



# From Land to Lake: Tracking Tributary Total Phosphorus Contributions into Western Lake Ontario

## Additional Findings

Phosphorus loads are variable! Measuring water quality and flow for many years will help provide more reliable results. Load estimates are only as good as the data used to calculate them.

Phosphorus is delivered to the lake year-round. Some years, we get a lot of phosphorus transported to the lake in winter and other years there is a lot of phosphorus coming in spring and summer.

Phosphorus loads are likely higher than estimates but to what extent needs further study. Available data relies on random sampling which tends to miss big rain events. However, there are intensive studies underway looking at how storm events influence phosphorus loads which will yield new insights and more accurate estimates.

Loads can be influenced by external factors. For example, weather patterns can impact how much phosphorus is washed from the watershed and from what source. This can also change year to year.

Different load calculation methods produce different estimates. When comparing results for the same year (2008) from this project with the most recent available estimate, some tributaries have higher and some have lower loads.

Tributaries are not the only source of phosphorus to Lake Ontario. Scientists in Canada and the U.S. are working together to update phosphorus loads estimates to include other sources and for the whole lake.

This project was led through a collaboration between the [Canada Water Agency](https://www2.ec.gc.ca/) and Toronto and Region Conservation Authority (TRCA). We would like to acknowledge the organizations from the Land to Lake Initiative for providing local expertise and data to support this project.

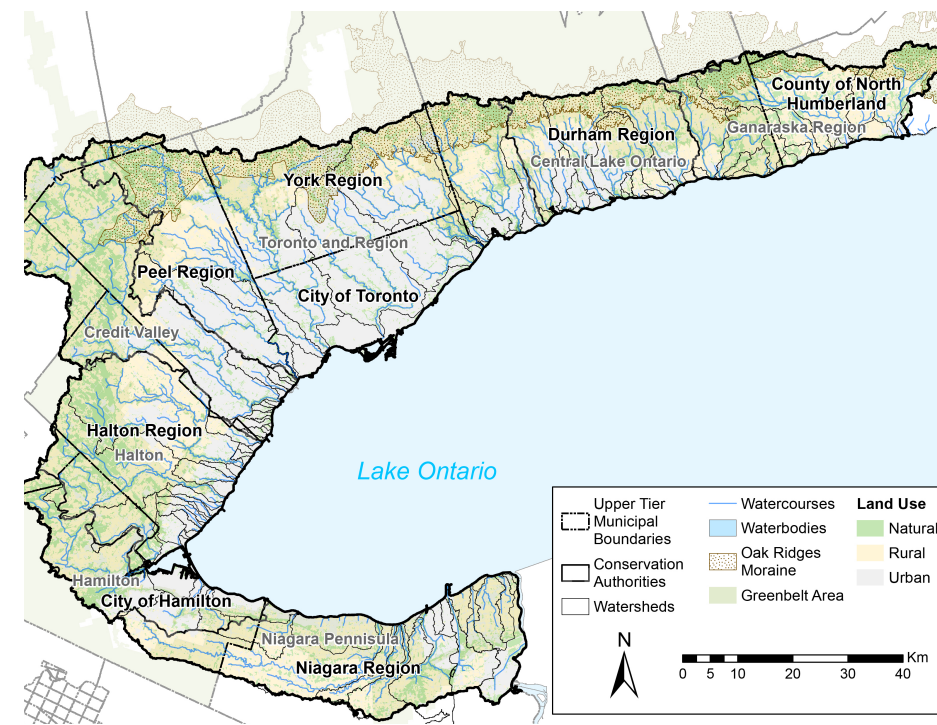
For more information, please contact: [land2lake@trca.ca](mailto:land2lake@trca.ca)

## What Can We Do?

Phosphorus plays a key role in lake health. Too much can lead to algae blooms but very low levels can impact the lake's food web, especially in offshore areas where nutrients are declining. Finding the right balance to support a healthy ecosystem in Lake Ontario is crucial.

From nearshore conditions to climate change impacts and growth of our communities means that we all have a role in maintaining healthy phosphorus levels. Here are a few ways to help:

- Develop or support rural clean water programs (example: <https://trca.ca/get-involved/private-land-grants/rural-clean-water/peel/> )
- Promote 4R certification programs for sustainable farming (example: <https://fertilizercanada.ca/our-focus/stewardship/4r-certification/> )
- Upgrade sewer infrastructure to eliminate wastewater cross-connections
- Support Low Impact Development techniques to help manage urban stormwater (example: <https://sustainabletechnologies.ca/home/urban-runoff-green-infrastructure/low-impact-development/> )
- Protect and restore natural cover to retain nutrients (example: <https://www.conservationhalton.ca/financial-assistance-programs/> )



Did you know the WLO-L2L Initiative is comprised of 8 upper or single-tier and 27 lower-tier municipalities, 7 Conservation Authorities, and the provincial and federal governments?

This project estimates the amount of phosphorus from tributaries into western Lake Ontario. It complements other ongoing studies and efforts.

The western Lake Ontario region is home to over 20% of the Canadian population and is one of the most industrialized and densely populated areas in the country. Recognizing both the region's valuable ecosystem and the threats it faces, the Western Lake Ontario Land to Lake (WLO-L2L) Initiative was established in 2022.

This initiative brings together groups from Niagara to Cobourg to build stronger and more coordinated partnerships and supports collaborative projects that help implement land-based actions to improve water quality and ecosystem health in Western Lake Ontario. This factsheet highlights one of the first demonstration projects from the initiative, focused on improving information and knowledge on phosphorus loads from our tributaries and what this means for the health of Western Lake Ontario.

## What is total phosphorus and why measure it?

Phosphorus is a vital nutrient for all living things, from plants, animals, fish, and even humans! But when there's too much phosphorus in lakes, it can cause:

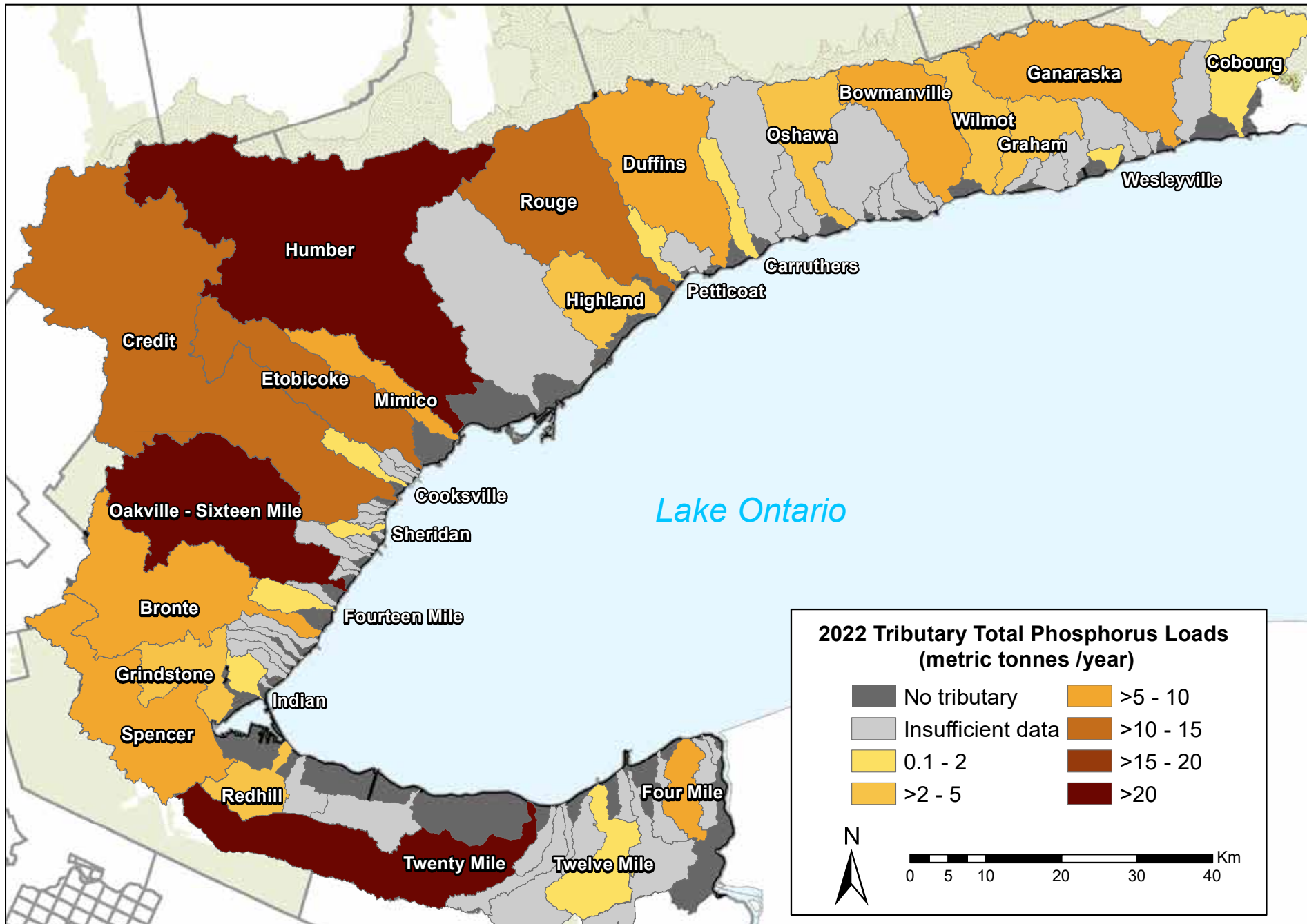
- extensive growth of algae (blooms),
- changes to the species living in the environment including lower biodiversity, and
- low oxygen conditions.

Phosphorus is carried from our tributaries (i.e. rivers, streams, and channels) into Lake Ontario. It can come from agricultural fertilizers, cleaning products, pet and human waste, soil erosion, wastewater and natural sources. Phosphorus levels in Lake Ontario are complicated. High concentrations can be found near the shoreline, leading to algae growth and water quality issues. But in deeper waters, phosphorus concentrations are low, which can impact the food web including fish.

Different levels of governments and other organizations are working hard to manage nutrient sources and improve conditions along Lake Ontario's shoreline. It's important to continue to improve our understanding of how and when nutrients, pollutants and other materials from our watersheds enter the Great Lakes, so we can better manage future growth and protect the environment, ecosystems, and lake health.

# DID YOU KNOW THAT 72 TRIBUTARIES FLOW INTO WESTERN LAKE ONTARIO?

For this project, we had enough data to estimate total phosphorus loads for 32 of them.



Tributary Name	Dominant Land use	2022 Phosphorus Load (mT TP/ yr)	2022 Spring* Phosphorus Load (%)	2022 Winter * Phosphorus Load (%)	2008** - 2022 Phosphorus Load mean and standard deviation in (mT/year)
Four Mile	Rural	5.9	44.4	32.0	5.5 ± 1.8
Welland Canal	Mixed				144.8 ± 26.4
Twelvemile	Urban/Rural	1.5	31.3	48.0	1.5 ± 0.4
Twenty Mile	Rural	41.5	19.2	58.5	46.7 ± 21.3
Redhill	Urban	2.8	19.2	52.0	2.6 ± 0.7
Spencer	Rural/Natural	6.4	29.2	55.0	6.6 ± 1.8
Grindstone	Rural/Natural	2.5	44.8	45.1	4.1 ± 2.3
Indian	Urban	1.8	57.1	29.3	1.8
Bronte	Rural/Natural	9.1	40.3	52.6	6.8 ± 3.1
Fourteen Mile	Urban	1.4	22.1	69.8	2.3 ± 1.4
Sixteen Mile (Oakville)	Mixed	22.7	46.3	37.0	20.6 ± 1
Sheridan	Urban	1.1	27.4	39.4	1.4 ± 0.3
Credit	Mixed	11.8	36.0	48.3	14.6 ± 5
Cooksville	Urban	0.7	39.0	57.5	0.5 ± 0.2
Etobicoke	Urban	11.3	17.7	56.7	19.3 ± 11.1
Mimico	Urban	5.1	16.7	61.7	6.6 ± 2.2
Humber	Rural/Urban	39.3	47.8	31.8	42.2 ± 15.6
Don	Urban				34.8 ± 10.7
Highland	Urban	4.2	32.1	36.8	8.2 ± 2.9
Rouge	Urban/Rural	13.2	44.3	47.0	26.3 ± 15.9
Petticoat	Rural	0.5	44.1	39.0	0.8 ± 0.4
Duffins	Rural	9.1	51.0	41.3	27.6 ± 26.9
Carruthers	Rural/Urban	1.0	38.4	44.1	1.5 ± 0.7
Lynde	Rural				3.0 ± 1.2
Oshawa	Rural	3.9	26.6	69.0	6.5 ± 5.7
Bowmanville	Rural	6.0	53.3	40.0	5.4 ± 3.5
Wilmot	Rural	2.5	40.8	53.5	3.8 ± 2.5
Graham	Rural	2.9	33.6	55.6	2.3 ± 1.5
Wesleyville	Rural/Natural	0.1	75.5	20.8	0.2 ± 0.1
Ganaraska	Natural/Rural	6.1	59.1	28.2	10.6 ± 6.8
Gages	Rural				1.2 ± 0.5
Cobourg	Rural/Natural	1.9	50.2	29.8	2.4 ± 0.8

Mixed represents Rural, Natural, and Urban land uses.  
 \*Note: Spring represents the March to July period and winter represents the December to February period.  
 \*\*Note: Date range of mean and standard deviation may begin after 2008 for some locations depending on data availability.

## Estimating Tributary Loading

A load is the total amount of a substance, like phosphorus, delivered to a waterbody. Measuring nutrient loads helps us understand the health of the lake, including how much algae a lake can support, and how to manage it.

Phosphorus load is calculated by measuring how much water is flowing from a tributary, and the concentration of phosphorus in that water over a period of time (e.g., year or season).

The last time that Lake Ontario's phosphorus load was estimated was for 2008, using data collected from both Canada and the U.S.

This WLO-L2L project, uses the best available data from L2L partner routine monitoring programs to estimate recent tributary phosphorus loads to Western Lake Ontario and these estimates can add to intensive storm studies currently underway.

## Tracking Phosphorus Entering Western Lake Ontario (2022)

- Annual total phosphorus (TP) loads from Tributaries ranged from 0.1 to 42 metric tonnes (mT). That's as heavy as six school buses!
- On average, 40% of TP loads entered the lake between March 1st and July 31st, during the algae growth season.
- On average, 46% of the load was delivered in winter (Dec - Feb) proving that TP export is important in all seasons.
- Phosphorus loads can change a lot from year to year (more than 100%) depending on weather and local land use.

Between 2018 and 2022, the tributaries that contributed the most phosphorus to Western Lake Ontario were:

- Twenty Mile Creek (Niagara)
- Sixteen Mile Creek (Oakville)
- Credit River (Mississauga)
- Humber River (Toronto)
- Don River, (Toronto)
- Rouge River (Toronto/Pickering)
- Duffins Creek (Ajax)