

# Western Lake Erie Tributary Water Monitoring Summary

March 1, 2023 - July 31, 2023

[lakeerie.ohio.gov](http://lakeerie.ohio.gov)

## Why is water monitoring done, and by whom?

Federal, state, and educational institutions conduct water monitoring for a variety of reasons.

The U. S. Geological Survey (USGS), along with its federal, state, and local partners, investigates the occurrence, quantity, quality, distribution, and movement of water and shares data with the public and other agencies involved with managing our water resources.

Ohio EPA conducts water monitoring to assess stream condition and to develop Total Maximum Daily Loads for impaired waters.

Ohio DNR is interested in protecting recreation, fish, and wildlife water uses by installing nutrient reducing wetlands.

Educational institutions such as Heidelberg University's National Center for Water Quality Research do water monitoring to answer research questions.

## What do we measure?

Many components are measured. This summary focuses on total phosphorus, dissolved reactive phosphorus, & nitrogen as nitrite ( $\text{NO}_2$ )+nitrate ( $\text{NO}_3$ ).

USGS measures the amount of water that flows in rivers at streamflow gaging stations.

## Why this summary?

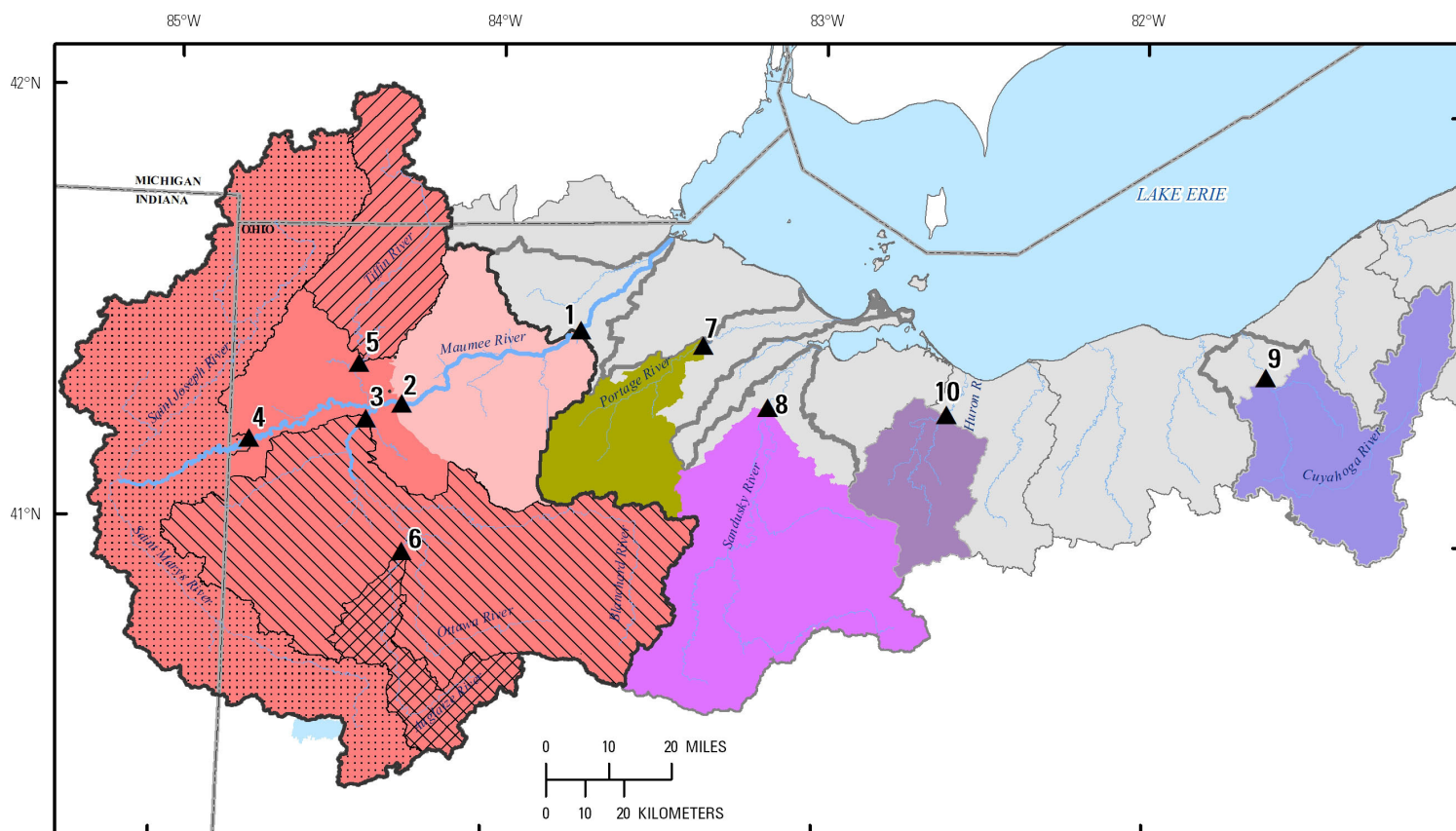
This summary provides an overview of nutrient loads and concentrations that cause harmful algal blooms in Lake Erie. Summarizing the results of these water monitoring efforts provides critical information to agencies and the public.

We are tracking annual changes and comparisons to water quality goals established by Annex 4 of the 2012 Great Lakes Water Quality Agreement and the 2015 Western Basin of Lake Erie Collaborative Agreement. The targets are compared to conditions in the 2008 base year.

## Where is the water monitored?

Ohio EPA, Ohio DNR, USGS, and Heidelberg University have established many sampling stations in the Lake Erie watershed. These stations are located at USGS streamflow gages. This allows loads to be calculated from sample data.

Figure 1 shows a subset of over 30 monitoring stations used to assess the nutrient contributions upstream of the lake influenced sections of the rivers. Due to the large size of the Maumee River watershed, its large tributaries were included.



**Figure 1: Sampling stations discussed in this report.**

**Station 1:** Gage 04193500 - Maumee River at Waterville

**Station 2:** Gage 04192500 - Maumee River near Defiance

**Station 3:** Gage 04191500 - Auglaize River near Defiance d/s Dam

**Station 4:** Gage 04183500 - Maumee River at Antwerp

**Station 5:** Gage 04185318 - Tiffin River near Evansport

**Station 6:** Gage 04186500 - Auglaize River near Fort Jennings

**Station 7:** Gage 04195500 - Portage River at Woodville

**Station 8:** Gage 04198000 - Sandusky River near Fremont

**Station 9:** Gage 04208000 - Cuyahoga River at Independence

**Station 10:** Gage 04199000 - Huron River at Milan

## What were the nutrient loads and concentrations for the loading season in 2023?

The charts in Figure 2 compare nutrient levels for the months of March through July. This period is used because the Annex 4 subcommittee determined that phosphorus contributions in this period is the main driver of the growth of harmful algal blooms. Nitrogen is included because of its role in augmenting the blooms and/or their toxicity. The six Maumee River basin stations are grouped together to the left of the vertical line inside each chart for ease of comparison, going upstream to downstream from the left to right. Red lines indicate the targets where they apply.

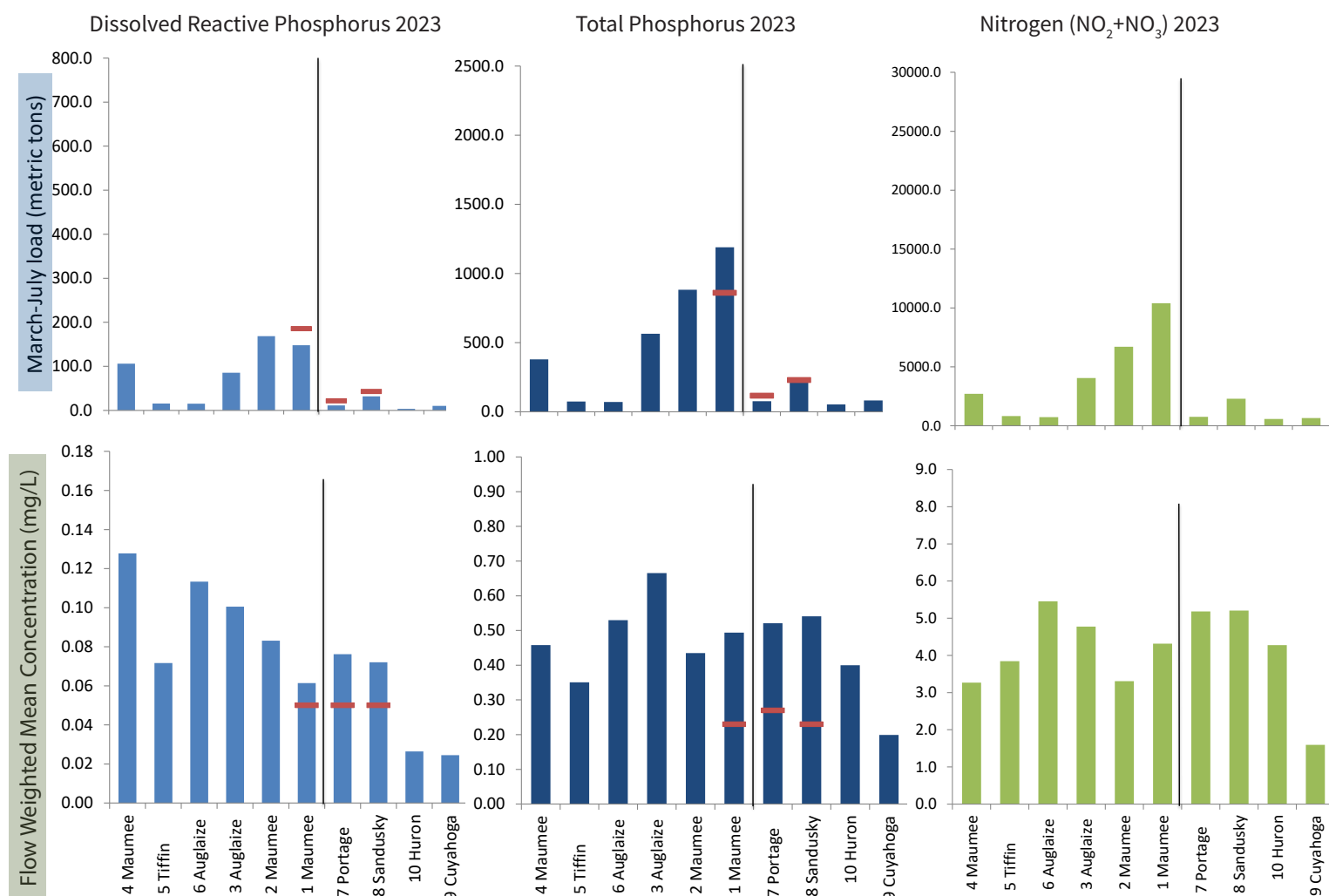


Figure 2: Side by side comparison of loads and flow-weighted mean concentrations. Axis titles at bottom and left. Red lines indicate target levels (targets may vary by location). Station numbers as in Figure 1.

### March-July Load (MT)

The loading graphs across the top of Figure 2 show that the two most downstream sites on the mainstem of the Maumee River have the largest nutrient loads. The Portage, Sandusky, Huron, and Cuyahoga Rivers have a much lower contribution to the overall nutrient loading; however they also drain smaller areas.

In 2023, the Annex 4 target loads were met for dissolved reactive

phosphorus and not met for total phosphorus as seen by the red lines at the Maumee River near Waterville station where the target is applied. Sandusky River load targets were met for dissolved reactive phosphorus and not met for total phosphorus. Both dissolved reactive phosphorus and total phosphorus target loads were met for the Portage River.

There are no targets for nitrogen, but the pattern of loading is similar because it is also influenced by

the amount of flow.

### Flow-Weighted Mean Concentration (mg/L)

The corresponding concentration graphs are shown across the bottom. The Annex 4 target flow weighted mean concentrations were exceeded at all stations for dissolved reactive phosphorus and total phosphorus.

Dissolved reactive phosphorus concentrations in the Maumee watershed ranged from 0.061 mil-

ligrams/liter (mg/L) in the Maumee near Waterville, to 0.128 mg/L in the Maumee River at Antwerp. The Huron River had a dissolved reactive phosphorus concentration of 0.026 mg/L.

Concentrations of total phosphorus in the Maumee watershed ranged from 0.351 mg/L in the Tiffin River to 0.530 mg/L in the Auglaize at Ft Jennings.

The lowest total phosphorus concentration was 0.199 mg/L in the Cuyahoga River.

### What is Flow-Weighted Mean Concentration (FWMC)?

The FWMC is the total load for the time period divided by the total discharge volume for the time period. FWMC standardizes the measure of phosphorus delivery from a tributary so that year-to-year and trib-to-trib performance can be compared despite different flows.

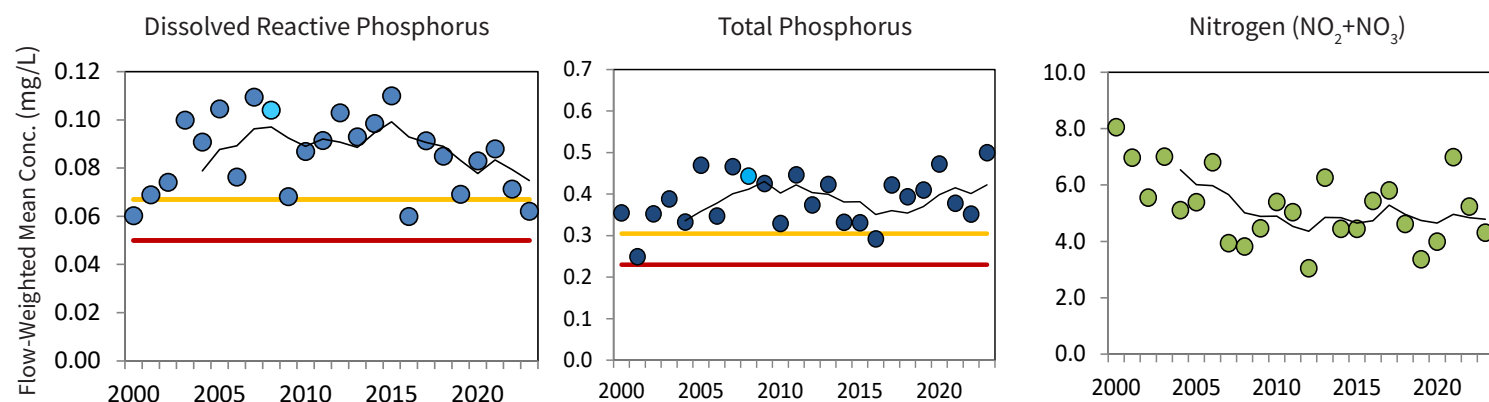


Figure 3: Loading season nutrient flow-weighted mean concentrations for the Maumee River near Waterville by water year. The five-year running average (black line) smooths out annual variation and shows trends. The brighter blue dot highlights 2008. The red line is the Annex 4 target flow-weighted mean concentrations. The yellow line is the Western Lake Erie Basin Collaborative 20% reduction target.

### How does 2023 compare to previous years?

The top left chart of Figure 3 shows the dissolved reactive phosphorus flow-weighted mean concentration at 0.062 mg/L in 2023. Although dissolved reactive phosphorus levels are not yet reaching the target, they have been lower since 2015. Total phosphorus flow weighted mean concentrations have been around 0.4 mg/L since 2000. In 2023, total phosphorus was 0.5 mg/L, slightly higher than the past 5 years. Nitrogen flow weighted mean concentrations have decreased since 2000 but have been about the same since around 2005.

### Where are the nutrients coming from?

This map shows the spatial distribution of dissolved reactive phosphorus flow-weighted mean concentrations (triangles) on top of total phosphorus load (circles) across nine stations. Dissolved reactive phosphorus concentration was highest in the Maumee River at Antwerp (4) and the Auglaize River at Ft. Jennings (6): 0.128 mg/L and 0.113 mg/L, respectively. Total phosphorus load was highest at Maumee River near Waterville (1): 1190 MT. Within the Maumee watershed, the Maumee River near Waterville (1) and the Tiffin River at Evansport (5) had the lowest dissolved reactive phosphorus levels at 0.061 mg/L and 0.072 mg/L respectively while the Auglaize River at Ft. Jennings (6) and the Tiffin River near Evansport (5) had the lowest total phosphorus loads at 15 MT each. The Cuyahoga River (9) had the lowest dissolved reactive phosphorus concentration (0.025 mg/L) and a low total phosphorus load (82 MT). The Huron River (10) had a low dissolved reactive phosphorus concentration (0.026 mg/L) and a low total phosphorus load (53 MT).

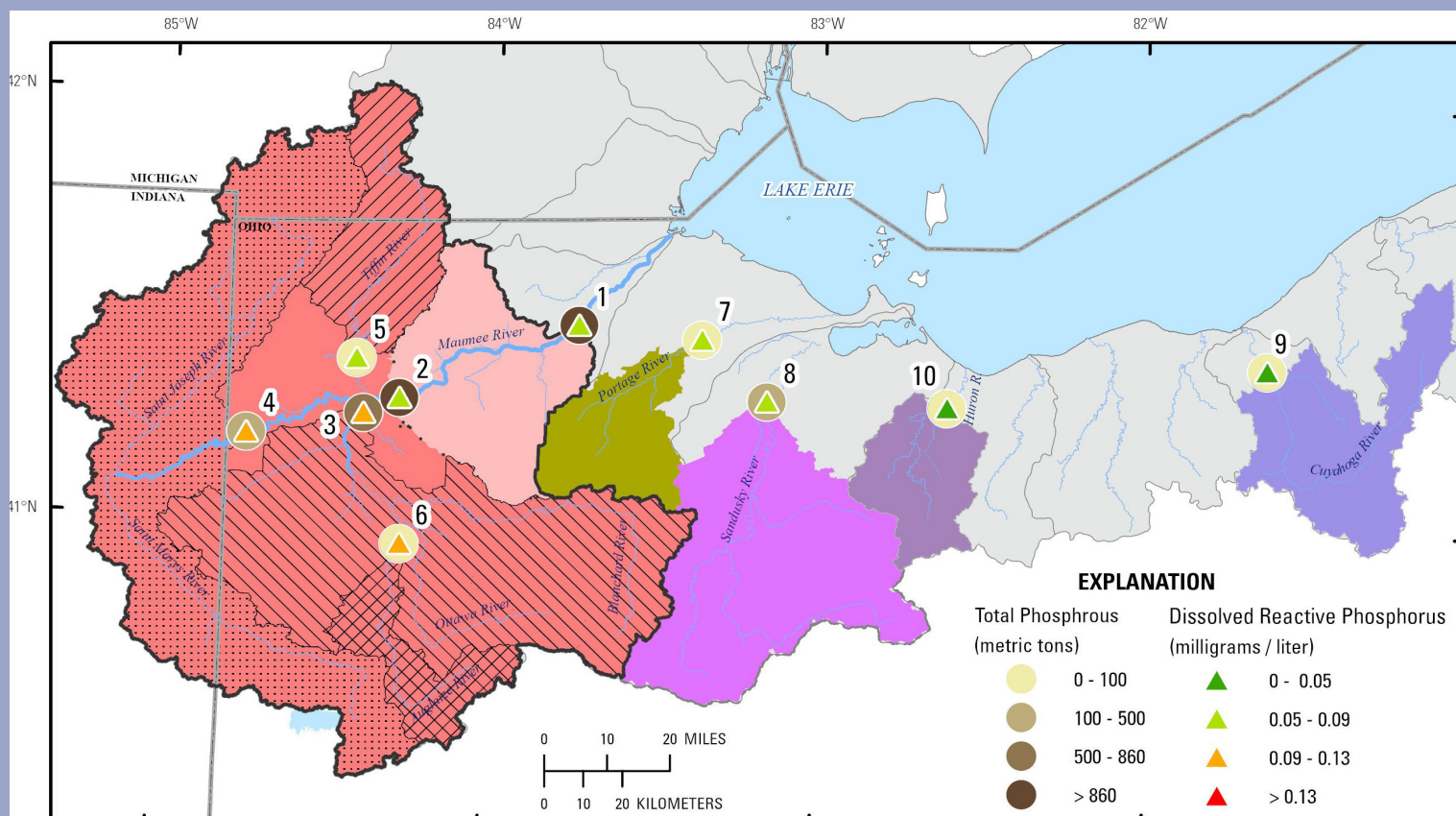


Figure 4: Phosphorus monitoring in the Lake Erie watershed. Data from March 1, 2023 - July 31, 2023.



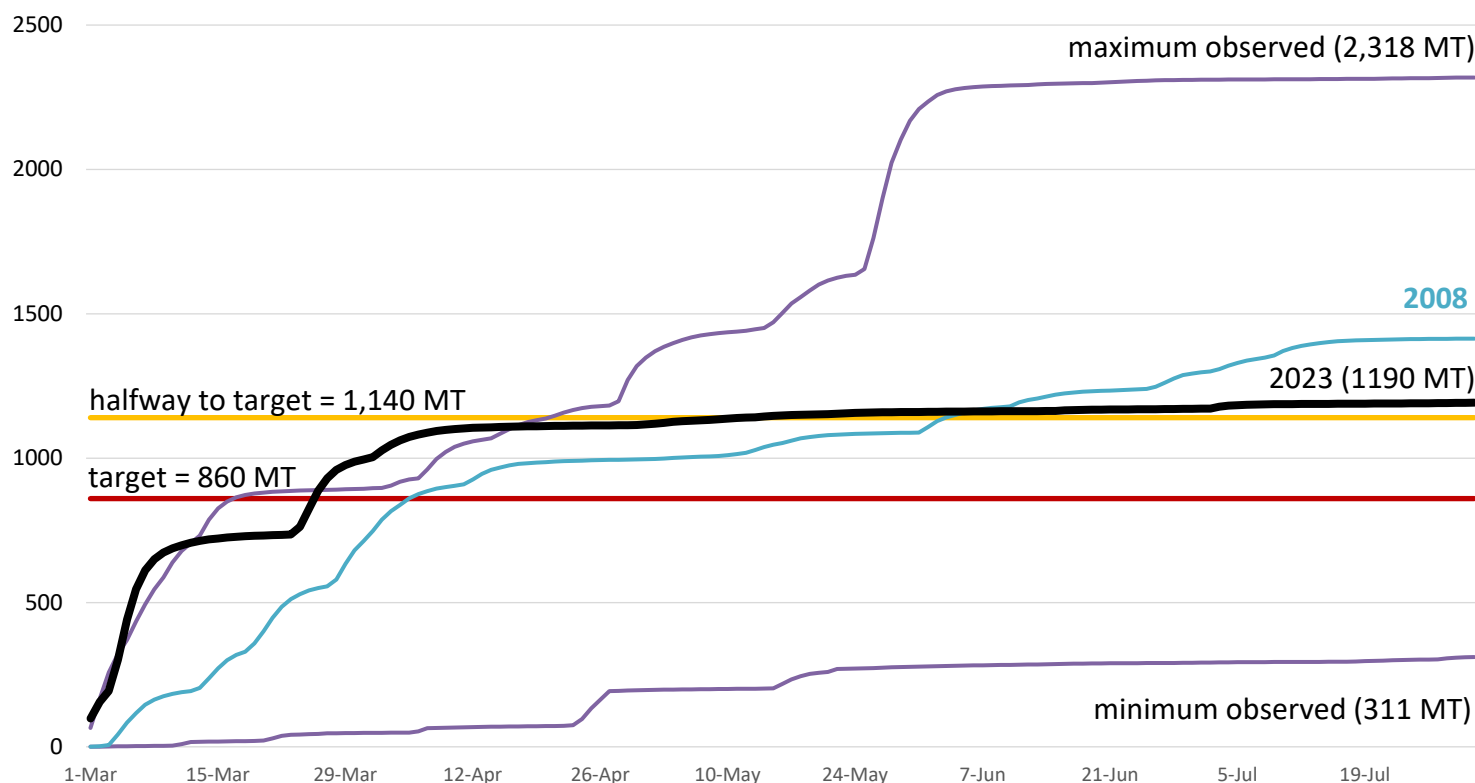


Figure 5: Cumulative total phosphorus loads in metric tons at the Maumee River at Waterville station (1) in March-July 2023 compared to maximum and minimum cumulative daily values for the period 2002-2020 and the cumulative chart for the baseline year of 2008.

### When does total phosphorus enter the rivers?

Figure 5 shows the cumulative load of total phosphorus at the Maumee River at Waterville (1) station for March 1 to July 31, 2023. Each day, the water in the river carries more load past the monitoring station which is

summed with the running total to create the cumulative total for that day.

Total phosphorus movement through the system is closely coupled to the timing of rainfall, as shown by the steeper in-

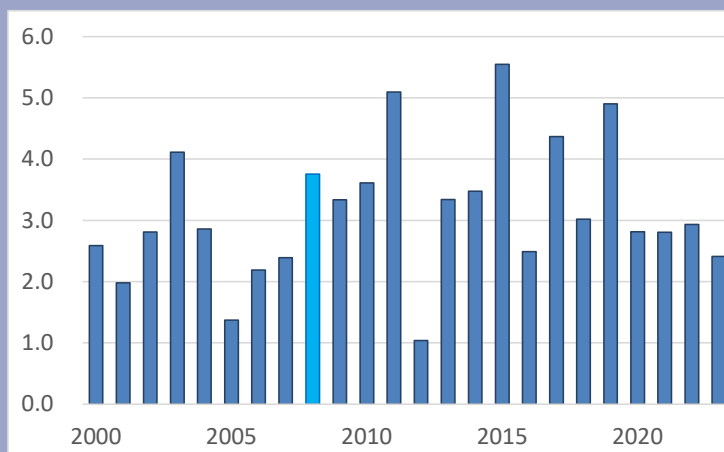
creases in loads. In 2023, loads remained below or near the target for most of the season. Rain in mid-June increased the cumulative total phosphorus load at this station above the 860 MT Annex 4 target load. The final total of 1,190 MT was 38%

higher than the target.

Minimum and maximum lines are provided for comparison. These are the lowest or highest cumulative load values for each day, selected from 2002-2020, summed for the season.

### How wet was March-July 2023 in comparison to March-July in the target year of 2008?

The total volume of water for the period is a major factor influencing how much phosphorus and nitrogen is carried to the lake. This chart shows that for the period March 1-July 31, 2023, total volume for the Maumee River at Waterville (1) was **2.4 km<sup>3</sup>**, similar to 2016. By comparison, volume for March 1-July 31, 2008 (base year for the target loads and concentrations, and selected because it represented a wet year) was **3.8 km<sup>3</sup>**. Volumes at this station for these months for the period 2000-2023 averaged 3.1 km<sup>3</sup>. Volume in 2023 was less than the baseline year - about 36% less than volume in 2008 - and lower than the five year running average of 3.1 km<sup>3</sup>.



Concentration and Loading information can be accessed at <http://arcg.is/21i9CUF> (USGS) and <https://ncwqr.org/> (Heidelberg). Expanded Monitoring Report with complete data set: <https://lakeerie.ohio.gov/wps/portal/gov/lec/planning-and-priorities/03-wms/wms>

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