Lower Fox River Tributary

Volunteer Monitoring Program

Project Summary

November 2019 – Draft #3

Project Title:

Lower Fox River Tributary Volunteer Monitoring

AOC(s):

Lower Green Bay/Fox River

Project Applicant:

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Project Summary

Project Location

This project is in support of the Lower Green Bay and Fox River Area of Concern (AOC). Specifically, the project location consists of the 13 major tributary streams within the Lower Fox River Basin in Northeast Wisconsin. These streams contribute nutrients and sediment directly to and via the Fox River to the Lower Green Bay and Fox River Area of Concern. The basin comprises approximately 640 sq. miles, and in general, extends from the outlet of Lake Winnebago to Green Bay. Monitoring locations were previously established in the first year of the Lower Fox River Tributary Monitoring (2015) with three new sites added in 2018 (map attached; Appendix A)

Project Background

The monitoring program was initiated with the Lower Fox River TMDL project, which identified and calculated sources of total phosphorus and total suspended solids in the Lower Fox River watershed, that was approved by the EPA in 2012. One of the objectives with the TMDL implementation stage is to evaluate long-term water quality trends within the entirety of the Lower Fox River watershed. To achieve some of the monitoring objectives, the volunteer monitoring program was created in 2015. Volunteers play the essential role of data collectors, as they collect water samples once a month, at 17 different locations, May to October of each year in each of the 13 streams. All but one, Lancaster Creek which is our reference stream, of the monitored streams are impaired due to high levels of total phosphorus and/or total suspended solid levels in the water. Volunteers are trained before the sampling season by Wisconsin DNR staff to ensure reliable and accurate results are achieved each month

Problem Statement

Currently, the Lower Green Bay and Fox River Area of Concern (AOC) has a total of 13 Beneficial Use Impairments (BUI's). Of these, the following eight impairments are linked to excessive nutrient and sediment loads:

- Degradation of fish and wildlife populations;
- Degradation of benthos;
- Eutrophication or undesirable algae;
- Restrictions on drinking water, or taste and odor problems;
- Beach closings;
- Degradation of aesthetics;
- Degradation of phytoplankton and zooplankton populations;
- Loss of fish and wildlife habitat

12 of the 13 streams located within the Lower Fox basin are listed as impaired for total phosphorus (TP) and/or total suspended solids (TSS). In addition, their downstream receiving waters, the Lower Green Bay and Fox River (LGBFR), are also impaired for TP and TSS. The EPA-approved Total Maximum Daily Load (TMDL) for the Lower Fox River Basin identifies the relatively substantial reductions needed to meet water quality goals. Given the effect of nutrient and sediment loading on several of the BUI's in the LGBFR AOC, the goals of the AOC and TMDL (removal of the BUI's and meeting the TMDL reductions, respectively) are closely intertwined, and effective implementation of the TMDL is critical to the restoration of the AOC.

Project Goals

There are two goals for this project: (1) increasing public outreach and awareness/engaging citizen science and (2) collecting reliable data. We want to increase community awareness on local water quality issues and on the impact of land use decisions around them. The focus is to raise awareness through building our volunteer base and increasing community involvement and engagement.

Through citizen science we want to collect reliable data to characterize total phosphorus, dissolved reactive phosphorus, diatom phosphorus index (every 5 years), total suspended solids, and associated chemical and physical characteristics in the Lower Fox tributary streams during the primary algae and aquatic plant "growing season" of May through October. The monitoring data helps to focus on which of the streams are affected by elevated phosphorus and total suspended solids concentrations.

It is important to note, however, that investigations are currently ongoing into their relationship between the reduction of total phosphorus, dissolved reactive phosphorus, and biological responses. The collection of both total phosphorus and dissolved reactive phosphorus will help strengthen the understanding of these relationships and effects they may have on biological responses in the Lower Fox River tributaries.

Additional goals of this project include:

1. Evaluate nutrient and sediment concentrations in the tributaries discharging to the lower Green Bay and Fox River AOC.
2. Monitor the health of the watershed overtime.
3. Provide a basis for evaluation of the long-term effectiveness of implementation of the Lower Fox River TMDL; are there water quality improvements in watersheds with the implementation of best management practices?

Proposed Work

2019 is the fifth year that the WDNR has led the Fox River Tributary Monitoring project for the LGBFR AOC. Project structure remained the same this year as coordination and implementation of volunteer monitoring efforts have been controlled by WDNR staff. Specifically, the WDNR:

- Continues to develop a well-trained volunteer base through various means of recruitment and community engagement:
    - Volunteers are trained to follow DNR monitoring protocols for surface water collection
    - Volunteers collect streamflow and transparency data at the time of surface water collection
    - Volunteers ship surface water samples on the day of collection to the Wisconsin State Lab of Hygiene for analysis of total and dissolved reactive phosphorus and total suspended solids
- Continue to provide support to volunteers as needed
    - Ensure safe access and suitability at each monitoring station
    - Ordering, preparing, and maintaining supplies for volunteers to successfully carry out monitoring activities and shipment of samples
    - Fostering an open line of communication with volunteers to ensure that all stations are being monitored at the frequency outlined in the project QAPP
- Confirm that all 17 monitoring locations are monitored monthly from May to October for a total of 6 monitoring events

- Provide WDNR Office of the Great Waters staff with quarterly progress reports and corresponding invoices. Reporting periods are January to March, April to June, July to September, and October to December
- Provide WDNR Office of Great Waters staff with a final project report summarizing volunteer monitoring efforts and analytical results

Sampling Procedure

- Samples are collected once a month from May to October of each year
- Trained volunteers take 3 water chemistry samples (total phosphorus, dissolved reactive phosphorus, and total suspended solids) with stream flow and turbidity as well. Volunteers are trained to follow WAV volunteer monitoring protocol to ensure consistency is being met in each sample
- Once collected, the samples get put on ice and shipped to WSLH where they are analyzed
- Duplicate samples were taken from several streams in 2015, 2016, 2018 (Appendix D). Duplicates were taken on the same day, at the same time and the concentration values were averaged to get 1 concentration reading for the month. Other "duplicate" samples were taken, but had to be considered separate data points due to being collected on different days

2018 Sampling Season

Summary

Three new sites were added for the 2018 sampling season: Mid Duck Creek (SWIMSs ID; 453255), Upper Duck Creek (SWIM's ID: 10029975), and Upper East River (SWIMs ID: 53508). New and replacement equipment was purchased from Ben Meadows (now Forestry Supply), with most of the expenses allocated to funding the three new sites. Shipping methods were changed to utilize a FedEx Business account that cut costs from ~$40 a shipment to ~$11 a shipment, including the upgrade to Priority Overnight Shipping to minimize the risk of exceeding the 48-hour hold for DRP.

15 individuals, some with their respective groups, monitored the 17 sites, two chapters of the Izaak Walton League each monitored an additional site. Of the 2018 volunteers, six were new while eight returned from 2017 and one returned from 2015. New volunteers were found by reaching out to local organizations and through citizen interest and contacting the DNR program coordinator. Volunteers include members of the following organizations:

- Appleton Business Rotary Club, Izaak Walton League, Neenah High School, Freedom High School, Clean Water Action Council, UW-Fox Valley, and UW- Oshkosh

Volunteer training was held on 4/28/2018 and all new volunteers either attended or were trained during their first sampling date. Returning volunteers were not required to attend; two did. After the training, an email detailing the protocol for each sampling procedure and reminders were sent to all volunteers and included common mistakes to avoid. Each volunteer was also given a hard copy of the volunteer manual detailing the protocol for sample collection, shipment, and how to fill out sample lab slips.

All 104 samples, including two duplicate samples, were collected during the 2018 season. There was an issue with shipment of the August Apple Creek sample and as such the sample collected was not

analyzed. There were three instances where the volunteer could not sample their site and the DNR program coordinator filled in.

Problems and Resolutions

1. There was an initial question on whether we should sample for Total Dissolved Phosphorus or Dissolved Reactive Phosphorus (DRP). It was determined that we sampled for DRP in the past and should continue to do so.
    a. Dissolved Reactive Phosphorus was decided upon. Field filtration was performed by the volunteers.
    b. Dissolved Reactive Phosphorus has been reported as Dissolved Ortho Phosphate
2. Many volunteers were unable to attend the volunteer training. In the future, consider setting up an alternative pick-up date or location to reduce future travel to exchange equipment one volunteer at a time.
    a. Utilize Green Bay and Oshkosh Service Centers
3. We frequently had an issue with DRP samples analyzed past the 48-hour collection window or no longer on ice.
    a. It is important to emphasize the importance of shipping the same day or early the next day. If early the next day, samples should be stored in the refrigerator overnight and cooler should be filled with ice before sealing.
4. Ensure volunteers include a return shipping address on the shipping box index card. If they **do not** receive their shipping box back within a week, they should contact the project coordinator.
5. The coordinator manual did not specify the budget account code to use for lab invoices; verify and prefill this out in the future: the 2018 account code was “GL047”
6. There were occasional problems with FedEx billing and they double charged for the same package.
    a. Call the Government Services branch of FedEx (800-645-9424) and they will cancel the incorrect charge. One of the charges does not have a delivery date and should be the one canceled.
    b. The DNR program coordinator should continue to keep track of the Tracking ID’s on the shipping label for each stream and match with charges on each invoice
7. Volunteer collection dates slowly moved toward the end of the month. In the future. Although the volunteers did a great job of collecting their samples every month, sampling late into the month can be difficult to solve if there is a problem. The DNR coordinator should remind volunteers that it is best to sample before the end of the third week of the month. That way if any problems occur, there is ample time to find a solution before the end of the month.
8. Communication between the DNR coordinator and volunteers proved difficult at times. With coordinator not physically seeing the volunteers, email was relied on for communication. The DNR coordinator should utilize phone calls to communicate sampling events with the volunteers.
9. There was no sample analyzed for Apple Creek in August. The volunteer delivered the package to the Walgreens in Menasha on 8/30/2018 and it was not picked up by FedEx driver until 9/4, when the package was damaged, and water spilled out. It was decided to discard the package, as it was past the 48-hour DRP hold and the water was warm. FedEx support, Walgreens Manager, and volunteer were contacted, and the order of events was unclear from each person’s perspective. Volunteer did not zip-tie the liner bag and instead tied a knot. We were not charged for the shipment.

Deliverables and Work Accomplished

- All samples were collected in 2018
    - Duplicate samples were collected from Lower Duck Creek (8/14/2018) and Neenah Slough (9/25/2018)
- Quarterly reports sent for each project quarter.
- Outreach Events
    - Presentations/Meetings
        - 4/19/2018: Green Bay Conservation Partners Presentation
            - ~150 people
        - 4/19/2018: Izaak Walton League Partnership
            - 2 people
        - 6/28/2018: Appleton Rotary Club Presentation
            - ~50 people
        - 10/23/2018: Baird Creek Preservation Foundation and City of Green Bay Parks Department
            - 3 people
        - 12/11/2018: Agriculture Committee Lower Fox TMDL Implementation Presentation
            - ~15 people
    - Newsletters
        - 10/2018: Fox Wolf Watershed Alliance Newsletter
            - 3221-person newsletter reach
            - Story shared 13 times on Facebook
        - 10/30/2018: DNR Facebook Post
            - 44 likes and shared 8 times by other organizations
            - No analytics on views, DNR Facebook has 116, 706 people who follow it
    - Neighborhood Associations:
        - Note: Neighborhood Associations were in the City of Green Bay and specific locations can be found at: https://greenbaywi.gov/428/Find-My-Neighborhood-Association.
        - 11/2108: Marquette Neighborhood Association Newsletter
            - 850-person newsletter reach
        - Est. 12/2018: East Drive Neighborhood Association
            - Schedule an article to be released in late December, reach unknown
        - Est. 01/2019: Starlite Neighborhood Association
            - Schedule an article to be released in January, reach unknown
        - Est. Spring 2019: Nicolet Drive Neighborhood Association Spring Newsletter
            - Scheduled to be released in spring 2019, 280-person newsletter reach

Expenses Summary

Expense	Planned Budgeted	Actual Expenses	Balance (+/-)
Personnel/Salaries	$17,663	$10,714.25	$6,948.75
Fringe Benefits	$4,475.80	$0.00	$4,475.80
Supplies and Shipping	$6,990	$1,356.89	$5,633.11
Travel	$1,172	$672.41	$499.59
Lab Services	$8,802	$8,868.00	($66.00)
Total Direct Charges	39,102.80	$21,611.55	$17,641.25
Indirect (20.52% Salary + Fringe)	4,542.88	$0.00	$4,542.88
Total Charges	43,645.69	$21,611.55	$22,184.13

Explanation of Deviations

1. Personnel/Salaries
    a. No hours were accrued from January-March while this position was vacant.
    b. Had the coordinator position been filled during this time, using a rough estimate of average hours worked per month, the position would have filled around 80% of the planned budget.
2. Fringe benefits/indirect
    a. N/A
3. Equipment
    a. Very little replacement equipment was needed, and new equipment was only necessary for three sites
4. Shipping
    a. Shipping was changed to utilize FedEx Business and reduced prices from ~$40 per shipment to ~$11. If future coordinators use the FedEx Business account established (Account Number 852 101 490), this price will remain. Melissa Lake and Emily Punke have access to this account.
5. Travel
    a. This is highly variable based on volunteer availability (drop off and pick up of equipment, missed sampling events) and outreach events
6. Lab Supplies
    a. There were 104 sampling events in 2018 and at $86 (this include the DRP field filter kit) per sampling event, the expected budget should have been $8,944. The realized budget was $8,868 because the August Apple Creek sample was not analyzed, and the field filter kit was still used.

2019 Sampling Season

Summary

The 17 sampling sites from 2018 remained the same and no additional sites were added for the 2019 sampling season. Equipment was reclaimed by volunteers at the end of the 2018 sampling season and re-distributed for the 2019 sampling season. No additional equipment was purchased. Shipping methods remained through the FedEx business account that was established in 2018. Shipping cost per sample event remained ~$11 a shipment with Priority Overnight Shipping.

A group of 13 volunteers monitored the 17 sites in 2019. Three volunteers sampled two sites each, two volunteers sampled the same site together, and one volunteer sampled three sites. Of the 2019 volunteers, 11 of them returned from 2018. The program gained 1 new volunteer for 2019 while losing 5 volunteers from 2018.

Volunteer received their supplies and equipment late into the month of May, but all but one sample were still collected. With only one new volunteer, a program-wide volunteer training was not held. Instead, the DNR coordinator went with the new volunteer to train him during the month of May sample collection.

Problems/Resolutions and Future Needs

Problems and Resolutions

1. Equipment pick-up was difficult for some of the volunteers as the volunteer base is spread across the basin.
    a. The Green Bay Service Center was utilized in addition to the Oshkosh Service Center to help those closer to Green Bay. If pick-up didn't occur, the coordinator brought the supplies to the volunteer.
2. There were many samples that were flagged for having ice melted or no ice on their samples.
    a. DNR coordinator should remind volunteers to put multiple FULL bags of ice with their samples. More ice means there is less of a change for it to be flagged.
3. There were many DRP samples that were flagged for being analyzed past the 48-hour period.
    a. Volunteers were reminded to ship their samples the same day and at worst first thing in the morning after. If shipping the morning after, the sample needs to be placed in the refrigerator overnight. In some cases, the samples were received by the lab less than 24 hours after a sampling event and didn't get analyzed in time. In that case, the volunteers were not at fault for the error.
4. There were a few cases of sampling coolers not getting shipped back to the volunteers after sample analyses.
    a. Replacement coolers were ordered, and the volunteers were reminded to add their return shipping address on the index card prior to shipping the samples. The index card is the only way for the WSLH to know a return shipping address since the shipping labels are created by the DNR coordinator.
5. Collection dates started late into the month of May and got later as the season moved forward.
    a. Equipment should get out to volunteers no later than the first week of May. Also, there should be a strong emphasis by the DNR coordinator at the start of the sampling season and a reminder every month that sampling should be completed no later than the start of the third week in any given month.

6. Communication between the DNR coordinator and volunteers proved difficult at times. With coordinator not physically seeing the volunteers, email was relied on for communication. The DNR coordinator should utilize phone calls to communicate sampling events with the volunteers.
7. Samples, that were supposed to be duplicate samples, were taken on different days during the 2019 sampling season
    a. Instead of being duplicates, the points will be used as separate data points.

Future Needs

1. The program should start to sample nitrogen concentrations in the water, in addition to the phosphorus concentrations
2. The program should think about getting water monitoring meters (such as a YSI meter). The automatic meters would give more consistent data and more parameters that could help explain deviations in the data better
3. Program coordinator needs to make sure duplicate samples are taken every year at the correct frequency
4. Sampling should be conducted on the same day of every month. This will ensure that the samples are one-month apart and so they are collected in a reasonable time frame

Deliverables and Work Accomplished

- All but one sample were collected in 2019
    - Ashwaubenon Creek sample in May was not collected. Cited for dangerously high-water levels in stream
    - Samples, that were supposed to be duplicate samples, were collected from Kankapot Creek and Plum Creek
- Quarterly reports sent for each project quarter
- Outreach Events
    - Presentations/Meetings
        - Presentations were used for informational purposes. The DNR coordinator presented to the following groups to inform them of water quality issues in the area. They were not intended for volunteer recruitment.
            - 6/18/2019: Western Corridor Neighborhood Association
                - 7 people
            - 8/4/2019: Baird Creek Preservation Foundation
                - 3 people
            - 10/8/2019: Lower Fox Agricultural Committee
                - 10-12 people
            - 11/25/2019: Rotary Club of Green Bay
                - 30-35 people
    - Newsletters
        - Newsletter articles were written to expand the outreach range. They were used as volunteer recruitment notices. Several people have reached out to the DNR coordinator following the release of the following articles.
            - River Alliance of Wisconsin Blog Post
                - Reach unknown
                - Shared 24 times on Facebook
            - Fox-Wolf Watershed Alliance
                - 3221-person newsletter reach

        - Shared 16 times on Facebook
    - Times Villager Newspaper Article
        - Reach – Fox-Valley area households
    - Baird Creek Preservation Foundation Newsletter
        - Reach unknown
    - Trout Unlimited – Wisconsin Fall Issue Article
        - Reach unknown
- Outdoor Workshops
    - Outdoor workshops were used for both informational purposes and volunteer recruitment. Attendees were presented with background information (much like the PowerPoint presentations) and were then able to physically perform sampling in the stream. They were able to get hands-on experience with sampling protocol
        - 7/8/2019: Pamperin Park, Green Bay
            - 0 participants

Expenses Summary

Expense	Planned Budgeted	Actual Expenses	Balance (+/-)
Personnel/Salaries	$17,663.00		$17,663.00
Fringe Benefits	$3,974.17	$0.00	
Supplies and Shipping	$6,990.00	$962.23	$6,027.77
Travel	$1,172.00	$433.25	$738.75
Lab Services	$8,802.00	$8,944.00	($142.00)
Total Direct Charges	$38,601.17	$10,339.48	$28,261.69
Indirect (16.39% Salary + Fringe)	$6,869.13	$0.00	$6,869.13
Total Charges	$45,470.30	$10,339.48	$35,130.82

****NEED TO UPDATE PERSONNEL EXPENSE****

Explanation of Deviations

1. Personnel/Salaries
    a. *UPDATE*
2. Fringe benefits/indirect
    a. N/A
3. Supplies and Shipping
    a. No replacement supplies were needed for the 2019 season and no new equipment was purchased
    b. Shipping continued to utilize FedEx Business and reduced prices from ~$40 per shipment to ~$11. If future coordinators use the FedEx Business account established (Account Number 852 101 490), this price will remain. Melissa Lake and Emily Punke have access to this account.
4. Travel

   a. This is highly variable based on volunteer availability (drop off and pick up of equipment, missed sampling events) and outreach events
5. Lab Supplies
   a. There were 104 sampling events in 2018 at $86 (this include the DRP field filter kit) per sampling event.

Volunteer Recruitment

	2015	2016	2017	2018	2019
New	8	11	8	6	1
Returning		1	4	8	11

History of volunteers with the Lower Fox River Volunteer Monitoring Program

Volunteer recruitment is one aspect of the program that consistently needs to be carried out. The program should continue to recruit volunteers despite having a volunteer at every stream. It would be better to have multiple volunteers at each sampling location to learn with each other and help each other collect the samples. The more volunteers that are recruited, the more the message gets out in the community, which is the main goal of the program.

Program Conclusions

The main goal of the Lower Fox River Volunteer Monitoring Program is the engagement of the public and increasing their awareness on water quality issues. In total there have been 34 volunteers that have collected samples for the program since it started in 2015. However, several of the 34 volunteers were/are a part of larger organizations that are involved with the program, possibly making the volunteer contribution much higher. With the knowledge our past and present volunteers possess, they can teach other and be an extension of the program. Our volunteers can talk about their experiences and the things they have seen with others, which allows the information to be carried out to even more individuals in the basin.

Volunteer recruitment has been carried out in several ways throughout the project. Two main contributions to volunteer recruitment have been newsletter articles and presenting for larger organizations. Newsletter articles allowed the DNR to recruit volunteers on a bigger platform. The articles reached a bigger audience and many contacts have been made to the DNR following the release of different articles. Presentations were also a key contributor to spreading awareness of water quality issues. PowerPoint presentations provided information to the public and individuals that may not realize the impact of water quality on everyday life. The presentations were very well received, and many people commented on how the information opened their eyes to the issue we are seeing in the Lower Fox River Basin.

The use of volunteers has proved important for success. However, with as much positive there is within the program, there are some problems that have occurred. Many of the problems are because so many people are involved within the program. Communication proves to be the most important aspect of the DNR coordinator's position. The coordinator is the liaison between the volunteers and other DNR staff that are involved within the program. Without proper communication, some aspects of the program can potentially be impacted.

Data

2018

- Although there are no water quality standards for DRP, of the 101 samples collected in 2018, 77 samples (76%) had 50% or more of their total phosphorus concentrations from DRP.
- 11.88% of TP samples collected in 2018 were below the 0.075 mg/L water quality criteria for streams. For reference 12.35% of samples in 2017, 7.04% of samples in 2016, and 1.56% of samples in 2015 were below this limit. 8.8% of all samples collected in 2015-2018 have been below 0.075 mg/L.
    - This does not consider variations in temperature, precipitation, or best management practices.

2019

- Although there are no water quality standards for DRP, of the 101 samples collected in 2019, 76 samples (75.2%) had 50% or more of their total phosphorus concentrations from DRP.
- 11.88% of TP samples collected in 2019 were below the 0.075 mg/L water quality criteria for streams. For reference 11.88% of samples in 2018, 12.35% of samples in 2017, 7.04% of samples in 2016, and 1.56% of samples in 2015 were below this limit. 8.8% of all samples collected in 2015-2018 have been below 0.075 mg/L.
    - This does not consider variations in temperature, precipitation, or best management practices.

Wisconsin Listing Methodology

Data for total phosphorus was compared to Wisconsin's TP criteria by calculating the median and the upper and lower 90% confidence intervals. This was then compared to the 0.075 mg/L water quality criteria to determine the confidence level (Figure 1) of data sets for each site between 2015 and 2018. Median, upper 90%, and lower 90% confidence values were calculated for each stream using all data points across all years.

Based on the confidence values given (Appendix C), there was 1 stream (Lancaster Creek – 2019) that was listed as "Clearly Meets" the 0.75 mg/L water quality criteria limit while one site (Neenah Slough – 2018) "May Meet" the water quality criteria. In addition, there were 4 streams on 9 different occasions (Garner's Creek (2018), Mud Creek (2019, 2018), Neenah Slough (2017, 2015), and Lancaster Creek

(2018, 2017, 2016, 2015)) where the site "May Exceed" the water quality criteria, while every other stream in all other years "Clearly Exceed" the TP water quality criteria.

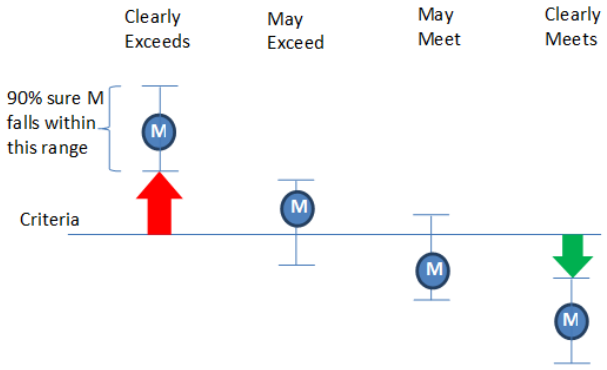


Figure 1: Wisconsin TP criteria confidence table. Criteria line indicates the 0.075 mg/L water quality criteria limit and M represents the Median value.

Total Phosphorus Analysis by monitoring station

The Lower Fox River basin is broken up into 20 HUC-12 watersheds (Appendix A). All 17 monitoring sites are contained within 12 of the 20 HUC-12 watersheds. Table 2 breaks down the average TP value for each monitoring station and Table 3 breaks down the median TP value for each monitoring station.

Red values in each table represent years that had less than 100% sample collection at that location for the sampling season of May-October. If sample collection was less than 100% at a given location in a given year, the median and average values were still calculated. The value in those years may not be a proper representation of the median and average TP values at that stream location for the specific year. Percent completion of sampling for each year can be seen in Table 1.

Trends and Analysis for 2015-2019

- Apart from Lancaster Creek (our reference stream), yearly median concentrations from 2015-2019 show every location is and was above Administrative Code NR 102 TP standard of 0.075 mg/L.

Table 1: Lower Fox River monitoring station breakdown (Percent completeness by year)

Sample Collection Completeness (%) - Out of 6 samples per year					
Station Name	2019	2018	2017	2016	2015
Apple Creek	100%	83.3%	100%	100%	100%
Ashwaubenon Creek	83.3%	100%	100%	100%	100%
Baird Creek	100%	100%	100%	83.3%	100%
Bower Creek	100%	100%	83.3%	66.67%	100%
Dutchman Creek	100%	100%	83.3%	33.3%	33.3%
Garner Creek	100%	100%	100%	83.3%	100%
Kankapot Creek	100%	100%	100%	83.3%	100%
Lower Duck Creek	100%	100%	100%	100%	100%
East River @ HLT	100%	100%	100%	100%	0%
Mid Duck Creek	100%	100%			
East River @ HWY G	100%	100%	100%	100%	100%
Mud Creek	100%	100%	100%	100%	33.3%
Neenah Slough	100%	100%	100%	100%	100%
Plum Creek	100%	100%	100%	100%	100%
Upper Duck Creek	100%	100%			
Upper East River	100%	100%			
Lancaster Creek (reference)	100%	100%	100%	100%	50%
Combined Percentage	99.02%	99.02%	97.61%	89.28%	79.76%

Table 2: Lower Fox River monitoring station breakdown (Average TP)

Red Values indicated years with missing samples

Average					
Station Name	2019	2018	2017	2016	2015
Apple Creek	0.2573	0.1894	0.5763	0.3611	0.2564
Ashwaubenon Creek	0.47225	0.3045	0.3467	0.3922	0.3218
Baird Creek	0.4726	0.335	0.303	0.1618	0.238
Bower Creek	0.3498	0.2696	0.3132	0.2428	0.2188
Dutchman Creek	0.2982	0.2102	0.1569	0.1165	0.4265
Garner Creek	0.125	0.0967	0.1242	0.1222	0.2046
Kankapot Creek	0.32925	0.4103	0.5173	0.2926	0.4264
Lower Duck Creek	0.17524	0.124	0.137	0.1435	0.1363
Lower East River	0.20018	0.3197	0.3242	0.3902	
Mid Duck Creek	0.1988	0.1673			
Mid East River	0.4092	0.3546	0.3242	0.3902	0.5206
Mud Creek	0.09754	0.0967	0.1027	0.1042	0.1135
Neenah Slough	0.21504	0.101533	0.0935	0.157167	0.085867
Plum Creek	0.3725	0.5018	0.7312	0.5865	0.1476
Upper Duck Creek	0.1486	0.2823			
Upper East River	0.4744	0.424333			
Lancaster Creek (reference)	0.06326	0.1015	0.0935	0.1572	0.0837

Table 3: Lower Fox River monitoring station breakdown (Median TP)

Red Values indicate years with missing samples

Median					
Station Name	2019	2018	2017	2016	2015
Apple Creek	0.2645	0.168	0.331	0.2965	0.2522
Ashwaubenon Creek	0.4305	0.301	0.321	0.316	0.2833
Baird Creek	0.51	0.289	0.317	0.156	0.249
Bower Creek	0.367	0.3225	0.318	0.2285	0.1985
Dutchman Creek	0.363	0.1405	0.127	0.1165	0.4265
Garner Creek	0.143	0.1	0.1285	0.131	0.1385
Kankapot Creek	0.3545	0.4015	0.4845	0.292	0.3653
Upper Duck Creek	0.136	0.2465			
Lower Duck Creek	0.192	0.1058	0.0993	0.1418	0.122
Lower East River	0.182	0.321	0.3125	0.347	No Data
Mid Duck Creek	0.173	0.158			
Mid East River	0.394	0.357	0.3125	0.347	0.453
Mud Creek	0.101	0.0975	0.0883	0.0978	0.1135
Neenah Slough	0.118	0.07645	0.09065	0.112	0.07725
Plum Creek	0.4005	0.4415	0.532	0.4805	0.1458
Upper East River	0.454	0.4779			
Lancaster Creek (reference)	0.0621	0.0764	0.0907	0.112	0.0773

Table 4: DRP Percentage of TP

DRP % of TP																	
	Apple Creek	Ashwaubenon Creek	Baird Creek	Bower Creek	Lower Duck Creek	Dutchman's Creek	East River @ HLT	East River @ HWY G	Garner's Creek	Kankapot Creek	Mud Creek	Neenah Slough	Plum Creek	Upper East River	Upper Duck Creek	Mid Duck Creek	Lancaster Creek
May-15	63.04%	47.91%	73.24%	69.30%	47.14%	15.34%		69.01%	31.49%	53.49%	30.19%	42.79%	45.81%				33.64%
Jun-15	67.16%	50.80%	68.14%	77.54%	44.90%			62.76%	40.14%	57.94%	47.82%	29.78%	22.56%				49.88%
Jul-15	76.27%	64.83%	57.37%	24.16%	53.14%	63.07%		79.14%	6.50%	67.24%		42.35%	7.43%				49.61%
Aug-15	72.30%	56.64%	66.30%	56.19%	60.25%			76.09%	19.19%	62.54%		75.51%	4.17%				
Sep-15	69.85%	48.84%	72.87%	50.70%	69.81%			75.28%	4.58%	61.84%		54.82%	19.00%				
Oct-15	0.00%			95.39%	48.19%			70.91%	29.05%	58.00%		65.70%	44.75%				
May-16	37.25%	56.67%	46.59%	52.46%	28.38%	29.72%	20.15%	53.09%	40.31%	45.50%	33.33%	40.88%					21.50%
Jun-16	54.68%	64.41%	55.53%	59.92%	56.48%		55.03%	74.17%		57.14%	54.35%	63.35%					48.58%
Jul-16	63.64%	74.40%	62.97%	75.52%	71.58%		74.06%	84.78%	45.11%	61.30%	65.24%	70.56%					45.40%
Aug-16	68.92%	39.77%	61.11%	59.50%	47.42%	39.29%	29.65%	83.42%	26.83%	43.97%	51.09%	61.24%	14.70%				25.44%
Sep-16	35.74%	58.90%			69.65%		64.12%	58.30%	2.35%		32.53%	57.91%	75.45%				52.86%
Oct-16	75.18%	71.68%	72.41%		76.85%		43.54%	59.44%	35.22%	58.36%	64.73%	68.12%	86.23%				42.01%
May-17	42.60%	61.42%	69.61%	34.89%	35.73%	41.56%	37.35%	44.82%	26.78%	58.15%	42.11%	15.50%	69.48%				61.75%
Jun-17	19.34%	72.40%	61.83%	72.01%	62.69%	73.06%	47.44%	54.51%	36.12%	52.91%	64.71%	62.77%	65.82%				39.91%
Jul-17	72.75%	74.23%	61.33%	69.54%	65.22%		57.82%	41.05%	57.79%	58.81%	51.72%	60.15%	76.96%				46.41%
Aug-17	59.06%	34.80%	72.31%		65.72%	44.51%	81.63%	63.56%	48.56%	63.95%	48.33%	46.86%	48.17%				60.19%
Sep-17	60.87%	79.92%	79.70%	65.41%	65.26%	78.07%	30.65%	80.28%	55.88%	75.50%	57.27%	42.79%	82.69%				52.99%
Oct-17	78.03%	80.47%	73.72%	8.22%	57.47%	81.10%	34.78%	87.20%	59.34%	75.74%	58.12%	47.04%	76.10%				53.37%
May-18	51.25%	71.13%	68.70%	47.90%	30.90%	44.42%	59.79%	66.67%	23.85%	70.02%	27.99%	62.63%	59.77%	76.16%	51.67%	55.89%	47.36%
Jun-18	68.44%	34.81%	55.50%	67.44%	60.50%	66.43%	56.12%	77.05%	38.97%	67.15%	59.11%	68.86%	69.73%	33.66%	35.38%	74.42%	55.56%
Jul-18	82.76%	77.11%	43.68%	69.01%	60.75%	24.73%	29.29%	79.62%	45.42%	72.51%	67.32%	58.47%	60.30%	27.67%	63.38%	77.68%	63.92%
Aug-18		27.76%	71.66%	53.37%	30.07%	57.67%	5.03%	65.52%	62.95%	66.08%	59.83%	1.85%	74.60%	84.63%	68.90%	78.97%	19.82%
Sep-18	49.25%	64.40%	85.77%	76.49%	71.40%	81.09%	31.14%	84.51%	62.77%	68.49%	63.71%	62.80%	83.52%	74.46%	66.39%	77.08%	48.80%
Oct-18	49.35%	89.62%	65.33%	62.24%	78.43%	75.09%	45.60%	67.30%	61.87%	58.65%	47.19%	64.25%	71.73%	70.92%	64.79%	79.02%	58.99%
May-19	47.39%		48.10%	54.20%	44.88%	67.77%	63.48%	52.17%	11.87%	67.12%	22.68%	48.23%	58.70%	65.26%	54.79%	55.23%	33.33%
Jun-19	46.95%	77.32%	67.13%	66.44%	48.33%	69.39%	45.60%	59.28%	27.34%	43.19%	23.44%	53.82%	75.73%	69.25%	58.72%	42.07%	75.35%
Jul-19	82.02%	64.71%	72.14%	63.54%	80.17%	72.22%	57.69%	88.58%	44.57%	70.05%	64.20%	86.44%	77.70%	87.37%	80.70%	72.87%	68.06%
Aug-19	47.22%	81.70%	53.73%	48.50%	57.12%	49.38%	12.59%	74.05%	23.36%	63.73%	63.96%	68.95%	67.76%	77.75%	77.21%	90.17%	49.54%
Sep-19	68.86%	69.65%	76.75%	70.18%	72.86%	81.09%	50.92%	77.19%	42.45%	65.80%	37.52%	62.39%	77.82%	71.20%	66.54%	74.48%	58.64%
Oct-19	71.43%	71.34%	62.45%	48.50%	72.78%	68.28%	60.38%	61.34%	46.57%	59.33%	62.05%	64.73%	54.88%	61.34%	55.31%	77.68%	82.04%

Data Conclusions

The data collected continues to make a strong case for the establishment of best management practices in each watershed. Since 2015, every stream but Lancaster Creek (our reference stream), based on their yearly median concentrations, has exceeded the 0.075 mg/L water quality criteria set in Wisconsin Administrative Code NR 102.

At this moment in time, there is not enough data to see a definitive trend in our streams. The program is still young, and trends will change throughout its existence, especially when best management practices and implementation start to grab ahold and improve the water quality in given watersheds. Raw data shows that variations in weather patterns, temperature, and time of year has an impact on the TP, DRP, and TSS concentrations. These are additional reasons definitive conclusions cannot be made at this time. It is also noteworthy that TSS concentrations are not mirroring TP-DRP concentrations at this point of the project.

Dissolved phosphorus was a higher fraction of total phosphorus than expected. 76% of samples collected in 2019 had 50% or more of total phosphorus come from the dissolved form. The dissolved form of phosphorus is readily available for plant uptake and contribute to algal blooms. What does this mean for TMDL implementation? What are the sources of DRP; is it a sign of a higher input of phosphorus through agricultural tiling? What kind of BMPs can/should be implemented to reduce dissolved phosphorus? It would be interesting to explore agricultural tiling in each watershed and if there is any correlation to dissolved phosphorus levels. Do point source dischargers contribute to dissolved P?

Throughout the entirety of the project, there have been many TSS samples that have been reported no detects (ND) or less than 4 mg/L, which is highly unexpected in the streams that we sample. At this time, it is unknown what is causing such low TSS concentrations, but further inquiries are being made. Many low concentrations are occurring in the Autumn months of September and October. Cooler weather and cooler water temperatures may be contributing to the low TSS concentrations being reported.

Given the consistently high levels of phosphorus, and unexpected levels of dissolved reactive phosphorus, it is recommended to continue this program at its current capacity.

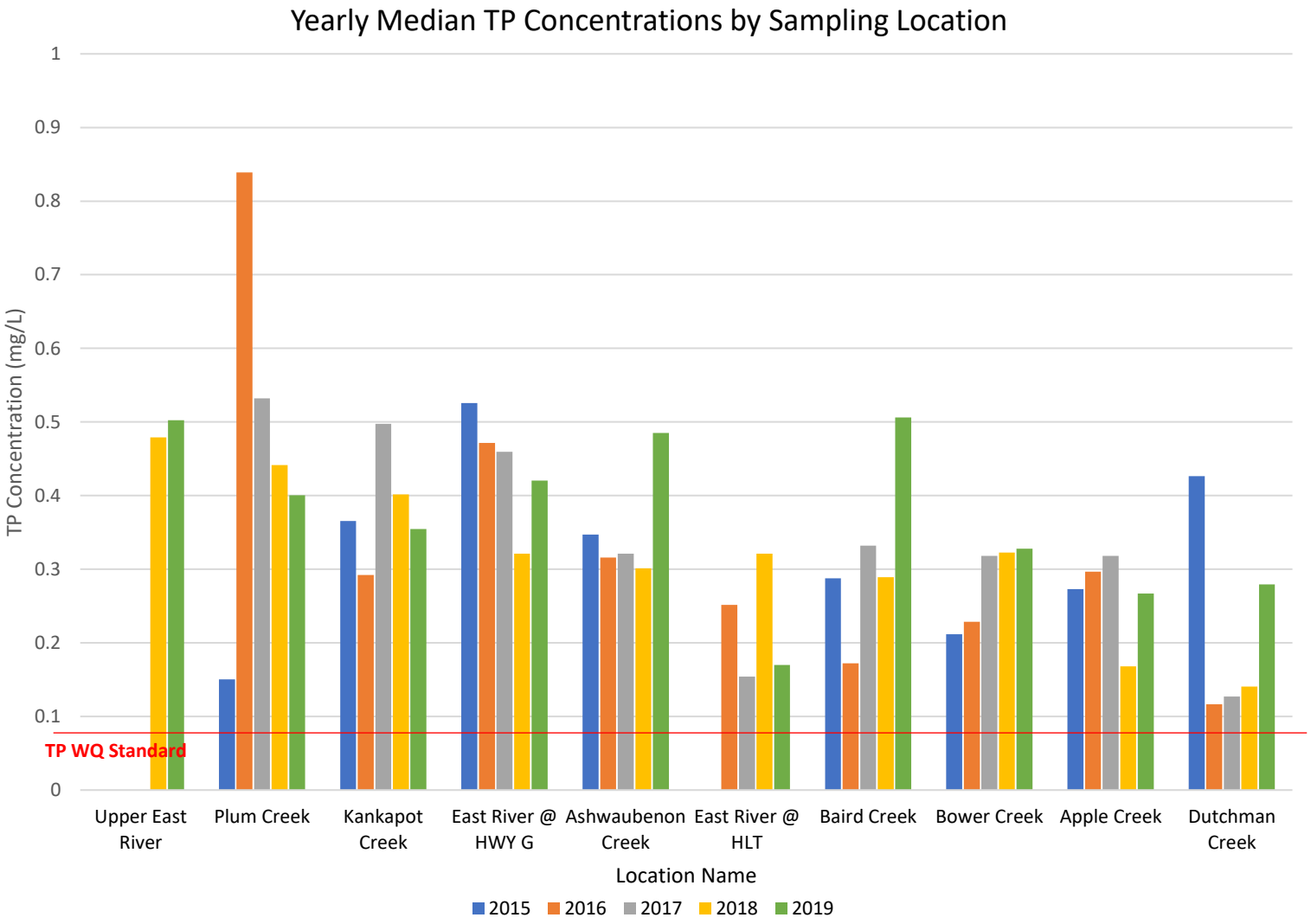
Future of the program

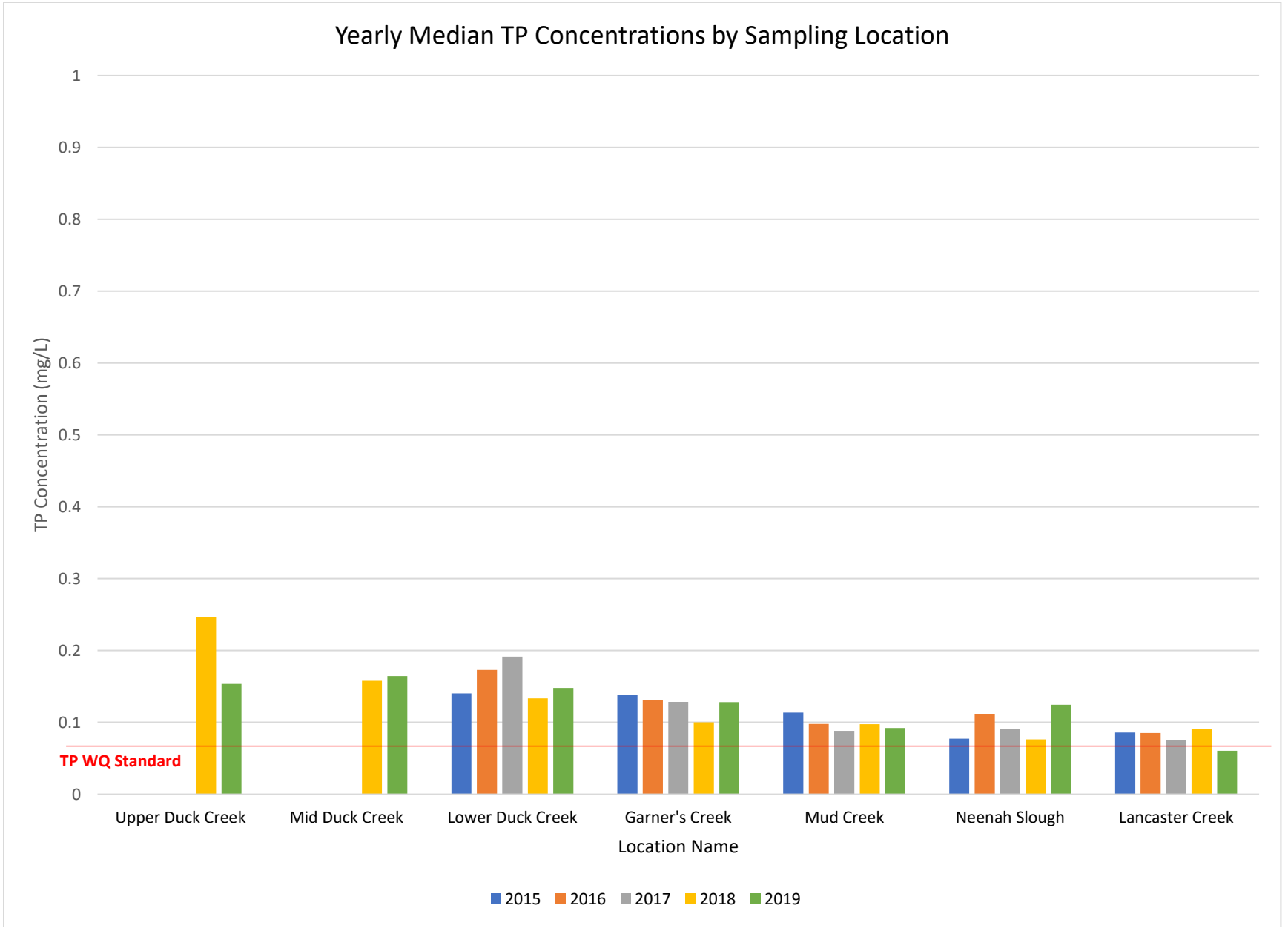
Acknowledgements

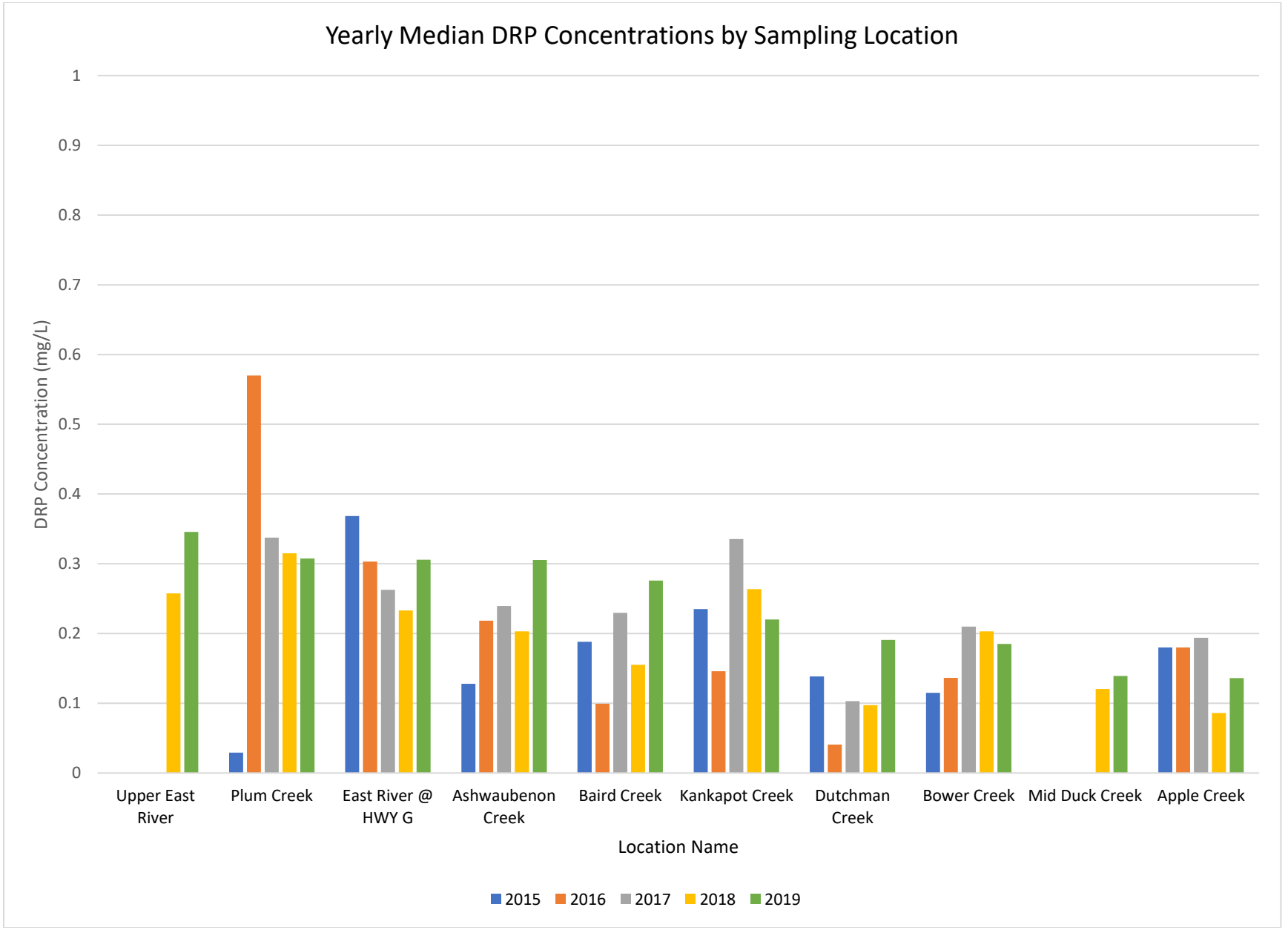
Thank you to all the volunteers that we have had present and past that have made the Lower Fox River Volunteer Monitoring Program possible. Thank you to the EPA, the Office of Great Waters, and the Wisconsin DNR for funding and support.

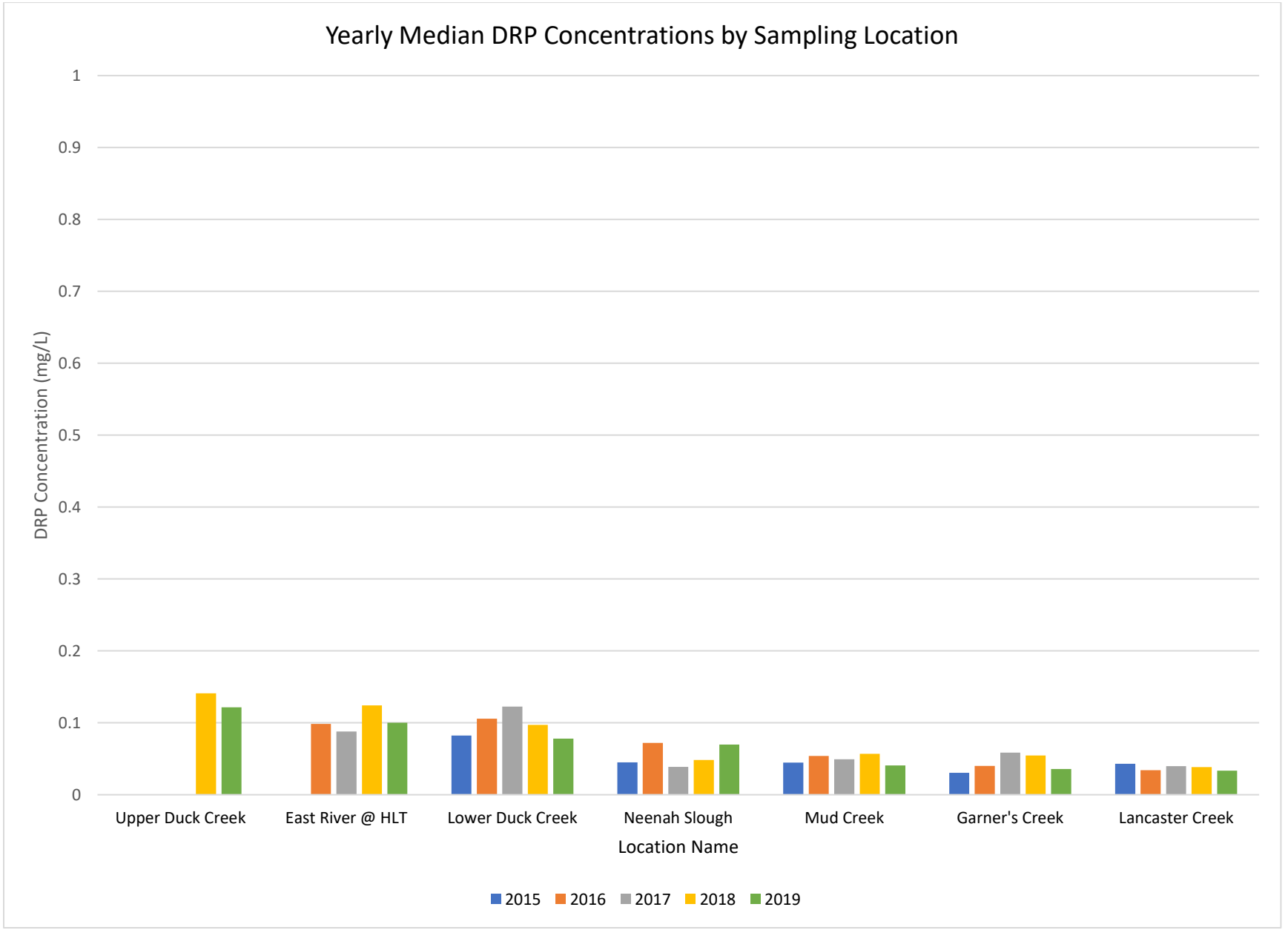
Watershed Trends

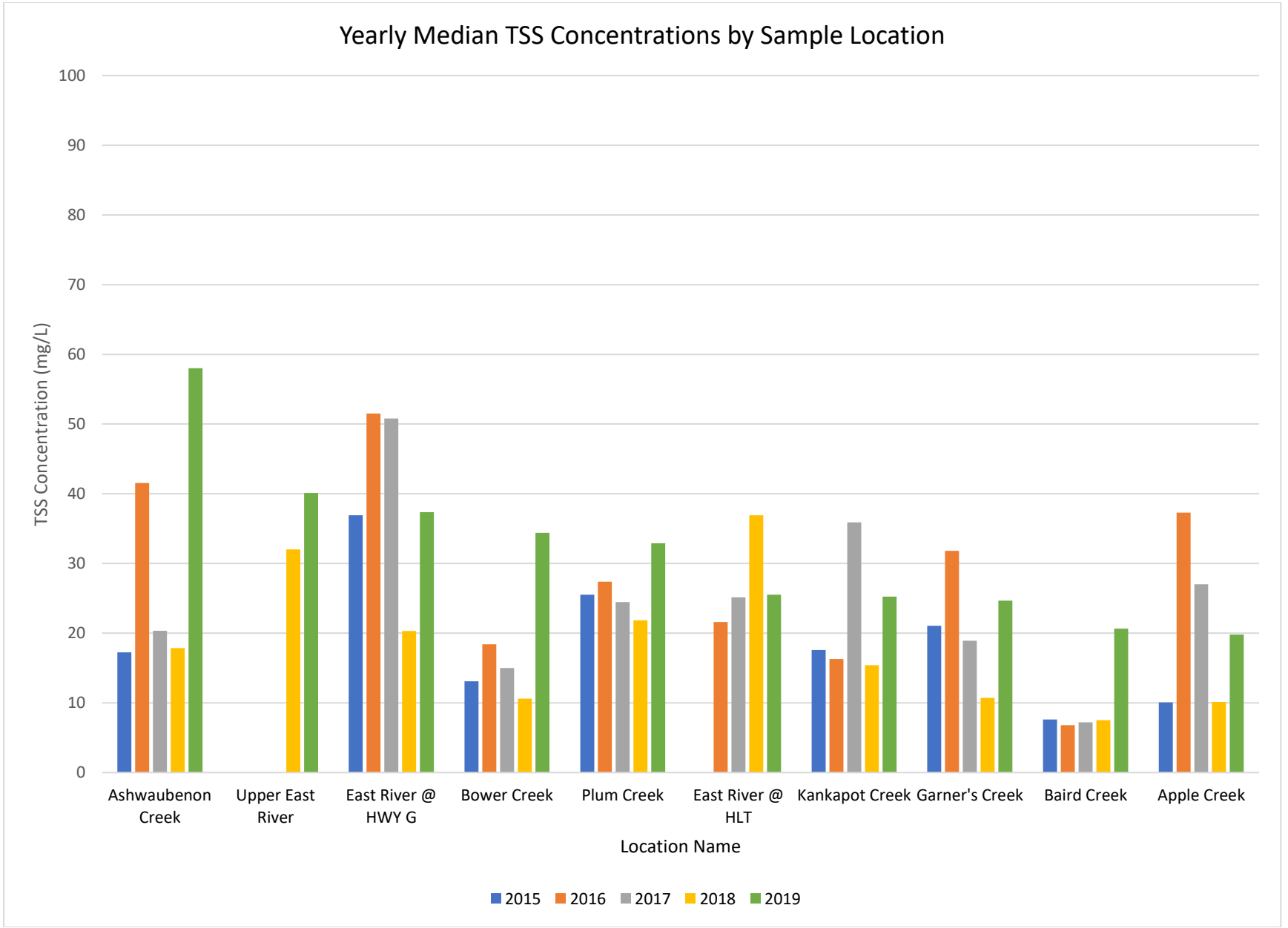
All Sites

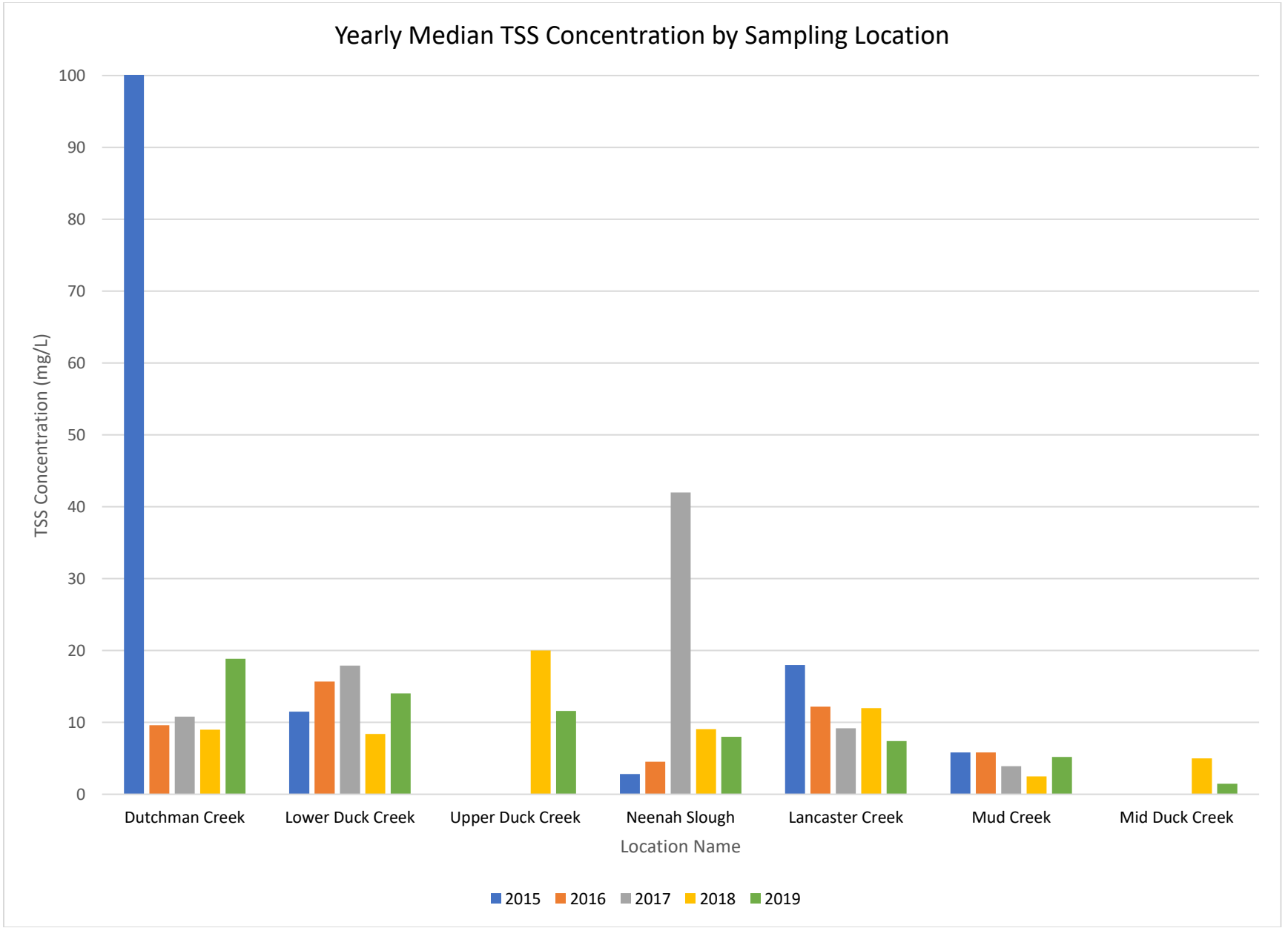



Yearly Median TP Concentrations by Sampling Location
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
TP Concentration (mg/L)
TP WQ Standard
Upper Duck Creek
Mid Duck Creek
Lower Duck Creek
Garner's Creek
Mud Creek
Neenah Slough
Lancaster Creek
Location Name
2015
2016
2017
2018
2019

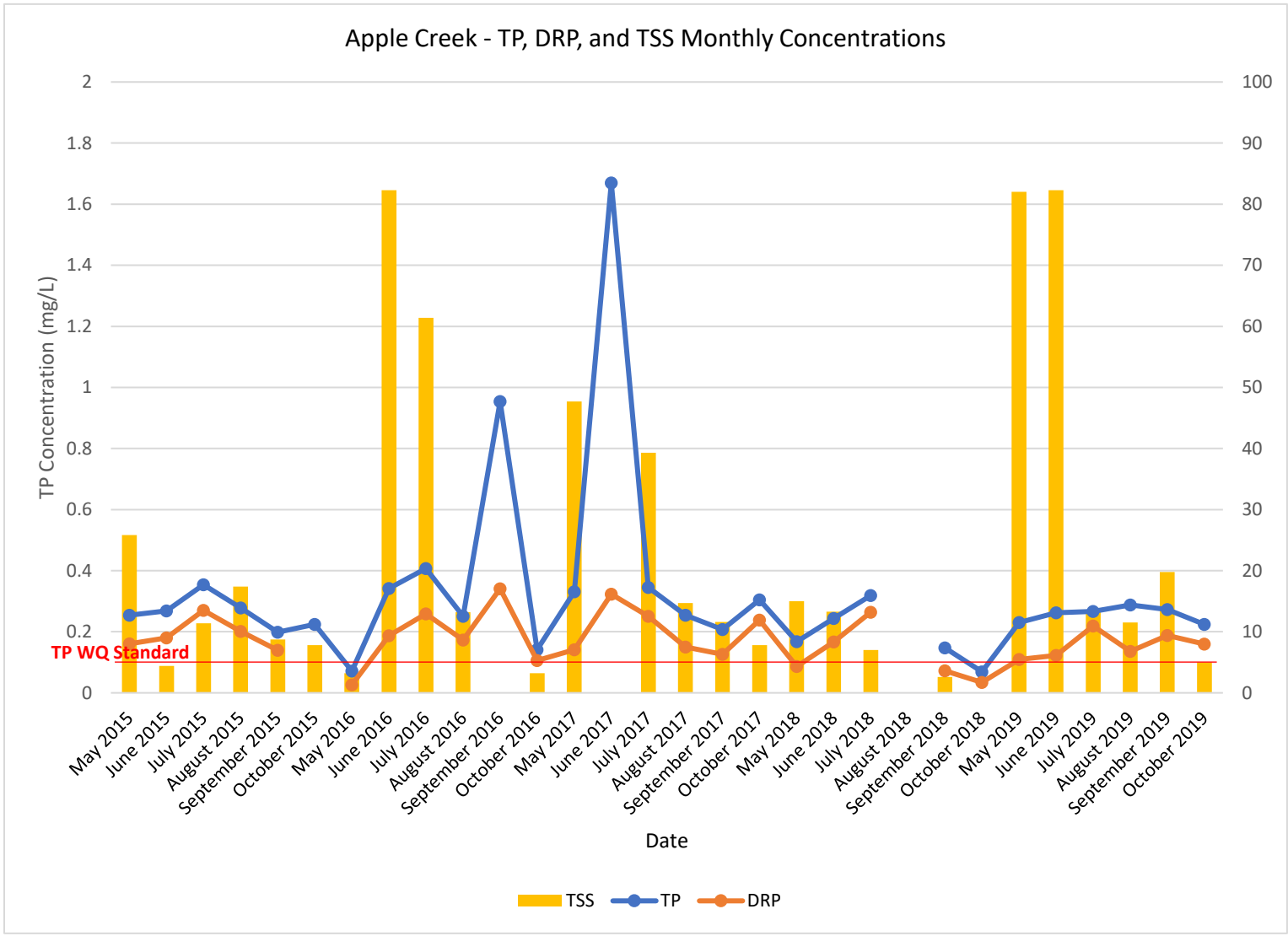

Yearly Median DRP Concentrations by Sampling Location
DRP Concentration (mg/L)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Upper East River
Plum Creek
East River @ HWY G
Ashwaubenon Creek
Baird Creek
Kankapot Creek
Dutchman Creek
Bower Creek
Mid Duck Creek
Apple Creek
Location Name
2015
2016
2017
2018
2019


Yearly Median DRP Concentrations by Sampling Location
DRP Concentration (mg/L)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Upper Duck Creek
East River @ HLT
Lower Duck Creek
Neenah Slough
Mud Creek
Garner's Creek
Lancaster Creek
Location Name
2015
2016
2017
2018
2019


Yearly Median TSS Concentrations by Sample Location
100
90
80
70
60
50
40
30
20
10
0
TSS Concentration (mg/L)
Ashwaubenon Creek
Upper East River
East River @ HWY G
Bower Creek
Plum Creek
East River @ HLT
Kankapot Creek
Garner's Creek
Baird Creek
Apple Creek
Location Name
2015
2016
2017
2018
2019

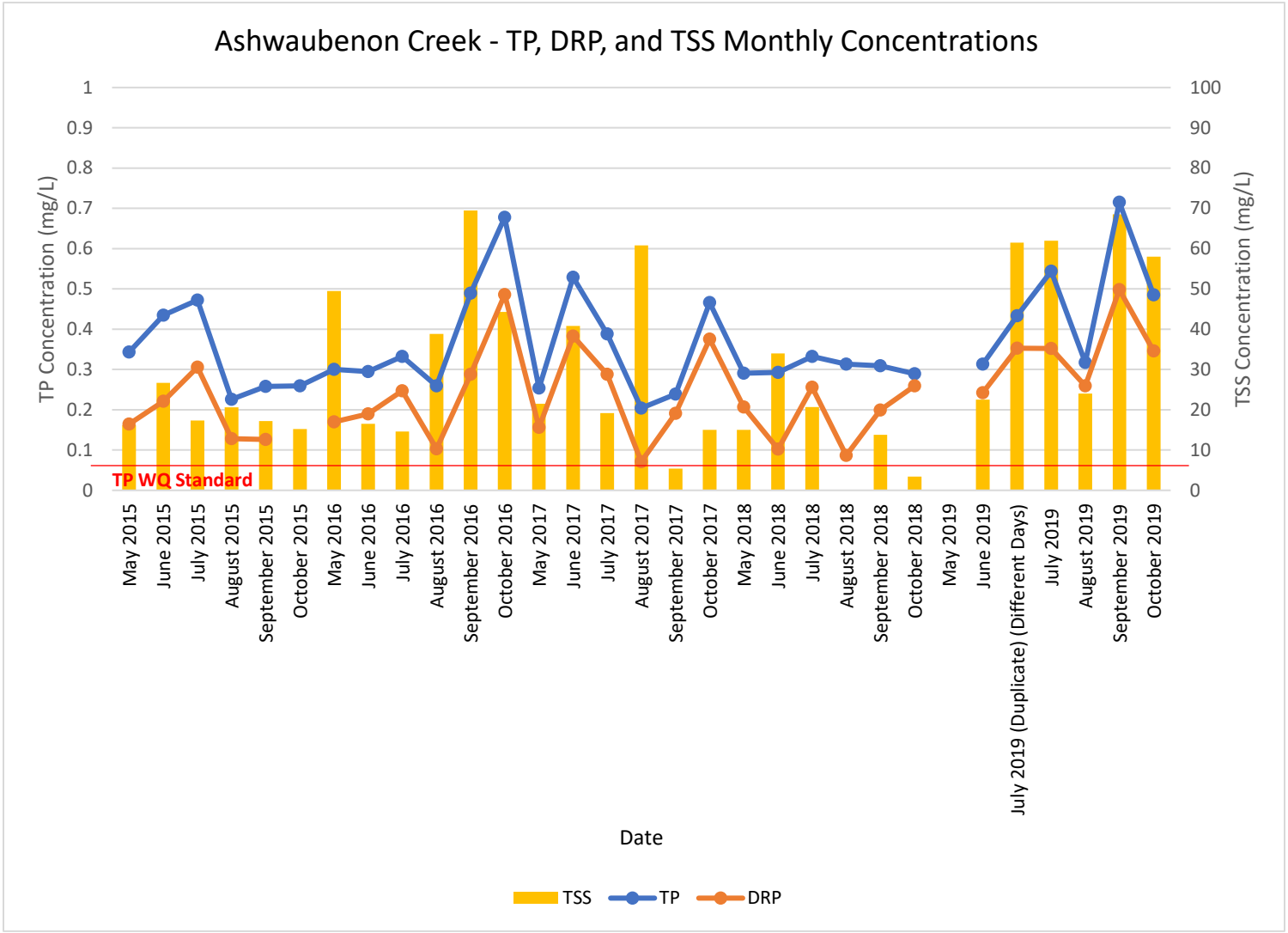

Yearly Median TSS Concentration by Sampling Location
TSS Concentration (mg/L)
100
90
80
70
60
50
40
30
20
10
0
Dutchman Creek
Lower Duck Creek
Upper Duck Creek
Neenah Slough
Lancaster Creek
Mud Creek
Mid Duck Creek
Location Name
2015
2016
2017
2018
2019

Apple Creek



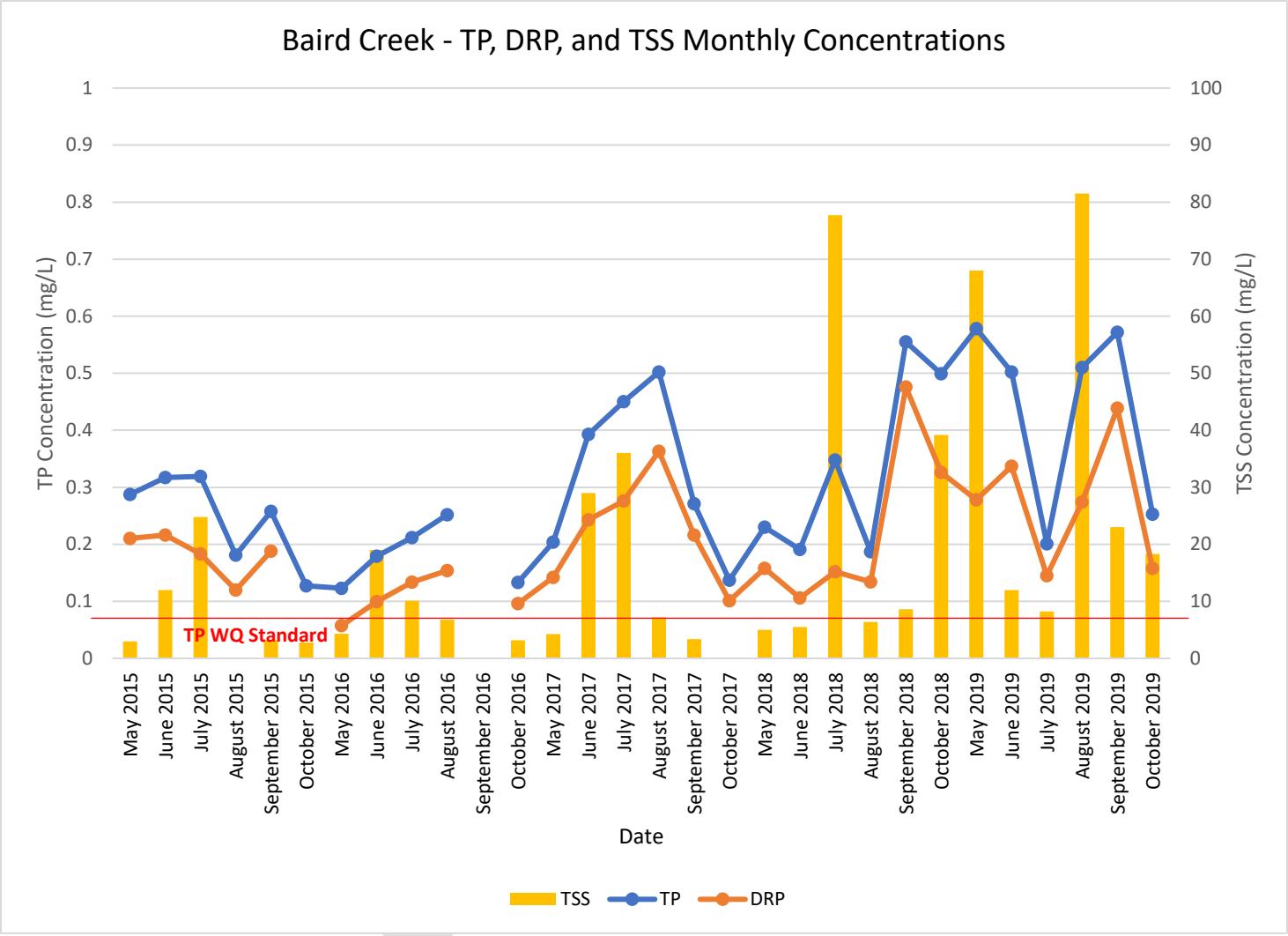
Apple Creek: TSS concentrations were below the LOD in September 2016 and June 2017, which appear as no data on the graph. There was a sample missed, which resulted in no data, on August 2018

Ashwaubenon Creek



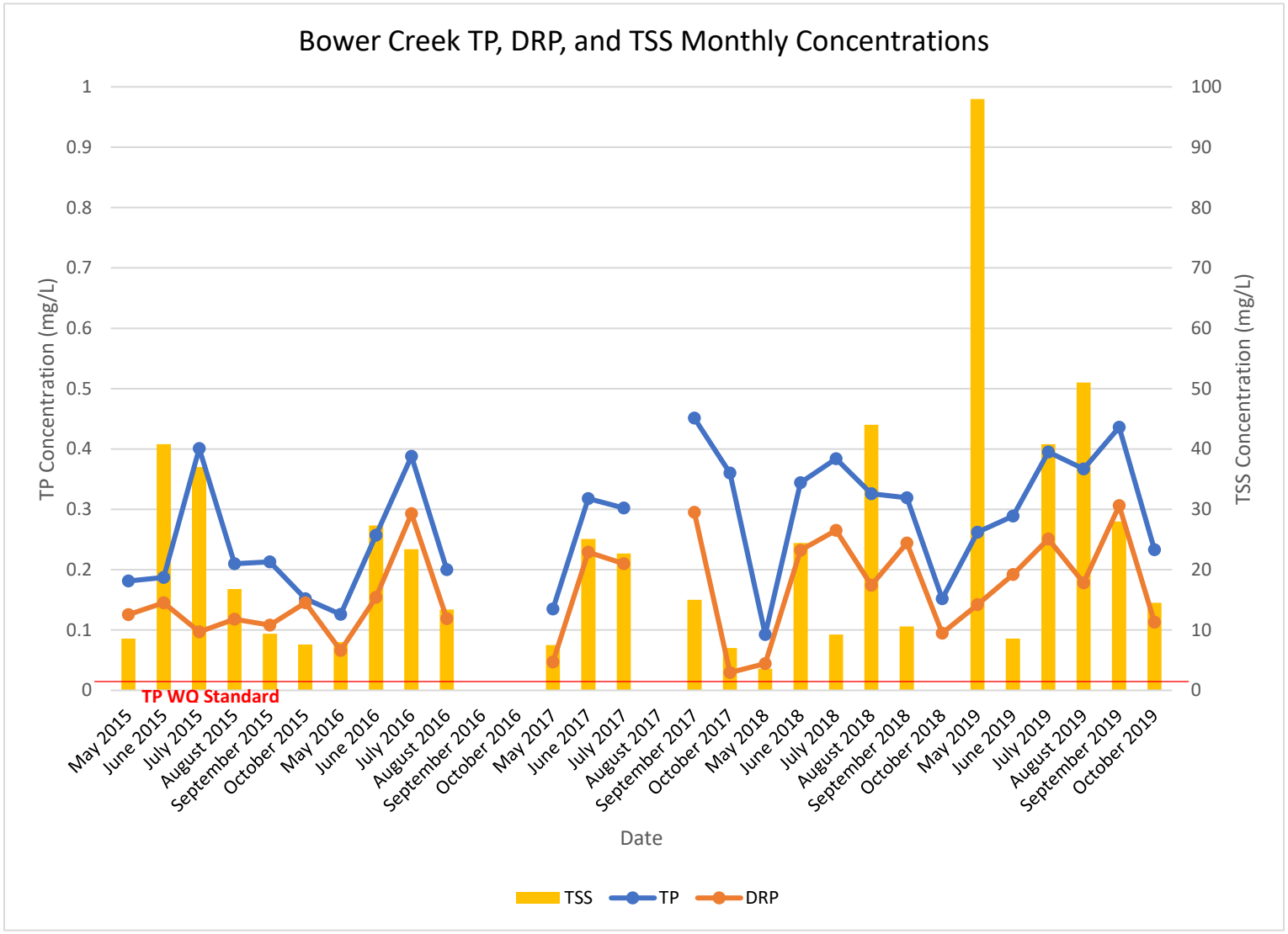
Ashwaubenon Creek: TSS concentrations were below the LOD in August 2018, which appear as no data on the graph. DRP was below the LOD in October 2015. There was a sample missed, which resulted in no data, in May 2019

Baird Creek



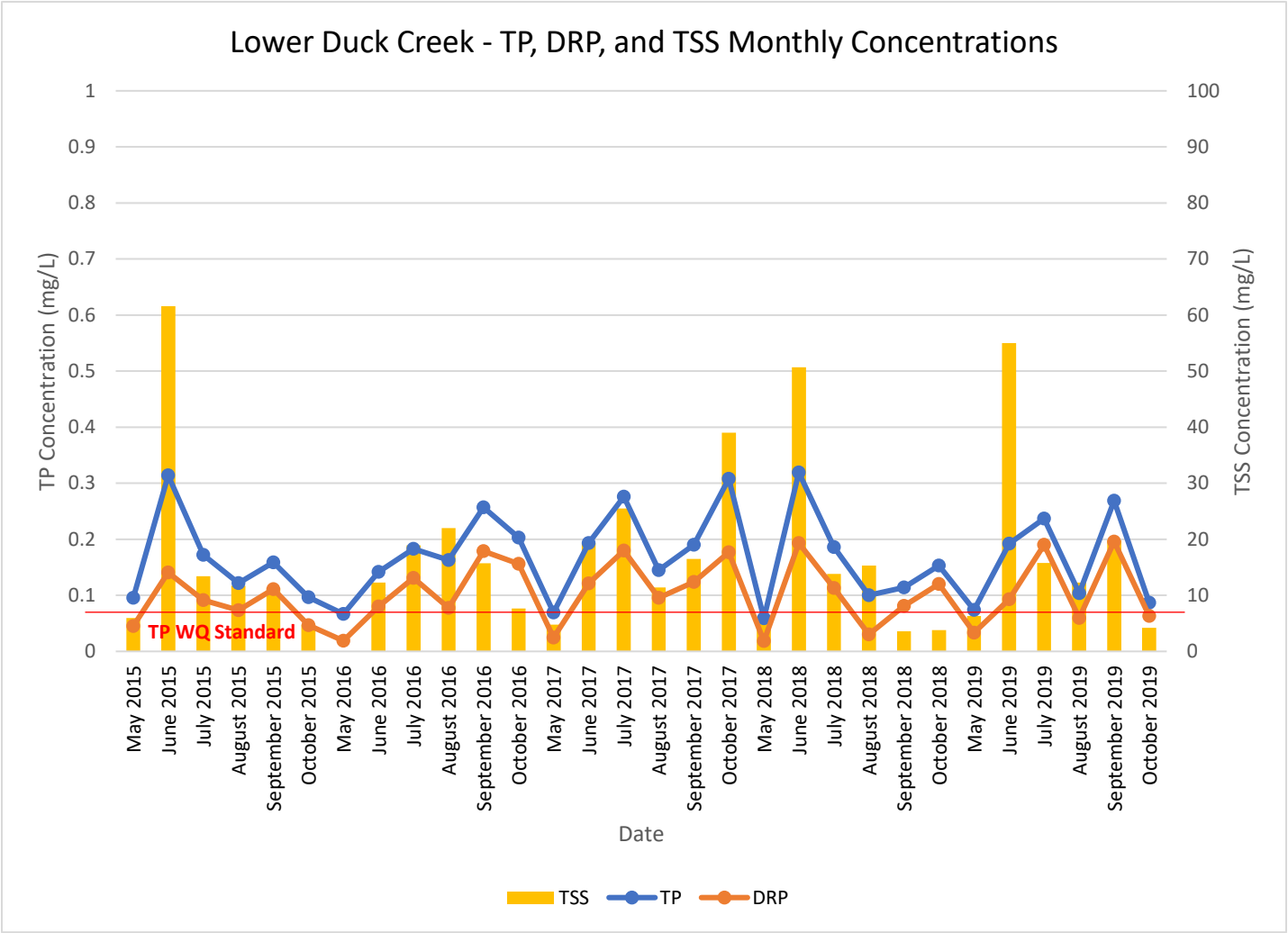
Baird Creek: TSS concentrations were below the LOD in August 2015 and October 2017, which appears as no data on the graph. DRP was below the LOD in October 2015. There was a sample missed in September 2016, which resulted in no data.

Bower Creek

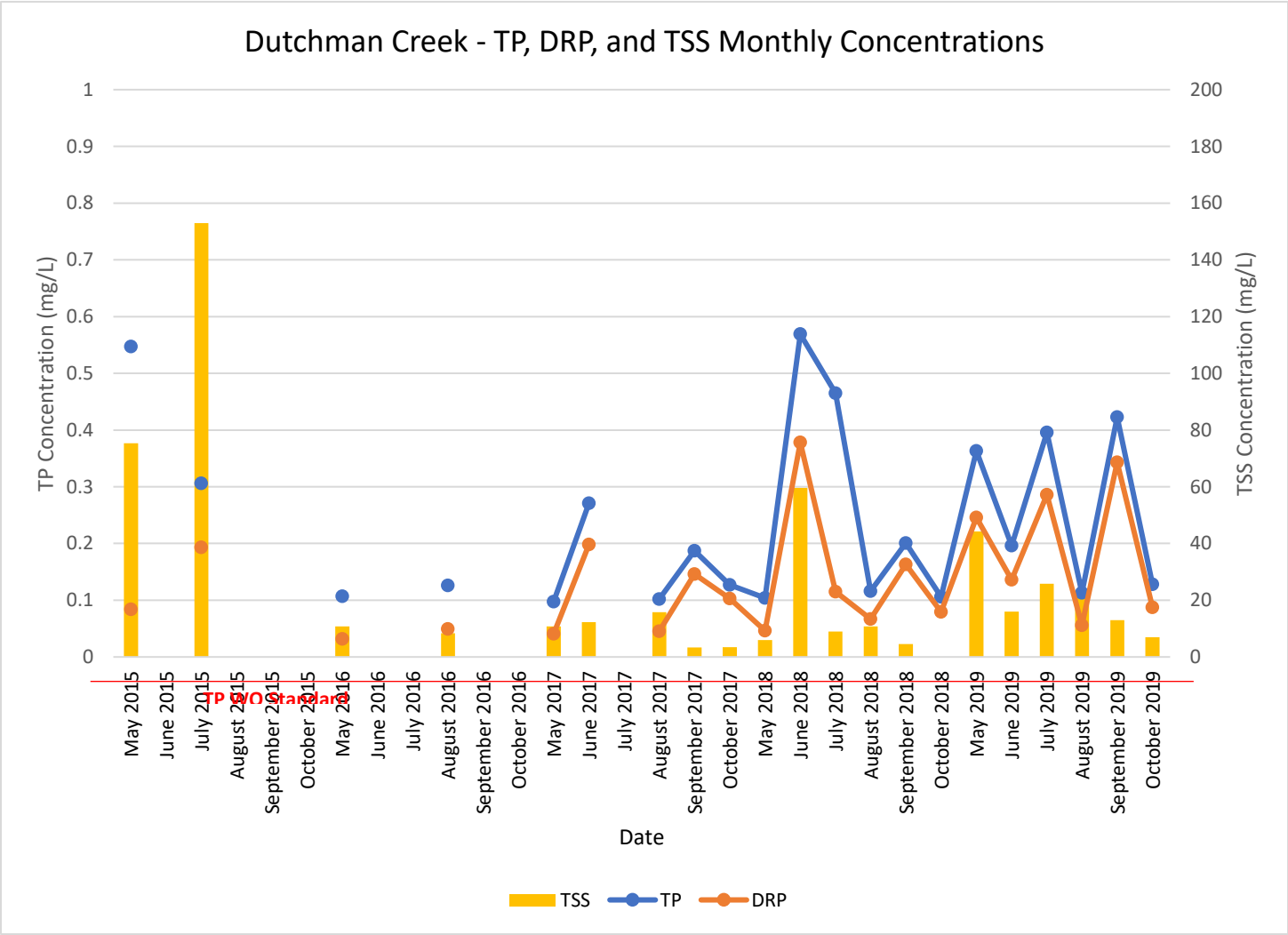


Bower Creek: TSS concentration was below the LOD in October 2018. There were missing samples, which resulted in no data, in September 2016, October 2016, and August 2017

Lower Duck Creek

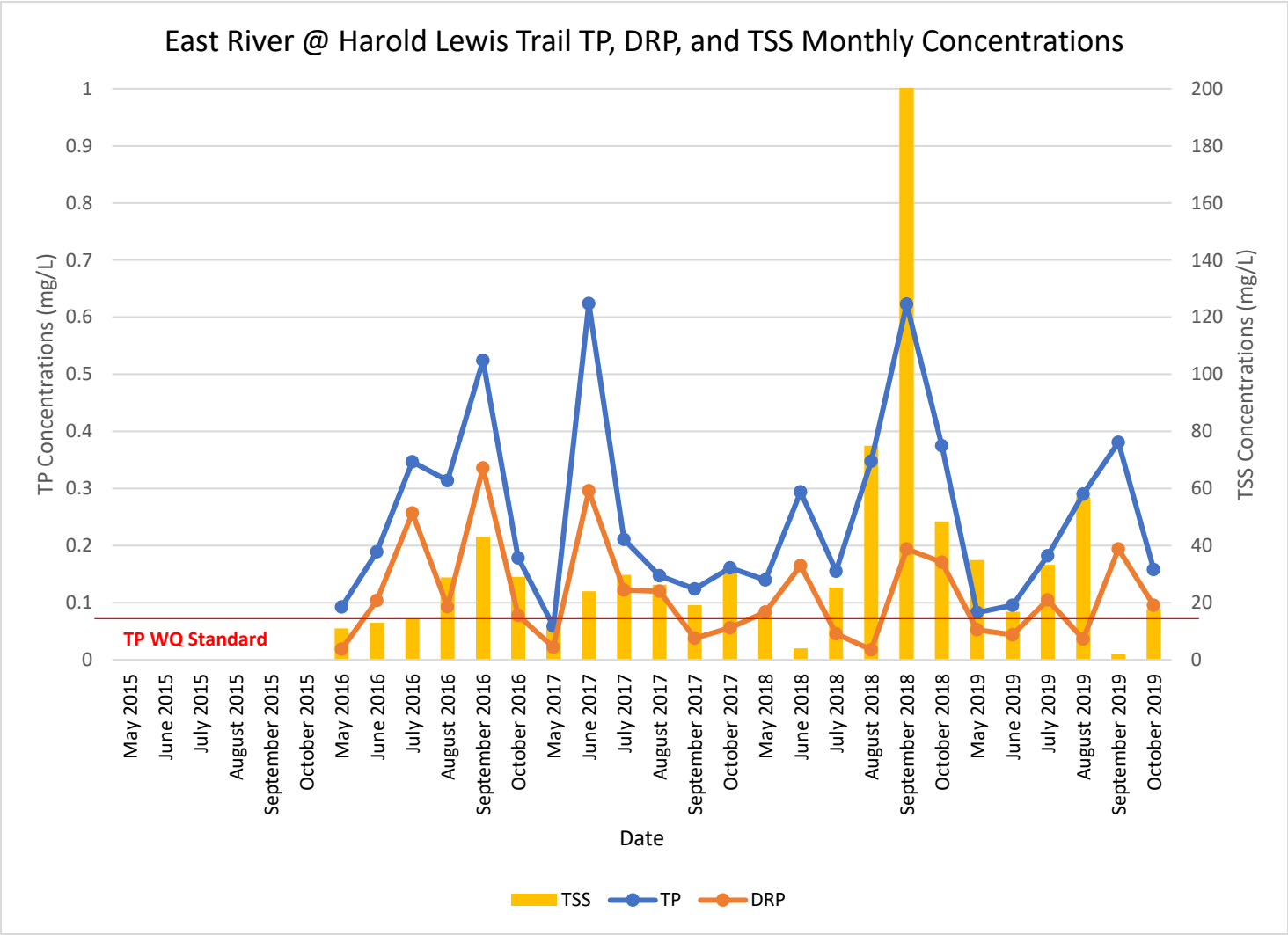


Dutchman Creek



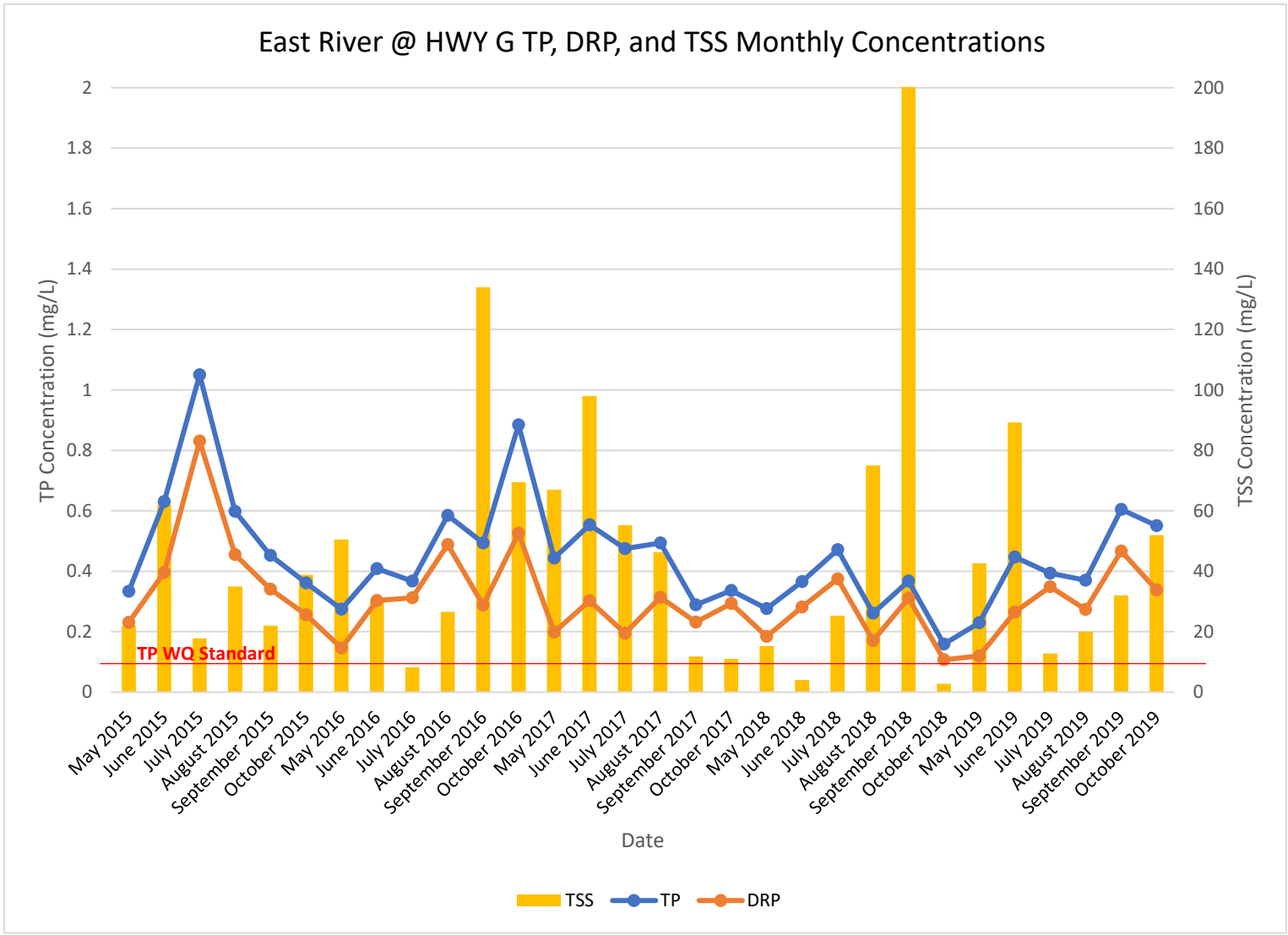
Dutchman Creek: TSS concentration was below the LOD in October 2018, which appears as no data. There were missing samples, which resulted in no data, in June 2015, August 2015, September 2015, October 2015, June 2016, July 2016, September 2016, October 2016, and July 2017

East River @ Harold Lewis Trail



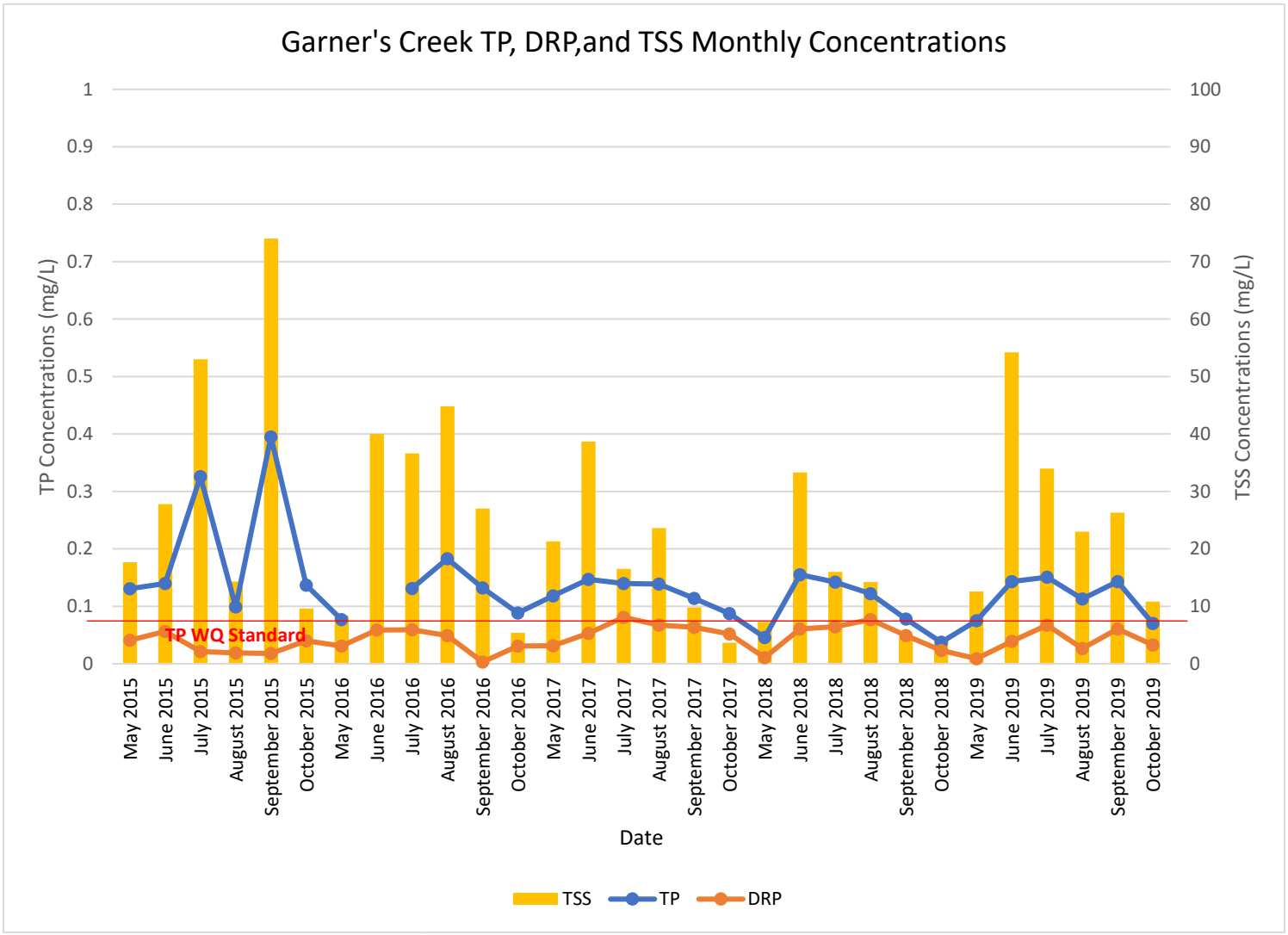
East River @ HLT: There were no samples taken in 2015, which resulted in no data for that year. TSS spike in September 2018 is 201 mg/L

East River @ HWY G



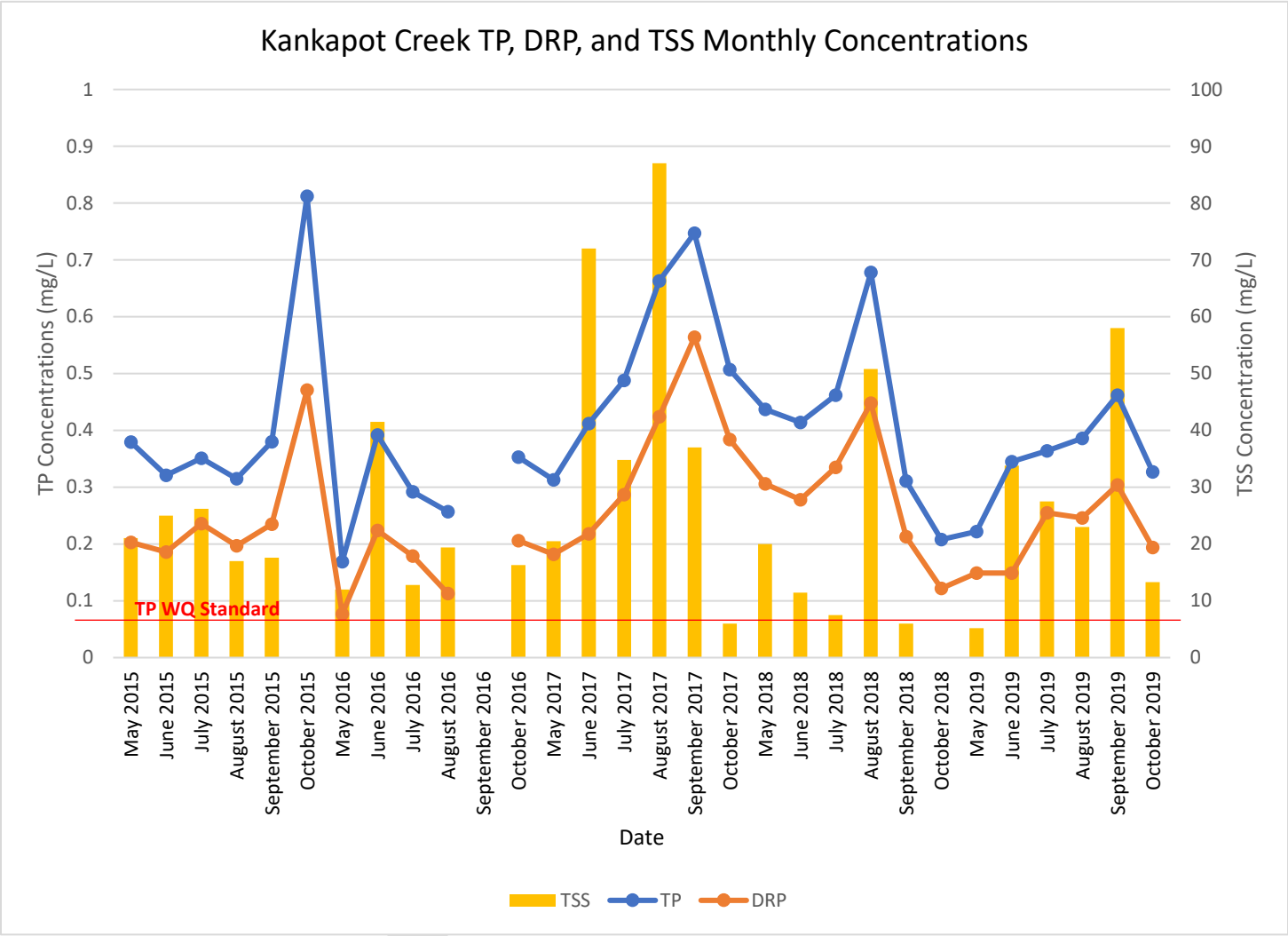
East River @ HWY G: TSS spike in September 2018 is 201 mg/L

Garner's Creek



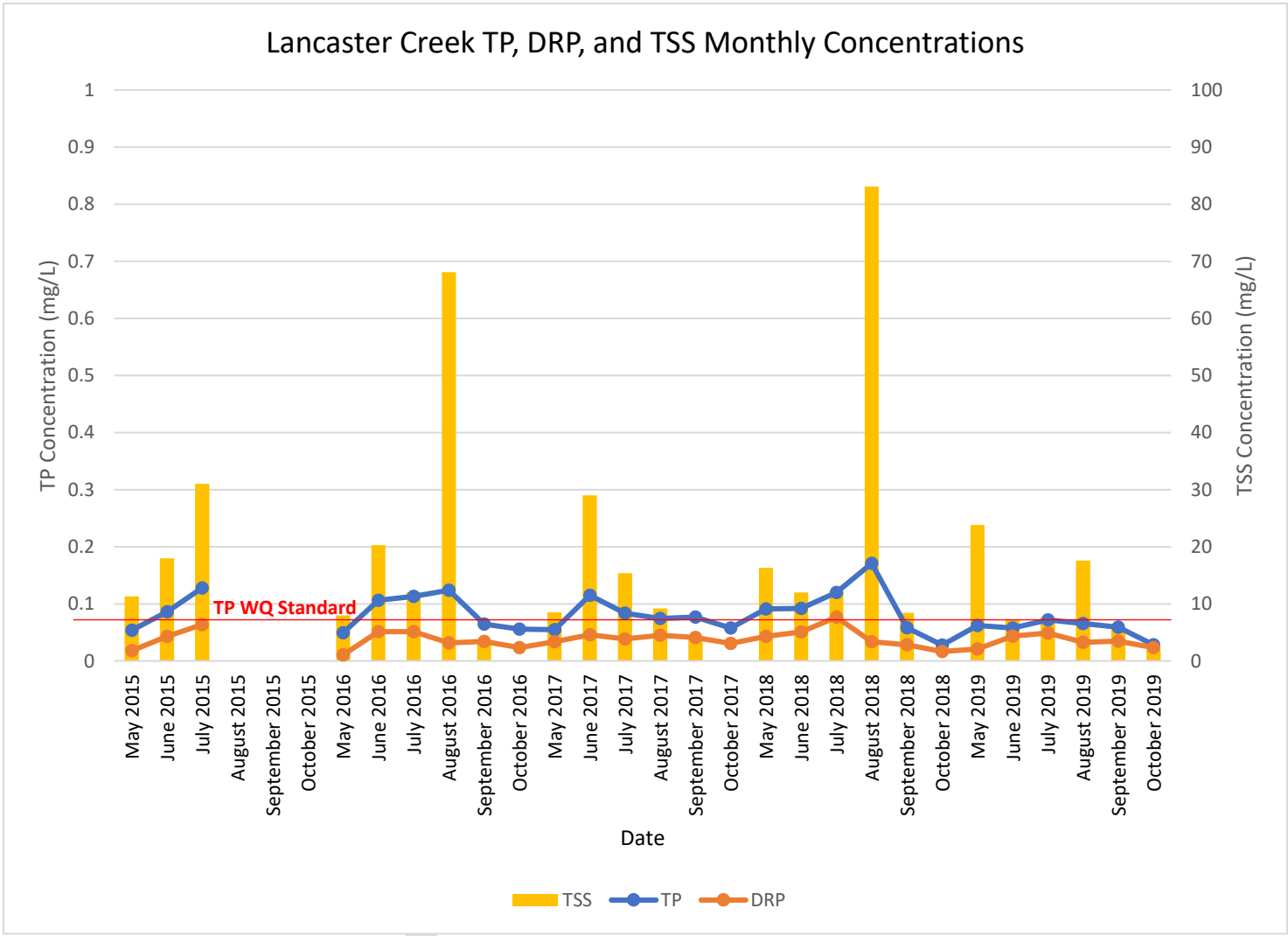
Garner's Creek: TP was not analyzed in June 2016, resulting in no TP data for that month

Kankapot Creek



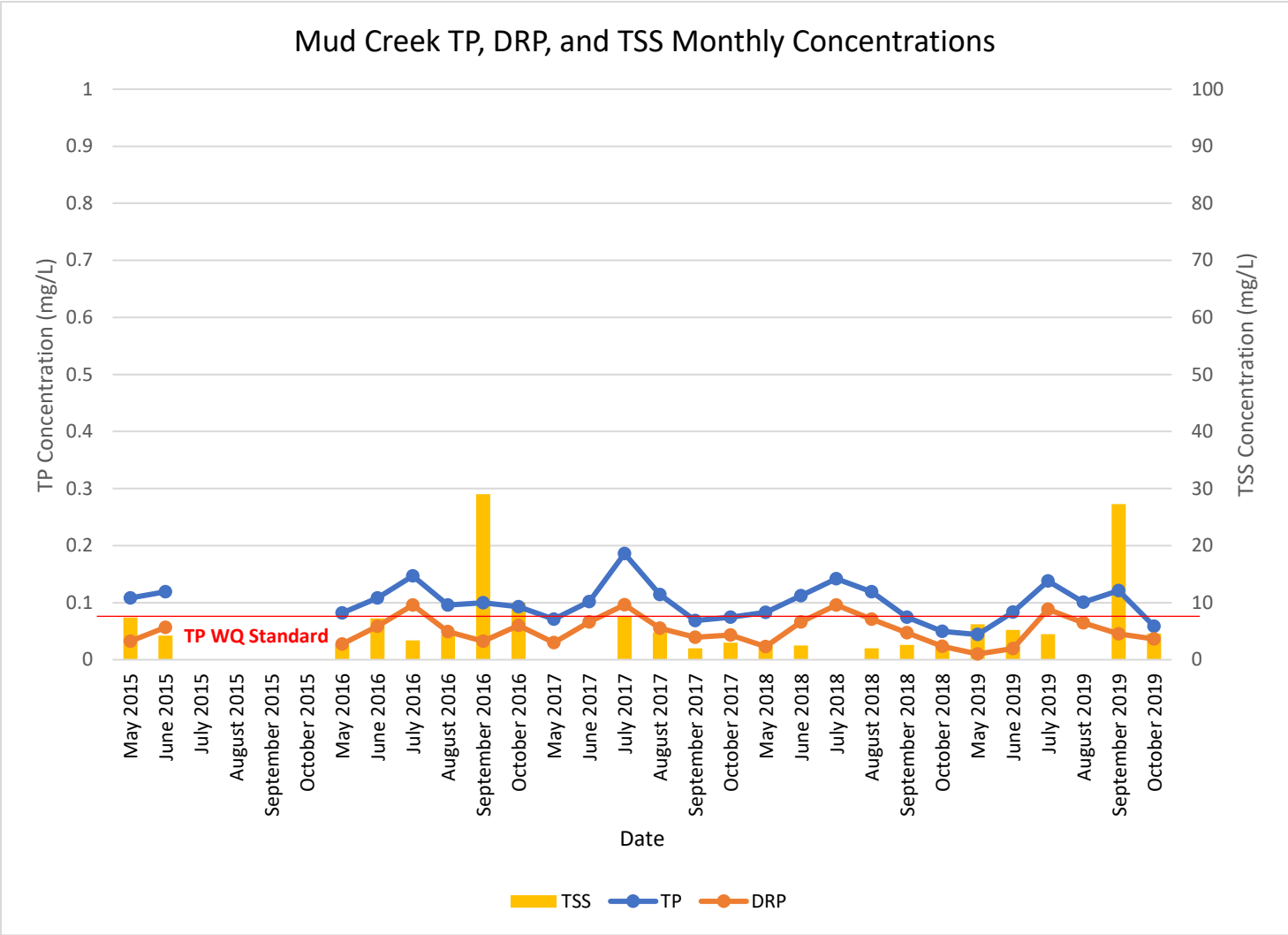
Kankapot Creek: TSS concentrations were below the LOD in October 2015 and October 2018, which appears as no data on the graph. A sample was missed, which resulted in no data, in September 2016

Lancaster Creek (reference stream)



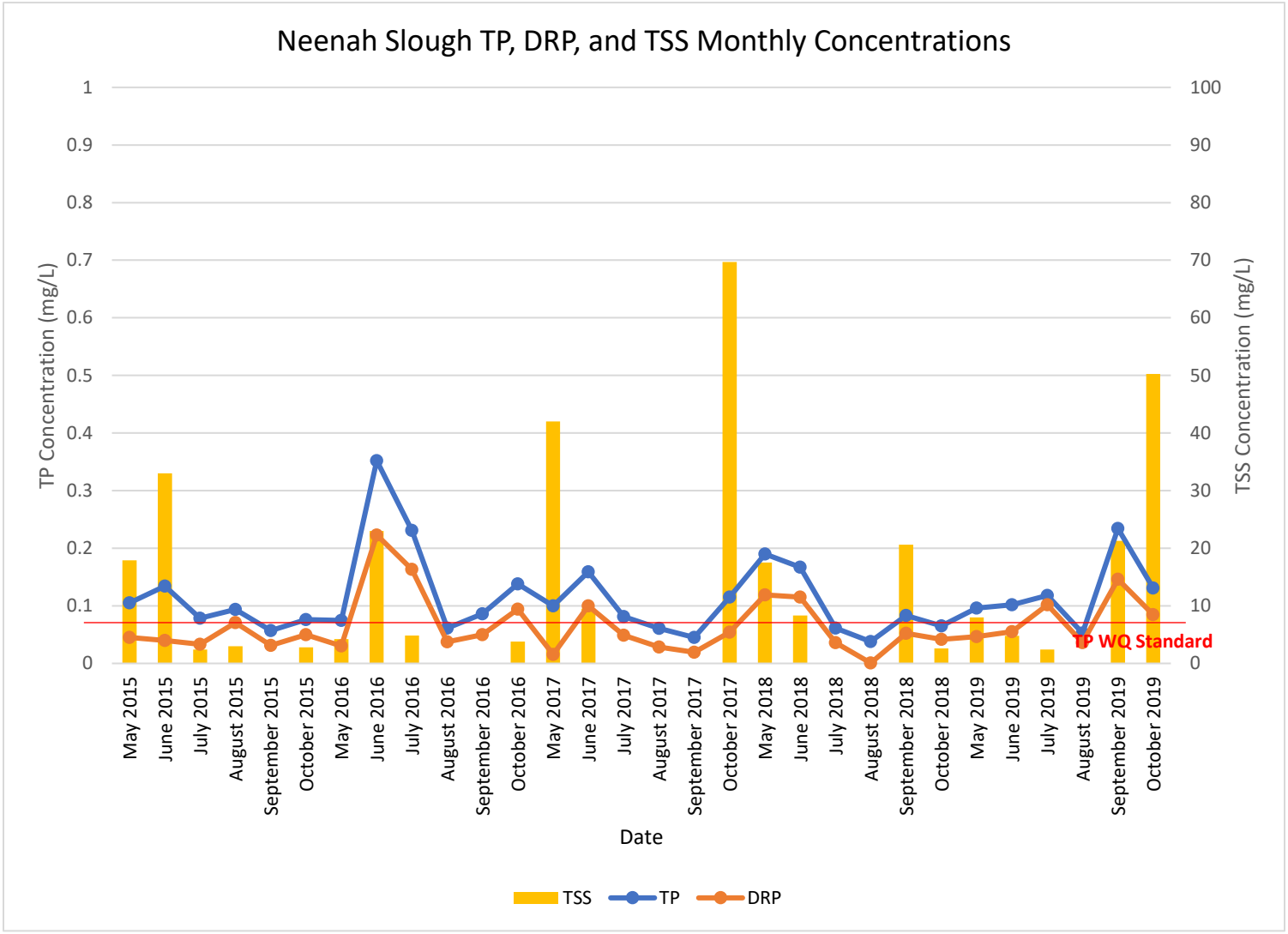
Lancaster Creek: TSS concentrations were below the LOD in October 2016 and October 2017, which appear as no data on the graph. Samples were missed, which resulted in no data, in August 2015, September 2015, and October 2015

Mud Creek



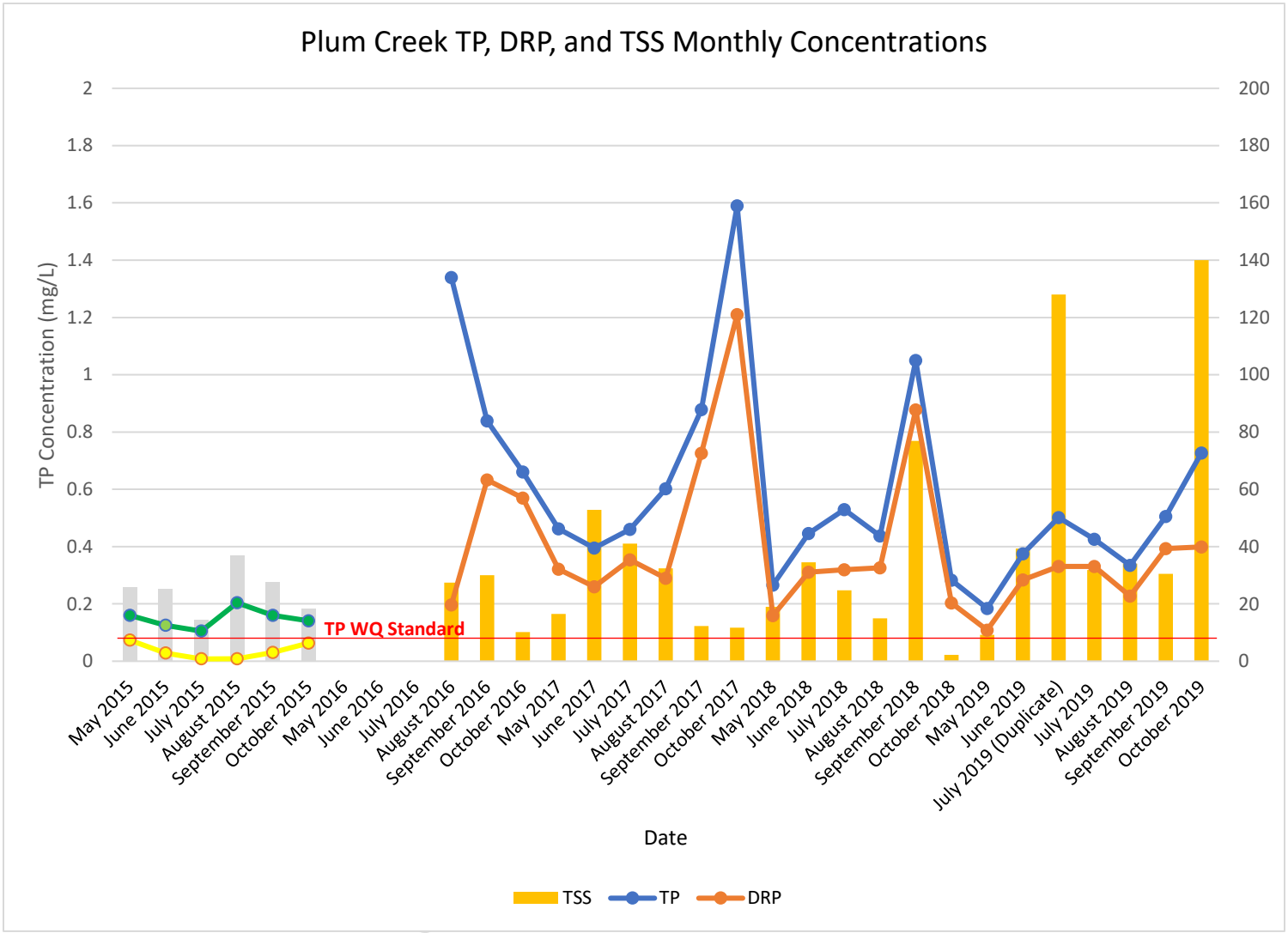
Mud Creek: TSS concentrations were below the LOD in May 2017, June 2017, July 2018, and August 2019, which appears as no data on the graph. Samples were missed, which resulted in no data, in July-October 2015

Neenah Slough



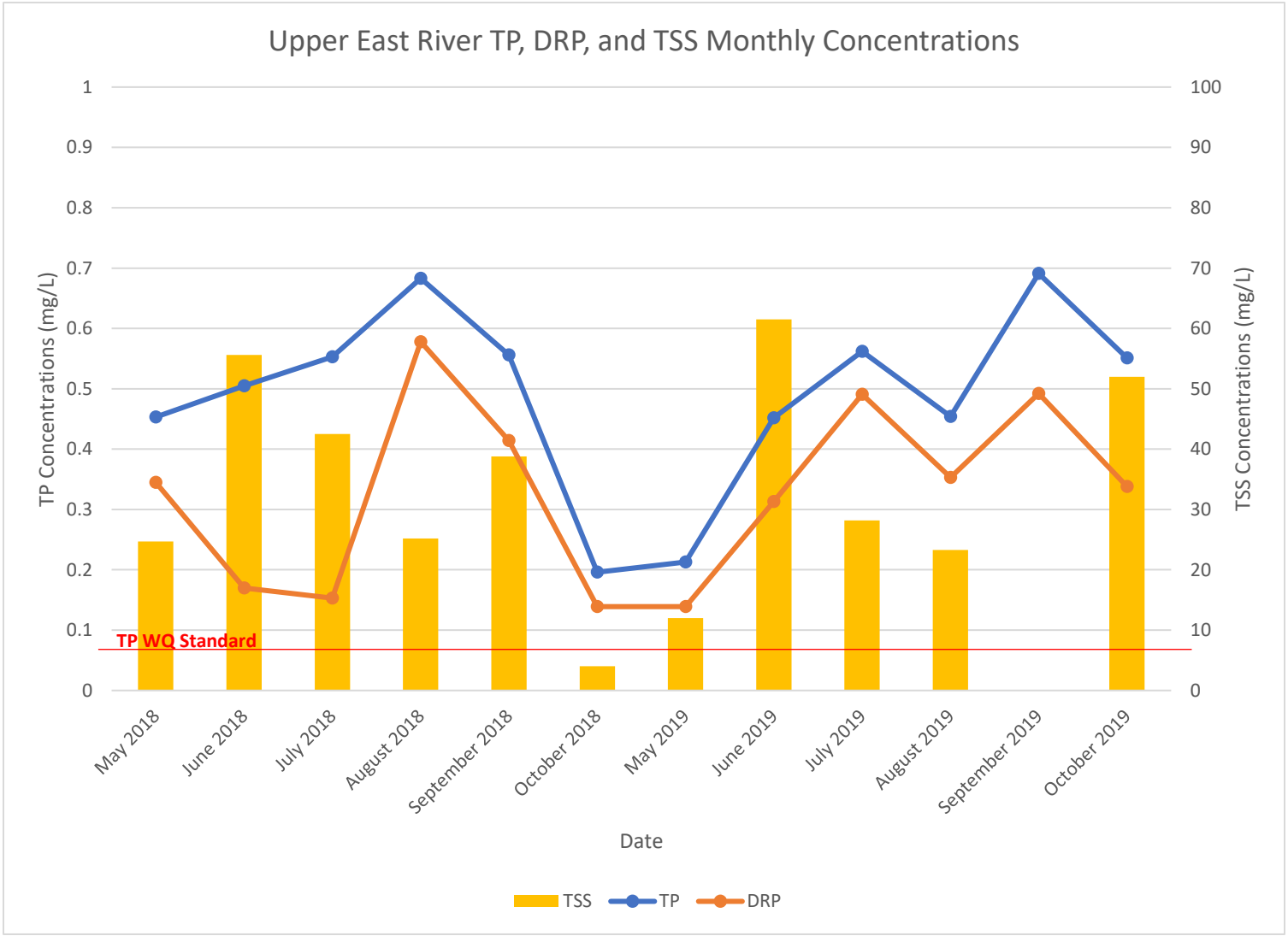
Neenah Slough: TSS concentrations were below the LOD in September 2015, August 2016, September 2016, July 2017, August 2017, September 2017, August 2018, and August 2019, which appear as no data on the graph

Plum Creek



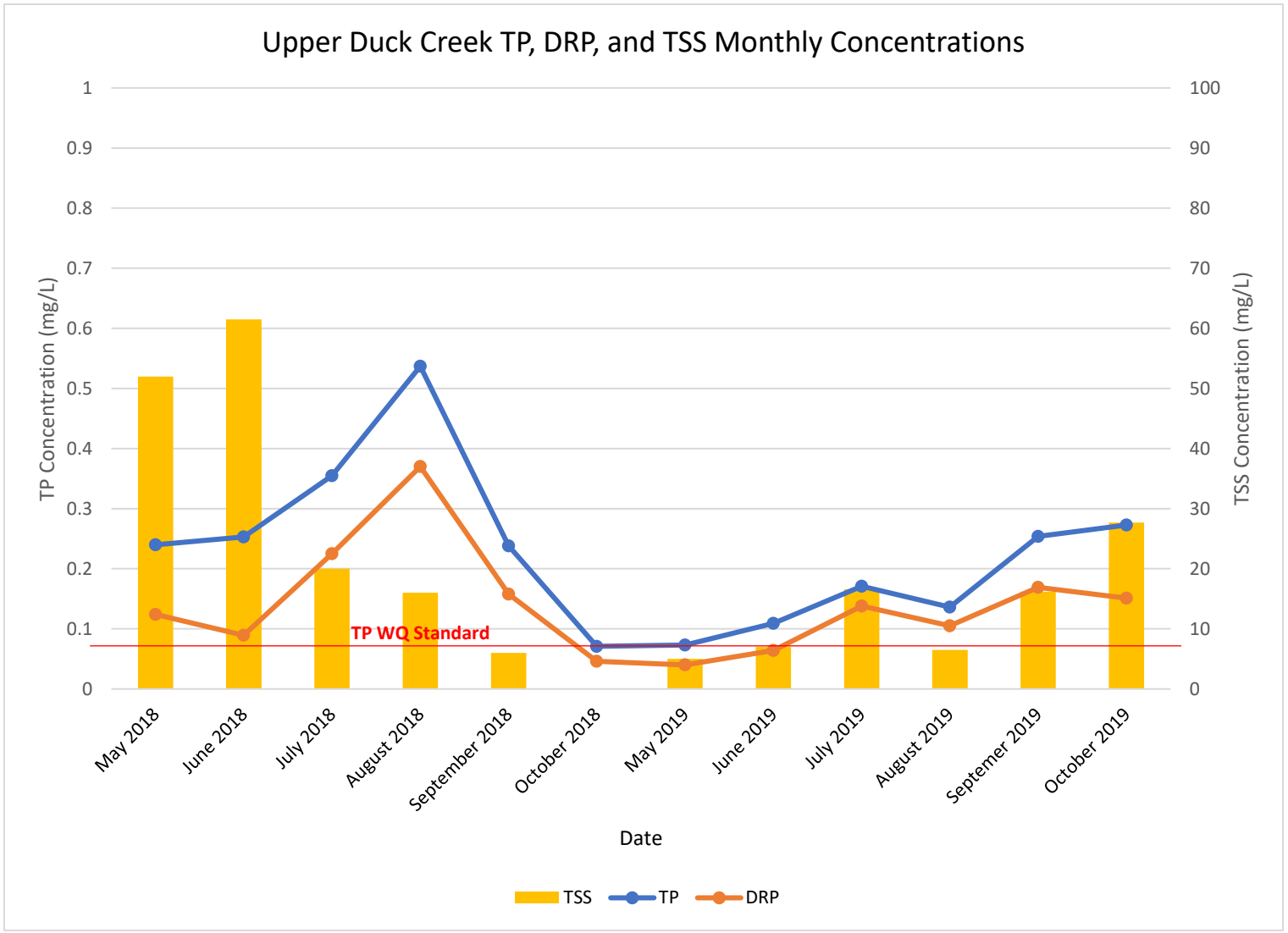
Plum Creek: Sampling location changed on Plum Creek after the 2015 sampling season, which is in part the reason for the concentration increases after 2015. Samples were missed, which resulted in no data, in May-July 2016

Upper East River



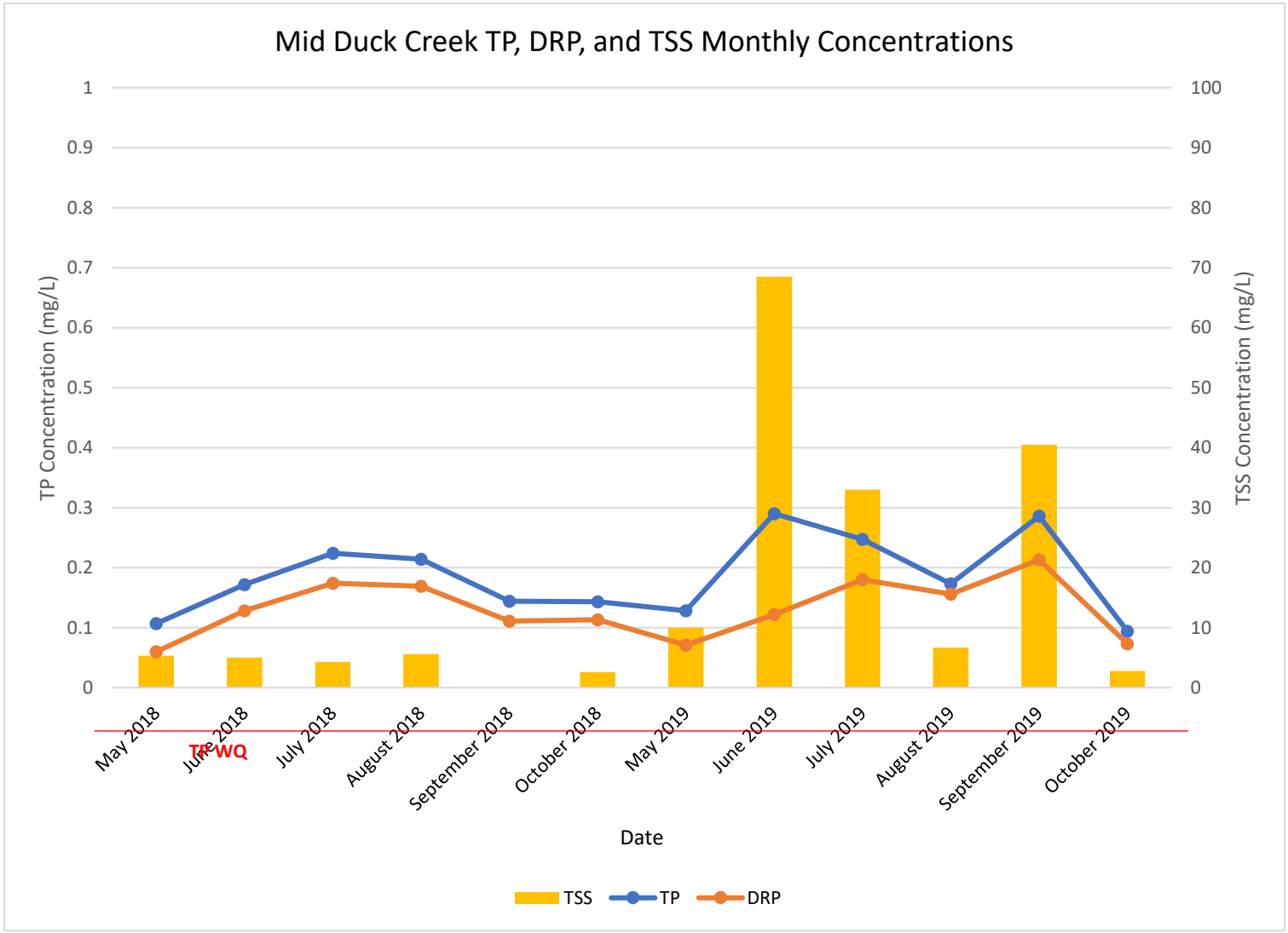
Upper East River: TSS concentration was below the LOD in September 2019, which appears as no data on the graph

Upper Duck Creek



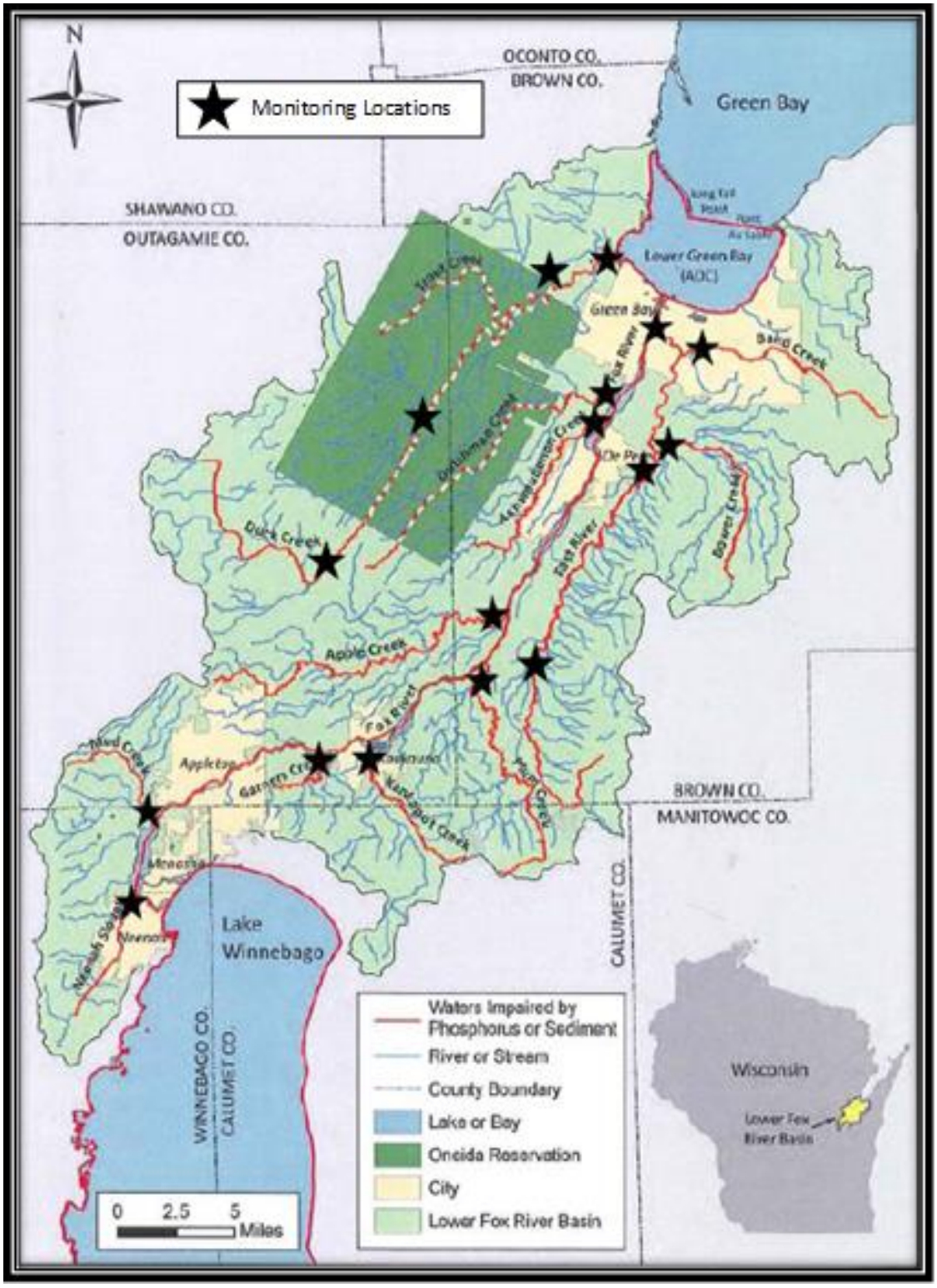
Upper Duck Creek: TSS concentration was below the LOD in October 2018, which appears as no data on the graph

Mid Duck Creek



Mid Duck Creek: TSS concentration was below the LOD in September 2018, which appears as no data on the graph

Appendix A: Lower Fox River Basin and Sub-Basin Boundaries



	Stream Name	WBIC	SWIMS ID	SWIMS Station Name	Latitude	Longitude	Impaired For
1	**Apple Creek**	124100	53684	Apple Creek - Rosin Rd	44.34861	-88.16119	TP and TSS
2	**Ashwaubenon Creek**	122200	10016502	Ashwaubenon Creek - Grant Street	44.44508	-88.09875	TP and TSS
3	**Baird's Creek**	118100	53683	Baird Creek at Preble WI	44.50741	-87.96754	TP and TSS
4	**Bower Creek**	118400	10009445	Bower Creek (1) 50m Upstream of Hwy GV	44.45179	-87.99543	TP and TSS
5	**Lower Duck Creek**	409700	10038644	Duck Creek - Pamperin Park	44.54773	-88.10285	TP and TSS
6	**Dutchman's Creek**	121600	10015851	Dutchman's Creek - Oneida Street	44.47859	-88.0723	TP
7	**East River**	118000	10043279	East River @ Harold Lewis Trail off Main Street	44.51633	-88.00587	TP and TSS
8	**East River (G)**	118000	53675	East River - Hwy G	44.43550	-88.02457	TP and TSS
9	**Garner's Creek**	127700	10043028	Garner's Creek - DS of CTY Z	44.2701	-88.29816	TP and TSS
10	**Kankapot Creek**	126800	453261	Kankapot Creek - CTY Z Dodge St 100 Ft US of Bridge	44.27504	-88.26778	TP and TSS
11	**Lancaster Creek**	410000	10034510	Unnamed Trib. (410000) - Lakeview Dr	44.56583	-88.06471	
12	**Mud Creek**	129500	453258	Mud Creek - County Highway BB	44.24417	-88.46037	TP and TSS
13	**Neenah Slough**	130800	10032175	Neenah Slough #2 (100ft S of Adams St)	44.18274	-88.47481	TP
14	**Plum Creek**	125100	10046999	Plum Creek - VandeHey Farm Crossing	44.31540	-88.17154	TP and TSS
15	**Upper East River**	118000	53508	East River at Mallard Rd	44.33542	-88.11198	TP and TSS
16	**Upper Duck Creek**	409700	10029975	Duck Creek at CTH S	44.38665	-88.32509	TP and TSS
17	**Mid Duck Creek**	409700	453255	Duck Creek at Seminary Rd	44.46608	-88.21892	TP and TSS

More information can be found at http://dnr.wi.gov

Appendix B: 2015-2019 Sampling Data (2018-2019 highlighted in yellow)

		TP					DRP					TSS				
Stream Name	Month	2019	2018	2017	2016	2015	2019	2018	2017	2016	2015	2019	2018	2017	2016	2015
Apple Creek	May	0.23	0.168	0.331	0.0714	0.2543	0.109	0.0861	0.141	0.027	0.1495	82	15	47.7	3.2	8.275
	June	0.262	0.244	1.67	0.342	0.268	0.123	0.167	0.323	0.187	0.18	82.3	13.3	1010	82.3	4.4
	July	0.267	0.319	0.345	0.407	0.354	0.219	0.264	0.251	0.259	0.27	13.6	7	39.3	61.4	11.4
	August	0.288		0.2305	0.251	0.278	0.136		0.138	0.173	0.201	11.5		13.15	13.2	17.4
	September	0.273	0.147	0.305	0.954	0.199	0.188	0.0724	0.238	0.341	0.139	19.8	2.6	7.8	420	8.75
	October	0.224	0.0691		0.141	0.224	0.16	0.0341		0.106		39.5	ND		3.2	7.8
Ashwaubenon Creek	May		0.291	0.254	0.3	0.3433		0.207	0.156	0.17	0.126		15	21.5	49.5	16.2
	June	0.313	0.293	0.529	0.295	0.435	0.242	0.102	0.383	0.19	0.221	22.5	34	40.8	16.5	26.7
	July	0.544	0.332	0.388	0.332	0.472	0.352	0.256	0.288	0.247	0.306	62	20.7	19.2	14.6	17.3
	August	0.317	0.313	0.204	0.259	0.226	0.259	0.0869	0.071	0.103	0.128	24	670	60.8	38.8	20.6
	September	0.715	0.309	0.239	0.489	0.258	0.498	0.199	0.191	0.288	0.126	68.5	13.8	5.4	69.5	17.2
	October	0.485	0.289	0.466	0.678	0.259	0.346	0.259	0.375	0.486		58	3.4	15	44.3	15.2
Baird Creek	May	0.578	0.23	0.204	0.123	0.2873	0.278	0.158	0.142	0.057	0.2665	68	5	4.25	4.33	3
	June	0.502	0.191	0.393	0.179	0.317	0.337	0.106	0.243	0.099	0.216	12	5.5	29	19	12
	July	0.201	0.348	0.45	0.212	0.319	0.145	0.152	0.276	0.134	0.183	8.2	77.7	36	10.1	24.8
	August	0.51	0.187	0.363		0.181	0.274	0.134	0.502		0.12	81.5	6.4	7.2		ND
	September	0.572	0.555	0.271		0.258	0.439	0.476	0.216		0.188	23	8.6	3.4		3.2
	October	0.253	0.499	0.137	0.133	0.127	0.158	0.326	0.101	0.096		18.3	39.2	ND	3.2	2.8
Bower Creek	May	0.262	0.0927	0.135	0.126	0.1813	0.142	0.0444	0.047	0.066	0.1285	98	3.6	7.5	8	8.6
	June	0.289	0.344	0.318	0.257	0.187	0.192	0.232	0.229	0.154	0.0969	8.6	24.4	25.1	27.3	40.8
	July	0.395	0.384	0.302	0.388	0.401	0.251	0.265	0.21	0.293	0.118	40.8	9.25	22.7	23.4	37
	August	0.367	0.326		0.2	0.21	0.178	0.174		0.119	0.108	51	44		13.4	16.8
	September	0.436	0.319	0.451		0.213	0.306	0.244	0.295		0.145	28	10.6	15		9.4
	October	0.233	0.152	0.36		0.152	0.113	0.0946	0.03			14.5	ND	7		7.6

Lower Duck Creek	May	0.0742	0.0589	0.0694	0.0666	0.0954	0.0333	0.0182	0.025	0.019	0.045	6.3	5	4.75	ND	5.975
	June	0.192	0.319	0.193	0.142	0.314	0.0928	0.193	0.121	0.08	0.141	55	50.7	19.3	12.3	61.6
	July	0.237	0.186	0.276	0.183	0.172	0.19	0.113	0.18	0.131	0.0914	15.8	13.8	25.5	18.9	13.4
	August	0.104	0.0975	0.145	0.163	0.122	0.0594	0.0302	0.095	0.077	0.0735	12.3	11.8	11.4	22	11.7
	September	0.269	0.114	0.19	0.257	0.159	0.196	0.0814	0.124	0.179	0.111	19.8	3.6	16.5	15.7	11.3
	October	0.0867	0.153	0.308	0.203	0.0967	0.0631	0.12	0.177	0.156	0.0466	4.2	3.8	39	7.67	4.75
Dutchman Creek	May	0.363	0.104	0.0977	0.107	0.547	0.246	0.0462	0.041	0.032	0.0839		6	10.8	10.8	75.3
	June	0.196	0.569	0.271			0.136	0.378	0.198				59.6	12.3		
	July	0.396	0.165			0.306	0.286	0.115			0.193		9			153
	August	0.113	0.116	0.102	0.126		0.0558	0.0669	0.045	0.05			10.8	15.8	8.4	
	September	0.423	0.201	0.187			0.343	0.163	0.146				4.6	3.4		
	October	0.128	0.106	0.127			0.0874	0.0796	0.103				ND	3.5		
East River (G)	May	0.23	0.276	0.444	0.275	0.334	0.12	0.184	0.199	0.146	0.2305	42.7	22	67	50.5	22
	June	0.447	0.366	0.554	0.4086	0.631	0.265	0.282	0.302	0.303	0.396	89.3	19.2	98	30.35	62
	July	0.394	0.471	0.475	0.585	1.05	0.349	0.375	0.195	0.488	0.831	12.8	18.5	55.3	26.6	17.8
	August	0.37	0.261	0.494	0.494	0.598	0.274	0.171	0.314	0.288	0.455	20	23.2	46.3	134	35
	September	0.605	0.368	0.289	0.885	0.453	0.467	0.311	0.232	0.526	0.341	32	21.2	11.8	69.5	22
	October	0.551	0.159	0.336		0.361	0.338	0.107	0.293		0.256	52	2.8	11		38.8
East River @Harold	May	0.0827	0.14	0.0589	0.0923		0.0525	0.0837	0.022	0.019		35	15.3	12.3	11	
	June	0.0954	0.294	0.624	0.189		0.0435	0.165	0.296	0.104		16.8	4	24	13	
	July	0.182	0.155	0.211	0.347		0.105	0.0454	0.122	0.257		33.3	25.3	29.7	14.4	
	August	0.29	0.348	0.12	0.314		0.0365	0.0175	0.147	0.093		57	75	26.3	28.8	
	September	0.381	0.623	0.124	0.524		0.194	0.194	0.038	0.336		2	201	19.2	43	
	October	0.158	0.375	0.161	0.178		0.0954	0.171	0.056	0.078		17.7	48.5	32	29	
Garner Creek	May	0.075	0.0457	0.118	0.0769	0.1305	0.0089	0.0109	0.032	0.031	0.0411	12.6	7.25	21.3	8.4	17.65
	June	0.143	0.155	0.147	0.131	0.14	0.0391	0.0604	0.053	0.059	0.0562	54.2	33.3	38.7	40	27.8
	July	0.151	0.142	0.14	0.183	0.326	0.0673	0.0645	0.081	0.059	0.0212	34	16	16.5	36.6	53
	August	0.113	0.122	0.139	0.132	0.099	0.0264	0.448	0.068	0.049	0.019	23	14.2	23.6	44.8	14.3
	September	0.143	0.0779	0.114	0.0883	0.395	0.0607	0.213	0.064	0.003	0.0181	26.3	4.6	9.8	27	74
	October	0.07	0.0375	0.0873	0.169	0.137	0.0326	0.0232	0.052	0.031	0.0398	10.8	4.2	3.67	5.4	9.6

Kankapot Creek	May	0.222	0.437	0.313	0.392	0.3795	0.149	0.306	0.182	0.077	0.203	5.2	20	20.5	12	21.05
	June	0.345	0.366	0.412	0.292	0.321	0.149	0.221	0.218	0.224	0.186	33.8	15.4	72	41.5	25
	July	0.364	0.462	0.462	0.257	0.351	0.255	0.335	0.282	0.179	0.236	27.5	7.5	35.9	12.8	26.2
	August	0.386	0.678	0.663	0.353	0.315	0.246	0.448	0.424	0.113	0.197	23	50.8	87	19.4	17
	September	0.462	0.311	0.747		0.38	0.304	0.213	0.564		0.235	58	6	37		17.6
	October	0.327	0.208	0.507	0.0819	0.812	0.194	0.122	0.384	0.206	0.471	13.3	ND	6	16.3	ND
Mud Creek	May	0.0441	0.0829	0.071		0.108	0.01	0.0232	0.03		0.0326	6.2	2.6	ND		7.4
	June	0.0836	0.112	0.102	0.147	0.119	0.0196	0.0662	0.066	0.059	0.0569	5.2	2.5	ND	7.25	4.25
	July	0.138	0.142	0.186	0.0959		0.0886	0.0956	0.096	0.096		4.5	ND	7.65	3.4	
	August	0.101	0.119	0.114	0.0996		0.0646	0.0712	0.055	0.049		ND	2	4.8	4.4	
	September	0.121	0.0744	0.0688	0.093		0.0454	0.0474	0.039	0.032		27.3	2.6	2	29	
	October	0.0585	0.0498	0.0745	0.0746		0.0363	0.0235	0.043	0.06		4.6	2.4	3	10	
Neenah Slough	May	0.0962	0.19	0.1		0.1051	0.0464	0.119	0.016		0.045	8	17.5	42		17.9
	June	0.102	0.167	0.159	0.231	0.0784	0.0549	0.115	0.1	0.223	0.0332	4.8	8.33	9.5	23	2.4
	July	0.118	0.0614	0.0813	0.0614	0.0935	0.102	0.0359	0.049	0.163	0.0706	2.4	ND	ND	4.86	3
	August	0.525	0.0379	0.0606	0.086	0.0571	0.0362	0.007	0.028	0.038	0.0313	ND	ND	ND	ND	ND
	September	0.234	0.088	0.0451	0.138		0.146	0.0548	0.019	0.05		21.3	9.8	ND	ND	
	October	0.131	0.0649	0.115	1.34	0.0761	0.0848	0.0417	0.054	0.094	0.05	50.23	2.6	69.7	3.8	2.8
Plum Creek	May	0.184	0.266	0.462			0.108	0.159	0.321			9.2	19	16.5		
	June	0.375	0.446	0.395			0.284	0.311	0.26			39.3	34.5	52.8		
	July	0.426	0.529	0.46			0.331	0.319	0.354			31.8	24.7	41		
	August	0.335	0.437	0.602	0.839		0.227	0.326	0.29	0.197		34	15	32.4	27.4	
	September	0.505	1.05	0.878	0.661		0.393	0.877	0.726	0.633		30.5	76.9	12.3	30	
	October	0.727	0.283	1.59	0.0493		0.399	0.203	1.21	0.571		140	2.2	11.7	10.2	
Upper Duck Creek	May	0.073	0.24				0.04	0.124				5	52			
	June	0.109	0.253				0.064	0.0895				7	61.5			
	July	0.171	0.355				0.138	0.225				16.6	20			
	August	0.136	0.537				0.105	0.37				6.5	16			
	September	0.254	0.238				0.169	0.158				16.2	6			
	October	0.273	0.071				0.151	0.046				27.7	ND			

Mid Duck Creek	May	0.128	0.107				0.0707	0.0598				10	5.33			
	June	0.29	0.172				0.122	0.128				68.5	5			
	July	0.247	0.224				0.18	0.174				33	4.25			
	August	0.173	0.214				0.156	0.169				6.67	5.6			
	September	0.156	0.144				0.213	0.111				40.5	ND			
	October	0.0941	0.143				0.0731	0.113				2.75	2.6			
Easter River @Mallard	May	0.213	0.453				0.139	0.345				12	24.7			
	June	0.452	0.505				0.313	0.17				61.5	55.6			
	July	0.562	0.153				0.491	0.553				28.2	42.5			
	August	0.454	0.683				0.353	0.578				23.3	25.2			
	September	0.691	0.556				0.492	0.414				ND	38.8			
	October	0.551	0.196				0.338	0.139				52	4			
Lancaster Creek	May	0.0621	0.0908	0.0549	0.106	0.0538	0.0207	0.043	0.034	0.011	0.0181	23.8	16.3	8.5	8	11.3
	June	0.0576	0.0918	0.115	0.113	0.086	0.0434	0.051	0.046	0.052	0.0429	7.2	12	29	20.3	18
	July	0.072	0.12	0.0836	0.1174	0.128	0.049	0.0767	0.039	0.083	0.0635	7.6	12	15.4	12.2	31
	August	0.0656	0.171	0.0746	0.1579		0.0325	0.0339	0.045	0.032		17.6	83.1	9.2	68.1	
	September	0.059	0.0582	0.077			0.0346	0.0284	0.041			5.6	8.4	4		
	October	0.0284	0.0278	0.0579			0.0233	0.0164	0.031			2	ND	ND		

Appendix C: 2015-2019 Confidence Interval Table (TP)

Stream Name	TP Calculation	2019	2018	2017	2016	2015
Apple Creek	**Median (mg/L)**	0.2645	0.1680	0.3180	0.2965	0.2612
	L90% (mg/L)	0.2414	0.1125	0.2427	0.1537	0.2296
	U90% (mg/L)	0.2721	0.2501	0.5980	0.4522	0.2912
Ashwaubenon Creek	**Median (mg/L)**	0.4850	0.3010	0.3210	0.3160	0.3012
	L90% (mg/L)	0.3533	0.2943	0.2568	0.2955	0.2660
	U90% (mg/L)	0.5765	0.3142	0.4121	0.4607	0.3838
Baird Creek	**Median (mg/L)**	0.5060	0.2890	0.3320	0.1790	0.2727
	L90% (mg/L)	0.3057	0.2276	0.2183	0.1407	0.1889
	U90% (mg/L)	0.5321	0.4064	0.4012	0.2135	0.2945
Bower Creek	**Median (mg/L)**	0.3280	0.3225	0.3180	0.2285	0.1985
	L90% (mg/L)	0.2772	0.1703	0.2131	0.1523	0.1739
	U90% (mg/L)	0.3741	0.3396	0.3988	0.3292	0.2600
Lower Duck Creek	**Median (mg/L)**	0.1480	0.1335	0.1915	0.1730	0.1405
	L90% (mg/L)	0.1018	0.0955	0.1286	0.1183	0.1114
	U90% (mg/L)	0.1980	0.1914	0.2452	0.2071	0.1912
Dutchman Creek	**Median (mg/L)**	0.2795	0.1405	0.1270	0.1165	0.4265
	L90% (mg/L)	0.1653	0.1150	0.1077	0.0903	0.1673
	U90% (mg/L)	0.3368	0.2512	0.1953	0.1493	1.0002
East River (G)	**Median (mg/L)**	0.1700	0.3210	0.1540	0.2515	
	L90% (mg/L)	0.1024	0.2015	0.1057	0.1639	
	U90% (mg/L)	0.2456	0.3987	0.2681	0.3428	
East River @Harold	**Median (mg/L)**	0.4205	0.3210	0.4595	0.4513	0.5255
	L90% (mg/L)	0.3360	0.2388	0.3627	0.3672	0.4089
	U90% (mg/L)	0.5087	0.3765	0.4898	0.5978	0.6814
Garner Creek	**Median (mg/L)**	0.1280	0.1000	0.1285	0.1310	0.1385
	L90% (mg/L)	0.0899	0.0586	0.1089	0.0918	0.1271
	U90% (mg/L)	0.1360	0.1212	0.1376	0.1479	0.2496
Kankapot Creek	**Median (mg/L)**	0.3545	0.4255	0.4975	0.2920	0.3653
	L90% (mg/L)	0.2960	0.3087	0.4142	0.2245	0.3238
	U90% (mg/L)	0.3972	0.4995	0.6059	0.3520	0.4965
Mud Creek	**Median (mg/L)**	0.0923	0.0975	0.0883	0.0978	0.1135
	L90% (mg/L)	0.0666	0.0742	0.0780	0.0919	0.0976
	U90% (mg/L)	0.1072	0.1124	0.1184	0.1141	0.1316
Neenah Slough	**Median (mg/L)**	0.1245	0.0740	0.0907	0.1120	0.0860
	L90% (mg/L)	0.1140	0.0611	0.0672	0.0881	0.0745
	U90% (mg/L)	0.2326	0.1203	0.1101	0.1863	0.1027

Plum Creek	**Median (mg/L)**	0.4005	0.4415	0.5320	0.8390	0.1505
	L90% (mg/L)	0.3052	0.3422	0.4830	0.6124	0.1288
	U90% (mg/L)	0.5028	0.5880	0.8556	1.3398	0.1653
East River @ Mallard	**Median (mg/L)**	0.5025	0.4790			
	L90% (mg/L)	0.3590	0.2568			
	U90% (mg/L)	0.5869	0.5358			
Upper Duck Creek	**Median (mg/L)**	0.1535	0.2465			
	L90% (mg/L)	0.1128	0.1603			
	U90% (mg/L)	0.2076	0.3622			
Mid Duck Creek	**Median (mg/L)**	0.1645	0.1580			
	L90% (mg/L)	0.1316	0.1371			
	U90% (mg/L)	0.2170	0.1918			
Lancaster Creek	**Median (mg/L)**	0.0606	0.0913	0.0758	0.0854	0.0860
	L90% (mg/L)	0.0451	0.0552	0.0637	0.0629	0.0524
	U90% (mg/L)	0.0676	0.1181	0.0879	0.1019	0.1347

Appendix D: Duplicate Sample Dates and Data

Site Name	Date	Parameter		
Apple Creek - Rosin Rd	5/31/2015	PHOSPHATE ORTHO DISS	0.139	MG/L
Apple Creek - Rosin Rd	5/31/2015	PHOSPHATE ORTHO DISS	0.16	MG/L
Apple Creek - Rosin Rd	5/31/2015	PHOSPHORUS TOTAL	0.199	MG/L
Apple Creek - Rosin Rd	5/31/2015	PHOSPHORUS TOTAL	0.224	MG/L
Apple Creek - Rosin Rd	5/31/2015	PHOSPHORUS TOTAL	0.34	MG/L
Apple Creek - Rosin Rd	5/31/2015	PHOSPHATE ORTHO DISS	0.182	MG/L
Apple Creek - Rosin Rd	5/31/2015	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	8.75	MG/L
Apple Creek - Rosin Rd	5/31/2015	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	7.8	MG/L
Apple Creek - Rosin Rd	5/31/2015	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	61	MG/L
Ashwaubenon Creek - Grant Street	5/31/2015	PHOSPHATE ORTHO DISS	0.126	MG/L
Ashwaubenon Creek - Grant Street	5/31/2015	PHOSPHORUS TOTAL	0.258	MG/L
Ashwaubenon Creek - Grant Street	5/31/2015	PHOSPHORUS TOTAL	0.259	MG/L
Ashwaubenon Creek - Grant Street	5/31/2015	PHOSPHORUS TOTAL	0.513	MG/L
Ashwaubenon Creek - Grant Street	5/31/2015	PHOSPHATE ORTHO DISS	0.203	MG/L
Ashwaubenon Creek - Grant Street	5/31/2015	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	17.2	MG/L
Ashwaubenon Creek - Grant Street	5/31/2015	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	15.2	MG/L
Baird Creek at Preble WI	5/31/2015	PHOSPHATE ORTHO DISS	0.188	MG/L
Baird Creek at Preble WI	5/31/2015	PHOSPHATE ORTHO DISS	0.345	MG/L
Baird Creek at Preble WI	7/25/2016	PHOSPHATE ORTHO DISS	0.113	MG/L
Baird Creek at Preble WI	7/25/2016	PHOSPHATE ORTHO DISS	0.154	MG/L
Baird Creek at Preble WI	5/31/2015	PHOSPHORUS TOTAL	0.258	MG/L
Baird Creek at Preble WI	5/31/2015	PHOSPHORUS TOTAL	0.127	MG/L
Baird Creek at Preble WI	5/31/2015	PHOSPHORUS TOTAL	0.477	MG/L
Baird Creek at Preble WI	7/25/2016	PHOSPHORUS TOTAL	0.172	MG/L
Baird Creek at Preble WI	7/25/2016	PHOSPHORUS TOTAL	0.252	MG/L
Baird Creek at Preble WI	5/31/2015	PHOSPHATE ORTHO DISS	0.0983	MG/L
Baird Creek at Preble WI	5/31/2015	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	3.2	MG/L
Baird Creek at Preble WI	5/31/2015	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	2.8	MG/L
Baird Creek at Preble WI	5/31/2015	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	ND	MG/L
Baird Creek at Preble WI	7/25/2016	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	13.4	MG/L
Baird Creek at Preble WI	7/25/2016	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	6.8	MG/L

Bower Creek (1) 50m Upstream Of Hwy Gv	5/31/2015	PHOSPHATE ORTHO DISS	0.112	MG/L
Bower Creek (1) 50m Upstream Of Hwy Gv	5/31/2015	PHOSPHATE ORTHO DISS	0.145	MG/L
Bower Creek (1) 50m Upstream Of Hwy Gv	5/31/2015	PHOSPHORUS TOTAL	0.179	MG/L
Bower Creek (1) 50m Upstream Of Hwy Gv	5/31/2015	PHOSPHORUS TOTAL	0.152	MG/L
Bower Creek (1) 50m Upstream Of Hwy Gv	5/31/2015	PHOSPHORUS TOTAL	0.213	MG/L
Bower Creek (1) 50m Upstream Of Hwy Gv	5/31/2015	PHOSPHATE ORTHO DISS	0.12	MG/L
Bower Creek (1) 50m Upstream Of Hwy Gv	5/31/2015	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	8.8	MG/L
Bower Creek (1) 50m Upstream Of Hwy Gv	5/31/2015	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	7.6	MG/L
Bower Creek (1) 50m Upstream Of Hwy Gv	5/31/2015	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	9.4	MG/L
Duck Creek-Pamperin Park	5/13/2015	PHOSPHATE ORTHO DISS	0.0466	MG/L
Duck Creek-Pamperin Park	5/13/2015	PHOSPHATE ORTHO DISS	0.0433	MG/L
Duck Creek-Pamperin Park	8/14/2018	PHOSPHATE ORTHO DISS	0.0301	MG/L
Duck Creek-Pamperin Park	8/15/2018	PHOSPHATE ORTHO DISS	0.0302	MG/L
Duck Creek-Pamperin Park	5/13/2015	PHOSPHORUS TOTAL	0.0967	MG/L
Duck Creek-Pamperin Park	5/13/2015	PHOSPHORUS TOTAL	0.094	MG/L
Duck Creek-Pamperin Park	8/16/2018	PHOSPHORUS TOTAL	0.0975	MG/L
Duck Creek-Pamperin Park	8/17/2018	PHOSPHORUS TOTAL	0.103	MG/L
Duck Creek-Pamperin Park	5/13/2015	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	4.75	MG/L
Duck Creek-Pamperin Park	5/13/2015	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	7.2	MG/L
Duck Creek-Pamperin Park	8/18/2018	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	11.8	MG/L
Duck Creek-Pamperin Park	8/19/2018	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	18.8	MG/L

East River - Hwy G	5/13/2015	PHOSPHATE ORTHO DISS	0.205	MG/L
East River - Hwy G	5/13/2015	PHOSPHATE ORTHO DISS	0.256	MG/L
East River - Hwy G	6/28/2016	PHOSPHATE ORTHO DISS	0.294	MG/L
East River - Hwy G	6/28/2016	PHOSPHATE ORTHO DISS	0.312	MG/L
East River - Hwy G	5/13/2015	PHOSPHORUS TOTAL	0.307	MG/L
East River - Hwy G	5/13/2015	PHOSPHORUS TOTAL	0.361	MG/L
East River - Hwy G	6/28/2016	PHOSPHORUS TOTAL	0.449	MG/L
East River - Hwy G	6/28/2016	PHOSPHORUS TOTAL	0.368	MG/L
East River - Hwy G	5/13/2015	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	5.2	MG/L
East River - Hwy G	5/13/2015	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	38.8	MG/L
East River - Hwy G	6/28/2016	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	52.5	MG/L
East River - Hwy G	6/28/2016	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	8.2	MG/L
Garner's Creek ds of CTH Z	5/27/2015	PHOSPHATE ORTHO DISS	0.0424	MG/L
Garner's Creek ds of CTH Z	5/27/2015	PHOSPHATE ORTHO DISS	0.0398	MG/L
Garner's Creek ds of CTH Z	5/27/2015	PHOSPHORUS TOTAL	0.124	MG/L
Garner's Creek ds of CTH Z	5/27/2015	PHOSPHORUS TOTAL	0.137	MG/L
Garner's Creek ds of CTH Z	5/27/2015	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	25.7	MG/L
Garner's Creek ds of CTH Z	5/27/2015	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	9.6	MG/L
Kankapot Creek - Cth Z Dodge St 100 Ft US of Bridge	5/18/2015	PHOSPHATE ORTHO DISS	0.171	MG/L
Kankapot Creek - Cth Z Dodge St 100 Ft US of Bridge	5/18/2015	PHOSPHATE ORTHO DISS	0.235	MG/L
Kankapot Creek - Cth Z Dodge St 100 Ft US of Bridge	6/28/2018	PHOSPHATE ORTHO DISS	0.221	MG/L
Kankapot Creek - Cth Z Dodge St 100 Ft US of Bridge	6/28/2018	PHOSPHATE ORTHO DISS	0.335	MG/L
Kankapot Creek - Cth Z Dodge St 100 Ft US of Bridge	5/18/2015	PHOSPHORUS TOTAL	0.379	MG/L
Kankapot Creek - Cth Z Dodge St 100 Ft US of Bridge	5/18/2015	PHOSPHORUS TOTAL	0.38	MG/L
Kankapot Creek - Cth Z Dodge St 100 Ft US of Bridge	6/28/2018	PHOSPHORUS TOTAL	0.366	MG/L
Kankapot Creek - Cth Z Dodge St 100 Ft US of Bridge	6/28/2018	PHOSPHORUS TOTAL	0.462	MG/L
Kankapot Creek - Cth Z Dodge St 100 Ft US of Bridge	5/18/2015	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	24.5	MG/L
Kankapot Creek - Cth Z Dodge St 100 Ft US of Bridge	5/18/2015	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	17.6	MG/L
Kankapot Creek - Cth Z Dodge St 100 Ft US of Bridge	6/28/2018	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	15.4	MG/L
Kankapot Creek - Cth Z Dodge St 100 Ft US of Bridge	6/28/2018	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	7.5	MG/L

Neenah Slough #2 (100ft S of Adams St)	5/11/2015	PHOSPHATE ORTHO DISS	0.05	MG/L
Neenah Slough #2 (100ft S of Adams St)	5/11/2015	PHOSPHATE ORTHO DISS	0.0399	MG/L
Neenah Slough #2 (100ft S of Adams St)	9/25/2018	PHOSPHATE ORTHO DISS	0.0548	MG/L
Neenah Slough #2 (100ft S of Adams St)	9/26/2018	PHOSPHATE ORTHO DISS	0.04944	MG/L
Neenah Slough #2 (100ft S of Adams St)	5/11/2015	PHOSPHORUS TOTAL	0.0761	MG/L
Neenah Slough #2 (100ft S of Adams St)	5/11/2015	PHOSPHORUS TOTAL	0.134	MG/L
Neenah Slough #2 (100ft S of Adams St)	9/27/2018	PHOSPHORUS TOTAL	0.088	MG/L
Neenah Slough #2 (100ft S of Adams St)	9/28/2018	PHOSPHORUS TOTAL	0.078	MG/L
Neenah Slough #2 (100ft S of Adams St)	5/11/2015	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	2.8	MG/L
Neenah Slough #2 (100ft S of Adams St)	5/11/2015	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	33	MG/L
Neenah Slough #2 (100ft S of Adams St)	9/29/2018	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	31.4	MG/L
Neenah Slough #2 (100ft S of Adams St)	9/30/2018	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	9.8	MG/L
Unnamed Trib.(410000)-Lakeview Dr.	8/24/2016	PHOSPHATE ORTHO DISS	0.0342	MG/L
Unnamed Trib.(410000)-Lakeview Dr.	8/24/2016	PHOSPHATE ORTHO DISS	0.0369	MG/L
Unnamed Trib.(410000)-Lakeview Dr.	8/24/2016	PHOSPHATE ORTHO DISS	0.0234	MG/L
Unnamed Trib.(410000)-Lakeview Dr.	8/24/2016	PHOSPHORUS TOTAL	0.0647	MG/L
Unnamed Trib.(410000)-Lakeview Dr.	8/24/2016	PHOSPHORUS TOTAL	0.251	MG/L
Unnamed Trib.(410000)-Lakeview Dr.	8/24/2016	PHOSPHORUS TOTAL	0.0557	MG/L
Unnamed Trib.(410000)-Lakeview Dr.	8/24/2016	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	3.2	MG/L
Unnamed Trib.(410000)-Lakeview Dr.	8/24/2016	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	133	MG/L
Unnamed Trib.(410000)-Lakeview Dr.	8/24/2016	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	ND	MG/L

Neenah Slough #2 (100ft S of Adams St)	5/11/2015	PHOSPHORUS TOTAL	0.0761	MG/L
Neenah Slough #2 (100ft S of Adams St)	5/11/2015	PHOSPHORUS TOTAL	0.134	MG/L
Neenah Slough #2 (100ft S of Adams St)	5/11/2015	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	2.8	MG/L
Neenah Slough #2 (100ft S of Adams St)	5/11/2015	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	33	MG/L
Neenah Slough #2 (100ft S of Adams St)	5/11/2015	PHOSPHATE ORTHO DISS	0.05	MG/L
Neenah Slough #2 (100ft S of Adams St)	5/11/2015	PHOSPHATE ORTHO DISS	0.0399	MG/L
Neenah Slough #2 (100ft S of Adams St)	9/25/2018	PHOSPHATE ORTHO DISS	0.0548	MG/L
Neenah Slough #2 (100ft S of Adams St)	9/26/2018	PHOSPHATE ORTHO DISS	0.04944	MG/L
Neenah Slough #2 (100ft S of Adams St)	9/27/2018	PHOSPHORUS TOTAL	0.088	MG/L
Neenah Slough #2 (100ft S of Adams St)	9/28/2018	PHOSPHORUS TOTAL	0.078	MG/L
Neenah Slough #2 (100ft S of Adams St)	9/29/2018	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	31.4	MG/L
Neenah Slough #2 (100ft S of Adams St)	9/30/2018	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	9.8	MG/L
Unnamed Trib. (410000)-Lakeview Dr.	8/24/2016	PHOSPHATE ORTHO DISS	0.0342	MG/L
Unnamed Trib. (410000)-Lakeview Dr.	8/24/2016	PHOSPHATE ORTHO DISS	0.0369	MG/L
Unnamed Trib. (410000)-Lakeview Dr.	8/24/2016	PHOSPHATE ORTHO DISS	0.0234	MG/L
Unnamed Trib. (410000)-Lakeview Dr.	8/24/2016	PHOSPHORUS TOTAL	0.0647	MG/L
Unnamed Trib. (410000)-Lakeview Dr.	8/24/2016	PHOSPHORUS TOTAL	0.251	MG/L
Unnamed Trib. (410000)-Lakeview Dr.	8/24/2016	PHOSPHORUS TOTAL	0.0557	MG/L
Unnamed Trib. (410000)-Lakeview Dr.	8/24/2016	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	3.2	MG/L
Unnamed Trib. (410000)-Lakeview Dr.	8/24/2016	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	133	MG/L
Unnamed Trib. (410000)-Lakeview Dr.	8/24/2016	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	ND	MG/L

Appendix E: Sample Article

Volunteers Lending a Hand Towards Water Quality in the Lower Fox River

The combination of land uses including urban development, agricultural cropland, limited natural areas, and a mix of industrial businesses have resulted in phosphorus and total suspended solid impacts to our rivers and streams in the Lower Fox River basin. Despite the different land uses, each land use contributes to runoff during snow melt and precipitation events. The runoff that is created from these events can carry impactful amounts of phosphorus and sediment into our rivers and streams. Phosphorus (TP) is an essential nutrient for all living things such as aquatic plants and algae. Plants rely on nutrients like phosphorus for growth. However excess amounts of phosphorus can increase the growth and intensity of algae in the water. Higher concentrations of algae can result in oxygen depletion, reduced submerged aquatic vegetation, reduced water clarity, and loss of fish habitat. Some algal blooms can even result in the release of harmful toxins, which may cause severe problems for wildlife and may cause harm to humans as well. In addition, excess sediment loads can raise the concentration of total suspended solids in the water. Total suspended solids (TSS) are any particles in the water that are not settled at the bottom of the stream or river. Higher concentrations of total suspended solids result in poor water clarity due to turbid, dirty water but can also impact temperature, dissolved oxygen, and habitat.

The Lower Fox River basin has seen that type of impact, first hand. Due to the excessive amount of phosphorus and total suspended solids in the Fox River basin, a Lower Fox River Total Maximum Daily Load (TMDL) was developed. TMDLs are used to address impaired (i.e. polluted) waterways by determining the amount of pollutant, in this case TP and TSS, a water body can receive and still meet the water quality standards set by the state. The U.S. Environmental Protection Agency (EPA) approved the Lower Fox River TMDL project in 2012, which will begin the process of improving the water quality in the Lower Fox River basin.

The Lower Fox River Volunteer Monitoring Program was started in 2015 to accomplish some of the monitoring goals outlined in the Lower Fox River TMDL. Fourteen main connecting streams carry phosphorus, as well as other nutrients, and suspended sediment into the main branch of the Fox River, which then flows directly into Lake Michigan via the Bay of Green Bay. Thirteen of the fourteen streams are impaired due to high phosphorus and/or total suspended solid concentrations. The Volunteer Monitoring Program uses volunteers of all ages and professions to help the WDNR cover more area with

the stream monitoring efforts. The volunteers are trained and given all necessary sampling supplies, every spring, to follow WDNR protocol. Currently, there are seventeen different site locations distributed across the streams in the Lower Fox River Basin. Each of the locations are monitored for phosphorus, dissolved reactive phosphorus, total suspended solids, transparency, and flow. Sampling is conducted once a month, May through October, which is during the primary "growing season" of many aquatic plants and algae. Once the samples are collected, the volunteers ship them to the Wisconsin State Lab of Hygiene in Madison where the water from the samples are analyzed for the previously mentioned parameters. The results from the tests are then sent to the Lower Fox River Volunteer Monitoring Program coordinator for data analysis.

The two main primary goals of the program are to engage the public in citizen science and collect reliable data. Over the duration of the program, we have had many volunteers become engaged in this local issue. The program has given them the tools to identify problems in our lakes, rivers, and streams, as well as giving them the ability to educate others around them. By building a network within the community, the water quality issues within the Lower Fox River Basin may be resolved quicker and kept safe for future generations.

If you or anyone that you know would be interested in supporting or volunteering for the program, please contact Parker Wyngaard (Lower Fox River Volunteer Monitoring Program Coordinator) at Parker.Wyngaard@wisconsin.gov or (920) 424-3061.