmers Cooperative
09020104	Upper Red River of the North	Moorhead RR Underpass Project
09020104	Upper Red River of the North	Moorhead WWTP
09020104	Upper Red River of the North	NuStar - Moorhead Terminal
09020104	Upper Red River of the North	Rothsay WWTP
09020104	Upper Red River of the North	Sabin WWTP
09020302	Upper/Lower Red Lake	Kelliher WWTP
09020302	Upper/Lower Red Lake	Northstar Materials Inc dba Knife River Materials
09020302	Upper/Lower Red Lake	Stoney Creek Sand & Gravel
09030002	Vermilion River	ArcelorMittal Minorca Mine Inc
09030002	Vermilion River	Crane Lake WWTP
09030002	Vermilion River	MDNR Soudan State Park
09030002	Vermilion River	Orr WWTP
09030002	Vermilion River	Tower/Breitung WWTP
09020108	Wild Rice River	Borup WWTP
09020108	Wild Rice River	Felton WWTP
09020108	Wild Rice River	Gary WWTP
09020108	Wild Rice River	Hendrum WWTP
09020108	Wild Rice River	Twin Valley WWTP
09020108	Wild Rice River	Ulen WWTP

Appendix C - Example Offset Practices

This appendix represents a selection of possible BMPs that could be implemented to produce a measurable TP load reduction benefit which could be part of a TP offset agreement. This does not represent an all-inclusive list of BMPs that could be accepted as part of an offset plan nor does it imply superior load reduction potential over non-listed practices, but many have wide acceptance and use within the Red River Basin.

In-field practices

In-field BMPs generally represent any practice or management technique that can be implemented within the boundary of a cultivated field, in tandem with crops or other plantings. This can include planting and cropping management, tillage practices, water storage techniques, nutrient management, etc. Brief descriptions of these practices are provided below and can also be found here:

<https://www.nrcs.usda.gov/resources/guides-and-instructions/conservation-practice-standards>

Conservation Cover (327)

In areas where agricultural land is not currently cultivated or in areas where farming is not feasible or practical, conservation cover can be used to establish and maintain perennial vegetative cover to protect soil and water resources. Benefits from conservation cover include reducing soil erosion and sedimentation, enhancing wildlife habitat, and improving water quality.

No-Till/Strip-Till (329)

Cultivation of agricultural areas with limited disturbance to the soil surface is meant to manage the amount of crop and plant residue at the soil surface. This reduces surface erosion by maintaining plant residue on the soil surface year round and increases soil health and organic matter.

Cover Crops (340)

Implementing a cover crop consists of growing grasses, small grain, or legumes for seasonal protection of soil that would otherwise be barren. Cover crops help to reduce erosion, add fertility and organic matter to the soil, increase infiltration and aeration of the soil, and improve overall soil health.

Reduced Tillage (345)

Cultivation of fields with reduced disturbance to the soil surface is meant to manage the amount of crop and plant residue at the soil surface. This decreases surface erosion by maintaining plant residue on the soil surface year round and improves soil health and increases organic matter.

Forage/Biomass planting (512)

Establishing perennial herbaceous plants suitable for pasture or hay production can be used to not only serve as a feedstock for animals, but can also reduce soil erosion, improve water quality by preventing sediment and nutrient runoff, and increase soil health by increasing soil organic matter.

Prescribed Grazing (528)

Controlled grazing and harvest of vegetation by livestock or other animals with the intent to achieve specific management objectives. Prescribed grazing can improve surface and/or subsurface water quality by reducing soil erosion and improving soil health.

Drainage Water Management (554)

Drainage water management is the process of managing the soil water table elevation by regulating the flow from a surface or subsurface agricultural drainage system. It can be used to reduce nutrient and chemical loads from drainage systems into downstream receiving waters.

Nutrient Management (590)

Nutrient management includes controlling the source, placement, rate, and timing fertilizers and soil amendments to prevent excess nutrients from entering surface and ground water.

Edge-of-field practices

Edge-of-field practices are those BMPs that work to catch runoff and contaminants from agricultural fields or facilities, reducing or preventing further transport downstream. Brief descriptions of these practices are provided below and can also be found here: <https://www.nrcs.usda.gov/resources/guides-and-instructions/conservation-practice-standards>

Filter Strip (393)

Filter strips are areas of herbaceous vegetation at the boundary of fields that trap and remove contaminants from overland flow. The purpose of a filter strip is to reduce the concentration of dissolved or suspended contaminants from runoff and overland flow.

Water and Sediment Control Basin (638)

A water and sediment control basin consists of an embankment constructed across an area of concentrated surface flow. Water is trapped and ponded behind the embankment, reducing erosion, trapping sediment and associated contaminants, and reducing downstream runoff.

Grassed Waterway (412)

Grassed waterways are vegetated channels which transport surface water across the landscape in a manner that slows the water velocity, preventing erosion and improving water quality.

Tile-end Reactor (782)

A structure or system that uses a nutrient capturing media to reduce the concentration in subsurface agricultural drainage flow. Nutrient reduction is accomplished through adsorption to the media, or other physical, chemical, or biological processes. Tile-end reactors are meant to improve water quality by reducing the concentration of nutrients from subsurface agricultural drainage systems.

Near channel and in-channel practices

Near channel and in-channel practices are meant to prevent nutrients and sediment from entering streams, stabilize streambanks, or alter the stream and floodplain to improve water quality and hydrologic stability. Brief descriptions of these practices are provided below and can also be found here: <https://www.nrcs.usda.gov/resources/guides-and-instructions/conservation-practice-standards>

Riparian Buffer (390, 391)

Riparian buffers consist of grasses, brush, trees, or other vegetation that is tolerant of intermittent flooding or saturated soils in the transitional zone between upland areas and streams or ditches. Buffers can maintain or improve water quality by trapping sediment and particulate contaminants or by preventing the continued movement of dissolved nutrients and chemicals to nearby waterbodies.

Note that buffers mandated by Minnesota Buffer Law are not eligible for offsets. Riparian buffers beyond the required size may be eligible for offset credit generation.

Grade Stabilization (410)

Grade stabilization can be considered any structure used to protect areas of the landscape with high slopes and concentrated surface water flow. These structures can improve water quality by reducing erosion and the concentrations of associated contaminants.

Streambank and Shoreline Protection (580)

Structures or treatments used to stabilize and protect streambanks, channels, and shorelines. These structures can improve water quality by preventing bank erosion and reducing concentrations of associated contaminants.

Multi-stage ditch (582)

A natural, improved, or constructed open channel that can transport water in a manner that is more similar to a natural channel structure than an artificial ditch system. This can reduce excessive streambank and instream erosion, and contaminants associated with eroded sediments.

Saturated Buffer (604)

A subsurface network of perforated pipes used to distribute drainage system discharge beneath a vegetated buffer, and eventually discharge that drainage water to a nearby channel or ditch. The saturated buffer reduces dissolved nutrient loading from subsurface drain outlets through vegetation uptake and denitrification.

Wetland (656, 657, 658, 659)

Natural or artificial wetlands that are in areas of existing wetlands, formerly existing wetlands, or in areas that were not previously wetlands. The improved or created wetlands are used for the biological treatment of water. Sediment and nutrients in runoff or wastewater from agricultural production, livestock, stormwater, etc. can be deposited or reduced within the wetland.

Note that wetlands enrolled in BWSR's wetland bank are not eligible for credit generation.

Urban practices

Certain practices and BMPs are better adapted and employed in an urban environment but can also be used to reduce nutrient loads to surface waters. Many urban BMPs are implemented through Municipal Separate Storm Sewer System (MS4) requirements. Urban BMPs used in offset practices must go beyond MS4 requirements. Brief descriptions of these practices are provided below and can also be found here: https://stormwater.pca.state.mn.us/index.php?title=Structural_stormwater_Best_Management_Practices

Constructed Stormwater Pond/Wetland

Any constructed basin that is built for the purpose of capturing and storing stormwater runoff in order to reduce or prevent downstream water quantity or quality impacts from that stormwater. Runoff water enters the pond or wetland where particulate contaminants can be deposited and dissolved contaminants can be incorporated into wetland vegetation.

Iron-enhanced Sand Filter

Iron-enhanced sand filters use sand with the addition of iron particles as a particulate filtration media. The iron that is added to the sand increases the removal of several dissolved constituents such as phosphorus from stormwater.

Bioretention Pond/Infiltration Basin

Bioretention BMPs are designed to infiltrate stormwater, reducing downstream flow and the movement of particulate and dissolved contaminants. The infiltration process traps and filters out particulate matter, while physical, chemical, and/or biological processes reduce dissolved nutrients and contaminants.

Street Sweeping

Street sweeping involves the removal of sediment and other accumulated materials on in urban and suburban areas. This process remove nutrients, sediment, and other chemicals from the landscape surface before they have the potential to run off to any nearby waterbody.

Lakeshore Restoration/Protection

Urban lakeshores can be a source of phosphorus to lakes from eroding banks and yard practices. Shoreline stabilization, restoration, or protection can reduce sediment and nutrient loading to lakes.

Appendix D - Examples of Eligible Trading Scenarios

This appendix provides examples of projects that could be used to complete an offset or trade. Each example project has been set into a template format that could be used for any offset project within the Red River Basin for consideration of a water quality trade in Minnesota. There are a few important exceptions to note for these example projects:

1. None of the example projects imply an agreement to complete a trade. The purpose of these examples are to show clear pathways towards the information that would be needed if a trade were to be completed.
2. Any real trade would need to be negotiated between the parties involved in the trade with the final authority to approved the trade resting with the Minnesota Pollution Control Agencies.
3. A permitted entity requesting a trade will need language in their permitted that allows for water quality trading.
4. Additional information will likely be needed beyond what is highlighted in these examples. For instance, the resources were not available to collect soil samples and analyze them at an approved laboratory for their total phosphorus content, so simplified assumptions were utilized for these example projects (see the Stony Creek example below). In order to execute a trade, more detailed information on the water quality benefits of the project will likely be required.

The following example project are included in this appendix:

- Stony Creek – a stream restoration project
- Black River Impoundment – A flood water retention impoundment
- South Branch Rock Arch Rapids – A large grade-stabilization implemented as a rock arch rapids

The full scenario for each of these project examples includes the design plans for each example project. Each of these design plans would add hundreds, if not thousands, of pages to this appendix. Therefore, only the summary memo for each example project is included in the body of this appendix. A separate and complete example package for each of these projects is available upon request through the Red River Basin Commission by emailing info@redriverbasincommission.org .

Technical Memorandum

To:

From:

Subject: Stony Creek Restoration Plan Package Proposal for Total Phosphorus Offset

Date: 11/12/2025

1. Purpose and Overview

This technical memorandum is intended to serve as the proposed BMP package submittal consistent with Minnesota Pollution Control Agency Trading Guidance Section 5.1 and Section 5.2.1 (<https://www.pca.state.mn.us/business-with-us/water-quality-trading>; accessed on 08/28/2025) as well as the Red River Basin Water Quality Offset Plan. This technical memorandum contains the following information:

Baseline Information

- This section includes information on the target water body, baseline water quality conditions, and the assessment of baseline conditions for XXXXX (entity seeking to offset its' baseline)

Practice Information

- This section includes a description of the practice that is proposed for the offset including the practice type, location, function, installation year, and lifespan. This section also references necessary design information associated with the proposed practice.

Offset Information

- This section describes the methods and outcomes associated with the total phosphorus offset from the proposed practice. It also includes information connected to trade ratios, risk/uncertainty, and offset renewal.

Declarations

- This section describes declarations associated with the proposed practice. This includes declarations connected to funding restrictions, limitations of sale, stacking of benefits, antidegradation or backsliding, and project stewardship.

Operations and Maintenance

- This section describes the monitoring and maintenance plan associated with the proposed practice to verify that the offset total phosphorus continues to be delivered.

Steps to Establish Trade

- This section provides the pathway forward from transitioning this proposed offset practice into a water quality trade

Supporting Material

- This section describes any appendices that are provided in support of this proposal

2. Baseline Information

Table 1 provides a summary of the baseline information associated with the proposed BMP package. *Target Water Body* is the location at which the goal of reduction in Total Phosphorus (TP) is to occur, the

Canadian border along the Red River of the North. The *Baseline Year(s)* were chosen per an International Joint Commission (IJC) agreement. *Baseline Loading at Buyer* is the amount of phosphorus loading occurring at the location of the offset buyer. *Calculations Method* describes model(s) or method(s) used to estimate the loading at the waterbody. *Baseline Loading At Waterbody* describes existing annual TP load on the Red River of the North at the Canadian Border. *Assimilation Method* describes model(s) or method(s) used to estimate the loading at the target water body. *Baseline Load Reduction Needed At Waterbody* is the amount of load reduction needed to meet the phosphorus loss limits proposed by the IJC. In this instance, the Red River of the North at Canadian Border has a loading limit of 3,086,500 lbs./year of TP (1400 metric tons) The remainder of this section describes how this summary baseline information was developed.

Table 1. Baseline information associated with the proposed BMP package.

Attribute	Value
Target Water Body:	Red River of the North at Canadian Border
Baseline Year(s):	2019-2024
Baseline Loading at Buyer:	Xx lbs./year of TP
Calculation Method:	GIS Elevation Analysis, HEI Field Edge Calculator
Baseline Loading at Waterbody:	5,418,556 lbs./year of TP
Assimilation Method:	GIS Elevation Analysis, HEI Field Edge Calculator, P-ROC/SPARROW model
Baseline Load Reduction Needed at Waterbody:	2,332,085 lbs./year of TP accounting for MOS

The Red River of the North at the Canadian Border has a baseline loading of 5,418,556 lbs./year of TP. The U.S. has a baseline phosphorus reduction at the border of the U.S. and Canada along the Red River of the North of 2,332,085 lbs. (accounting for MOS).

3. Practice Information

Table 2 provides summary information associated with the proposed practice. The *Geographic Extent of Watershed* describes the acres treated and the HUC 12 of the drainage area or footprint of the BMP. The

Offset Practice Type name of the practice along the NRCS code, if available. The *Offset Practice Description* is a brief description of the practice being proposed to facilitate the reduction of phosphorus. The *Offset Practice Installation Year* is the year the project became active/operable. *Offset Practice Lifespan* is the number of years in which the practice should last if proper maintenance and management have been followed through. The remainder of this section describes the proposed practice.

Table 2. Practice information associated with the proposed BMP package.

Attribute	Value
Geographic Extent of Watershed:	HUC 12: Upper Stony Creek (090201060501) Drainage Area: 47.53 acres
Offset Practice Type:	Stream restoration; NRCS Code 580
Offset Practice Description:	Installation of Streambank and Shoreline Protection
Offset Practice Installation Year:	2024
Offset Practice Lifespan:	20 years

Over a century ago, the construction of several legal ditch systems and other channel straightening efforts eliminated hundreds of acres of quality stream habitat with the Buffalo-Red River Watershed District with the goal of improving farmland drainage. Stony Creek became one of these streams when it was straightened in 1915 to 1916 and became Clay County Ditch No.31. Stony Creek and downstream waterways are now impaired for sediment (turbidity). Stony Creek sediment loading comes mainly from two sources: 1. Sever bank erosion and 2. Breakout flows causing field erosion and carrying significant volumes of sediment downstream. During 2 inch and larger rainfall events, breakout flows occur and severe scouring and gulying results. The current ditch capacity is about a 2-year event, at which time breakout flows begin.

The restoration, Figure 1, consists of a two-stage channel designed to mimic natural stream conditions. Channel geometry was designed through a collaborative effort between Houston Engineering Inc. and the MN DNR River Ecology Unit. The overall restoration is based on the Rosgen E-Channel design. The two-stage channel consists of a meandering low flow channel excavated into a valley floodplain. Pools were constructed along the outside bends of the channel to increase the overall channel area, trap water, and reduce flow velocities. Streamflows conveyed within the meandering low-flow channel range from baseflow conditions up to flows from a 1.5-year runoff event. The floodplain valley width was designed to convey runoff flows from larger events and restrict breakout flows up to the 10-year runoff event.

The stream restoration (NRCS Code 580 Streambank and Shoreline Protection bmp) was built in the Upper Stony Creek watershed, with 47.53 acres upstream of the end point of the project. This restoration converted 4.3 channelized stream miles of Stony Creek to 5.4 miles of meandering stream with an additional 187 acres of riparian wetland and prairie habitat. See Appendix C: Figure 1 and Figure 3 for maps of the project area. The lifespan of this project, according to the USDA National Handbook of Conservation Practices, is 20 years. The project was completed and operational in 2024.

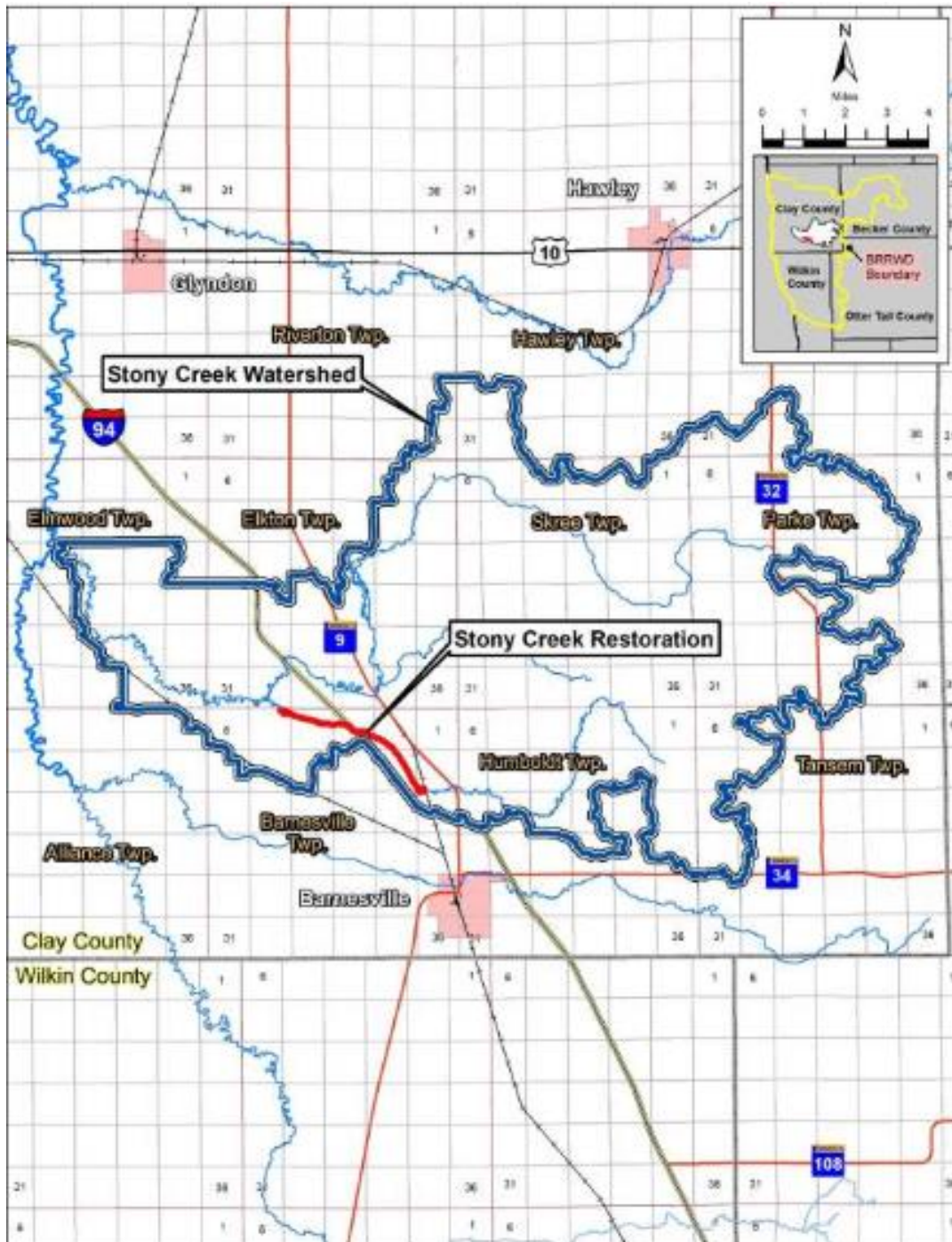


Figure 1. Project Location

4. Offset Information

Table 3 provides a summary of information associated with the proposed TP offsets associated with the BMP package. *Treatment Offset At Practice* is the amount of annual reduction in pounds, of TP at field edge/end of BMP. The *Offset Calculation Method(s)* describes model(s) or method(s) used to estimate the treatment offset. *Treatment Offset at Target Waterbody* is the estimated annual TP offset at Red River of the North at Canadian border, without a trade ratio applied. *Assimilation Calculation Method* described the model(s) or method(s) used to estimate the annual TP offset. *Trade Ratio* is the standard trade ratio (margin of safety) currently being used for MPCA water quality trading offset documentation for a point to nonpoint source trade. *Offset Mass* is the estimated annual TP offset at Red River of the North at Canadian border including the trade ratio. *Risk and Uncertainty* lists model(s) and method(s) in which risk or uncertainty could occur. *Duration of Offset* is based on the duration of the agreement between buyer and seller. *Offset Renewal* is based on the duration of the agreement between buyer and seller. The remainder of this section describes how this offset information was derived.

Table 3. Total Phosphorus offset information associated with the proposed practice.

Attribute	Value
Treatment Offset at Practice:	2,396 lbs./year of TP (see Appendix A)
Offset Calculation Method:	GIS Analysis/ P-ROC/ SPARROW model
Treatment Offset at Target Waterbody:	1518 lbs./year of TP (see Appendix B)
Assimilation Calculation Method:	GIS Elevation Analysis, HEI Field Edge Calculator, P-ROC/ SPARROW model
Trade Ratio:	Assumed 2.6 as standard from MPCA documentation
Offset Mass:	584 lbs./year of TP
Risk and Uncertainty:	Elevation data uncertainty, Assumptions within the BWSR calculator soil phosphorus concentrations, uncertainty in SPARROW delivery fraction

Duration of Offset:	Filled in based on the duration of the agreement between buyer and seller
Offset Renewal:	Filled in based on the duration of the agreement between buyer and seller

Using the information from the Engineer's Report and a GIS elevation analysis, estimations were made for annual sediment losses within the existing stream channel. Channel elevations from the 2008 LiDAR were compared to elevations from the more recent 2021 LiDAR data to get an idea of annual sediment erosion in the channel. Generally, through subtraction of the two elevation layers the volume of sediment loss due to erosion in the measured channel area was estimated.

Between 2008 and 2021 an estimated sediment volume of 712,649 cubic feet was lost from the existing stream channel. That suggests an annual rate of sediment loss of 54,819 cubic feet per year. Estimations of phosphorus reduction are based on a GIS analysis of localized sediment erosion. The area considered in the estimation was a 75-foot buffer from the centerline of the existing ditch. It is assumed that the restoration will prevent all of the measured erosion and associated phosphorus loss from within the area of analysis.

The HEI Field Edge Calculator was then used to determine the amount of phosphorus loss associated with the sediment erosion between 2008 and 2021, prior to the restoration project. Based on soil type, soil bulk density, and expected phosphorus concentration of the soil, approximately 2,396 lbs. of phosphorus was lost from the existing stream channel each year.

After the phosphorus load reduction estimate was calculated for the Stony Creek Restoration, measurable load reduction at the Canadian Border was estimated using the SPARROW model data and instream phosphorus loss calculations. It is assumed that the Stony Creek Restoration project will prevent the measured erosion and associated phosphorus loss. The annual phosphorus reduction (2,396 lbs./yr) was then entered into HEI's Custom Load Offset tool, P-ROC to calculate the measurable load reduction benefit at the Canadian border and the measurable phosphorus offset that could be claimed. Assuming a trade ratio of 2.6, the measured phosphorus offset was determined to be 584 lbs./year.

5. Declarations

The following declarations are made associated with the proposed practice within this BMP package.

Funding Restrictions

We are unaware of any funding restrictions associated with the proposed project that would preclude the development of total phosphorus offsets.

Limitations of Sale

Upon approval of a trade, both the buyer and project developer have agreed that this will be the sole total phosphorus credit associated with the proposed project so long as **Project Stewardship** agreements are in effect.

Multiple Offsets

We are unaware of any restrictions connected to the proposed BMP plan that would preclude the Buffalo-Red River Watershed District from pursuing water quality credits for other pollutants such as nitrogen or sediment.

Stacking

We are unaware of any restrictions connected to the proposed BMP plan that would preclude the Buffalo-Red River Watershed District from developing additional environmental attributes (e.g., greenhouse gas reductions or reductions in other water quality constituents) associated with the project.

Antidegradation or Backsliding

The proposed project within this BMP plan should not result in antidegradation or backsliding.

Project Stewardship

MN State Statute 103E.705 requires that after the construction of a drainage system has been completed, the drainage authority shall maintain the drainage system that is located in its jurisdiction, including the permanent strips of perennial vegetation under section 103E.021, and provide the repairs necessary to make the drainage system efficient. The drainage authority shall have the drainage system inspected on a regular basis by an inspection committee of the drainage authority or a drainage inspector appointed by the drainage authority. Open drainage ditches shall be inspected at a minimum of every five years when no violation of section 103E.021 is found and annually when a violation of section 103E.021 is found, until one year after the violation is corrected.

6. Operation and Maintenance

The Buffalo-Red River Watershed District is solely responsible for the maintenance of the project. At this time, as stated in section 6.3 of Appendix C, a Water Management District (WMD) is envisioned to cover costs not covered by existing grants and long-term maintenance of the project. The Water Management District will be specific to the establishment and maintenance of the Stony Creek Restoration Project.

7. Supporting Material

- Appendix A contains BMP phosphorus reduction estimates based on the GIS measured sediment erosion volume.
- Appendix B contains the measurable load reduction and offset mass at the Canadian Border
- Appendix C is the Engineers Report from Houston Engineering Inc.

Technical Memorandum

To:

From:

Subject: Black River Impoundment Plan Package Proposal for Total Phosphorus Offset

Date: DATE

1. Purpose and Overview

This technical memorandum is intended to serve as the proposed BMP package submittal consistent with Minnesota Pollution Control Agency Trading Guidance Section 5.1 and Section 5.2.1 (<https://www.pca.state.mn.us/business-with-us/water-quality-trading>; accessed on 08/28/2025) as well as the Red River Basin Water Quality Offset Plan. This technical memorandum contains the following information:

Baseline Information

- This section includes information on the target water body, baseline water quality conditions, and the assessment of baseline conditions for XXXXX (insert entity seeking to offset its' baseline)

Practice Information

- This section includes a description of the practice that is proposed for the offset including the practice type, location, function, installation year, and lifespan. This section also references necessary design information associated with the proposed practice.

Offset Information

- This section describes the methods and outcomes associated with the total phosphorus offset from the proposed practice. It also includes information connected to trade ratios, risk/uncertainty, and offset renewal.

Declarations

- This section describes declarations associated with the proposed practice. This includes declarations connected to funding restrictions, limitations of sale, stacking of benefits, antidegradation or backsliding, and project stewardship.

Operations and Maintenance

- This section describes the monitoring and maintenance plan associated with the proposed practice to verify that the offset total phosphorus continues to be delivered.

Steps to Establish Trade

- This section provides the pathway forward from transitioning this proposed offset practice into a water quality trade

Supporting Material

- This section describes any appendices that are provided in support of this proposal

2. Baseline Information

Error! Not a valid bookmark self-reference. provides a summary of the baseline information associated with the proposed BMP package. *Target Water Body* is the location at which the goal of reduction in Total Phosphorus (TP) is to occur, the Canadian border along the Red River of the North.

The *Baseline Year(s)* were chosen per an International Joint Commission (IJC) agreement. *Baseline Loading at Buyer* is the amount of phosphorus loading occurring at the location of the offset buyer. *Calculations Method* describes model(s) or method(s) used to estimate the loading at the waterbody. *Baseline Loading At Waterbody* describes existing annual TP load on the Red River of the North at the Canadian Border. *Assimilation Method* describes model(s) or method(s) used to estimate the loading at the target water body. *Baseline Load Reduction Needed At Waterbody* is the amount of load reduction needed to meet the phosphorus loss limits proposed by the IJC. In this instance, the Red River of the North at Canadian Border has a loading limit of 3,086,500 lbs/year of TP (1400 metric tons). The remainder of this section describes how this summary baseline information was developed.

Table 1. Baseline information associated with the proposed BMP package.

Attribute	Value
Target Waterbody:	Red River of the North at Canadian Border
Baseline Year(s):	2024
Baseline Loading at Buyer:	Xx lbs/year of TP
Calculation Method:	SPARROW Model and PTMApp
Baseline Loading at Waterbody:	5,418,556 lbs/year of TP
Assimilation Method:	SPARROW Model and P-ROC
Baseline Load Reduction Needed at Waterbody:	2,332,085 lbs/year of TP

The Red River of the North at the Canadian Border has a baseline loading of 5,418,556 lbs./year of TP. The U.S. has a baseline phosphorus reduction at the border of the U.S. and Canada along the Red River of the North of 2,332,085 lbs. (accounting for the margin of safety).

3. Practice Information

Table 2 provides summary information associated with the proposed practice. The Geographic Extent of Watershed describes the acres treated and the HUC 12 of the drainage area or footprint of the BMP. The Offset Practice Type name of the practice along the NRCS code, if available. The Offset Practice Description is a brief description of the practice being proposed to facilitate the reduction of phosphorus. The Offset Practice Installation Year is the year the project became active/operable. Offset Practice Lifespan is the number of years in which the practice should last if proper maintenance and management have been followed through. The remainder of this section describes the proposed practice.

Table 2. Practice information associated with the proposed BMP package.

Attribute	Value
Geographic Extent of Watershed:	Drainage Area: 10,816 acres HUC12(s): 090203030-404, -302, -401

Offset Practice Type:	Impoundment assessed as a regional wetland (NRCS 656)
Offset Practice Description:	This BMP is an impoundment with the main purpose of acting as flood control for the region. The maximum volume of water contained in this BMP is 4,064 ac.ft. This BMP was modeled as if it were a regional wetland.
Offset Practice Installation Year:	2019
Offset Practice Lifespan:	50 Years (estimated)

The Black River Impoundment (BRI) is located approximately 10 miles southwest of Thief River Falls in northwestern Minnesota (Figure 1). The purpose of this project was to develop an impoundment that would help reduce downstream flooding in the subwatershed and reduce flood risk and damage to local infrastructure and erosion of agricultural lands. By utilizing the storage capabilities that this impoundment offers, peak flows can be released over time, reducing stormflow, and helping to address lack of baseflow, and thus improving stressors of low biological oxygen demand impairment. This project stores, provides controlled release of water, and limits downstream damage from floodwaters by planning for upcoming storm events and managing water levels within the impoundment throughout the year. This project became operational in 2019.

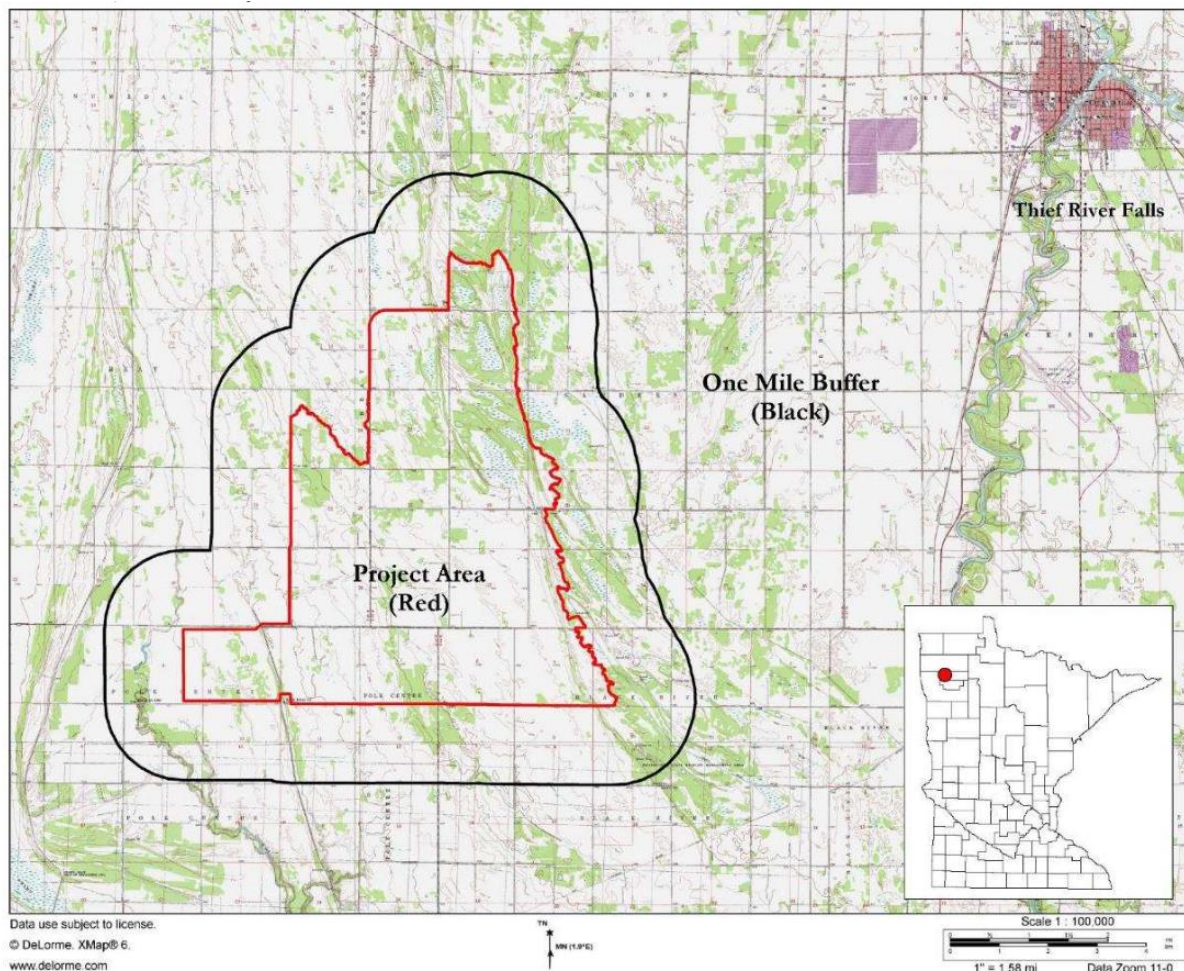


Figure 1: Location of Black River Impoundment

4. Offset Information

Table 3 provides a summary of information associated with the proposed TP offsets associated with the BMP package. *Treatment Offset At Practice* is the amount of annual reduction in pounds, of TP at field edge/end of BMP. *The Offset Calculation Method(s)* describes model(s) or method(s) used to estimate the treatment offset. *Treatment Offset at Target Waterbody* is the estimated annual TP offset at Red River of the North at Canadian border, without a trade ratio applied. *Assimilation Calculation Method* described the model(s) or method(s) used to estimate the annual TP offset. *Trade Ratio* is the standard trade ratio (margin of safety) currently being used for MPCA water quality trading offset documentation for a point to nonpoint source trade. *Offset Mass* is the estimated annual TP offset at Red River of the North at Canadian border including the trade ratio. *Risk and Uncertainty* lists model(s) and method(s) in which risk or uncertainty could occur. *Duration of Offset* is based on the duration of the agreement between buyer and seller. *Offset Renewal* is based on the duration of the agreement between buyer and seller. The remainder of this section describes how this offset information was derived.

Table 3. Total Phosphorus offset information associated with the proposed practice.

Attribute	Value
Treatment Offset at Practice:	1,249 lbs/year of TP (see Appendix A)
Offset Calculation Method:	SPARROW and PTMApp
Treatment Offset at Target Waterbody:	694 lbs/year of TP (see Appendix B)
Assimilation Calculation Method:	SPARROW and P-ROC
Trade Ratio:	2.6
Offset Mass (includes trade ratio):	267 lbs/year of TP
Risk and Uncertainty:	The efficiency ratio used to estimate phosphorus reduction for the regional wetland (NRCS 656) comes from the Prioritize, Target, and Measure Application. The efficiency ratio used in this offset plan is a TP reduction of 53% and comes from a literature review which can be viewed on the MN Board of Soil and Water Resources website. This offset plan also assumes the impoundment is completely full for the phosphorus reduction calculations. There is significant uncertainty here as the impoundment may be drawn down multiple times per year or partially drawn down multiple times per year. The total phosphorus reduction potential assumes full drawdown each time in a given year.
Duration of Offset:	Filled in based on the duration of the agreement between buyer and seller
Offset Renewal:	Filled in based on the duration of the agreement between buyer and seller

Estimations of phosphorus treated by the impoundment are based on the SPARROW model for the HUC12s that drain to the impoundment and practice reduction efficiencies from the Prioritize, Target, and Measure Application (PTMApp).

The three HUC 12s that partially drain to the impoundment are:

- HUC12 090203030-
 - -404 (Black River)
 - -302 (County Ditch No. 76)
 - -401 (Lanstad Cemetery – Black River)

Phosphorus yields (lbs/ac/year) were estimated for each of the HUC12 sections by dividing the non-point source load estimates from the SPARROW model by the acreage of the HUC12. Using the yield, phosphorus loads delivered to the impoundment were estimated by multiplying the yield by the acreage of the HUC12 that is within the BRI drainage area. These three masses were summed together to create the total estimated phosphorus load delivered to the BRI.

We assumed that the BRI would function similar to the reduction efficiencies documented regional wetland/pond (NRCS 656). Reduction efficiency estimates based on this BMP type are from the PTMApp model (Kronholm, 2020). This offset calculation used the second quartile efficiency reduction value, suggesting that 53% of the phosphorus entering BMP will be reduced.

After reduction estimates were calculated at the BRI, reduction estimates were routed to the Canadian Border using the SPARROW model to calculate instream phosphorus decay to create total reduction benefits at the border with the 2.6 trade ratio. The SPARROW model was used through a Microsoft Excel interface set up for the Red River Basin as part of a Water Quality Offset Plan (see Appendix B for methods description).

The Engineer's Report (Appendix C) indicates that the impoundment can store a total of 4,064-acre feet of water. The total dead and live storage provided by the impoundment is 3,162 ac.ft. and 902 ac.ft., respectively. The total storage capacity of the impoundment is large enough to contain a 24hr 10-day storm event. The Engineer's Report (Appendix C) notes that the impoundment "essentially cuts off the 16.9 square mile drainage area from the downstream basin" for storm events that are up to the 24-hr, 10-day rainfall event. Using this information, we assumed that the BMP has the ability to treat 100% of the phosphorus from the impoundment drainage area for typical years. Given these characteristics, we assumed that the impoundment would function similar to a regional wetland for phosphorus treatment (NRCS practice code 656). The total phosphorus load had the reduction efficiency applied to it to show treated phosphorus.

5. Declarations

The following declarations are made associated with the proposed practice within this BMP package.

Funding Restrictions

We are unaware of any funding restrictions associated with the proposed project that would preclude the development of total phosphorus offsets.

Limitations of Sale

Upon approval of a trade, both the buyer and project developer have agreed that this will be the sole total phosphorus credit associated with the proposed project so long as **Project Stewardship** agreements are in effect.

Multiple Offsets

We are unaware of any restrictions connected to the proposed BMP plan that would preclude the project developer from pursuing water quality credits for other pollutants such as nitrogen or sediment.

Stacking

We are unaware of any restrictions connected to the proposed BMP plan that would preclude the project developer from developing additional environmental attributes (e.g., greenhouse gas reductions or reductions in other water quality constituents) associated with the project.

Antidegradation or Backsliding

The proposed project within this BMP plan should not result in antidegradation or backsliding.

Project Stewardship

The Red Lake Watershed District is responsible for the operation and maintenance of the impoundment site and all ditches constructed as part of this project.

6. Operation and Maintenance

Monitoring should include following the full Operations and Maintenance plan outlined in Appendix H of the Engineer's Report (Appendix C). This plan outlines the necessary process for ensuring proper maintenance of the impoundment.

7. Supporting Material

- Appendix A contains BMP calculations at the BMP for complete impoundment storage drawdown.
- Appendix B contains the load reduction estimations at the Canadian Border for live and dead storage drawdown
- Appendix C is the Engineers Report from Houston Engineering

8. Citations

Kronholm (2020), "Benefits Analysis Technical Memorandum",
https://bwsr.state.mn.us/sites/default/files/2022-03/Benefits_Analysis_Tech_Memo.pdf

Technical Memorandum

To:

From:

Subject: South Branch Rock Arch Rapids Plan Package Proposal for Total Phosphorus Offset

Date: December 2025

1. Purpose and Overview

This technical memorandum is intended to serve as the proposed BMP package submittal consistent with Minnesota Pollution Control Agency Trading Guidance Section 5.1 and Section 5.2.1 (<https://www.pca.state.mn.us/business-with-us/water-quality-trading>; accessed on 08/28/2025) as well as the Red River Basin Water Quality Offset Plan. This technical memorandum contains the following information:

Baseline Information

- This section includes information on the target water body, baseline water quality conditions, and the assessment of baseline conditions for (insert entity seeking to offset its' baseline).

Practice Information

- This section includes a description of the practice that is proposed for the offset including the practice type, location, function, installation year, and lifespan. This section also references necessary design information associated with the proposed practice.

Offset Information

- This section describes the methods and outcomes associated with the total phosphorus offset from the proposed practice. It also includes information connected to trade ratios, risk/uncertainty, and offset renewal.

Declarations

- This section describes declarations associated with the proposed practice. This includes declarations connected to funding restrictions, limitations of sale, stacking of benefits, antidegradation or backsliding, and project stewardship.

Operations and Maintenance

- This section describes the monitoring and maintenance plan associated with the proposed practice to verify that the offset total phosphorus continues to be delivered.

Steps to Establish Trade

- This section provides the pathway forward from transitioning this proposed offset practice into a water quality trade

Supporting Material

- This section describes any appendices that are provided in support of this proposal.

2. Baseline Information

Table 1 provides a summary of the baseline information associated with the proposed BMP package. *Target Water Body* is the location at which the goal of reduction in Total Phosphorus (TP) is to occur, the Canadian border along the Red River of the North. The *Baseline Year(s)* were chosen per and

International Joint Commission (IJC) agreement. *Baseline Loading at Buyer* is the amount of phosphorus loading occurring at the location of the offset buyer. *Calculations Method* describes model(s) or method(s) used to estimate the loading at the waterbody. *Baseline Loading at Waterbody* describes existing annual TP load on the Red River of the North at the Canadian Border. *Assimilation Method* describes model(s) or method(s) used to estimate the loading at the target water body. *Baseline Load Reduction Needed at Waterbody* is the amount of load reduction needed to meet the phosphorus loss limits proposed by the IJC. In this instance, the Red River of the North at Canadian Border has a loading limit of 3,086,500 lbs./year of TP (1400 metric tons). The remainder of this section describes how this summary baseline information was developed.

Table 1. Baseline information associated with the proposed BMP package.

Attribute	Value
Target Water Body:	Red River of the North at Canadian Border
Baseline Year(s):	2019-2024
Baseline Loading at Buyer:	XX lbs./year of TP
Calculation Method:	GIS Elevation Analysis, HEI Field Edge Calculator
Baseline Loading at Waterbody:	5,418,556 lbs./year of TP
Assimilation Method:	GIS Elevation Analysis, HEI Field Edge Calculator, P-ROC Tool
Baseline Load Reduction Needed at Waterbody:	2,332,085 lbs./year of TP accounting for MOS

The Red River of the North at the Canadian Border has a baseline loading of 5,418,556 lbs./year of TP. The U.S. has a baseline phosphorus reduction at the border of the U.S. and Canada along the Red River of the North of 2,332,085 lbs. (accounting for MOS).

3. Practice Information

Table 2 provides summary information associated with the proposed practice. The *Geographic Extent of Watershed* describes the acres treated and the HUC 12 of the drainage area or footprint of the BMP. The *Offset Practice Type* name of the practice along the NRCS code, if available. The *Offset Practice Description* is a brief description of the practice being proposed to facilitate the reduction of phosphorus. The *Offset Practice Installation Year* is the year the project became active/operable. *Offset Practice Lifespan* is the number of years in which the practice should last if proper maintenance and management have been followed through. The remainder of this section describes the proposed practice.

Table 2. Practice information associated with the proposed BMP package.

Attribute	Value
Geographic Extent of Watershed:	HUC 12: 090201081004 Drainage Area: 193 mi ²

for a point to nonpoint source trade. *Offset Mass* is the estimated annual TP offset at Red River of the North at Canadian border including the trade ratio. *Risk and Uncertainty* lists model(s) and method(s) in which risk or uncertainty could occur. *Duration of Offset* is based on the duration of the agreement between buyer and seller. *Offset Renewal* is based on the duration of the agreement between buyer and seller. The remainder of this section describes how this offset information was derived.

Table 3. Total Phosphorus offset information associated with the proposed practice.

Attribute	Value
Treatment Offset at Practice:	2,163 lbs/year of TP (see Appendix A)
Offset Calculation Method:	LiDAR, Survey, HEI Field Edge Calculator
Treatment Offset at Target Waterbody:	832 lbs/year of TP (see Appendix B)
Assimilation Calculation Method:	USGS SPARROW
Trade Ratio:	Assumed 2.6 as standard from MPCA documentation
Offset Mass:	832 lbs/year of TP
Risk and Uncertainty:	Elevation data uncertainty, uncertainty in SPARROW delivery fraction, assumption that RAR accumulate sediment evenly over 25-year span, assumption that RAR will completely fill with sediment over 25-year span.
Duration of Offset:	Filled in based on the duration of the agreement between buyer and seller
Offset Renewal:	Filled in based on the duration of the agreement between buyer and seller

The amount of sediment captured by the RAR were estimated using LiDAR and survey information to estimate the total amount of sediment captured behind each structure. In this scenario, the proposed RAR structure's crest elevation is above the current water surface elevation.. To calculate the total fill, LiDAR and channel survey information was used to calculate available sediment storage volume between the crest of the proposed rock arch rapids and the channel bottom. The top of the expected sediment capture volume was then projected from the crest of the rapids at the expected final stable channel slope of 0.15%. The captured sediment upstream of the rapids is not expected to be level but

has been assumed to accumulate at the generalized slope of the South Branch. The volume calculations were then used to calculate TP reductions, using HEI's Field Edge Calculator, developed from the Board of Soil & Water Resources (BWSR) erosion calculators (Appendix A).

This value was used to calculate the amount of phosphorus at the Red River in Pembina based on in-stream attenuation of measurable TP load reduction and trade ratio, derived from the U.S. Geology Survey's (USGS) SPAtially-Referenced Regression on Watershed attributes (SPARROW; Appendix B).

This RAR structure is estimated to reduce sediment in the South Branch of the Wild Rice River by 2,545 tons/year (Appendix A). This amount of sediment would reduce phosphorus loading by more than 2,163 lbs./year of TP, which would ultimately result in a reduction of 832 lbs. (Appendix B) TP each year at the Canadian border. These values are slightly higher than the estimated numbers provided in the Clean Water Fund grant application (Appendix C) as the final project site is driven by willing landowners, which in this instance was downstream of the conceptual project site included in the grant application.

The lifespan of the project is estimated at 25 years, however capacity behind the RAR may be reached sooner. Then entire benefit will still be provided; however, the exact rate of sediment and TP reduced per year may vary depending on the rate of sediment capture behind the RAR structure. Note that these values are estimates and monitoring will be required to know the full volume of sediment captured.

5. Declarations

The following declarations are made associated with the proposed practice within this BMP package.

Funding Restrictions

We are unaware of any funding restrictions associated with the proposed project that would preclude the development of total phosphorus offsets.

Limitations of Sale

Upon approval of a trade, both the buyer and project developer have agreed that this will be the sole total phosphorus credit associated with the proposed project so long as **Project Stewardship** agreements are in effect.

Multiple Offsets

We are unaware of any restrictions connected to the proposed BMP plan that would preclude the **project developer** from pursuing water quality credits for other pollutants such as nitrogen or sediment.

Stacking

We are unaware of any restrictions connected to the proposed BMP plan that would preclude the **project developer** from developing additional environmental attributes (e.g., greenhouse gas reductions or reductions in other water quality constituents) associated with the project.

Antidegradation or Backsliding

The proposed project within this BMP plan should not result in antidegradation or backsliding.

Project Stewardship

Describe the planned contractual obligations among parties for ensuring the ongoing operation of the proposed project.

6. Operation and Maintenance

Refer to Engineering Manual for full Operations and Maintenance plan.

7. Supporting Material

- Appendix A contains BMP phosphorus reduction based on sediment erosion volume reduction.
- Appendix B contains the load reduction estimations at the Canadian Border
- Appendix C is the Clean Water Fund grant application for the RAR structure
- Appendix D is the preliminary Engineers Report from HEI for all 14 RARs. These preliminary structures do not represent the finalized site for the RAR discussed in this memo.

Appendix E - Guide for Permittee Distribution

What is an offset?

Offsets allow a point source discharge facility to partner with an outside party to implement a TP reduction project at another location in a watershed, with the resulting reduction at the outlet counting towards the point source

Who is involved?

The Red River Basin Commission has begun a pilot program for phosphorus offset projects. We are looking for interested permitted entities to enroll in the pilot program.

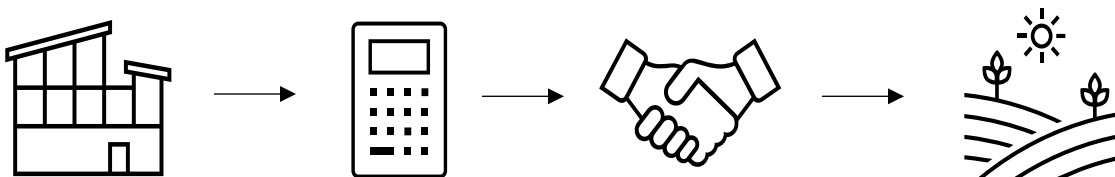
Any permitted facility in the Basin that has TP load requirements can be eligible!



What are offset projects?

Offset projects are any that have been shown to reduce phosphorus in surface water. These can be in-field management practices, structural practices, or capital improvement projects.

How does it work?



A permitted facility needs to meet a Waste Load Allocation for phosphorus at a point of discharge. The permittee connects with RRBC to determine eligibility for enrollment in the offset pilot program. The needed phosphorus reduction is determined, and the potential subwatershed of the offset project is plugged into a Calculator Tool to model the phosphorus reduction in the Red River of the North at the Canadian border. The permittee partners with a landowner to install the necessary projects that result in the phosphorus reduction at the border. The remainder of this appendix contains the steps needed for executing an offset.

Contact the Red River Basin Commission if you are interested or have any questions!

info@redriverbasincommission.org

Steps to Offset Water Quality

The steps below were adapted from Minnesota Pollution Control Agency (MPCA) water quality trade guidance to fit the calculation procedures specified in this plan. If a water quality trade will be generated through the offset project, it is recommended that the MPCA water quality trading staff be engaged early in the offset project's planning process.

1. **Establish or Consider Minimum Control Levels** – Any facility or entity wishing to offset phosphorus loads must first meet minimum control levels set for the individual facility or entity. This is to ensure that the offset will supplement pollution controls, not replace them. The MPCA will work with facilities or entities to establish these concentration limits if none currently exists.
2. **Establish the Parameter of Concern** - The organization initiated the offset needs to identify the amount of phosphorus that they need to offset. The organizations mass of phosphorus contribution can be inserted into the Calculator Tool's Planning functionality to derive this information.
3. **Identify Offset Practice and Location** – the entity seeking an offset should collaborate with stakeholders to select a project and project location. The P-ROC tool's Planning functionality can be used to aid in selecting locations in The Basin with the largest potential for providing an offset. The entity pursuing the offset should be aware of local permit obligations that may impact decisions on where to place the project. If a trade will be pursued, the entity pursuing the offset should also confirm that the type of practice is eligible for a trade with the MPCA.
4. **Establish Baseline Site Conditions** –Document the current condition of the proposed project site and waterbody through site visit(s) and assessment.
5. **Confirm Site Assessment** – A list of commonly used tools and models for performing the project load reduction assessment at the project site are provided above. The organization pursuing the offset will need to perform this assessment for use in later steps in finalizing the offset potential of the project.
6. **Calculate Offset** – Utilize the site assessment information from the previous step to calculate the offset potential of the project with the P-ROC tool. If offset will be utilized for a trade, determine trade ratio.
7. **Develop Operation, Maintenance, and Monitoring Plan** – Every project has a defined life cycle and likely will have standards for operating and maintaining the project in a manner consistent with initial design and construction. In addition, if an offset developed through The Basin WQOP will be utilized for a trade, annual inspections and maintenance will be required.
8. **Establish Trade Ratio** – At this stage, the entity pursuing the offset should have sufficient information to establish a trade ratio. The default ratio for a point to nonpoint offset is 2.6:1.0. Depending on the specific practice, offset potential, operation, maintenance, and monitoring plan, the entity pursuing the offset may be able to establish an improved trade ratio. The MPCA will have final authority over the trade ratio for the offset. If an adjusted trade ratio is utilized, the offset calculation from Step 6 will need to be updated in the P-ROC tool.

If the entities collaborating on an offset choose to pursue a water quality trade, they should be prepared to discuss the following items *prior to implementing the project*. These items were taken directly from MPCA trading guidance (Bosch et al., 2022).

- MPCA staff will likely inspect the BMP site(s) early in the planning stage, long before construction begins.
- Some BMPs may require a Professional Engineer (PE) signature. In the past, these were BMPs that included a structural component.
- The Permittee shall retain an independent auditor to certify project completion. The auditor shall be a PE for engineered projects designed by a PE. For other BMPs, the auditor can be a PE or other professional with demonstrated expertise in the field.
- Temporary impacts during construction.
- Regular maintenance will be required, just like at a WWTP.
- Minnesota Department of Natural Resources, the USACE, and other federal, state, or local authorities may have restrictions that will have to be considered.
- Some BMPs can lose their effectiveness over time. Some may become more effective. This may depend on the type of BMP, its location, and pollutant of concern.
- A legally binding contract between the Permittee and the landowner will have to be developed to clarify the details of the BMP. The contract will need to be submitted to the MPCA for review prior to signing by the Permittee and the landowner.
- Construction plans should be submitted to the MPCA for review prior to bidding.
- The NPDES permit must be reissued with trading language and trading attachments prior to approval of any trading credits. The NPDES permit will contain, at a minimum, a requirement for submittal of an annual report to provide the MPCA with an update on the status of the trades.
- Project cost and pollutant reduction cost in \$/kg per BMP must be reported to MPCA on an annual basis. Metric units are shown here in alignment with MPCA guidance.

In addition, the entities collaborating on the offset should plan to develop and retain the following records about the project in case a water quality trade is pursued. These items were taken directly from MPCA trading guidance (Bosch et al., 2022).

1. Site name
2. Site location
3. Identification of major and minor watersheds and map(s)
4. Presence of downstream lakes or wetlands
5. Landowner
6. Past five years of land use and vegetative cover type
7. Proposed legal agreement
8. Plan view
9. Plans and specifications (as needed)
10. Operation and maintenance plans

11. Vegetation establishment and maintenance criteria
12. Cost
13. Pollutant of concern reduction estimates