

Annual Report for Water Quality Monitoring Activities

City of Chattanooga and Hamilton County
of Chattanooga, TN

July 2024 – June 2025

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1 Introduction

In June 2021, Woolpert was retained to help the City of Chattanooga and Hamilton County enhance their current individual sampling efforts by developing a combined watershed monitoring program. Woolpert helped the City of Chattanooga and Hamilton County develop a comprehensive Monitoring Strategy (Strategy) to encompass needs across both communities related to water quality/quantity and to prioritize specific watersheds for more focused monitoring efforts. The Strategy included recommendations for continuous, real-time monitoring via permanently installed monitoring stations at key locations. In the Spring of 2022, the City of Chattanooga and Hamilton County began full implementation of the Strategy by collecting more targeted discrete samples during ambient/wet conditions in “Priority” watersheds and operating/maintaining four (4) permanent, continuous water quality monitoring stations in “High Priority” watersheds. In the Winter of 2023, the effort expanded to include an additional four permanent monitoring stations and their watersheds. Table 1 summarizes these stations, along with an accompanying overall map in Figure 1. Individual location maps for each station are included in the Appendix.

Table 1. Continuous Water Quality Monitoring Stations

Station Name	Description	Waterbody	Jurisdiction
Citico Creek	Citico Creek – adjacent to Waterwalk Place	Citico Creek	City of Chattanooga
Dobbs Park City	Cannon Avenue – Park City Park	Dobbs Branch	City of Chattanooga
Friar Branch Polymer	Polymer Drive – adjacent to Mayfield Dairy Farms	Friar Branch	City of Chattanooga
N. Chick Ivy Academy	Dayton Pike – Ivy Academy	North Chickamauga Creek	City of Chattanooga
N. Chick Greenway Farms	Walker Cemetery Road – Greenway Farms Parks	North Chickamauga Creek	City of Chattanooga
Stringers Signal Mountain	Signal Mountain Road – adjacent to Tire World & Auto Service	Stringers Branch	Hamilton County
South Chick at West Chick	South Chickamauga Creek Greenway – West Chickamauga Creek	South Chickamauga Creek	City of Chattanooga
Mountain Creek Elementary	North Runyan Drive – adjacent to Red Bank Elementary	Mountain Creek	City of Chattanooga

In order to align the monitoring results with the fiscal budget year for the City of Chattanooga and Hamilton County, the following report includes data collected from July 1, 2024, through June 30, 2025. The Methods section of the report includes information regarding the deployed monitoring equipment, calibration methods/frequencies, the data processing software and capabilities, and the volume of data included over the reporting term. The Results and Discussion section includes a general water quality analysis, in addition to seasonal trends and interpretation of results from the City of Chattanooga and Hamilton County’s discrete sampling program.

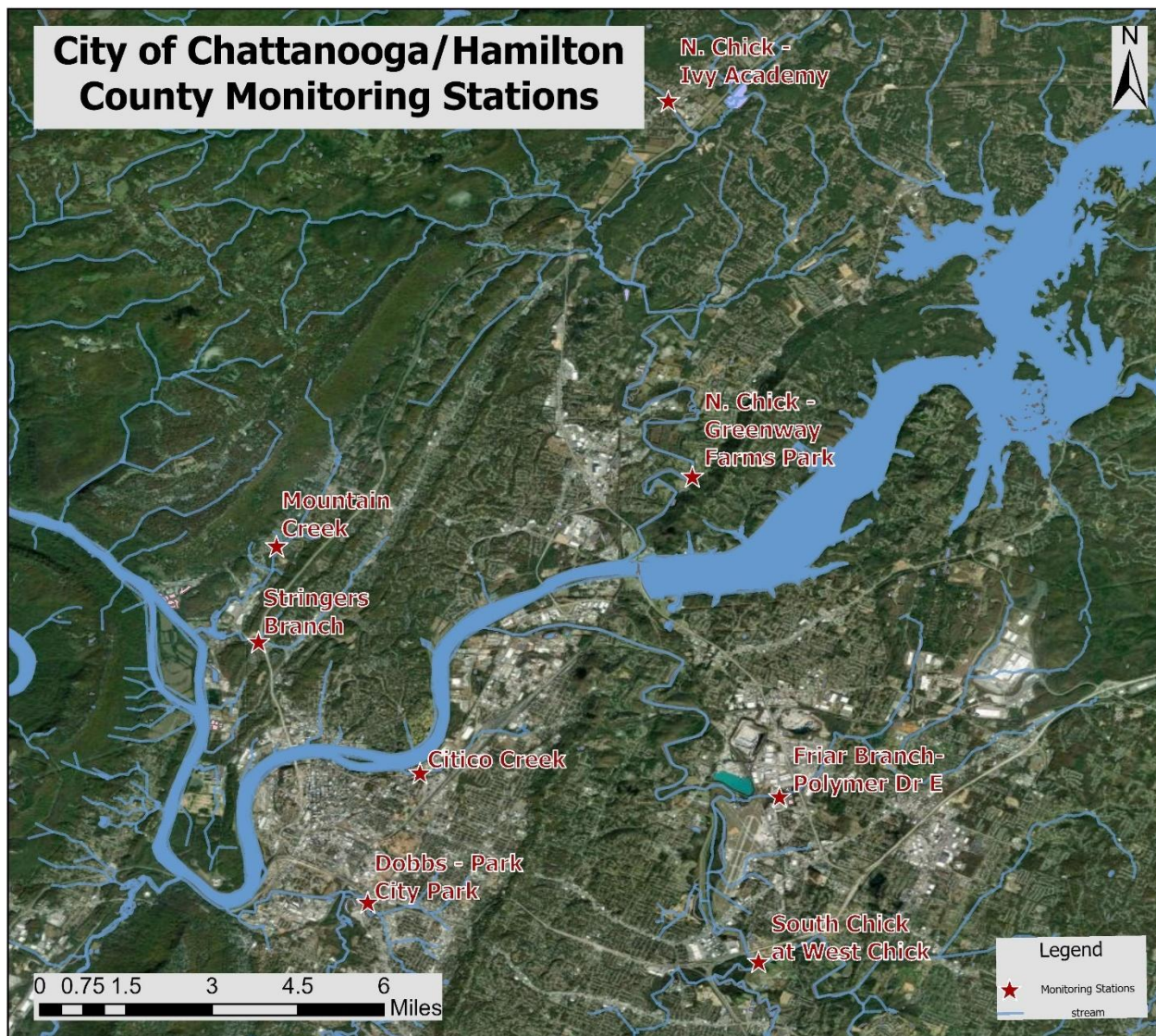


Figure 1. Overall Monitoring Station Location Map

2 Methods

This section describes the methods used in the collection of water quality data and rainfall data, as well as the methods used to perform the analyses presented in this report.

2.1 Data Collection

2.1.1 Continuous Water Quality Data

The City of Chattanooga and Hamilton County maintain YSI EXO Series sondes (EX02 and EX03) at eight monitoring stations located on Citico Creek, Dobbs Branch, Friar Branch, Greenway Farms, Ivy Academy,

Mountain Creek, South Chick, and Stringers Branch. The sondes record water quality data in 15-minute time increments for stage, water temperature, specific conductivity, dissolved oxygen (DO), turbidity, and pH. The equipment deployed at the City of Chattanooga and Hamilton County's monitoring stations is maintained and calibrated according to the manufacturer's standards. These data collected at each monitoring station are recorded on-site by a Campbell Scientific data logger (CR1000x or CR300 series) and transmitted via a remote telemetry system to a server that hosts the data and displays it on the City of Chattanooga and Hamilton County's real-time monitoring website. This website allows for remote monitoring of the field equipment. Woolpert personnel routinely review the website to alert the City of Chattanooga and Hamilton County to any anomalies and/or maintenance needs. City of Chattanooga and Hamilton County personnel perform site visits to conduct maintenance on the sondes as directed by website observations.

The City of Chattanooga and Hamilton County perform calibrations of the sondes at least bi-monthly, or as needed, followed by a quarterly correction of the collected water quality data, modeled after procedures outlined in USGS Techniques and Method 1-D3: Guidelines and Standard Procedures for Continuous Water-Quality Monitoring Station Operation, Record Computation, and Data Reporting. Additionally, the City of Chattanooga and Hamilton County will perform spot checks using a YSI ProDSS handheld multiparameter digital water quality meter to ensure the accuracy of the sonde.

2.1.2 Discrete Sample Water Quality Data

The City of Chattanooga and Hamilton County collect discrete samples at seven of the water quality monitoring stations mentioned throughout this report. Under this program, discrete samples for *E. coli*, total suspended solids (TSS), nitrate/nitrite, total Kjeldahl nitrogen (TKN), and total phosphorus (TP) are collected under ambient conditions and during storm events. Samples are then analyzed by a certified laboratory. Samples can only be collected when conditions are safe for field personnel and sufficient time is allowed for the samples to be delivered to the lab within the required maximum holding time for bacteria samples. Summary statistics are calculated in Section 3.4 to provide an indication of the concentration of these parameters generally observed at the monitoring stations.

2.1.3 Rainfall Data

The City of Chattanooga and Hamilton County maintain eight (8) Kisters TB-4 tipping bucket rain gauges. Each water quality monitoring station has a designated rain gauge. These rain gauges provide an accurate rainfall dataset by recording 5-minute incremental rainfall measurements to the nearest hundredth of an inch. Rain gauges are cleaned as needed and field-validated biannually according to manufacturer instructions.

2.2 Data Processing

Prior to analysis of the continuous water quality data, the raw dataset was corrected using specialized software named Aquarius by Aquatic Informatics, specifically designed for continuous water quality data preprocessing. Time series datasets are corrected so that erroneous data, which are not representative of true in-stream conditions, are not used in the data analysis process. This can be caused by sensor malfunction, entrapment of sediment or other debris in the stilling well or sonde guard, or other unpredictable equipment issues. These data are removed prior to analysis being performed to avoid introducing erroneous bias into the dataset. Approximating methods, such as linear interpolation and averaging techniques, are applied to fill data gaps of less than three hours during predictable conditions (e.g., baseflow). Longer gaps are not filled due to decreased confidence in the predictability of the water quality parameters.

2.3 Data Analysis

The City of Chattanooga and Hamilton County maintain a robust data collection program that results in extensive and insightful water quality datasets. The City of Chattanooga and Hamilton County's discrete sample monitoring program collected 117 *E. coli*, TSS, nitrate/nitrite, TKN, and TP samples across the eight monitoring stations over the one-year term. The continuous water quality monitoring program recorded over 1,830,000 water quality values across the five monitored watersheds during this monitoring period. By applying a set of statistical analyses, trends and observations are drawn from these datasets in Section 3 of this report.

In Section 3.1, basic summary statistics were calculated using the daily average values of the continuously monitored parameters. Daily averages were used instead of 15-minute continuous readings to portray general water quality trends better. This approach also mutes the impacts of individual data points that may be unreliable (i.e., organic debris temporarily blocking an optical sensor) but cannot be justifiably removed during the data correction process. These daily average datasets were used to generate a percent exceedance plot for each of the eight continuously monitored water quality stations. A percent exceedance plot is a visualization method for graphing the detailed distribution of a dataset. In this analysis, each water quality value is plotted against the percentage of the monitoring period that the parameter was observed to be at or above that value. For example, for the coldest recorded temperature at a water quality station, the corresponding percent exceedance would be 100%, indicating that all recorded data were at or above this minimum temperature value during the monitoring period. The median value of the dataset is equivalent to the 50% exceedance value.

In Section 3.2, collected data were analyzed seasonally as defined by the corresponding solstices and equinoxes to address such trends in water quality across the monitoring year. For the purposes of this analysis, seasons were defined as follows:

- Fall: September 22 to December 20
- Winter: December 21 to March 19
- Spring: March 20 to June 20
- Summer: June 21 to September 21

In Section 3.3, collected data were analyzed to generate basic summary statistics of annual averages for each measured parameter, using the averaging techniques described in Section 3.1 for site comparison.

In Section 3.4, discrete sampling results are summarized and compared to applicable TDEC water quality standards. Statistical summaries are provided for samples collected during ambient and storm conditions.

3 Results and Discussion

The City of Chattanooga and Hamilton County's continuous water quality monitoring program uses sondes at each of the eight monitoring stations to collect information on five water quality parameters: temperature, turbidity, pH, specific conductivity, and DO. The continuous water quality data records are in 15-minute increments. This dataset is supplemented with discrete sample data, which is analyzed in a laboratory to provide information on water quality parameters, such as *E. coli*, which cannot be measured with an in-stream sensor. Sections 3.1, 3.2, and 3.3 summarize the continuous, in-stream dataset. Data collected under the discrete sampling program are summarized in Section 3.4 of this report. Both the

continuous water quality and discrete sample data results are reported in the City of Chattanooga and Hamilton County’s quarterly water quality monitoring reports. These reports are available on the City of Chattanooga and Hamilton County websites and provide a high-level summary of results, but do not include data interpretation.

3.1 General Water Quality Analysis

The tables below contain summary statistics calculated from the water quality dataset collected by the continuous monitoring equipment at the five stations throughout the City of Chattanooga and Hamilton County. The datasets range from July 2024 through June 2025. In Table 2, summary statistics are calculated from a dataset of daily average values, providing a numeric representation of the water quality during this monitoring period. Results are also presented in graphical form in Figure 2 through Figure 6, which display percent exceedance distributions for each water quality parameter.

Table 2. Annual Statistics from Daily Average Water Quality Data

Temperature (°C)						
	Mean	Std Deviation	Median	Minimum	Maximum	Range
Citico Creek*	16.84	6.44	17.36	2.92	27.58	24.65
Dobbs Branch	16.83	6.03	17.40	3.17	26.49	23.33
Friar Branch	17.07	6.21	18.01	2.84	26.53	23.70
Greenway Farms**	17.98	5.94	18.32	3.51	27.37	23.86
Ivy Academy***	16.56	9.84	16.47	0.32	34.72	34.40
Mountain Creek	16.32	5.87	16.89	3.39	26.03	22.65
South Chick	17.28	6.96	18.09	2.11	28.17	26.06
Stringers Branch	15.95	2.37	16.50	10.21	20.29	10.08
Dissolved Oxygen (mg/L)						
	Mean	Std Deviation	Median	Minimum	Maximum	Range
Citico Creek*	5.15	3.21	5.13	0.14	11.67	11.52
Dobbs Branch	4.78	3.62	4.53	0.31	12.25	11.94
Friar Branch	8.00	1.78	7.54	1.64	12.76	11.12
Greenway Farms**	7.31	2.16	7.33	3.43	12.55	9.11
Ivy Academy***	7.77	2.08	7.96	0.52	11.54	11.02
Mountain Creek	8.53	2.12	8.40	4.69	13.38	8.69
South Chick	9.37	1.86	8.78	6.79	14.45	7.66
Stringers Branch	9.12	0.55	8.96	7.95	10.59	2.64
Specific Conductivity (µS/cm)						
	Mean	Std Deviation	Median	Minimum	Maximum	Range
Citico Creek*	396.88	100.52	408.49	151.96	721.47	569.51
Dobbs Branch	380.84	74.45	394.47	181.98	1,075.53	893.56
Friar Branch	350.73	93.02	380.72	54.02	632.67	578.65
Greenway Farms**	203.32	72.34	189.63	60.57	312.97	252.39
Ivy Academy***	15.60	10.10	14.66	0.00	44.74	44.73
Mountain Creek	285.85	54.58	292.15	148.05	539.16	391.11
South Chick	263.76	52.24	271.10	95.27	332.72	237.45
Stringers Branch	305.46	32.18	317.23	165.98	452.20	286.21
pH						
	Mean	Std Deviation	Median	Minimum	Maximum	Range
Citico Creek*	7.45	0.13	7.46	7.10	7.79	0.69
Dobbs Branch	7.51	0.21	7.55	7.02	7.89	0.86
Friar Branch	7.87	0.16	7.90	7.23	8.16	0.92
Greenway Farms**	7.55	0.22	7.52	6.93	7.95	1.02
Ivy Academy***	6.61	0.19	6.66	6.14	6.91	0.77
Mountain Creek	7.95	0.16	7.92	7.48	8.35	0.87
South Chick	7.93	0.22	7.95	7.09	8.65	1.56
Stringers Branch	7.61	0.11	7.61	7.29	7.80	0.51

Turbidity (FNU)						
	Mean	Std Deviation	Median	Minimum	Maximum	Range
Citico Creek*	79.59	135.41	18.49	2.49	718.65	716.15
Dobbs Branch	21.30	32.19	13.08	3.23	414.55	411.32
Friar Branch	39.95	115.02	4.69	0.59	863.23	862.63
Greenway Farms**	7.22	11.27	4.48	1.53	148.42	146.88
Ivy Academy***	39.30	47.10	22.56	0.05	207.76	207.70
Mountain Creek	9.00	16.76	4.12	1.46	144.39	142.92
South Chick	15.93	20.25	7.90	2.63	151.77	149.14
Stringers Branch	12.63	30.46	4.46	1.20	423.86	422.67

*Data between 9/2/2024 – 9/20/2024 are not available due to equipment un-submergence.

** Data between 12/24/2024 – 1/8/2025 and 02/1/2025 – 3/24/2025 are not available due to equipment un-submergence.

***Data between 2/25/2025– 7/1/2025 are not available due to sensor failure and maintenance.

Figure 2 displays the percent exceedance plot for daily average water temperature values during the monitoring period at all eight stations within the City of Chattanooga and Hamilton County’s monitoring network. As indicated by 8% of Ivy Academy’s values falling within the red area of the figure, this site was the only location that observed daily average values above the 30.5 °C TDEC maximum standard, most likely as a result of partial submergence resulting in ambient temperature readings.

Overall, the temperature distributions are typical for a year-long dataset, with higher and lower temperatures due to seasonal influences. The Ivy Academy Branch and South Chick Branch datasets show the greatest variability in distribution. This distribution pattern is typical of shallow flows as they are more susceptible to ambient temperature fluctuations. The Stringers Branch dataset shows a relatively flat distribution compared to the other seven sites with a year-long dataset, which have typical temperature swings on each end of the distribution. The Ivy Academy dataset displays such large variability due to data only being collected at that site between June 30, 2024, and Feb 25, 2025, which is not indicative of the annual distribution but rather half the typical. Contrastingly, the Stringers Branch dataset, which has little variability, is representative of the entire monitoring period. The stable distribution displayed could be due to a combination of the sonde being mounted against a high concrete wall, upstream conveyance through a large, concrete box culvert under the interstate, or tree canopy shading the stream. These site conditions could have insulated the water at this location, leading to water temperatures that are less sensitive to changes in air temperature compared to the other monitoring locations.

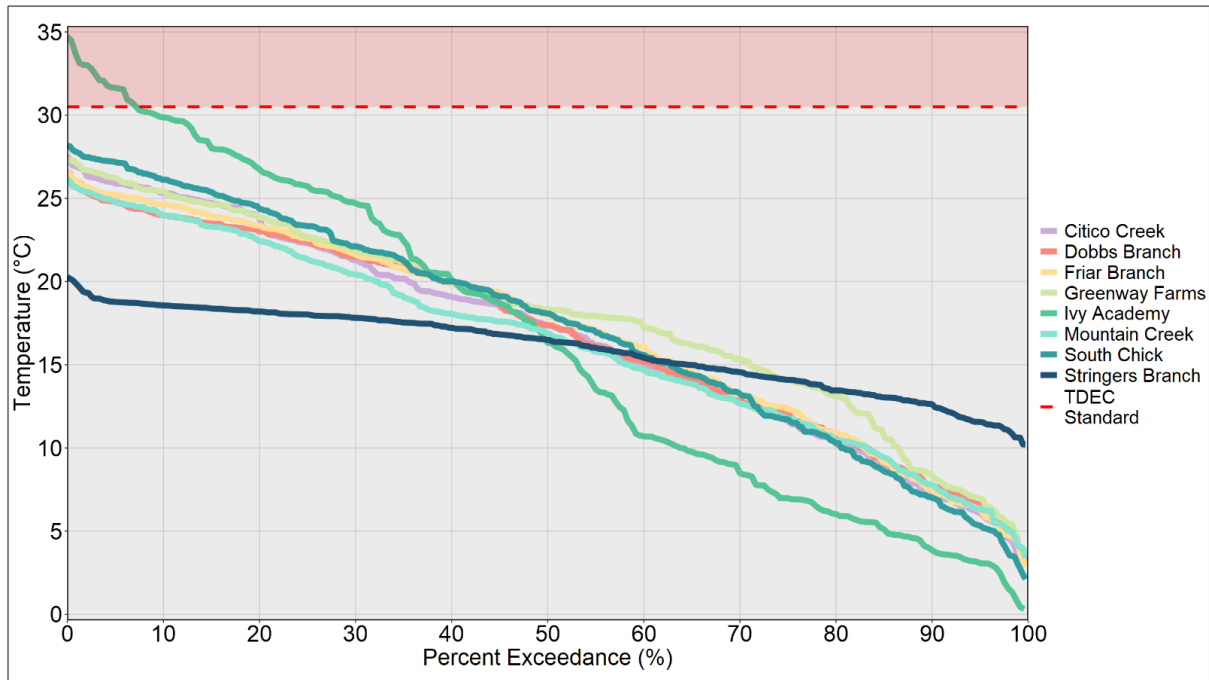


Figure 2. Percent Exceedance Distributions – Daily Average Data – Temperature

Figure 3 displays the percent exceedance distributions for daily DO values during the monitoring period at each of the eight stations. As stated previously, Ivy Academy's dataset is incomplete, and this parameter only displays data between June 30, 2024, and Feb 25, 2025, of the monitoring period. This likely influences the overall DO distribution to be more attuned to seasonal distributions rather than annual. Dobbs Branch experienced the largest variability in overall distribution when compared to the other seven sites. This trend is consistent with previous years, where the site has historically displayed low DO storage capacity, most likely as a result of being within a watershed next to surrounding urban influence that also results in a high average turbidity.

The daily DO average fell below the 5.0 mg/L minimum daily average TDEC standard at the Citico Creek station for 143 of the 297 monitored days within this monitoring period. The incomplete dataset, as a result of equipment failure and maintenance, skews the overall distribution to lower levels due to data being recorded during warmer periods. The daily average DO at the Dobbs Branch station fell below the 5.0 mg/L minimum daily average TDEC standard for 177 of the 331 monitored days during this monitoring period. This is indicative of a highly impaired waterway with a multitude of possible causes, given the urban influence within this watershed. Chemical oxygen demand and biological oxygen demand could be due to SSOs or other illicit discharges within the Dobbs Branch watershed. The daily average DO at the Greenway Farms station fell below the 5.0 mg/L minimum daily standard for 48 of the 297 monitored days during this monitoring period. This could be due to long periods without significant rainfall, leading to stagnant conditions and increased DO consumption by algae and other aquatic life. This is indicated by the recovery of DO levels following a significant rain event during those times. The incomplete dataset skews the overall distribution, and further observation is required. South Chick and Stringers Branch did not fall below the TDEC standard during this monitoring period.

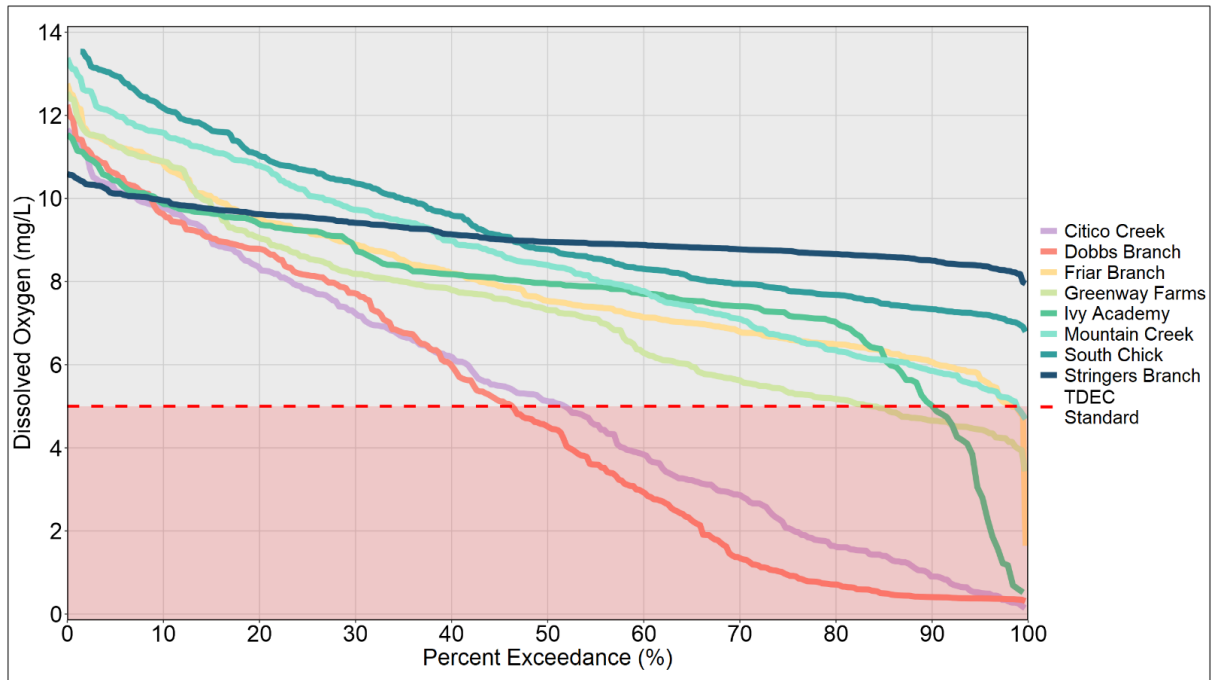


Figure 3. Percent Exceedance Distributions – Daily Average Data – Dissolved Oxygen

Figure 4 shows the percent exceedance distributions of daily average pH values at the eight City of Chattanooga and Hamilton County monitoring stations during the monitoring period. The figure displays the most conservative lower and upper TDEC standard of 6.5 – 9 pH units, respectively. All stations, with the exception of Ivy Academy, fell within the acceptable range for this monitoring period. Ivy Academy fell below the TDEC lower pH limit of 6.5 for roughly 23% of the days pH was monitored in this watershed, with daily averages ranging between 6.4 and 6.2 pH units. Potential causes of this could be illicit discharges occurring during this period or acidification from decaying vegetation. This could also be due to faulty readings, as pH sensor issues were observed during this time.

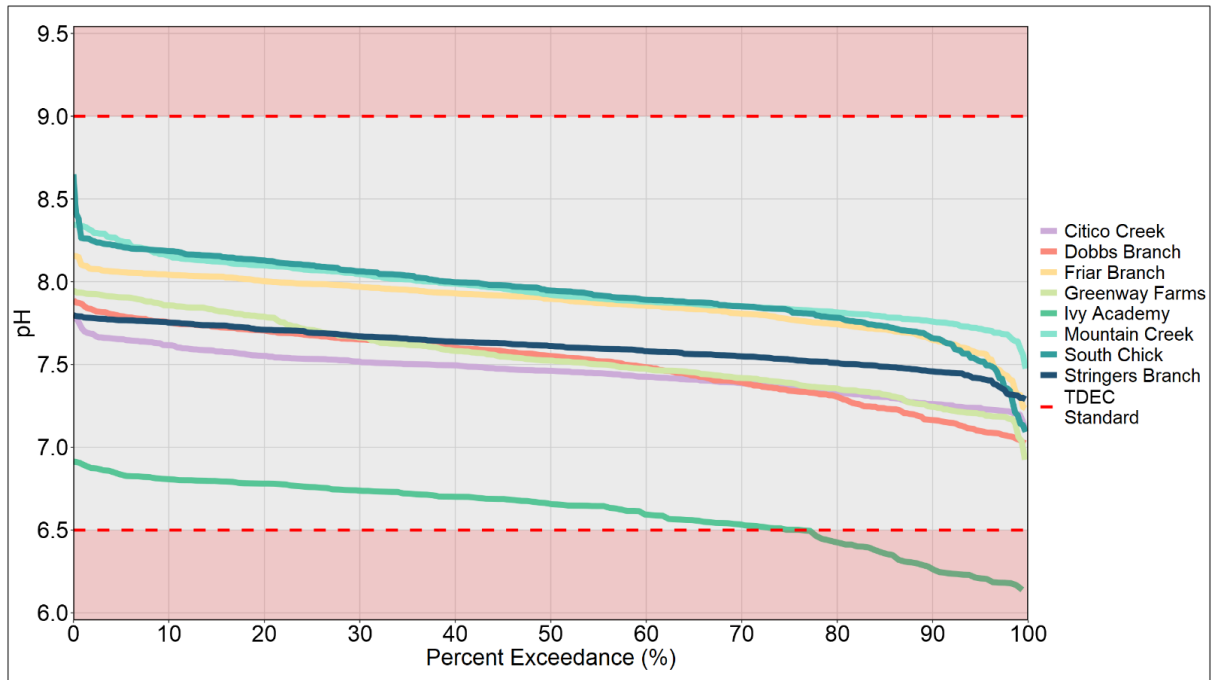


Figure 4. Percent Exceedance Distributions – Daily Average Data – pH

Figure 5 displays the percent exceedance distributions of daily average specific conductivity values at each of the eight stations monitored by the City of Chattanooga and Hamilton County. There is no established TDEC standard for this parameter. Stringers Branch and Ivy Academy (partial monitoring periods) displayed very steady specific conductivity distributions throughout the monitoring period.

The tail on the upper end of the percent exceedance distribution at Friar Branch occurred on Jan 12, 2025. This increase coincides with a recorded storm event and is likely the result of an illicit discharge occurring from de-icing attempts in the surrounding areas. Citico Branch measured specific conductivity daily averages higher than any other watershed for a majority of the monitoring period. Similar to the frequent low DO values at this site, this is likely caused by continuous discharges other than stormwater in the watershed during the shortened monitoring period. The tail on the upper end of the percent exceedance distribution at Mountain Creek occurred between January 11-13, 2025. Given that this did coincide with multiple small storm events during projected freezing temperatures, it is likely the result of an illicit discharge occurring from de-icing attempts during this time. Ivy Academy had consistently lower specific conductivity throughout the recorded distribution.

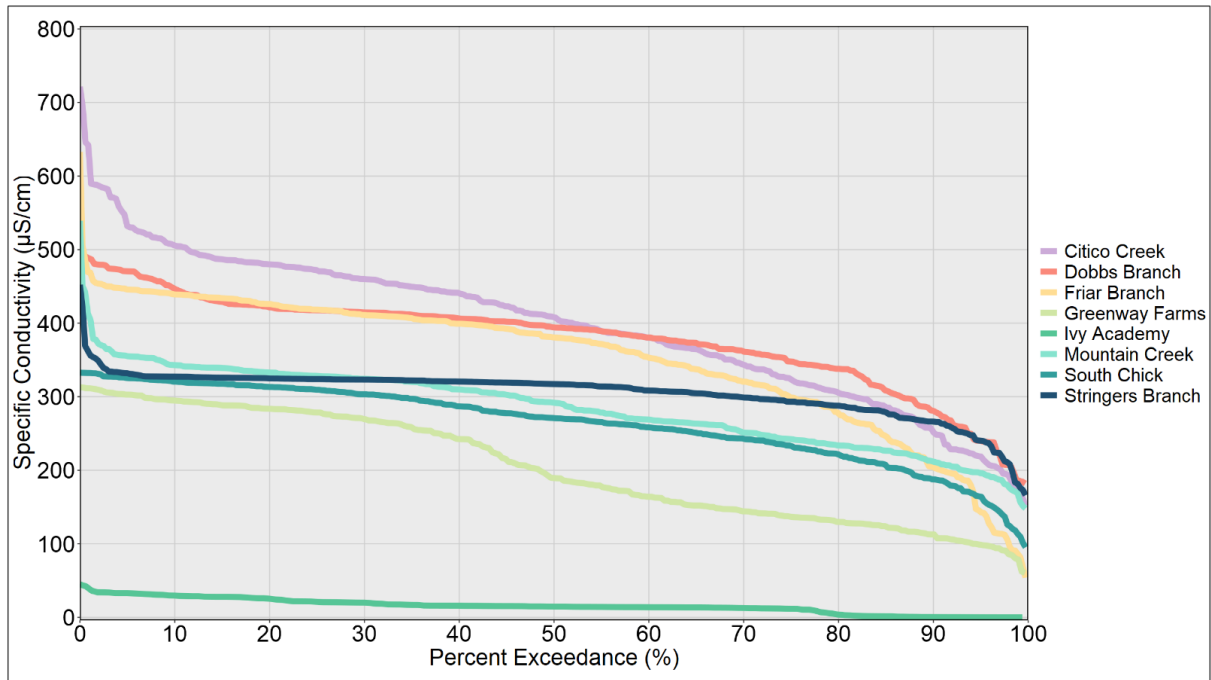


Figure 5. Percent Exceedance Distributions – Daily Average Data – Specific Conductivity

Figure 6 displays the percent exceedance distributions for daily average turbidity values. There is no numerical TDEC standard established for this parameter. Four stations exhibit values approaching 400 - 900 FNU on the upper end of the distributions. These elevated turbidity readings are in response to significant storm events that produce flashy runoff and high flow in the waterway. Turbidity can increase due to bank erosion and resuspension of prior sediment deposition in-stream. Dobbs Branch measured a higher daily average turbidity than any of the other four stations with complete datasets during approximately 70% of the monitoring period. This is likely the result of more exposed sediment due to erosion near this station. The Citico Creek and Ivy Academy average turbidities displayed within this figure belong to incomplete datasets and are not representative of the entire monitoring period.

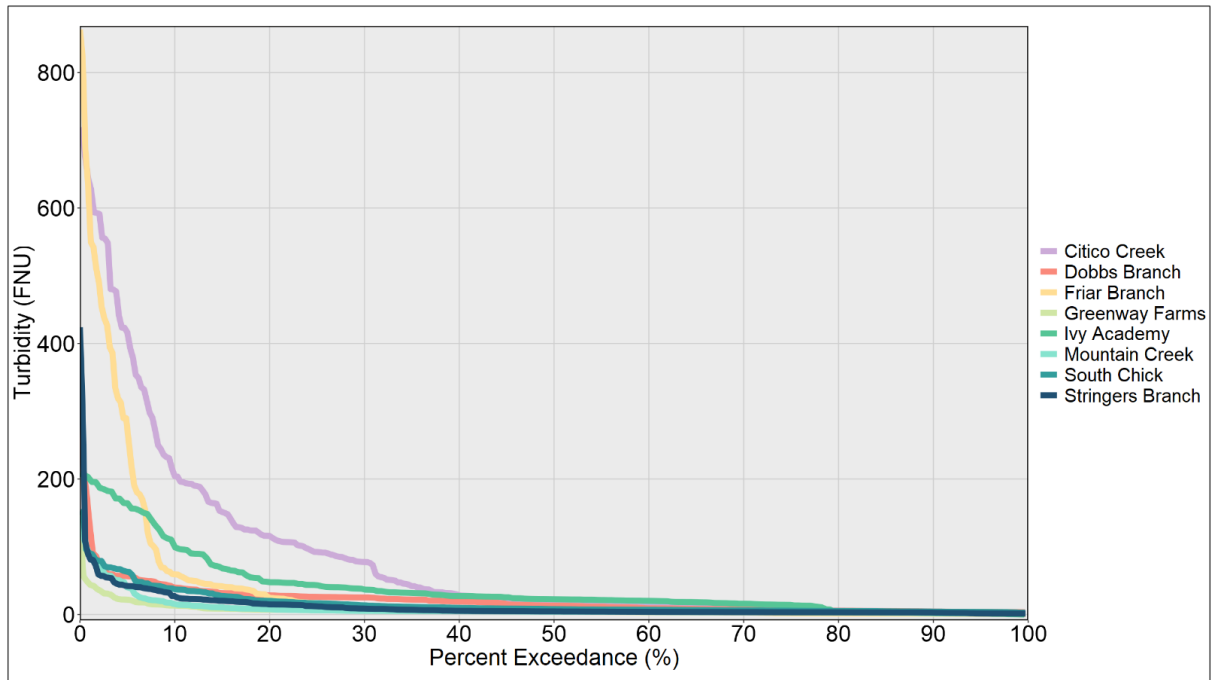


Figure 6. Percent Exceedance Distributions – Daily Average Data – Turbidity

3.2 Seasonal Trends

The datasets were divided into seasonal groups, as described in Section 2.3, to assess trends occurring in water quality seasonally across the monitoring year. For each seasonal group, a bar graph for each station summarizing the data are displayed in Figure 7 through Figure 11. Each bar represents the average daily data collected during the monitoring period. Patterns were evident with some parameters, while other parameters showed very little seasonal variability.

Figure 7 below displays the seasonal mean values for water temperature at each of the eight watersheds. Incomplete monitoring periods influenced the results for Citico Creek, Ivy Academy, and Greenway Branch. As expected, the temperature varies seasonally at each station due to seasonal changes in ambient air temperature. Average water temperature is warmest during the summer seasons and coolest during the winter seasons.

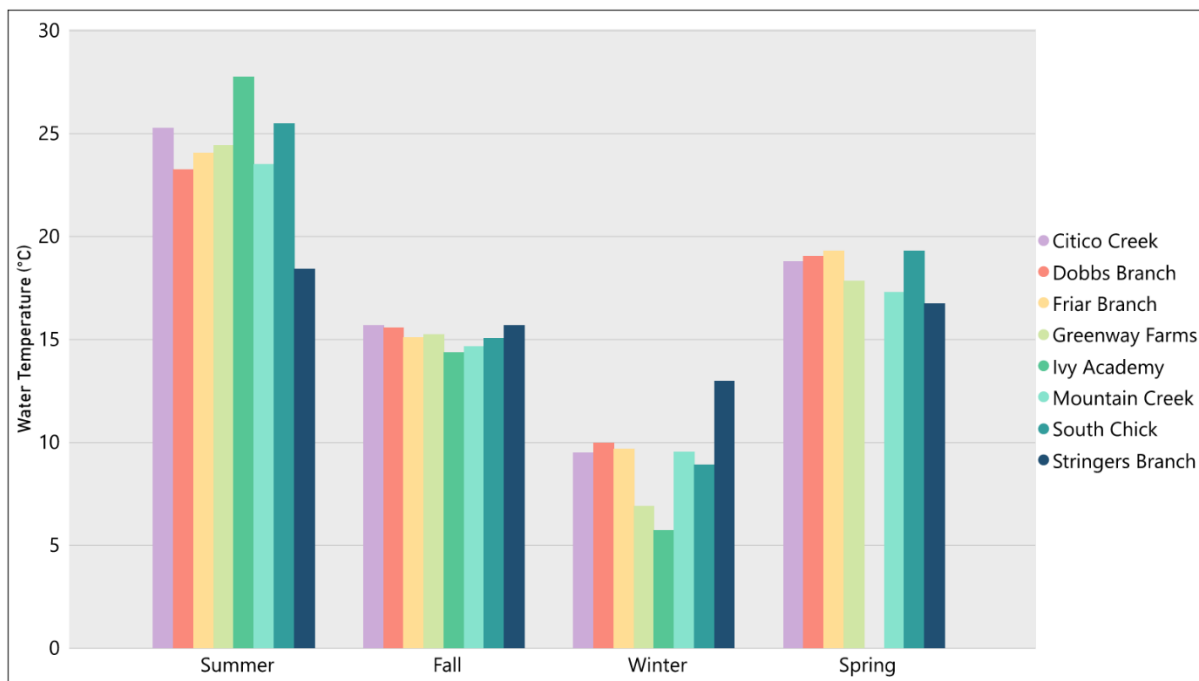


Figure 7. Seasonal Mean Water Temperature Values – Daily Average Data

Figure 8 displays the seasonal mean DO values at all monitored stations during the monitoring period. There is a clear seasonal trend in DO that mirrors the seasonal trend in water temperature. The lowest DO occurs in the summer season, while the highest DO occurs during the winter season. This relationship is expected because the DO levels in a body of water are dependent upon the water temperature, among several other factors. Water with a lower temperature has the capacity to hold more DO than water at a higher temperature.

Algal and other phytoplanktonic organisms have a minor impact on DO concentrations during warmer months. While the number of these organisms increases in the summer into fall seasons, the additional dissolved oxygen created by primary production is not enough to counteract the lower DO capacity of warm water. This leads to a net decrease in DO levels. The average seasonal DO was below the 5 mg/L TDEC standard for spring, summer, and fall seasons at Dobbs Branch, and it was lower than all other recorded stations during two of these seasons. This is evidence of a highly impaired waterway with a large amount of oxygen-demanding substances. This is exacerbated in the summer by higher water temperatures and stagnation due to periods of infrequent rainfall. Citico Branch average seasonal DO readings also fell below the 5mg/L TDEC standard during these months.

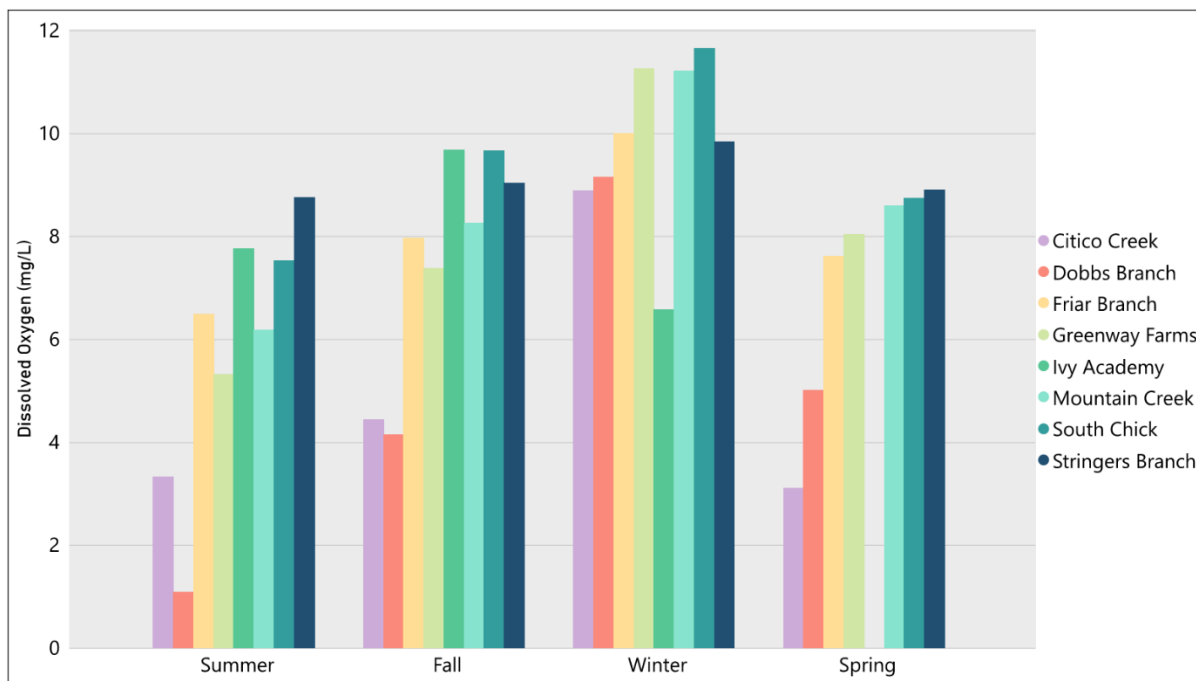


Figure 8. Seasonal Mean Dissolved Oxygen Values – Daily Average Data

Figure 9 and Figure 10 display the seasonal mean pH and specific conductivity levels at the City of Chattanooga and Hamilton County's eight monitoring stations. As seen in the figures below, there is little to no evident seasonal impact on pH and specific conductivity for each individual station, with the exception of lower pH occurring during spring at the Ivy Academy station. This station's pH probe has historically experienced malfunctions from sediment entrapment; therefore, these readings may not be accurate representations of the stream's conditions. Further monitoring will be required to assess seasonal patterns. Specific conductivity at Greenway Farms averaged notably lower during the winter and spring months than during the summer and fall months. This appears to be due to the winter and spring seasons recording much more frequent storm events than the other two seasons, leading to a consistent dilution of dissolved ions in the stream.

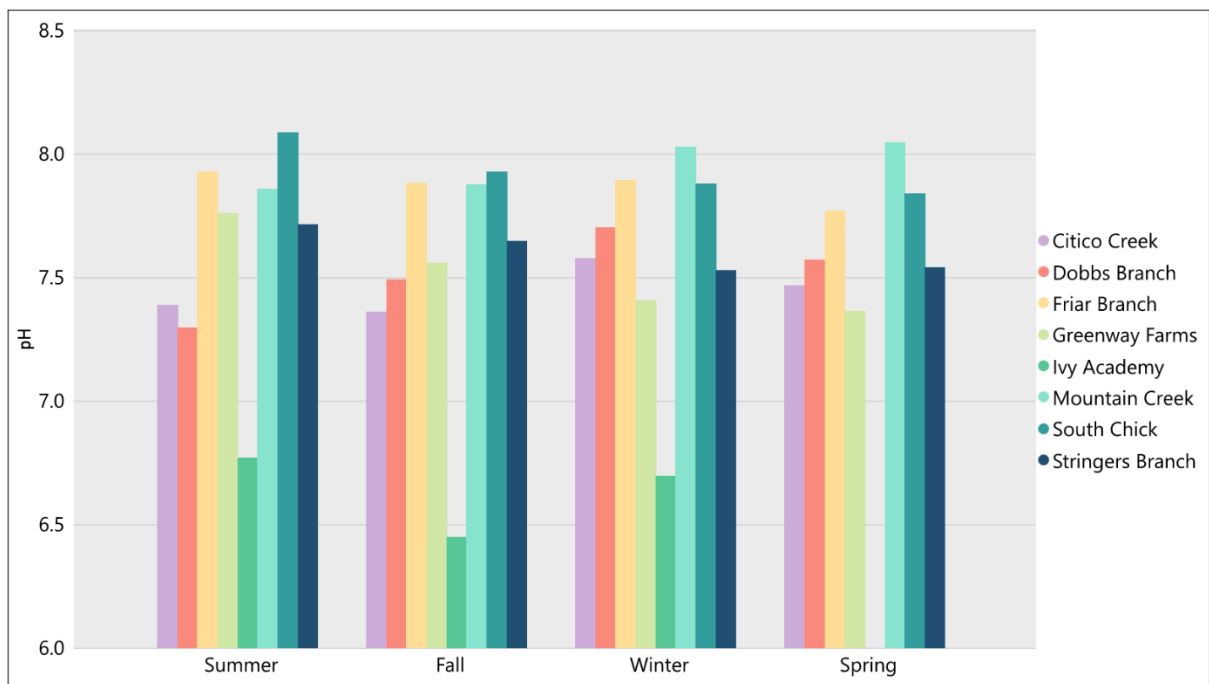


Figure 9. Seasonal Mean pH Values – Daily Average Data

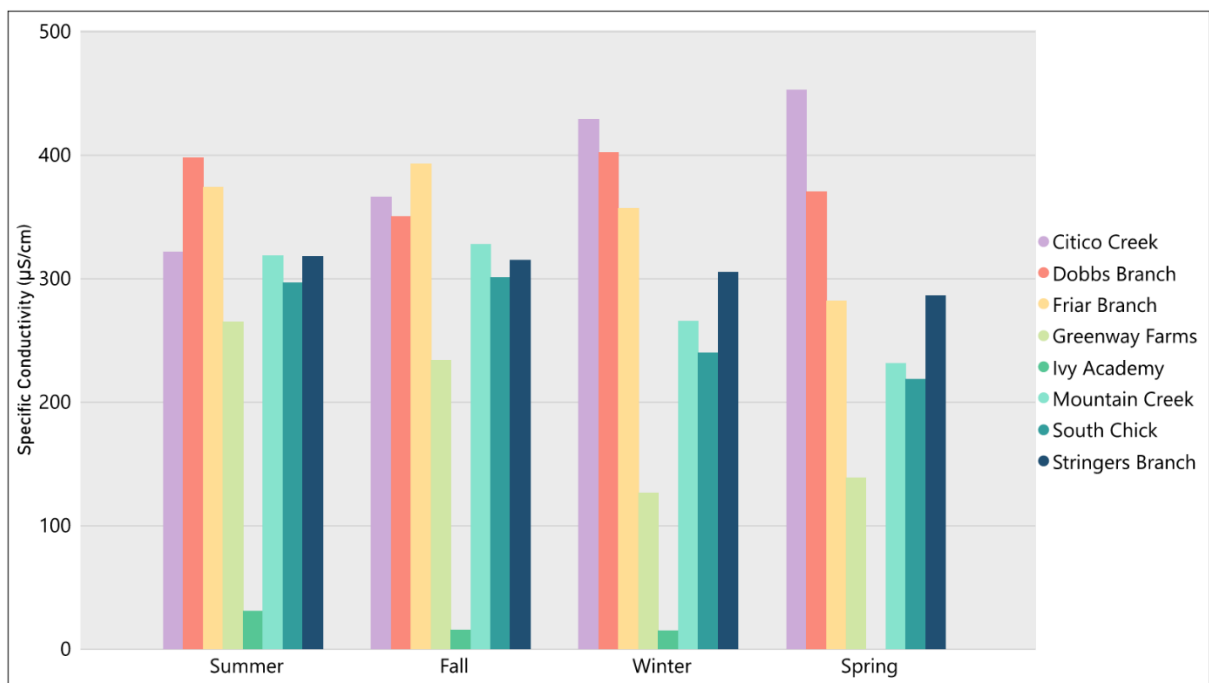


Figure 10. Seasonal Mean Specific Conductivity Values – Daily Average Data

Figure 11 displays the seasonal average turbidity levels recorded at each of the eight stations. Table 3 shows the seasonal sum of precipitation across the watersheds. Storm events drive turbidity levels in

water quality data, so turbidity can be found to have a seasonal pattern in a location with elevated seasonal rainfall and/or rainfall intensities. This correlation applied to a majority of the observed datasets during this monitoring period. However, within this monitoring period Citico Creek and Ivy Academy opposed historical trends regarding the seasonal average turbidity, where spring would be expected to display the highest averages and for summer to display the lowest. This could possibly be explained by lower erosion rates or lower rainfall intensities in their respective watersheds.

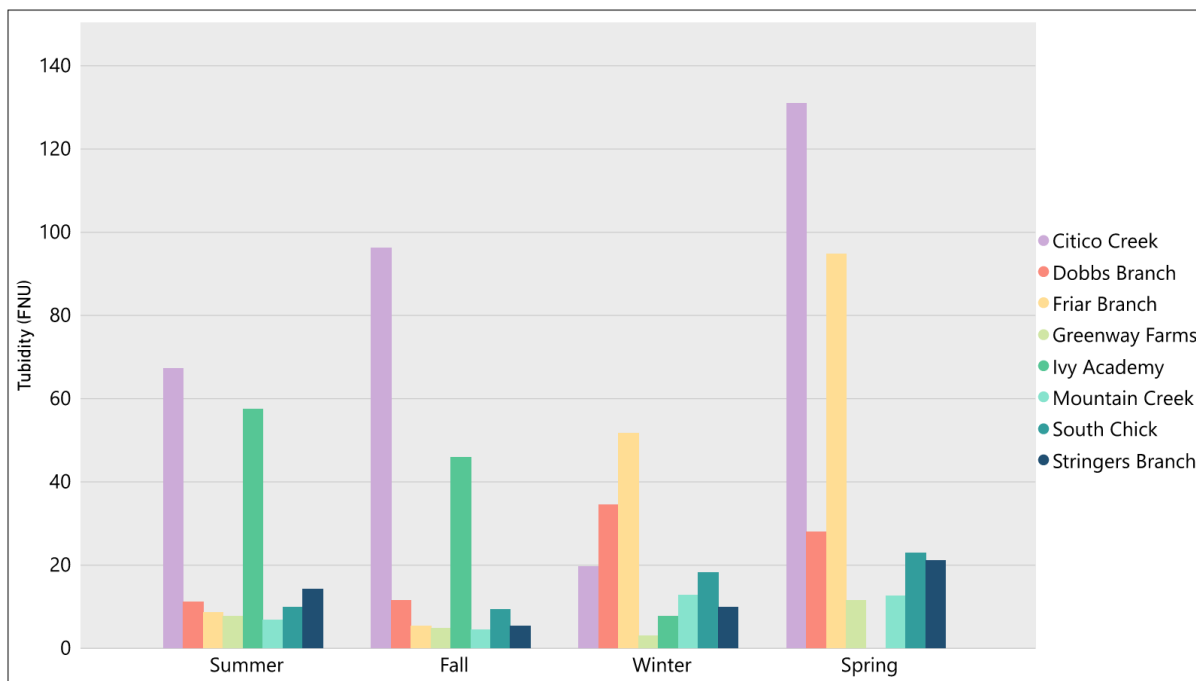


Figure 11. Seasonal Mean Turbidity Values – Daily Average Data

Table 3. Seasonal Precipitation Totals

Station	Summer	Fall	Winter	Spring	Total
Citico Creek*	5.09	11.87	16.20	22.53	55.69
Dobbs Branch	6.72	11.28	15.55	20.58	54.13
Friar Branch	6.25	11.61	15.42	23.60	56.88
Greenway Farms	5.78	12.07	17.47	22.27	57.59
Ivy Academy*	13.93	12.99	17.49	19.87	64.28
Mountain Creek*	5.79	12.51	17.60	20.63	56.53
South Chick	6.98	5.56	12.97	20.99	46.50
Stringers Branch*	4.89	0.20	14.29	18.47	37.85

*Complete seasonal data not available due to equipment failures.

3.3 Annual Trends

The datasets were divided into seasonal groups, as described in Section 2.3 to assess trends occurring in water quality annually across the monitoring period. For each seasonal group, a box plot for each station summarizing the data is displayed in Figures 12 through 16. Whiskers represent the minimum and maximum value recorded, while the black dot represents the mean of the data. The upper and lower edges of the colored boxes represent the 75th and 25th percentiles, respectively.

Figure 12 below displays the annual mean water temperature values for each of the eight watersheds. The temperature varies only slightly at each station, with the overall average water temperature consistently hovering around 18°C, which falls below the 30.5 °C TDEC maximum standard.

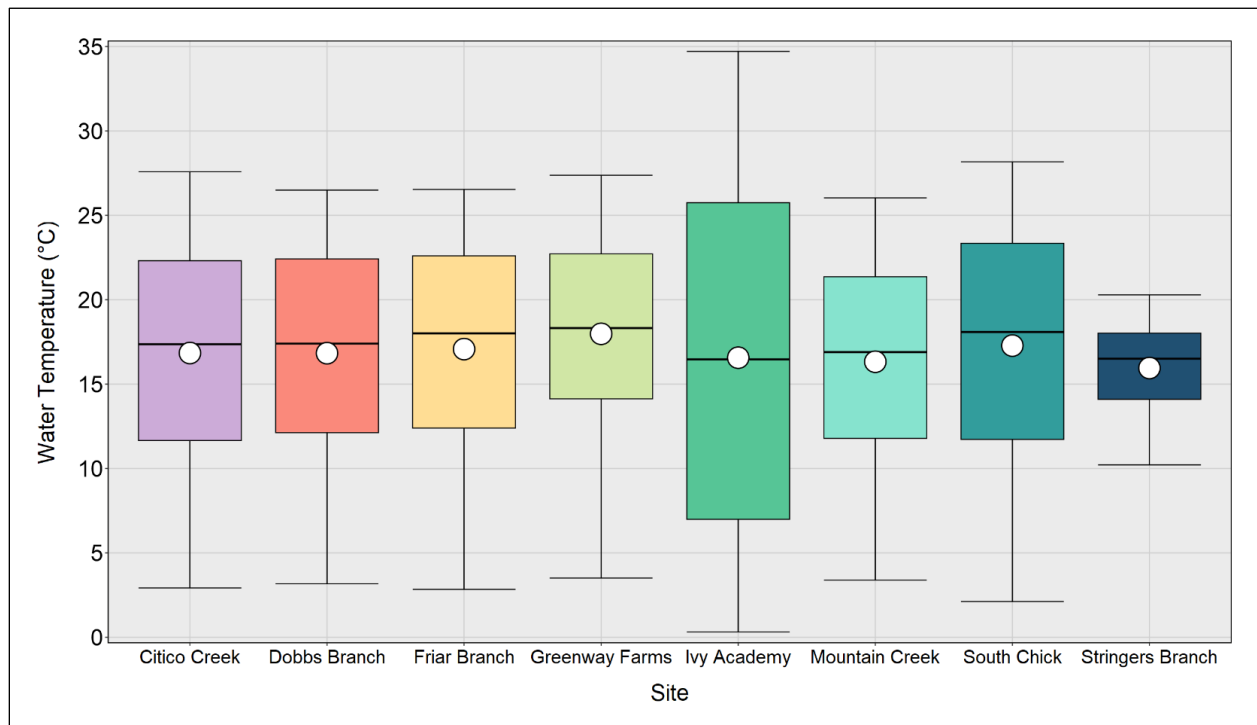


Figure 12. Annual Mean Water Temperature Values – Daily Average Data

Figure 13 displays the annual mean DO values at all monitored stations during the monitoring period. The lowest DO was observed at Dobbs Branch with the largest range, while the second-highest DO was observed at Stringers Branch with the smallest range of recorded measurements. These variabilities are visible within section 3.2, Seasonal Trends. However, the observed averages were above or at the 5.0 mg/L average TDEC standard when considering the entire monitoring period.

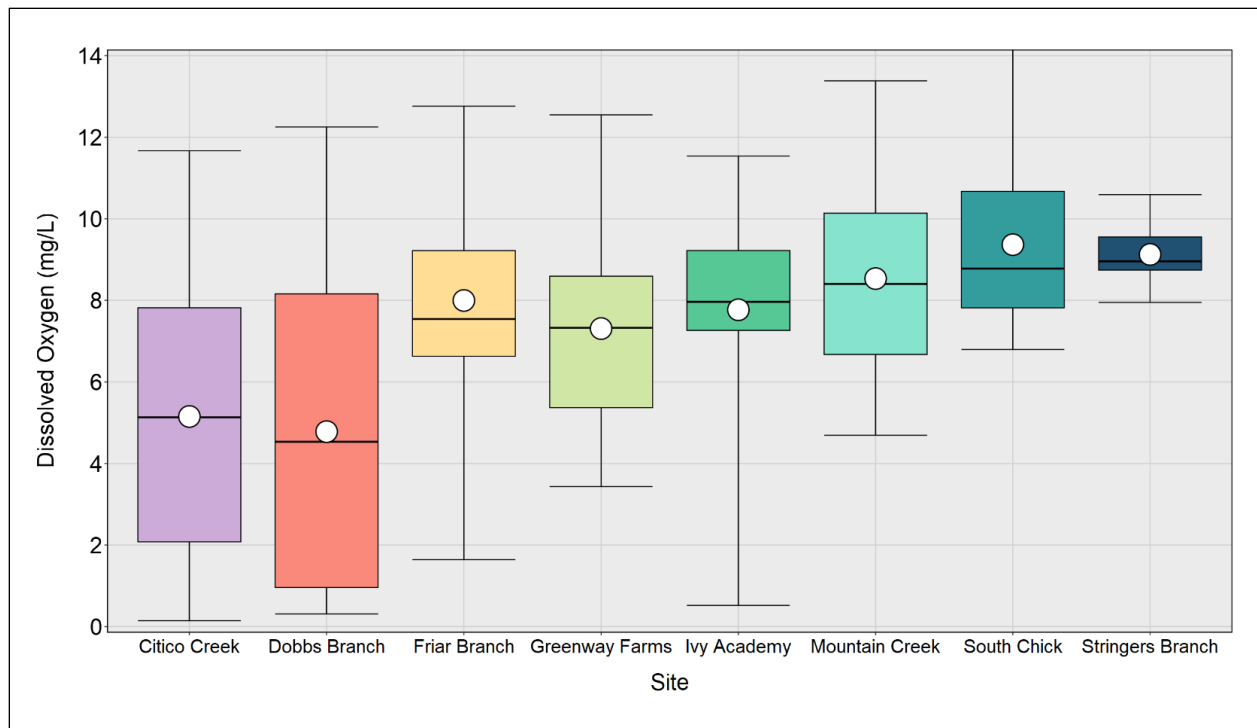


Figure 13. Annual Mean Dissolved Oxygen Values – Daily Average Data

Figure 14 and Figure 15 display the annual mean pH and specific conductivity levels at the City of Chattanooga and Hamilton County's eight monitoring stations. As seen in the figures below, there is largest variability in recorded measurements among pH and specific conductivity for each individual station. The annual average for Ivy Academy falls just above the TDEC lower pH limit of 6.5, despite 22% of the recorded period falling below this standard. While specific conductivity does not have an established TDEC standard limit, Ivy Academy also consistently maintained the lowest average specific conductivity readings throughout the incomplete monitored period. However, the stations with more complete datasets appear to trend more closely to each other throughout the monitoring year. This variability among stations is expected as pH and specific conductivity are the most easily impacted by rainfall.

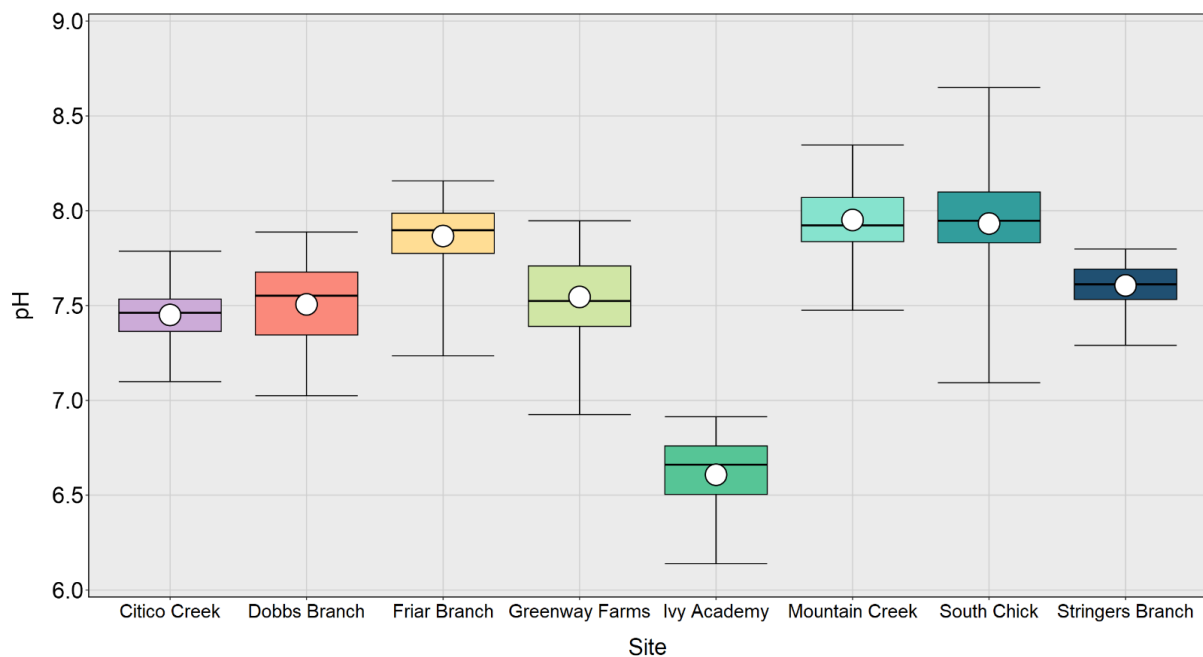


Figure 14. Annual Mean pH Values – Daily Average Data

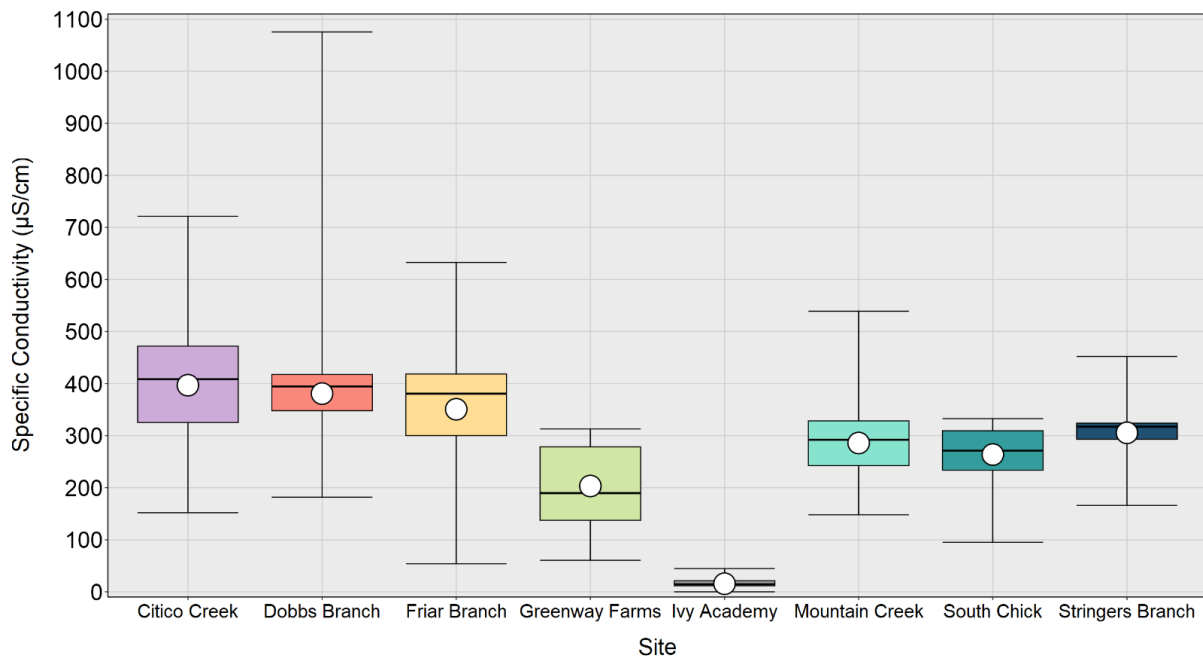


Figure 15. Annual Mean Specific Conductivity Values – Daily Average Data

Figure 16 displays the annual average turbidity levels recorded at each of the eight stations. Table 3 shows the yearly sum of precipitation across the watersheds. Storm events typically drive turbidity levels in water quality data, so turbidity can be found to have a pattern in a location with elevated seasonal rainfall and/or rainfall intensities. This monitoring period supports historical trends regarding

the annual average turbidity, where Ivy Academy would have been expected to display the highest average and Stringers Branch would be expected to display the lowest. This is typically due to there being less frequent, higher intensity storm events causing increased turbidity values as opposed to other sites experiencing more frequent, smaller storm events. Four stations experienced periodic equipment failures; Citico Creek, Ivy Academy, Mountain Creek, and Stringers Branch which affected seasonal rainfall totals.

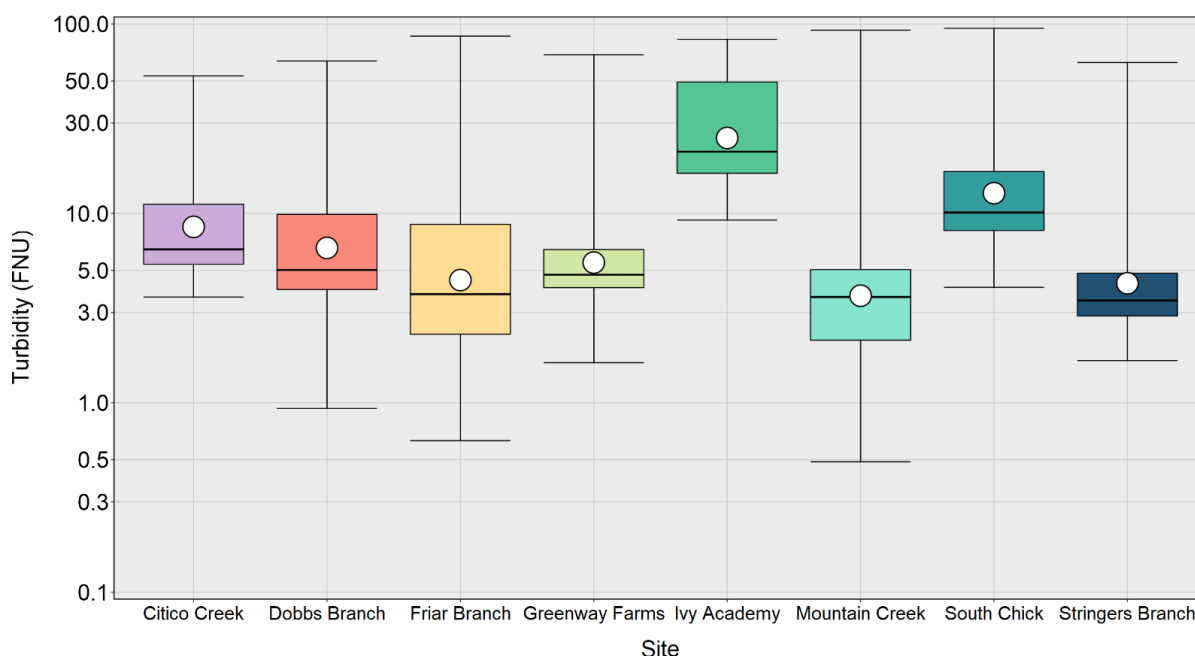


Figure 16. Annual Mean Turbidity Values – Daily Average Data

3.4 Discrete Sample Analysis

Discrete samples were collected periodically at the City of Chattanooga and Hamilton County’s monitoring stations during the reporting period. Samples were collected during ambient conditions throughout the year. Summary statistics for each collected parameter are provided in the sections below.

3.4.1 *E. coli*

As part of their discrete sample collection program, the City of Chattanooga and Hamilton County collected a total of 32 *E. coli* samples throughout the monitored watersheds (Table 4). All samples were collected during non-storm conditions. TDEC’s recreational water quality criteria single sample maximum for *E. coli* is 410 CFU/100ml. As seen in Table 4 below, samples from Dobbs Branch, Citico Creek, Mountain Creek, and South Chick exceeded the single-sample *E. coli* water quality standard. Dobbs Branch has a TMDL for *E. coli* and has been designated a high-priority watershed in the City of Chattanooga / Hamilton County Monitoring Strategy. Several potential sources of bacterial contamination have been identified and warrant further investigation to determine the primary contributors specific to each watershed.

Table 4. *E. coli* (MPN/100 mL) Sample Dataset Summary Statistics

<i>E. coli</i> (MPN/100mL) – Ambient Samples							
	Mean	Std Deviation	Median	Minimum	Maximum	Range	Count
Citico Creek	722.5	578.6	485	220	1700	1480	4
Dobbs Branch	11,531	16,597.5	3030	62	40,000	39,740	4
Friar Branch	137.5	88.7	130	20	270	250	4
Greenway Farms	125.5	3.1	4.5	2.4	10.5	230	4
Ivy Academy	-	-	-	-	-	-	-
Mountain Creek	214.3	129.8	175	62	420	358	8
South Chick	<411.3	>437.5	<200	<20	1100	>1080	8
Stringers Branch	-	-	-	-	-	-	-

3.4.2 Total Suspended Solids

As part of their discrete sample collection program, the City of Chattanooga and Hamilton County collected a total of 32 TSS samples throughout the monitored watersheds (Table 5). The highest TSS levels were observed at Dobbs Branch and South Chickamauga Creek, with respective maximum values of 53.7 mg/L and 56.4 mg/L, indicating potential contributions from upstream stormwater or erosion-related activities. Citico Creek, Friar Branch, and Greenway Farms exhibited relatively low TSS levels, with mean values ranging between 3.0 – 5.5 mg/L, consistent with baseline or dry-weather conditions. Mountain Creek samples fell below detection thresholds for most values, suggesting minimal suspended solids within this watershed.

Table 5. Total Suspended Solids (mg/L) Sample Dataset Summary Statistics

Total Suspended Solids (mg/L) – Ambient Samples							
	Mean	Std Deviation	Median	Minimum	Maximum	Range	Count
Citico Creek	4.3	2.2	3.2	2.7	8	5.33	4
Dobbs Branch	16.8	21.3	5.5	2.6	53.7	4.0	4
Friar Branch	3.0	1.9	2.1	1.6	6.2	4.6	4
Greenway farms	5.5	3.1	4.5	2.4	10.5	8.1	4
Ivy Academy	-	-	-	-	-	-	-
Mountain Creek	<2.3	>1.2	<1.7	<1.4	4.8	>3.4	8
South Chick	16.1	15.5	10.6	5	56.4	51.4	8
Stringers Branch	-	-	-	-	-	-	-

3.4.3 Nutrients

As part of the discrete water quality sampling program, the City of Chattanooga and Hamilton County collected 30 samples for nitrate+nitrite, Total Kjeldahl Nitrogen (TKN), and Total Phosphorus (TP). All samples were collected under ambient (non-storm event) conditions. The nutrient results are reported independently to allow for comparison with the Development of Regionally-based Interpretations of Tennessee's Narrative Nutrient Criterion guidance document, prepared by the Tennessee Department of Environment and Conservation (TDEC). Chattanooga is located within Level III Ecoregion 67, part of

Nutrient Ecoregion XI. For this ecoregion, TDEC recommends an interpretation threshold of 1.22 mg/L for nitrate+nitrite. As presented in Table 6, all observed nitrate+nitrite concentrations were below this threshold, indicating that ambient levels do not exceed regional nutrient guidance for this parameter.

Total Nitrogen values, presented in Table 7, were calculated as the sum of nitrate+nitrite and TKN concentrations. TKN was only detected at Dobbs Branch and South Chick Creek. The limited detection is likely attributable to relatively high laboratory detection limits (0.5 mg/L) associated with the analytical method in use. In cases where TKN was below detection, the method detection limit was used in TN calculations. Due to this constraint, some TN values are reported with less than (“<”) notation to reflect uncertainty associated with non-detects.

Table 6. Nitrate+Nitrite (mg/L) Sample Dataset Summary Statistics

Nitrate + Nitrite (mg/L) – Ambient Samples							
	Mean	Std Deviation	Median	Minimum	Maximum	Range	Count
Citico Creek	0.84	0.72	0.77	0.13	1.7	1.57	4
Dobbs Branch	0.71	0.53	0.60	0.16	1.47	1.32	4
Friar Branch	0.78	0.24	0.68	0.54	1.11	0.57	3
Greenway Farms	0.38	0.05	0.38	0.33	0.44	0.11	4
Ivy Academy	-	-	-	-	-	-	-
Mountain Creek	0.38	0.12	0.41	0.15	0.48	0.33	7
South Chick	0.46	0.11	0.47	0.32	0.66	0.15	8
Stringers Branch	-	-	-	-	-	-	-

Table 7. Total Nitrogen (mg/L) Sample Dataset Summary Statistics

Total Nitrogen (mg/L) – Ambient Samples							
	Mean	Std Deviation	Median	Minimum	Maximum	Range	Count
Citico Creek	<1.34	>0.72	<1.27	<0.63	2.20	>1.57	4
Dobbs Branch	<1.75	>0.71	<1.80	<0.79	2.62	>0.44	4
Friar Branch	<1.28	>0.24	<1.18	<1.04	1.61	>0.57	3
Greenway Farms	<0.88	>0.05	<0.88	<0.83	0.94	>0.11	4
Ivy Academy	-	-	-	-	-	-	-
Mountain Creek	<0.83	>0.12	<0.91	<0.65	0.98	>0.33	7
South Chick	<1.31	>1.02	<0.97	<0.82	4.01	>3.18	8
Stringers Branch	-	-	-	-	-	-	-

The recommended interpretation of the existing narrative criteria provided by TDEC is 0.04 mg/L for TP within this ecoregion. The high detection limit of 0.5 mg/L stations leads to difficulty interpreting the

results, given that TP is generally found at much lower concentrations within streams. Of all samples collected, only one— located at Dobbs Branch—was measured above the detection limit. This sample, with a concentration of 0.59 mg/L, exceeds the TDEC-recommended threshold and may warrant further investigation. All other stations reported TP concentrations below detection (<0.5 mg/L), which prevents any determination as to whether these monitoring locations and samples are in compliance with the recommended criteria.

Table 8. Total Phosphorus (mg/L) Sample Dataset Summary Statistics

Total Phosphorus (mg/L) – Ambient Samples							
	Mean	Std Deviation	Median	Minimum	Maximum	Range	Count
Citco Creek	<0.5	-	<0.5	<0.5	<0.5	-	4
Dobbs Branch*	0.52	-	<0.5	<0.5	0.59	0.09	4
Friar Branch	<0.5	-	<0.5	<0.5	<0.5	-	3
Greenway Farms	<0.5	-	<0.5	<0.5	<0.5	-	4
Ivy Academy	-	-	-	-	-	-	-
Mountain Creek	<0.5	-	<0.5	<0.5	<0.5	-	7
South Chick	<0.5	-	<0.5	<0.5	<0.5	-	8
Stringers Branch	-	-	-	-	-	-	-

*Mean, standard deviation, and range are not displayed due to only a single sample being above the detection limit of 0.500 mg/L. The maximum value displayed here reflects the results of that sample.

Appendix

Monitoring Station Location Maps

City of Chattanooga/Hamilton County Monitoring Stations - Citico Creek



0 300 600 900 1,200
US Feet

Legend

- ★ Monitoring Station
- Road
- Hydro Layer
- Stream



City of Chattanooga/Hamilton County Monitoring Stations - Dobbs Branch at Park City Park



0 300 600 1,200
US Feet

Legend

- Monitoring Station
- Stream
- Waterbody
- Road



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City of Chattanooga/Hamilton County Monitoring Stations - Friar Branch at Polymer Drive



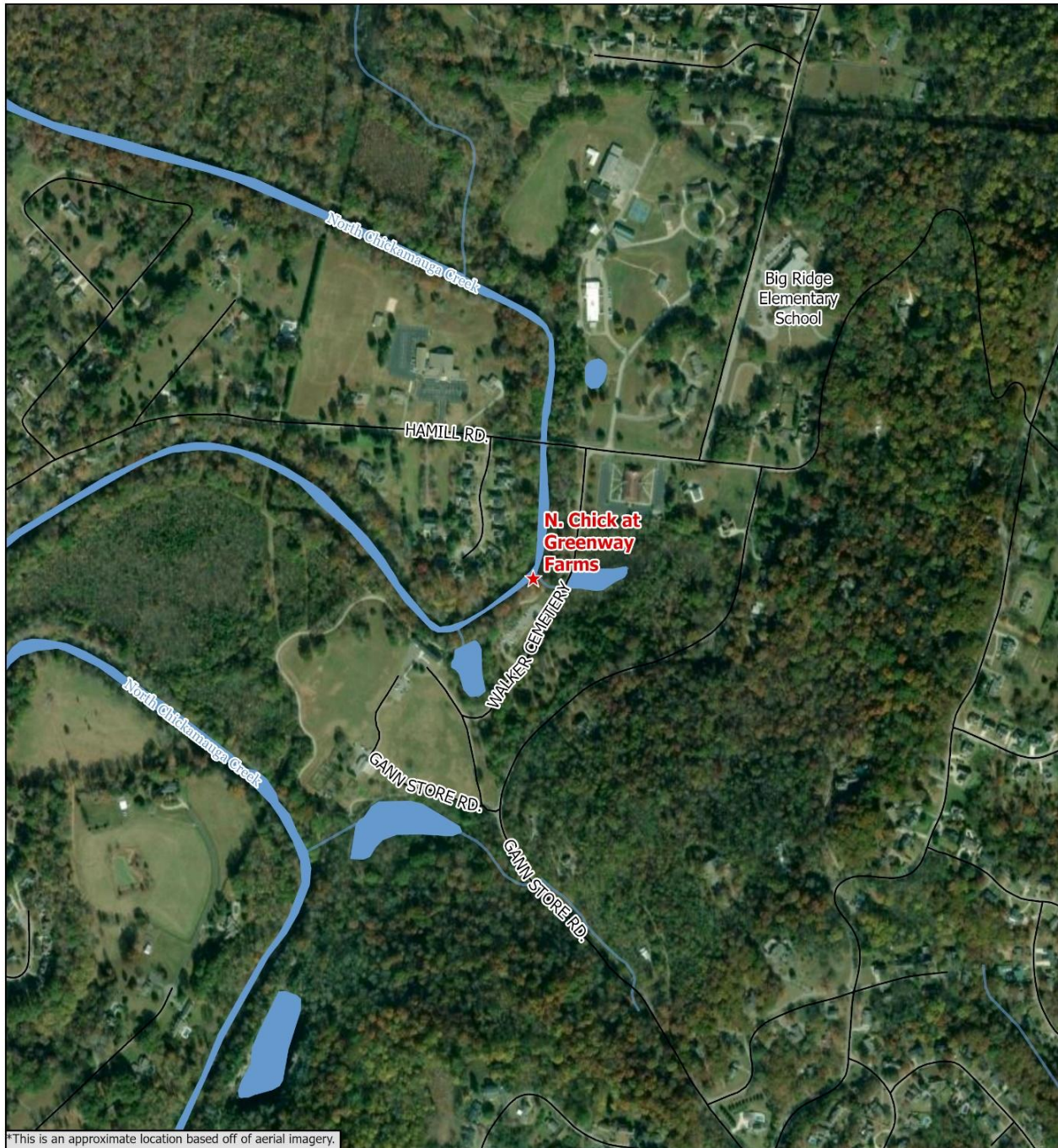
0 300 600 1,200
US Feet

Legend

- ★ Monitoring Station
- Road
- Stream
- Waterbody



City of Chattanooga/Hamilton County Monitoring Stations - North Chickamauga Creek at Greenway Farms



0 300 600 1,200
US Feet

Legend

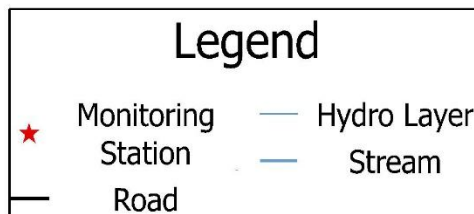
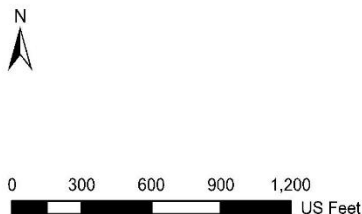
- ★ Monitoring Station
- Road

- Stream
- Waterbody



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City of Chattanooga/Hamilton County Monitoring Stations - North Chickamauga Creek at Ivy Academy



City of Chattanooga/Hamilton County Monitoring Stations - Mountain Creek at Red Bank Elementary



0 300 600 1,200
US Feet

Legend



Monitoring
Station

— Road

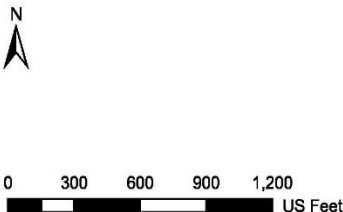
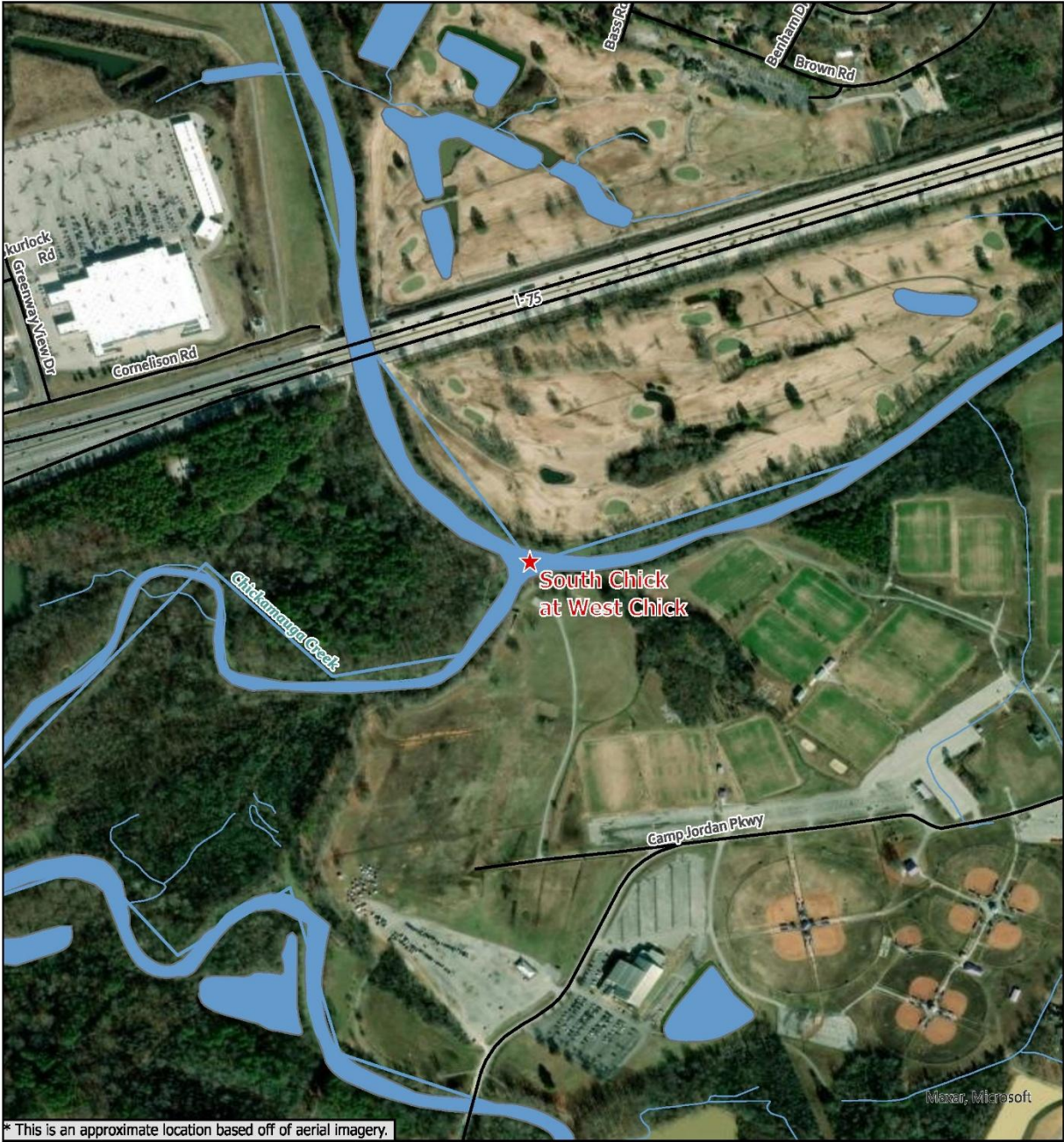
— Stream

Waterbody



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City of Chattanooga/Hamilton County Monitoring Stations - South Chickamauga Creek at West Chickamauga



Legend

★

Monitoring Station

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Hydro Layer

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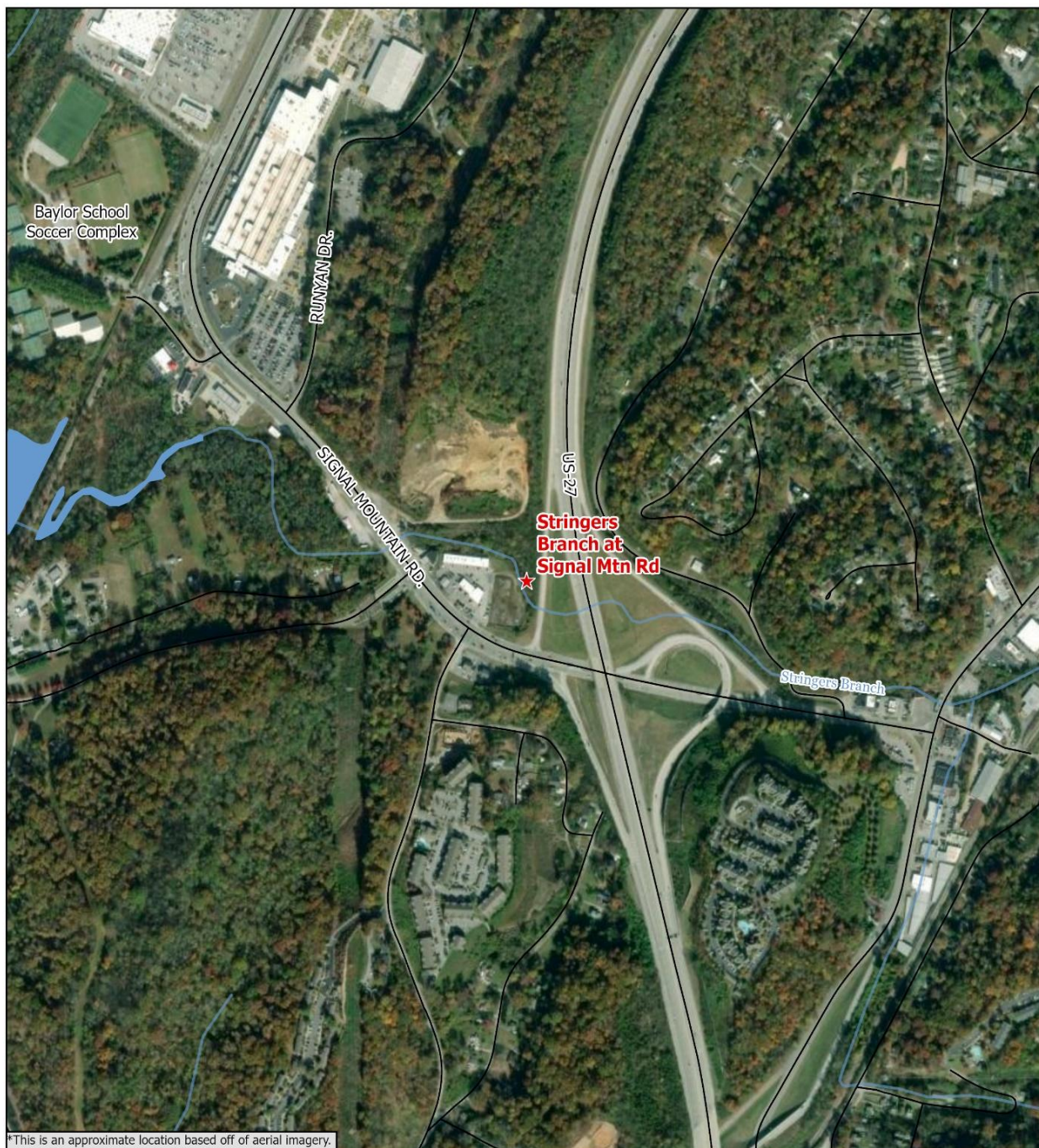
Stream

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Road



City of Chattanooga/Hamilton County Monitoring Stations - Stringers Branch at Signal Mountain Road



0 300 600 1,200
US Feet

Legend

- ★ Monitoring Station
- Road
- Stream
- Waterbody



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