# 2024 Livingston County Water Quality Monitoring Program: Unassessed Waters, USDA, and Reference Streams

Report Submitted to the Livingston County Planning Department, Geneseo, NY

By

Daniel T. Beers, Field and Lab Manager
Michael F. Chislock, PhD

Department of Environmental Science & Ecology, SUNY- Brockport, 350 New Campus Drive, Brockport, NY 14420

January 9, 2025

Signature

**Laboratory Director and Quality Assurance Officer:** Michael Chislock**,**
mchislock@brockport.edu, 585-395-5961
SUNY-Brockport Limnology Laboratory, ELAP #12116
125 Lennon Hall, Monroe Avenue, Brockport, NY 14420-2997, Monroe County
350 New Campus Drive, Brockport, NY 14420

**Project Sponsor:** Heather Ferrero, Livingston County Planning Department, Government Center, 6 Court St. Rm 304 Geneseo, NY

**QAPP ID:** QAPP-WQM-0019_V24-1_FLLOWPA-LIVI

**Effective:** February 28, 2024; **Expires:** February 28, 2025

# Table of Contents

## Summary

- Nine streams were sampled for water quality in 2024, measured total phosphorus (TP), total nitrogen (TN), and total suspended solids (TSS). Select former study tributaries were monitored to continue long-term monitoring efforts. Unassessed and reference streams were also monitored.
- A dry summer and fall period were observed, causing many study streams to dry up.
- Eagle Point Gully dried up after our May sampling date through November, so it is difficult to determine if there are any seasonal trends in water quality and to be able to compare it to other study streams.
- Densmore Gully was one of the “lower concentration” streams for all three analytes collected (TP, TSS, TN).
- North McMillan Creek TP and TSS concentrations were slightly greater than what were observed in 2023. The increasing trends of TP and TSS can likely be attributed to erosional issues found in the lower reaches of the stream and watershed. North McMillan Creek had the lowest average concentrations of TSS, TP, and TN of all streams studied during this period.
- Compared to other study streams, the Conesus Inlet had the greatest TSS and TP concentrations, while TN was on the lower side compared to other tributaries. The Inlet is one of the largest streams flowing into Conesus Lake; the high TP concentrations can be concerning due to this reason.
- North End Creek had some of the greatest TSS, TP, and TN concentrations. TN concentrations in 2024 were notably greater than what we observed in 2023.
- South Gully had the second lowest TSS, and 4th lowest TP. TN was the third greatest during baseflow.
- Compared to other streams sampled during this period, South McMillan had the 5th lowest TSS, 2nd lowest TP, and TN was the third lowest during baseflow. In 2024, TP and TSS concentrations were greater than what were observed in 2023, but still some of the lowest concentrations seen across our 2024 study sites
- 5574E dried up after our May sampling date through November. 2024, average TP and TSS concentrations were greater than what were observed in 2023. 2024 TN concentrations were similar to what we observed in 2023
- Compared to other study steams during this monitoring period, 6009W had the greatest TN concentrations, 2nd highest TP concentrations, 4th greatest TSS concentrations.

## Recommendations

- Increased year-round tributary sampling frequency for former USDA tributaries and other major tributaries, as allowed by resources and funding - selected tributaries could potentially be sampled annually on a rotating basis.

- Storm events should be sampled more frequently, as storm events have the potential to carry much greater concentrations and loads of nutrients into Conesus Lake than baseflow conditions. In some tributaries, elevated flows due to storm events are highly ephemeral, making them impossible to capture through routine (i.e., monthly) sampling trips. Heavy storm events are predicted to become more common in the future with climate change. BMP implementation and assessment of BMP effectiveness should also be considered in the context of storm event occurrence and climate change.
- If allowable for the 2025 scope of work, analysis of dissolved nutrients (e.g., orthophosphate, nitrate + nitrite, ammonia) is recommended for all of the 2024 unassessed tributaries. In streams with elevated concentrations of total phosphorus (i.e., TP>75 µg/L), understanding the potential importance of other forms of phosphorus (e.g., dissolved orthophosphate) is particularly important.
- Current information on agricultural practices for the USDA tributaries and other subwatersheds is needed.
- Due to the abnormally dry conditions observed in the summer and fall, we recommend continued sampling of the unassessed subwatersheds to capture the full range of conditions in these water bodies. This should be a high priority in winter and spring 2025.

## Introduction and Background

Nutrient and sediment pollution can have a myriad of impacts on aquatic ecosystem health and function. Nutrient and sediment pollution can also affect human use of water resources including drinking water, recreation, and aesthetics. There is no national standard for total suspended solids (TSS) in streams; however, high TSS can have negative impacts on aquatic ecosystem health. TSS can affect water clarity and light attenuation in the water column, which can have direct impacts on submerged aquatic vegetation and phytoplankton production. TSS can also affect the types of organisms that can survive in the system. Fine soil particles can clog gills in aquatic invertebrates and affect fish inhabitance. TSS includes inorganic soil particulates as well as organic particles including algae, leaves, and decomposing matter. TSS can be impacted by runoff, erosion, pollution, and disruptions of bottom sediment.

Phosphorus is a critical nutrient required for life and is often a limiting nutrient in aquatic ecosystems. Total phosphorus (TP) is the total of all dissolved and particulate forms of phosphorus. Excessive phosphorus can occur from poor agricultural practices, urban runoff, sewage treatment plant discharges, and from leaking septic systems (USEPA 2021). Excessive phosphorus in aquatic ecosystems can cause increased algal and plant growth and can lead to decreased dissolved oxygen and eutrophication. Algal blooms caused by excessive nutrient inputs (both phosphorus and nitrogen) can produce toxins in water which are often harmful to aquatic and human health (USEPA 2021). There is no national standard set by the EPA; however, in NYS, total phosphorus guidelines for most lakes and reservoirs is 20 µg/L (NYSDEC N.D.). Draft water quality guidance values to regulate phosphorus in New York State surface waters (https://dec.ny.gov/news/press-releases/2024/12/dec-seeks-public-comment-on-proposed-ambient-water-quality-guidance-values-for-phosphorus) now list 25, 30, and 75 µg/L as potential guidance values for lotic systems, depending on watershed and region of the state.

Nitrogen (dissolved and total) pollution is often caused by livestock manure runoff, human sewage, fertilizers, and can also occur from the erosion of natural deposits. The USEPA (2022) states the maximum contaminant level for nitrate is 10 mg/L in drinking water sources. If these levels are exceeded in drinking water resources, potential health effects, including blue baby syndrome (methemoglobinemia, a temporary blood disorder) in infants of less than six months old can occur (USEPA 2022).

*USDA Streams*

In the early 2000s, several small tributary sub-watersheds of Conesus Lake were selected to evaluate if agricultural best management practices (BMPs) could reduce soil and nutrient runoff to the lake and whether impacts of reduced loadings on the lake ecosystem could be documented (Herendeen and Glazier 2009; Makarewicz et al. 2009). Monitoring began in September 2002 (Makarewicz et al. 2008). BMP implementation was voluntary for farms on selected tributaries (Herendeen and Glazier 2009). Watersheds were selected based on the type of agricultural activities occurring, whether the farmers wanted to voluntarily use BMPs, if there was previous knowledge of sediment and nutrient loss in the watershed, and if macrophytes and algal cover were present in stream mouths in the lake (Herendeen and Glazier 2009). Selected watersheds included Graywood Gully, Cottonwood Gully, Long Point Gully, Sand Point Gully, Sutton Point Gully, and North McMillan Creek. Watershed area, management practices implemented, and agricultural percentage in watersheds for selected tributaries are found in Table 1. Most selected BMP tributaries received a combination of cultural and structural BMPs (e.g., installation of grass filter strips and reduction in winter manure spreading in the watershed of Graywood Gully) (Table 1). All tributaries were sampled at the base of their watersheds during the entire study (Herendeen and Glazier 2009). A main goal of implementing BMPs was to reduce the abundance and biomass of algal cover and macrophytes in the lake by reducing nutrient loss in watersheds and nutrient input near stream mouths (Makarewicz et al. 2001; Makarewicz et al. 2009). However, it is realized that recovery is not instantaneous and other systems where BMPs were implemented, such as those in the Irondequoit Bay and Lake Erie watersheds, took as long as 20-25 years to improve water quality (Makarewicz et al. 2001).

Prior to BMP implementation, high concentrations of nutrients during storm events were measured in Graywood, Hanna's Creek, Sand Point, Long Point Gully, and North Gully (Makarewicz et al. 2001). High nitrate/nitrite (NOx) concentrations were documented in Long Point Gully, Cottonwood Gully, Sutton Point, Rivulet 5989 (also named Southwest Creek), Graywood Gully, and North Gully (Makarewicz et al. 2001). High concentrations of nutrients were measured during baseflow conditions in Graywood Gully as well, indicating water quality degradation (Makarewicz et al. 2001).

After BMPs were implemented, periodic monitoring continued on study tributaries (Makarewicz et al. 2009). Graywood Gully was found to have the greatest percent reduction in concentrations (55% lower) across the largest suite of analytes (e.g., total phosphorus, orthophosphate (i.e., soluble reactive phosphate, SRP), NOx, and total suspended solids) prior to 2009 (Makarewicz et al. 2009). With implementation of cultural and structural BMPs, major impacts on soil and nutrient losses were documented (Makarewicz et al. 2009). Significant reductions in concentrations of NOx during all flow regimes were observed when fields were planted with vegetative crops or left fallow, while reductions in total nutrients (total plus dissolved) were measured following structural BMP implementation (Makarewicz et al. 2009). While significant reductions of nutrients were observed after implementing BMPs in managed streams, ambient concentrations remained above those measured in reference streams (Makarewicz et al. 2009). In contrast, after 5 years of monitoring, suspended solids concentrations were not significantly different from the reference watershed (North McMillan) during non-event and event sampling after 5 years of monitoring (Makarewicz et al. 2009). It is possible that the full effect of BMPs on nutrients was still not realized after 5 years of post-monitoring.

In 2015, more than a decade after initial BMPs were introduced, monitoring of Long Point Gully, Graywood Gully, and Sutton Point Gully was performed after some additional BMPs were implemented (Lewis and Makarewicz 2015). Generally, decreases in total phosphorus (except Graywood Gully), total suspended solids, and NOx were observed with the addition of more BMPs (Lewis and Makarewicz 2015). It is likely that total phosphorus did not improve in Graywood Gully because BMP construction was occurring in the watershed during the study period (Lewis and Makarewicz 2015). However, SRP was elevated in all three watersheds compared to historical data (Lewis and Makarewicz 2015). It is unclear as to why SRP concentrations had increased in streams draining these watersheds. Installation of additional BMPs was recommended to help reduce soluble nutrient runoff.

In general, the implemented BMPs have demonstrated that water quality can be improved both within tributaries and in-lake near tributary mouths. Bacteria, macrophytes, and algae can be reduced from these practices (Makarewicz et al. 2008; Bosch et al. 2009; Makarewicz and Lewis 2009). Water quality should continue to be monitored in the USDA study streams to evaluate whether water quality conditions are improving in these watersheds and in the lake (Makarewicz et al. 2008; Makarewicz and Lewis 2009). Continued monitoring of these tributaries can also guide future BMP and management efforts designed to improve water quality and ecosystem health of Conesus Lake and its tributaries.

The 2024 tributary monitoring program examined select BMP streams (as a continuation of our follow up study that began in April 2020), reference streams, and unassessed streams to evaluate the water quality conditions in these streams and continue to build long term datasets for those streams that have been monitored historically in the Conesus Lake watershed. The data presented here will continue to be used to examine long term trends in the streams and support long-term planning efforts to help facilitate best management practices (BMPs) and applied ecosystem management (AEM) in the Conesus Lake watershed.

## Methods

Nine streams were sampled for water quality in 2024. Select former USDA study tributaries were monitored to continue long-term monitoring efforts in the BMP streams. Unassessed and reference streams were also monitored (Tables 1 and 2; Appendix 1). All tributary sites were monitored monthly for baseflow from 18 March 2024 to 6 November 2024. A total of nine sampling events were captured for selected tributaries (unless streams were dry).

Each sampling event consisted of 1) collecting water samples for laboratory analyses, including total suspended solids (TSS), total phosphorus (TP), and total nitrogen (TN); (2) *in-situ* water chemistry measurements, including temperature, dissolved oxygen, pH, and specific conductivity; and (3) field observations (Table 3). Water chemistry samples were collected from flowing water using a grab sampler and plastic bucket rinsed with deionized water and respective stream water at each site prior to sample collection. Water was not collected from streams that contained stagnant water, had insufficient sampling depth (less than 4 inches) or were dry. Samples were appropriately processed and placed into pre-cleaned and labeled bottles according to standard methods and stored on ice while in the field (Table 3). One field duplicate and equipment blank were collected during each sampling event. All water chemistry samples were analyzed by the SUNY-Brockport Limnology Laboratory (ELAP ID #12116) within standard hold times. *In-situ* measurements were obtained using a calibrated YSI multimeter probe.

Concentration data from 2024 in select USDA streams were compared to past data collected by Beers and Chislock (2024) to assess if nutrients and TSS concentrations from watersheds were improving, declining, or stable, relative to the historical data. Due to available budget, it is important to note that sample frequency changed in 2020-2021 and 2023; samples were collected weekly from 2003 to 2010, but monthly from May to August 2020-2021, and 2023-2024. Historical concentration data from May through August are presented as averages by year on bar graphs with standard errors to compare the data. The 2024 sampling concentration data were also compared across sampling dates to examine water quality differences and if any temporal patterns exist on study tributaries.

## Results and Discussion

<u>Eagle Point Gully</u> <u>(Tables 1, 2, 5, Figure 1, appendix 1)</u>

Eagle Point Gully is considered an “unassessed stream,” so nutrients and water quality variables were monitored during 2024 for baseflow. The stream dried up after our May sampling date through November, so it is difficult to determine if there are any seasonal trends in water quality. From the dates we were able to sample, we observed the greatest TP, TSS, and TN concentrations on the April 18th sample date. The greater concentrations seen in the spring could possibly be explained from agricultural activities occurring in the watershed, especially before the peak growing season. During the height of growing season, excess nutrients can often be utilized by plants and crops, which also hold back sediment from running off. Because the stream was dry for most of the sampling period, it is also difficult to compare it to other streams in the watershed.

Densmore Gully (Tables 1, 2, 5, Figure 2, appendix 1)

Densmore Gully is considered an "unassessed stream", so nutrients and water quality variables were monitored during 2024 for baseflow. The stream was flowing all dates we sampled, except in August where it was dry. We observed the greatest TSS concentrations in April and September. During the other months, TSS was generally the same. For TP concentrations, the greatest were observed in April and October, while the lowest were seen in May. TN concentrations were generally the greatest in the first half of our sampling period, before decreasing to its lowest concentration we observed in November. Compared to other streams sampled during this period, Densmore Gully was one of the "lower concentration" streams for all three analytes collected.

North McMillan Creek (Tables 1, 2, 5, Figures 3 and 10, appendix 1)

North McMillan Creek was the reference watershed during the USDA study due to its low agricultural land use and did not have any BMPs installed in the watershed during the BMP study. In 2024, TP and TSS concentrations were slightly greater than what were observed in 2023. The increasing trends of TP and TSS can likely be attributed to erosional issues found in the lower reaches of the stream and watershed. We documented this in a segment analysis of North McMillan Creek; see Beers and Chislock (2023) for more details and conclusions. 2024 TN concentrations are comparable to 2023 and continue to be much lower than agricultural streams (Table 5, Figure 10).

In 2024, TP, and TSS concentrations were greatest during the September sampling date. There was a lot of periphyton growth in the stream during this month that may have influenced the greater concentrations seen. TN concentrations were generally the greatest during the first half of our sampling regime, before decreasing into the fall season. Compared to other study streams during this monitoring period, North McMillan Creek had the lowest average concentrations of TSS, TP, and TN.

Conesus Inlet (Tables 1, 2, 5, Figure 4, Appendix 1)

The Conesus Inlet is a reference stream, and TSS, TP, and TN concentrations were monitored in 2024. We observed the greatest TSS, TP and TN concentrations in the summer. Compared to other study streams, the Inlet had the greatest TSS and TP concentrations, while TN was on the lower side compared to other tributaries. The high TSS and TP is likely from the effects of the wetland upstream of our sample site. The Inlet is one of the largest streams flowing into Conesus Lake, the high TP concentrations can be concerning due to this reason.

North End Creek (Tables 1, 2, 5, Figures 5 and 10, appendix 1)

North End Creek is considered an “unassessed stream”, so nutrients and water quality variables were monitored during 2024 for baseflow. We observed the greatest TP and TSS concentrations during August baseflow, while the lowest were observed in the spring. We generally observed an increasing trend of TN concentrations through the summer, with the greatest TN concentrations being observed during July and September baseflow. Compared to other study steams during this monitoring period, North End Creek had some of the greatest TSS, TP and TN concentrations (2$^{nd}$ highest TSS, 3$^{rd}$ highest TP, and 2$^{nd}$ highest TN) (Table 5).

In 2024, TP and TSS concentrations were lower than what were observed in 2023, but still some of the greatest concentrations seen across our 2024 study sites (Table 5, Figure 10). 2024 TN concentrations were notably greater than what we observed in 2023 (Table 5, Figure 10).

South Gully (Tables 1, 2, 5, Figures 6, 10, appendix 1)

South Gully is considered an “unassessed stream”, so nutrients and water quality variables were monitored during 2024 for baseflow. The stream was flowing all dates we sampled through July, and then in October. We were unable to sample this stream in March due to construction activities happening at the study site. We observed the greatest TSS concentrations in June. During the other months, TSS was generally low. For TP concentrations, the greatest were observed in October, while the lowest were seen in May. TN concentrations were the greatest in June and July, while its lowest concentration we observed was in October. Compared to other streams sampled during this period, South Gully had the second lowest TSS, and 4$^{th}$ lowest TP. TN was the third greatest during baseflow.

In 2024, TSS concentrations were lower than what were observed in 2023 while TP concentrations increased slightly in 2024 compared to 2023 (Table 5, Figure 10). 2024 TN concentrations were similar to what we observed in 2023 (Table 5, Figure 10).

South McMillan Creek (Tables 1, 2, 5, Figures 7, 10, appendix 1)

South McMillan is another reference stream, and nutrients and water quality variables were monitored during 2024 for baseflow. The stream was flowing all dates we sampled through June, and then in August, before drying up for the fall. We observed the greatest TSS concentrations in April. During the other months, TSS was generally low. For TP concentrations, the greatest were observed in April, June and August, while the lowest were seen in May. TN concentrations were generally stable and low. Compared to other streams sampled during this period, South McMillan had the 5$^{th}$ lowest TSS, 2$^{nd}$ lowest TP, and TN was the third lowest during baseflow.

In 2024, TP and TSS concentrations were greater than what were observed in 2023, but still some of the lowest concentrations seen across our 2024 study sites (Table 5, Figure 10). 2024

TN concentrations were slightly greater than what we observed in 2023 (Table 5, Figure 10). South McMillan is generally a forested watershed, the relatively low concentrations of these analytes indicate a more forested watershed than agricultural. The concentrations in South McMillan Creek are slightly greater than the other reference tributary, North McMillan Creek.

5574 East Lake (Tables 1, 2, 5, Figures 8, 10, appendix 1)

5574E is considered an “unassessed stream”, so nutrients and water quality variables were monitored during 2024 for baseflow. The stream dried up after our May sampling date through November, so it is difficult to determine if there are any seasonal trends in water quality. From the dates we were able to sample, we observed the greatest TP, TSS, and TN concentrations on the April 18th sample date. Because the stream was dry for most of the sampling period, it is also difficult to compare it to other streams in the watershed.

In 2024, average TP and TSS concentrations were greater than what were observed in 2023 (Table 5, Figure 10). 2024 TN concentrations were similar to what we observed in 2023 (Table 5, Figure 10).

6009 West Lake (Tables 1, 2, 5, Figures 9, 10, appendix 1)

6009W is considered an “unassessed stream”, so nutrients and water quality variables were monitored during 2024 for baseflow. We observed the greatest TP and TSS concentrations during September baseflow, while the lowest were observed in the spring. We generally observed a stable trend of TN concentrations through the spring and summer, with the lowest TN concentrations being observed during September baseflow. The stream was dry in August, October, and November. Compared to other study steams during this monitoring period, 6009W had the greatest TN concentrations, 2nd highest TP concentrations, 4th greatest TSS concentrations.

In 2024, TP and TSS concentrations were similar to what were observed in 2023 (Table 5, Figure 10). 2024 TN concentrations were notably greater than what we observed in 2023 (Table 5, Figure 10).

**Conclusions**

Nine streams were monitored for water quality in 2024, including select USDA streams, reference streams and unassessed streams. For streams where historic data is available, we compared 2024 data to prior years’ data to see if there are increasing or decreasing trends over time. Eagle Point Gully dried up after our May sampling date through November, so it is difficult to determine if there are any seasonal trends in water quality and to be able to compare it to other study streams. Densmore Gully was one of the “lower concentration” streams for all three analytes collected (TP, TSS, TN). North McMillan Creek TP and TSS concentrations were slightly greater than what were observed in 2023. The increasing trends of TP and TSS can likely be attributed to erosional issues found in the lower reaches of the stream and watershed. North McMillan Creek had the lowest average concentrations of TSS, TP, and TN of all streams studied during this period.

Compared to other study streams, the Inlet had the greatest TSS and TP concentrations, while TN was on the lower side compared to other tributaries. The Inlet is one of the largest streams flowing into Conesus Lake; the high TP concentrations can be concerning due to this reason. North End Creek had some of the greatest TSS, TP and TN concentrations. 2024 TN concentrations were notably greater in North End Creek than what we observed in 2023. South Gully had the second lowest TSS, and 4th lowest TP, while TN was the third greatest during baseflow. Compared to other streams sampled during this period, South McMillan had the 5th lowest TSS, 2nd lowest TP, and TN was the third lowest during baseflow. In 2024, South McMillan TP and TSS concentrations were greater than what were observed in 2023, but still some of the lowest concentrations seen across our 2024 study sites. 5574E dried up after our May sampling date through November. 2024, average TP and TSS concentrations were greater than what were observed in 2023 while 2024 TN concentrations were similar to what we observed in 2023. Compared to other study steams during this monitoring period, 6009W had the greatest TN concentrations, 2nd highest TP concentrations, 4th greatest TSS concentrations. This monitoring period of 2024 was characterized by very dry weather conditions and low precipitation, especially in the summer and fall when many streams dried up. Due to the overly dry conditions, we recommend following up on these streams in the future to determine their water quality when there is more precipitation and greater flows. We also recommend verifying current land use practices in all study tributaries so we can have an accurate representation on what is going on in these watersheds.

**References**

Beers, D, and M. Chislock. 2023. Livingston County Tributary Water Quality Monitoring: North McMillan Stress Stream Analysis. Livingston County Planning Department.

Beers, D. and M. Chislock. 2024. 2023 Livingston County Water Quality Monitoring Program: Unassessed Waters, USDA, and Reference Streams. Livingston County Planning Department.

Bida, M. R., A. C. Tyler, and T. Pagano. 2015. Quantity and composition of stream dissolved organic matter in the watershed of Conesus Lake, New York. Journal of Great Lakes Research 41: 730-742.

Bosch, I., J. C. Makarewicz, T. W. Lewis, E. A. Bonk, M. Finiguerra, and B. Groveman. 2009. Management of agricultural practices results in declines of filamentous algae in the lake littoral. Journal of Great Lakes Research 35: 90-98.

Herendeen, N., and N. Glazier. 2009. Agricultural best management practices for Conesus Lake: the role of extension and soil/water conservation districts. Journal of Great Lakes Research 35: 15-22.

Lewis, T. W., and J. C. Makarewicz. 2015. Stream water quality assessment of Long Point Gully, Graywood Gully, and Sutton Point: Conesus Lake tributaries 2015. Livingston County Planning Department.

Makarewicz, J. C., I. Bosch, and T. W. Lewis. 2001. Soil and nutrient loss from selected subwatersheds of Conesus Lake. Technical Reports 3. subwatersheds of Conesus Lake. http://digitalcommons.brockport.edu/tech_rep/3.

Makarewicz, J. C., T. W. Lewis, and C. Severson. 2008. Conesus Lake 2008: baseline data on the stream bank restoration project, update on water quality of USDA monitored watersheds. Technical Reports 34. http://digitalcommons.brockport.edu/tech_rep/34.

Makarewicz, J. C., and T. W. Lewis. 2009. Conesus Lake limnology 2009: water quality of USDA monitored watersheds internal hypolimnetic phosphorus loading lake chemistry status of zooplankton community. Technical Reports. 9. Available at https://digitalcommons.brockport.edu/tech_rep/9.

Makarewicz, J. C., T. W. Lewis, I. Bosch, M. R. Noll, N. Herendeen, R. D. Simon, J. Zollweg, and A. Vodacek. 2009. The impact of agricultural best management practices on downstream systems: Soil loss and nutrient chemistry and flux to Conesus Lake, New York, USA. Journal of Great Lakes Research 35: 23-36.

Makarewicz, J. C., and T. W. Lewis. 2010. Conesus Lake Tributaries. Technical Reports 35. http://digitalcommons.brockport.edu/tech_rep/35.

Model my watershed. 2017. Stroud Research Center. Model my Watershed (Software). Available at https://wikiwatershed.org/

NYSDEC. N.D. Nutrient Criteria. Available at: https://www.dec.ny.gov/chemical/77704.html

USEPA 2021. Indicators: Phosphorus. Available at: https://www.epa.gov/national-aquatic-resource-surveys/indicators-phosphorus July 17, 2021.

USEPA. 2022. National primary drinking water standards. Available at https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations. January 26, 2022.

**Tables and Figures:**

**Table 1.** Selected subwatersheds of Conesus Lake. Watershed area, percentage of agriculture in watershed and implemented management plans are listed (Herendeen and Glazier 2009; Makarewicz *et al.* 2009; Bida *et al.* 2015; Model my Watershed 2017). * Indicates that land use needs to be verified.

| Tributary | Watershed area (ha) | Agricultural activity (% of watershed) | Implemented Management Practices |
|---|---|---|---|
| Eagle Point Gully | 172 | 62 | Unassessed Stream |
| North End Creek | 179.28 | 62 | Unassessed Stream |
| South Gully | 269.15 | 49 | Unassessed Stream |
| South McMillan Creek | 2821 | 24 | Reference Watershed |
| Conesus Inlet | 7302 | 28 | Unassessed Stream |
| Densmore Gully | 610 | 63 | Unassessed Stream |
| North McMillan Creek | 1778.2 | 12 | Reference watershed |
| Creek 5574E | 52.74 | 43* | Unassessed Stream |
| Creek 6009W | 145.1 | 68 | Unassessed Stream |

**Table 2.** Sampling Locations, Justifications, and Data Collection

| Site Code | Sampling Location | GPS Coordinates | | Sample Justification | Field Measurements[1] | Water Chemistry[2] |
|---|---|---|---|---|---|---|
| | | North | West | | | |
| EAGL | Eagle Point Gully | 42.798258 | -77.719621 | Unassessed stream | Multiprobe | Total phosphorus, total nitrogen, total suspended sediments |
| INLT | Conesus Lake Inlet | 42.715397 | -77.712280 | Reference stream | Multiprobe | Total phosphorus, total nitrogen, total suspended sediments |
| DENS | Densmore Gully | 42.792362 | -77.707392 | Unassessed stream | Multiprobe | Total phosphorus, total nitrogen, total suspended sediments |
| NEND | North End Creek | 42.833584 | -77.696457 | Unassessed stream | Multiprobe | Total phosphorus, total nitrogen, total suspended sediments |
| NMDN | Downstream-North McMillan | 42.725611 | -77.707056 | Remediated site for Erosion Control and Streambank Remediation Study; historical reference stream | Multiprobe | Total phosphorus, total nitrogen, total suspended sediments |
| SGUL | South Gully | 42.772123 | -77.712049 | Unassessed stream | Multiprobe | Total phosphorus, total nitrogen, total suspended sediments |
| SMCM | South McMillan | 42.719152 | -77.705499 | Reference stream | Multiprobe | Total phosphorus, total nitrogen, total suspended sediments |
| 5574E | Unnamed tributary at 5574 E Lake | 42.750459 | -77.712519 | Unassessed stream | Multiprobe | Total phosphorus, total nitrogen, total suspended sediments |
| 6009W | Unnamed tributary at 6009 W Lake | 42.727483 | -77.720087 | Unassessed stream | Multiprobe | Total phosphorus, total nitrogen, total suspended sediments |

[1]Water temperature (°C), specific conductivity (µS/cm), pH, dissolved oxygen (LDO - %, mg/L).[2]Total phosphorus (µg/L), total nitrogen (mg/L), and total suspended solids (TSS) (mg/L).

**Table 3:** Parameters, analytical specifications, and QA/QC requirements.

| ***Lab Measurements*** **Analyte** | **Method** | **Minimum Volume/ Container** | **Preservative** | **QC Sample** | **Frequency** | **QC Acceptance Limits** | **Corrective Action** | **Holding Time** | **Method Detection Limit** | **Report Limit** |
|---|---|---|---|---|---|---|---|---|---|---|
| Total nitrogen | SM 4500-N C-2011 | 125 ml plastic | Cool; -20°C | Method Blank | 10% | < 0.024 mg/L | Reanalyze or Qualify data | 28 days | 0.024 mg/l | 0.100 mg/l |
| | | | | ICC/LCS | 10% | % Recovery between 90% to 110% | Reanalyze or Qualify data | | | |
| | | | | Lab Duplicate | 10% | RPD within ± 10% | Reanalyze or Qualify data | | | |
| | | | | Matrix spike duplicate set | 10% | Between 90% to 110% | Qualify data<br>Reanalyze or Qualify data | | | |
| | | | | ICC/LCS | 10% | % Recovery between 90% to 110% | Reanalyze or Qualify data | | | |
| | | | | Lab Duplicate | 10% | RPD within ± 10% | Reanalyze or Qualify data | | | |
| | | | | Matrix spike duplicate set | 10% | Between 90% to 110% | Qualify data<br>Reanalyze or Qualify data | | | |
| Total phosphorus | SM 4500-P H-2011 | 125 ml plastic | H2SO4 to pH<2, cool; 4°C | Method Blank | 10% | < 0.002 mg/L | Reanalyze or Qualify data | 28 days | 0.002 mg/l | 0.003 mg/l |
| | | | | ICC/LCS | 10% | % Recovery between 90% to 110% | Reanalyze or Qualify data | | | |
| | | | | Lab Duplicate | 10% | RPD within ± 10% | Reanalyze or Qualify data | | | |
| | | | | Matrix spike duplicate set | 10% | Between 90% to 110% | Qualify data<br>Reanalyze or Qualify data | | | |
| Total suspended solids | SM 2540 D-2011 | 1000 ml plastic | Cool; 4°C | Method Blank | 10% | < 0.3 mg/L | Reanalyze or Qualify data | 7 days | *0.3 mg/l *For 1000 ml sample | *0.3 mg/l *For 1000 ml sample |
| | | | | ICC/LCS | 10% | % Recovery between 90% to 110% | Reanalyze or Qualify data | | | |
| | | | | Lab Duplicate | 10% | RPD within ± 10%, ±50% for values < 5 mg/L | Reanalyze or Qualify data | | | |
| | | | | Matrix spike duplicate set | NA | NA | NA | | | |

| ***Field Measurements*** **Parameter** | **Method** | **Calibration/ Verification** | **Precision** | **Range** | **QC Sample** | **QC Acceptance Limits** |
|---|---|---|---|---|---|---|
| Temperature | YSI, *in situ* | Factory set<br>annual check with NIST-reference thermometer | ±0.20 C | -5 to 70°C | Field Duplicate | RPD within +/- 20% or ±0.20 C for low numeric values |
| Luminescent Dissolved oxygen | YSI, *in situ* | Daily | ±0.1 mg/L or 1% | 0 to 50 mg/L | Field Duplicate | RPD within +/- 20% or ±0.1 mg/L for low numeric values |
| pH | YSI, *in situ* | Daily | ±0.2 | 0 to 14 | Field Duplicate | RPD within +/- 20% or ±0.2 for low numeric values |
| Specific Conductivity | YSI, *in situ* | Daily | ±0.001 mS/cm or 0.5% | 0 to 200 mS/cm | Field Duplicate | RPD within +/- 20% or ±0.001 mS/cm for low numeric values |

**Table 4**: Tributary sampling dates, previous 24-hour weather conditions, and event classification

| Date | Previous 24-hour Weather: | Event? |
|---|---|---|
| **3/18/2024** | Light Snow | No |
| **4/18/2024** | Light Rain | No |
| **5/2/2024** | Sunny | No |
| **6/12/2024** | Cloudy | No |
| **7/10/2024** | Light Rain | No |
| **8/1/2024** | Sunny | No |
| **9/4/2024** | Partly Cloudy | No |
| **10/2/2024** | Light Rain | No |
| **11/6/2024** | Light Rain | No |

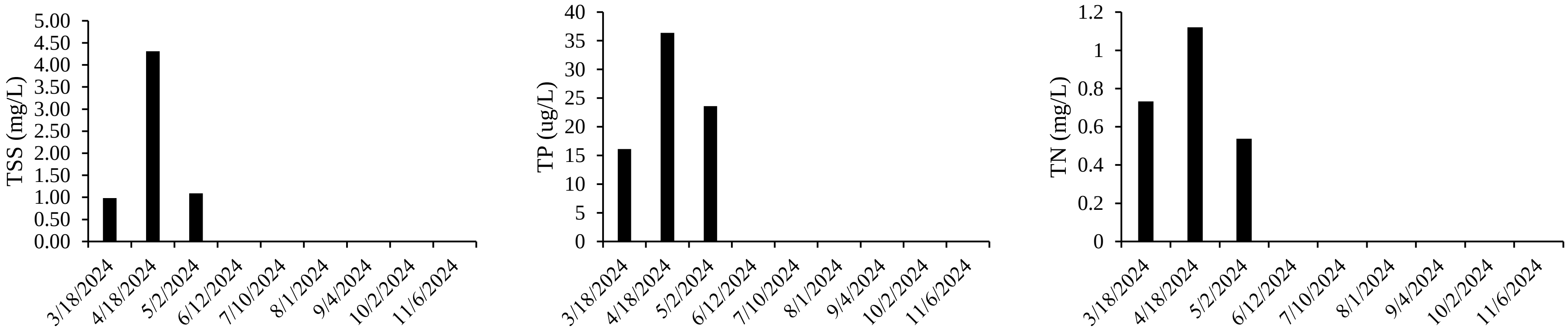



**Figure 1**: Concentrations of water quality parameters collected in Eagle Point Gully from 2024 sampling dates.

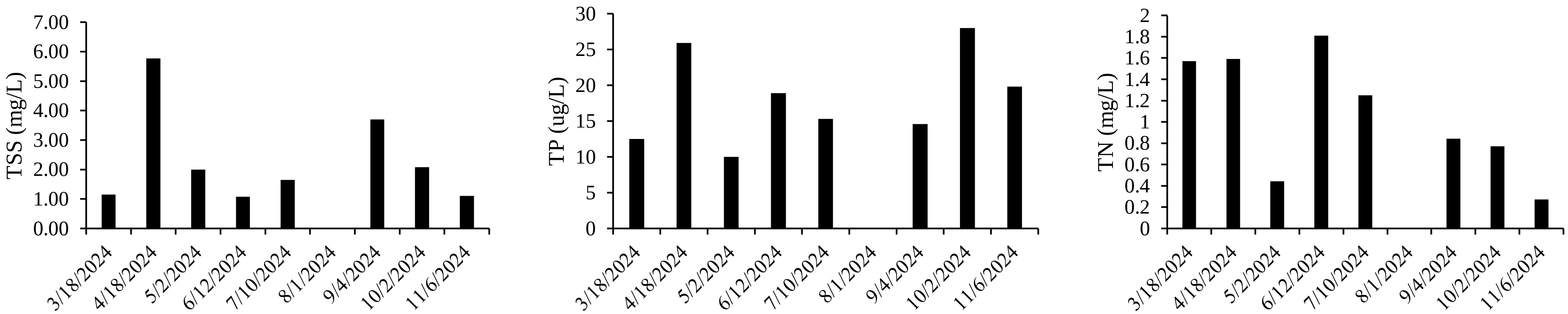



**Figure 2**: Concentrations of water quality parameters collected in Densmore Gully from 2024 sampling dates.

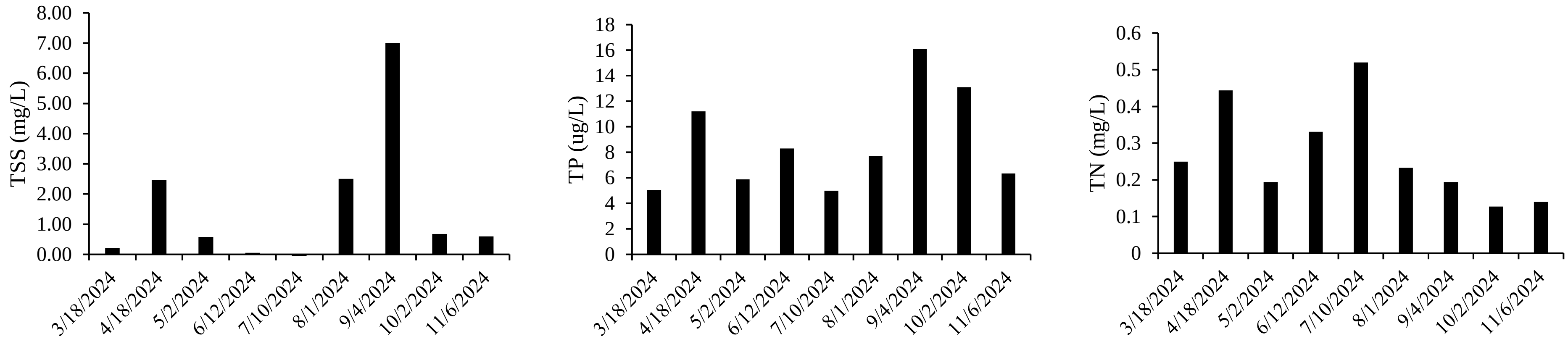



**Figure 3**: Concentrations of water quality parameters collected in North McMillan from 2024 sampling dates.

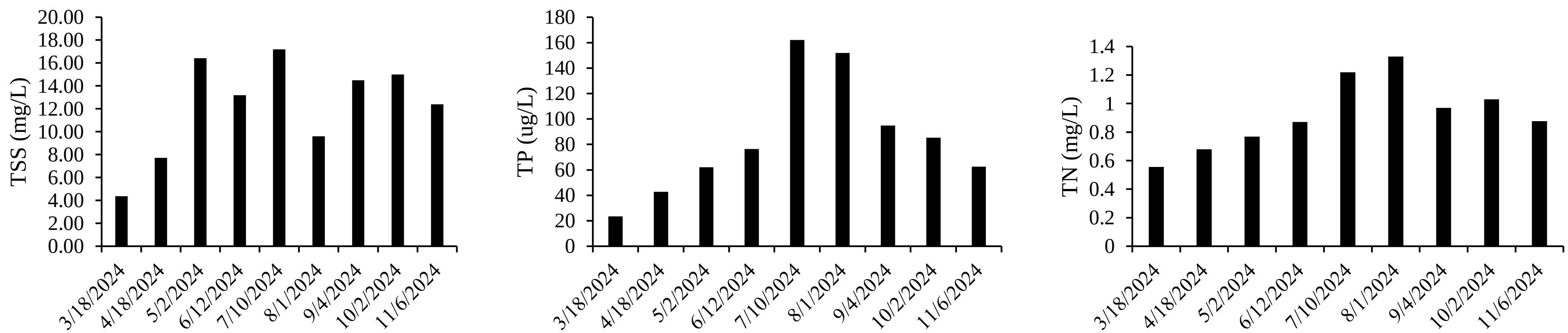



**Figure 4**: Concentrations of water quality parameters collected in Conesus Inlet from 2024 sampling dates.

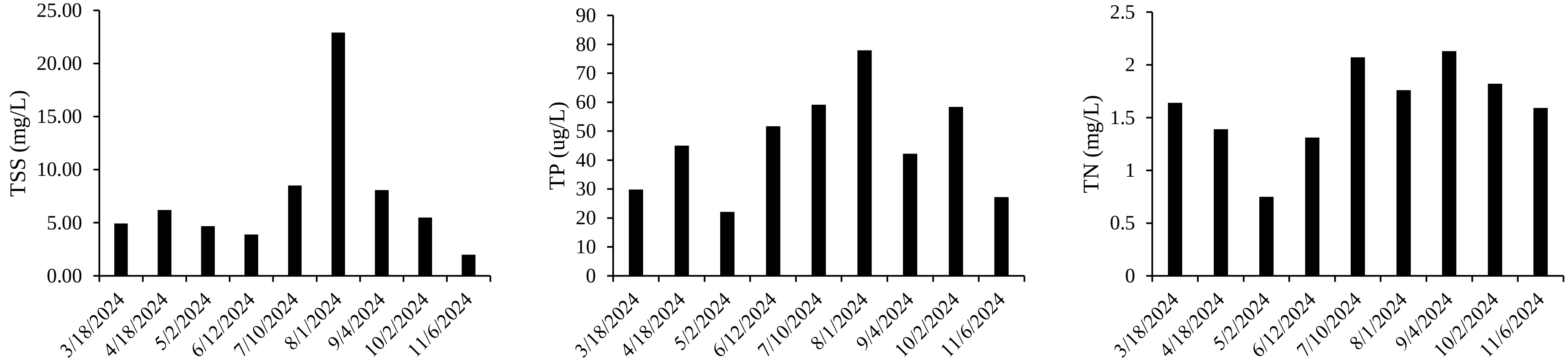



**Figure 5**: Concentrations of water quality parameters collected in North End Creek from 2024 sampling dates.

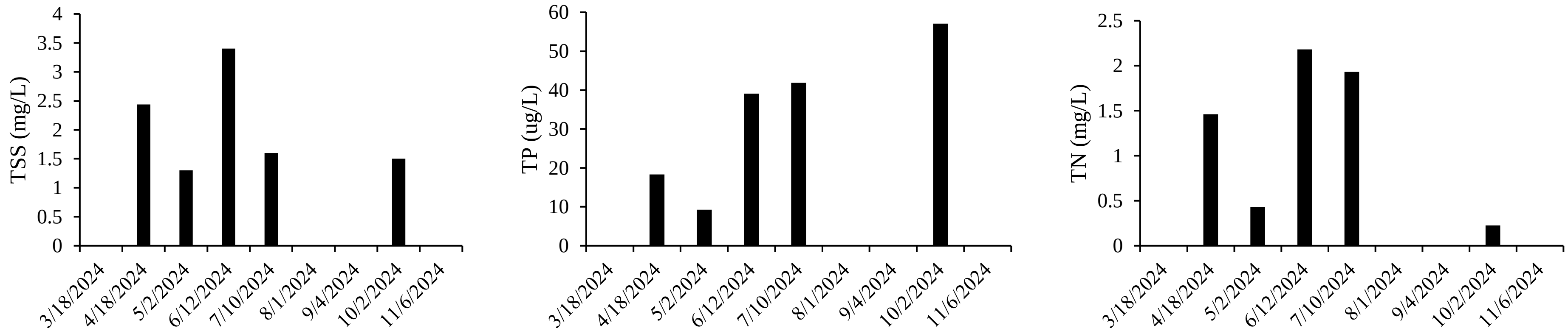



**Figure 6**: Concentrations of water quality parameters collected in South Gully from 2024 sampling dates.

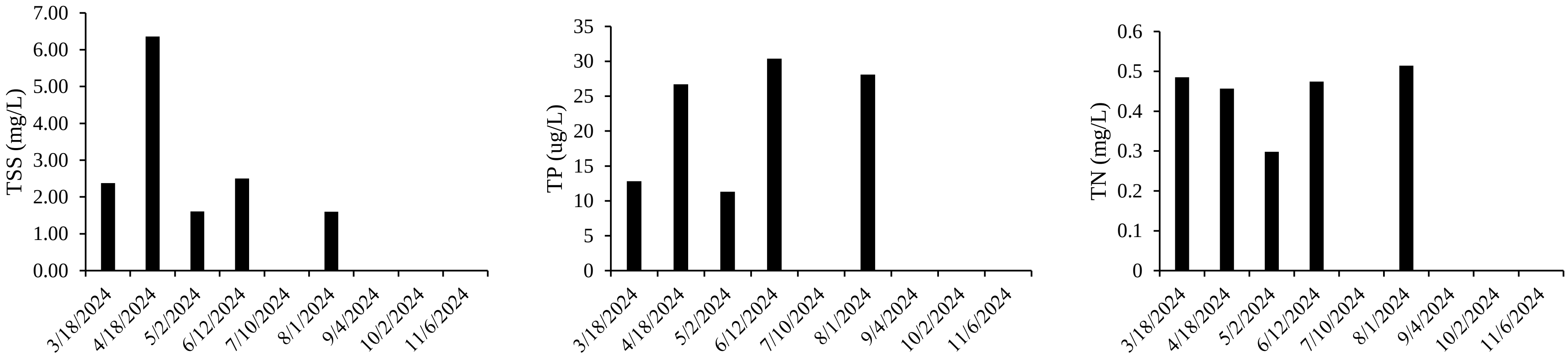



**Figure 7**: Concentrations of water quality parameters collected in South McMillan Creek from 2024 sampling dates.

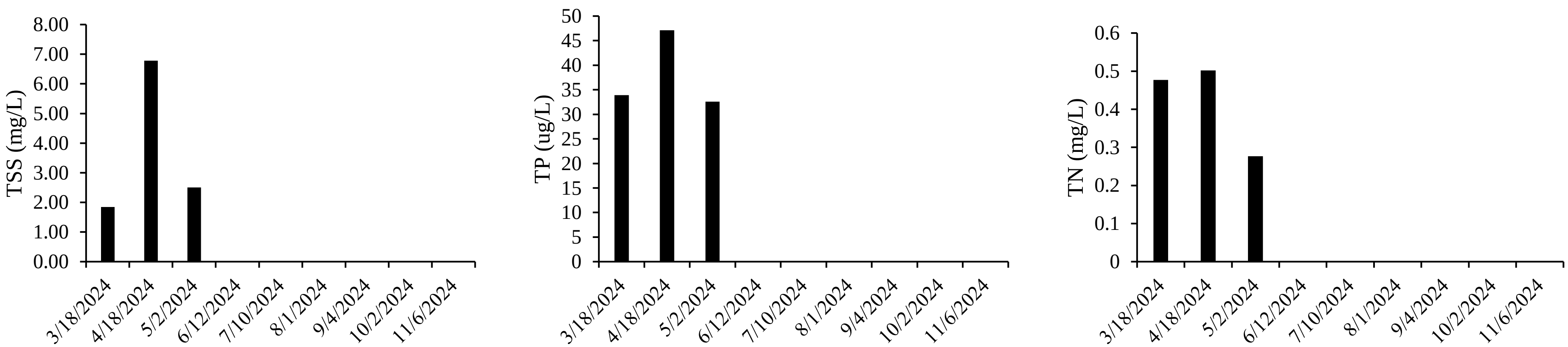



**Figure 8**: Concentrations of water quality parameters collected in Creek 5574E from 2024 sampling dates.

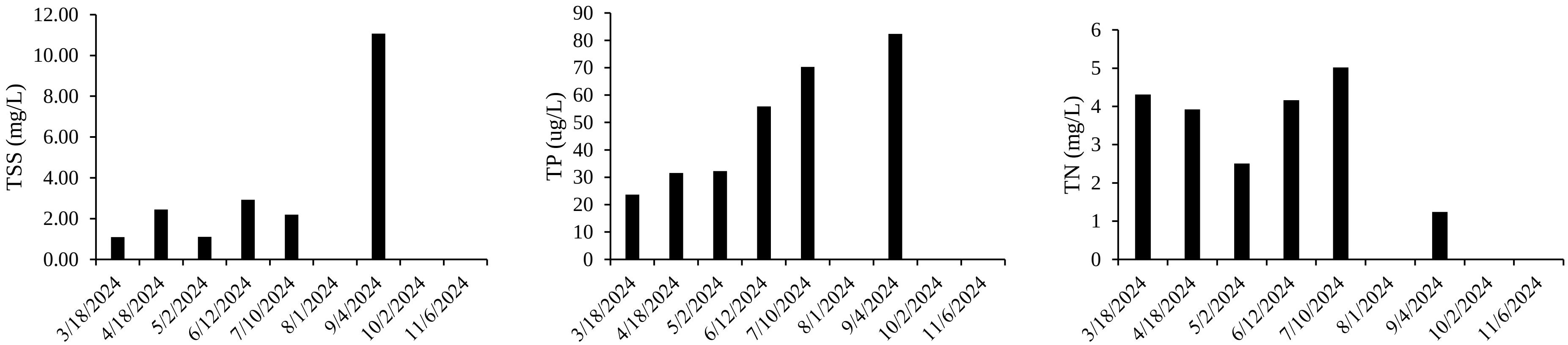
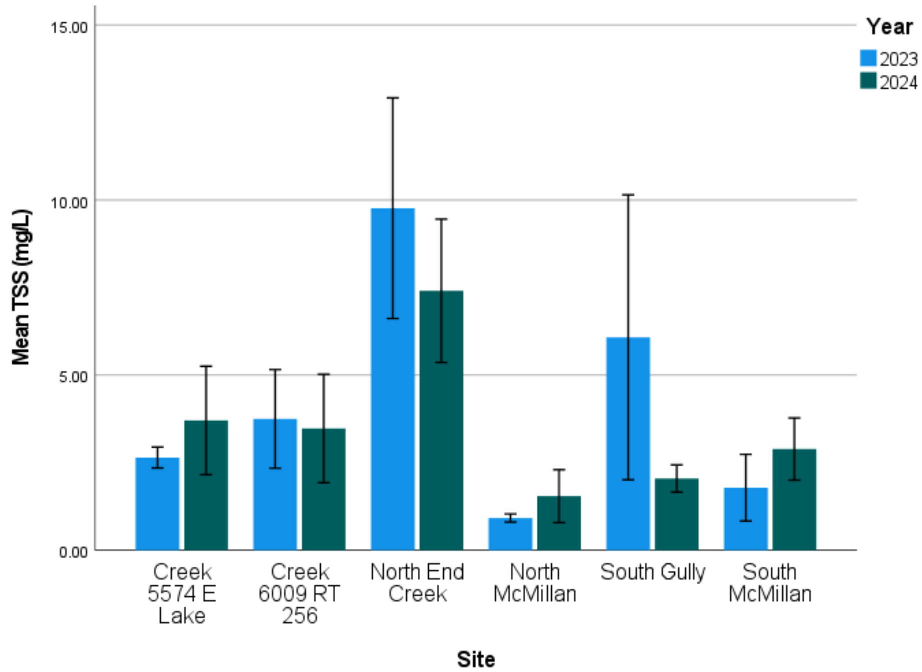
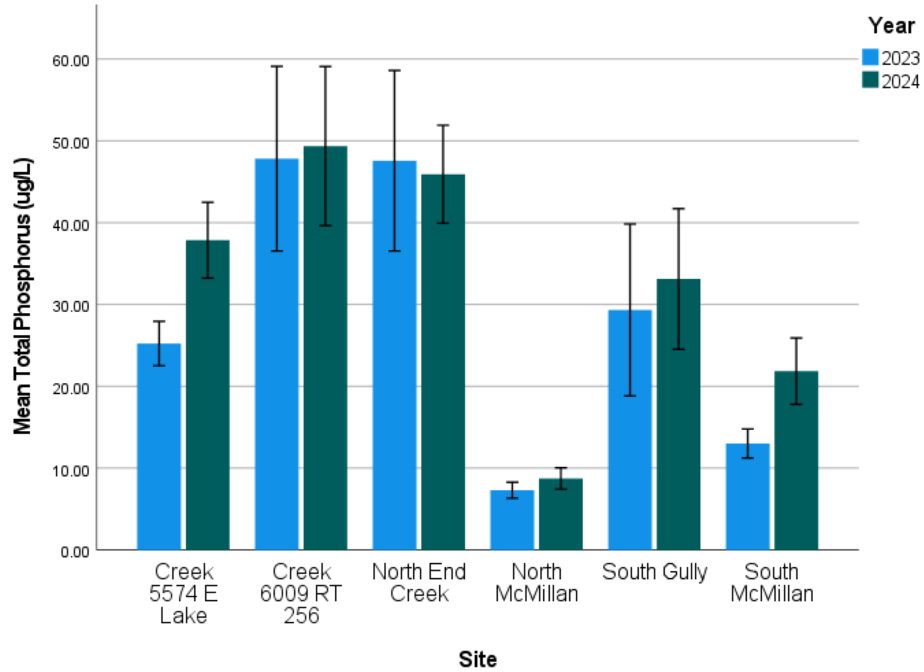



**Figure 9**: Concentrations of water quality parameters collected in Creek 6009W from 2024 sampling dates.



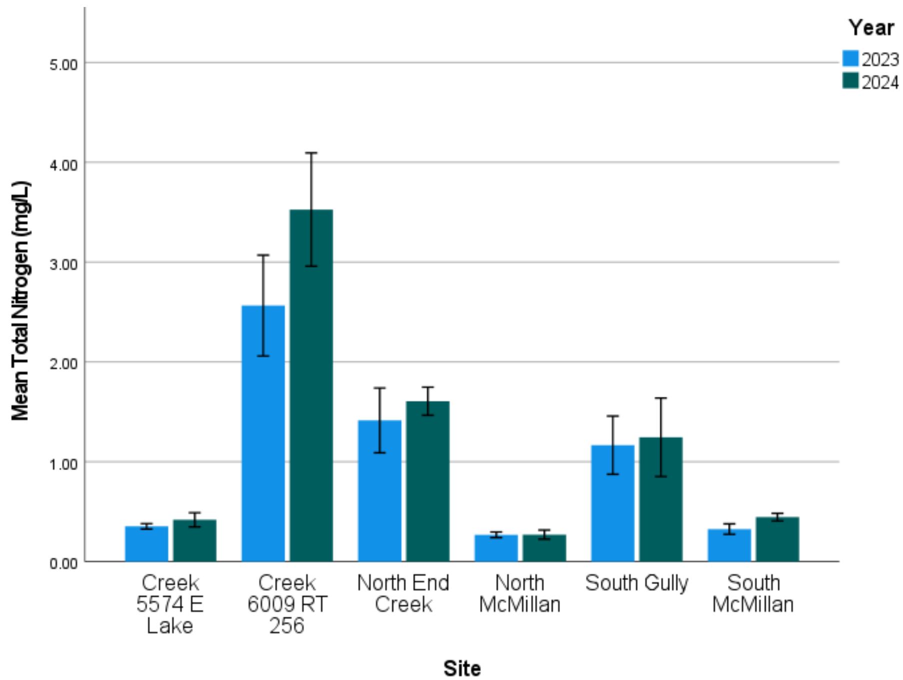
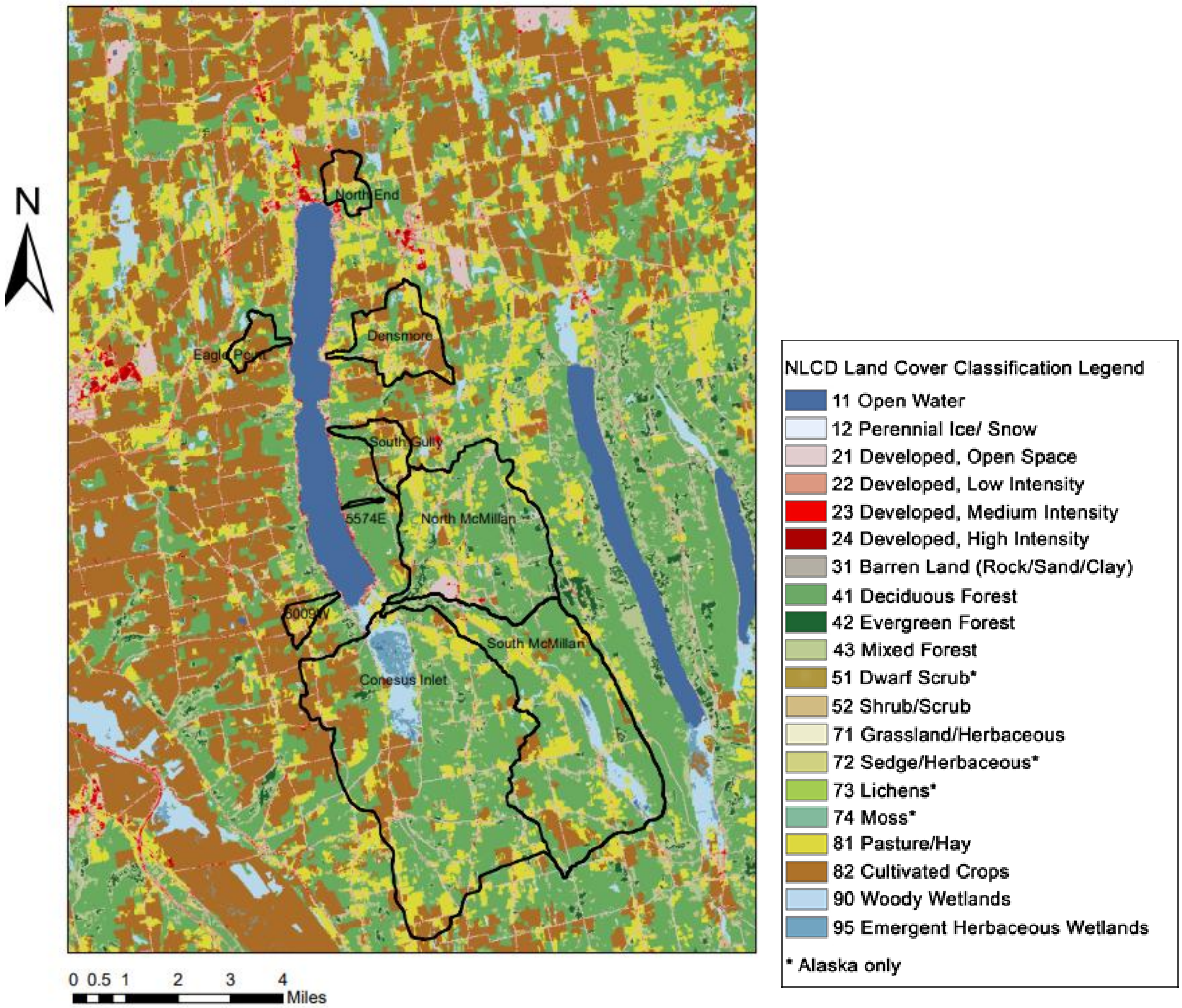




**Figure 10**: Average (+/- SE) concentrations (non-event) of total suspended solids (TSS), total phosphorus (TP), and total nitrogen (TN) in sampled streams from 2023 and 2024. S.E.=standard error. 2023 data from Beers and Chislock (2024)

**Table 5:** 2024 averages for each analyte for each stream monitored.

| | *TSS (mg/L)* | *TP (µg/L)* | *TN (mg/L)* |
|---|---|---|---|
| ***Conesus Inlet*** | | | |
| *Nonevent average* | 12.27 | 85 | 0.92 |
| ***5574E*** | | | |
| *Nonevent average* | 3.71 | 38 | 0.42 |
| ***6009W*** | | | |
| *Nonevent average* | 3.48 | 49 | 3.53 |
| ***Densmore*** | | | |
| *Nonevent average* | 2.32 | 18 | 1.07 |
| ***Eagle Point*** | | | |
| *Nonevent average* | 2.13 | 25 | 0.80 |
| ***North End*** | | | |
| *Nonevent average* | 7.41 | 46 | 1.61 |
| ***North McMillan*** | | | |
| *Nonevent average* | 1.54 | 9 | 0.27 |
| ***South Gully*** | | | |
| *Nonevent average* | 2.05 | 33 | 1.25 |
| ***South McMillan*** | | | |
| *Nonevent average* | 2.89 | 22 | 0.45 |

**Appendices:**




**Appendix 1**. Map of study watersheds with associated land use from the 2019 National Land Cover Database. GPS coordinates for sampling site locations are in Table 1.