NBWW 2018-2023 Water Quality Summary Report

Prepared by:

Geosyntec consultants

Prepared for:

NORTH BRANCH CHICAGO RIVER WATERSHED WORKGROUP

Foreword

The primary purpose of this Water Quality Summary Report is to engage North Branch Watershed Workgroup (NBWW) Municipal separate storm sewer systems (MS4) communities, wastewater treatment plant (WWTP) operators and associate members within the North Branch Chicago River watershed by providing them with comprehensive and actionable water quality data. The data in this report helps identify pollution sources, seasonal trends, and locations of the stream system needing improvement. The data includes parameters such as acidity/alkalinity (pH), presence of salt (chlorides), fertilizers/waste (nutrients), Sediment/turbidity (total suspended solids), algae (chlorophyll-a), oxygen for fish (dissolved oxygen), and bacteria (*E. coli)* on a watershed-wide scale. The NBWW has worked collaboratively with stakeholders within the watershed including MS4s, WWTPs, and associate members to establish the continued monitoring plan that continues to assess the water quality and sources of pollutants.

Report Highlights

- Identify critical locations in the watershed
- Time-based trends in the water quality parameters
- Suggesting targeted interventions (both nonpoint and point sources) to improve water quality
- Monitoring data that assesses the watershed ecosystem and the communities land use

How You can Utilize this Report to Strengthen Your MS4 Program

- Educate your residents and employees on beneficial practices to maintain and improve the watershed's environmental integrity within your MS4
- Foster collaboration with watershed stakeholders
- Develop and implement policy changes to address illicit discharges, erosion and sediment control, and pollutants associated with stormwater runoff
- Identify pollution sources (nonpoint vs. point source), and implement BMPs into your stormwater management program to reduce pollutants
- Assess the effectiveness of the current stormwater management program and establish measurable goals

General NPDES Permit No. ILR40 – Discharges from MS4s
Part V., Section A.2.b.x - Collaborative watershed-scale monitoring. The permittee may choose to work collaboratively with other permittees and/or a watershed group to design and implement a watershed or sub-watershed-scale monitoring program that assesses the water quality of the water bodies and the sources of pollutants. Such programs shall include elements which **assess the impacts of the permittee's storm water discharges and/or the effectiveness of the BMPs being implemented.**

Table of Contents

WATER QUALITY **OVERVIEW**

The North Branch Watershed Workgroup (NBWW) has collected instream water quality data from 2018 to 2023 in the North Branch Chicago River (NBCR) watershed to meet the requirements of National Pollutant Discharge Elimination System (NPDES) permits for Municipal Separate Storm Sewer Systems (MS4s) and wastewater reclamation facilities (WRFs). **Figure 1** shows the location of NBWW water quality monitoring stations. NBWW tasked Geosyntec Consultants, Inc. (Geosyntec) to assess the spatial and temporal trends in water quality.

The water quality parameters assessed were pH; chlorides; nutrients including ammonia (NH3), nitrates, Total Kjeldahl Nitrogen (TKN), total phosphorus (TP), total suspended solids (TSS), chlorophyll-a, *E. coli* and dissolved oxygen (DO). A description of these water quality parameters is provided on the next page.

The significant findings from this assessment are:

1. Chloride levels exceeded the Illinois water quality standard of 500 milligrams per liter (mg/L) during winter throughout the watershed **(See Appendix C)** and were determined to increase over time at several stations (See Figure E-7 for a spatial view of the stations with increasing temporal trends).
2. The effluent discharge from the Deerfield WRF and North Shore Water Reclamation District (NSWRD) Clayey Road WRF has a significant impact on the water quality by improving DO but increasing nutrient levels in West Fork and Skokie River, respectively (See water quality summary for West Fork and Skokie River for more details).
3. High TSS levels greater than 100 mg/L were reported at all stations in Middle Fork (with no point source input) and stations upstream of point sources in West Fork and Skokie River **(see Table A-4)**. Hence these high TSS levels potentially occur due to runoff from non-point sources.
4. Elevated E. coli levels were reported at several locations in the watershed which require further investigation to determine the sources **(See Table A-12)**.

WATER QUALITY PARAMETERS DESCRIPTION

pH: Indicator of water acidity or alkalinity. Ranges from 0 to 14, with 7 being neutral. Impacts water solubility and biological availability (amount that can be utilized by aquatic life) of chemical constituents such as nutrients and heavy metals. Illinois standard is 6.5 to 9 s.u.

Chloride: Measure of dissolved salt in water. Levels increased due to road salting operations during winter. High levels toxic to aquatic life and increase water corrosiveness. Illinois standard is 500 mg/L all year round.

Total Suspended Solids (TSS): Measure of particles (sediment, algae and organic material) that are suspended in water and can be trapped by a filter. TSS levels impact water clarity and high levels are harmful to aquatic life. No Illinois standard.

Ammonia: Nitrogen component commonly used in fertilizers and chemicals. Toxic to aquatic life at high levels. Illinois standard is a function of pH and temperature.

Total Nitrate: Inorganic forms of nitrogen, bioavailable for aquatic plant and algae growth. No Illinois standard for streams.

Total Kjeldahl Nitrogen (TKN): Measure of organic nitrogen plus dissolved ammonia. High levels indicate pollution from wastewater treatment plants, manure and other sources. No Illinois standard for streams.

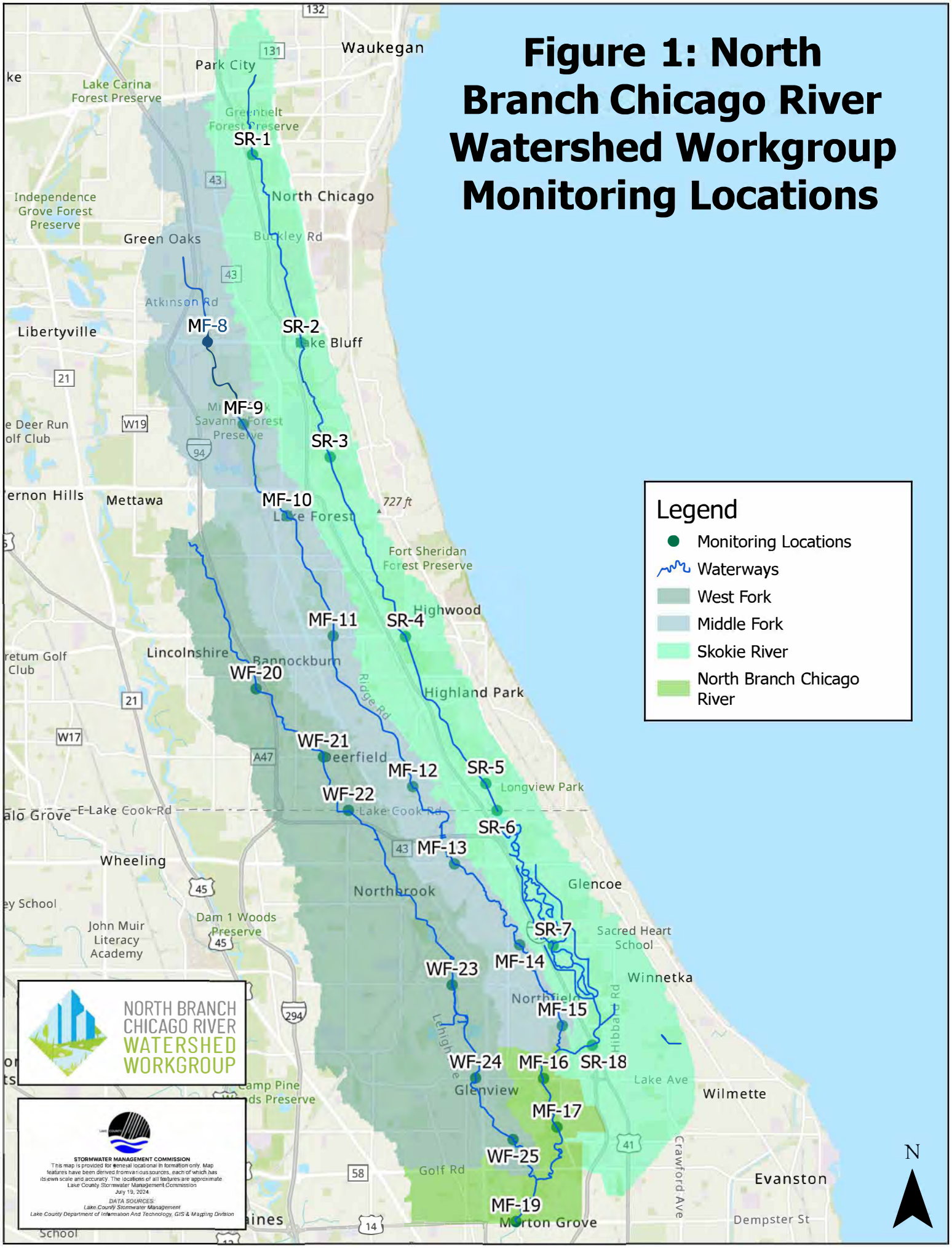
Total Phosphorus (TP): Sum of all forms of phosphorus in water, which can contribute algal blooms. No Illinois standard for streams.

Chlorophyll-a: Measure of suspended algae in water column. High levels indicate nutrient pollution and result in large daily variations in Dissolved Oxygen which is harmful to aquatic life.

Dissolved Oxygen (DO): DO levels indicate the water body's ability to support aquatic life. Illinois standards include a minimum DO of 5 mg/L from March through July and 3.5 mg/L from August through February.

E. coli: Escherichia coli (abbreviated as *E. coli*) are bacteria found in the environment, foods, and intestines of people and animals. *E. coli* are a large and diverse group of bacteria. This bacteria is a preferred indicator for freshwater recreation and its presence provides direct evidence of fecal contamination from warm-blooded animals. Illinois has a *E.coli* standard of 235 cfu/100 mL for contact recreation applicable only for bathing beaches and not streams.

Figure 1: North Branch Chicago River Watershed Workgroup Monitoring Locations



WATER QUALITY SUMMARY

The specific results for the water quality parameters in West Fork, Middle Fork, Skokie River, and NBCR mainstem are described below.

West Fork

The Deerfield WRF discharge significantly impacts some of the water quality parameters in the West Fork. Stations WF-20 and WF-21 are located upstream of Deerfield WRF discharge, while stations WF-22, WF-23, and WF-24 are located downstream **(Figure 1)**.

pH: The measured pH levels in West Fork were mainly within the Illinois water quality standard range of 6.5 to 9 s.u. except for a few outliers **(Figure B-1)**. No annual temporal trend was determined for pH except for station WF-21, which showed a decreasing temporal trend **(Table 1)**.

Chloride: The median chloride levels in the West Fork ranged from 216 to 281 mg/L with an increasing trend from upstream to downstream **(Figure B-3)**. However, the levels during winter exceeded the Illinois water quality standard of 500 mg/L **(Figures C-13 to C-18)**. These high levels indicate a need for better road salt management practices and potentially applying for a variance for chloride during winter to account for road salting operations, similar to the time-limited water quality standard for chloride in the Chicago Area Waterway System and the Lower Des Plaines River. An increasing annual temporal trend was determined for chloride at all stations except WF-22, which showed no trend **(Table 1)**. It is recommended to conduct biweekly sampling at more stations during winter time to identify the hotspots of chloride loadings into West Fork and quantify the benefits of better road salt management practices as they are implemented.

TSS: Median TSS levels were relatively low, ranging from 11 to 32 mg/L, with the highest median concentration reported at Station WF-23 **(Figure B-4)**. TSS levels greater than 100 mg/L were reported at the most upstream station WF-20, potentially driven by runoff from non-point sources. These high levels indicate the need to capture sediment loading with best management practices in the upper West Fork watershed. The only stations with an annual temporal trend in TSS were WF-21 (decreasing trend) and WF-23 (increasing trend) **(Table 1)**.

Nutrients: The median TP level was 0.15 mg/L upstream of the Deerfield WRF, which increased significantly to a value of 0.90 mg/L at WF-22 downstream of the Deerfield WRF. The TP levels were lower at downstream stations WF-23 and WF-24 **(Figure B-8)**. TP was determined to have an increasing trend at stations WF-20 and WF-21, upstream of the Deerfield WRF, potentially due to increased impacts from non-point sources **(Table 1)**. Similar to TP, median nitrate levels increased substantially from upstream of the Deerfield WRF at Station WF-21 (median value of 0.3 mg/L) to downstream at WF-22 (median value of 4.4 mg/L) **(Figure B-6)**. Elevated levels for TKN with median values greater than 0.9 mg/L were reported upstream of the Deerfield WRF **(Figure B-7)**. These elevated values indicate a non-point source of TKN in the headwater reaches, which warrants further investigation. No temporal trend was determined for total nitrogen and its constituents (ammonia, organic nitrogen, nitrates), except for an increasing trend for ammonia at station WF-24 and TKN at station WF-23 **(Table 1)**.

Chlorophyll-a: The median chlorophyll-a levels ranged from 1.40 to 8.50 micrograms per liter (µg/L) in West Fork, significantly below the Illinois Risk of Eutrophication threshold of 26 ug/L. The highest chlorophyll-a levels (>26 µg/L) were reported at Station WF-23, likely associated with increased nutrient loading from the Deerfield WRF. These high values occur during August with elevated temperatures, which promotes algae growth **(Figure C-49 to 54)**. The NBWW is currently developing a Nutrient Assessment Reduction Plan (NARP) to address algae growth in the NBCR watershed. Potential measures to reduce algae growth may include reduced loading from Deerfield WRF and other measures, such as increasing riparian shading to reduce stream temperature. Chlorophyll-a showed no temporal annual trend at all stations except WF-21, which had a decreasing trend **(Table 1)**.

Dissolved Oxygen: The DO levels at WF-20 and WF-21 upstream of the Deerfield WRF were consistently below the minimum Illinois water quality criterion due to low natural aeration associated with low flows **(Figure B-10)**. These stations showed a decreasing trend in DO. Downstream of the Deerfield WRF, the DO levels are mostly above the standard except at the most downstream Station WF-25. The DO excursions at this station occurred during low flows in 2019 **(Figure D-3)**. Continuous data collected at station WF-23 show large daily DO fluctuations. These are caused by algal photosynthetic activity during the day and respiration during the night (Figure D 2). DO downstream of the Deerfield WRF shows no annual temporal trend **(Table 1)**.

***E. coli*:** The *E. coli* levels in West Fork are high, with geometric mean values ranging from 857 to 1329 cfu/100 mL **(Table A-12)**. The maximum *E. coli* levels at Stations WF-20 and WF-21 (located upstream of Deerfield WRF) are of the order of 10^4 cfu /100 mL, indicating a potential *E. coli* source upstream. The higher *E. coli* levels occur during the warmer months of July and August when the bacteria can survive in the environment. It is recommended to conduct additional sampling and microbial source tracking to determine the source of high *E. coli* values, since *E. coli* could come from both animal and human sewage contamination. No annual temporal trend was determined at any station for *E. coli* **(Table 1)**.

[1] Deerfield WRF is required to achieve a total phosphorus annual geometric mean effluent limit of 0.5 mg/L per the National Pollutant Discharge Elimination System (NPDES) Permit

Table 1: Water Quality Trend in West Fork

Station	pH	Chloride	Total Suspended Solids	Ammonia	Total Nitrates	Total Kjeldahl Nitrogen (TKN)	Total Phosphorus	Chlorophyll a	Dissolved Oxygen	*E. coli*
WF-20	—	↑	—	—	—	—	↑	—	↓	—
WF-21	↓	↑	↓	—	—	—	↑	↓	↓	—
WF-22*	—	—	—	—	—	—	—	—	—	—
WF-23*	—	↑	↑	—	—	↑	—	—	—	—
WF-24*	—	↑	—	↑	—	—	—	—	—	—
WF-25*	—	↑	—	—	—	—	—	—	—	—

*Located downstream of Deerfield WRF Outfall

WATER QUALITY SUMMARY

Middle Fork

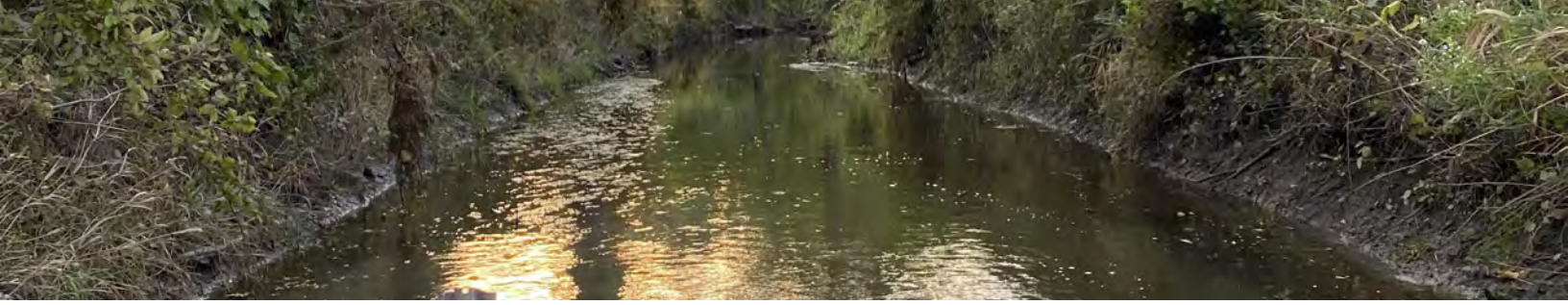
NBWW has collected data at eight stations in the Middle Fork, with MF-8 being the most upstream station and MF-15 being the most downstream station **(Figure 1)**.

pH: The measured pH levels were mostly within the Illinois water quality standard range of 6.5 to 9 s.u except at the most upstream station MF-8, which has a 25th percentile value below the minimum standard of 6.5 s.u. **(Figure B-13)**. No annual temporal trend was determined for pH at any station **(Table 2)**.

Chloride: The median chloride levels in the Middle Fork ranged from 210 to 314 mg/L with a slight decreasing trend from upstream to downstream **(Figure B-15)**. The levels exceeded the standard of 500 mg/L during the winter period **(Figures C-89 to C-96)**. No annual temporal trend was determined for chlorides except at station MF-13, which showed an increasing trend **(Table 2)**.

TSS: The median TSS levels were relatively low, ranging from 9 to 19 mg/L, with no spatial trend from upstream to downstream **(Figure B-16)**. High TSS levels greater than 100 mg/L were reported at all stations, potentially driven by runoff from non-point sources. These high levels indicate the need to capture sediment loading by installing best management practices. There were no temporal trends in TSS at any station **(Table 2)**.

Nutrients: Nutrient levels were relatively low but increased upstream to downstream due to increased runoff contributions from non-point sources. The median TP and total nitrate levels in the Middle Fork were below 0.15 mg/L and 0.20 mg/L, respectively **(Figure B-20 and Figure B-18)**. At least 50% of samples at all stations were at the detection limit of 0.05 mg/L for ammonia. Like West Fork, elevated values of TKN with median values greater than 0.7 mg/L were reported in the upper reaches, which increased further downstream **(Figure B-19)**. There was no annual temporal trend determined for nutrients in Middle Fork **(Table 2)**.



Chlorophyll-a: The median chlorophyll-a levels were below 10 ug/L, below the Illinois Risk of Eutrophication threshold of 26 ug/L. The levels decreased from upstream to downstream **(Figure B-21)**. No annual temporal trend was determined for chlorophyll-a except for station MF-14, which had a decreasing trend **(Table 2)**.

Dissolved Oxygen: The DO levels were below the minimum Illinois water quality criterion at all stations except the most downstream station MF-15, with more exceedances in the upstream reaches **(Figure B-22)**. These DO standard violations are potentially caused by a lack of natural reaeration associated with low flows. There was no annual temporal trend determined for DO at any station **(Table 2)**.

***E. coli*:** The geometric mean *E. coli* levels in Middle Fork ranged from 857 to 1329 cfu/100 mL, with an increasing trend from upstream to downstream **(Table A-12)**. The maximum *E. coli* levels at Stations MF-14 and MF-15 are of the order of 10^4 cfu /100 mL, indicating a potential *E. coli* source upstream. The higher *E. coli* levels occur in Middle Fork occur during May. It is recommended to conduct additional sampling and microbial source tracking to determine the source of high *E. coli* values, since *E. coli* could come from both animal and human sewage contamination. No annual temporal trend was determined at any station for *E. coli* **(Table 2)**.

Table 2: Water Quality Trend in Middle Fork

Station	pH	Chloride	Total Suspended Solids	Ammonia	Total Nitrates	Total Kjeldahl Nitrogen (TKN)	Total Phosphorus	Chlorophyll a	Dissolved Oxygen	*E. coli*
MF-08	—	—	—	—	—	—	—	—	—	—
MF-09	—	—	—	—	—	—	—	—	—	—
MF-10	—	—	—	—	—	—	—	—	—	—
MF-13	—	↑	—	—	—	—	—	—	—	—
MF-14	—	—	—	—	—	—	—	↓	—	—
MF-15	—	—	—	—	—	—	—	—	—	—

WATER QUALITY SUMMARY

Skokie River

The Skokie Lagoons and effluent discharge from the North Shore Water Reclamation District (NSWRD) Clavey Road WRF significantly impacts the water quality in the Skokie River. The Clavey Road WRF discharges just downstream of the Skokie Lagoons under normal conditions. During the emergency and overflow conditions, the Clavey Road discharges to Skokie Lagoon just upstream of Dundee Road. The NBWW has collected water quality data at nine locations in the Skokie River. Stations SR-1 to SR-5 are upstream of the lagoons, stations SR-6, SR-7, and SR-8 are in the lagoons, and station SR-18 is downstream of the lagoons and the Clavey Road WRF discharge **(Figure 1)**.

pH: The pH levels were within the range of 6.5 to 9 s.u except for a few outliers, mostly in the headwater stations SR-01 and SR-02 **(Figure B-25)**. No annual temporal trend was determined for pH at any station (**Table 3)**.

Chloride: The median chloride levels (144 to 310 mg/L) were below the Illinois water quality standard of 500 mg/L. However, the levels exceeded the standard during the winter months **(Figures C-204 to 211)** upstream of the Clavey Road WRF discharge. An increasing annual temporal trend for chloride was determined at stations SR-04, SR-06, and SR-18, with other stations showing no trend **(Table 3)**.

TSS: The median TSS levels were relatively low, ranging from 9.0 to 15.0 mg/L **(Figure B-28)**. High TSS levels greater than 100 mg/L were reported upstream of the Clavey Road WRF discharge, potentially driven by runoff from non-point sources. TSS was determined to have no annual temporal trend at all stations except Station SR-01 and SR-05, which showed a decreasing trend **(Table 3)**.

Dissolved Oxygen: The DO levels are frequently below the minimum Illinois water quality criterion with higher DO levels downstream of the Clavey WRF discharge **(Figure B-34)**. The DO violations are potentially caused by low flow and algae growth. The sediment oxygen demand exerted by legacy sediments also contributes to low DO levels in the Skokie Lagoon. No annual temporal trend was observed for DO in the Skokie River **(Table 3)**.

E. coli: The geometric mean *E. coli* levels in Skokie River ranged from 537 to 1845 cfu/100 mL **(Table A-12)**. The maximum *E. coli* levels at Stations SR-01 to SR-06 are of the order of 10^4 cfu /100 mL, indicating a potential *E. coli* source upstream. The higher *E. coli* levels occur in Skokie River during August. It is recommended to conduct additional sampling and microbial source tracking to determine the source of high E. coli values, since *E. coli* could come from both animal and human sewage contamination. Stations SR-04 and SR-06 show an increasing annual temporal trend for *E. coli* **(Table 3)**.

Table 3: Water Quality Trend in Skokie River

Station	pH	Chloride	Total Suspended Solids	Ammonia	Total Nitrates	Total Kjeldahl Nitrogen (TKN)	Total Phosphorus	Chlorophyll a	Dissolved Oxygen	*E. coli*
SR-01	—	—	↓	—	—	—	—	—	—	—
SR-02	—	—	—	—	—	—	—	—	—	—
SR-03	—	—	—	—	—	—	—	—	—	—
SR-04	—	↑	↓	—	↓	—	—	—	—	↑
SR-05	—	—	—	—	—	—	—	—	—	—
SR-06	—	↑	—	—	↓	—	—	—	—	↑
SR-07	—	—	—	—	—	—	—	—	—	—
SR-18*	—	↑	—	—	—	—	—	—	—	—

*Located downstream of NSWRD Clayey Road WRF Main Outfall and Skokie Lagoon

WATER QUALITY SUMMARY

North Branch Chicago River

The NBWW has collected water quality data at three locations in the NBCR. Stations MF-16 and MF-17 are upstream of the West Fork confluence, and station MF-19 is downstream of the confluence.

pH: The reported pH levels in the NBCR were within the Illinois water quality standard range of 6.5 to 9 s.u. **(Figure B-13)**. No annual temporal trend was determined for pH at any station **(Table 4)**.

Chloride: The chloride levels in the NBCR were much lower compared to the Middle Fork, with median values ranging from 163 to 174 mg/L. The lower chloride values are due to the impact of Clavey Road WRF discharge. The levels exceed the Illinois water quality standards at all three locations during the winter **(Figures C-97 to C-99)**. An increasing temporal trend for chloride was determined for all three stations **(Table 4)**.

Total Suspended Solids: Low TSS levels are reported in the NBCR with median values of less than 20 mg/L **(Figure B-16)**. Maximum TSS values are less than 100 ug/L due to the impact of the Clavey Road WRF discharge. There was no annual temporal trend in TSS at any station **(Table 4)**.

Nutrients: The nutrient levels were substantially higher than the Middle Fork of the NBCR due to the Skokie River inflow. The levels are reduced slightly after the confluence with the West Fork **(Figure B-17 to Figure B-20)**. No temporal trend was observed for nutrients at any of the NBCR stations, except for an increasing trend for TKN at Station MF-19 **(Table 4)**.

Chlorophyll-a: The median chlorophyll-a values in NBCR are relatively low, ranging from 7.1 to 11.0 ug/L. No annual temporal trend was observed for chlorophyll-a at any of the NBCR stations **(Table 4)**.

Dissolved Oxygen: The DO levels were below the minimum Illinois water quality criterion at stations MF-17 and MF-19 **(Figure B-22)**. These excursions were likely due to algal activity and sediment oxygen demand **(Table 4)**.

***E. coli*:** The geometric mean *E. coli* levels in Middle Fork ranged from 751 to 1,794 cfu/100 mL **(Table A-12)**. The maximum *E. coli* levels at Stations MF-17 are of the order of 10^4 cfu /100 mL, indicating a potential *E. coli* source upstream. The higher *E. coli* levels occur in Middle Fork occur during August. It is recommended to conduct additional sampling and microbial source tracking to determine the source of high *E. coli* values, since *E. coli* could come from both animal and human sewage contamination. Stations SR-04 and SR-06 show an increasing annual temporal trend for *E. coli* **(Table 4)**.

Table 4: Water Quality Trend in North Branch Chicago River

Station	pH	Chloride	Total Suspended Solids	Ammonia	Total Nitrates	Total Kjeldahl Nitrogen (TKN)	Total Phosphorus	Chlorophyll a	Dissolved Oxygen	*E. coli*
MF-16	—	↑	—	—	—	—	—	—	—	—
MF-17	—	↑	—	—	—	—	—	—	—	—
MF-19*	—	↑	—	—	—	↑	—	—	—	—

*Located downstream of West Fork confluence

DATA ANALYSIS METHODOLOGY

Geosyntec compiled the water quality data in the NCBR watershed from 2018 to 2023 into a single database. The data compilation included processing the data into a simple format for future use. The data includes both discrete and continuous water quality data. The compiled data was provided to NBWW as an Excel spreadsheet. The parameters analyzed were pH; chlorides; nutrients including ammonia (NH3), nitrates, Total Kjeldahl Nitrogen (TKN), total phosphorus (TP); total suspended solids (TSS); chlorophyll-a; *E. coli* and dissolved oxygen (DO). Geosyntec used several approaches to analyze the compiled data. The approaches are briefly described below, along with an example of how each item can be interpreted.

Statistical Summary

Several key statistics, including count, minimum, 10th percentile, mean, median, 90th percentile, maximum, and standard deviation, were calculated based on each monitoring station and parameter (**Appendix A: Statistical Summary by Parameter**). These statistics are useful for identifying parameters and locations that show elevated values compared to applicable standards or other locations.

Longitudinal Boxplots

Longitudinal boxplots were developed for each tributary of the North Branch Chicago River Watershed (West Fork, Middle Fork, and Skokie River). These are included in **Appendix B**. The x-axis on this plot lists the stations from upstream to downstream (headwater on the left). Confluences and major point sources were also plotted on the x-axis for reference. The total count of samples or data points contribution to the statistical boxplot is shown above each station/boxplot as “n=X.”. These plots are useful in identifying spatial patterns in water quality.

Monthly Boxplots

The changes in water quality over a month were assessed by developing monthly boxplots. These are included in **Appendix C**. The x-axis lists months, and the corresponding boxplot above shows the graphical statistical distribution of that month's data. The calculated median value for each month is shown as an orange line in the center of the box. The top and bottom of the blue box represent the 75th and 25th percentiles of the data, respectively. The top and bottom "whiskers" (arms extending to a tee) show the 95th and 5th percentiles, respectively. Outliers are shown as open points. The total count of data points in the month that contribute to the boxplot is shown above each boxplot as "n = X". These plots are useful for identifying intra-annual patterns for a given parameter.

Continuous Data Timeseries

The NBWW has collected continuous data for DO, specific conductivity, temperature, turbidity, and pH at 15 stations in the NBCR watershed. This entails installing a water quality sonde to record data at a regular interval (usually every 15 minutes). This data is useful for understanding daily cycles of water quality parameters for moderate to long-term monitoring. Timeseries plots were produced for each station based on the available continuous data **(Appendix D)**.

Water Quality Trend Analysis

The Seasonal Kendall Test (SKT) was performed to determine the water quality trends over time for the parameters monitored at each station. The SKT analyzes long-term data for monotonic trends (increasing or decreasing) with regular cyclical patterns (seasons). The minimum number of years of data needed for this test is four. The p-value (level of significance) used for this test was 0.10. The resulting water quality trends (increasing, decreasing, or no trend) for different parameters are presented in Tables 1 to 4 below. The resulting trends were mapped to show the spatial variation in the trend results for each parameter, which are included in **Appendix E**.

Appendix A
STATISTICAL SUMMARY

Table A-1: Statistical Summary for pH

Illinois standards include a minimum DO of 5 mg/L from March through July and 3.5 mg/L from August through February

Station	Mean	Median	Max	Min	10th%	50th%	90th%	Std	Count	Non-Detect
MF-08	7.0	7.1	7.7	6.3	6.4	7.1	7.6	0.5	24	0
MF-09	7.1	7.2	7.6	6.4	6.5	7.2	7.5	0.4	24	0
MF-10	7.9	7.9	8.8	6.4	7.6	7.9	8.5	0.4	6863	0
MF-11	7.2	7.3	7.9	6.5	6.6	7.3	7.7	0.4	24	0
MF-12	8.0	8.0	8.3	6.4	7.8	8.0	8.1	0.2	738	0
MF-13	7.3	7.4	8.1	6.4	6.7	7.4	7.7	0.4	23	0
MF-14	8.2	8.2	8.7	6.6	8.0	8.2	8.5	0.2	7438	0
MF-15	8.0	7.9	8.4	6.6	7.8	7.9	8.3	0.2	743	0
MF-16	7.4	7.4	7.8	6.5	7.0	7.4	7.8	0.3	24	0
MF-17	7.8	7.7	8.4	6.5	7.5	7.7	8.2	0.2	7576	0
MF-19	7.7	7.7	8.1	6.6	7.5	7.7	7.9	0.2	4953	0
SR-01	7.4	7.4	7.6	6.0	7.3	7.4	7.5	0.1	1018	0
SR-02	7.2	7.2	7.7	6.2	6.6	7.2	7.6	0.4	24	0
SR-03	7.7	7.7	8.0	6.4	7.6	7.7	7.9	0.1	1028	0
SR-04	7.4	7.5	8.1	6.5	6.7	7.5	7.8	0.5	24	0
SR-05	7.8	7.8	8.7	6.6	7.6	7.8	8.1	0.2	9886	0
SR-06	7.4	7.4	7.9	6.5	6.8	7.4	7.8	0.4	23	0
SR-07	7.5	7.5	8.7	6.4	7.4	7.5	7.7	0.2	429	0
SR-08	8.2	8.1	9.3	7.3	7.7	8.1	8.9	0.4	6607	0
SR-18	8.1	8.0	9.1	6.1	7.7	8.0	8.6	0.3	18279	0
SRLAG	8.2	8.2	9.2	7.5	7.7	8.2	8.8	0.4	9260	0
WF-20	7.1	7.1	7.7	6.3	6.6	7.1	7.6	0.4	24	0
WF-21	7.6	7.6	8.5	6.4	7.4	7.6	7.9	0.3	6213	1
WF-22	7.2	7.2	8.1	6.4	6.7	7.2	7.7	0.4	24	0
WF-23	8.1	7.9	9.2	6.5	7.7	7.9	8.6	0.4	6624	0
WF-24	7.4	7.5	8.2	6.5	6.8	7.5	7.9	0.4	23	0
WF-25	7.4	7.5	8.4	6.5	6.8	7.5	7.9	0.5	24	0

Table A-2: Statistical Summary for Specific Conductivity (uhmo/cm)

Illinois standards include a minimum DO of 5 mg/L from March through July and 3.5 mg/L from August through February

Station	Mean	Median	Max	Min	10th%	50th%	90th%	Std	Count	Non-Detect
MF-08	1826.9	1373.0	6410.0	539.0	641.4	1373.0	3211.0	1300.0	24	0
MF-09	1672.0	1225.5	4770.0	572.0	636.6	1225.5	3030.0	1037.2	24	0
MF-10	885.3	850.0	4060.0	123.0	627.0	850.0	1245.0	251.8	6432	0
MF-11	1345.2	1084.0	3350.0	314.0	577.2	1084.0	2259.0	753.0	24	0
MF-12	779.8	763.0	3900.0	411.0	650.0	763.0	868.3	197.1	738	0
MF-13	1318.8	1012.0	5020.0	385.0	480.4	1012.0	2156.8	1001.2	23	0
MF-14	593.5	603.0	4990.0	166.2	404.2	603.0	763.0	152.7	7438	0
MF-15	818.5	789.7	5120.0	426.0	581.9	789.7	1020.2	241.4	743	0
MF-16	1110.8	949.0	2970.0	585.0	722.3	949.0	1519.0	525.2	24	0
MF-17	688.8	638.0	3000.0	83.7	482.8	638.0	835.5	265.1	7576	0
MF-19	694.0	654.0	3880.0	87.7	538.0	654.0	846.1	149.2	4953	0
SR-01	1138.8	1282.0	8310.0	289.0	683.7	1282.0	1374.0	379.5	1018	0
SR-02	1664.8	1341.0	7700.0	438.0	729.1	1341.0	2633.0	1493.8	24	0
SR-03	953.3	979.0	8000.0	425.0	750.0	979.0	1164.0	263.9	1431	0
SR-04	1350.2	1036.0	5270.0	470.0	664.2	1036.0	2181.1	1097.7	24	0
SR-05	918.4	938.3	6240.0	184.5	636.1	938.3	1148.0	212.0	10894	0
SR-06	1228.4	1084.0	3960.0	363.0	632.0	1084.0	2130.6	756.5	23	0
SR-07	853.2	823.0	2450.0	530.0	791.0	823.0	958.0	89.4	1439	0
SR-08	607.3	625.1	888.0	140.2	396.2	625.1	759.0	135.4	6607	0
SR-18	832.2	826.0	2956.0	178.5	549.4	826.0	1128.0	255.4	18825	0
SRLAG	841.6	786.4	1248.0	3.4	656.1	786.4	1228.0	196.0	9260	0
WF-20	1220.8	1129.5	4430.0	381.0	534.3	1129.5	1952.6	845.3	24	0
WF-21	506.9	527.1	4670.0	63.5	337.1	527.1	666.3	170.0	4512	0
WF-22	1272.1	1123.5	4480.0	437.0	693.8	1123.5	1656.2	799.2	24	0
WF-23	838.7	869.0	4890.0	213.1	596.9	869.0	1031.8	187.7	7310	0
WF-24	1599.6	1337.0	4510.0	480.0	769.2	1337.0	2890.0	1050.8	24	0
WF-25	1031.7	1018.0	4550.0	497.0	876.0	1018.0	1269.4	243.4	725	0

Table A-3: Statistical Summary for Chloride (mg/L)

Illinois standards include a minimum DO of 5 mg/L from March through July and 3.5 mg/L from August through February

Station	Mean	Median	Max	Min	10th%	50th%	90th%	Std	Count	Non-Detect
MF-08	457.9	314.0	1890.0	84.0	141.4	314.0	867.4	369.8	29.0	0.0
MF-09	404.6	291.0	1360.0	86.0	159.8	291.0	753.6	284.1	29.0	0.0
MF-10	345.6	279.0	1130.0	88.0	116.8	279.0	637.6	233.6	29.0	0.0
MF-11	315.1	237.0	961.0	44.0	87.8	237.0	578.8	214.1	29.0	0.0
MF-12	314.4	250.0	1090.0	68.0	80.8	250.0	578.6	234.7	29.0	0.0
MF-13	311.3	241.0	1470.0	61.0	77.6	241.0	606.4	288.3	27.0	0.0
MF-14	297.8	210.0	1420.0	60.0	77.0	210.0	583.0	277.8	29.0	0.0
MF-15	299.9	233.0	1520.0	66.0	79.6	233.0	572.8	293.0	29.0	0.0
MF-16	214.1	174.0	852.0	95.0	126.6	174.0	324.6	153.8	29.0	0.0
MF-17	209.9	163.0	876.0	68.0	105.8	163.0	327.8	162.4	29.0	0.0
MF-19	252.8	174.0	1130.0	82.0	123.8	174.0	450.4	220.5	29.0	0.0
SR-01	418.1	310.0	2530.0	47.0	118.0	310.0	761.6	472.3	29.0	0.0
SR-02	379.7	274.0	2260.0	82.0	144.4	274.0	633.2	415.2	29.0	0.0
SR-03	336.9	216.5	2470.0	80.0	124.4	216.5	535.6	448.9	28.0	0.0
SR-04	272.0	182.0	1460.0	39.0	77.8	182.0	480.8	298.0	29.0	0.0
SR-05	299.8	186.0	1790.0	47.0	82.8	186.0	518.0	358.2	29.0	0.0
SR-06	254.6	174.5	1090.0	50.0	83.2	174.5	539.0	232.3	28.0	0.0
SR-07	203.4	156.0	618.0	61.0	99.2	156.0	421.2	140.3	29.0	0.0
SR-18	186.8	144.0	509.0	71.0	108.0	144.0	351.4	108.8	29.0	0.0
WF-20	265.2	216.0	1240.0	34.0	83.0	216.0	418.8	239.6	29.0	0.0
WF-21	281.1	218.0	1330.0	45.0	87.6	218.0	461.8	249.3	29.0	0.0
WF-22	274.6	219.0	1300.0	56.0	113.8	219.0	418.8	234.6	29.0	0.0
WF-23	331.8	252.0	1470.0	74.0	134.2	252.0	521.4	309.1	29.0	0.0
WF-24	338.4	281.5	1310.0	67.0	136.7	281.5	530.4	306.6	28.0	0.0
WF-25	351.0	273.0	1370.0	60.0	140.2	273.0	623.4	322.6	29.0	0.0

Table A-4: Statistical Summary for Total Suspended Solids (mg/L)

Illinois standards include a minimum DO of 5 mg/L from March through July and 3.5 mg/L from August through February

Station	Mean	Median	Max	Min	10th%	50th%	90th%	Std	Count	Non-Detect
MF-08	20.8	15.0	118.0	1.0	3.4	15.0	38.8	23.8	25	2
MF-09	21.3	15.0	90.0	2.0	4.2	15.0	46.4	20.6	25	0
MF-10	19.9	13.0	144.0	2.0	2.7	13.0	28.0	29.1	25	1
MF-11	29.9	19.0	230.0	1.0	4.4	19.0	47.6	45.6	25	1
MF-12	28.5	9.0	279.0	0.5	1.4	9.0	39.6	59.1	25	2
MF-13	30.1	15.0	206.0	3.0	5.0	15.0	49.9	46.8	24	0
MF-14	39.0	9.0	479.0	2.0	3.0	9.0	56.8	97.1	25	0
MF-15	30.2	13.0	180.0	1.0	5.0	13.0	56.6	45.8	25	0
MF-16	29.3	24.5	89.0	10.0	13.0	24.5	47.7	17.4	24	0
MF-17	22.8	20.0	65.0	1.0	5.4	20.0	44.0	16.0	25	1
MF-19	20.8	18.0	51.0	3.0	7.4	18.0	43.2	13.8	25	0
SR-01	13.9	10.0	44.0	2.0	4.4	10.0	29.6	10.9	25	0
SR-02	21.1	16.0	75.0	3.0	7.4	16.0	40.2	17.8	25	0
SR-03	22.4	12.0	132.0	1.0	4.4	12.0	51.0	29.3	25	1
SR-04	40.2	9.0	400.0	0.5	2.4	9.0	104.6	83.3	25	1
SR-05	31.4	9.0	236.0	1.0	2.4	9.0	86.2	51.7	25	2
SR-06	31.6	11.5	260.0	1.0	3.0	11.5	70.7	55.3	24	1
SR-07	20.0	19.0	43.0	2.0	11.0	19.0	35.2	9.9	25	0
SR-18	20.3	21.0	34.0	8.0	12.8	21.0	27.2	6.2	25	0
WF-20	46.3	17.0	312.0	1.5	4.4	17.0	139.2	74.0	25	0
WF-21	15.9	11.0	66.0	1.0	1.2	11.0	32.8	16.3	25	1
WF-22	21.5	17.0	65.0	2.0	5.0	17.0	53.0	17.8	25	0
WF-23	36.3	32.0	86.0	4.0	15.0	32.0	66.6	22.2	25	0
WF-24	21.5	21.0	52.0	0.5	2.0	21.0	39.8	15.0	25	1
WF-25	20.8	14.0	59.0	0.5	3.4	14.0	42.6	16.5	25	1

Table A-5: Statistical Summary for Ammonia (mg/L)

Illinois standards include a minimum DO of 5 mg/L from March through July and 3.5 mg/L from August through February

Station	Mean	Median	Max	Min	10th%	50th%	90th%	Std	Count	Non-Detect
MF-08	0.11	0.05	0.35	0.05	0.05	0.05	0.17	0.09	24	13
MF-09	0.09	0.05	0.48	0.05	0.05	0.05	0.15	0.09	25	18
MF-10	0.10	0.05	0.69	0.05	0.05	0.05	0.15	0.12	30	24
MF-11	0.09	0.05	0.64	0.05	0.05	0.05	0.13	0.12	24	17
MF-12	0.09	0.05	0.50	0.05	0.05	0.05	0.14	0.09	25	16
MF-13	0.10	0.05	0.47	0.05	0.05	0.05	0.17	0.09	24	13
MF-14	0.11	0.10	0.46	0.05	0.05	0.10	0.18	0.09	30	19
MF-15	0.11	0.05	0.43	0.05	0.05	0.05	0.19	0.10	25	13
MF-16	0.15	0.11	0.90	0.05	0.05	0.11	0.23	0.17	25	10
MF-17	0.15	0.15	0.47	0.05	0.05	0.15	0.23	0.09	30	12
MF-19	0.13	0.14	0.25	0.05	0.05	0.14	0.20	0.05	30	11
SR-01	0.11	0.05	0.26	0.05	0.05	0.05	0.23	0.08	25	13
SR-02	0.10	0.12	0.22	0.05	0.05	0.12	0.16	0.05	25	11
SR-03	0.11	0.11	0.32	0.05	0.05	0.11	0.18	0.07	25	11
SR-04	0.12	0.05	0.52	0.05	0.05	0.05	0.23	0.12	25	13
SR-05	0.12	0.12	0.34	0.05	0.05	0.12	0.21	0.08	25	10
SR-06	0.11	0.11	0.32	0.05	0.05	0.11	0.21	0.08	23	11
SR-07	0.13	0.11	0.30	0.05	0.05	0.11	0.24	0.08	25	9
SR-08	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.00	5	5
SR-18	0.13	0.14	0.27	0.05	0.05	0.14	0.19	0.06	30	14
WF-20	0.15	0.12	0.71	0.05	0.05	0.12	0.29	0.16	25	10
WF-21	0.24	0.15	1.07	0.05	0.05	0.15	0.47	0.23	30	11
WF-22	0.34	0.15	3.66	0.05	0.05	0.15	0.46	0.71	25	5
WF-23	0.20	0.16	0.54	0.05	0.05	0.16	0.37	0.13	30	11
WF-24	0.37	0.28	1.59	0.05	0.14	0.28	0.51	0.31	25	1
WF-25	0.24	0.23	0.62	0.05	0.13	0.23	0.37	0.12	25	1

Table A-6: Statistical Summary for Total Nitrates (mg/L)

Illinois standards include a minimum DO of 5 mg/L from March through July and 3.5 mg/L from August through February

Station	Mean	Median	Max	Min	10th%	50th%	90th%	Std	Count	Non-Detect
MF-08	0.09	0.05	0.36	0.05	0.05	0.05	0.15	0.08	29	22
MF-09	0.07	0.05	0.46	0.05	0.05	0.05	0.07	0.09	29	26
MF-10	0.10	0.05	0.51	0.05	0.05	0.05	0.20	0.11	29	19
MF-11	0.11	0.05	0.50	0.05	0.05	0.05	0.25	0.11	29	18
MF-12	0.14	0.05	0.65	0.05	0.05	0.05	0.26	0.15	29	15
MF-13	0.28	0.15	3.58	0.05	0.05	0.15	0.27	0.66	28	7
MF-14	0.31	0.17	3.52	0.05	0.05	0.17	0.41	0.64	29	7
MF-15	0.38	0.17	3.75	0.05	0.05	0.17	0.56	0.71	29	7
MF-16	6.50	5.52	17.50	1.30	1.78	5.52	13.70	4.68	29	0
MF-17	6.22	5.17	16.80	1.04	1.70	5.17	13.54	4.53	29	0
MF-19	4.63	3.52	12.20	1.05	1.45	3.52	9.42	3.42	29	0
SR-01	0.14	0.05	0.87	0.05	0.05	0.05	0.33	0.17	29	15
SR-02	0.23	0.22	0.49	0.05	0.10	0.22	0.36	0.10	29	2
SR-03	0.26	0.24	0.47	0.05	0.15	0.24	0.40	0.10	29	1
SR-04	0.28	0.28	0.55	0.05	0.05	0.28	0.48	0.14	29	4
SR-05	0.38	0.36	0.72	0.12	0.23	0.36	0.56	0.15	29	0
SR-06	0.70	0.43	6.16	0.22	0.29	0.43	0.87	1.09	28	0
SR-07	1.49	0.98	9.53	0.05	0.35	0.98	2.43	1.95	29	1
SR-18	7.40	5.94	18.90	0.77	2.40	5.94	12.62	4.56	29	0
WF-20	0.17	0.16	0.57	0.05	0.05	0.16	0.34	0.12	29	8
WF-21	0.26	0.27	0.76	0.05	0.05	0.27	0.44	0.16	29	5
WF-22	4.84	4.52	13.80	0.54	0.75	4.52	9.08	3.55	29	0
WF-23	2.50	2.27	5.33	0.80	1.04	2.27	4.28	1.26	29	0
WF-24	1.78	1.54	4.12	0.60	0.77	1.54	3.16	0.97	29	0
WF-25	1.79	1.57	3.94	0.56	0.75	1.57	2.86	0.90	29	0

Table A-7: Statistical Summary for Total Kjeldahl Nitrogen (mg/L)

Illinois standards include a minimum DO of 5 mg/L from March through July and 3.5 mg/L from August through February

Station	Mean	Median	Max	Min	10th%	50th%	90th%	Std	Count	Non-Detect
MF-08	0.96	0.71	3.40	0.25	0.25	0.71	1.44	0.74	25	4
MF-09	0.92	0.86	2.82	0.25	0.25	0.86	1.69	0.63	25	6
MF-10	1.06	0.87	4.62	0.25	0.25	0.87	1.82	0.84	30	7
MF-11	1.28	1.09	4.83	0.25	0.67	1.09	2.15	0.93	25	2
MF-12	1.05	0.96	2.13	0.25	0.38	0.96	1.86	0.55	25	3
MF-13	1.24	1.06	4.59	0.25	0.66	1.06	1.92	0.86	24	2
MF-14	1.26	1.13	4.59	0.25	0.50	1.13	2.00	0.84	30	6
MF-15	1.06	1.00	1.86	0.25	0.47	1.00	1.72	0.46	25	2
MF-16	1.41	1.34	3.13	0.53	0.75	1.34	1.94	0.60	25	0
MF-17	1.25	1.23	1.98	0.50	0.80	1.23	1.81	0.39	30	2
MF-19	1.44	1.25	4.10	0.54	0.86	1.25	2.22	0.69	30	0
SR-01	1.20	0.88	5.19	0.25	0.25	0.88	2.63	1.14	25	5
SR-02	0.82	0.82	2.13	0.25	0.25	0.82	1.29	0.44	25	4
SR-03	0.83	0.75	2.09	0.25	0.48	0.75	1.29	0.41	25	2
SR-04	1.12	0.81	3.77	0.25	0.51	0.81	1.89	0.80	25	2
SR-05	1.23	1.06	2.88	0.25	0.65	1.06	1.97	0.65	25	2
SR-06	1.15	1.04	2.83	0.25	0.58	1.04	1.63	0.56	24	1
SR-07	1.47	1.41	2.85	0.25	0.77	1.41	2.33	0.59	25	1
SR-08	0.65	0.50	1.25	0.50	0.50	0.50	0.95	0.34	5	5
SR-18	1.47	1.40	2.63	0.25	0.97	1.40	2.11	0.49	30	1
WF-20	1.48	1.40	4.01	0.25	0.55	1.40	2.28	0.86	25	2
WF-21	1.30	0.94	4.31	0.25	0.50	0.94	2.28	0.89	30	4
WF-22	1.76	1.59	5.63	0.25	0.95	1.59	2.41	1.05	25	1
WF-23	1.47	1.30	4.53	0.68	0.95	1.30	1.87	0.69	30	0
WF-24	1.70	1.41	6.10	0.52	0.73	1.41	3.07	1.22	25	0
WF-25	1.18	1.06	3.04	0.25	0.54	1.06	1.93	0.65	25	2

Table A-8: Statistical Summary for Total Phosphorus (mg/L)

Illinois standards include a minimum DO of 5 mg/L from March through July and 3.5 mg/L from August through February

Station	Mean	Median	Max	Min	10th%	50th%	90th%	Std	Count	Non-Detect
MF-08	0.08	0.05	0.28	0.04	0.05	0.05	0.13	0.05	29	14
MF-09	0.09	0.08	0.29	0.05	0.05	0.08	0.16	0.05	29	12
MF-10	0.10	0.10	0.24	0.05	0.05	0.10	0.16	0.05	35	16
MF-11	0.11	0.10	0.42	0.05	0.05	0.10	0.20	0.08	29	12
MF-12	0.11	0.11	0.42	0.02	0.05	0.11	0.16	0.08	29	12
MF-13	0.12	0.12	0.29	0.05	0.05	0.12	0.19	0.07	28	9
MF-14	0.13	0.12	0.62	0.02	0.05	0.12	0.18	0.11	35	14
MF-15	0.12	0.11	0.33	0.02	0.05	0.11	0.26	0.08	29	12
MF-16	0.46	0.31	2.87	0.10	0.18	0.31	0.63	0.53	29	0
MF-17	0.38	0.28	2.29	0.12	0.16	0.28	0.51	0.41	35	1
MF-19	0.32	0.27	0.96	0.12	0.18	0.27	0.43	0.20	35	1
SR-01	0.08	0.05	0.17	0.04	0.05	0.05	0.14	0.04	29	16
SR-02	0.08	0.05	0.21	0.04	0.05	0.05	0.14	0.05	29	14
SR-03	0.09	0.05	0.38	0.02	0.05	0.05	0.16	0.07	29	15
SR-04	0.12	0.05	0.74	0.05	0.05	0.05	0.23	0.14	29	15
SR-05	0.12	0.10	0.49	0.05	0.05	0.10	0.22	0.10	29	11
SR-06	0.14	0.12	0.45	0.05	0.05	0.12	0.26	0.10	28	10
SR-07	0.15	0.15	0.33	0.05	0.05	0.15	0.23	0.07	29	6
SR-08	0.14	0.12	0.22	0.10	0.10	0.12	0.20	0.05	6	1
SR-18	0.37	0.29	1.73	0.12	0.17	0.29	0.46	0.34	35	1
WF-20	0.27	0.15	1.40	0.05	0.05	0.15	0.49	0.30	29	5
WF-21	0.19	0.16	0.75	0.05	0.05	0.16	0.34	0.14	35	6
WF-22	1.15	0.87	3.46	0.08	0.24	0.87	2.38	0.93	29	0
WF-23	0.57	0.55	1.07	0.18	0.25	0.55	0.91	0.25	35	0
WF-24	0.38	0.37	0.78	0.15	0.19	0.37	0.57	0.16	29	0
WF-25	0.35	0.31	0.67	0.17	0.19	0.31	0.57	0.15	29	0

Table A-9: Statistical Summary for Chlorophyll-a (ug/L)

Illinois standards include a minimum DO of 5 mg/L from March through July and 3.5 mg/L from August through February

Station	Mean	Median	Max	Min	10th%	50th%	90th%	Std	Count	Non-Detect
MF-08	9.4	5.1	34.0	1.9	2.6	5.1	23.1	9.7	14	0
MF-09	5.5	4.1	20.0	1.1	1.9	4.1	11.0	5.1	14	0
MF-10	7.2	5.7	30.0	0.4	1.0	5.7	13.4	7.2	19	0
MF-11	5.2	4.2	15.0	0.0	0.5	4.2	13.5	5.0	14	0
MF-12	3.3	1.9	11.0	0.4	0.6	1.9	8.7	3.5	14	0
MF-13	3.0	1.2	17.0	0.0	0.1	1.2	6.4	4.5	14	0
MF-14	4.4	1.4	16.0	0.2	0.4	1.4	13.6	5.6	19	0
MF-15	4.5	1.8	26.0	0.0	0.1	1.8	13.0	7.4	14	0
MF-16	7.4	5.3	21.0	1.5	2.5	5.3	15.7	5.9	14	0
MF-17	11.0	3.9	50.0	0.4	0.6	3.9	28.4	13.9	19	0
MF-19	7.1	2.8	26.0	0.7	0.7	2.8	19.4	8.2	19	0
SR-01	4.5	4.0	8.8	0.8	1.2	4.0	8.4	2.8	14	0
SR-02	2.5	2.2	6.9	0.0	0.5	2.2	4.8	1.9	14	0
SR-03	1.8	1.7	5.6	0.0	0.1	1.7	3.6	1.6	14	0
SR-04	1.7	1.3	5.8	0.0	0.3	1.3	3.9	1.7	14	0
SR-05	9.0	7.2	536.1	0.4	3.9	7.2	14.0	9.7	9125	0
SR-06	2.7	2.0	7.1	0.0	0.4	2.0	5.7	2.2	14	0
SR-07	27.8	22.0	76.0	2.1	11.8	22.0	62.6	21.5	14	0
SR-08	9.7	8.4	16.0	4.8	5.8	8.4	14.4	4.4	5	0
SR-18	11.1	9.0	97.0	0.8	4.0	9.0	20.3	8.4	11273	0
SRLAG	48.9	46.3	175.6	-0.1	22.3	46.3	76.4	22.8	9260	0
WF-20	8.5	5.9	35.0	0.7	1.8	5.9	19.0	9.4	14	0
WF-21	6.6	4.3	32.0	0.5	1.1	4.3	18.0	8.1	19	0
WF-22	6.2	3.1	36.0	1.3	2.1	3.1	10.8	9.0	14	0
WF-23	16.9	8.5	73.0	1.3	2.3	8.5	33.8	18.6	19	0
WF-24	4.7	4.5	17.0	0.0	0.3	4.5	7.5	4.7	14	0
WF-25	5.5	1.4	40.0	0.3	0.3	1.4	8.2	10.3	14	0

Table A-10: Statistical Summary for Dissolved Oxygen (mg/L)

Illinois standards include a minimum DO of 5 mg/L from March through July and 3.5 mg/L from August through February

Station	Mean	Median	Max	Min	10th%	50th%	90th%	Std	Count	Non-Detect
MF-08	7.0	6.7	13.4	2.5	3.3	6.7	11.1	3.0	29	0
MF-09	7.1	6.8	13.6	1.9	3.7	6.8	12.5	3.2	29	0
MF-10	7.1	6.8	16.9	1.1	4.3	6.8	10.8	2.6	6868	0
MF-11	7.6	7.2	13.8	3.2	4.0	7.2	13.1	3.2	29	0
MF-12	5.7	5.5	14.1	2.8	4.3	5.5	7.4	1.3	743	0
MF-13	7.3	7.0	14.1	3.8	4.3	7.0	12.7	2.9	28	0
MF-14	7.2	6.9	14.7	4.5	5.7	6.9	9.0	1.3	7443	0
MF-15	7.7	7.4	14.4	5.9	6.3	7.4	9.8	1.3	748	0
MF-16	8.0	7.3	13.1	4.7	5.7	7.3	11.7	2.4	29	0
MF-17	4.5	4.8	13.0	0.5	2.1	4.8	6.5	1.7	7581	0
MF-19	5.2	5.2	13.2	2.5	3.7	5.2	6.8	1.2	4338	0
SR-01	4.7	4.4	12.5	2.4	2.9	4.4	6.7	1.5	1023	0
SR-02	7.5	6.6	13.6	3.9	5.0	6.6	12.0	2.6	29	0
SR-03	5.8	5.7	13.4	2.1	3.1	5.7	8.4	2.0	1436	0
SR-04	8.8	8.1	13.9	5.9	6.6	8.1	13.4	2.4	29	0
SR-05	5.7	5.8	13.4	0.8	3.1	5.8	7.9	1.8	10899	0
SR-06	7.7	7.3	13.7	4.0	4.9	7.3	12.6	2.7	28	0
SR-07	4.2	3.8	18.0	1.0	2.2	3.8	6.7	1.9	1444	0
SR-08	8.7	7.3	25.5	2.1	4.4	7.3	15.4	4.2	6607	0
SR-18	6.8	6.8	15.2	1.8	4.6	6.8	9.0	1.8	18847	0
SRLAG	6.4	5.9	18.4	0.9	3.5	5.9	10.1	2.6	9260	0
WF-20	6.6	6.2	13.1	2.3	3.2	6.2	11.9	3.1	29	0
WF-21	3.7	3.6	13.3	0.1	1.0	3.6	6.1	1.9	6383	0
WF-22	8.1	7.4	12.9	2.8	4.9	7.4	11.9	2.7	29	0
WF-23	7.5	7.1	20.4	1.6	4.3	7.1	11.5	2.9	7315	0
WF-24	7.5	6.6	13.2	3.5	4.2	6.6	12.6	3.0	29	0
WF-25	5.4	5.0	13.2	2.8	3.7	5.0	7.6	1.6	730	0

Table A-11: Statistical Summary for Dissolved Oxgen Saturation (%)

Illinois standards include a minimum DO of 5 mg/L from March through July and 3.5 mg/L from August through February

Station	Mean	Median	Max	Min	10th%	50th%	90th%	Std	Count	Non-Detect
MF-10	80.1	72.9	208.4	12.9	48.2	72.9	124.9	31.8	6839	0
MF-12	67.4	65.1	103.3	43.7	50.7	65.1	87.5	13.8	714	0
MF-14	80.3	78.3	130.3	54.2	65.0	78.3	99.7	13.5	7414	0
MF-15	89.6	84.7	131.1	67.2	72.0	84.7	118.5	16.9	719	0
MF-17	45.0	48.2	91.4	5.6	19.6	48.2	65.1	17.4	6536	0
MF-19	60.4	58.9	107.0	31.3	41.2	58.9	81.6	15.2	3293	0
SR-03	64.6	47.8	138.1	22.5	24.7	47.8	131.2	39.2	403	0
SR-05	65.4	67.2	155.1	9.0	35.9	67.2	92.5	21.2	9862	0
SR-07	43.4	36.5	95.1	12.0	21.0	36.5	74.3	20.6	405	0
SR-08	99.3	79.3	333.5	24.9	49.8	79.3	175.9	51.6	6607	0
SR-18	79.6	78.3	191.7	19.6	54.6	78.3	107.2	22.3	18255	0
SRLAG	76.9	70.8	236.9	10.5	40.9	70.8	125.0	32.2	9260	0
WF-21	40.4	40.6	101.9	0.8	11.3	40.6	66.7	20.3	6354	0
WF-23	84.0	74.4	258.6	18.7	48.4	74.4	132.0	37.2	7286	0
WF-25	62.6	57.7	99.1	32.0	42.5	57.7	91.0	18.2	701	0

Table A-12: Statistical Summary for *E. coli* (CFU/100 mL)

Illinois standards include a minimum DO of 5 mg/L from March through July and 3.5 mg/L from August through February

Station	Geomean	Median	Max	Min	10th%	50th%	90th%	Std	Count	Non-Detect
MF-08	262.7	148.0	1300.0	4.0	21.8	148.0	631.4	325.6	27	0
MF-09	453.3	222.0	1730.0	26.0	37.2	222.0	1082.0	465.0	27	0
MF-10	660.9	296.0	4350.0	10.0	33.2	296.0	1214.0	988.9	27	1
MF-11	820.5	365.0	4610.0	36.0	90.2	365.0	2130.0	1017.2	27	1
MF-12	786.5	261.0	5480.0	56.0	77.0	261.0	2624.0	1273.9	27	1
MF-13	984.9	173.0	8660.0	48.0	60.5	173.0	3240.0	1907.2	26	1
MF-14	1578.4	291.0	12100.0	60.0	97.2	291.0	4996.0	2844.1	27	1
MF-15	1839.3	548.0	13000.0	42.0	214.0	548.0	5214.0	3075.9	27	1
MF-16	750.9	365.0	3080.0	36.0	103.8	365.0	1798.0	845.8	27	2
MF-17	1793.6	496.0	17300.0	64.0	140.4	496.0	3000.0	3877.7	27	2
MF-19	1019.7	548.0	4610.0	122.0	166.0	548.0	2228.0	1069.8	27	1
SR-01	1306.0	350.0	12100.0	9.0	48.4	350.0	3116.0	2556.4	27	1
SR-02	1476.3	365.0	19900.0	59.0	92.6	365.0	2342.0	3857.5	27	1
SR-03	1618.7	210.0	14100.0	12.0	70.4	210.0	4196.0	3742.7	27	0
SR-04	1844.5	816.0	13000.0	91.0	210.8	816.0	3768.0	3169.9	27	0
SR-05	1919.9	548.0	15500.0	52.0	115.8	548.0	3096.0	4025.8	27	0
SR-06	2220.8	631.0	19900.0	41.0	137.5	631.0	3685.0	4349.0	26	0
SR-07	536.8	86.0	3440.0	3.0	11.8	86.0	2020.0	987.7	27	0
SR-18	837.2	443.0	3260.0	26.0	122.6	443.0	2186.0	866.0	27	0
WF-20	1135.9	298.0	19900.0	22.0	47.2	298.0	1254.0	3775.7	27	0
WF-21	1279.3	504.0	17300.0	62.0	166.8	504.0	1246.0	3242.0	27	3
WF-22	1152.9	576.0	8160.0	51.0	145.0	576.0	2174.0	1625.9	27	3
WF-23	1104.1	365.0	6870.0	5.0	73.2	365.0	2616.0	1784.6	27	1
WF-24	857.3	432.0	5170.0	64.0	132.8	432.0	1692.0	1160.5	27	1
WF-25	1328.9	1050.0	6870.0	108.0	262.8	1050.0	2586.0	1553.7	27	2

Appendix B
LONGITUDINAL PLOTS

West Fork

Figure B-1: Longitudinal Plot for pH in West Fork

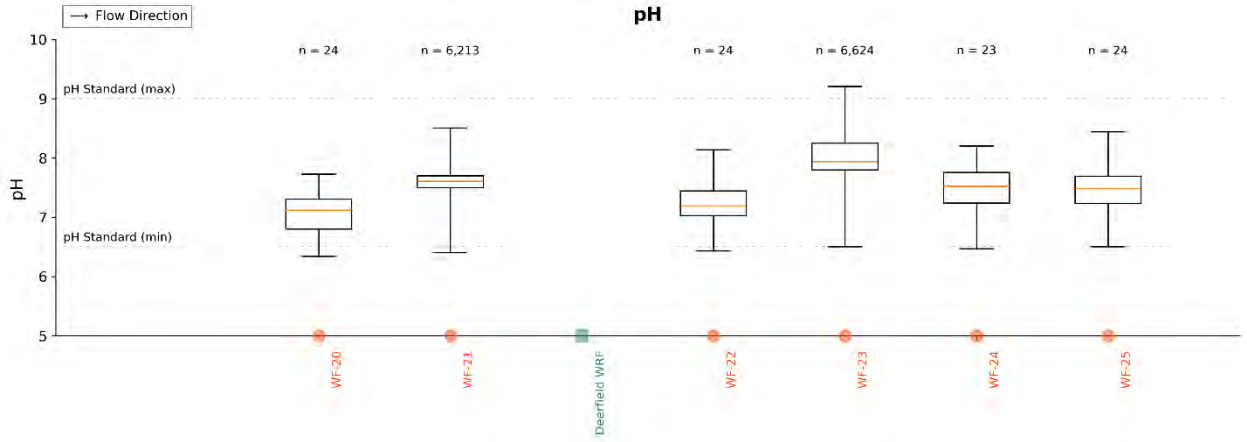


Figure B-2: Longitudinal Plot for Specific Conductivity in West Fork

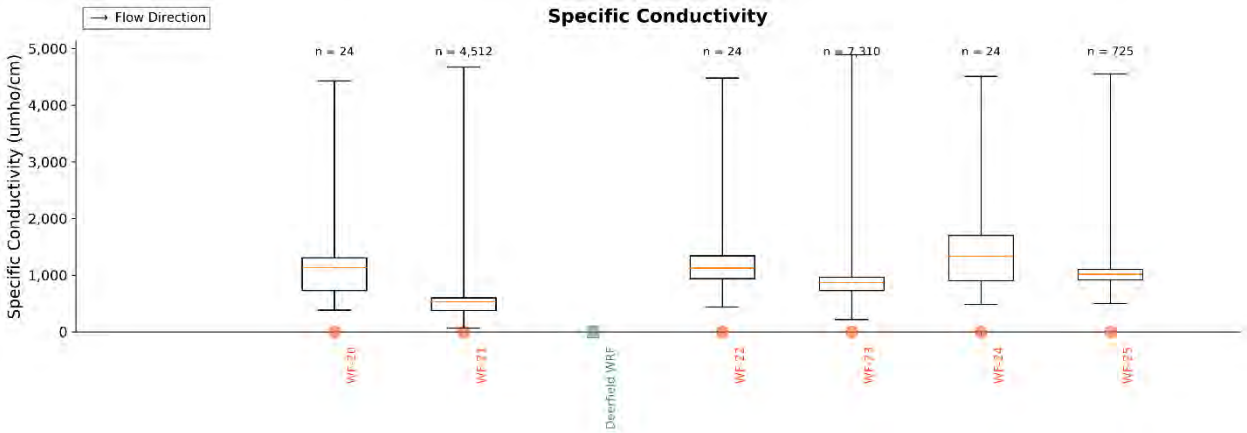


Figure B-3: Longitudinal Plot for Chloride in West Fork

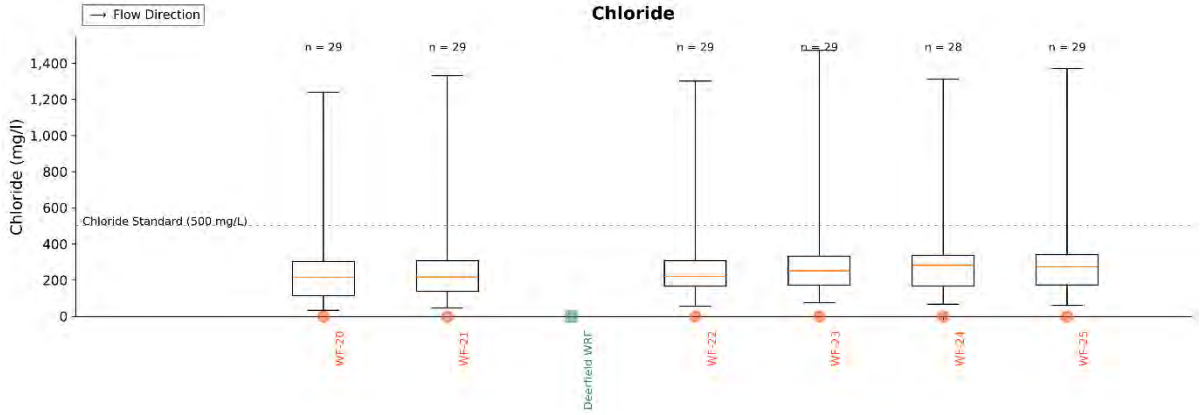


Figure B-4: Longitudinal Plots for Total Suspended Solids in West Fork

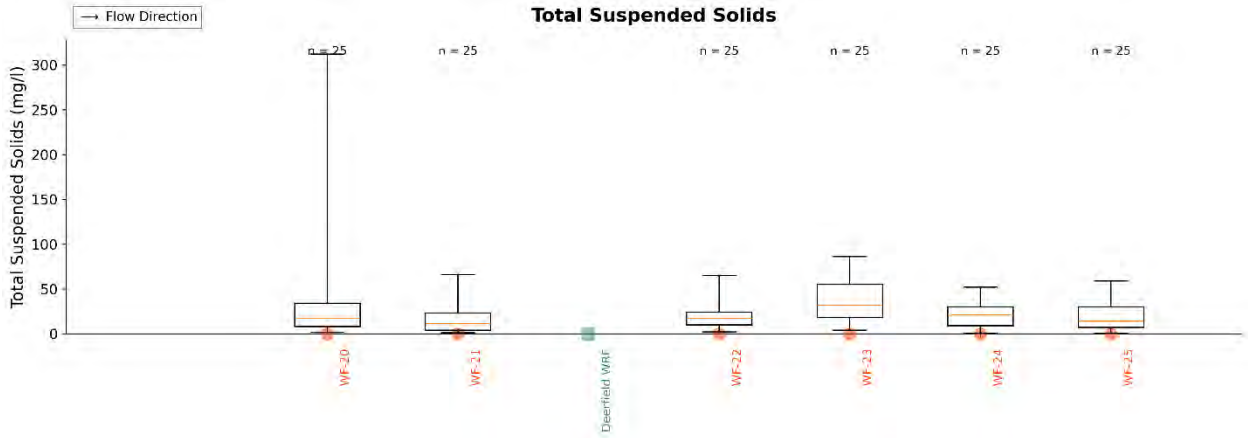


Figure B-5: Longitudinal Plot for Ammonia in West Fork

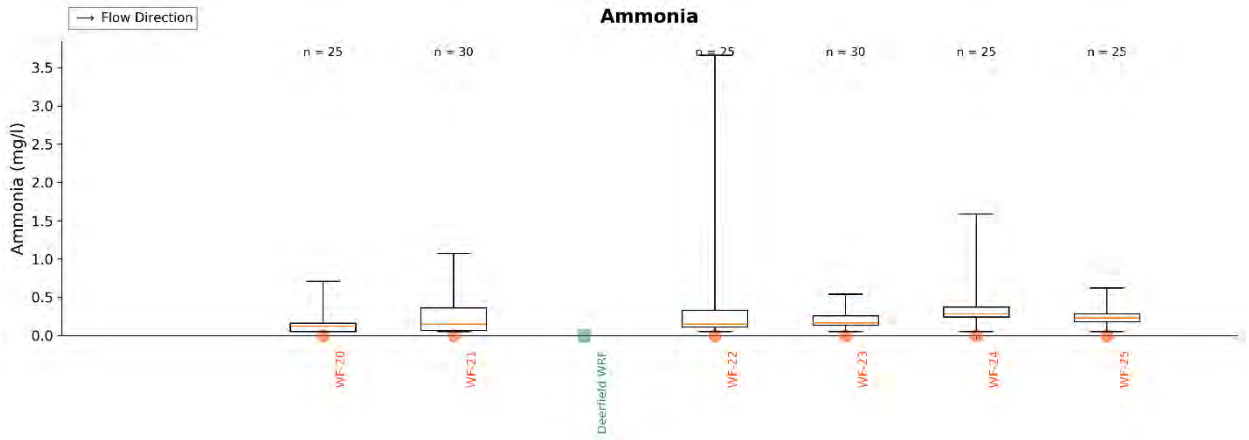


Figure B-6: Longitudinal Plot for Total Nitrates in West Fork

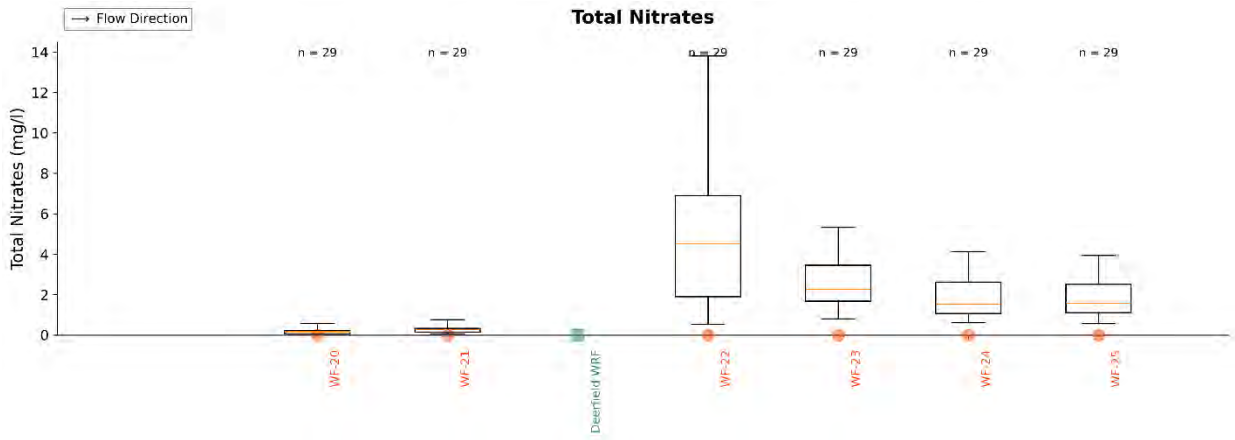


Figure B-7: Longitudinal Plot for Total Kjeldahl Nitrogen in West Fork

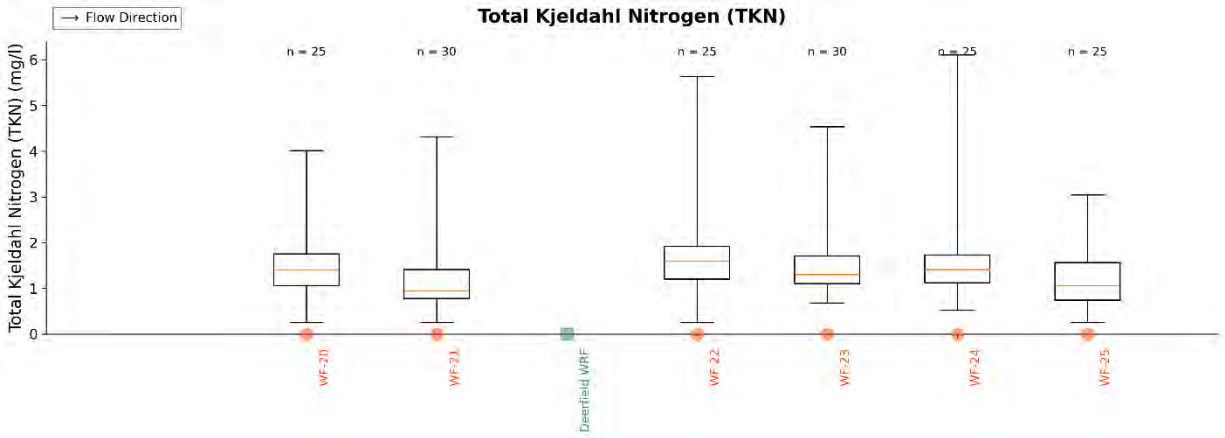


Figure B-8: Longitudinal Plot for Total Phosphorus in West Fork

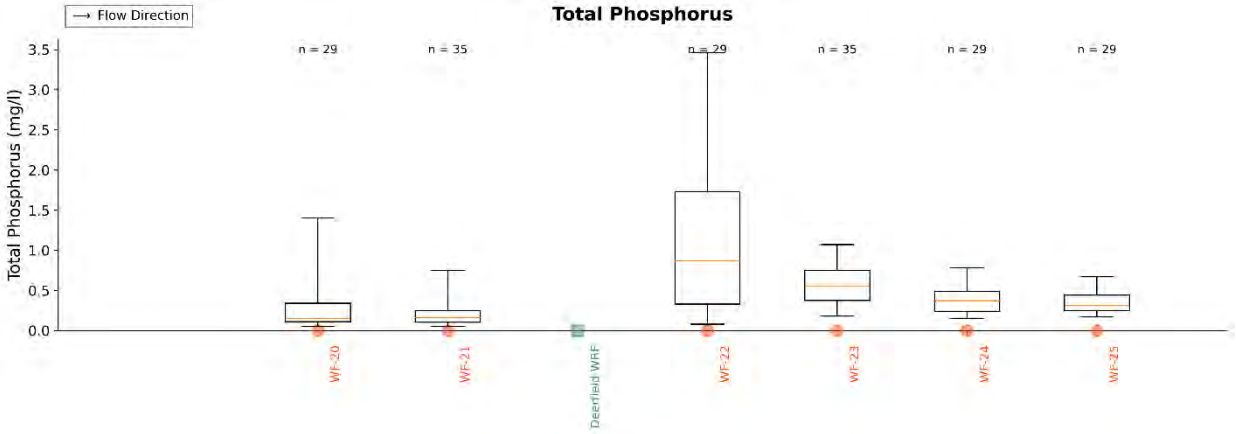


Figure B-9: Longitudinal Plot for Chlorophyll-a in West Fork

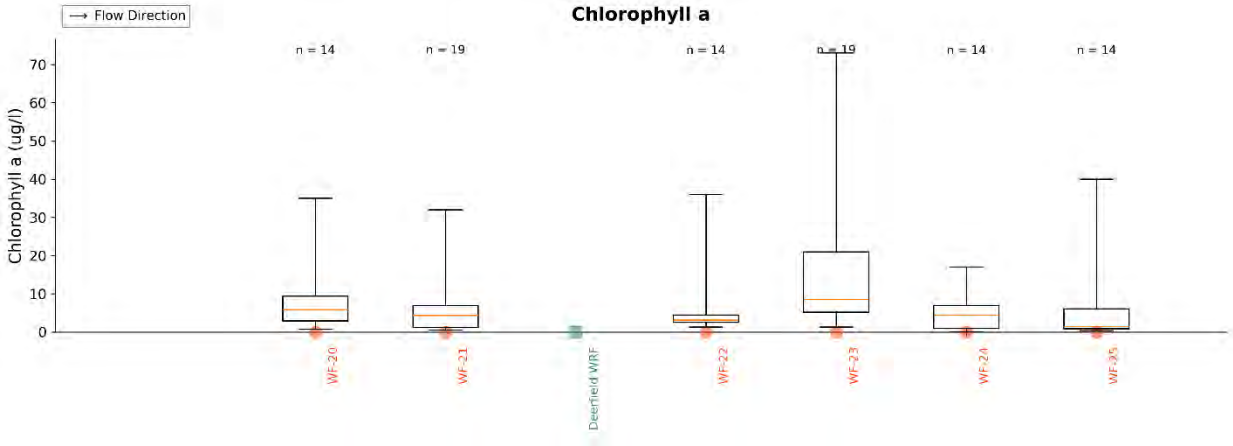


Figure B-10: Longitudinal Plots for Dissolved Oxygen in West Fork

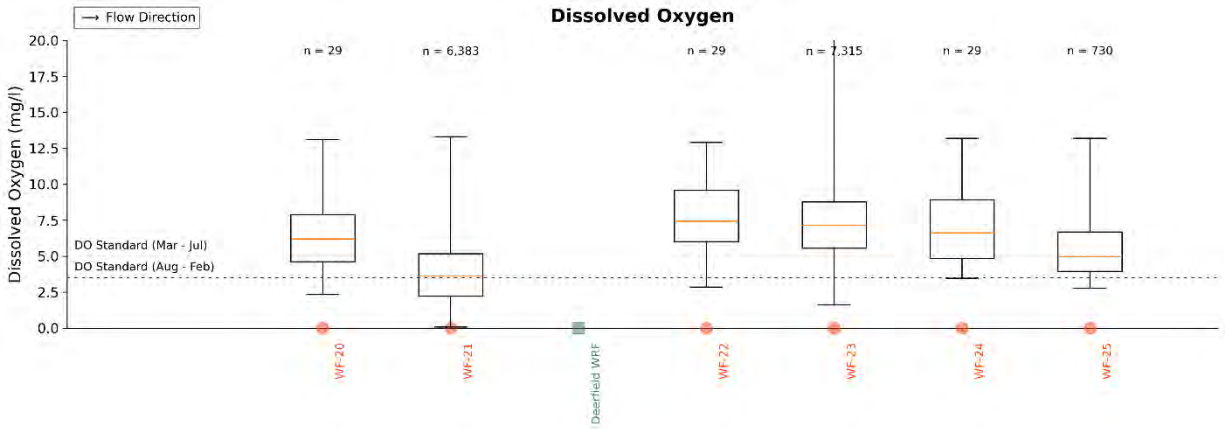


Figure B-11: Longitudinal Plots for Dissolved Oxygen Saturation in West Fork

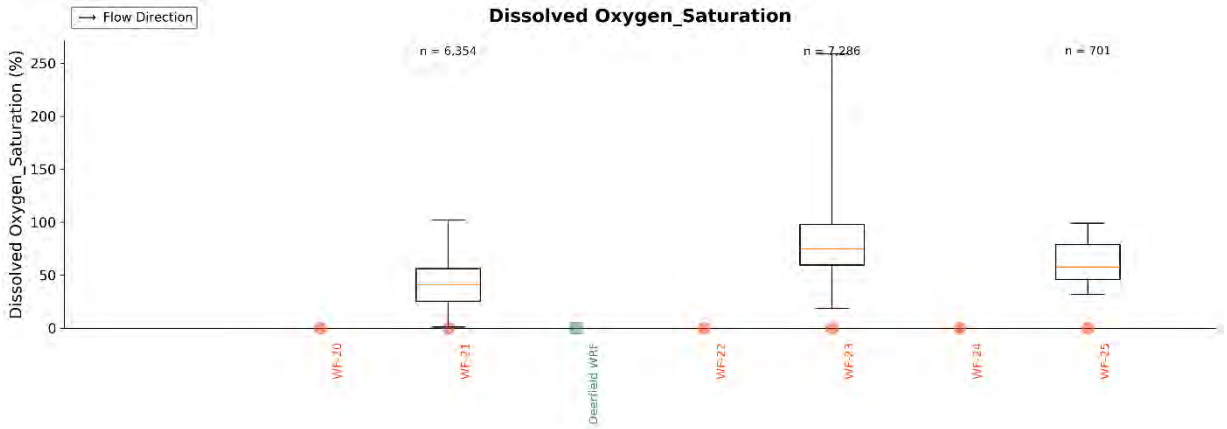
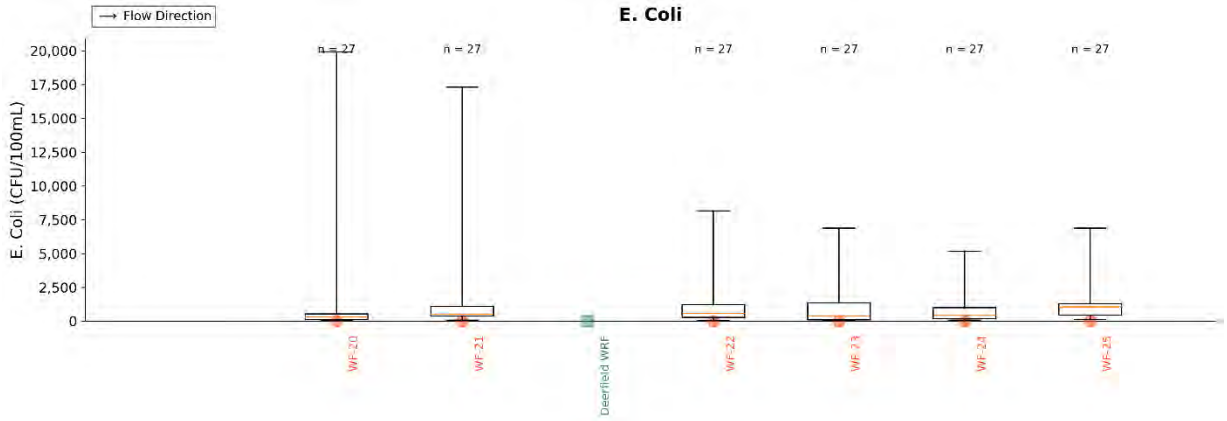


Figure B-12: Longitudinal Plots for E. Coli in West Fork



Middle Fork and North Branch Chicago River

Figure B-13: Longitudinal Plots for pH in Middle Fork

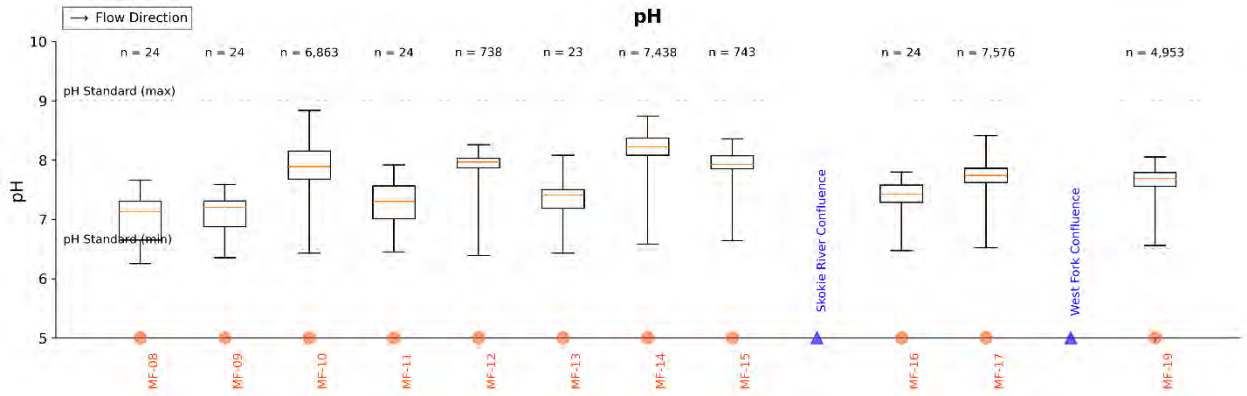


Figure B-14: Longitudinal Plot for Specific Conductivity in Middle Fork

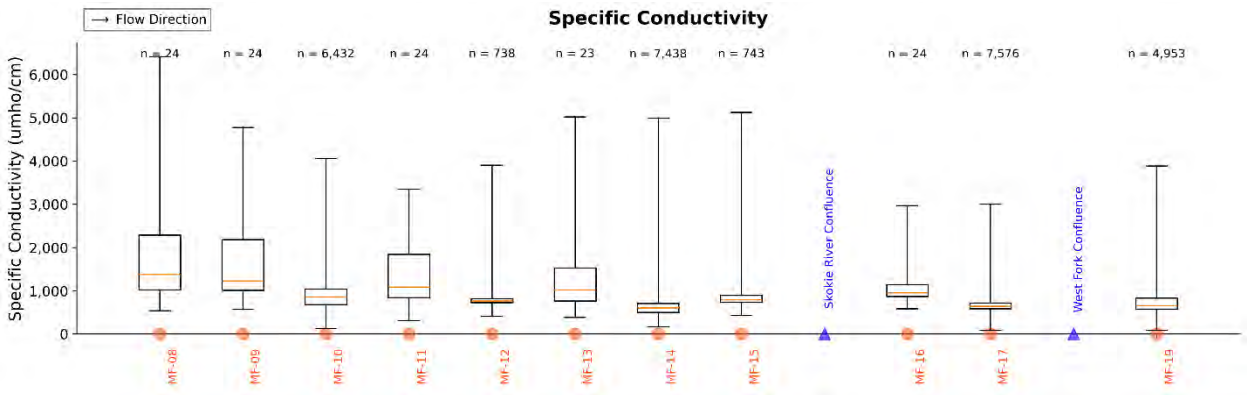


Figure B-15: Longitudinal Plot for Chloride in Middle Fork

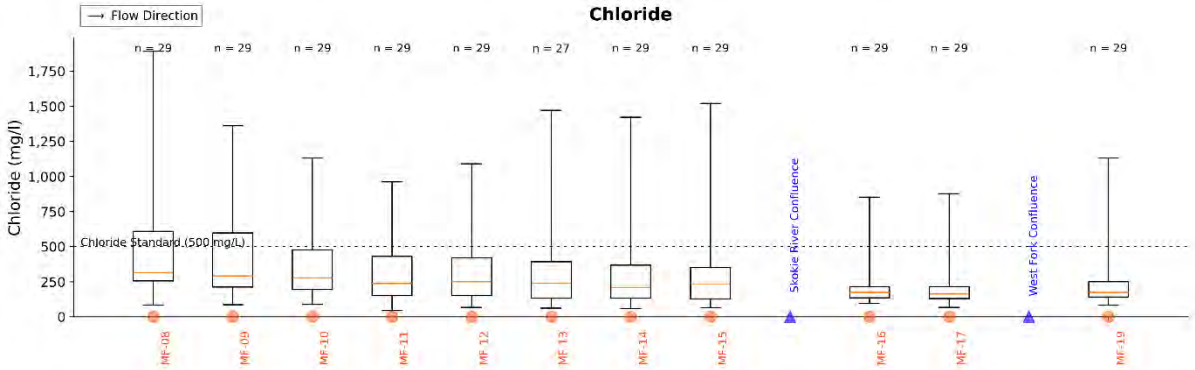


Figure B-16: Longitudinal Plots for Total Suspended Solids in Middle Fork

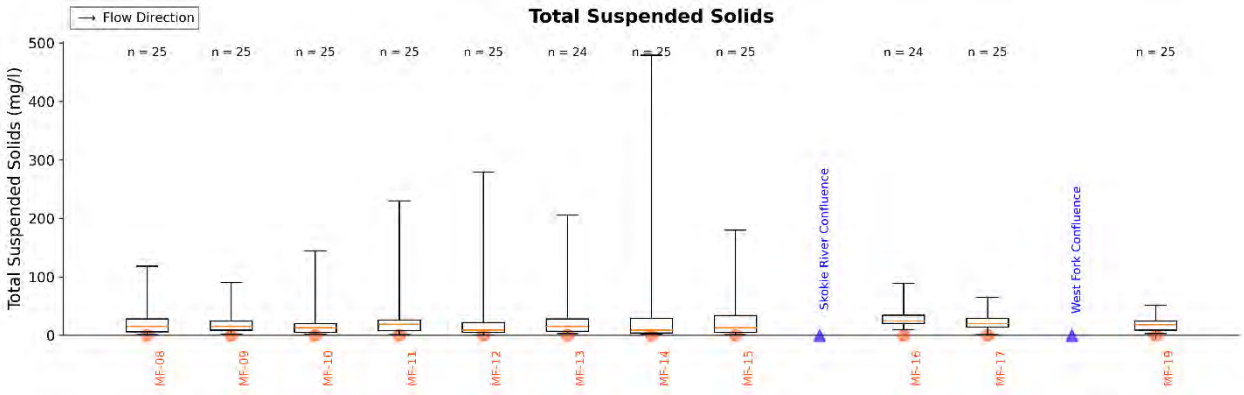


Figure B-17: Longitudinal Plot for Ammonia in Middle Fork

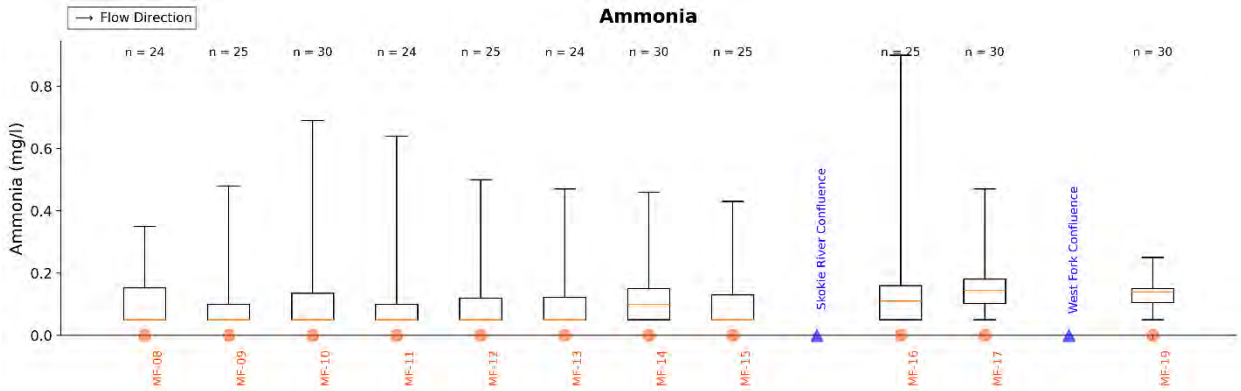


Figure B-18: Longitudinal Plots for Total Nitrates in Middle Fork

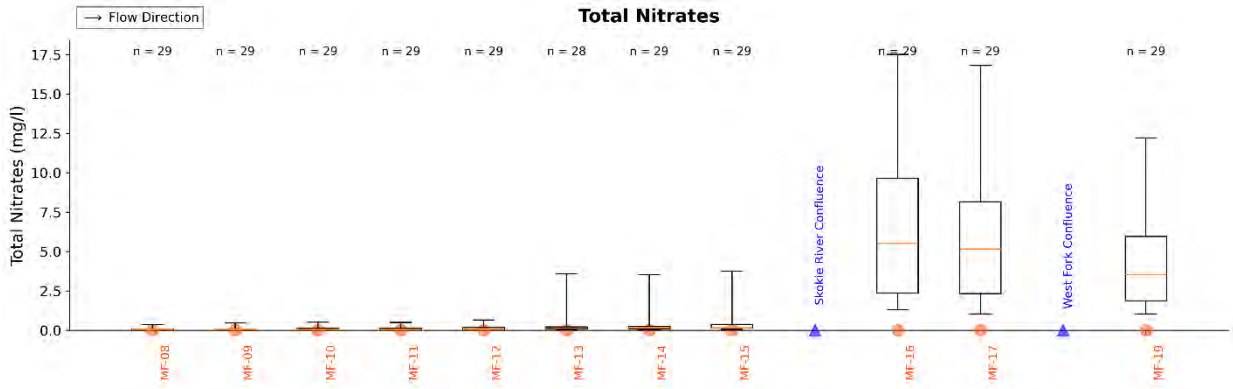


Figure B-19: Longitudinal Plots for Total Kjeldahl Nitrogen in Middle Fork

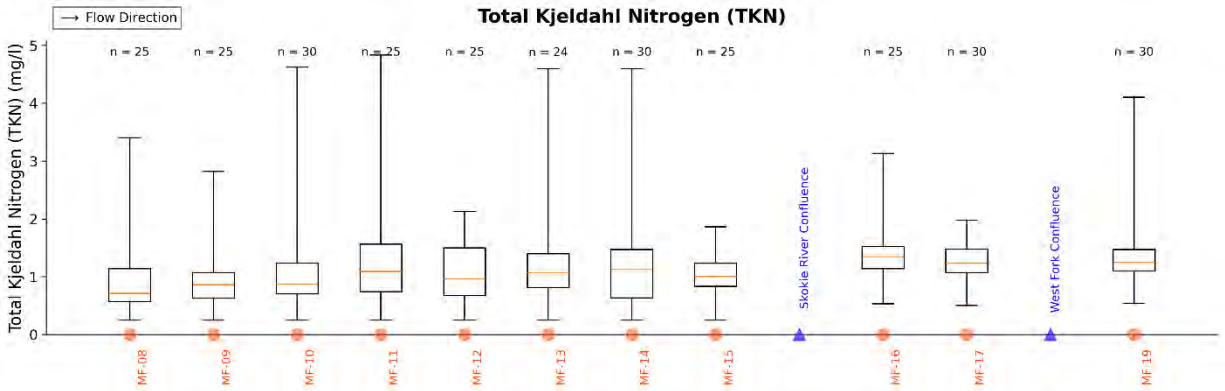


Figure B-20: Longitudinal Plots for Total Phosphorus in Middle Fork

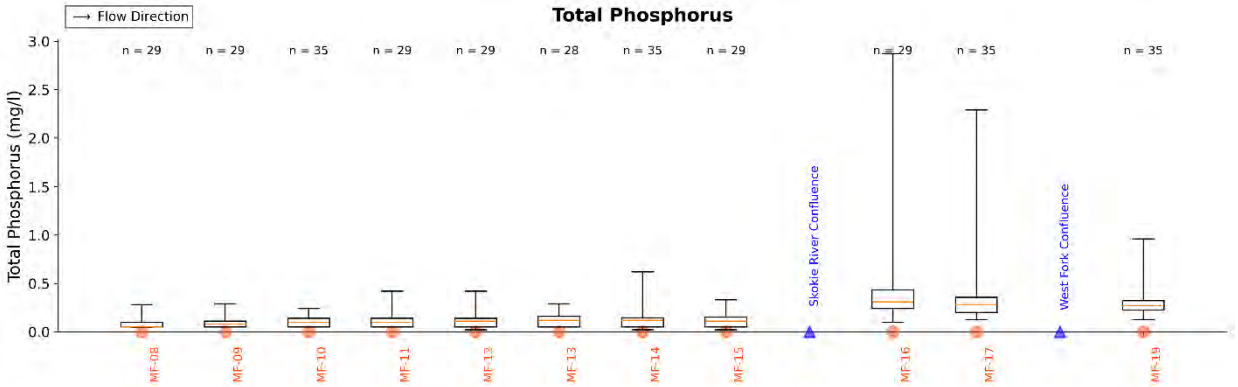


Figure B-21: Longitudinal Plots for Chlorophyll-a in Middle Fork

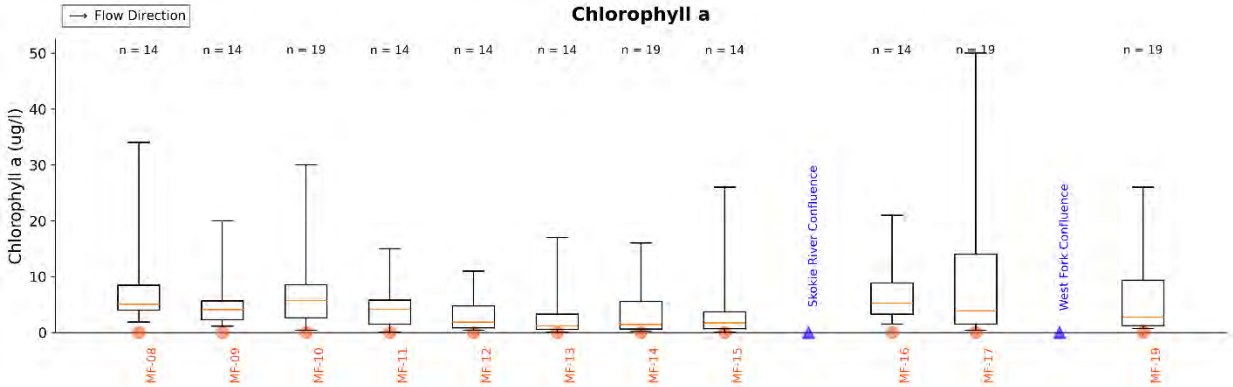


Figure B-22: Longitudinal Plots for Dissolved Oxygen in Middle Fork

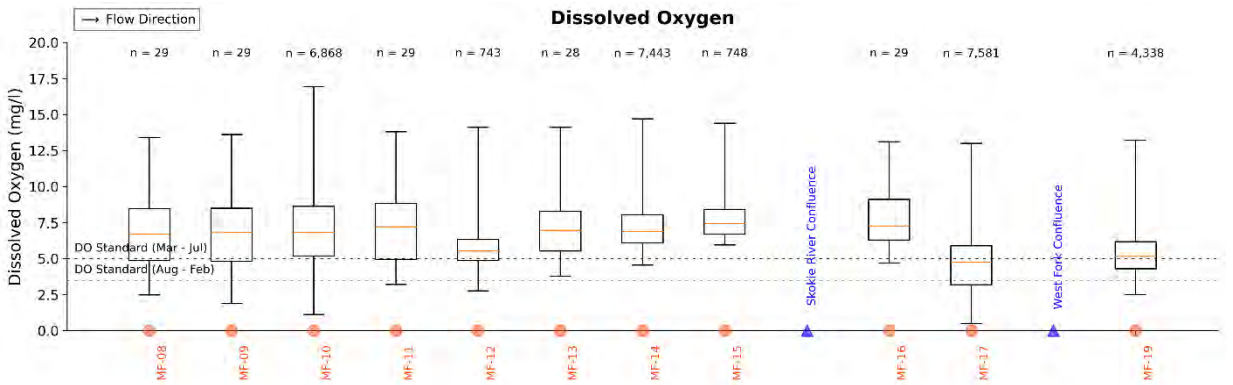


Figure B-23: Longitudinal Plots for Dissolved Oxygen Saturation in Middle Fork

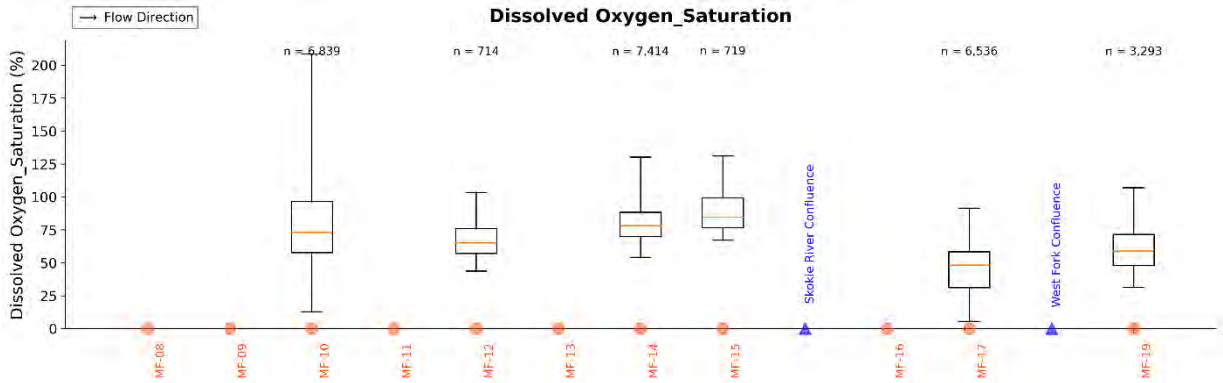
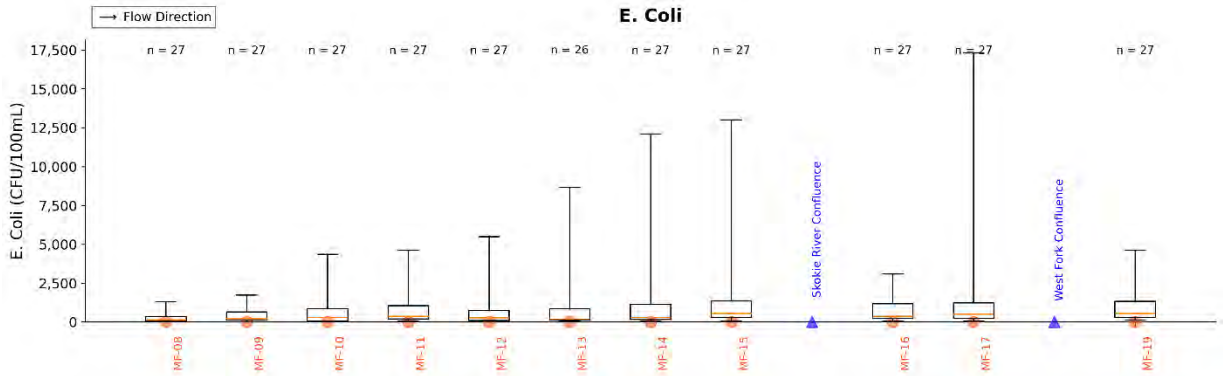


Figure B-24: Longitudinal Plots for E. Coli in Middle Fork



Skokie River

Figure B-25: Longitudinal Plot for pH in Skokie River

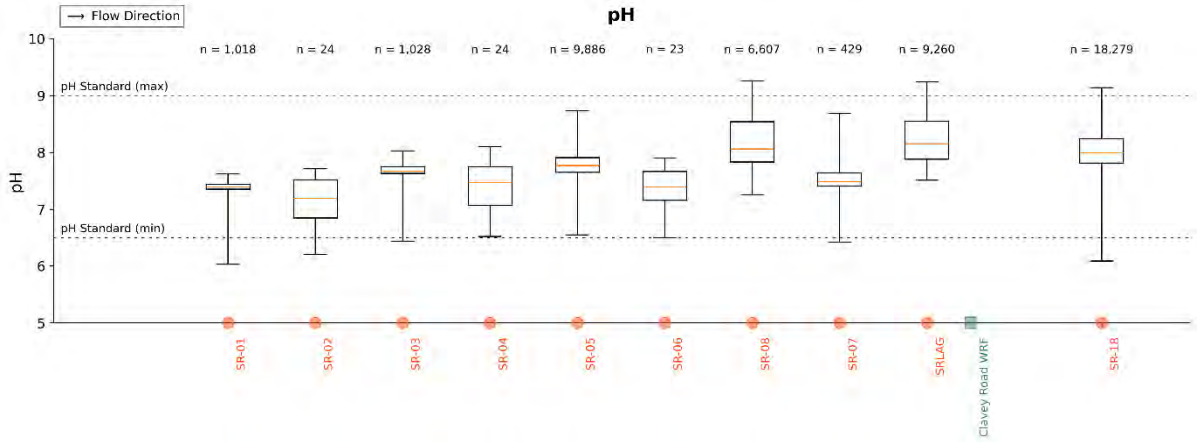


Figure B-26: Longitudinal Plot for Specific Conductivity in Skokie River

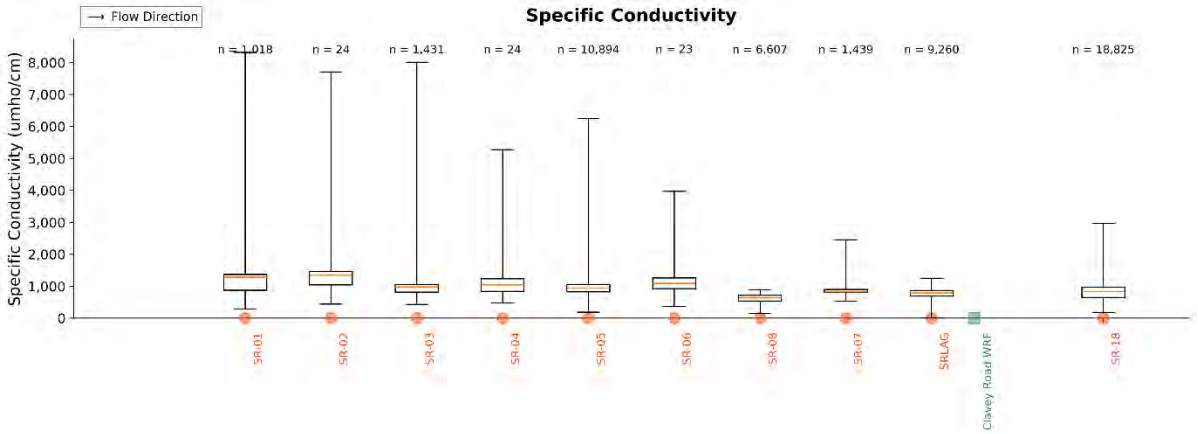


Figure B-27: Longitudinal Plot for Chloride in Skokie River

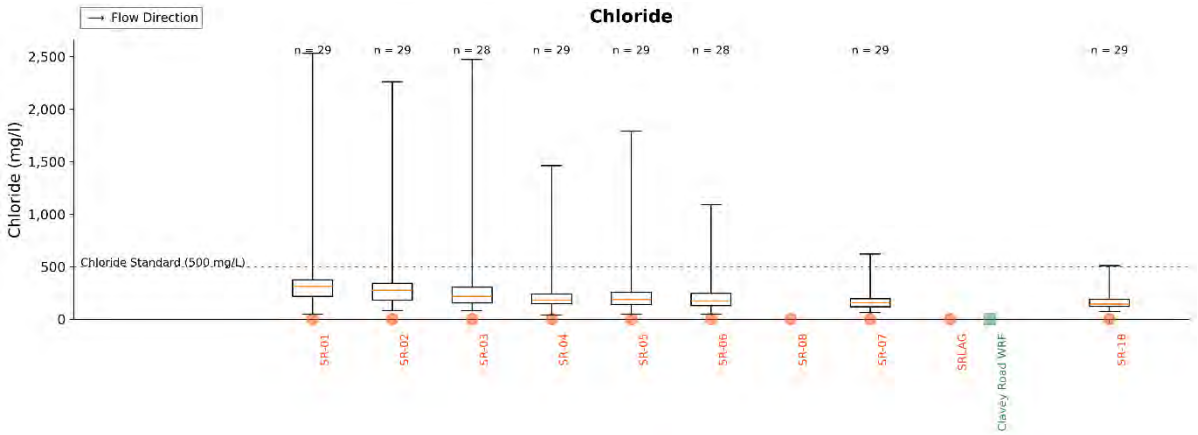


Figure B-28: Longitudinal Plots for Total Suspended Solids in Skokie River

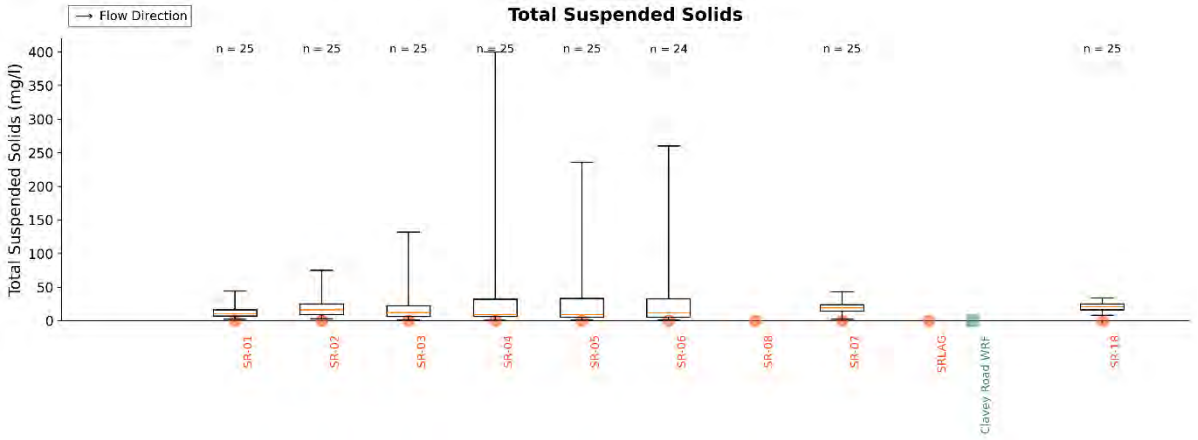
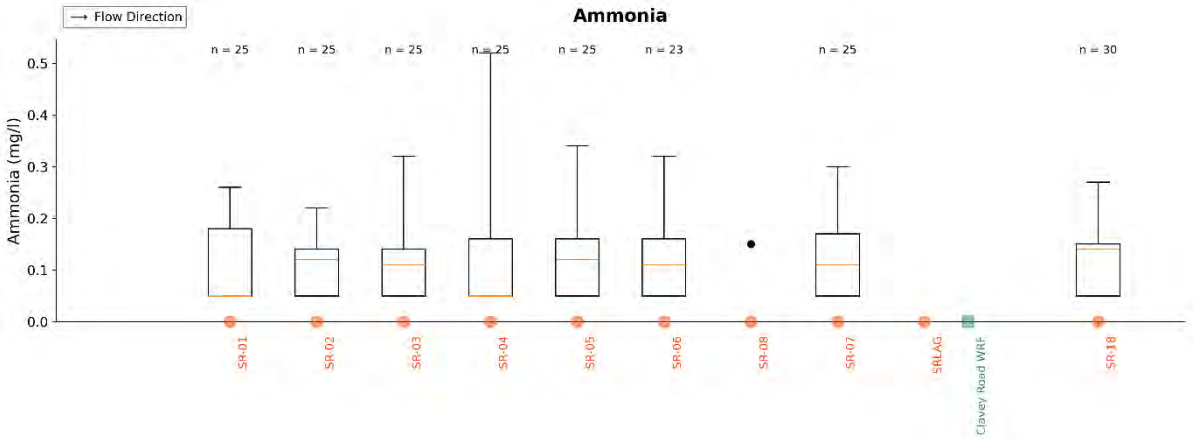


Figure B-29: Longitudinal Plot for Ammonia in Skokie River



FigureB-30: Longitudinal Plots for Total Nitrates in Skokie River

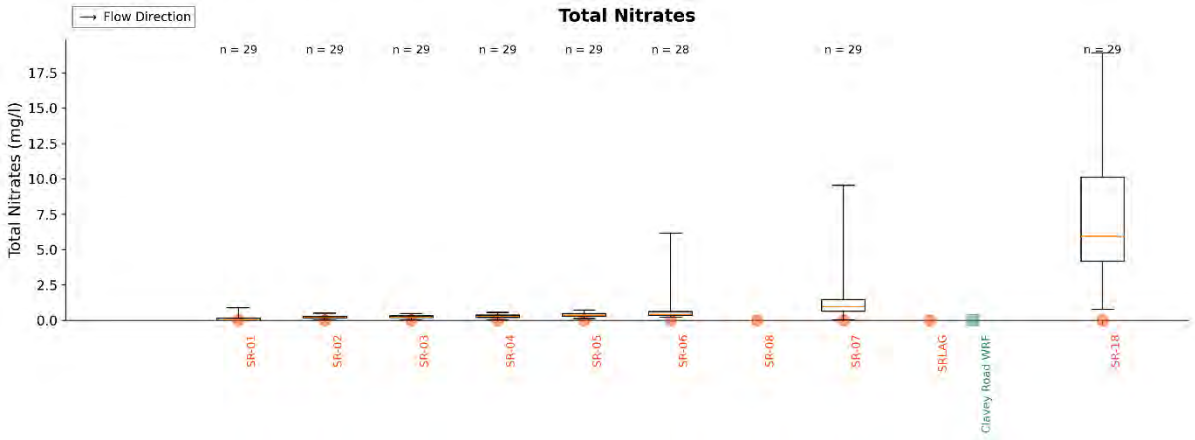


Figure B-31: Longitudinal Plots for Total Kjeldahl Nitrogen in Skokie River

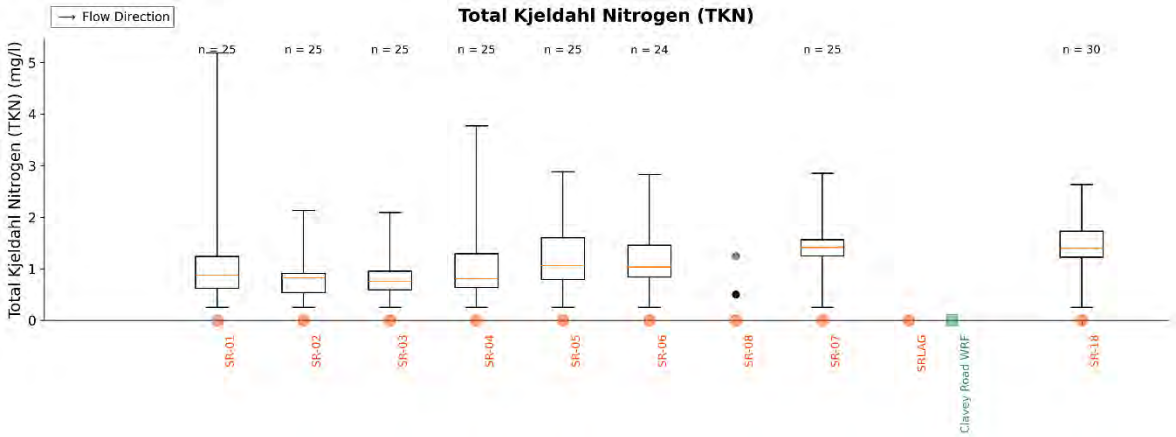


Figure B-32: Longitudinal Plots for Total Phosphorus in Skokie River

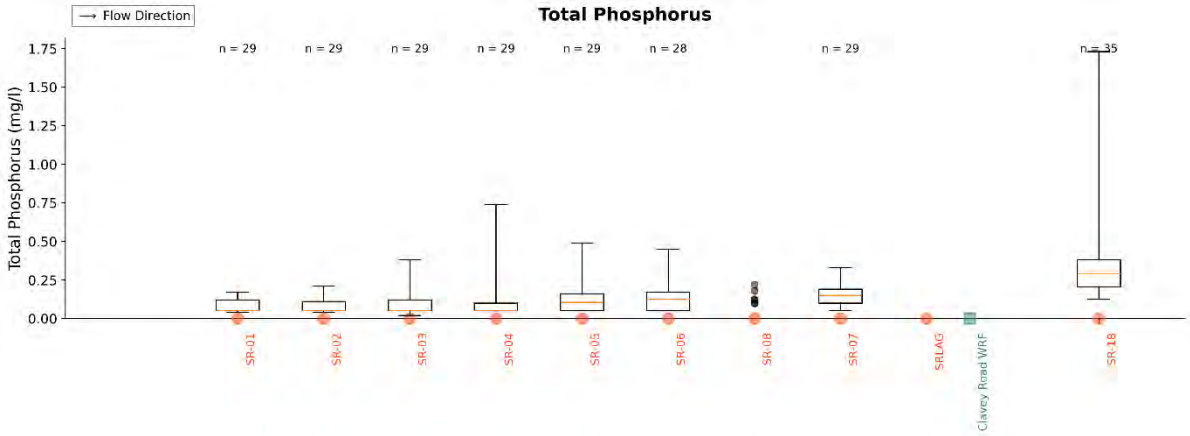


Figure B-33: Longitudinal Plots for Chlorophyll-a in Skokie River

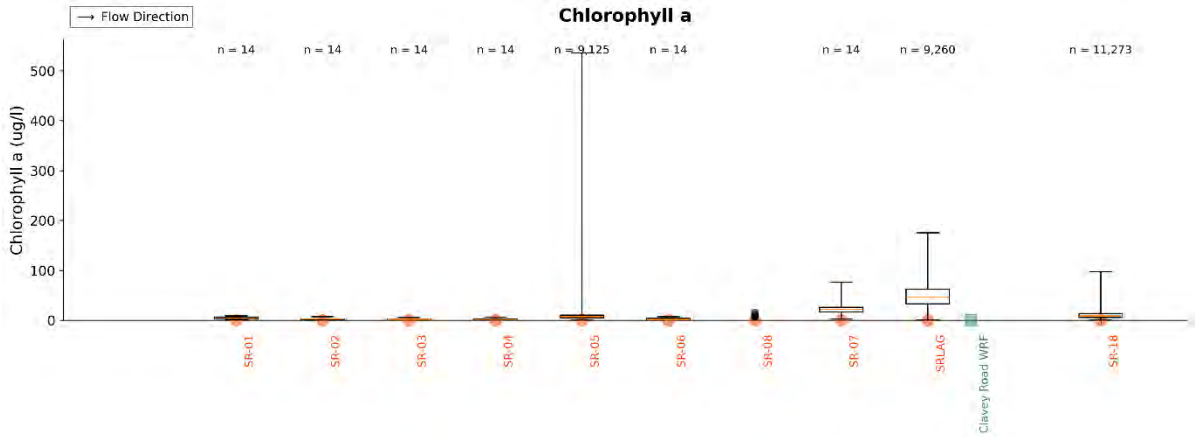


Figure B-34: Longitudinal Plots for Dissolved Oxygen in Skokie River

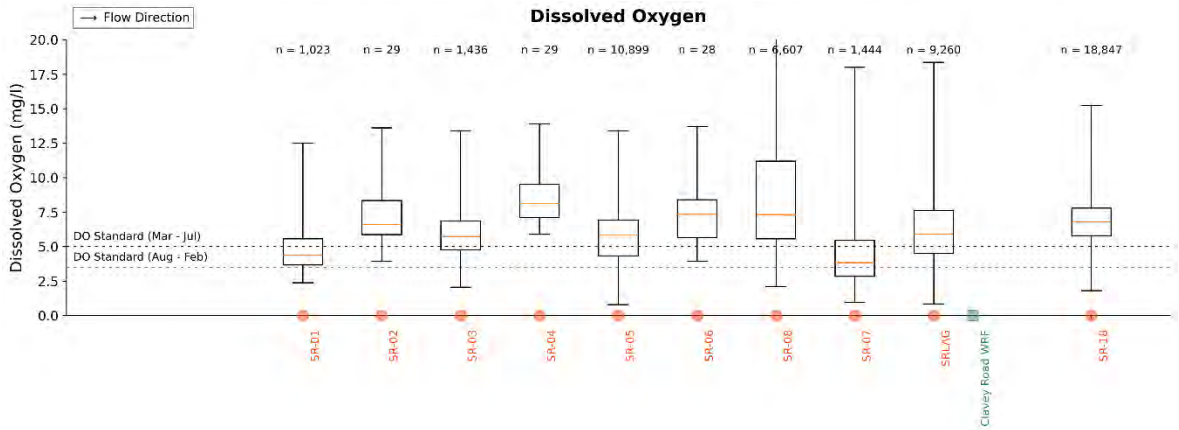


Figure B-35: Longitudinal Plots for Dissolved Oxygen Saturation in Skokie River

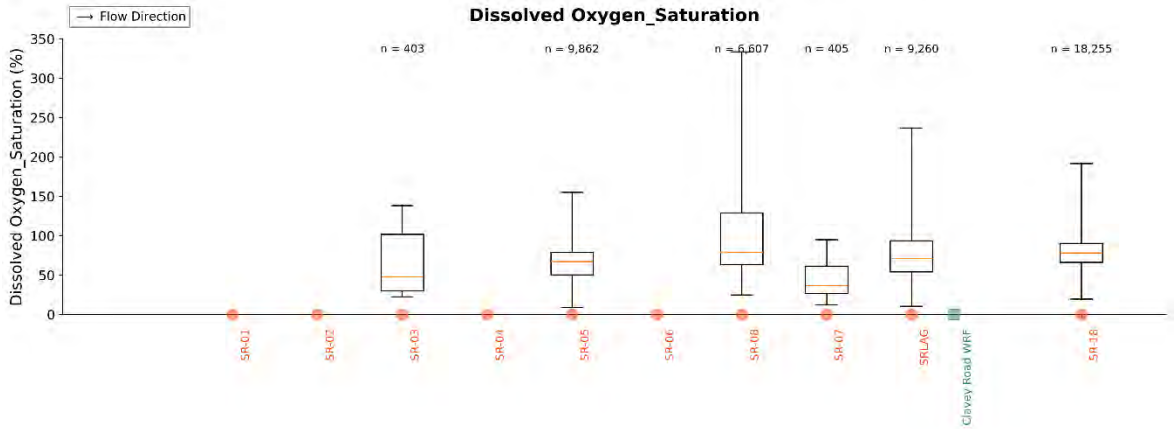
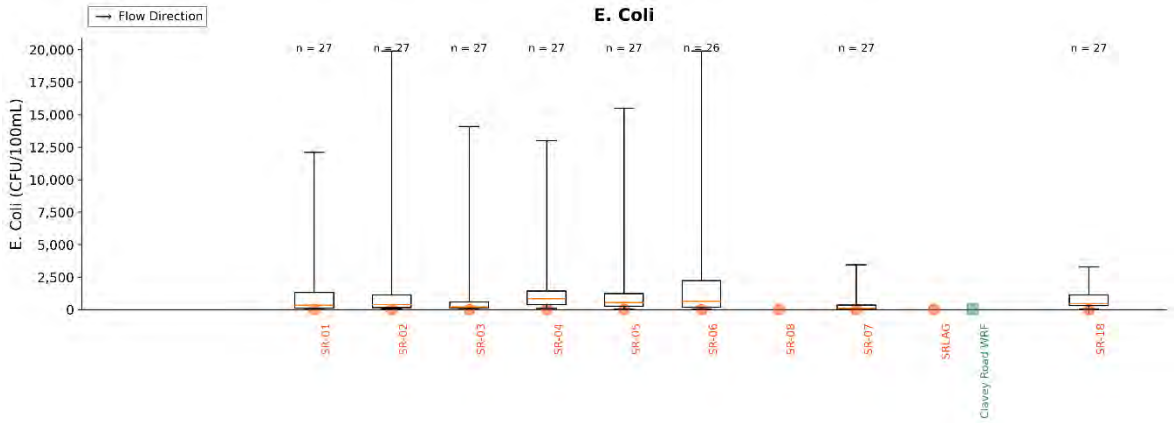


Figure B-36: Longitudinal Plots for E. Coli in Skokie River



Appendix C
MONTHLY BOX PLOTS

West Fork

pH

Figure C-1: Monthly Box Plot for pH at Station WF-20 in West Fork

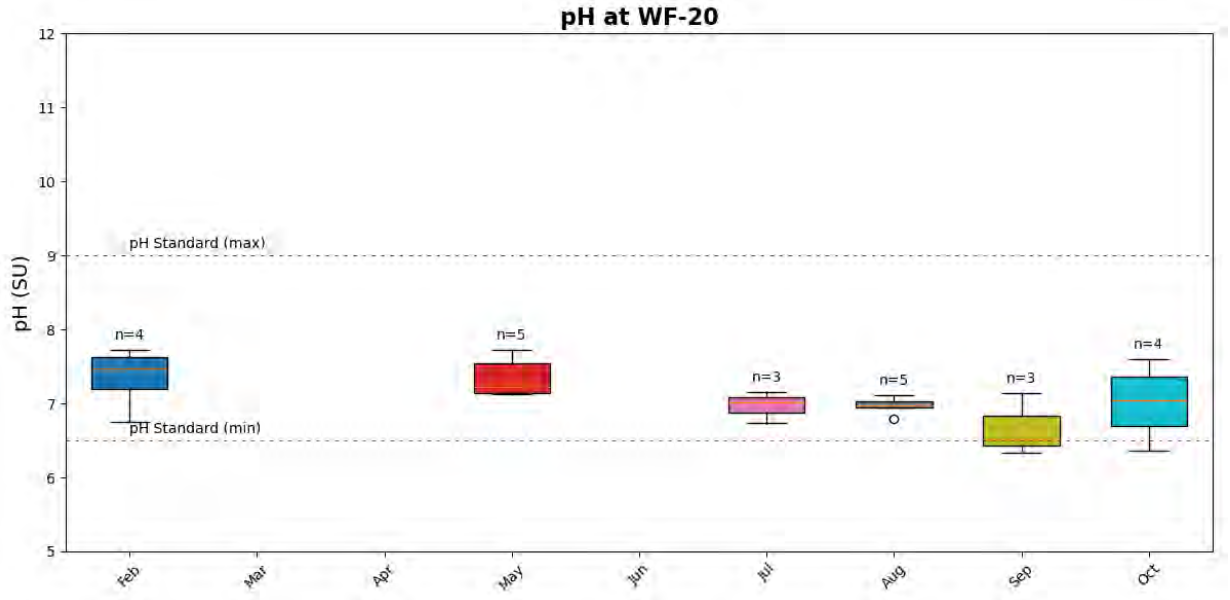


Figure C-2: Monthly Box Plot for pH at Station WF-21 in West Fork

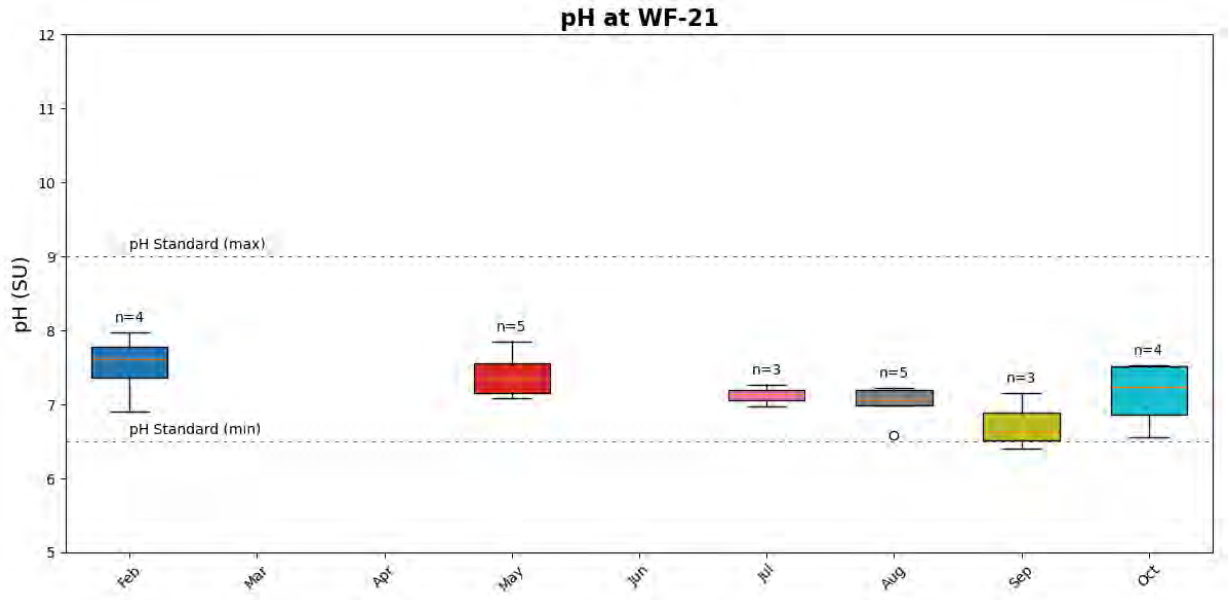


Figure C-3: Monthly Box Plot for pH at Station WF-22 in West Fork

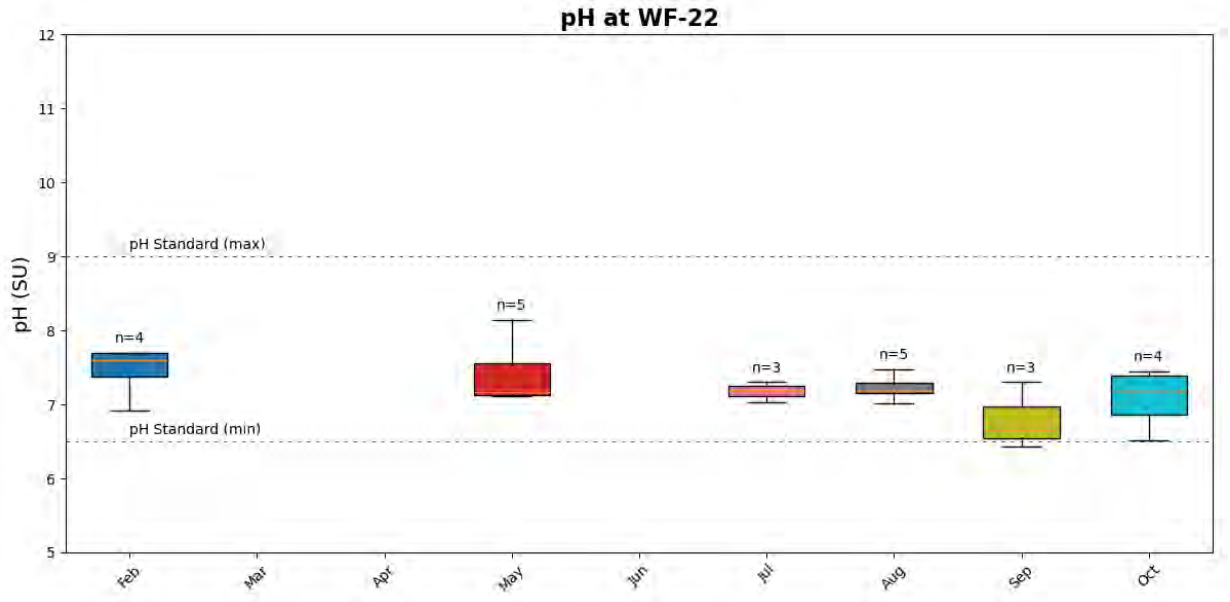


Figure C-4: Monthly Box Plot for pH at Station WF-23 in West Fork

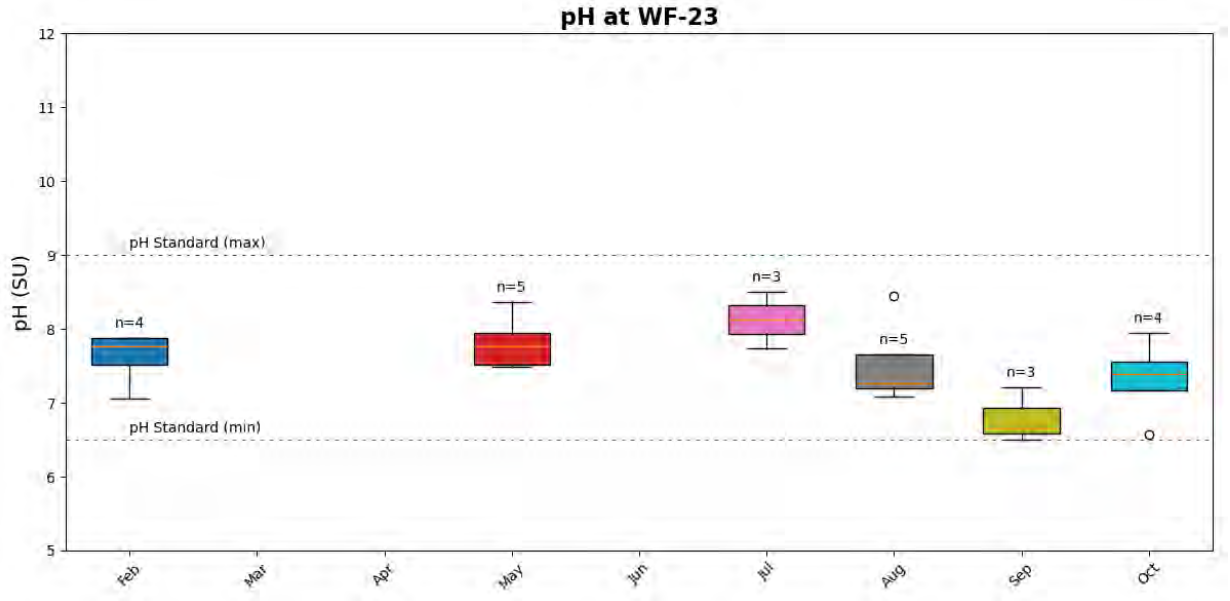


Figure C-5: Monthly Box Plot for pH at Station WF-24 in West Fork

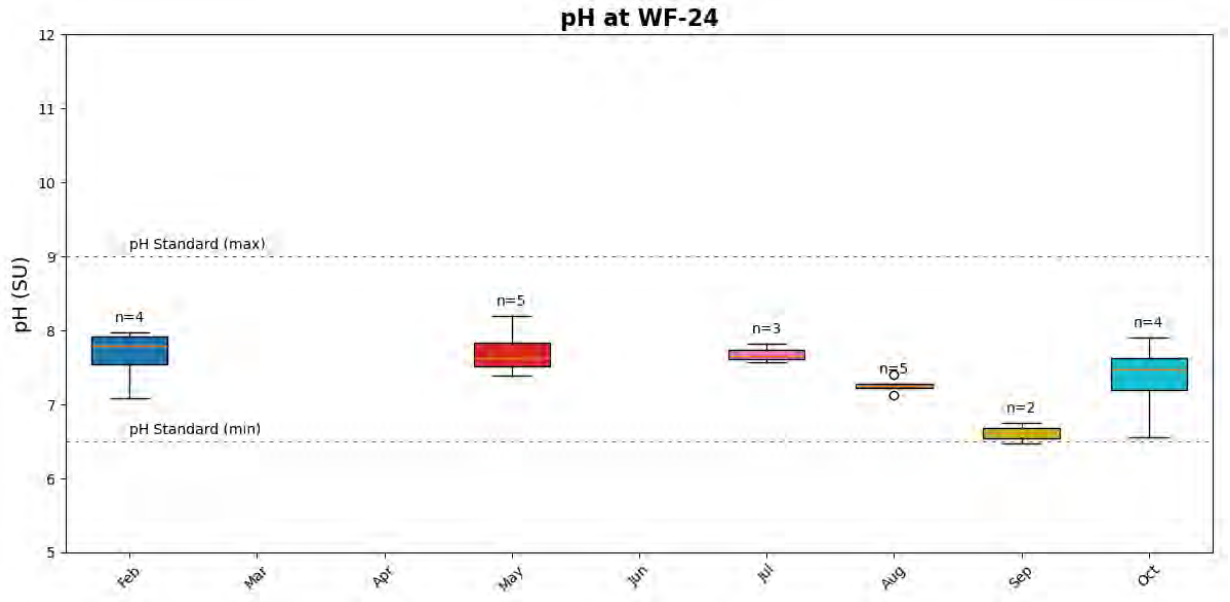
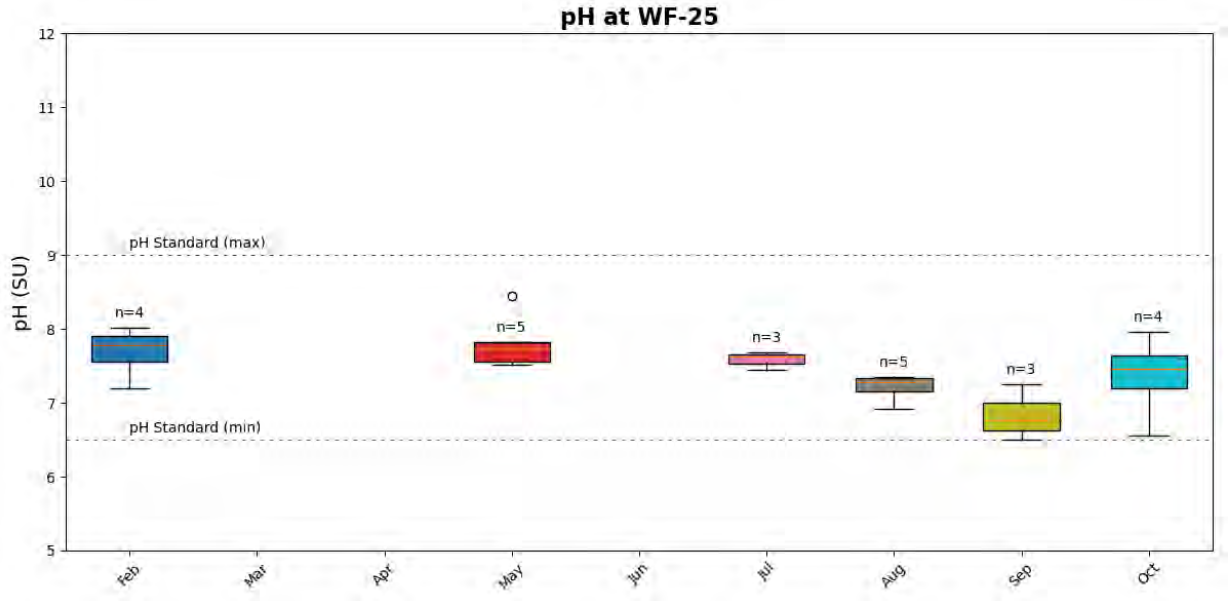


Figure C-6: Monthly Box Plot for pH at Station WF-25 in West Fork



Specific Conductivity

Figure C-7: Monthly Box Plot for Specific Conductivity at Station WF-20 in West Fork

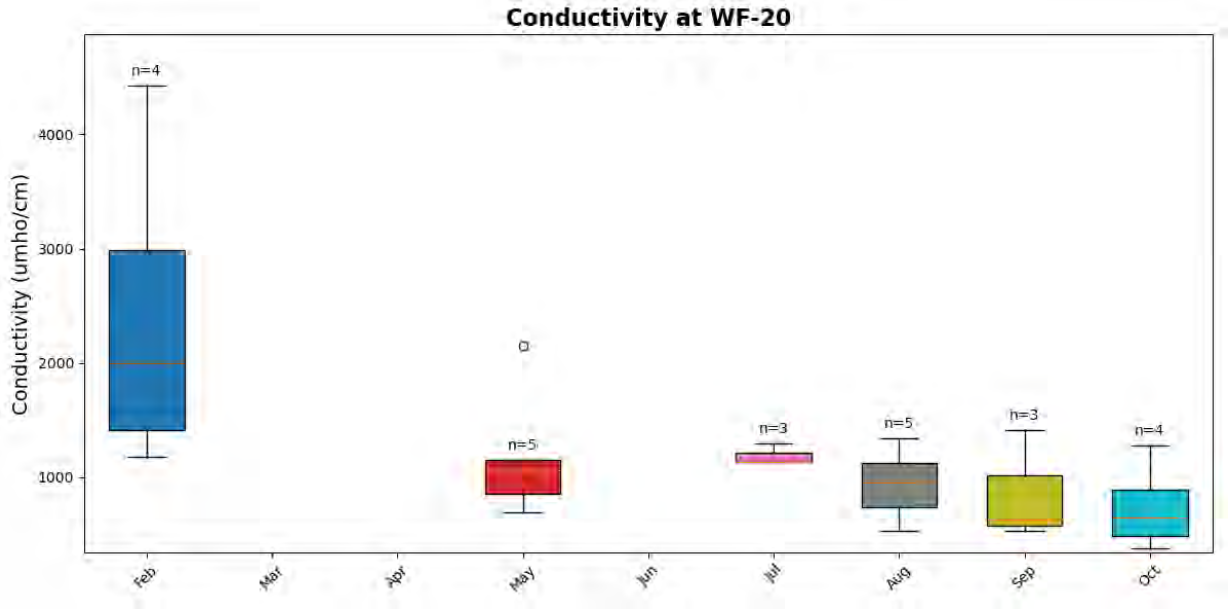


Figure C-8: Monthly Box Plot for Specific Conductivity at Station WF-21 in West Fork

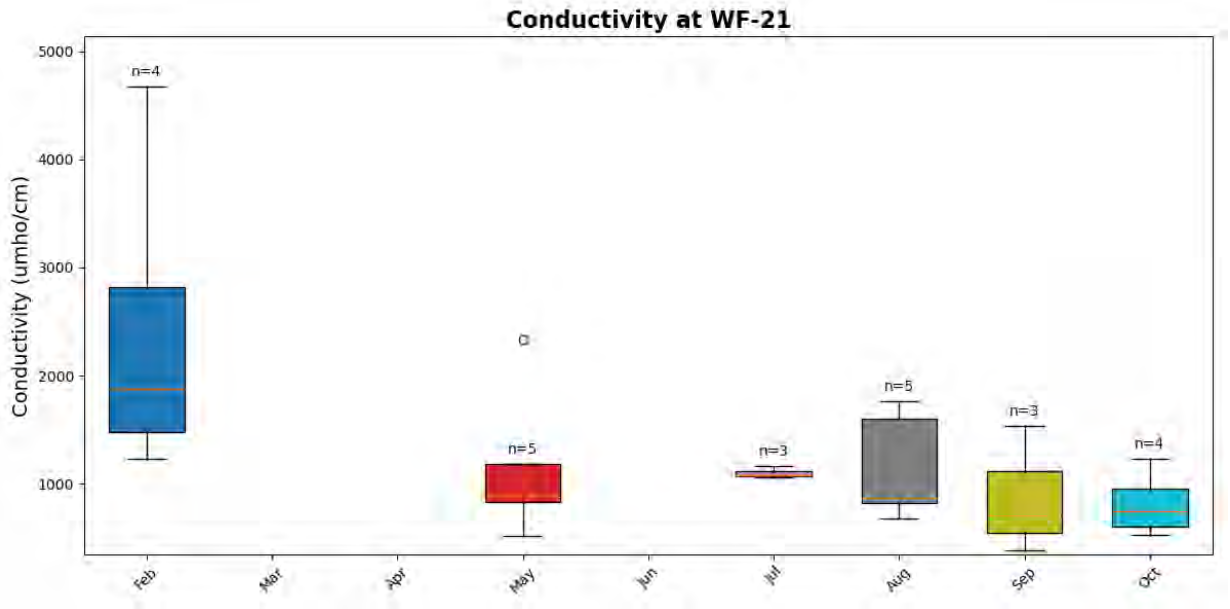


Figure C-9: Monthly Box Plot for Specific Conductivity at Station WF-22 in West Fork

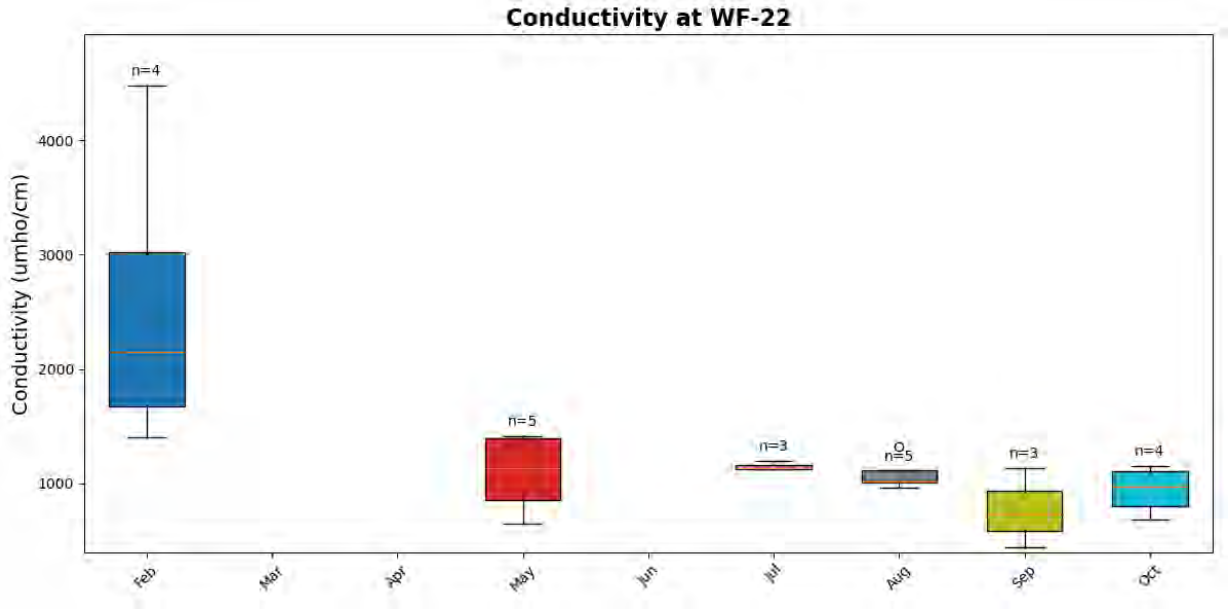


Figure C-10: Monthly Box Plot for Specific Conductivity at Station WF-23 in West Fork

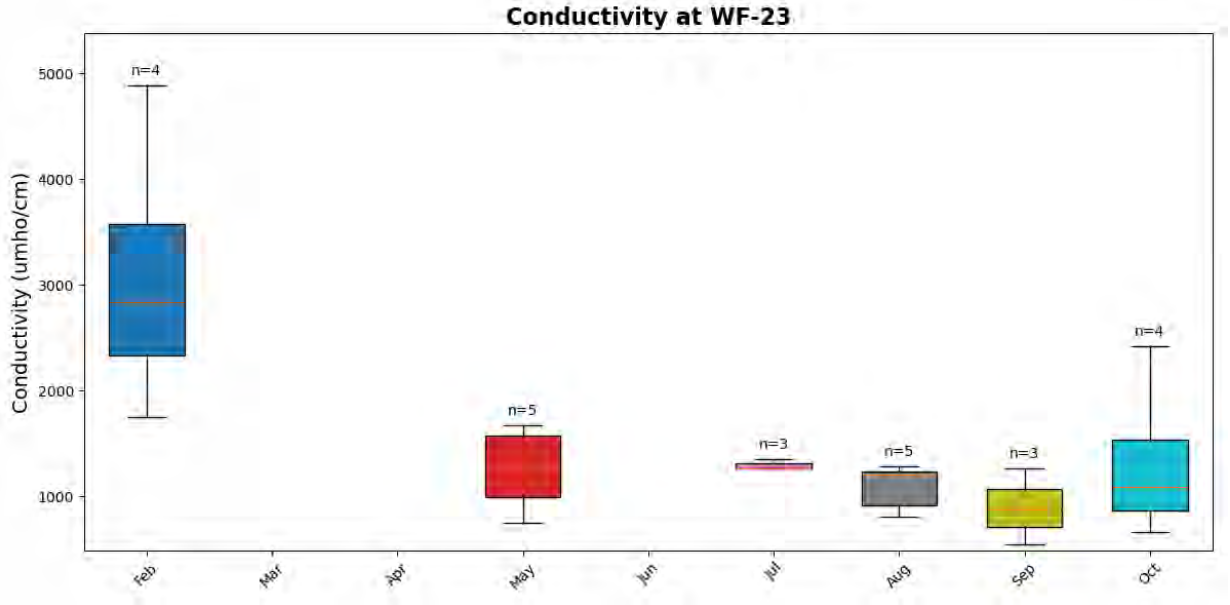


Figure C-11: Monthly Box Plot for Specific Conductivity at Station WF-24 in West Fork

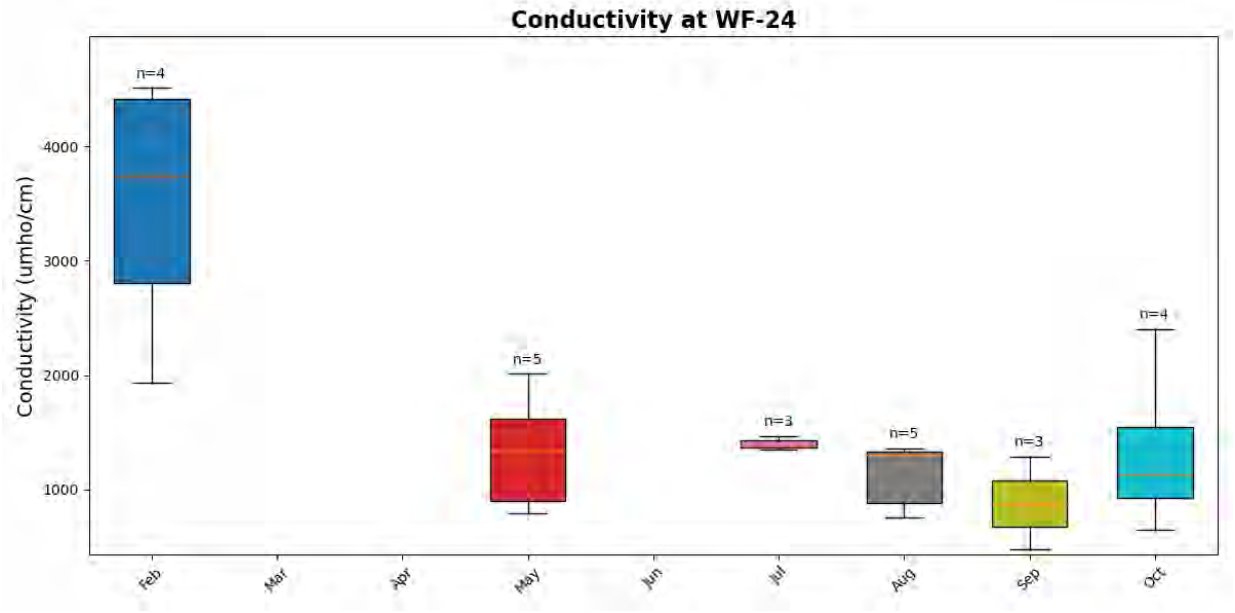
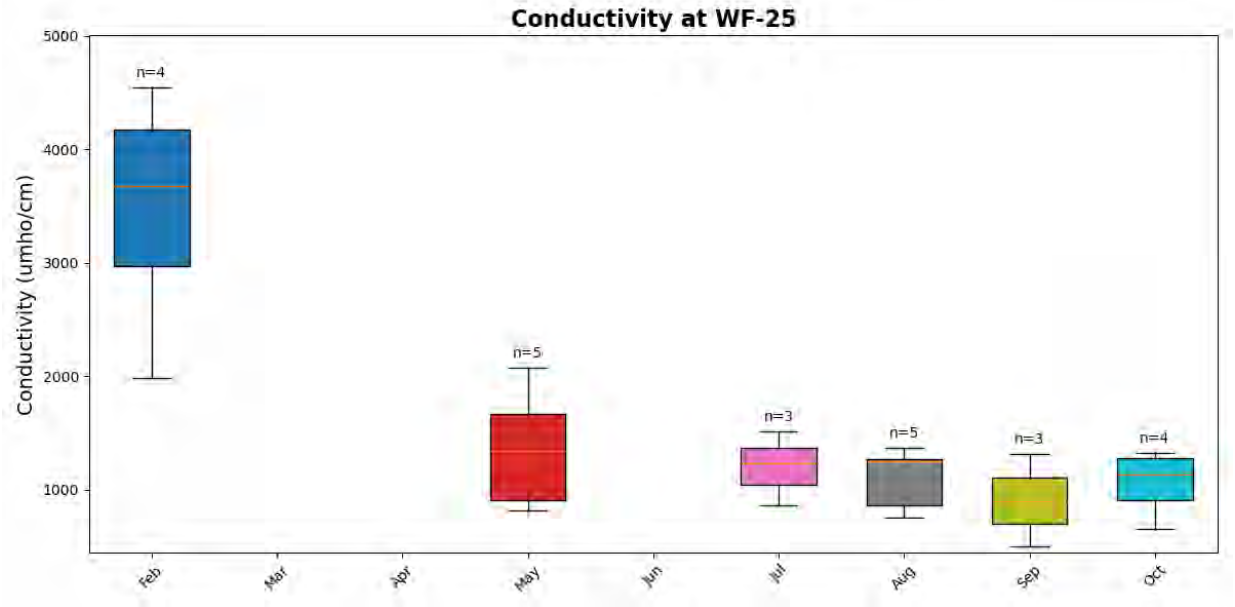


Figure C-12: Monthly Box Plot for Specific Conductivity at Station WF-25 in West Fork



Chloride

Figure C-13: Monthly Box Plot for Chloride at Station WF-20 in West Fork

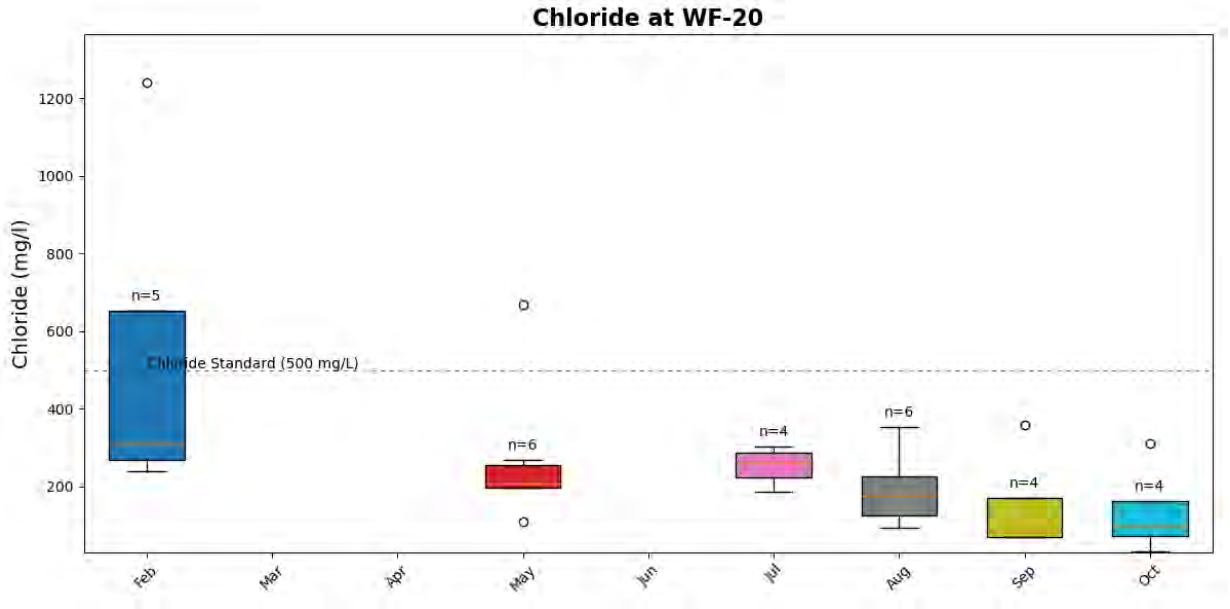


Figure C-14: Monthly Box Plot for Chloride at Station WF-21 in West Fork

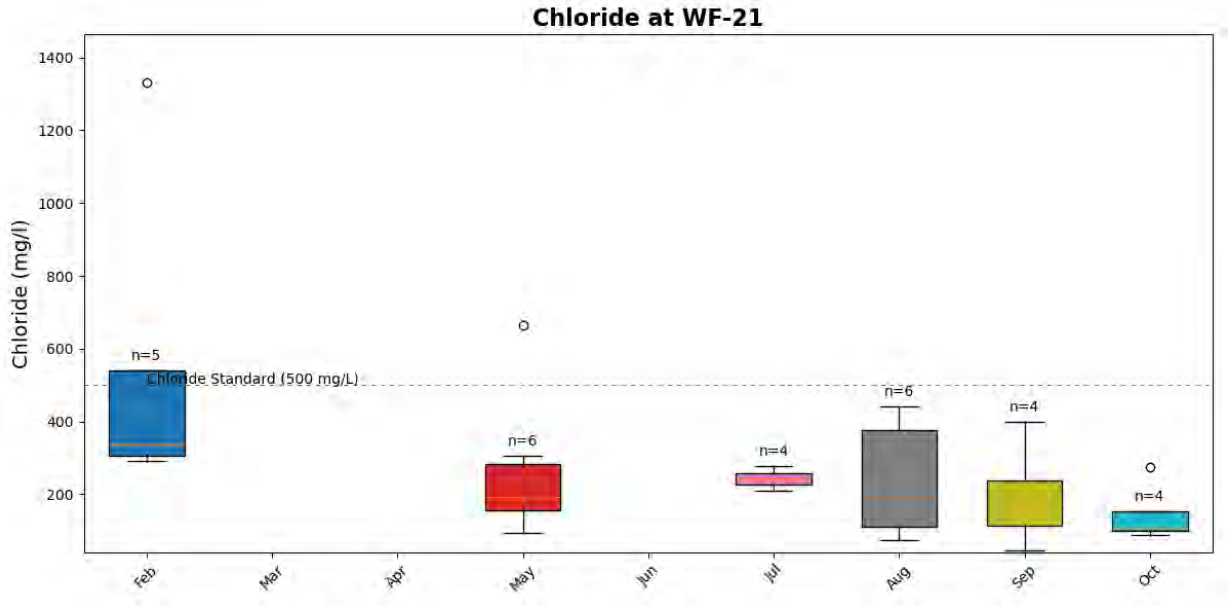


Figure C-15: Monthly Box Plot for Chloride at Station WF-22 in West Fork

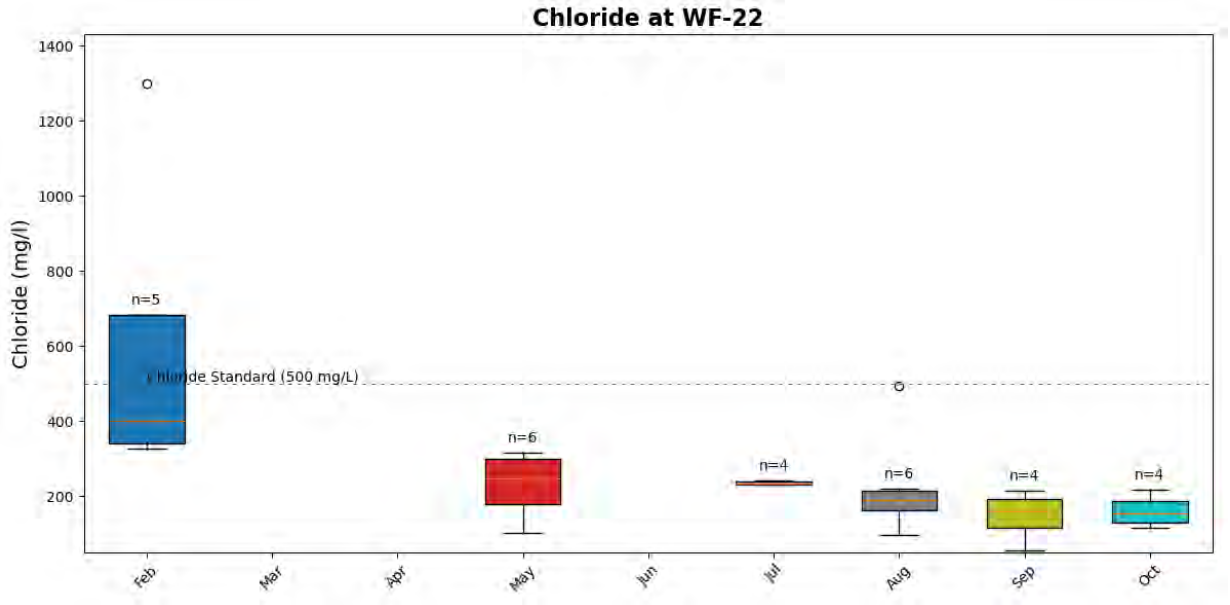


Figure C-16: Monthly Box Plot for Chloride at Station WF-23 in West Fork

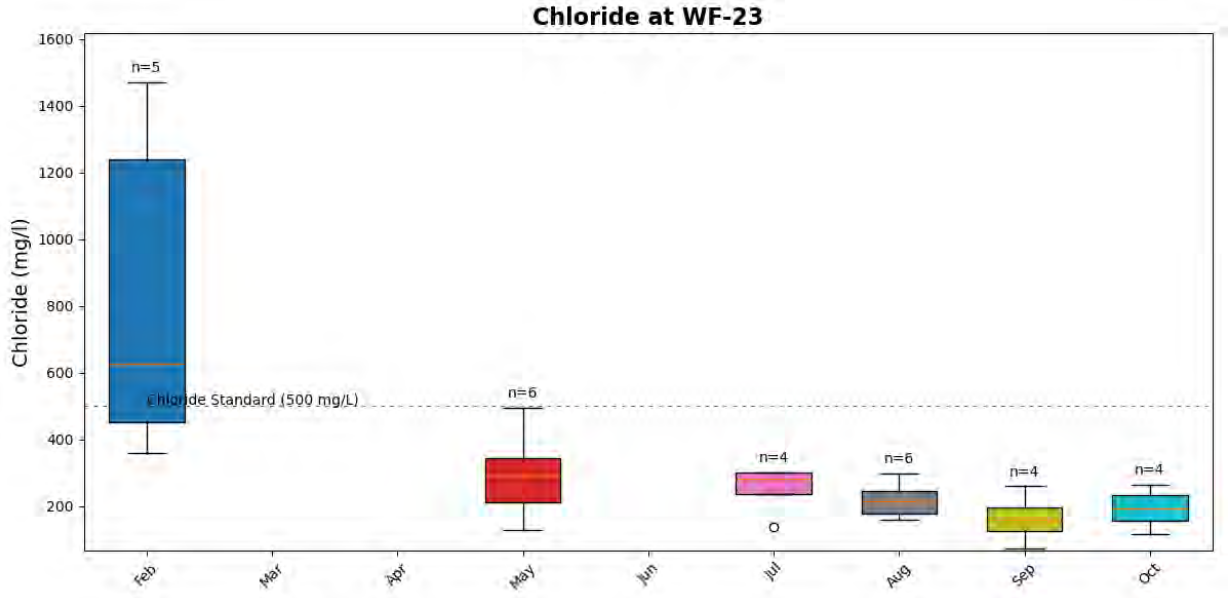


Figure C-17: Monthly Box Plot for Chloride at Station WF-24 in West Fork

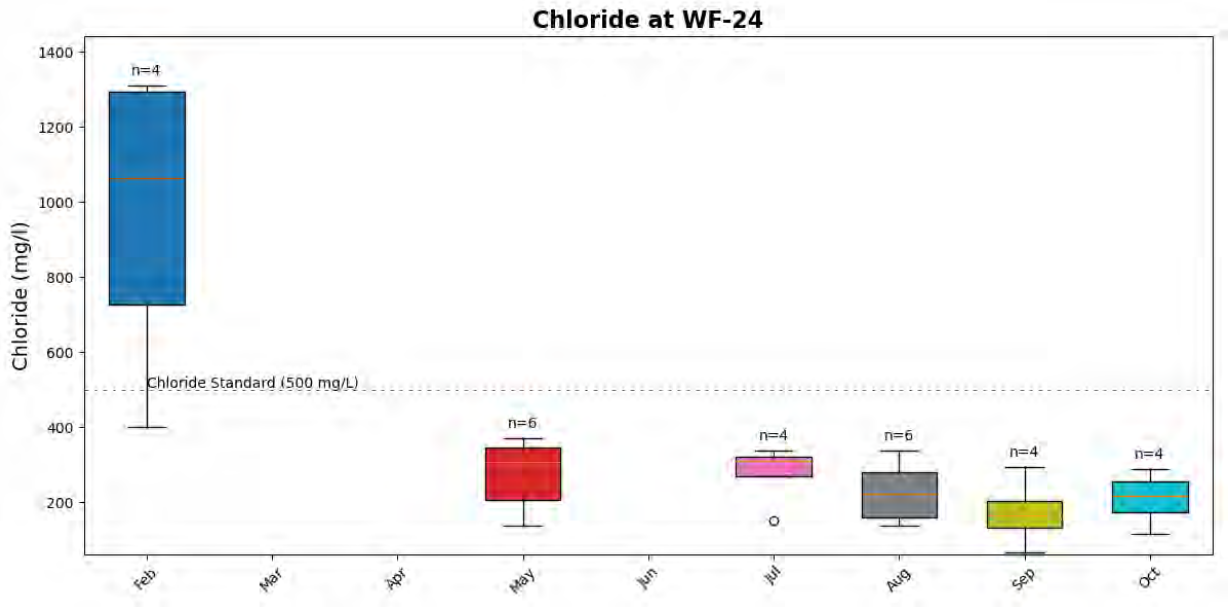
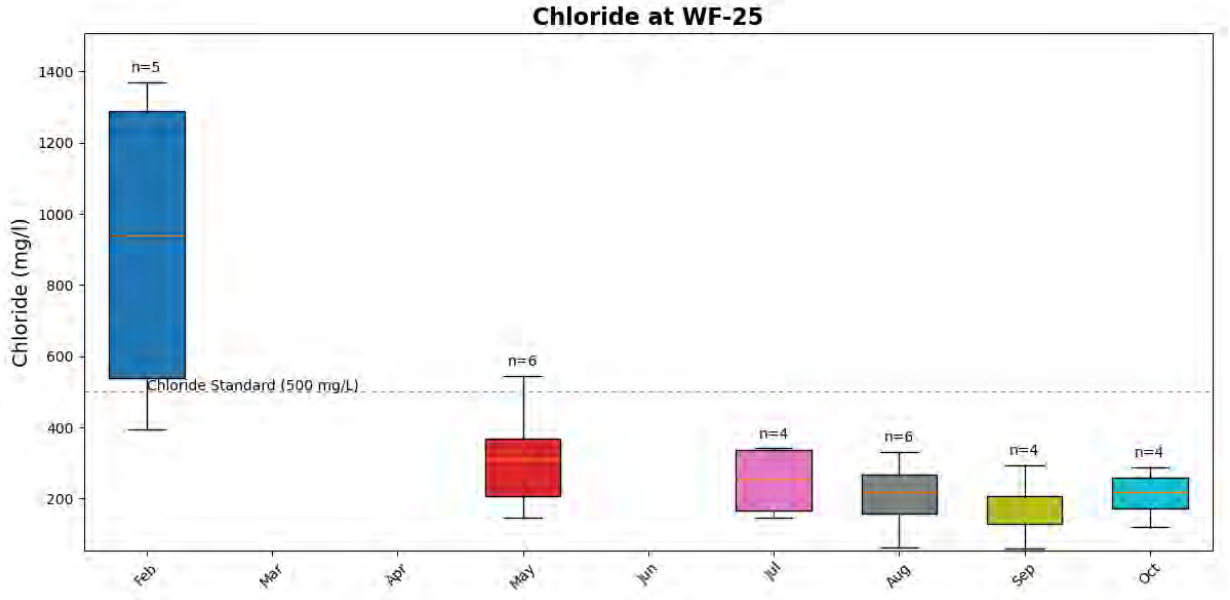


Figure C-18: Monthly Box Plot for Chloride at Station WF-25 in West Fork



Total Suspended Solids

Figure C-19: Monthly Box Plot for Total Suspended Solids at Station WF-20 in West Fork

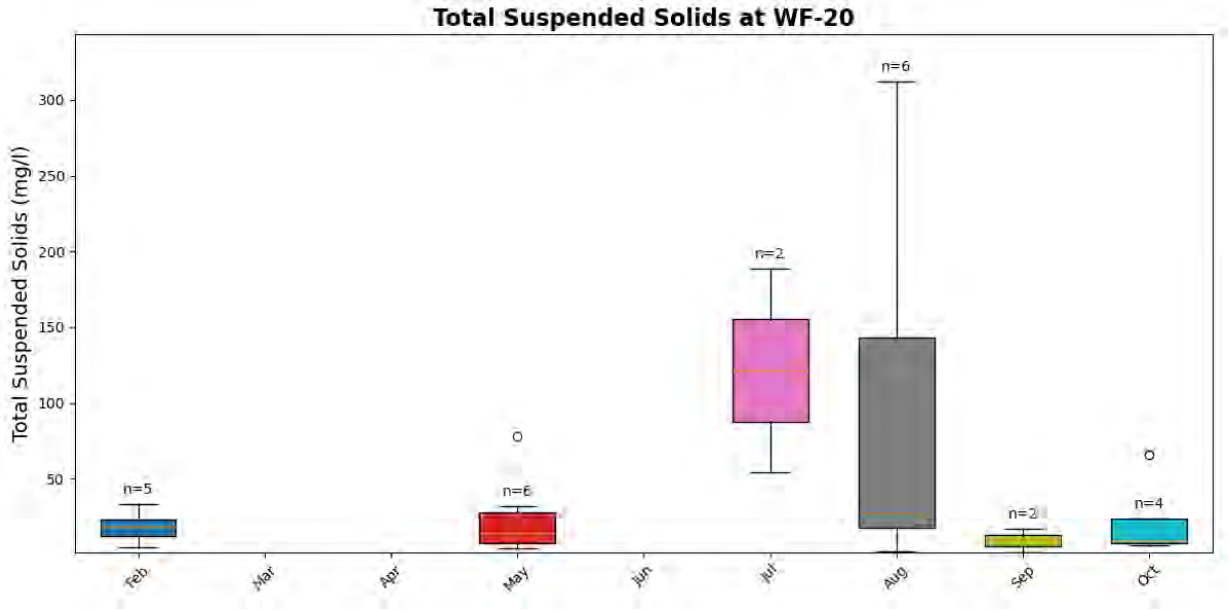


Figure C-20: Monthly Box Plot for Total Suspended Solids at Station WF-21 in West Fork

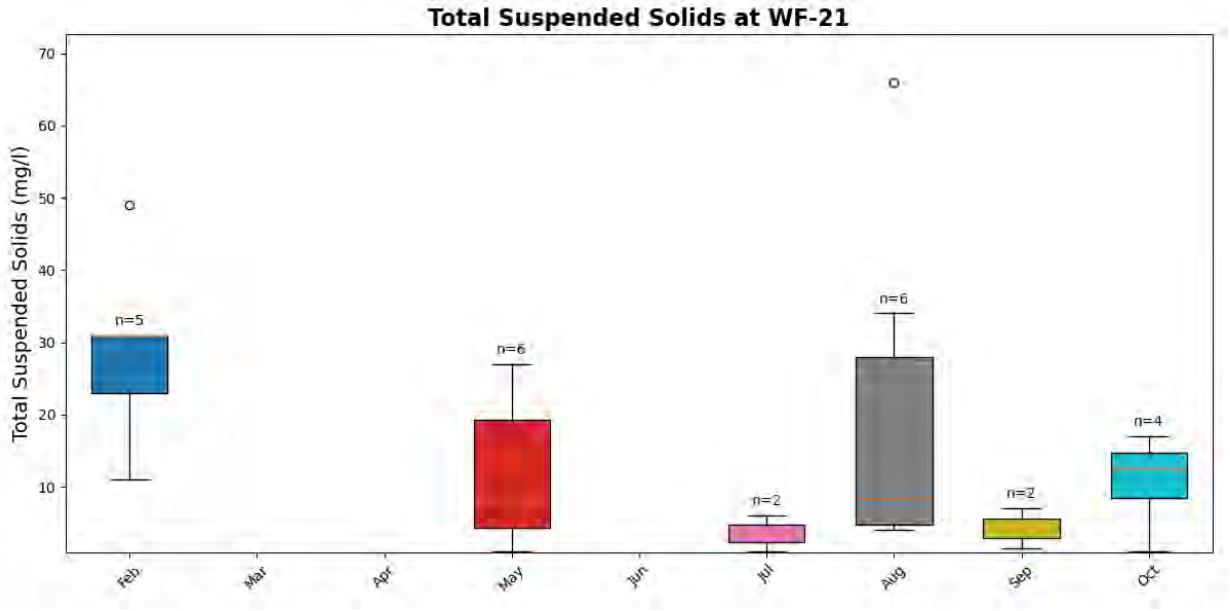


Figure C-21: Monthly Box Plot for Total Suspended Solids at Station WF-22 in West Fork

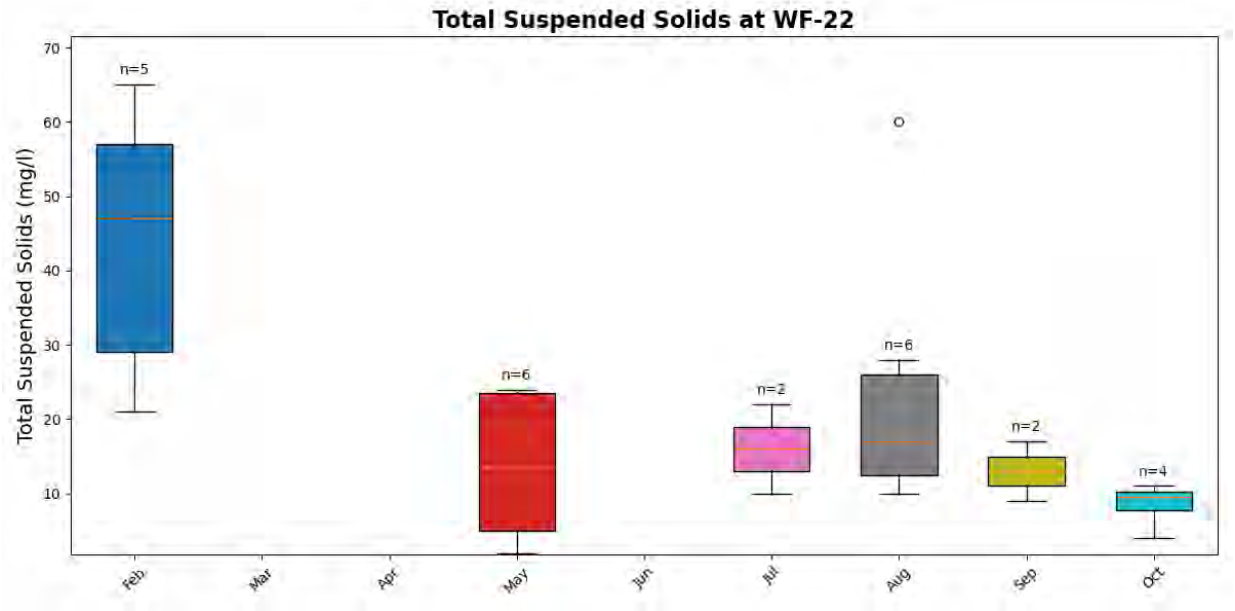


Figure C-22: Monthly Box Plot for Total Suspended Solids at Station WF-23 in West Fork

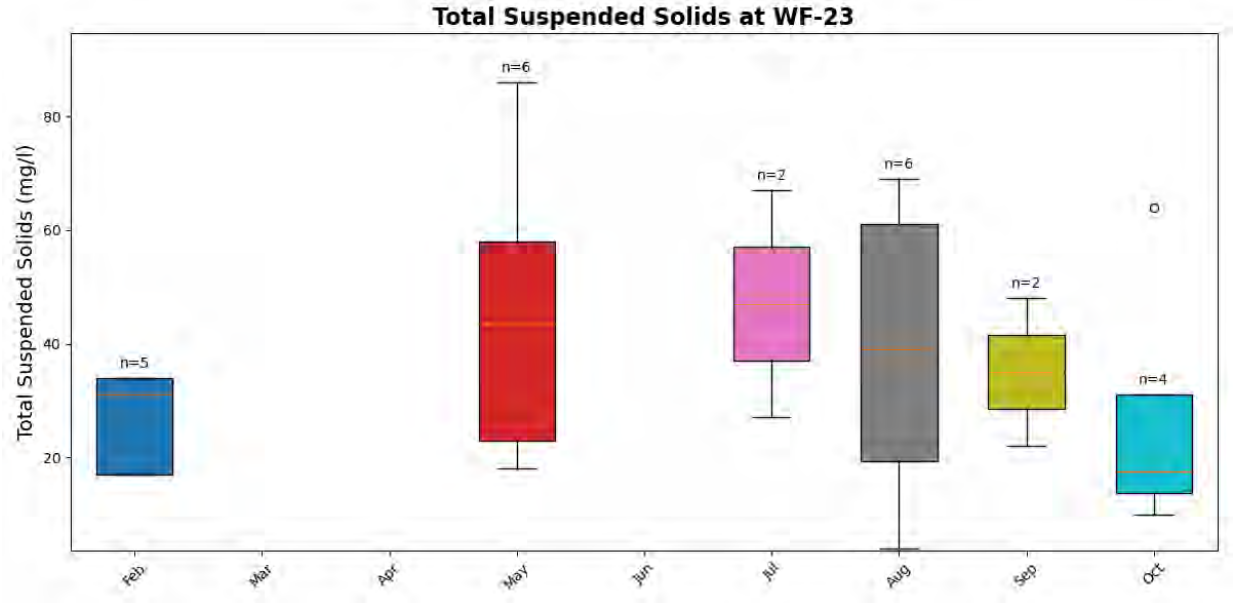


Figure C-23: Monthly Box Plot for Total Suspended Solids at Station WF-24 in West Fork

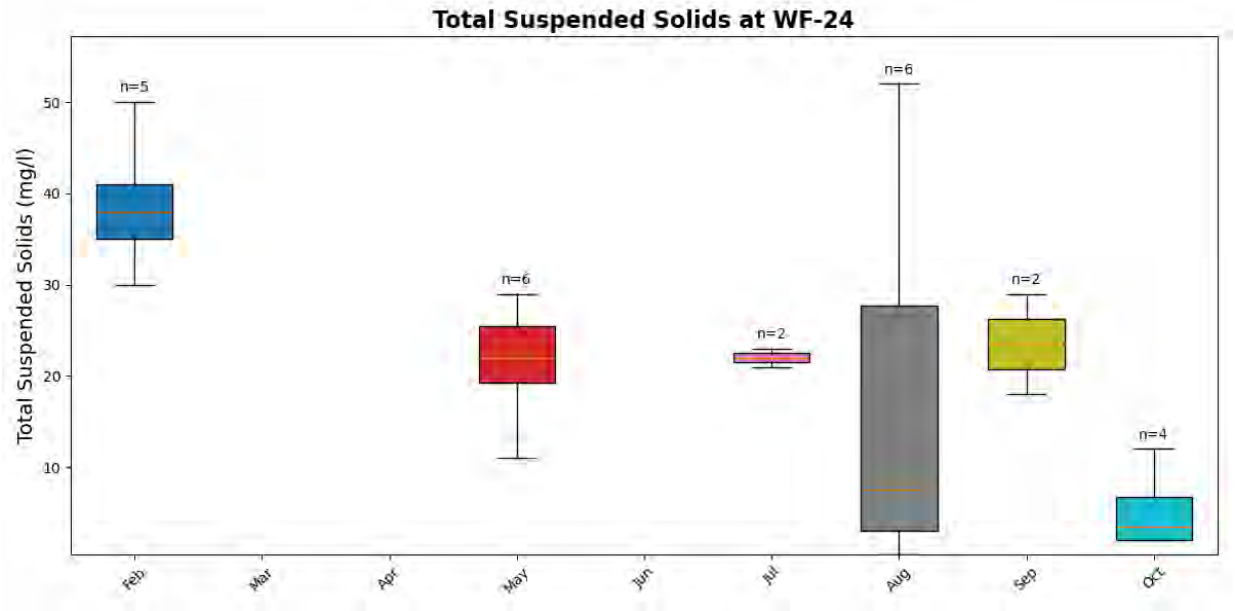
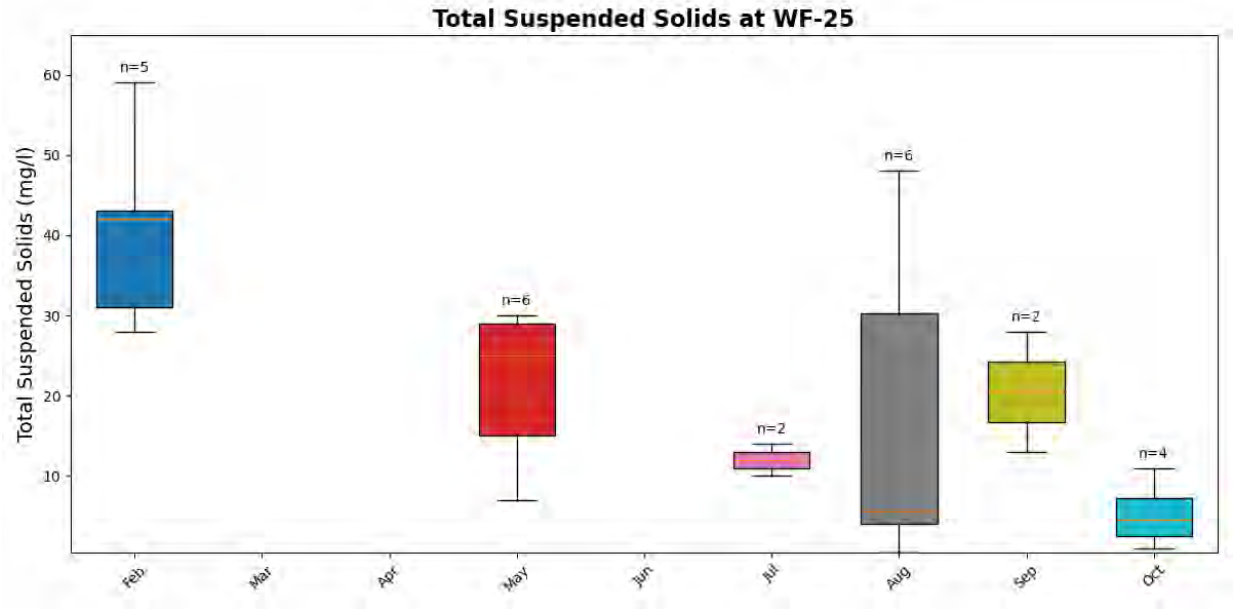


Figure C-24: Monthly Box Plot for Total Suspended Solids at Station WF-25 in West Fork



Ammonia

Figure C-25: Monthly Box Plot for Ammonia at Station WF-20 in West Fork

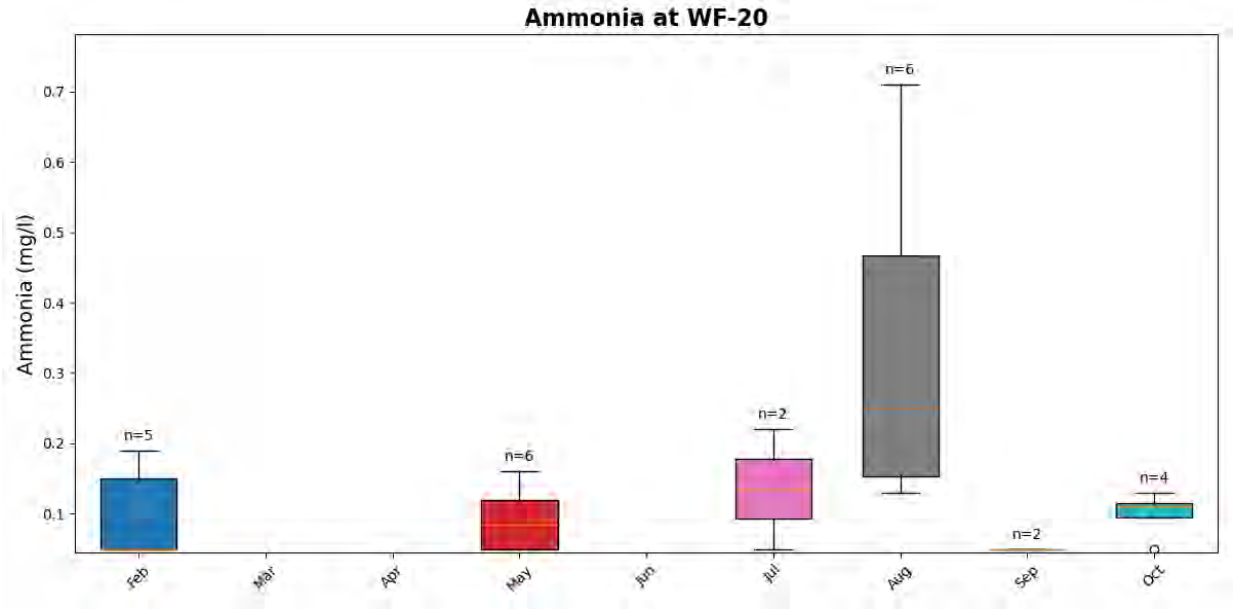


Figure C-26: Monthly Box Plot for Ammonia at Station WF-21 in West Fork

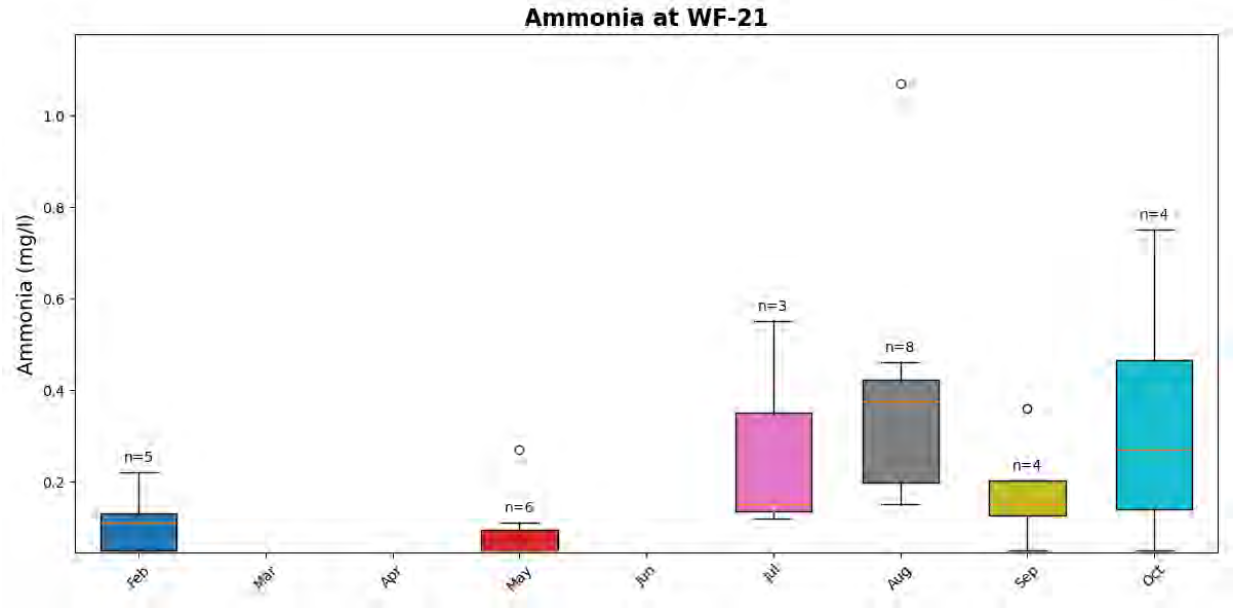


Figure C-27: Monthly Box Plot for Ammonia at Station WF-22 in West Fork

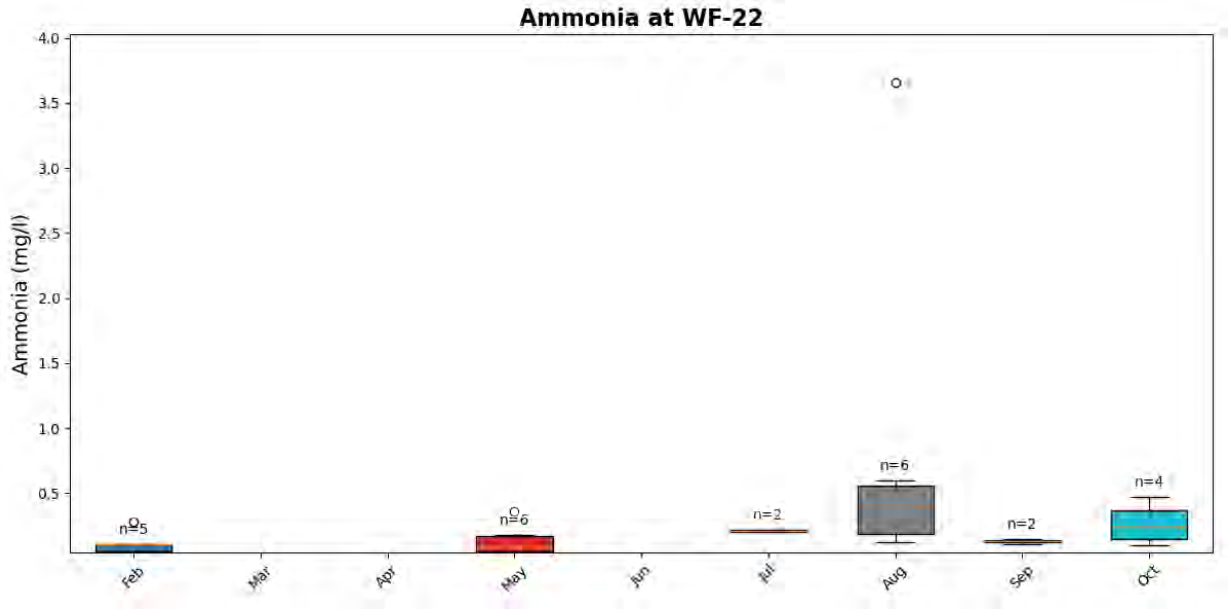


Figure C-28: Monthly Box Plot for Ammonia at Station WF-23 in West Fork

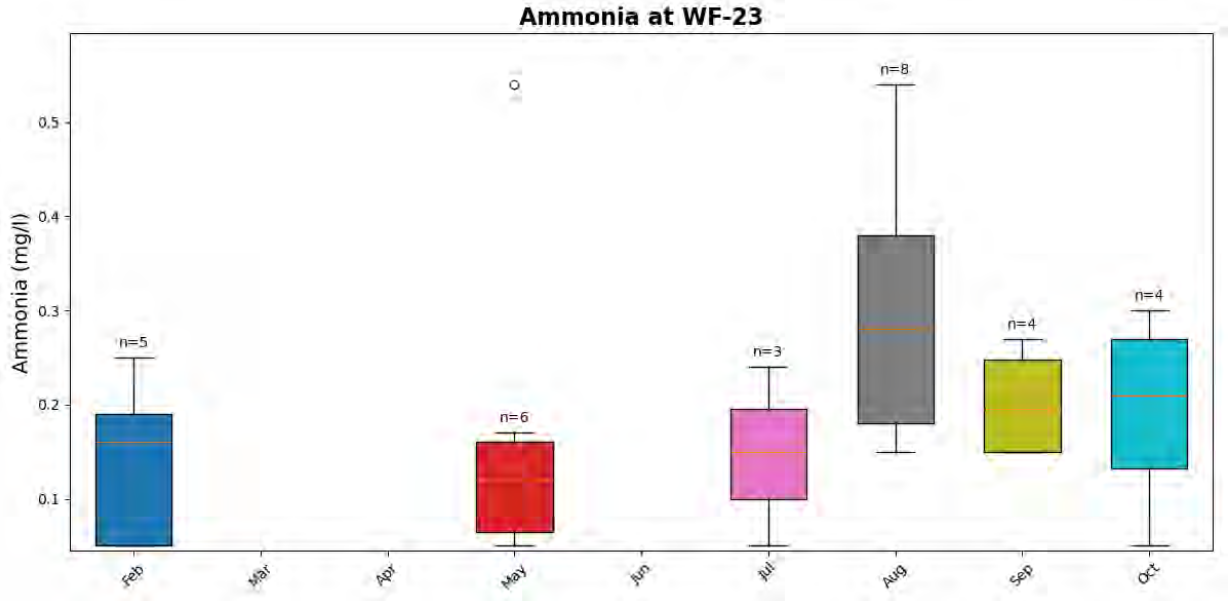


Figure C-29: Monthly Box Plot for Ammonia at Station WF-24 in West Fork

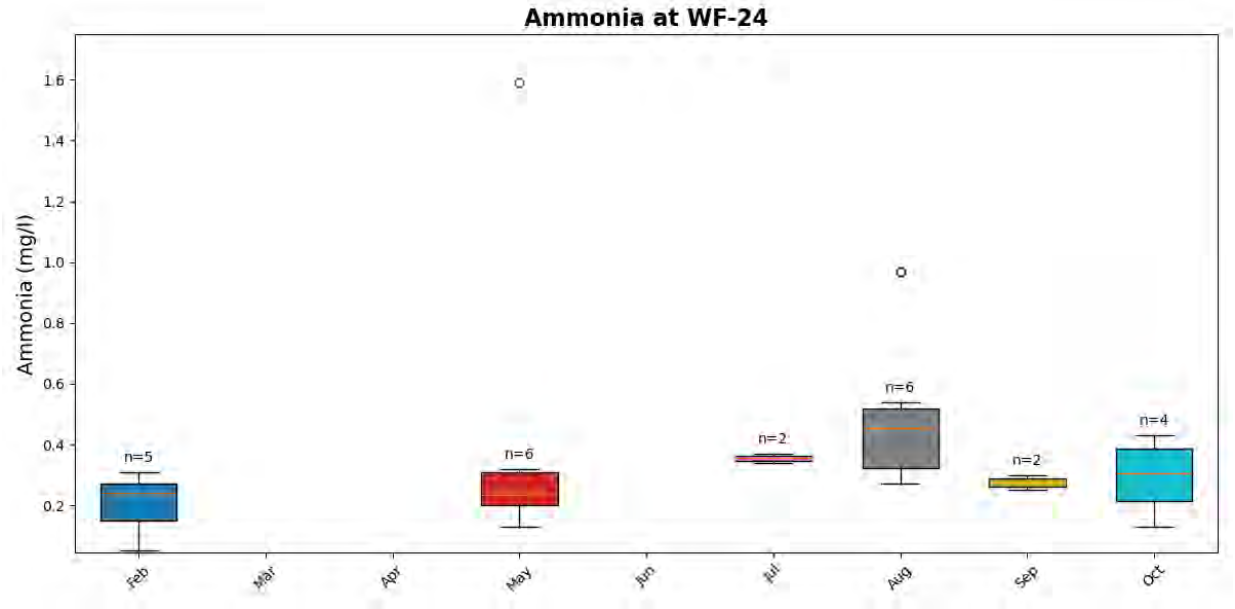
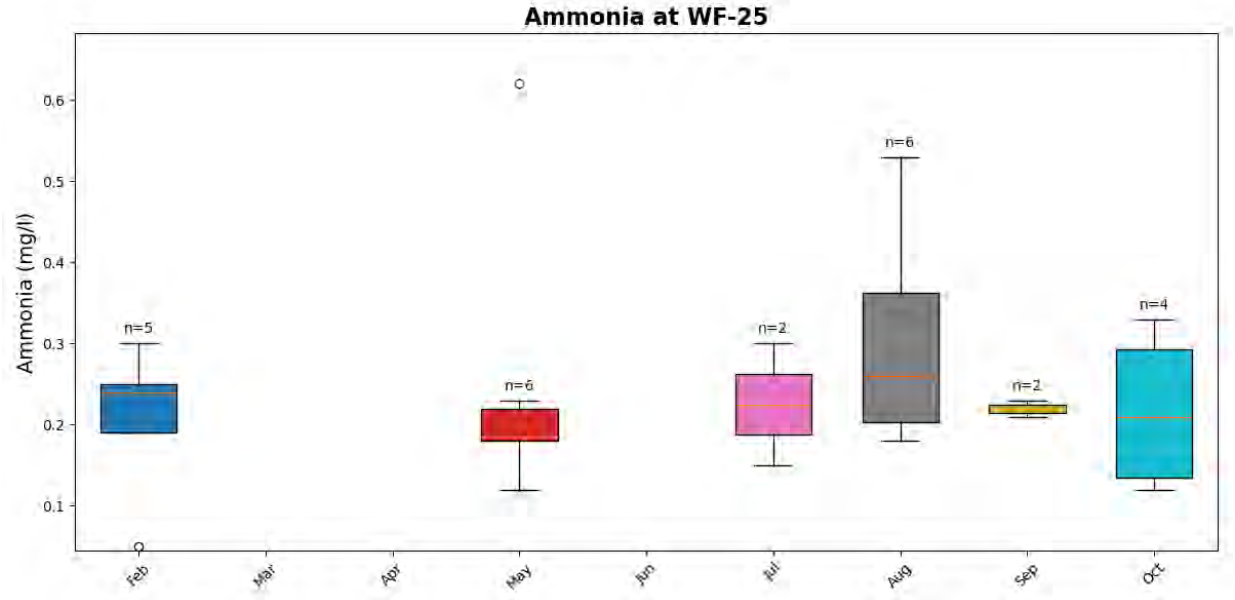


Figure C-30: Monthly Box Plot for Ammonia at Station WF-25 in West Fork



Total Nitrates

Figure C-31: Monthly Box Plot for Total Nitrates at Station WF-20 in West Fork

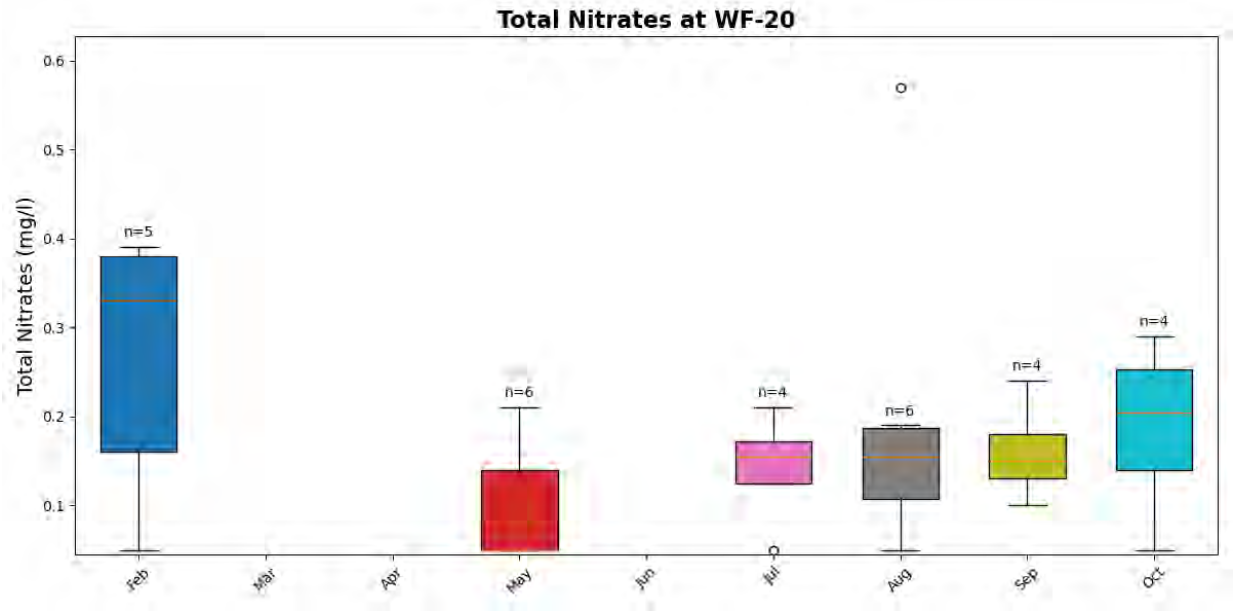


Figure C-32: Monthly Box Plot for Total Nitrates at Station WF-21 in West Fork

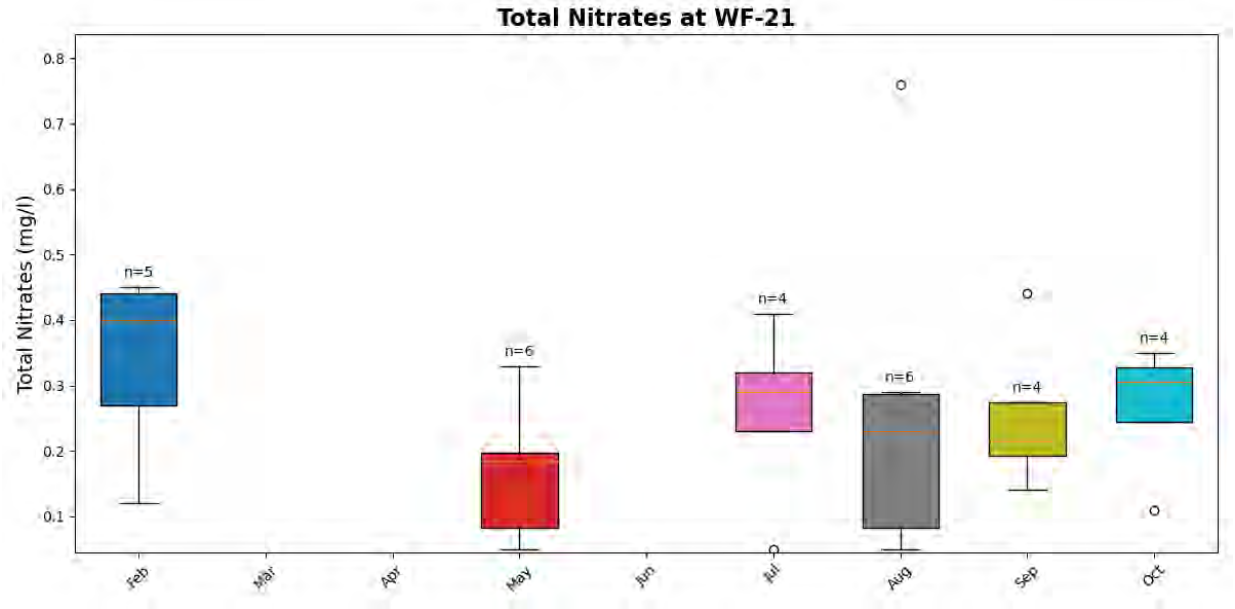


Figure C-33: Monthly Box Plot for Total Nitrates at Station WF-22 in West Fork

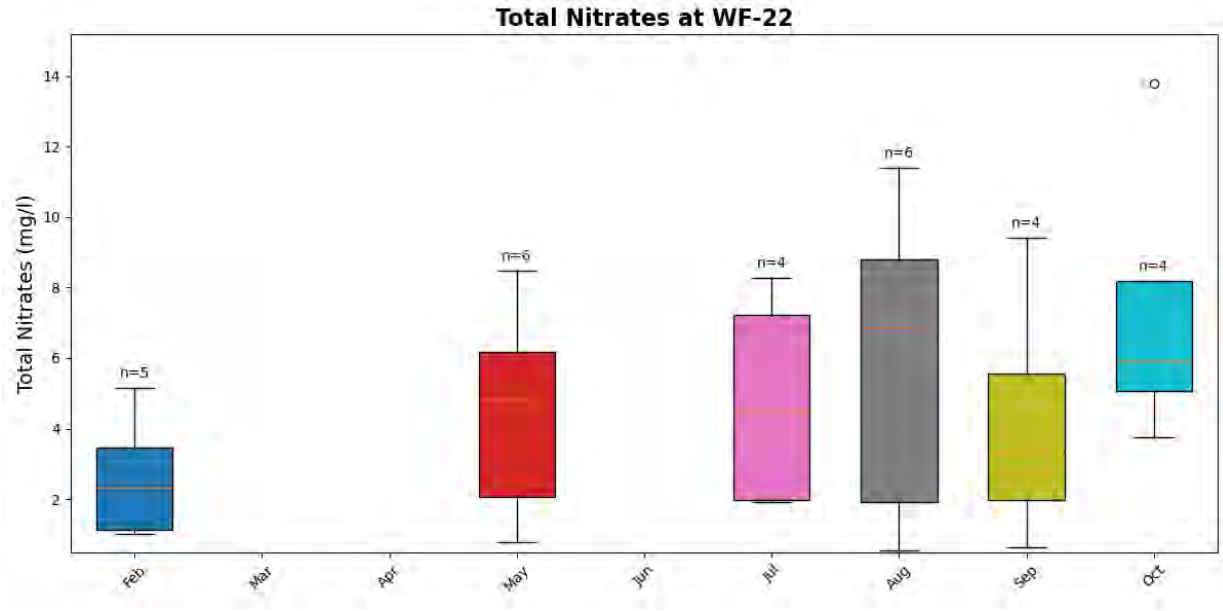


Figure C-34: Monthly Box Plot for Total Nitrates at Station WF-23 in West Fork

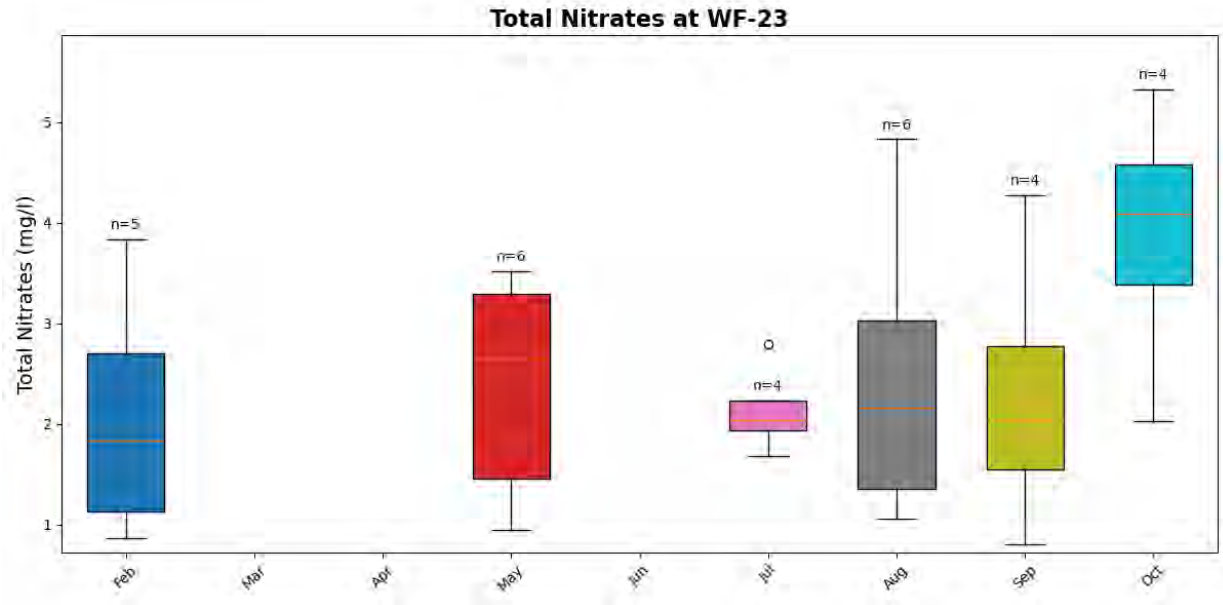


Figure C-35: Monthly Box Plot for Total Nitrates at Station WF-24 in West Fork

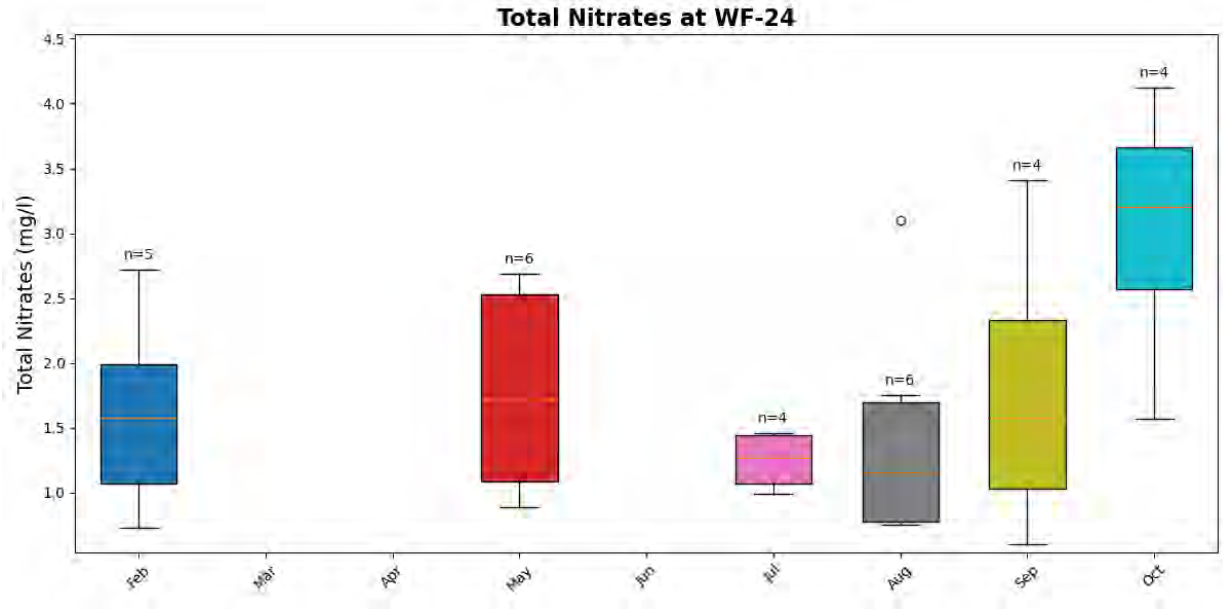
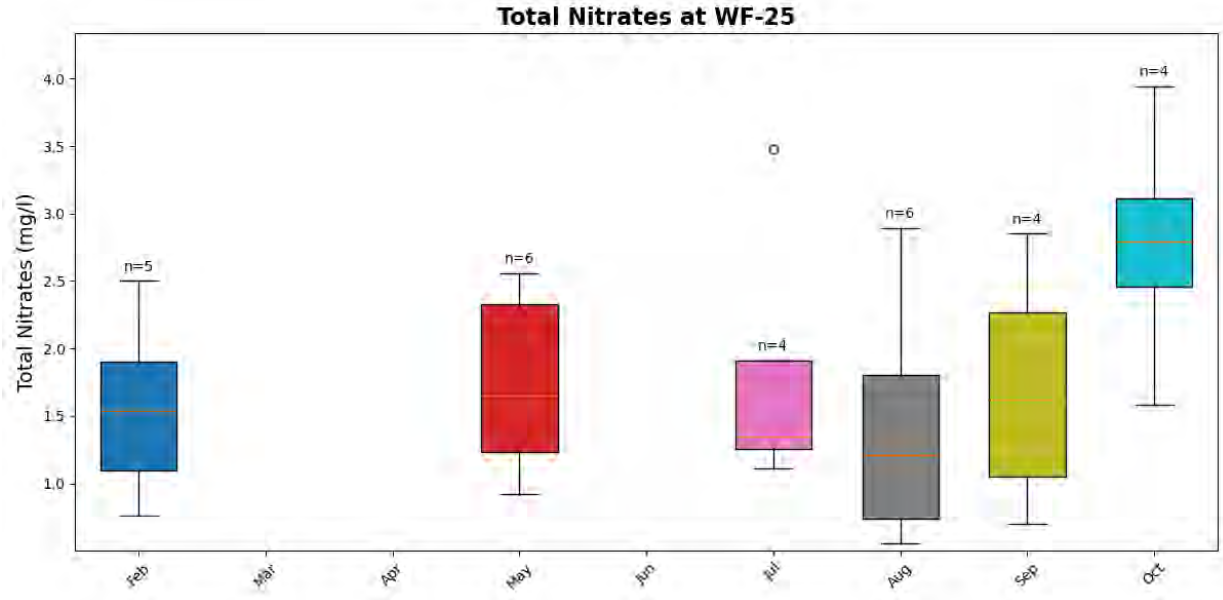


Figure C-36: Monthly Box Plot for Total Nitrates at Station WF-25 in West Fork



Total Kjeldahl Nitrogen

Figure C-37: Monthly Box Plot for Total Kjeldahl Nitrogen at Station WF-20 in West Fork

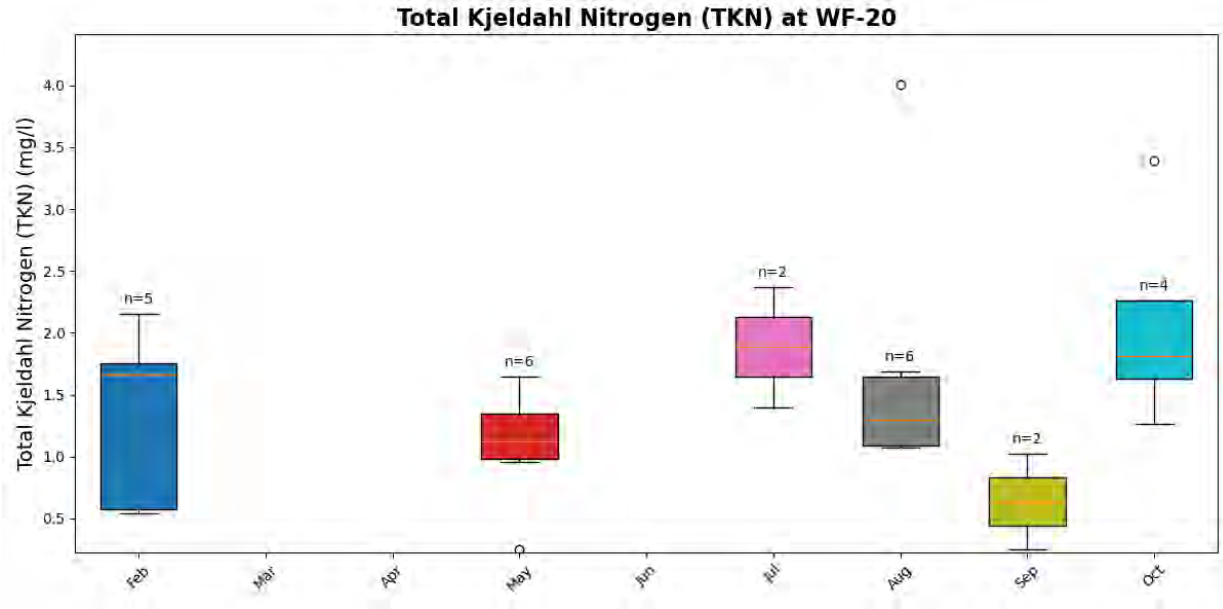


Figure C-38: Monthly Box Plot for Total Kjeldahl Nitrogen at Station WF-21 in West Fork

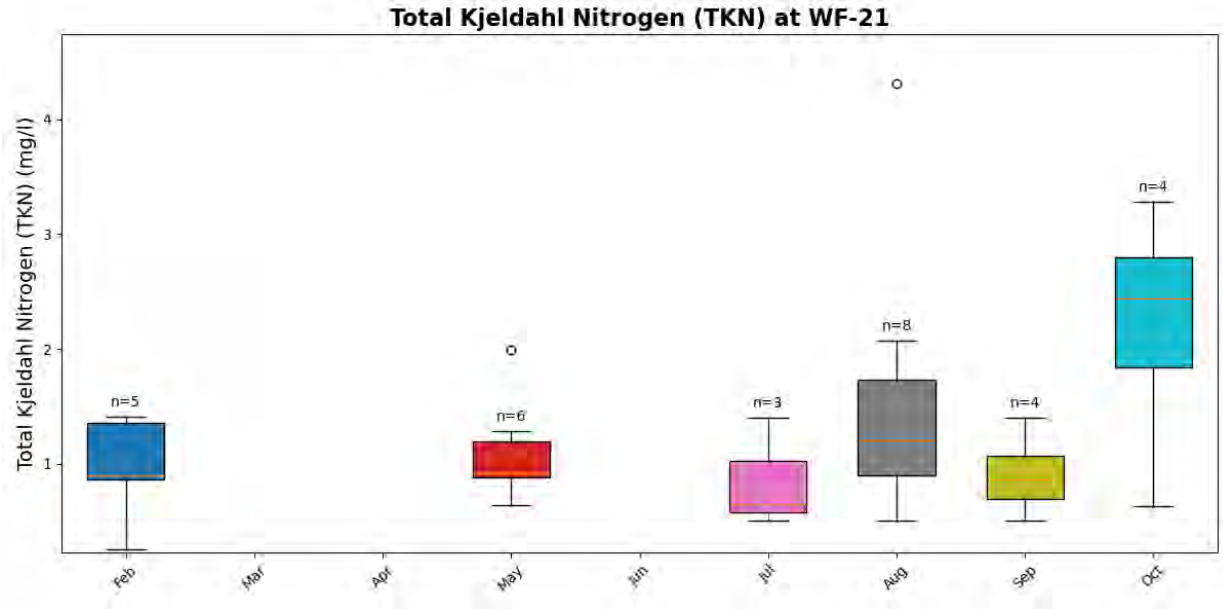


Figure C-39: Monthly Box Plot for Total Kjeldahl Nitrogen at Station WF-22 in West Fork

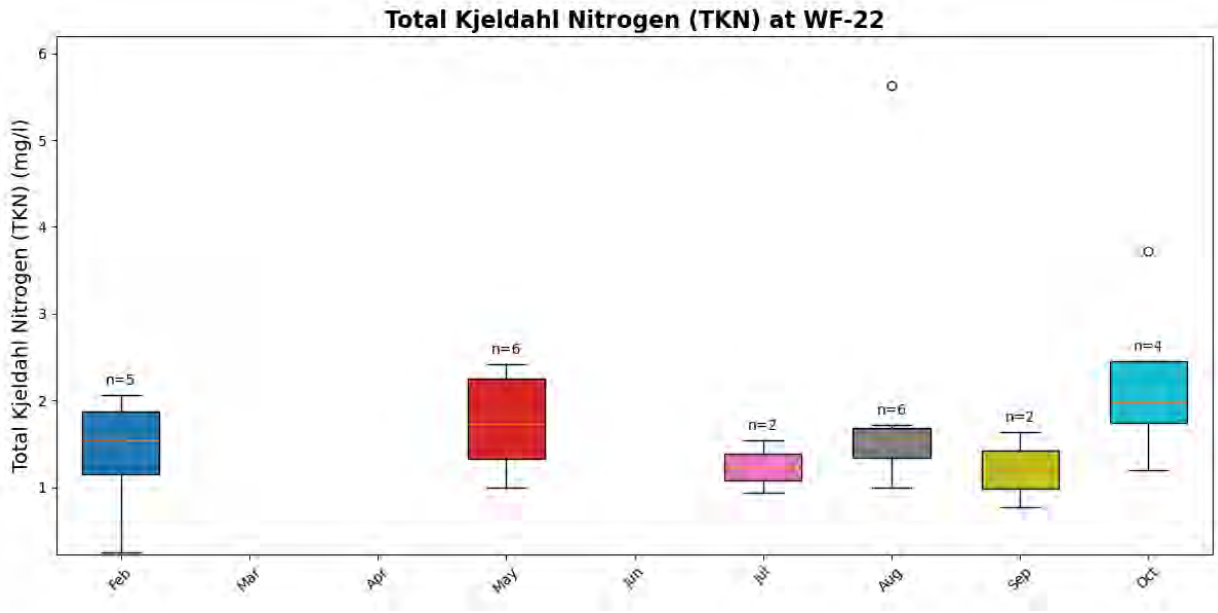


Figure C-40: Monthly Box Plot for Total Kjeldahl Nitrogen at Station WF-23 in West Fork

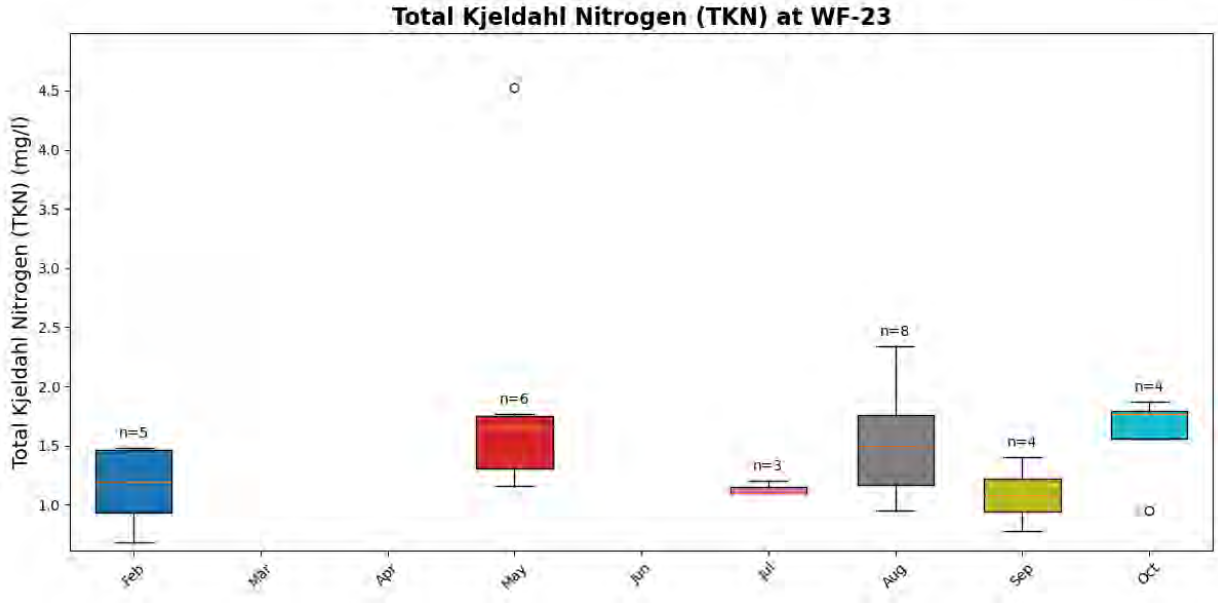


Figure C-41: Monthly Box Plot for Total Kjeldahl Nitrogen at Station WF-24 in West Fork

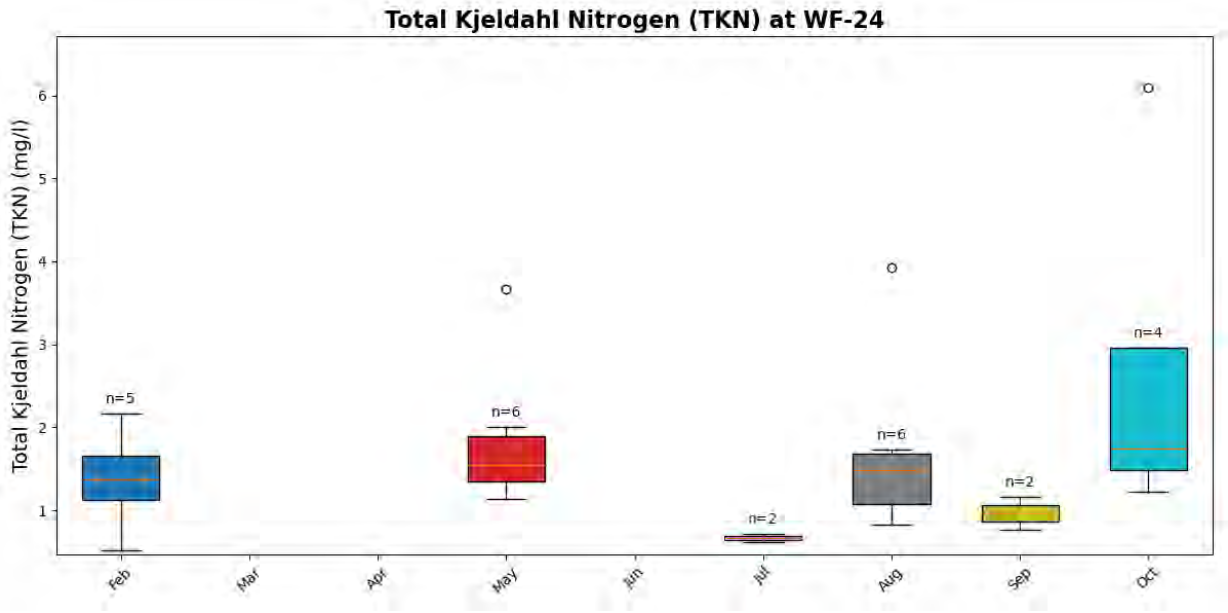
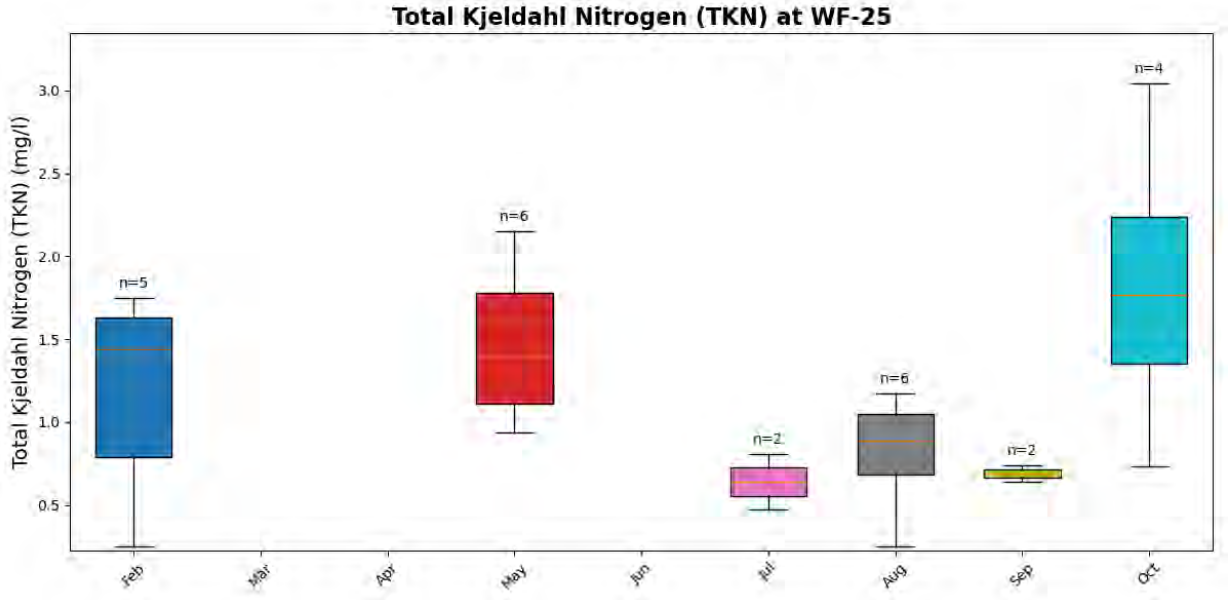


Figure C-42: Monthly Box Plot for Total Kjeldahl Nitrogen at Station WF-25 in West Fork



Total Phosphorus

Figure C-43: Monthly Box Plot for Total Phosphorus at Station WF-20 in West Fork

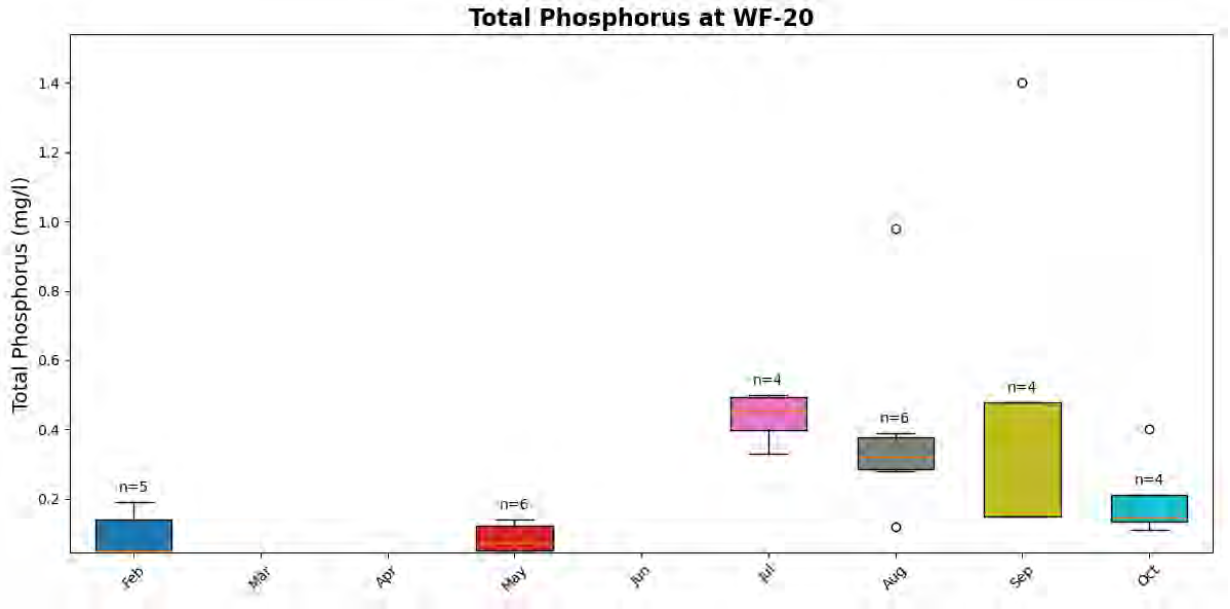


Figure C-44: Monthly Box Plot for Total Phosphorus at Station WF-21 in West Fork

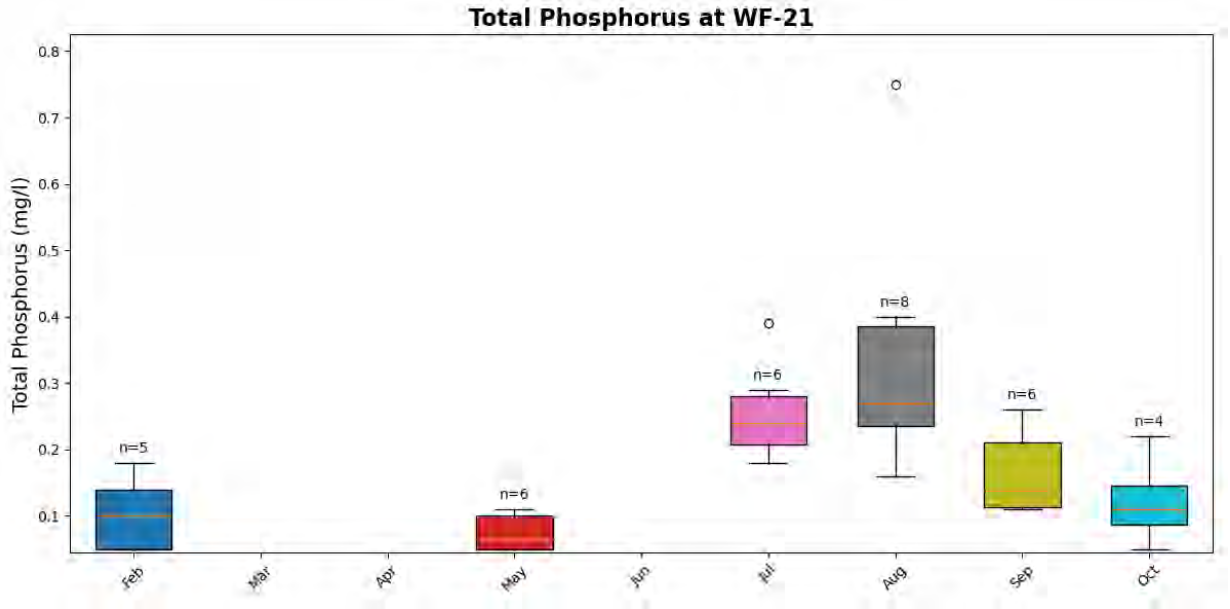


Figure C-45: Monthly Box Plot for Total Phosphorus at Station WF-22 in West Fork

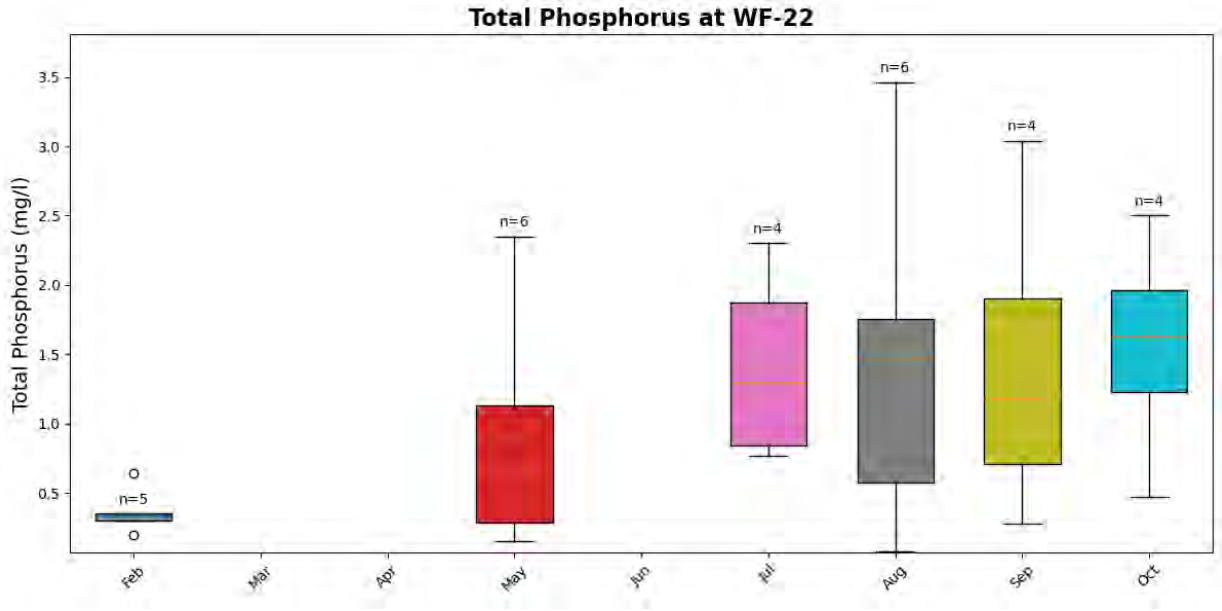


Figure C-46: Monthly Box Plot for Total Phosphorus at Station WF-23 in West Fork

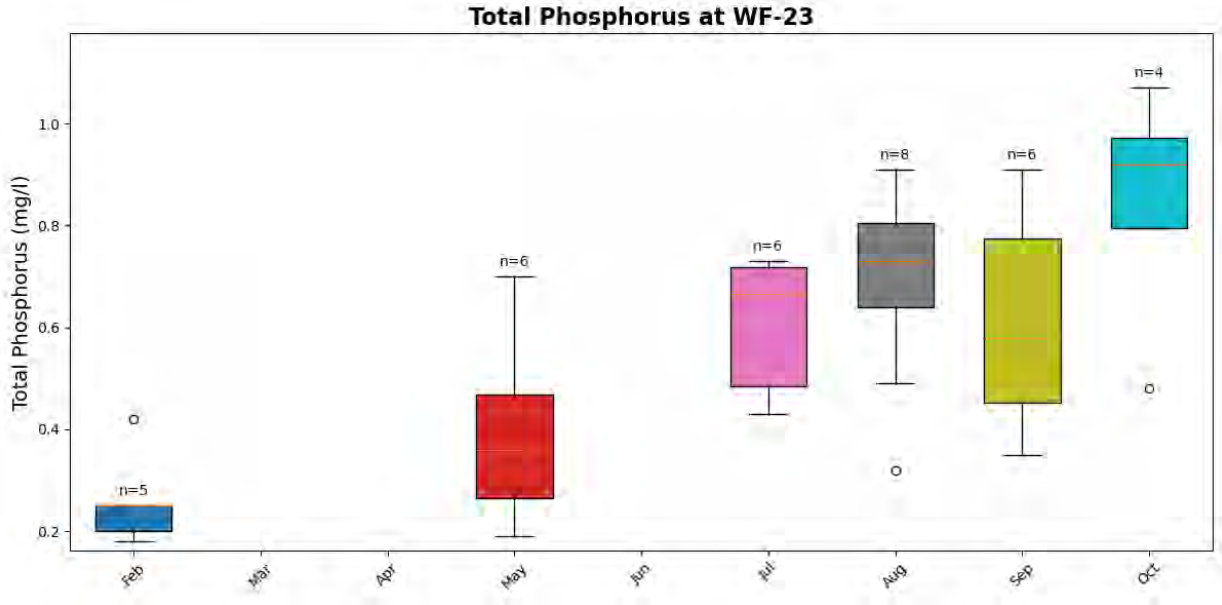


Figure C-47: Monthly Box Plot for Total Phosphorus at Station WF-24 in West Fork

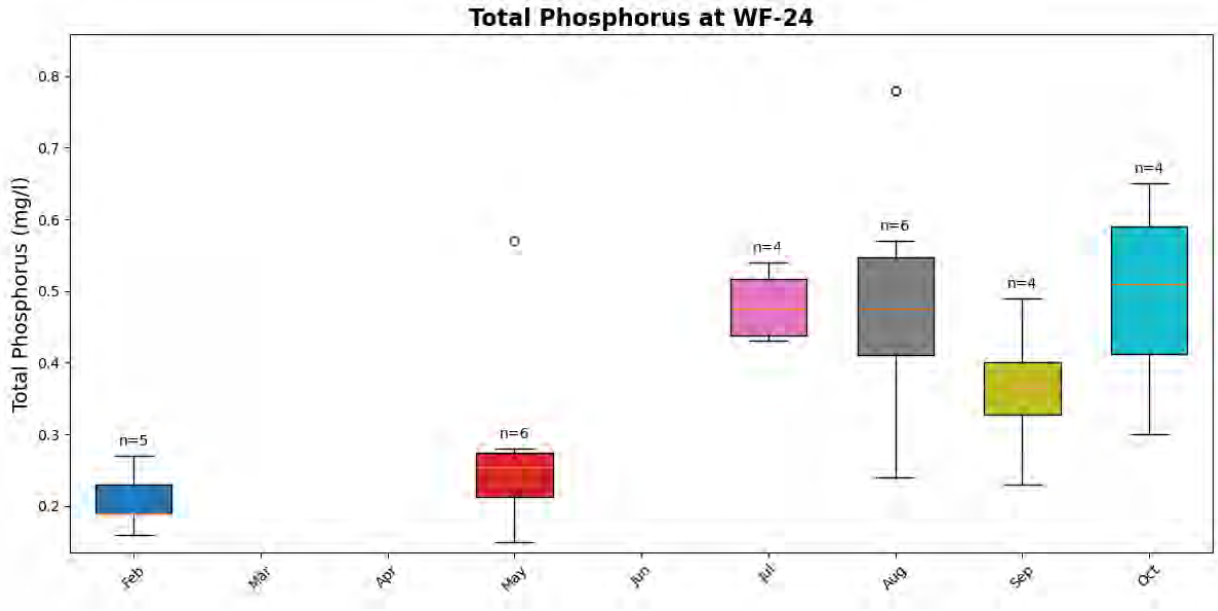
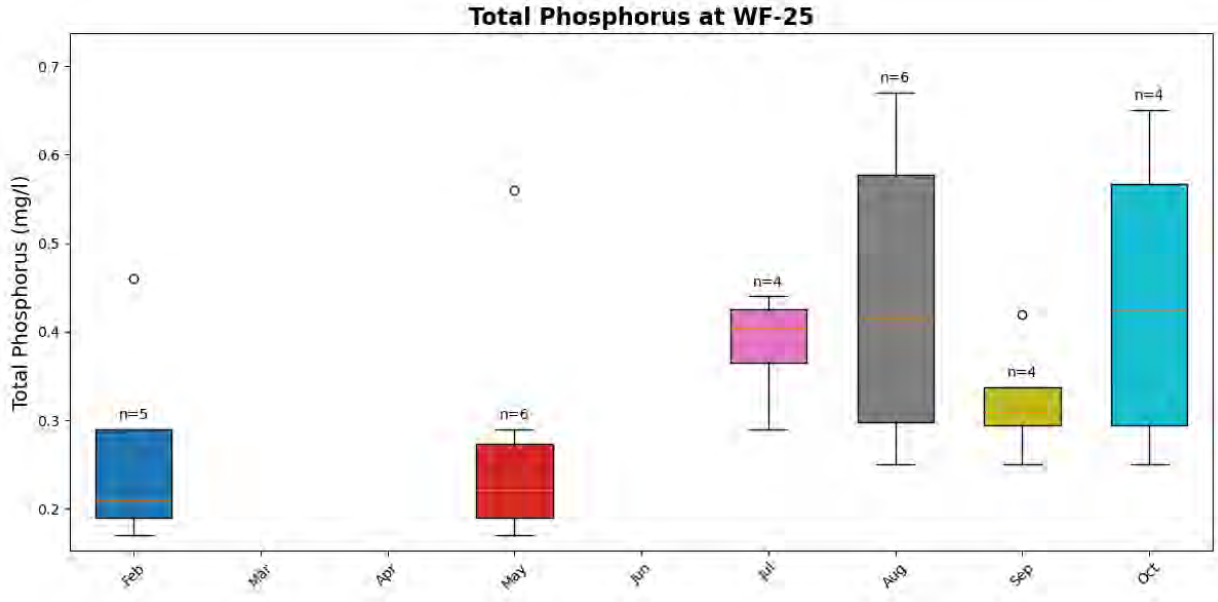


Figure C-48: Monthly Box Plot for Total Phosphorus at Station WF-25 in West Fork



Chlorophyll a

Figure C-49: Monthly Box Plot for Chlorophyll a at Station WF-20 in West Fork

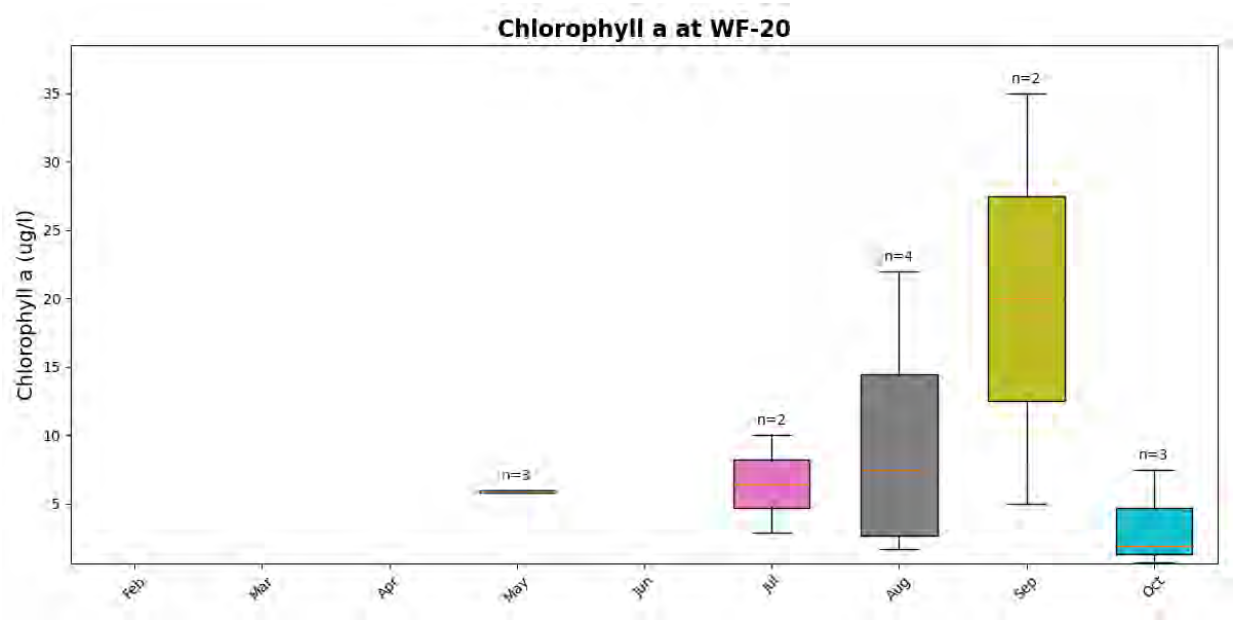


Figure C-50: Monthly Box Plot for Chlorophyll a at Station WF-21 in West Fork

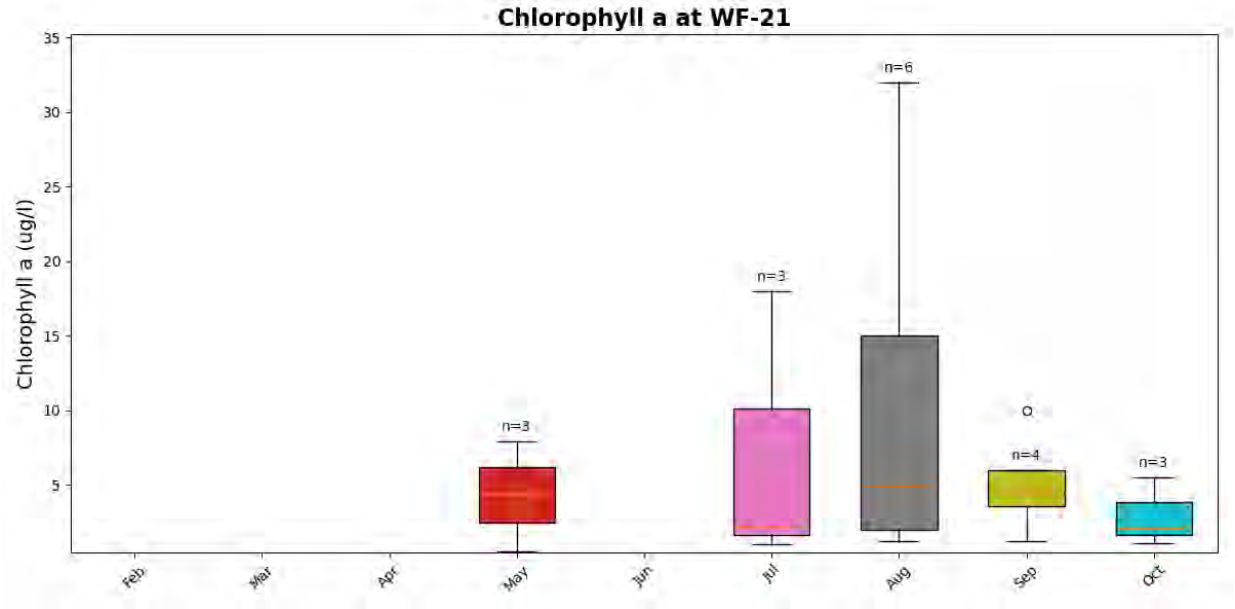


Figure C-51: Monthly Box Plot for Chlorophyll a at Station WF-22 in West Fork

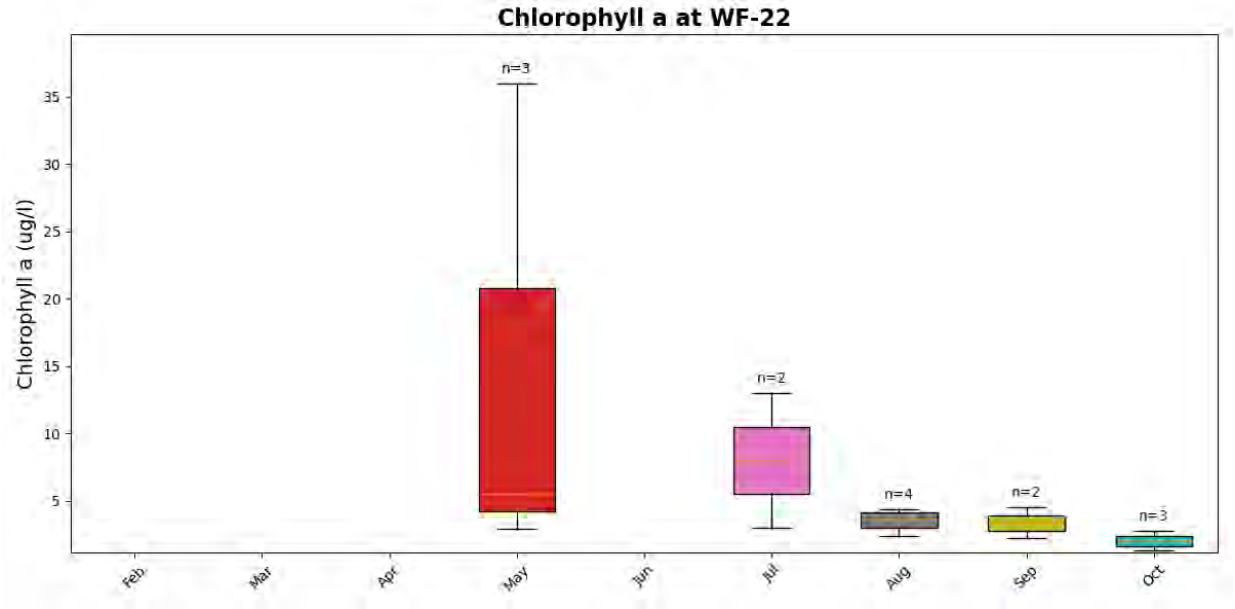


Figure C-52: Monthly Box Plot for Chlorophyll a at Station WF-23 in West Fork

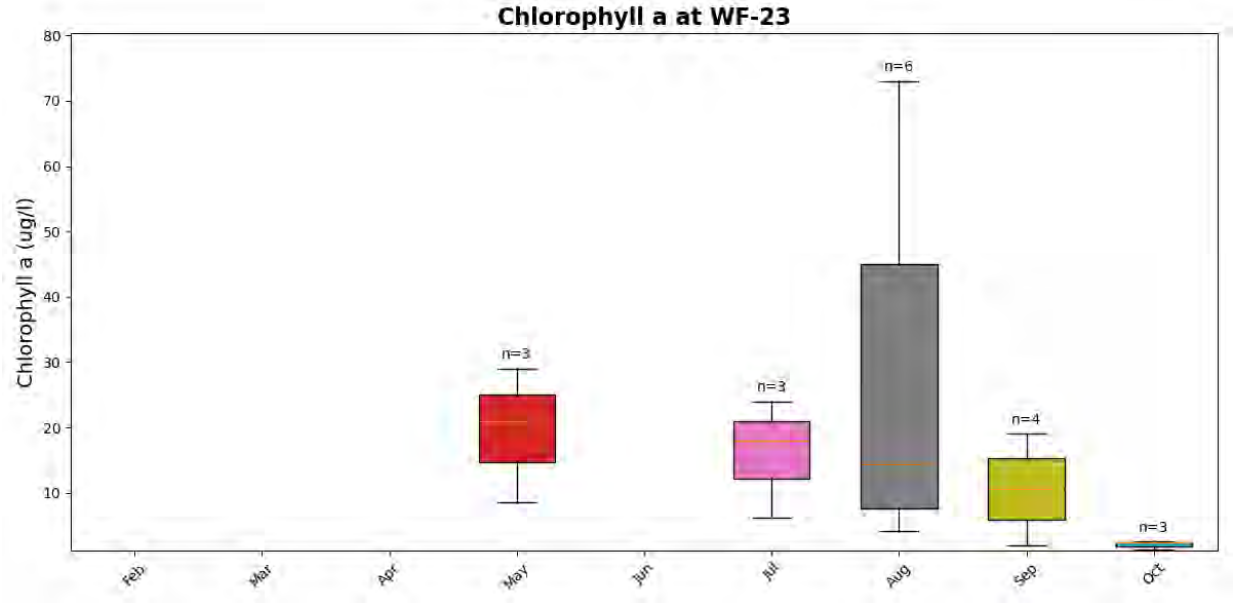


Figure C-53: Monthly Box Plot for Chlorophyll a at Station WF-24 in West Fork

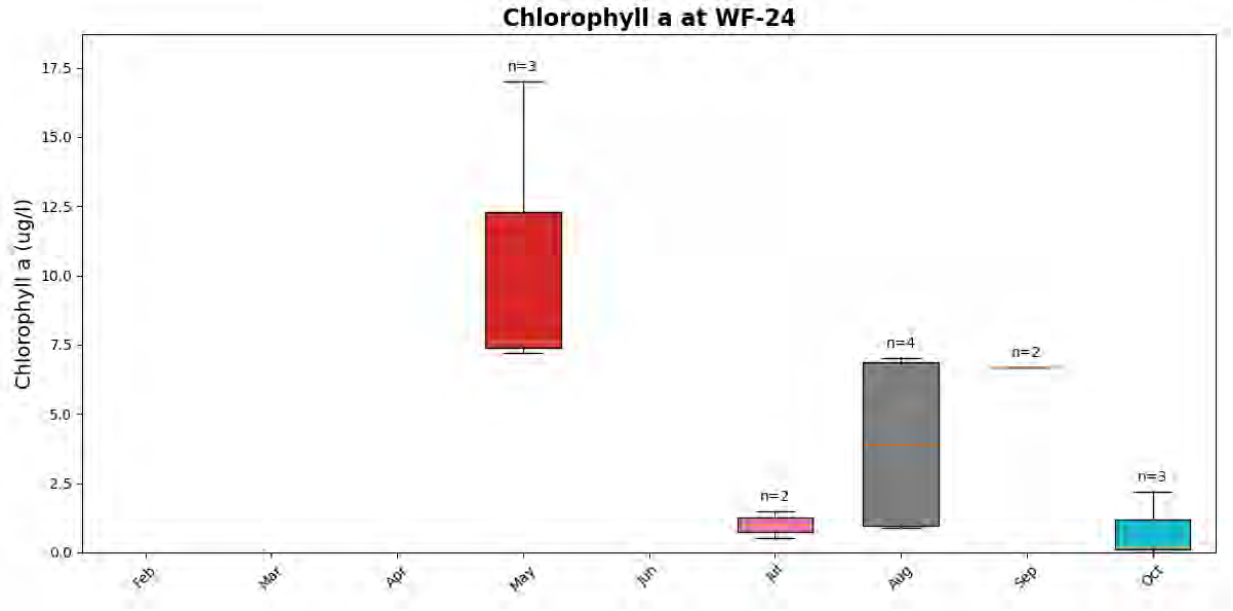
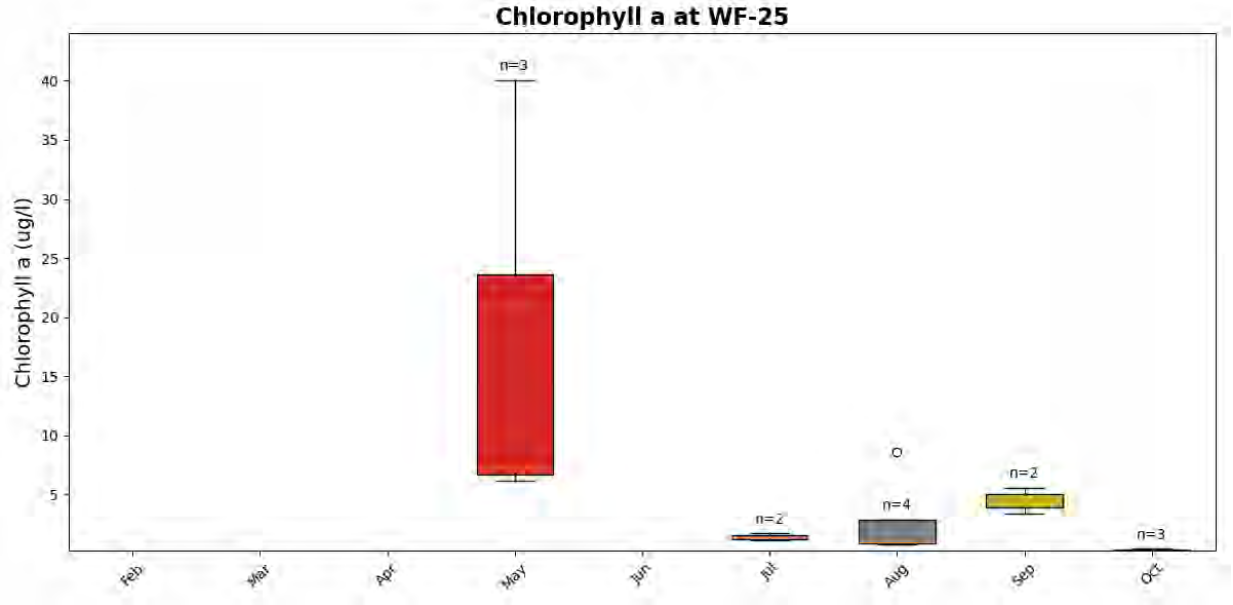


Figure C-54: Monthly Box Plot for Chlorophyll a at Station WF-25 in West Fork



Dissolved Oxygen

Figure C-55: Monthly Box Plot for Dissolved Oxygen at Station WF-20 in West Fork

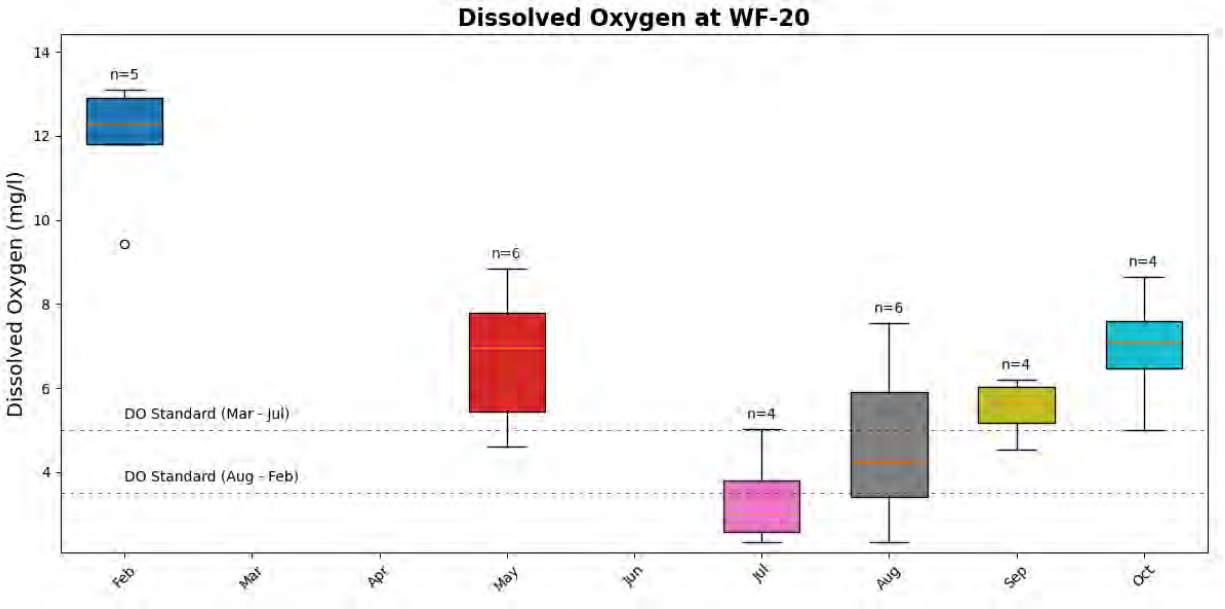


Figure C-56: Monthly Box Plot for Dissolved Oxygen at Station WF-21 in West Fork

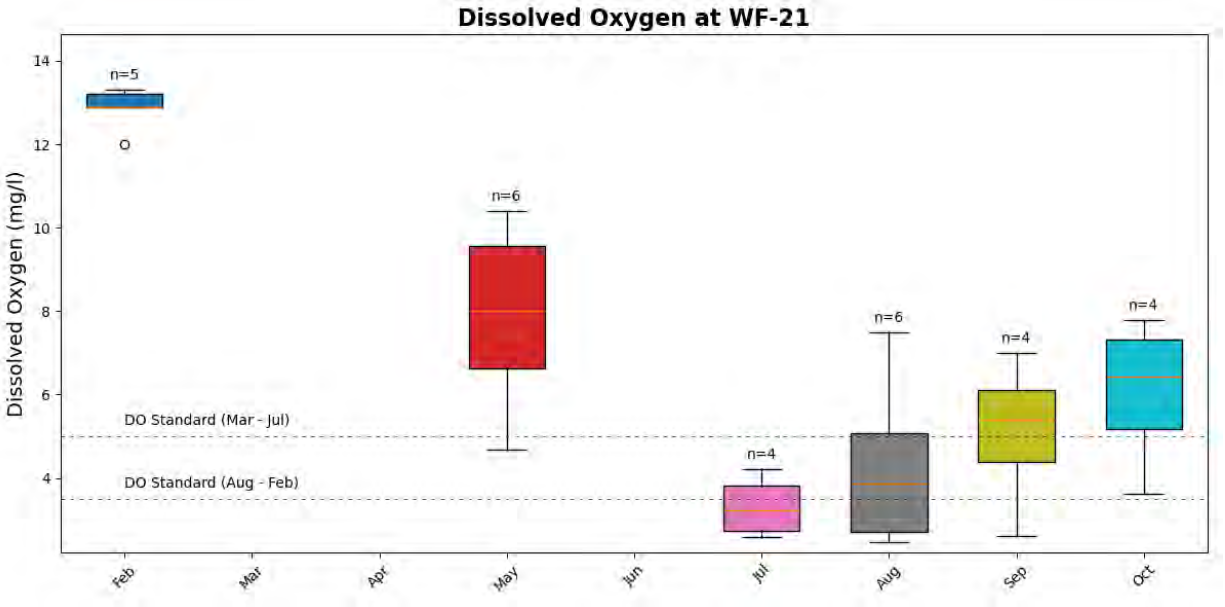


Figure C-57: Monthly Box Plot for Dissolved Oxygen at Station WF-22 in West Fork

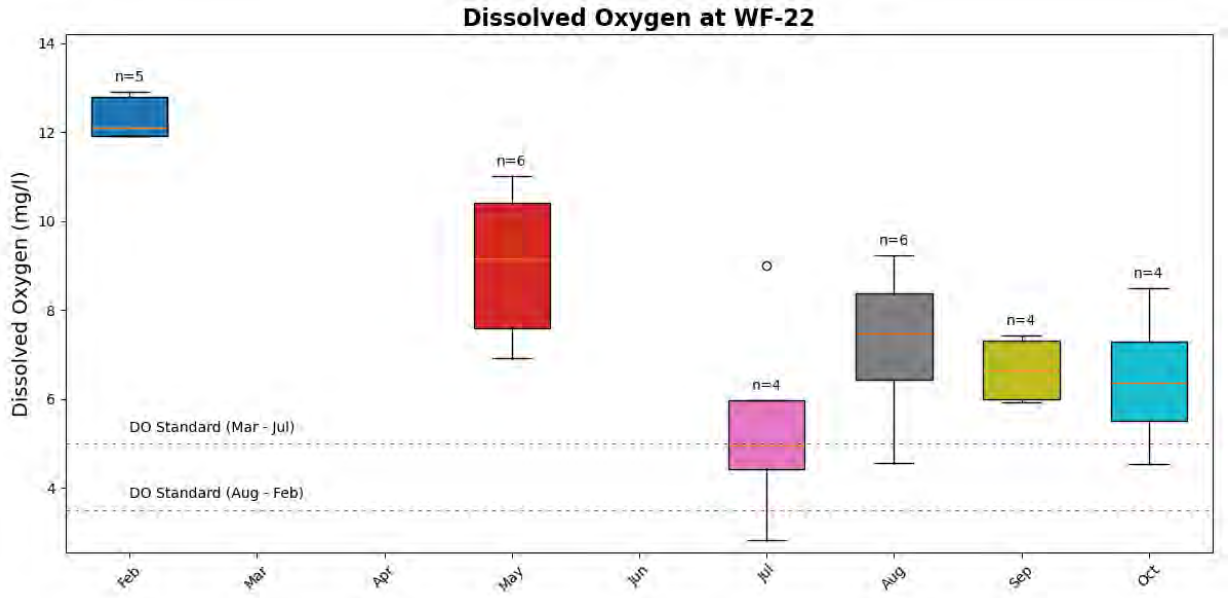


Figure C-58: Monthly Box Plot for Dissolved Oxygen at Station WF-23 in West Fork

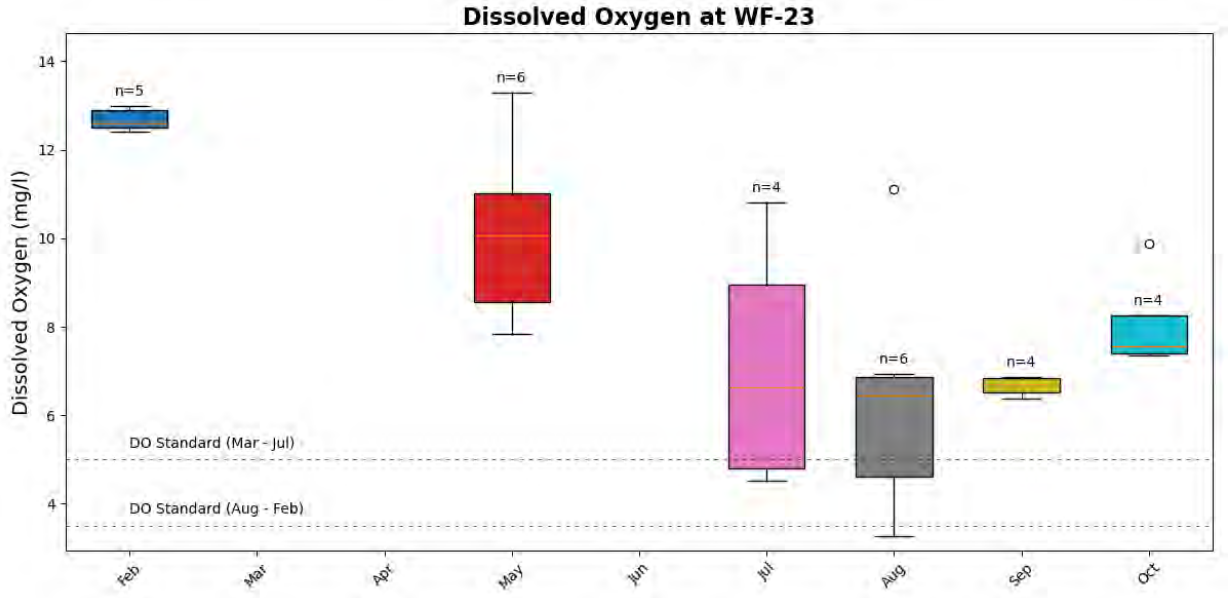


Figure C-59: Monthly Box Plot for Dissolved Oxygen at Station WF-24 in West Fork

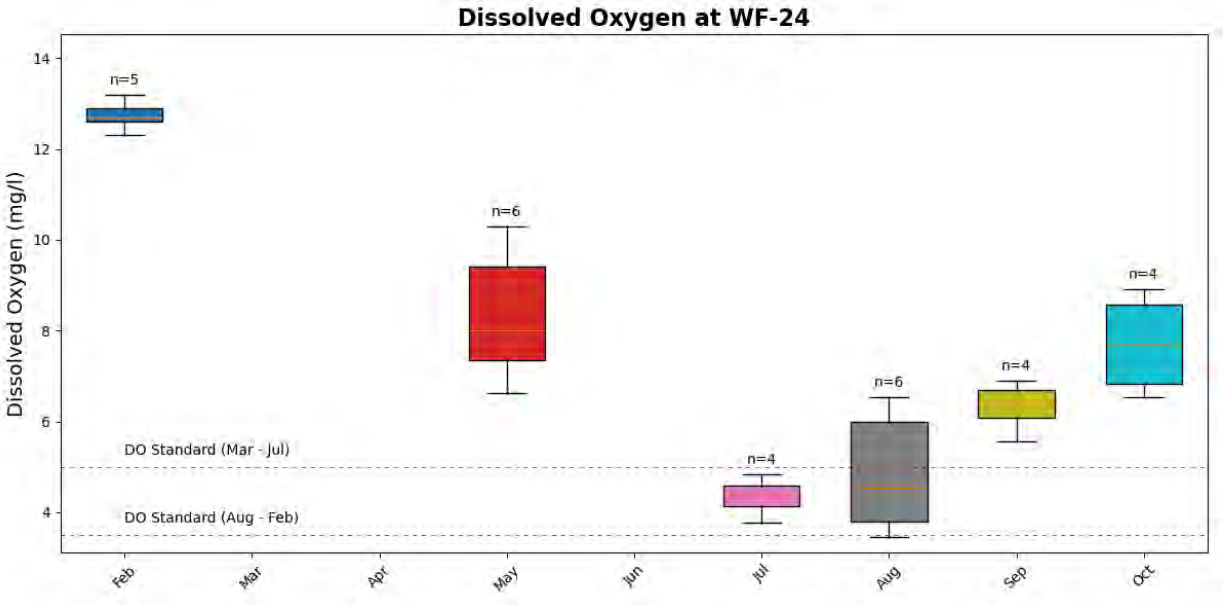
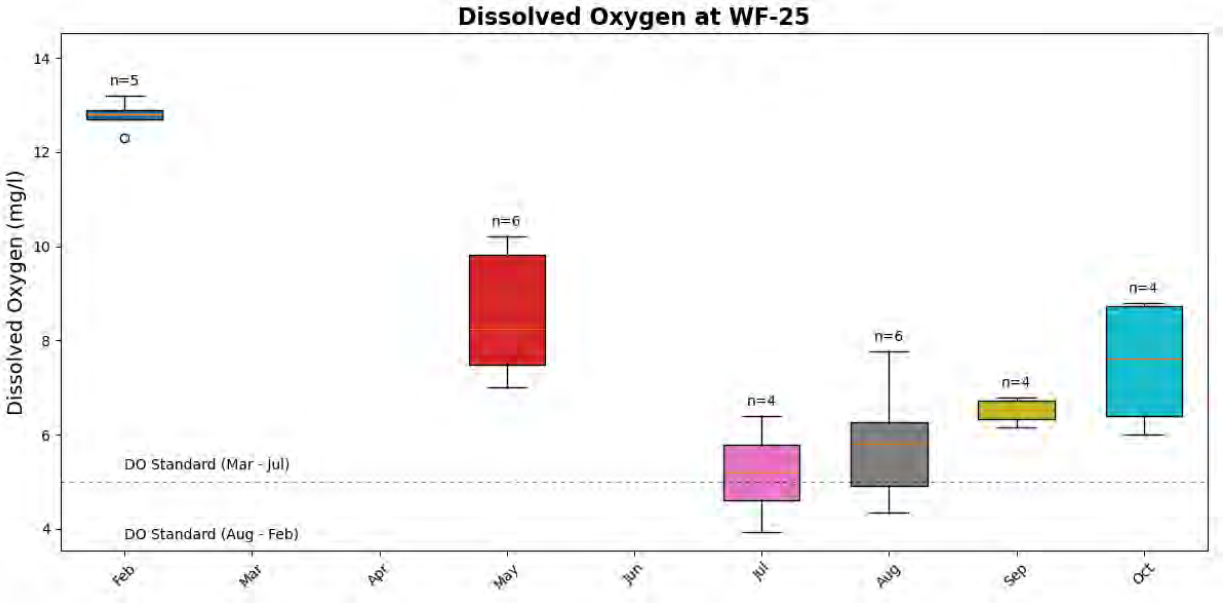


Figure C-60: Monthly Box Plot for Dissolved Oxygen at Station WF-25 in West Fork



E. Coli

Figure C-61: Monthly Box Plot for E. Coli at Station WF-20 in West Fork

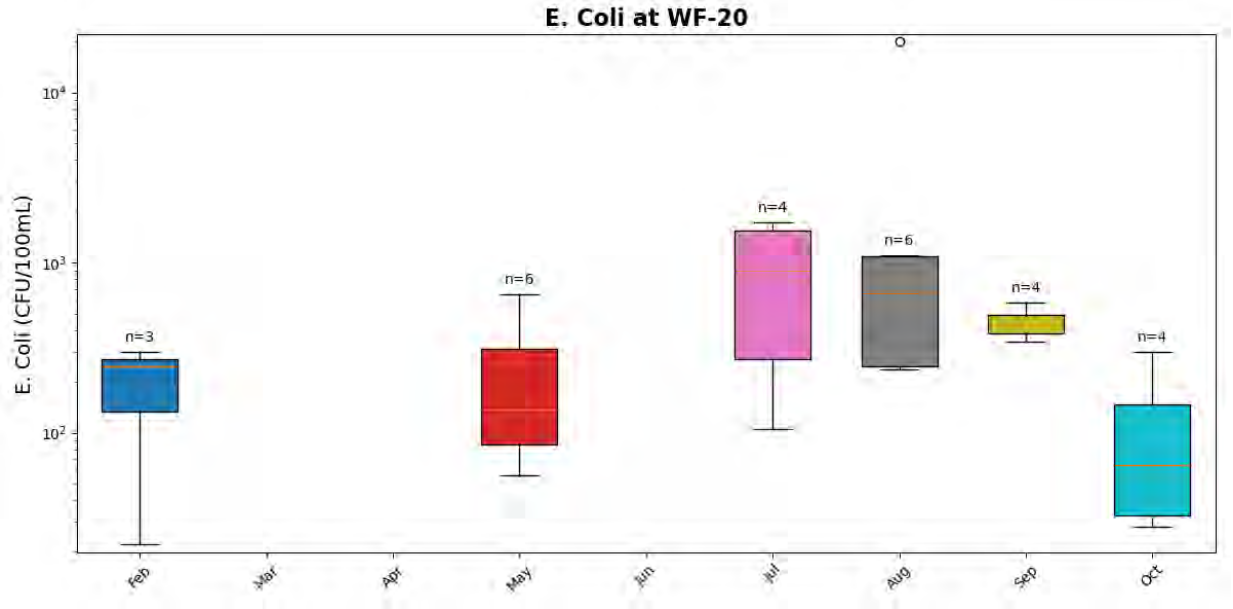


Figure C-62: Monthly Box Plot for E. Coli at Station WF-21 in West Fork

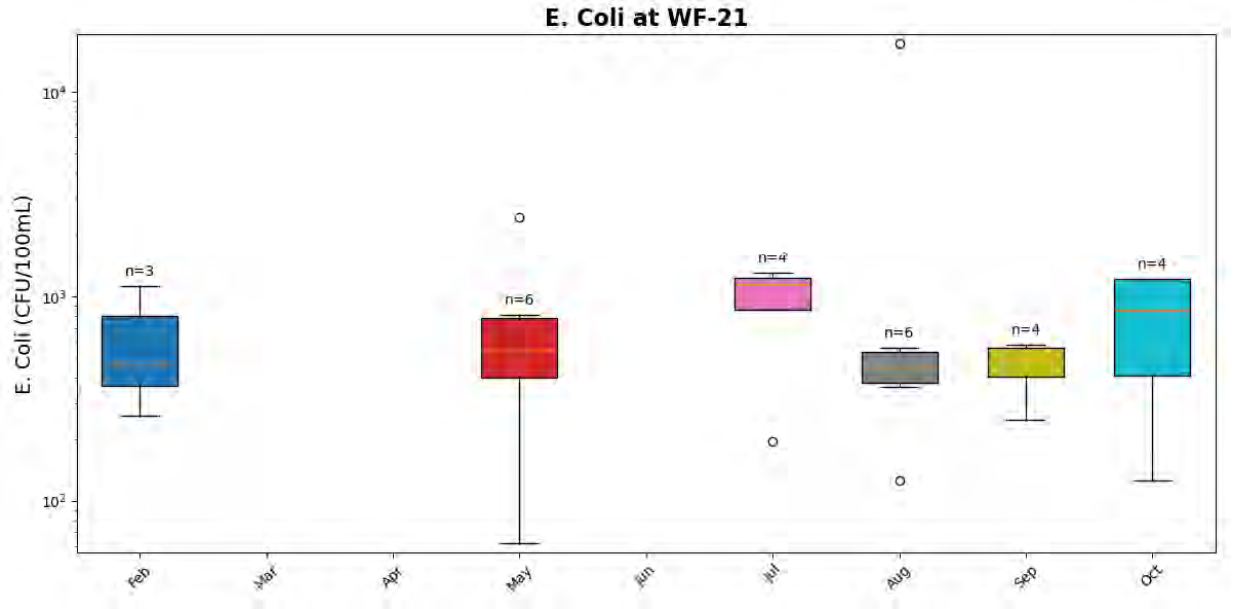


Figure C-63: Monthly Box Plot for E. Coli at Station WF-22 in West Fork

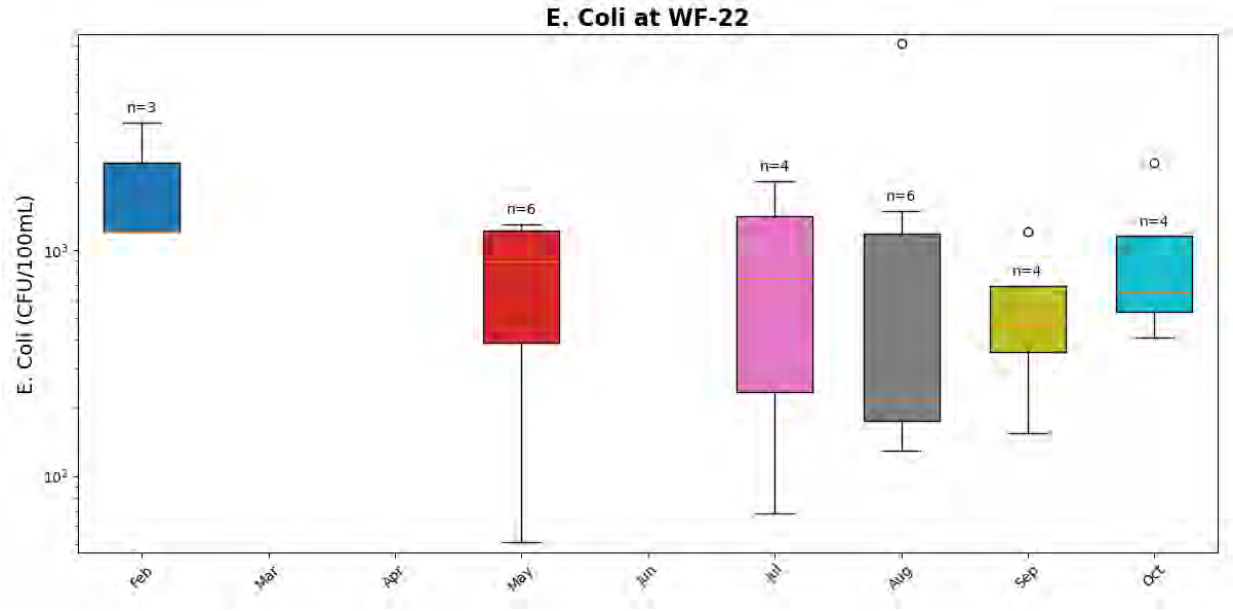


Figure C-64: Monthly Box Plot for E. Coli at Station WF-23 in West Fork

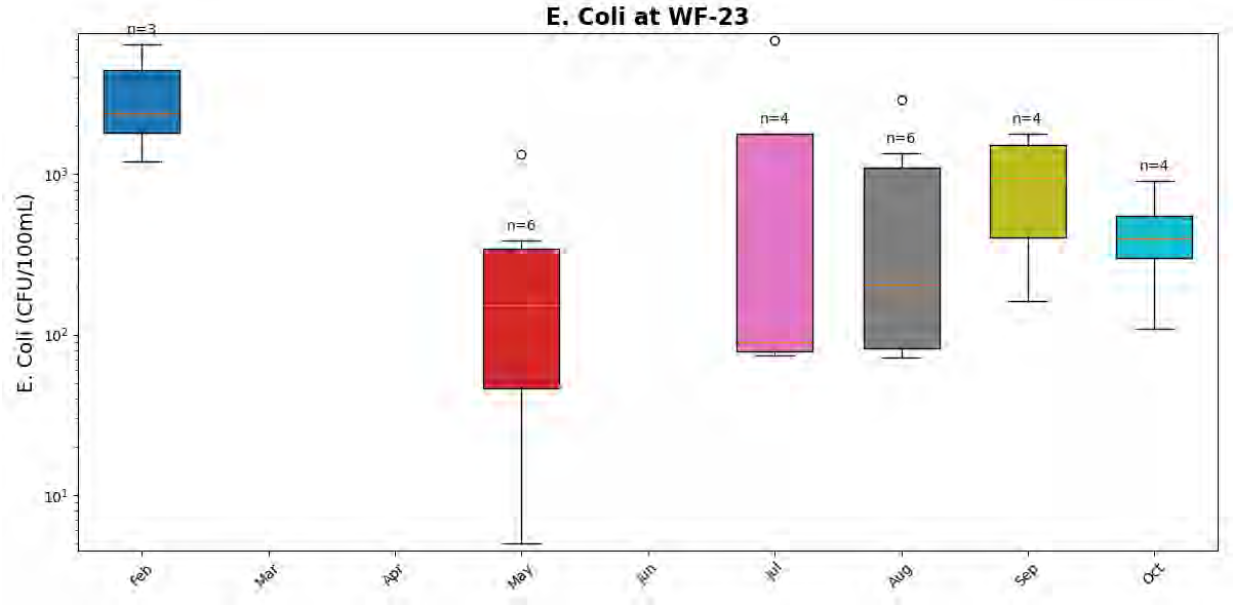


Figure C-65: Monthly Box Plot for E. Coli at Station WF-24 in West Fork

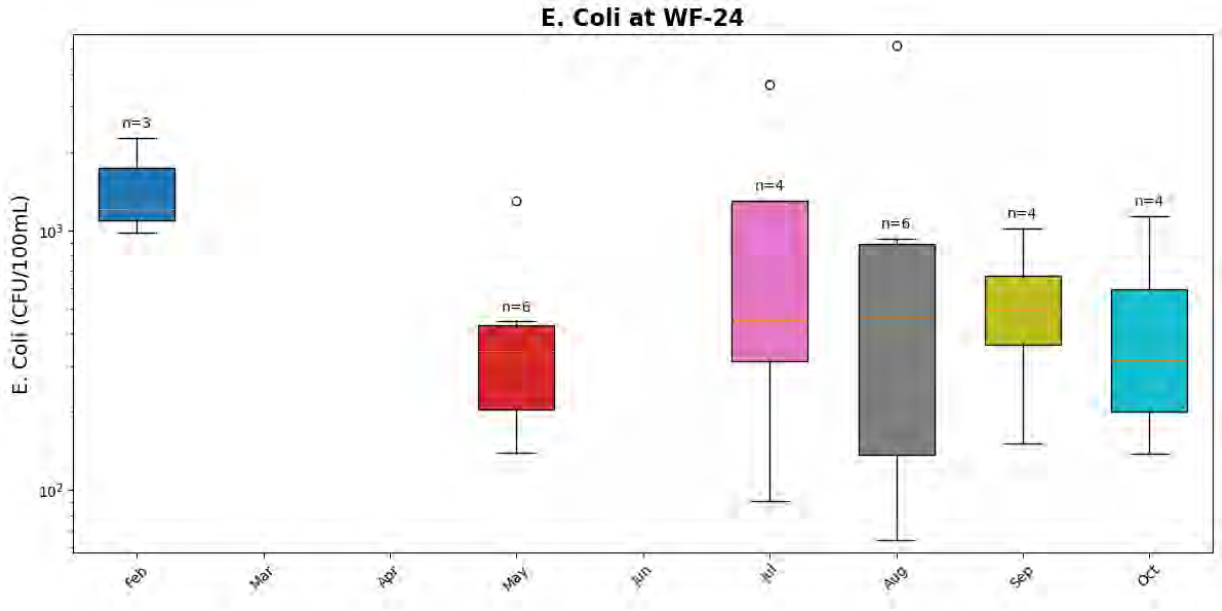
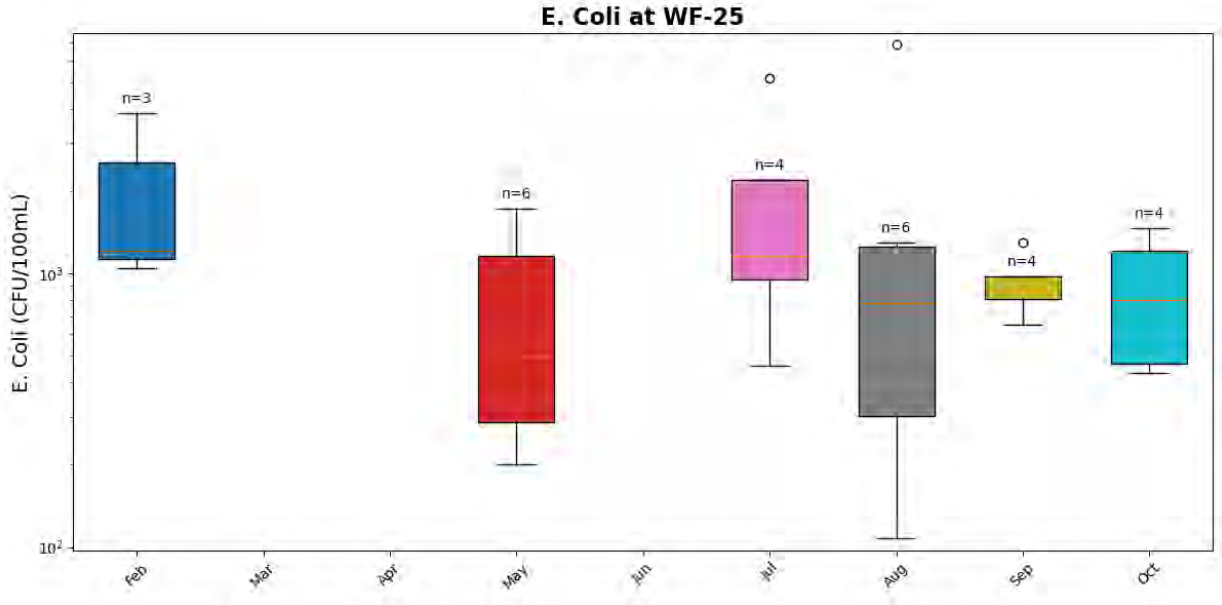


Figure C-66: Monthly Box Plot for E. Coli at Station WF-25 in West Fork



Middle Fork and North Branch Chicago River

pH

Figure C-67: Monthly Box Plot for pH at Station MF-08 in Middle Fork

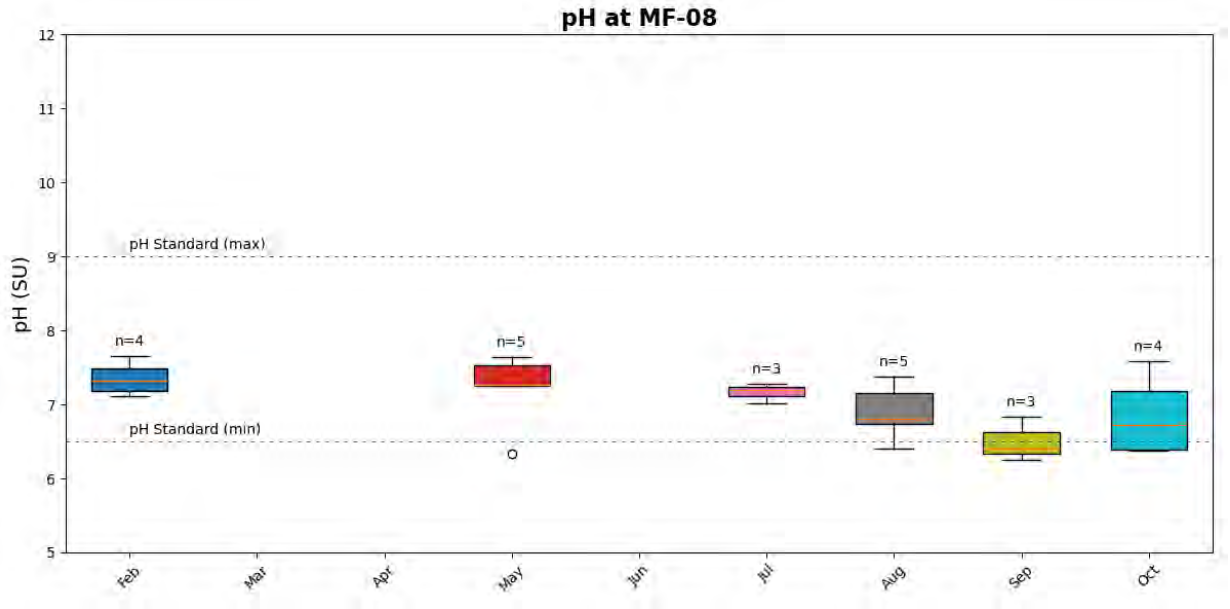


Figure C-68: Monthly Box Plot for pH at Station MF-09 in Middle Fork

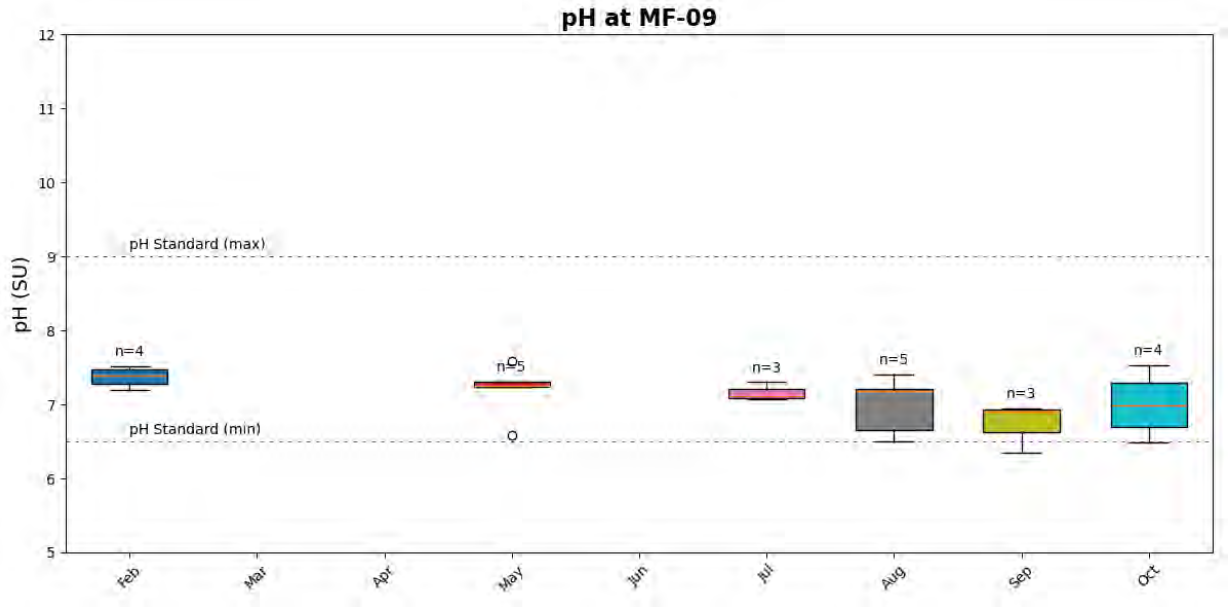


Figure C-69: Monthly Box Plot for pH at Station MF-10 in Middle Fork

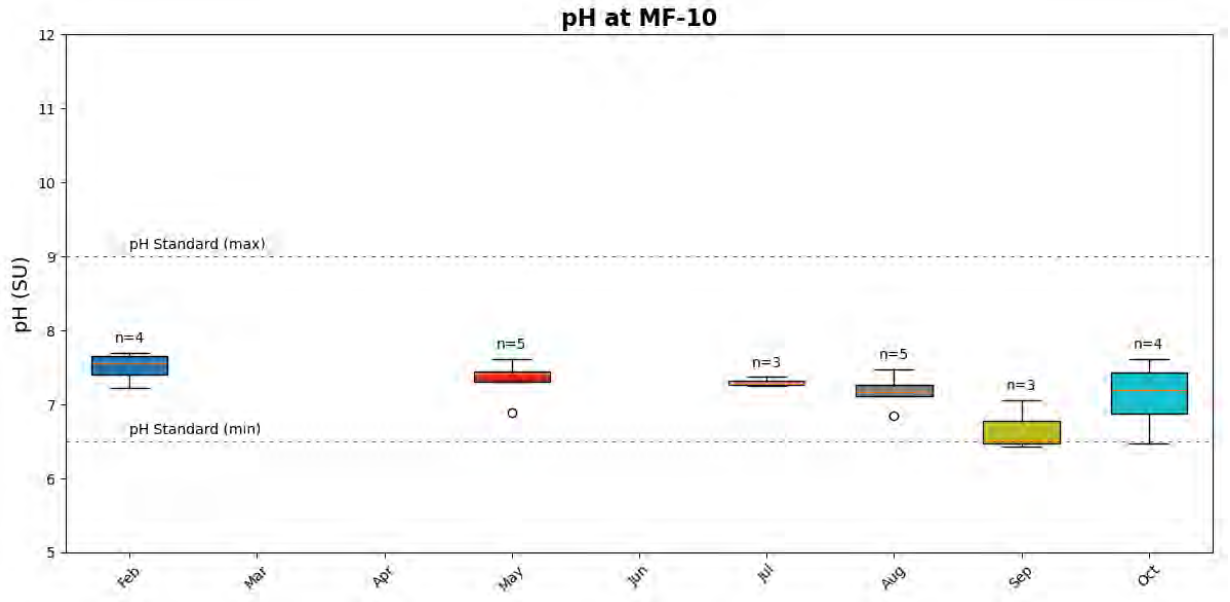


Figure C-70: Monthly Box Plot for pH at Station MF-11 in Middle Fork

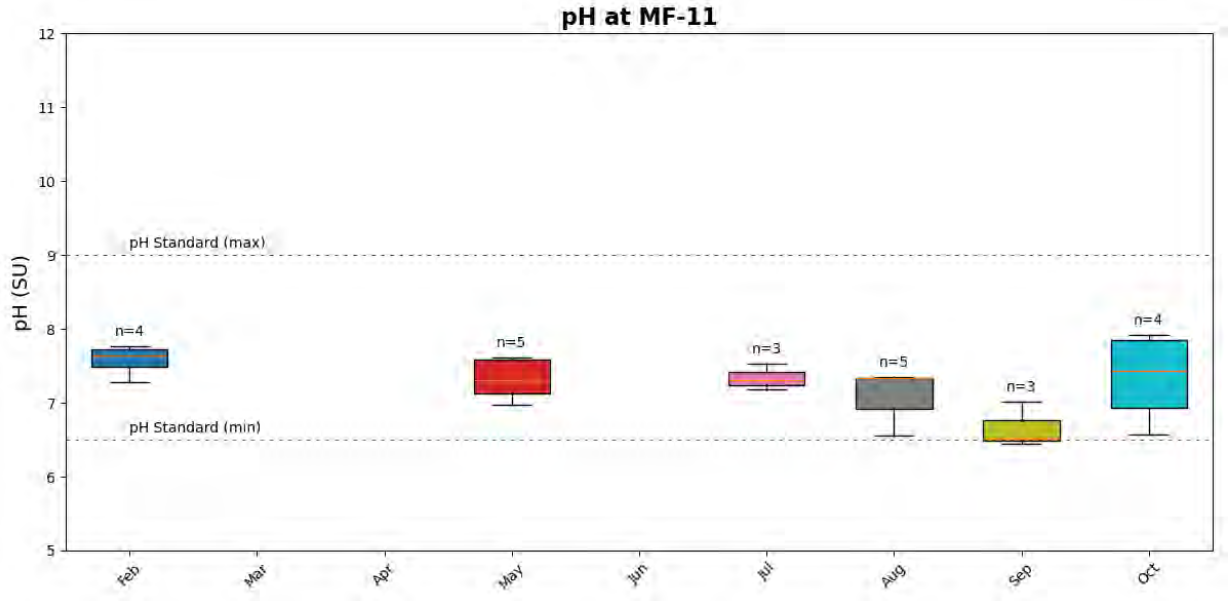


Figure C-71: Monthly Box Plot for pH at Station MF-12 in Middle Fork

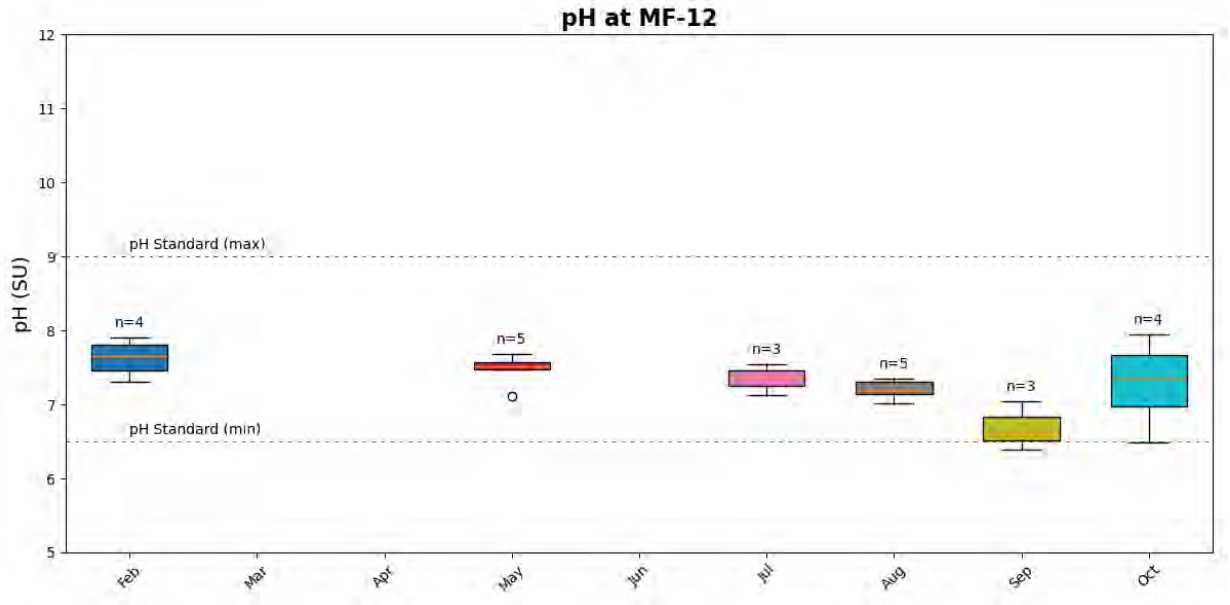


Figure C-72: Monthly Box Plot for pH at Station MF-13 in Middle Fork

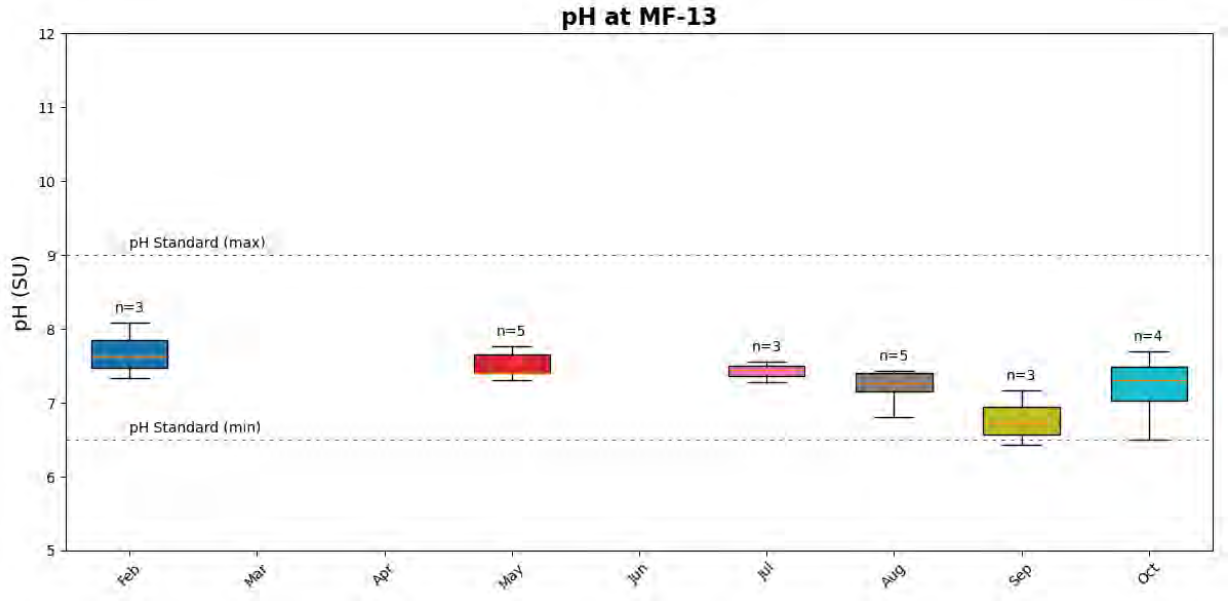


Figure C-73: Monthly Box Plot for pH at Station MF-14 in Middle Fork

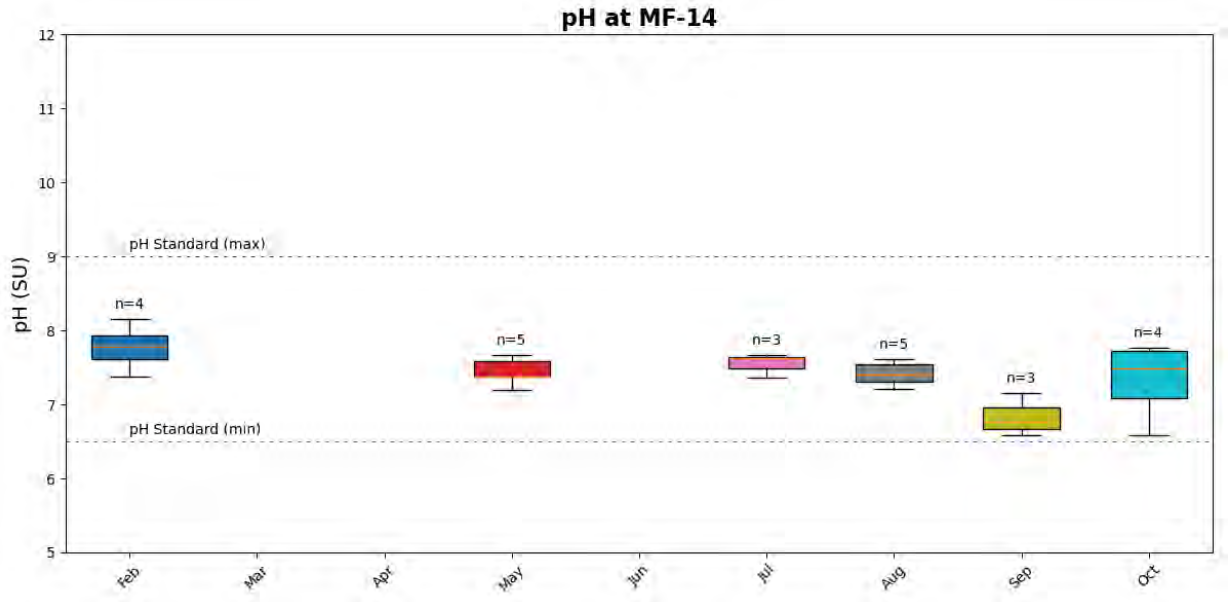


Figure C-74: Monthly Box Plot for pH at Station MF-15 in Middle Fork

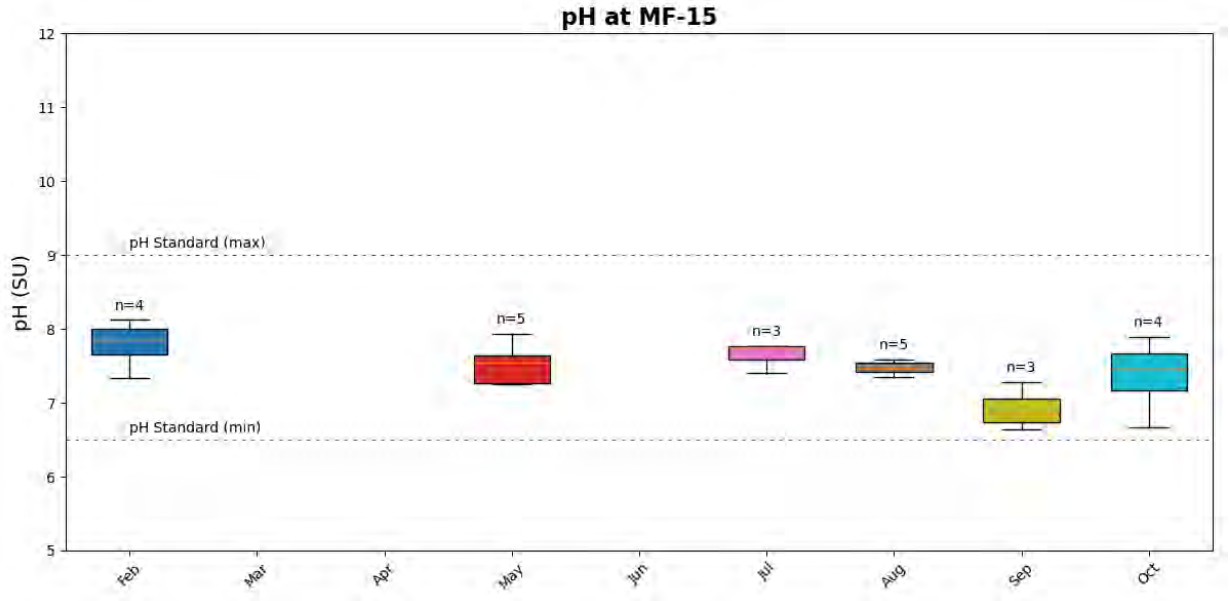


Figure C-75: Monthly Box Plot for pH at Station MF-16 in Middle Fork

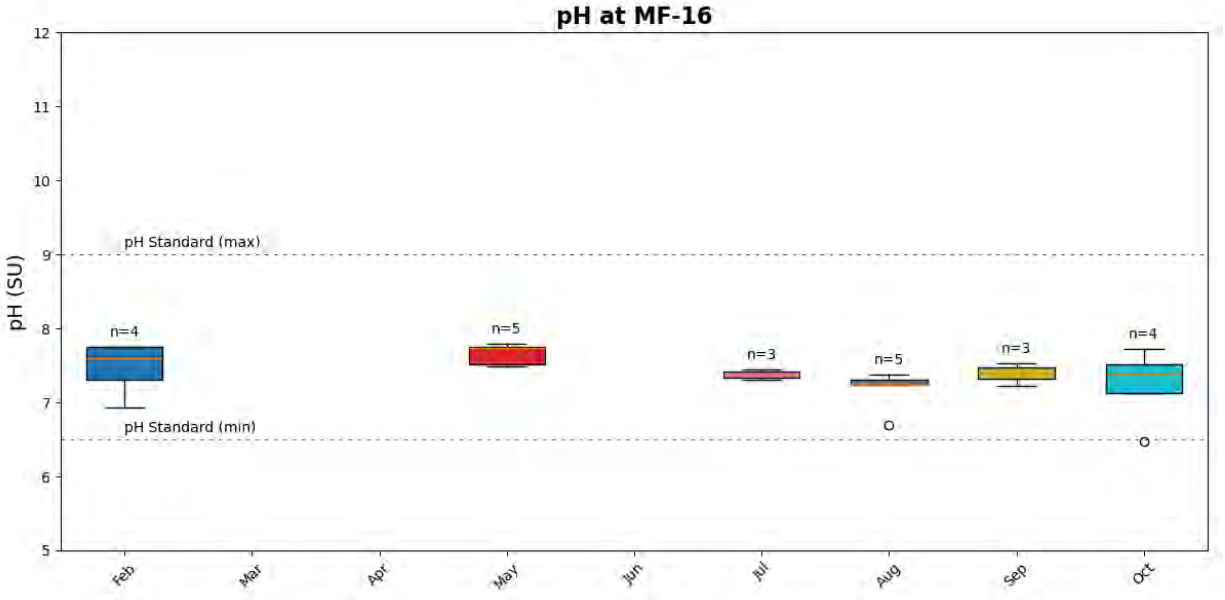


Figure C-76: Monthly Box Plot for pH at Station MF-17 in Middle Fork

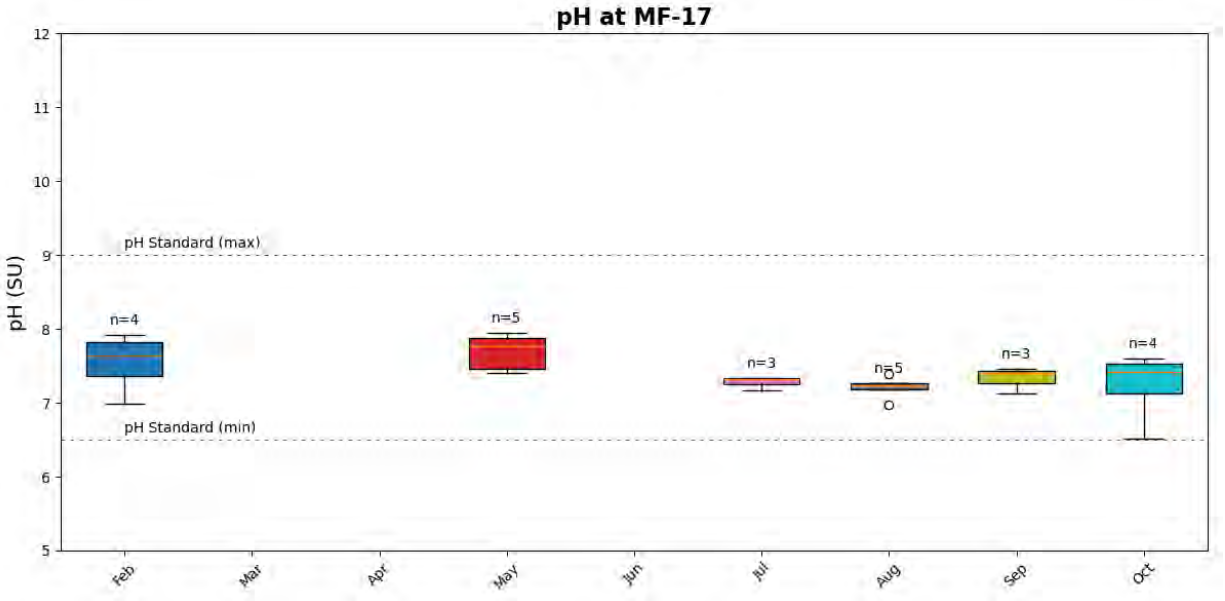
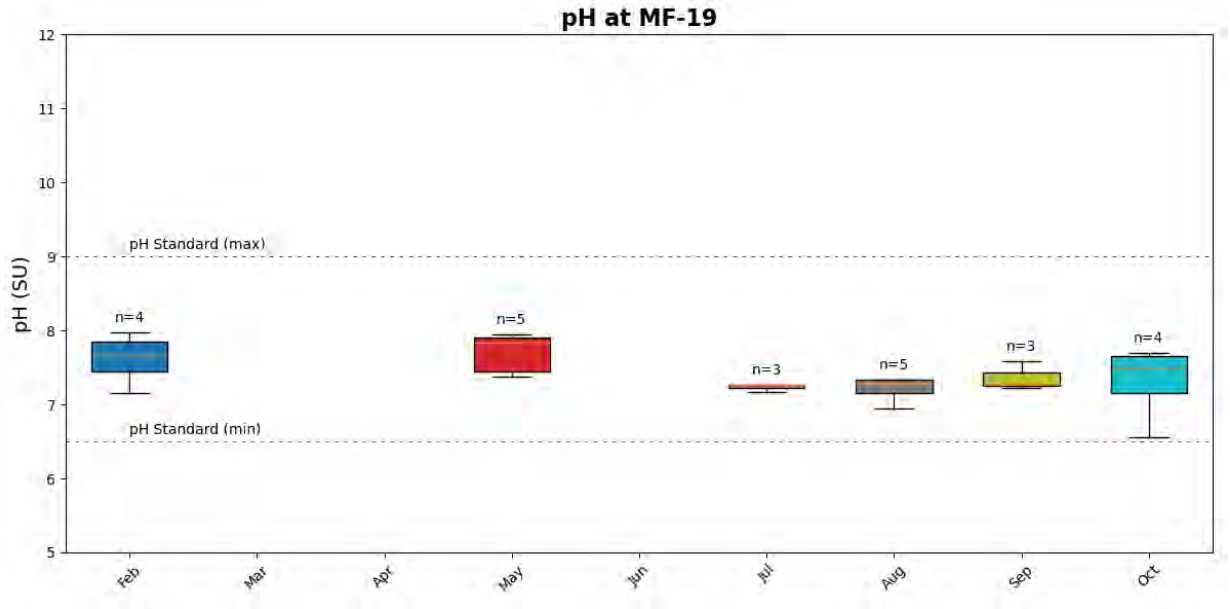


Figure C-77: Monthly Box Plot for pH at Station MF-19 in Middle Fork



Specific Conductivity

Figure C-78: Monthly Box Plot for Specific Conductivity at Station MF-08 in Middle Fork

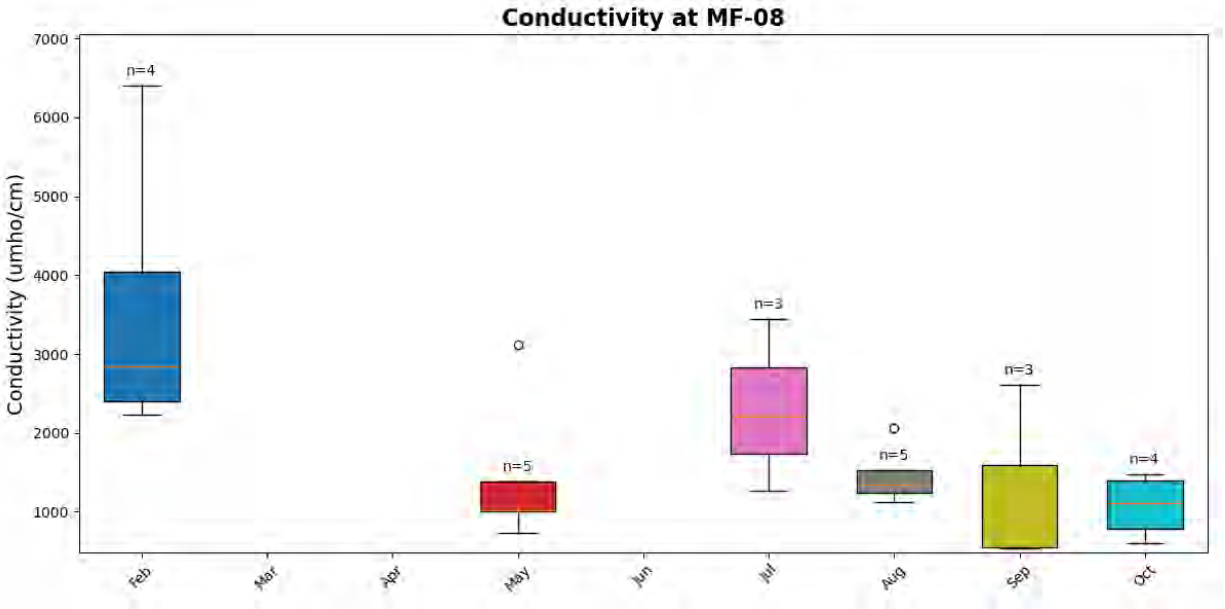


Figure C-79: Monthly Box Plot for Specific Conductivity at Station MF-09 in Middle Fork

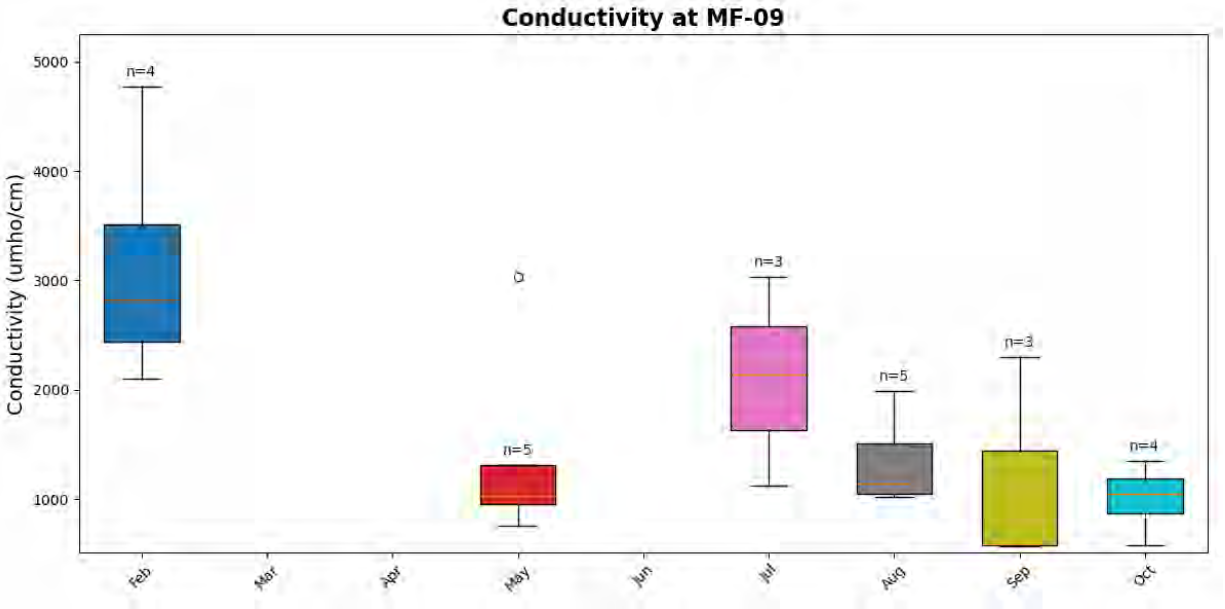


Figure C-80: Monthly Box Plot for Specific Conductivity at Station MF-10 in Middle Fork

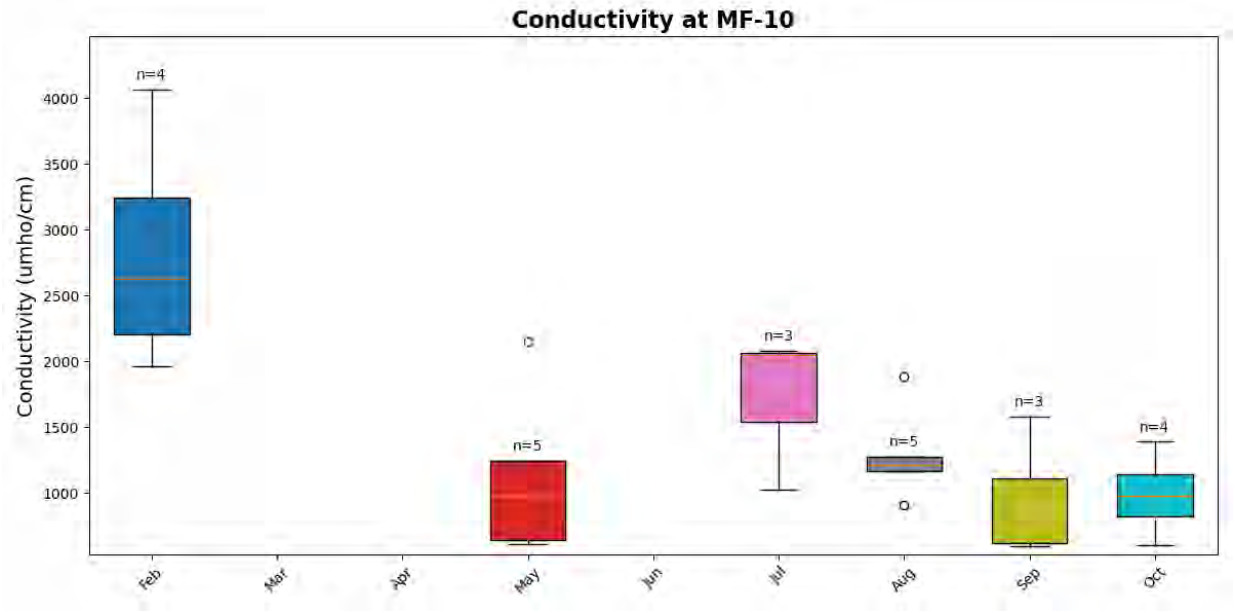


Figure C-81: Monthly Box Plot for Specific Conductivity at Station MF-11 in Middle Fork

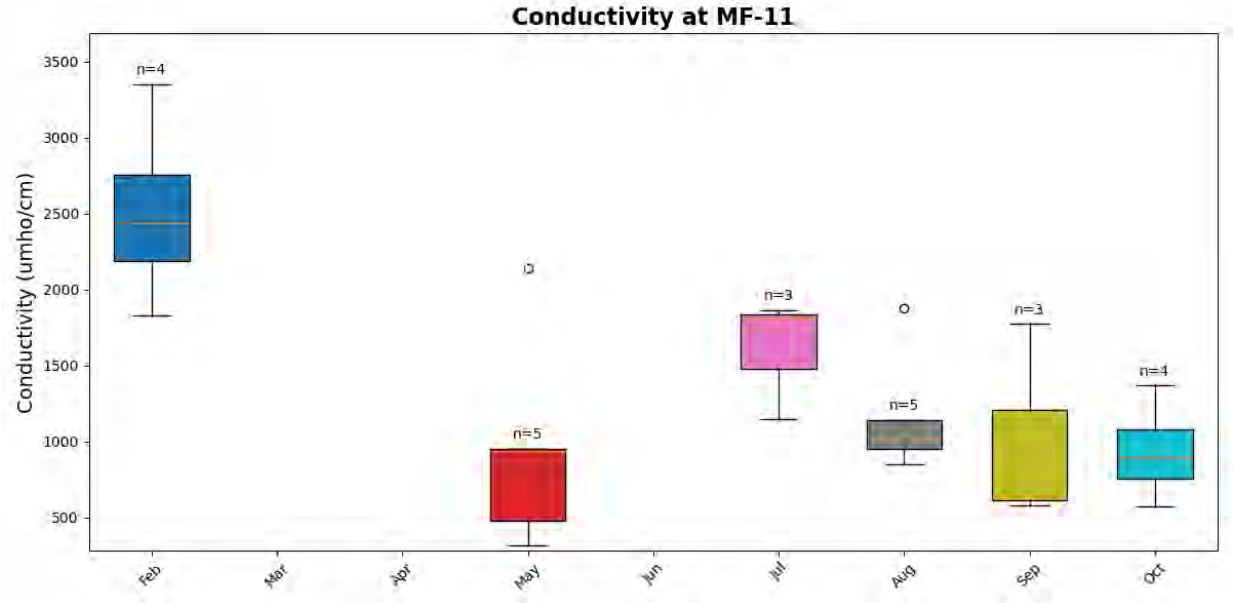


Figure C-82: Monthly Box Plot for Specific Conductivity at Station MF-12 in Middle Fork

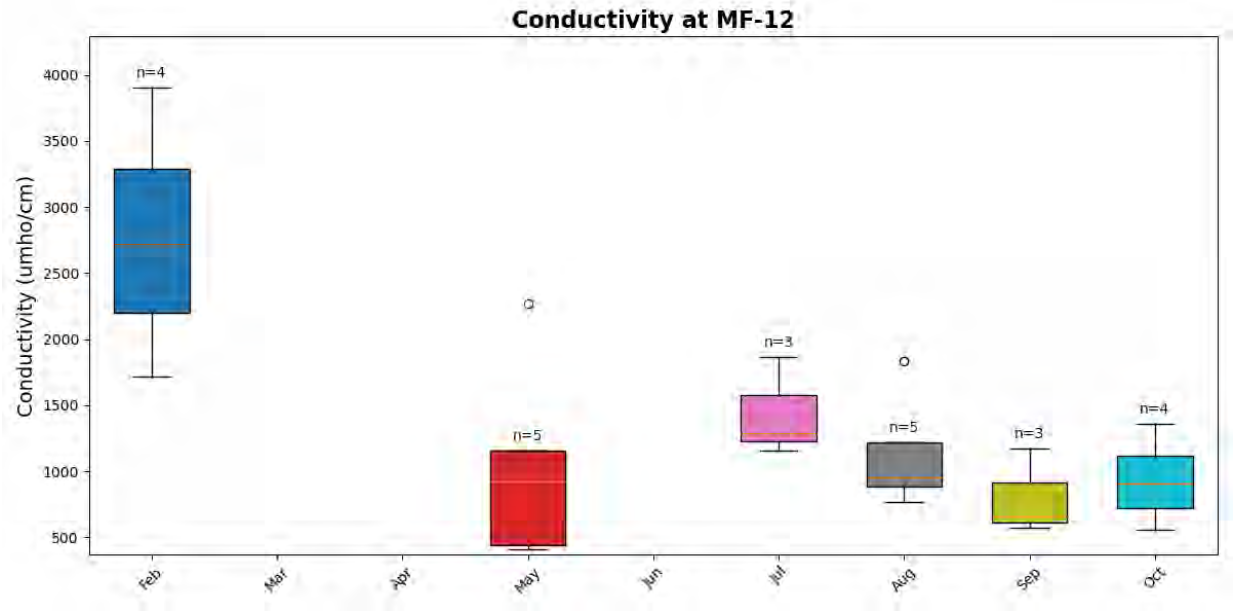


Figure C-83: Monthly Box Plot for Specific Conductivity at Station MF-13 in Middle Fork

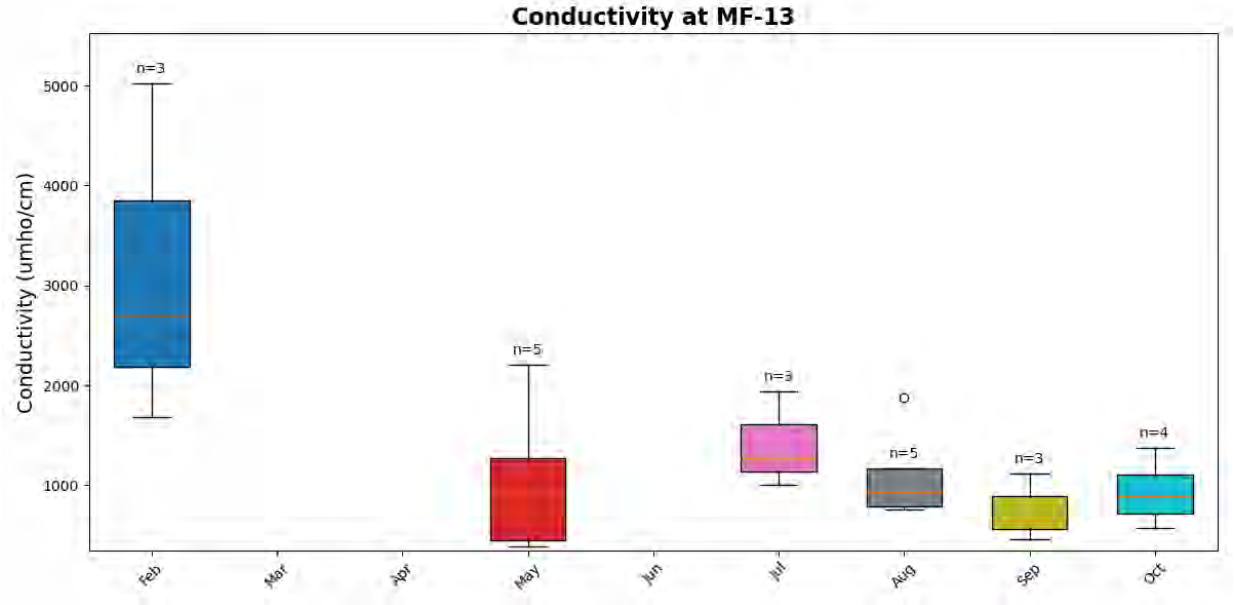


Figure C-84: Monthly Box Plot for Specific Conductivity at Station MF-14 in Middle Fork

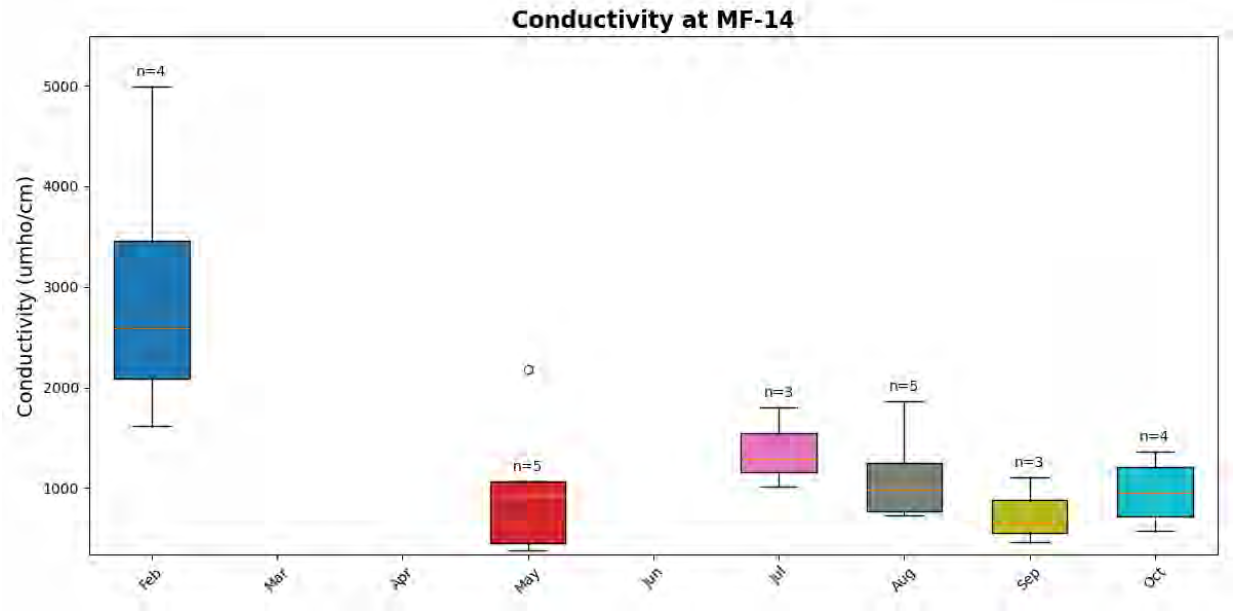


Figure C-85: Monthly Box Plot for Specific Conductivity at Station MF-15 in Middle Fork

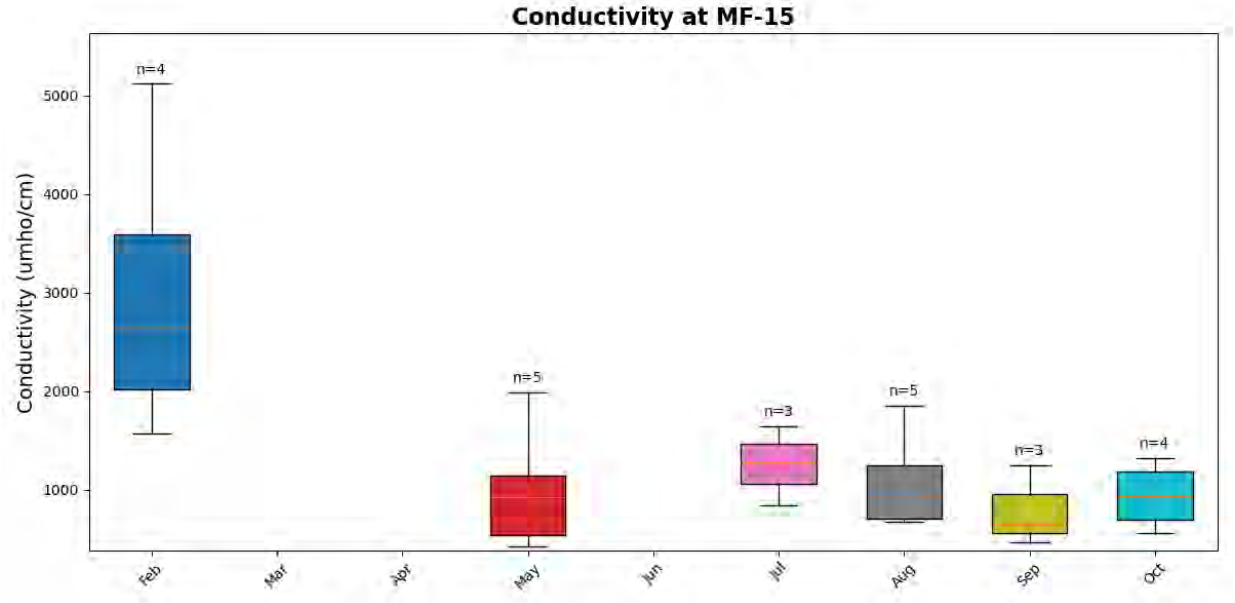


Figure C-86: Monthly Box Plot for Specific Conductivity at Station MF-16 in Middle Fork

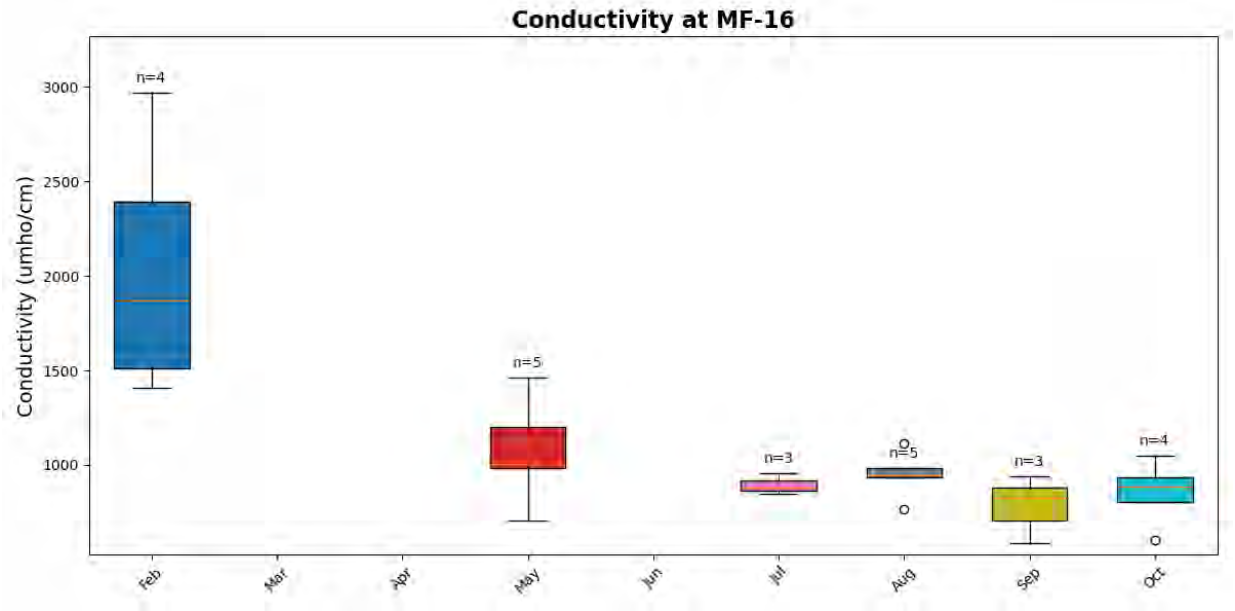


Figure C-87: Monthly Box Plot for Specific Conductivity at Station MF-17 in Middle Fork

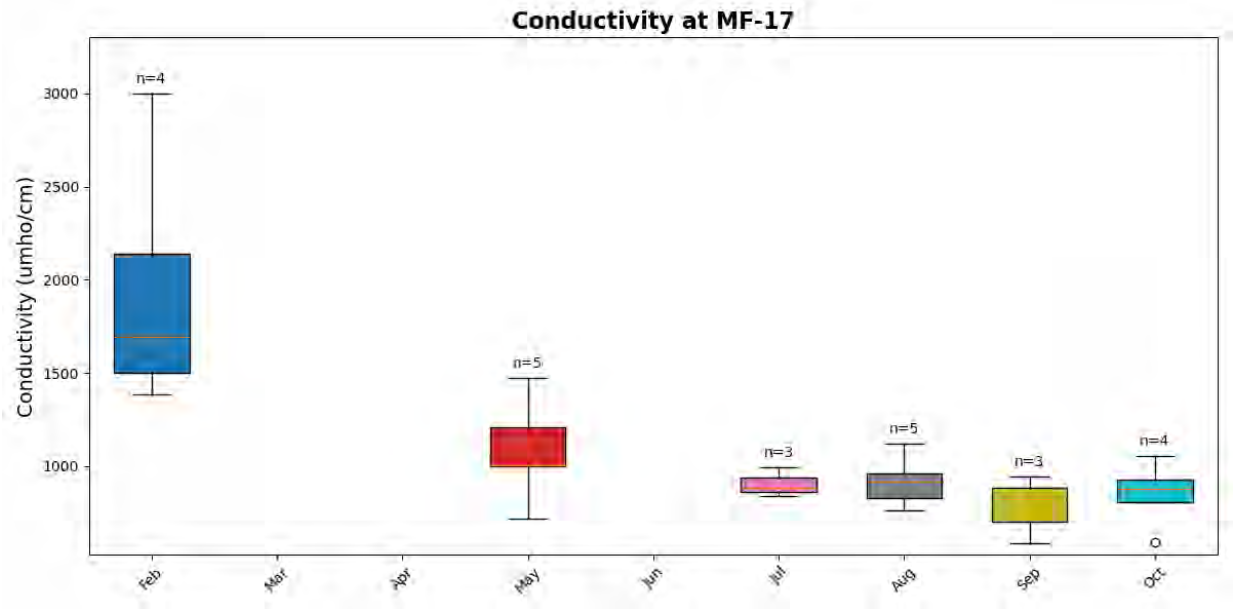
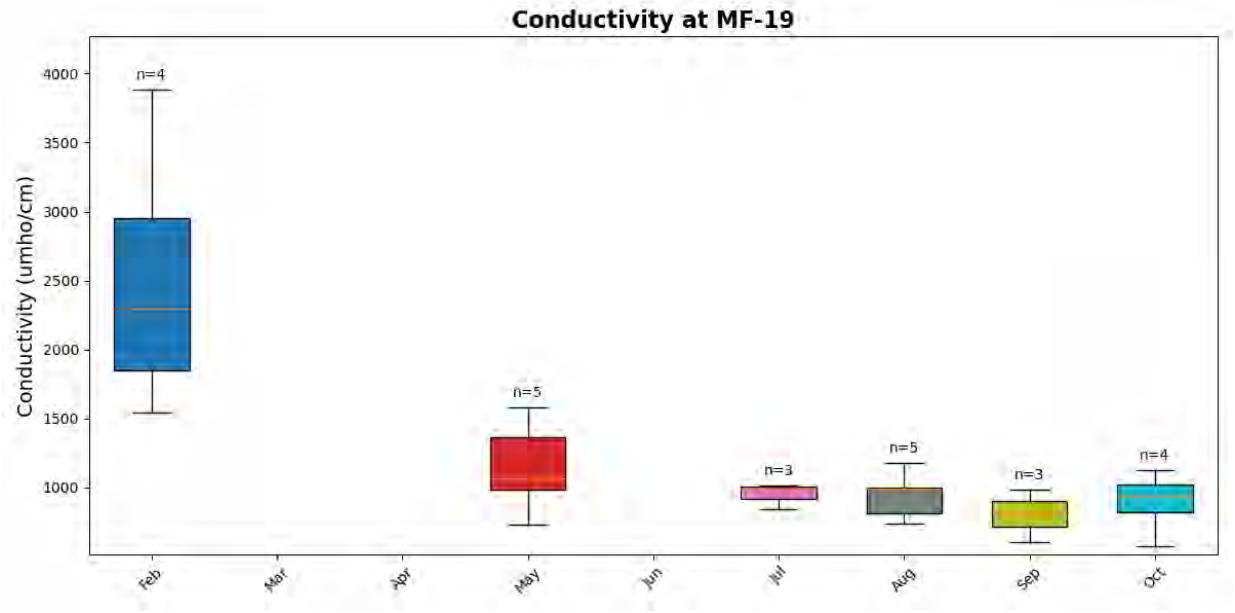


Figure C-88: Monthly Box Plot for Specific Conductivity at Station MF-19 in Middle Fork



Chloride

Figure C-89: Monthly Box Plot for Chloride at Station MF-08 in Middle Fork

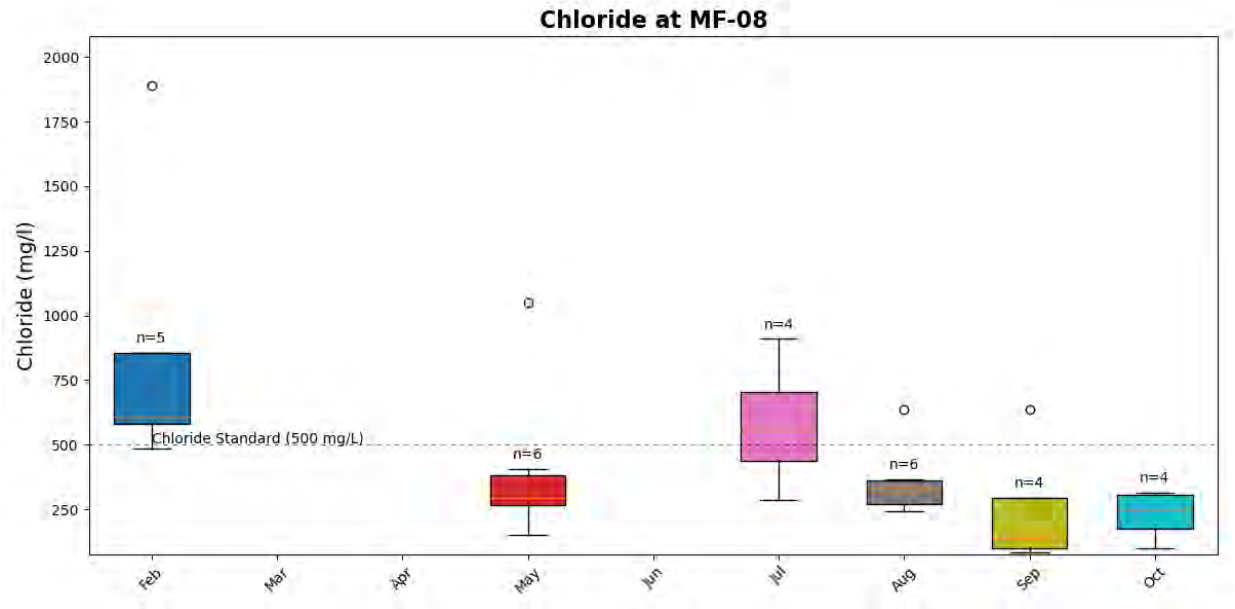


Figure C-90: Monthly Box Plot for Chloride at Station MF-09 in Middle Fork

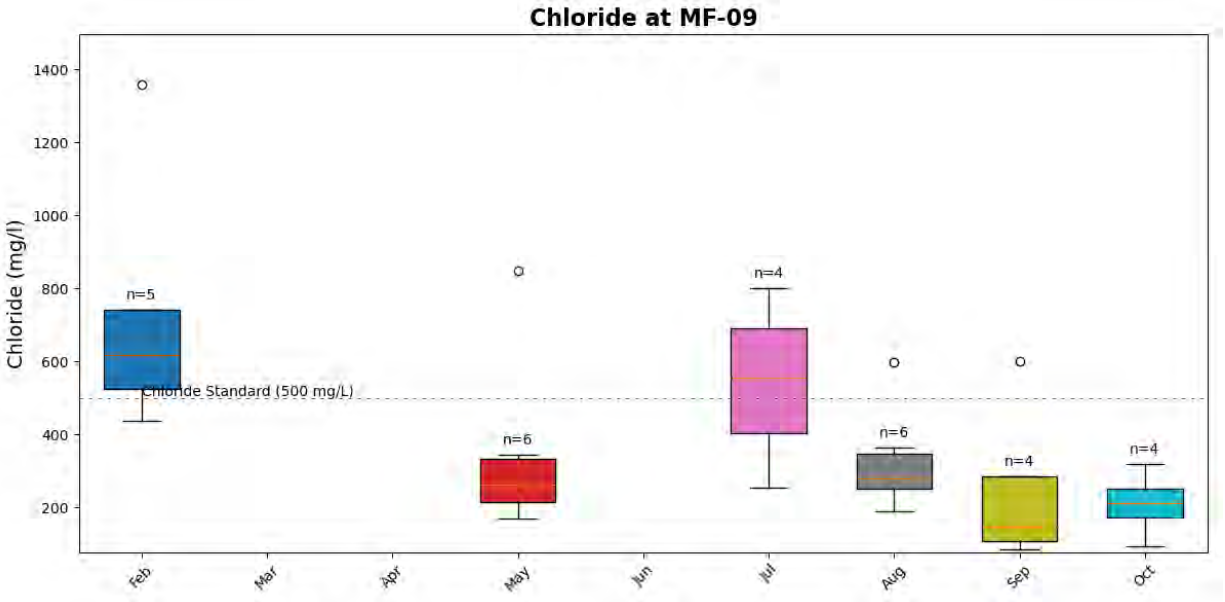


Figure C-91: Monthly Box Plot for Chloride at Station MF-10 in Middle Fork

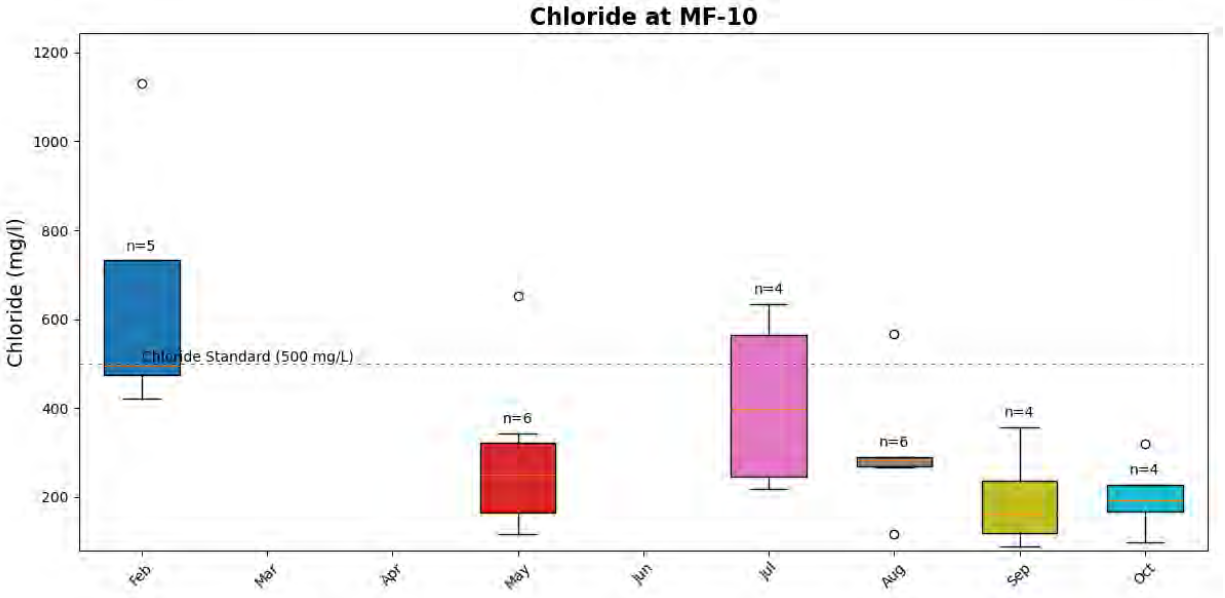


Figure C-92: Monthly Box Plot for Chloride at Station MF-11 in Middle Fork

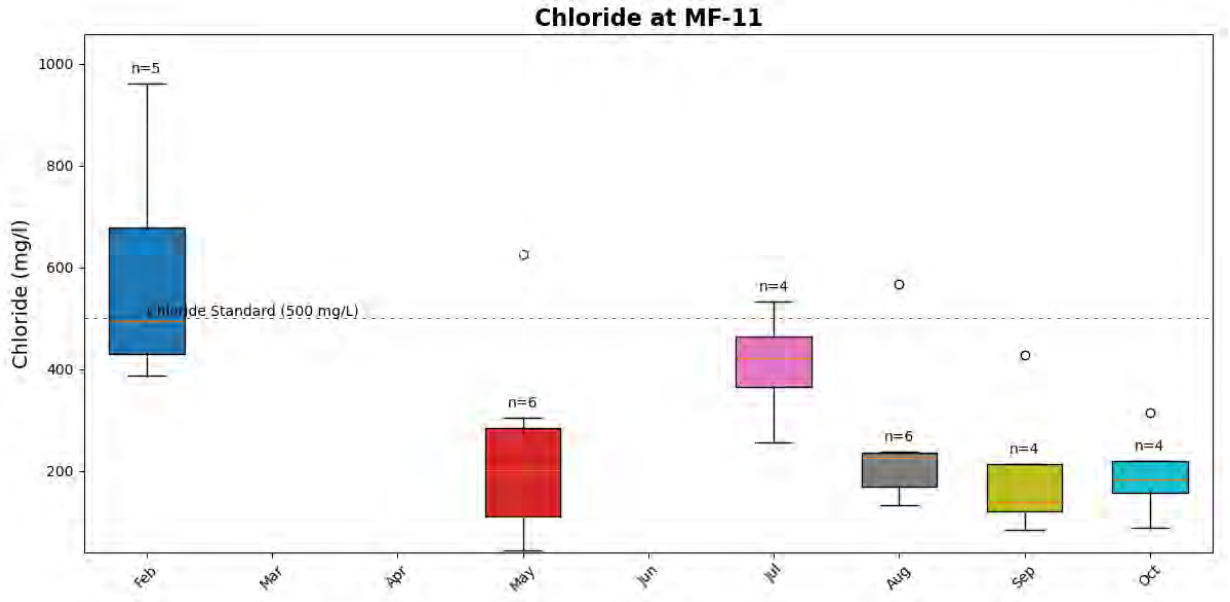


Figure C-93: Monthly Box Plot for Chloride at Station MF-12 in Middle Fork

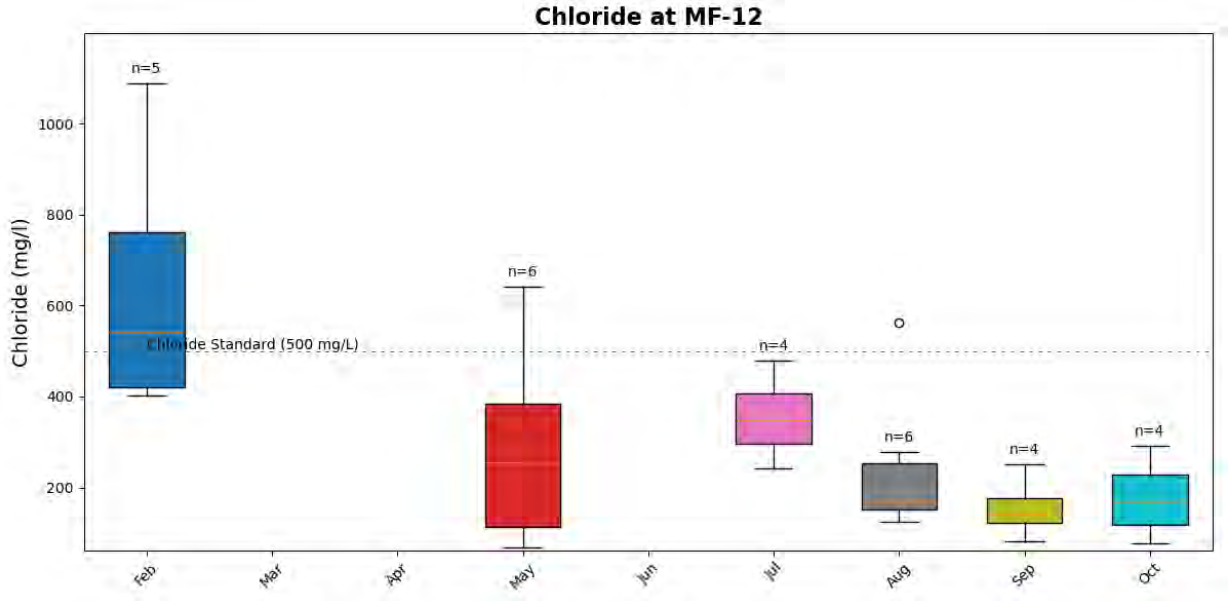


Figure C-94: Monthly Box Plot for Chloride at Station MF-13 in Middle Fork

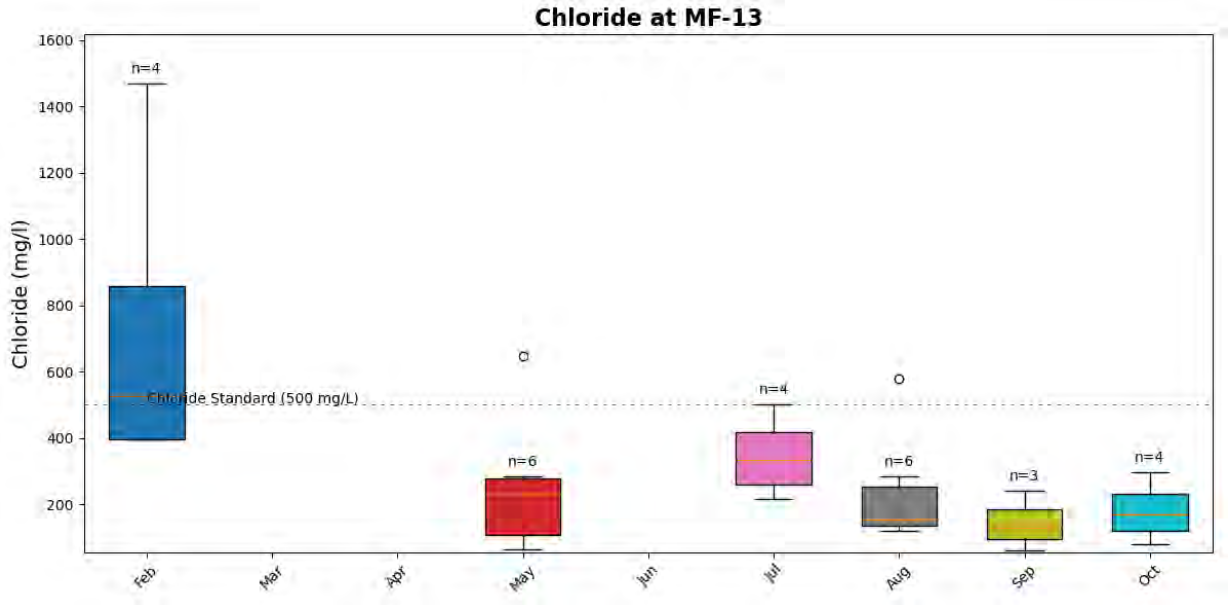


Figure C-95: Monthly Box Plot for Chloride at Station MF-14 in Middle Fork

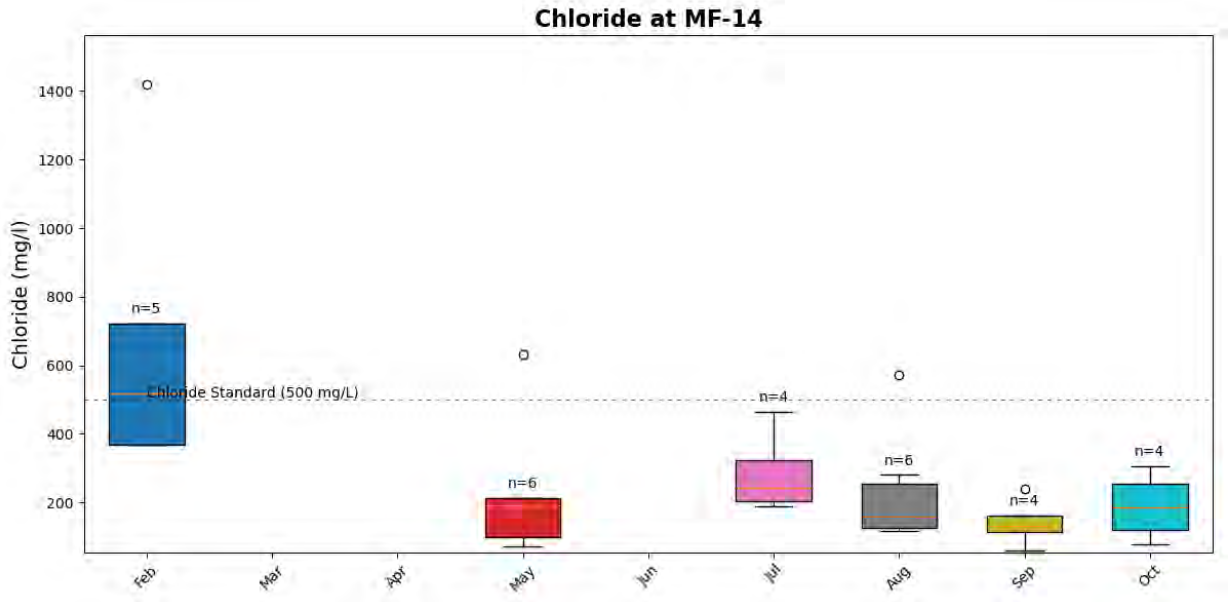


Figure C-96: Monthly Box Plot for Chloride at Station MF-15 in Middle Fork

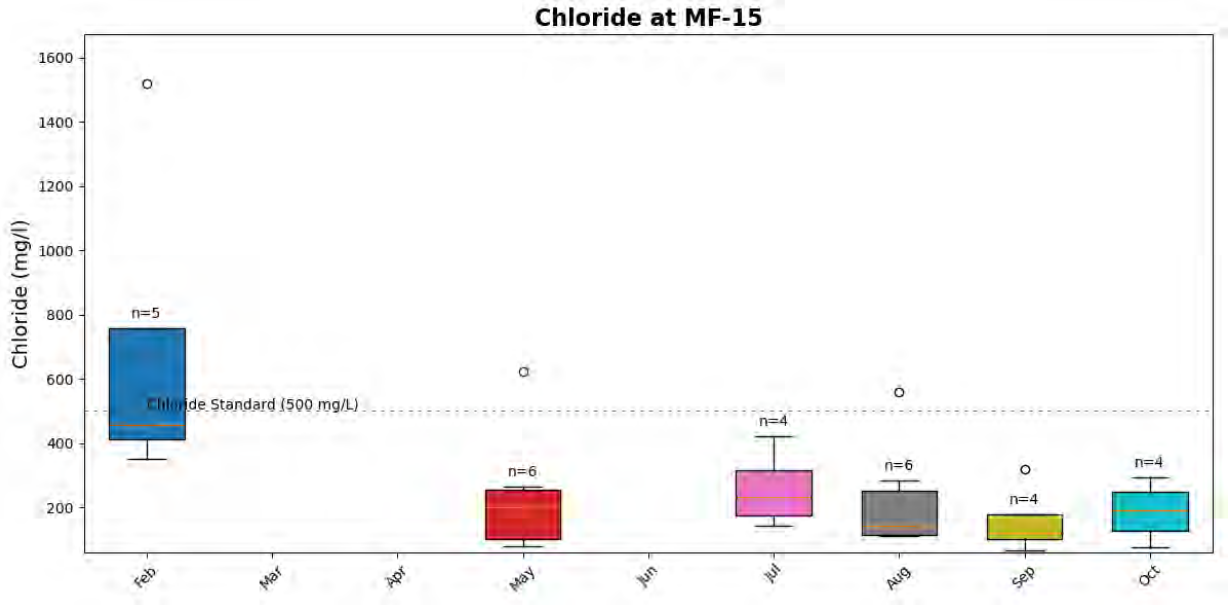


Figure C-97: Monthly Box Plot for Chloride at Station MF-16 in Middle Fork

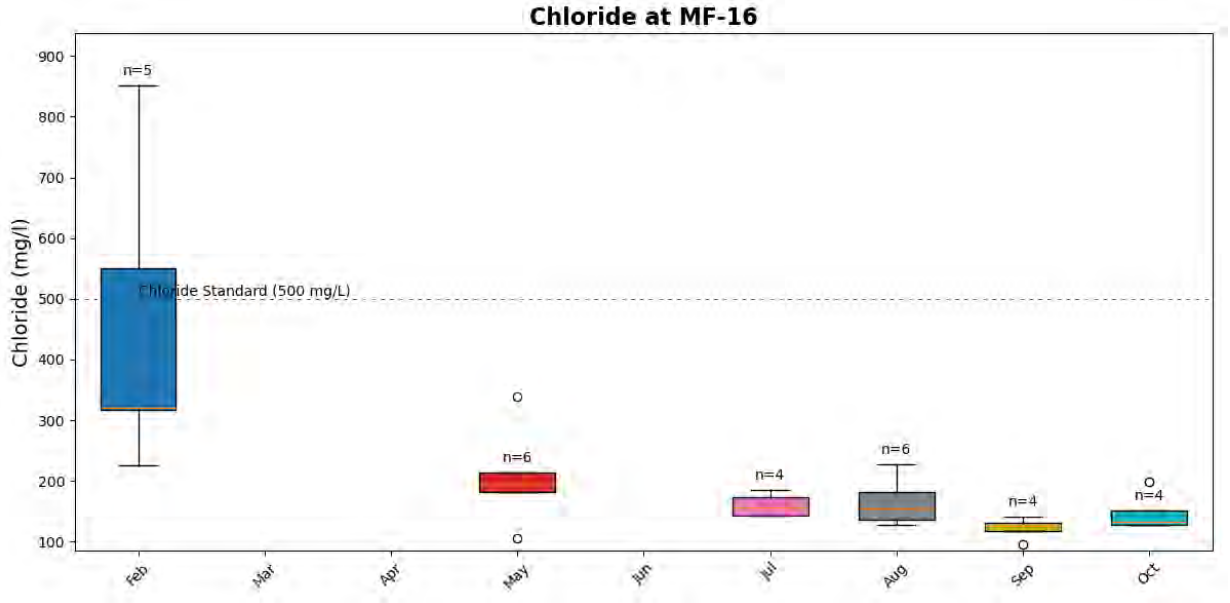


Figure C-98: Monthly Box Plot for Chloride at Station MF-17 in Middle Fork

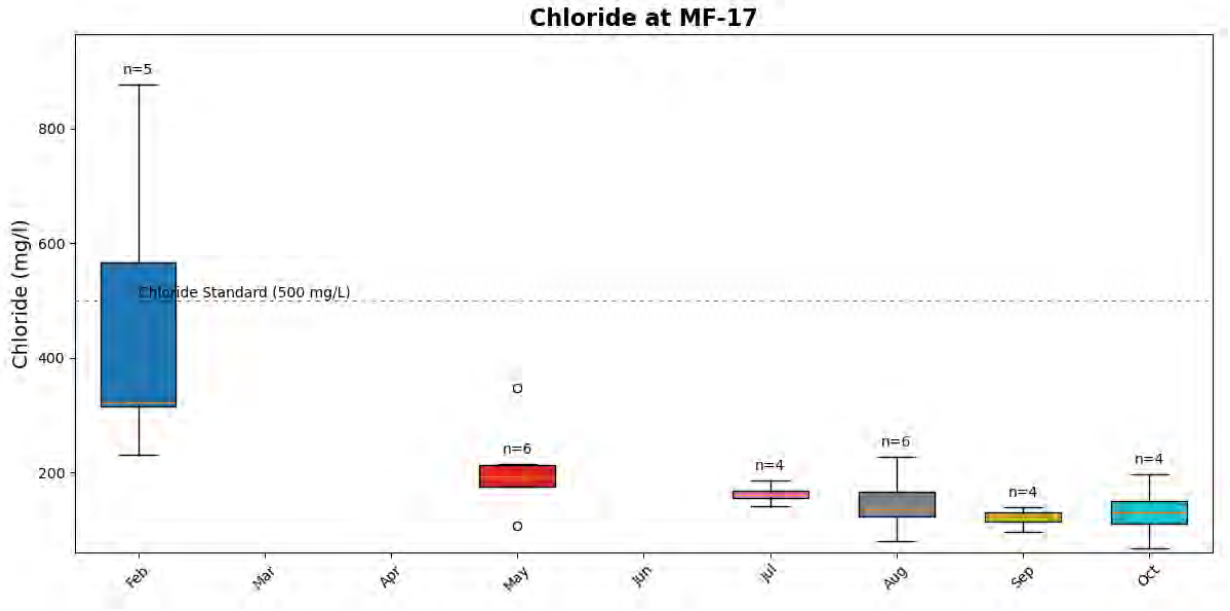
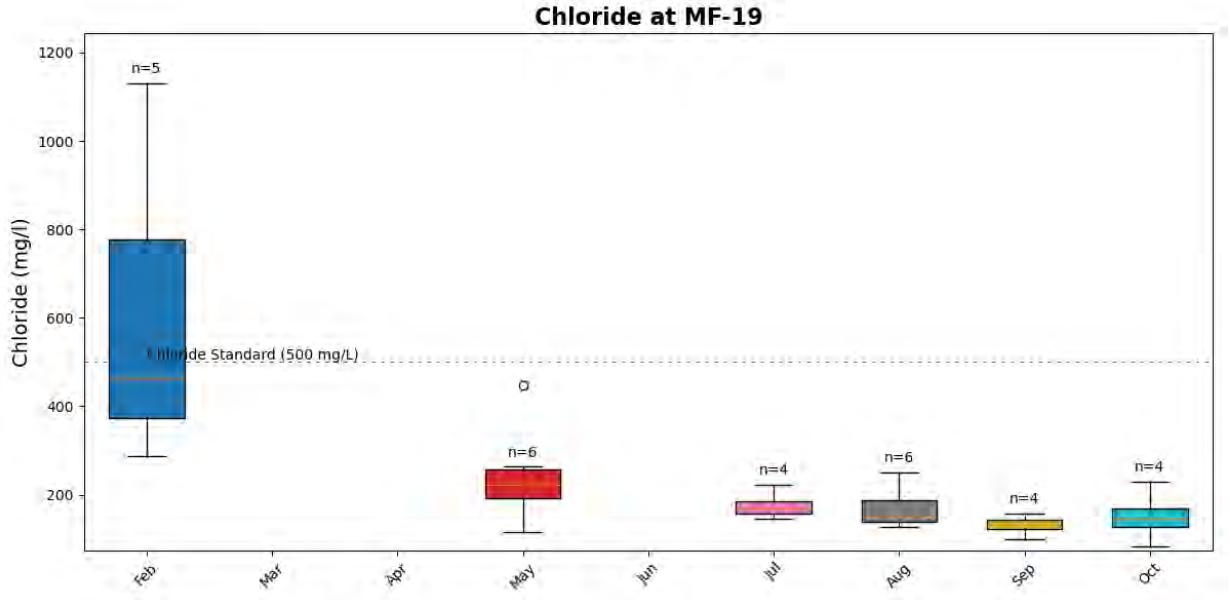


Figure C-99: Monthly Box Plot for Chloride at Station MF-19 in Middle Fork



Total Suspended Solids

Figure C-100: Monthly Box Plot for Total Suspended Solids at Station MF-08 in Middle Fork

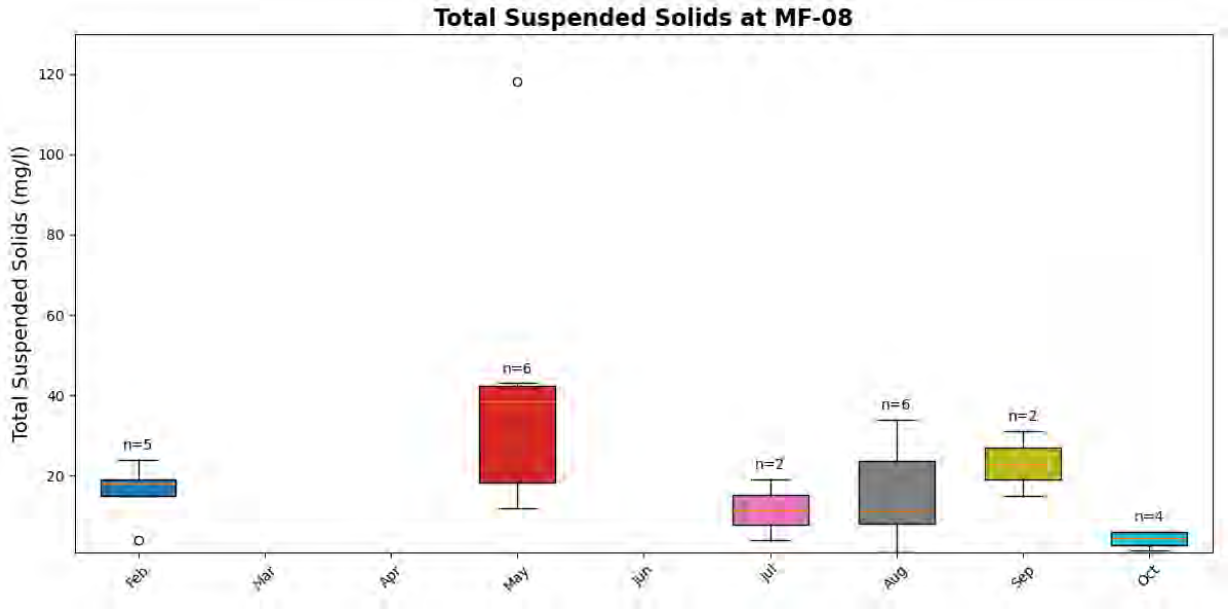


Figure C-101: Monthly Box Plot for Total Suspended Solids at Station MF-09 in Middle Fork

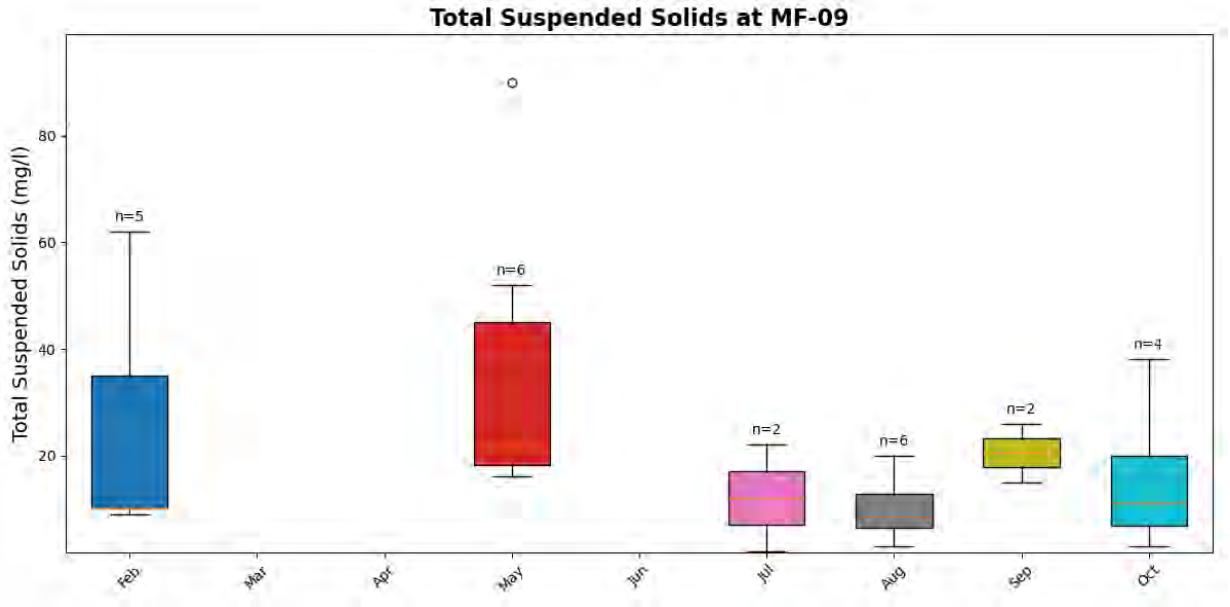


Figure C-102: Monthly Box Plot for Total Suspended Solids at Station MF-10 in Middle Fork

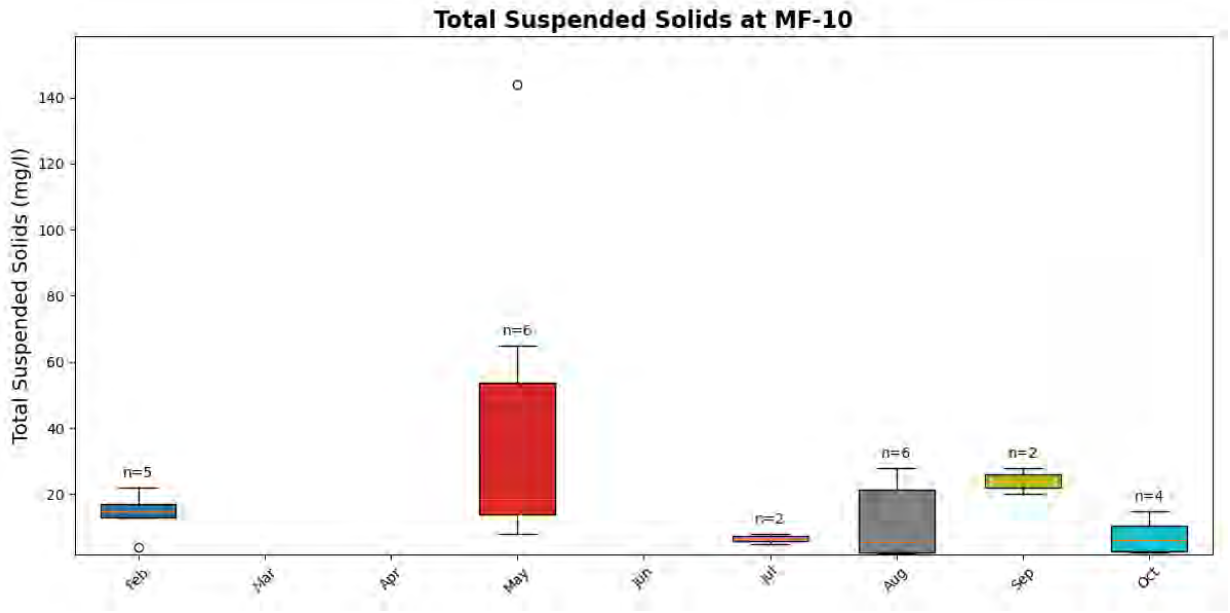


Figure C-103: Monthly Box Plot for Total Suspended Solids at Station MF-11 in Middle Fork

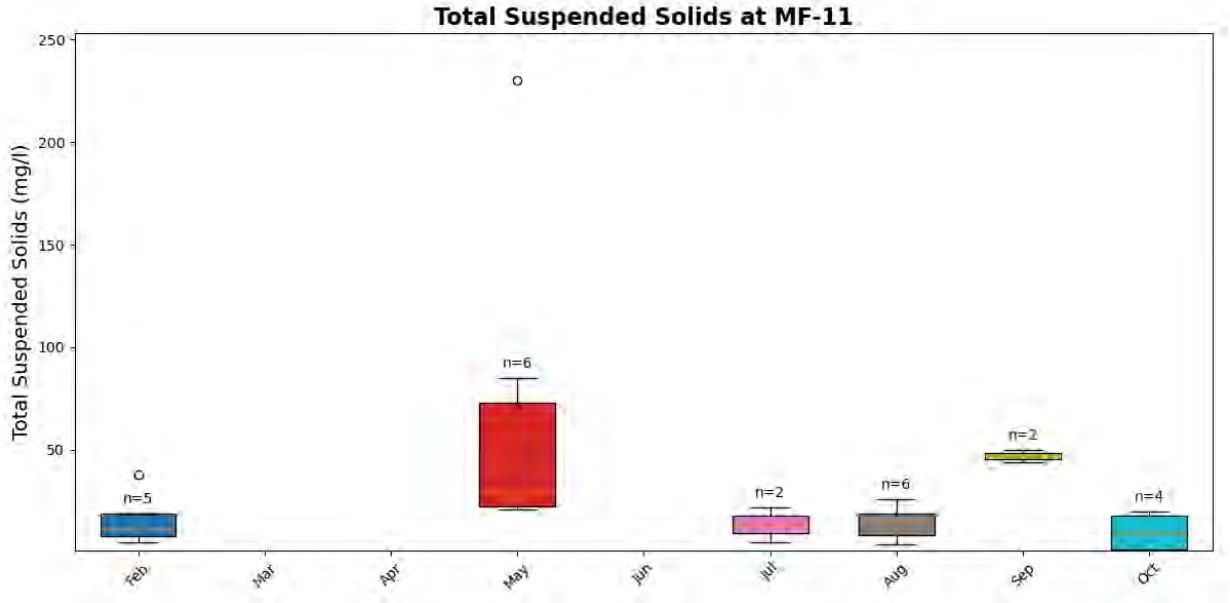


Figure C-104: Monthly Box Plot for Total Suspended Solids at Station MF-12 in Middle Fork

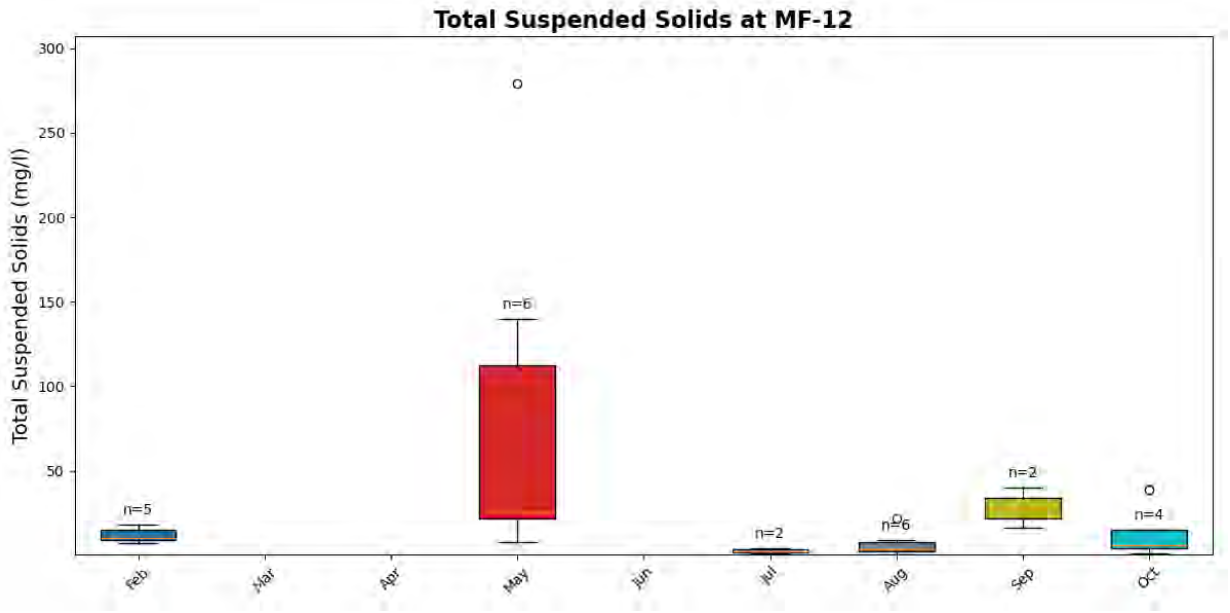


Figure C-105: Monthly Box Plot for Total Suspended Solids at Station MF-13 in Middle Fork

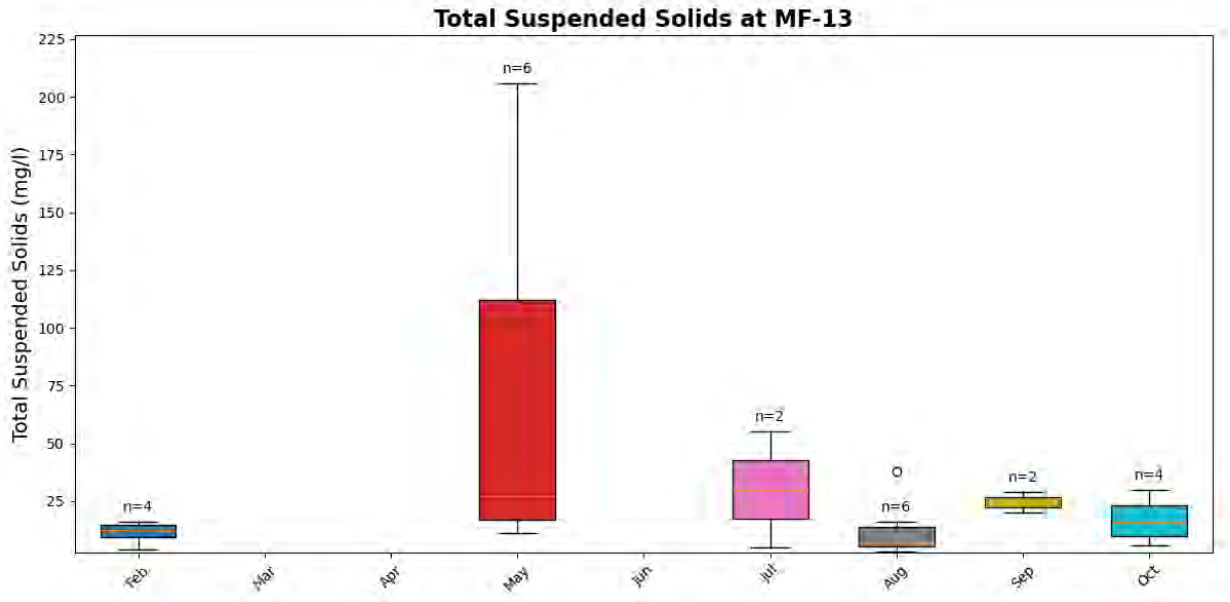


Figure C-106: Monthly Box Plot for Total Suspended Solids at Station MF-14 in Middle Fork

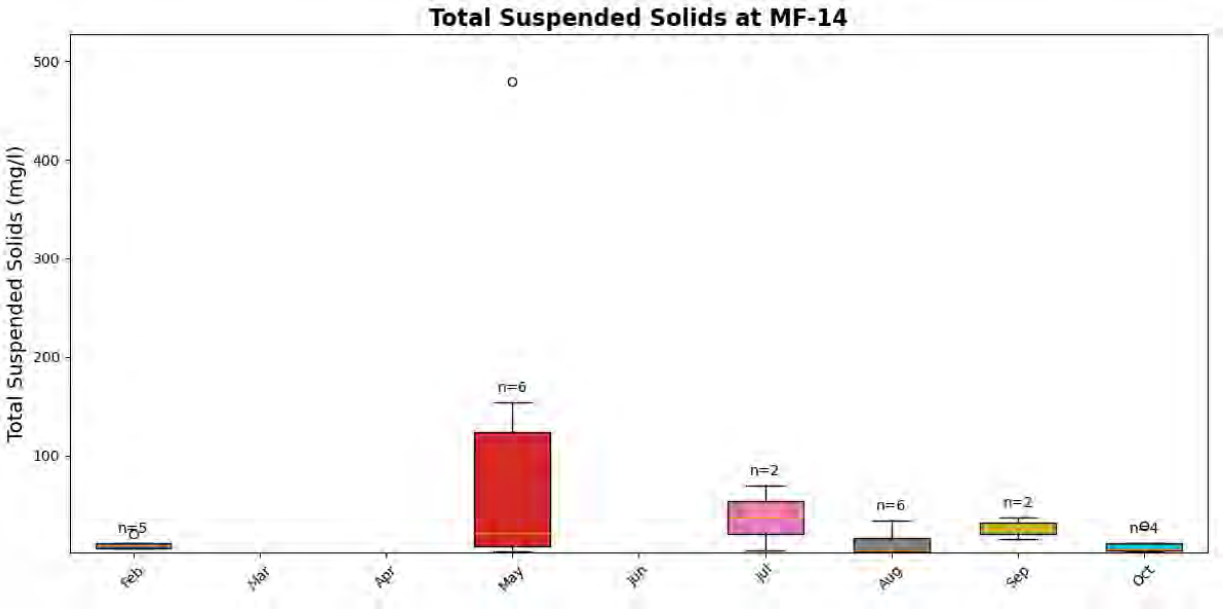


Figure C-107: Monthly Box Plot for Total Suspended Solids at Station MF-15 in Middle Fork

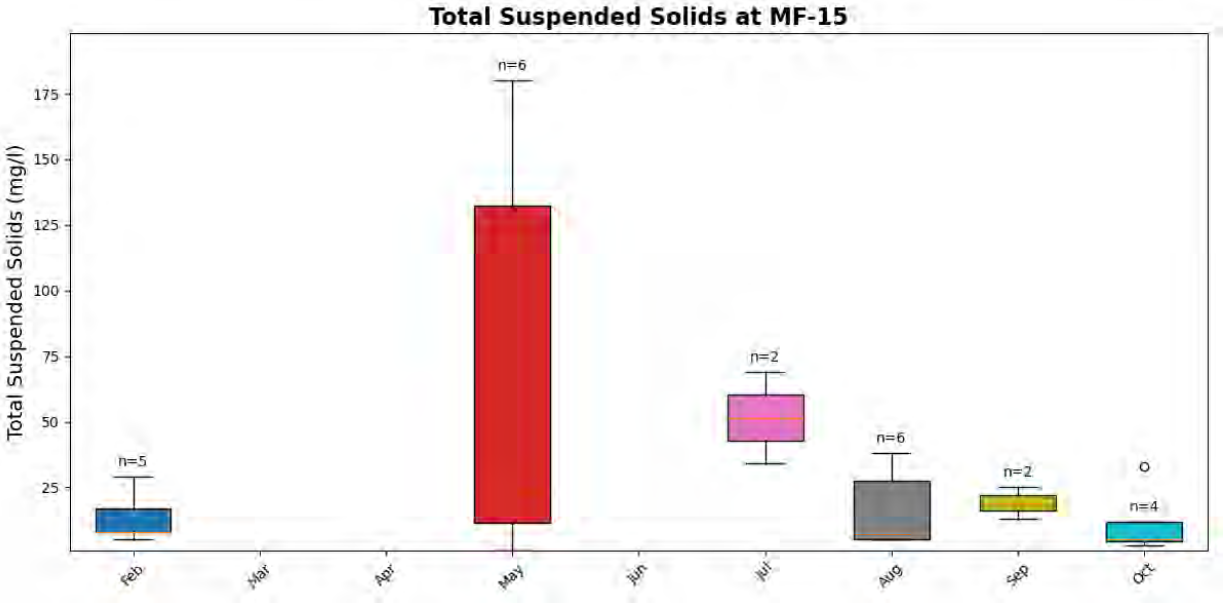


Figure C-108: Monthly Box Plot for Total Suspended Solids at Station MF-16 in Middle Fork

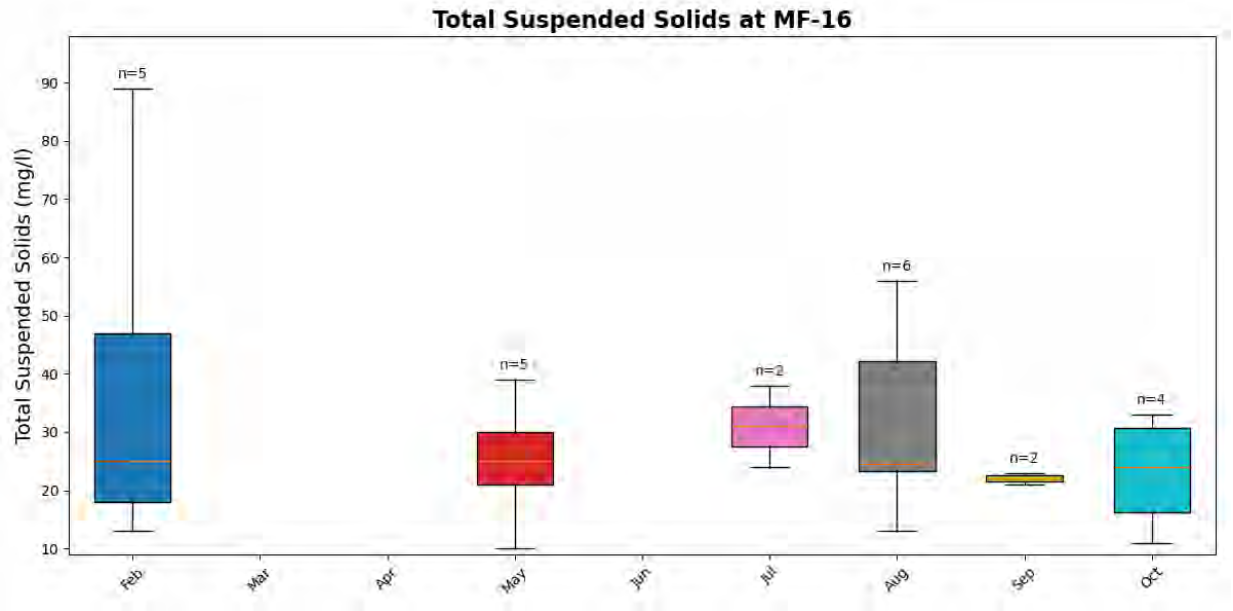


Figure C-109: Monthly Box Plot for Total Suspended Solids at Station MF-17 in Middle Fork

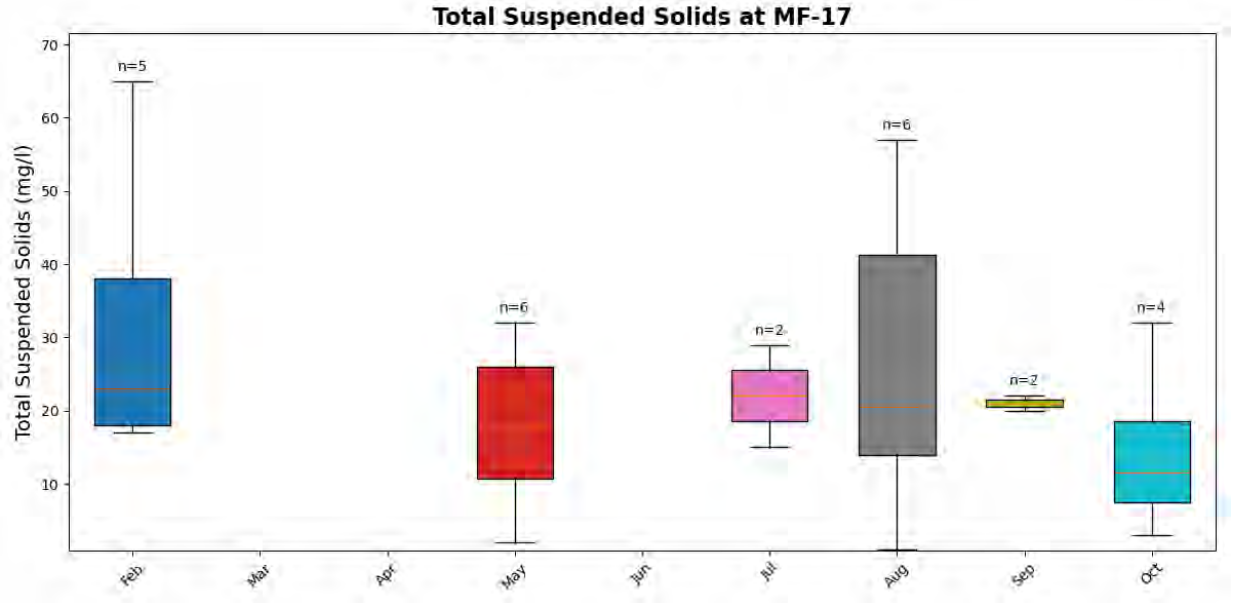
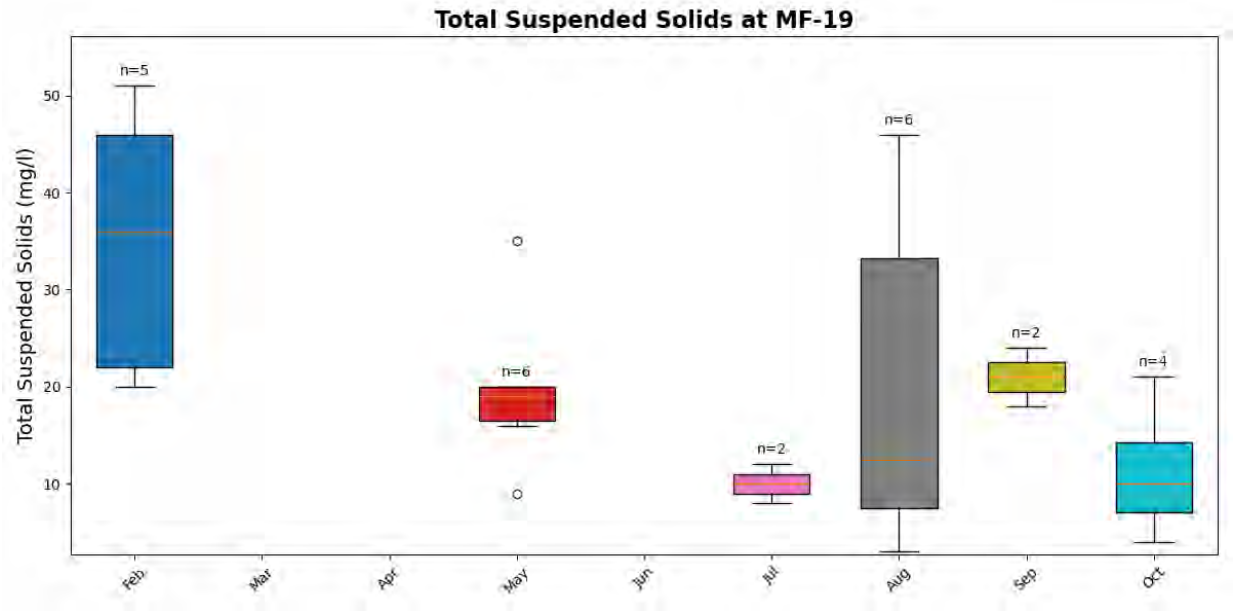


Figure C-110: Monthly Box Plot for Total Suspended Solids at Station MF-19 in Middle Fork



Ammonia

Figure C-111: Monthly Box Plot for Ammonia at Station MF-08 in Middle Fork

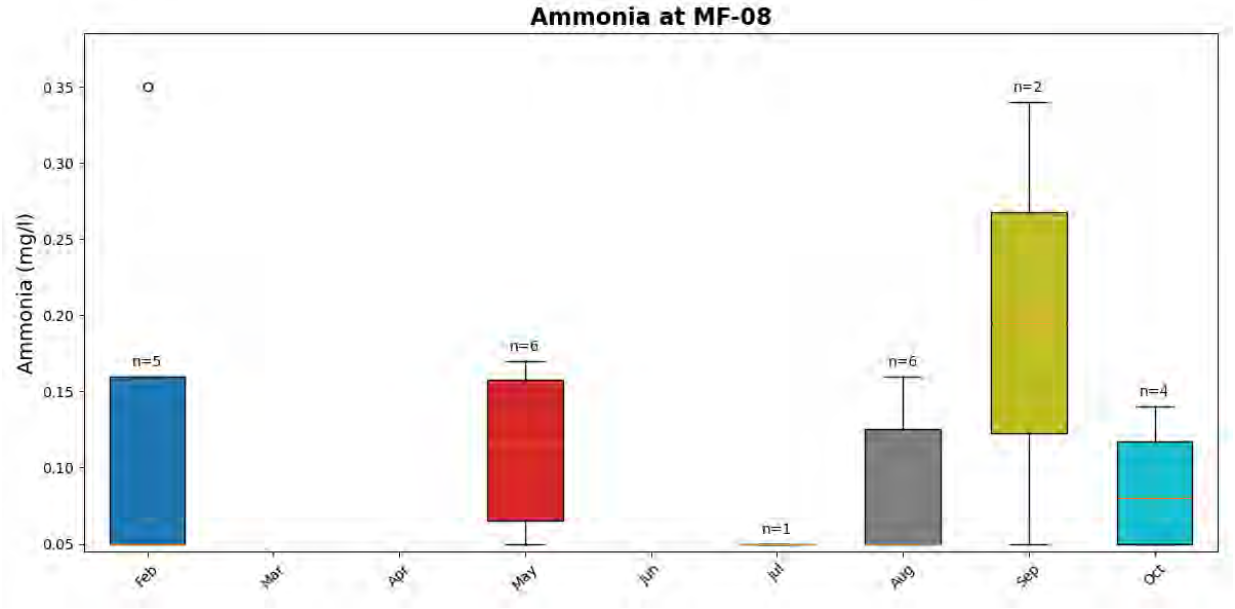


Figure C-112: Monthly Box Plot for Ammonia at Station MF-09 in Middle Fork

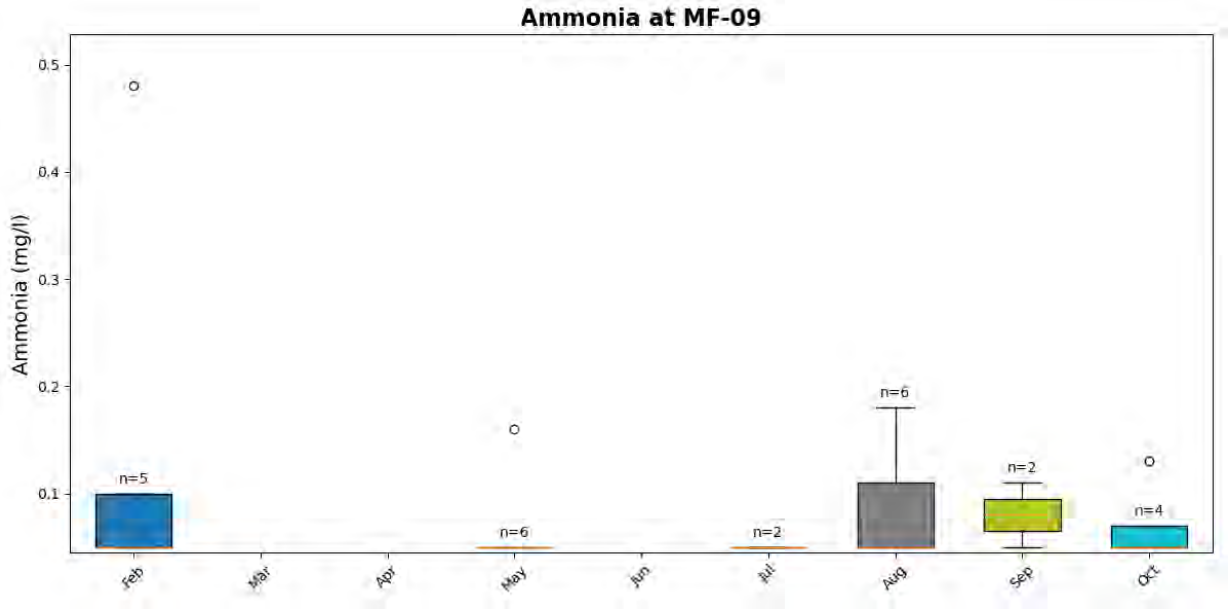


Figure C-113: Monthly Box Plot for Ammonia at Station MF-10 in Middle Fork

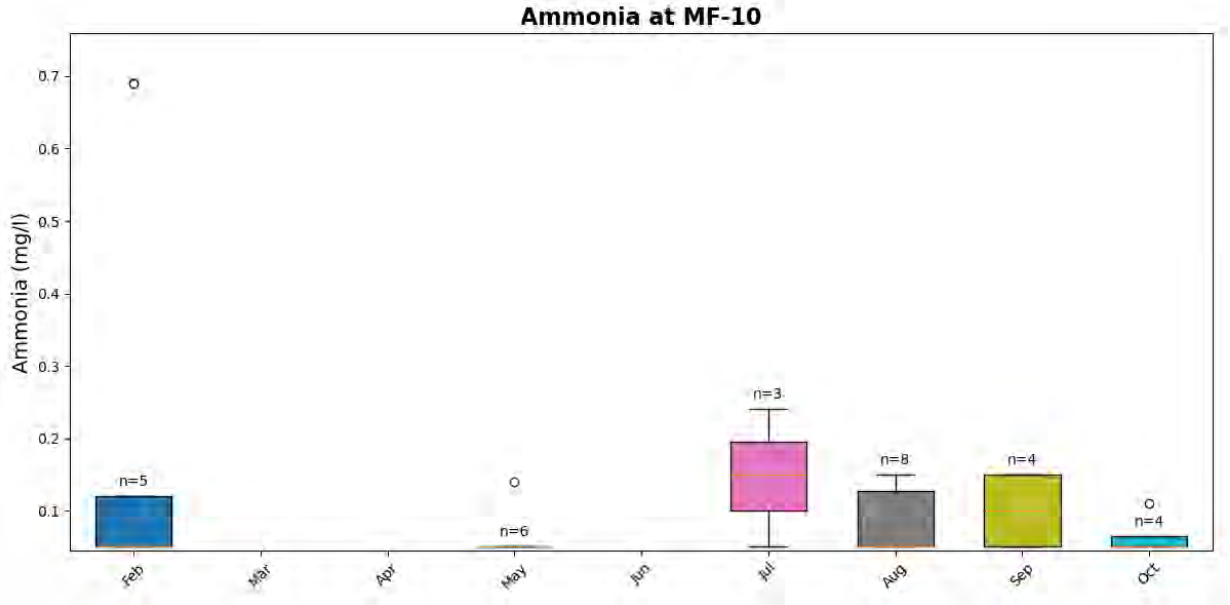


Figure C-114: Monthly Box Plot for Ammonia at Station MF-11 in Middle Fork

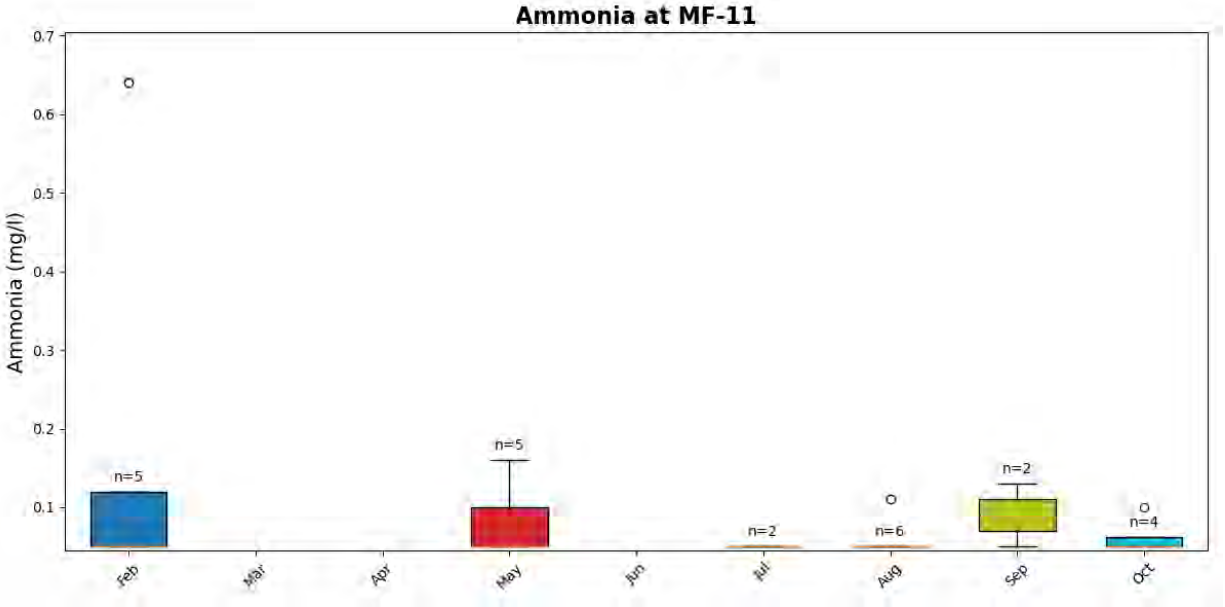


Figure C-115: Monthly Box Plot for Ammonia at Station MF-12 in Middle Fork

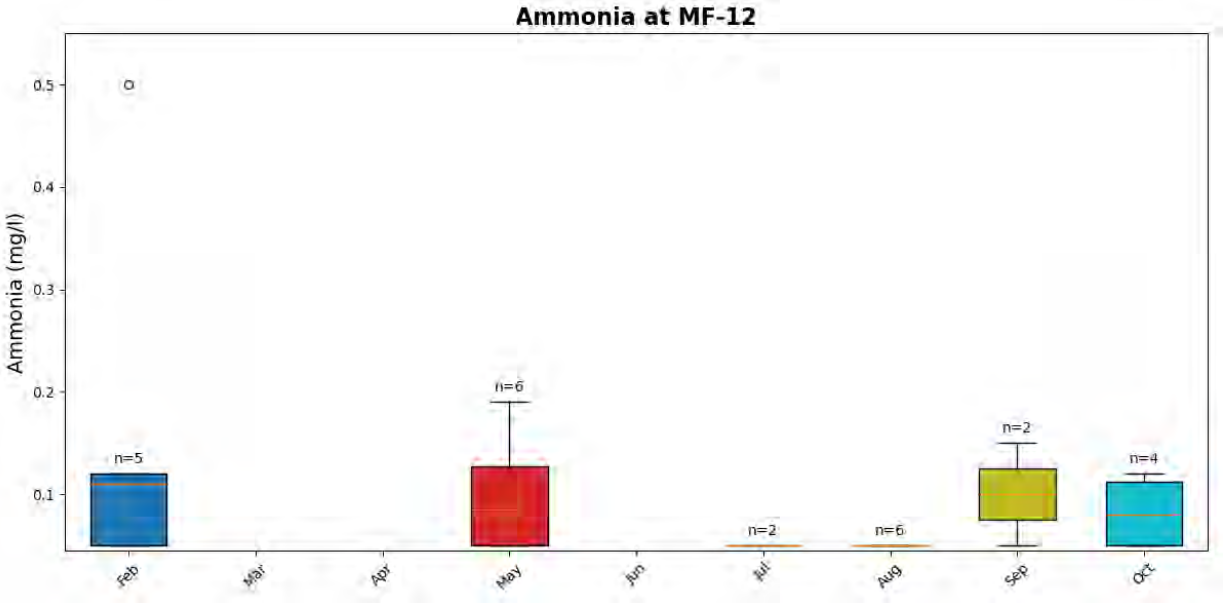


Figure C-116: Monthly Box Plot for Ammonia at Station MF-13 in Middle Fork

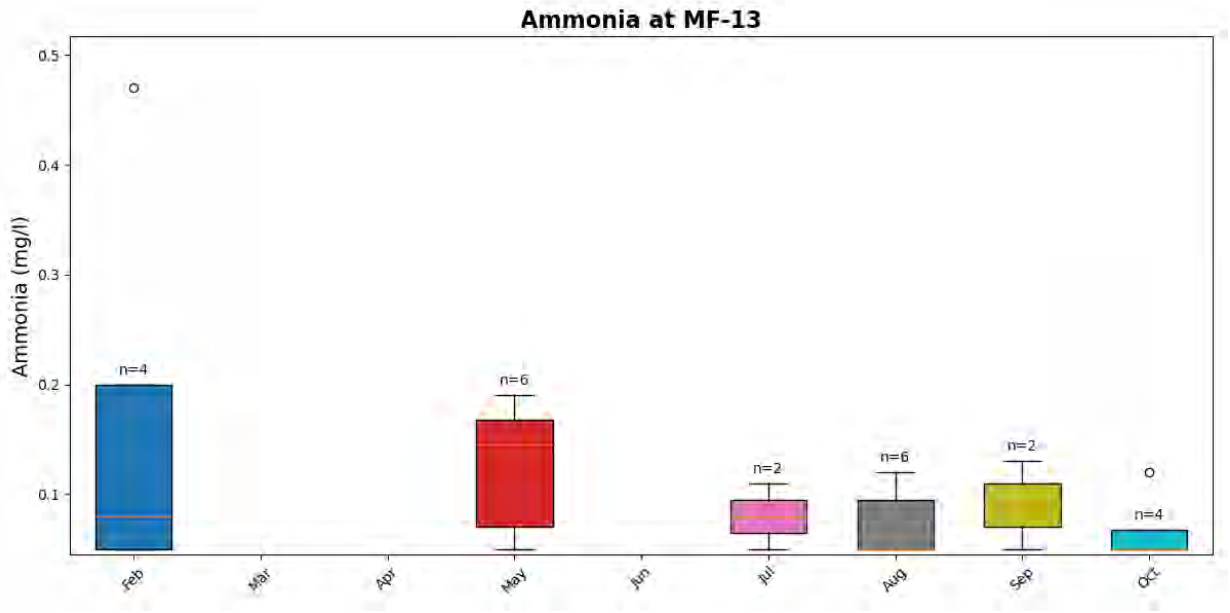


Figure C-117: Monthly Box Plot for Ammonia at Station MF-14 in Middle Fork

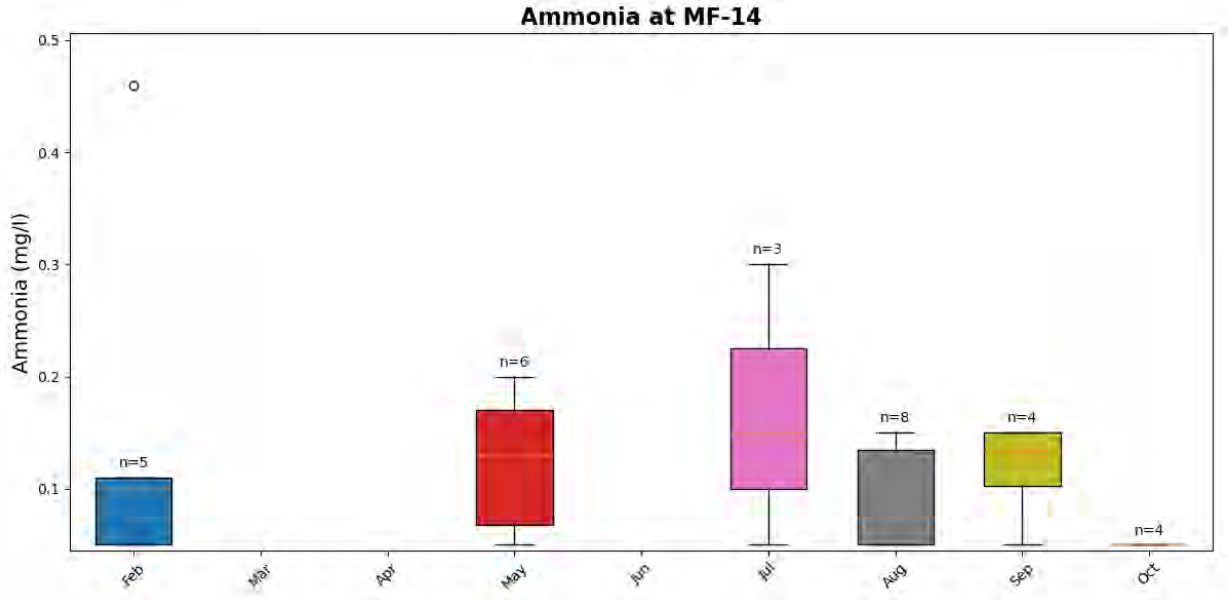


Figure C-118: Monthly Box Plot for Ammonia at Station MF-15 in Middle Fork

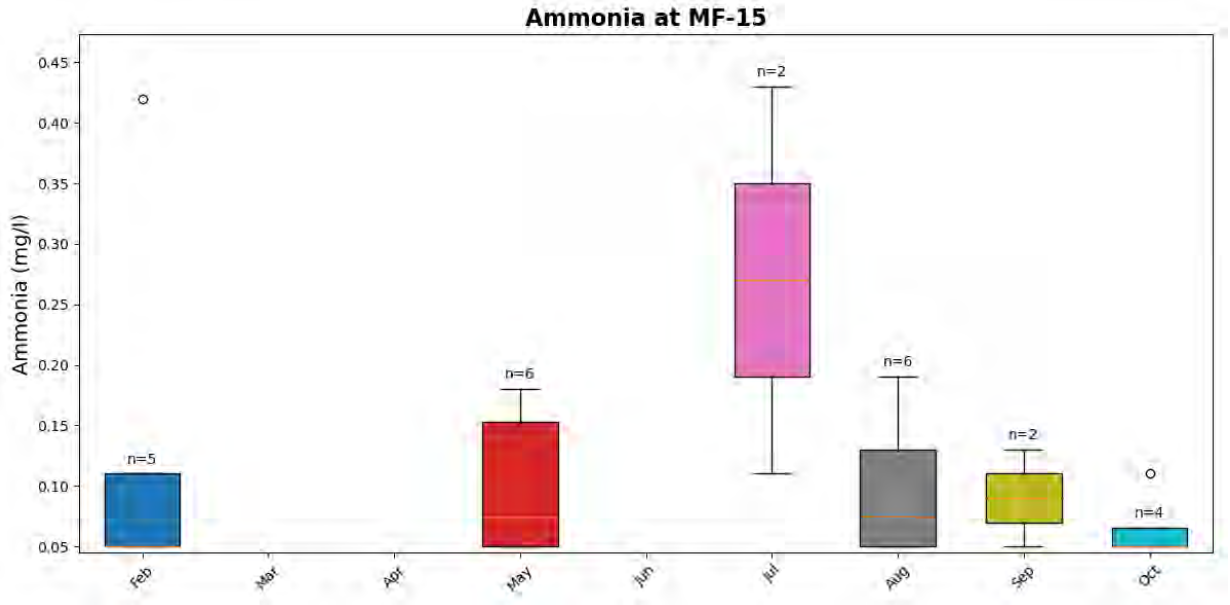


Figure C-119: Monthly Box Plot for Ammonia at Station MF-16 in Middle Fork

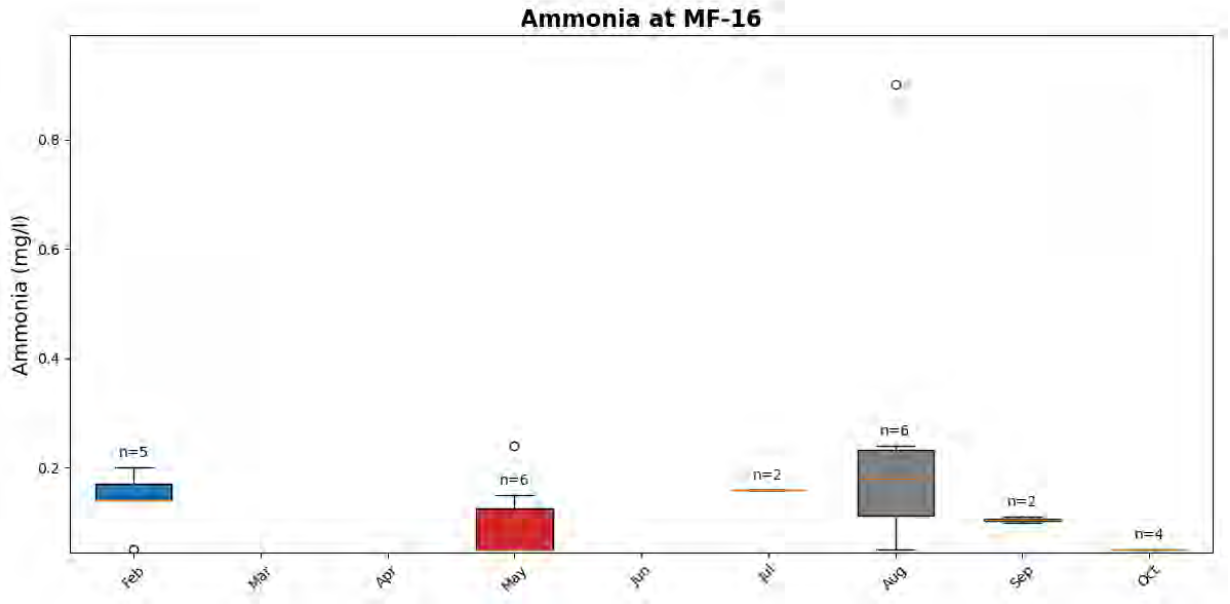


Figure C-120: Monthly Box Plot for Ammonia at Station MF-17 in Middle Fork

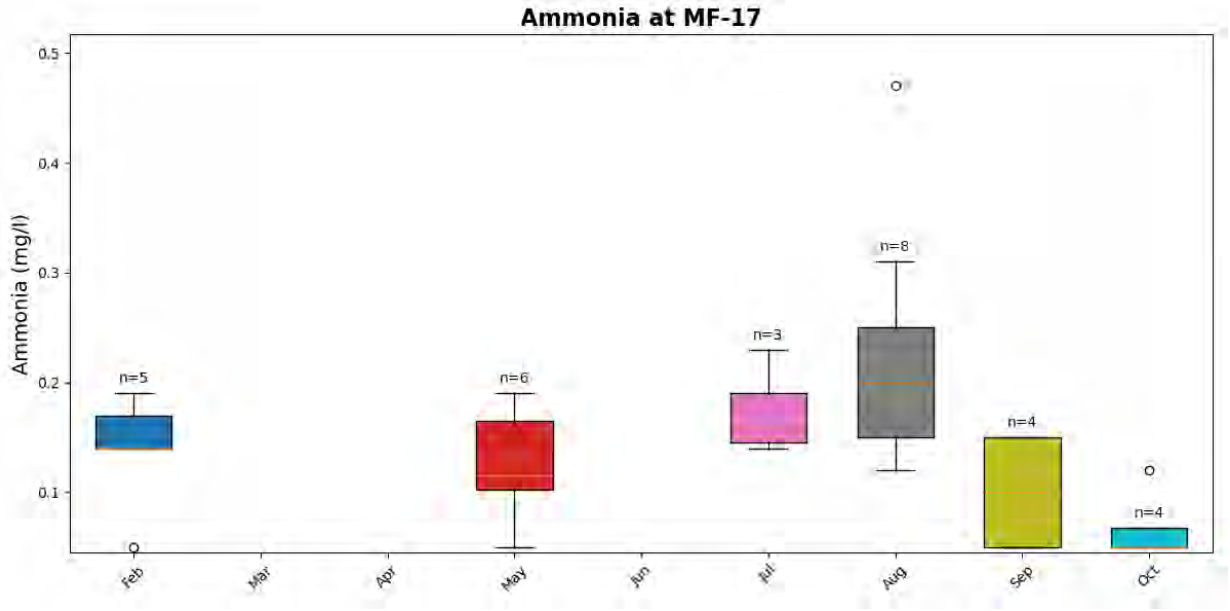
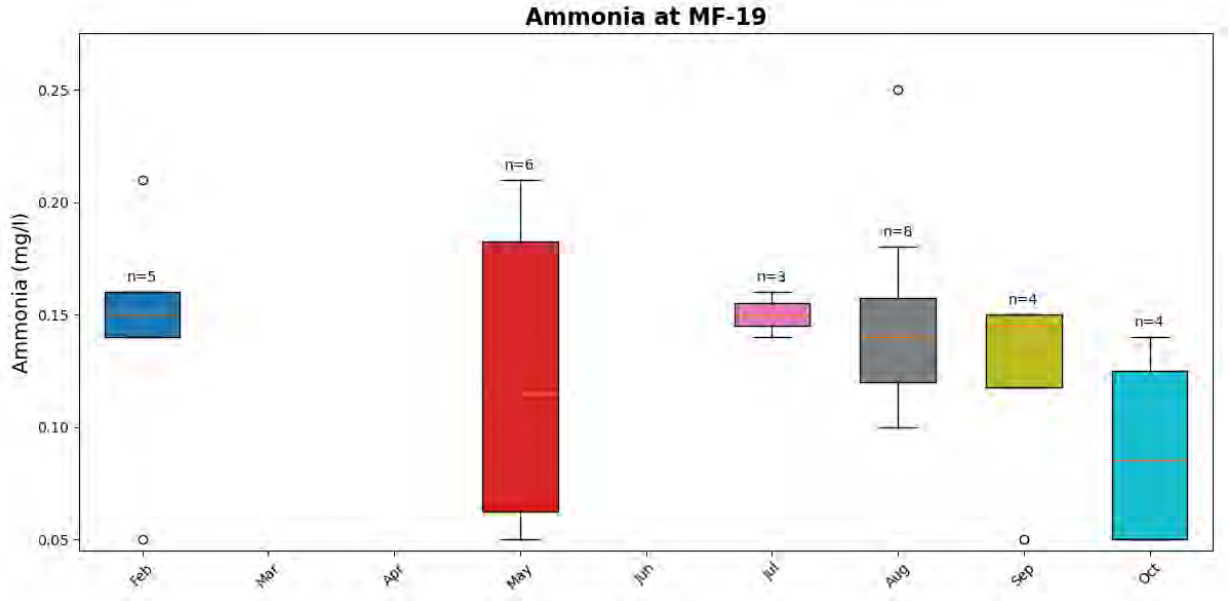


Figure C-121: Monthly Box Plot for Ammonia at Station MF-19 in Middle Fork



Total Nitrates

Figure C-122: Monthly Box Plot for Total Nitrates at Station MF-08 in Middle Fork

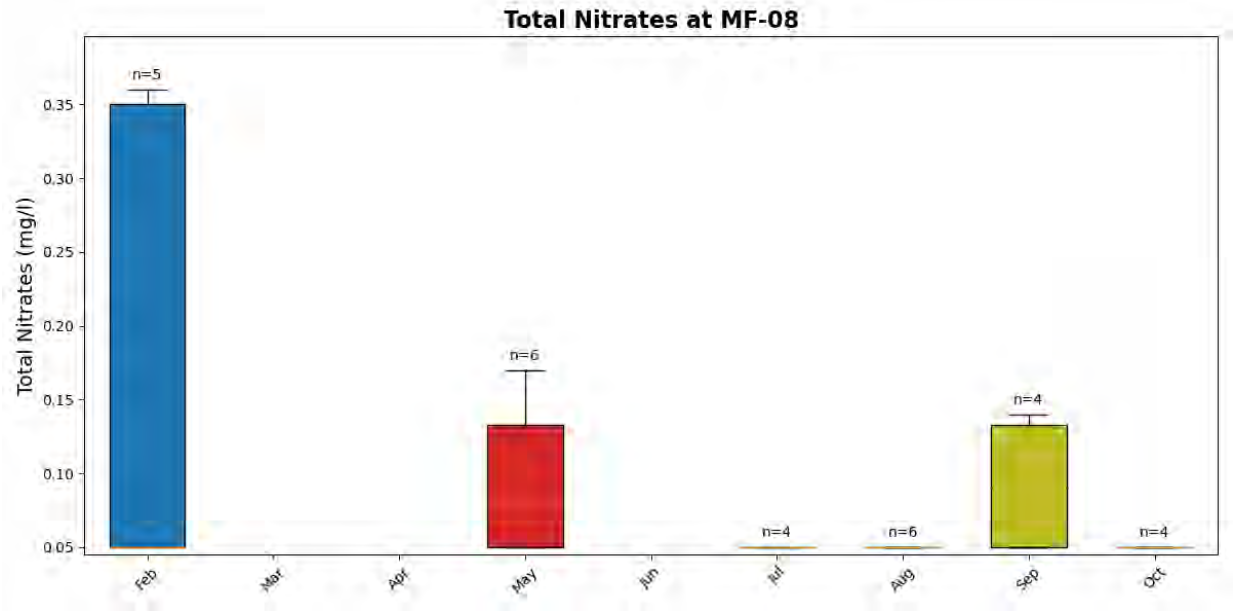


Figure C-123: Monthly Box Plot for Total Nitrates at Station MF-09 in Middle Fork

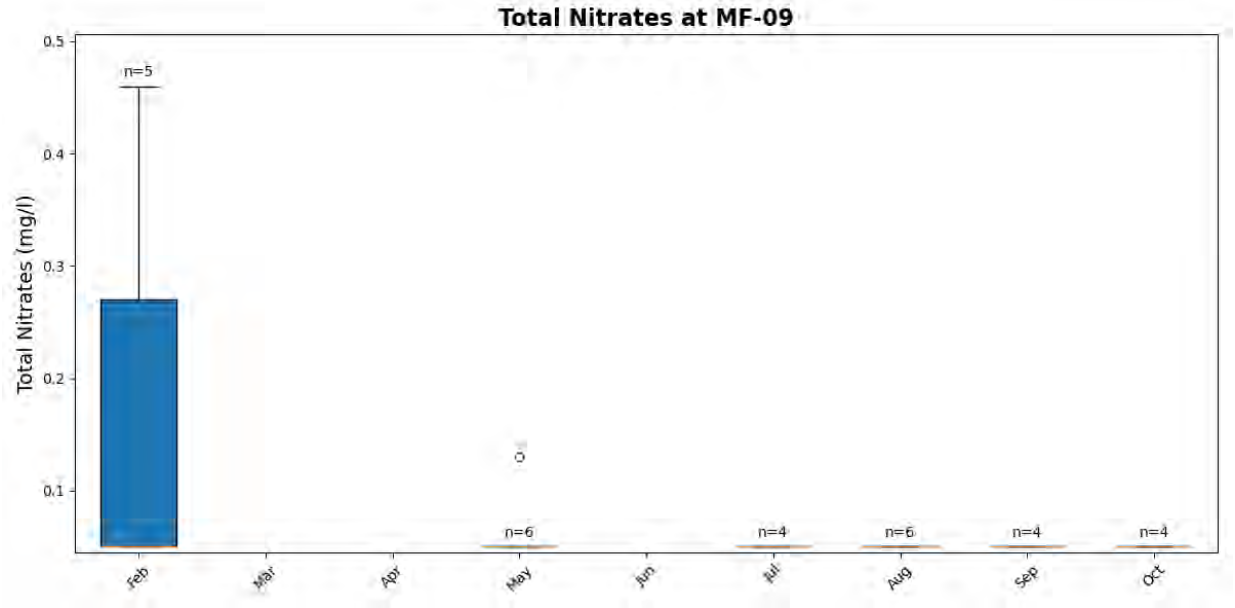


Figure C-124: Monthly Box Plot for Total Nitrates at Station MF-10 in Middle Fork

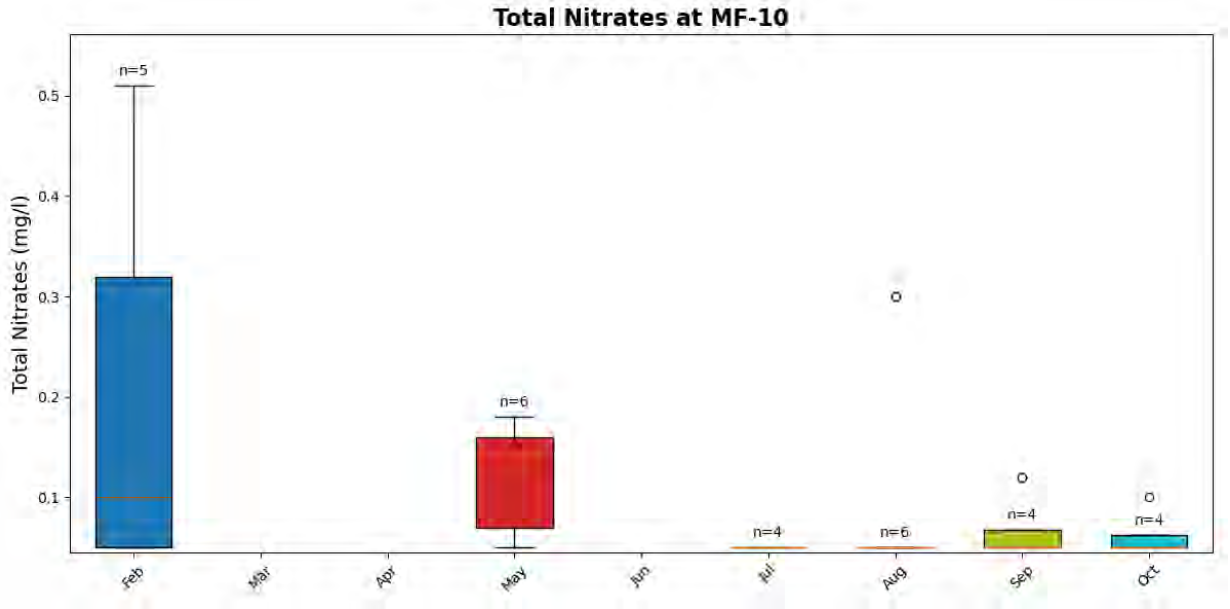


Figure C-125: Monthly Box Plot for Total Nitrates at Station MF-11 in Middle Fork

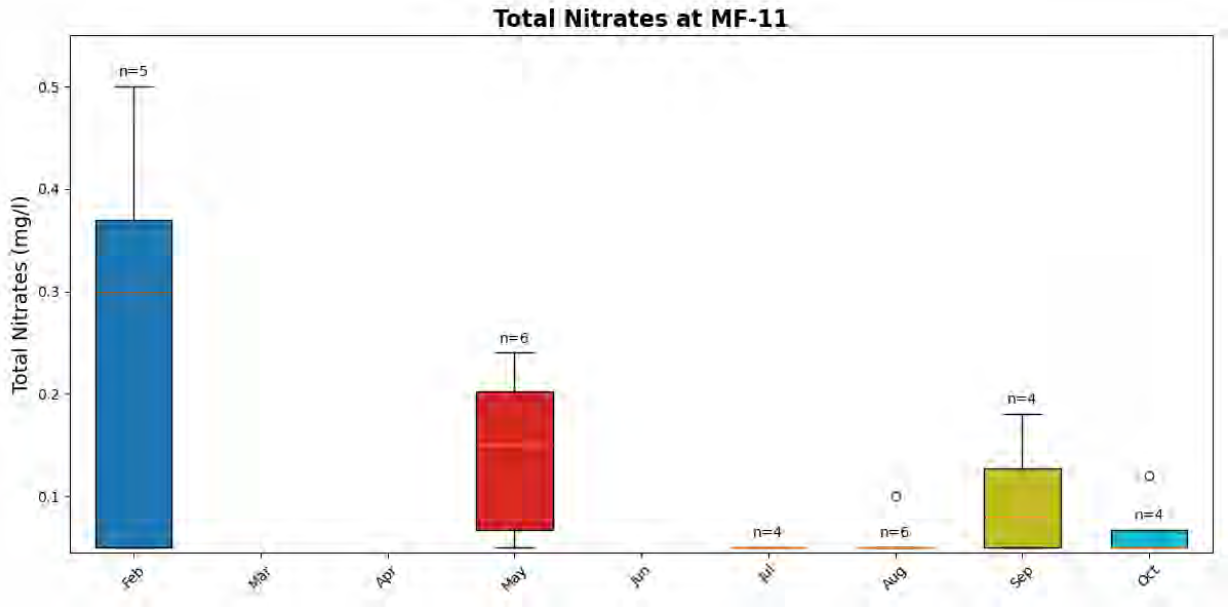


Figure C-126: Monthly Box Plot for Total Nitrates at Station MF-12 in Middle Fork

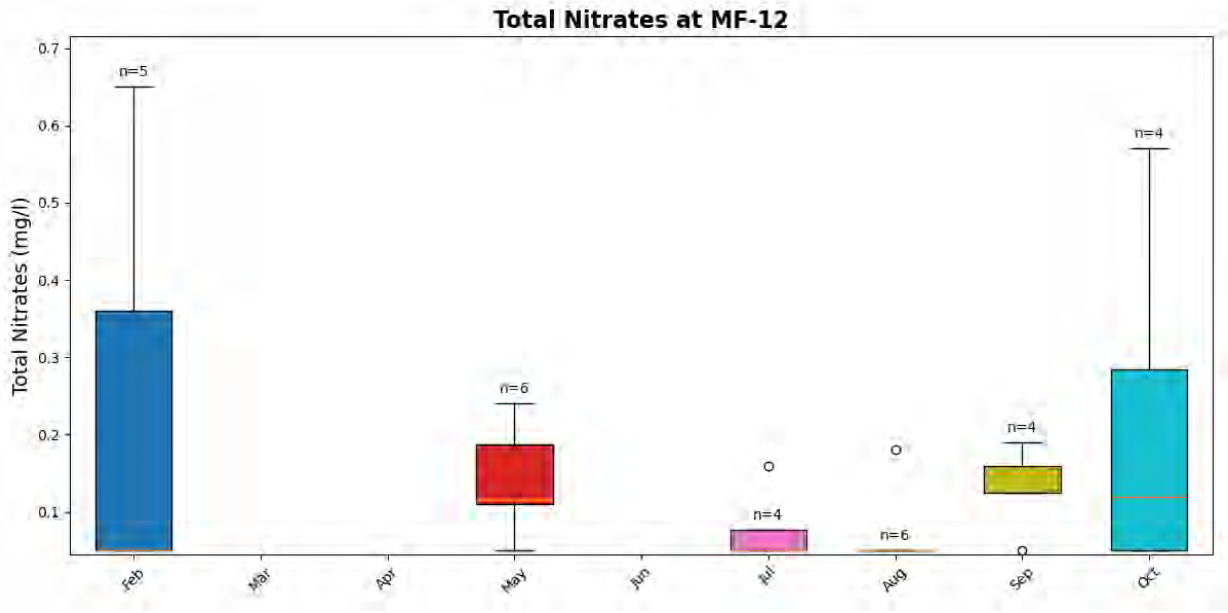


Figure C-127: Monthly Box Plot for Total Nitrates at Station MF-13 in Middle Fork

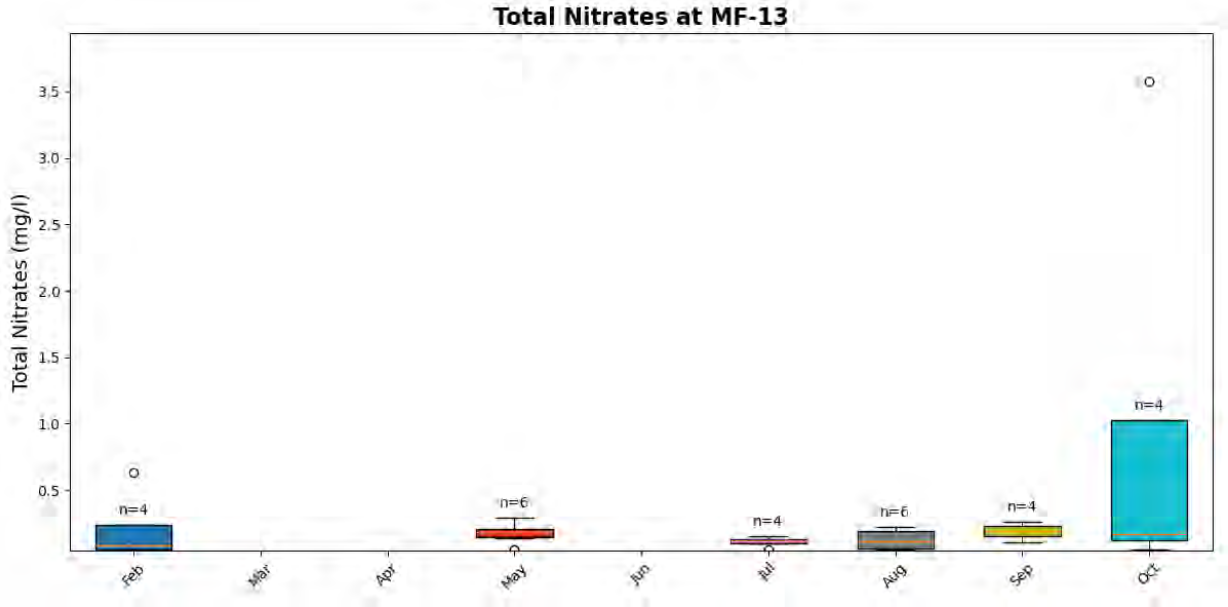


Figure C-128: Monthly Box Plot for Total Nitrates at Station MF-14 in Middle Fork

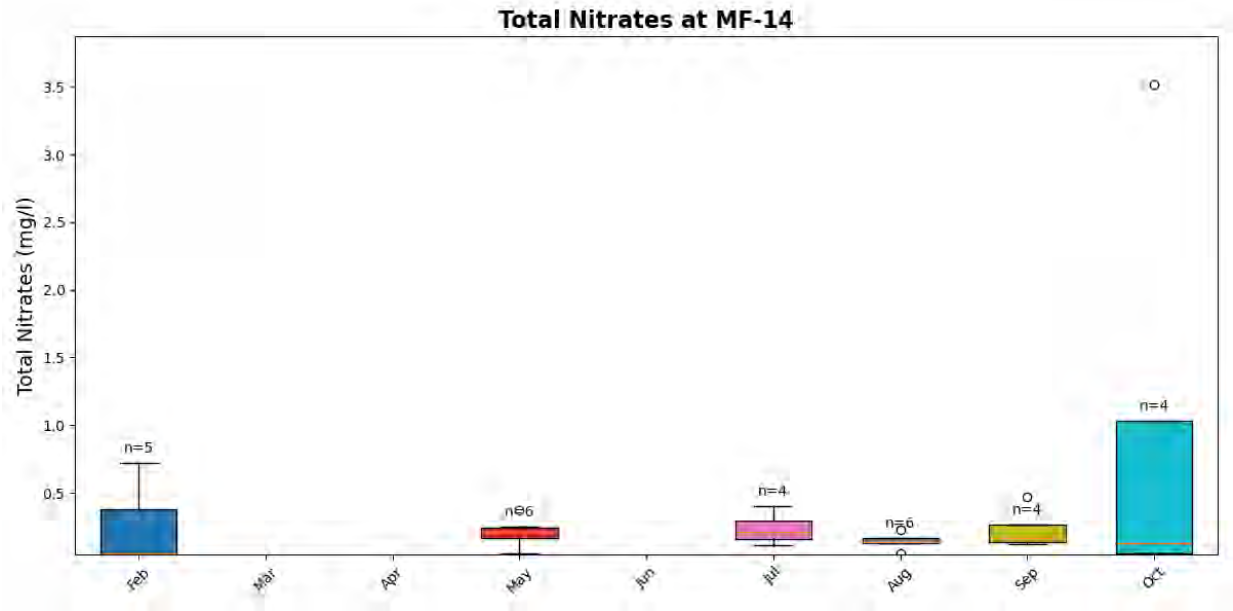


Figure C-129: Monthly Box Plot for Total Nitrates at Station MF-15 in Middle Fork

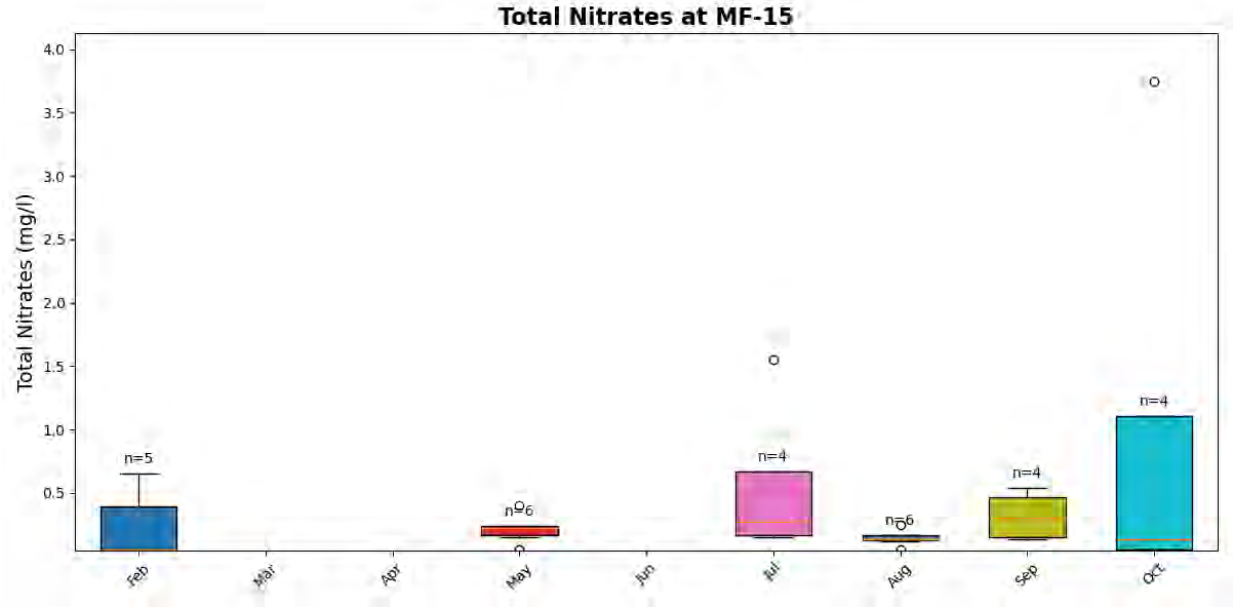


Figure C-130: Monthly Box Plot for Total Nitrates at Station MF-16 in Middle Fork

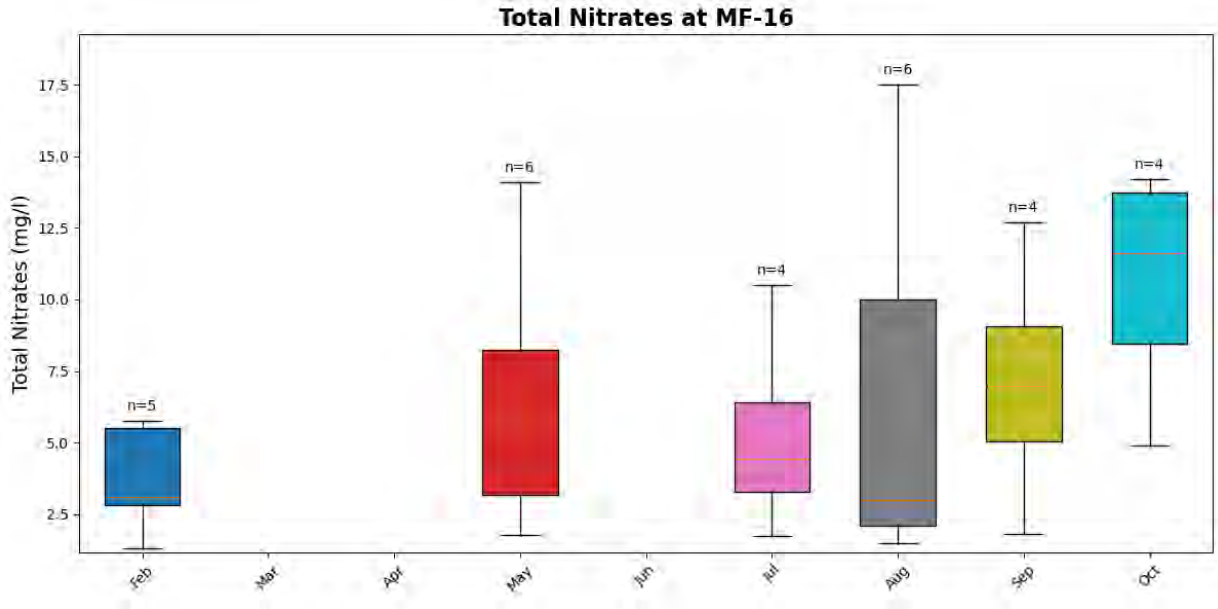


Figure C-131: Monthly Box Plot for Total Nitrates at Station MF-17 in Middle Fork

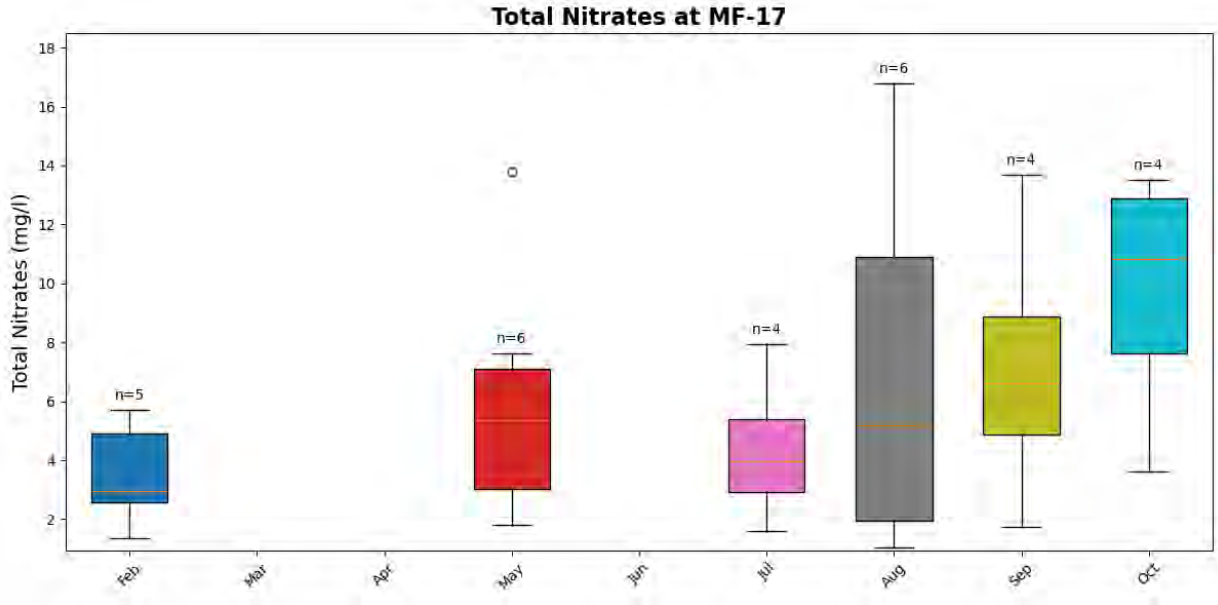
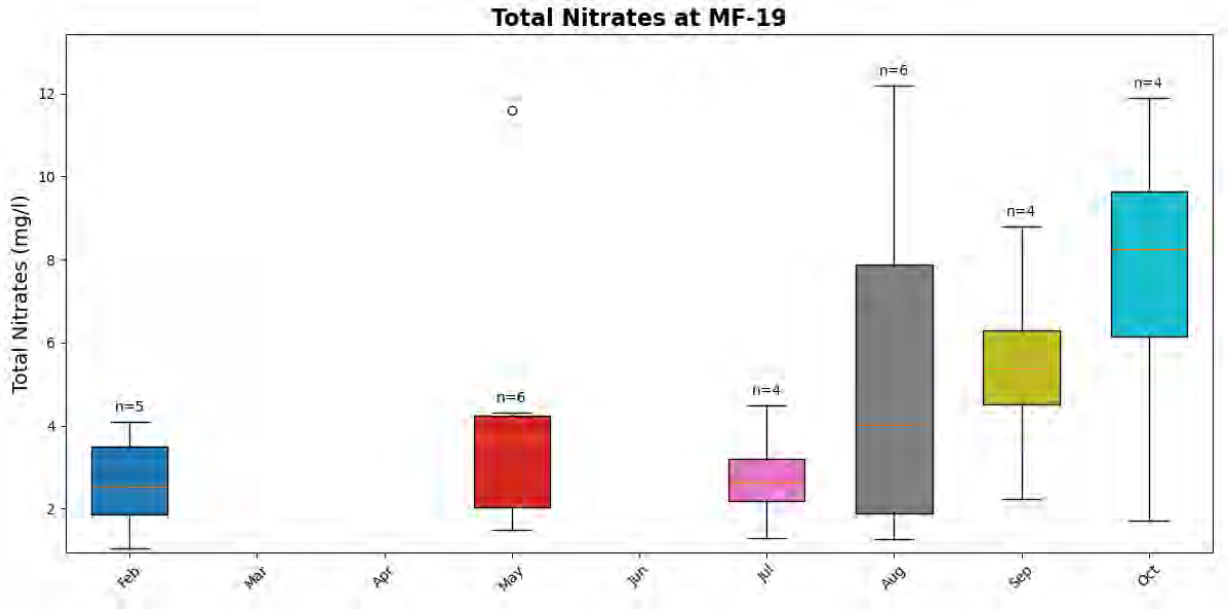


Figure C-132: Monthly Box Plot for Total Nitrates at Station MF-19 in Middle Fork



Total Kjeldahl Nitrogen

Figure C-133: Monthly Box Plot for Total Kjeldahl Nitrogen at Station MF-08 in Middle Fork

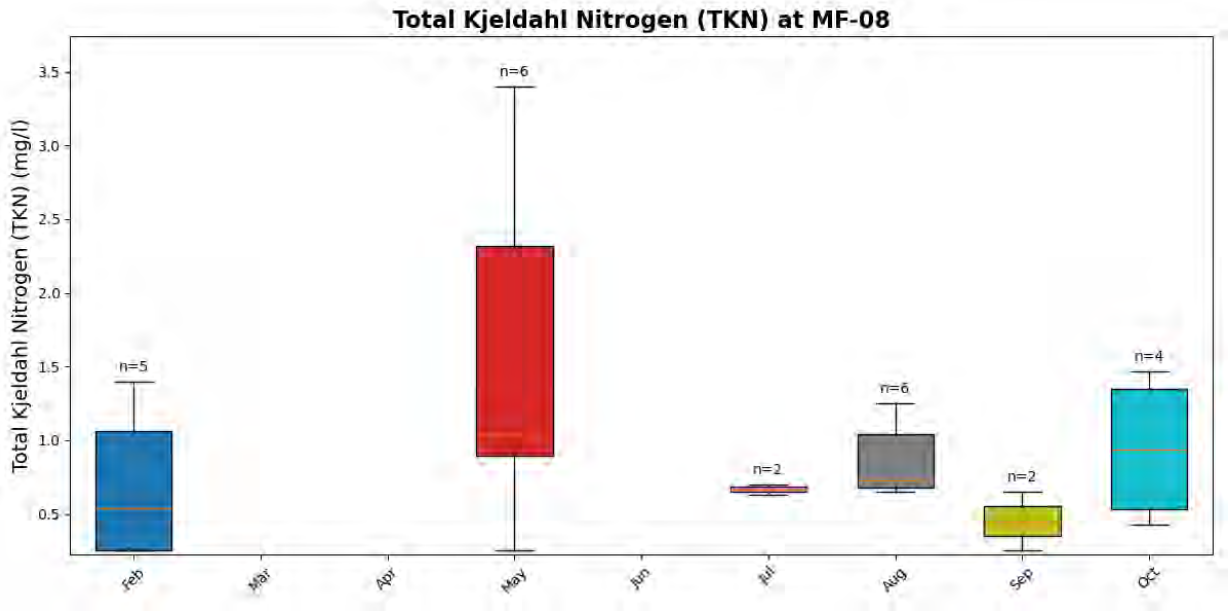


Figure C-134: Monthly Box Plot for Total Kjeldahl Nitrogen at Station MF-09 in Middle Fork

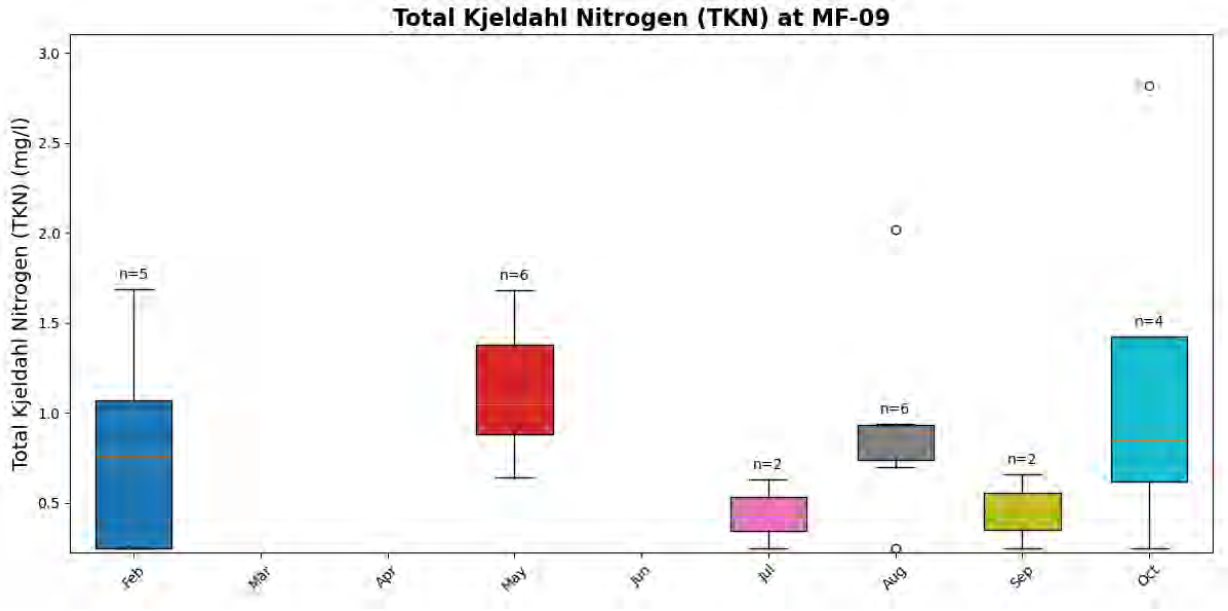


Figure C-135: Monthly Box Plot for Total Kjeldahl Nitrogen at Station MF-10 in Middle Fork

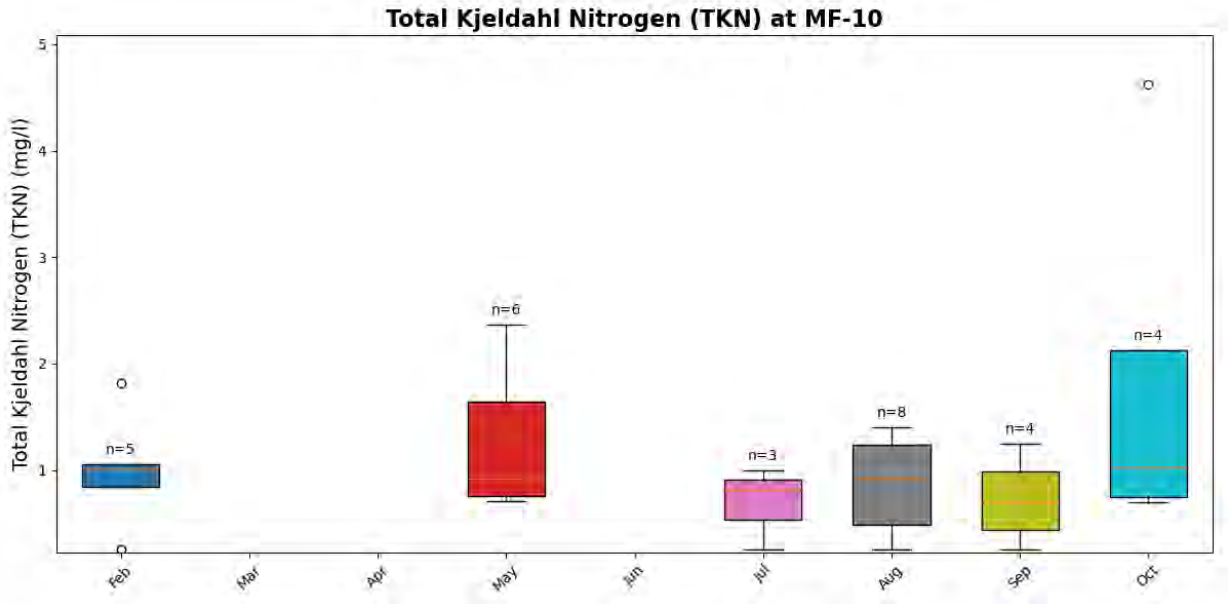


Figure C-136: Monthly Box Plot for Total Kjeldahl Nitrogen at Station MF-11 in Middle Fork

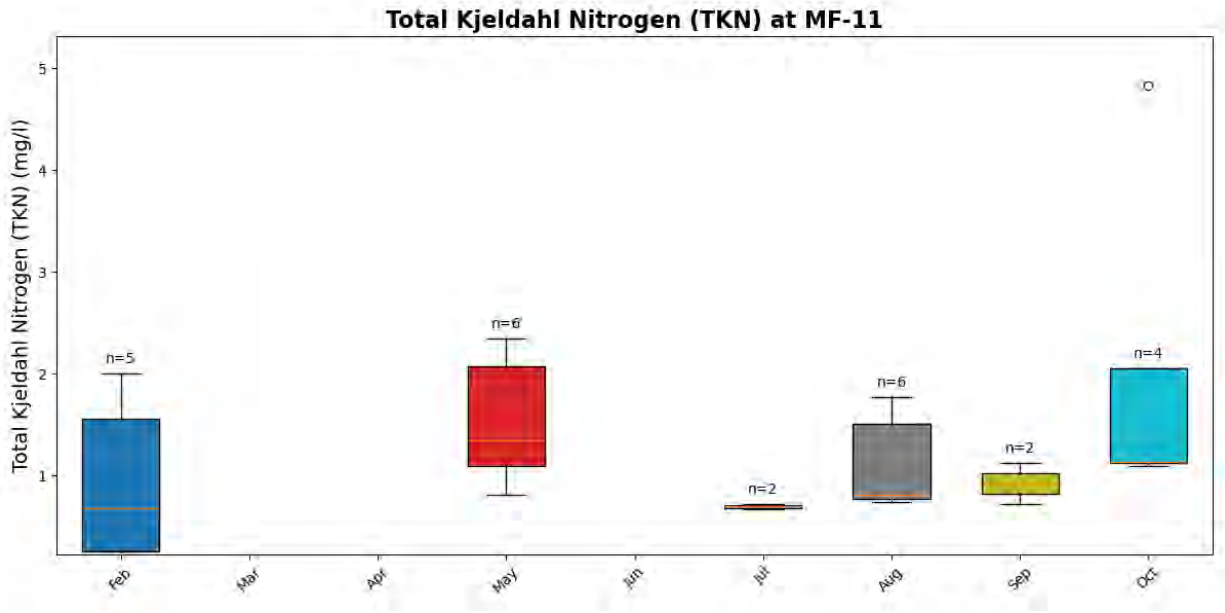


Figure C-137: Monthly Box Plot for Total Kjeldahl Nitrogen at Station MF-12 in Middle Fork

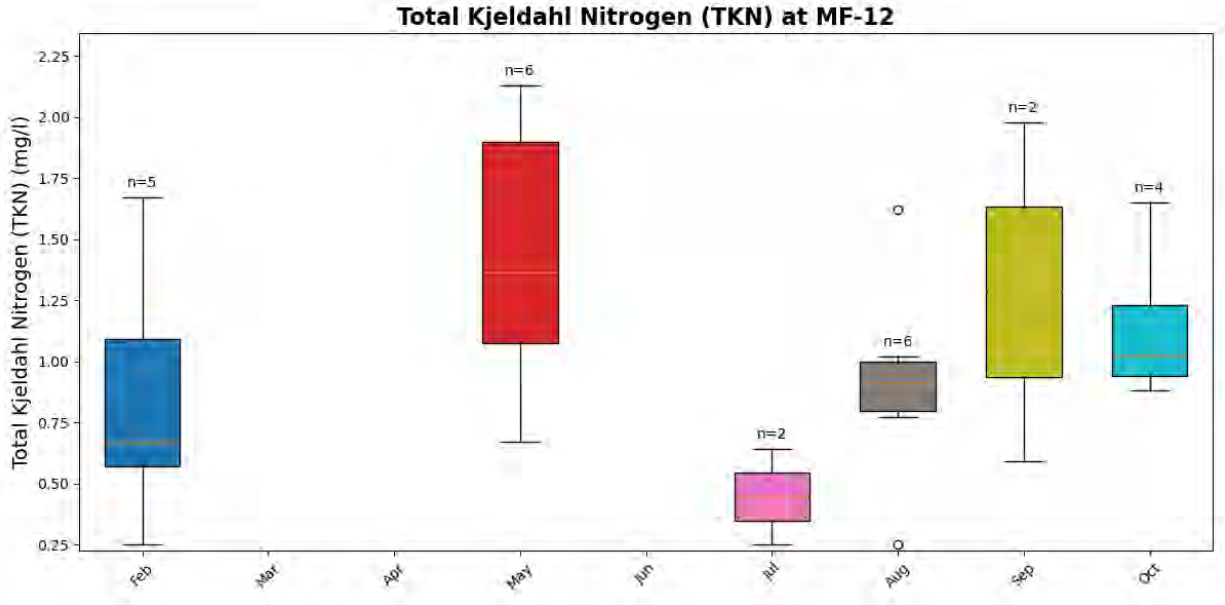


Figure C-138: Monthly Box Plot for Total Kjeldahl Nitrogen at Station MF-13 in Middle Fork

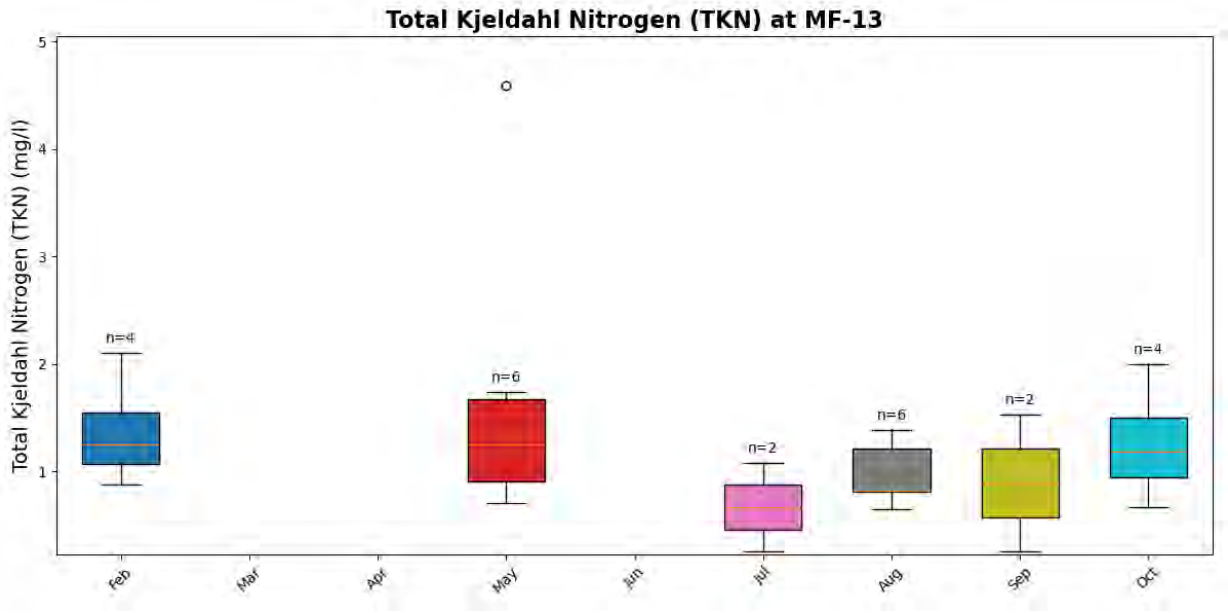


Figure C-139: Monthly Box Plot for Total Kjeldahl Nitrogen at Station MF-14 in Middle Fork

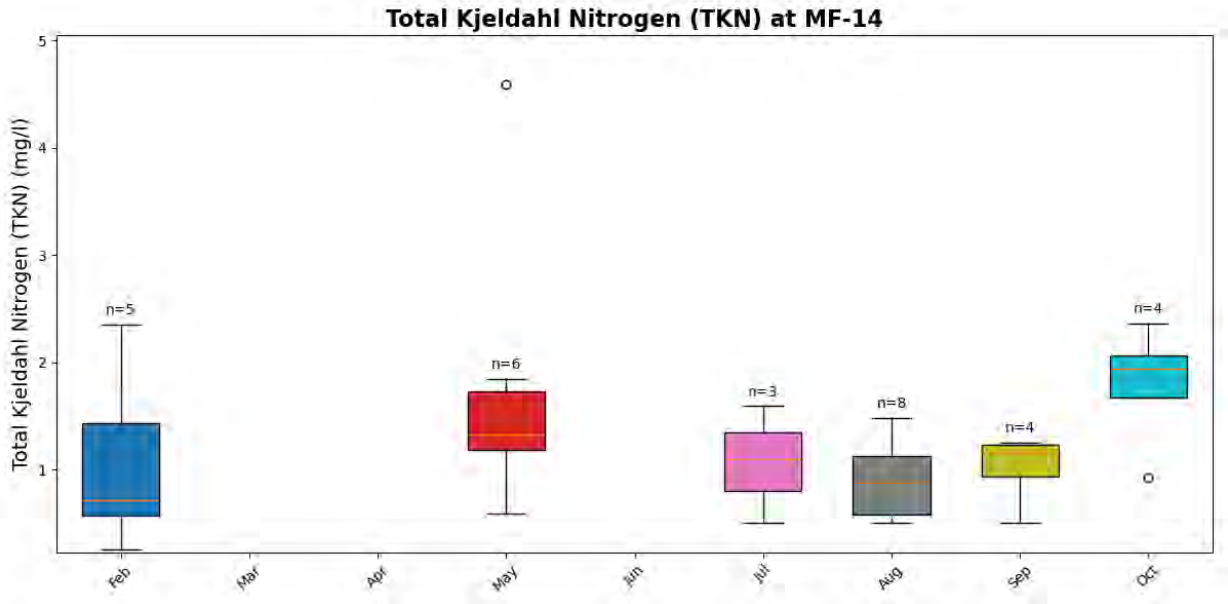


Figure C-140: Monthly Box Plot for Total Kjeldahl Nitrogen at Station MF-15 in Middle Fork

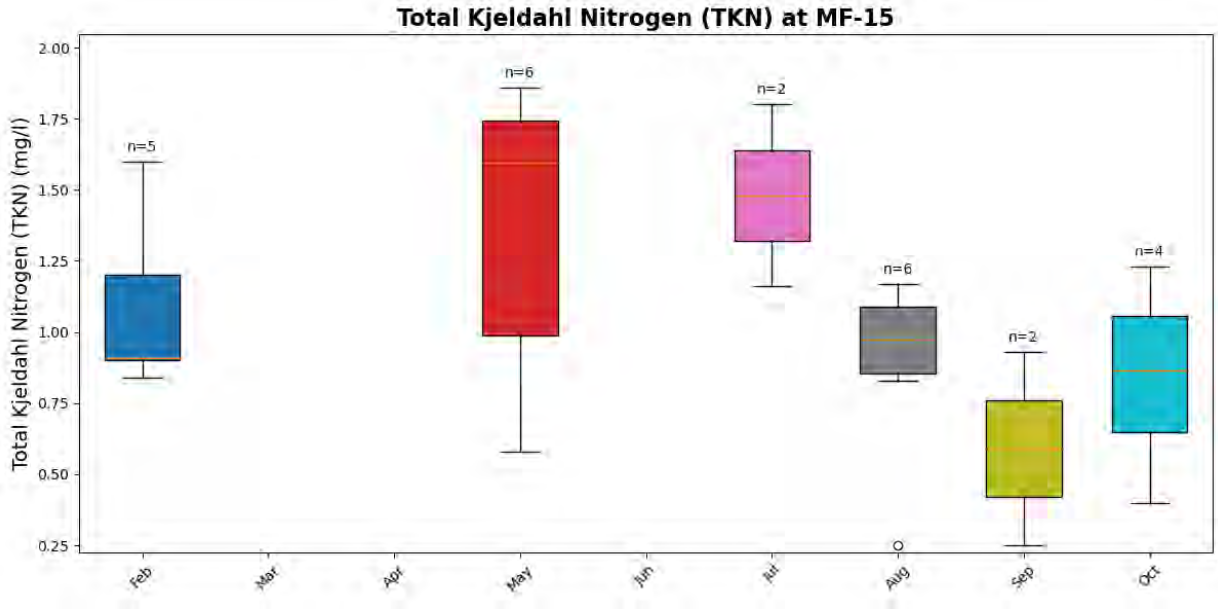


Figure C-141: Monthly Box Plot for Total Kjeldahl Nitrogen at Station MF-16 in Middle Fork

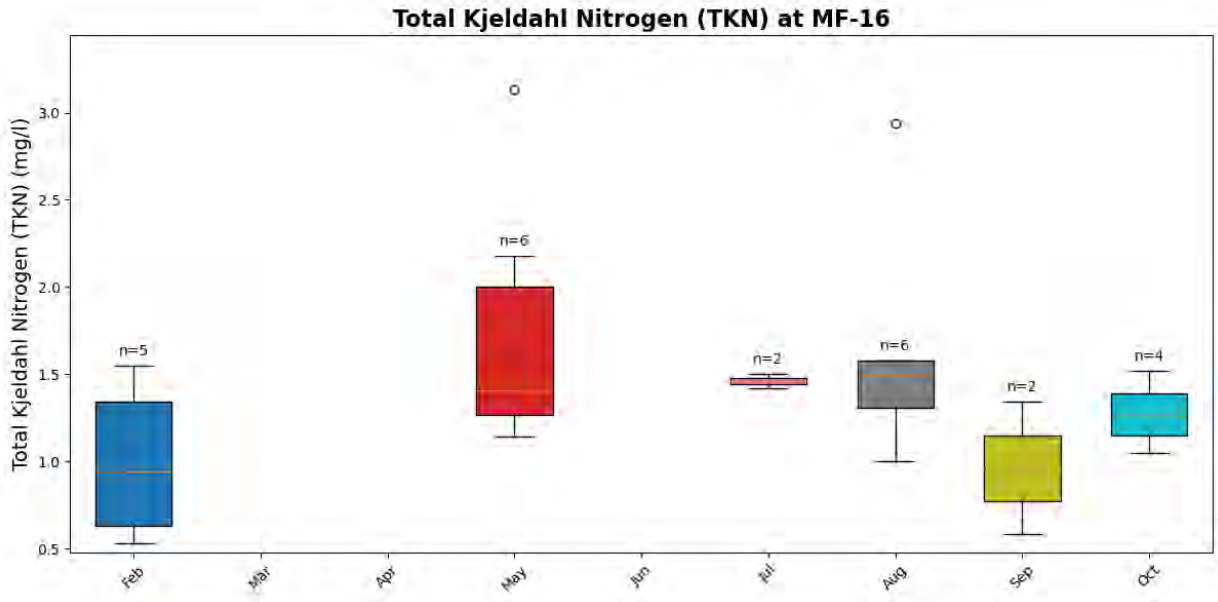


Figure C-142: Monthly Box Plot for Total Kjeldahl Nitrogen at Station MF-17 in Middle Fork

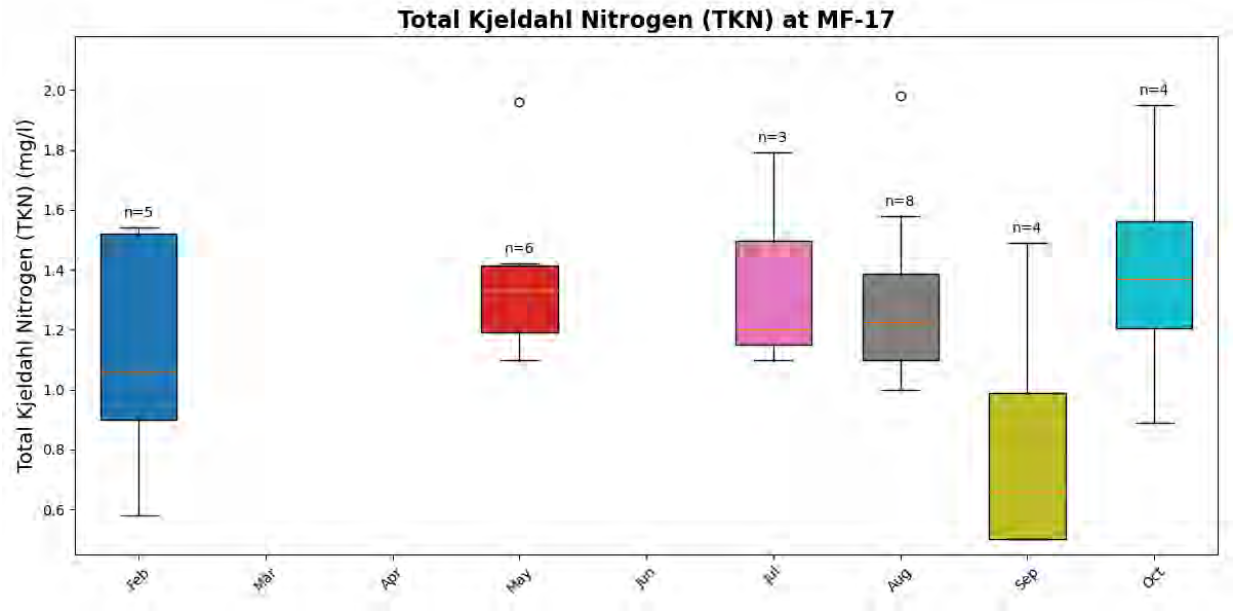
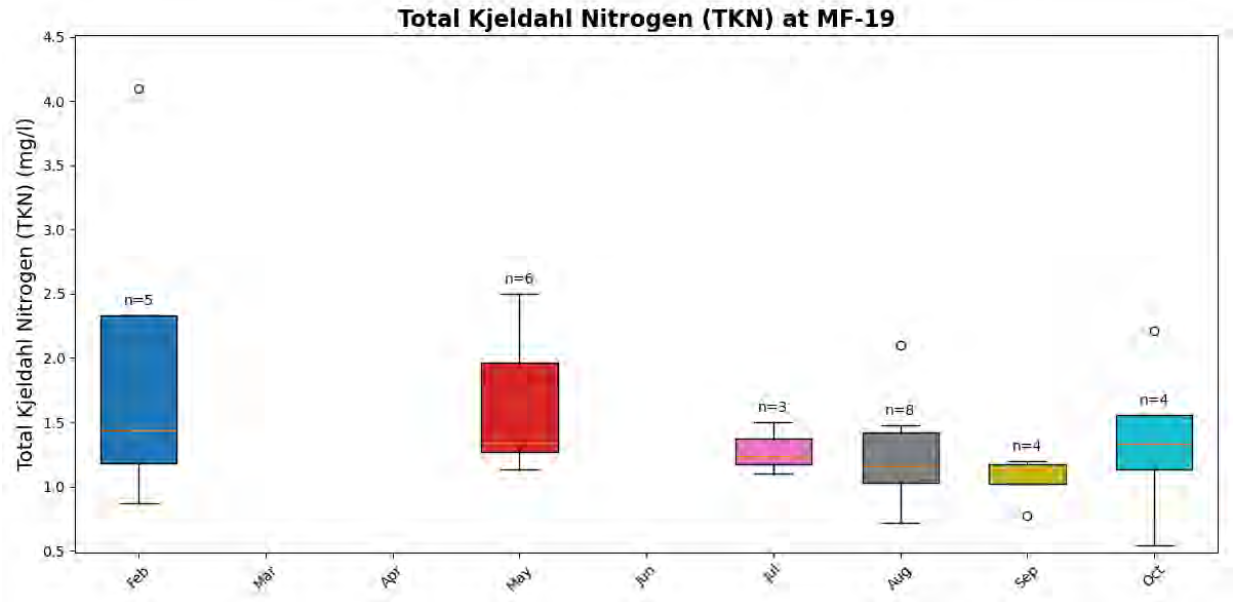


Figure C-143: Monthly Box Plot for Total Kjeldahl Nitrogen at Station MF-19 in Middle Fork



Total Phosphorus

Figure C-144: Monthly Box Plot for Total Phosphorus at Station MF-08 in Middle Fork

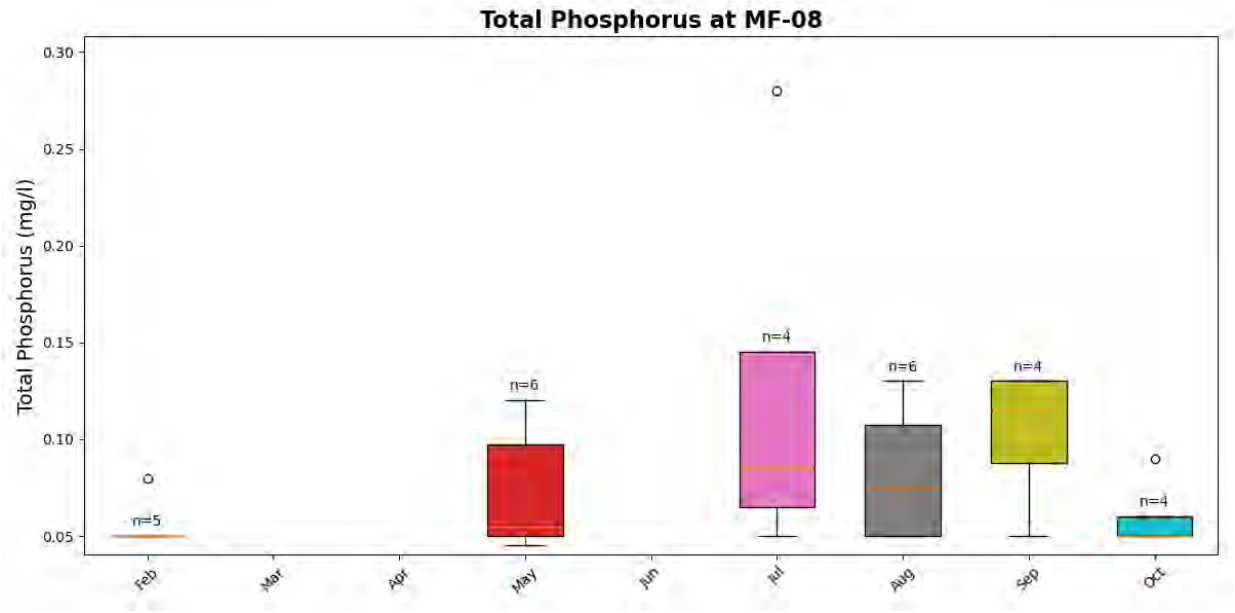


Figure C-145: Monthly Box Plot for Total Phosphorus at Station MF-09 in Middle Fork

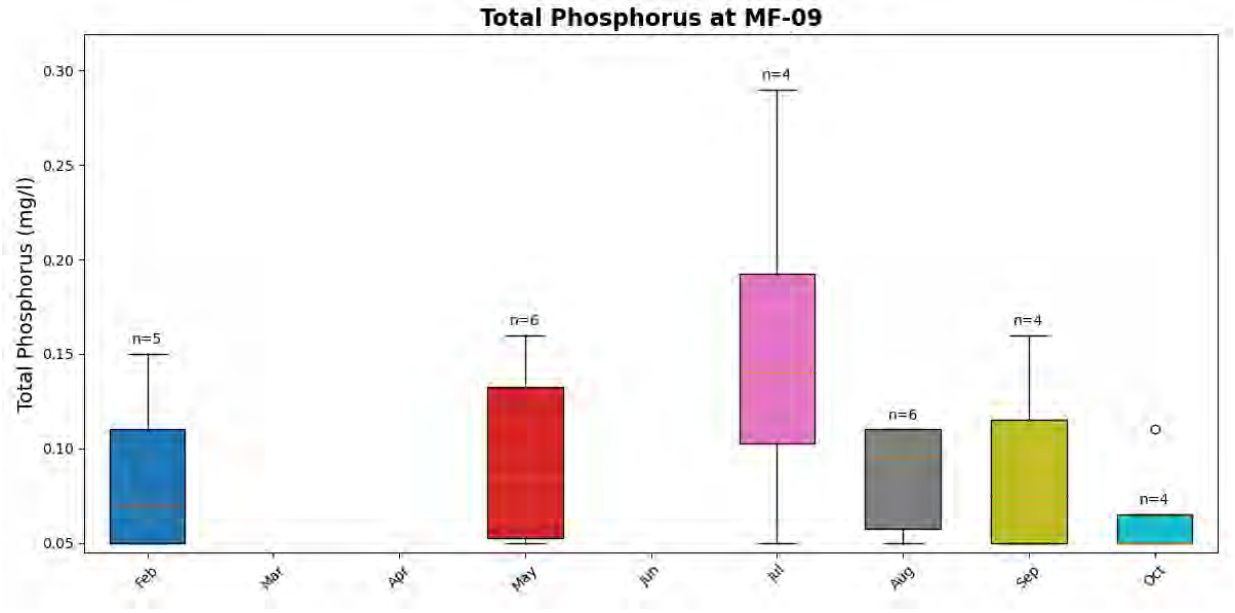


Figure C-146: Monthly Box Plot for Total Phosphorus at Station MF-10 in Middle Fork

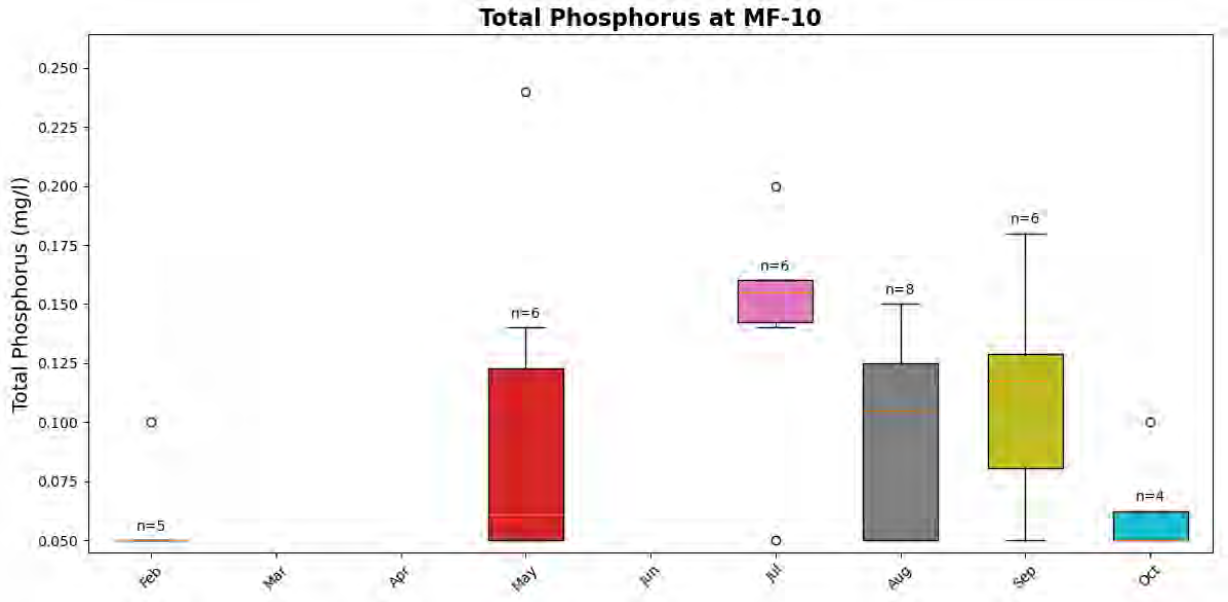


Figure C-147: Monthly Box Plot for Total Phosphorus at Station MF-11 in Middle Fork

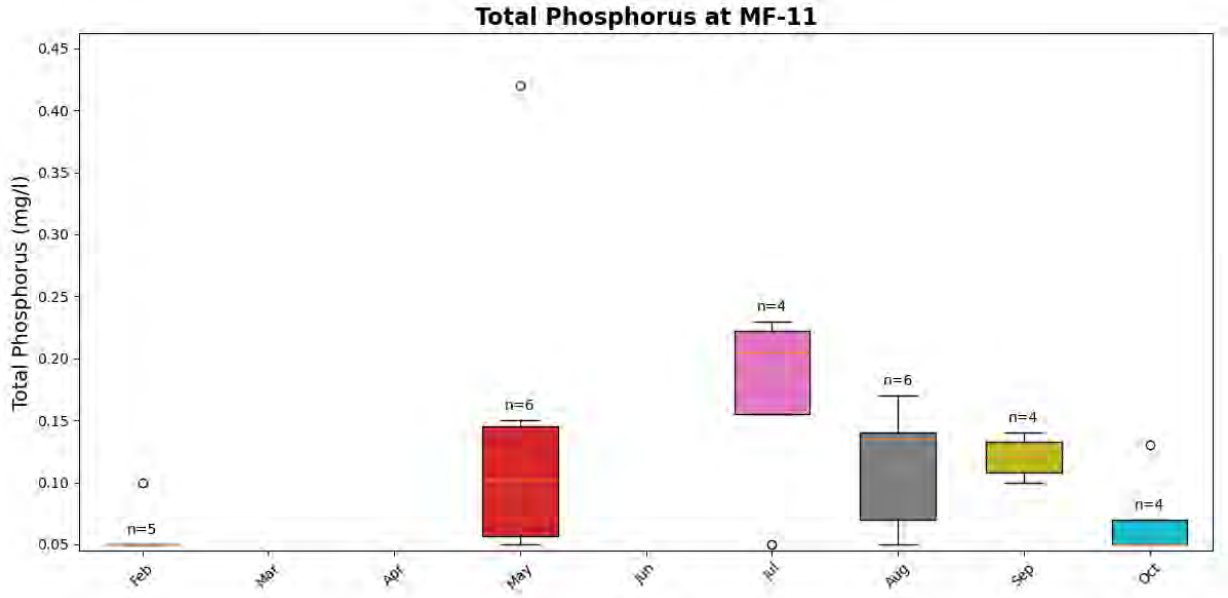


Figure C-148: Monthly Box Plot for Total Phosphorus at Station MF-12 in Middle Fork

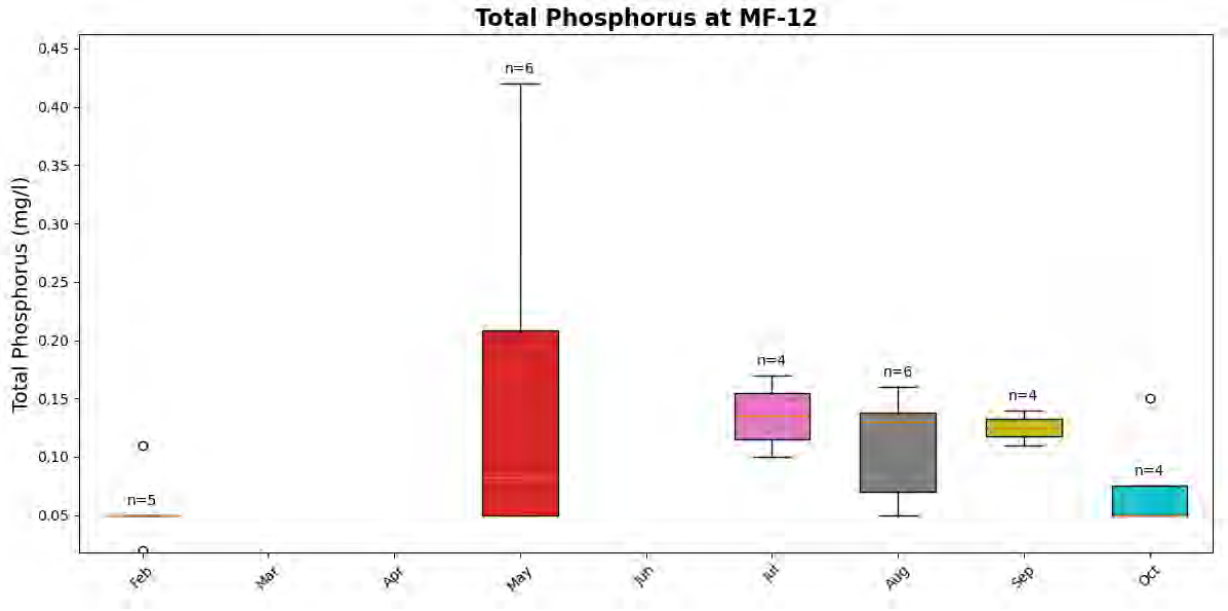


Figure C-149: Monthly Box Plot for Total Phosphorus at Station MF-13 in Middle Fork

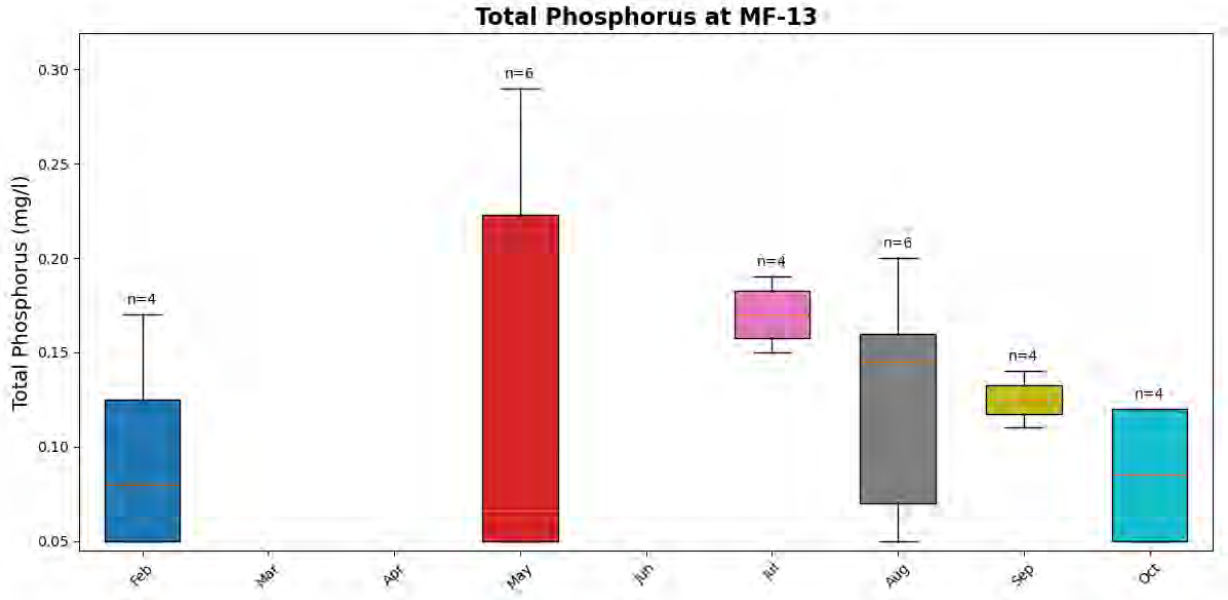


Figure C-150: Monthly Box Plot for Total Phosphorus at Station MF-14 in Middle Fork

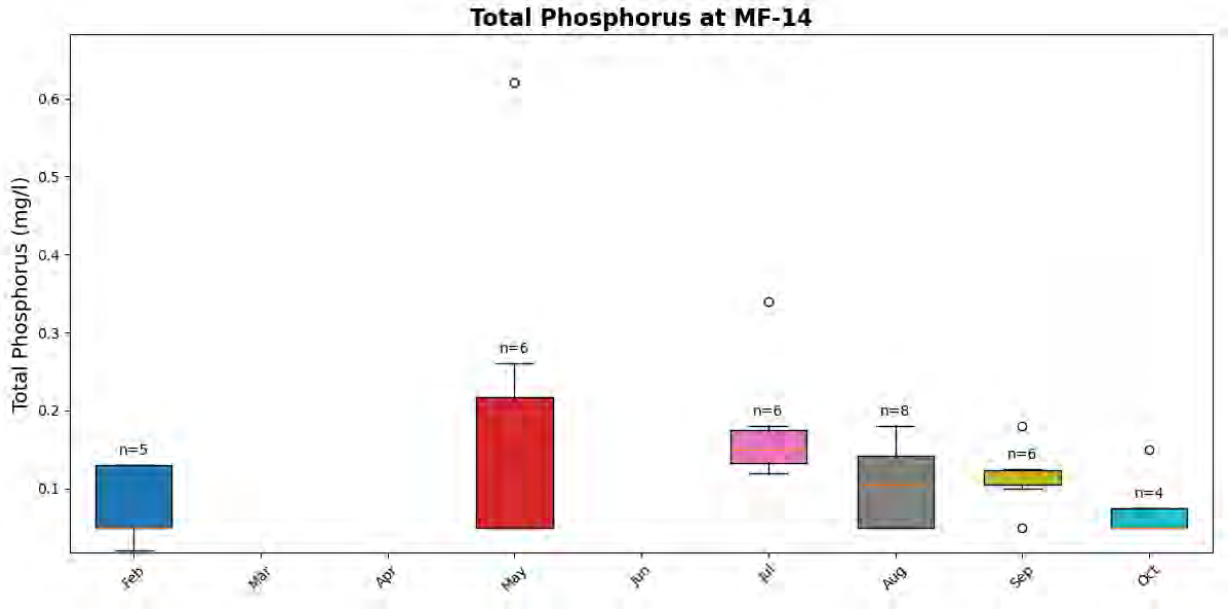


Figure C-151: Monthly Box Plot for Total Phosphorus at Station MF-15 in Middle Fork

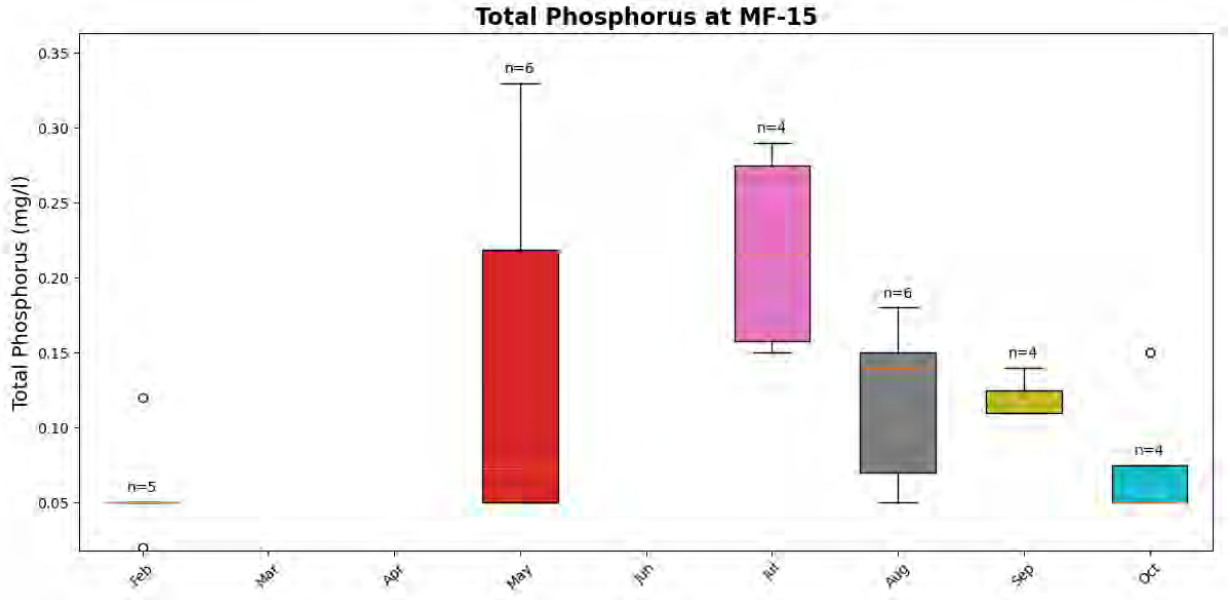


Figure C-152: Monthly Box Plot for Total Phosphorus at Station MF-16 in Middle Fork

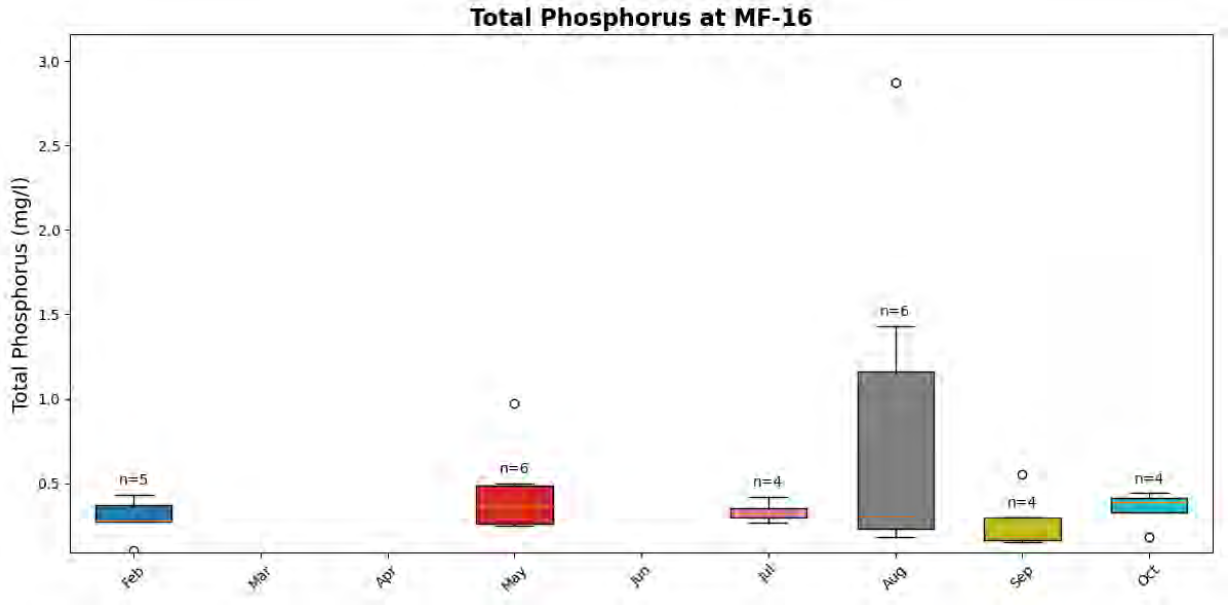


Figure C-153: Monthly Box Plot for Total Phosphorus at Station MF-17 in Middle Fork

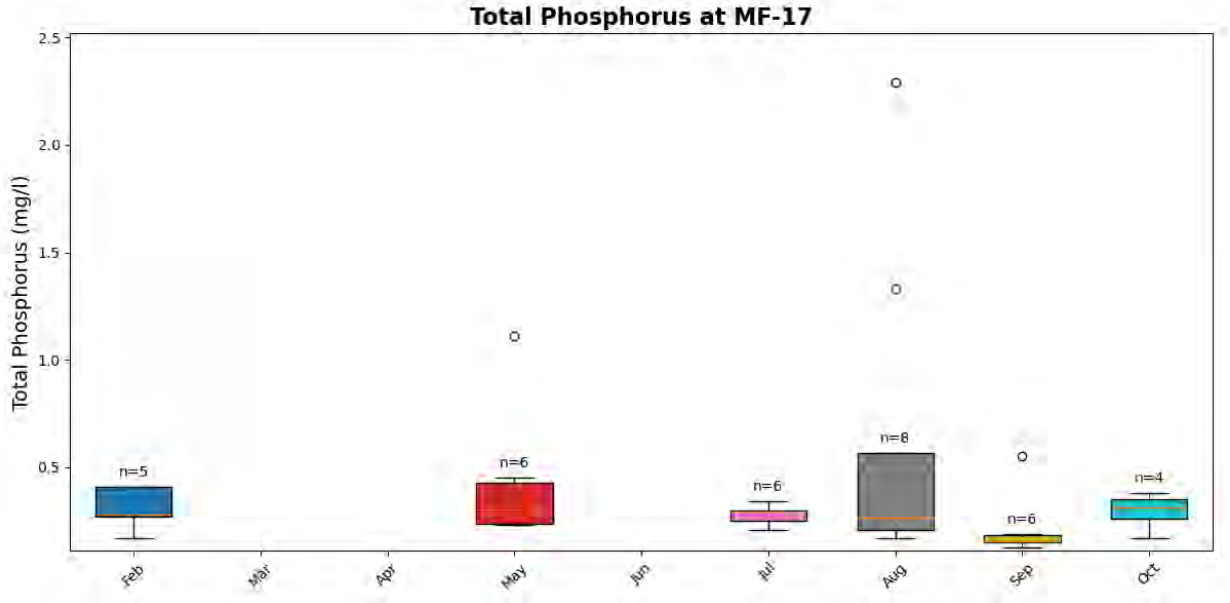
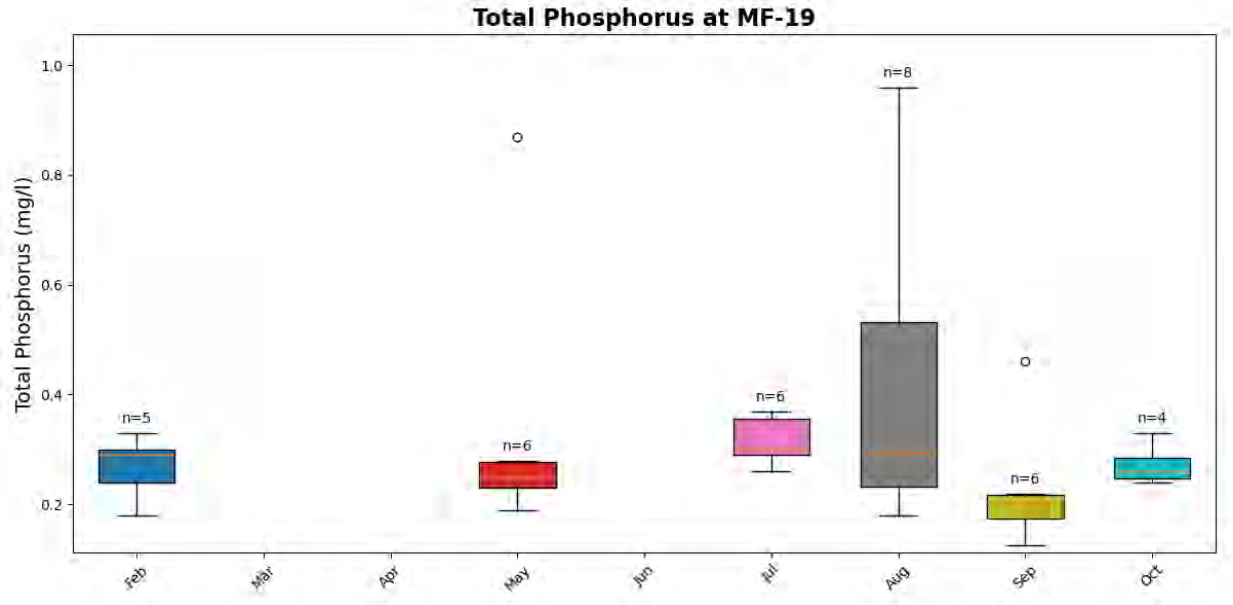


Figure C-154: Monthly Box Plot for Total Phosphorus at Station MF-19 in Middle Fork



Chlorophyll a

Figure C-155: Monthly Box Plot for Chlorophyll a at Station MF-08 in Middle Fork

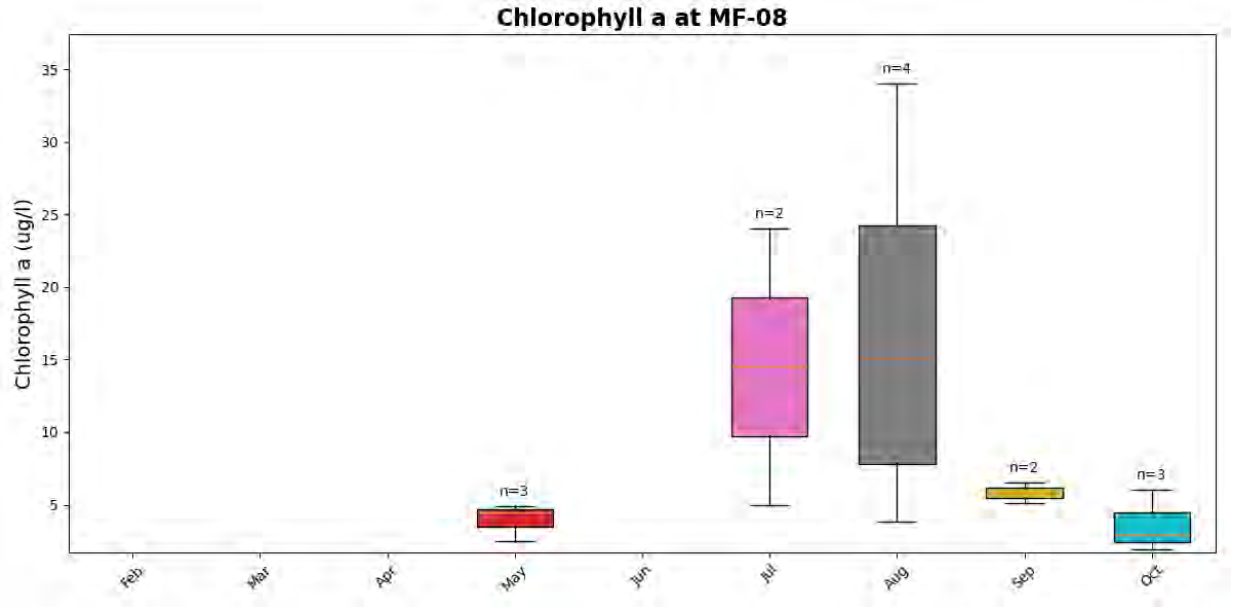


Figure C-156: Monthly Box Plot for Chlorophyll a at Station MF-09 in Middle Fork

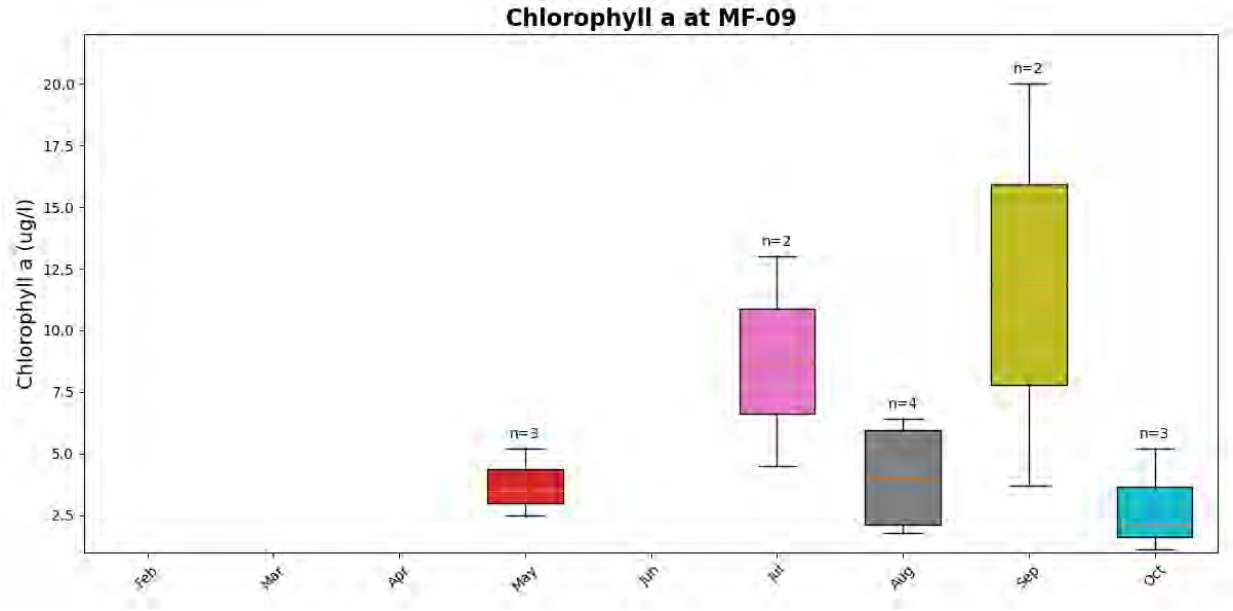


Figure C-157: Monthly Box Plot for Chlorophyll a at Station MF-10 in Middle Fork

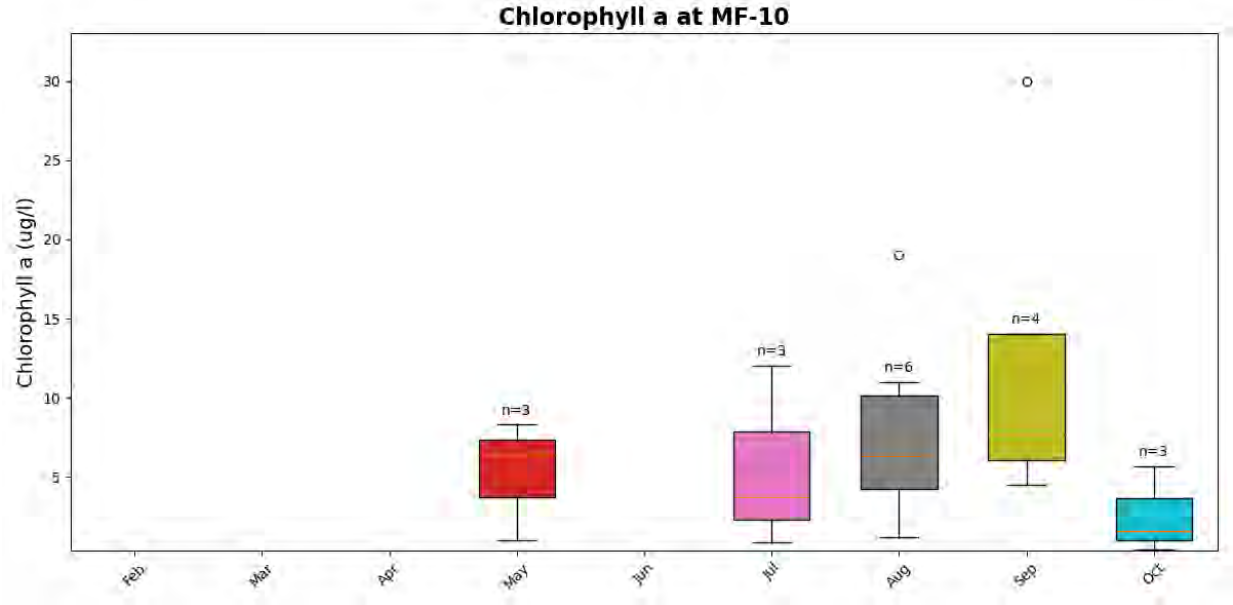


Figure C-158: Monthly Box Plot for Chlorophyll a at Station MF-11 in Middle Fork

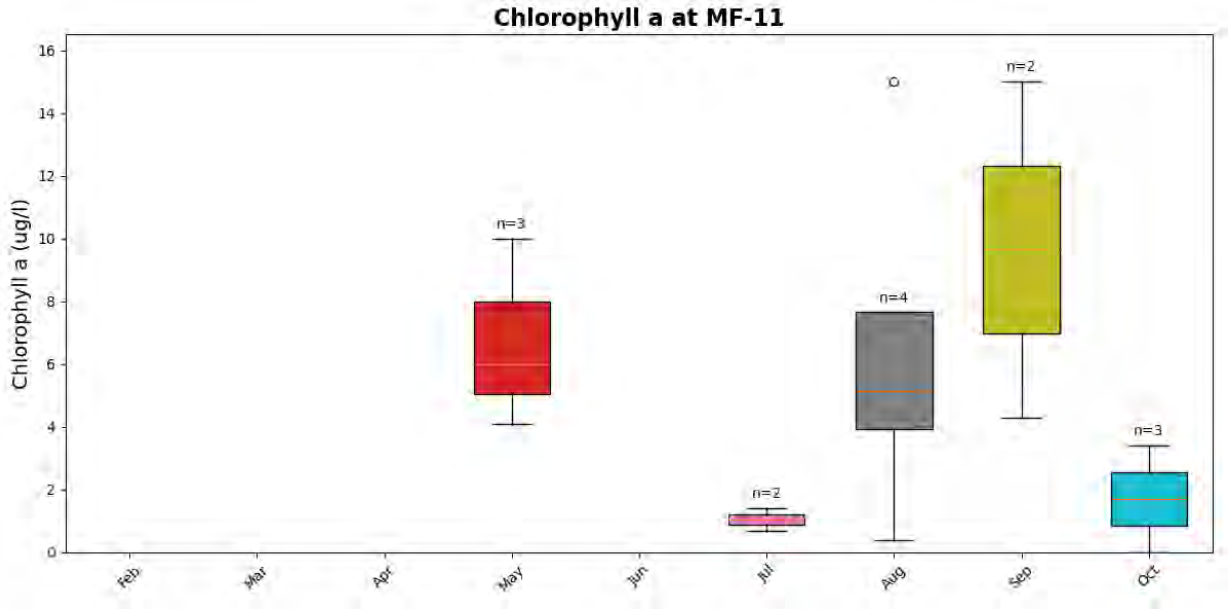


Figure C-159: Monthly Box Plot for Chlorophyll a at Station MF-12 in Middle Fork

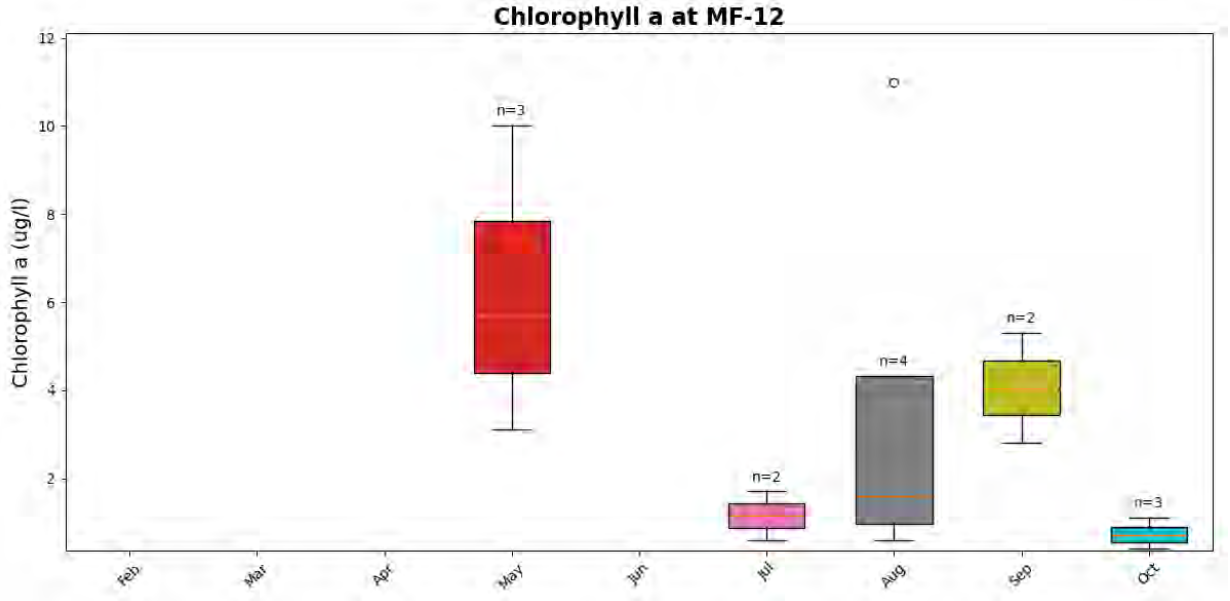


Figure C-160: Monthly Box Plot for Chlorophyll a at Station MF-13 in Middle Fork

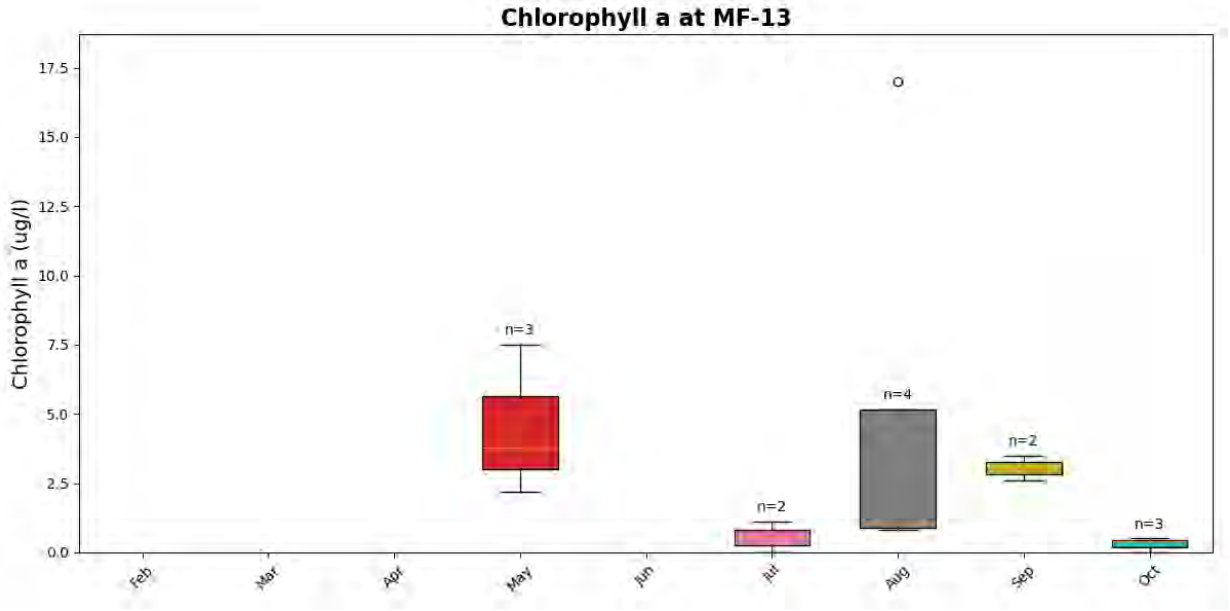


Figure C-161: Monthly Box Plot for Chlorophyll a at Station MF-14 in Middle Fork

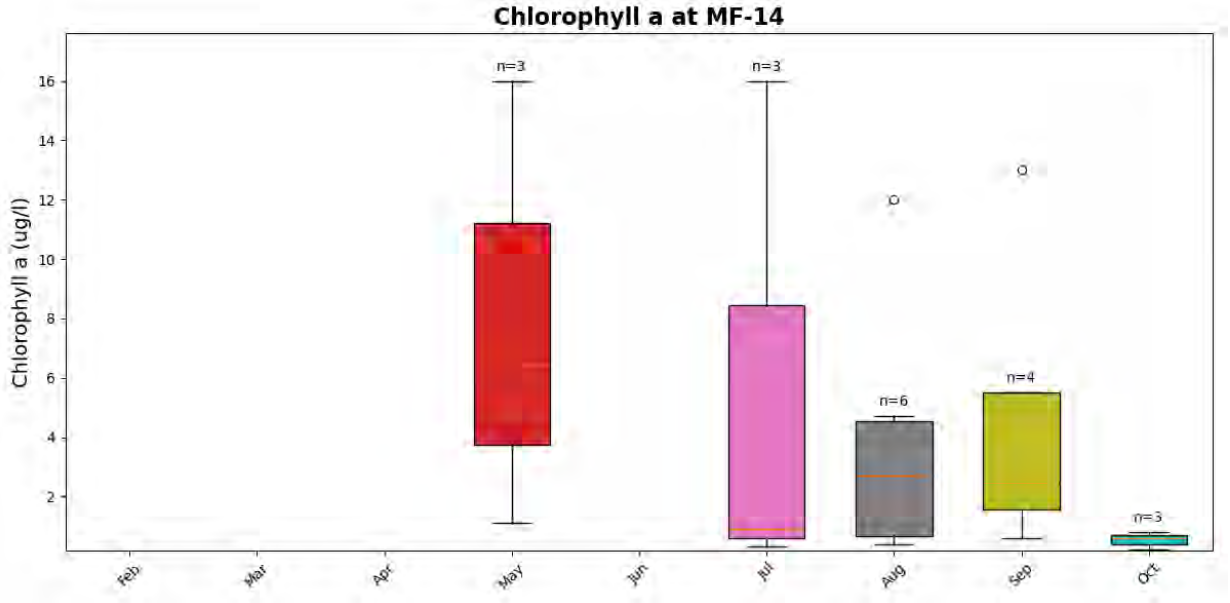


Figure C-162: Monthly Box Plot for Chlorophyll a at Station MF-15 in Middle Fork

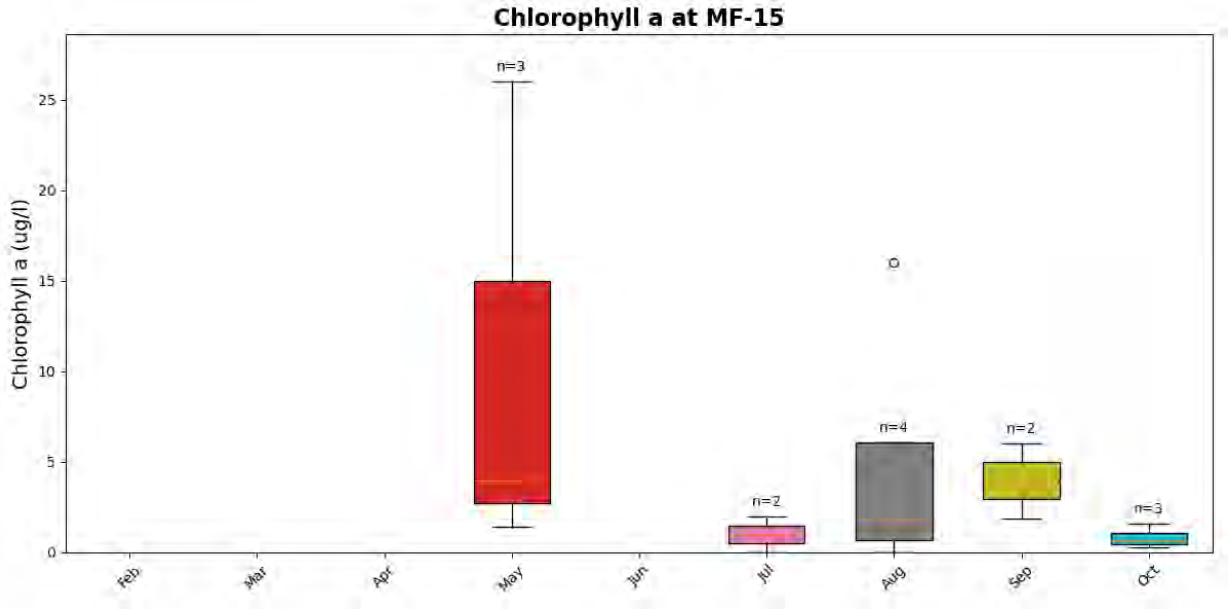


Figure C-163: Monthly Box Plot for Chlorophyll a at Station MF-16 in Middle Fork

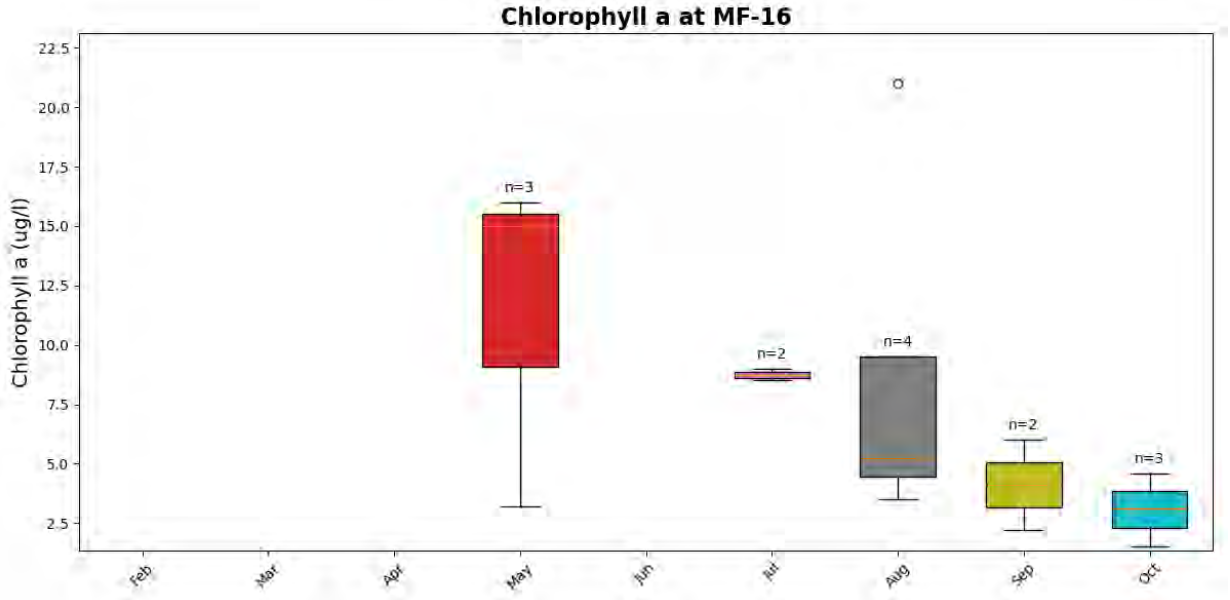


Figure C-164: Monthly Box Plot for Chlorophyll a at Station MF-17 in Middle Fork

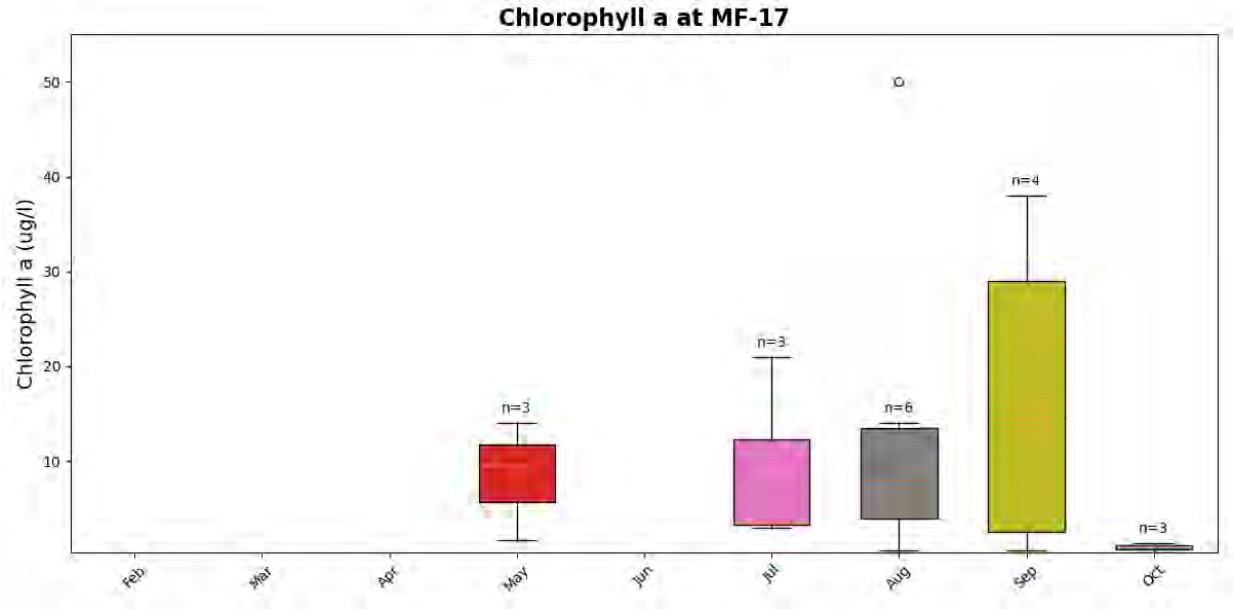
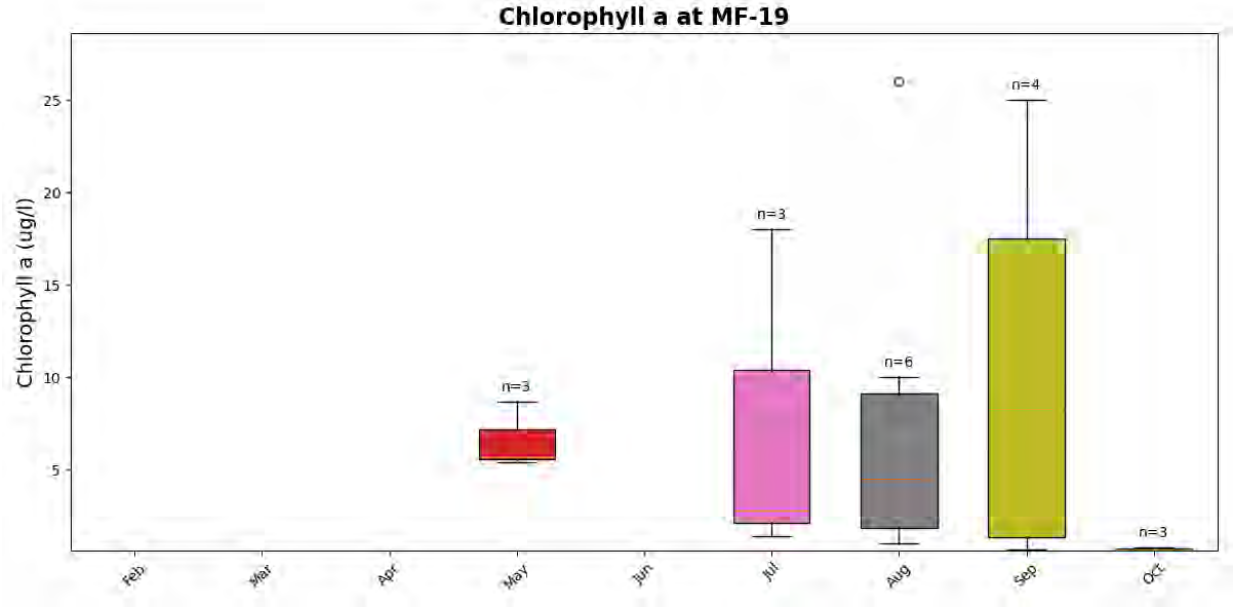


Figure C-165: Monthly Box Plot for Chlorophyll a at Station MF-19 in Middle Fork



Dissolved Oxygen

Figure C-166: Monthly Box Plot for Dissolved Oxygen at Station MF-08 in Middle Fork

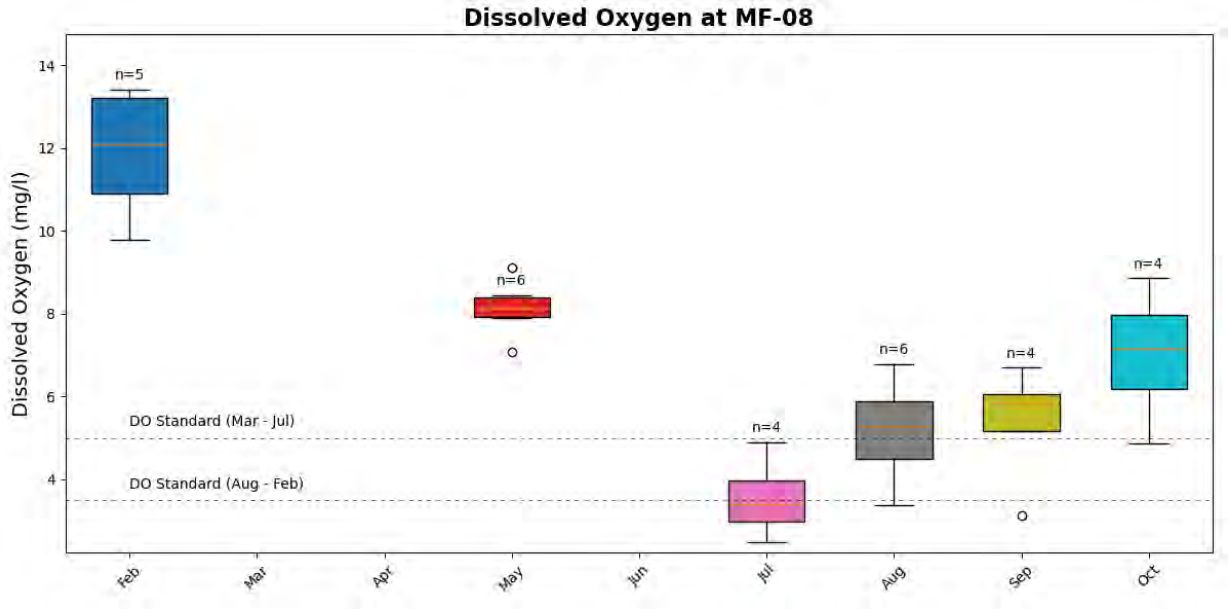


Figure C-167: Monthly Box Plot for Dissolved Oxygen at Station MF-09 in Middle Fork

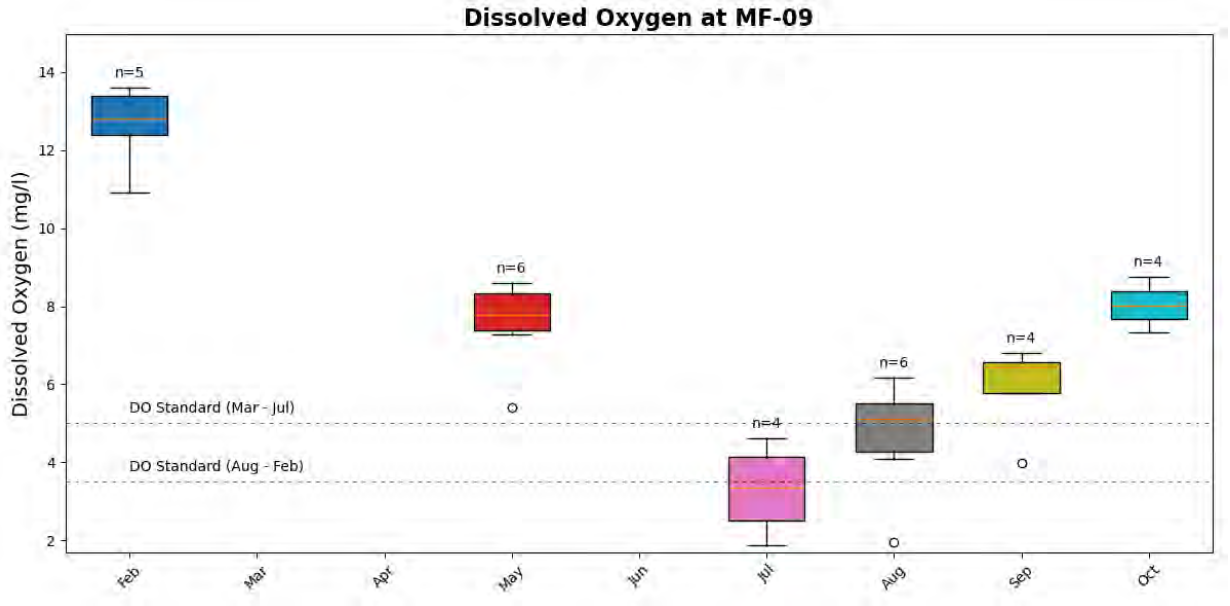


Figure C-168: Monthly Box Plot for Dissolved Oxygen at Station MF-10 in Middle Fork

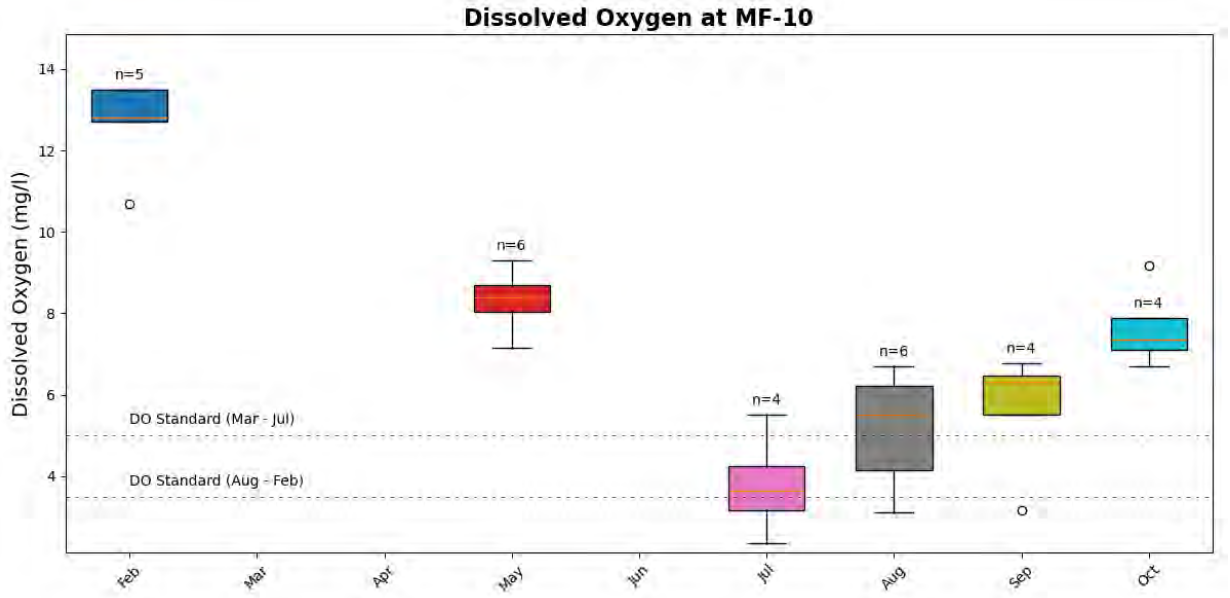


Figure C-169: Monthly Box Plot for Dissolved Oxygen at Station MF-11 in Middle Fork

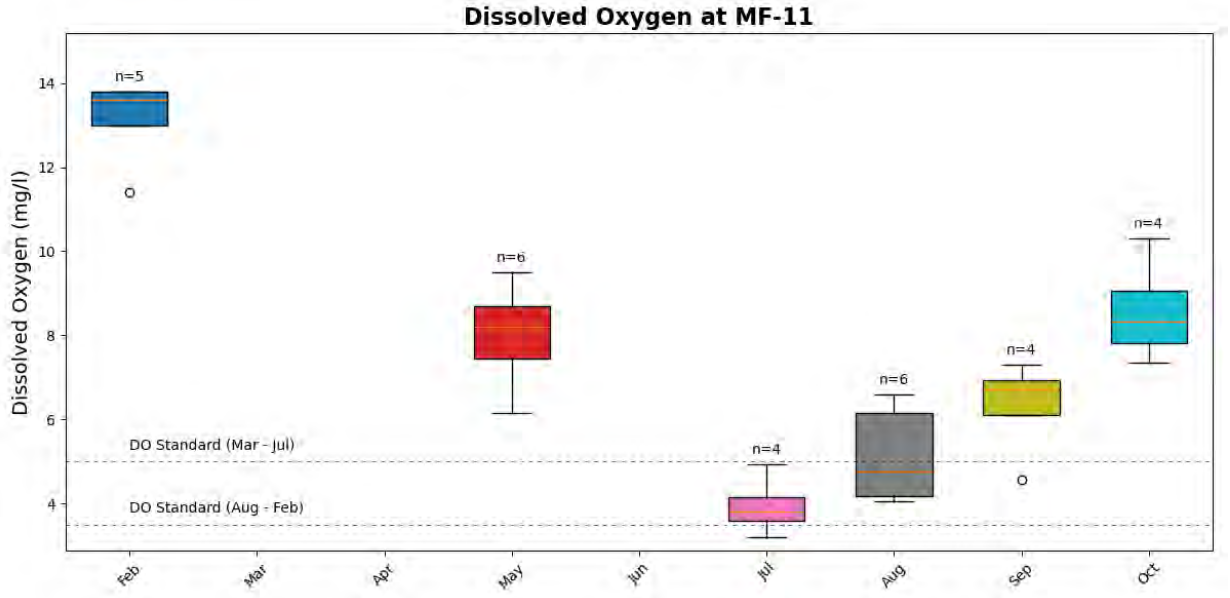


Figure C-170: Monthly Box Plot for Dissolved Oxygen at Station MF-12 in Middle Fork

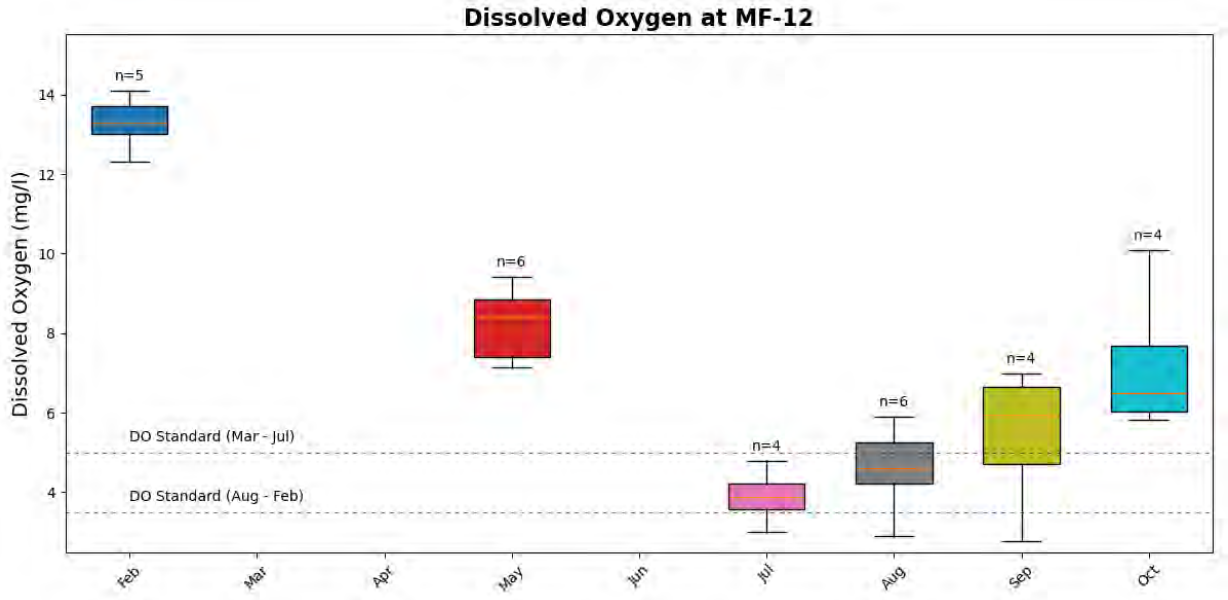


Figure C-171: Monthly Box Plot for Dissolved Oxygen at Station MF-13 in Middle Fork

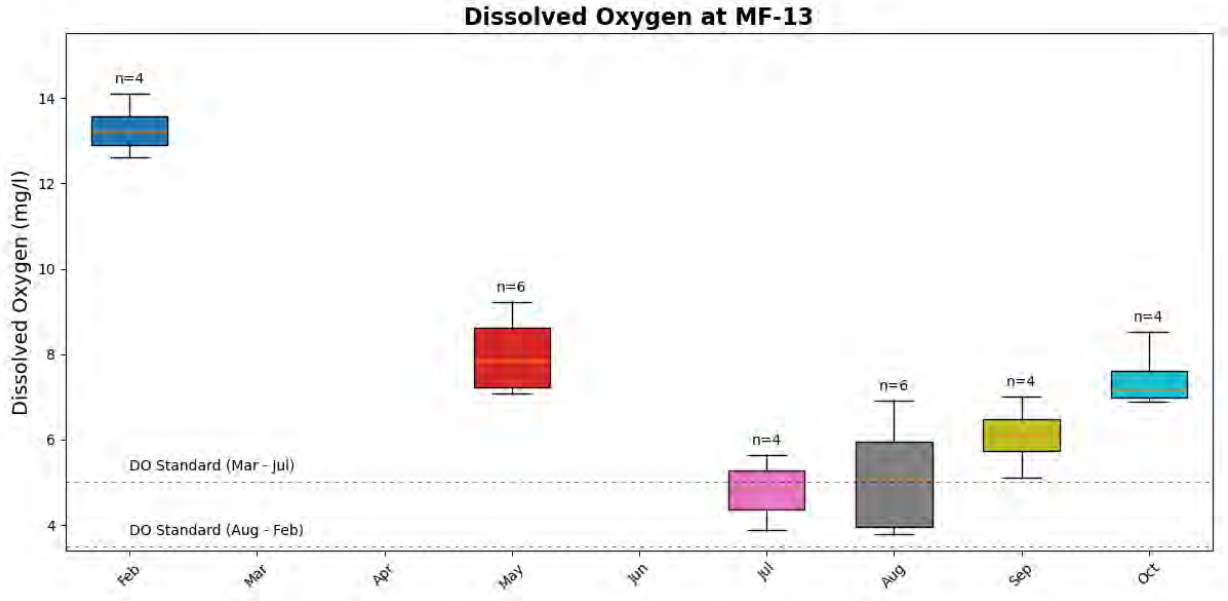


Figure C-172: Monthly Box Plot for Dissolved Oxygen at Station MF-14 in Middle Fork

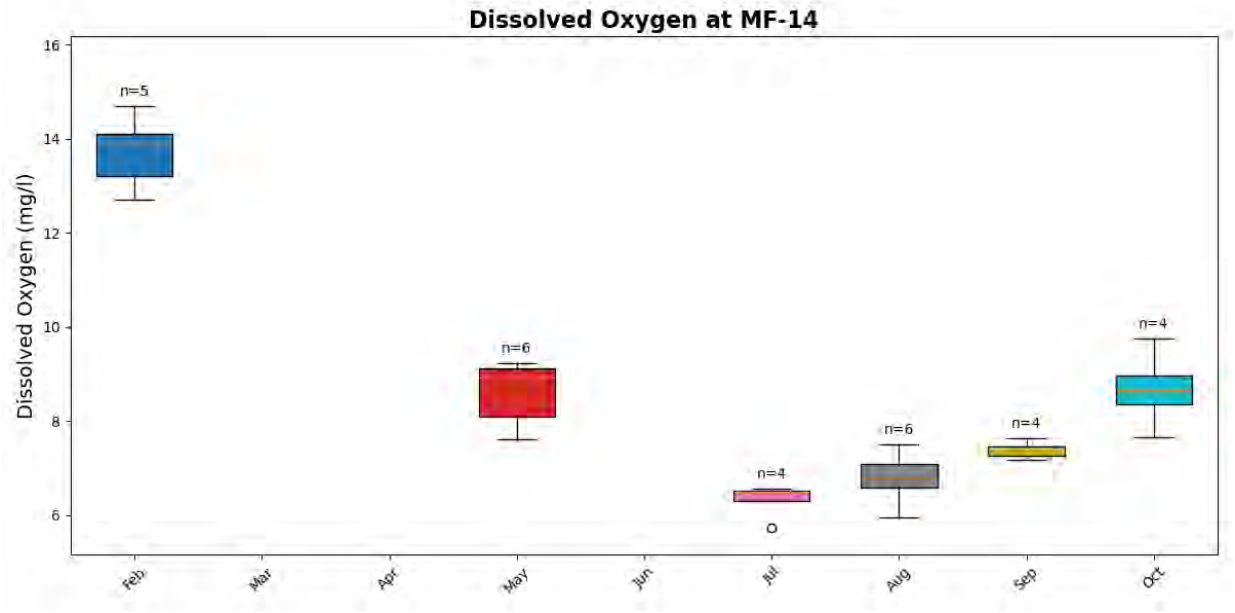


Figure C-173: Monthly Box Plot for Dissolved Oxygen at Station MF-15 in Middle Fork

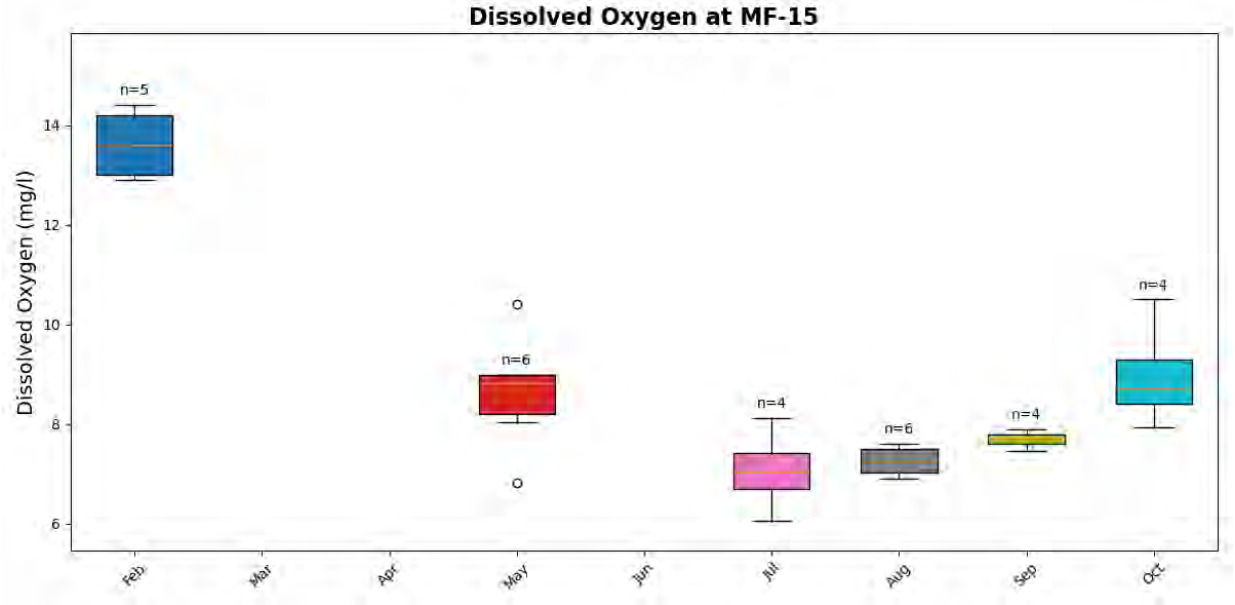


Figure C-174: Monthly Box Plot for Dissolved Oxygen at Station MF-16 in Middle Fork

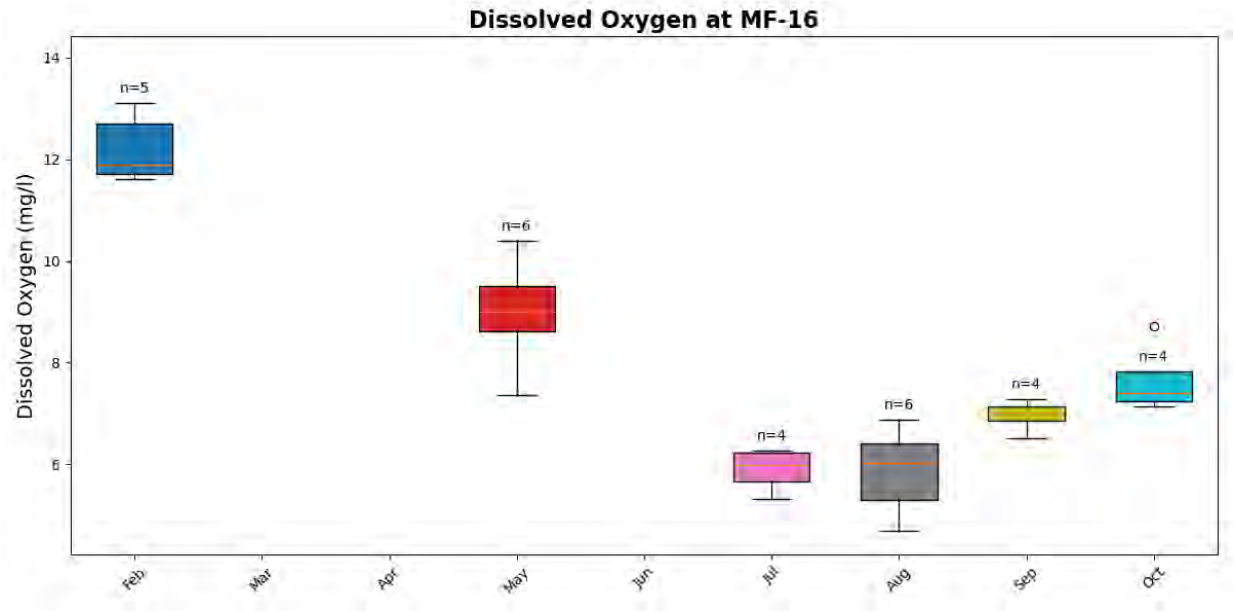


Figure C-175: Monthly Box Plot for Dissolved Oxygen at Station MF-17 in Middle Fork

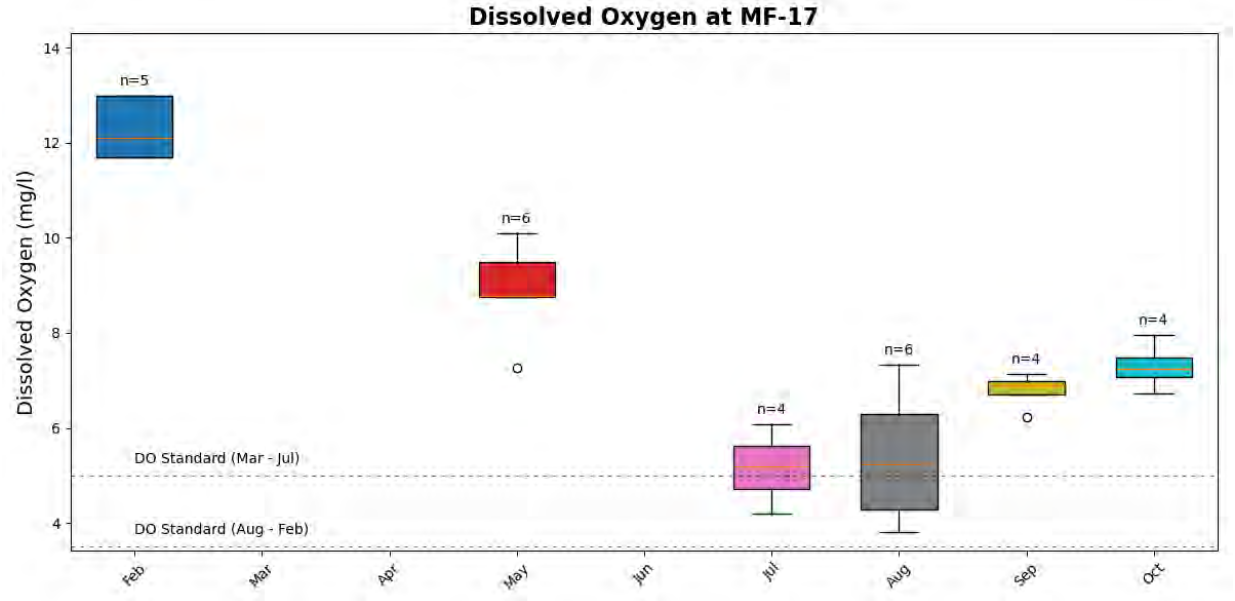
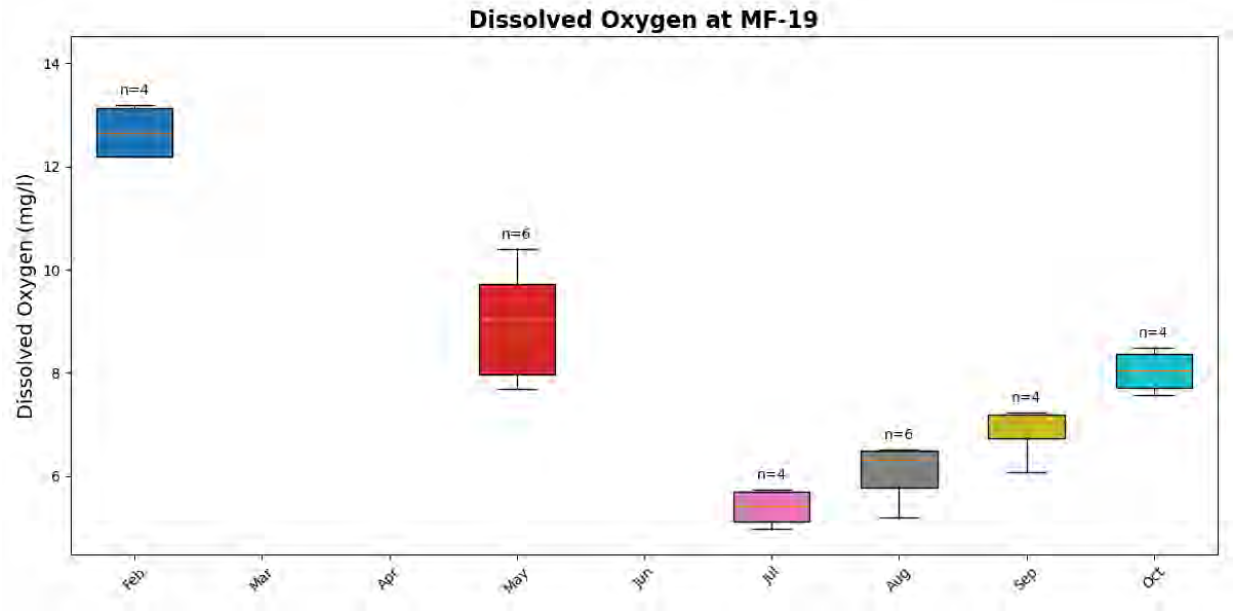


Figure C-176: Monthly Box Plot for Dissolved Oxygen at Station MF-19 in Middle Fork



E. Coli

Figure C-177: Monthly Box Plot for E. Coli at Station MF-08 in Middle Fork

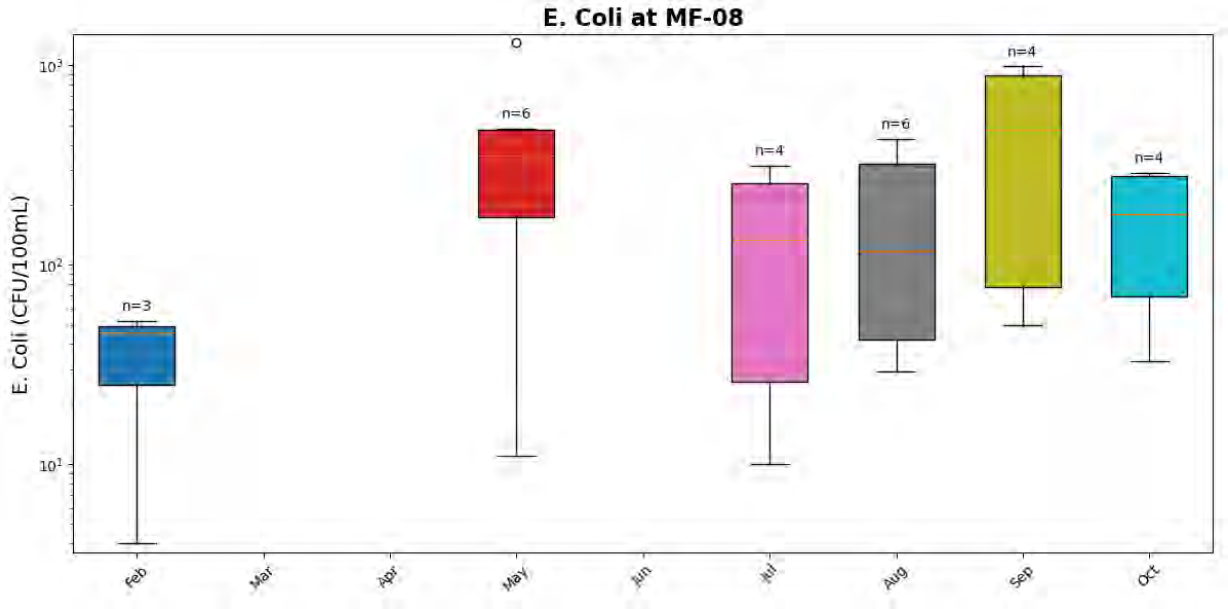


Figure C-178: Monthly Box Plot for E. Coli at Station MF-09 in Middle Fork

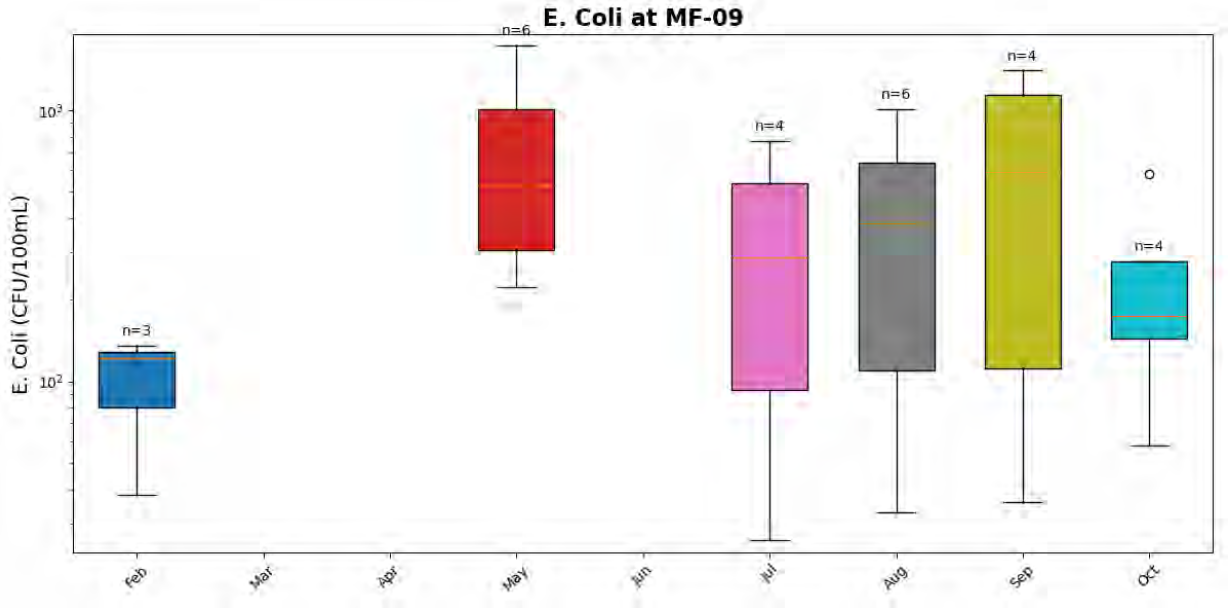


Figure C-179: Monthly Box Plot for E. Coli at Station MF-10 in Middle Fork

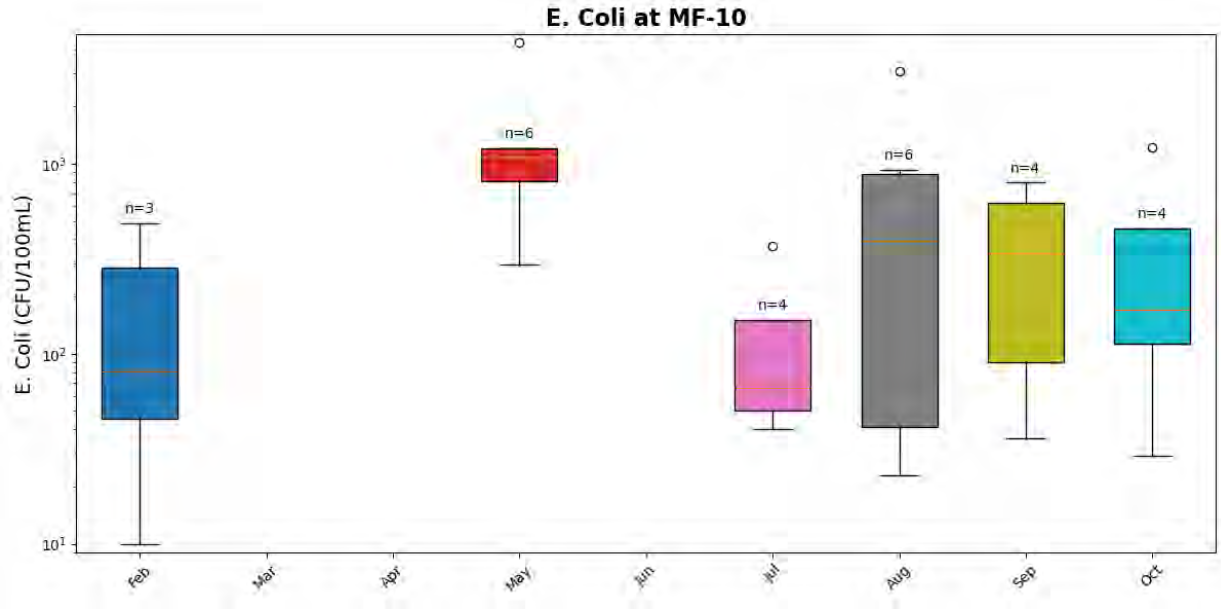


Figure C-180: Monthly Box Plot for E. Coli at Station MF-11 in Middle Fork

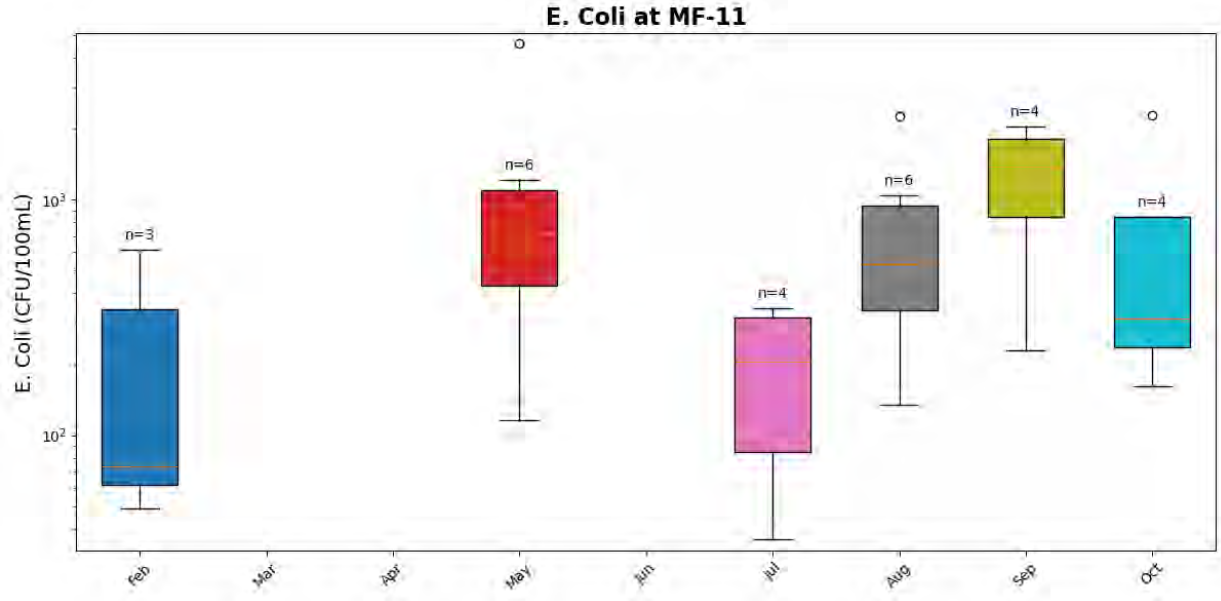


Figure C-181: Monthly Box Plot for E. Coli at Station MF-12 in Middle Fork

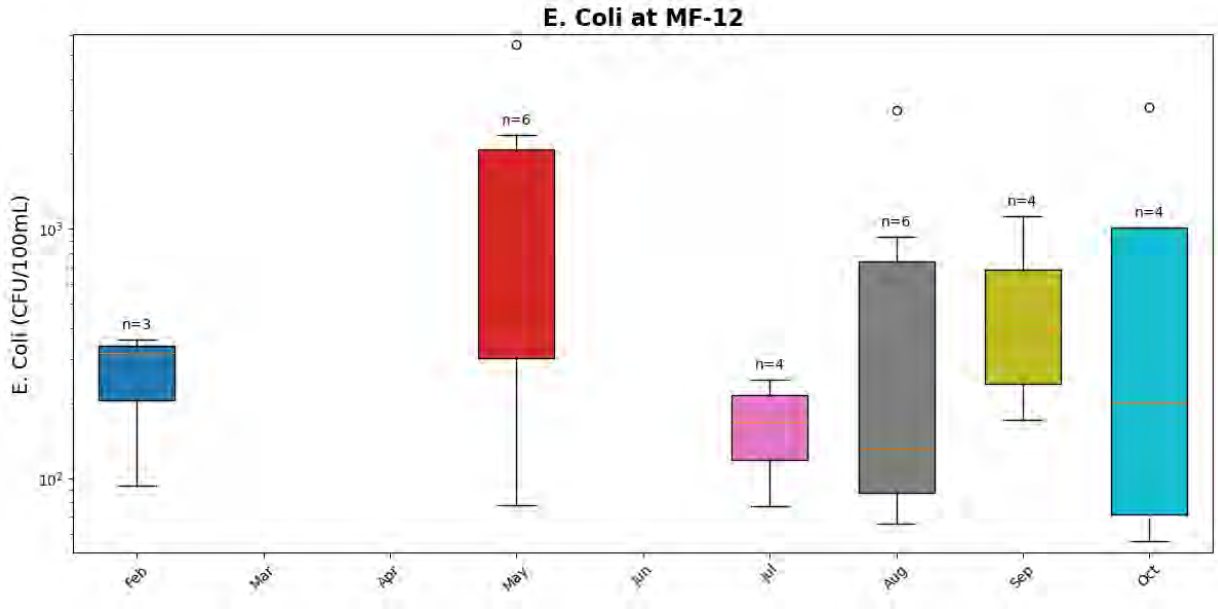


Figure C-182: Monthly Box Plot for E. Coli at Station MF-13 in Middle Fork

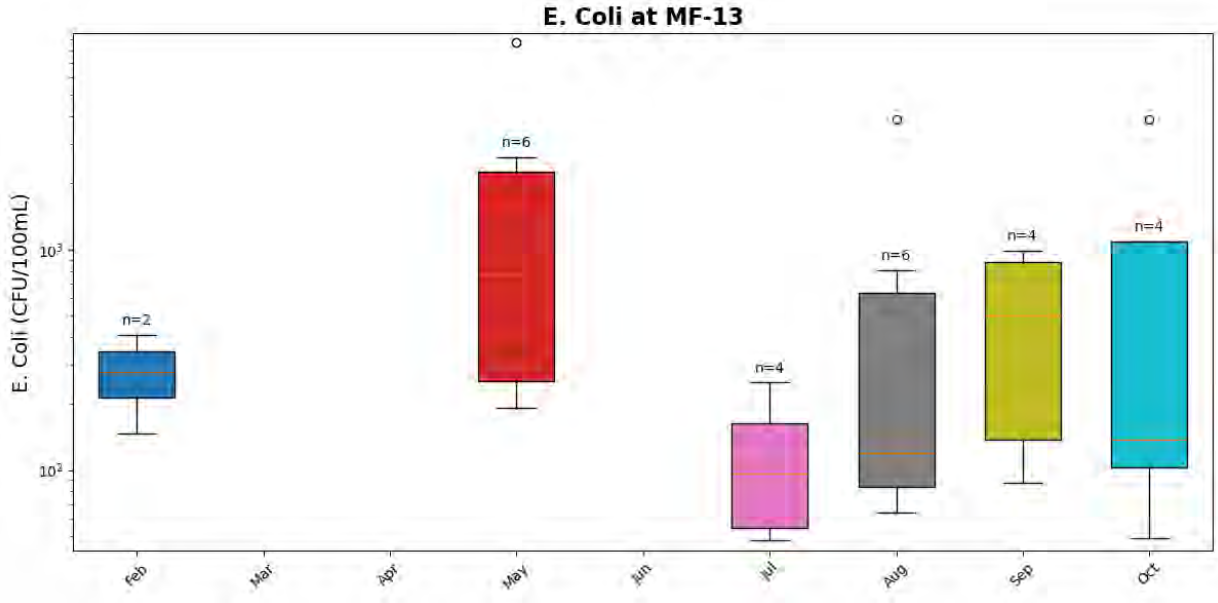


Figure C-183: Monthly Box Plot for E. Coli at Station MF-14 in Middle Fork

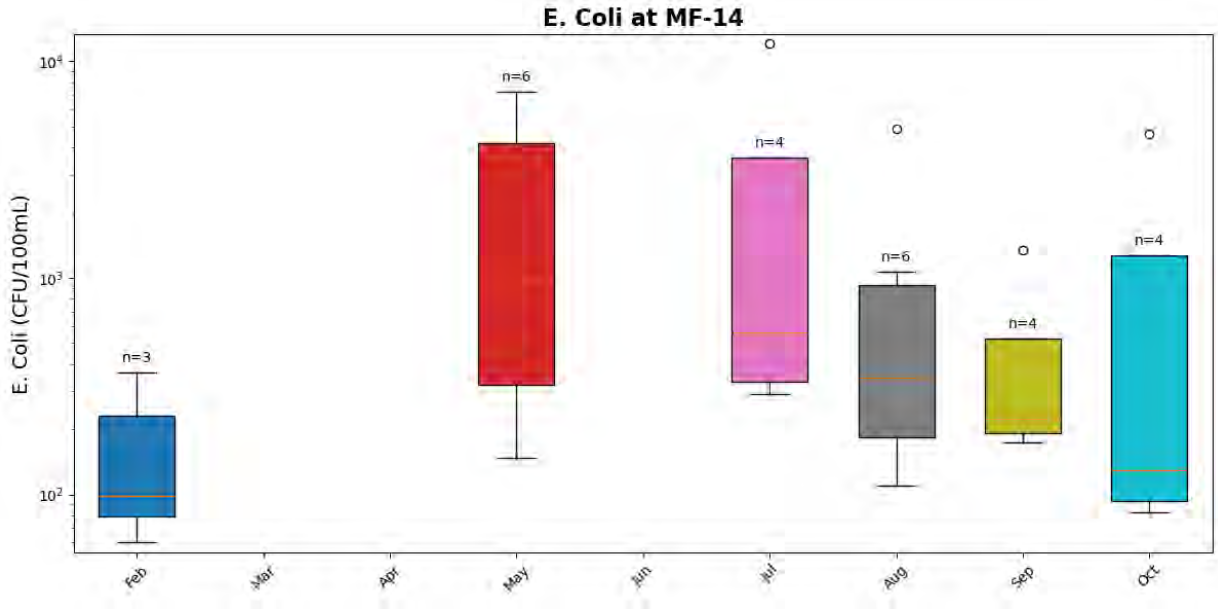


Figure C-184: Monthly Box Plot for E. Coli at Station MF-15 in Middle Fork

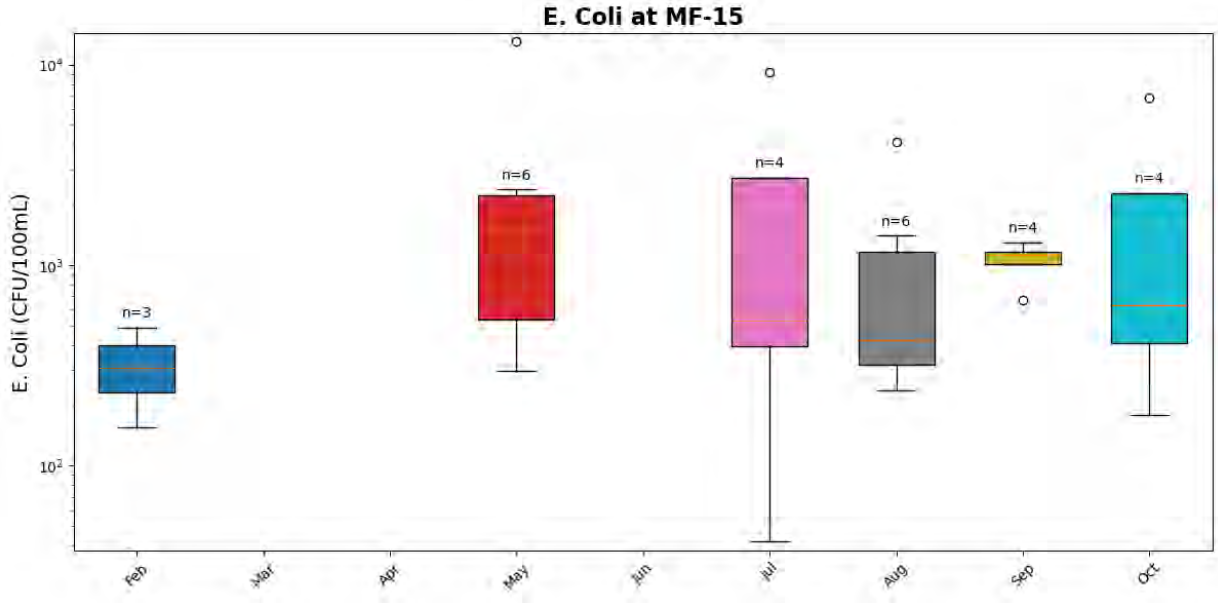


Figure C-185: Monthly Box Plot for E. Coli at Station MF-16 in Middle Fork

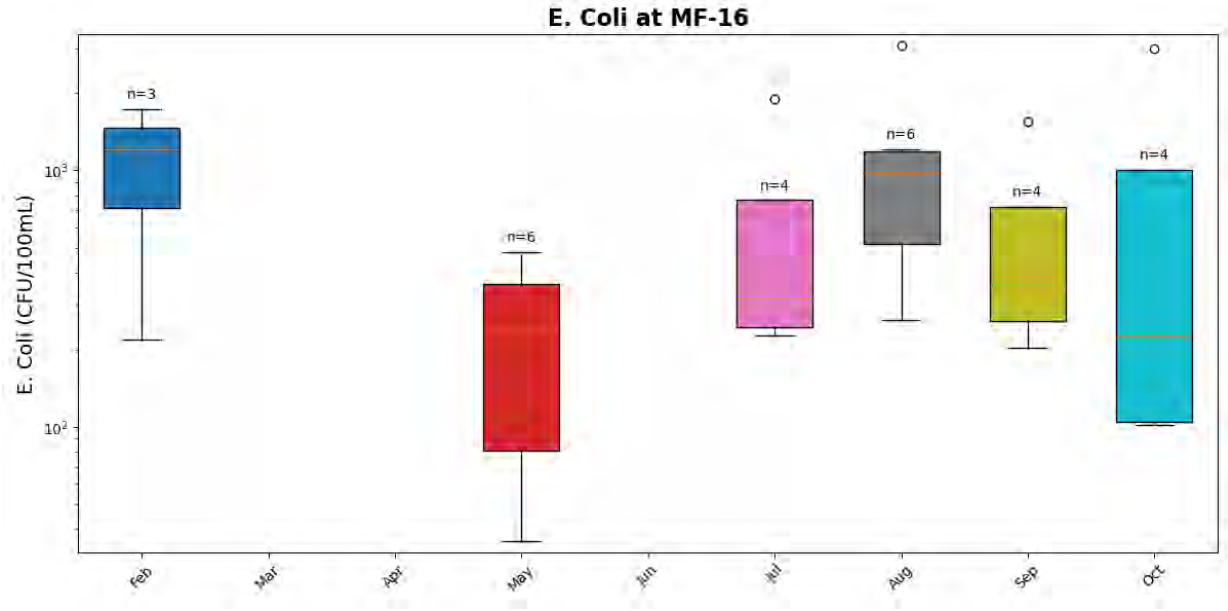


Figure C-186: Monthly Box Plot for E. Coli at Station MF-17 in Middle Fork

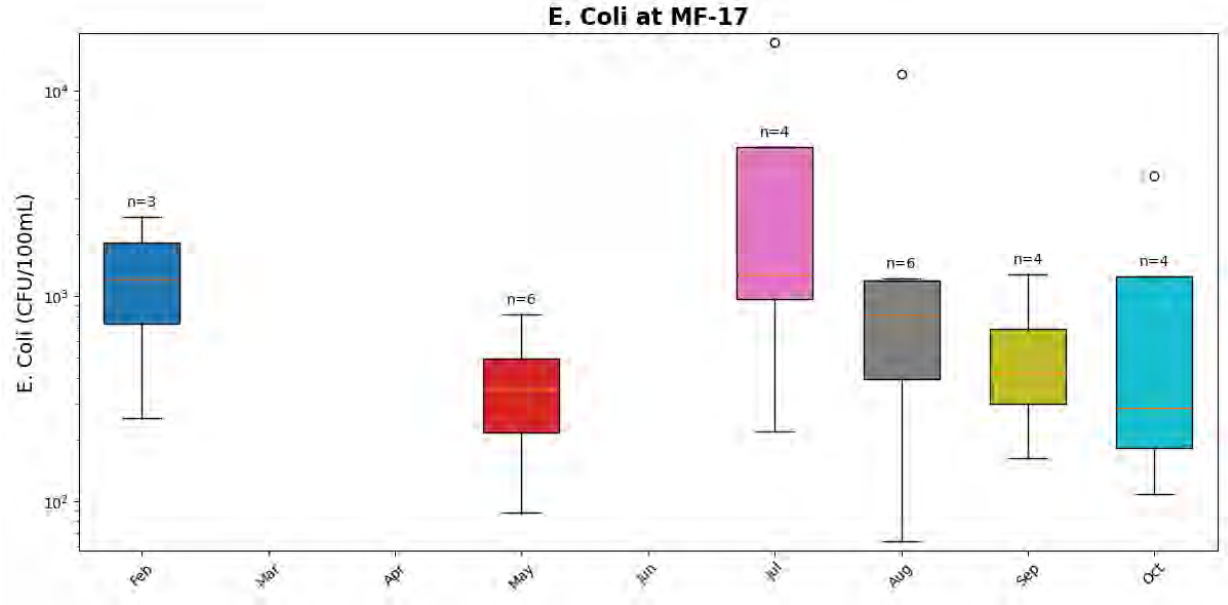
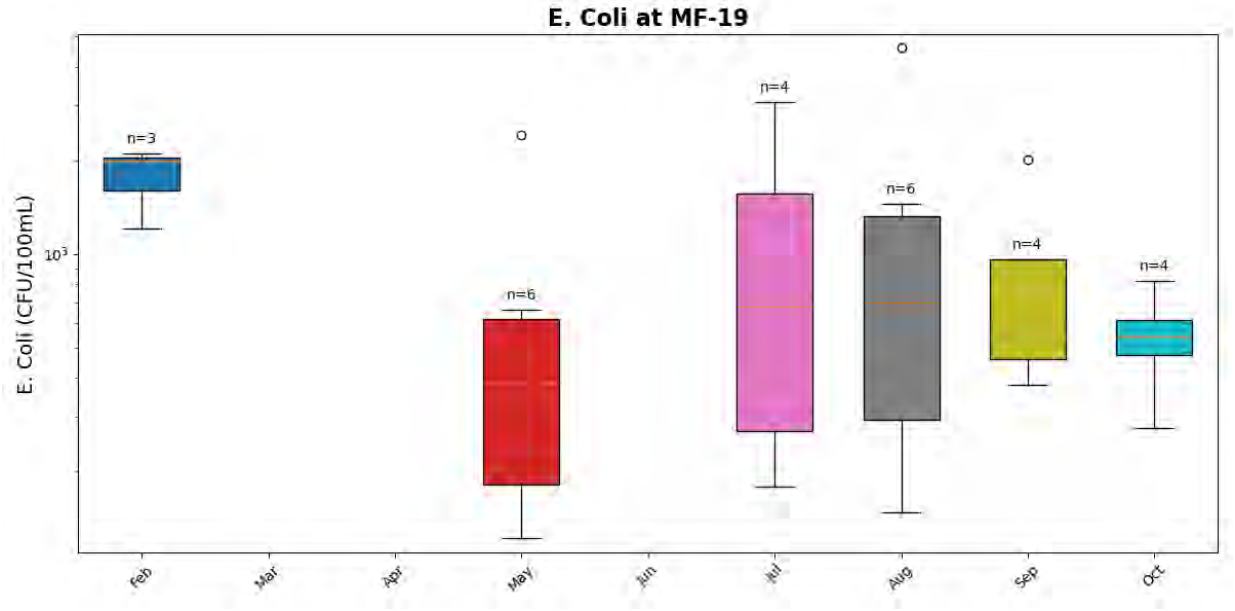


Figure C-187: Monthly Box Plot for E. Coli at Station MF-19 in Middle Fork



Skokie River

pH

Figure C-188: Monthly Box Plot for pH at Station SR-01 in Skokie River

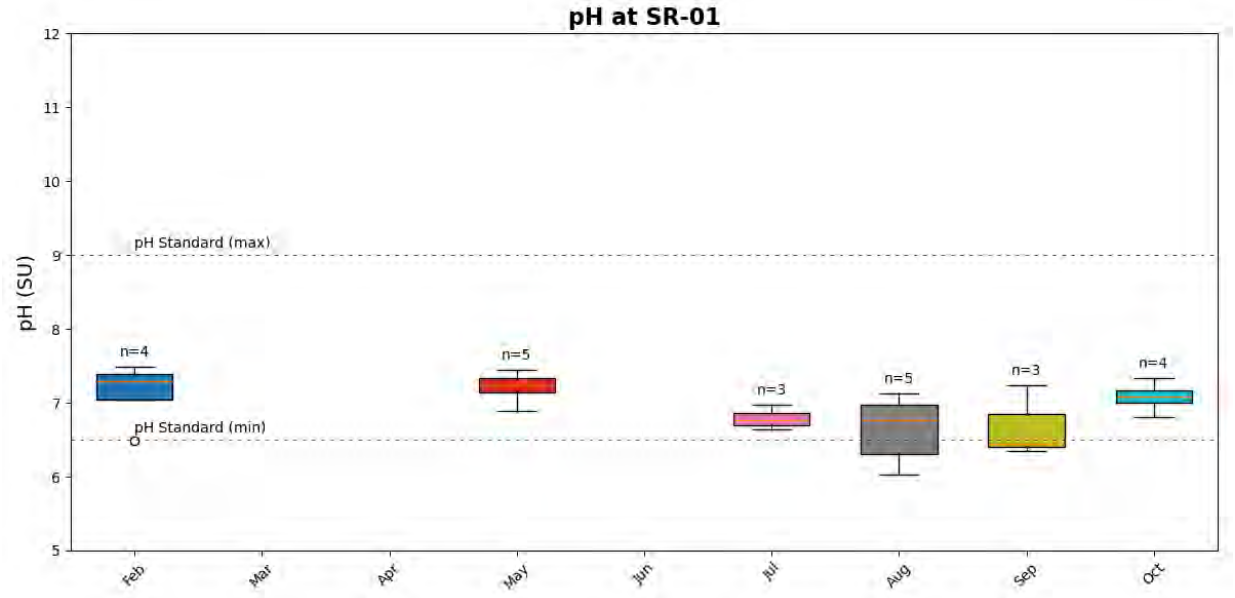


Figure C-189: Monthly Box Plot for pH at Station SR-02 in Skokie River

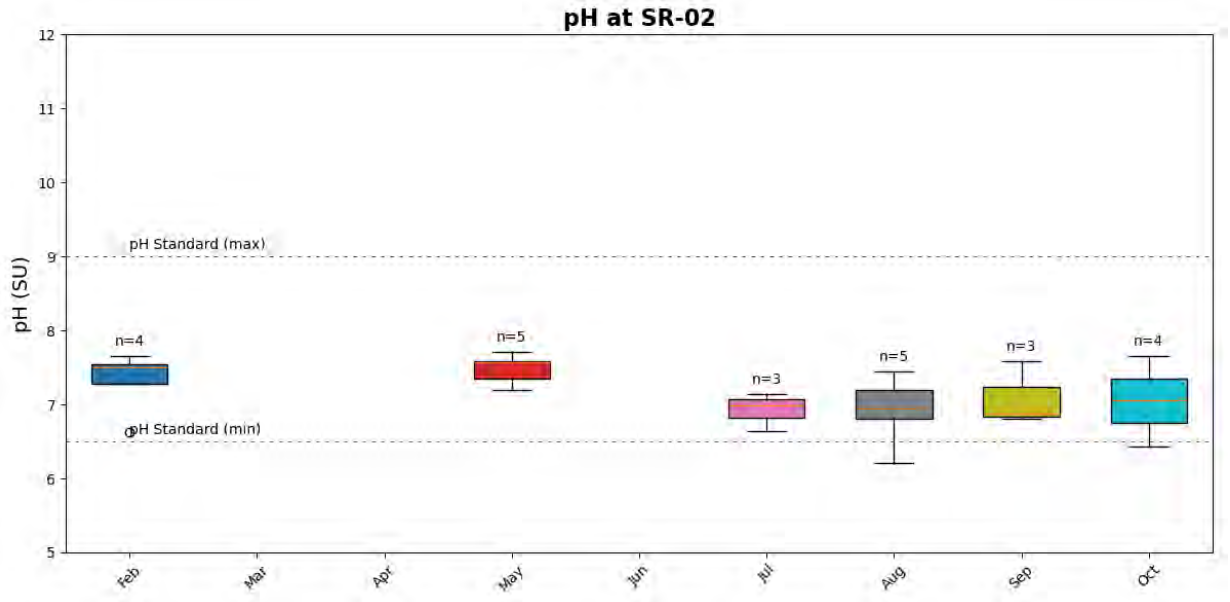


Figure C-190: Monthly Box Plot for pH at Station SR-03 in Skokie River

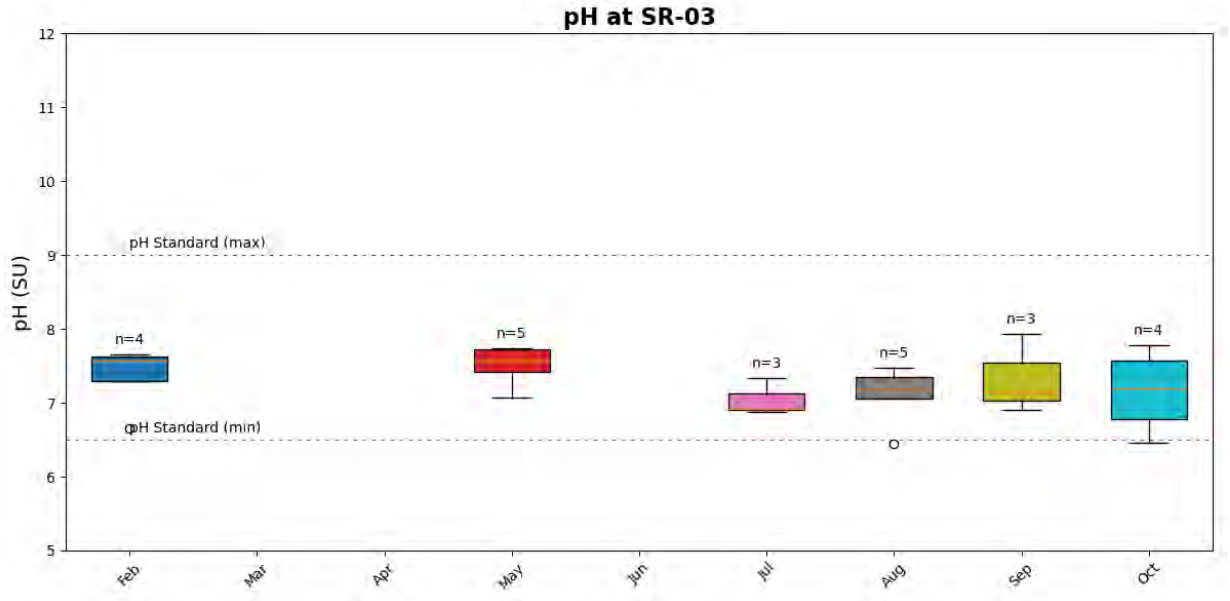


Figure C-191: Monthly Box Plot for pH at Station SR-04 in Skokie River

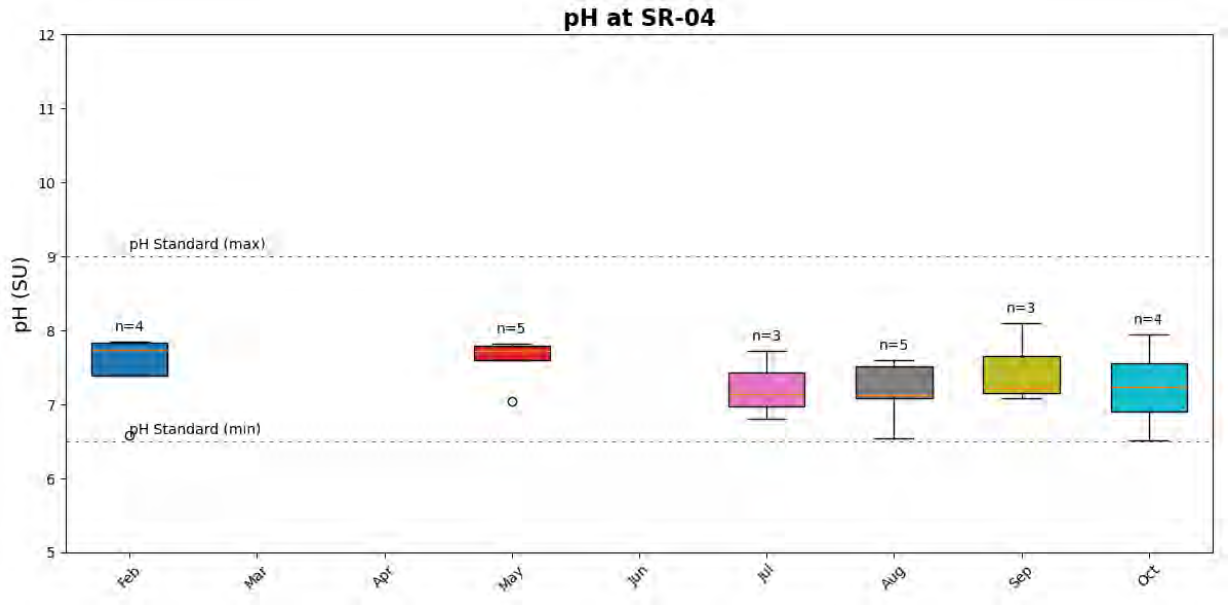


Figure C-192: Monthly Box Plot for pH at Station SR-05 in Skokie River

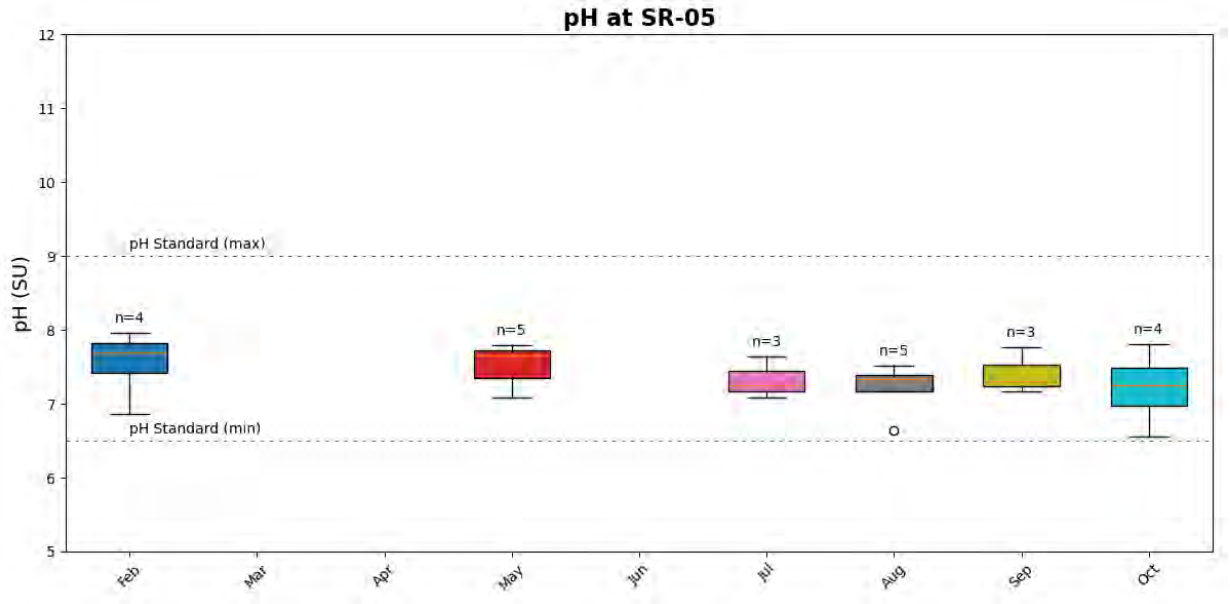


Figure C-193: Monthly Box Plot for pH at Station SR-06 in Skokie River

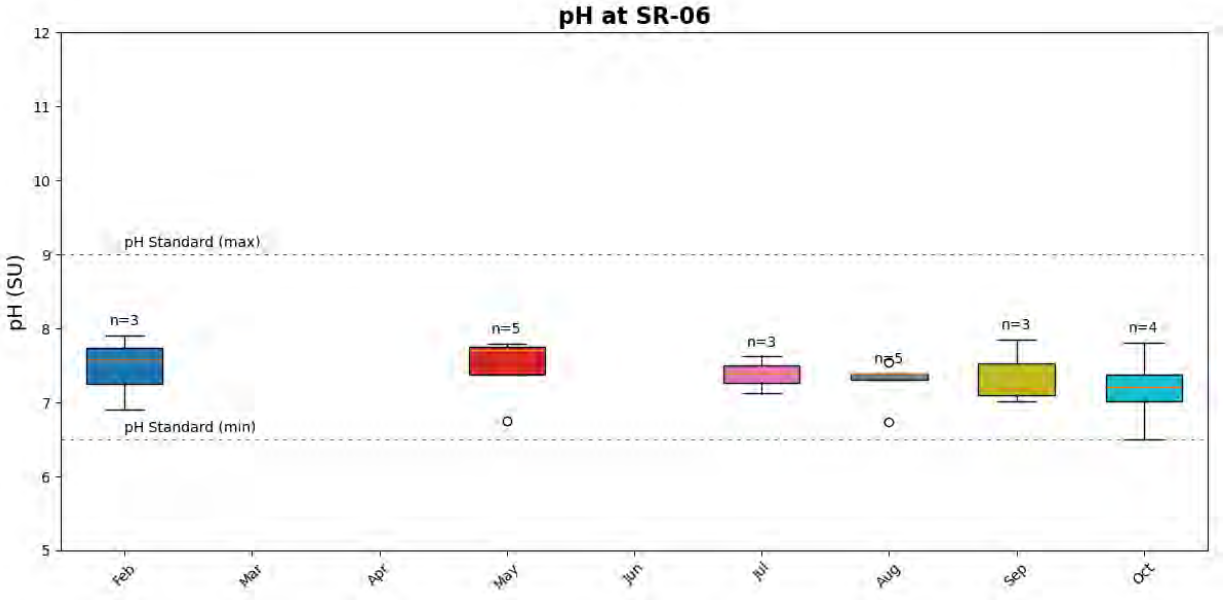


Figure C-194: Monthly Box Plot for pH at Station SR-07 in Skokie River

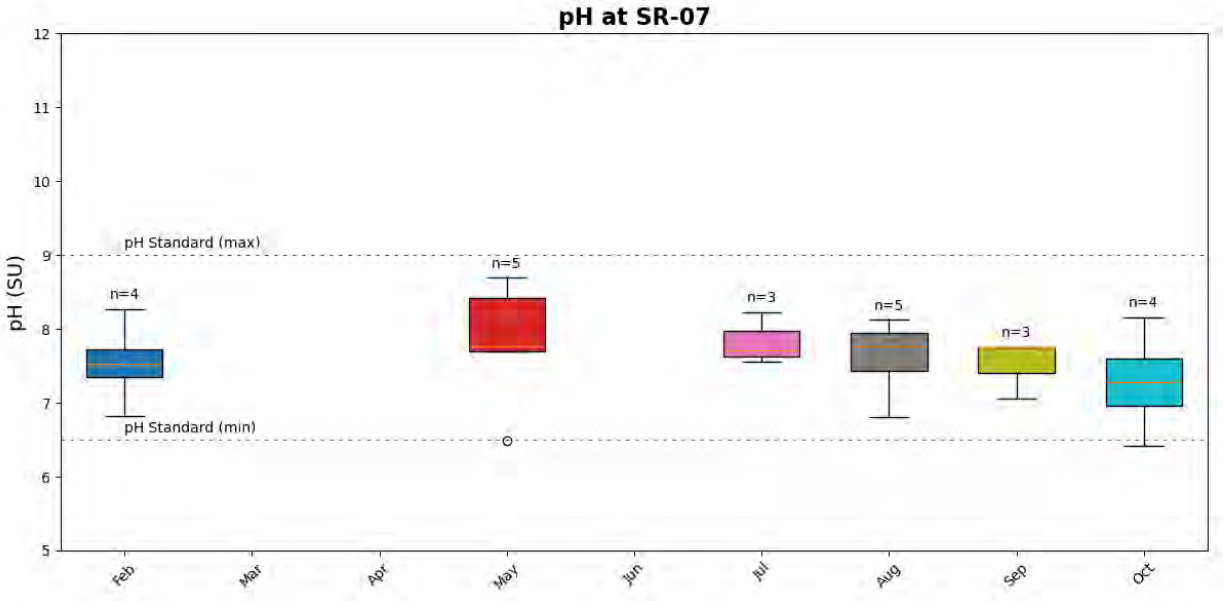
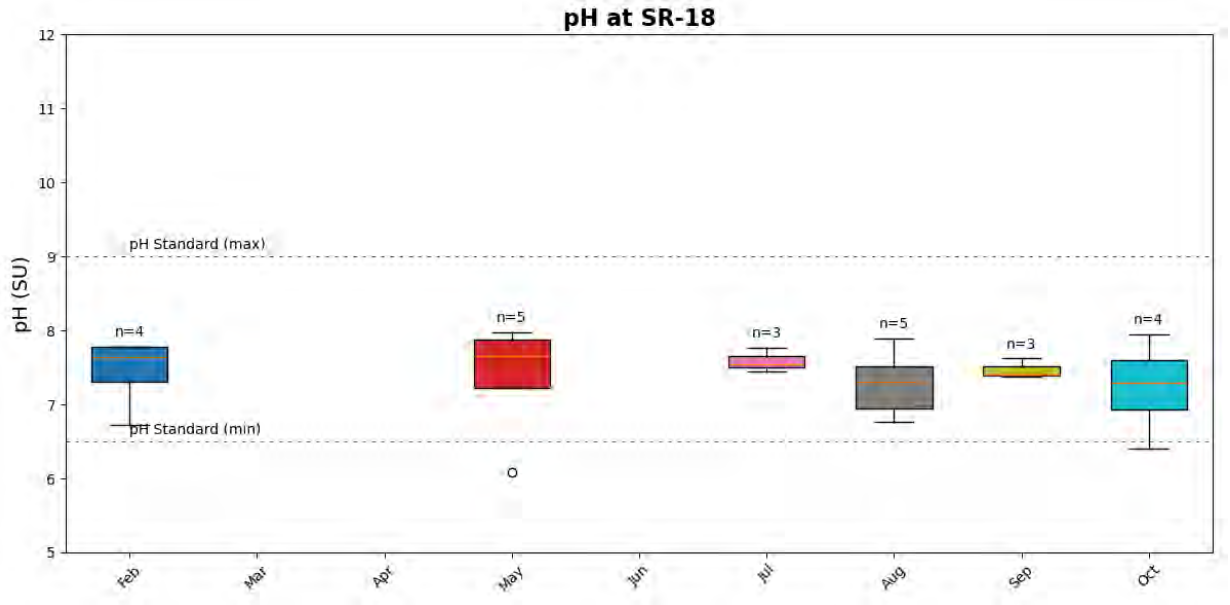


Figure C-195: Monthly Box Plot for pH at Station SR-18 in Skokie River



Specific Conductivity

Figure C-196: Monthly Box Plot for Specific Conductivity at Station SR-01 in Skokie River

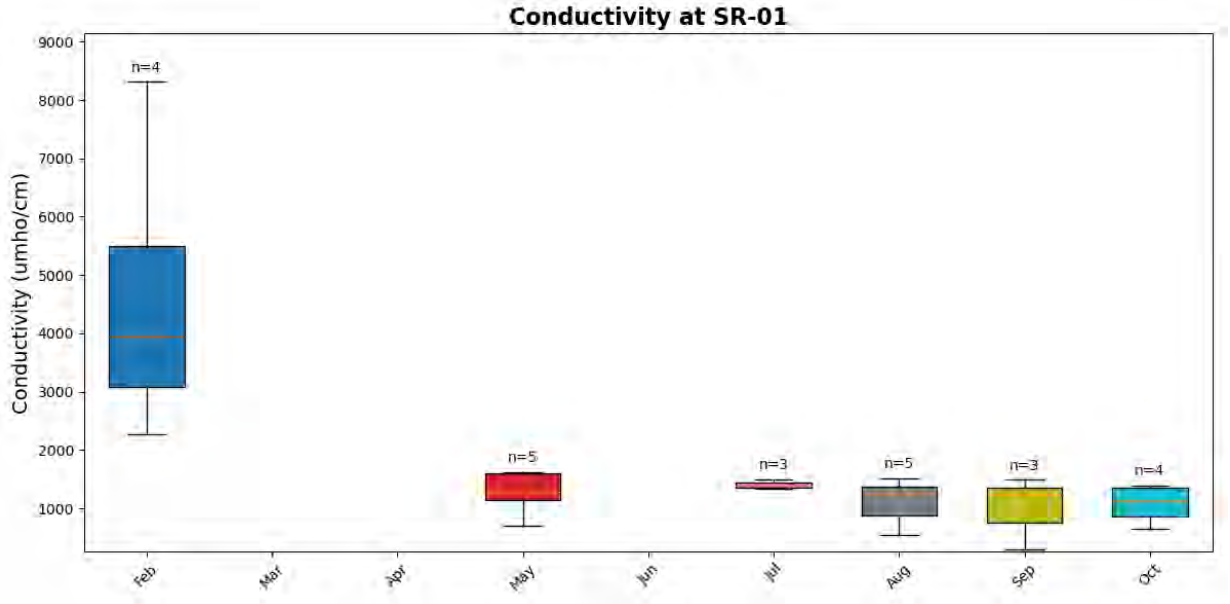


Figure C-197: Monthly Box Plot for Specific Conductivity at Station SR-02 in Skokie River

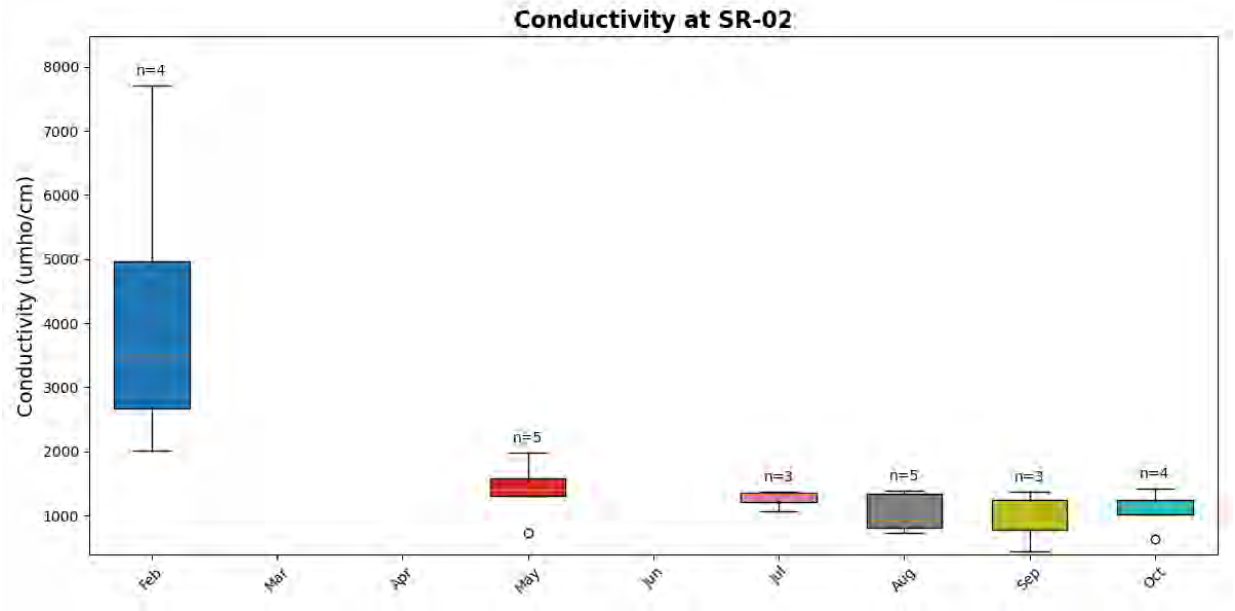


Figure C-198: Monthly Box Plot for Specific Conductivity at Station SR-03 in Skokie River

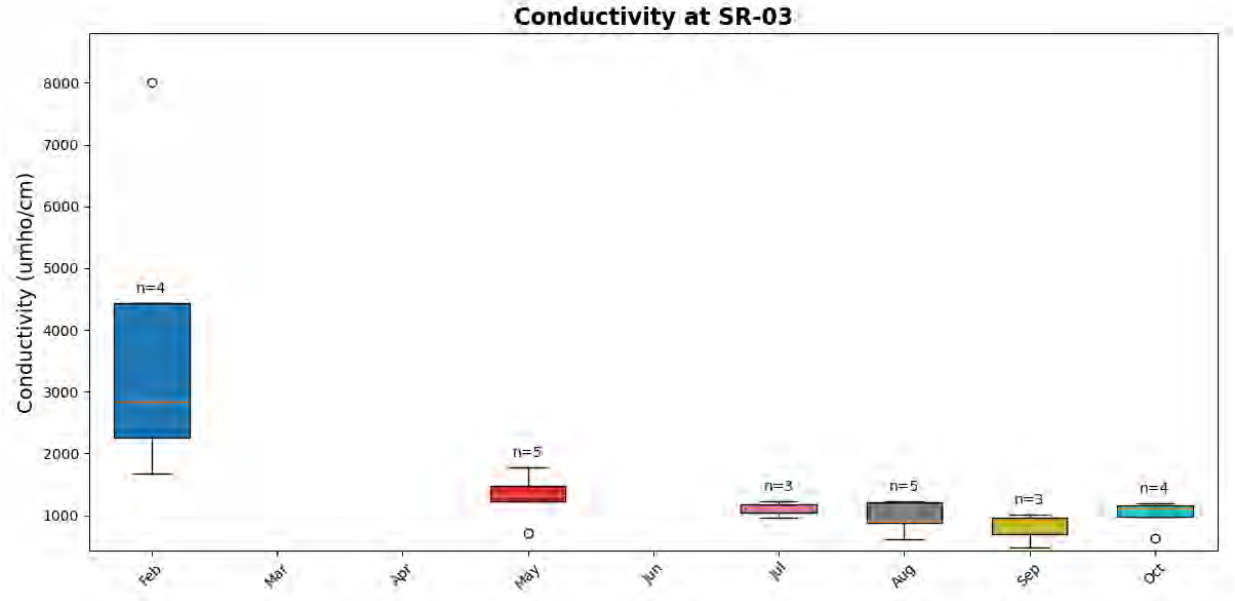


Figure C-199: Monthly Box Plot for Specific Conductivity at Station SR-04 in Skokie River

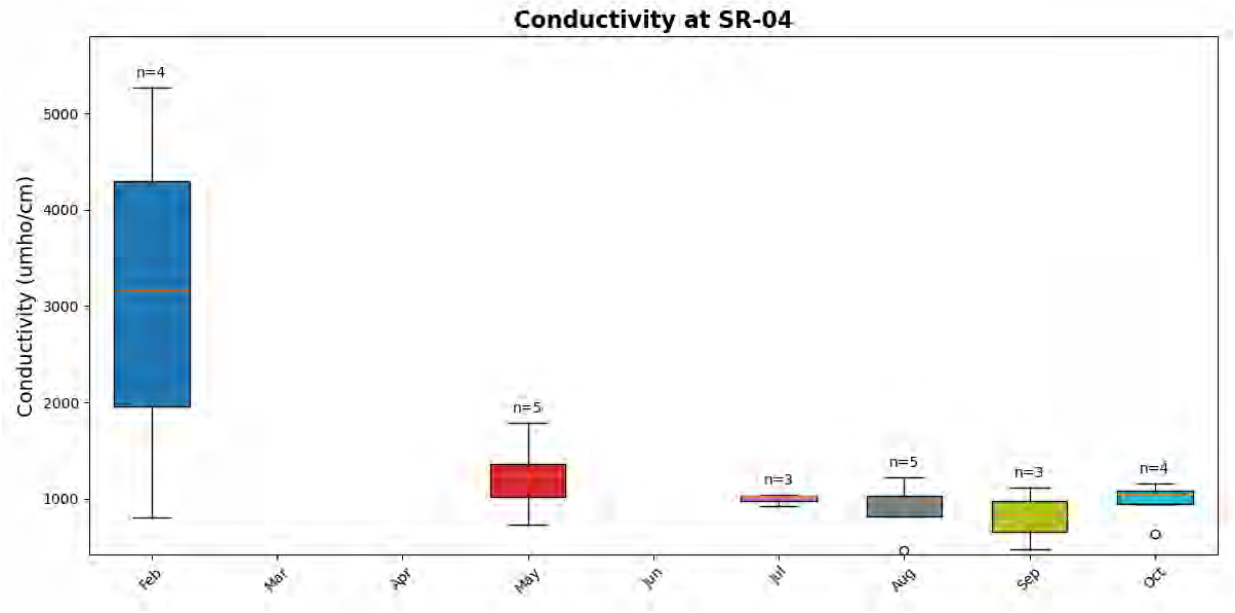


Figure C-200: Monthly Box Plot for Specific Conductivity at Station SR-05 in Skokie River

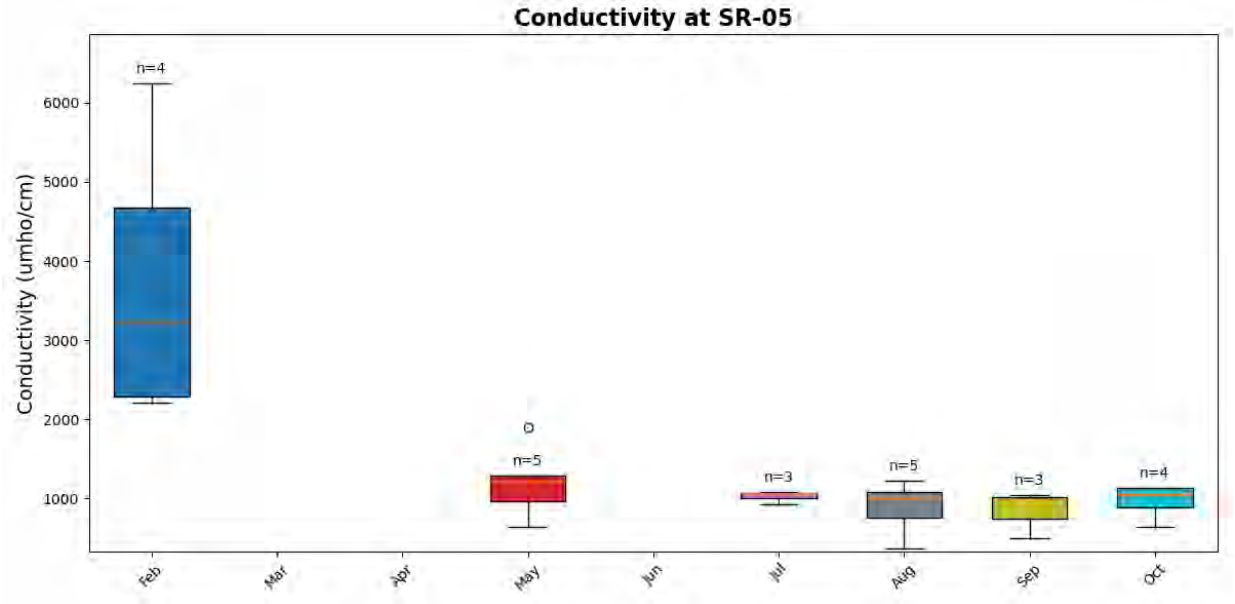


Figure C-201: Monthly Box Plot for Specific Conductivity at Station SR-06 in Skokie River

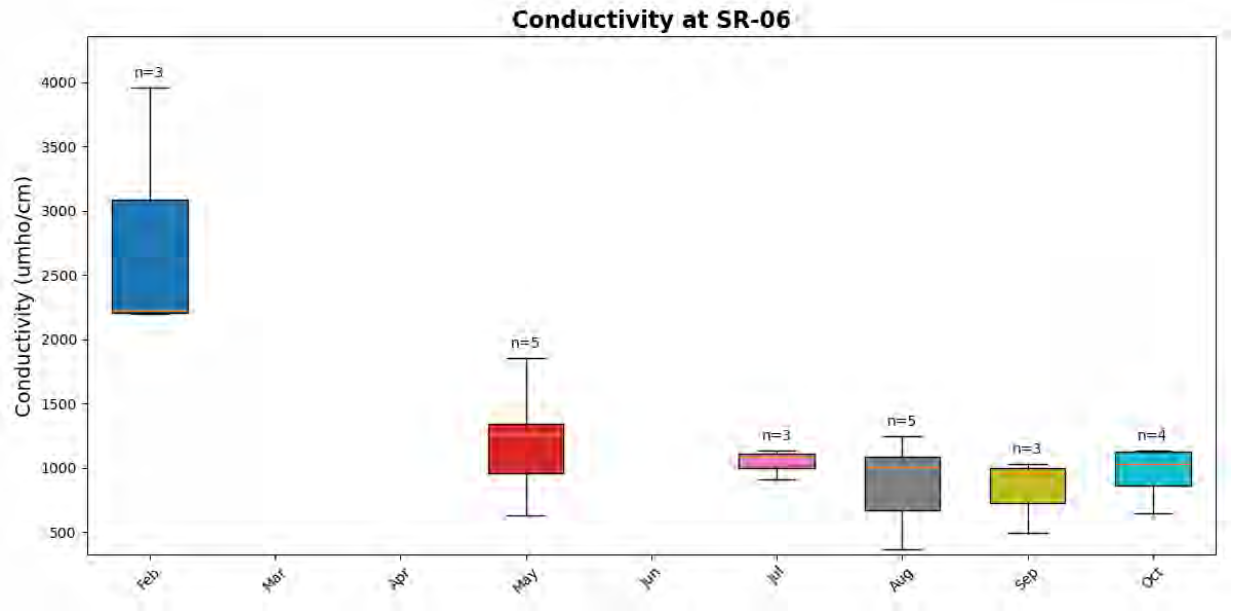


Figure C-202: Monthly Box Plot for Specific Conductivity at Station SR-07 in Skokie River

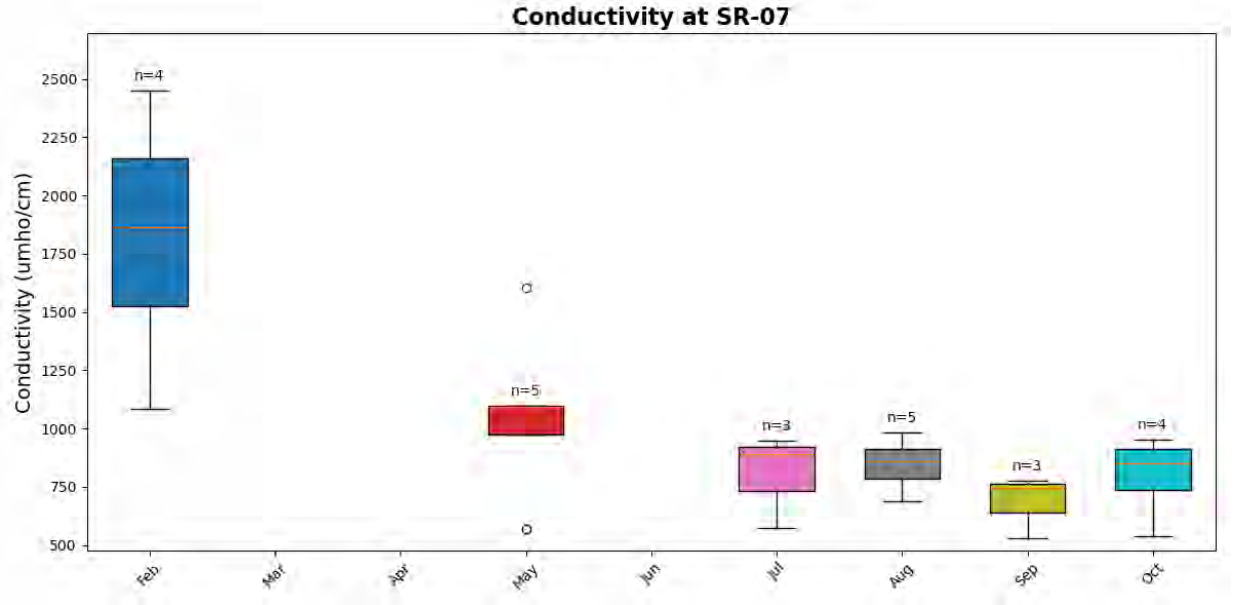
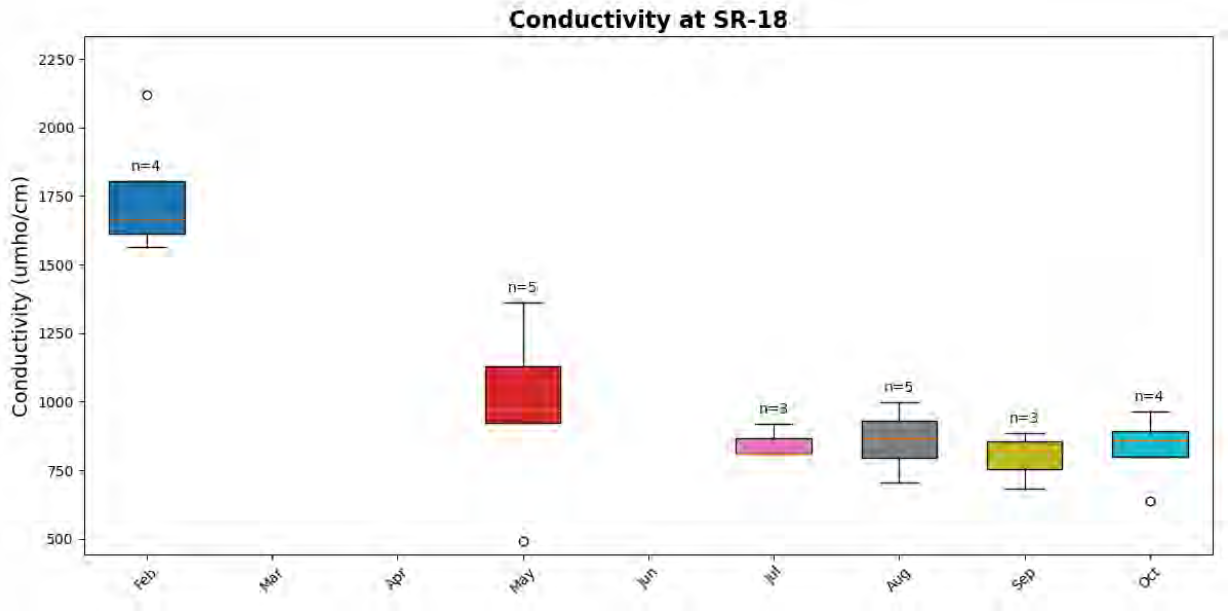


Figure C-203: Monthly Box Plot for Specific Conductivity at Station SR-18 in Skokie River



Chloride

Figure C-204: Monthly Box Plot for Chloride at Station SR-01 in Skokie River

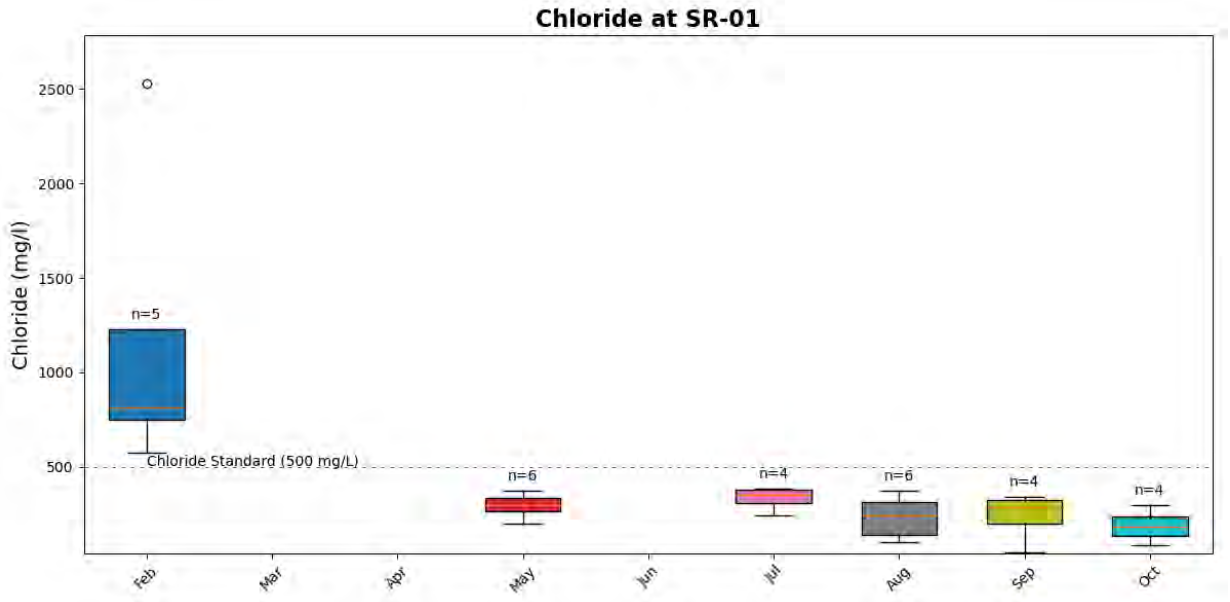


Figure C-205: Monthly Box Plot for Chloride at Station SR-02 in Skokie River

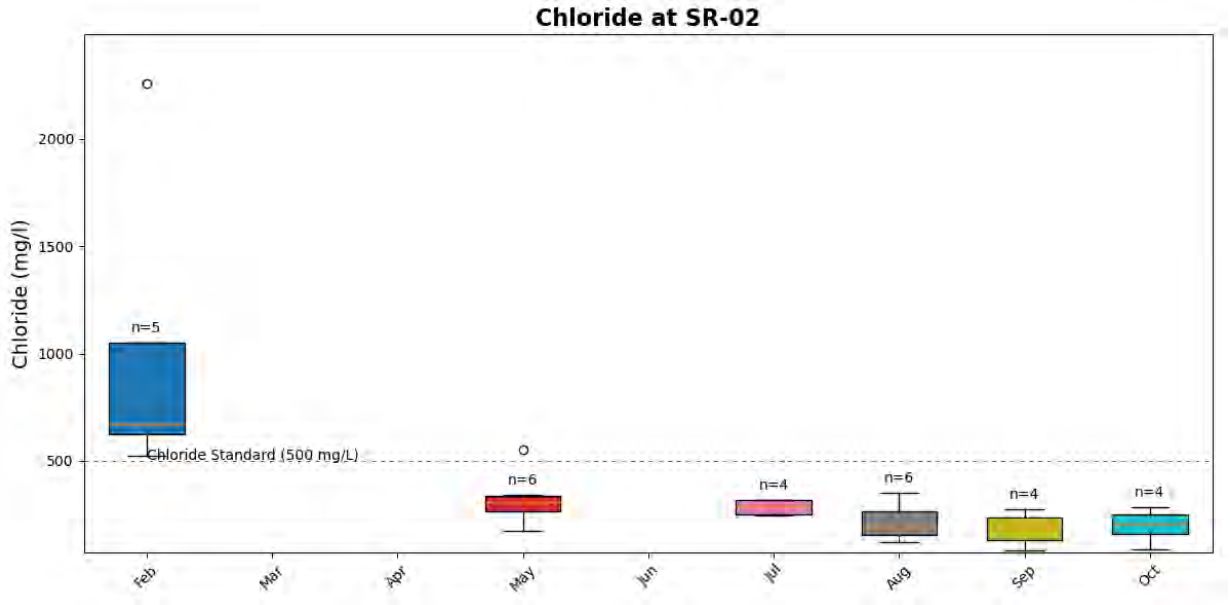


Figure C-206: Monthly Box Plot for Chloride at Station SR-03 in Skokie River

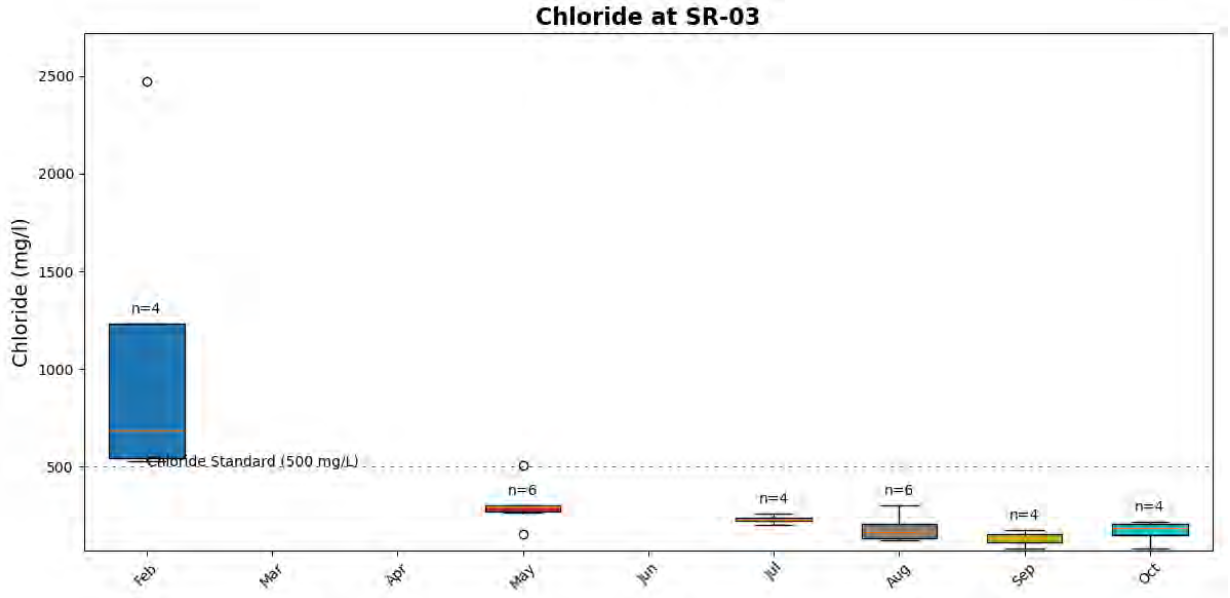


Figure C-207: Monthly Box Plot for Chloride at Station SR-04 in Skokie River

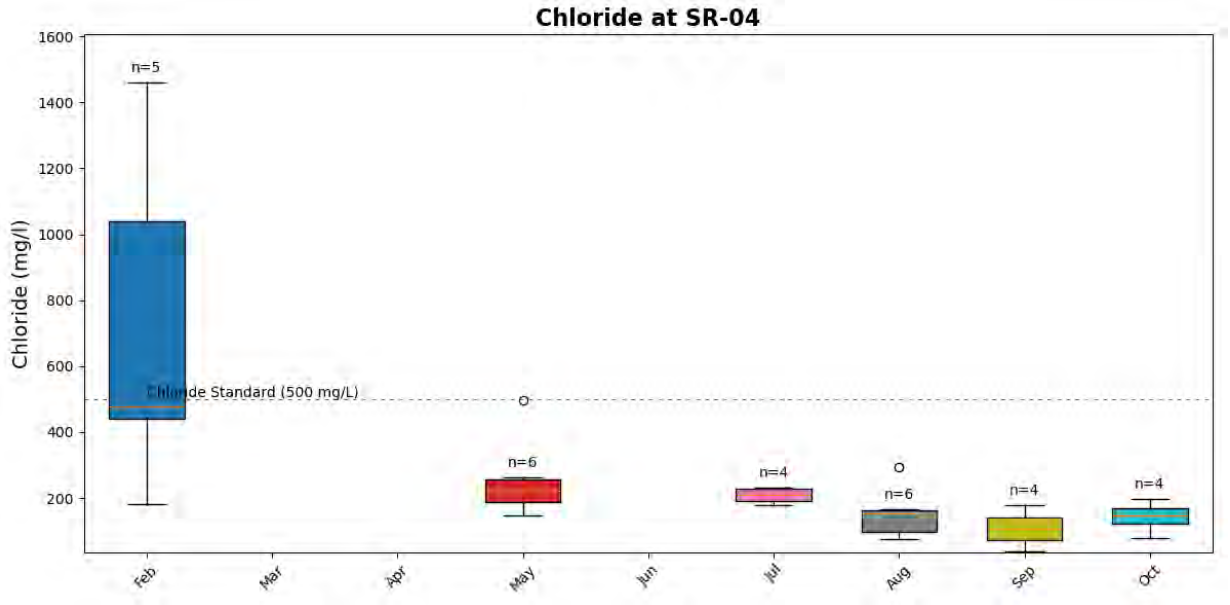


Figure C-208: Monthly Box Plot for Chloride at Station SR-05 in Skokie River

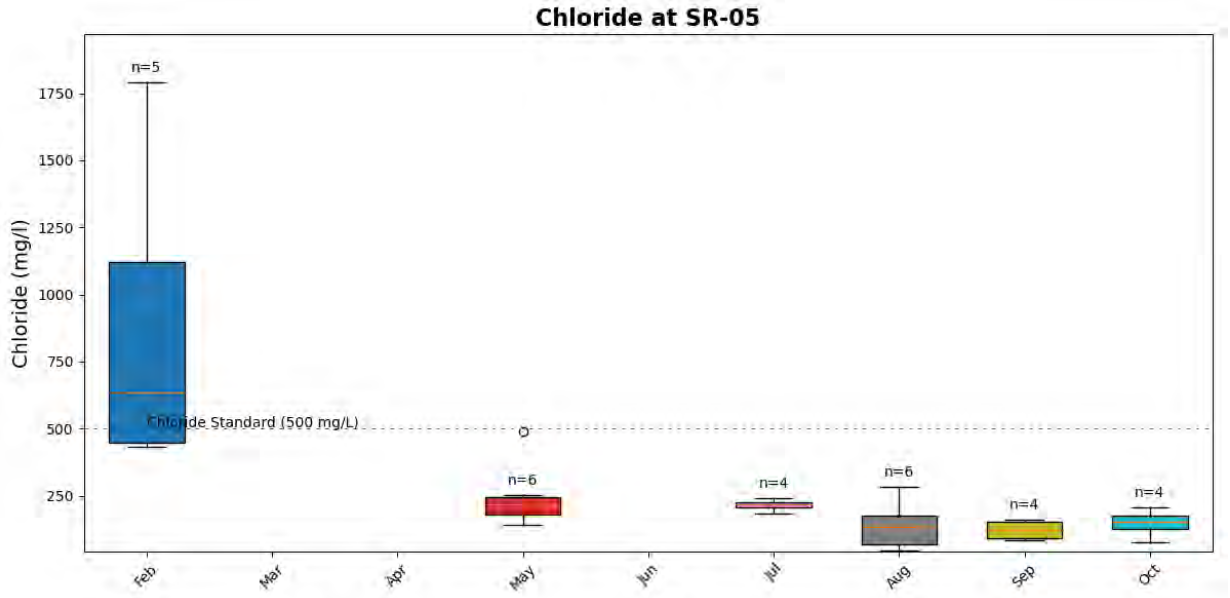


Figure C-209: Monthly Box Plot for Chloride at Station SR-06 in Skokie River

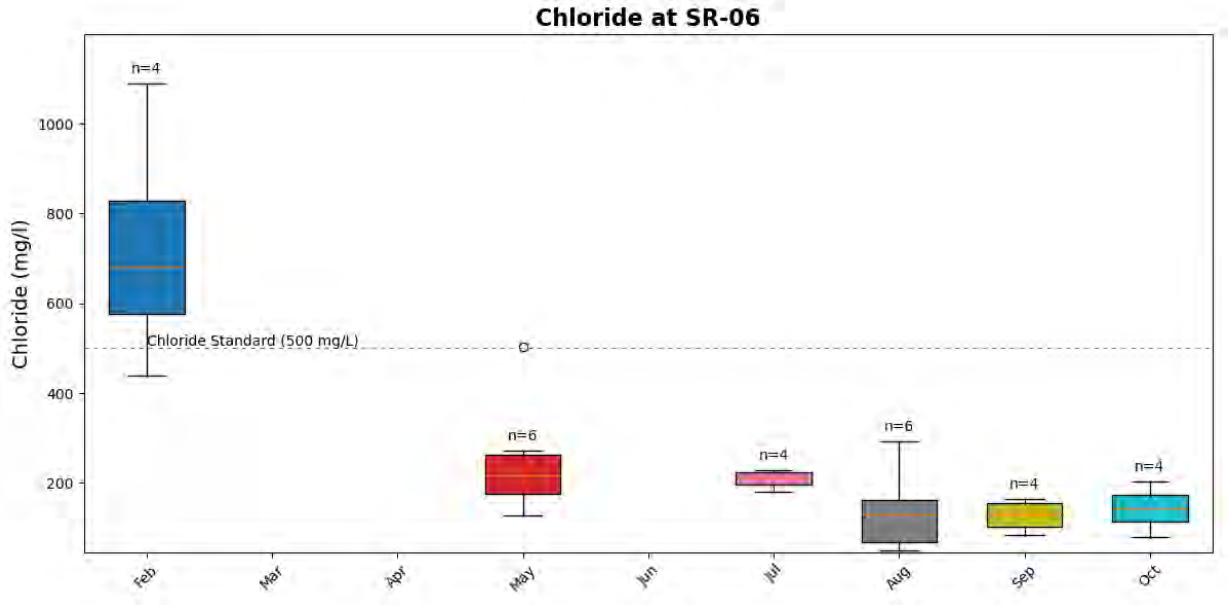


Figure C-210: Monthly Box Plot for Chloride at Station SR-07 in Skokie River

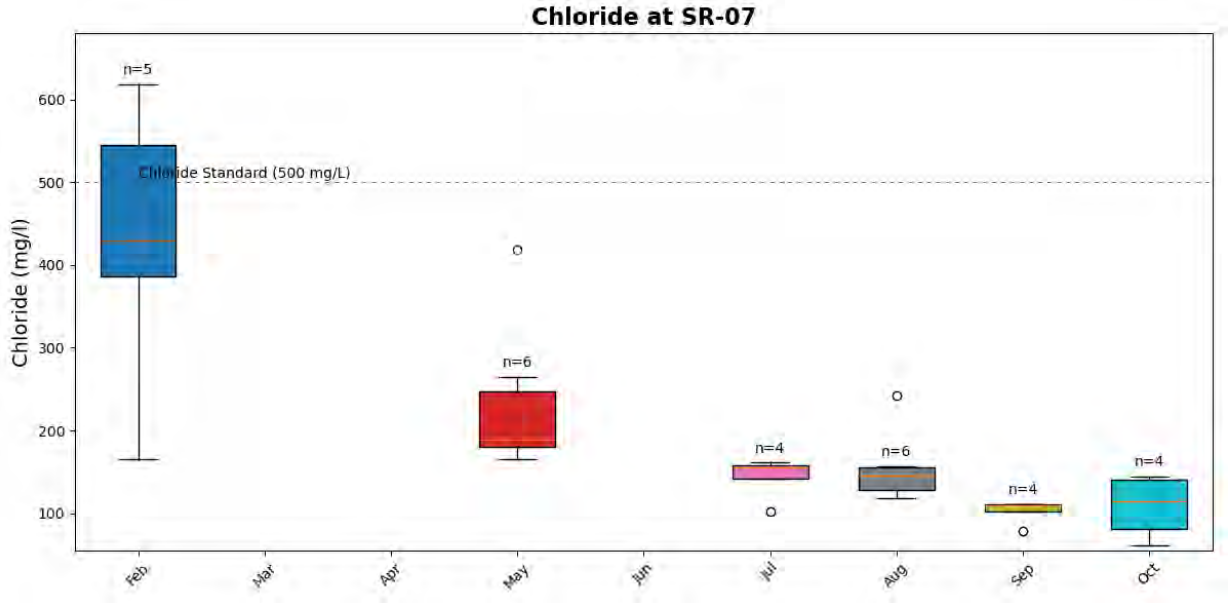
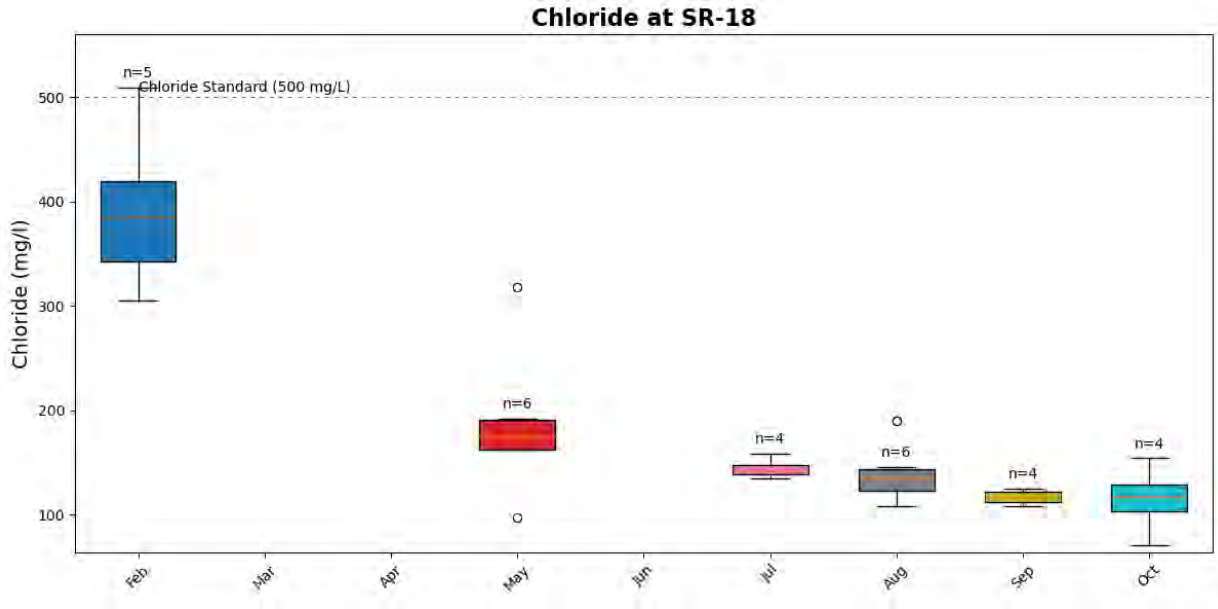


Figure C-211: Monthly Box Plot for Chloride at Station SR-18 in Skokie River



Total Suspended Solids

Figure C-212: Monthly Box Plot for Total Suspended Solids at Station SR-01 in Skokie River

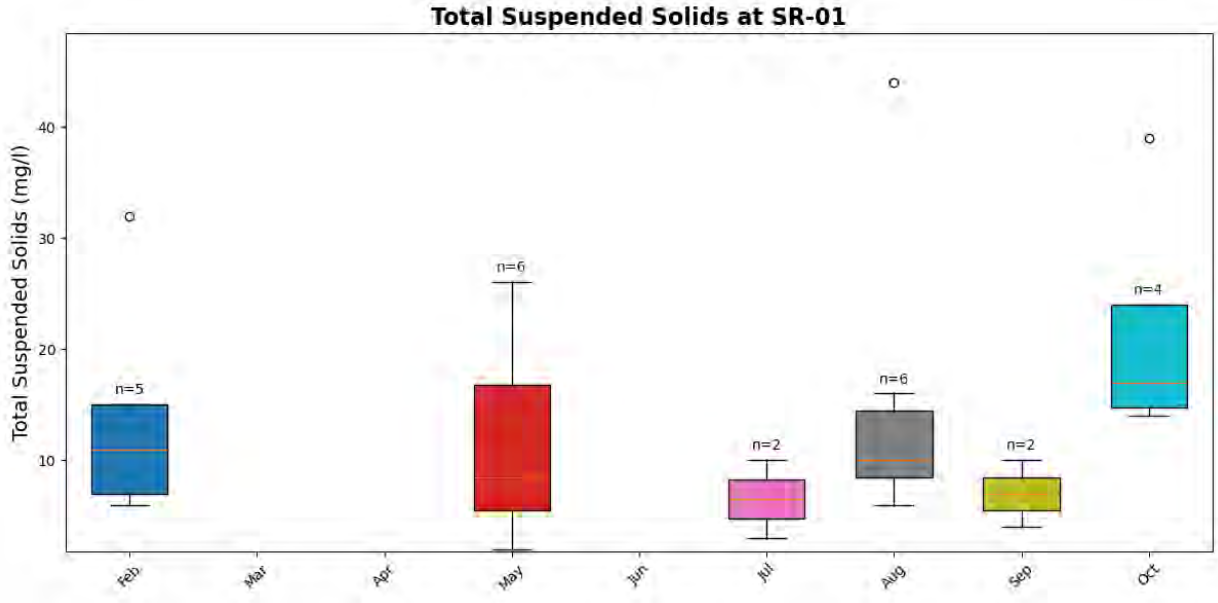


Figure C-213: Monthly Box Plot for Total Suspended Solids at Station SR-02 in Skokie River

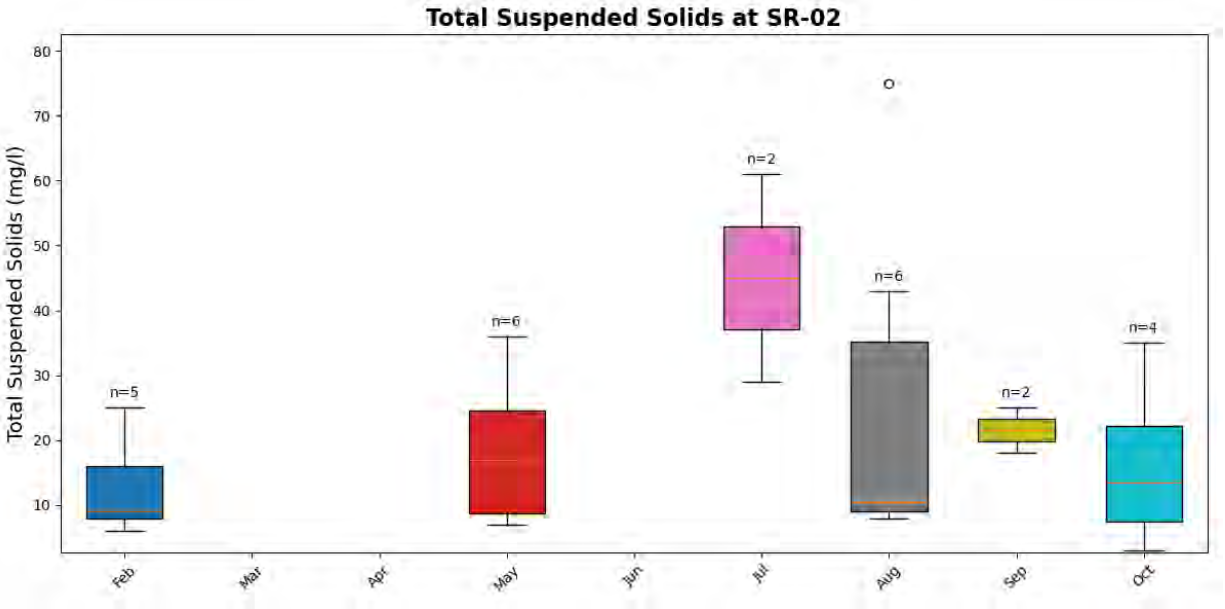


Figure C-214: Monthly Box Plot for Total Suspended Solids at Station SR-03 in Skokie River

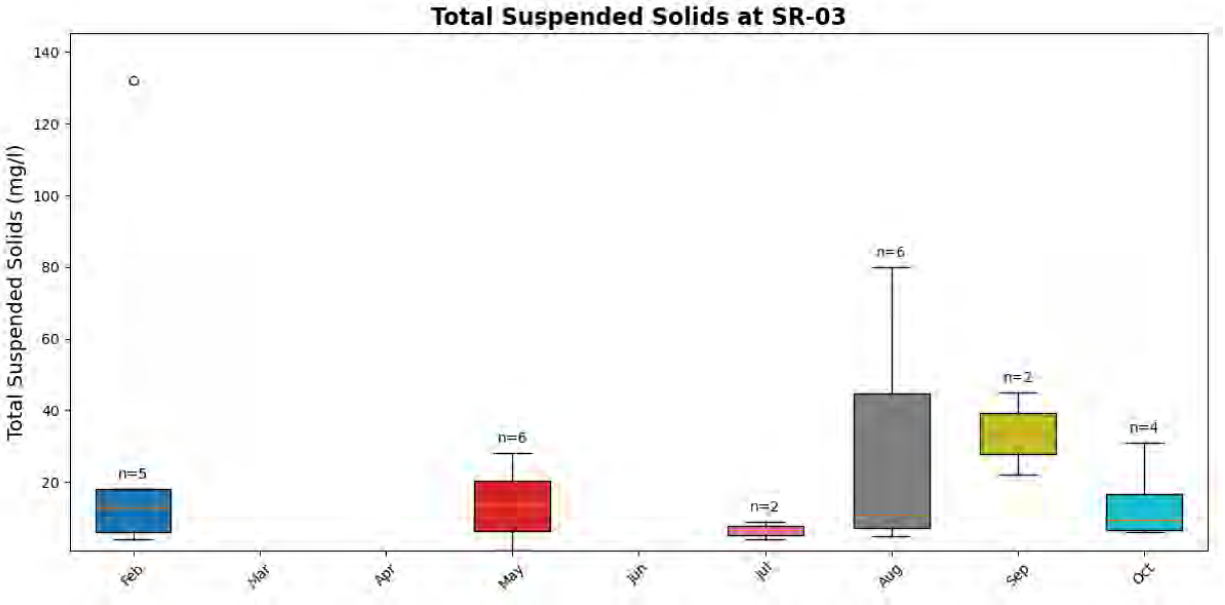


Figure C-215: Monthly Box Plot for Total Suspended Solids at Station SR-04 in Skokie River

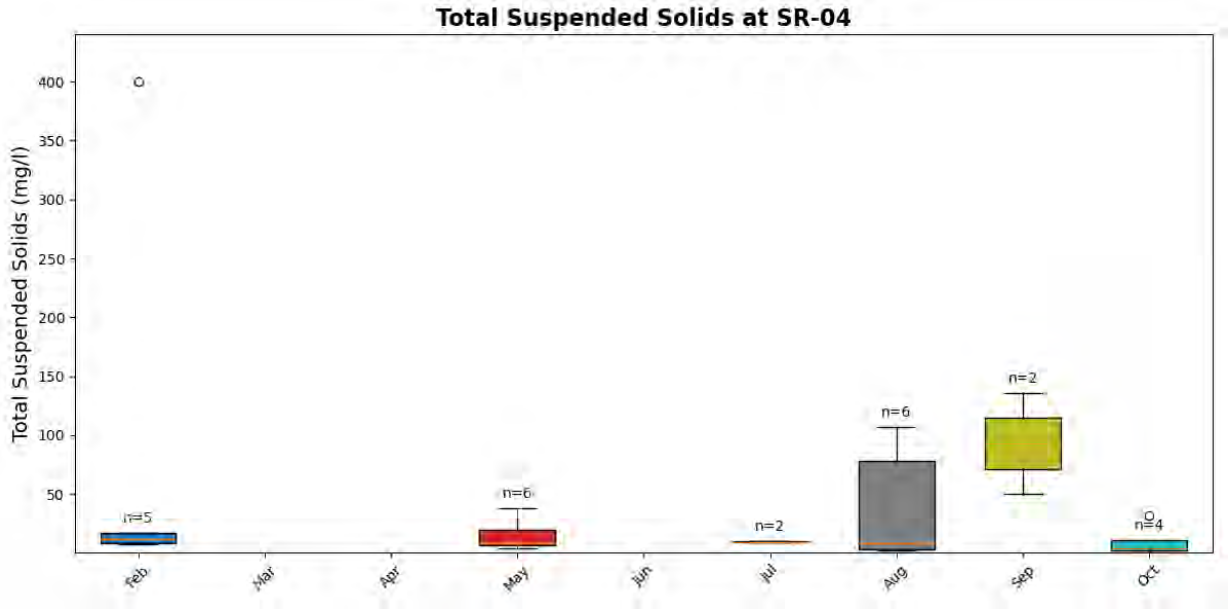


Figure C-216: Monthly Box Plot for Total Suspended Solids at Station SR-05 in Skokie River

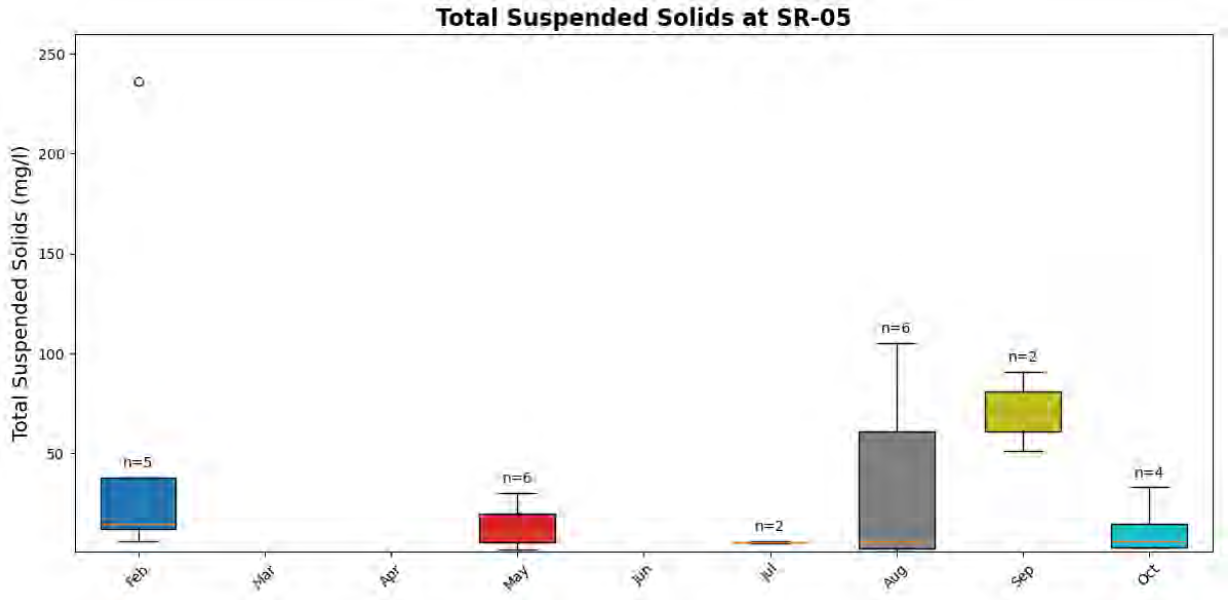


Figure C-217: Monthly Box Plot for Total Suspended Solids at Station SR-06 in Skokie River

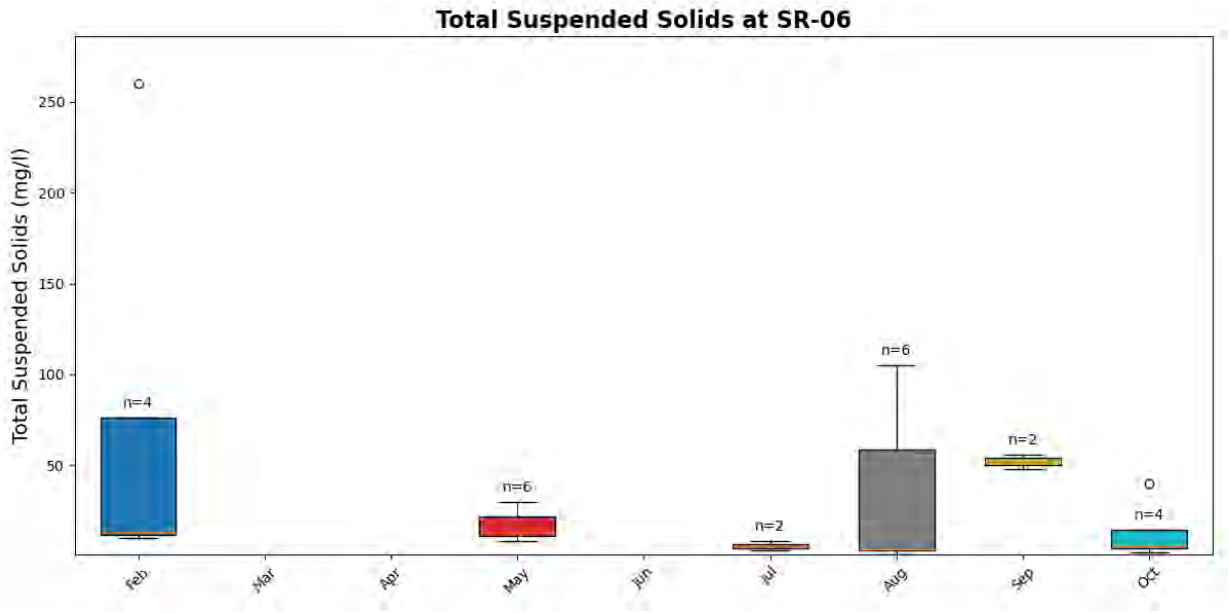


Figure C-218: Monthly Box Plot for Total Suspended Solids at Station SR-07 in Skokie River

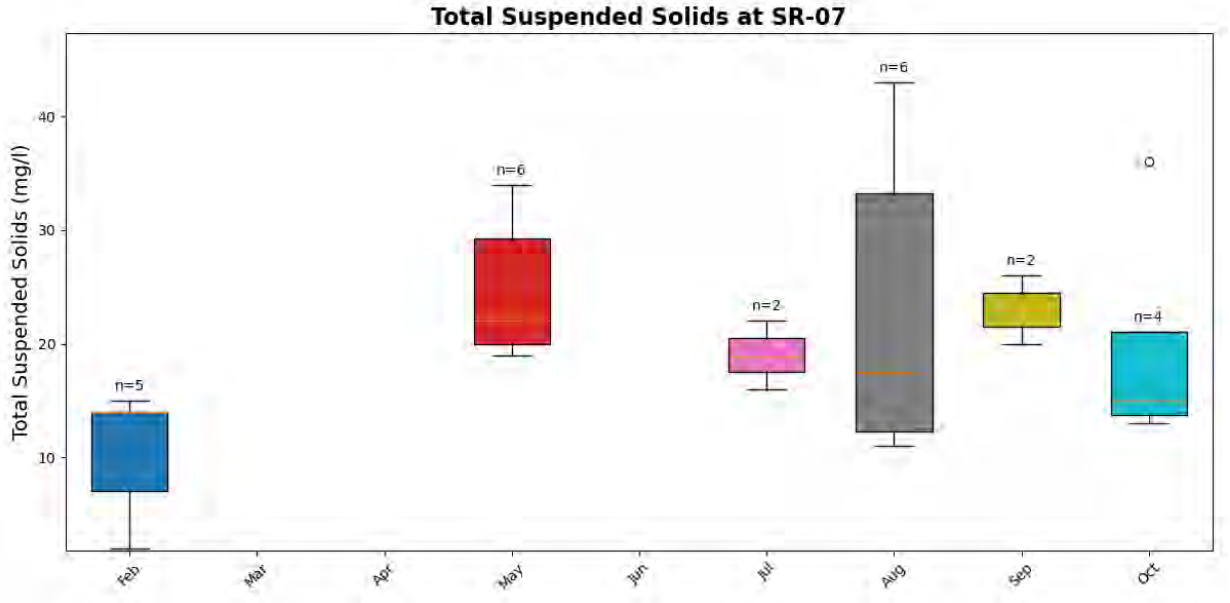
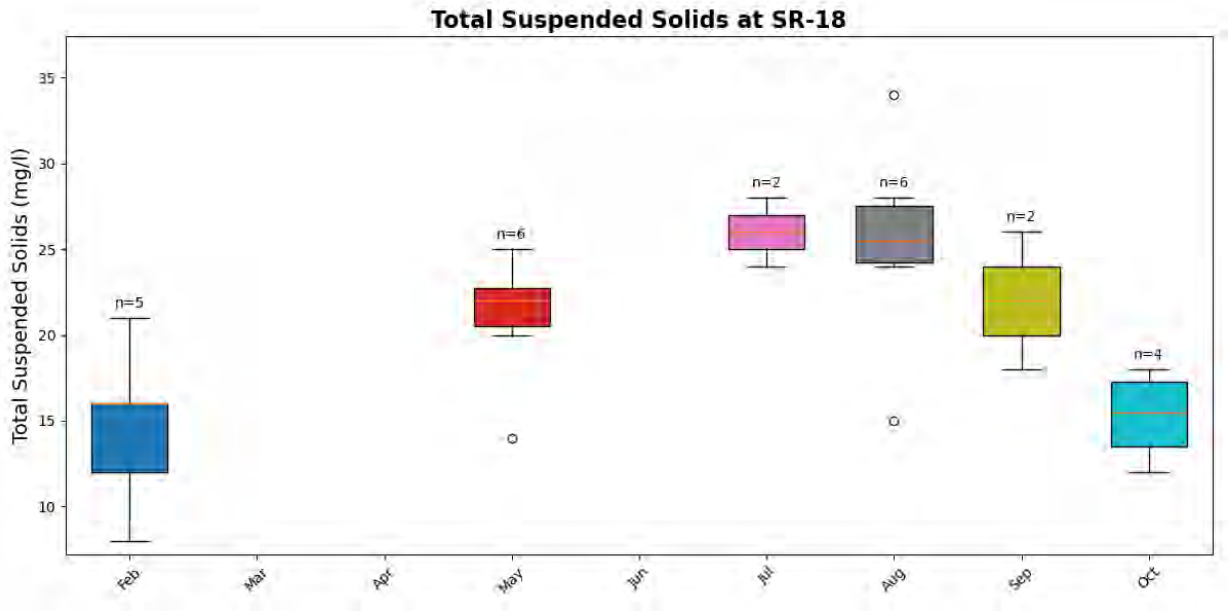


Figure C-219: Monthly Box Plot for Total Suspended Solids at Station SR-18 in Skokie River



Ammonia

Figure C-220: Monthly Box Plot for Ammonia at Station SR-01 in Skokie River

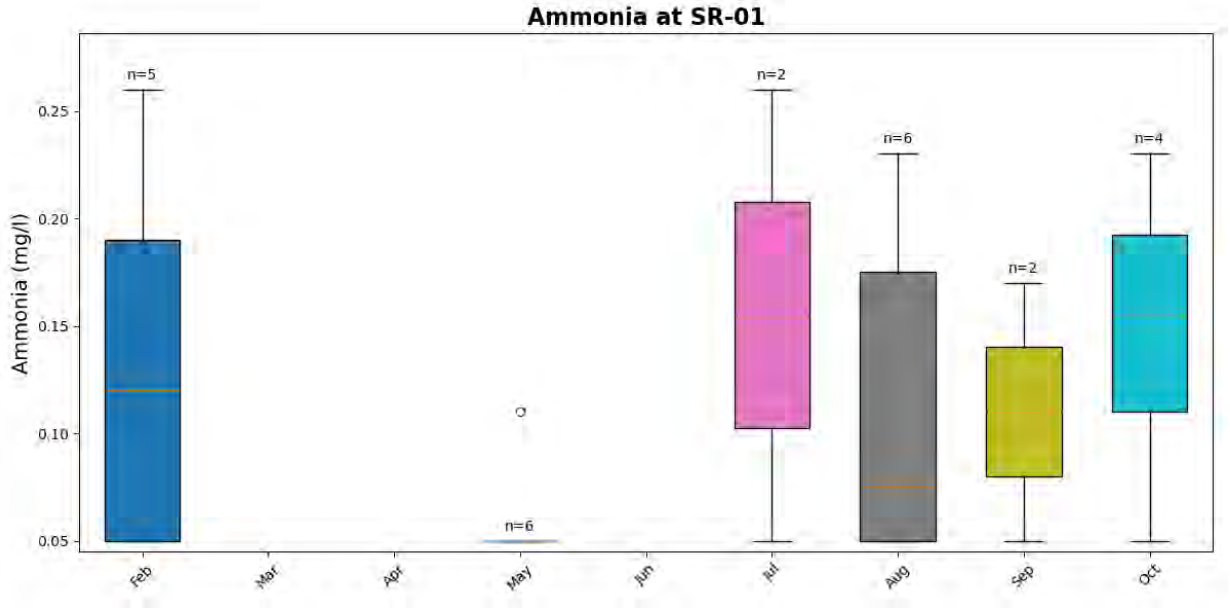


Figure C-221: Monthly Box Plot for Ammonia at Station SR-02 in Skokie River

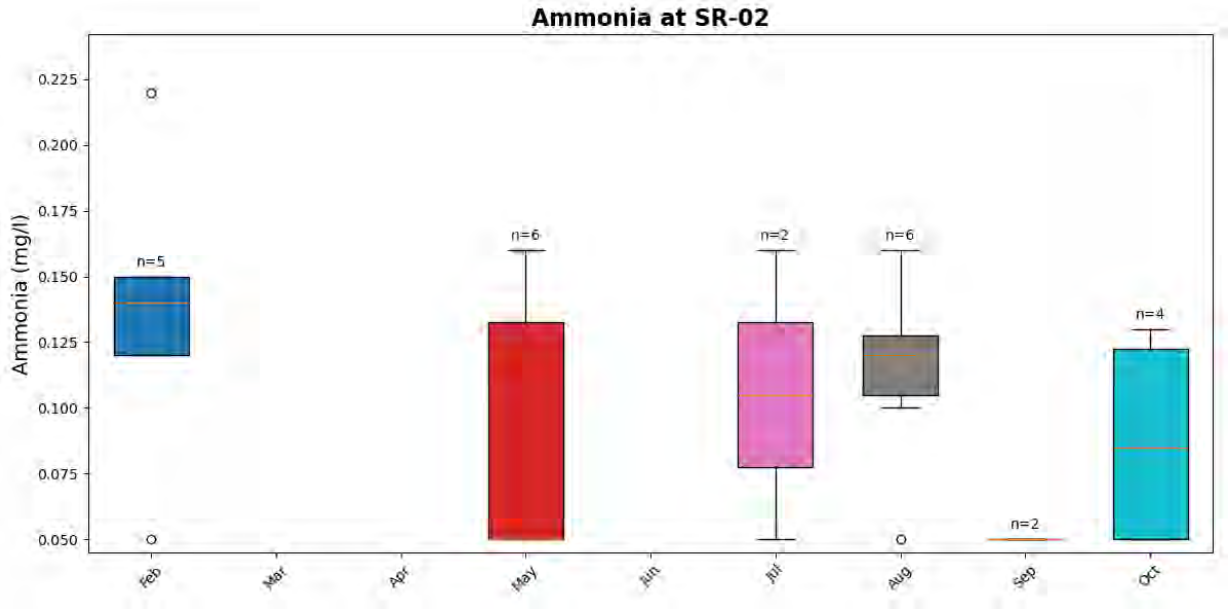


Figure C-222: Monthly Box Plot for Ammonia at Station SR-03 in Skokie River

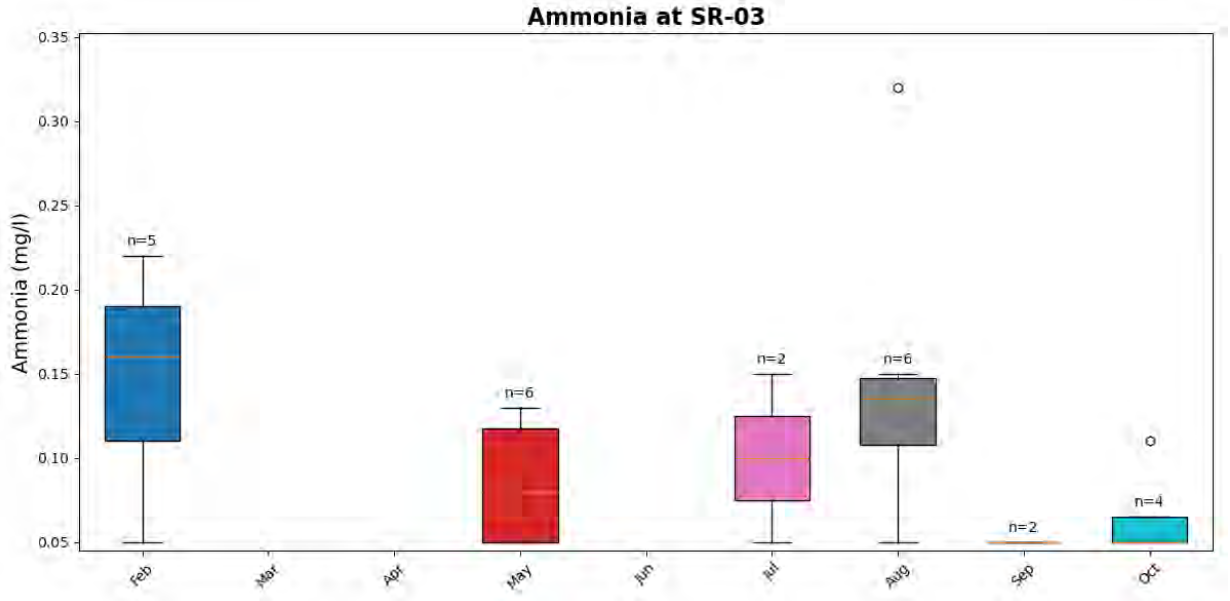


Figure C-223: Monthly Box Plot for Ammonia at Station SR-04 in Skokie River

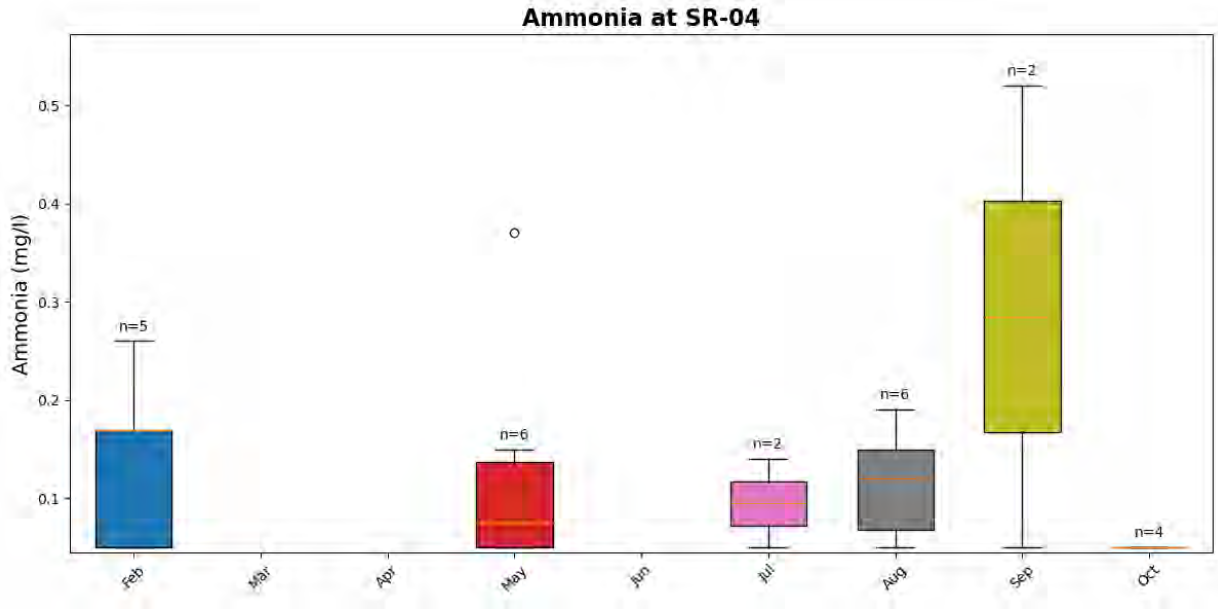


Figure C-224: Monthly Box Plot for Ammonia at Station SR-05 in Skokie River

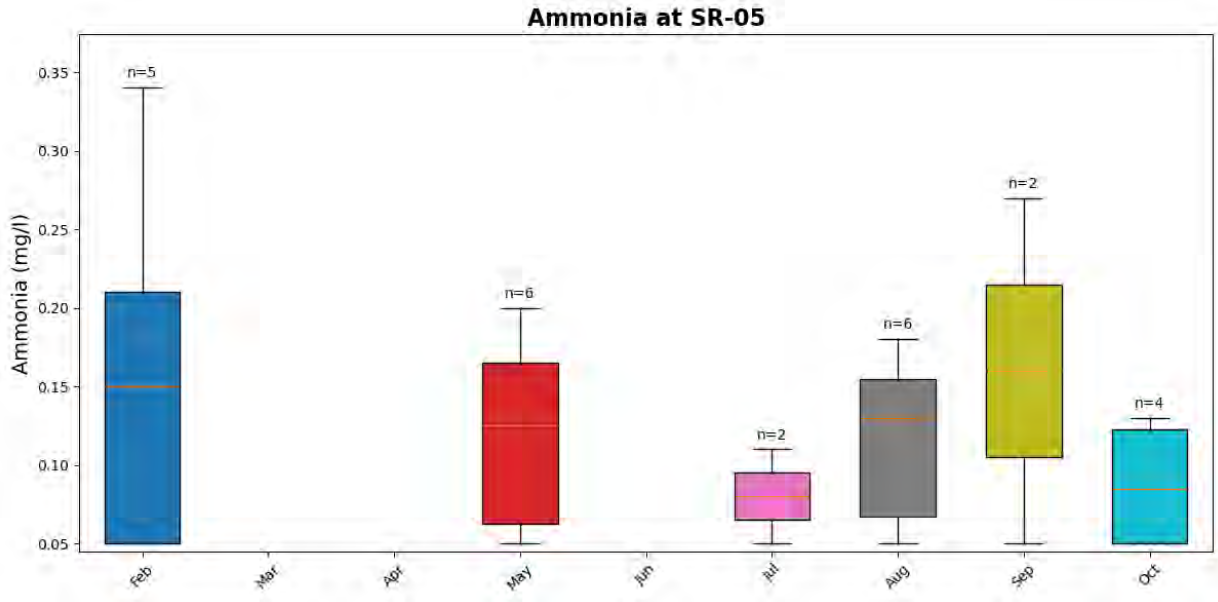


Figure C-225: Monthly Box Plot for Ammonia at Station SR-06 in Skokie River

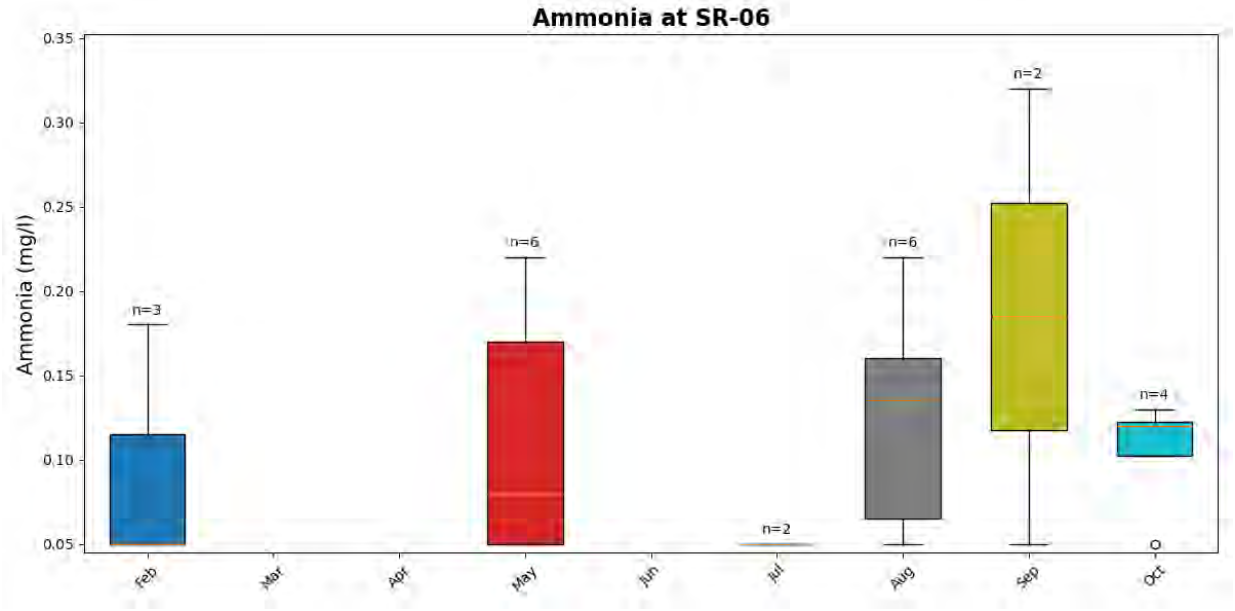


Figure C-226: Monthly Box Plot for Ammonia at Station SR-07 in Skokie River

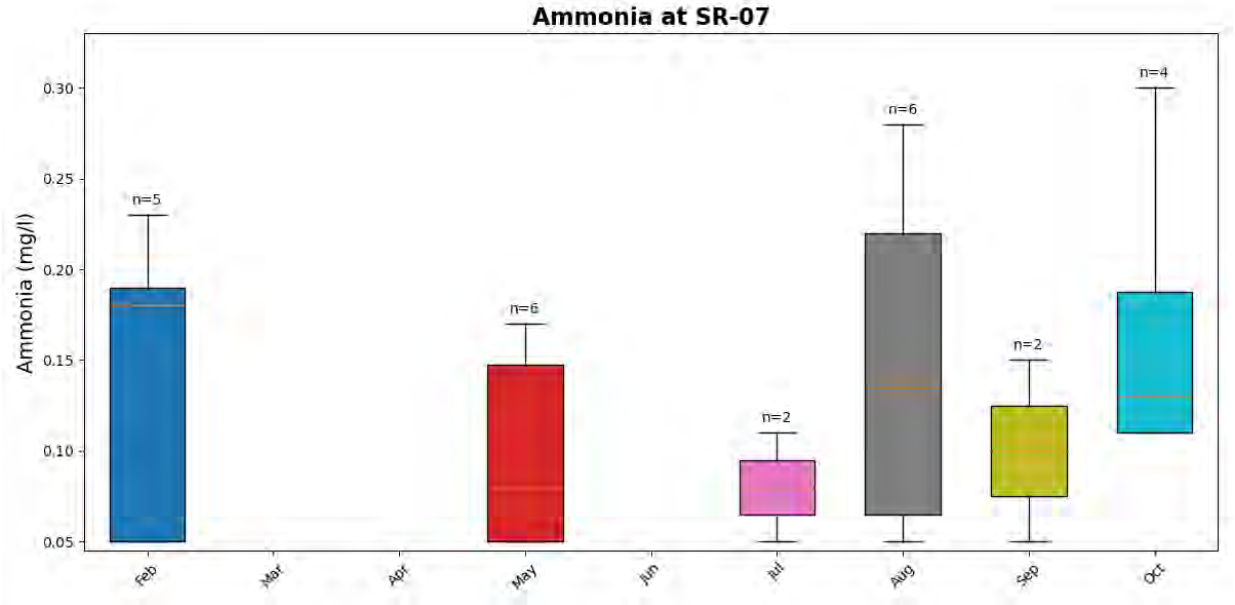


Figure C-227: Monthly Box Plot for Ammonia at Station SR-08 in Skokie River

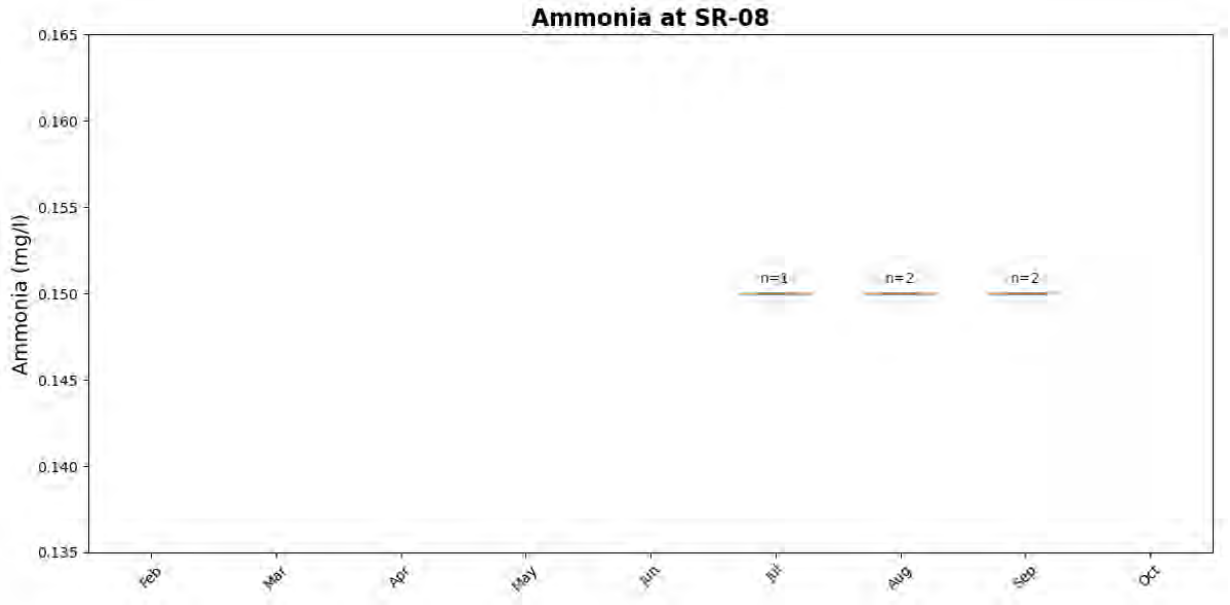
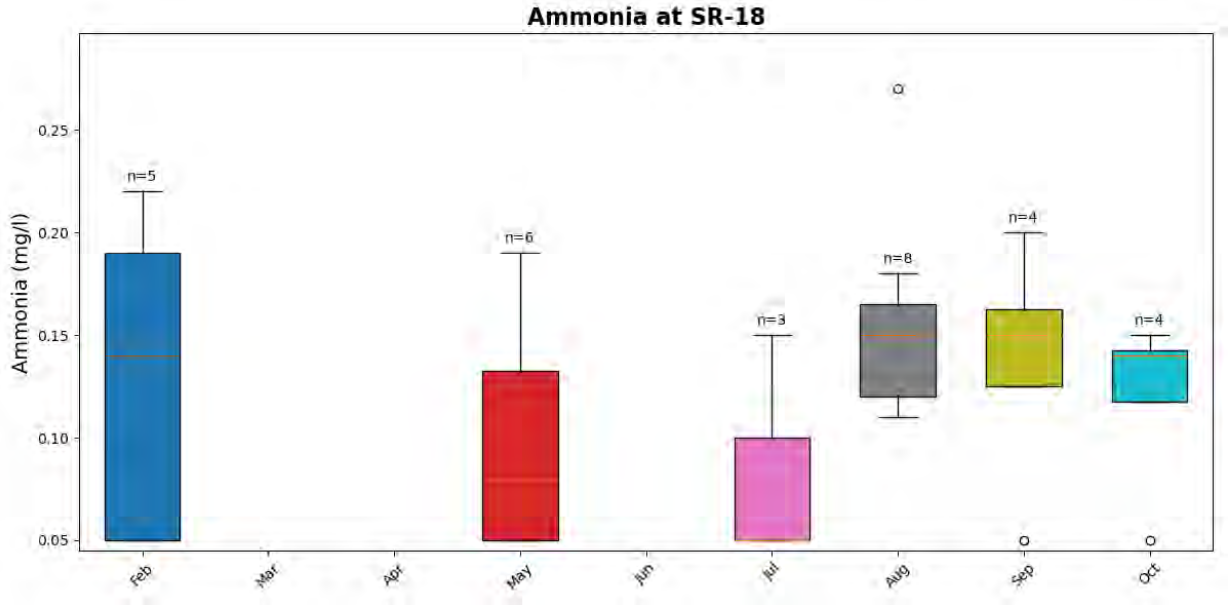


Figure C-228: Monthly Box Plot for Ammonia at Station SR-18 in Skokie River



Total Nitrates

Figure C-229: Monthly Box Plot for Total Nitrates at Station SR-01 in Skokie River

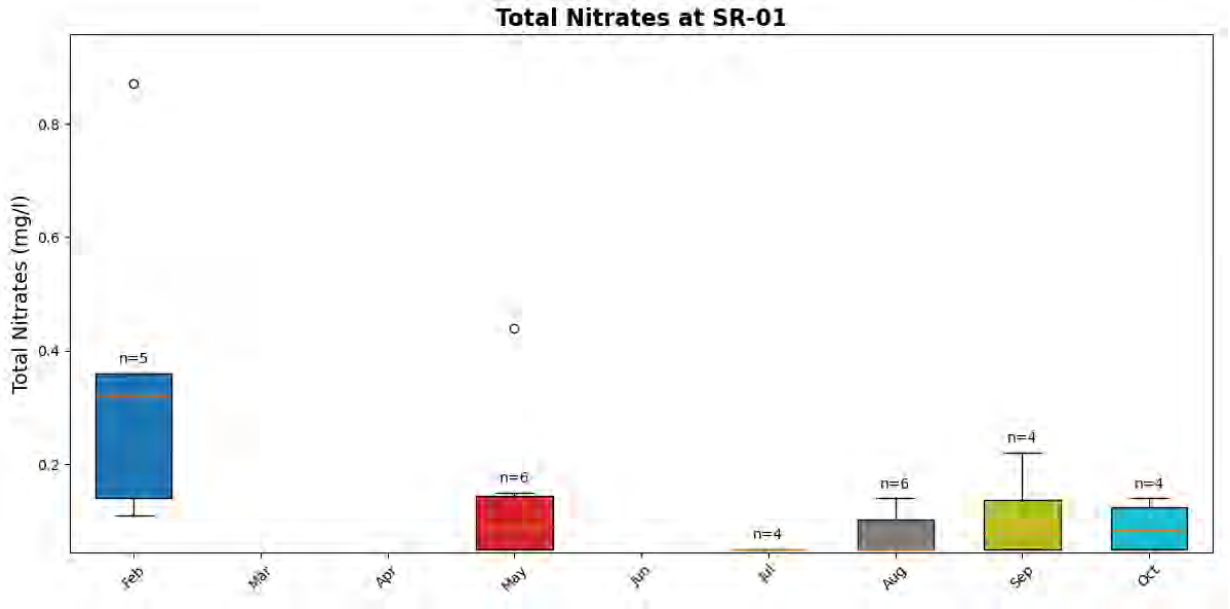


Figure C-230: Monthly Box Plot for Total Nitrates at Station SR-02 in Skokie River

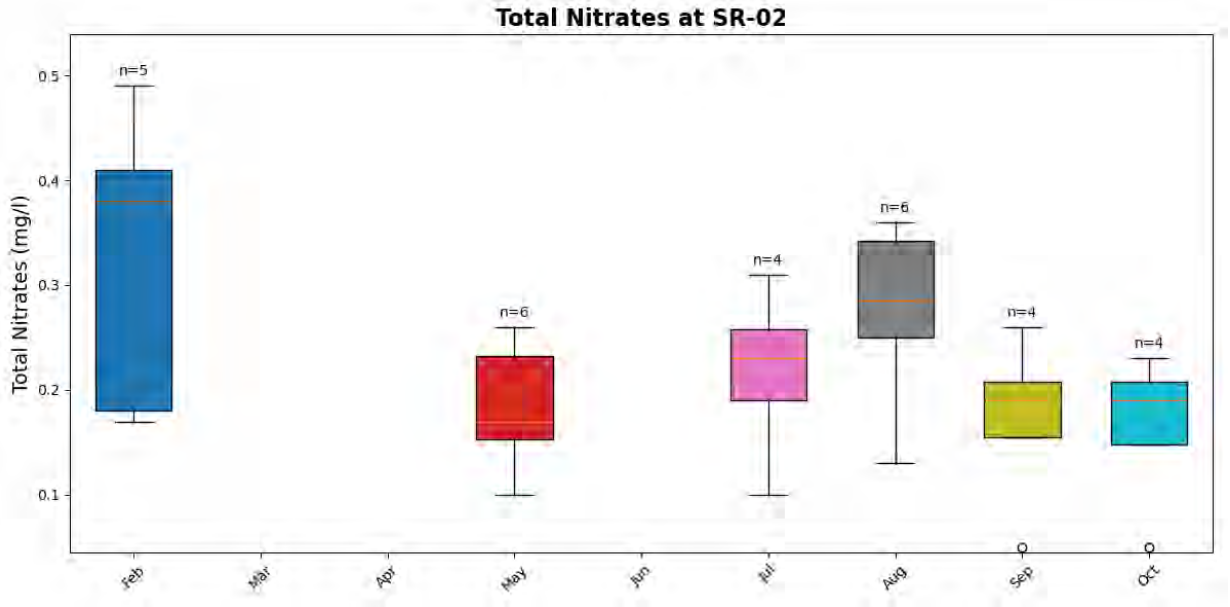


Figure C-231: Monthly Box Plot for Total Nitrates at Station SR-03 in Skokie River

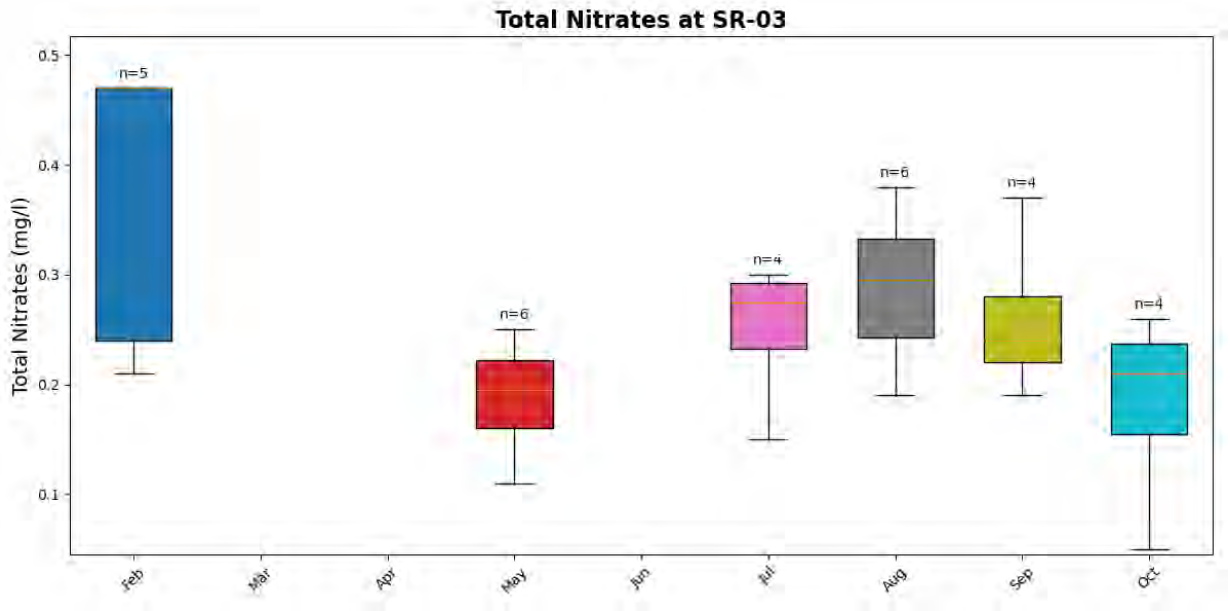


Figure C-232: Monthly Box Plot for Total Nitrates at Station SR-04 in Skokie River

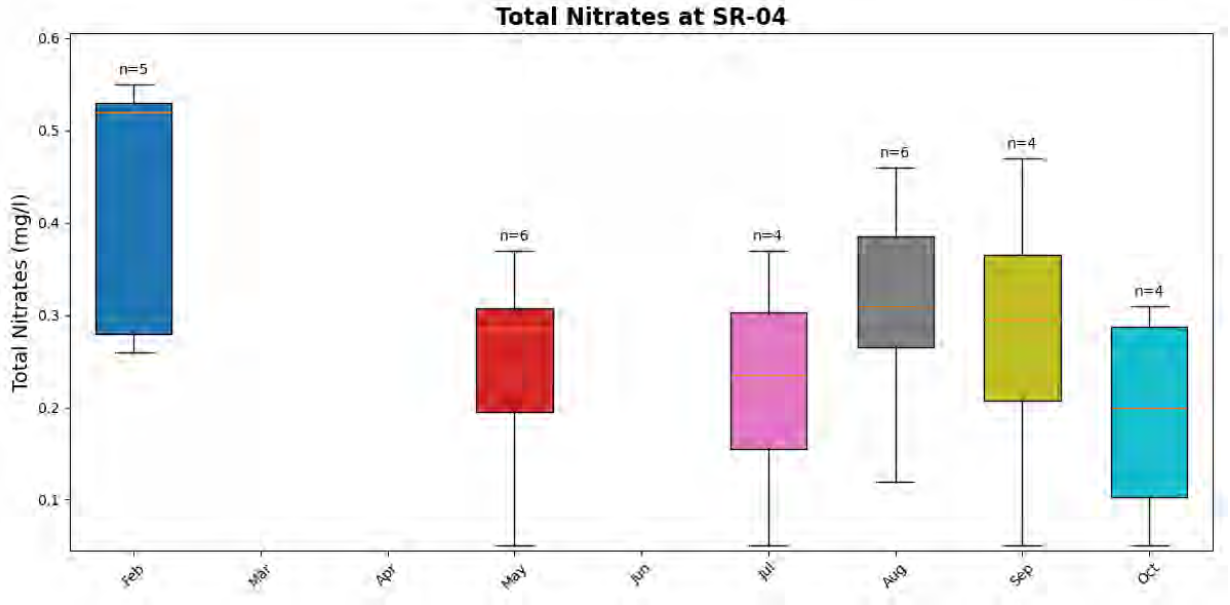


Figure C-233: Monthly Box Plot for Total Nitrates at Station SR-05 in Skokie River

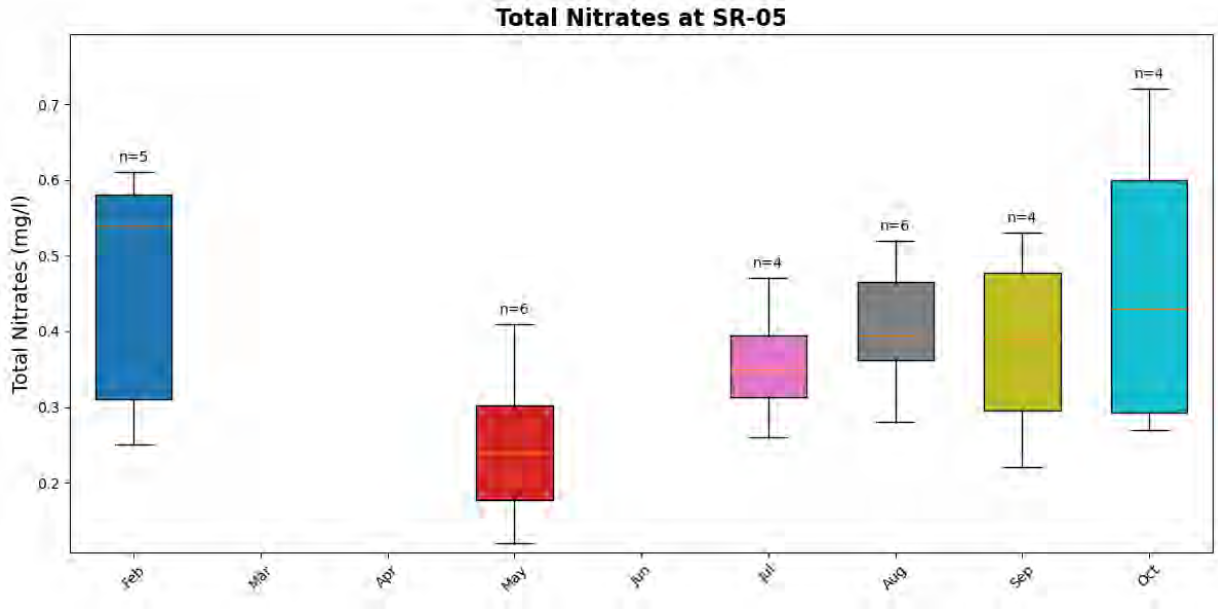


Figure C-234: Monthly Box Plot for Total Nitrates at Station SR-06 in Skokie River

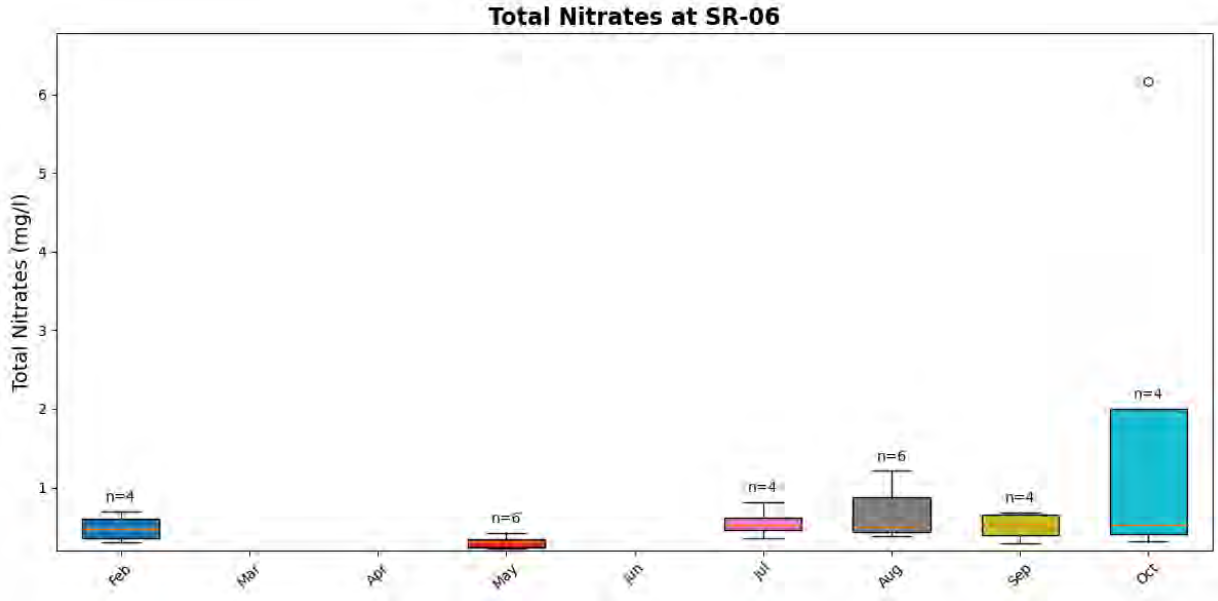


Figure C-235: Monthly Box Plot for Total Nitrates at Station SR-07 in Skokie River

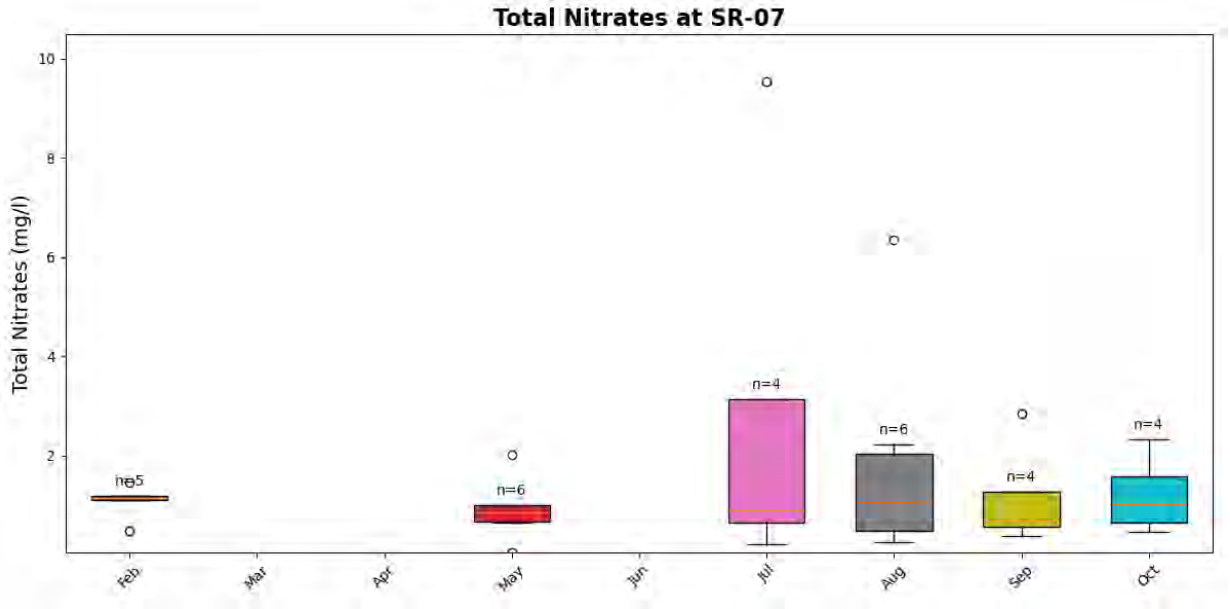
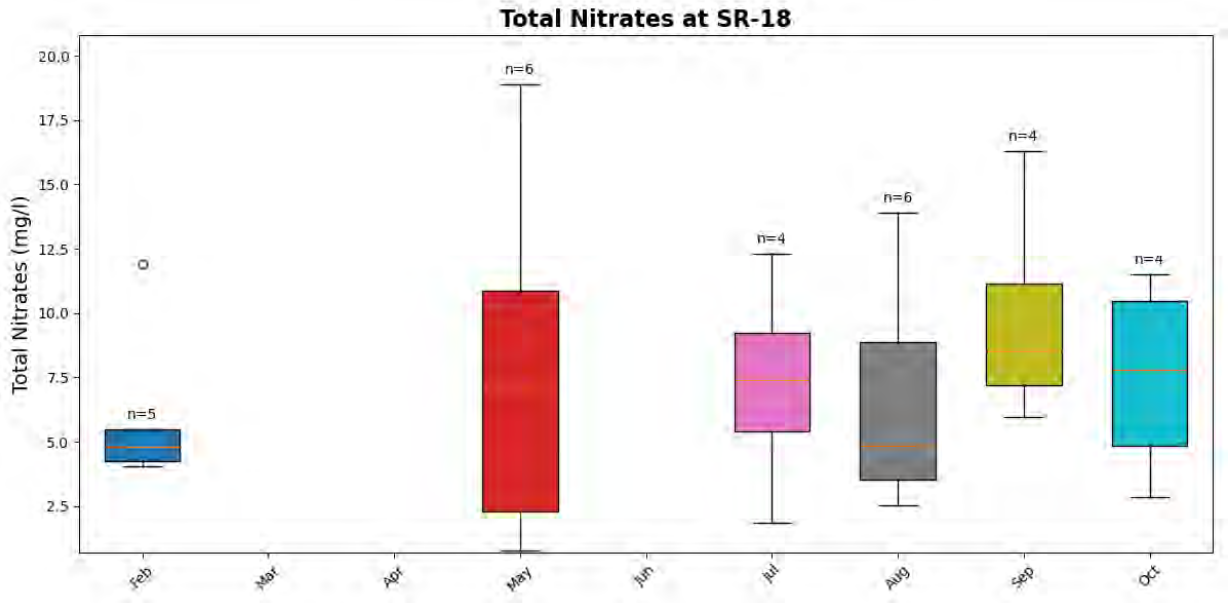


Figure C-236: Monthly Box Plot for Total Nitrates at Station SR-18 in Skokie River



Total Kjeldahl Nitrogen

Figure C-237: Monthly Box Plot for Total Kjeldahl Nitrogen at Station SR-01 in Skokie River

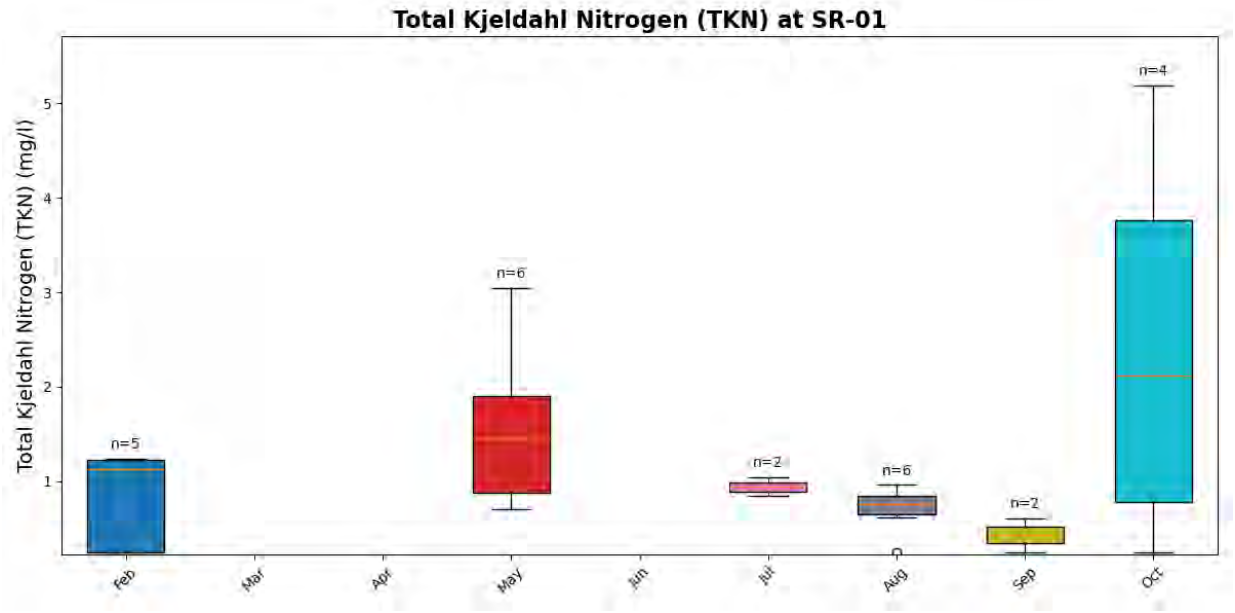


Figure C-238: Monthly Box Plot for Total Kjeldahl Nitrogen at Station SR-02 in Skokie River

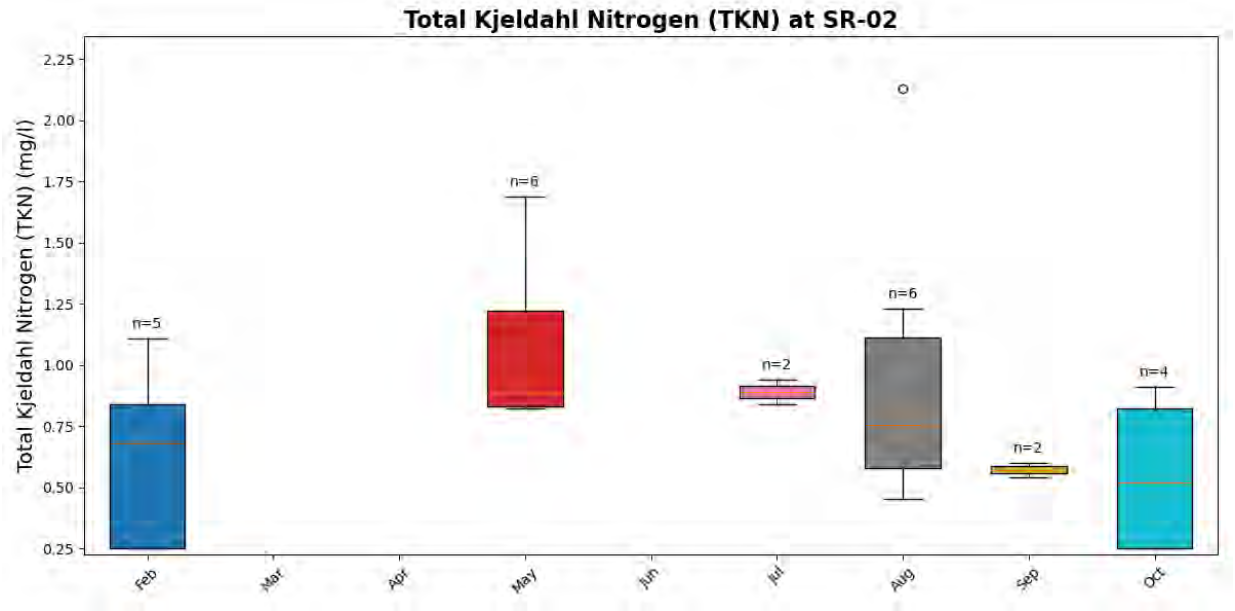


Figure C-239: Monthly Box Plot for Total Kjeldahl Nitrogen at Station SR-03 in Skokie River

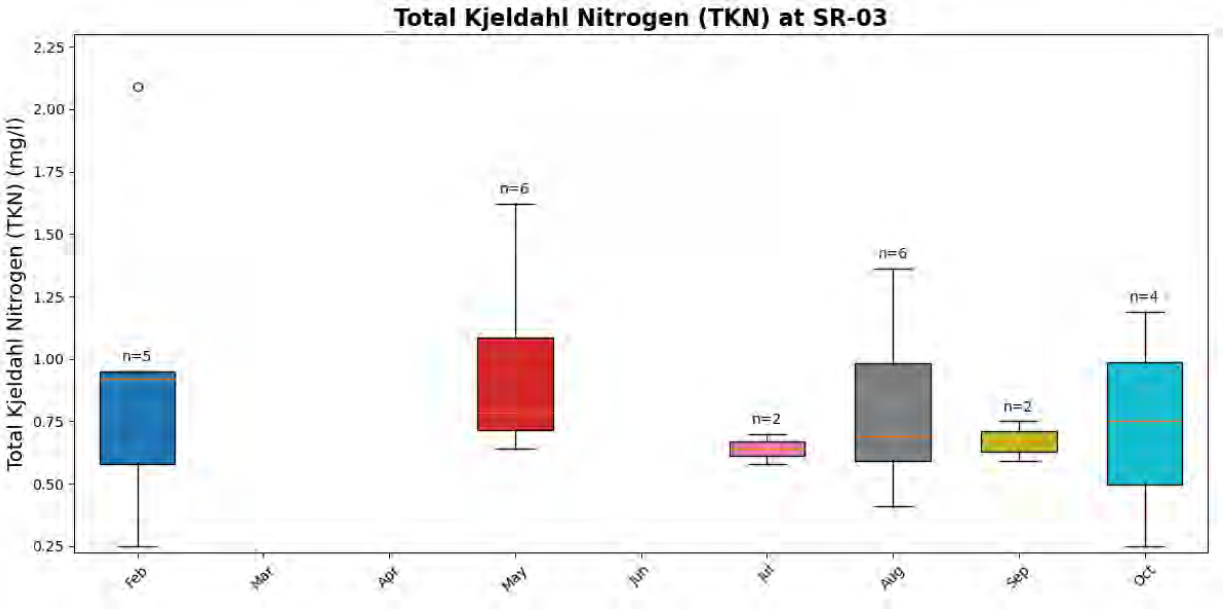


Figure C-240: Monthly Box Plot for Total Kjeldahl Nitrogen at Station SR-04 in Skokie River

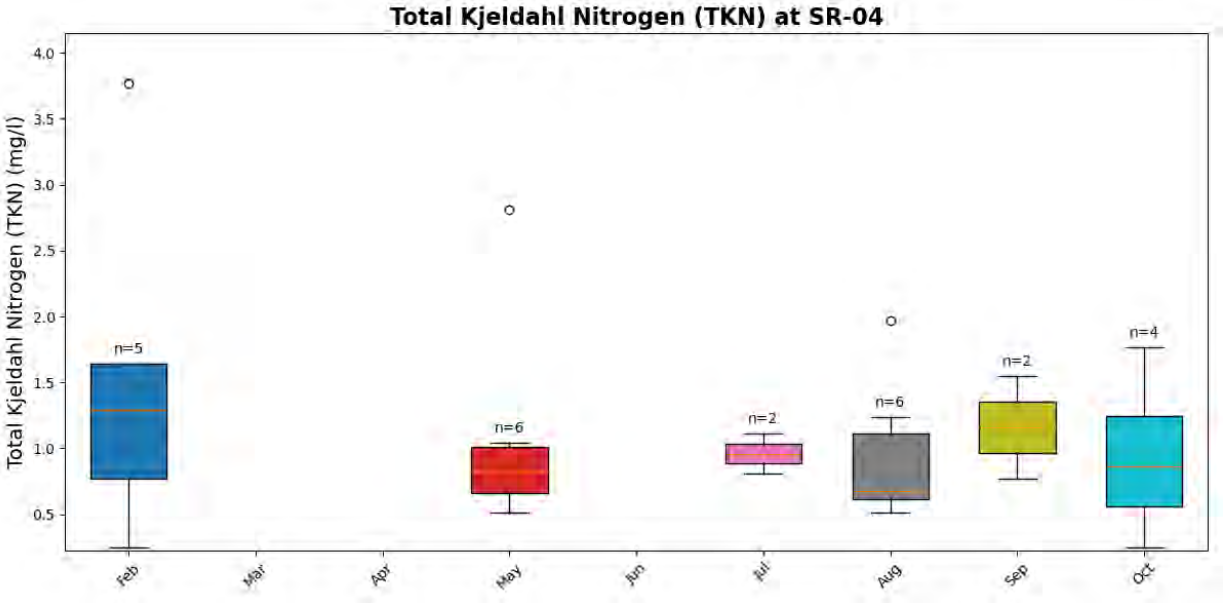


Figure C-241: Monthly Box Plot for Total Kjeldahl Nitrogen at Station SR-05 in Skokie River

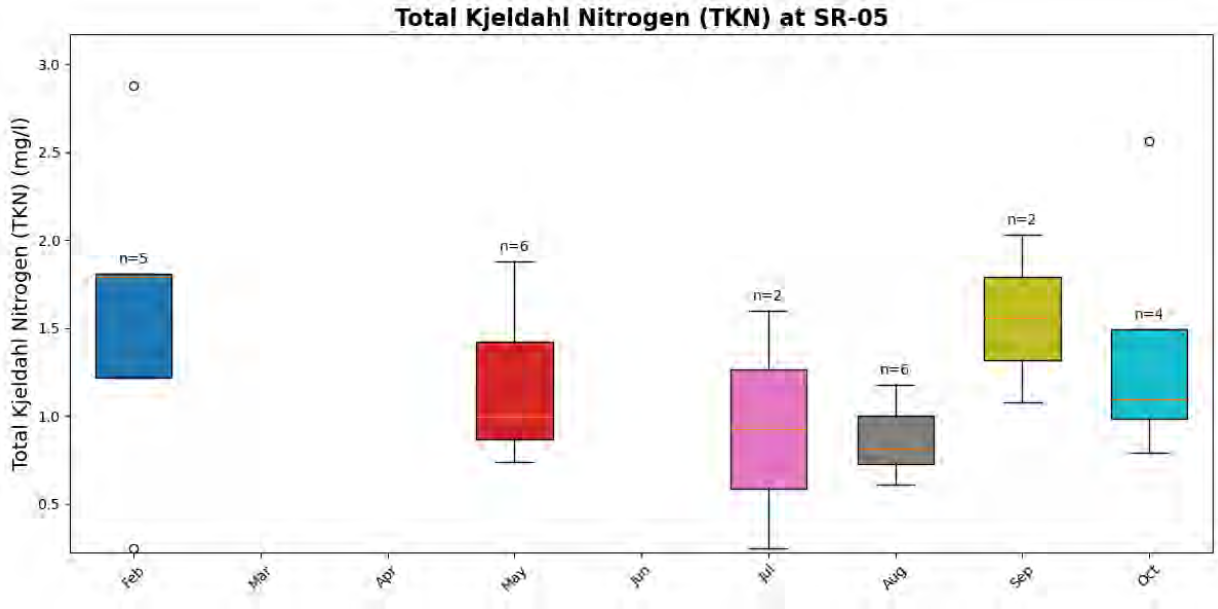


Figure C-242: Monthly Box Plot for Total Kjeldahl Nitrogen at Station SR-06 in Skokie River

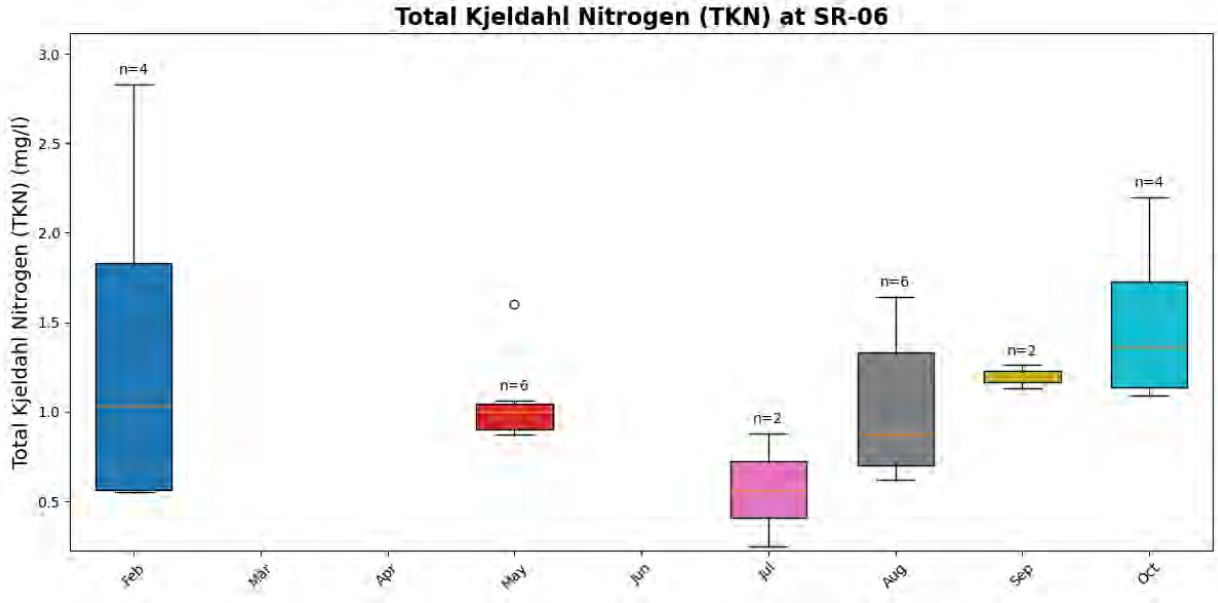


Figure C-243: Monthly Box Plot for Total Kjeldahl Nitrogen at Station SR-07 in Skokie River

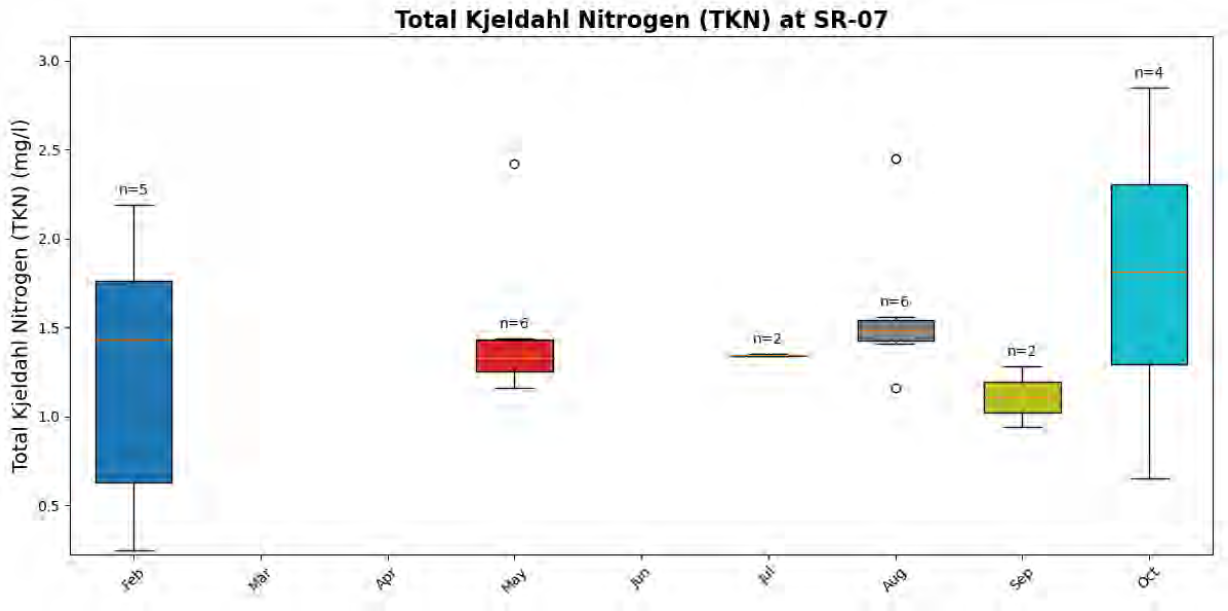


Figure C-244: Monthly Box Plot for Total Kjeldahl Nitrogen at Station SR-08 in Skokie River

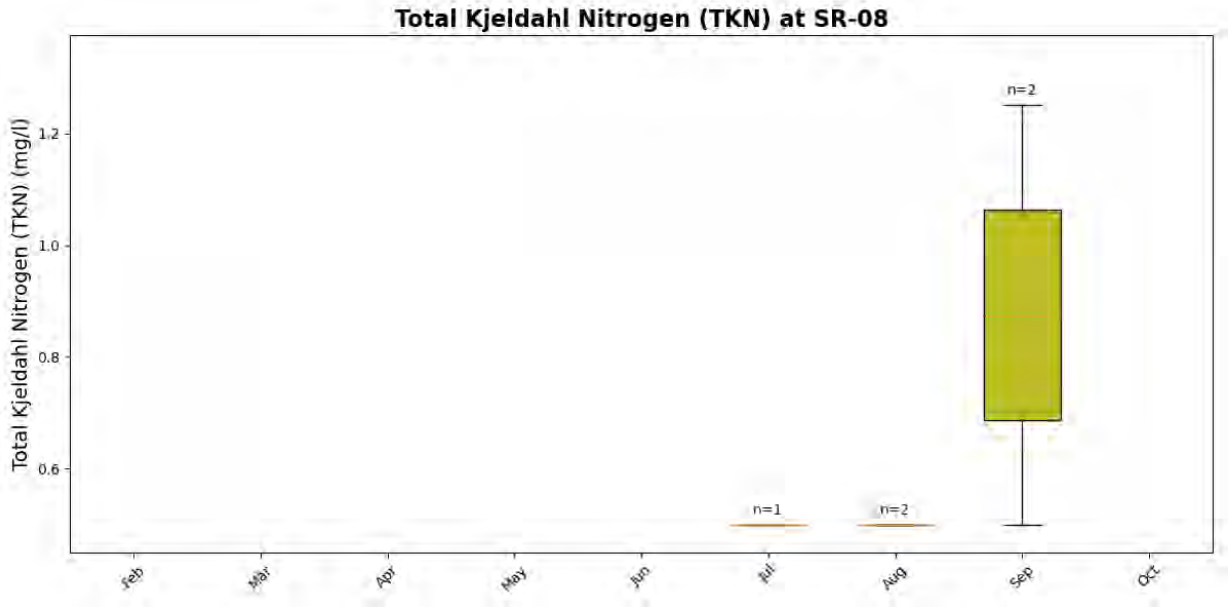
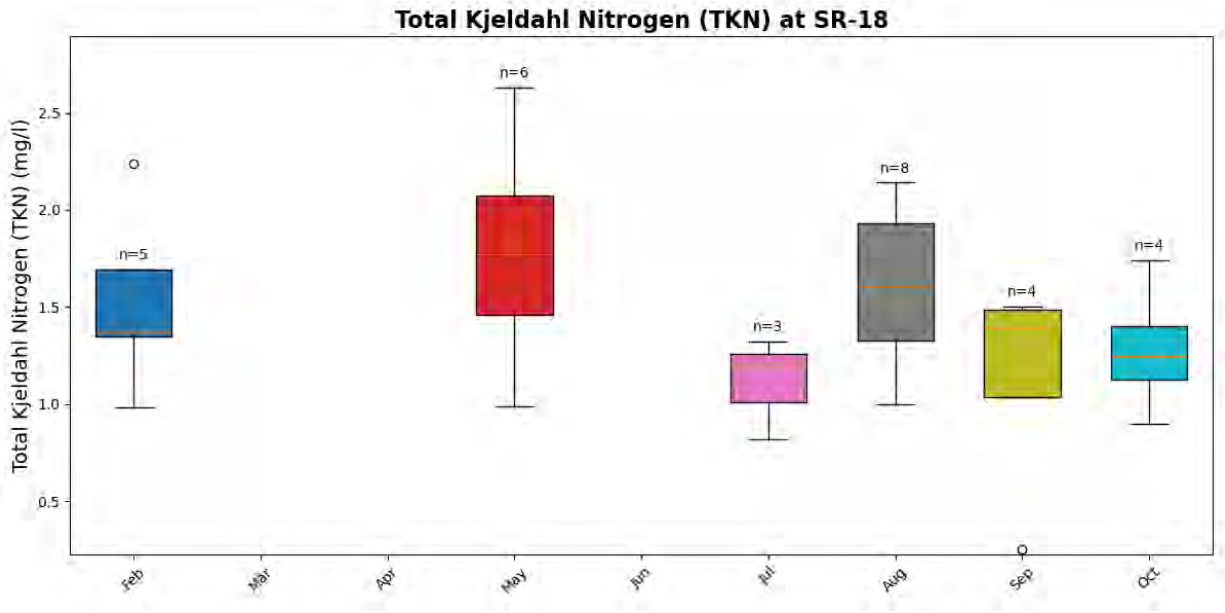


Figure C-245: Monthly Box Plot for Total Kjeldahl Nitrogen at Station SR-18 in Skokie River



Total Phosphorus

Figure C-246: Monthly Box Plot for Total Phosphorus at Station SR-01 in Skokie River

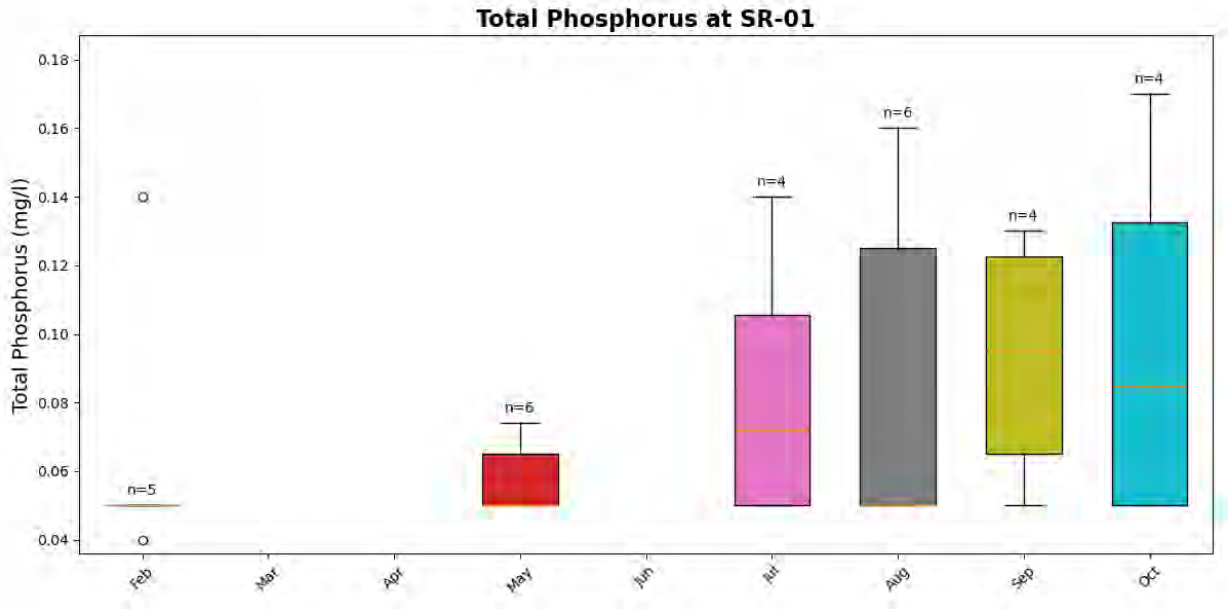


Figure C-247: Monthly Box Plot for Total Phosphorus at Station SR-02 in Skokie River

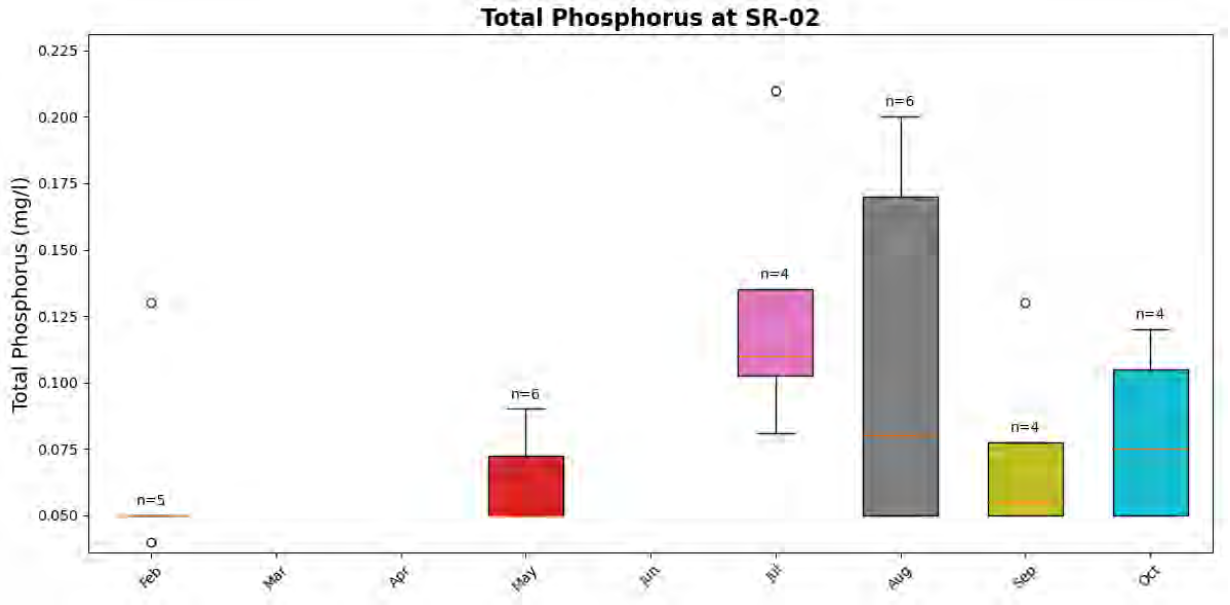


Figure C-248: Monthly Box Plot for Total Phosphorus at Station SR-03 in Skokie River

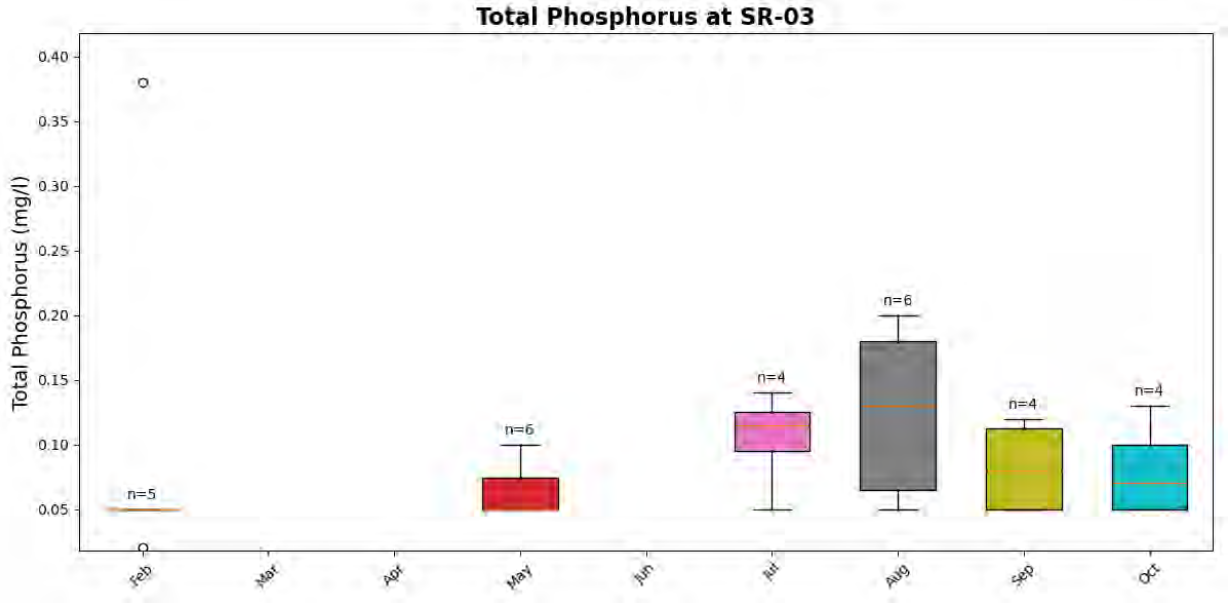


Figure C-249: Monthly Box Plot for Total Phosphorus at Station SR-04 in Skokie River

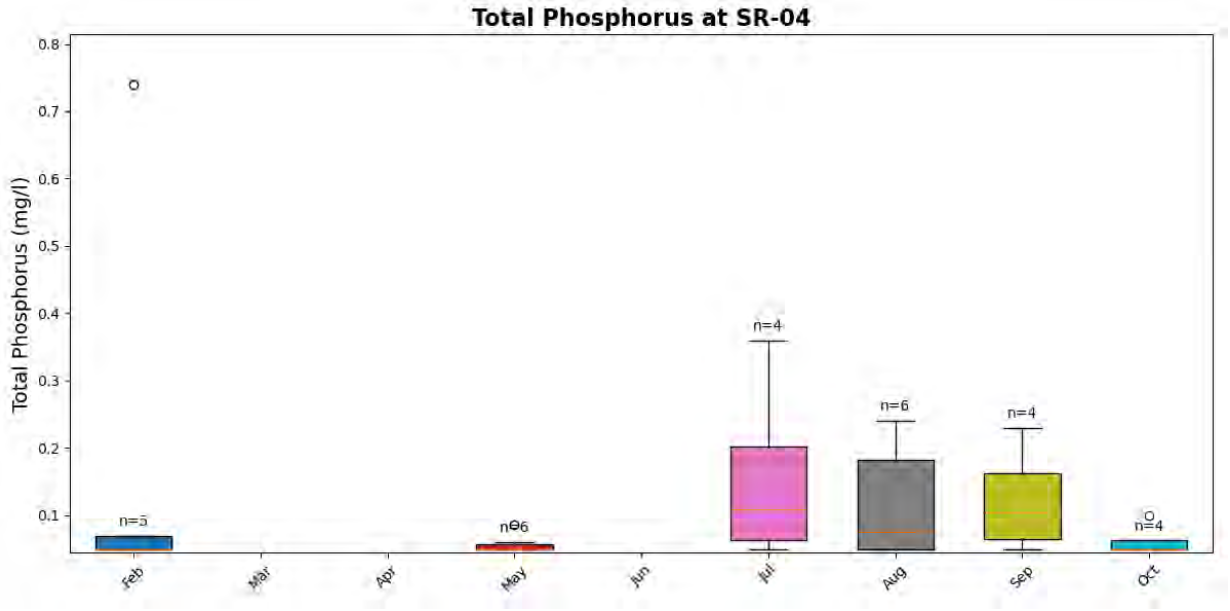


Figure C-250: Monthly Box Plot for Total Phosphorus at Station SR-05 in Skokie River

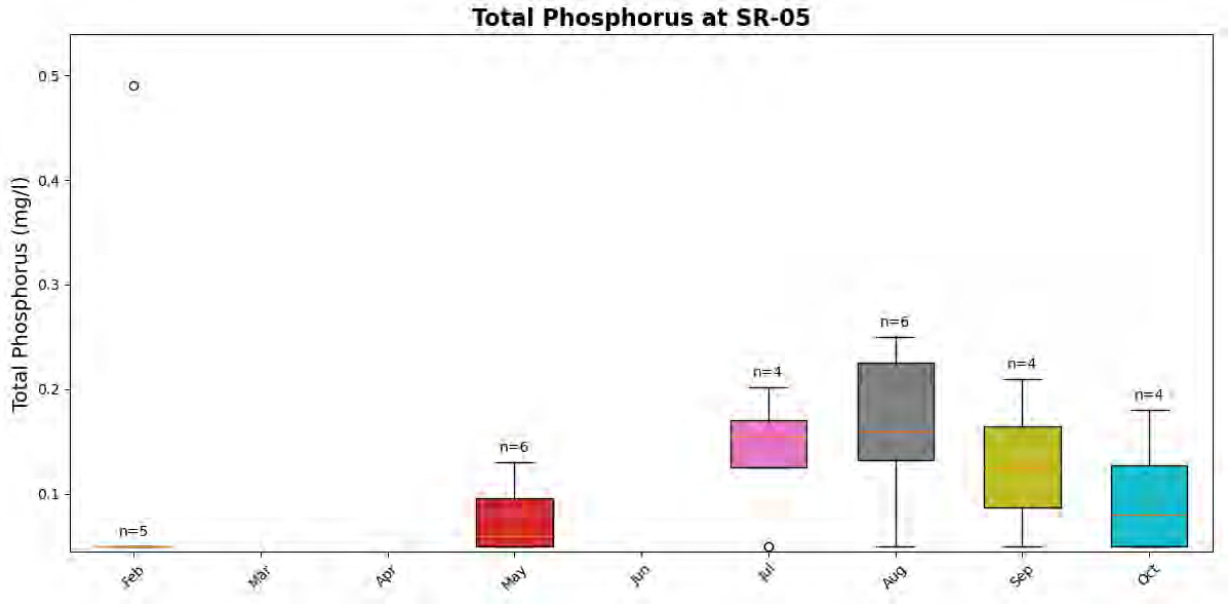


Figure C-251: Monthly Box Plot for Total Phosphorus at Station SR-06 in Skokie River

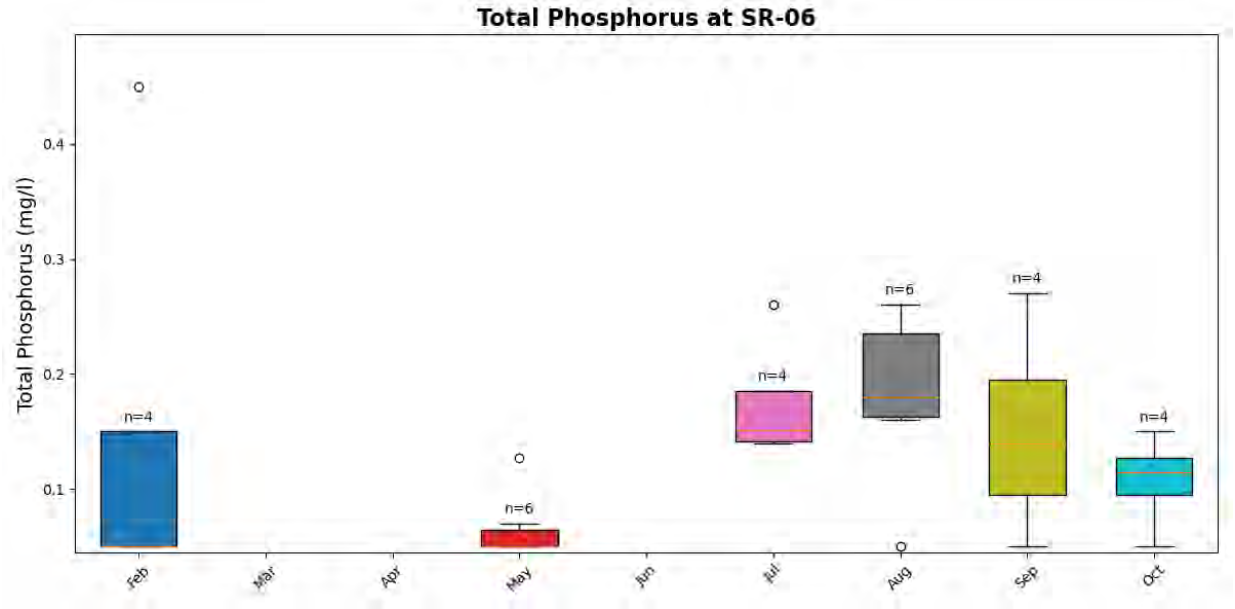


Figure C-252: Monthly Box Plot for Total Phosphorus at Station SR-07 in Skokie River

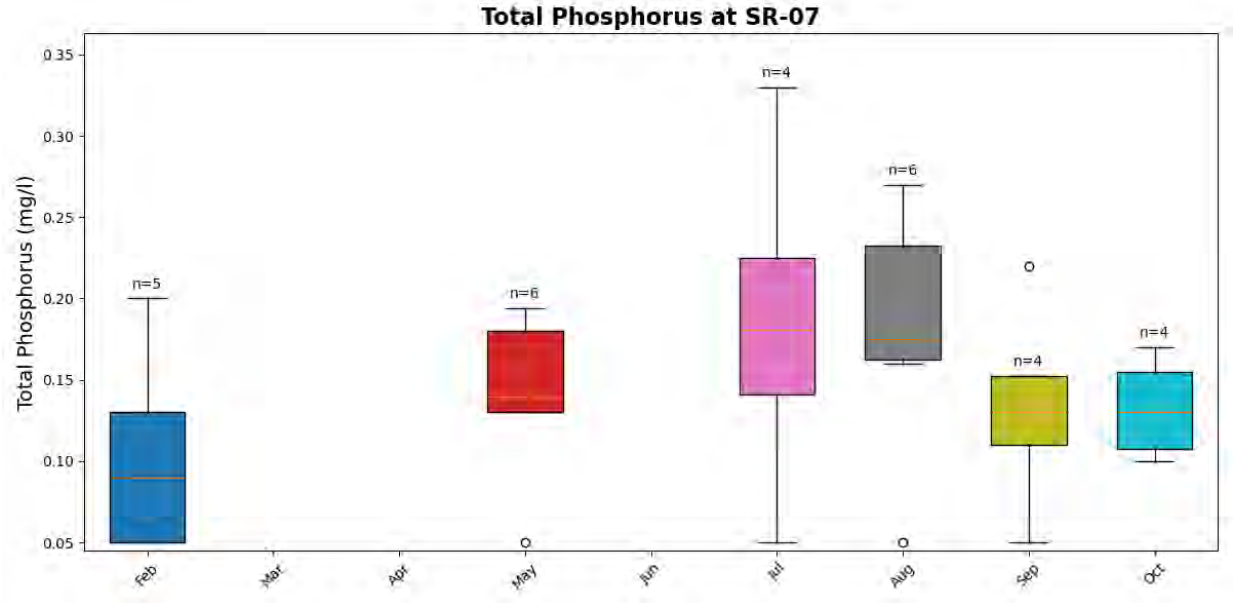


Figure C-253: Monthly Box Plot for Total Phosphorus at Station SR-08 in Skokie River

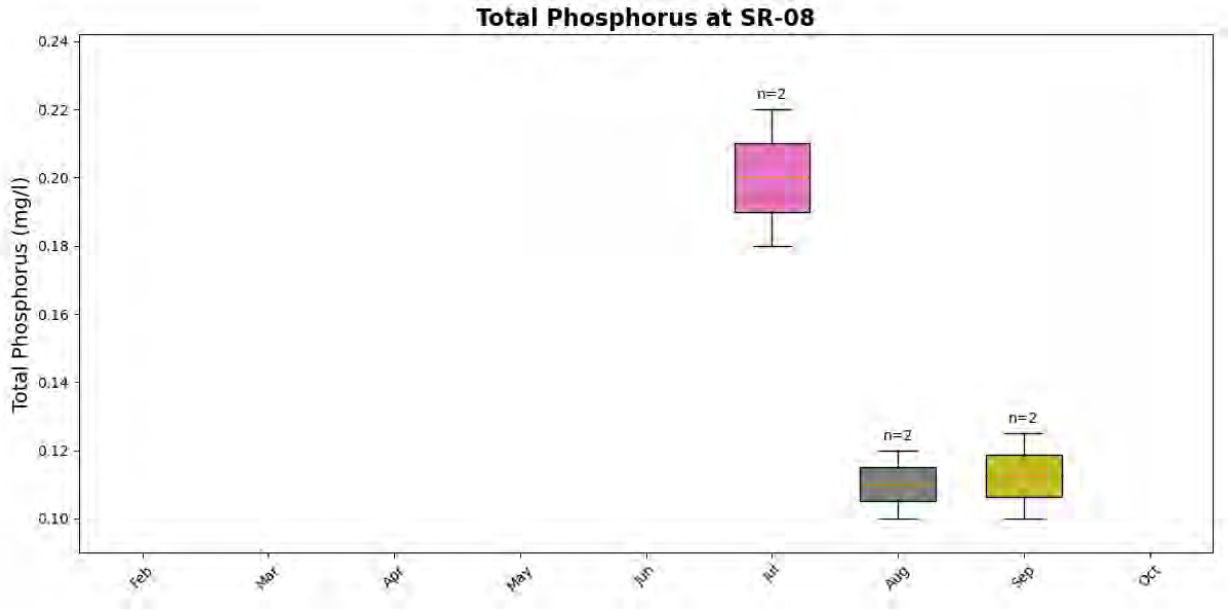
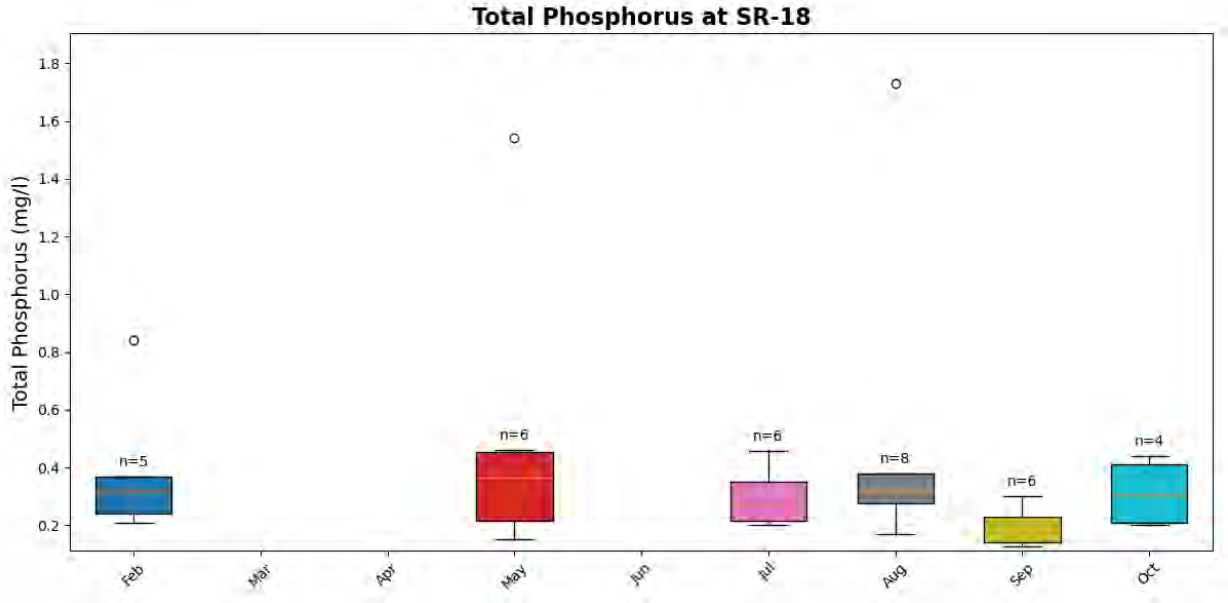


Figure C-254: Monthly Box Plot for Total Phosphorus at Station SR-18 in Skokie River



Chlorophyll a

Figure C-255: Monthly Box Plot for Chlorophyll a at Station SR-01 in Skokie River

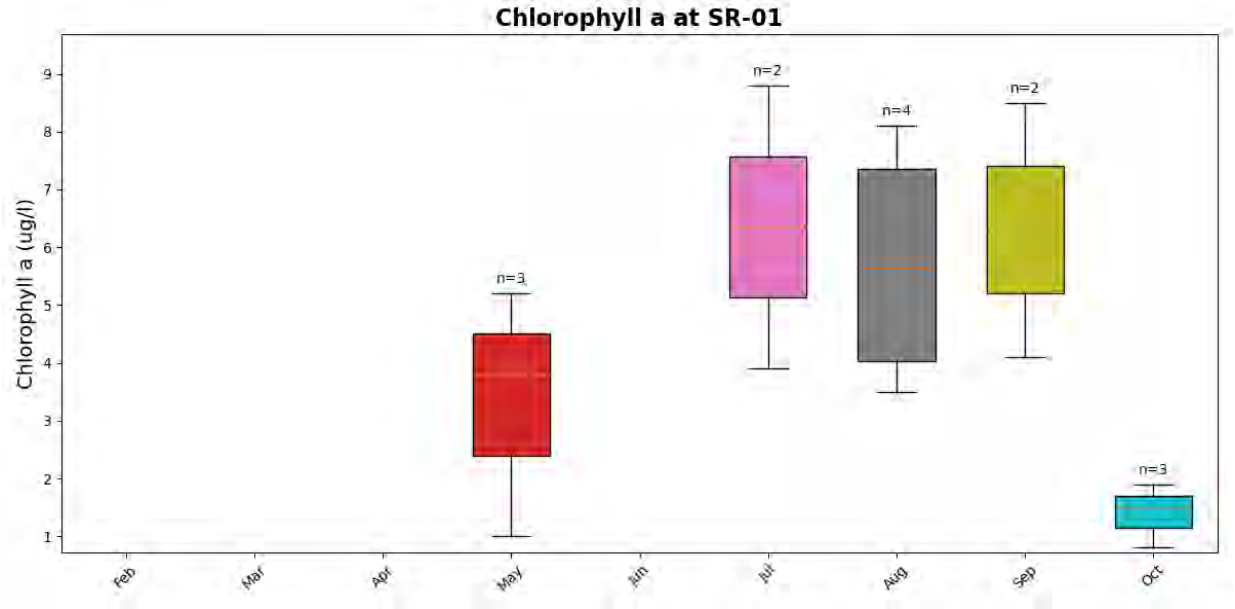


Figure C-256: Monthly Box Plot for Chlorophyll a at Station SR-02 in Skokie River

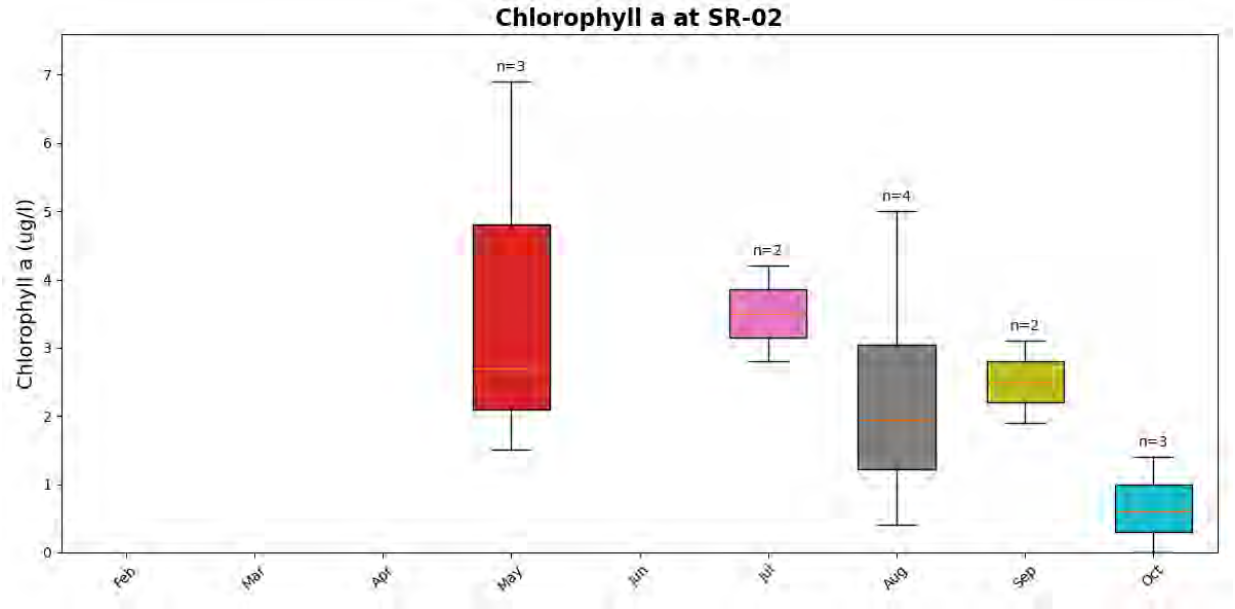


Figure C-257: Monthly Box Plot for Chlorophyll a at Station SR-03 in Skokie River

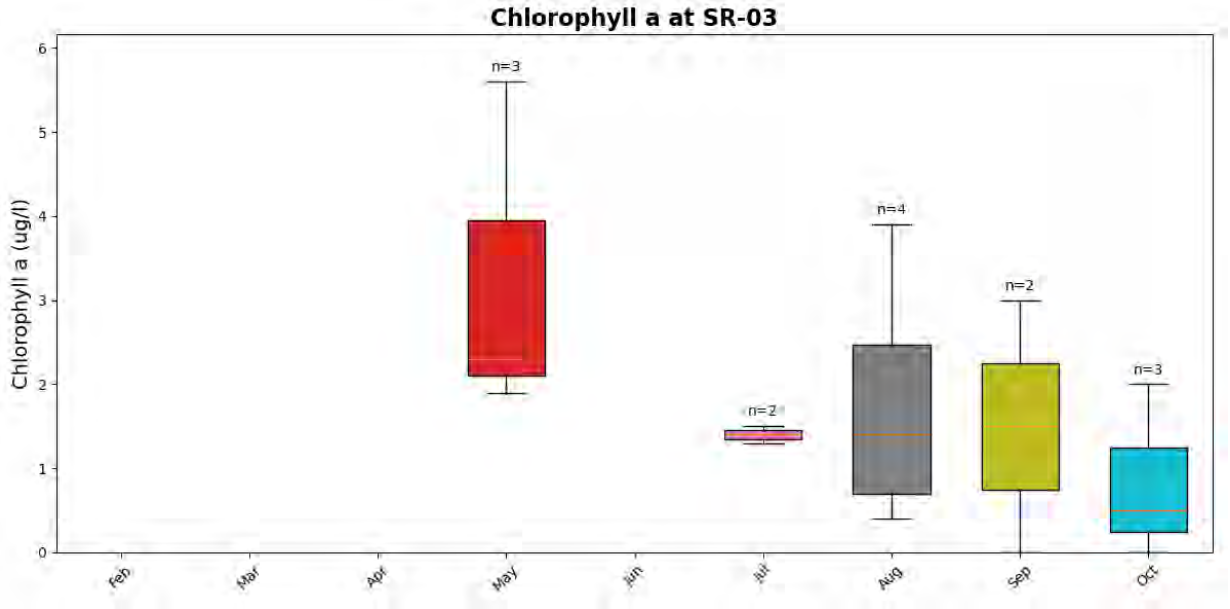


Figure C-258: Monthly Box Plot for Chlorophyll a at Station SR-04 in Skokie River

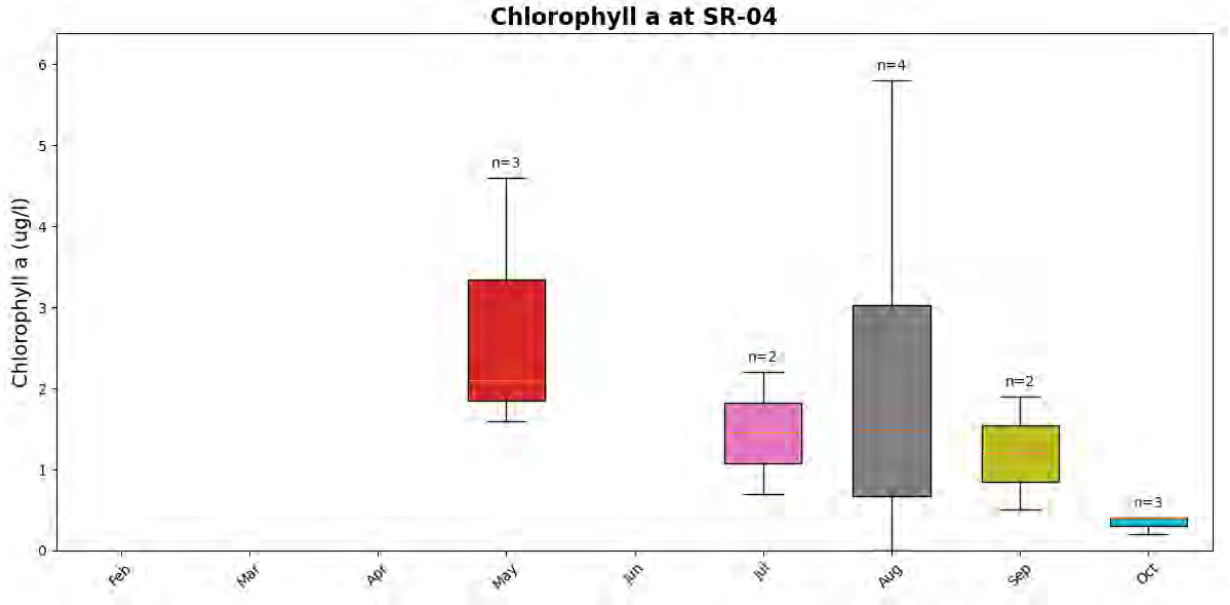


Figure C-259: Monthly Box Plot for Chlorophyll a at Station SR-05 in Skokie River

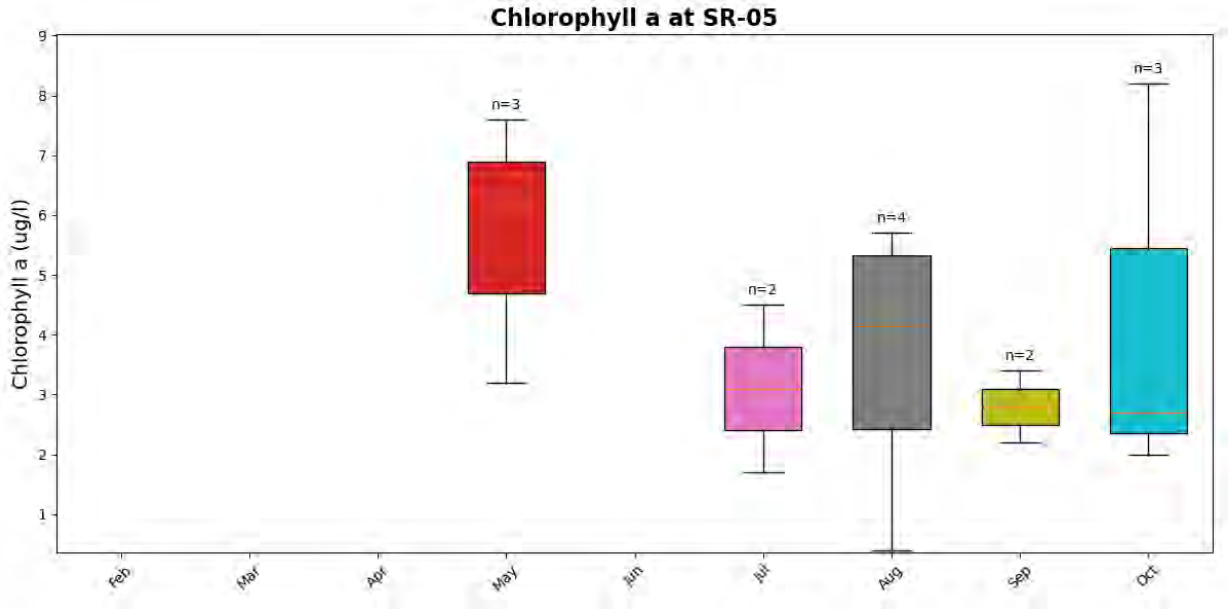


Figure C-260: Monthly Box Plot for Chlorophyll a at Station SR-06 in Skokie River

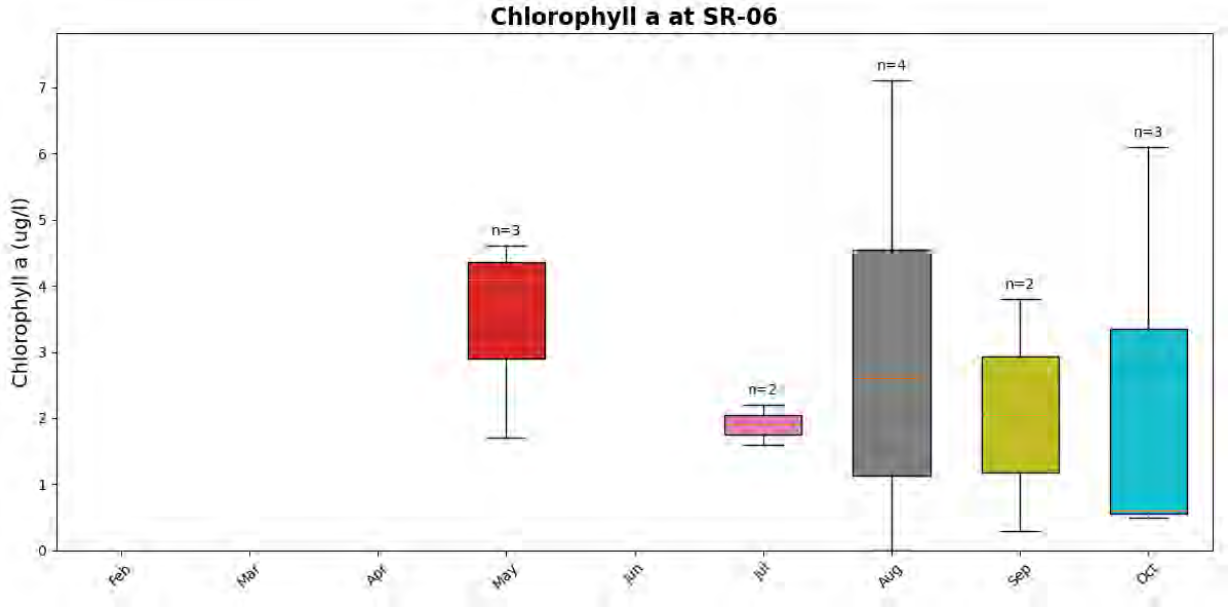


Figure C-261: Monthly Box Plot for Chlorophyll a at Station SR-07 in Skokie River

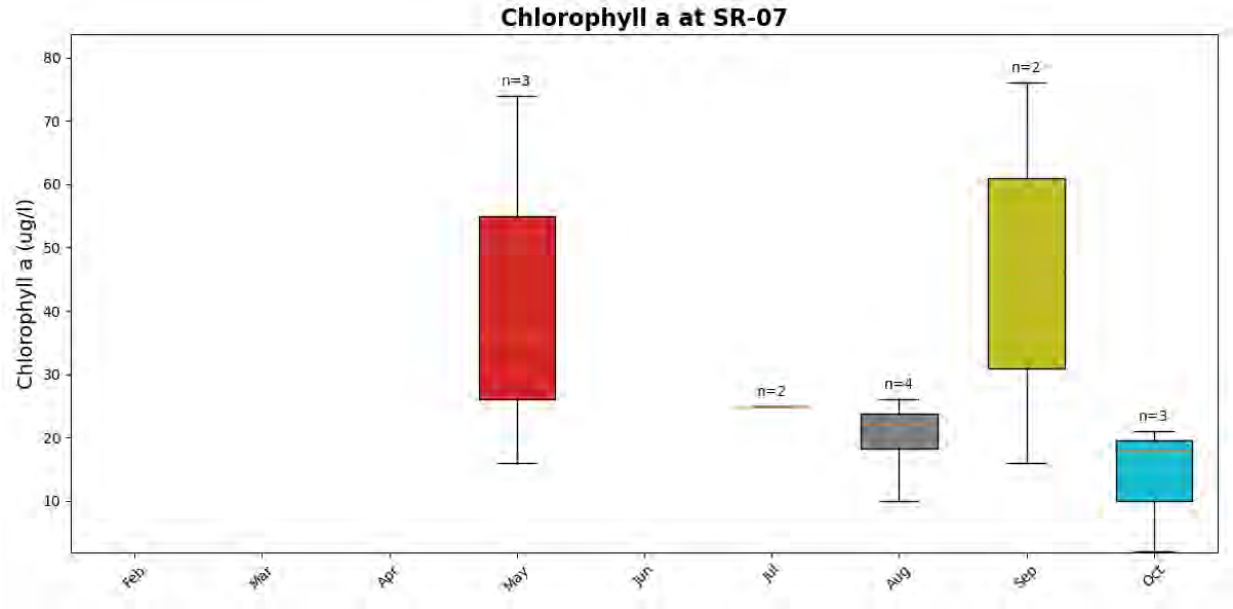


Figure C-262: Monthly Box Plot for Chlorophyll a at Station SR-08 in Skokie River

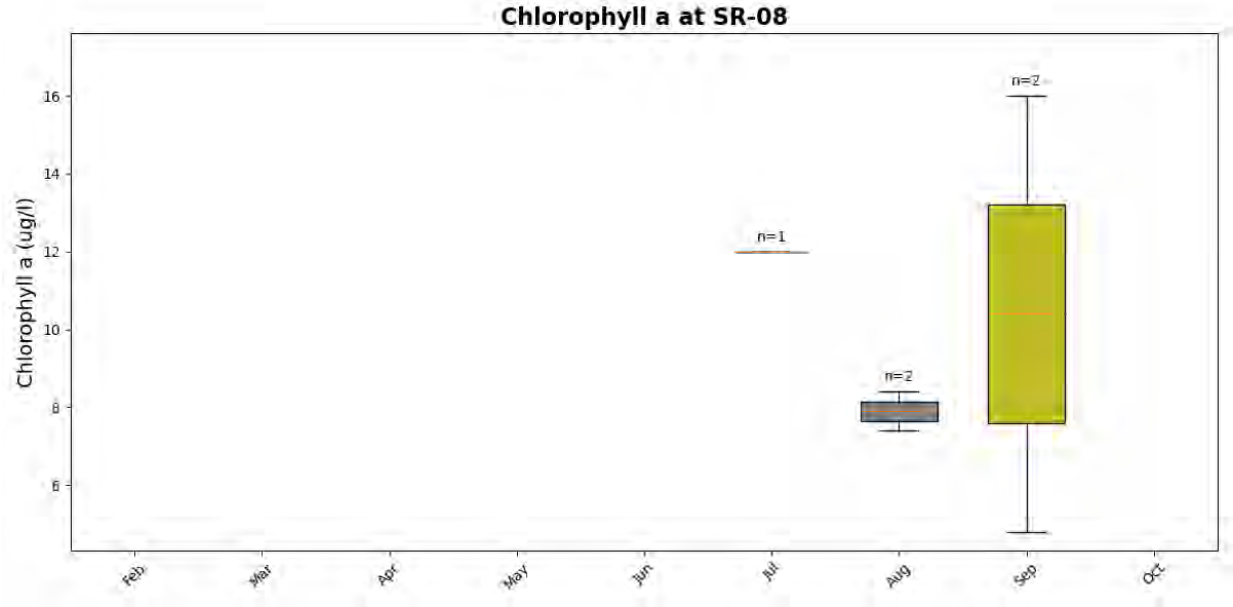
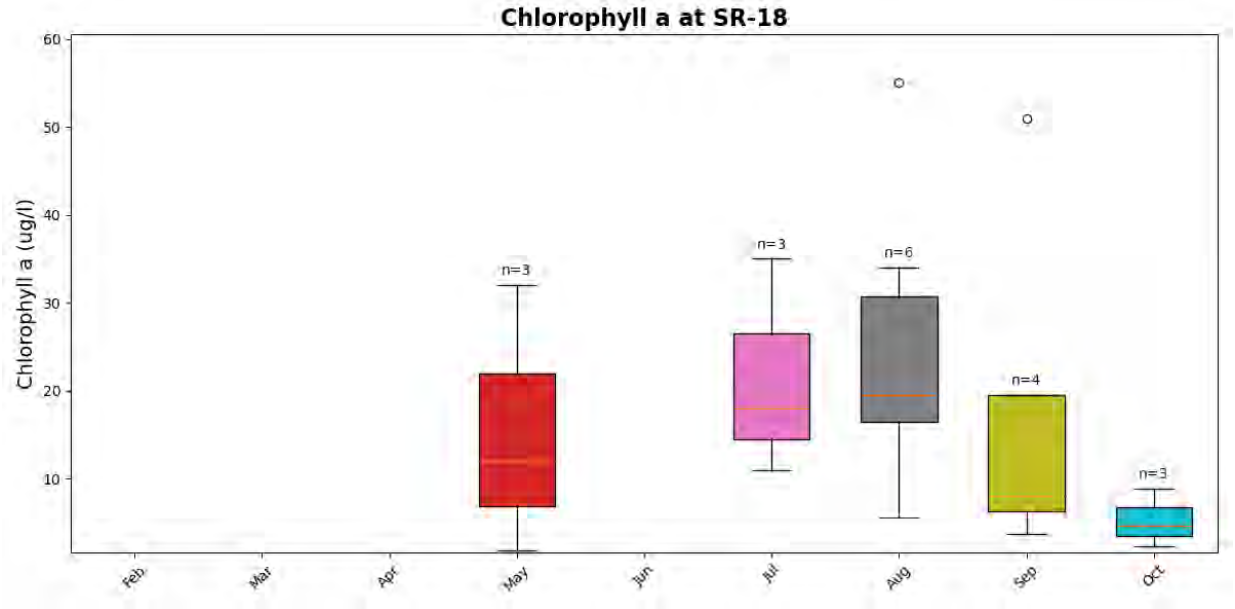


Figure C-263: Monthly Box Plot for Chlorophyll a at Station SR-18 in Skokie River



Dissolved Oxygen

Figure C-264: Monthly Box Plot for Dissolved Oxygen at Station SR-01 in Skokie River

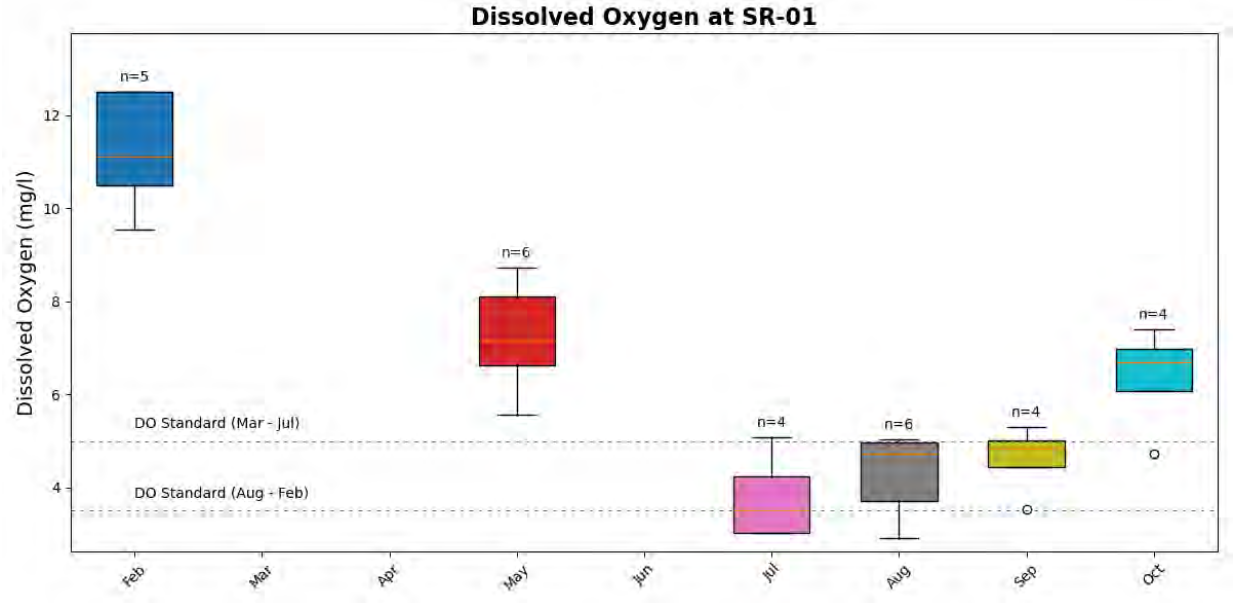


Figure C-265: Monthly Box Plot for Dissolved Oxygen at Station SR-02 in Skokie River

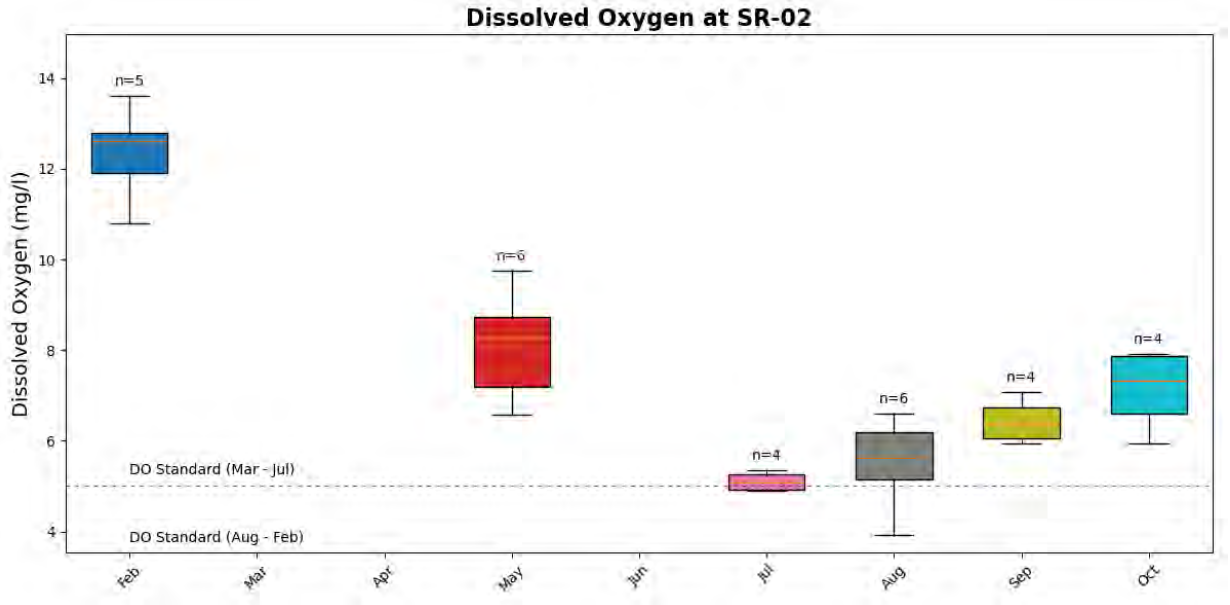


Figure C-266: Monthly Box Plot for Dissolved Oxygen at Station SR-03 in Skokie River

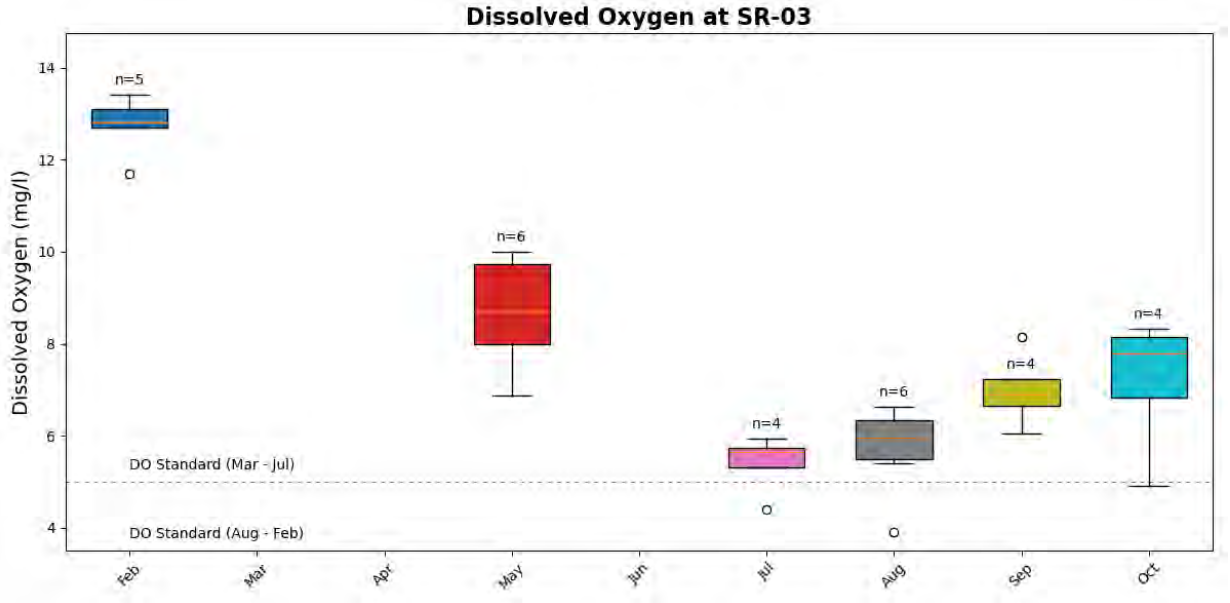


Figure C-267: Monthly Box Plot for Dissolved Oxygen at Station SR-04 in Skokie River

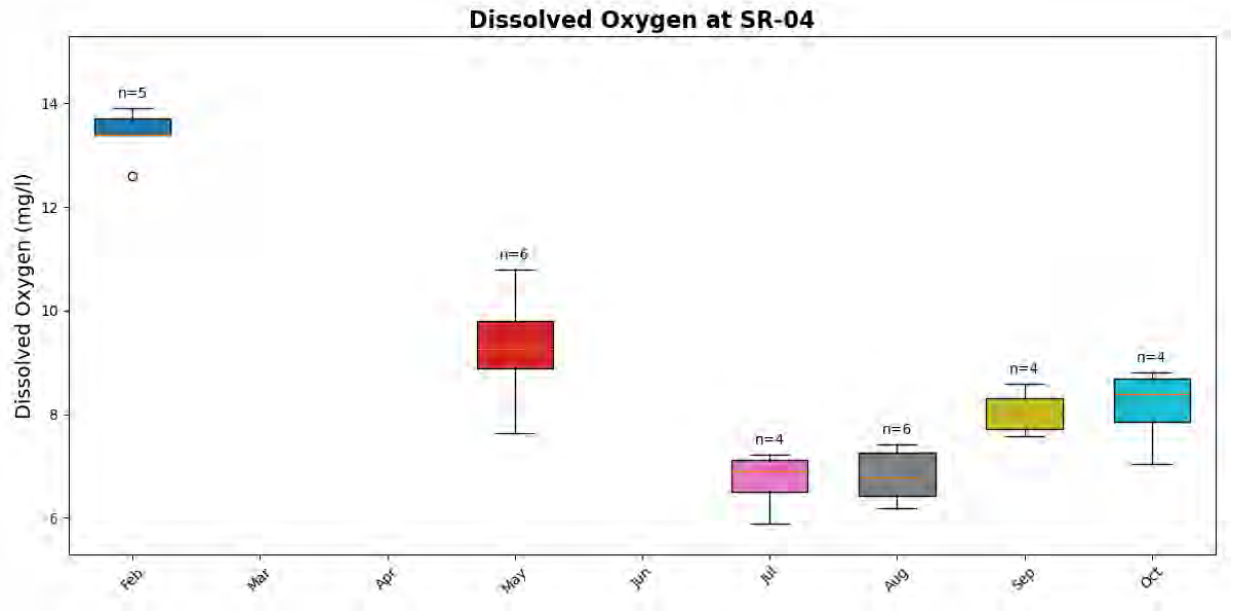


Figure C-268: Monthly Box Plot for Dissolved Oxygen at Station SR-05 in Skokie River

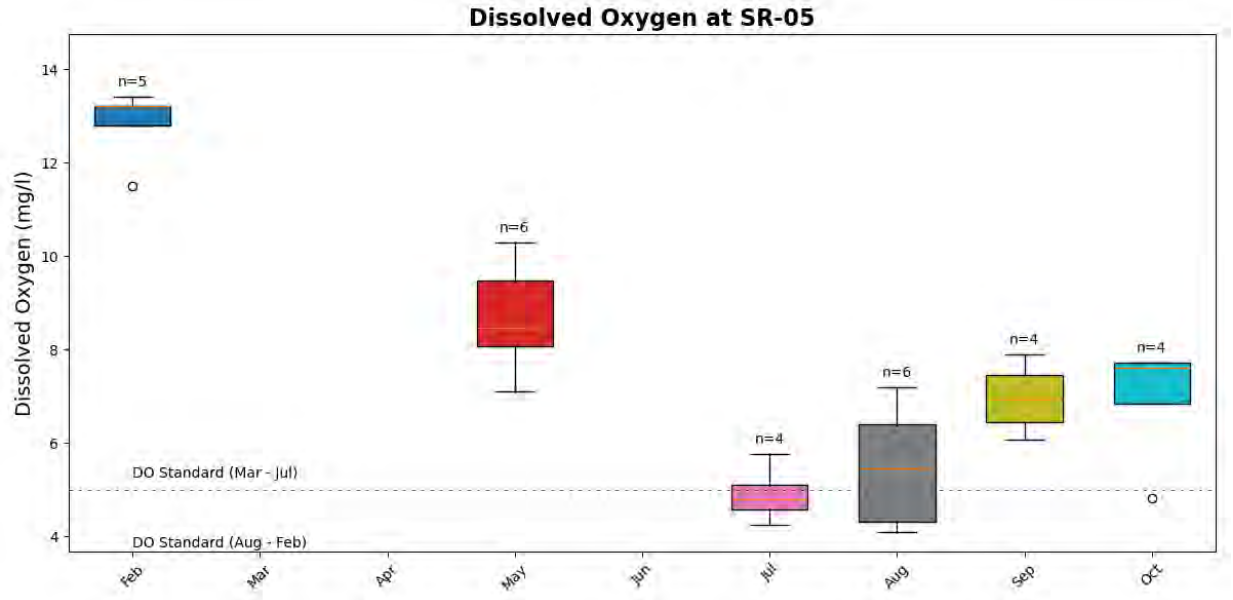


Figure C-269: Monthly Box Plot for Dissolved Oxygen at Station SR-06 in Skokie River

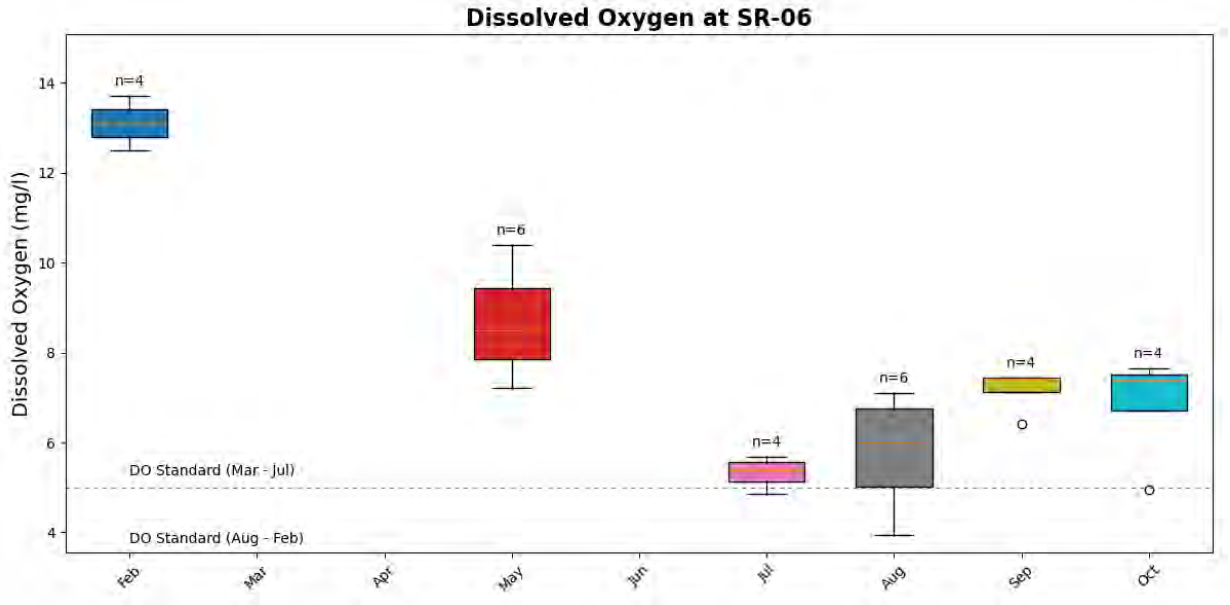


Figure C-270: Monthly Box Plot for Dissolved Oxygen at Station SR-07 in Skokie River

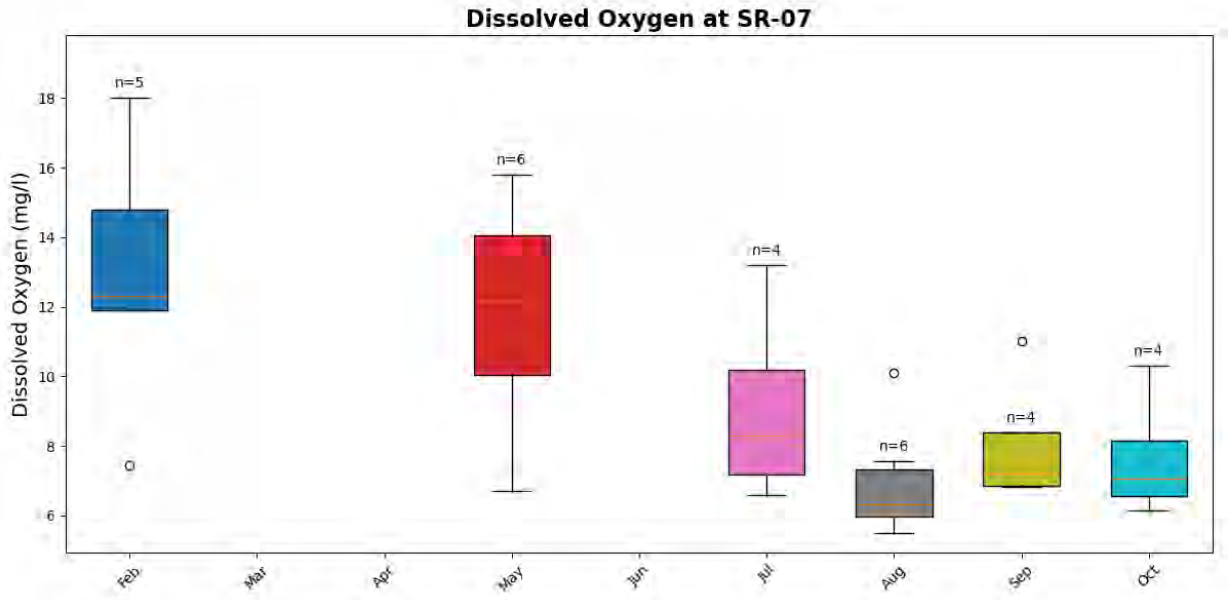
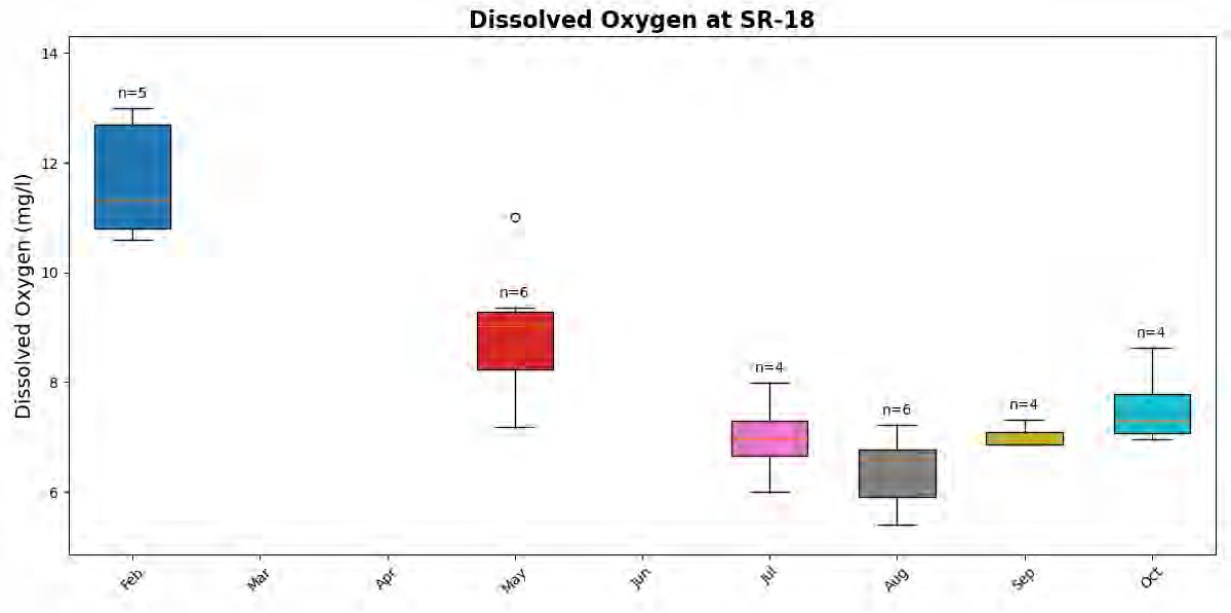


Figure C-271: Monthly Box Plot for Dissolved Oxygen at Station SR-18 in Skokie River



E. coli

Figure C-272: Monthly Box Plot for E. Coli at Station SR-01 in Skokie River

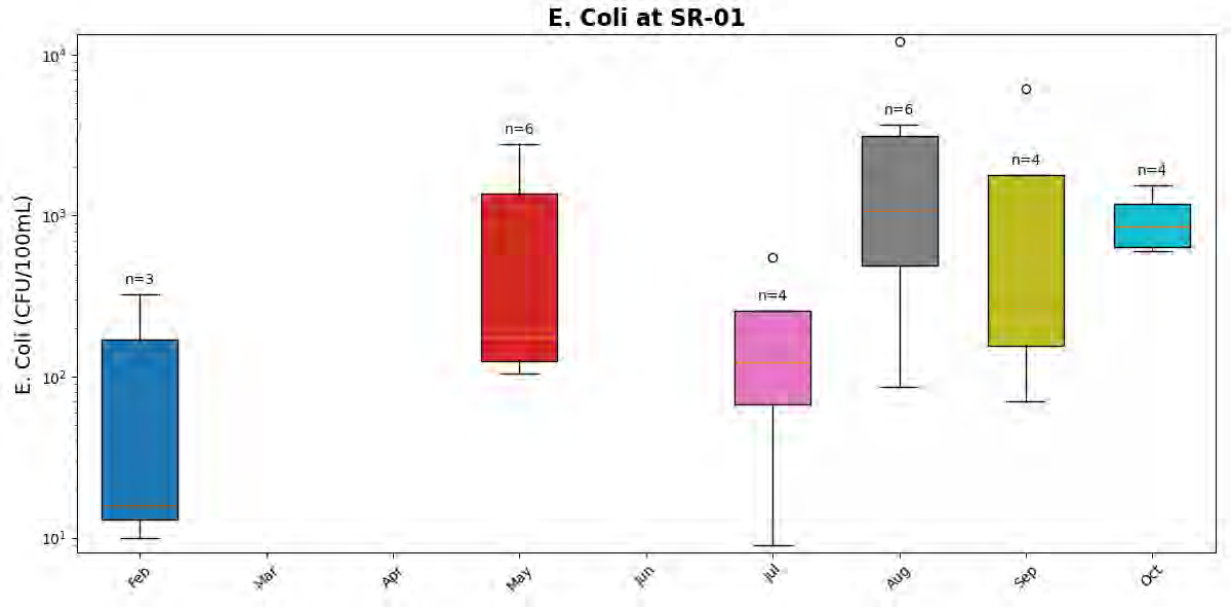


Figure C-273: Monthly Box Plot for E. Coli at Station SR-02 in Skokie River

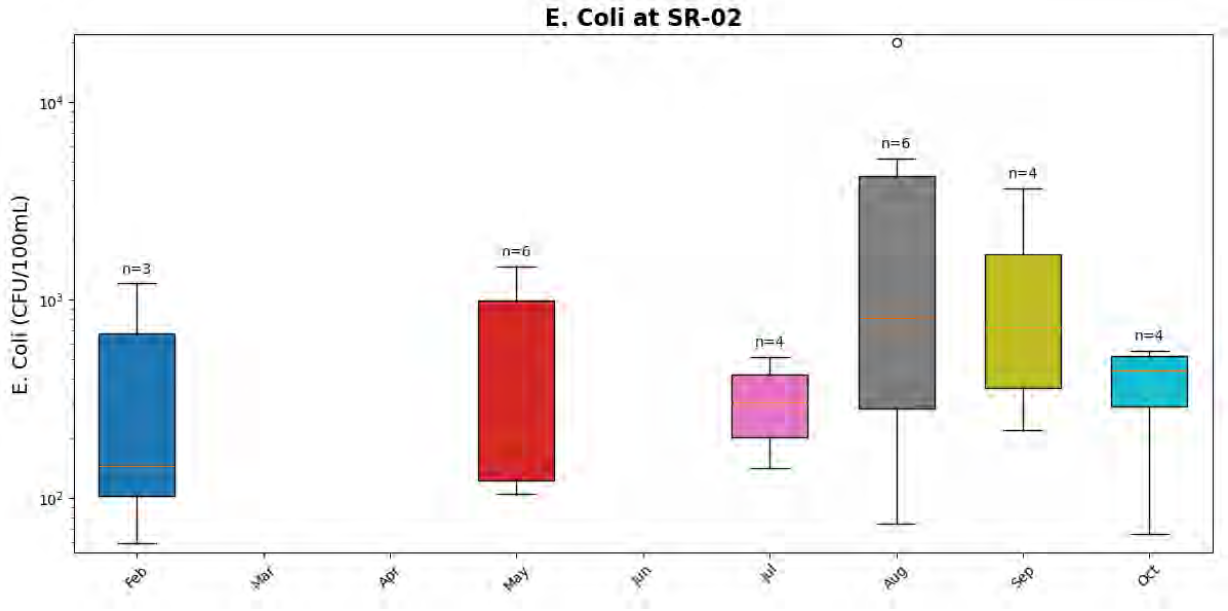


Figure C-274: Monthly Box Plot for E. Coli at Station SR-03 in Skokie River

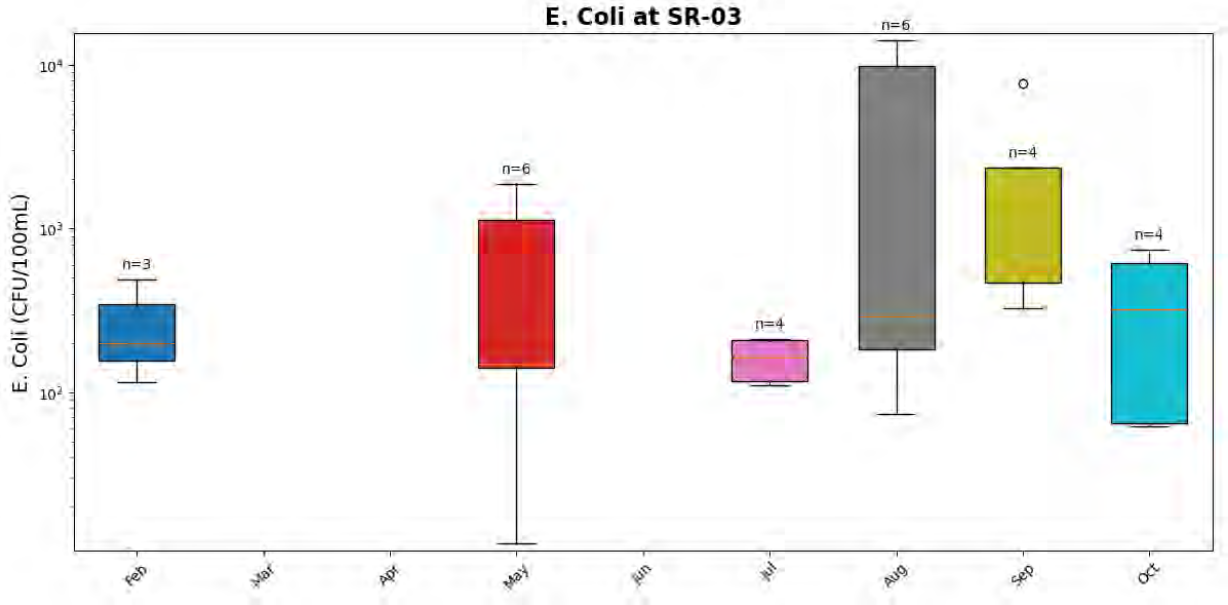


Figure C-275: Monthly Box Plot for E. Coli at Station SR-04 in Skokie River

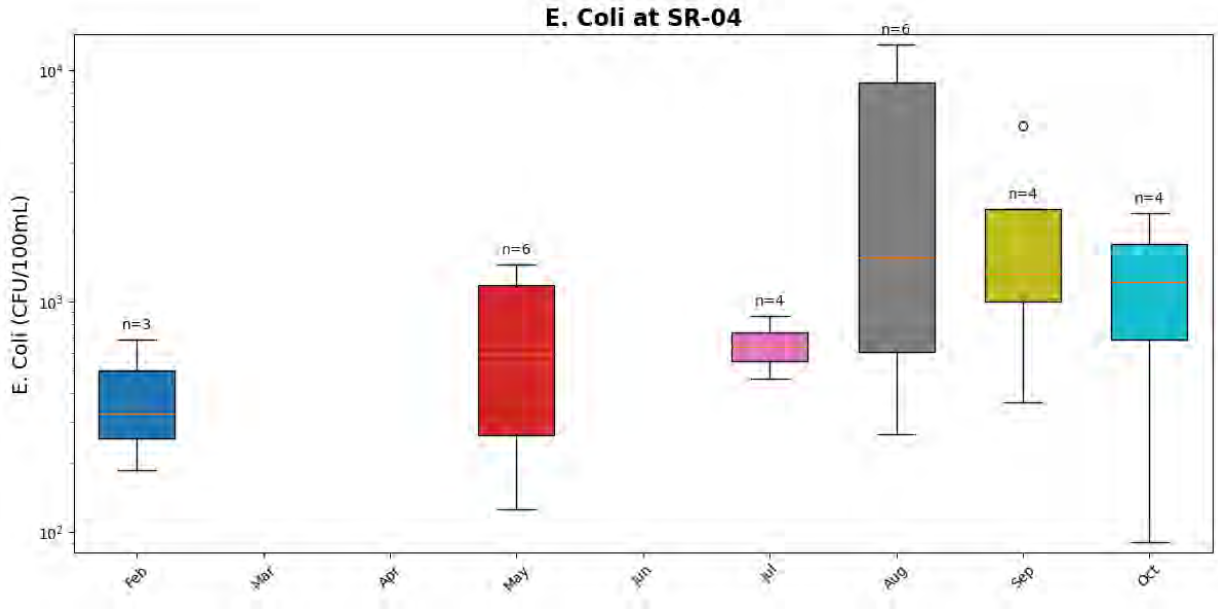


Figure C-276: Monthly Box Plot for E. Coli at Station SR-05 in Skokie River

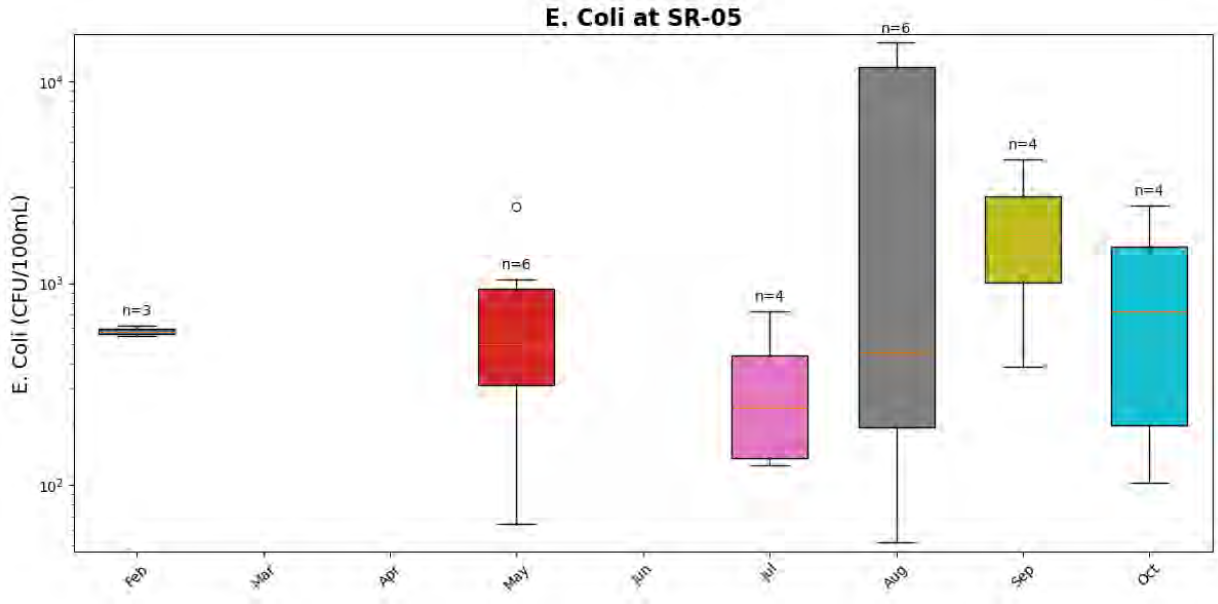


Figure C-277: Monthly Box Plot for E. Coli at Station SR-06 in Skokie River

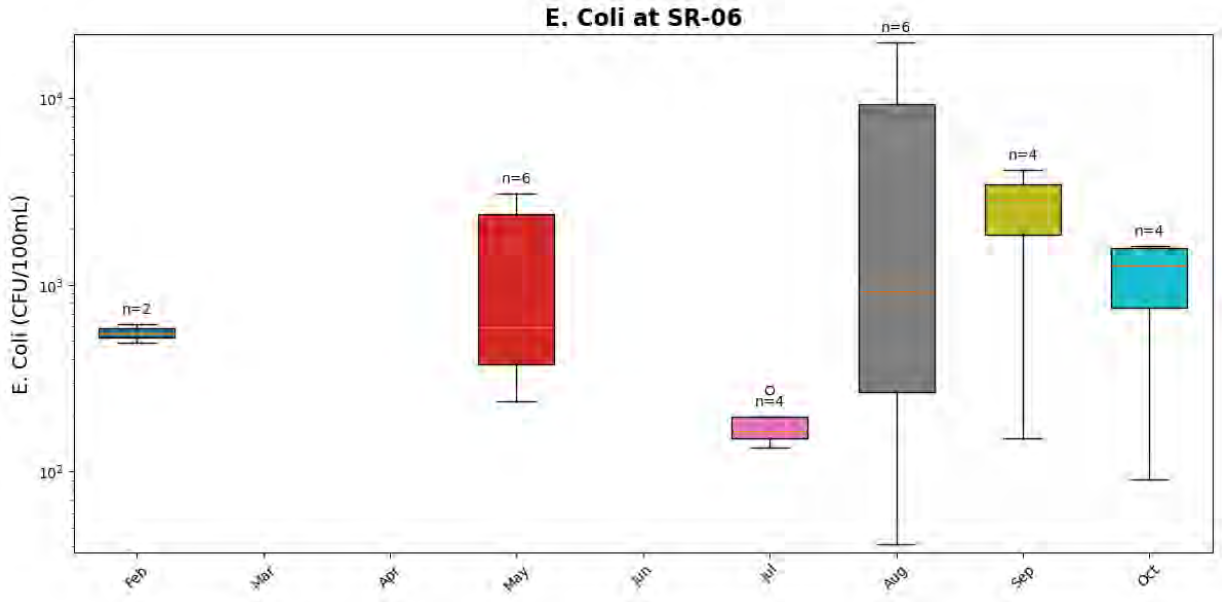


Figure C-278: Monthly Box Plot for E. Coli at Station SR-07 in Skokie River

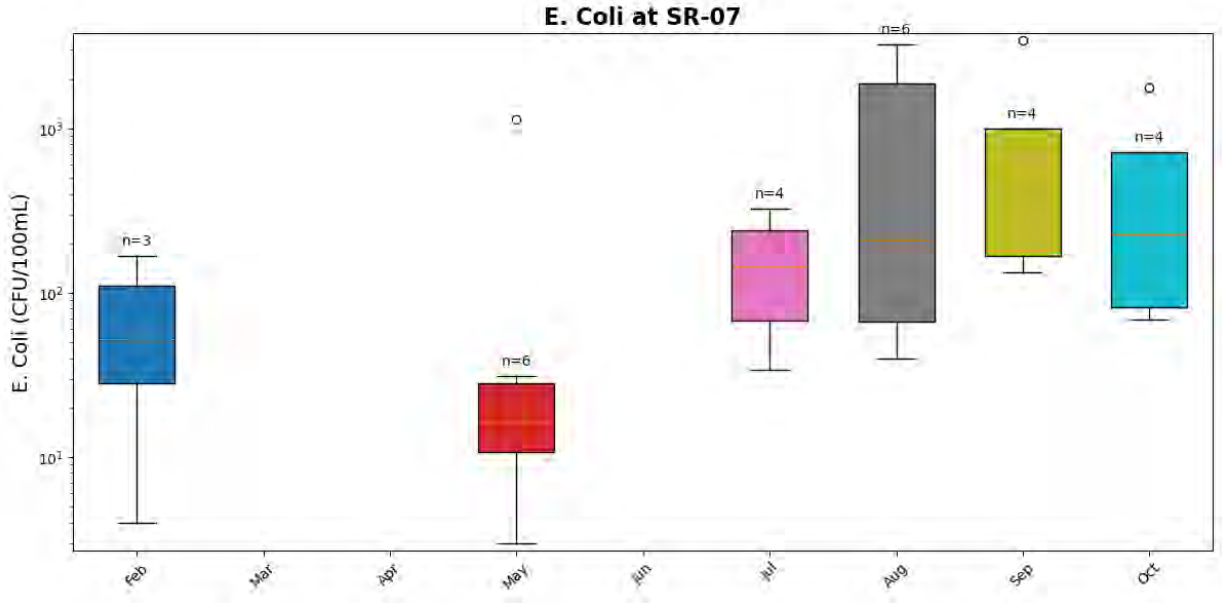
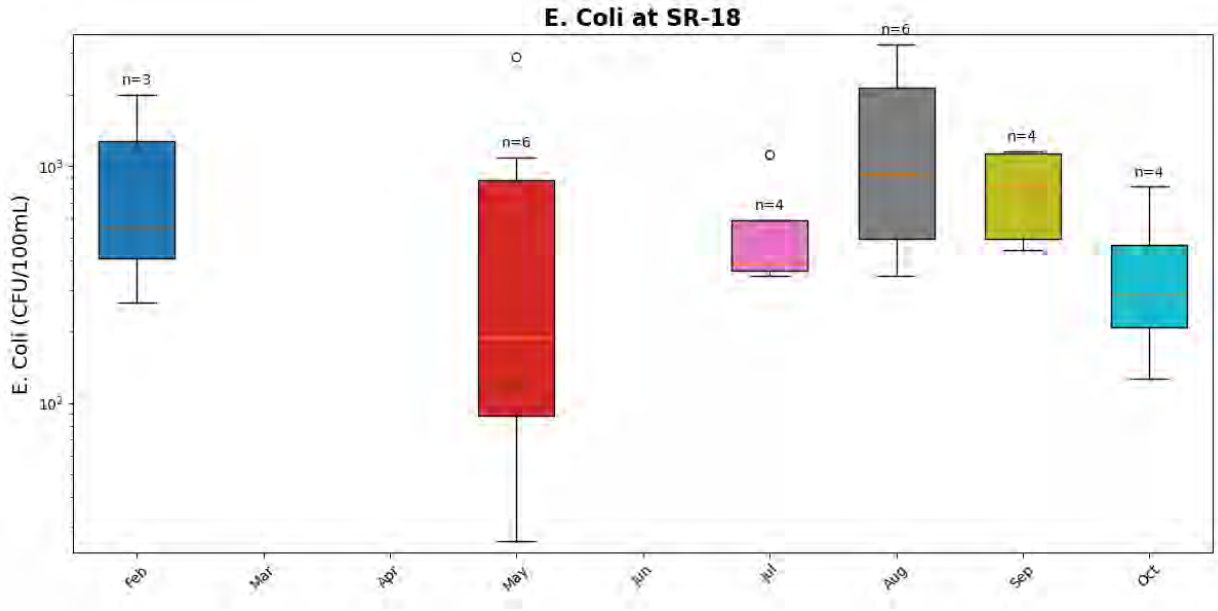


Figure C-279: Monthly Box Plot for E. Coli at Station SR-18 in Skokie River



Appendix D
TIMESERIES PLOTS

West Fork

2019

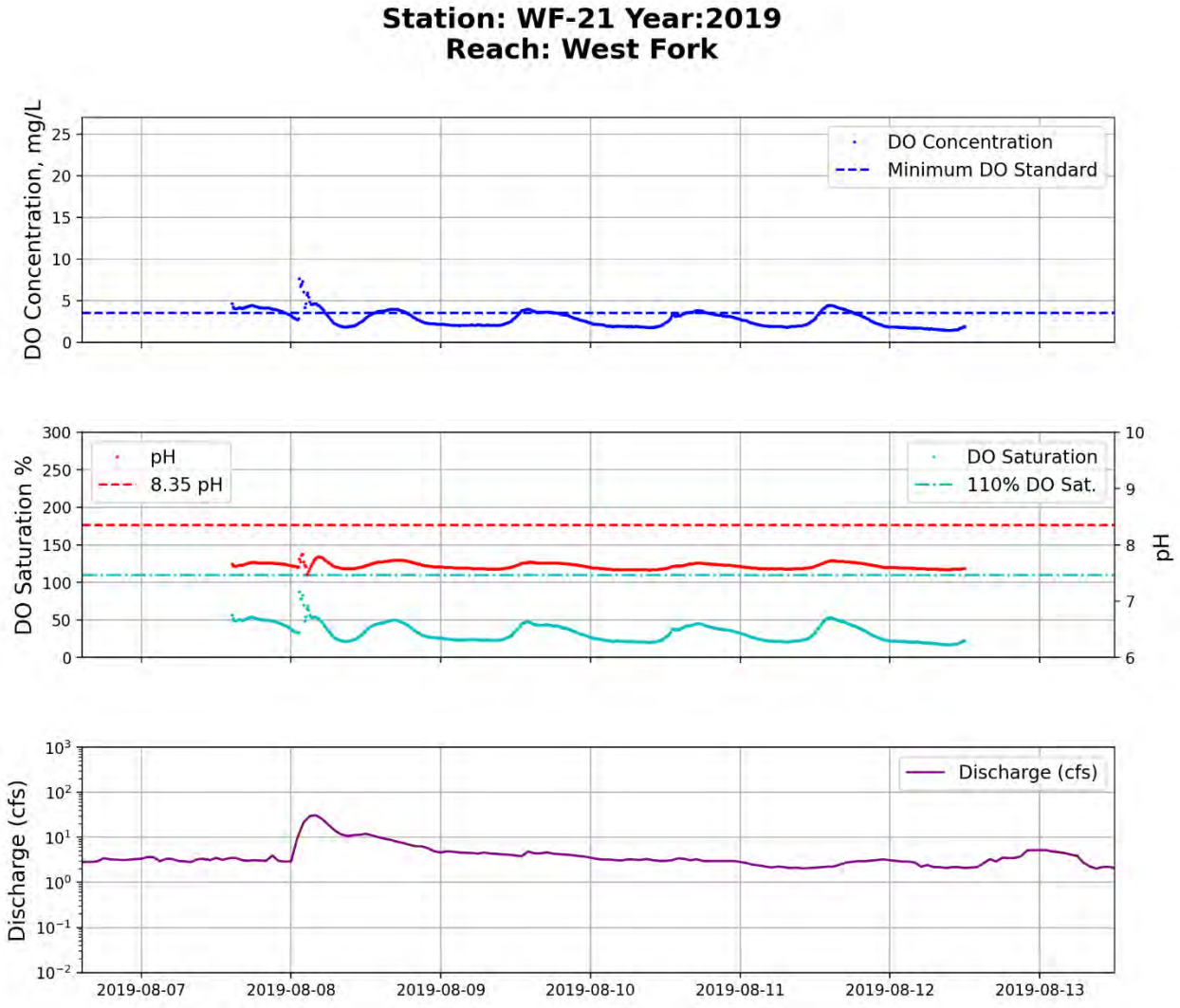


Figure D-1: Continuous Timeseries data for Station WF-21 in West Fork

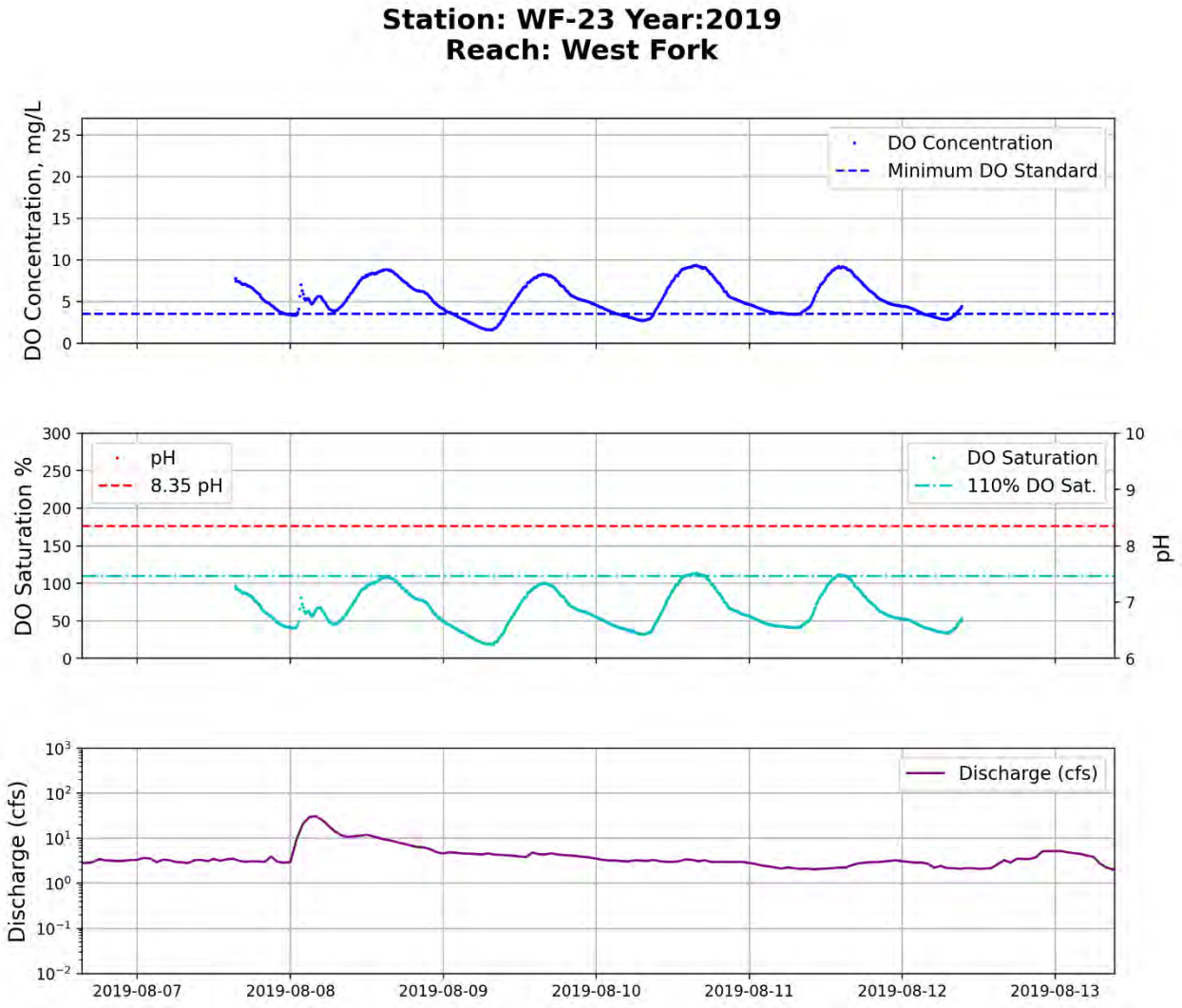


Figure D-2: Continuous Timeseries data for Station WF-23 in West Fork

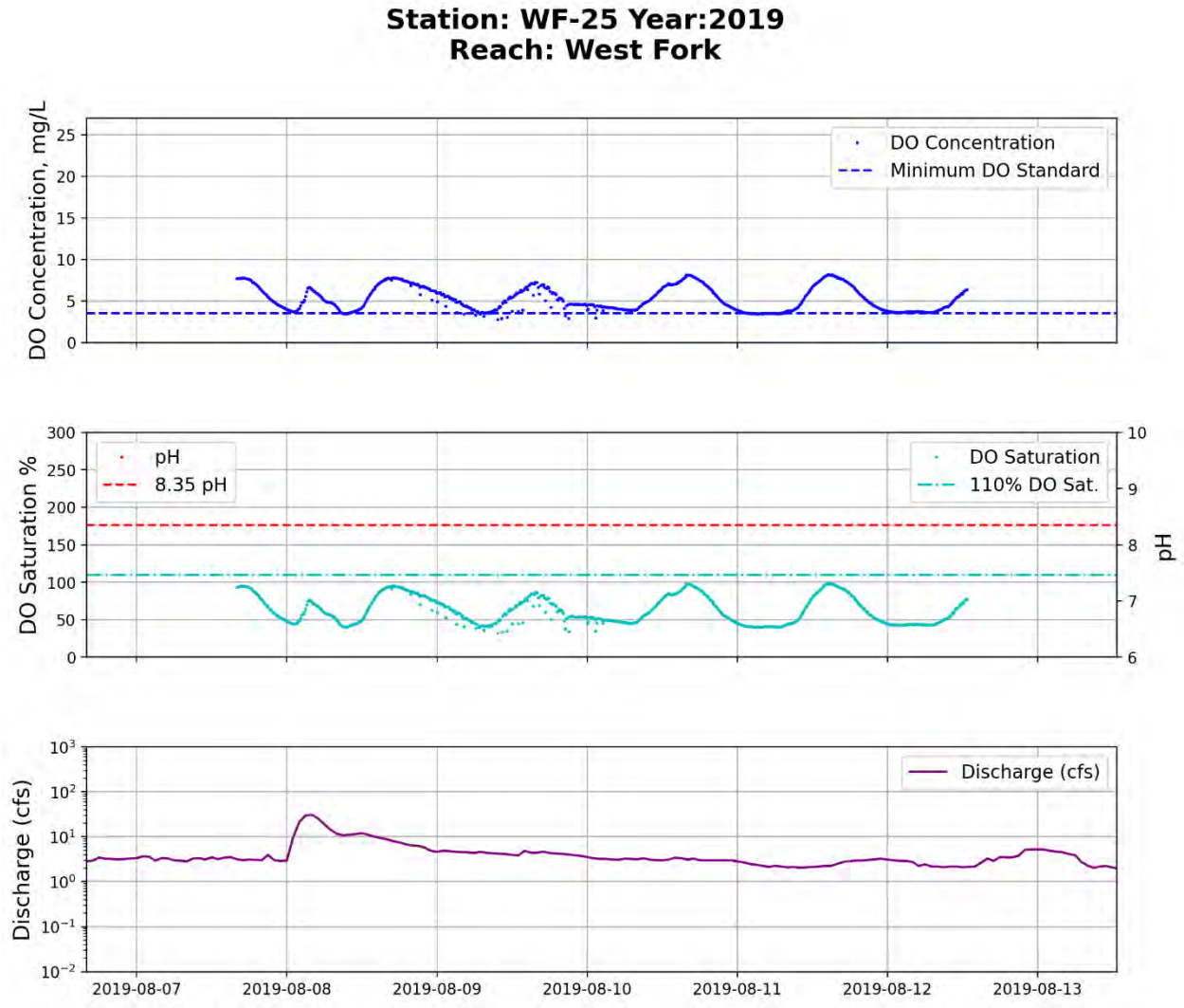


Figure D-3: Continuous Timeseries data for Station WF-25 in West Fork

2022

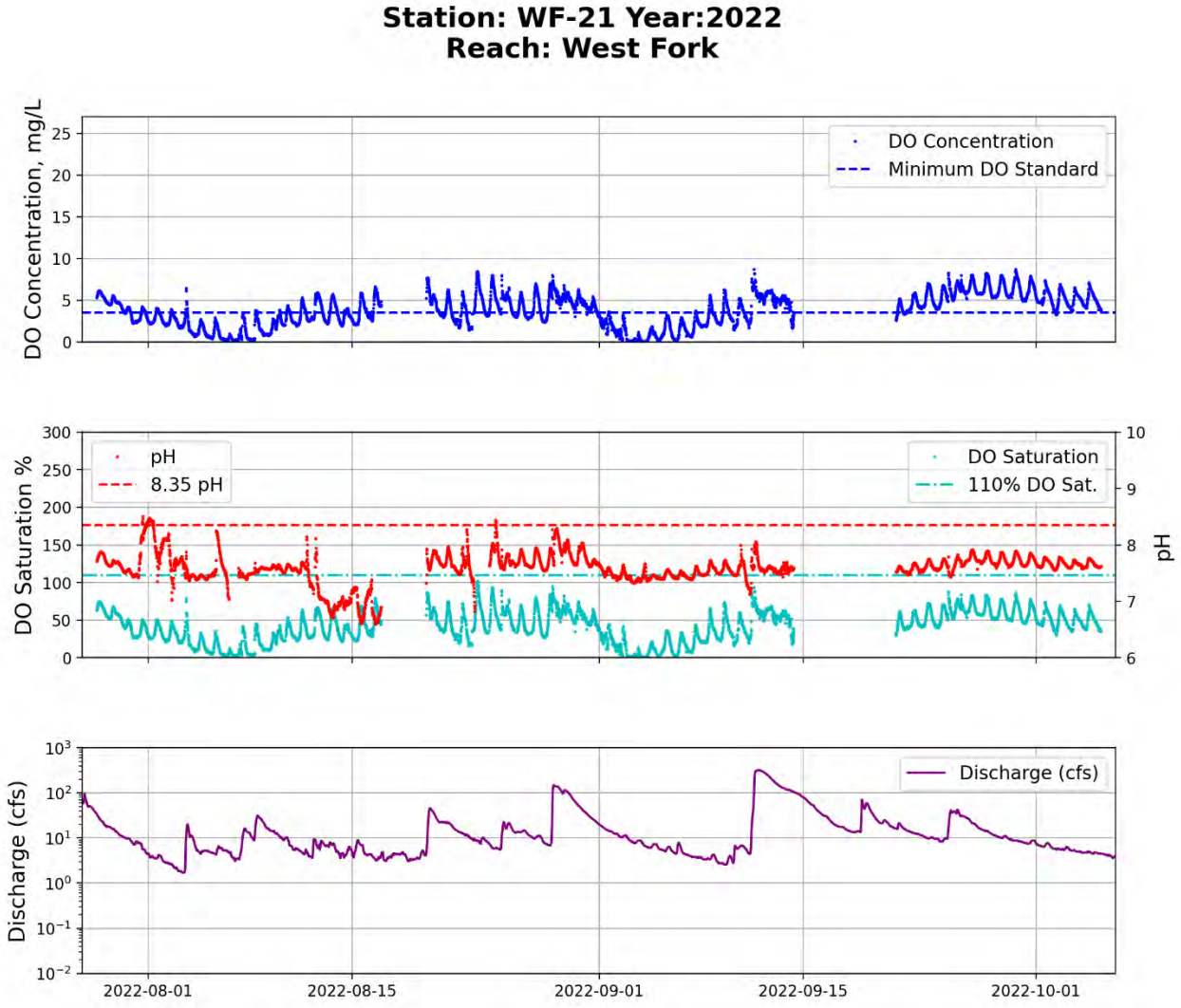


Figure D-4: Continuous Timeseries data for Station WF-21 in West Fork

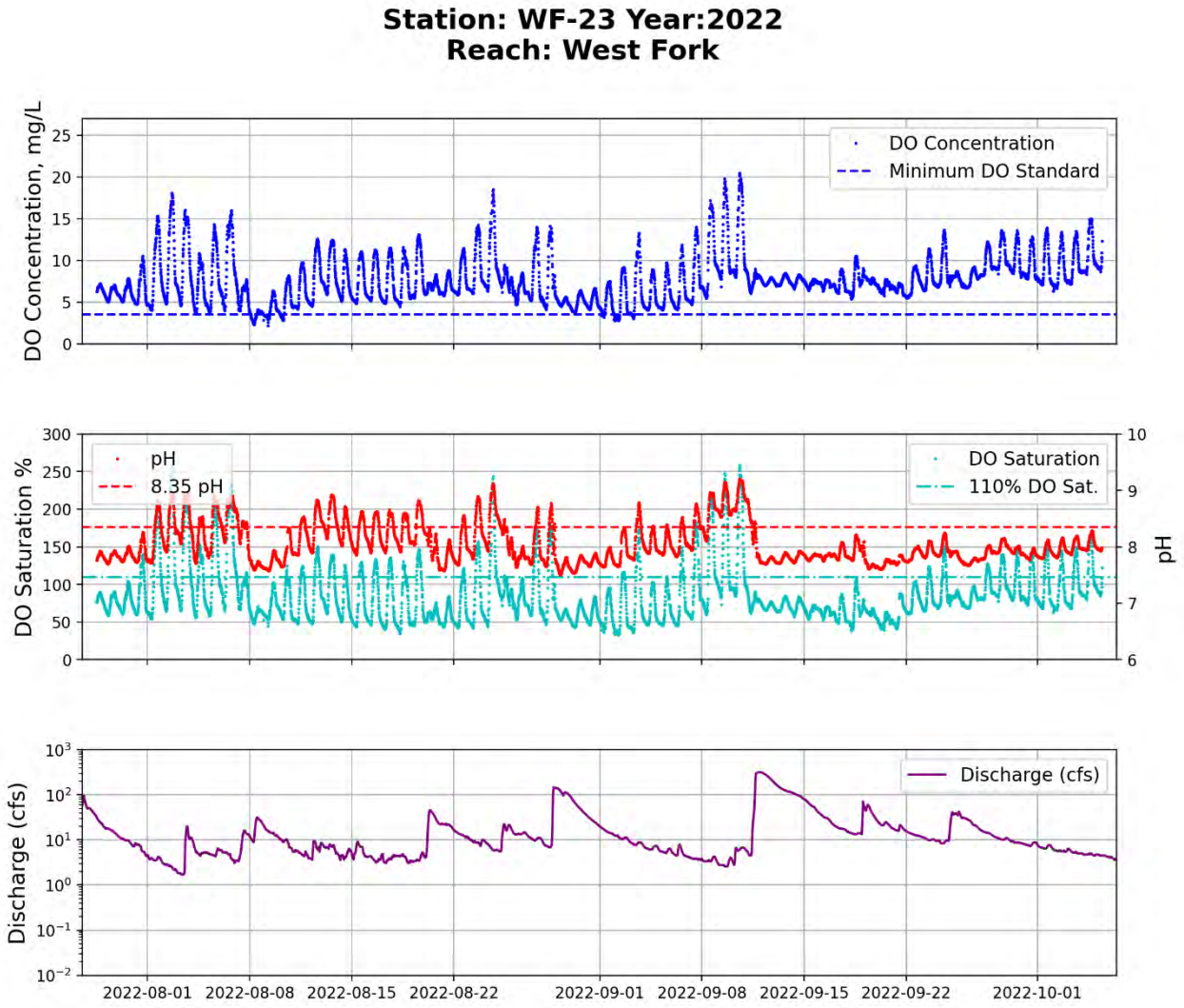


Figure D-5: Continuous Timeseries data for Station WF-23 in West Fork

Middle Fork and North Branch Chicago River

2018

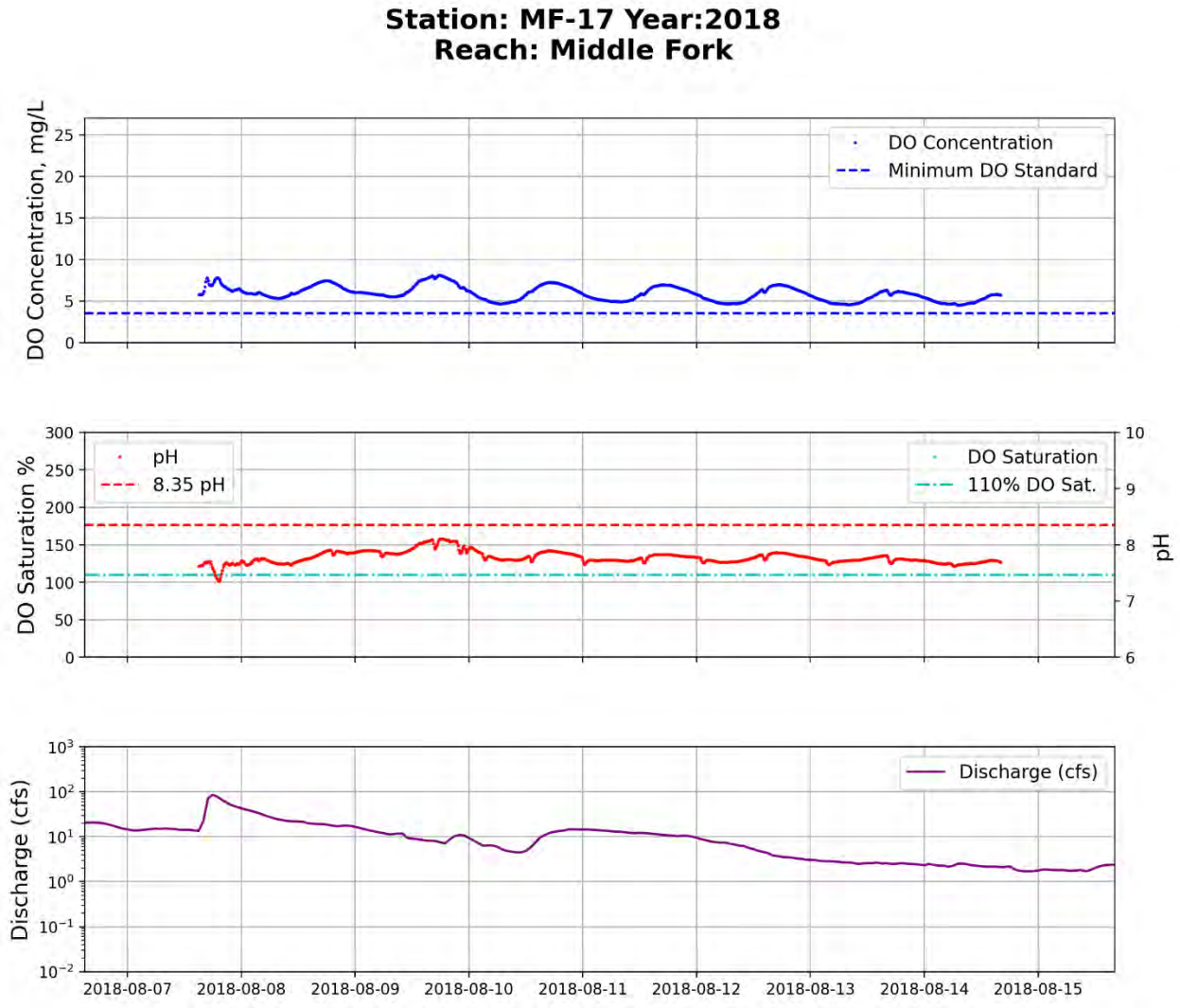


Figure D-6: Continuous Timeseries data for Station MF-17 in Middle Fork

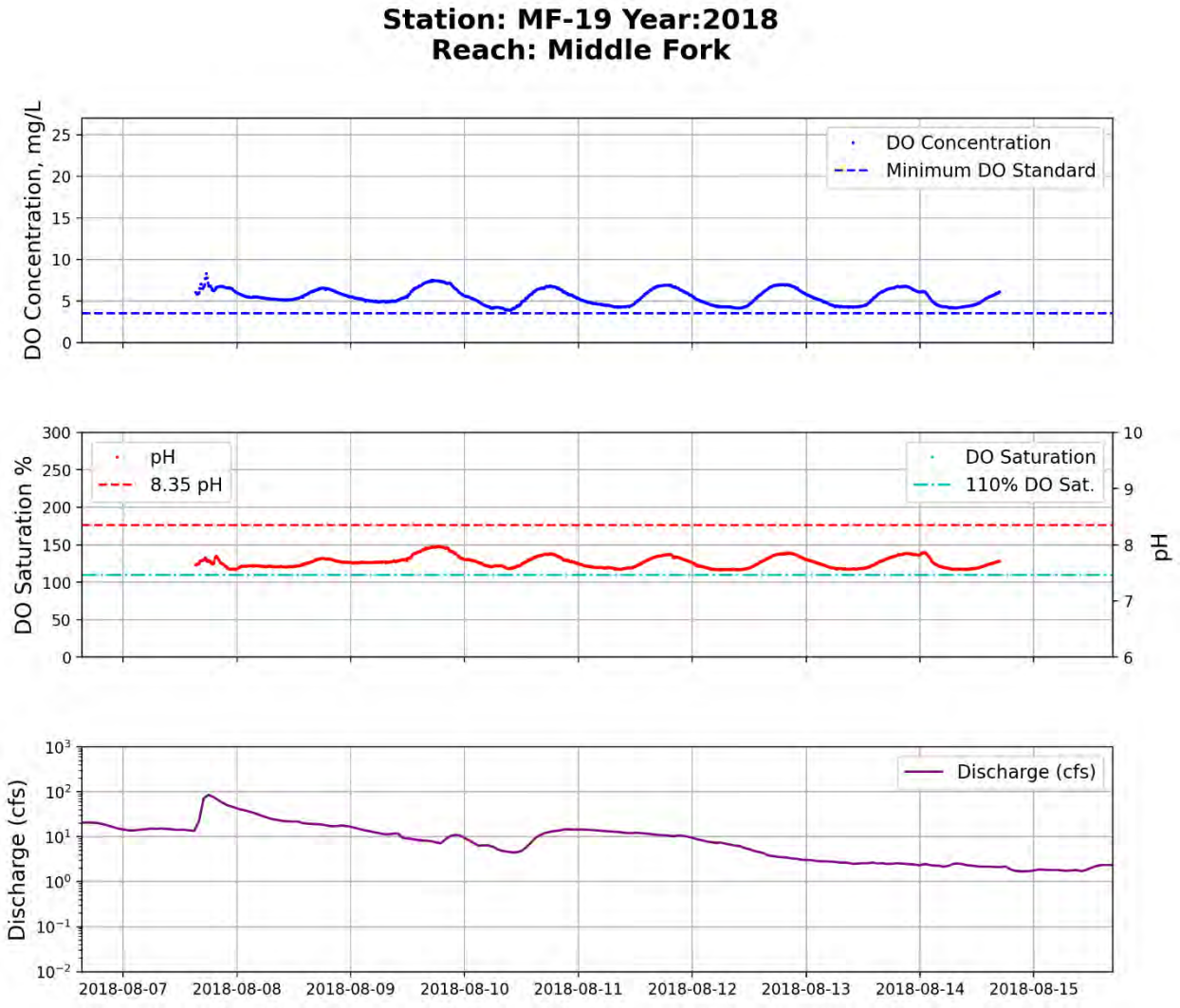


Figure D-7: Continuous Timeseries data for Station MF-19 in Middle Fork

2019

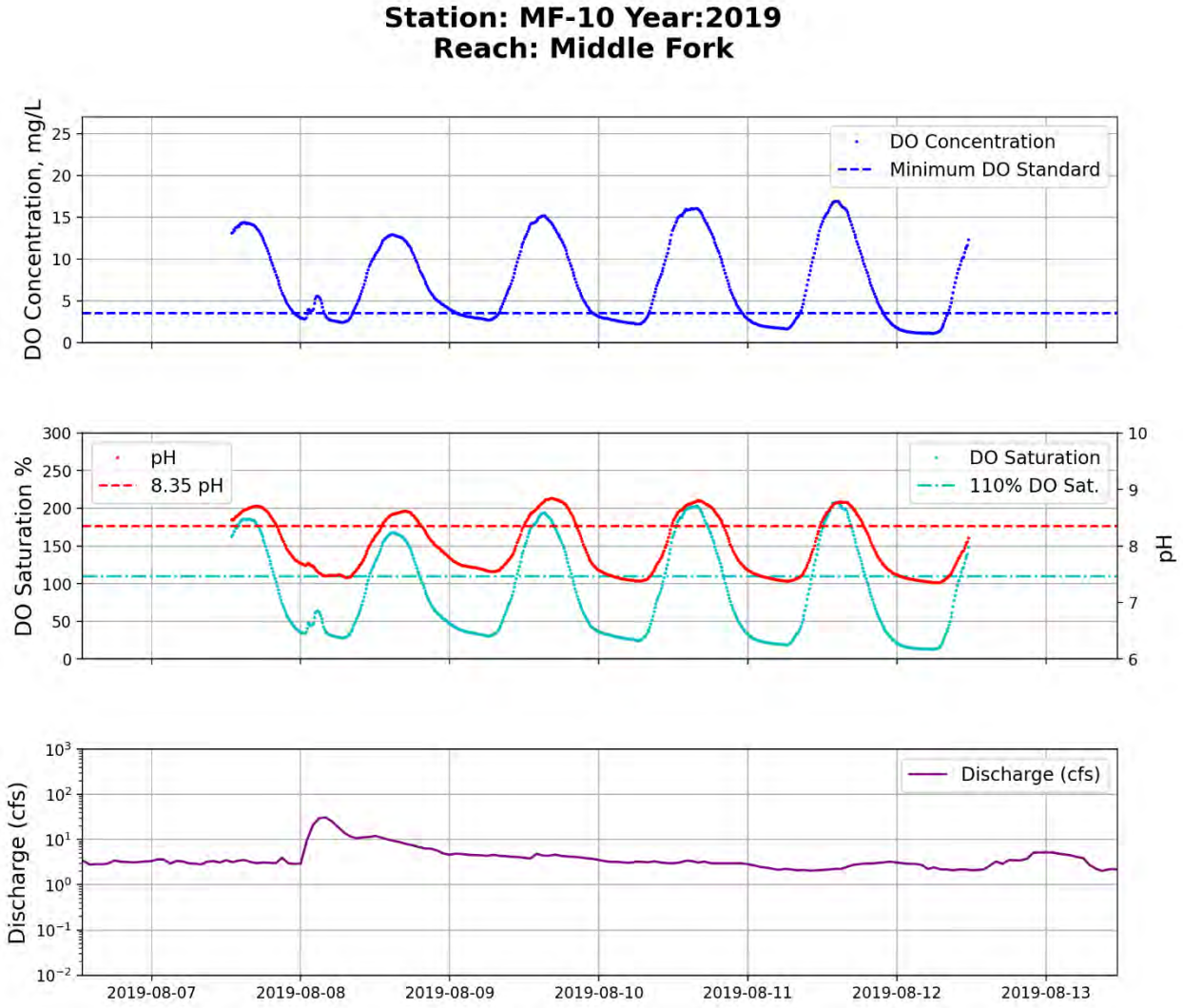


Figure D-8: Continuous Timeseries data for Station MF-10 in Middle Fork

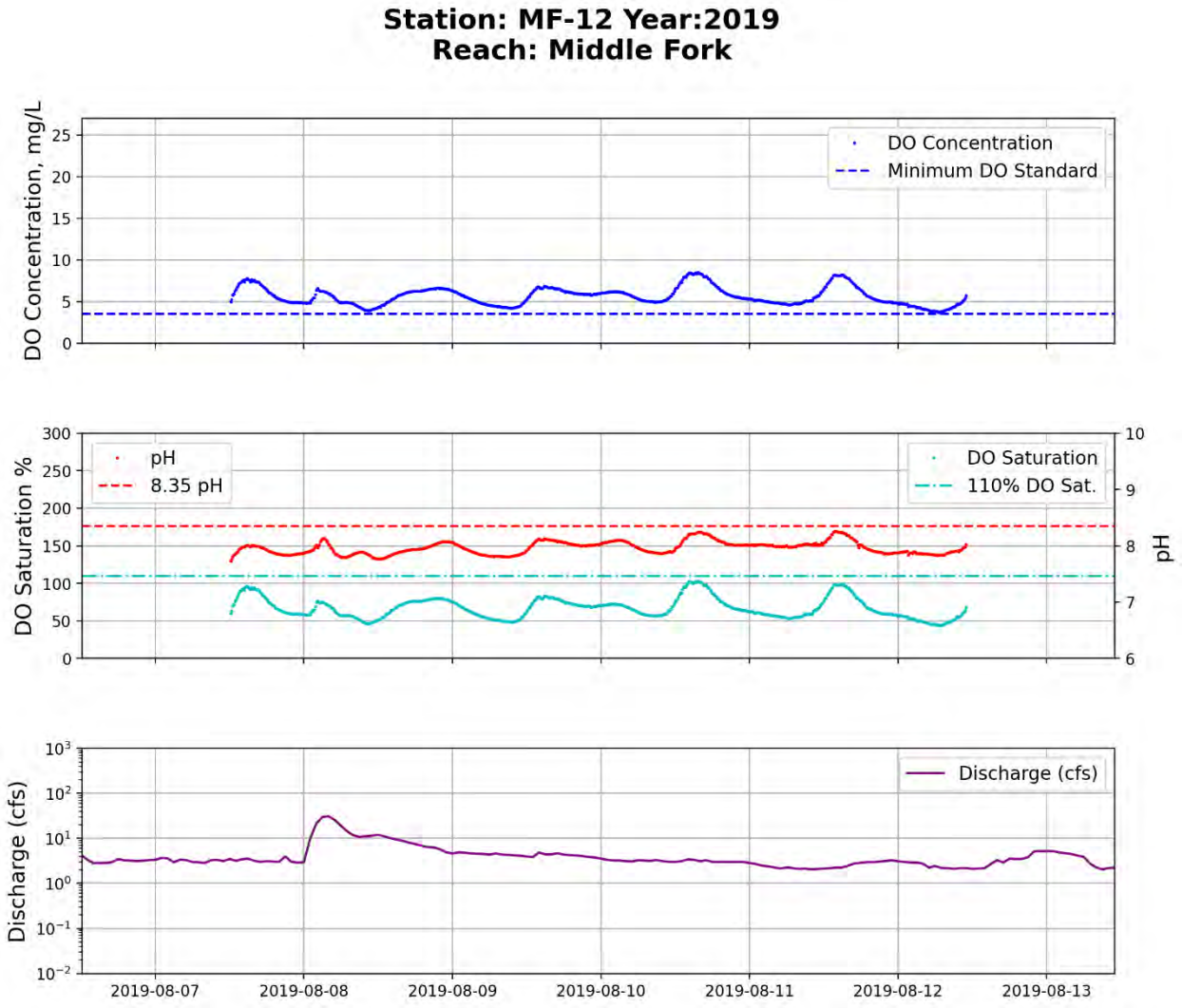


Figure D-9: Continuous Timeseries data for Station MF-12 in Middle Fork

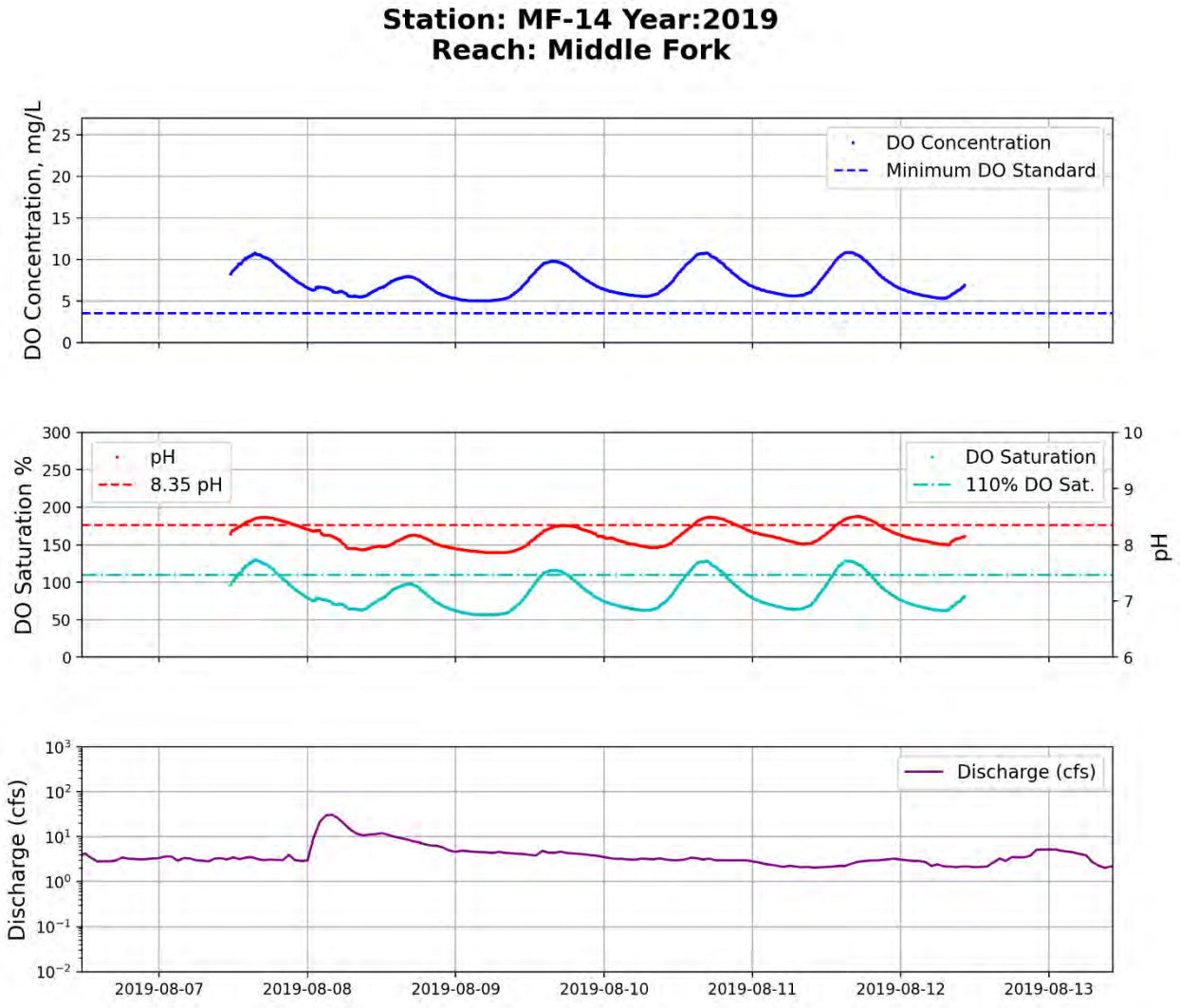


Figure D-10: Continuous Timeseries data for Station MF-14 in Middle Fork

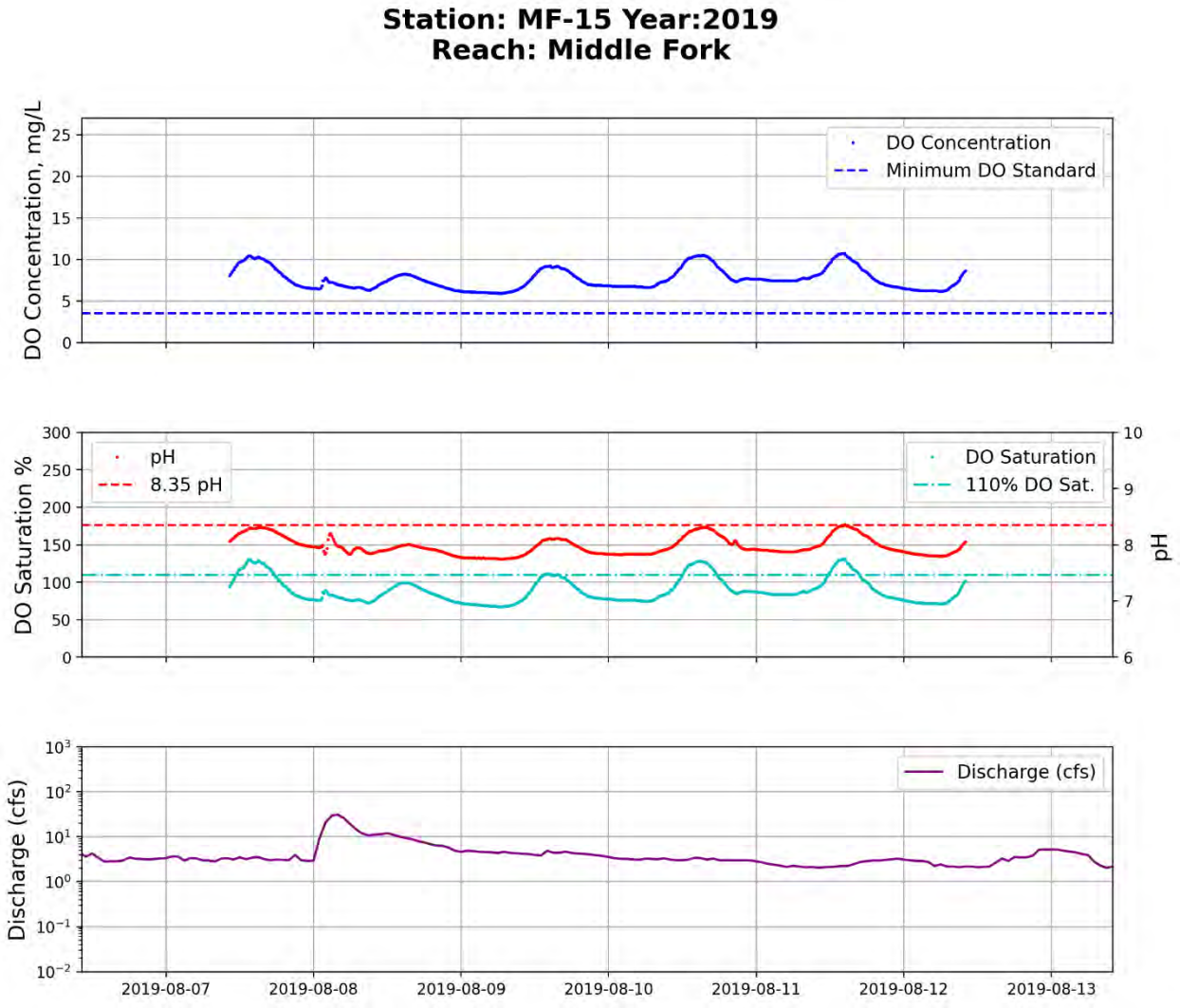


Figure D-11: Continuous Timeseries data for Station MF-15 in Middle Fork

2020

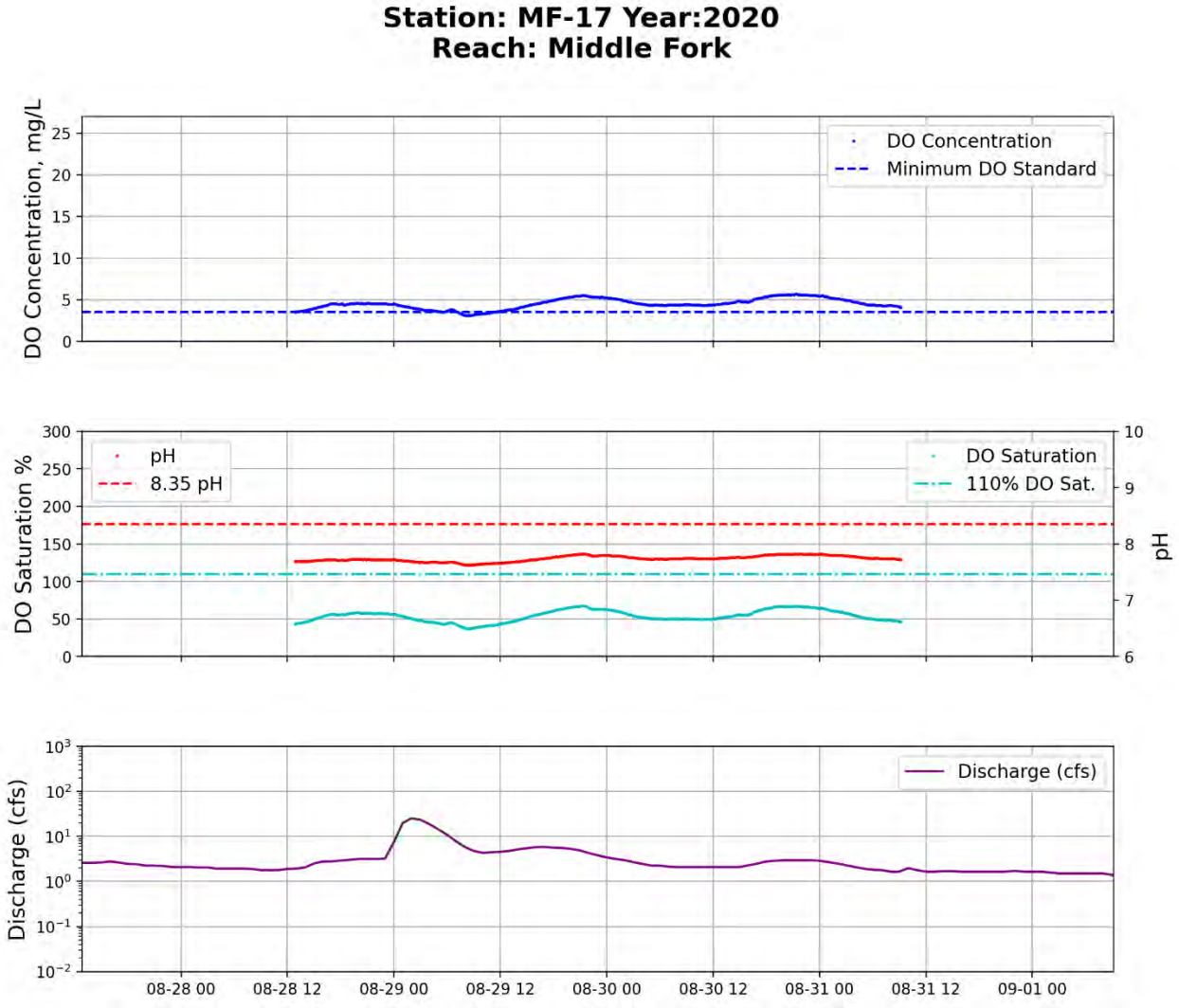


Figure D-12: Continuous Timeseries data for Station MF-17 in Middle Fork

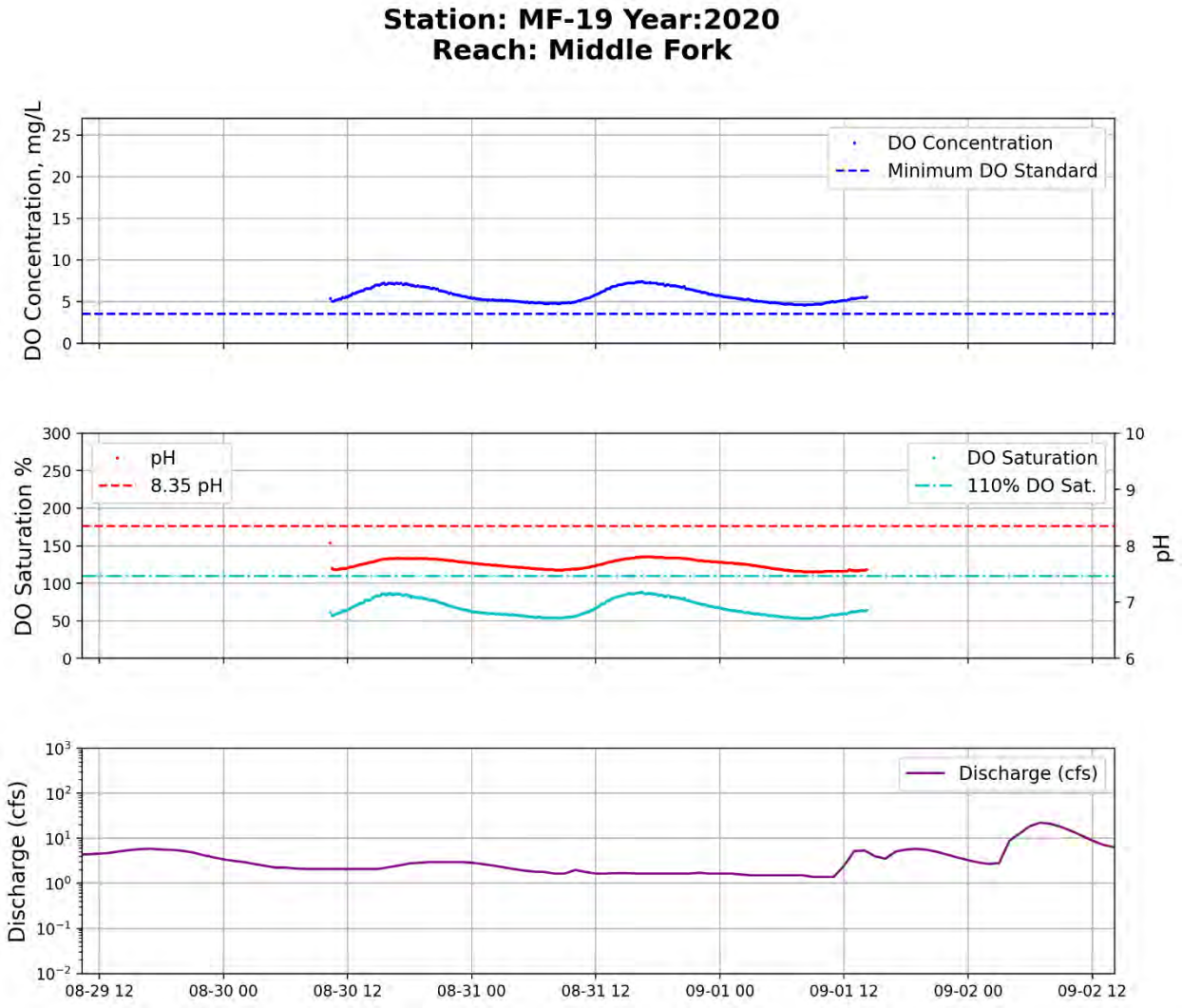


Figure D-13: Continuous Timeseries data for Station MF-19 in Middle Fork

2022

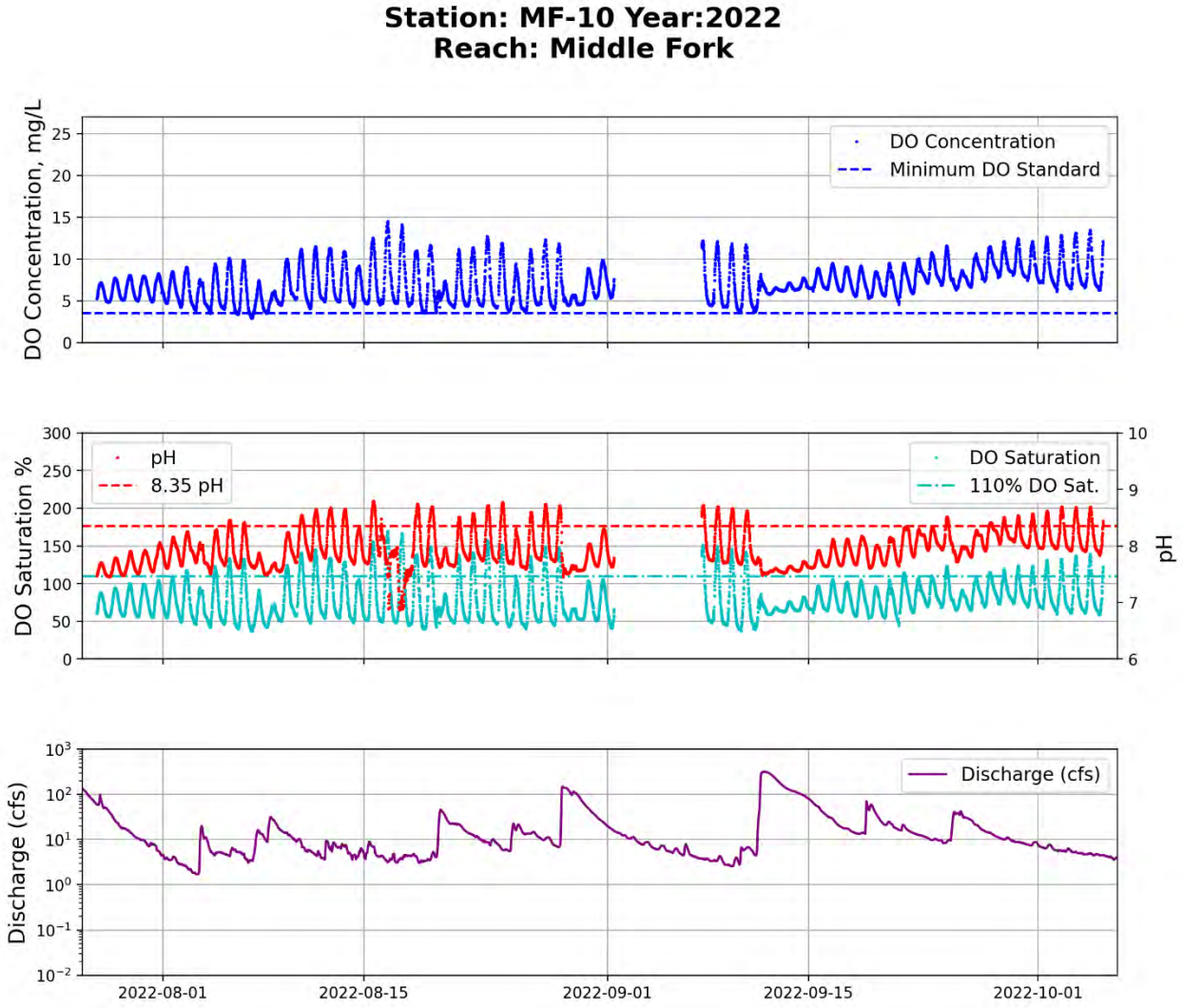


Figure D-14: Continuous Timeseries data for Station MF-10 in Middle Fork

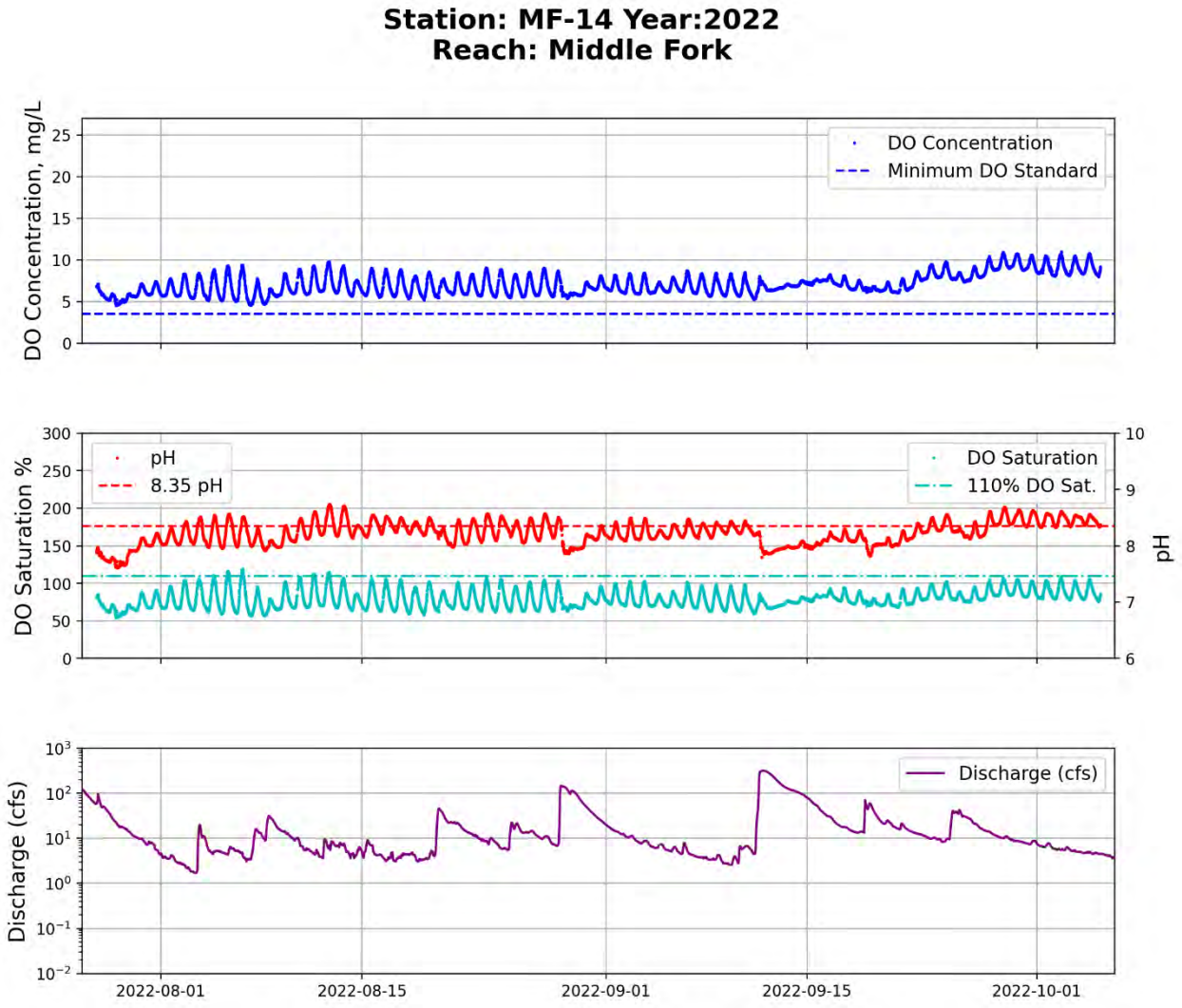


Figure D-15: Continuous Timeseries data for Station MF-14 in Middle Fork

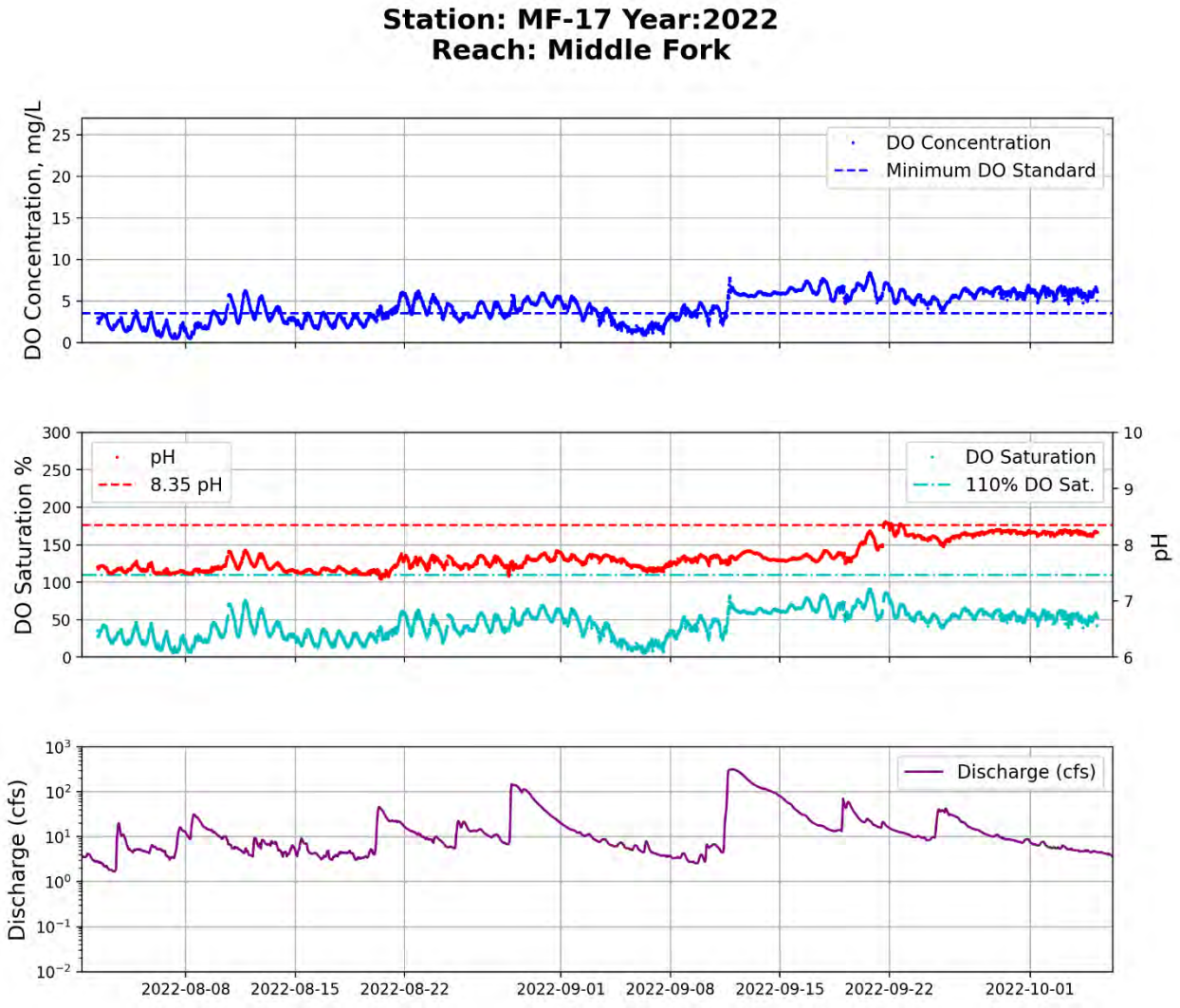


Figure D-16: Continuous Timeseries data for Station MF-17 in Middle Fork

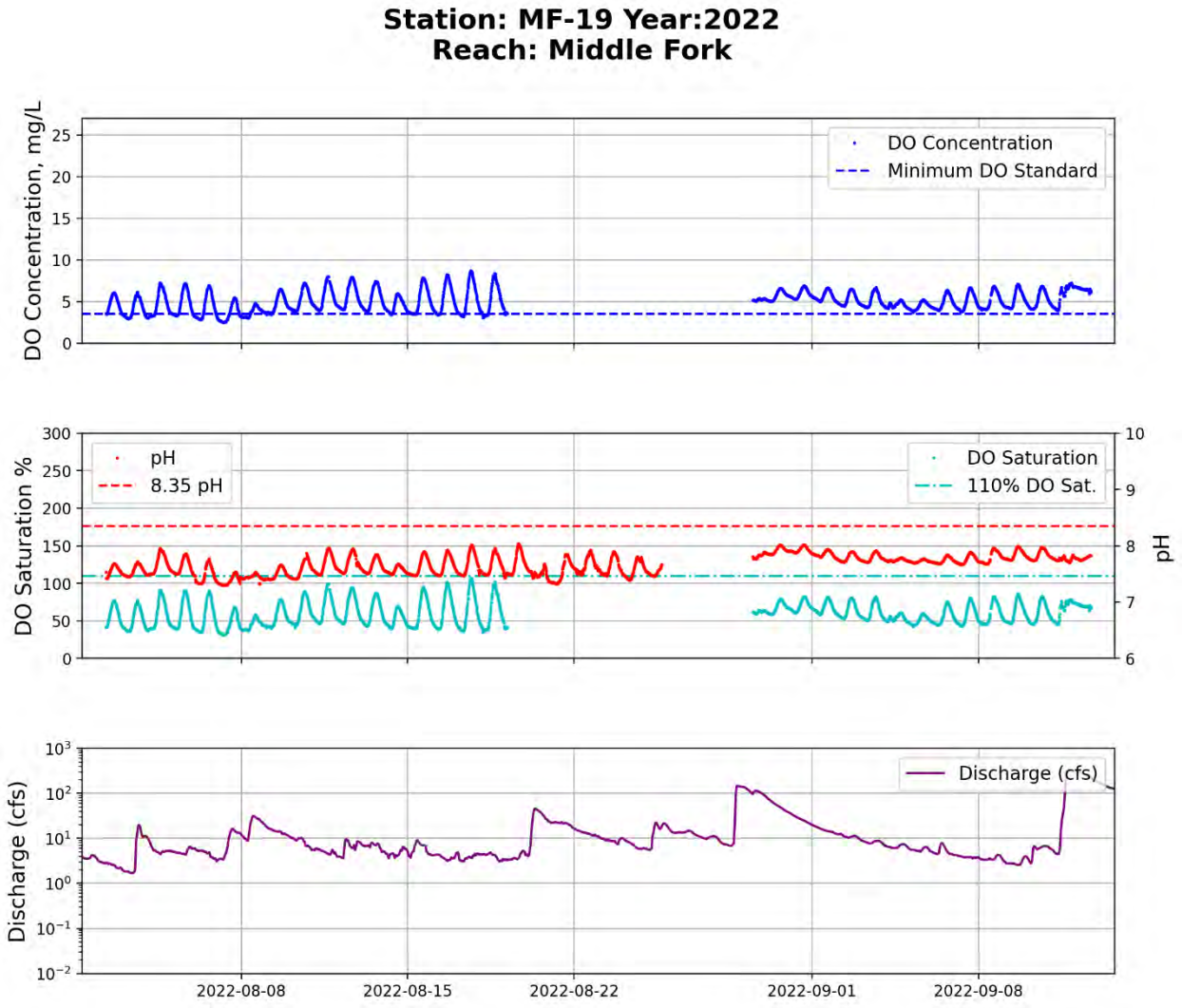


Figure D-17: Continuous Timeseries data for Station MF-19 in Middle Fork

Skokie River

2018

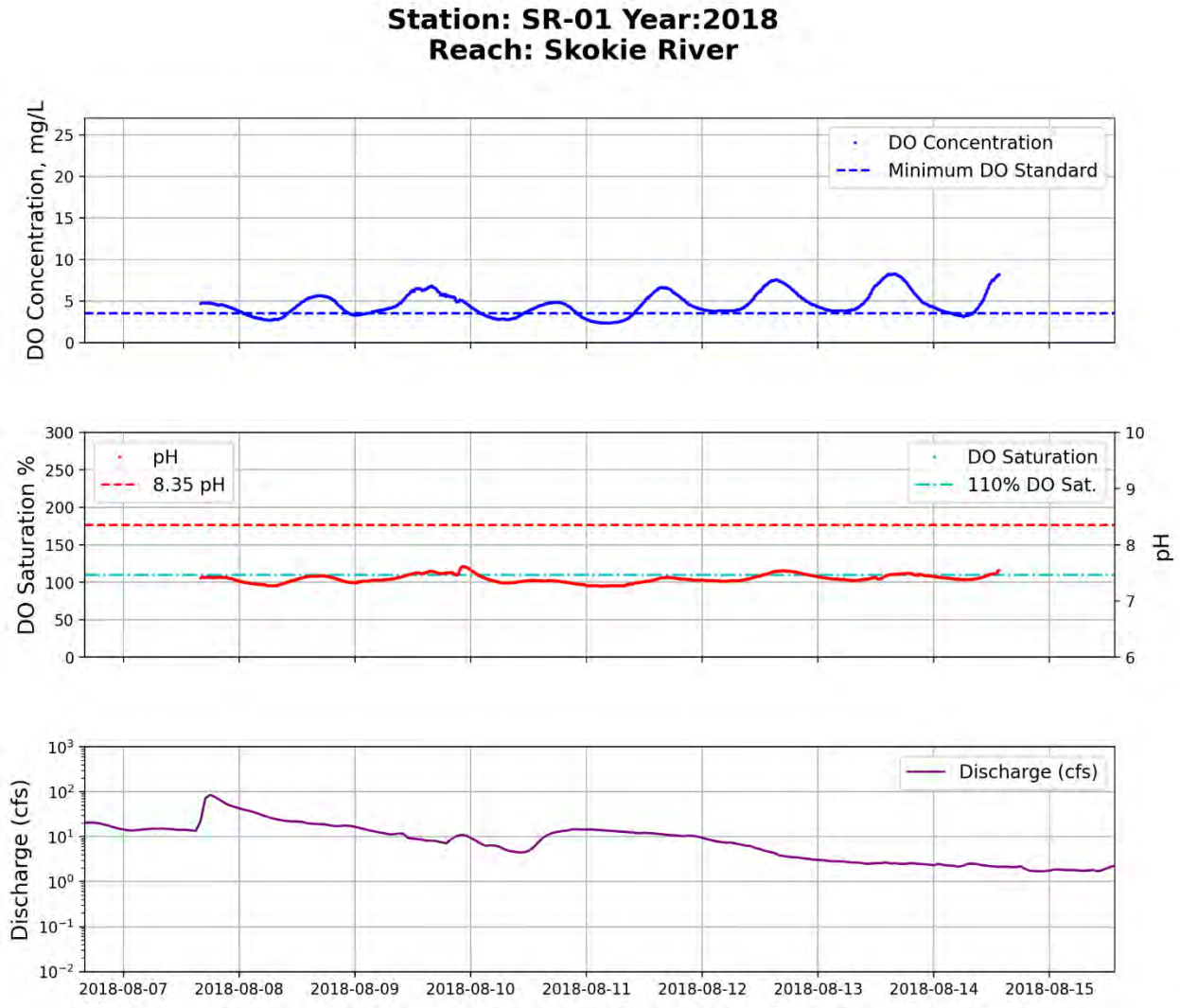


Figure D-18: Continuous Timeseries data for Station SR-01 in Skokie River

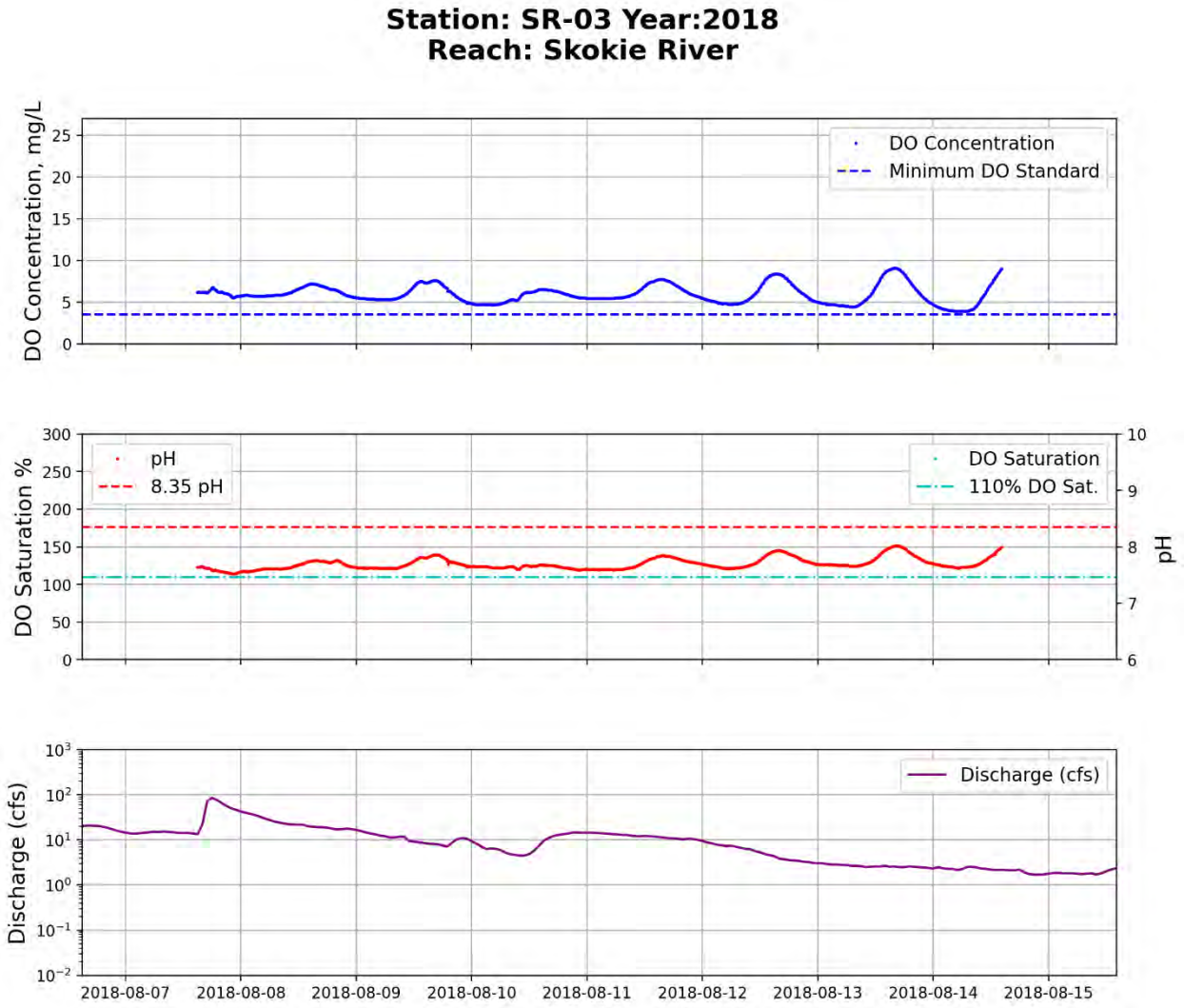


Figure D-19: Continuous Timeseries data for Station SR-03 in Skokie River

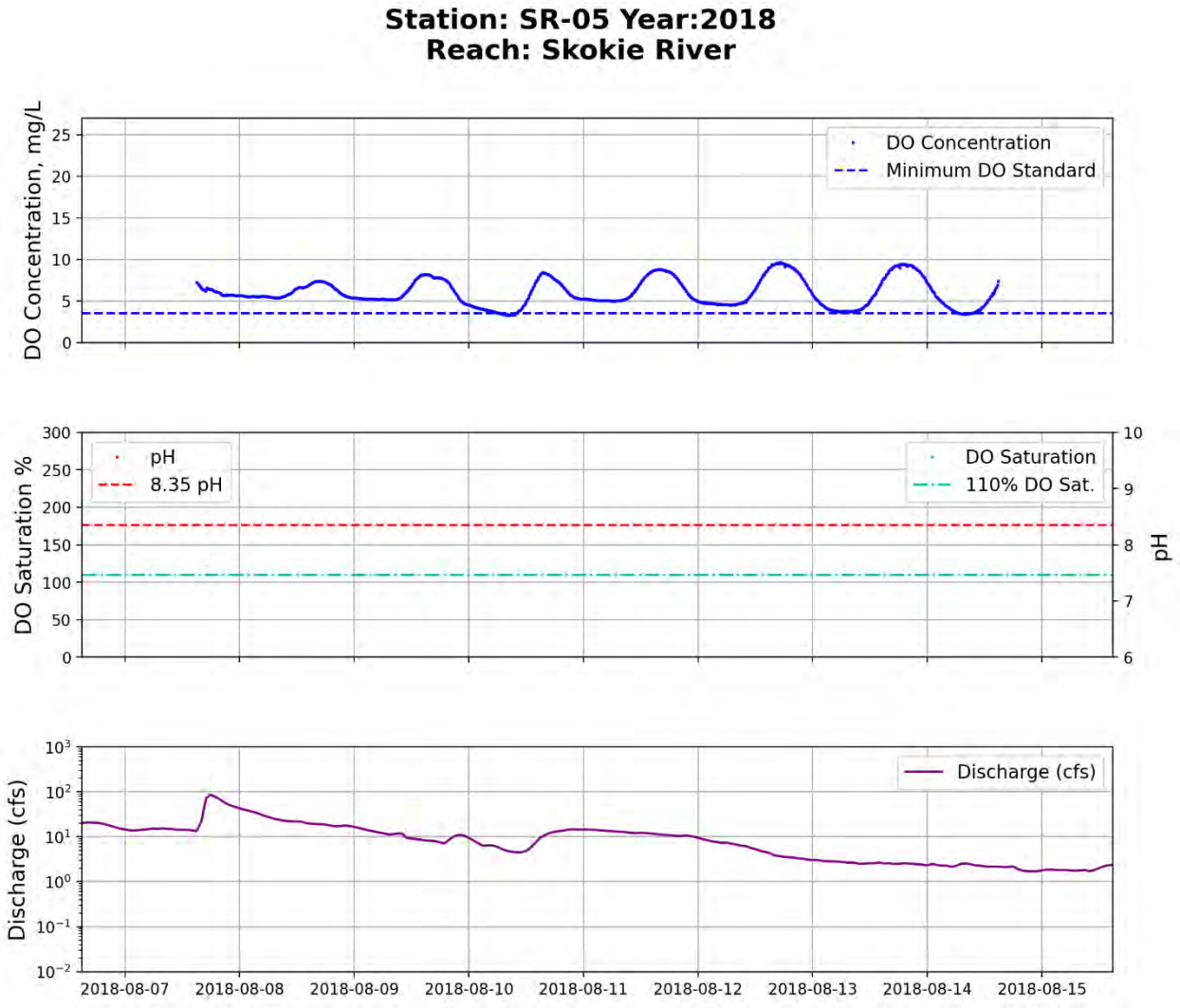


Figure D-20: Continuous Timeseries data for Station SR-05 in Skokie River

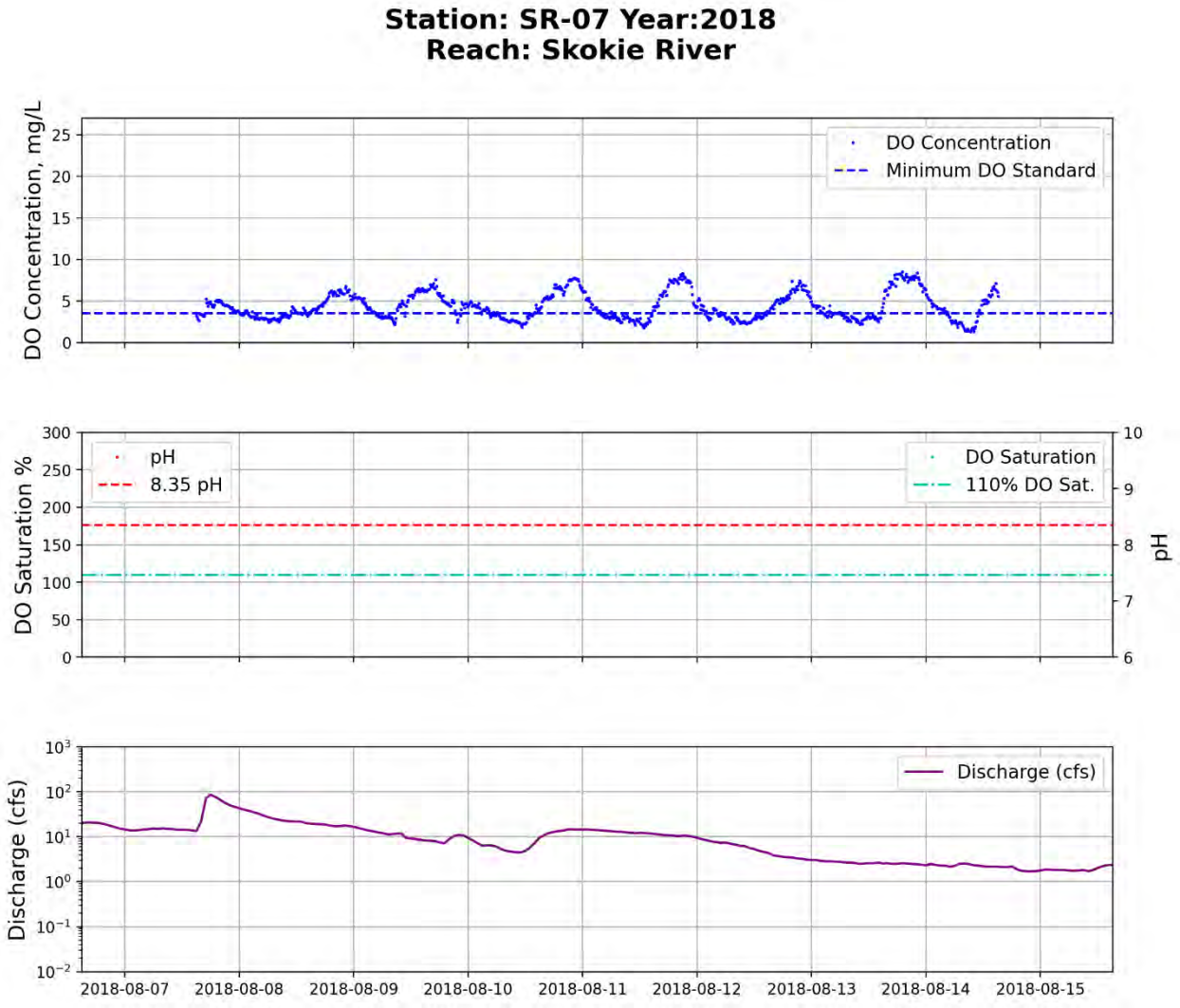


Figure D-21: Continuous Timeseries data for Station SR-07 in Skokie River

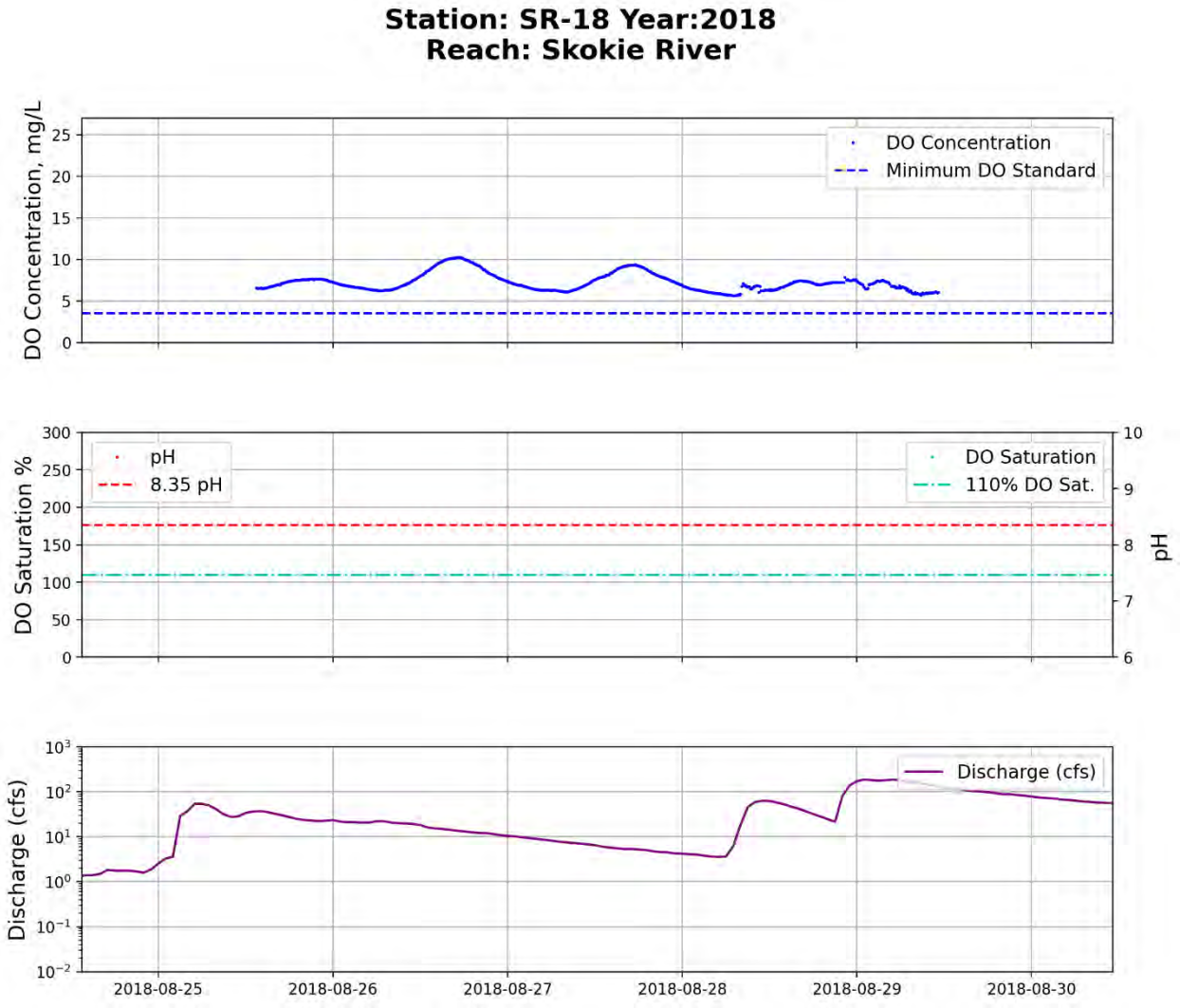


Figure D-23: Continuous Timeseries data for Station SR-18 in Skokie River

2020

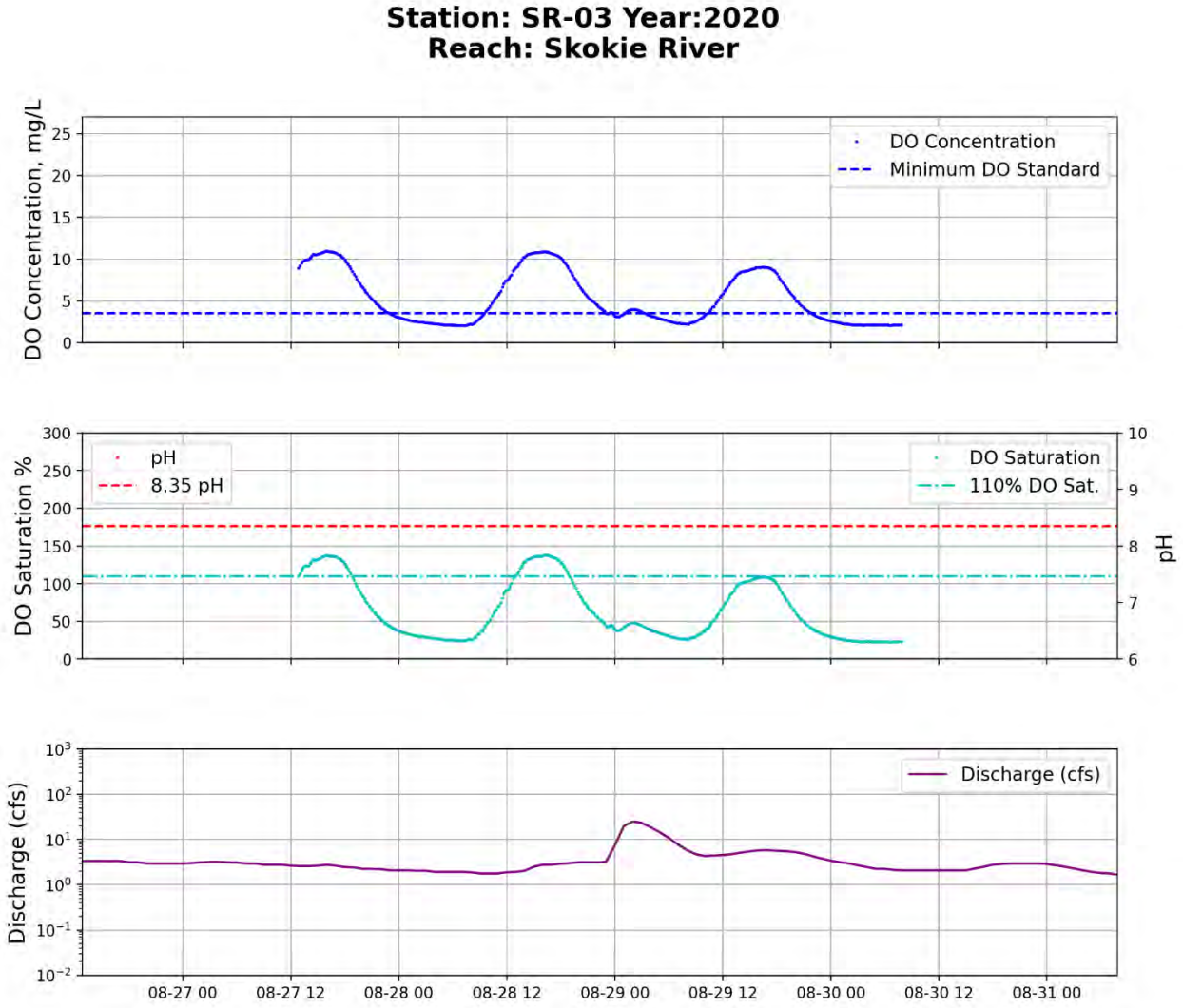


Figure D-23: Continuous Timeseries data for Station SR-03 in Skokie River

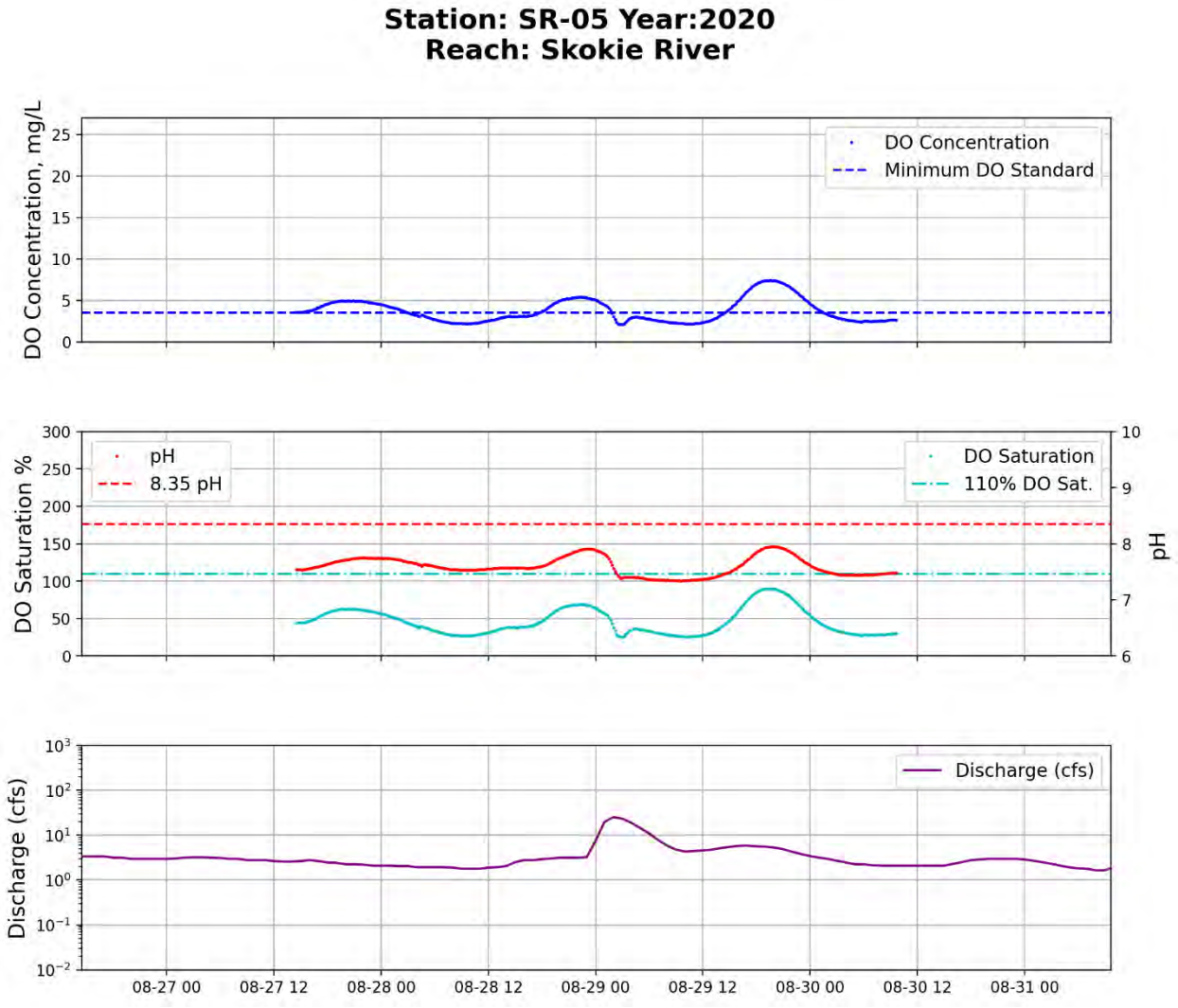


Figure D-44: Continuous Timeseries data for Station SR-05 in Skokie River

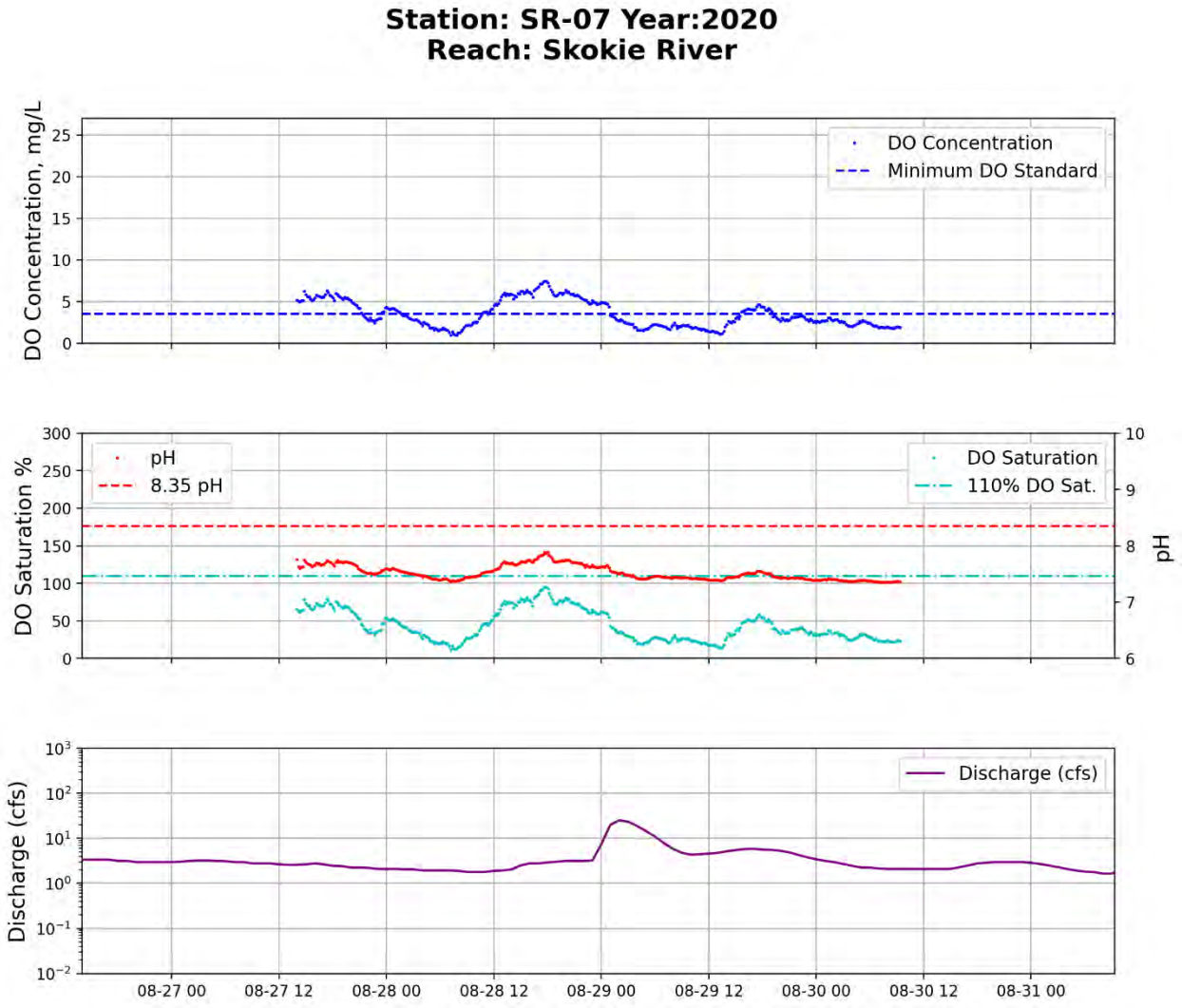


Figure D-55: Continuous Timeseries data for Station SR-07 in Skokie River

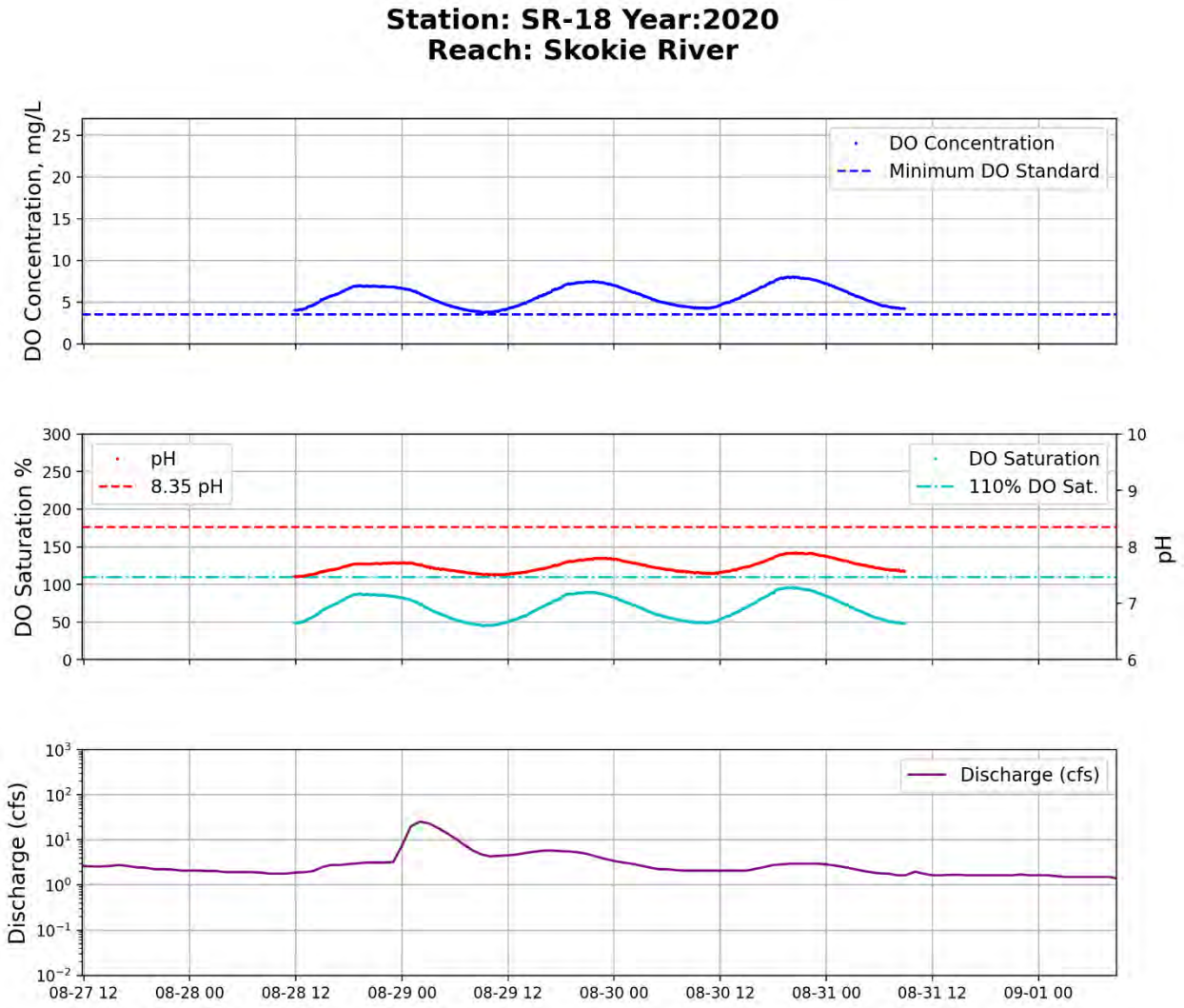


Figure D-66: Continuous Timeseries data for Station SR-18 in Skokie River

2022

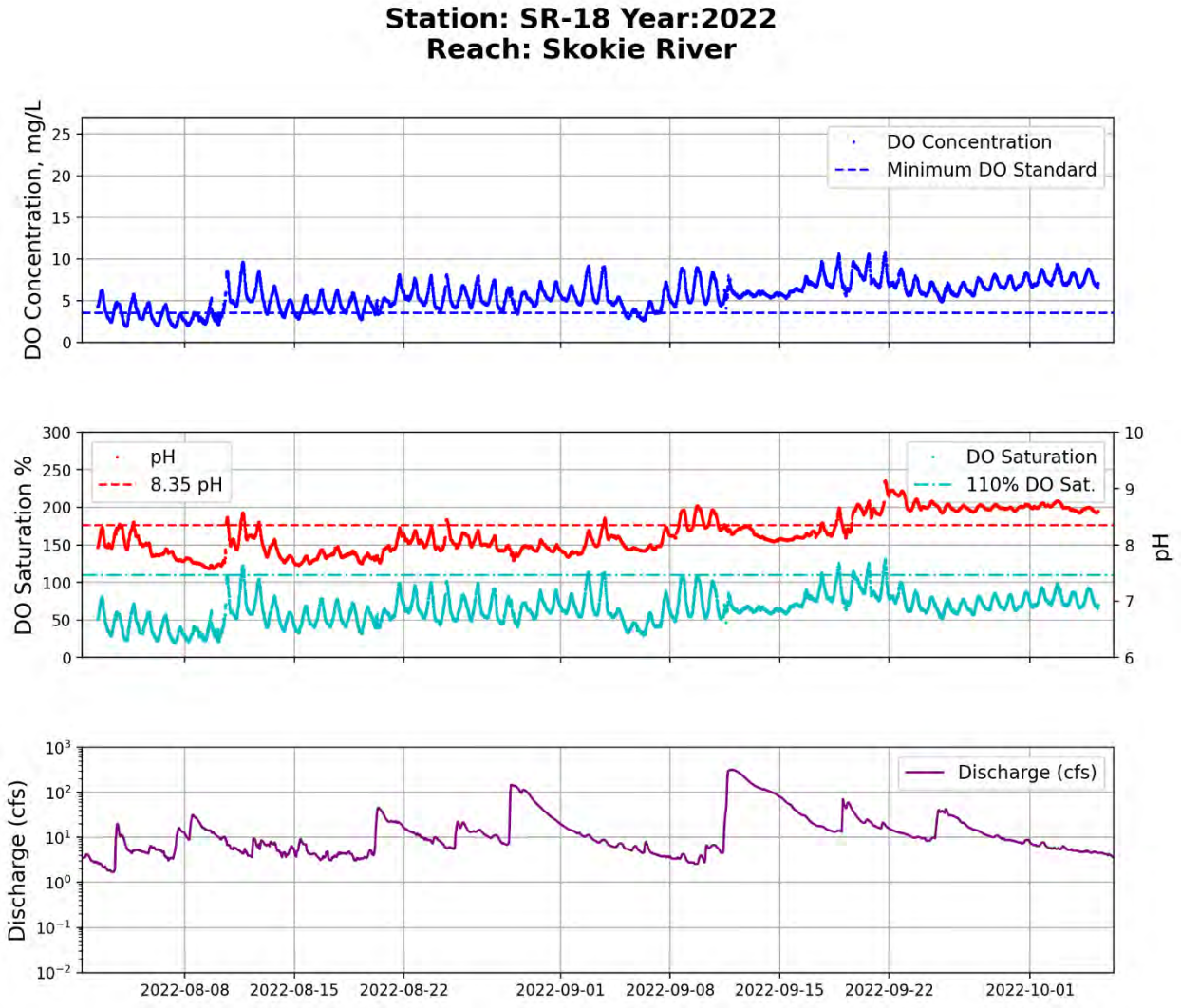


Figure D-77: Continuous Timeseries data for Station SR-18 in Skokie River

2023

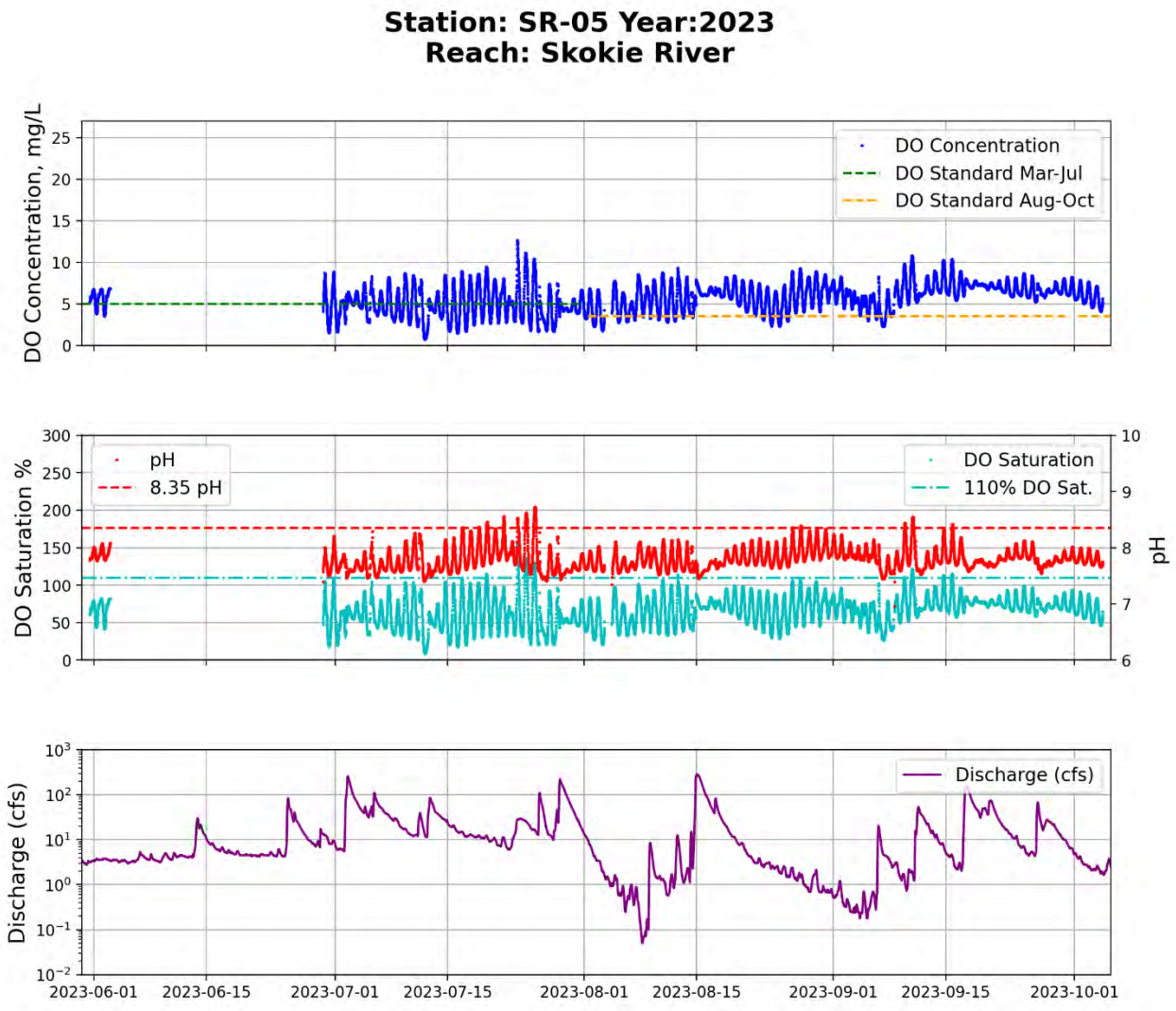


Figure D-28: Continuous Timeseries data for Station SR-05 in Skokie River

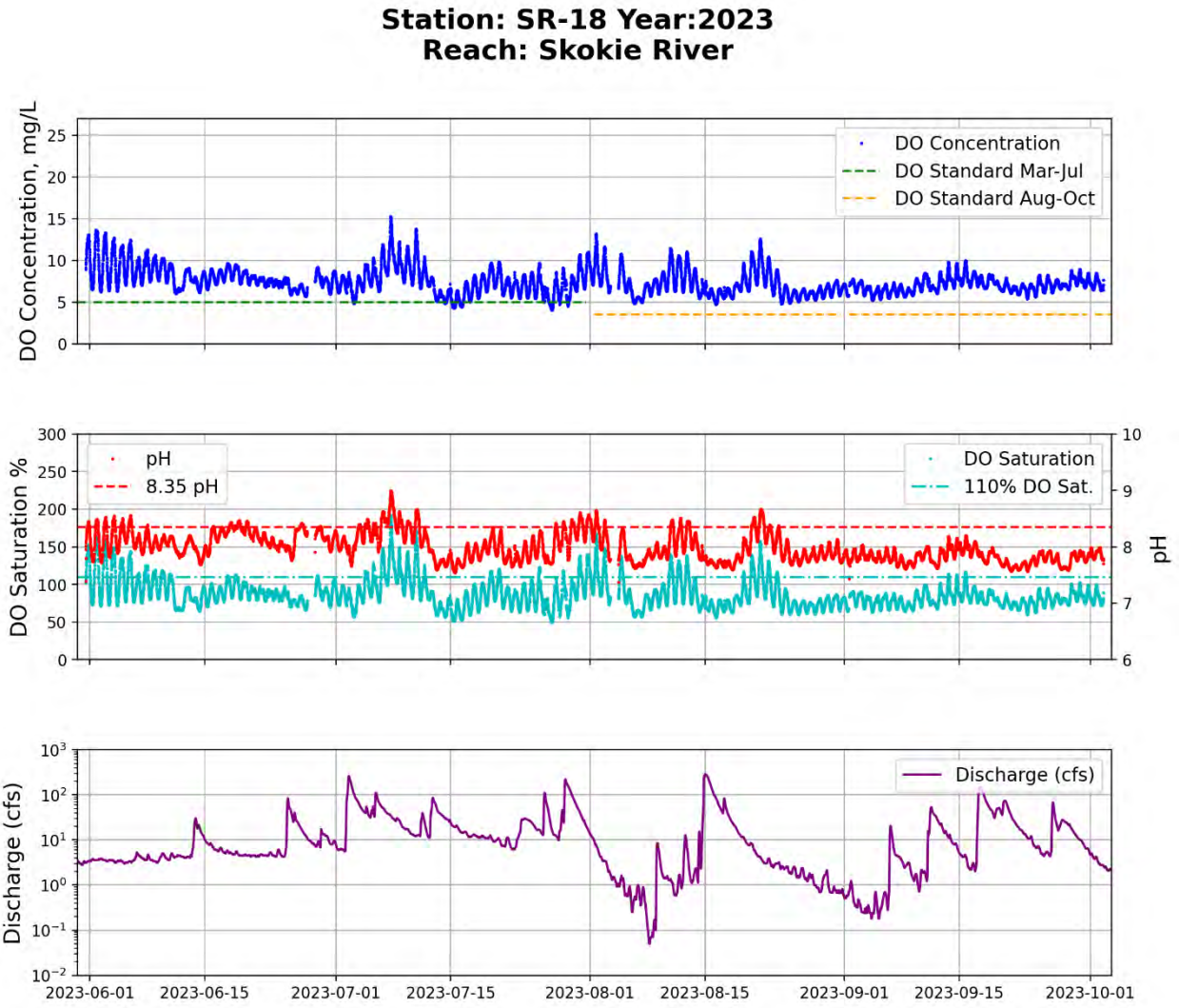


Figure D-89: Continuous Timeseries data for Station SR-18 in Skokie River

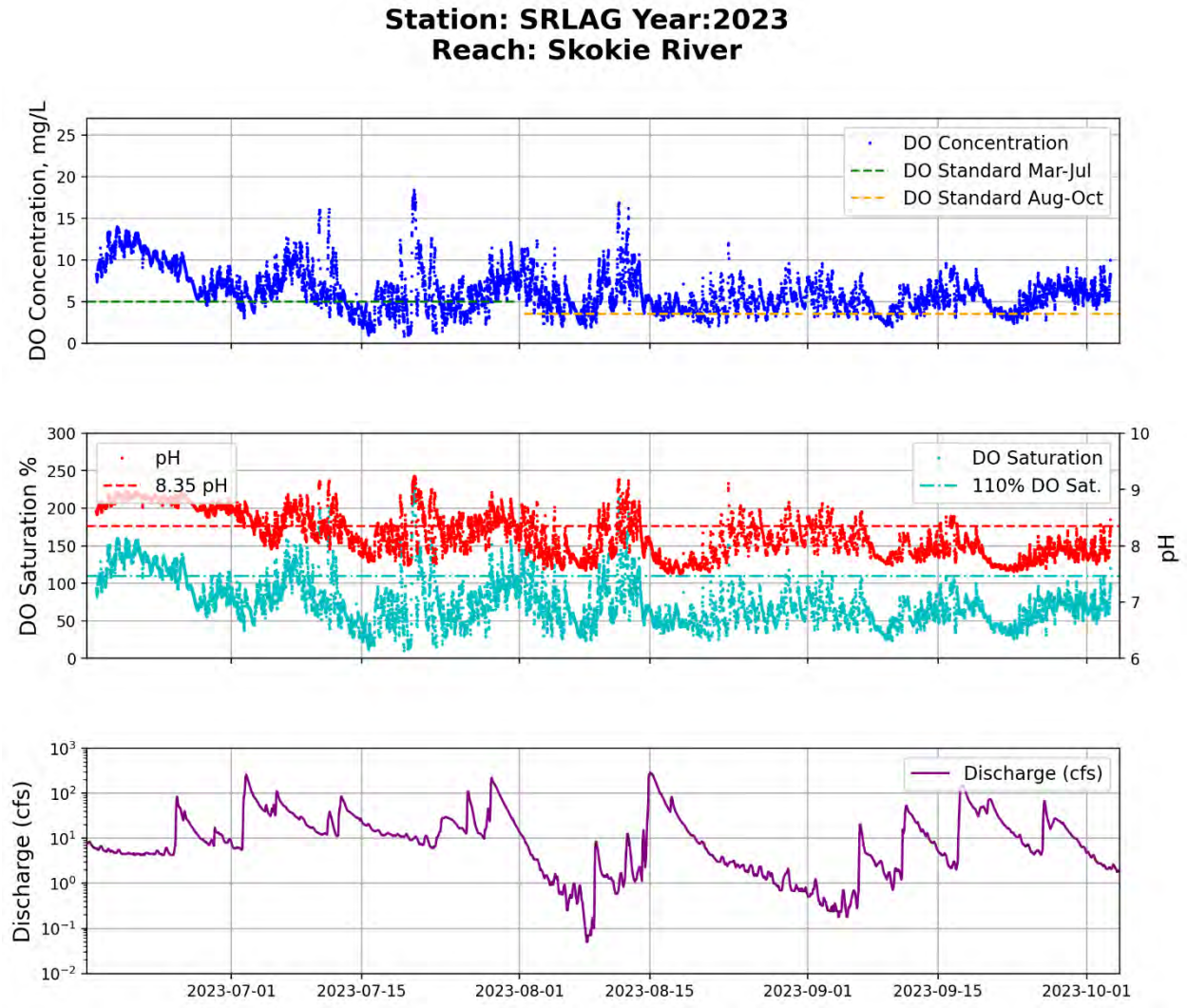
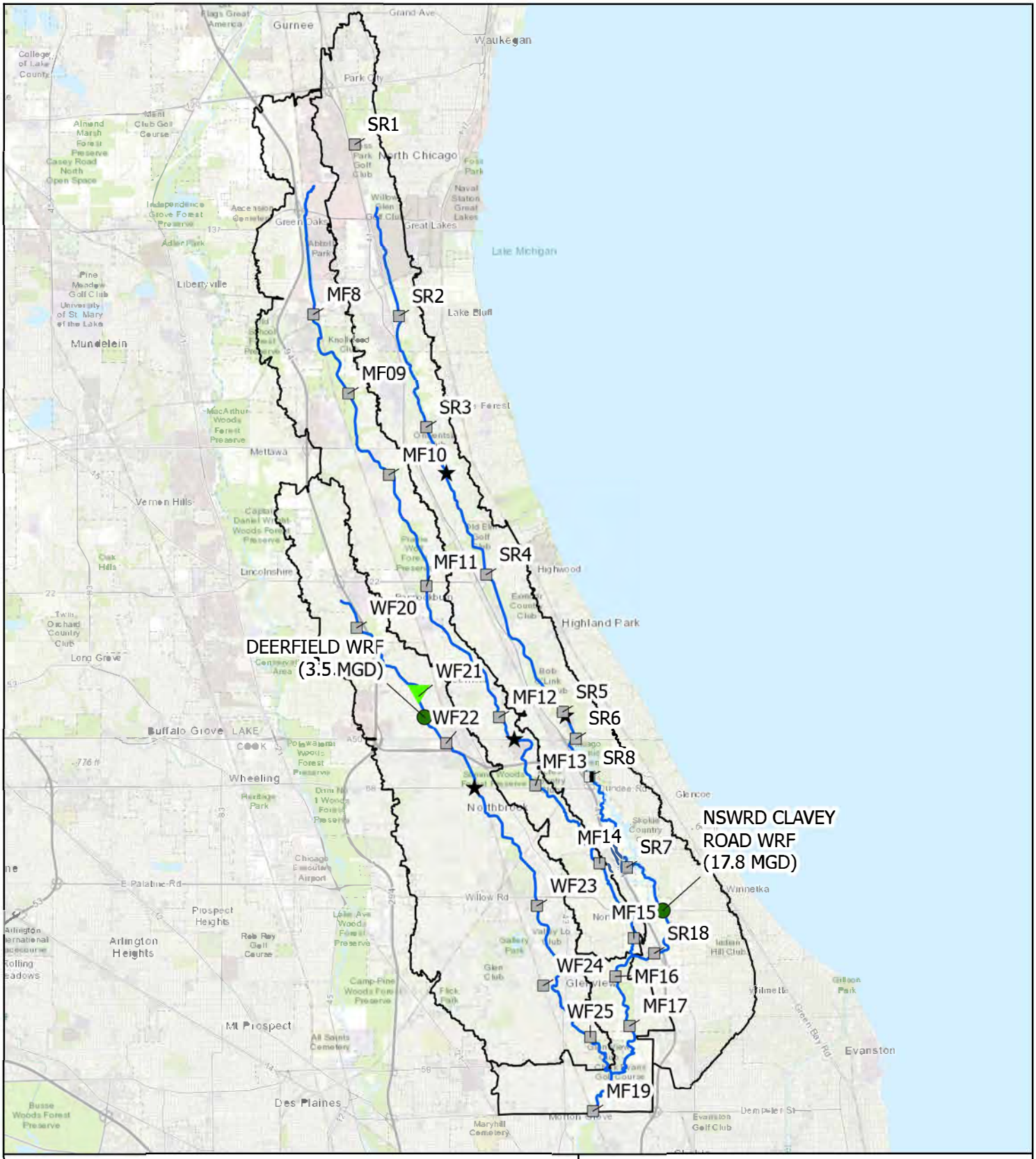


Figure D-30: Continuous Timeseries data for Station SRLAG in Skokie River

Appendix E
WATER QUALITY TREND MAP



Seasonal Kendall Trend in pH

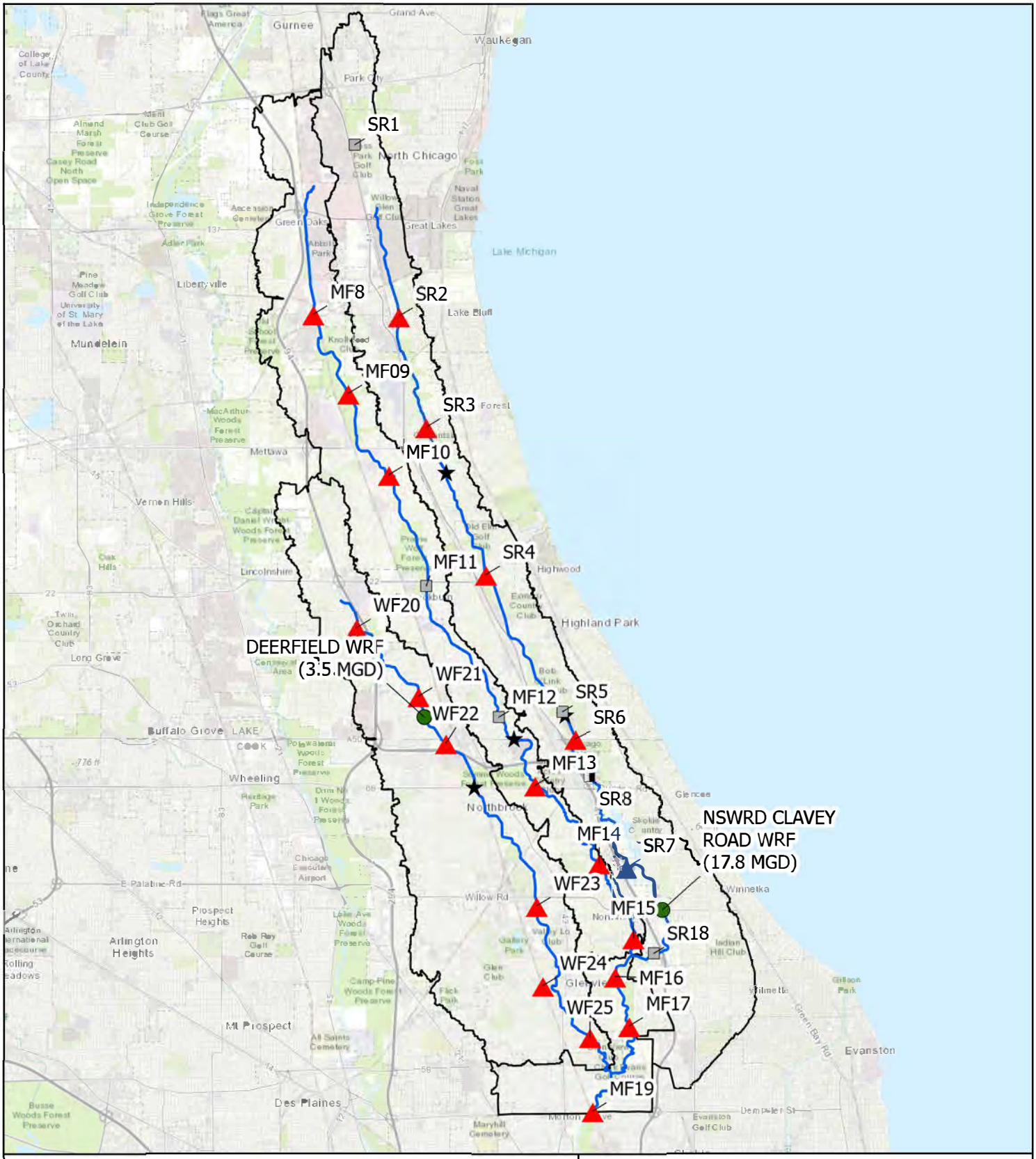
North Branch Watershed Workgroup

Geosyntec consultants

CSWR3015	August 2024

Figure E-1

P:\prj1_CSWR\CSWR3015 NBWW WQ Summary\4.0 GIS\Working\Annual Trends in pH.aprx\8.5 x 11 Portrait 8/13/2024 3:56 PM (avandermus)



Legend

- North Branch Watersheds
- Stream
- USGS Stations
- WWTP

Conductivity - Trend

- Increasing
- Decreasing
- No Trend
- Not Analyzed

N

0 15,000 Feet

Seasonal Kendall Trend in Conductivity

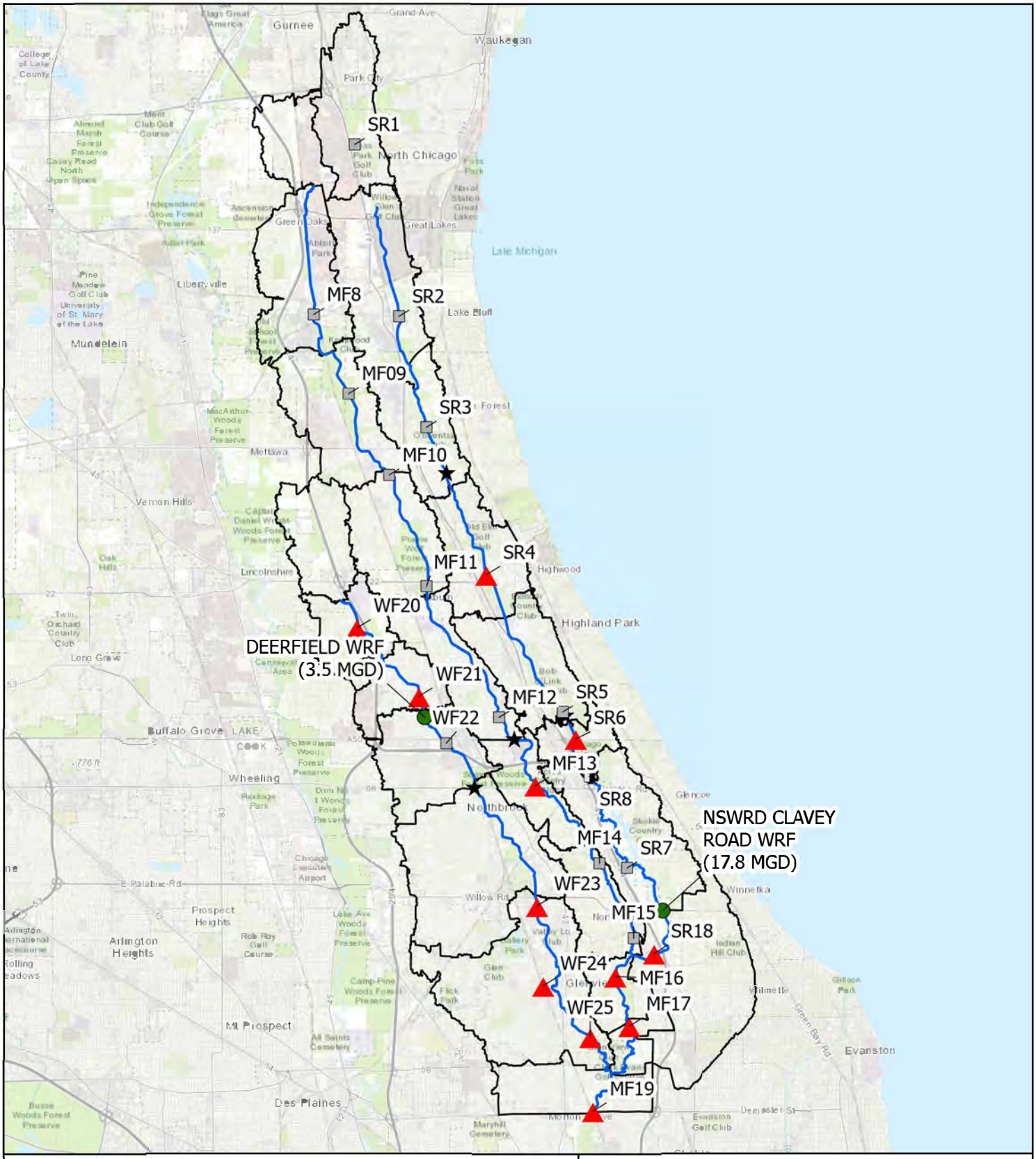
North Branch Watershed Workgroup

Geosyntec consultants

CSWR3015	August 2024

Figure E-2

P:\prj1_CSWR\CSWR3015 NBWW WQ Summary\4.0 GIS\Working\Annual Trends in Conductivity.aprx\8.5 x 11 Portrait 6/25/2024 12:27 PM (avandermus)



Legend

- North Branch Watersheds
- Stream
- USGS Stations
- WWTP

Chloride - Trend

- Increasing
- Decreasing
- No Trend
- Not Analyzed

N

0 15,000 Feet

Seasonal Kendall Trend in Chloride

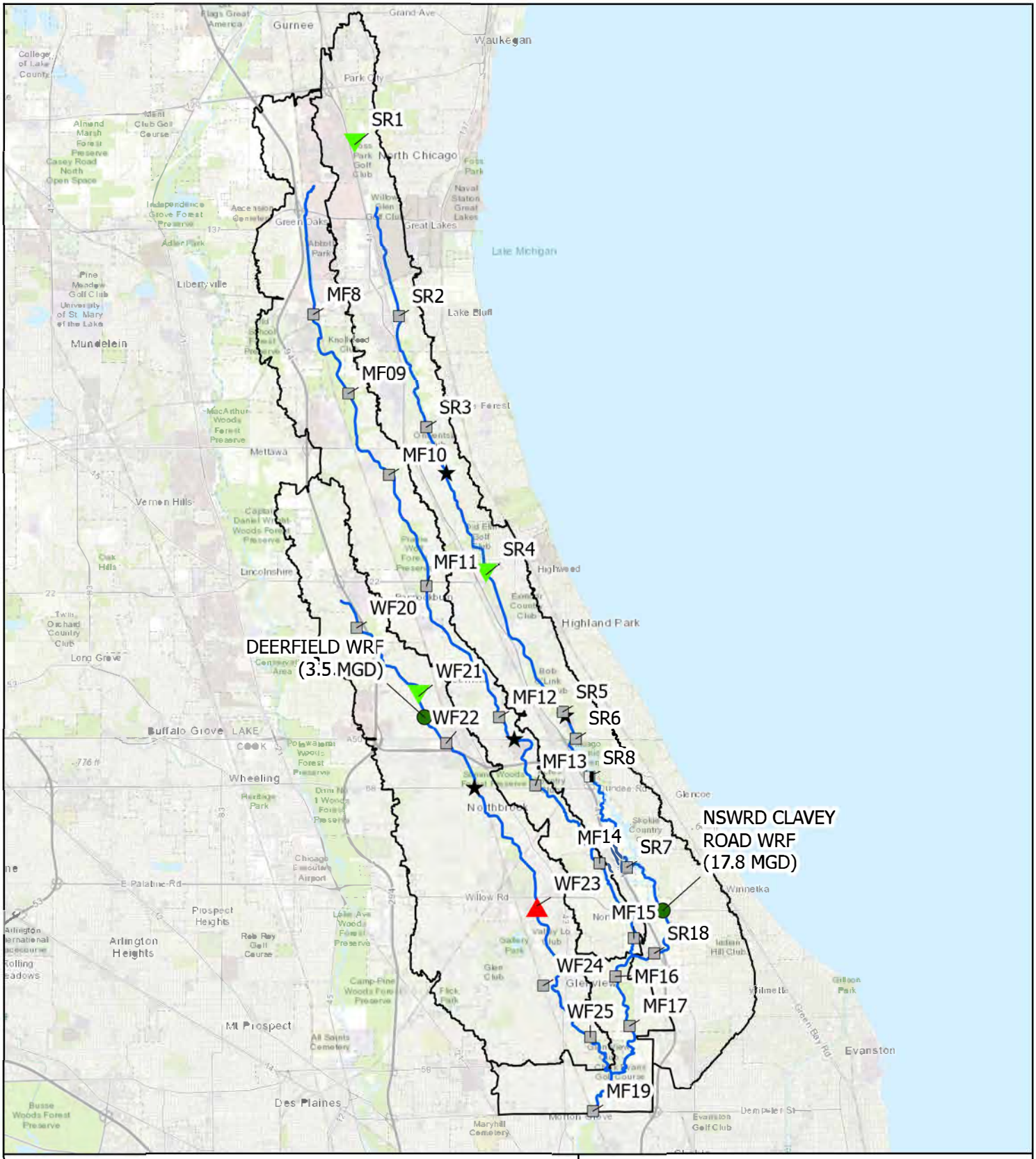
North Branch Watershed Workgroup

Geosyntec consultants

CSWR3015	August 2024

Figure E-3

P:\prj1_CSWR\CSWR3015 NBWW WQ Summary\4.0 GIS\Working\Annual Trends in Chloride.aprx\8.5 x 11 Portrait 8/13/2024 3:21 PM (avandermus)



Legend

- North Branch Watersheds
- Stream
- USGS Stations
- WWTP

TSS - Trend

- Increasing
- Decreasing
- No Trend
- Not Analyzed

N

0 15,000 Feet

Seasonal Kendall Trend in Total Suspended Solids

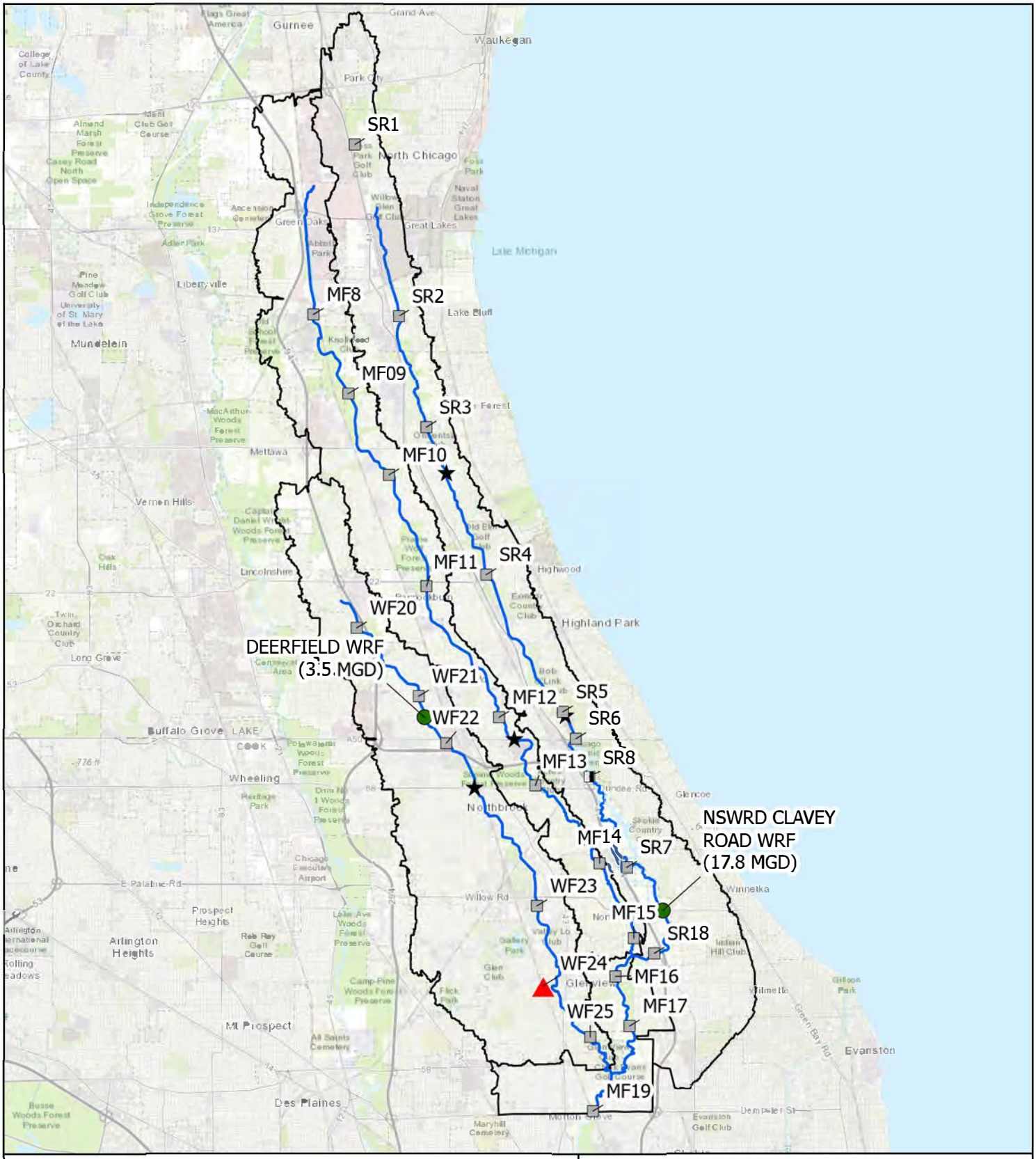
North Branch Watershed Workgroup

Geosyntec consultants

CSWR3015	August 2024

Figure E-4

P:\prj1_CSWR\CSWR3015 NBWW WQ Summary\4.0 GIS\Working\Annual Trends in Total Suspended Solids.aprx\8.5 x 11 Portrait 6/25/2024 2:44 PM (avandermus)



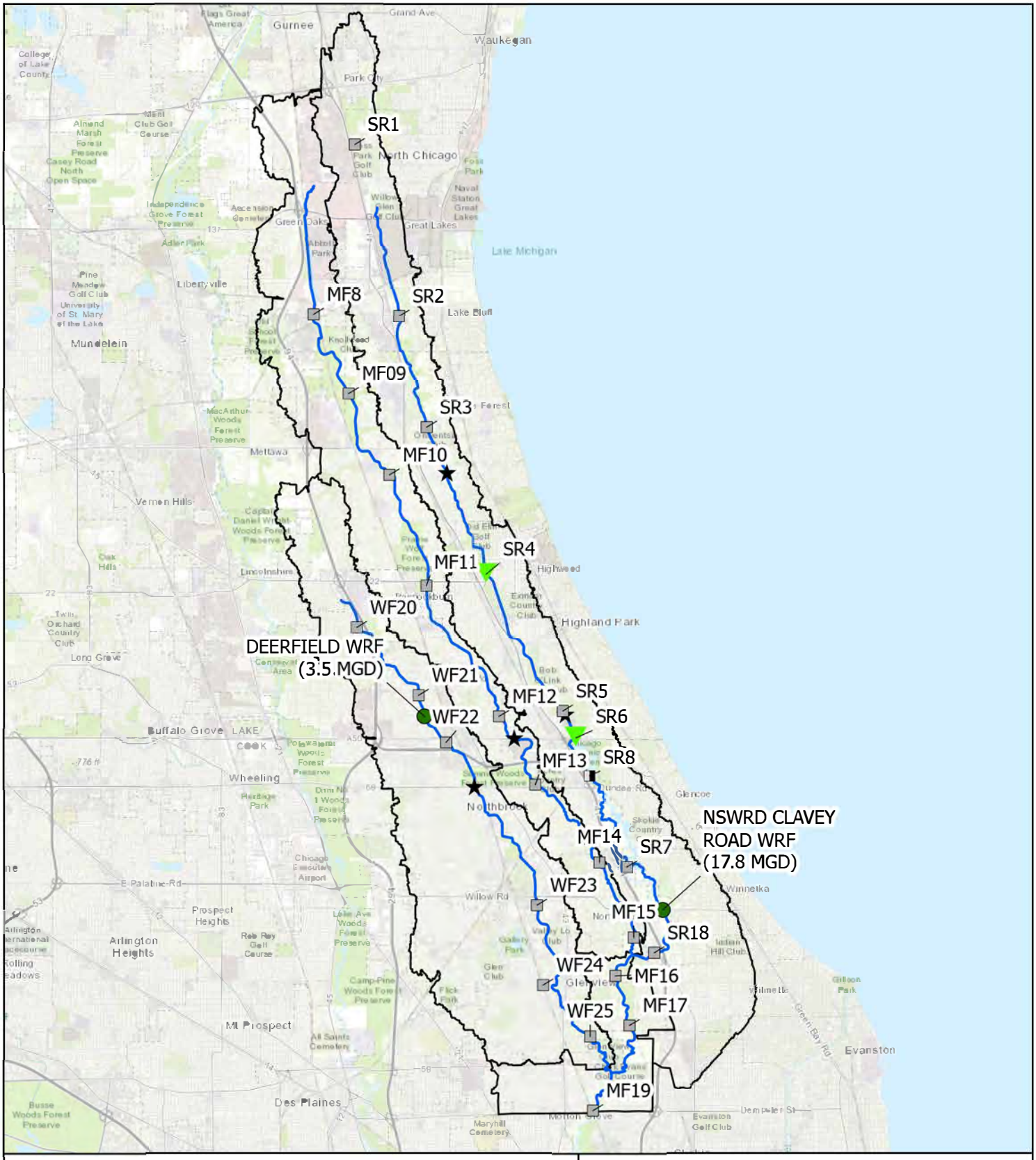
Seasonal Kendall Trend in Ammonia

North Branch Watershed Workgroup

Geosyntec consultants

CSWR3015	August 2024	**Figure E-5**

P:\prj1_CSWR\CSWR3015 NBWW WQ Summary\4.0 GIS\Working\Annual Trends in Ammonia.aprx\8.5 x 11 Portrait 6/25/2024 11:21 AM (avandermus)



Legend

- North Branch Watersheds
- Stream
- USGS Stations
- WWTP

Nitrate/Nitrite - Trend

- Increasing
- Decreasing
- No Trend
- Not Analyzed

N

0 15,000 Feet

Seasonal Kendall Trend in Total Nitrates

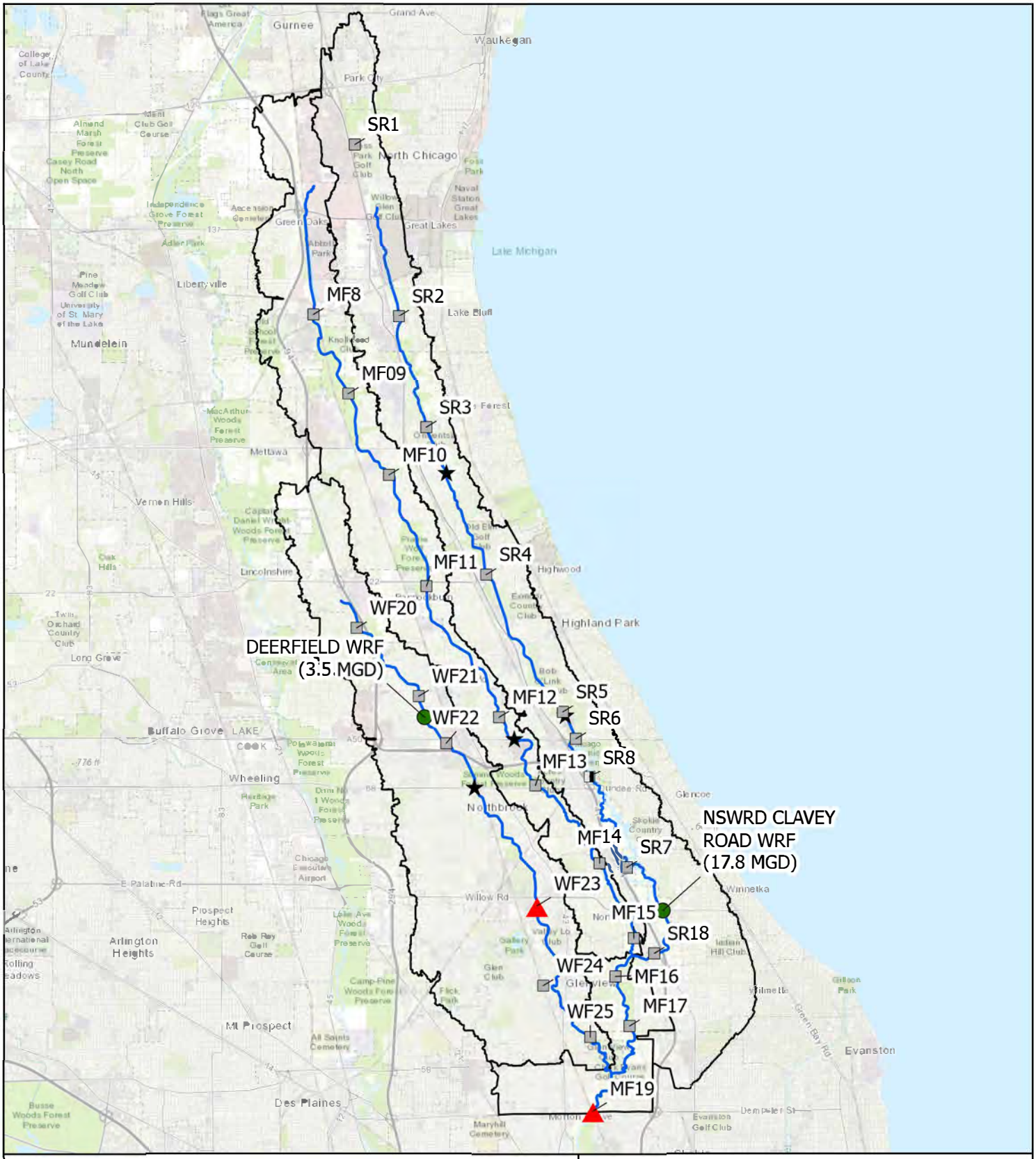
North Branch Watershed Workgroup

Geosyntec consultants

CSWR3015	August 2024

Figure E-6

P:\prj1_CSWR\CSWR3015 NBWW WQ Summary\4.0 GIS\Working\Annual Trends in Total Nitrates.aprx\8.5 x 11 Portrait 8/13/2024 4:13 PM (avandermus)



Annual Trends in TKN

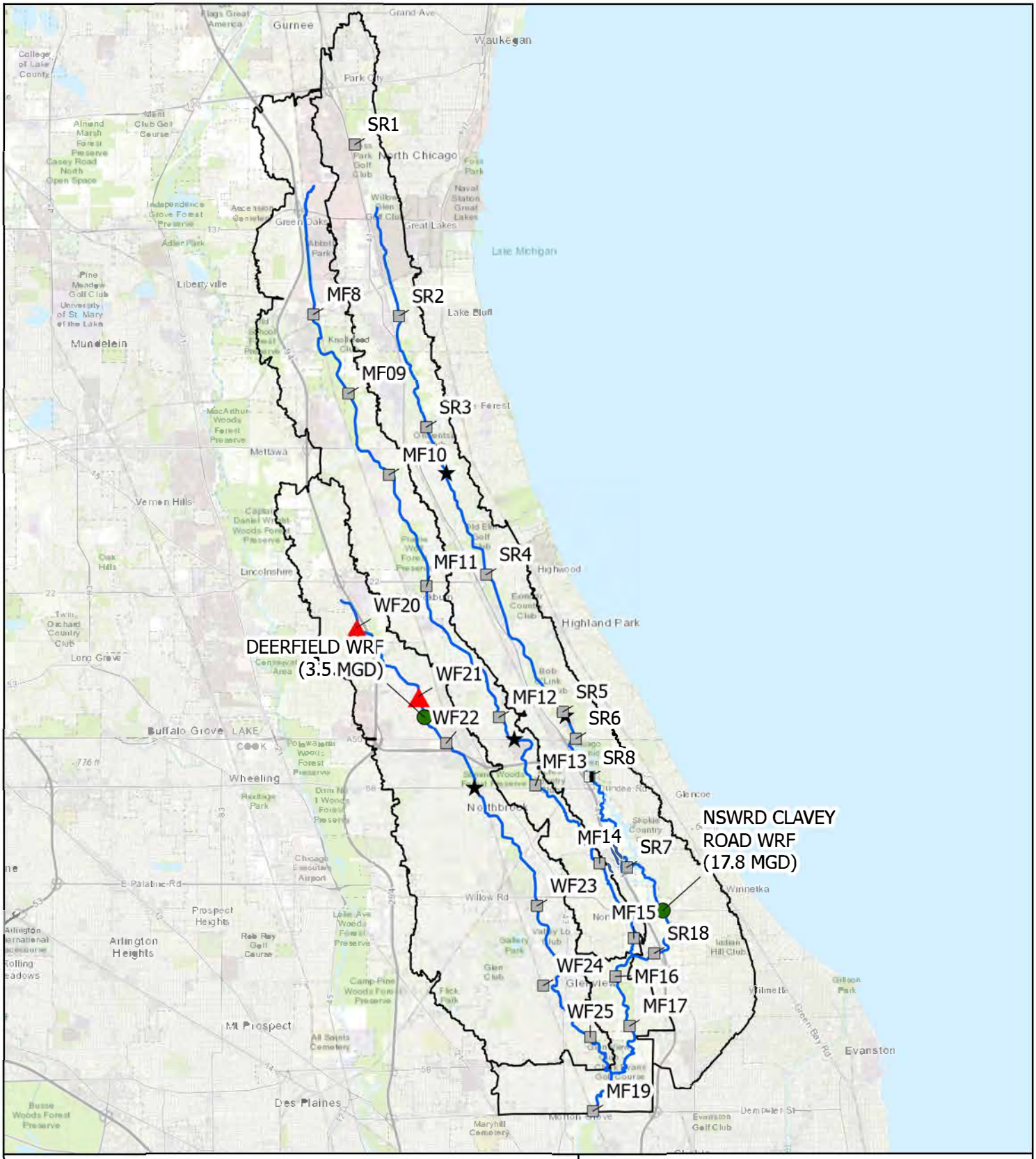
North Branch Watershed Workgroup

Geosyntec consultants

CSWR3015	August 2024

Figure E-7

P:\prj1_CSWR\CSWR3015 NBWW WQ Summary\4.0 GIS\Working\Annual Trends in TKN.aprx\8.5 x 11 Portrait 8/13/2024 4:07 PM (avandermus)



Legend

- North Branch Watersheds
- Stream
- USGS Stations
- WWTP

Total Phosphorus - Trend

- Increasing
- Decreasing
- No Trend
- Not Analyzed

N

0 15,000 Feet

Seasonal Kendall Trend in Total Phosphorous

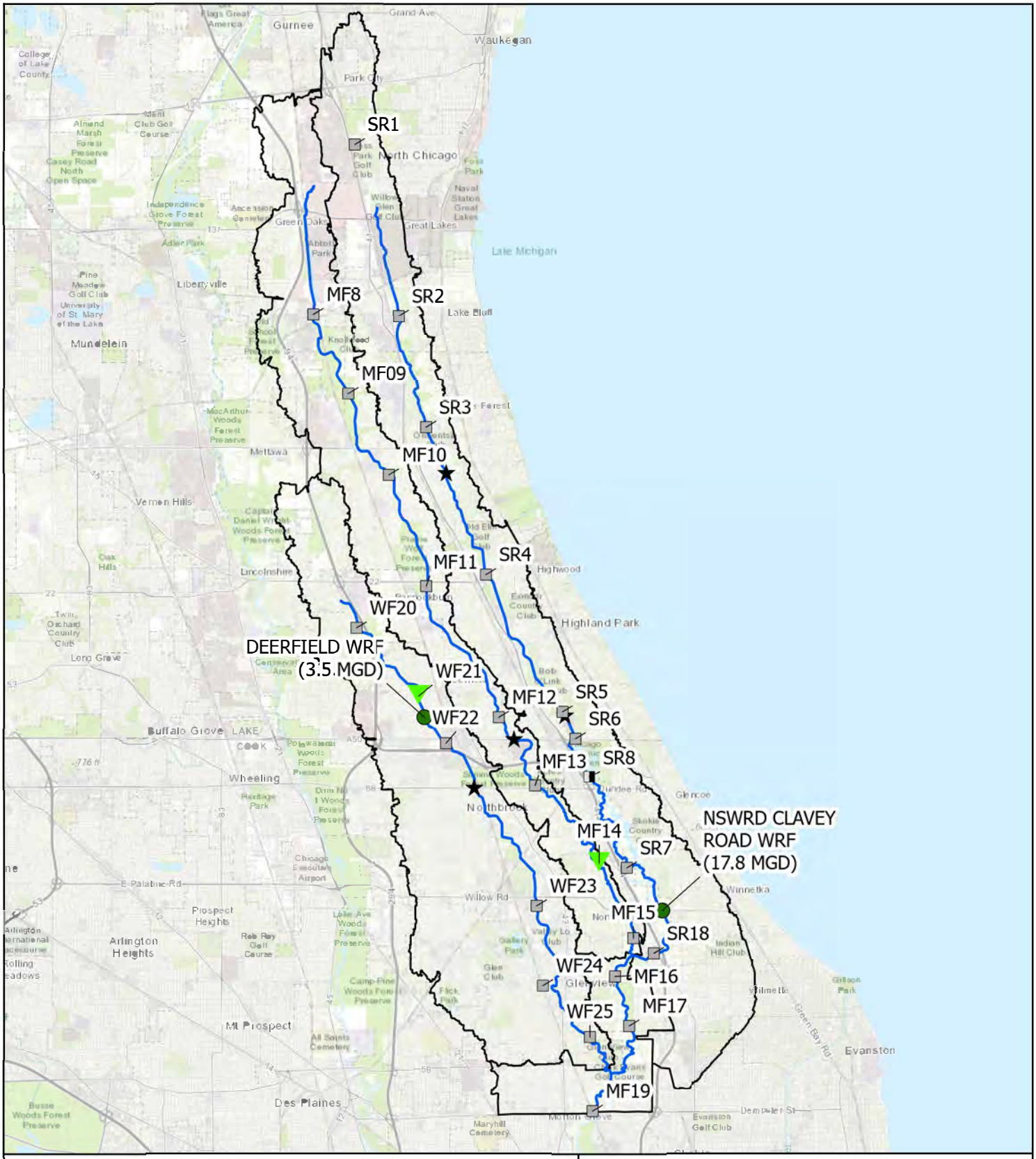
North Branch Watershed Workgroup

Geosyntec consultants

CSWR3015	August 2024

Figure E-8

P:\prj1_CSWR\CSWR3015 NBWW WQ Summary\4.0 GIS\Working\Annual Trends in Total Phosphorous.aprx\8.5 x 11 Portrait 8/13/2024 4:17 PM (avandermus)



Legend

- North Branch Watersheds
- Stream
- USGS Stations
- WWTP

Chlorophyll-a - Trend

- Increasing
- Decreasing
- No Trend
- Not Analyzed

N

0 15,000 Feet

Seasonal Kendall Trend in Chlorophyll a

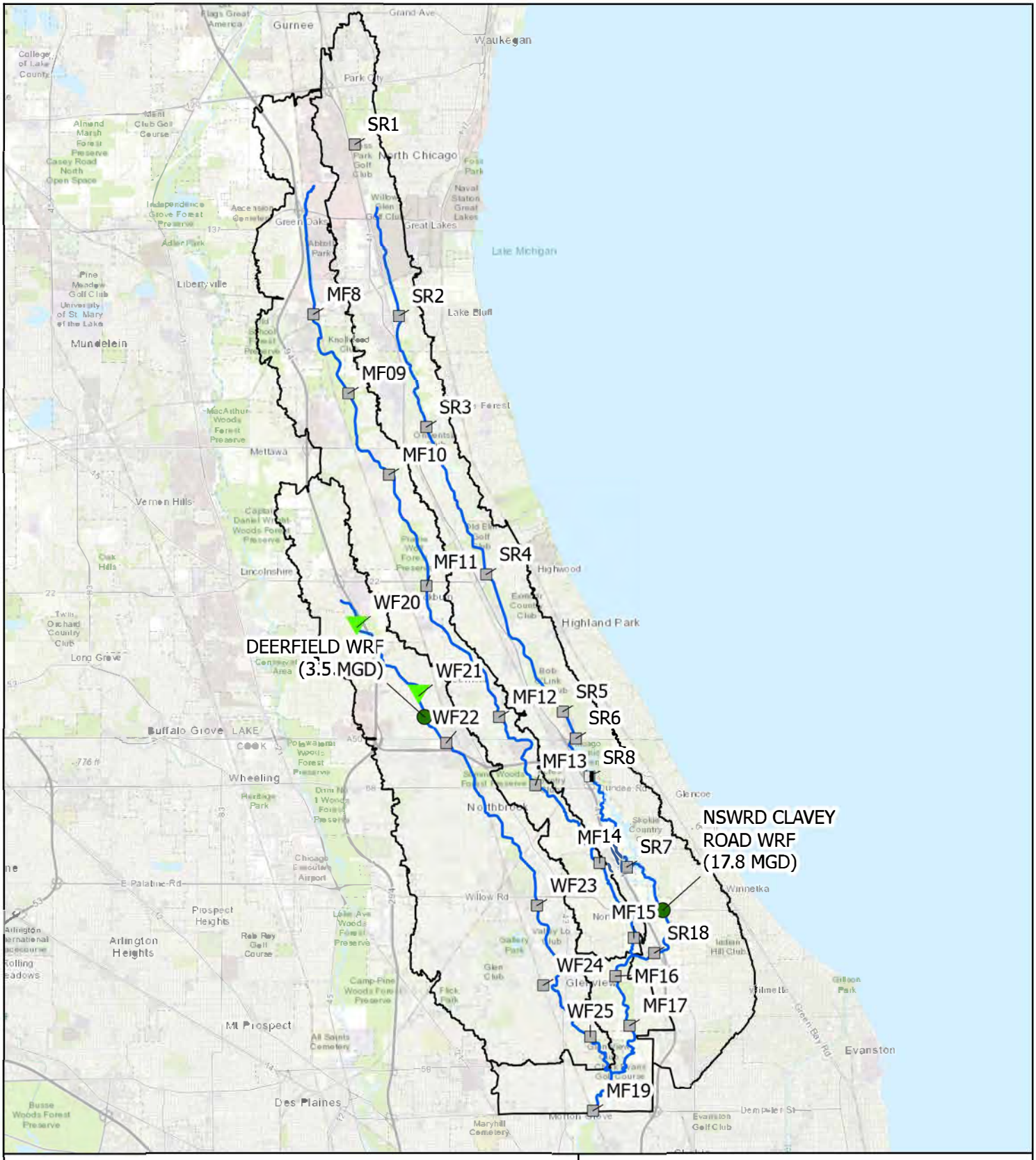
North Branch Watershed Workgroup

Geosyntec consultants

CSWR3015	August 2024

Figure E-9

P:\prj1_CSWR\CSWR3015 NBWW WQ Summary\4.0 GIS\Working\Annual Trends in Chlorophylla.aprx\8.5 x 11 Portrait 8/13/2024 3:34 PM (avandermus)



Seasonal Kendall Trend in DO

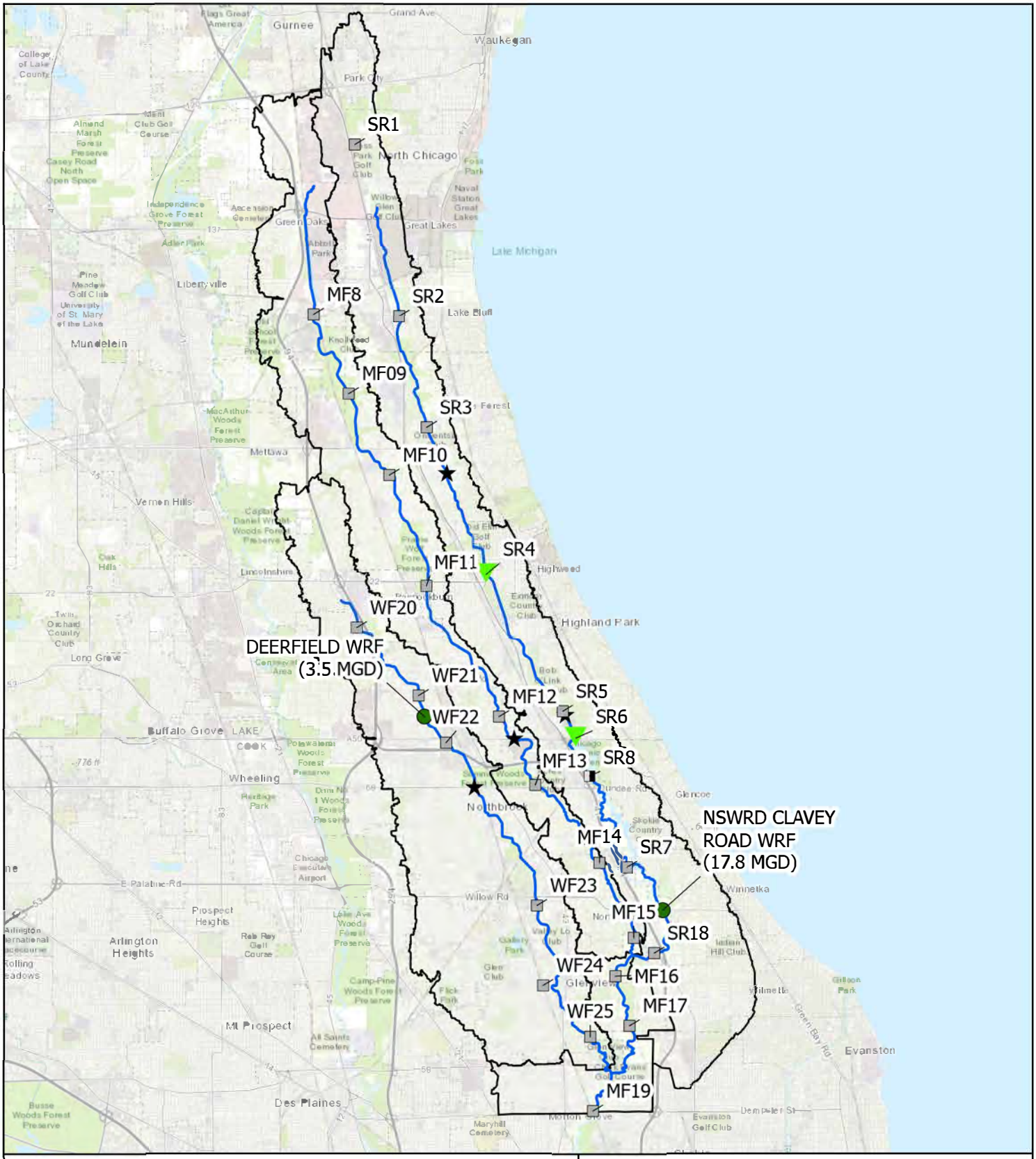
North Branch Watershed Workgroup

Geosyntec consultants

CSWR3015	August 2024

Figure E-10

P:\prj1_CSWR\CSWR3015 NBWW WQ Summary\4.0 GIS\Working\Annual Trends in DO.aprx\8.5 x 11 Portrait 8/13/2024 3:50 PM (avandermus)



Legend

- North Branch Watersheds
- Stream
- USGS Stations
- WWTP

***E. coli* - Trend**

- Increasing
- Decreasing
- No Trend
- Not Analyzed

N

0 15,000 Feet

Seasonal Kendall Trend in E. Coli

North Branch Watershed Workgroup

Geosyntec consultants

CSWR3015	August 2024

Figure E-11

P:\prj1_CSWR\CSWR3015 NBWW WQ Summary\4.0 GIS\Working\Annual Trends in Total E Coli.aprx\8.5 x 11 Portrait 8/13/2024 4:10 PM (avandermus)

We are engineers, scientists and innovators.



Founded in 1983, Geosyntec combines the expertise and experience of over 2,600 scientists and engineers to address complex environmental and infrastructure problems all over the world.

Geosyntec consultants

engineers | scientists | innovators

Offices in Principal Cities of the United States and Select International Locations

geosyntec.com