

APPENDIX 2



WATER QUALITY DATA ANALYSIS and WATERSHED PRIORITIZATION

Annex 4 Summary using IDEM, Allen County SWCD and the City of Fort Wayne Data

Load calculations and flow weighted mean concentrations were calculated using results from the USGS LOADEST model in R. This model uses flow data from USGS gaging stations, which are primarily located on larger streams and river systems. Most of the sampling sites along the main stems are collocated with or have a proximity to gaging stations which results in more precise modelling estimates. Some of the sites along tributaries have much smaller drainage areas than the nearest stream gage which introduces error to the estimates. Load estimates for the smaller tributaries without stream gages might not be reliable, but the calculations can still be used to compare load contributions across the tributaries or within a tributary across time. Bias estimators were calculated as part of the LOADEST model, and analyses were excluded if the absolute value of the bias estimator was greater than 25.

Here is the breakdown of the dataset, both holistically and by basin:

Entire Dataset

N=31 sites

87% of sites (N = 27) have a Drainage Area Ratio >90% and <110%

84% of sites (N = 26) fail the Annual FWMC target of 0.23 mg/L (0.63 Max, 0.16 Min, 0.36 Mean)

90% of sites (N = 28) fail the Seasonal FWMC target of 0.23 mg/L (0.68 Max, 0.19 Min, 0.37 Mean)

St Joseph River

N=11 Sites

91% of sites (N = 10) have a Drainage Area Ratio >90% and <110%

72% of sites (N = 8) fail the Annual FWMC (0.30 Max, 0.18 Min, 0.25 Mean)

91% of sites (N = 10) fail the Seasonal FWMC (0.34 Max, 0.21 Min, 0.27 Mean)

St Marys River

N=12 Sites

67% of sites (N = 8) have a Drainage Area Ratio >90% and <110%

83% of sites (N = 10) fail the Annual FWMC target of 0.23 mg/L (0.63 Max, 0.16 Min, 0.43 Mean)

83% of sites (N = 10) fail the Seasonal FWMC target of 0.23 mg/L (0.68 Max, 0.19 Min, 0.46 Mean)

Maumee River

N=8 Sites

86% of sites (N = 7) have a Drainage Area Ratio >90% and <110%

100% of sites fail the Annual FWMC target of 0.23 mg/L (0.49 Max, 0.36 Min, 0.39 Mean)

100% of sites fail the Seasonal FWMC target of 0.23 mg/L (0.46 Max, 0.36 Min, 0.40 Mean)

St. Marys River Basin

The St. Marys River (STM) originates in Ohio and flows into Indiana near the town of Pleasant Mills. It flows in the northwest direction until it reaches the City of Fort Wayne (CFW), Indiana where it bends north and east to meet with the St. Joseph River (STJ). The St. Marys and the St. Joseph rivers join to form the Maumee River (M) which flows eastward back into Ohio.

Total Phosphorus

The furthest upstream site on the St. Marys River is an Allen County Soil and Water Conservation District (SWCD) site that sits on the Ohio side of the border (STM-205) at 40.5 miles upstream of the confluence and has an annual FWMC of 0.44 mg/L. STM-37 (IDEM) and STM-222 (SWCD) are the next sites sitting another 4.2 miles downstream in Pleasant Mills, Indiana. These two sites represent the phosphorus load that is coming into Indiana from Ohio and have an annual FWMC of total phosphorus at 0.48 mg/L. In the 4-mile stretch of river upstream of the two Pleasant Mills sites, the drainage area increases by 168 square miles due to Twentyseven Mile Creek and Blue Creek watersheds, which may be contributing to the increase in phosphorus loadings.

Another 6.4 miles downstream is site STM-221 (SWCD). This site had load estimates for the years 2014-2017 and had the lowest average FWMC of sites on the St. Marys mainstem at 0.24 mg/L. The year 2016 was a drought year and may help explain why the average concentration was so low during this time period. The Nickelsen Creek watershed joins the St. Marys River at 16.9 river miles upstream of the confluence and is monitored by Allen County at site NC-STM-211 (SWCD). This site is not a mainstem site, but a site located on the tributary. The annual FWMC was 0.39 mg/L of total phosphorus, which is relatively high for a tributary.

STM-212 (SWCD) is just 1.4 miles downstream of the Nickelsen Creek watershed and the annual FWMC was 0.5 mg/L of total phosphorus. STM-11 (IDEM) and STM-F (Ferguson Rd. CFW) both sit 9.9 miles upstream of the confluence and have an average FWMC of 0.55 mg/L. Snyder ditch and Simmerman Ditch watersheds contribute to the increase in phosphorus loadings between STM-212 and STM-11/STM-F.

The next site downstream is STM-P (Paulding St. CFW), and represents the first site in Fort Wayne, Indiana. The annual FWMC at STM-P was 0.54 mg/L of total phosphorus. The final mainstem site is just 0.5 miles upstream of the confluence with the St. Joseph River at site STM-.8 (IDEM). The FWMC of the St. Marys River at this location is 0.63 mg/L of total phosphorus.

Just 0.4 miles before the confluence, another small tributary enters the St. Marys called Spy Run Creek. The total phosphorus loadings contributed by the Spy Run Creek watershed is measured at the site SRC-STM-C (Clinton St. CFW) and is estimated to have an annual FWMC of 0.16 mg/L.

Table 1. The flow weighted mean concentration (FWMC) of total phosphorus (mg/L) is estimated for sites along the St. Marys River. The white rows are sites on the mainstem of the St. Joseph River and the grey rows are tributary sites. The sites are listed in order from the furthest upstream site to the confluence with the St. Joseph River where the Maumee is formed. River miles are measured upstream from the confluence. The target FWMC is 0.23 mg/L of total phosphorus.

Site	River Miles Upstream	Years	Drainage Area (mi ²)	Annual FWMC (mg/L)	Springtime FWMC (mg/L)
STM-205	40.5	2012-2022	386	0.44	0.46
STM-37	36.3	2008-2022	554	0.48	0.52
STM-222	36.3	2020-2022	554	0.48	0.40
STM-221	29.9	2014-2017	615	0.24	0.29
Nickelsen Creek	16.9				
NC-STM-211		2018-2021	13	0.39	0.43
STM-212	15.5	2012-2022	730	0.50	0.55
STM-11	9.9	2008-2022	761	0.55	0.57
STM-F	9.9	2008-2022	765	0.55	0.58
STM-P	6.2	2013-2022	781	0.54	0.58
STM-.8	0.5	2011-2022	821	0.63	0.68
Spy Run Creek	0.4				
SRC-STM-C		2013-2022	15	0.16	0.19

Orthophosphate / Dissolved Reactive Phosphorus (DRP)

There was only 1 site in the St. Marys River Basin where orthophosphate was modeled. The Nickelsen Creek site NC-STM-211 (SWCD) had an annual FWMC of 0.19 mg/L of orthophosphate.

Table 2. The flow weighted mean concentration (FWMC) of orthophosphate (mg/L) is estimated for sites along the St. Marys River. The only site where the FWMC of orthophosphate was measured was at a tributary site in Nickelsen Creek (NC). River miles are measured on the St. Marys River upstream of the confluence and represent where Nickelsen Creek flows into the St. Marys. The target FWMC is 0.05 mg/L of orthophosphate.

Site	River Miles Upstream	Years	Drainage Area (mi ²)	Annual FWMC (mg/L)	Springtime FWMC (mg/L)
Nickelsen Creek	16.9				
NC-STM-211		2018-2021	13	0.19	0.17

St. Joseph River Basin

The headwaters of the St. Joseph River originate in Michigan. The river flows through Northwest Ohio before entering Northeast Indiana. St. Joseph River flows in the southwest direction into Fort Wayne, Indiana, where it meets the St. Marys River. The St. Joseph and St. Marys rivers join to form the Maumee River which flows eastward back into Ohio.

Total Phosphorus

The furthest upstream site on the St. Joseph River (STJ-163) is monitored by Allen Co SWCD and sits 42.3 river miles upstream near the Ohio-Indiana border in Ohio. The annual FWMC is 0.18 mg/L of total phosphorus. The next site is 6 miles downstream at STJ-36 (IDEM) and sits just inside the Ohio-Indiana border in Indiana. This site represents the total phosphorus contribution of Ohio and Michigan entering Indiana. The estimated annual FWMC is 0.23 mg/L of total phosphorus. In the 6-mile stretch between the first two sites upstream there are three watersheds that potentially contribute to the increase in phosphorus loads including Buck Creek, Sol Shank Ditch, and Willow Run watersheds.

At 14.8 river miles upstream of the confluence, the river is dammed to form the Cedarville Reservoir. The next mainstem site is STJ-M (Mayhew Rd. CFW) and is located 5.3 river miles downstream of the dam. STJ-M had an annual FWMC of 0.23 mg/L of total phosphorus.

Between the Cedarville Reservoir dam and site STJ-M, Cedar Creek flows into the St. Joseph at 13.4 miles upstream of the confluence. The Cedar Creek is a large tributary the St. Joseph and has a drainage area of about 270 mi². There are four sites along Cedar Creek. The furthest upstream site is CC-STJ-105 (SWCD) and is 22 river miles upstream of where Cedar Creek flows into the St. Joseph. The annual FWMC at this site is 0.26 mg/L of total phosphorus. Site CC-STJ-100 (SWCD) sits 5.8 miles upstream and has an annual FWMC of 0.3 mg/L of total phosphorus. The final two sites, CC-4 (IDEM) and CC-STJ-H (Hursh Rd. CFW) at 3.6 river miles upstream. The IDEM site estimated an annual FWMC of 0.26 mg/L and the City of Fort Wayne site estimated 0.3 mg/L of total phosphorus. Both sites had water samples collected monthly and the City of Fort Wayne data predicted higher total phosphorus loading and higher FWMC values compared the IDEM data.

At 5.6 river miles upstream on the St. Joseph mainstem, site STJ-4 (IDEM) represents the first site in Fort Wayne. This site had an estimated annual FWMC of 0.25 mg/L of total phosphorus for the years. The last two sites, STJ-.5 (IDEM) and STJ-T (Tennessee Ave. CFW), sit just 0.4 river miles upstream of the confluence and had an estimated FWMC of 0.23 and 0.22 mg/L of total phosphorus, respectively. The annual FWMC in the St. Joseph River just before it joins with the St. Marys to form the Maumee is at or below the target concentration of 0.23 mg/L of total phosphorus.

Table 3. The flow weighted mean concentration (FWMC) of total phosphorus (mg/L) is estimated for sites along the St. Joseph River. The white rows are sites on the mainstem of the St. Joseph River and the grey rows are tributary sites. The sites are listed in order from the furthest upstream site to the confluence with the St. Marys River where the Maumee is formed. River miles are measured on the St. Joseph River upstream of the confluence with the St. Marys River, except in the case of the multiple sites along Cedar Creek, where the river miles represent the river miles upstream of where Cedar Creek joins the St. Joseph River. The target FWMC is 0.23 mg/L of total phosphorus.

Site	River Miles Upstream	Years	Drainage Area (mi ²)	Annual FWMC (mg/L)	Springtime FWMC (mg/L)
STJ-163	42.3	2014-2022	610	0.18	0.21
STJ-36	36.3	2008-2022	650	0.23	0.25
Cedar Creek	13.4				
CC-STJ-105	22 (CC)	2014-2022	87	0.26	0.30
CC-STJ-100	5.8 (CC)	2014-2022	269	0.30	0.34
CC-4	3.6 (CC)	2008-2022	270	0.26	0.26
CC-STJ-H	3.6 (CC)	2008-2022	270	0.30	0.30
STJ-M	9.5	2008-2022	1065	0.23	0.26
STJ-4	5.6	2011-2022	1082	0.25	0.27
STJ-.5	0.4	2008-2022	1093	0.23	0.25
STJ-T	0.4	2008-2022	1094	0.22	0.24

Orthophosphate / Dissolved Reactive Phosphorus (DRP)

Orthophosphate was estimated to be at a FWMC of 0.08 mg/L in Cedar Creek as it flows into the St. Joseph River. The next site downstream had an estimated annual FWMC of 0.10 mg/L of orthophosphate. The final site (STJ-.5) which sits near the confluence with St. Marys River had an estimated FWMC of 0.11 mg/L of orthophosphate. The average FWMC of these sites never met the target FWMC of 0.05 mg/L of orthophosphate, though the values calculated in individual years did sometimes meet the target.

Table 4. The flow weighted mean concentration (FWMC) of orthophosphate (mg/L) is estimated for sites along the St. Joseph River and its tributaries. River miles are measured on the St. Joseph River upstream of the confluence except where the Cedar Creek site is measured upstream of where Cedar Creek flows into St. Joseph River. The target FWMC is 0.05 mg/L of orthophosphate.

Site	River Miles Upstream	Years	Drainage Area (mi ²)	Annual FWMC (mg/L)	Springtime FWMC (mg/L)
Cedar Creek	13.4				
CC-4	3.6 (CC)	2018-2022	270	0.08	0.07
STJ-4	5.6	2018-2022	1082	0.10	0.09
STJ-.5	0.4	2018-2022	1093	0.11	0.09

Maumee River

The Maumee River begins where the St. Marys River and the St. Joseph River meet, in Fort Wayne, Indiana. It flows in an east to northeast direction out of Indiana and into Ohio.

Total Phosphorus

Two sites are in Fort Wayne and are the furthest upstream sites on the Maumee River, M-A (Anthony Blvd. CFW) and M-132 (IDEM). The annual FWMC of the upstream part of the river, as measured by the City of Fort Wayne, was 0.38 mg/L of total phosphorus. The annual FWMC at M-132 was 0.36 mg/L of total phosphorus.

Another 6 river miles downstream are sites M-L (Landin St. CFW) and M-129 (IDEM) in New Haven, Indiana. The annual FWMC of these two sites are 0.38 mg/L and 0.36 mg/L, respectively. Downstream, Sixmile Creek joins the Maumee River and Bottern Ditch contributes to the Maumee further downstream. The next large watershed to join the Maumee is the Black Creek, which is monitored by Allen Co SWCD at site BC-M-304. The FWMC was 0.49 mg/L of total phosphorus at the site where Black Creek flows into the Maumee.

The last site downstream on the Maumee River mainstem is M-SR101 (SR 101, CFW), M-114 (IDEM), and M-312 (SWCD). This location represents the phosphorus load that is exiting Indiana and going into Ohio. The FWMC measured by the three agencies were 0.42, 0.36, and 0.37 mg/L of total phosphorus, respectively. The differences in the average annual FWMC are likely due to differences in sampling frequency. The Allen County SWCD collects samples weekly from April to October, IDEM and City of Fort Wayne collected samples monthly, but the City of Fort Wayne had several missing samples in the winter months.

Table 5. The flow weighted mean concentration (FWMC) of total phosphorus (mg/L) is estimated for sites along the Maumee River. The white rows are sites on the mainstem of the Maumee River and the grey rows are tributary sites. The sites are listed in order from the furthest upstream site at the confluence of St. Joseph and St. Marys rivers. River miles are measured on the Maumee River downstream of start of the Maumee River. The target FWMC is 0.23 mg/L of total phosphorus.

Site	River Miles Downstream	Years	Drainage Area (mi ²)	Annual FWMC (mg/L)	Springtime FWMC (mg/L)
M-A	1.3	2008-2022	1935	0.38	0.41
M-132	1.3	2008-2022	1935	0.36	0.37
M-L	7.3	2008-2022	1977	0.38	0.41
M-129	7.3	2008-2022	1977	0.36	0.36
Black Creek	21.3				
BC-M-304		2015-2022	19	0.49	0.43
M-SR101	22.5	2008-2022	2090	0.42	0.45
M-114	22.5	2008-2022	2090	0.36	0.36
M-312	22.5	2014-2022	2090	0.37	0.39

Orthophosphate / Dissolved Reactive Phosphorus (DRP)

Site M-129 (IDEM) is 7.3 miles downstream and the annual FWMC was 0.16 mg/L of orthophosphate. The last site before the Maumee River reaches Ohio is 22.5 miles downstream (M-114) and the annual FWMC was 0.17 mg/L of orthophosphate.

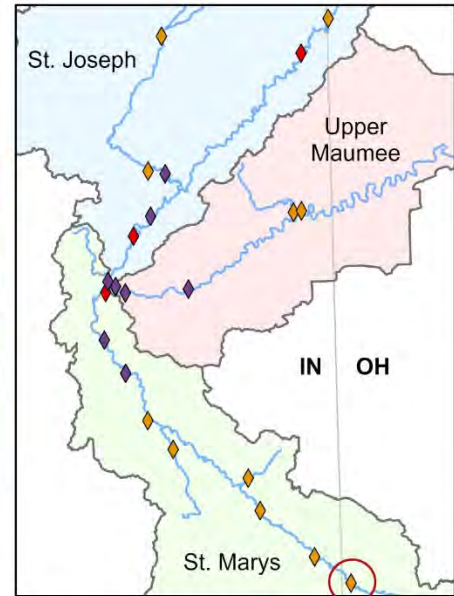
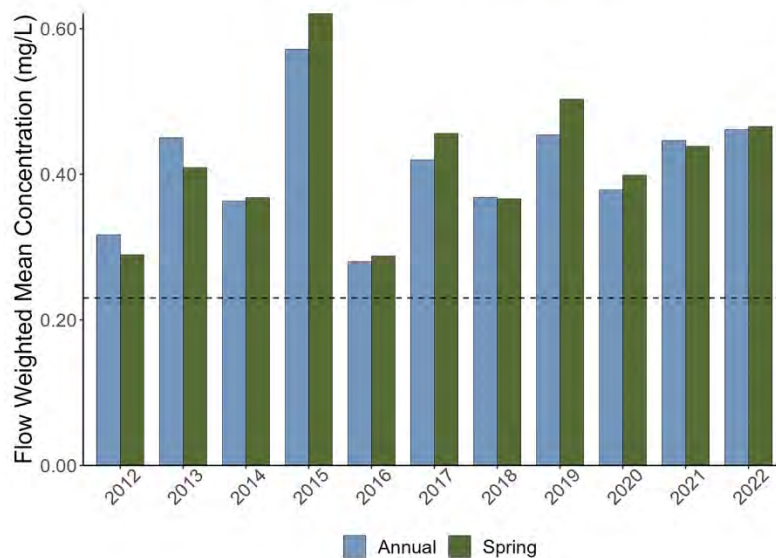
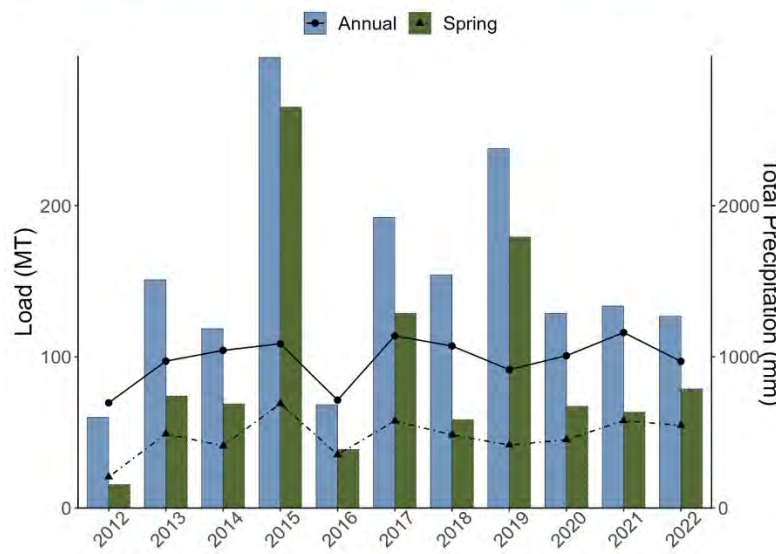
Table 6. The flow weighted mean concentration (FWMC) of orthophosphate (mg/L) is estimated for sites along the Maumee River. River miles are measured on the Maumee River downstream of start of the Maumee River. The target FWMC is 0.05 mg/L of orthophosphate.

Site	River Miles Downstream	Years	Drainage Area (mi ²)	Annual FWMC (mg/L)	Springtime FWMC (mg/L)
M-129	7.3	2018-2022	1977	0.16	0.13
M-114	22.5	2018-2022	2090	0.17	0.14

St. Marys River Mainstem

at OH-IN border (Allen Co STM-205)

Total Phosphorus (TP)	
USGS Streamgage	04181500
Drainage Area Ratio	0.62
Allen Co SWCD Data (April – October)	2012-2022
Average Annual Load (pounds/year)	575,136
Average Springtime Load (1 Mar – 31 Jul)	350,593
Reduction Needed to Meet Spring Target	176,378



Site Allen Co SWCD site STM-205 is the far upstream site on the St. Marys River in Ohio at the border with Indiana (red circle and orange diamond in map). TP samples were collected weekly from April to October in 2012-2022.

Figure 1. (upper left) The colored bars represent the estimated total annual (blue) and springtime (green) load (metric tons; primary y-axis). The lines represent the total annual (solid) and springtime (dashed) precipitation (mm; secondary y-axis).

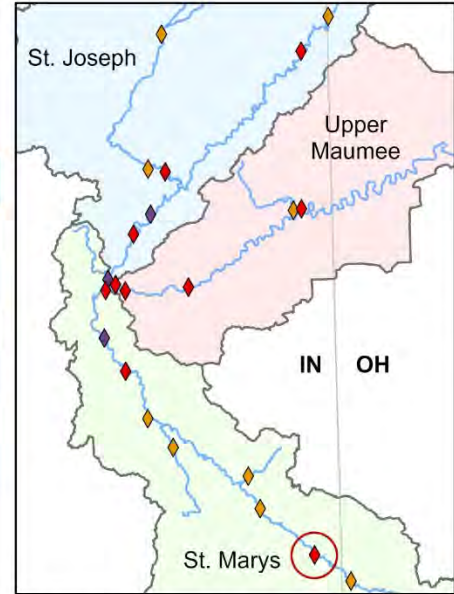
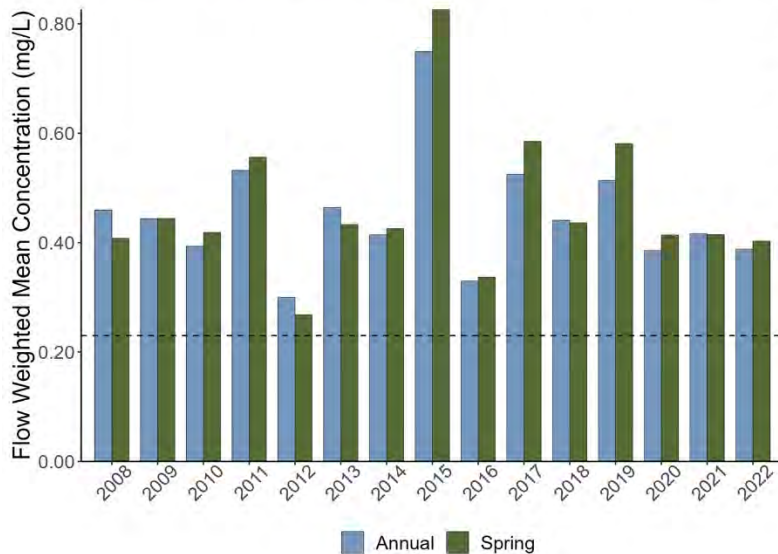
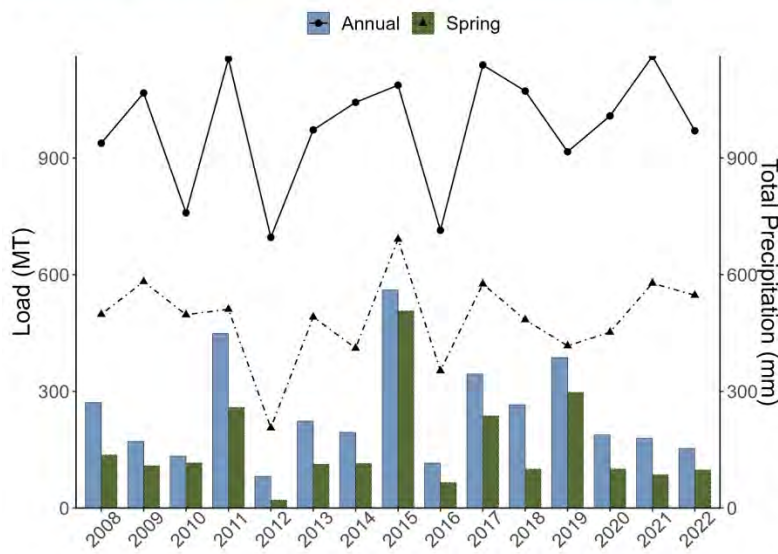
Figure 2. (lower left) The colored bars represent the average estimated annual (blue) and springtime (green) flow-weighted mean concentration (mg/L). The horizontal line represents the total phosphorus target concentration of 0.23 mg/L.

Results There is a large variation in the load estimates across years with the highest values occurring in 2015 and 2019. Load estimates have been relatively stable since 2020. Springtime TP loads made up an average of 61% of total annual loads.

St. Marys River Mainstem

at OH-IN border (Fixed Station STM-37)

Total Phosphorus (TP)	
USGS Streamgage	04181500
Drainage Area Ratio	0.89
IDEM Fixed Station Data	2008-2022
Average Annual Load (pounds/year)	546,432
Average Springtime Load (1 Mar – 31 Jul)	347,008
Reduction Needed to Meet Spring Target	192,228



Site IDEM Fixed Station site STM-37 is collocated with the Allen Co site STM-222. It is a far upstream site on the St. Marys River in Indiana and sits at the border with Ohio (red circle and red diamond in map). TP samples were collected monthly in 2008-2022.

Figure 1. (upper left) The colored bars represent the estimated total annual (blue) and springtime (green) load (metric tons; primary y-axis). The lines represent the total annual (solid) and springtime (dashed) precipitation (mm; secondary y-axis).

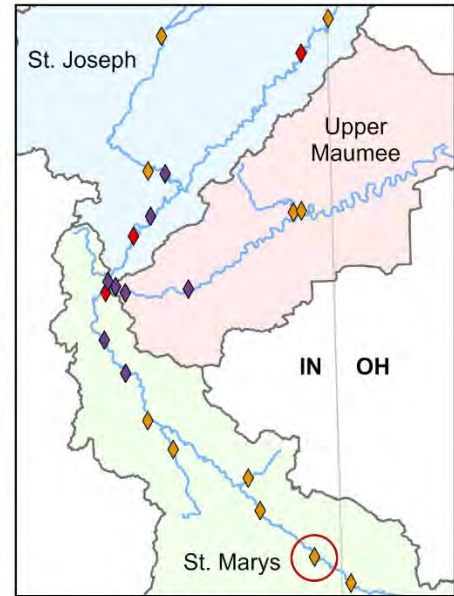
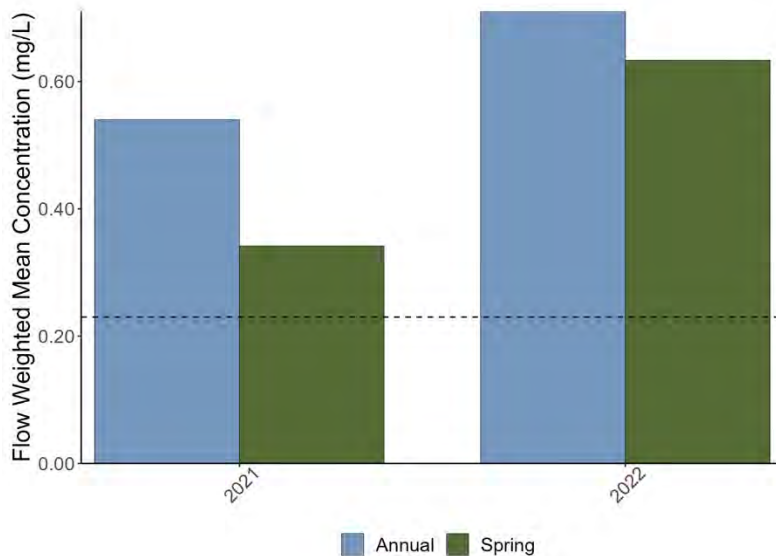
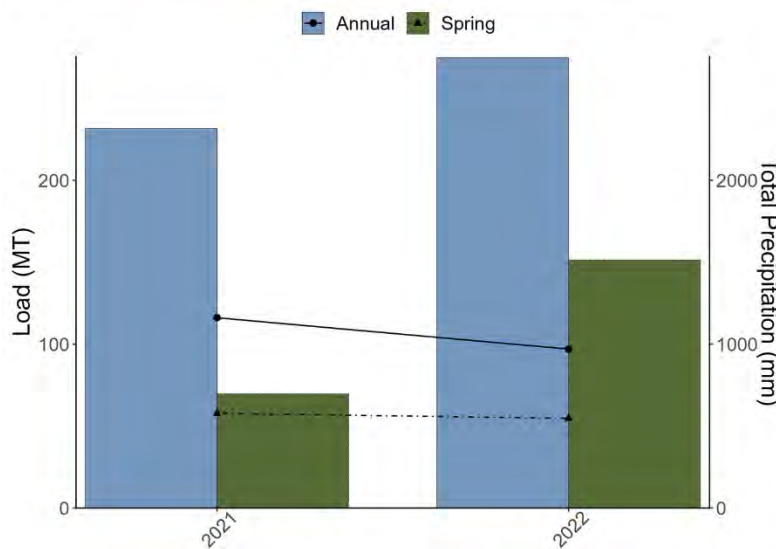
Figure 2. (lower left) The colored bars represent the average estimated annual (blue) and springtime (green) flow-weighted mean concentration (mg/L). The horizontal line represents the total phosphorus target concentration of 0.23 mg/L.

Results The lowest precipitation years (2012 and 2016) resulted in the lowest TP load and flow weighted mean concentration. Springtime TP loads made up an average of 64% of total annual loads.

St. Marys River Mainstem

Upstream (Allen Co STM-222)

Total Phosphorus (TP)	
USGS Streamgage	04181500
Drainage Area Ratio	0.89
Allen Co SWCD Data (April – October)	2021-2022
Average Annual Load (pounds/year)	463,677
Average Springtime Load (1 Mar – 31 Jul)	200,734
Reduction Needed to Meet Spring Target	84,193



Site Allen Co SWCD site STM-222 is collocated with IDEM site STM-37. It is an upstream site on the St. Marys River in Pleasant Mills, Indiana (red circle and orange diamond in map). TP samples were collected weekly from April to October in 2021-2022.

Figure 1. (upper left) The colored bars represent the estimated total annual (blue) and springtime (green) load (metric tons; primary y-axis). The lines represent the total annual (solid) and springtime (dashed) precipitation (mm; secondary y-axis).

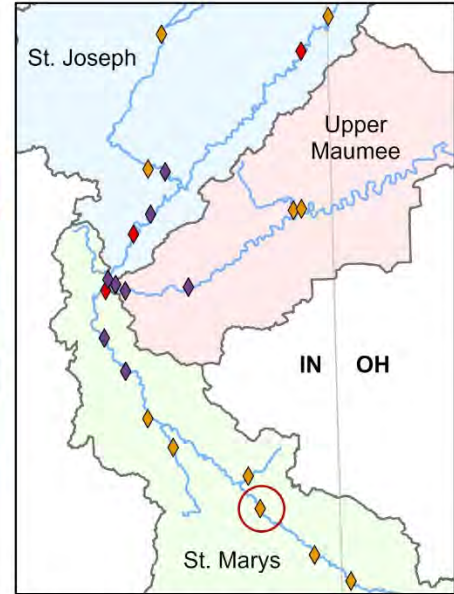
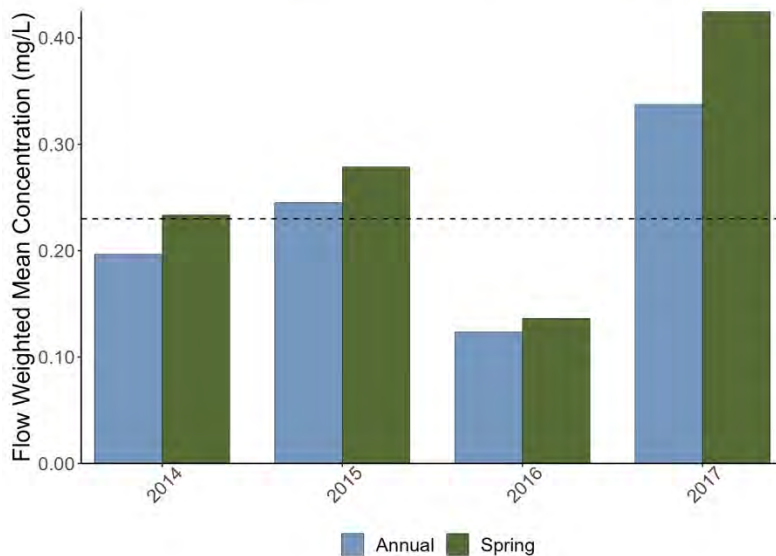
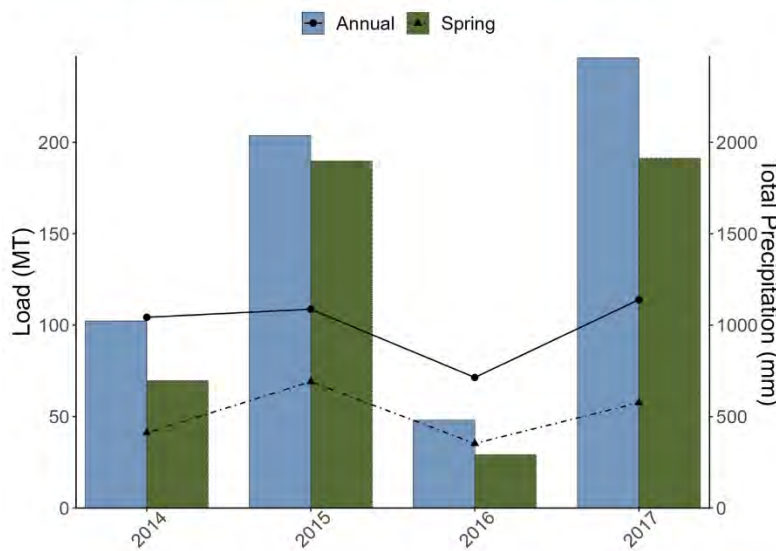
Figure 2. (lower left) The colored bars represent the average estimated annual (blue) and springtime (green) flow-weighted mean concentration (mg/L). The horizontal line represents the total phosphorus target concentration of 0.23 mg/L.

Results The flow weighted mean concentration was never below the target of 0.23 mg/L. Springtime TP loads made up an average of 43% of total annual loads.

St. Marys River Mainstem

Upstream (Allen Co STM-221)

Total Phosphorus (TP)	
USGS Streamgage	04181500
Drainage Area Ratio	0.99
Allen Co SWCD Data (April – October)	2014-2017
Average Annual Load (lb./yr.)	330,817
Average Springtime Load (1 Mar – 31 Jul)	264,671
Reduction Needed to Meet Spring Target	56,117



Site Allen Co SWCD site STM-221 is an upstream site on the St. Marys River in Indiana (red circle and orange diamond in map). TP samples were collected weekly from April to October in 2014-2017.

Figure 1. (upper left) The colored bars represent the estimated total annual (blue) and springtime (green) load (metric tons; primary y-axis). The lines represent the total annual (solid) and springtime (dashed) precipitation (mm; secondary y-axis).

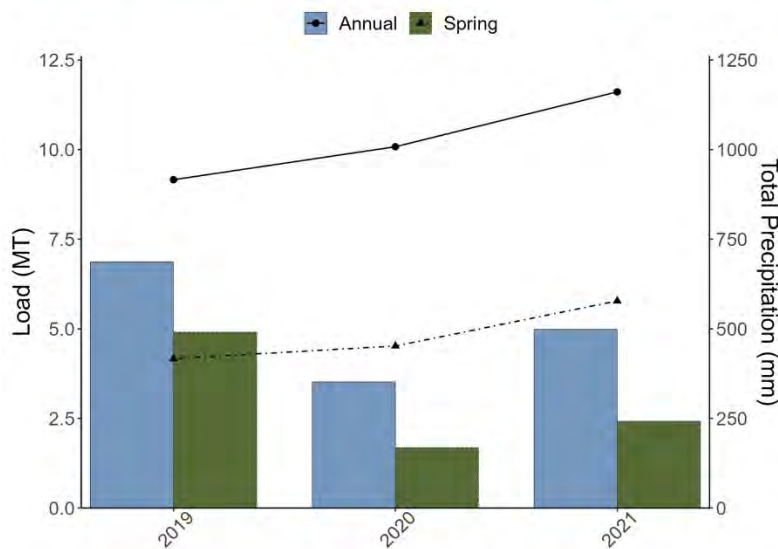
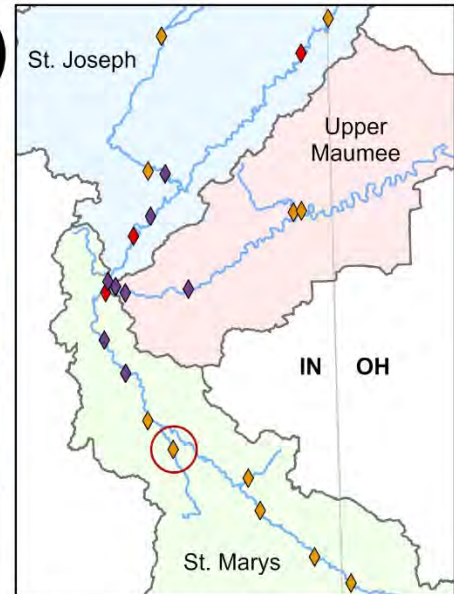
Figure 2. (lower left) The colored bars represent the average estimated annual (blue) and springtime (green) flow-weighted mean concentration (mg/L). The horizontal line represents the total phosphorus target concentration of 0.23 mg/L.

Results The springtime flow weighted mean concentration was lower than the target in 2016 (dry year). Springtime TP loads made up an average of 80% of total annual loads.

Nickelsen Creek (St. Marys)

Tributary to St. Marys (Allen Co NC-STM-211)

Total Phosphorus (TP)	
USGS Streamgage	04181755
Drainage Area Ratio	1
Allen Co SWCD Data (April – October)	2019-2021
Average Annual Load (lb./yr.)	9,961
Average Springtime Load (1 Mar – 31 Jul)	6,633
Reduction Needed to Meet Spring Target	3,074



Site Allen Co SWCD site NC-STM-211 is on a tributary to the St. Marys called Nickelsen Creek in Indiana (red circle and orange diamond in map). TP samples were collected weekly from April to October 2019 – 2021.

Figure 1. (upper left) The colored bars represent the estimated total annual (blue) and springtime (green) load (metric tons; primary y-axis). The lines represent the total annual (solid) and springtime (dashed) precipitation (mm; secondary y-axis).

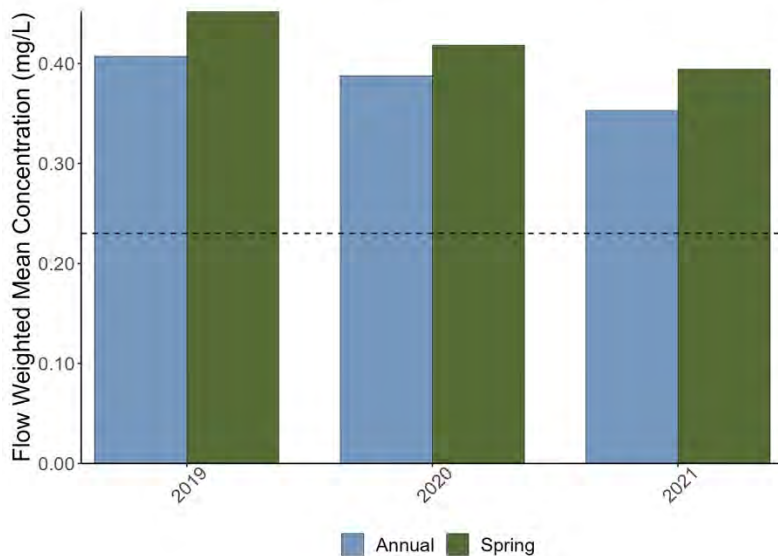


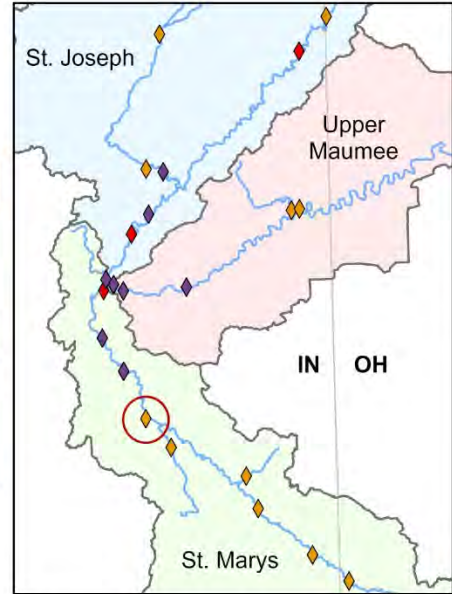
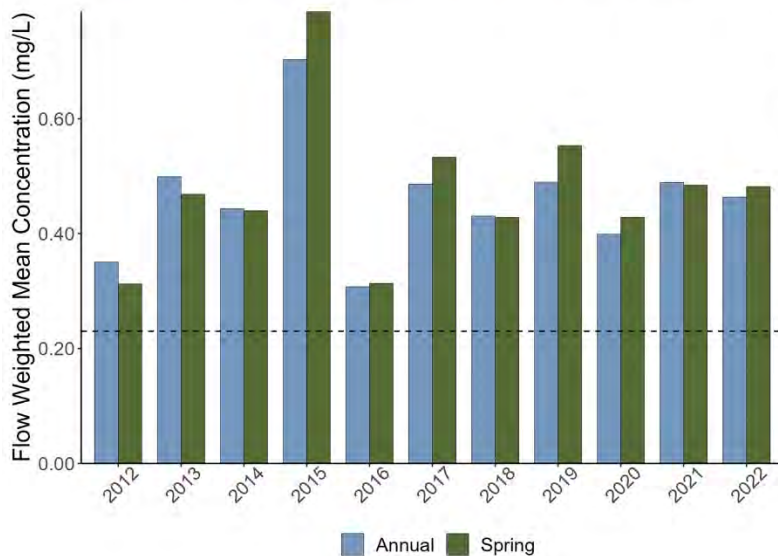
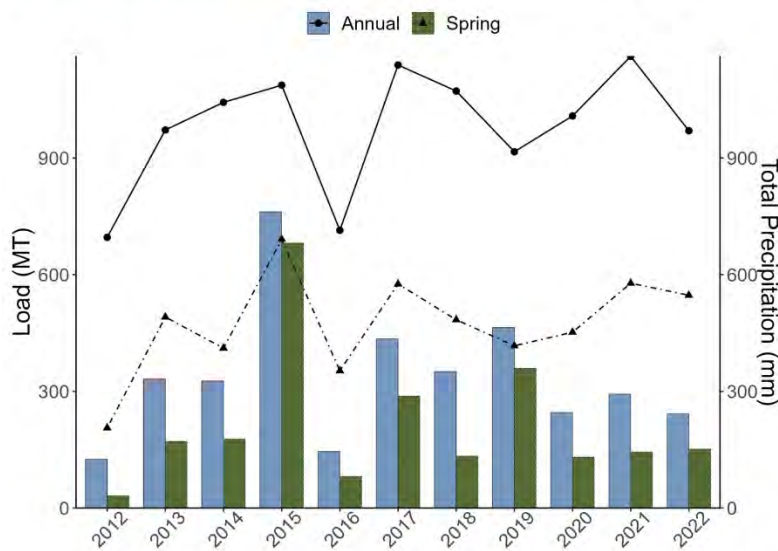
Figure 2. (lower left) The colored bars represent the average estimated annual (blue) and springtime (green) flow-weighted mean concentration (mg/L). The horizontal line represents the total phosphorus target concentration of 0.23 mg/L.

Results The springtime flow weighted mean concentration was higher than the annual mean concentrations for all years in 2019-2021. Springtime TP loads made up an average of 67% of total annual loads.

St. Marys River Mainstem

Midstream (Allen Co STM-212)

Total Phosphorus (TP)	
USGS Streamgage	04182000
Drainage Area Ratio	0.96
Allen Co SWCD Data (April – October)	2012-2022
Average Annual Load (lb./yr.)	774,956
Average Springtime Load (1 Mar – 31 Jul)	483,302
Reduction Needed to Meet Spring Target	279,582



Site Allen Co SWCD site STM-212 is a midstream site on the St. Marys River in Indiana (red circle and orange diamond in map). TP samples were collected weekly from April to October in 2012-2022.

Figure 1. (upper left) The colored bars represent the estimated total annual (blue) and springtime (green) load (metric tons; primary y-axis). The lines represent the total annual (solid) and springtime (dashed) precipitation (mm; secondary y-axis).

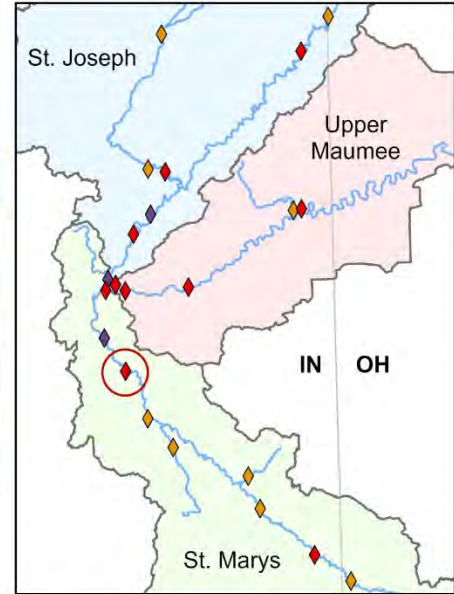
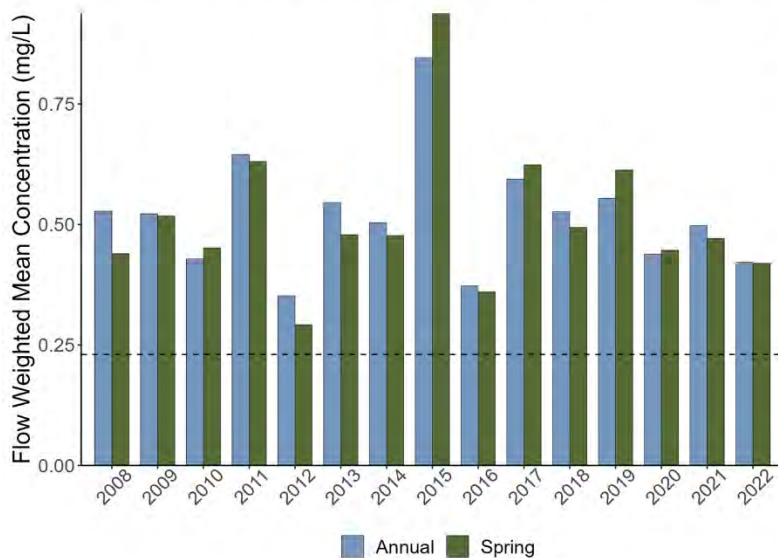
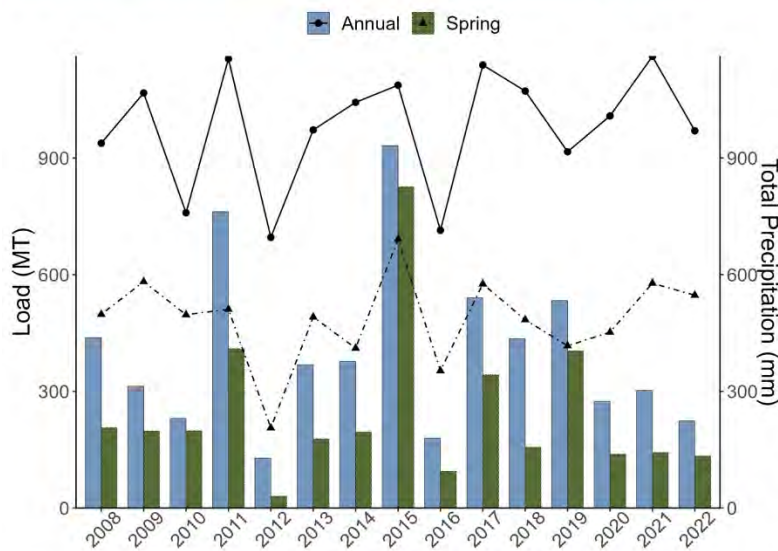
Figure 2. (lower left) The colored bars represent the average estimated annual (blue) and springtime (green) flow-weighted mean concentration (mg/L). The horizontal line represents the total phosphorus target concentration of 0.23 mg/L.

Results The lowest precipitation years (2012 and 2016) resulted in the lowest loadings. The flow-weighted mean concentration was the greatest in 2015 and has been relatively stable since 2017. Springtime TP loads made up an average of 62% of total annual loads.

St. Marys River Mainstem

Midstream (Fixed Station STM-11)

Total Phosphorus (TP)	
USGS Streamgage	04182000
Drainage Area Ratio	1
IDEM Fixed Station Data	2008-2022
Average Annual Load (lb./yr.)	887,766
Average Springtime Load (1 Mar – 31 Jul)	537,666
Reduction Needed to Meet Spring Target	320,109



Site The IDEM Fixed Station site STM-11 is collocated with the City of Fort Wayne site STM-F. It is a midstream site on the St. Marys River in Indiana (red circle and red diamond in map). TP samples were collected monthly in 2008-2022.

Figure 1. (upper left) The colored bars represent the estimated total annual (blue) and springtime (green) load (metric tons; primary y-axis). The lines represent the total annual (solid) and springtime (dashed) precipitation (mm; secondary y-axis).

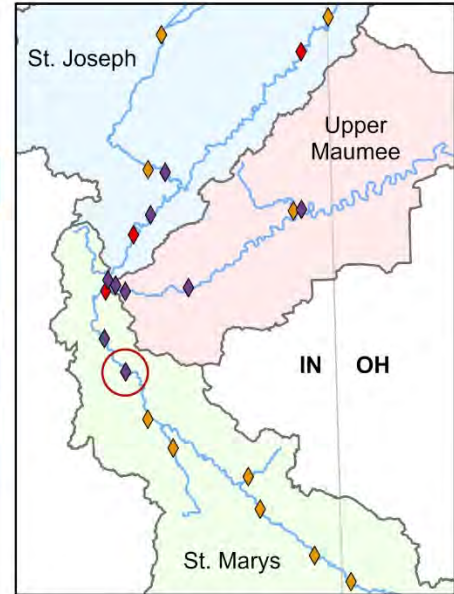
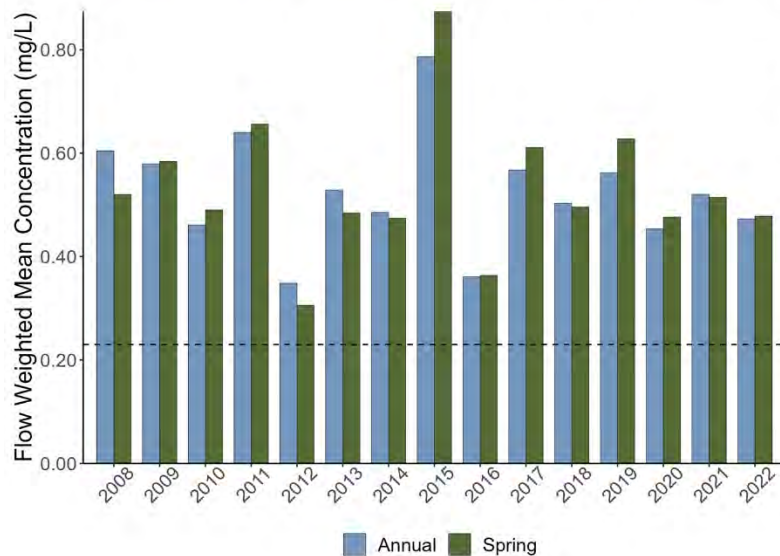
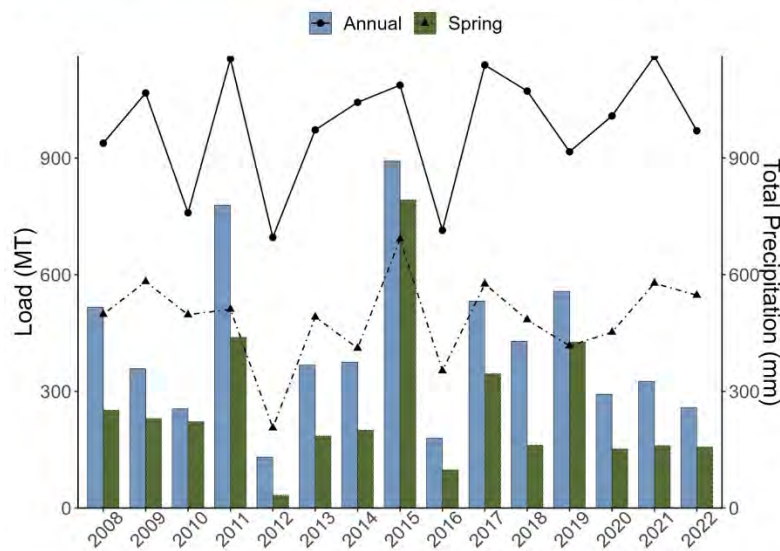
Figure 2. (lower left) The colored bars represent the average estimated annual (blue) and springtime (green) flow-weighted mean concentration (mg/L). The horizontal line represents the total phosphorus target concentration of 0.23 mg/L.

Results Heavy precipitation in the months outside of the springtime season contributed to very high annual loads in 2011. Springtime precipitation in 2015 was the highest and contributed to high TP loads and FWMC. Springtime TP loads made up an average of 61% of total annual loads.

St. Marys River Mainstem

Midstream (City of Fort Wayne STM-F)

Total Phosphorus (TP)	
USGS Streamgage	04182000
Drainage Area Ratio	1
City of Fort Wayne Data	2008-2022
Average Annual Load (lb./yr.)	918,417
Average Springtime Load (1 Mar – 31 Jul)	567,156
Reduction Needed to Meet Spring Target	343,143



Site The City of Fort Wayne site STM-F is collocated with IDEM site STM-11. It is a midstream site on the St. Marys River in Indiana (red circle and purple diamond in map). TP samples were collected weekly April-October and monthly November-March in 2008-2022.

Figure 1. (upper left) The colored bars represent the estimated total annual (blue) and springtime (green) load (metric tons; primary y-axis). The lines represent the total annual (solid) and springtime (dashed) precipitation (mm; secondary y-axis).

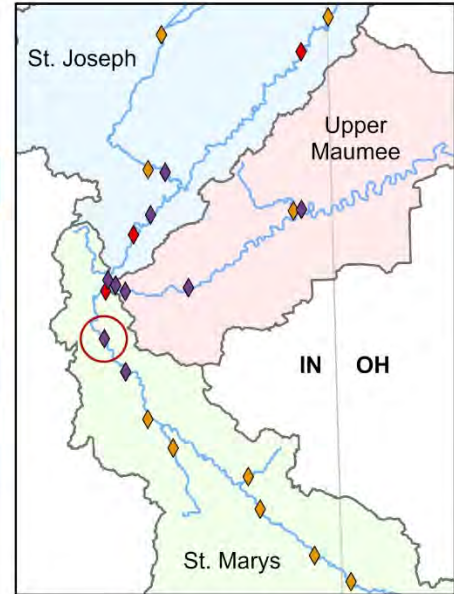
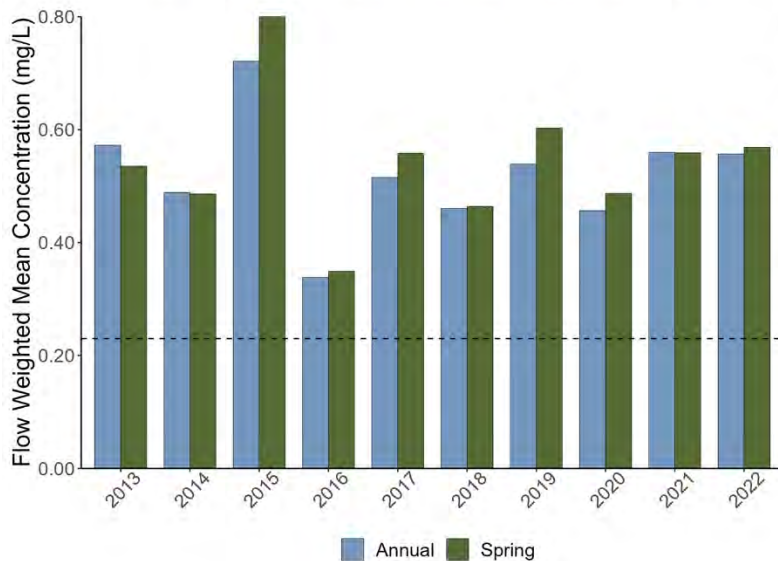
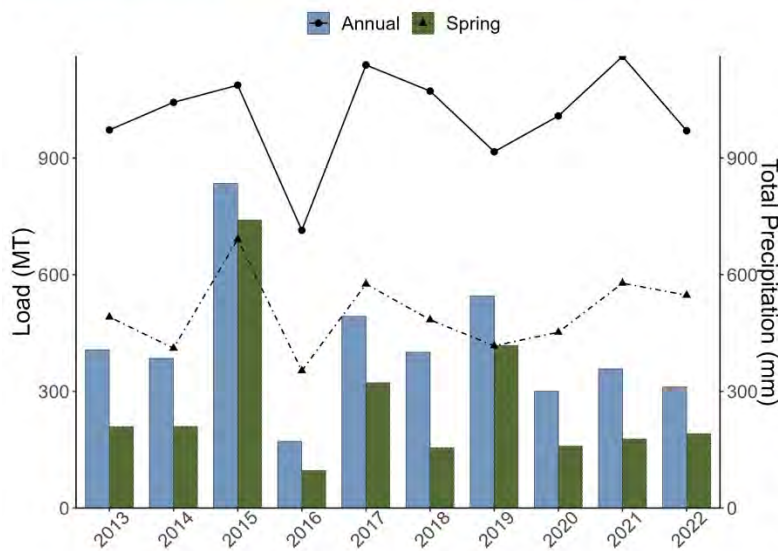
Figure 2. (lower left) The colored bars represent the average estimated annual (blue) and springtime (green) flow-weighted mean concentration (mg/L). The horizontal line represents the total phosphorus target concentration of 0.23 mg/L.

Results Springtime precipitation in 2015 was the highest and contributed to high TP loads and FWMC. Loads and mean concentrations have remained steady in 2020-2022. Springtime TP loads made up an average of 62% of total annual loads.

St. Marys River Mainstem

Midstream (City of Fort Wayne STM-P)

Total Phosphorus (TP)	
USGS Streamgage	04182000
Drainage Area Ratio	1
City of Fort Wayne Data	2013-2022
Average Annual Load (lb./yr.)	927,536
Average Springtime Load (1 Mar – 31 Jul)	591,238
Reduction Needed to Meet Spring Target	357,296



Site The City of Fort Wayne site STM-P is a midstream site on the St. Marys River in Indiana (red circle and purple diamond in map). TP samples were collected weekly April-October and monthly November-March in 2013-2022.

Figure 1. (upper left) The colored bars represent the estimated total annual (blue) and springtime (green) load (metric tons; primary y-axis). The lines represent the total annual (solid) and springtime (dashed) precipitation (mm; secondary y-axis).

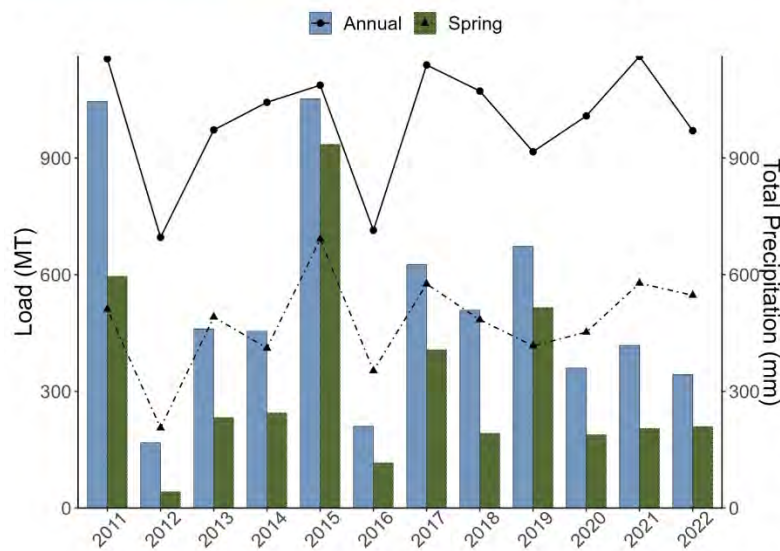
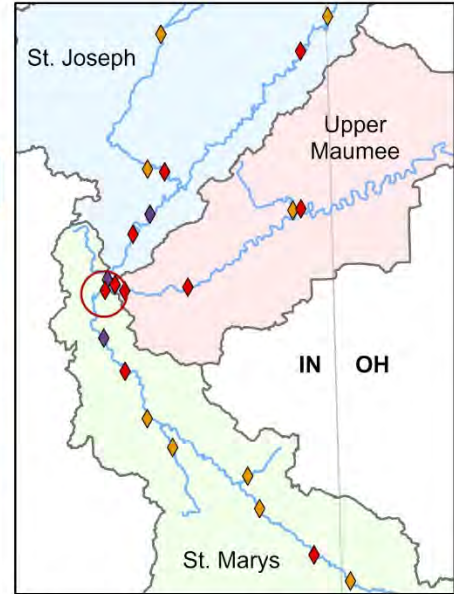
Figure 2. (lower left) The colored bars represent the average estimated annual (blue) and springtime (green) flow-weighted mean concentration (mg/L). The horizontal line represents the total phosphorus target concentration of 0.23 mg/L.

Results Springtime precipitation in 2015 was the highest and contributed to high TP loads and FWMC. Loads and mean concentrations have remained steady in 2021 & 2022. Springtime TP loads made up an average of 64% of total annual loads.

St. Marys River Mainstem

Downstream at confluence (Fixed Station STM-.8)

Total Phosphorus (TP)	
USGS Streamgage	04182000
Drainage Area Ratio	0.96
IDEM Fixed Station Data	2011-2022
Average Annual Load (lb./yr.)	1,161,012
Average Springtime Load (1 Mar – 31 Jul)	713,853
Reduction Needed to Meet Spring Target	473,484



Site The IDEM Fixed Station site STM-.8 is a downstream site on the St. Marys River in Fort Wayne Indiana just before the confluence with St. Joseph River (red circle and red diamond in map). TP samples were collected monthly in 2011-2022.

Figure 1. (upper left) The colored bars represent the estimated total annual (blue) and springtime (green) load (metric tons; primary y-axis). The lines represent the total annual (solid) and springtime (dashed) precipitation (mm; secondary y-axis).

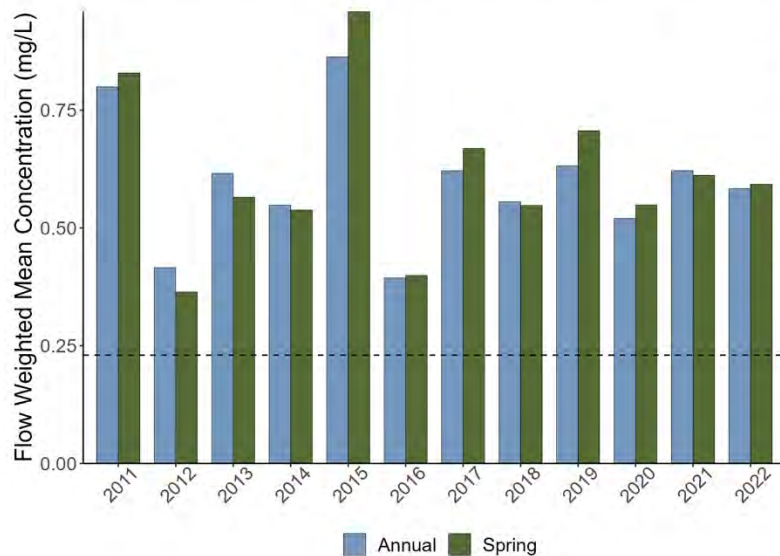


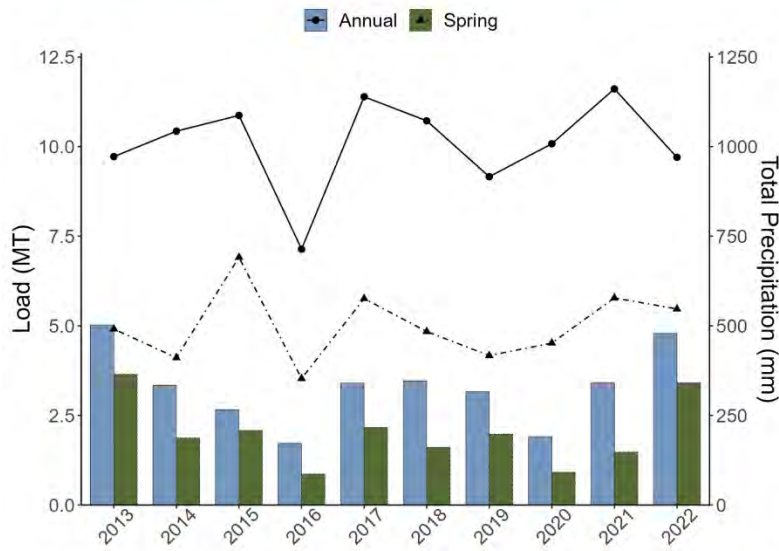
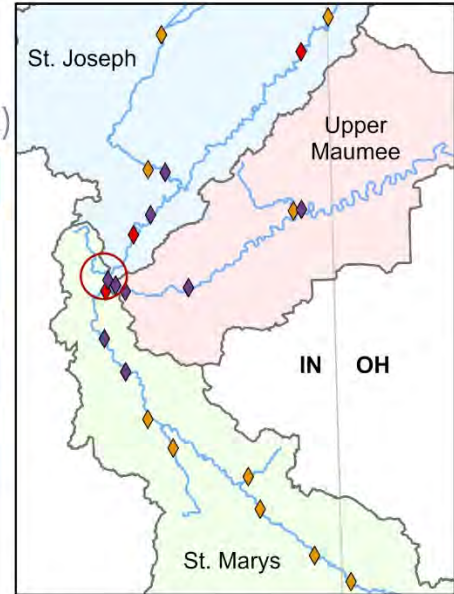
Figure 2. (lower left) The colored bars represent the average estimated annual (blue) and springtime (green) flow-weighted mean concentration (mg/L). The horizontal line represents the total phosphorus target concentration of 0.23 mg/L.

Results Heavy precipitation in the spring of 2015 contributed to very high annual loads and mean concentration. Mean concentration has remained relatively stable since 2017. Springtime TP loads made up an average of 61% of total annual loads.

Spy Run Creek (St. Marys)

Tributary St. Marys (City of Fort Wayne SRC-STM-C)

Total Phosphorus (TP)	
USGS Streamgage	04182808
Drainage Area Ratio	1.1
City of Fort Wayne Data	2013-2022
Average Annual Load (lb./yr.)	7,250
Average Springtime Load (1 Mar – 31 Jul)	4,423
Reduction Needed to Meet Spring Target	0



Site The City of Fort Wayne site SRC-STM-C is a downstream site on Spy Run Creek, a tributary to the St. Marys River, in Fort Wayne, Indiana (red circle and purple diamond in map). TP samples were collected weekly April-October and monthly November-March in 2013-2022.

Figure 1. (upper left) The colored bars represent the estimated total annual (blue) and springtime (green) load (metric tons; primary y-axis). The lines represent the total annual (solid) and springtime (dashed) precipitation (mm; secondary y-axis).

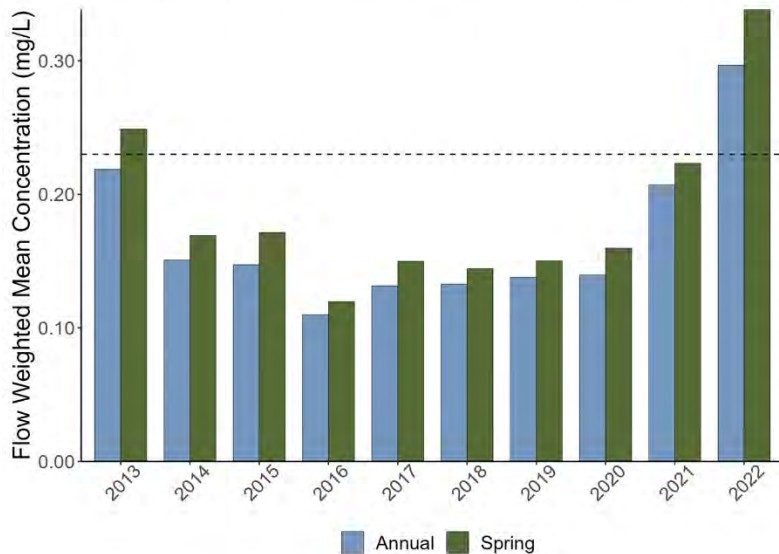


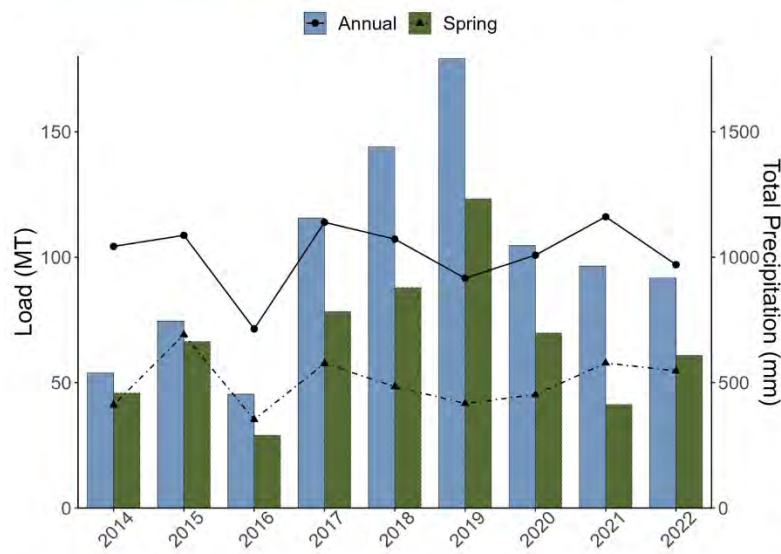
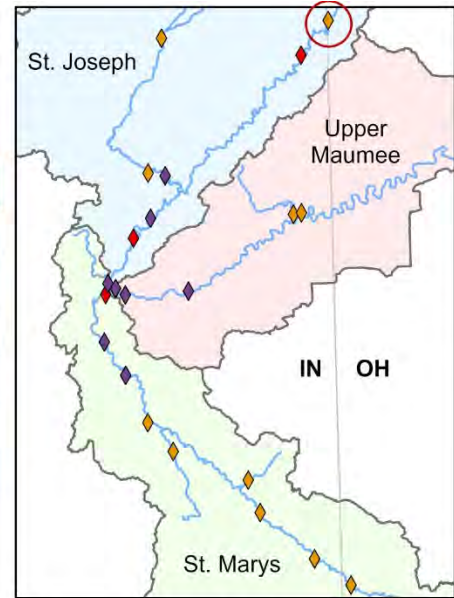
Figure 2. (lower left) The colored bars represent the average estimated annual (blue) and springtime (green) flow-weighted mean concentration (mg/L). The horizontal line represents the total phosphorus target concentration of 0.23 mg/L.

Results Flow weighted mean concentration has increased since 2020 and was not meeting the springtime target of 0.23 mg/L in 2022. Springtime TP loads made up an average of 61% of total annual loads.

St. Joseph River Mainstem

Upstream OH-IN border (Allen Co STJ-163)

Total Phosphorus (TP)	
USGS Streamgage	04178000
Drainage Area Ratio	1
Allen Co SWCD Data (April – October)	2014-2022
Average Annual Load (lb./yr.)	221,811
Average Springtime Load (1 Mar – 31 Jul)	147,674
Reduction Needed to Meet Spring Target	0



Site The Allen Co SWCD site STJ-163 is an upstream site on the St. Joseph River in Ohio at the border of Indiana (red circle and orange diamond in map). TP samples were collected weekly from April to October in 2014-2022.

Figure 1. (upper left) The colored bars represent the estimated total annual (blue) and springtime (green) load (metric tons; primary y-axis). The lines represent the total annual (solid) and springtime (dashed) precipitation (mm; secondary y-axis).

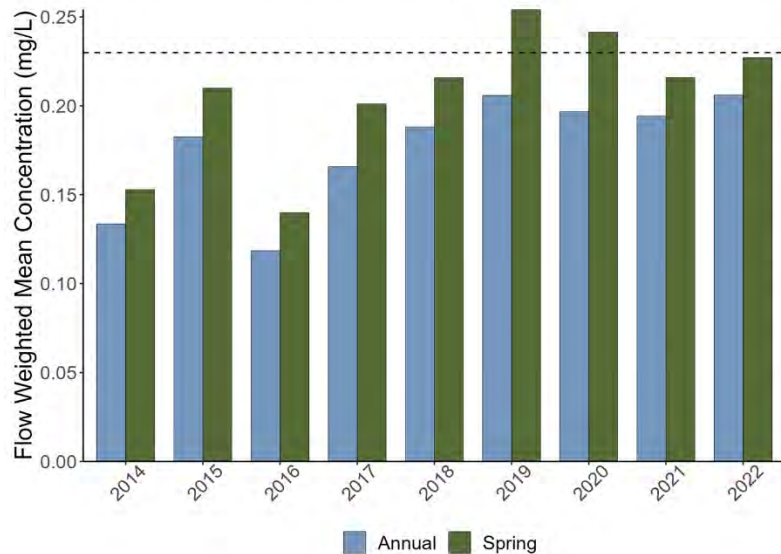


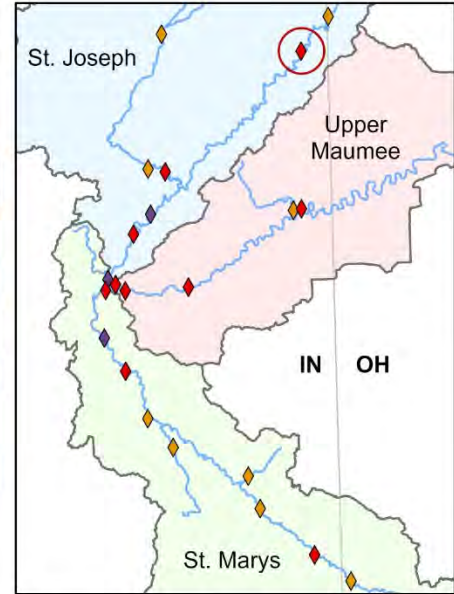
Figure 2. (lower left) The colored bars represent the average estimated annual (blue) and springtime (green) flow-weighted mean concentration (mg/L). The horizontal line represents the total phosphorus target concentration of 0.23 mg/L.

Results Springtime flow weighted mean concentration in 2019 and 2020 was above the target concentration of 0.23 mg/L, but all other springtime and annual flow weighted means were below the target. Springtime TP loads made up an average of 67% of total annual loads.

St. Joseph River Mainstem

Upstream OH-IN border (Fixed Station STJ-36)

Total Phosphorus (TP)	
USGS Streamgage	04178000
Drainage Area Ratio	1
IDEM Fixed Station Data	2008-2022
Average Annual Load (lb./yr.)	307,191
Average Springtime Load (1 Mar – 31 Jul)	193,854
Reduction Needed to Meet Spring Target	15,953



Site The IDEM Fixed Station site STJ-36 is an upstream site on the St. Joseph River in Ohio at the border of Indiana (red circle and orange diamond in map). TP samples were collected monthly in 2008-2022.

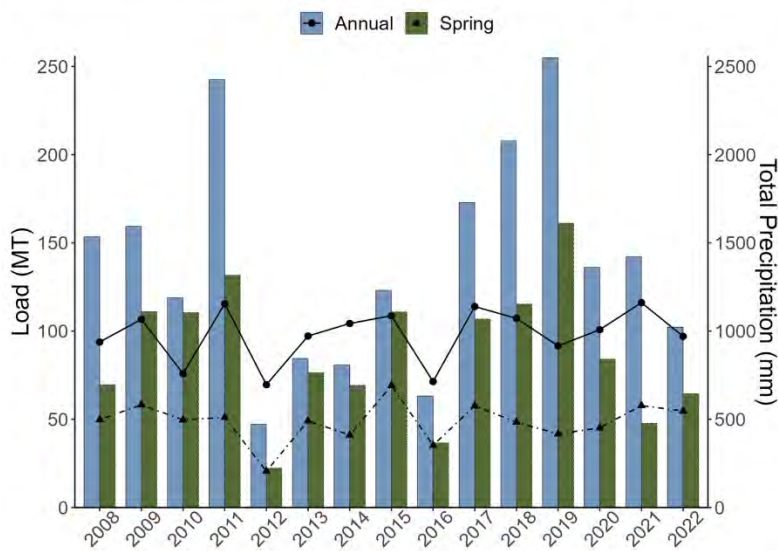


Figure 1. (upper left) The colored bars represent the estimated total annual (blue) and springtime (green) load (metric tons; primary y-axis). The lines represent the total annual (solid) and springtime (dashed) precipitation (mm; secondary y-axis).

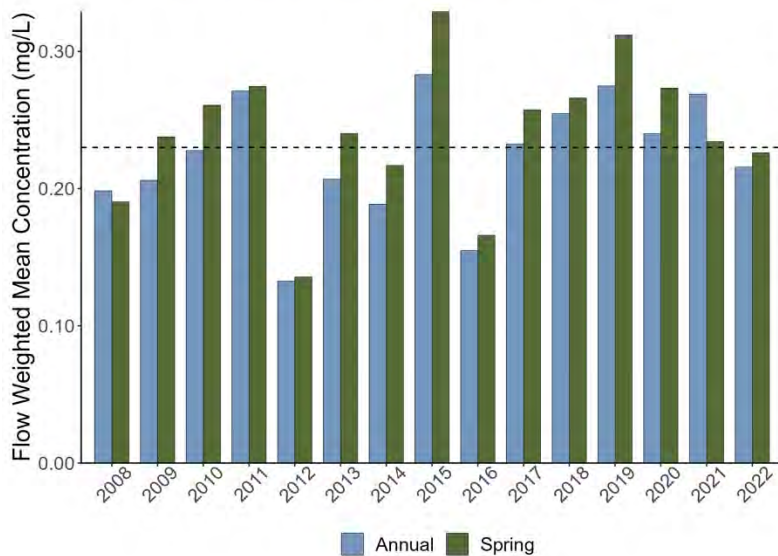


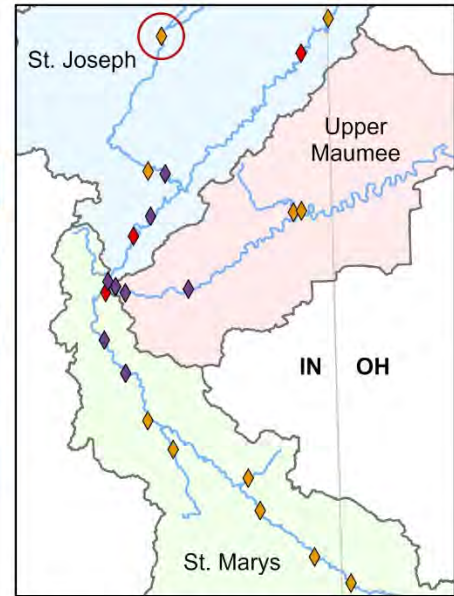
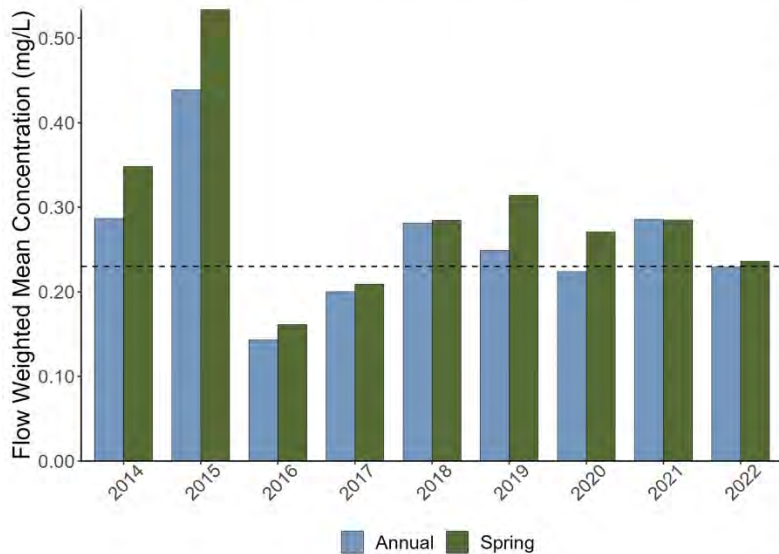
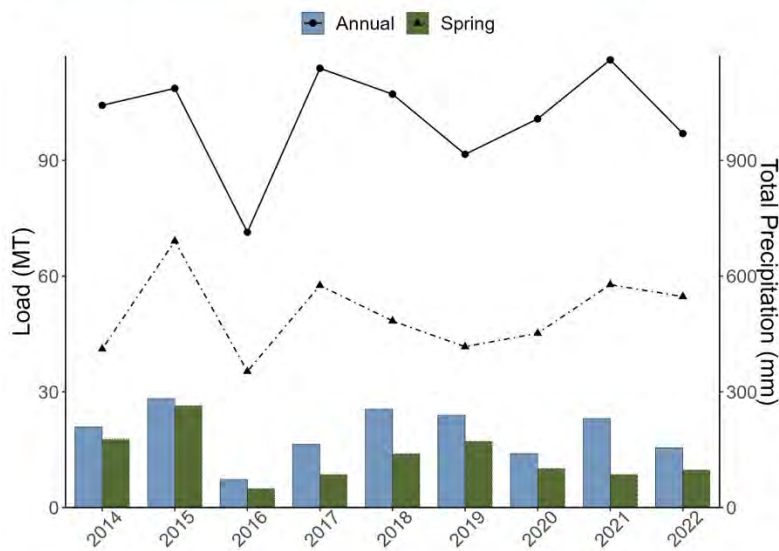
Figure 2. (lower left) The colored bars represent the average estimated annual (blue) and springtime (green) flow-weighted mean concentration (mg/L). The horizontal line represents the total phosphorus target concentration of 0.23 mg/L.

Results The 2022 springtime flow weighted mean concentration was under the target concentration of 0.23 mg/L. Five years total had springtime mean concentrations below the target. Springtime TP loads made up an average of 63% of total annual loads.

Cedar Creek (St. Joseph)

Tributary to St. Joseph (Allen Co CC-STJ-105)

Total Phosphorus (TP)	
USGS Streamgage	04179520
Drainage Area Ratio	0.96
Allen Co SWCD Data (April to October)	2014-2022
Average Annual Load (lb./yr.)	42,777
Average Springtime Load (1 Mar – 31 Jul)	28,619
Reduction Needed to Meet Spring Target	7,012



Site The Allen Co SWCD site CC-STJ-105 is an upstream site on the Upper Cedar Creek, a tributary to St. Joseph River, in Indiana (red circle and orange diamond in map). TP samples were collected weekly from April to October in 2014-2022.

Figure 1. (upper left) The colored bars represent the estimated total annual (blue) and springtime (green) load (metric tons; primary y-axis). The lines represent the total annual (solid) and springtime (dashed) precipitation (mm; secondary y-axis).

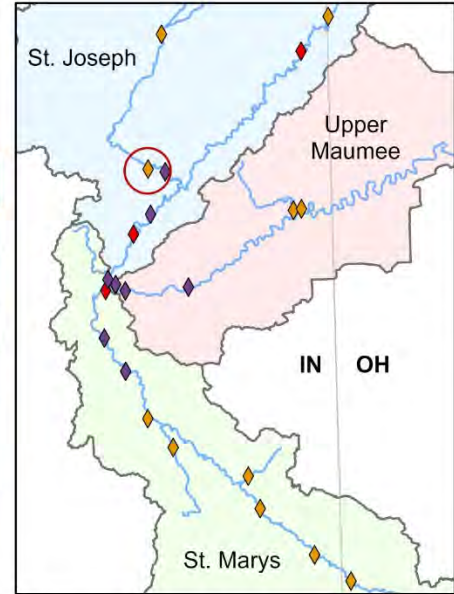
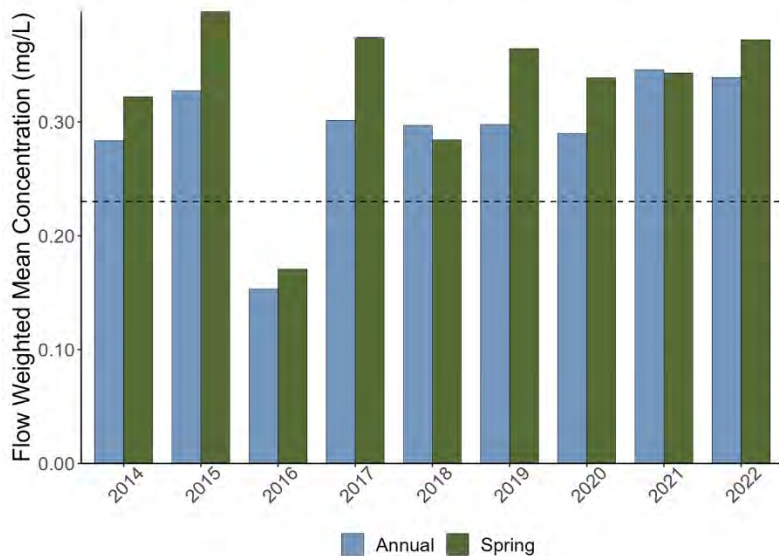
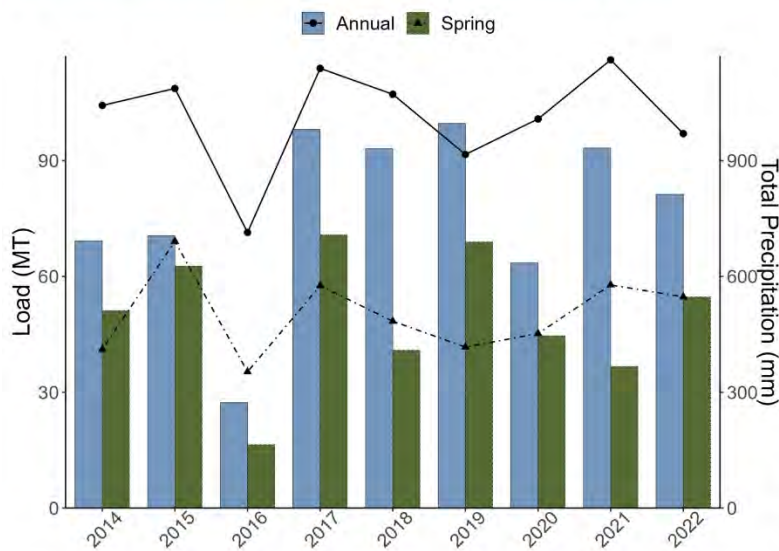
Figure 2. (lower left) The colored bars represent the average estimated annual (blue) and springtime (green) flow-weighted mean concentration (mg/L). The horizontal line represents the total phosphorus target concentration of 0.23 mg/L.

Results The annual flow weighted mean concentration (FWMC) in 2022 was below the target, and the springtime FWMC was just above the target of 0.23 mg/L. Springtime FWMC was below the target in 2016 (dry year) and 2017. Springtime TP loads made up an average of 67% of total annual loads.

Cedar Creek (St. Joseph)

Tributary to St. Joseph (Allen Co CC-STJ-100)

Total Phosphorus (TP)	
USGS Streamgage	04180000
Drainage Area Ratio	1
Allen Co SWCD Data (April to October)	2014-2022
Average Annual Load (lb./yr.)	170,518
Average Springtime Load (1 Mar – 31 Jul)	109,490
Reduction Needed to Meet Spring Target	35,086



Site The Allen Co SWCD site CC-STJ-100 is a downstream site on Cedar Creek, a tributary to the St. Joseph River, in Indiana (red circle and orange diamond in map). TP samples were collected weekly from April to October in 2014-2022.

Figure 1. (upper left) The colored bars represent the estimated total annual (blue) and springtime (green) load (metric tons; primary y-axis). The lines represent the total annual (solid) and springtime (dashed) precipitation (mm; secondary y-axis).

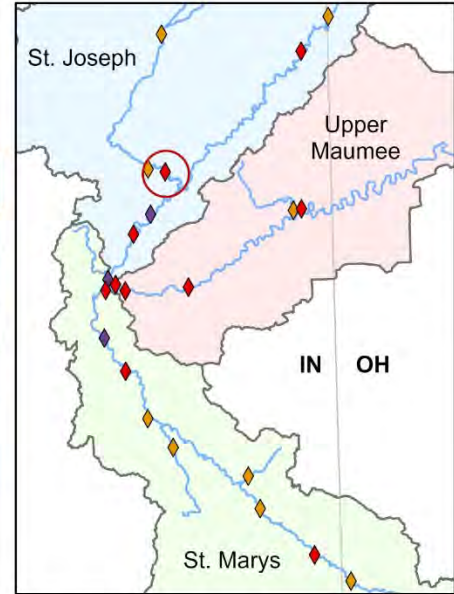
Figure 2. (lower left) The colored bars represent the average estimated annual (blue) and springtime (green) flow-weighted mean concentration (mg/L). The horizontal line represents the total phosphorus target concentration of 0.23 mg/L.

Results The flow weighted mean concentration was under the target concentration for only a single year in 2016 (dry year). Springtime TP loads made up an average of 64% of total annual loads.

Cedar Creek (St. Joseph)

Tributary to St. Joseph (Fixed Station CC-4)

Total Phosphorus (TP)	
USGS Streamgage	04180000
Drainage Area Ratio	1
Allen Co SWCD Data (April to October)	2008-2022
Average Annual Load (lb./yr.)	146,813
Average Springtime Load (1 Mar – 31 Jul)	84,240
Reduction Needed to Meet Spring Target	8,835



Site The IDEM Fixed Station site CC-4 is a downstream site on Cedar Creek, a tributary to the St. Joseph River, in Indiana (red circle and red diamond in map). TP samples were collected monthly in 2008-2022.

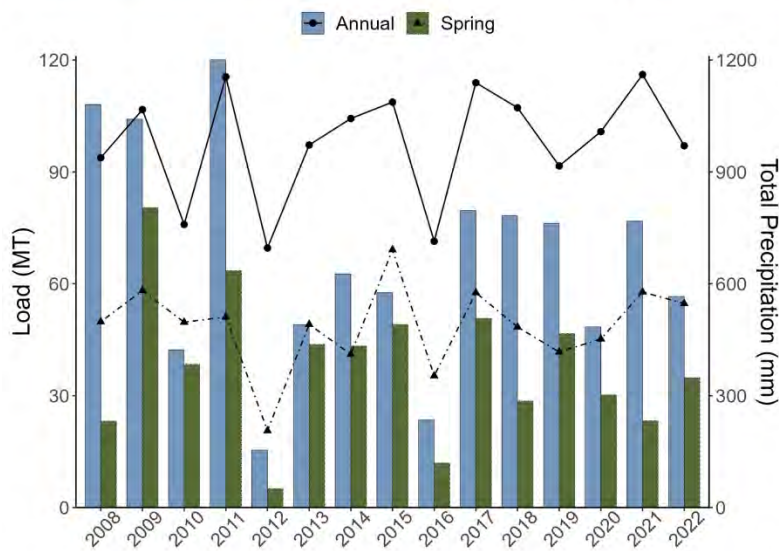


Figure 1. (upper left) The colored bars represent the estimated total annual (blue) and springtime (green) load (metric tons; primary y-axis). The lines represent the total annual (solid) and springtime (dashed) precipitation (mm; secondary y-axis).

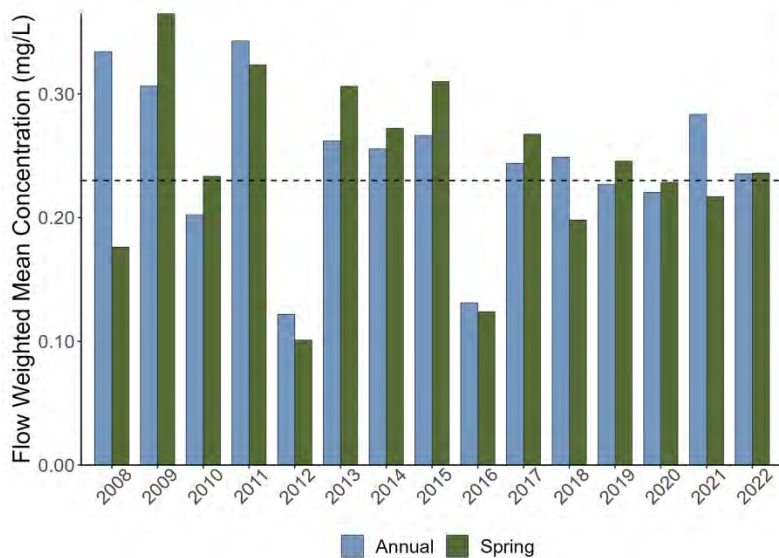


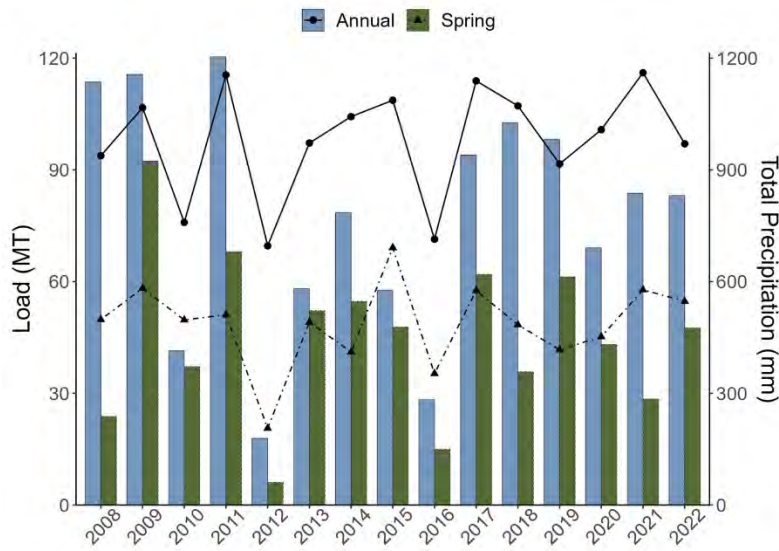
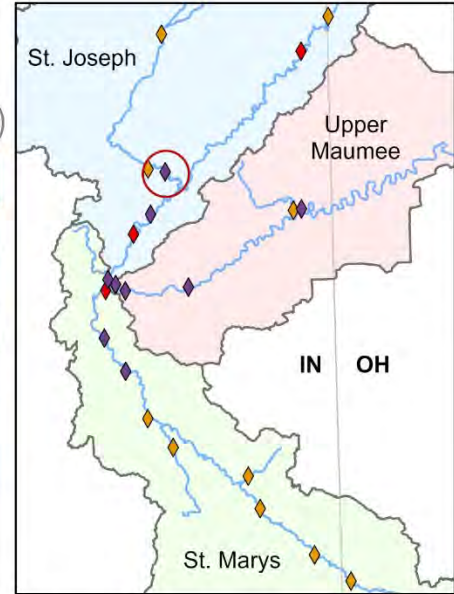
Figure 2. (lower left) The colored bars represent the average estimated annual (blue) and springtime (green) flow-weighted mean concentration (mg/L). The horizontal line represents the total phosphorus target concentration of 0.23 mg/L.

Results The springtime flow weighted mean concentration was under the target concentration for 6 years. Springtime TP loads made up an average of 57% of total annual loads.

Cedar Creek (St. Joseph)

Tributary St. Joseph (City of Fort Wayne CC-STJ-H)

Total Phosphorus (TP)	
USGS Streamgage	04180000
Drainage Area Ratio	1
City of Fort Wayne Data	2008-2022
Average Annual Load (lb./yr.)	170,891
Average Springtime Load (1 Mar – 31 Jul)	99,319
Reduction Needed to Meet Spring Target	23,900



Site The City of Fort Wayne site CC-STJ-H is collocated with IDEM site CC-4. It is a downstream site on Cedar Creek, a tributary to the St. Joseph River, in Indiana (red circle and purple diamond in map). TP samples were collected monthly in 2008-2022.

Figure 1. (upper left) The colored bars represent the estimated total annual (blue) and springtime (green) load (metric tons; primary y-axis). The lines represent the total annual (solid) and springtime (dashed) precipitation (mm; secondary y-axis).

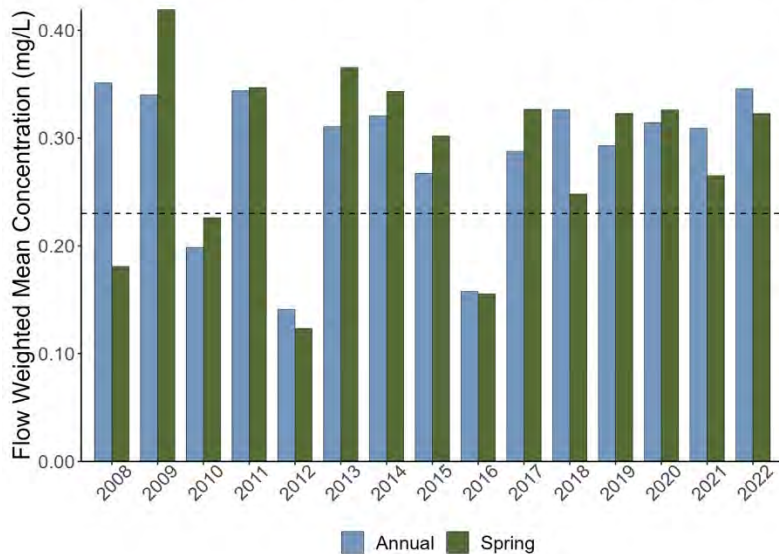


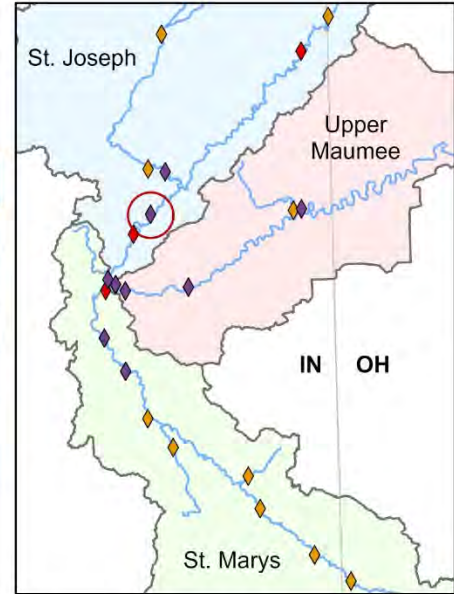
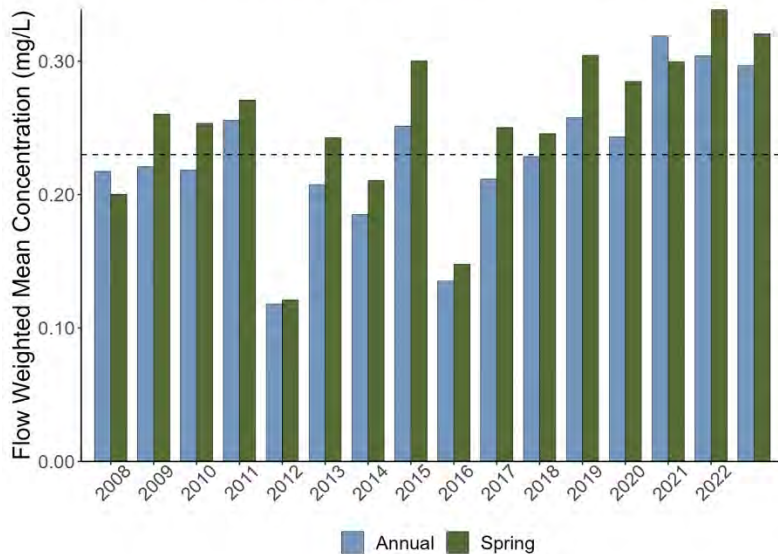
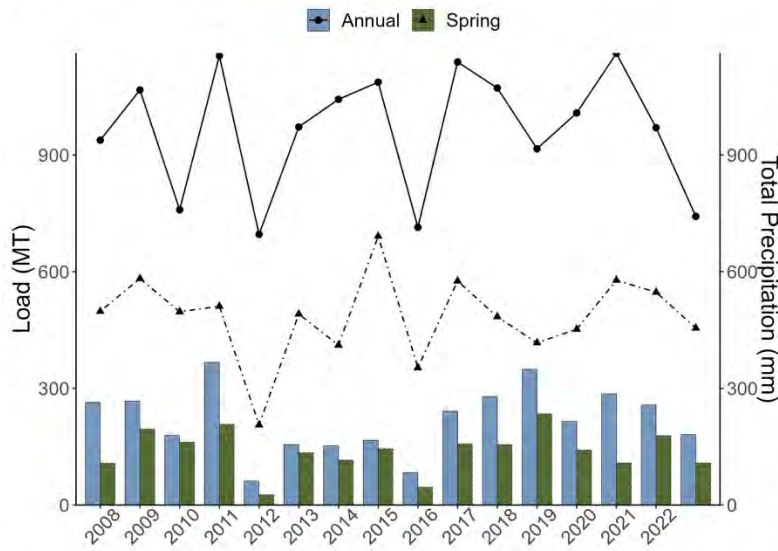
Figure 2. (lower left) The colored bars represent the average estimated annual (blue) and springtime (green) flow-weighted mean concentration (mg/L). The horizontal line represents the total phosphorus target concentration of 0.23 mg/L.

Results The springtime flow weighted mean concentration was under the target concentration for 4 years. Springtime TP loads made up an average of 58% of total annual loads.

St. Joseph River Mainstem

Midstream (City of Fort Wayne STJ-M)

Total Phosphorus (TP)	
USGS Streamgage	04180500
Drainage Area Ratio	1
City of Fort Wayne Data	2008-2022
Average Annual Load (lb./yr.)	483,418
Average Springtime Load (1 Mar – 31 Jul)	306,999
Reduction Needed to Meet Spring Target	34,996



Site The City of Fort Wayne site STJ-M is a midstream site on St. Joseph River in Indiana (red circle and purple diamond in map). TP samples were collected weekly April-October and monthly November-March in 2008-2022.

Figure 1. (upper left) The colored bars represent the estimated total annual (blue) and springtime (green) load (metric tons; primary y-axis). The lines represent the total annual (solid) and springtime (dashed) precipitation (mm; secondary y-axis).

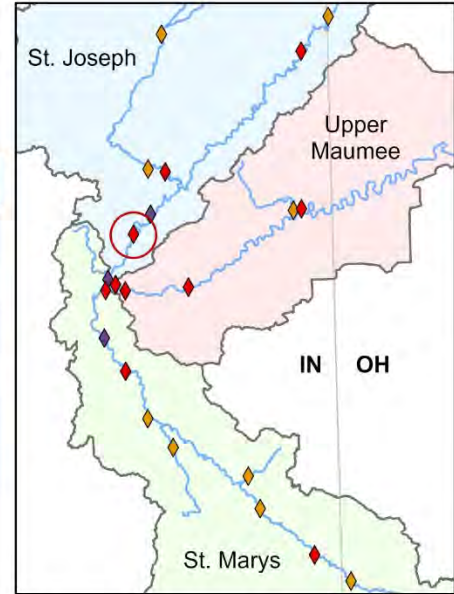
Figure 2. (lower left) The colored bars represent the average estimated annual (blue) and springtime (green) flow-weighted mean concentration (mg/L). The horizontal line represents the total phosphorus target concentration of 0.23 mg/L.

Results The springtime flow weighted mean concentration was under the target concentration for 4 years. 2020-2022 were years with some of the highest flow weighted mean concentrations and have remained steady. Springtime TP loads made up an average of 63% of total annual loads.

St. Joseph River Mainstem

Downstream (Fixed Station STJ-4)

Total Phosphorus (TP)	
USGS Streamgage	04180500
Drainage Area Ratio	1.02
IDEM Fixed Station Data	2011-2022
Average Annual Load (lb./yr.)	517,404
Average Springtime Load (1 Mar – 31 Jul)	314,558
Reduction Needed to Meet Spring Target	43,384



Site The IDEM Fixed Station site STJ-4 is a downstream site on the St. Joseph River in Indiana (red circle and red diamond in map). TP samples were collected monthly in 2011-2022.

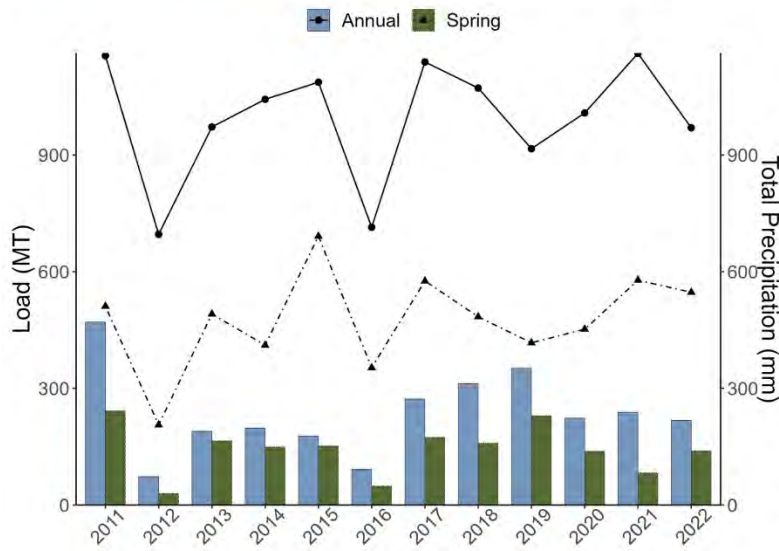


Figure 1. (upper left) The colored bars represent the estimated total annual (blue) and springtime (green) load (metric tons; primary y-axis). The lines represent the total annual (solid) and springtime (dashed) precipitation (mm; secondary y-axis).

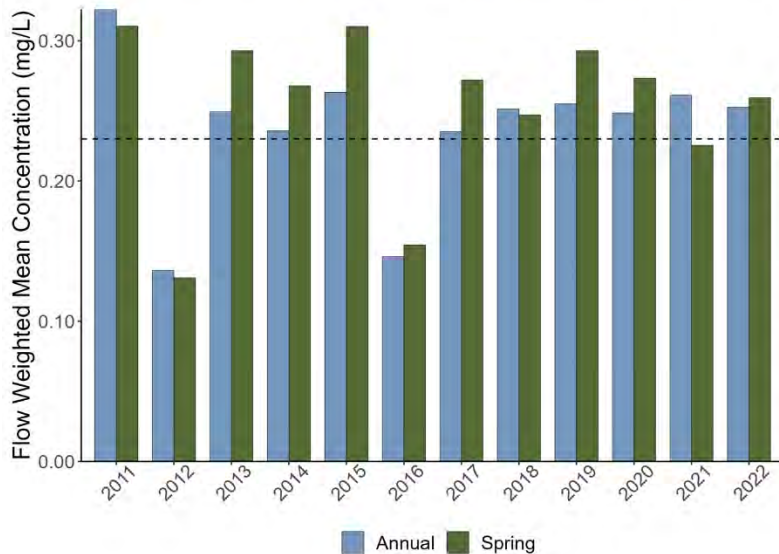


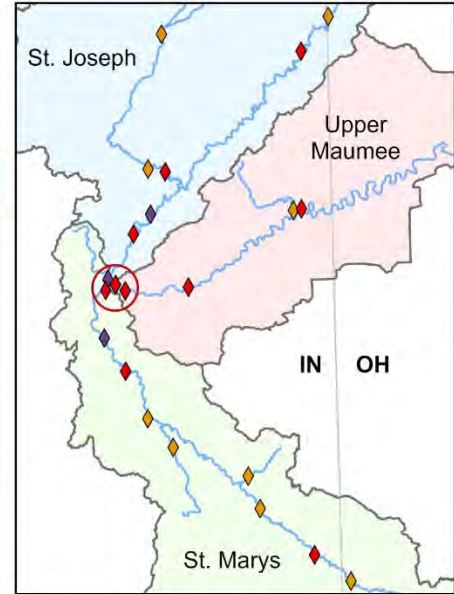
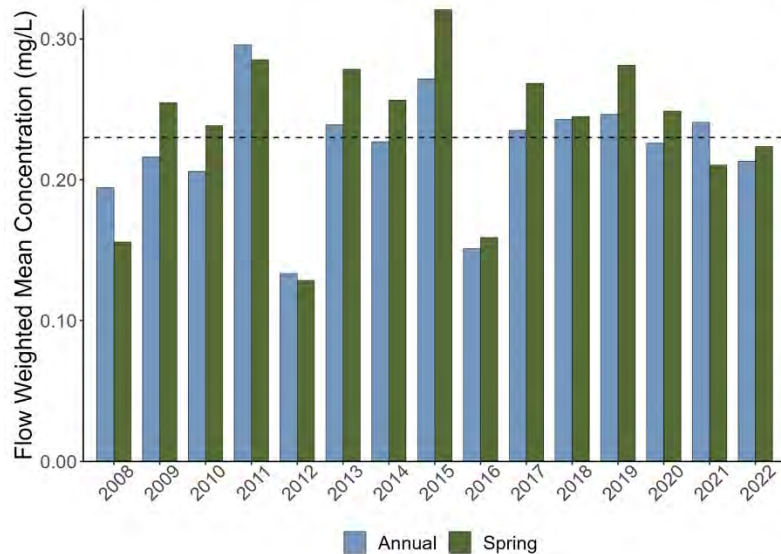
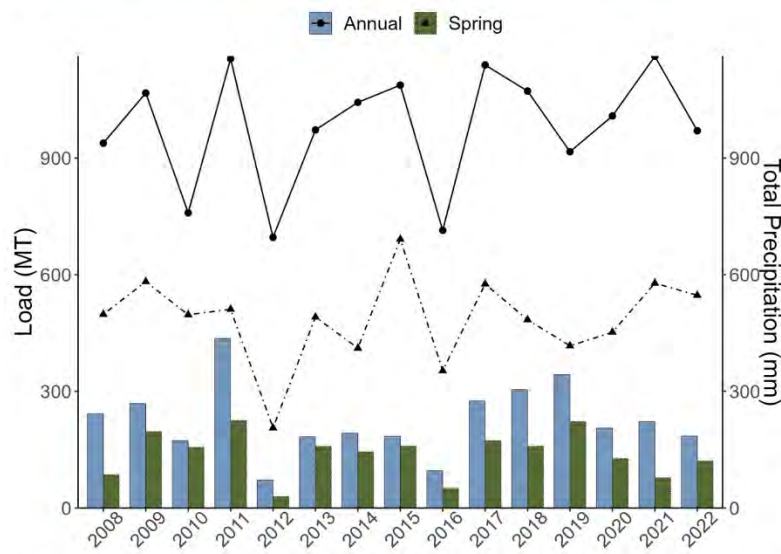
Figure 2. (lower left) The colored bars represent the average estimated annual (blue) and springtime (green) flow-weighted mean concentration (mg/L). The horizontal line represents the total phosphorus target concentration of 0.23 mg/L.

Results The springtime flow weighted mean concentration was below the target of 0.23 mg/L in 2021, in addition to the two dry years (2012 and 2016). Springtime TP loads made up an average of 61% of total annual loads.

St. Joseph River Mainstem

Downstream at confluence (Fixed Station STJ-.5)

Total Phosphorus (TP)	
USGS Streamgage	04180500
Drainage Area Ratio	1
IDEM Fixed Station Data	2008-2022
Average Annual Load (lb./yr.)	497,618
Average Springtime Load (1 Mar – 31 Jul)	307,132
Reduction Needed to Meet Spring Target	21,029



Site The IDEM Fixed Station site STJ-.5 is collocated with the City of Fort Wayne site STJ-T. It is a downstream site on the St. Joseph River in Fort Wayne, Indiana (red circle and red diamond in map) near the confluence with St. Marys. TP samples were collected monthly in 2008-2022.

Figure 1. (upper left) The colored bars represent the estimated total annual (blue) and springtime (green) load (metric tons; primary y-axis). The lines represent the total annual (solid) and springtime (dashed) precipitation (mm; secondary y-axis).

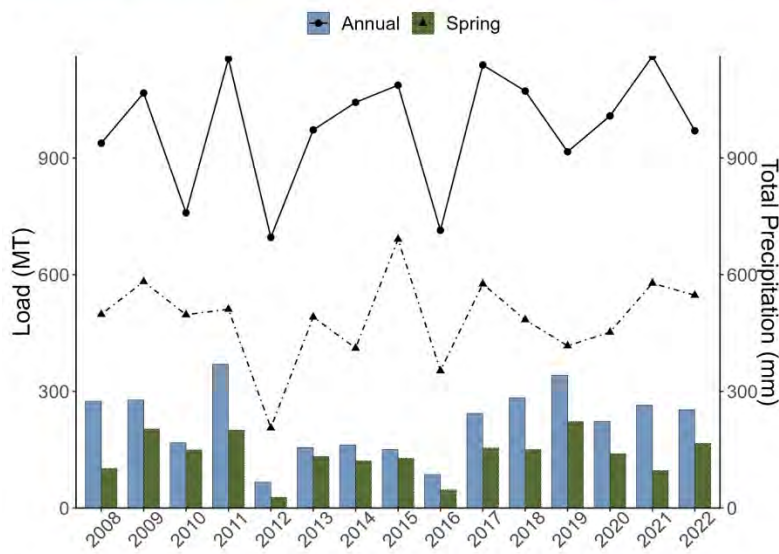
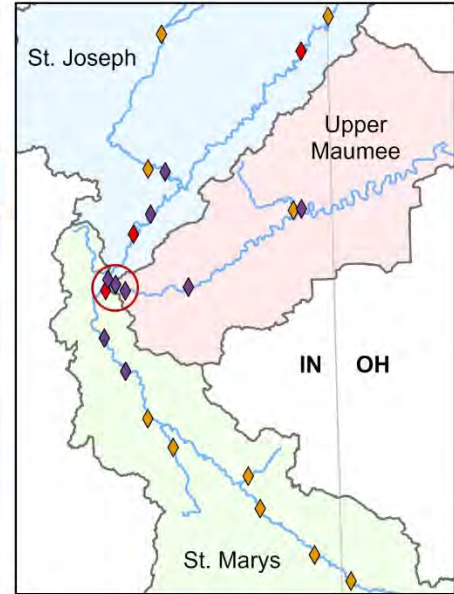
Figure 2. (lower left) The colored bars represent the average estimated annual (blue) and springtime (green) flow-weighted mean concentration (mg/L). The horizontal line represents the total phosphorus target concentration of 0.23 mg/L.

Results The springtime flow weighted mean concentration was below the target of 0.23 mg/L in 2021 and 2022, in addition to the two dry years (2012 and 2016) and the baseline year (2008). Springtime TP loads made up an average of 62% of total annual loads.

St. Joseph River Mainstem

At confluence (City of Fort Wayne STJ-T)

Total Phosphorus (TP)	
USGS Streamgage	04180500
Drainage Area Ratio	1
City of Fort Wayne Data	2008-2022
Average Annual Load (lb./yr.)	487,838
Average Springtime Load (1 Mar – 31 Jul)	300,293
Reduction Needed to Meet Spring Target	14,059



Site The City of Fort Wayne site STJ-T is collocated with IDEM site STJ-.5. It is a downstream site on the St. Joseph River in Fort Wayne, Indiana (red circle and purple diamond in map) near the confluence with St. Marys. TP samples were collected weekly April-October and monthly November-March in 2008-2022.

Figure 1. (upper left) The colored bars represent the estimated total annual (blue) and springtime (green) load (metric tons; primary y-axis). The lines represent the total annual (solid) and springtime (dashed) precipitation (mm; secondary y-axis).

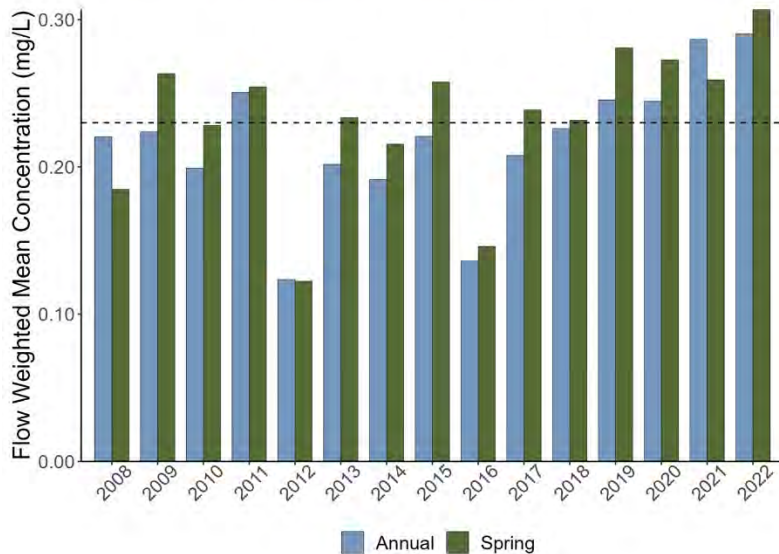


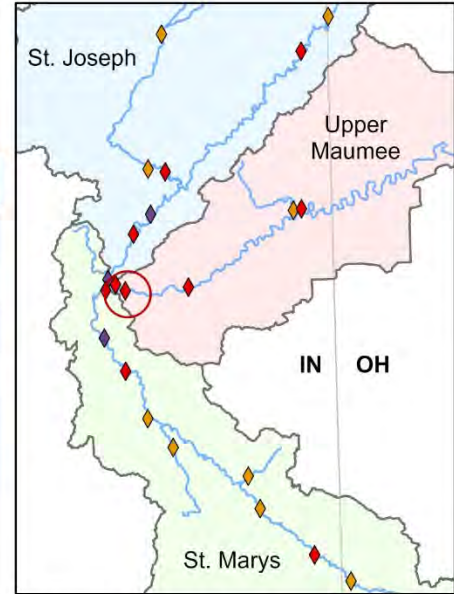
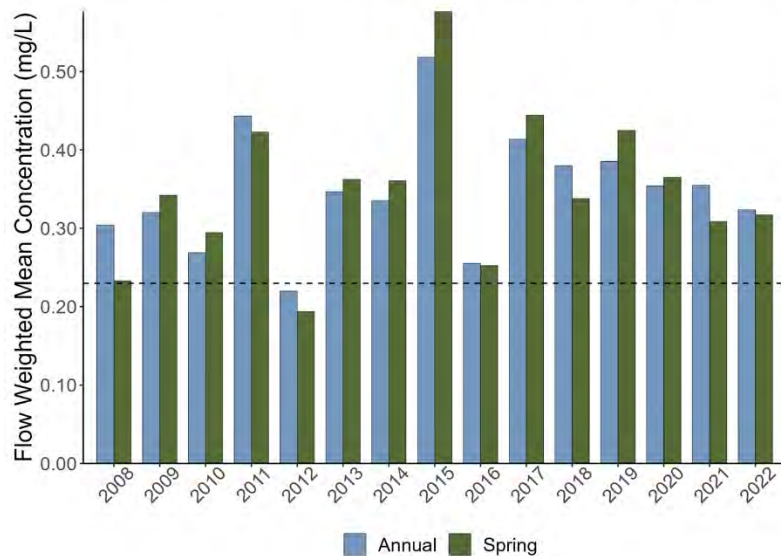
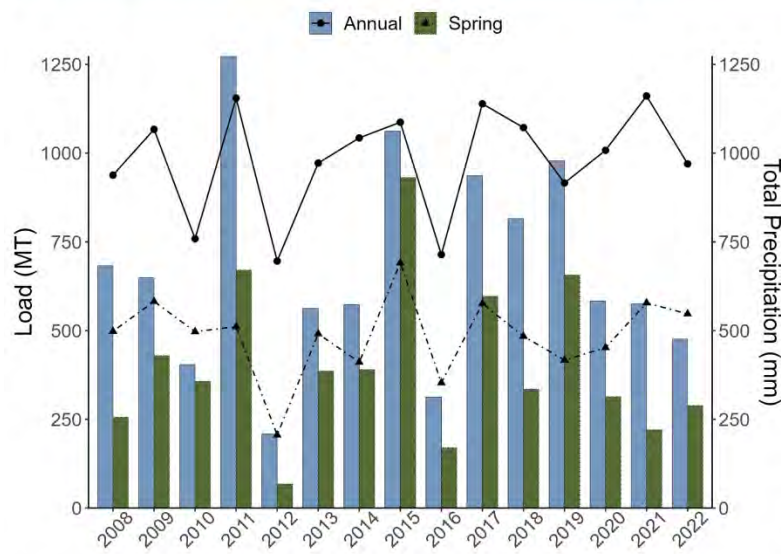
Figure 2. (lower left) The colored bars represent the average estimated annual (blue) and springtime (green) flow-weighted mean concentration (mg/L). The horizontal line represents the total phosphorus target concentration of 0.23 mg/L.

Results The springtime flow weighted mean concentration was at or below the target of 0.23 mg/L for 6 years. Springtime TP loads made up an average of 62% of total annual loads.

Maumee Mainstem

Upstream at confluence (Fixed Station M-132)

Total Phosphorus (TP)	
USGS Streamgage	04183000
Drainage Area Ratio	0.98
IDEM Fixed Station Data	2008-2022
Average Annual Load (lb./yr.)	1,483,678
Average Springtime Load (1 Mar – 31 Jul)	892,637
Reduction Needed to Meet Spring Target	341,454



Site The IDEM Fixed Station site M-132 is collocated with the City of Fort Wayne site M-A. It is an upstream site on the Maumee River in Fort Wayne, Indiana near the confluence of the St. Marys and St. Joseph rivers (red circle and red diamond in map). TP samples were collected monthly in 2008-2022.

Figure 1. (upper left) The colored bars represent the estimated total annual (blue) and springtime (green) load (metric tons; primary y-axis). The lines represent the total annual (solid) and springtime (dashed) precipitation (mm; secondary y-axis).

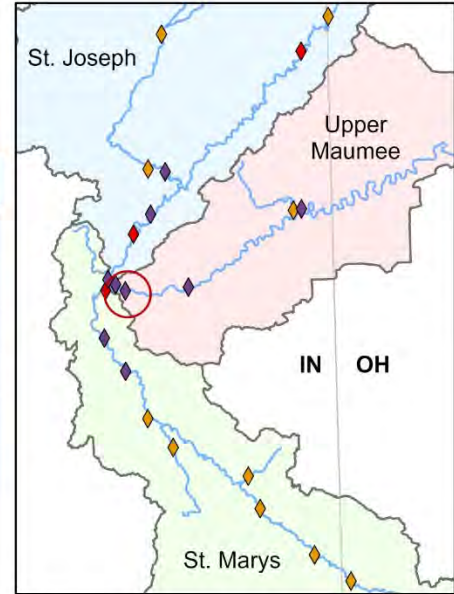
Figure 2. (lower left) The colored bars represent the average estimated annual (blue) and springtime (green) flow-weighted mean concentration (mg/L). The horizontal line represents the total phosphorus target concentration of 0.23 mg/L.

Results The springtime flow weighted mean concentration was below the target of 0.23 mg/L in 2012 (dry year). Springtime TP loads made up an average of 60% of total annual loads.

Maumee Mainstem

Upstream at confluence (City of Fort Wayne M-A)

Total Phosphorus (TP)	
USGS Streamgage	04182950
Drainage Area Ratio	1
City of Fort Wayne Data	2008-2022
Average Annual Load (lb./yr.)	1,538,476
Average Springtime Load (1 Mar – 31 Jul)	973,789
Reduction Needed to Meet Spring Target	431,134



Site The City of Fort Wayne site M-A is collocated with IDEM site M-132. It is an upstream site on the Maumee River in Fort Wayne, Indiana near the confluence of the St. Marys and St. Joseph rivers (red circle and purple diamond in map). TP samples were collected weekly April-October and monthly November-March in 2008-2022.

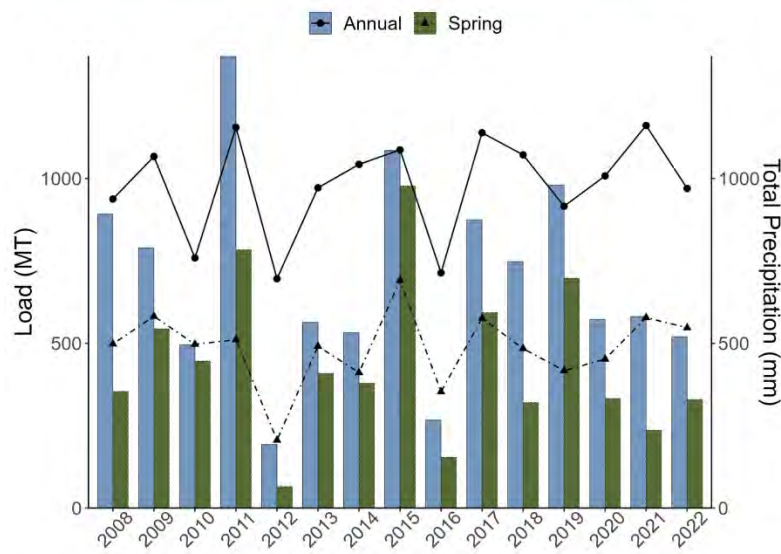


Figure 1. (upper left) The colored bars represent the estimated total annual (blue) and springtime (green) load (metric tons; primary y-axis). The lines represent the total annual (solid) and springtime (dashed) precipitation (mm; secondary y-axis).

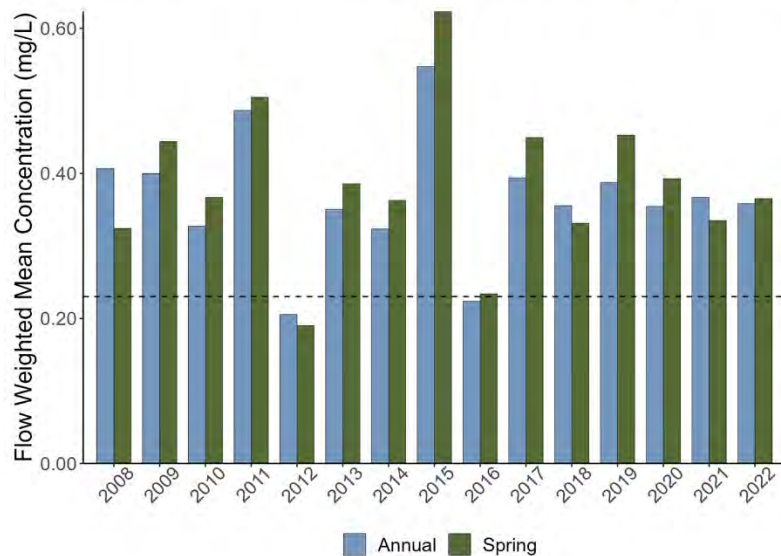


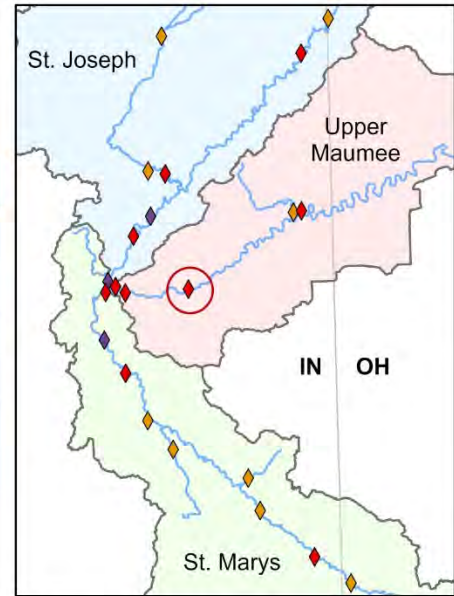
Figure 2. (lower left) The colored bars represent the average estimated annual (blue) and springtime (green) flow-weighted mean concentration (mg/L). The horizontal line represents the total phosphorus target concentration of 0.23 mg/L.

Results The springtime flow weighted mean concentration was below the target of 0.23 mg/L in 2012 (dry year). Springtime TP loads made up an average of 63% of total annual loads.

Maumee Mainstem

Midstream (Fixed Station M-129)

Total Phosphorus (TP)	
USGS Streamgage	04183000
Drainage Area Ratio	1
IDEM Fixed Station Data	2008-2022
Average Annual Load (lb./yr.)	1,518,653
Average Springtime Load (1 Mar – 31 Jul)	886,839
Reduction Needed to Meet Spring Target	323,815



Site The IDEM Fixed Station site M-129 is a midstream site on the Maumee River in Indiana (red circle and red diamond in map). TP samples were collected monthly in 2008-2022.

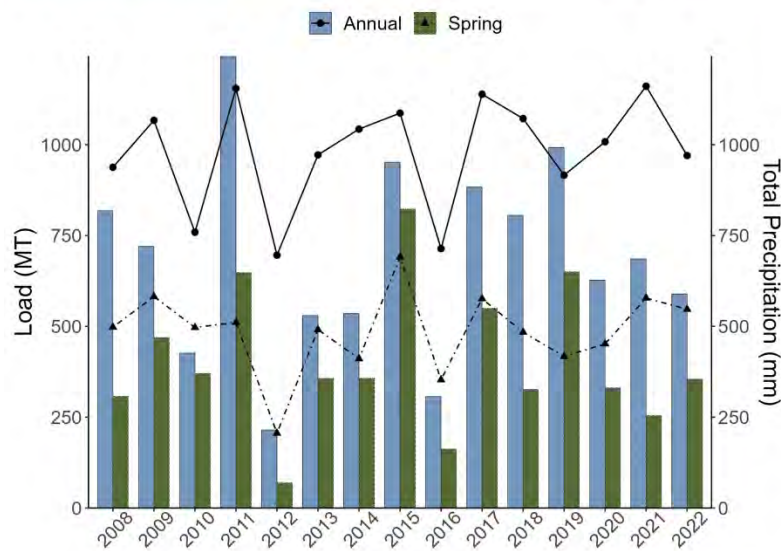


Figure 1. (upper left) The colored bars represent the estimated total annual (blue) and springtime (green) load (metric tons; primary y-axis). The lines represent the total annual (solid) and springtime (dashed) precipitation (mm; secondary y-axis).

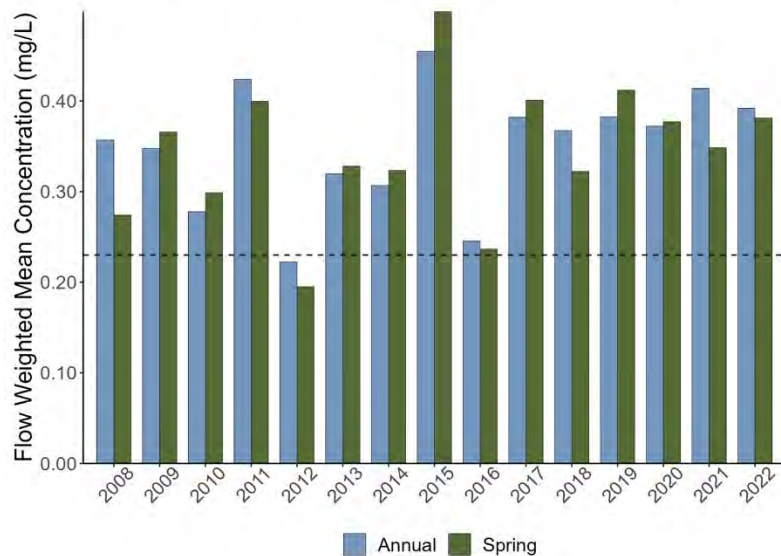


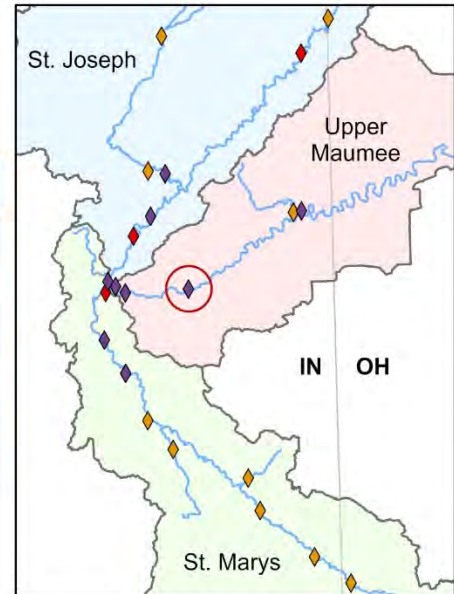
Figure 2. (lower left) The colored bars represent the average estimated annual (blue) and springtime (green) flow-weighted mean concentration (mg/L). The horizontal line represents the total phosphorus target concentration of 0.23 mg/L.

Results The springtime flow weighted mean concentration was below the target of 0.23 mg/L in 2012 (dry year). Springtime TP loads made up an average of 58% of total annual loads.

Maumee Mainstem

Upstream at confluence (City of Fort Wayne M-L)

Total Phosphorus (TP)	
USGS Streamgage	04182950
Drainage Area Ratio	1
City of Fort Wayne Data	2008-2022
Average Annual Load (lb./yr.)	1,569,299
Average Springtime Load (1 Mar – 31 Jul)	992,863
Reduction Needed to Meet Spring Target	438,222



Site The City of Fort Wayne site M-L is collocated with IDEM site M-129. It is an upstream site on the Maumee River in Indiana (red circle and purple diamond in map). TP samples were collected weekly April-October and monthly November-March in 2008-2022.

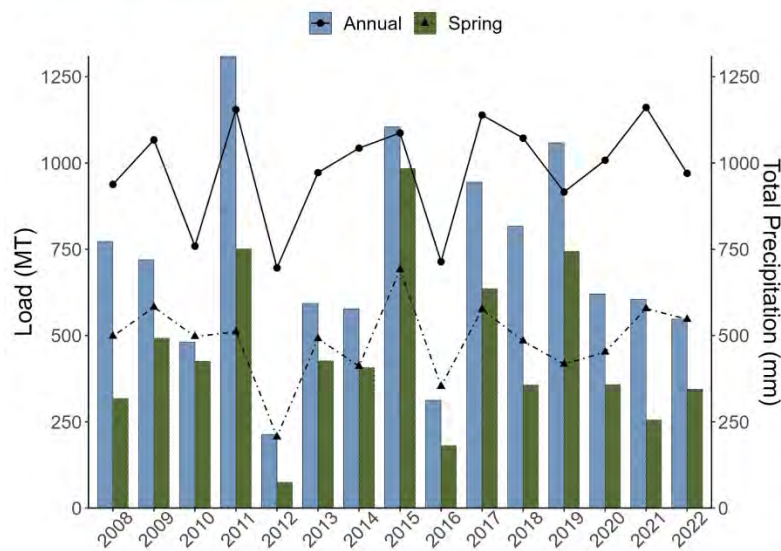


Figure 1. (upper left) The colored bars represent the estimated total annual (blue) and springtime (green) load (metric tons; primary y-axis). The lines represent the total annual (solid) and springtime (dashed) precipitation (mm; secondary y-axis).

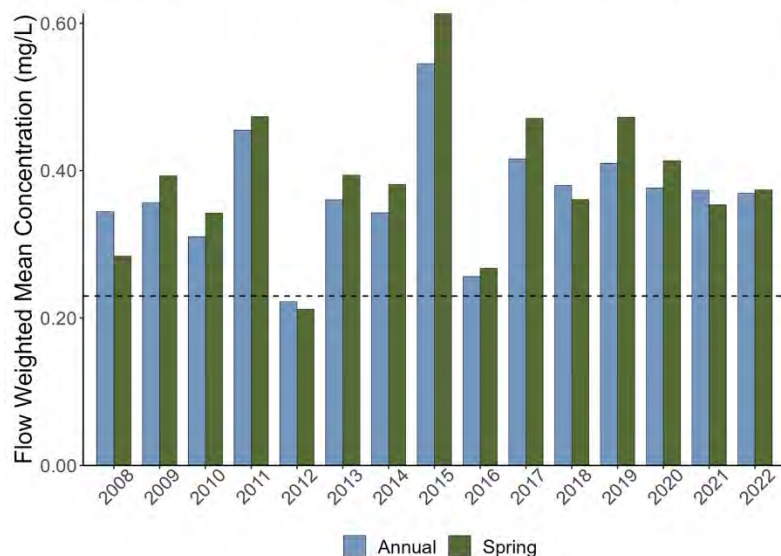


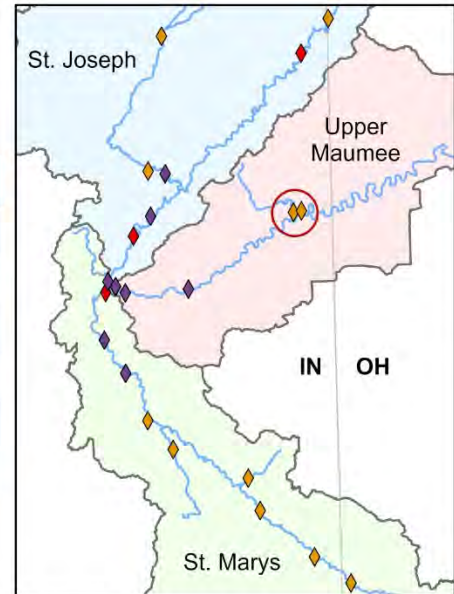
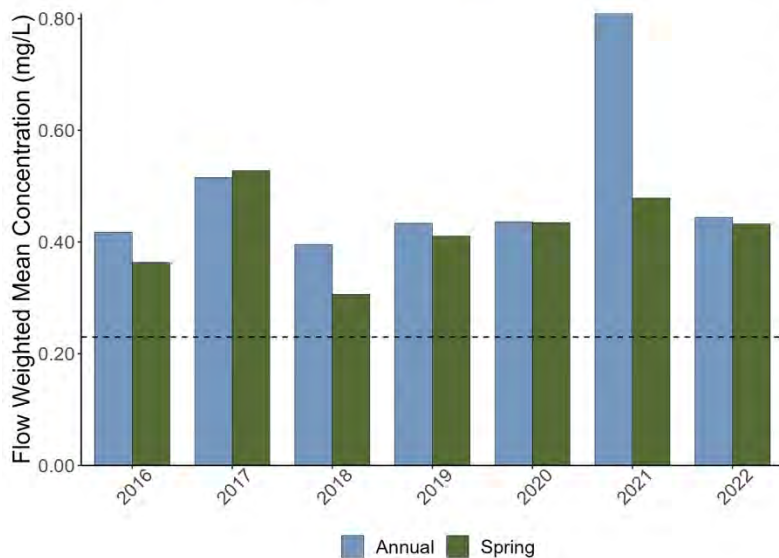
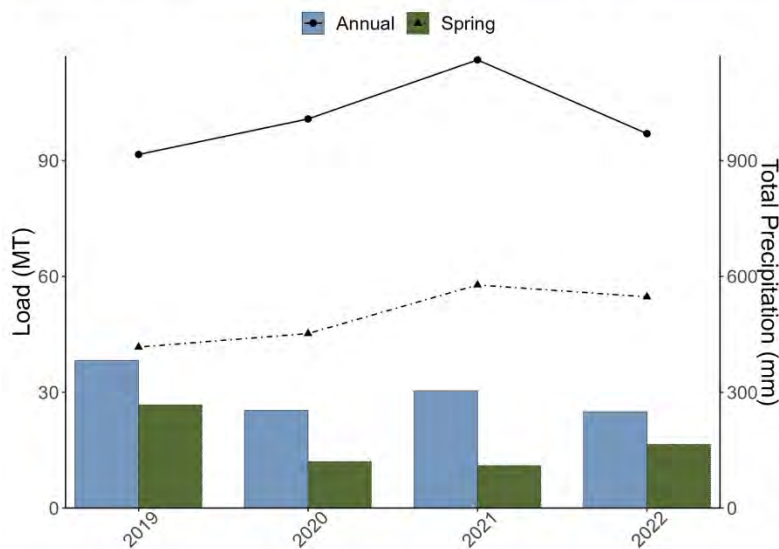
Figure 2. (lower left) The colored bars represent the average estimated annual (blue) and springtime (green) flow-weighted mean concentration (mg/L). The horizontal line represents the total phosphorus target concentration of 0.23 mg/L.

Results The springtime flow weighted mean concentration was below the target of 0.23 mg/L in 2012 (dry year). Springtime TP loads made up an average of 63% of total annual loads.

Black Creek (Maumee)

Tributary to Maumee (Allen Co BC-M-304)

Total Phosphorus (TP)	
USGS Streamgage	04183038
Drainage Area Ratio	1.52
Allen Co SWCD Data (April to October)	2016-2022
Average Annual Load (lb./yr.)	14,694
Average Springtime Load (1 Mar – 31 Jul)	7,345
Reduction Needed to Meet Spring Target	3,421



Site The Allen Co SWCD site BC-M-304 is a downstream site on Black Creek, a tributary to the Maumee River, in Indiana (red circle and orange diamond in map). TP samples were collected weekly April to October in 2016-2022.

Figure 1. (upper left) The colored bars represent the estimated total annual (blue) and springtime (green) load (metric tons; primary y-axis). The lines represent the total annual (solid) and springtime (dashed) precipitation (mm; secondary y-axis).

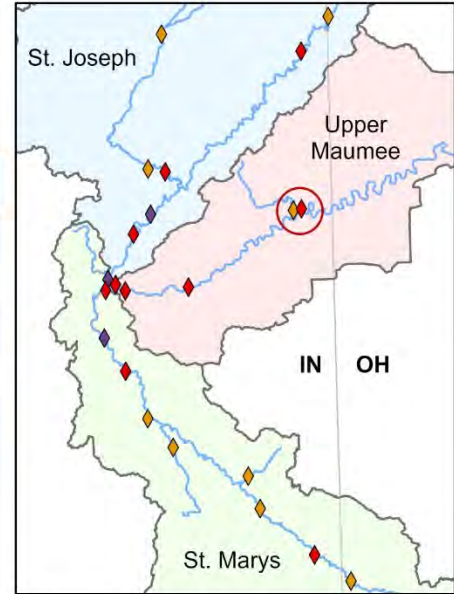
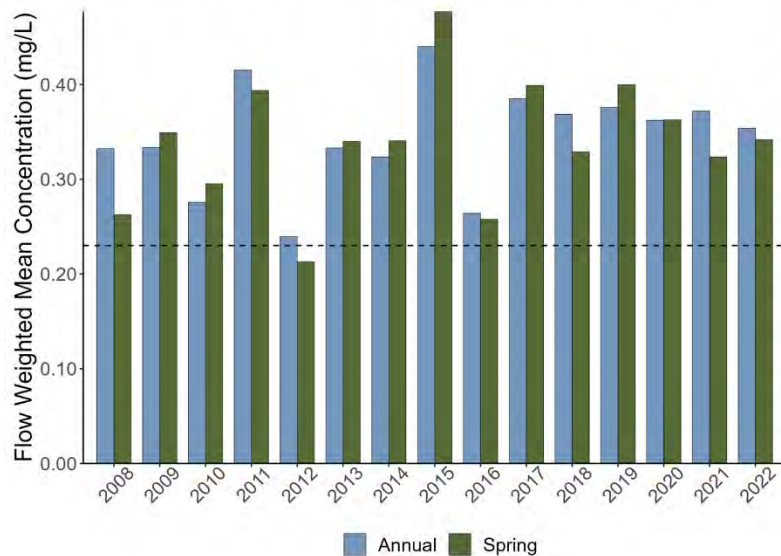
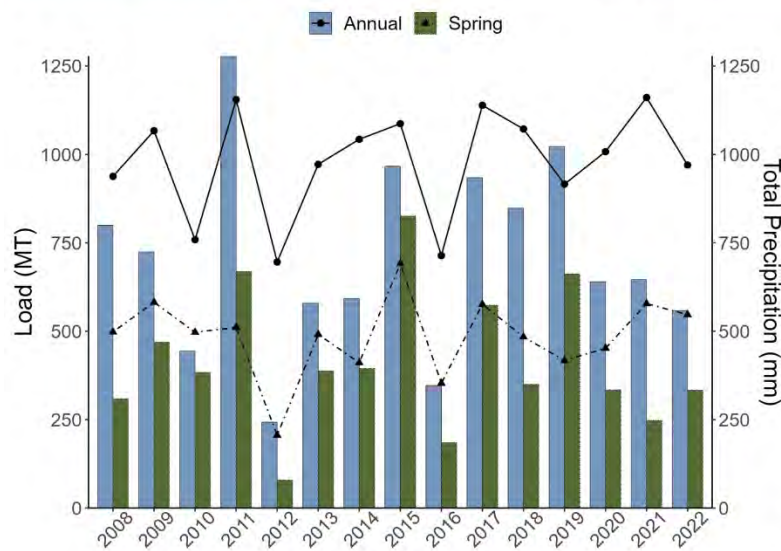
Figure 2. (lower left) The colored bars represent the average estimated annual (blue) and springtime (green) flow-weighted mean concentration (mg/L). The horizontal line represents the total phosphorus target concentration of 0.23 mg/L.

Results The flow weighted mean concentration never met the target of 0.23 mg/L. Springtime TP loads made up an average of 50% of total annual loads.

Maumee Mainstem

Downstream (Fixed Station M-114)

Total Phosphorus (TP)	
USGS Streamgage	04183000
Drainage Area Ratio	1.05
IDEM Fixed Station Data	2008-2022
Average Annual Load (lb./yr.)	1,561,523
Average Springtime Load (1 Mar – 31 Jul)	912,698
Reduction Needed to Meet Spring Target	321,968



Site The IDEM Fixed Station site M-114 is collocated with M-312 and M-SR101. It is a downstream site on the Maumee River near the border of Ohio in Indiana (red circle and red diamond in map). TP samples were collected monthly in 2008-2022.

Figure 1. (upper left) The colored bars represent the estimated total annual (blue) and springtime (green) load (metric tons; primary y-axis). The lines represent the total annual (solid) and springtime (dashed) precipitation (mm; secondary y-axis).

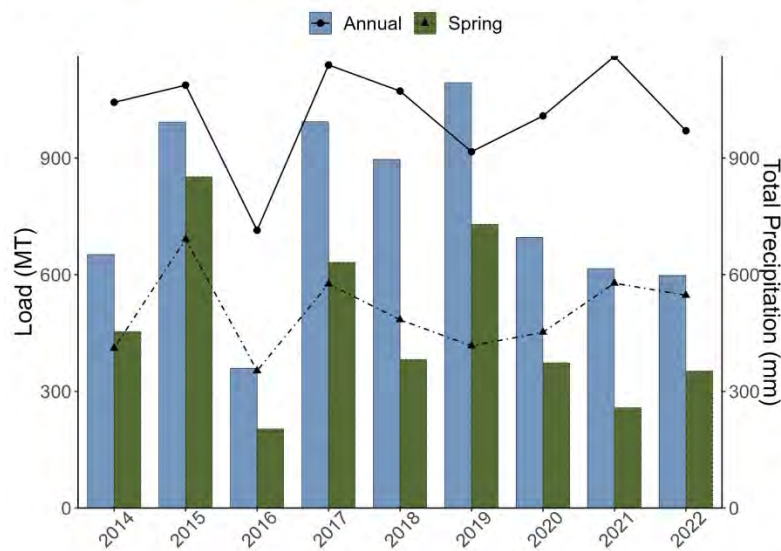
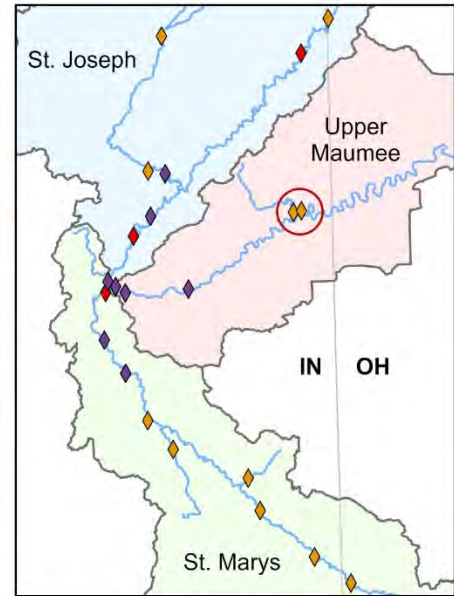
Figure 2. (lower left) The colored bars represent the average estimated annual (blue) and springtime (green) flow-weighted mean concentration (mg/L). The horizontal line represents the total phosphorus target concentration of 0.23 mg/L.

Results The springtime flow weighted mean concentration was below the target of 0.23 mg/L in 2012 (dry year). Springtime TP loads made up an average of 58% of total annual loads.

Maumee Mainstem

Downstream (Allen Co M-312)

Total Phosphorus (TP)	
USGS Streamgage	04183000
Drainage Area Ratio	1.06
Allen Co SWCD Data (April to October)	2014-2022
Average Annual Load (lb./yr.)	1,972,729
Average Springtime Load (1 Mar – 31 Jul)	1,167,773
Reduction Needed to Meet Spring Target	483,063



Site The Allen Co SWCD site M-312 is collocated with M-114 and M-SR101. It is a downstream site on the Maumee River near the border of Ohio in Indiana (red circle and red diamond in map). TP samples were collected weekly from April to October in 2014-2022.

Figure 1. (upper left) The colored bars represent the estimated total annual (blue) and springtime (green) load (metric tons; primary y-axis). The lines represent the total annual (solid) and springtime (dashed) precipitation (mm; secondary y-axis).

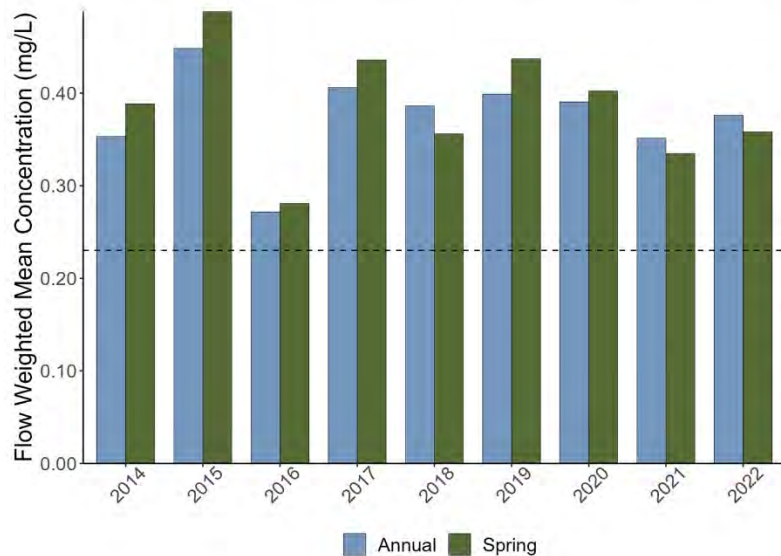


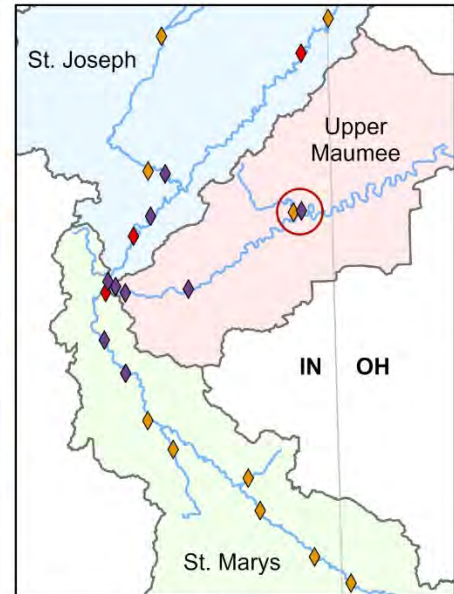
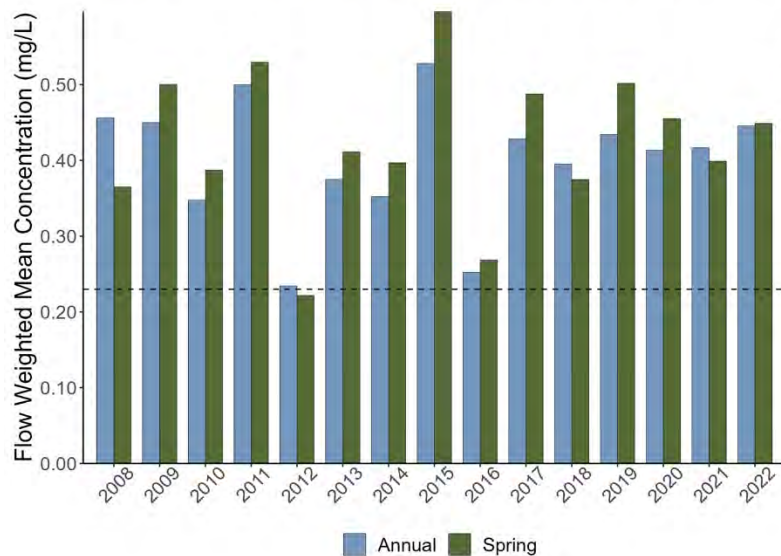
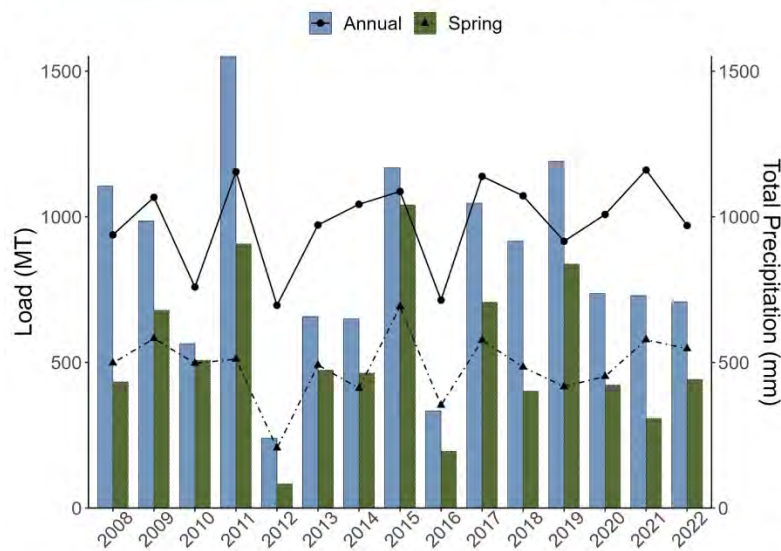
Figure 2. (lower left) The colored bars represent the average estimated annual (blue) and springtime (green) flow-weighted mean concentration (mg/L). The horizontal line represents the total phosphorus target concentration of 0.23 mg/L.

Results Springtime TP loads made up an average of 59% of total annual loads.

Maumee Mainstem

Downstream (City of Fort Wayne M-SR101)

Total Phosphorus (TP)	
USGS Streamgage	04183000
Drainage Area Ratio	1.06
City of Fort Wayne Data	2008-2022
Average Annual Load (lb./yr.)	2,105,177
Average Springtime Load (1 Mar – 31 Jul)	1,287,119
Reduction Needed to Meet Spring Target	636,437



Site The City of Fort Wayne site M-SR101 is collocated with M-114 and M-312. It is a downstream site on the Maumee River near the border of Ohio in Indiana (circled purple diamond in map). TP samples were collected monthly in 2008-2022.

Figure 1. (upper left) The colored bars represent the estimated total annual (blue) and springtime (green) load (metric tons; primary y-axis). The lines represent the total annual (solid) and springtime (dashed) precipitation (mm; secondary y-axis).

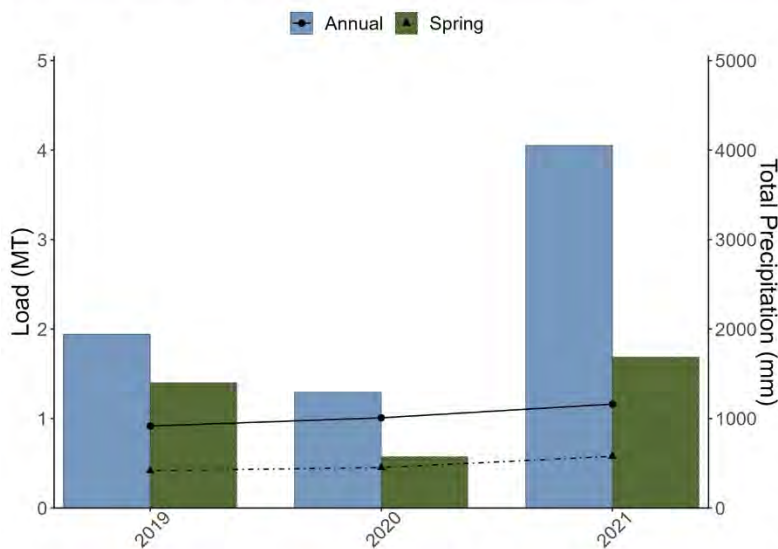
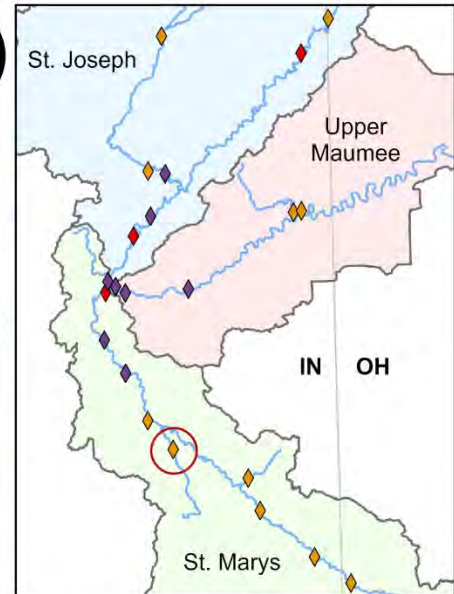
Figure 2. (lower left) The colored bars represent the average estimated annual (blue) and springtime (green) flow-weighted mean concentration (mg/L). The horizontal line represents the total phosphorus target concentration of 0.23 mg/L.

Results The springtime flow weighted mean concentration was under the target in 2012 (dry year). Springtime TP loads made up an average of 61% of total annual loads.

Nickelsen Creek (St. Marys)

Tributary to St. Marys (Allen Co NC-STM-211)

Orthophosphate	
USGS Streamgage	04181755
Drainage Area Ratio	1
Allen Co SWCD Data (April – October)	2019-2021
Average Annual Load (lb./yr.)	4,712
Average Springtime Load (1 Mar – 31 Jul)	2,693
Reduction Needed to Meet Spring Target	1,919



Site Allen Co SWCD site NC-STM-211 is on a tributary to the St. Marys called Nickelsen Creek in Indiana (red circle and orange diamond in map). Orthophosphate samples were collected weekly from April to October 2019 – 2021.

Figure 1. (upper left) The colored bars represent the estimated total annual (blue) and springtime (green) load (metric tons; primary y-axis). The lines represent the total annual (solid) and springtime (dashed) precipitation (mm; secondary y-axis).

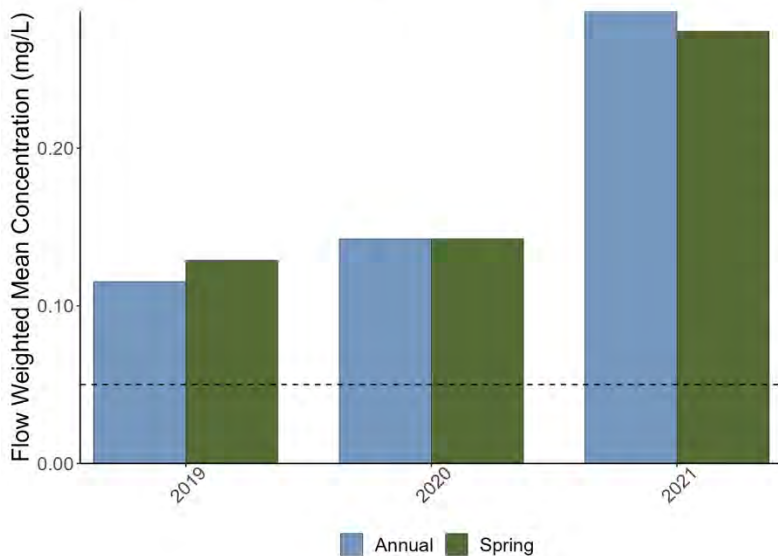


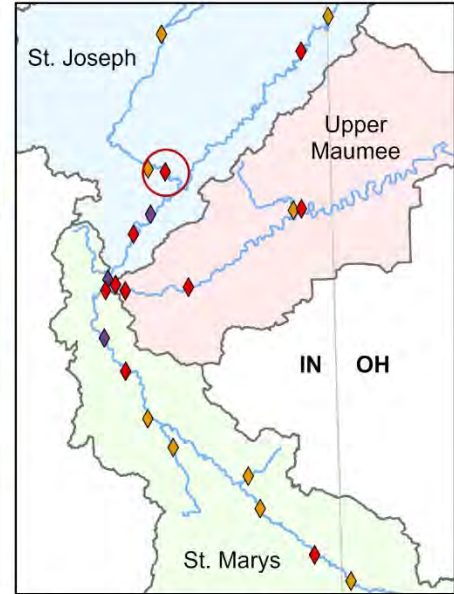
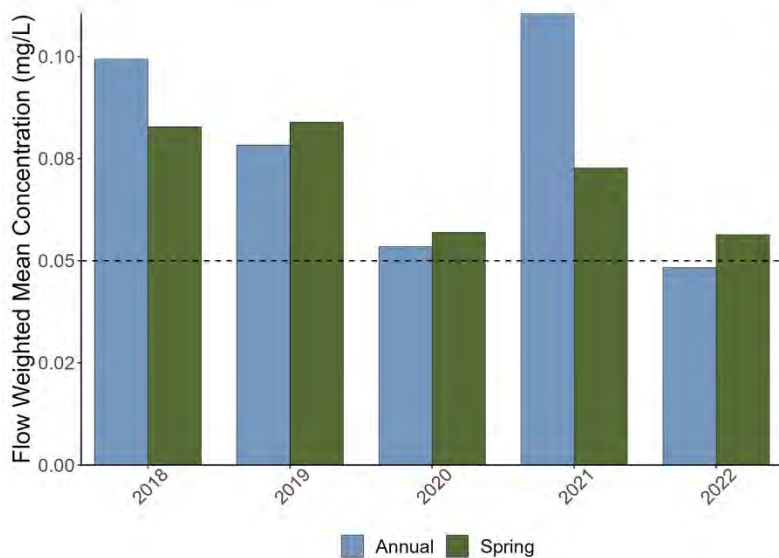
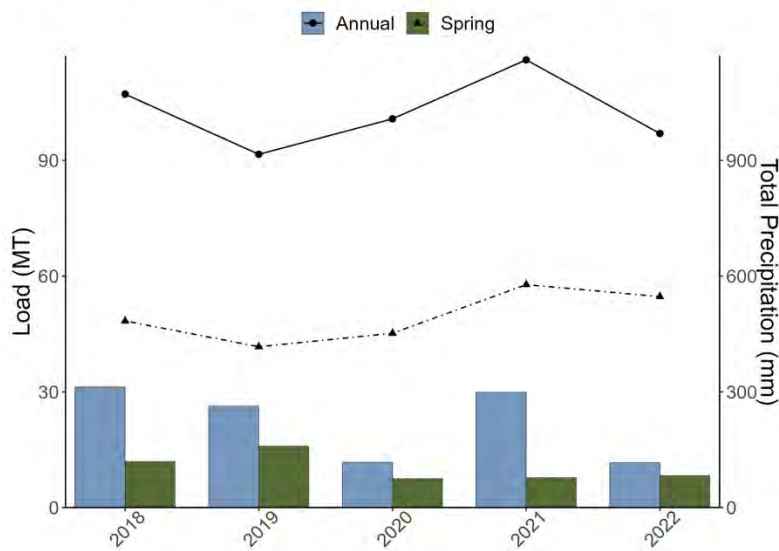
Figure 2. (lower left) The colored bars represent the average estimated annual (blue) and springtime (green) flow-weighted mean concentration (mg/L). The horizontal line represents the orthophosphate target concentration of 0.05 mg/L.

Results The springtime flow weighted mean concentration was higher than the annual mean concentrations for all years in 2019-2021. Springtime orthophosphate loads made up an average of 57% of total annual loads.

Cedar Creek (St. Joseph)

Tributary to St. Joseph (Fixed Station CC-4)

Orthophosphate	
USGS Streamgage	04180000
Drainage Area Ratio	1
IDEM Fixed Station Data	2018-2022
Average Annual Load (lb./yr.)	48,865
Average Springtime Load (1 Mar – 31 Jul)	22,714
Reduction Needed to Meet Spring Target	6,815



Site The IDEM Fixed Station site CC-4 is a downstream site on Cedar Creek, a tributary to the St. Joseph River, in Indiana (red circle and red diamond in map). Orthophosphate samples were collected monthly in 2018-2022.

Figure 1. (upper left) The colored bars represent the estimated total annual (blue) and springtime (green) load (metric tons; primary y-axis). The lines represent the total annual (solid) and springtime (dashed) precipitation (mm; secondary y-axis).

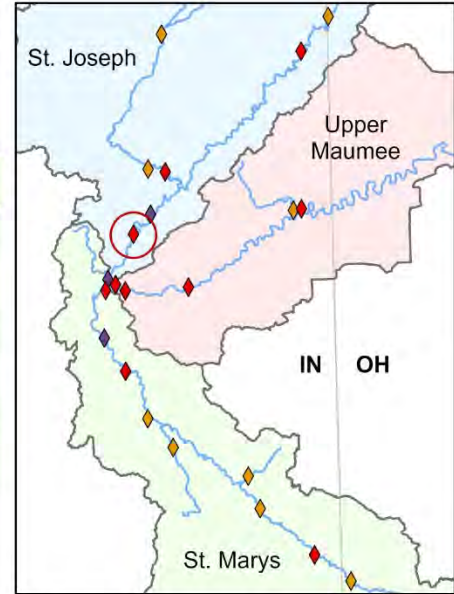
Figure 2. (lower left) The colored bars represent the average estimated annual (blue) and springtime (green) flow-weighted mean concentration (mg/L). The horizontal line represents the orthophosphate target concentration of 0.05 mg/L.

Results The annual flow weighted mean concentration was under the target concentration of 0.05 mg/L in 2022. Springtime orthophosphate loads made up an average of 46% of total annual loads.

St. Joseph River Mainstem

Downstream (Fixed Station STJ-4)

Orthophosphate	
USGS Streamgage	04180500
Drainage Area Ratio	1.02
IDEM Fixed Station Data	2018-2022
Average Annual Load (lb./yr.)	233,909
Average Springtime Load (1 Mar – 31 Jul)	115,235
Reduction Needed to Meet Spring Target	52,667



Site The IDEM Fixed Station site STJ-4 is a downstream site on the St. Joseph River in Indiana (red circle and red diamond in map). Orthophosphate samples were collected monthly in 2018-2022.

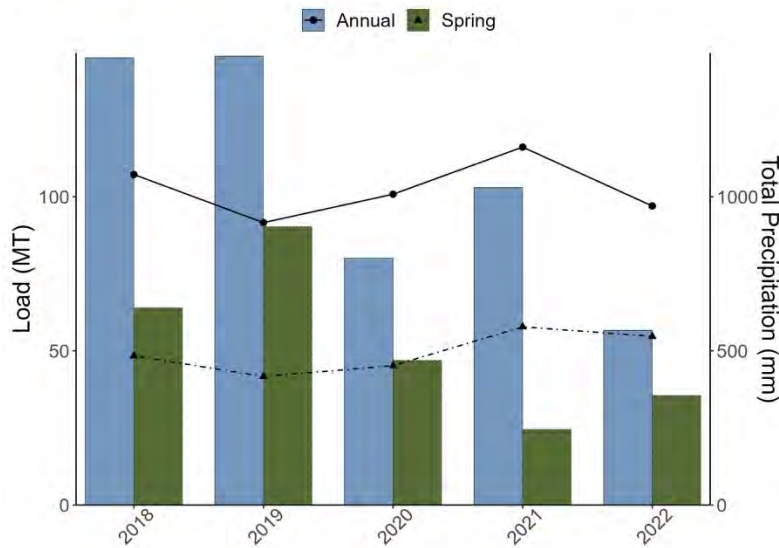


Figure 1. (upper left) The colored bars represent the estimated total annual (blue) and springtime (green) load (metric tons; primary y-axis). The lines represent the total annual (solid) and springtime (dashed) precipitation (mm; secondary y-axis).

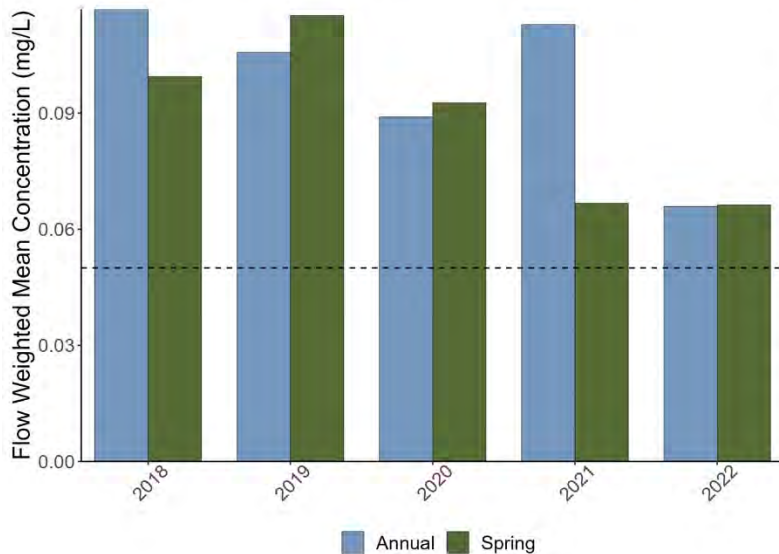


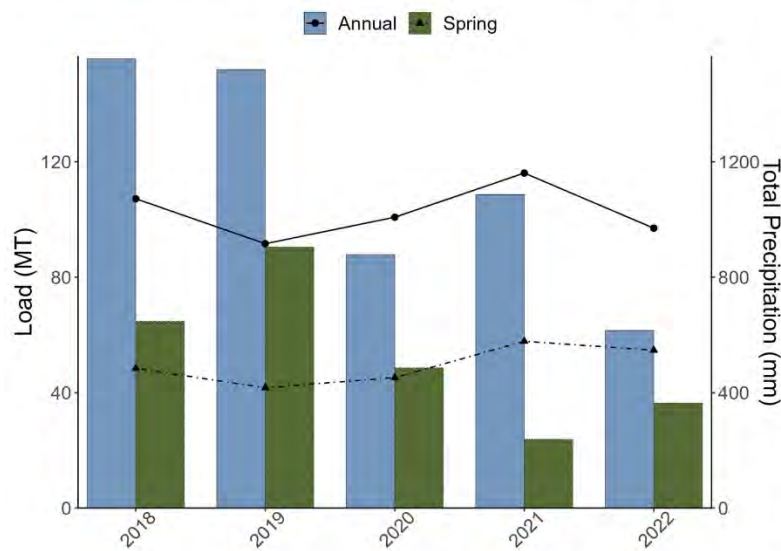
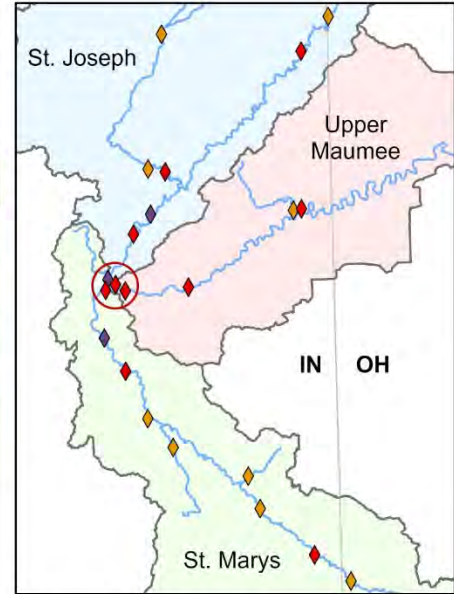
Figure 2. (lower left) The colored bars represent the average estimated annual (blue) and springtime (green) flow-weighted mean concentration (mg/L). The horizontal line represents the orthophosphate target concentration of 0.05 mg/L.

Results The flow weighted mean concentration was never below the target of 0.05 mg/L. Springtime orthophosphate loads made up an average of 49% of total annual loads.

St. Joseph River Mainstem

Downstream at confluence (Fixed Station STJ-.5)

Orthophosphate	
USGS Streamgage	04180500
Drainage Area Ratio	1
IDEM Fixed Station Data	2018-2022
Average Annual Load (lb./yr.)	249,447
Average Springtime Load (1 Mar – 31 Jul)	116,481
Reduction Needed to Meet Spring Target	53,281



Site The IDEM Fixed Station site STJ-.5 is a downstream site on the St. Joseph River in Fort Wayne, Indiana near the confluence with St. Marys (red circle and red diamond in map). Orthophosphate samples were collected monthly in 2018-2022.

Figure 1. (upper left) The colored bars represent the estimated total annual (blue) and springtime (green) load (metric tons; primary y-axis). The lines represent the total annual (solid) and springtime (dashed) precipitation (mm; secondary y-axis).

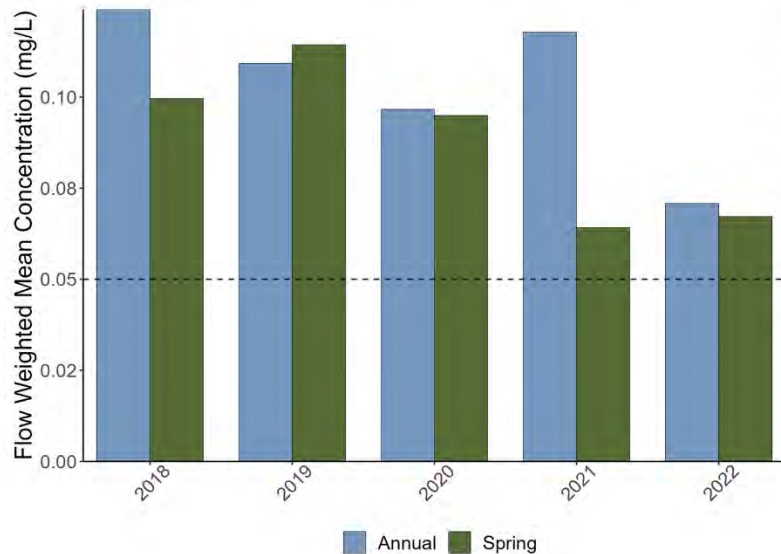


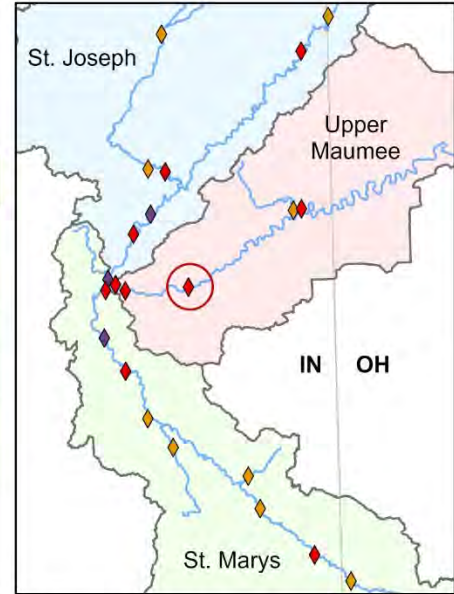
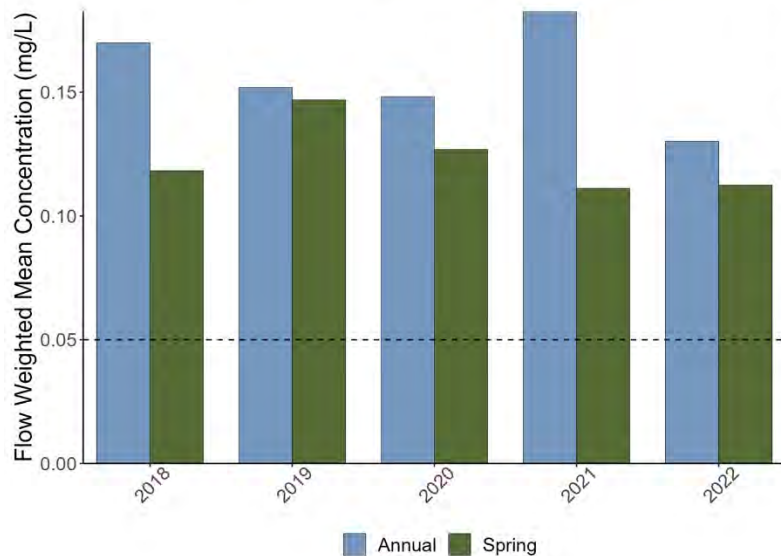
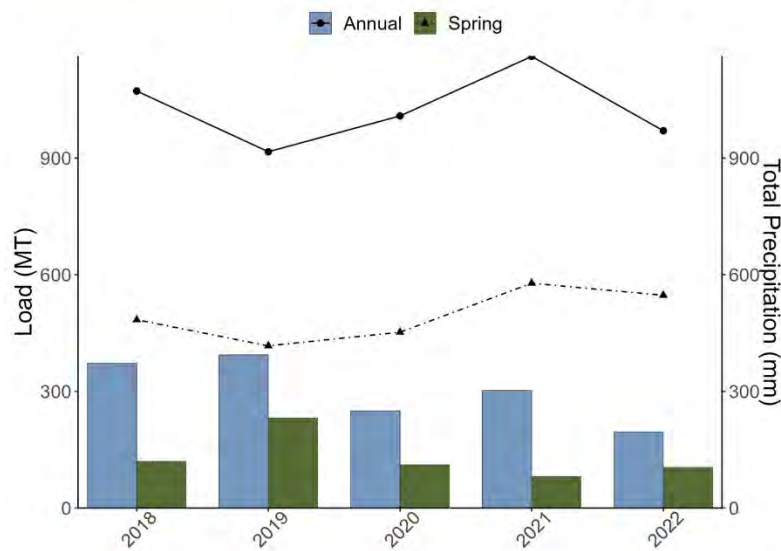
Figure 2. (lower left) The colored bars represent the average estimated annual (blue) and springtime (green) flow-weighted mean concentration (mg/L). The horizontal line represents the orthophosphate target concentration of 0.05 mg/L.

Results The flow weighted mean concentration was never below the target of 0.05 mg/L. Springtime orthophosphate loads made up an average of 47% of total annual loads.

Maumee Mainstem

Midstream (Fixed Station M-129)

Orthophosphate	
USGS Streamgage	04183000
Drainage Area Ratio	1
IDEM Fixed Station Data	2018-2022
Average Annual Load (lb./yr.)	667,963
Average Springtime Load (1 Mar – 31 Jul)	286,441
Reduction Needed to Meet Spring Target	173,259



Site The IDEM Fixed Station site M-129 is a midstream site on the Maumee River in Indiana (red circle and red diamond in map). Orthophosphate samples were collected monthly in 2018-2022.

Figure 1. (upper left) The colored bars represent the estimated total annual (blue) and springtime (green) load (metric tons; primary y-axis). The lines represent the total annual (solid) and springtime (dashed) precipitation (mm; secondary y-axis).

Figure 2. (lower left) The colored bars represent the average estimated annual (blue) and springtime (green) flow-weighted mean concentration (mg/L). The horizontal line represents the orthophosphate target concentration of 0.05 mg/L.

Results The flow weighted mean concentration was never below the target of 0.05 mg/L. Springtime orthophosphate loads made up an average of 43% of total annual loads.