TECHNICAL MEMORANDUM

Task 2.5 SSO 700 IWAP Water Quality Data Collection Program Summary

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Hamilton County and the Metropolitan Sewer District of Greater Cincinnati (MSDGC) are developing an Integrated Watershed Action Plan (IWAP) for the SSO 700 watershed. The objectives of this work are to maximize improvement to water quality and meet the Consent Decree and Final WWIP SSO and CSO control requirements. To achieve these objectives, CH2M, Hamilton County, and MSDGC will characterize the various sources of pollution and the roles they have in impairments in the SSO 700 watershed. The team will also identify an optimum combination of cost-effective and affordable gray infrastructure, sustainable infrastructure, and watershed-based controls for the watershed. Mathematical modeling of collection systems, watersheds, and surface water quality will be necessary to perform characterizations and evaluate plan alternatives. A data gap analysis was performed to identify data needs for the models and recommend a sampling program to fill the gaps. A Water Quality Data Collection Program was approved and performed in 2015. This technical memorandum documents the water quality data collection program that was conducted in 2015 for the SSO 700 IWAP.

1.0 Introduction

The Water Quality Data Collection Program was designed to characterize sources and surface waters during dry and wet weather events to support the updating and/or development of existing and new watershed and surface water quality models for use in the development of the IWAP. The objective of the Program was to fill data gaps identified in CH2M's *SSO 700 IWAP Task 2.4 Inventory and Gap Analysis* technical memorandum (CH2M, 2015a) and *SSO 700 IWAP Task 2.6.1 Watershed and Water Quality Models Gap Analysis and Update Assessment* technical memorandum (CH2M, 2015b). The Water Quality Data Collection Program was designed to further characterize stormwater, CSO, SSO, and tributary influences on Mill Creek and support surface water quality model development in a watershed-based approach. This technical memorandum describes implementation of the Water Quality Data Collection Program, presents summaries of the data collected, and assesses how data quality objectives were achieved.

This technical memorandum is organized as follows:

- Description of Sampling Components
- Sampling Locations and Parameters
- Sampling Events Log
- Data Collection Observations Summary
- QAPP/SAP Objectives Assessment

- Summary
- Works Cited
- Appendices

2.0 Description of Sampling Components

A variety of sampling methods were required to address the data gaps identified in the gap analysis. A Quality Assurance Project Plan (QAPP) was developed for the Water Quality Data Collection Program to assure that the Program was conducted in a manner consistent with applicable U.S. EPA guidance documents and with generally accepted and approved water quality assurance objectives (CH2M, 2015c). The QAPP integrates quality control policies and project-specific work tasks so that the water quality monitoring was conducted to support the project objectives.

The details of the Water Quality Monitoring Program were described in the Sampling and Analysis Plan (SAP) (CH2M, 2015d) that supplemented the QAPP. The program consisted of three components:

1. Dry weather water quality sampling in the Mill Creek and its tributaries - Measurements collected during dry weather conditions provided a baseline-level assessment of conditions and provided calibration data for typical, non-storm event conditions. These conditions reflect periods when the primary pollutant sources are permitted direct discharges, with minimal contributions from CSOs, SSOs, and non-point sources.
2. Wet weather water quality sampling in the Mill Creek, its tributaries, and CSO, SSO and stormwater outfalls – During storm events, CSOs, SSOs, and stormwater runoff can contribute flow and pollutant loading to waterbodies. Storm event sampling data are used to determine how high constituent concentrations can go and whether the model or inputs need to be adjusted to provide accurate calculations for storm event periods. Collection of multiple samples during storm events provide a quantification of pollutographs during wet weather events. (Pollutographs describe the variation in pollutant concentrations over time.)
3. Watershed flow monitoring at seven upstream/headwater tributary locations – In-stream flow is measured at seven locations within the SSO 700 study area, on the primary tributaries to Mill Creek. Measurement of flow data was required to provide a dataset for calibration of flows predicted by the SWMM watershed model and to provide flows from tributaries for the hydraulic calibration of the EFDC water quality model.

Mobilization to implement the QAPP and SAP started in June 2015. Sampling activities commenced in the mid-June and ceased at the end of November 2015, at which time equipment was removed from sampling locations. The program was led by CH2M with support from subconsultants LimnoTech, Browne E & C Services, Inc. (Browne), and Alloway Laboratories (Alloway).

3.0 Sampling Locations and Parameters

Monitoring and sampling locations were selected to characterize the watershed at a sub-watershed level recognizing key political boundaries, significant hydrologic features, land use, and potential pollutant sources. Site selection and analytical parameters were designed to characterize stream segments and pollutant sources primarily along the main stem of the Mill Creek. Sample locations were selected to balance the key geographical points for distinguishing wet weather sources with site accessibility and safety considerations.

As shown in Figure 1, water quality monitoring was undertaken at seventeen (17) in-stream locations (five of which are upstream tributary sampling locations) and fourteen (14) outfall or source channel discharge flow locations in the Mill Creek Watershed. Water quality monitoring and sampling were conducted as follows:

- All twelve (12) in-stream and five (5) upstream tributary locations were sampled for water quality for (3) dry weather events; one of which was targeted for collection during a low-flow period (less than 25th percentile flow). These events were distributed across the sampling season. Grab samples and in-situ measurements were collected at each location during each event.
- Four (4) of the in-stream locations were continuously monitored for physical parameters over a 5-day period during each dry weather event using data sondes. The U.S. Geological Survey (USGS) provided continuous monitoring capabilities at one of the four (4) locations. Daily grab samples were collected at these four (4) locations during the continuous monitoring period and analyzed for a subset of parameters.
- The twelve (12) in-stream locations were sampled for water quality using grab samples and in-situ monitoring for four (4) discrete wet weather events.
- Five (5) upstream tributary locations were sampled for water quality for the same four (4) discrete wet weather events. These samples were collected manually. No in-situ measurements were made at these locations.
- Thirteen (13) outfall locations were sampled for water quality for the same four (4) discrete wet weather events. Samples at all outfalls were collected using automatic water samplers. No in-situ measurements were made at these locations.
- Effluent water quality samples at the SSO 700 storage and treatment facility (SSO 700 TRT) were collected during wet weather events in which treatment activated and/or the facility tank system overflowed. Samples at this location were collected using an automatic water sampler. No in-situ measurements were made at this location.

These sampling types, conditions and timing for sampling, and sampling locations are summarized in Table 1. Specific details of the surface water sampling locations are provided in Table 2. Specific details of the outfall sampling locations are provided in Table 3.

Figure 1. SSO 700 IWAP Sampling Location Map

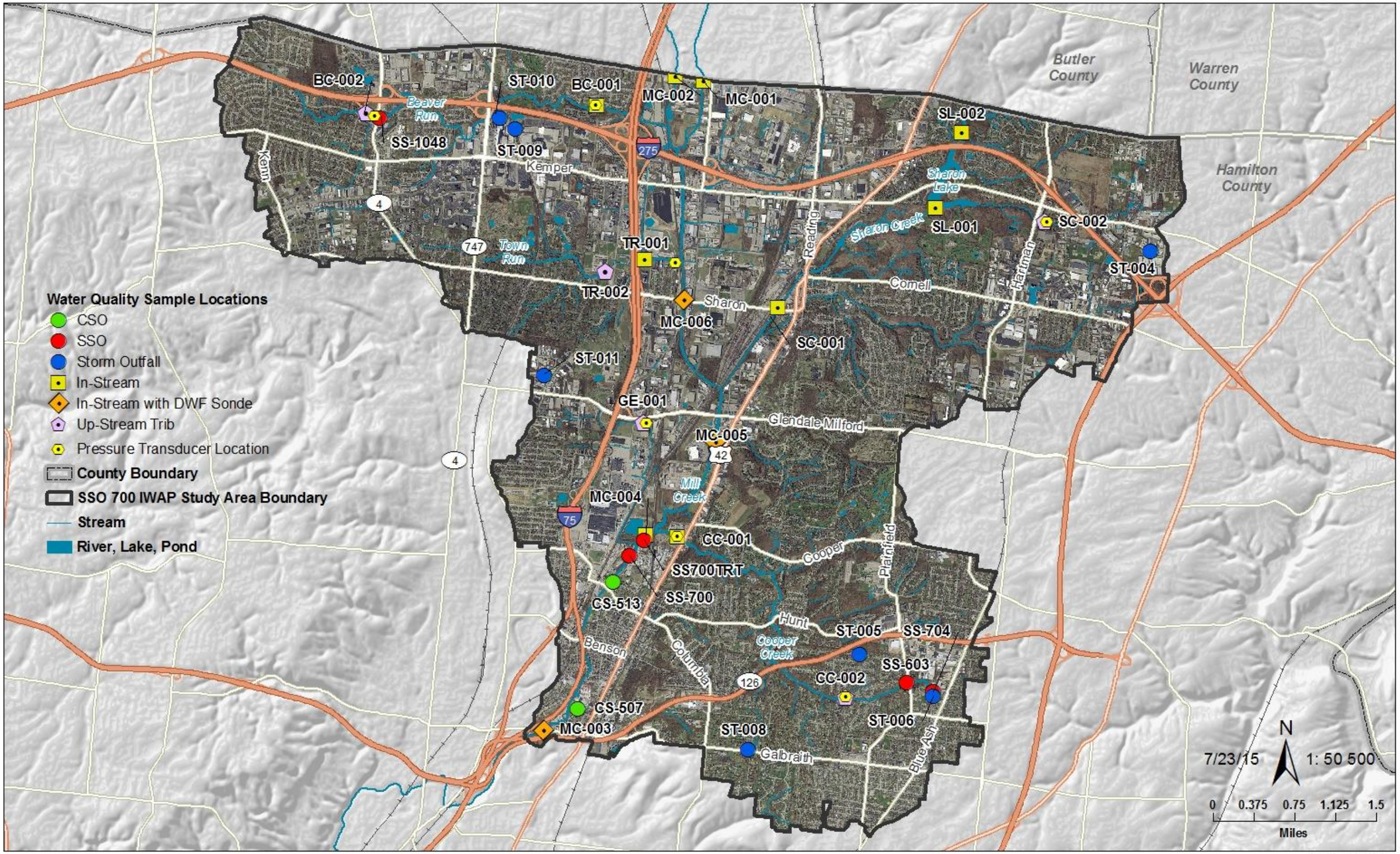

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Table 1. Summary of Water Quality Collection Sampling Program Components

Sampling Type	Condition	Sampling	Sampling Locations
Dry Weather In-Stream	Dry, no rain for previous 3 days	Grab Samples and in-situ physical measurements at all locations[1]	12 In-Stream Locations 5 Upstream Tributary Locations Sondes installation for 5 days at three locations (MC003, MC005, and MC006)
Wet Weather In-Stream	Forecast for more than 0.5“ rain, preceded by 48 hours of dry weather.	Grab Samples and in-situ physical measurements for 5 sampling rounds: 0.5-2.5 hours 4-6 hours 8-10 hours 14-16 hours 22-24 hours	12 In-Stream Locations
Wet Weather Upstream Tributary Locations	Forecast for more than 0.5“ rain, preceded by 48 hours of dry weather.	Grab Samples for 4 sampling rounds: - Pre-First Flush - First Flush - 30 min - 60 min	5 Upstream Tributary Locations
Wet Weather Outfalls	Forecast for more than 0.5“ rain, preceded by 48 hours of dry weather.	Samples collected via automatic sampler for 3 sampling rounds: First Flush - 30 min - 60 min	12 of 13 Outfall Locations via automatic water sampler
Wet Weather SSO 700 TRT	Forecast for more than 0.5“ rain, preceded by 48 hours of dry weather.	Samples collected via automatic sampler for 7 sampling rounds: First Flush - 30 min - 60 min - 2 hours - 4 hours - 6 hours - 8 hours	1 SSO 700 Outfall and 1 SSO 700 combined treatment facility effluent and overflow from facility storage tanks. Both sampled via automatic water samplers.
Flow Characterization	Distributed over 90 day deployment at varying conditions of dry and wet weather.	Pressure Transducers Manual flow measurements	7 Tributary Locations (BC-001, BC-002, SC-002, CC-001, CC-002, GE-001, TR-001)

[1] CSO, SSO, and stormwater outfalls were not included in the dry weather sampling since there should be no flow during these periods.

Table 2. Surface Water Sampling Locations

Station ID	Easting	Northing	Waterbody	Description	Rationale	Monitoring Type
In-Stream and Tributary Locations						
MC-001	1,422,494.20	478,832.60	East Fork Mill Creek	East Crescentville Road Bridge	Characterize water quality in East Fork Mill Creek as it enters Hamilton County and SSO 700 IWAP project area. Corresponds to MBI location MC14 and DIW MIL-CR-11	Dry weather, wet weather
MC-002	1,421,140.65	479,037.18	Mill Creek	East Crescentville Road Bridge	Characterize water quality in Mill Creek as it enters Hamilton County and SSO 700 IWAP project area. Corresponds to MBI location MC10 and DIW MIL-CR-12	Dry weather, wet weather
MC-003*	1,414,744.42	447,389.33	Mill Creek	Galbraith Road Bridge	Characterize water quality in Mill Creek as it flows out of the SSO 700 IWAP project area and upstream of West Fork Mill Creek confluence. Corresponds to MBI location MC01 and MIL-CR-07	Dry weather, wet weather, continuous
MC-004	1,419,693.73	456,872.27	Mill Creek	Upstream of SSO 700 Treatment Facility	Characterize water quality upstream of SSO 700 discharges. Corresponds to MBI location MC11	Dry weather, wet weather
MC-005*	1,423,047.09	461,354.62	Mill Creek	Cunningham Drive	Characterize water quality in Mill Creek downstream of Sharon Creek confluence. Near MBI location MC04 and DIW MIL-CR-09	Dry weather, wet weather, continuous
MC-006*	1,421,524.47	468,240.63	Mill Creek	East Sharon Road Bridge	Characterize water quality in Mill Creek upstream of Sharon Creek confluence, will capture Beaver Run, Town Run and East Fork Mill Creek contributions. Corresponds to MBI location MC06	Dry weather, wet weather, continuous
SC-001	1,426,072.74	467,868.47	Sharon Creek	YMCA Dr.	Characterize water quality from Sharon Creek watershed.	Dry weather, wet weather, continuous (USGS)
SL-001	1,433,730.05	472,692.82	Sharon Woods Lake	Buckeye Falls Drive	Characterize water quality at the downstream end of Sharon Woods Lake (at dam)	Dry weather, wet weather
SL-002	1,435,004.53	476,314.58	Sharon Woods Lake	Bike and walk pathway crossing off Big Ben Ct.	Characterize water quality into Sharon Woods Lake. Corresponds to MBI location MC29	Dry weather, wet weather

Table 2. Surface Water Sampling Locations

Station ID	Easting	Northing	Waterbody	Description	Rationale	Monitoring Type
BC-001	1,417,331.22	477,632.65	Beaver Run	Chesterdale Road	Characterize water quality from the Beaver Run watershed. Corresponds to MBI location MC22	Dry weather, wet weather, flow
CC-001	1,421,204.36	456,764.45	Cooper Creek	Downstream of Reading Road Bridge	Characterize water quality from the Cooper Creek watershed	Dry weather, wet weather, flow
TR-001	1,419,638.84	470,197.11	Town Run	Bridge to Travelodge hotel off Dowlin Drive	Characterize water quality from the Town Run watershed. Corresponds to MBI location MC25.	Dry weather, wet weather, flow
Upstream Tributary Locations						
SC-002	1,438,965.25	472,037.99	Sharon Creek watershed	Timber Ridge Apartment Complex off of Kemper Road.	Just upstream of MBI location MC36.	Dry weather, wet weather, flow
CC-002	1,429,317.95	449,020.79	Cooper Creek watershed	Wexford Avenue	Just upstream of MBI location MC32	Dry weather, wet weather, flow
BC-002	1,406,142.56	477,286.37	Beaver Run watershed	Glensprings and Rose Dr. (behind Howard Johnsons Hotel)	Corresponds to MBI location MC41	Dry weather, wet weather, continuous, flow
GE-001	1,419,566.68	462,287.56	G.E. tributary	Adj. Evendale Dr., upstream side of bridge	Corresponds to MBI location MC37	Dry weather, wet weather, flow
TR-002	1,417,732.60	469,616.20	Town Run watershed	Upstream of Glendale WWTP outfall at bridge between Princeton High School properties	Just upstream of MBI location MC34	Dry weather, wet weather

*The dissolved oxygen (DO) conditions at these locations (MC-003, MC-005, MC-006) were assessed during the dry weather surveys with continuous monitors to be deployed for 3 to 5 days. The DO conditions at SC-001 are being assessed by the USGS. Daily grab sampling of nutrients, oxygen-demanding parameters and chlorophyll over the sonde deployment period were also conducted to inform the DO water quality model calibration (described in Task 2.5.3 of the SAP).

Table 3. Outfall Water Sampling Locations

Station ID	Easting	Northing	Outfall ID	Description	Rationale
CS-507	1,416,420.81	448,451.13	CSO-507	214 Clark St. Grating	46 activations and ~31 MG OF in a typical year, highest among the CSOs in the SSO 700 project area. High probability of sufficient discharge to sample for WQ.
CS-513	1,418,126.28	454,608.71	CSO-513	Bernard & Reisenberg Grating	45 activations and ~18 MG OF in a typical year. High probability of sufficient discharge to sample for WQ.
SS-603	1,432,317.06	449,726.38	SSO-603	8879 Plainfield Avenue	30 activations and ~9.6 MG OF in a typical year, second highest (after SSO 700 HRT) among the SSOs in the project area. Highest likelihood of having sufficient discharge frequency and volume to sample. Largest SSO in Cooper Creek. Appears to be easily accessed from walking trail in Park.
SS-1048	1,406,805.34	477,053.06	SSO-1048	NE of Springfield and Glensprings Rds.	10 activations and ~10 MG OF in a typical year. Some likelihood of obtaining WQ samples. Only SSO location discharging to Beaver Run targeted for sampling.
SS-704	1,433,593.08	449,291.16	SSO-704	8811 Tudor Avenue	14 activations and ~7 MG OF in a typical year. Some likelihood of obtaining WQ samples.
SS-700	1,418,900.58	455,866.72	SSO 700	Constructed SSO 700 overflow, collected at SSO 700 Storage and Treatment Facility	Characterize constructed SSO 700 overflow discharge quality.
SS700TRT	1,419,604.59	456,628.53	SS700TRT	SSO 700 Storage and Treatment Facility discharge	Characterize pollutant loads discharged from facility (both effluent from treatment and overflow from tanks) to Mill Creek.
ST-004	1,444,117.69	470,586.13	ST-004	Outlet headwall for storm system serving Redsky Drive	Storm outlet to capture runoff from industrial uses.
ST-005	1,430,034.57	451,071.53	ST-005	Storm manhole in Tramore Drive, just west of Mantell Avenue	Storm outlet to capture runoff from residential uses.
ST-006	1,433,562.16	449,060.34	ST-006	Storm catch basin in Tudor Court, near intersection with Daffodil Avenue	Storm outlet to capture runoff from residential uses.
ST-008	1,424,661.80	446,467.60	ST-008	Headwall at northeast intersection of East Galbraith Road and Springvalley Drive	Storm outlet to capture runoff from low-density residential.
ST-009	1,413,386.26	476,529.08	ST-009	Headwall into detention basin serving Kemper Commons development	Storm outlet to capture runoff from commercial (including transportation).
ST-010	1,412,641.91	477,052.70	ST-010	Manhole for drainage system at Tri-County Mall	Storm outlet to capture runoff from commercial
ST-011	1,414,768.35	464,596.47	ST-011	Manhole serving Skillman Dr. in Woodlawn	Storm outlet to capture industrial

Alloway set up a mobile laboratory at MSDGC's Wastewater Collection Division facility on Galbraith Road to stage equipment and process samples collected in the field. The parameters collected for each sampling program component are summarized in Table 4.

Table 4. Analytical and Field Parameters

Parameter	Description	Sampling Program	Type of Measurement
E. coli	Escherichia coliform	Dry, Wet	Grab
TSS	Total suspended solids	Dry, Wet	Grab
Cl-	Chloride	Dry, Wet	Grab
Copper	Total recoverable copper	Dry, Wet	Grab
Lead	Total recoverable lead	Dry, Wet	Grab
Zinc	Total recoverable zinc	Dry, Wet	Grab
Hardness	Hardness	Dry, Wet	Grab
CBOD5	5-day Carbonaceous Oxygen Demand	Dry, Wet	Grab(s)[1]
NH3	Total ammonia (NH3)	Dry, Wet	Grab(s)[1]
NO3+NO2	Nitrate plus nitrite (NO3+NO2)	Dry, Wet	Grab(s)[1]
TKN	Total Kjeldahl nitrogen	Dry, Wet	Grab(s)[1]
TP	Total Phosphorus	Dry, Wet	Grab(s)[1]
oPO4	ortho-Phosphate	Dry, Wet	Grab(s)[1]
Chl a	Chlorophyll a	Dry	Grab(s)[1]
TOC	Total organic carbon	Dry, Wet	Grab(s)[1]
DO	Dissolved oxygen	Dry, Wet	In-situ
		Dry	Continuous 3-5 days[1]
wTemp	Water temperature	Dry, Wet	In-situ
		Dry	Continuous 3-5 days[1]
pH	pH	Dry, Wet	In-situ
		Dry	Continuous 3-5 days[1]
Cond	Conductivity	Dry, Wet	In-situ

[1] The continuous DO monitoring were conducted at three locations in Mill Creek. Additional grab samples for nutrient and BOD parameters were collected once per day during the continuous DO monitoring period at these three Mill Creek locations and at the Sharon Creek at Reading Road location where the USGS gauge is located.

Watershed runoff hydrology was characterized by flow monitoring at three upstream tributary and four downstream locations. Pressure transducers were deployed at these seven in-stream locations within the SSO 700 IWAP project area. Flow and velocity were measured approximately 20 times at each location to develop a rating curve relating flow to the depth measured by the transducers. The seven (7) monitoring locations are summarized below in Table 5.

Table 5. Watershed Flow Monitoring Locations

No.	Station ID	Location	Reason for Inclusion
1	CC-001	Cooper Creek near Reading Road	Measure flow from Cooper Creek
2	CC-002	Cooper Creek headwater near Wexford Avenue	Measure flow from residential area
3	GE-001	G.E. Tributary near Evendale Dr.	Measure flow from the G.E. Tributary and associated industrial area
4	BC-001	Beaver Creek near Chesterdale Road	Measure flow from Beaver Creek
5	BC-002	Beaver Creek headwater near Glensprings and Springfield Pike	Measure flow from residential area
6	SC-002	Sharon Creek headwater	Measure flow from mixed use area
7	TR-001	Town Run near Canal Road	Measure flow from Town Run

4.0 Sampling Events Log

CH2M, LimnoTech, Browne, and Alloway collaborated on weekly and sometimes daily calls to identify specific dates on which sampling would occur based on forecasted rainfall and the dry and wet weather sampling event criteria. This section summarizes the sampling events performed.

4.1 Dry Weather Sampling

Collection of dry weather water quality samples was performed for three (3) events; one of which occurred during a low-flow period (less than 25th percentile flow). These events were distributed across the sampling season, June through October of 2015. The criteria used to define a dry weather event were the following:

- No precipitation within the upstream watershed at least 48 hours before the event;
- No precipitation forecasted for a minimum of three days; and,
- For the low-flow survey, conditions when the in-stream flow at the USGS gage in Carthage (USGS 03259000 Mill Creek at Carthage) is less than the 25th percentile flow at this location were targeted for sampling.

During the first day of a dry weather event, sondes were installed at three locations in Mill Creek to monitor dissolved oxygen, temperature and pH on a 15-minute frequency for a period of approximately five days. The sonde data was downloaded at the end of the five day deployment period. In addition, the USGS has a gage in Sharon Creek at Reading Road (USGS 03255390 Sharon Creek at Sharonville) that collects continuous DO and temperature. These data were obtained from the USGS for the Mill Creek continuous monitoring periods.

Grab samples and in-situ measurements were collected at the 17 in-stream and tributary locations typically on the second day of the dry weather event. In-situ measurements were made at the same locations as the grab samples. At the Sharon Woods Lake outlet station (SL-001), in-situ measurements were made in 1-foot intervals over the depth of the water column. Grab samples were processed for the parameters listed in Table 4. Samples were delivered to Alloway's mobile laboratory each day for processing.

Grab samples at the continuous monitoring locations were collected each day that the sondes were deployed. Grab samples of nutrients (NH3, NO3+NO2, TKN, TP, ortho-PO4), BOD5, TOC and Chl-a were collected at each of the sonde locations, including the Sharon Creek location being monitored by the USGS.

A summary of the dry weather events is provided in Table 6.

Table 6. Dry Weather Events Summary

Dry Event Number	Start Date/Time	End Date/Time	Sampling Type	# of Grab Samples Collected	Comments
1	6/24/2015		Grab	17	No continuous monitoring data were downloaded due to battery failure. Event was less than 5 days due to rain entering the watershed.
	6/22/2015	6/25/2015	Continuous	12	
2 (Partial)	8/17/2015		Grab	15	On afternoon of 8/17/15, a thunderstorm formed over the SSO 700 study area resulting in rainfall accumulations of nearly 1 inch in isolated portions of the study area. The rain was enough to force the team to end the dry weather event before grab sampling at all in-stream locations could be completed. Two sites were not sampled.
	8/16/2015	8/17/2015	Continuous	4	The sondes were installed for approximately 24 hours before the rain fell. One set of samples was collected at the sondes on Day 1 of the event. Sondes were removed on Day 2.
2	8/25/2015		Grab	15	Flow at USGS Carthage was less than 25th percentile; therefore, low flow conditions were achieved for this event. Two sites did not have sufficient flow for sampling.
	8/24/2015	8/28/2015	Continuous	12	
3	10/6/2015		Grab	16	One site did not have sufficient flow for sampling.
	10/5/2015	10/9/2015	Continuous	12	

4.2 Wet Weather Sampling

Four wet weather events were monitored. The wet weather events spanned a range of precipitation, flow, and seasonal conditions. Rainfall observed at the USGS 03255420 Mill Creek at Evendale Station are tabulated in Appendix A. The goal was to sample storms of at least 0.5 inches of precipitation. The criteria used to define a wet weather event were the following:

- No precipitation within the upstream watershed 48 hours before the event;
- Forecasts for a 60% (or greater) chance of rain over the entire SSO 700 IWAP project area; and,
- A minimum of 0.50 inches of rainfall forecasted over a six-hour period.

The wet weather criteria served as the minimum requirements for initiating sampling. Best professional judgment was necessary to assess the suitability of a particular wet weather sampling event. Determination to mobilize for a rain event was a collaborative effort between CH2M, LimnoTech, Alloway, and Browne based on a forecast that the above criteria were satisfied and all resources were available through the intended duration of sampling. A standing weekly call was held to evaluate the weather forecast and schedule sampling events. More frequent communication occurred leading up to an identified potential event. Authorization for initializing a wet weather event was determined by consensus of CH2M, LimnoTech, Alloway, and Browne personnel, based on discussions concerning rain information provided by the National Weather Service, various weather websites, and local news.

Twelve (12) in-stream sampling locations had five (5) rounds of sampling conducted during each wet weather event. Sampling intervals were adjusted to address the timing of each distinct event. Because CSOs and SSOs do not always trigger as quickly as stormwater outfalls, it was necessary to sample these outfalls at times measured from the start of the overflow activation rather than from the beginning of precipitation. Although thirteen (13) outfalls were identified for water quality sampling, it is important

to note that not all of them overflowed during every wet weather event. Actively discharging outfalls among the thirteen (13) outfalls were sampled during each wet weather sampling event.

Additional samples were collected during each event to be used as field quality control (e.g., field blanks, field duplicates). Field duplicates were not collected at any outfall sample locations due to volume limitations.

When the SSO 700 TRT was discharging from the storage tanks and/or from the high rate flocculation and treatment system, the autosampler at this location was programed to collect effluent water quality samples at the following intervals: first flush, 30 minutes, 60 minutes, 2 hours, 4 hours, 6 hours, and 8 hours, with an option to collect an 8th sample to be used as a field duplicate. The autosampler used to sample the constructed SSO 700 overflow was programmed similarly.

A summary of the wet weather events is provided in Table 7. The return period for each wet weather event was estimated assuming a 24-hour event using NOAA's Bulletin 71 rainfall tables (NOAA and IDENR, 1992). The return periods are included in Table 7.

Table 7. Summary of Wet Weather Events

Wet Event Number	Start Date/Time	End Date/ Time	Rainfall Depth[1]	Maximum Hourly Rainfall Intensity[1]	# of Grab Samples Collected	Comments
1	8/5/2015	8/6/2015	1.36 in. (87th percentile)	0.28 in/hr (<3 mo.)	In-stream: 61 Upstream Tribs: 20 Outfalls: 25	Hour 0 was called at 4:30 a.m. on 8/6/15. The intensity of the initial rain varied significantly across the watershed, but the rainfall ultimately settled in to be consistent across the study area. CSOs 513 and 507 overflowed. SSOs 704 and 1048 overflowed. SSO 700 TRT treatment was turned on and discharge samples were collected.
2	9/29/2015	9/30/2015	0.48 in. (54th percentile)	0.08 in/hr (<2 mo.)	In-stream: 78 Upstream Tribs: 18 Outfalls: 9	The wet weather event began around 6 am with low-intensity rain. Hour 0 was called at 8:45 am on 9/29/15 after sufficient rain fell to generate runoff.
3	10/27/2015	10/28/2015	2.44 in. (95th percentile)	0.32 in/hr (1 year)	In-stream: 90 Upstream Tribs: 19 Outfalls: 47	Hour zero was called at 4:30 pm on 10/27/15 after several hours of light rain, which had not triggered any runoff. The rainfall intensity increased, and the ultimate rainfall depth reached 2.44 in. Due to the long duration of the event, a second set of outfall samples were collected at locations still discharging approximately 6 hours into the event. A sixth round of in-stream sampling was also added to better capture the stream return to base flow conditions. SSO 700 TRT treatment was turned on and discharge samples were collected.

Table 7. Summary of Wet Weather Events

Wet Event Number	Start Date/Time	End Date/ Time	Rainfall Depth[1]	Maximum Hourly Rainfall Intensity[1]	# of Grab Samples Collected	Comments
4	11/6/2015	11/7/2015	1.04 in. (80th percentile)	0.68 in/hr (<2 mo.)	In-stream: 78 Upstream Tribs: 19 Outfalls: 32	Hour 0 was called at 2:00 am on 11/6/15. This rainfall event was higher intensity and shorter duration than the previous wet weather event. Several CSOs and SSOs discharged. SSO 700 TRT treatment was turned on and discharge samples were collected.

[1] Rainfall data from USGS 03255420 Mill Creek at Evendale Station.

Table 8 summarizes the samples collected at each outfall by wet weather event. The collection of a sample is indication that the overflow or storm outfall activated for a given event. For combined sewer overflows and sanitary sewer overflows for which no sample was collected, the table entry indicates whether or not the overflow activated. In some cases, the overflow did activate according to MSDGC's Telog records, but no sample was taken. This may be due to an autosampler malfunction or flow levels too low to activate the autosampler. All stormwater outfalls are assumed to have activated during each wet weather event. Autosampler malfunction or low flow levels are the likely reasons why samples were not collected during some events at some stormwater outfall locations.

Table 8. Summary of Outfall Samples Collected by Event

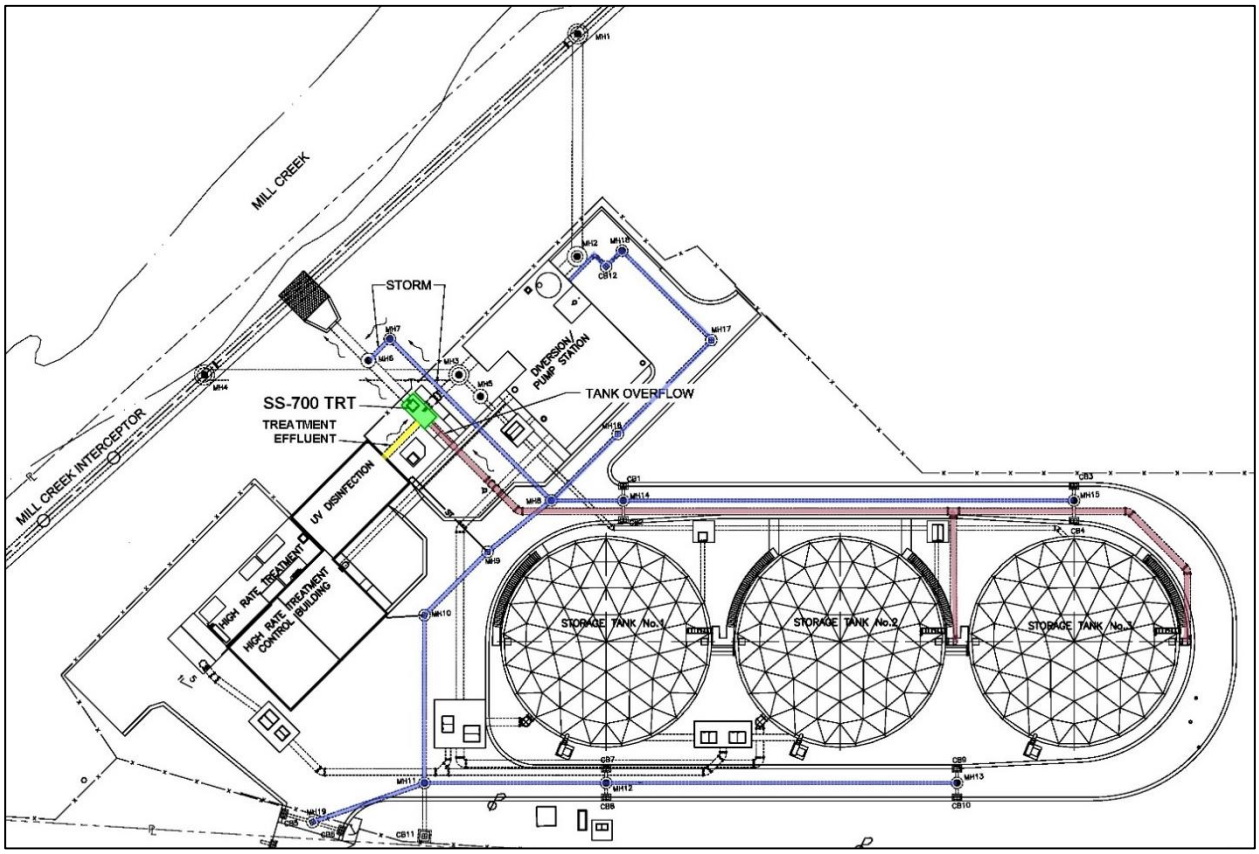
Location	Total Number of Samples Collected	Wet Weather Event #1	Wet Weather Event #2	Wet Weather Event #3	Wet Weather Event #4
Combined Sewer Overflow Locations					
CS-513 (CSO)	5	2	0 (no activation)	1	2
CS-507 (CSO)	8	3	3	0 (activation, but no sample collected)	2
Sanitary Sewer Overflow Locations					
SS-603 (SSO)	1	0 (no activation)	0 (no activation)	0 (no activation)	1
SS-1048 (SSO)	6	3	0 (no activation)	3	0 (no activation)
SS-704 (SSO)	2	0 (no activation)	0 (no activation)	0 (no activation)	2
SS-700 (SSO)	6	0 (no activation)	0 (no activation)	4	2
SS-700 TRT	13	4 (The first 3 samples are from combination of treated effluent and tank overflow. The fourth sample is treatment effluent only.)	0 (no activation)	7 (All samples from treated effluent; tanks overflowed later in the event, but no samples collected when tanks overflowed.)	2[1] (Both samples from treated effluent; tanks did not overflow.)

Table 8. Summary of Outfall Samples Collected by Event

Location	Total Number of Samples Collected	Wet Weather Event #1	Wet Weather Event #2	Wet Weather Event #3	Wet Weather Event #4
Stormwater Outfall Locations					
ST-004 (Ind.)	12	3	0	6	3
ST-011 (Ind.)	15	3	3	6	3
ST-009 (Com.)	11	0	3	6	2
ST-010 (Com.)	11	3	0	5	3
ST-005 (Res.)	3	0	0	0	3
ST-006 (Res.)	6	1	0	3	2
ST-008 (Res.)	12	3	0	6	3

[1] A total of six samples were collected at this location during Wet Event #4. Four of the six samples were collected before treatment at SSO 700 STF was turned on and while no overflow was discharged from the tanks. While the source of the flow collected for the first four samples cannot be determined with certainty, it was likely a mixture of stormwater backing up behind the outfall check valve to the sample location combined with residual fluid in the sump. See Figure 2 for the SS-700 TRT sample location on a schematic drawing of the SSO 700 STF.

Figure 2. SS-700 STF Location



4.3 Watershed Flow Monitoring

Pressure transducers were deployed at seven (7) in-stream locations within the upstream/headwater and lower tributary sections of the SSO 700 IWAP project area for a period of approximately 114 days, from July 29, 2015 through November 20, 2015, to collect stream stage (depth) data in the stream network for use in calibrating the watershed model.

Velocity and flow measurements were taken for approximately 18 events at each location under a range of conditions during the deployment to establish a relationship between stage and flow. The transducer deployed at CC-001 was washed away in late October so the stage data record and number of flow/velocity measurements was less than those recorded at the other six locations. A rating curve relating depth (and velocity) to flow was then developed for each location. This curve will be used to translate the transducer measurements into flow estimates.

Table 9. Summary of In-stream Flow Measurements at the Seven Flow Measurement Locations

Event Number	Date	Flow Condition	Comments
Continuous	7/29/2015 – 11/20/2015	Various	Record for CC-001 ends on 10/29/2015. Sensor was lost during a storm.
1	7/30/2015	Low	
2	8/6/2015	High	
3	8/19/2015	Low	
4	8/20/2015	Low	
5	8/28/2015	Low	
6	9/9/2015	Low	
7	9/10/2015	Low	
8	9/29/2015	Low	
9	9/29/2015	Mid-High	
10	9/30/2015	Low	
11	10/24/2015	Low	
12	10/27/2015	Low	
13	10/28/2015	Low-Mid	
14	10/28/2015	Mid-High	
15	11/6/2015	Low-Mid	Not performed for CC-001 site.
16	11/6/2015	Low-Mid	Not performed for CC-001 site.
17	11/6/2015	Mid-High	Not performed for CC-001 site.
18	11/18/2015	High	Not performed for CC-001 site.

4.4 Overflow Flow Monitoring

Concurrently with the SSO 700 Water Quality Data Collection Program, flow monitors were installed by MSDGC in the outfall pipes of three overflows: SSO 700, CSO 507, and CSO 513. Flow data at these locations were collected beginning on October 1, 2015. Therefore, flow data for these three overflows are available for Wet Weather Event #3 and Wet Weather Event #4 and were provided to the project team by MSDGC.

Additionally, MSDGC maintains a record of the hydraulic performance of the SSO 700 STF. Flow time series are available for each of the wet weather events for effluent discharge and for overflow from the storage tanks. These time series were provided by MSDGC and used to determine the alignment of the samples collected at SS-700 TRT with the source of the flow (effluent from treatment, overflow from tanks, or both).

5.0 Data Collection Observations Summary

This section presents a high level overview of the results from each of the Water Quality Data Collection Program elements. Additional detail on the data are provided in the appendices, as described below. Additional analysis and interpretation of the data will be conducted as part of the model development and calibration process.

5.1 Water Quality Sampling

Graphs of water quality sampling data for the in-stream locations (Mill Creek and downstream portion of the tributaries), the upstream tributary locations, and the outfall (CSO, SSO, and stormwater) locations are provided in Appendix B by parameter at sampling stations for each event. Examples of these graphs for *E. coli* are provided as Figures 3 through 8.

Figure 3. *E. coli* Measurements – In-stream Mainstem Stations

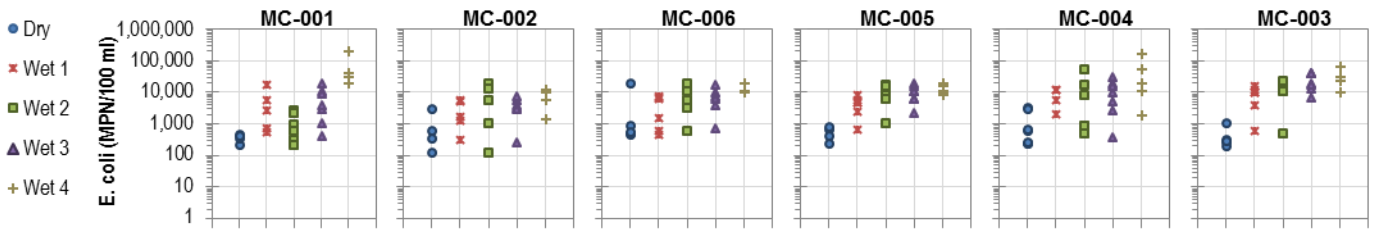


Figure 4. *E. coli* Measurements – In-stream Tributary Stations

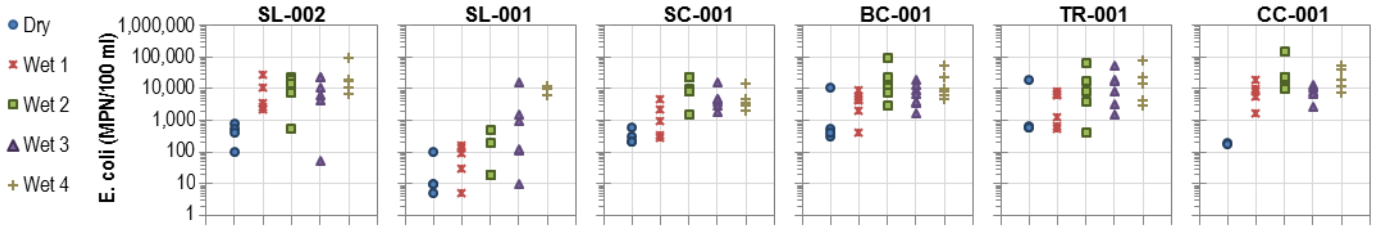


Figure 5. *E. coli* Measurements – Upstream Tributary Stations

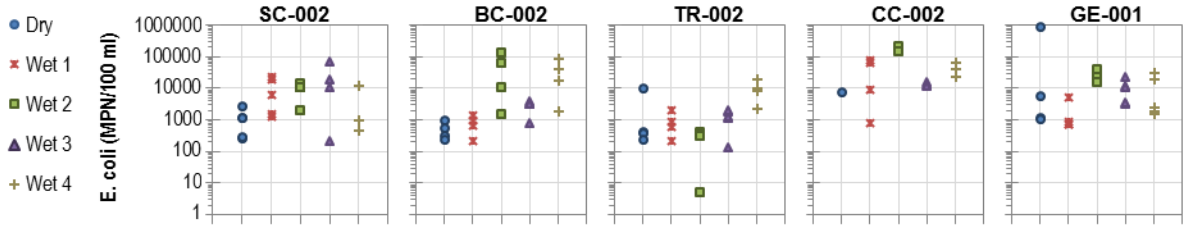


Figure 6. *E. coli* Measurements – CSO Outfalls

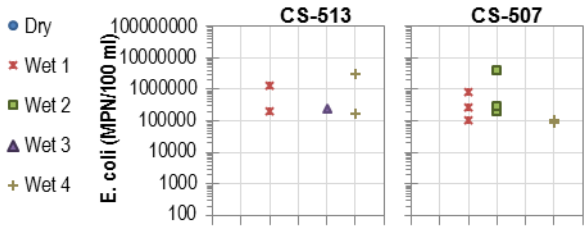


Figure 7. *E. coli* Measurements –SSO Outfalls

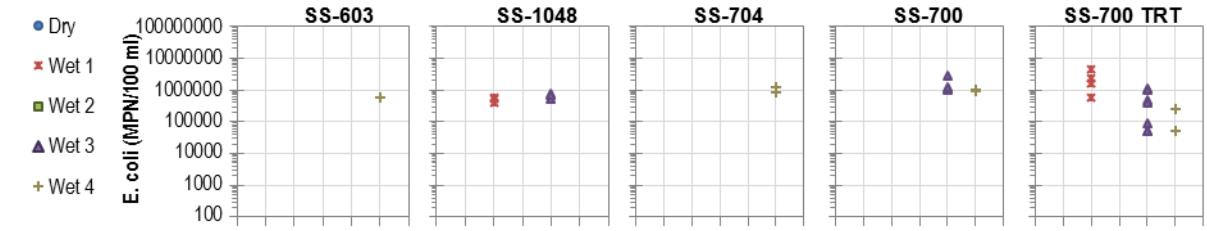
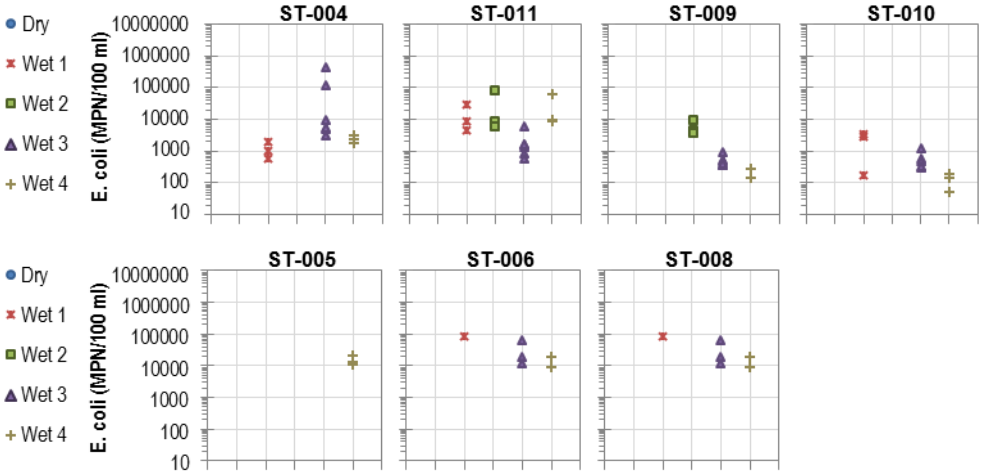


Figure 8. *E. coli* Measurements – Stormwater Outfalls



Minimum, median, average and maximum calculations for each parameter are also presented for each sampling location, grouped by the location type. Results include the data from the dry and wet weather sampling events. Non-detect data were assigned a value of one-half the reported detection limit for the calculation of the average concentration shown in the tables. Note that one of the fifteen laboratory parameters (chlorophyll a) and all four in situ parameters (DO, pH, specific conductance, and temperature) were not measured at the outfall locations so there are no results for these parameters at the CSO, SSO and stormwater sampling locations. An example of these tables for *E. coli* are provided as Tables 10 through 12. The tables for the remaining monitored parameters are provided in Appendix C.

Table 10. In-stream Mainstem - Escherichia coliform (*E. coli*) (MPN/100 ml)

Location	Number of Samples Collected	Minimum Concentration	Median Concentration	Average Concentration	Maximum Concentration	Location
In-stream Mill Creek (Upstream boundary locations)						
MC-001	28	216	2,613	15,161	199,000	East Fork Mill Creek (RM 0.79)
MC-002	25	120	3,255	4,871	20,000	Mill Creek (RM 18.88)
In-stream Mill Creek (Project area locations)						
MC-006	27	439	6,488	7,870	20,000	Mill Creek (RM 16.75)
MC-005	29	228	8,164	8,371	20,000	Mill Creek (RM 15.28)
MC-004	30	241	5,324	15,279	158,000	Mill Creek (RM 14.07)
MC-003	28	197	12,505	16,468	63,000	Mill Creek (RM 11.86)
In-stream Tributary Locations						
SL-002	25	52	7,270	13,550	97,000	Sharon Woods Lake (RM 3.78)
SL-001	24	<10	116	2,253	15,531	Sharon Woods Lake outlet (RM 3.0)
SC-001	27	213	3,076	5,550	24,196	Sharon Creek (RM 0.96)
BC-001	29	309	6,867	12,490	97,000	Beaver Creek (RM 0.74)
TR-001	26	422	6,499	13,944	75,000	Town Run (RM 0.34)
CC-001	22	183	10,600	20,238	146,000	Coopers Creek (RM 0.29)

Table 11. Upstream Tributary - Escherichia coliform (*E. coli*) (MPN/100 ml)

Location	Number of Samples Collected	Minimum Concentration	Median Concentration	Average Concentration	Maximum Concentration	Location
Upstream Tributary Locations						
SC-002	22	216	4,622	10,278	73,000	Sharon Cr (RM 3.82)
BC-002	20	216	1,701	18,623	134,000	Beaver Cr (RM 3.62)
TR-002	23	<10	908	3,116	20,000	Town Run Cr (RM 0.79)
CC-002	14	830	32,598	187,648	1,935,000	Cooper Cr (RM 3.36)
GE-001	22	717	5,483	50,569	880,000	Unnamed Trib (RM 1.42)

Table 12. Outfall - Escherichia coliform (*E. coli*) (MPN/100 ml)

Location	Number of Samples Collected	Minimum Concentration	Median Concentration	Average Concentration	Maximum Concentration	Location
Combined Sewer Overflow Locations						
CS-513 (CSO)	5	173,000	256,000	998,400	3,076,000	CSO (RM 0.11)
CS-507 (CSO)	8	84,000	237,000	755,750	4,106,000	CSO (RM 12.18)
Sanitary Sewer Overflow Locations						
SS-603 (SSO)	1	605,000	605,000	605,000	605,000	SSO (RM 3.98)
SS-1048 (SSO)	6	414,000	560,500	582,167	771,000	SSO (RM 3.49)
SS-704 (SSO)	2	857,000	1,040,000	1,040,000	1,223,000	SSO (RM 4.28)
SS-700 (SSO)	6	909,000	1,093,500	1,379,667	2,909,000	SSO (RM 13.82)
SS-700 TRT[1]	17	52,000	488,000	858,235	4,352,000	SSO (RM 14.03)
Stormwater Outfall Locations[2]						
ST-004 (Ind.)	12	613	3,255	48,322	426,000	SW (Ind.) (no RM)
ST-011 (Ind.)	15	605	6,131	15,796	85,000	SW (Ind.) (RM 2.75)
ST-009 (Com.)	11	146	480	2,002	10,000	SW (Com.) (RM 1.79)
ST-010 (Com.)	11	52	350	895	3,448	SW (Com.) (RM 2.11)
ST-005 (Res.)	3	11,199	12,997	14,732	20,000	SW (Res.) (RM 2.89)
ST-006 (Res.)	6	9,208	19,863	34,828	85,000	SW (Res.) (RM 4.36)
ST-008 (Res.)	12	8,664	14,834	62,172	565,000	SW (Res.) (RM 3.35)

[1]SSO 700 TRT samples are a combination of treated effluent from the treatment facility and untreated overflow from the tanks, when overflow occurred. The minimum concentration value corresponds to a sample from treated effluent only. The maximum concentration value corresponds to a sample taken from a combination of storage tank overflow and treated effluent.

[2]Stormwater outfalls are representative of commercial (Com.), industrial (Ind.) and residential (Res.) land use categories.

Overall results for each source category are also included for each parameter. An example of this table for *E. coli* is provided as Table 13. Note that stormwater observations are separated into commercial (Com.), industrial (Ind.) and residential (Res.) land use categories. The results in the SSO category are for the SSOs only and do not include the results from the SSO 700 TRT location, which reflect partial or full treatment from the treatment facility. Tables for the remaining parameters for each location are also provided in Appendix C.

Table 13. Outfall Averages - Escherichia coliform (*E. coli*) (MPN/100 ml)

All Locations	Number of Samples Collected	Minimum Concentration	Median Concentration	Average Concentration	Maximum Concentration
CSO	13	84,000	256,000	849,077	4,106,000
SSO	15	414,000	857,000	963,733	2,909,000
SW (Ind.)	27	605	5,172	30,252	426,000
SW (Com.)	22	52	447	1,449	10,000
SW (Res.)	21	8,664	15,531	47,582	565,000
SSO-700 TRT[1]	17	52,000	488,000	858,235	4,352,000

[1]SSO 700 TRT samples are a combination of treated effluent from the treatment facility and untreated overflow from the tanks, when overflow occurred.

5.2 Watershed Flow Monitoring

Watershed flow monitoring was performed to collect depth and flow data used to develop a rating curve for each flow monitoring location, relating flow to the depth measured by the transducers. The minimum, average and maximum results for the seven locations where transducers were installed are presented in Table 14.

Table 14. Flow Sampling Results

Station	Number of Observations	Minimum Flow (cfs)	Average Flow (cfs)	Maximum Flow (cfs)	Comments
BC-001	10,955	0.5	4.3	297.1	
BC-002	10,947	0.0	0.5	76.3	
CC-001[1]	8,728	0.3	2.5	138.6	
CC-002[2]	10,852	0.0	0.6	83.2	
GE-001	10,927	0.0	0.7	228.4	
SC-002	10,936	0.0	1.2	92.5	
TR-001	10,843	0.0	5.4	568.0	

[1] Transducer was lost during the 10/29/15 storm

[2]The transducer data for CC-002 showed a distinct change in the base flow depth after 10/24. Before the 24th, the recorded water depths spiked after a rainfall but dropped down to a base flow condition with a water depth around 0.07'. After the 24th, the recorded water depths only drops to 0.7'. The range of recorded depths for the whole period is 0 to 2.2'. The 0.7' minimum depth recorded after the 24th is a relatively large increase in base flow compared to the overall range and doubtfully correct. No changes to the monitoring setup were made and no signs of disturbance were found. The recording equipment was most likely out of calibration after the 24th. The data after the 24th were therefore considered unreliable.

The calculated depth-flow relationships were used to convert the depths measured by the seven transducers into flows. An example of a stage-discharge curve for Station BC-001 is provided as Figure 9. The complete set of stage-discharge curves is provided in Appendix D. Frequency discharge curves were developed to show the frequency at which a given flow would be met or exceeded. An example for Station BC-001 is provided as Figure 10. A frequency curve for each location is also provided in Appendix D.

Figure 9. Stage-Discharge Curve for BC-001.

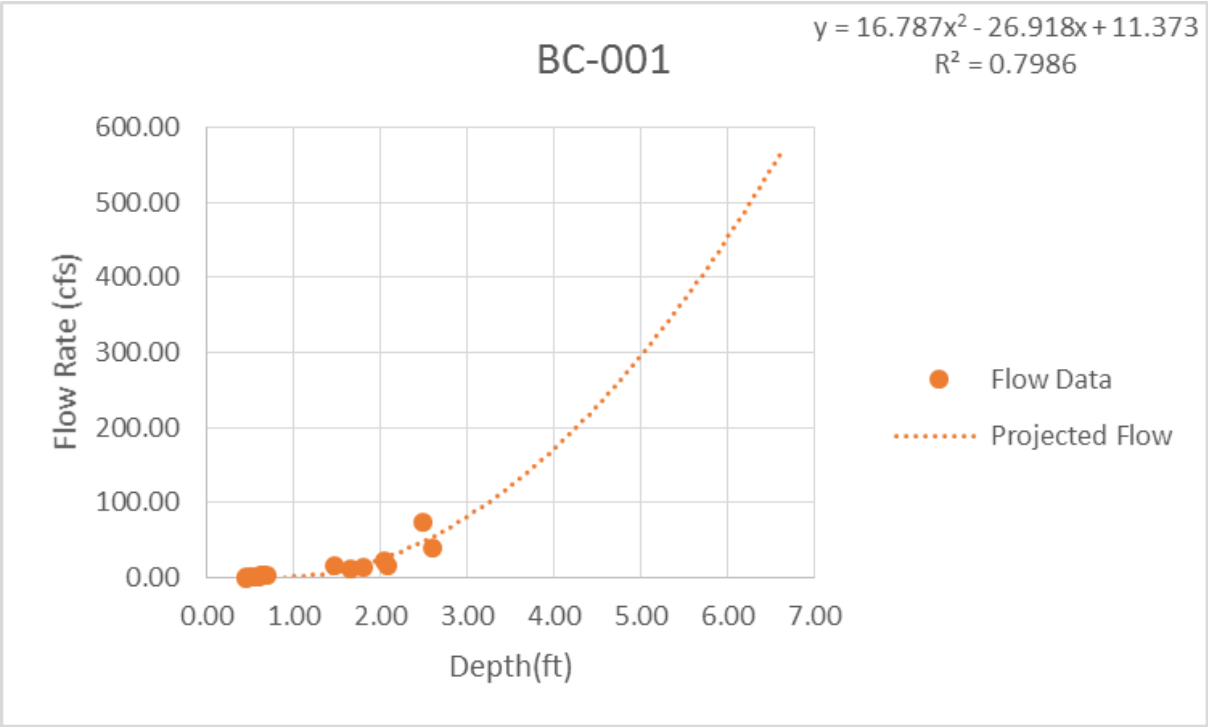
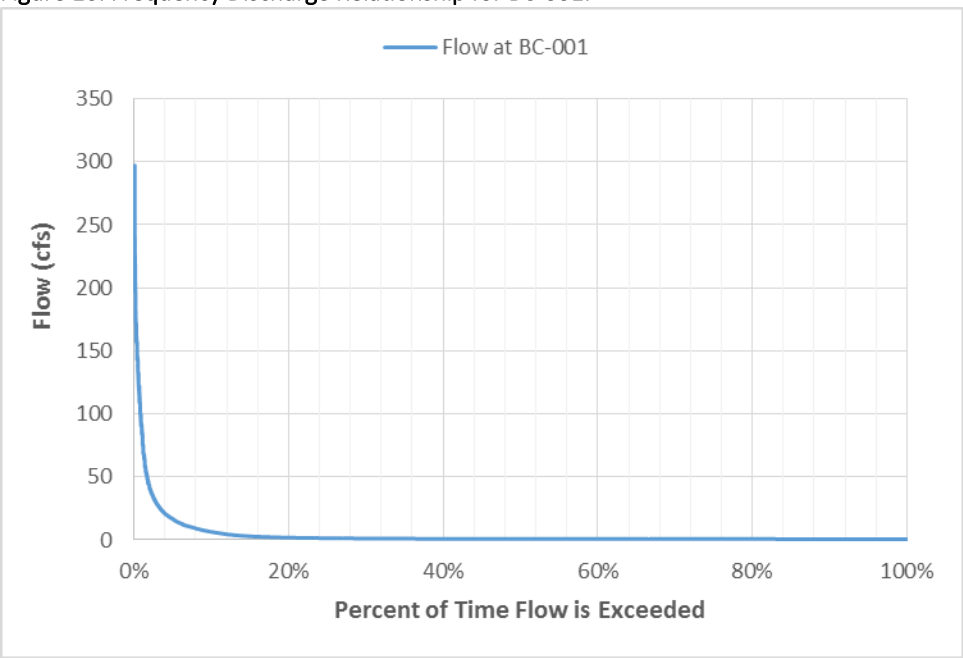


Figure 10. Frequency Discharge Relationship for BC-001.



6.0 QAPP/SAP Objectives Assessment

Quality objectives and criteria are presented in Section 1.4 of the QAPP and include accuracy, precision, completeness, representativeness, comparability and sensitivity. A comparison of the program objectives to the actual Water Quality Data Collection Program execution are summarized below for each of these elements.

6.1 Accuracy

Accuracy is the measure of agreement between an observed value and an accepted reference value or true value. Field accuracy was assessed through the use of field blanks. Laboratory accuracy was assessed through the analysis of method blanks as well as controls and matrix spikes. For the field and method blanks, the objective was to have results less than the detection limit. For the controls and matrix spikes, the objective was to have the percent recovery of the spiked constituent within the parameter-specific percentages specified in Table 1-5 of the QAPP. A summary of the accuracy results is provided in Table 15.

Table 15. Comparison of Accuracy Objectives and Performance

Measure	Metric	Target	Actual	Count
Field Blank	Frequency of collection relative to the frequency of sample collection	> 5%	8.5%	46 (samples)
Field Blank	Frequency of non-detected results	> 90%	96%	582 (results)
Laboratory Method Blank	Frequency of non-detected results	> 95%	100%	285 (results)
Laboratory Control/ Matrix Spikes	Percent of Results Meeting % Recovery Criteria	> 95%	100%	1,411 (results)

The Water Quality Data Collection Program successfully met all of the QAPP objectives for accuracy. Some field blank contamination was observed, primarily for ortho-phosphate (16 of the 22 contaminated blank results). It appears that the water used to prepare the blanks was the likely source of the contamination. Field blank contamination levels tended to be low, with results for most of the contaminated field blanks being within a factor of two of the detection limit. Results for the samples associated with the contaminated field blanks were inspected to determine whether additional data qualification was prudent. None of the associated sample results appeared anomalous so no data were flagged due to the contaminated field blanks.

6.2 Precision

Precision is a measure of agreement between two or more measurements. Field precision was assessed through the use of field duplicates, a second sample collected in the field. Laboratory precision was assessed through the use of matrix spike duplicates and replicates, a second aliquot of sample run through the analytical procedure. The objective was to have the relative percent difference (%RPD) within the parameter-specific percentages specified in Table 1-5 of the QAPP. A summary of the precision results is provided in Table 16. It should be noted that the %RPD calculation for field duplicate results was conducted for results that were at least 5x greater than the detection limit, as per the QAPP. Approximately 50% of the field duplicate results were at levels less than 5x the detection limit, which is not unusual for in-stream sampling programs.

Table 16. Comparison of Precision Objectives and Performance

Measure	Metric	Target	Actual	Count
Field duplicate	Frequency of collection relative to the frequency of sample collection	> 10%	6.6%	36 (samples)
Field duplicate	Percent of Results Meeting % RPD Criteria	> 90%	97%	241 (results)
Laboratory Replicates/ Matrix Spike Duplicates	Percent of Results Meeting % RPD Criteria	> 95%	99%	947 (results)

The Water Quality Data Collection Program successfully met two of the three the QAPP objectives for precision except for the frequency of field duplicate collection. This was largely due to the fact that automatic water samplers were utilized for all of the source sampling and could not be programmed to collect field duplicates and still provide enough sample volume needed for the laboratory analyses. Also, with sample collection being initiated 30 minutes after the start of the previous sample, the upstream tributary sampling was too dynamic to collect field duplicates. However, the available data for the field duplicates (97% of results meeting the QAPP % RPD criteria) indicates that the Sampling Program was conducted with the appropriate rigor to ensure reproducibility in the data.

6.3 Completeness

Completeness is a measure of the amount of valid data obtained from a monitoring program compared to the amount of data that were expected. Field completeness is determined by the number of measurements collected versus the number of measurements planned for collection. Laboratory completeness is a measure of the amount of valid measurements obtained from all samples submitted for the sampling activity. The targets for field and laboratory completeness were 90% and 95%, respectively. A summary of the completeness results is provided in Table 17.

Table 17. Comparison of Completeness Objectives and Performance

Measure	Metric	Target	Actual
Field completeness	Ratio of actual samples collected to planned samples	> 90%	Overall: 95% In-stream:98% CSO: 61% SSO: 80% Stormwater: 78%
Laboratory completeness	Ratio of actual measurements to requested measurements	> 95%	Overall: 100% In-stream:100% CSO: 100% SSO: 100% Stormwater: 100%

Events that may contribute to reductions in measurement completeness include sample container breakage, inaccessibility to sampling locations, automatic sampler failure and laboratory equipment failures. Inaccessible sample locations and automatic water sampler malfunctions were the primary reasons for less than 100% completeness. However, several corrective actions were taken during the Water Quality Data Collection Program to improve completeness, including:

- Collecting an additional round of in-stream sampling during the third wet weather event;
- Programming the automatic water samplers to collect a second set of source samples during the third wet weather event for the activated sources; and,

- Manually collecting stormwater samples at locations where the automatic water sampler malfunctioned during the fourth wet weather event.

In addition, one dry weather survey was partially completed before being terminated due to unexpected rainfall. With these adjustments and the additional dry weather survey, 31 additional samples were collected that were not part of the original Sampling Plan. Including these samples in the assessment of field completeness increases the overall field completeness to over 100% (102%).

The laboratory provided results for every requested measurement. The Water Quality Data Collection Program was highly successful in meeting the laboratory completeness objective.

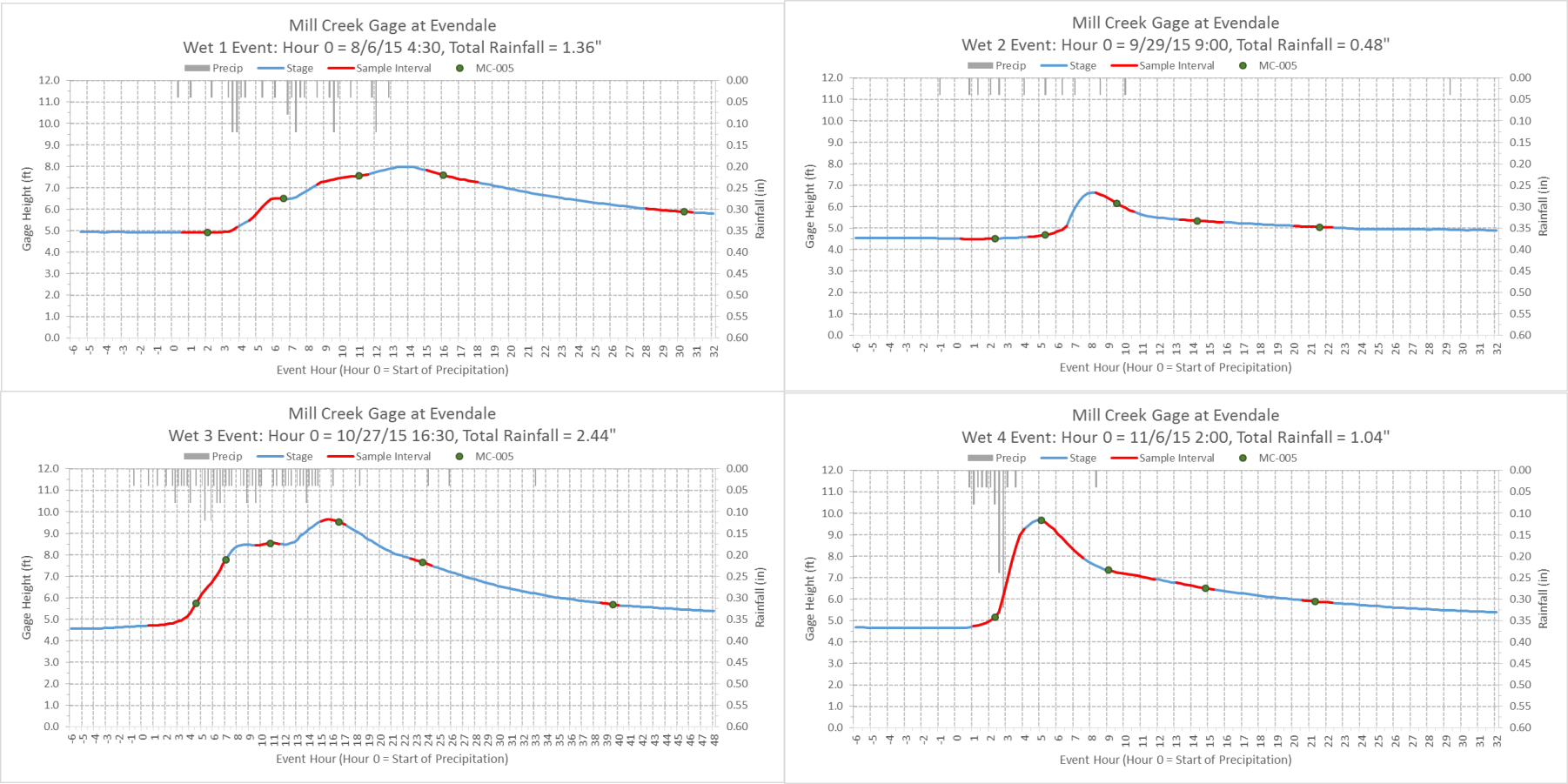
6.4 Representativeness

Representativeness is the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Monitoring representative environmental conditions were the key objective of this Water Quality Data Collection Program. The representativeness results are summarized in Table 18. Figure 11 shows when sampling was performed during wet weather events. Sampling times and rainfall are shown on hydrographs of Mill Creek stage data at the Evendale USGS gage (USGS 03255420 Mill Creek at Evendale) in panels for each of the four wet weather events. The figures show that wet weather data was collected at immediately before, on the rise, at the peak and during the fall of the hydrograph during the events.

Table 18. Comparison of Representative Objectives and Performance

Measure	Metric	Target	Actual	Successfully Met
Dry weather sampling conditions	Seasonal distribution	Spring Summer Fall	June August October	Mostly. First dry weather event was held in early Summer rather than Spring due to delay in program authorization.
	Low flow condition	Flow less than 15th percentile	Flow during October survey met criteria	Yes
Wet weather sampling conditions	Range of storm sizes	0.50 inches 1.00 inches 1.50 inches	Wet 2 = 0.48 inches Wet 4 = 1.04 inches Wet 1 = 1.36 inches Wet 3 = 2.44 inches	Yes
	Samples collected to characterize the pollutograph	Samples on the rising limb, near the peak response, on the falling limb and near the return to base flow conditions	See Figure 10	Yes
Flow monitoring conditions	Number of measurements used to derive stage-flow relationship	20	18	Nearly (90%)
	Range of flows	Low flow Average flow High flow	Measurements made over range of flows	Yes

Figure 11. Wet Weather Sampling Event Conditions



The Water Quality Data Collection Program successfully met almost all of the QAPP objectives for representativeness. One exception was not starting the program early enough to collect data during the spring (April-May). Data collected during the dry and wet weather events from June to November do provide sufficient observations across ambient temperatures, rainfall, and surface water flow conditions that were sought in a spring event. A second exception was not completing 20 stage/velocity observations to develop a relationship between stage and flow for the continuous transducer measurements. Eighteen events were measured over a wide range of conditions, providing abundant and sufficient information for developing the needed relationships. These two exceptions are minor and inconsequential.

6.5 Comparability

The objective for data comparability is to generate data for each parameter that are comparable between sampling locations and comparable over time. This is achieved through the use of standard sampling and analysis methods and following the procedures detailed in the QAPP and SAP. Data quality objectives were consistently achieved throughout the Water Quality Data Collection Program. The sampling procedures described in the SAP were consistently followed, the laboratory conducted their analyses using EPA-approved methods, and the amount of field and laboratory QA/QC were sufficient to confirm the quality of the data and its use in meeting the project objectives.

6.6 Sensitivity

Required detection limits (RQLs) were specified for each analytical parameter to ensure that the data had sufficient sensitivity to meet the project objectives. The RQLs are specified in Table 1-5 of the QAPP. The laboratory analyzed all of the samples at the required detection limits unless the concentration in the sample were sufficiently high to require dilution. The Water Quality Data Collection Program successfully met this objective.

7.0 Summary

The scope of sampling in the QAPP included collection of measurements during dry and wet weather for pH, conductivity, chlorides, nutrients, sediment, bacteria, dissolved oxygen, algae, and metals, and in-stream flow measurements. Data collection was desired at outfalls and in surface waters. The SAP was designed to meet these needs in order to support the development and calibration of watershed and surface water quality models for use in the development of the IWAP. The Water Quality Data Collection Program successfully fulfilled the scope of sampling in the QAPP. Three dry and four wet weather events were sampled, capturing flow and water quality measurements over a wide range of conditions. Data were collected successfully at outfalls and surface waters. Continuous flow measurements were successfully made on several tributaries. Quality objectives and criteria of the QAPP for accuracy, precision, completeness, representativeness, comparability and sensitivity were all achieved.

The Water Quality Data Collection Program was designed to fill data gaps necessary to characterize sources and surface waters during dry and wet weather events to support the updating and/or development of existing and new watershed and surface water quality models for use in the development of the IWAP. The Program fully achieved the objectives of collecting comprehensive and complete datasets that are needed to characterize pollutant sources and to produce well-calibrated watershed and surface water quality models. No further data collection is required to develop or calibrate the models for use in the SSO 700 IWAP.

8.0 Works Cited

CH2M. 2015a. "SSO 700 IWAP Task 2.4 Inventory and Gap Analysis" [Technical Memorandum]. November 23, 2015.

CH2M. 2015b. "SSO 700 IWAP Task 2.6.1 Watershed and Water Quality Models Gap Analysis and Update Assessment" [Technical Memorandum]. May 18, 2015.

CH2M. 2015c. Quality Assurance Project Plan: SSO 700 IWAP Water Quality Monitoring Cincinnati, Ohio. Prepared by CH2M HILL, Inc. and LimnoTech, Inc. for the Metropolitan Sewer District of Greater Cincinnati and Hamilton County. June 3, 2015.

CH2M. 2015d. Sampling and Analysis Plan: SSO 700 IWAP Water Quality Monitoring Cincinnati, Ohio. Prepared by CH2M HILL, Inc. and LimnoTech, Inc. for the Metropolitan Sewer District of Greater Cincinnati and Hamilton County. July 15, 2015.

NOAA and IDENR. 1992. "Rainfall Frequency Atlas of the Midwest." Bulletin 71. MCC Research Report 92-03.

9.0 Appendices

Appendix A – Rainfall Data

Appendix B – Water Quality Data Graphics

Appendix C – Water Quality Data Tables

Appendix D – Watershed Flow Monitoring Curves

Appendix A
Rainfall Data

Table A-1. Wet Event 1 - Rainfall at USGS 03255420 Mill Creek at Evendale

Date-Time	**Precipitation**
8/5/15 23:15	0
8/5/15 23:30	0
8/5/15 23:45	0
8/6/15 0:00	0
8/6/15 0:15	0
8/6/15 0:30	0
8/6/15 0:45	0
8/6/15 1:00	0
8/6/15 1:15	0
8/6/15 1:30	0
8/6/15 1:45	0
8/6/15 2:00	0
8/6/15 2:15	0
8/6/15 2:30	0
8/6/15 2:45	0
8/6/15 3:00	0
8/6/15 3:15	0
8/6/15 3:30	0
8/6/15 3:45	0
8/6/15 4:00	0
8/6/15 4:15	0
8/6/15 4:30	0
8/6/15 4:45	0.04
8/6/15 5:00	0
8/6/15 5:15	0
8/6/15 5:30	0.04
8/6/15 5:45	0
8/6/15 6:00	0
8/6/15 6:15	0
8/6/15 6:30	0
8/6/15 6:45	0.04
8/6/15 7:00	0
8/6/15 7:15	0
8/6/15 7:30	0
8/6/15 7:45	0.04
8/6/15 8:00	0.12
8/6/15 8:15	0.12
8/6/15 8:30	0.04
8/6/15 8:45	0.04
8/6/15 9:00	0
8/6/15 9:15	0
8/6/15 9:30	0

Table A-1. Wet Event 1 - Rainfall at USGS 03255420 Mill Creek at Evendale

Date-Time	**Precipitation**
8/6/15 9:45	0.04
8/6/15 10:00	
8/6/15 10:15	
8/6/15 10:30	0.04
8/6/15 10:45	0
8/6/15 11:00	
8/6/15 11:15	0.08
8/6/15 11:30	0.04
8/6/15 11:45	0.12
8/6/15 12:00	0.04
8/6/15 12:15	0.04
8/6/15 12:30	0
8/6/15 12:45	0
8/6/15 13:00	0.04
8/6/15 13:15	0
8/6/15 13:30	0
8/6/15 13:45	0.04
8/6/15 14:00	0.12
8/6/15 14:15	0.04
8/6/15 14:30	0
8/6/15 14:45	0
8/6/15 15:00	0.04
8/6/15 15:15	0
8/6/15 15:30	0
8/6/15 15:45	0
8/6/15 16:00	0
8/6/15 16:15	0.04
8/6/15 16:30	0.12
8/6/15 16:45	0
8/6/15 17:00	
8/6/15 17:15	0.04
8/6/15 17:30	0
8/6/15 17:45	0
8/6/15 18:00	
8/6/15 18:15	0
8/6/15 18:30	0
8/6/15 18:45	0
8/6/15 19:00	0
8/6/15 19:15	0
8/6/15 19:30	0
8/6/15 19:45	0
8/6/15 20:00	0

Table A-1. Wet Event 1 - Rainfall at USGS 03255420 Mill Creek at Evendale

Date-Time	**Precipitation**
8/6/15 20:15	0
8/6/15 20:30	0
8/6/15 20:45	0
8/6/15 21:00	0
8/6/15 21:15	0
8/6/15 21:30	0
8/6/15 21:45	0
8/6/15 22:00	0
8/6/15 22:15	0
8/6/15 22:30	0
8/6/15 22:45	0
8/6/15 23:00	0
8/6/15 23:15	0
8/6/15 23:30	0
8/6/15 23:45	0
8/7/15 0:00	0
8/7/15 0:15	0
8/7/15 0:30	0
8/7/15 0:45	0
8/7/15 1:00	0
8/7/15 1:15	0
8/7/15 1:30	0
8/7/15 1:45	0
8/7/15 2:00	0
8/7/15 2:15	0
8/7/15 2:30	0
8/7/15 2:45	0
8/7/15 3:00	0
8/7/15 3:15	0
8/7/15 3:30	0
8/7/15 3:45	0
8/7/15 4:00	0
8/7/15 4:15	0
8/7/15 4:30	0
8/7/15 4:45	0
8/7/15 5:00	0
8/7/15 5:15	0
8/7/15 5:30	0
8/7/15 5:45	0
8/7/15 6:00	0
8/7/15 6:15	0
8/7/15 6:30	0

Table A-1. Wet Event 1 - Rainfall at USGS 03255420 Mill Creek at Evendale

Date-Time	**Precipitation**
8/7/15 6:45	0
8/7/15 7:00	0
8/7/15 7:15	0
8/7/15 7:30	0
8/7/15 7:45	0
8/7/15 8:00	0
8/7/15 8:15	0
8/7/15 8:30	0
8/7/15 8:45	0
8/7/15 9:00	0
8/7/15 9:15	0
8/7/15 9:30	0
8/7/15 9:45	0
8/7/15 10:00	0
8/7/15 10:15	0
8/7/15 10:30	0
8/7/15 10:45	0
8/7/15 11:00	0
8/7/15 11:15	0
8/7/15 11:30	0
8/7/15 11:45	0
8/7/15 12:00	0
8/7/15 12:15	0
8/7/15 12:30	0
Total	**1.36**

Table A-2. Wet Event 2 - Rainfall at USGS 03255420 Mill Creek at Evendale

Date-Time	**Precipitation**
9/29/15 3:00	0
9/29/15 3:15	0
9/29/15 3:30	0
9/29/15 3:45	0
9/29/15 4:00	0
9/29/15 4:15	0
9/29/15 4:30	0
9/29/15 4:45	0
9/29/15 5:00	0
9/29/15 5:15	0
9/29/15 5:30	0
9/29/15 5:45	0
9/29/15 6:00	0
9/29/15 6:15	0
9/29/15 6:30	0
9/29/15 6:45	0
9/29/15 7:00	0
9/29/15 7:15	0
9/29/15 7:30	0
9/29/15 7:45	0
9/29/15 8:00	0.04
9/29/15 8:15	0
9/29/15 8:30	0
9/29/15 8:45	0
9/29/15 9:00	0
9/29/15 9:15	0
9/29/15 9:30	0
9/29/15 9:45	0.04
9/29/15 10:00	0
9/29/15 10:15	0.04
9/29/15 10:30	0
9/29/15 10:45	0
9/29/15 11:00	0.04
9/29/15 11:15	0
9/29/15 11:30	0.04
9/29/15 11:45	0
9/29/15 12:00	0
9/29/15 12:15	0
9/29/15 12:30	0
9/29/15 12:45	0
9/29/15 13:00	0.04
9/29/15 13:15	0

Table A-2. Wet Event 2 - Rainfall at USGS 03255420 Mill Creek at Evendale

Date-Time	**Precipitation**
9/29/15 13:30	0
9/29/15 13:45	0
9/29/15 14:00	0
9/29/15 14:15	0.04
9/29/15 14:30	0
9/29/15 14:45	0
9/29/15 15:00	0
9/29/15 15:15	0.04
9/29/15 15:30	0
9/29/15 15:45	0
9/29/15 16:00	0.04
9/29/15 16:15	0
9/29/15 16:30	0
9/29/15 16:45	0
9/29/15 17:00	0
9/29/15 17:15	0
9/29/15 17:30	0.04
9/29/15 17:45	0
9/29/15 18:00	0
9/29/15 18:15	0
9/29/15 18:30	0
9/29/15 18:45	0
9/29/15 19:00	0.04
9/29/15 19:15	0
9/29/15 19:30	0
9/29/15 19:45	0
9/29/15 20:00	0
9/29/15 20:15	0
9/29/15 20:30	0
9/29/15 20:45	0
9/29/15 21:00	0
9/29/15 21:15	0
9/29/15 21:30	0
9/29/15 21:45	0
9/29/15 22:00	0
9/29/15 22:15	0
9/29/15 22:30	0
9/29/15 22:45	0
9/29/15 23:00	0
9/29/15 23:15	0
9/29/15 23:30	0
9/29/15 23:45	0

Table A-2. Wet Event 2 - Rainfall at USGS 03255420 Mill Creek at Evendale

Date-Time	**Precipitation**
9/30/15 0:00	0
9/30/15 0:15	0
9/30/15 0:30	0
9/30/15 0:45	0
9/30/15 1:00	0
9/30/15 1:15	0
9/30/15 1:30	0
9/30/15 1:45	0
9/30/15 2:00	0
9/30/15 2:15	0
9/30/15 2:30	0
9/30/15 2:45	0
9/30/15 3:00	0
9/30/15 3:15	0
9/30/15 3:30	0
9/30/15 3:45	0
9/30/15 4:00	0
9/30/15 4:15	0
9/30/15 4:30	0
9/30/15 4:45	0
9/30/15 5:00	0
9/30/15 5:15	0
9/30/15 5:30	0
9/30/15 5:45	0
9/30/15 6:00	0
9/30/15 6:15	0
9/30/15 6:30	0
9/30/15 6:45	0
9/30/15 7:00	0
9/30/15 7:15	0
9/30/15 7:30	0
9/30/15 7:45	0
9/30/15 8:00	0
9/30/15 8:15	0
9/30/15 8:30	0
9/30/15 8:45	0
9/30/15 9:00	0
9/30/15 9:15	0
9/30/15 9:30	0
9/30/15 9:45	0
9/30/15 10:00	0
9/30/15 10:15	0

Table A-2. Wet Event 2 - Rainfall at USGS 03255420 Mill Creek at Evendale

Date-Time	**Precipitation**
9/30/15 10:30	0
9/30/15 10:45	0
9/30/15 11:00	0
9/30/15 11:15	0
9/30/15 11:30	0
9/30/15 11:45	0
9/30/15 12:00	0
9/30/15 12:15	0
9/30/15 12:30	0
9/30/15 12:45	0
9/30/15 13:00	0
9/30/15 13:15	0
9/30/15 13:30	0
9/30/15 13:45	0
9/30/15 14:00	0
9/30/15 14:15	0.04
9/30/15 14:30	0
9/30/15 14:45	0
9/30/15 15:00	0
9/30/15 15:15	0
9/30/15 15:30	0
9/30/15 15:45	0
9/30/15 16:00	0
9/30/15 16:15	0
9/30/15 16:30	0
9/30/15 16:45	0
9/30/15 17:00	0
Total	**0.48**

Table A-3. Wet Event 3 - Rainfall at USGS 03255420 Mill Creek at Evendale

Date-Time	**Precipitation**
10/27/15 10:30	0
10/27/15 10:45	0
10/27/15 11:00	0
10/27/15 11:15	0
10/27/15 11:30	0
10/27/15 11:45	0
10/27/15 12:00	0
10/27/15 12:15	0
10/27/15 12:30	0
10/27/15 12:45	0
10/27/15 13:00	0
10/27/15 13:15	0
10/27/15 13:30	0
10/27/15 13:45	0
10/27/15 14:00	0
10/27/15 14:15	0
10/27/15 14:30	0
10/27/15 14:45	0
10/27/15 15:00	0
10/27/15 15:15	0
10/27/15 15:30	0
10/27/15 15:45	0.04
10/27/15 16:00	0
10/27/15 16:15	0
10/27/15 16:30	0
10/27/15 16:45	0
10/27/15 17:00	0.04
10/27/15 17:15	0
10/27/15 17:30	0
10/27/15 17:45	0.04
10/27/15 18:00	0
10/27/15 18:15	0
10/27/15 18:30	0.04
10/27/15 18:45	0
10/27/15 19:00	0.04
10/27/15 19:15	0.08
10/27/15 19:30	0.04
10/27/15 19:45	0.04
10/27/15 20:00	0.04
10/27/15 20:15	0.04
10/27/15 20:30	0.08
10/27/15 20:45	0

Table A-3. Wet Event 3 - Rainfall at USGS 03255420 Mill Creek at Evendale

Date-Time	**Precipitation**
10/27/15 21:00	0.04
10/27/15 21:15	0
10/27/15 21:30	0.04
10/27/15 21:45	0.12
10/27/15 22:00	0.04
10/27/15 22:15	0.12
10/27/15 22:30	0.04
10/27/15 22:45	0.08
10/27/15 23:00	0.08
10/27/15 23:15	0.04
10/27/15 23:30	0.04
10/27/15 23:45	0.04
10/28/15 0:00	0.04
10/28/15 0:15	0
10/28/15 0:30	0
10/28/15 0:45	0.04
10/28/15 1:00	0.04
10/28/15 1:15	0.08
10/28/15 1:30	0.04
10/28/15 1:45	0.04
10/28/15 2:00	0.08
10/28/15 2:15	0.04
10/28/15 2:30	0.04
10/28/15 2:45	0
10/28/15 3:00	0
10/28/15 3:15	0
10/28/15 3:30	0.04
10/28/15 3:45	0.04
10/28/15 4:00	0
10/28/15 4:15	0.04
10/28/15 4:30	0.04
10/28/15 4:45	0.04
10/28/15 5:00	0.04
10/28/15 5:15	0
10/28/15 5:30	0.04
10/28/15 5:45	0.04
10/28/15 6:00	0.04
10/28/15 6:15	0.08
10/28/15 6:30	0.04
10/28/15 6:45	0.04
10/28/15 7:00	0.04
10/28/15 7:15	0.04

Table A-3. Wet Event 3 - Rainfall at USGS 03255420 Mill Creek at Evendale

Date-Time	**Precipitation**
10/28/15 7:30	0
10/28/15 7:45	0
10/28/15 8:00	0
10/28/15 8:15	0
10/28/15 8:30	0.04
10/28/15 8:45	0
10/28/15 9:00	0
10/28/15 9:15	0
10/28/15 9:30	0
10/28/15 9:45	0
10/28/15 10:00	0
10/28/15 10:15	0
10/28/15 10:30	0
10/28/15 10:45	0.04
10/28/15 11:00	0
10/28/15 11:15	0
10/28/15 11:30	0
10/28/15 11:45	0
10/28/15 12:00	0
10/28/15 12:15	0
10/28/15 12:30	0
10/28/15 12:45	0
10/28/15 13:00	0
10/28/15 13:15	0
10/28/15 13:30	0
10/28/15 13:45	0
10/28/15 14:00	0
10/28/15 14:15	0
10/28/15 14:30	0
10/28/15 14:45	0
10/28/15 15:00	0
10/28/15 15:15	0
10/28/15 15:30	0
10/28/15 15:45	0
10/28/15 16:00	0
10/28/15 16:15	0
10/28/15 16:30	0.04
10/28/15 16:45	0
10/28/15 17:00	0
10/28/15 17:15	0
10/28/15 17:30	0
10/28/15 17:45	0

Table A-3. Wet Event 3 - Rainfall at USGS 03255420 Mill Creek at Evendale

Date-Time	**Precipitation**
10/28/15 18:00	0
10/28/15 18:15	0.04
10/28/15 18:30	0
10/28/15 18:45	0
10/28/15 19:00	0
10/28/15 19:15	0
10/28/15 19:30	0
10/28/15 19:45	0
10/28/15 20:00	0
10/28/15 20:15	0
10/28/15 20:30	0
10/28/15 20:45	0
10/28/15 21:00	0
10/28/15 21:15	0
10/28/15 21:30	0
10/28/15 21:45	0
10/28/15 22:00	0
10/28/15 22:15	0
10/28/15 22:30	0
10/28/15 22:45	0
10/28/15 23:00	0
10/28/15 23:15	0
10/28/15 23:30	0
10/28/15 23:45	0
10/29/15 0:00	0
10/29/15 0:15	0
10/29/15 0:30	0
10/29/15 0:45	0
10/29/15 1:00	0
10/29/15 1:15	0
10/29/15 1:30	0.04
10/29/15 1:45	0
10/29/15 2:00	0
10/29/15 2:15	0
10/29/15 2:30	0
10/29/15 2:45	0
10/29/15 3:00	0
10/29/15 3:15	0
10/29/15 3:30	0
10/29/15 3:45	0
10/29/15 4:00	0
10/29/15 4:15	0

Table A-3. Wet Event 3 - Rainfall at USGS 03255420 Mill Creek at Evendale

Date-Time	**Precipitation**
10/29/15 4:30	0
10/29/15 4:45	0
10/29/15 5:00	0
10/29/15 5:15	0
10/29/15 5:30	0
10/29/15 5:45	0
10/29/15 6:00	0
10/29/15 6:15	0
10/29/15 6:30	0
10/29/15 6:45	0
10/29/15 7:00	0
10/29/15 7:15	0
10/29/15 7:30	0
10/29/15 7:45	0
10/29/15 8:00	0
10/29/15 8:15	0
10/29/15 8:30	0
10/29/15 8:45	0
10/29/15 9:00	0
10/29/15 9:15	0
10/29/15 9:30	0
10/29/15 9:45	0
10/29/15 10:00	0
10/29/15 10:15	0
10/29/15 10:30	0
10/29/15 10:45	0
10/29/15 11:00	0
10/29/15 11:15	0
10/29/15 11:30	0
10/29/15 11:45	0
10/29/15 12:00	0
10/29/15 12:15	0
10/29/15 12:30	0
10/29/15 12:45	0
10/29/15 13:00	0
10/29/15 13:15	0
10/29/15 13:30	0
10/29/15 13:45	0
10/29/15 14:00	0
10/29/15 14:15	0
10/29/15 14:30	0
10/29/15 14:45	0

Table A-3. Wet Event 3 - Rainfall at USGS 03255420 Mill Creek at Evendale

Date-Time	**Precipitation**
10/29/15 15:00	0
10/29/15 15:15	0
10/29/15 15:30	0
10/29/15 15:45	0
10/29/15 16:00	0
10/29/15 16:15	0
10/29/15 16:30	0
10/29/15 16:45	0
10/29/15 17:00	0
10/29/15 17:15	0
10/29/15 17:30	0
10/29/15 17:45	0
10/29/15 18:00	0
10/29/15 18:15	0
10/29/15 18:30	0
10/29/15 18:45	0
10/29/15 19:00	0
10/29/15 19:15	0
10/29/15 19:30	0
10/29/15 19:45	0
10/29/15 20:00	0
10/29/15 20:15	0
10/29/15 20:30	0
10/29/15 20:45	0
10/29/15 21:00	0
10/29/15 21:15	0
10/29/15 21:30	0
10/29/15 21:45	0
10/29/15 22:00	0
10/29/15 22:15	0
10/29/15 22:30	0
10/29/15 22:45	0
10/29/15 23:00	0
10/29/15 23:15	0
10/29/15 23:30	0
10/29/15 23:45	0
10/30/15 0:00	0
10/30/15 0:15	0
10/30/15 0:30	0
10/30/15 0:45	0
10/30/15 1:00	0
10/30/15 1:15	0

Table A-3. Wet Event 3 - Rainfall at USGS 03255420 Mill Creek at Evendale

Date-Time	**Precipitation**
10/30/15 1:30	0
10/30/15 1:45	0
10/30/15 2:00	0
10/30/15 2:15	0
10/30/15 2:30	0
10/30/15 2:45	0
10/30/15 3:00	0
10/30/15 3:15	0
10/30/15 3:30	0
10/30/15 3:45	0
10/30/15 4:00	0
10/30/15 4:15	0
10/30/15 4:30	0
10/30/15 4:45	0
10/30/15 5:00	0
10/30/15 5:15	0
10/30/15 5:30	0
10/30/15 5:45	0
10/30/15 6:00	0
10/30/15 6:15	0
10/30/15 6:30	0
10/30/15 6:45	0
10/30/15 7:00	0
10/30/15 7:15	0
10/30/15 7:30	0
10/30/15 7:45	0
10/30/15 8:00	0
10/30/15 8:15	0
10/30/15 8:30	0
10/30/15 8:45	0
10/30/15 9:00	0
10/30/15 9:15	0
10/30/15 9:30	0
10/30/15 9:45	0
10/30/15 10:00	0
10/30/15 10:15	0
10/30/15 10:30	0
10/30/15 10:45	0
10/30/15 11:00	0
10/30/15 11:15	0
10/30/15 11:30	0
10/30/15 11:45	0

Table A-3. Wet Event 3 - Rainfall at USGS 03255420 Mill Creek at Evendale

Date-Time	**Precipitation**
10/30/15 12:00	0
10/30/15 12:15	0
10/30/15 12:30	0
10/30/15 12:45	0
10/30/15 13:00	0
10/30/15 13:15	0
10/30/15 13:30	0
10/30/15 13:45	0
10/30/15 14:00	0
10/30/15 14:15	0
10/30/15 14:30	0
10/30/15 14:45	0
10/30/15 15:00	0
10/30/15 15:15	0
10/30/15 15:30	0
10/30/15 15:45	0
10/30/15 16:00	0
10/30/15 16:15	0
10/30/15 16:30	0
10/30/15 16:45	0
10/30/15 17:00	0
10/30/15 17:15	0
10/30/15 17:30	0
10/30/15 17:45	0
10/30/15 18:00	0
10/30/15 18:15	0
10/30/15 18:30	0
10/30/15 18:45	0
10/30/15 19:00	0
10/30/15 19:15	0
10/30/15 19:30	0
10/30/15 19:45	0
10/30/15 20:00	0
10/30/15 20:15	0
10/30/15 20:30	0
Total	**2.44**

Table A-4. Wet Event 4 - Rainfall at USGS 03255420 Mill Creek at Evendale

Date-Time	**Precipitation**
11/5/15 20:00	0
11/5/15 20:15	0
11/5/15 20:30	0
11/5/15 20:45	0
11/5/15 21:00	0
11/5/15 21:15	0
11/5/15 21:30	0
11/5/15 21:45	0
11/5/15 22:00	0
11/5/15 22:15	0
11/5/15 22:30	0
11/5/15 22:45	0
11/5/15 23:00	0
11/5/15 23:15	0
11/5/15 23:30	0
11/5/15 23:45	0
11/6/15 0:00	0
11/6/15 0:15	0
11/6/15 0:30	0
11/6/15 0:45	0
11/6/15 1:00	0
11/6/15 1:15	0
11/6/15 1:30	0
11/6/15 1:45	0
11/6/15 2:00	0
11/6/15 2:15	0
11/6/15 2:30	0
11/6/15 2:45	0.04
11/6/15 3:00	0.08
11/6/15 3:15	0.04
11/6/15 3:30	0.04
11/6/15 3:45	0.04
11/6/15 4:00	0.04
11/6/15 4:15	0.08
11/6/15 4:30	0.24
11/6/15 4:45	0.32
11/6/15 5:00	0.04
11/6/15 5:15	0
11/6/15 5:30	0.04
11/6/15 5:45	0
11/6/15 6:00	0
11/6/15 6:15	0

Table A-4. Wet Event 4 - Rainfall at USGS 03255420 Mill Creek at Evendale

Date-Time	**Precipitation**
11/6/15 6:30	0
11/6/15 6:45	0
11/6/15 7:00	0
11/6/15 7:15	0
11/6/15 7:30	0
11/6/15 7:45	0
11/6/15 8:00	0
11/6/15 8:15	0
11/6/15 8:30	0
11/6/15 8:45	0
11/6/15 9:00	0
11/6/15 9:15	0
11/6/15 9:30	0
11/6/15 9:45	0
11/6/15 10:00	0
11/6/15 10:15	0.04
11/6/15 10:30	0
11/6/15 10:45	0
11/6/15 11:00	0
11/6/15 11:15	0
11/6/15 11:30	0
11/6/15 11:45	0
11/6/15 12:00	0
11/6/15 12:15	0
11/6/15 12:30	0
11/6/15 12:45	0
11/6/15 13:00	0
11/6/15 13:15	0
11/6/15 13:30	0
11/6/15 13:45	0
11/6/15 14:00	0
11/6/15 14:15	0
11/6/15 14:30	0
11/6/15 14:45	0
11/6/15 15:00	0
11/6/15 15:15	0
11/6/15 15:30	0
11/6/15 15:45	0
11/6/15 16:00	0
11/6/15 16:15	0
11/6/15 16:30	0
11/6/15 16:45	0

Table A-4. Wet Event 4 - Rainfall at USGS 03255420 Mill Creek at Evendale

Date-Time	**Precipitation**
11/6/15 17:00	0
11/6/15 17:15	0
11/6/15 17:30	0
11/6/15 17:45	0
11/6/15 18:00	0
11/6/15 18:15	0
11/6/15 18:30	0
11/6/15 18:45	0
11/6/15 19:00	0
11/6/15 19:15	0
11/6/15 19:30	0
11/6/15 19:45	0
11/6/15 20:00	0
11/6/15 20:15	0
11/6/15 20:30	0
11/6/15 20:45	0
11/6/15 21:00	0
11/6/15 21:15	0
11/6/15 21:30	0
11/6/15 21:45	0
11/6/15 22:00	0
11/6/15 22:15	0
11/6/15 22:30	0
11/6/15 22:45	0
11/6/15 23:00	0
11/6/15 23:15	0
11/6/15 23:30	0
11/6/15 23:45	0
11/7/15 0:00	0
11/7/15 0:15	0
11/7/15 0:30	0
11/7/15 0:45	0
11/7/15 1:00	0
11/7/15 1:15	0
11/7/15 1:30	0
11/7/15 1:45	0
11/7/15 2:00	0
11/7/15 2:15	0
11/7/15 2:30	0
11/7/15 2:45	0
11/7/15 3:00	0
11/7/15 3:15	0

Table A-4. Wet Event 4 - Rainfall at USGS 03255420 Mill Creek at Evendale

Date-Time	**Precipitation**
11/7/15 3:30	0
11/7/15 3:45	0
11/7/15 4:00	0
11/7/15 4:15	0
11/7/15 4:30	0
11/7/15 4:45	0
11/7/15 5:00	0
11/7/15 5:15	0
11/7/15 5:30	0
11/7/15 5:45	0
11/7/15 6:00	0
11/7/15 6:15	0
11/7/15 6:30	0
11/7/15 6:45	0
11/7/15 7:00	0
11/7/15 7:15	0
11/7/15 7:30	0
11/7/15 7:45	0
11/7/15 8:00	0
11/7/15 8:15	0
11/7/15 8:30	0
11/7/15 8:45	0
11/7/15 9:00	0
11/7/15 9:15	0
11/7/15 9:30	0
11/7/15 9:45	0
11/7/15 10:00	0
Total	**1.04**

Appendix B
Water Quality Data Graphics

Physical Characteristics

Temperature

Figure B-1. Temperature Measurements – Mainstem Stations

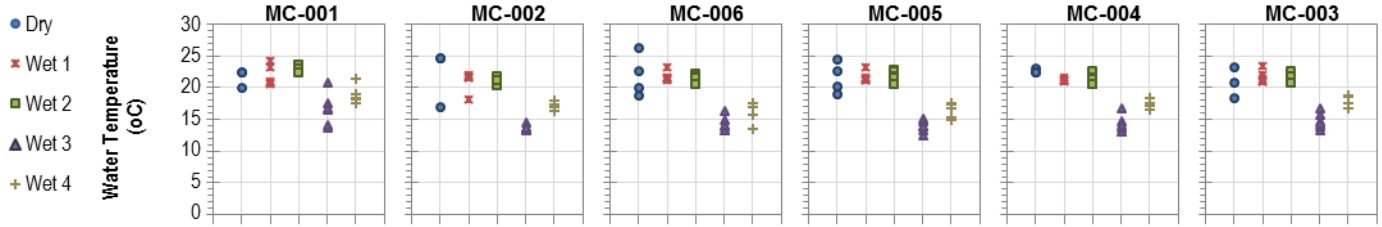


Figure B-2. Temperature Measurements – In-stream Tributary Stations

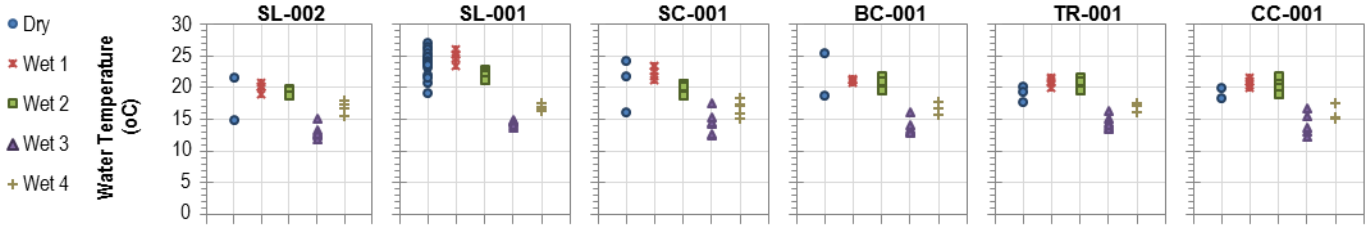
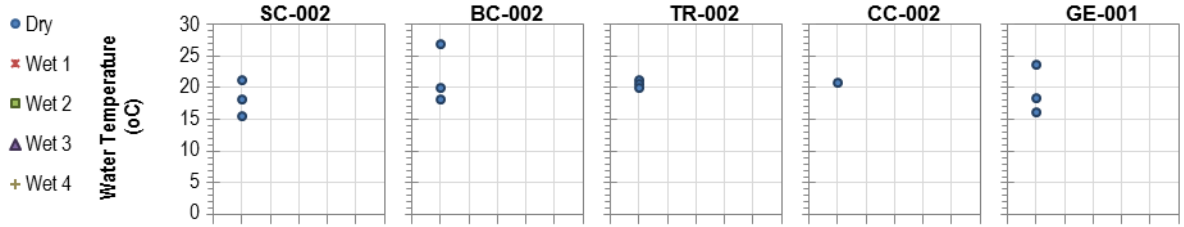


Figure B-3. Temperature Measurements – Upstream Tributary Stations



Dissolved Oxygen

Figure B-4. DO Measurements – Mainstem Stations

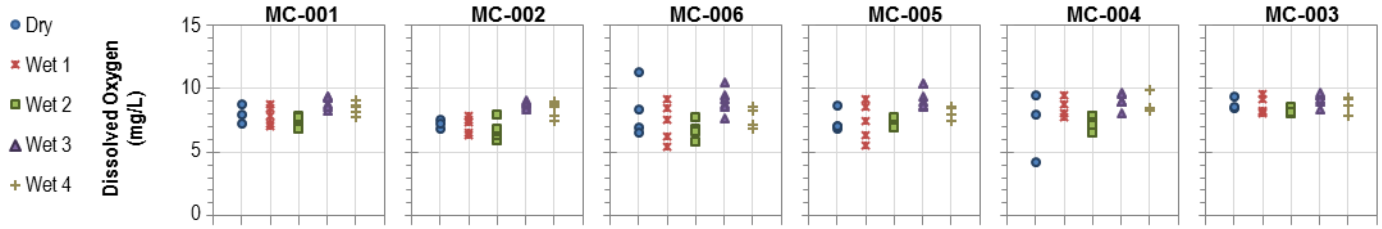


Figure B-5. DO Measurements – In-stream Tributary Stations

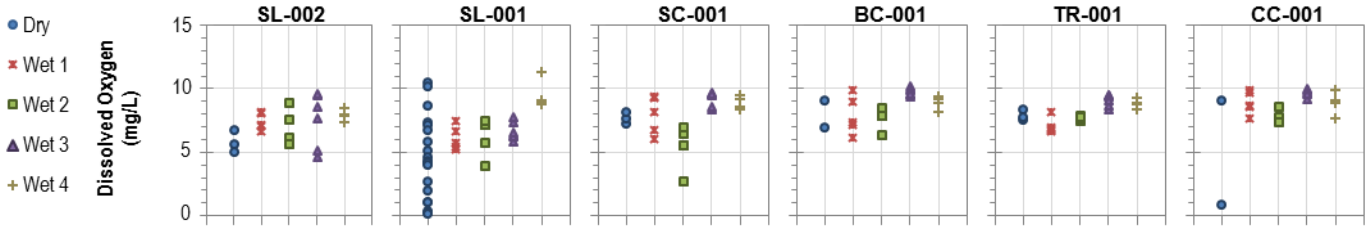
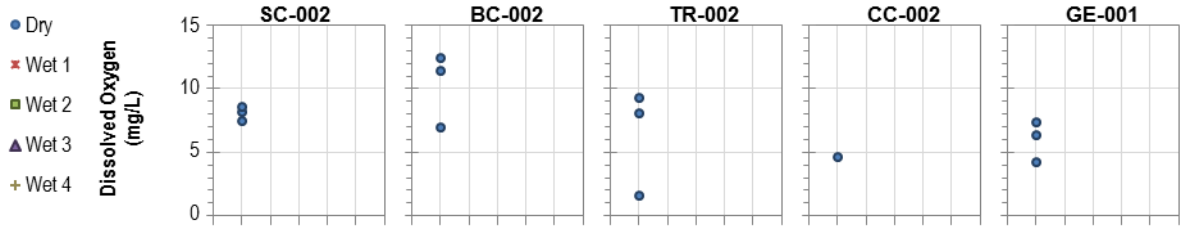


Figure B-6. DO Measurements – Upstream Tributary Stations



Specific Conductance

Figure B-7. Specific Conductance Measurements – Mainstem Stations

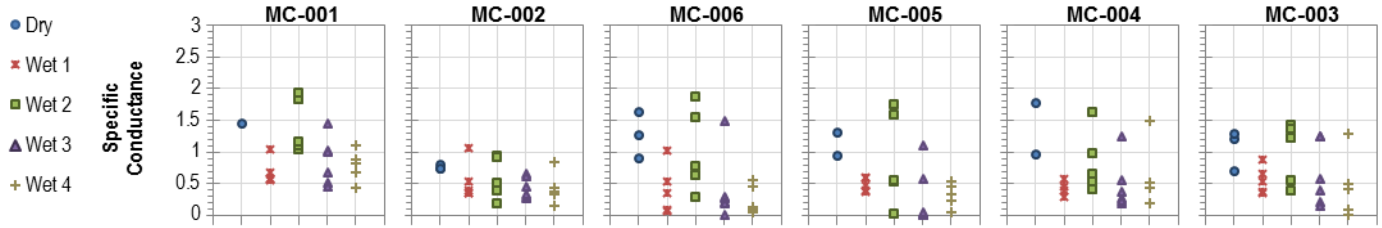


Figure B-8. Specific Conductance Measurements – In-stream Tributary Stations

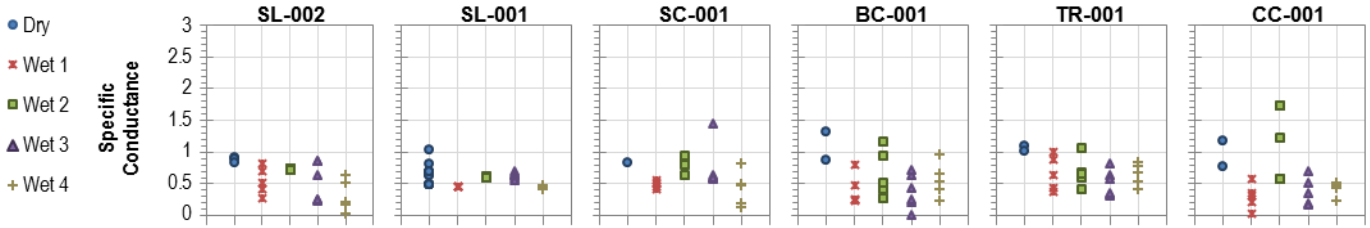
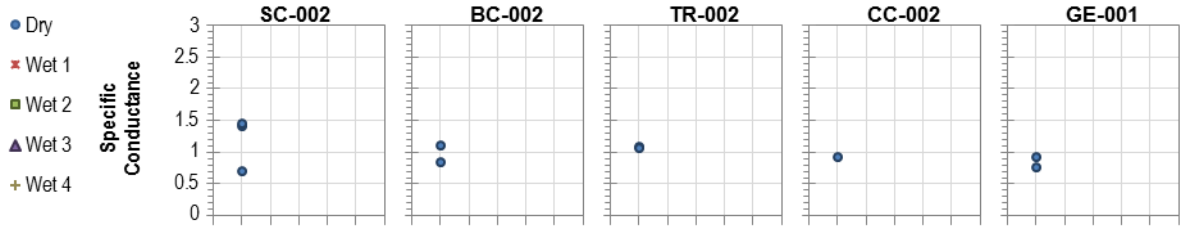


Figure B-9. Specific Conductance Measurements – Upstream Tributary Stations



Total Hardness

Figure B-10. Total Hardness Measurements – Mainstem Stations

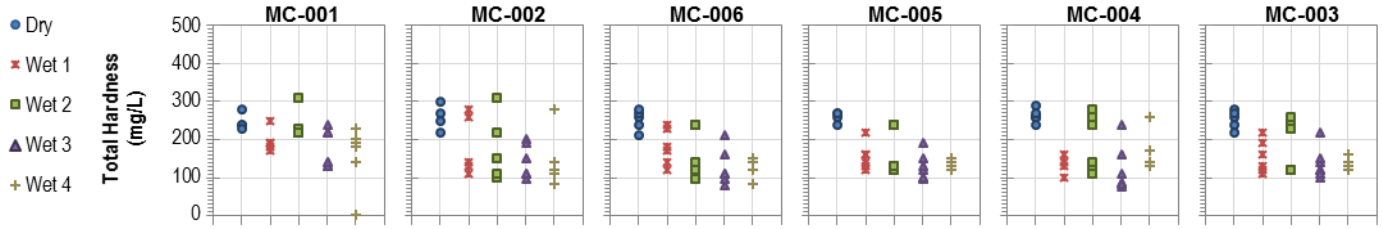


Figure B-11. Total Hardness Measurements – In-stream Stations

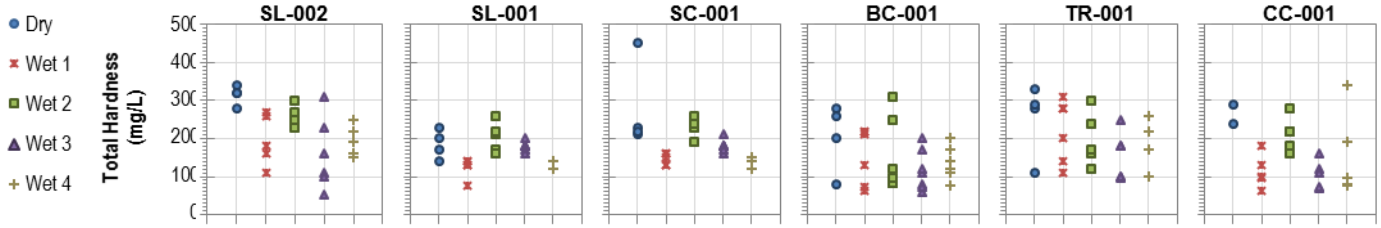


Figure B-12. Total Hardness Measurements – Upstream Stations

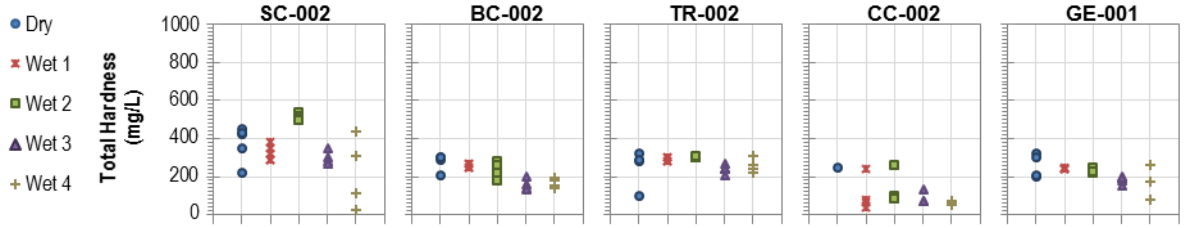


Figure B-13. Total Hardness Measurements – CSO Stations

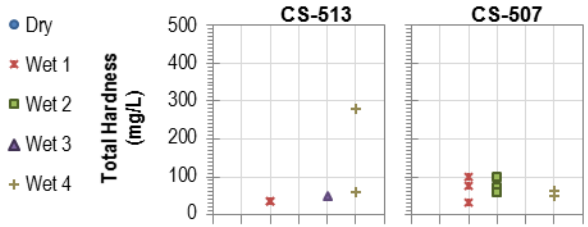
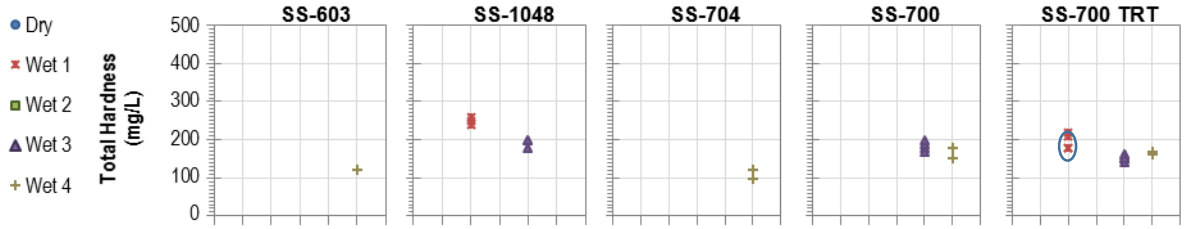
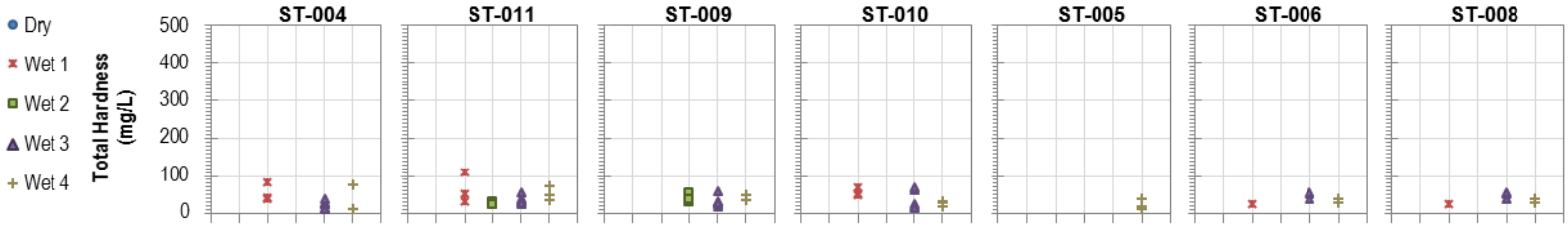


Figure B-14. Total Hardness Measurements – SSO Stations



Note: Circled samples at SS-700 TRT indicate combined treated effluent and overflow. All other samples are treated effluent only.

Figure B-15. Total Hardness Measurements – Stormwater Outfall Stations



pH

Figure B-16. pH Measurements – Mainstem Stations

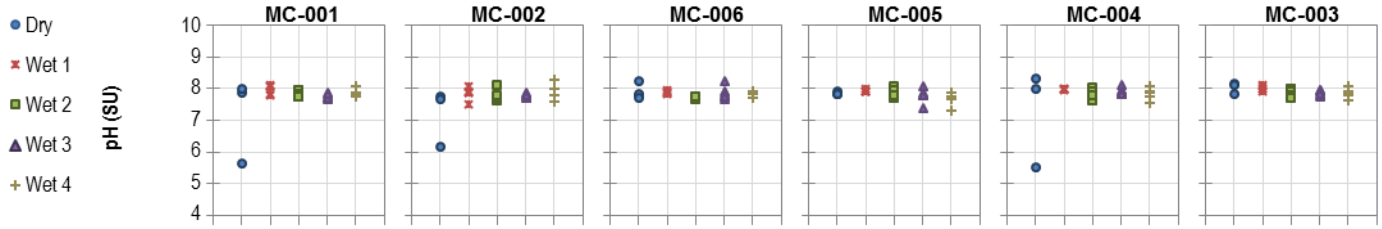


Figure B-17. pH Measurements – In-stream Stations

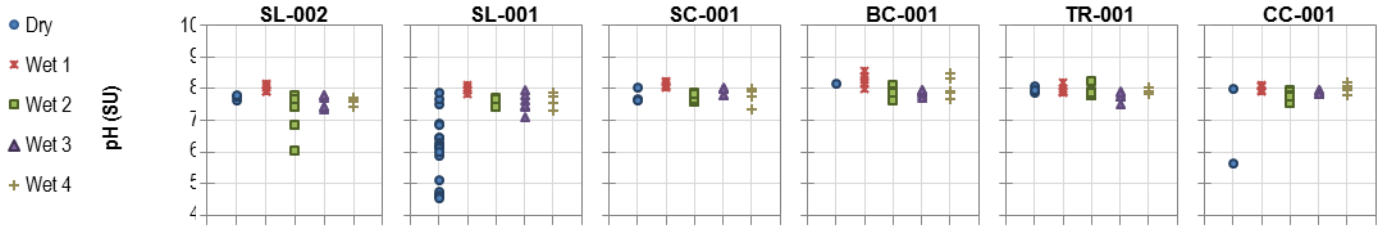
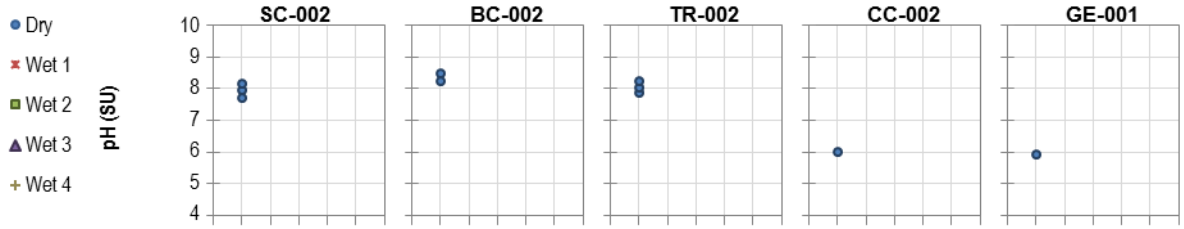


Figure B-18. pH Measurements – Upstream Stations



Nutrient Related

CBOD5

Figure B-19. CBOD5 Measurements – Mainstem Stations

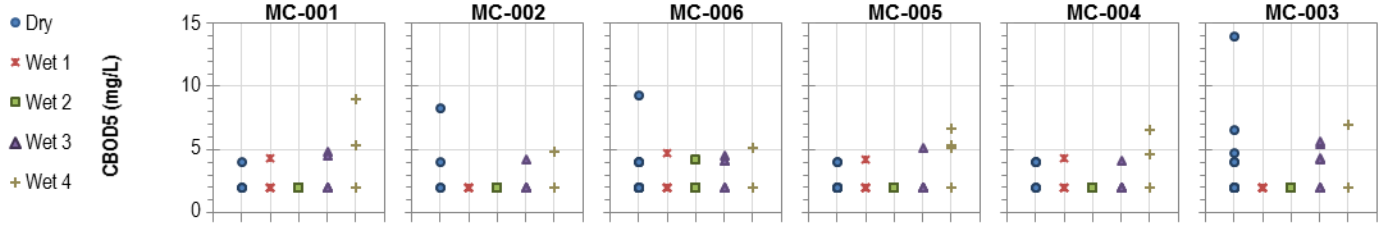


Figure B-20. CBOD5 Measurements – In-stream Tributary Stations

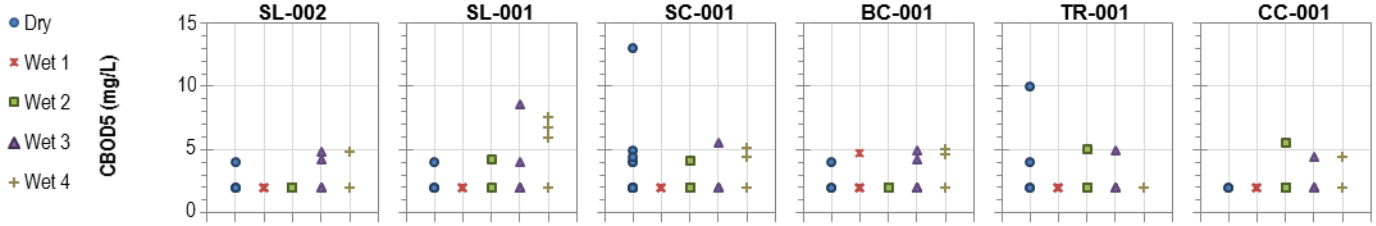


Figure B-21. CBOD5 Measurements – Upstream Tributary Stations

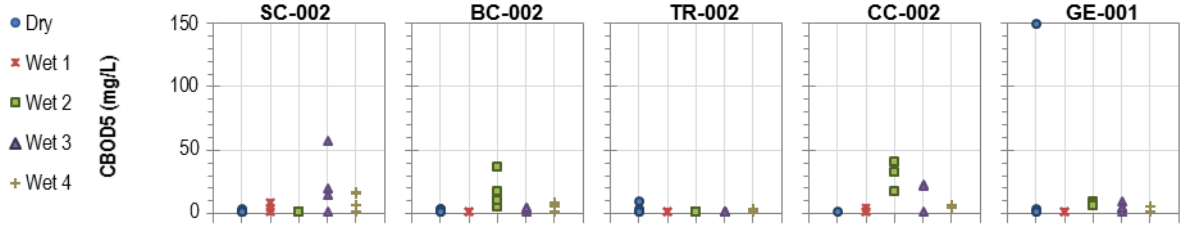


Figure B-22. CBOD5 Measurements – CSO Stations

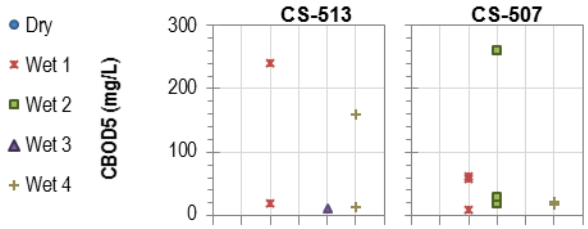
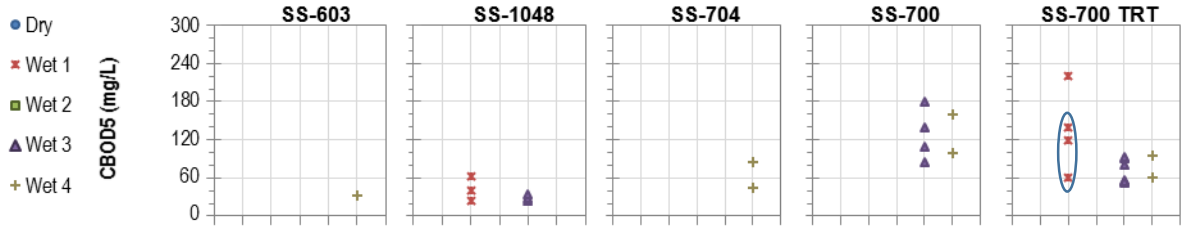
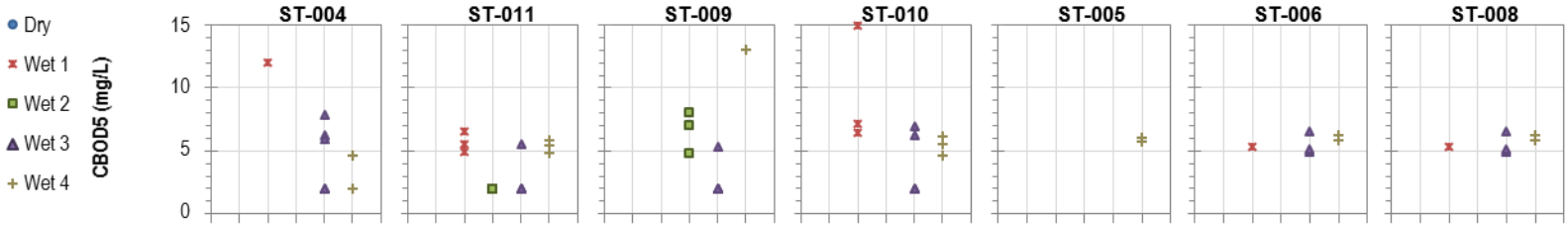


Figure B-23. CBOD5 Measurements – SSO Stations



Note: Circled samples at SS-700 TRT indicate combined treated effluent and overflow. All other samples are treated effluent only.

Figure B-24. CBOD5 Measurements – Stormwater Outfall Stations



Ammonia

Figure B-25. Ammonia Measurements – Mainstem Stations

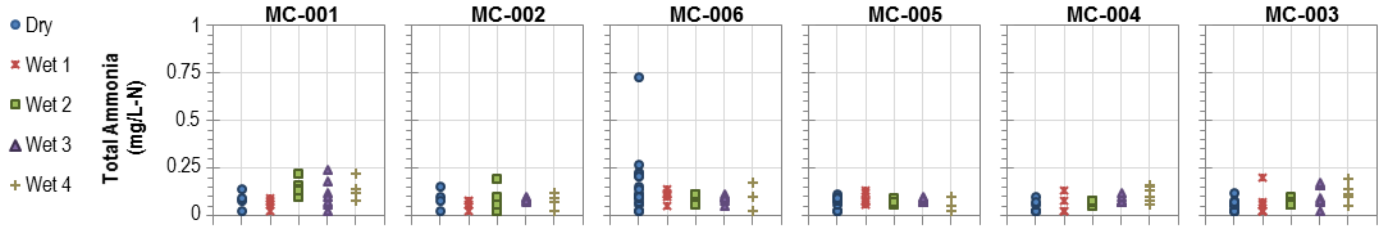


Figure B-26. Ammonia Measurements – In-stream Tributary Stations

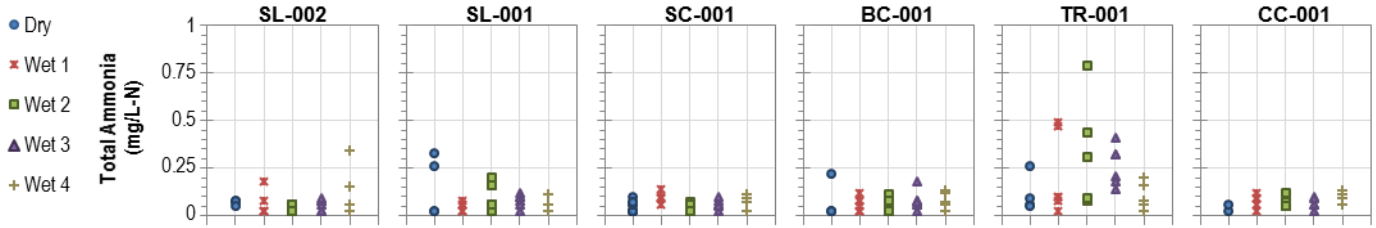


Figure B-27. Ammonia Measurements – Upstream Tributary Stations

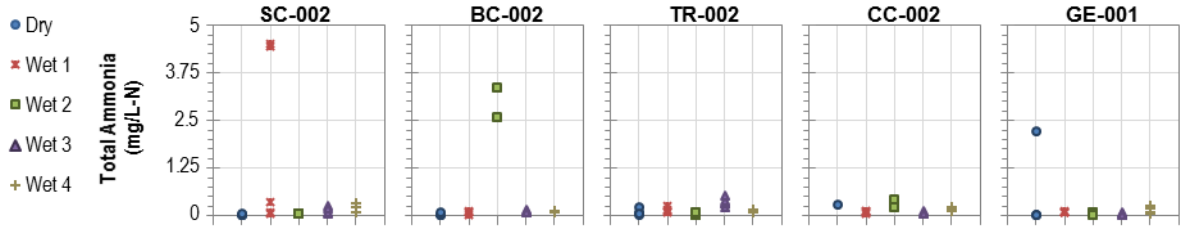


Figure B-28. Ammonia Measurements – CSO Stations

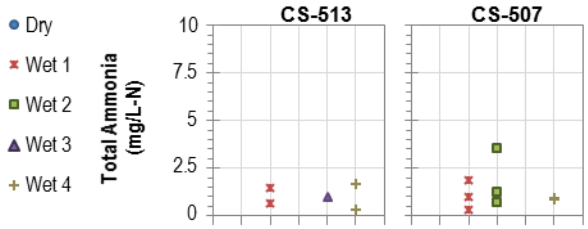
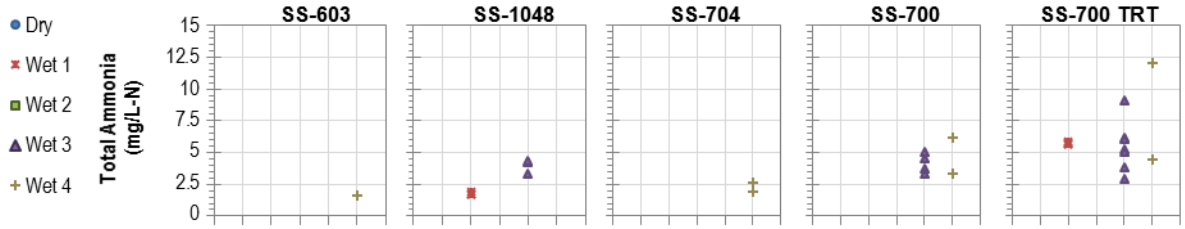
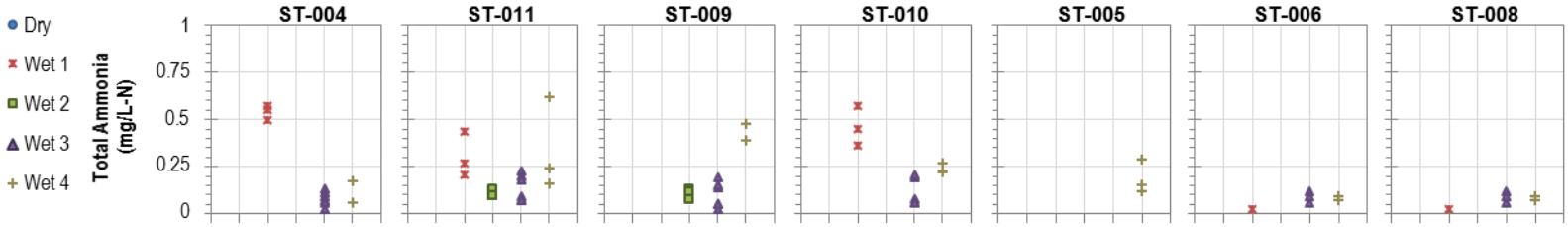


Figure B-29. Ammonia Measurements –SSO Stations



Note: For Wet Event #1, three of the four samples at SS-700 TRT were a combination of treated effluent and tank overflow. All other samples are treated effluent only.

Figure B-30. Ammonia Measurements – Stormwater Outfall Stations



NO3+NO2

Figure B-31. Nitrate-Nitrite Measurements – Mainstem Stations

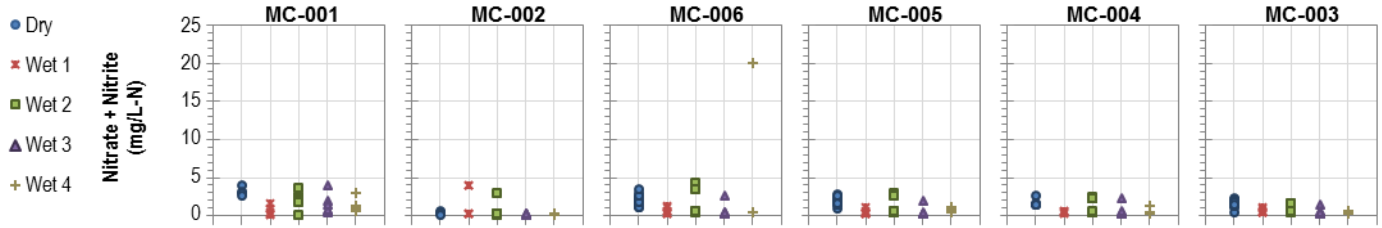


Figure B-32. Nitrate-Nitrite Measurements – In-stream Tributary Stations

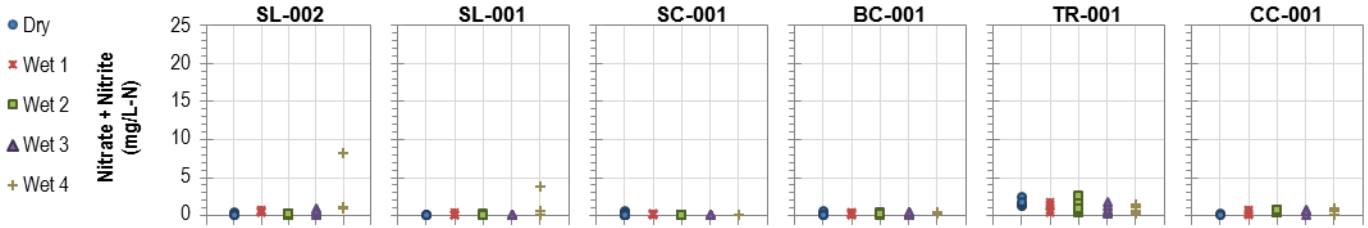


Figure B-33. Nitrate-Nitrite Measurements – Upstream Tributary Stations

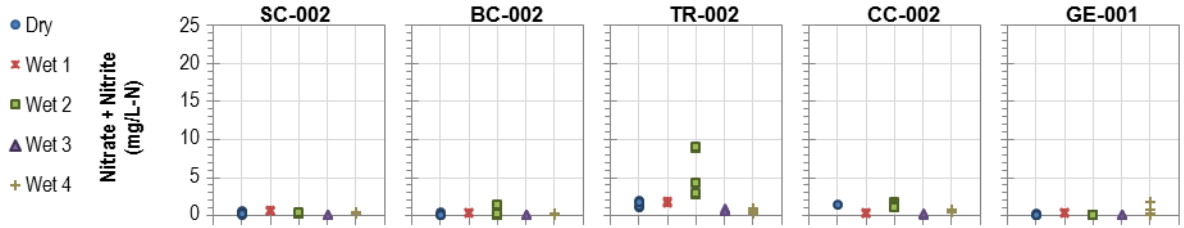


Figure B-34. Nitrate-Nitrite Measurements – CSO Stations

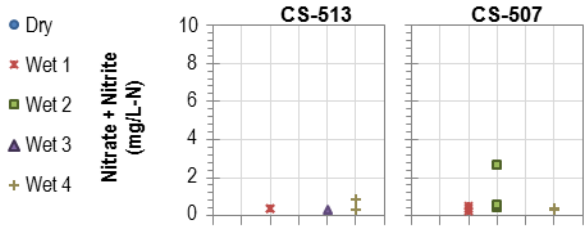
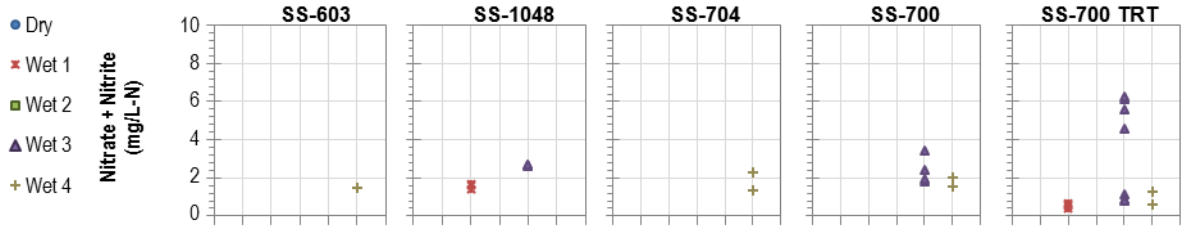
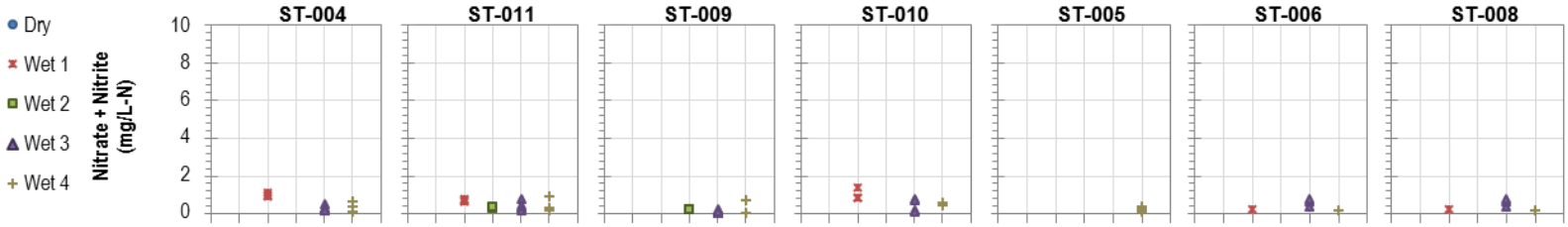


Figure B-35. Nitrate-Nitrite Measurements –SSO Stations



Note: For Wet Event #1, three of the four samples at SS-700 TRT were a combination of treated effluent and tank overflow. All other samples are treated effluent only.

Figure B-36. Nitrate-Nitrite Measurements – Stormwater Outfall Stations



Total Kjeldahl Nitrogen

Figure B-37. TKN Measurements – Mainstem Stations

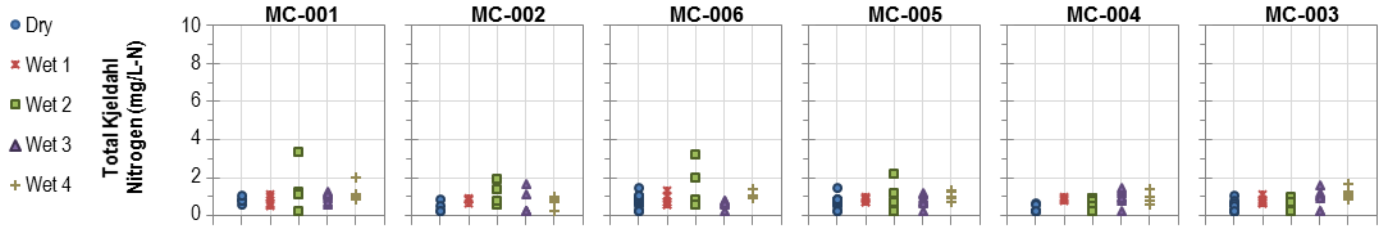


Figure B-38. TKN Measurements – In-stream Tributary Stations

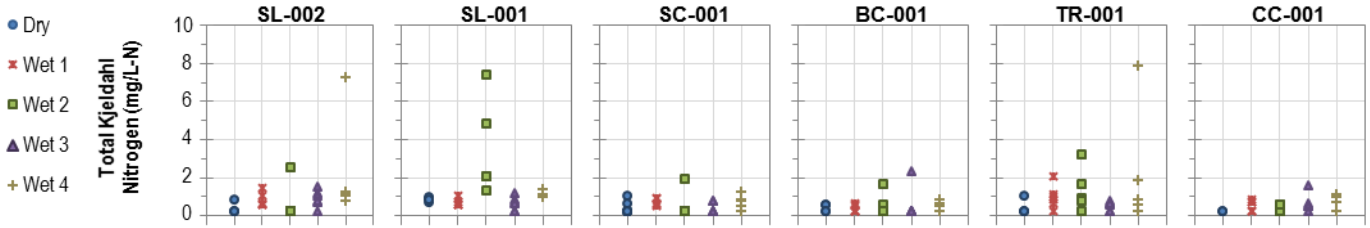


Figure B-39. TKN Measurements – Upstream Tributary Stations

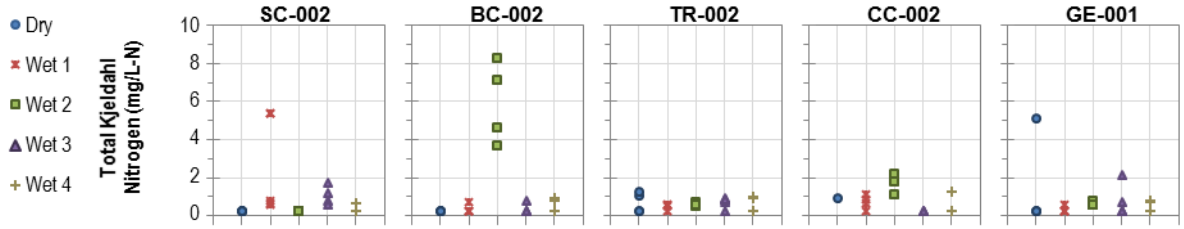


Figure B-40. TKN Measurements – CSO Tributary Stations

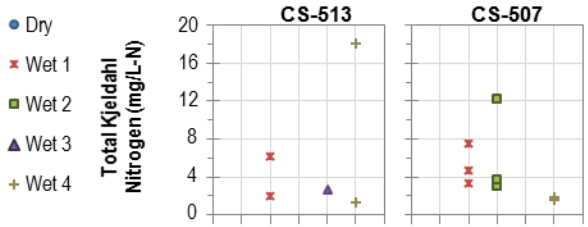
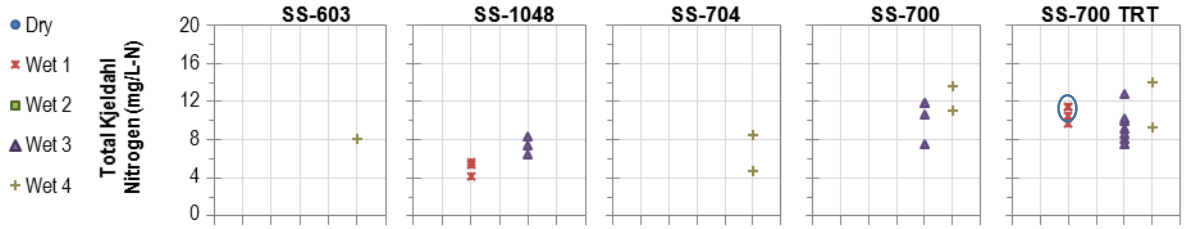
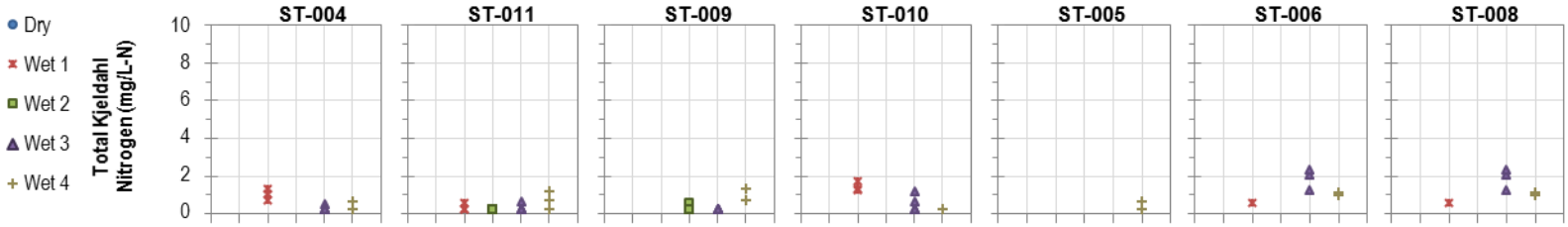


Figure B-41. TKN Measurements – SSO Tributary Stations



Note: Circled samples at SS-700 TRT indicate combined treated effluent and overflow. All other samples are treated effluent only.

Figure B-42. TKN – Stormwater Outfall Tributary Stations



Ortho-Phosphate

Figure B-43. Ortho-Phosphate Measurements – Mainstem Stations

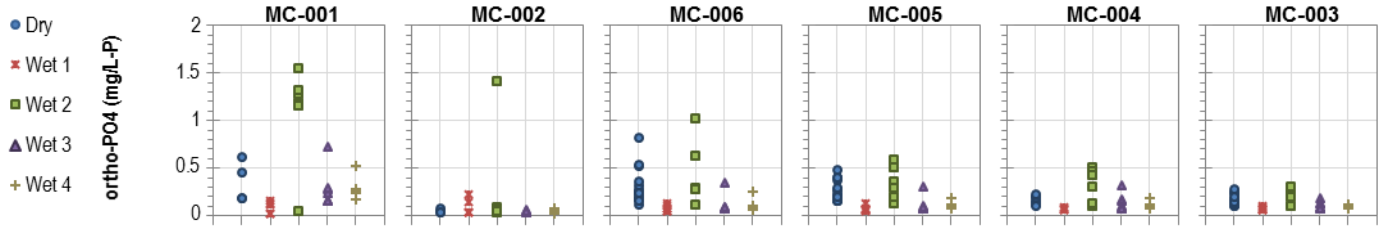


Figure B-44. Ortho-Phosphate Measurements – In-stream Tributary Stations

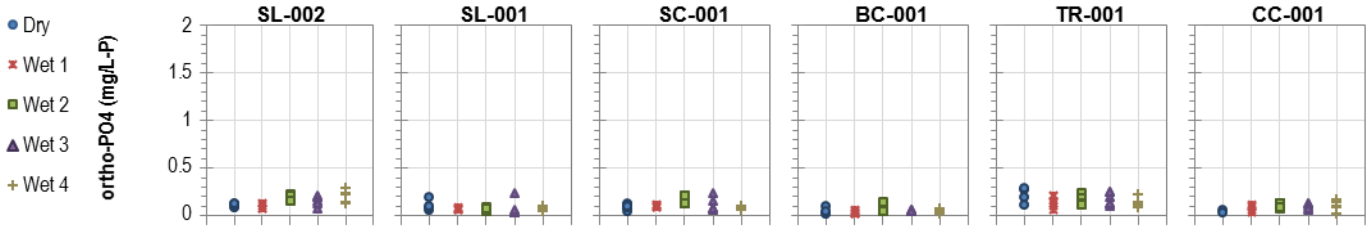


Figure B-45. Ortho-Phosphate Measurements – Upstream Tributary Stations

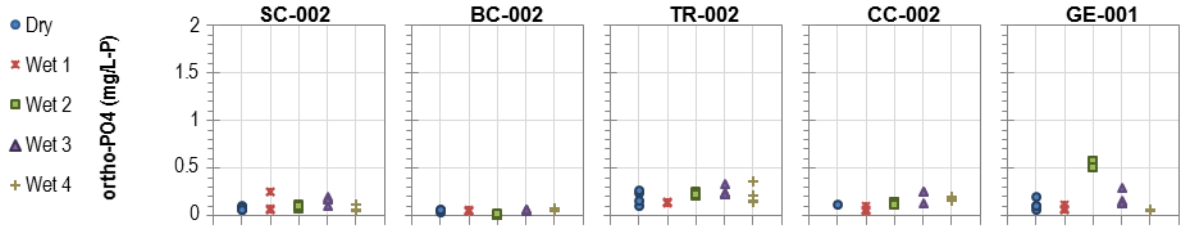


Figure B-46. Ortho-Phosphate Measurements – CSO Tributary Stations

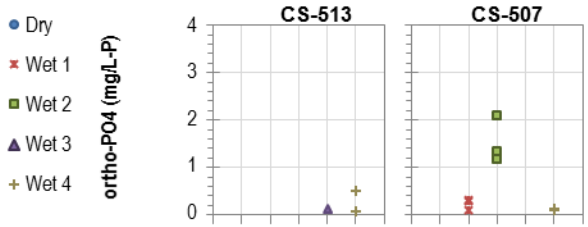
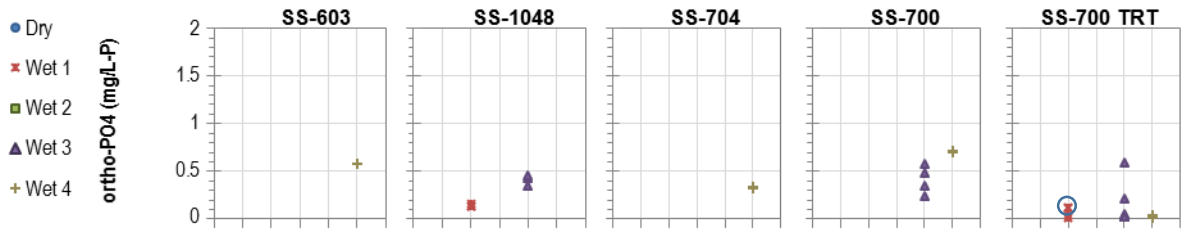
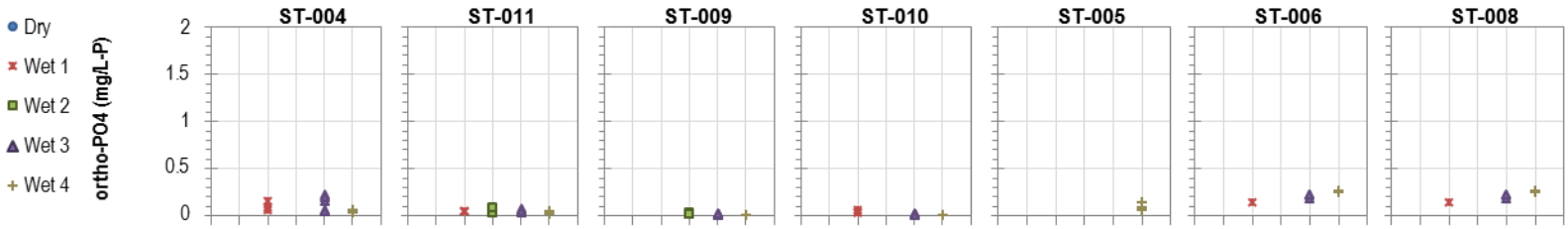


Figure B-47. Ortho-Phosphate Measurements – SSO Tributary Stations



Note: Circled samples at SS-700 TRT indicate combined treated effluent and overflow. All other samples are treated effluent only.

Figure B-48. Ortho-Phosphate Measurements – Stormwater Outfall Tributary Stations



Total Phosphorus

Figure B-49. Total Phosphorus Measurements – Mainstem Stations

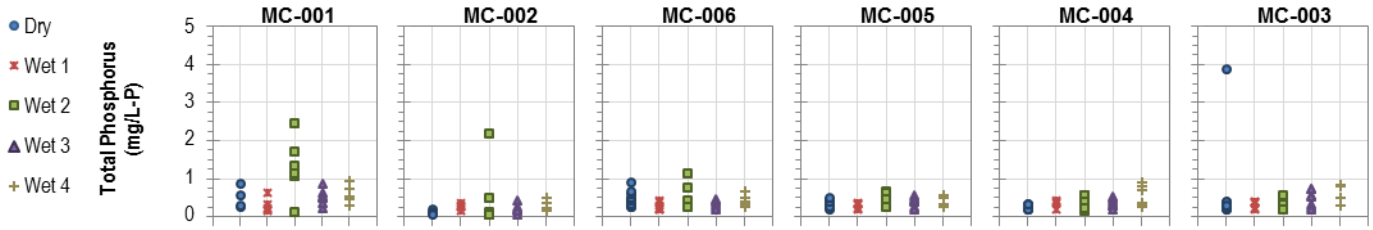


Figure B-50. Total Phosphorus Measurements – In-stream Tributary Stations

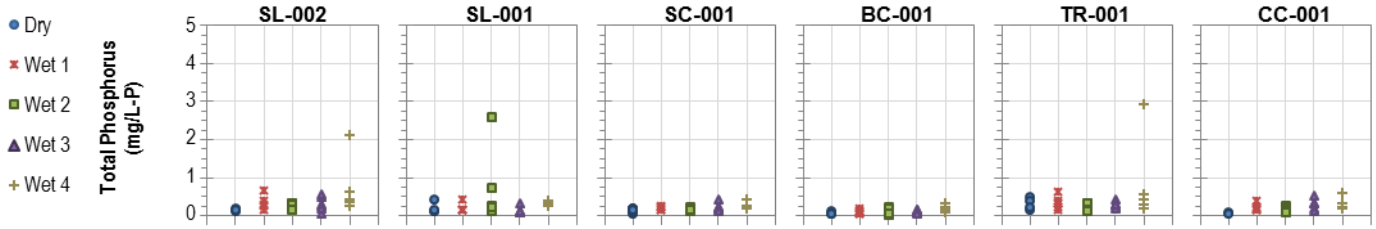


Figure B-51. Total Phosphorus Measurements – Upstream Tributary Stations

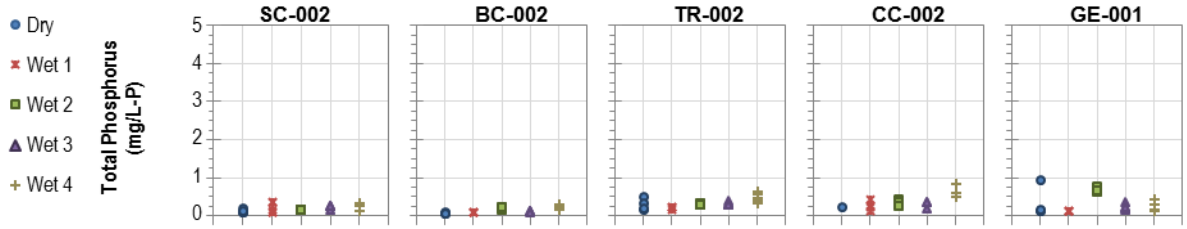


Figure B-52. Total Phosphorus Measurements – CSO Stations

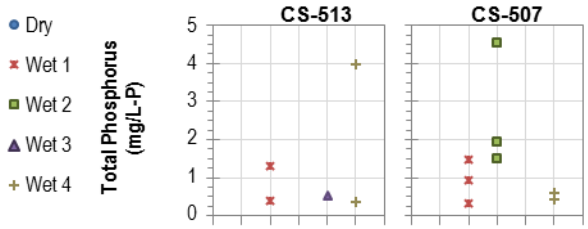
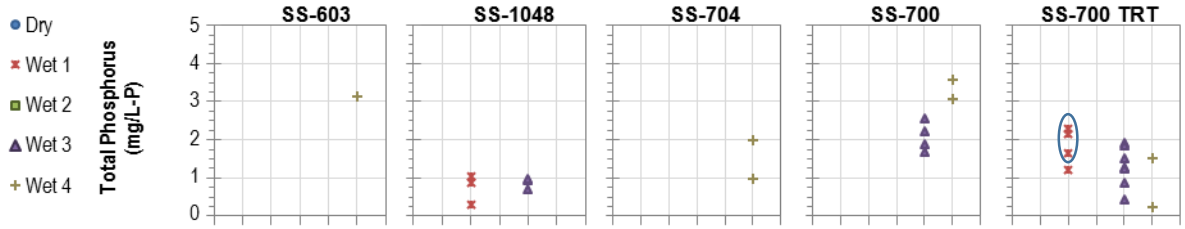
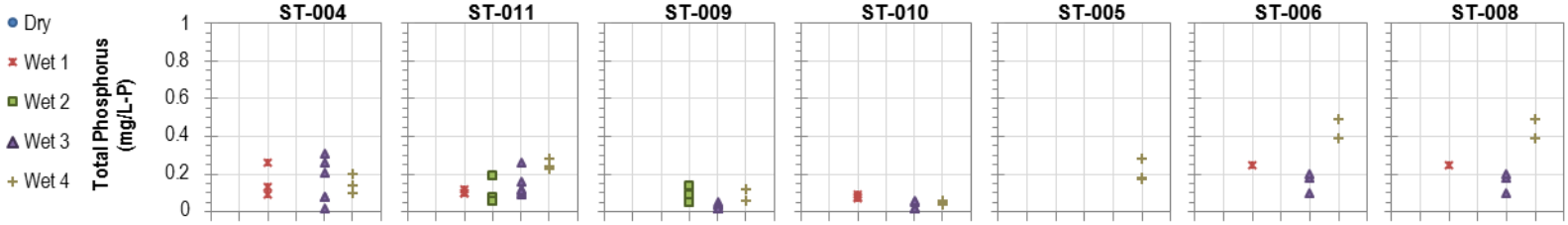


Figure B-53. Total Phosphorus Measurements –SSO Stations



Note: Circled samples at SS-700 TRT indicate combined treated effluent and overflow. All other samples are treated effluent only.

Figure B-54. Total Phosphorus Measurements – Stormwater Outfall Stations



Total Organic Carbon

Figure B-55. TOC Measurements – Mainstem Stations

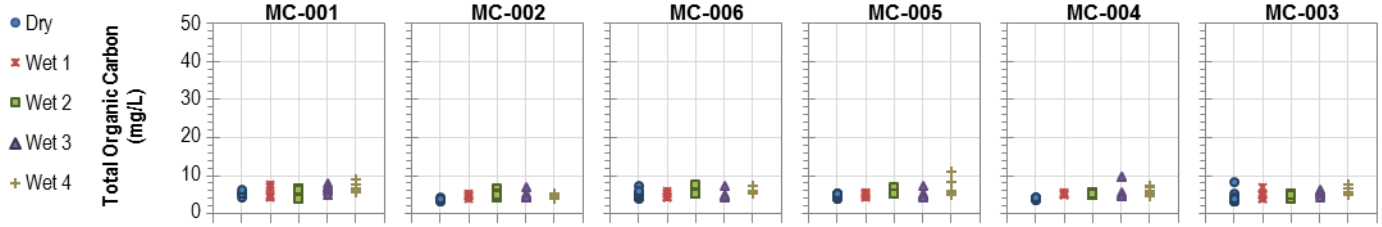


Figure B-56. TOC Measurements – In-stream Tributary Stations

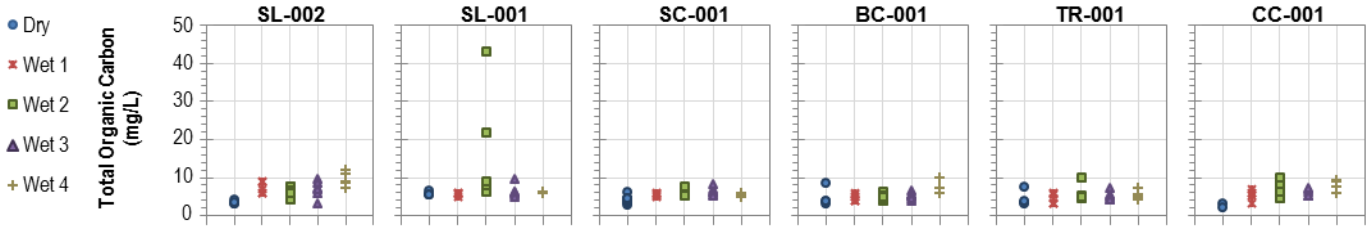


Figure B-57. TOC Measurements – Upstream Tributary Stations

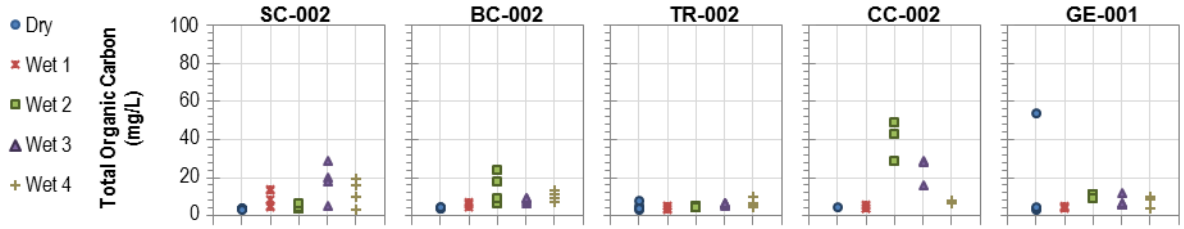


Figure B-58. TOC Measurements – CSO Tributary Stations

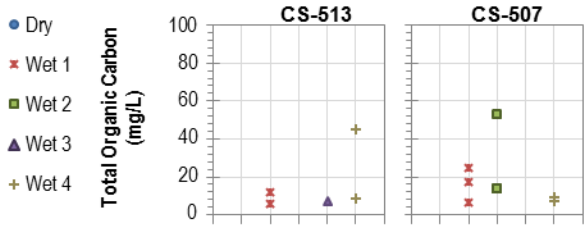
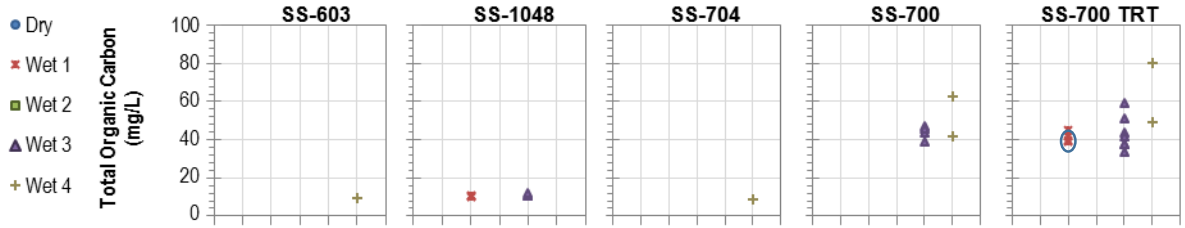
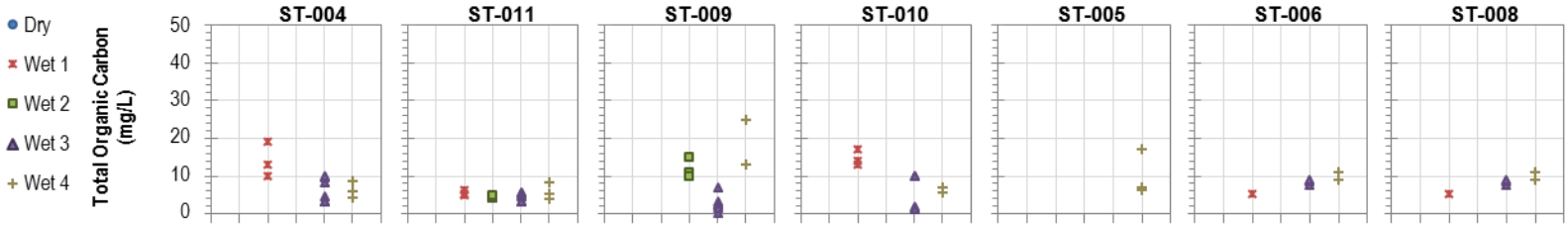


Figure B-59. TOC Measurements – SSO Tributary Stations



Note: Circled samples at SS-700 TRT indicate combined treated effluent and overflow. All other samples are treated effluent only.

Figure B-60. TOC Measurements – Stormwater Outfall Tributary Stations



Chlorophyll *a*

Figure B-61. Chlorophyll *a* Measurements – Mainstem Stations

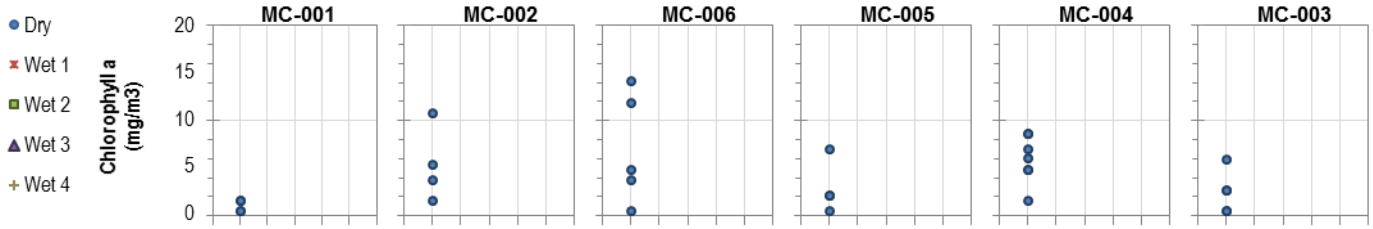


Figure B-62. Chlorophyll *a* Measurements – In-stream Tributary Stations

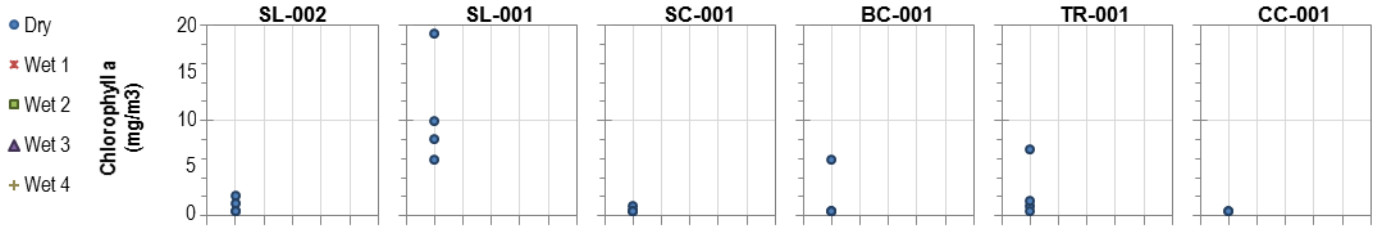
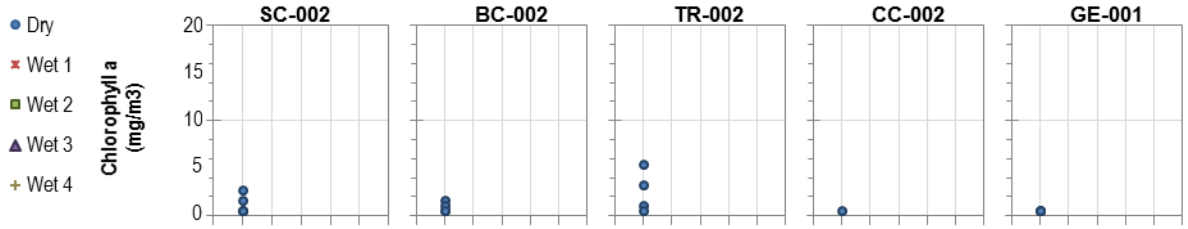


Figure B-63. Chlorophyll *a* Measurements – Upstream Tributary Stations



Bacteria, Chloride, TSS, and Metals

E. coli

Figure B-64. E coli Measurements – Mainstem Stations

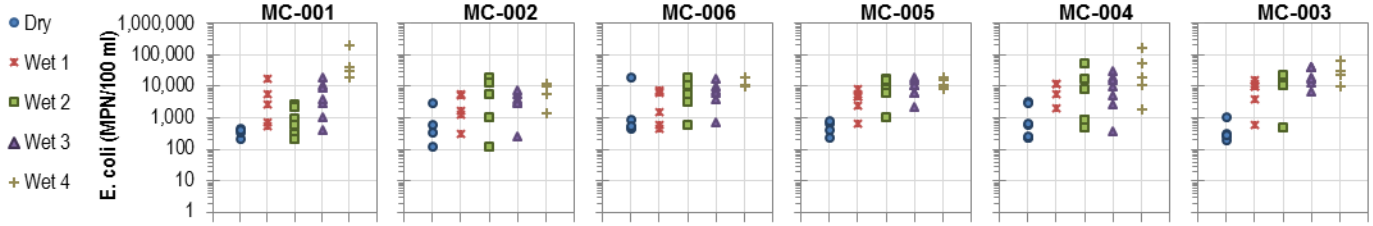


Figure B-65. E coli Measurements – In-stream Tributary Stations

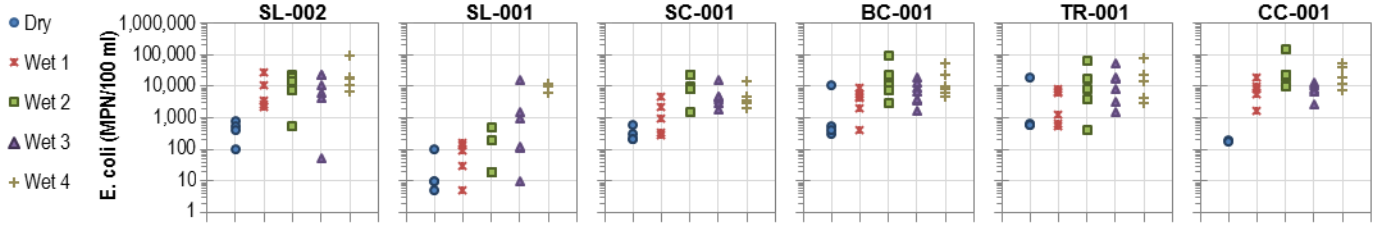


Figure B-66. E coli Measurements – Upstream Tributary Stations

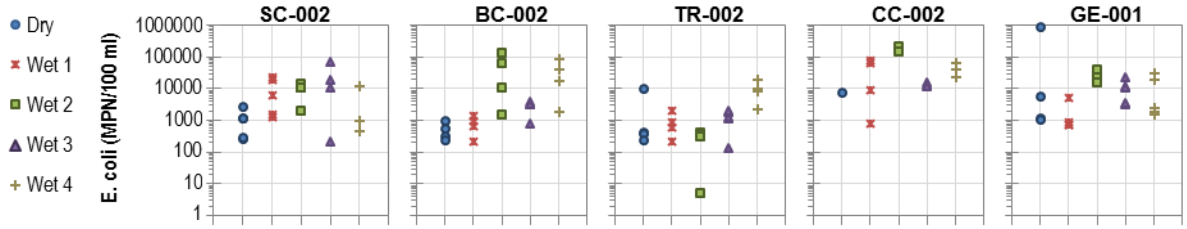


Figure B-67. E coli Measurements – CSO Stations

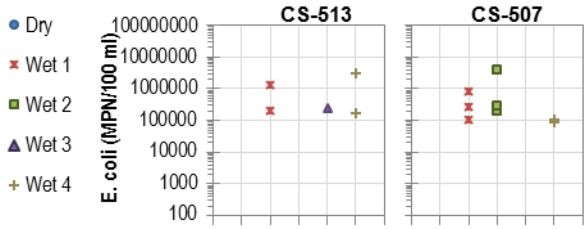
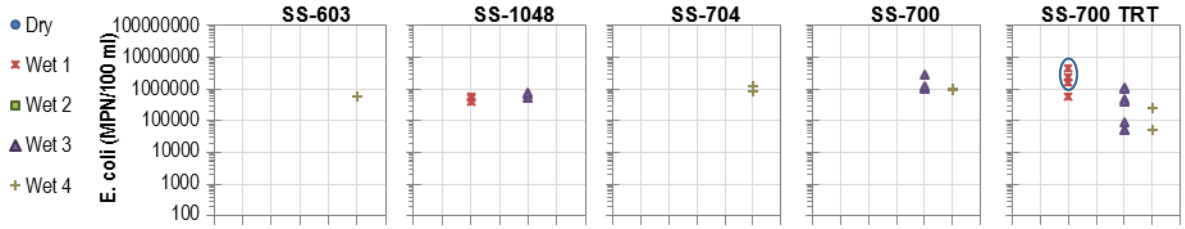
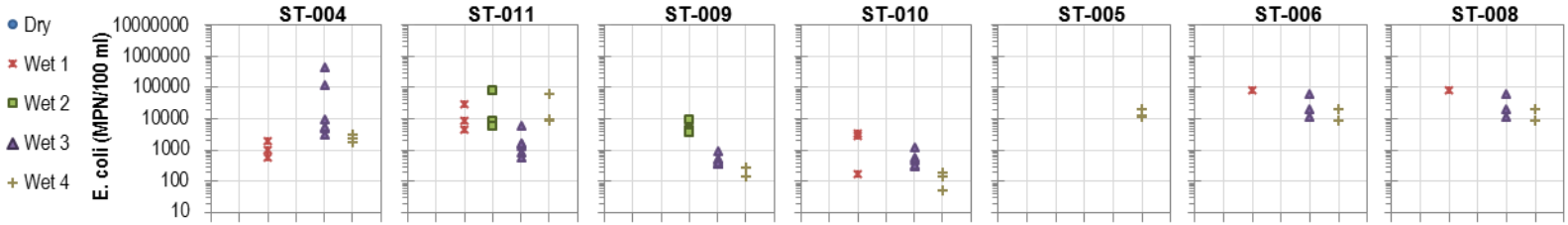


Figure B-68. E coli Measurements –SSO Stations



Note: Circled samples at SS-700 TRT indicate combined treated effluent and overflow. All other samples are treated effluent only.

Figure B-69. E coli Measurements – Stormwater Outfall Stations



Chloride

Figure B-70. Chloride Measurements – Mainstem Stations

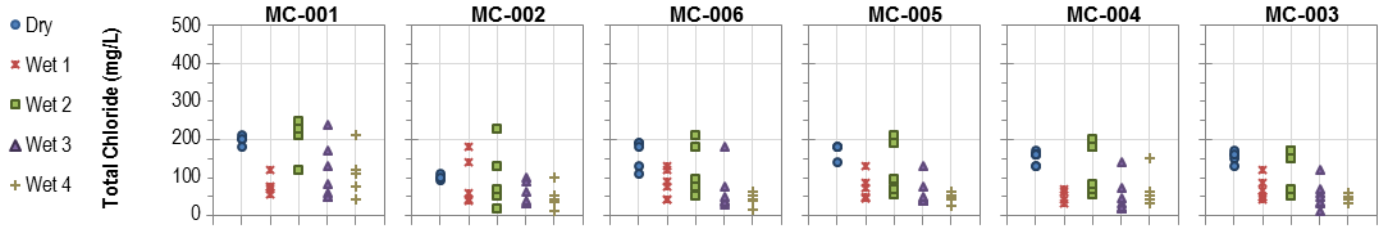


Figure B-71. Chloride Measurements – In-stream Tributary Stations

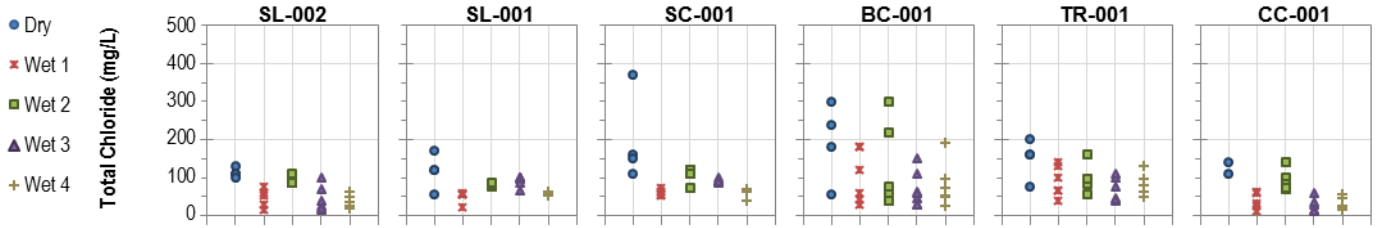


Figure B-72. Chloride Measurements – Upstream Tributary Stations

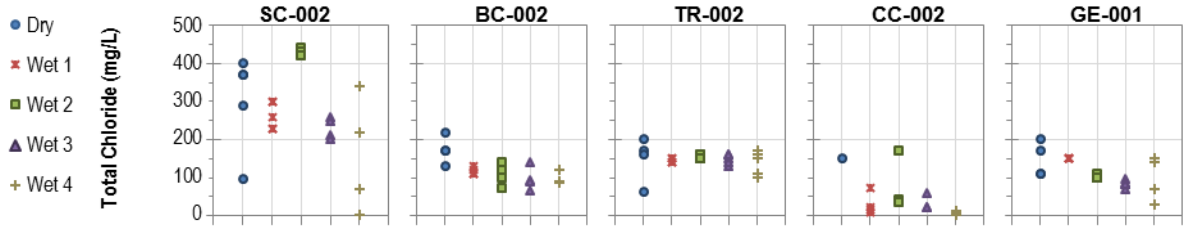


Figure B-73. Chloride Measurements – CSO Stations

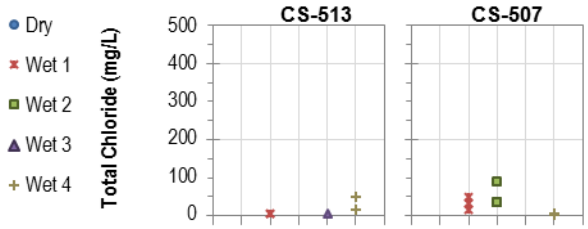
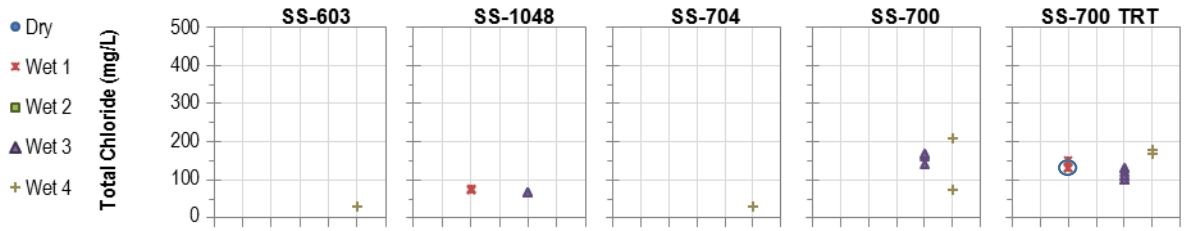
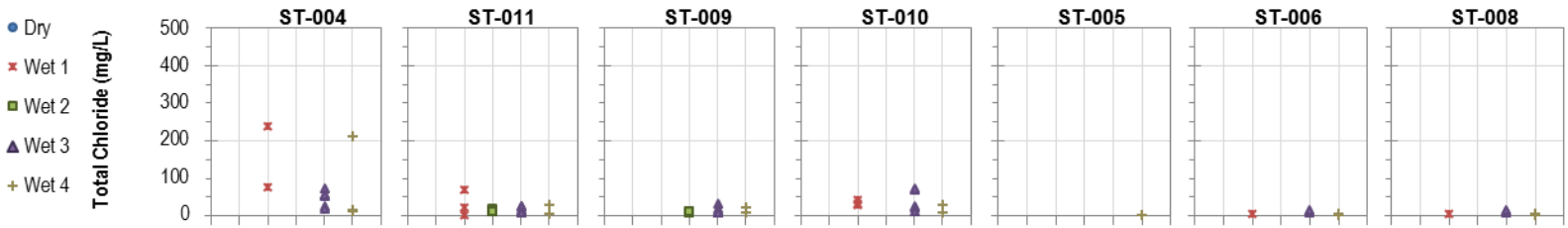


Figure B-74. Chloride Measurements –SSO Stations



Note: Circled samples at SS-700 TRT indicate combined treated effluent and overflow. All other samples are treated effluent only.

Figure B-75. Chloride Measurements – Stormwater Outfall Stations



Total Suspended Solids

Figure B-76. Total Suspended Solids Measurements – Mainstem Stations

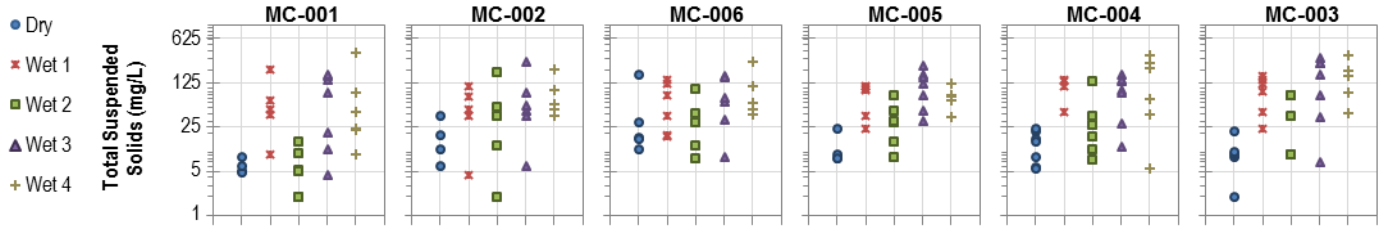


Figure B-77. Total Suspended Solids Measurements – In-stream Tributary Stations

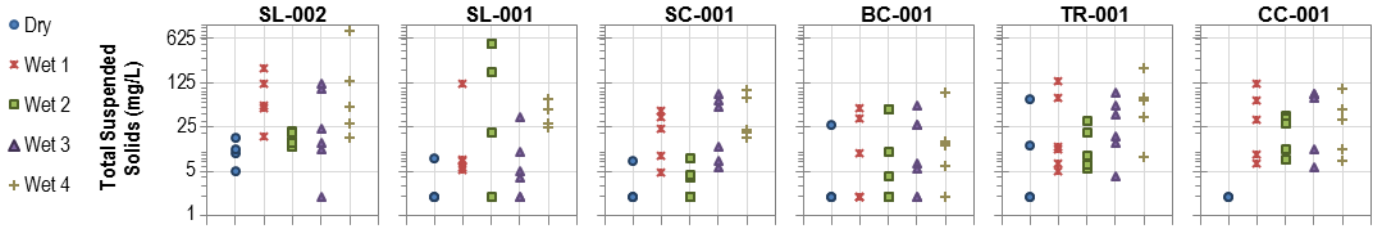


Figure B-78. Total Suspended Solids Measurements – Upstream Tributary Stations

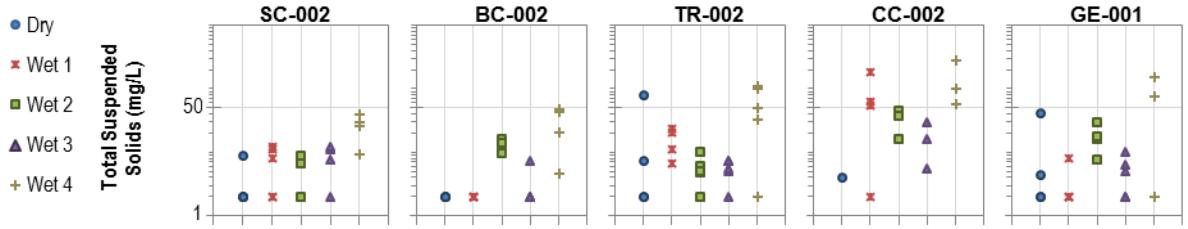


Figure B-79. Total Suspended Solids Measurements – CSO Stations

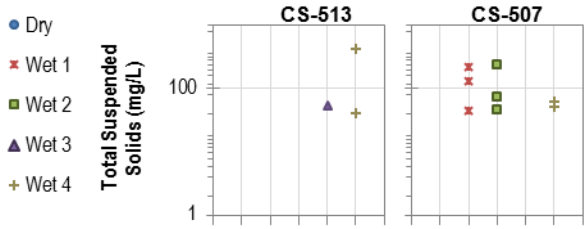
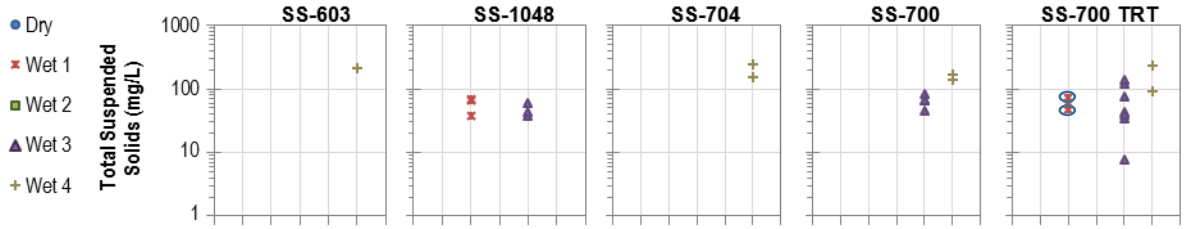
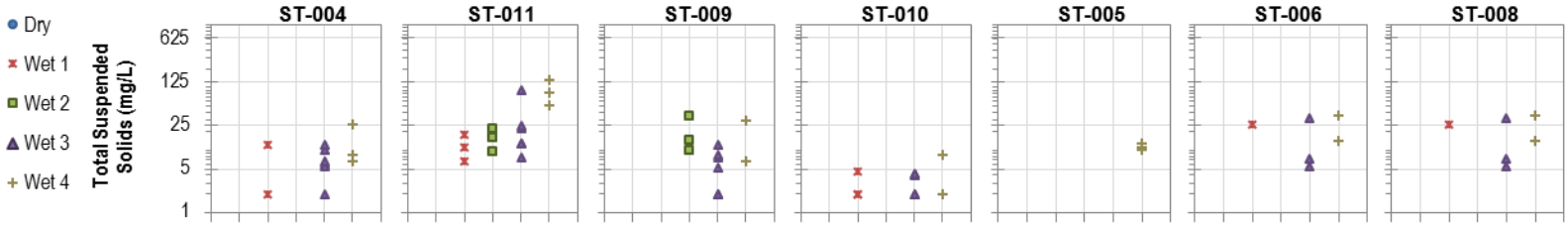


Figure B-80. Total Suspended Solids Measurements –SSO Stations



Note: Circled samples at SS-700 TRT indicate combined treated effluent and overflow. All other samples are treated effluent only.

Figure B-81. Total Suspended Solids Measurements – Stormwater Outfall Stations



Copper

Figure B-82. Copper Measurements – Mainstem Stations

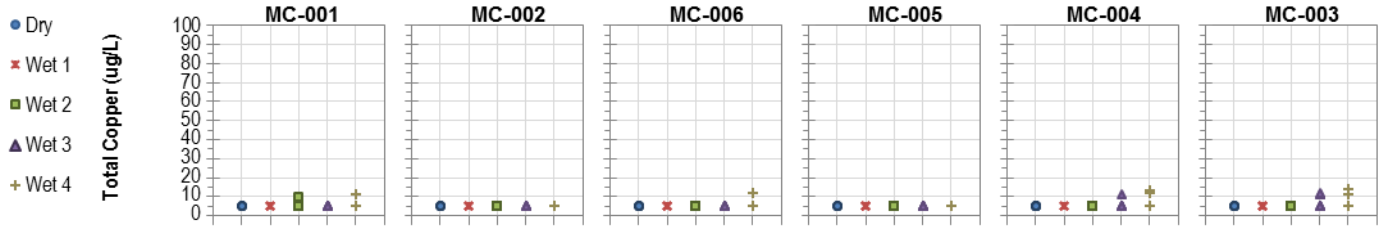


Figure B-83. Copper Measurements – In-stream Tributary Stations

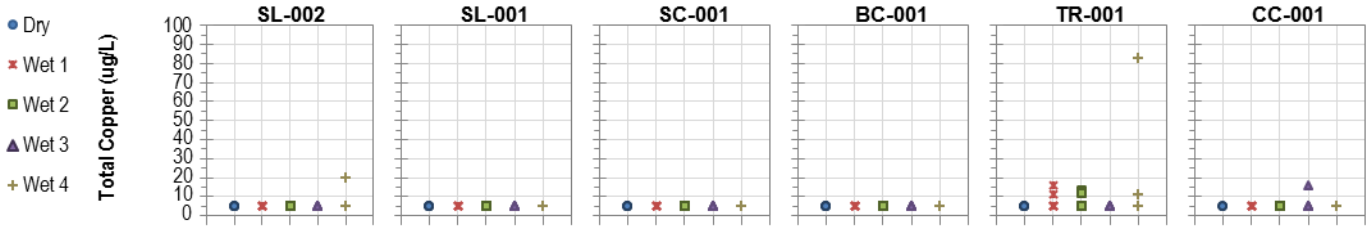


Figure B-84. Copper Measurements – Upstream Tributary Stations

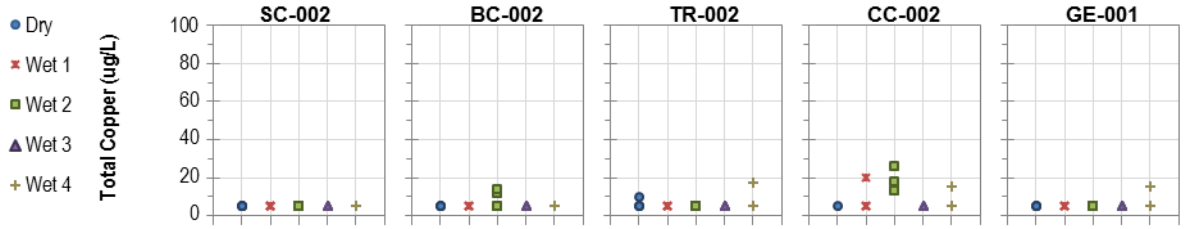


Figure B-85. Copper Measurements – CSO Tributary Stations

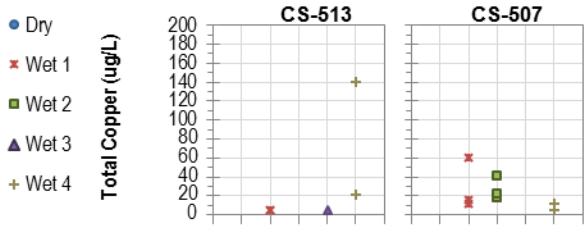
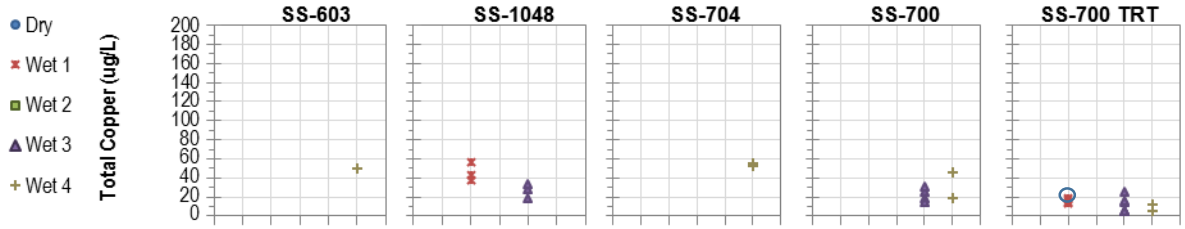
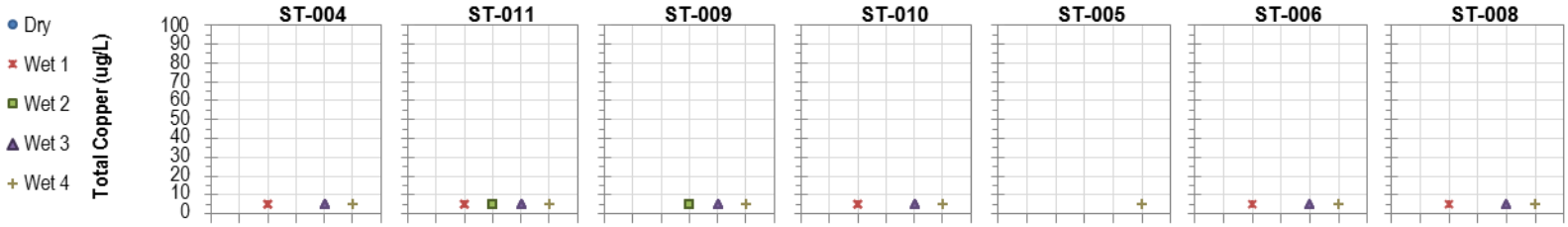


Figure B-86. Copper Measurements – SSO Tributary Stations



Note: Circled samples at SS-700 TRT indicate combined treated effluent and overflow. All other samples are treated effluent only.

Figure B-87. Copper Measurements – Stormwater Outfall Tributary Stations



Lead

Figure B-88. Lead Measurements – Mainstem Stations

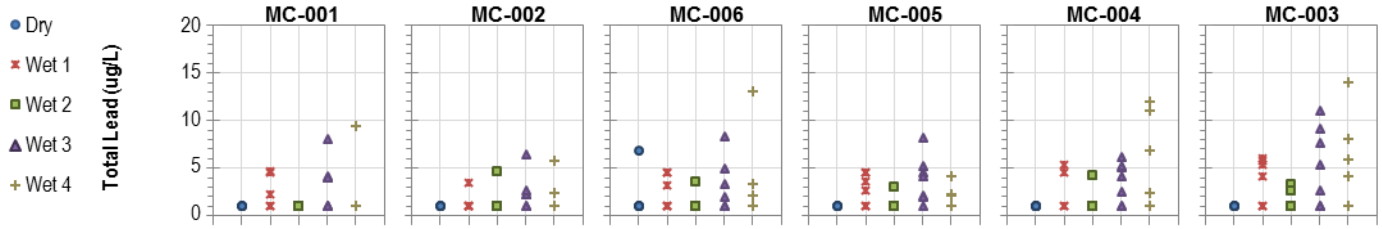


Figure B-89. Lead Measurements – In-stream Tributary Stations

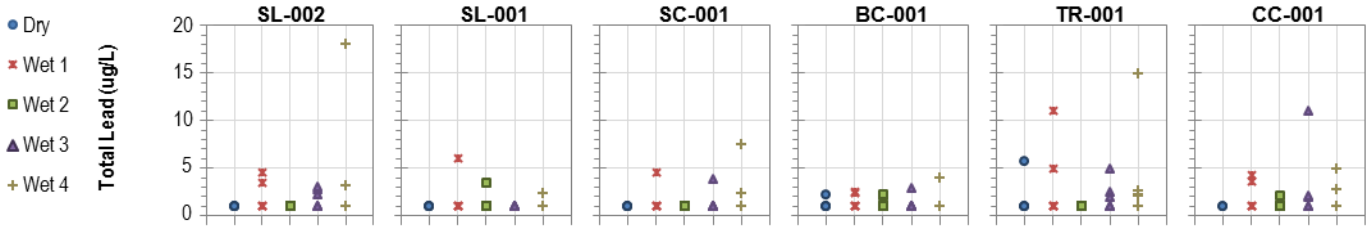


Figure B-90. Lead Measurements – Upstream Tributary Stations

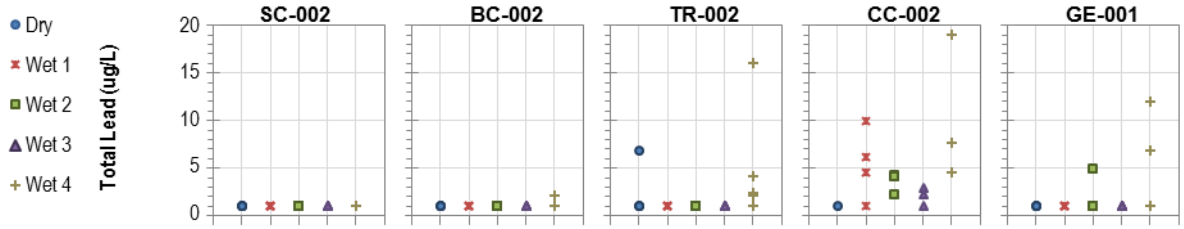


Figure B-91. Lead Measurements – CSO Tributary Stations

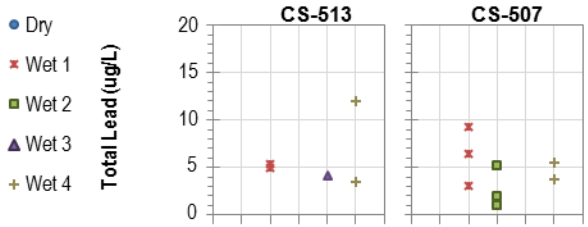
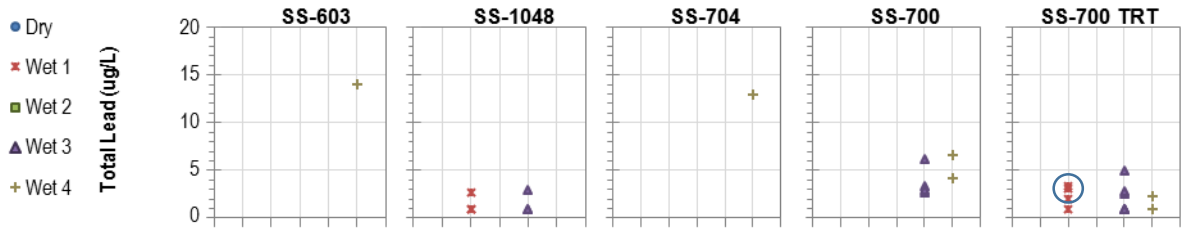
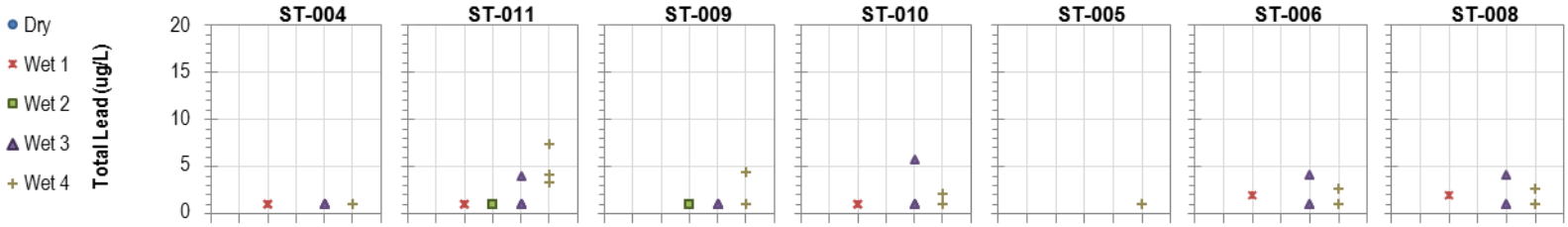


Figure B-92. Lead Measurements – SSO Tributary Stations



Note: Circled samples at SS-700 TRT indicate combined treated effluent and overflow. All other samples are treated effluent only.

Figure B-93. Lead Measurements – Stormwater Outfall Tributary Stations



Zinc

Figure B-94. Zinc Measurements – Mainstem Stations

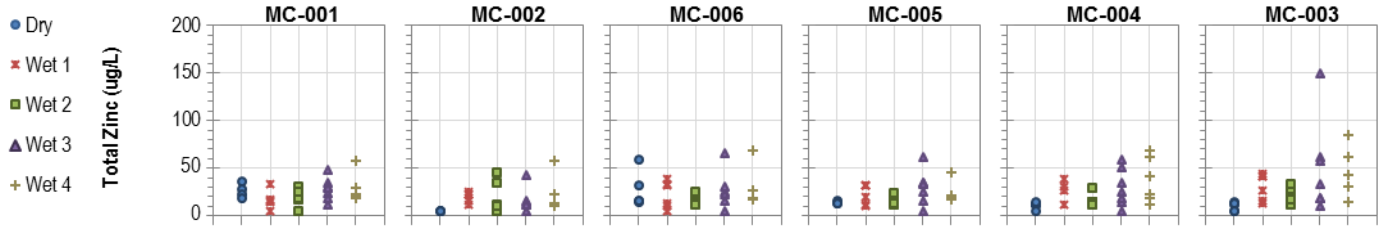


Figure B-95. Zinc Measurements – In-stream Tributary Stations

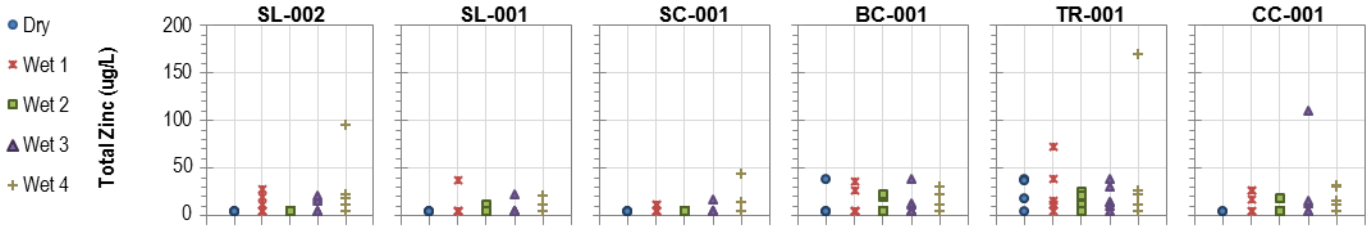


Figure B-96. Zinc Measurements – Upstream Tributary Stations

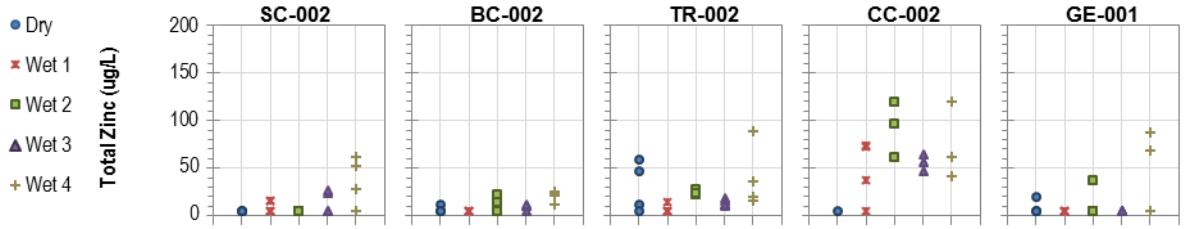


Figure B-97. Zinc Measurements – CSO Tributary Stations

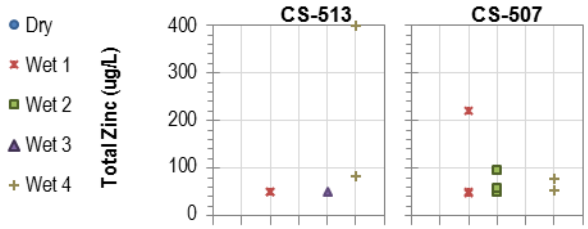
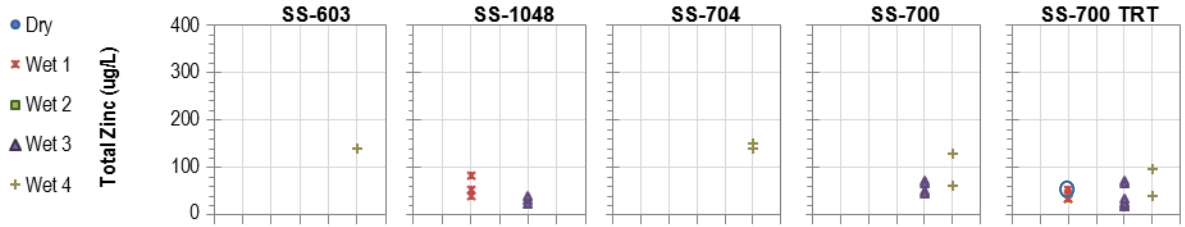
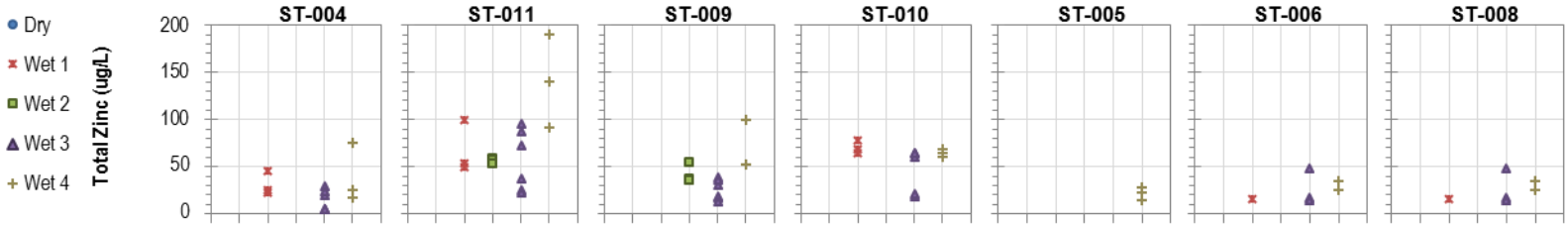


Figure B-98. Zinc Measurements – SSO Tributary Stations



Note: Circled samples at SS-700 TRT indicate combined treated effluent and overflow. All other samples are treated effluent only.

Figure B-99. Zinc Measurements – Stormwater Outfall Tributary Stations



Appendix C
Water Quality Data Tables

Physical Characteristics

Table C-1. Instream Sampling - Water Temperature (°C)

Note: In-situ Sampling - at the source locations was not done for this parameter because autosamplers were utilized.

Location	Number of Samples Collected	Minimum	Median	Average	Maximum	Location
In-stream Mill Creek (Upstream boundary locations)						
MC-001	24	13.7	20.8	20.2	24.2	East Fork Mill Creek (RM 0.79)
MC-002	24	13.3	18.1	18.5	24.7	Mill Creek (RM 18.88)
In-stream Mill Creek (Project area locations)						
MC-006	25	13.3	20.0	18.9	26.3	RM 16.75
MC-005	25	12.5	20.3	18.8	24.4	RM 15.28
MC-004	23	13.2	20.7	18.8	23.1	RM 14.07
MC-003	24	13.3	19.8	19.1	23.5	RM 11.86
In-stream Tributary Locations						
SL-002	24	12.0	18.4	17.5	21.7	RM 3.78
SL-001	54	13.8	21.4	20.8	27.1	Sharon Woods Lake outlet (RM 3.0)
SC-001	24	12.6	18.5	18.5	24.2	RM 0.96
BC-001	24	12.9	18.3	18.3	25.4	RM 0.74
TR-001	24	13.4	18.6	18.3	21.7	RM 0.34
CC-001	22	12.2	18.7	18.1	21.8	RM 0.29

Table C-2. Upstream Sampling - Water Temperature (°C)

Location	Number of Samples Collected	Minimum	Median	Average	Maximum	Location
Upstream Tributary Locations						
SC-002	3	15.5	18.2	18.3	21.3	Sharon Cr (RM 3.82)
BC-002	3	18.1	19.9	21.6	26.9	Beaver Cr (RM 3.62)
TR-002	3	20.0	20.6	20.6	21.2	Town Run Cr (RM 0.79)
CC-002	1	20.8	20.8	20.8	20.8	Cooper Cr (RM 3.36)
GE-001	3	16.2	18.3	19.4	23.6	Unnamed Trib (RM 1.42)

Table C-3. Instream Sampling - Dissolved Oxygen (mg/L)

Note: In-situ Sampling - at the source locations was not done for this parameter because autosamplers were utilized.

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
In-stream Mill Creek (Upstream boundary locations)						
MC-001	24	6.9	8.2	8.2	9.4	East Fork Mill Creek (RM 0.79)
MC-002	24	5.9	7.7	7.7	9.1	Mill Creek (RM 18.88)
In-stream Mill Creek (Project area locations)						
MC-006	25	5.5	7.8	7.9	11.3	RM 16.75
MC-005	25	5.6	8.0	8.0	10.4	RM 15.28
MC-004	23	4.2	8.4	8.3	9.9	RM 14.07
MC-003	24	7.8	8.6	8.8	9.7	RM 11.86
In-stream Tributary Locations						
SL-002	24	4.6	7.5	7.2	9.6	RM 3.78
SL-001	54	0.1	5.0	4.7	11.3	Sharon Woods Lake outlet (RM 3.0)
SC-001	24	2.7	8.4	7.9	9.7	RM 0.96
BC-001	24	6.2	9.0	8.6	10.2	RM 0.74
TR-001	24	6.7	8.3	8.2	9.5	RM 0.34
CC-001	22	0.9	8.9	8.4	10.0	RM 0.29

Table C-4. Upstream Sampling - Dissolved Oxygen (mg/L)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
Upstream Tributary Locations						
SC-002	3	7.5	8.1	8.1	8.6	Sharon Cr (RM 3.82)
BC-002	3	7.0	11.4	10.3	12.4	Beaver Cr (RM 3.62)
TR-002	3	1.5	8.0	6.3	9.3	Town Run Cr (RM 0.79)
CC-002	1	4.6	4.6	4.6	4.6	Cooper Cr (RM 3.36)
GE-001	3	4.3	6.4	6.0	7.4	Unnamed Trib (RM 1.42)

Table C-5. Instream Sampling - pH (S.U.)

Note: In-situ Sampling - at the source locations was not done for this parameter because autosamplers were utilized.

Location	Number of Samples Collected	Minimum Value	Median Value	Average Value	Maximum Value	Location
In-stream Mill Creek (Upstream boundary locations)						
MC-001	24	5.6	7.8	7.8	8.1	East Fork Mill Creek (RM 0.79)
MC-002	24	6.2	7.8	7.7	8.3	Mill Creek (RM 18.88)
In-stream Mill Creek (Project area locations)						
MC-006	25	7.7	7.8	7.8	8.3	RM 16.75
MC-005	25	7.3	7.8	7.8	8.1	RM 15.28
MC-004	23	5.5	7.9	7.8	8.3	RM 14.07
MC-003	24	7.6	7.9	7.9	8.2	RM 11.86
In-stream Tributary Locations						
SL-002	24	6.1	7.7	7.6	8.2	RM 3.78
SL-001	54	0.5	7.3	6.8	8.1	Sharon Woods Lake outlet (RM 3.0)
SC-001	24	7.4	7.9	7.9	8.2	RM 0.96
BC-001	23	7.6	8.0	8.0	8.6	RM 0.74
TR-001	24	7.5	7.9	7.9	8.3	RM 0.34
CC-001	22	5.6	7.9	7.8	8.2	RM 0.29

Table C-6. Upstream Sampling – pH (S.U.)

Location	Number of Samples Collected	Minimum Value	Median Value	Average Value	Maximum Value	Location
Upstream Tributary Locations						
SC-002	3	7.7	7.9	7.9	8.2	Sharon Cr (RM 3.82)
BC-002	2	8.3	8.4	8.4	8.5	Beaver Cr (RM 3.62)
TR-002	3	7.9	8.0	8.1	8.3	Town Run Cr (RM 0.79)
CC-002	1	6.0	6.0	6.0	6.0	Cooper Cr (RM 3.36)
GE-001	3	5.9	7.7	7.3	8.2	Unnamed Trib (RM 1.42)

Table C-6. Instream Sampling -Specific Conductance (mS/cm)

Note: In-situ Sampling - at the source locations was not done for this parameter because autosamplers were utilized.

Location	Number of Samples Collected	Minimum Value	Median Value	Average Value	Maximum Value	Location
In-stream Mill Creek (Upstream boundary locations)						
MC-001	24	0.429	0.947	0.987	1.939	East Fork Mill Creek (RM 0.79)
MC-002	24	0.144	0.451	0.532	1.070	Mill Creek (RM 18.88)
In-stream Mill Creek (Project area locations)						
MC-006	24	0.018	0.409	0.616	1.870	RM 16.75
MC-005	25	0.002	0.534	0.631	1.759	RM 15.28
MC-004	22	0.193	0.494	0.656	1.768	RM 14.07
MC-003	24	0.003	0.569	0.716	1.425	RM 11.86
In-stream Tributary Locations						
SL-002	24	0.034	0.681	0.574	0.917	RM 3.78
SL-001	54	0.416	0.600	0.590	1.056	Sharon Woods Lake outlet (RM 3.0)
SC-001	24	0.137	0.600	0.648	1.450	RM 0.96
BC-001	24	0.006	0.491	0.567	1.328	RM 0.74
TR-001	23	0.306	0.643	0.663	1.102	RM 0.34
CC-001	22	0.025	0.503	0.611	1.737	RM 0.29

Table C-7. Upstream Sampling - Specific Conductance (mS/cm)

Location	Number of Samples Collected	Minimum Value	Median Value	Average Value	Maximum Value	Location
Upstream Tributary Locations						
SC-002	3	0.708	1.403	1.187	1.450	Sharon Cr (RM 3.82)
BC-002	2	0.844	0.978	0.978	1.111	Beaver Cr (RM 3.62)
TR-002	2	1.067	1.081	1.081	1.095	Town Run Cr (RM 0.79)
CC-002	1	0.927	0.927	0.927	0.927	Cooper Cr (RM 3.36)
GE-001	2	0.768	0.847	0.847	0.925	Unnamed Trib (RM 1.42)

Table C-8. Instream Sampling - Total Hardness (mg/L)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
In-stream Mill Creek (Upstream boundary locations)						
MC-001	28	<5	220	198	310	East Fork Mill Creek (RM 0.79)
MC-002	25	84	150	178	310	Mill Creek (RM 18.88)
In-stream Mill Creek (Project area locations)						
MC-006	27	80	150	169	280	RM 16.75
MC-005	29	96	130	159	270	RM 15.28
MC-004	30	76	150	178	290	RM 14.07
MC-003	28	100	145	172	280	RM 11.86
In-stream Tributary Locations						
SL-002	25	52	230	218	340	RM 3.78
SL-001	24	76	165	165	260	Sharon Woods Lake outlet (RM 3.0)
SC-001	27	120	180	191	450	RM 0.96
BC-001	29	60	120	149	310	RM 0.74
TR-001	26	96	190	200	330	RM 0.34
CC-001	22	64	145	158	340	RM 0.29

Table C-9. Upstream Sampling - Total Hardness (mg/L)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
Upstream Tributary Locations						
SC-002	22	24	350	348	540	Sharon Cr (RM 3.82)
BC-002	20	130	215	219	300	Beaver Cr (RM 3.62)
TR-002	23	100	280	267	320	Town Run Cr (RM 0.79)
CC-002	14	40	74	112	260	Cooper Cr (RM 3.36)
GE-001	22	76	235	222	320	Unnamed Trib (RM 1.42)

Table C-10. Outfall Sampling - Total Hardness (mg/L)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
Combined Sewer Overflow Locations						
CS-513 (CSO)	5	36	48	92	280	CSO (RM 0.11)
CS-507 (CSO)	8	32	68	69	100	CSO (RM 12.18)
Sanitary Sewer Overflow Locations						
SS-603 (SSO)	1	120	120	120	120	SSO (RM 3.98)
SS-1048 (SSO)	6	180	220	222	260	SSO (RM 3.49)
SS-704 (SSO)	2	96	108	108	120	SSO (RM 4.28)
SS-700 (SSO)	6	150	180	178	200	SSO (RM 13.82)
SS-700 TRT (combination of treated effluent and tank overflow)	17	140	160	166	220	SSO (RM 14.03)
Stormwater Outfall Locations						
ST-004 (Ind)	12	12	26	34	84	SW (Ind) (no RM)
ST-011 (Ind)	15	24	36	43	110	SW (Ind) (RM 2.75)
ST-009 (Com)	11	20	32	37	60	SW (Com) (RM 1.79)
ST-010 (Com)	11	16	32	40	68	SW (Com) (RM 2.11)
ST-005 (Res)	3	12	20	24	40	SW (Res) (RM 2.89)
ST-006 (Res)	6	24	40	40	56	SW (Res) (RM 4.36)
ST-008 (Res)	12	20	36	40	76	SW (Res) (RM 3.35)

Table C-11. Outfall Averages - Total Hardness (mg/L)

All Locations	Number of Samples Collected	Minimum Concentration	Median Concentration	Average Concentration	Maximum Concentration
CSO	13	32	60	78	280
SSO	15	96	180	182	260
SW (Ind)	27	12	32	39	110
SW (Com)	22	16	32	38	68
SW (Res)	21	12	36	38	76

Nutrient Related

Table C-12. Instream Sampling - Ammonia, Total (mg/L-N)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
In-stream Mill Creek (Upstream boundary locations)						
MC-001	28	<0.05	0.10	0.11	0.24	East Fork Mill Creek (RM 0.79)
MC-002	25	<0.05	0.08	0.08	0.19	Mill Creek (RM 18.88)
In-stream Mill Creek (Project area locations)						
MC-006	40	<0.05	0.10	0.12	0.73	RM 16.75
MC-005	40	<0.05	0.08	0.08	0.13	RM 15.28
MC-004	30	<0.05	0.07	0.08	0.16	RM 14.07
MC-003	38	<0.05	0.06	0.08	0.20	RM 11.86
In-stream Tributary Locations						
SL-002	25	<0.05	0.06	0.07	0.34	RM 3.78
SL-001	24	<0.05	0.06	0.09	0.33	Sharon Woods Lake outlet (RM 3.0)
SC-001	38	<0.05	0.06	0.05	0.14	RM 0.96
BC-001	29	<0.05	0.06	0.07	0.22	RM 0.74
TR-001	26	<0.05	0.15	0.21	0.79	RM 0.34
CC-001	22	<0.05	0.07	0.07	0.13	RM 0.29

Table C-13. Upstream Sampling - Ammonia, Total (mg/L-N)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
Upstream Tributary Locations						
SC-002	22	<0.05	0.08	0.52	4.53	Sharon Cr (RM 3.82)
BC-002	20	<0.05	0.10	0.96	6.46	Beaver Cr (RM 3.62)
TR-002	23	<0.05	0.11	0.16	0.51	Town Run Cr (RM 0.79)
CC-002	14	0.06	0.13	0.17	0.41	Cooper Cr (RM 3.36)
GE-001	22	<0.05	0.08	0.18	2.23	Unnamed Trib (RM 1.42)

Table C-14. Outfall Sampling - Ammonia, Total (mg/L-N)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
Combined Sewer Overflow Locations						
CS-513 (CSO)	5	0.34	0.99	1.01	1.65	CSO (RM 0.11)
CS-507 (CSO)	8	0.31	0.94	1.31	3.56	CSO (RM 12.18)
Sanitary Sewer Overflow Locations						
SS-603 (SSO)	1	1.66	1.66	1.66	1.66	SSO (RM 3.98)
SS-1048 (SSO)	6	1.71	2.59	2.88	4.33	SSO (RM 3.49)
SS-704 (SSO)	2	1.90	2.26	2.26	2.61	SSO (RM 4.28)
SS-700 (SSO)	6	3.32	4.17	4.35	6.12	SSO (RM 13.82)
SS-700 TRT (combination of treated effluent and tank overflow)	17	2.89	5.49	5.78	12.00	SSO (RM 14.03)
Stormwater Outfall Locations						
ST-004 (Ind)	12	<0.05	0.12	0.21	0.57	SW (Ind) (no RM)
ST-011 (Ind)	15	0.07	0.18	0.21	0.62	SW (Ind) (RM 2.75)
ST-009 (Com)	11	<0.05	0.13	0.16	0.48	SW (Com) (RM 1.79)
ST-010 (Com)	11	0.06	0.22	0.25	0.57	SW (Com) (RM 2.11)
ST-005 (Res)	3	0.12	0.15	0.19	0.29	SW (Res) (RM 2.89)
ST-006 (Res)	6	<0.05	0.08	0.08	0.12	SW (Res) (RM 4.36)
ST-008 (Res)	12	<0.05	0.18	0.17	0.32	SW (Res) (RM 3.35)

Table C-15. Outfall Averages - Ammonia, Total (mg/L-N)

All Locations	Number of Samples Collected	Minimum Concentration	Median Concentration	Average Concentration	Maximum Concentration
CSO	13	0.310	0.970	1.198	3.560
SSO	15	1.660	3.320	3.303	6.120
SW (Ind)	27	<0.05	0.160	0.208	0.620
SW (Com)	22	<0.05	0.170	0.205	0.570
SW (Res)	21	<0.05	0.120	0.143	0.320

Table C-16. Instream Sampling - Nitrate + Nitrite (mg/L-N)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
In-stream Mill Creek (Upstream boundary locations)						
MC-001	28	0.09	1.38	1.63	4.00	East Fork Mill Creek (RM 0.79)
MC-002	25	<0.05	0.26	0.65	4.06	Mill Creek (RM 18.88)
In-stream Mill Creek (Project area locations)						
MC-006	40	0.30	1.21	1.90	20.00	RM 16.75
MC-005	40	0.24	0.88	1.19	2.99	RM 15.28
MC-004	30	0.27	0.56	0.99	2.69	RM 14.07
MC-003	38	0.26	1.02	1.02	2.37	RM 11.86
In-stream Tributary Locations						
SL-002	25	0.07	0.45	0.81	8.18	RM 3.78
SL-001	24	<0.05	0.04	0.26	3.89	Sharon Woods Lake outlet (RM 3.0)
SC-001	38	<0.05	0.12	0.16	0.64	RM 0.96
BC-001	29	<0.05	0.30	0.30	0.54	RM 0.74
TR-001	26	0.25	1.18	1.14	2.57	RM 0.34
CC-001	22	<0.05	0.57	0.51	0.87	RM 0.29

Table C-17. Upstream Sampling - Nitrate + Nitrite (mg/L-N)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
Upstream Tributary Locations						
SC-002	22	<0.05	0.34	0.36	0.76	Sharon Cr (RM 3.82)
BC-002	20	<0.05	0.18	0.26	1.50	Beaver Cr (RM 3.62)
TR-002	23	0.25	1.23	2.07	9.10	Town Run Cr (RM 0.79)
CC-002	14	0.17	0.46	0.69	1.75	Cooper Cr (RM 3.36)
GE-001	22	<0.05	0.16	0.27	1.84	Unnamed Trib (RM 1.42)

Table C-18. Outfall Sampling - Nitrate + Nitrite (mg/L-N)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
Combined Sewer Overflow Locations						
CS-513 (CSO)	5	0.32	0.36	0.44	0.82	CSO (RM 0.11)
CS-507 (CSO)	8	0.25	0.43	0.70	2.66	CSO (RM 12.18)
Sanitary Sewer Overflow Locations						
SS-603 (SSO)	1	1.47	1.47	1.47	1.47	SSO (RM 3.98)
SS-1048 (SSO)	6	1.44	2.17	2.12	2.68	SSO (RM 3.49)
SS-704 (SSO)	2	1.35	1.83	1.83	2.31	SSO (RM 4.28)
SS-700 (SSO)	6	1.52	1.99	2.20	3.44	SSO (RM 13.82)
SS-700 TRT (combination of treated effluent and tank overflow)	17	<0.05	0.66	1.74	6.27	SSO (RM 14.03)
Stormwater Outfall Locations						
ST-004 (Ind)	12	0.14	0.35	0.49	1.12	SW (Ind) (no RM)
ST-011 (Ind)	14	0.20	0.39	0.48	0.89	SW (Ind) (RM 2.75)
ST-009 (Com)	11	<0.05	0.15	0.20	0.71	SW (Com) (RM 1.79)
ST-010 (Com)	11	0.11	0.58	0.60	1.40	SW (Com) (RM 2.11)
ST-005 (Res)	3	0.14	0.22	0.25	0.39	SW (Res) (RM 2.89)
ST-006 (Res)	6	0.18	0.32	0.40	0.77	SW (Res) (RM 4.36)
ST-008 (Res)	12	0.10	0.31	1.46	13.80	SW (Res) (RM 3.35)

Table C-19. Outfall Averages - Nitrate + Nitrite (mg/L-N)

All Locations	Number of Samples Collected	Minimum Concentration	Median Concentration	Average Concentration	Maximum Concentration
CSO	13	0.25	0.39	0.60	2.66
SSO	15	1.35	1.98	2.07	3.44
SW (Ind)	26	0.14	0.38	0.48	1.12
SW (Com)	22	<0.05	0.22	0.40	1.40
SW (Res)	21	0.10	0.26	0.98	13.80

Table C-20. Instream Sampling -Total Kjeldahl Nitrogen (mg/L-N)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
In-stream Mill Creek (Upstream boundary locations)						
MC-001	28	<0.50	1.01	1.05	3.34	East Fork Mill Creek (RM 0.79)
MC-002	25	<0.50	0.81	0.75	1.93	Mill Creek (RM 18.88)
In-stream Mill Creek (Project area locations)						
MC-006	40	<0.50	0.79	0.88	3.23	RM 16.75
MC-005	40	<0.50	0.80	0.81	2.19	RM 15.28
MC-004	30	<0.50	0.81	0.79	1.44	RM 14.07
MC-003	38	<0.50	0.68	0.72	1.69	RM 11.86
In-stream Tributary Locations						
SL-002	25	<0.50	0.77	1.06	7.28	RM 3.78
SL-001	24	<0.50	0.93	1.38	7.42	Sharon Woods Lake outlet (RM 3.0)
SC-001	38	<0.50	<0.50	0.48	1.90	RM 0.96
BC-001	29	<0.50	<0.50	0.50	2.33	RM 0.74
TR-001	26	<0.50	0.72	1.12	7.85	RM 0.34
CC-001	22	<0.50	0.51	0.56	1.57	RM 0.29

Table C-21. Upstream Sampling - Total Kjeldahl Nitrogen (mg/L-N)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
Upstream Tributary Locations						
SC-002	22	<0.50	<0.50	0.94	5.39	Sharon Cr (RM 3.82)
BC-002	20	<0.50	<0.50	1.49	8.28	Beaver Cr (RM 3.62)
TR-002	23	<0.50	0.60	0.61	1.23	Town Run Cr (RM 0.79)
CC-002	14	<0.50	0.89	0.88	2.17	Cooper Cr (RM 3.36)
GE-001	22	<0.50	<0.50	0.70	5.08	Unnamed Trib (RM 1.42)

Table C-22. Outfall Averages - Total Kjeldahl Nitrogen (mg/L-N)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
Combined Sewer Overflow Locations						
CS-513 (CSO)	5	1.26	2.60	6.02	18.10	CSO (RM 0.11)
CS-507 (CSO)	8	1.61	3.57	4.78	12.30	CSO (RM 12.18)
Sanitary Sewer Overflow Locations						
SS-603 (SSO)	1	8.11	8.11	8.11	8.11	SSO (RM 3.98)
SS-1048 (SSO)	6	4.23	6.07	6.23	8.30	SSO (RM 3.49)
SS-704 (SSO)	2	4.73	6.64	6.64	8.54	SSO (RM 4.28)
SS-700 (SSO)	6	7.60	11.45	11.12	13.60	SSO (RM 13.82)
SS-700 TRT (combination of treated effluent and tank overflow)	17	7.11	9.26	9.61	14.00	SSO (RM 14.03)
Stormwater Outfall Locations						
ST-004 (Ind)	12	<0.50	<0.50	0.50	1.32	SW (Ind) (no RM)
ST-011 (Ind)	15	<0.50	<0.50	0.39	1.16	SW (Ind) (RM 2.75)
ST-009 (Com)	11	<0.50	<0.50	0.43	1.35	SW (Com) (RM 1.79)
ST-010 (Com)	11	<0.50	<0.50	0.70	1.76	SW (Com) (RM 2.11)
ST-005 (Res)	3	<0.50	<0.50	0.38	0.65	SW (Res) (RM 2.89)
ST-006 (Res)	6	0.60	1.21	1.40	2.31	SW (Res) (RM 4.36)
ST-008 (Res)	12	<0.50	0.65	0.85	3.06	SW (Res) (RM 3.35)

Table C-23. Outfall Sampling - Total Kjeldahl Nitrogen (mg/L-N)

All Locations	Number of Samples Collected	Minimum Concentration	Median Concentration	Average Concentration	Maximum Concentration
CSO	13	1.26	3.38	5.26	18.10
SSO	15	4.23	8.11	8.36	13.60
SW (Ind)	27	<0.50	<0.50	0.44	1.32
SW (Com)	22	<0.50	<0.50	0.56	1.76
SW (Res)	21	<0.50	0.71	0.94	3.06

Table C-24. Instream Sampling - Ortho-Phosphate (mg/L-P)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
In-stream Mill Creek (Upstream boundary locations)						
MC-001	28	0.023	0.240	0.433	1.550	East Fork Mill Creek (RM 0.79)
MC-002	25	0.015	0.045	0.112	1.420	Mill Creek (RM 18.88)
In-stream Mill Creek (Project area locations)						
MC-006	40	0.052	0.173	0.234	1.020	RM 16.75
MC-005	40	0.054	0.157	0.197	0.586	RM 15.28
MC-004	30	0.063	0.115	0.167	0.508	RM 14.07
MC-003	38	0.057	0.118	0.141	0.308	RM 11.86
In-stream Tributary Locations						
SL-002	25	0.072	0.141	0.157	0.297	RM 3.78
SL-001	24	0.038	0.068	0.079	0.232	Sharon Woods Lake outlet (RM 3.0)
SC-001	38	0.052	0.098	0.108	0.232	RM 0.96
BC-001	29	0.017	0.048	0.052	0.147	RM 0.74
TR-001	26	0.066	0.149	0.166	0.295	RM 0.34
CC-001	22	0.024	0.101	0.094	0.165	RM 0.29

Table C-25. Upstream Sampling - Ortho-Phosphate (mg/L-P)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
Upstream Tributary Locations						
SC-002	22	0.042	0.093	0.110	0.249	Sharon Cr (RM 3.82)
BC-002	20	<0.010	0.051	0.046	0.070	Beaver Cr (RM 3.62)
TR-002	23	0.098	0.218	0.209	0.357	Town Run Cr (RM 0.79)
CC-002	14	0.054	0.134	0.140	0.251	Cooper Cr (RM 3.36)
GE-001	22	0.052	0.110	0.187	0.575	Unnamed Trib (RM 1.42)

Table C-26. Outfall Sampling - Ortho-Phosphate (mg/L-P)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
Combined Sewer Overflow Locations						
CS-513 (CSO)	3	0.073	0.131	0.240	0.515	CSO (RM 0.11)
CS-507 (CSO)	8	0.097	0.292	0.694	2.110	CSO (RM 12.18)
Sanitary Sewer Overflow Locations						
SS-603 (SSO)	1	0.574	0.574	0.574	0.574	SSO (RM 3.98)
SS-1048 (SSO)	6	0.131	0.251	0.277	0.456	SSO (RM 3.49)
SS-704 (SSO)	2	0.327	0.335	0.335	0.343	SSO (RM 4.28)
SS-700 (SSO)	6	0.240	0.530	0.510	0.711	SSO (RM 13.82)
SS-700 TRT (combination of treated effluent and tank overflow)	17	0.012	0.034	0.082	0.591	SSO (RM 14.03)
Stormwater Outfall Locations						
ST-004 (Ind)	12	0.034	0.064	0.099	0.223	SW (Ind) (no RM)
ST-011 (Ind)	15	0.027	0.046	0.049	0.088	SW (Ind) (RM 2.75)
ST-009 (Com)	11	<0.010	0.015	0.017	0.032	SW (Com) (RM 1.79)
ST-010 (Com)	11	0.010	0.018	0.023	0.057	SW (Com) (RM 2.11)
ST-005 (Res)	3	0.062	0.088	0.096	0.139	SW (Res) (RM 2.89)
ST-006 (Res)	6	0.141	0.218	0.212	0.260	SW (Res) (RM 4.36)
ST-008 (Res)	12	0.032	0.063	0.094	0.197	SW (Res) (RM 3.35)

Table C-27. Outfall Averages - Ortho-Phosphate (mg/L-P)

All Locations	Number of Samples Collected	Minimum Concentration	Median Concentration	Average Concentration	Maximum Concentration
CSO	11	0.073	0.283	0.570	2.110
SSO	15	0.131	0.346	0.398	0.711
SW (Ind)	27	0.027	0.050	0.071	0.223
SW (Com)	22	<0.010	0.017	0.020	0.057
SW (Res)	21	0.032	0.139	0.128	0.260

Table C-28. Instream Sampling - Total Phosphorus (mg/L-P)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
In-stream Mill Creek (Upstream boundary locations)						
MC-001	28	0.12	0.52	0.66	2.46	East Fork Mill Creek (RM 0.79)
MC-002	25	0.05	0.20	0.30	2.20	Mill Creek (RM 18.88)
In-stream Mill Creek (Project area locations)						
MC-006	40	0.19	0.36	0.40	1.15	RM 16.75
MC-005	40	0.19	0.36	0.37	0.65	RM 15.28
MC-004	30	0.15	0.35	0.38	0.91	RM 14.07
MC-003	38	0.18	0.35	0.47	3.89	RM 11.86
In-stream Tributary Locations						
SL-002	25	0.04	0.28	0.37	2.11	RM 3.78
SL-001	24	0.08	0.17	0.33	2.60	Sharon Woods Lake outlet (RM 3.0)
SC-001	38	0.05	0.18	0.19	0.44	RM 0.96
BC-001	29	<0.04	0.11	0.12	0.34	RM 0.74
TR-001	26	0.12	0.30	0.41	2.91	RM 0.34
CC-001	22	0.06	0.20	0.23	0.59	RM 0.29

Table C-29. Upstream Sampling - Total Phosphorus (mg/L-P)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
Upstream Tributary Locations						
SC-002	22	0.08	0.14	0.19	0.36	Sharon Cr (RM 3.82)
BC-002	20	0.07	0.11	0.14	0.30	Beaver Cr (RM 3.62)
TR-002	23	0.17	0.30	0.33	0.64	Town Run Cr (RM 0.79)
CC-002	14	0.13	0.36	0.37	0.84	Cooper Cr (RM 3.36)
GE-001	22	0.11	0.18	0.31	0.93	Unnamed Trib (RM 1.42)

Table C-30. Outfall Sampling - Total Phosphorus (mg/L-P)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
Combined Sewer Overflow Locations						
CS-513 (CSO)	5	0.37	0.53	1.32	3.99	CSO (RM 0.11)
CS-507 (CSO)	8	0.34	1.21	1.47	4.55	CSO (RM 12.18)
Sanitary Sewer Overflow Locations						
SS-603 (SSO)	1	3.12	3.12	3.12	3.12	SSO (RM 3.98)
SS-1048 (SSO)	6	0.30	0.91	0.81	1.05	SSO (RM 3.49)
SS-704 (SSO)	2	0.96	1.47	1.47	1.98	SSO (RM 4.28)
SS-700 (SSO)	6	1.68	2.38	2.50	3.56	SSO (RM 13.82)
SS-700 TRT (combination of treated effluent and tank overflow)	17	0.24	1.24	1.19	2.29	SSO (RM 14.03)
Stormwater Outfall Locations						
ST-004 (Ind)	12	0.02	0.14	0.16	0.31	SW (Ind) (no RM)
ST-011 (Ind)	15	0.06	0.12	0.15	0.28	SW (Ind) (RM 2.75)
ST-009 (Com)	11	<0.04	0.05	0.06	0.14	SW (Com) (RM 1.79)
ST-010 (Com)	11	<0.04	0.05	0.05	0.09	SW (Com) (RM 2.11)
ST-005 (Res)	3	0.17	0.18	0.21	0.28	SW (Res) (RM 2.89)
ST-006 (Res)	6	0.10	0.23	0.27	0.49	SW (Res) (RM 4.36)
ST-008 (Res)	12	0.10	0.19	0.20	0.32	SW (Res) (RM 3.35)

Table C-31. Outfall Averages - Total Phosphorus (mg/L-P)

All Locations	Number of Samples Collected	Minimum Concentration	Median Concentration	Average Concentration	Maximum Concentration
CSO	13	0.34	0.93	1.41	4.55
SSO	15	0.30	1.68	1.73	3.56
SW (Ind)	27	<0.04	0.12	0.15	0.31
SW (Com)	22	<0.04	0.05	0.06	0.14
SW (Res)	21	0.10	0.19	0.22	0.49

Table C-32. Instream Sampling - Total Organic Carbon (mg/L)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
In-stream Mill Creek (Upstream boundary locations)						
MC-001	28	4.0	6.4	6.2	9.1	East Fork Mill Creek (RM 0.79)
MC-002	25	3.1	4.6	4.7	7.0	Mill Creek (RM 18.88)
In-stream Mill Creek (Project area locations)						
MC-006	40	4.0	5.1	5.1	7.5	RM 16.75
MC-005	40	4.0	5.1	5.3	11.0	RM 15.28
MC-004	30	3.7	4.9	5.3	9.8	RM 14.07
MC-003	38	3.1	4.9	4.9	8.3	RM 11.86
In-stream Tributary Locations						
SL-002	25	3.2	7.0	6.9	12.0	RM 3.78
SL-001	24	4.9	6.0	8.5	43.0	Sharon Woods Lake outlet (RM 3.0)
SC-001	38	3.0	5.3	5.4	8.2	RM 0.96
BC-001	29	3.2	5.4	5.4	10.0	RM 0.74
TR-001	26	3.4	5.0	5.2	10.0	RM 0.34
CC-001	22	2.3	6.2	6.3	9.9	RM 0.29

Table C-33. Upstream Sampling - Total Organic Carbon (mg/L)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
Upstream Tributary Locations						
SC-002	22	3.0	5.0	9.2	29.0	Sharon Cr (RM 3.82)
BC-002	20	3.9	7.4	8.6	24.0	Beaver Cr (RM 3.62)
TR-002	23	3.3	5.0	5.4	10.0	Town Run Cr (RM 0.79)
CC-002	14	3.5	8.0	17.0	49.0	Cooper Cr (RM 3.36)
GE-001	22	3.3	6.1	8.7	54.0	Unnamed Trib (RM 1.42)

Table C-34. Outfall Sampling - Total Organic Carbon (mg/L)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
Combined Sewer Overflow Locations						
CS-513 (CSO)	5	5.6	8.2	15.6	45.0	CSO (RM 0.11)
CS-507 (CSO)	8	6.3	14.0	18.2	53.0	CSO (RM 12.18)
Sanitary Sewer Overflow Locations						
SS-603 (SSO)	1	9.4	9.4	9.4	9.4	SSO (RM 3.98)
SS-1048 (SSO)	6	9.9	11.0	11.0	12.0	SSO (RM 3.49)
SS-704 (SSO)	2	8.7	8.9	8.9	9.0	SSO (RM 4.28)
SS-700 (SSO)	6	39.0	45.0	46.8	63.0	SSO (RM 13.82)
SS-700 TRT (combination of treated effluent and tank overflow)	17	20.0	40.0	40.7	80.0	SSO (RM 14.03)
Stormwater Outfall Locations						
ST-004 (Ind)	12	3.2	8.5	8.3	19.0	SW (Ind) (no RM)
ST-011 (Ind)	15	3.1	4.9	5.0	8.4	SW (Ind) (RM 2.75)
ST-009 (Com)	11	<0.7	6.9	8.2	25.0	SW (Com) (RM 1.79)
ST-010 (Com)	11	1.2	6.9	7.9	17.0	SW (Com) (RM 2.11)
ST-005 (Res)	3	6.3	7.1	10.1	17.0	SW (Res) (RM 2.89)
ST-006 (Res)	6	5.4	8.8	8.5	11.0	SW (Res) (RM 4.36)
ST-008 (Res)	12	3.5	6.8	8.4	27.0	SW (Res) (RM 3.35)

Table C-35. Outfall Averages - Total Organic Carbon (mg/L)

All Locations	Number of Samples Collected	Minimum Concentration	Median Concentration	Average Concentration	Maximum Concentration
CSO	13	5.6	12.0	17.2	53.0
SSO	15	8.7	11.0	24.9	63.0
SW (Ind)	27	3.1	5.3	6.5	19.0
SW (Com)	22	<0.7	6.9	8.1	25.0
SW (Res)	21	3.5	7.5	8.7	27.0

Table C-36. Instream Sampling - Carbonaceous Biochemical Oxygen Demand, 5-day (mg/L)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
In-stream Mill Creek (Upstream boundary locations)						
MC-001	28	<4	<4	2.7	9.0	East Fork Mill Creek (RM 0.79)
MC-002	25	<4	<4	2.5	8.3	Mill Creek (RM 18.88)
In-stream Mill Creek (Project area locations)						
MC-006	40	<4	<4	2.8	9.3	RM 16.75
MC-005	40	<4	<4	2.5	6.7	RM 15.28
MC-004	30	<4	<4	3.6	31.0	RM 14.07
MC-003	38	<4	<4	3.0	14.0	RM 11.86
In-stream Tributary Locations						
SL-002	25	<4	<4	3.0	17.0	RM 3.78
SL-001	24	<4	<4	11.0	90.0	Sharon Woods Lake outlet (RM 3.0)
SC-001	38	<4	<4	2.8	13.0	RM 0.96
BC-001	29	<4	<4	3.2	21.0	RM 0.74
TR-001	26	<4	<4	4.6	38.0	RM 0.34
CC-001	22	<4	<4	2.4	5.5	RM 0.29

Table C-37. Upstream Sampling - Carbonaceous Biochemical Oxygen Demand, 5-day (mg/L)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
Upstream Tributary Locations						
SC-002	22	<4	<4	8.3	57	Sharon Cr (RM 3.82)
BC-002	20	<4	4	6.6	37	Beaver Cr (RM 3.62)
TR-002	23	<4	<4	2.5	10	Town Run Cr (RM 0.79)
CC-002	14	<4	5.1	12.0	41	Cooper Cr (RM 3.36)
GE-001	22	<4	3	10.8	150	Unnamed Trib (RM 1.42)

Table C-38. Outfall Sampling - Carbonaceous Biochemical Oxygen Demand, 5-day (mg/L)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
Combined Sewer Overflow Locations						
CS-513 (CSO)	5	12	19	88.8	240	CSO (RM 0.11)
CS-507 (CSO)	8	8.4	25.5	59.4	260	CSO (RM 12.18)
Sanitary Sewer Overflow Locations						
SS-603 (SSO)	1	33	33	33.0	33	SSO (RM 3.98)
SS-1048 (SSO)	6	24	31.5	35.8	62	SSO (RM 3.49)
SS-704 (SSO)	2	44	64.5	64.5	85	SSO (RM 4.28)
SS-700 (SSO)	6	85	125	129.2	180	SSO (RM 13.82)
SS-700 TRT (combination of treated effluent and tank overflow)	17	25	60	77.0	220	SSO (RM 14.03)
Stormwater Outfall Locations						
ST-004 (Ind)	11	<4	4.6	7.5	36	SW (Ind) (no RM)
ST-011 (Ind)	15	<4	4.8	5.3	27	SW (Ind) (RM 2.75)
ST-009 (Com)	11	<4	4.8	7.5	34	SW (Com) (RM 1.79)
ST-010 (Com)	11	<4	6.1	5.8	15	SW (Com) (RM 2.11)
ST-005 (Res)	3	5.7	6	9.6	17	SW (Res) (RM 2.89)
ST-006 (Res)	6	4.9	5.6	5.6	6.5	SW (Res) (RM 4.36)
ST-008 (Res)	12	<4	3	3.9	10	SW (Res) (RM 3.35)

Table C-40. Outfall Averages – Carbonaceous Biochemical Oxygen Demand, 5 day (mg/L)

All Locations	Number of Samples Collected	Minimum Concentration	Median Concentration	Average Concentration	Maximum Concentration
CSO	13	8.4	21.0	70.7	260.0
SSO	15	24.0	62.0	76.8	180.0
SW (Ind)	26	<4.0	4.7	6.2	36.0
SW (Com)	22	<4.0	5.4	6.7	34.0
SW (Res)	21	<4.0	5.1	5.2	17.0

Table C-39. Instream Sampling - Chlorophyll a (mg/m3)

Note: The source locations were not sampled for this parameter. Results are shown for in-stream and upstream tributary locations only.

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
In-stream Mill Creek (Upstream boundary locations)						
MC-001	4	<1	1.05	1.05	1.60	East Fork Mill Creek (RM 0.79)
MC-002	4	1.60	4.54	5.35	10.70	Mill Creek (RM 18.88)
In-stream Mill Creek (Project area locations)						
MC-006	5	<1	4.81	7.01	14.20	RM 16.75
MC-005	4	<1	2.14	2.93	6.94	RM 15.28
MC-004	7	1.60	6.01	5.89	8.54	RM 14.07
MC-003	5	<1	2.67	2.44	5.87	RM 11.86
In-stream Tributary Locations						
SL-002	4	<1	0.92	1.12	2.14	RM 3.78
SL-001	4	5.87	9.01	10.77	19.20	Sharon Woods Lake outlet (RM 3.0)
SC-001	4	<1	<1	0.64	1.07	RM 0.96
BC-001	4	<1	<1	1.84	5.87	RM 0.74
TR-001	4	<1	1.34	2.53	6.94	RM 0.34
CC-001	2	<1	<1	0.50	0.50	RM 0.29

Table C-40. Upstream Sampling - Chlorophyll a (mg/m3)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
Upstream Tributary Locations						
SC-002	5	<1	<1	1.15	2.67	Sharon Cr (RM 3.82)
BC-002	4	<1	0.79	0.92	1.60	Beaver Cr (RM 3.62)
TR-002	4	<1	2.14	2.53	5.34	Town Run Cr (RM 0.79)
CC-002	1	<1	<1	<1	<1	Cooper Cr (RM 3.36)
GE-001	4	<1	<1	<1	<1	Unnamed Trib (RM 1.42)

Table C-43. Bacteria, Chloride, Metals, and TSS

All Locations	Number of Samples Collected	Minimum Concentration	Median Concentration	Average Concentration	Maximum Concentration
CSO	13	8.4	21.0	70.7	260.0
SSO	15	24.0	62.0	76.8	180.0
SW (Ind)	26	<4.0	4.7	6.2	36.0
SW (Com)	22	<4.0	5.4	6.7	34.0
SW (Res)	21	<4.0	5.1	5.2	17.0

Table C-44. Instream Sampling - Chloride (mg/L)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
In-stream Mill Creek (Upstream boundary locations)						
MC-001	28	42	120	139	250	East Fork Mill Creek (RM 0.79)
MC-002	25	13	63	79	230	Mill Creek (RM 18.88)
In-stream Mill Creek (Project area locations)						
MC-006	27	14	76	94	210	RM 16.75
MC-005	29	25	64	87	210	RM 15.28
MC-004	30	19	69	93	200	RM 14.07
MC-003	28	13	63	87	170	RM 11.86
In-stream Tributary Locations						
SL-002	25	16	64	64	130	RM 3.78
SL-001	24	22	78	80	170	Sharon Woods Lake outlet (RM 3.0)
SC-001	27	38	89	99	370	RM 0.96
BC-001	29	27	64	107	300	RM 0.74
TR-001	26	38	90	95	200	RM 0.34
CC-001	22	12	52	56	140	RM 0.29

Table C-45. Upstream Sampling - Chloride (mg/L)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
Upstream Tributary Locations						
SC-002	22	<5	275	278	440	Sharon Cr (RM 3.82)
BC-002	20	67	115	118	220	Beaver Cr (RM 3.62)
TR-002	23	63	150	147	200	Town Run Cr (RM 0.79)
CC-002	14	<5	23	46	170	Cooper Cr (RM 3.36)
GE-001	22	29	110	116	200	Unnamed Trib (RM 1.42)

Table C-46. Outfall Sampling - Chloride (mg/L)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
Combined Sewer Overflow Locations						
CS-513 (CSO)	5	5.1	5.8	16	50	CSO (RM 0.11)
CS-507 (CSO)	8	<5	34.5	33	89	CSO (RM 12.18)
Sanitary Sewer Overflow Locations						
SS-603 (SSO)	1	29	29	29	29	SSO (RM 3.98)
SS-1048 (SSO)	6	66	71	71	77	SSO (RM 3.49)
SS-704 (SSO)	2	29	29.5	30	30	SSO (RM 4.28)
SS-700 (SSO)	6	73	165	154	210	SSO (RM 13.82)
SS-700 TRT (combination of treated effluent and tank overflow)	17	41	130	122	180	SSO (RM 14.03)
Stormwater Outfall Locations						
ST-004 (Ind)	11	13	56	76	240	SW (Ind) (no RM)
ST-011 (Ind)	15	2.5	15	19	71	SW (Ind) (RM 2.75)
ST-009 (Com)	11	7.2	11	14	31	SW (Com) (RM 1.79)
ST-010 (Com)	11	9.6	30	32	72	SW (Com) (RM 2.11)
ST-005 (Res)	3	<5	<5	2.5	2.5	SW (Res) (RM 2.89)
ST-006 (Res)	6	<5	6.9	8	14	SW (Res) (RM 4.36)
ST-008 (Res)	12	<5	8.55	9	24	SW (Res) (RM 3.35)

Table C-47. Outfall Averages - Chloride (mg/L)

All Locations	Number of Samples Collected	Minimum Concentration	Median Concentration	Average Concentration	Maximum Concentration
CSO	13	<5	14	27	89
SSO	15	29	74	96	210
SW (Ind)	26	3	20	43	240
SW (Com)	22	7	16	23	72
SW (Res)	21	<5	6	8	24

Table C-48. Instream Sampling - Escherichia coliform (E. coli) (MPN/100 ml)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
In-stream Mill Creek (Upstream boundary locations)						
MC-001	28	216	2,613	15,161	199,000	East Fork Mill Creek (RM 0.79)
MC-002	25	120	3,255	4,871	20,000	Mill Creek (RM 18.88)
In-stream Mill Creek (Project area locations)						
MC-006	27	439	6,488	7,870	20,000	RM 16.75
MC-005	29	228	8,164	8,371	20,000	RM 15.28
MC-004	30	241	5,324	15,279	158,000	RM 14.07
MC-003	28	197	12,505	16,468	63,000	RM 11.86
In-stream Tributary Locations						
SL-002	25	52	7,270	13,550	97,000	RM 3.78
SL-001	24	<10	116	2,253	15,531	Sharon Woods Lake outlet (RM 3.0)
SC-001	27	213	3,076	5,550	24,196	RM 0.96
BC-001	29	309	6,867	12,490	97,000	RM 0.74
TR-001	26	422	6,499	13,944	75,000	RM 0.34
CC-001	22	183	10,600	20,238	146,000	RM 0.29

Table C-49. Upstream Sampling - Escherichia coliform (E. coli) (MPN/100 ml)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
Upstream Tributary Locations						
SC-002	22	216	4,622	10,278	73,000	Sharon Cr (RM 3.82)
BC-002	20	216	1,701	18,623	134,000	Beaver Cr (RM 3.62)
TR-002	23	<10	908	3,116	20,000	Town Run Cr (RM 0.79)
CC-002	14	830	32,598	187,648	1,935,000	Cooper Cr (RM 3.36)
GE-001	22	717	5,483	50,569	880,000	Unnamed Trib (RM 1.42)

Table C-50. Outfall Sampling - Escherichia coliform (E. coli) (MPN/100 ml)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
Combined Sewer Overflow Locations						
CS-513 (CSO)	5	173,000	256,000	998,400	3,076,000	CSO (RM 0.11)
CS-507 (CSO)	8	84,000	237,000	755,750	4,106,000	CSO (RM 12.18)
Sanitary Sewer Overflow Locations						
SS-603 (SSO)	1	605,000	605,000	605,000	605,000	SSO (RM 3.98)
SS-1048 (SSO)	6	414,000	560,500	582,167	771,000	SSO (RM 3.49)
SS-704 (SSO)	2	857,000	1,040,000	1,040,000	1,223,000	SSO (RM 4.28)
SS-700 (SSO)	6	909,000	1,093,500	1,379,667	2,909,000	SSO (RM 13.82)
SS-700 TRT (combination of treated effluent and tank overflow)	17	52,000	488,000	858,235	4,352,000	SSO (RM 14.03)
Stormwater Outfall Locations						
ST-004 (Ind)	12	613	3,255	48,322	426,000	SW (Ind) (no RM)
ST-011 (Ind)	15	605	6,131	15,796	85,000	SW (Ind) (RM 2.75)
ST-009 (Com)	11	146	480	2,002	10,000	SW (Com) (RM 1.79)
ST-010 (Com)	11	52	350	895	3,448	SW (Com) (RM 2.11)
ST-005 (Res)	3	11,199	12,997	14,732	20,000	SW (Res) (RM 2.89)
ST-006 (Res)	6	9,208	19,863	34,828	85,000	SW (Res) (RM 4.36)
ST-008 (Res)	12	8,664	14,834	62,172	565,000	SW (Res) (RM 3.35)

Table C-51. Outfall Averages - Escherichia coliform (E. coli) (MPN/100 ml)

All Locations	Number of Samples Collected	Minimum Concentration	Median Concentration	Average Concentration	Maximum Concentration
CSO	13	84,000	256,000	849,077	4,106,000
SSO	15	414,000	857,000	963,733	2,909,000
SW (Ind)	27	605	5,172	30,252	426,000
SW (Com)	22	52	447	1,449	10,000
SW (Res)	21	8,664	15,531	47,582	565,000

Table C-52. Instream Sampling - Copper (Total) (ug/L)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
In-stream Mill Creek (Upstream boundary locations)						
MC-001	28	<10	<10	5	11	East Fork Mill Creek (RM 0.79)
MC-002	25	<10	<10	<10	<10	Mill Creek (RM 18.88)
In-stream Mill Creek (Project area locations)						
MC-006	27	<10	<10	5	12	RM 16.75
MC-005	29	<10	<10	<10	<10	RM 15.28
MC-004	30	<10	<10	6	13	RM 14.07
MC-003	28	<10	<10	6	14	RM 11.86
In-stream Tributary Locations						
SL-002	25	<10	<10	6	20	RM 3.78
SL-001	24	<10	<10	<10	<10	Sharon Woods Lake outlet (RM 3.0)
SC-001	27	<10	<10	<10	<10	RM 0.96
BC-001	29	<10	<10	<10	<10	RM 0.74
TR-001	26	<10	<10	9	83	RM 0.34
CC-001	22	<10	<10	6	16	RM 0.29

Table C-53. Upstream Sampling - Copper (Total) (ug/L)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
Upstream Tributary Locations						
SC-002	22	<10	<10	<10	<10	Sharon Cr (RM 3.82)
BC-002	20	<10	<10	6	14	Beaver Cr (RM 3.62)
TR-002	23	<10	<10	6	17	Town Run Cr (RM 0.79)
CC-002	14	<10	<10	10	26	Cooper Cr (RM 3.36)
GE-001	22	<10	<10	5	15	Unnamed Trib (RM 1.42)

Table C-54. Outfall Sampling - Copper (Total) (ug/L)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
Combined Sewer Overflow Locations						
CS-513 (CSO)	5	<10	<10	35	140	CSO (RM 0.11)
CS-507 (CSO)	8	<10	17	23	60	CSO (RM 12.18)
Sanitary Sewer Overflow Locations						
SS-603 (SSO)	1	50	50	50	50	SSO (RM 3.98)
SS-1048 (SSO)	6	19	36	37	57	SSO (RM 3.49)
SS-704 (SSO)	2	52	54	54	55	SSO (RM 4.28)
SS-700 (SSO)	6	15	23	26	46	SSO (RM 13.82)
SS-700 TRT (combination of treated effluent and tank overflow)	17	<10	<10	10	25	SSO (RM 14.03)
Stormwater Outfall Locations						
ST-004 (Ind)	12	<10	<10	<10	<10	SW (Ind) (no RM)
ST-011 (Ind)	15	<10	<10	<10	<10	SW (Ind) (RM 2.75)
ST-009 (Com)	11	<10	<10	<10	<10	SW (Com) (RM 1.79)
ST-010 (Com)	11	<10	<10	<10	<10	SW (Com) (RM 2.11)
ST-005 (Res)	3	<10	<10	<10	<10	SW (Res) (RM 2.89)
ST-006 (Res)	6	<10	<10	<10	<10	SW (Res) (RM 4.36)
ST-008 (Res)	11	<10	<10	7	19	SW (Res) (RM 3.35)

Table C-55. Outfall Averages - Copper (Total) (ug/L)

All Locations	Number of Samples Collected	Minimum Concentration	Median Concentration	Average Concentration	Maximum Concentration
CSO	13	<10	15.0	27.7	140.0
SSO	15	15.0	34.0	35.5	57.0
SW (Ind)	27	<10	<10	<10	<10
SW (Com)	22	<10	<10	<10	<10
SW (Res)	20	<10	<10	6.0	19.0

Table C-56. Instream Sampling - Lead (Total) (ug/L)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
In-stream Mill Creek (Upstream boundary locations)						
MC-001	28	<2.0	<2.0	2.2	9.4	East Fork Mill Creek (RM 0.79)
MC-002	25	<2.0	<2.0	1.9	6.5	Mill Creek (RM 18.88)
In-stream Mill Creek (Project area locations)						
MC-006	27	<2.0	<2.0	2.8	13.0	RM 16.75
MC-005	29	<2.0	2.1	2.4	8.2	RM 15.28
MC-004	30	<2.0	<2.0	2.9	12.0	RM 14.07
MC-003	28	<2.0	2.7	3.9	14.0	RM 11.86
In-stream Tributary Locations						
SL-002	25	<2.0	<2.0	2.2	18.0	RM 3.78
SL-001	24	<2.0	<2.0	1.4	6.0	Sharon Woods Lake outlet (RM 3.0)
SC-001	27	<2.0	<2.0	1.5	7.5	RM 0.96
BC-001	29	<2.0	<2.0	1.4	4.0	RM 0.74
TR-001	26	<2.0	<2.0	2.7	15.0	RM 0.34
CC-001	22	<2.0	<2.0	2.1	11.0	RM 0.29

Table C-57. Upstream Sampling - Lead (Total) (ug/L)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
Upstream Tributary Locations						
SC-002	22	<2.0	<2.0	<2.0	<2.0	Sharon Cr (RM 3.82)
BC-002	20	<2.0	<2.0	1.1	2.1	Beaver Cr (RM 3.62)
TR-002	23	<2.0	<2.0	2.1	16.0	Town Run Cr (RM 0.79)
CC-002	14	<2.0	4.2	5.1	19.0	Cooper Cr (RM 3.36)
GE-001	22	<2.0	<2.0	1.9	12.0	Unnamed Trib (RM 1.42)

Table C-58. Outfall Sampling - Lead (Total) (ug/L)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
Combined Sewer Overflow Locations						
CS-513 (CSO)	5	3.5	5.0	6.0	12.0	CSO (RM 0.11)
CS-507 (CSO)	8	<2.0	4.5	4.5	9.3	CSO (RM 12.18)
Sanitary Sewer Overflow Locations						
SS-603 (SSO)	1	14.0	14.0	14.0	14.0	SSO (RM 3.98)
SS-1048 (SSO)	6	<2.0	<2.0	1.6	2.9	SSO (RM 3.49)
SS-704 (SSO)	2	13.0	13.0	13.0	13.0	SSO (RM 4.28)
SS-700 (SSO)	6	2.7	3.8	4.3	6.6	SSO (RM 13.82)
SS-700 TRT (combination of treated effluent and tank overflow)	17	<2.0	<2.0	1.9	5.0	SSO (RM 14.03)
Stormwater Outfall Locations						
ST-004 (Ind)	12	<2.0	<2.0	<2.0	<2.0	SW (Ind) (no RM)
ST-011 (Ind)	15	<2.0	<2.0	2.0	7.4	SW (Ind) (RM 2.75)
ST-009 (Com)	11	<2.0	<2.0	1.3	4.4	SW (Com) (RM 1.79)
ST-010 (Com)	11	<2.0	<2.0	1.5	5.7	SW (Com) (RM 2.11)
ST-005 (Res)	3	<2.0	<2.0	<2.0	<2.0	SW (Res) (RM 2.89)
ST-006 (Res)	6	<2.0	1.5	2.0	4.1	SW (Res) (RM 4.36)
ST-008 (Res)	11	<2.0	<2.0	1.2	2.3	SW (Res) (RM 3.35)

Table C-59. Outfall Averages - Lead (Total) (ug/L)

All Locations	Number of Samples Collected	Minimum Concentration	Median Concentration	Average Concentration	Maximum Concentration
CSO	13	<2.0	5.0	5.09	12.00
SSO	15	<2.0	2.9	5.03	14.00
SW (Ind)	27	<2.0	<2.0	1.55	7.40
SW (Com)	22	<2.0	<2.0	1.42	5.70
SW (Res)	20	<2.0	<2.0	1.41	4.10

Table C-60. Instream Sampling -Total Suspended Solids (mg/L)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
In-stream Mill Creek (Upstream boundary locations)						
MC-001	28	<4.0	17.5	56.2	370.0	East Fork Mill Creek (RM 0.79)
MC-002	25	<4.0	46.0	62.7	270.0	Mill Creek (RM 18.88)
In-stream Mill Creek (Project area locations)						
MC-006	27	8.0	41.0	69.0	270.0	RM 16.75
MC-005	29	8.2	66.0	69.0	230.0	RM 15.28
MC-004	30	5.4	38.0	77.3	330.0	RM 14.07
MC-003	28	<4.0	78.0	99.0	330.0	RM 11.86
In-stream Tributary Locations						
SL-002	25	<4.0	20.0	75.8	820.0	RM 3.78
SL-001	24	<4.0	8.0	67.6	520.0	Sharon Woods Lake outlet (RM 3.0)
SC-001	27	<4.0	9.0	23.1	95.0	RM 0.96
BC-001	29	<4.0	6.6	17.5	87.0	RM 0.74
TR-001	26	<4.0	16.0	38.6	210.0	RM 0.34
CC-001	22	<4.0	30.5	36.8	120.0	RM 0.29

Table C-61. Upstream Sampling - Total Suspended Solids (mg/L)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
Upstream Tributary Locations						
SC-002	22	<4.0	8.0	9.8	39.0	Sharon Cr (RM 3.82)
BC-002	20	<4.0	<4.0	9.8	48.0	Beaver Cr (RM 3.62)
TR-002	23	<4.0	7.2	21.7	110.0	Town Run Cr (RM 0.79)
CC-002	14	<4.0	41.5	63.5	280.0	Cooper Cr (RM 3.36)
GE-001	22	<4.0	4.7	17.9	150.0	Unnamed Trib (RM 1.42)

Table C-62. Outfall Sampling - Total Suspended Solids (mg/L)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
Combined Sewer Overflow Locations						
CS-513 (CSO)	3	42.0	54.0	172.0	420.0	CSO (RM 0.11)
CS-507 (CSO)	8	45.0	68.5	108.9	240.0	CSO (RM 12.18)
Sanitary Sewer Overflow Locations						
SS-603 (SSO)	1	210.0	210.0	210.0	210.0	SSO (RM 3.98)
SS-1048 (SSO)	6	37.0	52.0	52.3	68.0	SSO (RM 3.49)
SS-704 (SSO)	2	150.0	195.0	195.0	240.0	SSO (RM 4.28)
SS-700 (SSO)	6	45.0	74.5	95.0	170.0	SSO (RM 13.82)
SS-700 TRT (combination of treated effluent and tank overflow)	17	7.6	48.0	63.8	230.0	SSO (RM 14.03)
Stormwater Outfall Locations						
ST-004 (Ind)	11	2.0	6.8	8.9	26.0	SW (Ind) (no RM)
ST-011 (Ind)	15	6.6	18.0	34.6	130.0	SW (Ind) (RM 2.75)
ST-009 (Com)	11	<4.0	8.4	12.2	36.0	SW (Com) (RM 1.79)
ST-010 (Com)	11	<4.0	<4.0	3.4	8.6	SW (Com) (RM 2.11)
ST-005 (Res)	3	10.0	11.0	11.3	13.0	SW (Res) (RM 2.89)
ST-006 (Res)	6	5.4	20.0	20.0	35.0	SW (Res) (RM 4.36)
ST-008 (Res)	12	7.0	15.0	16.1	32.0	SW (Res) (RM 3.35)

Table C-63. Outfall Averages - Total Suspended Solids (mg/L)

All Locations	Number of Samples Collected	Minimum Concentration	Median Concentration	Average Concentration	Maximum Concentration
CSO	11	42.0	63.0	126.1	420.0
SSO	15	37.0	67.0	98.9	240.0
SW (Ind)	26	<4.0	12.0	23.7	130.0
SW (Com)	22	<4.0	4.4	7.8	36.0
SW (Res)	21	5.4	14.0	16.5	35.0

Table C-64. Instream Sampling - Zinc (Total) (ug/L)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
In-stream Mill Creek (Upstream boundary locations)						
MC-001	28	<10	23	25	58	East Fork Mill Creek (RM 0.79)
MC-002	25	<10	12	18	57	Mill Creek (RM 18.88)
In-stream Mill Creek (Project area locations)						
MC-006	27	<10	19	25	69	RM 16.75
MC-005	29	<10	19	22	61	RM 15.28
MC-004	30	<10	14	24	68	RM 14.07
MC-003	28	<10	23	33	150	RM 11.86
In-stream Tributary Locations						
SL-002	25	<10	<10	14	95	RM 3.78
SL-001	24	<10	<10	9	37	Sharon Woods Lake outlet (RM 3.0)
SC-001	27	<10	<10	8	44	RM 0.96
BC-001	29	<10	<10	13	39	RM 0.74
TR-001	26	<10	17	26	170	RM 0.34
CC-001	22	<10	8	17	110	RM 0.29

Table C-65. Upstream Sampling - Zinc (Total) (ug/L)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
Upstream Tributary Locations						
SC-002	22	<10	<10	14	62	Sharon Cr (RM 3.82)
BC-002	20	<10	8	10	25	Beaver Cr (RM 3.62)
TR-002	23	<10	19	23	89	Town Run Cr (RM 0.79)
CC-002	14	<10	62	62	120	Cooper Cr (RM 3.36)
GE-001	22	<10	<10	14	87	Unnamed Trib (RM 1.42)

Table C-66. Outfall Sampling - Zinc (Total) (ug/L)

Location	Number of Samples Collected	Minimum Concentra-tion	Median Concentra-tion	Average Concentra-tion	Maximum Concentra-tion	Location
Combined Sewer Overflow Locations						
CS-513 (CSO)	5	50	51	127	400	CSO (RM 0.11)
CS-507 (CSO)	8	48	56	82	220	CSO (RM 12.18)
Sanitary Sewer Overflow Locations						
SS-603 (SSO)	1	140	140	140	140	SSO (RM 3.98)
SS-1048 (SSO)	6	25	40	46	83	SSO (RM 3.49)
SS-704 (SSO)	2	140	145	145	150	SSO (RM 4.28)
SS-700 (SSO)	6	45	65	71	130	SSO (RM 13.82)
SS-700 TRT (combination of treated effluent and tank overflow)	17	19	46	67	190	SSO (RM 14.03)
Stormwater Outfall Locations						
ST-004 (Ind)	12	<10	24	25	75	SW (Ind) (no RM)
ST-011 (Ind)	15	23	59	76	190	SW (Ind) (RM 2.75)
ST-009 (Com)	11	13	36	39	100	SW (Com) (RM 1.79)
ST-010 (Com)	11	18	65	58	78	SW (Com) (RM 2.11)
ST-005 (Res)	3	14	22	21	28	SW (Res) (RM 2.89)
ST-006 (Res)	6	14	21	26	48	SW (Res) (RM 4.36)
ST-008 (Res)	11	<10	13	18	70	SW (Res) (RM 3.35)

Table C-67. Outfall Averages - Zinc (Total) (ug/L)

All Locations	Number of Samples Collected	Minimum Concentration	Median Concentration	Average Concentration	Maximum Concentration
CSO	13	48	53	99	400
SSO	15	25	61	76	150
SW (Ind)	27	<10	45	53	190
SW (Com)	22	13	54	49	100
SW (Res)	20	<10	15	21	70

Appendix D
Watershed Flow Monitoring Curves

Flow Station BC-001

Figure D-1. Stage-Discharge Curve

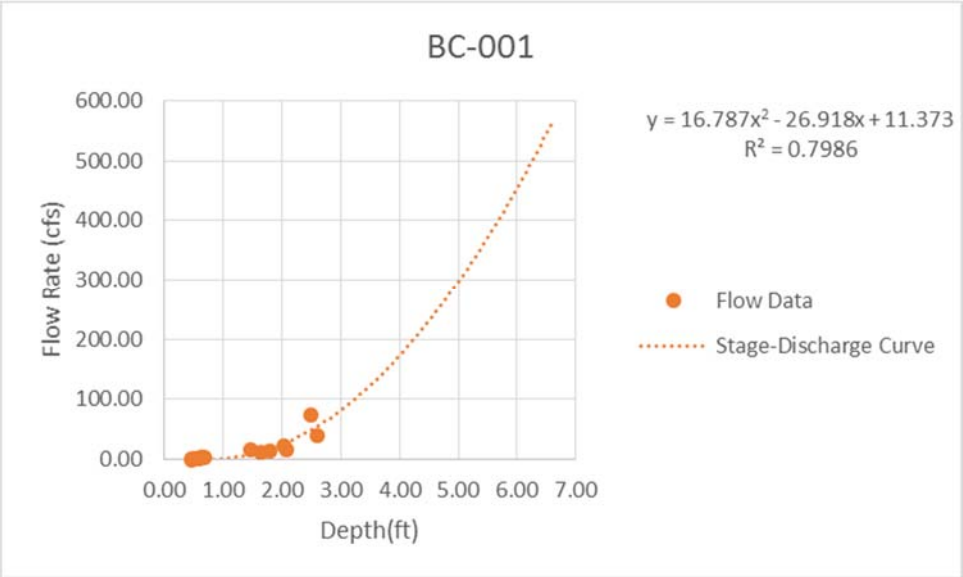
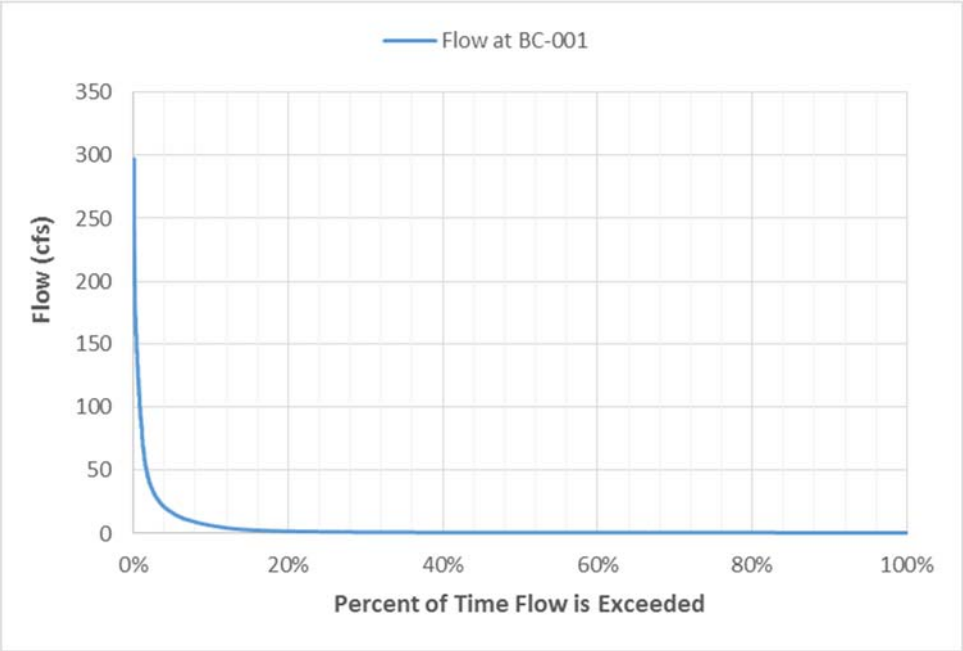


Figure D-2. Cumulative Frequency Curve



Flow Station BC-002

Figure D-3. Stage-Discharge Curve

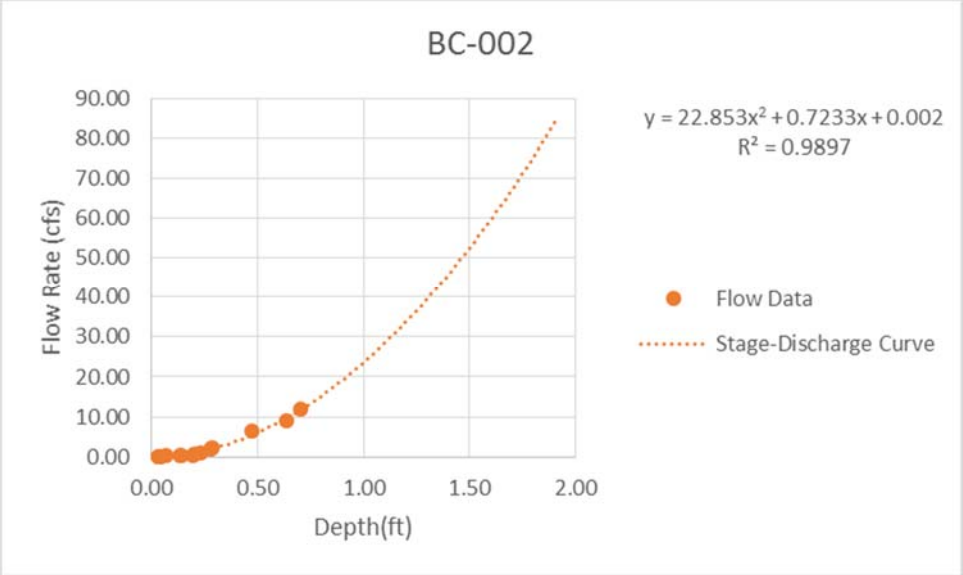
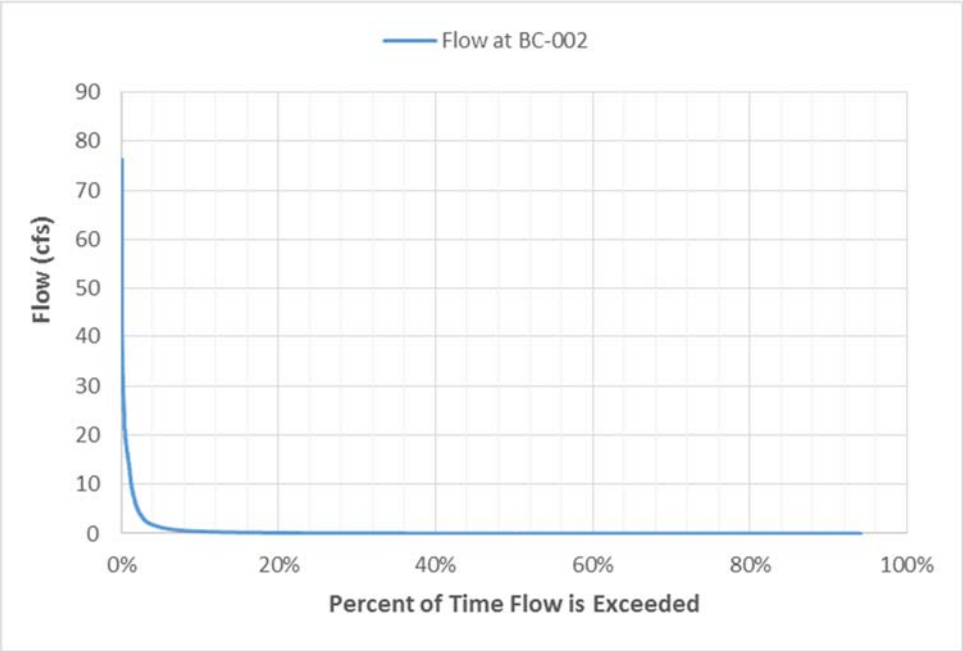


Figure D-4. Cumulative Frequency Curve



Flow Station CC-001

Figure D-5. Stage-Discharge Curve

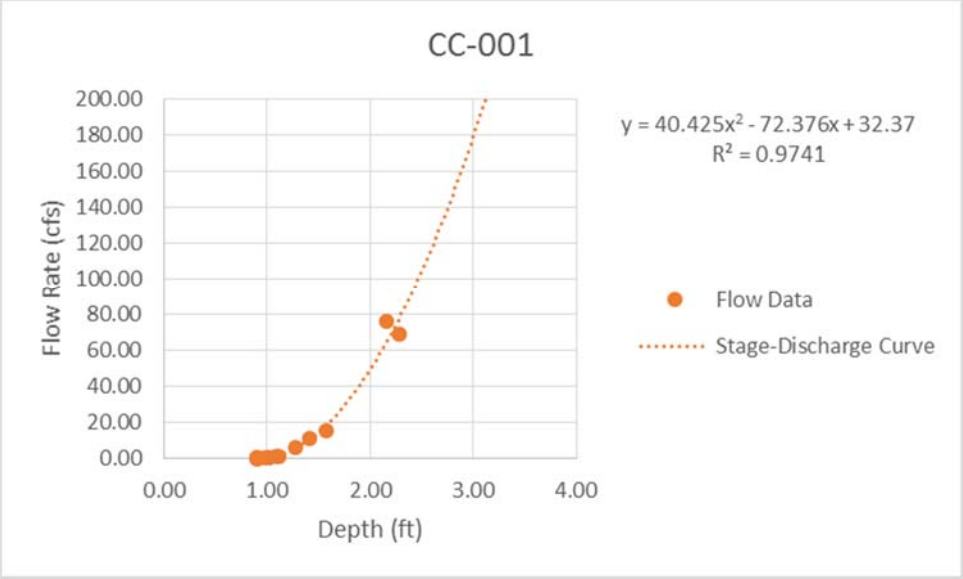
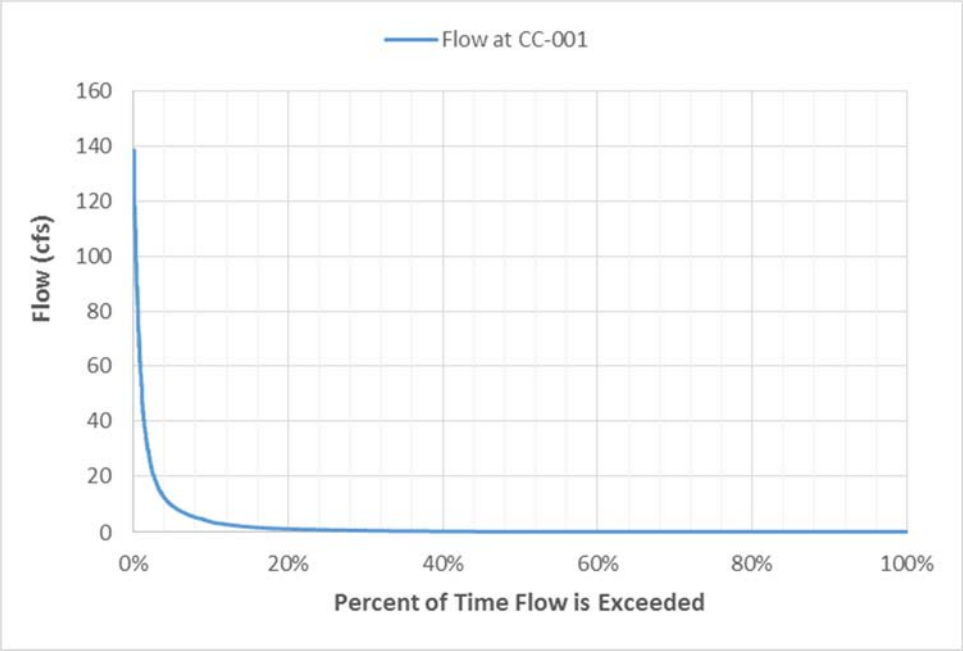


Figure D-6. Cumulative Frequency Curve



Flow Station CC-002

Figure D-7. Stage-Discharge Curve

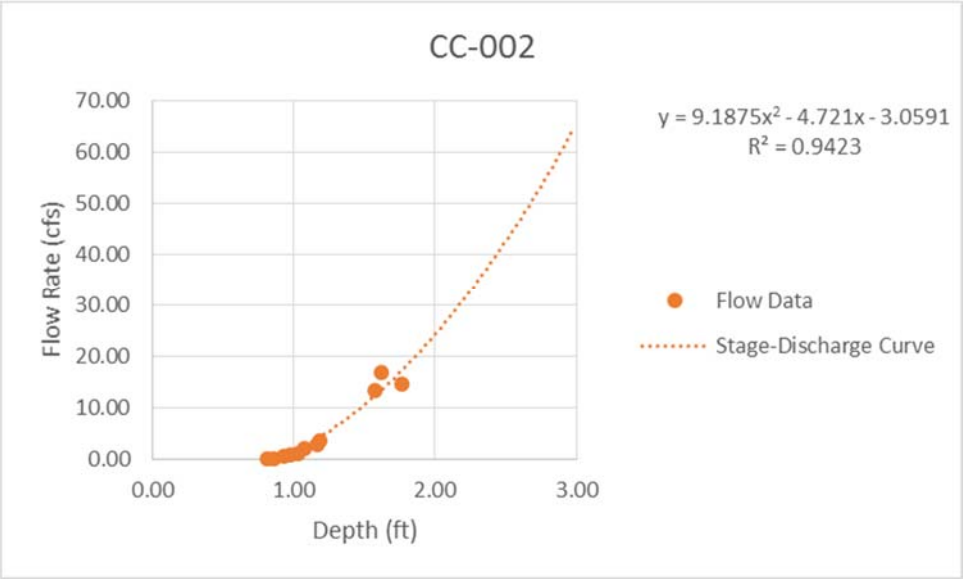
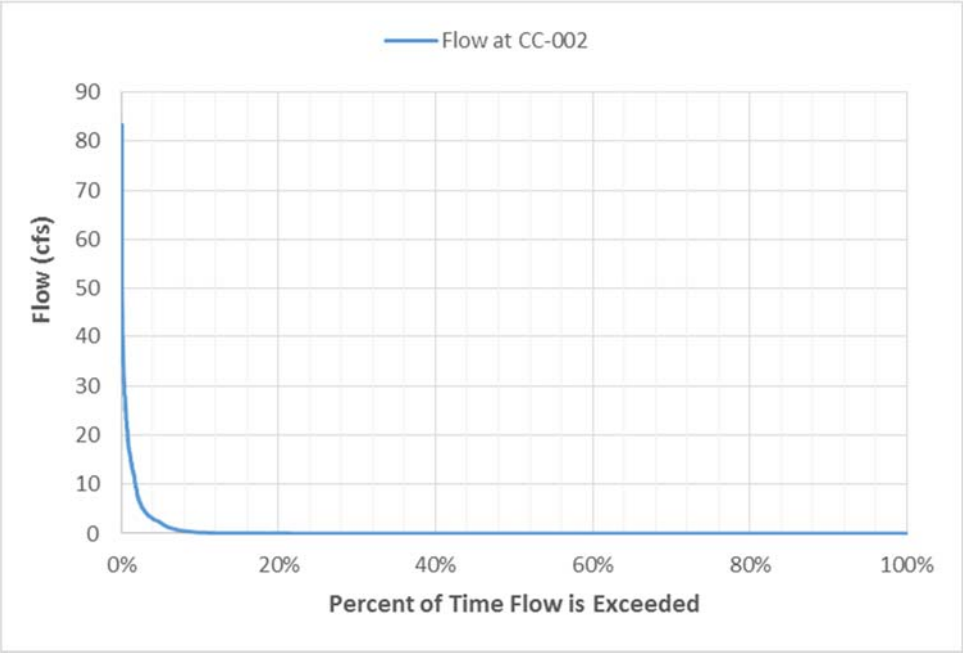


Figure D-8. Cumulative Frequency Curve



Flow Station GE-001

Figure D-9. Stage-Discharge Curve

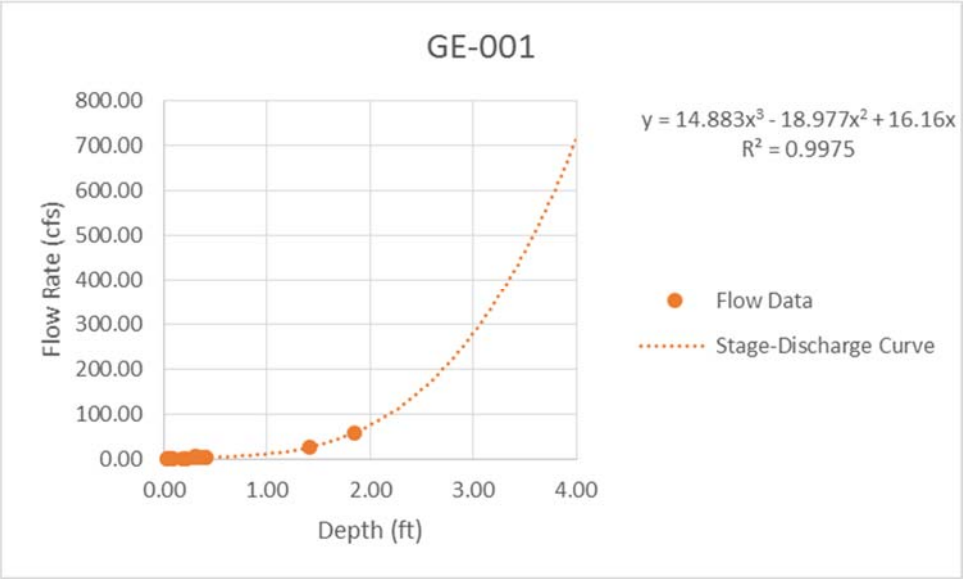
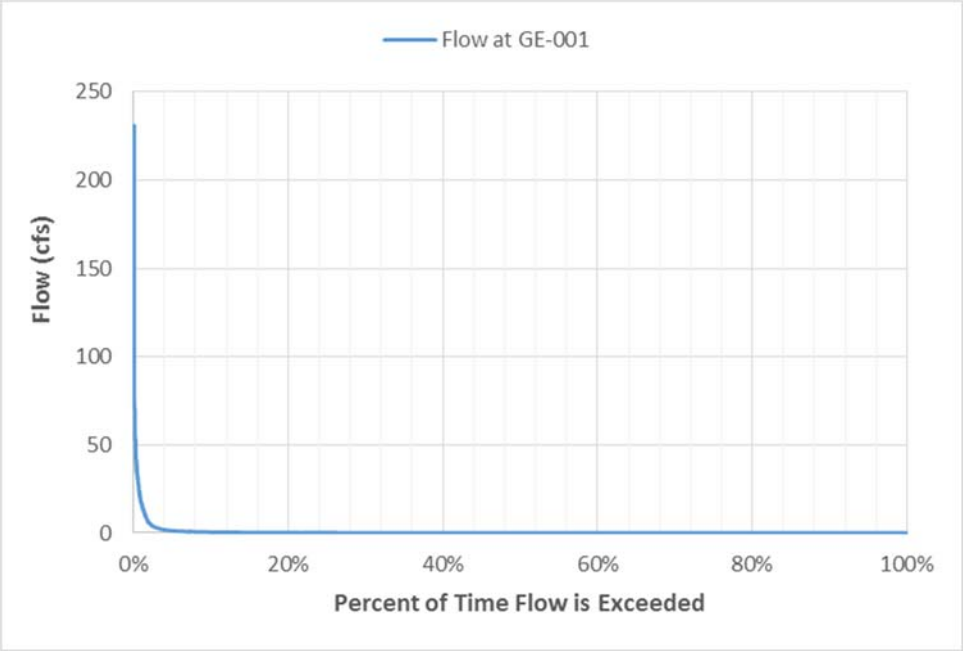


Figure D-10. Cumulative Frequency Curve



Flow Station SC-002

Figure D-11. Stage-Discharge Curve

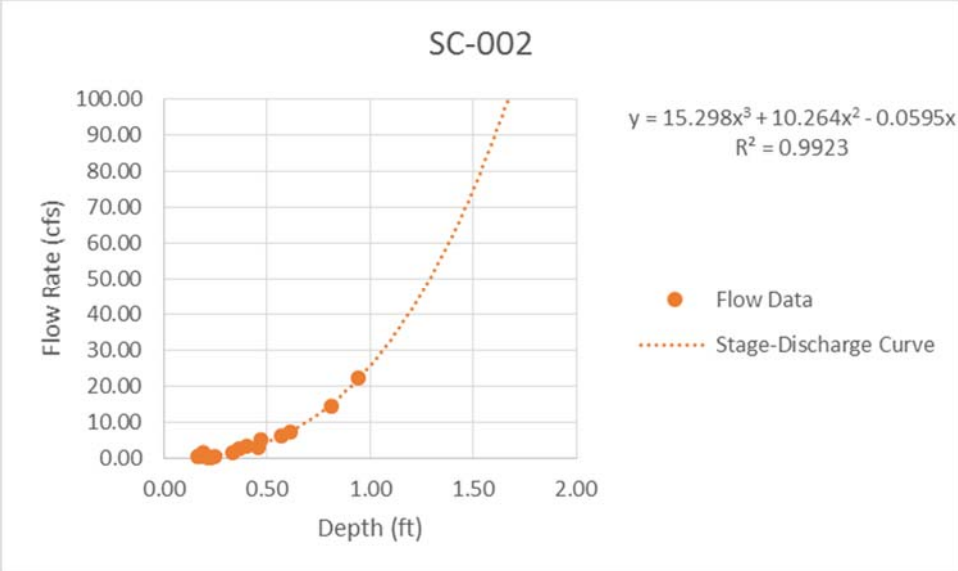
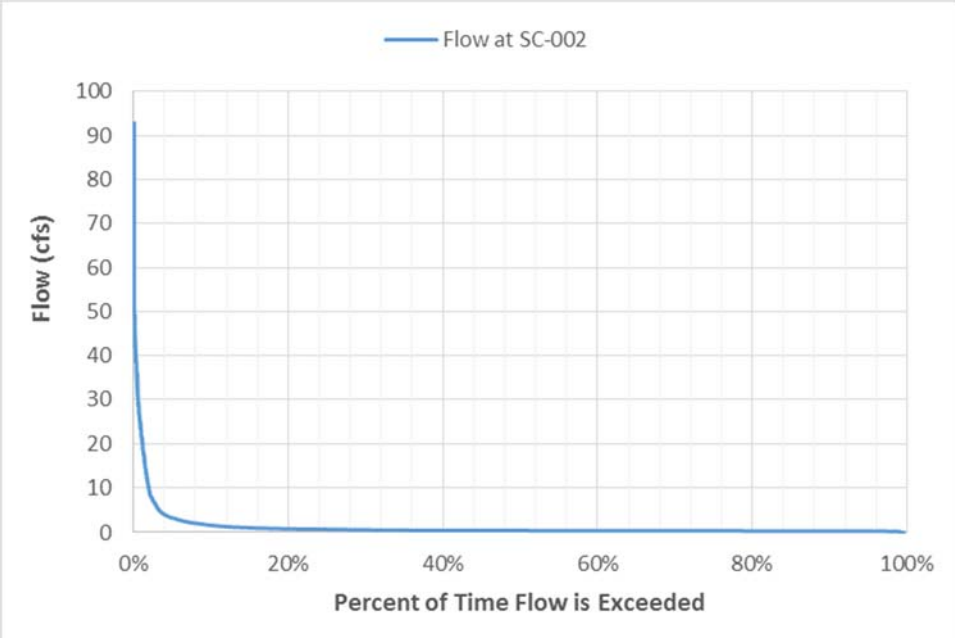


Figure D-12. Cumulative Frequency Curve



Flow Station TR-001

Figure D-13. Stage-Discharge Curve

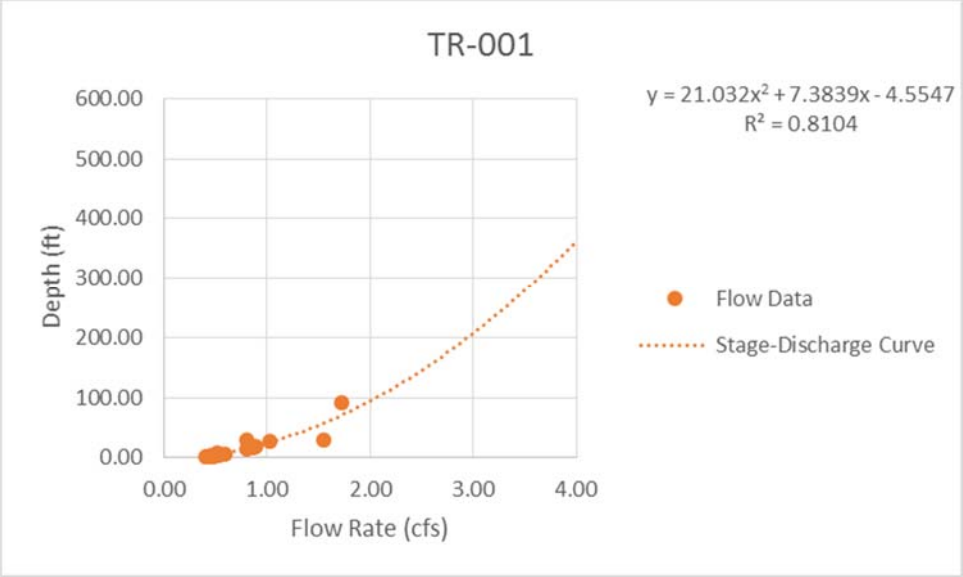
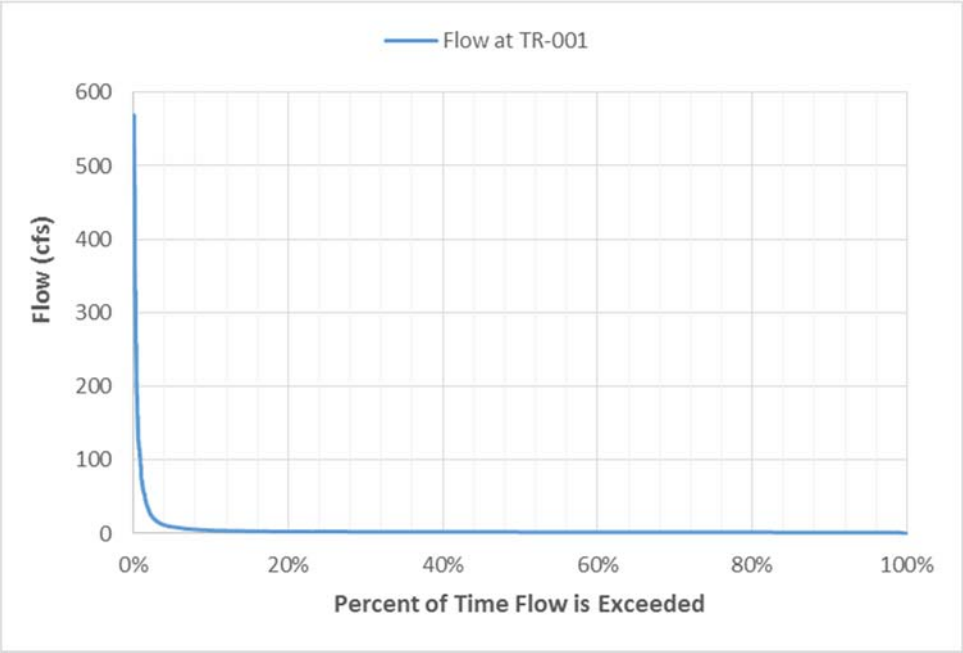



Figure D-14. Cumulative Frequency Curve