Ohio | Lake Erie Commission

Expanded Lake Erie Tributary Nutrient Load Monitoring

Photo Credit: Historic Waterville Railroad Bridge 2015 Life on Lake Erie Photo Contest Winner by Lou McLove

October 2019

Expanded Lake Erie Tributary Nutrient Load Monitoring

What is this report?

This bulletin accompanies the Ohio Lake Erie Commission's annual Western Lake Erie Tributary Water Monitoring Summary. It provides complete monitoring information used in the Monitoring Summary in a tabular format. It also includes monitoring data from all additional Lake Erie tributary sites that are monitored in Ohio.

The Monitoring Summary presents information on total phosphorus, dissolved reactive phosphorus (DRP) and nitrogen loads and concentrations. Total phosphorus and DRP loads are compared to targets established to manage harmful algae blooms in Lake Erie. These targets were set by the Annex 4 Subcommittee (Annex 4, 2015) for the spring period of March 1 through July 31 and for a Water Year (October 1 through September 30). Data in this report include the most recently concluded water year for sites in the Monitoring Summary plus several additional sites. The results for many of the remaining sites will lag one year due to time constraints for the data calculations. The lag is necessary to provide results that have been reviewed for quality and approved.

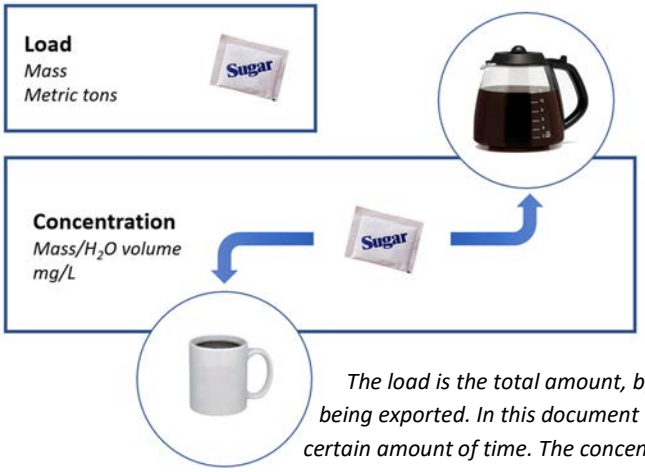
Heidelberg University, the U.S. Geological Survey (USGS), U.S. EPA and Ohio EPA are cooperating to review and publish these data in the hope that this effort will promote consistency in how the data are used by all stakeholders striving to reduce nutrients loading in Lake Erie tributaries.

All data tables in this report can be downloaded via a supplemental Excel Workbook posted on the Ohio Lake Erie Commission's website. Original source data for the information provided here is available directly from the National Center for Water Quality Research at Heidelberg University and from USGS National Water Information System: Web Interface (see source links and information at the end of this report).

How does water monitoring work?

Computing loads (i.e. the mass of material transported) for a parameter (e.g. total phosphorus) requires measurements of both concentration and streamflow (see box).

All load monitoring included in this report occurs at USGS streamflow gages. Water quality samples (from which concentrations are determined) are collected primarily with refrigerated automatic samplers (see Figures 1 and 2). The samples are collected either as a function of time or change in water levels (stage) as determined by the sampling organization. The sampling organization retrieves the samples on a regular basis and has them analyzed for concentration at an accredited lab. Samples are also collected manually at selected sites for quality assurance and/or to meet other site-specific needs. Once sufficient amounts of data have been collected, loads can be determined for the spring and/or annual time periods.



The load is the total amount, by weight, of nutrient being exported. In this document we report load over a certain amount of time. The concentration is how much nutrient there is for a given amount of water. A common analogy is the amount of sugar in coffee and the sweetness of coffee. One packet of sugar is the load. When you put that one packet (or load) of sugar into one cup of coffee it gets very sweet – the sugar concentration is high. However, if you put the same load into a whole pot of coffee, it wouldn't be that sweet at all – the sugar concentration is low. At both the high and low concentrations in this example, however, the load of sugar is the same.

Flow-weighted mean concentration (FWMC) goals have been established to help track progress on nutrient reduction efforts. Compared to loads, which are heavily influenced by streamflow, FWMCs provide a measure of nutrient contribution that is more independent of basin size and flow conditions. Using FWMCs helps with making comparisons between watersheds of differing size and/or periods with differing flow conditions. This, for example, helps avoid declaring victory in dry years and thinking no progress has been made in wet years. Note that FWMCs deemphasize the

effects of the variation in streamflow on concentrations, however, changes in streamflow do influence FWMCs (Choquette, 2019).

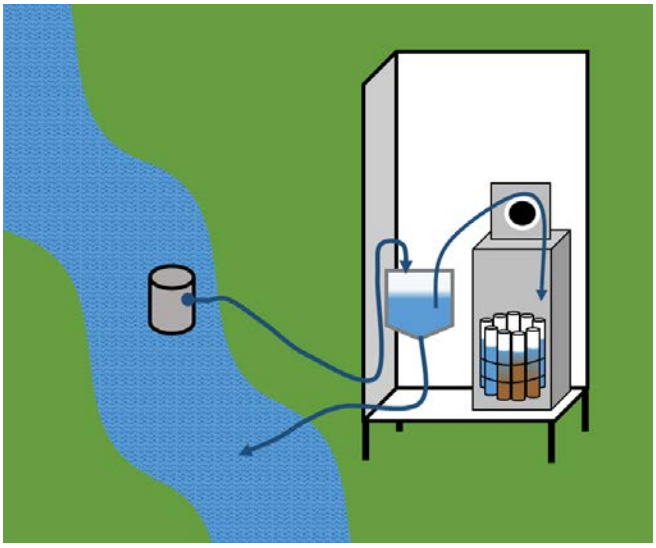


Figure 1. Schematic of water quality monitoring at USGS gages

Figure 2. The stream gage and water quality sampling station at the Sandusky River near Fremont, Ohio (Site # 4198000)

What partners are involved with Lake Erie tributary nutrient load monitoring?

In Ohio, the National Center for Water Quality Research at Heidelberg University (NCWQR) and the United States Geological Survey's Ohio-Kentucky-Indiana Water Science Center are currently doing all the tributary load monitoring. Both agencies have a long history of detailed and systematic water quality monitoring.

There is no single funding mechanism for the efforts required to perform the tributary monitoring. The funding sources for these monitoring efforts are diverse and most must be renewed on an annual or biannual basis. Funding sources include:

- U.S. EPA Great Lakes Restoration Initiative
- Ohio Clean Lakes Initiative Healthy Lake Erie Fund
- Ohio Department of Higher Education
- U.S. Department of Agriculture Natural Resource Conservation Service Conservation Effects Assessment Project
- City of Findlay
- Ohio EPA Surface Water Improvement Fund
- Ohio Water Development Authority
- Northeast Ohio Regional Sewer District
- National Oceanic and Atmospheric Administration National Estuarine Research Reserves Program
- The Andersons, Inc.
- Michigan Department of Environmental Quality

Where are Lake Erie tributary nutrient loads monitored?

Over time, the USGS has established a stream gage network focused on monitoring flows on streams to support research and other hydrologic information goals. Using this established system, Heidelberg University started, and has maintained, a tributary monitoring program at mainstem and small tributary sites of scientific interest that coincide with the pre-existing gage network.

In recent years, due to the increasing incidence of harmful algal blooms (HABs) in western Lake Erie, additional tributary nutrient load monitoring capability has been added in the Maumee River Basin at sites with a wide range of watershed sizes. The Maumee is a key contributor to conditions that cause the western basin HABs because it is the largest tributary to Lake Erie and it discharges to the western basin of the lake. Select other tributaries also have spring loading targets to address localized Lake Erie blooms.

Table 1 lists the sites draining to the Western Lake Erie Basin and the sampling agencies responsible for each site. Table 2 shows the sites draining to the Sandusky Bay and the Central Lake Erie Basin. Figures 3 and 4 are maps that show these Western Basin and Sandusky/Central Basin sites, respectively.

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Note that USGS is collecting "**surrogate**" data at several sites. Various multi-parameter water quality sondes are deployed at these surrogate gages along with the periodic collection and analysis of traditional nutrient samples. The goal of this data collection effort is to develop statistical relationships between the time series of water quality measurements with the sondes and measured nutrient concentrations (Robertson, 2018). Once these surrogate relationships are developed, nutrient concentration time series can be estimated based on the surrogate parameters. Three tributaries to the Central Lake Erie Basin currently have surrogate relations in development (noted in Table 2). Loading results for those gages are not presented in this report.

Table 1: Western Lake Erie Basin tributary nutrient load monitoring sites by sampling agency and location details

Site USGS Station Number and Name	Water Quality Sampling Agency	HUC8	Drainage Area (mi^2)
River Raisin			
04176500 - River Raisin near Monroe, MI	NCWQR	04100002 (River Raisin)	1,042
Maumee River			
04177080 - E Br St Joseph R NR Waldron, MI	USGS – MI	04100003 (St. Joseph River)	71
04177266 - W Branch St. Joseph R NR Nettle Lk, OH	USGS – MI		102
04178000 - St. Joseph River near Newville, IN	USGS – OH		610
04181049 - St. Marys River at Willshire, OH	USGS – OH	04100004 (St. Marys River)	386
04182000 - St. Marys River near Fort Wayne, IN	USGS – IN		762
04183000 - Maumee River at New Haven, IN	USGS – IN	04100005 (Upper Maumee River)	1,967
04183105 - Maumee R. at SR 101 nr Woodburn, IN	USGS – IN		2,089
04183500 - Maumee River at Antwerp, OH *	USGS – OH		2,129
04183979 - Platter Creek near Sherwood, OH	USGS – OH		20
04184500 - Bean Creek at Powers, OH	USGS – MI	04100006 (Tiffin River)	206
04185000 - Tiffin River at Stryker, OH	NCWQR		410
04185318 - Tiffin River near Evansport, OH	USGS – OH		563
04185440 - Unnamed Tributary to Lost Ck nr Farmer, OH	NCWQR		4
04185935 - (Upper) Auglaize River near Kossuth, OH	USGS – OH	04100007 (Auglaize River)	201
04186500 - Auglaize River near Fort Jennings, OH	USGS – OH		332
04188100 - Ottawa River near Kalida, OH	USGS – OH		350
04188252 - Unnamed Trib. to Blanchard R.(Shallow R)	NCWQR	04100008 (Blanchard River)	8
04188324 - Potato Run near Wharton, OH	NCWQR		17
04188496 - Eagle Creek above Findlay, OH	USGS – OH		51
04189000 - Blanchard River near Findlay, OH	NCWQR		346
04190000 - Blanchard River near Dupont, OH	USGS – OH		756
04191058 - Little Auglaize River at Melrose, OH	USGS – OH	04100007 (Auglaize River)	401
04191444 - Little Flatrock Creek near Junction, OH	USGS – OH		15
04191500 - Auglaize River near Defiance, OH	USGS – OH		2,318
04192500 - Maumee River near Defiance, OH	USGS – OH	04100009 (Lower Maumee River)	5,545
04192574 - West Creek near Hamler, OH	NCWQR		16
04192599 - S. Turkeyfoot Creek near Shunk, OH	NCWQR		116
04193500 - Maumee River at Waterville, OH *	USGS/NCWQR at gage station 4193490)		6,330
04193999 - Wolf Creek at Holland, OH	NCWQR		25
Portage River			
04195500 - Portage River at Woodville, OH	NCWQR	04100010 (Cedar-Portage R.)	428

* USGS surrogate (super) gages are also developed for these sites.

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Table 2: Sandusky Bay and Central Lake Erie Basin tributary nutrient load monitoring sites by sampling agency and location details

Site USGS Gage code and site name	Water Quality Sampling Agency	Surrogate Gage	HUC 8	Drainage Area (mi^2)
Sandusky River				
04197100 - Honey Creek at Melmore, OH	NCWQR	No	04100011	149
04197152 - Rock Creek near Republic, OH	NCWQR	No		15
04197170 - Rock Creek at Tiffin, OH	NCWQR	No		35
04198000 - Sandusky River near Fremont, OH	NCWQR	No		1,251
Huron – Vermillion HUC 8				
04199000 - Huron River at Milan, OH	NCWQR	Yes	04100012	371
04199155 - Old Woman Ck near Huron, OH	NCWQR	No		22
04199500 - Vermilion River near Vermilion, OH [1]	USGS	Yes		262
Black River				
04200500 - Black River at Elyria, OH [1]	USGS	Yes	04110001	396
Cuyahoga River				
04208000 - Cuyahoga River at Independence, OH	NCWQR	Yes	04110002	707
Grand River				
04212100 - Grand River near Painesville, OH [1]	USGS	Yes	04110004	685

[1] No water quality results are presented in this report for these stations as samples currently collected are only to support the surrogate gage development.

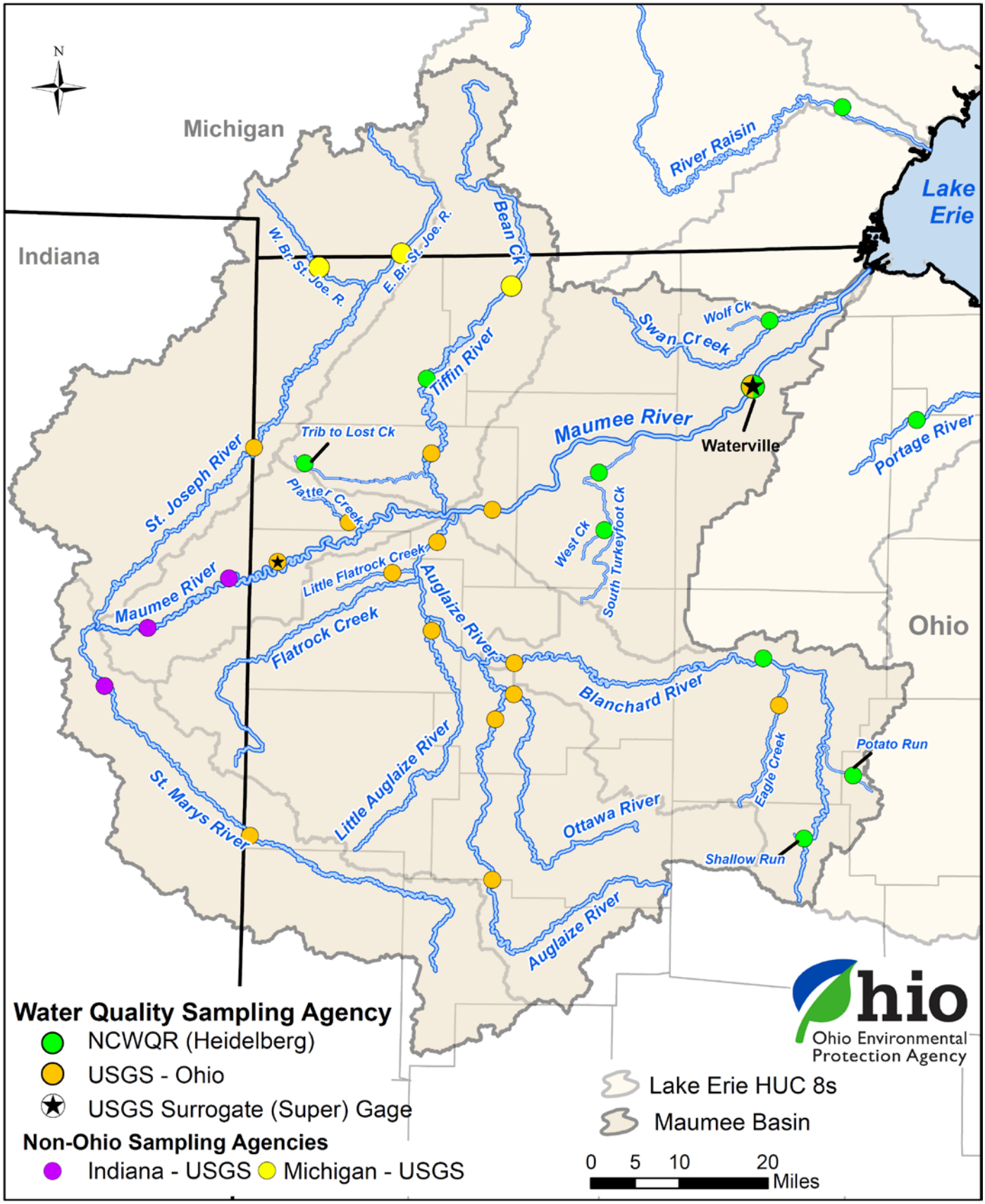

Figure 3. Western Lake Erie Basin tributary nutrient load monitoring sites by sampling agency

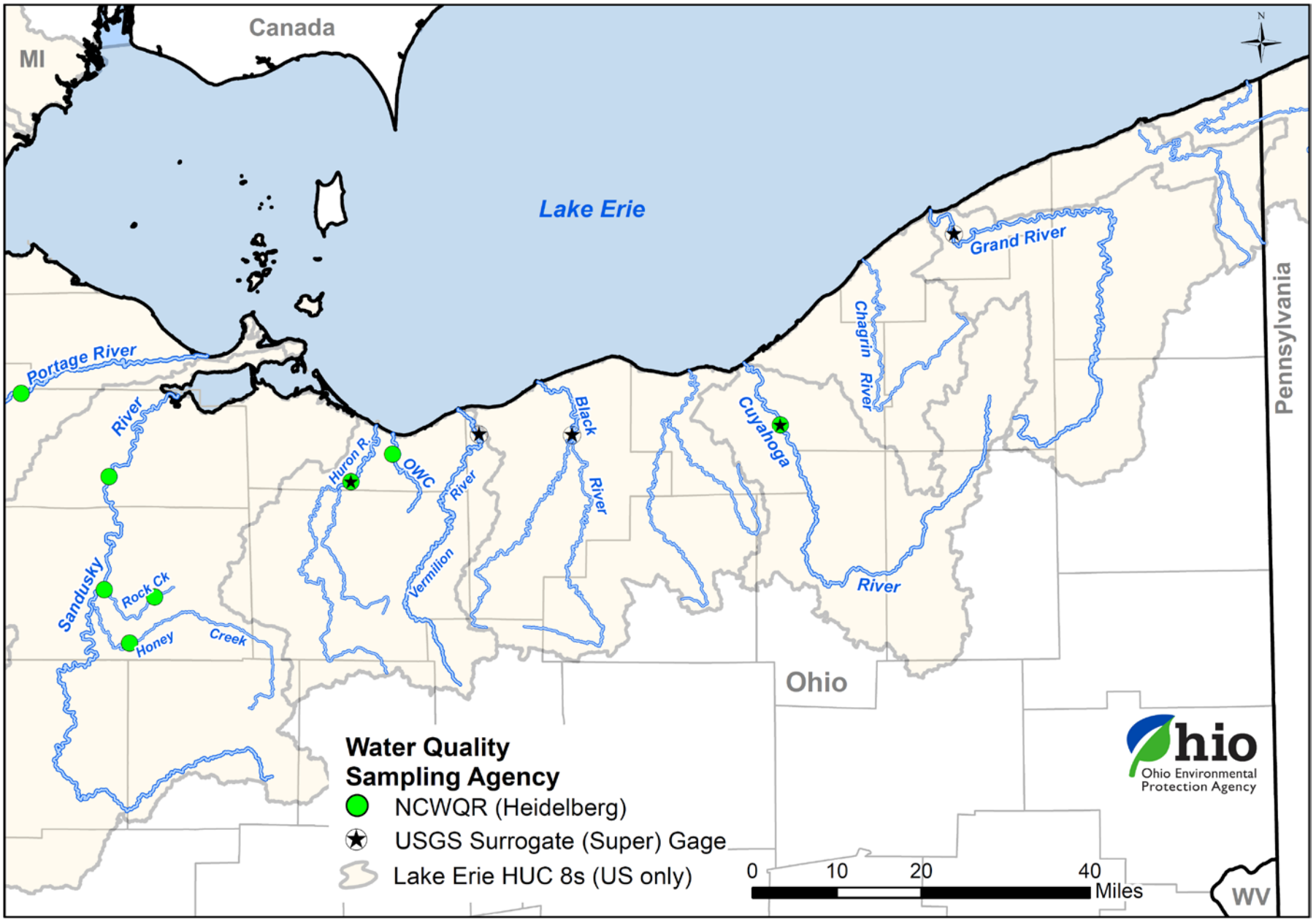

Figure 4. Sandusky Bay and Central Lake Erie Basin tributary nutrient load monitoring sites by sampling agency

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How are nutrient loads and flow weighted mean concentraitons calculated?

This report includes information on tributary sites with nutrient data collected at a frequency that facilitates estimates of daily load. At each site between 100-500 stream samples are analyzed per year for nutrient concentrations. NCWQR and USGS differ in their sampling and load calculation techniques.

- **NCWQR- Heidelberg:** All the NCWQR sites except the River Raisin use refrigerated autosamplers to collect three samples per day at 8-hour intervals. When streamflow is stable only one sample per day is analyzed (collected at noon). When streamflow fluctuations occur, two to three samples per day are analyzed. Typically, this program provides 450-500 samples per stations per year. Samples at the River Raisin are collected 5-7 days a week providing 200-340 samples per year.

  Annual loads are calculated using a custom version of an automated stratified Beale Ratio Estimator (BRE; Richards et al. 1996). This procedure fills in for days when samples were not collected. For days on which sample concentrations are available, daily loads are calculated as the product of the daily mean discharge from USGS records and a flow weighted average concentration for that day. The year is divided into sequential time intervals called strata. The strata are based on periods where the ratio of load to flow is fairly consistent. Depending on the stratification method used, the strata can be formed as a function of time, flow range, or both. Within each stratum, an average daily load was computed from the days with samples; this load was adjusted by the ratio of the average discharge for all days in the stratum divided by the average discharge on days with samples, with an additional bias correction related to the variance in discharge and the covariance of discharge and load. Each stratum load is the product of the adjusted average daily load and the number of days in the stratum. Stratum loads were summed to obtain the annual load. Most days had at least one sample, so the BRE adjustment procedure has a minimal effect in comparison to a simple summation of daily loads. However, the BRE does provide a statistically valid uncertainty estimate for the annual load.

  Daily loads are calculated by multiplying the daily FWMC by the daily USGS flow. Any days with missing concentrations (<5% of the time) are interpolated from concentrations nearest to the missing day(s). Monthly and spring loads are calculated from the daily loads. Additional details, including quality assurance protocols, can be found at NCWQR's website: https://ncwqr.org/monitoring.

- **USGS- Ohio-Kentucky-Indiana Water Science Center:** Autosamplers are programed to collect samples when the stream stage changes by set amounts that differ depending on whether stage is rising or falling. Additionally, a sample is collected usually at least once per week during periods when stage does not change sufficiently to trigger the sampler. Periodically, depth- and width-integrated samples are collected manually at each site. All samples that are collected are analyzed for concentration. Concentrations from the depth- and width-integrated samples are compared to concentrations from concurrent autosampler samples to ensure that the autosampler is providing concentration results that are representative of the flow-weighted mean concentration in the cross section. If a systematic bias is observed between the autosampler-based concentrations and the cross section flow-weighted mean concentrations, mathematical adjustments to the autosampler concentrations are made to compute concentrations that are more representative of the flow-weighted mean concentrations.

  USGS uses the Graphical Constituent Loading Analysis System (GCLAS; Koltun and others, 2006) to compute loads. GCLAS has tools to facilitate estimation of concentrations during periods that are not sampled or are under sampled. In addition, GCLAS has tools to identify and correct for systematic bias between samples from fixed-location samplers (e.g. autosampler) and cross section flow-weighted mean concentrations. GCLAS interpolates linearly in time between measured/estimated concentrations to estimate concentrations that correspond to each flow value in the streamflow time series (see Figure 5). So, for example, if the streamflow time series is at 15-minute intervals, concentrations and loads (determined from the product of concentration and flow divided by the time interval) are computed for each 15-minute interval. The time series of loading values are summed to compute daily, monthly and annual loads.

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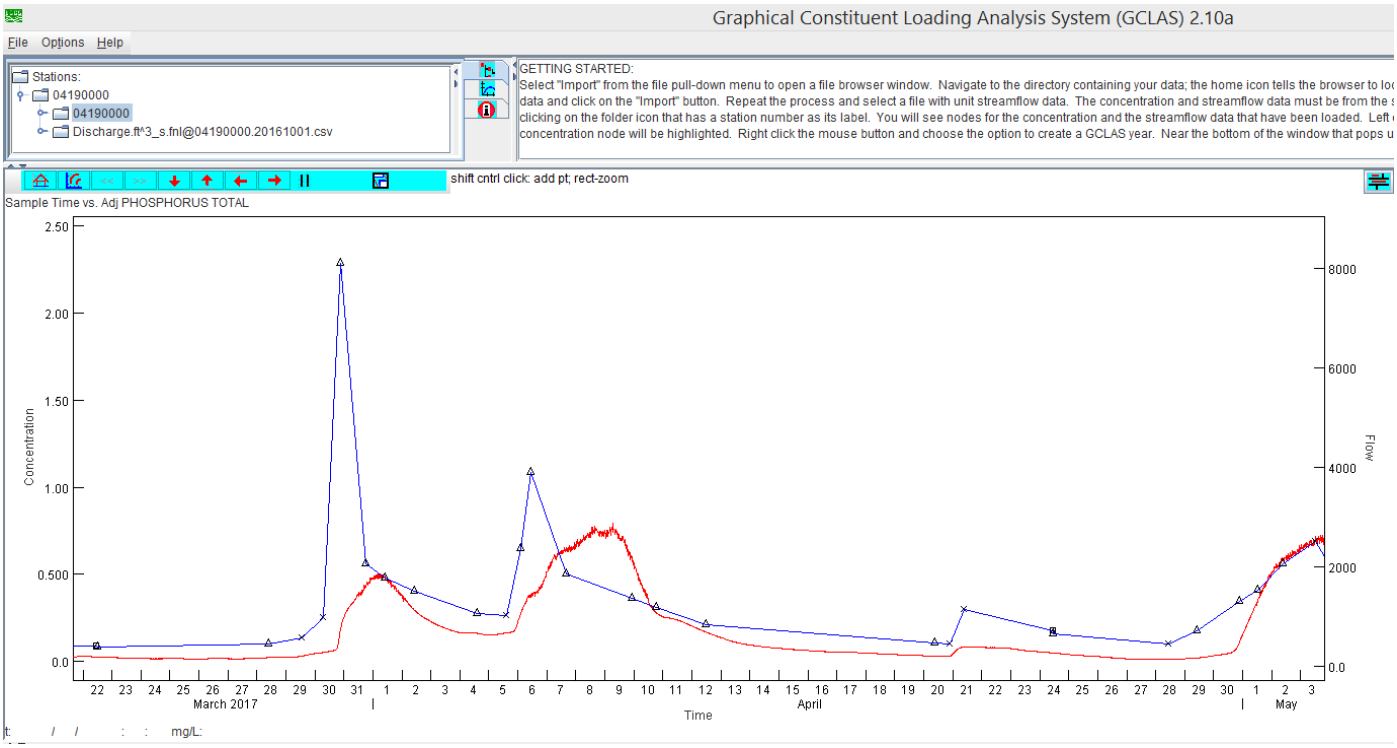

Figure 5. Example screen from GCLAS, the software used by USGS-Ohio to compute nutrient loads. Here, the red line is streamflow and the blue line is the total phosphorus concentration with triangles representing observed concentations and X's representing estimated concentrations.

- Flow-weighted mean concentrations (FWMC) are calculated for all tributary load monitoring stations. Concentrations and loadings of nutrients typically vary with streamflow. When nutrients are from primarily nonpoint sources (i.e., land runoff), a vast majority of the seasonal or annual loading will occur during periods of high runoff. Consequently, it is the concentrations that occur during the high flow periods that are most important with respect to the total loading contributed over a period of time. The FWMC is calculated in a manner so that concentrations are weighted by the volume of water they represent rather than by the period of time, thus high flow periods have greater weight than lower-flow periods.

  The FWMC is equivalent to the total load divided by the total volume of streamflow at the gaging station. If all of the water from a river during the year or spring period were collected in a large container, the FWMC would be the average concentration in that container. Alternatively, mean concentrations can also be calculated by the period of time they represent [time-weighted mean concentration (TWMC)]. Thus, a TWMC would be the average concentration an organism living in the river would experience during the spring or a year. More information about these calculations can be found on a factsheet developed by NCWQR (Heidelberg, 2005).

- Peer review: In addition to each agency's rigorous internal calculation verification process, each station's results have also been reviewed by another agency prior to being added to this report. In most cases, Ohio EPA provided this second peer review. These reviews include examining the monitored and interpolated concentrations and checking the load and FWMC calculations.

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Data tables

This report includes spring season (March 1-July 31) and annual water year nutrient loads and concentrations for the most recent year calculated for all Lake Erie tributary sites with continuous nutrient monitoring. Phosphorus loads and FWMCs from previous years are then presented. Finally, a series of tables outlines stream flow discharge data to provided context to variations in spring seasons. Only data from monitoring locations within the state of Ohio and by Ohio-based offices are included in this report. All data tables in this report can be downloaded via a supplemental Excel Workbook posted on the Ohio Lake Erie Commission's website. In the data tables, "TBD" indicates a value that can be derived from data that already have been collected but remain to be determined. The "nc" in the data tables indicates that data was not collected; this means that monitoring site was not yet operational or the necessary amount of data to make this calculation was not collected. Table 3 below provides an index to the data tables.

Table 3: An index of the data tables in this report

Table #	Data Table Content	Table #	Data Table Content
Spring (March 1 – July 31) Loading Season Results			
4	2018 Western Basin TP, DRP & NO_2+NO_3 loads & FWMCs	13	Historic Central Basin TP FWMCs
5	2018 Central Basin TP, DRP & NO_2+NO_3 loads & FWMCs	14	Historic Central Basin DRP loads
6	Historic Western Basin TP loads	15	Historic Central Basin DRP FWMCs
7	Historic Western Basin TP FWMCs	16	Historic Central Basin NO_2+NO_3 loads
8	Historic Western Basin DRP loads	17	Historic Central Basin NO_2+NO_3 FWMCs
9	Historic Western Basin DRP FWMCs	18	Historic Western Basin stream volume
10	Historic Western Basin NO_2+NO_3 loads	19	Historic Western Basin stream volume divided by drainage area
11	Historic Western Basin NO_2+NO_3 FWMCs	20	Historic Central Basin stream volume
12	Historic Central Basin TP loads	21	Historic Central Basin stream volume divided by drainage area
Water Year (Oct 1 – Sep 31) Annual Results			
22	2018 Western Basin TP, DRP & NO_2+NO_3 loads & FWMCs	31	Historic Central Basin TP FWMCs
23	2018 Central Basin TP, DRP & NO_2+NO_3 loads & FWMCs	32	Historic Central Basin DRP loads
24	Historic Western Basin TP loads	33	Historic Central Basin DRP FWMCs
25	Historic Western Basin TP FWMCs	34	Historic Central Basin NO_2+NO_3 loads
26	Historic Western Basin DRP loads	35	Historic Central Basin NO_2+NO_3 FWMCs
27	Historic Western Basin DRP FWMCs	36	Historic Western Basin stream volume
28	Historic Western Basin NO_2+NO_3 loads	37	Historic Western Basin stream volume divided by drainage area
29	Historic Western Basin NO_2+NO_3 FWMCs	38	Historic Central Basin stream volume
30	Historic Central Basin TP loads	39	Historic Central Basin stream volume divided by drainage area

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Table 4: Western Lake Erie Basin tributary nutrient load monitoring sites 2018 spring load and FWMC for TP, DRP and NO_2+NO_3

Site USGS Gage Code and Site Name	2018 Spring Load and FWMC (metric tons and mg/L)					
	Total Phosphorus		Dissolved Reactive P		Nitrate + Nitrite	
	Load	FWMC	Load	FWMC	Load	FWMC
04176500 - River Raisin near Monroe, MI	89.0	0.17	18.9	0.04	2,020	3.92
04178000 - St. Joseph River near Newville, IN	TBD	TBD	TBD	TBD	TBD	TBD
04181049 - St. Marys River at Willshire, OH	98.5	0.51	31.7	0.16	1,180	6.07
04183500 - Maumee River at Antwerp, OH	440	0.41	121	0.11	3,910	3.65
04183979 - Platter Creek near Sherwood, OH	TBD	TBD	TBD	TBD	TBD	TBD
04185000 - Tiffin River at Stryker, OH	TBD	TBD	TBD	TBD	TBD	TBD
04185318 - Tiffin River near Evansport, OH	122	0.37	30.0	0.09	1,410	4.24
04185440 - Unnamed Tributary to Lost Ck nr Farmer, OH	TBD	TBD	TBD	TBD	TBD	TBD
04185935 - (Upper) Auglaize River near Kossuth, OH	42.9	0.44	12.1	0.12	508	5.24
04186500 - Auglaize River nr Fort Jennings, OH	51.6	0.34	16.3	0.11	1,070	7.09
04188100 - Ottawa River near Kalida, OH	TBD	TBD	TBD	TBD	TBD	TBD
04188252 - Unnamed Trib. to Blanchard R. (Shallow Run) near Dunkirk, OH	nc	nc	nc	nc	nc	nc
04188324 - Potato Run near Wharton, OH	nc	nc	nc	nc	nc	nc
04188496 - Eagle Creek above Findlay, OH	13.4	0.52	3.12	0.12	151	5.88
04189000 - Blanchard River near Findlay, OH	TBD	TBD	TBD	TBD	TBD	TBD
04190000 - Blanchard River near Dupont, OH	TBD	TBD	TBD	TBD	TBD	TBD
04191058 - L. Auglaize River at Melrose, OH	85.4	0.52	17.2	0.11	1,100	6.76
04191444 - L. Flatrock Creek nr Junction, OH	TBD	TBD	TBD	TBD	TBD	TBD
04191500 - Auglaize River near Defiance, OH	424	0.41	95.2	0.09	6,210	6.02
04192500 - Maumee River near Defiance, OH	1,140	0.44	261	0.10	11,000	4.20
04192574 - West Creek near Hamler, OH	4.53	0.55	0.464	0.06	72.3	8.70
04192599 - S. Turkeyfoot Creek nr Shunk, OH	16.1	0.37	2.30	0.05	295	6.77
04193500 - Maumee River at Waterville, OH	1,080	0.36	217	0.07	15,200	5.02
04193999 - Wolf Creek at Holland, OH	2.25	nc	0.252	nc	31.7	nc
04195500 - Portage River at Woodville, OH	68.7	0.36	15.2	0.08	1,220	6.46

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Table 5: Sandusky & Central Basin trib. nutrient load monitoring sites 2018 spring load and FWMC for TP, DRP and NO2+NO3

Site USGS Gage Code and Site Name	2018 Spring Load and FWMC (metric tons and mg/L)					
	Total Phosphorus		Dissolved Reactive P		Nitrate + Nitrite	
	Load	FWMC	Load	FWMC	Load	FWMC
04197100 - Honey Creek at Melmore, OH	TBD	TBD	TBD	TBD	TBD	TBD
04197152 - Rock Creek near Republic, OH	TBD	TBD	TBD	TBD	TBD	TBD
04197170 - Rock Creek at Tiffin, OH	TBD	TBD	TBD	TBD	TBD	TBD
04198000 - Sandusky River near Fremont, OH	244	0.43	50.0	0.09	3,280	5.71
04199000 - Huron River at Milan, OH	63.0	0.16	7.18	0.02	536	1.34
04199155 - Old Woman Ck near Huron, OH	TBD	TBD	TBD	TBD	TBD	TBD
04208000 - Cuyahoga River at Independence, OH	109	0.19	10.2	0.02	620	1.10

Table 6: Western Lake Erie Basin tributary nutrient load monitoring sites spring TP load

Site; USGS Gage Code	Total Phosphorus Spring Load (metric tons)										
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
04176500	83.0	92.0	68.0	133	27.0	57.0	59.0	75.0	40.0	116	89.0
04178000	nc	nc	nc	nc	nc	nc	nc	nc	nc	97.5	TBD
04181049	nc	nc	nc	nc	nc	nc	nc	nc	nc	152	98.5
04183500	nc	nc	nc	nc	nc	nc	496	1,650	564	827	440
04183979	nc	nc	nc	nc	nc	nc	nc	nc	nc	8.02	TBD
04185000	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
04185318	nc	nc	nc	nc	nc	nc	85.7	94.4	59.7	132	122
04185440	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
04185935	nc	nc	nc	nc	nc	nc	nc	nc	nc	64.6	42.9
04186500	nc	nc	nc	nc	nc	nc	73.8	173	47.6	156	51.6
04188100	nc	nc	nc	nc	nc	nc	nc	142	54.3	113	TBD
04188252	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
04188324	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
04188496	nc	nc	nc	nc	nc	20.6	12.3	34.2	14.5	24.6	13.4
04189000	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
04190000	nc	nc	nc	nc	nc	nc	157	238	127	211	TBD
04191058	nc	nc	nc	nc	nc	nc	nc	nc	67.3	144	85.4
04191444	nc	nc	nc	nc	nc	nc	nc	nc	nc	8.12	TBD
04191500	nc	nc	nc	nc	nc	nc	513	940	334	867	424
04192500	nc	nc	nc	nc	nc	nc	1,220	1,960	783	2,110	1,140
04192574	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	4.53
04192599	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	16.1
04193500	1,410	1,370	1,310	2,320	393	1,250	1,160	2,060	755	1,910	1,080
*04193999	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	2.25
04195500	nc	nc	nc	186	35.0	73.0	63.0	111	67.0	109	68.7

* For 2018 only 22 samples, loads were interpolated. Weekly sampling began March 1st.

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Table 7: Western Lake Erie Basin tributary nutrient load monitoring sites spring TP flow weighted mean concentration

Site; USGS Gage Code	Total Phosphorus Spring Flow Weighted Mean Concentration (mg/L)										
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
04176500	0.15	0.16	0.13	0.19	0.11	0.13	0.13	0.15	0.12	0.23	0.17
04178000	nc	nc	nc	nc	nc	nc	nc	nc	nc	0.25	TBD
04181049	nc	nc	nc	nc	nc	nc	nc	nc	nc	0.49	0.51
04183500	nc	nc	nc	nc	nc	nc	0.44	0.93	0.75	0.55	0.41
04183979	nc	nc	nc	nc	nc	nc	nc	nc	nc	0.61	TBD
04185000	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
04185318	nc	nc	nc	nc	nc	nc	0.35	0.30	0.30	0.40	0.37
04185440	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
04185935	nc	nc	nc	nc	nc	nc	nc	nc	nc	0.44	0.44
04186500	nc	nc	nc	nc	nc	nc	0.46	0.43	0.40	0.61	0.34
04188100	nc	nc	nc	nc	nc	nc	nc	0.34	0.38	0.46	TBD
04188252	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
04188324	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
04188496	nc	nc	nc	nc	nc	0.76	0.55	0.70	0.52	0.62	0.52
04189000	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
04190000	nc	nc	nc	nc	nc	nc	0.45	0.39	0.44	0.48	TBD
04191058	nc	nc	nc	nc	nc	nc	nc	nc	0.47	0.48	0.52
04191444	nc	nc	nc	nc	nc	nc	nc	nc	nc	0.75	TBD
*04191500	nc	nc	nc	nc	nc	nc	0.42	0.39	0.37	0.52	0.41
04192500	nc	nc	nc	nc	nc	nc	0.41	0.41	0.37	0.56	0.44
04192574	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	0.55
04192599	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	0.37
04193500	0.38	0.41	0.36	0.46	0.38	0.37	0.33	0.37	0.30	0.44	0.36
04193999	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
04195500	nc	nc	nc	0.43	0.35	0.32	0.34	0.29	0.34	0.37	0.36

* Flow-weighted mean concentrations were computed with Auglaize River near Defiance daily mean discharge data at the gage location (near the dam) for water years 2014-2017, and Auglaize River near Defiance daily mean discharge data at the water-quality sampling location starting in water year 2018.

Expanded Lake Erie Tributary Nutrient Load Monitoring

Table 8: Western Lake Erie Basin tributary nutrient load monitoring sites spring DRP Load

Site; USGS Gage Code	Dissolved Reactive Phosphorus Spring Load (metric tons)										
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
04176500	19.6	16.7	16.8	29.4	6.37	14.3	17.8	24.1	9.10	20.9	18.9
04178000	nc	nc	nc	nc	nc	nc	nc	nc	nc	25.8	TBD
04181049	nc	nc	nc	nc	nc	nc	nc	nc	nc	53.7	31.7
04183500	nc	nc	nc	nc	nc	nc	133	245	49.9	177	121
04183979	nc	nc	nc	nc	nc	nc	nc	nc	nc	2.35[a]	TBD
04185000	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
04185318	nc	nc	nc	nc	nc	nc	24.5	38.2	11.3	27.9	30.0
04185440	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
04185935	nc	nc	nc	nc	nc	nc	nc	nc	nc	16.3	12.1
04186500	nc	nc	nc	nc	nc	nc	20.5	55.3	8.69	35.1	16.3
04188100	nc	nc	nc	nc	nc	nc	nc	52.4	12.9	33.8	TBD
04188252	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
04188324	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
04188496	nc	nc	nc	nc	nc	3.98	2.61	6.78	2.51	5.6	3.12
04189000	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
04190000	nc	nc	nc	nc	nc	nc	34.5	81.3	22.8	57.6	TBD
04191058	nc	nc	nc	nc	nc	nc	nc	nc	9.06	31.3	17.2
04191444	nc	nc	nc	nc	nc	nc	nc	nc	nc	1.37	TBD
04191500	nc	nc	nc	nc	nc	nc	135	325	63.8	201	95.2
04192500	nc	nc	nc	nc	nc	nc	285	700	151	456	261
04192574	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	0.464
04192599	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	2.30
04193500	302	211	324	430	63.8	289	306	609	144	399	217
*04193999	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	0.252
04195500	nc	nc	nc	35.5	7.10	22.1	14.2	40.1	11.0	29.4	15.2

[a] Data are in review and subject to revision.

* For 2018 only 22 samples, loads were interpolated. Weekly sampling began March 1st.

Expanded Lake Erie Tributary Nutrient Load Monitoring

Table 9: Western Lake Erie Basin tributary nutrient load monitoring sites spring DRP flow weighted mean concentration

Site; USGS Gage Code	Dissolved Reactive Phosphorus Spring Flow Weighted Mean Concentration (mg/L)										
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
04176500	0.04	0.03	0.03	0.04	0.03	0.03	0.04	0.05	0.03	0.04	0.04
04178000	nc	nc	nc	nc	nc	nc	nc	nc	nc	0.07	TBD
04181049	nc	nc	nc	nc	nc	nc	nc	nc	nc	0.17	0.16
04183500	nc	nc	nc	nc	nc	nc	0.12	0.14	0.07	0.12	0.11
04183979	nc	nc	nc	nc	nc	nc	nc	nc	nc	0.18[a]	TBD
04185000	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
04185318	nc	nc	nc	nc	nc	nc	0.10	0.12	0.06	0.08	0.09
04185440	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
04185935	nc	nc	nc	nc	nc	nc	nc	nc	nc	0.11	0.12
04186500	nc	nc	nc	nc	nc	nc	0.13	0.14	0.07	0.14	0.11
04188100	nc	nc	nc	nc	nc	nc	nc	0.12	0.09	0.14	TBD
04188252	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
04188324	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
04188496	nc	nc	nc	nc	nc	0.15	0.12	0.14	0.09	0.14	0.12
04189000	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
04190000	nc	nc	nc	nc	nc	nc	0.10	0.13	0.08	0.13	TBD
04191058	nc	nc	nc	nc	nc	nc	nc	nc	0.06	0.10	0.11
04191444	nc	nc	nc	nc	nc	nc	nc	nc	nc	0.13	TBD
*04191500	nc	nc	nc	nc	nc	nc	0.11	0.14	0.07	0.12	0.09
04192500	nc	nc	nc	nc	nc	nc	0.10	0.15	0.07	0.12	0.10
04192574	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	0.06
04192599	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	0.05
04193500	0.08	0.06	0.09	0.08	0.06	0.09	0.09	0.11	0.06	0.09	0.07
04193999	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
04195500	nc	nc	nc	0.08	0.07	0.10	0.08	0.10	0.06	0.10	0.08

[a] Data are in review and subject to revision.

* Flow-weighted mean concentrations were computed with Auglaize River near Defiance daily mean discharge data at the gage location (near the dam) for water years 2014-2017, and Auglaize River near Defiance daily mean discharge data at the water-quality sampling location starting in water year 2018.

Expanded Lake Erie Tributary Nutrient Load Monitoring

Table 10: Western Lake Erie Basin tributary nutrient load monitoring sites spring nitrate + nitrite load

Site; USGS Gage Code	Nitrate + Nitrite Spring Load (metric tons)										
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
04176500	1,870	1,540	1,780	2,810	713	2,110	1,450	2,160	1,660	2,010	2,020
04178000	nc	nc	nc	nc	nc	nc	nc	nc	nc	816	TBD
04181049	nc	nc	nc	nc	nc	nc	nc	nc	nc	2,180	1,180
04183500	nc	nc	nc	nc	nc	nc	4,780	3,320	3,240	5,850	3,910
04183979	nc	nc	nc	nc	nc	nc	nc	nc	nc	83	TBD
04185000	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
04185318	nc	nc	nc	nc	nc	nc	837	1,580	1,260	1,650	1,410
04185440	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
04185935	nc	nc	nc	nc	nc	nc	nc	nc	nc	1,030	508
04186500	nc	nc	nc	nc	nc	nc	1,130	1,900	703	1,610	1,070
04188100	nc	nc	nc	nc	nc	nc	nc	1,570	900	1,410	TBD
04188252	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
04188324	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
04188496	nc	nc	nc	nc	nc	114	126	265	176	266	151
04189000	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
04190000	nc	nc	nc	nc	nc	nc	1,720	3,090	1,930	2,680	TBD
04191058	nc	nc	nc	nc	nc	nc	nc	nc	958	1,320	1,100
04191444	nc	nc	nc	nc	nc	nc	nc	nc	nc	83	TBD
04191500	nc	nc	nc	nc	nc	nc	6,640	10,500	5,730	10,100	6,210
04192500	nc	nc	nc	nc	nc	nc	13,600	16,500	11,100	16,500	11,000
04192574	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	72.3
04192599	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	295
04193500	14,600	14,600	21,200	24,500	2,970	21,800	16,100	26,600	15,200	24,400	15,200
*04193999	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	31.7
04195500	nc	nc	nc	2,290	391	1,400	857	2,190	1,170	2,340	1,220

* For 2018 only 22 samples, loads were interpolated. Weekly sampling began March 1st.

Table 11: Western Lake Erie Basin tributary nutrient load monitoring sites spring TP flow weighted mean concentration

Site; USGS Gage Code	Nitrate + Nitrite Spring Flow Weighted Mean Concentration (mg/L)										
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
04176500	3.33	2.68	3.31	4.07	2.85	4.75	3.18	4.23	4.99	4.02	3.92
04178000	nc	nc	nc	nc	nc	nc	nc	nc	nc	2.09	TBD
04181049	nc	nc	nc	nc	nc	nc	nc	nc	nc	6.99	6.07
04183500	nc	nc	nc	nc	nc	nc	4.21	1.87	4.32	3.90	3.65
04183979	nc	nc	nc	nc	nc	nc	nc	nc	nc	6.34	TBD
04185000	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
04185318	nc	nc	nc	nc	nc	nc	3.42	4.97	6.36	4.98	4.24
04185440	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
04185935	nc	nc	nc	nc	nc	nc	nc	nc	nc	6.96	5.24
04186500	nc	nc	nc	nc	nc	nc	7.05	4.76	5.96	6.27	7.09
04188100	nc	nc	nc	nc	nc	nc	nc	3.72	6.34	5.65	TBD
04188252	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
04188324	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
04188496	nc	nc	nc	nc	nc	4.20	5.62	5.43	6.29	6.76	5.88
04189000	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
04190000	nc	nc	nc	nc	nc	nc	4.94	5.03	6.70	6.06	TBD
04191058	nc	nc	nc	nc	nc	nc	nc	nc	6.64	4.36	6.76
04191444	nc	nc	nc	nc	nc	nc	nc	nc	nc	7.64	TBD
*04191500	nc	nc	nc	nc	nc	nc	5.40	4.37	6.41	6.06	6.02
04192500	nc	nc	nc	nc	nc	nc	4.58	3.43	5.27	4.34	4.20
04192574	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	8.70
04192599	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	6.77
04193500	3.89	4.36	5.88	4.80	2.86	6.51	4.62	4.79	6.10	5.58	5.02
04193999	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
04195500	nc	nc	nc	5.25	3.95	6.19	4.56	5.63	6.01	8.00	6.46

* Flow-weighted mean concentrations were computed with Auglaize River near Defiance daily mean discharge data at the gage location (near the dam) for water years 2014-2017, and Auglaize River near Defiance daily mean discharge data at the water-quality sampling location starting in water year 2018.

Expanded Lake Erie Tributary Nutrient Load Monitoring

Table 12: Sandusky and Central Basin tributary nutrient load monitoring sites spring TP load

Site; USGS Gage Code	Total Phosphorus Spring Load (metric tons)										
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
04197100	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
04197152	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	TBD
04197170	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
04198000	367	204	312	752	151	373	271	329	161	350	244
04199000	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	63.0
04199155	nc	nc	nc	nc	nc	nc	nc	nc	TBD	TBD	TBD
04208000	139	154	98.0	190	52.0	111	170	145	48.0	132	109

Table 13: Sandusky and Central Basin tributary nutrient load monitoring sites spring TP flow weighted mean concentration

Site; USGS Gage Code	Total Phosphorus Spring Flow Weighted Mean Concentration (mg/L)										
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
04197100	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
04197152	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	TBD
04197170	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
04198000	0.38	0.46	0.43	0.56	0.53	0.42	0.41	0.36	0.32	0.45	0.43
04199000	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	0.16
04199155	nc	nc	nc	nc	nc	nc	nc	nc	TBD	TBD	TBD
04208000	0.25	0.42	0.26	0.22	0.19	0.26	0.31	0.23	0.13	0.22	0.19

Expanded Lake Erie Tributary Nutrient Load Monitoring

Table 14: Sandusky and Central Basin tributary nutrient load monitoring sites spring dissolved reactive phosphorus load

Site; USGS Gage Code	Dissolved Reactive Phosphorus Spring Load (metric tons)										
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
04197100	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
04197152	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	TBD
04197170	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
04198000	69.1	29.8	65.9	137	16.0	89.2	60.2	91.9	30.8	90.1	50.0
04199000	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	7.18
04199155	nc	nc	nc	nc	nc	nc	nc	nc	TBD	TBD	TBD
04208000	14.3	11.0	13.0	12.7	7.60	10.6	7.50	9.70	8.70	13.0	10.2

Table 15: Sandusky and Central Basin tributary nutrient load monitoring sites spring DRP flow weighted mean concentration

Site; USGS Gage Code	Dissolved Reactive Phosphorus Spring Flow Weighted Mean Concentration (mg/L)										
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
04197100	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
04197152	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	TBD
04197170	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
04198000	0.07	0.07	0.09	0.10	0.06	0.10	0.09	0.10	0.06	0.12	0.09
04199000	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	0.02
04199155	nc	nc	nc	nc	nc	nc	nc	nc	TBD	TBD	TBD
04208000	0.03	0.03	0.04	0.02	0.03	0.03	0.01	0.02	0.02	0.02	0.02

Expanded Lake Erie Tributary Nutrient Load Monitoring

Table 16: Sandusky and Central Basin tributary nutrient load monitoring sites spring nitrate + nitrite load

Site; USGS Gage Code	Nitrate + Nitrite Spring Load (metric tons)										
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
04197100	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
04197152	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	TBD
04197170	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
04198000	3,530	2,290	4,870	5,170	1,100	4,410	3,270	4,930	2,450	4,860	3,280
04199000	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	536
04199155	nc	nc	nc	nc	nc	nc	nc	nc	TBD	TBD	TBD
04208000	741	590	606	676	484	631	730	641	538	723	620

Table 17: Sandusky and Central Basin tributary nutrient load monitoring sites spring NO_2+NO_3 FWMC

Site; USGS Gage Code	Nitrate + Nitrite Spring Flow Weighted Mean Concentration (mg/L)										
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
04197100	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
04197152	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	TBD
04197170	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
04198000	3.66	5.16	6.64	3.81	3.90	4.97	5.01	5.41	4.91	6.22	5.71
04199000	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	1.34
04199155	nc	nc	nc	nc	nc	nc	nc	nc	TBD	TBD	TBD
04208000	1.32	1.59	1.62	0.79	1.77	1.46	1.31	1.01	1.49	1.22	1.10

Table 18: Western Lake Erie Basin tributary nutrient load monitoring sites spring stream volume

Site; USGS Gage Code	Spring Stream Volume (cubic kilometers)					
	2013	2014	2015	2016	2017	2018
04176500	0.44	0.46	0.51	0.33	0.50	0.52
04178000	nc	nc	nc	nc	0.39	TBD
04181049	nc	nc	nc	nc	0.31	0.19
04183500	nc	1.14	1.77	0.75	1.50	1.07
04183979	nc	nc	nc	nc	0.01	TBD
04185000	0.17	0.20	0.22	0.15	0.23	0.22
04185318	nc	0.25	0.32	0.20	0.33	0.33
04185440	0.002	0.002	0.003	0.002	0.003	0.002
04185935	nc	nc	nc	nc	0.15	0.10
04186500	TBD	0.16	0.40	0.12	0.26	0.15
04188100	nc	nc	0.42	0.14	0.25	TBD
04188252	nc	nc	nc	nc	nc	nc
04188324	nc	nc	nc	nc	nc	nc
04188496	0.03	0.02	0.05	0.03	0.04	0.03
04189000	0.22	0.14	0.24	0.13	0.25	0.14
04190000	nc	0.35	0.61	0.29	0.44	TBD
04191058	nc	nc	nc	TBD	TBD	TBD
04191444	nc	nc	TBD	TBD	0.01	TBD
04191500	TBD	1.23	2.41	0.89	1.66	0.99
04192500	TBD	2.96	4.80	2.11	3.79	2.62
04192574	nc	nc	0.02	0.01	0.01	0.01
04192599	nc	nc	0.11	0.06	0.07	0.04
04193500	3.34	3.47	5.55	2.45	4.34	3.02
04193999	nc	nc	0.02	0.01	0.02	0.02
04195500	0.23	0.19	0.39	0.19	0.29	0.19

Expanded Lake Erie Tributary Nutrient Load Monitoring

Table 19: Western Lake Erie Basin tributary nutrient load monitoring sites spring stream volume reported as average depth over the drainage area

Site; USGS Gage Code	Spring Stream Volume Reported as Average Depth Over the Drainage Area (in)					
	2013	2014	2015	2016	2017	2018
04176500	6.49	6.64	7.46	4.86	7.28	7.53
04178000	nc	nc	nc	nc	9.71	TBD
04181049	nc	nc	nc	nc	12.3	7.65
04183500	nc	8.10	12.7	5.35	10.7	7.64
04183979	nc	nc	nc	nc	10.2	TBD
04185000	6.37	7.50	8.22	5.55	8.50	8.33
04185318	nc	6.62	8.57	5.36	8.96	8.98
04185440	7.69	7.39	9.68	5.51	9.10	6.25
04185935	nc	nc	nc	nc	11.2	7.33
04186500	TBD	7.33	18.3	5.40	11.7	6.94
04188100	nc	nc	18.4	6.17	10.8	TBD
04188252	nc	nc	nc	nc	nc	nc
04188324	nc	nc	nc	nc	nc	nc
04188496	8.07	6.69	14.6	8.34	11.7	7.66
04189000	9.54	6.07	10.6	5.54	10.8	6.32
04190000	nc	6.99	12.3	5.79	8.89	TBD
04191058	nc	nc	nc	TBD	TBD	TBD
04191444	nc	nc	TBD	TBD	10.8	TBD
04191500	TBD	8.06	15.8	5.86	10.9	6.47
04192500	TBD	8.13	13.2	5.78	10.4	7.17
04192574	nc	nc	19.8	8.14	11.5	8.16
04192599	nc	nc	14.5	7.87	8.85	5.72
04193500	8.02	8.34	13.3	5.89	10.4	7.25
04193999	nc	nc	13.9	8.60	10.7	9.82
04195500	8.03	6.66	13.8	6.91	10.3	6.71

Expanded Lake Erie Tributary Nutrient Load Monitoring

Table 20: Sandusky and Central Basin tributary nutrient load monitoring sites spring stream volumue

Site; USGS Gage Code	Spring Stream Volume (cubic kilometers)					
	2013	2014	2015	2016	2017	2018
04197100	0.08	0.09	0.10	0.07	0.09	0.07
04197152	nc	nc	0.01	0.00	0.01	0.00
04197170	TBD	TBD	0.02	0.02	0.01	0.02
04198000	0.89	0.66	0.91	0.50	0.78	0.57
04199000	0.22	0.22	0.23	0.17	0.18	0.17
04199155	0.01	0.01	0.01	0.01	0.01	0.01
04208000	0.43	0.56	0.63	0.36	0.59	0.57

Table 21: Sandusky and Central Basin tributary nutrient load monitoring sites spring stream volume reported as average depth over the drainage area

Site; USGS Gage Code	Spring Stream Volume Reported as Average Depth Over the Drainage Area (in)					
	2013	2014	2015	2016	2017	2018
04197100	8.41	8.85	10.3	7.30	9.49	7.17
04197152	nc	nc	6.76	4.74	5.76	4.92
04197170	TBD	TBD	8.68	10.4	5.26	7.14
04198000	10.8	7.98	11.1	6.06	9.49	6.97
04199000	9.09	8.92	9.39	6.88	7.48	6.84
04199155	8.55	8.34	9.85	6.56	7.94	6.89
04208000	9.30	12.0	13.6	7.74	12.8	12.2

Expanded Lake Erie Tributary Nutrient Load Monitoring

Table 22: Western Lake Erie Basin tributary nutrient load monitoring sites 2018 annual load and FWMC for TP, DRP and NO_2+NO_3

Site USGS Gage Code and Site Name	2018 Water Year (Oct. 1, 2017 - Sep. 31, 2018) Load & FWMC (metric tons and mg/L)					
	Total Phosphorus		Dissolved Reactive P		Nitrate + Nitrite	
	Load	FWMC	Load	FWMC	Load	FWMC
04176500 - River Raisin near Monroe, MI	153	0.18	36.4	0.04	3,440	4.02
04178000 - St. Joseph River nr Newville, IN	TBD	TBD	TBD	TBD	TBD	TBD
04181049 - St. Marys River at Willshire, OH	206	0.48	74.7	0.18	2,320	5.46
04183500 - Maumee River at Antwerp, OH	939	0.43	280	0.13	7,390	3.38
04183979 - Platter Creek nr Sherwood, OH	TBD	TBD	TBD	TBD	TBD	TBD
04185000 - Tiffin River at Stryker, OH	118	0.30	31.1	0.08	1,490	3.74
04185318 - Tiffin River near Evansport, OH	220	0.38	58.5	0.10	2,380	4.15
04185440 - Unnamed Trib to Lost Ck nr Farmer, OH	1.36	0.44	0.375	0.12	9.18	2.98
04185935 - (Upper) Auglaize R nr Kossuth, OH	85.1	0.45	24.9	0.13	922	4.84
04186500 - Auglaize R nr Fort Jennings, OH	118	0.39	39.2	0.13	1,860	6.12
04188100 - Ottawa River near Kalida, OH	TBD	TBD	TBD	TBD	TBD	TBD
04188252 - Unnamed Trib. to Blanchard R. (Shallow Run) near Dunkirk, OH	nc	nc	nc	nc	nc	nc
04188324 - Potato Run near Wharton, OH	nc	nc	nc	nc	nc	nc
04188496 - Eagle Creek above Findlay, OH	29.1	0.53	7.37	0.14	266	4.90
04189000 - Blanchard River near Findlay, OH	143	0.45	43.8	0.14	1,480	4.70
04190000 - Blanchard River nr Dupont, OH	TBD	TBD	TBD	TBD	TBD	TBD
04191058 - L. Auglaize River at Melrose, OH	204	0.59	44.7	0.13	1,990	5.78
04191444 - L. Flatrock Creek nr Junction, OH	TBD	TBD	TBD	TBD	TBD	TBD
04191500 - Auglaize River near Defiance, OH	1,090	0.49	239	0.11	11,600	5.18
04192500 - Maumee River nr Defiance, OH	2,510	0.48	604	0.12	20,500	3.91
04192574 - West Creek near Hamler, OH	nc	nc	nc	nc	nc	nc
04192599 - S. Turkeyfoot Creek nr Shunk, OH	43.5	nc	5.90	nc	222	nc
04193500 - Maumee River at Waterville, OH	2,510	0.39	544	0.09	29,400	4.62
04193999 - Wolf Creek at Holland, OH	nc	nc	nc	nc	nc	nc
04195500 - Portage River at Woodville, OH	184	0.42	45.6	0.10	2,430	5.51

Expanded Lake Erie Tributary Nutrient Load Monitoring

Table 23: Sandusky & Central Basin tributary nutrient load monitoring sites 2018 annual load and FWMC for TP, DRP and NO2+NO3

Site USGS Gage Code and Site Name	2018 Water Year (Oct. 1, 2017 - Sep. 31, 2018) Load & FWMC (metric tons and mg/L)					
	Total Phosphorus		Dissolved Reactive P		Nitrate + Nitrite	
	Load	FWMC	Load	FWMC	Load	FWMC
04197100 - Honey Creek at Melmore, OH	78.1	0.47	21.7	0.13	704	4.22
04197152 - Rock Creek near Republic, OH	TBD	TBD	TBD	TBD	TBD	TBD
04197170 - Rock Creek at Tiffin, OH	17.8	0.50	3.94	0.11	102	2.84
04198000 - Sandusky River near Fremont, OH	567	0.43	130	0.10	5,740	4.37
04199000 - Huron River at Milan, OH	184	0.46	22.6	0.06	1,270	3.17
04199155 - Old Woman Ck near Huron, OH	6.69	0.26	1.12	0.04	63.3	2.48
04208000 - Cuyahoga River at Independence, OH	220	0.20	30.4	0.03	1,550	1.44

Expanded Lake Erie Tributary Nutrient Load Monitoring

Table 24: Western Lake Erie Basin tributary nutrient load monitoring sites annual TP load

Site; USGS Gage Code	Total Phosphorus Annual Load (metric tons)										
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
04176500	172	128	83.2	135	163	67.7	79.7	88.9	62.5	175	153
04178000	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	TBD
04181049	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	206
04183500	nc	nc	nc	nc	nc	nc	nc	2,030	861	1,310	939
04183979	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	TBD
04185000	98.9	105	78.4	85.1	109	51.7	64.7	50.9	44.9	115	118
04185318	nc	nc	nc	nc	nc	nc	nc	105	83.4	220	220
04185440	1.89	1.21	1.55	1.30	1.48	1.36	0.906	1.13	0.775	1.83	1.36
04185935	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	85.1
04186500	nc	nc	nc	nc	nc	nc	nc	199	78.9	204	118
04188100	nc	nc	nc	nc	nc	nc	nc	172	99.3	158	TBD
04188252	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
04188324	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
04188496	nc	nc	nc	nc	nc	33.4	26.3	36.0	24.9	31.8	29.1
04189000	240	110	67.5	216	154	173	130	97.2	82.2	154	143
04190000	nc	nc	nc	nc	nc	nc	nc	264	210	305	TBD
04191058	nc	nc	nc	nc	nc	nc	nc	nc	109	227	204
04191444	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	TBD
04191500	nc	nc	nc	nc	nc	nc	nc	1,060	591	1,320	1,090
04192500	nc	nc	nc	nc	nc	nc	nc	2,300	1,380	3,180	2,510
04192574	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
04192599	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	43.5
04193500	3,560	2,160	1,530	2,780	2,230	2,130	1,960	2,200	1,160	2,880	2,510
04193999	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
04195500	nc	nc	nc	232	188	117	163	123	103	135	184

Table 25: Western Lake Erie Basin tributary nutrient load monitoring sites annual TP flow weighted mean concentration

Site; USGS Gage Code	Total Phosphorus Annual Flow Weighted Mean Concentration (mg/L)										
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
04176500	TBD	0.13	TBD	0.15	TBD	TBD	0.12	0.14	0.12	0.20	0.18
04178000	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	TBD
04181049	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	0.48
04183500	nc	nc	nc	nc	nc	nc	nc	0.90	0.64	0.54	0.43
04183979	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	TBD
04185000	0.19	0.27	0.23	0.23	0.26	0.23	0.21	0.20	0.20	0.27	0.30
04185318	nc	nc	nc	nc	nc	nc	nc	0.28	0.28	0.37	0.38
04185440	0.38	0.32	0.41	0.34	0.43	0.54	0.30	0.35	0.31	0.42	0.44
04185935	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	0.45
04186500	nc	nc	nc	nc	nc	nc	nc	0.42	0.35	0.58	0.39
04188100	nc	nc	nc	nc	nc	nc	nc	0.34	0.39	0.45	TBD
04188252	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
04188324	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
04188496	nc	nc	nc	nc	nc	0.69	0.51	0.66	0.52	0.64	0.53
04189000	0.50	0.46	0.38	0.50	0.42	0.50	0.41	0.35	0.37	0.47	0.45
04190000	nc	nc	nc	nc	nc	nc	nc	0.37	0.42	0.50	TBD
04191058	nc	nc	nc	nc	nc	nc	nc	nc	0.44	0.50	0.59
04191444	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	TBD
*04191500	nc	nc	nc	nc	nc	nc	nc	0.38	0.38	0.55	0.49
04192500	nc	nc	nc	nc	nc	nc	nc	0.39	0.39	0.53	0.48
04192574	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
04192599	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
04193500	0.44	0.43	0.33	0.45	0.37	0.42	0.34	0.33	0.29	0.42	0.39
04193999	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
04195500	nc	nc	nc	0.40	0.37	0.31	0.37	0.28	0.34	0.34	0.42

* Flow-weighted mean concentrations were computed with Auglaize River near Defiance daily mean discharge data at the gage location (near the dam) for water years 2014-2017, and Auglaize River near Defiance daily mean discharge data at the water-quality sampling location starting in water year 2018.

Expanded Lake Erie Tributary Nutrient Load Monitoring

Table 26: Western Lake Erie Basin tributary nutrient load monitoring sites annual DRP Load

Site; USGS Gage Code	Dissolved Reactive Phosphorus Annual Load (metric tons)										
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
04176500	42.0	26.3	20.2	34.6	37.8	17.3	24.5	37.5	16.0	39.5	36.4
04178000	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	TBD
04181049	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	74.7
04183500	nc	nc	nc	nc	nc	nc	nc	310	123	293	280
04183979	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	TBD
04185000	34.5	20.9	22.7	25.4	33.5	13.2	27.4	21.7	9.2	30.9	31.1
04185318	nc	nc	nc	nc	nc	nc	nc	42.3	17.7	57.2	58.5
04185440	0.79	0.29	0.408	0.293	0.256	0.187	0.238	0.351	0.162	0.424	0.375
04185935	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	24.9
04186500	nc	nc	nc	nc	nc	nc	nc	63.9	21.2	46.2	39.2
04188100	nc	nc	nc	nc	nc	nc	nc	65.7	26.8	47.2	TBD
04188252	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
04188324	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
04188496	nc	nc	nc	nc	nc	7.02	7.88	7.45	4.88	7.05	7.37
04189000	64.5	19.1	19.9	51.1	61.4	47.9	43.3	37.5	26.4	49.6	43.8
04190000	nc	nc	nc	nc	nc	nc	nc	91.3	43.6	77.2	TBD
04191058	nc	nc	nc	nc	nc	nc	nc	nc	17.8	42.6	44.7
04191444	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	TBD
04191500	nc	nc	nc	nc	nc	nc	nc	365	127	292	239
04192500	nc	nc	nc	nc	nc	nc	nc	851	296	737	604
04192574	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
04192599	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	5.90
04193500	835	346	404	570	614	468	577	752	237	634	544
04193999	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
04195500	nc	nc	nc	51.0	58.6	35.2	50.1	45.1	20.2	38.8	45.6

Table 27: Western Lake Erie Basin tributary nutrient load monitoring sites annual DRP flow weighted mean concentration

Site; USGS Gage Code	Dissolved Reactive Phosphorus Annual Flow Weighted Mean Concentration (mg/L)										
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
04176500	TBD	0.03	TBD	0.04	TBD	TBD	0.04	0.06	0.03	0.04	0.04
04178000	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	TBD
04181049	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	0.18
04183500	nc	nc	nc	nc	nc	nc	nc	0.14	0.09	0.12	0.13
04183979	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	TBD
04185000	0.07	0.05	0.07	0.07	0.08	0.06	0.09	0.08	0.04	0.07	0.08
04185318	nc	nc	nc	nc	nc	nc	nc	0.11	0.06	0.10	0.10
04185440	0.16	0.08	0.11	0.08	0.07	0.07	0.08	0.11	0.07	0.10	0.12
04185935	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	0.13
04186500	nc	nc	nc	nc	nc	nc	nc	0.13	0.09	0.13	0.13
04188100	nc	nc	nc	nc	nc	nc	nc	0.13	0.11	0.14	TBD
04188252	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
04188324	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
04188496	nc	nc	nc	nc	nc	0.14	0.15	0.14	0.10	0.14	0.14
04189000	0.13	0.08	0.11	0.12	0.17	0.14	0.14	0.14	0.12	0.15	0.14
04190000	nc	nc	nc	nc	nc	nc	nc	0.13	0.09	0.13	TBD
04191058	nc	nc	nc	nc	nc	nc	nc	nc	0.07	0.09	0.13
04191444	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	TBD
*04191500	nc	nc	nc	nc	nc	nc	nc	0.13	0.08	0.12	0.11
04192500	nc	nc	nc	nc	nc	nc	nc	0.15	0.08	0.12	0.12
04192574	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
04192599	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
04193500	0.10	0.07	0.09	0.09	0.10	0.09	0.10	0.11	0.06	0.09	0.09
04193999	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
04195500	nc	nc	nc	0.09	0.12	0.09	0.11	0.10	0.07	0.10	0.10

* Flow-weighted mean concentrations were computed with Auglaize River near Defiance daily mean discharge data at the gage location (near the dam) for water years 2014-2017, and Auglaize River near Defiance daily mean discharge data at the water-quality sampling location starting in water year 2018.

Expanded Lake Erie Tributary Nutrient Load Monitoring

Table 28: Western Lake Erie Basin tributary nutrient load monitoring sites annual nitrate + nitrite load

Site; USGS Gage Code	Nitrate + Nitrite Annual Load (metric tons)										
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
04176500	3,600	2,630	2,110	3,320	2,860	2,290	1,730	2,270	1,960	3,780	3,440
04178000	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	TBD
04181049	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	2,320
04183500	nc	nc	nc	nc	nc	nc	nc	4,620	5,670	10,500	7,390
04183979	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	TBD
04185000	1,480	1,440	1,190	1,550	1,370	1,370	1,020	1,180	1,230	2,080	1,490
04185318	nc	nc	nc	nc	nc	nc	nc	1,760	1,600	3,060	2,380
04185440	12.9	11.4	8.33	12	6.43	13.6	7.9	10.7	11.3	14.9	9.18
04185935	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	922
04186500	nc	nc	nc	nc	nc	nc	nc	2,150	1,190	2,310	1,860
04188100	nc	nc	nc	nc	nc	nc	nc	1,870	1,460	2,020	TBD
04188252	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
04188324	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
04188496	nc	nc	nc	nc	nc	230	236	283	296	333	266
04189000	1,800	1,210	1,180	1,600	918	1,780	1,300	1,380	1,260	1,720	1,480
04190000	nc	nc	nc	nc	nc	nc	nc	3,400	3,190	3,770	TBD
04191058	nc	nc	nc	nc	nc	nc	nc	nc	1,440	2,120	1,990
04191444	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	TBD
04191500	nc	nc	nc	nc	nc	nc	nc	11,800	9,500	15,400	11,600
04192500	nc	nc	nc	nc	nc	nc	nc	19,800	18,700	26,800	20,500
04192574	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
04192599	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	222
04193500	30,700	22,700	25,100	31,400	18,200	31,500	25,900	29,600	21,600	39,900	29,400
04193999	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
04195500	nc	nc	nc	2,960	1,340	2,340	1,740	2,410	1,950	3,120	2,430

Table 29: Western Lake Erie Basin tributary nutrient load monitoring sites annual TP flow weighted mean concentration

Site; USGS Gage Code	Nitrate + Nitrite Annual Flow Weighted Mean Concentration (mg/L)										
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
04176500	TBD	2.77	TBD	3.74	TBD	TBD	2.63	3.46	3.73	4.26	4.02
04178000	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	TBD
04181049	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	5.46
04183500	nc	nc	nc	nc	nc	nc	nc	2.05	4.19	4.30	3.38
04183979	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	TBD
04185000	2.81	3.68	3.53	4.25	3.23	6.14	3.26	4.59	5.59	4.96	3.74
04185318	nc	nc	nc	nc	nc	nc	nc	4.73	5.43	5.20	4.15
04185440	2.63	3.01	2.23	3.15	1.87	5.42	2.64	3.27	4.54	3.43	2.98
04185935	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	4.84
04186500	nc	nc	nc	nc	nc	nc	nc	4.50	5.23	6.61	6.12
04188100	nc	nc	nc	nc	nc	nc	nc	3.69	5.76	5.78	TBD
04188252	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
04188324	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
04188496	nc	nc	nc	nc	nc	4.72	4.56	5.17	6.22	6.68	4.90
04189000	3.73	5.08	6.63	3.71	2.50	5.11	4.14	5.04	5.65	5.20	4.70
04190000	nc	nc	nc	nc	nc	nc	nc	4.81	6.43	6.22	TBD
04191058	nc	nc	nc	nc	nc	nc	nc	nc	5.85	4.64	5.78
04191444	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	TBD
*04191500	nc	nc	nc	nc	nc	nc	nc	4.18	6.15	6.34	5.18
04192500	nc	nc	nc	nc	nc	nc	nc	3.38	5.23	4.50	3.91
04192574	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
04192599	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
04193500	3.83	4.47	5.40	5.04	3.05	6.26	4.43	4.45	5.44	5.82	4.62
04193999	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
04195500	nc	nc	nc	5.09	2.64	6.24	3.95	5.49	6.50	7.90	5.51

* Flow-weighted mean concentrations were computed with Auglaize River near Defiance daily mean discharge data at the gage location (near the dam) for water years 2014-2017, and Auglaize River near Defiance daily mean discharge data at the water-quality sampling location starting in water year 2018.

Expanded Lake Erie Tributary Nutrient Load Monitoring

Table 30: Sandusky and Central Basin tributary nutrient load monitoring sites annual TP load

Site; USGS Gage Code	Total Phosphorus Annual Load (metric tons)										
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
04197100	96.5	53.9	29.4	127	82.1	71.7	68.4	38.8	50.8	79.6	78.1
04197152	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	TBD
04197170	26.9	13.7	6.40	36.1	17.5	15.1	13.9	6.78	8.05	16.8	17.8
04198000	877	368	345	938	640	642	558	352	295	539	567
04199000	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	184
04199155	nc	nc	nc	nc	nc	nc	nc	nc	5.06	6.73	6.69
04208000	300	259	148	329	197	240	264	194	109	216	220

Table 31: Sandusky and Central Basin tributary nutrient load monitoring sites annual TP flow weighted mean concentration

Site; USGS Gage Code	Total Phosphorus Annual Flow Weighted Mean Concentration (mg/L)										
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
04197100	0.40	0.45	0.34	0.55	0.48	0.46	0.42	0.34	0.42	0.51	0.47
04197152	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	TBD
04197170	0.51	0.49	0.37	0.61	0.42	0.46	0.41	0.32	0.38	0.56	0.50
04198000	0.46	0.39	0.39	0.49	0.42	0.43	0.39	0.33	0.34	0.46	0.43
04199000	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	0.46
04199155	nc	nc	nc	nc	nc	nc	nc	nc	0.30	0.36	0.26
04208000	0.26	0.30	0.21	0.24	0.18	0.24	0.25	0.20	0.15	0.19	0.20

Expanded Lake Erie Tributary Nutrient Load Monitoring

Table 32: Sandusky and Central Basin tributary nutrient load monitoring sites annual dissolved reactive phosphorus load

Site; USGS Gage Code	Dissolved Reactive Phosphorus Annual Load (metric tons)										
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
04197100	28.1	12.3	10.5	35.0	33.1	20.4	26.2	13.5	13.4	21.4	21.7
04197152	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	TBD
04197170	4.34	1.69	1.27	5.29	4.13	2.62	3.33	1.91	1.72	3.00	3.94
04198000	187	70.7	74.0	194	181	153	160	98.7	63.8	129	130
04199000	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	22.6
04199155	nc	nc	nc	nc	nc	nc	nc	nc	0.465	0.69	1.12
04208000	44.8	30.5	31.0	29.0	27.8	38.0	25.5	23.8	19.3	34.6	30.4

Table 33: Sandusky and Central Basin tributary nutrient load monitoring sites annual DRP flow weighted mean concentration

Site; USGS Gage Code	Dissolved Reactive Phosphorus Annual Flow Weighted Mean Concentration (mg/L)										
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
04197100	0.12	0.10	0.12	0.15	0.19	0.13	0.16	0.12	0.11	0.14	0.13
04197152	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	TBD
04197170	0.08	0.06	0.07	0.09	0.10	0.08	0.10	0.09	0.08	0.10	0.11
04198000	0.10	0.07	0.08	0.10	0.12	0.10	0.11	0.09	0.07	0.11	0.10
04199000	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	0.06
04199155	nc	nc	nc	nc	nc	nc	nc	nc	0.03	0.04	0.04
04208000	0.04	0.04	0.04	0.02	0.03	0.04	0.02	0.02	0.03	0.03	0.03

Expanded Lake Erie Tributary Nutrient Load Monitoring

Table 34: Sandusky and Central Basin tributary nutrient load monitoring sites annual nitrate + nitrite load

Site; USGS Gage Code	Nitrate + Nitrite Annual Load (metric tons)										
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
04197100	838	592	552	809	380	848	712	686	560	946	704
04197152	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	TBD
04197170	118	93.0	84.8	147	43.4	118	102	74.1	57.6	129	102
04198000	7,250	4,950	5,590	7,310	3,810	7,580	5,330	5,400	4,470	7,300	5,740
04199000	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	1270
04199155	nc	nc	nc	nc	nc	nc	nc	nc	53.1	79.6	63.3
04208000	1,700	1,420	1,410	1,580	1,380	1,560	1,620	1,430	1,380	1,720	1,550

Table 35: Sandusky and Central Basin tributary nutrient load monitoring sites annual NO_2+NO_3 FWMC

Site; USGS Gage Code	Nitrate + Nitrite Annual Flow Weighted Mean Concentration (mg/L)										
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
04197100	3.46	4.89	6.43	3.50	2.21	5.47	4.40	5.97	4.67	6.10	4.22
04197152	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	TBD
04197170	2.23	3.32	4.96	2.49	1.03	3.60	2.99	3.50	2.72	4.29	2.84
04198000	3.80	5.23	6.34	3.85	2.51	5.09	3.76	5.09	5.16	6.21	4.37
04199000	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	3.17
04199155	nc	nc	nc	nc	nc	nc	nc	nc	3.19	4.21	2.48
04208000	1.45	1.63	2.00	1.15	1.28	1.58	1.56	1.47	1.84	1.55	1.44

Table 36: Western Lake Erie Basin tributary nutrient load monitoring sites annual stream volume

Site; USGS Gage Code	Annual Stream Volume (cubic kilometers)					
	2013	2014	2015	2016	2017	2018
04176500	0.58	0.66	0.66	0.52	0.89	0.86
04178000	nc	nc	nc	nc	nc	TBD
04181049	nc	nc	nc	nc	nc	0.42
04183500	nc	nc	2.25	1.35	2.43	2.18
04183979	nc	nc	nc	nc	nc	TBD
04185000	0.22	0.31	0.26	0.22	0.42	0.39
04185318	nc	nc	0.37	0.29	0.59	0.57
04185440	0.00	0.00	0.00	0.00	0.00	0.00
04185935	nc	nc	nc	nc	TBD	0.19
04186500	TBD	TBD	0.48	0.23	0.35	0.30
04188100	nc	nc	0.51	0.25	0.35	TBD
04188252	nc	nc	nc	nc	nc	nc
04188324	nc	nc	nc	nc	nc	nc
04188496	0.05	0.05	0.05	0.05	TBD	0.05
04189000	0.35	0.31	0.27	0.22	0.33	0.31
04190000	nc	nc	0.71	0.50	0.61	TBD
04191058	nc	nc	nc	TBD	TBD	TBD
04191444	nc	nc	nc	TBD	TBD	TBD
04191500	TBD	TBD	2.82	1.55	2.43	2.15
04192500	TBD	TBD	5.86	3.57	5.96	5.23
04192574	nc	nc	nc	0.01	0.02	0.02
04192599	nc	nc	nc	0.09	0.12	0.09
04193500	5.03	5.85	6.64	3.97	6.86	5.86
04193999	nc	nc	nc	0.02	0.03	TBD
04195500	0.38	0.44	0.44	0.30	0.39	0.44

Table 37: Western Lake Erie Basin tributary nutrient load monitoring sites annual stream volume reported as average depth over the drainage area

Site; USGS Gage Code	Annual Stream Volumue Reported as Average Depth Over the Drainage Area (in)					
	2013	2014	2015	2016	2017	2018
04176500	8.51	9.60	9.59	7.65	12.9	12.5
04178000	nc	nc	nc	nc	nc	TBD
04181049	nc	nc	nc	nc	nc	16.72
04183500	nc	nc	16.1	9.67	17.4	15.6
04183979	nc	nc	nc	nc	nc	TBD
04185000	8.28	11.6	9.53	8.17	15.5	14.6
04185318	nc	nc	10.0	7.96	15.9	15.5
04185440	9.03	10.8	11.7	8.95	15.6	11.1
04185935	nc	nc	nc	nc	TBD	14.4
04186500	TBD	TBD	21.8	10.4	16.0	13.9
04188100	nc	nc	22.0	11.0	15.1	TBD
04188252	nc	nc	nc	nc	nc	nc
04188324	nc	nc	nc	nc	nc	nc
04188496	14.5	15.4	16.3	14.2	TBD	16.2
04189000	15.3	13.8	12.0	9.78	14.5	13.8
04190000	nc	nc	14.23	9.99	12.2	TBD
04191058	nc	nc	nc	TBD	TBD	TBD
04191444	nc	nc	nc	TBD	TBD	TBD
04191500	TBD	TBD	18.5	10.1	15.9	14.1
04192500	TBD	TBD	16.1	9.79	16.3	14.3
04192574	nc	nc	nc	13.0	20.9	16.9
04192599	nc	nc	nc	11.3	15.7	11.9
04193500	12.1	14.0	16.0	9.53	16.5	14.1
04193999	nc	nc	nc	13.9	18.0	TBD
04195500	13.3	15.6	15.6	10.7	14.0	15.6

Table 38: Sandusky and Central Basin tributary nutrient load monitoring sites annual stream volume

Site; USGS Gage Code	Annual Total Stream Volume (cubic kilometers)					
	2013	2014	2015	2016	2017	2018
04197100	0.15	0.16	0.11	0.12	0.15	0.17
04197152	nc	nc	nc	0.01	0.01	0.01
04197170	TBD	TBD	TBD	0.04	0.02	0.03
04198000	1.49	1.42	1.06	0.87	1.18	1.31
04199000	0.44	0.43	0.28	0.29	0.31	0.40
04199155	0.02	0.02	0.02	0.02	0.02	0.03
04208000	0.99	1.04	0.97	0.75	1.11	1.08

Table 39: Sandusky and Central Basin tributary nutrient load monitoring sites annual stream volume reported as average depth over the drainage area

Site; USGS Gage Code	Annual Stream Volume Reported as Average Depth Over Drainage Area (in)					
	2013	2014	2015	2016	2017	2018
04197100	15.8	16.5	11.7	12.2	15.8	17.1
04197152	nc	nc	nc	7.93	10.2	11.7
04197170	TBD	TBD	TBD	17.4	7.7	11.4
04198000	18.1	17.2	12.9	10.5	14.3	16.0
04199000	18.1	17.8	11.4	11.7	12.7	16.4
04199155	16.5	16.7	14.3	11.4	13.0	17.6
04208000	21.3	22.4	20.9	16.1	23.9	23.2

How to access the raw water quality data?

As noted above, all data in the tables in this report are available in an Excel workbook that can be downloaded at the Ohio Lake Erie Commission website. Nutrient concentration results, stream flow discharge, and most calculated loading data can be downloaded directly from the sampling agencies. Refer to Tables 1 and 2 to determine which agency samples each gage.

USGS streamflow, concentration and loading data can be obtained from the ***USGS National Water Information System: Web Interface***. Additional information can be found at the ***Nutrients and Sediment In The Western Lake Erie Basin*** webpage. Email ***dlrunkle@usgs.gov***, ***dpfinneg@usgs.gov*** or ***kshaffer@usgs.gov*** for assistance.

NCWQR at Heidelberg University sampling data can be downloaded from the ***Tributary Data Download Website***. Email: ***ljohnson@heidelberg.edu*** or ***nmiller@heidelberg.edu*** for assistance.

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