LAKE WINNIPEG COMMUNITY-BASED MONITORING NETWORK

Pembina Valley Conservation District

2018 Regional Report

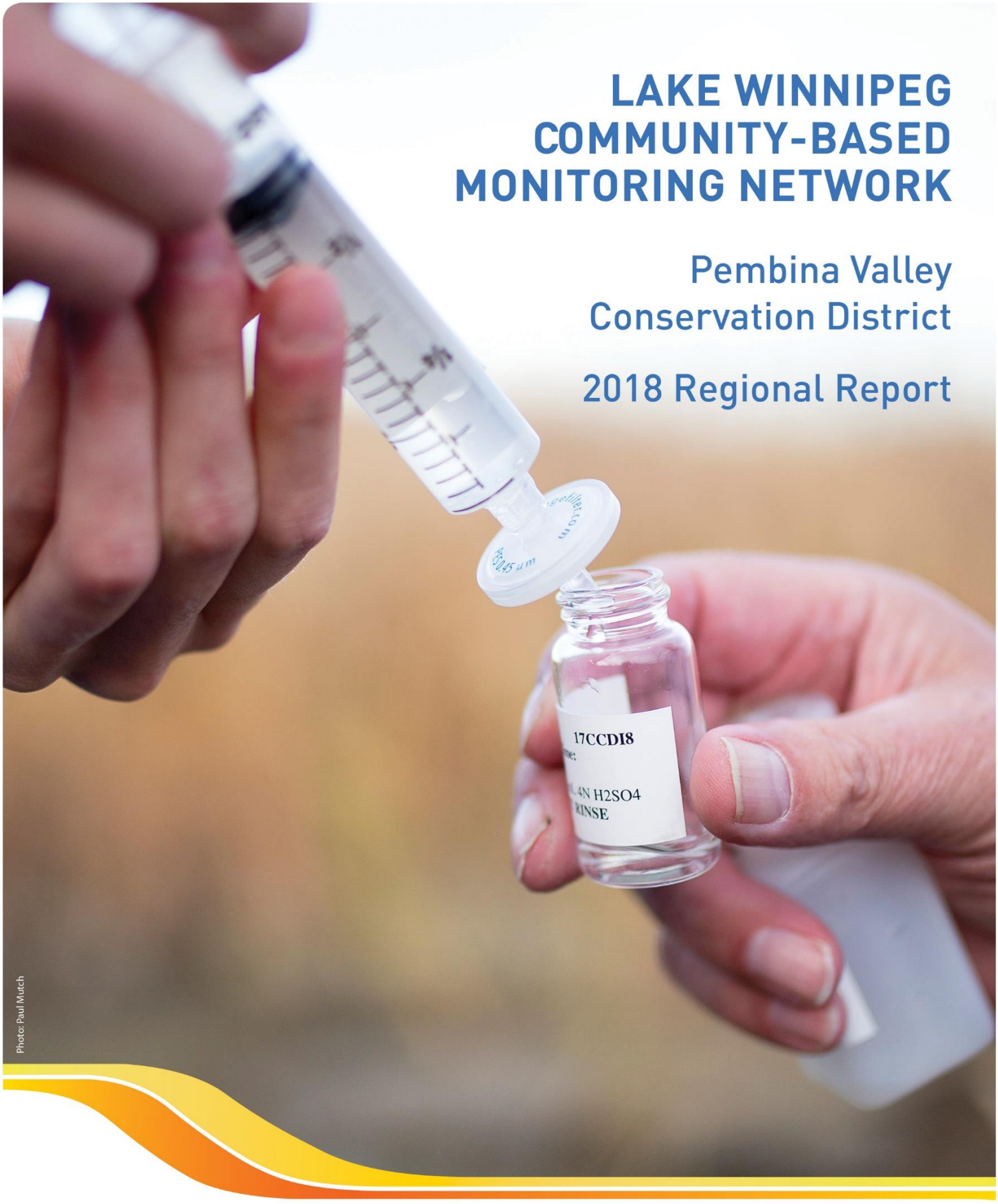

Photo: Paul Mutch

LWF LAKE WINNIPEG FOUNDATION

Pembina Valley Conservation District

Agriculture and Agri-Food Canada

LAKE WINNIPEG COMMUNITY-BASED MONITORING NETWORK: OVERVIEW

Lake Winnipeg, the world's 10th largest freshwater lake, receives its water from a vast watershed – an area of land 40 times larger than the lake itself which includes many smaller sub-watersheds. All human activities across this huge watershed have the potential to impact our water quality. However, the closer you are to Lake Winnipeg, the bigger your impact will likely be.

Phosphorus is the nutrient responsible for the potentially harmful blue-green algae blooms on Lake Winnipeg and on other lakes within the watershed. Different sub-watersheds contribute different proportions of Lake Winnipeg's total phosphorus load. With the help of a strong network of local organizations and citizen scientists, the Lake Winnipeg Community-Based Monitoring Network (LWCBMN) is identifying phosphorus hotspots on the landscape, creating opportunities to target funding and action to achieve the greatest return on investment.

Snow melts, floods and heavy rainfall events are responsible for most of the phosphorus that is flushed from the land and carried into our waterways. LWCBMN samples frequently throughout the season, and particularly during the spring melt, to ensure we capture phosphorus runoff during these high-water events.

Most community-based monitoring (CBM) sampling is conducted at stations where water flow is continuously monitored by the Water Survey of Canada. By tracking flow online using the Water Survey of Canada's real-time data, the network can mobilize partners and citizen scientists across the watershed to ensure frequent sampling during peak flows. Sampling at these stations provides corresponding flow data, allowing CBM data to be used to calculate **phosphorus loads**. We need several samples throughout the season to accurately calculate these loads. Phosphorus loads can subsequently be used to calculate **phosphorus exports**, based on the area of the watershed.

Phosphorus load is the total amount of phosphorus flowing past a sample site over a given period of time.

Phosphorus export is the amount of phosphorus exported by each hectare of land in a year, expressed as kg/ha/y.

The network in action – 2018

In 2018, in its third field season, LWCBMN grew to cover more drainage areas across the province, collecting samples at new sites in the western Red River valley, along Winnipeg River tributaries and in the City of Winnipeg. A total of 1000 samples were collected from 101 sites.

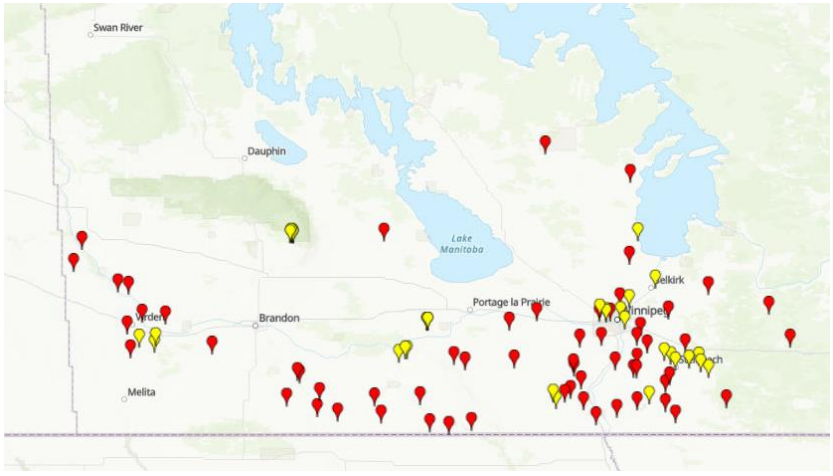

Figure 1. 2018 sample sites. Sites in red are located at Water Survey of Canada flow-metered stations. Sites in yellow are monitored by volunteer samplers where flow is not measured.

2018 RESULTS: OVERVIEW

Table 1. Overview of findings from 2018 LWCBMN phosphorus monitoring data.

REGION	# years of LWCBMN data	# sites in 2018	# samples collected in 2018	Highest phosphorus export in region (2017)	Highest phosphorus export in region (2018)	Regional lead
East Interlake Conservation District	2	4	74	0.33 kg/ha/y (Icelandic River)	0.03 kg/ha/y (Icelandic River and Grassmere Creek)	Armand Belanger (EICD)
Seine Rat River Conservation District	3	20	204	1.64 kg/ha/y (Manning Canal)	0.22 kg/ha/y (Main Drain near Dominion City)	Jodi Goerzen and Chris Randall (SRRCD)
La Salle Redboine Conservation District	3	12	139	0.76 kg/ha/y (La Salle River at Sanford)	0.12 kg/ha/y (Roseisle Creek near Roseisle)	Justin Reid (LSRBCD)
Upper Assiniboine River Conservation District	2	6	102	0.62 kg/ha/y (Arrow River)	0.08 kg/ha/y (Bailey's Creek near Oak Lake)	Ryan Canart (UARCD)
Pembina Valley Conservation District	2	12	102	1.88 kg/ha/y* (Pembina River near Windygates)	0.21 kg/ha/y (Pembina River near Lorne Lake)	Cliff Greenfield (PVCD) and Jason Vanrobaeys (AAFC)
West Souris River Conservation District	1	5	97	-	0.01 kg/ha/y (Pipestone Creek near Pipestone)	Dean Brooker and Scott Hainsworth (WSRCD)
City of Winnipeg	1	6	68	-	0.03 kg/ha/y (Omand's Creek near Empress Street)	Lake Winnipeg Foundation
Western Tributaries of Red River	1	5	27	-	0.11 kg/ha/y (Buffalo Creek near Rosenfeld)	Lake Winnipeg Foundation
Little Saskatchewan River Conservation District	1	6	47	-	No flow metered stations	Colleen Cuvelier (LSRCD)
Cooks Creek Conservation District	2	4	34	-	0.01 kg/ha/y (Cooks Creek below Diversion and at Diversion)	Lake Winnipeg Foundation

In the 2018 field season, southern Manitoba was very dry with low discharge at all sampling sites, resulting in low phosphorus exports and low spatial variation between sub-watersheds. The dry conditions in 2018 highlight the important relationship between water discharge and phosphorus load entering Lake Winnipeg: high water years are high phosphorus loading years and low water years are low phosphorus loading years. For example, the Manning Canal was a phosphorus hotspot in 2016 and 2017 with phosphorus exports of 1.10 kg/ha/y and 1.62 kg/ha/y respectively. In contrast, the Manning Canal had a phosphorus export of 0.07 kg/ha/y in 2018. Though peak phosphorus concentrations were similar in all three years, the water load was ten times lower in 2018 (Figure 2). **Results from the 2018 field season demonstrate that we can reduce the phosphorus entering our lakes by reducing water runoff across the watershed.**

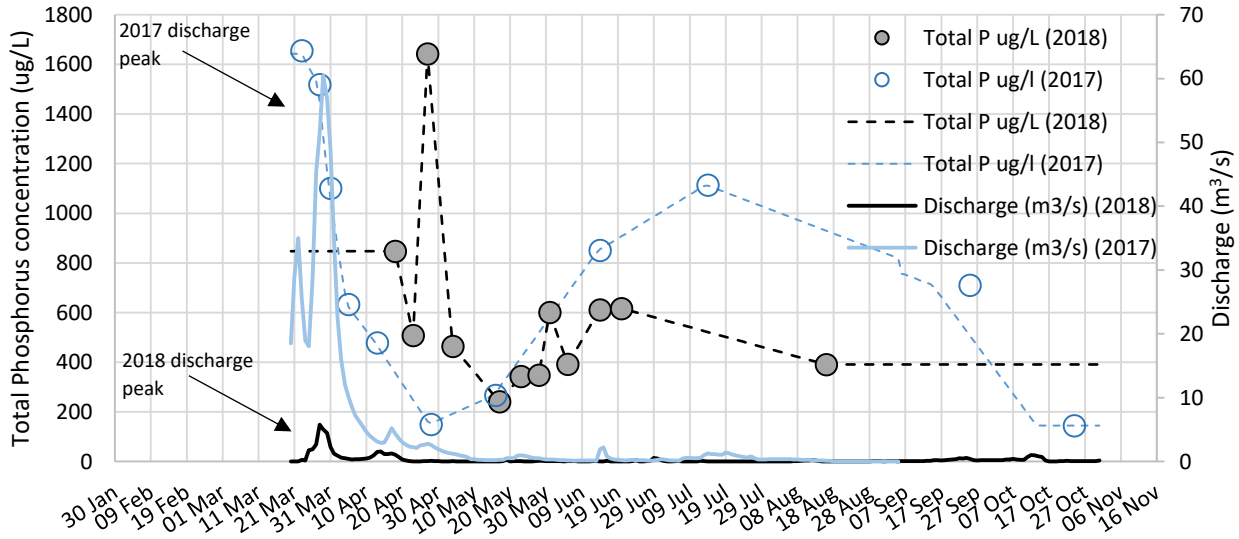

Figure 2. Comparison of phosphorus concentration and discharge in 2017 (blue) and 2018 (black) at the Manning Canal site.

PEMBINA VALLEY CONSERVATION DISTRICT

The Pembina Valley Conservation District (PVCD) is located in southern Manitoba along the Canada-United States border. Approximately half of the Pembina River basin is located in the United States. The Pembina River is the main waterway in this region, with many tributaries and lakes flowing into it. The primary land-use and economy in PVCD is agriculture, specifically cereal, oilseed and forage crops (2006 census). Other potential phosphorus contributors include the approximately 780 livestock farms in the watershed (2006 census). In addition to agricultural activities, wastewater treatment plants and lagoons in municipalities throughout PVCD contribute phosphorus to local waterways. Major municipalities include Winkler, Morden and Manitou.

In partnership with LWCBMN, PVCD staff and partners from the Agriculture and Agri-Food Canada (AAFC) Morden Research and Development Center sampled 12 sites in the PVCD region, of which 10 were at stations where flow is measured. For the sites where flow is not measured, useful information can be drawn from the phosphorus concentrations; however, we cannot calculate the phosphorus load because we cannot multiply the concentration by the volume of water flowing by the site.

PVCD staff and partners collected samples frequently at all sites, specifically during the spring runoff period, resulting in high-quality data. For all sample sites, most of the water (69%) and phosphorus (72%) contribution occurred during the spring, from March 1st to May 31st.

Table 2. Overview of findings from 2018 PVCD sample sites.

Sampling station	Phosphorus load (tonnes/y)	Phosphorus export (kg/ha/y)
B. Mowbray Creek near Mowbray	2	0.08
C. Snowflake Creek near Snowflake	4	0.04
D. Cypress Creek near Clearwater	2	0.04
E. Long River near Holmfield	1	0.02
F. Pelican Lake outlet	0	0
G. Pembina River near Lorne Lake	12	0.21
H+A. Pembina River below Crystal Creek (including Badger Creek)	-9	-0.03
I. Pembina River near La Rivière	-2	-0.06
J. Pembina River near Windygates	1	0.01
K. Pembina River downstream of Swan Lake	7	0.13

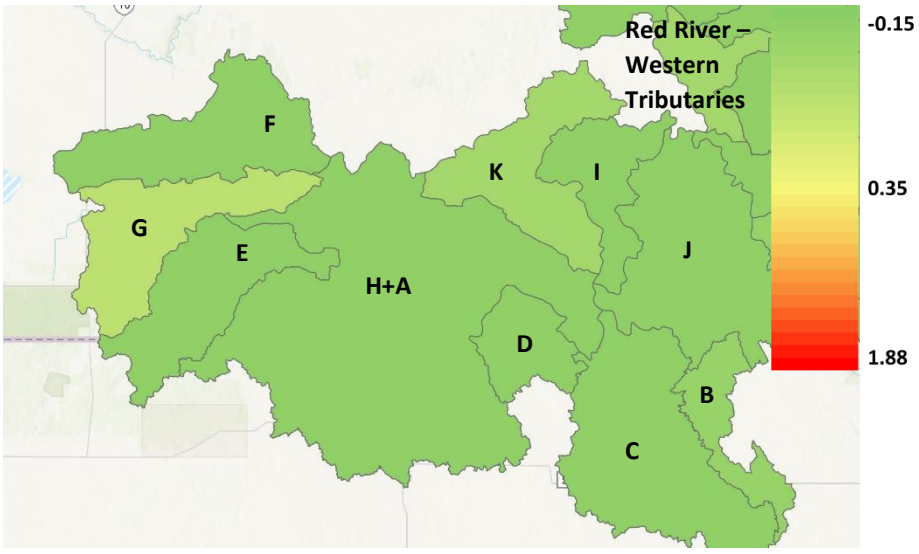

Figure 3. Phosphorus export (kg /ha/y) map for sub-watersheds in the Pembina Valley Conservation District.

2018 RESULTS BY SAMPLE SITE

Pembina River tributaries

Mowbray Creek near Mowbray

Mowbray Creek is located south of the Pembina River. The majority of the Mowbray Creek drainage area is located in North Dakota. The drainage area for this sample site is approximately 263 km^2 and drains a portion of the Rural Municipality of Mowbray, MB as well as the city of Langdon, North Dakota.

Samples were taken at Water Survey of Canada flow meter 05OB021, near Mowbray. In 2018, 9 samples were collected between April 14th and July 3rd.

	2017	2018
Discharge peaked:	April 2nd	April 20th
Greatest phosphorus concentration:	1196 µg/L* (March 26th)	1235 µg/L (April 14th)
Total phosphorus load:	20 tonnes	2.0 tonnes
Total water load:	0.025 km^3	0.003 km^3
Phosphorus export:	0.76 kg/ha/y	0.08 kg/ha/y
Percent water load in spring:**	97%	82%
Percent phosphorus load in spring:	97%	85%

*The symbol "µg" is used to express micrograms
**Spring is considered to be March 1st to May 31st

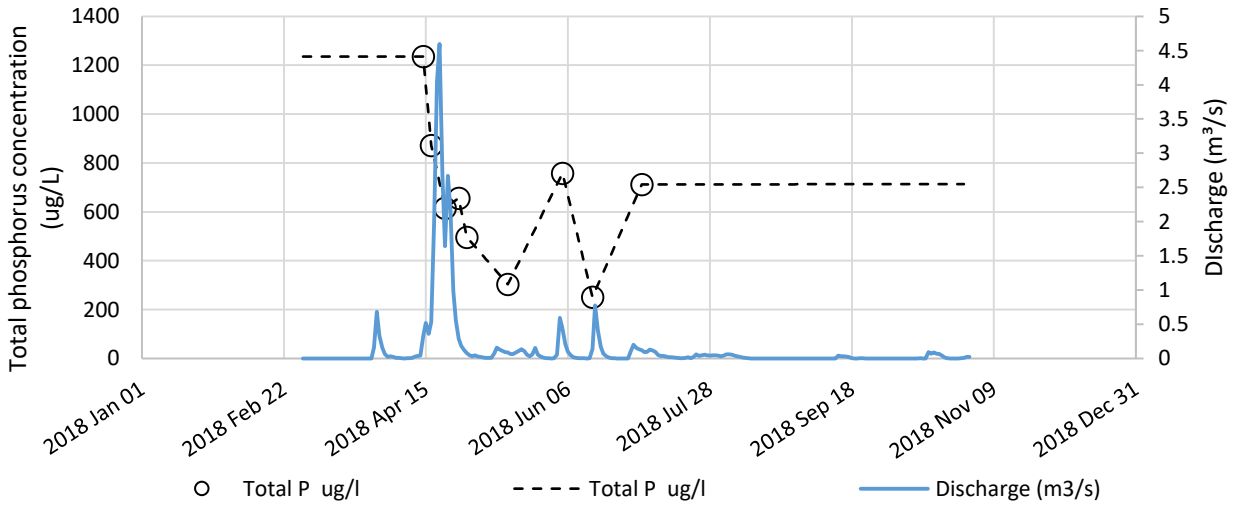

Figure 4. Discharge and total phosphorus concentration over the 2018 sampling season at Mowbray Creek near Mowbray (Water Survey of Canada Station 05OB021).

Snowflake Creek near Snowflake

Snowflake Creek is located south of the Pembina River. The majority of the Snowflake Creek drainage area is located in North Dakota. The drainage area for this sample site is approximately 975 km^2 and drains a largely agricultural area and a portion of the Rural Municipality of Snowflake.

Samples were taken at Water Survey of Canada flow meter 05OB016, near Snowflake. In 2018, 12 samples were collected between April 14th and July 3rd.

	2017	2018
Discharge peaked:	April 5th	April 22nd
Greatest phosphorus concentration:	912 µg/L (March 31st)	748 µg/L (April 23rd)
Total phosphorus load:	41 tonnes	4.0 tonnes
Total water load:	0.066 km^3	0.007 km^3
Phosphorus export:	0.42 kg/ha/y	0.04 kg/ha/y
Percent water load in spring:	98%	55%
Percent phosphorus load in spring:	97%	58%

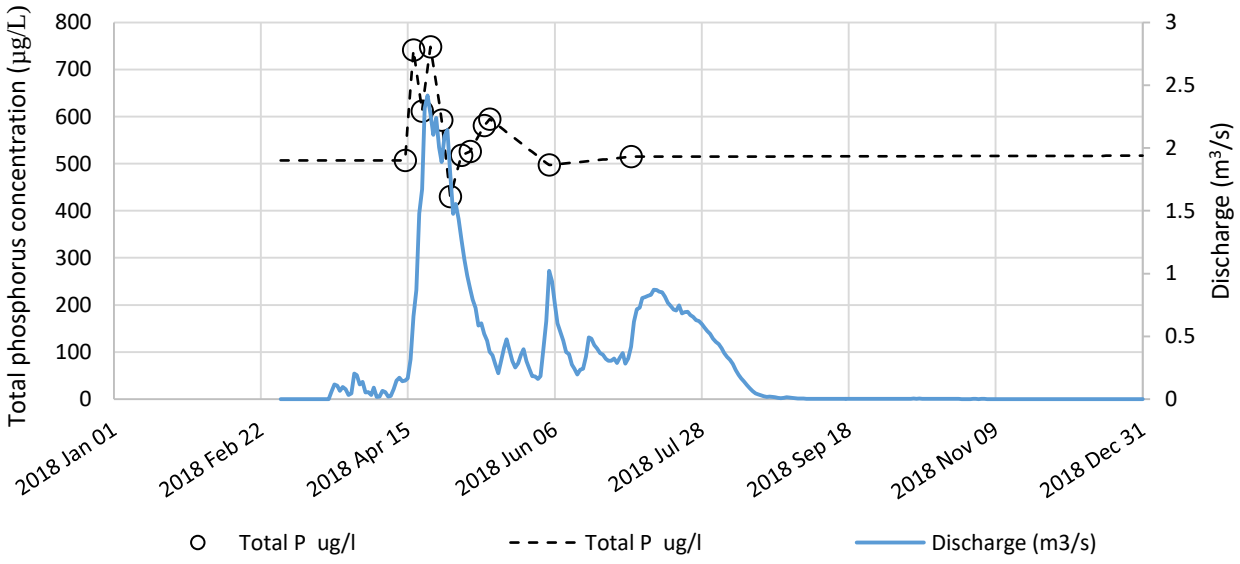

Figure 5. Discharge and total phosphorus concentration over the 2018 sampling season at Snowflake Creek near Snowflake (Water Survey of Canada Station 05OB016).

Cypress Creek near Clearwater

Cypress Creek is located south of the Pembina River. There are portions of the drainage area in Manitoba and North Dakota. The drainage area for this sample site is approximately 397 km^2 and drains a largely agricultural area.

Samples were taken at Water Survey of Canada flow meter 05OB010, near Clearwater. In 2018, 7 samples were collected between April 17th and July 3rd.

	2017	2018
Discharge peaked:	March 30th	April 20th
Greatest phosphorus concentration:	1271 µg/L (March 27th)	802 µg/L (April 22nd)
Total phosphorus load:	22 tonnes	1.8 tonnes
Total water load:	0.027 km^3	0.002 km^3
Phosphorus export:	0.56 kg/h/y	0.04 kg/h/y
Percent water load in spring:	98%	60%
Percent phosphorus load in spring:	100%	60%

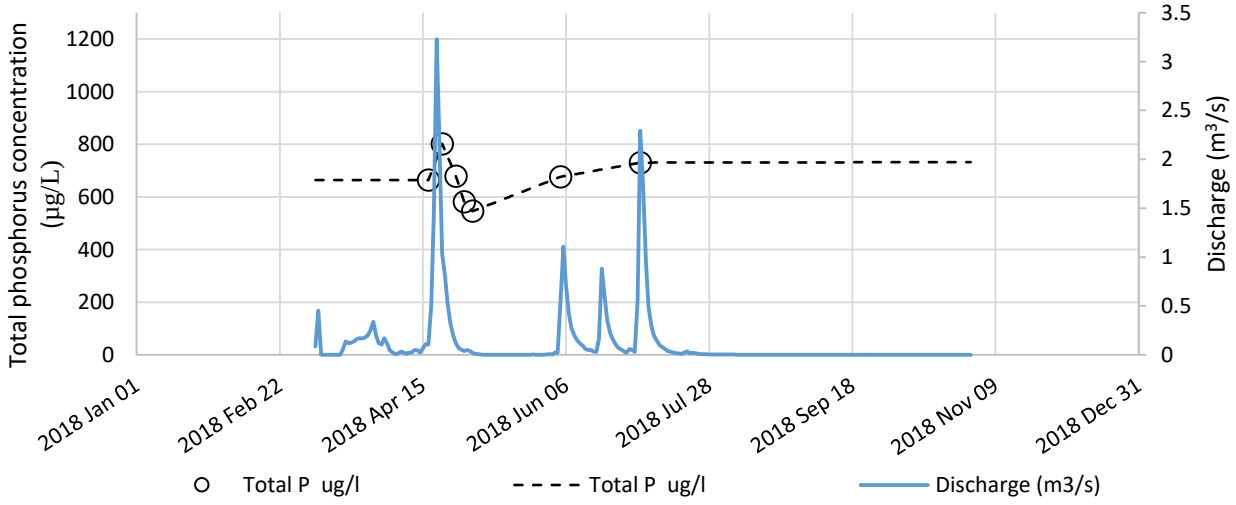

Figure 6. Discharge and total phosphorus concentration over the 2018 sampling season at Cypress Creek near Clearwater (Water Survey of Canada Station 05OB010).

Long River near Holmfield

Long River is located south of the Pembina River. The drainage area for this sample site is approximately 574 km^2 and drains a largely agricultural area and a portion of the town of Killarney.

Samples were taken at Water Survey of Canada flow meter 05OA006, near Holmfield. In 2018, 7 samples were collected between April 17th and October 17th.

	2017	2018
Discharge peaked:	April 2nd	March 29th
Greatest phosphorus concentration:	608 µg/L (March 31st)	485 µg/L (April 22nd)
Total phosphorus load:	13 tonnes	1.1 tonne
Total water load:	0.038 km^3	0.004 km^3
Phosphorus export:	0.22 kg/ha/y	0.02 kg/ha/y
Percent water load in spring:	95%	88%
Percent phosphorus load in spring:	98%	92%

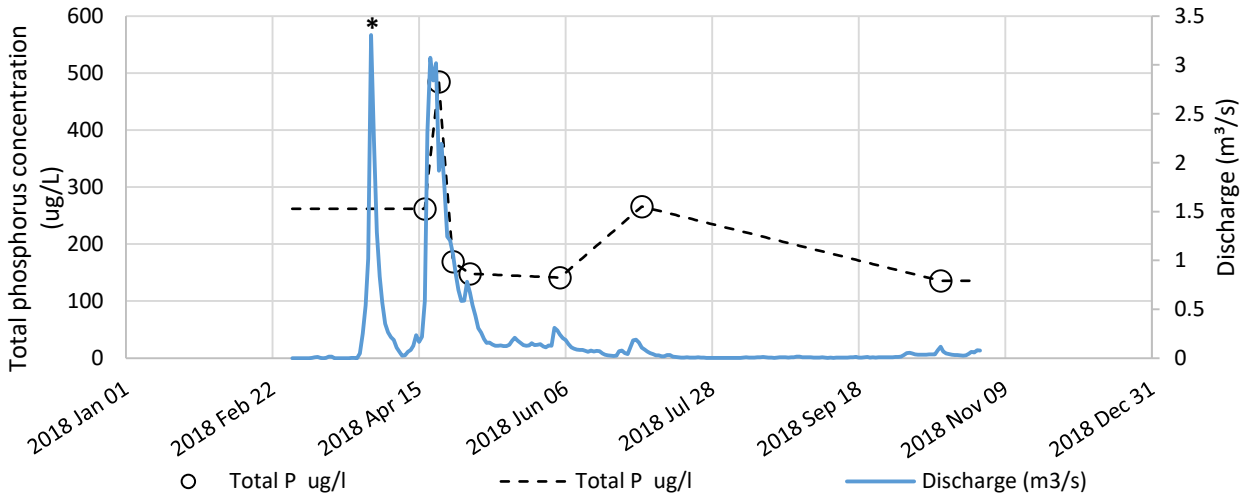

Figure 7. Discharge and total phosphorus concentration over the 2018 sampling season at Long River near Holmfield (Water Survey of Canada Station 05OA006).

***In 2018 Long River discharge peaked while the river was covered by ice and therefore we were unable to collect samples during this time. This may have resulted in a portion of the phosphorus load being missed.**

Pelican Lake outlet

Pelican Lake is a popular camping and cottage destination in south-western Manitoba. The drainage area for this sample site is approximately 686 km^2 and drains the town of Ninette, located at the north end of the lake.

The sample site is located at a Manitoba Infrastructure flow meter at the outlet of Pelican Lake. In 2018, no samples could be collected. There was no water flow out of Pelican Lake, and therefore no phosphorus loading from this site.

	2017	2018
Discharge peaked:	April 8th to May 2nd	-
Greatest phosphorus concentration:	462 µg/L (May 5th)	-
Total phosphorus load:	16 tonnes	0 tonnes
Total water load:	0.044 km^3	0 km^3
Phosphorus export:	0.23 kg/ha/y	0 kg/ha/y
Percent water load in spring:	100%	-
Percent phosphorus load in spring:	100%	-

Pembina River sample sites

Pembina River near Lorne Lake

This reach of the Pembina River drains a largely agricultural area of approximately 573 km^2.

Samples were taken at Water Survey of Canada flow meter 05OA010, above Lorne Lake. In 2018, 8 samples were collected between April 18th and June 15th.

	2017	2018
Discharge peaked:	March 31st	March 31st
Greatest phosphorus concentration:	960 µg/L (March 29th)	534 µg/L (April 23rd)
Total phosphorus load:	43 tonnes	12 tonnes
Total water load:	0.06 km^3	0.028 km^3
Phosphorus export:	0.75 kg/ha/y	0.21 kg/ha/y
Percent water load in spring:	96%	97%
Percent phosphorus load in spring:	99%	99%

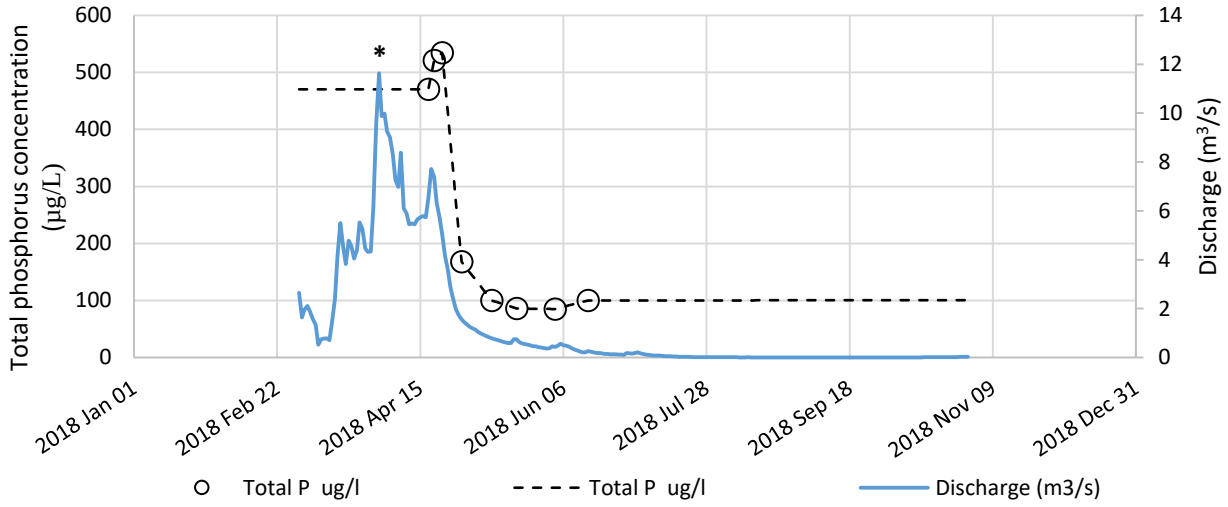

Figure 8. Discharge and total phosphorus concentration over the 2018 sampling season at Pembina River near Lorne Lake (Water Survey of Canada Station 05OA010).

***In 2018 Pembina River near Lorne Lake discharge peaked while the river was covered by ice and therefore we were unable to collect samples during this time. This may have resulted in a portion of the phosphorus load being missed.**

Pembina River below Crystal Creek

This stretch of the Pembina River drains a largely agricultural area of 2,936 km^2. In 2018, this stretch of the Pembina River included the Badger Creek tributary because there was no flow data available for Badger Creek as there was in 2017. Differences in drainage area should be considered when comparing 2017 and 2018 data.

Samples were taken at Water Survey of Canada flow meter 05OB023, below Crystal Creek. In 2018, 10 samples were collected between April 18th and August 10th.

	2017 (2,157 km^2)	2018 (2,936 km^2)
Discharge peaked:	April 2nd	April 21st
Greatest phosphorus concentration:	897 µg/L (March 31st)	474 µg/L (April 18th)
Total phosphorus load:	25 tonnes	-8.9 tonnes*
Total water load:	0.117 km^3	-0.004 km^3
Phosphorus export:	0.18 kg/ha/y	-0.04 kg/ha/y
Percent water load in spring:	90%	62%
Percent phosphorus load in spring:	96%	80%

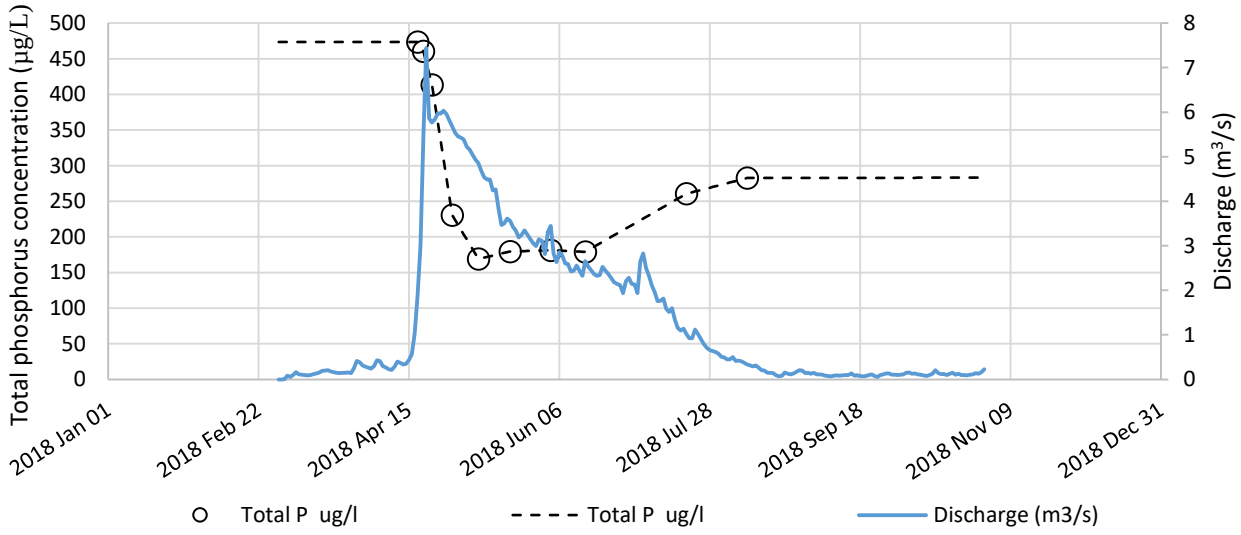

Figure 9. Discharge and total phosphorus concentration over the 2018 sampling season at Pembina River below Crystal Creek (Water Survey of Canada Stations 05OB023).

***When there are multiple sites along a waterway, phosphorus loads are calculated by subtracting the upstream load from the downstream load resulting in the amount of phosphorus contributed by the stretch of the waterway between the two sites. A negative phosphorus load means that the upstream site had a greater phosphorus load than the downstream site and therefore phosphorus was sequestered in that stretch of the waterway, as indicated by the negative export.**

Pembina River downstream of Swan Lake

The drainage area for this stretch of the Pembina River is 510 km^2, and was included in the Pembina River near La Riviere drainage area in the 2017 report, which is now split into two sample sites. This stretch of the Pembina River includes Swan Lake First Nation.

Samples were collected at Water Survey of Canada flow meter 05OB019, downstream of Swan Lake. In 2018, 8 samples were collected between April 18th and July 20th.

	2018
Discharge peaked:	May 7th
Greatest phosphorus concentration:	870 µg/L (April 18th)
Total phosphorus load:	7.0 tonnes
Total water load:	0.002 km^3
Phosphorus export:	0.13 kg/ha/y
Percent water load in spring:	72%
Percent phosphorus load in spring:	65%

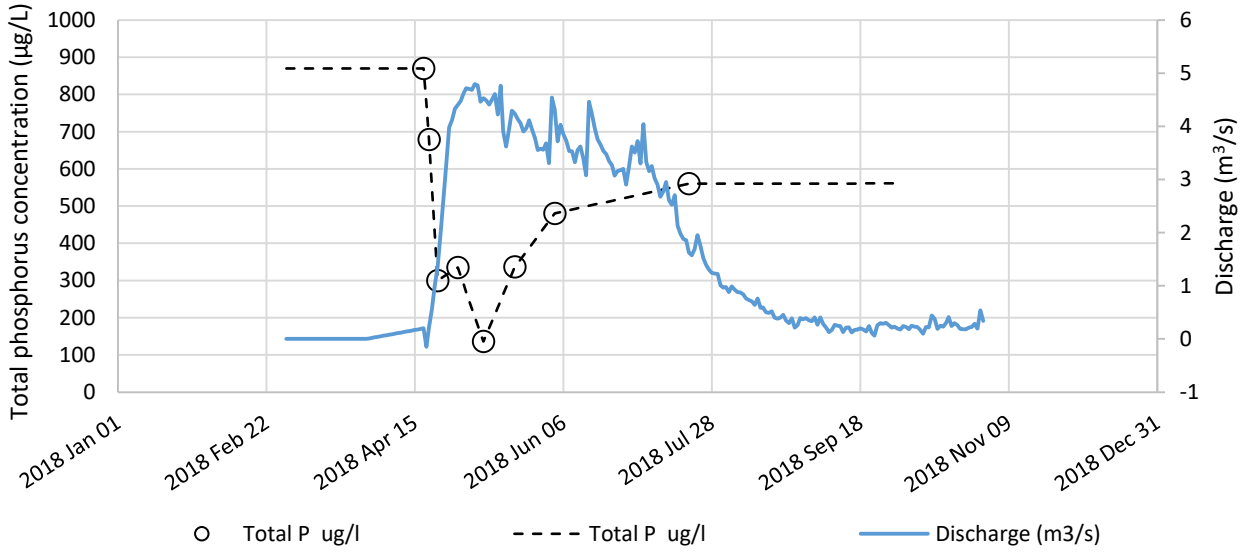

Figure 10. Discharge and total phosphorus concentration over the 2018 sampling season at Pembina River downstream of Swan Lake (Water Survey of Canada Station 05OB019).

Pembina River near La Rivière

The drainage area for this stretch of the Pembina River is 341 km^2. This stretch of the Pembina River drains a largely agricultural area and the town of La Rivière, MB. In 2017, this drainage area was larger (850 km^2) and included Swan Lake but in 2018 this site was split into two smaller drainage areas.

Samples were taken at Water Survey of Canada flow meter 05OB001, near La Rivière. In 2018, 12 samples were collected between April 17th and July 3rd.

	2017 (850 km^2)	2018 (341 km^2)
Discharge peaked:	April 5th	June 16th
Greatest phosphorus concentration:	662 µg/L (March 31st)	890 µg/L (April 20th)
Total phosphorus load:	-13 tonnes	-2.0 tonnes*
Total water load:	0.079 km^3	0.008 km^3
Phosphorus export:	- 0.15 kg/ha/y	- 0.06 kg/ha/y
Percent water load in spring:	86%	55%
Percent phosphorus load in spring:	90%	60%

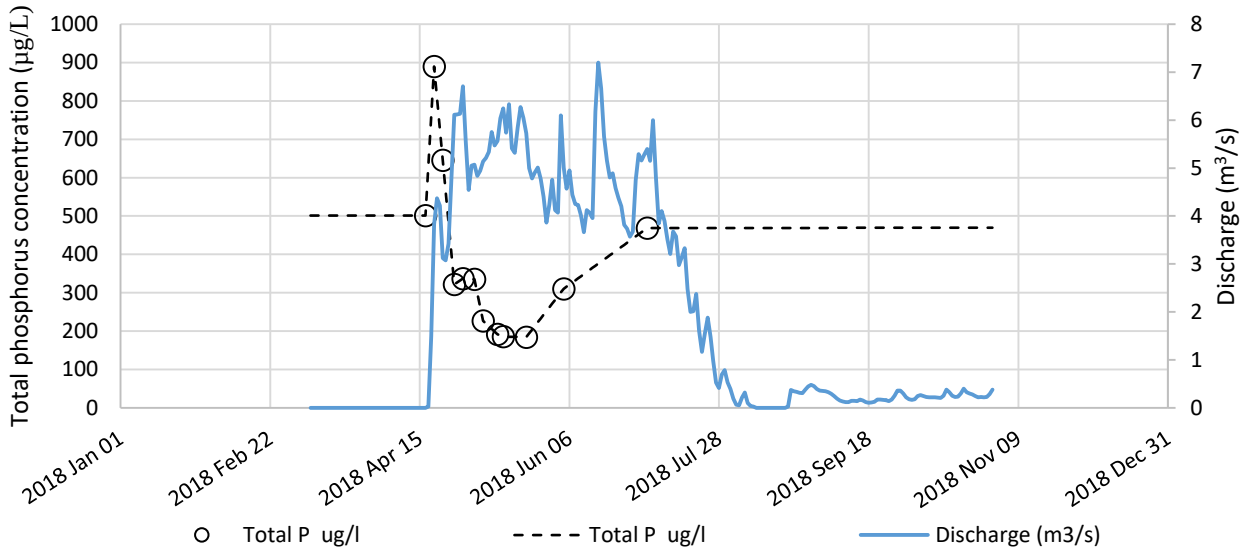

Figure 11. Discharge and total phosphorus concentration over the 2018 sampling season at Pembina River near La Rivière (Water Survey of Canada Station 05OB001).

***When there are multiple sites along a waterway, phosphorus loads are calculated by subtracting the upstream load from the downstream load resulting in the amount of phosphorus contributed by the stretch of the waterway between the two sites. A negative phosphorus load means that the upstream site had a greater phosphorus load than the downstream site and therefore phosphorus was sequestered in that stretch of the waterway, as indicated by the negative export.**

Pembina River near Windygates

This reach of the Pembina River drains a largely agricultural area of approximately 932 km^2.

Samples were taken at Water Survey of Canada flow meter 05OB007, near Windygates. In 2018, 11 samples were collected between April 17th and July 3rd.

	2017	2018
Discharge peaked:	April 8th	April 22nd
Greatest phosphorus concentration:	1329 µg/L (April 22nd)	691 µg/L (April 22nd)
Total phosphorus load:	162 tonnes	2 tonnes
Total water load:	0.058 km^3	-0.001 km^{3*}
Phosphorus export:	1.88 kg/ha/y	0.02 kg/ha/y
Percent water load in spring:	89%	48%
Percent phosphorus load in spring:	94%	49%

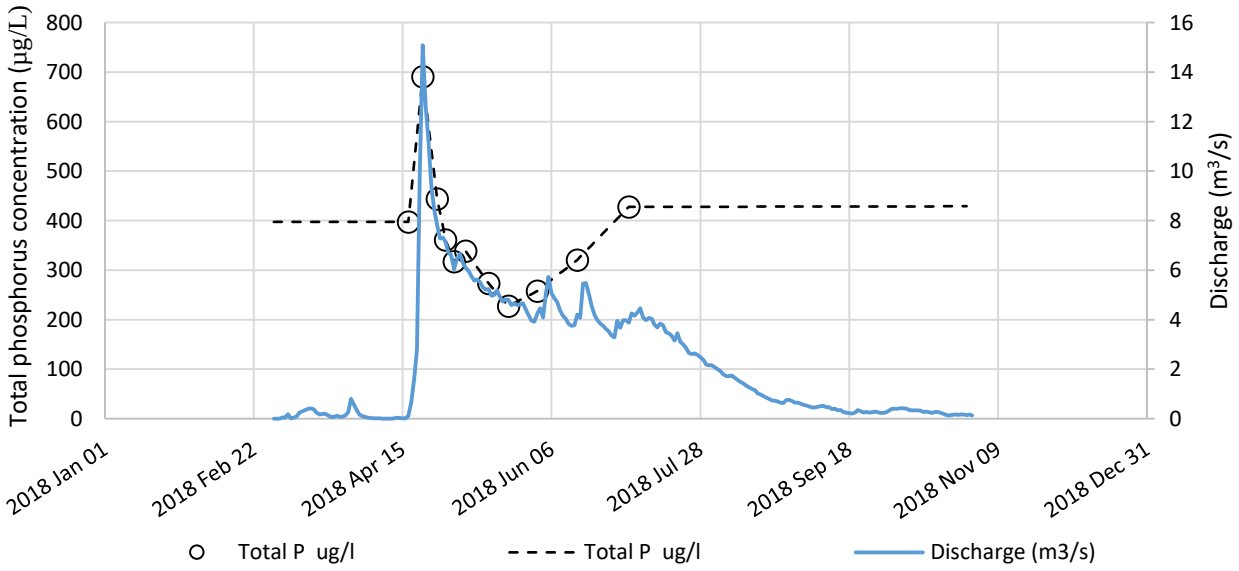

Figure 12. Discharge and total phosphorus concentration over the 2018 sampling season at Pembina River near Windygates (Water Survey of Canada Station 05OB007).

***When there are multiple sites along a waterway, phosphorus and water loads are calculated by subtracting the upstream load from the downstream load resulting in the amount of water contributed by the stretch of the waterway between the two sites. A negative water load means that the upstream site had a greater water load than the downstream site and therefore water was sequestered in that stretch of the waterway.**

Sample site without flow data

Badger Creek near Cartwright

Badger Creek is located south of the Pembina River. The majority of the Badger Creek drainage area is located in North Dakota. The drainage area for this sample site is approximately 779 km^2 and drains the Rural Municipality of Cartwright, Manitoba and the city of Rolla, North Dakota.

In 2018, Water Survey of Canada station 05OA007 measured only primary water level therefore phosphorus loads and exports could not be calculated. In 2018, 11 samples were collected between April 14th and October 17th.

	2017	2018
Discharge peaked:	March 31st	April 20th (water level peak)
Greatest phosphorus concentration:	779 µg/L (March 31st)	799 µg/L (April 22nd)
Total phosphorus load:	54 tonnes	-
Total water load:	0.115 km^3	-
Phosphorus export:	0.35 kg/ha/y	-
Percent water load in spring:	97%	-
Percent phosphorus load in spring:	97%	-

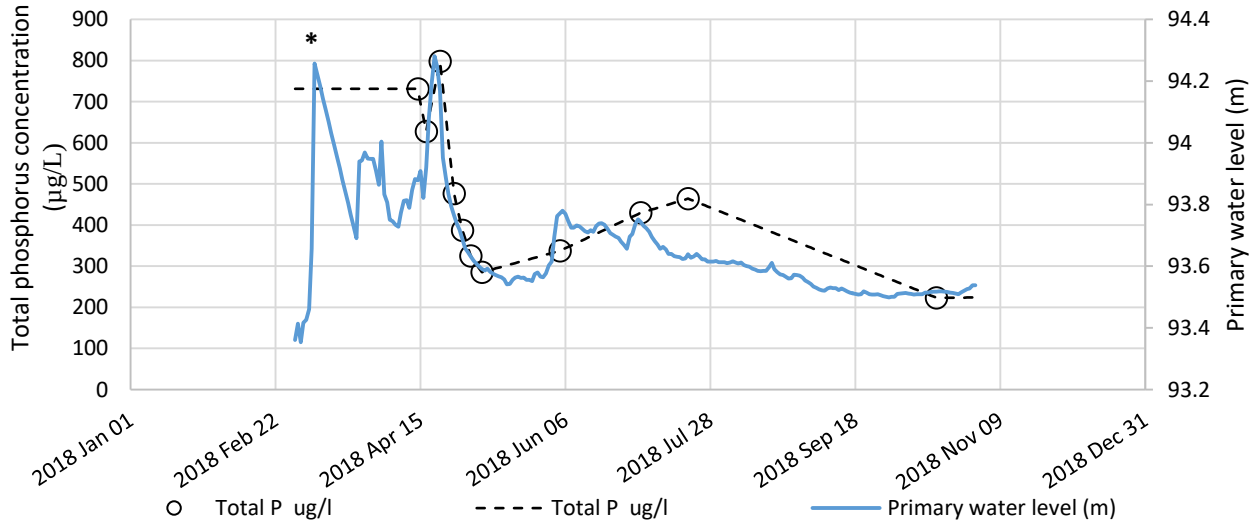

Figure 13. Primary water level and total phosphorus concentration over the 2018 sampling season at Badger Creek near Cartwright (Water Survey of Canada Station 05OA007).

***In 2018 Badger Creek water level peaked while the creek was covered by ice and therefore we were unable to collect samples during this time. This may have resulted in a peak phosphorus concentration being missed.**

Bone Lake Outlet

The Bone Lake outlet sample site drains an area of 407 km^2.

Samples were taken at Water Survey of Canada water level meter 05OA019. In 2018, 7 samples were collected between April 23rd and August 10th. Because flow is not measured at this site, we cannot calculate phosphorus loads and exports.

	2017	2018
Water level peaked:	April 4th	Match 28th
Greatest phosphorus concentration:	702 µg/L (April 4th)	299 µg/L (August 10th)

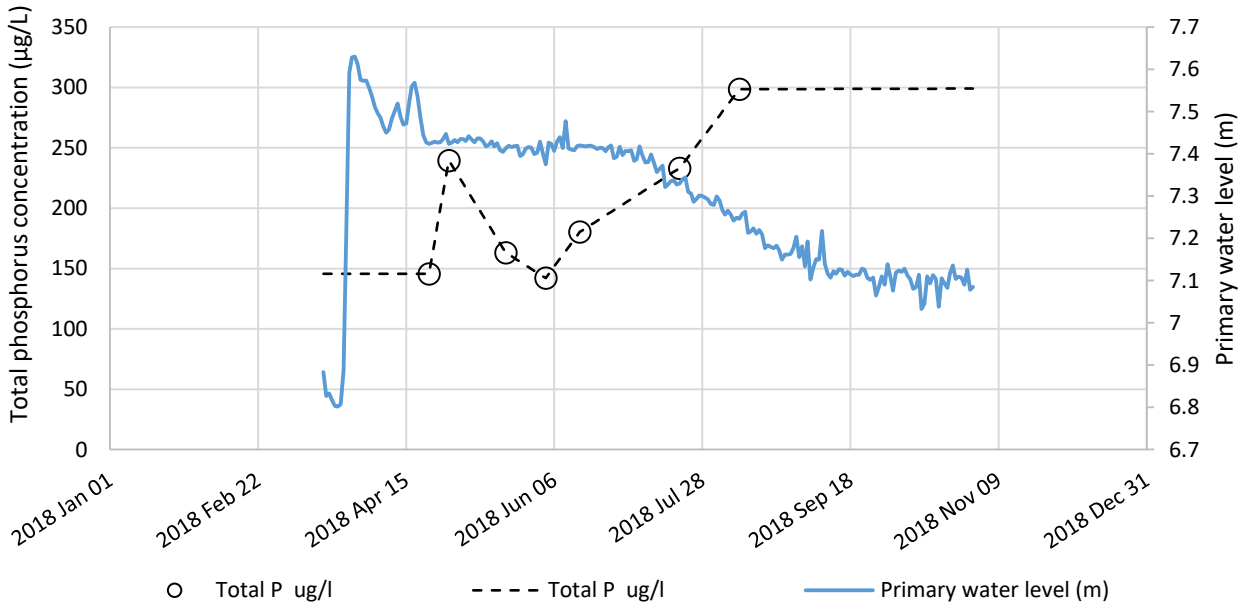

Figure 14. Water level and total phosphorus concentration over the 2018 sampling season at Bone Lake (Water Survey of Canada Station 05OA019).

INTERESTED IN SAMPLING WITH LWCBMN?

LWCBMN provides hands-on opportunities for citizens to get involved in water sampling activities. We are looking for volunteers to sample at Water Survey of Canada stations in 2019. You can find a map of potential sites **here**.

If you are interested in sampling, please contact the LWCBMN program manager at **cbm@lakewinnipegfoundation.org**. Together, we can choose a sample site near where you live, work or commute and begin collecting valuable information to measure phosphorus loading to local waterways.

THANK YOU TO OUR 2018 FUNDERS

This project was undertaken with the financial support of the Government of Canada.

Ce projet a été réalisé avec l'appui financier du gouvernement du Canada.

Canada

THE THOMAS SILL FOUNDATION INC

WALTER & DUNCAN GORDON FOUNDATION

CO-OP Red River

CÉCS CONSEIL ÉCONOMIQUE ET COOPÉRATIF DE LA SASKATCHEWAN

Tides Canada

patagonia

cira BUILDING A BETTER ONLINE CANADA

Assiniboine CREDIT UNION

JEUNESSE CANADA AU TRAVAIL JCT YCW YOUNG CANADA WORKS

eco canada