<u>Nutrients and Water Quality in the East Souris River Watershed</u>

Phosphorus and nitrogen occur naturally and are important plant nutrient sources in water bodies. However, several human factors have created an excess of nitrogen and phosphorus in many water bodies. Factors contributing to excess nitrogen and phosphorus concentrations include:

- Inadequate sewage treatment
- Malfunctioning private septic systems
- Accelerated soil erosion
- Application of inorganic field and lawn fertilizers
- Runoff from animal waste
- Enhanced drainage and reduced riparian vegetation
- Use of household cleaning products than contain phosphorus
- Decomposing vegetation (*i.e.,* leaves) deposited in rivers and streams

Like many rivers in southern Manitoba, activities within the Souris River watershed greatly affect the water quality of the river water. Numerous studies have investigated various aspects of the water quality and quantity in the Souris River and its surrounding drainage area (*e.g.*, Environment Canada 1978, EMD 1979, Beck 1981, Chacko 1986, Blachford 1987, Beak Associates Consulting Ltd. 1991, Jones *et al.* 1998, Hughes 1999a). The general consensus of these studies is that the river and many of its tributaries contain high concentrations of nitrogen and phosphorus. Sources of these nutrients include wastewater discharges from communities in North Dakota, such as Minot, Velva, and Towner (Chako 1986), and several communities in Manitoba, including Melita, Souris, and Wawanesa (EMD 1979). As well, significant amounts of nutrients are believed to originate from non-point sources such as run-off from agricultural land (EMD 1979, Blachford 1987, Beak Associates Consulting Ltd. 1991).

Manitoba Water Stewardship's Water Quality Management Section examined trends in total nitrogen and phosphorus concentrations in steams across Manitoba (Jones and Armstrong 2001) with the United States Geological Survey's *QWTrend* program (Vecchia 2000). *QWTrend* was used on data sets with over 60 data points and more than 15 years of data. The program uses relatively complex statistical methods to identify trends in concentration data after accounting for variation due to flow. Data from the water quality sampling station on the Souris River at the town of Souris (WQ0371) in the East Souris River Watershed was included in the trend analysis. Flow data for the analysis were provided by Environment Canada from the hydrometric station MB05NG021 which is located in the immediate vicinity of WQ0371.

In the Souris River at the Town of Souris, there was a significant increase (p = 0.0024) in flow-adjusted TN concentration from 1978 to 1997 (Figure 1). Although some relatively high TP concentrations were recorded in the latter half of the reporting period, these were highly positively correlated with flow and no significant trend (p = 0.3351) was found once the influence of flow had been taken into account (Figure 2).

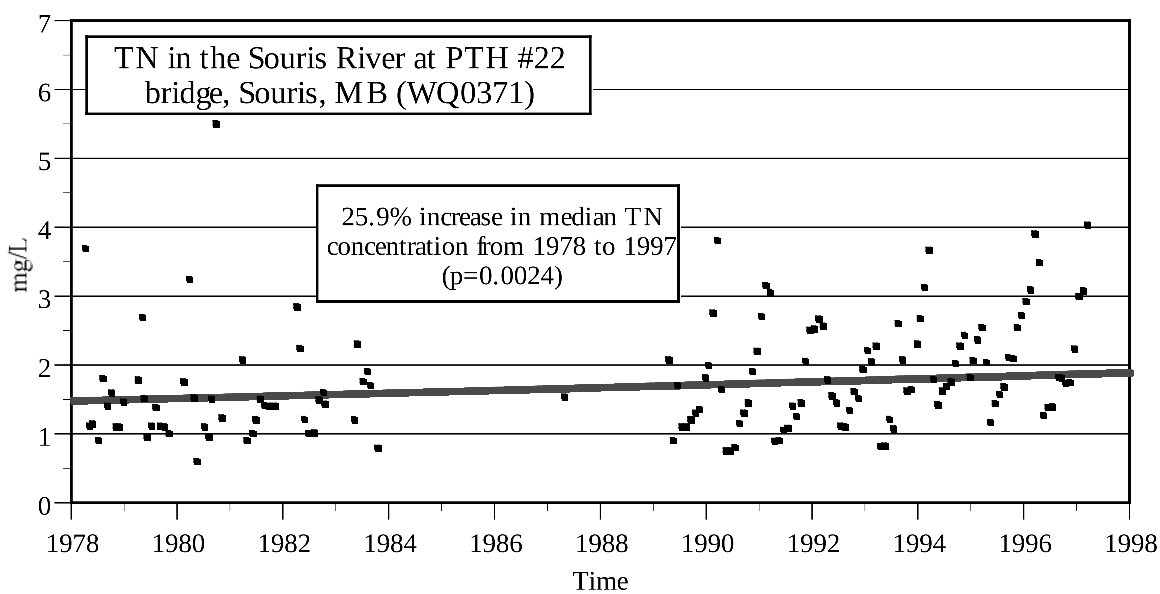


Figure 1. Trend in TN concentration in the Souris River at PTH #22, Souris, MB, 1978 to 1997 (inclusive). Dots represent measured concentrations, while the solid line represents the trend in flow-adjusted concentrations. The % change in median concentration refers to the median concentration of the flow-adjusted trend line.

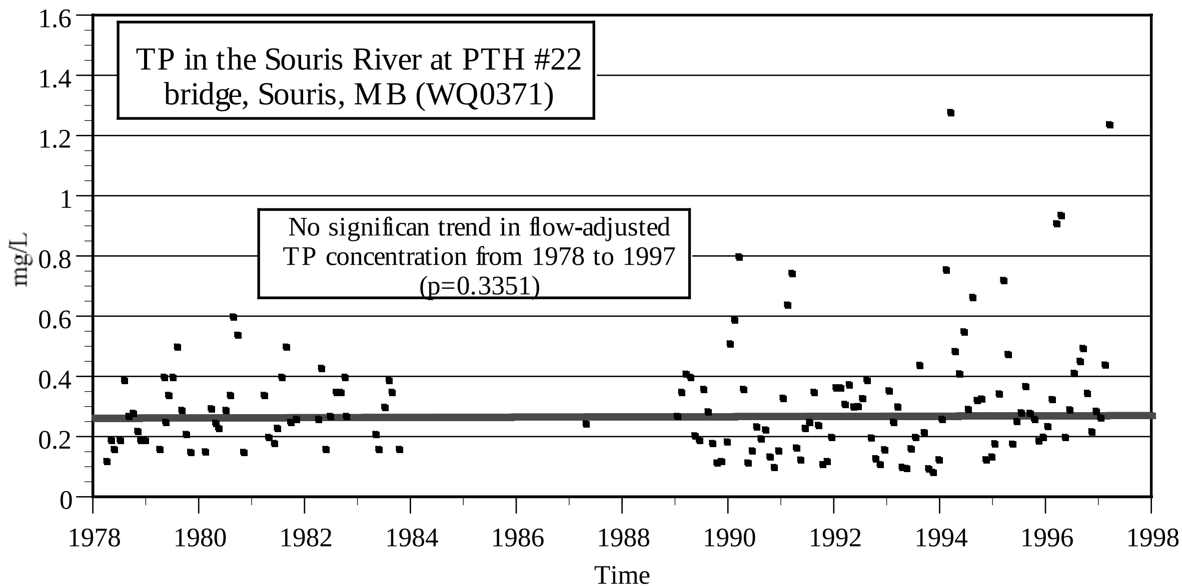


Figure 2. Trend in TP concentration in the Souris River at PTH #22, Souris, MB, 1978 to 1997 (inclusive). Dots represent measured concentrations, while the solid line represents the trend in flow-adjusted concentrations.

More information on the Souris River and watershed can be obtained from the Water Quality Management Section's long-term water quality station (WQ0350) located at PR #530, near the community of Treesbank. The site is approximately 70 km downstream of the water quality station at the Town of Souris and is about 8 km upstream of the river's confluence with the Assiniboine River. Flow data for the analysis were supplied by hydrometric station MB05NG001 near Wawanesa, about 9 km upstream of the water quality monitoring station.

Both flow-adjusted TN and TP concentrations increased significantly ($p < 0.0001$) over approximately 30 years (Figures 3 and 4). The degree of increase over the entire period of record was relatively substantial, with the median of the trend increasing over 45 % for TN, and over 50 % for TP.

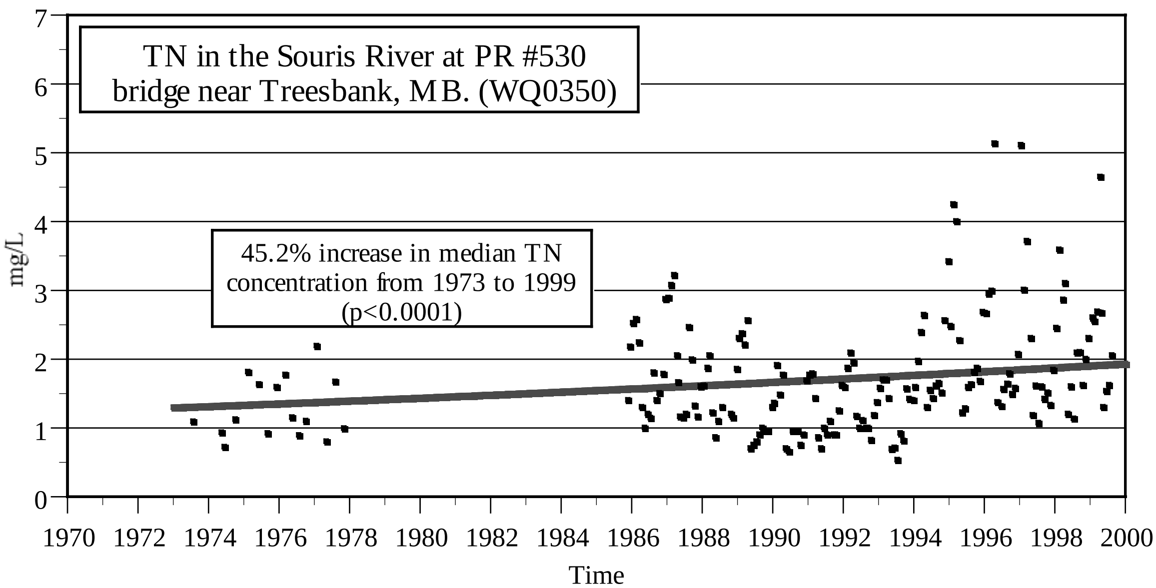


Figure 3. Trend in TN concentration in the Souris River at PR #530 near Treesbank, MB, 1973 to 1999 (inclusive). Dots represent measured concentrations, while the solid line represents the trend in flow-adjusted concentrations. The % change in median concentration refers to the median concentration of the flow-adjusted trend line.

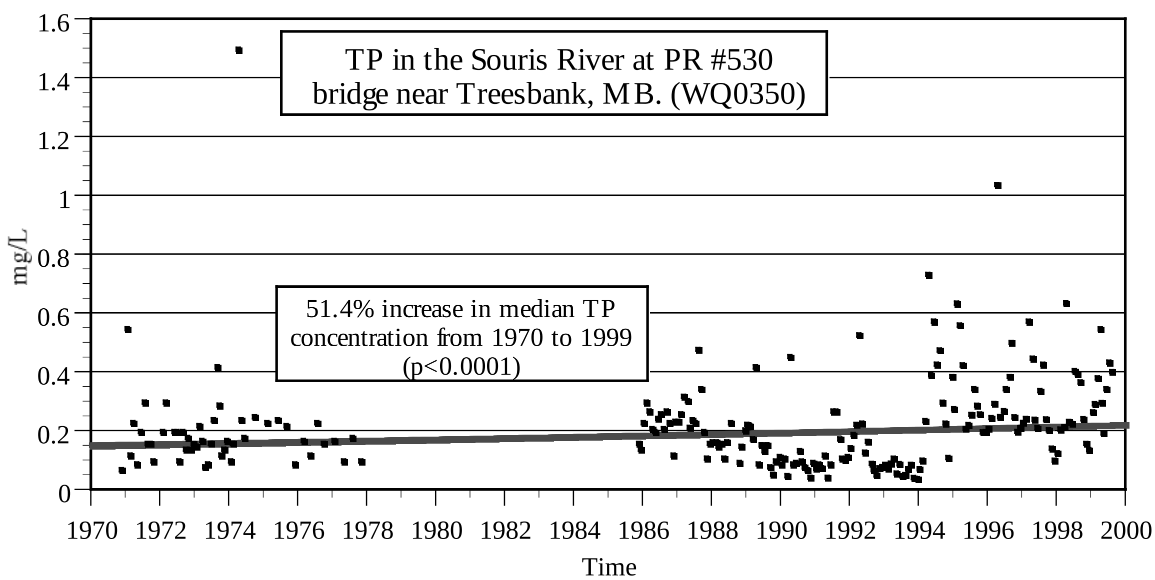


Figure 4. Trend in TP concentration in the Souris River at PR #530 near Treesbank, MB, 1970 to 1999 (inclusive). Dots represent measured concentrations, while the solid line represents the trend in flow-adjusted concentrations. The % change in median concentration refers to the median concentration of the flow-adjusted trend line.

A positive trend at a water quality monitoring station could be attributed to an increase in nutrient additions to the waterway. However, the potential source of nutrient addition (*i.e.* point or non-point source, anthropogenic or natural) was not identified. Also assessment of the potential impact of an increase in nutrients on an aquatic system depends on the magnitude of the increase and the actual recorded concentrations present. In addition, monitoring stations where trends were not detected may still be subject to anthropogenic nutrient additions leading to eutrophication.

## Lake Winnipeg Watershed

The Souris River is part of the Lake Winnipeg watershed which stretches across four provinces and four U.S. states (Figure 5). Excessive concentrations of nitrogen and phosphorus in Lake Winnipeg are causing gradual changes to occur in the lake's water quality and biological communities. Nitrogen and phosphorus are contributed from virtually all of our activities in Lake Winnipeg's large watershed and are directly associated with the production of nuisance growths of algae - affecting fish habitat, recreation, drinking water quality, and clogging fishing nets. Some nuisance growths of algae can also produce toxins.

Manitobans, including those in the Souris River watershed, contribute about 41 % of the phosphorus and 36 % of the nitrogen to Lake Winnipeg (Bourne *et al.* 2002). About 14 % of the phosphorus and 5 % of the nitrogen entering Lake Winnipeg is contributed by agricultural activities within Manitoba. In contrast, about 10 % of the phosphorus and 7 % of the nitrogen entering Lake Winnipeg from Manitoba is contributed by wastewater treatment facilities such as lagoons and sewage treatments plants.

In February of 2003, the provincial government announced the Lake Winnipeg Action Plan, a commitment to reduce nitrogen and phosphorus loads to Lake Winnipeg to pre-1970s levels. The Lake Winnipeg Action Plan recognizes that nutrients are contributed by most activities occurring within the drainage basin and that reductions will need to occur across all sectors. Reductions in nutrient loads across the Lake Winnipeg watershed will benefit not only Lake Winnipeg but also improve water quality in the many rivers and streams that are part of the watershed including the Souris River.

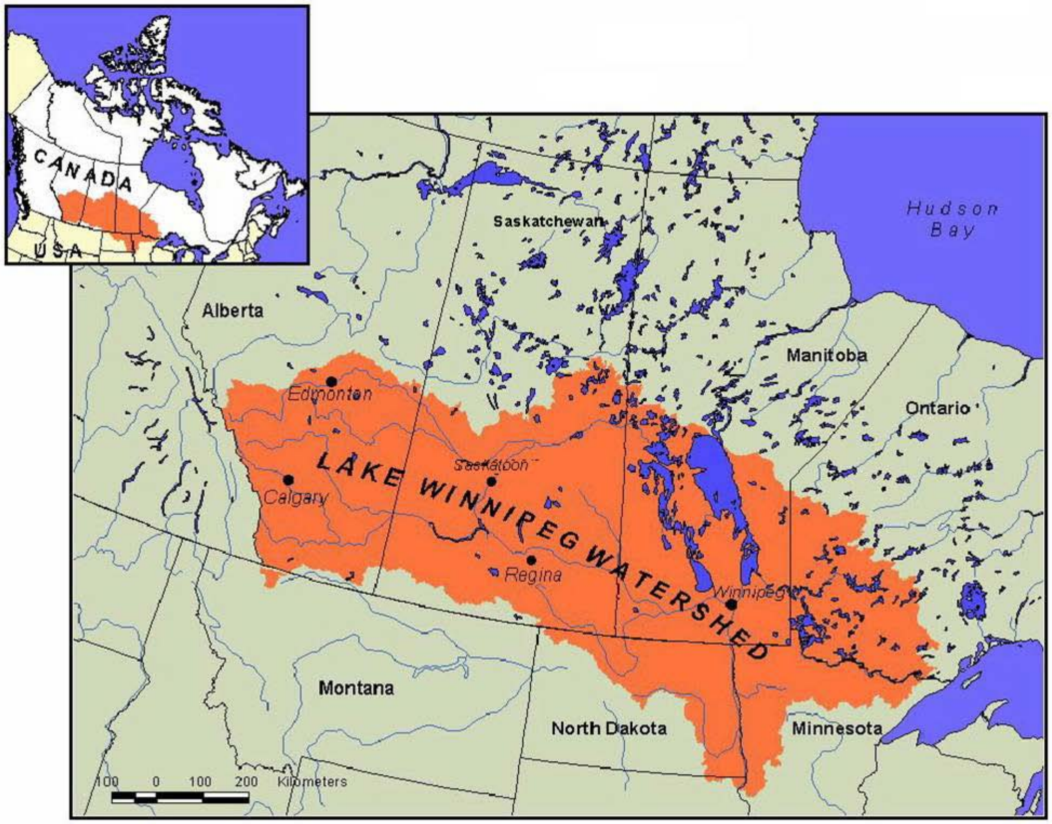


Figure 5. The Lake Winnipeg watershed, the second largest in Canada, stretches across four provinces and four U.S. States.

As part of the Lake Winnipeg Action Plan (www.manitoba.ca/lakewinnipeg), the Manitoba government has:

- Established a Lake Winnipeg Stewardship Board to help Manitobans identify further actions necessary to reduce nitrogen and phosphorous to pre-1970 levels in the lake by 13 percent or more;
- Provided a program to expand soil testing to ensure appropriate fertilizer application in both rural and urban settings;
- Introduced a new sewage and septic field regulation that outlines clear standards for the placement of systems, and;
- Commenced cross-border nutrient management discussions.

However, reducing nutrients across the Lake Winnipeg watershed is a challenge that will require the participation and co-operation of all Manitobans and will involve:

- Implementing expensive controls on nutrients in municipal and industrial wastewater treatment facilities.
- Developing scientifically-based measures to control the application of inorganic fertilizers, animal manure, and municipal sludge to agricultural lands.
- Reducing nutrient contributions from individual cottagers and homeowners.
- Working with our upstream neighbours.

You can help by taking the following steps:

- Maintain a natural, riparian buffer along waterways. Natural vegetation slows erosion and helps reduce the amount of nitrogen and phosphorus entering lakes, rivers and streams.
- Value and maintain wetlands. Similar to riparian buffers along waterways, wetlands slow erosion and help reduce nutrient inputs to lakes, rivers, and streams. Wetlands also provide flood protection by trapping and slowly releasing excess water while providing valuable habitat for animals and plants.
- Don't use fertilizer close to waterways. Heavy rains or over-watering your lawn can wash nutrients off the land and into the water.
- Use phosphate-free soaps and detergents. Phosphates have been prohibited from laundry detergents but many common household cleaners including dishwasher detergent, soaps, and other cleaning supplies still contain large amounts of phosphorus. Look for phosphate-free products when you are shopping.
- Ensure that your septic system is operating properly and is serviced on a regular basis. It's important that your septic system is pumped out regularly and that your disposal field is checked on a regular basis to ensure that it is not leaking or showing signs of saturation.

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