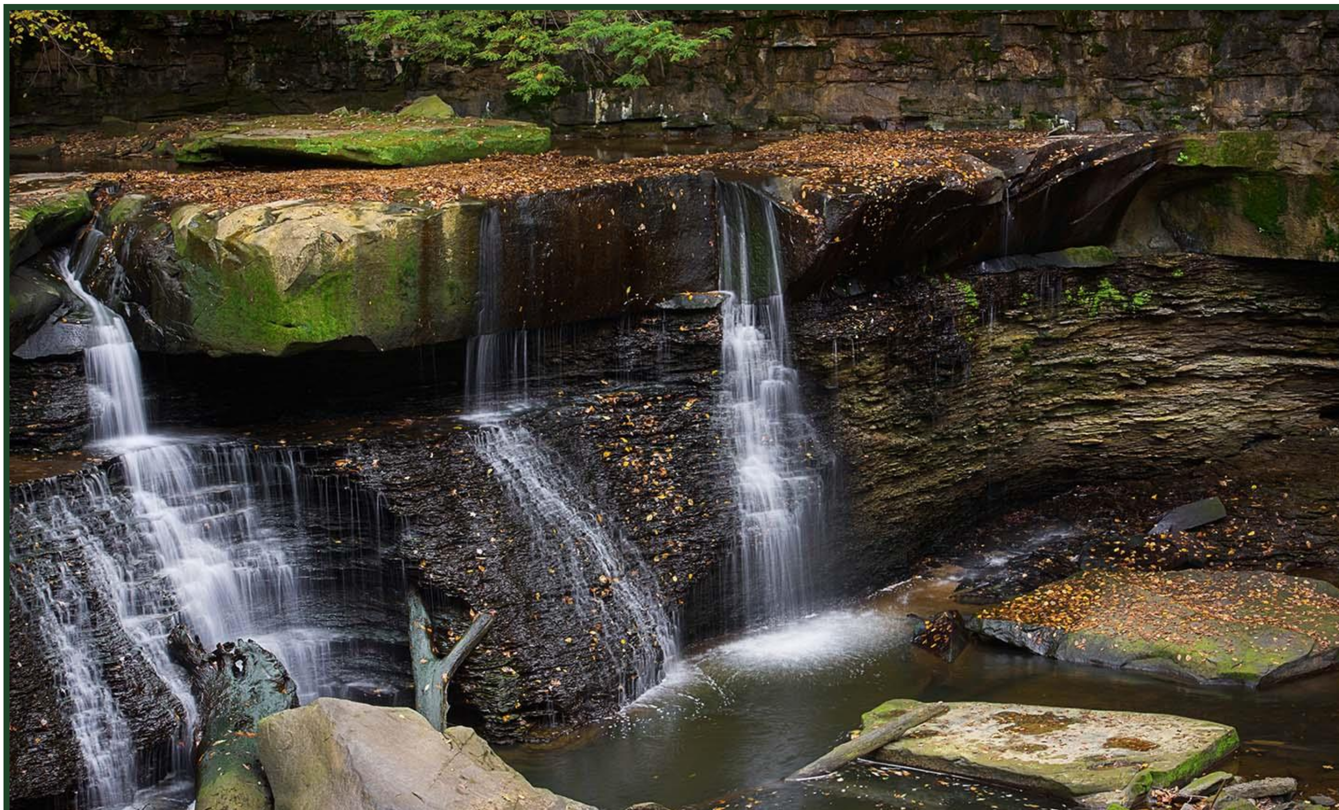

Tinker’s Creek Watershed

2020 Water Quality Report

TinkersCreek
WATERSHED PARTNERS
Rediscover • Respect • Revitalize

Acknowledgements

Tinker's Creek Watershed Partners (TCWP) would like to acknowledge the following staff members for their contribution to our water quality monitoring program:

- Kelli Herrick, Watershed Coordinator (Program Lead)
- Kate Chapel, Senior Project Manager
- Gina Messina, Student Intern (author of this report)

Additionally, TCWP is grateful for the assistance of our watershed volunteers. Without the aid of our volunteers, our monitoring program could not continue to grow from year to year. TCWP would like to acknowledge the following watershed volunteers for their ongoing stewardship:

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TCWP would also like to acknowledge Twinsburg Wastewater Treatment Plant (WWTP) for their assistance in analyzing our water quality samples, especially Corey Yugulis from Twinsburg WWTP for sample analysis and program coordination.

TCWP would also like to acknowledge Ohio University's Voinovich School of Leadership and Public Affairs for access to watersheddata.com for data management. All data collected by TCWP is publicly available on this website.

Finally, TCWP would like to acknowledge its partners for their roles in stream restoration and protection efforts throughout the watershed, including Northeast Ohio Regional Sewer District (NEORSD), Ohio Environmental Protection Agency (EPA), US EPA, Cuyahoga River Area of Concern (AOC) Advisory Committee, Dominion and Western Reserve Land Conservancy, Central Lake Erie Basin (CLEB) collaborative, Chagrin River Watershed Partners (CRWP), Cuyahoga Soil and Water Conservation District (SWCD), Portage SWCD, Summit SWCD, Geauga SWCD, and the 24 communities within Tinker's Creek watershed.

Table of Contents

Introduction

About TCWP

Tinker’s Creek Watershed Partners (TCWP) is a non-profit, 501(c)(3) watershed organization officially established in 2006. Our mission is to protect and restore water quality and habitats of the Tinker’s Creek watershed through community partnerships. The Tinker’s Creek watershed drains 96.4 square miles and is the largest tributary to the Cuyahoga River. The watershed area spans 24 communities in Cuyahoga, Summit, Portage and Geauga counties.

TCWP is governed by 15 dedicated volunteer Board of Directors who bring a variety of expertise in the fields of stormwater management, environmental education, engineering, natural resources conservation, planning, and economic development. TCWP is guided in their efforts to protect and restore the watershed and educate the public by three Ohio and U.S. EPA endorsed nonpoint source implementation strategic plans (NPS-IS Plans). Each plan encompasses a subset of the Tinker’s Creek watershed. They can be found under the Information tab. The group’s mission, along with the NPS-IS plans, shaped the goals of TCWP.

The goals of Tinker’s Creek Watershed Partners are to:

- Increase the understanding of community officials and the public regarding the natural and monetary value of protecting their water resources
- Promote low-impact and conservation development practices that balance environmental integrity with human development
- Educate watershed communities about their daily activities and habits which negatively impact their environmental surroundings and provide alternative approaches to those practices
- Encourage a no-net-loss wetland mitigation policy where mitigation remains localized within the watershed rather than outsourced to other watersheds
- Lead a watershed-based approach to decision making that advances the concept of connectivity between the different political jurisdictions within the watershed
- Increase recreational opportunities by connecting greenways, corridors, and bike paths between the different jurisdictions within the watershed

Program Overview

In 2018, TCWP was able to begin a pilot water quality monitoring program with the assistance of Earth Echo International as well as Dominion Energy and Western Reserve Land Conservancy. Earth Echo International donated water quality test kits that allowed volunteers to measure temperature, pH, turbidity, and dissolved oxygen. Through Dominion Energy and Western Reserve Land Conservancy’s Watershed Mini Grant Program, TCWP was awarded funds to purchase additional supplies for the water quality monitoring program, including HDPE bottles, chest waders, and an Oakton DO 6+ portable dissolved oxygen meter.

During the pilot year of the program, TCWP utilized volunteer and staff assistance to collect 10 samples at 10 different sites between June 3 and August 19. This pilot year allowed us to work through access, feasibility, and technical issues. TCWP also forged its partnership with Twinsburg Wastewater Treatment Plant (WWTP) for sample analysis in 2018.

2019 served as the first official year of water quality monitoring throughout Tinker's Creek watershed. TCWP has expanded the program to sample 12 sites each month from May through September. TCWP relies heavily on volunteer help to meet these monitoring demands at nine of these sites.

We continue to study our watershed in 2020 with 12 sites each month from May to September. Our volunteer force has expanded this year, and we are so grateful to the folks that spend time with us each month and each season to help us understand our watershed. With multiple years of data, we will be able to start seeing trends and making comparisons.

Program Goals

TCWP's water quality monitoring program serves multiple purposes. By utilizing volunteer assistance, TCWP is able to provide stewardship opportunities for citizen scientists throughout the watershed. Volunteers who adopt particular sites also serve as a type of early alert system. These volunteers visit the same sites each month during the program, so they gain a sense of what is "normal behavior" for that site. If any water quality parameters come back unusual, an atypical discharge is entering the creek, or the surface of the creek looks oily or otherwise polluted, volunteers can serve as a first alert reporting potential issues to TCWP and surrounding municipalities.

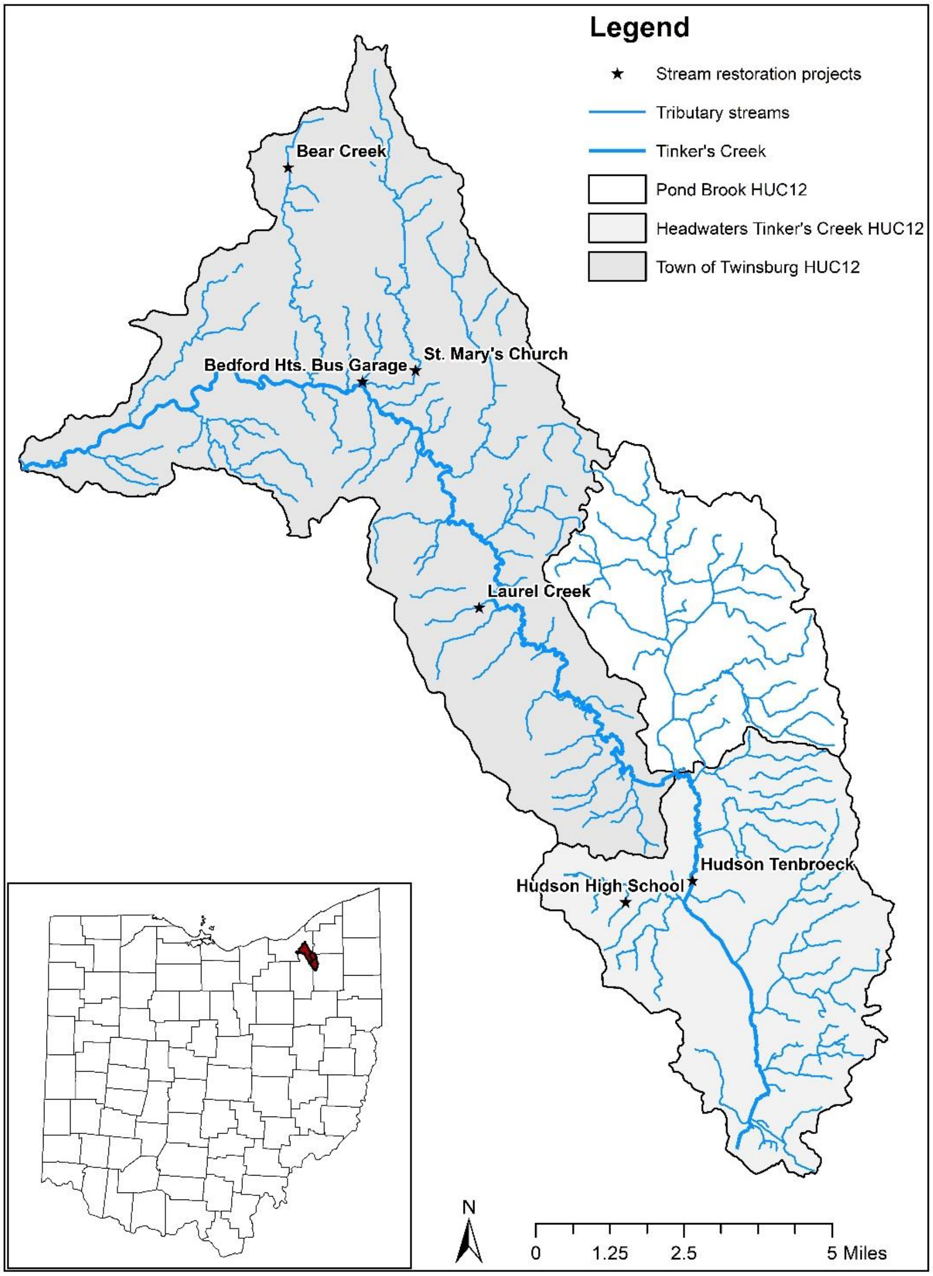
Additionally, the water quality monitoring program provides data to determine baseline water quality conditions in the creek. Prior to the beginning of TCWP's water quality monitoring program, Tinker's Creek was only monitored every few years. By sampling these same 12 sites every month, TCWP can provide insight into baseline conditions in the creek. This allows TCWP, municipalities, and other agencies to identify potential pollution issues much more quickly.

TCWP has completed multiple restoration projects throughout the watershed (see page 7) with the goal of improving water quality. In the years immediately following completion, these restoration projects are monitored by contractors to ensure proper function. TCWP's water quality monitoring program is designed for long-term monitoring at each site beyond the usual post-restoration monitoring. After several years of monitoring these sites, TCWP will be able to observe trends in water quality that can be attributed to successful restoration and mitigation efforts or long-term pollution issues. This program will allow TCWP to measure ongoing success of restoration projects and determine the larger impact of these projects on a watershed scale.

The overarching goals of TCWP's water quality monitoring program are as follows:

- Train citizen scientists to monitor water quality
- Encourage greater watershed stewardship
- Detect potential water quality issues early, like oil and grease or illicit discharges
- Generate a comprehensive understanding of water quality and major impairments throughout the watershed
- Measure the long-term success of completed stream restoration and stormwater mitigation projects in Tinker's Creek watershed

Restoration Projects in Tinker's Creek Watershed



Completed Projects:

Hudson Tenbroeck Stream Restoration

St. Mary's Stream Restoration

Laurel Creek Restoration Project in Twinsburg

Bear Creek Restoration Project in Warrensville Heights

Hudson High School Stream Restoration and Land Lab

Bedford Heights Bus Garage Project

Major stream restoration projects aren't the only thing that can improve water quality and watershed health. TCWP also works with local communities, nonprofits, schools, and property owners to install stormwater best management practices. These include rain barrels, native plantings, rain gardens, and more. These practices are also important in improving local water quality by reducing inputs of sediment, nutrients, and other pollutants to Tinker's Creek.

Methodology

Prior to use, staff or volunteers rinse a stainless-steel bucket and two HDPE bottles three times in creek water to prevent sample contamination. At each site, TCWP and/or volunteers measure water temperature, dissolved oxygen, pH, and channel width and depth (Table 1). Water temperature, dissolved oxygen, and pH are measured using a water sample collected in the stainless-steel bucket. Water temperature and dissolved oxygen are measured using the Oakton meter, while pH is measured using an aquarium test kit. Each site is also scanned for any unusual discharges or surface oils. Staff and/or volunteer also take note of weather conditions, wildlife, and any other items of interest.

Three grab water samples are also taken at each site from the water sample collected in the bucket. These samples are then placed in a cooler and transported to Twinsburg WWTP promptly. These samples are analyzed at Twinsburg WWTP to measure the concentrations of each parameter listed in Table 2.

Table 1: Field parameters collected by TCWP

Parameter:	**Units:**
Water temperature	degrees Celsius (^oC)
Dissolved oxygen	mg/L and percent saturation (%)
pH	S.U.
Channel width	M
Channel depth	Cm

Table 2: Water quality parameters analyzed by Twinsburg WWTP

Compound name:	**Units:**
Nitrite and nitrate ($NO_2 + NO_3$)	mg/L
Ammonia (NH_3)	mg/L
Total phosphorous (TP)	mg/L
Total suspended solids (TSS)	mg/L
E. coli	cfu/100 mL

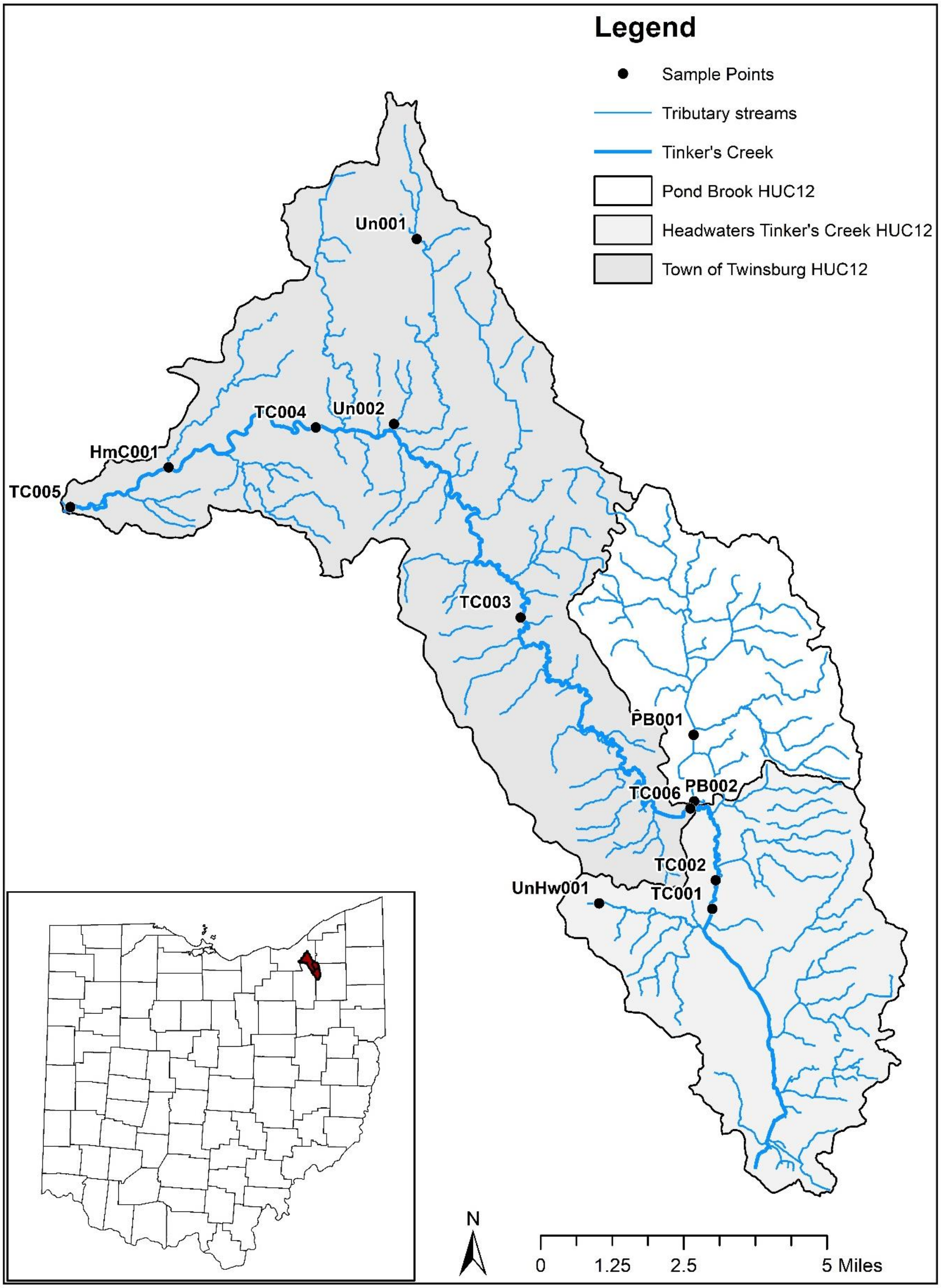
2020 Water Quality Monitoring Sites

Using volunteer and staff assistance, TCWP sampled 12 sites between May and September, 2020 (Table 3). These sites are located throughout the watershed from the headwaters to the confluence of Tinker’s Creek and the Cuyahoga River. A map of these sites is provided on page 10. Of these 12 sites, one site was undergoing stream restoration projects in 2020 (Bedford Heights Bus Garage Project).

Table 3: Water quality sites sampled during 2020

Site ID:	Site Name:	Stream:	Coordinates:
TC001	Hudson-Tenbroeck Project	Tinker's mainstem	41.262003, -81.394144
TC002	Trumbull Woods Park	Tinker's mainstem	41.269070, -81.392790
UnHw001	Darrow Road Park	Unnamed headwaters	41.263752, -81.431937
PB001	Liberty Park Pond Brook Conservation Area	Pond Brook	41.305938, -81.399144
Un001	Highland Woods Apartments	Unnamed tributary	41.432241, -81.490515
TC003	East Idlewood Park	Tinker's mainstem	41.336324, -81.457075
HmC001	Bedford Reservation Hemlock Creek Picnic Area	Hemlock Creek	41.375314, -81.574836
TC004	Broadway Trailhead near Bridal Veil Falls	Tinker's mainstem	41.385043, -81.525098
Un002	Bedford Heights Bus Garage	Unnamed tributary	41.385636, -81.499103
TC005	Tinker’s Creek Aqueduct	Tinker's mainstem	41.365475, -81.608117
PB002	Pond Brook upstream of confluence	Pond Brook	41.289170, -81.399671
TC006	Tinker's Creek at Bissell	Tinker's mainstem	41.287499, -81.401056

2020 Water Quality Sites Map



2020 Monitoring Results

According to the Ohio Environmental Protection Agency's (EPA's) 2016 Integrated Water Quality Monitoring and Assessment Report, Tinker's Creek watershed is impaired by organic enrichment or low dissolved oxygen, oil and grease, nutrients, natural limits, flow alteration, direct habitat alterations, particle distribution or embeddedness, sedimentation or siltation, and unknown causes. To target these impairments, TCWP measures nitrite and nitrate (NO2 + NO3), ammonia (NH3), total phosphorous (TP), total suspended solids (TSS), and *E. coli*. These parameters are defined in detail in Appendix A.

Dissolved Oxygen Results

Dissolved oxygen is crucial for aquatic life to survive. The level of oxygen in the water must be above 2 mg/L for fish to be able to live. The threshold that warmwater bodies should be above is 5 mg/L. All sites in Tinkers Creek were above this threshold besides Darrow Road Park (UnHw001) (Figure 1). The level average level at the site was 2.53 mg/L. This could be due to the high amounts of suspended solids that are causing a decrease in the oxygen levels.

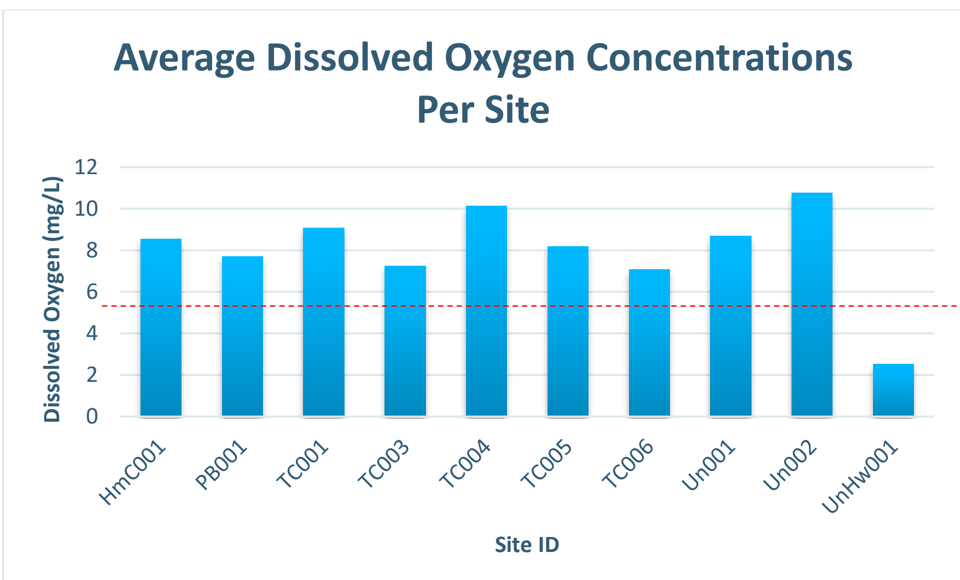


Figure 1: Average dissolved oxygen concentrations at each sampling site

E. coli Results

Escherichia coli (*E. coli)* is a kind of bacteria that is found the intestines of both animals and humans. Waterbodies naturally contain *E. coli* due to animal feces near the stream sites. It becomes dangerous when the numbers are unusually high. The State of Ohio regulates the concentrations for aquatic us and recreational use. Tinkers Creek is a WWH (warmwater habitat) and PCR (primary contact recreation). In the table below, is the average levels per site at each month sampled.

Table 4*:* Average E. coli concentrations

Site ID	Month	E. coli concentration (cfu/100 mL)
HmC001	May	210*
	June	80
	July	330*
	August	70
	September	90
PB001	may	540*
	September	200*
PB002	July	670*
TC001	May	780*
	June	16
	July	380*
	September	5400**
TC002	May	540*
	June	110
	July	25
	August	6
	September	80
TC003	May	10000**
	June	600*
	July	290*
	August	150*
	September	150*
TC004	June	230*
	July	1200**
	August	520*
	September	100

Site ID	Month	E. coli concentration (cfu/100 mL)
TC004	June	230*
	July	1200**
	August	520*
	September	100
TC005	May	75
	June	130*
	July	260*
	August	100
	September	60
TC006	June	80
	July	190*
	August	90
	September	420*
Un001	May	430*
	June	6600**
	July	3200**
	August	980*
	September	170*
Un002	July	390*
	August	440*
	September	20
UnHw001	May	765*
	June	60
	July	90
	August	440*
	September	430*

* indicates values that exceed PCR criteria (geometric mean > 126 cfu/100 mL)

** indicates values that exceed WWH criteria (geometric mean > 1,030 cfu/100 mL)

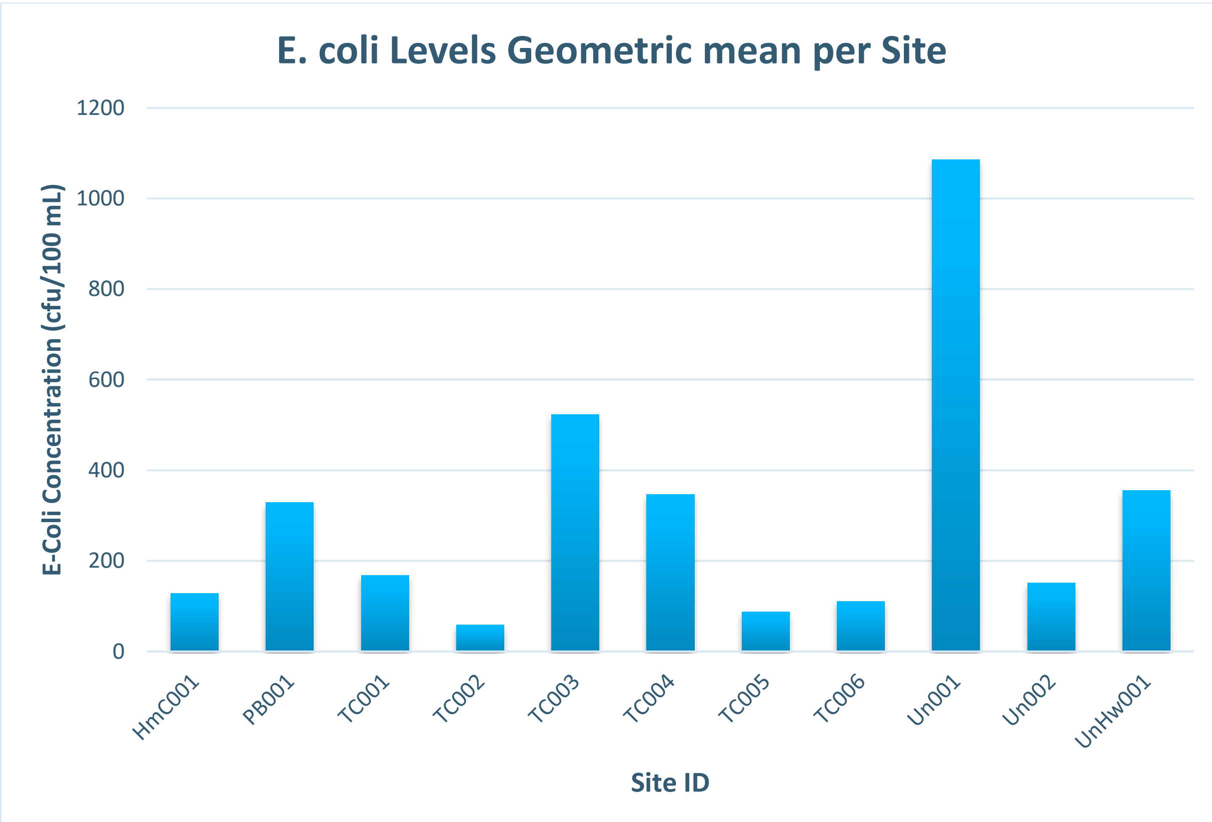


Figure 2: Geometric mean of *E. coli* levels at each sampling site

The OEPA has set a level that if passed becomes a public health nuisance. The levels differ depending on the water body type. For areas that are considered PCR, the level of exceedance is 126 cfu/100mL and WWH being 1,030 cfu/100mL. For sites PB001, PB002, and Un002 data was limited making the results for those areas not as accurate as the others. The graph below shows the number of exceedances for each type and site.

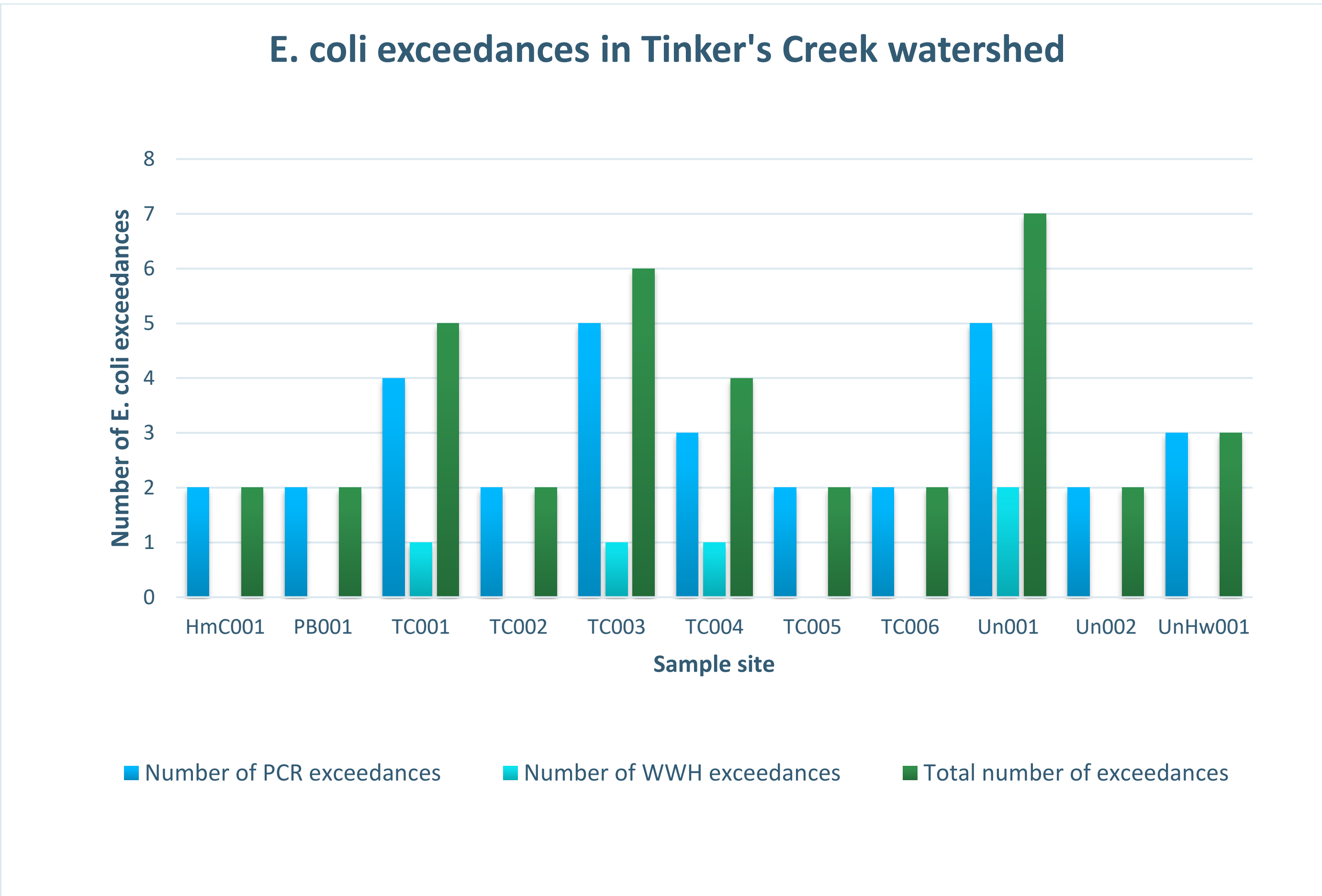


Figure 3: Average dissolved oxygen concentrations at each sampling site

Nutrient Results

Over the course of the sampling season, nutrient concentrations varied greatly at each site. During rain events, nutrients and other pollutants get washed into the creek with stormwater. This causes temporary spikes in nutrient and total suspended solids (TSS) concentrations. TCWP's water quality monitoring data captures several storm events, so these spikes are expected and evident in our dataset.

Nitrate and Nitrite

The average nitrate and nitrite concentration were below 5 mg/L at each site besides Hemlock Creek Picnic (HmC001) (Figure 5). In Hemlock Creek the average high was 11.602 mg/L. The concentrations were high through the whole year (Figure 6). This could be an indication that there is possible pollution upstream. Nitrate and nitrite in large abundances can affect dissolved oxygen levels and be harmful to aquatic organisms.

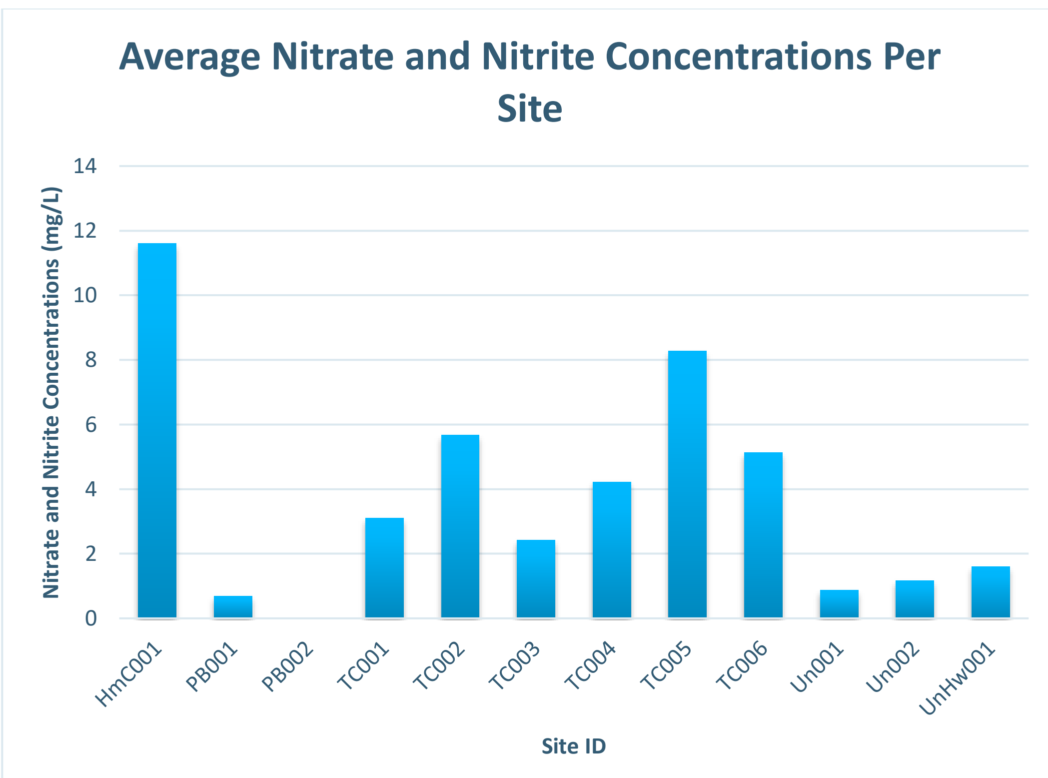


Figure 4: Average nitrite and nitrate concentrations at each sampling site

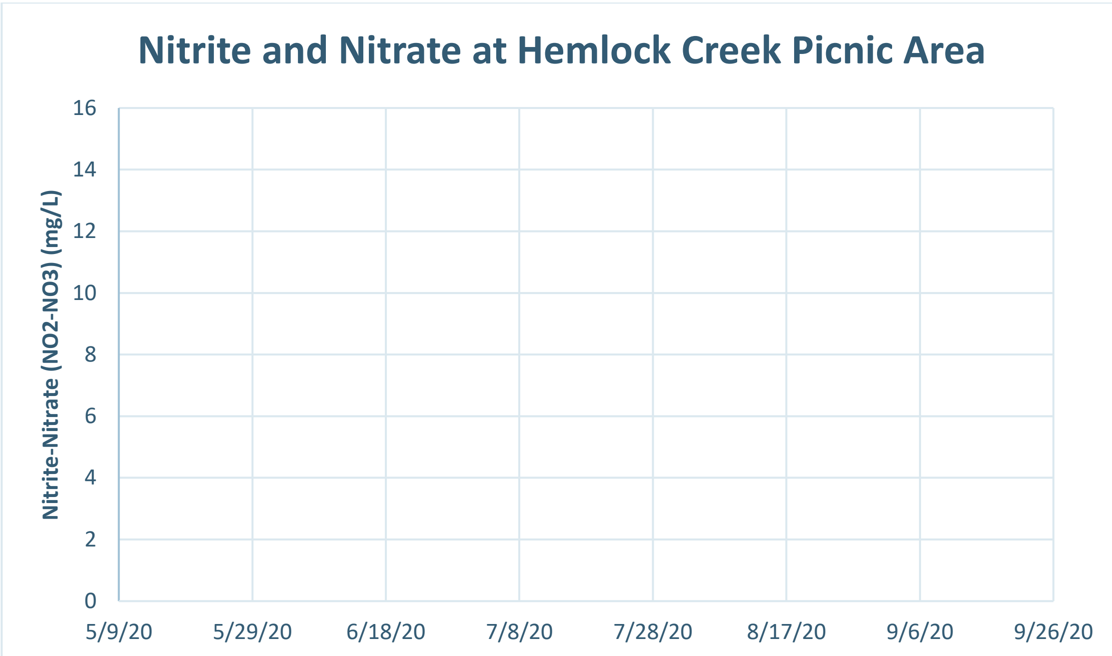


Figure 5: Nitrite-nitrate concentrations at Hemlock Creek Picnic Area (HmC001)

Ammonia

The ammonia concentration levels were low throughout the whole watershed with an average of 0.075 mg/L (Figure 6). The highest average of 0.15 mg/L was at Darrow Road Park (UnHw001). The levels are Darrow Road remained 0.2 and below through the year except for July 27 when it reached 0.31 (Figure 7). Higher levels of ammonia could be a result from animal waste or decaying matter and become toxic to aquatic organisms.

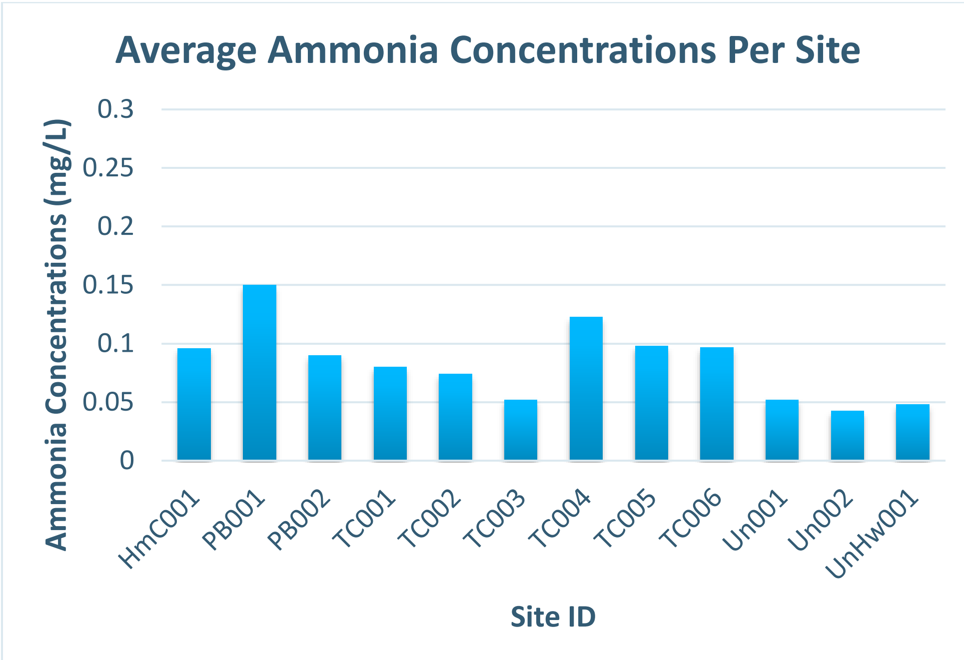


Figure 6: Average ammonia concentrations at each site

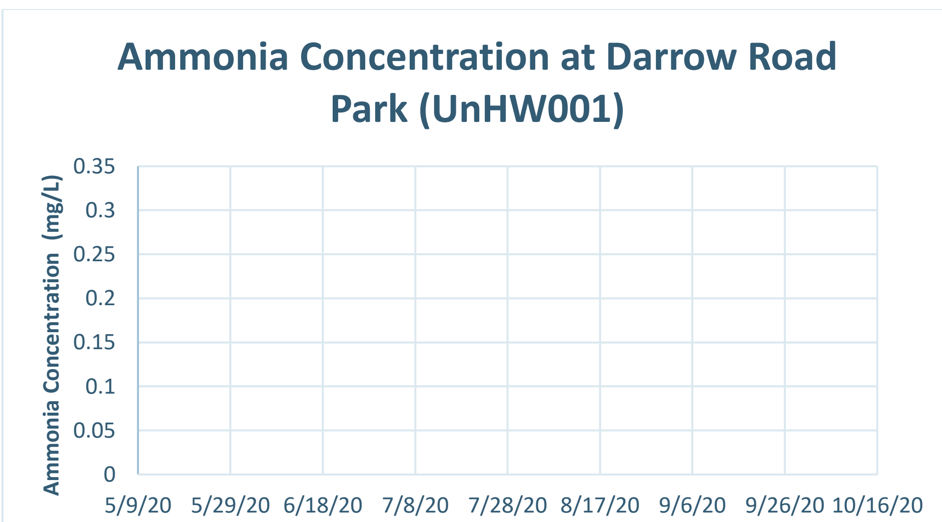


Figure 7: Average ammonia concentrations at Darrow Road Park

Total Phosphorous

Total Phosphorous concentrations varied between the sites. The average level remained below 0.28 mg/L (Figure 9). The highest amounts were found at Pond Brook upstream confluence (PB002) and Darrow Road Park (UnHw001) on July 27th and 28th. Bedford Heights Bus Garage (Un002) had less than .02 mg/L at each date sampled. According to the EPA the phosphorous levels should remain below .10 mg/L. All site averages remained slightly above this threshold besides Bedford Heights Bus Garage (Un002), Tinkers Creek at Bissell (TC006), and Highland Woods Apartments (Un001).

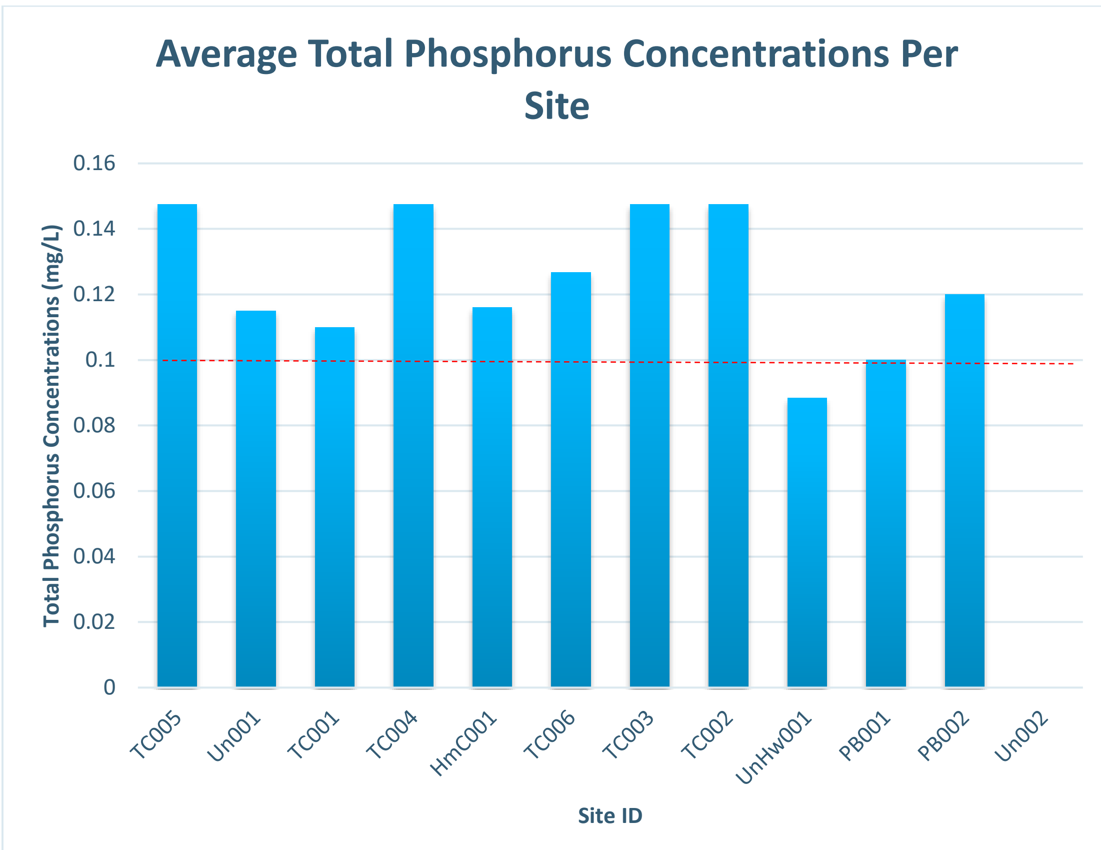


Figure 8: Average total phosphorus concentrations at each site

Total Suspended Solids (TSS) Results

Total suspended solids are dissolved matter in the water that are able to be captured by a filter. This included silt, decaying matter, waste and sewage. The importance of measuring the number of suspended solids because it greatly affects the light passing through. This results in a slowdown of photosynthesis that causes a decrease in dissolved oxygen as well. Spikes of TSS typically occur after storm events causing an increase in sedimentation and erosion. The highest average concentration of TSS was at HmC001 with a TSS of 11.602 mg/L. The second highest average was recorded at TC005 with a TSS of 8.282 mg/L (Figure 10).

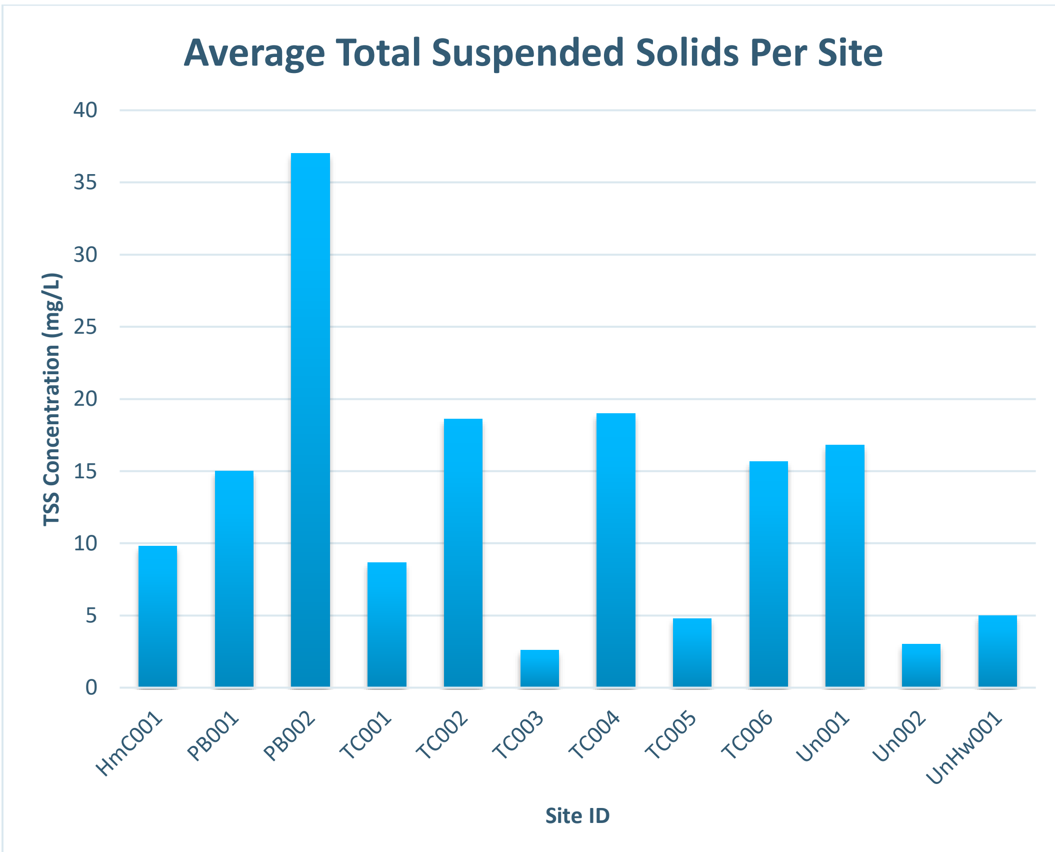


Figure 9: Average total suspended solids concentrations at each site

Conclusions

Looking at the data from the previous year there have been improvements but much of the data were similar between both years. The nitrate and nitrite concentrations were roughly the same as the previous year with Hemlock Creek (HmC001) being the highest. TC002 and TC005 slightly increased this year while Un001 decreased. The ammonia concentrations at PB001 dropped from 0.25 mg/L to roughly 0.15 mg/L from last year. Most of the sites were just slightly higher overall. The total phosphorus levels dropped at sites PB002 and UnHw001. All sites were still above the 0.10 mg/L threshold except for UnHw001. The suspended solids this year were extremely lower. The highest average last year was over 100 mg/L while this year's highest average was 37 mg/L.

The Bus Garage site has seen improvement after the restoration project. Meandering the stream away from the bank helped with flooding by creating a larger flood plan to slow down the flow and erosion. Fish and many macroinvertebrates have been present throughout the year at the site as well after the removal of a V-notch dam that was acting as a fish barrier.

Because 2020 is only the second year of TCWP's monitoring program, the trends observed in this report should be taken with a grain of salt. To truly understand the health of Tinker's Creek and major pollution sources, TCWP will need to monitor the creek for several years, even decades. Additionally, this dataset was largely affected by storm events, which may or may not be indicative of normal water quality in Tinker's Creek. As we continue this program, TCWP will continue to publish Water Quality Reports to paint a better picture of watershed health and pollution sources.

Water quality in Tinker's Creek watershed has been improving since restoration actions began in the Cuyahoga River basin. To continue these improvements, we need your help. To learn more about watershed stewardship and what **you** can do to protect and restore Tinker's Creek, please contact us at info@tinkerscreekwatershed.org or 330-963-6243.

Thank you to all of our volunteers for a successful monitoring season! We hope to work with you all again in 2021. TCWP also wants to thank all of our partners who have contributed to and assisted with the monitoring, restoration, and protection of Tinker's Creek watershed.

Appendix A: Definitions

Air temperature: measured in degrees Celsius

Water temperature: measured in degrees Celsius, impacts amount of dissolved oxygen, influences water chemistry, limits what organisms can live in a body of water

pH: measure of how acidic/ basic water is. Determines solubility, biological availability and chemical constituents of nutrients, limits what organism can live in the water.

Dissolved oxygen (DO) (mg/L): amount of oxygen available for use as respiration for fish and aquatic organisms.

Total suspended solids (TSS) (mg/L): amount of sediment suspended in the water. High levels can cause decrease in sunlight, accumulate in fish gills causing them to be unable to breathe, decrease disease resistance, decrease food availability, and/or cause high concentrations of bacteria, metals, nutrients, and pesticides.

Total phosphorous (mg/L): one of the key elements (other than nitrogen) needed for plant growth. Too much can cause eutrophication, which can cause fish kills and plant deaths.

Ammonia (NH_3) (mg/L): amount of ammonia in the water. Ammonia is a product of microbiological activity and may be indicative of sanitary pollution.

Nitrite-nitrate (NO_2, NO_3) (mg/L): nitrite/ nitrate levels in the water. Intermediate and end products of the biological breakdown of organic nitrogen.

Nitrite: high quantities can show waste water pollution

Nitrate: not very toxic to fish but may indicate poor water quality

***Escherichia coli (E. coli)* (cfu/100mL)**: Escherichia coli bacteria, found in intestines of animals and humans. Indication of sewage or animal waste contamination.

Appendix B: Additional Resources

Dominion Energy and Western Reserve Land Conservancy Watershed Mini Grant Program. Retrieved from https://www.wrlandconservancy.org/articles/tag/dominion-energy-watershed-mini-grant-program/.

EarthEcho International: Water Challenge. Retrieved from http://www.monitorwater.org/.

Ohio Administrative Code 3475-1-01 through 3475-1-44 and 3475-1-50 through 3475-1-54. Retrieved from https://www.epa.gov/sites/production/files/2015-09/documents/oh_34751_1_to_40.pdf.

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Tinker's Creek Nine-Element Non-Point Source Implementation Strategic Plan: Headwaters Tinker's Creek (HUC12: 041100020502). Retrieved from https://tinkerscreek.org/wp-content/uploads/2017/07/Tinkers-Creek-Headwaters_Ver1.0_7-6-2017.pdf.

Tinker's Creek Nine-Element Non-Point Source Implementation Strategic Plan: Town of Twinsburg (HUC12: 041100020504). Retrieved from https://tinkerscreek.org/wp-content/uploads/2017/07/Tinkers-Creek-%E2%80%94Town-of-Twinsburg_Ver1.0_8-8-2017.pdf.