
NUTRIENT TARGETS REGULATION: REPORT ON NUTRIENT LEVELS THROUGH 2019 AND ACTION UNDERWAY

Water Science and Watershed Management Branch

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INTRODUCTION

The Manitoba government is committed to protecting, maintaining, and improving the health of aquatic ecosystems and water resources across the province. Manitoba is leading by example in developing and implementing legislation protecting surface waters from the impacts of nutrient pollution. In June 2018, The Sustainable Watersheds Act received royal assent and amended sections 4.0.1 (1) through 4.0.2 (5) of [The Water Protection Act](#) to enable the development of nutrient targets for Lake Winnipeg and its tributaries. The changes to the act also commit Manitoba to reporting regularly (every four years) on progress towards implementing the targets.

Manitoba Agriculture and Resource Development (ARD) is [proposing a regulation](#) that would establish nutrient loading targets for the four major tributaries (Red, Winnipeg, Saskatchewan and Dauphin Rivers) that flow into Lake Winnipeg, and nutrient concentration targets for total phosphorus and total nitrogen in Lake Winnipeg. Targets are expected to help Manitoba's collective nutrient reduction efforts by helping to guide future nutrient reduction activities, implement best practices, identify priorities, and track progress over time.

This report satisfies the reporting requirements under The Water Protection Act by providing a summary of nutrient levels (nitrogen and phosphorus) at locations specified by the nutrient target regulation. This report also describes government policies and programs aimed at reducing nutrient levels in water bodies in the province, and the steps taken by the government to promote and support nutrient reduction policies and programs in other jurisdictions that share a transboundary river basin with Manitoba.

BACKGROUND

The gradual, but steady, increase in nitrogen and phosphorus over the past several decades is one of the single, largest water quality challenges facing jurisdictions all over the world, including Manitoba. Although nutrients are vital for healthy lakes and rivers, excessive concentrations can lead to algal blooms that spoil drinking water, ruin beaches, reduce property values, and harm fish and other aquatic life. In addition, some forms of blue green algae (also called cyanobacteria) can produce highly potent toxins that can harm animals (e.g., livestock, pets) and humans.

With its beautiful beaches and wide open waters, Lake Winnipeg is one of Manitoba's greatest freshwater resources. Lake Winnipeg plays a critical role in tourism, recreation, commercial and sport

fishing, and hydroelectric generation in Manitoba. Since the 1990s, Lake Winnipeg has experienced an increase in the frequency and severity of cyanobacterial blooms, at times covering more than 10,000 square kilometers of the lake surface area. Although less commonly reported, other lakes (as well as streams and rivers) throughout the Lake Winnipeg watershed periodically experience algal blooms, particularly during warm weather and when flows and water levels are low.

SOURCES OF NUTRIENTS IN LAKE WINNIPEG AND ITS WATERSHED

The Lake Winnipeg watershed is very large, at a million square kilometres, and stretches across two countries, four provinces, four states, and many municipalities and counties. Virtually all activities across the large Lake Winnipeg basin contribute nutrients to the lake, including point sources such as wastewater and industrial discharges, and non-point source runoff from golf courses, urban and cottage areas, agriculture, and natural areas. Actions to improve water quality in Lake Winnipeg are challenging given the many small sources of nutrients spread across the very large basin.

A summary of estimated annual total phosphorus and total nitrogen loading to Lake Winnipeg from Manitoba and upstream jurisdictions is provided in Table 1.

In general, about half of the nutrients in Lake Winnipeg originate from within Manitoba with the remaining nutrients being contributed from upstream jurisdictions (Ontario, Saskatchewan, Alberta, North Dakota, Minnesota, and small areas of South Dakota and Montana). Despite only contributing about 15 per cent of the total inflow, the Red River contributes the largest load of nutrients to Lake Winnipeg (Figure 1). Therefore, it has been the primary focus for nutrient management strategies and nutrient reduction on a provincial and international scale. However, other major tributaries discharging into the lake (Winnipeg, Saskatchewan, Dauphin Rivers) also contribute a significant proportion of nutrient load and streamflow to the lake (Figure 1).

Table 1. Summary of estimated annual total phosphorus and total nitrogen loads to Lake Winnipeg from Manitoba and from upstream jurisdictions (1994-2018 average)

	Phosphorus Load		Nitrogen Load	
	Tonnes per year	Per cent Contribution	Tonnes per year	Per cent Contribution
Upstream Jurisdictions	3,745	52	37,415	39
United States - Red River	2,397	33	16,604	18
United States - Souris River	199	3	1,174	1
Saskatchewan and Alberta - Assiniboine, Qu'Appelle and Saskatchewan River	223	3	1,738	2
Ontario and United States - Winnipeg River	853	12	16,508	17
Ontario - Other East Side Lake Winnipeg Rivers	73	1	1,391	1
Manitoba Sources	3,442	48	57,406	61
Red River and Tributaries	2,095	29	15,727	16
Winnipeg River	183	2	3,495	4
Saskatchewan River	410	6	11,106	12
Dauphin River	84	1	5,479	6
West and South Lake Winnipeg Rivers	59	1	668	1
East Side Lake Winnipeg Rivers	112	2	2,131	2
Atmospheric Deposition	500	7	9,500	10
Nitrogen Fixation	-	-	9,300	10
Total Lake Winnipeg Nutrient Load	7,187	100	94,822	100

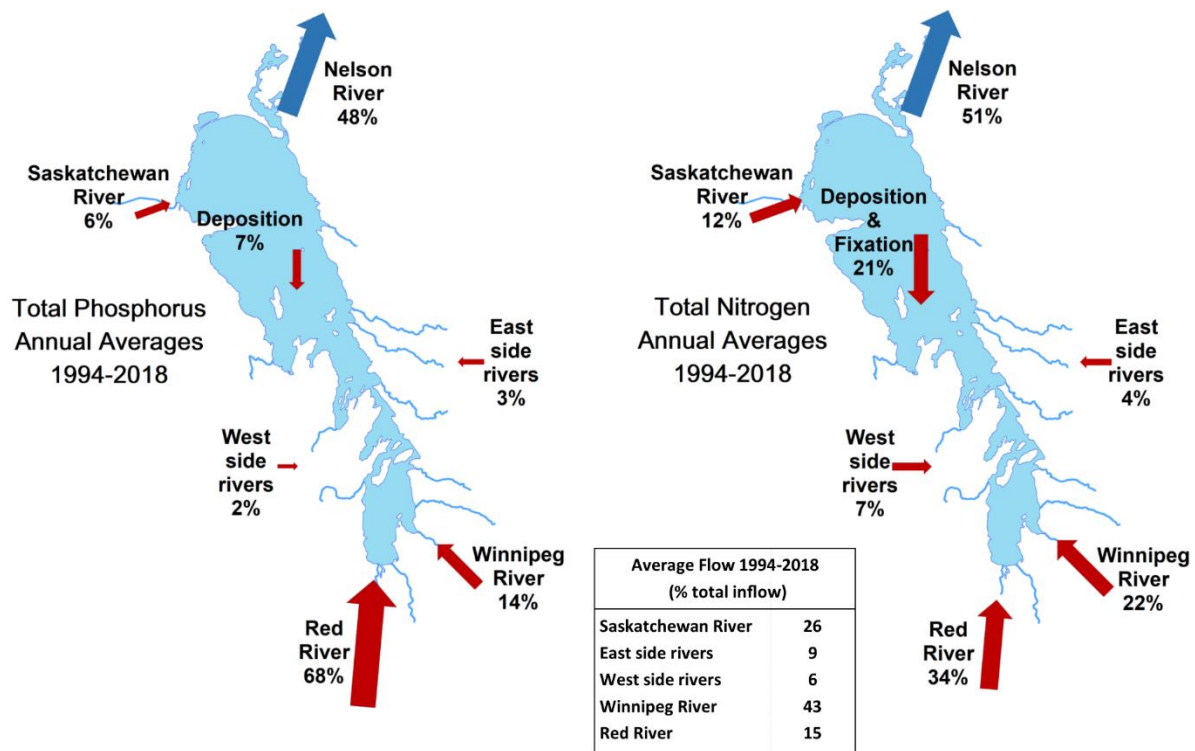


Figure 1. Estimated total phosphorus and total nitrogen loads, and flow to Lake Winnipeg, 1994-2018

NUTRIENT LOADING FOR LAKE WINNIPEG TRIBUTARIES

Proposed Nutrient Loading Targets

The proposed Nutrient Targets Regulation under The Water Protection Act includes total phosphorus and total nitrogen targets for the four main tributaries flowing into Lake Winnipeg (Table 2). Nutrient load targets were developed, based on the following [nutrient concentration targets, and a water quality model for Lake Winnipeg developed by Environment and Climate Change Canada](#). Although the Red River is the primary contributor of nutrients to Lake Winnipeg, the modelling work showed that additional nutrient reductions from other tributaries were necessary to meet the nutrient concentration targets in Lake Winnipeg over the long-term. Indeed, all major tributaries play an important role influencing nutrient concentrations and phytoplankton dynamics in Lake Winnipeg.

Table 2. Annual nutrient loading targets for the four main tributaries flowing into Lake Winnipeg

Location	Total Phosphorus Load Target (tonnes/year)	Total Nitrogen Load Target (tonnes/year)
Red River at Selkirk	2,800	19,050
Saskatchewan River at Grand Rapids	340	8,960
Winnipeg River at Pine Falls	1,050	19,450
Dauphin River midway between Anama Bay and Gypsumville	60	4,550

Comparison of Nutrient Loading Targets to Current Nutrient Loads in Major Tributaries Flowing into Lake Winnipeg

The increase in nutrient concentrations, and more frequent and intense algal blooms in Lake Winnipeg observed since the mid-1990s, has been partially attributed to increased precipitation and runoff, more frequent flooding, and increased river flows (particularly in the Red River). A comparison of nutrient load targets to measured historical loads to Lake Winnipeg from each main tributary show that during wet years, meeting the proposed nutrient targets is challenging. Annual nutrient loads in the Red River (Figure 2), Saskatchewan River (Figure 3), and Dauphin River (Figure 4) exceeded the total phosphorus and total nitrogen load targets during most years between 1994 and 2019. Except in high annual flow years, nutrient loads in the Winnipeg River were similar to nutrient load targets between 1994 and 2019 (Figure 5). Nevertheless, the most significant nutrient reductions are required in the Red River, which contributes the largest load of nutrients to Lake Winnipeg.

Between 2015 and 2018, below average flows in the Red River compared to the long-term historical average (1994-2019) (Figure 2), led to below average total phosphorus (Table 3) and total nitrogen loads (Table 4) discharged to Lake Winnipeg. However, in 2019, excess rainfall in the Red River watershed during the fall period led to above average annual total phosphorus and total nitrogen loads discharged to the lake. In 2019, the phosphorus load discharged to the lake from the Red River was more than double the proposed phosphorus load target, ranking among one of the highest calculated annual phosphorus loads discharged over the historical long-term record (1994 to 2019).

Similarly, the total nitrogen load in the Red River was nearly double the proposed nitrogen load target in 2019. Between 2015 and 2018, above average flows to Lake Winnipeg from the Saskatchewan (Figure 3) and Dauphin Rivers (Figure 4) compared to the long-term historical average (1994-2019) resulted in

above average nutrient loads discharged to the lake. In 2019, below average flows in the Dauphin River resulted in nutrient loads below the long-term historical average (1994 to 2019) and significantly below the proposed phosphorus load target (Table 3) and proposed nitrogen load target (Table 4). Although the flow in the Saskatchewan River increased in 2019 compared to 2018, nutrient loads decreased which may be due to the impact of several reservoirs and lakes and/or flow regulation for hydroelectric power generation.

In 2019, phosphorus loads in the Saskatchewan River were below the long-term historical average (1994-2019) and similar to the phosphorus load target. The nitrogen load in the Saskatchewan River was below the long-term average in 2019. However, it exceeded the proposed total nitrogen load target (Table 4). Flows in the Winnipeg River (which contributes nearly half of flows to Lake Winnipeg) varied significantly from year to year between 1994 and 2019. Between 2015 and 2019, average total phosphorus loads (Table 3) and total nitrogen loads (Table 4) were slightly below the long-term average (1994 to 2019). While flows and nutrient loads in the Winnipeg River were below the long-term average in 2018, flows and nutrient loads exceeded the long-term average in 2019, exceeding the proposed nutrient load targets.

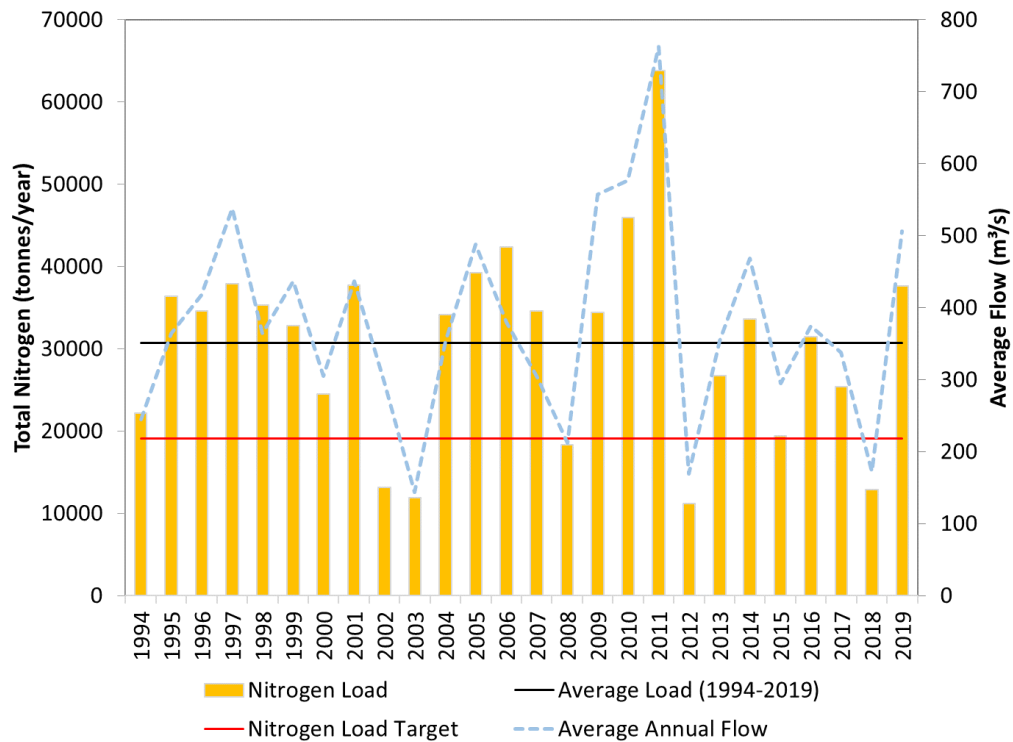
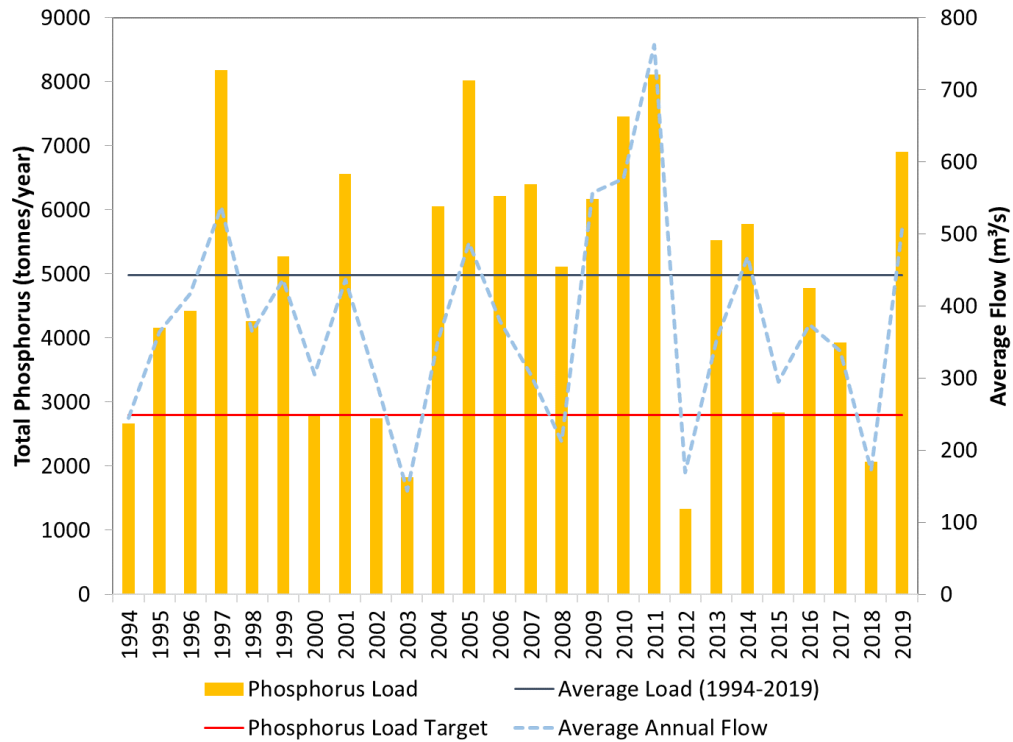


Figure 2. Annual total phosphorus and total nitrogen loads (tonnes/year) and flows in the Red River (at Selkirk), 1994 to 2019, compared to the proposed nutrient loading targets

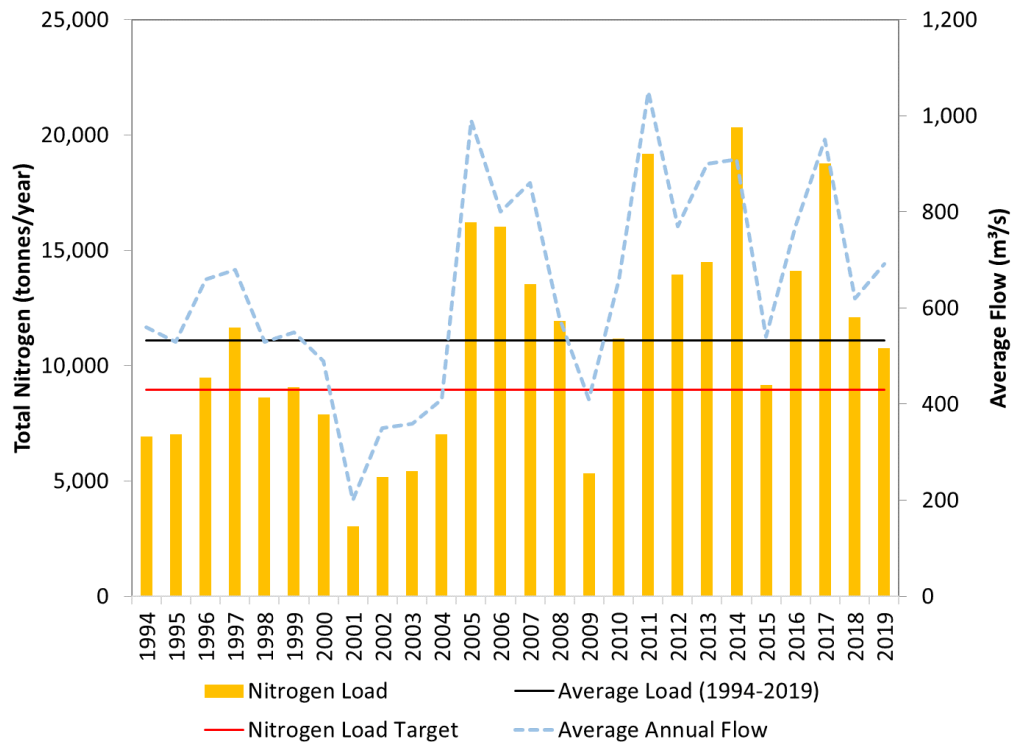
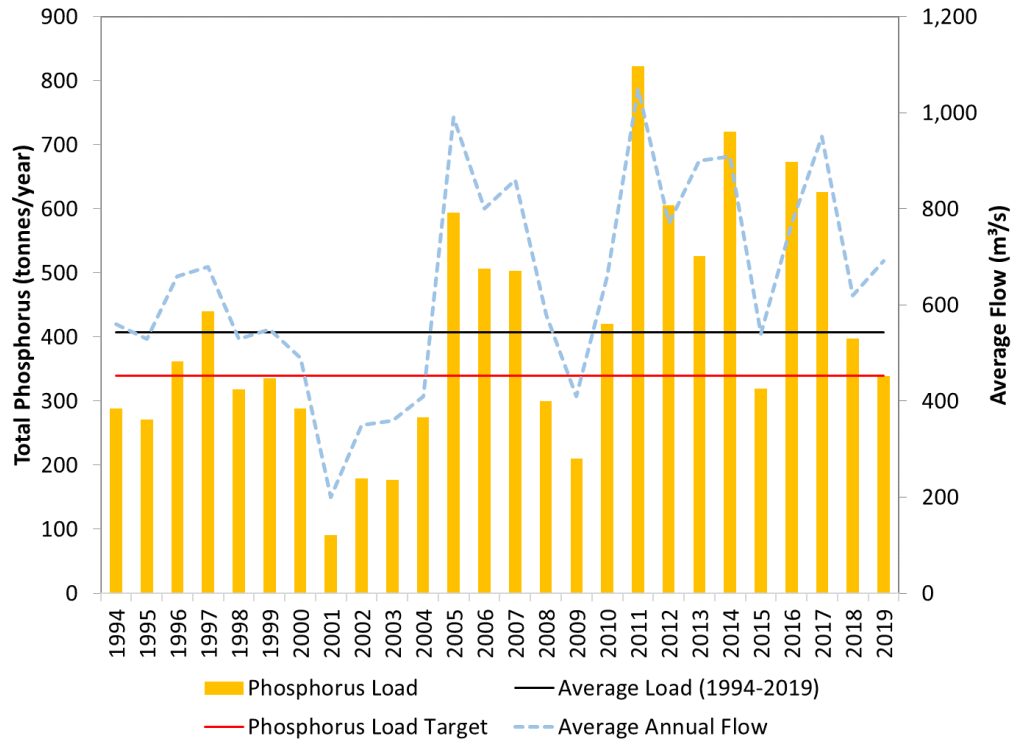


Figure 3. Annual total phosphorus and total nitrogen loads (tonnes/year) and flows in the Saskatchewan River (at Grand Rapids), 1994 to 2019, compared to the proposed nutrient loading targets

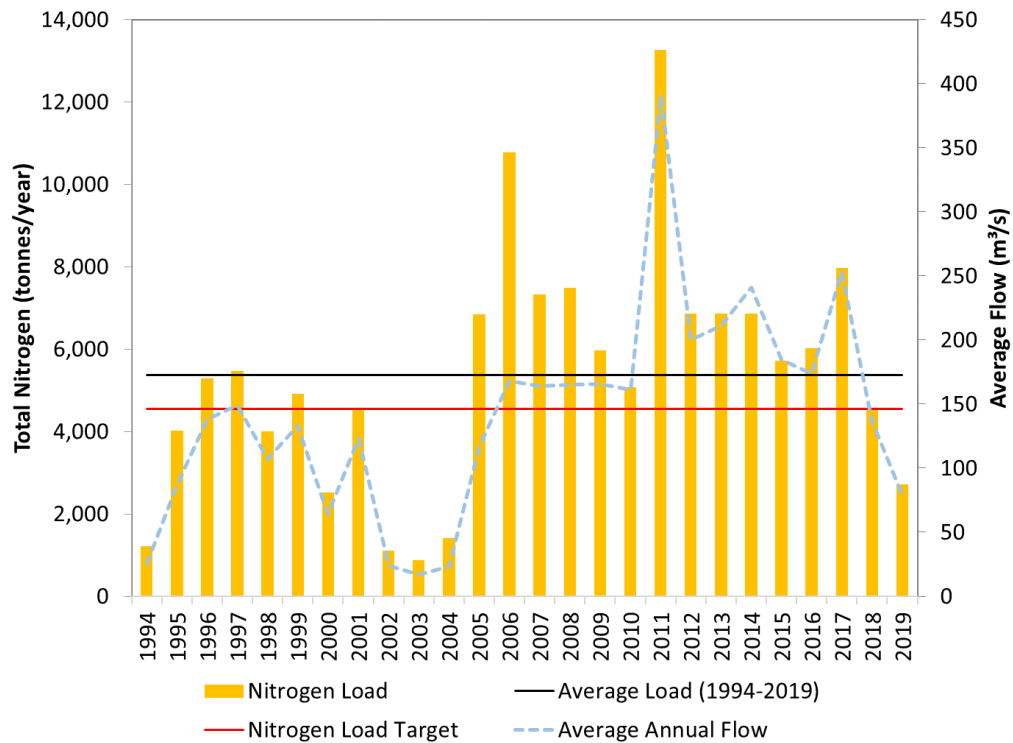
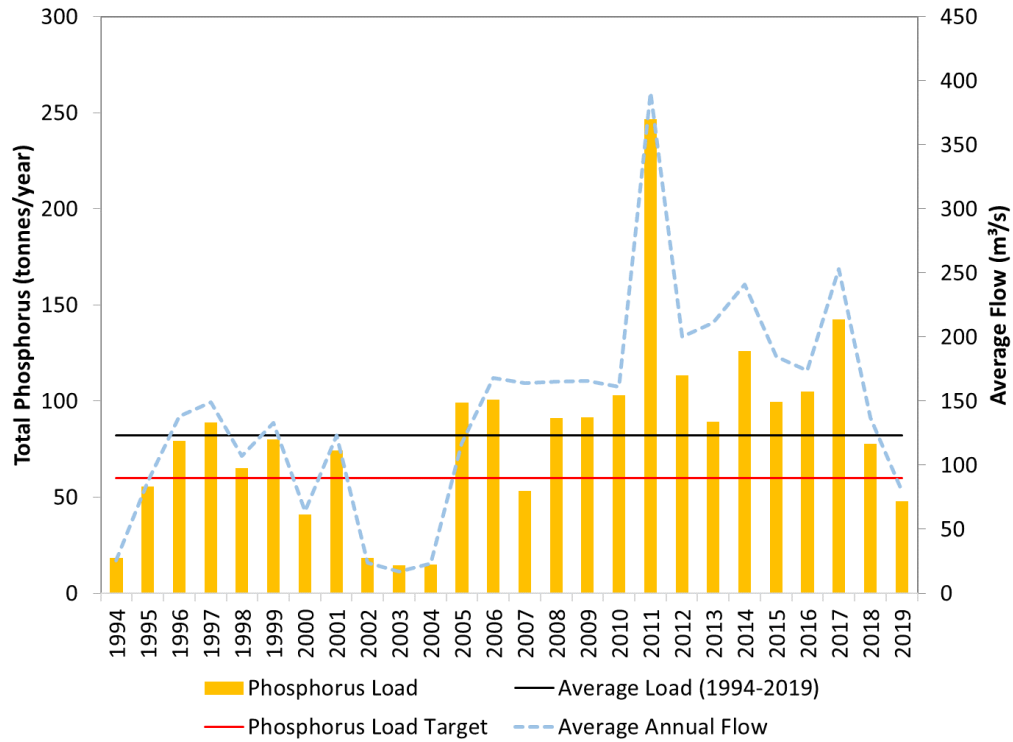


Figure 4. Annual total phosphorus and total nitrogen loads (tonnes/year) and flows in the Dauphin River (midway between Anama Bay and Gypsumville), 1994 to 2019, compared to the proposed nutrient loading targets

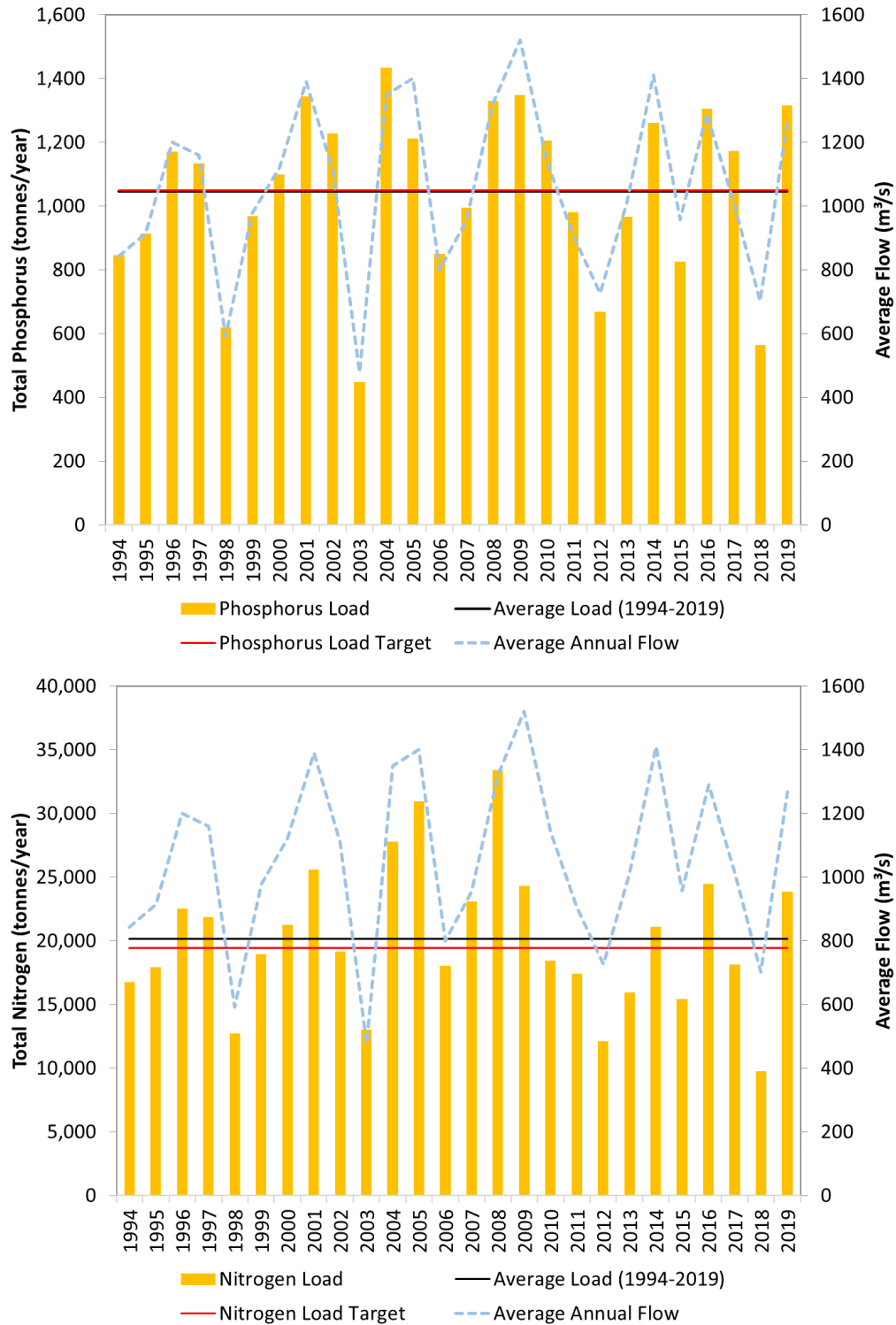


Figure 5. Annual total phosphorus and total nitrogen loads (tonnes/year) and flows in the Winnipeg River (at Pine Falls), 1994 to 2019, compared to the proposed nutrient loading targets

Table 3. Comparison of phosphorus loading targets to recent measured loads (2015-2019) and historical loads (1994-2019) in major tributaries flowing into Lake Winnipeg; nutrient loads calculated per methods described in the [2011 State of Lake Winnipeg Report](#)

	Year	Red River at Selkirk	Saskatchewan River at Grand Rapids	Winnipeg River at Pine Falls	Dauphin River midway between Anama Bay and Gypsumville
Phosphorus Load Targets (tonnes/year)	-	2,800	340	1,050	60
Average Annual Phosphorus Loading (tonnes/year)	2015	2,833	319	825	100
	2016	4,780	673	1,304	105
	2017	3,932	626	1,172	142
	2018	2,065	398	564	78
	2019	6,910	339	1,315	48
Average Phosphorus Loading (tonnes/year)	2015-2019	4,104	471	1,036	95
	1994-2019	4,984	407	1,046	82

Table 4. Comparison of nitrogen loading targets to recent measured loads (2015-2019) and historical loads (1994-2019) in major tributaries flowing into Lake Winnipeg; nutrient loads calculated per methods described in the [2011 State of Lake Winnipeg Report](#)

	Year	Red River at Selkirk	Saskatchewan River at Grand Rapids	Winnipeg River at Pine Falls	Dauphin River midway between Anama Bay and Gypsumville
Nitrogen Load Targets (tonnes/year)	-	19,050	8,960	19,450	4,550
Average Annual Nitrogen Loading (tonnes/year)	2015	19,395	9,167	15,430	5,717
	2016	31,503	14,101	24,461	6,028
	2017	25,351	18,754	18,156	7,971
	2018	12,907	12,112	9,740	4,521
	2019	37,604	10,745	23,829	2,710
Average Nitrogen Loading (tonnes/year)	2015-2019	25,352	12,976	18,323	5,389
	1994-2019	30,672	11,092	20,150	5,373

NUTRIENT CONCENTRATIONS IN LAKE WINNIPEG

Nutrient Concentration Targets

The proposed regulation, under The Water Protection Act, includes total phosphorus and total nitrogen concentration targets for Lake Winnipeg (Table 5). Paleolimnological records, used to reconstruct historical water quality conditions in Lake Winnipeg, indicated that total phosphorus concentrations increased from 0.015 mg/L in the 1800s, to more than 0.05 mg/L in the early 1990s, to more than 0.1 mg/L in the present day.

Similarly, a shift in the algal community structure occurred in the south basin of the lake over the past three decades, as evidenced by more frequent nitrogen-fixing cyanobacteria blooms. In an effort to reduce the frequency and severity of cyanobacteria blooms, a total phosphorus concentration target of 0.05 mg/L is recommended to return Lake Winnipeg to conditions similar to those in the 1990s (Table 5). A total nitrogen concentration target of 0.75 mg/L is recommended to ensure that the ratio of nitrogen to phosphorus in the lake will not promote the growth of potentially nitrogen-fixing algal blooms (i.e. cyanobacteria that can use nitrogen from the atmosphere) (Table 5). If nutrient concentration targets of 0.75 mg/L total nitrogen and 0.05 mg/L total phosphorus are achieved, this would result in a nitrogen to phosphorus molar ratio of 33:1, which helps ensure that the lake is, on average, phosphorus-limited.

Table 5. Total phosphorus and total nitrogen concentration targets for the south basin (including narrows) and north basins of Lake Winnipeg

Location	Total Phosphorus (mg/L)	Total Nitrogen (mg/L)
Lake Winnipeg – South Basin and Narrows	0.05	0.75
Lake Winnipeg – North Basin	0.05	0.75

Comparison of Nutrient Concentration Targets to Current Total Phosphorus and Total Nitrogen Concentrations in Lake Winnipeg

The proposed nutrient concentration targets were compared to nutrient concentrations in Lake Winnipeg from 1999 to 2019 (Figure 6). While variability between years occurs, nutrient concentrations have not increased or decreased significantly over the long-term. In general, average total phosphorus concentrations in the south basin and narrows are approximately two times higher than the phosphorus target of 0.05 mg/L. Meanwhile, concentrations in the north basin have been below the phosphorus target in most years. Significant reductions in phosphorus concentrations in the south basin and narrows

will be required to achieve the phosphorus concentration target. Similarly, nitrogen concentrations vary from year to year. Since 2012, they have been below the nutrient concentration target of 0.75 mg/L in the north basin and close to the target in the south basin and narrows.

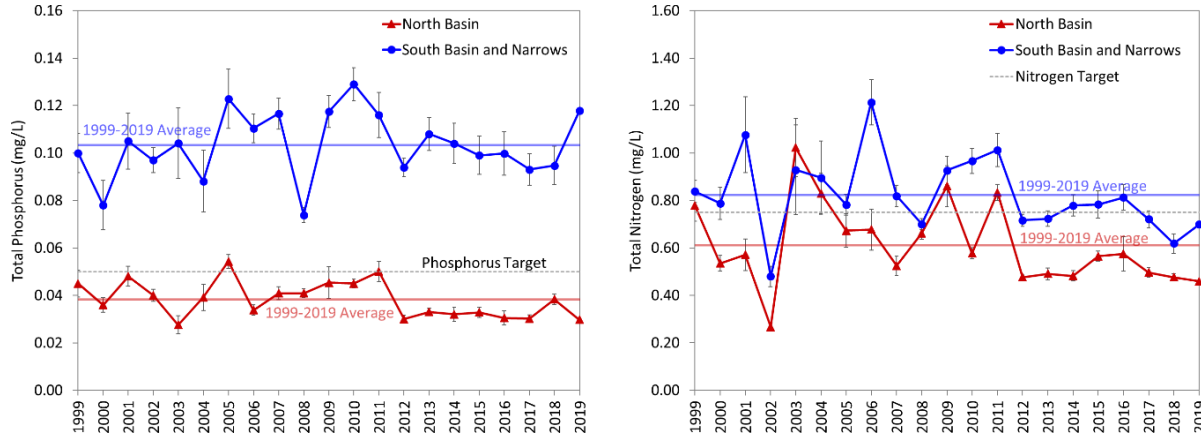


Figure 6. Total phosphorus concentrations (left) and total nitrogen concentrations (right) in the north basin and south basin and narrows of Lake Winnipeg, 1999 to 2019 (average during the open water season)

In the south basin and narrows, the average concentration of total phosphorus, measured between 2015 and 2019, was 0.101 mg/L, which is slightly lower than the long-term average concentration measured between 1999 and 2019 (Table 6). A decreasing trend in average total phosphorus concentration was observed in the south basin and narrows in recent years (e.g., 2010 to 2018). However, a dramatic increase in the average total phosphorus concentration was observed in 2019 (Figure 6).

The average total phosphorus concentration measured in the south basin and narrows in 2019 (0.118 mg/L) exceeded the long-term average (0.103 mg/L), was more than two times higher than the phosphorus concentration target of 0.05 mg/L, and was among the highest reported average concentrations for the period of 1999 to 2019. Only in 2005 and 2010 was the concentration of total phosphorus higher than concentrations measured in 2019 in the south basin and narrows (Figure 6).

The average total nitrogen concentration in the south basin and narrows, measured between 2015 and 2019 (0.73 mg/L), was below the long-term average concentration measured between 1999 and 2019 (0.82 mg/L), and slightly below the nitrogen concentration target of 0.75 mg/L (Table 7). In 2019, the average total nitrogen concentration in the south basin and narrows (0.69 mg/L) was among the lowest concentrations reported for the period of 1999 to 2019 (Table 7). Only in 2002 and 2018 was the

concentration of total nitrogen lower than concentrations measured in 2019 in the south basin and narrows (Figure 6).

In the north basin, the average concentration of total phosphorus, measured between 2015 and 2019 (0.032 mg/L), was significantly lower than the long-term average measured between 1999 and 2019 (0.038 mg/L) (Table 6). The concentration of total phosphorus in the north basin and narrows has remained relatively stable since 2010, with the exception of elevated concentrations measured in 2018 (Figure 6).

In 2019, the average total phosphorus concentration measured in the north basin was 0.030 mg/L, which is among the lowest concentration reported for the period from 1999 to 2019 (Figure 6). Only in 2003, was the average concentration of total phosphorus in the north basin below 0.030 mg/L. The average total nitrogen concentration in the north basin, measured between 2015 and 2019 (0.514 mg/L), was below the long-term average measured for the period from 1999 to 2019 (0.611 mg/L) (Figure 6).

Since 2012, the average total nitrogen concentration in the north basin has remained below the long-term average (1999 to 2019), and below the total nitrogen concentration target of 0.75 mg/L (Table 7). In 2019, the average total nitrogen concentration in the north basin of 0.50 mg/L was among the lowest reported concentrations for the period of 1999 to 2019 (Table 7). Only in 2002, was the average concentration of total nitrogen in the north basin below 0.50 mg/L (Figure 6).

Table 6. Comparison of the total phosphorus target to more recently measured concentrations (2015-2019) and historical concentrations (1999-2019) in the north basin and south basin and narrows of Lake Winnipeg (average during the open water season with methods per the [2011 State of Lake Winnipeg Report](#))

	Year	Lake Winnipeg – South Basin and Narrows	Lake Winnipeg – North Basin
Phosphorus Concentration Target (mg/L)	-	0.05	0.05
Average Total Phosphorus Concentration (mg/L)	2015	0.099	0.033
	2016	0.100	0.031
	2017	0.093	0.030
	2018	0.095	0.038
	2019	0.118	0.030
Average Total Phosphorus Concentration (mg/L)	2015-2019	0.101	0.032
	1999-2019	0.103	0.038

Table 7. Comparison of the total nitrogen target to more recently measured concentrations (2015-2019) and historical concentrations (1999-2019) in the north basin and south basin and narrows of Lake Winnipeg (average during the open water season with methods per the [2011 State of Lake Winnipeg Report](#))

	Year	Lake Winnipeg – South Basin and Narrows	Lake Winnipeg – North Basin
Nitrogen Concentration Target (mg/L)	-	0.75	0.75
Average Total Nitrogen Concentration (mg/L)	2015	0.783	0.565
	2016	0.813	0.575
	2017	0.721	0.497
	2018	0.618	0.476
	2019	0.699	0.459
Average Total Nitrogen Concentration (mg/L)	2015-2019	0.727	0.514
	1999-2019	0.823	0.611

ACTIONS TO REDUCE NUTRIENTS IN MANITOBA SURFACE WATERS

Legislation and Regulations

The Manitoba government has established strong water protection legislation aimed at reducing nutrients from both point sources (e.g., wastewater treatment plant effluents, industrial effluents, household product bans) and non-point sources (e.g., urban and rural runoff) to protect water quality and water resources. Significant efforts to reduce nutrients are ongoing through the implementation of the:

- Nutrient Management Regulation under The Water Protection Act
- Manitoba Water Quality Standards, Objectives, and Guidelines Regulation under The Water Protection Act
- Phosphorus Reduction Regulation under The Water Protection Act
- Livestock Manure and Mortalities Management Regulation under The Environment Act

Manitoba Water Quality Standards, Objectives and Guidelines Regulation

The Manitoba [Water Quality Standards, Objectives, and Guidelines Regulation](#), under The Water Protection Act, sets effluent quality standards for nutrients discharged to surface waters from industrial and municipal wastewater treatment facilities. Under the regulation, large and medium-sized municipal and industrial wastewater treatment facilities are required to meet a 1 mg/L total phosphorus standard. Between 2016 and 2019, on average, 73 per cent of the wastewater treatment facilities in Manitoba discharging more than 820 kilograms of phosphorus per year (that is, facilities serving 2,000 people or more or equivalent due to industrial contributions), were in compliance with the total phosphorus standard. The regulation also required major facilities to meet a 15 mg/L total nitrogen standard when building new, upgrading, or expanding.

As a result of this regulation, upgrades to wastewater treatment facilities are already underway, or have been completed, for many facilities in Manitoba to meet the wastewater standards for nutrients. For example, the City of Brandon and the Rural Municipality of Headingley have completed upgrades to their wastewater facilities to remove phosphorus and nitrogen, and upgrades are underway by the City of Selkirk. Funding was [recently announced](#) for upgrades to Portage la Prairie's wastewater treatment facility that receives substantial industrial contributions.

The City of Winnipeg, the single largest point source contributor of nutrients to the Red River and Lake Winnipeg, has been working to reduce nutrient discharges from its wastewater treatment facilities. The

city has upgraded its West End Water Pollution Control Centre to meet the 1 mg/L phosphorus and 15 mg/L nitrogen standards, and construction is underway on similar upgrades to the South End Water Pollution Control Centre.

Significant upgrades are still required to the North End Water Pollution Control Centre, one of the oldest and largest wastewater treatment facilities in Canada, to meet the requirements of its Environment Act licence, The Water Protection Act, and the Water Quality Standards, Objectives, and Guidelines Regulation. The City of Winnipeg and the Province of Manitoba are [working together](#) to accelerate improvements to reduce nutrients in wastewater originating from this facility.

The Planning Act

Land use planning in Manitoba is legislated by [The Planning Act](#) and guided by the Provincial Planning Regulation. The Provincial Land Use Policies (PLUPs) state the provincial interest in land, resources and sustainable development, and serve as a guide to planning districts and municipalities in preparing local development plans. The PLUPs include nine policy areas, each focused on a specific area of provincial interest supported by land use planning. For example, the Agriculture, Water, and Infrastructure Policy Areas all recognize the importance of protecting land and water resources to ensure a healthy environment and support climate change mitigation and adaptation. The General Development policy ensures that development minimizes economic risks to the public, anticipates future needs and cumulative impacts, protects ecological integrity and maximizes public investments.

Development plans are required under The Planning Act to consider, and be mutually supportive of, the policies of integrated watershed management plans and aquifer management plans. A development plan must consider a number of factors, including water quality protection. There are formal links between land use planning and watershed planning through The Planning Act and The Water Protection Act.

Cleaning Products and Phosphorus in Cosmetic Fertilizers

The Water Protection Act includes provisions to regulate the sale, supply, manufacture or distribution of cleaning products containing phosphorus (e.g., dishwashing detergents) and the Nutrient Management Regulation includes provisions related to the application of cosmetic fertilizers to urban and rural residential areas. These measures are intended to reduce nutrient contributions to Manitoba surface waters from urban and rural residential sources. Cleaning products may contain phosphorus that can flow to wastewater treatment plants and ultimately surface waters. Fertilizers, applied for cosmetic purposes, can also contain phosphorus that can enter surface waters through runoff, particularly when more fertilizer is applied than required, or when it is applied inappropriately to impervious surfaces, such as on sidewalks or driveways.

Sustainable Watersheds Act

In June 2018, The Sustainable Watersheds Act received royal assent amending four pieces of legislation – The Conservation Districts Act, The Manitoba Habitat Heritage Act, The Water Protection Act, and The Water Rights Act. Amendments under The Sustainable Watersheds Act strengthened watershed management in the province through a suite of complementary measures that provide a solid framework for water management in the province including:

- increased protection, enhancement, and restoration of wetlands
- modernization of the Conservation Districts Program
- a new provision for the establishment of nutrient targets to track nutrient levels and guide future actions to improve water quality

The Sustainable Watersheds Act addressed critical watershed management challenges and was a necessary first step toward implementing actions in the Made-in-Manitoba Climate and Green Plan.

Watershed Districts Act and Regulation

As one of the most successful land and water partnership programs in Canada, Watershed Districts support healthy and sustainable watersheds through focused, priority-based programs that address water quality, flooding, drought, land use, and climate change. Watershed Districts are established under The Watershed Districts Act and its regulation as a partnership between the Manitoba government and municipalities. Recent program changes, made through the new Watershed Districts Act and its regulation, build on the success of the program and could further benefit water quality. Through new provisions, watershed districts now have the flexibility to establish meaningful

partnerships with non-municipal entities, including Indigenous communities, and to create standing committees to deliver initiatives such as Growing Outcomes in Watersheds (GROW). More information on the districts and their work is available in the following section on incentives.

The Water Rights Act and Regulation

The Sustainable Watersheds Act amended The Water Rights Act to include a new requirement to compensate for the loss or alteration of a prescribed class of wetlands. In October 2019, the Water Rights Regulations was registered which prescribed Class III wetlands (seasonal) as requiring compensation if lost or altered. Manitoba further committed to continuing a policy that prohibits the drainage of Class IV and V wetlands (semi-permanent and permanent wetlands), except in cases that demonstrate broad socio-economic benefits. Wetlands perform a critical function by sequestering nutrients and protecting water quality. More information including the online portal for applications is available at www.manitoba.ca/drainage.

Nutrient Management Regulation

Although point sources of nitrogen and phosphorus are relatively easy to measure and control, diffuse non-point sources are often more challenging to measure and control. Actions to reduce nutrients from non-point sources have been established through the [Nutrient Management Regulation](#) by encouraging responsible nutrient planning, regulating the application of materials containing nutrients, and restricting the development of certain types of facilities (e.g., sewage treatment plants or lagoons, manure storage facilities, septic fields) in environmentally-sensitive areas (e.g., near vulnerable rivers and lakes).

The Nutrient Management Regulation ensures that nutrients (from all sources, including inorganic fertilizer, municipal sludge/biosolids, and manure) are not either over-applied to land (based on soil threshold values for phosphorus and limits for nitrogen) or applied to land between November 10th and April 10th each year. The intent of the seasonal restriction is to eliminate, or at minimum to reduce, the application of nutrients to frozen land where it may be susceptible to runoff in the spring. The Nutrient Management Regulation also requires golf courses in Manitoba to soil test and prepare annual nutrient management plans to demonstrate how nutrients will be used on them to reduce the risk that excess nutrients will run off into waterways.

Since nutrient application to land is required for crop production, the Nutrient Management Regulation is complemented by educational activities, including through the Fertilizer Canada 4R Nutrient

Stewardship program that teaches producers to apply the right amount of nutrients at the right time, right place, and from the right source. See more in the following sections on the 4R program.

Livestock Manure and Mortalities Management Regulation

The intent of the [Livestock Manure and Mortalities Management Regulation](#) is to manage and reduce nutrient export to surface waters by ensuring the safe storage, transportation, use, composting and disposal of livestock manure and mortalities from agricultural operations. Specific requirements for the storage and application of manure to land are outlined in this regulation, including setback distances from surface waters or a surface watercourse or a groundwater feature. In addition, all operations are prohibited from applying manure in the winter and larger livestock operations are required to submit annual manure management plans that include information on how manure is managed within their agricultural operation to meet the requirements of the regulation including soil nutrient restrictions.

Manure Application

The [Pesticides and Fertilizers Control Act](#) requires the training and licensing of Commercial and Off-farm Manure Applicators. The Manure Regulation describes the types of licences that may be issued and specifies supervision and record-keeping requirements for Commercial Manure Applicators.

Policies

Made-in-Manitoba Climate & Green Plan

In 2017, the Manitoba government released the [Made-in-Manitoba Climate and Green Plan](#) (the Plan) which provides a strategic framework aimed at supporting Manitoba's economy, while protecting the environment for future generations. The Plan is built on four pillars (climate, jobs, water, and nature) and 16 keystones designed to combat and adapt to climate change. The Plan includes a number of commitments regarding improving water quality and reducing nutrients, including committing to a 'no net loss' of water retention, improving wastewater treatment, and implementing precision agriculture. The plan also commits to exploring options for water quality trading for nutrient reductions. Work to implement the Climate and Green Plan is underway.

Water Strategy

Manitoba Agriculture and Resource Development is leading the development of a comprehensive

provincial management strategy to conserve wetlands, enhance resiliency, improve surface water quality, manage nutrients, protect biodiversity and sustain economic development. Other provincial departments, such as Conservation and Climate and Infrastructure, will help develop the strategy. That work is underway, including input from Manitoba's Expert Advisory Council under The Climate and Green Plan Act, to provide advice on the scope and elements of the strategy. Manitoba's provincial Water Management Strategy is expected to include specific recommendations and actions to support water quality improvements and nutrient reduction in Lake Winnipeg and elsewhere.

Incentives and Research

Establishment of Three Conservation-Based Trusts and Growing Outcomes in Watersheds (GROW)

The Made-in-Manitoba Climate and Green Plan called for the establishment of a trust to provide long-term and stable support to conservation efforts throughout the province. In 2018, the Conservation Trust was created by Manitoba with a \$102 million contribution to an endowment fund, managed by The Winnipeg Foundation and administered by the Manitoba Habitat Heritage Corporation. In 2019, two additional trusts, the GROW Trust and the Wetlands GROW Trust, were created, bringing Manitoba's total investment in these three trusts to \$204 million.

The interest generated from this funding will be used to enhance ecological goods and services on working landscapes through activities such as wetland conservation and restoration, water retention projects, grassland conservation, soil health improvements, buffer establishments (e.g., shelterbelts), and riparian area conservation and restoration. Over time, enhancing ecological goods and services will improve water quality and nutrient management.

Two of the three trusts directly support a new Manitoba initiative called [GROW \(Growing Outcomes in Watersheds\)](#). First identified under the Water Pillar in Manitoba's Climate and Green Plan, GROW builds on the ALUS Program and is a way of encouraging the delivery of ecological goods and services (EG&S). GROW promotes conservation of natural areas or changes to land uses that provide EG&S by helping farmers develop projects that maintain or improve local watershed health and work for their operations. GROW is a made-in-Manitoba approach on working lands that focuses on "farming the best, conserving the rest." With a focus on watershed health, management and resiliency, GROW will directly improve water quality and nutrient management in Manitoba. Manitoba's Watershed Districts are leading the implementation of GROW.

Several rounds of projects have already been supported by the three trusts. In April 2019, 35 organizations received a total investment of \$7.8 million (\$2.2 million granted and \$5.6 million matched) from the Conservation Trust for 41 projects, as part of the first funding cycle. The projects were divided into four categories related to watersheds, habitat and wildlife, connecting people to nature and innovation, and conservation planning. In 2020, 18 organizations received a total investment of \$7.2 million (\$1.8 million granted and \$5.4 million matched) from the Conservation Trust for 23 projects related to soil health, planning and innovation, connecting people with nature, and habitat and wildlife.

In July 2020, Manitoba announced the first projects funded through the GROW Trust (approx. \$5.3 million) for the establishment of Local GROW programs in all 14 watershed districts. It is important to note that the majority of the grant money will be provided as incentive payments for producers.

More information, including descriptions of each approved project through the GROW Trust and Conservation Trust, is available at: <https://mhhc.mb.ca/the-conservation-trust/>.

Watershed Districts Program

Manitoba's [Watershed Districts Program](#), established through The Watershed Districts Act and its regulation, is an incentive-based program, funded primarily by the Province of Manitoba and local municipalities. Through the program, a locally-appointed watershed district board is responsible for developing and implementing programming and delivering on local solutions contributing to healthier and more resilient watersheds. As of December 2020, there are 14 watershed districts in Manitoba and together they partner with 104 municipalities.

In 2019-20, the Manitoba government provided more than \$5.3 million in funding to watershed districts across the province. Participating municipalities are required to match the provincial grant distribution at a 3:1 ratio. In 2019-20, a total of \$1.7 million was provided by municipalities. An additional \$3.4 million in funding was obtained from other sources, including environmental organizations, industry, and other municipal, provincial, and federal government programs. It is the responsibility of the watershed district board to use the funding to implement projects and programs relevant to their local integrated watershed management plans.

In 2019-2020, the majority of watershed district funding (57 per cent) was spent on surface water management projects, such as water retention, erosion control, grassed waterways, wetland restoration and drain maintenance, many of which will support water quality improvements and nutrient

reductions. Fourteen per cent of the funding was provided for projects that directly reduce nutrients and improve water quality, such as the establishment of exclusion fencing, alternative water systems, and riparian buffer strips. The remaining 29 per cent of the funding was spent on habitat conservation and enhancement, drinking water protection, and watershed awareness and education. Since 2015, watershed districts have built 173 water retention projects (storage capacity of 4,135 acre- feet) and installed 221 km of riparian fencing and 197 off-site watering systems to restrict 50,000 head of cattle from riparian areas. These initiatives reduced nutrients and improved water quality, and educated over 6,500 participants about soil and water management strategies by hosting hundreds of workshops and project tours.

Progress on Integrated Watershed Management Plans

Watershed management plans are led by watershed districts and provide a decision-making framework for the protection, restoration, and management of water, aquatic ecosystems, and drinking water sources. Governed by The Water Protection Act, the planning process engages watershed residents, stakeholders, and governments to identify and prioritize watershed issues, gather and analyze local, technical, and traditional knowledge, and develop recommendations to address priority issues in targeted areas. Plan implementation is shared by watershed districts, all levels of government, stakeholder organizations, and watershed residents. Watershed Districts are formally designated under the Watershed Management Regulation as water planning authorities responsible for watershed management planning.

Watershed districts have initiated 27 Integrated Watershed Management Plans (IWMPs) as of 2019-20, of which 23 plans are complete, four plans are at various stages of development, and two plans are being renewed as part of their 10-year renewal process. Although plans are implemented by any organization or person within a watershed, Watershed Districts are required, under The Watershed Districts Act, to ensure that their programs and priorities meet those identified in their watershed management plans. All of the watershed management plans include information on water quality in the local area and specific actions to improve water quality and reduce nutrient loading.

Canadian Agricultural Partnership

The [Canadian Agricultural Partnership](#) (CAP) is a federal-provincial policy framework for agriculture that will invest a total of \$176 million in Manitoba's agriculture industry by 2023. The CAP ensures a collaborative approach that encourages investment, adaptation, and sustainable growth in the sector.

The CAP replaced Growing Forward 2, which expired in March 2018.

The CAP enables funding of a variety of activities through the program Ag Action Manitoba, which is divided into four client groups – farmers, agri-processors, industry organizations, researchers and industry service providers.

Environmental Farm Planning

[Environmental Farm Planning](#) (EFP) is a voluntary, confidential, self-assessment of a producer's own farm or ranch delivered in partnership with Keystone Agricultural Producers (KAP). An EFP helps farmers manage risk on their farm operations regarding water quality and supply, soil health, air quality and biodiversity.

Environmental Farm Planning began in Manitoba in 2004 and is currently supported through the Canadian Agricultural Partnership. Farmers attend workshops and complete EFP workbooks that encompass the full spectrum of agri-environmental subjects. Farmers then develop action plans to address identified risks, thereby becoming eligible to apply for incentive funding and specific commodity contracts (e.g. Potato and Field Pea). Since 2004, farmers in Manitoba have completed 7,121 Environmental Farm Plans.

Ag Action Manitoba – Assurance: Watershed Ecological Goods and Services

Ecological goods and services (EGS) are the environmental benefits that result from the physical, chemical, and biological processes of a healthy ecosystem. This Ag Action Manitoba program activity provides financial assistance to watershed districts to work with farmers to implement practices to conserve and enhance EGS on the agricultural landscape. This activity focusses on water quality and management and provides other important environmental services derived from well-managed stocks of natural capital on farmlands. The targeted focus areas for Assurance-Watershed EGS practices that are eligible for funding include water retention and runoff management, wetland restoration and enhancement, soil health improvement, and riparian area enhancement. Additional information on the EGS grant provided through Ag Action Manitoba is available at:

<https://www.gov.mb.ca/agriculture/environment/ecological-goods-and-services/watershed-egs.html>.

Sustainable Agriculture Incentive Program (Ag Action Manitoba – Assurance Beneficial Management Practices)

Funded by the Made-in-Manitoba Climate and Green Fund and delivered through Ag Action Manitoba,

this targeted incentive programming is available to farmers and eligible industry service providers to advance the adoption of on-farm Beneficial Management Practices (BMPs). Among the BMPs targeting water quality benefits are professional management planning, improved livestock management, and enhanced manure application. To be eligible, farmers are required to complete an Environmental Farm Plan. Additional information on the Sustainable Agriculture Incentive Program is available at: <https://www.gov.mb.ca/agriculture/environment/environmental-farm-plan/assurance-bmp.html>.

Fertilizer Canada and 4R Nutrient Stewardship

The flagship technical and extension vehicle for sound nutrient management in agriculture, 4R Nutrient Stewardship is an industry-originated initiative supported, both locally and internationally, by governments, researchers, and non-governmental organizations. The 4Rs serve as a framework for studying and communicating the principles and practices of Right Source of nutrient applied at the Right Rate, at the Right Time, and in the Right Place.

In Manitoba, 4R Nutrient Stewardship is exemplified by a partnership between the Manitoba government, farmers (represented by [KAP](#)) and the fertilizer industry (represented by [Fertilizer Canada](#)). This partnership is fostered and formalized by a [memorandum of understanding \(MOU\)](#), signed in 2013, 2015 and 2018. Funding is pledged annually by Fertilizer Canada for allocation, largely to extension activities, under the guidance of a local 4R MOU Implementation Committee. 4R Nutrient Stewardship is featured in Manitoba's Environmental Farm Plan and other extension efforts and products.

4R Designation is a program that encourages in-person or on-line training that tracks individuals' 4R-managed acres and rate level of 4R practice annually. These metrics of performance may be related to environmental outcomes, such as surface water quality.

Fertilizer use surveys collect crop-specific information that can be categorized according to the 4Rs, indicating level of adoption by farms on the Canadian Prairies. Like 4R designation, these surveys may provide a way to characterize risk mitigation by farmers regarding water quality.

Provincial specialists with Agriculture and Resource Development serve as technical experts for the 4R Nutrient Stewardship campaign. In addition to regularly featuring the 4Rs in extension materials and at training events, staff serve an enabling role in 4R Designation, an industry-led national training program of agronomists and agri-retailers that empowers the counting of clients' 4R-managed acres.

Over a hundred agricultural professionals operating in Manitoba have now completed the training and

qualified to participate.

Provincial Extension related to Nutrient Management

Staff from Agriculture and Resource Development provide technical information on land management, agricultural practice and water quality implications in multiple ways (e.g., publications, presentations, and training events) to a wide range of audiences (e.g., farmers, agricultural professionals, municipal councils, water quality advocates, teachers, students) both within and outside of Manitoba.

Agronomic advice links production with environmental sustainability by describing water quality benefits that accompany superior fertilization technology and techniques, such as sub-surface placement that protects fertilizer from runoff and reduces the rate of application needed to achieve yield objectives. Growers and agriculture professionals attend events throughout the year, such as the Crop Diagnostic School that has an approximate annual attendance of four hundred. Soil health workshops inform farmers and land managers of the principles and management practices that increase water storage and nutrient retention in soil, enhance nutrient uptake by crops and minimize the loss of nutrients to surface waters.

Manure management extension facilitates regulatory compliance by livestock operations, professional manure management planners and commercial manure applicators. Extension equips farmers and their agronomic advisers to achieve better nutrient use efficiency through superior liquid manure application methods, as well as, calculating land base requirements for new and expanded operations.

Water management extension helps farmers to reduce the risk of nutrient transport to surface waters because water movement is the means by which that transport occurs. An innovative component of this extension is the deployment of learning stations (indoor and outdoor) that simulate hydrological process including rainfall, snowmelt, infiltration, and runoff. Combined with other visuals, these simulations facilitate understanding of water movement on agricultural land, making connections to soil, crop and nutrient management, and acknowledging limitations to the adoption and efficacy of BMPs.

Extremes of Moisture Initiative

The [Manitoba Crop Alliance](#) is coordinating research into the science and management of both excess and shortage of water on agricultural lands. This includes funding proposal submissions and enabling optimal study designs, data collection, and results dissemination. Nutrient fate is a key element of some of the studies and is indirectly addressed by all of the projects as water movement drives nutrient

movement. In addition to Manitoba Agriculture and Resource Development, participating agencies include the Universities of Brandon and Manitoba, Agriculture and Agri-Food Canada (AAFC), the Prairie Agricultural Machinery Institute (PAMI), the Manitoba Association of Watersheds (MAW) and KAP.

Living Laboratories Initiative

In 2019, the Government of Canada announced \$10 million in funding for the [Living Laboratories Initiative](#) that was designed to increase agricultural innovation through collaboration between farmers, scientists, and other partners by promoting the development, testing and monitoring of new technologies. Innovative solutions will be developed to adapt to climate change, improve conservation of soil and water, and maximize biodiversity on agricultural landscapes. The Living Laboratories Initiative – Eastern Prairies Team is managed through the Manitoba Association of Watersheds. The team prioritized agri-environmental challenges to be targeted for federally funded on-farm study in four representative watersheds. Among the types of practices being implemented and studied are zone management, use of slow release phosphorus fertilizer, soil health measurement and improvement, water retention and sub-surface drainage water management.

Red River Basin/Cold Climate Agricultural Nutrients BMPs Workshop

In April 2019, several organizations across the international Red River Basin, including the Province of Manitoba, came together to share information on the efficacy of agricultural BMPs to reduce nitrogen and phosphorus loading to surface waters. Agricultural BMPs are fundamental to reducing nutrient runoff and improving water quality. Participants in the workshop included academic researchers; provincial, state and federal government staff, industry professionals, and water resource managers. The workshop specifically explored differences in the effectiveness of BMPs in cold climates, as compared to warmer areas.

A [final report](#) was published on the Red River Basin Commission's web site and contains information about:

- the level of efficacy currently expected for each of a wide range of practices
- the level of consensus among participants for each BMPs efficacy rating
- identified research needs
- recommended next steps to be collectively pursued

Participants plan to develop fact sheets to share the findings from the workshop.

Lake Winnipeg Research Consortium

The [Lake Winnipeg Research Consortium](#) (LWRC) is a registered charity, established in 1998, to facilitate scientific research and whole ecosystem monitoring on Lake Winnipeg. The LWRC owns and operates two research vessels – Motor Vessel (M/V) NAMA0 and M/V FYLGJA. The M/V NAMA0 is used to conduct three field surveys throughout the open water season (spring, summer, and fall).

Scientists and students from academia, various government, private and non-government organizations participate in these surveys, collecting a wide range of ecological data from an established network of sampling stations throughout the entire lake. Over 30 agencies comprise the membership of the LWRC, including the Government of Manitoba, which was one of the LWRC's founding members.

Manitoba is also a core funder and participates on the LWRC's board of directors. Water quality and biological data collected by the Government of Manitoba as part of the M/V NAMA0 field surveys provides the information to support reporting on Lake Winnipeg including this report on progress towards nutrient targets.

Whole ecosystem data, collected from the LWRC-led field surveys on Lake Winnipeg, is integral to broadening our understanding of in-lake ecological processes, assessing changes over time, and supporting management decisions, including ways to reduce nutrient concentrations and improve water quality.

In addition, the LWRC hosts an annual science workshop convening the active science member agencies to increase awareness and understanding of long-term ecological changes due to multiple stressors, including excess nutrients (eutrophication), aquatic invasive species, climate change, and fishing pressures. It also offers a unique education program dedicated to providing students with hands-on experiential learning opportunities on board the M/V NAMA0 (Lake Ecology Field Program), as well as online resources, classroom visits, and two scholarships.

Inter-jurisdictional Activities

Supporting Nutrient Reduction Policies and Programs in Other Jurisdictions That Share a Transboundary River Basin with Manitoba

Given that approximately half of the nutrients (and 70 per cent of the water flow) entering Lake Winnipeg originate from outside of Manitoba, a critical component for improving water quality in the

Lake Winnipeg watershed involves collaboration with external jurisdictions. Manitoba participates in, and, in some cases, provides funding to a number of transboundary water organizations, including the [International Joint Commission](#), the [Prairie Provinces Water Board](#), the [Red River Basin Commission](#) (RRBC) and the Assiniboine River Basin Initiative (ARBI). Manitoba also has a number of Memorandums of Understanding related to water including the [Saskatchewan-Manitoba Memorandum of Understanding Regarding Water Management](#).

Manitoba works through transboundary organizations to influence actions and activities in upstream jurisdictions that can affect water quality and nutrient loading to Lake Winnipeg. For example, the Prairie Provinces Water Board (of which Manitoba is a member) has adopted nitrogen and phosphorus objectives for eastward-flowing streams in the Lake Winnipeg watershed, including the Saskatchewan, Assiniboine, and Qu'Appelle Rivers that flow into Manitoba from Saskatchewan.

Manitoba participates on several boards for the International Joint Commission, which has a mandate to prevent and resolve disputes by helping the Governments of Canada and the US protect the transboundary environment through the [Boundary Waters Treaty \(1909\)](#).

The International Joint Commission's [International Red River Board recently developed nutrient concentration objectives and load targets for the Red River at the US-Canada border](#). The International Joint Commission has subsequently recommended the objectives and targets to the US and Canadian federal governments with the mandate to establish water quality objectives at the US-Canada border.

Since the Red River contributes about 68 per cent of the phosphorus load and 34 per cent of the nitrogen load to Lake Winnipeg, implementation of nutrient concentration objectives and load targets for the Red River at the US/Canada border could lead to a significant improvement in water quality.

Significant work is underway through the state of [Minnesota](#) to reduce nutrient loading. [North Dakota](#) has also initiated work on a nutrient management strategy and has programming underway to reduce loading, including through nonpoint source pollution prevention programming.

Manitoba is also a participant and funder of the Assiniboine River Basin Initiative (ARBI) and the Red River Basin Commission (RRBC), both of which are undertaking work to improve water quality and reduce nutrients. ARBI, which works across the inter-jurisdictional shared watersheds of the Assiniboine, Souris and Qu'Appelle Rivers, has developed a framework for water stewardship, outlining key strategies, basin goals, objectives, and desired outcomes to become a more resilient basin, respecting

land and water issues. Objectives include the development of basin strategies for water quality (e.g., developing a jurisdictional approach that identifies the nutrient loads and the impacts from urban and rural areas on nutrient loads across the basin) and water quantity (e.g., increasing opportunities for increasing capacity for multipurpose water storage).

The RRBC is also working to reduce nutrients across the international Red River watershed and has established a Natural Resource Framework Plan that spans provincial and international borders. The commission supports the International Red River Board's Water Quality Committee. It helped facilitate the development of nutrient objectives and targets for the Red River and hosted the Red River Basin/Cold Climate Agricultural Nutrients BMP Workshop previously described.

The RRBC is also leading a tile drainage integration project that will look at tile drainage and its relationship to water quality. RRBC is also working with Minnesota on a water quality trading project that is expected to be expanded to include North Dakota and Minnesota.

Organizations, such as ARBI and RRBC, play an important role in promoting and developing coordinated water management including nutrient reduction. In 2018, The Water Protection Act was amended to recognize the important role of transboundary organizations, including the RRBC and ARBI.

Memorandum of Understanding between Canada and Manitoba on Lake Winnipeg

In 2010, the governments of Canada and Manitoba signed a five-year Canada-Manitoba [Memorandum of Understanding \(MOU\)](#) Respecting Lake Winnipeg and the Lake Winnipeg Basin. The memorandum recognizes the need to promote and undertake governance and management activities aimed at protecting the ecological health of Lake Winnipeg and the Lake Winnipeg basin, including nutrient reduction.

A steering committee was established to oversee the implementation of the MOU and to increase communication between the two parties. In 2015, the MOU was extended for another five-year term. The committee has met at least twice a year since 2010 and brings together federal and provincial government staff from a number of departments with links to efforts to improve water quality and reduce nutrients in Lake Winnipeg and its watershed. Canada and Manitoba use the committee to share information, coordinate efforts, and identify priorities. Work is currently underway between the parties to renew the MOU.

As part of a science subsidiary arrangement developed under the memorandum, Canada and Manitoba

agreed to improve reporting on environmental conditions in Lake Winnipeg. As part of this work, Manitoba Agriculture and Resource Development and Environment and Climate Change Canada released the 2nd edition of the *State of Lake Winnipeg* report on April 20, 2020. The full Technical Report and Highlights are available at www.gov.mb.ca/lakewinnipeg and include an assessment of nutrients in Lake Winnipeg and loading to the lake, as well other topics, including algal blooms.

Lake Winnipeg Basin Program

In addition to the Canada-Manitoba MOU on Lake Winnipeg and its Basin, the Government of Canada has invested approximately \$62.2M since 2007 to engage citizens, scientists, and domestic and international partners in actions to restore the ecological health of Lake Winnipeg, reduce nutrient pollution, and improve water quality. Through two phases of the Lake Winnipeg Basin Initiative, and the current Lake Winnipeg Basin Program (LWBP), the Government of Canada has supported efforts to reduce nutrient loading to the lake, increase collaboration with other parties to protect the lake and its basin, and engage with Indigenous Peoples on issues regarding freshwater.

Canada's most recent investment includes \$25.7 million, through Budget 2017, for Lake Winnipeg related programming, including \$8 million in funding for action-oriented projects that meet one or more of the program goals related to nutrient reduction.

Some of the projects funded through the program include:

- restoring wetlands and building retention ponds to intercept water flow across the landscape and capture nutrients
- using innovative approaches, such as floating treatment islands and duckweed, to remove phosphorus from municipal wastewater lagoons
- citizen-led phosphorus monitoring
- implementing management practices to prevent livestock from entering lakes and rivers
- stabilizing creek banks to reduce erosion

OTHER ACTIVITIES ACROSS THE WATERSHED

In addition to work underway by the Manitoba Government and other jurisdictions that share a transboundary river basin with the province, many other agencies, stakeholders, and individuals are contributing to nutrient reduction efforts. From non-government agencies, such as the Lake Winnipeg Foundation and the International Institute of Sustainable Development (IISD), to municipalities to

industries to individuals such as shoppers choosing phosphorus-free products and farmers adopting best management practices, there is much that can, and is, being done to reduce nutrients and improve water quality. While this report focuses on the work of the Manitoba government and other jurisdictions, we must acknowledge the contributions and commitments of others to nutrient reduction.

Academic institutions, non-government organizations, community action groups, industries, businesses, agricultural producers, landowners, and local watershed inhabitants are leading and/or participating in activities to reduce nutrient export to surface waters in Manitoba. For example, Manitoba's academic institutions and education system are providing educational programs to improve understanding of water quality issues and watershed management in Manitoba.

Non-governmental organizations are conducting environmental research and monitoring, encouraging collaboration, facilitating educational opportunities, hosting innovative competitions, and advancing our knowledge and understanding of the Lake Winnipeg ecosystem and BMPs within the Lake Winnipeg watershed.

Grassroots community action groups are providing a voice within local watersheds to raise awareness of the concerns of nutrient pollution. Many industries, businesses, and land owners in Manitoba are showing a commitment towards environmental protection and are adopting BMPs to reduce their impact on local water quality. All residents within the Lake Winnipeg watershed play a role in reducing their nutrient contribution to the lake.

CONCLUSION

As of 2019, nutrient concentrations in Lake Winnipeg remain elevated, due to significant contributions of nutrient loads from the four major tributaries (Red, Winnipeg, Saskatchewan, and Dauphin) discharging into the lake. Establishing and implementing the proposed nutrient targets in Lake Winnipeg and its major tributaries provide a way to measure and track progress over time.

Significant progress has been made to implement actions to reduce nutrient contributions to surface waters. However, much remains to be done, and the Province of Manitoba will continue to work collectively to address the challenging issue of nutrient pollution and to improve surface water quality.