Delaware County Regional Water Quality Control Authority
CSO Long Term Control Plan Update

Water Quality Model Report

Final

Submitted: February 2018

GREELEY AND HANSEN

LimnoTech

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Report Signature Cover Sheet

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DELCORA OPERATIONS AND MAINTENANCE		
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REVISION CONTROL

REV. NO.	DATE ISSUED	PREPARED BY	DESCRIPTION OF CHANGES

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Glossary

CDPS: Central Delaware Pump Station
CSO: Combined sewer overflow
CSS: Combined sewer system
CWA: Clean Water Act
DCIA: Directly connected impervious area
DEM: Digital elevation model
EFDC: Environmental Fluid Dynamic Code
EMC: Event mean concentration
HSG: Hydrologic soil group
LiDAR: Light detection and ranging
LTCP: Long Term Control Plan
MRLC: Multi-Resolution Land Characteristics
MS4: Municipal separate storm sewer system
NCDC: National Climatic Data Center
NLCD: National Land Cover Database
NMC: Nine Minimum Controls
NOAA: National Oceanic and Atmospheric Administration
NPDES : National Pollutant Discharge Elimination System
NRCS: National Resources Conservation Service
PADEP: Pennsylvania Department of Environmental Protection
PWD-SWPCP: Philadelphia Water Department's Southwest Water Pollution Control Plant
SSO: Sanitary sewer overflow
SSURGO: Soil Survey Geographic database
SWMM: Stormwater Management Model
USGS: United States Geological Survey
WRTP: Western Regional Treatment Plant

Executive Summary

Introduction

The DELCORA Consent Decree requires that a Water Quality Model be developed to support the Long Term Control Plan Update. This report describes DELCORA's receiving water quality model, including the development and calibration of the model, and the initial application of the model to quantify baseline pollutant of concern (POC) water quality conditions in the receiving waters for the typical period. The POCs include Fecal coliform, *E.coli*, and *Enterococcus*. The objective of the water quality modeling was to compute POC concentrations in the tidal portions of Chester Creek and Ridley Creek, and in the Delaware River, by accounting for all major POC sources within the model domain. The intended use of the water quality modeling framework is to evaluate the water quality under typical year conditions and to evaluate CSO control alternatives.

Model Development

Three types of models, which comprise the modeling framework, were jointly applied to compute POC concentrations in Chester and Ridley Creeks and the Delaware River:

- A watershed model which simulates flows and POC loads from the Chester and Ridley Creeks watersheds;
- CSO models to simulate flows and POC loads from the DELCORA and Philadelphia Water Department (PWD) combined sewer systems (CSS) to the streams; and,
- A receiving water quality model that computes POC concentrations in Chester and Ridley Creeks and the Delaware River resulting from the various sources of POCs to the streams.

The watershed and CSS models were developed using the EPA Stormwater Management Model (SWMM) and the receiving water quality model was developed using the EPA Environmental Fluid Dynamics Code (EFDC) model.

Model Calibration

Site specific data was used for calibrating the various models, including USGS flow data, NOAA tide data, wet and dry weather water quality data obtained by DELCORA, and ambient water quality data obtained from the Delaware River Basin Commission (DRBC). The water quality data obtained by DELCORA proved particularly useful in calibration the water quality model, as it contained both wet and dry weather data at various locations within the study area, including both upstream and downstream of the DELCORA CSO discharges.

Calibration of the various models was evaluated using metrics such as total runoff volume, peak flow rates, timing of the flow response, frequency of discharge, water levels, water velocities, and in-stream water quality concentration. The calibration approach was to adjust model parameters and evaluate changes in model results against the entire calibration dataset, and identify the model values that were most consistent with the central tendencies of the dataset by stream. Each model within the framework was developed and calibrated using the best available data, and found to be reasonably consistent with observed data and therefore reliable to be applied for the Long Term Control Plan Update.

Model Application

The water quality model was applied for the typical year hydrologic period of 1994-1996, which includes one relatively dry year, a relatively wet year, and an average year (DELCORA, 2016b). Modeled POC concentrations were compared to the currently applicable and potential future water quality standards, as described in the table below. The Upper Delaware River and the tidal zones of Chester and Ridley Creek currently have secondary contact water quality standards whereas the Lower Delaware River currently has primary contact water quality standards for bacteria. The boundary between the Upper and Lower Delaware River occurs at river mile 81.8, which is just downstream of Chester Creek and CSO-11.

Table ES-1: Water Quality Standards for Comparisons with Model Results

Segment	*Enterococcus* (#/100 mL)	Fecal Coliform (#/100 mL)	*E.coli*[1] (#/100 mL)
Upper Delaware River and Tidal Zones of Creeks	Monthly Geomean: 88 #/100 mL	Monthly Geomean: 770 #/100 mL	n/a
Lower Delaware River	Monthly Geomean: 33 #/100 mL	Monthly Geomean: 200 #/100 mL	Monthly Geomean: 126 #/100 mL Statistical Threshold Value: 410 #/100 mL

1. *E.coli* (EC) standards likely to be codified by PADEP 12-24 months from July 2017. These criteria would apply to the non-tidal tributaries and Delaware River below R.M. 81.8, during recreational months only (May 1 - September 30).

Model results were summarized over the stream reaches that receive CSO discharges, and that occur within Pennsylvania water. Generally, the modeling indicated that the *Enterococcus* standards are the most stringent (relative to current concentrations) among the three POCs. Excursions above the WQS are frequent in the two Creeks and infrequent in the Delaware River. The excursions are almost always due to background sources coming from upstream of the DELCORA CSO area. DELCORA CSOs have a relatively smaller (less than 10%, on average) impact on monthly geometric mean concentrations than background sources.

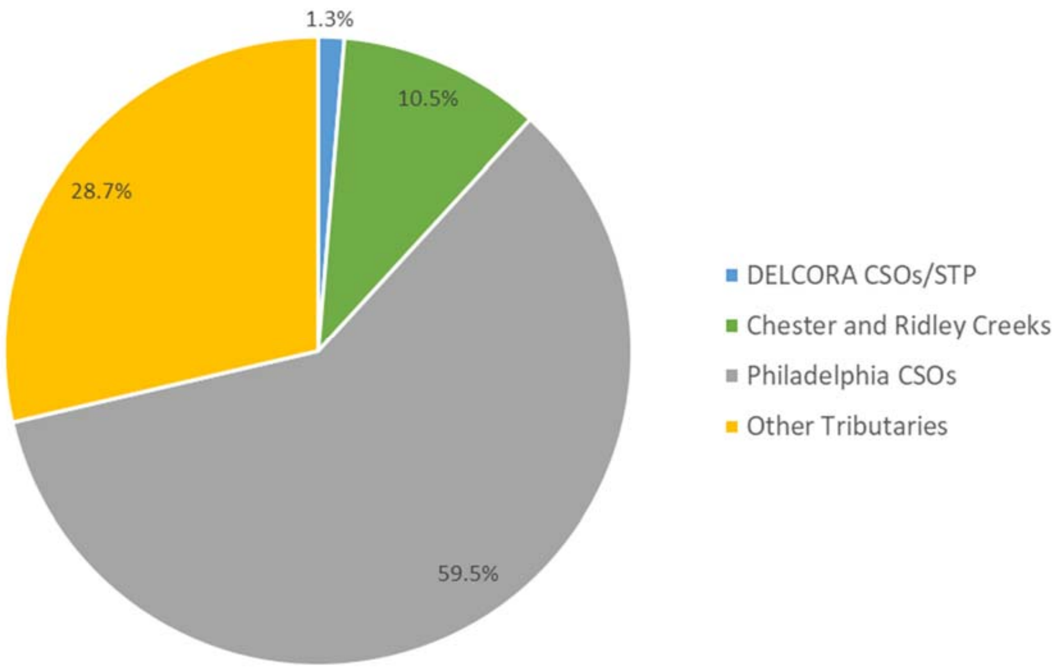
Findings and Implications

A water quality model was developed to compute POC concentrations in the tidal sections of Chester Creek and Ridley Creek, as well as in the Delaware River. Major findings of the modeling are as follows:

- The model is deemed adequate to assess the local water quality conditions in the DELCORA project area, including in the tidal portions of Chester and Ridley Creek, and in the Delaware River from roughly river mile 80 near Marcus Hook Creek, to river mile 85 near Crum Creek.
- Outputs of the hydrologic and hydraulic model relative to volumes and loadings were adequate for utilization as inputs for the development of the water quality model.
- The monitoring data shows that wet weather concentration at the most upstream monitoring locations (located upstream of CSO influence) in Chester Creek and Ridley Creek often exceed the monthly geometric mean WQS concentration for the three POCs. Wet weather exceedances are also observed in the most upstream monitoring location for the Delaware River, but less frequently as compared to the creeks. The *E.coli* statistical threshold value WQS[1] concentration (410 #/100 mL) was exceeded once under wet weather conditions during the sampling periods in the Delaware River.
- The modeling results show that when water quality standards are exceeded during wet weather events, upstream and background sources typically prevent the attainment of both the monthly geometric mean and STV water quality standards.
- The modeling results show that CSOs by themselves do not cause water quality violations in any of the stream segments.
- The DELCORA CSO loads are small compared to upstream and background loads entering the DELCORA project area (Figure ES-1).

[1] E.coli (EC) standards likely to be codified by PADEP 12-24 months from July 2017. These criteria would apply to the non-tidal tributaries and Delaware River below R.M. 81.8, during recreational months only (May 1 - September 30).

Figure ES-1: Percent of Bacteria Load by Source



Further, each model within the framework was developed and calibrated using the best available data, and found to be reasonably consistent with observed data and therefore reliable to be applied for the LTCPU. Two major observations can be made from the water quality modeling application results. One is that background sources dominate the modeled POC concentrations (and by extension, DELCORA CSO loads are small compared to background loads, as shown in the figure above), and the second is that the DELCORA CSOs by themselves do not cause non-attainment, or preclude the attainment, of WQS. Moreover, the modeling results show that regardless of additional CSO controls, even complete separation, water quality standards would still be exceeded under current conditions because background sources typically prevent compliance with WQS. While the Consent Decree addresses the issue of background sources by requiring CSO controls to also be assessed assuming that background sources are reduced to 75% of the applicable WQS, it is not clear that imposing CSO controls under these conditions is reasonable given that there is no current plan for reducing background loads in Chester and Ridley Creeks. The CSO Policy states that "where WQS and designated uses are not met in part because of natural background conditions or pollution sources other than CSOs, a total maximum daily load, including a wasteload allocation and a load allocation, or other means should be used to apportion pollutant loads". Such apportionment of loads does not currently exist for Ridley and Chester Creeks for bacteria.

The intended use of the water quality modeling framework is to evaluate CSO control alternatives with respect to applicable water quality standards and demonstrate that alternatives selected for the LTCPU program will meet the water quality-based requirements of the Clean Water Act and Consent Decree. The water quality model is adequate to assess presumption levels of control to show that the CSOs after controls are in place do or do not preclude the attainment of water quality standards. The model framework could also be used to assess the demonstration approach, however, as explained in this report, the modeling shows that CSOs alone do not cause WQS violation and do not preclude the attainment of WQS, and background loads are currently causing WQS violations upstream of the CSOs and the CSO influence. Without a State plan for estimating the cost and practicality for controlling the background load upstream of DELCORA's CSO area, it is difficult to justify the demonstration approach.

As such, DELCORA will utilize the presumption approach, which is shown in this report to be reasonable in light of the data and analysis as called for in the National CSO Policy.

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Section 1 Introduction

1.1 Background of DELCORA's Facilities

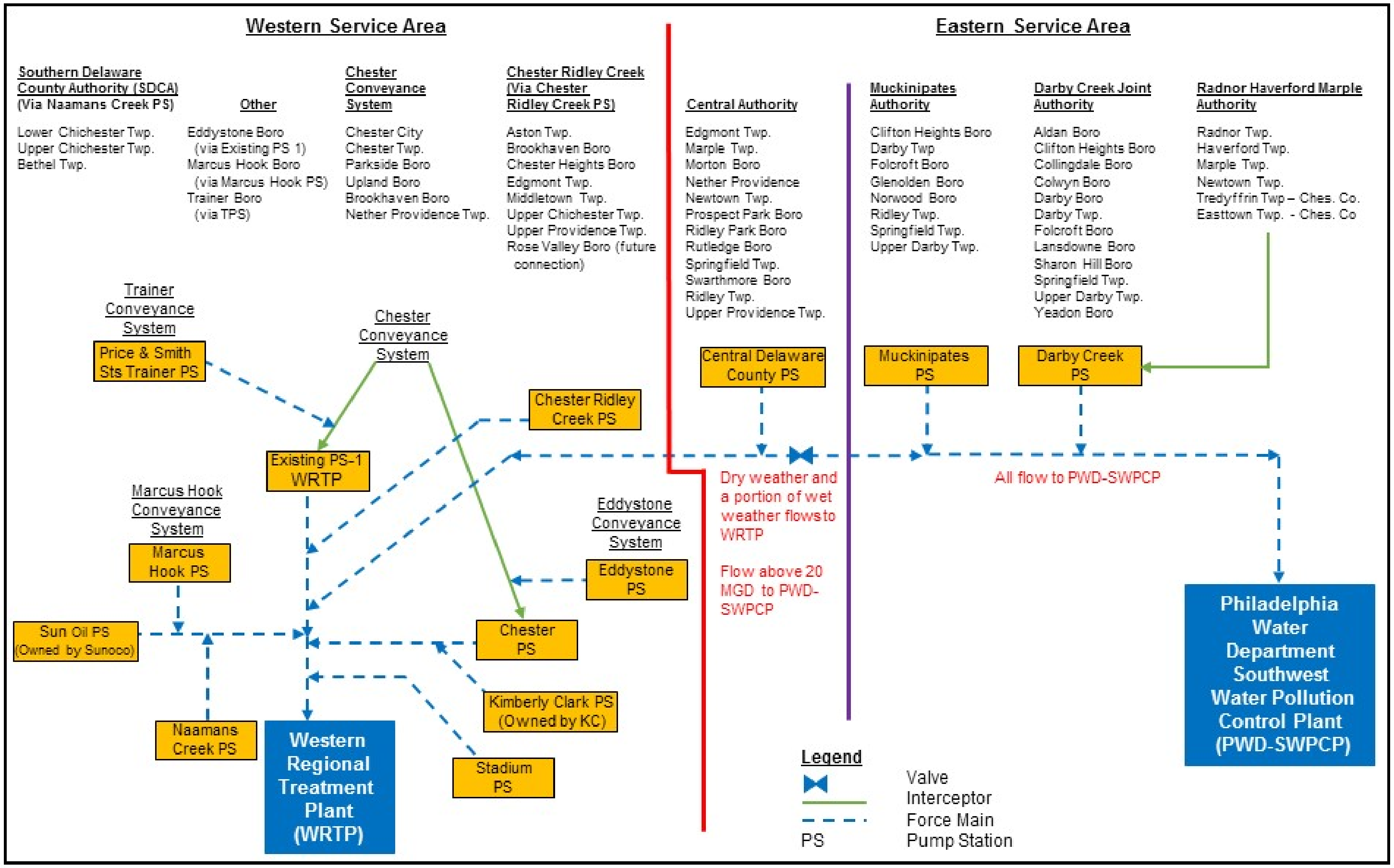
Delaware County Regional Water Quality Control Authority (DELCORA) is responsible for the collection, transmission, treatment and disposal of approximately 65 million gallons per day (MGD) of wastewater generated in southeastern Pennsylvania. DELCORA's facilities serve residential, commercial, institutional, and industrial customers in Delaware County. DELCORA owns and operates an extensive system of pump stations, force mains, and sewers that provide the core infrastructure for the transmission of wastewater to treatment facilities in Delaware County and the City of Philadelphia as shown diagrammatically in Figure 1-1. The total service area served by DELCORA, as shown on Figure 1-2, is approximately 82,977 acres which illustrates that DELCORA serves a significant and widespread portion of Delaware County.

The combined sewer area simulated in DELCORA's existing Hydrologic and Hydraulic model is located within the City of Chester and consists of a drainage area of approximately 1,510 acres. It comprises approximately half of Chester City's serviced area. To support the service area, DELCORA owns and operates over 129 miles of separate and combined sewers. Included in the 129 miles of sewers are: 11.7 miles of an interceptor system; 3,209 manholes; and twenty-five (25) combined sewer outfall regulators controlling storm overflows. The location of Chester City's service area is illustrated on Figure 1-2.

Historically, DELCORA has characterized its service areas as "Eastern" and "Western." The Western service area discharges to DELCORA's Western Regional Treatment Plant (WRTP). The Eastern service area discharges to the Philadelphia Water Department's Southwest Water Pollution Control Plant (PWD-SWPCP). In 2002, DELCORA completed the installation of a force main that connects the Eastern Service Area's Central Delaware Pump Station (CDPS) to the Chester Force Main. This connection allows DELCORA to send flow from the CDPS to the WRTP. Flows above 20 MGD are directed to the PWDSWPCP. As such, dry weather flows and a portion of the wet weather flows (total flow less than 20 MGD) from the Central Delaware County Authority in the Eastern Service Area are discharged to the WRTP.

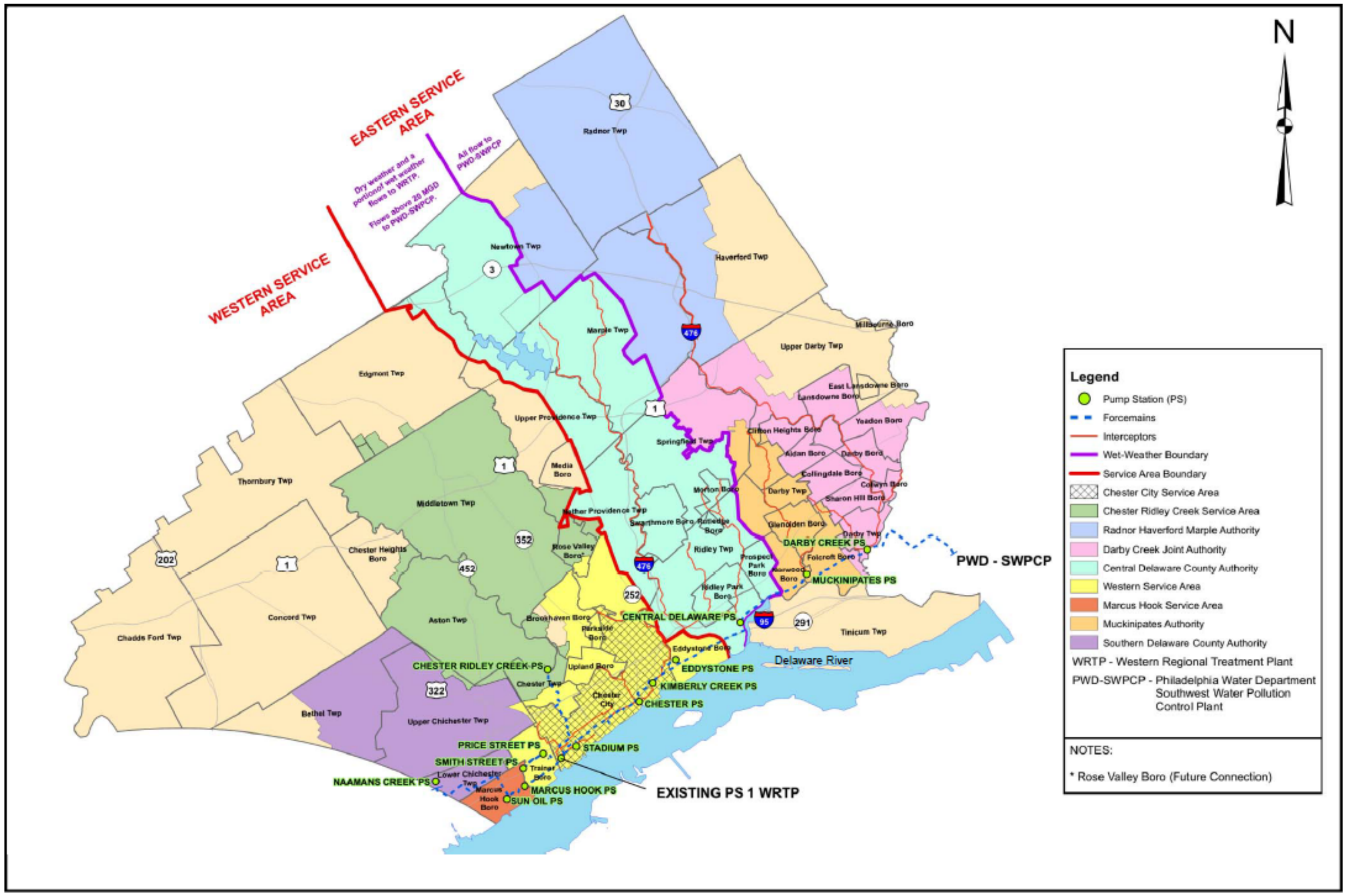
There are a total of 26 combined sewer overflow outfalls listed with 25 discharge points (Outfall #009 and #010 both discharge at Outfall #009) in DELCORA's existing National Pollutant Discharge Elimination System (NPDES) Permit. Under its NPDES Permit No. PA0027103, issued and administered by the Pennsylvania Department of Environmental Protection (PADEP), DELCORA is authorized to discharge from the Western Regional Treatment Plant (Outfall #001), four stormwater outfalls at the WRTP (028-031) and from 26 combined sewer overflow outfalls (#002-#026, #032, #033) that ultimately discharge to the Delaware River, Chester Creek and/or Ridley Creek.

Figure 1-1: DELCORA's Conveyance System



CSO Long-Term Control Plan Delaware County Regional Water Quality Control Authority	GREELEY AND HANSEN WESTON SOLUTIONS	Figure 1-1 DELCORA'S CONVEYANCE SYSTEM

Figure 1-2: DELCORA's Service Area



CSO Long-Term Control Plan Delaware County Regional Water Quality Control Authority	GREELEY AND HANSEN	Figure 1-2 DELCORA'S SERVICE AREA

Part C – Other Requirements, Section V – Combined Sewer Overflows of the NPDES Permit details DELCORA's responsibilities with respect to the CSO system including reporting, continued implementation of and continued compliance with the Nine Minimum Controls (NMC), and implementation of the existing Long-Term Control Plan (LTCP) dated April 1999 and the July 2008 addendum to the LTCP until the updated LTCP is approved.

1.2 Consent Decree Requirements

On August 17, 2015, a Consent Decree was lodged in the United States District Court for the Eastern District of Pennsylvania that requires DELCORA to complete and submit a revised and updated LTCP to the United States Environmental Protection Agency (USEPA or EPA) and the Pennsylvania Department of Environmental Protection (PADEP or DEP) for review and approval. The Consent Decree specifies that within sixty (60) days after the approved Water Quality Model Plan is fully implemented according to the schedule included in the Modeling Work Plan, DELCORA shall submit to EPA and PADEP a Water Quality Model Report for review and approval pursuant to Section VI (Review and Approval of Submittals) which shall specifically address each item set forth in Paragraph 15(a)(i)-(vi).

The work plan was first submitted in January 11, 2017 and a revision was submitted in July 31, 2017.

1.3 CSO and Receiving Water System Description

The combined portion of DELCORA's sewer system is located within the City of Chester (City), and it comprises approximately half of the City's serviced area. The combined wastewater/stormwater system in the City of Chester is complicated by the fact that parts of the system are owned, operated and maintained by two governmental entities, the City and DELCORA. DELCORA owns, operates and maintains the parts of the system that convey wastewater, such as the street sewers, collectors, interceptors, and CSO regulators and CSO outfalls. The City owns, operates and maintains the inlets, stormwater-only sewers that connect to the combined sewer system and any stormwater-only outfalls. The City is also responsible for the maintenance and cleaning of the streets, planning, zoning, and development controls. The Chester CSO system contains 26 permitted outfalls and they discharge to three receiving water bodies: the Delaware River, Chester Creek, and Ridley Creek. However, there are only 25 CSO discharge locations, as CSO #010 discharges to the Delaware River through CSO #009. Figure 1-3 depicts the locations of CSO regulators and outfalls that are DELCORA's responsibility. Figure 1-3 also provides a sewer system characterization and illustrate the breakdown of each outfall and how each drainage area has combined sewers and separate sewers. Figure 1-4 is a schematic of the Chester CSO system and shows the outfalls and the interceptors that are connected to each CSO. Note that CSO #033 does not appear to overflow during the typical year period. This CSO will be evaluated in the LTCP but, as a practical matter, it does not cause or contribute to WQS being exceeded.

Figure 1-3: Location of Regulators and Combined Sewer Outfalls with Drainage Areas

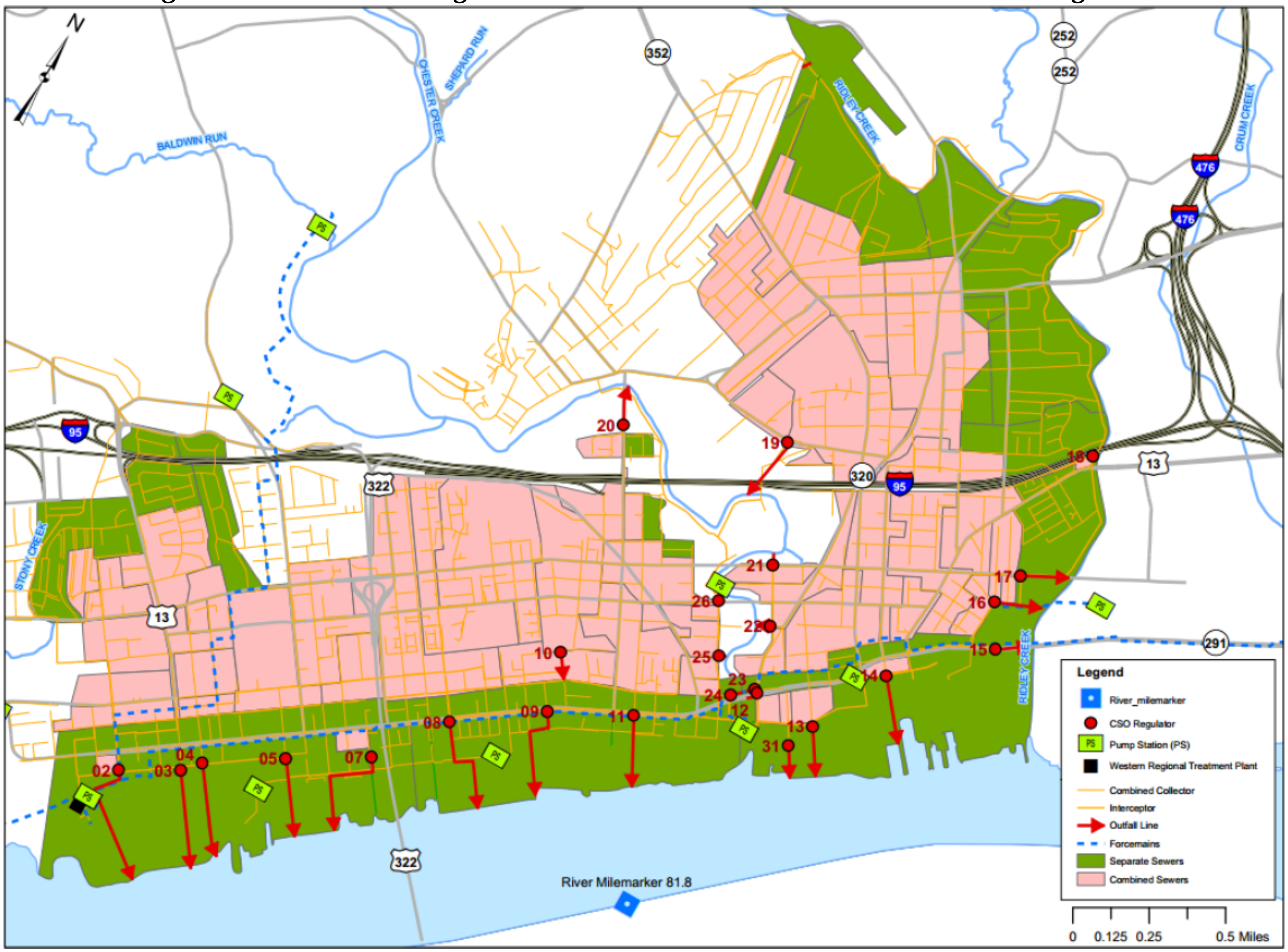
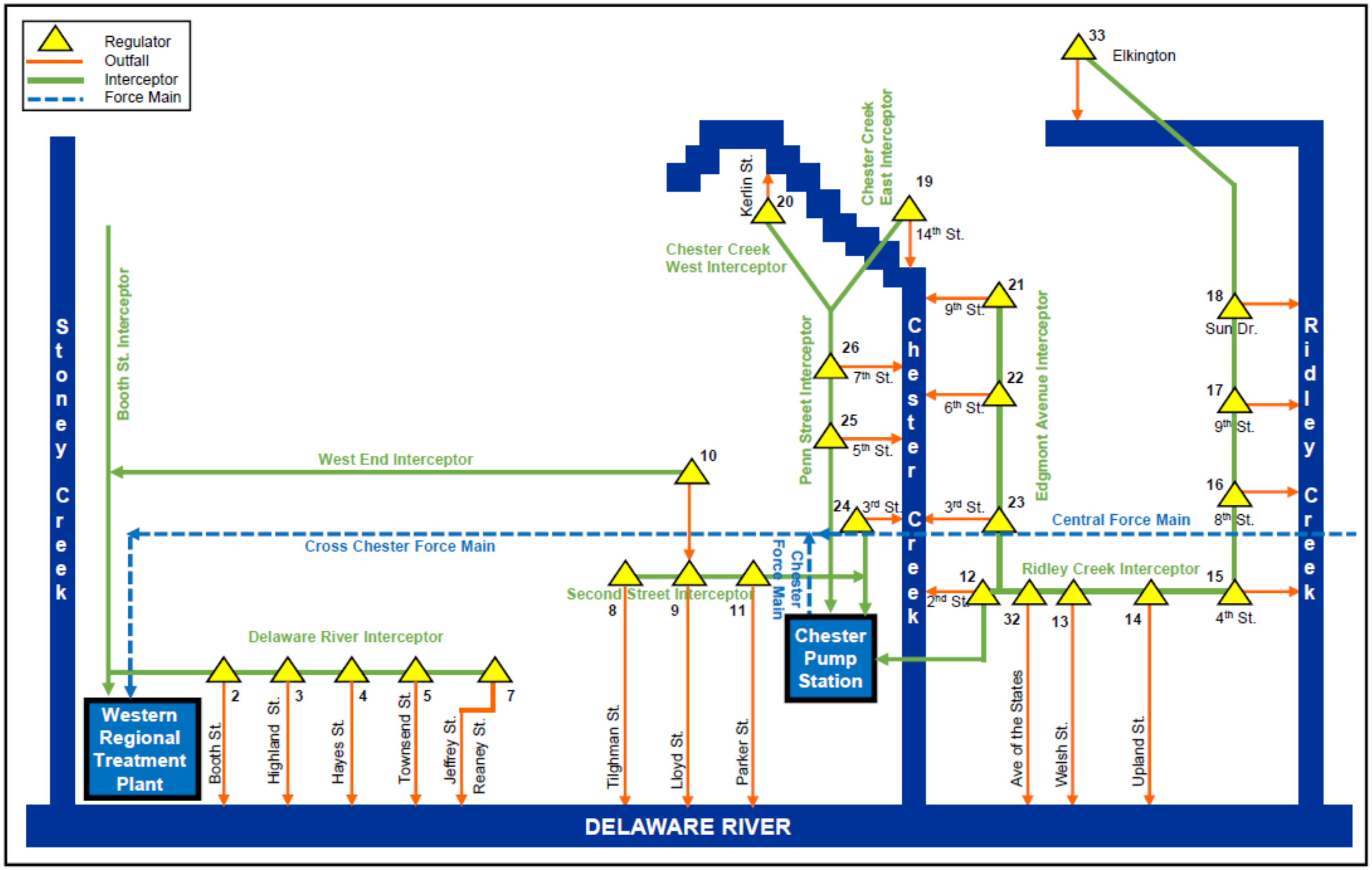


Figure 1-4: Schematic of Chester CSO System



CSO Long-Term Control Plan Delaware County Regional Water Quality Control Authority	GREELEY AND HANSEN	Figure 1-4 SCHEMATIC OF CHESTER CSO SYSTEM

The pollutants of concern (POC) in the receiving waters are described in the "Identification of Sensitive Areas and Pollutants of Concern Report" (DELCORA, 2016a), and include Fecal coliform, *E.coli*, and *Enterococcus*.

DELCORA conducted an extensive wet and dry weather monitoring program between March and June 2017 to better characterize the POC loads within the project area. Site selection and analytical parameters were designed to characterize stormwater outfalls, CSOs, tributaries upstream and within the Chester CSO discharge area, and the main stem of the Delaware River in the project area. More information on the DELCORA Water Quality Monitoring Program can be found in Section 4.1.3 as well as in Appendix B.

1.4 Report Purpose and Objectives

This report describes DELCORA's receiving water quality model, which will support the Long Term Control Plan update (LTCPU). Specifically, the report describes the development and calibration of the model, and the initial application of the model to quantify baseline POC water quality conditions in the receiving waters for the typical period. The objective of the water quality modeling was to compute POC concentrations in Chester Creek, Ridley Creek, and the Delaware River, by accounting for all major POC sources within the model domain. Furthermore, the objective of the water quality model is to produce results for the typical period that will serve as the basis for evaluating CSO control alternatives. The primary focus of the water quality model is on the local water conditions, including the tidal zones of Chester and Ridley Creeks, and the Delaware River from roughly river mile 80 near Marcus Hook Creek to river mile 85 near Crum Creek. The intended use of the water quality modeling framework is to evaluate the water quality under typical year conditions and for the LTCP CSO control alternatives.

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Section 2 Water Quality Modeling Software

Three types of models, which comprise the modeling framework, were jointly applied to compute pollutant of concern (POC) concentrations in Chester and Ridley Creeks and the Delaware River:

- A watershed model which simulates flows and POC loads from the Chester and Ridley Creeks watersheds;
- CSO models to simulate flows and POC loads from the DELCORA and Philadelphia Water Department (PWD) combined sewer systems (CSS) to the streams; and,
- A receiving water quality model that computes POC concentrations in Chester and Ridley Creeks and the Delaware River resulting from the various sources of POCs to the streams.

The watershed model framework for this project is the EPA Stormwater Management Model (SWMM), which is supported by the USEPA. SWMM is a dynamic rainfall-runoff simulation model used for single event or continuous simulation of runoff quantity and quality from primarily urban areas (USEPA, 2014). The watershed model is based upon the EPA SWMM, Version 5.1.010, which is consistent with the version used for the CSS model. A variety of enhanced SWMM platforms are available that integrate the EPA SWMM software with user friendly interfaces and GIS capabilities. For this project, PCSWMM, developed by Computational Hydraulics International (CHI), was used.

The DELCORA combined sewer system hydrologic and hydraulic (H&H) model used for this study was developed by Greeley and Hansen (GH) to support DELCORA's Long Term Control Plan Update (LTCPU). The CSS model is based upon the EPA SWMM, Version 5.1, Build 5.1.012 and was applied through the proprietary software InfoSWMM Version 14.5 Update 4, developed by Innovyze (DELCORA, 2017).

A simplified Philadelphia combined sewer system model was developed by LimnoTech to estimate Philadelphia CSO flow and POC load contributions. The reason for including these loads is because large contributions of POCs occur upstream of DELCORA that impact the water quality in the DELCORA project area. The Philadelphia CSS model is also based on the EPA SWMM, Version 5.1.010 model using PCSWMM. Unlike the DELCORA CSS model, it does not represent hydraulics of the Philadelphia combined sewer system; instead it represents the storage capacity of the system and the frequency and magnitude of combined sewer overflows.

The receiving water quality model was developed based on USEPA's EFDC (Environmental Fluid Dynamics Code) modeling framework. This model has been applied to support numerous CSO water quality projects (Lynchburg, VA; Northern Kentucky; Evansville, IN; Cincinnati, OH) and is suitable for representing hydrodynamic and water quality conditions occurring in the Delaware River and its tributaries. EFDC is a state-of-the-art finite difference model that can be used to simulate hydrodynamic and water quality behavior in one, two, or three dimensions in riverine, lacustrine, and estuarine environments (TetraTech, 2007). The model has been applied to hundreds of water bodies across the United States, including in the Delaware Bay and Chesapeake Bay.

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Section 3 Model Configuration and Development

Model configuration and development is the process of configuring a model to represent certain conditions of interest (e.g. combined sewer overflows, or bacteria concentrations) at a particular site. The model development process for DELCORA's water quality modeling framework included definition of 1) important physical and chemical processes, 2) model inputs and assumptions influencing the modeled processes, 3) the spatial extent of model calculations, and 4) the time span of model calculations. This process is described below for each of the components of the modeling framework.

3.1 Watershed Model

3.1.1 Purpose and Description

The purpose of the Chester and Ridley Creek watershed model is to estimate flow conditions in the creeks for periods when USGS flow data for the two creeks are unavailable for the application period. Gage data are available through much of the typical period, except for a long data gap in Ridley Creek (9/22/1995 through 12/31/1996) and some shorter periods at both gages. The watershed model is used to fill in those data gaps, as well as to estimate the flow contribution of the separate storm sewer areas within the DELCORA project area as represented in Figure 1-3.

The watershed model consists of a set of subcatchments representing the hydrology of the system. The subcatchments are connected to a network of stream segments representing the hydraulics of the system. During wet weather events, runoff and associated pollutants are transported from the subcatchments to the stream network, and ultimately discharge to Chester Creek, Ridley Creek, or the Delaware River.

To set up the watershed model in SWMM, processes influencing the system's hydrology and hydraulics were characterized. Several different types of data were used for this characterization. The processes that were modeled and the relevant data that were collected and analyzed for setting up the watershed model are further described below.

3.1.2 Model Processes

The first step in model development is determining what hydraulic and water quality processes should be included. SWMM is capable of modeling six processes: rainfall/runoff, infiltration, snow melt, groundwater, flow routing, and water quality. To meet the objectives of this model three of these processes were used: rainfall/runoff, infiltration, and flow routing. The other three processes were not used or were modified as follows:

- Snow melt: it was assumed that snow melt typically does not generate significant runoff in the DELCORA area, so this process was not included.

- Groundwater: the contribution of groundwater to stream flow was approximated using a base flow time pattern for select model nodes as well as the RTK model for faster interflow response (See Section 3.1.2.3), so explicitly modeling groundwater was not necessary.
- Water quality: water quality was modeled by assigning wet weather and dry weather flow bacteria concentration to the modeled flows. These concentrations were calculated based on the results from the dry and wet weather monitoring program. Explicitly modeling pollutant loads through build-up/wash-off functions was therefore not necessary.

Site-specific watershed data were used to define key inputs and to represent the local relationship between precipitation, runoff, and in-stream flow conditions. These data include area, slope, percent impervious, soil type (infiltration), depression storage, base flow, and Manning's roughness coefficient. General watershed model characteristics for each watershed and the source of information are provided in Table 3-1, and are further explained in the subsections following the table. The modeled hydraulic and runoff response was further refined through the calibration process.

Table 3-1: Watershed Model Characteristics

	Chester Creek	Ridley Creek	Data Source
Annual Precipitation (in)	41.6	41.6	NOAA NCDC (Philadelphia International Airport)[2]
Drainage Area (sq. miles)	65.6	38.2	USGS Streamstats[3]
Imperviousness (%)	13.2	8.5	USGS Streamstats[2]
Average Overland Slope (%)	7.5	7.5	USGS Streamstats[2]
Top Three Land Uses (%)	Residential (45%)	Residential (44%)	Delaware Valley Regional Planning Commission[4]
	Wooded (24%)	Wooded (29%)	
	Agriculture (7%)	Agriculture (13%)	
Dominant Hydrologic Soil Group	HSG B	HSG B	USDA NRCS SSURGO 2016[5]
Average Watershed Yield (MG/mi^2)	10.4	9.2	USGS Gage Data[6]

[2] https://www.ncdc.noaa.gov/cdo-web/
[3] https://streamstats.usgs.gov/ss/
[4] https://www.dvrpc.org/Mapping/Data/
[5] https://websoilsurvey.nrcs.usda.gov/
[6] https://waterdata.usgs.gov

3.1.2.1 Subwatershed Delineations

The watershed model consists of a set of subcatchments representing the drainage area of the Chester Creek and Ridley Creek watershed. For modeling purposes, each tributary's watershed was subdivided into smaller subwatersheds using the hydrologic unit code (HUC) delineations developed by the USGS[7] as the initial basis for the delineation. These HUC 10 subwatersheds were then divided into smaller subcatchments through interpretation of a digital elevation model (DEM) in ArcGIS, and consideration of tributary confluences, flow metering stations, water quality monitoring stations, road planimetric data, and the delineation of the Chester City separate sewer area as well as the combined sewer area. The separate sewer area and combined sewer area were previously delineated by the City of Chester and Greeley & Hansen respectively. Overall, the drainage areas downstream of the USGS gages were divided into smaller subcatchments compared to the upstream areas because more information was available to facilitate the delineations at the subcatchment level. Additionally, the majority of drainage area downstream of the USGS gages also coincides with the focus area of the modeling. The delineation of the two watersheds are shown in Figure 3-1.

3.1.2.2 Meteorology

SWMM requires two meteorological inputs: a precipitation time series to generate runoff, and temperature data to calculate evaporation. Several meteorological stations are located in or near the Ridley and Chester Creek Watershed, as shown in Figure 3-2.

Complete time series for precipitation (hourly and daily), daily minimum and maximum temperatures were available at Philadelphia International Airport from 1948 through current conditions, including the watershed calibration time period of 2006 through 2016. All meteorological data at this station was obtained from NCDC, which is operated by the National Oceanic and Atmospheric Administration (NOAA). The other stations either have incomplete data sets, recordings that do not overlap with the complete calibration period, or the recorded time steps are too coarse (larger time step than hourly). These stations are therefore not suitable for the watershed hydrology calibration.

[7] https://water.usgs.gov/GIS/huc.html

Figure 3-1: Extent of Watershed Model

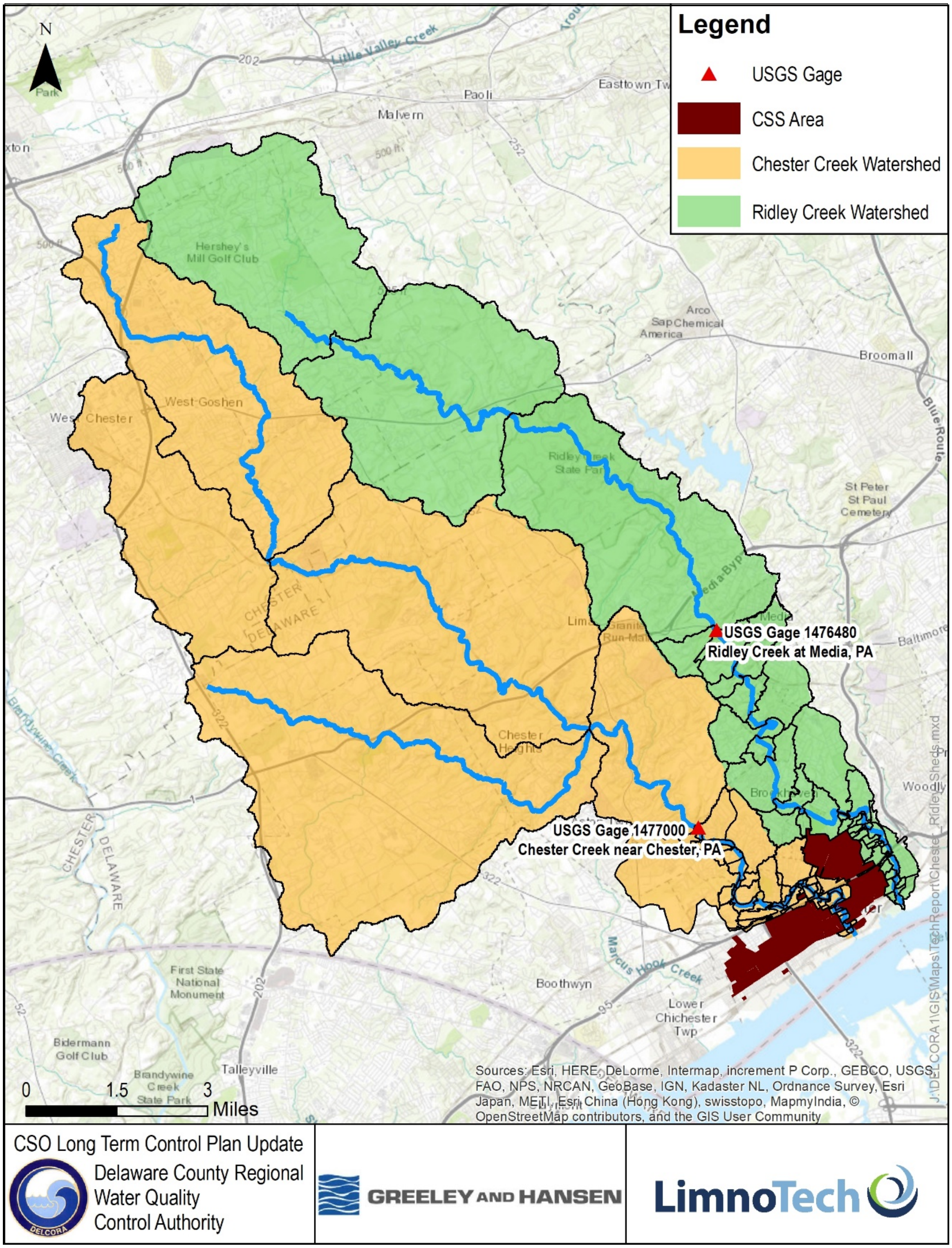
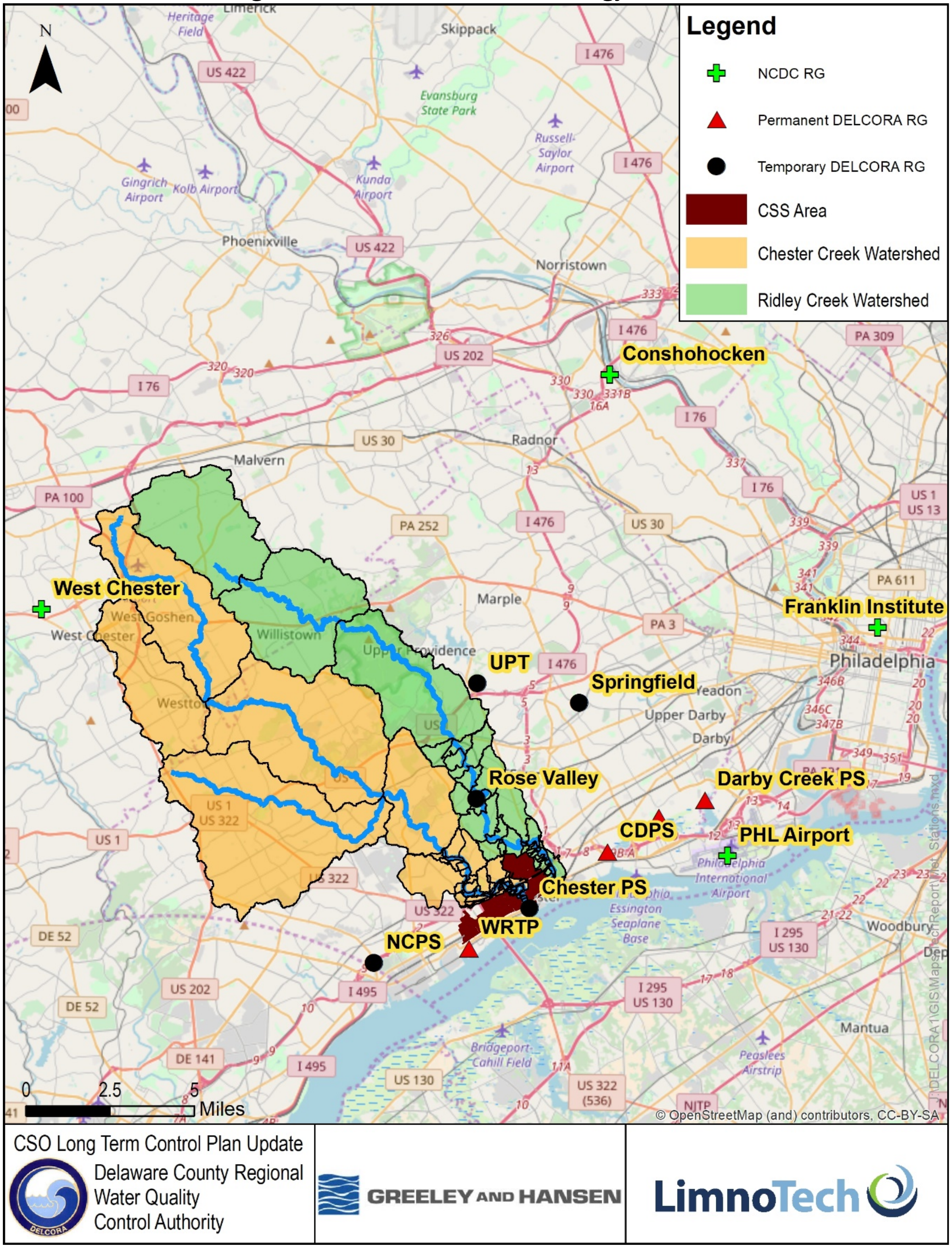
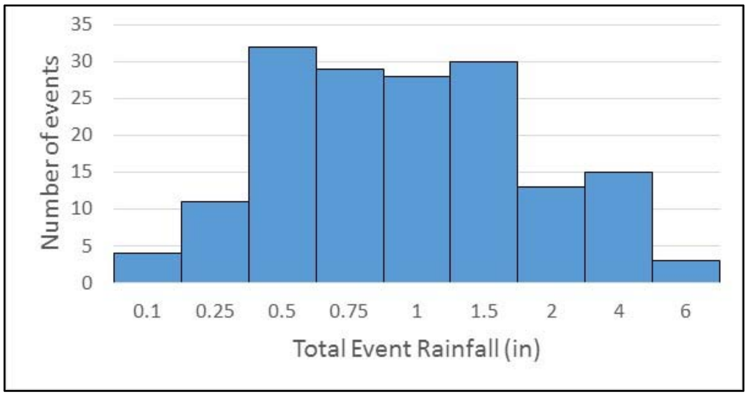


Figure 3-2: Location of Meteorology Stations



The availability of only one gage for the watershed calibration means that the model may be less accurate for rainfall patterns that vary across the watershed. In order to minimize the effect of this spatial variability on the calibration, a set of 165 rainfall events were chosen from the 10-year calibration period when there was consistency between the total rainfall depth at Philadelphia International Airport and the observed flow runoff depth at the Ridley and Chester Creek USGS gages. Two criteria were used to evaluate "consistency" between observed precipitation and flow: (1) precipitation events must increase baseflow by at least 3 times, and (2) the observed flow response occurs within 4 hours of the precipitation event. The selected rainfall events vary in intensity, duration, and overall rainfall depth, as shown in Figure 3-3 below.

Figure 3-3: Watershed Calibration Events: Rainfall Depths



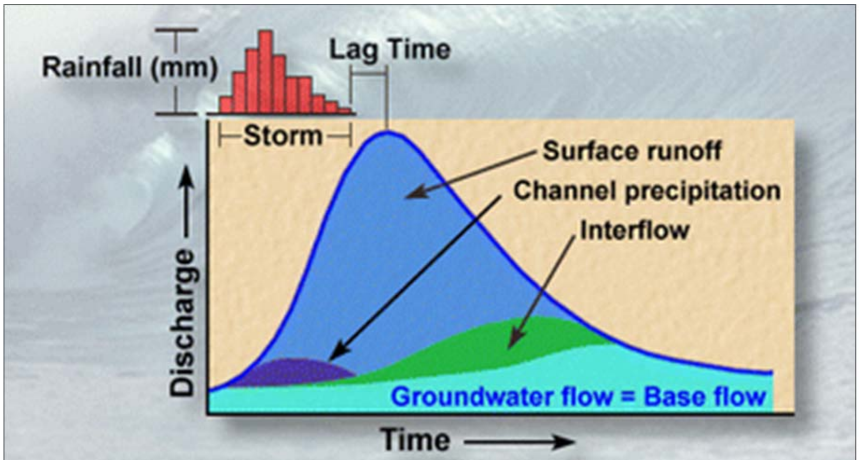
3.1.2.3 Hydrology

The total observed stream discharge relative to a rain event can be separated into different categories of flow, including:

- Channel precipitation: This is flow from rain that falls directly on streams. It represents a very small portion of the total stream flow, but produces an almost instantaneous increase in flow relative to the beginning of a rain event.
- Direct surface runoff: This represents the portion of rain that lands on the ground surface and becomes stormwater runoff. This flow builds up quickly (i.e.: short lag time) relative to the beginning of a rain event, especially in urban areas. Direct runoff can enter streams through overland flow (flow moving over the top of the ground surface) or through a sewer pipe conveyance system.
- Interflow: This is the flow from the portion of rain that infiltrates into the ground and moves laterally through the shallow unsaturated soils towards streams. This flow has a more delayed response compared to surface runoff.
- Groundwater or base flow: This is flow entering the creek from the groundwater table. This flow has a much slower response time to rainfall compared to direct surface runoff and interflow.

A generalized streamflow response to a rainfall event is shown in Figure 3-4 below.

Figure 3-4: Generic Streamflow Hydrograph



(Source: www.aquatic.uoguelph.ca/rivers/chphys.htm)

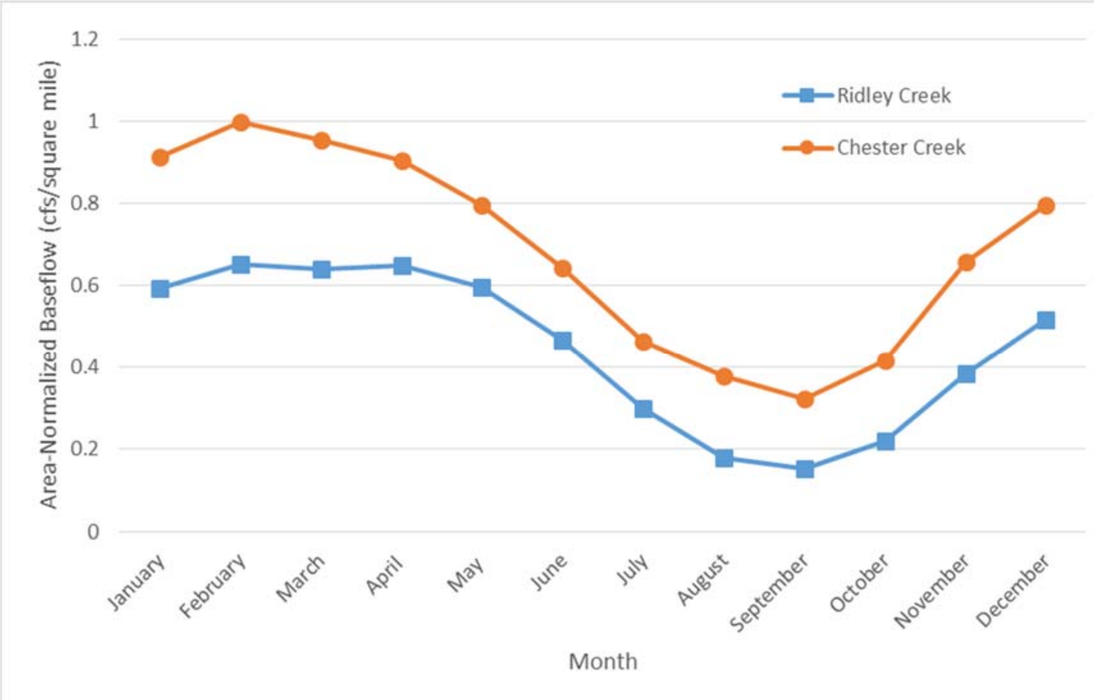
The watershed model simulates the direct surface runoff via the SWMM runoff block using a nonlinear reservoir method. Parameters that influence the surface runoff are explained in the subsections below.

Initial model results and comparisons with observed stream flows at the USGS gages indicated a significant interflow response during wet weather. Interflow was therefore simulated using the RTK approach in the SWMM model since sufficient data for explicit groundwater modeling within SWMM was not available. RTK is an application of the synthetic unit hydrograph method and is based on fitting up to three triangular unit hydrographs to an observed hydrograph to estimate the fast, medium, and slow stream responses (EPA 2008; Lai, 2017).

Surface Runoff and Channel precipitation are represented by one of the three RTK hydrographs that is generally used to represent inflow to sewers. Interflow is represented by the RTK hydrograph that is used to represent short term infiltration. Base flow is represented by the RTK hydrograph that is used to estimate groundwater flow.

Base flow comprises the majority of stream flow during extended periods of dry weather, and can be estimated from measured flow data time series. The flow records from the two USGS gages at Ridley and Chester Creek were used to approximate base flow within each creek. Using 10 years of flow data, monthly 7Q10 flows were calculated using methods from Risley et al (2008). The 7Q10 flows represent flows in a stream during dry periods and can be estimated on a monthly basis to capture the seasonal variability in these dry flows. These values were then normalized to watershed area (in mi^2) and applied to subcatchments that contribute to the streams and creeks that are included in the watershed model (Figure 3-5). Base flow was added to the watershed model as a constant inflow with monthly variations based on the area of the contributing subwatershed.

Figure 3-5: Area-Normalized Base Flow Values for Ridley and Chester Creek



3.1.2.4 Soil infiltration

SWMM offers several methods for soil infiltration (listed in order of increasing complexity): Curve Number, Horton's, and Green-Ampt. The curve number methodology is a fairly coarse representation of soil infiltration and does not allow for time-and-rain variable soil infiltration variations. The Green-Ampt method requires very site-specific knowledge to characterize infiltration parameters, which were not readily available for this project. Therefore, the Horton method was selected as most appropriate for the watershed model. Horton's method uses a set of parameters that defines the maximum infiltration rate, the minimum infiltration rate, the decay rate for transitioning from maximum to minimum infiltration rates, a recovery rate for transitioning from minimum to maximum infiltration rates, and an overall maximum infiltration volume. These parameters are determined based on the hydrologic soil groups that are present in the watershed model extent.

The hydrologic properties of soils influence how quickly and how much precipitation is converted to runoff. In general, soils can be classified by hydrologic soil group (HSG). There are four basic HSGs, called HSG A, HSG B, HSG C, and HSG D. Soils in group A have the lowest runoff potential, while soils in group D have the greatest runoff potential (Mockus et al., 2004). These four basic classifications can then be broken down into dual classifications such as A/D or B/D. Dual classifications represent soils that are classified as group D because of a high water table, causing them to have a high runoff potential. However, if the water table were lowered, these soils would have a lower runoff potential (such as group A or B).

To characterize the soils within the model extent, data were downloaded from the 2016 Soil Survey Geographic (SSURGO) database provided by the National Resources Conservation Service (NRCS). A wide range of HSGs are represented within the SWMM model extent (Table 3-2). In addition to the four standard categories (HSG A through D), several dual classifications are also represented. These dual classifications were assumed to be undrained, and were therefore assigned the same soil properties as HSG D. Any soil types with no official hydrologic soil group classification were also assumed to be mainly poorly drained and would have a high potential for runoff. Therefore, they were assigned the same soil properties as HSG D.

The soil infiltration parameters associated with each HSG were estimated from tables provided in the *User's Guide to SWMM 5* (James et al., 2010). An average minimum and average maximum value from the suggested range was used for the infiltration rate. In the absence of detailed soil data, the decay constant and drying time were assumed to be the same for all soil types within the model extent, and a maximum infiltration volume was not specified.

Table 3-2: Description of Hydrologic Soil Groups within Watershed Model Extent

Hydrologic Soil Group	Description	Ridley Creek		Chester Creek	
		Area (acres)	% of Total	Area (acres)	% of Total
A	Soils with low runoff potential	7.3	19%	7.0	11%
A/D	Soils with high runoff potential unless drained. Otherwise classified as HSG A.	0.0	0%	0.0	0%
B	Soils with moderately low runoff potential	12.6	33%	27.8	42%
B/D	Soils with high runoff potential unless drained. Otherwise classified as HSG B.	2.0	5%	4.1	6%
C	Soils with moderately high runoff potential	12.0	32%	18.8	29%
C/D	Soils with high runoff potential unless drained. Otherwise classified as HSG C.	3.2	8%	6.8	10%
D	Soils with high runoff potential	1.1	3%	1.1	2%
	TOTAL	38.2	100.0%	65.6	100.0%

3.1.2.5 Impervious Area and Slope

Percent impervious area and percent slope strongly influence the amount of precipitation that runs off to the streams. Large amounts of impervious area and/or high slopes can lead to high-volume and "flashy" runoff. To estimate median percent impervious area for each subcatchment, a high-resolution land cover raster was downloaded from the Chesapeake Conservancy[8]. Percent slope for each subcatchment was estimated using the National Elevation Dataset (NED) (Gesch et al., 2002). The average percent imperviousness for Chester and Ridley creek are 10% and 8.5% respectively.

3.1.2.6 Other Subcatchment Parameters

In addition to the major subcatchment parameters listed in the sections above, there are five additional parameters that were characterized for each subcatchment: Manning's n coefficient for overland flow over pervious and impervious areas, depression storage for pervious and impervious areas, and percent of impervious area with zero depression storage (Table 3-3). These parameters can be used to adjust the shape and the timing of the hydrograph. For simplicity, these parameters were set to constant values for all subcatchments. The values were selected based on literature values from the SWMM5 manual (James et al., 2010).

Table 3-3: Additional SWMM Subcatchment Parameters

Parameter	Value	Description	Source
Manning's n for overland flow over impervious area	0.018	Average value	Mc Cuen et al. (1996)
Manning's n for overland flow over pervious area	0.25	Dense grass	Mc Cuen et al. (1996)
Depression storage for impervious area	0.075	Average value for impervious surfaces	ASCE (1992)
Depression storage for pervious areas	0.15	Average value for lawns	ASCE (1992)
Percent of impervious area with no depression storage	25%	Default value in SWMM	-

3.1.2.7 Hydraulics and Routing

SWMM offers three methods for routing water through the stream network (listed in order of increasing complexity): steady flow, kinematic wave, and dynamic wave. Dynamic wave was selected for the routing portion of the model. The dynamic wave model can account for channel storage, backwater, entrance/exit losses, flow reversal, and pressurized flow. The dynamic wave model allows for more complex flow conditions than the other routing methods, but requires the use of smaller computational time steps, so choosing this method generally increases the model run times. This method was selected because it has the potential to produce more accurate results.

[8] https://chesapeakeconservancy.org/conservation-innovation-center/high-resolution-data/land-cover-data-project/.

3.1.2.8 Stream Network

The stream network that makes up Chester and Ridley Creek upstream of Chester City were developed using two sources. Hydrography data were acquired from the National Hydrography Dataset (NHD Plus), which is developed by USEPA Office of Water and the US Geological Survey (USGS)[9]. This dataset includes nationwide spatial information about a variety of waterbodies, including streams, rivers, lakes, and ponds. NHD Plus was modified using a digital elevation model developed from LiDAR mass points. Modifications of the NHD Plus flow lines were made to align with the lowest nearby digital elevation model (DEM) elevation and with aerial photographs. No bathymetric data was available for the stream network upstream of Chester City, so the channels were assumed to be trapezoidal channels with a connected floodplain. The geometry of the channels were first estimated using the available DEM data, and then modified during the hydrology calibration process. In the tidal regions of the two Creeks, bathymetric data was collected through a field survey and was used to specify the channel geometry in the receiving water model. The bathymetric field survey of Chester and Ridley Creek was conducted in March of 2017, and the results are described in Appendix A.

3.1.2.9 Water Quality

To estimate tributary water quality concentrations, modeled tributary flows were separated into base flow and runoff components. Event mean concentrations for each component were then estimated based on sampling data (see Section 4.1), then later refined during the water quality model calibration process, which is described in Section 4.2. These event mean concentrations were then associated with each flow component (i.e. runoff and base flow) to estimate POC loads in the tributaries. This method allowed for time-variable POC concentrations that are consistent with the timing of the wet weather flow response.

3.1.2.10 Linkage to the EFDC Water Quality Model

The hydrograph time series (TS) produced by the watershed model were tied into the EFDC at the most appropriate geographic location. These linkages are shown in Figure 3-6.

3.2 DELCORA Combined Sewer System Model Development

The DELCORA combined sewer system (CSS) hydrologic and hydraulic (H&H) model used for this study was developed by Greeley and Hansen (GH) to support the DELCORA Long Term Control Plan Update (LTCPU). This model has been documented in detail in the Sewer System Hydrologic and Hydraulic Model Report (DELCORA, 2017).

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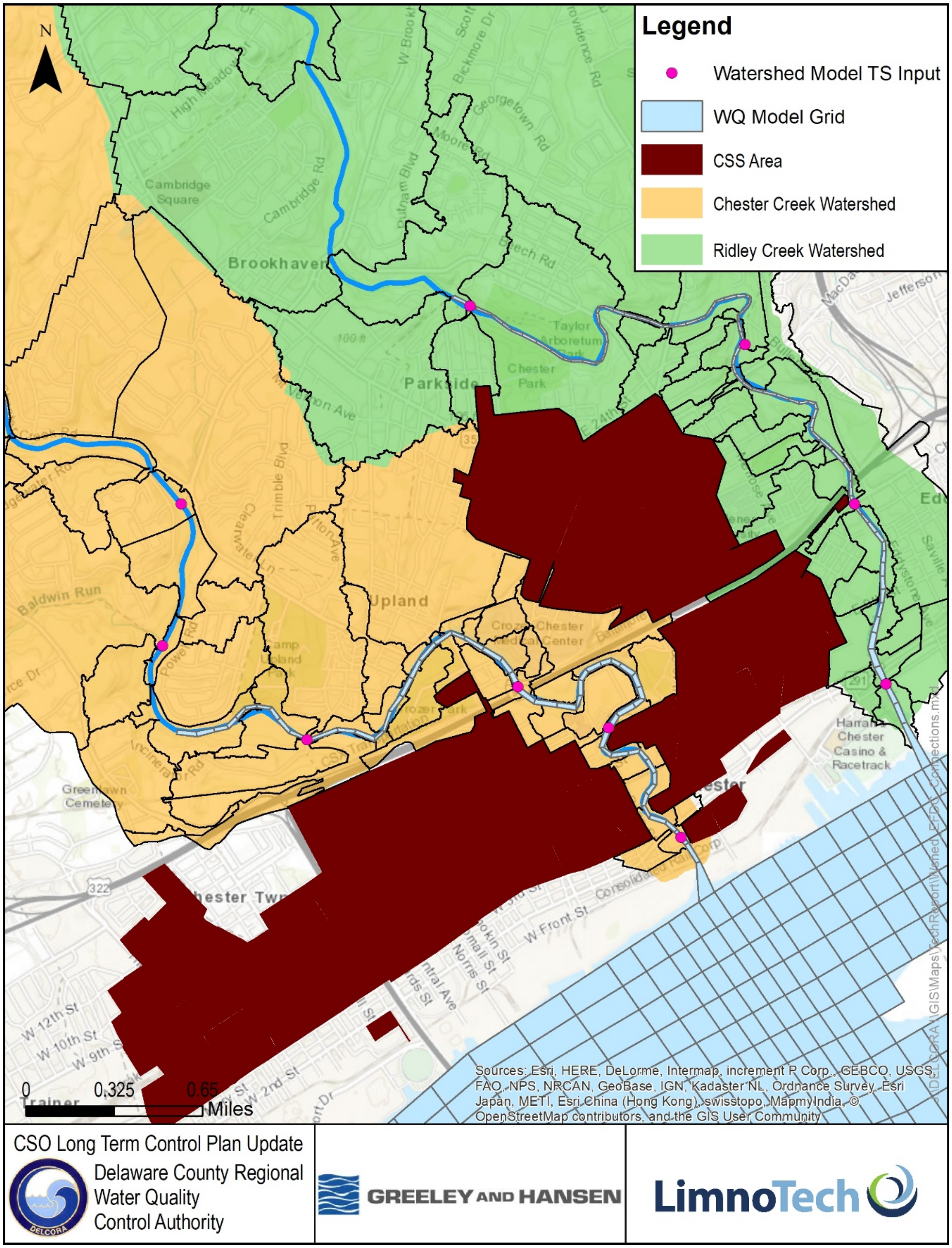
[9] https://nhd.usgs.gov/

Figure 3-6: Watershed-Receiving Water Model Connections



3.3 Philadelphia Simplified CSO Model

3.3.1 Purpose and Description

The Philadelphia CSO system is a complex sewer system network managed by the Philadelphia Water Department. It has CSO outfalls located along the Western shore of the Delaware River, the Schuylkill River, Frankford Creek, Pennypack Creek, Tacony Creek, and Cobbs Creek. The bacteria loads from these outfalls contribute to the overall bacteria concentrations in the Delaware River upstream of the DELCORA project area. The Philadelphia CSO model developed for the purpose of this project is a simplified model that approximates the storage volume within the CSO network and magnitude and frequency of Philadelphia CSO discharges and associated POC loads, thereby accounting for Philadelphia CSO POC water quality impacts on the downstream DELCORA service area.

3.3.2 Model Processes

Due to the limited amount of publically available information related to the Philadelphia sewer network, and no publically available calibration data such as metered flows, the Philadelphia CSO model constructed for the purposes of this project is a simplified hydrologic model. It does not explicitly represent the hydraulics of the Philadelphia combined sewer network but rather uses hydrologic functions and parameters available in the SWMM software to approximate the storage volume and flow characteristics within the CSO sewer network, thereby simulating the magnitude (volume) and frequency (timing) of Philadelphia CSO discharges.

Development and calibration of this model relied principally on information from the 2015 and 2016 annual reports of Philadelphia CSO model overflows (PWD, 2015-2016). A summary of information available from these this reports are is shown in Table 3-4. Data from the 2015 annual report was then used to verify the developed model.

Table 3-4: Information Available from the 2016 Philadelphia CSO Model Annual Reports

Receiving Stream	Number of Outfalls (#)	Total Annual Overflow Events (#)	Total Annual Overflow Duration (hours)	Total Annual Overflow Volume (MG)
Cobbs Creek	34	21	46	667
Delaware River	54	33	135	5,025
Frankford Creek	16	39	111	1,000
Pennypack Creek	5	30	165	617
Schuylkill River	41	42	117	2,811
Tacony Creek	15	42	122	2,314

The information presented in the reports helped to constrain model inputs related to the CSS sewersheds, including the total subwatershed area, depression storage, average surface slope, and subwatershed width and length. These parameters were defined for each combined sewer outfall.

Section 4.3 describes how these model inputs were calibrated so that the model accurately computes the volume and frequency of Philadelphia CSOs.

3.4 Receiving Water Model Development

3.4.1 Purpose and Description

The receiving water quality model simulates POC concentrations in the tidal reaches of Chester and Ridley Creeks, as well as in the Delaware River near the DELCORA service area. These modeled POC concentrations will be compared to water quality standards to assess the influence of DELCORA CSO loads on present day water quality compliance. CSO control scenarios will then be simulated within the modeling framework to describe the associated improvements to water quality.

3.4.2 Model Processes

To compute POC concentrations in the receiving waters, the receiving water quality model integrates different known flow and POC contributions, the subsequent transport and mixing of these sources, and the decay of the POCs. Key features represented in the model include upstream Delaware River flows; tributary dry and wet weather flows, tidal conditions, and POC loads from the tributaries, the DELCORA CSOs, and the Philadelphia CSOs. The processes that were modeled and the relevant data that were collected and analyzed for setting up the receiving water quality model are further described below.

Figure 3-7 and Figure 3-8 illustrate the elements related to the development and calibration of the receiving water quality model. These are also further explained in the following subsections.

Figure 3-7: Water Quality Model Extent and Related Features

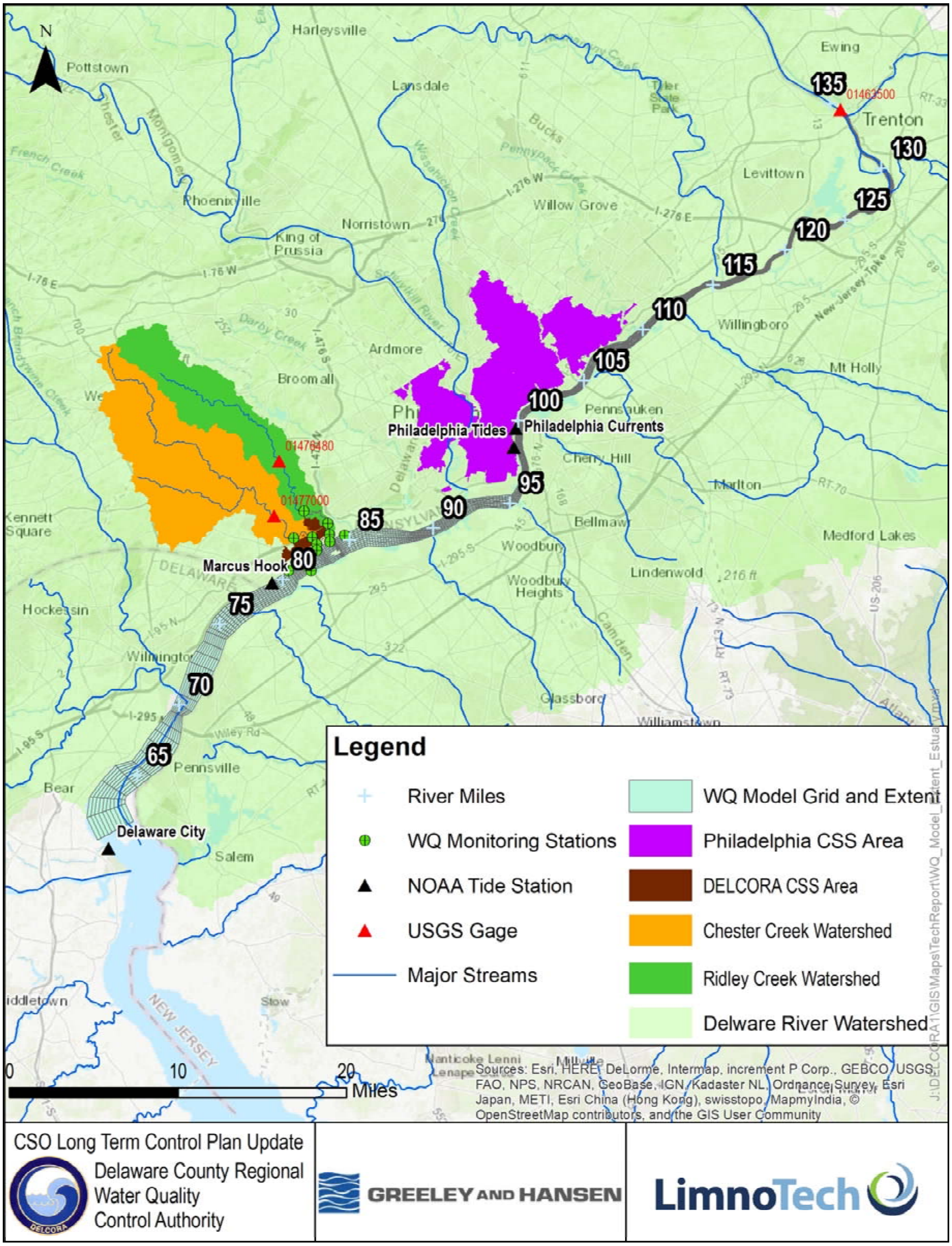
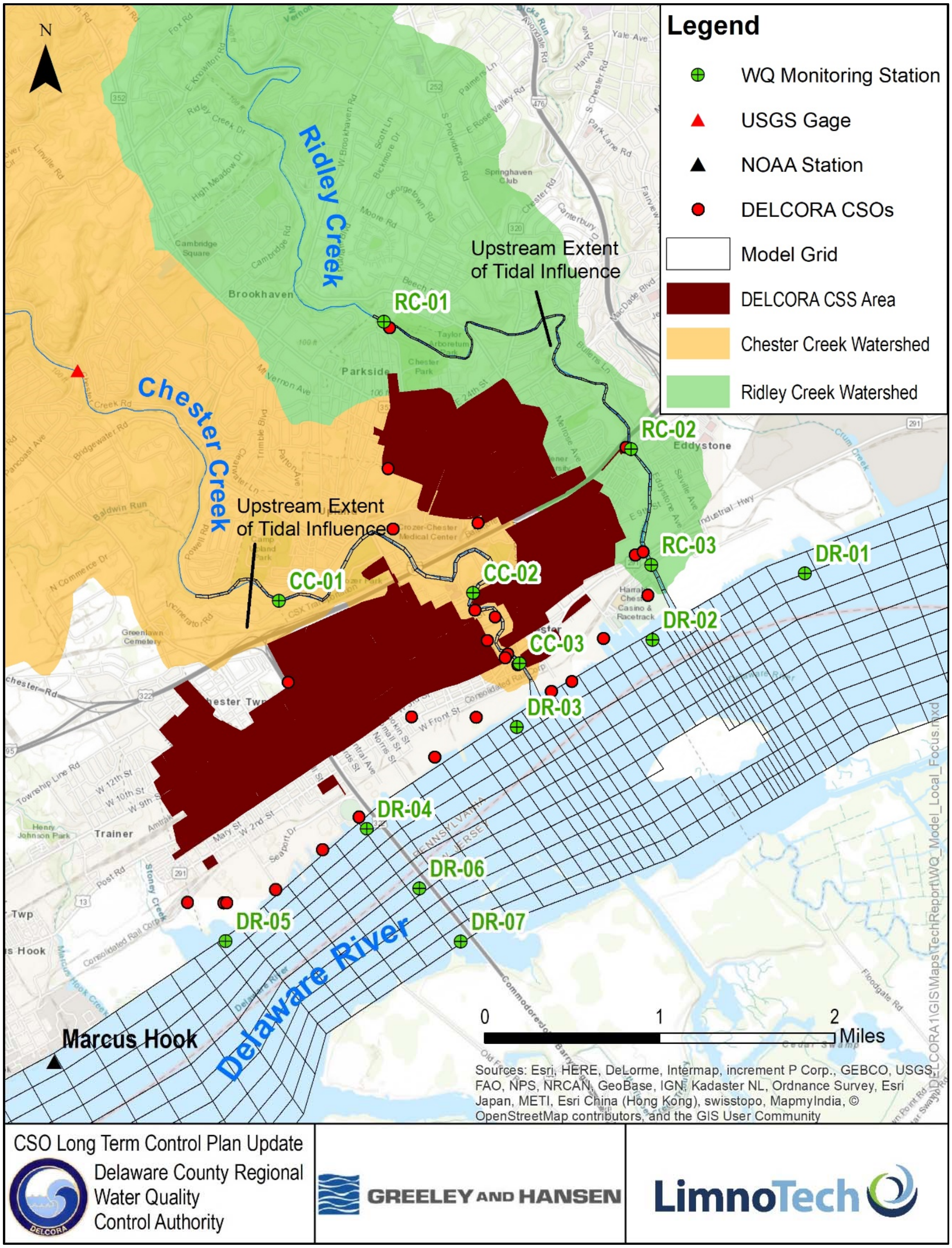


Figure 3-8: Water Quality Model and Related Features near DELCORA System



3.4.2.1 Model Extent and Grid Development

The intended use of the water quality model is to predict the local water quality near the DELCORA combined sewer outfalls. However, the extent of the model is much greater than this localized area in order to appropriately represent the mixing of DELCORA POC sources with background POC sources, and the back-and-forth tidal movement that occurs in the Delaware River. The DELCORA water quality model extends from the head of tide in Trenton, NJ to Delaware City, DE. The upstream limit was chosen because that is the limit of the tidal influence and because there is a USGS flow gage present. The downstream limit was chosen because it is well below the DELCORA CSO discharges and because there is a NOAA tidal station present. Both the USGS flow gage and the NOAA tidal station are used as boundary conditions to the model, as further described in Section 3.4.2.1.

The stream lengths that are represented in the model, along with the average grid cell dimensions are shown in Table 3-5. The model grid has the greatest detail near DELCORA CSOs to describe near-field concentration patterns during periods of CSO discharge, and less detail farther from DELCORA CSOs. Grid cell dimensions in Chester and Ridley Creeks were chosen to be long enough that they would not overly constrain the model time step and short enough that they would follow the sinuous paths of the creeks.

Table 3-5: EFDC Water Quality Model Grid Summary

	Miles of Stream Represented	Average Grid Cell Dimensions (LxWxD)*	Total Number of Cells Used	Average Number of Cells Across Stream Width	Average Number of Layers Through Stream Depth
Delaware River	73	1,000ft x 300ft x 23ft	3,766	10	4
Chester Creek	3.5	320ft x 90ft x 4ft	55	1	1
Ridley Creek	3.5	230ft x 60ft x 2ft	80	1	1
* Cell dimensions vary greatly across the model extent depending on the physical properties of the river.					

3.4.2.2 Flow and POC Contributions

The EFDC water quality model includes flows and POC loads from a variety of sources, including:

- DELCORA CSOs, represented by the DELCORA H&H model and entered as flow and bacteria concentration time series at each location where DELCORA CSOs discharge into Ridley Creek, Chester Creek, and the Delaware River.
- Philadelphia CSOs, represented by the simplified Philadelphia CSO model, and entered as flow and bacteria concentration time series at the mouth of the tributaries where CSO discharges occur, or directly to the CSO discharge location along the Delaware River.

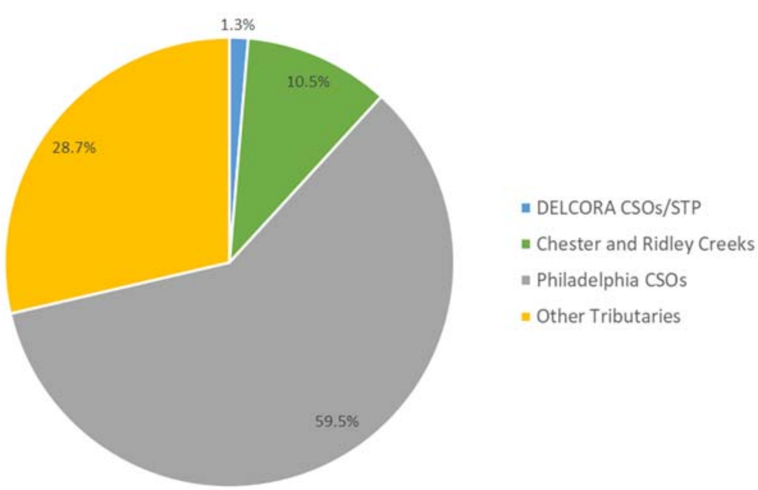
- Ridley and Chester Creek watershed sources, represented by the watershed model or USGS gage data, and entered as flow and bacteria time series at various locations along the two creeks, as explained in Section 3.1.2.9.
- Tributaries along the Delaware River but outside of the DELCORA project area, including, for examples, the Schuylkill River and Darby Creek. These are entered as flow and bacteria time series at the confluence of the tributaries and the Delaware River. The contributions from these tributaries were based on available USGS flow data. Average drainage area ratios were used for the ungaged portions of tributaries, including some tributaries which are entirely ungaged. Bacteria concentrations were estimated as they were for Ridley and Chester Creeks; by separating base flow and runoff and associating EMCs with each flow component, as explained in Section 3.1.2.9.

The respective percent contribution of modeled bacteria load from the different sources are shown in the figure below. The principle loads include the following:

- DELCORA CSO/STP: 1.3% of total load
- Chester and Ridley Creek above the CSO area: 10.5% of total load
- Philadelphia CSO: 59.5% of total load
- Other tributary loads: 28.7% of total load

These modeled bacteria loads were calculated by summing up the total flow contributions from each of the four major sources during both wet and dry weather conditions for the 3-year "Typical Year" application period. These volumes were multiplied by the respective EMC values to calculate the 3-year modeled load and relative percent contribution from each source. It should be noted that the relative contribution from the "Other Tributaries" source is the least constrained by actual monitoring data and is likely much higher in reality than what is shown in the figure. This load has little impact on the water quality and the calibration results near the DELCORA focus area.

Figure 3-9: Percent of Bacteria Load by Source



3.4.2.3 Hydrodynamic Processes

To quantify rates of transport and mixing, the receiving water model represents tidal hydrodynamics in the lower reaches of the creeks and in the Delaware River estuary. The main processes that effect river hydrodynamics include tidal phasing and amplitude, river velocities, flow contributions from tributaries along the Delaware River, and sediment bed resistance (roughness). To simulate the loss of POCs within the receiving water, a first-order, in-stream net decay rate was applied within the model.

Two boundary conditions are used to specify the hydrodynamic and water quality conditions at the upstream and downstream ends of the water quality model. At the upstream end of the model, near Trenton, NJ, flow from USGS gage #01463500 was used to specify the flow coming into the system. At the downstream end of the model, near Delaware City, DE, the Reedy Point NOAA gage #8551910 was used to specify the tidal water surface elevation. Constant bacteria concentrations of 10 #/100 mL were assumed at the upstream and downstream model boundaries, and model tests showed that the boundary conditions had a negligible influence on concentrations near the project area due to the long distances between the boundaries and the project area, and due to bacterial decay. Table 3-6 below summarizes the primary water quality model inputs and supporting data sources.

Table 3-6: Receiving Water Quality Model Inputs and Data Sources

Model Input	Data Source	Notes
Delaware River Bathymetry	NOAA bathymetric soundings	Used most contemporary data available for each reach of the Delaware River
Chester and Ridley Creek Bathymetry	LimnoTech bathymetric soundings	Survey conducted in 2017 (See appendix A)
Tributary Flow Rates	USGS gaged flow data	Used drainage area ratios to estimate flows in ungaged areas
Water Surface Elevations	NOAA 6-minute tidal water level data	Used NOAA gages within the model extent
Water Temperature	USGS daily water temperature data	Delaware River at Chester station (#01477050) Delaware River at Reedy Island Jetty (#1482800)
Meteorological Inputs (e.g. atmospheric pressure)	NOAA hourly meteorological data	Philadelphia International Airport
Upstream Boundary Condition	USGS gaged flow data	Delaware River at Trenton (#01463500)
Downstream Boundary Condition	NOAA 6-minute tidal water level data	Reedy Point station (#8551910)

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Section 4 Model Calibration

Model calibration is described in USEPA guidance (USEPA, 1994) as the "process of adjusting model parameters within physically defensible ranges until the resulting predictions give the best possible fit to the observed data." Model parameters and assumptions were initially defined to the extent possible based on site specific data. However, if site-specific data were not available, model parameters and assumptions were initially defined based on literature values. The calibration process fine-tuned these parameters, within reasonable bounds, to improve model calculations.

4.1 Site Specific Calibration Data

Site specific data used for calibrating the various models include USGS flow data, NOAA tide data, wet and dry weather monitoring within the DELCORA project area, and Delaware River Basin Commission (DRBC) monitoring data. These datasets are explained in further detail in the sections below. Water quality data was organized in a Microsoft (MS) Access database system to ensure consistency in naming and unit conventions, and for ease of extracting information for calibration purposes.

4.1.1 USGS Data

USGS flow data were used to calibrate the watershed model. The information is available through the USGS[10]. Two stations were used for calibration: Ridley Creek gage (#01476480) and Chester Creek gage (#01477000). The time period of 2006 to 2016 was used for watershed calibration, flow data from 2017 was used for the receiving water quality modeling calibration, and the time period of 1994-1996 was used for the typical period application. Availability of gage data during the typical period is variable, with a long period of data missing in Ridley Creek (9/22/1995 through 12/31/1996) and a few multi-day periods missing at both gages during the three year period. A third station at Trenton, NJ (#01463500) was used to specify the upstream boundary condition for the Delaware River portion of the water quality model. The locations of the USGS gages are shown in Figure 3-7.

4.1.2 NOAA Tide Data

Tide data representing tidal phasing (timing), amplitude (variations in water surface elevation), and current velocity (water speed and direction) were used to calibrate the hydrodynamic component of the water quality model. This information is available through NOAA[11]. Two tidal stations were used for calibration: the Philadelphia station (#8545240) and the Marcus Hook (#8540433) station. A third station at Reedy Point (#8551910) was used to specify the downstream boundary condition for the Delaware River portion of the water quality model. NOAA data from

[10] https://waterdata.usgs.gov/nwis
[11] https://tidesandcurrents.noaa.gov/

2017 was used to calibrate the hydrodynamics of the water quality model. The locations of the NOAA gages are shown in Figure 3-7.

4.1.3 DELCORA Wet and Dry Weather Monitoring Program

DELCORA conducted an extensive wet and dry weather monitoring program between March and June of 2017. Water quality data from this monitoring program was used to calibrate the water quality component of the water quality model and to set initial values for the dry weather, stormwater, and CSO POC event mean concentrations (EMCs). Monitoring was undertaken at thirteen (13) in-stream locations (seven on the Delaware River, three on Ridley Creek, and three on Chester Creek), four (4) CSO locations in the DELCORA combined sewer system area, and two (2) stormwater locations in the City of Chester municipal separate storm sewer system, as shown in Figure 3-7 and in more detail in Figure 4-1.

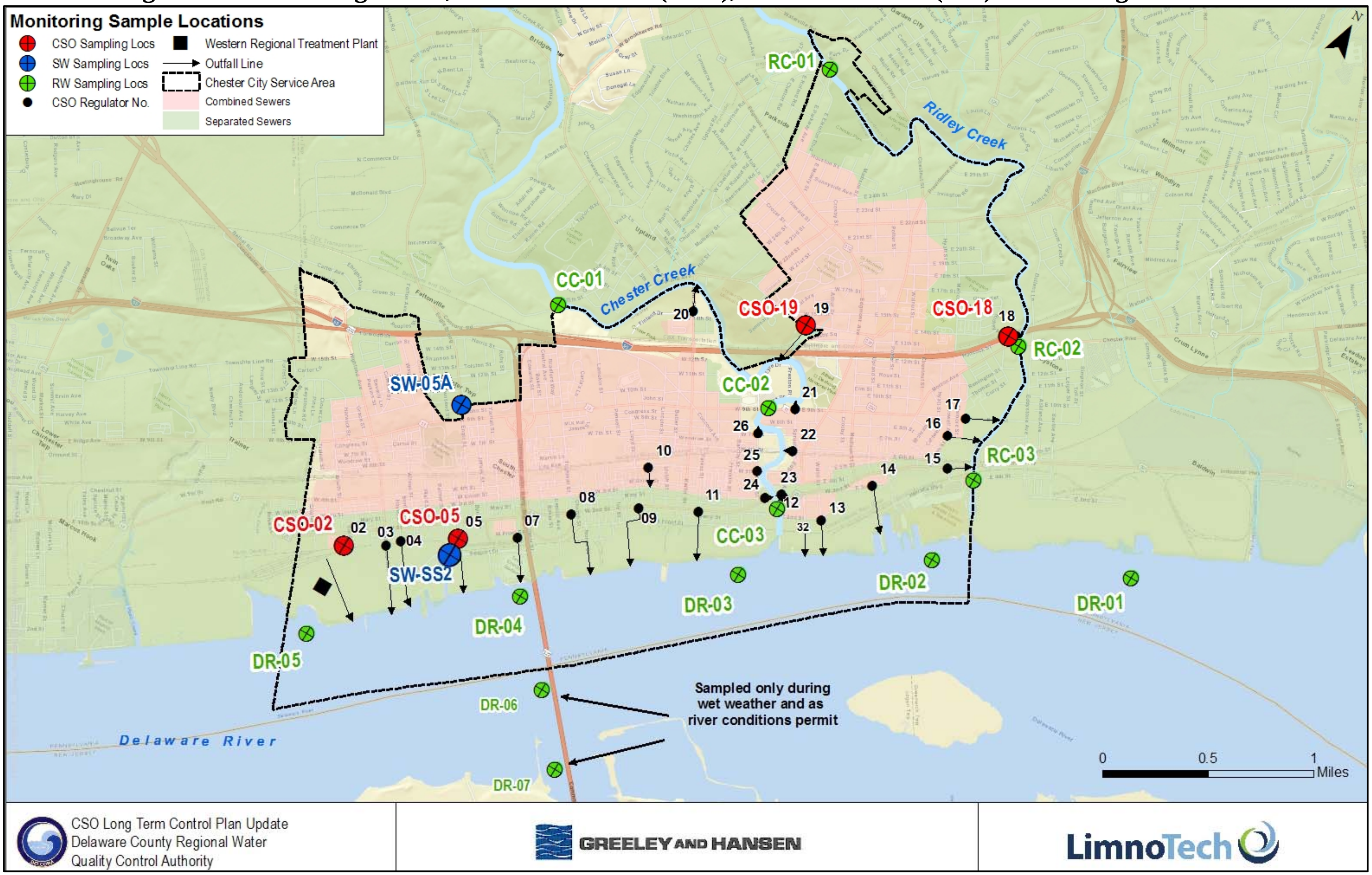
Monitoring locations were selected to characterize the watershed at a sub-watershed level, recognizing various political and hydrologic features, land uses and potential pollutant sources. Site selection and analytical parameters are designed to characterize stormwater outfalls, CSOs, tributaries upstream and within the Chester CSO discharge area, and the main stem of the Delaware River in the project area. The POCs sampled were Fecal coliform, *E.coli*, and *Enterococcus*.

Water quality monitoring and sampling was conducted as follows:

- Eleven (11) in-stream locations in the vicinity of the DELCORA CSO area were sampled for water quality for (3) dry weather events. The mid-stream and far-shore Delaware River locations were not sampled during the dry weather surveys because the water quality in the river is found to be relatively uniform laterally due to the lack of active sources during dry weather. These dry weather events were distributed across the sampling season, which was from March through June of 2017. Grab samples and *in situ* measurements were collected at each location during each event.
- All thirteen (13) in-stream locations were sampled for water quality using grab samples and *in situ* monitoring for three (3) discrete wet weather events.
- Up to four (4) CSO and two (2) stormwater outfall locations were sampled for water quality for the same three (3) discrete wet weather. Samples for all outfalls were collected as grab samples.

The sampling events were planned and distributed across the sampling season, which was from March through June 2017.

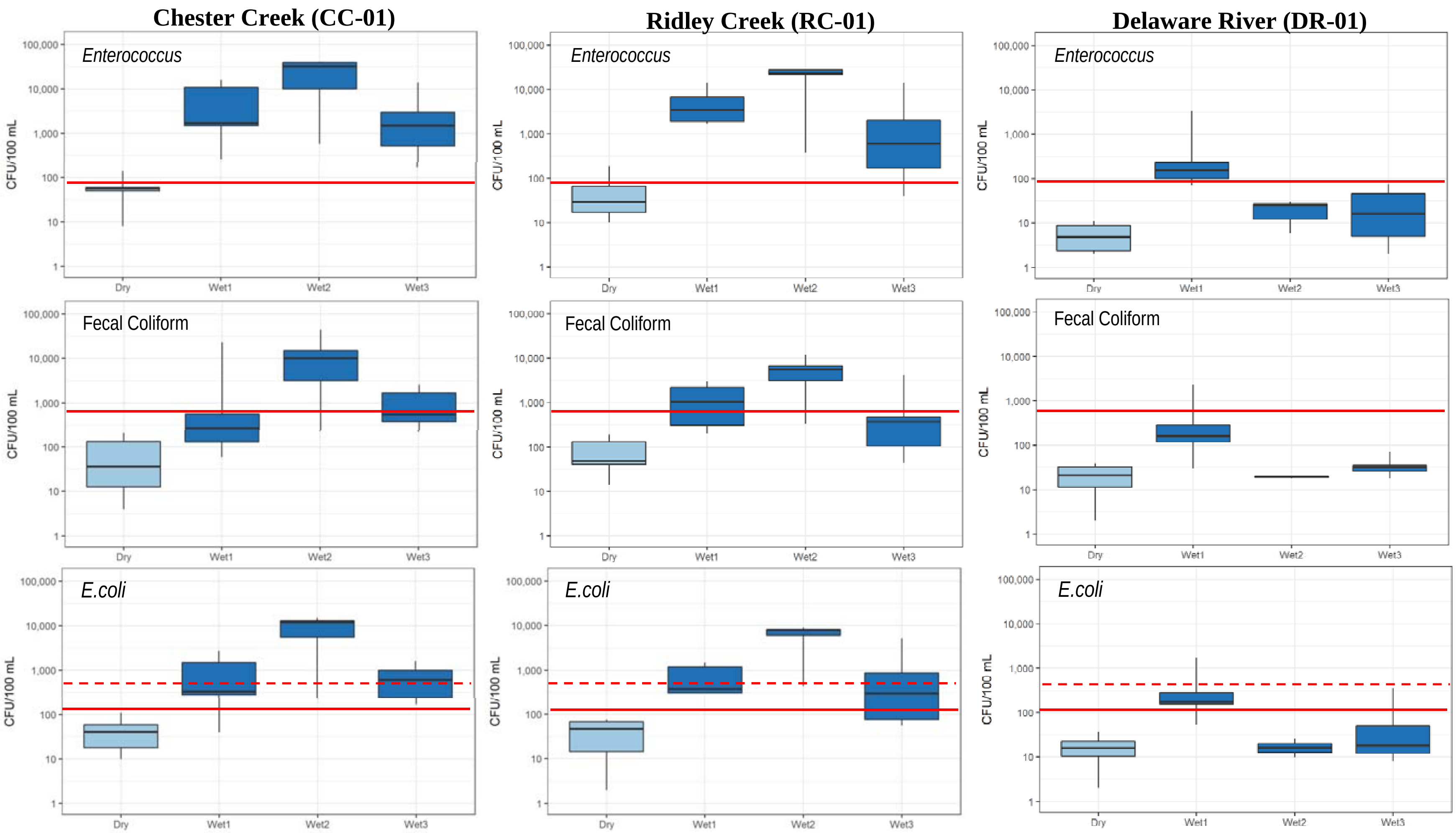
Figure 4-1: Receiving Water, Combined Sewer (CSO), and Stormwater (SW) Monitoring Locations



Detailed information on the results and observations from the DELCORA Water Quality Monitoring Program can be found in Appendix B. Some general observations are summarized below and shown in Figure 4-2.

- Dry weather POC concentrations at the most upstream locations (RC-01, CC-01, DR-01) in the creeks tended to be similar to each other;
- Dry weather concentrations at the most upstream locations (RC-01, CC-01) were mostly, but not always, below numeric thresholds used for water quality standard (WQS) criteria in the tributaries, and were well below WQS numeric thresholds in the Delaware River (DR-01);
- An increase in dry weather POC concentration from upstream to downstream was observed in each of the tributaries, suggesting there may be significant but currently unknown bacteria sources impacting these tributaries during dry weather. This occurs between sampling stations RC-01 and RC-02 in Ridley Creek and between CC-01 and CC-02 in Chester Creek, and is most pronounced for Fecal Coliform and *E.coli*;
- Wet weather concentrations at the most upstream monitoring locations in Chester Creek (CC-01) and Ridley Creek (RC-01) often exceed the monthly geometric mean WQS criteria for the three POCs. These stations are located upstream of the tidal influence, and the exceedances indicate that upstream areas of Ridley and Chester Creeks do not currently meet WQS (Figure 4-2). These data furthermore indicate the practical impossibility of meeting WQS through downstream CSO control.
- Wet weather concentrations at the most upstream monitoring location in the Delaware River sometimes also exceed numeric thresholds used for the monthly geometric mean water quality standard criteria, but less frequently as compared to the creeks. The E.coli statistical threshold value WQS was exceeded once under wet weather conditions during the sampling periods.
- The time series profiles in the Chester Creek and Ridley Creek waterbodies indicate that DELCORA's CSO discharges and Chester's stormwater discharges are not the only sources impacting these tributaries during wet weather. Upstream sources also contribute to high bacteria concentrations during wet weather events.

Figure 4-2: Sampling Results at Most Upstream Sampling Locations in the Creeks and the Delaware River



- - - STV WQS (E.coli: 410 CFU/100ml (proposed); Fecal Coliform and Enterococcus: no STV standard)
—— Monthly Geometric Mean WQS (E.coli: 126#/100ml (proposed); Fecal Coliform: 770#/100ml; Enterococcus: 88#/100ml)

4.1.4 DRBC Monitoring Data

The Delaware River Basin Commission conducts regular monitoring of bacteria through its "Delaware Estuary Boat Run" program[12]. Ambient samples are collected monthly along the navigational channel from the head of tide at Trenton, N.J. to the mouth of the Delaware Bay. Samples are collected at 22 stations, once monthly from April to October. Data collected in 2012 were used to validate the water quality component of the water quality model, especially outside of the DELCORA project area, to evaluate the accuracy of modeled POC loads from the Philadelphia CSOs and the Schuylkill River, which are estimated to be the largest POC loads to the estuary. The locations of the DRBC monitoring locations are shown in Figure 3-7.

4.2 Watershed Model Calibration

The modeled hydraulic and runoff response was refined through the calibration process. In this process, the percent impervious, Manning's roughness, RTK interflow and base flow parameters were adjusted within defensible (literature) ranges so that modeled runoff volumes and peak flows were consistent with the observed flow data. Runoff response was calibrated using 165 wet weather events from 2006 to 2016. The rainfall events were chosen to represent a range of different intensities, duration, and rainfall depth. Moreover, these events were chosen when there was consistency between the total rainfall depth at Philadelphia International Airport and observed flow at the Ridley and Chester Creek USGS gages. Two criteria were used to evaluate "consistency" between observed precipitation and flow: (1) precipitation events must increase baseflow by at least 3 times, and (2) the observed flow response occurs within 4 hours of the precipitation event. Calibrating to this subset of events helps minimize the effect of issues with spatial variability of rainfall.

Calibration was evaluated both on total runoff volume, peak flow rates, and timing of the flow response. Various types of plots were used to help assess the calibration, including 1-to-1 plots, event-based time-series hydrographs, and bar charts. To evaluate the overall reasonableness of the watershed calibration, a weight of evidence approach (USEPA, 2015b; Donigian, 2002) was applied using several evaluation metrics, including:

1. Goodness of fit based on correlation coefficients for a wide range of calibration events;
2. Visual checks on continuous time series hydrograph data; and
3. Long term annual performance.

The performance of the model was first evaluated using 1-to-1 plots for comparisons of wet weather event flow volume and peak flows. This is illustrated in Figure 4-3. Both the correlation coefficient (R^2) and the Integral Square Error (ISE) can be used as measures of goodness-of-fit between observed and modeled hydrographs (Sarma, 1969). Overall, the watershed model performed satisfactorily for the total event volume and for the peak flow rates, as shown in the

[12] http://www.state.nj.us/drbc/quality/datum/boat-run.html#3

table below. The slope of each trend line is nearly 1, indicating that the modeled runoff response is unbiased.

Table 4-1: Watershed Model Performance Metrics

	Ridley Creek		Chester Creek	
	R^2	ISE	R^2	ISE
Total Event Volume	0.778 (Good)	5.6 (Very Good)	0.778 (Good)	4.61 (Very Good)
Peak Flow Rate	0.61 (Fair)	8.84 (Good)	0.605 (Fair)	7.2 (Good)

In addition to 1-to-1 plots, a visual check of flow time series (hydrographs) was conducted for the time period of March through May of 2017, when wet weather water quality sampling was conducted. Figure 4-4 and Figure 4-5 compare the observed and modeled flow hydrographs for Chester and Ridley Creeks respectively. The modeled response to the rainfall at the Philadelphia Airport closely tracks the gaged response observed at the two USGS gages. The timing of the peaks occur as expected relative to the occurrence of the rainfall event and to the observed data, providing confidence that the routing parameters used were adequately calibrated. The hydrograph figures also support the previous conclusion that overall, the model predicts volume well, but slightly over predicts peak flow rates. The hydrographs show that the model tends to under predict the effect of baseflow and interflow, despite using the SWMM RTK function.

The hydrograph figures show that there was a notable discrepancy between the observed data and modeled results for the event labeled as "Wet Weather Event 3". This event and other specific wet weather events like this where the modeled runoff volume differed significantly from the observed runoff volume were reviewed more closely. Based upon this review, it was concluded that notable deviation between modeled and observed runoff volumes can occur when rainfall is not uniform over the watershed (e.g. when rainfall is concentrated in a small portion of the watershed) due to the fact that a single rain gage (Philadelphia Airport) is used in the watershed model to represent rainfall conditions over the entire watershed.

In the case of Wet Weather Event 3, the rainfall was concentrated in the vicinity of the City of Chester and areas east of the Delaware River (Figure 4-6). So while the observed rain at the Philadelphia Airport is significant (0.51 inches), very little rainfall fell in the upstream areas of the Ridley and Chester watersheds (less than 0.1 inches), and consequently, very little wet weather flow was observed at the two USGS flow gages (consistent with what would be expected from a small (<0.1-inch) rainfall event) whereas the model predicted more flow (consistent with what would be expected from a 0.5-inch storm).

While the limited number of rainfall gages is a constraint on the accuracy of the watershed model for a single wet weather event, on a long term basis (such as the three year typical hydrologic period) the model provides reasonably accurate estimates of creek flow, as demonstrated in Figure 4-3 on the previous page. In other words, even if an individual event was modeled too high or too low, on a long term basis, the model produces a typical response to rainfall conditions and yearly modeled creek flows during dry weather and wet weather are consistent with the observed data.

Figure 4-3: 1 to 1 Watershed Model Wet Weather Calibration Plots

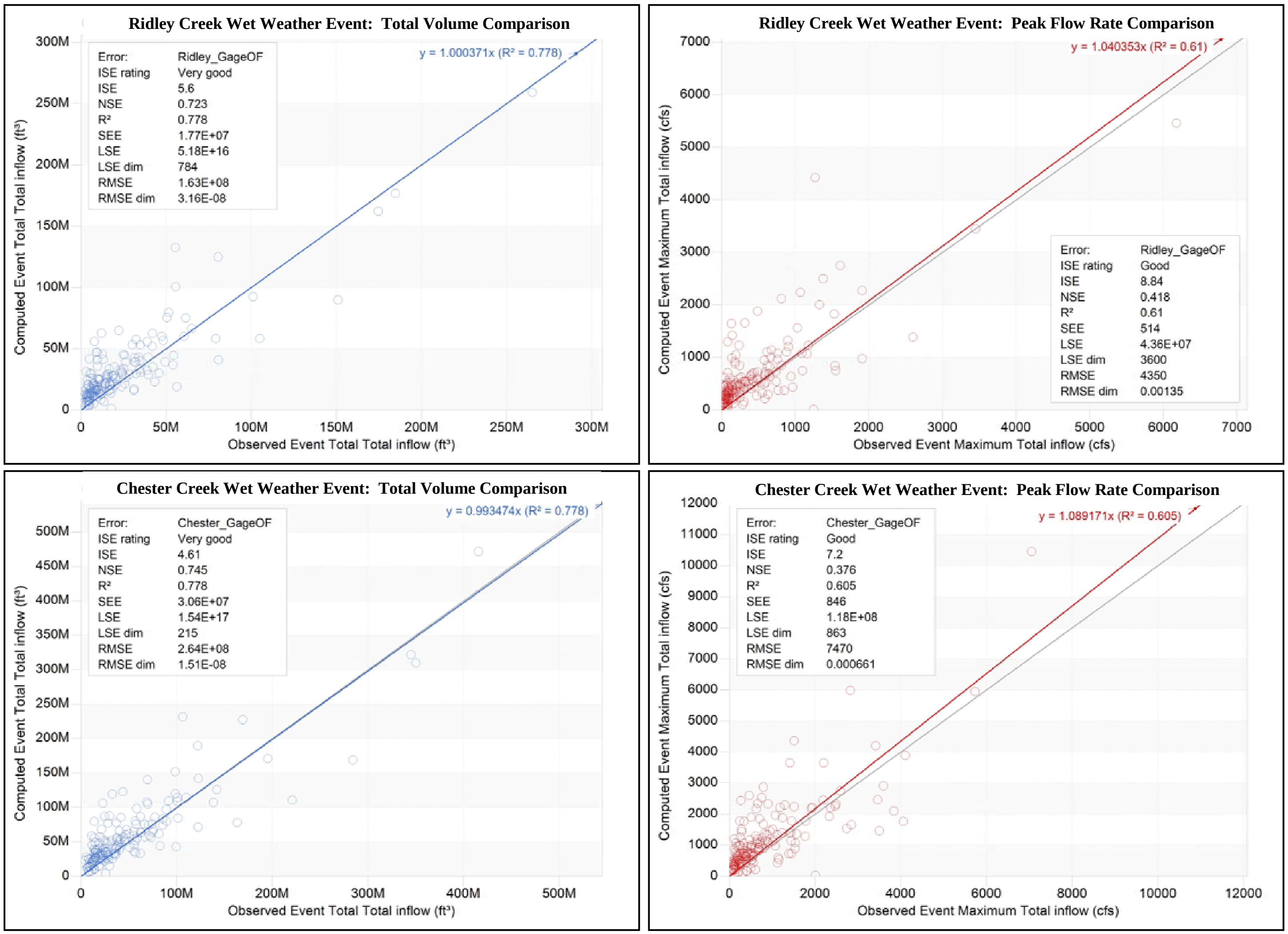


Figure 4-4: Chester Creek - Comparison of Modeled vs. Observed Flow Hydrograph

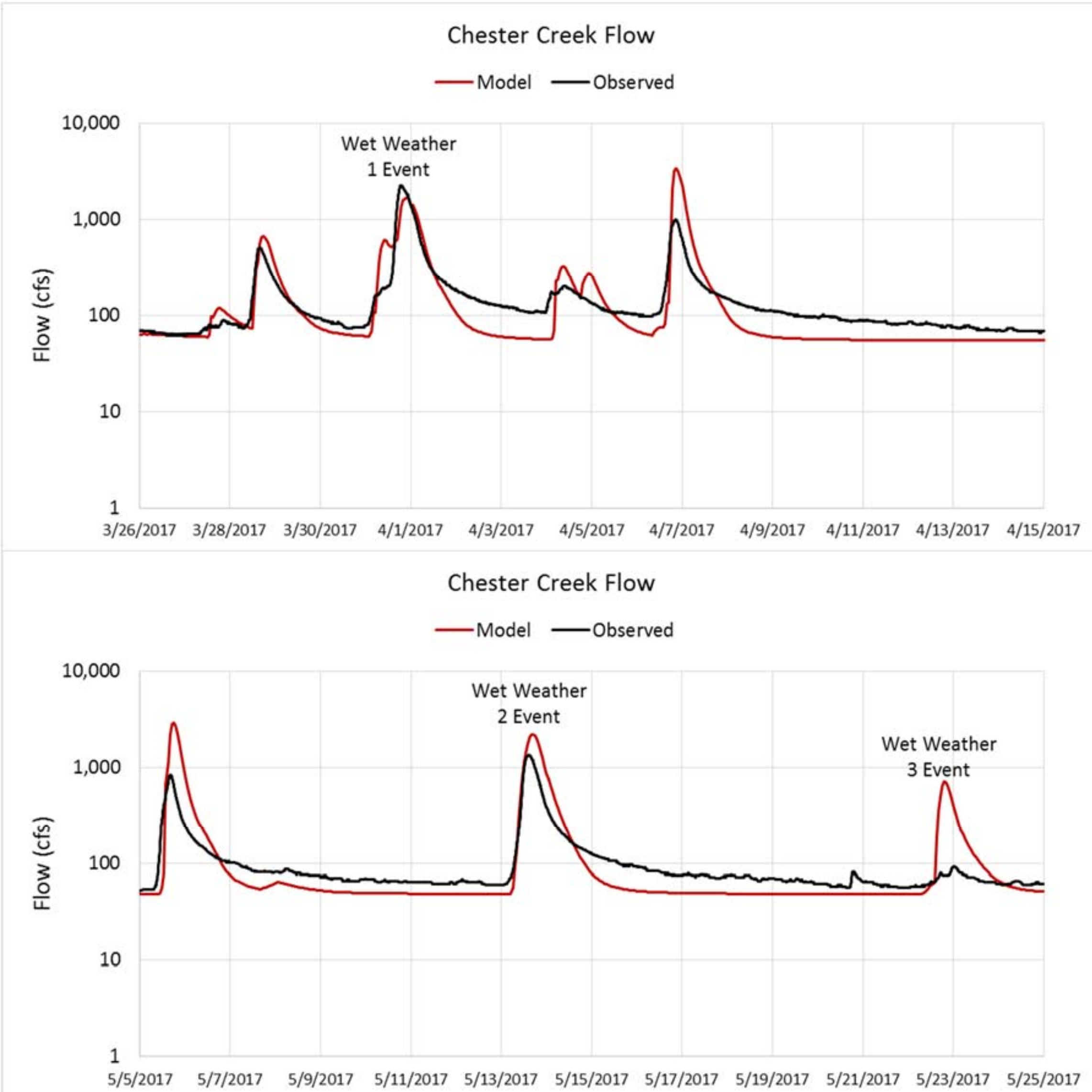
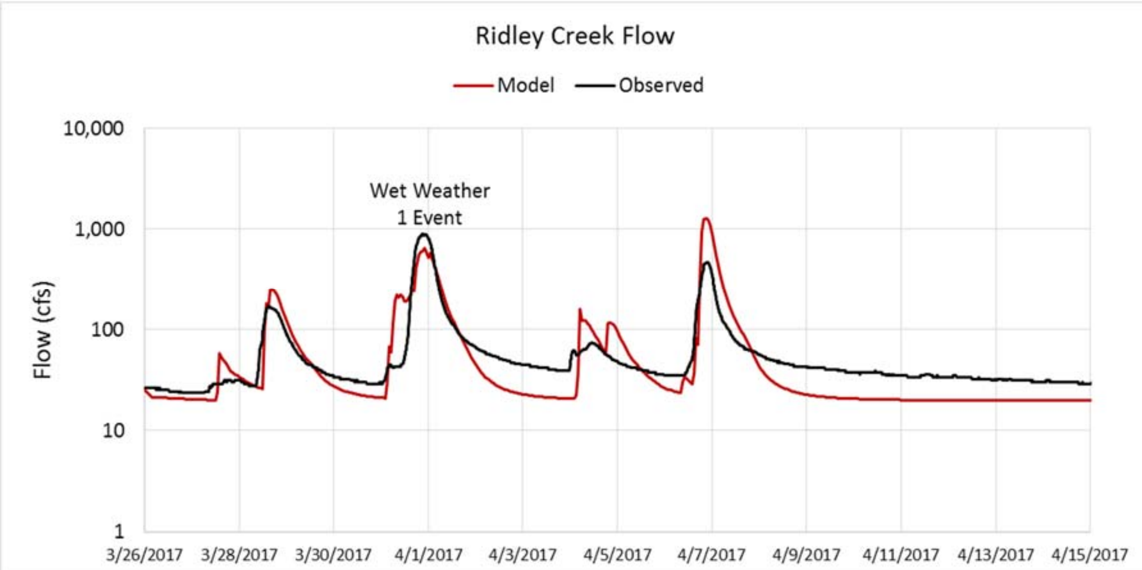


Figure 4-5: Ridley Creek - Comparison of Modeled vs. Observed Flow Hydrograph



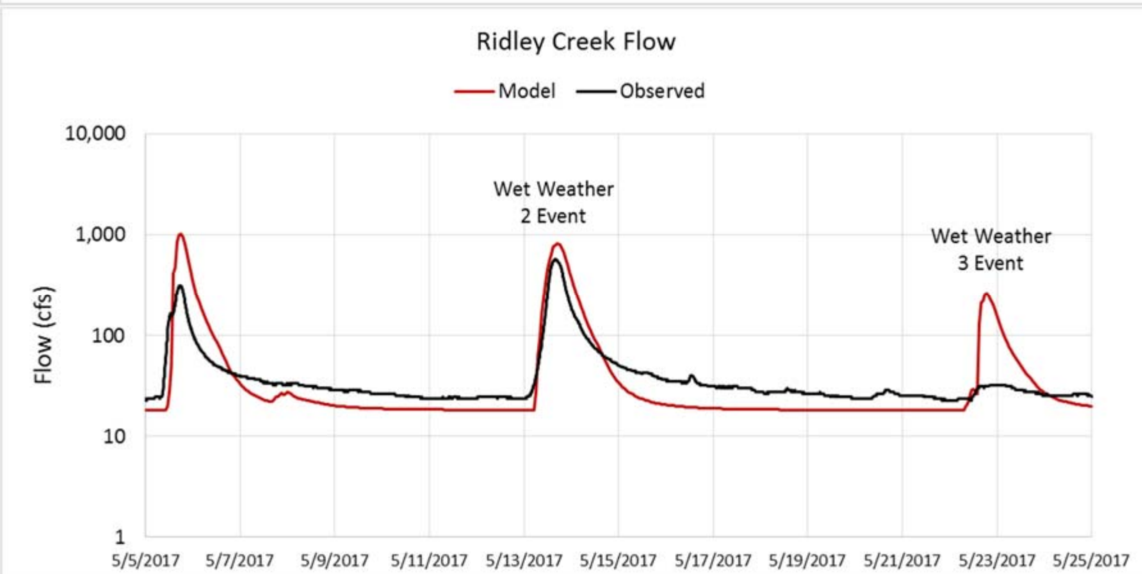
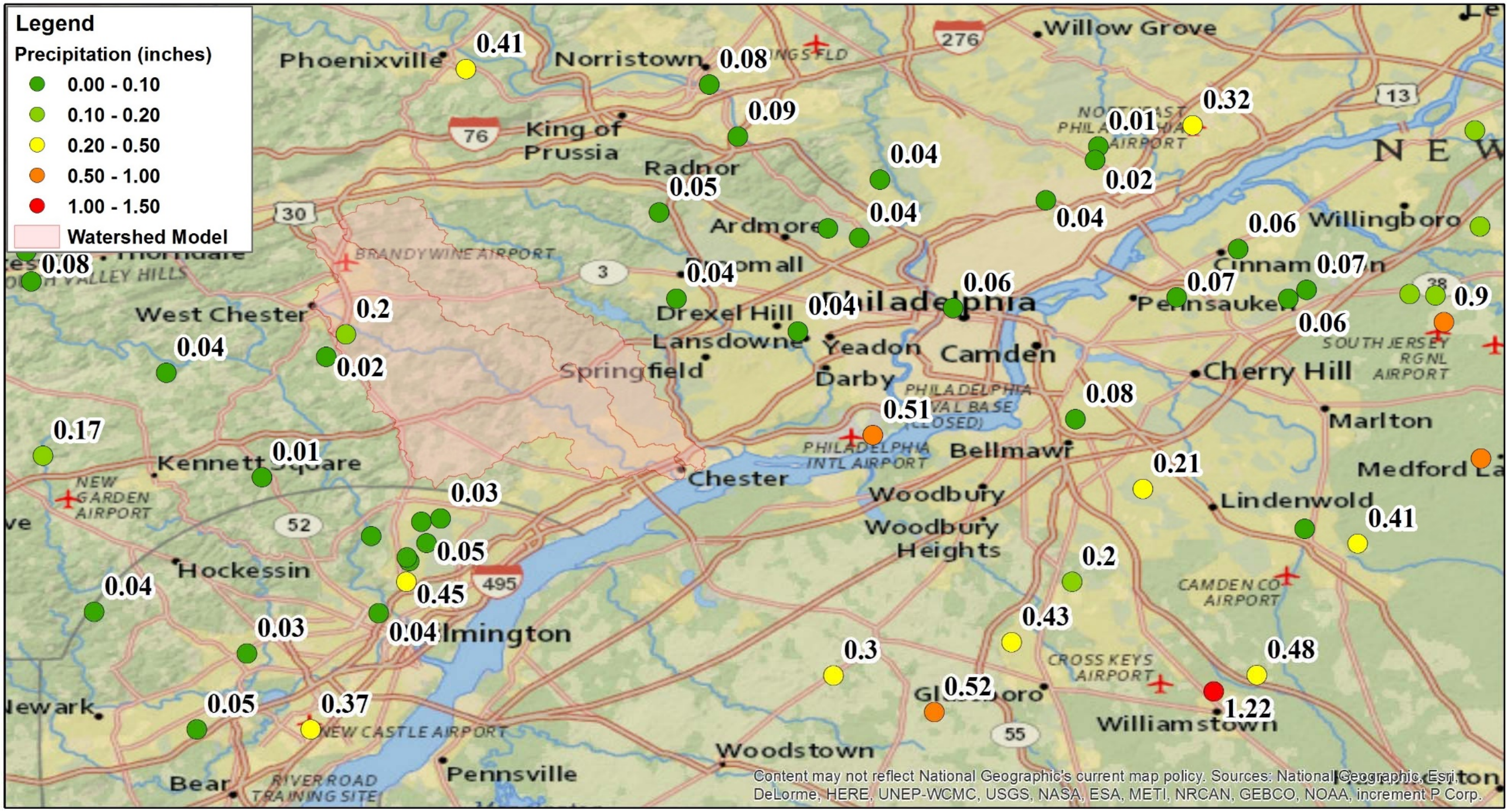


Figure 4-6: Rainfall Distribution for Wet Weather Event 3 (May 22, 2017)



In addition to evaluating the performance of the watershed model on an event basis, the overall annual performance was evaluated. This analysis accounts for contributions from base flow, interflow, and runoff, and compares the model performance against observed flow volume at the USGS gages. The results are shown in the table below and in Figure 4-7.

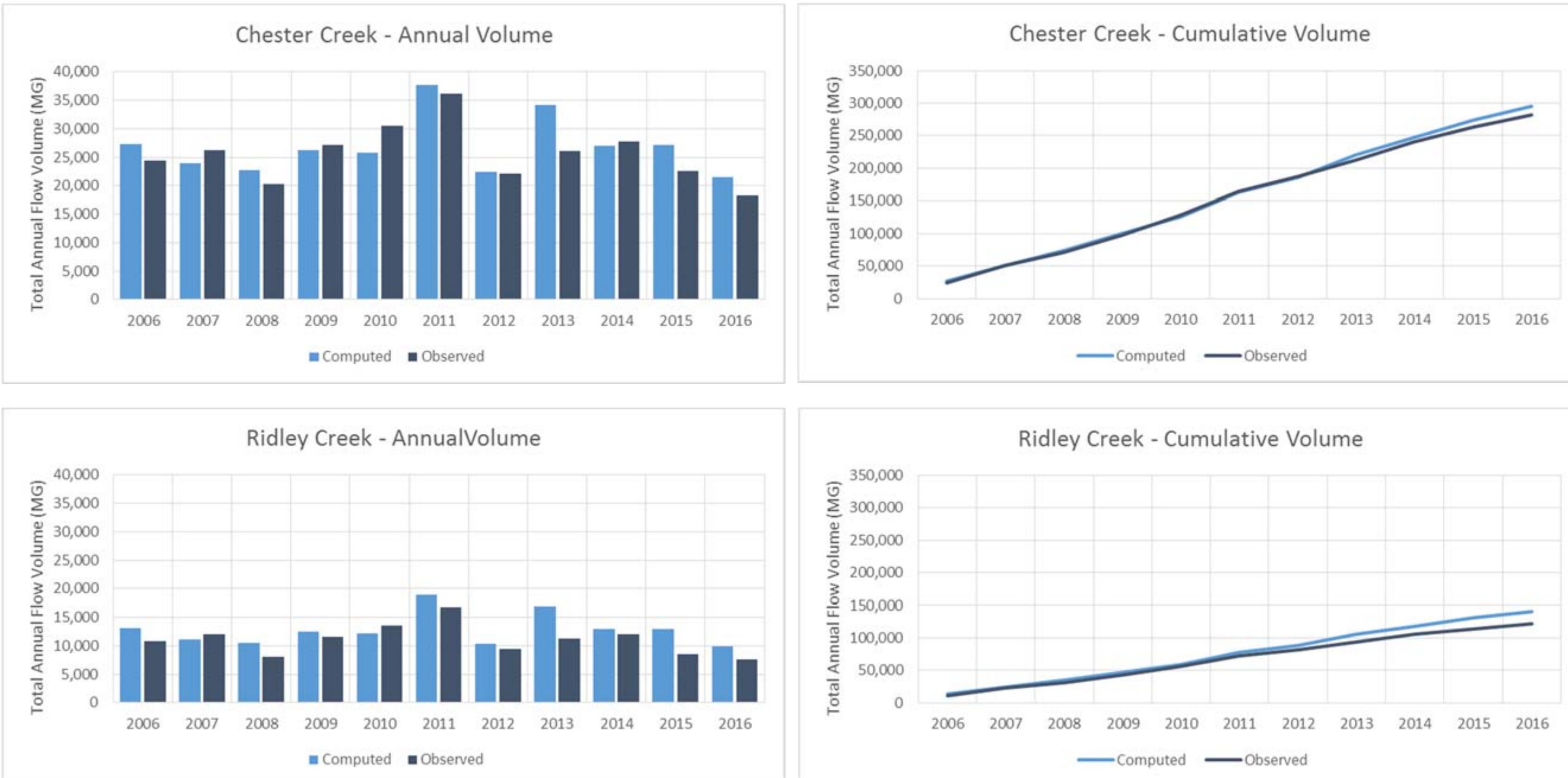
Table 4-2: Watershed Model Overall Annual Performance

	Chester Creek			Ridley Creek		
Year	Modeled Volume (MG)	Observed* Volume (MG)	Percent Difference	Modeled Volume (MG)	Observed* Volume (MG)	Percent Difference
2006	27,324	24,340	12%	13,093	10,865	21%
2007	23,999	26,172	-8%	11,086	12,005	-8%
2008	22,674	20,278	12%	10,460	8,101	29%
2009	26,255	27,175	-3%	12,486	11,540	8%
2010	25,762	30,512	-16%	12,234	13,539	-10%
2011	37,727	36,184	4%	18,844	16,794	12%
2012	22,375	22,068	1%	10,297	9,390	10%
2013	34,210	26,094	31%	16,981	11,234	51%
2014	26,980	27,722	-3%	12,890	12,093	7%
2015	27,108	22,639	20%	12,948	8,513	52%
2016	21,487	18,226	18%	9,845	7,555	30%

*Missing gage data periods were interpolated using the average flow over the whole time series.

This table shows that the model response is variable from year to year, sometimes over predicting and sometimes under predicting total volume. Our understanding is that these over- and under-predictions are largely driven by rainfall variations over the watershed that are not represented in the watershed model because of lack of limited precipitation data over the entire watersheds. In other words, if the total rainfall observed at the Philadelphia Airport is larger than what was observed in the upper portions of the watershed, then the model would likely over predict total flow volume compared to the observed total flow volume. Conversely, if the total rainfall observed at the Philadelphia Airport is smaller than what was observed in the upper portions of the watershed, then the model would likely under predict total volume compared to the observed total volume. For example, in 2010, less rain was recorded at the Philly Airport than at the West Chester Rain Gage, which is located north of the Chester Creek Watershed, and the model accordingly under predicted total volume in that year. And in 2013, more rain was recorded at the Philly Airport than at the West Chester Rain gage, and the model over predicted volume in that year.

Figure 4-7: Comparison of Modeled vs. Observed Annual Flow Volume and Cumulative Flow Volume



This pattern was observed for some but not all of the years, suggesting that other factors may contribute too. One of those factors may be that there was missing flow data at the two USGS gages during the calibration period. The missing data was replaced by the average flow for the purpose of this specific evaluation, but that may have also led to some over or under prediction in the observed flow volumes. Due to the uncertainty related to rainfall and flow data, this evaluation was not used to fine-tune the calibration because it would compromise the calibration of the individual calibration events and hydrographs.

Taking into account the results from the 1-to-1 plots that showed satisfactory correlation coefficients (see Table 4-1 and Figure 4-3) and the visual checks of the flow time series that confirmed satisfactory responsiveness of the model to rainfall data, the watershed model was deemed sufficiently calibrated, consistent with observed data, and reliable to be applied for the purpose of predicting flows when observed data are not available during the typical year period. As explained in Section 4.1.1, availability of gage data during the typical period is variable, with a long period of data missing in Ridley Creek (9/22/1995 through 12/31/1996) and a few shorter periods (of a few days at a time) missing at both gages during the three year period.

To estimate tributary water quality concentrations, modeled tributary flows were separated into dry and wet weather flow components based on the methodology described in Section 3.1.2.3. Dry weather is the sum of base flow and interflow, while wet weather is represented by the direct runoff and channel precipitation. Statistical reference concentrations for the POC event mean concentrations were initially estimated based on the sampling data obtained from the DELCORA Wet and Dry Weather Monitoring Program (See section 4.1.3). These reference concentrations are shown in Table 4-3. It was somewhat surprising that the *enterococcus* results tended to be higher than the fecal coliform and *E.coli* data. However, there is very little data in the literature for *enterococcus* so it was difficult to assess whether these results are unusual. The fecal coliform concentrations however, are within the range of urban storm water bacteria concentrations reported in the literature (EPA 2004). It should also be noted that, as previously shown in Section 4.1.3, the monitoring data shows that wet weather concentration at the most upstream monitoring locations (located upstream of CSO influence) in Chester Creek and Ridley Creek often exceed the applicable monthly geometric mean or STV WQS concentration for all three POCs.

Table 4-3: Reference POC Concentrations Used to Develop EMCs for Modeled Flows

	Enterococcus (#/100 mL)			Fecal Coliform (#/100 mL)			*E.coli* (#/100 mL)		
	25th %ile	75th %ile	Geo-mean	25th %ile	75th %ile	Geo-mean	25th %ile	75th %ile	Geo-mean
Dry Weather Flow	19	65	39	22	180	40	13	69	28
Wet Weather Flow	8,500	59,500	31,784	799	22,750	4,516	668	18,750	3,042

The POC concentration assumptions were further refined during the water quality model calibration process, which is described in Section 4.5.2. Event mean concentrations were applied to each dry and wet weather flow component to estimate POC loads in the tributaries. This method allows for time-variable POC concentrations that are consistent with the timing of the wet weather flow responses. The final EMCs were determined based on the results of the receiving water model calibration, as explained in Section 4.5. The selected dry weather EMC (30 #/100 mL) is consistent with the geometric mean of the observed data. It was also not varied by POC because the dry weather sampling data were variable but had similar central tendencies. The final calibrated EMC values used in the watershed model are shown in the table below.

Table 4-4: Calibrated POC EMC values for Ridley and Chester Creek

Model Input	*Enterococcus* (#/100 mL)	Fecal Coliform (#/100 mL)	*E.coli* (#/100 mL)
Dry Weather Flow	30	30	30
Wet Weather Flow	20,000	8,000	4,000

4.3 DELCORA Combined Sewer System Model

DELCORA CSO flows were obtained from the calibrated DELCORA CSS H&H Model. The calibration and application of the CSS H&H model is discussed in detail in the H&H model report (DELCORA, 2016).

To model the POC loads from the CSO system, Statistical reference concentrations for the POC event mean concentrations were initially estimated based on the sampling data obtained from the DELCORA Wet and Dry Weather Monitoring Program (See section 4.1.3). These reference concentrations are shown in Table 4-5. Measured concentrations were within the range of CSO bacteria concentrations reported in the literature (EPA, 2004) but tended to be lower than the median concentrations measured in other communities. Several potential explanations for this include: 1) the highly industrialized nature of the DELCORA service area may result in a smaller bacteria load via runoff to the combined system than communities with less industrial land; 2) DELCORA may have a relatively high percentage of stormwater in the combined system.

The data presented a challenge in that the *E.coli* values are generally higher than the fecal coliform values, which is not physically possible since *E.coli* is a subset of fecal coliform. These data were therefore used as initial estimates, but then further refined and adjusted during the water quality model calibration process so as to reflect both the physical constraints (i.e.: *E.coli* EMCs that are smaller than Fecal Coliform EMCs) and the observed ranges.

Table 4-5: Reference POC Concentrations Used to Develop EMCs for the Modeled DELCORA CSOs

	Enterococcus (#/100 mL)			Fecal Coliform (#/100 mL)			*E.coli* (#/100 mL)		
	25th %ile	75th %ile	Geo-mean	25th %ile	75th %ile	Geo-mean	25th %ile	75th %ile	Geo-mean
CSO Concen-tration	42,250	191,750	81,510	53,000	157,000	95,310	66,000	265,500	129,920

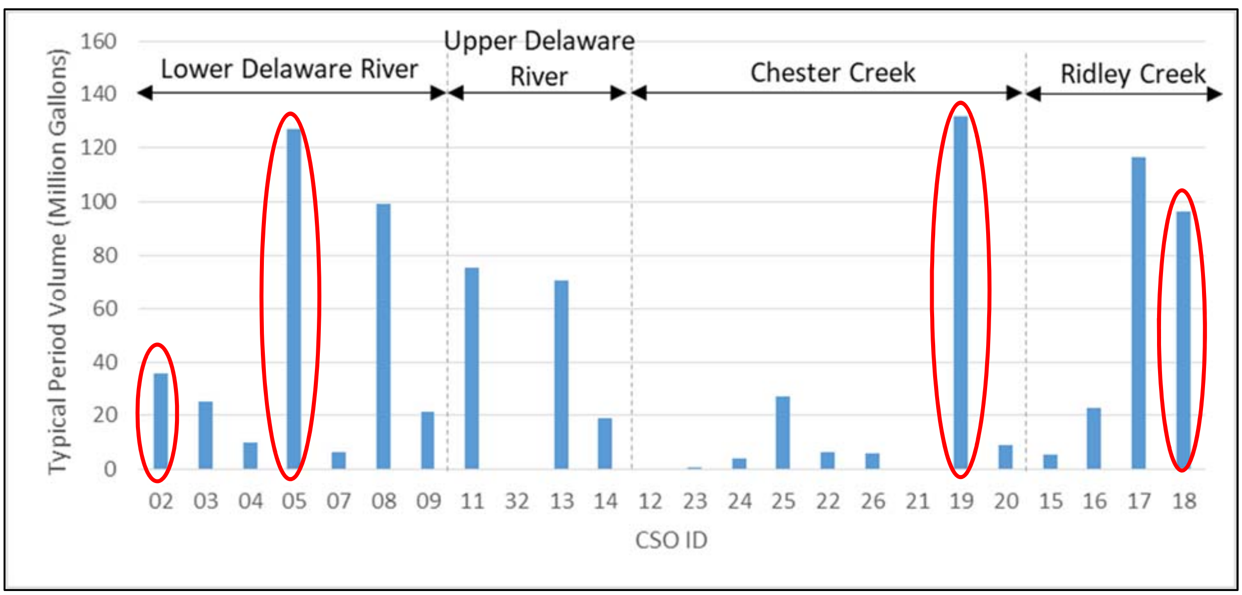
The water quality model was ultimately calibrated using the CSO EMCs shown in Table 4-6 below.

Table 4-6: Calibrated POC EMC Values for the DELCORA CSOs

Model Input	*Enterococcus* (#/100 mL)	Fecal Coliform (#/100 mL)	*E.coli* (#/100 mL)
CSO EMC	125,000	150,000	125,000

Figure 4-8 illustrates the distribution of CSO volumes among the various outfalls by receiving water. The CSOs that were part of the wet weather monitoring program are circled in red.

Figure 4-8: CSO Volumes for Typical Period (1994-1996)



POC loads associated with DELCORA CSOs are estimated by multiplying modeled CSO flow rates by POC EMC concentrations.

4.4 Philadelphia Simplified CSO Model

Calibration of this SWMM model relied principally on information from annual reports of Philadelphia CSO model overflows (PWD, 2017). Tables from these reports, which describe the annual overflow volume, number of overflow events, and total overflow duration per CSO, helped to constrain model inputs related to the combined sewersheds, including the total impervious area, depression storage, average surface slope, and sewershed width and length.

Model parameters described above were first calibrated to reported overflow volumes and frequencies from the 2016 annual CSO reports, then validated using the 2015 annual CSO reports. Modeled and reported overflow volumes and frequencies were in close agreement for the 165 CSO locations in both 2015 and 2016, as shown in Figure 4-9 and Figure 4-10. However, at one overflow location, identified as "F_FRFG," the reported overflow changed significantly between 2015 (1,250 million gallons) and 2016 (<1 million gallons), indicating that some change occurred in the Philadelphia sewer system that eliminated overflows at that discharge location. The SWMM model was configured for the 2016 condition for the water quality calibration. Overall, the model provides reliable estimates of Philadelphia CSO overflow volume and frequency of discharge.

The process for calibration of the model was as follows:

1. Gather CSO information from the Philadelphia CSO Annual Reports[13], including total annual overflow volumes, number of overflow events, and overflow event durations.
2. Develop annual rainfall event statistics, including total rainfall depth and duration for Philadelphia Airport rain gage.
3. Rank the developed rainfall events by total depth and distribute the reported overflow volume over the reported number of overflow events for each CSO. This method assumes that overflows occur during the highest volume rainfall events and that the overflow volume is proportional to the total rainfall depth.
4. Parameterize the SWMM runoff model relying principally on the total assumed rainfall depth which cause overflows, and the reported overflow characteristics (volume, number of overflows and duration).
5. Use the SWMM runoff model to compute the hourly CSO response for each rainfall event and CSO location.
    a. Assume 100% impervious sewersheds and calculate necessary sewershed area for each CSO by dividing the reported annual overflow volume by the assumed total rainfall depth causing overflow.
    b. Set depression storage input equivalent to largest rainfall depth that does not result in an overflow. Further, a constant evaporation rate was used to deplete the depression storage between rainfall events.

[13] http://www.phillywatersheds.org/what_were_doing/documents_and_data/CSO_SW_AnnualReports

c. Adjust sewershed width-to-length ratio, which influences runoff dynamics, for consistency with reported number of overflow events and reported overflow duration.

4.5 Receiving Water Model Calibration

The receiving water model calibration was comprised of two components: calibration of the hydrodynamic calculations (water movement), and calibration of the water quality calculations. These are explained in the following sections.

4.5.1 Hydrodynamic Model Calibration

Calibration of tidal hydrodynamics occurred first. Modeled tidal propagation is principally influenced by sediment bed resistance which varies due to changes in sediment grain size and bed forms. Model inputs related to bed resistance (roughness) were calibrated for consistency with NOAA tidal data at multiple stations near DELCORA CSOs, including the Marcus Hook Station (only water level measured) and Philadelphia Station (water level and currents measured). Modeled and observed water levels were compared for the 2017 water quality sampling period (March through June 2017). The model's representation of changes in tidal phasing and amplitude along the Delaware River estuary, which influence rates of pollutant transport and mixing, were refined during the calibration process.

Figure 4-11 and Figure 4-12 illustrate the hydrodynamic model performance relative to observations. These figures show good agreement between modeled and observed water levels and sufficient agreement between modeled and observed current velocities. Modeled current velocities tend to be low relative to observed current velocities, which is likely due to differences in scale between the observations and the model output. Model output represent average velocities over approximately a 200 foot width and 1,400 foot length, while the observations represent velocities at a much smaller scale (i.e. tens of feet laterally and vertically). Consistency between modeled and observed water levels is a strong indication that at larger spatial scales (i.e. the scale of the model grid and larger scales), the model accurately computes tidal current velocities.

Figure 4-9: Philadelphia CSOs – Comparison of Modeled and Reported Overflow Volumes

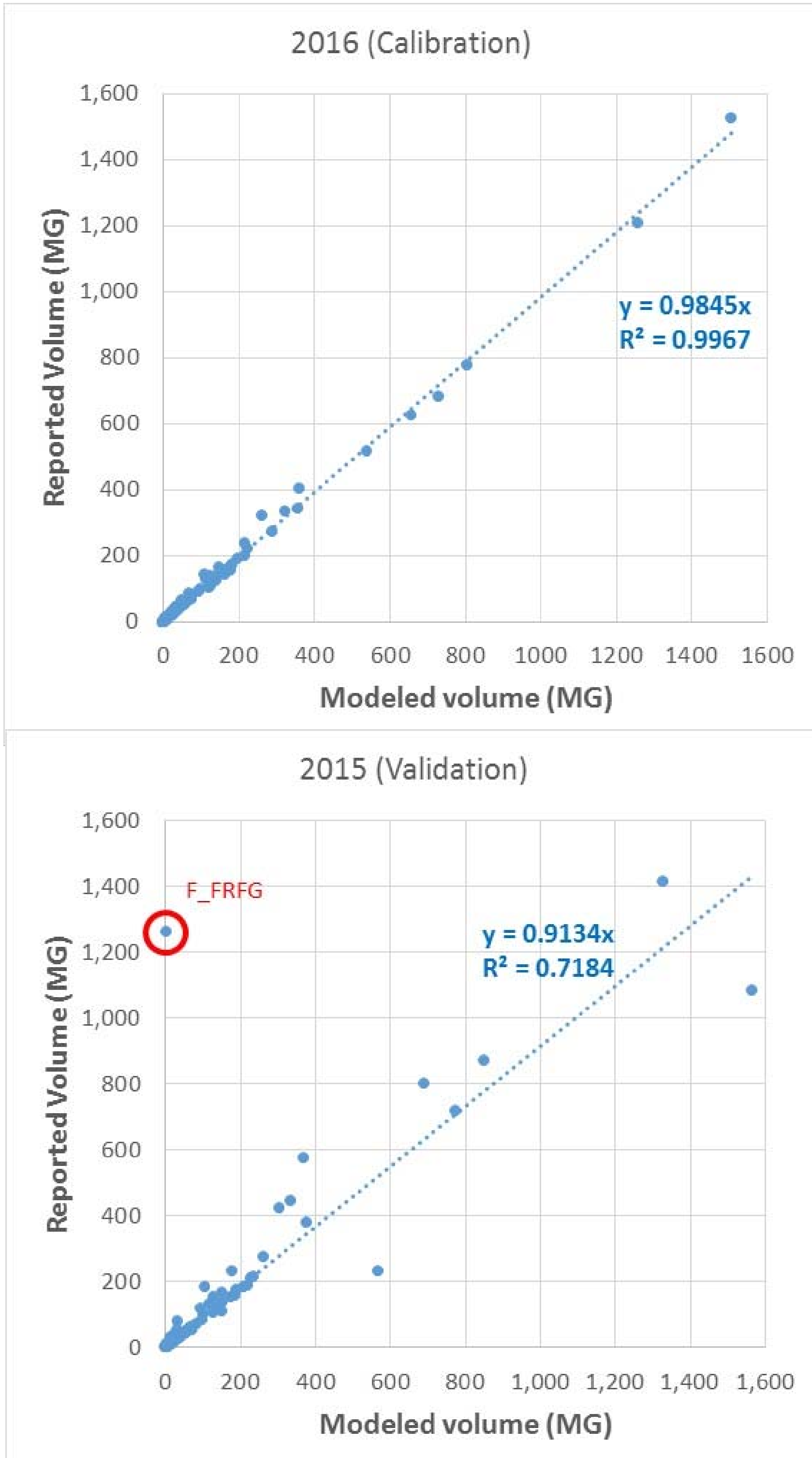


Figure 4-10: Philadelphia CSOs – Comparison of Modeled and Reported Overflow Events

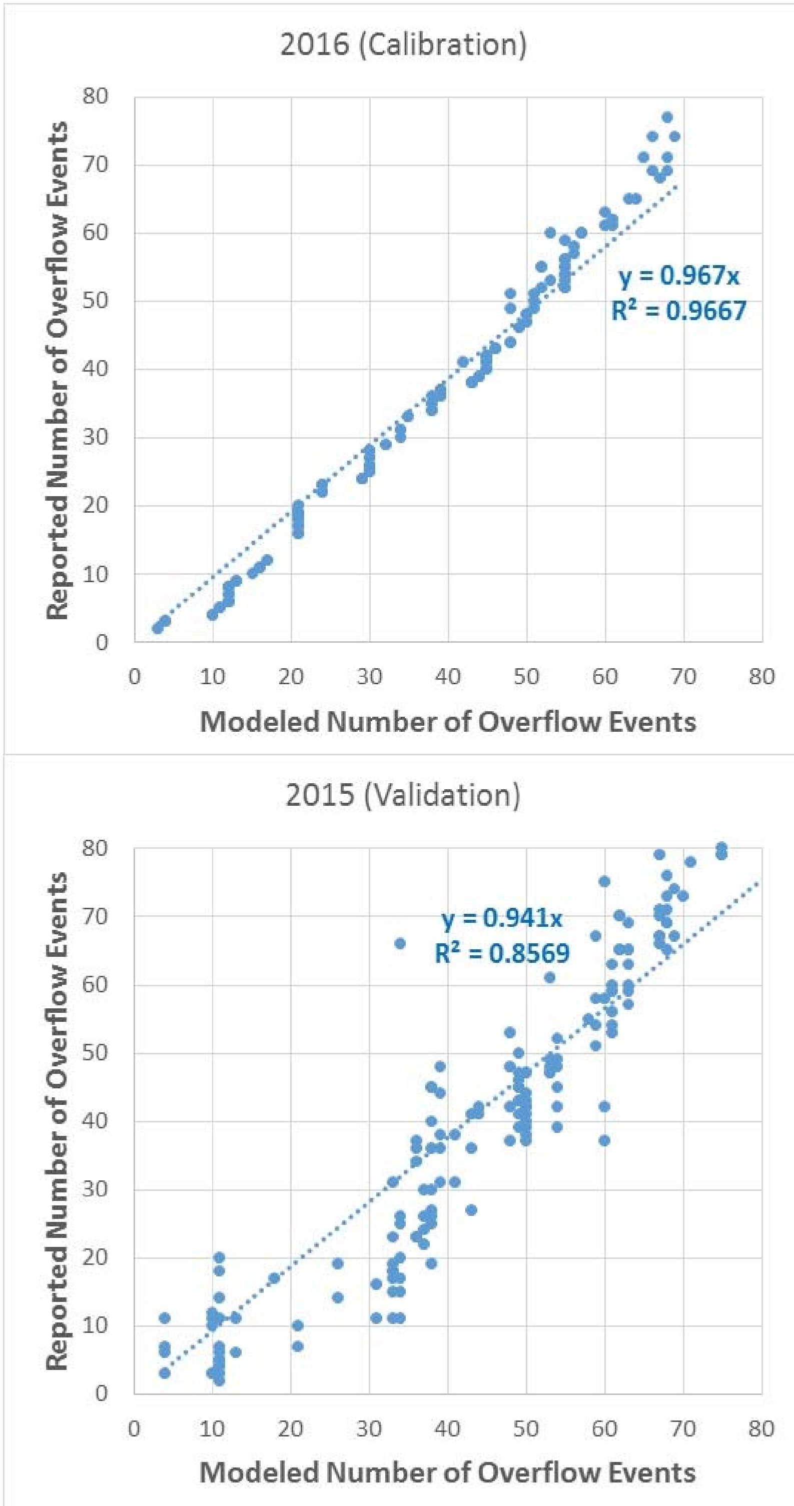


Figure 4-11: Delaware River – Comparison of Modeled and Observed Water Levels

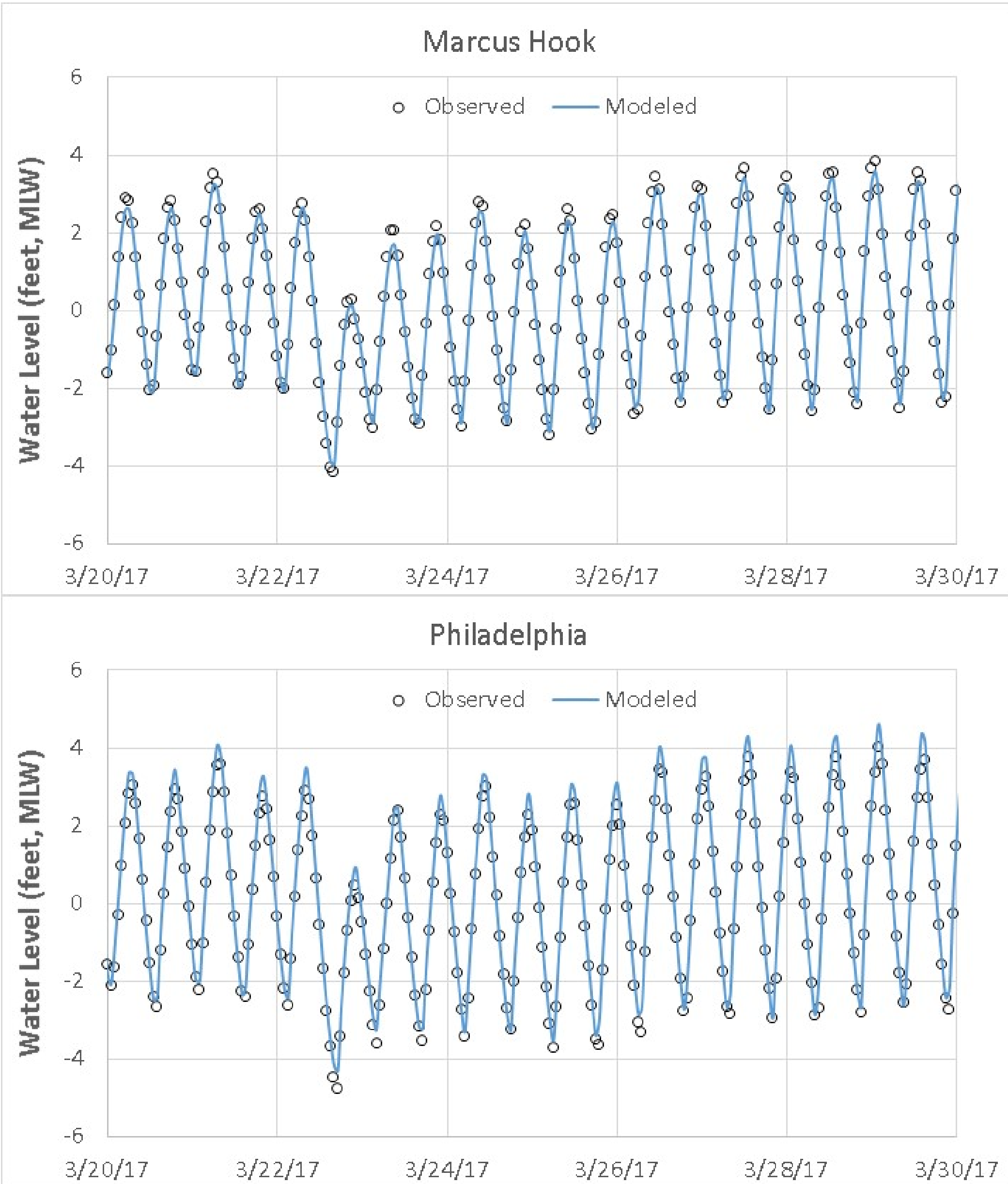
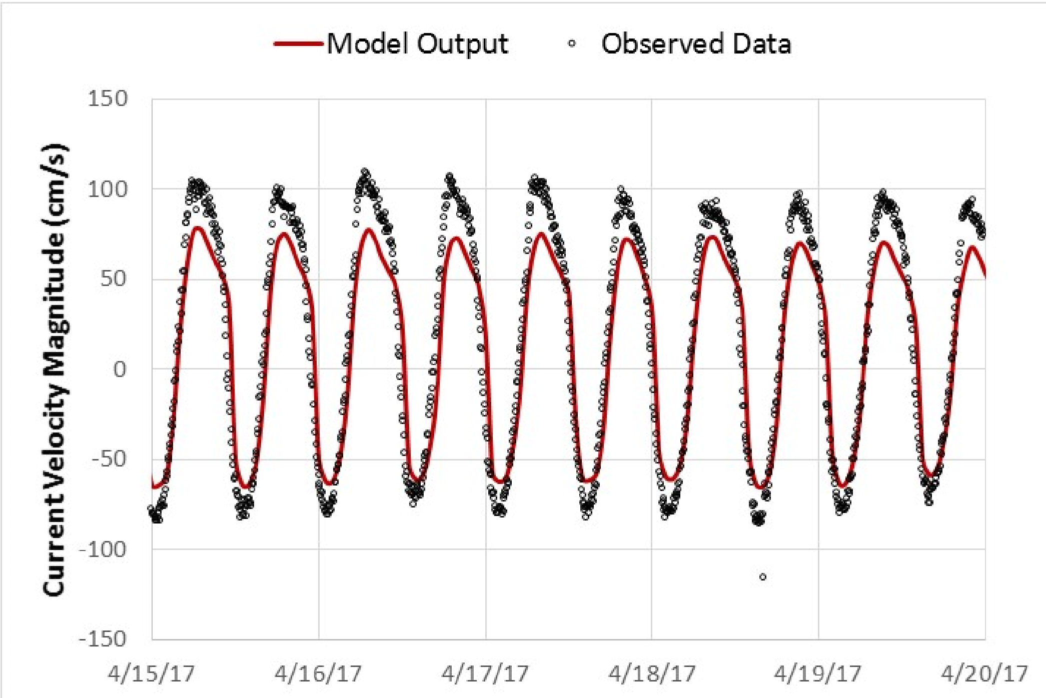


Figure 4-12: Delaware River – Comparison of Modeled and Observed Velocities at NOAA Philadelphia Currents Station



4.5.2 Water Quality Calibration and Validation

4.5.2.1 Approach

The water quality model component was calibrated to sampling data collected in 2017 by DELCORA (see section 4.1.3) and validated to water quality data collected in 2012 by the Delaware River Basin Commission (DRBC). The intent of the calibration is to refine initial POC load (EMC and flow) estimates and the assumed first-order, in-stream POC net decay rate. The POC loads control the amount, the timing, and the intensity of the bacteria loads from the various sources to the receiving water. The decay rate then controls how quickly bacteria decays (decreases in concentration due to the net effects of multiple bacterial processes) over time. The calibration approach was to adjust POC load and decay rate values, evaluate changes in model results against the entire calibration dataset, and identify the model values that were most consistent with the central tendencies of the dataset by stream.

The central tendencies are evaluated through the use of event-based pollutographs and 1-to-1 plots. The pollutographs were evaluated using visual checks for individual events at relevant water quality stations. These visual checks include an evaluation for goodness of fit with respect to the modeled vs observed concentrations, and the time-response of the POC concentrations. The 1-to-1 plots were evaluated with respect to how closely the modeled data could replicate the observed data within a certain range to account for the typical variability observed with bacteria data. The intent of the water quality calibration was to find the overall best fit across all of the different sampling events and all the relevant monitoring stations, with more emphasis placed on the water quality stations within the DELCORA CSO area. This approach invariably leads to calibration results that are better at some locations or for some events than others. Using different POC load assumptions may improve results for some stations and events, but may diminish results for other stations and events. Model assumptions were refined to obtain the best fit across all of the stations.

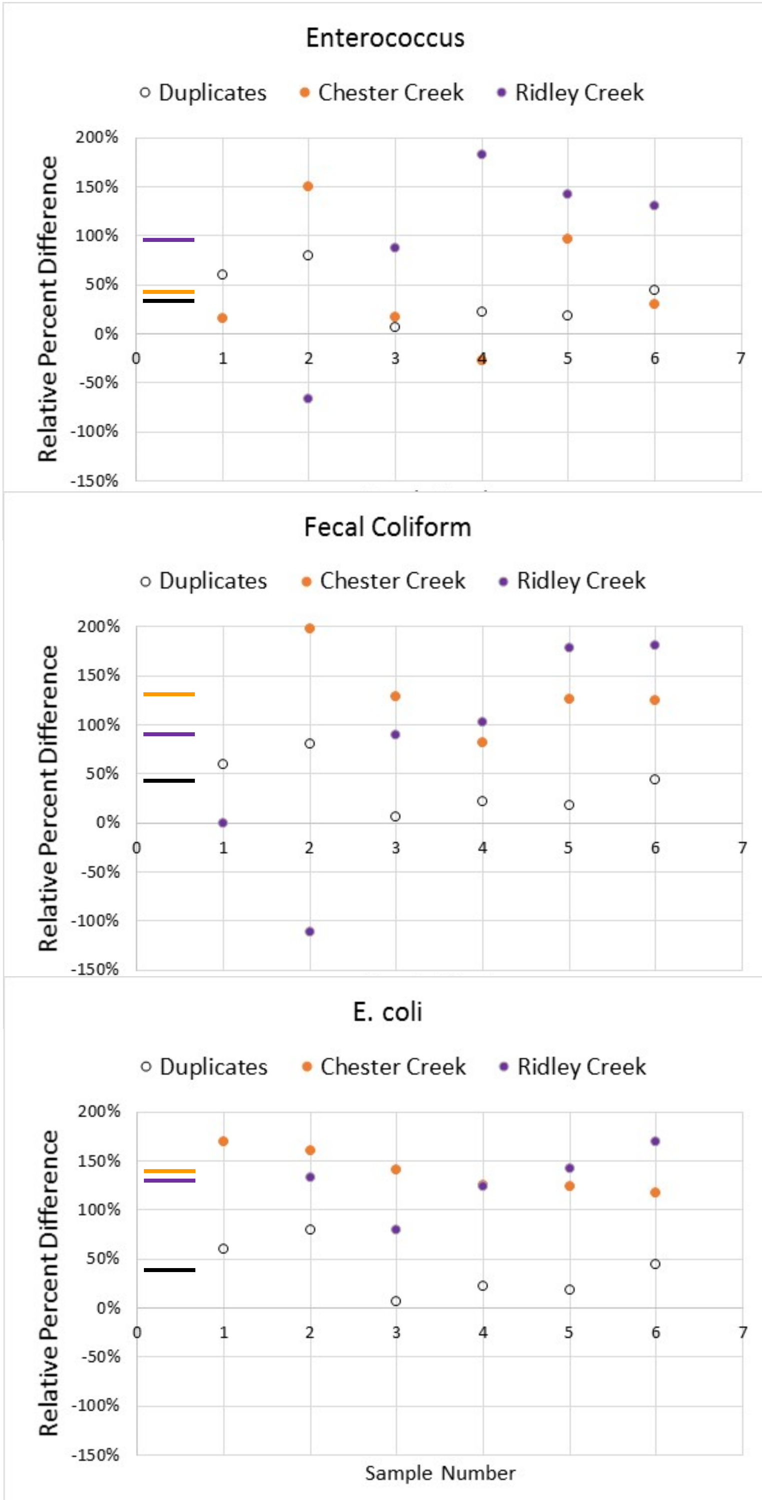
The approach focused first on establishing the appropriate dry weather model values, followed by the wet weather model values. Based on this approach, the decay rate was calibrated to 1.0 per day (1/day), dry weather flow POC concentrations were set to 30 #/100 mL, and wet weather POC EMCs for the tributaries and CSOs were calibrated to the values listed in the table below.

Table 4-7: Model Inputs for POC EMC Concentrations

Model Input	*Enterococcus* (#/100 mL)	Fecal Coliform (#/100 mL)	*E.coli* (#/100 mL)
Background Tributary Runoff POC Concentration	20,000	8,000	4,000
DELCORA and Philadelphia CSOs POC Concentration	125,000	150,000	125,000

As discussed in Section 4.1.3, the results from DELCORA's monitoring program showed an increase in POC concentration from upstream to downstream in each of the tributaries, indicating there may be bacteria sources entering these tributaries during dry weather. Dry weather POC concentrations generally appreciably increase from the most upstream sampling stations (RC-01 and CC-01) to the next downstream sampling stations (RC-02 and CC-02), as illustrated in the figure on the next page. This figure shows the relative percent difference in concentrations from the upstream to downstream sampling locations. When the relative difference is positive, it indicates an increase in concentration from upstream to downstream. While small (+/- 50%) changes could be due to the typical variability observed in sampling data, larger increases (>50%) could be indicative of a bacteria source entering the tributary somewhere between CC-01 and CC-02, and between RC-01 and RC-02. These unknown sources were included in the water quality model and were calibrated for consistency with the central tendency of the dry weather POC data at stations RC-02 and CC-02. The final calibrated loads of the unknown sources ranged from 1.1e6 to 9.1e6 cfu/s depending on POC and stream. Such a source was not included in the model of *Enterococcus* in Chester Creek because no consistent *Enterococcus* concentration increase was observed in the sampling data.

Figure 4-13. Difference in POC Concentration in Upstream vs Downstream Station



Horizontal bars represent mean relative percent difference of paired observations

4.5.2.2 Calibration and Validation Results

The results from the dry weather calibration is shown in Figure 4-14 and Figure 4-15 for Fecal Coliform for dry weather event 2. Model results are shown with the red line and observed data are shown using the gray squares. The figure also shows how the model performs for 50% higher and 50% lower POC load assumptions. Showing the +/- 50% results helps demonstrate that the model represents the central tendencies of the observed water quality data. Generally speaking, the model reasonably predicts dry weather Fecal Coliform concentrations for dry weather event 2, over predicts for dry weather event 1 and under predicts for dry weather event 3. Performance for the other POCS is shown in the table below. A complete set of figures for model calibration for all dry weather events and all POCs can be found in Appendix C.

Table 4-8: Assessment of Dry Weather Events Water Quality Calibration

		Enterococcus	Fecal Coliform	*E.coli*
Dry Weather Event 1	Ridley	Biased High	Biased High	Biased High
	Chester	Biased High	Biased Low	Reasonable fit
	Delaware	Biased High	Biased High	Biased High
Dry Weather Event 2	Ridley	Reasonable fit	Reasonable fit	Reasonable fit
	Chester	Reasonable fit	Reasonable fit	Reasonable fit
	Delaware	Biased High	Reasonable fit	Reasonable fit
Dry Weather Event 3	Ridley	Reasonable fit	Biased Low	Reasonable fit
	Chester	Reasonable fit	Biased Low	Reasonable fit
	Delaware	Reasonable fit	Reasonable fit	Reasonable fit

After calibrating the model to the dry weather events, attention turned to calibrating the wet weather events. Figure 4-16 illustrates the water quality model calibration for fecal coliform during the first wet weather event at select stations in the tributaries and the Delaware River, along with sensitivity tests that show how the model performs for 50% higher and 50% lower POC load assumptions. The objective of the in-stream calibration is to provide the overall best fit across all stations, thus providing consistency with the central tendency along the length of the modeled river. Modeled POC concentrations are consistent with the range of observed concentrations from the DELCORA monitoring program and the model performance is reasonable compared to the observed data. Performance for the other POCS is shown in the table below. A complete set of figures for model calibration for all wet weather events and all POCs can be found in Appendix C.

Table 4-9: Assessment of Wet Weather Events Water Quality Calibration

		Enterococcus	Fecal Coliform	*E.coli*
Wet Weather Event 1	Ridley	Reasonable fit	Biased High	Biased High
	Chester	Reasonable fit	Reasonable fit	Reasonable fit
	Delaware	Biased High	Biased High	Reasonable fit
Wet Weather Event 2	Ridley	Biased Low	Biased Low	Reasonable fit
	Chester	Biased Low	Biased Low	Reasonable fit
	Delaware	Reasonable fit	Reasonable fit	Reasonable fit
Wet Weather Event 3	Ridley	Reasonable fit	Reasonable fit	Reasonable fit
	Chester	Reasonable fit	Biased Low	Biased Low
	Delaware	Reasonable fit	Biased High	Reasonable fit

Following calibration of the dry and wet weather events using the data from the DELCORA Monitoring Program, the water quality model was subsequently validated to water quality data collected in 2012 by the Delaware River Basin Commission (DRBC). Seven samples per location were taken between April and November of 2012 in the Delaware River from Trenton to the mouth of the Delaware River. These data are primarily useful for evaluating accuracy of modeled POC loads from the Philadelphia CSOs and the Schuylkill River, which are estimated to be the largest POC loads to the estuary. Figure 4-17 illustrates the water quality model validation for fecal coliform at stations near Delaware County, starting at river mile 87.9 which is upstream of the DELCORA CSO area. Modeled POC concentrations are consistent with the range and timing of observed concentrations in the DRBC data, and the model performance is reasonable compared to the observed data. Modeled results are also consistent with the observed pattern of higher concentrations near Philadelphia and lower concentrations near DELCORA. A complete set of figures for all POCs and stations used for model validation can be found in Appendix C.

Figure 4-14. Fecal Coliform Dry Weather Calibration at Ridley and Chester Creek (Dry Weather Event #2, 5/10/17)

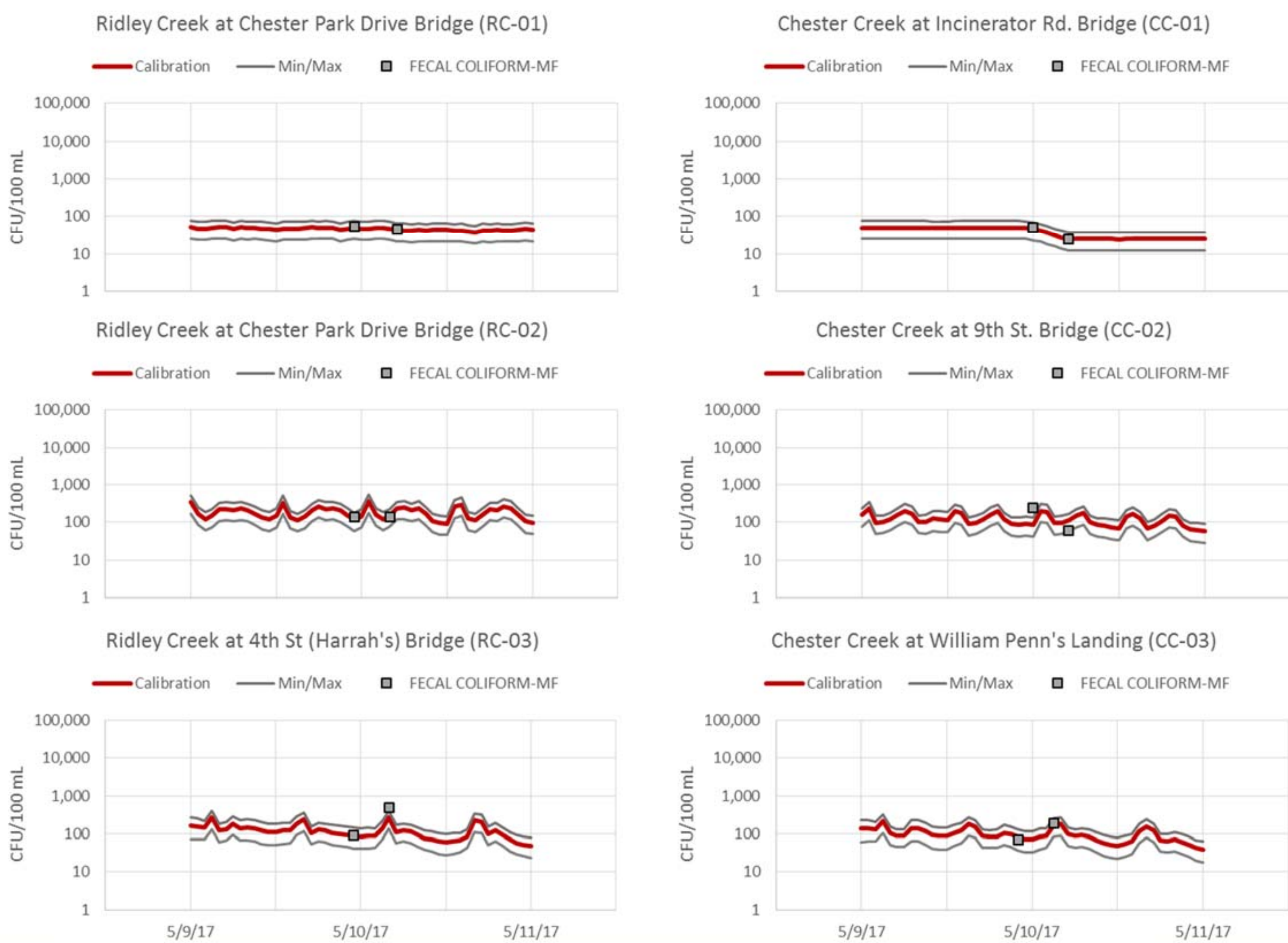


Figure 4-15. Fecal Coliform Dry Weather Calibration at Delaware River Stations (Dry Weather Event #2, 5/10/17)

Figure 4-16. Fecal Coliform Calibration at Ridley Creek, Chester Creek, and Delaware River Stations (Wet Weather Event #1, 3/30/17-4/1/17)

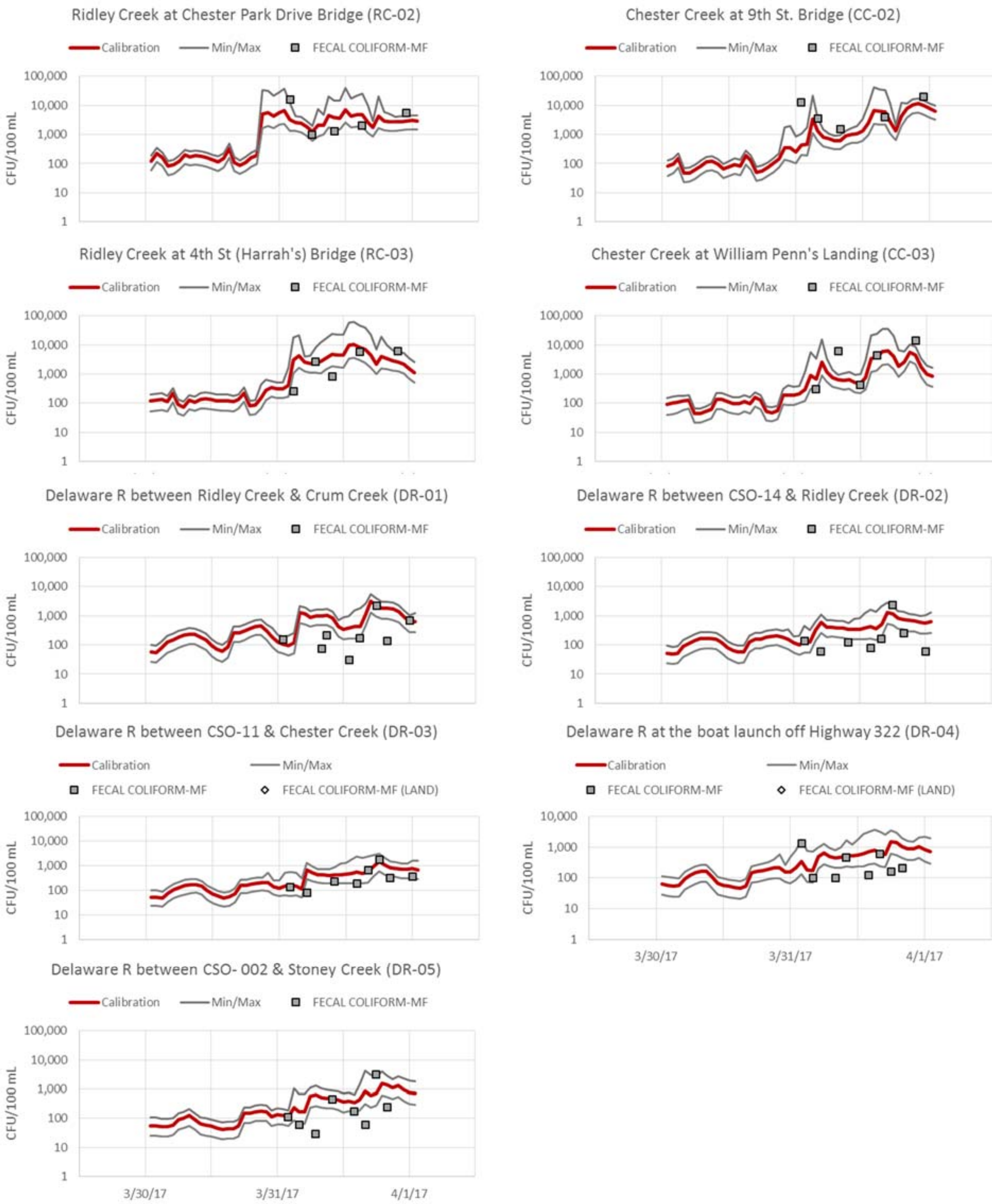
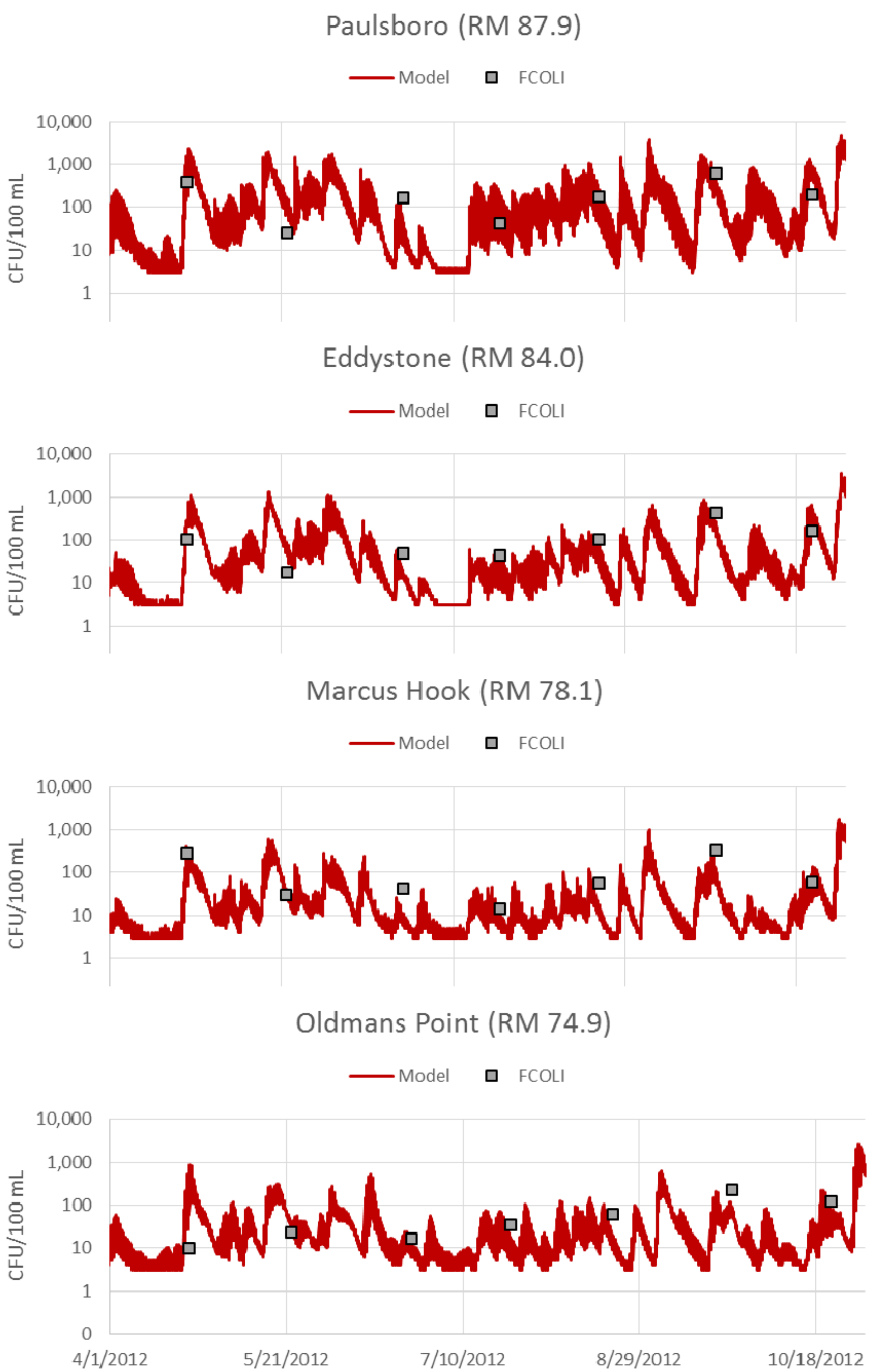


Figure 4-17: Fecal Coliform Model Validation Results near Delaware County



One-to-one plots were also used to assess model performance relative to all observed data at all stations. This is shown in Figure 4-18, Figure 4-19, and Figure 4-20 for the three POCs. These figures pair observed POC concentrations with their associated modeled concentrations for both wet and dry weather events. To account for the natural variability that can occur when sampling POCs, two additional sets of lines were added to the 1-to-1 plot to represent confidence intervals. The first set of dashed lines represent a two times (2x) confidence interval representing the variability in monitoring data results associated with field-collection efforts. The second set of dotted lines represents a ten-time (10x) confidence interval which represents the possible variability in monitoring data results associated with the combination of field and laboratory factors. This confidence interval is based on best professional judgement and variability with field and analytical duplicate results. The majority of points on the one-to-one plots fall within the 10x confidence interval for all stations, however the creek predictions are biased slightly low whereas the Delaware River has an overall reasonable fit, as shown in the table below. Overall, even if an individual event was modeled too high or too low, on a long term basis, the model produces a fairly typical response to POC loads that follow the central tendencies observed.

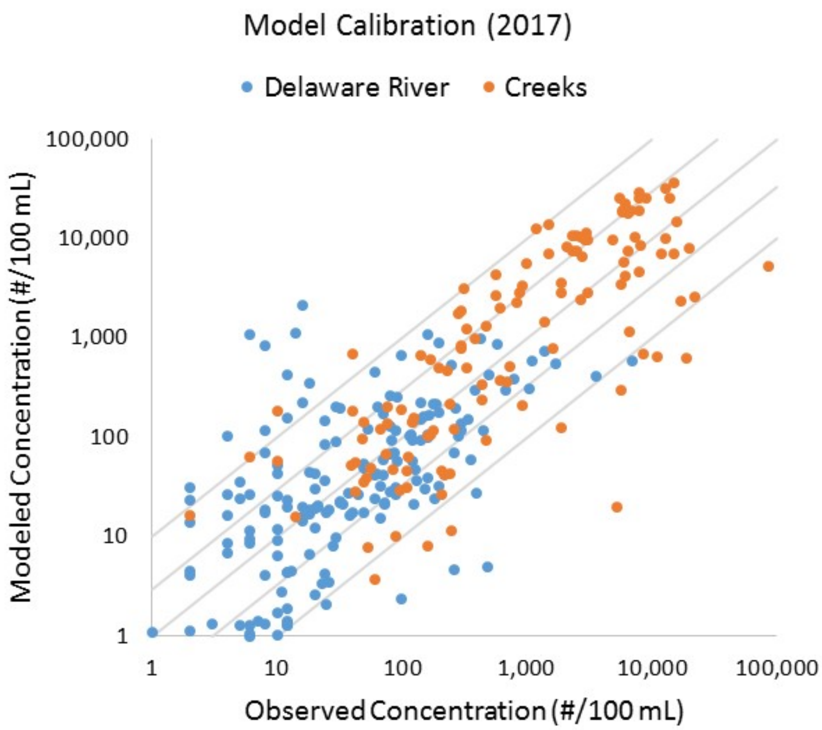
Table 4-10: Assessment of Overall Water Quality Calibration and Validation

	Enterococcus	Fecal Coliform	*E.coli*
Creeks Calibration	Biased Slightly Low	Biased Slightly Low	Biased Slightly Low
Delaware Calibration	Reasonable fit	Biased Slightly High	Biased Slightly High
Delaware Validation	Reasonable fit	Reasonable fit	Reasonable fit

4.6 Overall Calibration Observations

A water quality modeling framework has been developed and calibrated, and is ready for application to compute POC concentrations in the tidal portions of Chester and Ridley Creeks and in the Delaware River adjacent to DELCORA, for the typical year period. Each model within the framework was developed and calibrated using the best available data, and found to be reasonably consistent with the central tendencies of the observed data and therefore reliable to be applied for the Long Term Control Plan Update.

Figure 4-18: *Enterococcus* Model Calibration and Validation Summary



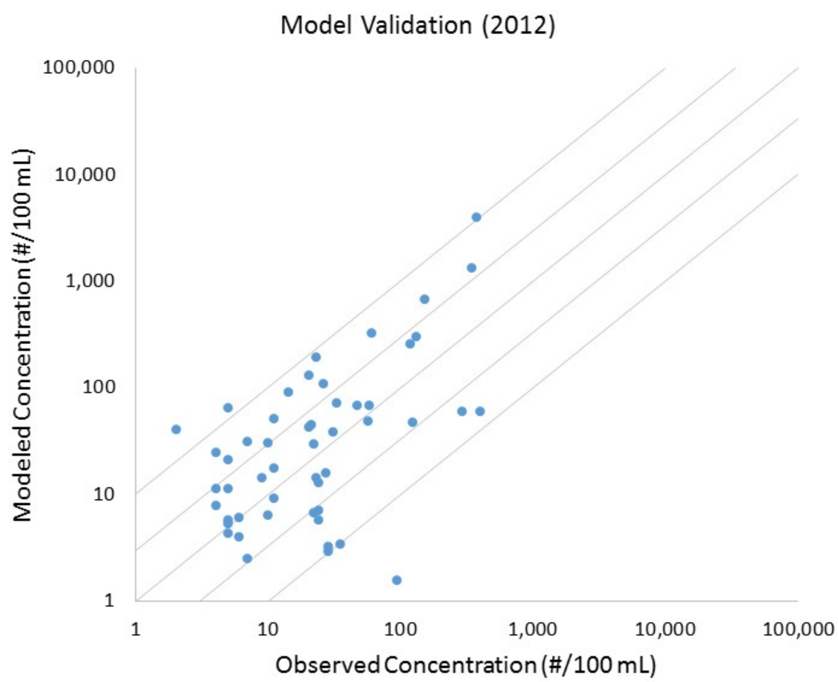
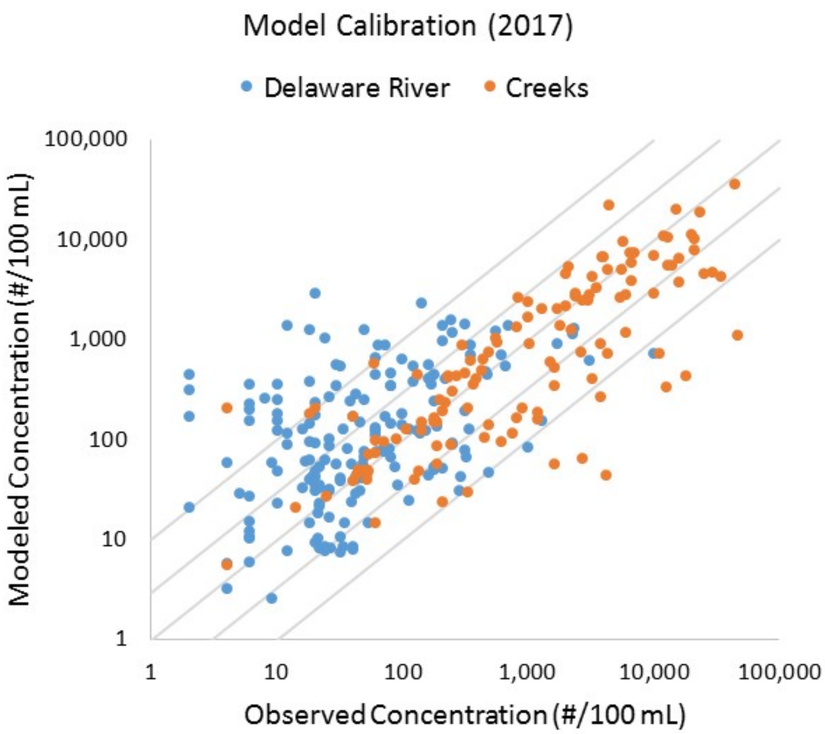


Figure 4-19: Fecal Coliform Model Calibration and Validation Summary



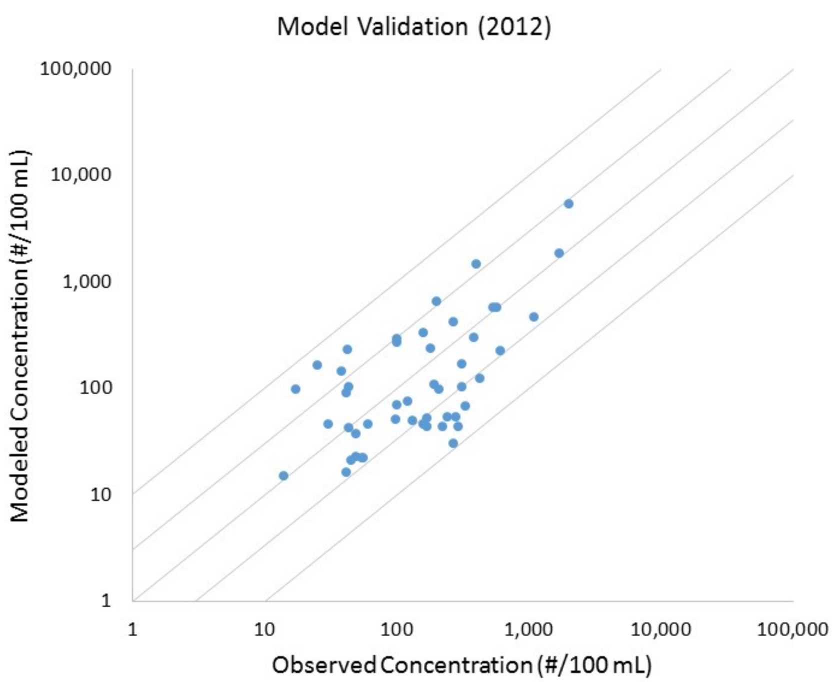
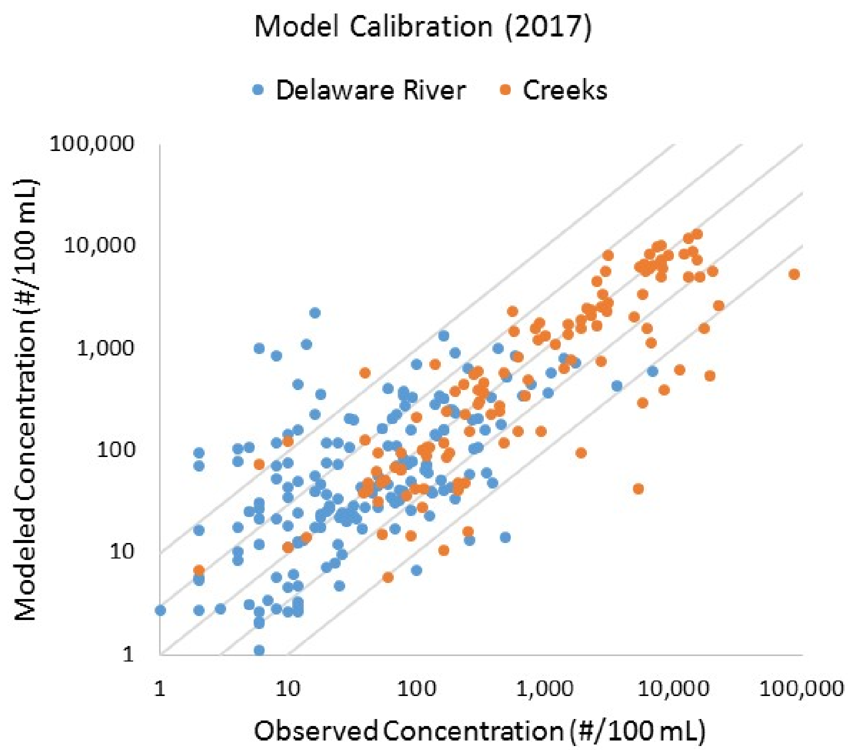
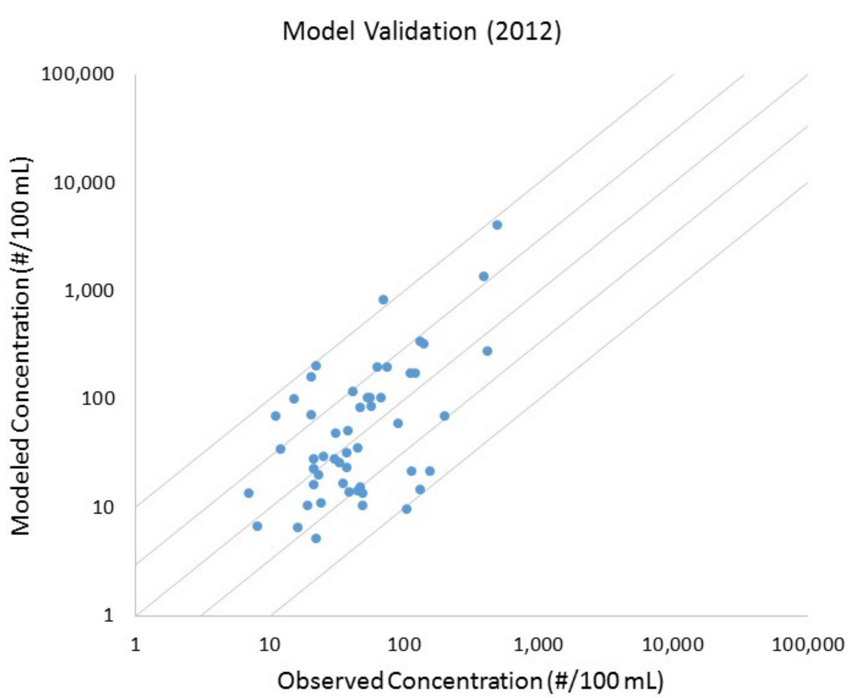


Figure 4-20: *E.coli* Model Calibration and Validation Summary





Section 5 Water Quality Model Application to Evaluate Typical Year Condition

5.1 Typical year simulation description

The purpose of the DELCORA water quality model is to compute water quality concentrations for a baseline scenario and potential future control scenarios, and to quantify the water quality benefits of potential future infrastructure projects. The baseline conditions represent the in-stream water quality conditions using the most recent and appropriate data to represent current watershed, tributary, and CSO loads, including the existing DELCORA combined sewer system configuration and operation. The water quality model was applied for the typical year hydrologic period of 1994-1996. This period was identified as being representative of longer-term hydrologic conditions, and includes one relatively dry year, a relatively wet year, and an average year (DELCORA, 2016b).

5.2 Relevant Water Quality Standards

Modeled POC concentrations were compared to the currently applicable and potential future water quality standards. The standards vary by POC and by stream segment, and are summarized in the table below (Table 5-1). The Upper Delaware River and the tidal zones of Chester and Ridley Creek currently have secondary contact WQS whereas the Lower Delaware River currently has primary contact WQS for bacteria. The boundary between the Upper and Lower Delaware River occurs at river mile 81.8, which is just downstream of Chester Creek and CSO-11 (Figure 5-1). Generally, the modeling work indicated that the *enterococcus* standards are the most stringent (relative to current concentrations) among the three POCs.

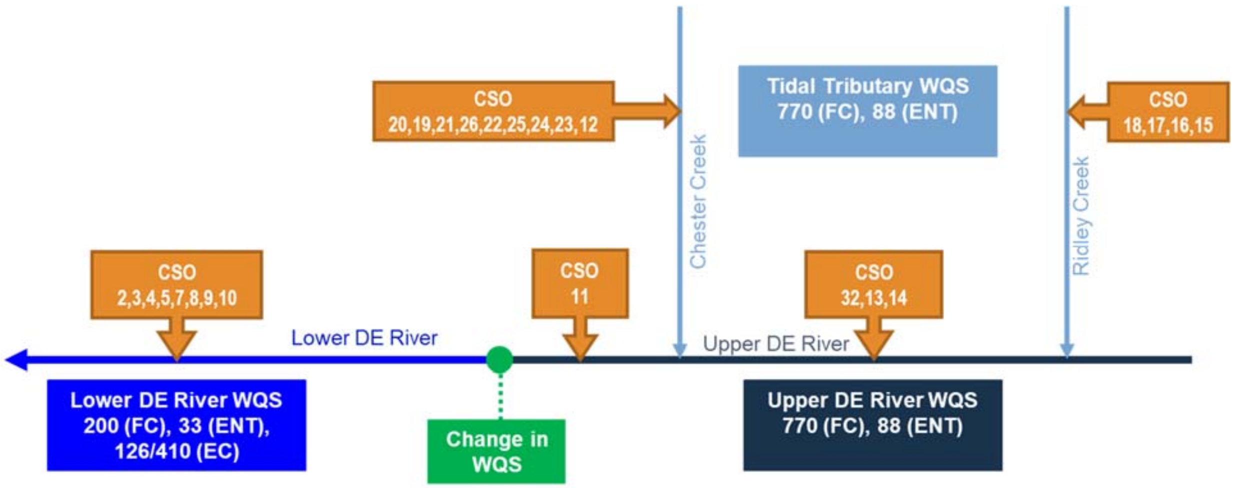
Table 5-1: Water Quality Thresholds for Comparisons with Model Results

Segment	*Enterococcus* (#/100 mL)	Fecal Coliform (#/100 mL)	*E.coli*[1] (#/100 mL)
Upper Delaware River and Tidal Zones of Creeks	Monthly Geomean: 88 #/100 mL	Monthly Geomean: 770 #/100 mL	n/a
Lower Delaware River	Monthly Geomean: 33 #/100 mL	Monthly Geomean: 200 #/100 mL	Monthly Geomean: 126 #/100 mL Statistical Threshold Value: 410 #/100 mL

1. *E.coli* (EC) standards likely to be codified by PADEP 12-24 months from July 2017. These criteria would apply to the non-tidal tributaries and Delaware River below R.M. 81.8, during recreational months only (May 1 - September 30).

E.coli standards similar to the Lower Delaware River are also proposed for the non-tidal tributaries, which are located upstream of DELCORA's CSO discharges. Outfall CSO-033 is located in the non-tidal portion of Ridley Creek, but this outfall does not appear to overflow during the typical year period. CSO-033 will be evaluated in the LTCP but, as a practical matter, it does not cause or contribute to WQS being exceeded.

Figure 5-1: Schematic of Applicable POC Water Quality Standards

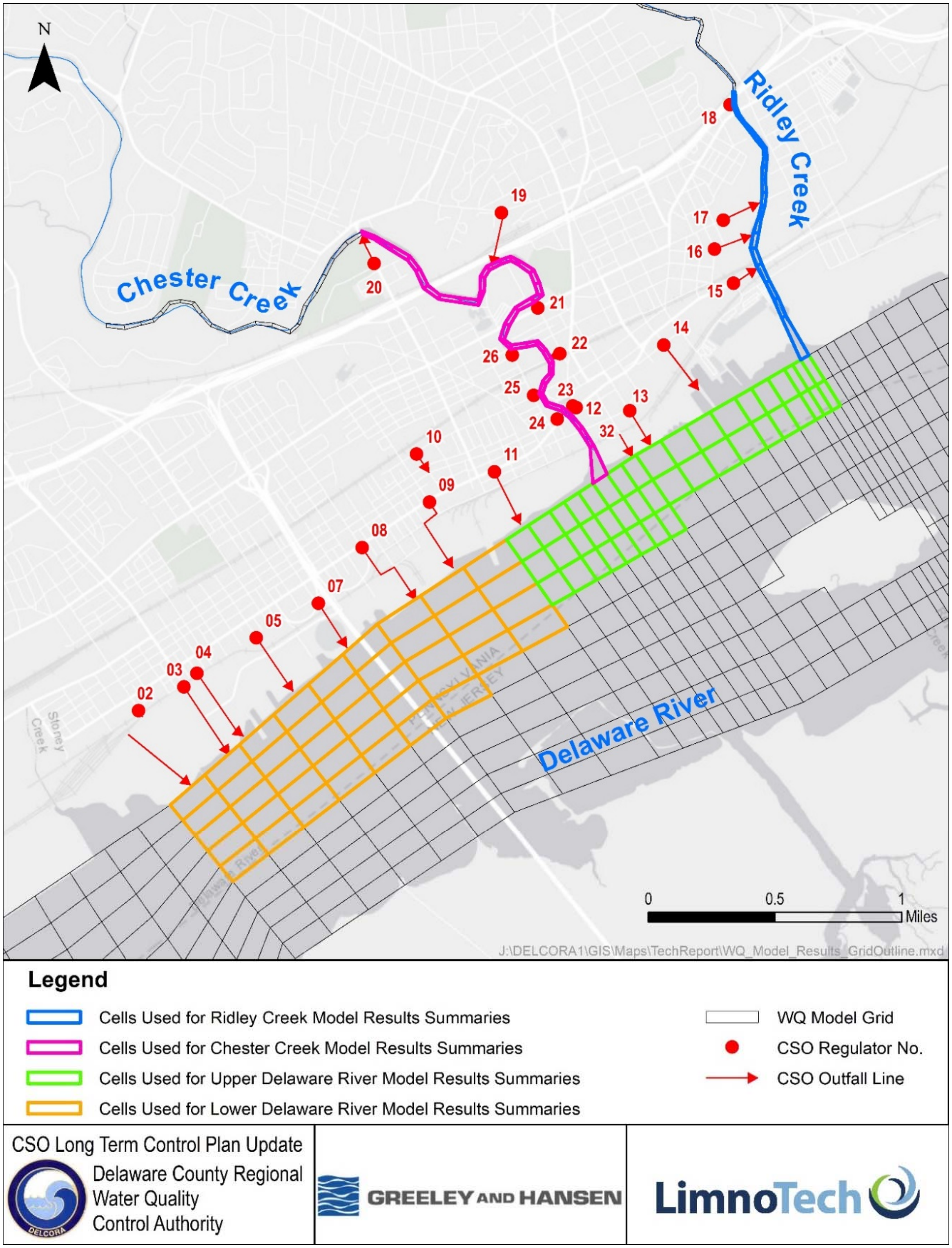


The model has been configured to separately track the in-stream concentration associated with background sources from the in-stream concentration associated with DELCORA sources (CSO and WWTP). This separate accounting will allow for background and non-background sources to be reduced independently from each other. Non-background sources include the DELCORA CSOs and DELCORA STP.

5.3 Typical year simulation results

Model results were summarized for comparison with the applicable water quality standards, which include monthly geometric mean (GM) and statistical threshold value (STV) standards. Model results were summarized over the stream reaches that receive CSO discharges, and that occur within Pennsylvania water as shown in Figure 5-2 below. Monthly geometric mean concentrations and exceedances of the STV standard are computed from hourly model output within each of the selected model grid cells. Model results for the typical year are presented in the sections below.

Figure 5-2: Model Grid Cells Used for Presenting Model Results



5.3.1 Ridley and Chester Creek Observations

Excursions above the *Enterococcus* monthly geomean water quality standards occur in the tidal zone of Ridley Creek almost every single month of the simulation period, and about one third of the time in Chester Creek. No excursions above the Fecal Coliform monthly geomean WQS are observed in either creek. The tidal zone of these creeks do not have a current or proposed *E.coli* WQS.

The excursions are largely due to background sources. As shown in Section 4.1.3, the water quality monitoring data shows that wet weather concentration at the most upstream monitoring locations (located upstream of CSO influence) in Chester Creek and Ridley Creek often exceed the monthly geometric mean and STV WQS concentration for the three POCs. DELCORA CSOs have a relatively smaller impact (less than 10%, on average) on monthly geometric mean concentrations than background sources, because they are intermittent discharges that are only active for short time periods within a monthly geometric mean evaluation period. The assimilative capacity of Ridley Creek is less than in Chester Creek due to its smaller stream flows, so DELCORA CSOs have a larger relative impact on in-stream water quality in Ridley Creek versus Chester Creek. Table 5-2 below shows the number of months where water quality standards are exceeded for each of the three POCs in the creeks. Results are shown for all sources (background and CSOs) and for CSO-only sources. This table shows that CSOs by themselves do not cause water quality violations in the Creeks and are not precluding the attainment of WQS.

5.3.2 Delaware River Observations

Occasional (less than 10%) excursions above the *Enterococcus* monthly geomean water quality standards occur in the Upper Delaware River within the DELCORA LTCPU focus area. No excursions above the Fecal Coliform monthly geomean WQS are observed for the Upper Delaware River. The Upper Delaware River does not have a current or proposed *E.coli* WQS.

Occasional (less than 10%) excursions above all three POC monthly geomean and STV water quality standards occur in the Lower Delaware River within the DELCORA LTCPU focus area. Excursions are somewhat more frequent in the Lower Delaware River than in the Upper Delaware due to the significantly lower water quality standard in the Lower Delaware. Background concentrations near DELCORA are similar in both zones because upstream background sources have a large influence on concentrations in both the upper and lower segments. DELCORA CSOs have a greater impact on the Lower Delaware zone than the Upper Delaware zone because more CSO volume discharges to the Lower Delaware. However, the DELCORA contribution to monthly geometric mean concentrations is generally low (less than 7%, on average) relative to background sources. As shown in Section 4.1.3, the water quality monitoring data shows that wet weather exceedances are observed in the most upstream monitoring location for the Delaware River (DR-01).

Table 5-2 shows the number of months where water quality standards are exceeded for each of the three POCs in the Upper and Lower Delaware River. Results are shown for all sources (background and CSOs) and for CSO-only sources. This tables shows that CSOs by themselves do not cause water quality violations in the upper or lower Delaware River and are not precluding the attainment of WQS.

Table 5-2: Number of Months Exceeding the Monthly Geomean Water Quality Standard

	Enterococcus *Monthly Geomean*	Fecal Coliform *Monthly Geomean*	*E.coli*[1] *Monthly Geomean*	*E.coli*[1] *STV*
Ridley Creek				
All Sources	35/36	27/36	n/a	n/a
CSO only	0/36	0/36	n/a	n/a
Chester Creek				
All Sources	14/36	0/36	n/a	n/a
CSO only	0/36	0/36	n/a	n/a
Upper Delaware				
All Sources	2/36	0/36	n/a	n/a
CSO only	0/36	0/36	n/a	n/a
Lower Delaware				
All Sources	5/36	2/36	2/36	12/36
CSO only	0/36	0/36	0/36	0/36

1. No *E.coli* standard currently exists or has been proposed for the tidal portions of Ridley and Chester Creeks or for the upper Delaware River, therefore results for these segments are marked as "n/a" in this table.

5.4 Intended Application of the Water Quality Model

The water quality model is deemed adequate to evaluate compliance with the WQS and the degree to which DELCORA CSOs contribute to non-attainment of WQS. The water quality model will be used to help assess the water quality benefits of potential infrastructure projects considered for the LTCPU (i.e.: CSO alternative scenarios). These CSO alternatives will be simulated by the DELCORA hydrologic and hydraulic (H&H) model (i.e. CSS model) and then evaluated with the receiving water quality model. Resulting changes to in-stream POC concentrations will be compared to the applicable water quality standards as well as to the concentrations observed under the baseline conditions. Water quality model output will be used to summarize the predicted reduction to in-stream POC concentrations.

Two major observations can be made from the water quality modeling application results. One is that background sources dominate the modeled POC concentrations (and by extension, DELCORA CSO loads are small compared to background loads), and the second is that the

DELCORA CSOs by themselves do not cause non-attainment, or preclude the attainment, of WQS. Moreover, the modeling results show that regardless of additional CSO controls, even complete separation, water quality standards would still be exceeded under current conditions because background sources typically prevent compliance with WQS. The modeling results are supported by the water quality data results from the wet weather sampling program, which shows that wet weather concentrations at the most upstream monitoring locations (located upstream of CSO influence) in Chester Creek and Ridley Creek (and to a lesser extent in the Delaware River) often exceed the monthly geometric mean and STV WQS concentration for the three POCs. These monitoring and modeling data taken together indicate the upstream bacteria loads result in a practical impossibility of meeting Water Quality standards in the tidal waters through CSO control. While the Consent Decree addresses the issue of background sources by requiring CSO controls to also be assessed assuming that background sources are reduced to 75% of the applicable WQS, it is not clear that imposing CSO controls under these conditions is reasonable given that there is no current plan for reducing background loads in Chester and Ridley Creeks. The CSO Policy states that "*where WQS and designated uses are not met in part because of natural background conditions or pollution sources other than CSOs, a total maximum daily load, including a wasteload allocation and a load allocation, or other means should be used to apportion pollutant loads*". Such apportionment of loads does not currently exist for Ridley and Chester Creeks for bacteria.

As stated previously, the intended use of the water quality modeling framework is to evaluate CSO control alternatives with respect to applicable water quality standards and demonstrate that alternatives selected for the LTCPU program will meet the water quality-based requirements of the Clean Water Act and Consent Decree. The water quality model is adequate to assess presumption levels of control to show that the CSOs after controls are in place do or do not preclude the attainment of water quality standards. The model framework could also be used to assess the demonstration approach, however, as explained in this report, the modeling shows that CSOs alone do not cause WQS violation and do not preclude the attainment of WQS, and background loads are currently causing WQS violations upstream of the CSOs and the CSO influence. Without a State plan for estimating the cost and practicality for controlling the background load upstream of DELCORA's CSO area, it is difficult to justify the demonstration approach.

As such, DELCORA will utilize the presumption approach, which is shown in this report to be reasonable in light of the data and analysis as called for in the National CSO Policy.

5.4.1 Interpretation of Section 19.b.iv of the Consent Decree

The typical year simulation results show that background sources prevent compliance with the applicable water quality results during some months, and the CSOs are not precluding the attainment of WQS. DELCORA's consent decree requires that if DELCORA uses the demonstration approach and background sources prevent compliance with water quality standards, then DELCORA must also run its water quality model assuming that background sources have been controlled to 75% of the applicable water quality standards (EPA, 2015). More specifically, section 19.b.iv of the DELCORA Consent Decree states that "*If background sources currently prevent compliance with the water quality standards, DELCORA shall also assess the impact of each size of the CSO controls assuming background pollutant levels are reduced such that in-stream concentrations upstream of the CSO Outfalls are no more than seventy-five (75) percent of the applicable water quality standard.*"

"*Background sources*" are generally understood to be the sources that would not be controlled through the LTCPU, and includes watershed sources of intermittent POCs (e.g. from washoff of POCs from wildlife and pets due to rainfall) as well as continuous sources (e.g. failing septic tanks, etc.), and CSOs from other communities. In other words, background sources are all sources accounted for in the model except for DELCORA CSOs and the DELCORA WWTP. Based on our interpretation of this consent decree language, we could reduce background sources to 75% of the water quality standard during months when there is an excursion above the water quality standard and background sources exceed 75% of the water quality standard.

The Consent Decree states that simulations be conducted with background sources set to seventy-five percent of the water quality standards "*upstream of the CSO outfalls*". However the water quality standard upstream of the outfalls (i.e. in the Upper Delaware) is higher than the standard in the Lower Delaware. So if background sources are reduced to seventy-five percent of the Upper Delaware standard, then the Lower Delaware background concentration would still exceed the Lower Delaware standard (i.e. 75% of the *Enterococcus* Upper Delaware River WQS is 66 #/100ml, which is higher than the Lower Delaware River WQS of 33#/100ml).

The assumed intent of this Consent Decree requirement is to provide some assimilative capacity in the river such that the water quality benefits of potential DELCORA LTCPU infrastructure projects can be more readily identified. With that understanding, the proposed approach to reducing background sources is to separately evaluate CSO controls in the Lower and Upper Delaware zones. First, background sources would be controlled to 75% of the Upper Delaware and Tidal Tributary standard, and control scenarios would be evaluated for CSOs discharging directly to the Upper Delaware and to Chester and Ridley Creeks (which discharge to the Upper Delaware). Second, background sources would be controlled to 75% of the Lower Delaware standard, which would require a larger reduction in background sources, and control scenarios would be evaluated for CSOs discharging directly to the Lower Delaware.

The model has been configured to separately track the in-stream concentration associated with background sources from the in-stream concentration associated with DELCORA sources (CSO and WWTP). This separate accounting will allow for background sources to be reduced independently from non-background sources. Using the time series output from the model, the background sources will be scaled back in the tributaries and in the Upper Delaware River to 75% of the Tidal Tributaries & Upper Delaware River WQS using scaling factors that are specific to each water segment and each month such that background sources are at 75% of the applicable water quality standard for months when non-compliance can be demonstrated.

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APPENDIX A
Bathymetry Survey of Ridley and Chester Creeks

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Memorandum

From:	Cullen O'Brien, LimnoTech	**Date:**	4/30/2017
		Project:	DELCORA
To:	Carrie Turner, LimnoTech Anouk Savineau, Limnotech	**CC:**	Click here to enter text.

SUBJECT: Bathymetric Survey of Chester and Ridley Creeks

This memo summaries field work activities conducted by LimnoTech the week of March 27, 2017. An elevation (bathymetric) survey was completed in support of water quality model development on the lower portions of Chester and Ridley Creeks. The creeks are located in the city of Chester, Pennsylvania and are tidally influenced tributaries to the Delaware River. The field crew was made up of LimnoTech employees Cullen O'Brien and Robert Betz.

Survey methods consisted of acquiring cross sectional bank and bed elevation data. Reaches surveyed included the lower 2.75 miles of Chester Creek and 3.25 miles of Ridley Creek to their discharge into the Delaware River. The most upstream transect location corresponds to the most upstream water quality sampling location included in the 2017 wet and dry weather monitoring program conducted by Weston, Greeley and Hansen, and LimnoTech. Transects were collected on ¼-mile interval spacing. Access to the creeks on the upper portions, generally greater than 1 mile upstream, was by wading where the bottom was shallow and firm. The portions below 1 mile were too deep and soft to be accessed on foot and a john boat with tagline was utilized.

Survey position and elevation was collected using Real Time Kinematic-Global Positioning System RTK-GPS techniques. This technique utilizes satellite positioning with real-time corrections for accurate georeferencing spatial locations and reference information to convert measured depths to elevations. GPS equipment consisted of a Trimble GeoXH centimeter edition with external Hurricane antenna. Real-time position corrections were accessed through cellular connection with the Pennsylvania Virtual Reference Station (VRS) network, ensuring high accuracy position data. Each creek cross section was surveyed at approximately five locations across the bed, water surface, bank toe, and bank top. Access to the entire upland bank at transect locations was not always possible; so the closest points safely accessed to the bank toe were surveyed. Elevation measurements collected from the boat were completed by marking the location at the water surface and subsequently measuring the water depth.

Quality control for horizontal and vertical position was verified with a local National Geodetic Survey (NGS) benchmark. A benchmark is an established survey monument with a known lateral and longitudinal (X, Y) position and elevation (Z) position that is stable. An approximate error estimate of +/- 0.5 feet in the vertical and less than 0.5 feet for horizontal position was observed at some transects, but the majority of locations surveyed were considerably more accurate. The observed errors are due to applying GPS technology in a challenging environment with overhead obstructions such as tree cover, buildings, and local thunderstorms that can dilute or interfere with the GPS signal.

The map below (Figure 1) shows the transect locations where elevation measurements were collected.

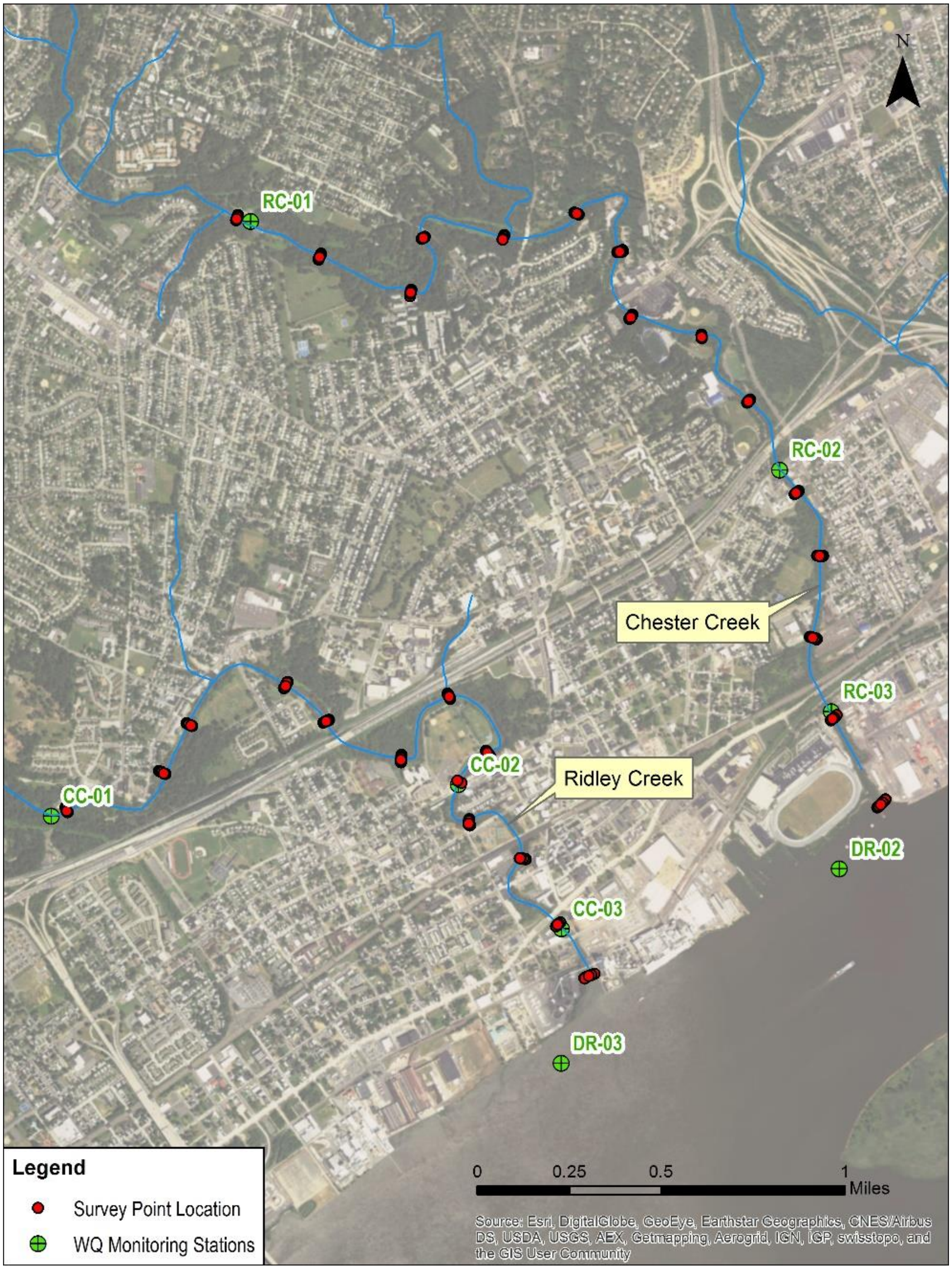

Figure 1: Locations of Creek Elevation Measurements in Chester and Ridley Creeks

Elevation measurements from this survey were compared with similar elevation data from a 1977 Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS) of the creeks (FEMA, 2015). Though the FEMA study was completed several decades ago, it serves as a useful check on the accuracy and sufficiency of the bathymetric survey data. Figures 1 and 2 compare the LimnoTech survey data with the FEMA data.

A few characteristics of these figures are relevant to the water quality modeling of the creeks. In Chester Creek, the LimnoTech bed elevations are substantially higher (about five to ten feet) than FEMA elevations. Higher contemporary creek elevations influence both the degree of tidal exchange in the lower reaches of the creeks, and travel times of upland runoff and base flow to the Delaware River.

To check for potential bias in the LimnoTech measurements, the LimnoTech measurements of water surface elevation were compared to similar data maintained by NOAA at a nearby tide gage (Philadelphia gage, #8545240). These measurements of water surface elevation agreed well (within two inches) which is a strong indication that the LimnoTech creek bed elevations are not biased high.

Higher creek bed elevations near the Chester Creek mouth are an indication that soft sediments have accumulated there since the 1970s. The highest observed peak flow in Chester Creek occurred a few years before the FEMA survey (in 1971, peak flow of 21,000 cfs) while recent peak flows have been significantly lower (average peak flow of 4,000 cfs in the last ten years) (USGS, 2017). Lower contemporary peak flows may have allowed for the accumulation of soft sediments in the lower reaches of Chester Creek.

Another significant observation from the LimnoTech data is that a pipe crossing near river mile 1.0 in Chester Creek created a high point in the creek bed profile. This high point acts to slightly reduce upstream water currents during lower flow conditions. This would tend to lengthen travel times of bacteria.

In Ridley Creek the LimnoTech data show a more constant bed slope between river miles 2.0 and 3.5 than the FEMA data. This is because low head dams existed in the 1970s near river miles 2.0 and 3.0, but are no longer in place. These dams previously acted to accumulate sediments in their shallow upstream pools, but when the dams were no longer present these accumulated sediments were likely washed away downstream.

These comparisons between the LimnoTech survey data, the historical FEMA data, and the NOAA tide gage, show consistency and provide confidence in the data collected. These comparison also help to identify locations where the creek bed has changed in the last several decades in ways that would influence creek hydraulics and pollutant transport.

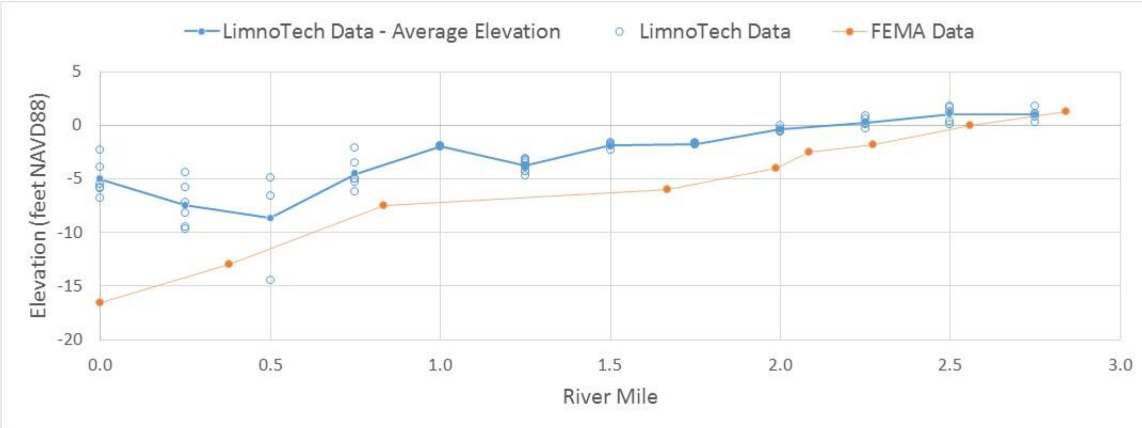

Figure 2: Comparison of Chester Creek bed elevation measurements

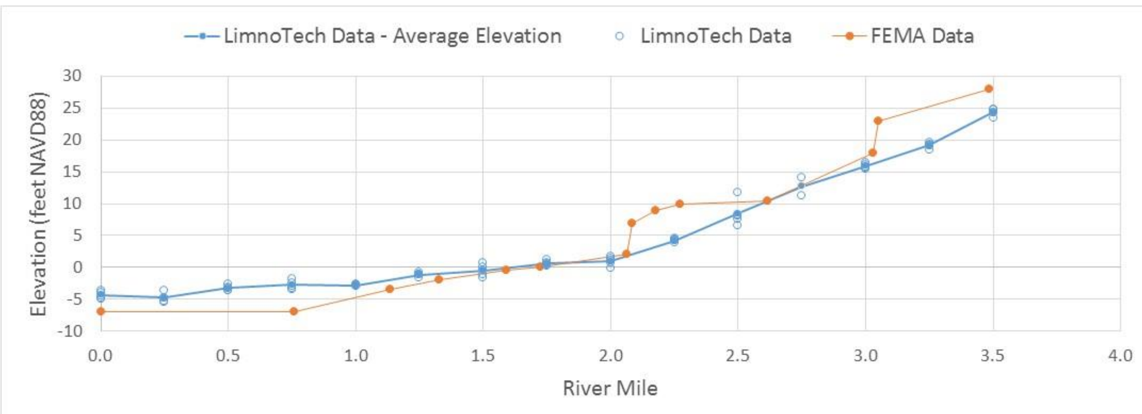

Figure 3: Comparison of Ridley Creek bed elevation measurements

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USGS, 2017. Peak Streamflow for Pennsylvania: USGS 01477000 Chester Creek near Chester, PA. Website accessed on April 25, 2017 at: https://nwis.waterdata.usgs.gov/pa/nwis/peak/?site_no=01477000&agency_cd=USGS

APPENDIX B
DELCORA Water Quality Sampling Report

Delaware County Regional Water Quality Control Authority (DELCORA)
CSO Long Term Control Plan Update

Water Quality Sampling Report

October 2017

GREELEY AND HANSEN

REVISION CONTROL

REV. NO.	DATE ISSUED	PREPARED BY	DESCRIPTION OF CHANGES

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Appendices

* Chain of Custody Forms and Complete Lab Results for **Appendices A-F** and the Sampling Analysis Plan (SAP) for **Appendix L** are provided in digital form only on CD attached to this report.

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Section 1 Introduction

1.1 Background of DELCORA's Facilities

Delaware County Regional Water Quality Control Authority (DELCORA) is responsible for the collection, transmission, treatment and disposal of approximately 65 million gallons per day (MGD) of wastewater generated in southeastern Pennsylvania. DELCORA's facilities serve residential, commercial, institutional, and industrial customers in Delaware County. DELCORA owns and operates an extensive system of pump stations, force mains, and sewers that provide the core infrastructure for the transmission of wastewater to treatment facilities in Delaware County and the City of Philadelphia as shown diagrammatically in Figure 1-1. The total service area served by DELCORA, as shown on Figure 1-2, is approximately 82,977 acres which illustrates that DELCORA serves a significant and widespread portion of Delaware County.

The combined sewer area simulated in DELCORA's existing Hydrologic and Hydraulic model is located within the City of Chester and consists of a drainage area of approximately 1,510 acres. It comprises approximately half of Chester City's serviced area. To support the service area, DELCORA owns and operates over 129 miles of separate and combined sewers. Included in the 129 miles of sewers are 11.7 miles of an interceptor system; 3,209 manholes; and twenty-five (25) combined sewer regulated outfalls controlling storm overflows. The location of Chester City's service area is illustrated on Figure 1-2.

Historically, DELCORA has characterized its service areas as "Eastern" and "Western." The Western Service Area discharges to DELCORA's Western Regional Treatment Plant (WRTP). The Eastern Service Area discharges to the Philadelphia Water Department's Southwest Water Pollution Control Plant (PWDSWPCP). In 2002, DELCORA completed the installation of a force main that connects the Eastern Service Area's Central Delaware Pump Station (CDPS) to the Chester Force Main. This connection allows DELCORA to send flow from the CDPS to the WRTP. As such, dry weather flows and a portion of the wet weather flows (total flow less than 20 MGD) from the Central Delaware County Authority in the Eastern Service Area are discharged to the WRTP. Flows above 20 MGD are directed to the PWDSWPCP.

1.2 CSO and Receiving Water System Description

The Chester Combined Sewer Overflow (CSO) system contains 26 permitted outfalls and they discharge to three receiving water bodies: the Delaware River, Chester Creek, and Ridley Creek. However, there are only 25 CSO discharge locations, as CSO #010 discharges to the Delaware River through CSO #009. Figure 1-3 depicts the locations of CSO regulators and outfalls that are DELCORA's responsibility. Figure 1-3 also provides a sewer characterization and illustrates the breakdown of each outfall and how each drainage area has combined sewers and separate sewers. Figure 1-4 is a schematic of the Chester CSO system and shows the outfalls and the interceptors that are connected to each CSO.

1.3 NPDES Permit Requirements

There are a total of 26 combined sewer overflow outfalls listed with 25 discharge points (Outfall #009 and #010 both discharge at Outfall #009) in DELCORA's existing National Pollutant Discharge Elimination System (NPDES) Permit. Under its NPDES Permit No. PA0027103, issued and administered by the Pennsylvania Department of Environmental Protection (PADEP), DELCORA is authorized to discharge from the Western Regional Treatment Plant (Outfall #001), four storm water outfalls at the WRTP (028-031) and from 26 combined sewer overflow outfalls (#002-#026, #032, #033) that ultimately discharge to the Delaware River, Chester Creek and/or Ridley Creek.

Part C - Other Requirements, Section V - Combined Sewer Overflows of the NPDES Permit details DELCORA's responsibilities with respect to the CSO system including reporting, continued implementation of and continued compliance with the Nine Minimum Controls (NMC), and implementation of the existing Long-Term Control Plan (LTCP) dated April 1999 and the July 2008 addendum to the LTCP until the updated LTCP is approved.

1.4 Consent Decree Requirements

On August 17, 2015, a Consent Decree was lodged in the United States District Court for the Eastern District of Pennsylvania that requires DELCORA to complete and submit a revised and updated LTCP to the United States Environmental Protection Agency (USEPA or EPA) and the Pennsylvania Department of Environmental Protection (PADEP or DEP) for review and approval. Consent Decree Paragraph V.A.15 (Water Quality Model Plan) requires that within ninety (90) days after EPA reviews and approves the Alternatives Evaluation Approach, DELCORA shall submit to EPA and PADEP a Water Quality Model Plan for review and approval.

The Alternatives Evaluation Approach Report was approved by US EPA on October 13, 2016. The "Demonstration Approach" was selected for each CSO, receiving streams based on the methodology outlined in the Alternatives Evaluation Report.

1.5 Water Quality Sampling Program Purpose and Objectives

The "Demonstration Approach" requires that a Water Quality Model be developed for each receiving stream. The Water Quality Modeling effort will require calibration and validation of the model and therefore Water Quality Sampling is required. The Water Quality Sampling Program will gather data required for this effort. The three water bodies that receive overflows from DELCORA's CSS include the Delaware River, Chester Creek and Ridley Creek.

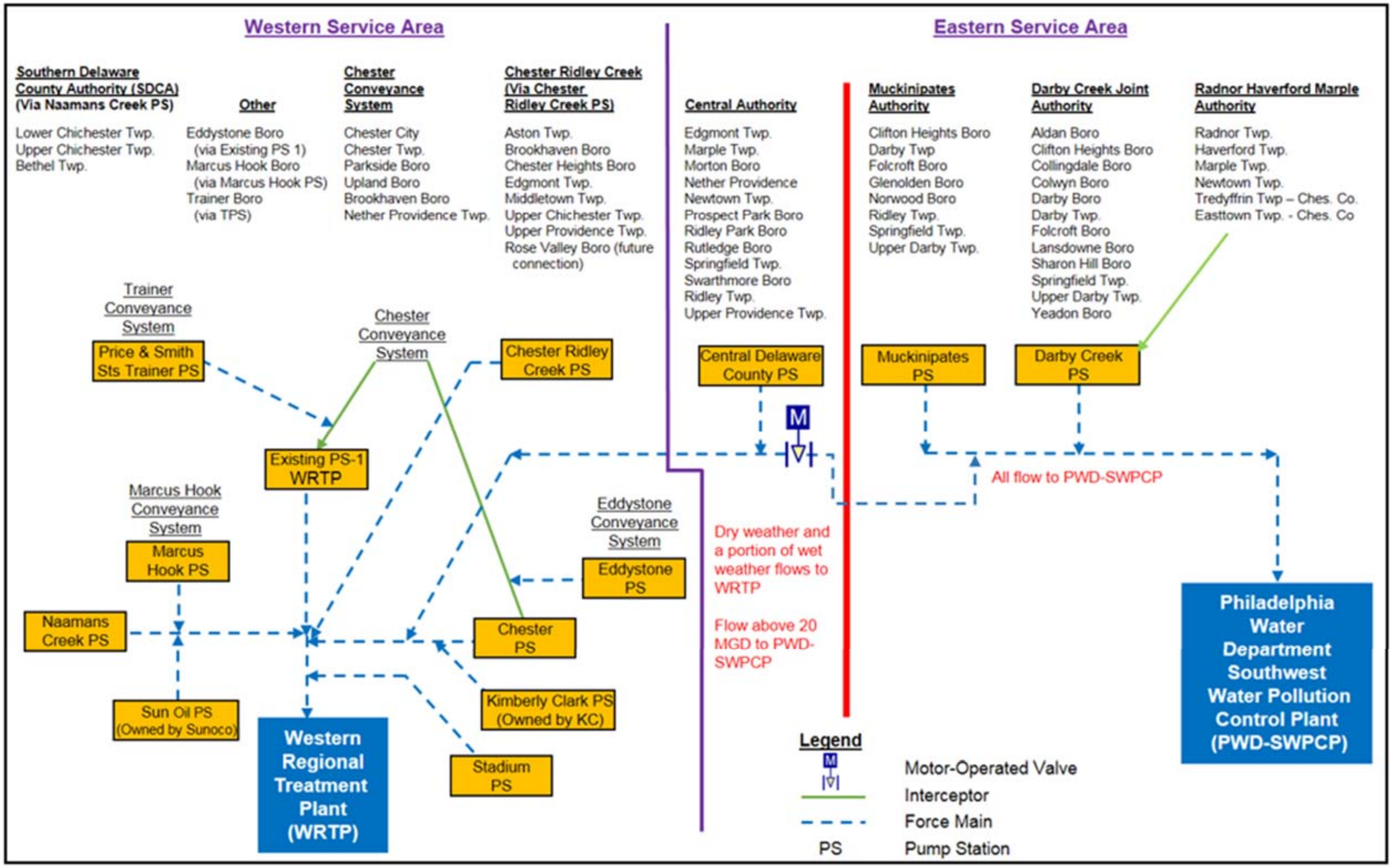
1.6 Water Quality Sampling Report Purpose and Objectives

The purpose and objective of the Water Quality Sampling Report is to provide a detailed description of the water quality sampling task undertaken to gather field data as required to build and calibrate the Water Quality Model in accordance with the Water Quality Monitoring and Modeling Work plan (Greeley and Hansen / Limnotech, Revised July 2017). The data gathered through sampling efforts on the Creeks, River, Combined Sewer Outfalls (CSO) and Stormwater (SW) locations has been analyzed and is discussed at length in this report. The report also provides a summary of the sampling activities for each

Dry and Wet weather sampling event along with laboratory testing results and in-situ field data collected on-site for each sampling event.

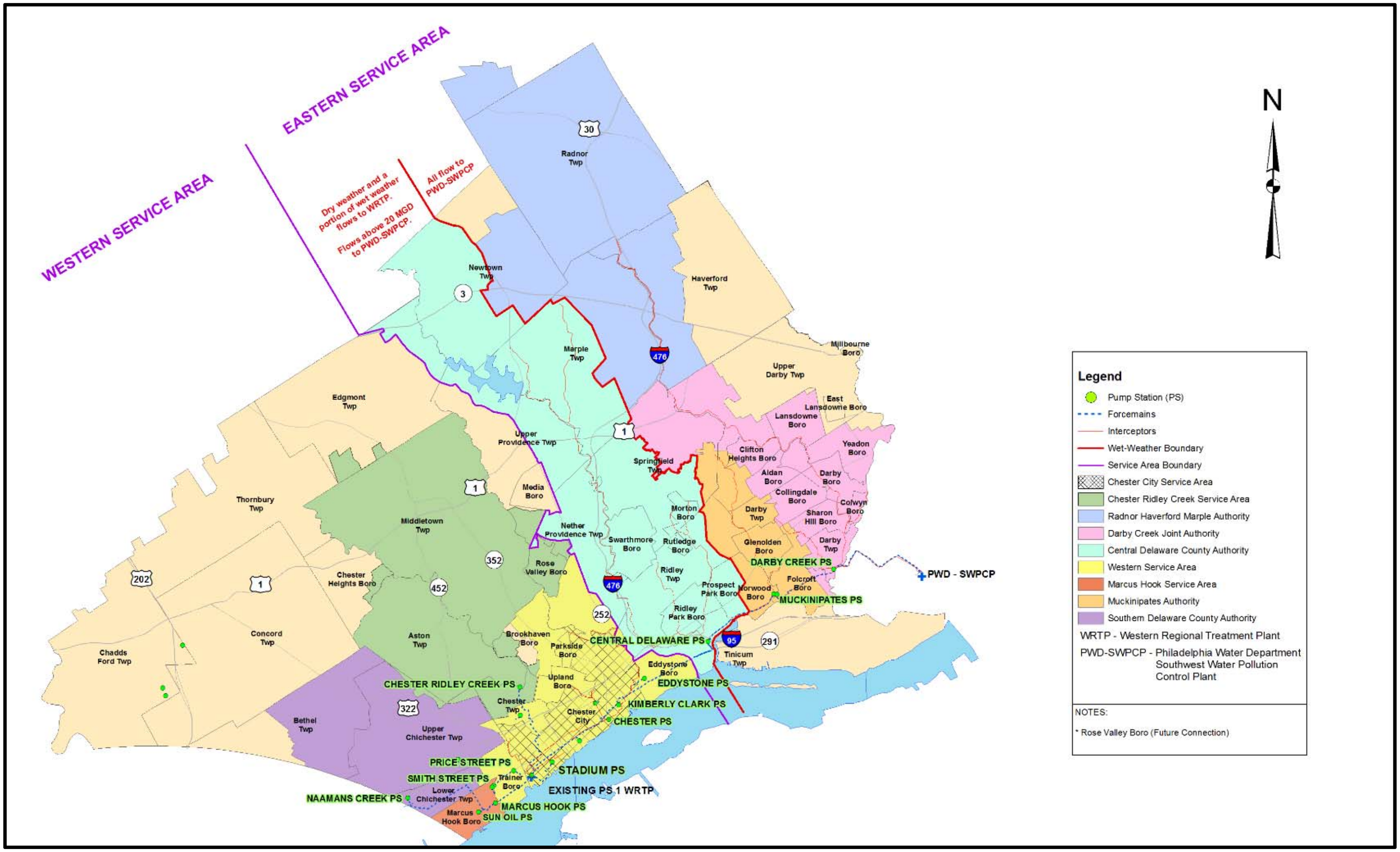
Delaware County Regional Water Quality Control Authority

Figure 1-1: DELCORA'S Conveyance Systems



Delaware County Regional Water Quality Control Authority

Figure 1-2: DELCORA's Service Area



Delaware County Regional Water Quality Control Authority

Figure 1-3: Location of Regulators and Combined Sewer Outfalls with Drainage Areas

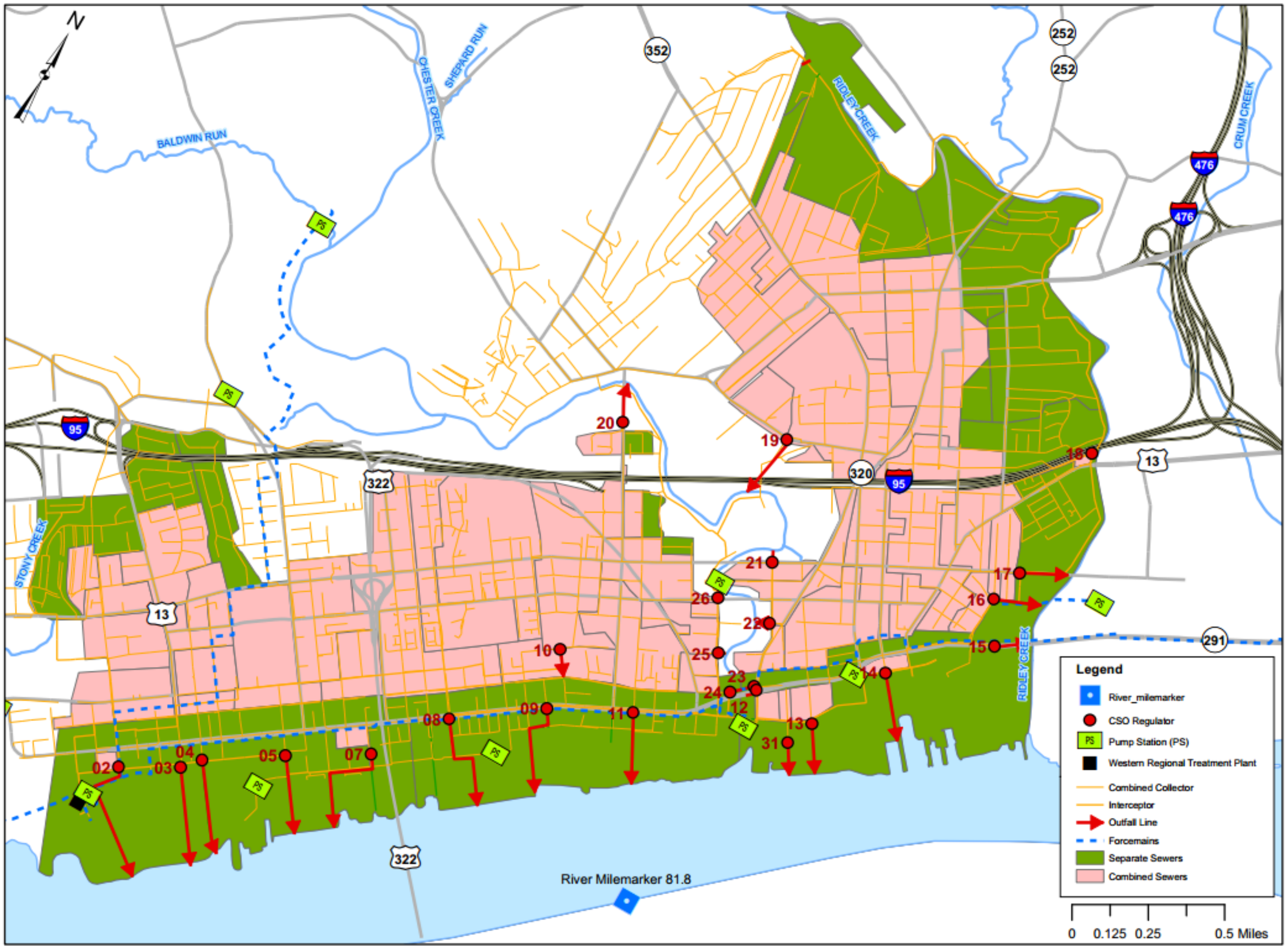
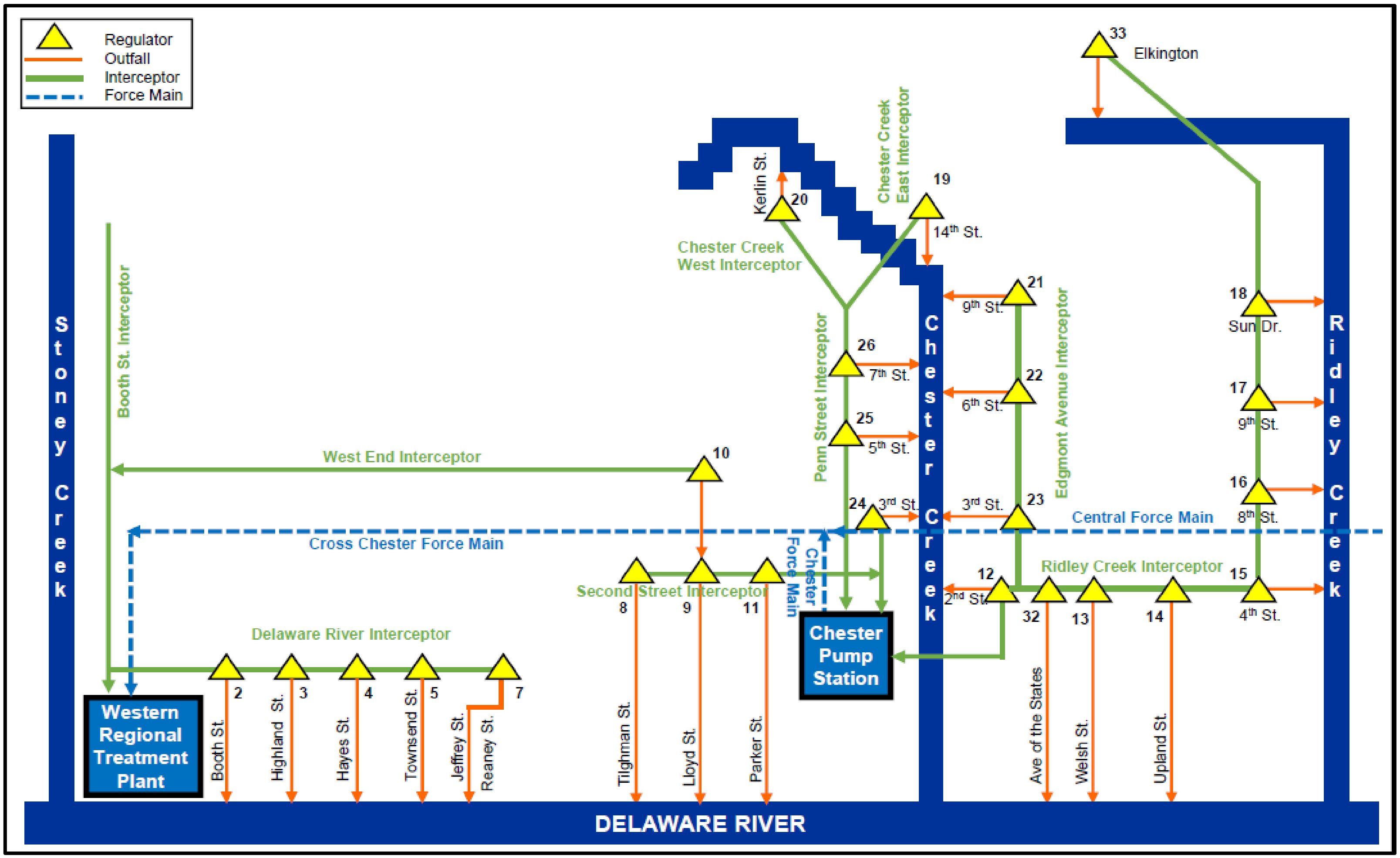


Figure 1-4: Schematic of Chester CSO System



Section 2 Sampling and Analysis Plan Overview

2.1 Existing Water Quality Monitoring Overview

The Water Quality Monitoring Program (WQMP) was designed to collect data that will be used to assess water quality concerns identified in the Delaware River watershed and its tributaries, Chester Creek and Ridley Creek, in the vicinity of Chester, PA. Pollutants of concern (POCs) are identified in the Identification of Sensitive Areas and Pollutants of Concern Report (Greeley and Hansen, 2016c) which was approved by US EPA on October 13, 2016. Table 2-1 below lists the POCs that were identified which exceeded the maximum water quality standards (WQS) in the receiving streams and were approved for further investigation through water quality monitoring and modelling. The POCs are Fecal coliform, *E. coli*, and *Enterococcus* and are the primary focus of the WQMP. Figure 2-1 shows the water quality standards in the receiving streams.

Table 2-1: List of Pollutants of Concern (POC)

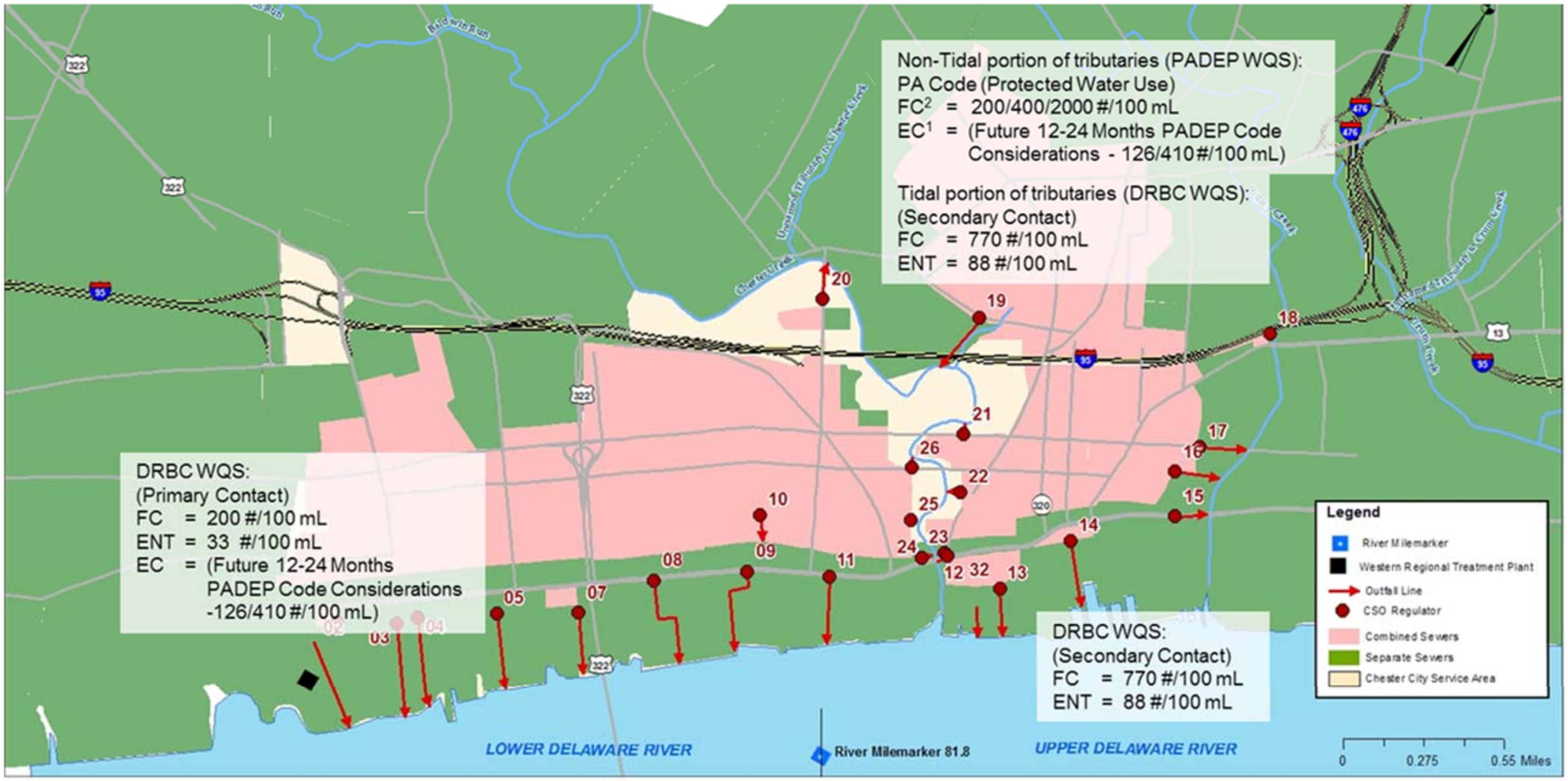
No.	Upper Delaware River		Lower Delaware River		Chester Creek		Ridley Creek	
Pollutants of Concern (>10% of observed samples exceed WQS)								
1	Fecal Coliform[(b)]	100%	Fecal Coliform[(b)]	100%	Fecal Coliform[(a),(b)]	100%	Fecal Coliform[(a),(b)]	100%
2	Enterococcus [(b),(c)]	100%	Enterococcus [(b),(c)]	100%	Enterococcus [(b),(c)]	100%	Enterococcus [(b),(c)]	100%
3	E. coli[(c)]	100%	E. coli[(c)]	100%	E. coli[(c)]	100%	E. coli[(c)]	100%

(a) Based on historical sampling conducted in 2010 upstream and downstream of CSO outfalls only on Chester and Ridley Creeks.

(b) Fecal Coliform and Enterococcus are listed as POCs due to both being parameters typically associated with CSOs.

(c) DRBC regulations are available for Enterococcus and it is typically associated with CSOs and therefore it is included as a POC. However, in consultation with PADEP Enterococcus could be replaced with E. coli bacteria in the future (based on the anticipation that national standards on E. coli will be adopted in Pennsylvania) and therefore E.coli is also included as a POC.

Figure 2-1: Water Quality Standards in the Receiving Streams



[1] E.coli (EC) standards likely to be codified by PADEP 12-24 months from July 2017. These criteria would apply to the non-tidal tributaries and Delaware River below R.H. 81.8, during recreational months only (May 1 - September 30). First value is a geometric mean standard, second is a statistical threshold value (STV) standard (no more than 10% of concentrations can be above this value).

[2] First value is a geometric mean standard, second is a statistical threshold value (STV) standard (no more than 10% of concentrations can be above this value), third value is a non-recreational season standard (October 1 - April 31).

2.2 Sampling and Analysis Plan Overview

Water quality sampling was undertaken at thirteen (13) in-stream locations (seven of which are Delaware River sampling locations), four (4) CSO locations in the DELCORA combined sewer system area, and two (2) stormwater locations in the City of Chester municipal separate storm sewer system, as shown in Figure 2-1. Water quality sampling was conducted as follows:

- Eleven (11) in-stream locations in the vicinity of the DELCORA CSO area were sampled for water quality for (3) dry weather events; one of which was targeted for collection during a tributary low-flow period (less than 25th percentile flow). The mid-stream and far-shore Delaware River locations were not sampled during the dry weather surveys because the water quality in the river is found to be relatively uniform laterally due to the lack of active sources during dry weather. These dry weather events were distributed across the sampling season, which was from March through June of 2017. Grab samples and *in situ* measurements were collected at each location during each event.
- All thirteen (13) in-stream locations were sampled for water quality using grab samples and *in situ* monitoring for three (3) discrete wet weather events, according to the surface water quality monitoring program protocols described in the Water Quality Monitoring and Modeling Work Plan (Greeley and Hansen / Limnotech, Revised July 2017);
- Up to four (4) CSO and two (2) stormwater outfall locations were sampled for water quality for the same three (3) discrete wet weather events according to the outfall monitoring program protocols described in the Water Quality Monitoring and Modeling Work Plan (Greeley and Hansen / Limnotech, Revised July 2017). Samples for all outfalls were collected as grab samples.

The sampling events were planned and distributed across the sampling season, which was from March through June 2017.

2.3 Sampling Locations

Sampling locations were selected to characterize the watershed at a sub-watershed level, recognizing various political and hydrologic features, land uses and potential pollutant sources. Site selection and analytical parameters are designed to characterize stormwater outfalls, CSOs, tributaries upstream and within the Chester CSO discharge area, and the main stem of the Delaware River in the project area. The sampling locations are shown in Figure 2-2.

Tables 2-2, 2-3 and 2-4 include summaries of the rationales for each sampling location selected. The Chester Creek and Ridley Creek locations were selected to distinguish, to the extent possible, between upstream, stormwater and Chester CSO pollutant loads. The Delaware River sampling locations provided a characterization of water quality entering the Chester CSO area from either tidal direction as well as water quality within the CSO discharge area. During wet weather, three samples were collected across the transect corresponding to the DR-03 sampling location during each sampling round, when sampling across the river was feasible, to characterize lateral variability in the Delaware River during storm events.

The CSO sampling locations were selected based on their outfall discharge location, relatively high frequency of overflow, their overflow volume, and their accessibility. The stormwater sampling locations

Figure 2-2: Receiving Water, Combined Sewer (CSO), and Stormwater (SW) Sampling Locations

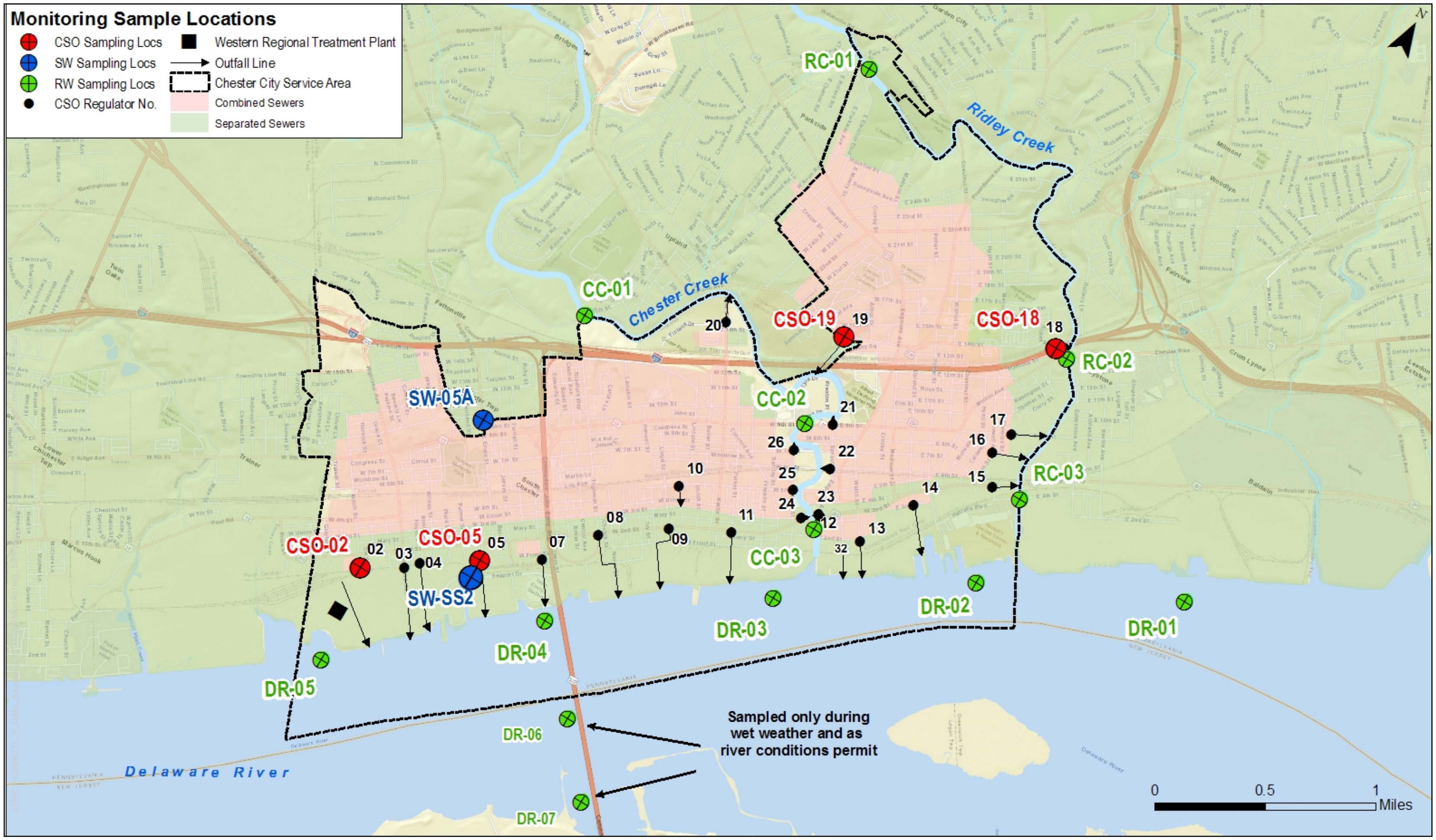


Table 2-2: Tributary Receiving Water Sampling Locations

Station ID	Latitude[1]	Longitude[1]	Receiving Water	Type	Description	Rationale
CC-01	39.850122	-75.386348	Chester Creek	Tributary	Chester Creek at Upland-Incinerator Rd.	Upstream of all City sources and upstream of tidal influence
CC-02	39.850709	-75.365530	Chester Creek	Tributary	Chester Creek at the 9th St Bridge; 54 W 9th St	Characterize impacts from non-CSO urban runoff sources
CC-03	39.845227	-75.360284	Chester Creek	Tributary	Chester Creek at E 2nd St., William Penn's Landing Park	Characterize impacts from all CSOs discharging to Chester Creek
RC-01	39.873264	-75.375183	Ridley Creek	Tributary	Ridley Creek at Chester Park Drive Bridge; 298 East Elkington Blvd	Upstream of all City sources and upstream of tidal influence
RC-02	39.863016	-75.348686	Ridley Creek	Tributary	Ridley Creek at Morton Ave. Bridge; 1300 Sun Drive	Characterize impacts from non-CSO urban runoff sources
RC-03	39.853435	-75.346350	Ridley Creek	Tributary	Ridley Creek at East 4th St. (Harrah's) Bridge	Characterize impacts from all CSOs discharging to Ridley Creek

Notes:
[1] GPS Coordinates, WGS 1984

Table 2-3: Main Stem Receiving Water Sampling Locations

Station ID	Latitude[1]	Longitude[1]	Receiving Water	Type	Description	Rationale
DR-01	39.85282	-75.3299	Delaware River	Main stem	Delaware River between Ridley Creek and Crum Creek	"Upstream" of DELCORA's CSO discharges[2]
DR-02	39.84715	-75.3462	Delaware River	Main stem	Delaware River between CSO-14 and Ridley Creek	Characterize Ridley Creek impacts on Delaware River, in the upper Delaware River (Secondary contact area)
DR-03	39.8398	-75.3606	Delaware River	Main stem	Delaware River between CSO-11 and Chester Creek	Characterize Chester Creek impacts on Delaware River, in the upper Delaware River (Secondary contact area)
DR-04	39.83132	-75.3766	Delaware River	Main stem	Delaware River at the boat launch off Highway 322	Priority area, in the lower Delaware River (Primary contact area)
DR-05	39.82182	-75.3917	Delaware River	Main stem	Delaware River between CSO-002 and Stony Creek	"Downstream" of DELCORA's CSO discharges[2], in the Atlantic sturgeon sensitive area
DR-06[3]	39.82636	-75.371	Delaware River	Main stem	Delaware River mid-stream along the transect of DR-04	Characterize lateral variability in the Delaware River during storm events
DR-07[3]	39.82203	-75.3665	Delaware River	Main stem	Delaware River far shore (left descending bank) along the transect of DR-04	Characterize lateral variability in the Delaware River during storm events

Notes:
[1] GPS Coordinates, WGS 1984
[2] "Upstream" and "downstream" subject to tidal conditions at time of sampling
[3] These locations will be sampled during the wet weather events only, when river conditions permit. POC concentrations are assumed to be laterally well-mixed during dry weather due to the absence of significant pollutant sources.

Table 2-4: CSO and Stormwater Sampling Locations

Station ID	Latitude[1]	Longitude[1]	Receiving Water	Type	Description	Rationale
CSO-19	39.857132	-75.366105	Chester Creek	CSO	14th and Crozer Hospital; 1 Medical Center Blvd	Discharges to Chester Creek, one of the largest volume CSOs in DELCORA system
CSO-05	39.832598	-75.383958	Delaware River	CSO	Front and Townsend; 101 Townsend St	Discharges to Delaware River, one of the largest volume CSOs in DELCORA system
CSO-02	39.828334	-75.392570	Delaware River	CSO	Front and Booth; 100 Booth St	Aggregates cumulative effect of CS conditions, one of the largest volume CSOs in DELCORA system
CSO-18	39.863501	-75.349203	Ridley Creek	CSO	Sun Drive and Hancock St.; 1310 Sun Dr	Discharges to Ridley Creek
SW-05A	39.838501	-75.387708	Chester Creek	SW	7th and Engle Street; by tennis courts	Characterize runoff quality from predominantly residential area representative of the residential portion of the study area
SW-SS2	39.832853	-75.384193	Delaware River	SW	Front and Townsend; 105 Townsend St	Characterize runoff quality from predominantly commercial/industrial area representative of the commercial/industrial portion of the study area

Notes:
[1] GPS Coordinates, WGS 1984

were selected to characterize the water quality associated with the predominant land uses (residential and commercial/industrial) in the study area. Each stormwater sampling location is in an area that is representative of the land use elsewhere in the City's stormwater area.

2.4 Analytical Parameters

All of the in-stream dry and wet weather samples was analyzed for the parameters shown in Table 2-5. The outfall samples was analyzed for *E. coli*, *Enterococcus* and Fecal coliform.

Table 2-5: Analytical and Field Parameters

Parameter	Description	Sampling Program	Type of Measurement
E. coli	Escherichia coli	Dry, Wet	Grab
Enterococcus	Enterococcus sp.	Dry, Wet	Grab
Fecal coliform	Fecal coliform	Dry, Wet	Grab
Temp	Water temperature	Dry, Wet, Receiving Water Only	In-situ
Cond	Conductivity	Dry, Wet, Receiving Water Only	In-situ
Salinity	Salinity	Dry, Wet, Receiving Water Only	In-situ

2.5 Sampling Schedule

2.5.1 Dry Weather Sampling

Collection of water quality samples was performed for three (3) dry weather events; with one dry weather sampling event collected during a low-flow period (less than 25th percentile flow) in Chester Creek and Ridley Creek.

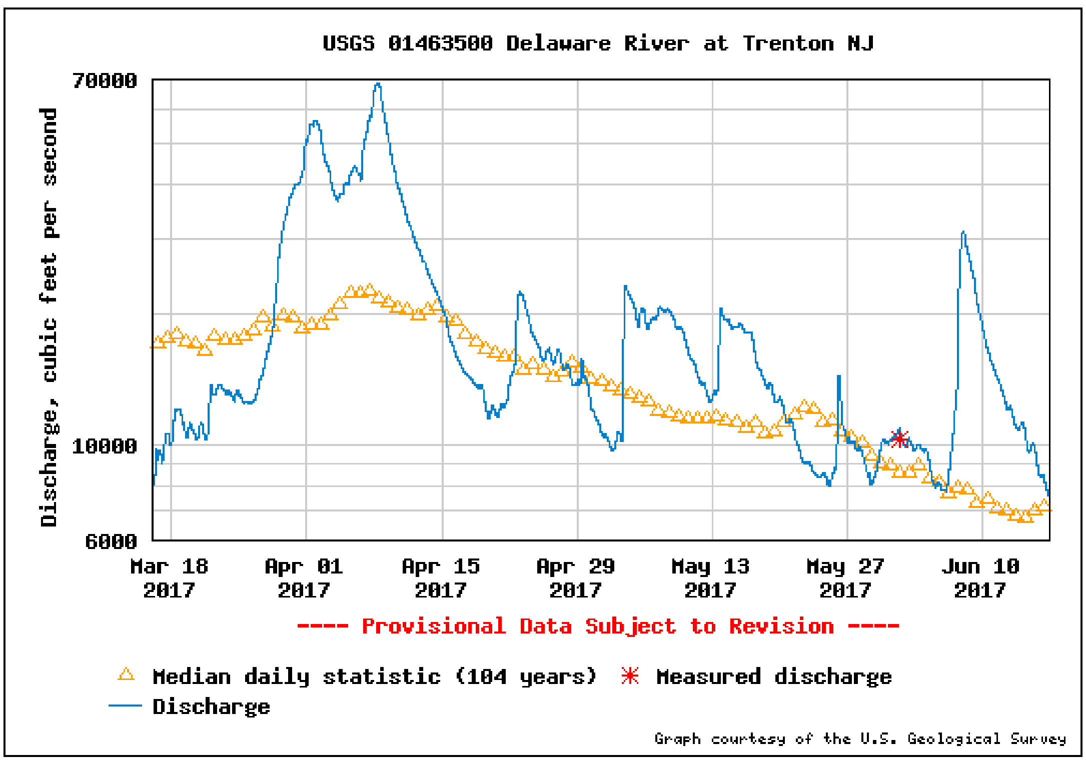
The values and statistics in Tables 2-6 and 2-7 were obtained from the United States Geological Survey (USGS). The USGS StreamStats (https://streamstats.usgs.gov/ss/) website provided the 25th percentile for the period of record for each water body and the National Water Information System (NWIS) provided current flow data. For each Dry Weather Event, the flow listed was reported as the average for the time of the sampling event calculated from 15-minute recorded observations not the average daily flow.

Table 2-6: Gage Information

Water Body	Gage Identification	Gage Description	Latitude	Longitude	Period of Record	StreamStats Weblink	NWIS Weblink
Delaware River	USGS 01463500	Delaware River at Trenton, NJ	40°13'18"	-74°46'41"	1912-2015	https://streamstatsags.cr.usgs.gov/gagepages/html/01463500.htm	https://nwis.waterdata.usgs.gov/nwis/inventory/?site_no=01463500
Chester Creek	USGS 01477000	Chester Creek near Chester, PA	39°52'08"	-75°24'31"	1931-2015	https://streamstatsags.cr.usgs.gov/gagepages/html/01477000.htm	https://nwis.waterdata.usgs.gov/nwis/inventory/?site_no=01477000
Ridley Creek	USGS 01476480	Ridley Creek at Media, PA	39°54'58"	-75°24'13"	1986-2015	https://streamstatsags.cr.usgs.gov/gagepages/html/01476480.htm	https://nwis.waterdata.usgs.gov/nwis/inventory/?site_no=01476480

A graph of the stream flow for each gage over the duration of the sampling program is shown below in Figures 2.3 - 2.5. The percentile for the streamflow during each event was interpolated from the statistical data provided on the StreamStats page.

Figure 2-3: Delaware River Flow, USGS Gage at Trenton, NJ



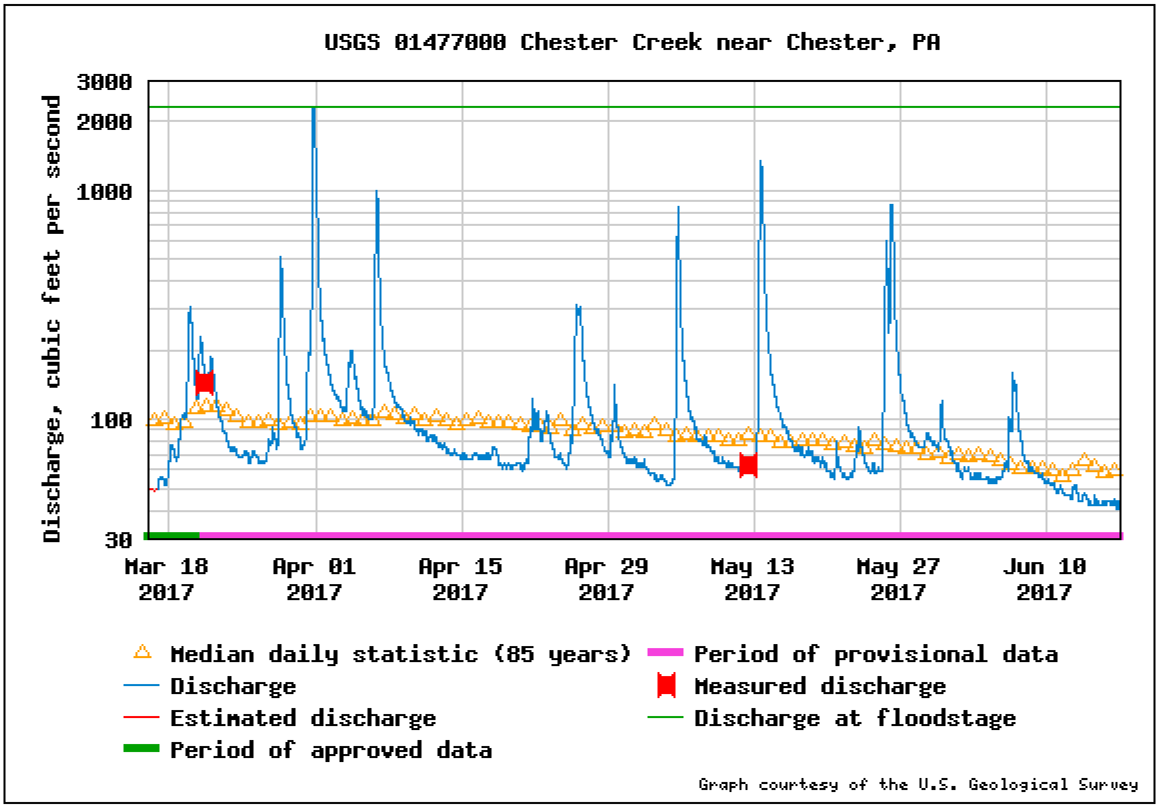
https://nwis.waterdata.usgs.gov/nwisweb/graph?agency_cd=USGS&site_no=01463500&parm_cd=00060&begin_date=2017-03-16&end_date=2017-06-16

Table 2-7: Receiving Waters 25th Percentile Flow

Water Body	Gage Identification	Gage Description	25th Percentile Flow	Dry Weather Event 1 Average Flow		Dry Weather Event 2 Average Flow		Dry Weather Event 3 Average Flow	
			(cfs)	(cfs)	Percentile	(cfs)	Percentile	(cfs)	Percentile
Delaware River	USGS 01463500	Delaware River at Trenton, NJ	4,600	13,323	70.1	16,306	78.1	10,862	62.1
Chester Creek	USGS 01477000	Chester Creek near Chester, PA	41	75.7	60.5	63.9	50.7	46.8	32.2
Ridley Creek	USGS 01476480	Ridley Creek at Media, PA	18	29.4	49	25.0	41.7	19.0	27.5

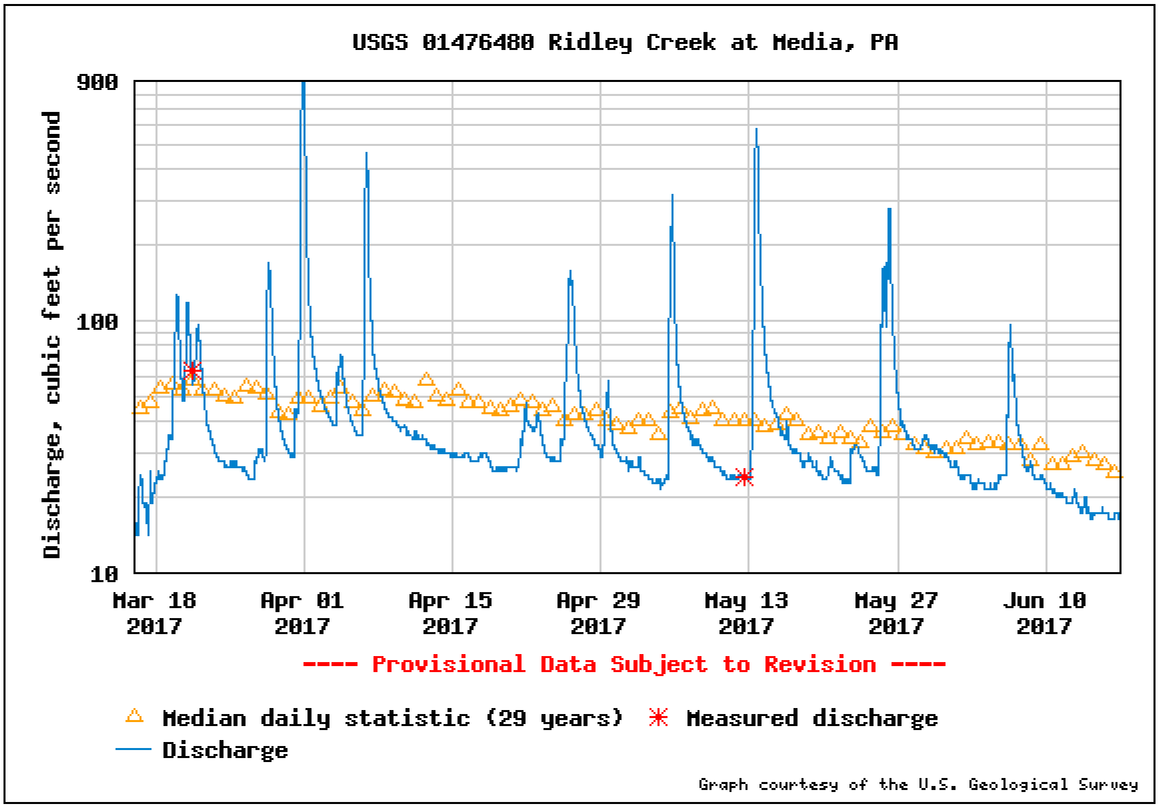
Source:
-25th percentile flow (cfs) and percentile for each water body is courtesy of the U.S. Geological Survey (USGS) StreamStats (https://streamstats.usgs.gov/ss/)
-Observed flow data (cfs) for each Dry Weather Event is courtesy of the following current/historical observations link on the National Water Information System (NWIS) webpage:
Delaware River: https://nwis.waterdata.usgs.gov/nwis/inventory/?site_no=01463500
Chester Creek: https://nwis.waterdata.usgs.gov/nwis/inventory/?site_no=01477000
Ridley Creek: https://nwis.waterdata.usgs.gov/nwis/inventory/?site_no=01476480

Figure 2-4: Chester Creek Flow, USGS Gage near Chester, PA



https://nwis.waterdata.usgs.gov/nwisweb/graph?agency_cd=USGS&site_no=01477000&parm_cd=00060&begin_date=2017-03-16&end_date=2017-06-16

Figure 2-5: Ridley Creek Flow, USGS Gage at Media, PA



https://nwis.waterdata.usgs.gov/nwisweb/graph?agency_cd=USGS&site_no=01476480&parm_cd=00060&begin_date=2017-03-16&end_date=2017-06-16

Two rounds of sampling were conducted for each dry weather survey: one round was completed during ebb (outgoing) tide and the second round was completed during flood (incoming) tide.

Dry weather event samples were taken at eleven (11) locations:

- **Three (3) locations on Chester Creek** that characterizes water quality upstream of DELCORA's service area as well as in the portion of the creek adjacent to DELCORA's CSO discharges and the area adjacent to the City of Chester outside the combined sewer service area. Additionally, because DELCORA's CSO discharges are within the tidal extent of the Delaware Bay, the downstream sampling locations used reflect these tidal influences on water quality.
- **Three (3) locations on Ridley Creek** that characterizes water quality upstream of DELCORA's service area as well as in the portion of the creek adjacent to DELCORA's CSO discharges and the area adjacent to the City of Chester outside the combined sewer service area. Additionally, because DELCORA's CSO discharges are within the tidal extent of the Delaware Bay, the downstream sampling locations used reflect these tidal influences on water quality.
- **Five (5) locations on the Delaware River** that characterizes water quality in the vicinity of DELCORA's CSO discharges. Sampling locations used are selected to separate to the extent possible the effect of DELCORA's CSOs on water quality from other sources contributing pollutants to the waterways. Sampling was conducted near the shoreline adjacent to the City of Chester

The locations of these stations are shown in Figure 2-1. Details for the parameters for which the samples were analyzed is provided in Table 2-5. In-situ measurements of physical parameters, such as salinity, temperature, and conductivity were collected at each sampling location with a YSI sonde. In the Delaware River, *in situ* measurements were collected at three depths at each sampling location during each round of sampling.

2.5.2 Wet Weather Sampling

Collection of water quality samples were performed for three (3) wet weather events. The purpose of the wet weather sampling was to characterize the impact of CSO discharges and non-CSO source runoff on in-stream water quality. The wet weather events spanned a range of precipitation, flow and seasonal conditions.

Wet weather event samples were taken at all 13 in-stream locations as well as at up to six source locations in the intervals described below:

- **Six (6) In-Stream Tributary Sampling Locations:** Three (3) locations were on Chester Creek and three (3) locations on Ridley Creek. The locations were the same locations used for the dry weather surveys. Tributary locations were sampled up to five times per event at the following approximate intervals: Hour 0.5-2.5, Hour 4.5-6.5, Hour 8.5-10.5, Hour 14.5-16.5, and Hour 22-24. Sampling intervals were defined by the start of rainfall rather than CSO or SSO activation. A total of 30 samples were collected during each wet weather sampling event from in-stream locations. One field blank and one field duplicate were collected during each event to be used as field quality control (QC).

- **Up to Seven (7) In-Stream Delaware River Locations:** Up to seven locations were on the Delaware River and were sampled up to ten times per event at the following approximate intervals: Hour 0, Hour 2, Hour 4, Hour 6, Hour 9, Hour 12, Hour 15, Hour 18, Hour 21, and Hour 24. Sampling intervals were defined by the start of rainfall rather than CSO or SSO activation. The frequency of sampling was intended to capture in-stream impacts in the vicinity of DELCORA's service area from both DELCORA's CSOs as well as upstream sources. Two additional locations on the Delaware River, one at mid-stream and one near the far shore, were added to characterize lateral variability in water quality during storm event conditions, when sampling across the river is feasible. The sampling regimen was also designed to allow a semi-quantitative mass balance to be computed over a complete tidal cycle. When the river conditions were unsafe for sampling (e.g. small craft advisories, heavy barge traffic, etc.), sampling was suspended for one or more locations and/or sampling rounds. One field blank and one field duplicate were collected during each event to be used as field QC. Final selection of sampling locations and sampling intervals were determined prior to the start of the sampling program and were based on logistic considerations (e.g. can seven locations be sampled and dropped off to a courier within the 3 hour sampling window), safety and accessibility to the Delaware River, and available resources.
- **Up to Six (6) Outfall Locations:** Sampling was be conducted at up to two (2) stormwater outfalls and up to four (4) combined sewer overflow outfalls. The CSO and stormwater sampling locations were finalized prior to the initiation of the sampling program based on accessibility of sampling, safety of sampling personnel, equipment risk, and available resources. It was assumed that each of the outfall locations will have up to eight sets of samples collected for each event at the following intervals: 1st flush, 30 minutes, and 60 minutes, 2 hours, 4 hours, 8 hours, 12 hours, 24 hours. If a location was found to be not flowing, no sample was collected. One field blank and one field duplicate were collected during each event to be used as field QC.

The locations of these stations are shown in Figure 2-2. The set of parameters for which the samples will be analyzed are summarized in Table 2-4. *In-situ* measurements was not collected at the outfall locations.

Sampling crews conducted all wet weather event sampling using the protocols described in the Water Quality Monitoring and Modeling Quality Assurance Project Plan (Greeley and Hansen / Limnotech, Revised July 2017). Crews were required to keep a City of Chester Map with sampling locations clearly marked as well as a letter from DELCORA permitting the crews access to manholes, shorelines, outfalls, and surface waters (see Appendix J). Samples were delivered to the laboratory where the samples were analyzed for the laboratory parameters identified in Table 2-5.

Determination to mobilize for a Wet Weather Event was a collaborative effort between Greeley and Hansen, LimnoTech, the field sampling contractor and the laboratory contractor personnel. The intent was to identify a 4 to 6 hour window in which a wet weather event that commenced 24 hours in advance to assist in mobilization of the sampling crews.

Section 3 Dry and Wet Weather Sampling Activities

3.1 Dry Weather Sampling Event 1

Dry Weather Sampling Event-1 occurred on March 23, 2017. See Table 2-7 for receiving water flows and percentiles based on USGS gages.

3.1.1 Activity on Creeks

Sampling was conducted on Chester Creek (CC) and Ridley Creek (RC). On this date, the observed daily average flows for Chester Creek and Ridley Creek were 75.7 cfs and 29.4 cfs, respectively, at the locations indicated in Table 2-7.

3.1.1.1 Sample Type and Locations

Grab samples were collected from the following locations on the Creeks:

- Three (3) on Chester Creek - CC-01, CC-02, CC-03
- Three (3) on Ridley Creek - RC-01, RC-02, RC-03

A single in-situ measurement was collected at every location and sampling round.

See Figure 2-2 for map of sampling locations. See Appendix K for sampling photos.

3.1.1.2 Sampling Round and Sampling Time

An incoming tide and outgoing tide sample was collected at each of the three Chester Creek and three Ridley Creek locations described above along with the required Field Blanks and Duplicates. Field Blanks were collected at the first sampling location for each event regardless of tide condition. Samples from the downstream end of the creeks were collected first to capture the outgoing tide at the earliest. The samples on creeks were collected in the following order for each sampling round - CC-03, RC-03, RC-02, RC-01, CC-02 and CC-01. The number and type of samples collected from the Creeks for Dry Event 1 are shown in Appendix A - Dry Weather Event 1 - Field Logs and Lab Results Summary.

The sampling event started on March 23, 2017 at 1:00 PM and ended at 7:30 PM. The sampling times were selected so that they were in between the high tide and low tide time data. The outgoing tide samples were collected first followed by the incoming tide later in the evening. The tide data for that date showed a range of high tide to low tide from 9:15 AM to 4:22 PM and a range of low tide to high tide from 4:22 PM to 9: 54 PM. The sample collection times from the Creeks for Dry Weather Event 1 are shown in Appendix A - Dry Weather Event 1 - Field Logs and Lab Results Summary.

See Appendix G for Sample collection matrix.

3.1.1.3 Field Observation and Sample Management

The grab samples were collected as per the requirements of the Sampling and Analysis Plan (SAP) (Weston Solutions, Inc., March 2017) using appropriate equipment and protective gear. The samples were preserved immediately on ice for transfer to laboratory for further analysis. The hold time for all the Dry Weather Event 1 samples on the creeks was held within the recommended time for lab analysis. While collecting the samples the field observations were noted to indicate any specific weather, water body, site, and sample conditions. In-situ field measurements were taken using a YSI Model 556 with a 6920 V2 sonde. The sonde was used and decontaminated using DI water at every sampling location. The field observations and in-situ field measurements including water salinity readings, temperature and conductivity are shown in Appendix A - Dry Weather Event 1 - Field Logs and Lab Results Summary.

The samples were handed over the laboratory for analysis with their respective Chain of Custody Forms. The Chain of Custody Forms included details on the sample IDs, type of sample and release of samples. Copies of Dry Weather Event 1 Chain of Custody Forms are shown in Appendix A - Dry Weather Event 1 - Field Logs and Lab Results Summary.

3.1.2 Activity on Delaware River

Sampling was conducted on Delaware River (DR) with 5 locations on the Pennsylvania side of the river. On this date, the observed daily average flow for the Delaware River was 13,323 cfs at the location indicated in Table 2-7.

3.1.2.1 Sample Type and Locations

Grab samples were collected from the following locations on the Delaware River:

- Five (5) on Delaware River – DR-01, DR-02, DR-03, DR-04, DR-05

A single in-situ measurement was collected at every location at surface, mid and near bottom depths.

See Figure 2-2 for map of sampling locations.

3.1.2.2 Sampling Round and Sampling Time

There was an incoming tide and outgoing tide sample collected at each of the five Delaware River locations along with the required Field Blanks and Duplicates. The samples on the river were collected in the following order for each sampling round - DR-01, DR-02, DR-03, DR-04 and DR-05. The number and type of samples collected from the river for Dry Weather Event 1 are shown in Appendix A - Dry Weather Event 1 - Field Logs and Lab Results Summary.

The sampling event started on March 23, 2017 at 12:55 PM and ended at around 6:30 PM. The sampling times were selected so that they were in between the high tide and low tide time data. The outgoing tide samples were collected first followed by the incoming tide later in the afternoon/evening. The tide data for that date showed a range of high tide to low tide from 9:15 AM to 4:22 PM and a range of low tide to high tide from 4:22 PM to 9:54 PM. The sample collection times from the Creeks for Dry Weather Event 1 are shown in Appendix A - Dry Weather Event 1 - Field Logs and Lab Results Summary.

See Appendix G for Sample collection matrix.

3.1.2.3 Field Observation and Sample Management

The grab sample was collected as per the requirements of the Sampling and Analysis Plan (SAP) using appropriate equipment and protective gear. The samples were preserved immediately on ice for transfer to laboratory for further analysis. The hold time for all the Dry Weather Event 1 samples on the creeks was held within the recommended time for lab analysis. While collecting the samples the field observations were noted to indicate any specific weather, water body, site and sample conditions. In-situ field measurements were taken using a YSI Model 556 with a 6920 V2 sonde at surface, mid and near bottom depths of the river. The sonde was used and decontaminated using DI water at every sampling location. The field observations and in-situ field measurements including water salinity readings, temperature and conductivity are shown in Appendix A - Dry Weather Event 1- Field Logs and Lab Results Summary.

The samples were handed over the laboratory for analysis with their respective Chain of Custody Forms. The Chain of Custody Forms included details on the sample IDs, type of sample and release of samples. Copies of Dry Weather Event 1 Chain of Custody Forms are shown in Appendix A - Dry Weather Event 1 - Field Logs and Lab Results Summary.

3.2 Dry Weather Sampling Event 2

Dry Weather Sampling Event-2 occurred on 5/10/2017. See Table 2-7 for receiving water flows and percentiles based on USGS gages.

3.2.1 Activity on Creeks

Sampling was conducted on Chester Creek (CC) and Ridley Creek (RC). On this date, the observed daily average flows for Chester Creek and Ridley Creek were 63.9 cfs and 25.0 cfs respectively at the locations indicated in Table 2-7.

3.2.1.1 Sample Type and Locations

Grab samples were collected from the following locations on the Creeks:

- Three (3) on Chester Creek – CC-01, CC-02, CC-03
- Three (3) on Ridley Creek – RC-01, RC-02, RC-03

A single in-situ measurement was collected at every location and sampling round.

See Figure 2-2 for map of sampling locations.

3.2.1.2 Sampling Round and Sampling Time

An incoming tide and outgoing tide sample was collected at each of the three Chester Creek and three Ridley Creek locations described above along with the required Field Blanks and Duplicates. Field Blanks were collected at the first sampling location for each event regardless of tide condition. Samples from the downstream end of the creeks were collected first to capture the outgoing tide at the earliest. The samples on creeks were collected in the following order for each sampling round – CC-03, RC-03, RC-02, RC-01, CC-01 and CC-02. The number and type of samples collected from the Creeks for Dry Weather Event 2 are shown in Appendix B - Dry Weather Event 2 - Field Logs and Lab Results Summary.

The sampling event started on May 10, 2017 at 10:00 AM and ended at 5:45 PM. The sampling times were selected so that they were in between the high tide and low tide time data. The incoming tide samples were collected first followed by the outgoing tide later in the afternoon. The tide data for that date showed a range of low tide to high tide from 7:35 AM to 12:56 PM and a range of high tide to low tide from 12:56 PM to 7: 45 PM. The sample collection times from the Creeks for Dry Weather Event 2 are shown in Appendix B - Dry Weather Event 2 - Field Logs and Lab Results Summary.

See Appendix G for Sample Collection Matrix.

3.2.1.3 Field Observation and Sample Management

The grab samples were collected as per the requirements of the Sampling and Analysis Plan (SAP) using appropriate equipment and protective gear. The samples were preserved immediately on ice for transfer to laboratory for further analysis. The hold time for all the Dry Weather Event 2 samples on the creeks was held within the recommended time for lab analysis. While collecting the samples the field observations were noted to indicate any specific weather, water body, site and sample conditions. In-situ field measurements were taken using a YSI Model 556 with a 6920 V2 sonde. The sonde was used and decontaminated using DI water at every sampling location. The field observations and in-situ field measurements including water salinity readings, temperature and conductivity are shown in Appendix B - Dry Weather Event 2 - Field Logs and Lab Results Summary.

The samples were handed over the laboratory for analysis with their respective Chain of Custody Forms. The Chain of Custody Forms included details on the sample IDs, type of sample and release of samples. Copies of Dry Weather Event 2 Chain of Custody Forms are shown in Appendix B - Dry Weather Event 2 - Field Logs and Lab Results Summary.

3.2.2 Activity on Delaware River

Sampling was conducted on Delaware River (DR) with 5 locations on the Pennsylvania side of the river. On this date, the observed daily average flow for the Delaware River was 16,306 cfs at the location indicated in Table 2-7.

3.2.2.1 Sample Type and Locations

Grab samples were collected from the following locations on the Delaware River:

- Five (5) on Delaware River – DR-01, DR-02, DR-03, DR-04, DR-05

A single in-situ measurement was collected at every location at surface, mid and near bottom depths.

See Figure 2-2 for map of sampling locations.

3.2.2.2 Sampling Round and Sampling Time

There was an incoming tide and outgoing tide sample collected at each of the five Delaware River locations along with the required Field Blanks and Duplicates. The samples on river were collected in the following order for each sampling round - DR-01, DR-02, DR-03, DR-04 and DR-05. The number and type of samples collected from the river for Dry Weather Event 2 are shown in Appendix B - Dry Weather Event 2 - Field Logs and Lab Results Summary.

The sampling event started on May 10, 2017 at 10:00 AM and ended at 5:45 PM. The sampling times were selected so that they were in between the high tide and low tide time data. The incoming tide samples were collected first followed by the outgoing tide later in the afternoon. The tide data for that date showed a range of low tide to high tide from 7:35 AM to 12:56 PM and a range of high tide to low tide from 12:56 PM to 7: 45 PM. The sample collection times from the Creeks for Dry Weather Event 2 are shown in Appendix B - Dry Weather Event 2 - Field Logs and Lab Results Summary.

See Appendix G for Sample collection matrix.

3.2.2.3 Field Observation and Sample Management

The grab samples were collected as per the requirements of the Sampling and Analysis Plan (SAP) using appropriate equipment and protective gear. The samples were preserved immediately on ice for transfer to laboratory for further analysis. The hold time for all the Dry Weather Event 2 samples on the creeks was held within the recommended time for lab analysis. While collecting the samples the field observations were noted to indicate any specific weather, water body, site and sample conditions. In-situ field measurements were taken using a YSI Model 556 with a 6920 V2 sonde at surface, mid and near bottom depths of the river. The sonde was used and decontaminated using DI water at every sampling location. The field observations and in-situ field measurements including water salinity readings, temperature and conductivity are shown in Appendix B - Dry Weather Event 2 - Field Logs and Lab Results Summary.

The samples were handed over the laboratory for analysis with their respective Chain of Custody Forms. The Chain of Custody Forms included details on the sample IDs, type of sample and release of samples. Copies of the Dry Weather Event 2 Chain of Custody Forms are shown in Appendix B - Dry Weather Event 2 - Field Logs and Lab Results Summary.

3.3 Dry Weather Sampling Event 3

Dry Weather Sampling Event-3 occurred on 6/13/2017. See Table 2-7 for receiving water flows and percentiles based on USGS gages.

3.3.1 Activity on Creeks

Sampling was conducted on Chester Creek (CC) and Ridley Creek (RC). On this date, the observed flows for Chester Creek and Ridley Creek were 46.8 cfs and 19.0 cfs, respectively, at the locations indicated in Table 2-7.

3.3.1.1 Sample Type and Locations

Grab samples were collected from the following locations on the Creeks:

- Three (3) on Chester Creek – CC-01, CC-02, CC-03
- Three (3) on Ridley Creek – RC-01, RC-02, RC-03

A single in-situ measurement was collected at every location and sampling round.

See Figure 2-2 for map of sampling locations.

3.3.1.2 Sampling Round and Sampling Time

An incoming tide and outgoing tide sample was collected at each of the three Chester Creek and three Ridley Creek locations described above along with the required Field Blanks and Duplicates. Field Blanks were collected at the first sampling location for each event regardless of tide condition. Samples from the downstream end of the creeks were collected first to capture the outgoing tide at the earliest. The samples on creeks were collected in the following order for each sampling round - CC-03, RC-03, RC-02, RC-01, CC-01 and CC-02. The number and type of samples collected from the Creeks for Dry Weather Event -3 are shown in Appendix C - Dry Weather Event 3 - Field Logs and Lab Results Summary.

The sampling event started on June 13, 2017 at 12:50 AM and ended at 20:06 PM. The sampling times were selected so that they were in between the high tide and low tide time data. The incoming tide samples were collected first followed by the outgoing tide later in the evening. The tide data for that date showed a range of low tide to high tide from 10:33 AM to 3:42 PM and a range of high tide to low tide from 3:42 PM to 10:24 PM. The sample collection times from the Creeks for Dry Weather Event 3 are shown in Appendix C - Dry Weather Event 3 - Field Logs and Lab Results Summary.

See Appendix G for Sample collection matrix.

3.3.1.3 Field Observation and Sample Management

The grab samples were collected as per the requirements of the Sampling and Analysis Plan (SAP) using appropriate equipment and protective gear. The samples were preserved immediately on ice for transfer to laboratory for further analysis. The hold time for all the Dry Weather Event-3 samples on the creeks was held within the recommended time for lab analysis. While collecting the samples the field observations were noted to indicate any specific weather, water body, site and sample conditions. In-situ field measurements were taken using a YSI Model 556 with a 6920 V2 sonde. The sonde was used and decontaminated using DI water at every sampling location. The field observations and in-situ field measurements including water salinity readings, temperature and conductivity are shown in Appendix C - Dry Weather Event 3 - Field Logs and Lab Results Summary.

The samples were handed over the laboratory for analysis with their respective Chain of Custody Forms. The Chain of Custody Forms included details on the sample IDs, type of sample and release of samples. Copies of the Dry Weather Event 3 Chain of Custody Forms are shown in Appendix C - Dry Weather Event 3 - Field Logs and Lab Results Summary.

3.3.2 Activity on Delaware River

Sampling was conducted on Delaware River (DR) with 5 locations on the Pennsylvania side of the river. On this date, the observed flow for the Delaware River was 10,862 cfs at the location indicated in Table 2-7.

3.3.2.1 Sample Type and Locations

Grab samples were collected from the following locations on the Delaware River:

- Five (5) on Delaware River – DR-01, DR-02, DR-03, DR-04, DR-05

A single in-situ measurement was collected at every location at surface, mid and near bottom depths.

See Figure 2-2 for map of sampling locations.

3.3.2.2 Sampling Round and Sampling Time

There was an incoming tide and outgoing tide sample collected at each of the five Delaware River locations along with the required Field Blanks and Duplicates. The samples on river were collected in the following order for each sampling round - DR-01, DR-02, DR-03, DR-04 and DR-05. The number and type of samples collected from the river for Dry Weather Event 3 are shown in Appendix C - Dry Weather Event 3 - Field Logs and Lab Results Summary.

The sampling event started on June 13, 2017 at 12:50 PM and ended at 20:06 PM. The sampling times were selected so that they were in between the high tide and low tide time data. The incoming tide samples were collected first followed by the outgoing tide later in the evening. The tide data for that date showed a range of low tide to high tide from 10:33 AM to 3:42 PM and a range of high tide to low tide from 3:42 PM to 10:24 PM. The sample collection times from the Creeks for Dry Weather Event 3 are shown in Appendix C - Dry Weather Event 3 - Field Logs and Lab Results Summary.

3.3.2.3 Field Observation and Sample Management

The grab samples were collected as per the requirements of the Sampling and Analysis Plan (SAP) using appropriate equipment and protective gear. The samples were preserved immediately on ice for transfer to laboratory for further analysis. The hold time for all the Dry Weather Event-3 samples on the creeks was held within the recommended time for lab analysis. While collecting the samples the field observations were noted to indicate any specific weather, water body, site and sample conditions. In-situ field measurements were taken using a YSI Model 556 with a 6920 V2 sonde at surface, mid and near bottom depths of the river. The sonde was used and decontaminated using DI water at every sampling location. The field observations and in-situ field measurements including water salinity readings, temperature and conductivity are shown in Appendix C - Dry Weather Event 3 - Field Logs and Lab Results Summary.

The samples were handed over the laboratory for analysis with their respective Chain of Custody Forms. The Chain of Custody Forms included details on the sample IDs, type of sample and release of samples. Copies of the Dry Weather Event 3 Chain of Custody Forms are shown in Appendix C - Dry Weather Event 3 - Field Logs and Lab Results Summary.

3.4 Wet Weather Sampling Event 1

Wet Weather Sampling Event 1 occurred on 3/31/2017. See Table 2-7 and Figures 2-2 thru 2-4 for receiving water flows based on USGS gages.

3.4.1 Activity on Creeks

Sampling was conducted on Chester Creek (CC) and Ridley Creek (RC). The observed flows for Chester Creek were 79.1 cfs at the beginning of the sampling event, reached a peak flow of 2,260 cfs at 6:45PM, and was 1,330 cfs when the sampling event concluded. For Ridley Creek, flow was 28.8 cfs at the beginning of the sampling event, reached a peak flow of 898 cfs at 9:30PM, and was 790 cfs when the sampling event concluded. The flow gauge locations are shown on Figure 3-1 - Flow Gauge Locations.

3.4.1.1 Sample Type and Locations

Grab samples were collected from the following locations on the Creeks:

- Three (3) on Chester Creek – CC-01, CC-02, CC-03
- Three (3) on Ridley Creek – RC-01, RC-02, RC-03

A first grab sample collected on creek was during T=0 at the beginning for the rainfall event. Time T=0 for collection of the in-stream sample was initiated approximately 0.5 hours after the start of rainfall, or when 0.1 inches of rain had fallen or when CSO discharges start occurring (whichever occurs first). Significant rainfall began at 11:45 PM and sampling personnel were already in place to begin sampling within the first half hour. Accordingly, the first storm water sample was taken at location SW-SS2 at 11:50 PM and the first creek sample was collected on Chester Creek at CC-03 at midnight 0:00 hours. The sampling round intervals for all sampling locations are shown in the sampling collection matrix in Appendix G. See Figure 2-2 for map of sampling locations.

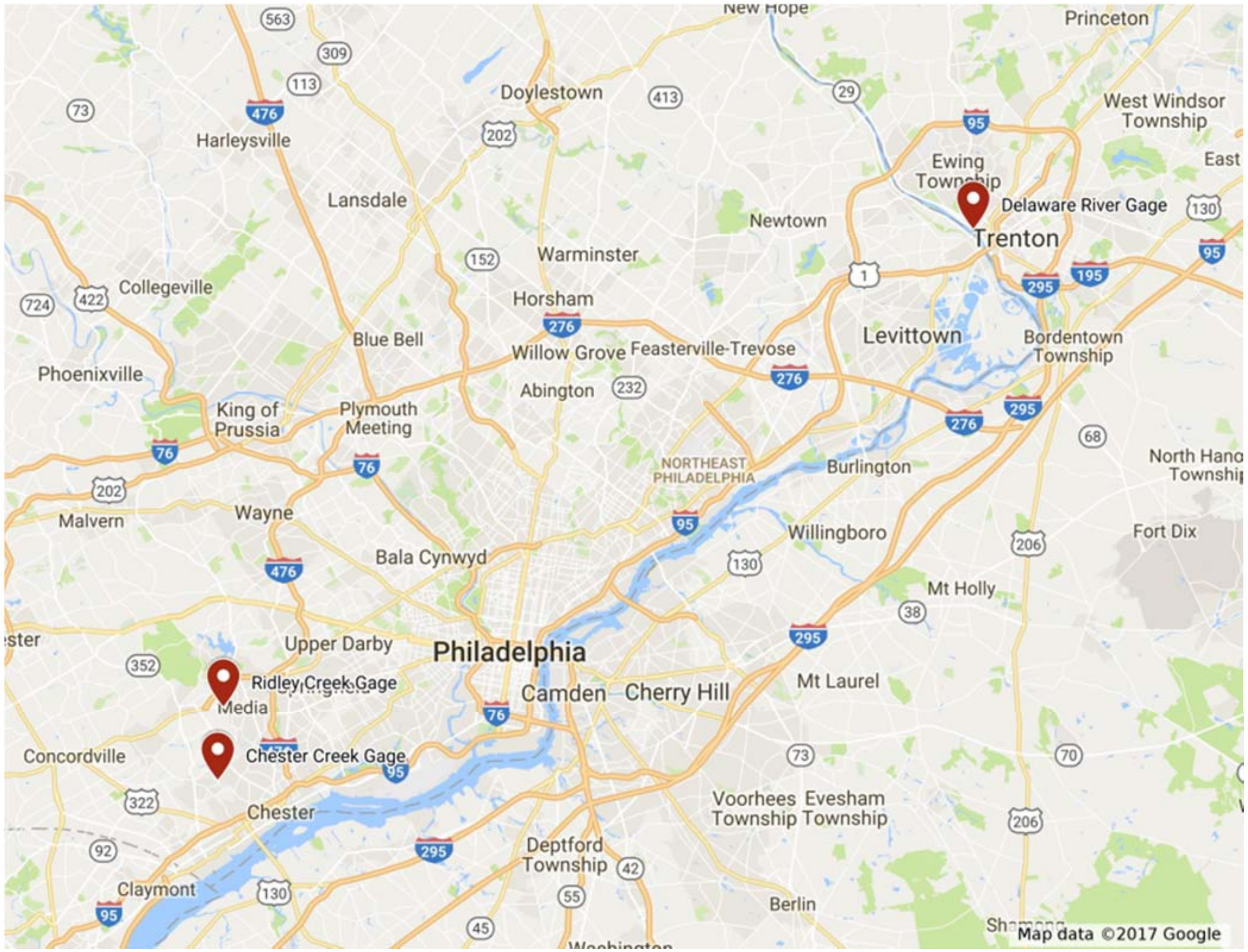
A single in-situ measurement was collected at every location and sampling round.

3.4.1.2 Sampling Round and Sampling Time

The grab samples collected on the Creeks as shown above were collected in intervals. The sampling intervals spanned over a 24 hour rain event. The intervals for sampling on creeks were at hour 0.5-2.5, hour 4.5-6.5, hour 8.5-10.5, hour 14.5-16.5, and hour 22-24. The samples also included the required Field Blanks and Duplicates as indicated in the Sampling collection matrix shown in Appendix G. Field Blanks were collected at the first sampling location. Samples from the downstream end of the creeks were collected first to capture the outgoing tide at the earliest. The samples on creeks were collected in the following order for each sampling round - CC-03, RC-03, RC-02, RC-01, CC-02 and CC-01. The number and type of samples collected from the Creeks for Wet Weather Event 1 are shown in Appendix D - Wet Weather Event 1 - Field Logs and Lab Results Summary.

The sampling event started on March 31, 2017 at 12:30 AM and ended on April 1, 2017 at 12:30 AM. There were a total of five (5) rounds of sampling conducted on the creeks. The sampling intervals were selected to capture the earlier part of the rainfall event and any impact of CSOs and Storm water runoff on the Creeks water quality. All samples from each location and from each sampling round were collected

Figure 3-1: Flow Gauge Locations



for analysis. The sample collection times from the Creeks for Wet Weather Event 1 are shown in Appendix D - Wet Weather Event 1 - Field Logs and Lab Results Summary.

See Appendix G for Sample collection matrix.

3.4.1.3 Field Observation and Sample Management

The grab samples were collected as per the requirements of the Sampling and Analysis Plan (SAP) using appropriate equipment and protective gear. The samples were preserved immediately on ice for transfer to laboratory for further analysis. The hold time for all the Dry Weather Event 1 samples on the creeks was held within the recommended time for lab analysis. While collecting the samples the field observations were noted to indicate any specific weather, water body, site and sample conditions. In-situ field measurements were taken using a YSI Model 556 with a 6920 V2 sonde. The sonde was used and decontaminated using DI water at every sampling location. The field observations and in-situ field measurements including water salinity readings, temperature and conductivity are shown in Appendix D – Wet Weather Event 1 – Field Logs and Lab Results Summary.

The samples were handed over the laboratory for analysis with their respective Chain of Custody Forms. The Chain of Custody Forms included details on the sample IDs, type of sample and release of samples. Copies of the Wet Weather Event 1 Chain of Custody Forms are shown in Appendix D - Wet Weather Event 1 - Field Logs and Lab Results Summary.

3.4.2 Activity on Delaware River

Sampling was conducted on Delaware River (DR) with 5 locations on the Pennsylvania side of the river and 2 locations, mid-channel and New Jersey side, on a transect near the Commodore Barry Bridge. On this date, the observed flow for the Delaware River was 44,100 cfs at the location shown on Figure 3-1.

3.4.2.1 Sample Type and Locations

Grab samples were collected from the following locations on the Delaware River:

- Seven (7) on Delaware River – DR-01, DR-02, DR-03, DR-04, DR-05, DR-06, DR-07

A first grab sample collected on river was during T=0 at the beginning for the rainfall event. Time T=0 for collection of the in-stream sample was initiated approximately 0.5 hours after the start of rainfall, or when 0.1 inches of rain had fallen or when CSO discharges start occurring (whichever occurs first). The sampling round intervals for all sampling locations are shown in the sampling collection matrix in Appendix G. See Figure 2-2 for map of sampling locations.

A single in-situ measurement was collected at every location at surface, mid and near bottom depths.

3.4.2.2 Sampling Round and Sampling Time

The grab samples collected on the Creeks as shown above were collected in intervals. The sampling intervals spanned over a 24 hour rain event. The intervals for sampling on creeks were at hour 0, hour 2, hour 4, hour 6, hour 9, hour 12, hour 15, hour 18, hour 21, and hour 24. The samples also included the required Field Blanks and Duplicates as indicated in the Sampling collection matrix shown in Appendix G. The samples on river were collected in the by two boat crews. One of the boat crews were assigned to sample the northern sampling locations DR-01, DR-02, DR-03 and the other boat crew was assigned to sample the southern sampling locations and points across the river at DR-04, DR-05, DR-06 and DR-07. The two boat crews were used to collect samples during the first five (5) sampling rounds to provide enough time to return the samples to the lab and complete the entire sampling loop on the river within the decided sampling intervals. After the first five (5) rounds only one boat crew was required to sample at all locations due to the availability of more time between sampling intervals after completing the entire loop. The number and type of samples collected from the river for Wet Weather Event 1 are shown in Appendix D - Wet Weather Event 1 - Field Logs and Lab Results Summary.

Boat activities became too hazardous as determined by the boat captain and all on-water activities were halted at 4:45 AM. A couple of shore grabs were collected at near locations DR-04, DR-05 between 7:00 AM and 7:30 AM. Conditions improved allowing for the resumption of boat activities after a period of approximately 4 hours. Delaware River loop was behind by one (1) entire set due to skipped locations because of boat motor issues, ship docking on river near sampling location and hazardous conditions on river.

See Appendix G for Sample collection matrix.

3.4.2.3 Field Observation and Sample Management

The grab samples were collected as per the requirements of the Sampling and Analysis Plan (SAP) using appropriate equipment and protective gear. The samples were preserved immediately on ice for transfer to laboratory for further analysis. The hold time for all the Dry Weather Event-1 samples on the creeks was held within the recommended time for lab analysis. While collecting the samples the field observations were noted to indicate any specific weather, water body, site, and sample conditions. In-situ field measurements were taken using a YSI Model 556 with a 6920 V2 sonde at surface, mid and near bottom depths of the river. The sonde was used and decontaminated using DI water at every sampling location. The field observations and in-situ field measurements including water salinity readings, temperature and conductivity are shown in Appendix D - Wet Weather Event 1 - Field Logs and Lab Results Summary.

The samples were handed over the laboratory for analysis with their respective Chain of Custody Forms. The Chain of Custody Forms included details on the sample IDs, type of sample and release of samples. Copies of the Wet Weather Event 1 Chain of Custody Forms are shown in Appendix D - Wet Weather Event 1 - Field Logs and Lab Results Summary.

3.4.3 Activity at Combined Sewer Overflow (CSO) Locations

3.4.3.1 Sample Type and Locations

Grab samples were collected from the following CSO locations:

- Four (4) locations – CSO-02, CSO-05, CSO-18, CSO-19

See Figure 2-2 for map of sampling locations.

3.4.3.2 Sampling Round and Sampling Time

The samples were collected at each of the CSO locations along with the required Field Blanks and Duplicates. The samples at the CSOs were collected in the following order for each sampling round - first flush, 30 minutes, 60 minutes, 2 hours, 4 hours, 8 hours, 12 hours, and 24 hours. The samples were collected only if there was any active overflow occurring over the weir at the CSO location. The number and type of samples collected from the river for Wet Weather Event 1 are shown in Appendix D - Wet Weather Event 1 - Field Logs and Lab Results Summary.

The sampling event started on March 30, 2017 at 12:30 AM and ended on April 1, 2017 at around 12:30 AM. The sampling was started at time T=0 at the start of rain fall event to collect the first flush sample. The sampling intervals were distributed over a 24 hour sampling period. If it was found that a CSO was not active then no samples were collected at those locations during those sampling rounds. It was observed that CSO-02 activated very fast whereas CSO-05 took longer to activate compared to CSO-18 and CSO-19. Any samples that were not collected in the previous round were recaptured in the next round so as to have the desired number of samples for analysis. The sample collection times from the CSO locations for Wet Weather Event 1 are shown in Appendix D - Wet Weather Event 1 - Field Logs and Lab Results Summary.

See Appendix G for Sample collection matrix.

3.4.3.3 Field Observation and Sample Management

The grab samples were collected as per the requirements of the Sampling and Analysis Plan (SAP) using appropriate equipment and protective gear. The samples were preserved immediately on ice for transfer to laboratory for further analysis. The hold time for all the Wet Weather Event 1 samples at the CSO locations was held within the recommended time for lab analysis. While collecting the samples the sample was collected on the downstream side of the overflow for an active overflow at the CSO locations. The sampling equipment was used and then decontaminated using DI water at every sampling location. The field observations and Field Blanks and Duplicate information is provided in Appendix D - Wet Weather Event 1 - Field Logs and Lab Results Summary.

The samples were handed over the laboratory for analysis with their respective Chain of Custody Forms. The Chain of Custody Forms included details on the sample IDs, type of sample and release of samples. Copies of the Wet Weather Event 1 Chain of Custody Forms are shown in Appendix D - Wet Weather Event 1 - Field Logs and Lab Results Summary.

3.4.4 Activity at Storm Water (SW) Locations

3.4.4.1 Sample Type and Locations

Grab samples were collected from the following storm water locations:

- Two (2) locations – SW-05A, SW-SS2

See Figure 2-2 for map of sampling locations.

3.4.4.2 Sampling Round and Sampling Time

Samples were collected at both of the storm water locations along with the required Field Blanks and Duplicates. The samples on were collected in the following order for each sampling round - SW-SS2 and SW-05A. The number and type of samples collected for Wet Weather Event 1 are shown in Appendix D - Wet Weather Event 1 - Field Logs and Lab Results Summary.

The sampling event started on March 30, 2017 at 12:30 AM and ended on March 31 at 12:30 PM. The sampling times were distributed to cover the storm over 24 hour period and samples were collected whenever there was active storm flow occurring. The sample collection times from the Storm water locations for Wet Weather Event 1 are shown in Appendix D - Wet Weather Event 1 - Field Logs and Lab Results Summary.

See Appendix G for Sample collection matrix.

3.4.4.3 Field Observation and Sample Management

The grab samples were collected as per the requirements of the Sampling and Analysis Plan (SAP) using appropriate equipment and protective gear. The samples were preserved immediately on ice for transfer to laboratory for further analysis. The hold time for all the Wet Weather Event 1 samples at the Storm water locations was held within the recommended time for lab analysis. The sampling equipment was used and decontaminated using DI water at every sampling location. The number of samples, Field Blanks and Duplicates are shown in Appendix D - Wet Weather Event 1 - Field Logs and Lab Results Summary.

The samples were handed over the laboratory for analysis with their respective Chain of Custody Forms. The Chain of Custody Forms included details on the sample IDs, type of sample and release of samples. Copies of the Wet Weather Event 1 Chain of Custody Forms are shown in Appendix D - Wet Weather Event 1 - Field Logs and Lab Results Summary.

3.5 Wet Weather Sampling Event 2

Wet Weather Sampling Event 2 occurred on 5/5/2017. See Table 2-7 and Figures 2-2 through 2-4 for receiving water flows based on USGS gages.

3.5.1 Activity on Creeks

Sampling was conducted on Chester Creek (CC) and Ridley Creek (RC). The observed flows for Chester Creek were 54.8 cfs at the beginning of the sampling event, reached a peak flow of 841 cfs at 4:15PM, and was 160 cfs when the sampling event concluded. For Ridley Creek, flow was 24.5 cfs at the beginning of the sampling event, reached a peak flow of 315 cfs at 5:30PM, and was 60.8 cfs when the sampling event concluded. The flow gauge locations are shown on Figure 3-1.

3.5.1.1 Sample Type and Locations

Grab samples were collected from the following locations on the Creeks:

- Three (3) on Chester Creek – CC-01, CC-02, CC-03
- Three (3) on Ridley Creek – RC-01, RC-02, RC-03

A first grab sample collected on creek was during T=0 at the beginning for the rainfall event. Time T=0 for collection of the in-stream sample was initiated approximately 0.5 hours after the start of rainfall, or when 0.1 inches of rain had fallen or when CSO discharges start occurring (whichever occurs first). Significant rainfall began at 7:00 AM and sampling personnel were already in place to begin sampling within the first half hour. Accordingly, the first creek sample was taken at 7:20 AM. The sampling round intervals for all sampling locations are shown in the sampling collection matrix in Appendix G. See Figure 2-2 for map of sampling locations.

A single in-situ measurement was collected at every location and sampling round.

3.5.1.2 Sampling Round and Sampling Time

The grab samples collected on the Creeks as shown above were collected in intervals. The sampling intervals spanned over a 24-hour period. The intervals for sampling on creeks were at hour 0.5-2.5, hour 4.5-6.5, hour 8.5-10.5, hour 14.5-16.5, and hour 22-24. The samples also included the required Field Blanks and Duplicates as indicated in the sampling collection matrix shown in Appendix G. Field Blanks were collected at the first sampling location. Samples from the downstream end of the creeks were collected first to capture the outgoing tide at the earliest. The samples on creeks were collected in the following order for each sampling round - CC-03, RC-03, RC-02, RC-01, CC-02 and CC-01. The number and type of samples collected from the Creeks for Wet Weather Event 2 are shown in Appendix E - Wet Weather Event 2 - Field Logs and Lab Results Summary.

The sampling event started on May 5, 2017 at 7:00 AM and ended on May 6, 2017 at 7:00 AM. There were a total of five (5) rounds of sampling conducted on the creeks. The sampling intervals were selected to capture the earlier part of the rainfall event and any impact of CSOs and Storm water runoff on the Creeks water quality. All samples from each location and from each sampling round were collected for analysis. The sample collection times from the Creeks for Wet Weather Event 2 are shown in Appendix E - Wet Weather Event 2 - Field Logs and Lab Results Summary.

See Appendix G for sample collection matrix.

3.5.1.3 Field Observation and Sample Management

The grab samples were collected as per the requirements of the Sampling and Analysis Plan (SAP) using appropriate sampling and personal protection equipment. The samples were preserved immediately on ice for transfer to laboratory for further analysis. The hold time for all the Wet Weather Event 2 samples on the creeks was within the recommended time for lab analysis. While collecting the samples, field observations were noted to indicate any specific weather, water body, site, and sample conditions. In-situ field measurements were taken using a YSI Model 556 with a 6920 V2 sonde. The sonde was used and decontaminated using DI water at every sampling location. The field observations and in-situ field measurements including water salinity readings, temperature and conductivity are shown in Appendix E - Wet Weather Event 2 - Field Logs and Lab Results Summary.

The samples were handed over the laboratory for analysis with their respective Chain of Custody Forms. The Chain of Custody Forms included details on the sample IDs, type of sample and release of samples. Copies of the Wet Weather Event 2 Chain of Custody Forms are shown in Appendix E - Wet Weather Event 2 - Field Logs and Lab Results Summary.

3.5.2 Activity on Delaware River

Sampling was conducted on Delaware River (DR) with 5 locations on the Pennsylvania side of the river and 2 locations, mid-channel and New Jersey side, on a transect near the Commodore Barry Bridge. On this date, the observed flow for the Delaware River was 19,900 cfs at the location shown on Figure 3-1.

3.5.2.1 Sample Type and Locations

Grab samples were collected from the following locations on the Delaware River:

- Seven (7) on Delaware River – DR-01, DR-02, DR-03, DR-04, DR-05, DR-06, DR-07

A first grab sample collected on river was during T=0 at the beginning for the rainfall event. Time T=0 for collection of the in-stream sample was initiated approximately 0.5 hours after the start of rainfall, or when 0.1 inches of rain had fallen or when CSO discharges start occurring (whichever occurs first). The sampling round intervals for all sampling locations are shown in the sampling collection matrix in Appendix G. See Figure 2-2 for map of sampling locations.

A single in-situ measurement was collected at every location at surface, mid and near bottom depths.

3.5.2.2 Sampling Round and Sampling Time

The grab samples collected on the Creeks as shown above were collected in intervals. The sampling intervals spanned over a 24-hour period. The intervals for sampling on the Delaware River were at hour 0, hour 2, hour 4, hour 6, hour 9, hour 12, hour 15, hour 18, hour 21, and hour 24. The samples also included the required Field Blanks and Duplicates as indicated in the sampling collection matrix shown in Appendix G. The samples on the river were collected by two boat crews. One of the boat crews was assigned to sample the northern sampling locations DR-01, DR-02, DR-03 and the other boat crew was assigned to sample the southern sampling locations and points across the river at DR-04, DR-05, DR-06 and DR-07. The two boat crews were planned for sample collection during the first five (5) sampling rounds, to provide enough time to return the samples to the lab and complete the entire sampling loop on the river within the decided sampling intervals. After the first three (3) rounds, only one boat crew would be required to sample at all locations because of the availability of more time between sampling intervals after completing the entire loop.

As Round 2 was being completed, lightning was observed in the area. Safety protocols required that both boats be removed from the water and that 30 minutes elapse with no lightning before resumption of boat activities. This resulted in a 35-minute delay in the start of Round 3. After the third round of sampling, several punctures were discovered in one of the boat's hull causing water to inundate the boat see Appendix K - Sampling Photos). For safety and maneuverability concerns, this boat was pulled from the river. As the second boat began Round 4, it also encountered mechanical issues when its engine could not propel the boat forward. After inspection, a problem with the transmission was identified and this boat was also removed from the river. It was suggested to switch out the engine so that sampling on the Delaware River could continue, but was unsuccessful due to the incompatibility of the steering systems between the two boats. At this point two (2) rounds were missed, hour 6 and hour 9. As an alternative option (to get as much data as possible) the remainder of sampling on the Delaware River for rounds six through ten were taken from shore locations close to DR-03 and DR- 04. There were no accessible points along Chester City shoreline to collect grab samples for DR-01, DR-02 and DR-05. Grab sample for DR-03 was collected from shore on Norris Street and that for DR-04 was collected from the boat launch ramp near the stadium. Grab samples were collected using bailer and rope along with insitu readings for both locations. For reference, the number and type of samples collected from the river for Wet Weather Event 2 are shown in Appendix E - Wet Weather Event 2 - Field Logs and Lab Results Summary.

The sampling event started on May 5, 2017 at 7:00 AM and ended on May 6, 2017 at 7:00 AM. There were a total of eight (8) rounds of sampling conducted on the Delaware. The sampling intervals were selected to capture the earlier part of the rainfall event and any impact the CSOs and storm water runoff had on river water quality. The sample collection times from the Creeks for Wet Weather Event 2 are shown in Appendix E - Wet Weather Event 2 - Field Logs and Lab Results Summary.

See Appendix G for sample collection matrix.

3.5.2.3 Field Observation and Sample Management

The grab samples were collected as per the requirements of the Sampling and Analysis Plan (SAP) using appropriate sampling and personal protective equipment. The samples were preserved immediately on ice for transfer to laboratory for further analysis. The hold time for all the Wet Weather Event 2 samples on the Delaware River was within the recommended time for lab analysis. While collecting the samples the field observations were noted to indicate any specific weather, water body, site, and sample conditions. In-situ field measurements were taken using a YSI Model 556 with a 6920 V2 sonde at surface, mid and near bottom depths of the river. The sonde was used and decontaminated using DI water at every sampling location. The field observations and in-situ field measurements including water salinity readings, temperature and conductivity are shown in Appendix E - Wet Weather Event 2 - Field Logs and Lab Results Summary.

The samples were handed over the laboratory for analysis with their respective Chain of Custody Forms. The Chain of Custody Forms included details on the sample IDs, type of sample and release of samples.

Copies of the Wet Weather Event 2 Chain of Custody Forms are shown in Appendix E - Wet Weather Event 2 - Field Logs and Lab Results Summary.

3.5.3 Activity at Combined Sewer Overflow (CSO) Locations

3.5.3.1 Sample Type and Locations

Grab samples were collected from the following CSO locations:

- Four (4) locations – CSO-02, CSO-05, CSO-18, CSO-19

See Figure 2-2 for map of sampling locations.

3.5.3.2 Sampling Round and Sampling Time

Grab samples were collected at each of the CSO locations along with the required Field Blanks and Duplicates. The samples at the CSOs were collected in the following order for each sampling round - first flush, 30 minutes, 60 minutes, 2 hours, 4 hours, 8 hours, 12 hours, and 24 hours. The samples were collected only for the first five (5) rounds for all CSO locations because there was not any active overflow occurring over the weir after 6 hours. The number and type of samples collected from the river for Wet Weather Event 2 are shown in Appendix E - Wet Weather Event 2 - Field Logs and Lab Results Summary.

The sampling event started on May 5, 2017 at 7:00 AM and ended on May 6, 2017 at around 7:00 AM. The sampling was started at time T=0, the beginning of an active overflow, to collect the first flush sample. The sampling intervals were distributed over a 24 hour sampling period, but before sampling rounds six through eight, it was found that no CSOs were actively discharging, therefore no samples were collected at those locations during those sampling rounds. Because of the precipitation intensity for this particular round of sampling, all CSOs discharged within minutes of each other. The sample collection times from the CSO locations for Wet Weather Event 2 are shown in Appendix E - Wet Weather Event 2 - Field Logs and Lab Results Summary.

See Appendix G for Sample collection matrix.

3.5.3.3 Field Observation and Sample Management

The samples were collected as per the requirements of the Sampling and Analysis Plan (SAP) using appropriate sampling and personal protective equipment. The samples were preserved immediately on ice for transfer to laboratory for further analysis. The hold time for all the Wet Weather Event 2 samples at the CSO locations was within the recommended time for lab analysis. Samples were collected on the downstream side of the overflow for an active overflow at the CSO locations. The sampling equipment was used and then decontaminated using DI water at every sampling location. The field observations, Field Blanks, and Duplicate information is provided in Appendix E - Wet Weather Event 2 - Field Logs and Lab Results Summary.

The samples were handed over the laboratory for analysis with their respective Chain of Custody Forms. The Chain of Custody Forms included details on the sample IDs, type of sample and release of samples.

Copies of the Wet Weather Event 2 Chain of Custody Forms are shown in Appendix E - Wet Weather Event 2 - Field Logs and Lab Results Summary.

3.5.4 Activity at Storm Water (SW) Locations

3.5.4.1 Sample Type and Locations

Grab samples were collected from the following storm water locations:

- Two (2) locations – SW-05A, SW-SS2

See Figure 2-2 for map of sampling locations.

3.5.4.2 Sampling Round and Sampling Time

Samples were collected at both of the storm water locations along with the required Field Blanks and Duplicates. The samples at SW-05A and SW-SS2 were collected in the following order for each sampling round - first flush, 30 minutes, 60 minutes, 2 hours, 4 hours, 8 hours, 12 hours, and 24 hours. The samples were collected only for the first five (5) rounds for both storm water locations because there was not any flow occurring in the storm sewers after 6 hours. The number and type of samples collected from the river for Wet Weather Event 2 are shown in Appendix E - Wet Weather Event 2 - Field Logs, Chain of Custody Forms, and Lab Results.

The sampling event started on May 5, 2017 at 7:00 AM and ended on May 6, 2017 at around 7:00 AM. The sampling was started at time T=0, the beginning of an active flow, to collect the first flush sample. The sampling intervals were distributed over a 24 hour sampling period, but before sampling rounds six through eight, it was found that neither storm sewer had active flow occurring, therefore no samples were collected at those locations during those sampling rounds. The sample collection times from the CSO locations for Wet Weather Event 2 are shown in Appendix E - Wet Weather Event 2 - Field Logs and Lab Results Summary.

See Appendix G for Sample collection matrix.

3.5.4.3 Field Observation and Sample Management

The samples were collected as per the requirements of the Sampling and Analysis Plan (SAP) using appropriate sampling and personal protective equipment. The samples were preserved immediately on ice for transfer to laboratory for further analysis. The hold time for all the Wet Weather Event 2 samples at the storm water locations was within the recommended time for lab analysis. The sampling equipment was used and decontaminated using DI water at every sampling location. The number of samples, Field Blanks and Duplicates are shown in Appendix E – Wet Weather Event 2 – Field Logs and Lab Results Summary.

The samples were handed over the laboratory for analysis with their respective Chain of Custody Forms. The Chain of Custody Forms included details on the sample IDs, type of sample and release of samples. Copies of the Wet Weather Event 2 Chain of Custody Forms are shown in Appendix E - Wet Weather Event 2 - Field Logs and Lab Results Summary.

3.6 Wet Weather Sampling Event 3

Wet Weather Sampling Event 3 occurred on 5/22/2017

3.6.1 Activity on Creeks

Sampling was conducted on Chester Creek (CC) and Ridley Creek (RC). The observed flows for Chester Creek were 58.1 cfs at the beginning of the sampling event, reached a peak flow of 92.1 cfs at 12:15AM, and was 70.4 cfs when the sampling event concluded. For Ridley Creek, flow was 23.6 cfs at the beginning of the sampling event, reached a peak flow of 32.5 cfs at 8:15PM, and was 28.8 cfs when the sampling event concluded. The flow gauge locations are shown on Figure 3-1.

3.6.1.1 Sample Type and Locations

Grab samples were collected from the following locations on the Creeks:

- Three (3) on Chester Creek – CC-01, CC-02, CC-03
- Three (3) on Ridley Creek – RC-01, RC-02, RC-03

A first grab sample collected on creek was during T=0 at the beginning for the rainfall event. Time T=0 for collection of the in-stream sample was initiated approximately 0.5 hours after the start of rainfall, or when 0.1 inches of rain had fallen or when CSO discharges started occurring (whichever occurs first). Significant rainfall began at 10:20 AM and sampling personnel were already in place to begin sampling within the first half hour. Accordingly, the first creek sample was taken at 10:42 AM. The sampling round intervals for all sampling locations are shown in the sampling collection matrix in Appendix G. See Figure 2-2 for map of sampling locations.

A single in-situ measurement was collected at every location and sampling round.

3.6.1.2 Sampling Round and Sampling Time

The grab samples collected on the Creeks as shown above were collected in intervals. The sampling intervals spanned over a 24 hour period. The intervals for sampling on creeks were at hour 0.5-2.5, hour 4.5-6.5, hour 8.5-10.5, hour 14.5-16.5, and hour 22-24. The samples also included the required Field Blanks and Duplicates as indicated in the sampling collection matrix shown in Appendix G. Field Blanks were collected at the first sampling location. Samples from the downstream end of the creeks were collected first to capture the outgoing tide at the earliest. The samples on creeks were collected in the following order for each sampling round - CC-03, RC-03, RC-02, RC-01, CC-02 and CC-01. The number and type of samples collected from the Creeks for Wet Weather Event 3 are shown in Appendix F - Wet Weather Event 3 - Field Logs and Lab Results Summary.

The sampling event started on May 22, 2017 at 9:00 AM and ended on May 23, 2017 at 10:30 AM. There were a total of five (5) rounds of sampling conducted on the creeks. The sampling intervals were selected to capture the earlier part of the rainfall event and any impact of CSOs and Storm water runoff on the Creeks water quality. All samples from each location and from each sampling round were collected for analysis. The sample collection times from the Creeks for Wet Weather Event 3 are shown in Appendix F - Wet Weather Event 3 - Field Logs and Lab Results Summary.

See Appendix G for sample collection matrix.

3.6.1.3 Field Observation and Sample Management

The samples were collected as per the requirements of the Sampling and Analysis Plan (SAP) using appropriate sampling and personal protection equipment. The samples were preserved immediately on ice for transfer to laboratory for further analysis. The hold time for all the Wet Weather Event 3 samples on the creeks was within the recommended time for lab analysis. While collecting the samples, field observations were noted to indicate any specific weather, water body, site, and sample conditions. In-situ field measurements were taken using a YSI Model 556 with a 6920 V2 sonde. The sonde was used and decontaminated using DI water at every sampling location. The field observations and in-situ field measurements including water salinity readings, temperature and conductivity are shown in Appendix F - Wet Weather Event 3 - Field Logs and Lab Results Summary.

The samples were handed over the laboratory for analysis with their respective Chain of Custody Forms. The Chain of Custody Forms included details on the sample IDs, type of sample and release of samples. Copies of the Wet Weather Event 3 Chain of Custody Forms are shown in Appendix F - Wet Weather Event 3 - Field Logs and Lab Results Summary.

3.6.2 Activity on Delaware River

Sampling was conducted on Delaware River (DR) with 5 locations on the Pennsylvania side of the river and 2 locations, mid-channel and New Jersey side, on a transect near the Commodore Barry Bridge. On this date, the observed flow for the Delaware River was 9,180 cfs at the location shown on Figure 3-1 - Flow Gauge Locations.

3.6.2.1 Sample Type and Locations

Grab samples were collected from the following locations on the Delaware River:

- Seven (7) on Delaware River – DR-01, DR-02, DR-03, DR-04, DR-05, DR-06, DR-07

A first grab sample collected on river was during T=0 at the beginning for the rainfall event. Time T=0 for collection of the in-stream sample was initiated approximately 0.5 hours after the start of rainfall, or when 0.1 inches of rain had fallen or when CSO discharges started occurring (whichever occurs first). Very light precipitation had occurred intermittently throughout the early morning hours (2:00 AM to 9:00 AM). Steady rainfall began after 9:00 AM, by which time 0.05 inches of rain had fallen, according to the WRTP rain gauge. Sampling personnel were already in place to begin sampling immediately. Accordingly, the first river sample was taken at 9:05 AM. The sampling round intervals for all sampling locations are shown in the sampling collection matrix in Appendix G. See Figure 2-2 for map of sampling locations.

A single in-situ measurement was collected at every location at surface, mid and near bottom depths.

3.6.2.2 Sampling Round and Sampling Time

The grab samples collected on the Creeks as shown above were collected in intervals. The sampling intervals spanned over a 24 hour period. The intervals for sampling on the Delaware River were at hour 0, hour 2, hour 4, hour 6, hour 9, hour 12, hour 15, hour 18, hour 21, and hour 24. The samples also included the required Field Blanks and Duplicates as indicated in the sampling collection matrix shown in Appendix G. The samples on the river were collected by two boat crews. One of the boat crews was assigned to sample the northern sampling locations DR-01, DR-02, DR-03 and the other boat crew was assigned to sample the southern sampling locations and points across the river at DR-04, DR-05, DR-06 and DR-07. The two boat crews were planned for sample collection during the first five (5) sampling rounds, to provide enough time to return the samples to the lab and complete the entire sampling loop on the river within the decided sampling intervals. After the first five (5) rounds, only one boat crew would be required to sample at all locations because of the availability of more time between sampling intervals after completing the entire loop.

In actuality, two boat crews were used for 3 rounds, due to mechanical issues with the boats. After the third round of sampling, several small punctures were discovered in one of the boat's hull causing water to inundate the boat. For safety and maneuverability concerns, the boat was pulled from the river. The second boat also encountered issues at this time when its engine could not propel the boat forward. After inspection, a problem with the transmission was identified and this boat was also removed from the river. An attempt to switch out the engine was made so that sampling on the Delaware River could continue, but was unsuccessful. At this point two (2) rounds were missed, hour 6 and hour 9. As an alternative option (to get as much data as possible) the remainder of sampling on the Delaware River for rounds six through ten were taken from shore locations close to DR-03 and DR- 04. There were no accessible points along Chester City shoreline to collect grab samples for DR-01, DR-02 and DR-05. Grab sample for DR-03 was collected from shore on Norris Street and that for DR-04 was collected from the boat launch ramp near the stadium. Grab samples were collected using bailer and rope along with in-situ readings for both locations. For reference, the number and type of samples collected from the river for Wet Weather Event 3 are shown in Appendix F - Wet Weather Event 3 - Field Logs and Lab Results Summary.

The sampling event started on May 22, 2017 at 9:00 AM and ended on May 23, 2017 at 10:30 AM. There were a total of ten (10) rounds of sampling conducted on the Delaware. The sampling intervals were selected to capture the earlier part of the rainfall event and any impact the CSOs and storm water runoff had on river water quality. The sample collection times from the Creeks for Wet Weather Event 3 are shown in Appendix F - Wet Weather Event 3 - Field Logs and Lab Results Summary.

See Appendix G for sample collection matrix.

3.6.2.3 Field Observation and Sampling Management

The samples were collected as per the requirements of the Sampling and Analysis Plan (SAP) using appropriate sampling and personal protective equipment. The samples were preserved immediately on ice for transfer to laboratory for further analysis. The hold time for all the Wet Weather Event 3 samples on the Delaware River was within the recommended time for lab analysis. While collecting the samples the field observations were noted to indicate any specific weather, water body, site, and sample conditions. In-situ field measurements were taken using a YSI Model 556 with a 6920 V2 sonde at surface, mid and near bottom depths of the river. The sonde was used and decontaminated using DI water at every sampling location. The field observations and in-situ field measurements including water salinity readings, temperature and conductivity are shown in Appendix F - Wet Weather Event 3 - Field Logs and Lab Results Summary.

The samples were handed over the laboratory for analysis with their respective Chain of Custody Forms. The Chain of Custody Forms included details on the sample IDs, type of sample and release of samples. Copies of the Wet Weather Event 3 Chain of Custody Forms are shown in Appendix F - Wet Weather Event 3 - Field Logs and Lab Results Summary.

3.6.3 Activity at Combined Sewer Overflow (CSO) Locations

3.6.3.1 Sample Type and Locations

Grab samples were collected from the following CSO locations:

- Four (4) locations – CSO-02, CSO-05, CSO-18, CSO-19

See Figure 2-2 for map of sampling locations.

3.6.3.2 Sampling Round and Sampling Time

Samples were collected at each of the CSO locations along with the required Field Blanks and Duplicates. The samples at the CSOs were collected in the following order for each sampling round - first flush, 30 minutes, 60 minutes, 2 hours, 4 hours, 8 hours, 12 hours, and 24 hours. The samples were collected only for the first five (5) rounds for all CSO locations because there was not any active overflow occurring over the weir after 6 hours. The number and type of samples collected from the river for Wet Weather Event 3 are shown in Appendix F - Wet Weather Event 3 - Field Logs and Lab Results Summary.

The sampling event started on May 22, 2017 at 9:00 AM and ended on May 23, 2017 at around 10:30 AM. The CSO sampling was started at time T=0, the beginning of an active overflow, to collect the first flush sample. Significant rainfall began at 10:20 AM and sampling personnel were already in place to begin CSO sampling at first flush, which occurred at 10:25 AM. Because of the precipitation intensity for this particular round of sampling, all CSOs discharged within minutes of each other. The sampling intervals were distributed over a 24-hour sampling period, but before sampling rounds six through eight, it was found that no CSOs were actively discharging, therefore no samples were collected at those locations during those sampling rounds. The sample collection times from the CSO locations for Wet Weather Event 3 are shown in Appendix F - Wet Weather Event 3 - Field Logs and Lab Results Summary.

See Appendix G for Sample collection matrix.

3.6.3.3 Field Observation and Sample Management

The grab samples were collected as per the requirements of the Sampling and Analysis Plan (SAP) using appropriate sampling and personal protective equipment. The samples were preserved immediately on ice for transfer to laboratory for further analysis. The hold time for all the Wet Weather Event 3 samples at the CSO locations was within the recommended time for lab analysis. Samples were collected on the downstream side of the overflow for an active overflow at the CSO locations. The sampling equipment was used and then decontaminated using DI water at every sampling location. The field observations, Field Blanks, and Duplicate information is provided in Appendix F - Wet Weather Event 3 - Field Logs, Chain of Custody Forms, and Lab Results.

The samples were handed over the laboratory for analysis with their respective Chain of Custody Forms. The Chain of Custody Forms included details on the sample IDs, type of sample and release of samples. Copies of the Wet Weather Event 3 Chain of Custody forms are shown in Appendix F - Wet Weather Event 3 - Field Logs and Lab Results Summary.

3.6.4 Activity at Storm Water (SW) Locations

3.6.4.1 Sample Type and Locations

Grab samples were collected from the following storm water locations:

- Two (2) locations – SW-05A, SW-SS2

See Figure 2-2 for map of sampling locations.

3.6.4.2 Sampling Round and Sampling Time

Samples were collected at both of the storm water locations along with the required Field Blanks and Duplicates. The samples at SW-05A and SW-SS2 were collected in the following order for each sampling round - first flush, 30 minutes, 60 minutes, 2 hours, 4 hours, 8 hours, 12 hours, and 24 hours. The samples were collected only for the first five (5) rounds for both storm water locations because there was not any flow occurring in the storm sewers after 6 hours. The number and type of samples collected from the river for Wet Weather Event 3 are shown in Appendix F - Wet Weather Event 3 - Field Logs, Chain of Custody Forms, and Lab Results.

The sampling event started on May 5, 2017 at 7:00 AM and ended on May 6, 2017 at around 7:00 AM. The sampling was started at time T=0, the beginning of active flow, to collect the first flush sample. Significant rainfall began at 10:20 AM and sampling personnel were already in place to begin SW sampling at first flush, which occurred at 10:30 AM. The sampling intervals were distributed over a 24-hour sampling period, but before sampling rounds six through eight, it was found that neither storm sewer had active flow occurring, therefore no samples were collected at those locations during those sampling rounds. The sample collection times from the CSO locations for Wet Weather Event 3 are shown in Appendix F - Wet Weather Event 3 - Field Logs and Lab Results Summary.

See Appendix G for Sample collection matrix.

3.6.4.3 Field Observation and Sample Management

The sample was collected as per the requirements of the Sampling and Analysis Plan (SAP) using appropriate sampling and personal protective equipment. The samples were preserved immediately on ice for transfer to laboratory for further analysis. The hold time for all the Wet Weather Event 3 samples at the storm water locations was within the recommended time for lab analysis. The sampling equipment was used and decontaminated using DI water at every sampling location. The number of samples, Field Blanks and Duplicates are shown in Appendix F - Wet Weather Event 3 - Field Logs and Lab Results Summary.

The samples were handed over the laboratory for analysis with their respective Chain of Custody Forms. The Chain of Custody Forms included details on the sample IDs, type of sample and release of samples. Copies of the Wet Weather Event 3 Chain of Custody Forms are shown in Appendix F - Wet Weather Event 3 - Field Logs and Lab Results Summary.

Section 4 Laboratory Results

The Sampling Program succeeded in acquiring the volume and range of pollutant data needed to construct, calibrate and validate the water quality model. Table 4-1 provides a summary of the number of samples collected for each of the sampling events at each sampling station. Table 4-2 provides a summary of the range of observed pollutant concentrations collected during the dry and wet weather sampling events.

The pollutants of concern (POCs) analyzed in the samples collected in the Sampling Program include fecal coliform, *Escherichia coliform (E. coli)*, and enterococcus. The coliform group has been used to assess sanitary quality in recreational waterways for decades (Standard Methods, 1980). Fecal coliform is a member of the coliform group present in the gut and feces of warm-blooded animals and is used as an indicator of fecal contamination and associated pathogens. The fecal coliform group includes many genera, including *Enterobacter, Klebsiella, Citrobacter, and Escherichia* (Standard Methods, 1998). E. coli is a one member of the fecal coliform group that provides more specificity than fecal coliform as a potential indicator of pathogenic organisms (USEPA, 1986), particularly in freshwater systems (USEPA, 2012). Enterococcus is a subgroup of the fecal streptococcus group, another type of bacteria found in the gastrointestinal tract of warm-blooded animals (Standard Methods, 1998). Enterococci have been found to be the best pathogenic indicator of fecal contamination in marine waters (USEPA, 2012). Because the DELCORA service area includes both freshwater and tidal/marine waterways, all of these indicators are pertinent to assessing water quality conditions in the local waterways and comparing to corresponding water quality standards.

This section describes the laboratory results for each of the individual sampling events. The environmental conditions of each of these sampling events were described in Section 3. Plots of concentrations over time are presented in this section for a subset of locations, and plots for all locations are included in Appendix H. For the tributaries, the flow at the upstream USGS gage is also included in the figures. However, for the Delaware River, no flow values are shown because the nearest flow gage is in Trenton, NJ, which is too far away (~80 miles upstream) to be indicative of local conditions.

The quality of the data with respect to the QAPP objectives are described in additional detail in Section 5. Additional analysis of the data, such as developing Event Mean Concentrations (EMCs) for the CSOs and stormwater locations are described in Section 6.

Table 4-1: Number of Samples Collected During the Sampling Program

Sample Summary	Dry1	Dry2	Dry3	Wet1	Wet2	Wet3	Total
Chester Creek							
CC-01	2	2	2	5	5	5	**21**
CC-02	2	2	2	5	5	5	**21**
CC-03	2	2	2	5	5	5	**21**
Ridley Creek							
RC-01	2	2	2	5	5	5	**21**
RC-02	2	2	2	5	5	5	**21**
RC-03	2	2	2	5	5	5	**21**
Delaware River							
DR-01	2	2	2	8	3	9	**26**
DR-02	2	2	2	8	3	10	**27**
DR-03	2	2	2	8	3	10	**27**
DR-03 (Shore)					5		**5**
DR-04	2	2	2	9	3	10	**28**
DR-04 (Shore)					5		**5**
DR-05	2	2	2	9	3	10	**28**
DR-06				7	3	10	**20**
DR-07				7	3	10	**20**
CSO							
CSO-02				9	5	4	**18**
CSO-05				8	5	5	**18**
CSO-18				7	5	4	**16**
CSO-19				8	5	2	**15**
SW							
SW-05A				8	6	5	**19**
SW-SS2				8	6	5	**19**
Field Blanks and Duplicates							
Blanks	3	2	2	5	4	5	**21**
Duplicates	3	3	3	5	4	5	**23**

Notes: At DR-06 and DR-07, the CSOs and SW locations were only sampled during wet weather. Due to challenges described in Section 3, DR-03 (Shore) and DR-04 (Shore) were added to collect samples from the bank of the river.

Table 4-2: Range of Observed Pollutant Concentrations during Dry and Wet Weather Events

Parameter	Event Type	Location	Minimum	Maximum	Average	Count
E. COLI	DRY	Chester Creek	10	470	130	18
		Delaware River	1	45	17	27
		Ridley Creek	2	1,900	265	16
	WET	Chester Creek	40	22,000	4,937	45
		Delaware River	2	6,900	207	143
		Ridley Creek	56	87,000	5,690	45
		CSO	25,000	1,780,000	254,403	67
		Stormwater	36	156,000	16,248	38
ENTERO-COCCUS	DRY	Chester Creek	8	190	70	18
		Delaware River	1	320	21	22
		Ridley Creek	6	900	167	16
	WET	Chester Creek	40	41,000	9,584	44
		Delaware River	2	40,000	476	141
		Ridley Creek	20	31,000	8,112	45
		CSO	4,800	3,220,000	193,961	67
		Stormwater	1,091	505,000	72,206	38
FECAL COLIFORM	DRY	Chester Creek	4	1,200	361	17
		Delaware River	2	54	27	30
		Ridley Creek	4	3,800	709	18
	WET	Chester Creek	52	44,000	7,134	45
		Delaware River	2	10,000	250	145
		Ridley Creek	44	103,000	7,646	45
		CSO	15,300	1,630,000	165,486	67
		Stormwater	20	1,480,000	54,081	38

4.1 Dry Weather Sampling – Event 1 Results

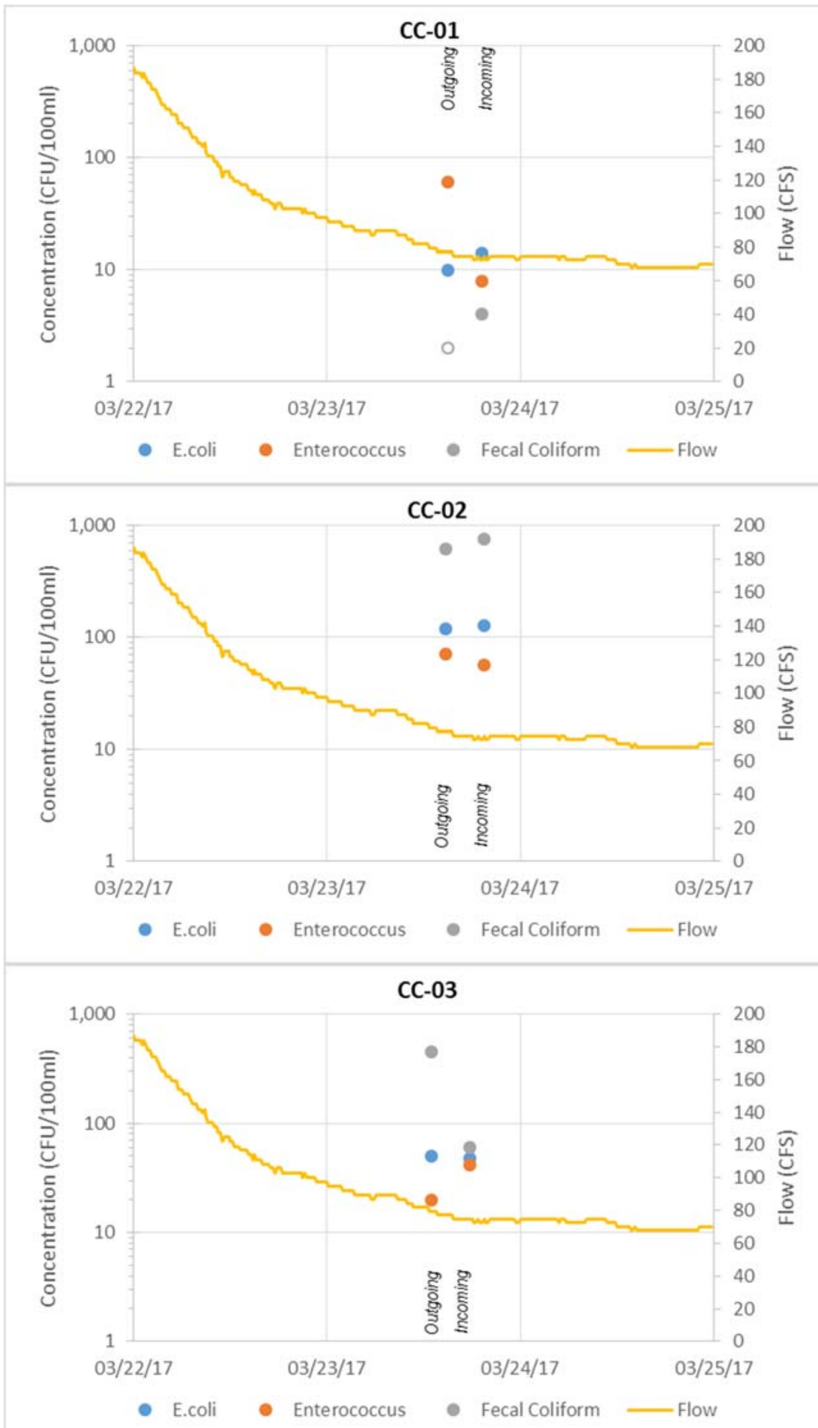
The first dry weather event (Dry 1), on March 23, 2017, had the highest tributary (i.e. Chester Creek, Ridley Creek) flows of all of the dry weather sampling events (as shown in Table 2-7). This was expected as the Spring (mid-March) season tends to have higher base flow due to snow melt infiltration and higher frequency of rainfall that typically occurs. Laboratory results are presented by waterbody below.

4.1.1 Chester Creek Results

Samples collected on incoming and outgoing tides were fairly similar in concentrations of each pollutant and the majority of concentrations were within values used as maximum water quality standard criteria. Maximum water quality standard criteria are shown in Figure 2.1 in Section 2. Figure 4-1 shows the concentrations at each station. Note that in this figure, solid dots are measured results while open dots are non-detect results plotted at the detection limit. Additional plots are provided in Appendix H.

Fecal coliform levels tended to have the highest concentrations of the three pollutants of concern (POC) while enterococcus tended to have the lowest concentrations. However, the fecal coliform results at CC-01 appear to be anomalous, as they are the lowest concentrations of the POCs and lower than corresponding E. coli levels, which is physically impossible because E. coli is a subgroup within the fecal coliform group. These anomalies are likely mostly due to the difficulty in measuring low levels of bacteria concentrations (see Section 5 for additional discussion). These figures also illustrate an increase in each POC levels from the upstream location (CC-01) to the downstream locations (CC-02 &CC-03) during both incoming and outgoing tidal conditions. This may be indicative of dry weather sources of bacteria entering Chester Creek, such as illicit discharges and connections or wildlife and pet contributions. Additional analysis and interpretation of the data will be conducted as part of the water quality model development and calibration process.

Figure 4-1: Dry Weather 1 Concentrations in Chester Creek

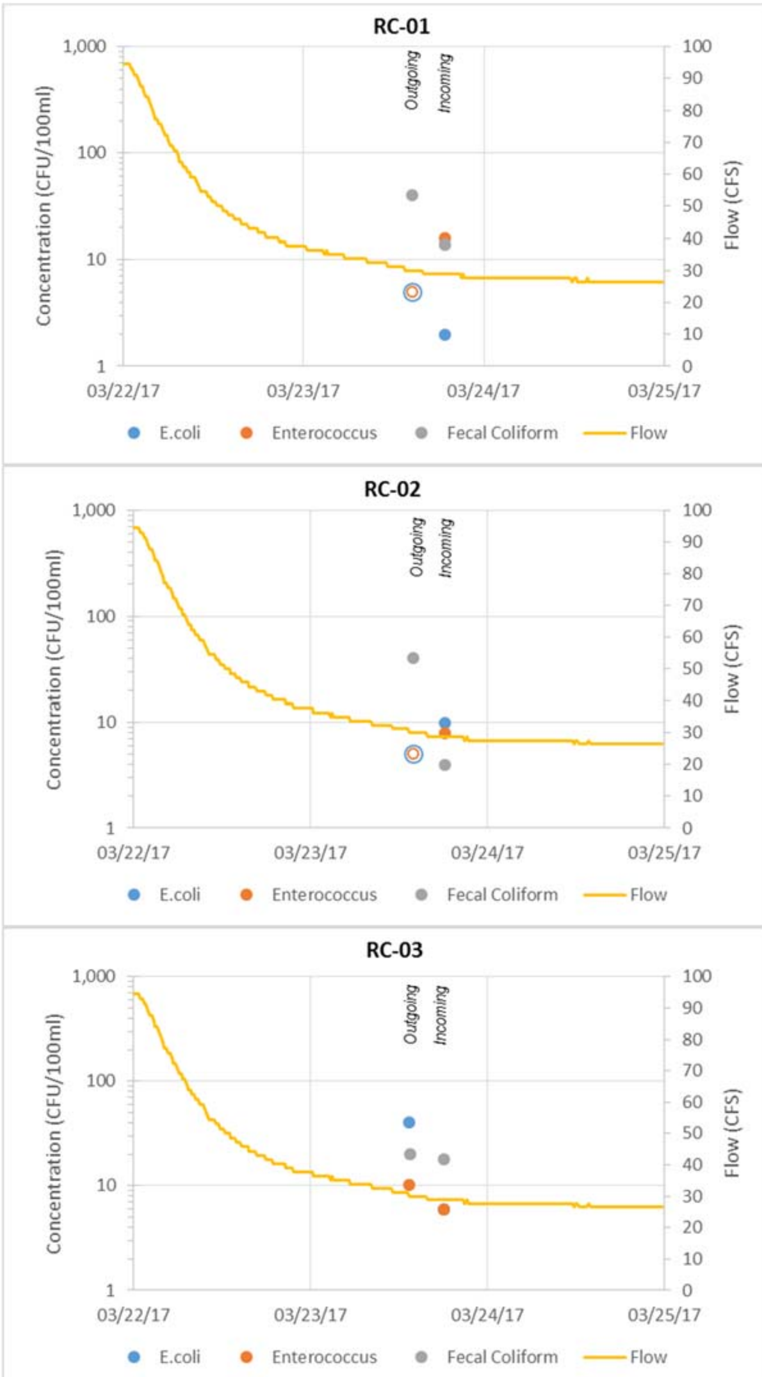


4.1.2 Ridley Creek Results

Samples collected on incoming and outgoing tides were fairly similar in concentrations of each pollutant and the majority of concentrations were within values used as maximum water quality standard criteria. Maximum water quality standard criteria are shown in Figure 2.1 in Section 2. Figure 4-2 shows the concentrations at each station. Note that in this figure, solid dots are measured results while open dots are non-detect results plotted at the detection limit. Additional plots are provided in Appendix H.

With few exceptions, fecal coliform tended to have the highest concentrations of the three pollutants of concern (POC) while enterococcus tended to have the lowest concentrations. These figures also illustrate an increase in E. coli levels from the upstream (RC-01) locations to the downstream locations (RC-02 and RC-03). However, the spatial trend for fecal coliform show a decrease in concentrations from upstream to downstream, while enterococcus levels were similar at all locations. Additional analysis and interpretation of the data will be conducted as part of the water quality model development and calibration process.

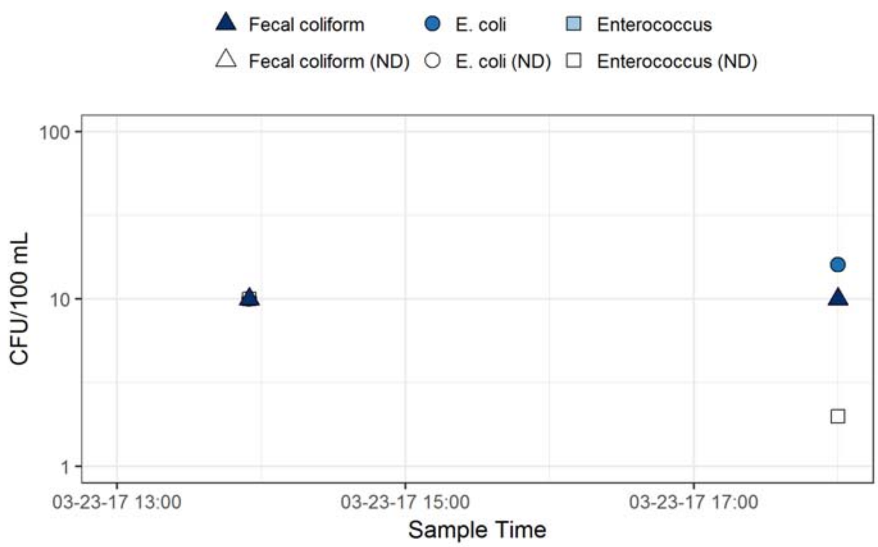
Figure 4-2: Dry Weather 1 Concentrations in Ridley Creek



4.1.3 Delaware River Results

Samples collected on incoming and outgoing tides were fairly similar in concentrations of each pollutant and all of concentrations were within values used as maximum water quality standard criteria. Maximum water quality standard criteria are shown in Figure 2.1 in Section 2. Figure 4-3 shows the concentrations at DR-03, the mid-point station on the river. Additional plots are provided in Appendix H.

Figure 4-3: Dry Weather 1 Concentrations in Delaware River at DR-03



Fecal coliform levels tended to have the highest of the three pollutants of concern (POC) while enterococcus levels tended to be the lowest. Concentrations for all POCs were all fairly low, with twelve (12) of the 33 results reported as less than the reporting limit (shown as open symbols in the Appendix figures). In addition, nineteen (19) of the 33 results were flagged as based on counts outside the ideal counting range, which is often applied when the concentrations are very low. Results are similar to historical data collected previously by the Delaware River Basin Commission (DRBC).

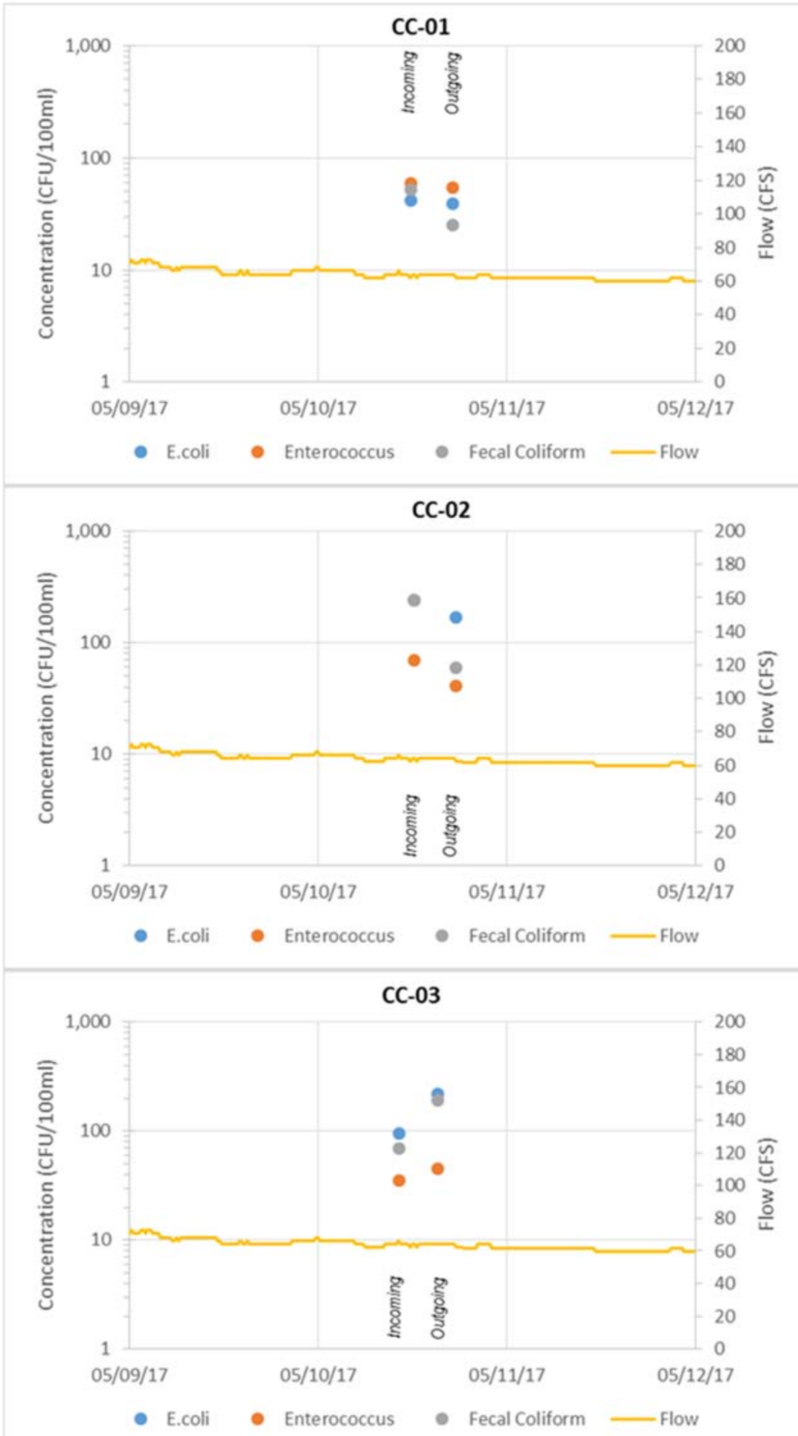
4.2 Dry Weather Sampling – Event 2 Results

The second dry weather event (Dry 2), on May 10, 2017, had fairly typical dry weather flows in each waterbody (as shown in Table 2-7). Laboratory results are presented by waterbody below.

4.2.1 Chester Creek Results

Samples collected on incoming and outgoing tides were fairly similar in concentrations of each pollutant and the majority of concentrations were within values used as maximum water quality standard criteria. Maximum water quality standard criteria are shown in Figure 2.1 in Section 2. Figure 4-4 shows the concentrations at each station. Additional plots are provided in Appendix H.

Figure 4-4: Dry Weather 2 Concentrations in Chester Creek



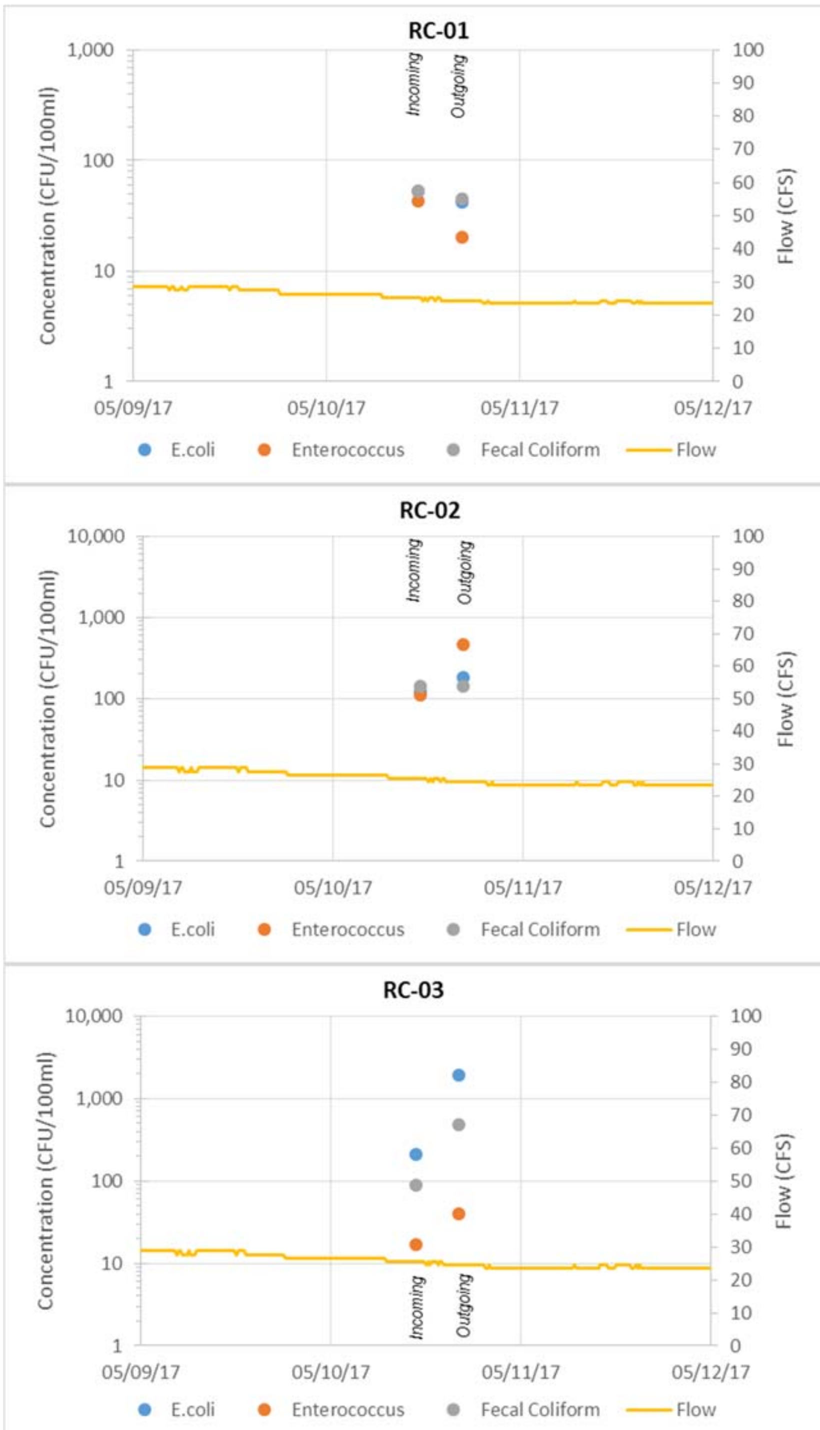
E. coli levels tended to have the highest of the three pollutants of concern (POC) while enterococcus levels tended to be the lowest. As noted in the introduction to Section 4, E. coli is a subgroup of fecal coliform and should have lower concentrations than fecal coliform. It is, however, fairly common for E. coli to be reported with higher concentrations than corresponding fecal coliform results, due to differences in the analytical methodology, the challenge of obtaining a homogenous sample, and the difficulty in measuring low levels of bacteria concentrations (see Section 5 for additional discussion). These figures also illustrate an increase in fecal coliform and E. coli POC levels from upstream (CC-01) to downstream to the mouth (CC-03) during both incoming and outgoing tidal conditions while enterococcus levels tended to be similar from upstream to downstream. Additional analysis and interpretation of the data will be conducted as part of the water quality model development and calibration process.

4.2.2 Ridley Creek Results

Samples collected on incoming and outgoing tides were fairly similar in concentrations of each pollutant and the majority of concentrations were within values used as maximum water quality standard criteria. Maximum water quality standard criteria are shown in Figure 2.1 in Section 2. Figure 4-5 shows the concentrations at each station. Additional plots are provided in Appendix H.

At RC-01 and RC-02, fecal coliform levels tended to have the highest of the three pollutants of concern (POC) while enterococcus levels tended to be the lowest. At RC-03, E. coli concentrations were higher than corresponding fecal coliform concentrations. As noted in the introduction to Section 4, E. coli is a subgroup of fecal coliform and should have lower concentrations than fecal coliform. It is, however, fairly common for E. coli to be reported with higher concentrations than corresponding fecal coliform results, due to differences in the analytical methodology, the challenge of obtaining a homogenous sample, and the difficulty in measuring low levels of bacteria concentrations. These figures also illustrate an increase in fecal coliform and E. coli levels from upstream (RC-01) to downstream to the mouth (RC-03), while enterococcus levels were similar at all locations. Additional analysis and interpretation of the data will be conducted as part of the water quality model development and calibration process.

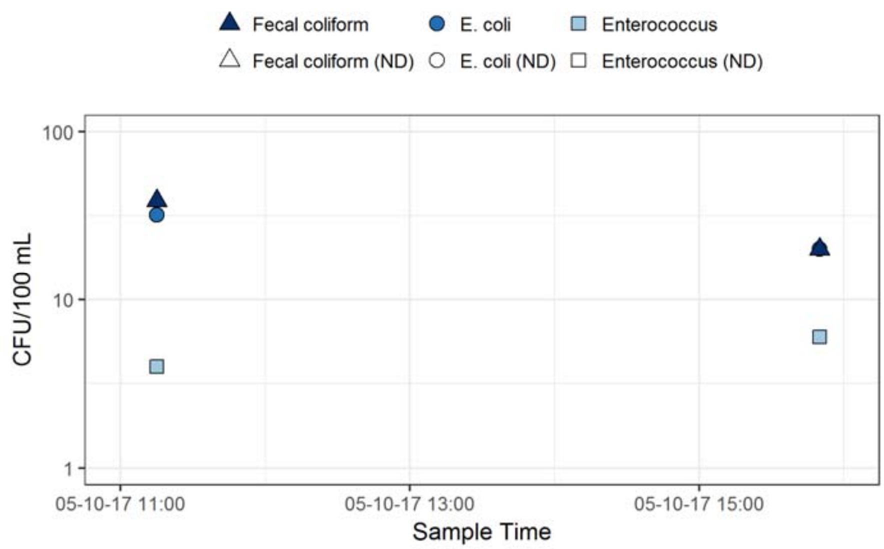
Figure 4-5: Dry Weather 2 Concentrations in Ridley Creek



4.2.3 Delaware River Results

Samples collected on incoming and outgoing tides were fairly similar in concentrations of each pollutant and all of concentrations were within values used as maximum water quality standard criteria. Maximum water quality standard criteria are shown in Figure 2.1 in Section 2. Figure 4-6 shows the concentrations at DR-03, the mid-point station on the river. Additional plots are provided in Appendix H.

Figure 4-6: Dry Weather 2 Concentrations in Delaware River at DR-03



Concentrations for all POCs were higher than Dry 1 but were still fairly low, well below maximum water quality standard criteria. Results were similar to historical data collected previously by the Delaware River Basin Commission (DRBC).

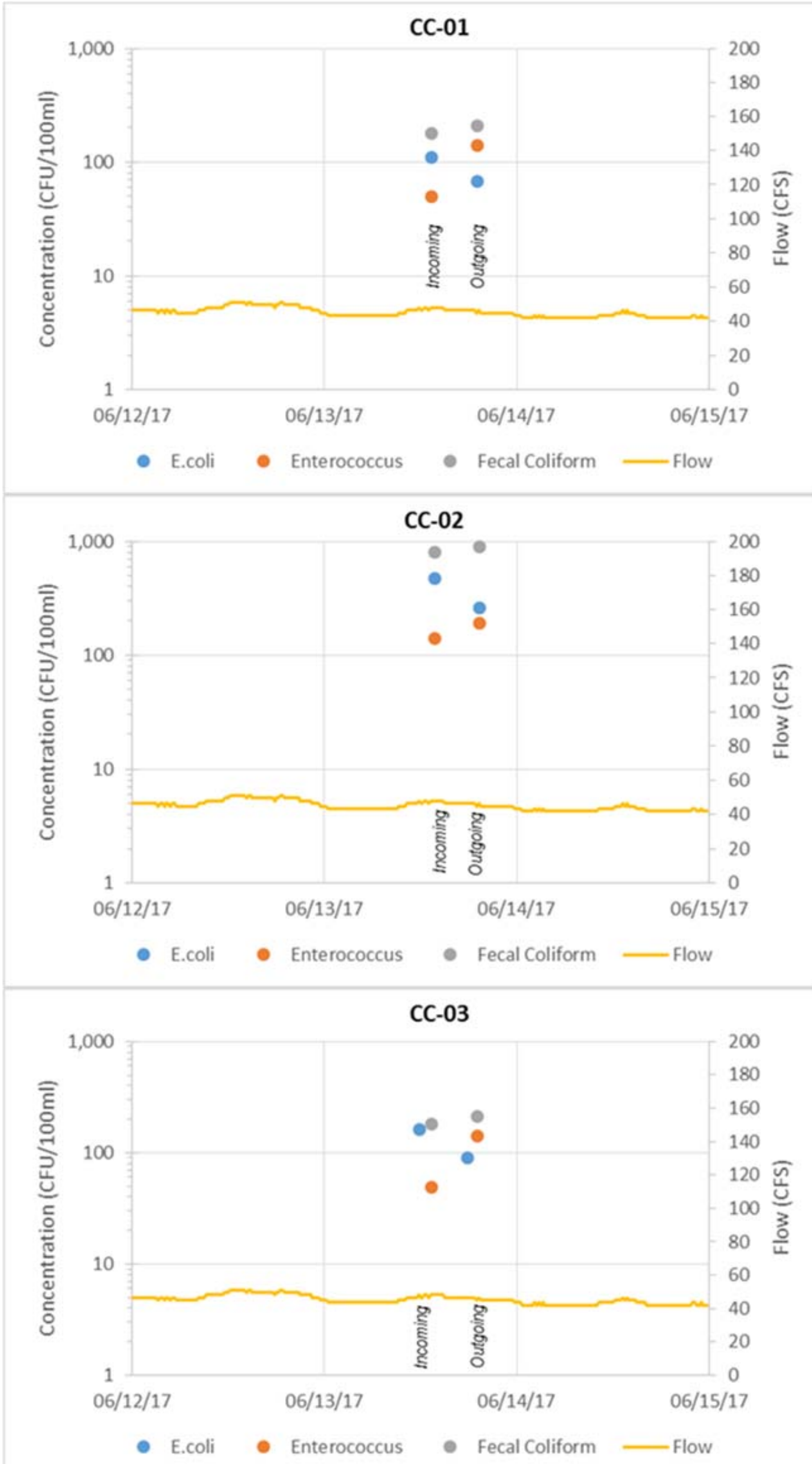
4.3 Dry Weather Sampling – Event 3 Results

The third dry weather event (Dry 3), on June 13, 2017, had the lowest dry weather flows in each waterbody (as shown in Table 2-7), approaching the 25th percentile flow. Laboratory results are presented by waterbody below.

4.3.1 Chester Creek Results

Samples collected on incoming and outgoing tides were fairly similar in concentrations of each pollutant. Enterococcus concentrations at each location tended to be higher on outgoing tide samples than incoming tide samples while the reverse was observed for E. coli. The majority of concentrations were higher than values used as maximum water quality standard criteria. Maximum water quality standard criteria are shown in Figure 2.1 in Section 2. Figure 4-7 shows the concentrations at each station. Additional plots are provided in Appendix H.

Figure 4-7: Dry Weather 3 Concentrations in Chester Creek



Fecal coliform levels tended to have the highest of the three pollutants of concern (POC) while enterococcus levels tended to be the lowest. These figures also illustrate an increase in POC levels from upstream (CC-01) to downstream to the mid-point (CC-02) during both incoming and outgoing tidal conditions, followed by a decline in POC levels near the mouth (CC-03). Additional analysis and interpretation of the data will be conducted as part of the water quality model development and calibration process.

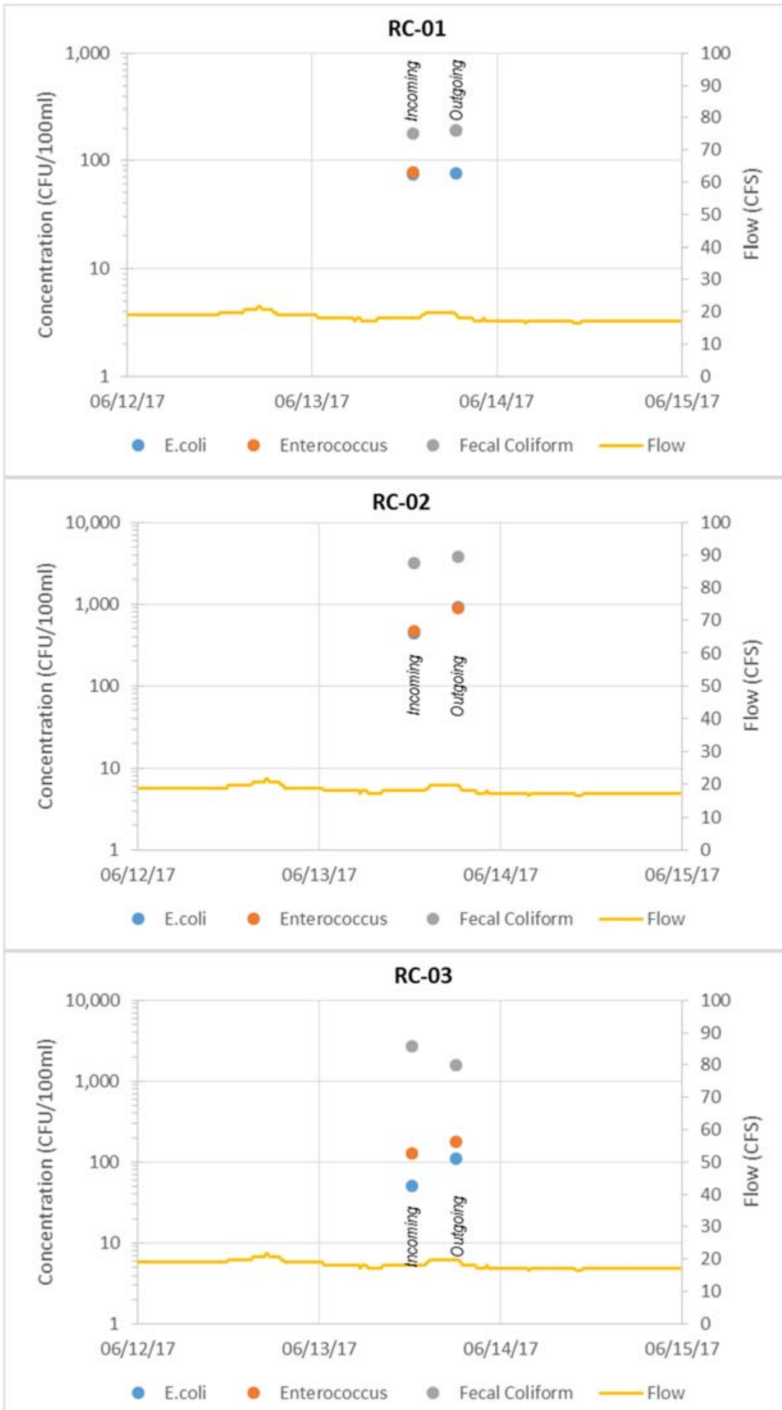
4.3.2 Ridley Creek Results

Samples collected on incoming and outgoing tides were fairly similar in concentrations of each pollutant. However, concentrations of enterococcus tended to be about two times higher in the outgoing samples than incoming sample levels.

Fecal coliform and enterococcus concentrations tended to be higher than the other dry weather events and maximum water quality standard criteria. The majority of E. coli concentrations were within values used as maximum water quality standard criteria. Maximum water quality standard criteria are shown in Figure 2.1 in Section 2. Figure 4-8 shows the concentrations at each station. Additional plots are provided in Appendix H.

Fecal coliform levels tended to have the highest of the three pollutants of concern (POC) while enterococcus levels tended to be the lowest, except at RC-03. As with the other dry weather events, the laboratory encountered difficulties in analyzing the samples at the best dilution and quantifying results for samples with low concentrations. These figures also illustrate an increase in POC levels from upstream (RC-01) to downstream to the mid-point (RC-02) during both incoming and outgoing tidal conditions, followed by a decline in POC levels near the mouth (RC-03).

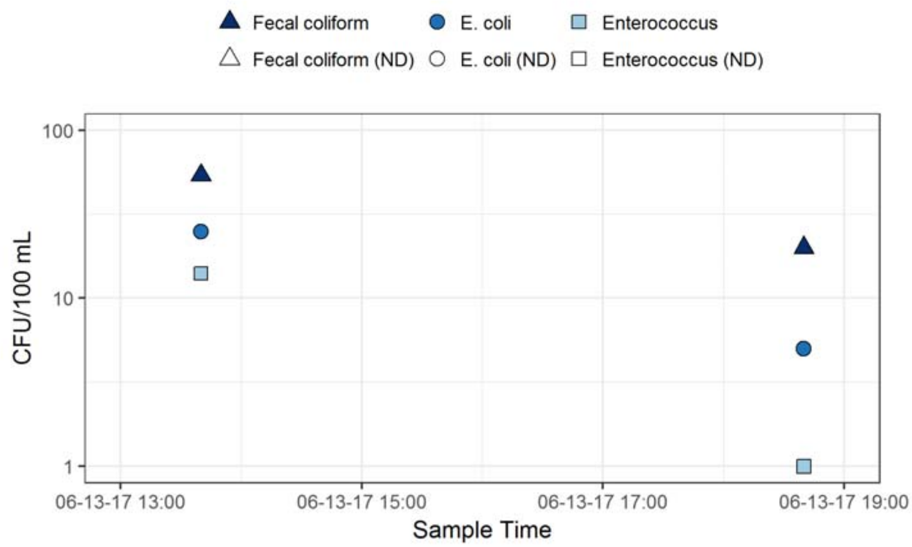
Figure 4-8: Dry Weather 3 Concentrations in Ridley Creek



4.3.3 Delaware River Results

Samples collected on incoming and outgoing tides were fairly similar in concentrations of each pollutant and all of concentrations were within values used as maximum water quality standard criteria. Maximum water quality standard criteria are shown in Figure 2.1 in Section 2. Figure 4-9 shows the concentrations at DR-03, the mid-point station on the river. Additional sampling plots are provided in Appendix H.

Figure 4-9: Dry Weather 3 Concentrations in Delaware River at DR-03



Concentrations for all POCs were fairly low, well below maximum water quality standard criteria. Results were similar to historical data collected previously by the Delaware River Basin Commission (DRBC).

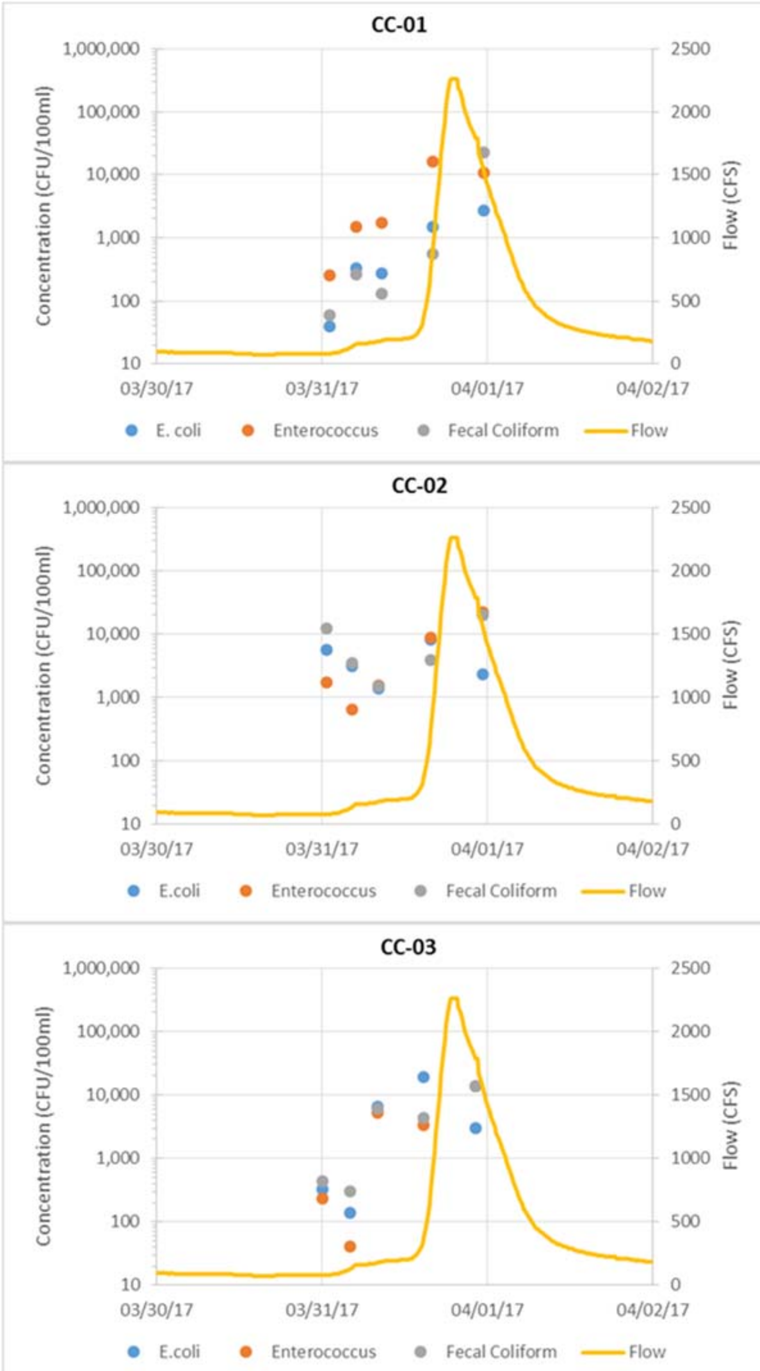
4.4 Wet Weather Sampling – Event 1 Results

Wet weather event 1 (Wet 1), was conducted on March 31-April 1, 2017. This event was the largest of the three events, with just over 1.5" recorded at the Philadelphia Airport. Rainfall was also mostly uniform across the watershed. This event also had the highest flows in the tributaries of the three sampled wet weather events. Laboratory results are presented by waterbody and source type below.

4.4.1 Chester Creek Results

Samples were collected at the intervals specified in the Sampling and Analysis Plan and summarized in Section 2.5.2. The majority of concentrations for all of the POCs were higher than values used as maximum water quality standard criteria. Maximum water quality standard criteria are shown in Figure 2.1 in Section 2. Figure 4-10 shows the concentrations at each station in the creek and the flow measured at the USGS gage just upstream of the DELCORA study area. Additional sampling plots are provided in Appendix H.

Figure 4-10: Wet Weather Event 1 Concentrations in Chester Creek



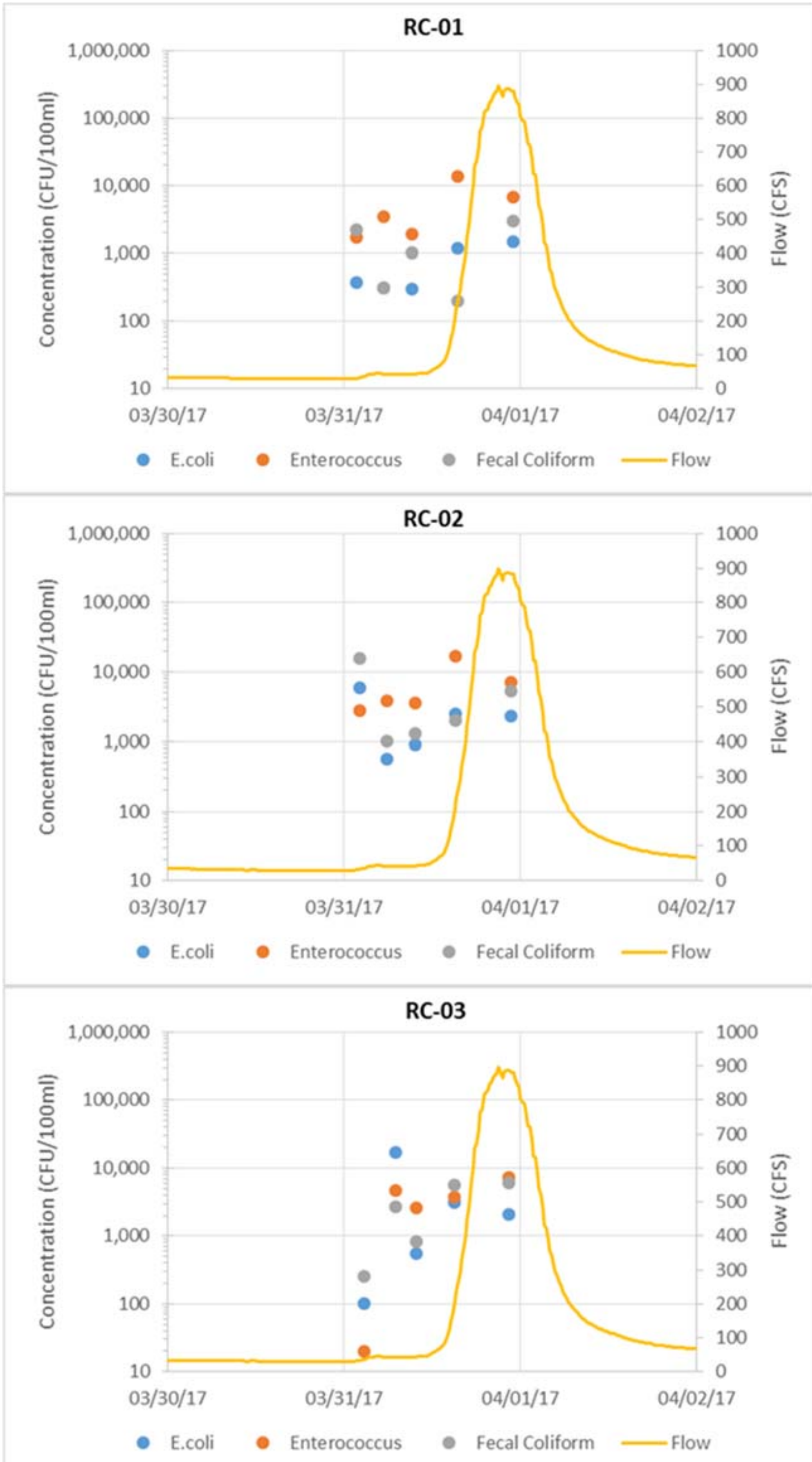
The impact of DELCORA’s CSOs and Chester stormwater POC loads are most evident in the data at CC-02 for first two rounds of sampling, which correspond to roughly the first six hours of the event. Similar concentrations were measured further downstream at CC-03 during the third and fourth rounds of sampling, which corresponds to approximately hours 8 through 16 of the event. The data at CC-01 suggest that loads from upstream sources reached the study area in the fourth and fifth rounds of sampling, approximately 16 to 24 hours of the event. POC concentrations peak at 23,000 cfu/100 ml (fecal coliform).

4.4.2 Ridley Creek Results

Samples were collected at the intervals specified in the Sampling and Analysis Plan and Section 2.5.2. The majority of concentrations for all of the POCs were higher than values used as maximum water quality standard criteria. Maximum water quality standard criteria are shown in Figure 2.1 in Section 2. Figure 4-11 shows the concentrations at each station in the creek and the flow measured at the USGS gage just upstream of the DELCORA study area. Additional sampling plots are provided in Appendix H.

The impact of DELCORA’s CSOs and Chester stormwater POC loads are most evident in the data at RC-02 for first two rounds of sampling. Similar concentrations were measured further downstream at RC-03 during the third and fourth rounds of sampling. The data at RC-01 suggest that loads from upstream sources reached the study area in the fourth and fifth rounds of sampling. POC concentrations peak at 17,000 cfu/100 ml (enterococcus).

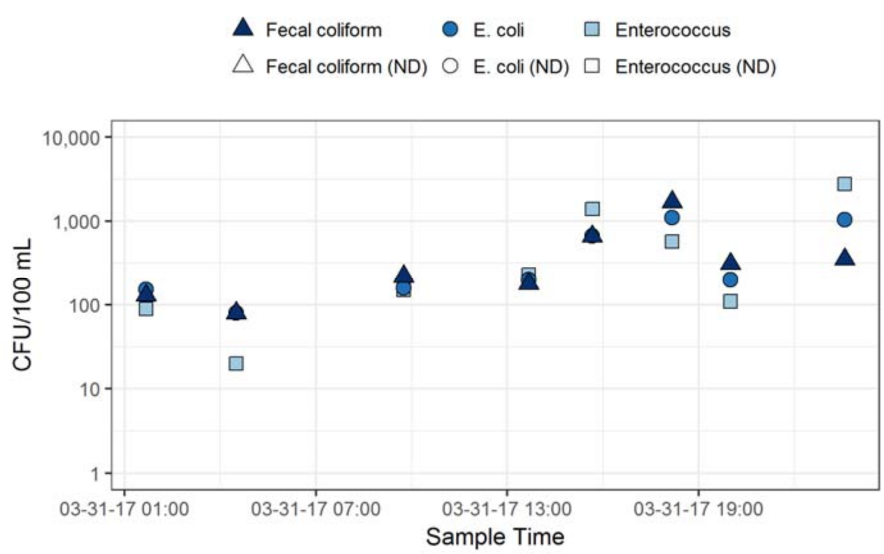
Figure 4-11: Wet Weather Event 1 Concentrations in Ridley Creek



4.4.3 Delaware River Results

Samples were collected at the intervals specified in the Sampling and Analysis Plan and summarized in Section 2.5.2. Samples were collected more frequently in the Delaware River than in the tributaries to ensure that wet weather impacts were characterized under an entire tidal cycle. Figure 4-12 shows the concentrations at DR-03, the mid-point station on the river. CSOs impacts would be captured at this station under all tidal conditions. Similar levels were observed at the other near shore Delaware River locations. These time series plots are provided in Appendix H.

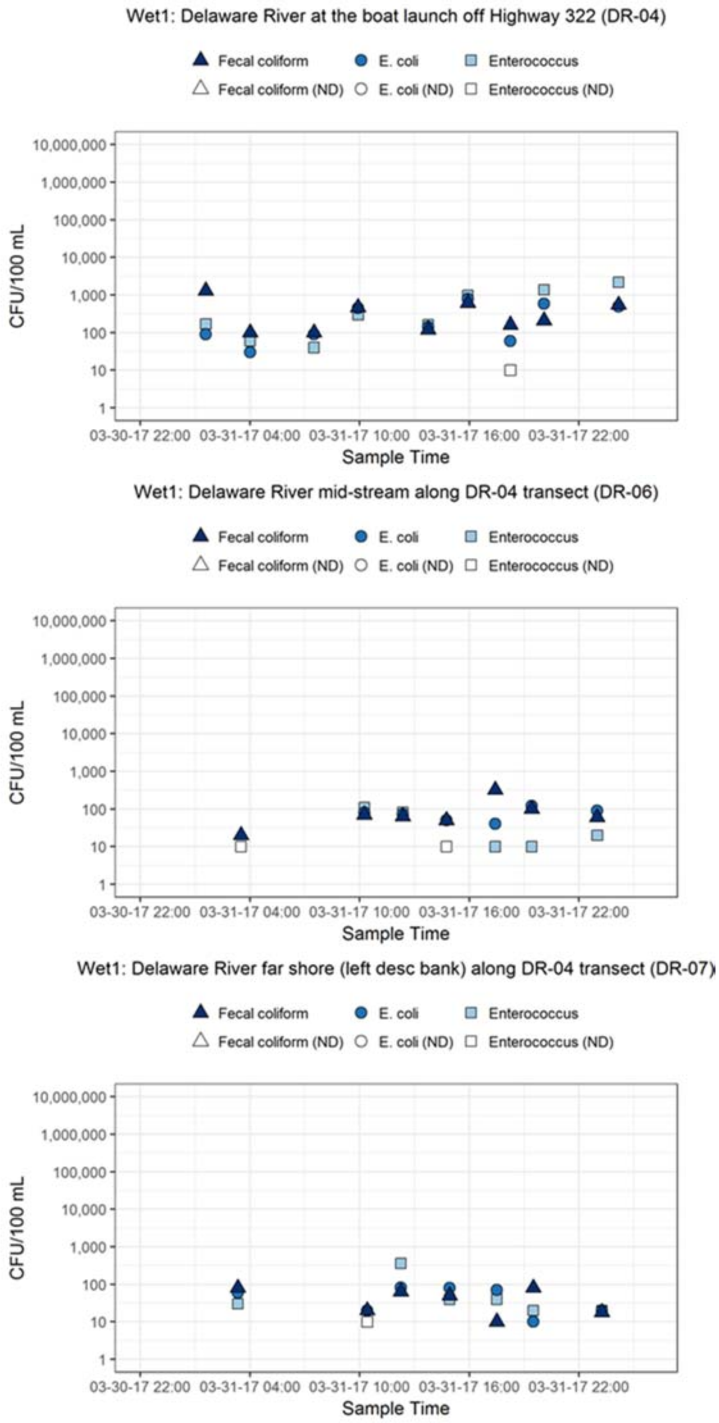
Figure 4-12: Wet Weather Event 1 Concentrations in Delaware River at DR-03



POC concentrations in the Delaware River tend to be approximately an order of magnitude lower than the levels observed in the tributaries, though there are several measurements that are higher than values used as maximum water quality standard criteria. Maximum water quality standard criteria are shown in Figure 2.1 in Section 2.

Near shore impacts of DELCORA's CSOs were assessed by collecting samples across the transect corresponding to near shore station DR-04 (see Figure 2-2). Results are shown for DR-04, DR-06 (mid-stream) and DR-07 (far shore) in Figure 4-13. This figure indicates that there is a small lateral gradient during the period when DELCORA's CSOs were discharging. The near shore concentrations are typically an order of magnitude larger than the mid or far shore concentrations, indicating that the influence of the DELCORA CSOs is limited to the near shore area. A better understanding of lateral mixing will be obtained through the model calibration process.

Figure 4-13: Wet Weather Event 1 Concentrations Across the Delaware River



4.4.4 Combined Sewer Overflow (CSO) Location Results

All of the CSOs were sampled during this event. Samples were collected at the intervals specified in the Sampling and Analysis Plan and summarized in Section 2.5.2. A full set of samples (i.e. 8 rounds) were collected at each CSO, except CSO-018, which had 7 rounds of sampling conducted before it stopped discharging. Concentrations for each POC for each CSO are presented in Figures 4-14 through 4-16. Concentration time series figures are presented in Appendix H.

Figure 4-14: CSO Fecal coliform Concentrations in Wet 1 Event

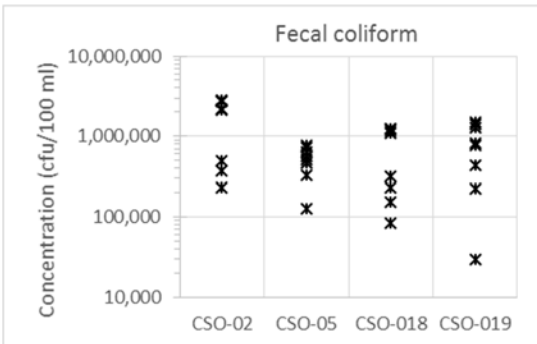


Figure 4-15: CSO E. coli Concentrations in Wet 1 Event

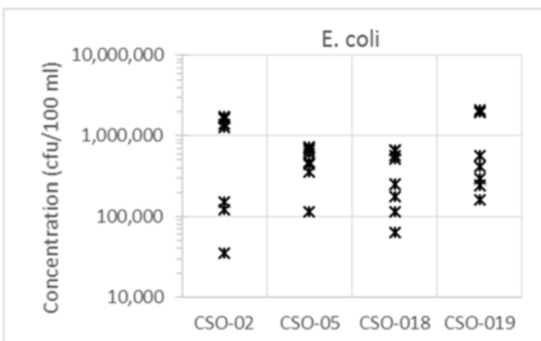
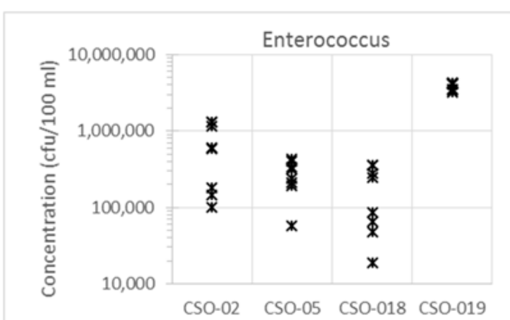


Figure 4-16: CSO Enterococcus Concentrations in Wet 1 Event



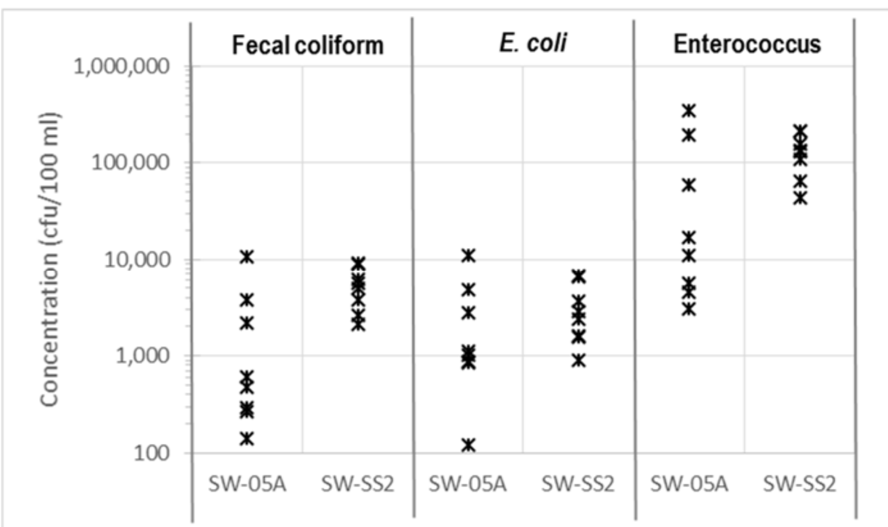
One potential outlier result was identified: the enterococcus result in round 1 at CSO-019 was 3,220,000 cfu/100 ml, and flagged as quantified with a count outside the ideal counting range. The next highest quantified result was 500,000 cfu/100 ml, nearly an order of magnitude lower. However, in round 4 at CSO-019, the result was reported as >600,000 cfu/100 ml (ie. actual concentration is greater than 600,000 cfu/100 ml), which provides some supporting evidence that enterococcus results in CSO-019 were higher than in the other CSOs and the potential outlier may be a legitimate reflection of conditions. The effect of this potential outlier will be further evaluated through the model calibration process.

Measured concentrations were within the range of CSO bacteria concentrations reported in the literature (EPA 2002) but tended to be lower than concentrations measured in other communities. Several potential explanations for this include: 1) the highly industrialized nature of the DELCORA service area may result in a smaller bacteria load to the combined system than communities with less industrial land; 2) DELCORA may have a relatively high percentage of stormwater in the combined system.

4.4.5 Stormwater Location Results

Both stormwater outfalls were sampled during this event. Samples were collected at the intervals specified in the Sampling and Analysis Plan and summarized in Section 2.5.2. A full set of samples (e.g. 8 rounds) were collected at each stormwater location. Concentrations for each POC are presented in Figure 4-17. Concentration time series figures are provided in Appendix H.

Figure 4-17: Stormwater POC Concentrations in Wet 1 Event



Most of the measured concentrations were within the range of stormwater bacteria concentrations reported in the literature (NSQD, 2015). It was somewhat surprising that the enterococcus results tended to be higher than the fecal coliform and E. coli data at both locations. However, there is very little data in the literature for enterococcus so it is difficult to assess whether these results are unusual. Additional evaluation of POC loads will be conducted as part of the watershed and water quality model calibrations.

4.5 Wet Weather Sampling – Event 2 Results

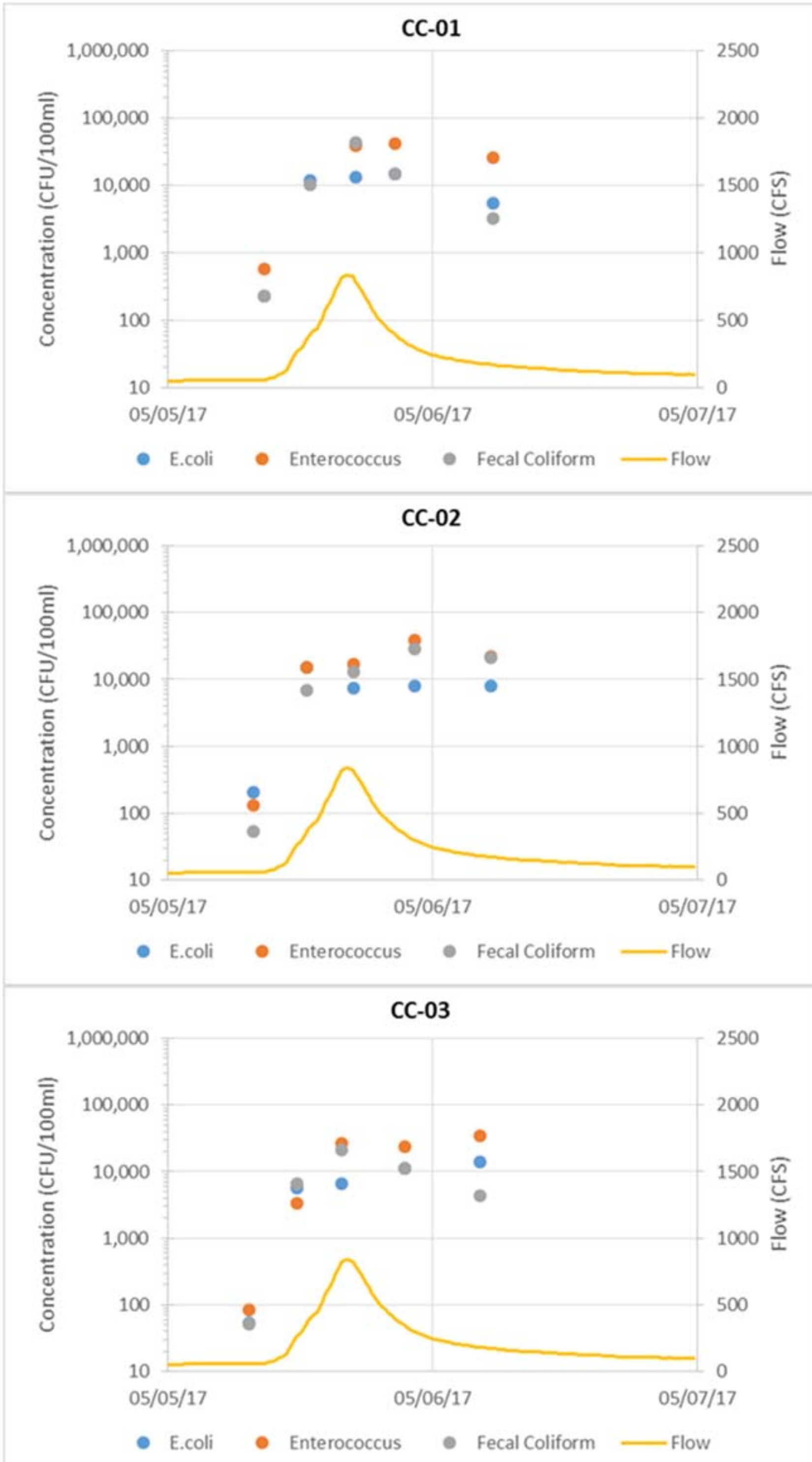
Wet weather event 2 (Wet 2), was conducted on May 5, 2017. This event was slightly smaller than the first wet weather event, with 1.47" recorded at the Philadelphia Airport. Rainfall varied somewhat across the watershed, with less rain falling in the DELCORA area and the upstream Chester and Ridley Creek watersheds, than in the Philadelphia area and areas bordering the Delaware River. Laboratory results are presented by waterbody and source type below.

4.5.1 Chester Creek Results

Samples were collected at the intervals specified in the Sampling and Analysis Plan (SAP). The majority of concentrations for all of the POCs were higher than values used as maximum water quality standard criteria. Maximum water quality standard criteria are shown in Figure 2.1 in Section 2. Figure 4-18 shows the concentrations at each station in the creek and the flow measured at the USGS gage just upstream of the DELCORA study area. Additional sampling plots are provided in Appendix H.

The impact of DELCORA's CSOs and Chester stormwater POC loads appear to begin in the second round of sampling. Concentrations remain elevated throughout the rest of the event at all three locations, despite the fact that DELCORA CSOs stopped discharging within 8 hours. This suggests that upstream and/or other bacteria sources are likely also impacting the creek. POC concentrations peak at 44,000 cfu/100 ml (fecal coliform).

Figure 4-18: Wet Weather Event 2 Concentrations in Chester Creek

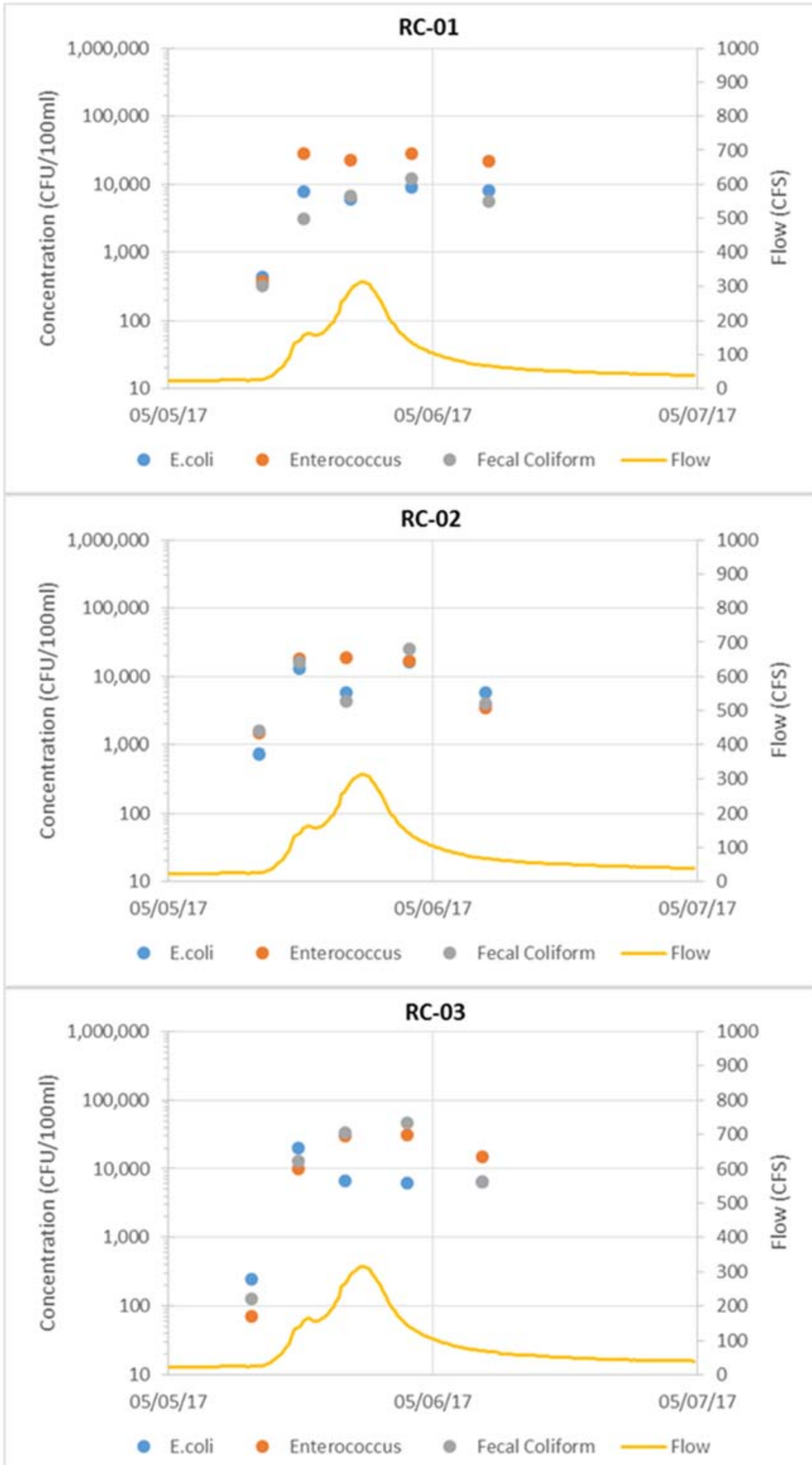


4.5.2 Ridley Creek Results

Samples were collected at the intervals specified in the Sampling and Analysis Plan and summarized in Section 2.5.2. The majority of concentrations for all of the POCs were higher than values used as maximum water quality standard criteria. Maximum water quality standard criteria are shown in Figure 2.1 in Section 2. Figure 4-19 shows the concentrations at each station in the creek and the flow measured at the USGS gage just upstream of the DELCORA study area. Additional sampling plots are provided in Appendix H.

The impact of DELCORA's CSOs and Chester stormwater POC loads appear to begin in the second round of sampling. Concentrations remain elevated throughout the rest of the event at all three locations, despite the fact that DELCORA CSOs stopped discharging within 8 hours (based on sampling intervals where samples could be collected in the CSOs). This suggests that upstream and/or other bacteria sources are likely also impacting the creek. POC concentrations peak at 47,000 cfu/100 ml (fecal coliform).

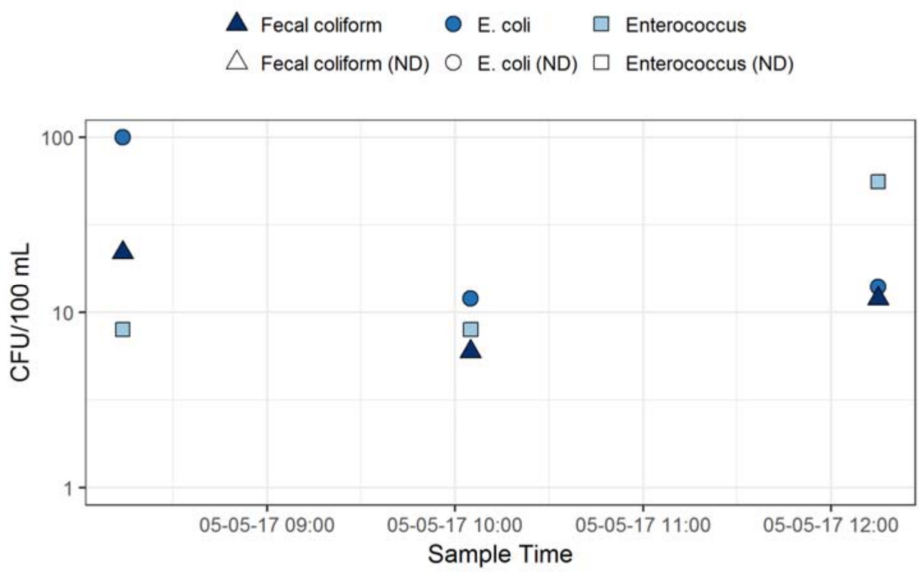
Figure 4-19: Wet Weather Event 2 Concentrations in Ridley Creek



4.5.3 Delaware River Results

Samples were collected at the intervals specified in the Sampling and Analysis Plan and summarized in Section 2.5.2. Samples were collected more frequently in the Delaware River than in the tributaries to ensure that wet weather impacts were characterized under an entire tidal cycle. Figure 4-20 shows the concentrations at DR-03, the mid-point station on the river. CSOs impacts would be captured at this station under all tidal conditions. Similar levels were observed at the other near shore Delaware River locations. All concentration time series figures are provided in Appendix H.

Figure 4-20: Wet Weather Event 2 Concentrations in Delaware River at DR-03



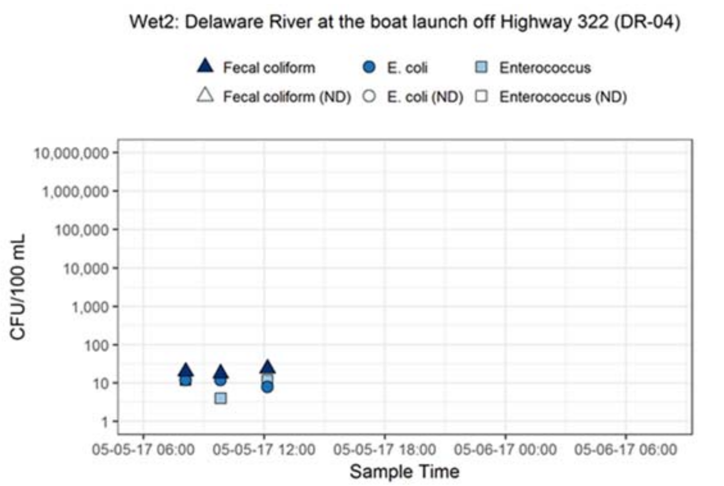
Note that sample collection in the Delaware River had to be stopped midway through the event, as described in Section 3 so the time series includes the three rounds of sampling that were completed as per the Sampling and Analysis Plan. Additional samples were collected from the bank during this event. The data from these locations are higher than the samples collected with the boat and likely reflect localized conditions rather than conditions at the scale of the water quality model.

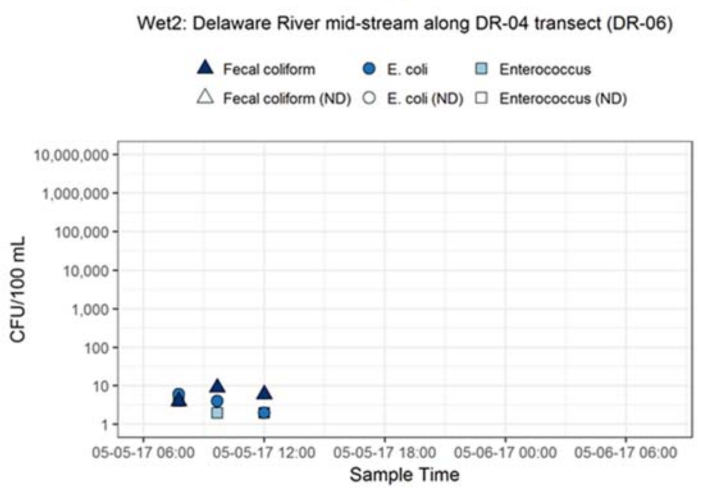
POC concentrations in the Delaware River tend to be approximately 1-2 orders of magnitude lower than the levels observed in the tributaries. Only the last round of sampling at DR-05 had any POC concentrations greater than 100 cfu/100 ml (the maximum value shown on the y-axis). Because DELCORA’s CSOs had stopped discharging well before this round, the concentrations are likely due to loads from other sources. All of the other measurements in the Delaware River are lower than values used as values used as maximum water quality standard criteria. Maximum water quality standard criteria are shown in Figure 2.1 in Section 2.

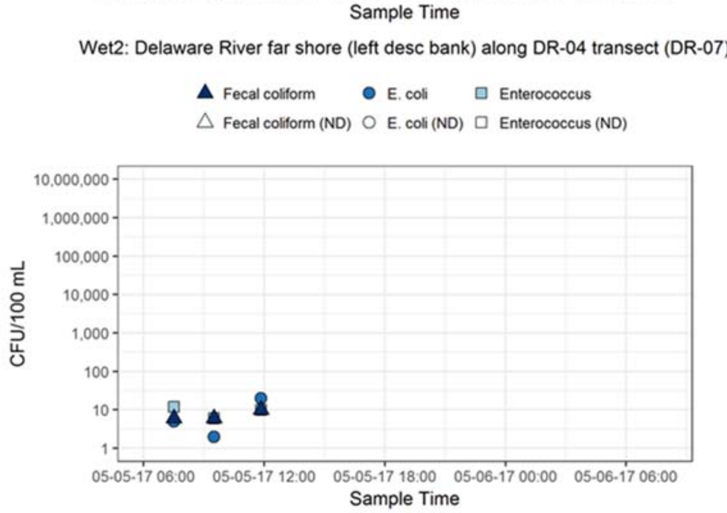
Near shore impacts of DELCORA’s CSOs were assessed by collecting samples across the transect corresponding to near shore station DR-04. Results are shown for DR-04, DR-06 (mid-stream) and DR-07 (far shore) in Figure 4-21. This figure indicates that a lateral gradient is very slight for the sampling rounds that could be collected. POC concentrations on the near shore and far shore are slightly higher

(~2x) than the mid-stream concentrations. A better understanding of lateral mixing will be obtained through the model calibration process.

Figure 4-21: Wet Weather Event 2 Concentrations Across the Delaware River







4.5.4 Combined Sewer Overflow (CSO) Location Results

All of the CSOs were sampled during this event. Samples were collected at the intervals specified in the Sampling and Analysis Plan and summarized in Section 2.5.2. Five rounds of samples were collected at each CSO before discharges ended. Concentrations for each POC for each CSO are presented in Figures 4-22 through 4-24. Time series plots are presented in Appendix H.

Figure 4-22: CSO Fecal coliform Concentrations in Wet 2 Event

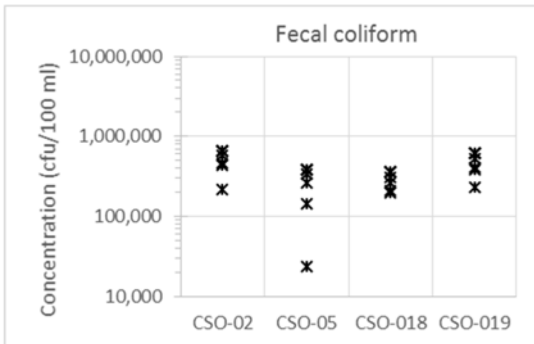


Figure 4-23: CSO E. coli Concentrations in Wet 2 Event

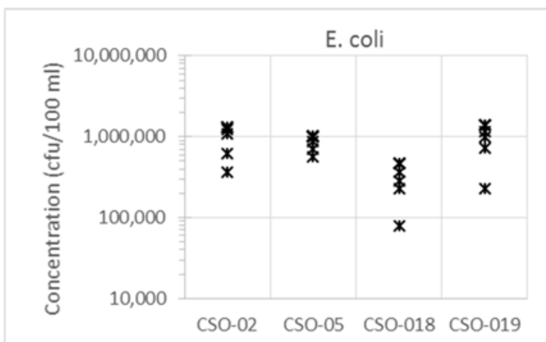
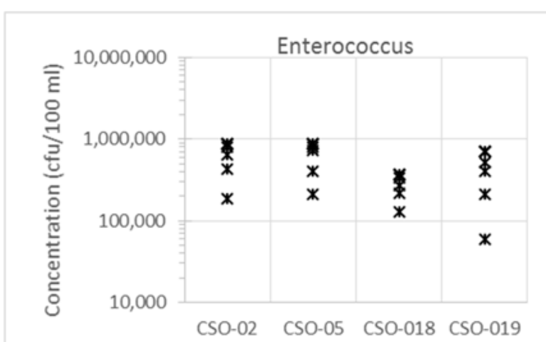


Figure 4-24: CSO Enterococcus Concentrations in Wet 2 Event

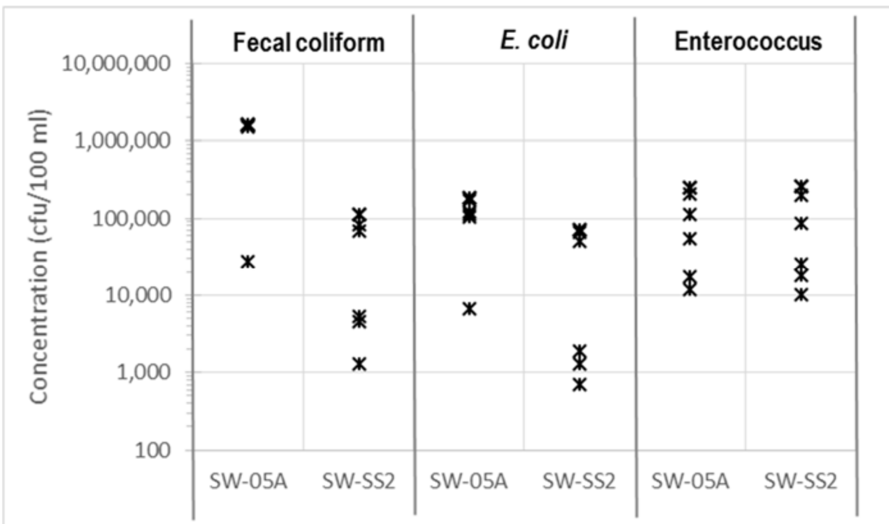


Measured concentrations were within the range of CSO bacteria concentrations reported in the literature (EPA 2002) and were similar to concentrations measured in other communities. Because this event had less rain than Wet Weather Event 1, CSO discharges likely had a smaller fraction of stormwater than in Wet Weather Event 1, resulting in slightly higher concentrations throughout the discharge period.

4.5.5 Stormwater Location Results

Both stormwater outfalls were sampled during this event. Samples were collected at the intervals specified in the Sampling and Analysis Plan and summarized in Section 2.5.2. Six rounds of samples were collected at each stormwater location before the runoff ended. Concentrations for each POC are presented in Figure 4-25. Time series plots are provided in Appendix H.

Figure 4-25: Stormwater POC Concentrations in Wet 2 Event



Most of the measured concentrations were within the range of stormwater bacteria concentrations reported in the literature. The enterococcus results were similar in magnitude to, though still higher on average than, the fecal coliform and E. coli data. Additional evaluation of POC loads will be conducted as part of the watershed and water quality model calibrations.

4.6 Wet Weather Sampling – Event 3 Results

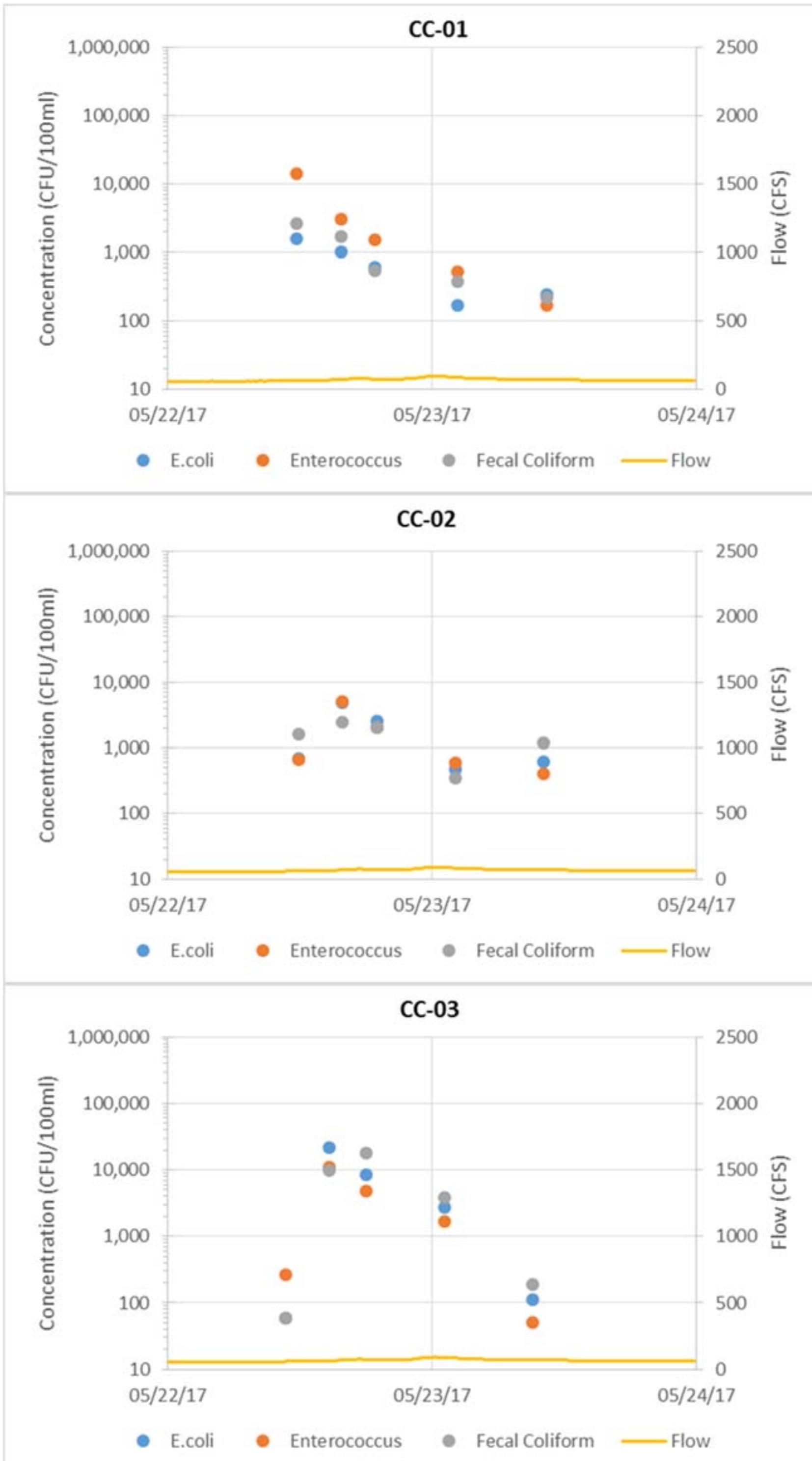
Wet weather event 3 (Wet 3), was conducted on May 22, 2017. This event was the smallest storm, with 0.51” recorded at the Philadelphia Airport. Rainfall varied across the watershed, with the upper tributary watersheds receiving much less rain than the areas closer to the Delaware River. Less rain fell in the DELCORA area than Philadelphia. Laboratory results are presented by waterbody and source type below.

4.6.1 Chester Creek Results

Samples were collected at the intervals specified in the Sampling and Analysis Plan and summarized in Section 2.5.2. The majority of concentrations for all of the POCs were higher than values used as maximum water quality standard criteria. Maximum water quality standard criteria are shown in Figure 2.1 in Section 2. Figure 4-26 shows the concentrations at each station in the creek and the flow measured at the USGS gage just upstream of the DELCORA study area. Additional sampling plots are provided in Appendix H.

The impact of DELCORA's CSOs and Chester stormwater POC loads are most evident in the data at CC-03 for second and third rounds of sampling. The data at CC-01 suggest that loads from upstream sources reached the study area at the beginning of the event, which likely reflects the spatial variability in the rainfall. POC concentrations peak at 22,000 cfu/100 ml (E. coli).

Figure 4-26: Wet Weather Event 3 Concentrations in Chester Creek

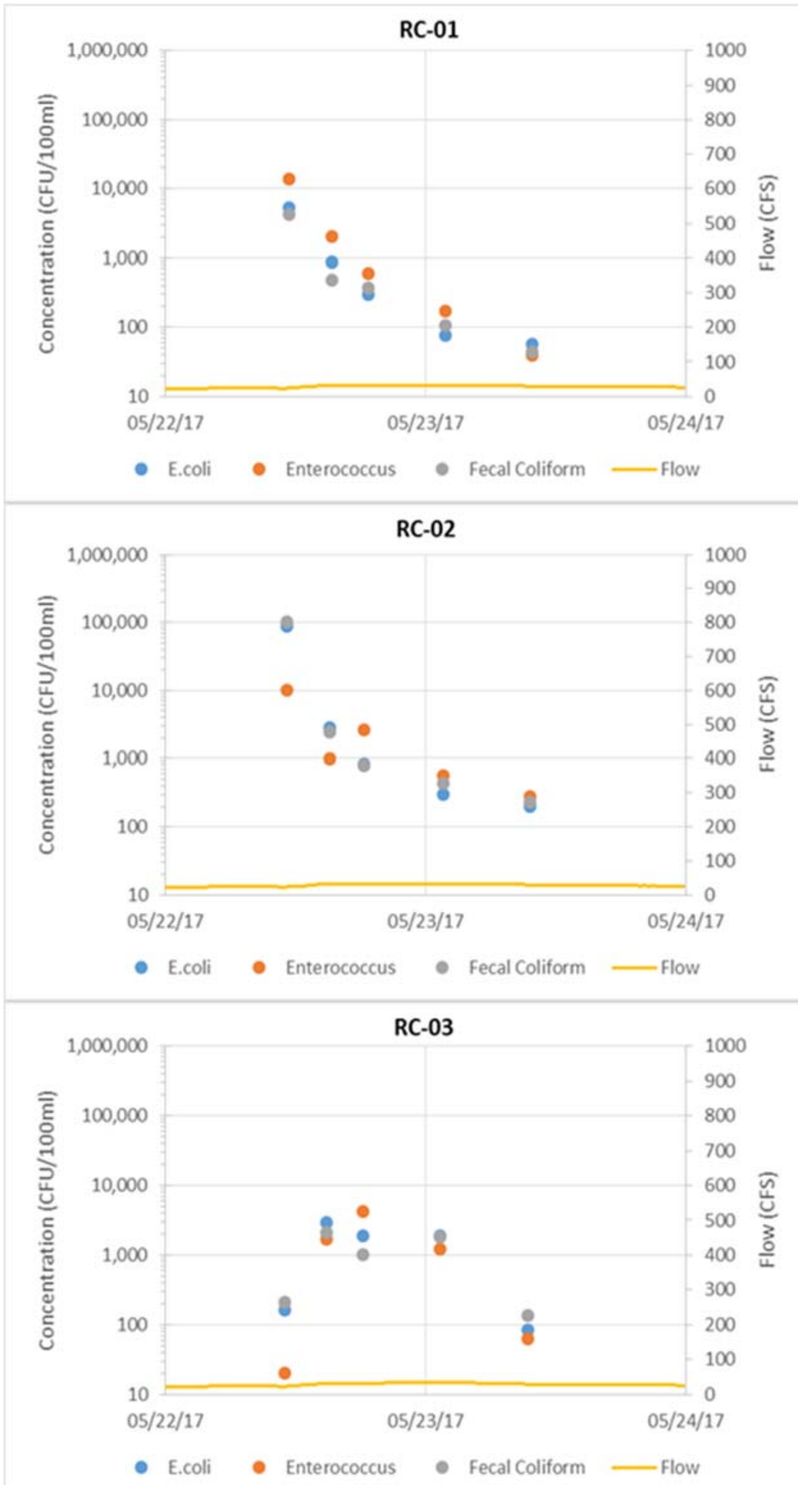


4.6.2 Ridley Creek Results

Samples were collected at the intervals specified in the Sampling and Analysis Plan and summarized in Section 2.5.2. The majority of concentrations for all of the POCs were higher than values used as maximum water quality standard criteria. Maximum water quality standard criteria are shown in Figure 2.1 in Section 2. Figure 4-27 shows the concentrations at each station in the creek and the flow measured at the USGS gage just upstream of the DELCORA study area. Additional sampling plots are provided in Appendix H.

The impact of DELCORA's CSOs and Chester stormwater POC loads are most evident in the data at RC-02 in the second round and RC-03 in the second and third rounds of sampling. The data at RC-01 suggest that loads from upstream sources reached the study area at the beginning of the event, which likely reflects the spatial variability in the rainfall. POC concentrations peak at 103,000 cfu/100 ml (fecal coliform).

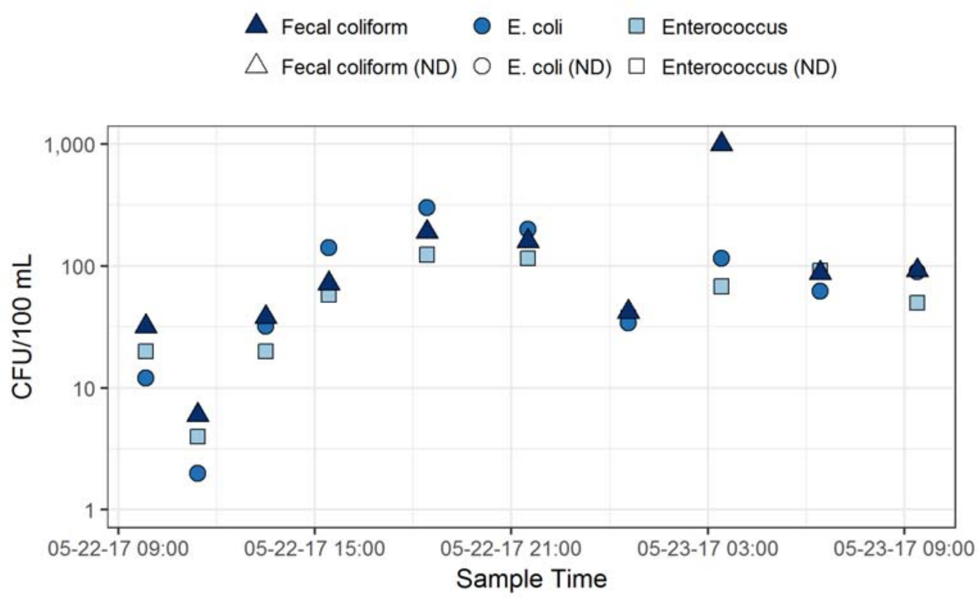
Figure 4-27: Wet Weather Event 3 Concentrations in Ridley Creek



4.6.3 Delaware River Results

Samples were collected at the intervals specified in the Sampling and Analysis Plan and summarized in Section 2.5.2. Samples were collected more frequently in the Delaware River than in the tributaries to ensure that wet weather impacts were characterized under an entire tidal cycle. Figure 4-28 shows the concentrations at DR-03, the mid-point station on the river. CSOs impacts would be captured at this station under all tidal conditions. Similar levels were observed at the other near shore Delaware River locations. All concentration time series figures are provided in Appendix H.

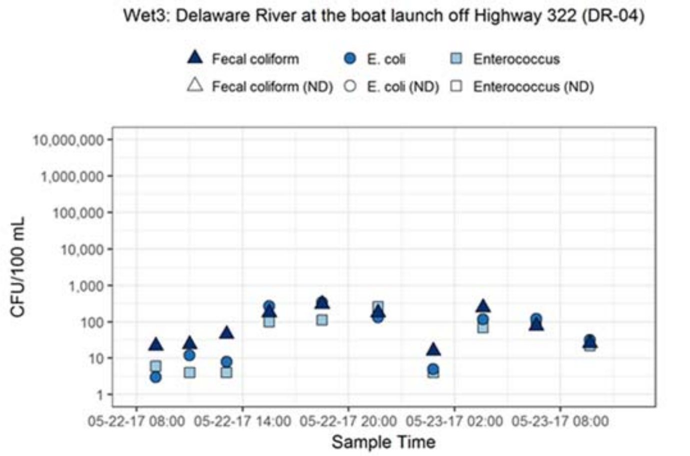
Figure 4-28: Wet Weather Event 3 Concentrations in Delaware River at DR-03

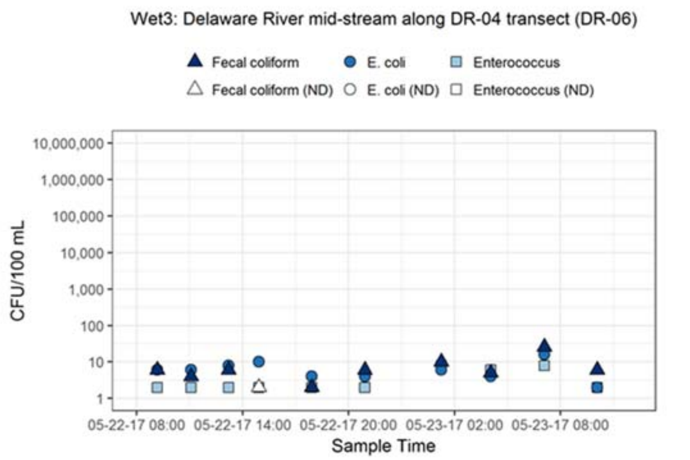


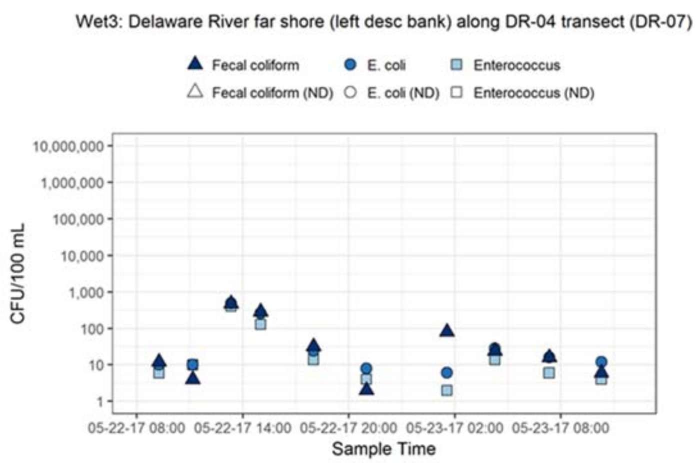
POC concentrations in the Delaware River tend to be approximately 1-2 orders of magnitude lower than the levels observed in the tributaries. The highest concentrations were observed in Rounds 5 and 8 (Hours 9 and 18) at this location. Most of the other measurements in the Delaware River are lower than values used as maximum water quality standard criteria. Maximum water quality standard criteria are shown in Figure 2.1 in Section 2.

Near shore impacts of DELCORA's CSOs were assessed by collecting samples across the transect corresponding to near shore station DR-04. Results are shown for DR-04, DR-06 (mid-stream) and DR-07 (far shore) in Figure 4-29. This figure indicates that a lateral gradient exists with both shores. POC concentrations on the near shore and far shore are approximately 1-2 orders of magnitude higher than the mid-stream concentrations. A better understanding of lateral mixing will be obtained through the model calibration process.

Figure 4-29: Wet Weather Event 3 Concentrations Across the Delaware River







4.6.4 Combined Sewer Overflow (CSO) Location Results

All of the CSOs were sampled during this event. Samples were collected at the intervals specified in the Sampling and Analysis Plan (SAP). Four rounds of samples were collected at each CSO before discharges ended. Concentrations for each POC for each CSO are presented in Figures 4-30 through 4-32. Figures of concentrations over time are presented in Appendix H.

Figure 4-30: CSO Fecal coliform Concentrations in Wet 3 Event

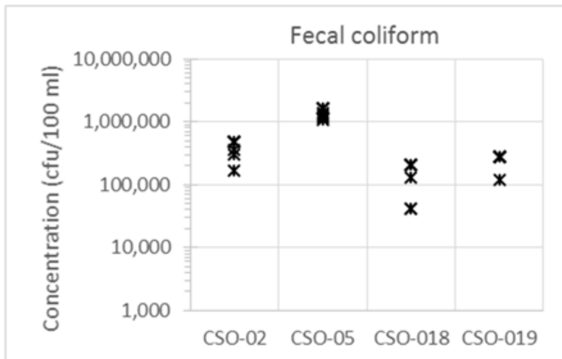


Figure 4-31: CSO E. coli Concentrations in Wet 3 Event

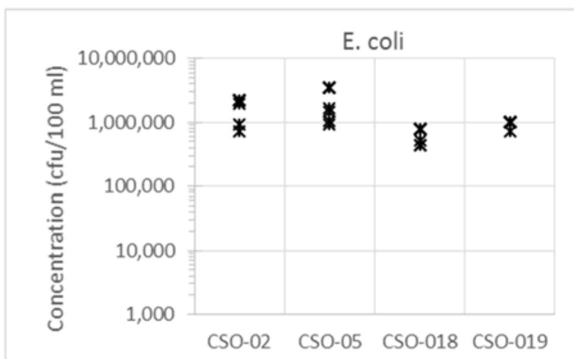
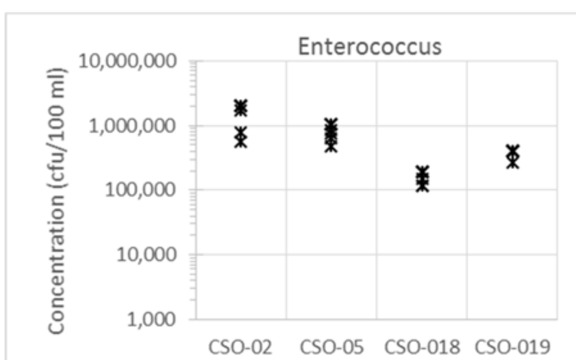


Figure 4-32: CSO Enterococcus Concentrations in Wet 3 Event

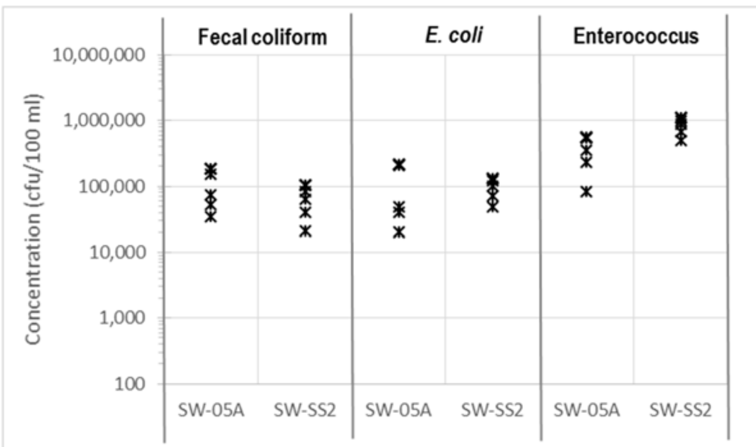


Measured concentrations were within the range of CSO bacteria concentrations reported in the literature (EPA 2002) and tended to be somewhat higher overall than concentrations measured in other communities. Because this event had much less rain than the first two wet weather events, the CSO discharges likely contained a much higher percentage of sanitary sewage than the other events.

4.6.5 Stormwater Location Results

Both stormwater outfalls were sampled during this event. Samples were collected at the intervals specified in the Sampling and Analysis Plan and summarized in Section 2.5.2. Five rounds of samples were collected at each stormwater location before the runoff ended. Concentrations for each POC are presented in Figure 4-33. Figures of concentration over time are provided in Appendix H.

Figure 4-33: Stormwater POC Concentrations in Wet 3 Event



Most of the measured concentrations were within the range of stormwater bacteria concentrations reported in the literature (NSQD 2015). It was somewhat surprising that the enterococcus results tended to be higher than the fecal coliform and E. coli data at both locations. However, there is very little stormwater data in the literature for enterococcus so it is difficult to assess whether these results are unusual. Additional evaluation of POC loads will be conducted as part of the watershed and water quality model calibrations.

Section 5 Comparison of Laboratory Results to QAPP

The Sampling Program execution was consistent with the QAPP objectives. This section presents a summary of the quality of the data relative to the QAPP objectives. Out of a total of 1,195 analysis, 1,104 (92%) did not require data qualifications as a result of poor QA/QC. The remaining 91 analysis were conducted outside the specified 8 hour hold time. However, of these 91 analyses, 84 were completed within 10 hours. These results have been qualified but minimal impact on the use of the data is anticipated due to the similarity in concentrations between results measured within and outside the analytical hold time. Much more uncertainty exists within the analytical methodology and field practices (e.g. obtaining a homogenous, representative sample, etc.). The most common qualifier applied to the data was due to bacteria counts outside ideal ranges. Most of these were the result of low ambient concentrations and the uncertainty associated with their quantification reflects the limitations of the analytical methodology.

Complete Laboratory QA Program Manuals and SOPs for each laboratory procedure are found in Appendix I.

5.1 QAPP Requirements

Section 2.4 of the QAPP provided data quality objectives for the following areas:

- Accuracy
- Precision
- Completeness
- Representativeness
- Comparability
- Required detection limits

Accuracy, precision and detection limits requirements for field and laboratory activities are summarized in Table 5-1. Completeness objectives for the field measurements and sample collection was 90%. The completeness objective was 95% for the laboratory (see Section 2.1.4.3 of the QAPP). Representativeness and comparability objectives were qualitative and will be presented in the context of the sample program comparison in Section 5.2.

Table 5-1: Data Quality Objectives

Parameter	Data Accuracy Objectives (% R)		Data Precision Objectives				Required Detection Limits	
			Field Precision (RPD)		Analytical Precision (RPD)			
	Estimated By	Objective	Estimated By	Objective	Estimated By	Objective	Reference Method	RL*
Fecal coliform	Presence/ Absence Control	P/A	Field Duplicates	50%	Lab Replicates	40%	SM 9222D	10 No./ 100 ml
Escherichia coliform (E. coli)	Presence/ Absence Control	P/A	Field Duplicates	50%	Lab Replicates	40%	EPA 1603	10 No./ 100 ml
Enterococcus	Presence/ Absence Control	P/A	Field Duplicates	50%	Lab Replicates	40%	EPA 1600	10 No./ 100 ml

P/A - method detects presence when bacteria is present in control (P) and method does not detect bacteria when absent in control (A).
RL - Reporting Limit
SM - Standard Methods of the Examination of Water and Wastewater, 22nd Edition

5.2 Comparison of Results to QAPP

This section presents a high level summary of the comparison of the QAPP objectives to the results from the Sampling Program.

5.2.1 Accuracy

Accuracy cannot be directly measured for bacterial samples. Accuracy was assessed by the laboratory through the analysis of positive and negative controls and matrix spikes and with field blanks in the field. Field blanks are used to determine if samples collected were contaminated. Dilution blank samples and method blank samples were generated by the contract laboratory and used to assess contamination resulting from laboratory procedures. Overall, the accuracy of the Sampling Program was excellent.

A total of 21 field blanks were collected during the Sampling Program with at least one field blank collected per sampling event. Each field blank was analyzed for all three POCs, providing up to 63 measures of field accuracy. Only two of the 63 field blank results had a measurement higher than the analytical reporting limit. The field blank concentrations for these two results were inspected for potential evidence of contamination in the associated sample. The comparison indicated that the field blank concentration was much lower than the corresponding sample concentration, so the apparent field contamination impact on the sample result was nominal.

Eurofins, the laboratory that conducted the bacteria analyses for the sampling program, conducted positive/negative controls for E.Coli and Enterococci. Fecal coliform does not require analysis of this QA/QC measure. A positive control is a sample known to have bacteria while a negative control is a sample known to be bacteria-free. The test is intended to confirm that the laboratory can grow bacteria for the positive controls and does not grow any measurable bacteria for the negative controls. For both E. coli and Enterococcus, six positive and six negative controls were analyzed. All measures met the requirements except one E. coli positive control, which did not have sufficient bacteria growth. Overall, this corresponds to a 96% success rate.

Matrix spikes are analyzed at a frequency of approximately one every 20 samples, depending on available sample volume, sufficient hold time and laboratory capacity. Matrix spikes are prepared by adding a known quantity of bacteria to a sample and measuring the amount recovered. Although this QA/QC measure was not included in the Sample Program QAPP, it provides another measure of laboratory accuracy. Matrix spikes were performed for all three parameters of interest using DELCORA samples.

Results are summarized in the table below. A percent recovery range of 50% - 150% recovery was used for acceptance windows. Note that percent recovery cannot be calculated under the following circumstances:

1. If the unspiked sample has a very high concentration relative to the amount spiked
2. If the matrix spike sample concentration exceeds the quantitation range (e.g. ">")

Both of these situations occurred with each parameter, as shown in the table below.

Table 5-2: Laboratory Matrix Spike Summary

Parameter	Number of MS samples analyzed	Number of MS samples without calculable percent recovery	Number of MS samples with measurable percent recovery	Number of MS samples with acceptable percent recovery
E. coli	13	4	9	6 (67%)
Enterococcus	12	4	8	8 (100%)
Fecal Coliform	10	5	5	3 (60%)

Overall, 77% of the matrix spikes where a percent recovery could be calculated were within the 50% - 150% windows.

5.2.2 Precision

Precision is a measure of agreement between two or more measurements. The precision test objective is shown in Table 5-1. Field duplicates and laboratory replicates samples were taken for a portion of the samples. As noted in the QAPP (Section 2.4.1.2), the precision test (i.e.: comparison between two or more samples) is applied if the average result of the duplicate/replicate samples is greater than five times the analysis detection limit. If the average result of the duplicate/replicate samples is less than five times the analysis detection limit, the precision test was not utilized. Overall, the precision of the Sampling Program was mostly successful at meeting the QAPP objectives. The issues impacting field precision were largely due to factors outside the control of sampling personnel as well as by the well-established difficulty in generating reproducible results analytically for these parameters.

A total of 23 field duplicates were collected during the Sampling Program, with at least one field duplicate collected per sampling event. Each field duplicate was analyzed for all three POCs, providing up to 69 measures of field precision. Table 5-2 provides a summary of the field duplicate precision, calculated as the relative percent difference (% RPD).

Table 5-3: Field Precision % RPD Summary

Event	Location	E. coli % RPD	Fecal % RPD	Entero % RPD
Dry1	CC-01	<5x RL	<5x RL	<5x RL
Dry1	DR-02	<5x RL	<5x RL	<5x RL
Dry1	RC-03	91%	<5x RL	<5x RL
Dry2	CC-02	60%	59%	11%
Dry2	DR-04	80%	7%	<5x RL
Dry2	RC-02	7%	49%	42%
Dry3	CC-03	22%	9%	55%
Dry3	DR-03	18%	5%	<5x RL
Dry3	RC-01	44%	10%	0%
Wet1	CC-03	44%	36%	56%
Wet1	CSO-02	45%	107%	20%
Wet1	DR-02	55%	41%	<5x RL
Wet1	DR-04	133%	0%	52%
Wet1	RC-01	34%	67%	1%
Wet2	CC-01	27%	35%	3%
Wet2	CSO-018	2%	19%	18%
Wet2	DR-03 (LAND)	75%	147%	15%
Wet2	RC-02	34%	6%	18%
Wet3	CC-02	2%	50%	18%
Wet3	CSO-019	22%	1%	36%
Wet3	DR-01	50%	58%	<5x RL
Wet3	DR-02	6%	40%	34%
Wet3	RC-03	41%	21%	26%

Twelve (12) of the 69 RPDs could not be calculated because of the low pollutant concentrations in the samples and the field duplicates. For E. coli, 15 of the 21 calculable field duplicates met the 50% precision objective. For fecal coliform, 15 of the 20 calculable field duplicates met the 50% precision objective. For enterococcus, 13 of the 16 calculable field duplicates met the 50% precision objective.

Laboratory replicates are analyzed at a frequency of approximately one every 20 samples, depending on available sample volume, sufficient hold time and laboratory capacity. Replicates are prepared by analyzing a second aliquot of a sample and measuring the agreement between the two analyses as the relative % difference (% RPD). Replicates provide an assessment of laboratory precision. Replicates were performed for all three parameters of interest using DELCORA samples.

Results are summarized in the table below. A % RPD target of 40% was specified in the QAPP for acceptance windows. Note that % RPD cannot be calculated under the following circumstances:

1. If the sample or replicate concentration exceeds the quantitation range (e.g. ">")
2. If the sample or replicate concentration is less than the reporting limit (e.g. "<")

Both of these situations occurred with each parameter, as shown in the table below. In addition, the sample id for one of the replicates for each parameter was inadvertently not recorded so it was not possible to compare its concentration to the first aliquot.

Table 5-4: Relative Percent Difference Summary

Parameter	Number of replicate samples analyzed	Number of replicate samples without calculable % RPD	Number of replicate samples with measurable % RPD	Number of replicate samples with acceptable % RPD
E. coli	13	6	7	7 (100%)
Enterococcus	12	7	5	3 (40%)
Fecal Coliform	10	7	3	1 (40%)

Overall, 73% of the replicates where a % RPD could be calculated were within the 40% window.

5.2.3 Completeness

Completeness is a measure of the amount of valid data obtained from the monitoring program compared to the amount of data that were expected. Events that may contribute to reduction in measurement completeness include sample container breakage, inaccessibility to desired sampling locations, automatic sampler failure, and laboratory equipment failures.

Field completeness is determined by the number of measurements collected versus the number of measurements planned for collection. As noted in the QAPP, The completeness criterion for all measurements and sample collection is 90 percent, but will be influenced by environmental situations that may alter monitoring schedules. These environmental situations were presented in Section 3 of this report for each event. Laboratory completeness is a measure of the amount of valid measurements obtained from all samples submitted for each sampling activity. The completeness criterion for all measurements is 95 percent.

All analyses were completed on the samples that were collected so the laboratory completeness measure is 100%. The overall field completeness was 87%. Field completeness was impacted by the sampling challenges described in Section 3, including weather-related safety issues and mechanical problems with the boat that resulted in several rounds of sampling that could not be conducted as planned. These issues only impacted the wet weather sampling in the Delaware River. When possible, samples were collected from the bank but access was limited to only two stations. For the tributaries, CSOs and stormwater locations, the field completeness was 100%. Depending on the location in the Delaware River, the field completeness ranged from 67% to 78%. Overall, the completeness objective was successfully achieved as most of the problems affecting the ability to collect the planned samples in the Delaware River were unavoidable.

5.2.4 Representativeness

Representativeness is the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representative data of dry weather and wet weather conditions are required to support the evaluation and modeling efforts.

For sample collection, representativeness will be assured by following the Water Quality Monitoring and Modeling Work Plan (Greeley and Hansen / Limnotech, Revised July 2017) and applying proper collection techniques including the proper sample sizes and volumes, sampling times, and sampling locations. The volumes of the samples depend on the analytical methods and should allow for QC sample analysis and reanalysis, if required. In the laboratory, representativeness will be ensured by using the appropriate sample preparation techniques, by following appropriate analytical procedures, and by meeting the recommended sample holding times.

Representativeness was achieved in the Sampling Program by sampling three dry weather events under a range of flow conditions and during both the spring and summer season, and by sampling three wet weather events under a range of environmental conditions, with rainfall ranging from 0.5 inches to more than 1.5 inches. Figures 5-1 and 5-2 shows the sampling intervals in each of the waterways for the three dry weather and three wet weather events, respectively. There were no instances where samples lacked sufficient volume for analysis. In the laboratory, representativeness was generally good.

All samples were analyzed for all POCs using accepted methods. However, of the 459 samples collected in the Sampling Program, 61 had at least one parameter analyzed outside the specified hold time of 8 hours. Most of these samples were associated with the wet weather events, reflecting the logistical challenges associated with this type of sampling. A total of 91 analyses were conducted after the hold time had expired. However, 84 of these analyses were completed within 10 hours, so the hold time was missed by less than 2 hours for the vast majority of samples. These results have been qualified but minimal impact on the use of the data is anticipated due to the similarity in concentrations between results measured within and outside the analytical hold time. Much more uncertainty exists within the analytical methodology and field practices (e.g. obtaining a homogenous, representative sample, etc.).

Overall, the representativeness objectives of the QAPP was achieved through the selection of sampling events that collectively, capture the river and tributary characteristics over a range of environmental conditions.

Figure 5-1: Representativeness of Dry Weather Sampling Events and Sampling Intervals in Each Waterway

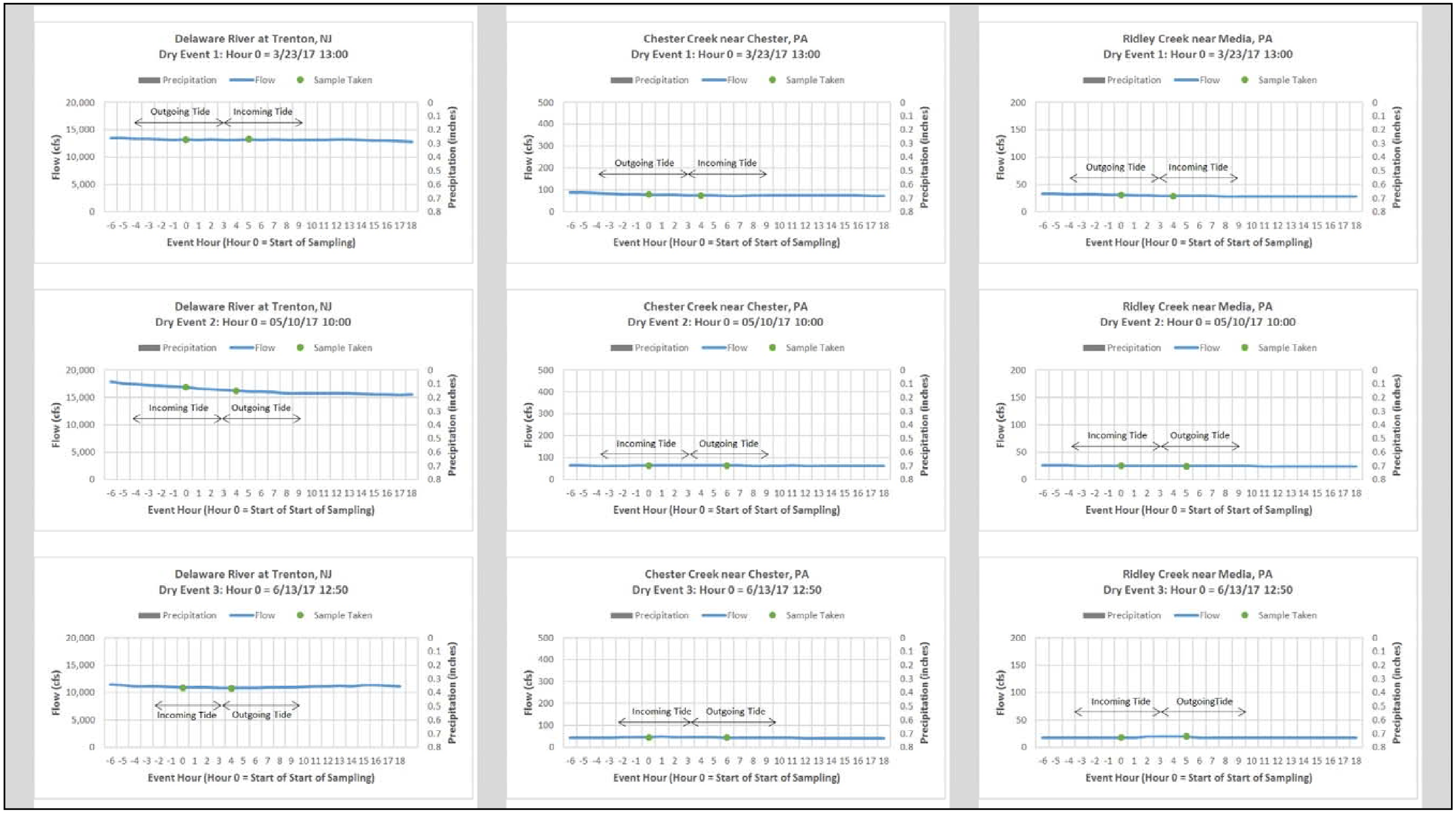
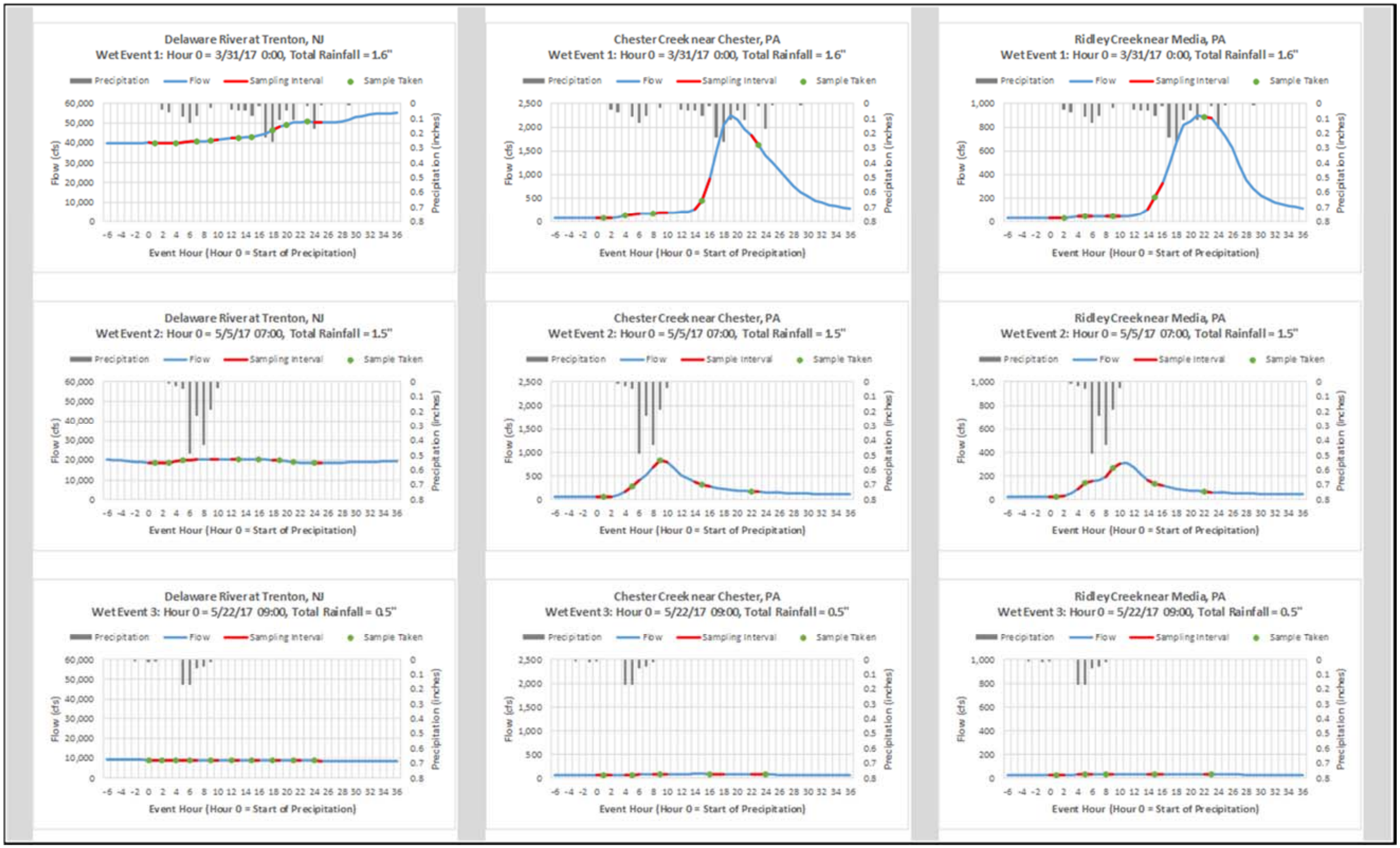


Figure 5-2: Representativeness of Wet Weather Sampling Events and Sampling Intervals in Each Waterway



5.2.5 Comparability

The objective for data comparability is to generate data for each parameter that related water quality conditions between sampling locations and over time. Data comparability will be promoted by:

1. Using standard U.S. EPA approved methods, where possible.
2. Consistently following the sampling methods detailed in the SAP.
3. Consistently following the analytical methods detailed in the QAPP.
4. Achieving the required detection limits detailed in the QAPP.

All sample collection and analytical methods will be specified, and any deviations from the methods will be documented. All results will be reported in the standard units as shown in QAPP. All field and laboratory calibrations will be performed using standards traceable to National Institute of Science and Technology (NIST) or other U.S. EPA approved sources.

The field crews and laboratory were consistent in collecting and analyzing the samples from the Sampling Program in a manner that allows the data to be compared between events. In the laboratory, the same EPA-approved analytical method was used for each parameter across all sampling events and samples were consistently analyzed at the dilutions specified in the QAPP and Work Plan. The Sampling Program successfully met this objective of the QAPP.

5.2.6 Required Detection Limits

All required detection limits were met in the Sampling Program.

Section 6 Water Quality Sampling Results Summary

This section presents additional analysis of the water quality sampling program results, particularly with respect to their use in the development and calibration of the water quality model.

6.1 Data Analysis

Section 4 presented an overview of the dry and wet weather datasets by individual event. The following observations were presented with respect to the data:

- Bacteria concentrations tended to be similar in all of the waterbodies during dry weather for both incoming and outgoing tidal conditions;
- Dry weather concentrations in the tributaries were mostly below numeric thresholds used for water quality standard criteria;
- Dry weather concentrations in the Delaware River tended to be well below numeric thresholds used for water quality standard criteria;
- An increase in POC concentration from upstream to downstream was observed in each of the tributaries, suggesting there may be significant bacteria sources impacting these tributaries during dry weather;
- Wet weather concentrations in all of the waterbodies tended to exceed numeric thresholds used for water quality standard criteria;
- Lateral POC gradients in the Delaware River were present but not at a significant level (e.g. orders of magnitude); and,
- The time series profiles in the Chester Creek and Ridley Creek waterbodies suggest that DELCORA's CSO discharges and Chester's stormwater discharges are not the only sources impacting these tributaries during wet weather. Upstream or other wet-weather sources also contribute to high bacteria concentrations during wet weather events.

In addition to the insights gleaned from the time series figures described in Section 4 and presented in Appendix H, this section presents data analyses that considered the results for the events more holistically than the individual event summaries presented in Section 4. Additional data analyses presented in this section include 1) an evaluation of the waterway response to the various environmental conditions during the sampled events and 2) an evaluation of whether a first flush could be discerned for any of the POCs in the source (e.g. CSO and stormwater) data.

6.1.1 Evaluation of Waterway Response to Environmental Conditions

Because multiple storm events were sampled, along with several dry weather events, a comparison of the response at each stream location across the sampling events may yield insight into how sensitive a given stream reach is to the amount and distribution of rainfall. This may be an important factor to consider in developing CSO control strategies. For example, a control strategy may target reductions of CSOs in non-tidal areas if those portions of the streams show a stronger response to rainfall than tidal areas.

Figure 6-1 presents box-and-whisker plots of the tributary sampling locations in Chester Creek and Ridley Creek. The figures are ordered such that the top figure is the most upstream sampling location and the bottom figure is the most downstream sampling location. The boxes in the figure correspond to the 25th and 75th percentiles of the data. The line in the center of the box is the median concentration. The end of the whiskers correspond to the minimum and maximum concentrations. The data for each wet and dry weather events were grouped separately into subsets for the purpose of the plot. Similar figures are presented in Appendix H for the other POCs and sampling locations.

The following insights can be gleaned from these figures:

- Dry weather concentrations of the analyzed bacteria are lower than each of the wet weather event concentrations;
- The stream response was most pronounced for the second wet weather event. This event was slightly less depth than the first wet weather event (1.47 inches vs. 1.5 inches) but the rainfall occurred over a shorter duration and with higher intensity in the second wet weather event, resulting in a stronger in-stream response.
- Downstream locations show more spread in the distribution of concentrations within each event as compared to the most upstream locations. This is likely the result of higher mixing with the Delaware River and the tidal influence on water quality at the more downstream locations.

Figure 6-2 presents box-and-whisker plots of three Delaware River locations: DR-01, which is the most upstream (e.g. least tidally impacted) station, DR-03, which is approximately midway along the reach of the river adjacent to the DELCORA service area, and DR-05, which is the most downstream station.

This figure shows some of the same characteristics as Figure 6-1 as well as some differences. Like the tributaries, the most downstream location shows the largest spread in concentrations, likely the result of higher mixing associated with the tidal influence on water quality at this station compared to the others located further upstream. Unlike the tributaries, which had the largest response to the second wet weather event, the Delaware River had the highest concentrations in the first wet weather event, though at DR-05, the peak concentration occurred during the second wet weather event. Another difference between the characteristics of the Delaware River and the tributaries' water quality is that the dry and wet weather concentrations in the Delaware River tended to be more similar than in the tributaries. Additional analysis and interpretation of the data will be conducted as part of the water quality model development and calibration process.

Figure 6-1: Comparison of Fecal Coliform Concentrations for the Sampling Events in Chester and Ridley Creeks

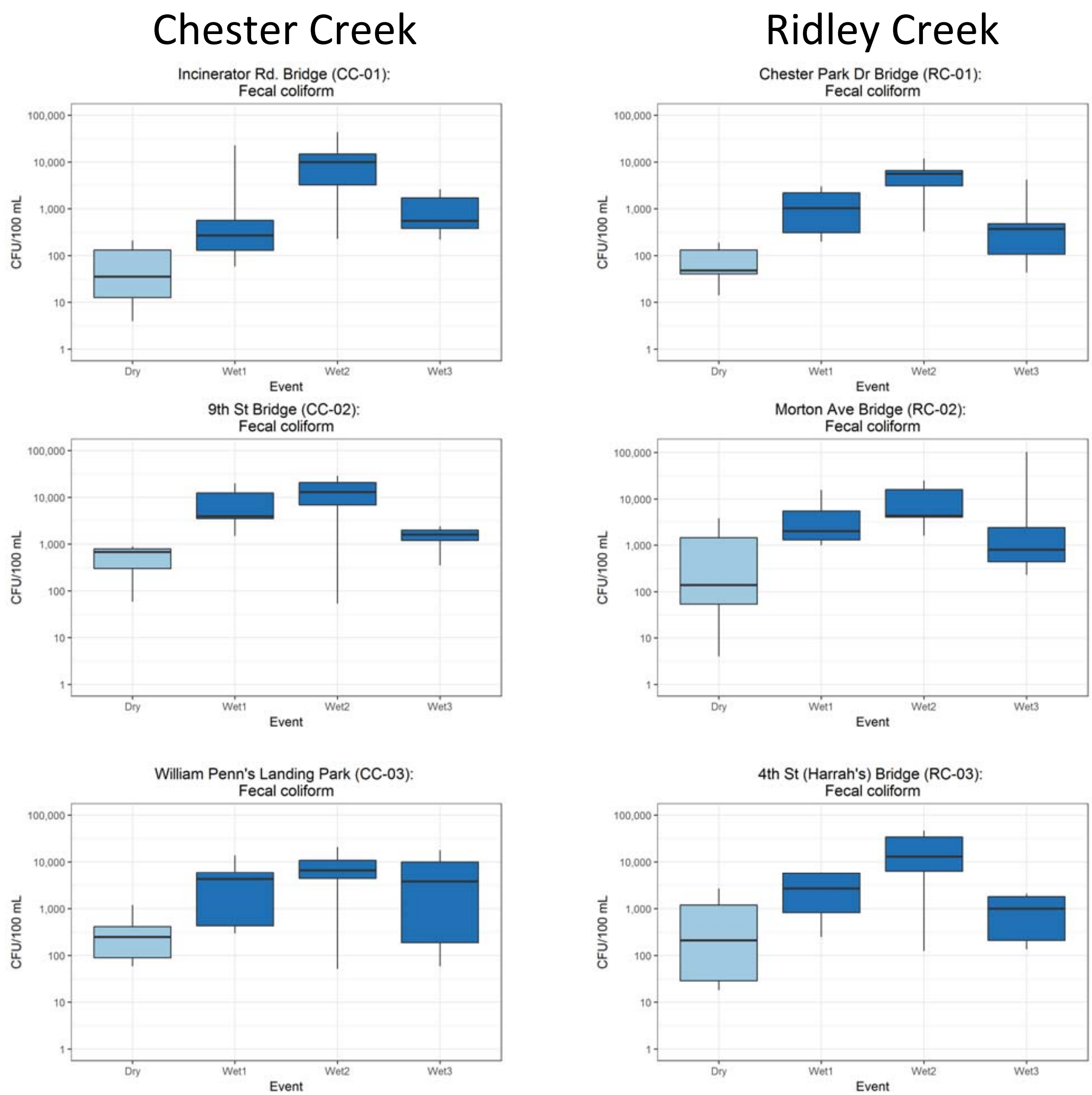
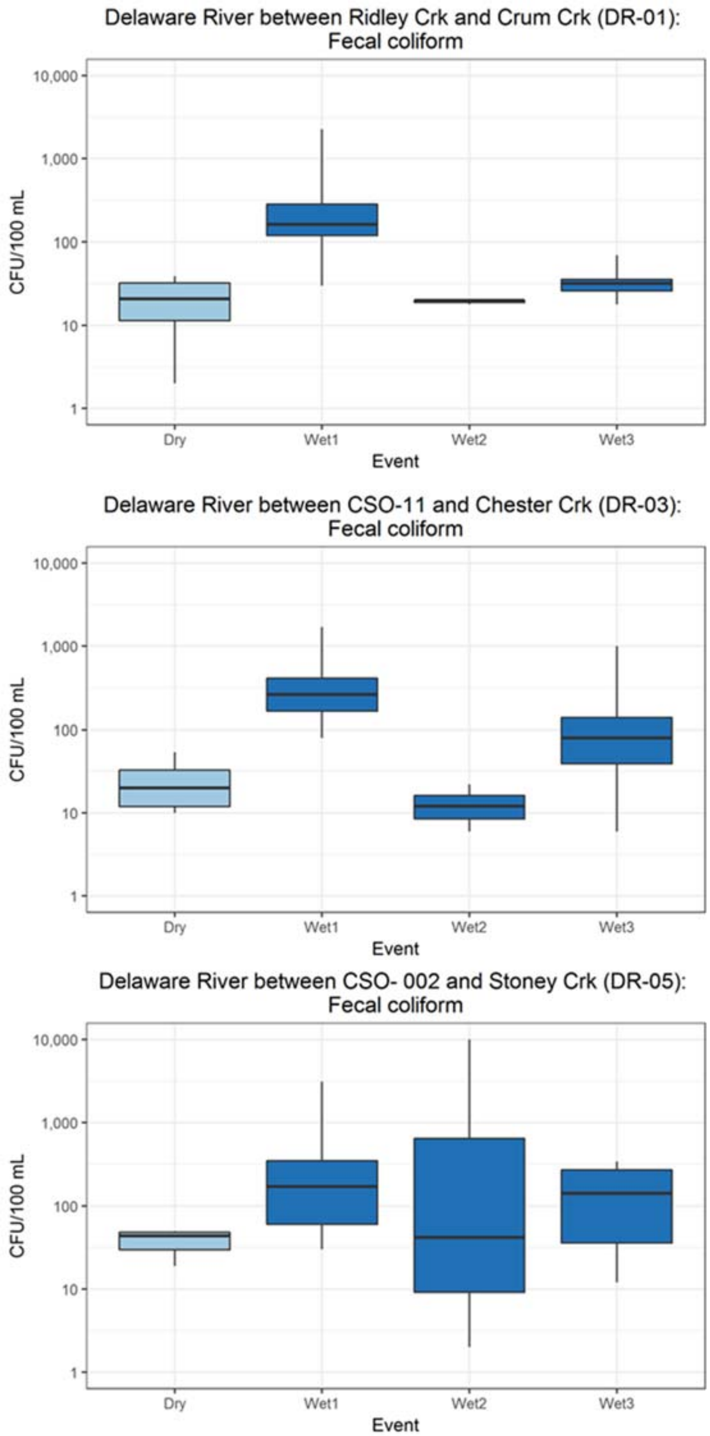


Figure 6-2: Comparison of Fecal Coliform Concentrations for the Sampling Events in the Delaware River



6.1.2 CSO and Stormwater First Flush Effect Analysis

A second analysis that was conducted across all of the event datasets was an evaluation of the CSO and stormwater data for first flush effects. A first flush effect means that pollutant concentrations that build up on the land surface between rainfall events are quickly washed off and flushed through the collection system, resulting in higher pollutant concentrations during the beginning of the discharge period compared to concentrations during the later portion of the discharge event.

Figure 6-3 presents a comparison of fecal coliform data in each of the CSOs for each of the wet weather events by sampling round. Note that the first three rounds are sampled within the first hour of discharge, with the fourth round representing the 2nd hour of discharge. If a first flush effect existed, concentrations during one or more of these rounds of sampling would be consistently higher than the later rounds. As this figure illustrates, there are combinations of events and rounds where the concentration is significantly higher than other events and/or other rounds, but no consistent pattern is discernible. Similar results were obtained for the other POCs (see Appendix H). Bacteria concentrations can be highly variable and it is typically very difficult to identify a consistent first flush for these parameters.

Figure 6-4 presents a similar analysis and result for the two stormwater outfalls for fecal coliform. Plots for the other POCs are presented in Appendix H.

This figure also shows a significant outlier data point during Wet 2 (1,500,000 cfu/100 ml) that is not believed to be representative of the quality of the stormwater runoff. The field notes, chain of custodies and laboratory analytical reports were inspected for potential explanation for the high value but none could be determined from the record set. This data point was not used in any statistical calculations or other data analyses.

6.1.3 CSO and Stormwater Event Mean Concentrations

Based on the first flush effect analysis presented in the previous section, the CSO and stormwater data were further analyzed to develop an initial estimate of representative concentration for each source type to calculate pollutant loads. These representative concentrations are referred to as event mean concentrations (EMCs) and represent the average water quality in the CSO and storm sewer systems.

Figure 6-3: CSO Fecal Coliform Concentrations by Sampling Round

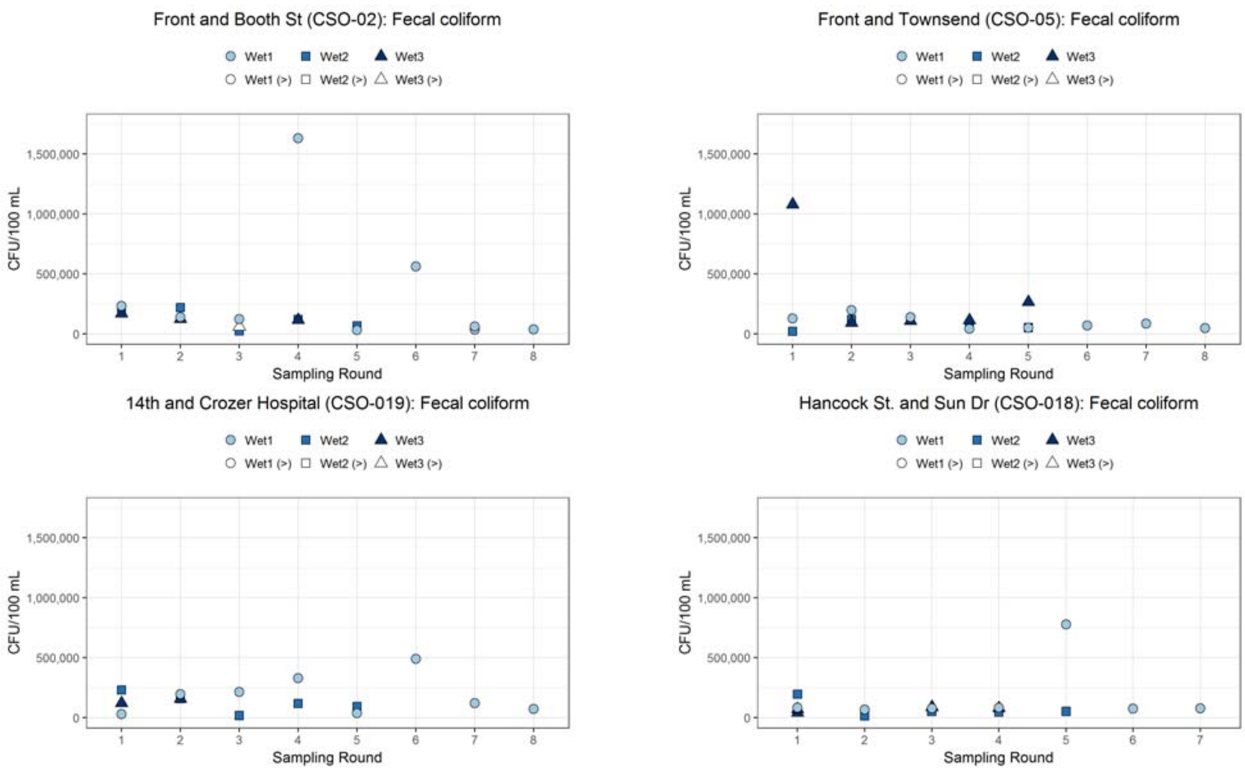
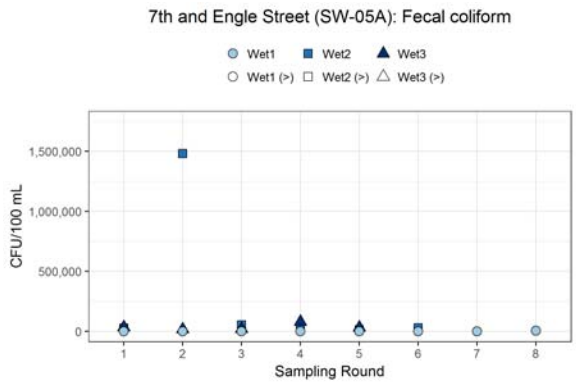
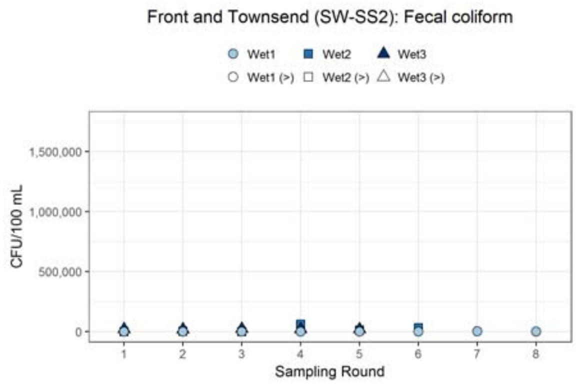


Figure 6-4: Stormwater Fecal Coliform Concentrations by Sampling Round





Flow-weighted EMCs were calculated for CSO-02, CSO-05, and CSO-019 using the metered flow data at the CSO diversion structure and the measured concentration data. Since CSO-018 was not metered, this method could not be applied for this CSO. A summary is presented in Table 6-1 for each event and POC.

Table 6-1: Flow-weighted CSO Event Mean Concentrations

	CSO-019	CSO-02	CSO-05
Fecal coliform			
Wet 1	175,264	160,758	75,948
Wet 2	97,421	95,158	72,093
Wet 3	125,183	124,408	126,934
Average	128,814	123,924	88,578
E. coli			
Wet 1	233,830	112,097	42,575
Wet 2	232,809	176,018	107,485
Wet 3	689,748	304,759	370,265
Average	334,860	181,845	119,216
Enterococcus			
Wet 1	167,891	110,237	52,790
Wet 2	149,515	141,616	119,217
Wet 3	254,176	305,311	142,677
Average	185,474	168,291	96,475

It should be noted that these calculations are a starting point for determining EMCs for use in the water quality model. The calculations shown in Table 1 present a challenge in that the E. coli values are higher than the fecal coliform values, which is not physically possible.

A statistical analysis was conducted on the CSO and stormwater data directly with results shown in Table 6-2. This analysis allows the data from locations without flow data, such as CSO-018 and the two stormwater locations, to be included for consideration. All of the data for a given location were evaluated together in developing the statistics presented in Table 6-2.

Table 6-2: Distribution of CSO and Stormwater Pollutant Concentrations

	Sample Count	Geomean	25th Percentile	75th Percentile
Fecal coliform				
CSO-02	18	116,611	60,750	205,250
CSO-05	18	99,861	56,750	126,750
CSO-018	17	74,335	53,000	85,000
CSO-019	15	116,754	83,773	206,000
SW-05A	19	5,522	883	31,000
SW-SS2	19	3,693	913	21,000
E. coli				
CSO-02	18	158,546	60,500	345,500
CSO-05	18	144,369	66,000	231,250
CSO-018	17	95,812	63,000	104,000
CSO-019	15	189,860	100,000	286,000
SW-05A	19	3,843	1,180	16,500
SW-SS2	19	2,407	625	18,000
Enterococcus				
CSO-02	18	123,582	73,250	288,750
CSO-05	18	90,052	61,250	180,000
CSO-018	17	48,669	29,000	83,000
CSO-019	15	131,911	56,500	197,000
SW-05A	19	25,118	5,700	112,000
SW-SS2	19	40,217	19,250	119,250

Results in this table for each location are slightly lower than the results using the flow-weighted method average results presented in Table 6-1. The results also show that the CSO E. coli values are higher than the CSO fecal coliform values, which is not physically possible since E. coli is a subset of fecal coliform. The 25th and 75th percentile values will be used as a basis for adjusting the EMC value used in estimating the loads from each source type. Additional analysis and interpretation of the data will be conducted as part of the water quality model development and calibration process.

6.2 Conclusion

The DELCORA Sampling Program was designed to fill data gaps necessary to characterize sources and surface waters during dry and wet weather events to support the development of water quality models for use in the development of the CSO Long Term Control Plan Update. It provides the first co-located, coordinated sampling of Chester Creek, Ridley Creek and the Delaware River for the three bacteria parameters most often used to protect recreational water quality and identified as Pollutants of Concern. This was also the first Sampling Program to capture both dry and wet weather in-stream conditions, conduct time-intensive wet weather sampling, and concurrently characterize CSO and stormwater sources. The data are sufficient to characterize DELCORA's CSO and stormwater source loads for the water quality model. The data also span a range of environmental conditions and provide an extensive dataset for demonstrating the robustness of the water quality model. The Sampling Program fully achieved the objectives of collecting comprehensive and complete datasets needed to characterize pollutant sources, produce an appropriately calibrated watershed and water quality model, and successfully meet the quality objectives of the QAPP. No further data collection is required at this time to develop or calibrate the models for use in the development of DELCORA's Long Term Control Plan Update.

Section 7 References

Greeley and Hansen / Limnotech. (Revised July 2017). *Water Quality Monitoring and Modeling Quality Assurance Project Plan.* Originally submitted January 2017, Revised March 2017: Report prepared for Delaware County Regional Water Quality Control Authority (DELCORA).

Greeley and Hansen / Limnotech. (Revised July 2017). *Water Quality Monitoring and Modeling Work Plan.* Report prepared for Delaware County Regional Water Quality Control Authority (DELCORA).

Greeley and Hansen. (2016c). *Identification of Sensitive Areas and Pollutants of Concern Report.* Report prepared for Delaware County Regional Water Quality Control Authority (DELCORA). This report was approved by USEPA and PADEP on October 13, 2016. See approval letters in this section.

USEPA. (1999). *Combined Sewer Overflows: Guidance for Monitoring and Modeling.* Washington, DC: United States Environmental Protection Agency.

Weston Solutions, Inc. (March 2017). *Sampling Analysis Plan.* Prepared for Greeley and Hansen for submittal to Delaware County Regional Water Quality Control Authority (DELCORA).

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

OCT 13 2016

Mr. Robert Willert, Executive Director
Delaware County Regional Quality Control Authority
100 East Fifth Street
Chester, PA 19013

RE: Civil Action 2:15-cv-04652-RB

Dear Mr. Willert:

The United States Environmental Protection Agency (EPA) has received the Delaware County Regional Quality Control Authority (DELCORA) Revised Identification of Sensitive Area Analysis (RISAA) dated May 13, 2016. EPA has consulted with the Pennsylvania Department of the Environment (PaDEP). EPA hereby approves the RISAA.

Sincerely,

Andrew F. Seligman, Environmental Scientist
Water Enforcement Branch

cc: R. Smolski, EPA
P. Yeany, EPA
M. DeSantis, DELCORA

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Section 8 Abbreviations

CSO:	Combined Sewer Overflow
CSS:	Combined Sewer System
CWA:	Clean Water Act
DELCORA:	Delaware County Municipal Utilities Authority
DEP:	Pennsylvania Department of Environmental Protection
DRBC:	Delaware River Basin Commission
e-DMR:	electronic Discharge Monitoring Report
EMC:	Event Mean Concentration
GIS:	Geographic Information System
H&H:	Hydrologic and Hydraulic
KCPS:	Kimberly Clark Pump Station
LTCP:	Long Term Control Plan
LTCPU:	Long-Term Control Plan Update
MDL:	Method Detection Limit
MGD:	Million Gallons per Day
NPDES	National Pollutant Discharge Elimination System
NRCS:	Natural Resources Conservation Service
PA Integrated Report:	PA Integrated Water Quality Monitoring and Assessment Report
PADEP:	Pennsylvania Department of Environmental Protection
POC:	Pollutant of Concern
PSWPCP:	Philadelphia Water Department's Southwest Water Pollution Control Plant
QA/QC:	Quality Assurance/Quality Control
QAPP:	Quality Assurance Project Plan
R.M.:	River Mile
RHM:	Radnor Haverford Marple Authority
STORET:	Storage and Retrieval for Water Quality Data
TMDL:	Total Maximum Daily Load
UH:	Unit Hydrograph
USEPA or EPA:	United States Environmental Protection Agency
WQMP:	Water Quality Monitoring Program
WQR:	Water Quality Regulations
WQS:	Water Quality Standards
WRTP:	Western Regional Treatment Plant
WWF:	Warm Water Fishes
EMC:	Event Mean Concentration

APPENDIX A

DRY WEATHER EVENT 1 – FIELD LOGS AND LAB RESULTS SUMMARY

(Chain of Custody Forms and Complete Lab Results provided in digital form only on CD attached to this report)

DRY WEATHER EVENT: 1

DATE: 3/23/2017 **Note Temperature of Receiving Stream if below 10 ^{o}C threshhold**

EVENT START TIME: 12:55

Sampling Station	Sampling Round	Estimated Target Sample Collection (hh:mm)	Actual Sample Collection Time (hh:mm)	Duplicate Sample Collected? [1] (Y/N)	Duplicate Collection Time (hh:mm)	Field Blank Sample Collected? [1] (Y/N)	Field Blank Collection Time (hh:mm)	Chain of Custody Provided & Completed (Y/N)	Time Sample Transferred to Lab (hh:mm)	Water Salinity Reading (%)	Water Temperature Reading (^{o}C)	Conductivity Reading (umhos/cm)	Field Observations[2] (see notes, below)
CC-01	Incoming tide	19:30	19:34	N	-	N	-	Y	19:55	0.55	6.52	718	Dusk, clear, little debris, foam
	Outgoing tide	15:05	15:09	Y	15:10	N	-	Y	15:30	0.55	5.87	698	Sunny & clear, no debris, little foam
CC-02	Incoming tide	19:10	19:12	N	-	N	-	Y	19:55	0.55	5.37	695	Dusk, clear, no debris, little foam
	Outgoing tide	14:45	14:48	N	-	N	-	Y	15:30	0.55	5.77	698	Sunny & clear, no debris, no foam, tree branches, bark
CC-03	Incoming tide	17:45	17:44	N	-	N	-	Y	19:55	0.55	5.82	701	Sunny & clear, no debris, no foam, some scum
	Outgoing tide	13:00	13:00	N	-	Y	13:03	Y	15:30	0.55	3.36	659	Sunny & clear, mild debris, clear water, no turbidity
RC-01	Incoming tide	18:40	18:47	N	-	N	-	Y	19:55	0.41	5.66	523	Dusk, clear, no debris, foam
	Outgoing tide	14:22	14:25	N	-	N	-	Y	15:30	0.39	5.72	503	Sunny & clear, no debris, little foam, (non-tidal)
RC-02	Incoming tide	18:15	18:20	N	-	N	-	Y	19:55	0.4	6.54	532	Dusk, clear, no debris, little foam
	Outgoing tide	13:55	14:00	N	-	N	-	Y	15:30	0.41	5.34	518	Flushing hydrant, sunny clear, very mild foam
RC-03	Incoming tide	17:55	18:00	Y	18:00	N	-	Y	19:55	0.41	6.60	536	Sunny & clear, no debris, clear water
	Outgoing tide	13:30	13:35	N	-	Y	13:35	Y	15:30	0.41	3.26	496	Sunny & clear, no debris, clear water
DR-01	Incoming tide	17:30	17:25	N	-	N	-	Y	19:55	0.28/ 0.29/ 0.29	5.49/ 5.32/ 5.38	362/ 373/ 376	Total depth = 20.6 ft.
	Outgoing tide	12:55	12:55	N	-	Y	12:55	Y	15:30	0.26/ 0.27/ 0.28	5.50/ 5.40/ 5.30	345/ 349/ 357	Total depth = 25.0 ft.
DR-02	Incoming tide	17:45	17:45	N	-	N	-	Y	19:55	0.28/ 0.29/ 0.29	5.48/ 5.54/ 5.56	366/ 372/ 374	Total depth = 33.0 ft.
	Outgoing tide	13:15	13:30	Y	13:30	N	-	Y	15:30	0.27/ 0.27/ 0.27	5.5/ 5.4/ 5.4	345/ 346/ 349	Total depth = 35.0 ft.
DR-03	Incoming tide	18:00	18:00	N	-	N	-	Y	19:55	0.29/ 0.29/ 0.29	5.58/ 5.59/ 5.59	375/ 374/ 374	Total depth = 33 ft.
	Outgoing tide	13:30	13:55	N	-	N	-	Y	15:30	0.26/ 0.27/ 0.27	5.5/ 5.5/ 5.5	342/ 350/ 349	Total depth = 34 ft.
DR-04	Incoming tide	18:15	18:15	N	-	N	-	Y	19:55	0.29/ 0.28/ 0.28	6.22/ 6.21/ 6.22	363/ 364/ 365	Total depth = 25.0 ft.
	Outgoing tide	13:50	14:10	N	-	N	-	Y	15:30	0.27/ 0.28/ 0.28	5.6/ 5.6/ 5.6	357/ 358/ 359	Total depth = 19.4 ft.
DR-05	Incoming tide	18:30	18:30	N	-	N	-	Y	19:55	0.28/ 0.28/ 0.28	6.22/ 6.21/ 6.22	363/ 364/ 365	Total depth = 7.0 ft.
	Outgoing tide	14:15	14:30	N	-	N	-	Y	15:30	0.42/ 0.42/ 0.40	9.5/ 9.6/ 9.2	603/ 600/ 571	Total depth = 4.8 ft.

Login Number	Sample ID	Sample Date/Time	Parm Stored	Method	Result (cfu/100 mL)	Analysis Date/Time	Tech Initials
L6724475-1	RC-01-1	03/23/17 02:30pm	E. COLI-MF (1603)	EPA 1603	<10	03/23/17 06:26PM	BHS
L6724475-1	RC-01-1	03/23/17 02:30pm	ENTEROCOCCUS-MF 24	EPA 1600	<10	03/23/17 06:33PM	BHS
L6724475-1	RC-01-1	03/23/17 02:30pm	FECAL COLIFORM-MF	SM 9222D	40 E	03/23/17 06:43PM	BHS
L6724476-1	CL-02-8	03/23/17 01:00pm	E. COLI-MF (1603)	EPA 1603	<10	03/23/17 06:26PM	BHS
L6724476-1	CL-02-8	03/23/17 01:00pm	ENTEROCOCCUS-MF 24	EPA 1600	<10	03/23/17 06:33PM	BHS
L6724476-1	CL-02-8	03/23/17 01:00pm	FECAL COLIFORM-MF	SM 9222D	<10	03/23/17 06:43PM	BHS
L6729205-1	DR-05-1	03/23/17 02:30pm	E. COLI-MF (1603)	EPA 1603	30 E	03/23/17 06:26PM	BHS
L6729205-1	DR-05-1	03/23/17 02:30pm	ENTEROCOCCUS-MF 24	EPA 1600	320	03/23/17 06:33PM	BHS
L6729205-1	DR-05-1	03/23/17 02:30pm	FECAL COLIFORM-MF	SM 9222D	50 E	03/23/17 06:43PM	BHS
L6729206-1	DUP DR-02-2	03/23/17 01:30pm	E. COLI-MF (1603)	EPA 1603	10 E	03/23/17 06:26PM	BHS
L6729206-1	DUP DR-02-2	03/23/17 01:30pm	ENTEROCOCCUS-MF 24	EPA 1600	<10	03/23/17 06:33PM	BHS
L6729206-1	DUP DR-02-2	03/23/17 01:30pm	FECAL COLIFORM-MF	SM 9222D	50 E	03/23/17 06:43PM	BHS
L6729207-1	DR-01-1	03/23/17 01:00pm	E. COLI-MF (1603)	EPA 1603	10 E	03/23/17 06:26PM	BHS
L6729207-1	DR-01-1	03/23/17 01:00pm	ENTEROCOCCUS-MF 24	EPA 1600	<10	03/23/17 06:33PM	BHS
L6729207-1	DR-01-1	03/23/17 01:00pm	FECAL COLIFORM-MF	SM 9222D	10 E	03/23/17 06:43PM	BHS
L6729208-1	DR-02-1	03/23/17 01:30pm	E. COLI-MF (1603)	EPA 1603	<10	03/23/17 06:26PM	BHS
L6729208-1	DR-02-1	03/23/17 01:30pm	ENTEROCOCCUS-MF 24	EPA 1600	<10	03/23/17 06:33PM	BHS
L6729208-1	DR-02-1	03/23/17 01:30pm	FECAL COLIFORM-MF	SM 9222D	40 E	03/23/17 06:43PM	BHS
L6729209-1	DR-03-01	03/23/17 01:55pm	E. COLI-MF (1603)	EPA 1603	<10	03/23/17 06:26PM	BHS
L6729209-1	DR-03-01	03/23/17 01:55pm	ENTEROCOCCUS-MF 24	EPA 1600	<10	03/23/17 06:33PM	BHS
L6729209-1	DR-03-01	03/23/17 01:55pm	FECAL COLIFORM-MF	SM 9222D	10 E	03/23/17 06:43PM	BHS
L6729210-1	DR-04-1	03/23/17 02:10pm	E. COLI-MF (1603)	EPA 1603	<10	03/23/17 06:26PM	BHS
L6729210-1	DR-04-1	03/23/17 02:10pm	ENTEROCOCCUS-MF 24	EPA 1600	<10	03/23/17 06:33PM	BHS
L6729210-1	DR-04-1	03/23/17 02:10pm	FECAL COLIFORM-MF	SM 9222D	20 E	03/23/17 06:43PM	BHS
L6729211-1	BLANK	03/23/17 12:55pm	E. COLI-MF (1603)	EPA 1603	<2	03/23/17 06:26PM	BHS
L6729211-1	BLANK	03/23/17 12:55pm	ENTEROCOCCUS-MF 24	EPA 1600	<2	03/23/17 06:33PM	BHS
L6729211-1	BLANK	03/23/17 12:55pm	FECAL COLIFORM-MF	SM 9222D	<2	03/23/17 06:43PM	BHS
L6729212-1	DUP CC-01-D	03/23/17 03:00pm	E. COLI-MF (1603)	EPA 1603	<10	03/23/17 06:26PM	BHS
L6729212-1	DUP CC-01-D	03/23/17 03:00pm	ENTEROCOCCUS-MF 24	EPA 1600	40 E	03/23/17 06:33PM	BHS
L6729212-1	DUP CC-01-D	03/23/17 03:00pm	FECAL COLIFORM-MF	SM 9222D	<10	03/23/17 06:43PM	BHS
L6729213-1	CC-01-1	03/23/17 03:00pm	E. COLI-MF (1603)	EPA 1603	10 E	03/23/17 06:26PM	BHS
L6729213-1	CC-01-1	03/23/17 03:00pm	ENTEROCOCCUS-MF 24	EPA 1600	60 E	03/23/17 06:33PM	BHS
L6729213-1	CC-01-1	03/23/17 03:00pm	FECAL COLIFORM-MF	SM 9222D	<10	03/23/17 06:43PM	BHS
L6729214-1	CC-02-1	03/23/17 02:45pm	E. COLI-MF (1603)	EPA 1603	120 E	03/23/17 06:26PM	BHS
L6729214-1	CC-02-1	03/23/17 02:45pm	ENTEROCOCCUS-MF 24	EPA 1600	70 E	03/23/17 06:33PM	BHS
L6729214-1	CC-02-1	03/23/17 02:45pm	FECAL COLIFORM-MF	SM 9222D	610 E	03/23/17 06:43PM	BHS
L6729215-1	CC-03-1	03/23/17 01:00pm	E. COLI-MF (1603)	EPA 1603	50 E	03/23/17 06:26PM	BHS
L6729215-1	CC-03-1	03/23/17 01:00pm	ENTEROCOCCUS-MF 24	EPA 1600	20 E	03/23/17 06:33PM	BHS
L6729215-1	CC-03-1	03/23/17 01:00pm	FECAL COLIFORM-MF	SM 9222D	450	03/23/17 06:43PM	BHS
L6729216-1	RC-03-B	03/23/17 01:30pm	E. COLI-MF (1603)	EPA 1603	<10	03/23/17 06:26PM	BHS
L6729216-1	RC-03-B	03/23/17 01:30pm	ENTEROCOCCUS-MF 24	EPA 1600	<10	03/23/17 06:33PM	BHS
L6729216-1	RC-03-B	03/23/17 01:30pm	FECAL COLIFORM-MF	SM 9222D	<10	03/23/17 06:43PM	BHS

Login Number	Sample ID	Sample Date/Time	Parm Stored	Method	Result (cfu/100 mL)	Analysis Date/Time	Tech Initials
L6729217-1	RC-03-1	03/23/17 01:30pm	E. COLI-MF (1603)	EPA 1603	40 E	03/23/17 06:26PM	BHS
L6729217-1	RC-03-1	03/23/17 01:30pm	ENTEROCOCCUS-MF 24	EPA 1600	10 E	03/23/17 06:33PM	BHS
L6729217-1	RC-03-1	03/23/17 01:30pm	FECAL COLIFORM-MF	SM 9222D	20 E	03/23/17 06:43PM	BHS
L6729218-1	RC-02-1	03/23/17 02:00pm	E. COLI-MF (1603)	EPA 1603	<10	03/23/17 06:26PM	BHS
L6729218-1	RC-02-1	03/23/17 02:00pm	ENTEROCOCCUS-MF 24	EPA 1600	<10	03/23/17 06:33PM	BHS
L6729218-1	RC-02-1	03/23/17 02:00pm	FECAL COLIFORM-MF	SM 9222D	40 E	03/23/17 06:43PM	BHS
L6729227-1	DR-05-2	03/23/17 06:30pm	ENTEROCOCCUS-MF 24	EPA 1600	10 E	03/23/17 10:04PM	BHS
L6729227-1	DR-05-2	03/23/17 06:30pm	E. COLI-MF (1603)	EPA 1603	18 E	03/23/17 09:57PM	BHS
L6729227-1	DR-05-2	03/23/17 06:30pm	FECAL COLIFORM-MF	SM 9222D	48	03/23/17 10:09PM	BHS
L6729227-2	DR-04-2	03/23/17 06:15pm	ENTEROCOCCUS-MF 24	EPA 1600	<2	03/23/17 10:04PM	BHS
L6729227-2	DR-04-2	03/23/17 06:15pm	E. COLI-MF (1603)	EPA 1603	6 E	03/23/17 09:57PM	BHS
L6729227-2	DR-04-2	03/23/17 06:15pm	FECAL COLIFORM-MF	SM 9222D	18 E	03/23/17 10:09PM	BHS
L6729227-3	DR-03-2	03/23/17 06:00pm	ENTEROCOCCUS-MF 24	EPA 1600	<2	03/23/17 10:04PM	BHS
L6729227-3	DR-03-2	03/23/17 06:00pm	E. COLI-MF (1603)	EPA 1603	16 E	03/23/17 09:57PM	BHS
L6729227-3	DR-03-2	03/23/17 06:00pm	FECAL COLIFORM-MF	SM 9222D	10 E	03/23/17 10:09PM	BHS
L6729227-4	DR-01-2	03/23/17 05:25pm	ENTEROCOCCUS-MF 24	EPA 1600	<2	03/23/17 10:04PM	BHS
L6729227-4	DR-01-2	03/23/17 05:25pm	E. COLI-MF (1603)	EPA 1603	2 E	03/23/17 09:57PM	BHS
L6729227-4	DR-01-2	03/23/17 05:25pm	FECAL COLIFORM-MF	SM 9222D	2 E	03/23/17 10:09PM	BHS
L6729227-5	DR-02-2	03/23/17 05:45pm	ENTEROCOCCUS-MF 24	EPA 1600	<2	03/23/17 10:04PM	BHS
L6729227-5	DR-02-2	03/23/17 05:45pm	E. COLI-MF (1603)	EPA 1603	4 E	03/23/17 09:57PM	BHS
L6729227-5	DR-02-2	03/23/17 05:45pm	FECAL COLIFORM-MF	SM 9222D	8 E	03/23/17 10:09PM	BHS
L6729227-6	CC-03-2	03/23/17 05:40pm	ENTEROCOCCUS-MF 24	EPA 1600	42	03/23/17 10:04PM	BHS
L6729227-6	CC-03-2	03/23/17 05:40pm	E. COLI-MF (1603)	EPA 1603	48	03/23/17 09:57PM	BHS
L6729227-6	CC-03-2	03/23/17 05:40pm	FECAL COLIFORM-MF	SM 9222D	60 E	03/23/17 10:09PM	BHS
L6729227-7	CC-01-2	03/23/17 07:10pm	ENTEROCOCCUS-MF 24	EPA 1600	8 E	03/23/17 10:04PM	BHS
L6729227-7	CC-01-2	03/23/17 07:10pm	E. COLI-MF (1603)	EPA 1603	14 E	03/23/17 09:57PM	BHS
L6729227-7	CC-01-2	03/23/17 07:10pm	FECAL COLIFORM-MF	SM 9222D	4 E	03/23/17 10:09PM	BHS
L6729227-8	RC-03-2	03/23/17 06:10pm	ENTEROCOCCUS-MF 24	EPA 1600	6 E	03/23/17 10:04PM	BHS
L6729227-8	RC-03-2	03/23/17 06:10pm	E. COLI-MF (1603)	EPA 1603	6 E	03/23/17 09:57PM	BHS
L6729227-8	RC-03-2	03/23/17 06:10pm	FECAL COLIFORM-MF	SM 9222D	18 E	03/23/17 10:09PM	BHS
L6729227-9	CC-02-2	03/23/17 07:30pm	ENTEROCOCCUS-MF 24	EPA 1600	56	03/23/17 10:04PM	BHS
L6729227-9	CC-02-2	03/23/17 07:30pm	E. COLI-MF (1603)	EPA 1603	126	03/23/17 09:57PM	BHS
L6729227-9	CC-02-2	03/23/17 07:30pm	FECAL COLIFORM-MF	SM 9222D	750 E	03/23/17 10:09PM	BHS
L6729227-10	RC-01-2	03/23/17 06:45pm	ENTEROCOCCUS-MF 24	EPA 1600	16 E	03/23/17 10:04PM	BHS
L6729227-10	RC-01-2	03/23/17 06:45pm	E. COLI-MF (1603)	EPA 1603	2 E	03/23/17 09:57PM	BHS
L6729227-10	RC-01-2	03/23/17 06:45pm	FECAL COLIFORM-MF	SM 9222D	14 E	03/23/17 10:09PM	BHS
L6729227-11	RC-02-2	03/23/17 06:20pm	ENTEROCOCCUS-MF 24	EPA 1600	8 E	03/23/17 10:04PM	BHS
L6729227-11	RC-02-2	03/23/17 06:20pm	E. COLI-MF (1603)	EPA 1603	10 E	03/23/17 09:57PM	BHS
L6729227-11	RC-02-2	03/23/17 06:20pm	FECAL COLIFORM-MF	SM 9222D	4 E	03/23/17 10:09PM	BHS
L6729227-12	DUP RC-02-2-X	03/23/17 06:00pm	ENTEROCOCCUS-MF 24	EPA 1600	14 E	03/23/17 10:04PM	BHS
L6729227-12	DUP RC-02-2-X	03/23/17 06:00pm	E. COLI-MF (1603)	EPA 1603	16 E	03/23/17 09:57PM	BHS
L6729227-12	DUP RC-02-2-X	03/23/17 06:00pm	FECAL COLIFORM-MF	SM 9222D	16 E	03/23/17 10:09PM	BHS

APPENDIX B

DRY WEATHER EVENT 2 – FIELD LOGS AND LAB RESULTS SUMMARY

(Chain of Custody Forms and Complete Lab Results provided in digital form only on CD attached to this report)

DRY WEATHER EVENT: 2

DATE: 5/10/2017 — **Note Temperature of Receiving Stream if below 10 °C threshhold**

EVENT START TIME: 10:00

Sampling Station	Sampling Round	Target Sample Collection Time (hh:mm)	Actual Sample Collection Time (hh:mm)	Duplicate Sample Collected? [1] (Y/N)	Duplicate Collection Time (hh:mm)	Field Blank Sample Collected? [1] (Y/N)	Field Blank Collection Time (hh:mm)	Chain of Custody Provided & Completed (Y/N)	Time Sample Transferred to Lab Courier (hh:mm)	Water Salinity Reading (%)	Water Temperature Reading (^oC)	Conductivity Reading (umhos/cm)	Field Observations[2] (see notes, below)
CC-01	Incoming tide	11:00	11:46	N	N/A	N	N/A	Y	12:07	0.02	11.33	0.330	Clear sky, 61 °F, water very clear, no debris
	Outgoing tide	17:00	17:07	N	N/A	N	N/A	Y	18:00	0.33	12.54	0.511	Clear sky 71 °F, water clear, no debris
CC-02	Incoming tide	12:00	12:07	N	N/A	N	N/A	Y	12:07	0.23	13.86	0.378	Clear sky 61 °F, water mostly clear, minimal debris
	Outgoing tide	17:25	17:30	Y	17:31	N	N/A	Y	18:00	0.30	11.69	0.464	Clear sky 71 °F, water little cloudy, no debris
CC-03	Incoming tide	10:00	10:16	N	N/A	Y	10:09	Y	12:07	0.32	10.56	0.467	Clear sky, 59 °F, water mostly clear, no debris
	Outgoing tide	15:40	15:44	N	N/A	N	N/A	Y	18:00	0.21	14.44	0.339	Clear sky 71 °F, water mostly clear, minimal debris
RC-01	Incoming tide	11:20	11:26	N	N/A	N	N/A	Y	12:07	0.34	16.73	0.590	Clear sky 60 °F, water very clear, small amount of foam
	Outgoing tide	16:40	16:45	N	N/A	N	N/A	Y	18:00	0.35	16.47	0.590	Clear sky 70 °F, water clear, some foam
RC-02	Incoming tide	11:00	11:02	Y	11:02	N	N/A	Y	12:07	0.26	16.00	0.439	Clear sky 60 °F, water clear, small amount of floating debris
	Outgoing tide	16:20	16:21	N	N/A	N	N/A	Y	18:00	0.25	16.69	0.440	Clear sky 70 °F, water clear, some floating debris
RC-03	Incoming tide	10:30	10:43	N	N/A	N	N/A	Y	12:07	0.27	16.49	0.458	Clear sky 59 °F, water mostly clear, no debris
	Outgoing tide	16:00	16:04	N	N/A	N	N/A	Y	18:00	0.22	15.93	0.378	Clear sky 71 °F, water clear, no debris
DR-01	Incoming tide	10:25	10:25	N	N/A	N	N/A	Y	12:42	0.15 /0.15/ 0.15	16.70 / 16.67/ 16.68	269/ 286/ 267	Total depth = 28 ft ; calm water
	Outgoing tide	15:30	15:30	N	N/A	N	N/A	Y	18:00	0.23/ 0.22/ 0.22	14.55/ 14.38/ 14.37	374/ 368/ 362	Total depth = 28 ft ; calm water
DR-02	Incoming tide	10:50	10:50	N	N/A	N	N/A	Y	12:42	0.16/ 0.16/ 0.16	16.78/ 16.72/ 16.71	280/ 280/ 277	Total Depth = 25 ft; calm water
	Outgoing tide	15:40	15:40	N	N/A	N	N/A	Y	18:00	0.23/ 0.22/ 0.22	14.43/ 14.42/ 14.42	371/ 370/ 366	Total Depth = 28 ft; calm water
DR-03	Incoming tide	11:15	11:15	N	N/A	N	N/A	Y	12:42	0.16/ 01.6/ 0.16	16.91/ 16.88/ 16.88	285/ 285/ 285	Total Depth = 17 ft; calm water
	Outgoing tide	15:50	15:50	N	N/A	N	N/A	Y	18:00	0.22/ 0.22/ 0.22	14.39/ 14.38/ 14.39	369/ 368/ 364	Total Depth = 19 ft; calm water
DR-04	Incoming tide	12:00	12:00	Y	12:05	N	N/A	Y	12:42	0.16/ 0.16/ 0.16	17.03/ 16.94/ 16.95	289/ 286/ 286	Total Depth = 12 ft; calm water
	Outgoing tide	16:00	16:00	N	N/A	N	N/A	Y	18:00	0.23/ 0.23/ 0.23	14.53/ 14.53/ 14.53	380/ 380/ 378	Total Depth = 9 ft; calm water
DR-05	Incoming tide	12:20	12:20	N	N/A	Y	12:25	Y	12:42	0.16/ 0.16/ 0.16	17.34/ 17.24/ 17.25	287/ 286/ 286	Total Depth = 6 ft; calm water
	Outgoing tide	16:10	16:10	N	N/A	N	N/A	Y	18:00	0.23/ 0.22/ 0.22	14.51/ 14.48/ 14.48	372/ 370/ 368	Total Depth = 7 ft; calm water

Login Number	Sample ID	Sample Date/Time	Parm Stored	Method	Result (cfu/100 mL)	Analysis Date/Time	Tech Initials
L6778952-1	CC-03-1	05/10/17 10:16am	FECAL COLIFORM-MF	SM 9222D	70 E	05/10/17 03:04PM	DYS
L6778952-1	CC-03-1	05/10/17 10:16am	ENTEROCOCCUS-MF 24	EPA 1600	35	05/10/17 03:09PM	SYM
L6778952-1	CC-03-1	05/10/17 10:16am	E. COLI-MF (1603)	EPA 1603	96 E	05/10/17 03:19PM	BHS
L6778952-2	RC-03-1	05/10/17 10:43am	FECAL COLIFORM-MF	SM 9222D	90 E	05/10/17 03:04PM	DYS
L6778952-2	RC-03-1	05/10/17 10:43am	ENTEROCOCCUS-MF 24	EPA 1600	17	05/10/17 03:09PM	SYM
L6778952-2	RC-03-1	05/10/17 10:43am	E. COLI-MF (1603)	EPA 1603	210	05/10/17 03:19PM	BHS
L6778952-3	RC-02-1	05/10/17 11:02am	FECAL COLIFORM-MF	SM 9222D	140 E	05/10/17 03:04PM	DYS
L6778952-3	RC-02-1	05/10/17 11:02am	ENTEROCOCCUS-MF 24	EPA 1600	110 E	05/10/17 03:09PM	SYM
L6778952-3	RC-02-1	05/10/17 11:02am	E. COLI-MF (1603)	EPA 1603	120 E	05/10/17 03:19PM	BHS
L6778952-4	RC-01-1	05/10/17 11:26am	FECAL COLIFORM-MF	SM 9222D	53	05/10/17 03:04PM	DYS
L6778952-4	RC-01-1	05/10/17 11:26am	ENTEROCOCCUS-MF 24	EPA 1600	43	05/10/17 03:09PM	SYM
L6778952-4	RC-01-1	05/10/17 11:26am	E. COLI-MF (1603)	EPA 1603	52	05/10/17 03:19PM	BHS
L6778952-5	CC-01-1	05/10/17 11:47am	FECAL COLIFORM-MF	SM 9222D	52	05/10/17 03:04PM	DYS
L6778952-5	CC-01-1	05/10/17 11:47am	ENTEROCOCCUS-MF 24	EPA 1600	59	05/10/17 03:09PM	SYM
L6778952-5	CC-01-1	05/10/17 11:47am	E. COLI-MF (1603)	EPA 1603	42	05/10/17 03:19PM	BHS
L6778952-6	CC-02-1	05/10/17 12:08pm	FECAL COLIFORM-MF	SM 9222D	240	05/10/17 03:04PM	DYS
L6778952-6	CC-02-1	05/10/17 12:08pm	ENTEROCOCCUS-MF 24	EPA 1600	70 E	05/10/17 03:09PM	SYM
L6778952-6	CC-02-1	05/10/17 12:08pm	E. COLI-MF (1603)	EPA 1603	240	05/10/17 03:19PM	BHS
L6778952-7	DR-01-1	05/10/17 10:25am	FECAL COLIFORM-MF	SM 9222D	26	05/10/17 03:04PM	DYS
L6778952-7	DR-01-1	05/10/17 10:25am	ENTEROCOCCUS-MF 24	EPA 1600	4	05/10/17 03:09PM	SYM
L6778952-7	DR-01-1	05/10/17 10:25am	E. COLI-MF (1603)	EPA 1603	37	05/10/17 03:19PM	BHS
L6778952-8	DR-02-1	05/10/17 10:50am	FECAL COLIFORM-MF	SM 9222D	26	05/10/17 03:04PM	DYS
L6778952-8	DR-02-1	05/10/17 10:50am	ENTEROCOCCUS-MF 24	EPA 1600	13	05/10/17 03:09PM	SYM
L6778952-8	DR-02-1	05/10/17 10:50am	E. COLI-MF (1603)	EPA 1603	45	05/10/17 03:19PM	BHS
L6778952-9	DR-03-1	05/10/17 11:15am	FECAL COLIFORM-MF	SM 9222D	39	05/10/17 03:04PM	DYS
L6778952-9	DR-03-1	05/10/17 11:15am	ENTEROCOCCUS-MF 24	EPA 1600	4	05/10/17 03:09PM	SYM
L6778952-9	DR-03-1	05/10/17 11:15am	E. COLI-MF (1603)	EPA 1603	32	05/10/17 03:19PM	BHS
L6778952-10	DR-04-1	05/10/17 12:00pm	FECAL COLIFORM-MF	SM 9222D	52	05/10/17 03:04PM	DYS
L6778952-10	DR-04-1	05/10/17 12:00pm	ENTEROCOCCUS-MF 24	EPA 1600	6	05/10/17 03:09PM	SYM
L6778952-10	DR-04-1	05/10/17 12:00pm	E. COLI-MF (1603)	EPA 1603	18	05/10/17 03:19PM	BHS
L6778952-11	DR-05-1	05/10/17 12:20pm	FECAL COLIFORM-MF	SM 9222D	48	05/10/17 03:04PM	DYS
L6778952-11	DR-05-1	05/10/17 12:20pm	ENTEROCOCCUS-MF 24	EPA 1600	2	05/10/17 03:09PM	SYM
L6778952-11	DR-05-1	05/10/17 12:20pm	E. COLI-MF (1603)	EPA 1603	25	05/10/17 03:19PM	BHS
L6778952-12	DUP-DR-04-1	05/10/17 12:00pm	FECAL COLIFORM-MF	SM 9222D	56	05/10/17 03:04PM	DYS
L6778952-12	DUP-DR-04-1	05/10/17 12:00pm	ENTEROCOCCUS-MF 24	EPA 1600	10 E	05/10/17 03:09PM	SYM
L6778952-12	DUP-DR-04-1	05/10/17 12:00pm	E. COLI-MF (1603)	EPA 1603	42	05/10/17 03:19PM	BHS
L6778952-13	DUP-RC-02-1	05/10/17 11:02am	FECAL COLIFORM-MF	SM 9222D	230	05/10/17 03:04PM	DYS
L6778952-13	DUP-RC-02-1	05/10/17 11:02am	ENTEROCOCCUS-MF 24	EPA 1600	72	05/10/17 03:09PM	SYM
L6778952-13	DUP-RC-02-1	05/10/17 11:02am	E. COLI-MF (1603)	EPA 1603	112	05/10/17 03:19PM	BHS
L6778952-14	BLANK-01	05/10/17 00:00am	FECAL COLIFORM-MF	SM 9222D	<2 Q	05/10/17 03:04PM	DYS
L6778952-14	BLANK-01	05/10/17 00:00am	ENTEROCOCCUS-MF 24	EPA 1600	<2 Q	05/10/17 03:09PM	SYM
L6778952-14	BLANK-01	05/10/17 00:00am	E. COLI-MF (1603)	EPA 1603	<2 Q	05/10/17 03:19PM	BHS

Login Number	Sample ID	Sample Date/Time	Parm Stored	Method	Result (cfu/100 mL)	Analysis Date/Time	Tech Initials
L6778952-15	BLANK-02	05/10/17 12:25pm	FECAL COLIFORM-MF	SM 9222D	<2	05/10/17 03:04PM	DYS
L6778952-15	BLANK-02	05/10/17 12:25pm	ENTEROCOCCUS-MF 24	EPA 1600	<2	05/10/17 03:09PM	SYM
L6778952-15	BLANK-02	05/10/17 12:25pm	E. COLI-MF (1603)	EPA 1603	<2	05/10/17 03:19PM	BHS
L6778952-16	CC-03-2	05/10/17 03:14pm	ENTEROCOCCUS-MF 24	EPA 1600	45	05/10/17 08:47PM	BHS
L6778952-16	CC-03-2	05/10/17 03:14pm	FECAL COLIFORM-MF	SM 9222D	190 E	05/10/17 08:37PM	BHS
L6778952-16	CC-03-2	05/10/17 03:14pm	E. COLI-MF (1603)	EPA 1603	220	05/10/17 08:30PM	BHS
L6778952-17	RC-03-2	05/10/17 04:04pm	ENTEROCOCCUS-MF 24	EPA 1600	40 E	05/10/17 08:47PM	BHS
L6778952-17	RC-03-2	05/10/17 04:04pm	FECAL COLIFORM-MF	SM 9222D	490	05/10/17 08:37PM	BHS
L6778952-17	RC-03-2	05/10/17 04:04pm	E. COLI-MF (1603)	EPA 1603	1900 E	05/10/17 08:30PM	BHS
L6778952-18	RC-02-2	05/10/17 04:20pm	ENTEROCOCCUS-MF 24	EPA 1600	460	05/10/17 08:47PM	BHS
L6778952-18	RC-02-2	05/10/17 04:20pm	FECAL COLIFORM-MF	SM 9222D	140 E	05/10/17 08:37PM	BHS
L6778952-18	RC-02-2	05/10/17 04:20pm	E. COLI-MF (1603)	EPA 1603	180 E	05/10/17 08:30PM	BHS
L6778952-19	RC-01-2	05/10/17 04:45pm	ENTEROCOCCUS-MF 24	EPA 1600	20 E	05/10/17 08:47PM	BHS
L6778952-19	RC-01-2	05/10/17 04:45pm	FECAL COLIFORM-MF	SM 9222D	45	05/10/17 08:37PM	BHS
L6778952-19	RC-01-2	05/10/17 04:45pm	E. COLI-MF (1603)	EPA 1603	42	05/10/17 08:30PM	BHS
L6778952-20	CC-01-2	05/10/17 05:07pm	ENTEROCOCCUS-MF 24	EPA 1600	54	05/10/17 08:47PM	BHS
L6778952-20	CC-01-2	05/10/17 05:07pm	FECAL COLIFORM-MF	SM 9222D	25	05/10/17 08:37PM	BHS
L6778952-20	CC-01-2	05/10/17 05:07pm	E. COLI-MF (1603)	EPA 1603	39	05/10/17 08:30PM	BHS
L6778952-21	CC-02-2	05/10/17 05:28pm	ENTEROCOCCUS-MF 24	EPA 1600	41	05/10/17 08:47PM	BHS
L6778952-21	CC-02-2	05/10/17 05:28pm	FECAL COLIFORM-MF	SM 9222D	60 E	05/10/17 08:37PM	BHS
L6778952-21	CC-02-2	05/10/17 05:28pm	E. COLI-MF (1603)	EPA 1603	170 E	05/10/17 08:30PM	BHS

APPENDIX C

DRY WEATHER EVENT 3 – FIELD LOGS AND LAB RESULTS SUMMARY

(Chain of Custody Forms and Complete Lab Results provided in digital form only on CD attached to this report)

DRY WEATHER EVENT: 3

DATE: 6/13/2017 **Note Temperature of Receiving Stream if below 10 °C threshhold**

EVENT START TIME: 11:40

Sampling Station	Sampling Round	Target Sample Collection Time (hh:mm)	Actual Sample Collection Time (hh:mm)	Duplicate Sample Collected? (Y/N)	Duplicate Collection Time (hh:mm)	Field Blank Sample Collected? (Y/N)	Field Blank Collection Time (hh:mm)	Chain of Custody Provided & Completed (Y/N)	Time Sample Transferred to Lab Courier (hh:mm)	Water Salinity Reading (%)	Water Temperature Reading (°C)	Conductivity Reading (umhos/cm)	Field Observations (see notes, below)
CC-01	Incoming tide	13:19	13:23	N	N/A	N	N/A	Y	14:17	0.38	23.17	748	Clear sky, very little foam, no debris
	Outgoing tide	19:05	19:07	N	N/A	N	N/A	Y	20:06	0.38	25.02	786	Clear sky, little foam, no debris
CC-02	Incoming tide	13:36	13:41	N	N/A	N	N/A	Y	14:17	0.39	21.98	749	Clear sky, some debris, no foam
	Outgoing tide	19:25	19:24	N	N/A	N	N/A	Y	20:06	0.39	23.79	776	Clear sky, little debris, no foam little turbidity
CC-03	Incoming tide	11:57	12:00	Y	12:00	Y	11:59	Y	14:17	0.38	22.30	733	Clear sky, little debris, no foam little turbidity
	Outgoing tide	17:48	17:48	N	N/A	N	N/A	Y	20:06	0.24	21.37	455	Clear sky, 95 F, some floating debris
RC-01	Incoming tide	12:59	13:02	N	N/A	N	N/A	Y	14:17	0.32	22.08	624	Clear sky, little foam, little debris
	Outgoing tide	18:40	18:43	Y	18:43	N	N/A	Y	20:06	0.32	23.38	637	Clear sky, little foam, 94 F
RC-02	Incoming tide	12:34	12:37	N	N/A	N	N/A	Y	14:17	0.33	20.91	617	Clear sky, little debris, very little foam
	Outgoing tide	18:25	18:20	N	N/A	N	N/A	Y	20:06	0.34	23.35	675	Clear sky, 94 F, little debris, no turbidity
RC-03	Incoming tide	12:14	12:20	N	N/A	N	N/A	Y	14:17	0.32	22.08	609	Clear sky, no foam, no debris, little turbidity
	Outgoing tide	18:05	18:04	N	N/A	N	N/A	Y	20:06	0.26	22.86	512	Clear sky, 94 F, debris, little turbidity
DR-01	Incoming tide	13:00	13:00	N	N/A	Y	13:05	Y	14:17	0.14/0.14/0.14	21.82/21.8/21.7	275/274/273	Total Depth = 24 ft
	Outgoing tide	18:15	18:15	N	N/A	N	N/A	Y	20:06	0.14/0.14/0.14	22.5/22.2/22.2	287/283/282	Total Depth = 27 ft
DR-02	Incoming tide	13:25	13:25	N	N/A	N	N/A	Y	14:17	0.14/0.14/0.14	21.9/21.8/21.8	274/273/272	Total Depth = 36 ft
	Outgoing tide	18:30	18:30	N	N/A	N	N/A	Y	20:06	0.14/0.14/0.14	22.4/22.3/22.3	286/286/286	Total Depth = 33 ft
DR-03	Incoming tide	13:40	13:40	N	N/A	N	N/A	Y	14:17	0.15/0.15/0.15	22.3/22.3/22.3	291/291/289	Total Depth = 18 ft
	Outgoing tide	18:40	18:40	N	N/A	N	N/A	Y	20:06	0.14/0.14/0.14	22.4/22.4/22.3	286/286/286	Total Depth = 16 ft
DR-04	Incoming tide	13:50	13:50	N	N/A	N	N/A	Y	14:17	0.15/0.15/0.15	22.4/22.3/22.4	291/291/291	Total Depth = 17 ft
	Outgoing tide	18:50	18:50	N	N/A	N	N/A	Y	20:06	0.15/0.15/0.15	22.5/22.5/22.5	294/294/293	Total Depth = 15 ft
DR-05	Incoming tide	14:05	14:05	N	N/A	N	N/A	Y	14:17	0.14/0.14/0.14	22.5/22.3/22.3	290/289/288	Total Depth = 8 ft
	Outgoing tide	19:00	19:00	N	N/A	N	N/A	Y	20:06	0.19/0.15/0.15	23.0/22.5/22.4	376/304/291	Total Depth = 12 ft

Login Number	Sample ID	Sample Date/Time	Parm Stored	Method	Result (cfu/100 mL)	Analysis Date/Time	Tech Initials
L6851627-1	BLANK 01	06/13/17 11:48am	ENTEROCOCCUS-MF 24	EPA 1600	<1	06/13/17 05:28PM	SYM
L6851627-1	BLANK 01	06/13/17 11:48am	E. COLI-MF (1603)	EPA 1603	<1	06/13/17 05:29PM	SYM
L6851627-1	BLANK 01	06/13/17 11:48am	FECAL COLIFORM-MF	SM 9222D	<1	06/13/17 05:24PM	BHS
L6851627-2	CC-03-01	06/13/17 11:48am	ENTEROCOCCUS-MF 24	EPA 1600	85	06/13/17 05:28PM	SYM
L6851627-2	CC-03-01	06/13/17 11:48am	E. COLI-MF (1603)	EPA 1603	160 E	06/13/17 05:29PM	SYM
L6851627-2	CC-03-01	06/13/17 11:48am	FECAL COLIFORM-MF	SM 9222D	1200 E	06/13/17 05:24PM	BHS
L6851627-3	RC-03-01	06/13/17 12:19pm	ENTEROCOCCUS-MF 24	EPA 1600	130 E	06/13/17 05:28PM	SYM
L6851627-3	RC-03-01	06/13/17 12:19pm	E. COLI-MF (1603)	EPA 1603	50 E	06/13/17 05:29PM	SYM
L6851627-3	RC-03-01	06/13/17 12:19pm	FECAL COLIFORM-MF	SM 9222D	2700	06/13/17 05:24PM	BHS
L6851627-4	DUP-CC	06/13/17 00:00am	ENTEROCOCCUS-MF 24	EPA 1600	150 Q	06/13/17 05:28PM	SYM
L6851627-4	DUP-CC	06/13/17 00:00am	E. COLI-MF (1603)	EPA 1603	200 Q	06/13/17 05:29PM	SYM
L6851627-4	DUP-CC	06/13/17 00:00am	FECAL COLIFORM-MF	SM 9222D	1100 E, Q	06/13/17 05:24PM	BHS
L6851627-5	RC-02-01	06/13/17 12:37pm	ENTEROCOCCUS-MF 24	EPA 1600	460	06/13/17 05:28PM	SYM
L6851627-5	RC-02-01	06/13/17 12:37pm	E. COLI-MF (1603)	EPA 1603	440	06/13/17 05:29PM	SYM
L6851627-5	RC-02-01	06/13/17 12:37pm	FECAL COLIFORM-MF	SM 9222D	3200	06/13/17 05:24PM	BHS
L6851627-6	RC-01-01	06/13/17 01:02pm	ENTEROCOCCUS-MF 24	EPA 1600	78	06/13/17 05:28PM	SYM
L6851627-6	RC-01-01	06/13/17 01:02pm	E. COLI-MF (1603)	EPA 1603	75	06/13/17 05:29PM	SYM
L6851627-6	RC-01-01	06/13/17 01:02pm	FECAL COLIFORM-MF	SM 9222D	180 E	06/13/17 05:24PM	BHS
L6851627-7	CC-01-01	06/13/17 01:23pm	ENTEROCOCCUS-MF 24	EPA 1600	49	06/13/17 05:28PM	SYM
L6851627-7	CC-01-01	06/13/17 01:23pm	E. COLI-MF (1603)	EPA 1603	110 E	06/13/17 05:29PM	SYM
L6851627-7	CC-01-01	06/13/17 01:23pm	FECAL COLIFORM-MF	SM 9222D	180 E	06/13/17 05:24PM	BHS
L6851627-8	CC-02-01	06/13/17 01:42pm	ENTEROCOCCUS-MF 24	EPA 1600	140 E	06/13/17 05:28PM	SYM
L6851627-8	CC-02-01	06/13/17 01:42pm	E. COLI-MF (1603)	EPA 1603	470	06/13/17 05:29PM	SYM
L6851627-8	CC-02-01	06/13/17 01:42pm	FECAL COLIFORM-MF	SM 9222D	800 E	06/13/17 05:24PM	BHS
L6851627-9	DR-01-1	06/13/17 01:00pm	ENTEROCOCCUS-MF 24	EPA 1600	11	06/13/17 05:28PM	SYM
L6851627-9	DR-01-1	06/13/17 01:00pm	E. COLI-MF (1603)	EPA 1603	23	06/13/17 05:29PM	SYM
L6851627-9	DR-01-1	06/13/17 01:00pm	FECAL COLIFORM-MF	SM 9222D	39	06/13/17 05:24PM	BHS
L6851627-10	BLANK-02	06/13/17 01:05pm	ENTEROCOCCUS-MF 24	EPA 1600	<1	06/13/17 05:28PM	SYM
L6851627-10	BLANK-02	06/13/17 01:05pm	E. COLI-MF (1603)	EPA 1603	<1	06/13/17 05:29PM	SYM
L6851627-10	BLANK-02	06/13/17 01:05pm	FECAL COLIFORM-MF	SM 9222D	<1	06/13/17 05:24PM	BHS
L6851627-11	DR-02-1	06/13/17 01:25pm	ENTEROCOCCUS-MF 24	EPA 1600	9	06/13/17 05:28PM	SYM
L6851627-11	DR-02-1	06/13/17 01:25pm	E. COLI-MF (1603)	EPA 1603	11	06/13/17 05:29PM	SYM
L6851627-11	DR-02-1	06/13/17 01:25pm	FECAL COLIFORM-MF	SM 9222D	21	06/13/17 05:24PM	BHS
L6851627-12	DR-03-1	06/13/17 01:40pm	ENTEROCOCCUS-MF 24	EPA 1600	14	06/13/17 05:28PM	SYM
L6851627-12	DR-03-1	06/13/17 01:40pm	E. COLI-MF (1603)	EPA 1603	25	06/13/17 05:29PM	SYM
L6851627-12	DR-03-1	06/13/17 01:40pm	FECAL COLIFORM-MF	SM 9222D	54	06/13/17 05:24PM	BHS
L6851627-13	DR-04-1	06/13/17 01:50pm	ENTEROCOCCUS-MF 24	EPA 1600	4	06/13/17 05:28PM	SYM
L6851627-13	DR-04-1	06/13/17 01:50pm	E. COLI-MF (1603)	EPA 1603	12	06/13/17 05:29PM	SYM
L6851627-13	DR-04-1	06/13/17 01:50pm	FECAL COLIFORM-MF	SM 9222D	21	06/13/17 05:24PM	BHS
L6851627-14	DR-05-1	06/13/17 02:05pm	ENTEROCOCCUS-MF 24	EPA 1600	6	06/13/17 05:28PM	SYM
L6851627-14	DR-05-1	06/13/17 02:05pm	E. COLI-MF (1603)	EPA 1603	10	06/13/17 05:29PM	SYM
L6851627-14	DR-05-1	06/13/17 02:05pm	FECAL COLIFORM-MF	SM 9222D	40	06/13/17 05:24PM	BHS

Login Number	Sample ID	Sample Date/Time	Parm Stored	Method	Result (cfu/100 mL)	Analysis Date/Time	Tech Initials
L6851627-15	DR-01-2	06/13/17 06:15pm	ENTEROCOCCUS-MF 24	EPA 1600	6	06/13/17 10:17PM	BHS
L6851627-15	DR-01-2	06/13/17 06:15pm	E. COLI-MF (1603)	EPA 1603	12	06/13/17 10:13PM	BHS
L6851627-15	DR-01-2	06/13/17 06:15pm	FECAL COLIFORM-MF	SM 9222D	35	06/13/17 10:34PM	BHS
L6851627-16	DR-02-2	06/13/17 06:30pm	ENTEROCOCCUS-MF 24	EPA 1600	2	06/13/17 10:17PM	BHS
L6851627-16	DR-02-2	06/13/17 06:30pm	E. COLI-MF (1603)	EPA 1603	7	06/13/17 10:13PM	BHS
L6851627-16	DR-02-2	06/13/17 06:30pm	FECAL COLIFORM-MF	SM 9222D	32	06/13/17 10:34PM	BHS
L6851627-17	DR-03-2	06/13/17 06:40pm	ENTEROCOCCUS-MF 24	EPA 1600	1	06/13/17 10:17PM	BHS
L6851627-17	DR-03-2	06/13/17 06:40pm	E. COLI-MF (1603)	EPA 1603	5	06/13/17 10:13PM	BHS
L6851627-17	DR-03-2	06/13/17 06:40pm	FECAL COLIFORM-MF	SM 9222D	20	06/13/17 10:34PM	BHS
L6851627-18	DR-04-2	06/13/17 06:50pm	ENTEROCOCCUS-MF 24	EPA 1600	2	06/13/17 10:17PM	BHS
L6851627-18	DR-04-2	06/13/17 06:50pm	E. COLI-MF (1603)	EPA 1603	2	06/13/17 10:13PM	BHS
L6851627-18	DR-04-2	06/13/17 06:50pm	FECAL COLIFORM-MF	SM 9222D	34	06/13/17 10:34PM	BHS
L6851627-19	DR-05-2	06/13/17 07:00pm	ENTEROCOCCUS-MF 24	EPA 1600	2	06/13/17 10:17PM	BHS
L6851627-19	DR-05-2	06/13/17 07:00pm	E. COLI-MF (1603)	EPA 1603	1	06/13/17 10:13PM	BHS
L6851627-19	DR-05-2	06/13/17 07:00pm	FECAL COLIFORM-MF	SM 9222D	27	06/13/17 10:34PM	BHS
L6851627-20	DUP-DR	06/13/17 00:00am	ENTEROCOCCUS-MF 24	EPA 1600	5 Q	06/13/17 10:17PM	BHS
L6851627-20	DUP-DR	06/13/17 00:00am	E. COLI-MF (1603)	EPA 1603	6 Q	06/13/17 10:13PM	BHS
L6851627-20	DUP-DR	06/13/17 00:00am	FECAL COLIFORM-MF	SM 9222D	21 Q	06/13/17 10:34PM	BHS
L6851627-21	CC-03-02	06/13/17 05:48pm	ENTEROCOCCUS-MF 24	EPA 1600	87	06/13/17 10:17PM	BHS
L6851627-21	CC-03-02	06/13/17 05:48pm	E. COLI-MF (1603)	EPA 1603	90 E	06/13/17 10:13PM	BHS
L6851627-21	CC-03-02	06/13/17 05:48pm	FECAL COLIFORM-MF	SM 9222D	330	06/13/17 10:34PM	BHS
L6851627-22	RC-03-02	06/13/17 06:04pm	ENTEROCOCCUS-MF 24	EPA 1600	180 E	06/13/17 10:17PM	BHS
L6851627-22	RC-03-02	06/13/17 06:04pm	E. COLI-MF (1603)	EPA 1603	110 E	06/13/17 10:13PM	BHS
L6851627-22	RC-03-02	06/13/17 06:04pm	FECAL COLIFORM-MF	SM 9222D	1600 E	06/13/17 10:34PM	BHS
L6851627-23	RC-02-02	06/13/17 06:23pm	ENTEROCOCCUS-MF 24	EPA 1600	900 E	06/13/17 10:17PM	BHS
L6851627-23	RC-02-02	06/13/17 06:23pm	E. COLI-MF (1603)	EPA 1603	920 E	06/13/17 10:13PM	BHS
L6851627-23	RC-02-02	06/13/17 06:23pm	FECAL COLIFORM-MF	SM 9222D	3800	06/13/17 10:34PM	BHS
L6851627-24	RC-01-02	06/13/17 06:43pm	ENTEROCOCCUS-MF 24	EPA 1600	190 E	06/13/17 10:17PM	BHS
L6851627-24	RC-01-02	06/13/17 06:43pm	E. COLI-MF (1603)	EPA 1603	76	06/13/17 10:13PM	BHS
L6851627-24	RC-01-02	06/13/17 06:43pm	FECAL COLIFORM-MF	SM 9222D	190 E	06/13/17 10:34PM	BHS
L6851627-25	CC-01-02	06/13/17 07:06pm	ENTEROCOCCUS-MF 24	EPA 1600	140 E	06/13/17 10:17PM	BHS
L6851627-25	CC-01-02	06/13/17 07:06pm	E. COLI-MF (1603)	EPA 1603	67	06/13/17 10:13PM	BHS
L6851627-25	CC-01-02	06/13/17 07:06pm	FECAL COLIFORM-MF	SM 9222D	210	06/13/17 10:34PM	BHS
L6851627-26	CC-02-02	06/13/17 07:24pm	ENTEROCOCCUS-MF 24	EPA 1600	190 E	06/13/17 10:17PM	BHS
L6851627-26	CC-02-02	06/13/17 07:24pm	E. COLI-MF (1603)	EPA 1603	260	06/13/17 10:13PM	BHS
L6851627-26	CC-02-02	06/13/17 07:24pm	FECAL COLIFORM-MF	SM 9222D	900 E	06/13/17 10:34PM	BHS
L6851627-27	DUP-RC	06/13/17 00:00am	ENTEROCOCCUS-MF 24	EPA 1600	190 E, Q	06/13/17 10:17PM	BHS
L6851627-27	DUP-RC	06/13/17 00:00am	E. COLI-MF (1603)	EPA 1603	119 Q	06/13/17 10:13PM	BHS
L6851627-27	DUP-RC	06/13/17 00:00am	FECAL COLIFORM-MF	SM 9222D	210 Q	06/13/17 10:34PM	BHS

APPENDIX D

WET WEATHER EVENT 1 – FIELD LOGS AND LAB RESULTS SUMMARY

(Chain of Custody Forms and Complete Lab Results provided in digital form only on CD attached to this report)

WET WEATHER EVENT: 1

IN-STREAM TRIBUTARY STATION: CC-01

DATE: *3/31/2017* Note Temperature of Receiving Stream if below 10 °C threshhold

START OF RAINFALL TIME: *23:30*

Sampling Round	Sample Interval from Start of Rainfall (Hours)	Target Sample Collection Time (hh:mm)	Actual Sample Collection Time (hh:mm)	Duplicate Sample Collected? (Y/N)	Duplicate Collection Time (hh:mm)	Field Blank Sample Collected? (Y/N)	Field Blank Collection Time (hh:mm)	Chain of Custody Provided & Completed (Y/N)	Time Sample Transferred to Lab Courier (hh:mm)	Water Salinity Reading (%)	Water Temperature Reading (°C)	Conductivity Reading (umhos/cm)	Field Observations (see notes, below)
1	0.5-2.5	1:00	1:03	N	N/A	N	N/A	Y	3:04	0.30	9.00	431.9	Raining
2	4.5-6.5	6:00	4:54	N	N/A	N	N/A	Y	6:55	0.20	8.90	515	Raining
3	8.5-10.5	10:00	8:37	N	N/A	N	N/A	Y	10:15	0.28	8.16	567	Raining
4	14.5-16.5	16:00	16:05	N	N/A	N	N/A	Y	16:40	0.17	8.04	349	Raining
5	22-24	23:00	23:25	N	N/A	N	N/A	Y	23:45	0.11	8.01	233	Raining
IN-STREAM TRIBUTARY STATION: CC-02													
1	0.5-2.5	0:40	0:43	N	N/A	N	N/A	Y	3:04	0.3	10.30	433.4	Raining
2	4.5-6.5	5:40	4:16	N	N/A	N	N/A	Y	6:55	0.3	9.80	548	Raining
3	8.5-10.5	9:40	8:18	N	N/A	N	N/A	Y	10:15	0.26	8.59	527	Raining
4	14.5-16.5	15:40	15:40	N	N/A	N	N/A	Y	16:40	0.19	8.13	403	Raining
5	22-24	22:40	23:15	N	N/A	N	N/A	Y	23:45	0.11	8.00	228	Raining
IN-STREAM TRIBUTARY STATION: CC-03													
1	0.5-2.5	0:00	0:00	Y	0:01	Y	0:05	Y	3:04	0.20	9.00	479.3	Raining
2	4.5-6.5	5:00	4:05	N	N/A	N	N/A	Y	6:55	0.20	7.40	384.6	Raining
3	8.5-10.5	9:00	8:18	N	N/A	N	N/A	Y	10:15	0.28	9.26	574.0	Raining
4	14.5-16.5	15:00	14:40	N	N/A	N	N/A	Y	16:40	0.25	8.20	520.0	Raining
5	22-24	22:00	22:15	N	N/A	N	N/A	Y	23:45	0.12	8.01	120.0	Raining
IN-STREAM TRIBUTARY STATION: RC-01													
1	0.5-2.5	1:30	1:30	N	N/A	N	N/A	Y	3:04	0.20	8.80	419.4	Raining
2	4.5-6.5	6:30	5:22	N	N/A	N	N/A	Y	6:55	0.20	8.40	404.2	Raining
3	8.5-10.5	10:30	9:15	N	N/A	N	N/A	Y	10:15	0.19	7.94	399.0	Raining
4	14.5-16.5	16:30	15:25	Y	15:26	N	N/A	Y	16:40	0.13	8.09	270.0	Raining
5	22-24	23:30	22:55	N	N/A	N	N/A	Y	23:45	0.10	7.65	216.0	Raining
IN-STREAM TRIBUTARY STATION: RC-02													
1	0.5-2.5	2:00	2:10	N	N/A	N	N/A	Y	3:04	0.20	9.60	474.8	Raining
2	4.5-6.5	7:00	6:43	N	N/A	N	N/A	Y	6:55	0.17	8.17	353.0	Raining
3	8.5-10.5	11:00	9:36	N	N/A	N	N/A	Y	10:15	0.20	7.97	421.0	Raining
4	14.5-16.5	17:00	15:10	N	N/A	N	N/A	Y	16:40	0.13	8.06	273.0	Raining
5	22-24	0:00	22:40	N	N/A	N	N/A	Y	23:45	0.11	7.75	224.0	Raining
IN-STREAM TRIBUTARY STATION: RC-03													
1	0.5-2.5	2:30	2:39	N	N/A	N	N/A	Y	3:04	0.10	7.40	373.6	Raining
2	4.5-6.5	7:30	7:00	N	N/A	N	N/A	Y	6:55	0.20	8.33	423.0	Raining
3	8.5-10.5	11:30	9:56	N	N/A	N	N/A	Y	10:15	0.19	8.01	391.0	Raining
4	14.5-16.5	17:30	14:55	N	N/A	N	N/A	Y	16:40	0.19	8.00	395.0	Raining
5	22-24	0:30	22:25	N	N/A	N	N/A	Y	23:45	0.00	7.40	228.0	Raining

WET WEATHER EVENT: 1
DELAWARE RIVER STATION: DR-01

DATE: *3/31/2017* **Note Temperature of Receiving Stream if below 10 °C threshhold**

START OF RAINFALL TIME: *23:30*

Sampling Round	Sample Interval from Start of Rainfall (Hours)	Target Sample Collection Time (hh:mm)	Actual Sample Collection Time (hh:mm)	Duplicate Sample Collected? (Y/N)	Duplicate Collection Time (hh:mm)	Field Blank Sample Collected? (Y/N)	Field Blank Collection Time (hh:mm)	Chain of Custody Provided & Completed (Y/N)	Time Sample Transferred to Lab Courier (hh:mm)	Surface, Mid-depth & Bottom Water Salinity Reading(s) (%)	Surface, Mid-depth & Bottom Water Temperature Reading(s) (°C)	Surface, Mid-depth & Bottom Water Conductivity Reading(s) (umhos/cm)	Field Observations (see notes, below)
1	0	1:00	1:10	N	N/A	N	N/A	Y	2:54	0.18/ 0.18/	3.33/ 3.32/	0.376/ 0.372/	Mid depth = 12 ft
2	2	3:00		N	N/A	N	N/A	N		/ /	/ /	/ /	Weather delay
3	4	5:00	7:45	N	N/A	N	N/A	Y	9:56	/ /	/ /	/ /	No logs
4	6	7:00	9:20	N	N/A	N	N/A	Y	10:40	0.18/ 0.17/ 0.17	3.39/ 3.38/ 3.37	0.366/ 0.361/ 0.359	Mid depth = 13 ft, Bottom depth = 26 ft
5	9	10:00	13:03	N	N/A	N	N/A	Y	14:35	0.17/ 0.17/ 0.17	3.44/ 3.50/ 3.50	0.363/ 0.363/ 0.364	Mid depth = 10 ft, Bottom depth = 25 ft
6	12	13:00	15:20	N	N/A	N	N/A	Y	17:07	0.17/ 0.17/ 0.17	3.37/ 3.38/ 3.38	0.362/ 0.362/ 0.362	Mid depth = 15 ft, Bottom depth = 27 ft
7	15	16:00	17:55	N	N/A	N	N/A	Y	18:00	0.17/ 0.17/ 0.17	3.36/ 3.36/ 3.37	0.363/ 0.363/ 0.363	Mid depth = 15 ft, Bottom depth = 26 ft
8	18	19:00	19:50	N	N/A	N	N/A	Y	21:20	0.17/ 0.17/ 0.17	3.44/ 3.45/ 3.46	0.354/ 0.355/ 0.355	Mid depth = 13 ft, Bottom depth = 25 ft
9	21	22:00	23:35	N	N/A	N	N/A	Y	0:52	0.16/ 0.16/ 0.16	3.58/ 3.59/ 3.59	0.333/ 0.334/ 0.335	Mid depth = 11 ft, Bottom depth = 10 ft
10	24	1:00		N	N/A	N	N/A	Y		/ /	/ /	/ /	
DELAWARE RIVER STATION: DR-02													
1	0	1:30	1:31	N	N/A	N	N/A	Y	2:54	0.18/ 0.18/	3.23/ 3.22/	0.371/ 0.370/	Mid depth = 12 ft
2	2	3:30	4:50	Y	4:50	N	N/A	Y	6:34	0.18/ 0.18/ 0.18	3.05/ 3.12/ 3.12	0.380/ 0.381/ 0.381	Mid depth = 16 ft, Bottom depth = 28.65 ft
3	4	5:30		N	N/A	N	N/A	Y		/ /	/ /	/ /	Weather delay
4	6	7:30	9:35	N	N/A	N	N/A	Y	10:40	0.17/ 0.17/ 0.17	3.31/ 3.32/ 3.34	0.361/ 0.362/ 0.363	Mid depth = 18 ft, Bottom depth = 35 ft
5	9	10:30	13:20	N	N/A	N	N/A	Y	14:35	0.17/ 0.17/ 0.17	3.33/ 3.33/ 3.34	0.351/ 0.357/ 0.351	Mid depth = 15 ft, Bottom depth = 34 ft
6	12	13:30	15:30	N	N/A	N	N/A	Y	17:07	0.17/ 0.17/ 0.17	3.31/ 3.31/ 3.31	0.362/ 0.363/ 0.363	Mid depth = 15 ft, Bottom depth = 30 ft
7	15	16:30	18:05	N	N/A	N	N/A	Y	18:00	0.17/ 0.17/ 0.17	3.39/ 3.39/ 3.40	0.350/ 0.350/ 0.352	Mid depth = 20 ft, Bottom depth = 35 ft
8	18	19:30	19:55	N	N/A	N	N/A	Y	21:20	0.16/ 0.17/ 0.16	3.36/ 3.37/ 3.38	0.343/ 0.343/ 0.344	Mid depth = 17 ft., Bottom depth = 35 ft
9	21	22:30	23:45	N	N/A	N	N/A	Y	0:52	0.15/ 0.15/ 0.15	3.35/ 3.35/ 3.36	0.317/ 0.317/ 0.316	Mid depth = 15 ft, Bottom depth = 30 ft
10	24	1:30		N	N/A	N	N/A	Y		/ /	/ /	/ /	
DELAWARE RIVER STATION: DR-03													
1	0	1:40	1:40	N	N/A	N	N/A	Y	2:54	0.19/ 0.19/	3.41/ 3.44/	0.390/ 0.391/	Mid depth = 7.6 ft
2	2	3:40	4:30	N	N/A	Y	4:33	Y	6:34	0.19/ 0.18/ 0.18	3.05/ 3.06/ 3.04	0.388/ 0.386/ 0.386	Mide depth = 10 ft, Bottom depth = 18 ft
3	4	5:40		N	N/A	N	N/A	Y		/ /	/ /	/ /	Weather delay
4	6	7:40	9:45	N	N/A	N	N/A	Y	10:40	0.18/ 0.18/ 0.18	3.32/ 3.33/ 3.34	0.367/ 0.365/ 0.362	Mid depth = 13 ft, Bottom depth = 24 ft
5	9	10:40	13:35	N	N/A	N	N/A	Y	14:35	0.18/ 0.18/ 0.18	3.42/ 3.42/ 3.44	0.371/ 0.371/ 0.372	Mid depth = 7.5 ft, Bottom depth = 13 ft
6	12	13:40	15:40	N	N/A	N	N/A	Y	17:07	0.18/ 0.18/ 0.18	3.33/ 3.34/ 3.34	0.370/ 0.370/ 0.370	Mid depth = 8 ft, Botto depth = 16 ft
7	15	16:40	18:10	N	N/A	N	N/A	Y	18:00	0.18/ 0.18/ 0.18	3.36/ 3.37/ 3.37	0.377/ 0.377/ 0.378	Mid depth = 15, Bottom depth = 30 ft
8	18	19:40	20:00	N	N/A	N	N/A	Y	21:20	0.17/ 0.17/ 0.17	3.37/ 3.38/ 3.38	0.353/ 0.353/ 0.353	Mid depth = 15 ft, Bottom depth = 29 ft
9	21	22:40	23:55	N	N/A	N	N/A	Y	0:52	0.16/ 0.16/ 0.16	3.59/ 3.60/ 3.60	0.341/ 0.341/ 0.341	Mid depth = 12 ft, Bottom depth = 22 ft
10	24	1:40		N	N/A	N	N/A	Y		/ /	/ /	/ /	
DELAWARE RIVER STATION: DR-04													
1	0	1:35	1:35	Y	1:35	N	N/A	Y	2:54	0.19/ 0.19/ 0.19	7.52/7.53/ 7.54	0.386/ 0.387/ 0.388	Mid depth = 16.12 ft, Bottom depth = 32.5 ft
2	2	3:35	4:00	N	N/A	N	N/A	Y	6:35	0.19/ 0.19/ 0.18	3.12/ 3.10/ 3.08	0.389/ 0.386/ 0.385	Mid depth = 11 ft, Bottom depth = 22 ft
3	4	5:35	7:30	N	N/A	N	N/A	Y	9:56	0.18	3.71	0.385	Only one reading recorded
4	6	7:35	9:55	N	N/A	N	N/A	Y	10:40	0.18/ 0.18/ 0.18	3.33/ 3.35/ 3.35	0.381/ 0.382/ 0.383	Mid depth = 13 ft, Bottom depth = 25 ft
5	9	10:35	13:15	N	N/A	N	N/A	Y	14:35	0.17/ 0.17/ 0.17	3.39/ 3.40/ 3.40	0.363/ 0.364/ 0.363	Mid depth = 10 ft, Bottom depth = 16 ft
6	12	13:35	15:55	N	N/A	N	N/A	Y	17:07	0.18/ 0.18/ 0.18	3.15/ 3.15/ 3.11	0.368/ 0.369/ 0.368	Mid depth = 11 ft, Bottom depth = 20 ft
7	15	16:35	18:15	N	N/A	N	N/A	Y	18:00	0.17/ 0.17/ 0.17	3.01/ 3.02/ 3.02	0.365/ 0.365/ 0.365	Mid depth = 15 ft , Bottom depth = 29 ft
8	18	19:35	20:05	N	N/A	N	N/A	Y	21:20	0.17/ 0.17/ 0.17	3.49/ 3.49/ 3.49	0.354/ 0.355/ 0.355	Mid dpeth = 15 ft, Bottom depth = 27 ft
9	21	22:35	0:10	N	N/A	N	N/A	Y	0:52	0.17/ 0.16/ 0.16	3.59/ 3.59/ 3.60	0.344/ 0.344/ 0.345	Mid dpeth = 12 ft, Bottom depth = 22 ft
10	24	1:35		N	N/A	N	N/A	Y		/ /	/ /	/ /	

WET WEATHER EVENT: 1
DELAWARE RIVER STATION: DR-05

DATE: *3/31/2017* **Note Temperature of Receiving Stream if below 10 ^{o}C threshhold**

START OF RAINFALL TIME: *23:30*

Sampling Round	Sample Interval from Start of Rainfall (Hours)	Target Sample Collection Time (hh:mm)	Actual Sample Collection Time (hh:mm)	Duplicate Sample Collected? (Y/N)	Duplicate Collection Time (hh:mm)	Field Blank Sample Collected? (Y/N)	Field Blank Collection Time (hh:mm)	Chain of Custody Provided & Completed (Y/N)	Time Sample Transferred to Lab Courier (hh:mm)	Surface, Mid-depth & Bottom Water Salinity Reading(s) (%)	Surface, Mid-depth & Bottom Water Temperature Reading(s) (^{o}C)	Surface, Mid-depth & Bottom Water Conductivity Reading(s) (umhos/cm)	Field Observations (see notes, below)
1	0	2:10	2:10	N	N/A	N	N/A	Y	2:54	0.18/ 0.18/ 0.18	3.11/ 3.14/ 3.14	0.383/ 0.383/ 0.383	Mid depth = 4 ft, Bottom depth = 7.5 ft
2	2	4:10	3:45	N	N/A	N	N/A	Y	6:35	0.18/ 0.18/ 0.18	3.06/ 3.06/ 3.06	0.384/ 0.384/ 0.384	Mid depth = 4 ft, Bottom depth = 8 ft
3	4	6:10	7:00	N	N/A	N	N/A	Y	9:56	0.29	5.88	0.596	Only one reading recorded
4	6	8:10	10:05	N	N/A	N	N/A	Y	10:40	0.18/ 0.18/ 0.18	3.36/ 3.36/ 3.37	0.382/ 0.383/ 0.383	Mid depth = 5 ft, Mid depth = 11 ft
5	9	11:10	13:50	N	N/A	N	N/A	Y	14:35	0.17/ 0.17/ 0.17	3.41/ 3.41/ 3.42	0.372/ 0.372/ 0.372	Mid depth = 4 ft, Bottom depth = 7 ft
6	12	14:10	16:05	N	N/A	N	N/A	Y	17:07	0.18/ 0.18/ 0.18	3.17/ 3.17/ 3.17	0.380/ 0.380/ 0.380	Mid depth = 7 ft, Bottom depth = 13 ft
7	15	17:10	18:25	N	N/A	N	N/A	Y	18:00	0.17/ 0.17/ 0.17	3.19/ 3.18/ 3.19	0.378/ 0.378/ 0.378	Mid depth = 10 ft, Bottom depth = 15 ft
8	18	20:10	20:15	N	N/A	N	N/A	Y	21:20	0.17/ 0.17/ 0.17	3.30/ 3.31/ 3.32	0.360/ 0.360/ 0.360	Mid depth = 9 ft, Bottom depth = 15 ft
9	21	23:10	0:20	N	N/A	N	N/A	Y	0:52	0.16/ .016/ 0.16	3.47/ 3.48/ 3.48	0.336/ 0.337/ 0.337	Mid dpeth = 9 ft, Bottom depth = 15 ft
10	24	2:10		N	N/A	N	N/A	Y		/ /	/ /	/ /	
DELAWARE RIVER STATION: DR-06													
1	0	2:00								/ /	/ /	/ /	Missed station / time delay
2	2	4:00	3:45	N	N/A	N	N/A	Y	6:35	0.18/ 0.18/ 0.18	2.92/ 2.91/ 2.91	0.375/ 0.375/ 0.375	Mid depth = 15 ft, Bottom Depth = 30 ft
3	4	6:00		N	N/A	N	N/A	Y		/ /	/ /	/ /	Weather delay
4	6	8:00	10:15	N	N/A	N	N/A	Y	10:40	0.17/ 0.17/ 0.17	2.90/ 2.91/ 2.91	0.354/ 0.355/ 0.356	Mid depth = 11 ft, Bottom depth = 21 ft
5	9	11:00	12:22	N	N/A	N	N/A	Y	14:35	0.16/ 0.16/ 0.15	3.0/ 2.9/ 2.9	0.349/ 0.350/ 0.351	Mid depth = 10 ft, Bottom depth = 24 ft
6	12	14:00	14:45	N	N/A	N	N/A	Y	17:07	0.17/ 0.17/ 0.17	3.00/ 3.01/ 3.01	0.357/ 0.357/ 0.358	Mid depth = 15 ft, Bottom depth = 25 ft
7	15	17:00	17:25	N	N/A	N	N/A	Y	18:00	0.17/ 0.17/ 0.17	2.93/ 2.93/ 2.93	0.365/ 0.366/ 0.366	Mid depth = 15 ft, Bottom depth = 28 ft
8	18	20:00	19:25	N	N/A	N	N/A	Y	21:20	0.17/ 0.17/ 0.17	3.04/ 3.05/ 3.08	0.354/ 0.355/ 0.355	Mid depth - 15 ft, Bottom depth = 25 ft
9	21	23:00	23:00	N	N/A	N	N/A	Y	0:52	0.16/ 0.16/ 0.16	3.21/ 3.21/ 3.21	0.335/ 0.335/ 0.335	Mid depth = 10 ft, Bottom depth = 19 ft
10	24	2:00		N	N/A	N	N/A	Y		/ /	/ /	/ /	
DELAWARE RIVER STATION: DR-07													
1	0	1:50								/ /	/ /	/ /	Missed station / time delay
2	2	3:50	3:20	N	N/A	N	N/A	Y	6:35	0.17/ 0.17/ 0.17	3.05/ 3.05/ 3.05	0.364/ 0.364/ 0.364	Mid depth = 3.5 ft, Bottom depth = 7.2 ft
3	4	5:50		N	N/A	N	N/A	Y		/ /	/ /	/ /	Weather delay
4	6	7:50	10:25	N	N/A	N	N/A	Y	10:40	0.18/ 0.18	3.15/ 3.16	0.370/ 0.370	Bottom depth = 2.5 ft, Mid too shallow
5	9	10:50	12:15	N	N/A	N	N/A	Y	14:35	0.17/ 0.17	2.94/ 2.94	0.353/ 0.354	Bottom depth = 4.05 ft, Mid too shallow
6	12	13:50	14:55	N	N/A	N	N/A	Y	17:07	0.17	3.04	0.352	Total depth = ft, too shallow fro multiple readings
7	15	16:50	17:30	N	N/A	N	N/A	Y	18:00	0.17/ 0.17/ 0.17	3.08/ 3.08/ 3.09	0.354/ 0.354/ 0.355	Mid depth = 7 ft, Bottom depth = 13 ft
8	18	19:50	19:30	N	N/A	N	N/A	Y	21:20	0.17/ 0.17/ 0.17	3.18/ 3.18/ 3.18	0.361/ 0.360/ 0.362	Mid depth = 6 ft, Bottom depth = 10 ft
9	21	22:50	23:15	N	N/A	N	N/A	Y	0:52	0.16/ 0.16/ 0.16	3.24/ 3.24/ 3.24	0.343/ 0.343/ 0.344	Mid depth = 3 ft, Bottom depth = 6 ft
10	24	1:50		N	N/A	N	N/A	Y		/ /	/ /	/ /	

WET WEATHER EVENT: 1

CSO STATION: CSO-02

DATE: *3/31/2017* **Note Temperature of Receiving Stream if below 10 °C threshhold**

START OF RAINFALL TIME: *23:30*

Sampling Round	Sample Interval from Start of Rainfall (Hours)	Target Sample Collection Time (hh:mm)	Actual Sample Collection Time (hh:mm)	Duplicate Sample Collected? (Y/N)	Duplicate Collection Time (hh:mm)	Field Blank Sample Collected? (Y/N)	Field Blank Collection Time (hh:mm)	Chain of Custody Provided & Completed (Y/N)	Time Sample Transferred to Lab Courier (hh:mm)	Filed Observations (see notes, below)
1	T=0 (First Flush)	23:54	23:54	N	N/A	Y	23:48	Y	2:20	
2	30 Min	0:24	1:35	N	N/A	N	N/A	Y	3:42	NO OVERFLOW UNTIL 01:30
3	60 Min	0:54	2:08	N	N/A	N	N/A	Y	3:42	
4	2 Hours	1:54	3:09	N	N/A	N	N/A	Y	3:42	
5	4 Hours	3:54	5:15	N	N/A	N	N/A	Y	7:10	
6	8 Hours	7:54	9:25	Y	N/A	N	N/A	Y	10:12	
7	12 Hours	11:54	12:30	N	N/A	N	N/A	Y	13:37	
7-X	16 Hours		16:55	N	N/A	N	N/A	Y	18:00	
8	24 Hours	23:54	0:00	N	N/A	N	N/A	Y	1:10	
CSO STATION: CSO-05										
1	T=0 (First Flush)	0:17	0:17	N	N/A	Y	12:08	Y	2:20	
2	30 Min	0:47	1:45	N	N/A	N	N/A	Y	3:42	NO OVERFLOW UNTIL 01:45
3	60 Min	1:17	2:20	N	N/A	N	N/A	Y	3:42	
4	2 Hours	2:17	3:20	N	N/A	N	N/A	Y	3:42	
5	4 Hours	4:17	9:55	N	N/A	N	N/A	Y	10:12	NO OVERFLOW UNTIL 09:55
6	8 Hours	8:17	12:45	N	N/A	N	N/A	Y	13:37	
7	12 Hours	12:17	17:15	N	N/A	N	N/A	Y	18:00	
8	24 Hours	0:17	0:15	N	N/A	N	N/A	Y	1:10	
CSO STATION: CSO-18										
1	T=0 (First Flush)	0:07	0:07	N	N/A	Y	0:03	Y	3:29	
2	30 Min	0:37	1:45	N	N/A	N	N\A	Y	3:29	NO OVERFLOW UNTIL 01:45
3	60 Min	1:07	2:10	N	N/A	N	N\A	Y	3:29	
4	2 Hours	2:07	3:10	N	N/A	N	N\A	Y	3:29	
5	4 Hours	4:07	9:40	N	N/A	N	N\A	Y	9:52	NO OVERFLOW UNTIL 09:40
6	8 Hours	8:07	13:00	N	N/A	N	N\A	Y	13:37	
7	12 Hours	12:07	17:25	N	N/A	N	N\A	Y	18:00	
8	24 Hours	0:07	0:35	N	N/A	N	N\A	-	-	NO OVERFLOW
CSO STATION: CSO-19										
1	T=0 (First Flush)	0:25	0:25	N	N/A	Y		Y	3:29	
2	30 Min	0:55	1:35	N	N/A	N	N/A	Y	3:29	NO OVERFLOW UNTIL 01:35
3	60 Min	1:25	1:58	N	N/A	N	N/A	Y	3:29	
4	2 Hours	2:25	2:55	N	N/A	N	N/A	Y	3:29	
5	4 Hours	4:25	4:55	N	N/A	N	N/A	Y	6:35	
6	8 Hours	8:25	8:50	N	N/A	N	N/A	Y	9:52	
7	12 Hours	12:25	17:40	N	N/A	N	N/A	Y	18:00	NO OVERFLOW UNTIL 17:40
8	24 Hours	0:25	0:40	N	N/A	N	N/A	Y	1:10	

WET WEATHER EVENT: 1										
STORM WATER STATION: SW-05A										
DATE: *3/31/2017*		Note Temperature of Receiving Stream if below 10 °C threshhold								
START OF RAINFALL TIME: *23:30*										
Sampling	Sample Interval (Hours)	Target Sample (hh:mm)	Actual Sample (hh:mm)	Duplicate (Y/N)	Duplicate (hh:mm)	Field Blank (Y/N)	Field Blank (hh:mm)	Chain of (Y/N)	Time Sample (hh:mm)	Filed Observations (see notes, below)
1	T=0 (First Flush)	0:00	0:00					Y	2:19	43°F, Rain
2	30 Min	0:30	0:30					Y	2:19	
3	60 Min	1:00	1:00					Y	2:19	
4	2 Hours	2:00	2:00					Y	2:18	
5	4 Hours	4:00	4:00					Y	6:20	
6	8 Hours	8:00	8:00					Y	8:07	
7	12 Hours	12:00	12:00					Y	13:37	
8	24 Hours	0:00	0:15					Y	1:10	
STORM WATER STATION: SW-SS2										
1	T=0 (First Flush)	23:50	23:50					Y	2:19	43°F, Rain
2	30 Min	0:20	0:20					Y	2:19	
3	60 Min	0:50	0:50					Y	2:19	
4	2 Hours	1:50	1:50					Y	2:18	
5	4 Hours	3:50	3:50					Y	6:20	
6	8 Hours	7:50	7:50					Y	8:07	
7	12 Hours	11:50	11:50					Y	13:37	
8	24 Hours	23:50	0:20					Y	1:10	

Login Number	Sample ID	Sample Date/Time	Parm Stored	Method	Result (cfu/100 mL)	Analysis Date/Time	Tech Initials
L6732900-1	SW-SS2-4	03/31/17 01:50am	ENTEROCOCCUS-MF 24	EPA 1600	19000 E	03/31/17 09:25AM	ARD
L6732900-1	SW-SS2-4	03/31/17 01:50am	FECAL COLIFORM-MF	SM 9222D	1280 E	03/31/17 09:09AM	ARD
L6732900-1	SW-SS2-4	03/31/17 01:50am	E. COLI-MF (1603)	EPA 1603	790 E, Q	03/31/17 10:34AM	ARD
L6732900-2	SW-05A-4	03/31/17 02:00am	ENTEROCOCCUS-MF 24	EPA 1600	5300	03/31/17 09:25AM	ARD
L6732900-2	SW-05A-4	03/31/17 02:00am	FECAL COLIFORM-MF	SM 9222D	180 E	03/31/17 09:09AM	ARD
L6732900-2	SW-05A-4	03/31/17 02:00am	E. COLI-MF (1603)	EPA 1603	144 E, Q	03/31/17 10:34AM	ARD
L6732900-3	SW-SS2-1	03/30/17 11:50pm	ENTEROCOCCUS-MF 24	EPA 1600	44000	03/31/17 07:36AM	ARD
L6732900-3	SW-SS2-1	03/30/17 11:50pm	FECAL COLIFORM-MF	SM 9222D	2100	03/31/17 07:43AM	ARD
L6732900-3	SW-SS2-1	03/30/17 11:50pm	E. COLI-MF (1603)	EPA 1603	900 E, Q	03/31/17 10:34AM	ARD
L6732900-4	SW-05A-1	03/31/17 12:00am	FECAL COLIFORM-MF	SM 9222D	140 E	03/31/17 07:43AM	ARD
L6732900-4	SW-05A-1	03/31/17 12:00am	E. COLI-MF (1603)	EPA 1603	120 E,Q	03/31/17 08:04AM	BHS
L6732900-4	SW-05A-1	03/31/17 12:00am	ENTEROCOCCUS-MF 24	EPA 1600	3100 Q	03/31/17 09:25AM	ARD
L6732900-5	SW-S52-2	03/31/17 12:20am	E. COLI-MF (1603)	EPA 1603	660 E	03/31/17 08:04AM	BHS
L6732900-5	SW-S52-2	03/31/17 12:20am	ENTEROCOCCUS-MF 24	EPA 1600	20000 Q	03/31/17 09:25AM	ARD
L6732900-5	SW-S52-2	03/31/17 12:20am	FECAL COLIFORM-MF	SM 9222D	503 E, Q	03/31/17 08:59AM	ARD
L6732900-6	SW-05A-2	03/31/17 12:30am	ENTEROCOCCUS-MF 24	EPA 1600	1455 E, Q	03/31/17 09:25AM	ARD
L6732900-6	SW-05A-2	03/31/17 12:30am	FECAL COLIFORM-MF	SM 9222D	130 E, Q	03/31/17 09:09AM	ARD
L6732900-6	SW-05A-2	03/31/17 12:30am	E. COLI-MF (1603)	EPA 1603	720 E, Q	03/31/17 10:34AM	ARD
L6732900-7	SW-SS2-3	03/31/17 12:50am	ENTEROCOCCUS-MF 24	EPA 1600	46000 Q	03/31/17 09:25AM	ARD
L6732900-7	SW-SS2-3	03/31/17 12:50am	FECAL COLIFORM-MF	SM 9222D	1140 E, Q	03/31/17 09:09AM	ARD
L6732900-7	SW-SS2-3	03/31/17 12:50am	E. COLI-MF (1603)	EPA 1603	50 E, Q	03/31/17 10:34AM	ARD
L6732900-8	SW-SSA-3	03/31/17 01:00am	FECAL COLIFORM-MF	SM 9222D	20	03/31/17 08:02AM	ARD
L6732900-8	SW-SSA-3	03/31/17 01:00am	ENTEROCOCCUS-MF 24	EPA 1600	1091 E,Q	03/31/17 09:25AM	ARD
L6732900-8	SW-SSA-3	03/31/17 01:00am	E. COLI-MF (1603)	EPA 1603	36 E, Q	03/31/17 10:34AM	ARD
L6732900-9	CS0-02-B	03/30/17 11:48pm	ENTEROCOCCUS-MF 24	EPA 1600	<10	03/31/17 07:36AM	ARD
L6732900-9	CS0-02-B	03/30/17 11:48pm	FECAL COLIFORM-MF	SM 9222D	<10	03/31/17 07:43AM	ARD
L6732900-9	CS0-02-B	03/30/17 11:48pm	E. COLI-MF (1603)	EPA 1603	81 E, Q	03/31/17 10:34AM	ARD
L6732904-1	SW-SS2-5	03/31/17 03:50am	ENTEROCOCCUS-MF 24	EPA 1600	6600 E	03/31/17 11:26AM	GNM
L6732904-1	SW-SS2-5	03/31/17 03:50am	E. COLI-MF (1603)	EPA 1603	490	03/31/17 11:46AM	BHS
L6732904-1	SW-SS2-5	03/31/17 03:50am	FECAL COLIFORM-MF	SM 9222D	550	03/31/17 11:36AM	ARD
L6732904-2	SW-05A-5	03/31/17 04:00am	ENTEROCOCCUS-MF 24	EPA 1600	6100 E	03/31/17 11:26AM	GNM
L6732904-2	SW-05A-5	03/31/17 04:00am	E. COLI-MF (1603)	EPA 1603	100 E	03/31/17 11:46AM	BHS
L6732904-2	SW-05A-5	03/31/17 04:00am	FECAL COLIFORM-MF	SM 9222D	146 E	03/31/17 11:36AM	ARD
L6732904-3	DR-03-2	03/31/17 04:30am	ENTEROCOCCUS-MF 24	EPA 1600	20 E	03/31/17 11:26AM	GNM
L6732904-3	DR-03-2	03/31/17 04:30am	E. COLI-MF (1603)	EPA 1603	80 E	03/31/17 11:46AM	BHS
L6732904-3	DR-03-2	03/31/17 04:30am	FECAL COLIFORM-MF	SM 9222D	80 E	03/31/17 11:50AM	GNM
L6732904-4	DR-02-2-D	03/31/17 04:50am	ENTEROCOCCUS-MF 24	EPA 1600	20 E	03/31/17 11:26AM	GNM
L6732904-4	DR-02-2-D	03/31/17 04:50am	E. COLI-MF (1603)	EPA 1603	40 E	03/31/17 11:46AM	BHS
L6732904-4	DR-02-2-D	03/31/17 04:50am	FECAL COLIFORM-MF	SM 9222D	91 E	03/31/17 11:36AM	ARD
L6732904-5	DR-02-2	03/31/17 04:50am	ENTEROCOCCUS-MF 24	EPA 1600	10 E	03/31/17 11:26AM	GNM
L6732904-5	DR-02-2	03/31/17 04:50am	E. COLI-MF (1603)	EPA 1603	70 E	03/31/17 11:46AM	BHS
L6732904-5	DR-02-2	03/31/17 04:50am	FECAL COLIFORM-MF	SM 9222D	60 E	03/31/17 11:11AM	ARD
L6732904-6	BLANK-DR	03/31/17 04:33am	ENTEROCOCCUS-MF 24	EPA 1600	<2	03/31/17 11:26AM	GNM
L6732904-6	BLANK-DR	03/31/17 04:33am	E. COLI-MF (1603)	EPA 1603	<2	03/31/17 11:46AM	BHS
L6732904-6	BLANK-DR	03/31/17 04:33am	FECAL COLIFORM-MF	SM 9222D	<2	03/31/17 11:36AM	ARD
L6732904-7	DR-04-2	03/31/17 04:00am	ENTEROCOCCUS-MF 24	EPA 1600	60 E	03/31/17 11:26AM	GNM
L6732904-7	DR-04-2	03/31/17 04:00am	E. COLI-MF (1603)	EPA 1603	30 E	03/31/17 11:46AM	BHS
L6732904-7	DR-04-2	03/31/17 04:00am	FECAL COLIFORM-MF	SM 9222D	100 E	03/31/17 11:11AM	ARD

Login Number	Sample ID	Sample Date/Time	Parm Stored	Method	Result (cfu/100 mL)	Analysis Date/Time	Tech Initials
L6732904-8	DR-05-2	03/31/17 03:45am	ENTEROCOCCUS-MF 24	EPA 1600	40 E	03/31/17 11:26AM	GNM
L6732904-8	DR-05-2	03/31/17 03:45am	FECAL COLIFORM-MF	SM 9222D	60 E	03/31/17 11:11AM	ARD
L6732904-8	DR-05-2	03/31/17 03:45am	E. COLI-MF (1603)	EPA 1603	73 E, Q	03/31/17 11:46AM	BHS
L6732904-9	DR-06-2	03/31/17 03:30am	ENTEROCOCCUS-MF 24	EPA 1600	<10	03/31/17 11:26AM	GNM
L6732904-9	DR-06-2	03/31/17 03:30am	FECAL COLIFORM-MF	SM 9222D	20 E	03/31/17 11:11AM	ARD
L6732904-9	DR-06-2	03/31/17 03:30am	E. COLI-MF (1603)	EPA 1603	E, Q	03/31/17 11:46AM	BHS
L6732905-1	DR-05-3	03/31/17 07:00am	E. COLI-MF (1603)	EPA 1603	<10 Q	03/31/17 04:29PM	BHS
L6732905-1	DR-05-3	03/31/17 07:00am	FECAL COLIFORM-MF	SM 9222D	30 E, Q	03/31/17 04:36PM	BHS
L6732905-1	DR-05-3	03/31/17 07:00am	ENTEROCOCCUS-MF 24	EPA 1600	<10 Q	03/31/17 04:37PM	BHS
L6732905-2	DR-04-3	03/31/17 07:30am	E. COLI-MF (1603)	EPA 1603	91 E, Q	03/31/17 04:29PM	BHS
L6732905-2	DR-04-3	03/31/17 07:30am	FECAL COLIFORM-MF	SM 9222D	100 E, Q	03/31/17 04:36PM	BHS
L6732905-2	DR-04-3	03/31/17 07:30am	ENTEROCOCCUS-MF 24	EPA 1600	40 E, Q	03/31/17 04:37PM	BHS
L6732905-3	SW-SS2-6	03/31/17 07:00am	E. COLI-MF (1603)	EPA 1603	838 E, Q	03/31/17 04:29PM	BHS
L6732905-3	SW-SS2-6	03/31/17 07:00am	FECAL COLIFORM-MF	SM 9222D	685 E, Q	03/31/17 04:36PM	BHS
L6732905-3	SW-SS2-6	03/31/17 07:00am	ENTEROCOCCUS-MF 24	EPA 1600	20000 Q	03/31/17 04:37PM	BHS
L6732905-4	SW-05A-6	03/31/17 08:00am	E. COLI-MF (1603)	EPA 1603	1640 E, Q	03/31/17 04:29PM	BHS
L6732905-4	SW-05A-6	03/31/17 08:00am	FECAL COLIFORM-MF	SM 9222D	1586 E, Q	03/31/17 04:36PM	BHS
L6732905-4	SW-05A-6	03/31/17 08:00am	ENTEROCOCCUS-MF 24	EPA 1600	42000 Q	03/31/17 04:37PM	BHS
L6732905-5	DR-01-3	03/31/17 07:45am	E. COLI-MF (1603)	EPA 1603	164 E, Q	03/31/17 08:39PM	BHS
L6732905-5	DR-01-3	03/31/17 07:45am	ENTEROCOCCUS-MF 24	EPA 1600	200 Q	03/31/17 08:51PM	BHS
L6732905-5	DR-01-3	03/31/17 07:45am	FECAL COLIFORM-MF	SM 9222D	73 E, Q	03/31/17 09:05PM	BHS
L6732905-6	CS0-19-6	03/31/17 08:50am	E. COLI-MF (1603)	EPA 1603	1380000 E	03/31/17 04:29PM	BHS
L6732905-6	CS0-19-6	03/31/17 08:50am	FECAL COLIFORM-MF	SM 9222D	490000	03/31/17 04:36PM	BHS
L6732905-6	CS0-19-6	03/31/17 08:50am	ENTEROCOCCUS-MF 24	EPA 1600	132000 E	03/31/17 04:37PM	BHS
L6732905-7	CS0-18-5	03/31/17 09:40am	E. COLI-MF (1603)	EPA 1603	267000 E	03/31/17 04:29PM	BHS
L6732905-7	CS0-18-5	03/31/17 09:40am	FECAL COLIFORM-MF	SM 9222D	780000 E	03/31/17 04:36PM	BHS
L6732905-7	CS0-18-5	03/31/17 09:40am	ENTEROCOCCUS-MF 24	EPA 1600	160000 E	03/31/17 04:37PM	BHS
L6732905-8	CS0-02-6	03/31/17 09:25am	E. COLI-MF (1603)	EPA 1603	265000 E	03/31/17 04:29PM	BHS
L6732905-8	CS0-02-6	03/31/17 09:25am	FECAL COLIFORM-MF	SM 9222D	560000	03/31/17 04:36PM	BHS
L6732905-8	CS0-02-6	03/31/17 09:25am	ENTEROCOCCUS-MF 24	EPA 1600	550000	03/31/17 04:37PM	BHS
L6732905-9	DUPCS0-02	03/31/17 09:25am	E. COLI-MF (1603)	EPA 1603	168000 E	03/31/17 04:29PM	BHS
L6732905-9	DUPCS0-02	03/31/17 09:25am	FECAL COLIFORM-MF	SM 9222D	170000 E	03/31/17 04:36PM	BHS
L6732905-9	DUPCS0-02	03/31/17 09:25am	ENTEROCOCCUS-MF 24	EPA 1600	450000	03/31/17 04:37PM	BHS
L6735514-1	CS0-02-8	04/01/17 12:00am	FECAL COLIFORM-MF	SM 9222D	39000 Q	04/01/17 08:18AM	ARD
L6735514-1	CS0-02-8	04/01/17 12:00am	E. COLI-MF (1603)	EPA 1603	25000	04/01/17 07:44AM	ARD
L6735514-1	CS0-02-8	04/01/17 12:00am	ENTEROCOCCUS-MF 24	EPA 1600	5600	04/01/17 07:00AM	ARD
L6735514-2	CS0-02-8	04/01/17 12:15am	FECAL COLIFORM-MF	SM 9222D	50000	04/01/17 07:23AM	ARD
L6735514-2	CS0-02-8	04/01/17 12:15am	E. COLI-MF (1603)	EPA 1603	33000	04/01/17 07:44AM	ARD
L6735514-2	CS0-02-8	04/01/17 12:15am	ENTEROCOCCUS-MF 24	EPA 1600	28000	04/01/17 07:00AM	ARD
L6735514-3	CS0-05-8	04/01/17 12:20am	FECAL COLIFORM-MF	SM 9222D	126 E	04/01/17 08:18AM	ARD
L6735514-3	CS0-05-8	04/01/17 12:20am	E. COLI-MF (1603)	EPA 1603	100 E	04/01/17 06:55AM	ARD
L6735514-3	CS0-05-8	04/01/17 12:20am	ENTEROCOCCUS-MF 24	EPA 1600	2300	04/01/17 07:00AM	ARD
L6735514-4	150-19-8	04/01/17 12:40am	FECAL COLIFORM-MF	SM 9222D	74546 E	04/01/17 08:18AM	ARD
L6735514-4	150-19-8	04/01/17 12:40am	E. COLI-MF (1603)	EPA 1603	80000 E	04/01/17 07:44AM	ARD
L6735514-4	150-19-8	04/01/17 12:40am	ENTEROCOCCUS-MF 24	EPA 1600	46000	04/01/17 07:00AM	ARD
L6735514-5	SW-05A-8	04/01/17 12:55am	FECAL COLIFORM-MF	SM 9222D	6937 E	04/01/17 08:18AM	ARD
L6735514-5	SW-05A-8	04/01/17 12:55am	E. COLI-MF (1603)	EPA 1603	6100	04/01/17 07:44AM	ARD
L6735514-5	SW-05A-8	04/01/17 12:55am	ENTEROCOCCUS-MF 24	EPA 1600	150000 E	04/01/17 07:00AM	ARD
L6735514-6	DR-06-09	03/31/17 11:00pm	E. COLI-MF (1603)	EPA 1603	90 E	04/01/17 06:55AM	ARD
L6735514-6	DR-06-09	03/31/17 11:00pm	FECAL COLIFORM-MF	SM 9222D	60 Q,E	04/01/17 07:23AM	ARD
L6735514-6	DR-06-09	03/31/17 11:00pm	ENTEROCOCCUS-MF 24	EPA 1600	20 E	04/01/17 07:00AM	ARD

Login Number	Sample ID	Sample Date/Time	Parm Stored	Method	Result (cfu/100 mL)	Analysis Date/Time	Tech Initials
L6735514-7	DR-07-09	03/31/17 11:15pm	E. COLI-MF (1603)	EPA 1603	20 E	04/01/17 06:55AM	ARD
L6735514-7	DR-07-09	03/31/17 11:15pm	FECAL COLIFORM-MF	SM 9222D	18 Q, E	04/01/17 07:23AM	ARD
L6735514-7	DR-07-09	03/31/17 11:15pm	ENTEROCOCCUS-MF 24	EPA 1600	20 E	04/01/17 07:00AM	ARD
L6735514-8	DR-01-09	03/31/17 11:35pm	E. COLI-MF (1603)	EPA 1603	1700 E	04/01/17 06:55AM	ARD
L6735514-8	DR-01-09	03/31/17 11:35pm	FECAL COLIFORM-MF	SM 9222D	700 E	04/01/17 07:23AM	ARD
L6735514-8	DR-01-09	03/31/17 11:35pm	ENTEROCOCCUS-MF 24	EPA 1600	3300	04/01/17 07:00AM	ARD
L6735514-9	DR-02-09	03/31/17 11:45pm	E. COLI-MF (1603)	EPA 1603	80 E	04/01/17 06:55AM	ARD
L6735514-9	DR-02-09	03/31/17 11:45pm	FECAL COLIFORM-MF	SM 9222D	60 E	04/01/17 07:23AM	ARD
L6735514-9	DR-02-09	03/31/17 11:45pm	ENTEROCOCCUS-MF 24	EPA 1600	90 E	04/01/17 07:00AM	ARD
L6732900-10	CS0-02-1	03/30/17 11:54pm	ENTEROCOCCUS-MF 24	EPA 1600	100000 E	03/31/17 07:36AM	ARD
L6732900-10	CS0-02-1	03/30/17 11:54pm	FECAL COLIFORM-MF	SM 9222D	234000 E	03/31/17 07:43AM	ARD
L6732900-10	CS0-02-1	03/30/17 11:54pm	E. COLI-MF (1603)	EPA 1603	35000 Q	03/31/17 10:34AM	ARD
L6732900-11	CS0-05-1	03/31/17 12:17am	E. COLI-MF (1603)	EPA 1603	115000 E	03/31/17 08:04AM	BHS
L6732900-11	CS0-05-1	03/31/17 12:17am	ENTEROCOCCUS-MF 24	EPA 1600	57000 Q	03/31/17 09:25AM	ARD
L6732900-11	CS0-05-1	03/31/17 12:17am	FECAL COLIFORM-MF	SM 9222D	128000 E, Q	03/31/17 09:09AM	ARD
L6732900-12	DR-01-1	03/31/17 01:10am	FECAL COLIFORM-MF	SM 9222D	153 E	03/31/17 08:02AM	ARD
L6732900-12	DR-01-1	03/31/17 01:10am	ENTEROCOCCUS-MF 24	EPA 1600	72 E, Q	03/31/17 09:25AM	ARD
L6732900-12	DR-01-1	03/31/17 01:10am	E. COLI-MF (1603)	EPA 1603	390 Q	03/31/17 10:34AM	ARD
L6732900-13	DR-02-1	03/31/17 01:31am	FECAL COLIFORM-MF	SM 9222D	137 E	03/31/17 08:02AM	ARD
L6732900-13	DR-02-1	03/31/17 01:31am	ENTEROCOCCUS-MF 24	EPA 1600	40 E	03/31/17 09:25AM	ARD
L6732900-13	DR-02-1	03/31/17 01:31am	E. COLI-MF (1603)	EPA 1603	182 E, Q	03/31/17 10:34AM	ARD
L6732900-14	DR-03-1	03/31/17 01:40am	ENTEROCOCCUS-MF 24	EPA 1600	90 E	03/31/17 07:36AM	ARD
L6732900-14	DR-03-1	03/31/17 01:40am	FECAL COLIFORM-MF	SM 9222D	130 E	03/31/17 08:02AM	ARD
L6732900-14	DR-03-1	03/31/17 01:40am	E. COLI-MF (1603)	EPA 1603	153 E, Q	03/31/17 10:34AM	ARD
L6732900-15	DR-04-1	03/31/17 01:35am	ENTEROCOCCUS-MF 24	EPA 1600	170 E	03/31/17 07:36AM	ARD
L6732900-15	DR-04-1	03/31/17 01:35am	FECAL COLIFORM-MF	SM 9222D	1300 E	03/31/17 08:02AM	ARD
L6732900-15	DR-04-1	03/31/17 01:35am	E. COLI-MF (1603)	EPA 1603	91 E, Q	03/31/17 10:34AM	ARD
L6732900-16	DR-05-1	03/31/17 02:10am	ENTEROCOCCUS-MF 24	EPA 1600	30 E	03/31/17 07:36AM	ARD
L6732900-16	DR-05-1	03/31/17 02:10am	E. COLI-MF (1603)	EPA 1603	60 E	03/31/17 08:04AM	BHS
L6732900-16	DR-05-1	03/31/17 02:10am	FECAL COLIFORM-MF	SM 9222D	112 E	03/31/17 08:02AM	ARD
L6732900-17	DUP DR-04-HR15	03/31/17 01:35am	ENTEROCOCCUS-MF 24	EPA 1600	100 E	03/31/17 07:36AM	ARD
L6732900-17	DUP DR-04-HR15	03/31/17 01:35am	E. COLI-MF (1603)	EPA 1603	450	03/31/17 08:04AM	BHS
L6732900-17	DUP DR-04-HR15	03/31/17 01:35am	FECAL COLIFORM-MF	SM 9222D	1300 E	03/31/17 08:02AM	ARD
L6732900-18	CC-03-01	03/31/17 12:00am	ENTEROCOCCUS-MF 24	EPA 1600	230	03/31/17 07:36AM	ARD
L6732900-18	CC-03-01	03/31/17 12:00am	FECAL COLIFORM-MF	SM 9222D	430	03/31/17 07:43AM	ARD
L6732900-18	CC-03-01	03/31/17 12:00am	E. COLI-MF (1603)	EPA 1603	330 Q	03/31/17 08:04AM	BHS
L6732900-19	CC-03-DUP	03/31/17 12:00am	ENTEROCOCCUS-MF 24	EPA 1600	130 E	03/31/17 07:36AM	ARD
L6732900-19	CC-03-DUP	03/31/17 12:00am	FECAL COLIFORM-MF	SM 9222D	300	03/31/17 07:43AM	ARD
L6732900-19	CC-03-DUP	03/31/17 12:00am	E. COLI-MF (1603)	EPA 1603	210 Q	03/31/17 08:04AM	BHS
L6732900-20	CC-02-01	03/31/17 12:40am	ENTEROCOCCUS-MF 24	EPA 1600	1700 E	03/31/17 07:36AM	ARD
L6732900-20	CC-02-01	03/31/17 12:40am	E. COLI-MF (1603)	EPA 1603	5700	03/31/17 08:04AM	BHS
L6732900-20	CC-02-01	03/31/17 12:40am	FECAL COLIFORM-MF	SM 9222D	12500 E	03/31/17 08:02AM	ARD
L6732900-21	BLANK CC	03/31/17 12:05am	ENTEROCOCCUS-MF 24	EPA 1600	<2	03/31/17 07:36AM	ARD
L6732900-21	BLANK CC	03/31/17 12:05am	E. COLI-MF (1603)	EPA 1603	<2	03/31/17 08:04AM	BHS
L6732900-21	BLANK CC	03/31/17 12:05am	FECAL COLIFORM-MF	SM 9222D	<2 Q	03/31/17 09:09AM	ARD
L6732900-22	CC-01-01	03/31/17 01:00am	E. COLI-MF (1603)	EPA 1603	40 E	03/31/17 08:04AM	BHS
L6732900-22	CC-01-01	03/31/17 01:00am	FECAL COLIFORM-MF	SM 9222D	59	03/31/17 08:59AM	ARD
L6732900-22	CC-01-01	03/31/17 01:00am	ENTEROCOCCUS-MF 24	EPA 1600	260 Q	03/31/17 09:25AM	ARD
L6732900-23	RC-01-01	03/31/17 01:35am	E. COLI-MF (1603)	EPA 1603	380	03/31/17 08:04AM	BHS
L6732900-23	RC-01-01	03/31/17 01:35am	FECAL COLIFORM-MF	SM 9222D	2200	03/31/17 08:02AM	ARD
L6732900-23	RC-01-01	03/31/17 01:35am	ENTEROCOCCUS-MF 24	EPA 1600	1700 E	03/31/17 09:25AM	ARD

Login Number	Sample ID	Sample Date/Time	Parm Stored	Method	Result (cfu/100 mL)	Analysis Date/Time	Tech Initials
L6732900-24	RC-02-01	03/31/17 02:06am	FECAL COLIFORM-MF	SM 9222D	15700 E	03/31/17 08:02AM	ARD
L6732900-24	RC-02-01	03/31/17 02:06am	ENTEROCOCCUS-MF 24	EPA 1600	2800	03/31/17 09:25AM	ARD
L6732900-24	RC-02-01	03/31/17 02:06am	E. COLI-MF (1603)	EPA 1603	6000 Q	03/31/17 10:34AM	ARD
L6732900-25	RC-03-01	03/31/17 02:37am	ENTEROCOCCUS-MF 24	EPA 1600	20 E	03/31/17 09:25AM	ARD
L6732900-25	RC-03-01	03/31/17 02:37am	FECAL COLIFORM-MF	SM 9222D	250	03/31/17 09:09AM	ARD
L6732900-25	RC-03-01	03/31/17 02:37am	E. COLI-MF (1603)	EPA 1603	100 E	03/31/17 10:34AM	ARD
L6732900-26	CS0-18-1	03/31/17 12:07am	ENTEROCOCCUS-MF 24	EPA 1600	19000 E	03/31/17 07:36AM	ARD
L6732900-26	CS0-18-1	03/31/17 12:07am	E. COLI-MF (1603)	EPA 1603	63000 E	03/31/17 08:04AM	BHS
L6732900-26	CS0-18-1	03/31/17 12:07am	FECAL COLIFORM-MF	SM 9222D	85000 E, Q	03/31/17 09:34AM	ARD
L6732900-27	CS0-19-1	03/31/17 12:25am	ENTEROCOCCUS-MF 24	EPA 1600	3220000 E	03/31/17 07:36AM	ARD
L6732900-27	CS0-19-1	03/31/17 12:25am	E. COLI-MF (1603)	EPA 1603	160000 E	03/31/17 08:04AM	BHS
L6732900-27	CS0-19-1	03/31/17 12:25am	FECAL COLIFORM-MF	SM 9222D	30100 E, Q	03/31/17 09:09AM	ARD
L6732900-28	CS0-19-2	03/31/17 01:55am	ENTEROCOCCUS-MF 24	EPA 1600	200000	03/31/17 09:25AM	ARD
L6732900-28	CS0-19-2	03/31/17 01:55am	FECAL COLIFORM-MF	SM 9222D	197000 E	03/31/17 09:09AM	ARD
L6732900-28	CS0-19-2	03/31/17 01:55am	E. COLI-MF (1603)	EPA 1603	80000 Q	03/31/17 10:34AM	ARD
L6732900-29	CS0-18-2	03/31/17 01:45am	ENTEROCOCCUS-MF 24	EPA 1600	29000	03/31/17 09:25AM	ARD
L6732900-29	CS0-18-2	03/31/17 01:45am	FECAL COLIFORM-MF	SM 9222D	69000 E	03/31/17 09:34AM	ARD
L6732900-29	CS0-18-2	03/31/17 01:45am	E. COLI-MF (1603)	EPA 1603	51000 Q	03/31/17 10:34AM	ARD
L6732900-30	CS0-19-3	03/31/17 01:58am	ENTEROCOCCUS-MF 24	EPA 1600	53000	03/31/17 09:25AM	ARD
L6732900-30	CS0-19-3	03/31/17 01:58am	FECAL COLIFORM-MF	SM 9222D	215000 E	03/31/17 09:09AM	ARD
L6732900-30	CS0-19-3	03/31/17 01:58am	E. COLI-MF (1603)	EPA 1603	52000 Q	03/31/17 10:34AM	ARD
L6732900-31	CS0-18-3	03/31/17 02:10am	ENTEROCOCCUS-MF 24	EPA 1600	17000 E	03/31/17 09:25AM	ARD
L6732900-31	CS0-18-3	03/31/17 02:10am	FECAL COLIFORM-MF	SM 9222D	78000 E	03/31/17 09:34AM	ARD
L6732900-31	CS0-18-3	03/31/17 02:10am	E. COLI-MF (1603)	EPA 1603	67000 Q	03/31/17 10:34AM	ARD
L6732900-32	CS0-19-4	03/31/17 02:55am	ENTEROCOCCUS-MF 24	EPA 1600	>600000	03/31/17 09:25AM	ARD
L6732900-32	CS0-19-4	03/31/17 02:55am	E. COLI-MF (1603)	EPA 1603	120000 E	03/31/17 10:34AM	ARD
L6732900-32	CS0-19-4	03/31/17 02:55am	FECAL COLIFORM-MF	SM 9222D	330000	03/31/17 09:34AM	ARD
L6732900-33	CS0-18-4	03/31/17 03:10am	ENTEROCOCCUS-MF 24	EPA 1600	20000	03/31/17 09:25AM	ARD
L6732900-33	CS0-18-4	03/31/17 03:10am	E. COLI-MF (1603)	EPA 1603	69000	03/31/17 10:34AM	ARD
L6732900-33	CS0-18-4	03/31/17 03:10am	FECAL COLIFORM-MF	SM 9222D	85000 E	03/31/17 09:34AM	ARD
L6732900-34	BLANK CS0-18	03/31/17 12:03am	ENTEROCOCCUS-MF 24	EPA 1600	<2	03/31/17 07:36AM	ARD
L6732900-34	BLANK CS0-18	03/31/17 12:03am	E. COLI-MF (1603)	EPA 1603	<2 Q	03/31/17 08:04AM	BHS
L6732900-34	BLANK CS0-18	03/31/17 12:03am	FECAL COLIFORM-MF	SM 9222D	<2 Q	03/31/17 09:09AM	ARD
L6732900-35	CS0-02-2	03/31/17 01:35am	ENTEROCOCCUS-MF 24	EPA 1600	43000	03/31/17 09:25AM	ARD
L6732900-35	CS0-02-2	03/31/17 01:35am	FECAL COLIFORM-MF	SM 9222D	140000 E	03/31/17 09:09AM	ARD
L6732900-35	CS0-02-2	03/31/17 01:35am	E. COLI-MF (1603)	EPA 1603	89000 E, Q	03/31/17 10:34AM	ARD
L6732900-36	CS0-05-02	03/31/17 01:45am	ENTEROCOCCUS-MF 24	EPA 1600	135000 E	03/31/17 09:25AM	ARD
L6732900-36	CS0-05-02	03/31/17 01:45am	FECAL COLIFORM-MF	SM 9222D	199000 E	03/31/17 09:09AM	ARD
L6732900-36	CS0-05-02	03/31/17 01:45am	E. COLI-MF (1603)	EPA 1603	240000 Q	03/31/17 10:34AM	ARD
L6732900-37	CS0-02-3	03/31/17 02:08am	ENTEROCOCCUS-MF 24	EPA 1600	37000	03/31/17 09:25AM	ARD
L6732900-37	CS0-02-3	03/31/17 02:08am	FECAL COLIFORM-MF	SM 9222D	123000 E	03/31/17 09:09AM	ARD
L6732900-37	CS0-02-3	03/31/17 02:08am	E. COLI-MF (1603)	EPA 1603	30000 E, Q	03/31/17 10:34AM	ARD
L6732900-38	CS0-05-3	03/31/17 02:20am	ENTEROCOCCUS-MF 24	EPA 1600	19000 E	03/31/17 09:25AM	ARD
L6732900-38	CS0-05-3	03/31/17 02:20am	FECAL COLIFORM-MF	SM 9222D	140000 E	03/31/17 08:59AM	ARD
L6732900-38	CS0-05-3	03/31/17 02:20am	E. COLI-MF (1603)	EPA 1603	90000 E, Q	03/31/17 10:34AM	ARD
L6732900-39	CS0-02-4	03/31/17 03:09am	ENTEROCOCCUS-MF 24	EPA 1600	410000	03/31/17 09:25AM	ARD
L6732900-39	CS0-02-4	03/31/17 03:09am	FECAL COLIFORM-MF	SM 9222D	1630000 E	03/31/17 08:59AM	ARD
L6732900-39	CS0-02-4	03/31/17 03:09am	E. COLI-MF (1603)	EPA 1603	1130000 E	03/31/17 10:34AM	ARD
L6732900-40	CS0-05-4	03/31/17 03:20am	ENTEROCOCCUS-MF 24	EPA 1600	27000	03/31/17 09:25AM	ARD
L6732900-40	CS0-05-4	03/31/17 03:20am	FECAL COLIFORM-MF	SM 9222D	43000	03/31/17 08:59AM	ARD
L6732900-40	CS0-05-4	03/31/17 03:20am	E. COLI-MF (1603)	EPA 1603	29000	03/31/17 10:34AM	ARD

Login Number	Sample ID	Sample Date/Time	Parm Stored	Method	Result (cfu/100 mL)	Analysis Date/Time	Tech Initials
L6732900-41	CS0-05-B	03/31/17 12:08am	ENTEROCOCCUS-MF 24	EPA 1600	<2	03/31/17 07:36AM	ARD
L6732900-41	CS0-05-B	03/31/17 12:08am	E. COLI-MF (1603)	EPA 1603	<2	03/31/17 08:04AM	BHS
L6732900-41	CS0-05-B	03/31/17 12:08am	FECAL COLIFORM-MF	SM 9222D	<2 Q	03/31/17 09:09AM	ARD
L6732904-10	DR-07-2	03/31/17 03:20am	FECAL COLIFORM-MF	SM 9222D	80 E	03/31/17 11:11AM	ARD
L6732904-10	DR-07-2	03/31/17 03:20am	ENTEROCOCCUS-MF 24	EPA 1600	30 E, Q	03/31/17 11:26AM	GNM
L6732904-10	DR-07-2	03/31/17 03:20am	E. COLI-MF (1603)	EPA 1603	60 E, Q	03/31/17 11:46AM	BHS
L6732904-11	CS0-19-5	03/31/17 04:55am	ENTEROCOCCUS-MF 24	EPA 1600	15000 E	03/31/17 11:26AM	GNM
L6732904-11	CS0-19-5	03/31/17 04:55am	E. COLI-MF (1603)	EPA 1603	151000 E	03/31/17 11:46AM	BHS
L6732904-11	CS0-19-5	03/31/17 04:55am	FECAL COLIFORM-MF	SM 9222D	38000	03/31/17 11:36AM	ARD
L6732904-12	CC-03-2	03/31/17 04:00am	ENTEROCOCCUS-MF 24	EPA 1600	40 E	03/31/17 11:26AM	GNM
L6732904-12	CC-03-2	03/31/17 04:00am	E. COLI-MF (1603)	EPA 1603	140 E	03/31/17 11:46AM	BHS
L6732904-12	CC-03-2	03/31/17 04:00am	FECAL COLIFORM-MF	SM 9222D	300 E	03/31/17 11:50AM	GNM
L6732904-13	CC-02-2	03/31/17 04:15am	ENTEROCOCCUS-MF 24	EPA 1600	660 E	03/31/17 11:26AM	GNM
L6732904-13	CC-02-2	03/31/17 04:15am	E. COLI-MF (1603)	EPA 1603	3100	03/31/17 11:46AM	BHS
L6732904-13	CC-02-2	03/31/17 04:15am	FECAL COLIFORM-MF	SM 9222D	3500	03/31/17 11:36AM	ARD
L6732904-14	CC-01-2	03/31/17 04:52am	ENTEROCOCCUS-MF 24	EPA 1600	1500 E	03/31/17 11:26AM	GNM
L6732904-14	CC-01-2	03/31/17 04:52am	E. COLI-MF (1603)	EPA 1603	330	03/31/17 11:46AM	BHS
L6732904-14	CC-01-2	03/31/17 04:52am	FECAL COLIFORM-MF	SM 9222D	270	03/31/17 11:36AM	ARD
L6732904-15	RC-01-2	03/31/17 05:19am	ENTEROCOCCUS-MF 24	EPA 1600	3500	03/31/17 11:26AM	GNM
L6732904-15	RC-01-2	03/31/17 05:19am	E. COLI-MF (1603)	EPA 1603	310	03/31/17 11:46AM	BHS
L6732904-15	RC-01-2	03/31/17 05:19am	FECAL COLIFORM-MF	SM 9222D	310	03/31/17 11:50AM	GNM

APPENDIX E

WET WEATHER EVENT 2 – FIELD LOGS AND LAB RESULTS SUMMARY

(Chain of Custody Forms and Complete Lab Results provided in digital form only on CD attached to this report)

WET WEATHER EVENT: 2
IN-STREAM TRIBUTARY STATION: CC-01

DATE: *5/5/2017* **Note Temperature of Receiving Stream if below 10 °C threshhold**

START OF RAINFALL TIME: *7:30*

Sampling Round	Sample Interval from Start of Rainfall (Hours)	Target Sample Collection Time (hh:mm)	Actual Sample Collection Time (hh:mm)	Duplicate Sample Collected? (Y/N)	Duplicate Collection Time (hh:mm)	Field Blank Sample Collected? (Y/N)	Field Blank Collection Time (hh:mm)	Chain of Custody Provided & Completed (Y/N)	Time Sample Transferred to Lab Courier (hh:mm)	Water Salinity Reading (%)	Water Temperature Reading (^oC)	Conductivity Reading (umhos/cm)	Field Observations (see notes, below)
1	0.5-2.5	8:42	8:45	N	N/A	Y	8:35	Y	9:15	0.30	15.50	512	Raining
2	4.5-6.5	12:49	12:55	N	N/A	N	N/A	Y	13:15	0.10	25.80	222.5	Raining
3	8.5-10.5	16:58	17:05	N	N/A	N	N/A	Y	17:30	0.10	24.90	203.5	Raining
4	14.5-16.5	22:35	22:40	N	N/A	N	N/A	Y	23:15	0.18	12.98	291	Raining
5	22-24	5:30	5:35	N	N/A	N	N/A	Y	5:55	0.24	13.24	377	Raining
IN-STREAM TRIBUTARY STATION: CC-02													
1	0.5-2.5	7:44	7:45	Y	7:45	N	N/A	Y	8:15	0.2	16.60	415.3	Raining
2	4.5-6.5	12:33	12:35	N	N/A	N	N/A	Y	13:15	0.2	23.80	353.7	Raining
3	8.5-10.5	16:43	16:48	N	N/A	N	N/A	Y	17:30	0.1	25.80	228.6	Raining
4	14.5-16.5	22:20	22:25	N	N/A	N	N/A	Y	23:15	0.24	12.66	375	Raining
5	22-24	5:15	5:20	N	N/A	N	N/A	Y	5:55	0.24	13.25	381	Raining
IN-STREAM TRIBUTARY STATION: CC-03													
1	0.5-2.5	7:10	7:20	N	N/A	N	N/A	Y	7:55	0.20	16.70	321.4	Raining
2	4.5-6.5	11:37	11:40	N	N/A	N	N/A	Y	13:15	0.20	20.30	351.5	Raining
3	8.5-10.5	15:40	15:45	N	N/A	N	N/A	Y	17:30	0.10	25.40	255.2	Raining
4	14.5-16.5	21:15	21:20	N	N/A	N	N/A	Y	23:15	0.33	27.10	597.0	Raining
5	22-24	4:20	4:25	N	N/A	N	N/A	Y	5:55	0.20	13.15	316.0	Raining
IN-STREAM TRIBUTARY STATION: RC-01													
1	0.5-2.5	1:30	1:30	N	N/A	N	N/A	Y	3:04	0.20	8.80	419.4	Raining
2	4.5-6.5	6:30	5:22	N	N/A	N	N/A	Y	6:55	0.20	8.40	404.2	Raining
3	8.5-10.5	10:30	9:15	N	N/A	N	N/A	Y	10:15	0.19	7.94	399.0	Raining
4	14.5-16.5	16:30	15:25	Y	15:26	N	N/A	Y	16:40	0.13	8.09	270.0	Raining
5	22-24	23:30	22:55	N	N/A	N	N/A	Y	23:45	0.10	7.65	216.0	Raining
IN-STREAM TRIBUTARY STATION: RC-02													
1	0.5-2.5	8:26	8:30	N	N/A	N	N/A	Y	9:15	0.20	14.70	495.5	Raining
2	4.5-6.5	12:12	12:15	N	N/A	N	N/A	Y	13:15	0.10	23.60	188.8	Raining
3	8.5-10.5	16:25	16:30	N	N/A	N	N/A	Y	17:30	0.10	25.30	185.2	Raining
4	14.5-16.5	22:05	22:10	N	N/A	N	N/A	Y	23:15	0.27	34.90	433.0	Raining
5	22-24	5:05	5:10	N	N/A	N	N/A	Y	5:55	0.19	12.73	308.0	Raining
IN-STREAM TRIBUTARY STATION: RC-03													
1	0.5-2.5	7:30	7:35	N	N/A	N	N/A	Y	7:55	0.10	16.70	308.7	Used Bailer to collect sample
2	4.5-6.5	11:44	11:47	N	N/A	N	N/A	Y	13:15	0.20	20.30	351.5	Used Bailer to collect sample
3	8.5-10.5	15:53	16:00	N	N/A	N	N/A	Y	17:30	0.10	23.50	188.0	Used Bailer to collect sample
4	14.5-16.5	21:35	21:40	N	N/A	N	N/A	Y	23:15	0.48	31.30	846.0	Used Bailer to collect sample
5	22-24	4:30	4:35	N	N/A	N	N/A	Y	5:55	0.21	12.79	327.0	Used Bailer to collect sample

WET WEATHER EVENT: 2

DELAWARE RIVER STATION: DR-01

DATE: *5/5/2017* **Note Temperature of Receiving Stream if below 10 °C threshhold**

START OF RAINFALL TIME: *7:30*

Sampling Round	Sample Interval from Start of Rainfall (Hours)	Target Sample Collection Time (hh:mm)	Actual Sample Collection Time (hh:mm)	Duplicate Sample Collected? (Y/N)	Duplicate Collection Time (hh:mm)	Field Blank Sample Collected? (Y/N)	Field Blank Collection Time (hh:mm)	Chain of Custody Provided & Completed (Y/N)	Time Sample Transferred to Lab Courier (hh:mm)	Surface, Mid-depth & Bottom Water Salinity Reading(s) (%)	Surface, Mid-depth & Bottom Water Temperature Reading(s) (°C)	Surface, Mid-depth & Bottom Water Conductivity Reading(s) (umhos/cm)	Field Observations (see notes, below)
1	0	7:36	7:36	N	N/A	Y	7:34	Y		0.19/ 0.19/ 0.19	14.36/ 14.35/ 14.36	322/ 321/ 320	
2	2	9:36	9:50	N	N/A	N	N/A	Y		0.15/ 0.15/ 0.15	16.89/ 16.81/ 16.80	271/ 271/ 271	Total Depth = 20.1 ft
3	4	11:36	12:00	N	N/A	N	N/A	Y		0.15/ 0.15/ 0.15	16.82/ 16.82/ 16.83	270/ 270/ 271	Total Depth = 20.4 ft
4	6												Round skipped due to boat issues
5	9												Round skipped due to boat issues
6	12												Round skipped due to boat issues
7	15												Round skipped due to boat issues
8	18												Round skipped due to boat issues
9	21												Round skipped due to boat issues
10	24												Round skipped due to boat issues
DELAWARE RIVER STATION: DR-02													
1	0	8:00	8:00	N	N/A	N	N/A	Y		0.20/ 0.20/ 0.20	14.50/ 14.47/ 14.45	328/ 326/ 324	
2	2	10:00	10:00	N	N/A	N	N/A	Y		0.15/ 0.15/ 0.15	16.96/ 16.96/ 16.96	264/ 263/ 262	Total Depth = 28 ft
3	4	12:00	12:10	N	N/A	N	N/A	Y		0.15/0.15/0.15	16.92/16.92/16.89	264/264/265	Total Depth = 28.2 ft
4	6												Round skipped due to boat issues
5	9												Round skipped due to boat issues
6	12												Round skipped due to boat issues
7	15												Round skipped due to boat issues
8	18												Round skipped due to boat issues
9	21												Round skipped due to boat issues
10	24												Round skipped due to boat issues
DELAWARE RIVER STATION: DR-03													
1	0	8:14	8:14	N	N/A	N	N/A	Y		0.20/ 0.20/ 0.20	14.51/ 14.51/ 14.52	334/ 333/333	
2	2	10:05	10:05	N	N/A	N	N/A	Y		0.16/ 0.16/ 0.16	17.00/ 17.00/ 16.49	276/ 276/ 275	Total Depth = 30.1
3	4	12:15	12:15	N	N/A	N	N/A	Y		0.15/0.15/0.15	16.95/16.95/16.94	265/264/264	Total Depth = 30.0
4	6	-											Round skipped due to boat issues
5	9	-											Round skipped due to boat issues
6	12	20:30	20:35	N	N/A	N	N/A	Y	23:30	0.1	23.9	246.2	Sample collected from shore near Norris Street due to boat issues
7	15	23:00	23:05	N	N/A	N	N/A	Y	23:30	0.22	14.88	363	Sample collected from shore near Norris Street due to boat issues
8	18	2:00	2:05	N	N/A	N	N/A	Y	5:55	0.2	14.4	339	Sample collected from shore near Norris Street due to boat issues
9	21	4:00	4:05	Y	4:05	N	N/A	Y	5:55	0.19	14.34	321	Sample collected from shore near Norris Street due to boat issues
10	24	6:00	6:05	N	N/A	N	N/A	Y	5:55	0.2	14.29	323	Sample collected from shore near Norris Street due to boat issues
DELAWARE RIVER STATION: DR-04													
1	0	8:05	8:05	N	N/A	N	N/A	Y		0.16/ 0.16/ 0.16	16.98/ 17.00/ 17.00	278/ 280/ 284	Total Depth = 22.5 ft
2	2	9:50	9:50	N	N/A	N	N/A	Y		0.20/ 0.20/ 0.20	14.69/ 14.67/ 14.69	327/ 332/ 335	Total Depth = 15 ft
3	4	12:10	12:10	N	N/A	N	N/A	Y		0.19/ 0.19/ 0.19	14.60/ 14.61/ 14.60	323/ 321/ 322	Total Depth = 14 ft
4	6	-											Round skipped due to boat issues
5	9	-											Round skipped due to boat issues
6	12	20:50	20:50	N	N/A	N	N/A	Y	23:30	0.1	23.6	256.1	Sample collected from shore near boat launch ramp due to boat issues
7	15	23:10	23:15	N	N/A	N	N/A	Y	23:30	0.22	14.92	371	Sample collected from shore near boat launch ramp due to boat issues
8	18	2:15	2:20	N	N/A	N	N/A	Y	5:55	0.21	14.51	340	Sample collected from shore near boat launch ramp due to boat issues
9	21	4:10	4:15	N	N/A	N	N/A	Y	5:55	0.2	14.37	331	Sample collected from shore near boat launch ramp due to boat issues
10	24	6:10	6:15	N	N/A	N	N/A	Y	5:55	0.2	14.27	324	Sample collected from shore near boat launch ramp due to boat issues

WET WEATHER EVENT: 2
DELAWARE RIVER STATION: DR-05

DATE: *5/5/2017* **Note Temperature of Receiving Stream if below 10 °C threshhold**

START OF RAINFALL TIME: *7:30*

Sampling Round	Sample Interval from Start of Rainfall (Hours)	Target Sample Collection Time (hh:mm)	Actual Sample Collection Time (hh:mm)	Duplicate Sample Collected? (Y/N)	Duplicate Collection Time (hh:mm)	Field Blank Sample Collected? (Y/N)	Field Blank Collection Time (hh:mm)	Chain of Custody Provided & Completed (Y/N)	Time Sample Transferred to Lab Courier (hh:mm)	Surface, Mid-depth & Bottom Water Salinity Reading(s) (%)	Surface, Mid-depth & Bottom Water Temperature Reading(s) (°C)	Surface, Mid-depth & Bottom Water Conductivity Reading(s) (umhos/cm)	Field Observations (see notes, below)
1	0	7:55	7:55	N	N/A	N	N/A	Y		0.17/ 0.17/ 0.17	17.02/ 17.02/ 17.02	293/ 295/ 295	
2	2	10:05	10:05	N	N/A	N	N/A	Y		0.19/ 0.19/ 0.19	14.65/ 14.65/ 14.65	320/ 320/ 320	
3	4	12:17	12:17	N	N/A	N	N/A	Y		0.24/ 0.21/ 0.20	15.37/ 14.82/ 14.69	415/ 350/ 331	Total Depth = 10 ft
4	6												Round skipped due to boat issues
5	9												Round skipped due to boat issues
6	12												Round skipped due to boat issues
7	15												Round skipped due to boat issues
8	18												Round skipped due to boat issues
9	21												Round skipped due to boat issues
10	24												Round skipped due to boat issues
DELAWARE RIVER STATION: DR-06													
1	0	7:45	7:45	N	N/A	N	N/A	Y		0.14/ 0.14/ 0.14	16.88/ 16.89/ 16.89	255/ 255/ 255	Total Depth = 16 ft
2	2	9:40	9:40	N	N/A	N	N/A	Y		0.19/ 0.19/ 0.19	14.62/ 14.61/ 14.60	309/ 309/ 310	Total Depth = 27 ft
3	4	12:00	12:00	N	N/A	N	N/A	Y		0.18/ 0.18/ 0.18	14.48/ 14.48/ 14.47	306/ 306/ 307	Total Depth = 27 ft
4	6												Round skipped due to boat issues
5	9												Round skipped due to boat issues
6	12												Round skipped due to boat issues
7	15												Round skipped due to boat issues
8	18												Round skipped due to boat issues
9	21												Round skipped due to boat issues
10	24												Round skipped due to boat issues
DELAWARE RIVER STATION: DR-07													
1	0	7:30	7:30	N	N/A	N	N/A	Y		0.14/ 0.14/ 0.14	16.58/ 16.59/ 16.59	253/ 253/ 253	Total Depth = 15 ft
2	2	9:30	9:30	N	N/A	N	N/A	Y		0.19/ 0.19/ 0.18	14.33/ 14.33/ 14.33	306/ 306/ 305	Total Depth = 9.5 ft
3	4	11:50	11:50	N	N/A	N	N/A	Y		0.18/ 0.18/ 0.18	14.15/ 14.14/ 14.15	301/ 301/ 301	Total Depth = 4 ft
4	6												Round skipped due to boat issues
5	9												Round skipped due to boat issues
6	12												Round skipped due to boat issues
7	15												Round skipped due to boat issues
8	18												Round skipped due to boat issues
9	21												Round skipped due to boat issues
10	24												Round skipped due to boat issues

WET WEATHER EVENT: 2

CSO STATION: CSO-02

DATE: *5/5/2017* Note Temperature of Receiving Stream if below 10 °C threshhold

START OF RAINFALL TIME: *7:30*

Sampling Round	Sample Interval from Start of Rainfall (Hours)	Target Sample Collection Time (hh:mm)	Actual Sample Collection Time (hh:mm)	Duplicate Sample Collected? (Y/N)	Duplicate Collection Time (hh:mm)	Field Blank Sample Collected? (Y/N)	Field Blank Collection Time (hh:mm)	Chain of Custody Provided & Completed (Y/N)	Time Sample Transferred to Lab Courier (hh:mm)	Filed Observations (see notes, below)
1	T=0 (First Flush)	8:20	8:20	N	N/A	N	N/A	Y	9:20	
2	30 Min	8:50	8:50	N	N/A	N	N/A	Y	9:20	
3	60 Min	9:30	9:30	N	N/A	N	N/A	Y	9:50	
4	2 Hours	10:30	10:30	N	N/A	N	N/A	Y	10:55	
5	4 Hours	12:30	12:30	N	N/A	N	N/A	Y	12:55	
6	8 Hours	16:20	-	-	-	-	-	-	-	No overflow over weir
7	12 Hours	20:20	-	-	-	-	-	-	-	No overflow over weir
8	24 Hours	8:20	-	-	-	-	-	-	-	No overflow over weir
CSO STATION: CSO-05										
1	T=0 (First Flush)	8:40	8:40	N	N/A	N	N/A	Y	9:20	
2	30 Min	9:05	9:05	N	N/A	N	N/A	Y	9:20	
3	60 Min	9:40	9:40	N	N/A	N	N/A	Y	9:50	
4	2 Hours	10:40	10:40	N	N/A	N	N/A	Y	10:55	
5	4 Hours	12:40	12:40	N	N/A	N	N/A	Y	12:55	
6	8 Hours	16:40	-	-	-	-	-	-	-	No overflow over weir
7	12 Hours	20:40	-	-	-	-	-	-	-	No overflow over weir
8	24 Hours	8:40	-	-	-	-	-	-	-	No overflow over weir
CSO STATION: CSO-18										
1	T=0 (First Flush)	8:40	8:42	N	N/A	N	N/A	Y	8:54	Overflowing to Creek
2	30 Min	9:17	9:19	N	N/A	N	N/A	Y	9:35	
3	60 Min	9:42	9:47	Y	9:47	Y	9:45	Y	9:55	
4	2 Hours	10:40	10:45	N	N/A	N	N/A	Y	10:55	
5	4 Hours	12:40	12:47	N	N/A	N	N/A	Y	12:57	
6	8 Hours	16:40	-	-	-	-	-	-	-	No overflow over weir
7	12 Hours	20:40	-	-	-	-	-	-	-	No overflow over weir
8	24 Hours	8:40	-	-	-	-	-	-	-	No overflow over weir
CSO STATION: CSO-19										
1	T=0 (First Flush)	8:35	8:27	N	N/A	N	N/A	Y	8:54	Weir not overflowing until 8:27; Water level just at top of weir wall
2	30 Min	9:05	9:07	N	N/A	N	N/A	Y	9:35	
3	60 Min	9:35	9:37	N	N/A	N	N/A	Y	9:35	
4	2 Hours	10:35	10:34	N	N/A	N	N/A	Y	10:55	
5	4 Hours	12:35	12:35	N	N/A	N	N/A	Y	12:57	
6	8 Hours	16:35	-	-	-	-	-	-	-	No overflow over weir.
7	12 Hours	20:35	-	-	-	-	-	-	-	No overflow over weir
8	24 Hours	8:35	-	-	-	-	-	-	-	No overflow over weir

WET WEATHER EVENT: 2
STORM WATER STATION: SW-05A

DATE: *5/5/2017* **Note Temperature of Receiving Stream if below 10 °C threshhold**

START OF RAINFALL TIME: *7:30*

Sampling Round	Sample Interval from Start of Rainfall (Hours)	Target Sample Collection Time (hh:mm)	Actual Sample Collection Time (hh:mm)	Duplicate Sample Collected? (Y/N)	Duplicate Collection Time (hh:mm)	Field Blank Sample Collected? (Y/N)	Field Blank Collection Time (hh:mm)	Chain of Custody Provided & Completed (Y/N)	Time Sample Transferred to Lab Courier (hh:mm)	Filed Observations (see notes, below)
1	T=0 (First Flush)	6:45	6:45					Y	7:00	
2	30 Min	7:20	7:20					Y	8:00	
3	60 Min	7:45	7:50					Y	8:00	
4	2 Hours	8:45	8:50					Y	9:00	
5	4 Hours	10:45	10:50					Y	11:00	
6	8 Hours	14:45	14:45					Y	15:00	
7	12 Hours	18:45	-					-	-	No flow to collect sample
8	24 Hours	6:45	-					-	-	No flow to collect sample
STORM WATER STATION: SW-SS2										
1	T=0 (First Flush)	6:40	6:40					Y	7:00	
2	30 Min	7:10	7:10					Y	8:00	
3	60 Min	7:40	7:40					Y	8:00	
4	2 Hours	8:40	8:40					Y	9:00	
5	4 Hours	10:40	10:40					Y	11:00	
6	8 Hours	14:40	14:35					Y	15:00	
7	12 Hours	18:40	-					-	-	No flow to collect sample
8	24 Hours	6:40	-					-	-	No flow to collect sample

Login Number	Sample ID	Sample Date/Time	Parameter Stored	Method	Result (cfu/100 mL)	Analysis Date/Time	Tech Initials
L6794156-1	SW-SS2-1	05/05/17 06:40am	ENTEROCOCCUS-MF 24	EPA 1600	10000 E	05/05/17 12:31PM	
L6794156-1	SW-SS2-1	05/05/17 06:40am	E. COLI-MF (1603)	EPA 1603	690	05/05/17 12:26PM	
L6794156-1	SW-SS2-1	05/05/17 06:40am	FECAL COLIFORM-MF	SM 9222D	1300 E	05/05/17 12:44PM	
L6794156-2	SW-05A-1	05/05/17 06:45am	ENTEROCOCCUS-MF 24	EPA 1600	12000 E	05/05/17 12:31PM	
L6794156-2	SW-05A-1	05/05/17 06:45am	E. COLI-MF (1603)	EPA 1603	6600	05/05/17 12:26PM	
L6794156-2	SW-05A-1	05/05/17 06:45am	FECAL COLIFORM-MF	SM 9222D	27000	05/05/17 12:44PM	
L6794156-3	SW-SS2-2	05/05/17 07:10am	ENTEROCOCCUS-MF 24	EPA 1600	8000 E	05/05/17 12:31PM	
L6794156-3	SW-SS2-2	05/05/17 07:10am	E. COLI-MF (1603)	EPA 1603	580	05/05/17 12:26PM	
L6794156-3	SW-SS2-2	05/05/17 07:10am	FECAL COLIFORM-MF	SM 9222D	3300	05/05/17 12:44PM	
L6794156-4	SW-05A-2	05/05/17 07:20am	ENTEROCOCCUS-MF 24	EPA 1600	5000 E	05/05/17 12:31PM	
L6794156-4	SW-05A-2	05/05/17 07:20am	E. COLI-MF (1603)	EPA 1603	96000 E	05/05/17 12:26PM	
L6794156-4	SW-05A-2	05/05/17 07:20am	FECAL COLIFORM-MF	SM 9222D	1480000 E	05/05/17 12:44PM	
L6794156-5	SW-SS2-3	05/05/17 07:40am	ENTEROCOCCUS-MF 24	EPA 1600	6900 E	05/05/17 12:31PM	
L6794156-5	SW-SS2-3	05/05/17 07:40am	E. COLI-MF (1603)	EPA 1603	590	05/05/17 12:26PM	
L6794156-5	SW-SS2-3	05/05/17 07:40am	FECAL COLIFORM-MF	SM 9222D	650 E	05/05/17 12:44PM	
L6794156-6	SW-05A-3	05/05/17 07:50am	ENTEROCOCCUS-MF 24	EPA 1600	38000	05/05/17 12:31PM	
L6794156-6	SW-05A-3	05/05/17 07:50am	E. COLI-MF (1603)	EPA 1603	9600 E	05/05/17 12:26PM	
L6794156-6	SW-05A-3	05/05/17 07:50am	FECAL COLIFORM-MF	SM 9222D	55000	05/05/17 12:44PM	
L6794156-7	CC-02-1	05/05/17 07:45am	ENTEROCOCCUS-MF 24	EPA 1600	132 E	05/05/17 12:31PM	
L6794156-7	CC-02-1	05/05/17 07:45am	E. COLI-MF (1603)	EPA 1603	210	05/05/17 12:26PM	
L6794156-7	CC-02-1	05/05/17 07:45am	FECAL COLIFORM-MF	SM 9222D	54	05/05/17 12:44PM	
L6794156-8	CC-03-1	05/05/17 07:20am	ENTEROCOCCUS-MF 24	EPA 1600	84	05/05/17 12:31PM	
L6794156-8	CC-03-1	05/05/17 07:20am	E. COLI-MF (1603)	EPA 1603	54	05/05/17 12:26PM	
L6794156-8	CC-03-1	05/05/17 07:20am	FECAL COLIFORM-MF	SM 9222D	52	05/05/17 12:44PM	
L6794156-9	RC-03-1	05/05/17 07:35am	ENTEROCOCCUS-MF 24	EPA 1600	72	05/05/17 12:31PM	
L6794156-9	RC-03-1	05/05/17 07:35am	E. COLI-MF (1603)	EPA 1603	250	05/05/17 01:06PM	
L6794156-9	RC-03-1	05/05/17 07:35am	FECAL COLIFORM-MF	SM 9222D	126 E	05/05/17 12:44PM	
L6794156-10	DR-01-1	05/05/17 07:36am	ENTEROCOCCUS-MF 24	EPA 1600	25 E	05/05/17 12:31PM	
L6794156-10	DR-01-1	05/05/17 07:36am	E. COLI-MF (1603)	EPA 1603	26 E	05/05/17 01:06PM	
L6794156-10	DR-01-1	05/05/17 07:36am	FECAL COLIFORM-MF	SM 9222D	20 E	05/05/17 12:44PM	
L6794156-11	DR-02-1	05/05/17 08:00am	ENTEROCOCCUS-MF 24	EPA 1600	18 E	05/05/17 12:31PM	
L6794156-11	DR-02-1	05/05/17 08:00am	E. COLI-MF (1603)	EPA 1603	20 E	05/05/17 01:06PM	
L6794156-11	DR-02-1	05/05/17 08:00am	FECAL COLIFORM-MF	SM 9222D	22 E	05/05/17 12:44PM	
L6794156-12	DR-03-1	05/05/17 08:14am	ENTEROCOCCUS-MF 24	EPA 1600	8 E	05/05/17 12:31PM	
L6794156-12	DR-03-1	05/05/17 08:14am	E. COLI-MF (1603)	EPA 1603	100	05/05/17 01:06PM	
L6794156-12	DR-03-1	05/05/17 08:14am	FECAL COLIFORM-MF	SM 9222D	22 E	05/05/17 12:44PM	
L6794156-13	BLANK-DR-2	05/05/17 07:24am	ENTEROCOCCUS-MF 24	EPA 1600	<2	05/05/17 12:31PM	
L6794156-13	BLANK-DR-2	05/05/17 07:24am	E. COLI-MF (1603)	EPA 1603	<2	05/05/17 01:06PM	
L6794156-13	BLANK-DR-2	05/05/17 07:24am	FECAL COLIFORM-MF	SM 9222D	2 E	05/05/17 12:44PM	
L6794156-14	DR-04-1	05/05/17 08:05am	ENTEROCOCCUS-MF 24	EPA 1600	12 E	05/05/17 12:31PM	
L6794156-14	DR-04-1	05/05/17 08:05am	E. COLI-MF (1603)	EPA 1603	12 E	05/05/17 01:06PM	
L6794156-14	DR-04-1	05/05/17 08:05am	FECAL COLIFORM-MF	SM 9222D	20 E	05/05/17 12:44PM	
L6794156-15	DR-05-1	05/05/17 07:55am	ENTEROCOCCUS-MF 24	EPA 1600	6 E	05/05/17 12:31PM	
L6794156-15	DR-05-1	05/05/17 07:55am	E. COLI-MF (1603)	EPA 1603	13 E	05/05/17 01:06PM	
L6794156-15	DR-05-1	05/05/17 07:55am	FECAL COLIFORM-MF	SM 9222D	42	05/05/17 12:44PM	
L6794156-16	DR-06-1	05/05/17 07:45am	ENTEROCOCCUS-MF 24	EPA 1600	4 E	05/05/17 12:31PM	
L6794156-16	DR-06-1	05/05/17 07:45am	E. COLI-MF (1603)	EPA 1603	6	05/05/17 12:26PM	
L6794156-16	DR-06-1	05/05/17 07:45am	FECAL COLIFORM-MF	SM 9222D	4 E	05/05/17 12:44PM	

Login Number	Sample ID	Sample Date/Time	Parm Stored	Method	Result (cfu/100 mL)	Analysis Date/Time	
L6794156-17	DR-07-1	05/05/17 07:30am	ENTEROCOCCUS-MF 24	EPA 1600	12 E	05/05/17 12:31PM	
L6794156-17	DR-07-1	05/05/17 07:30am	E. COLI-MF (1603)	EPA 1603	5 E	05/05/17 01:06PM	
L6794156-17	DR-07-1	05/05/17 07:30am	FECAL COLIFORM-MF	SM 9222D	6 E	05/05/17 12:44PM	
L6794156-18	RC-02-01	05/05/17 08:15am	ENTEROCOCCUS-MF 24	EPA 1600	1500 E	05/05/17 12:31PM	
L6794156-18	RC-02-01	05/05/17 08:15am	E. COLI-MF (1603)	EPA 1603	730	05/05/17 12:26PM	
L6794156-18	RC-02-01	05/05/17 08:15am	FECAL COLIFORM-MF	SM 9222D	1600 E	05/05/17 12:44PM	
L6794156-19	RC-01-01	05/05/17 08:30am	ENTEROCOCCUS-MF 24	EPA 1600	380	05/05/17 12:31PM	
L6794156-19	RC-01-01	05/05/17 08:30am	E. COLI-MF (1603)	EPA 1603	440	05/05/17 01:06PM	
L6794156-19	RC-01-01	05/05/17 08:30am	FECAL COLIFORM-MF	SM 9222D	330	05/05/17 12:44PM	
L6794156-20	CC-01-01	05/05/17 08:45am	ENTEROCOCCUS-MF 24	EPA 1600	580	05/05/17 12:31PM	
L6794156-20	CC-01-01	05/05/17 08:45am	E. COLI-MF (1603)	EPA 1603	230	05/05/17 01:06PM	
L6794156-20	CC-01-01	05/05/17 08:45am	FECAL COLIFORM-MF	SM 9222D	230	05/05/17 12:44PM	
L6794156-21	BLANK-CREEK-1	05/05/17 08:35am	ENTEROCOCCUS-MF 24	EPA 1600	<2	05/05/17 12:31PM	
L6794156-21	BLANK-CREEK-1	05/05/17 08:35am	E. COLI-MF (1603)	EPA 1603	<1	05/05/17 01:06PM	
L6794156-21	BLANK-CREEK-1	05/05/17 08:35am	FECAL COLIFORM-MF	SM 9222D	<2	05/05/17 12:44PM	
L6794156-22	DUP-RC1	05/05/17 08:15am	ENTEROCOCCUS-MF 24	EPA 1600	1800 E	05/05/17 12:31PM	
L6794156-22	DUP-RC1	05/05/17 08:15am	E. COLI-MF (1603)	EPA 1603	520	05/05/17 01:06PM	
L6794156-22	DUP-RC1	05/05/17 08:15am	FECAL COLIFORM-MF	SM 9222D	1500 E	05/05/17 12:44PM	
L6794156-23	CSO-19-1	05/05/17 08:27am	ENTEROCOCCUS-MF 24	EPA 1600	>60000	05/05/17 12:31PM	
L6794156-23	CSO-19-1	05/05/17 08:27am	E. COLI-MF (1603)	EPA 1603	229000 E	05/05/17 01:06PM	
L6794156-23	CSO-19-1	05/05/17 08:27am	FECAL COLIFORM-MF	SM 9222D	230000 E	05/05/17 12:44PM	
L6794156-24	CSO-18-1	05/05/17 08:42am	ENTEROCOCCUS-MF 24	EPA 1600	127000 E	05/05/17 12:31PM	
L6794156-24	CSO-18-1	05/05/17 08:42am	E. COLI-MF (1603)	EPA 1603	>80000	05/05/17 12:26PM	
L6794156-24	CSO-18-1	05/05/17 08:42am	FECAL COLIFORM-MF	SM 9222D	196000 E	05/05/17 12:44PM	
L6794156-25	SW-SS2-4	05/05/17 08:40am	ENTEROCOCCUS-MF 24	EPA 1600	>60000	05/05/17 12:31PM	
L6794156-25	SW-SS2-4	05/05/17 08:40am	E. COLI-MF (1603)	EPA 1603	49000	05/05/17 01:06PM	
L6794156-25	SW-SS2-4	05/05/17 08:40am	FECAL COLIFORM-MF	SM 9222D	63000 E	05/05/17 12:44PM	
L6794156-26	SW-05A-4	05/05/17 08:50am	ENTEROCOCCUS-MF 24	EPA 1600	59000	05/05/17 12:31PM	
L6794156-26	SW-05A-4	05/05/17 08:50am	E. COLI-MF (1603)	EPA 1603	8000	05/05/17 01:06PM	
L6794156-26	SW-05A-4	05/05/17 08:50am	FECAL COLIFORM-MF	SM 9222D	22000	05/05/17 12:44PM	
L6794156-27	CSO-19-2	05/05/17 09:07am	ENTEROCOCCUS-MF 24	EPA 1600	152000 E	05/05/17 02:21PM	
L6794156-27	CSO-19-2	05/05/17 09:07am	E. COLI-MF (1603)	EPA 1603	504000 E	05/05/17 02:51PM	
L6794156-27	CSO-19-2	05/05/17 09:07am	FECAL COLIFORM-MF	SM 9222D	160000 E	05/05/17 01:05PM	
L6794156-28	CSO-18-2	05/05/17 09:19am	ENTEROCOCCUS-MF 24	EPA 1600	90000 E	05/05/17 02:21PM	
L6794156-28	CSO-18-2	05/05/17 09:19am	E. COLI-MF (1603)	EPA 1603	150000 E	05/05/17 02:51PM	
L6794156-28	CSO-18-2	05/05/17 09:19am	FECAL COLIFORM-MF	SM 9222D	15300 E	05/05/17 02:50PM	
L6794156-29	CSO-19-3	05/05/17 09:34am	ENTEROCOCCUS-MF 24	EPA 1600	189000 E	05/05/17 02:21PM	
L6794156-29	CSO-19-3	05/05/17 09:34am	E. COLI-MF (1603)	EPA 1603	272000 E	05/05/17 02:51PM	
L6794156-29	CSO-19-3	05/05/17 09:34am	FECAL COLIFORM-MF	SM 9222D	18800 E	05/05/17 02:50PM	
L6794156-30	CSO-18-3	05/05/17 09:47am	ENTEROCOCCUS-MF 24	EPA 1600	54000	05/05/17 02:21PM	
L6794156-30	CSO-18-3	05/05/17 09:47am	E. COLI-MF (1603)	EPA 1603	53000	05/05/17 02:51PM	
L6794156-30	CSO-18-3	05/05/17 09:47am	FECAL COLIFORM-MF	SM 9222D	53000	05/05/17 01:05PM	
L6794156-31	DUP-CSO	05/05/17 09:47am	ENTEROCOCCUS-MF 24	EPA 1600	45000	05/05/17 02:21PM	
L6794156-31	DUP-CSO	05/05/17 09:47am	E. COLI-MF (1603)	EPA 1603	52000	05/05/17 02:51PM	
L6794156-31	DUP-CSO	05/05/17 09:47am	FECAL COLIFORM-MF	SM 9222D	44000	05/05/17 01:05PM	
L6794156-32	BLANK-04	05/05/17 09:45am	ENTEROCOCCUS-MF 24	EPA 1600	<2	05/05/17 02:21PM	
L6794156-32	BLANK-04	05/05/17 09:45am	E. COLI-MF (1603)	EPA 1603	2	05/05/17 02:51PM	
L6794156-32	BLANK-04	05/05/17 09:45am	FECAL COLIFORM-MF	SM 9222D	<2	05/05/17 01:05PM	
L6794156-33	CSO-02-03	05/05/17 09:30am	ENTEROCOCCUS-MF 24	EPA 1600	211000 E	05/05/17 02:21PM	
L6794156-33	CSO-02-03	05/05/17 09:30am	E. COLI-MF (1603)	EPA 1603	468000 E	05/05/17 02:51PM	
L6794156-33	CSO-02-03	05/05/17 09:30am	FECAL COLIFORM-MF	SM 9222D	24300 E	05/05/17 02:50PM	

Login Number	Sample ID	Sample Date/Time	Parm Stored	Method	Result (cfu/100 mL)	Analysis Date/Time	
L6794156-34	CSO-05-03	05/05/17 09:40am	ENTEROCOCCUS-MF 24	EPA 1600	306000 E	05/05/17 02:21PM	
L6794156-34	CSO-05-03	05/05/17 09:40am	E. COLI-MF (1603)	EPA 1603	177000 E	05/05/17 02:51PM	
L6794156-34	CSO-05-03	05/05/17 09:40am	FECAL COLIFORM-MF	SM 9222D	123000 E	05/05/17 01:05PM	
L6794156-35	CSO-02-01	05/05/17 08:20am	ENTEROCOCCUS-MF 24	EPA 1600	187000 E	05/05/17 02:21PM	
L6794156-35	CSO-02-01	05/05/17 08:20am	E. COLI-MF (1603)	EPA 1603	364000 E	05/05/17 02:51PM	
L6794156-35	CSO-02-01	05/05/17 08:20am	FECAL COLIFORM-MF	SM 9222D	217000 E	05/05/17 01:05PM	
L6794156-36	CSO-05-01	05/05/17 08:40am	ENTEROCOCCUS-MF 24	EPA 1600	213000 E	05/05/17 02:21PM	
L6794156-36	CSO-05-01	05/05/17 08:40am	E. COLI-MF (1603)	EPA 1603	568000 E	05/05/17 02:51PM	
L6794156-36	CSO-05-01	05/05/17 08:40am	FECAL COLIFORM-MF	SM 9222D	23500 E	05/05/17 02:50PM	
L6794156-37	BLANK-S	05/05/17 08:20am	ENTEROCOCCUS-MF 24	EPA 1600	<2	05/05/17 02:21PM	
L6794156-37	BLANK-S	05/05/17 08:20am	E. COLI-MF (1603)	EPA 1603	7 E	05/05/17 02:51PM	
L6794156-37	BLANK-S	05/05/17 08:20am	FECAL COLIFORM-MF	SM 9222D	2 E	05/05/17 01:05PM	
L6794156-38	CSO-02-02	05/05/17 08:50am	ENTEROCOCCUS-MF 24	EPA 1600	243000 E	05/05/17 02:21PM	
L6794156-38	CSO-02-02	05/05/17 08:50am	E. COLI-MF (1603)	EPA 1603	253000 E	05/05/17 02:51PM	
L6794156-38	CSO-02-02	05/05/17 08:50am	FECAL COLIFORM-MF	SM 9222D	219000 E	05/05/17 01:05PM	
L6794156-39	CSO-05-02	05/05/17 09:05am	ENTEROCOCCUS-MF 24	EPA 1600	195000 E	05/05/17 02:21PM	
L6794156-39	CSO-05-02	05/05/17 09:05am	E. COLI-MF (1603)	EPA 1603	141000 E	05/05/17 02:51PM	
L6794156-39	CSO-05-02	05/05/17 09:05am	FECAL COLIFORM-MF	SM 9222D	120000 E	05/05/17 01:05PM	
L6794156-40	DR-01-2	05/05/17 09:50am	ENTEROCOCCUS-MF 24	EPA 1600	6 E	05/05/17 05:20PM	
L6794156-40	DR-01-2	05/05/17 09:50am	E. COLI-MF (1603)	EPA 1603	10 E	05/05/17 05:45PM	
L6794156-40	DR-01-2	05/05/17 09:50am	FECAL COLIFORM-MF	SM 9222D	18 E	05/05/17 05:30PM	
L6794156-41	DR-02-2	05/05/17 10:00am	ENTEROCOCCUS-MF 24	EPA 1600	3 E	05/05/17 05:20PM	
L6794156-41	DR-02-2	05/05/17 10:00am	E. COLI-MF (1603)	EPA 1603	8 E	05/05/17 05:20PM	
L6794156-41	DR-02-2	05/05/17 10:00am	FECAL COLIFORM-MF	SM 9222D	12 E	05/05/17 05:30PM	
L6794156-42	DR-03-2	05/05/17 10:05am	ENTEROCOCCUS-MF 24	EPA 1600	8 E	05/05/17 05:20PM	
L6794156-42	DR-03-2	05/05/17 10:05am	E. COLI-MF (1603)	EPA 1603	12 E	05/05/17 05:20PM	
L6794156-42	DR-03-2	05/05/17 10:05am	FECAL COLIFORM-MF	SM 9222D	6 E	05/05/17 05:30PM	
L6794156-43	DR-04-2	05/05/17 09:50am	ENTEROCOCCUS-MF 24	EPA 1600	4 E	05/05/17 05:20PM	
L6794156-43	DR-04-2	05/05/17 09:50am	E. COLI-MF (1603)	EPA 1603	12 E	05/05/17 05:45PM	
L6794156-43	DR-04-2	05/05/17 09:50am	FECAL COLIFORM-MF	SM 9222D	18 E	05/05/17 05:30PM	
L6794156-44	DR-05-2	05/05/17 10:05am	ENTEROCOCCUS-MF 24	EPA 1600	4 E	05/05/17 05:20PM	
L6794156-44	DR-05-2	05/05/17 10:05am	E. COLI-MF (1603)	EPA 1603	18 E	05/05/17 05:45PM	
L6794156-44	DR-05-2	05/05/17 10:05am	FECAL COLIFORM-MF	SM 9222D	2 E	05/05/17 05:30PM	
L6794156-45	DR-06-2	05/05/17 09:40am	ENTEROCOCCUS-MF 24	EPA 1600	2 E	05/05/17 05:20PM	
L6794156-45	DR-06-2	05/05/17 09:40am	E. COLI-MF (1603)	EPA 1603	4 E	05/05/17 05:20PM	
L6794156-45	DR-06-2	05/05/17 09:40am	FECAL COLIFORM-MF	SM 9222D	9 E	05/05/17 05:30PM	
L6794156-46	DR-07-2	05/05/17 09:30am	ENTEROCOCCUS-MF 24	EPA 1600	6 E	05/05/17 05:20PM	
L6794156-46	DR-07-2	05/05/17 09:30am	E. COLI-MF (1603)	EPA 1603	2 E	05/05/17 05:20PM	
L6794156-46	DR-07-2	05/05/17 09:30am	FECAL COLIFORM-MF	SM 9222D	6 E	05/05/17 05:30PM	
L6794156-47	CSO-02-04	05/05/17 10:30am	ENTEROCOCCUS-MF 24	EPA 1600	145000 E	05/05/17 05:20PM	
L6794156-47	CSO-02-04	05/05/17 10:30am	E. COLI-MF (1603)	EPA 1603	132000 E	05/05/17 05:20PM	
L6794156-47	CSO-02-04	05/05/17 10:30am	FECAL COLIFORM-MF	SM 9222D	122000 E	05/05/17 05:30PM	
L6794156-48	CSO-05-04	05/05/17 10:40am	ENTEROCOCCUS-MF 24	EPA 1600	77000 E	05/05/17 05:20PM	
L6794156-48	CSO-05-04	05/05/17 10:40am	E. COLI-MF (1603)	EPA 1603	95000 E	05/05/17 05:20PM	
L6794156-48	CSO-05-04	05/05/17 10:40am	FECAL COLIFORM-MF	SM 9222D	68000 E	05/05/17 05:30PM	
L6794156-49	CSO-18-4	05/05/17 10:34am	ENTEROCOCCUS-MF 24	EPA 1600	109000 E	05/05/17 05:20PM	
L6794156-49	CSO-18-4	05/05/17 10:34am	E. COLI-MF (1603)	EPA 1603	163000 E	05/05/17 05:20PM	
L6794156-49	CSO-18-4	05/05/17 10:34am	FECAL COLIFORM-MF	SM 9222D	119000 E	05/05/17 05:30PM	
L6794156-50	CSO-18-4	05/05/17 10:45am	ENTEROCOCCUS-MF 24	EPA 1600	59000	05/05/17 05:20PM	
L6794156-50	CSO-18-4	05/05/17 10:45am	E. COLI-MF (1603)	EPA 1603	80000	05/05/17 05:20PM	
L6794156-50	CSO-18-4	05/05/17 10:45am	FECAL COLIFORM-MF	SM 9222D	47000	05/05/17 05:30PM	

Login Number	Sample ID	Sample Date/Time	Parm Stored	Method	Result (cfu/100 mL)	Analysis Date/Time	
L6794156-51	SW-SS2-5	05/05/17 10:40am	ENTEROCOCCUS-MF 24	EPA 1600	114000 E	05/05/17 05:20PM	
L6794156-51	SW-SS2-5	05/05/17 10:40am	E. COLI-MF (1603)	EPA 1603	15000 E	05/05/17 05:20PM	
L6794156-51	SW-SS2-5	05/05/17 10:40am	FECAL COLIFORM-MF	SM 9222D	13000 E	05/05/17 05:30PM	
L6794156-52	SW-05A-5	05/05/17 10:50am	ENTEROCOCCUS-MF 24	EPA 1600	95000 E	05/05/17 05:20PM	
L6794156-52	SW-05A-5	05/05/17 10:50am	E. COLI-MF (1603)	EPA 1603	50000	05/05/17 05:20PM	
L6794156-52	SW-05A-5	05/05/17 10:50am	FECAL COLIFORM-MF	SM 9222D	15000 E	05/05/17 05:30PM	
L6794156-53	DR-04-3	05/05/17 12:10pm	ENTEROCOCCUS-MF 24	EPA 1600	12 E	05/05/17 05:20PM	
L6794156-53	DR-04-3	05/05/17 12:10pm	E. COLI-MF (1603)	EPA 1603	8 E	05/05/17 05:45PM	
L6794156-53	DR-04-3	05/05/17 12:10pm	FECAL COLIFORM-MF	SM 9222D	24 E	05/05/17 05:30PM	
L6794156-54	DR-05-3	05/05/17 12:17pm	ENTEROCOCCUS-MF 24	EPA 1600	40000	05/05/17 05:20PM	
L6794156-54	DR-05-3	05/05/17 12:17pm	E. COLI-MF (1603)	EPA 1603	6900	05/05/17 06:11PM	
L6794156-54	DR-05-3	05/05/17 12:17pm	FECAL COLIFORM-MF	SM 9222D	10000 E	05/05/17 05:30PM	
L6794156-55	DR-06-3	05/05/17 12:00pm	ENTEROCOCCUS-MF 24	EPA 1600	2 E	05/05/17 05:20PM	
L6794156-55	DR-06-3	05/05/17 12:00pm	E. COLI-MF (1603)	EPA 1603	2 E	05/05/17 05:20PM	
L6794156-55	DR-06-3	05/05/17 12:00pm	FECAL COLIFORM-MF	SM 9222D	6 E	05/05/17 05:30PM	
L6794156-56	DR-07-3	05/05/17 11:50am	ENTEROCOCCUS-MF 24	EPA 1600	10 E	05/05/17 05:20PM	
L6794156-56	DR-07-3	05/05/17 11:50am	E. COLI-MF (1603)	EPA 1603	20 E	05/05/17 05:45PM	
L6794156-56	DR-07-3	05/05/17 11:50am	FECAL COLIFORM-MF	SM 9222D	10 E	05/05/17 05:30PM	
L6794156-57	DR-01-3	05/05/17 12:00pm	ENTEROCOCCUS-MF 24	EPA 1600	30 E	05/05/17 05:20PM	
L6794156-57	DR-01-3	05/05/17 12:00pm	E. COLI-MF (1603)	EPA 1603	16 E	05/05/17 05:20PM	
L6794156-57	DR-01-3	05/05/17 12:00pm	FECAL COLIFORM-MF	SM 9222D	20 E	05/05/17 05:30PM	
L6794156-58	DR-02-3	05/05/17 12:10pm	ENTEROCOCCUS-MF 24	EPA 1600	8 E	05/05/17 05:20PM	
L6794156-58	DR-02-3	05/05/17 12:10pm	E. COLI-MF (1603)	EPA 1603	6 E	05/05/17 05:20PM	
L6794156-58	DR-02-3	05/05/17 12:10pm	FECAL COLIFORM-MF	SM 9222D	18 E	05/05/17 05:30PM	
L6794156-59	DR-03-3	05/05/17 12:15pm	ENTEROCOCCUS-MF 24	EPA 1600	56	05/05/17 05:20PM	
L6794156-59	DR-03-3	05/05/17 12:15pm	E. COLI-MF (1603)	EPA 1603	14 E	05/05/17 05:20PM	
L6794156-59	DR-03-3	05/05/17 12:15pm	FECAL COLIFORM-MF	SM 9222D	12 E	05/05/17 05:30PM	
L6794156-60	CSO-02-05	05/05/17 12:15pm	ENTEROCOCCUS-MF 24	EPA 1600	89000 E	05/05/17 05:20PM	
L6794156-60	CSO-02-05	05/05/17 12:15pm	E. COLI-MF (1603)	EPA 1603	96000 E	05/05/17 05:45PM	
L6794156-60	CSO-02-05	05/05/17 12:15pm	FECAL COLIFORM-MF	SM 9222D	68000 E	05/05/17 05:30PM	
L6794156-61	CSO-05-05	05/05/17 12:40pm	ENTEROCOCCUS-MF 24	EPA 1600	75000 E	05/05/17 05:20PM	
L6794156-61	CSO-05-05	05/05/17 12:40pm	E. COLI-MF (1603)	EPA 1603	55000	05/05/17 06:11PM	
L6794156-61	CSO-05-05	05/05/17 12:40pm	FECAL COLIFORM-MF	SM 9222D	53000	05/05/17 05:30PM	
L6794156-62	CC-01-02	05/05/17 12:55pm	ENTEROCOCCUS-MF 24	EPA 1600	LA Q	05/05/17 05:20PM	
L6794156-62	CC-01-02	05/05/17 12:55pm	E. COLI-MF (1603)	EPA 1603	12000 E	05/05/17 05:20PM	
L6794156-62	CC-01-02	05/05/17 12:55pm	FECAL COLIFORM-MF	SM 9222D	10000 E	05/05/17 05:30PM	
L6794156-63	CC-02-2	05/05/17 12:35pm	ENTEROCOCCUS-MF 24	EPA 1600	15000 E	05/05/17 05:20PM	
L6794156-63	CC-02-2	05/05/17 12:35pm	E. COLI-MF (1603)	EPA 1603	15000 E	05/05/17 05:20PM	
L6794156-63	CC-02-2	05/05/17 12:35pm	FECAL COLIFORM-MF	SM 9222D	6900 E	05/05/17 05:30PM	
L6794156-64	CC-03-2	05/05/17 11:40am	ENTEROCOCCUS-MF 24	EPA 1600	3400	05/05/17 05:20PM	
L6794156-64	CC-03-2	05/05/17 11:40am	E. COLI-MF (1603)	EPA 1603	5700	05/05/17 06:11PM	
L6794156-64	CC-03-2	05/05/17 11:40am	FECAL COLIFORM-MF	SM 9222D	6700 E	05/05/17 05:30PM	
L6794156-65	RC-01-2	05/05/17 12:15pm	ENTEROCOCCUS-MF 24	EPA 1600	28000	05/05/17 05:20PM	
L6794156-65	RC-01-2	05/05/17 12:15pm	E. COLI-MF (1603)	EPA 1603	7900	05/05/17 05:20PM	
L6794156-65	RC-01-2	05/05/17 12:15pm	FECAL COLIFORM-MF	SM 9222D	3100	05/05/17 05:30PM	
L6794156-66	RC-02-2	05/05/17 11:55am	ENTEROCOCCUS-MF 24	EPA 1600	18000 E	05/05/17 05:20PM	
L6794156-66	RC-02-2	05/05/17 11:55am	E. COLI-MF (1603)	EPA 1603	13000 E	05/05/17 06:11PM	
L6794156-66	RC-02-2	05/05/17 11:55am	FECAL COLIFORM-MF	SM 9222D	16000 E	05/05/17 05:30PM	
L6794156-67	RC-03-2	05/05/17 11:47am	ENTEROCOCCUS-MF 24	EPA 1600	10000 E	05/05/17 05:20PM	
L6794156-67	RC-03-2	05/05/17 11:47am	E. COLI-MF (1603)	EPA 1603	20000	05/05/17 06:11PM	
L6794156-67	RC-03-2	05/05/17 11:47am	FECAL COLIFORM-MF	SM 9222D	13000 E	05/05/17 05:30PM	

Login Number	Sample ID	Sample Date/Time	Parm Stored	Method	Result (cfu/100 mL)	Analysis Date/Time	
L6794156-68	CSO-19-5	05/05/17 12:35pm	ENTEROCOCCUS-MF 24	EPA 1600	194000 E	05/05/17 05:20PM	
L6794156-68	CSO-19-5	05/05/17 12:35pm	E. COLI-MF (1603)	EPA 1603	234000 E	05/05/17 06:11PM	
L6794156-68	CSO-19-5	05/05/17 12:35pm	FECAL COLIFORM-MF	SM 9222D	93000 E	05/05/17 05:30PM	
L6794156-69	CSO-18-5	05/05/17 12:47pm	ENTEROCOCCUS-MF 24	EPA 1600	37000	05/05/17 05:20PM	
L6794156-69	CSO-18-5	05/05/17 12:47pm	E. COLI-MF (1603)	EPA 1603	104000 E	05/05/17 05:20PM	
L6794156-69	CSO-18-5	05/05/17 12:47pm	FECAL COLIFORM-MF	SM 9222D	53000	05/05/17 05:30PM	
L6794156-70	CC-01-3	05/05/17 05:05pm	ENTEROCOCCUS-MF 24	EPA 1600	39000	05/05/17 07:49PM	
L6794156-70	CC-01-3	05/05/17 05:05pm	E. COLI-MF (1603)	EPA 1603	13000 E	05/05/17 07:41PM	
L6794156-70	CC-01-3	05/05/17 05:05pm	FECAL COLIFORM-MF	SM 9222D	44000	05/05/17 07:49PM	
L6794156-71	CC-02-3	05/05/17 04:48pm	ENTEROCOCCUS-MF 24	EPA 1600	17000 E	05/05/17 07:49PM	
L6794156-71	CC-02-3	05/05/17 04:48pm	E. COLI-MF (1603)	EPA 1603	7300	05/05/17 07:41PM	
L6794156-71	CC-02-3	05/05/17 04:48pm	FECAL COLIFORM-MF	SM 9222D	13000 E	05/05/17 07:49PM	
L6794156-72	CC-03-3	05/05/17 03:45pm	ENTEROCOCCUS-MF 24	EPA 1600	27000	05/05/17 07:49PM	
L6794156-72	CC-03-3	05/05/17 03:45pm	E. COLI-MF (1603)	EPA 1603	6500	05/05/17 07:41PM	
L6794156-72	CC-03-3	05/05/17 03:45pm	FECAL COLIFORM-MF	SM 9222D	21000	05/05/17 07:49PM	
L6794156-73	RC-01-3	05/05/17 04:30pm	ENTEROCOCCUS-MF 24	EPA 1600	23000	05/05/17 07:49PM	
L6794156-73	RC-01-3	05/05/17 04:30pm	E. COLI-MF (1603)	EPA 1603	6100	05/05/17 07:41PM	
L6794156-73	RC-01-3	05/05/17 04:30pm	FECAL COLIFORM-MF	SM 9222D	6700 E	05/05/17 07:49PM	
L6794156-74	RC-02-3	05/05/17 04:10pm	ENTEROCOCCUS-MF 24	EPA 1600	19000 E	05/05/17 07:49PM	
L6794156-74	RC-02-3	05/05/17 04:10pm	E. COLI-MF (1603)	EPA 1603	5900	05/05/17 07:41PM	
L6794156-74	RC-02-3	05/05/17 04:10pm	FECAL COLIFORM-MF	SM 9222D	4300	05/05/17 07:49PM	
L6794156-75	RC-03-3	05/05/17 04:00pm	ENTEROCOCCUS-MF 24	EPA 1600	30000	05/05/17 07:49PM	
L6794156-75	RC-03-3	05/05/17 04:00pm	E. COLI-MF (1603)	EPA 1603	6800	05/05/17 07:41PM	
L6794156-75	RC-03-3	05/05/17 04:00pm	FECAL COLIFORM-MF	SM 9222D	34000	05/05/17 07:49PM	
L6794156-76	SW-SS2-6	05/05/17 04:35pm	ENTEROCOCCUS-MF 24	EPA 1600	57000	05/05/17 07:49PM	
L6794156-76	SW-SS2-6	05/05/17 04:35pm	E. COLI-MF (1603)	EPA 1603	6200	05/05/17 07:41PM	
L6794156-76	SW-SS2-6	05/05/17 04:35pm	FECAL COLIFORM-MF	SM 9222D	33000	05/05/17 07:49PM	
L6794156-77	SW-05A-6	05/05/17 04:45pm	ENTEROCOCCUS-MF 24	EPA 1600	44000	05/05/17 07:49PM	
L6794156-77	SW-05A-6	05/05/17 04:45pm	E. COLI-MF (1603)	EPA 1603	13000 E	05/05/17 07:41PM	
L6794156-77	SW-05A-6	05/05/17 04:45pm	FECAL COLIFORM-MF	SM 9222D	30000	05/05/17 07:49PM	
L6794156-78	DUP-CC	05/05/17 00:00pm	ENTEROCOCCUS-MF 24	EPA 1600	40000 Q	05/05/17 07:49PM	
L6794156-78	DUP-CC	05/05/17 00:00pm	E. COLI-MF (1603)	EPA 1603	17000 E, Q	05/05/17 07:41PM	
L6794156-78	DUP-CC	05/05/17 00:00pm	FECAL COLIFORM-MF	SM 9222D	31000 Q	05/05/17 07:49PM	
L6794156-79	DR-03-07 (LAND)	05/05/17 11:00pm	ENTEROCOCCUS-MF 24	EPA 1600	15000 E	05/06/17 01:05AM	
L6794156-79	DR-03-07 (LAND)	05/05/17 11:00pm	E. COLI-MF (1603)	EPA 1603	5500	05/06/17 12:40AM	
L6794156-79	DR-03-07 (LAND)	05/05/17 11:00pm	FECAL COLIFORM-MF	SM 9222D	23000	05/06/17 12:50AM	
L6794156-80	DR-04-07 (LAND)	05/05/17 11:10pm	ENTEROCOCCUS-MF 24	EPA 1600	12000 E	05/06/17 01:05AM	
L6794156-80	DR-04-07 (LAND)	05/05/17 11:10pm	E. COLI-MF (1603)	EPA 1603	4500	05/06/17 12:40AM	
L6794156-80	DR-04-07 (LAND)	05/05/17 11:10pm	FECAL COLIFORM-MF	SM 9222D	3800	05/06/17 12:50AM	
L6794156-81	CC-01-04	05/05/17 10:35pm	ENTEROCOCCUS-MF 24	EPA 1600	41000	05/06/17 01:05AM	
L6794156-81	CC-01-04	05/05/17 10:35pm	E. COLI-MF (1603)	EPA 1603	15000 E	05/06/17 12:40AM	
L6794156-81	CC-01-04	05/05/17 10:35pm	FECAL COLIFORM-MF	SM 9222D	15000 E	05/06/17 12:50AM	
L6794156-82	CC-02-04	05/05/17 10:20pm	ENTEROCOCCUS-MF 24	EPA 1600	38000	05/06/17 01:05AM	
L6794156-82	CC-02-04	05/05/17 10:20pm	E. COLI-MF (1603)	EPA 1603	8000 E	05/06/17 12:40AM	
L6794156-82	CC-02-04	05/05/17 10:20pm	FECAL COLIFORM-MF	SM 9222D	29000	05/06/17 12:50AM	
L6794156-83	CC-03-04	05/05/17 09:30pm	ENTEROCOCCUS-MF 24	EPA 1600	24000	05/06/17 01:05AM	
L6794156-83	CC-03-04	05/05/17 09:30pm	E. COLI-MF (1603)	EPA 1603	11000 E	05/06/17 12:40AM	
L6794156-83	CC-03-04	05/05/17 09:30pm	FECAL COLIFORM-MF	SM 9222D	11000 E	05/06/17 12:50AM	
L6794156-84	RC-01-04	05/05/17 10:05pm	ENTEROCOCCUS-MF 24	EPA 1600	28000	05/06/17 01:05AM	
L6794156-84	RC-01-04	05/05/17 10:05pm	E. COLI-MF (1603)	EPA 1603	9000 E	05/06/17 12:40AM	
L6794156-84	RC-01-04	05/05/17 10:05pm	FECAL COLIFORM-MF	SM 9222D	12000 E	05/06/17 12:50AM	

Login Number	Sample ID	Sample Date/Time	Parm Stored	Method	Result (cfu/100 mL)	Analysis Date/Time	
L6794156-85	RC-02-04	05/05/17 09:50pm	ENTEROCOCCUS-MF 24	EPA 1600	17000 E	05/06/17 01:05AM	
L6794156-85	RC-02-04	05/05/17 09:50pm	E. COLI-MF (1603)	EPA 1603	16000 E	05/06/17 12:40AM	
L6794156-85	RC-02-04	05/05/17 09:50pm	FECAL COLIFORM-MF	SM 9222D	25000	05/06/17 12:50AM	
L6794156-86	RC-03-04	05/05/17 09:40pm	ENTEROCOCCUS-MF 24	EPA 1600	31000	05/06/17 01:05AM	
L6794156-86	RC-03-04	05/05/17 09:40pm	E. COLI-MF (1603)	EPA 1603	6100 E	05/06/17 12:40AM	
L6794156-86	RC-03-04	05/05/17 09:40pm	FECAL COLIFORM-MF	SM 9222D	47000	05/06/17 12:50AM	
L6794156-87	DR-03-06 (LAND)	05/05/17 08:35pm	ENTEROCOCCUS-MF 24	EPA 1600	28000	05/06/17 01:05AM	
L6794156-87	DR-03-06 (LAND)	05/05/17 08:35pm	E. COLI-MF (1603)	EPA 1603	6700 E	05/06/17 12:40AM	
L6794156-87	DR-03-06 (LAND)	05/05/17 08:35pm	FECAL COLIFORM-MF	SM 9222D	18000 E	05/06/17 12:50AM	
L6794156-88	DR-04-06 (LAND)	05/05/17 08:50pm	ENTEROCOCCUS-MF 24	EPA 1600	24000	05/06/17 01:05AM	
L6794156-88	DR-04-06 (LAND)	05/05/17 08:50pm	E. COLI-MF (1603)	EPA 1603	5700	05/06/17 12:40AM	
L6794156-88	DR-04-06 (LAND)	05/05/17 08:50pm	FECAL COLIFORM-MF	SM 9222D	32000	05/06/17 12:50AM	
L6794156-89	DR-03-08 (LAND)	05/06/17 02:00am	ENTEROCOCCUS-MF 24	EPA 1600	4700	05/06/17 09:18AM	
L6794156-89	DR-03-08 (LAND)	05/06/17 02:00am	E. COLI-MF (1603)	EPA 1603	2000	05/06/17 09:48AM	
L6794156-89	DR-03-08 (LAND)	05/06/17 02:00am	FECAL COLIFORM-MF	SM 9222D	2800	05/06/17 09:44AM	
L6794156-90	DR-04-08 (LAND)	05/06/17 02:15am	ENTEROCOCCUS-MF 24	EPA 1600	6100 E	05/06/17 09:18AM	
L6794156-90	DR-04-08 (LAND)	05/06/17 02:15am	E. COLI-MF (1603)	EPA 1603	2100	05/06/17 09:48AM	
L6794156-90	DR-04-08 (LAND)	05/06/17 02:15am	FECAL COLIFORM-MF	SM 9222D	3900	05/06/17 09:44AM	
L6794156-91	RC-01-05	05/06/17 05:05am	ENTEROCOCCUS-MF 24	EPA 1600	22000	05/06/17 09:18AM	
L6794156-91	RC-01-05	05/06/17 05:05am	E. COLI-MF (1603)	EPA 1603	8000	05/06/17 09:48AM	
L6794156-91	RC-01-05	05/06/17 05:05am	FECAL COLIFORM-MF	SM 9222D	5600	05/06/17 09:44AM	
L6794156-92	RC-02-05	05/06/17 04:50am	ENTEROCOCCUS-MF 24	EPA 1600	3400	05/06/17 09:18AM	
L6794156-92	RC-02-05	05/06/17 04:50am	E. COLI-MF (1603)	EPA 1603	5800	05/06/17 09:48AM	
L6794156-92	RC-02-05	05/06/17 04:50am	FECAL COLIFORM-MF	SM 9222D	4000	05/06/17 09:44AM	
L6794156-93	RC-03-05	05/06/17 04:30am	ENTEROCOCCUS-MF 24	EPA 1600	15000 E	05/06/17 09:18AM	
L6794156-93	RC-03-05	05/06/17 04:30am	E. COLI-MF (1603)	EPA 1603	6500	05/06/17 09:48AM	
L6794156-93	RC-03-05	05/06/17 04:30am	FECAL COLIFORM-MF	SM 9222D	6400	05/06/17 09:44AM	
L6794156-94	CC-01-05	05/06/17 05:30am	ENTEROCOCCUS-MF 24	EPA 1600	26000	05/06/17 09:18AM	
L6794156-94	CC-01-05	05/06/17 05:30am	E. COLI-MF (1603)	EPA 1603	5500	05/06/17 09:48AM	
L6794156-94	CC-01-05	05/06/17 05:30am	FECAL COLIFORM-MF	SM 9222D	3200	05/06/17 09:44AM	
L6794156-95	CC-02-05	05/06/17 05:15am	ENTEROCOCCUS-MF 24	EPA 1600	22000	05/06/17 09:18AM	
L6794156-95	CC-02-05	05/06/17 05:15am	E. COLI-MF (1603)	EPA 1603	7900	05/06/17 09:48AM	
L6794156-95	CC-02-05	05/06/17 05:15am	FECAL COLIFORM-MF	SM 9222D	21000	05/06/17 09:44AM	
L6794156-96	CC-03-05	05/06/17 04:20am	ENTEROCOCCUS-MF 24	EPA 1600	35000	05/06/17 09:18AM	
L6794156-96	CC-03-05	05/06/17 04:20am	E. COLI-MF (1603)	EPA 1603	14000 E	05/06/17 09:48AM	
L6794156-96	CC-03-05	05/06/17 04:20am	FECAL COLIFORM-MF	SM 9222D	4400	05/06/17 09:44AM	
L6794156-97	DR-03-09 (LAND)	05/06/17 04:00am	ENTEROCOCCUS-MF 24	EPA 1600	5000	05/06/17 09:18AM	
L6794156-97	DR-03-09 (LAND)	05/06/17 04:00am	E. COLI-MF (1603)	EPA 1603	1500 E	05/06/17 09:48AM	
L6794156-97	DR-03-09 (LAND)	05/06/17 04:00am	FECAL COLIFORM-MF	SM 9222D	2000	05/06/17 09:44AM	
L6794156-98	DR-04-09 (LAND)	05/06/17 04:10am	ENTEROCOCCUS-MF 24	EPA 1600	5000	05/06/17 09:18AM	
L6794156-98	DR-04-09 (LAND)	05/06/17 04:10am	E. COLI-MF (1603)	EPA 1603	1200 E	05/06/17 09:48AM	
L6794156-98	DR-04-09 (LAND)	05/06/17 04:10am	FECAL COLIFORM-MF	SM 9222D	2100	05/06/17 09:44AM	
L6794156-99	DUP-DR	05/06/17 00:00am	ENTEROCOCCUS-MF 24	EPA 1600	4300 Q	05/06/17 09:18AM	
L6794156-99	DUP-DR	05/06/17 00:00am	E. COLI-MF (1603)	EPA 1603	3300 Q	05/06/17 09:48AM	
L6794156-99	DUP-DR	05/06/17 00:00am	FECAL COLIFORM-MF	SM 9222D	13000 E, Q	05/06/17 09:44AM	
L6794156-100	DR-04-10 (LAND)	05/06/17 06:10am	ENTEROCOCCUS-MF 24	EPA 1600	5500	05/06/17 09:18AM	
L6794156-100	DR-04-10 (LAND)	05/06/17 06:10am	E. COLI-MF (1603)	EPA 1603	2300	05/06/17 09:48AM	
L6794156-100	DR-04-10 (LAND)	05/06/17 06:10am	FECAL COLIFORM-MF	SM 9222D	23000	05/06/17 09:44AM	
L6794156-101	DR-03-10 (LAND)	05/06/17 06:00am	ENTEROCOCCUS-MF 24	EPA 1600	3700	05/06/17 09:18AM	
L6794156-101	DR-03-10 (LAND)	05/06/17 06:00am	E. COLI-MF (1603)	EPA 1603	1700 E	05/06/17 09:48AM	
L6794156-101	DR-03-10 (LAND)	05/06/17 06:00am	FECAL COLIFORM-MF	SM 9222D	3300	05/06/17 09:44AM	

APPENDIX F

WET WEATHER EVENT 3 – FIELD LOGS AND LAB RESULTS SUMMARY

(Chain of Custody Forms and Complete Lab Results provided in digital form only on CD attached to this report)

WET WEATHER EVENT: 3

IN-STREAM TRIBUTARY STATION: CC-01

DATE: *5/22/2017* **Note Temperature of Receiving Stream if below 10 °C threshhold**

START OF RAINFALL TIME: *10:30*

Sampling Round	Sample Interval from Start of Rainfall (Hours)	Target Sample Collection Time (hh:mm)	Actual Sample Collection Time (hh:mm)	Duplicate Sample Collected? (Y/N)	Duplicate Collection Time (hh:mm)	Field Blank Sample Collected? (Y/N)	Field Blank Collection Time (hh:mm)	Chain of Custody Provided & Completed (Y/N)	Time Sample Transferred to Lab Courier (hh:mm)	Water Salinity Reading (%)	Water Temperature Reading (°C)	Conductivity Reading (umhos/cm)	Field Observations (see notes, below)
1	0.5-2.5	10:30	11:42	N	N/A	N	N/A	Y	12:28	0.27	16.18	465	Raining
2	4.5-6.5	14:30	15:40	N	N/A	N	N/A	Y	17:48	0.26	16.21	439	Raining
3	8.5-10.5	18:30	18:46	N	N/A	N	N/A	Y	19:50	0.27	16.36	462	Raining
4	14.5-16.5	0:30	2:17	N	N/A	N	N/A	Y	3:52	0.28	16.13	483	Raining
5	22-24	8:30	10:20	N	N/A	N	N/A	Y	10:45	0.28	15.88	479	Raining
IN-STREAM TRIBUTARY STATION: CC-02													
1	0.5-2.5	10:30	12:00	N	N/A	N	N/A	Y	12:28	0.3	16.85	520	Raining
2	4.5-6.5	14:30	15:50	Y	15:50	N	N/A	Y	17:48	0.126	16.67	450	Raining
3	8.5-10.5	18:30	19:00	N	N/A	N	N/A	Y	19:50	0.26	16.81	454	Raining
4	14.5-16.5	0:30	2:05	N	N/A	N	N/A	Y	3:52	0.27	16.36	467	Raining
5	22-24	8:30	10:05	N	N/A	N	N/A	Y	10:45	0.23	16.65	395	Raining
IN-STREAM TRIBUTARY STATION: CC-03													
1	0.5-2.5	10:30	10:42	N	N/A	N	N/A	Y	12:28	0.13	17.66	233.0	Raining
2	4.5-6.5	14:30	14:40	N	N/A	N	N/A	Y	17:48	0.29	16.69	497.0	Raining
3	8.5-10.5	18:30	18:00	N	N/A	N	N/A	Y	19:50	0.27	16.73	465.0	Raining
4	14.5-16.5	0:30	1:05	N	N/A	N	N/A	Y	3:52	0.20	17.33	352.0	Raining
5	22-24	8:30	9:05	N	N/A	N	N/A	Y	10:45	0.13	17.58	244.0	Raining
IN-STREAM TRIBUTARY STATION: RC-01													
1	0.5-2.5	10:30	11:26	N	N/A	N	N/A	Y	12:28	0.18	16.43	307.0	Raining
2	4.5-6.5	14:30	15:18	N	N/A	N	N/A	Y	17:48	0.19	16.46	336.0	Raining
3	8.5-10.5	18:30	18:40	N	N/A	N	N/A	Y	19:50	0.22	16.49	375.0	Raining
4	14.5-16.5	0:30	1:52	N	N/A	N	N/A	Y	3:52	0.22	16.13	373.0	Raining
5	22-24	8:30	9:50	N	N/A	N	N/A	Y	10:45	0.21	15.90	367.0	Raining
IN-STREAM TRIBUTARY STATION: RC-02													
1	0.5-2.5	10:30	11:10	N	N/A	N	N/A	Y	12:28	0.23	16.09	398.0	Raining
2	4.5-6.5	14:30	15:05	N	N/A	N	N/A	Y	17:48	0.20	16.35	353.0	Raining
3	8.5-10.5	18:30	18:18	N	N/A	N	N/A	Y	19:50	0.20	16.68	345.0	Raining
4	14.5-16.5	0:30	1:35	N	N/A	N	N/A	Y	3:52	0.23	16.38	393.0	Raining
5	22-24	8:30	9:35	N	N/A	N	N/A	Y	10:45	0.23	15.85	384.0	Raining
IN-STREAM TRIBUTARY STATION: RC-03													
1	0.5-2.5	10:30	11:00	N	N/A	N	N/A	Y	12:28	0.13	17.57	226.0	Used Bailer to collect sample
2	4.5-6.5	14:30	14:50	Y	14:50	N	N/A	Y	17:48	0.22	16.27	371.0	Used Bailer to collect sample
3	8.5-10.5	18:30	18:12	N	N/A	N	N/A	Y	19:50	0.20	16.72	357.0	Used Bailer to collect sample
4	14.5-16.5	0:30	1:20	N	N/A	N	N/A	Y	3:52	0.19	16.91	332.0	Used Bailer to collect sample
5	22-24	8:30	9:22	N	N/A	N	N/A	Y	10:45	0.13	17.61	229.0	Used Bailer to collect sample

WET WEATHER EVENT: 3

DELAWARE RIVER STATION: DR-01

DATE: *5/22/2017* **Note Temperature of Receiving Stream if below 10 °C threshhold**

START OF RAINFALL TIME: *10:30*

Sampling Round	Sample Interval from Start of Rainfall (Hours)	Target Sample Collection Time (hh:mm)	Actual Sample Collection Time (hh:mm)	Duplicate Sample Collected? (Y/N)	Duplicate Collection Time (hh:mm)	Field Blank Sample Collected? (Y/N)	Field Blank Collection Time (hh:mm)	Chain of Custody Provided & Completed (Y/N)	Time Sample Transferred to Lab Courier (hh:mm)	Surface, Mid-depth & Bottom Water Salinity Reading(s) (%)	Surface, Mid-depth & Bottom Water Temperature Reading(s) (°C)	Surface, Mid-depth & Bottom Water Conductivity Reading(s) (umhos/cm)	Field Observations (see notes, below)
1	0	9:30	9:25	N	N/A	N	N/A	Y	10:38	-	17.8/17.8/17.8	205/205/205	TOTAL DEPTH = 27 FEET
2	2	11:30	11:10	N	N/A	Y	11:05	Y	12:28	-	17.83/17.83/17.84	205/204/205	TOTAL DEPTH = 25 FEET
3	4	13:30	13:15	Y	13:15	N	N/A	Y	15:35	-	17.82/17.81/17.81	207/207/206	TOTAL DEPTH = 25 FEET
4	6	15:30	15:15	N	N/A	N	N/A	Y	17:40	0.19/0.19/0.19	15.80/15.79/15.79	318/318/319	TOTAL DEPTH = 24.7 FEET
5	9	18:30	18:15	N	N/A	N	N/A	Y	19:30	0.19/0.19/0.19	15.82/15.81/15.81	327/326/326	TOTAL DEPTH = 23.26 FEET
6	12	21:30	21:15	N	N/A	N	N/A	Y	22:15	0.19/0.19/0.19	15.85/15.87/15.88	320/322/323	TOTAL DEPTH = 28 FEET
7	15	0:30	0:05	N	N/A	N	N/A	Y	3:52	0.18/0.18/0.18	15.90/15.90/15.90	309/310/310	TOTAL DEPTH = 27 FEET
8	18	3:30	3:00	N	N/A	N	N/A	Y	5:35	0.18/0.18/0.18	15.72/15.73/15.73	308/308/308	TOTAL DEPTH = 25 FEET
9	21	6:30	6:00	N	N/A	N	N/A	Y	10:45	0.18/0.18/0.18	15.68/15.68/15.68	299/303/307	TOTAL DEPTH = 23 FEET
10	24	9:30	9:00	N	N/A	N	N/A	Y	10:45	0.16/0.17/0.17	15.69/15.69/15.68	281/284/287	TOTAL DEPTH = 26 FEET

DELAWARE RIVER STATION: DR-02

Sampling Round	Sample Interval from Start of Rainfall (Hours)	Target Sample Collection Time (hh:mm)	Actual Sample Collection Time (hh:mm)	Duplicate Sample Collected? (Y/N)	Duplicate Collection Time (hh:mm)	Field Blank Sample Collected? (Y/N)	Field Blank Collection Time (hh:mm)	Chain of Custody Provided & Completed (Y/N)	Time Sample Transferred to Lab Courier (hh:mm)	Surface, Mid-depth & Bottom Water Salinity Reading(s) (%)	Surface, Mid-depth & Bottom Water Temperature Reading(s) (°C)	Surface, Mid-depth & Bottom Water Conductivity Reading(s) (umhos/cm)	Field Observations (see notes, below)
1	0	9:30	9:30	N	N/A	N	N/A	Y	10:38	-	17.85/17.85/17.85	209/206/206	TOTAL DEPTH = 37 FEET
2	2	11:30	11:15	N	N/A	N	N/A	Y	12:28	-	17.87/17.87/17.87	203/204/207	TOTAL DEPTH = 35 FEET
3	4	13:30	13:20	N	N/A	N	N/A	Y	15:35	-	17.79/17.80/17.80	210/210/210	TOTAL DEPTH = 30 FEET
4	6	15:30	15:20	N	N/A	N	N/A	Y	17:40	0.18/0.18/0.18	15.73/15.74/15.75	309/311/312	TOTAL DEPTH = 36 FEET
5	9	18:30	18:20	N	N/A	N	N/A	Y	19:30	0.18/0.18/0.18	15.74/15.76/15.76	314/314/314	TOTAL DEPTH = 33 FEET
6	12	21:30	21:25	Y	21:25	N	N/A	Y	22:15	0.19/0.19/0.19	15.92/15.92/15.93	322/322/322	TOTAL DEPTH = 28 FEET
7	15	0:30	0:20	N	N/A	N	N/A	Y	3:52	0.18/0.18/0.18	15.93/15.93/15.93	313/313/313	TOTAL DEPTH = 40 FEET
8	18	3:30	3:15	N	N/A	N	N/A	Y	5:35	0.18/0.18/0.18	15.77/15.78/15.78	310/312/315	TOTAL DEPTH = 31 FEET
9	21	6:30	6:13	N	N/A	N	N/A	Y	10:45	0.18/0.18/0.18	15.70/15.70/15.70	314/315/313	TOTAL DEPTH = 34 FEET
10	24	9:30	9:12	N	N/A	N	N/A	Y	10:45	0.17/0.17/0.17	15.79/15.79/15.79	295/297/300	TOTAL DEPTH = 38 FEET

DELAWARE RIVER STATION: DR-03

Sampling Round	Sample Interval from Start of Rainfall (Hours)	Target Sample Collection Time (hh:mm)	Actual Sample Collection Time (hh:mm)	Duplicate Sample Collected? (Y/N)	Duplicate Collection Time (hh:mm)	Field Blank Sample Collected? (Y/N)	Field Blank Collection Time (hh:mm)	Chain of Custody Provided & Completed (Y/N)	Time Sample Transferred to Lab Courier (hh:mm)	Surface, Mid-depth & Bottom Water Salinity Reading(s) (%)	Surface, Mid-depth & Bottom Water Temperature Reading(s) (°C)	Surface, Mid-depth & Bottom Water Conductivity Reading(s) (umhos/cm)	Field Observations (see notes, below)
1	0	9:30	9:35	N	N/A	N	N/A	Y	10:38	-	17.91/17.91/17.91	213/212/212	TOTAL DEPTH = 20 FEET
2	2	11:30	11:20	N	N/A	N	N/A	Y	12:28	-	17.86/17.91/17.91	206/207/207	TOTAL DEPTH = 20 FEET
3	4	13:30	13:30	N	N/A	N	N/A	Y	15:35	-	17.83/17.84/17.84	207/207/207	TOTAL DEPTH = 22 FEET
4	6	15:30	15:25	N	N/A	N	N/A	Y	17:40	0.19/0.19/0.19	15.75/15.80/15.82	319/328/320	TOTAL DEPTH = 13.3 FEET
5	9	18:30	18:25	N	N/A	N	N/A	Y	19:30	0.19/0.20/0.21	15.79/15.79/15.79	341/353/353	TOTAL DEPTH = 11.5 FEET
6	12	21:30	21:30	N	N/A	N	N/A	Y	22:15	0.19/0.19/0.19	15.97/15.98/15.98	325/323/323	TOTAL DEPTH = 19 FEET
7	15	0:30	0:34	N	N/A	N	N/A	Y	3:52	0.18/0.19/0.19	15.99/15.99/15.98	317/318/320	TOTAL DEPTH = 23 FEET
8	18	3:30	3:25	N	N/A	N	N/A	Y	5:35	0.18/0.19/0.19	15.78/15.78/15.78	316/317/318	TOTAL DEPTH = 22 FEET
9	21	6:30	6:26	N	N/A	N	N/A	Y	10:45	0.19/0.19/0.19	15.69/15.69/15.69	319/320/323	TOTAL DEPTH = 20 FEET
10	24	9:30	9:24	N	N/A	N	N/A	Y	10:45	0.18/0.19/0.19	15.75/15.75/15.73	314/316/319	TOTAL DEPTH = 21 FEET

DELAWARE RIVER STATION: DR-04

Sampling Round	Sample Interval from Start of Rainfall (Hours)	Target Sample Collection Time (hh:mm)	Actual Sample Collection Time (hh:mm)	Duplicate Sample Collected? (Y/N)	Duplicate Collection Time (hh:mm)	Field Blank Sample Collected? (Y/N)	Field Blank Collection Time (hh:mm)	Chain of Custody Provided & Completed (Y/N)	Time Sample Transferred to Lab Courier (hh:mm)	Surface, Mid-depth & Bottom Water Salinity Reading(s) (%)	Surface, Mid-depth & Bottom Water Temperature Reading(s) (°C)	Surface, Mid-depth & Bottom Water Conductivity Reading(s) (umhos/cm)	Field Observations (see notes, below)
1	0	9:30	9:05	N	N/A	N	N/A	Y	10:38	0.18/0.18/0.18	15.97/15.95/15.95	306/308/309	TOTAL DEPTH = 14 FEET
2	2	11:30	11:00	N	N/A	N	N/A	Y	12:28	0.19/0.19/0.19	16.08/16.09/16.10	320/322/324	TOTAL DEPTH = 11 FEET
3	4	13:30	13:05	N	N/A	N	N/A	Y	15:35	0.18/0.18/0.18	15.91/15.92/15.92	311/312/312	TOTAL DEPTH = 8.5 FEET
4	6	15:30	15:30	N	N/A	N	N/A	Y	17:40	0.19/0.19/0.19	15.78/15.88/15.85	328/328/328	TOTAL DEPTH = 10 FEET
5	9	18:30	18:30	N	N/A	N	N/A	Y	19:30	0.19/0.19/0.19	15.81/15.82/15.83	327/327/328	TOTAL DEPTH = 9.3 FEET
6	12	21:30	21:40	N	N/A	N	N/A	Y	22:15	0.19/0.19/0.19	16.17/16.17/16.18	327/329/329	TOTAL DEPTH = 11.4 FEET
7	15	0:30	0:48	N	N/A	N	N/A	Y	3:52	0.18/0.18/0.18	16.02/16.02/16.01	313/313/313	TOTAL DEPTH = 19 FEET
8	18	3:30	3:37	N	N/A	N	N/A	Y	5:35	0.19/0.19/0.19	15.80/15.82/15.82	320/322/322	TOTAL DEPTH = 26 FEET
9	21	6:30	6:38	N	N/A	N	N/A	Y	10:45	0.19/0.19/0.19	15.66/15.66/15.67	329/331/331	TOTAL DEPTH = 24 FEET
10	24	9:30	9:40	N	N/A	N	N/A	Y	10:45	0.18/0.18/0.18	15.87/15.86/15.86	301/302/303	TOTAL DEPTH = 22 FEET

WET WEATHER EVENT: 3

DELAWARE RIVER STATION: DR-05

DATE: *5/22/2017* **Note Temperature of Receiving Stream if below 10 °C threshhold**

START OF RAINFALL TIME: *10:30*

Sampling Round	Sample Interval from Start of Rainfall (Hours)	Target Sample Collection Time (hh:mm)	Actual Sample Collection Time (hh:mm)	Duplicate Sample Collected? (Y/N)	Duplicate Collection Time (hh:mm)	Field Blank Sample Collected? (Y/N)	Field Blank Collection Time (hh:mm)	Chain of Custody Provided & Completed (Y/N)	Time Sample Transferred to Lab Courier (hh:mm)	Surface, Mid-depth & Bottom Water Salinity Reading(s) (%)	Surface, Mid-depth & Bottom Water Temperature Reading(s) (°C)	Surface, Mid-depth & Bottom Water Conductivity Reading(s) (umhos/cm)	Field Observations (see notes, below)
1	0	9:30	9:30	N	N/A	N	N/A	Y	10:38	0.18/0.18/0.18	16.15/16.15/16.10	312/317/318	TOTAL DEPTH = 9 FEET
2	2	11:30	11:20	N	N/A	N	N/A	Y	12:28	0.22/0.22/0.18	16.69/16.43/16.23	383/380/317	TOTAL DEPTH = 10 FEET
3	4	13:30	13:30	N	N/A	N	N/A	Y	15:35	0.18/0.18/0.18	15.94/15.94/15.94	307/308/310	TOTAL DEPTH = 11.6 FEET
4	6	15:30	15:35	N	N/A	N	N/A	Y	17:40	0.24/0.20/0.20	16.56/16.25/16.08	383/341/343	TOTAL DEPTH = 9.2 FEET
5	9	18:30	18:35	N	N/A	N	N/A	Y	19:30	0.19/0.19/0.19	16.84/16.40/16.39	334/340/343	TOTAL DEPTH = 11.3 FEET
6	12	21:30	21:45	N	N/A	N	N/A	Y	22:15	0.19/0.19/0.19	16.15/16.19/16.19	323/319/319	TOTAL DEPTH = 12.2 FEET
7	15	0:30	1:02	N	N/A	N	N/A	Y	3:52	0.18/0.18/0.18	16.04/16.04/16.03	313/313/313	TOTAL DEPTH = 16 FEET
8	18	3:30	3:50	N	N/A	N	N/A	Y	5:35	0.18/0.19/0.19	15.85/15.86/15.86	316/320/320	TOTAL DEPTH = 11 FEET
9	21	6:30	6:52	N	N/A	N	N/A	Y	10:45	0.20/0.20/0.19	16.33/15.88/15.75	345/335/325	TOTAL DEPTH = 10 FEET
10	24	9:30	9:53	N	N/A	N	N/A	Y	10:45	0.18/0.18/0.18	15.97/15.97/15.97	309/310/311	TOTAL DEPTH = 10 FEET
DELAWARE RIVER STATION: DR-06													
1	0	9:30	9:10	N	N/A	N	N/A	Y	10:38	0.17/0.17/0.18	15.81/15.84/15.85	295/300/300	TOTAL DEPTH = 28 FEET
2	2	11:30	11:05	N	N/A	N	N/A	Y	12:28	0.18/0.18/0.18	15.88/15.88/15.88	301/302/303	TOTAL DEPTH = 29 FEET
3	4	13:30	13:12	N	N/A	N	N/A	Y	15:35	0.17/0.17/0.17	15.82/15.84/15.85	298/299/299	TOTAL DEPTH = 25.1 FEET
4	6	15:30	14:55	N	N/A	N	N/A	Y	17:40	0.17/0.18/0.18	15.82/15.85/15.86	299/301/302	TOTAL DEPTH = 23.5 FEET
5	9	18:30	17:55	N	N/A	N	N/A	Y	19:30	0.17/0.17/0.17	15.73/15.71/15.70	293/294/294	TOTAL DEPTH = 24 FEET
6	12	21:30	20:55	N	N/A	N	N/A	Y	22:15	0.17/0.17/0.17	15.84/15.85/15.85	298/299/299	TOTAL DEPTH = 27 FEET
7	15	0:30	1:15	N	N/A	N	N/A	Y	3:52	0.18/0.18/0.18	15.92/15.91/15.91	303/303/303	TOTAL DEPTH = 24 FEET
8	18	3:30	4:03	N	N/A	N	N/A	Y	5:35	0.18/0.18/0.18	15.77/15.78/15.78	300/302/302	TOTAL DEPTH = 20 FEET
9	21	6:30	7:05	N	N/A	N	N/A	Y	10:45	0.18/0.18/0.18	15.72/15.72/15.72	299/300/301	TOTAL DEPTH = 24 FEET
10	24	9:30	10:05	N	N/A	N	N/A	Y	10:45	0.17/0.17/0.17	15.80/15.80/15.80	288/291/293	TOTAL DEPTH = 25 FEET
DELAWARE RIVER STATION: DR-07													
1	0	9:30	9:15	N	N/A	N	N/A	Y	10:38	0.18/0.18/0.18	15.77/15.77/15.77	300/300/300	TOTAL DEPTH = 5.5 FEET
2	2	11:30	11:10	N	N/A	N	N/A	Y	12:28	0.17/0.17/0.17	15.78/15.78/15.78	297/297/298	TOTAL DEPTH = 5 FEET
3	4	13:30	13:20	N	N/A	N	N/A	Y	15:35	0.17/0.17/0.17	15.77/15.77/15.77	299/299/299	TOTAL DEPTH = 4.1 FEET
4	6	15:30	15:00	N	N/A	N	N/A	Y	17:40	0.18/0.18/0.18	16.01/16.01/15.99	304/304/304	TOTAL DEPTH = 2.7 FEET
5	9	18:30	18:00	N	N/A	N	N/A	Y	19:30	0.18/0.18/0.18	15.89/15.89/15.89	300/300/300	TOTAL DEPTH = 1.5 FEET
6	12	21:30	21:00	N	N/A	N	N/A	Y	22:15	0.18/0.18/0.18	15.89/15.89/15.91	303/303/303	TOTAL DEPTH = 5 FEET
7	15	0:30	1:33	N	N/A	N	N/A	Y	3:52	0.18/0.18/0.18	15.94/15.93/15.93	303/303/303	TOTAL DEPTH = 6 FEET
8	18	3:30	4:16	N	N/A	N	N/A	Y	5:35	0.18/0.18/0.18	15.92/15.92/15.91	306/306/307	TOTAL DEPTH = 5 FEET
9	21	6:30	7:20	N	N/A	N	N/A	Y	10:45	0.18/0.18/0.18	15.68/15.67/15.67	301/301/302	TOTAL DEPTH = 5 FEET
10	24	9:30	10:17	N	N/A	N	N/A	Y	10:45	0.18/0.18/0.18	15.76/15.76/15.76	295/297/297	TOTAL DEPTH = 8 FEET

WET WEATHER EVENT: 3

CSO STATION: CSO-02

DATE: *5/22/2017* **Note Temperature of Receiving Stream if below 10 °C threshhold**

START OF RAINFALL TIME: *10:30*

Sampling Round	Sample Interval from Start of Rainfall (Hours)	Target Sample Collection Time (hh:mm)	Actual Sample Collection Time (hh:mm)	Duplicate Sample Collected? (Y/N)	Duplicate Collection Time (hh:mm)	Field Blank Sample Collected? (Y/N)	Field Blank Collection Time (hh:mm)	Chain of Custody Provided & Completed (Y/N)	Time Sample Transferred to Lab Courier (hh:mm)	Filed Observations (see notes, below)
1	T=0 (First Flush)	10:25	10:30	N	N/A	Y	10:31	Y	12:28	
2	30 Min	10:55	11:00	N	N/A	N	N/A	Y	12:28	
3	60 Min	11:25	11:30	N	N/A	N	N/A	Y	12:28	
4	2 Hours	0:25	0:40	N	N/A	N	N/A	Y	15:35	
5	4 Hours	14:25	-	-	-	-	-	-		NO OVERFLOW
6	8 Hours	18:25	-	-	-	-	-	-		NO OVERFLOW
7	12 Hours	22:25	-	-	-	-	-	-		NO OVERFLOW
8	24 Hours	10:25	-	-	-	-	-	-		NO OVERFLOW
CSO STATION: CSO-05										
1	T=0 (First Flush)	10:25	10:25	N	N/A	N	N/A	Y	12:28	
2	30 Min	10:55	11:05	N	N/A	N	N/A	Y	12:28	
3	60 Min	11:25	11:35	N	N/A	N	N/A	Y	12:28	
4	2 Hours	0:25	0:35	N	N/A	N	N/A	Y	15:35	
5	4 Hours	14:25	14:35	N	N/A	N	N/A	Y	15:35	
6	8 Hours	18:25	-	-	-	-	-	-		NO OVERFLOW
7	12 Hours	22:25	-	-	-	-	-	-		NO OVERFLOW
8	24 Hours	10:25	-	-	-	-	-	-		NO OVERFLOW
CSO STATION: CSO-18										
1	T=0 (First Flush)	10:45	10:45	N	N/A	N	N/A	Y	12:28	
2	30 Min	11:15	11:15	N	N/A	N	N/A	Y	12:28	
3	60 Min	11:45	0:05	N	N/A	Y	0:00	Y	12:28	
4	2 Hours	0:45	0:45	N	N/A	N	N/A	Y	15:35	
5	4 Hours	14:45	-	-	-	-	-	-		NO OVERFLOW at 14:45
6	8 Hours	18:45	-	-	-	-	-	-		NO OVERFLOW at 18:45
7	12 Hours	22:45	-	-	-	-	-	-		NO OVERFLOW at 22:45
8	24 Hours	10:45	-	-	-	-	-	-		NO OVERFLOW at 10:45
CSO STATION: CSO-19										
1	T=0 (First Flush)	10:45	11:00	N	N/A	N	N/A	Y	12:28	
2	30 Min	11:15	-	-	-	-	-	-		NO OVERFLOW at 11:25
3	60 Min	11:45	-	-	-	-	-	-		NO OVERFLOW at 12:15
4	2 Hours	0:45	0:55	Y	0:55	N	N/A	Y	15:35	
5	4 Hours	14:45	-	-	-	-	-	-		NO OVERFLOW at 14:45
6	8 Hours	18:45	-	-	-	-	-	-		NO OVERFLOW at 18:45
7	12 Hours	22:45	-	-	-	-	-	-		NO OVERFLOW at 22:45
8	24 Hours	10:45	-	-	-	-	-	-		NO OVERFLOW at 10:45

WET WEATHER EVENT: 3
STORM WATER STATION: SW-05A

DATE: *5/22/2017* **Note Temperature of Receiving Stream if below 10 ^{o}C threshhold**

START OF RAINFALL TIME: *10:30*

Sampling Round	Sample Interval from Start of Rainfall (Hours)	Target Sample Collection Time (hh:mm)	Actual Sample Collection Time (hh:mm)	Duplicate Sample Collected? (Y/N)	Duplicate Collection Time (hh:mm)	Field Blank Sample Collected? (Y/N)	Field Blank Collection Time (hh:mm)	Chain of Custody Provided & Completed (Y/N)	Time Sample Transferred to Lab Courier (hh:mm)	Filed Observations (see notes, below)
1	T=0 (First Flush)	10:30	10:40					Y	12:28	
2	30 Min	11:00	11:10					Y	12:28	
3	60 Min	11:30	11:40					Y	12:28	
4	2 Hours	0:30	0:40					Y	15:35	
5	4 Hours	14:30	14:40					Y	15:35	
6	8 Hours	18:30	-					-	-	NO FLOW OR VERY LESS FLOW TO SAMPLE
7	12 Hours	22:30	-					-	-	NO FLOW OR VERY LESS FLOW TO SAMPLE
8	24 Hours	10:30	-					-	-	NO FLOW OR VERY LESS FLOW TO SAMPLE
STORM WATER STATION: SW-SS2										
1	T=0 (First Flush)	10:30	10:30					Y	12:28	
2	30 Min	11:00	11:00					Y	12:28	
3	60 Min	11:30	11:30					Y	12:28	
4	2 Hours	0:30	0:30					Y	15:35	
5	4 Hours	14:30	14:30					Y	15:35	
6	8 Hours	18:30	-					-	-	NO FLOW OR VERY LESS FLOW TO SAMPLE
7	12 Hours	22:30	-					-	-	NO FLOW OR VERY LESS FLOW TO SAMPLE
8	24 Hours	10:30	-					-	-	NO FLOW OR VERY LESS FLOW TO SAMPLE

Login Number	Sample ID	Sample Date/Time	Parameter Stored	Method	Result (cfu/100 mL)	Analysis Date/Time	Tech Initials
L6810904-1	DR-01-1	05/22/17 09:20am	ENTEROCOCCUS-MF 24	EPA 1600	2 E	05/22/17 05:05PM	
L6810904-1	DR-01-1	05/22/17 09:20am	E. COLI-MF (1603)	EPA 1603	12E	05/22/17 05:04PM	
L6810904-1	DR-01-1	05/22/17 09:20am	FECAL COLIFORM-MF	SM 9222D	24E	05/22/17 05:04PM	
L6810904-2	DR-02-1	05/22/17 09:35am	ENTEROCOCCUS-MF 24	EPA 1600	14E	05/22/17 05:05PM	
L6810904-2	DR-02-1	05/22/17 09:35am	E. COLI-MF (1603)	EPA 1603	8E	05/22/17 05:04PM	
L6810904-2	DR-02-1	05/22/17 09:35am	FECAL COLIFORM-MF	SM 9222D	40	05/22/17 05:04PM	
L6810904-3	DR-03-1	05/22/17 09:50am	ENTEROCOCCUS-MF 24	EPA 1600	20E	05/22/17 05:05PM	
L6810904-3	DR-03-1	05/22/17 09:50am	E. COLI-MF (1603)	EPA 1603	12E	05/22/17 05:04PM	
L6810904-3	DR-03-1	05/22/17 09:50am	FECAL COLIFORM-MF	SM 9222D	32E	05/22/17 05:04PM	
L6810904-4	DR-04-1	05/22/17 09:05am	ENTEROCOCCUS-MF 24	EPA 1600	6E	05/22/17 05:05PM	
L6810904-4	DR-04-1	05/22/17 09:05am	E. COLI-MF (1603)	EPA 1603	3 E	05/22/17 05:04PM	
L6810904-4	DR-04-1	05/22/17 09:05am	FECAL COLIFORM-MF	SM 9222D	22	05/22/17 05:04PM	
L6810904-5	DR-05-1	05/22/17 09:30am	ENTEROCOCCUS-MF 24	EPA 1600	12E	05/22/17 05:05PM	
L6810904-5	DR-05-1	05/22/17 09:30am	E. COLI-MF (1603)	EPA 1603	6E	05/22/17 05:04PM	
L6810904-5	DR-05-1	05/22/17 09:30am	FECAL COLIFORM-MF	SM 9222D	12E	05/22/17 05:04PM	
L6810904-6	DR-06-1	05/22/17 09:10am	ENTEROCOCCUS-MF 24	EPA 1600	2 E	05/22/17 05:05PM	
L6810904-6	DR-06-1	05/22/17 09:10am	E. COLI-MF (1603)	EPA 1603	6E	05/22/17 05:04PM	
L6810904-6	DR-06-1	05/22/17 09:10am	FECAL COLIFORM-MF	SM 9222D	6E	05/22/17 05:04PM	
L6810904-7	DR-07-1	05/22/17 09:15am	ENTEROCOCCUS-MF 24	EPA 1600	6E	05/22/17 05:05PM	
L6810904-7	DR-07-1	05/22/17 09:15am	E. COLI-MF (1603)	EPA 1603	10E	05/22/17 05:04PM	
L6810904-7	DR-07-1	05/22/17 09:15am	FECAL COLIFORM-MF	SM 9222D	12E	05/22/17 05:04PM	
L6810904-8	BLANK 03	05/22/17 09:05am	ENTEROCOCCUS-MF 24	EPA 1600	<2	05/22/17 05:05PM	
L6810904-8	BLANK 03	05/22/17 09:05am	E. COLI-MF (1603)	EPA 1603	<2	05/22/17 05:04PM	
L6810904-8	BLANK 03	05/22/17 09:05am	FECAL COLIFORM-MF	SM 9222D	<2	05/22/17 05:04PM	
L6810904-9	CSO-05-1	05/22/17 10:25am	ENTEROCOCCUS-MF 24	EPA 1600	476000E	05/22/17 06:24PM	
L6810904-9	CSO-05-1	05/22/17 10:25am	E. COLI-MF (1603)	EPA 1603	920000E	05/22/17 06:21PM	
L6810904-9	CSO-05-1	05/22/17 10:25am	FECAL COLIFORM-MF	SM 9222D	1080000E	05/22/17 06:23PM	
L6810904-10	CSO-02-1	05/22/17 10:30am	ENTEROCOCCUS-MF 24	EPA 1600	558000E	05/22/17 06:24PM	
L6810904-10	CSO-02-1	05/22/17 10:30am	E. COLI-MF (1603)	EPA 1603	730000E	05/22/17 06:21PM	
L6810904-10	CSO-02-1	05/22/17 10:30am	FECAL COLIFORM-MF	SM 9222D	170000E	05/22/17 06:23PM	
L6810904-11	BLANK 04	05/22/17 10:31am	ENTEROCOCCUS-MF 24	EPA 1600	<10	05/22/17 06:24PM	
L6810904-11	BLANK 04	05/22/17 10:31am	E. COLI-MF (1603)	EPA 1603	<10	05/22/17 06:21PM	
L6810904-11	BLANK 04	05/22/17 10:31am	FECAL COLIFORM-MF	SM 9222D	<10	05/22/17 06:23PM	
L6810904-12	SW-SS2-1	05/22/17 10:31am	ENTEROCOCCUS-MF 24	EPA 1600	505000E	05/22/17 06:24PM	
L6810904-12	SW-SS2-1	05/22/17 10:31am	E. COLI-MF (1603)	EPA 1603	49000	05/22/17 06:21PM	
L6810904-12	SW-SS2-1	05/22/17 10:31am	FECAL COLIFORM-MF	SM 9222D	21000	05/22/17 06:23PM	
L6810904-13	SW-05A-1	05/22/17 10:40am	ENTEROCOCCUS-MF 24	EPA 1600	82000E	05/22/17 06:24PM	
L6810904-13	SW-05A-1	05/22/17 10:40am	E. COLI-MF (1603)	EPA 1603	20000	05/22/17 06:21PM	
L6810904-13	SW-05A-1	05/22/17 10:40am	FECAL COLIFORM-MF	SM 9222D	35000	05/22/17 06:23PM	
L6810904-14	SW-SS2-2	05/22/17 11:00am	ENTEROCOCCUS-MF 24	EPA 1600	177000E	05/22/17 06:24PM	
L6810904-14	SW-SS2-2	05/22/17 11:00am	E. COLI-MF (1603)	EPA 1603	21000	05/22/17 06:21PM	
L6810904-14	SW-SS2-2	05/22/17 11:00am	FECAL COLIFORM-MF	SM 9222D	19000E	05/22/17 06:23PM	
L6810904-15	SW-05A-2	05/22/17 11:10am	ENTEROCOCCUS-MF 24	EPA 1600	148000E	05/22/17 06:24PM	
L6810904-15	SW-05A-2	05/22/17 11:10am	E. COLI-MF (1603)	EPA 1603	20000	05/22/17 06:21PM	
L6810904-15	SW-05A-2	05/22/17 11:10am	FECAL COLIFORM-MF	SM 9222D	18000E	05/22/17 06:23PM	
L6810904-16	SW-05A-3	05/22/17 11:40am	ENTEROCOCCUS-MF 24	EPA 1600	129000E	05/22/17 06:24PM	
L6810904-16	SW-05A-3	05/22/17 11:40am	E. COLI-MF (1603)	EPA 1603	9000E	05/22/17 06:21PM	
L6810904-16	SW-05A-3	05/22/17 11:40am	FECAL COLIFORM-MF	SM 9222D	21000	05/22/17 06:23PM	

Login Number	Sample ID	Sample Date/Time	Parm Stored	Method	Result (cfu/100 mL)	Analysis Date/Time	
L6810904-17	SW-SS2-3	05/22/17 11:30am	ENTEROCOCCUS-MF 24	EPA 1600	185000E	05/22/17 06:24PM	
L6810904-17	SW-SS2-3	05/22/17 11:30am	E. COLI-MF (1603)	EPA 1603	32000	05/22/17 06:21PM	
L6810904-17	SW-SS2-3	05/22/17 11:30am	FECAL COLIFORM-MF	SM 9222D	23000	05/22/17 06:23PM	
L6810904-18	CC-03	05/22/17 10:42am	ENTEROCOCCUS-MF 24	EPA 1600	270	05/22/17 06:24PM	
L6810904-18	CC-03	05/22/17 10:42am	E. COLI-MF (1603)	EPA 1603	60E	05/22/17 06:21PM	
L6810904-18	CC-03	05/22/17 10:42am	FECAL COLIFORM-MF	SM 9222D	60E	05/22/17 06:23PM	
L6810904-19	RC-03	05/22/17 10:56am	ENTEROCOCCUS-MF 24	EPA 1600	20E	05/22/17 06:24PM	
L6810904-19	RC-03	05/22/17 10:56am	E. COLI-MF (1603)	EPA 1603	160E	05/22/17 06:21PM	
L6810904-19	RC-03	05/22/17 10:56am	FECAL COLIFORM-MF	SM 9222D	210	05/22/17 06:23PM	
L6810904-20	RC-02	05/22/17 11:07am	ENTEROCOCCUS-MF 24	EPA 1600	10000E	05/22/17 06:24PM	
L6810904-20	RC-02	05/22/17 11:07am	E. COLI-MF (1603)	EPA 1603	87000 E	05/22/17 06:54PM	
L6810904-20	RC-02	05/22/17 11:07am	FECAL COLIFORM-MF	SM 9222D	103000E	05/22/17 06:23PM	
L6810904-21	RC-01	05/22/17 11:23am	ENTEROCOCCUS-MF 24	EPA 1600	14000E	05/22/17 06:24PM	
L6810904-21	RC-01	05/22/17 11:23am	E. COLI-MF (1603)	EPA 1603	5300	05/22/17 06:21PM	
L6810904-21	RC-01	05/22/17 11:23am	FECAL COLIFORM-MF	SM 9222D	4200	05/22/17 06:23PM	
L6810904-22	CC-01	05/22/17 11:42am	ENTEROCOCCUS-MF 24	EPA 1600	14000E	05/22/17 06:24PM	
L6810904-22	CC-01	05/22/17 11:42am	E. COLI-MF (1603)	EPA 1603	1600E	05/22/17 06:21PM	
L6810904-22	CC-01	05/22/17 11:42am	FECAL COLIFORM-MF	SM 9222D	2600	05/22/17 06:23PM	
L6810904-23	CC-02	05/22/17 11:54am	ENTEROCOCCUS-MF 24	EPA 1600	660E	05/22/17 06:24PM	
L6810904-23	CC-02	05/22/17 11:54am	E. COLI-MF (1603)	EPA 1603	700E	05/22/17 06:21PM	
L6810904-23	CC-02	05/22/17 11:54am	FECAL COLIFORM-MF	SM 9222D	1600E	05/22/17 06:23PM	
L6810904-24	BLANK 01	05/22/17 12:00pm	ENTEROCOCCUS-MF 24	EPA 1600	<10	05/22/17 06:24PM	
L6810904-24	BLANK 01	05/22/17 12:00pm	E. COLI-MF (1603)	EPA 1603	<10	05/22/17 06:21PM	
L6810904-24	BLANK 01	05/22/17 12:00pm	FECAL COLIFORM-MF	SM 9222D	<10	05/22/17 06:23PM	
L6810904-25	CSO-18-1	05/22/17 10:45am	ENTEROCOCCUS-MF 24	EPA 1600	116000E	05/22/17 06:24PM	
L6810904-25	CSO-18-1	05/22/17 10:45am	E. COLI-MF (1603)	EPA 1603	441000E	05/22/17 06:21PM	
L6810904-25	CSO-18-1	05/22/17 10:45am	FECAL COLIFORM-MF	SM 9222D	42000	05/22/17 06:23PM	
L6810904-26	CSO-19-1	05/22/17 11:00am	ENTEROCOCCUS-MF 24	EPA 1600	267000E	05/22/17 06:24PM	
L6810904-26	CSO-19-1	05/22/17 11:00am	E. COLI-MF (1603)	EPA 1603	730000E	05/22/17 06:21PM	
L6810904-26	CSO-19-1	05/22/17 11:00am	FECAL COLIFORM-MF	SM 9222D	122000E	05/22/17 06:23PM	
L6810904-27	CSO-02-2	05/22/17 11:00am	ENTEROCOCCUS-MF 24	EPA 1600	238000E	05/22/17 06:24PM	
L6810904-27	CSO-02-2	05/22/17 11:00am	E. COLI-MF (1603)	EPA 1603	209000 E	05/22/17 06:54PM	
L6810904-27	CSO-02-2	05/22/17 11:00am	FECAL COLIFORM-MF	SM 9222D	126000E	05/22/17 06:23PM	
L6810904-28	CSO-05-2	05/22/17 11:05am	ENTEROCOCCUS-MF 24	EPA 1600	147000E	05/22/17 06:24PM	
L6810904-28	CSO-05-2	05/22/17 11:05am	E. COLI-MF (1603)	EPA 1603	135000 E	05/22/17 06:54PM	
L6810904-28	CSO-05-2	05/22/17 11:05am	FECAL COLIFORM-MF	SM 9222D	92000E	05/22/17 06:23PM	
L6810904-29	DR-01-2	05/22/17 11:10am	ENTEROCOCCUS-MF 24	EPA 1600	4E	05/22/17 06:24PM	
L6810904-29	DR-01-2	05/22/17 11:10am	E. COLI-MF (1603)	EPA 1603	10 E	05/22/17 06:54PM	
L6810904-29	DR-01-2	05/22/17 11:10am	FECAL COLIFORM-MF	SM 9222D	30E	05/22/17 06:23PM	
L6810904-30	DR-02-2	05/22/17 11:15am	ENTEROCOCCUS-MF 24	EPA 1600	4 Q, E	05/22/17 08:18PM	
L6810904-30	DR-02-2	05/22/17 11:15am	E. COLI-MF (1603)	EPA 1603	<2	05/22/17 06:54PM	
L6810904-30	DR-02-2	05/22/17 11:15am	FECAL COLIFORM-MF	SM 9222D	26E	05/22/17 06:23PM	
L6810904-31	DR-03-2	05/22/17 11:25am	ENTEROCOCCUS-MF 24	EPA 1600	4E	05/22/17 06:24PM	
L6810904-31	DR-03-2	05/22/17 11:25am	E. COLI-MF (1603)	EPA 1603	2 E, Q	05/22/17 07:40PM	
L6810904-31	DR-03-2	05/22/17 11:25am	FECAL COLIFORM-MF	SM 9222D	6E	05/22/17 06:23PM	
L6810904-32	DR-04-2	05/22/17 11:00am	ENTEROCOCCUS-MF 24	EPA 1600	4E	05/22/17 06:24PM	
L6810904-32	DR-04-2	05/22/17 11:00am	E. COLI-MF (1603)	EPA 1603	12 E, Q	05/22/17 07:40PM	
L6810904-32	DR-04-2	05/22/17 11:00am	FECAL COLIFORM-MF	SM 9222D	24E	05/22/17 06:23PM	
L6810904-33	DR-05-2	05/22/17 11:20am	ENTEROCOCCUS-MF 24	EPA 1600	32E	05/22/17 06:24PM	
L6810904-33	DR-05-2	05/22/17 11:20am	E. COLI-MF (1603)	EPA 1603	4E	05/22/17 06:54PM	
L6810904-33	DR-05-2	05/22/17 11:20am	FECAL COLIFORM-MF	SM 9222D	34E	05/22/17 06:23PM	

Login Number	Sample ID	Sample Date/Time	Parm Stored	Method	Result (cfu/100 mL)	Analysis Date/Time	
L6810904-34	DR-06-2	05/22/17 11:05am	ENTEROCOCCUS-MF 24	EPA 1600	2 E, Q	05/22/17 08:18PM	
L6810904-34	DR-06-2	05/22/17 11:05am	E. COLI-MF (1603)	EPA 1603	6 E, Q	05/22/17 07:40PM	
L6810904-34	DR-06-2	05/22/17 11:05am	FECAL COLIFORM-MF	SM 9222D	4E	05/22/17 06:23PM	
L6810904-35	DR-07-2	05/22/17 11:10am	ENTEROCOCCUS-MF 24	EPA 1600	10E	05/22/17 06:24PM	
L6810904-35	DR-07-2	05/22/17 11:10am	E. COLI-MF (1603)	EPA 1603	10E	05/22/17 06:21PM	
L6810904-35	DR-07-2	05/22/17 11:10am	FECAL COLIFORM-MF	SM 9222D	4E	05/22/17 06:23PM	
L6810904-36	BLANK 02	05/22/17 11:05am	ENTEROCOCCUS-MF 24	EPA 1600	650E	05/22/17 06:24PM	
L6810904-36	BLANK 02	05/22/17 11:05am	E. COLI-MF (1603)	EPA 1603	<2 Q	05/22/17 07:40PM	
L6810904-36	BLANK 02	05/22/17 11:05am	FECAL COLIFORM-MF	SM 9222D	<2	05/22/17 06:23PM	
L6810904-37	CSO-18-1	05/22/17 11:15am	ENTEROCOCCUS-MF 24	EPA 1600	72000E	05/22/17 06:24PM	
L6810904-37	CSO-18-1	05/22/17 11:15am	E. COLI-MF (1603)	EPA 1603	101000 E, Q	05/22/17 07:40PM	
L6810904-37	CSO-18-1	05/22/17 11:15am	FECAL COLIFORM-MF	SM 9222D	71000E	05/22/17 06:23PM	
L6810904-38	CSO-02-3	05/22/17 11:30am	ENTEROCOCCUS-MF 24	EPA 1600	920000E	05/22/17 06:24PM	
L6810904-38	CSO-02-3	05/22/17 11:30am	E. COLI-MF (1603)	EPA 1603	1030000 E, Q	05/22/17 07:40PM	
L6810904-38	CSO-02-3	05/22/17 11:30am	FECAL COLIFORM-MF	SM 9222D	>60000	05/22/17 07:28PM	
L6810904-39	CSO-05-3	05/22/17 11:35am	ENTEROCOCCUS-MF 24	EPA 1600	141000 E, Q	05/22/17 08:18PM	
L6810904-39	CSO-05-3	05/22/17 11:35am	E. COLI-MF (1603)	EPA 1603	401000 Q,E	05/22/17 07:40PM	
L6810904-39	CSO-05-3	05/22/17 11:35am	FECAL COLIFORM-MF	SM 9222D	110000 E	05/22/17 07:28PM	
L6810904-40	BLANK-05	05/22/17 12:00pm	ENTEROCOCCUS-MF 24	EPA 1600	<10	05/22/17 06:24PM	
L6810904-40	BLANK-05	05/22/17 12:00pm	E. COLI-MF (1603)	EPA 1603	10 E, Q	05/22/17 07:40PM	
L6810904-40	BLANK-05	05/22/17 12:00pm	FECAL COLIFORM-MF	SM 9222D	<10	05/22/17 07:28PM	
L6810904-41	CSO-18-3	05/22/17 12:05pm	ENTEROCOCCUS-MF 24	EPA 1600	33000	05/22/17 06:24PM	
L6810904-41	CSO-18-3	05/22/17 12:05pm	E. COLI-MF (1603)	EPA 1603	76000 E, Q	05/22/17 07:40PM	
L6810904-41	CSO-18-3	05/22/17 12:05pm	FECAL COLIFORM-MF	SM 9222D	88000E	05/22/17 06:23PM	
L6810904-42	SW-SS2-4	05/22/17 12:30pm	ENTEROCOCCUS-MF 24	EPA 1600	137000E	05/22/17 08:18PM	
L6810904-42	SW-SS2-4	05/22/17 12:30pm	E. COLI-MF (1603)	EPA 1603	21000 Q	05/22/17 08:16PM	
L6810904-42	SW-SS2-4	05/22/17 12:30pm	FECAL COLIFORM-MF	SM 9222D	21000	05/22/17 07:28PM	
L6810904-43	SW-05A-4	05/22/17 12:40pm	ENTEROCOCCUS-MF 24	EPA 1600	172000E	05/22/17 08:18PM	
L6810904-43	SW-05A-4	05/22/17 12:40pm	E. COLI-MF (1603)	EPA 1603	156000 E, Q	05/22/17 08:16PM	
L6810904-43	SW-05A-4	05/22/17 12:40pm	FECAL COLIFORM-MF	SM 9222D	81000 E	05/22/17 07:28PM	
L6810904-44	CSO-05-4	05/22/17 12:35pm	ENTEROCOCCUS-MF 24	EPA 1600	98000E	05/22/17 08:18PM	
L6810904-44	CSO-05-4	05/22/17 12:35pm	E. COLI-MF (1603)	EPA 1603	205000 E, Q	05/22/17 08:16PM	
L6810904-44	CSO-05-4	05/22/17 12:35pm	FECAL COLIFORM-MF	SM 9222D	114000 E	05/22/17 07:28PM	
L6810904-45	CSO-02-4	05/22/17 12:40pm	ENTEROCOCCUS-MF 24	EPA 1600	304000E	05/22/17 08:18PM	
L6810904-45	CSO-02-4	05/22/17 12:40pm	E. COLI-MF (1603)	EPA 1603	290000 E, Q	05/22/17 08:16PM	
L6810904-45	CSO-02-4	05/22/17 12:40pm	FECAL COLIFORM-MF	SM 9222D	117000 E	05/22/17 07:28PM	
L6810904-46	CSO-18-4	05/22/17 12:45pm	ENTEROCOCCUS-MF 24	EPA 1600	40000	05/22/17 08:18PM	
L6810904-46	CSO-18-4	05/22/17 12:45pm	E. COLI-MF (1603)	EPA 1603	255000 E, Q	05/22/17 08:16PM	
L6810904-46	CSO-18-4	05/22/17 12:45pm	FECAL COLIFORM-MF	SM 9222D	79000 E	05/22/17 07:28PM	
L6810904-47	CSO-19-2	05/22/17 12:55pm	ENTEROCOCCUS-MF 24	EPA 1600	130000E	05/22/17 08:18PM	
L6810904-47	CSO-19-2	05/22/17 12:55pm	E. COLI-MF (1603)	EPA 1603	300000 E, Q	05/22/17 08:16PM	
L6810904-47	CSO-19-2	05/22/17 12:55pm	FECAL COLIFORM-MF	SM 9222D	156000 E	05/22/17 07:28PM	
L6810904-48	DUP-CSO	05/22/17 12:55pm	ENTEROCOCCUS-MF 24	EPA 1600	188000E	05/22/17 08:18PM	
L6810904-48	DUP-CSO	05/22/17 12:55pm	E. COLI-MF (1603)	EPA 1603	241000 Q, E	05/22/17 08:16PM	
L6810904-48	DUP-CSO	05/22/17 12:55pm	FECAL COLIFORM-MF	SM 9222D	155000 E	05/22/17 07:28PM	
L6810904-49	DR-01-3	05/22/17 01:15pm	ENTEROCOCCUS-MF 24	EPA 1600	5 E	05/22/17 08:18PM	
L6810904-49	DR-01-3	05/22/17 01:15pm	E. COLI-MF (1603)	EPA 1603	12 E, Q	05/22/17 08:16PM	
L6810904-49	DR-01-3	05/22/17 01:15pm	FECAL COLIFORM-MF	SM 9222D	32 E	05/22/17 07:28PM	
L6810904-50	DR-02-3	05/22/17 01:20pm	ENTEROCOCCUS-MF 24	EPA 1600	26E	05/22/17 08:18PM	
L6810904-50	DR-02-3	05/22/17 01:20pm	E. COLI-MF (1603)	EPA 1603	30 E, Q	05/22/17 08:16PM	
L6810904-50	DR-02-3	05/22/17 01:20pm	FECAL COLIFORM-MF	SM 9222D	50 E	05/22/17 07:28PM	

Login Number	Sample ID	Sample Date/Time	Parm Stored	Method	Result (cfu/100 mL)	Analysis Date/Time	
L6810904-51	DR-03-3	05/22/17 01:30pm	ENTEROCOCCUS-MF 24	EPA 1600	20E	05/22/17 08:18PM	
L6810904-51	DR-03-3	05/22/17 01:30pm	E. COLI-MF (1603)	EPA 1603	32 E, Q	05/22/17 08:16PM	
L6810904-51	DR-03-3	05/22/17 01:30pm	FECAL COLIFORM-MF	SM 9222D	38 E	05/22/17 07:28PM	
L6810904-52	DUP-DR1	05/22/17 01:15pm	ENTEROCOCCUS-MF 24	EPA 1600	10E	05/22/17 08:18PM	
L6810904-52	DUP-DR1	05/22/17 01:15pm	E. COLI-MF (1603)	EPA 1603	20 E, Q	05/22/17 08:16PM	
L6810904-52	DUP-DR1	05/22/17 01:15pm	FECAL COLIFORM-MF	SM 9222D	58	05/22/17 07:28PM	
L6810904-53	DR-04-3	05/22/17 00:00pm	ENTEROCOCCUS-MF 24	EPA 1600	4 E, Q	05/22/17 08:18PM	
L6810904-53	DR-04-3	05/22/17 00:00pm	E. COLI-MF (1603)	EPA 1603	8 E, Q	05/22/17 08:16PM	
L6810904-53	DR-04-3	05/22/17 00:00pm	FECAL COLIFORM-MF	SM 9222D	46 Q	05/22/17 07:28PM	
L6810904-54	DR-05-3	05/22/17 00:00pm	ENTEROCOCCUS-MF 24	EPA 1600	58 Q	05/22/17 08:18PM	
L6810904-54	DR-05-3	05/22/17 00:00pm	E. COLI-MF (1603)	EPA 1603	86 Q	05/22/17 08:16PM	
L6810904-54	DR-05-3	05/22/17 00:00pm	FECAL COLIFORM-MF	SM 9222D	250 Q	05/22/17 07:28PM	
L6810904-55	DR-06-3	05/22/17 00:00pm	ENTEROCOCCUS-MF 24	EPA 1600	2 E	05/22/17 08:18PM	
L6810904-55	DR-06-3	05/22/17 00:00pm	E. COLI-MF (1603)	EPA 1603	8 Q, E	05/22/17 08:16PM	
L6810904-55	DR-06-3	05/22/17 00:00pm	FECAL COLIFORM-MF	SM 9222D	6 Q, E	05/22/17 07:28PM	
L6810904-56	DR-07-3	05/22/17 00:00pm	ENTEROCOCCUS-MF 24	EPA 1600	410 Q	05/22/17 08:18PM	
L6810904-56	DR-07-3	05/22/17 00:00pm	E. COLI-MF (1603)	EPA 1603	490 Q	05/22/17 08:16PM	
L6810904-56	DR-07-3	05/22/17 00:00pm	FECAL COLIFORM-MF	SM 9222D	480 Q	05/22/17 07:28PM	
L6810904-57	CSO-05-5	05/22/17 02:35pm	ENTEROCOCCUS-MF 24	EPA 1600	191000E	05/22/17 08:18PM	
L6810904-57	CSO-05-5	05/22/17 02:35pm	E. COLI-MF (1603)	EPA 1603	1780000 E, Q	05/22/17 08:16PM	
L6810904-57	CSO-05-5	05/22/17 02:35pm	FECAL COLIFORM-MF	SM 9222D	266000 E	05/22/17 07:28PM	
L6810904-58	SW-SS2-5	05/22/17 02:30pm	ENTEROCOCCUS-MF 24	EPA 1600	121000E	05/22/17 08:18PM	
L6810904-58	SW-SS2-5	05/22/17 02:30pm	E. COLI-MF (1603)	EPA 1603	8546 Q	05/22/17 08:16PM	
L6810904-58	SW-SS2-5	05/22/17 02:30pm	FECAL COLIFORM-MF	SM 9222D	21000	05/22/17 07:28PM	
L6810904-59	SW-05A-5	05/22/17 02:40pm	ENTEROCOCCUS-MF 24	EPA 1600	19000E	05/22/17 08:18PM	
L6810904-59	SW-05A-5	05/22/17 02:40pm	E. COLI-MF (1603)	EPA 1603	8000 Q	05/22/17 08:16PM	
L6810904-59	SW-05A-5	05/22/17 02:40pm	FECAL COLIFORM-MF	SM 9222D	32000	05/22/17 07:28PM	
L6810904-60	CC-03	05/22/17 02:40pm	ENTEROCOCCUS-MF 24	EPA 1600	11000E	05/22/17 10:17PM	
L6810904-60	CC-03	05/22/17 02:40pm	E. COLI-MF (1603)	EPA 1603	22000	05/22/17 10:26PM	
L6810904-60	CC-03	05/22/17 02:40pm	FECAL COLIFORM-MF	SM 9222D	10000E	05/22/17 10:39PM	
L6810904-61	RC-03	05/22/17 02:50pm	ENTEROCOCCUS-MF 24	EPA 1600	1700E	05/22/17 10:17PM	
L6810904-61	RC-03	05/22/17 02:50pm	E. COLI-MF (1603)	EPA 1603	2900	05/22/17 10:26PM	
L6810904-61	RC-03	05/22/17 02:50pm	FECAL COLIFORM-MF	SM 9222D	2100	05/22/17 10:39PM	
L6810904-62	RC-02	05/22/17 03:05pm	ENTEROCOCCUS-MF 24	EPA 1600	1000E	05/22/17 10:17PM	
L6810904-62	RC-02	05/22/17 03:05pm	E. COLI-MF (1603)	EPA 1603	2800	05/22/17 10:26PM	
L6810904-62	RC-02	05/22/17 03:05pm	FECAL COLIFORM-MF	SM 9222D	2400	05/22/17 10:39PM	
L6810904-63	RC-01	05/22/17 03:18pm	ENTEROCOCCUS-MF 24	EPA 1600	2000	05/22/17 10:17PM	
L6810904-63	RC-01	05/22/17 03:18pm	E. COLI-MF (1603)	EPA 1603	870E	05/22/17 10:26PM	
L6810904-63	RC-01	05/22/17 03:18pm	FECAL COLIFORM-MF	SM 9222D	480	05/22/17 10:39PM	
L6810904-64	CC-07	05/22/17 03:40pm	ENTEROCOCCUS-MF 24	EPA 1600	3000	05/22/17 10:17PM	
L6810904-64	CC-07	05/22/17 03:40pm	E. COLI-MF (1603)	EPA 1603	1000E	05/22/17 10:26PM	
L6810904-64	CC-07	05/22/17 03:40pm	FECAL COLIFORM-MF	SM 9222D	1700E	05/22/17 10:39PM	
L6810904-65	CC-02	05/22/17 03:50pm	ENTEROCOCCUS-MF 24	EPA 1600	5000	05/22/17 10:17PM	
L6810904-65	CC-02	05/22/17 03:50pm	E. COLI-MF (1603)	EPA 1603	4900	05/22/17 10:26PM	
L6810904-65	CC-02	05/22/17 03:50pm	FECAL COLIFORM-MF	SM 9222D	2400	05/22/17 10:39PM	
L6810904-66	DUPLICATE-CC	05/22/17 00:00pm	ENTEROCOCCUS-MF 24	EPA 1600	6000 Q	05/22/17 10:17PM	
L6810904-66	DUPLICATE-CC	05/22/17 00:00pm	E. COLI-MF (1603)	EPA 1603	4800 Q	05/22/17 10:26PM	
L6810904-66	DUPLICATE-CC	05/22/17 00:00pm	FECAL COLIFORM-MF	SM 9222D	4000 Q	05/22/17 10:39PM	
L6810904-67	DUPLICATE-RC	05/22/17 00:00pm	ENTEROCOCCUS-MF 24	EPA 1600	2200 Q	05/22/17 10:17PM	
L6810904-67	DUPLICATE-RC	05/22/17 00:00pm	E. COLI-MF (1603)	EPA 1603	4400 Q	05/22/17 10:26PM	
L6810904-67	DUPLICATE-RC	05/22/17 00:00pm	FECAL COLIFORM-MF	SM 9222D	2600 Q	05/22/17 10:39PM	

Login Number	Sample ID	Sample Date/Time	Parm Stored	Method	Result (cfu/100 mL)	Analysis Date/Time	
L6810904-68	DR-01-4	05/22/17 03:15pm	ENTEROCOCCUS-MF 24	EPA 1600	46	05/22/17 10:17PM	
L6810904-68	DR-01-4	05/22/17 03:15pm	E. COLI-MF (1603)	EPA 1603	64	05/22/17 10:26PM	
L6810904-68	DR-01-4	05/22/17 03:15pm	FECAL COLIFORM-MF	SM 9222D	26E	05/22/17 10:39PM	
L6810904-69	DR-02-4	05/22/17 03:20pm	ENTEROCOCCUS-MF 24	EPA 1600	4E	05/22/17 10:17PM	
L6810904-69	DR-02-4	05/22/17 03:20pm	E. COLI-MF (1603)	EPA 1603	24E	05/22/17 10:26PM	
L6810904-69	DR-02-4	05/22/17 03:20pm	FECAL COLIFORM-MF	SM 9222D	18E	05/22/17 10:39PM	
L6810904-70	DR-03-4	05/22/17 03:25pm	ENTEROCOCCUS-MF 24	EPA 1600	58	05/22/17 10:17PM	
L6810904-70	DR-03-4	05/22/17 03:25pm	E. COLI-MF (1603)	EPA 1603	142	05/22/17 10:26PM	
L6810904-70	DR-03-4	05/22/17 03:25pm	FECAL COLIFORM-MF	SM 9222D	72	05/22/17 10:39PM	
L6810904-71	DR-04-4	05/22/17 03:30pm	ENTEROCOCCUS-MF 24	EPA 1600	100E	05/22/17 10:17PM	
L6810904-71	DR-04-4	05/22/17 03:30pm	E. COLI-MF (1603)	EPA 1603	270	05/22/17 10:26PM	
L6810904-71	DR-04-4	05/22/17 03:30pm	FECAL COLIFORM-MF	SM 9222D	180E	05/22/17 10:39PM	
L6810904-72	DR-05-4	05/22/17 03:35pm	ENTEROCOCCUS-MF 24	EPA 1600	1600E	05/22/17 10:17PM	
L6810904-72	DR-05-4	05/22/17 03:35pm	E. COLI-MF (1603)	EPA 1603	16E	05/22/17 10:26PM	
L6810904-72	DR-05-4	05/22/17 03:35pm	FECAL COLIFORM-MF	SM 9222D	42	05/22/17 10:39PM	
L6810904-73	DR-06-4	05/22/17 02:55pm	ENTEROCOCCUS-MF 24	EPA 1600	2 E	05/22/17 10:17PM	
L6810904-73	DR-06-4	05/22/17 02:55pm	E. COLI-MF (1603)	EPA 1603	10 E	05/22/17 10:26PM	
L6810904-73	DR-06-4	05/22/17 02:55pm	FECAL COLIFORM-MF	SM 9222D	<2	05/22/17 10:39PM	
L6810904-74	DR-07-4	05/22/17 03:00pm	ENTEROCOCCUS-MF 24	EPA 1600	130E	05/22/17 10:17PM	
L6810904-74	DR-07-4	05/22/17 03:00pm	E. COLI-MF (1603)	EPA 1603	260	05/22/17 10:26PM	
L6810904-74	DR-07-4	05/22/17 03:00pm	FECAL COLIFORM-MF	SM 9222D	290	05/22/17 10:39PM	
L6810904-75	DR-06-5	05/22/17 05:55pm	ENTEROCOCCUS-MF 24	EPA 1600	2E	05/22/17 11:55PM	
L6810904-75	DR-06-5	05/22/17 05:55pm	E. COLI-MF (1603)	EPA 1603	4E	05/22/17 10:26PM	
L6810904-75	DR-06-5	05/22/17 05:55pm	FECAL COLIFORM-MF	SM 9222D	2E	05/22/17 10:39PM	
L6810904-76	DR-07-5	05/22/17 06:00pm	ENTEROCOCCUS-MF 24	EPA 1600	14E	05/22/17 11:55PM	
L6810904-76	DR-07-5	05/22/17 06:00pm	E. COLI-MF (1603)	EPA 1603	24E	05/22/17 10:26PM	
L6810904-76	DR-07-5	05/22/17 06:00pm	FECAL COLIFORM-MF	SM 9222D	32E	05/22/17 10:39PM	
L6810904-77	DR-01-5	05/22/17 06:15pm	ENTEROCOCCUS-MF 24	EPA 1600	66	05/22/17 11:55PM	
L6810904-77	DR-01-5	05/22/17 06:15pm	E. COLI-MF (1603)	EPA 1603	50	05/22/17 10:26PM	
L6810904-77	DR-01-5	05/22/17 06:15pm	FECAL COLIFORM-MF	SM 9222D	36E	05/22/17 10:39PM	
L6810904-78	DR-02-5	05/22/17 06:20pm	ENTEROCOCCUS-MF 24	EPA 1600	30 E	05/22/17 11:55PM	
L6810904-78	DR-02-5	05/22/17 06:20pm	E. COLI-MF (1603)	EPA 1603	24E	05/22/17 10:26PM	
L6810904-78	DR-02-5	05/22/17 06:20pm	FECAL COLIFORM-MF	SM 9222D	20E	05/22/17 10:39PM	
L6810904-79	DR-03-5	05/22/17 06:25pm	ENTEROCOCCUS-MF 24	EPA 1600	124E	05/22/17 11:55PM	
L6810904-79	DR-03-5	05/22/17 06:25pm	E. COLI-MF (1603)	EPA 1603	300	05/22/17 10:26PM	
L6810904-79	DR-03-5	05/22/17 06:25pm	FECAL COLIFORM-MF	SM 9222D	190E	05/22/17 10:39PM	
L6810904-80	DR-04-5	05/22/17 06:30pm	ENTEROCOCCUS-MF 24	EPA 1600	112	05/22/17 11:55PM	
L6810904-80	DR-04-5	05/22/17 06:30pm	E. COLI-MF (1603)	EPA 1603	340	05/22/17 10:26PM	
L6810904-80	DR-04-5	05/22/17 06:30pm	FECAL COLIFORM-MF	SM 9222D	310	05/22/17 10:39PM	
L6810904-81	DR-05-5	05/22/17 06:35pm	ENTEROCOCCUS-MF 24	EPA 1600	280E	05/22/17 11:55PM	
L6810904-81	DR-05-5	05/22/17 06:35pm	E. COLI-MF (1603)	EPA 1603	280	05/22/17 10:26PM	
L6810904-81	DR-05-5	05/22/17 06:35pm	FECAL COLIFORM-MF	SM 9222D	340	05/22/17 10:39PM	
L6810904-82	RC-01-03	05/22/17 06:40pm	ENTEROCOCCUS-MF 24	EPA 1600	600	05/22/17 10:17PM	
L6810904-82	RC-01-03	05/22/17 06:40pm	E. COLI-MF (1603)	EPA 1603	300	05/22/17 10:26PM	
L6810904-82	RC-01-03	05/22/17 06:40pm	FECAL COLIFORM-MF	SM 9222D	370	05/22/17 10:39PM	
L6810904-83	RC-02-03	05/22/17 06:18pm	ENTEROCOCCUS-MF 24	EPA 1600	2600	05/22/17 11:55PM	
L6810904-83	RC-02-03	05/22/17 06:18pm	E. COLI-MF (1603)	EPA 1603	840E	05/22/17 10:26PM	
L6810904-83	RC-02-03	05/22/17 06:18pm	FECAL COLIFORM-MF	SM 9222D	800E	05/22/17 10:39PM	
L6810904-84	RC-03-03	05/22/17 06:12pm	ENTEROCOCCUS-MF 24	EPA 1600	4200	05/22/17 10:17PM	
L6810904-84	RC-03-03	05/22/17 06:12pm	E. COLI-MF (1603)	EPA 1603	1900E	05/22/17 10:26PM	
L6810904-84	RC-03-03	05/22/17 06:12pm	FECAL COLIFORM-MF	SM 9222D	1000E	05/22/17 10:39PM	

Login Number	Sample ID	Sample Date/Time	Parm Stored	Method	Result (cfu/100 mL)	Analysis Date/Time	
L6810904-85	CC-01-03	05/22/17 06:46pm	ENTEROCOCCUS-MF 24	EPA 1600	1500E	05/22/17 11:55PM	
L6810904-85	CC-01-03	05/22/17 06:46pm	E. COLI-MF (1603)	EPA 1603	610	05/22/17 10:26PM	
L6810904-85	CC-01-03	05/22/17 06:46pm	FECAL COLIFORM-MF	SM 9222D	550	05/22/17 10:39PM	
L6810904-86	CC-02-03	05/22/17 07:00pm	ENTEROCOCCUS-MF 24	EPA 1600	2000	05/22/17 10:17PM	
L6810904-86	CC-02-03	05/22/17 07:00pm	E. COLI-MF (1603)	EPA 1603	2500	05/22/17 10:26PM	
L6810904-86	CC-02-03	05/22/17 07:00pm	FECAL COLIFORM-MF	SM 9222D	2000	05/22/17 10:39PM	
L6810904-87	CC-03-03	05/22/17 06:00pm	ENTEROCOCCUS-MF 24	EPA 1600	4800	05/22/17 11:55PM	
L6810904-87	CC-03-03	05/22/17 06:00pm	E. COLI-MF (1603)	EPA 1603	8500E	05/22/17 10:26PM	
L6810904-87	CC-03-03	05/22/17 06:00pm	FECAL COLIFORM-MF	SM 9222D	18000E	05/22/17 10:39PM	
L6810904-88	DR-01-06	05/22/17 09:15pm	ENTEROCOCCUS-MF 24	EPA 1600	76	05/22/17 11:55PM	
L6810904-88	DR-01-06	05/22/17 09:15pm	E. COLI-MF (1603)	EPA 1603	353	05/22/17 11:44PM	
L6810904-88	DR-01-06	05/22/17 09:15pm	FECAL COLIFORM-MF	SM 9222D	70	05/22/17 11:47PM	
L6810904-89	DR-02-06	05/22/17 09:25pm	ENTEROCOCCUS-MF 24	EPA 1600	72	05/22/17 11:55PM	
L6810904-89	DR-02-06	05/22/17 09:25pm	E. COLI-MF (1603)	EPA 1603	162E	05/22/17 11:44PM	
L6810904-89	DR-02-06	05/22/17 09:25pm	FECAL COLIFORM-MF	SM 9222D	210	05/22/17 11:47PM	
L6810904-90	DR-03-06	05/22/17 09:30pm	ENTEROCOCCUS-MF 24	EPA 1600	116	05/22/17 11:55PM	
L6810904-90	DR-03-06	05/22/17 09:30pm	E. COLI-MF (1603)	EPA 1603	200	05/22/17 11:44PM	
L6810904-90	DR-03-06	05/22/17 09:30pm	FECAL COLIFORM-MF	SM 9222D	160E	05/22/17 11:47PM	
L6810904-91	DR-04-06	05/22/17 09:40pm	ENTEROCOCCUS-MF 24	EPA 1600	260	05/22/17 11:55PM	
L6810904-91	DR-04-06	05/22/17 09:40pm	E. COLI-MF (1603)	EPA 1603	132	05/22/17 11:44PM	
L6810904-91	DR-04-06	05/22/17 09:40pm	FECAL COLIFORM-MF	SM 9222D	180E	05/22/17 11:47PM	
L6810904-92	DR-05-06	05/22/17 09:45pm	ENTEROCOCCUS-MF 24	EPA 1600	100	05/22/17 11:55PM	
L6810904-92	DR-05-06	05/22/17 09:45pm	E. COLI-MF (1603)	EPA 1603	124	05/22/17 11:44PM	
L6810904-92	DR-05-06	05/22/17 09:45pm	FECAL COLIFORM-MF	SM 9222D	280	05/22/17 11:47PM	
L6810904-93	DR-06-06	05/22/17 08:55pm	ENTEROCOCCUS-MF 24	EPA 1600	2E	05/22/17 11:55PM	
L6810904-93	DR-06-06	05/22/17 08:55pm	E. COLI-MF (1603)	EPA 1603	4E	05/22/17 11:44PM	
L6810904-93	DR-06-06	05/22/17 08:55pm	FECAL COLIFORM-MF	SM 9222D	6E	05/22/17 11:47PM	
L6810904-94	DR-07-06	05/22/17 09:00pm	ENTEROCOCCUS-MF 24	EPA 1600	4E	05/22/17 11:55PM	
L6810904-94	DR-07-06	05/22/17 09:00pm	E. COLI-MF (1603)	EPA 1603	8E	05/22/17 11:44PM	
L6810904-94	DR-07-06	05/22/17 09:00pm	FECAL COLIFORM-MF	SM 9222D	2E	05/22/17 11:47PM	
L6810904-95	DUP-DR	05/22/17 00:00pm	ENTEROCOCCUS-MF 24	EPA 1600	102 Q	05/22/17 11:55PM	
L6810904-95	DUP-DR	05/22/17 00:00pm	E. COLI-MF (1603)	EPA 1603	152 Q	05/22/17 11:44PM	
L6810904-95	DUP-DR	05/22/17 00:00pm	FECAL COLIFORM-MF	SM 9222D	140 E, Q	05/22/17 11:47PM	
L6810904-96	DR-01-07	05/23/17 12:05am	ENTEROCOCCUS-MF 24	EPA 1600	24E	05/23/17 07:33AM	
L6810904-96	DR-01-07	05/23/17 12:05am	E. COLI-MF (1603)	EPA 1603	18E	05/23/17 07:08AM	
L6810904-96	DR-01-07	05/23/17 12:05am	FECAL COLIFORM-MF	SM 9222D	18E	05/23/17 07:53AM	
L6810904-97	DR-02-07	05/23/17 12:20am	ENTEROCOCCUS-MF 24	EPA 1600	10E	05/23/17 07:33AM	
L6810904-97	DR-02-07	05/23/17 12:20am	E. COLI-MF (1603)	EPA 1603	6E	05/23/17 07:08AM	
L6810904-97	DR-02-07	05/23/17 12:20am	FECAL COLIFORM-MF	SM 9222D	22E	05/23/17 07:53AM	
L6810904-98	DR-03-07	05/23/17 12:34am	ENTEROCOCCUS-MF 24	EPA 1600	38E	05/23/17 07:33AM	
L6810904-98	DR-03-07	05/23/17 12:34am	E. COLI-MF (1603)	EPA 1603	34E	05/23/17 07:08AM	
L6810904-98	DR-03-07	05/23/17 12:34am	FECAL COLIFORM-MF	SM 9222D	42	05/23/17 07:53AM	
L6810904-99	DR-04-07	05/23/17 12:48am	ENTEROCOCCUS-MF 24	EPA 1600	4E	05/23/17 07:33AM	
L6810904-99	DR-04-07	05/23/17 12:48am	E. COLI-MF (1603)	EPA 1603	5 E	05/23/17 07:08AM	
L6810904-99	DR-04-07	05/23/17 12:48am	FECAL COLIFORM-MF	SM 9222D	16E	05/23/17 07:53AM	
L6810904-100	DR-05-07	05/23/17 01:02am	ENTEROCOCCUS-MF 24	EPA 1600	56	05/23/17 07:33AM	
L6810904-100	DR-05-07	05/23/17 01:02am	E. COLI-MF (1603)	EPA 1603	12E	05/23/17 07:08AM	
L6810904-100	DR-05-07	05/23/17 01:02am	FECAL COLIFORM-MF	SM 9222D	22E	05/23/17 07:53AM	
L6810904-101	DR-06-07	05/23/17 01:15am	ENTEROCOCCUS-MF 24	EPA 1600	8E	05/23/17 07:33AM	
L6810904-101	DR-06-07	05/23/17 01:15am	E. COLI-MF (1603)	EPA 1603	6E	05/23/17 07:08AM	
L6810904-101	DR-06-07	05/23/17 01:15am	FECAL COLIFORM-MF	SM 9222D	10E	05/23/17 07:53AM	

Login Number	Sample ID	Sample Date/Time	Parm Stored	Method	Result (cfu/100 mL)	Analysis Date/Time	
L6810904-102	DR-07-07	05/23/17 01:33am	ENTEROCOCCUS-MF 24	EPA 1600	2E	05/23/17 07:33AM	
L6810904-102	DR-07-07	05/23/17 01:33am	E. COLI-MF (1603)	EPA 1603	6E	05/23/17 07:08AM	
L6810904-102	DR-07-07	05/23/17 01:33am	FECAL COLIFORM-MF	SM 9222D	80	05/23/17 07:53AM	
L6810904-103	RC-01-04	05/23/17 01:50am	ENTEROCOCCUS-MF 24	EPA 1600	170E	05/23/17 07:33AM	
L6810904-103	RC-01-04	05/23/17 01:50am	E. COLI-MF (1603)	EPA 1603	76	05/23/17 07:08AM	
L6810904-103	RC-01-04	05/23/17 01:50am	FECAL COLIFORM-MF	SM 9222D	108	05/23/17 07:53AM	
L6810904-104	RC-02-04	05/23/17 01:35am	ENTEROCOCCUS-MF 24	EPA 1600	580	05/23/17 07:33AM	
L6810904-104	RC-02-04	05/23/17 01:35am	E. COLI-MF (1603)	EPA 1603	300	05/23/17 07:08AM	
L6810904-104	RC-02-04	05/23/17 01:35am	FECAL COLIFORM-MF	SM 9222D	440	05/23/17 07:53AM	
L6810904-105	RC-03-04	05/23/17 01:20am	ENTEROCOCCUS-MF 24	EPA 1600	1200E	05/23/17 07:33AM	
L6810904-105	RC-03-04	05/23/17 01:20am	E. COLI-MF (1603)	EPA 1603	1900E	05/23/17 07:08AM	
L6810904-105	RC-03-04	05/23/17 01:20am	FECAL COLIFORM-MF	SM 9222D	1800E	05/23/17 07:53AM	
L6810904-106	CC-01-04	05/23/17 02:17am	ENTEROCOCCUS-MF 24	EPA 1600	520	05/23/17 07:33AM	
L6810904-106	CC-01-04	05/23/17 02:17am	E. COLI-MF (1603)	EPA 1603	170E	05/23/17 07:08AM	
L6810904-106	CC-01-04	05/23/17 02:17am	FECAL COLIFORM-MF	SM 9222D	380	05/23/17 07:53AM	
L6810904-107	CC-02-04	05/23/17 02:05am	ENTEROCOCCUS-MF 24	EPA 1600	600	05/23/17 07:33AM	
L6810904-107	CC-02-04	05/23/17 02:05am	E. COLI-MF (1603)	EPA 1603	470	05/23/17 07:08AM	
L6810904-107	CC-02-04	05/23/17 02:05am	FECAL COLIFORM-MF	SM 9222D	350	05/23/17 07:53AM	
L6810904-108	CC-03-04	05/23/17 01:05am	ENTEROCOCCUS-MF 24	EPA 1600	1700E	05/23/17 07:33AM	
L6810904-108	CC-03-04	05/23/17 01:05am	E. COLI-MF (1603)	EPA 1603	2700E	05/23/17 07:08AM	
L6810904-108	CC-03-04	05/23/17 01:05am	FECAL COLIFORM-MF	SM 9222D	3800	05/23/17 07:53AM	
L6810904-109	DR-02-08	05/23/17 03:15am	ENTEROCOCCUS-MF 24	EPA 1600	70E	05/23/17 10:18AM	
L6810904-109	DR-02-08	05/23/17 03:15am	E. COLI-MF (1603)	EPA 1603	50E	05/23/17 10:32AM	
L6810904-109	DR-02-08	05/23/17 03:15am	FECAL COLIFORM-MF	SM 9222D	9 E	05/23/17 10:54AM	
L6810904-110	DR-03-08	05/23/17 03:25am	ENTEROCOCCUS-MF 24	EPA 1600	68	05/23/17 10:18AM	
L6810904-110	DR-03-08	05/23/17 03:25am	E. COLI-MF (1603)	EPA 1603	116	05/23/17 10:32AM	
L6810904-110	DR-03-08	05/23/17 03:25am	FECAL COLIFORM-MF	SM 9222D	1000 E	05/23/17 10:54AM	
L6810904-111	DR-04-08	05/23/17 03:37am	ENTEROCOCCUS-MF 24	EPA 1600	70	05/23/17 10:18AM	
L6810904-111	DR-04-08	05/23/17 03:37am	E. COLI-MF (1603)	EPA 1603	118	05/23/17 10:32AM	
L6810904-111	DR-04-08	05/23/17 03:37am	FECAL COLIFORM-MF	SM 9222D	250	05/23/17 10:54AM	
L6810904-112	DR-05-08	05/23/17 03:50am	ENTEROCOCCUS-MF 24	EPA 1600	110	05/23/17 10:18AM	
L6810904-112	DR-05-08	05/23/17 03:50am	E. COLI-MF (1603)	EPA 1603	260	05/23/17 10:32AM	
L6810904-112	DR-05-08	05/23/17 03:50am	FECAL COLIFORM-MF	SM 9222D	310	05/23/17 10:54AM	
L6810904-113	DR-06-08	05/23/17 04:03am	ENTEROCOCCUS-MF 24	EPA 1600	6E	05/23/17 10:18AM	
L6810904-113	DR-06-08	05/23/17 04:03am	E. COLI-MF (1603)	EPA 1603	4E	05/23/17 10:32AM	
L6810904-113	DR-06-08	05/23/17 04:03am	FECAL COLIFORM-MF	SM 9222D	5 E	05/23/17 10:54AM	
L6810904-114	DR-07-08	05/23/17 04:16am	ENTEROCOCCUS-MF 24	EPA 1600	14E	05/23/17 10:18AM	
L6810904-114	DR-07-08	05/23/17 04:16am	E. COLI-MF (1603)	EPA 1603	28E	05/23/17 10:32AM	
L6810904-114	DR-07-08	05/23/17 04:16am	FECAL COLIFORM-MF	SM 9222D	24E	05/23/17 10:54AM	
L6810904-115	DR-01-09	05/23/17 06:00am	ENTEROCOCCUS-MF 24	EPA 1600	10E	05/23/17 01:29PM	
L6810904-115	DR-01-09	05/23/17 06:00am	E. COLI-MF (1603)	EPA 1603	8E	05/23/17 01:26PM	
L6810904-115	DR-01-09	05/23/17 06:00am	FECAL COLIFORM-MF	SM 9222D	32 Q, E	05/23/17 02:22PM	
L6810904-116	DR-02-09	05/23/17 06:13am	ENTEROCOCCUS-MF 24	EPA 1600	40	05/23/17 01:29PM	
L6810904-116	DR-02-09	05/23/17 06:13am	E. COLI-MF (1603)	EPA 1603	68	05/23/17 01:26PM	
L6810904-116	DR-02-09	05/23/17 06:13am	FECAL COLIFORM-MF	SM 9222D	46	05/23/17 02:22PM	
L6810904-117	DR-03-09	05/23/17 06:26am	ENTEROCOCCUS-MF 24	EPA 1600	92	05/23/17 01:29PM	
L6810904-117	DR-03-09	05/23/17 06:26am	E. COLI-MF (1603)	EPA 1603	62	05/23/17 01:26PM	
L6810904-117	DR-03-09	05/23/17 06:26am	FECAL COLIFORM-MF	SM 9222D	88	05/23/17 02:22PM	
L6810904-118	DR-04-09	05/23/17 06:38am	ENTEROCOCCUS-MF 24	EPA 1600	86	05/23/17 01:29PM	
L6810904-118	DR-04-09	05/23/17 06:38am	E. COLI-MF (1603)	EPA 1603	122	05/23/17 01:26PM	
L6810904-118	DR-04-09	05/23/17 06:38am	FECAL COLIFORM-MF	SM 9222D	78	05/23/17 02:22PM	

Login Number	Sample ID	Sample Date/Time	Parm Stored	Method	Result (cfu/100 mL)	Analysis Date/Time	
L6810904-119	DR-05-09	05/23/17 06:52am	ENTEROCOCCUS-MF 24	EPA 1600	90	05/23/17 01:29PM	
L6810904-119	DR-05-09	05/23/17 06:52am	E. COLI-MF (1603)	EPA 1603	128	05/23/17 01:26PM	
L6810904-119	DR-05-09	05/23/17 06:52am	FECAL COLIFORM-MF	SM 9222D	180E	05/23/17 02:22PM	
L6810904-120	DR-06-09	05/23/17 07:05am	ENTEROCOCCUS-MF 24	EPA 1600	8E	05/23/17 01:29PM	
L6810904-120	DR-06-09	05/23/17 07:05am	E. COLI-MF (1603)	EPA 1603	16E	05/23/17 01:26PM	
L6810904-120	DR-06-09	05/23/17 07:05am	FECAL COLIFORM-MF	SM 9222D	26E	05/23/17 02:22PM	
L6810904-121	DR-07-09	05/23/17 07:20am	ENTEROCOCCUS-MF 24	EPA 1600	6E	05/23/17 01:29PM	
L6810904-121	DR-07-09	05/23/17 07:20am	E. COLI-MF (1603)	EPA 1603	16E	05/23/17 01:26PM	
L6810904-121	DR-07-09	05/23/17 07:20am	FECAL COLIFORM-MF	SM 9222D	16E	05/23/17 02:22PM	
L6810904-122	DR-01-10	05/23/17 09:00am	ENTEROCOCCUS-MF 24	EPA 1600	16E	05/23/17 01:29PM	
L6810904-122	DR-01-10	05/23/17 09:00am	E. COLI-MF (1603)	EPA 1603	24E	05/23/17 01:26PM	
L6810904-122	DR-01-10	05/23/17 09:00am	FECAL COLIFORM-MF	SM 9222D	44	05/23/17 02:22PM	
L6810904-123	DR-02-10	05/23/17 09:12am	ENTEROCOCCUS-MF 24	EPA 1600	42	05/23/17 01:29PM	
L6810904-123	DR-02-10	05/23/17 09:12am	E. COLI-MF (1603)	EPA 1603	68	05/23/17 01:26PM	
L6810904-123	DR-02-10	05/23/17 09:12am	FECAL COLIFORM-MF	SM 9222D	42	05/23/17 02:22PM	
L6810904-124	DR-03-10	05/23/17 09:24am	ENTEROCOCCUS-MF 24	EPA 1600	50	05/23/17 01:29PM	
L6810904-124	DR-03-10	05/23/17 09:24am	E. COLI-MF (1603)	EPA 1603	90	05/23/17 01:26PM	
L6810904-124	DR-03-10	05/23/17 09:24am	FECAL COLIFORM-MF	SM 9222D	92	05/23/17 02:22PM	
L6810904-125	DR-04-10	05/23/17 09:40am	ENTEROCOCCUS-MF 24	EPA 1600	22E	05/23/17 01:29PM	
L6810904-125	DR-04-10	05/23/17 09:40am	E. COLI-MF (1603)	EPA 1603	32E	05/23/17 01:26PM	
L6810904-125	DR-04-10	05/23/17 09:40am	FECAL COLIFORM-MF	SM 9222D	26E	05/23/17 02:22PM	
L6810904-126	DR-05-10	05/23/17 09:53am	ENTEROCOCCUS-MF 24	EPA 1600	16E	05/23/17 01:29PM	
L6810904-126	DR-05-10	05/23/17 09:53am	E. COLI-MF (1603)	EPA 1603	38E	05/23/17 01:26PM	
L6810904-126	DR-05-10	05/23/17 09:53am	FECAL COLIFORM-MF	SM 9222D	112	05/23/17 02:22PM	
L6810904-127	DR-06-10	05/23/17 10:05am	ENTEROCOCCUS-MF 24	EPA 1600	2E	05/23/17 01:29PM	
L6810904-127	DR-06-10	05/23/17 10:05am	E. COLI-MF (1603)	EPA 1603	2E	05/23/17 01:26PM	
L6810904-127	DR-06-10	05/23/17 10:05am	FECAL COLIFORM-MF	SM 9222D	6E	05/23/17 02:22PM	
L6810904-128	DR-07-10	05/23/17 10:17am	ENTEROCOCCUS-MF 24	EPA 1600	4E	05/23/17 01:29PM	
L6810904-128	DR-07-10	05/23/17 10:17am	E. COLI-MF (1603)	EPA 1603	12E	05/23/17 01:26PM	
L6810904-128	DR-07-10	05/23/17 10:17am	FECAL COLIFORM-MF	SM 9222D	6E	05/23/17 02:22PM	
L6810904-129	CC-01-05	05/23/17 10:20am	ENTEROCOCCUS-MF 24	EPA 1600	170E	05/23/17 01:29PM	
L6810904-129	CC-01-05	05/23/17 10:20am	E. COLI-MF (1603)	EPA 1603	240	05/23/17 01:26PM	
L6810904-129	CC-01-05	05/23/17 10:20am	FECAL COLIFORM-MF	SM 9222D	220	05/23/17 02:22PM	
L6810904-130	CC-02-05	05/23/17 10:05am	ENTEROCOCCUS-MF 24	EPA 1600	400	05/23/17 01:29PM	
L6810904-130	CC-02-05	05/23/17 10:05am	E. COLI-MF (1603)	EPA 1603	610	05/23/17 01:26PM	
L6810904-130	CC-02-05	05/23/17 10:05am	FECAL COLIFORM-MF	SM 9222D	1200E	05/23/17 02:22PM	
L6810904-131	CC-03-05	05/23/17 09:05am	ENTEROCOCCUS-MF 24	EPA 1600	50	05/23/17 01:29PM	
L6810904-131	CC-03-05	05/23/17 09:05am	E. COLI-MF (1603)	EPA 1603	112	05/23/17 01:26PM	
L6810904-131	CC-03-05	05/23/17 09:05am	FECAL COLIFORM-MF	SM 9222D	190E	05/23/17 02:22PM	
L6810904-132	RC-01-05	05/23/17 09:50am	ENTEROCOCCUS-MF 24	EPA 1600	40	05/23/17 01:29PM	
L6810904-132	RC-01-05	05/23/17 09:50am	E. COLI-MF (1603)	EPA 1603	56	05/23/17 01:26PM	
L6810904-132	RC-01-05	05/23/17 09:50am	FECAL COLIFORM-MF	SM 9222D	44	05/23/17 02:22PM	
L6810904-133	RC-02-05	05/23/17 09:35am	ENTEROCOCCUS-MF 24	EPA 1600	280	05/23/17 01:29PM	
L6810904-133	RC-02-05	05/23/17 09:35am	E. COLI-MF (1603)	EPA 1603	200	05/23/17 01:26PM	
L6810904-133	RC-02-05	05/23/17 09:35am	FECAL COLIFORM-MF	SM 9222D	230	05/23/17 02:22PM	
L6810904-134	RC-03-05	05/23/17 09:22am	ENTEROCOCCUS-MF 24	EPA 1600	64	05/23/17 01:29PM	
L6810904-134	RC-03-05	05/23/17 09:22am	E. COLI-MF (1603)	EPA 1603	84	05/23/17 01:26PM	
L6810904-134	RC-03-05	05/23/17 09:22am	FECAL COLIFORM-MF	SM 9222D	136E	05/23/17 02:22PM	

APPENDIX G

SAMPLE COLLECTION MATRIX

Dry Weather Event										Field Measurement Water Depth			Field Duplicate Locations			
Water Body	Location	# Rounds	Round Notes	No. Samples/ Event	No. of Field Duplicates/ Event	No. of Field Blanks/ Event	Lab Analytes	Field Measurements	Surface	Mid-depth	Bottom	# Lab Samples/Event	Dry 1 Field Duplicate Locations	Dry 2 Field Duplicate Locations	Dry 3 Field Duplicate Locations	Notes
Chester Creek	CC-01	2	Incoming & outgoing tide	2	1	1 See notes column	E. coli, Enterococcus, Fecal coliform	Salinity, Temperature, Conductivity (surface water depth)	X			8	CC-01 outgoing tide			Prepare field blank at first sampling location for each event, regardless of tide condition.
Chester Creek	CC-02	2	Incoming & outgoing tide	2			E. coli, Enterococcus, Fecal coliform	Salinity, Temperature, Conductivity (surface water depth)	X					CC-02 outgoing tide		
Chester Creek	CC-03	2	Incoming & outgoing tide	2			E. coli, Enterococcus, Fecal coliform	Salinity, Temperature, Conductivity (surface water depth)	X						CC-03 incoming tide	
Ridley Creek	RC-01	2	Incoming & outgoing tide	2	1	none	E. coli, Enterococcus, Fecal coliform	Salinity, Temperature, Conductivity (surface water depth)	X			7			RC-01 outgoing tide	
Ridley Creek	RC-02	2	Incoming & outgoing tide	2		none	E. coli, Enterococcus, Fecal coliform	Salinity, Temperature, Conductivity (surface water depth)	X					RC-02 incoming tide		
Ridley Creek	RC-03	2	Incoming & outgoing tide	2		none	E. coli, Enterococcus, Fecal coliform	Salinity, Temperature, Conductivity (surface water depth)	X				RC-03 incoming tide			
Delaware River	DR-01	2	Incoming & outgoing tide	2	1	1 See notes column	E. coli, Enterococcus, Fecal coliform	Salinity, Temperature, Conductivity (at surface water, mid, near bottom depths)	X	X	X	12				
Delaware River	DR-02	2	Incoming & outgoing tide	2			E. coli, Enterococcus, Fecal coliform	Salinity, Temperature, Conductivity (at surface water, mid, near bottom depths)	X	X	X		DR-02 outgoing tide			
Delaware River	DR-03	2	Incoming & outgoing tide	2			E. coli, Enterococcus, Fecal coliform	Salinity, Temperature, Conductivity (at surface water, mid, near bottom depths)	X	X	X				DR-03 outgoing tide	
Delaware River	DR-04	2	Incoming & outgoing tide	2			E. coli, Enterococcus, Fecal coliform	Salinity, Temperature, Conductivity (at surface water, mid, near bottom depths)	X	X	X			DR-04 incoming tide		
Delaware River	DR-05	2	Incoming & outgoing tide	2			E. coli, Enterococcus, Fecal coliform	Salinity, Temperature, Conductivity (at surface water, mid, near bottom depths)	X	X	X					
Delaware River	DR-06		not sampled				none	none				none				
Delaware River	DR-07		not sampled				none	none				none				
Outfall (combined sewer)	CSO-02		not sampled				none	none				none				
Outfall (combined sewer)	CSO-05		not sampled				none	none				none				
Outfall (combined sewer)	CSO-18		not sampled				none	none				none				
Outfall (combined sewer)	CSO-19		not sampled				none	none				none				
Outfall (storm water)	SW-05A		not sampled				none	none				none				
Outfall (storm water)	SW-SS2		not sampled				none	none				none				

Wet Weather Event									Field Measurement Water Depth			Field Duplicate Locations				
Water Body	Location	# Rounds	Sample Collection Times/Intervals from T=0 (hours)	No. Samples/ Event	No. of Field Duplicates/ Event	No. of Field Blanks/ Event	Lab Analytes	Field Measurements	Surface	Mid-depth	Bottom	per event	Wet 1 Field Duplicate Locations	Wet 2 Field Duplicate Locations	Wet 3 Field Duplicate Locations	Notes
Chester Creek	CC-01	5	0.5-2.5, 4.5-6.5, 8.5-10.5, 14.5-16.5, 22-24	5	1	1 See notes column	E. coli, Enterococcus, Fecal coliform	Salinity, Temperature, Conductivity (surface water depth)	x			17		CC-01 HR 8.5-10.5		Prepare field blank at first sampling location for each event, regardless of tide condition.
Chester Creek	CC-02	5	0.5-2.5, 4.5-6.5, 8.5-10.5, 14.5-16.5, 22-24	5			E. coli, Enterococcus, Fecal coliform	Salinity, Temperature, Conductivity (surface water depth)	x						CC-02 HR 4.5-6.5	
Chester Creek	CC-03	5	0.5-2.5, 4.5-6.5, 8.5-10.5, 14.5-16.5, 22-24	5			E. coli, Enterococcus, Fecal coliform	Salinity, Temperature, Conductivity (surface water depth)	x				CC-03 HR0.5-2.5			
Ridley Creek	RC-01	5	0.5-2.5, 4.5-6.5, 8.5-10.5, 14.5-16.5, 22-24	5	1	1 See notes column	E. coli, Enterococcus, Fecal coliform	Salinity, Temperature, Conductivity (surface water depth)	x			17	RC-01 HR 14.5-16.5			
Ridley Creek	RC-02	5	0.5-2.5, 4.5-6.5, 8.5-10.5, 14.5-16.5, 22-24	5			E. coli, Enterococcus, Fecal coliform	Salinity, Temperature, Conductivity (surface water depth)	x					RC-02 HR0.5-2.5		
Ridley Creek	RC-03	5	0.5-2.5, 4.5-6.5, 8.5-10.5, 14.5-16.5, 22-24	5			E. coli, Enterococcus, Fecal coliform	Salinity, Temperature, Conductivity (surface water depth)	x						RC-03 HR4.5-6.5	
Delaware River	DR-01	10	0, 2, 4, 6, 9, 12, 15, 18, 21, 24	10	2	1 See notes column	E. coli, Enterococcus, Fecal coliform	Salinity, Temperature, Conductivity (at surface water, mid, near bottom depths)	x	x	x	73		DR-01 HR 9		
Delaware River	DR-02	10	0, 2, 4, 6, 9, 12, 15, 18, 21, 24	10			E. coli, Enterococcus, Fecal coliform	Salinity, Temperature, Conductivity (at surface water, mid, near bottom depths)	x	x	x		DR-02 HR 2			
Delaware River	DR-03	10	0, 2, 4, 6, 9, 12, 15, 18, 21, 24	10			E. coli, Enterococcus, Fecal coliform	Salinity, Temperature, Conductivity (at surface water, mid, near bottom depths)	x	x	x			DR-03 HR 21	DR-03 HR 4	
Delaware River	DR-04	10	0, 2, 4, 6, 9, 12, 15, 18, 21, 24	10			E. coli, Enterococcus, Fecal coliform	Salinity, Temperature, Conductivity (at surface water, mid, near bottom depths)	x	x	x		DR-04 HR 15			
Delaware River	DR-05	10	0, 2, 4, 6, 9, 12, 15, 18, 21, 24	10			E. coli, Enterococcus, Fecal coliform	Salinity, Temperature, Conductivity (at surface water, mid, near bottom depths)	x	x	x				DR-05 HR 12	
Delaware River	DR-06	10	0, 2, 4, 6, 9, 12, 15, 18, 21, 24	10			E. coli, Enterococcus, Fecal coliform	Salinity, Temperature, Conductivity (at surface water, mid, near bottom depths)	x	x	x					
Delaware River	DR-07	10	0, 2, 4, 6, 9, 12, 15, 18, 21, 24	10			E. coli, Enterococcus, Fecal coliform	Salinity, Temperature, Conductivity (at surface water, mid, near bottom depths)	x	x	x					
Outfall (combined sewer)	CSO-02	8	0, 0.5, 1, 2, 4, 8, 12, 24	8 max	1	1 Same location as field duplicate, See notes column	E. coli, Enterococcus, Fecal coliform	none				34	CSO-02 HR 1			Prepare field blank at same location as field duplicate. Prepare field blank once crew arrives at sampling location.
Outfall (combined sewer)	CSO-05	8	0, 0.5, 1, 2, 4, 8, 12, 24	8 max			E. coli, Enterococcus, Fecal coliform	none								
Outfall (combined sewer)	CSO-18	8	0, 0.5, 1, 2, 4, 8, 12, 24	8 max			E. coli, Enterococcus, Fecal coliform	none						CSO-18 HR 1		
Outfall (combined sewer)	CSO-19	8	0, 0.5, 1, 2, 4, 8, 12, 24	8 max			E. coli, Enterococcus, Fecal coliform	none							CSO-19 HR 1	
Outfall (storm water)	SW-05A	8	0, 0.5, 1, 2, 4, 8, 12, 24	8 max	0	0	E. coli, Enterococcus, Fecal coliform	none				16				
Outfall (storm water)	SW-SS2	8	0, 0.5, 1, 2, 4, 8, 12, 24	8 max	0	0	E. coli, Enterococcus, Fecal coliform	none								

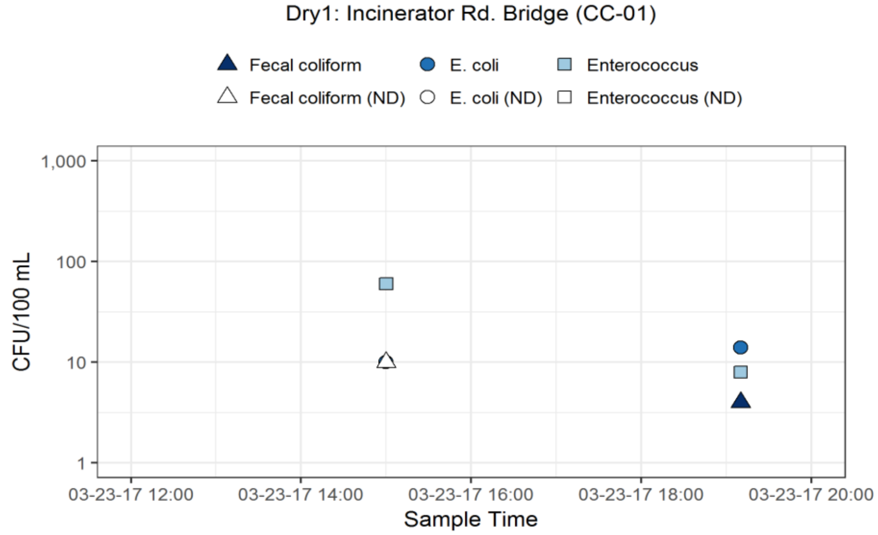
APPENDIX H

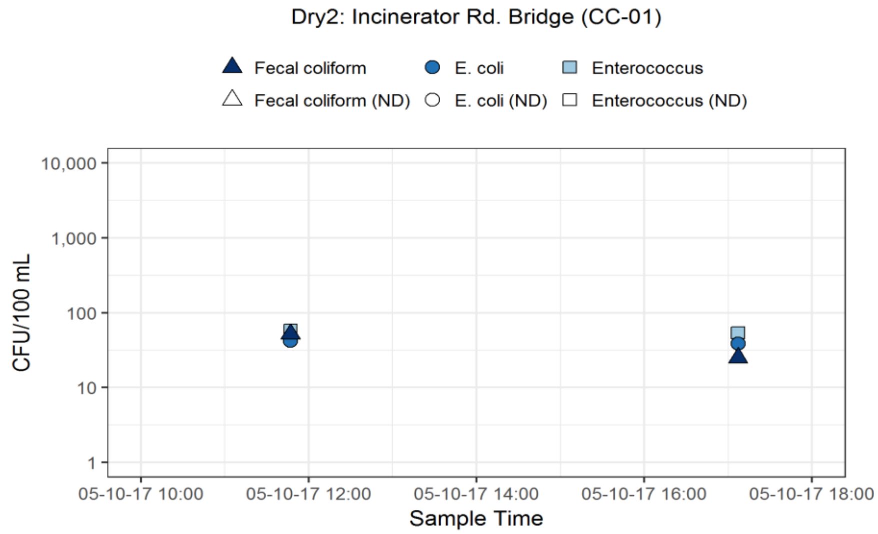
WATER QUALITY SAMPLING PLOTS

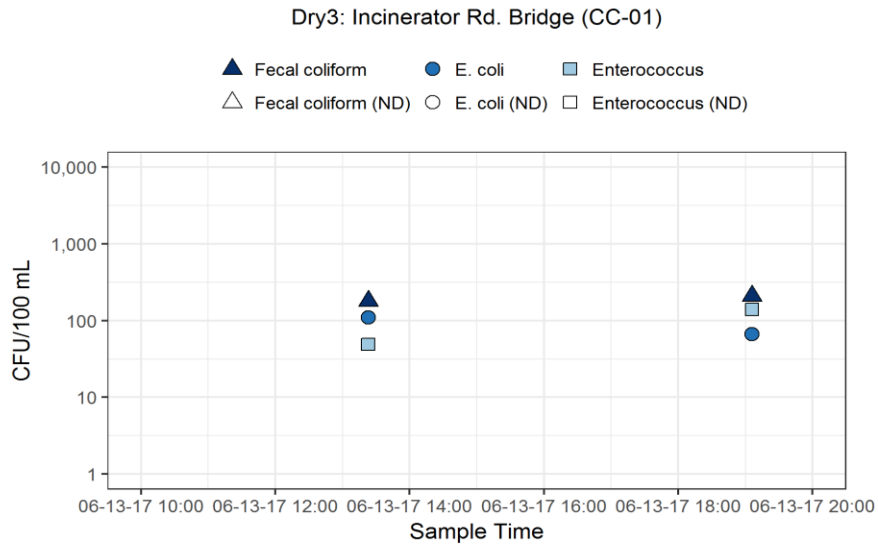
Table of Contents

Section 1 Sampling Results by Station

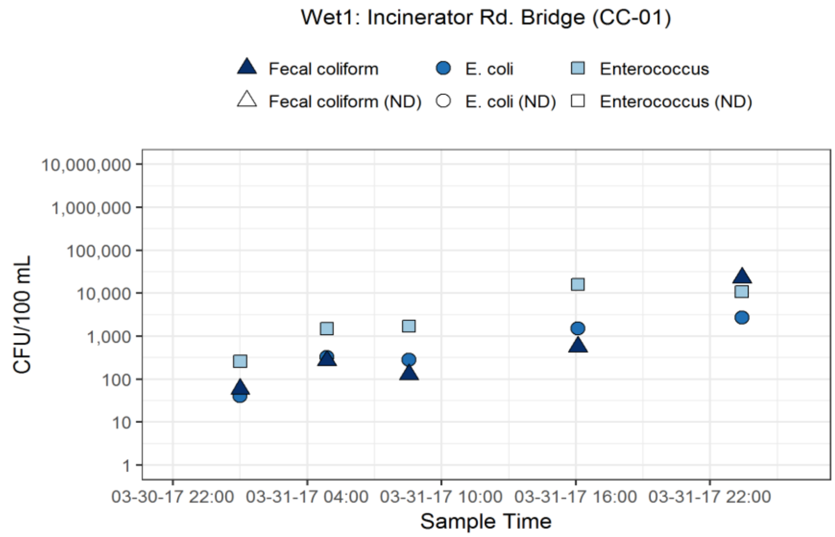
1.1 CC-01 Dry

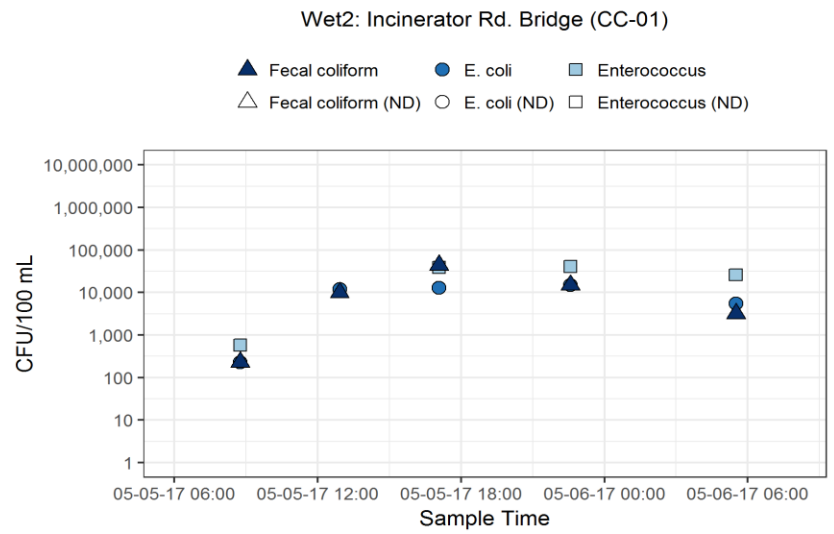

Dry1: Incinerator Rd. Bridge (CC-01)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
CFU/100 mL
1,000
100
10
1
03-23-17 12:00
03-23-17 14:00
03-23-17 16:00
03-23-17 18:00
03-23-17 20:00
Sample Time

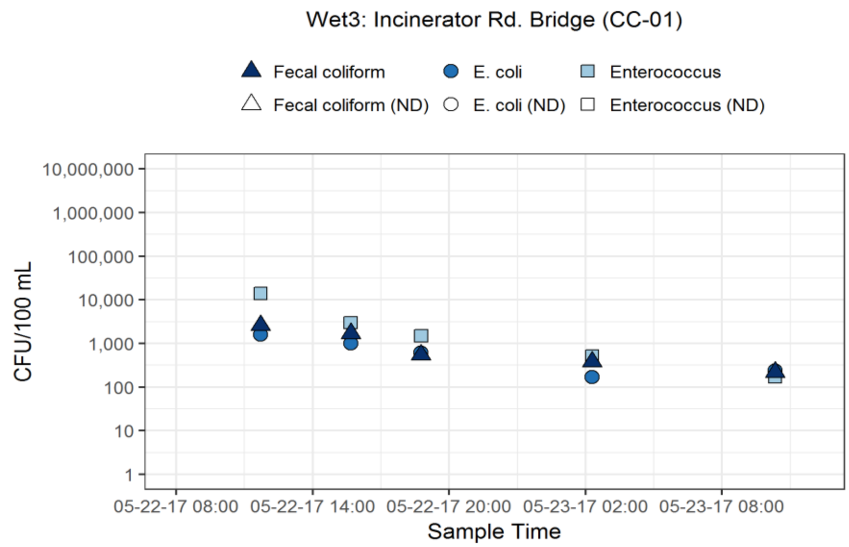

Dry2: Incinerator Rd. Bridge (CC-01)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
CFU/100 mL
10,000
1,000
100
10
1
05-10-17 10:00
05-10-17 12:00
05-10-17 14:00
05-10-17 16:00
05-10-17 18:00
Sample Time


Dry3: Incinerator Rd. Bridge (CC-01)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
CFU/100 mL
10,000
1,000
100
10
1
06-13-17 10:00
06-13-17 12:00
06-13-17 14:00
06-13-17 16:00
06-13-17 18:00
06-13-17 20:00
Sample Time

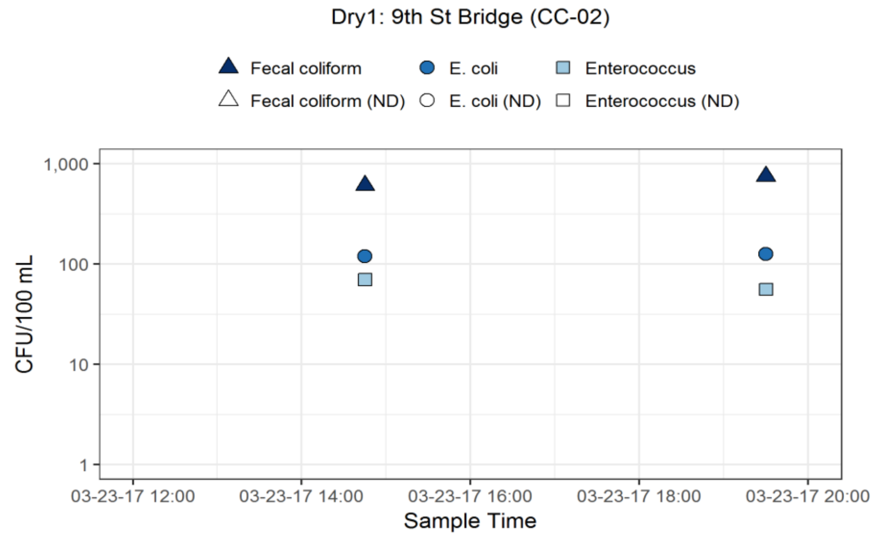
1.1 CC-01 Wet

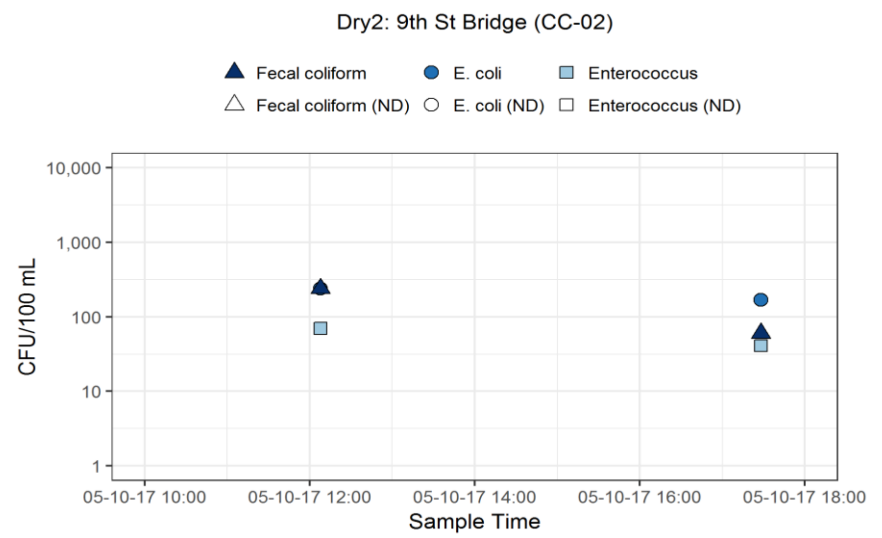

Wet1: Incinerator Rd. Bridge (CC-01)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
CFU/100 mL
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
03-30-17 22:00
03-31-17 04:00
03-31-17 10:00
03-31-17 16:00
03-31-17 22:00
Sample Time

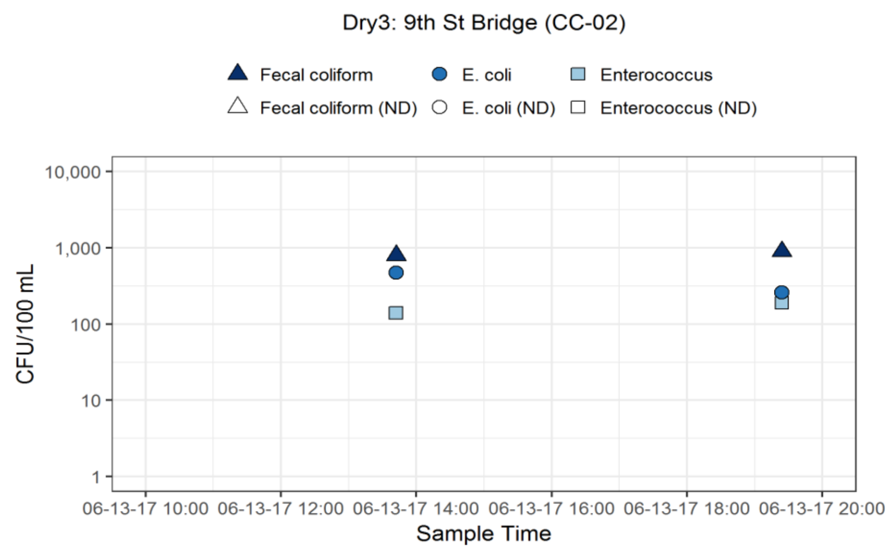

Wet2: Incinerator Rd. Bridge (CC-01)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
CFU/100 mL
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
05-05-17 06:00
05-05-17 12:00
05-05-17 18:00
05-06-17 00:00
05-06-17 06:00
Sample Time


Wet3: Incinerator Rd. Bridge (CC-01)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
CFU/100 mL
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
05-22-17 08:00
05-22-17 14:00
05-22-17 20:00
05-23-17 02:00
05-23-17 08:00
Sample Time

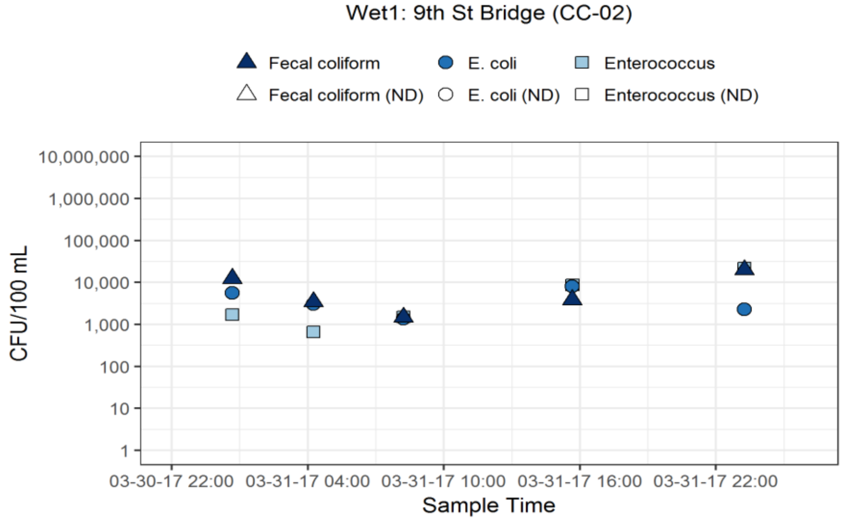
1.2 CC-02 Dry

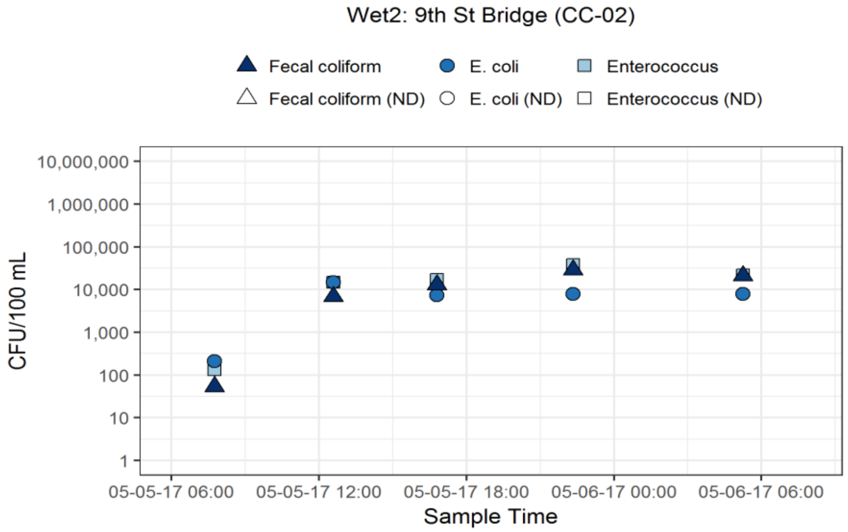

Dry1: 9th St Bridge (CC-02)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
CFU/100 mL
1,000
100
10
1
03-23-17 12:00
03-23-17 14:00
03-23-17 16:00
03-23-17 18:00
03-23-17 20:00
Sample Time

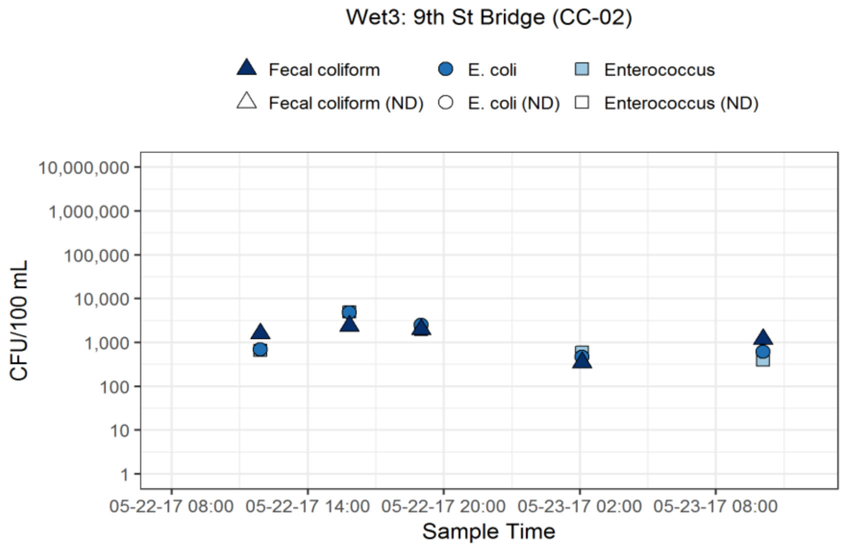

Dry2: 9th St Bridge (CC-02)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
CFU/100 mL
10,000
1,000
100
10
1
05-10-17 10:00
05-10-17 12:00
05-10-17 14:00
05-10-17 16:00
05-10-17 18:00
Sample Time


Dry3: 9th St Bridge (CC-02)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
CFU/100 mL
10,000
1,000
100
10
1
06-13-17 10:00
06-13-17 12:00
06-13-17 14:00
06-13-17 16:00
06-13-17 18:00
06-13-17 20:00
Sample Time

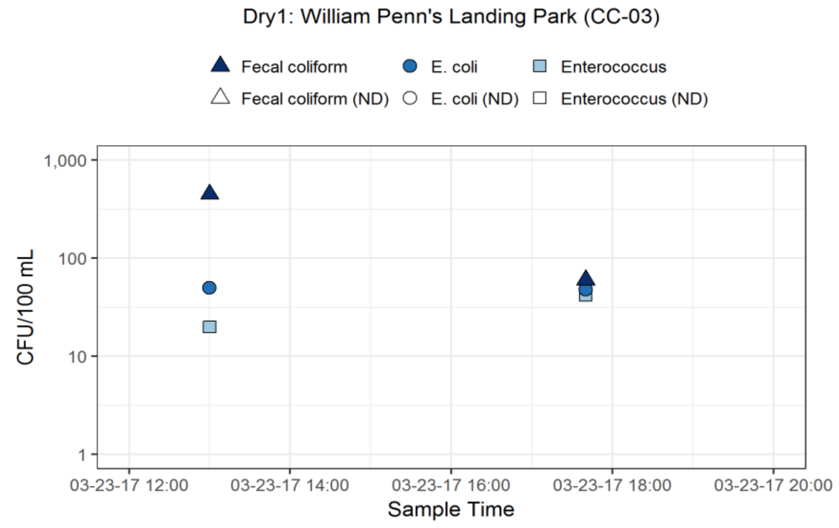
1.2 CC-02 Wet

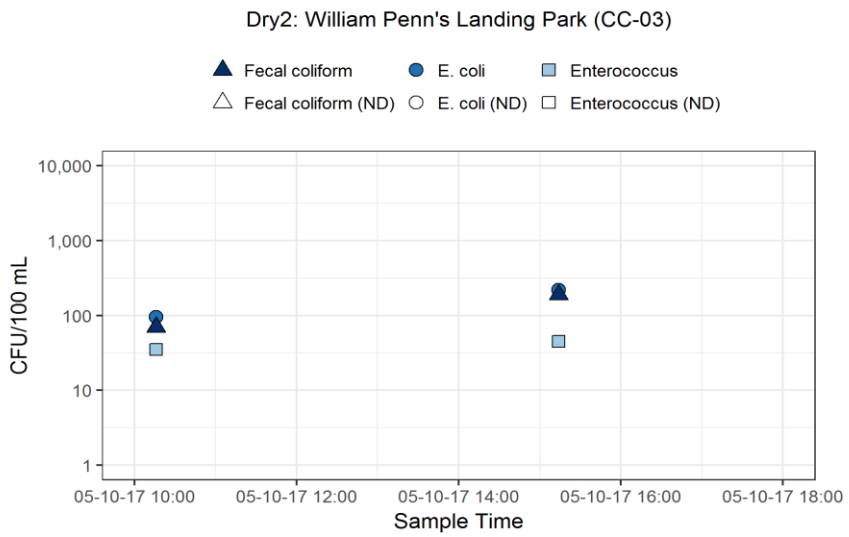

Wet1: 9th St Bridge (CC-02)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
CFU/100 mL
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
03-30-17 22:00
03-31-17 04:00
03-31-17 10:00
03-31-17 16:00
03-31-17 22:00
Sample Time

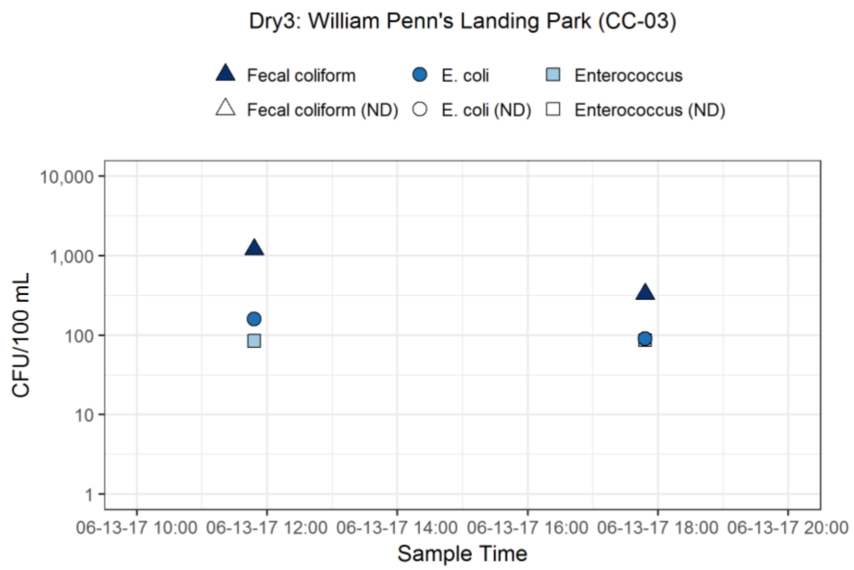

Wet2: 9th St Bridge (CC-02)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
CFU/100 mL
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
05-05-17 06:00
05-05-17 12:00
05-05-17 18:00
05-06-17 00:00
05-06-17 06:00
Sample Time


Wet3: 9th St Bridge (CC-02)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
CFU/100 mL
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
05-22-17 08:00
05-22-17 14:00
05-22-17 20:00
05-23-17 02:00
05-23-17 08:00
Sample Time

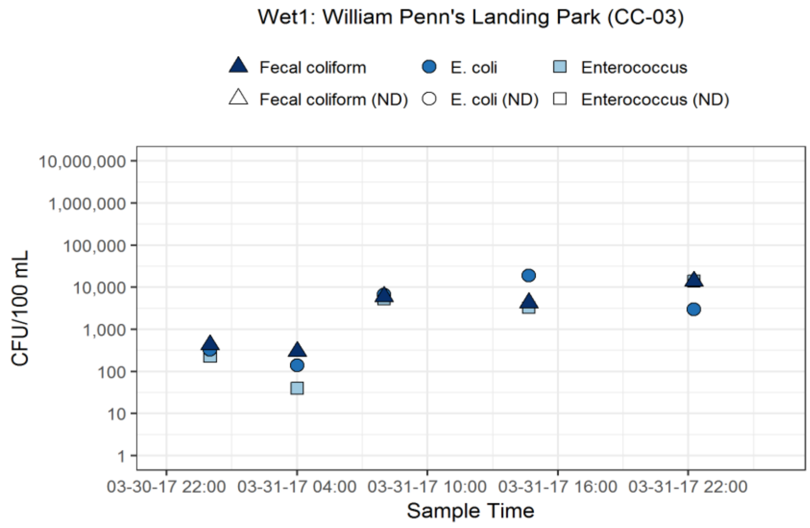
1.3 CC-03 Dry

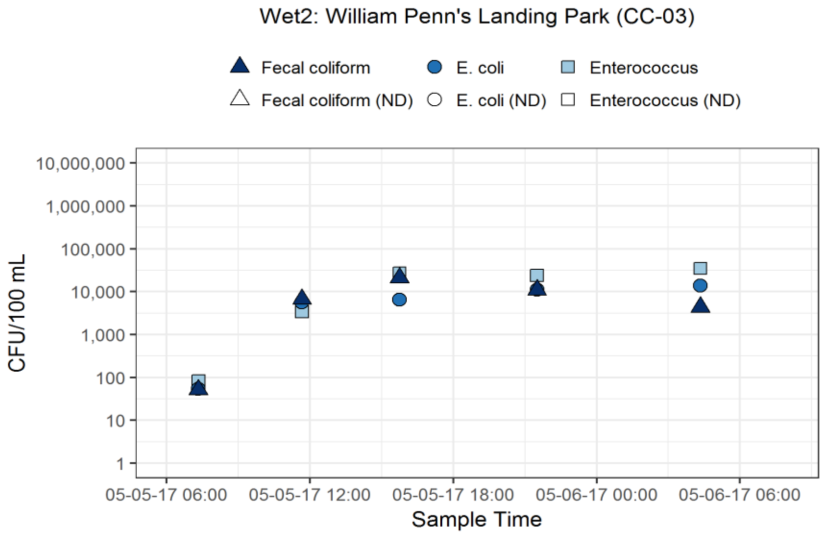

Dry1: William Penn's Landing Park (CC-03)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
1,000
100
10
1
CFU/100 mL
03-23-17 12:00
03-23-17 14:00
03-23-17 16:00
03-23-17 18:00
03-23-17 20:00
Sample Time

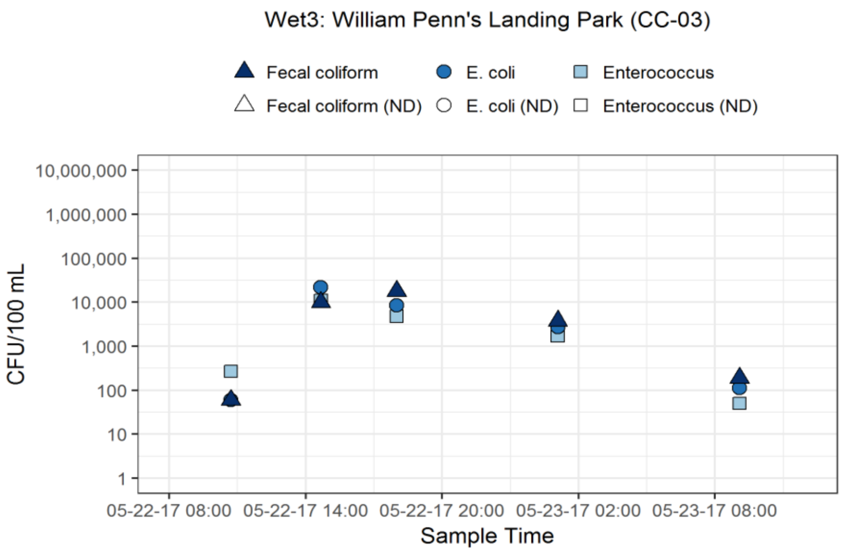

Dry2: William Penn's Landing Park (CC-03)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
10,000
1,000
100
10
1
CFU/100 mL
05-10-17 10:00
05-10-17 12:00
05-10-17 14:00
05-10-17 16:00
05-10-17 18:00
Sample Time


Dry3: William Penn's Landing Park (CC-03)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
10,000
1,000
100
10
1
CFU/100 mL
06-13-17 10:00
06-13-17 12:00
06-13-17 14:00
06-13-17 16:00
06-13-17 18:00
06-13-17 20:00
Sample Time

1.3 CC-03 Wet

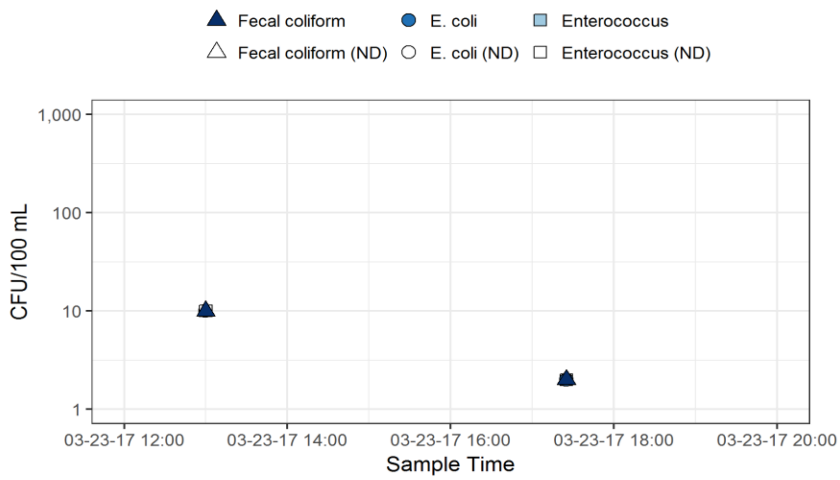

Wet1: William Penn's Landing Park (CC-03)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
CFU/100 mL
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
03-30-17 22:00
03-31-17 04:00
03-31-17 10:00
03-31-17 16:00
03-31-17 22:00
Sample Time


Wet2: William Penn's Landing Park (CC-03)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
CFU/100 mL
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
05-05-17 06:00
05-05-17 12:00
05-05-17 18:00
05-06-17 00:00
05-06-17 06:00
Sample Time

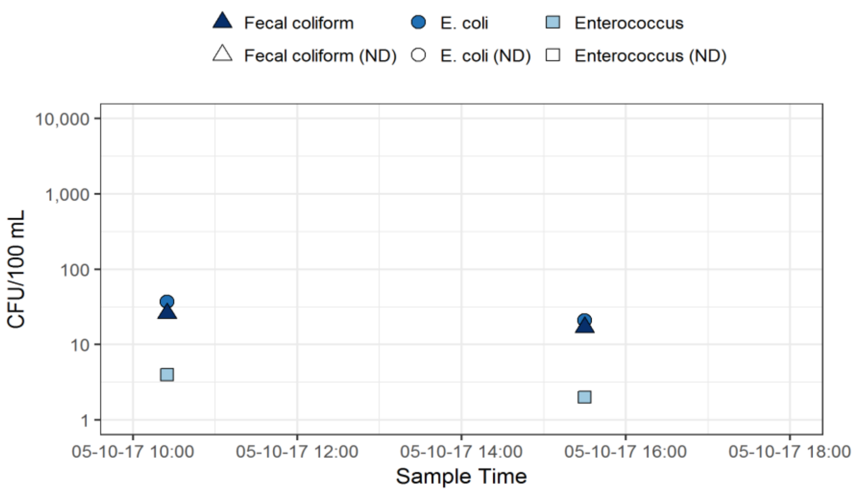

Wet3: William Penn's Landing Park (CC-03)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
CFU/100 mL
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
05-22-17 08:00
05-22-17 14:00
05-22-17 20:00
05-23-17 02:00
05-23-17 08:00
Sample Time

1.4 DR-01 Dry

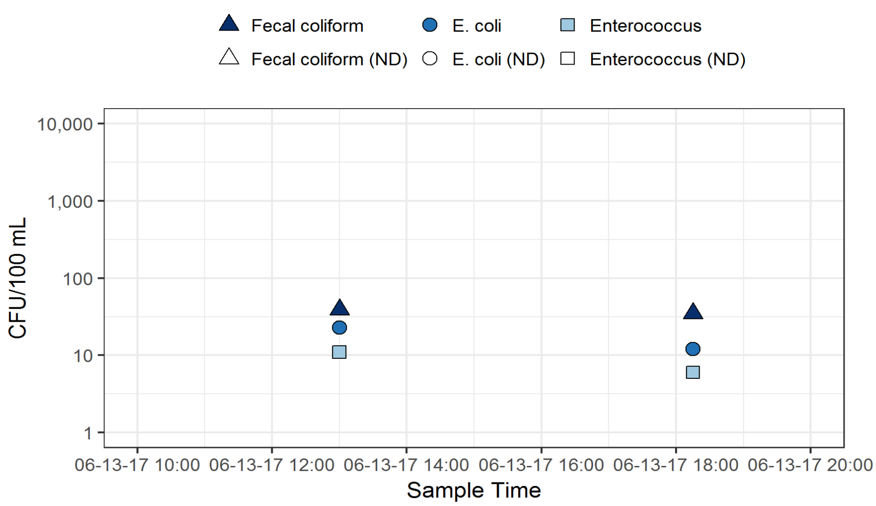
Dry1: Delaware River between Ridley Crk and Crum Crk (DR-01)



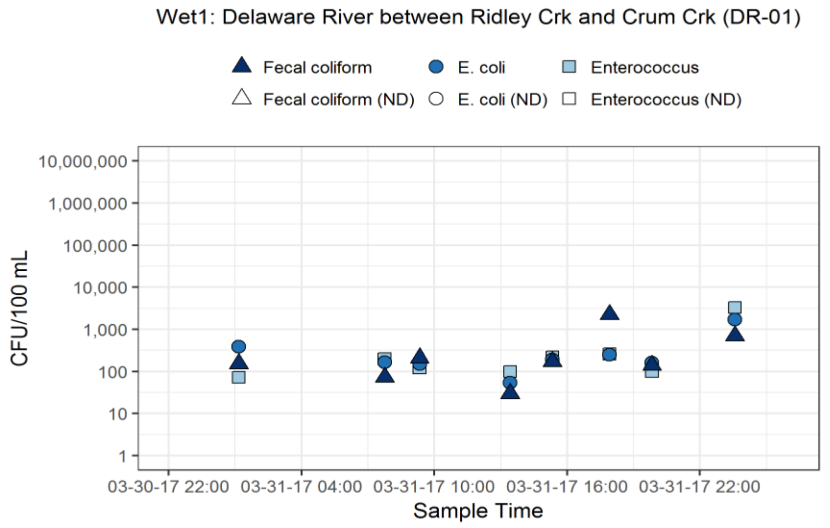
Dry2: Delaware River between Ridley Crk and Crum Crk (DR-01)

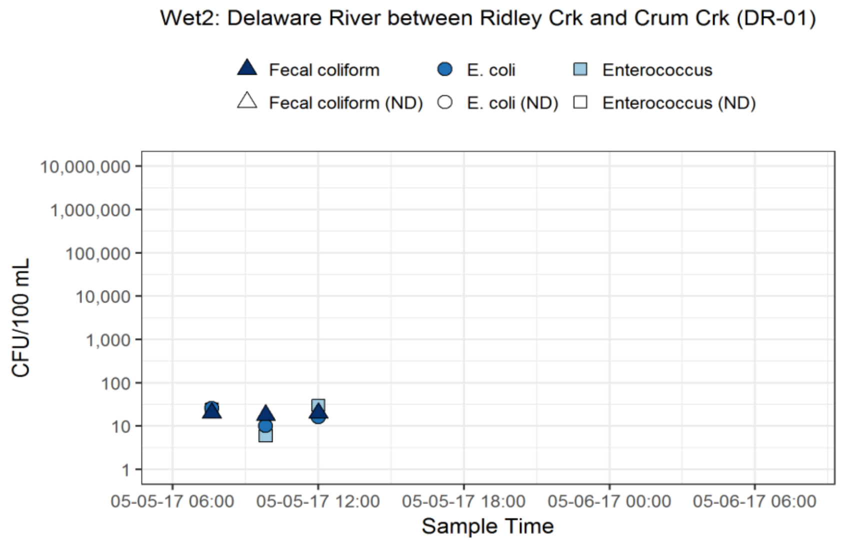


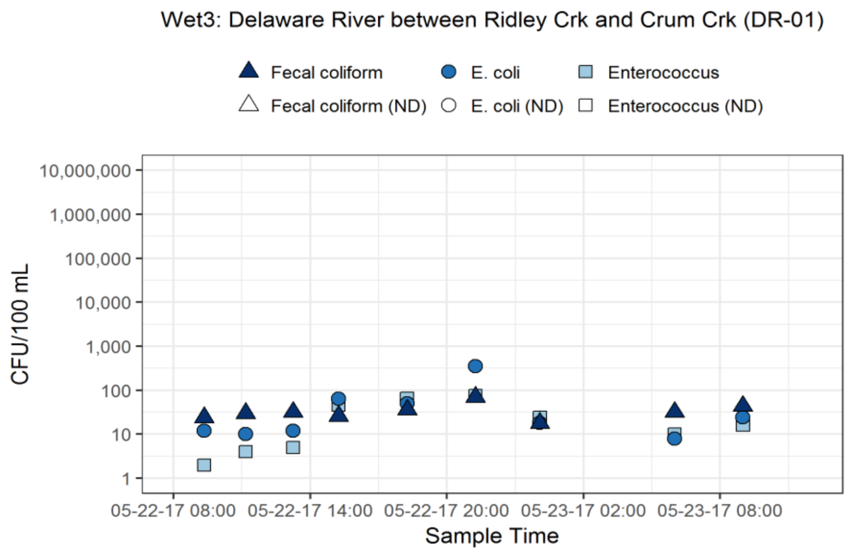
Dry3: Delaware River between Ridley Crk and Crum Crk (DR-01)



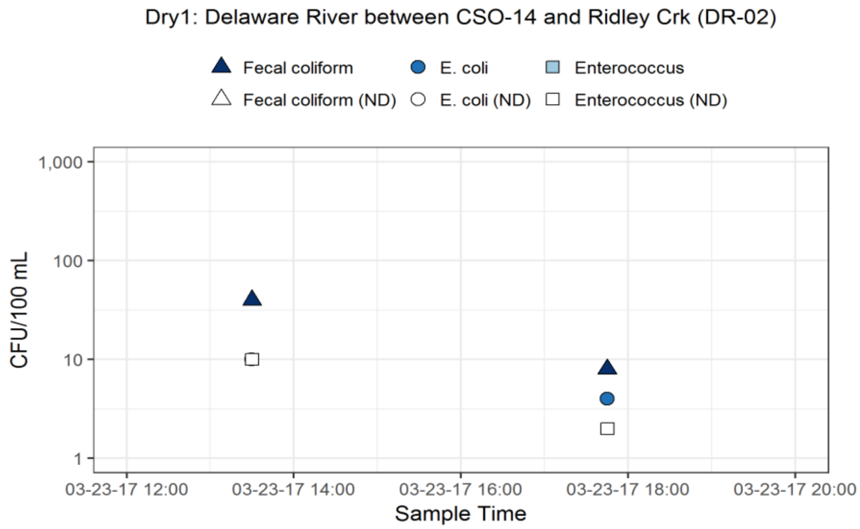
1.4 DR-01 Wet

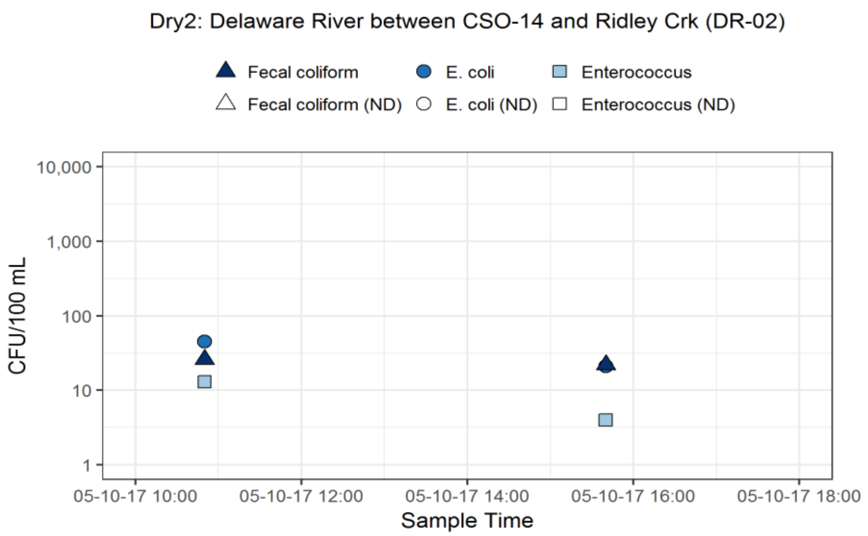

Wet1: Delaware River between Ridley Crk and Crum Crk (DR-01)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
CFU/100 mL
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
03-30-17 22:00
03-31-17 04:00
03-31-17 10:00
03-31-17 16:00
03-31-17 22:00
Sample Time

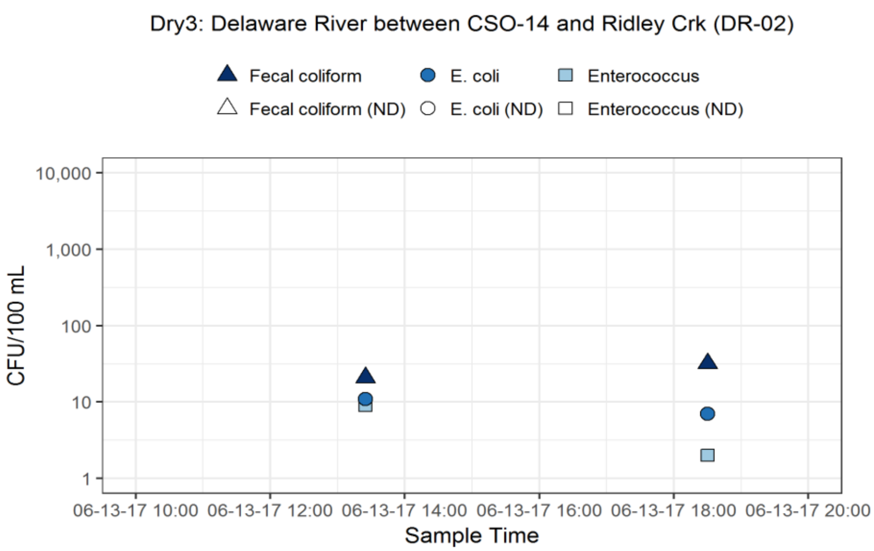

Wet2: Delaware River between Ridley Crk and Crum Crk (DR-01)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
CFU/100 mL
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
05-05-17 06:00
05-05-17 12:00
05-05-17 18:00
05-06-17 00:00
05-06-17 06:00
Sample Time


Wet3: Delaware River between Ridley Crk and Crum Crk (DR-01)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
CFU/100 mL
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
05-22-17 08:00
05-22-17 14:00
05-22-17 20:00
05-23-17 02:00
05-23-17 08:00
Sample Time

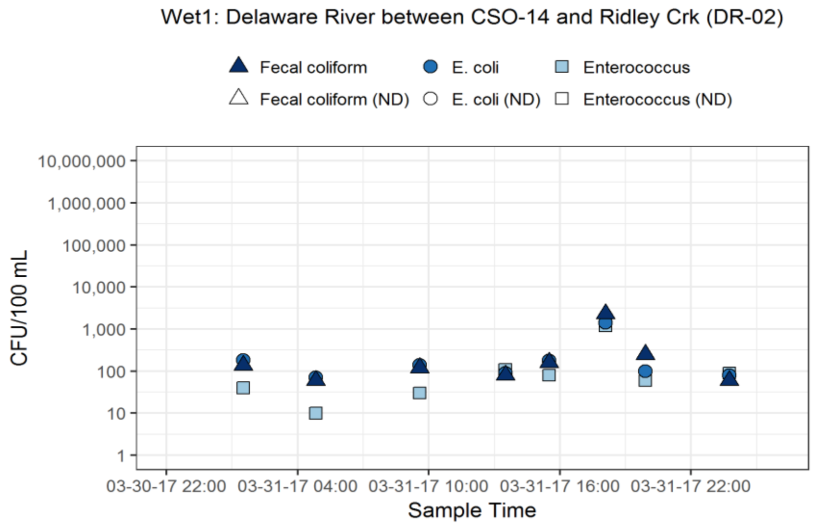
1.5 DR-02 Dry

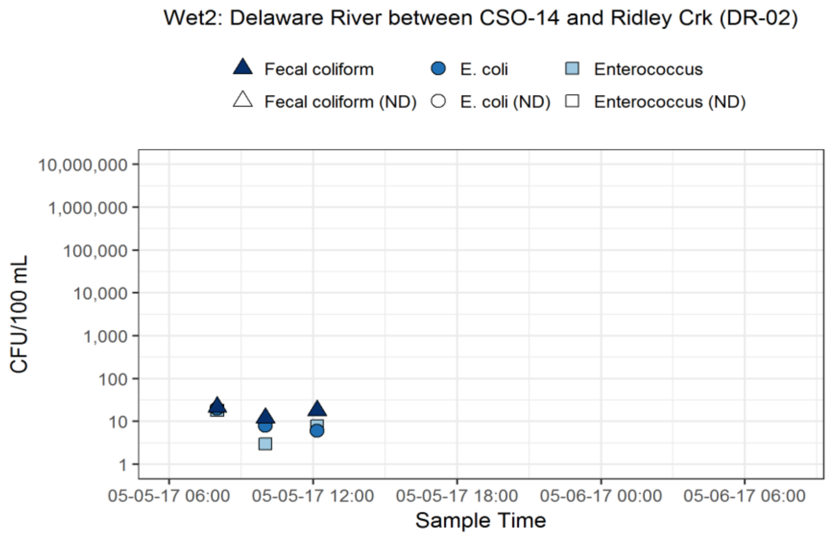

Dry1: Delaware River between CSO-14 and Ridley Crk (DR-02)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
CFU/100 mL
1,000
100
10
1
03-23-17 12:00
03-23-17 14:00
03-23-17 16:00
03-23-17 18:00
03-23-17 20:00
Sample Time

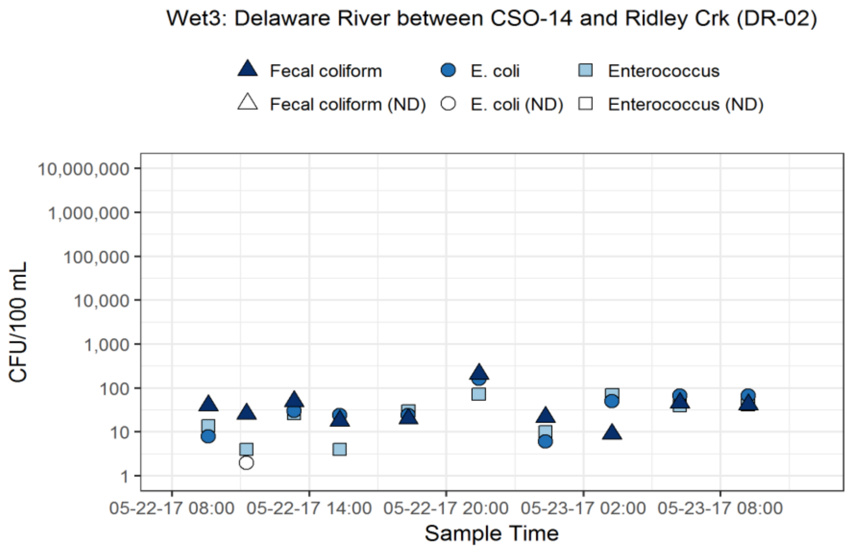

Dry2: Delaware River between CSO-14 and Ridley Crk (DR-02)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
CFU/100 mL
10,000
1,000
100
10
1
05-10-17 10:00
05-10-17 12:00
05-10-17 14:00
05-10-17 16:00
05-10-17 18:00
Sample Time


Dry3: Delaware River between CSO-14 and Ridley Crk (DR-02)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
CFU/100 mL
10,000
1,000
100
10
1
06-13-17 10:00
06-13-17 12:00
06-13-17 14:00
06-13-17 16:00
06-13-17 18:00
06-13-17 20:00
Sample Time

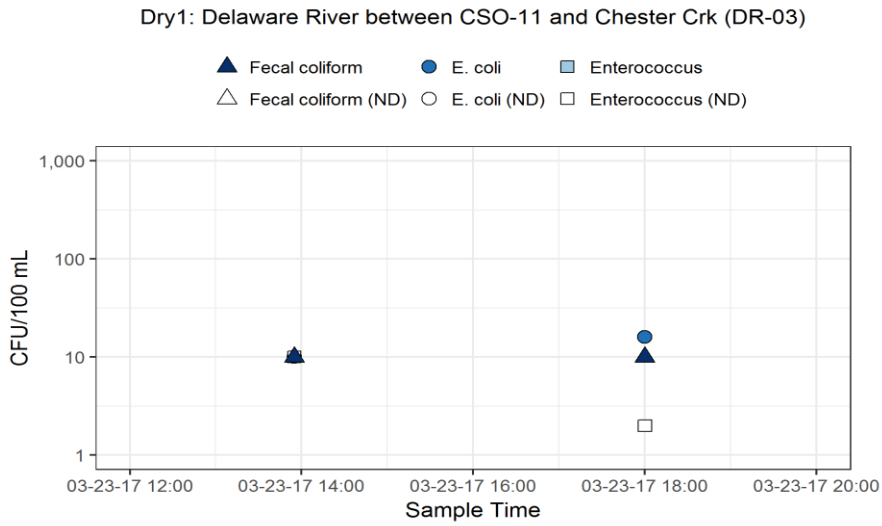
1.5 DR-02 Wet

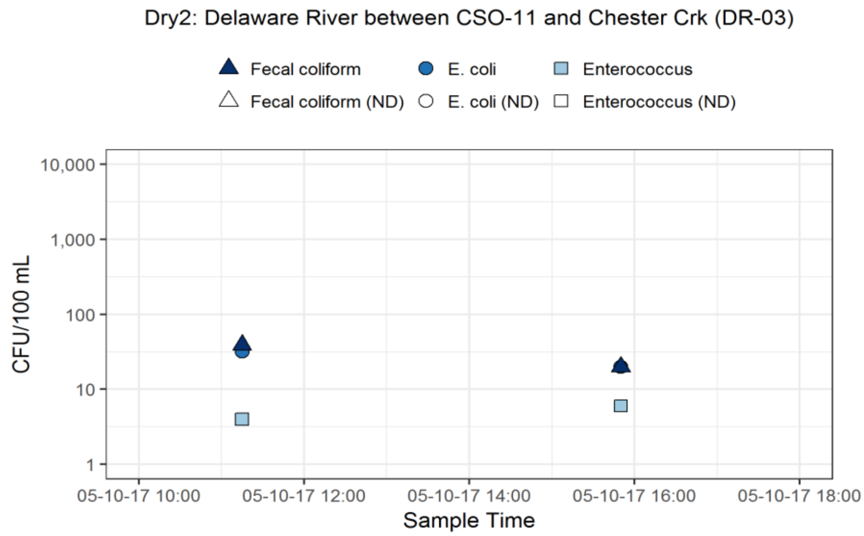

Wet1: Delaware River between CSO-14 and Ridley Crk (DR-02)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
CFU/100 mL
03-30-17 22:00
03-31-17 04:00
03-31-17 10:00
03-31-17 16:00
03-31-17 22:00
Sample Time

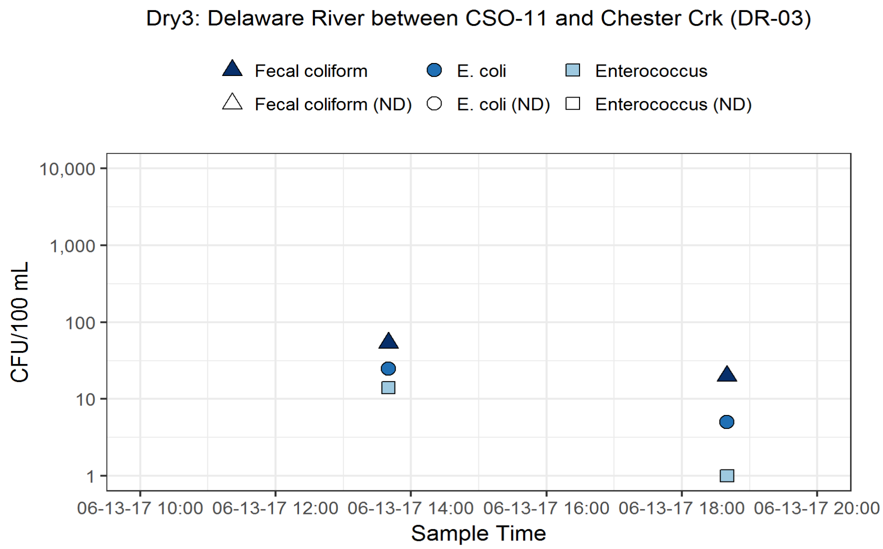

Wet2: Delaware River between CSO-14 and Ridley Crk (DR-02)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
CFU/100 mL
05-05-17 06:00
05-05-17 12:00
05-05-17 18:00
05-06-17 00:00
05-06-17 06:00
Sample Time


Wet3: Delaware River between CSO-14 and Ridley Crk (DR-02)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
CFU/100 mL
05-22-17 08:00
05-22-17 14:00
05-22-17 20:00
05-23-17 02:00
05-23-17 08:00
Sample Time

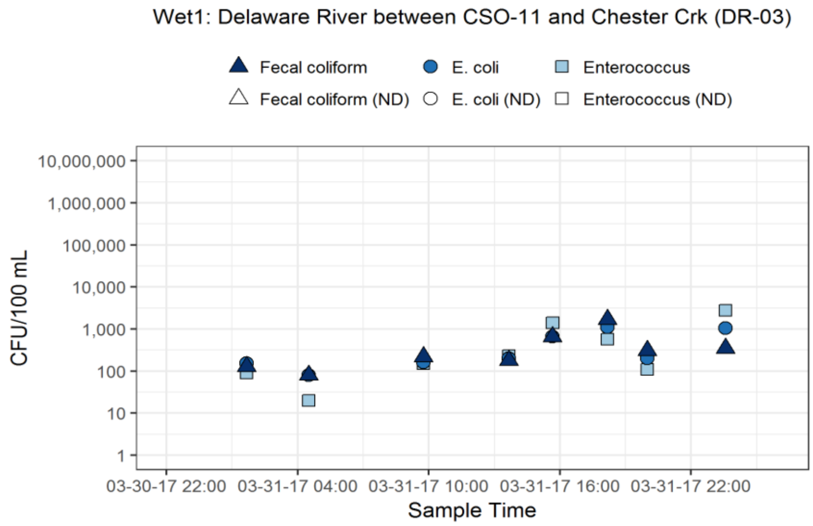
1.6 DR-03 Dry

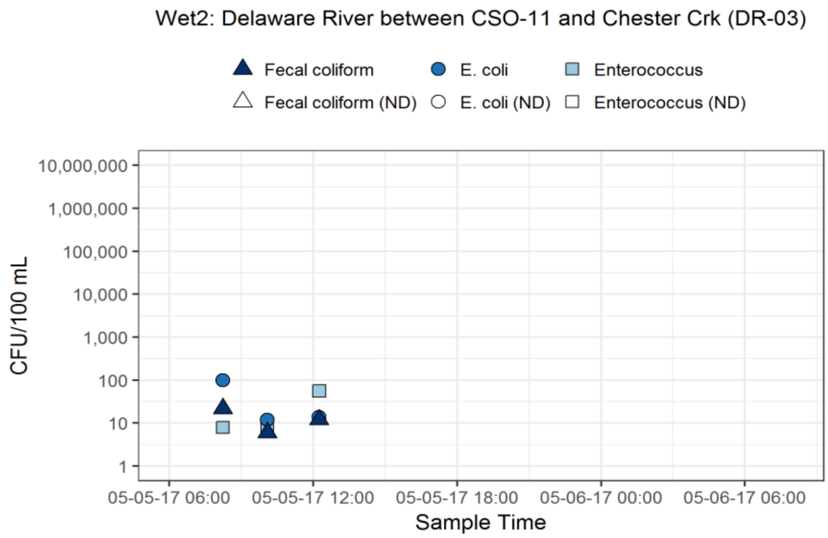

Dry1: Delaware River between CSO-11 and Chester Crk (DR-03)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
CFU/100 mL
1,000
100
10
1
03-23-17 12:00
03-23-17 14:00
03-23-17 16:00
03-23-17 18:00
03-23-17 20:00
Sample Time

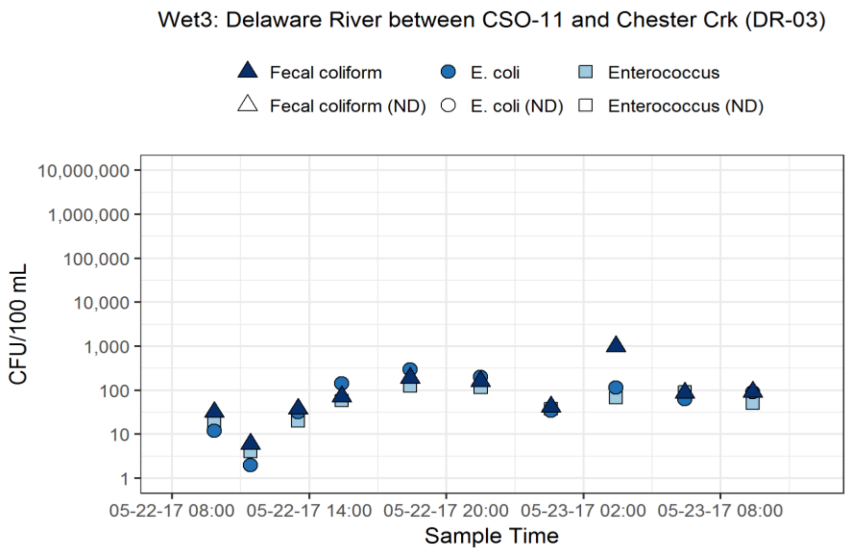

Dry2: Delaware River between CSO-11 and Chester Crk (DR-03)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
CFU/100 mL
10,000
1,000
100
10
1
05-10-17 10:00
05-10-17 12:00
05-10-17 14:00
05-10-17 16:00
05-10-17 18:00
Sample Time


Dry3: Delaware River between CSO-11 and Chester Crk (DR-03)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
CFU/100 mL
10,000
1,000
100
10
1
06-13-17 10:00
06-13-17 12:00
06-13-17 14:00
06-13-17 16:00
06-13-17 18:00
06-13-17 20:00
Sample Time

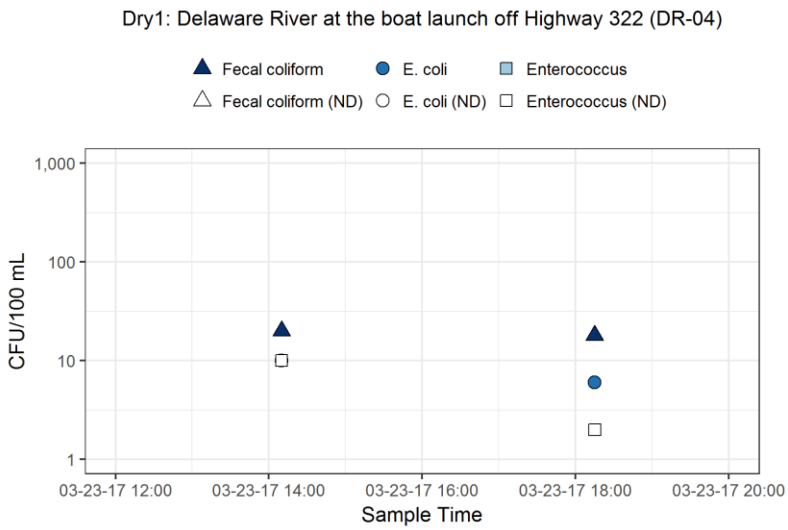
1.6 DR-03 Wet

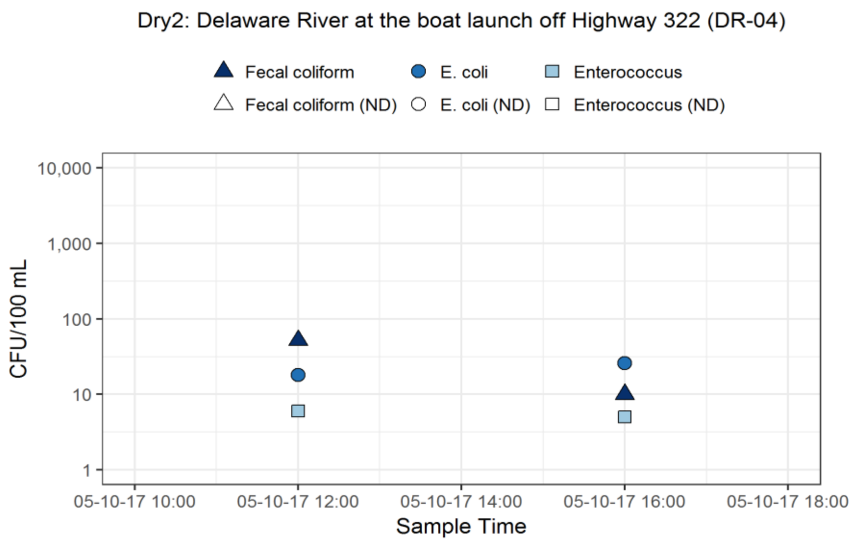

Wet1: Delaware River between CSO-11 and Chester Crk (DR-03)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
CFU/100 mL
03-30-17 22:00
03-31-17 04:00
03-31-17 10:00
03-31-17 16:00
03-31-17 22:00
Sample Time

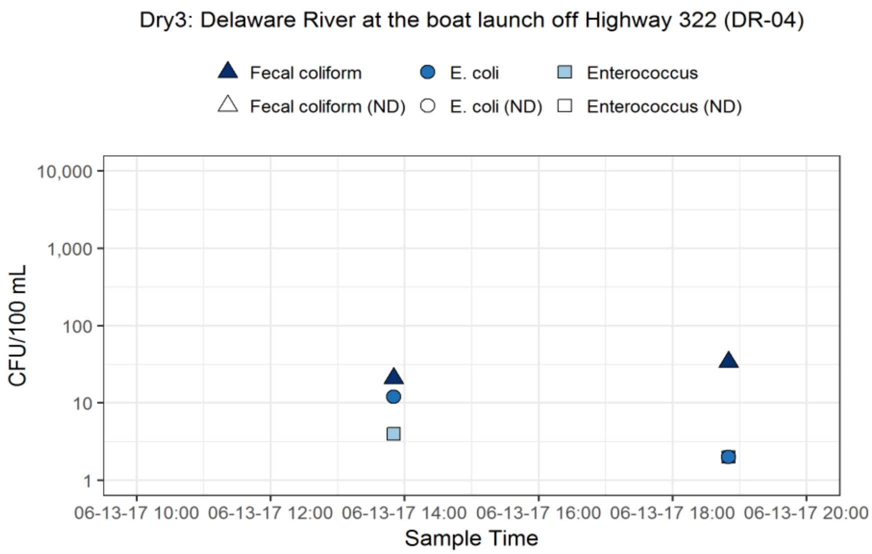

Wet2: Delaware River between CSO-11 and Chester Crk (DR-03)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
CFU/100 mL
05-05-17 06:00
05-05-17 12:00
05-05-17 18:00
05-06-17 00:00
05-06-17 06:00
Sample Time


Wet3: Delaware River between CSO-11 and Chester Crk (DR-03)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
CFU/100 mL
05-22-17 08:00
05-22-17 14:00
05-22-17 20:00
05-23-17 02:00
05-23-17 08:00
Sample Time

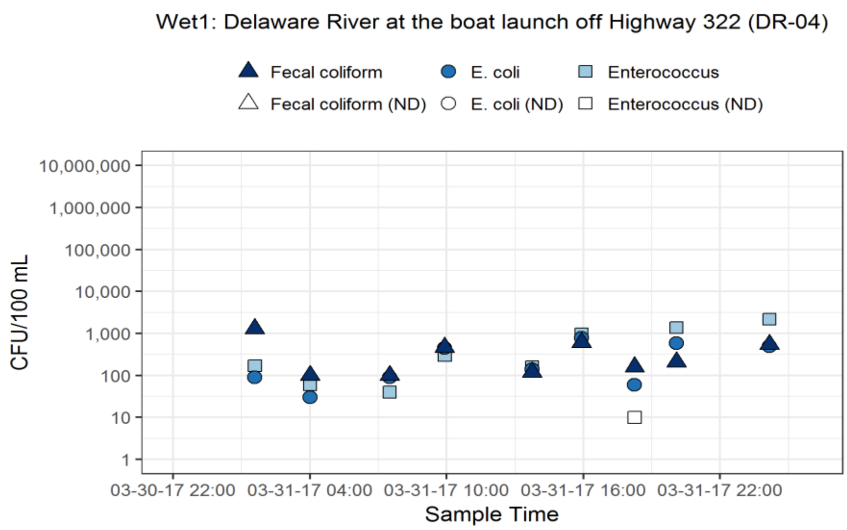
1.7 DR-04 Dry

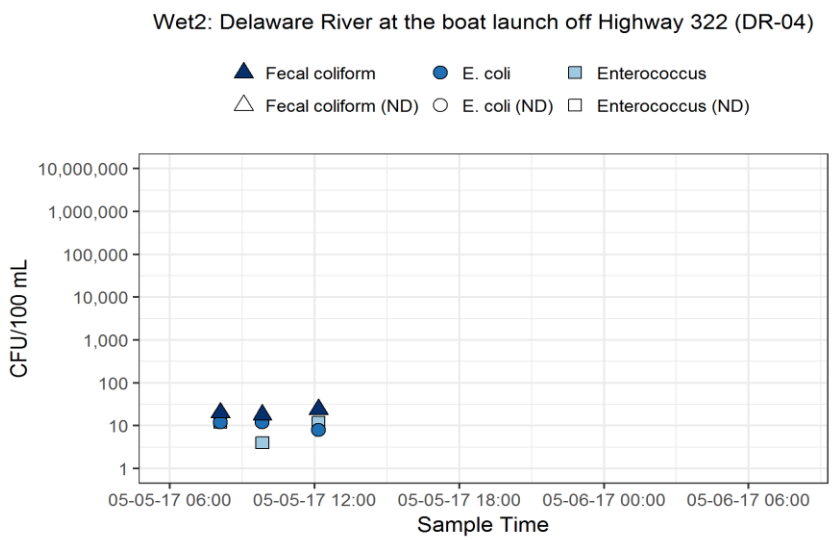

Dry1: Delaware River at the boat launch off Highway 322 (DR-04)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
CFU/100 mL
1,000
100
10
1
03-23-17 12:00
03-23-17 14:00
03-23-17 16:00
03-23-17 18:00
03-23-17 20:00
Sample Time

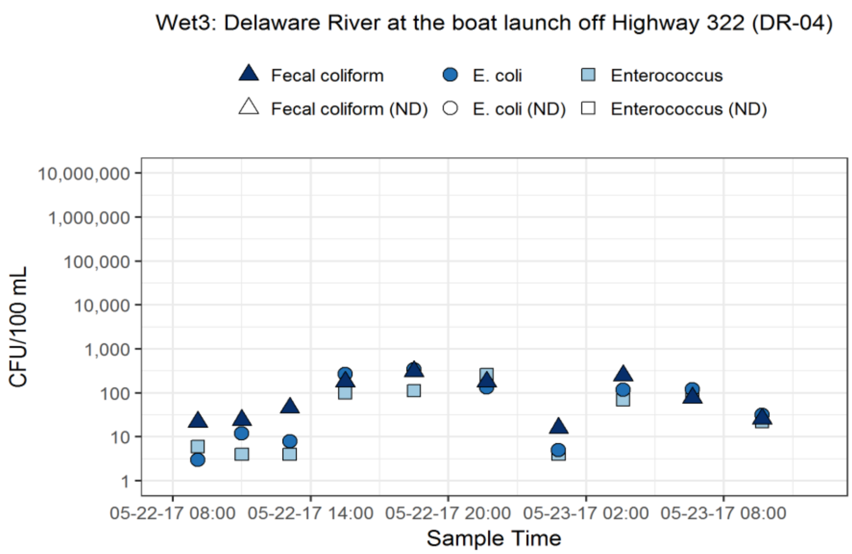

Dry2: Delaware River at the boat launch off Highway 322 (DR-04)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
CFU/100 mL
10,000
1,000
100
10
1
05-10-17 10:00
05-10-17 12:00
05-10-17 14:00
05-10-17 16:00
05-10-17 18:00
Sample Time


Dry3: Delaware River at the boat launch off Highway 322 (DR-04)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
CFU/100 mL
10,000
1,000
100
10
1
06-13-17 10:00
06-13-17 12:00
06-13-17 14:00
06-13-17 16:00
06-13-17 18:00
06-13-17 20:00
Sample Time

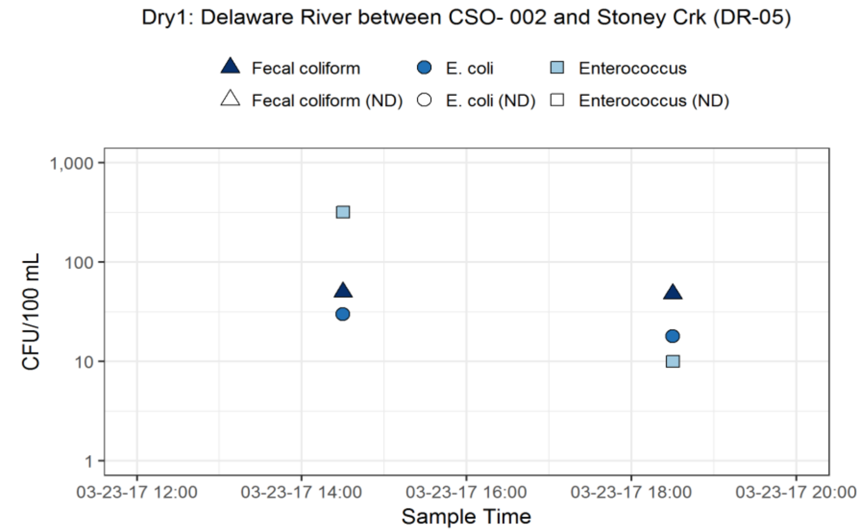
1.7 DR-04 Wet

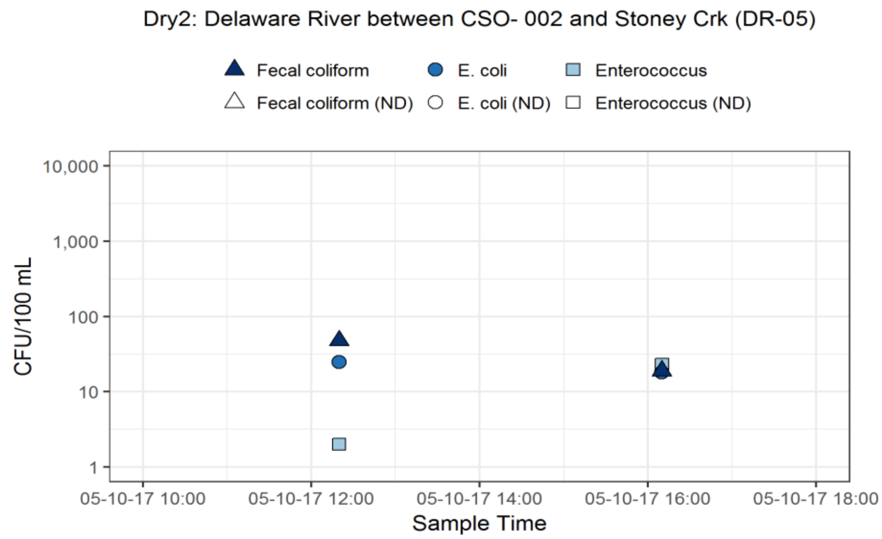

Wet1: Delaware River at the boat launch off Highway 322 (DR-04)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
CFU/100 mL
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
03-30-17 22:00
03-31-17 04:00
03-31-17 10:00
03-31-17 16:00
03-31-17 22:00
Sample Time

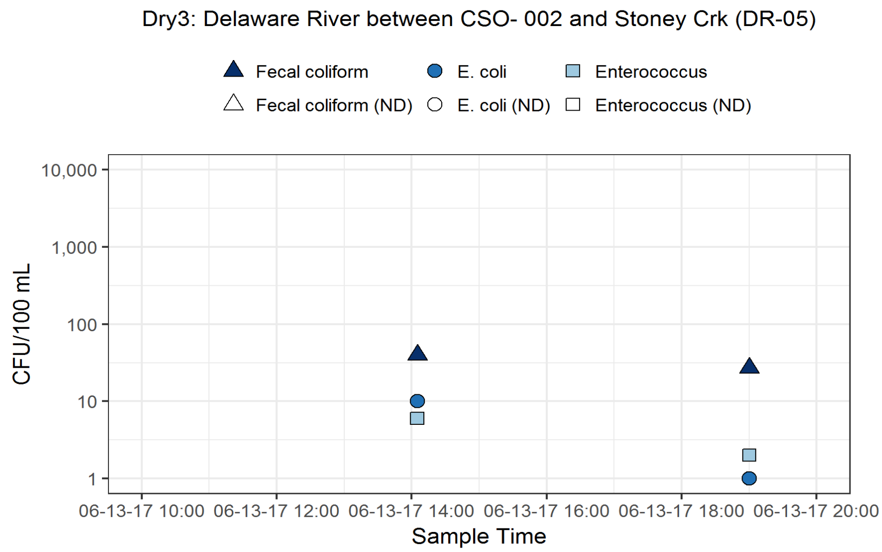

Wet2: Delaware River at the boat launch off Highway 322 (DR-04)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
CFU/100 mL
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
05-05-17 06:00
05-05-17 12:00
05-05-17 18:00
05-06-17 00:00
05-06-17 06:00
Sample Time


Wet3: Delaware River at the boat launch off Highway 322 (DR-04)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
CFU/100 mL
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
05-22-17 08:00
05-22-17 14:00
05-22-17 20:00
05-23-17 02:00
05-23-17 08:00
Sample Time

1.8 DR-05 Dry

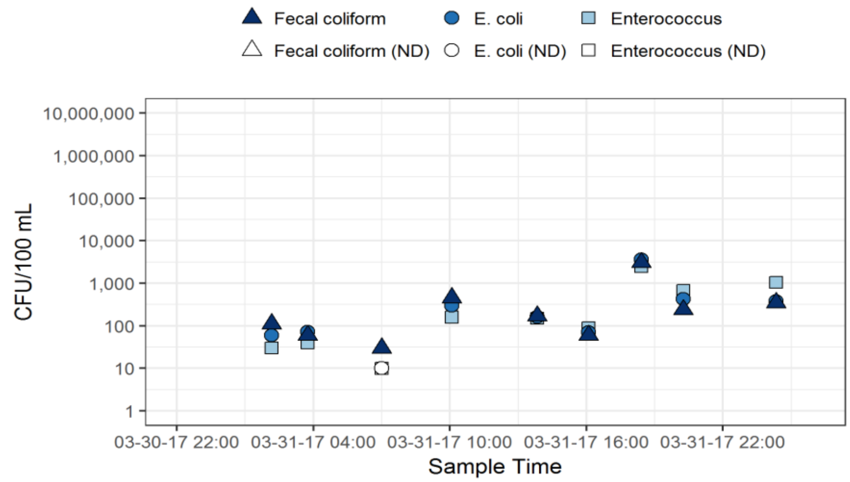

Dry1: Delaware River between CSO- 002 and Stoney Crk (DR-05)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
CFU/100 mL
1,000
100
10
1
03-23-17 12:00
03-23-17 14:00
03-23-17 16:00
03-23-17 18:00
03-23-17 20:00
Sample Time


Dry2: Delaware River between CSO- 002 and Stoney Crk (DR-05)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
CFU/100 mL
10,000
1,000
100
10
1
05-10-17 10:00
05-10-17 12:00
05-10-17 14:00
05-10-17 16:00
05-10-17 18:00
Sample Time

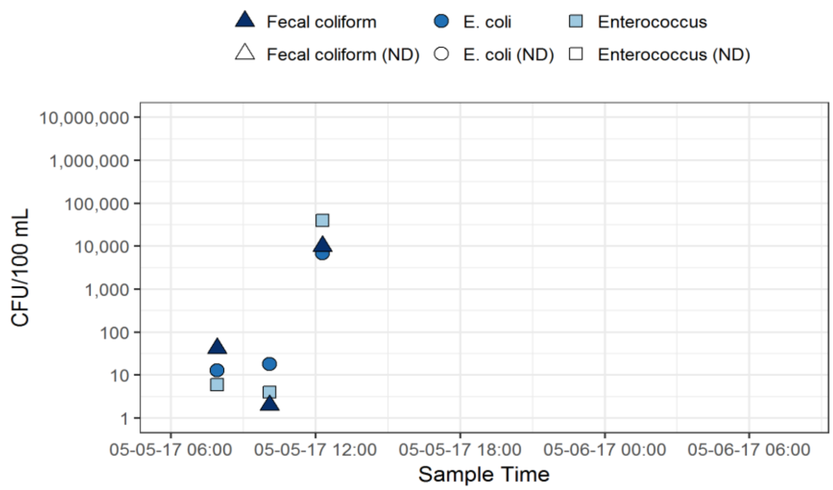

Dry3: Delaware River between CSO- 002 and Stoney Crk (DR-05)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
CFU/100 mL
10,000
1,000
100
10
1
06-13-17 10:00
06-13-17 12:00
06-13-17 14:00
06-13-17 16:00
06-13-17 18:00
06-13-17 20:00
Sample Time

1.8 DR-05 Wet

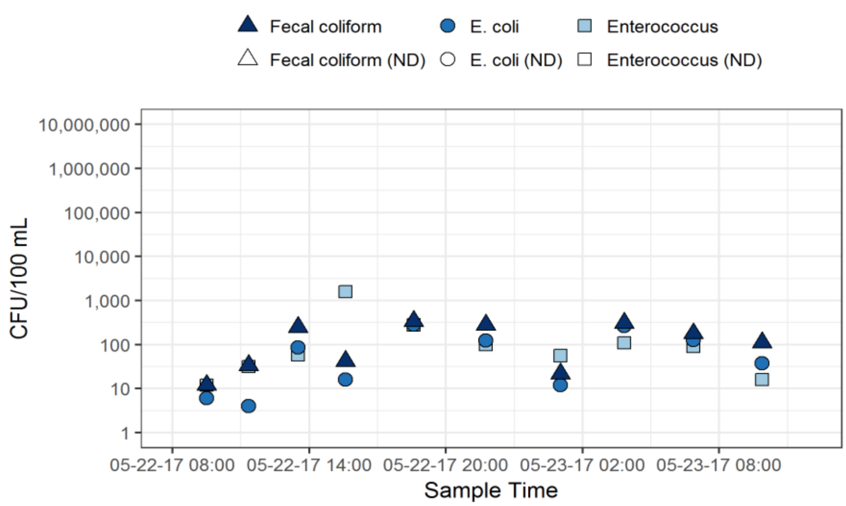
Wet1: Delaware River between CSO- 002 and Stoney Crk (DR-05)



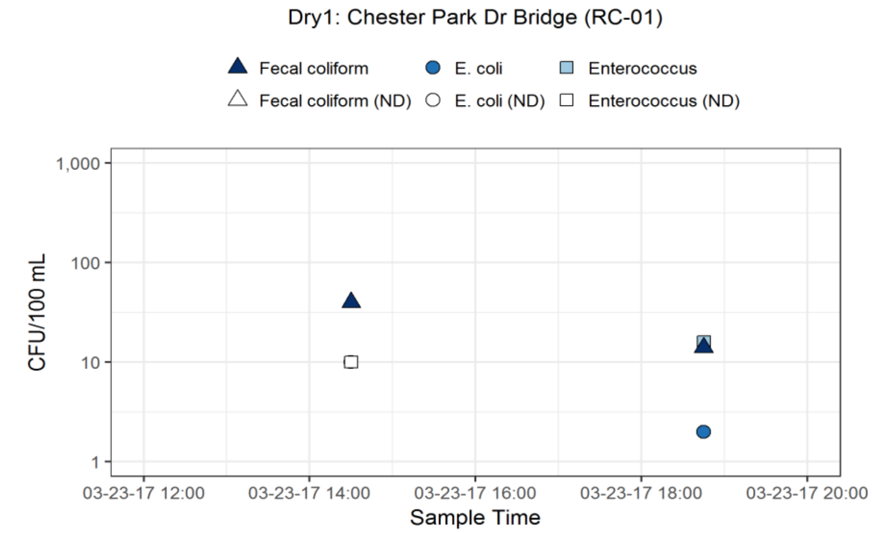
Wet2: Delaware River between CSO- 002 and Stoney Crk (DR-05)

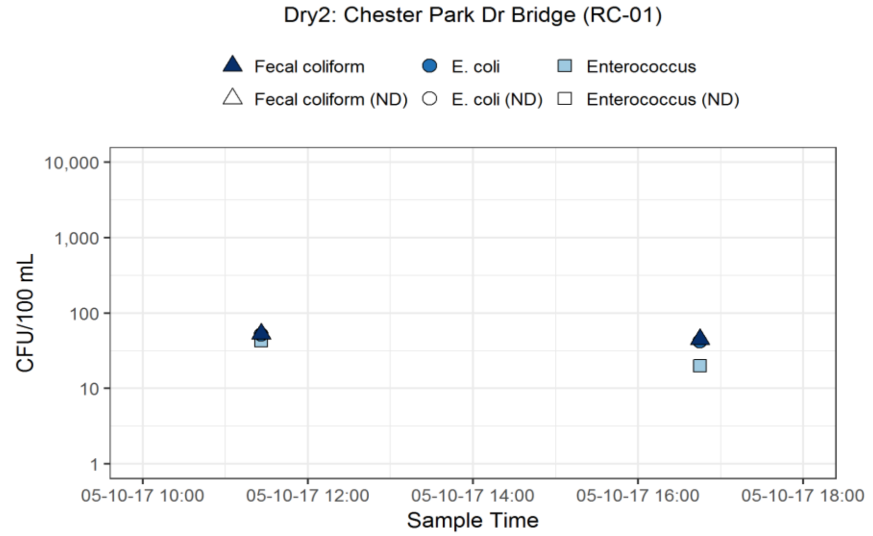


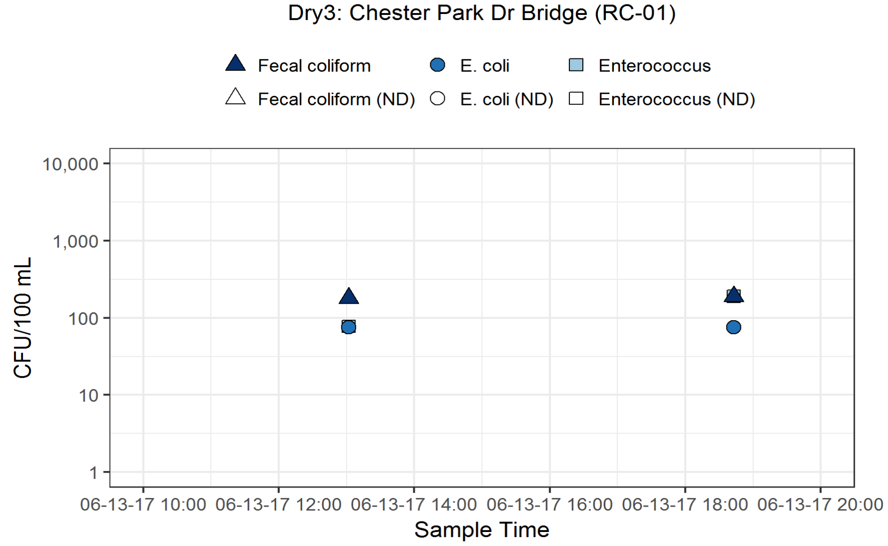
Wet3: Delaware River between CSO- 002 and Stoney Crk (DR-05)



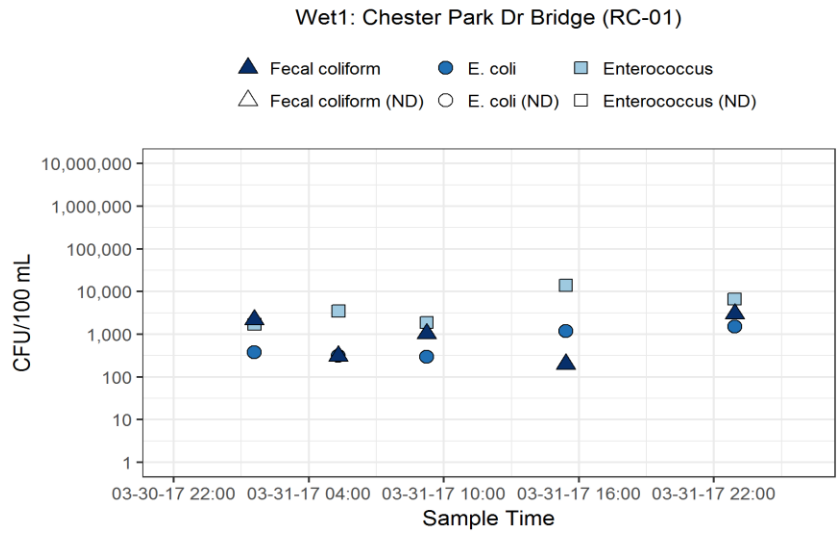
1.9 RC-01 Dry

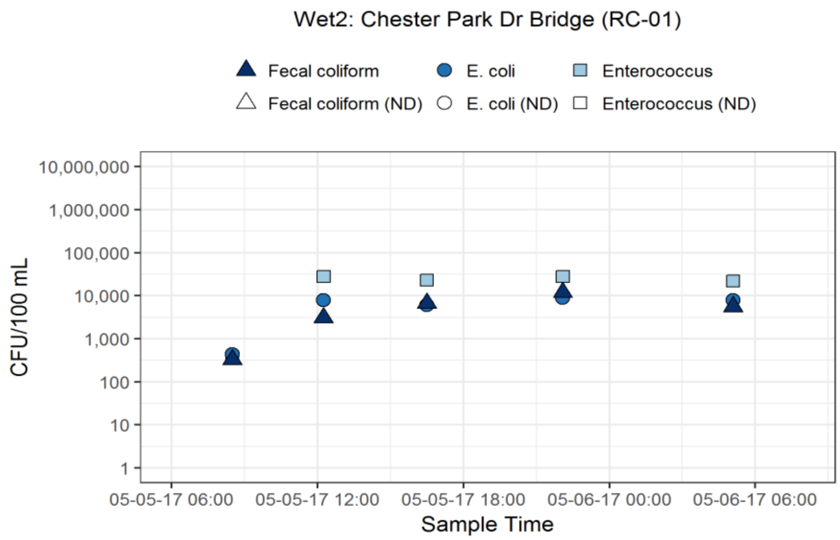

Dry1: Chester Park Dr Bridge (RC-01)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
CFU/100 mL
1,000
100
10
1
03-23-17 12:00
03-23-17 14:00
03-23-17 16:00
03-23-17 18:00
03-23-17 20:00
Sample Time

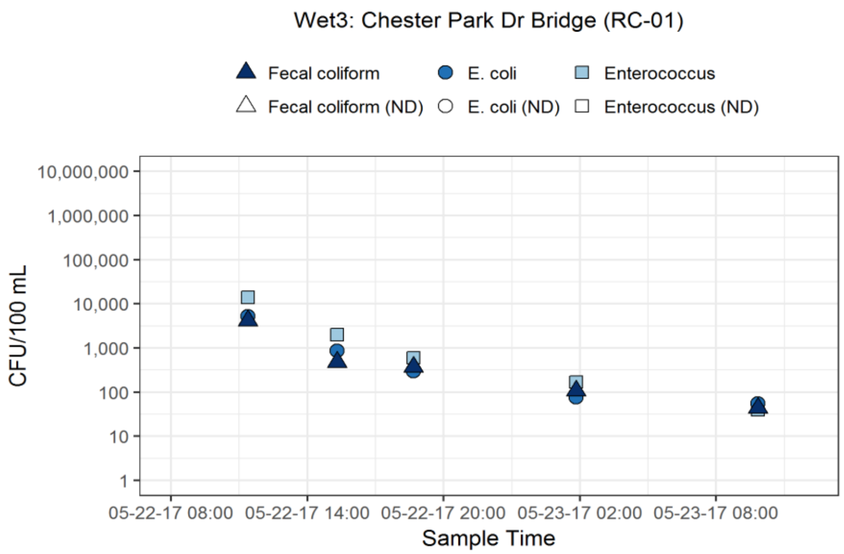

Dry2: Chester Park Dr Bridge (RC-01)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
CFU/100 mL
10,000
1,000
100
10
1
05-10-17 10:00
05-10-17 12:00
05-10-17 14:00
05-10-17 16:00
05-10-17 18:00
Sample Time


Dry3: Chester Park Dr Bridge (RC-01)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
CFU/100 mL
10,000
1,000
100
10
1
06-13-17 10:00
06-13-17 12:00
06-13-17 14:00
06-13-17 16:00
06-13-17 18:00
06-13-17 20:00
Sample Time

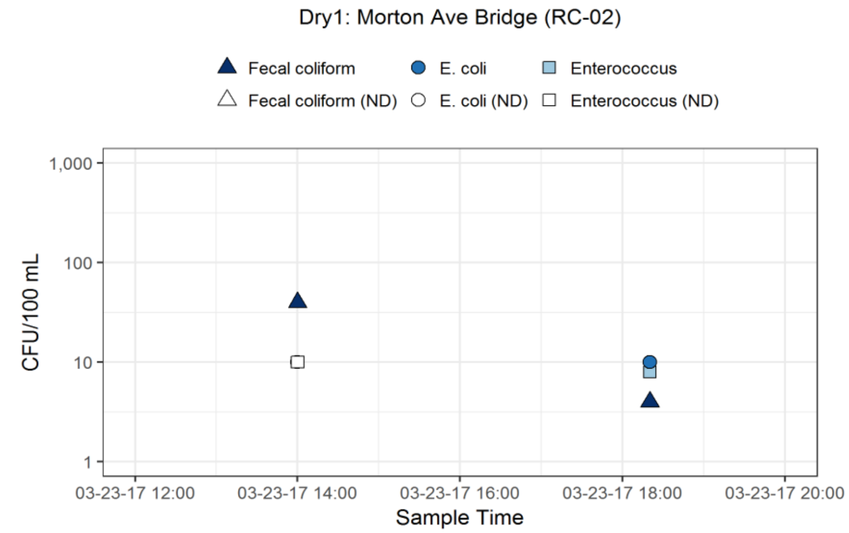
1.9 RC-01 Wet

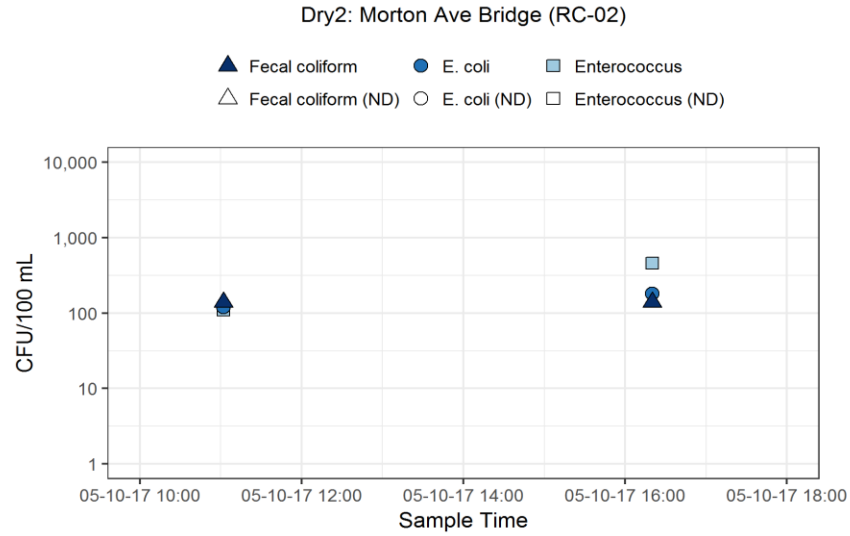

Wet1: Chester Park Dr Bridge (RC-01)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
CFU/100 mL
03-30-17 22:00
03-31-17 04:00
03-31-17 10:00
03-31-17 16:00
03-31-17 22:00
Sample Time

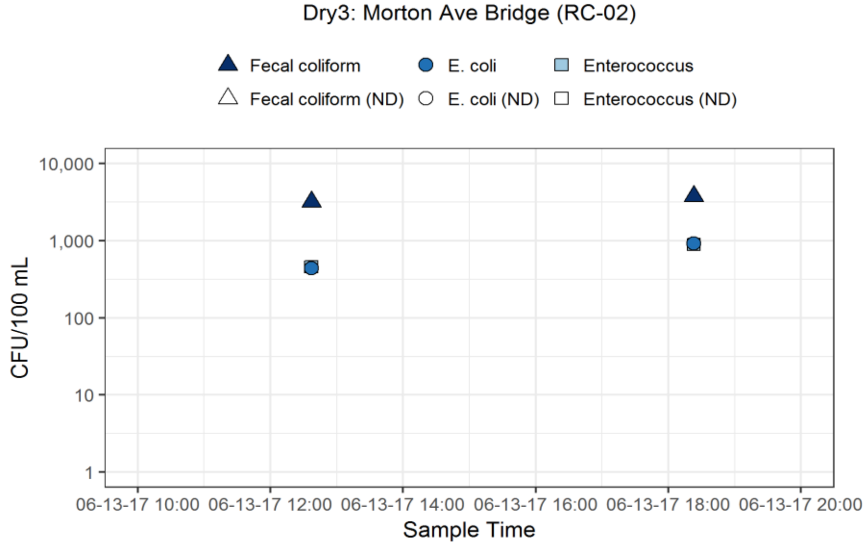

Wet2: Chester Park Dr Bridge (RC-01)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
CFU/100 mL
05-05-17 06:00
05-05-17 12:00
05-05-17 18:00
05-06-17 00:00
05-06-17 06:00
Sample Time


Wet3: Chester Park Dr Bridge (RC-01)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
CFU/100 mL
05-22-17 08:00
05-22-17 14:00
05-22-17 20:00
05-23-17 02:00
05-23-17 08:00
Sample Time

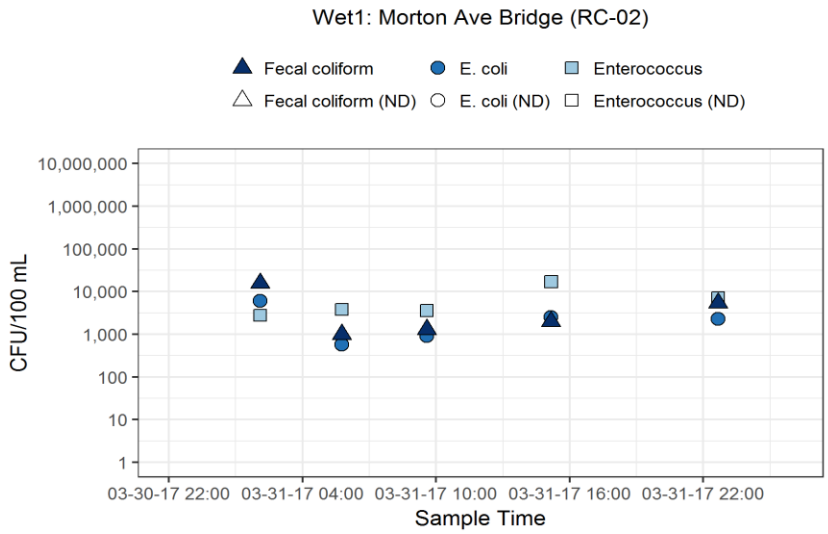
1.10 RC-02 Dry

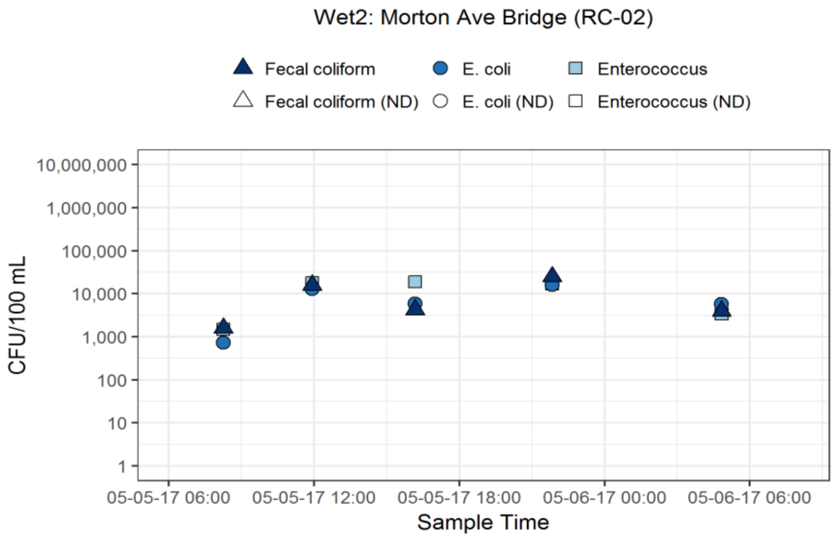

Dry1: Morton Ave Bridge (RC-02)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
1,000
100
10
1
CFU/100 mL
03-23-17 12:00
03-23-17 14:00
03-23-17 16:00
03-23-17 18:00
03-23-17 20:00
Sample Time

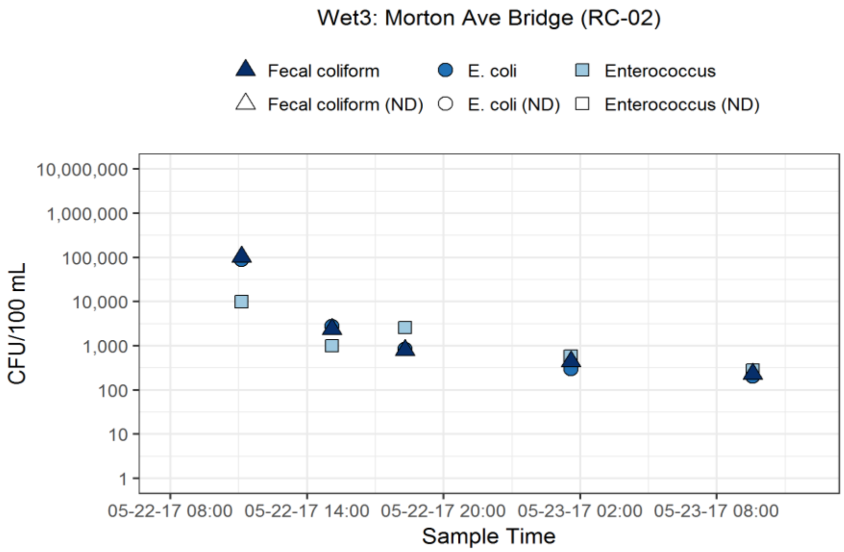

Dry2: Morton Ave Bridge (RC-02)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
10,000
1,000
100
10
1
CFU/100 mL
05-10-17 10:00
05-10-17 12:00
05-10-17 14:00
05-10-17 16:00
05-10-17 18:00
Sample Time


Dry3: Morton Ave Bridge (RC-02)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
10,000
1,000
100
10
1
CFU/100 mL
06-13-17 10:00
06-13-17 12:00
06-13-17 14:00
06-13-17 16:00
06-13-17 18:00
06-13-17 20:00
Sample Time

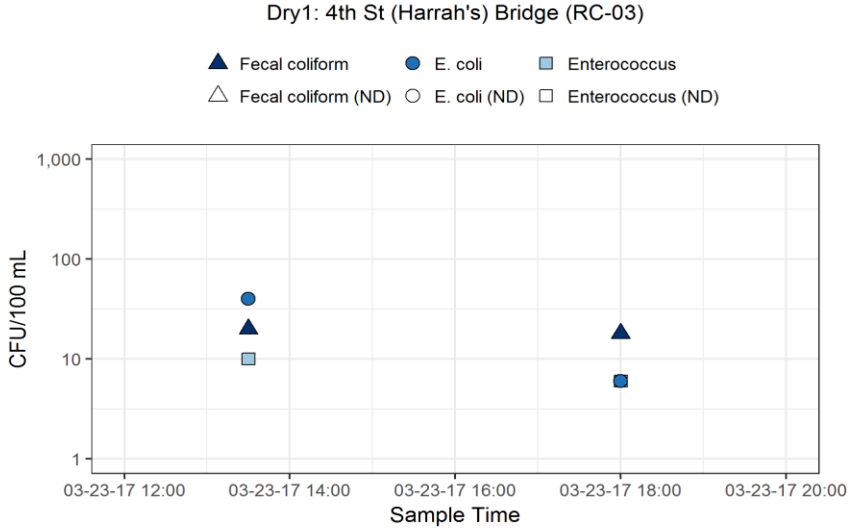
1.10 RC-02 Wet

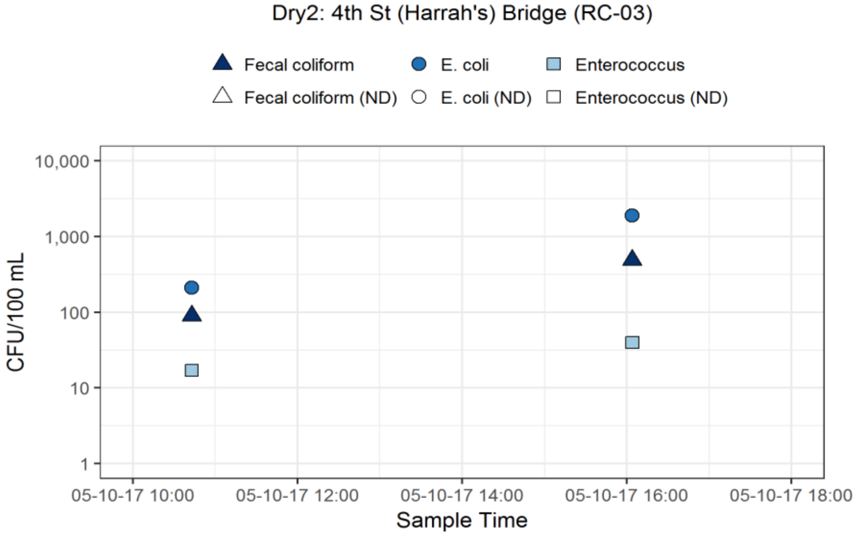

Wet1: Morton Ave Bridge (RC-02)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
CFU/100 mL
03-30-17 22:00
03-31-17 04:00
03-31-17 10:00
03-31-17 16:00
03-31-17 22:00
Sample Time

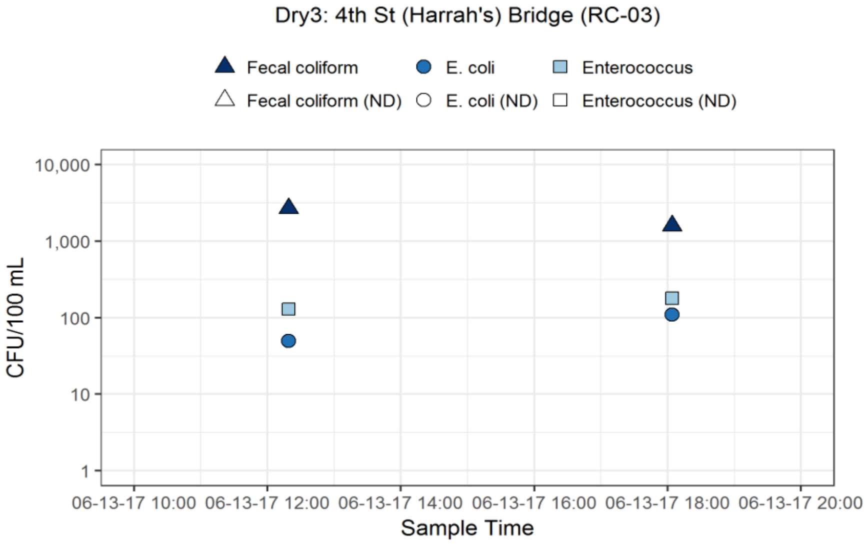

Wet2: Morton Ave Bridge (RC-02)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
CFU/100 mL
05-05-17 06:00
05-05-17 12:00
05-05-17 18:00
05-06-17 00:00
05-06-17 06:00
Sample Time


Wet3: Morton Ave Bridge (RC-02)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
CFU/100 mL
05-22-17 08:00
05-22-17 14:00
05-22-17 20:00
05-23-17 02:00
05-23-17 08:00
Sample Time

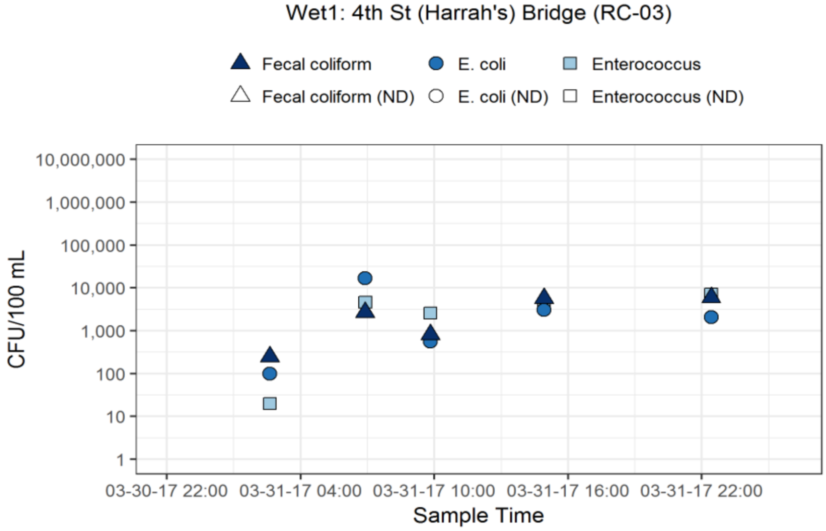
1.11 RC-03 Dry

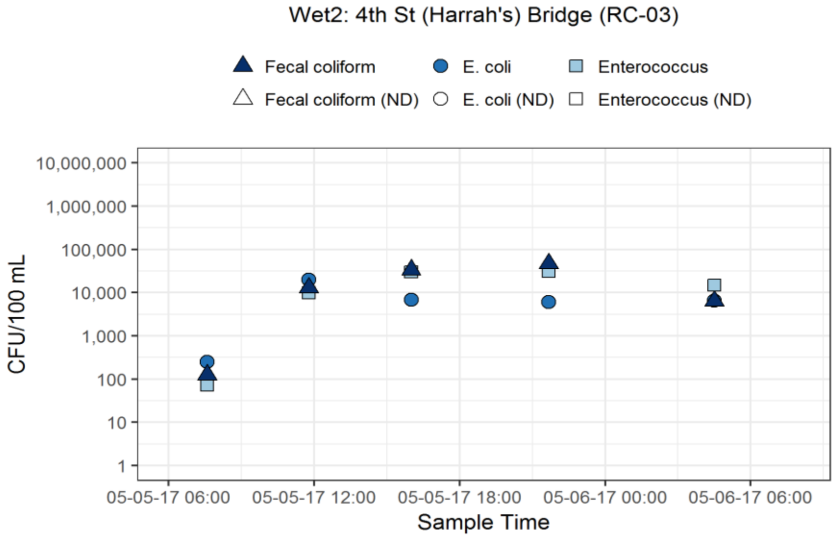

Dry1: 4th St (Harrah's) Bridge (RC-03)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
CFU/100 mL
1,000
100
10
1
03-23-17 12:00
03-23-17 14:00
03-23-17 16:00
03-23-17 18:00
03-23-17 20:00
Sample Time

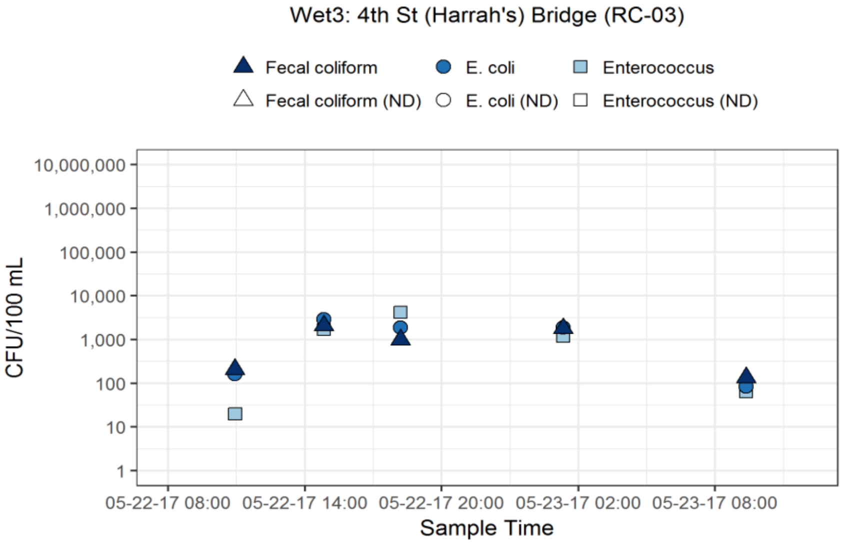

Dry2: 4th St (Harrah's) Bridge (RC-03)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
CFU/100 mL
10,000
1,000
100
10
1
05-10-17 10:00
05-10-17 12:00
05-10-17 14:00
05-10-17 16:00
05-10-17 18:00
Sample Time


Dry3: 4th St (Harrah's) Bridge (RC-03)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
CFU/100 mL
10,000
1,000
100
10
1
06-13-17 10:00
06-13-17 12:00
06-13-17 14:00
06-13-17 16:00
06-13-17 18:00
06-13-17 20:00
Sample Time

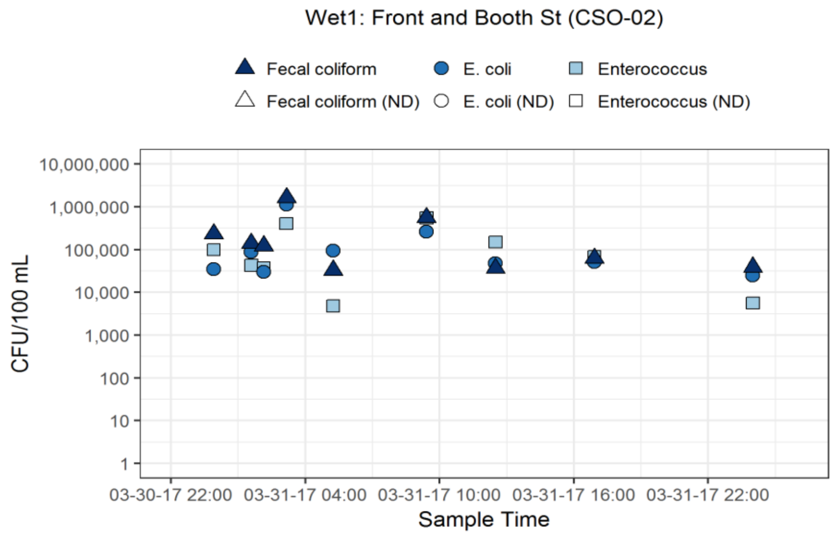
1.11 RC-03 Wet

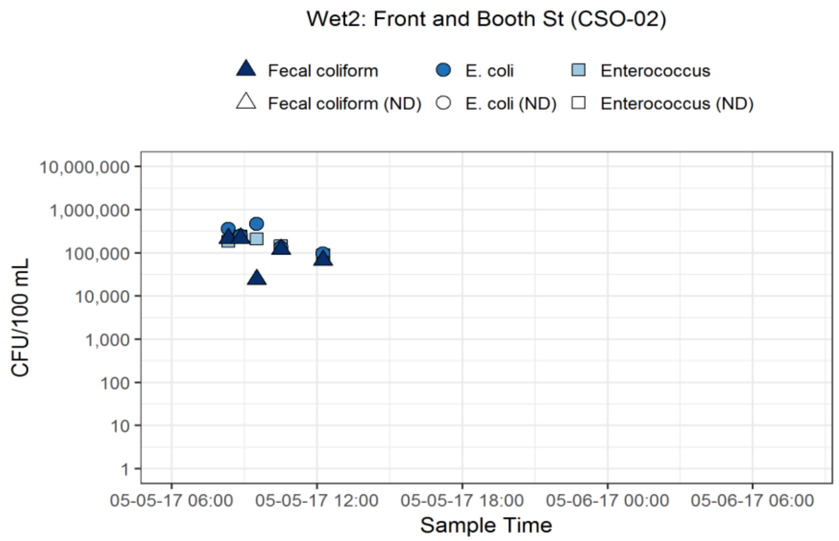

Wet1: 4th St (Harrah's) Bridge (RC-03)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
CFU/100 mL
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
03-30-17 22:00
03-31-17 04:00
03-31-17 10:00
03-31-17 16:00
03-31-17 22:00
Sample Time

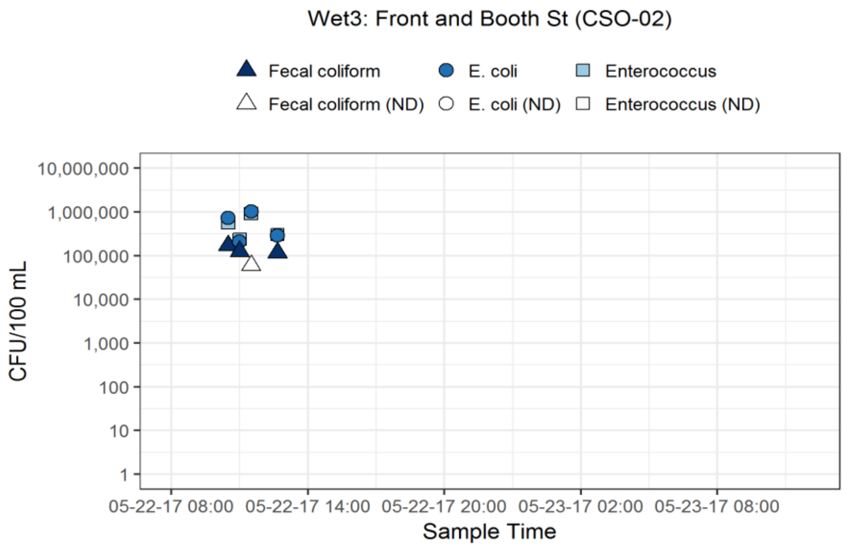

Wet2: 4th St (Harrah's) Bridge (RC-03)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
CFU/100 mL
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
05-05-17 06:00
05-05-17 12:00
05-05-17 18:00
05-06-17 00:00
05-06-17 06:00
Sample Time


Wet3: 4th St (Harrah's) Bridge (RC-03)
Fecal coliform
E. coli
Enterococcus
Fecal coliform (ND)
E. coli (ND)
Enterococcus (ND)
CFU/100 mL
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
05-22-17 08:00
05-22-17 14:00
05-22-17 20:00
05-23-17 02:00
05-23-17 08:00
Sample Time

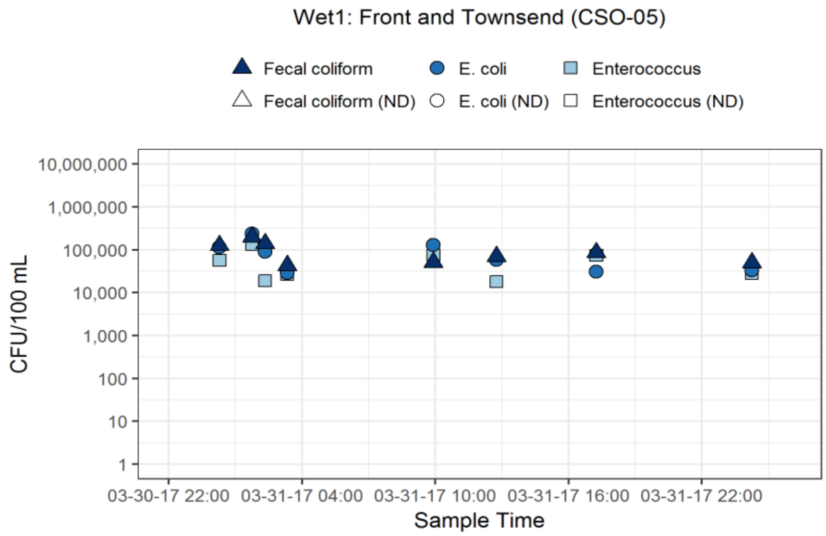
1.12 CSO-02 Wet

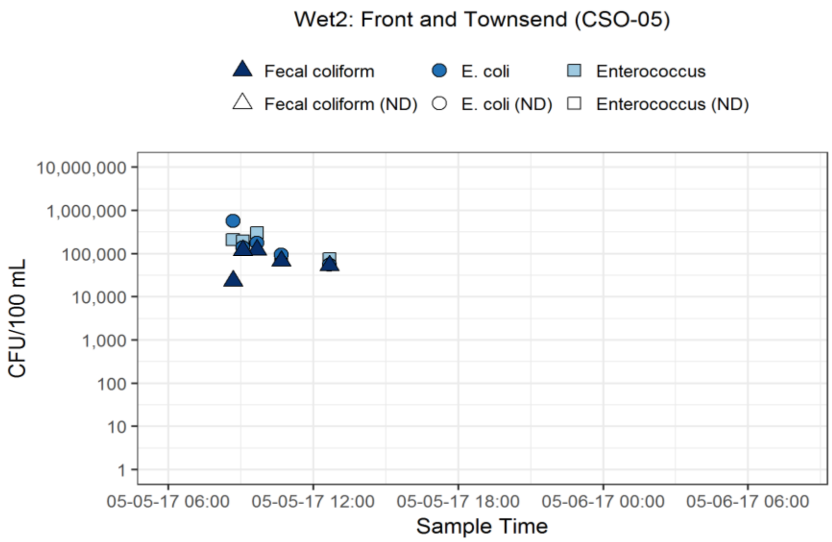


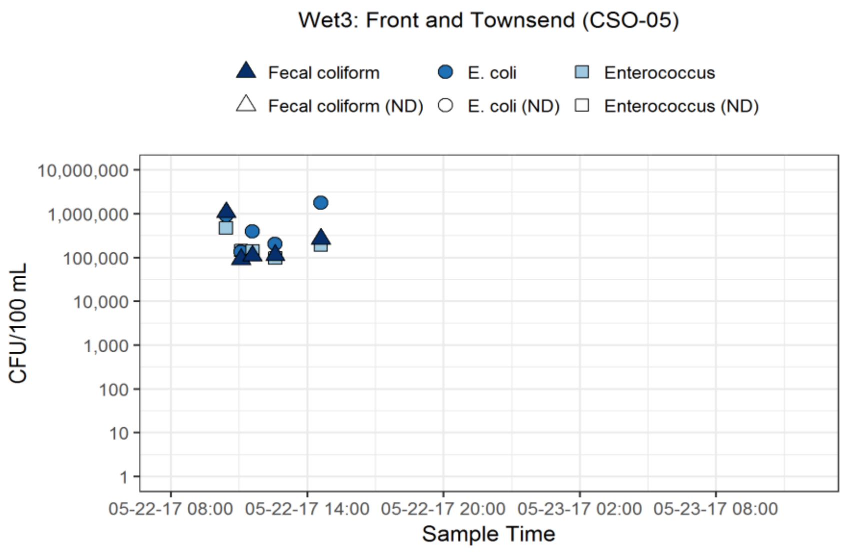




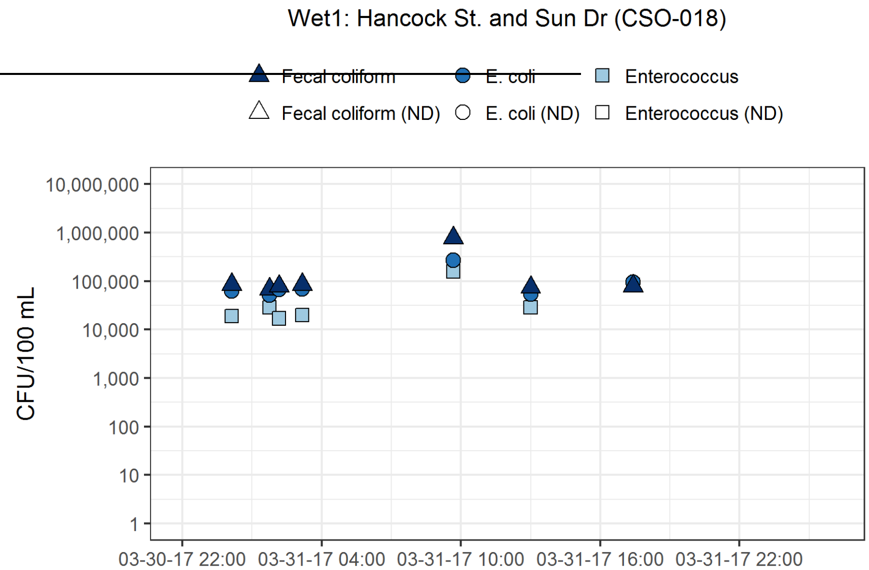
1.12 CSO-05 Wet

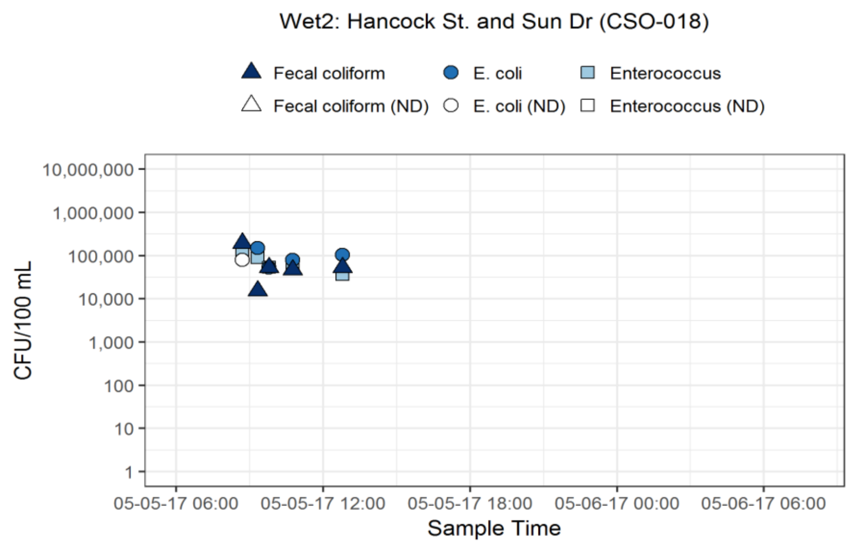


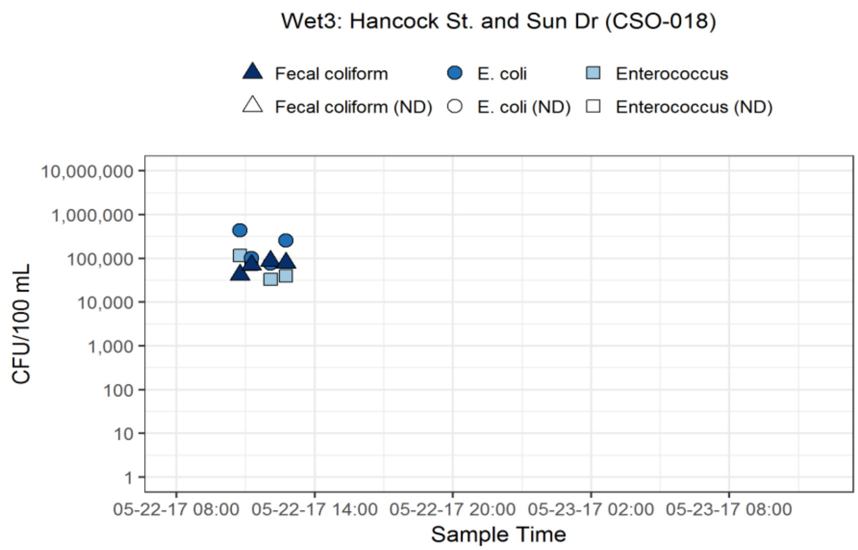




1.13 CSO-18 Wet

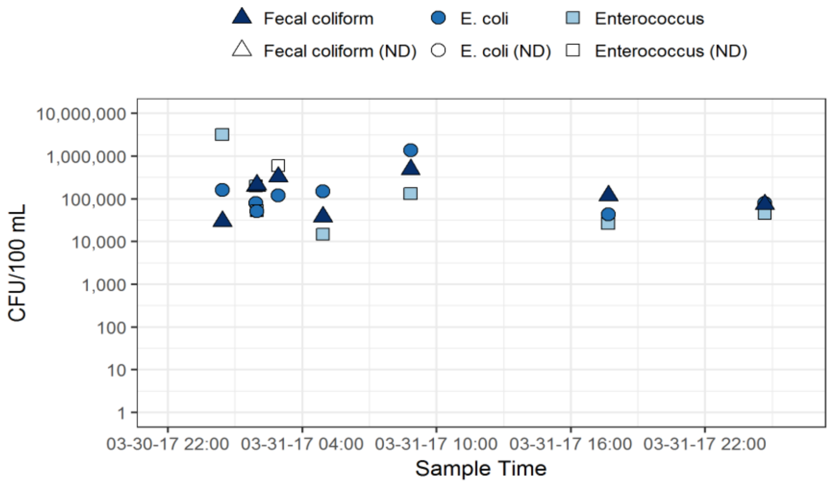




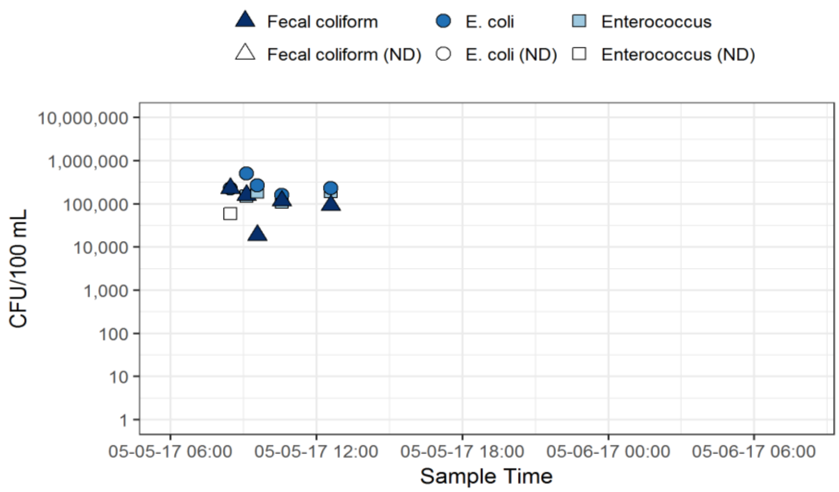


1.14 CSO-19 Wet

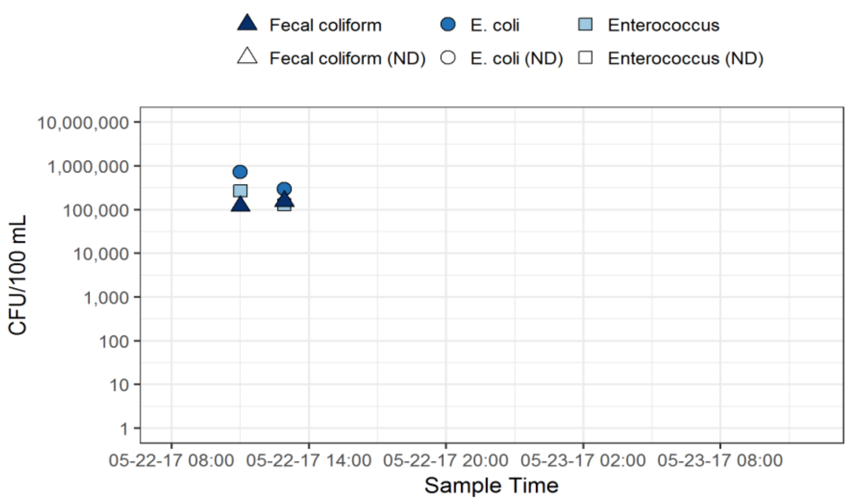
Wet1: 14th and Crozer Hospital (CSO-019)



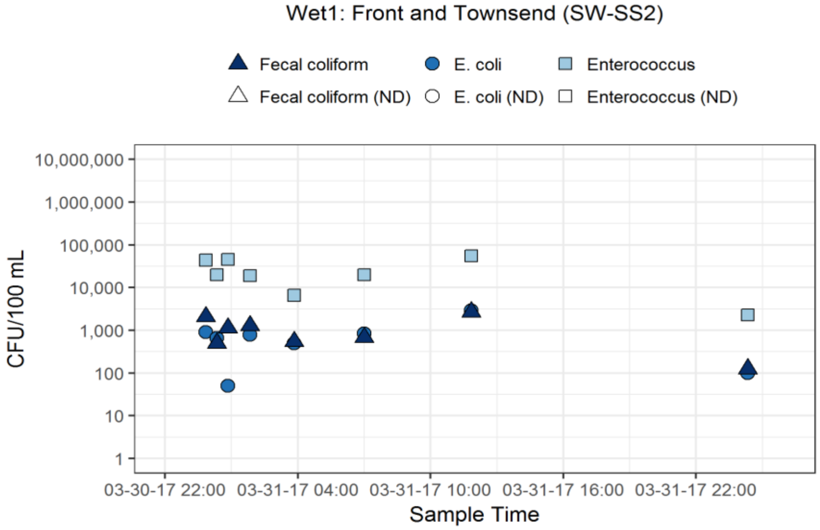
Wet2: 14th and Crozer Hospital (CSO-019)

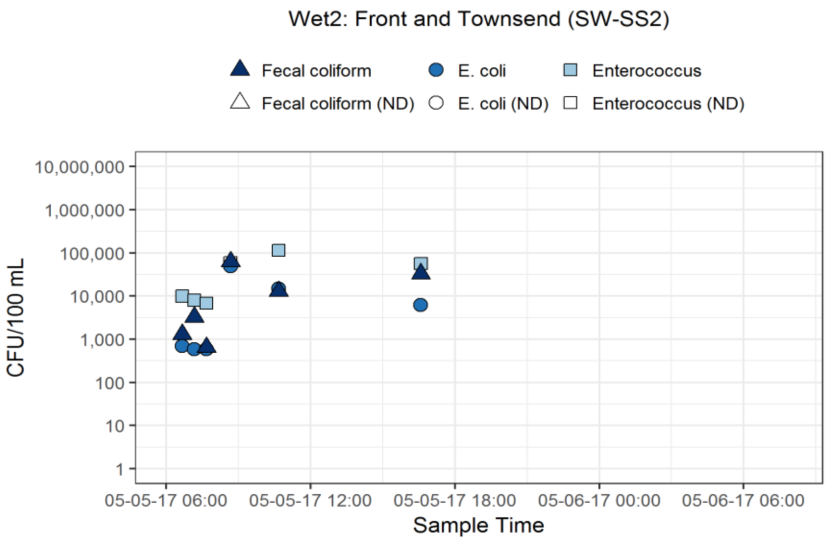


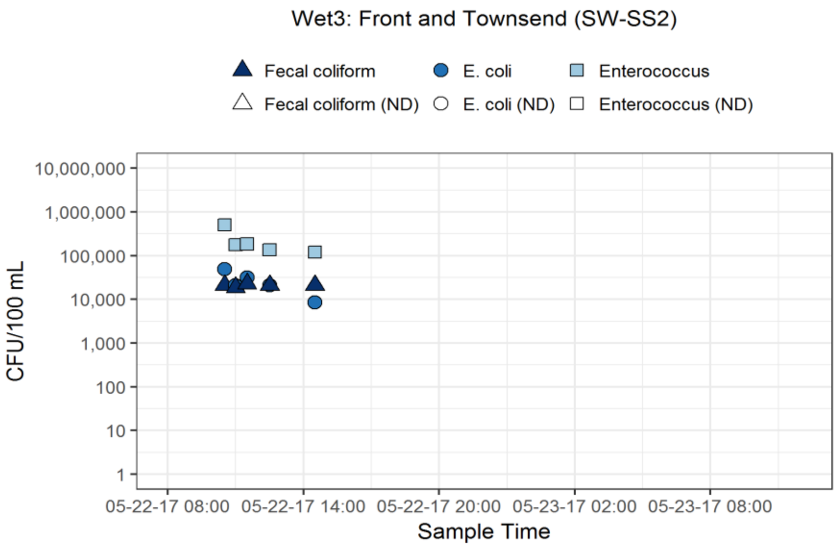
Wet3: 14th and Crozer Hospital (CSO-019)



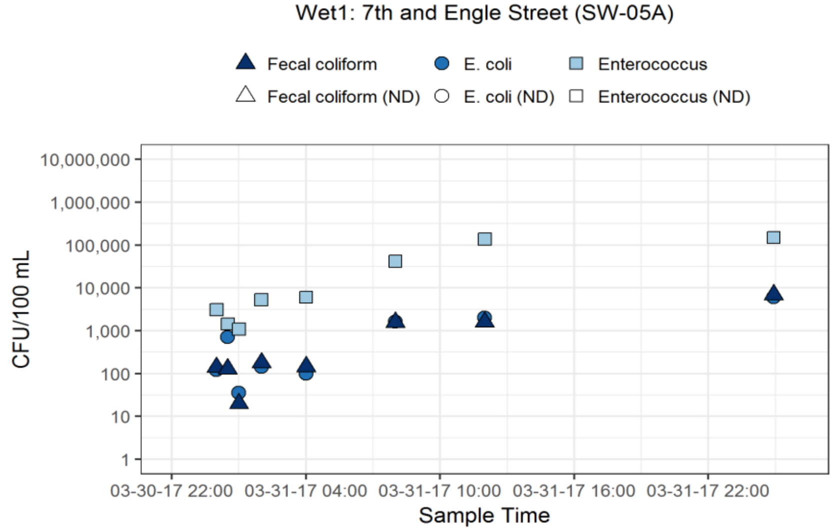
1.15 SW-SS2 Wet

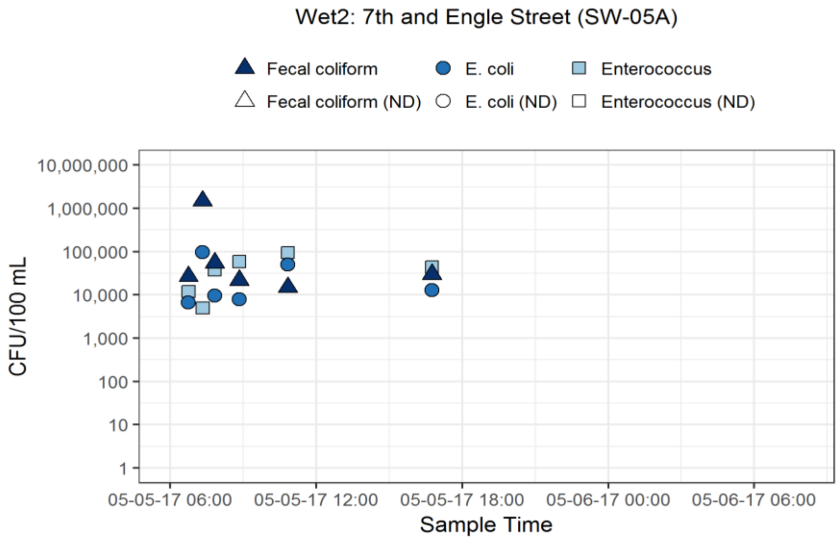


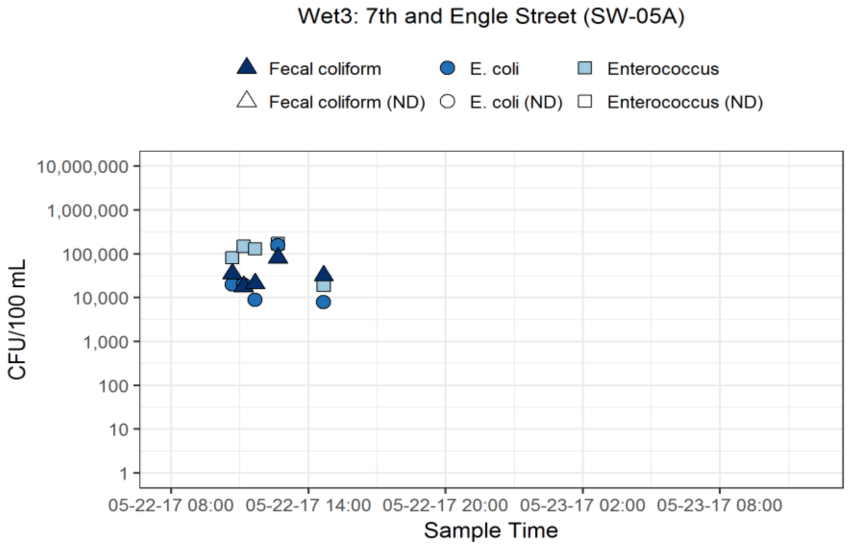




1.16 SW-O5A Wet

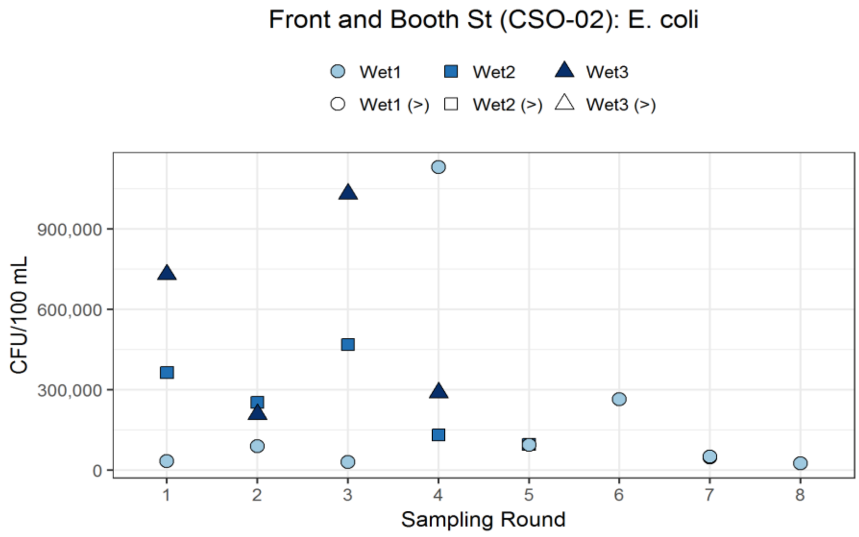


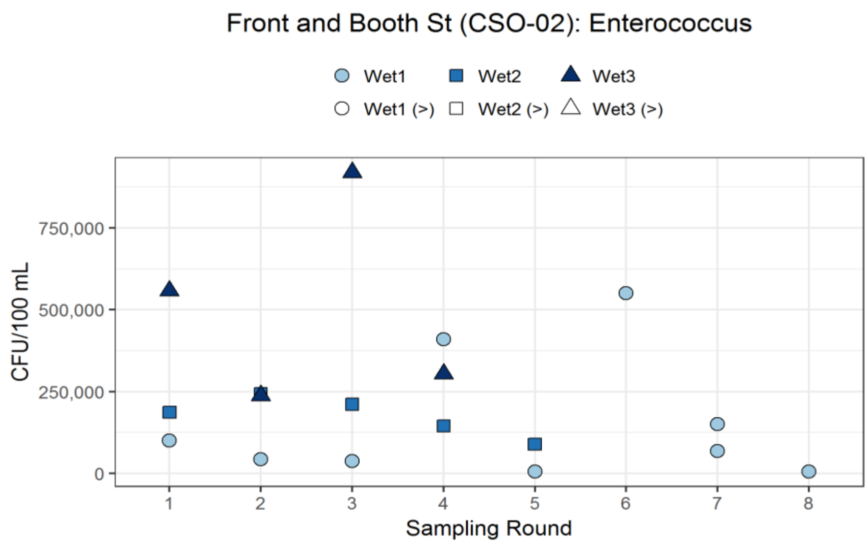


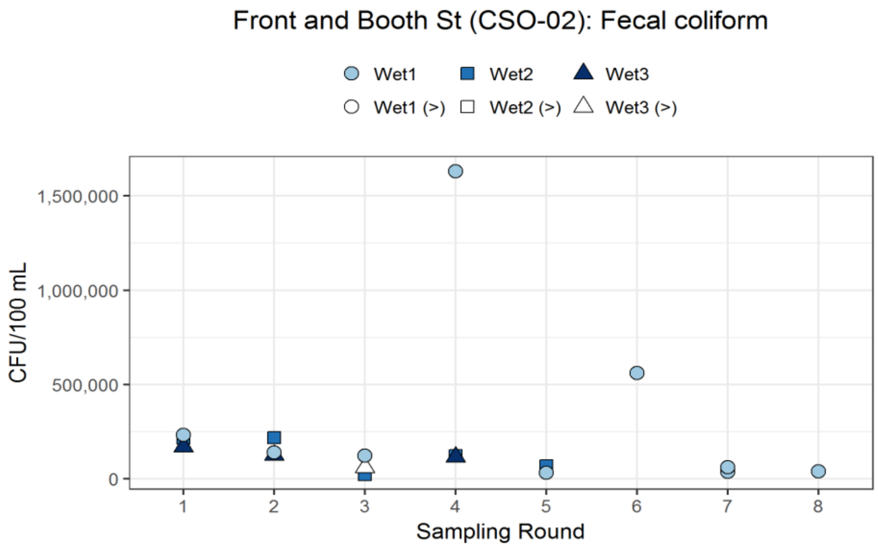


Section 2 First Flush Analysis

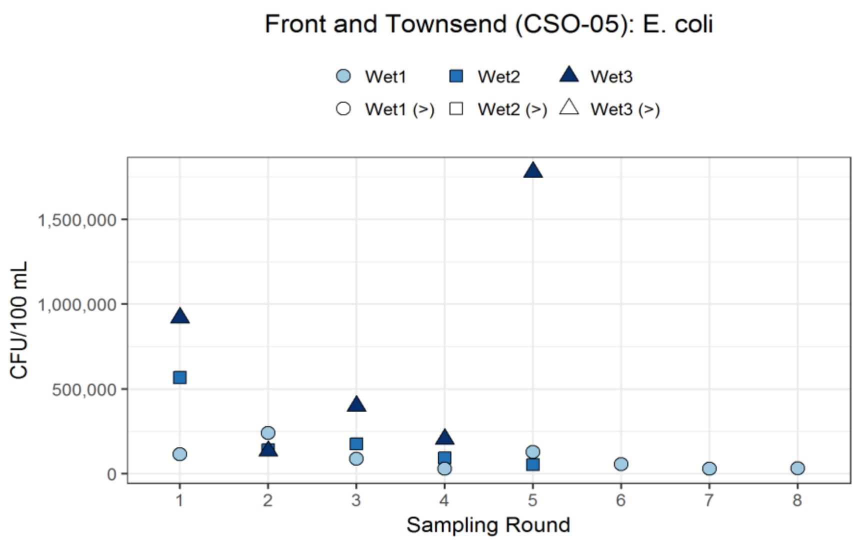
2.1 CSO-02

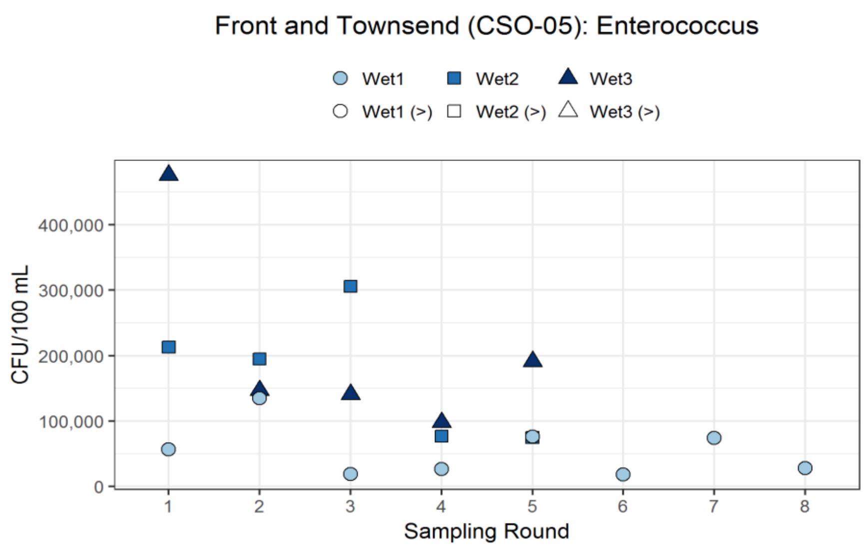

Front and Booth St (CSO-02): E. coli
Wet1
Wet2
Wet3
Wet1 (>)
Wet2 (>)
Wet3 (>)
CFU/100 mL
900,000
600,000
300,000
0
1
2
3
4
5
6
7
8
Sampling Round

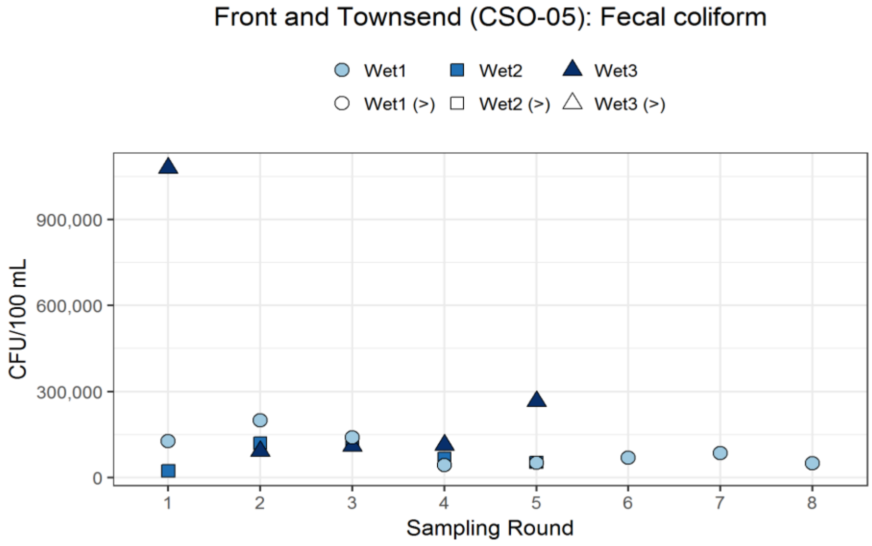

Front and Booth St (CSO-02): Enterococcus
Wet1
Wet2
Wet3
Wet1 (>)
Wet2 (>)
Wet3 (>)
CFU/100 mL
750,000
500,000
250,000
0
1
2
3
4
5
6
7
8
Sampling Round


Front and Booth St (CSO-02): Fecal coliform
Wet1
Wet2
Wet3
Wet1 (>)
Wet2 (>)
Wet3 (>)
CFU/100 mL
1,500,000
1,000,000
500,000
0
1
2
3
4
5
6
7
8
Sampling Round

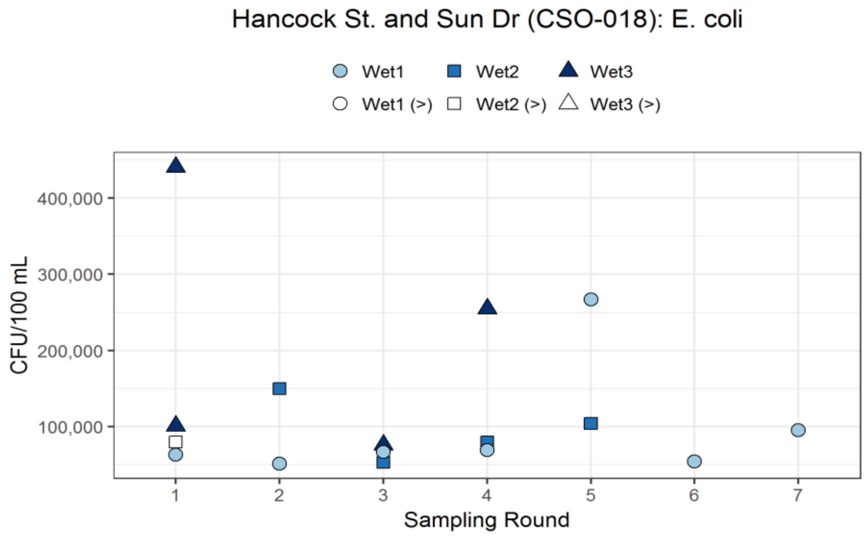
2.2 CSO-05

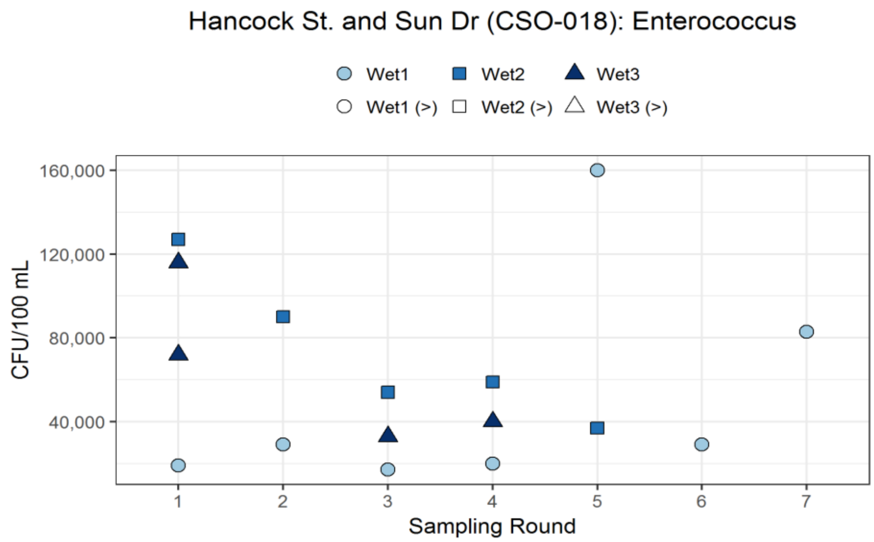

Front and Townsend (CSO-05): E. coli
Wet1
Wet2
Wet3
Wet1 (>)
Wet2 (>)
Wet3 (>)
1,500,000
1,000,000
500,000
0
CFU/100 mL
1
2
3
4
5
6
7
8
Sampling Round

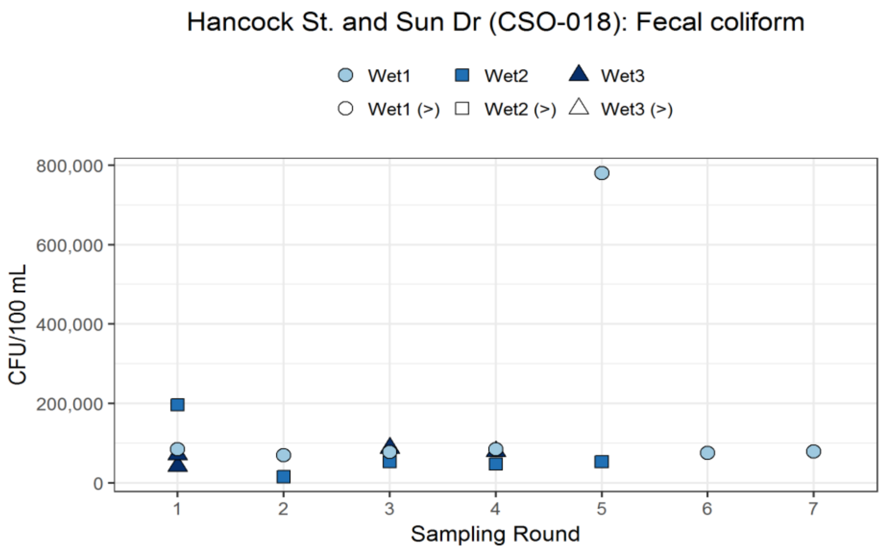

Front and Townsend (CSO-05): Enterococcus
Wet1
Wet2
Wet3
Wet1 (>)
Wet2 (>)
Wet3 (>)
400,000
300,000
200,000
100,000
0
CFU/100 mL
1
2
3
4
5
6
7
8
Sampling Round


Front and Townsend (CSO-05): Fecal coliform
Wet1
Wet2
Wet3
Wet1 (>)
Wet2 (>)
Wet3 (>)
900,000
600,000
300,000
0
CFU/100 mL
1
2
3
4
5
6
7
8
Sampling Round

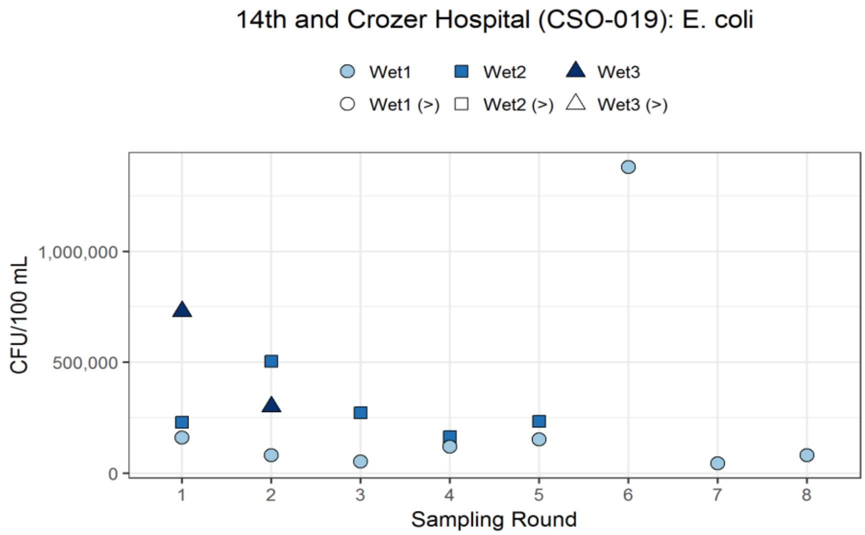
2.3 CSO-018

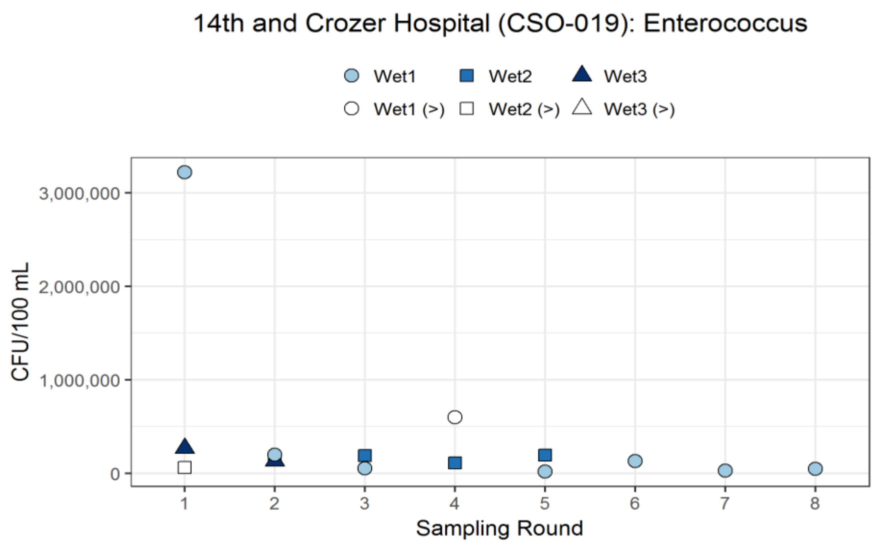

Hancock St. and Sun Dr (CSO-018): E. coli
Wet1
Wet2
Wet3
Wet1 (>)
Wet2 (>)
Wet3 (>)
CFU/100 mL
400,000
300,000
200,000
100,000
1
2
3
4
5
6
7
Sampling Round

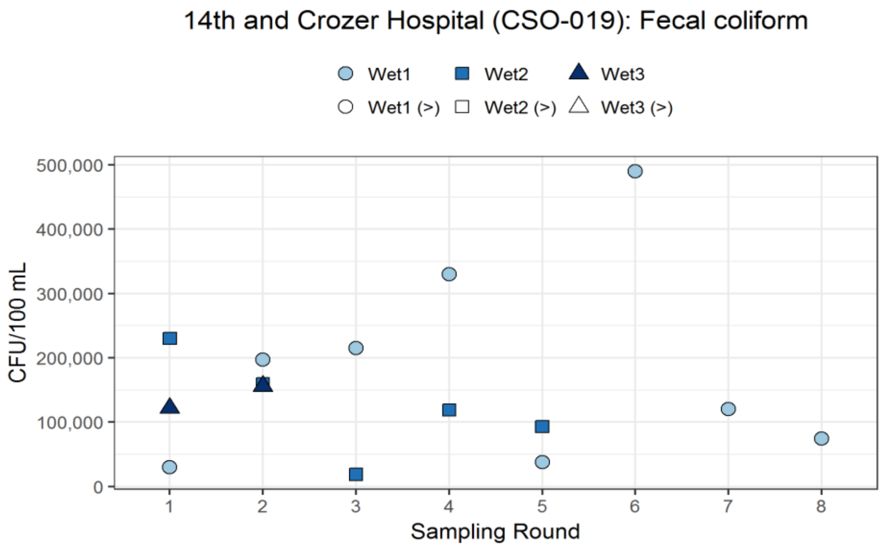

Hancock St. and Sun Dr (CSO-018): Enterococcus
Wet1
Wet2
Wet3
Wet1 (>)
Wet2 (>)
Wet3 (>)
CFU/100 mL
160,000
120,000
80,000
40,000
1
2
3
4
5
6
7
Sampling Round


Hancock St. and Sun Dr (CSO-018): Fecal coliform
Wet1
Wet2
Wet3
Wet1 (>)
Wet2 (>)
Wet3 (>)
CFU/100 mL
800,000
600,000
400,000
200,000
0
1
2
3
4
5
6
7
Sampling Round

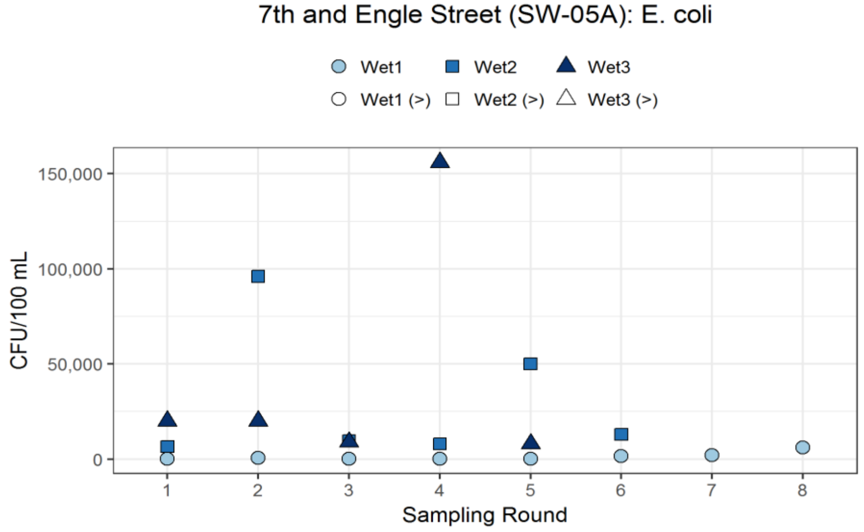
2.4 CSO-019

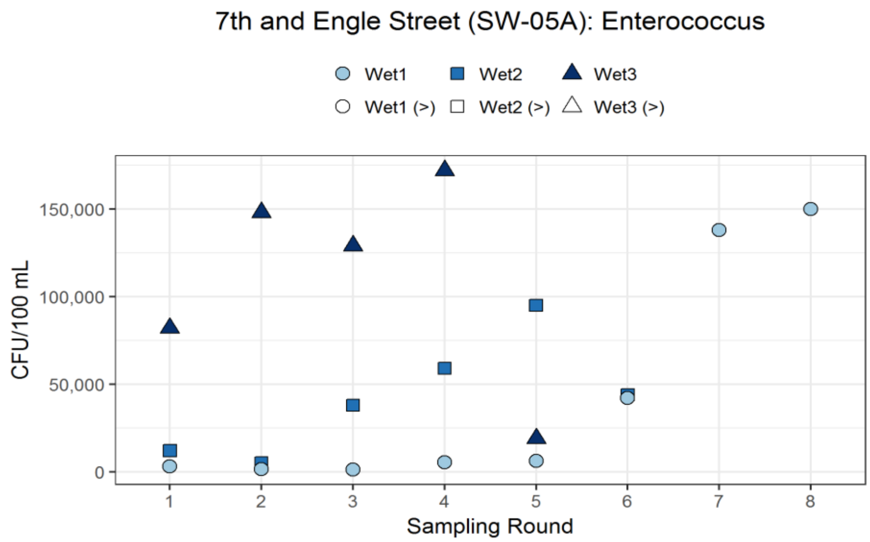

14th and Crozer Hospital (CSO-019): E. coli
Wet1
Wet2
Wet3
Wet1 (>)
Wet2 (>)
Wet3 (>)
CFU/100 mL
1,000,000
500,000
0
1
2
3
4
5
6
7
8
Sampling Round

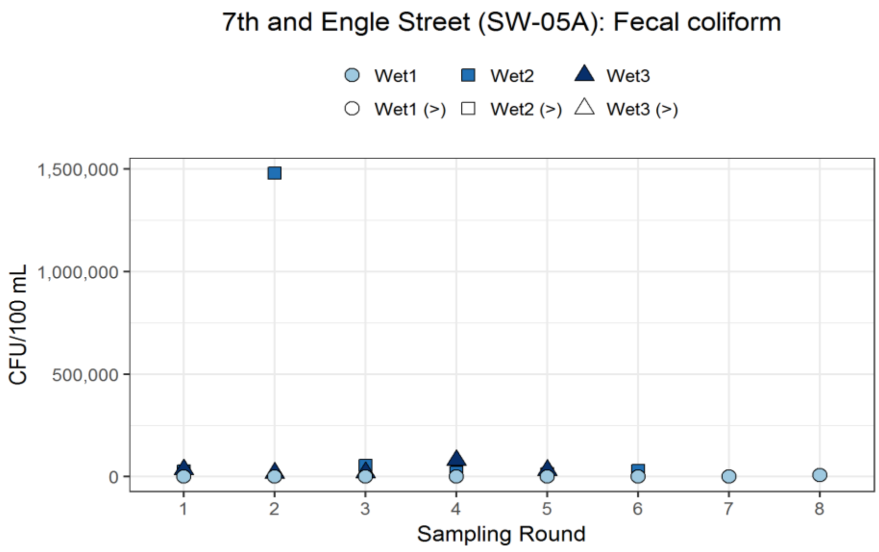

14th and Crozer Hospital (CSO-019): Enterococcus
Wet1
Wet2
Wet3
Wet1 (>)
Wet2 (>)
Wet3 (>)
CFU/100 mL
3,000,000
2,000,000
1,000,000
0
1
2
3
4
5
6
7
8
Sampling Round


14th and Crozer Hospital (CSO-019): Fecal coliform
Wet1
Wet2
Wet3
Wet1 (>)
Wet2 (>)
Wet3 (>)
CFU/100 mL
500,000
400,000
300,000
200,000
100,000
0
1
2
3
4
5
6
7
8
Sampling Round

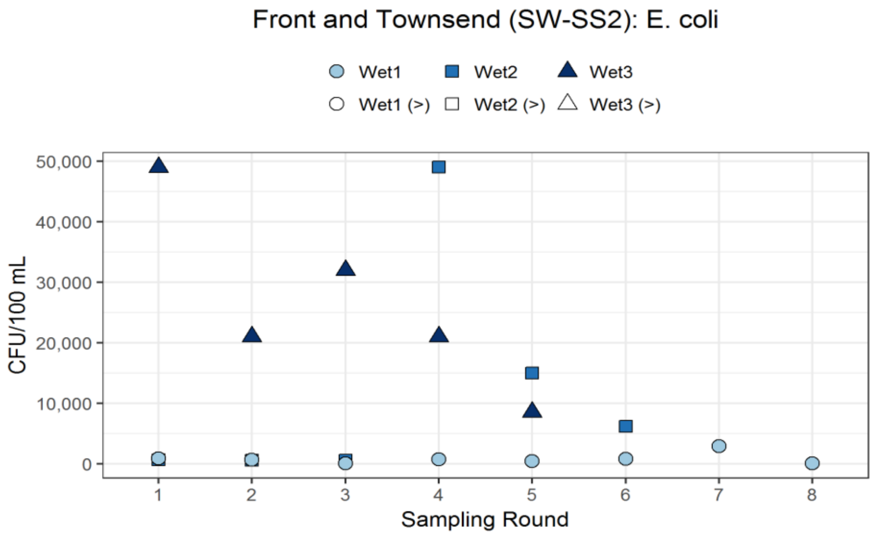
2.5 SW-05A

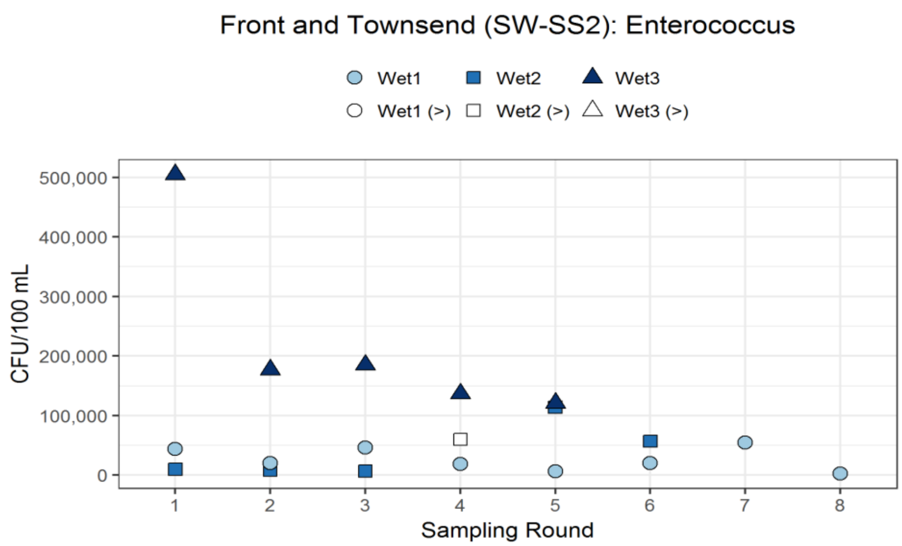

7th and Engle Street (SW-05A): E. coli
Wet1
Wet2
Wet3
Wet1 (>)
Wet2 (>)
Wet3 (>)
CFU/100 mL
150,000
100,000
50,000
0
1
2
3
4
5
6
7
8
Sampling Round

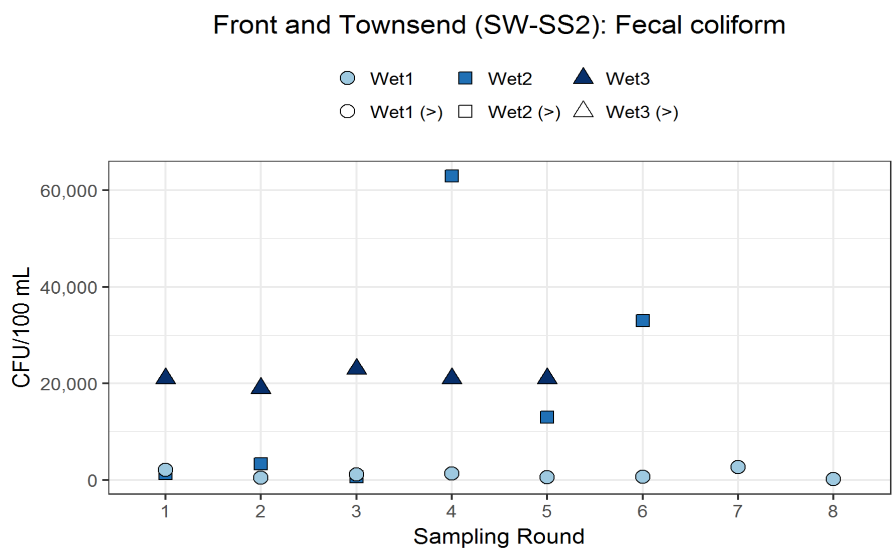

7th and Engle Street (SW-05A): Enterococcus
Wet1
Wet2
Wet3
Wet1 (>)
Wet2 (>)
Wet3 (>)
CFU/100 mL
150,000
100,000
50,000
0
1
2
3
4
5
6
7
8
Sampling Round


7th and Engle Street (SW-05A): Fecal coliform
Wet1
Wet2
Wet3
Wet1 (>)
Wet2 (>)
Wet3 (>)
CFU/100 mL
1,500,000
1,000,000
500,000
0
1
2
3
4
5
6
7
8
Sampling Round

2.6 SW-SS2

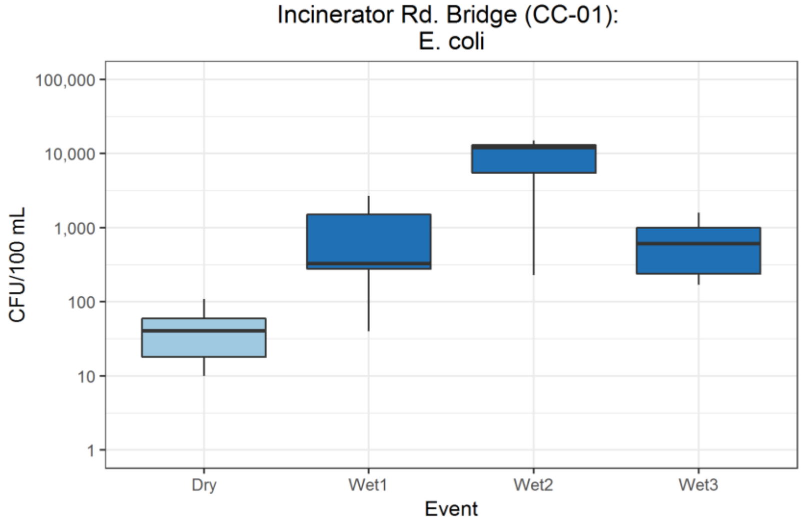

Front and Townsend (SW-SS2): E. coli
Wet1
Wet2
Wet3
Wet1 (>)
Wet2 (>)
Wet3 (>)
50,000
40,000
30,000
20,000
10,000
0
CFU/100 mL
1
2
3
4
5
6
7
8
Sampling Round

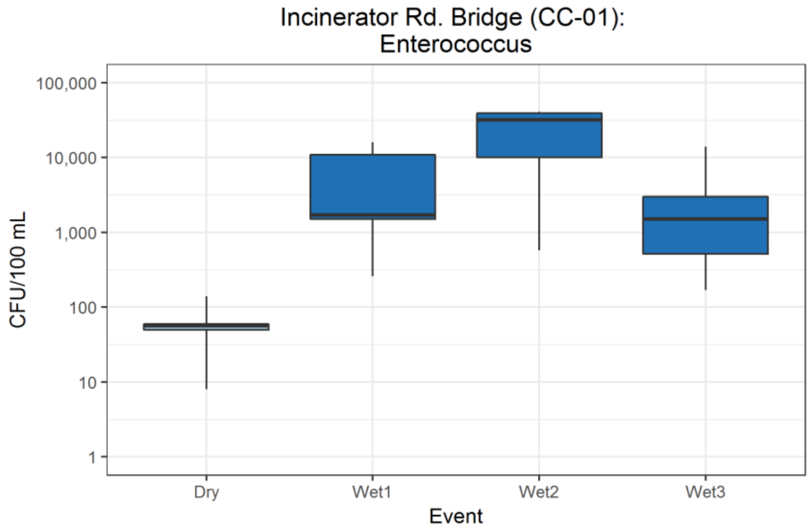

Front and Townsend (SW-SS2): Enterococcus
Wet1
Wet2
Wet3
Wet1 (>)
Wet2 (>)
Wet3 (>)
500,000
400,000
300,000
200,000
100,000
0
CFU/100 mL
1
2
3
4
5
6
7
8
Sampling Round

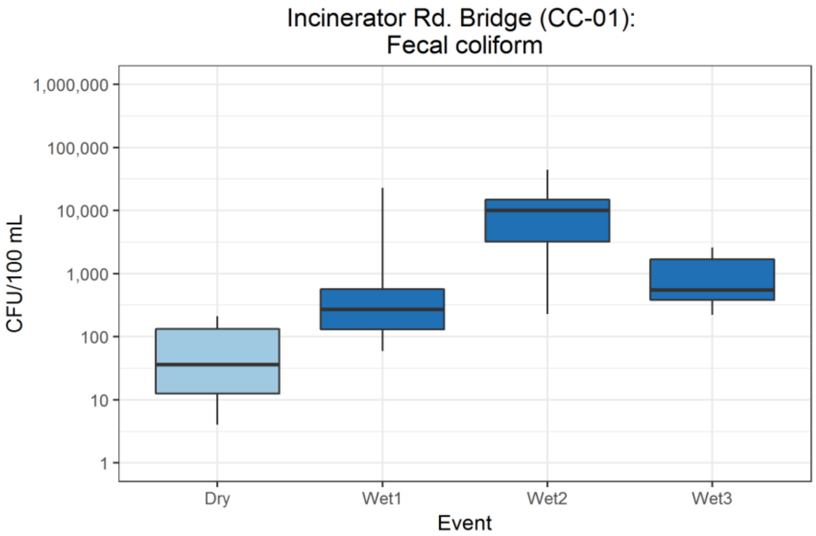

Front and Townsend (SW-SS2): Fecal coliform
Wet1
Wet2
Wet3
Wet1 (>)
Wet2 (>)
Wet3 (>)
60,000
40,000
20,000
0
CFU/100 mL
1
2
3
4
5
6
7
8
Sampling Round

Section 3 Receiving Water Wet Weather Sampling Results

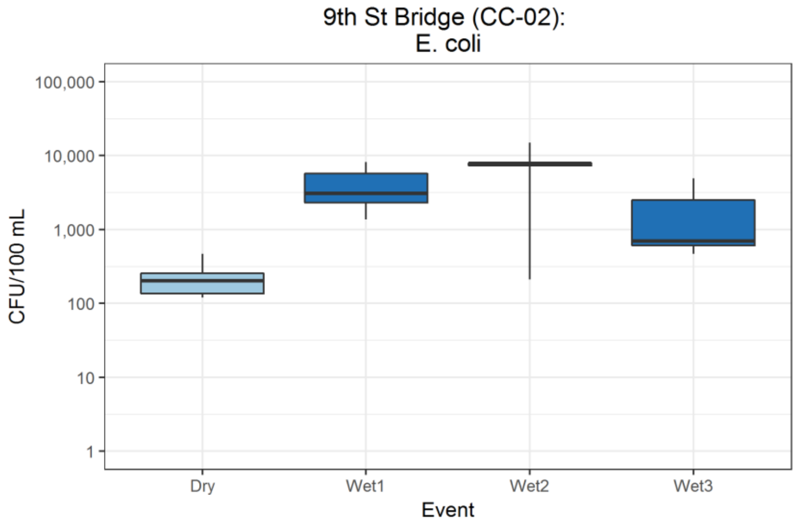
3.1 CC-01

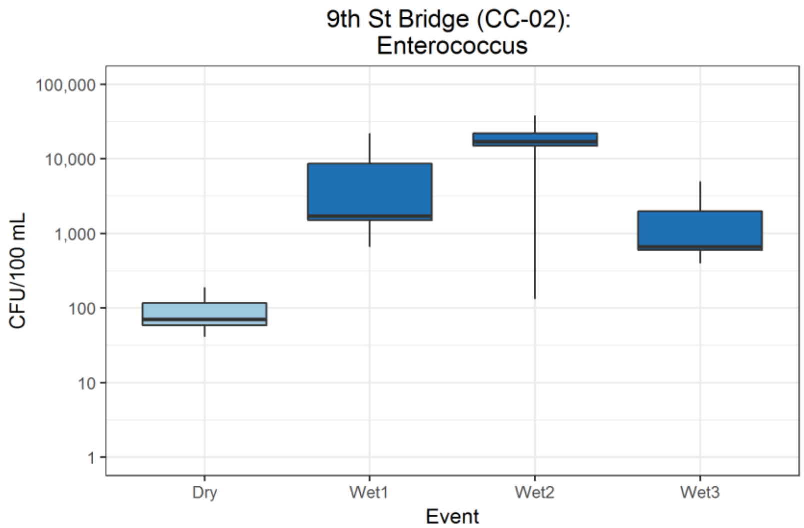

Incinerator Rd. Bridge (CC-01):
E. coli
100,000
10,000
1,000
100
10
1
CFU/100 mL
Dry
Wet1
Wet2
Wet3
Event

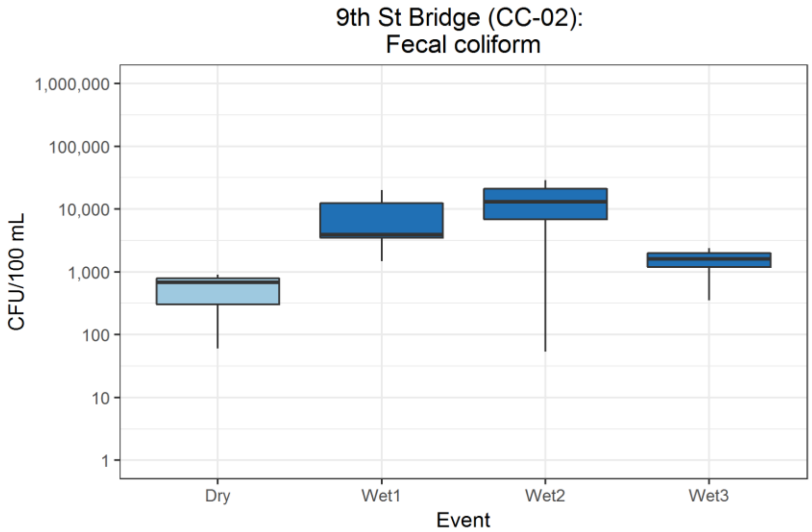

Incinerator Rd. Bridge (CC-01):
Enterococcus
100,000
10,000
1,000
100
10
1
CFU/100 mL
Dry
Wet1
Wet2
Wet3
Event


Incinerator Rd. Bridge (CC-01):
Fecal coliform
1,000,000
100,000
10,000
1,000
100
10
1
CFU/100 mL
Dry
Wet1
Wet2
Wet3
Event

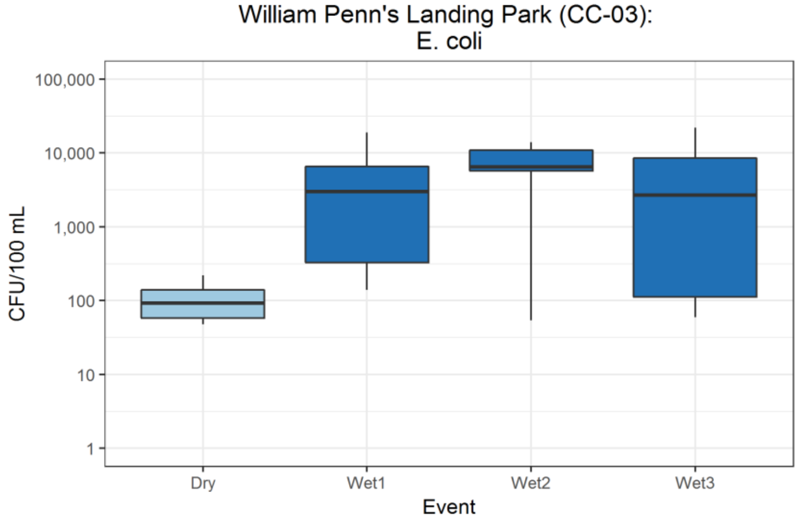
3.2 CC-02

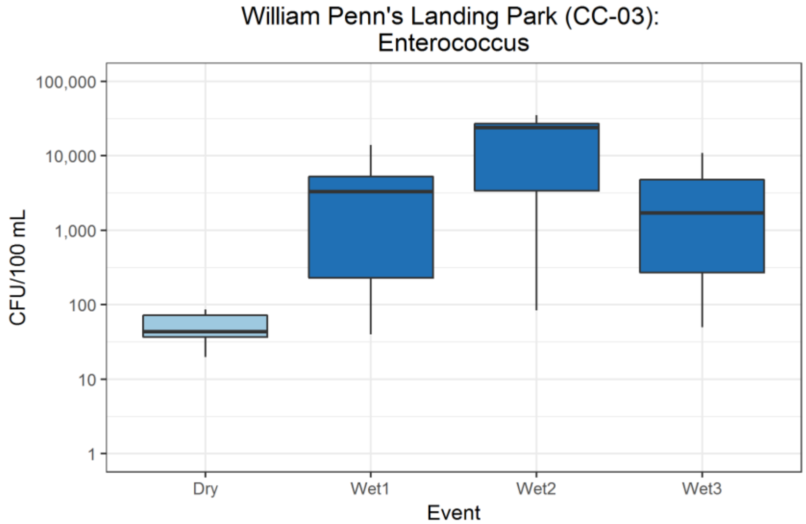

9th St Bridge (CC-02):
E. coli
CFU/100 mL
100,000
10,000
1,000
100
10
1
Dry
Wet1
Wet2
Wet3
Event

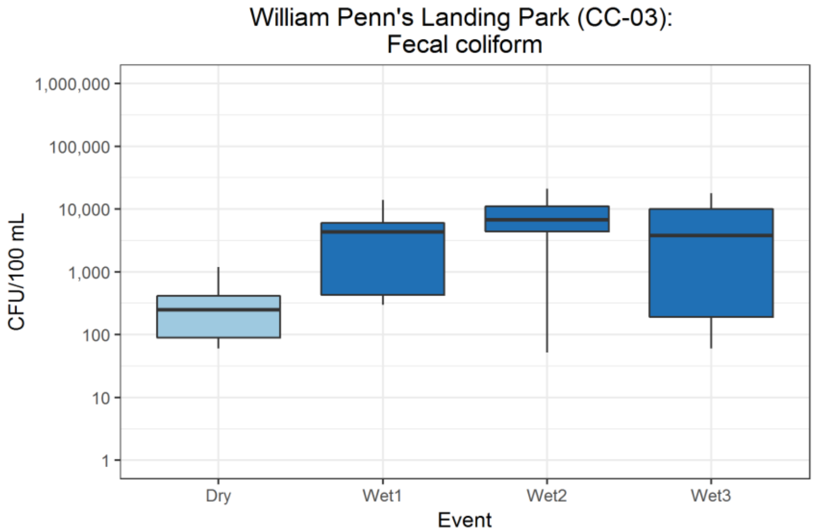

9th St Bridge (CC-02):
Enterococcus
CFU/100 mL
100,000
10,000
1,000
100
10
1
Dry
Wet1
Wet2
Wet3
Event


9th St Bridge (CC-02):
Fecal coliform
CFU/100 mL
1,000,000
100,000
10,000
1,000
100
10
1
Dry
Wet1
Wet2
Wet3
Event

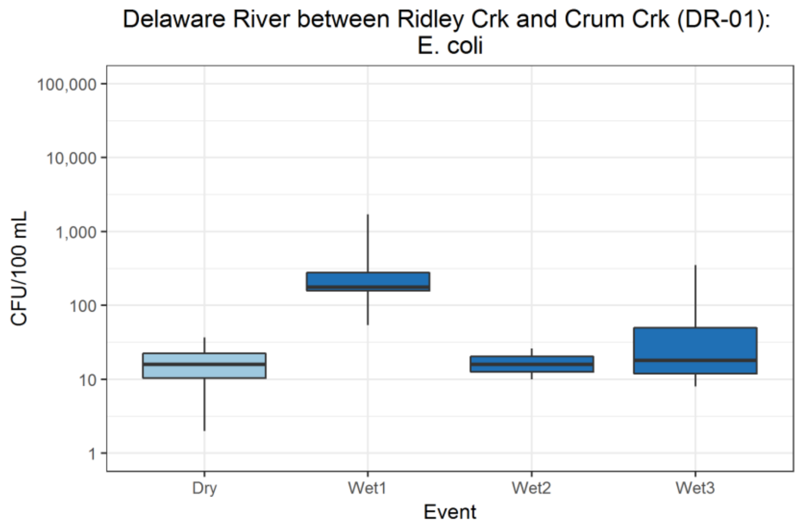
3.3 CC-03

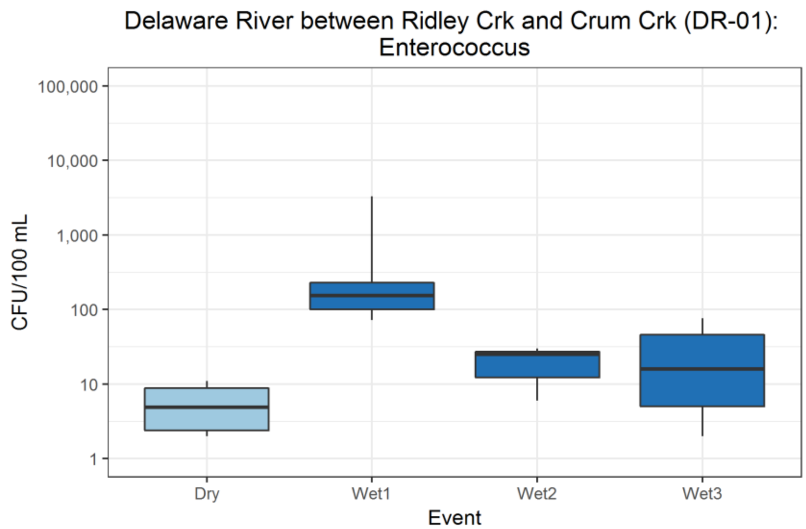

William Penn's Landing Park (CC-03):
E. coli
CFU/100 mL
100,000
10,000
1,000
100
10
1
Dry
Wet1
Wet2
Wet3
Event

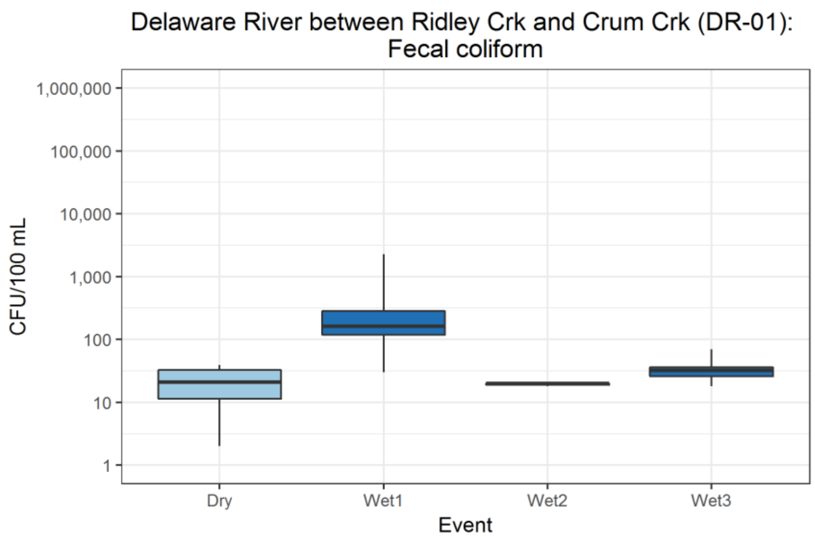

William Penn's Landing Park (CC-03):
Enterococcus
CFU/100 mL
100,000
10,000
1,000
100
10
1
Dry
Wet1
Wet2
Wet3
Event


William Penn's Landing Park (CC-03):
Fecal coliform
CFU/100 mL
1,000,000
100,000
10,000
1,000
100
10
1
Dry
Wet1
Wet2
Wet3
Event

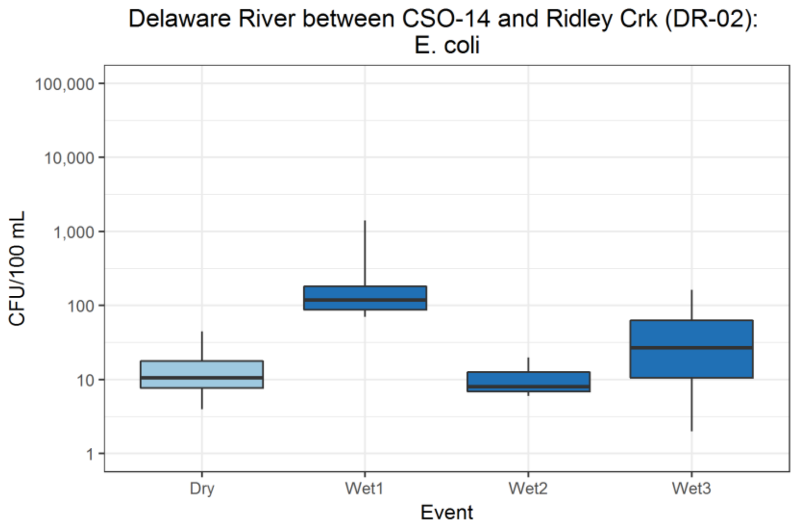
3.4 DR-01

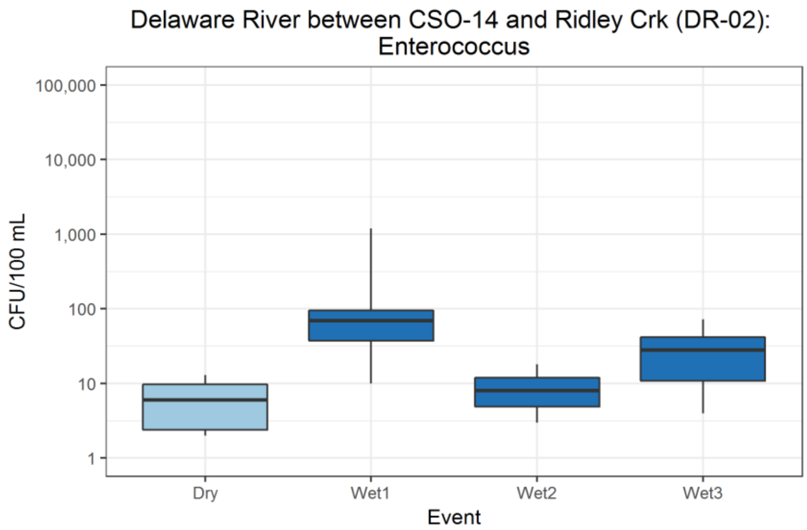

Delaware River between Ridley Crk and Crum Crk (DR-01):
E. coli
100,000
10,000
1,000
100
10
1
CFU/100 mL
Dry
Wet1
Wet2
Wet3
Event

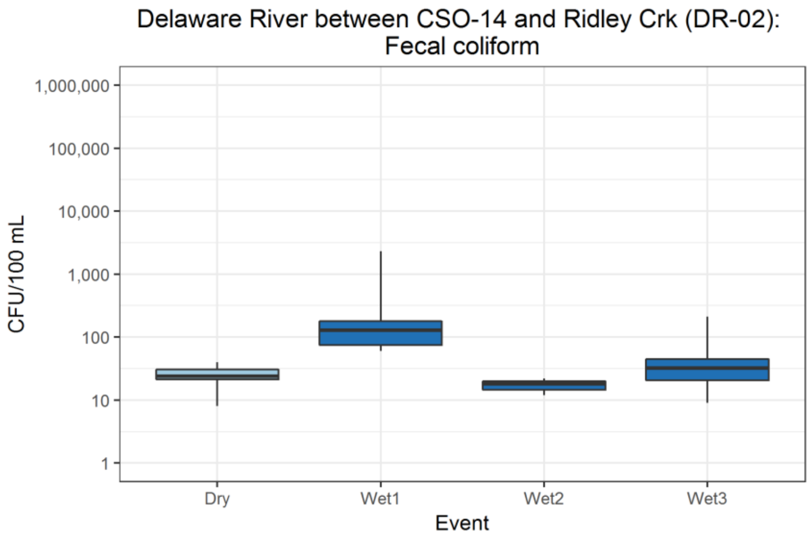

Delaware River between Ridley Crk and Crum Crk (DR-01):
Enterococcus
100,000
10,000
1,000
100
10
1
CFU/100 mL
Dry
Wet1
Wet2
Wet3
Event


Delaware River between Ridley Crk and Crum Crk (DR-01):
Fecal coliform
1,000,000
100,000
10,000
1,000
100
10
1
CFU/100 mL
Dry
Wet1
Wet2
Wet3
Event

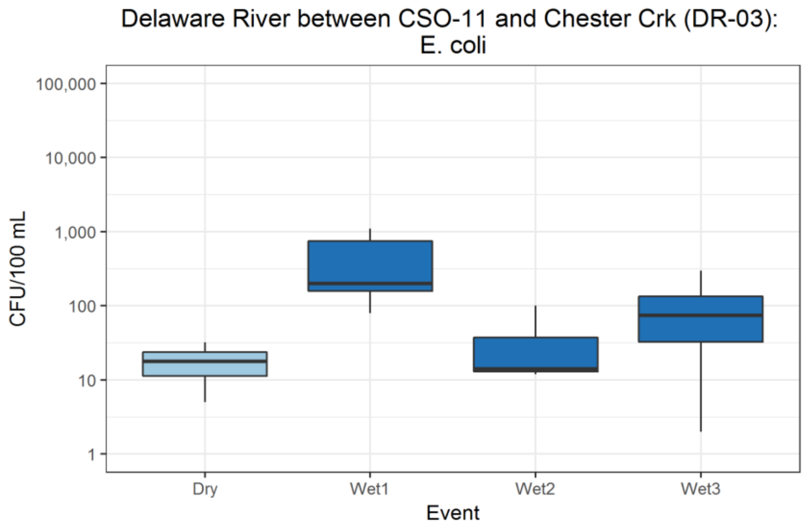
3.5 DR-02

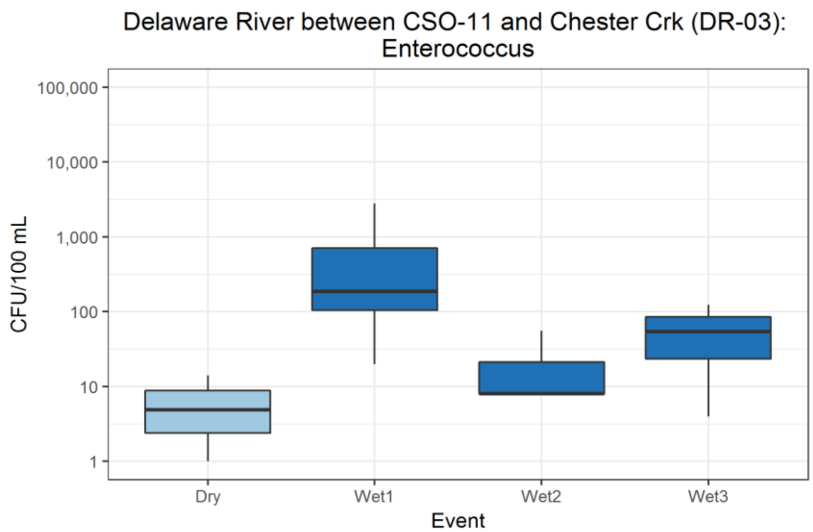

Delaware River between CSO-14 and Ridley Crk (DR-02):
E. coli
CFU/100 mL
100,000
10,000
1,000
100
10
1
Dry
Wet1
Wet2
Wet3
Event

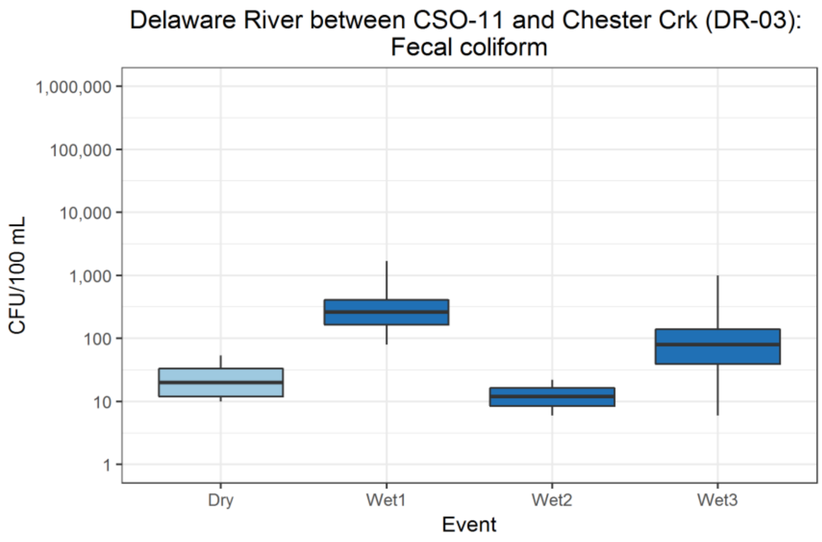

Delaware River between CSO-14 and Ridley Crk (DR-02):
Enterococcus
CFU/100 mL
100,000
10,000
1,000
100
10
1
Dry
Wet1
Wet2
Wet3
Event


Delaware River between CSO-14 and Ridley Crk (DR-02):
Fecal coliform
CFU/100 mL
1,000,000
100,000
10,000
1,000
100
10
1
Dry
Wet1
Wet2
Wet3
Event

3.6 DR-03

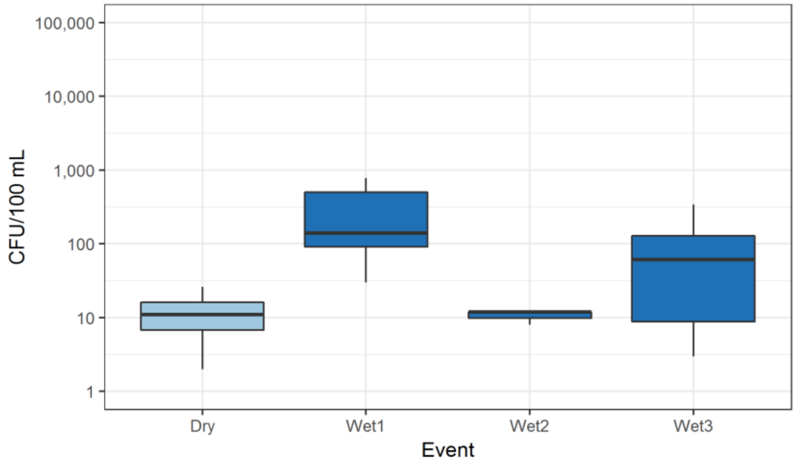

Delaware River between CSO-11 and Chester Crk (DR-03):
E. coli
CFU/100 mL
100,000
10,000
1,000
100
10
1
Dry
Wet1
Wet2
Wet3
Event


Delaware River between CSO-11 and Chester Crk (DR-03):
Enterococcus
CFU/100 mL
100,000
10,000
1,000
100
10
1
Dry
Wet1
Wet2
Wet3
Event

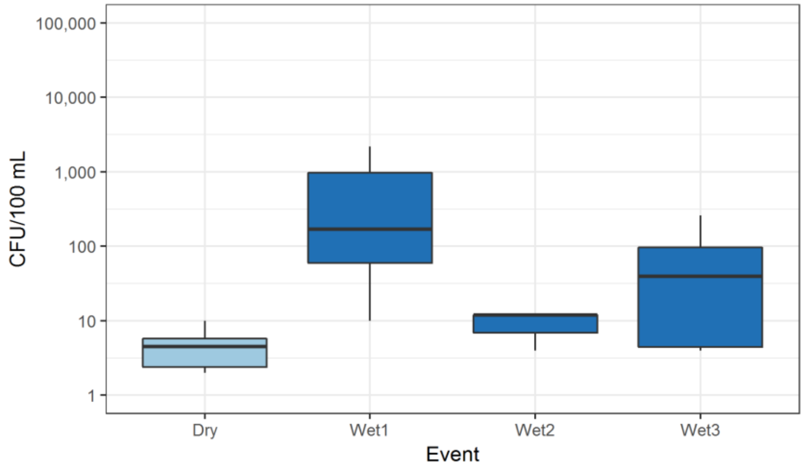

Delaware River between CSO-11 and Chester Crk (DR-03):
Fecal coliform
CFU/100 mL
1,000,000
100,000
10,000
1,000
100
10
1
Dry
Wet1
Wet2
Wet3
Event

3.7 DR-04

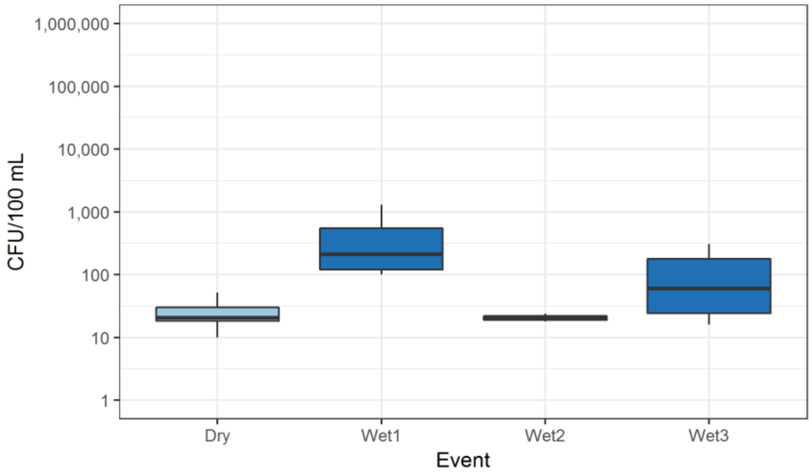
Delaware River at the boat launch off Highway 322 (DR-04):
E. coli



Delaware River at the boat launch off Highway 322 (DR-04):
Enterococcus

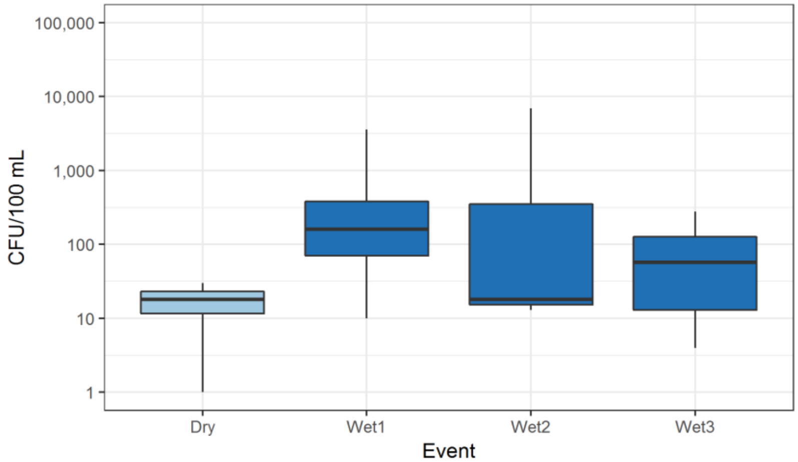


Delaware River at the boat launch off Highway 322 (DR-04):
Fecal coliform

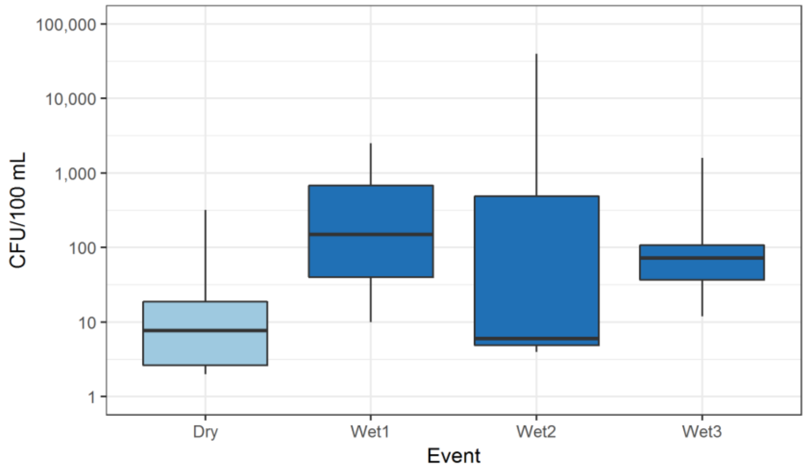


3.8 DR-05

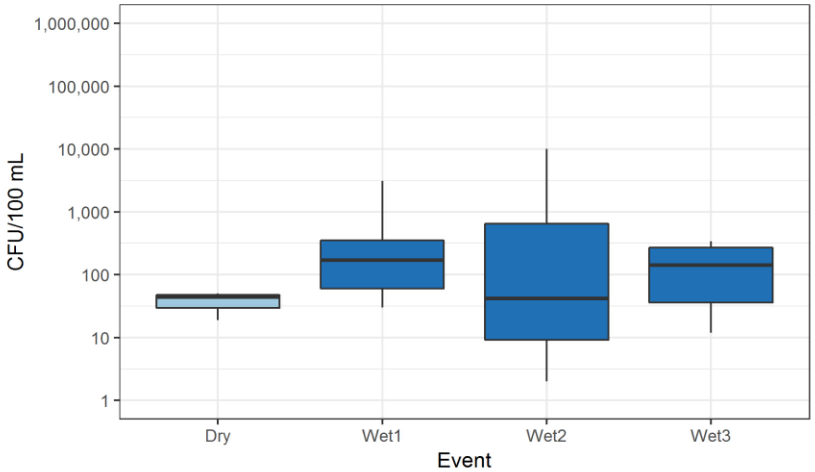
Delaware River between CSO- 002 and Stoney Crk (DR-05):
E. coli



Delaware River between CSO- 002 and Stoney Crk (DR-05):
Enterococcus

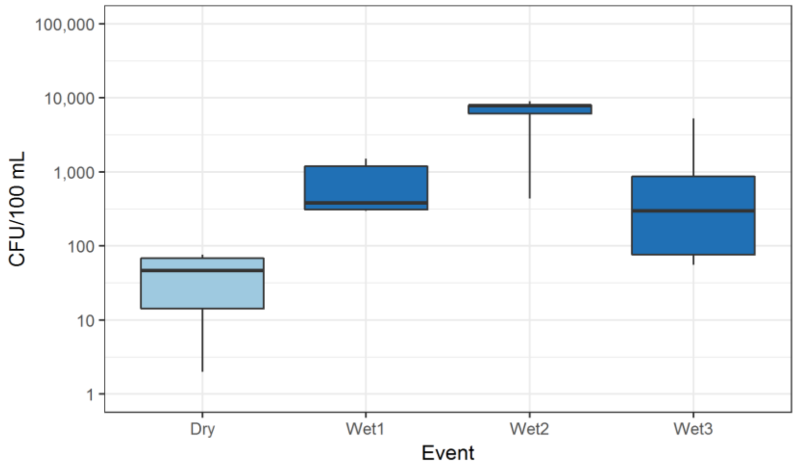


Delaware River between CSO- 002 and Stoney Crk (DR-05):
Fecal coliform

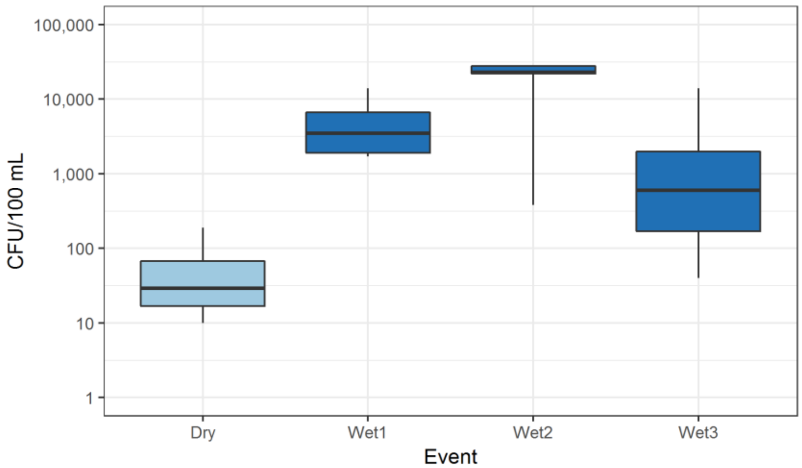


3.9 RC-01

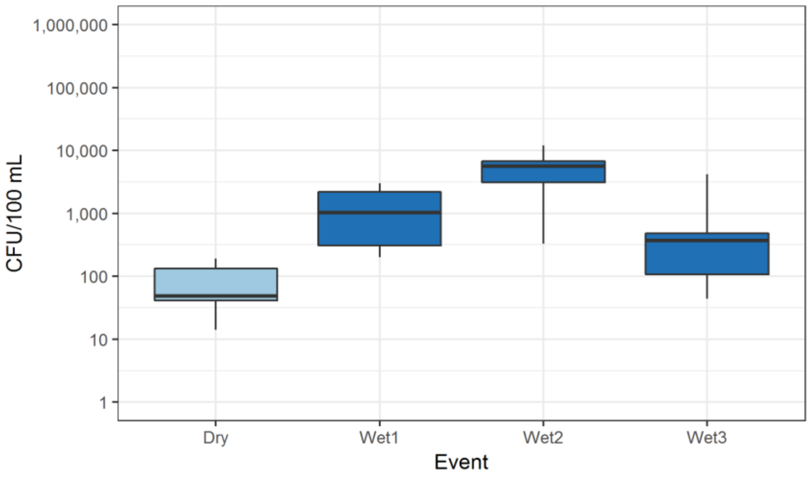
Chester Park Dr Bridge (RC-01):
E. coli



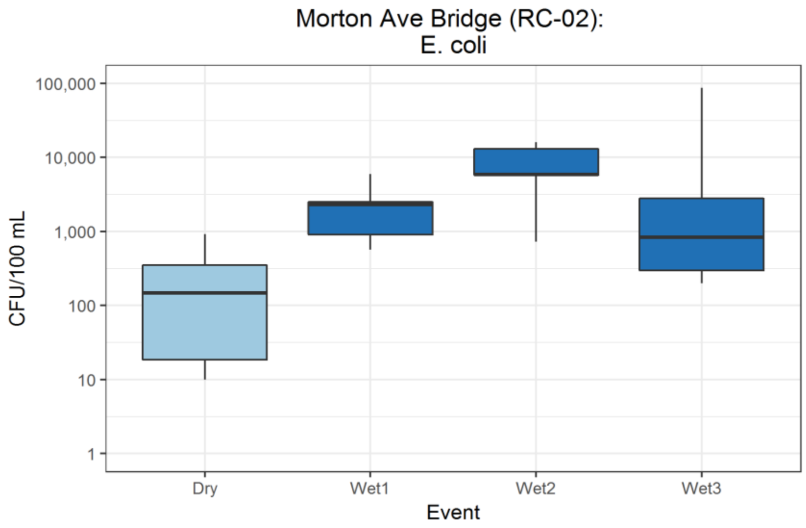
Chester Park Dr Bridge (RC-01):
Enterococcus

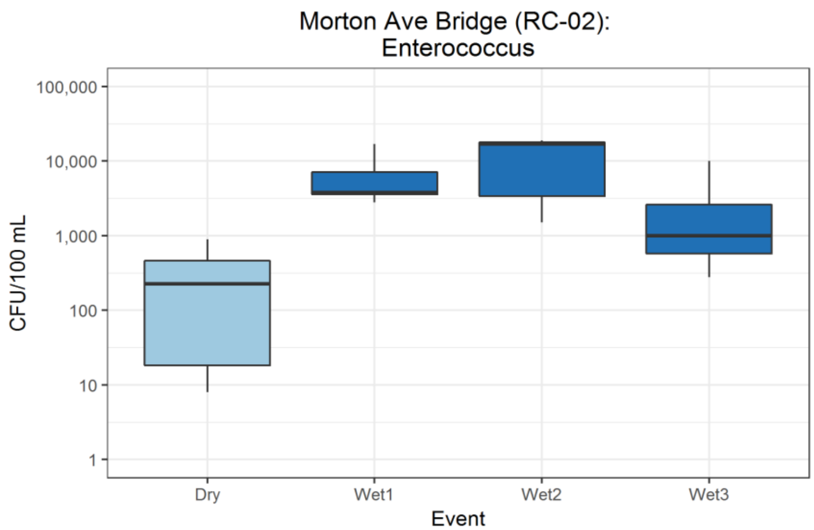


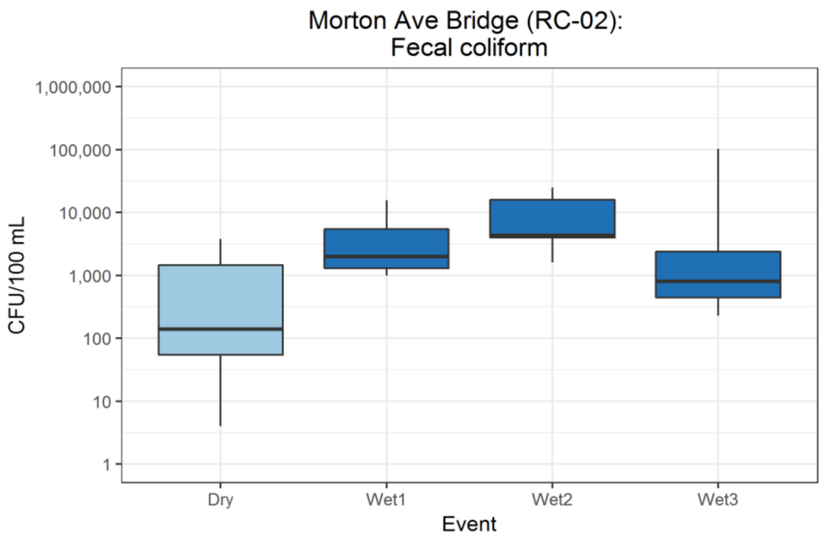
Chester Park Dr Bridge (RC-01):
Fecal coliform



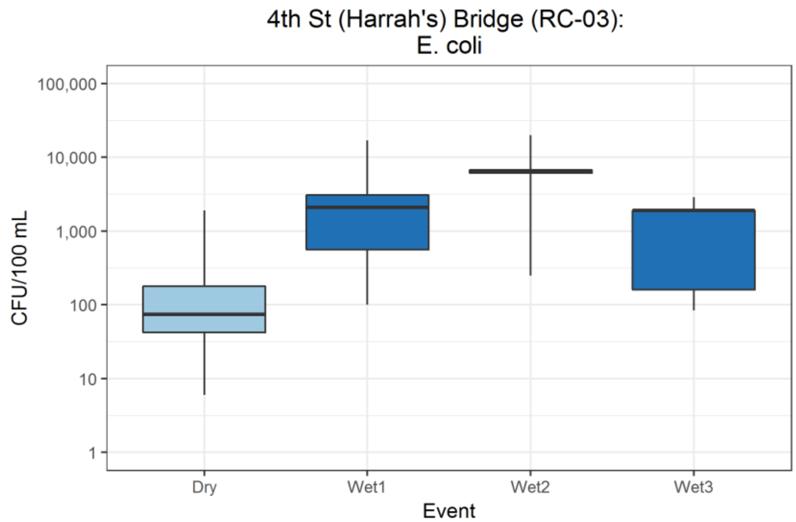
3.10 RC-02

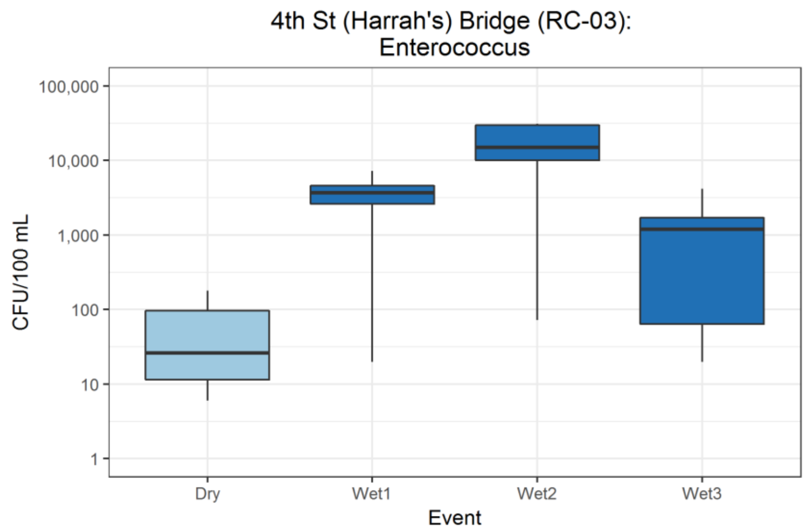

Morton Ave Bridge (RC-02):
E. coli
100,000
10,000
1,000
100
10
1
CFU/100 mL
Dry
Wet1
Wet2
Wet3
Event

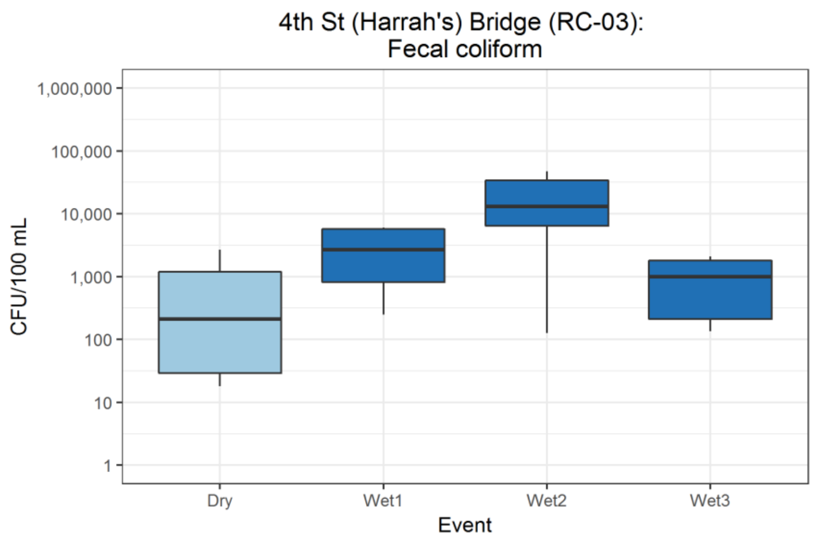

Morton Ave Bridge (RC-02):
Enterococcus
100,000
10,000
1,000
100
10
1
CFU/100 mL
Dry
Wet1
Wet2
Wet3
Event


Morton Ave Bridge (RC-02):
Fecal coliform
1,000,000
100,000
10,000
1,000
100
10
1
CFU/100 mL
Dry
Wet1
Wet2
Wet3
Event

3.11 RC-03

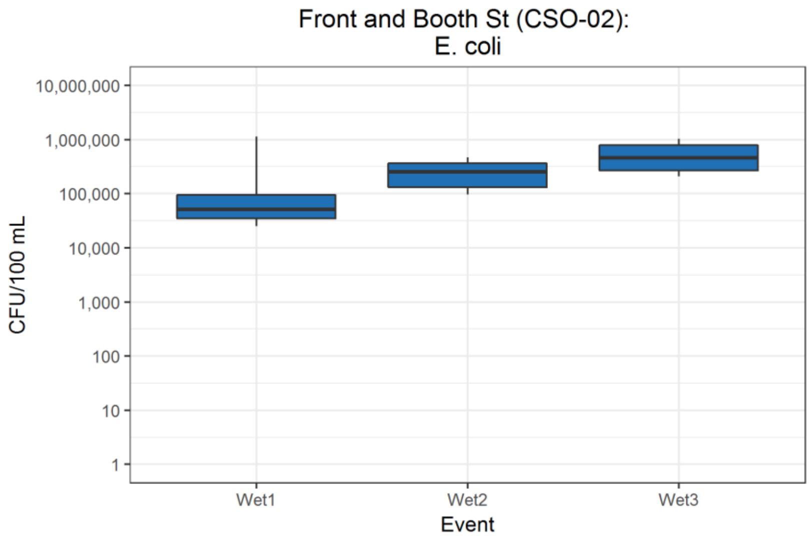

4th St (Harrah's) Bridge (RC-03):
E. coli
CFU/100 mL
100,000
10,000
1,000
100
10
1
Dry
Wet1
Wet2
Wet3
Event

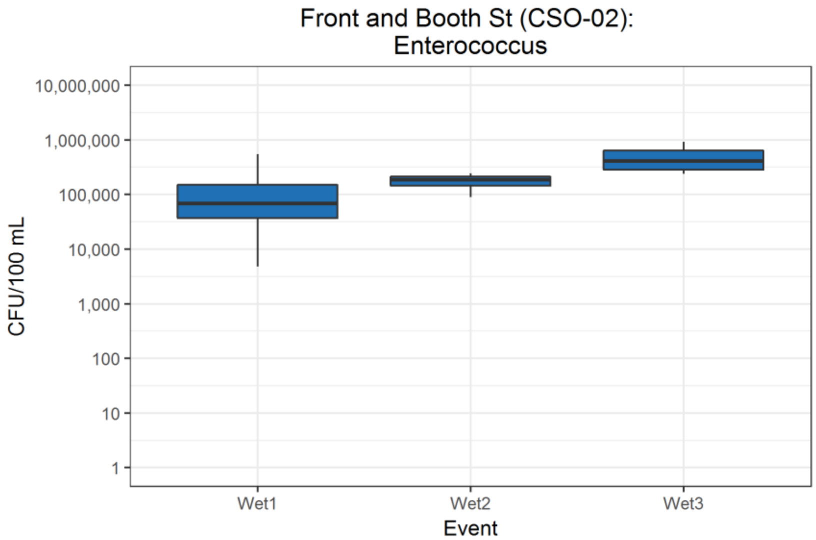

4th St (Harrah's) Bridge (RC-03):
Enterococcus
CFU/100 mL
100,000
10,000
1,000
100
10
1
Dry
Wet1
Wet2
Wet3
Event

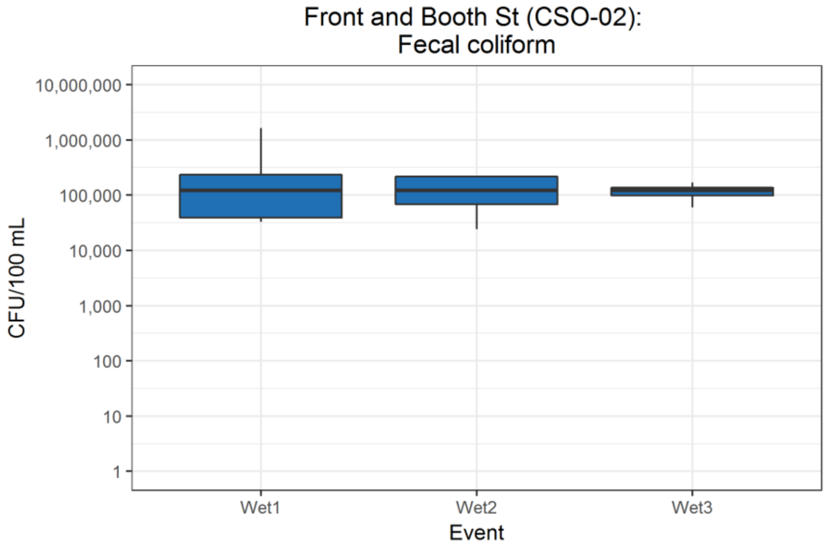

4th St (Harrah's) Bridge (RC-03):
Fecal coliform
CFU/100 mL
1,000,000
100,000
10,000
1,000
100
10
1
Dry
Wet1
Wet2
Wet3
Event

Section 4 Outfall Wet Weather Sampling Results

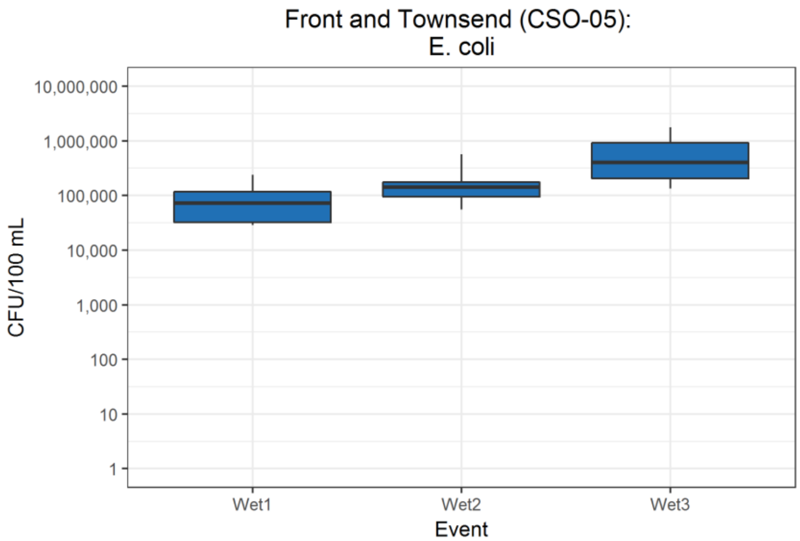
4.1 CSO-02

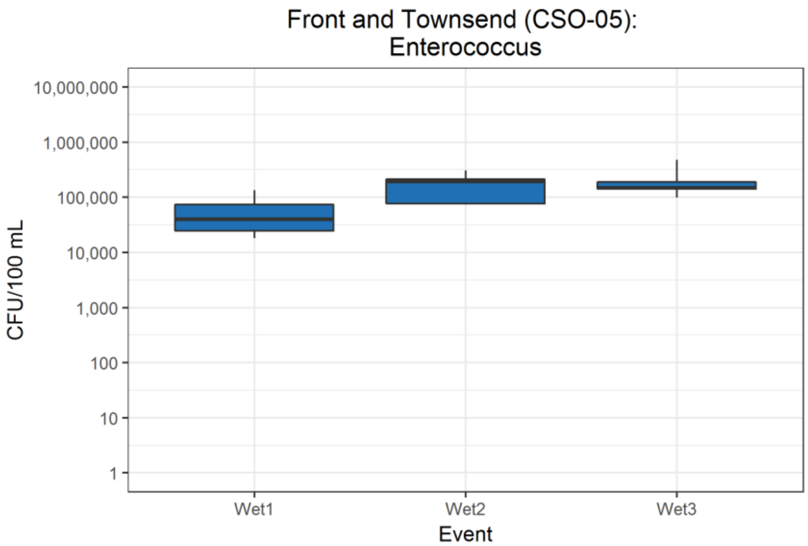

Front and Booth St (CSO-02):
E. coli
CFU/100 mL
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
Wet1
Wet2
Wet3
Event

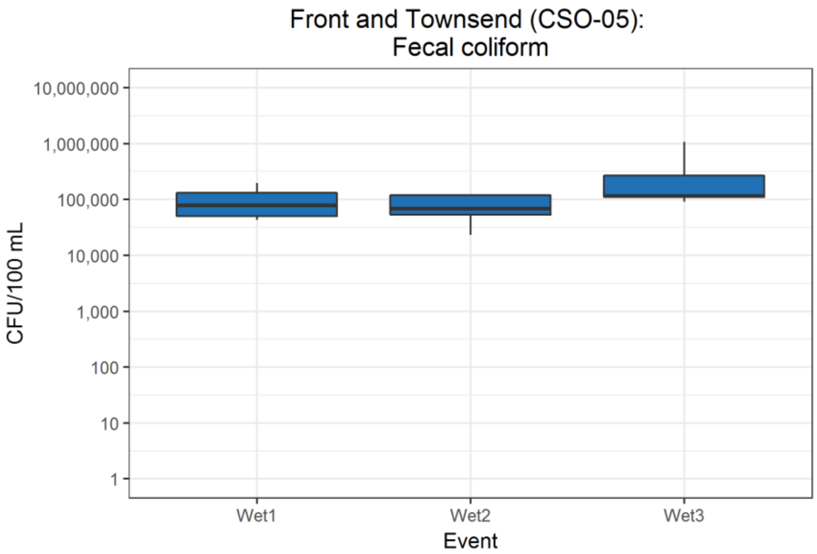

Front and Booth St (CSO-02):
Enterococcus
CFU/100 mL
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
Wet1
Wet2
Wet3
Event


Front and Booth St (CSO-02):
Fecal coliform
CFU/100 mL
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
Wet1
Wet2
Wet3
Event

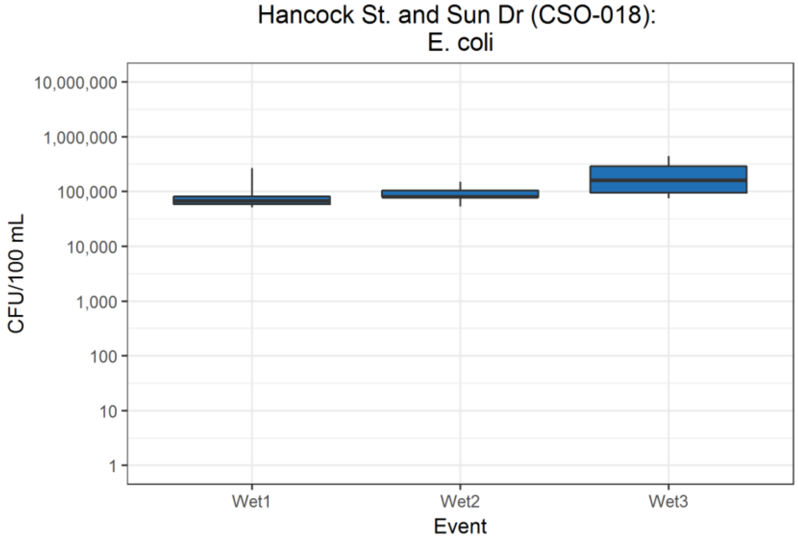
4.2 CSO-05

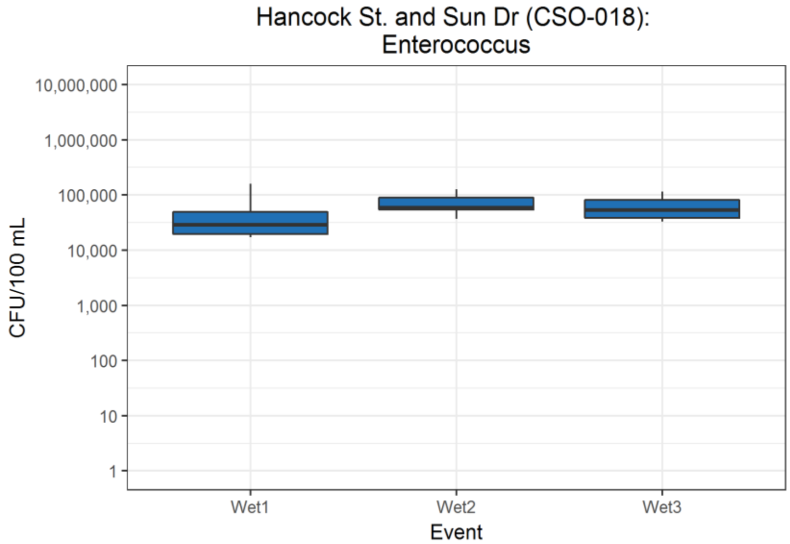

Front and Townsend (CSO-05):
E. coli
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
CFU/100 mL
Wet1
Wet2
Wet3
Event

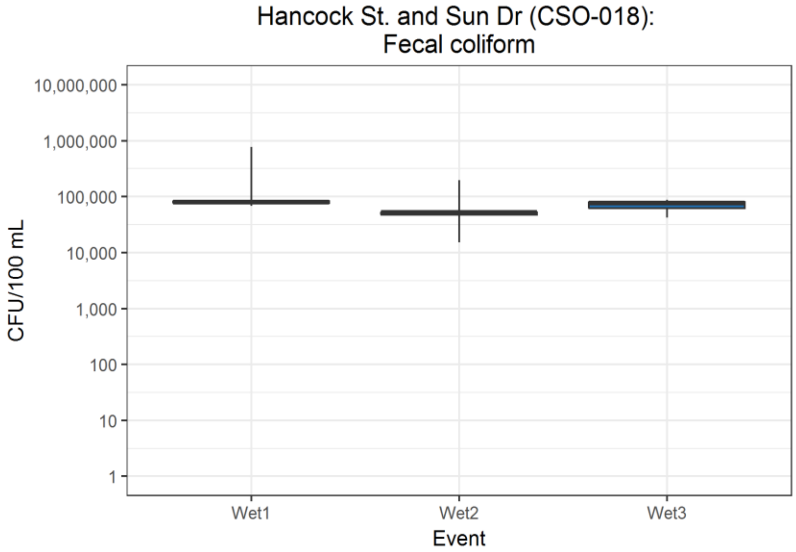

Front and Townsend (CSO-05):
Enterococcus
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
CFU/100 mL
Wet1
Wet2
Wet3
Event


Front and Townsend (CSO-05):
Fecal coliform
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
CFU/100 mL
Wet1
Wet2
Wet3
Event

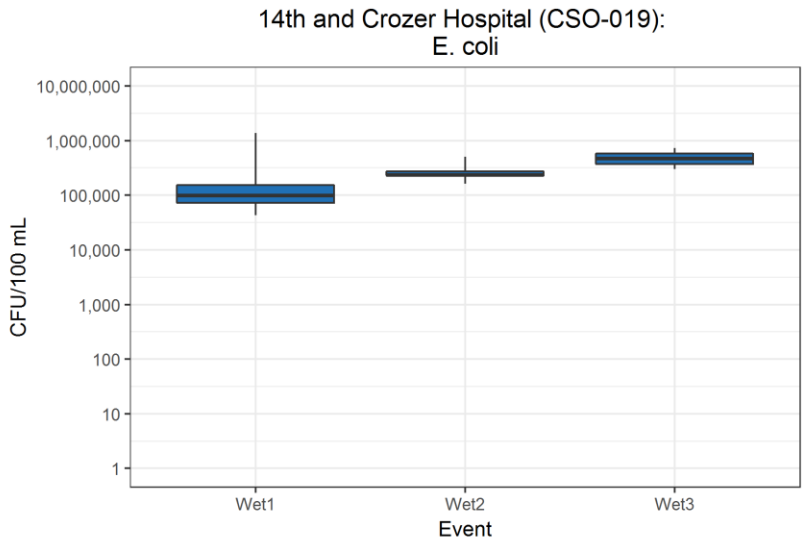
4.3 CSO-018

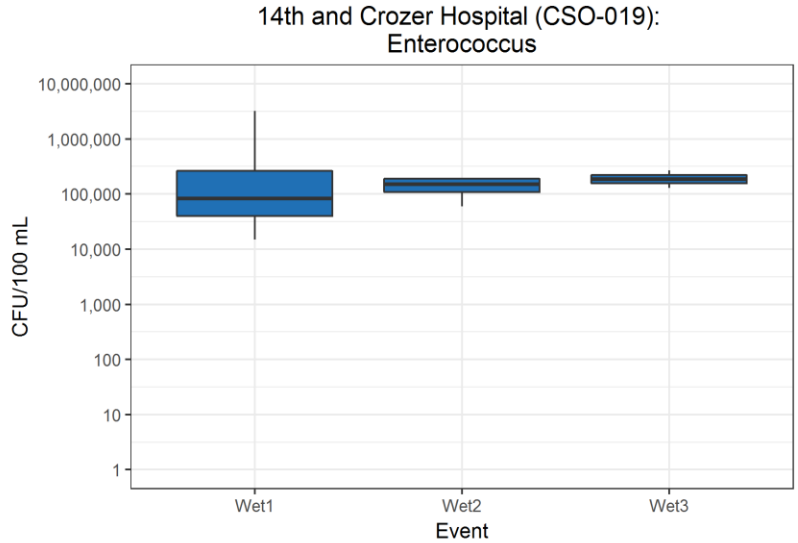

Hancock St. and Sun Dr (CSO-018):
E. coli
CFU/100 mL
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
Wet1
Wet2
Wet3
Event

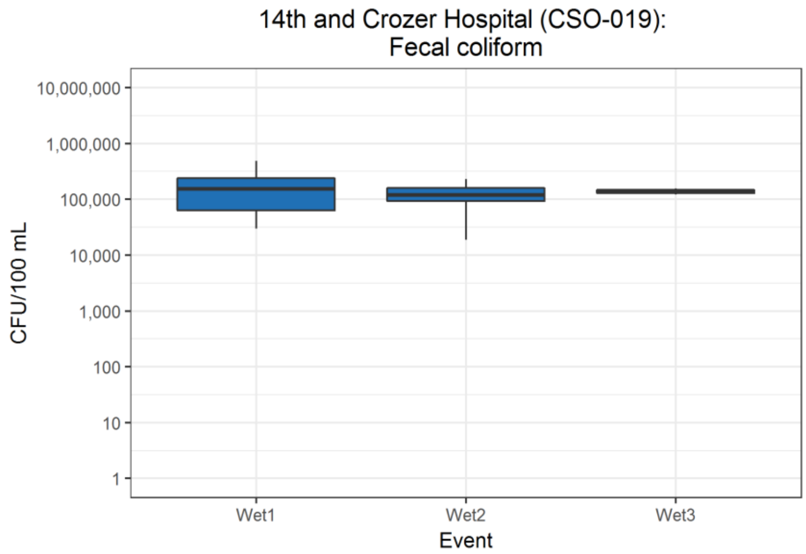

Hancock St. and Sun Dr (CSO-018):
Enterococcus
CFU/100 mL
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
Wet1
Wet2
Wet3
Event


Hancock St. and Sun Dr (CSO-018):
Fecal coliform
CFU/100 mL
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
Wet1
Wet2
Wet3
Event

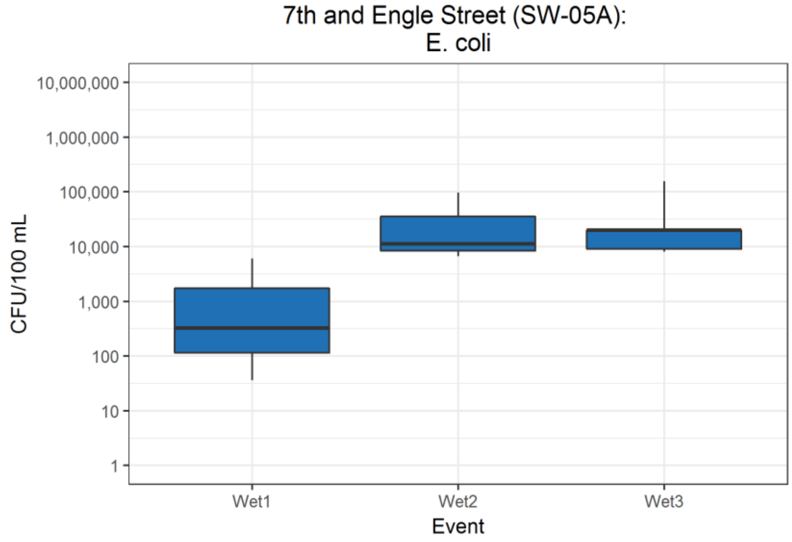
4.4 CSO-019

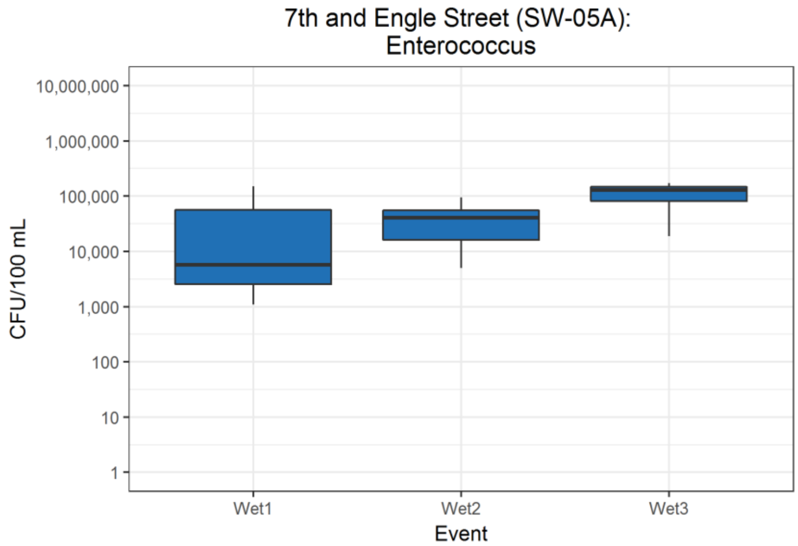

14th and Crozer Hospital (CSO-019):
E. coli
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
CFU/100 mL
Wet1
Wet2
Wet3
Event

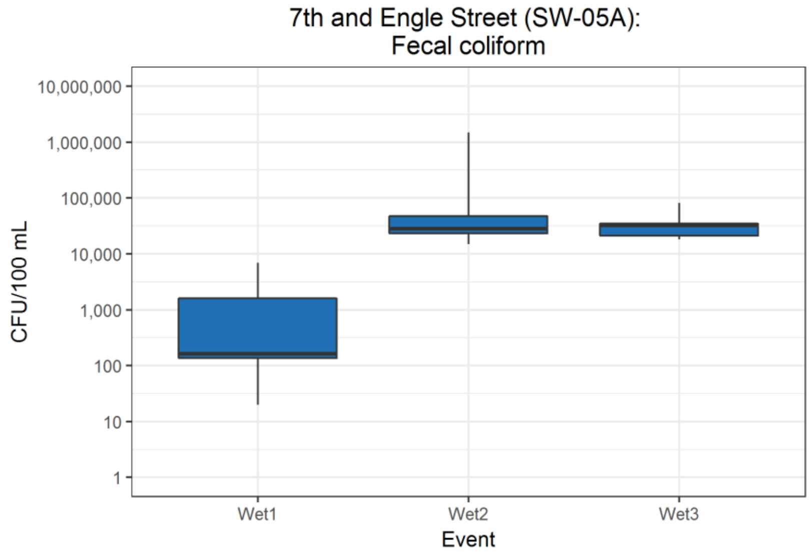

14th and Crozer Hospital (CSO-019):
Enterococcus
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
CFU/100 mL
Wet1
Wet2
Wet3
Event


14th and Crozer Hospital (CSO-019):
Fecal coliform
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
CFU/100 mL
Wet1
Wet2
Wet3
Event

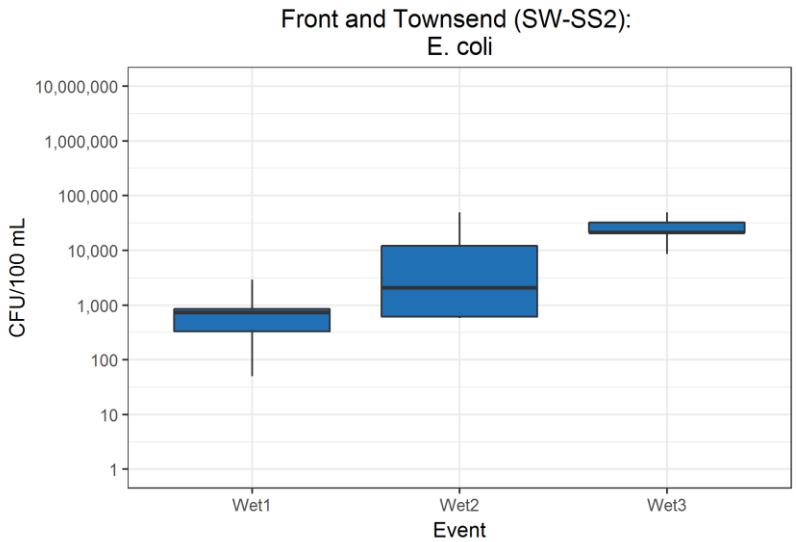
4.5 SW-05A

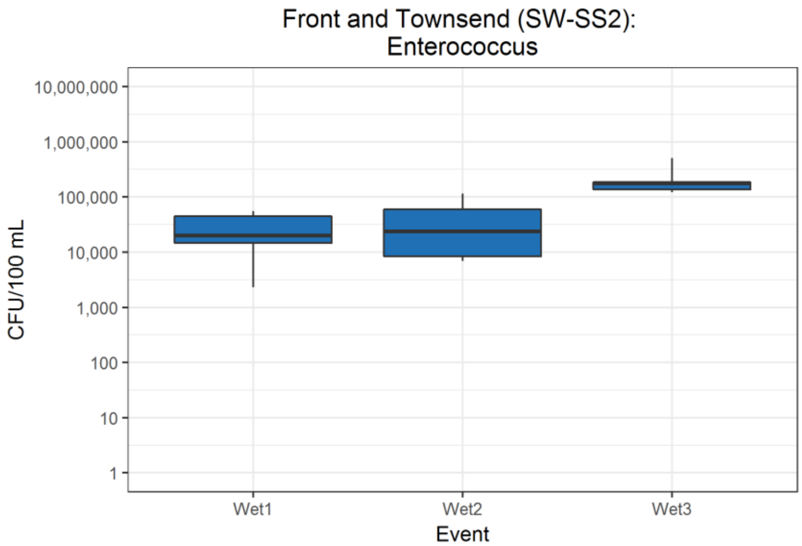

7th and Engle Street (SW-05A):
E. coli
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
CFU/100 mL
Wet1
Wet2
Wet3
Event

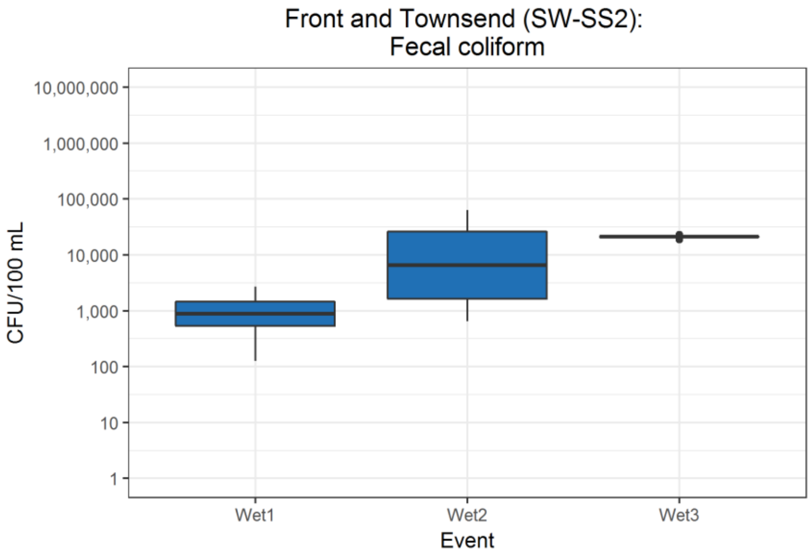

7th and Engle Street (SW-05A):
Enterococcus
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
CFU/100 mL
Wet1
Wet2
Wet3
Event


7th and Engle Street (SW-05A):
Fecal coliform
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
CFU/100 mL
Wet1
Wet2
Wet3
Event

4.6 SW-SS2


Front and Townsend (SW-SS2):
E. coli
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
CFU/100 mL
Wet1
Wet2
Wet3
Event


Front and Townsend (SW-SS2):
Enterococcus
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
CFU/100 mL
Wet1
Wet2
Wet3
Event


Front and Townsend (SW-SS2):
Fecal coliform
10,000,000
1,000,000
100,000
10,000
1,000
100
10
1
CFU/100 mL
Wet1
Wet2
Wet3
Event

APPENDIX I

LABORATORY QA/QC DATA

Positive / Negative Control Summary

Date Analyzed	Parameter	OPR POS LIMS #	OPR POS Result	Acceptable (Y/N)	OPR NEG LIMS #	OPR NEG Result	Acceptable (Y/N)
2/20/2017	E. coli 1603	L6645565-4	30	Y	L6645565-5	<1	Y
2/20/2017	Entero 1600	L6645565-1	28	Y	L6645565-2	<1	Y
3/27/2017	E. coli 1603	L6645566-4	30	Y	L6645566-5	<1	Y
3/27/2017	Entero 1600	L6645566-1	26	Y	L6645566-2	<1	Y
3/31/2017	E. coli 1603	L6645566-4	30	Y	L6645566-5	<1	Y
3/31/2017	Entero 1600	L6645566-1	26	Y	L6645566-2	<1	Y
4/24/2017	E. coli 1603	L6645568-4	33	Y	L6645568-5	<1	Y
4/24/2017	Entero 1600	L6645568-1	33	Y	L6645568-2	<1	Y
5/15/2017	E. coli 1603	L6645569-4	14	N	L6645569-5	<1	Y
5/15/2017	Entero 1600	L6645569-1	30	Y	L6645569-2	<1	Y
6/6/2017	E. coli 1603	L6839202-4	7	N	L6839202-5	<1	Y
6/6/2017	Entero 1600	L6839202-1	32	Y	L6839202-2	<1	Y

Matrix Spike Summary

Date Analyzed	Parameter	MS LIMS #	Amount Spiked	MS Result	Sample Result	Amount Recovered	Percent Recovery
5/22/17	E. coli 1603	L6687478-2	30.6	>80	>80	Unknown	Incalculable
5/23/17	Entero 1600	L6687479-2	30.6	25	4	21	68.63
5/22/17	E. coli 1603	L6687480-2	30.6	>80	>80	Unknown	Incalculable
5/22/17	Entero 1600	L6687481-2	30.7	46	2	44	143.32
5/22/17	E. coli 1603	L6687482-2	30.6	21	4	17	55.56
5/23/17	Entero 1600	L6687485-2	30.6	64	24	40	130.72
5/23/17	E. coli 1603	L6687483-2	31.3	45	12	33	105.43
3/31/17	Entero 1600	L6695428-2	29.2	30	<2	30	102.74
5/23/17	E. coli 1603	L6687486-2	31.3	45	8	37	118.21
3/23/17	Entero 1600	L6695441-2	29.2	25	<10	25	85.62
3/23/17	E. coli 1603	L6695439-2	29.6	26	<10	26	87.84
3/31/17	Entero 1600	L6695444-2	29.2	>60	>60	Unknown	Incalculable
3/31/17	E. coli 1603	L6695443-2	30.6	11	Blank	Blank	35.95
3/31/17	Entero 1600	L6695452-2	29.2	>60	>60	Unknown	Incalculable
5/22/17	E. coli 1603	L6695447-2	30.6	<1	2	<1	0
3/31/17	Entero 1600	L6695453-2	29.2	>60	>60	Unknown	Incalculable
3/31/17	E. coli 1603	L6695448-2	30.6	26	<2	26	84.97

5/5/17	Entero 1600	L6695467-2	30.7	25	6	19	61.89
3/31/17	E. coli 1603	L6695449-2	29.6	>60	>60	Unknown	Incalculable
5/22/17	Entero 1600	L6695469-2	30.7	31	12	19	61.89
3/31/17	E. coli 1603	L6695454-2	29.6	>60	>60	Unknown	Incalculable
5/5/17	Entero 1600	L6695475-2	30.7	>60	>60	Unknown	Incalculable
5/5/17	E. coli 1603	L6695468-2	29.6	47	26	21	70.95
6/13/17	Entero 1600	L6815251-2	30.6	23	<1	23	75.16
6/13/17	E. coli 1603	L6815247-2	30.6	14	<1	24	45.75

Lab Replicate Summary

Date Analyzed	Parameter	MS LIMS #	Replicate Result (cfu / 100 mL)	Original Result (cfu / 100 mL)	Relative Percent Difference (%)
5/22/17	E. coli 1603	L6687478-1	>800	401000	Incalculable
5/23/17	Entero 1600	L6687479-1	<10	2	Incalculable
5/22/17	E. coli 1603	L6687480-1	>800	241000	Incalculable
5/22/17	Entero 1600	L6687481-1	180	116	43.24
5/22/17	E. coli 1603	L6687482-1	150	152	1.32
5/23/17	Entero 1600	L6687485-1	550	580	5.31
5/23/17	E. coli 1603	L6687483-1	360	300	18.18
3/31/17	Entero 1600	L6695428-1	40	6600	197.59
5/23/17	E. coli 1603	L6687486-1	160	112	35.29
3/23/17	Entero 1600	L6695441-1	<10	<10	Incalculable
3/23/17	E. coli 1603	L6695439-1	<10	<10	Incalculable
3/31/17	Entero 1600	L6695444-1	>600	200000	Incalculable
3/31/17	E. coli 1603	L6695443-1	80	100	22.22
3/31/17	Entero 1600	L6695452-1	>600	550000	Incalculable
5/22/17	E. coli 1603	L6695447-1	<10	Blank	Incalculable
3/31/17	Entero 1600	L6695453-1	>600	3300	Incalculable
3/31/17	E. coli 1603	L6695448-1	50	40	22.22
5/5/17	Entero 1600	L6695467-1	<10	12	Incalculable
3/31/17	E. coli 1603	L6695449-1	>600	2020	Incalculable
5/22/17	Entero 1600	L6695469-1	20	12	50
3/31/17	E. coli 1603	L6695454-1	>600	19000	Incalculable
5/5/17	Entero 1600	L6695475-1	>600	37000	Incalculable
5/5/17	E. coli 1603	L6695468-1	240	230	4.26
6/13/17	Entero 1600	L6815251-1	180	150	18.18
6/13/17	E. coli 1603	L6815247-1	200	200	0

BioBall SingleShot

Certificate of Analysis

Lot Number: B3628

Reference Material Data

Organism:	*Escherichia coli*
Designation:	NCTC 9001
Reference:	413832 10 Vials
	56033 20 Vials
BTF Internal Reference:	B-EC9001-30-10
	B-EC9001-30-20
Date of Manufacture:	19 July 2016
Expiry Date:	19 July 2018
Extended Expiry Date*:	N/A

Quantification Data

(Method Ref: BB-001)

cfu Count per BioBall®

Mean cfu	SD
29.6	2.6

95% Prediction Interval

Lower Limit	Upper Limit
24.3	34.8

For an explanation of the Prediction Interval see the BioBall Instructions For Use on the BioBall website - www.bioball.com

Culture Information

No. of Passages:	4
QC Media:	Nutrient agar
Plate Incubation Time (hrs):	14 - 24
Plate Incubation Temp °C:	37 Aerobic

Note: Number of passages are indicated from the original strain assuming original strain is zero.

Strain Confirmation

Bacteria strains are confirmed by genetic typing. Yeast and Mould strains are confirmed by Commonwealth Scientific and Industrial Research Organisation (CSIRO).

Quality Officer:

Fiona Pollock

15 August 2016

NATA

Accredited for compliance with ISO Guide 34

Accredited Reference Material Producer
Accreditation Number: 14993
Site Number: 15276

Strain sourced from NCTC (National Collection of Type Cultures)

*BTF occasionally extends the expiry dates on standard BioBall products. Please check the Bioball website http://bioball.com/bioball/certificate-of-analysis/ to determine whether or not the shelf life of your BioBall batch has been extended.

Manufactured by:
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Sydney Australia
Tel. 61 (0) 2 8877 9150
Fax. 61 (0) 2 8877 9589
www.bioball.com

Sales and General enquiries:
bioMérieux S.A
69280 Marcy l'Etoile - France
Tel. 33 (0) 4 78 87 20 00
Fax. 33 (0) 4 78 87 20 90
www.biomerieux-industry.com

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BIOMÉRIEUX INDUSTRY

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Issue: 5 - June 2016

BioBall™ SingleShot

Certificate of Analysis

Lot Number: B3827

Reference Material Data

Organism:	*Escherichia coli*
Designation:	NCTC 12923
Reference:	413833 10 Vials
	56034 20 Vials
BTF Internal Reference:	B-EC12923-30-10
	B-EC12923-30-20
Date of Manufacture:	22 November 2016
Expiry Date:	22 November 2018
Extended Expiry Date*:	N/A

Quantification Data

(Method Ref: BB-001)

cfu Count per BioBall®

Mean cfu	SD
30.6	2.3

95% Prediction Interval

Lower Limit	Upper Limit
25.9	35.3

For an explanation of the Prediction Interval see the BioBall Instructions For Use on the BioBall website - www.bioball.com

Culture Information

No. of Passages:	4
QC Media:	Nutrient agar
Plate Incubation Time (hrs):	14 - 24
Plate Incubation Temp °C:	37 Aerobic

Note: Number of passages are indicated from the original strain assuming original strain is zero.

Strain Confirmation

Bacteria strains are confirmed by genetic typing. Yeast and Mould strains are confirmed by Commonwealth Scientific and Industrial Research Organisation (CSIRO).

Quality Officer:

Fiona Pollock

14 December 2016

NATA Accredited for compliance with ISO Guide 34

Accredited Reference Material Producer
Accreditation Number: 14993
Site Number: 15276

Strain sourced from NCTC (National Collection of Type Cultures)

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Issue: 5 - June 2016

BioBall SingleShot

Certificate of Analysis

Lot Number: B3458

Reference Material Data

Organism:	*Escherichia coli*
Designation:	NCTC 9001
Reference:	413832 10 Vials
	56033 20 Vials
BTF Internal Reference:	B-EC9001-30-10
	B-EC9001-30-20
Date of Manufacture:	14 March 2016
Expiry Date:	14 March 2018
Extended Expiry Date*:	N/A

Quantification Data

(Method Ref: BB-001)

cfu Count per BioBall®

Mean cfu	SD
31.3	2.1

95% Prediction Interval

Lower Limit	Upper Limit
27.1	35.5

For an explanation of the Prediction Interval see the BioBall Instructions For Use on the BioBall website - www.bioball.com

Culture Information

No. of Passages:	4
QC Media:	Nutrient agar
Plate Incubation Time (hrs):	14 - 24
Plate Incubation Temp °C:	37 Aerobic

Note: Number of passages are indicated from the original strain assuming original strain is zero.

Strain Confirmation

Bacteria strains are confirmed by genetic typing. Yeast and Mould strains are confirmed by Commonwealth Scientific and Industrial Research Organisation (CSIRO).

Quality Officer:

Linh Le

6 April 2016

NATA Accredited for Technical Competence

Accredited for compliance with ISO Guide 34

Accredited Reference Material Producer
Accreditation Number: 14993
Site Number: 15276

Strain sourced from NCTC (National Collection of Type Cultures)

*BTF regularly extends the expiry dates on standard BioBall products. Please check the BTF website www.btfbio.com/cofa.php to determine whether or not the shelf life of your BioBall batch has been extended.

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www.btfbio.com

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Issue. 7 - May 2012

BioBall™ SingleShot

Certificate of Analysis

Lot Number: B3778

Reference Material Data

Organism:	*Enterococcus faecalis*
Designation:	NCTC 775
Reference:	413850 10 Vials
	56032 30 Vials
BTF Internal Reference:	B-EF775-30-10
	B-EF775-30-20
Date of Manufacture:	24 October 2016
Expiry Date:	24 October 2018
Extended Expiry Date*:	N/A

Quantification Data

(Method Ref: BB-001)

cfu Count per BioBall®

Mean cfu	SD
29.2	2.6

95% Prediction Interval

Lower Limit	Upper Limit
23.9	34.6

For an explanation of the Prediction Interval see the BioBall Instructions For Use on the BioBall website - www.bioball.com

Culture Information

No. of Passages:	4
QC Media:	Horse Blood agar
Plate Incubation Time (hrs):	14 - 24
Plate Incubation Temp °C:	37 Aerobic

Note: Number of passages are indicated from the original strain assuming original strain is zero.

Strain Confirmation

Bacteria strains are confirmed by genetic typing. Yeast and Mould strains are confirmed by Commonwealth Scientific and Industrial Research Organisation (CSIRO).

Quality Officer:

Fiona Pollock

28 November 2016

NATA — Accredited for technical competence

Accredited for compliance with ISO Guide 34

Accredited Reference Material Producer
Accreditation Number: 14993
Site Number: 15276

Strain sourced from NCTC (National Collection of Type Cultures)

*BTF occasionally extends the expiry dates on standard BioBall products. Please check the Bioball website http://bioball.com/bioball/certificate-of-analysis/ to determine whether or not the shelf life of your BioBall batch has been extended.

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Page 1 of 1
Issue: 5 - June 2016

BioBall SingleShot

Certificate of Analysis

Lot Number: B3698

Reference Material Data

Organism:	*Enterococcus faecalis*
Designation:	NCTC 775
Reference:	413850 10 Vials
	56032 20 Vials
BTF Internal Reference:	B-EF775-30-10
	B-EF775-30-20
Date of Manufacture:	30 August 2016
Expiry Date:	30 August 2018
Extended Expiry Date*:	N/A

Quantification Data

(Method Ref: BB-001)

cfu Count per BioBall®

Mean cfu	SD
30.7	2.5

95% Prediction Interval

Lower Limit	Upper Limit
25.6	35.8

For an explanation of the Prediction Interval see the BioBall Instructions For Use on the BioBall website - www.bioball.com

Culture Information

No. of Passages:	4
QC Media:	Horse Blood agar
Plate Incubation Time (hrs):	14 - 24
Plate Incubation Temp °C:	37 Aerobic

Note: Number of passages are indicated from the original strain assuming original strain is zero.

Strain Confirmation

Bacteria strains are confirmed by genetic typing. Yeast and Mould strains are confirmed by Commonwealth Scientific and Industrial Research Organisation (CSIRO).

Quality Officer:

Fiona Pollock

15 September 2016

NATA Accredited for compliance with ISO Guide 34

Accredited Reference Material Producer
Accreditation Number: 14993
Site Number: 15276

Strain sourced from NCTC (National Collection of Type Cultures)

*BTF occasionally extends the expiry dates on standard BioBall products. Please check the Bioball website http://bioball.com/bioball/certificate-of-analysis/ to determine whether or not the shelf life of your BioBall batch has been extended.

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Issue: 5 - June 2016

BioBall SingleShot

Certificate of Analysis

Lot Number: B3347

Reference Material Data

Organism:	*Enterococcus faecalis*
Designation:	NCTC 775
Reference:	413850 10 Vials
	56032 20 Vials
BTF Internal Reference:	B-EF775-30-10
	B-EF775-30-20
Date of Manufacture:	19 November 2015
Expiry Date:	18 November 2017
Extended Expiry Date*:	N/A

Quantification Data

(Method Ref: BB-001)

cfu Count per BioBall®

Mean cfu	SD
30.6	2.2

95% Prediction Interval

Lower Limit	Upper Limit
26.2	34.9

For an explanation of the Prediction Interval see the BioBall Instructions For Use on the BioBall website - www.bioball.com

Culture Information

No. of Passages:	4
QC Media:	Horse Blood agar
Plate Incubation Time (hrs):	14 - 24
Plate Incubation Temp °C:	37 Aerobic

Note: Number of passages are indicated from the original strain assuming original strain is zero.

Strain Confirmation

Bacteria strains are confirmed by genetic typing. Yeast and Mould strains are confirmed by Commonwealth Scientific and Industrial Research Organisation (CSIRO).

Quality Officer:

Fiona Pollock

9 December 2015

NATA

Accredited for compliance with ISO Guide 34

Accredited Reference Material Producer
Accreditation Number: 14993
Site Number: 15276

Strain sourced from NCTC (National Collection of Type Cultures)

*BTF regularly extends the expiry dates on standard BioBall products. Please check the BTF website www.btfbio.com/cofa.php to determine whether or not the shelf life of your BioBall batch has been extended.

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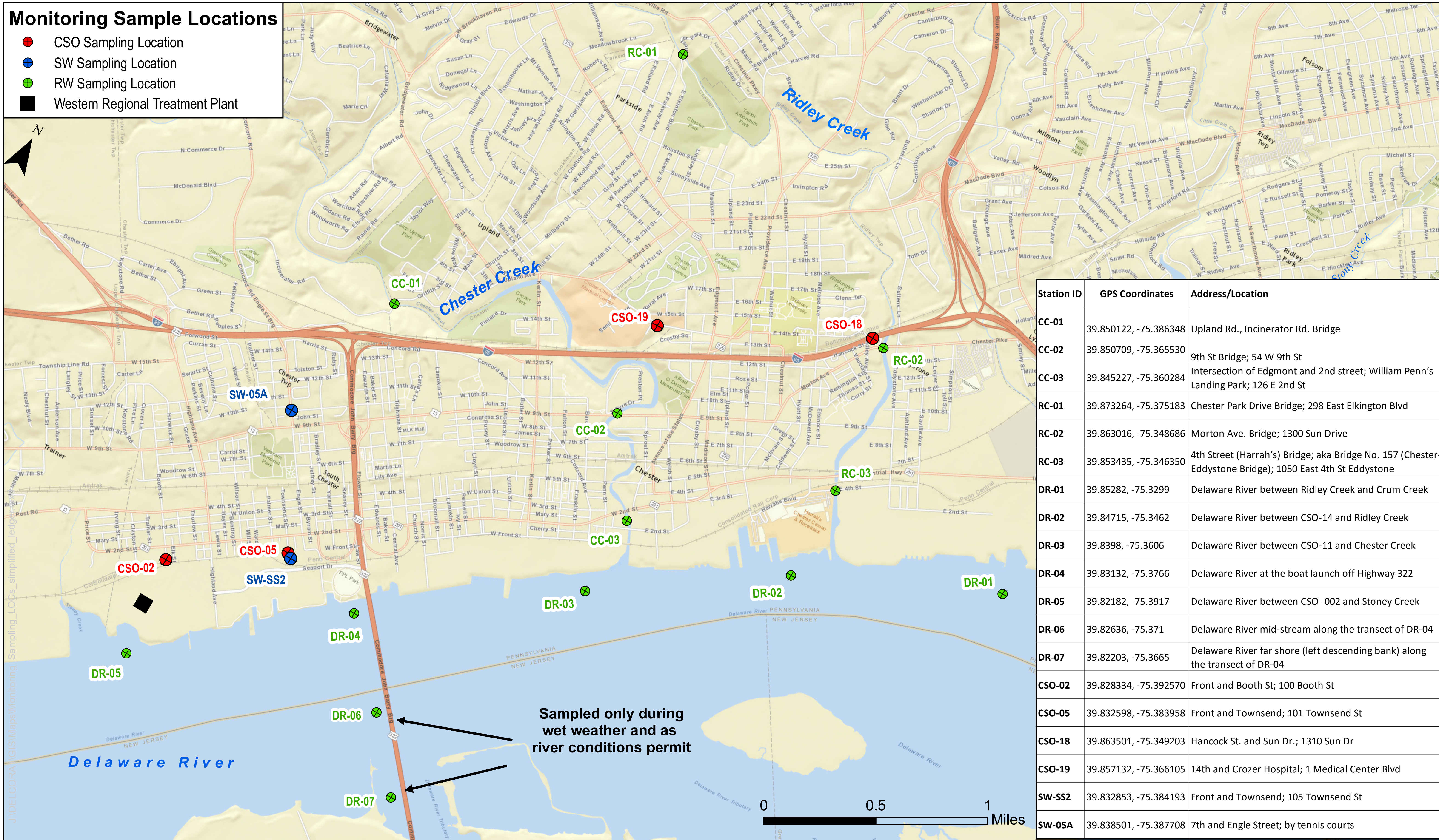
Issue. 7 - May 2012

APPENDIX J

CITY OF CHESTER MAP AND LETTER



Station ID	GPS Coordinates	Address/Location
CC-01	39.850122, -75.386348	Upland Rd., Incinerator Rd. Bridge
CC-02	39.850709, -75.365530	9th St Bridge; 54 W 9th St
CC-03	39.845227, -75.360284	Intersection of Edgmont and 2nd street; William Penn's Landing Park; 126 E 2nd St
RC-01	39.873264, -75.375183	Chester Park Drive Bridge; 298 East Elkington Blvd
RC-02	39.863016, -75.348686	Morton Ave. Bridge; 1300 Sun Drive
RC-03	39.853435, -75.346350	4th Street (Harrah's) Bridge; aka Bridge No. 157 (Chester-Eddystone Bridge); 1050 East 4th St Eddystone
DR-01	39.85282, -75.3299	Delaware River between Ridley Creek and Crum Creek
DR-02	39.84715, -75.3462	Delaware River between CSO-14 and Ridley Creek
DR-03	39.8398, -75.3606	Delaware River between CSO-11 and Chester Creek
DR-04	39.83132, -75.3766	Delaware River at the boat launch off Highway 322
DR-05	39.82182, -75.3917	Delaware River between CSO- 002 and Stoney Creek
DR-06	39.82636, -75.371	Delaware River mid-stream along the transect of DR-04
DR-07	39.82203, -75.3665	Delaware River far shore (left descending bank) along the transect of DR-04
CSO-02	39.828334, -75.392570	Front and Booth St; 100 Booth St
CSO-05	39.832598, -75.383958	Front and Townsend; 101 Townsend St
CSO-18	39.863501, -75.349203	Hancock St. and Sun Dr.; 1310 Sun Dr
CSO-19	39.857132, -75.366105	14th and Crozer Hospital; 1 Medical Center Blvd
SW-SS2	39.832853, -75.384193	Front and Townsend; 105 Townsend St
SW-05A	39.838501, -75.387708	7th and Engle Street; by tennis courts

DELAWARE COUNTY REGIONAL WATER QUALITY CONTROL AUTHORITY
P.O. BOX 999 • CHESTER, PA 19016-0999

March 17, 2017

To Whom It May Concern:

The Delaware County Water Quality Control Authority (DELCORA) is a municipal authority located in Chester, PA, established in 1970 with the acquisition and upgrade of the City of Chester's wastewater treatment plant to become DELCORA's Western Regional Treatment Plant (WRTP). DELCORA owns, operates and maintains collection systems that serve approximately a half million people in the Greater Philadelphia area, including 42 municipalities in Delaware and Chester Counties.

DELCORA entered into a Consent Decree (CD) with the United States Government to establish a schedule for implementation of Long Term Control Plan Update (LTCPU) to achieve full compliance with the Clean Water Act and the regulations and Clean Streams Law and regulations. As part of the DELCORA LTCPU, water quality monitoring is required.

Greeley and Hansen LLC currently serves as a consultant to DELCORA for the LTCPU Project in an effort to address combined sewer overflows (CSO) associated with the Consent Decree.

Greeley and Hansen's work incudes conducting receiving stream surveys and collecting samples from manholes, outfalls and surface waters. As such, Greeley and Hansen's employees, as well as employees from Greeley and Hansen's sub-consultants, will be working along shorelines and in boats and will be temporarily stopped in vans on local roadways to access sampling points from the spring of 2017 through the summer of 2017. Representatives of Greeley and Hansen LLC and their sub-consultants who are carrying out these responsibilities should not be deemed as trespassers as they are authorized to conduct these field surveys on behalf of DELCORA.

Should you have any questions, please do not hesitate to contact me by telephone at (610) 876-5523 or (267) 212-4559 or by e-mail at hurstc@delcora.org.

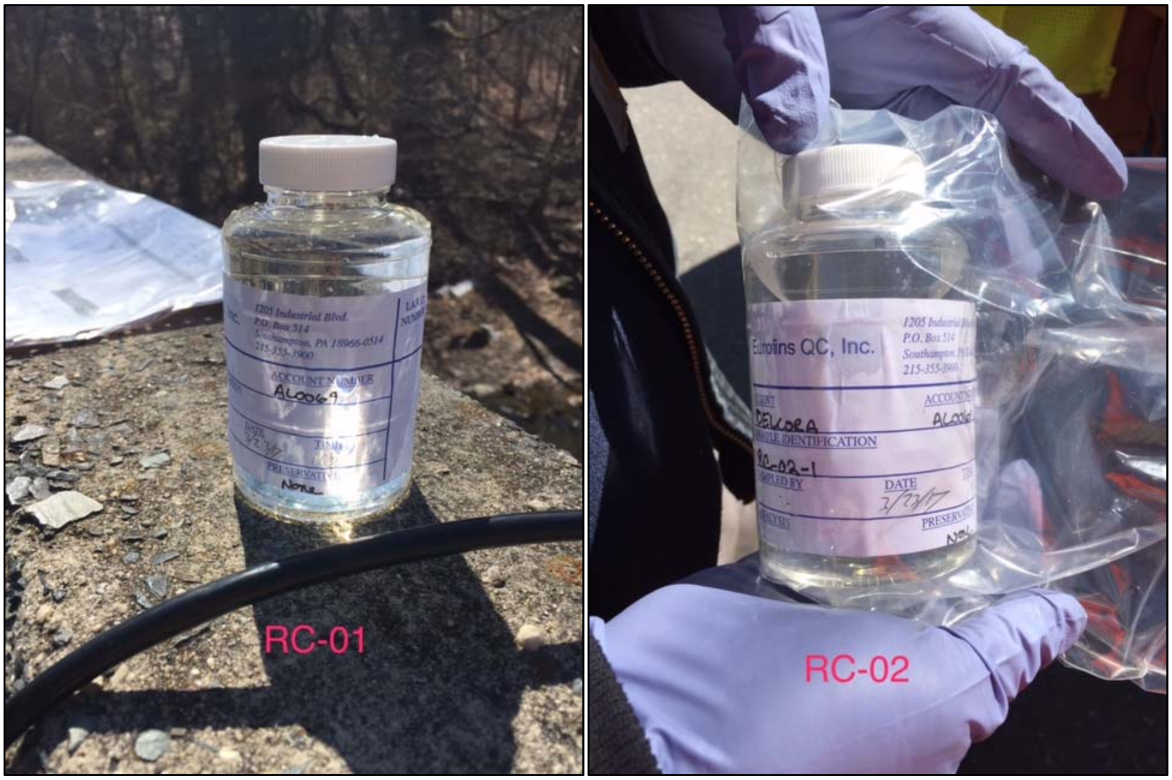
Thank you.

Sincerely,

Charles Hurst, P.E.

c: Robert Willert, DELCORA
Michael DiSantis, DELCORA
Edwin Bothwell, DELCORA
Margaret Hill, Blank Rome LLP

APPENDIX K
SAMPLING PHOTOS

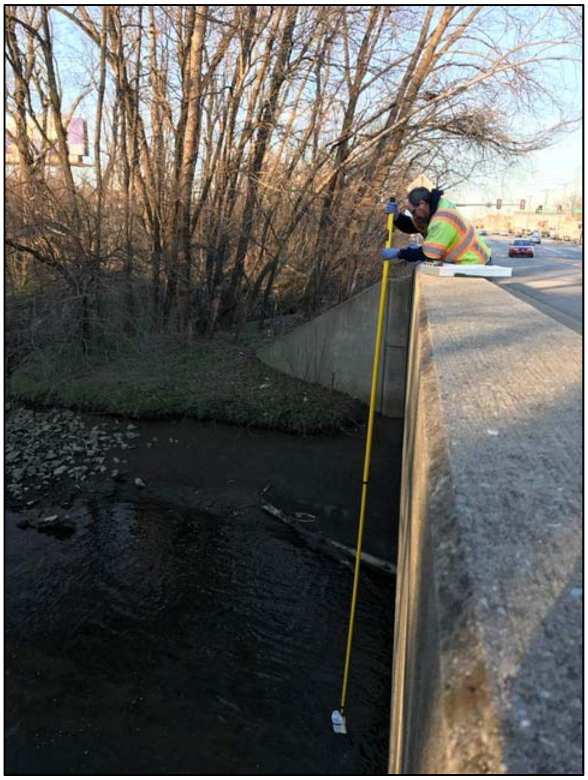


All water quality samples were collected and transeffered into 250 mL bottles provided by Eurofins QC, Inc. The samples were preserved immideatley on ice for transfer to the laboratory for further analysis.

A view of the Delaware River, looking out from the bulkhead wall at the WRTP toward sampling location DR-05.

Sampling off of overpass bridges at Chester Creek (CC-03) and Ridley Creek (RC-03) sampling locations.

Sampling off of the overpass bridge at Ridley Creek (RC-03) sampling location required use of a Bailer Bottle Sampler due to the increased height requirements at the site.



Sampling off of an overpass bridge at Ridley Creek (RC-02) sampling location.

Sampling off of an overpass bridge at Ridley Creek (RC-01) sampling location.

Sampling off of an overpass bridge at Chester Creek (CC-01) sampling location.

Sampling off of an overpass bridge at Chester Creek (CC-02) sampling location.

During the third wet-weather sampling event, one of the two boats in the Delaware River had to be removed from the river due to punctures in its hull. Grab samples were collected at accessible points along the Delaware shore in proximity to DR-03 and DR-04.

During the second wet-weather sampling event, boat activities were halted in the Delaware due to hazardous conditions (lightning and visibility issues). Conditions eventually improved, allowing for the resumption of boat activities after approximately four hours.

In-situ field measurements were taken using a YSI Model 556 with a 6920 V2 sonde. These measurements included water temperature, salinity, and conductivity in the receiving waters.

Sampling off of an overpass bridges at Ridley Creek (RC-02) sampling location.

Delaware County Regional Water Quality Control Authority

CSO Long Term Control Plan Update

Water Quality Sampling Report

Appendix K

GREELEY AND HANSEN

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APPENDIX L

SAMPLING ANALYSIS PLAN (SAP)

(Sampling Analysis Plan (SAP) provided in digital form only on CD attached to this report)

Greeley and Hansen LLC
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GREELEY AND HANSEN

APPENDIX C
Water Quality Model Calibration Results

Notes:

1. The 2017 Dry Weather Event in-stream sampling typically has two results per POC, per event, and per location. One sample was taken on the incoming tide and one sample was taken on the outgoing tide. There was no dry weather sampling at DR-05 and DR-06.
2. The 2017 Wet Weather Event in-stream sampling typically has five or more results per POC, per event, and per location. These were taken at t=0 (onset of rain) and then at approximately every 2 hours after that.
3. More information on the 2017 in-stream sampling results can be found in DELCORA's "Water Quality Sampling Report" (DELCORA, 2017).
4. More information on the 2012 DRBC boat run program can be found online at http://www.state.nj.us/drbc/programs/quality/boat-run.html

Fecal Coliform

Fecal Coliform—2017 Dry Weather Calibration

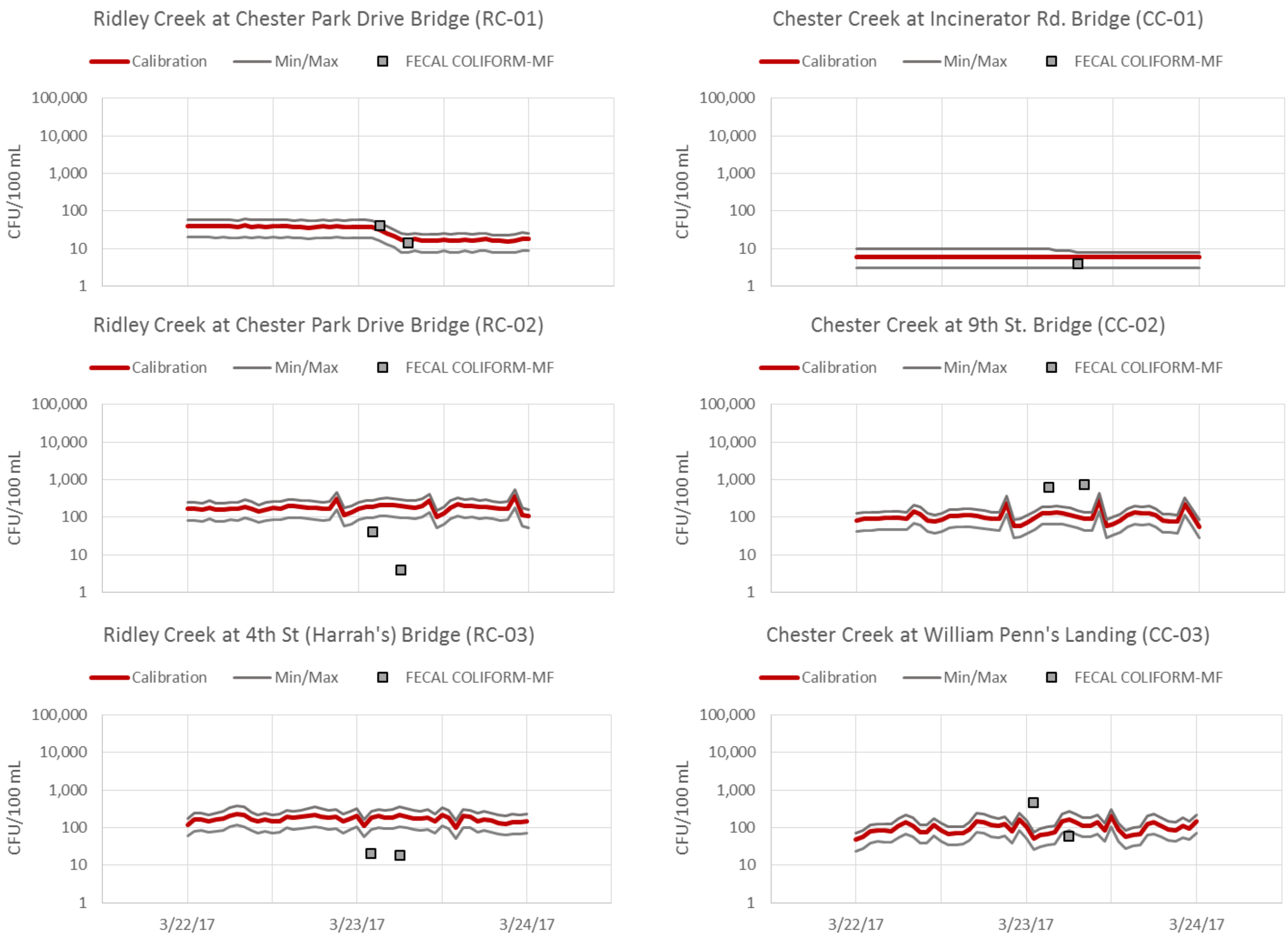

Figure 1. Fecal Coliform Calibration at Ridley Creek and Chester Creek Stations (Dry Weather Event #1, 3/23/17)

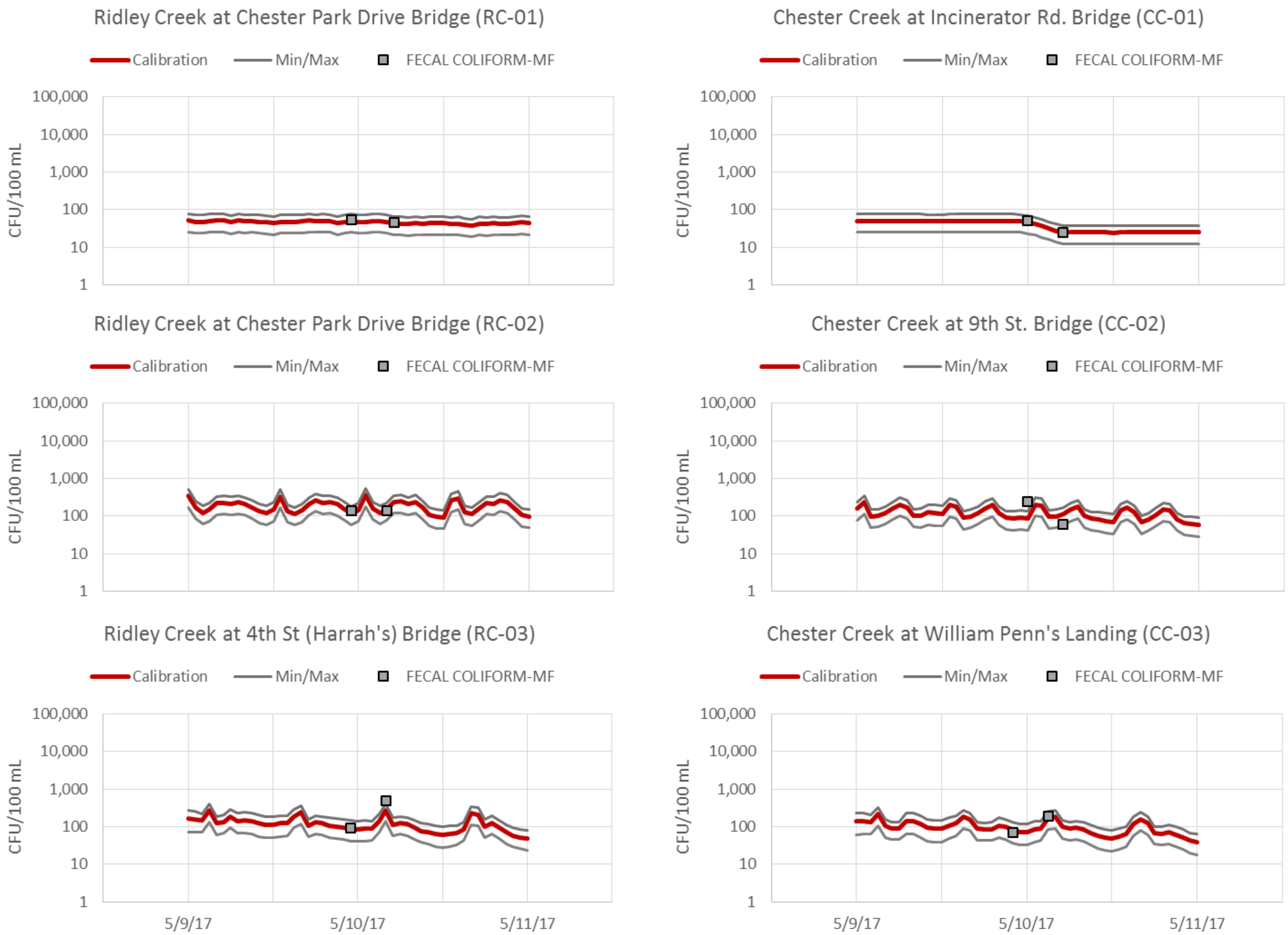

Figure 2. Fecal Coliform Calibration at Ridley Creek and Chester Creek Stations (Dry Weather Event #2, 5/10/17)

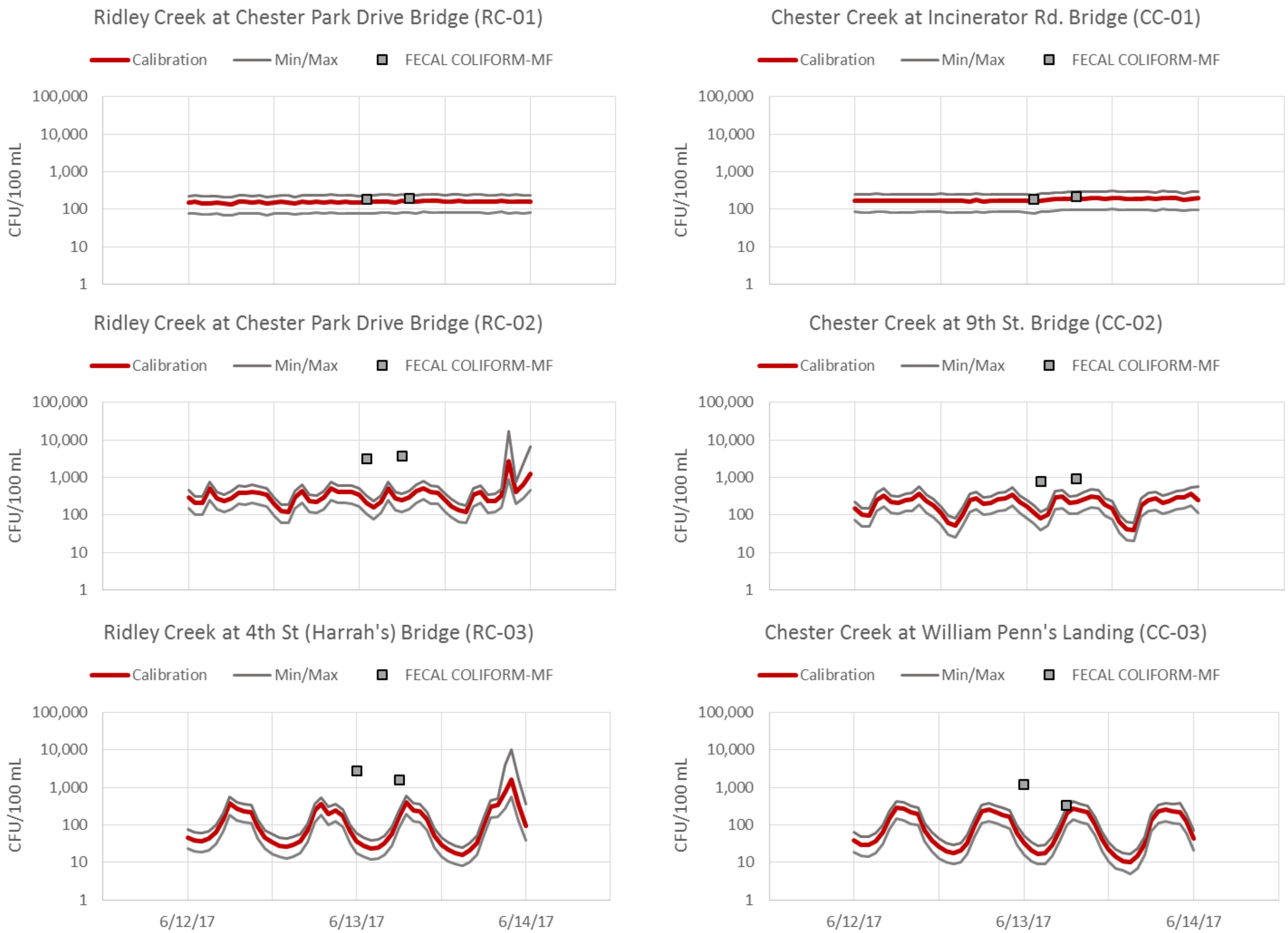

Figure 3. Fecal Coliform Calibration at Ridley Creek and Chester Creek Stations (Dry Weather Event #3, 6/13/17)

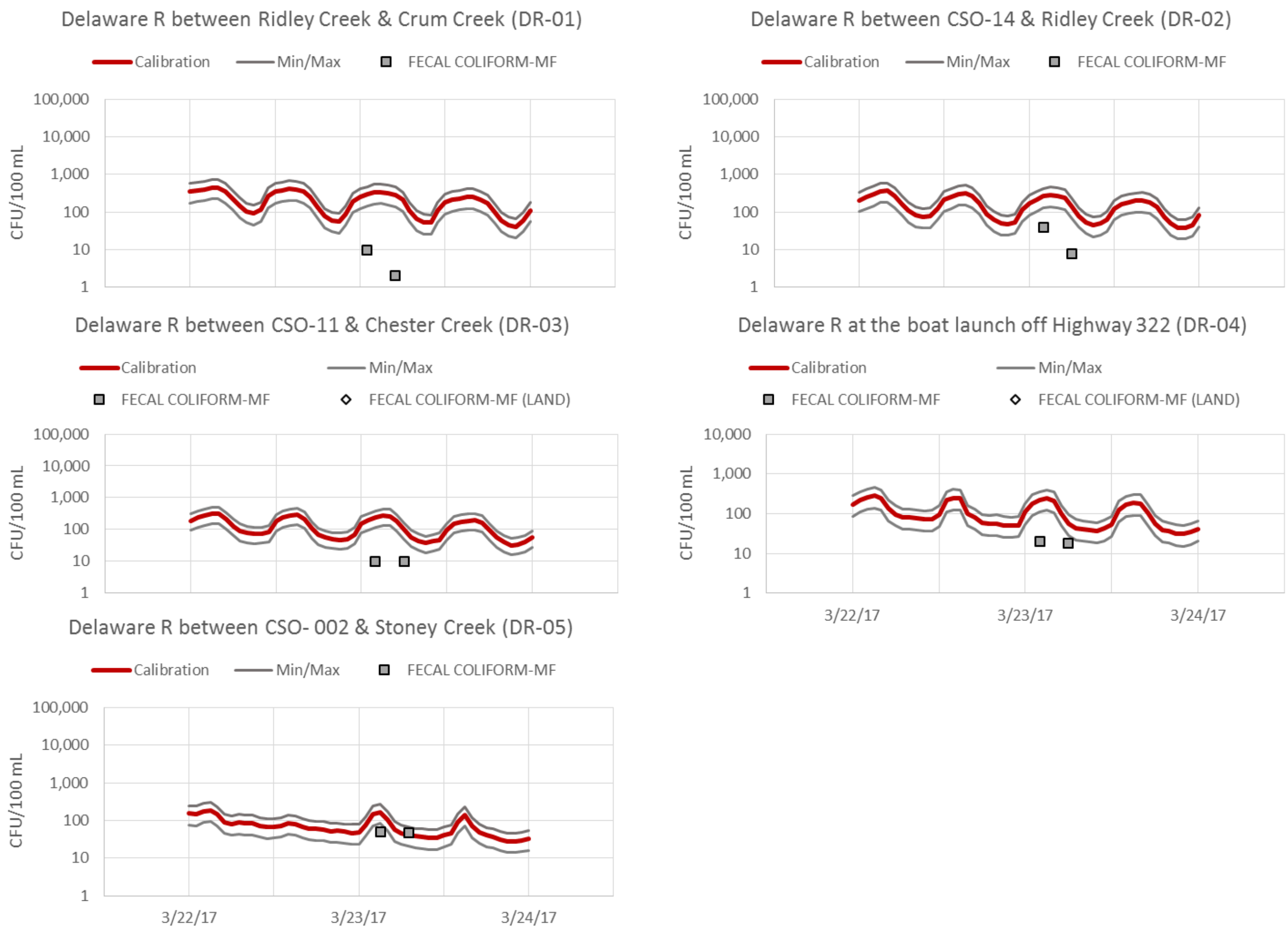

Figure 4. Fecal Coliform Calibration at Delaware River Stations (Dry Weather Event #1, 3/23/17)

Figure 5. Fecal Coliform Calibration at Delaware River Stations (Dry Weather Event #2, 5/10/17)

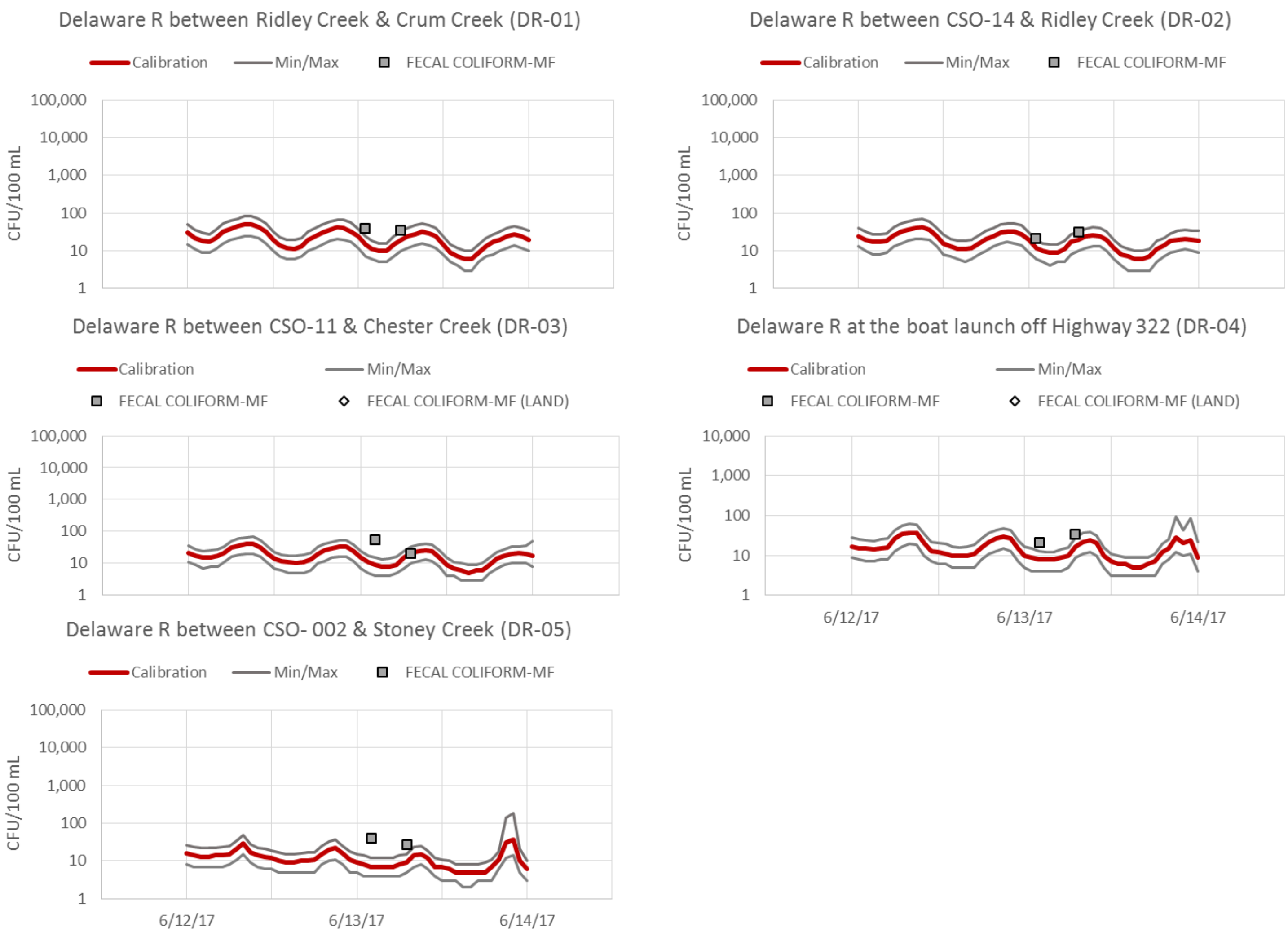

Figure 6. Fecal Coliform Calibration at Delaware River Stations (Dry Weather Event #3, 6/13/17)

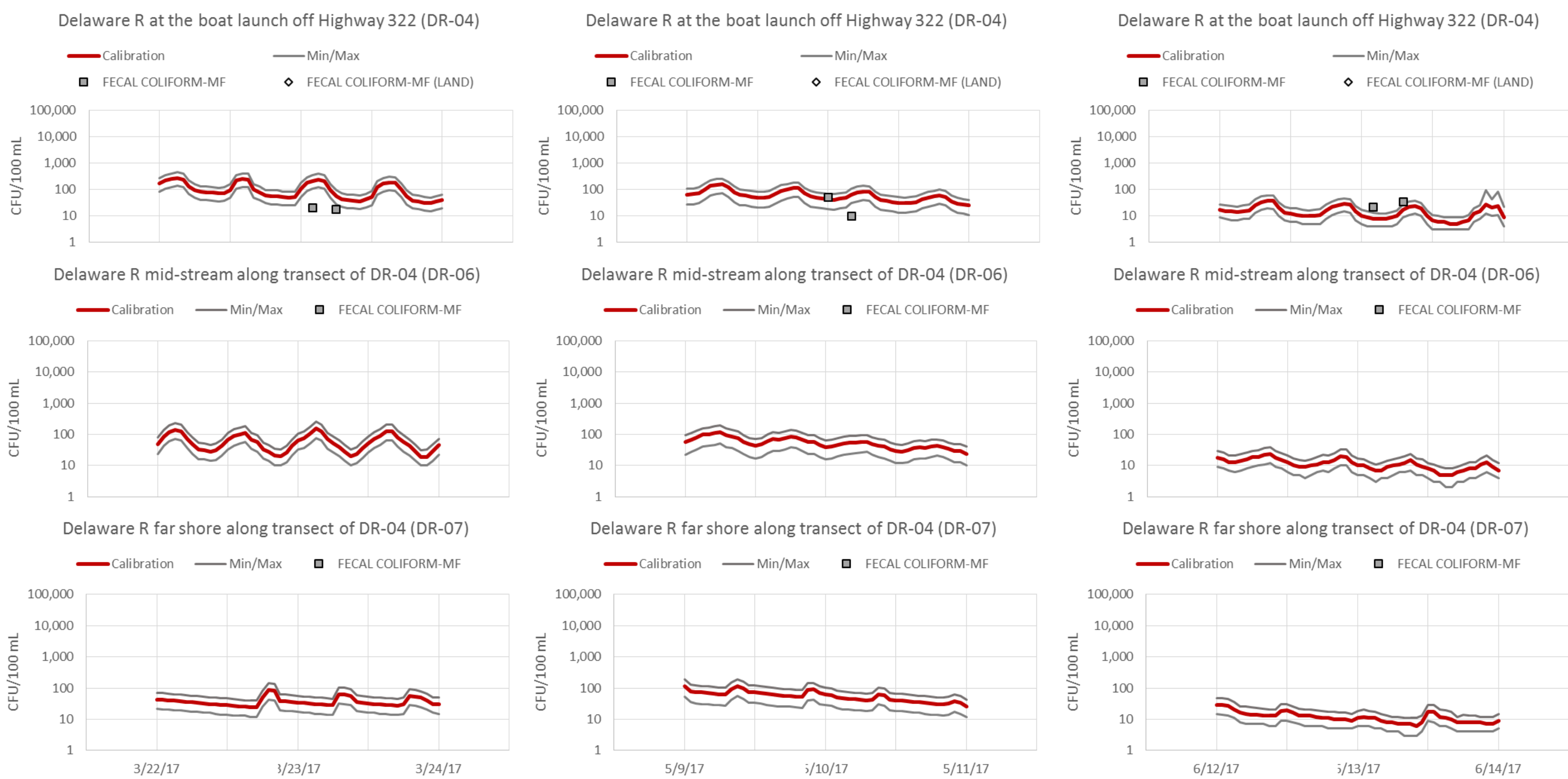

Figure 7. Fecal Coliform Calibration at Delaware River Cross Section (Dry Weather Events #1-3)

Fecal Coliform—2017 Wet Weather Calibration

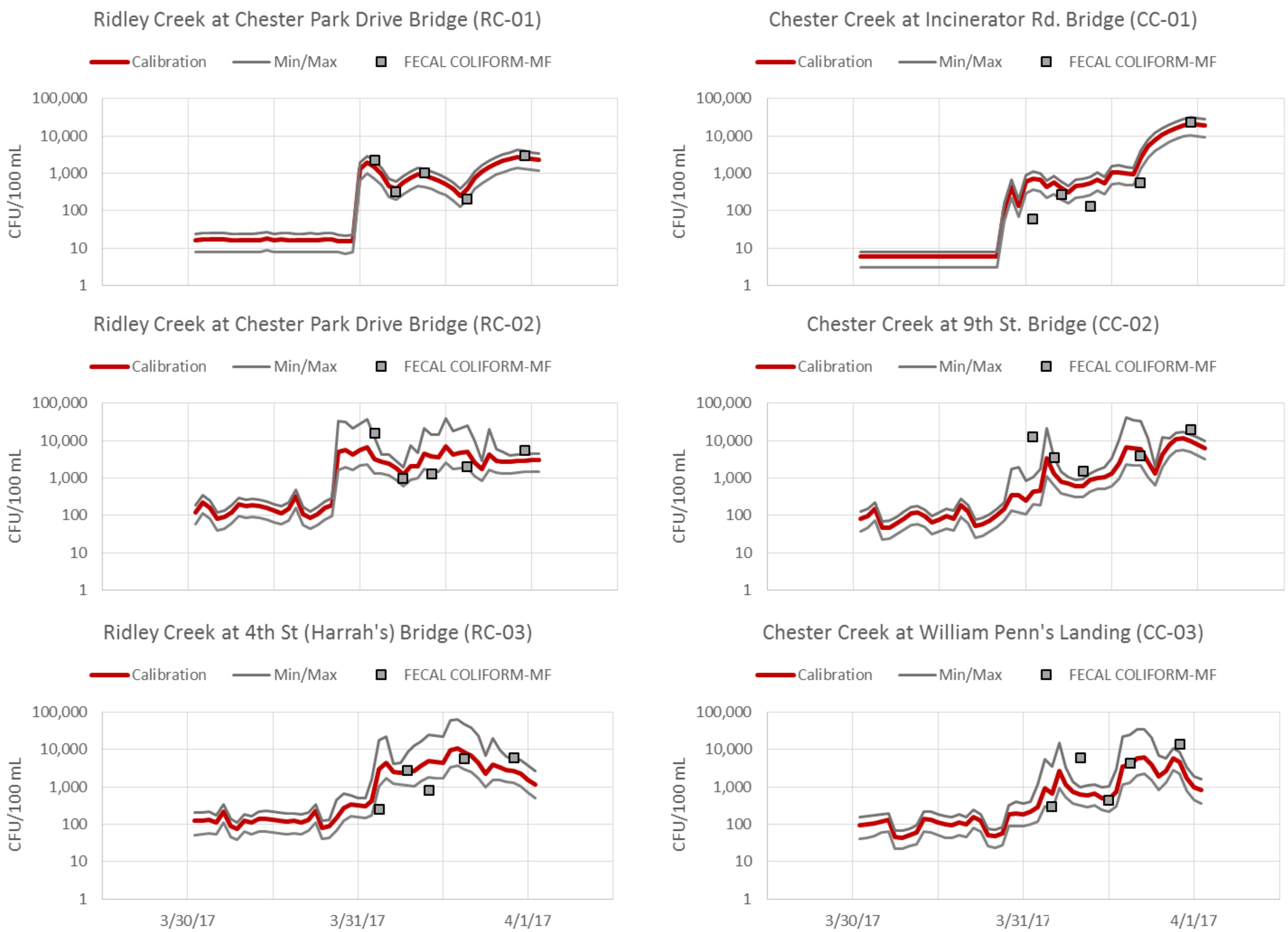

Figure 8. Fecal Coliform Calibration at Ridley Creek and Chester Creek Stations (Wet Weather Event #1, 3/30/17-4/1/17)

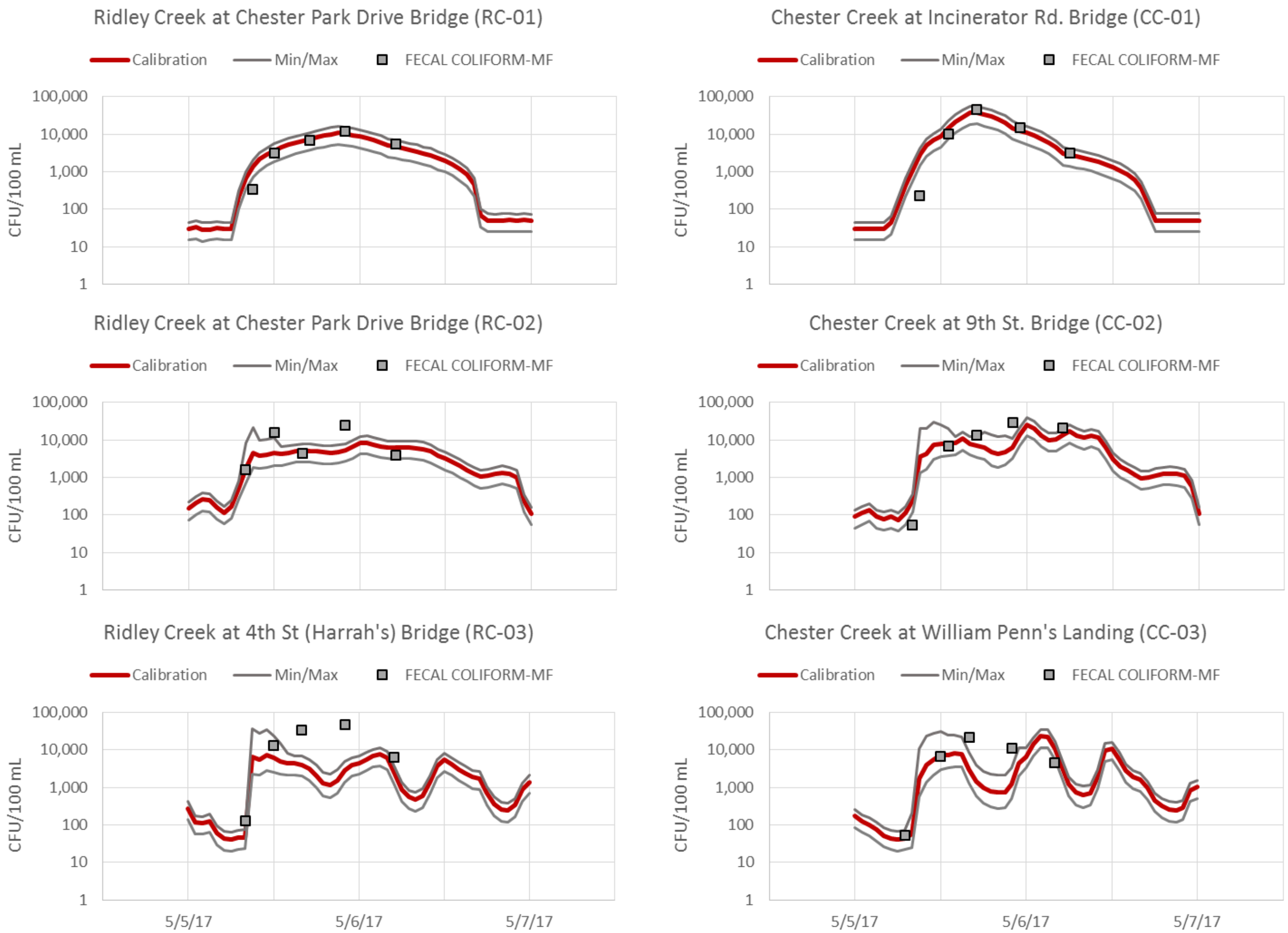

Figure 9. Fecal Coliform Calibration at Ridley Creek and Chester Creek Stations (Wet Weather Event #2, 5/5/17-5/6/17)

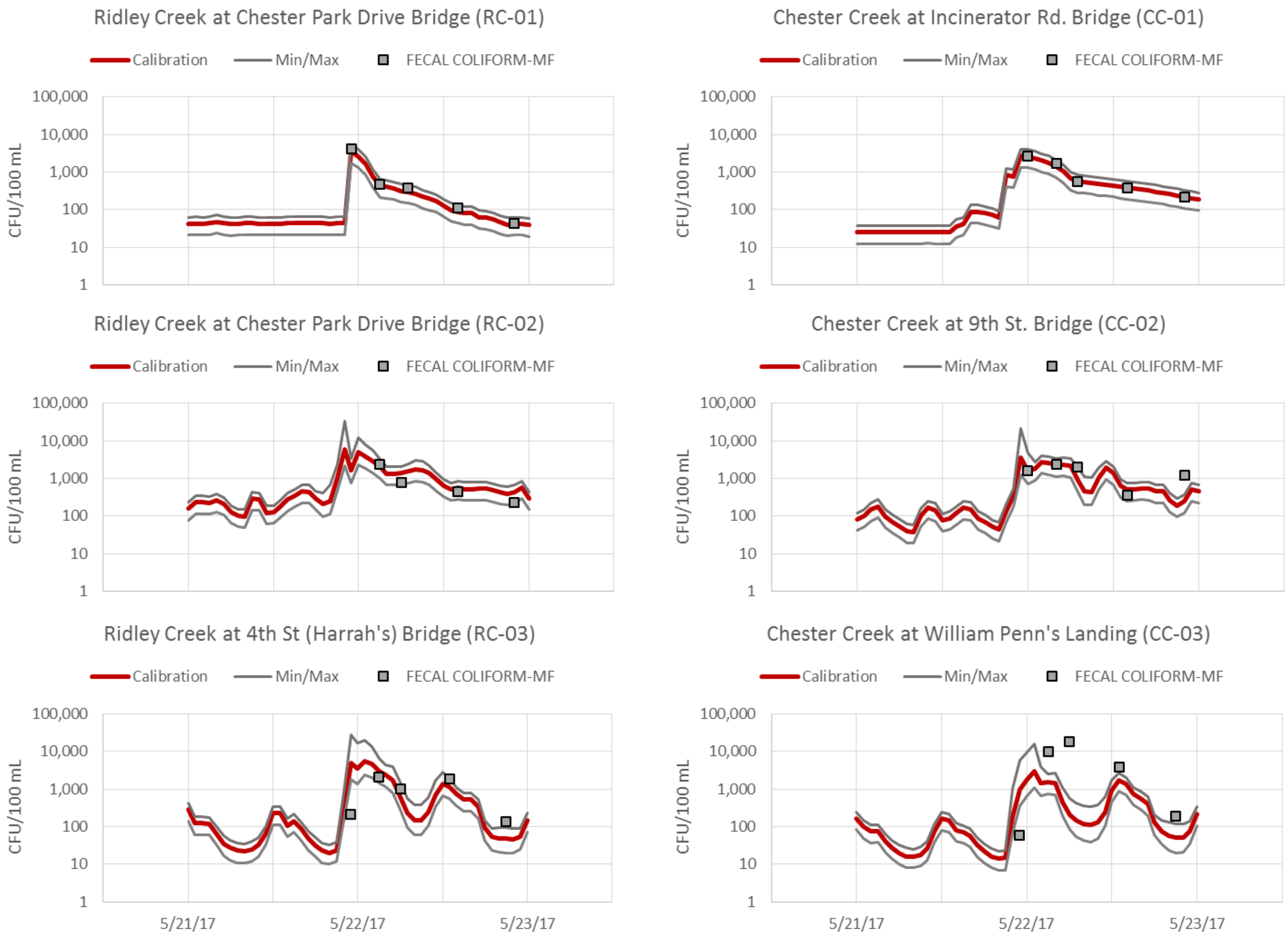

Figure 10. Fecal Coliform Calibration at Ridley Creek and Chester Creek Stations (Wet Weather Event #3, 5/22/17-5/23/17)

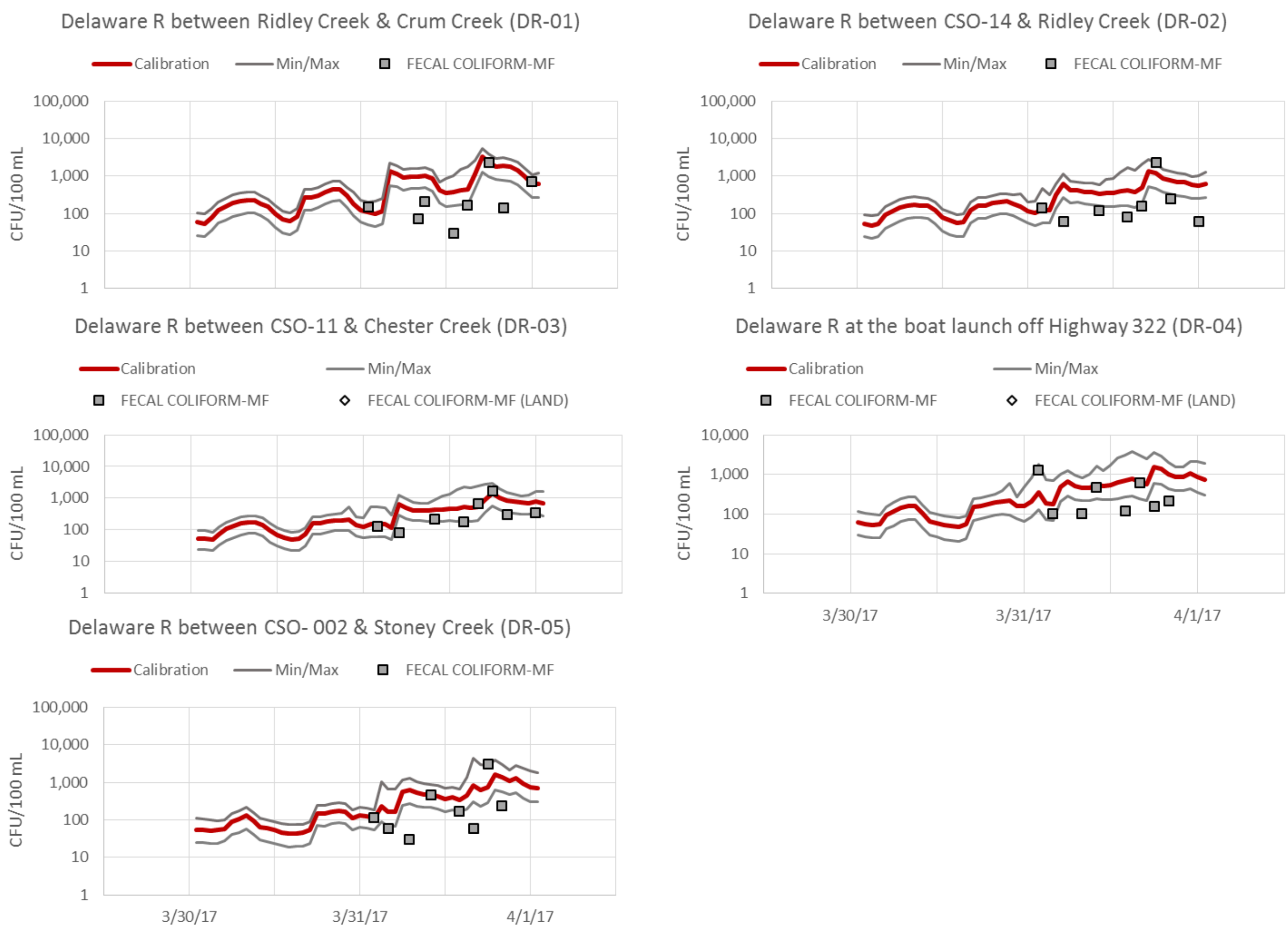

Figure 11. Fecal Coliform Calibration at Delaware River Stations (Wet Weather Event #1, 3/30/17-4/1/17)

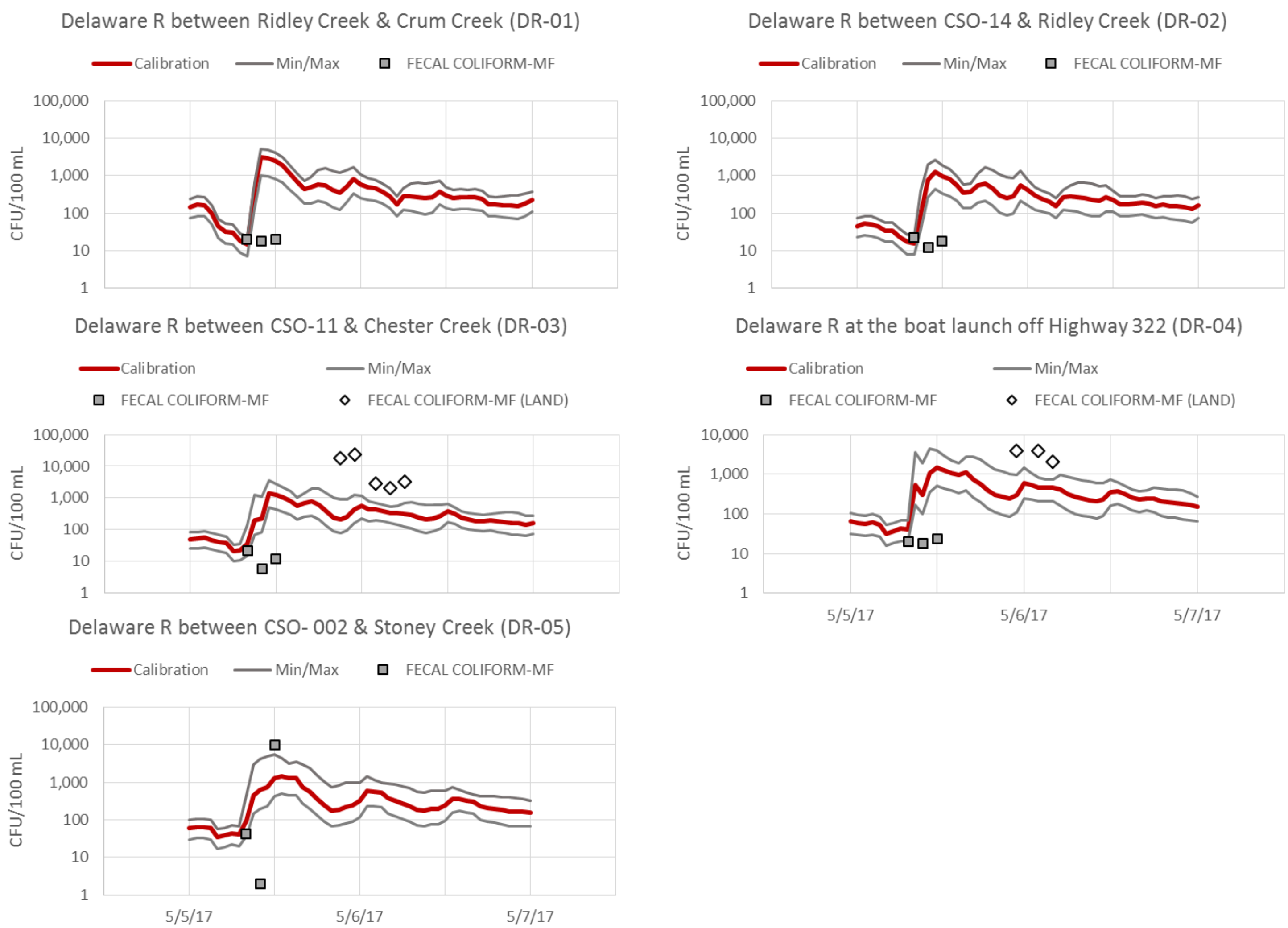

Figure 12. Fecal Coliform Calibration at Delaware River Stations (Wet Weather Event #2, 5/5/17-5/6/17)

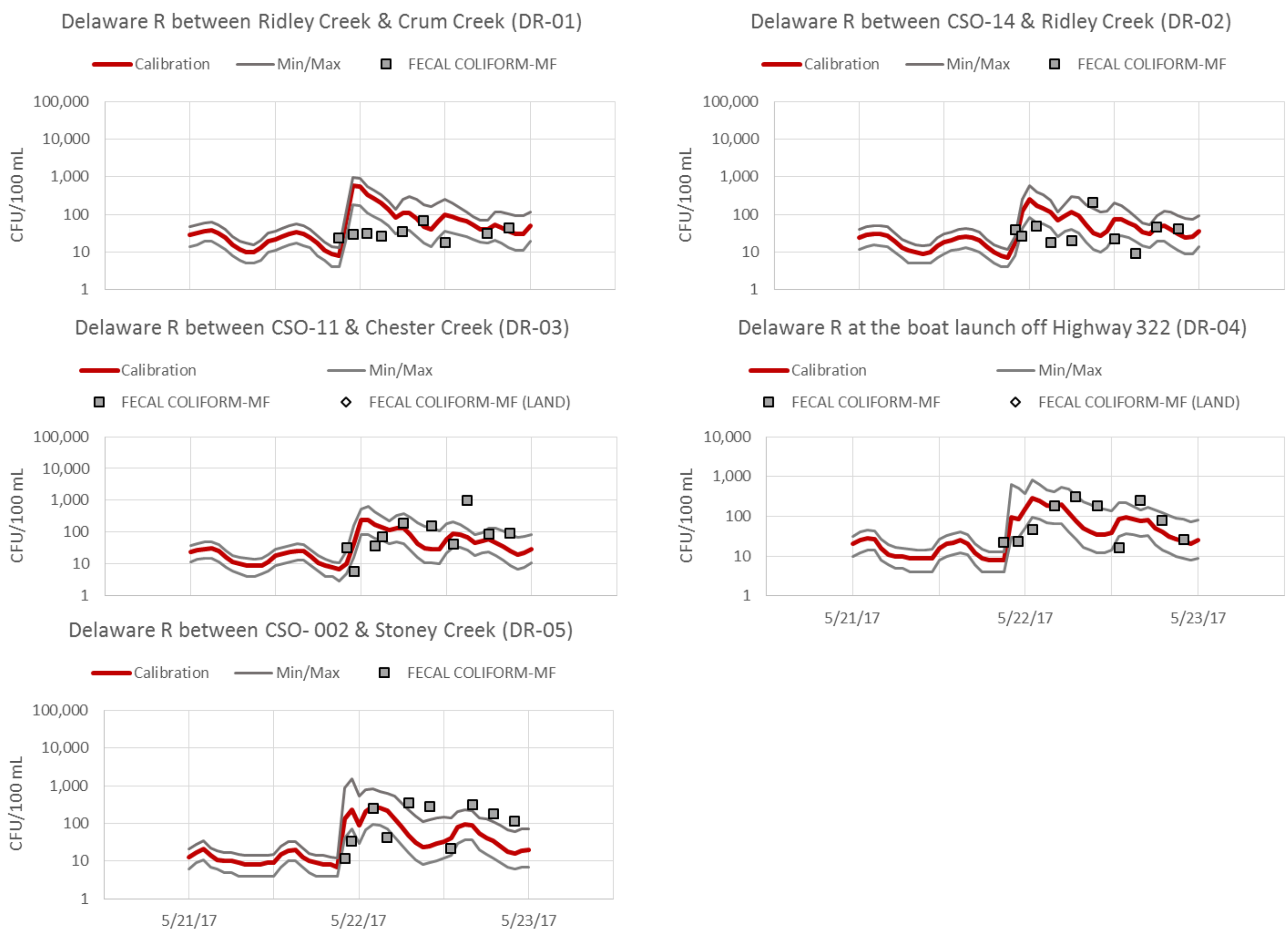

Figure 13. Fecal Coliform Calibration at Delaware River Stations (Wet Weather Event #3, 5/22/17-5/23/17)

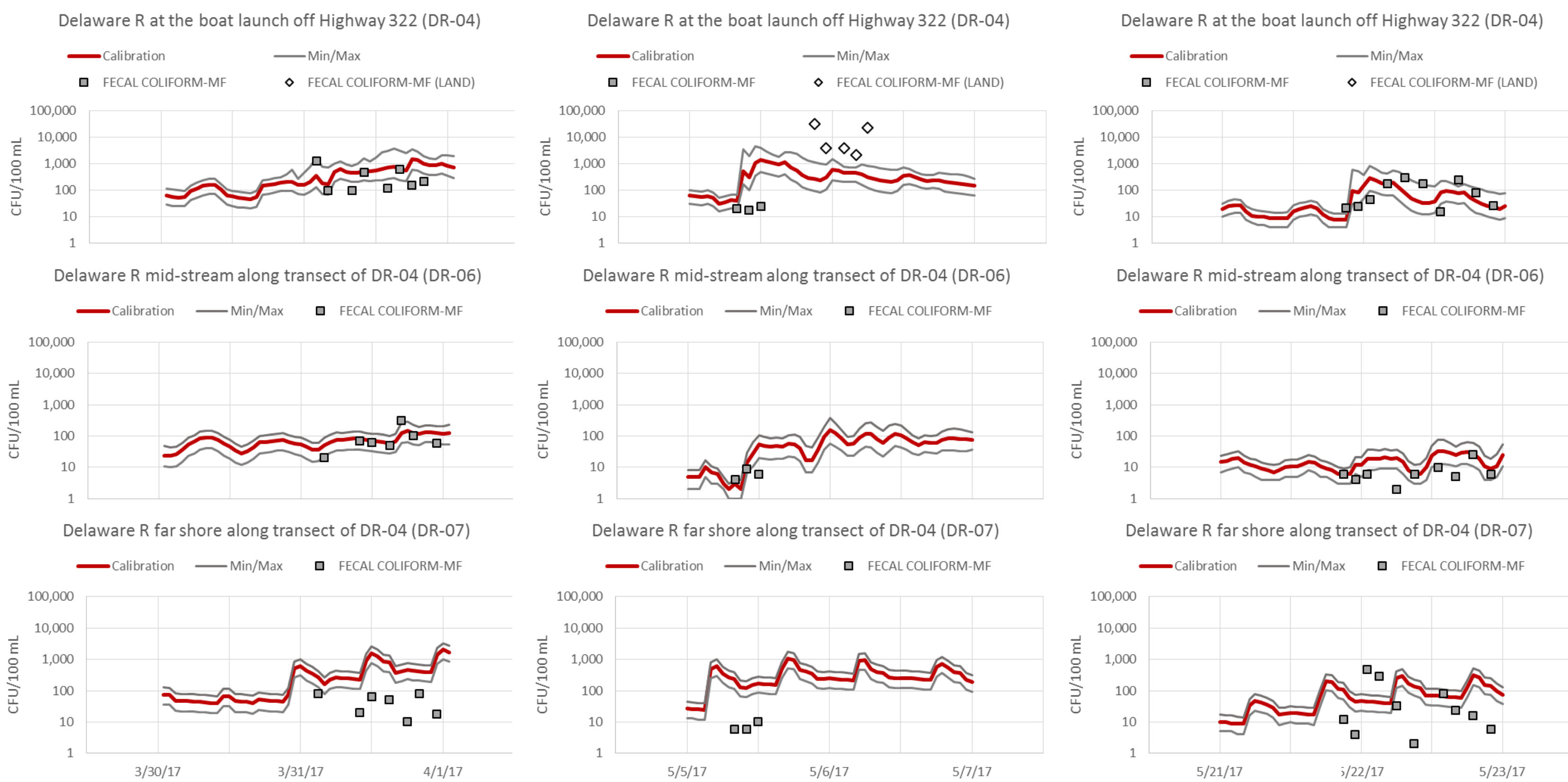

Figure 14. Fecal Coliform Calibration at Delaware River Cross Section (Wet Weather Events #1-3)

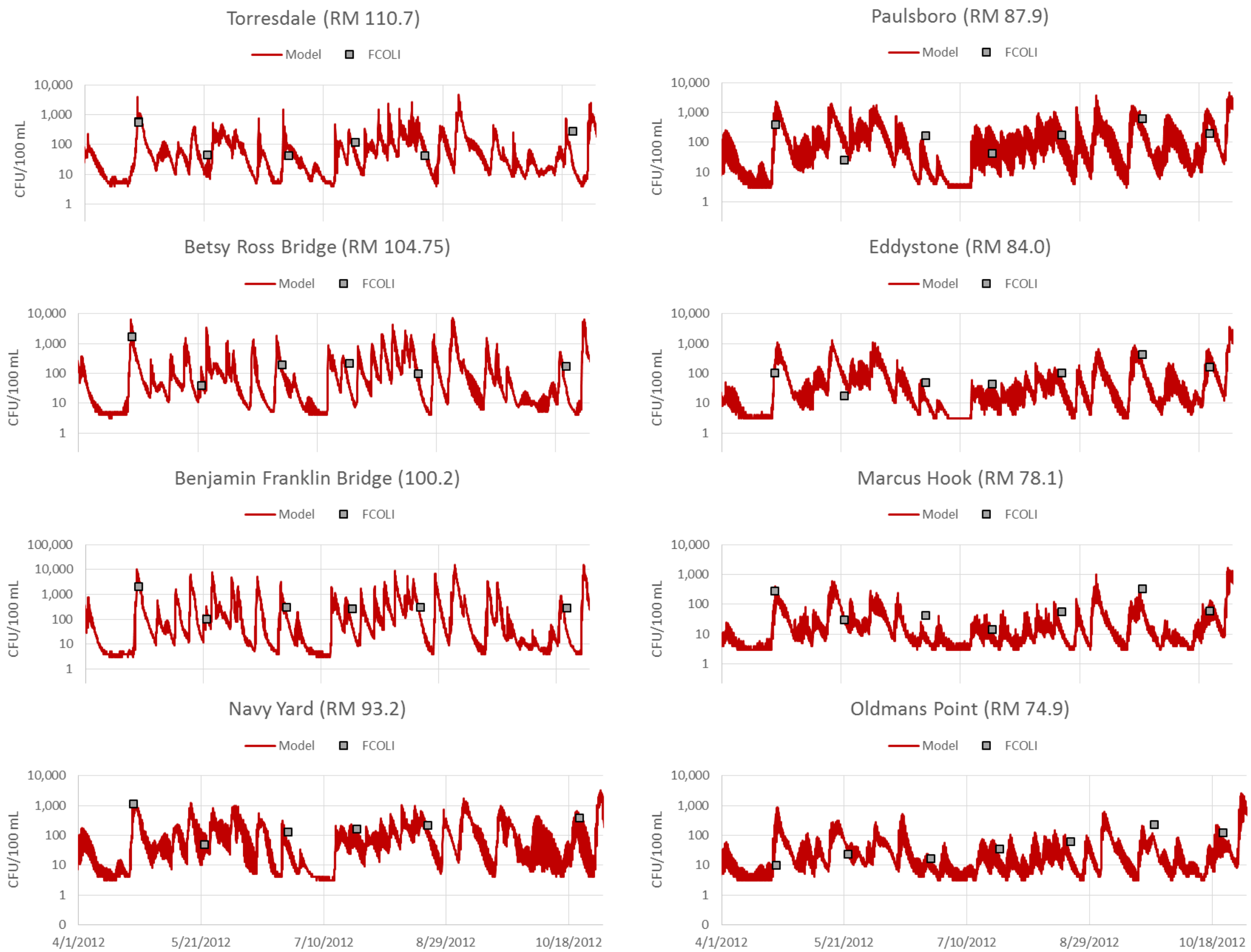

Figure 15. Fecal Coliform Model Validation at DRBC Delaware River Sampling Stations (2012)

E. coli

E. coli—2017 Dry Weather Calibration

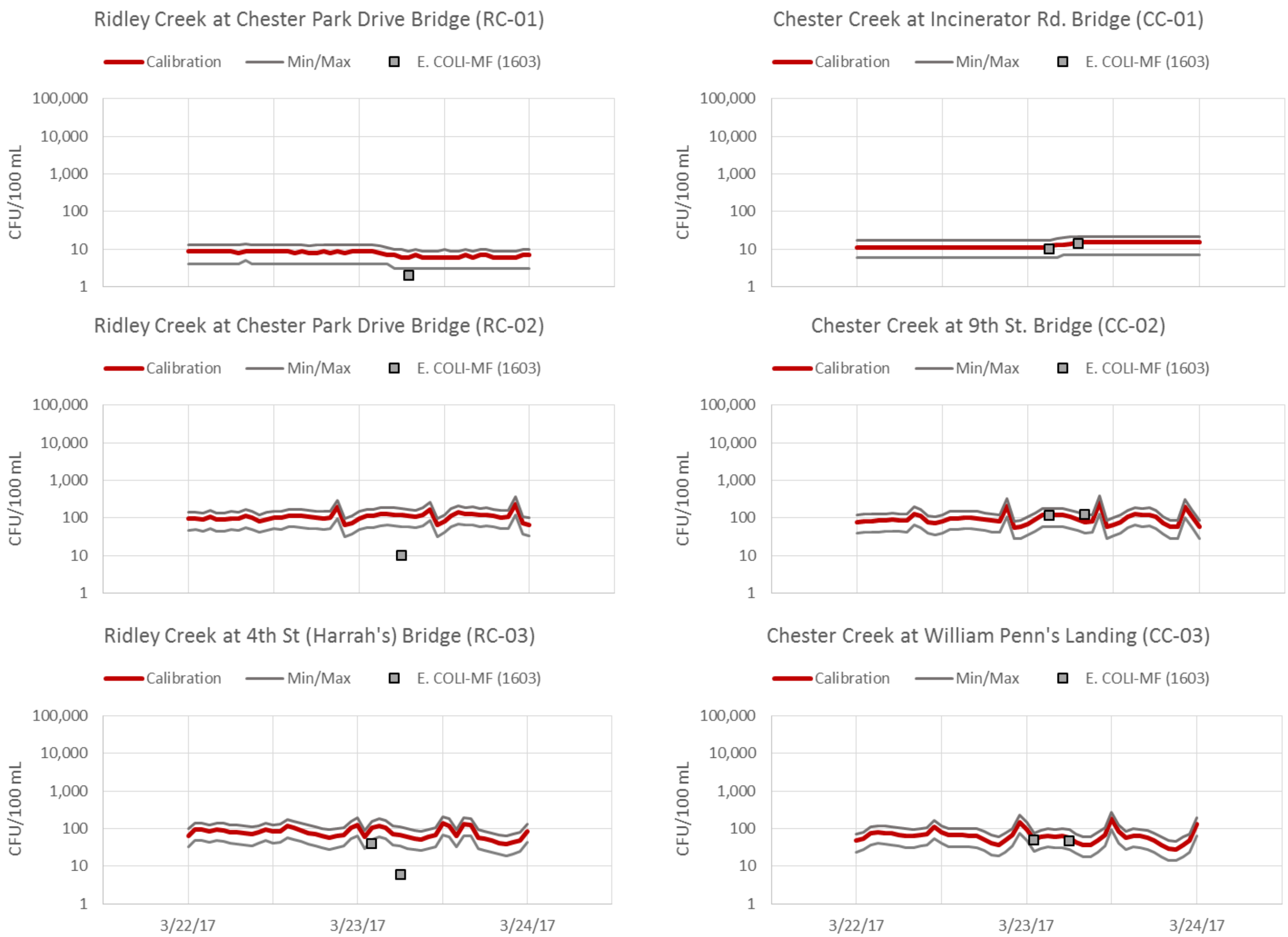

Figure 16. E. coli Calibration at Ridley Creek and Chester Creek Stations (Dry Weather Event #1, 3/23/17)

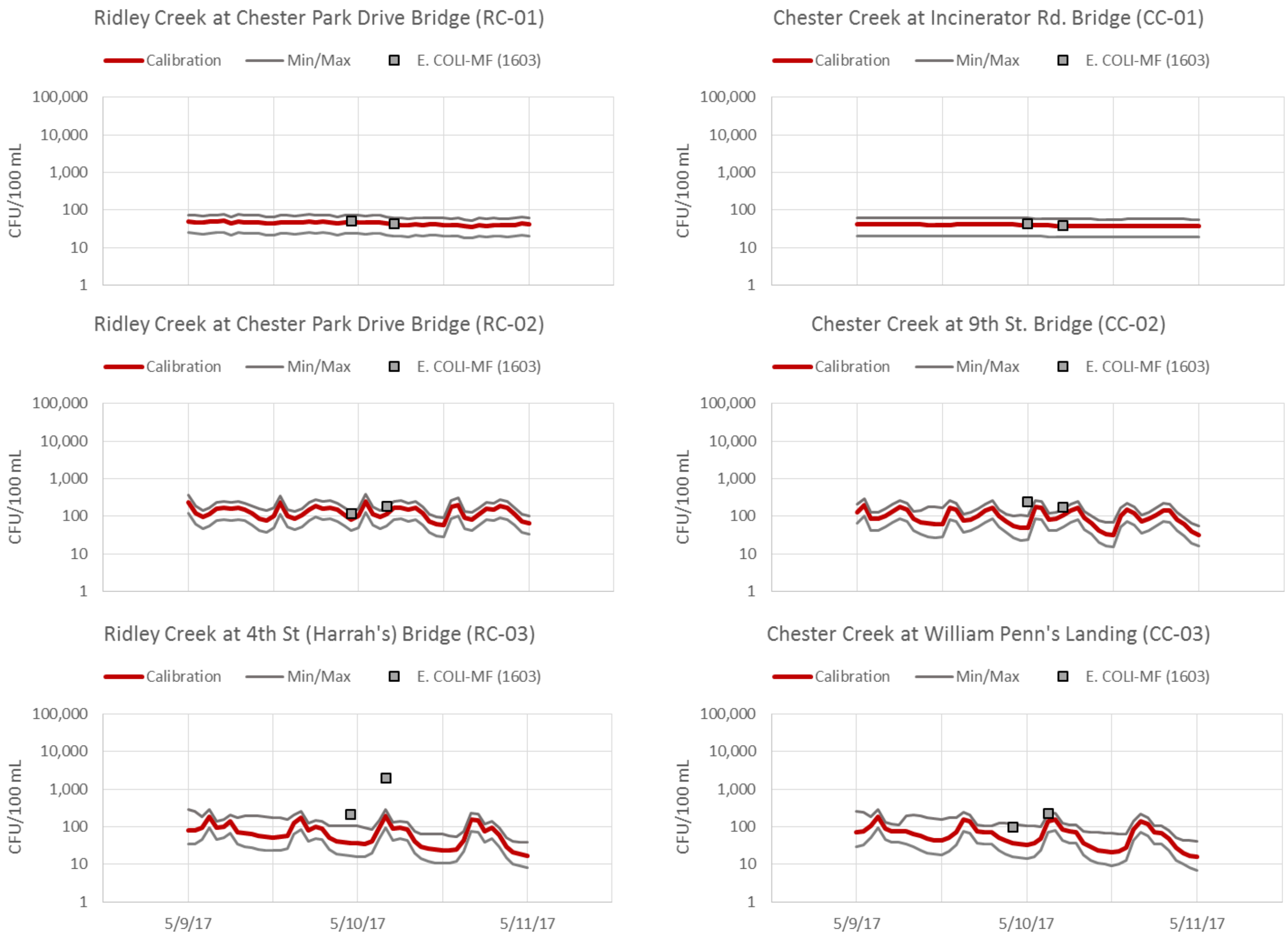

Figure 17. E. coli Calibration at Ridley Creek and Chester Creek Stations (Dry Weather Event #2, 5/10/17)

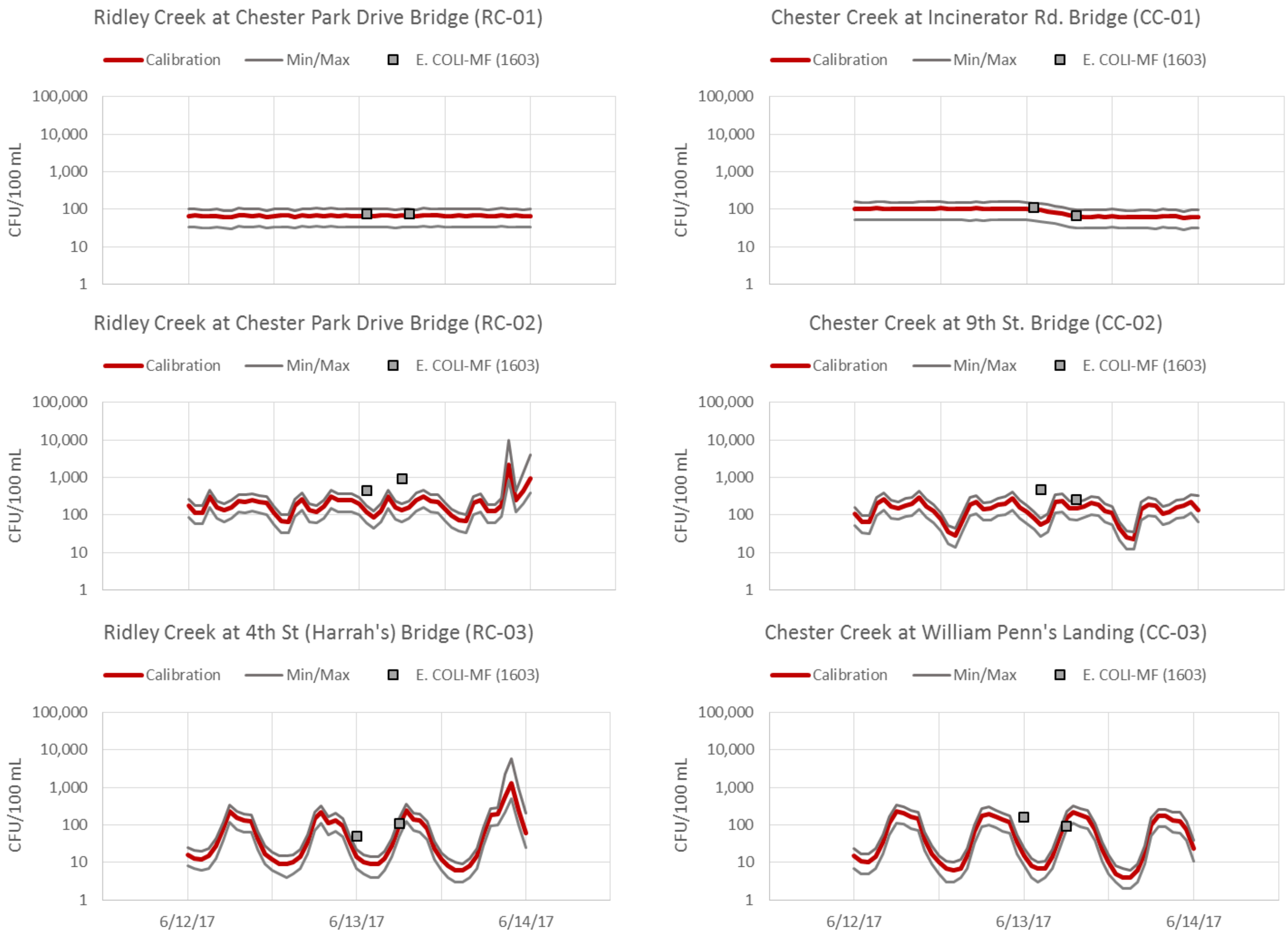

Figure 18. E. coli Calibration at Ridley Creek and Chester Creek Stations (Dry Weather Event #3, 6/13/17)

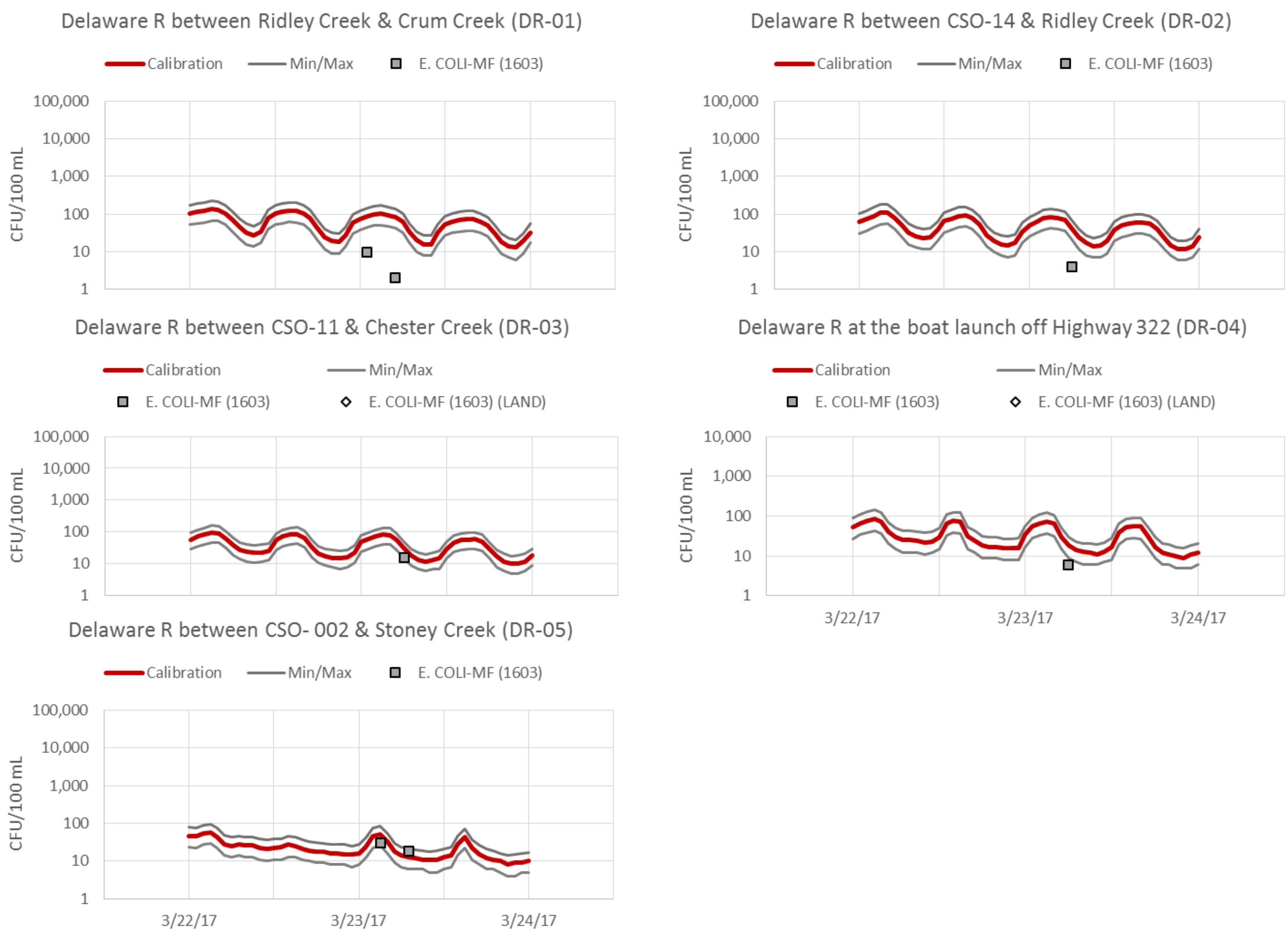

Figure 19. E. coli Calibration at Delaware River Stations (Dry Weather Event #1, 3/23/17)

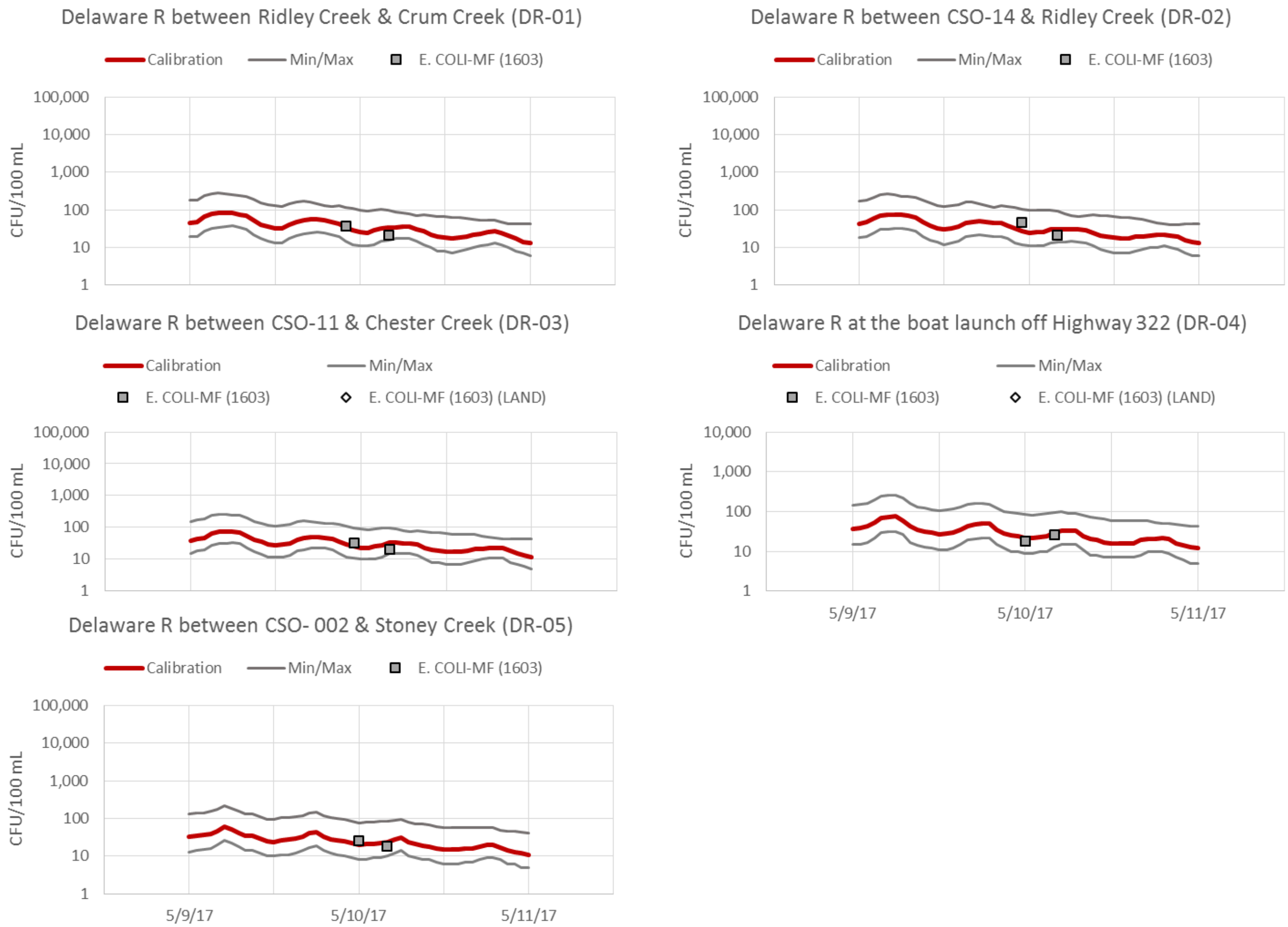

Figure 20. E. coli Calibration at Delaware River Stations (Dry Weather Event #2, 5/10/17)

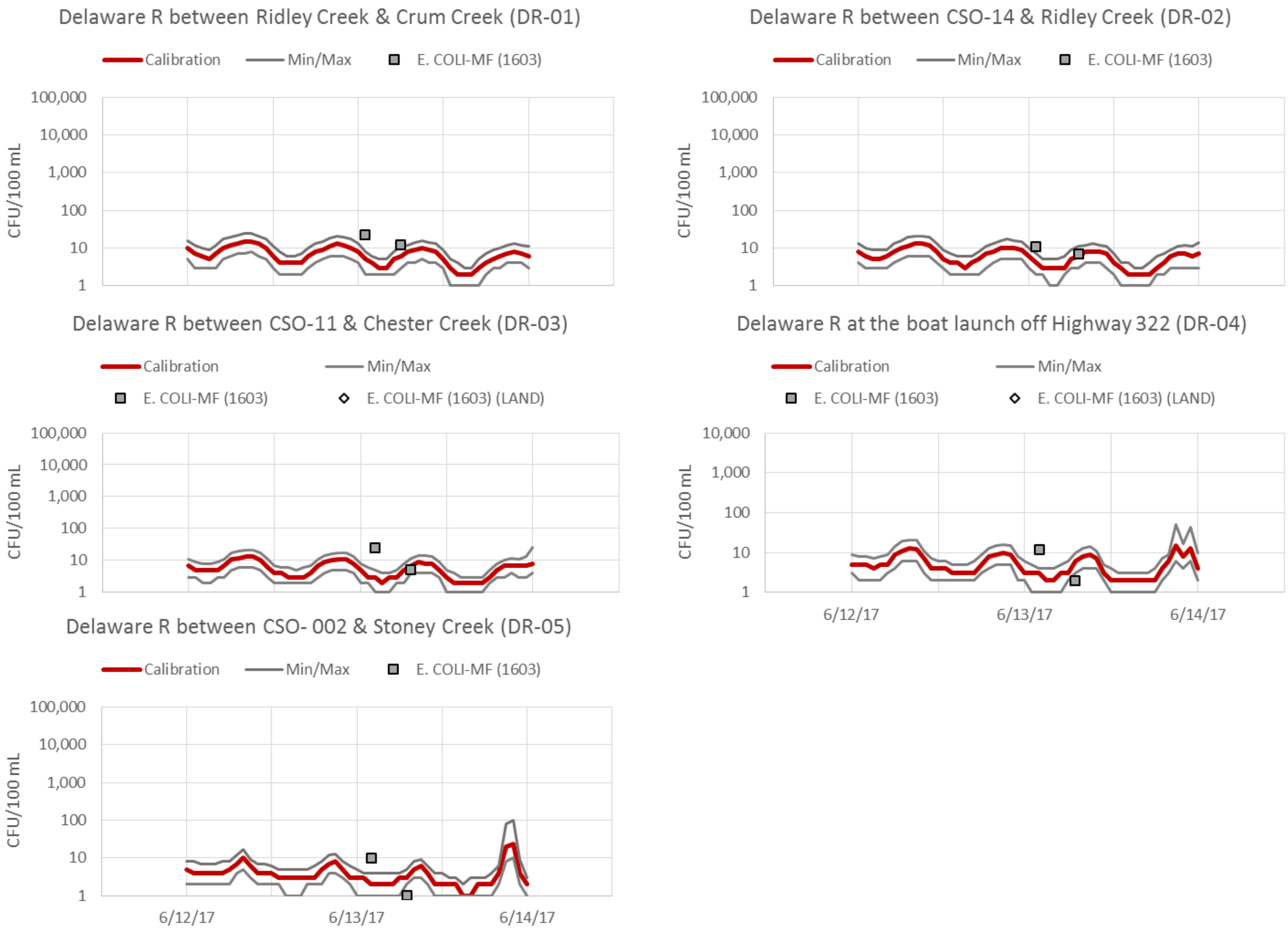

Figure 21. E. coli Calibration at Delaware River Stations (Dry Weather Event #3, 6/13/17)

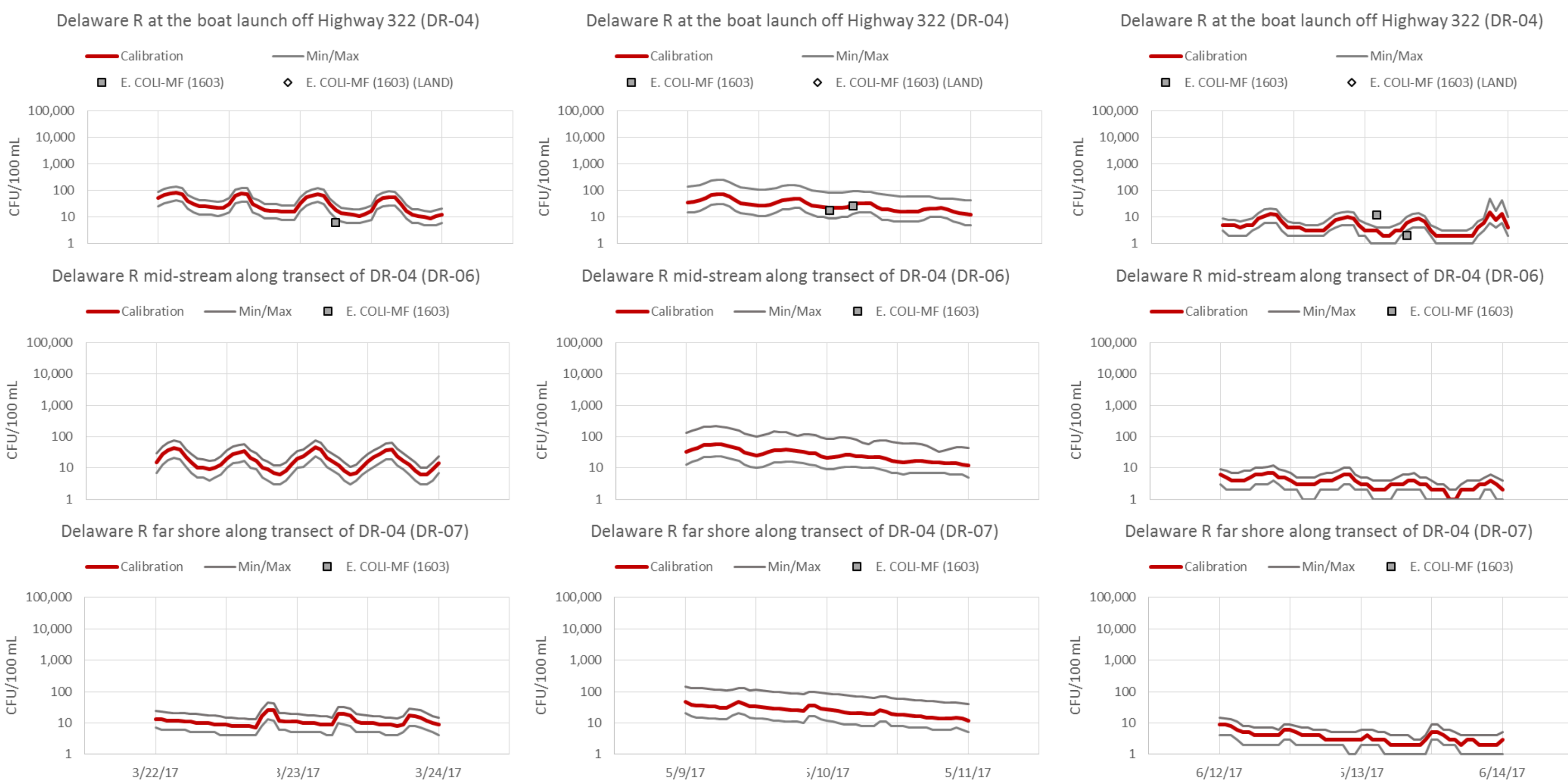

Figure 22. E. coli Calibration at Delaware River Cross Section (Dry Weather Events #1-3)

E. coli—2017 Wet Weather Calibration

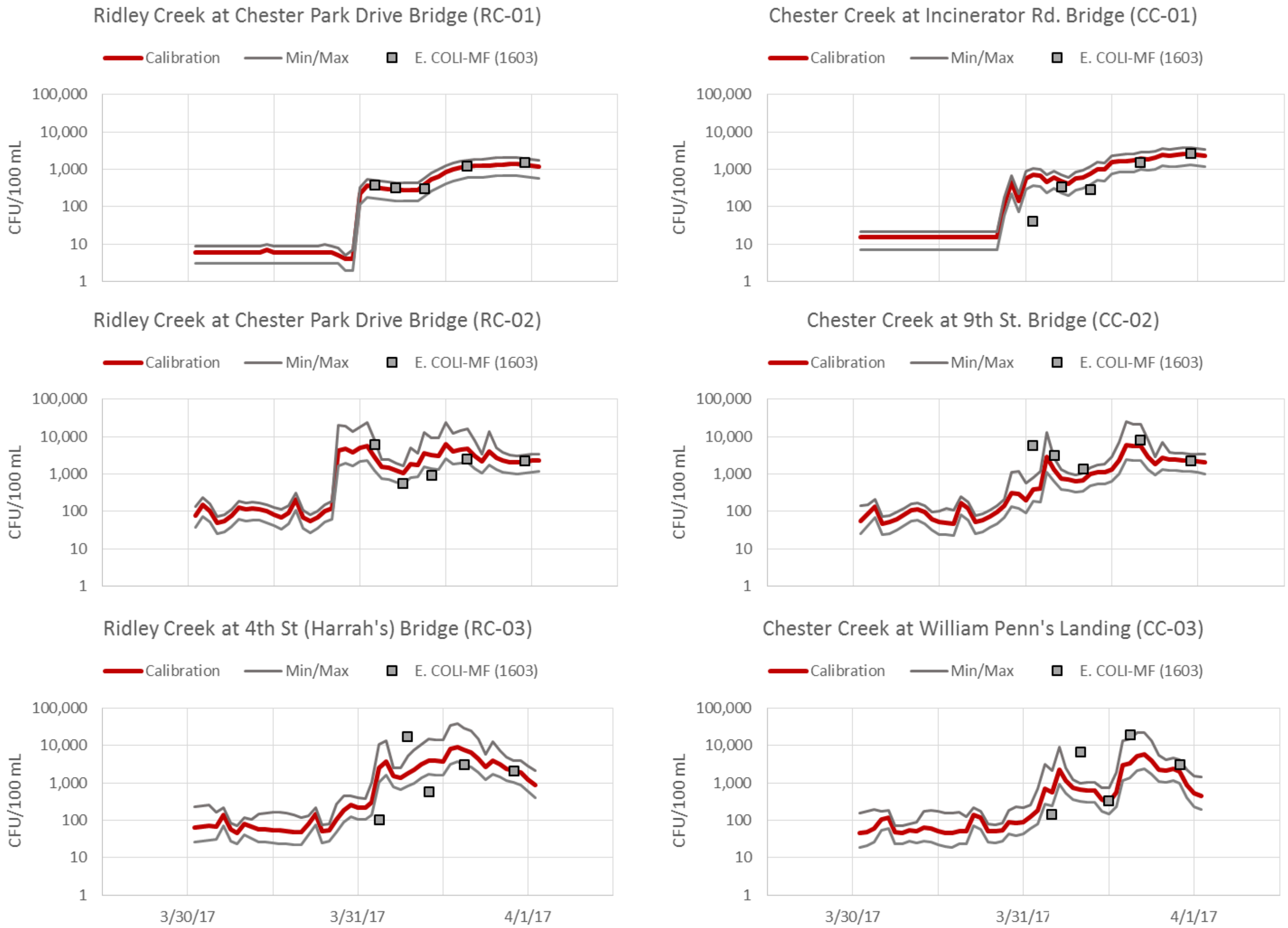

Figure 23. E. coli Calibration at Ridley Creek and Chester Creek Stations (Wet Weather Event #1, 3/30/17-4/1/17)

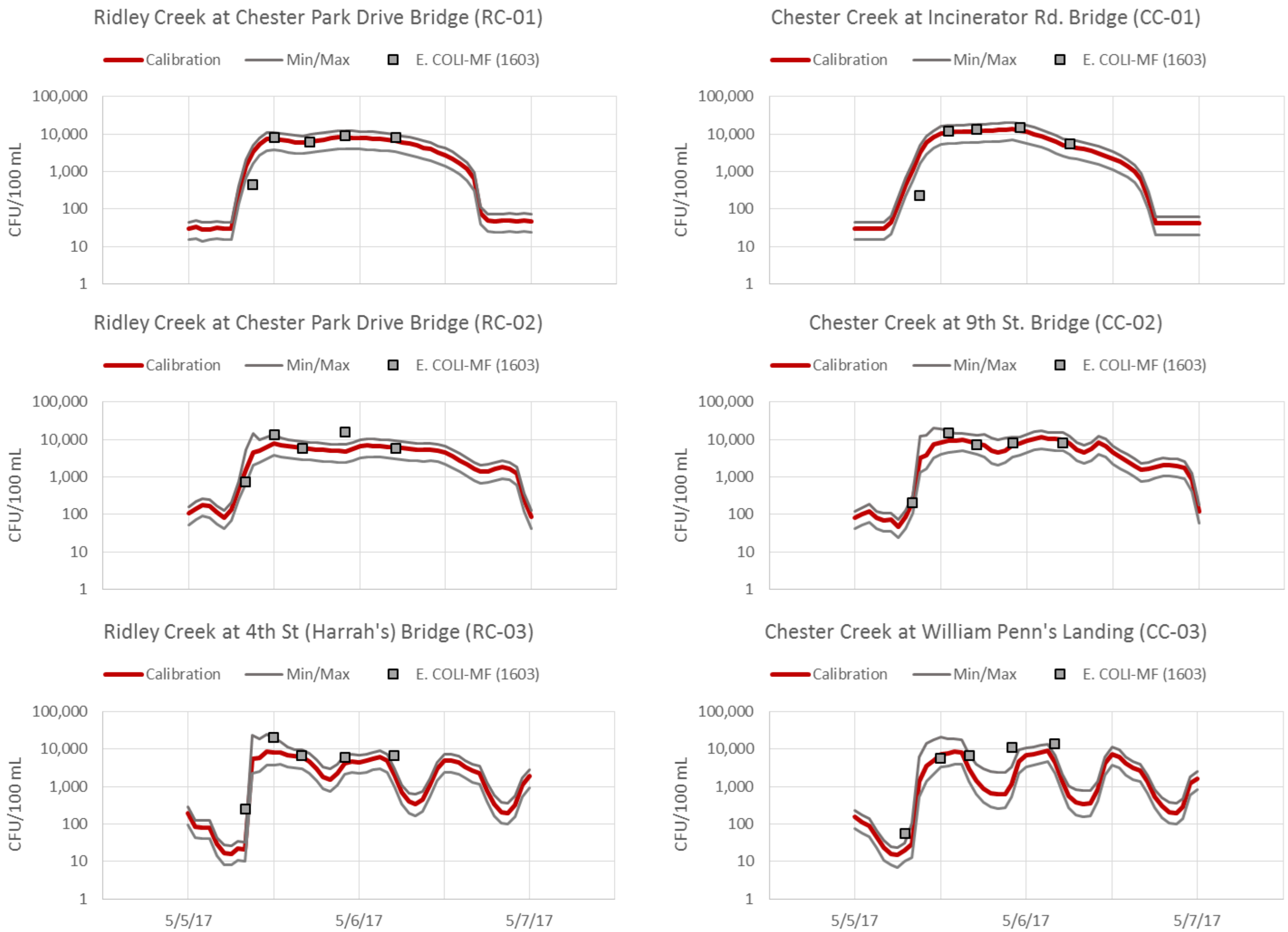

Figure 24. E. coli Calibration at Ridley Creek and Chester Creek Stations (Wet Weather Event #2, 5/5/17-5/6/17)

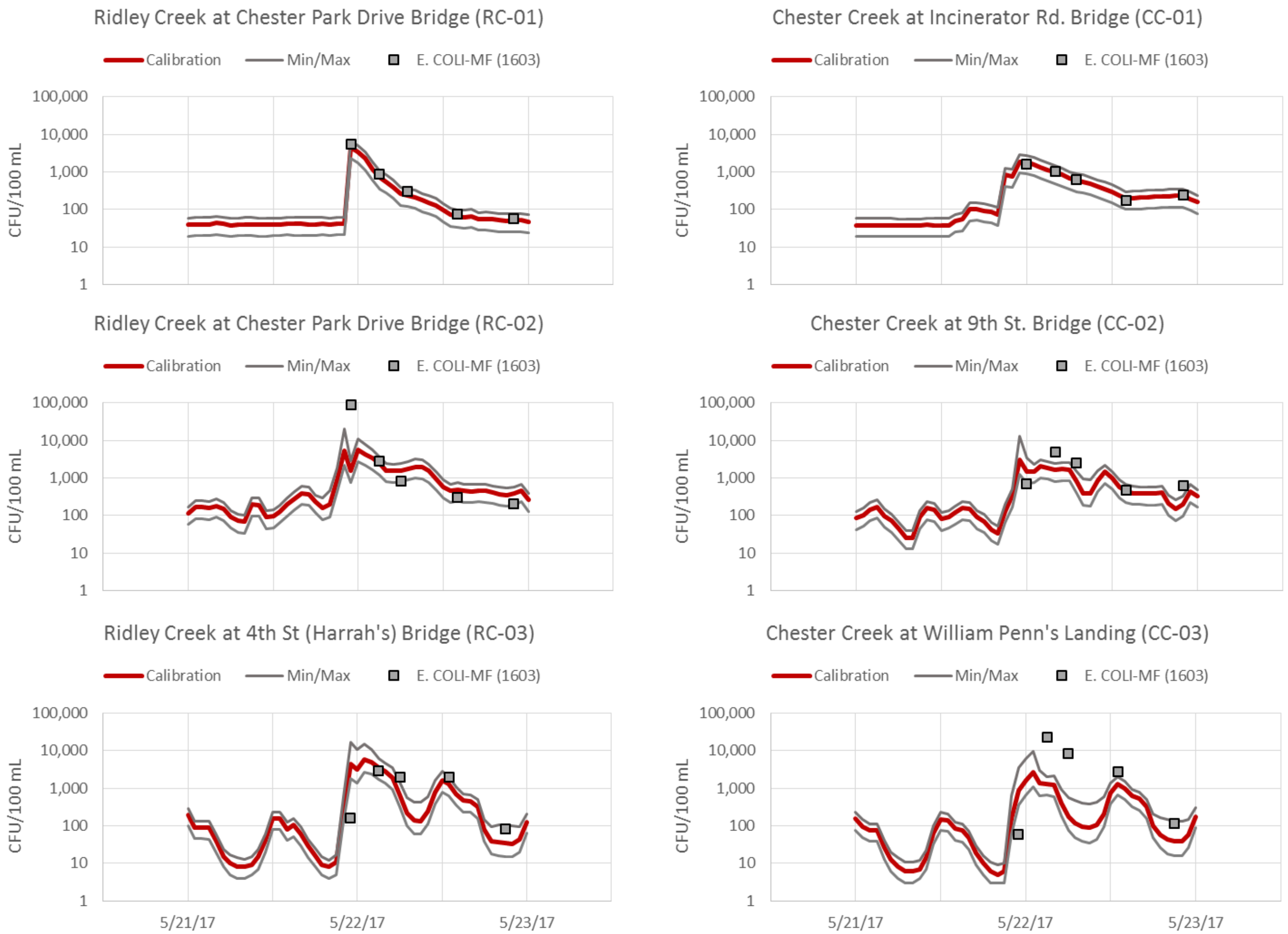

Figure 25. E. coli Calibration at Ridley Creek and Chester Creek Stations (Wet Weather Event #3, 5/22/17-5/23/17)

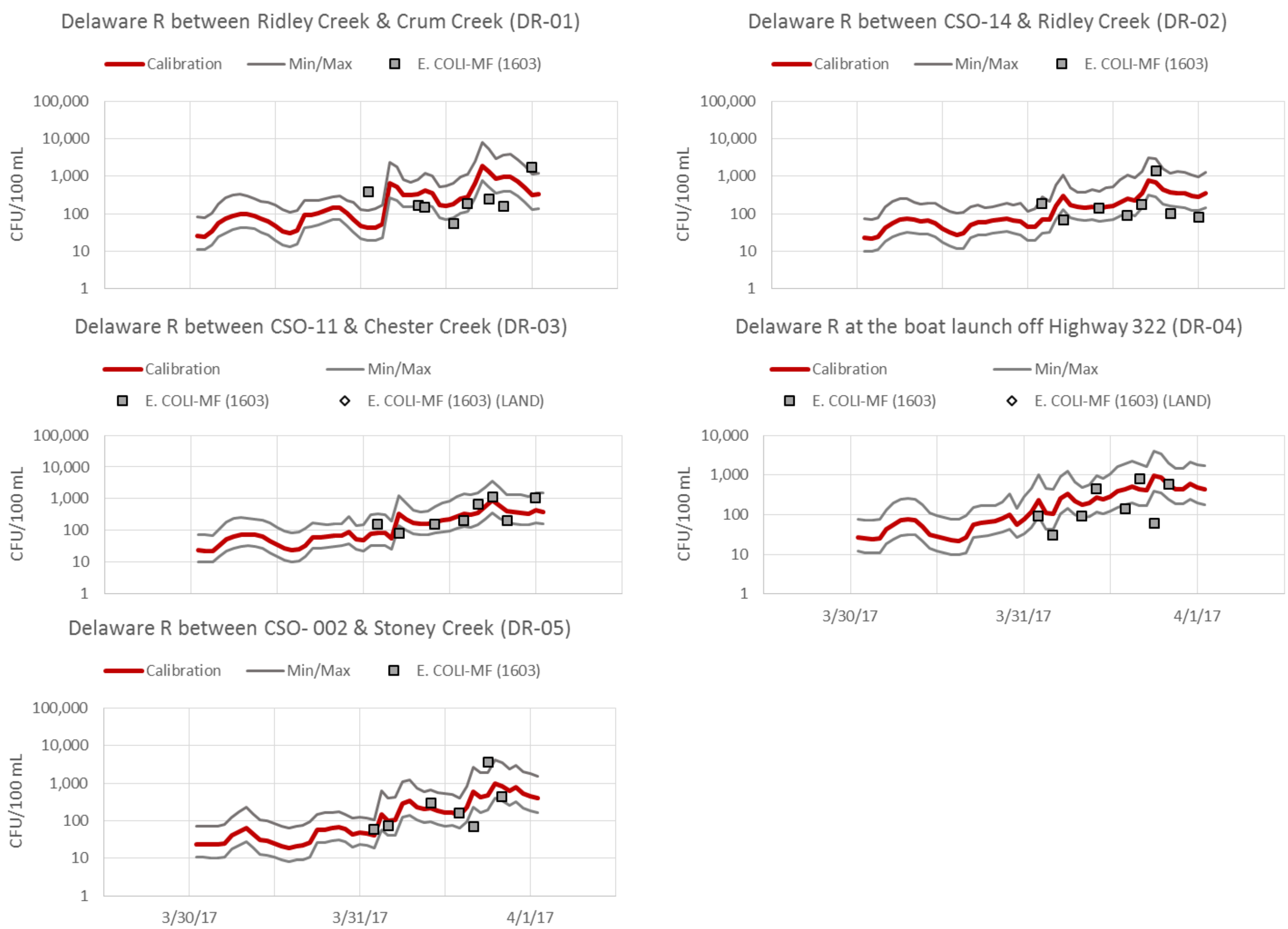

Figure 26. E. coli Calibration at Delaware River Stations (Wet Weather Event #1, 3/30/17-4/1/17)

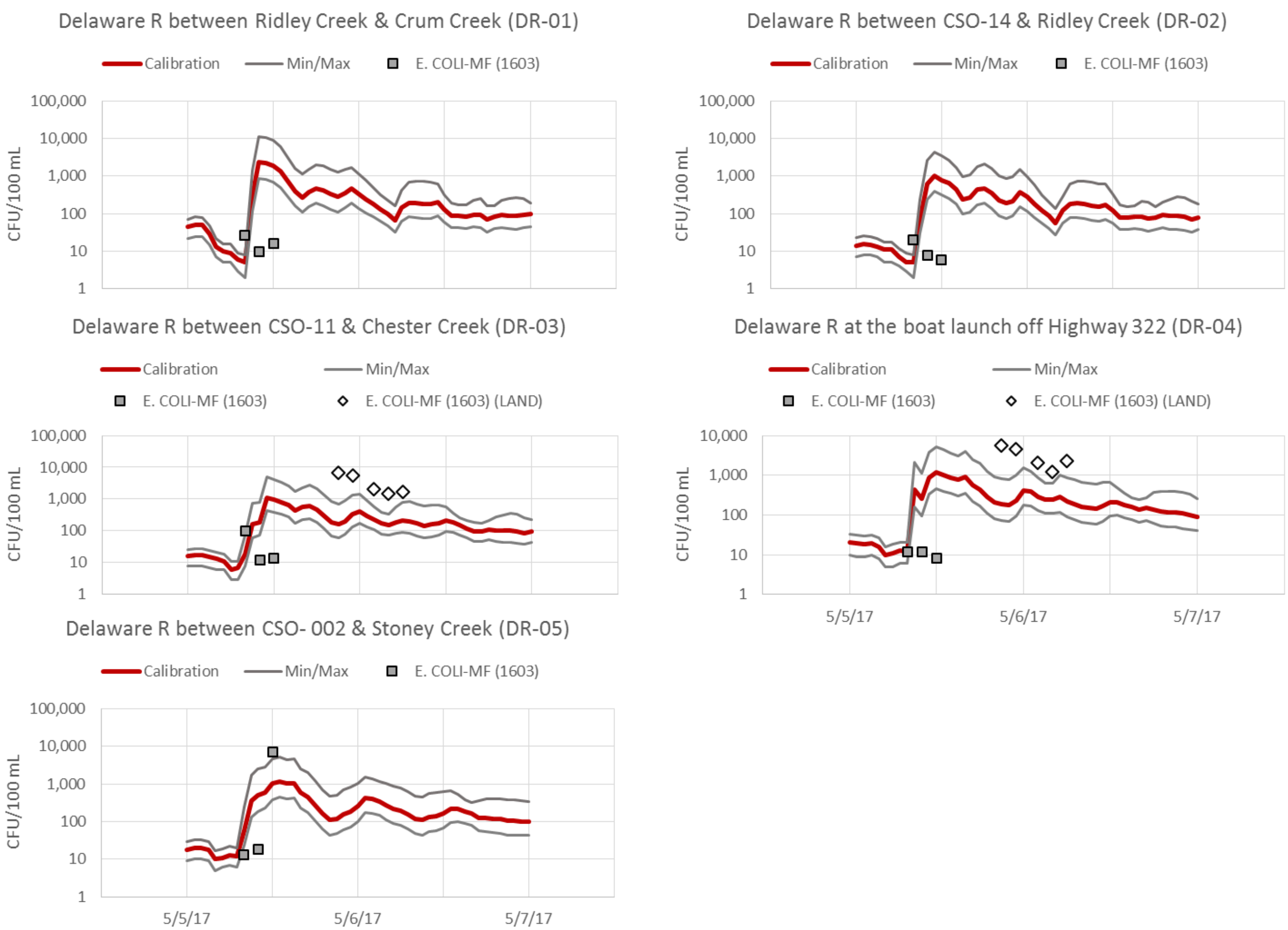

Figure 27. E. coli Calibration at Delaware River Stations (Wet Weather Event #2, 5/5/17-5/6/17)

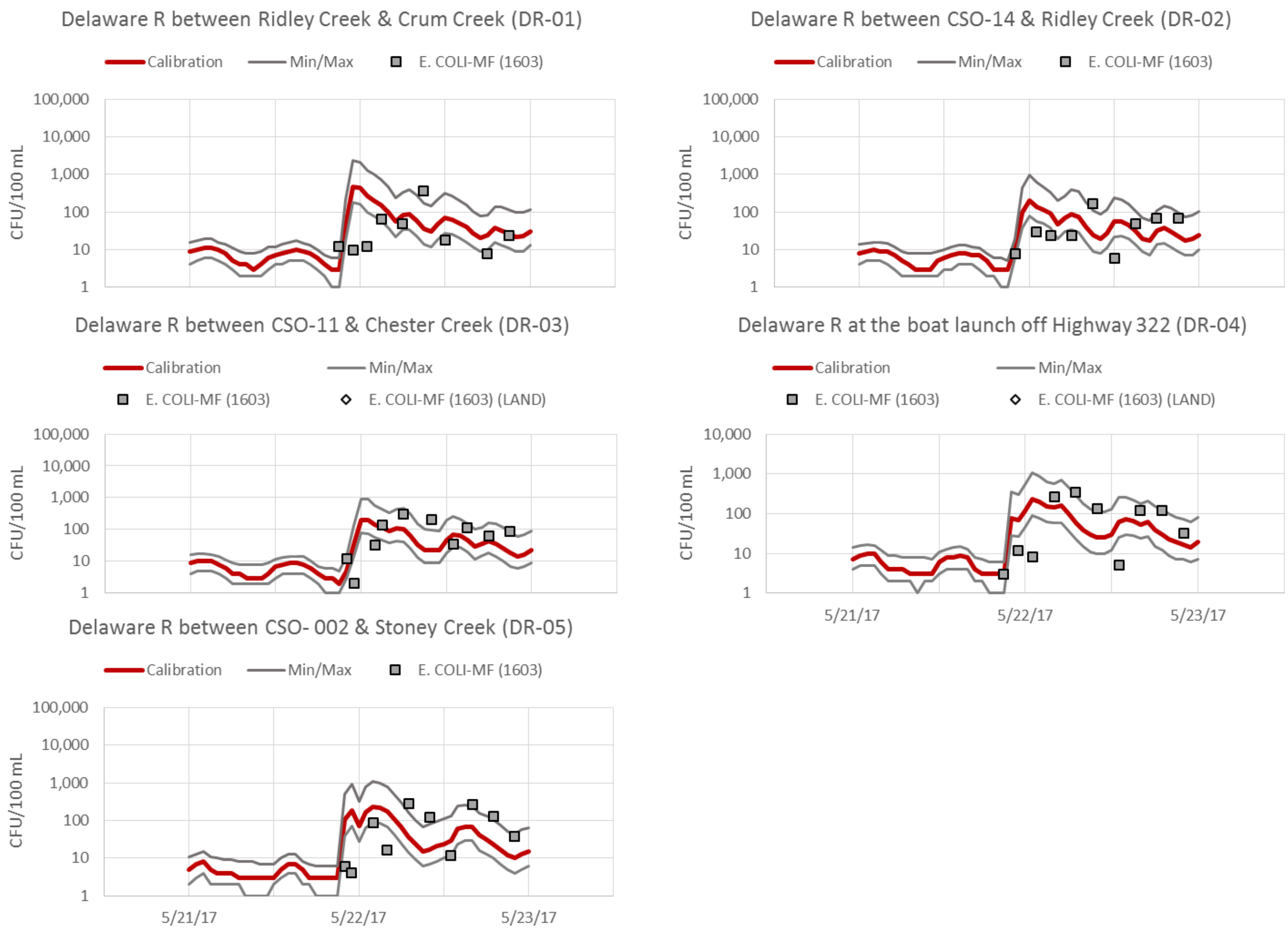

Figure 28. E. coli Calibration at Delaware River Stations (Wet Weather Event #3, 5/22/17-5/23/17)

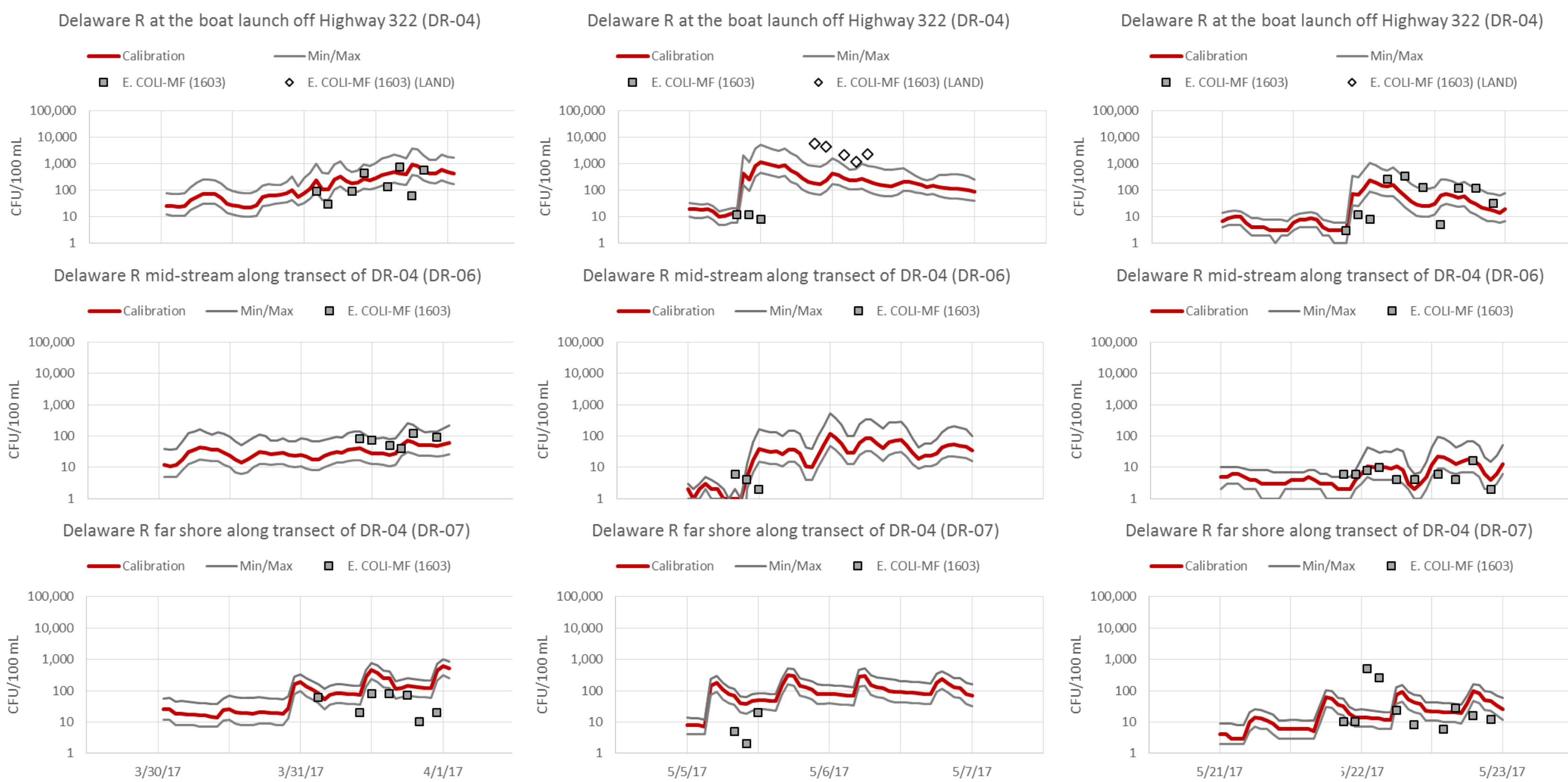

Figure 29. E. coli Calibration at Delaware River Cross Section (Wet Weather Events #1-3)

E. coli—2012 Model Validation

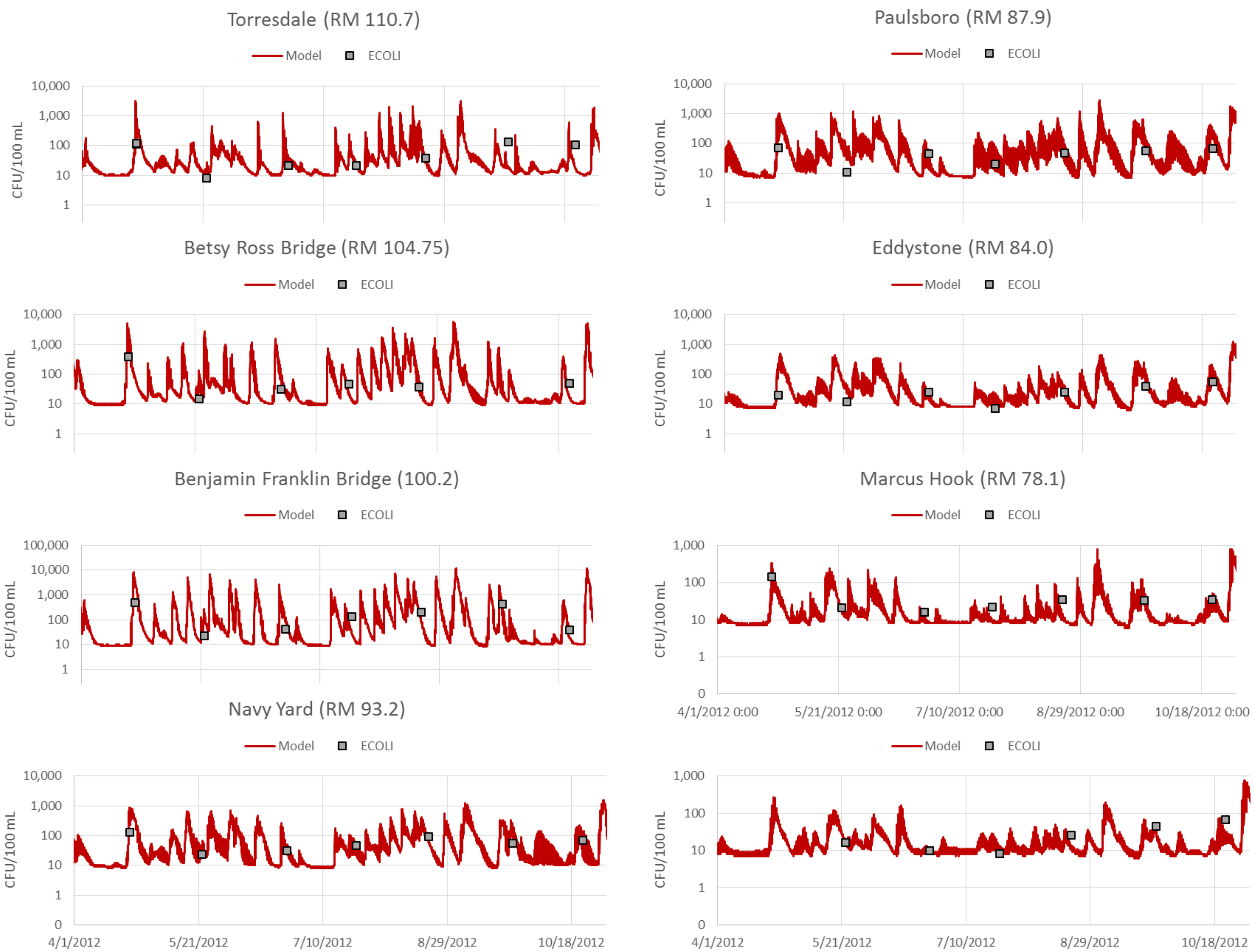

Figure 30. E. coli Model Validation at DRBC Delaware River Sampling Stations (2012)

Enterococcus

Enterococcus—2017 Dry Weather Calibration

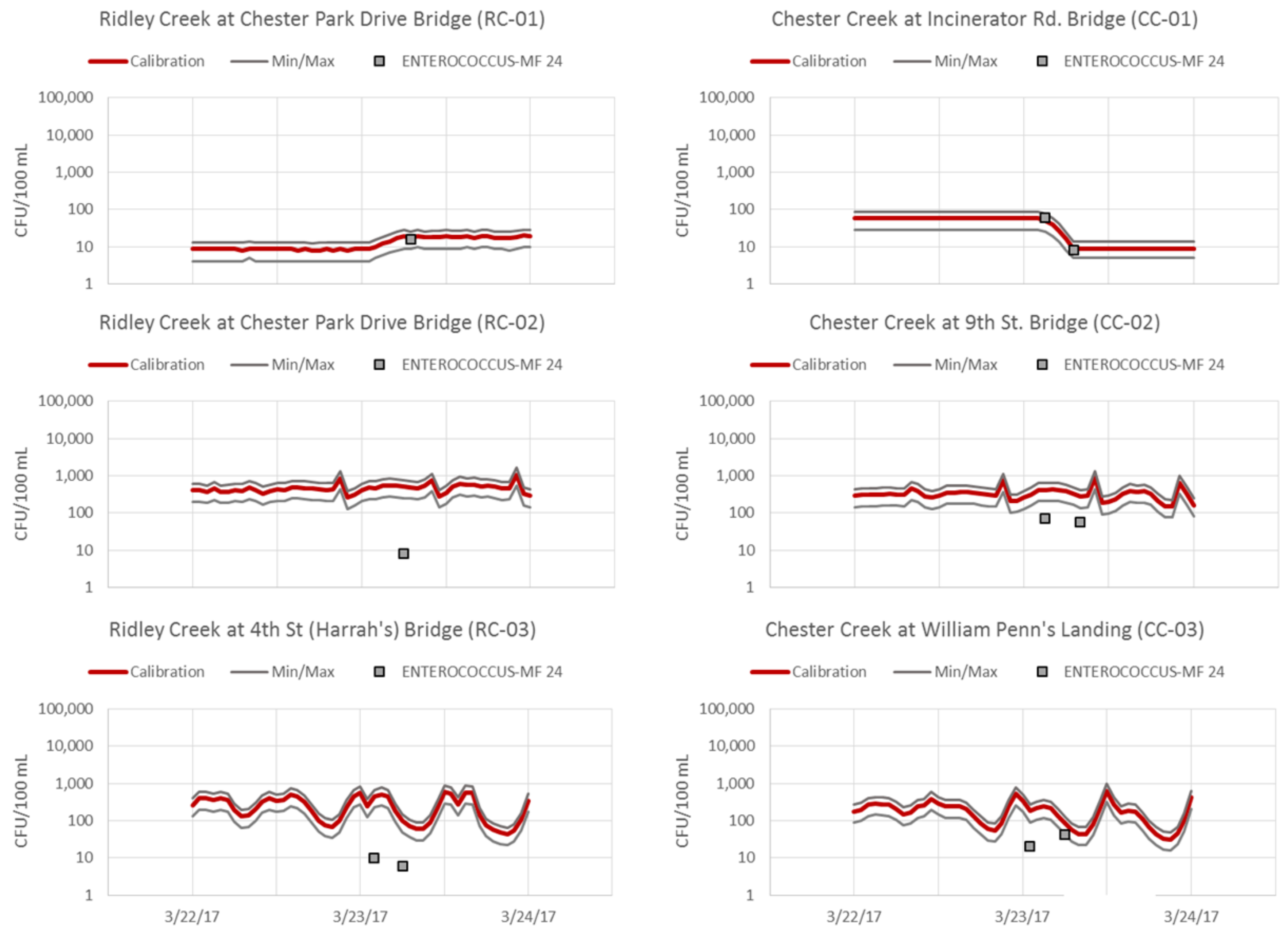

Figure 31. Enterococcus Calibration at Ridley Creek and Chester Creek Stations (Dry Weather Event #1, 3/23/17)

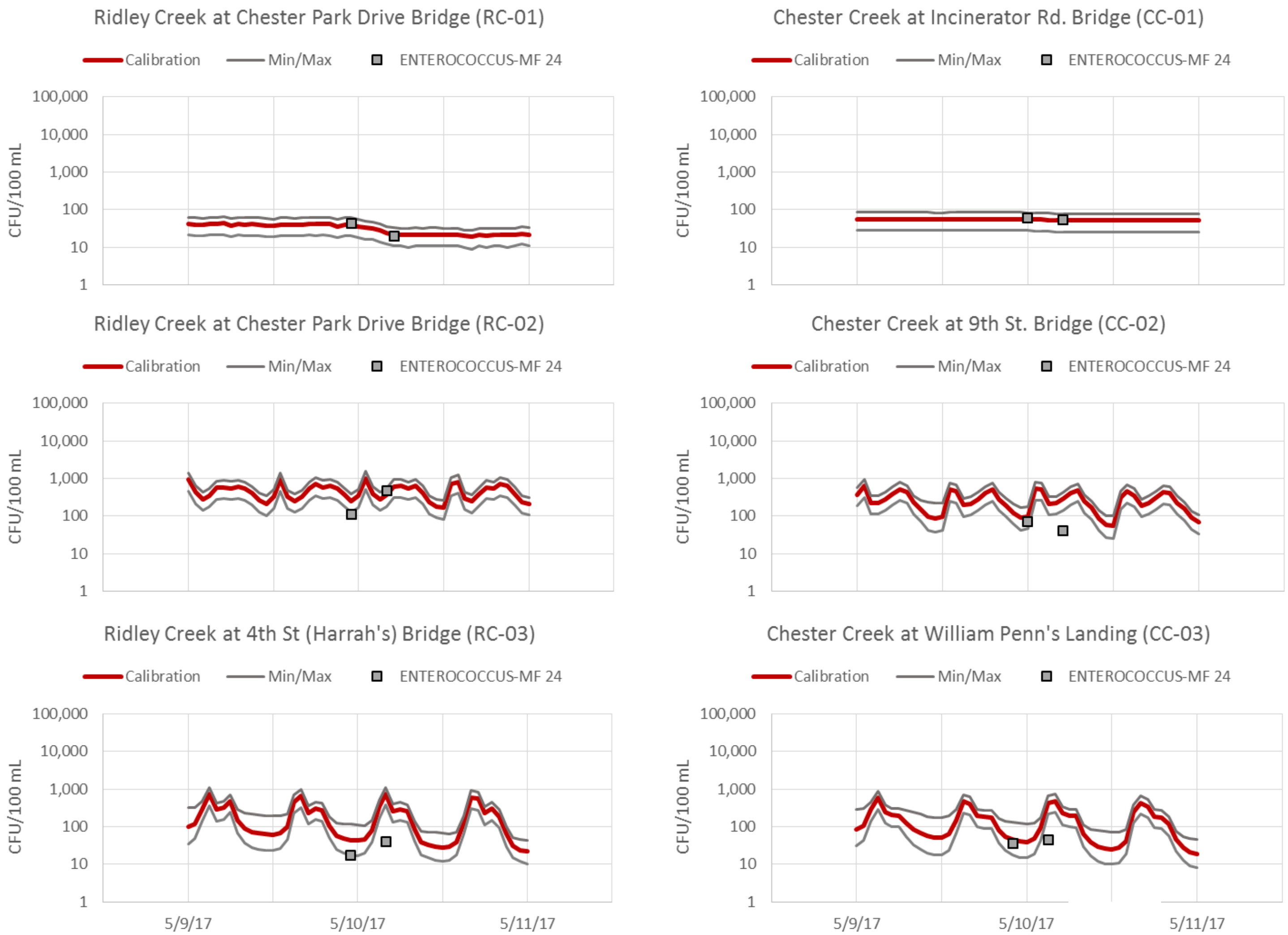

Figure 32. Enterococcus Calibration at Ridley Creek and Chester Creek Stations (Dry Weather Event #2, 5/10/17)

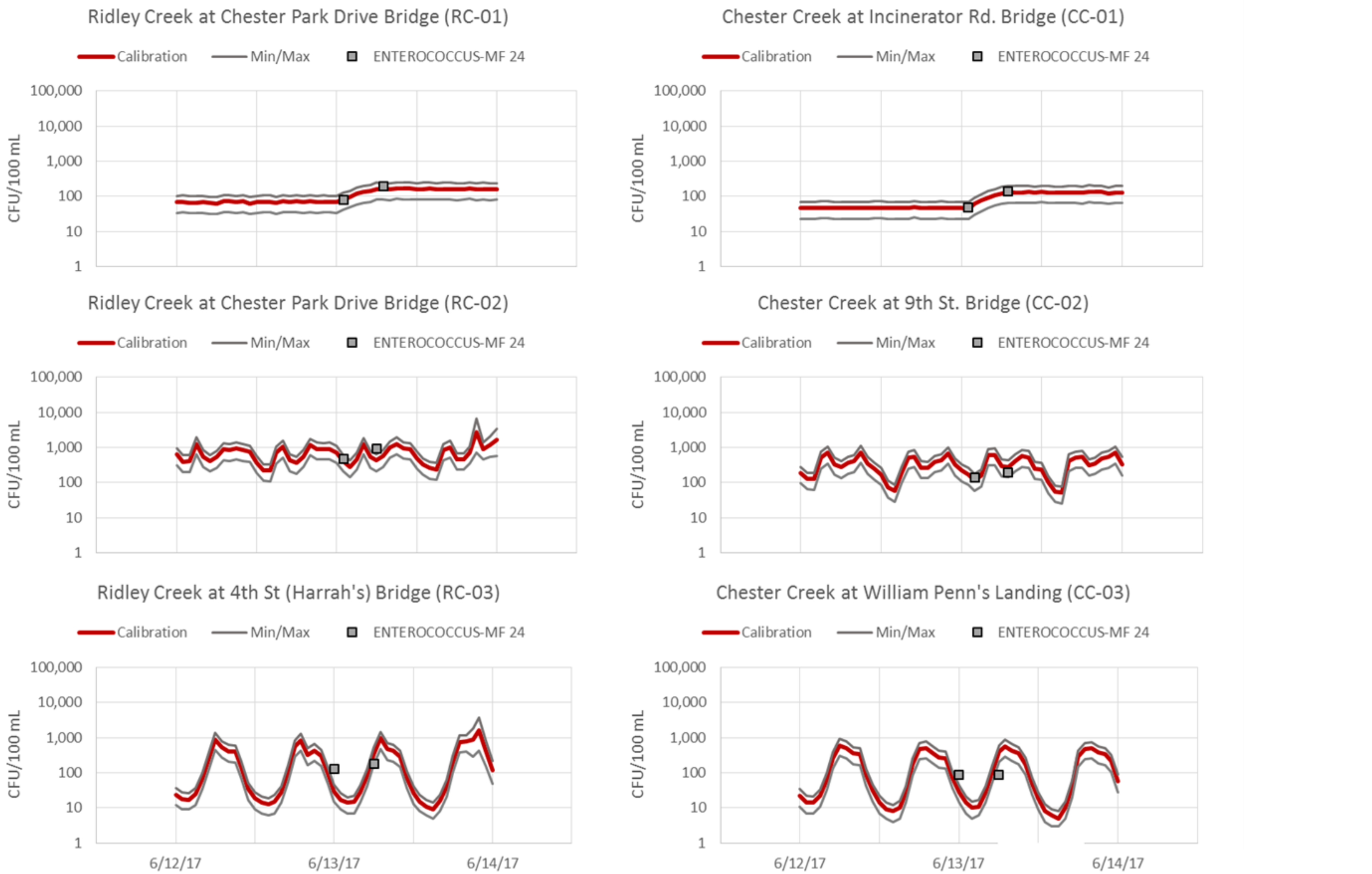

Figure 33. Enterococcus Calibration at Ridley Creek and Chester Creek Stations (Dry Weather Event #3, 6/13/17)

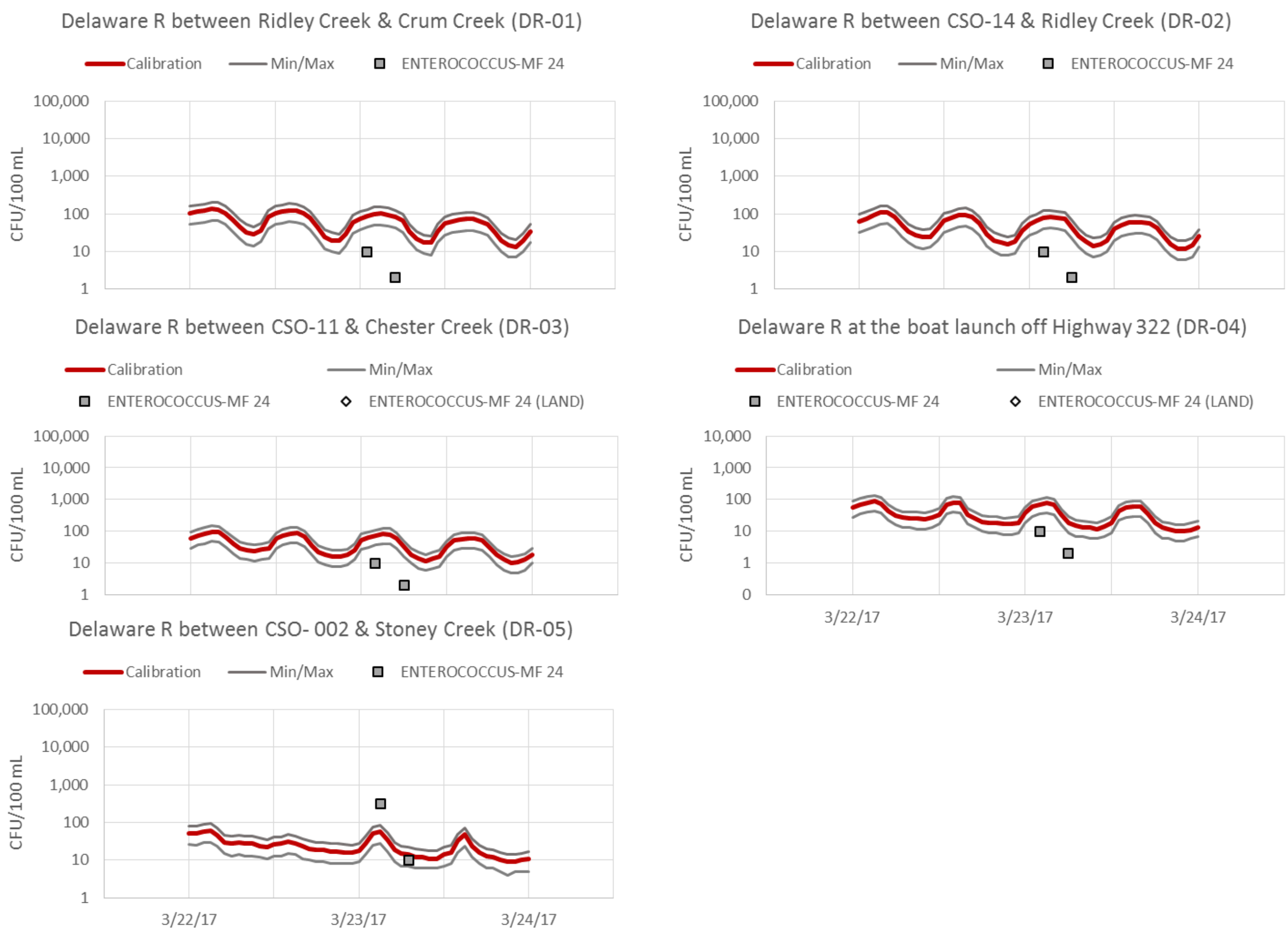

Figure 34. Enterococcus Calibration at Delaware River Stations (Dry Weather Event #1, 3/23/17)

Figure 35. Enterococcus Calibration at Delaware River Stations (Dry Weather Event #2, 5/10/17)

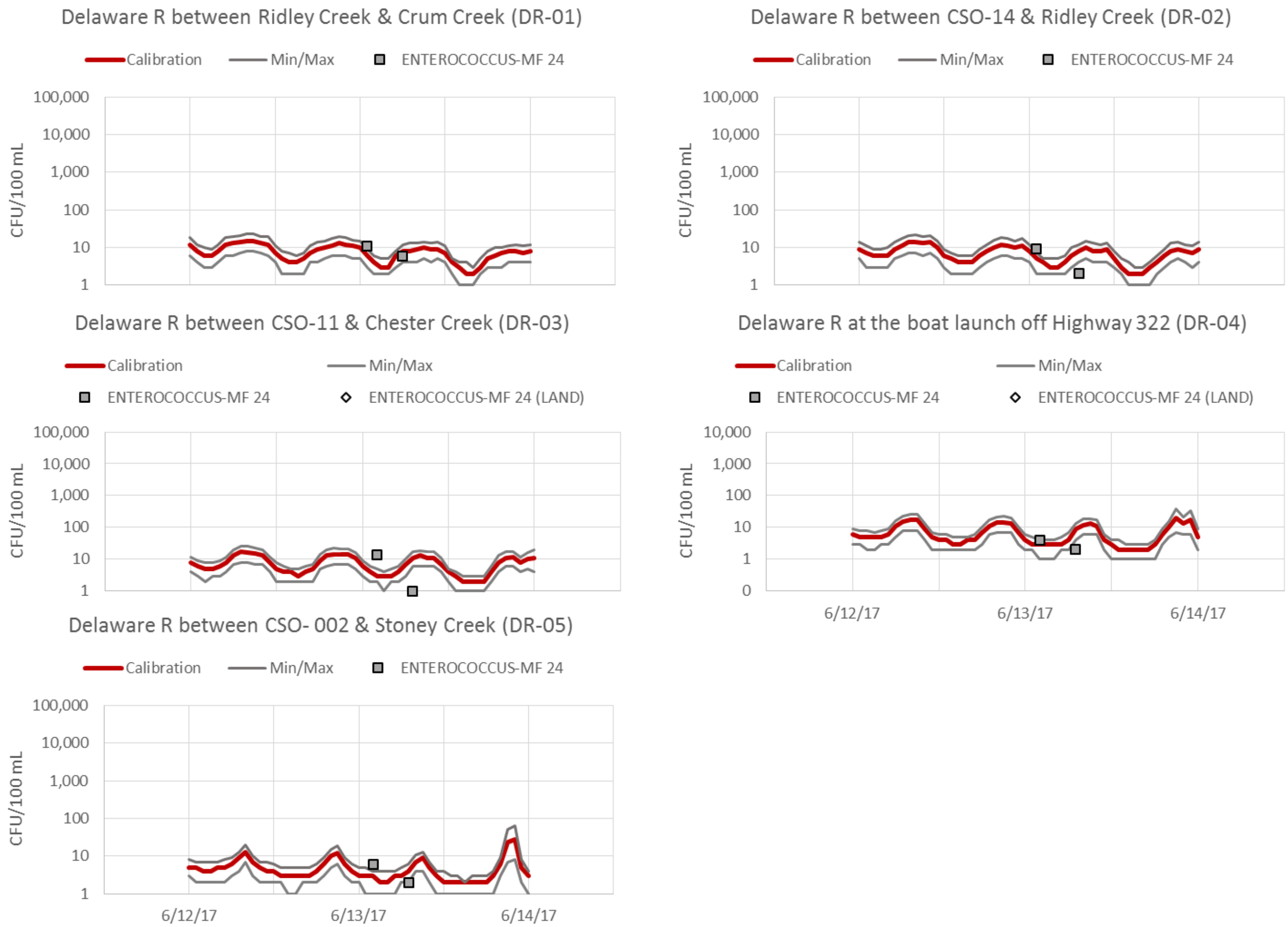

Figure 36. Enterococcus Calibration at Delaware River Stations (Dry Weather Event #3, 6/13/17)

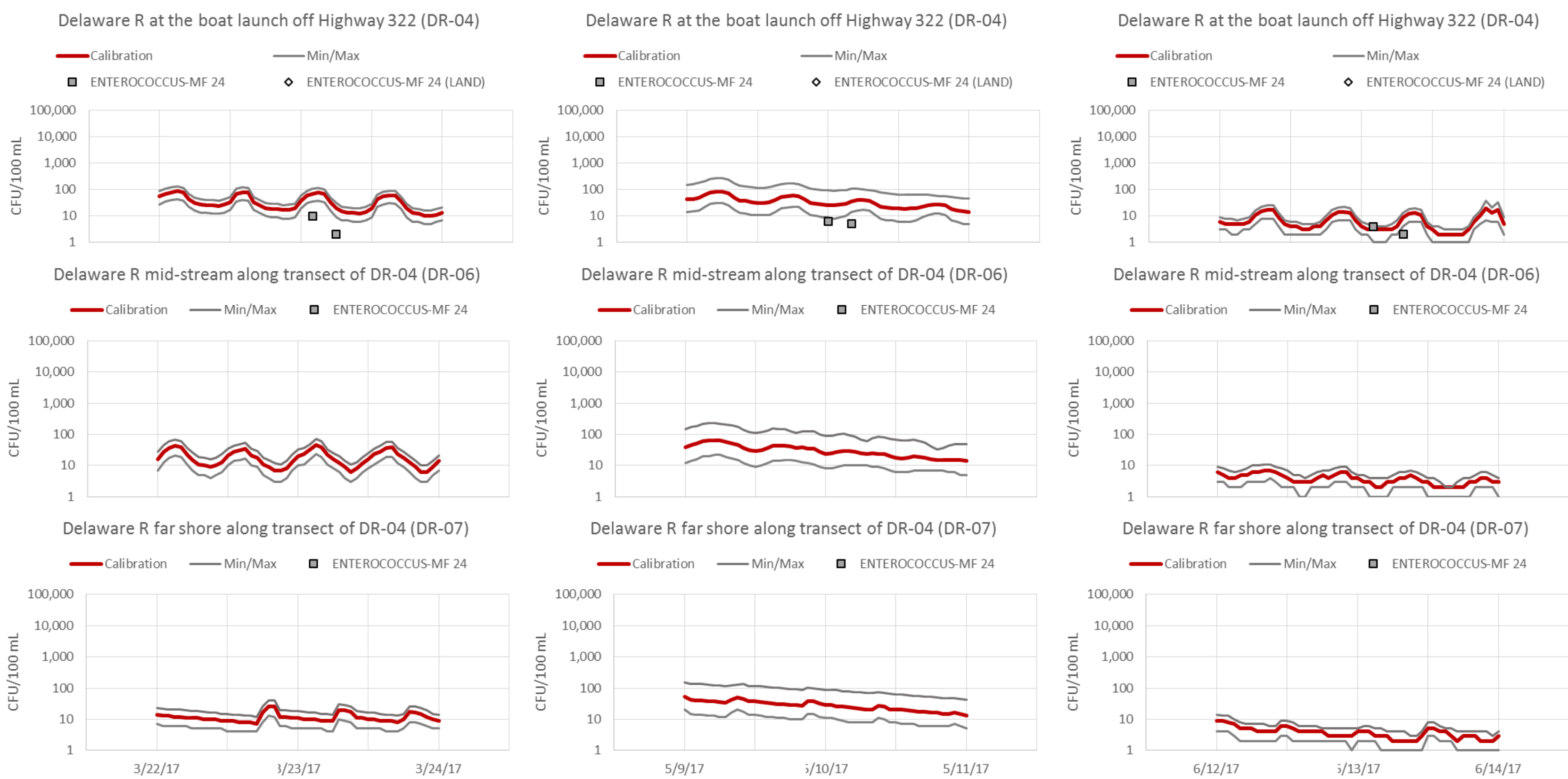

Figure 37. Enterococcus Calibration at Delaware River Cross Section (Dry Weather Events #1-3)

Enterococcus—2017 Wet Weather Calibration

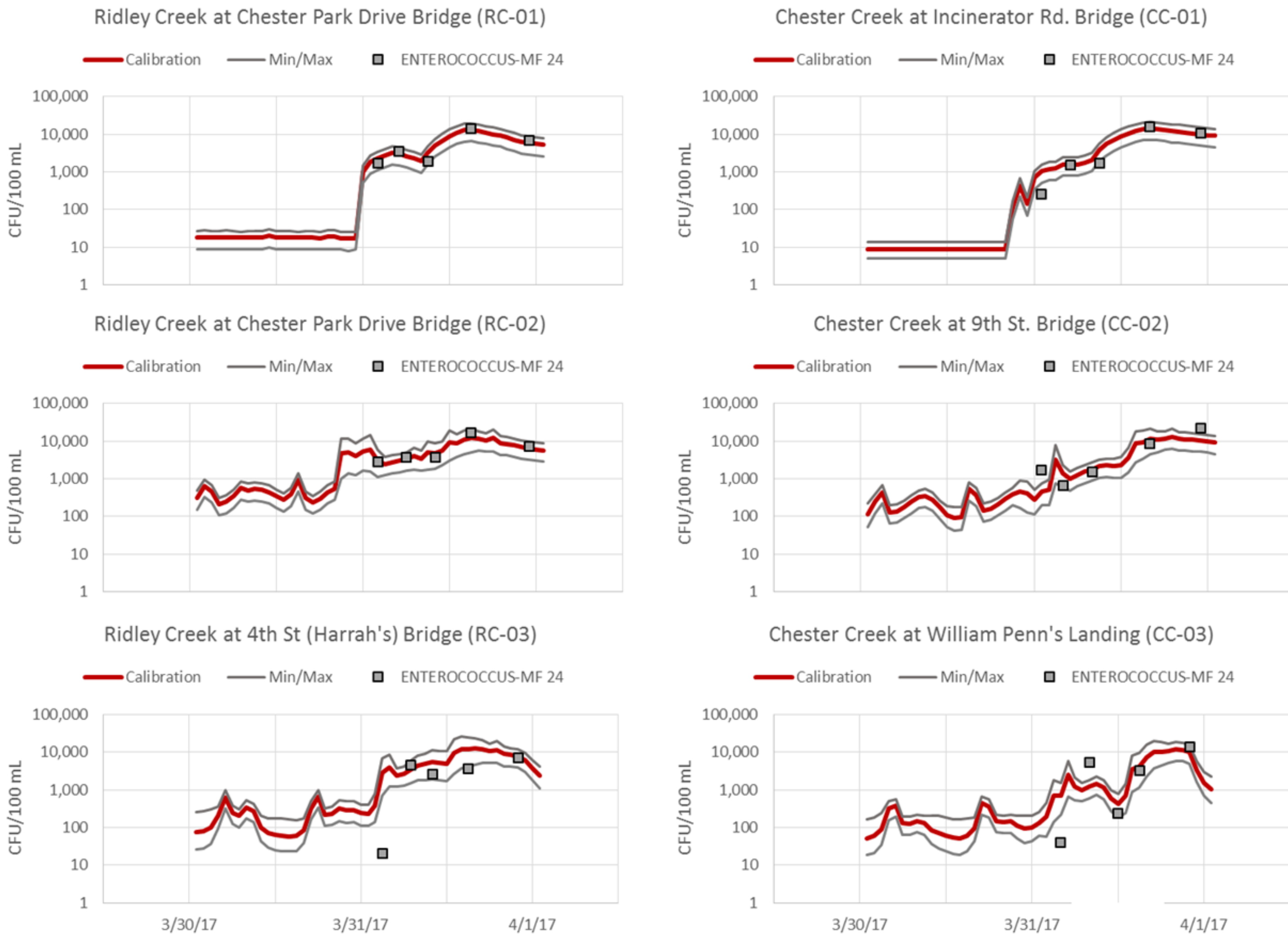

Figure 38. Enterococcus Calibration at Ridley Creek and Chester Creek Stations (Wet Weather Event #1, 3/30/17-4/1/17)

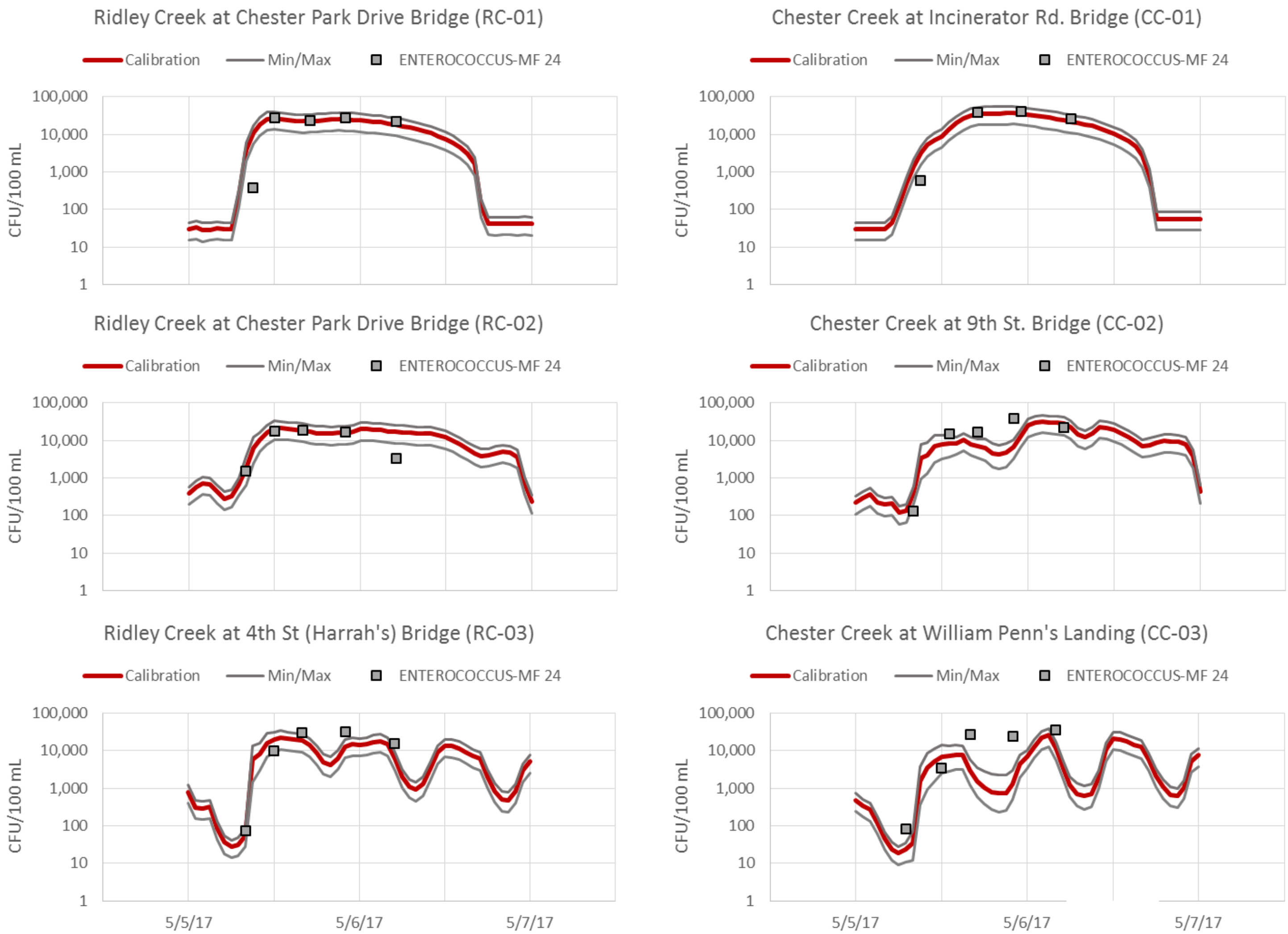

Figure 39. Enterococcus Calibration at Ridley Creek and Chester Creek Stations (Wet Weather Event #2, 5/5/17-5/6/17)

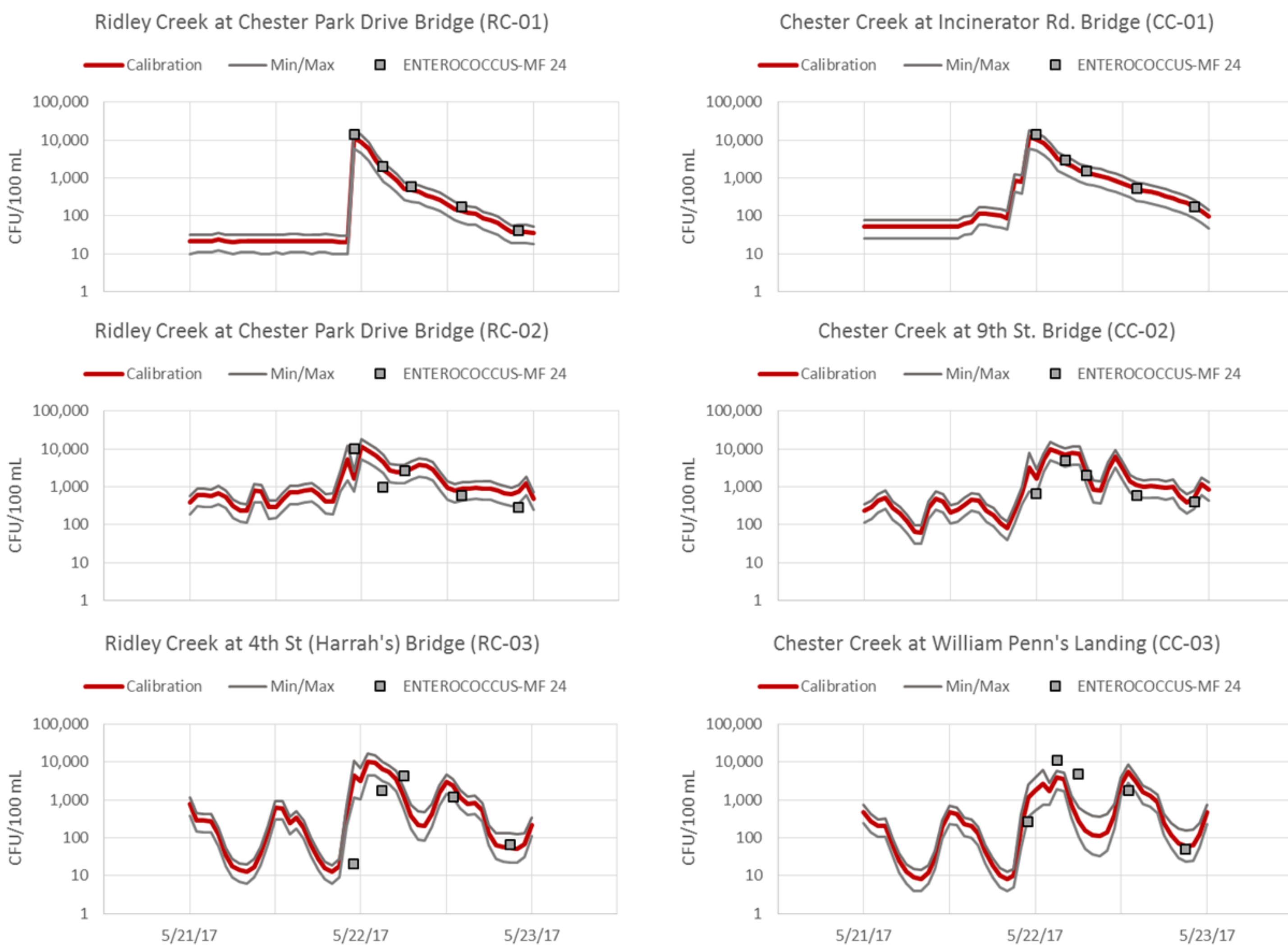

Figure 40. Enterococcus Calibration at Ridley Creek and Chester Creek Stations (Wet Weather Event #3, 5/22/17-5/23/17)

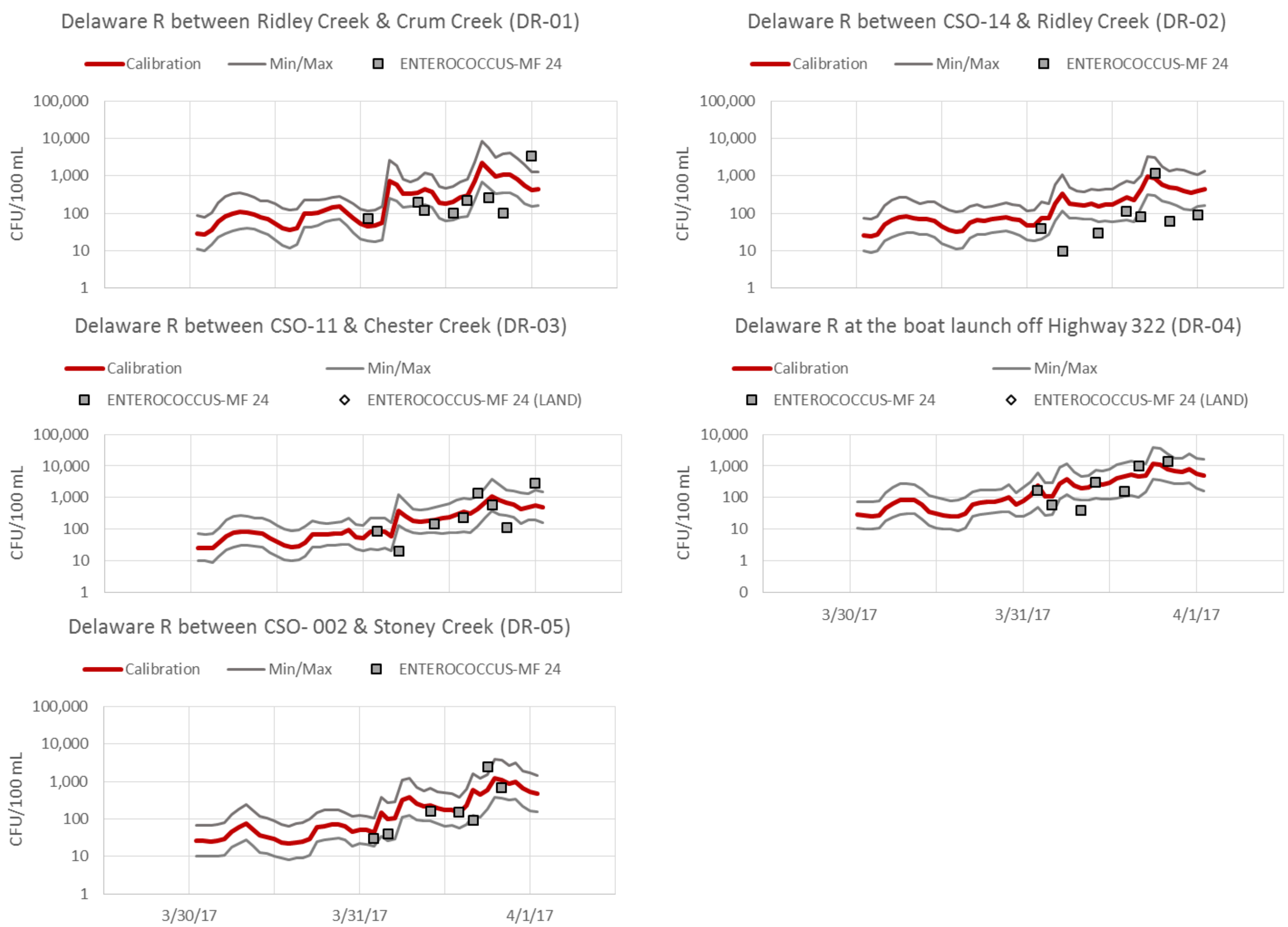

Figure 41. Enterococcus Calibration at Delaware River Stations (Wet Weather Event #1, 3/30/17-4/1/17)

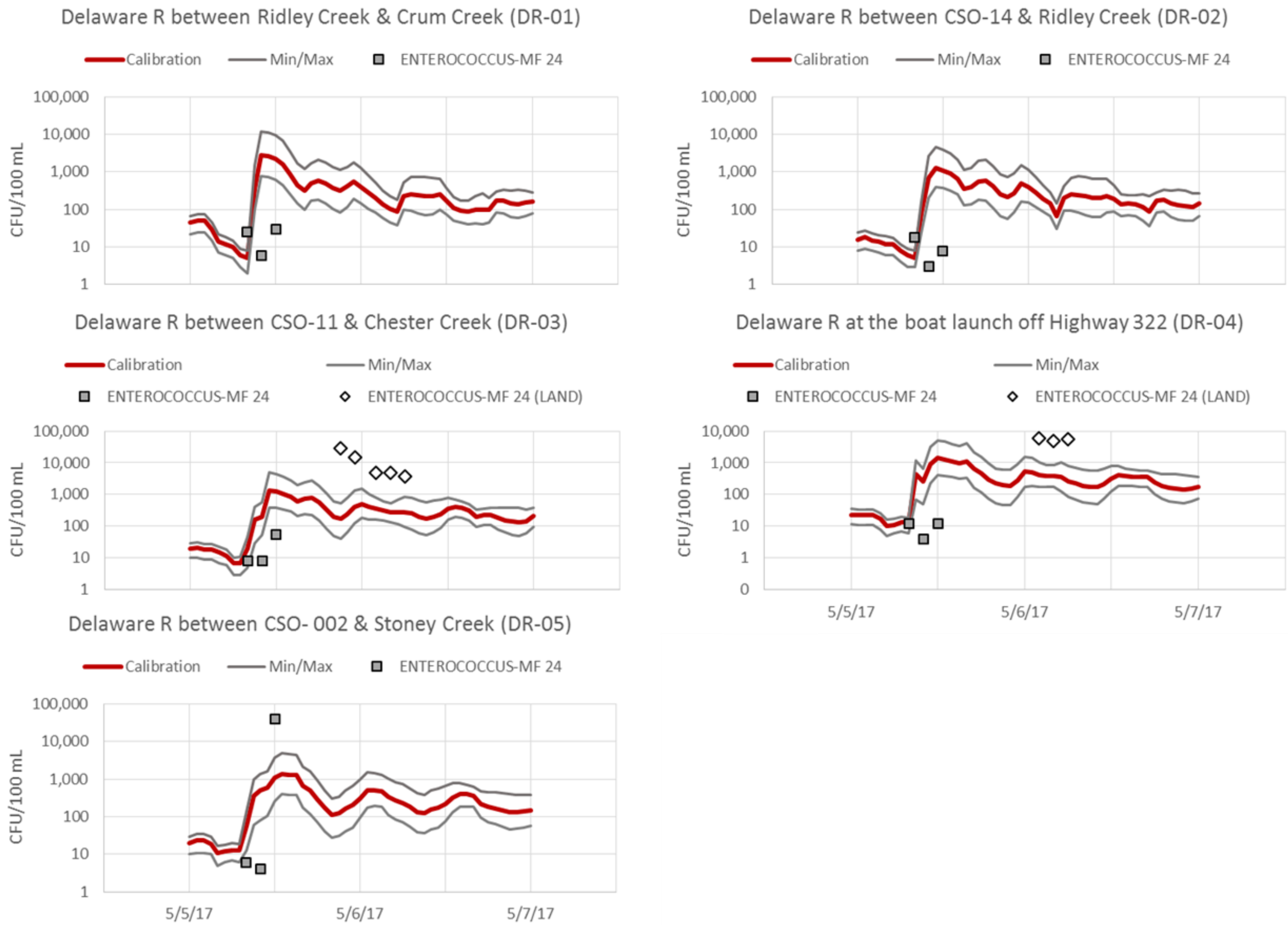

Figure 42. Enterococcus Calibration at Delaware River Stations (Wet Weather Event #2, 5/5/17-5/6/17)

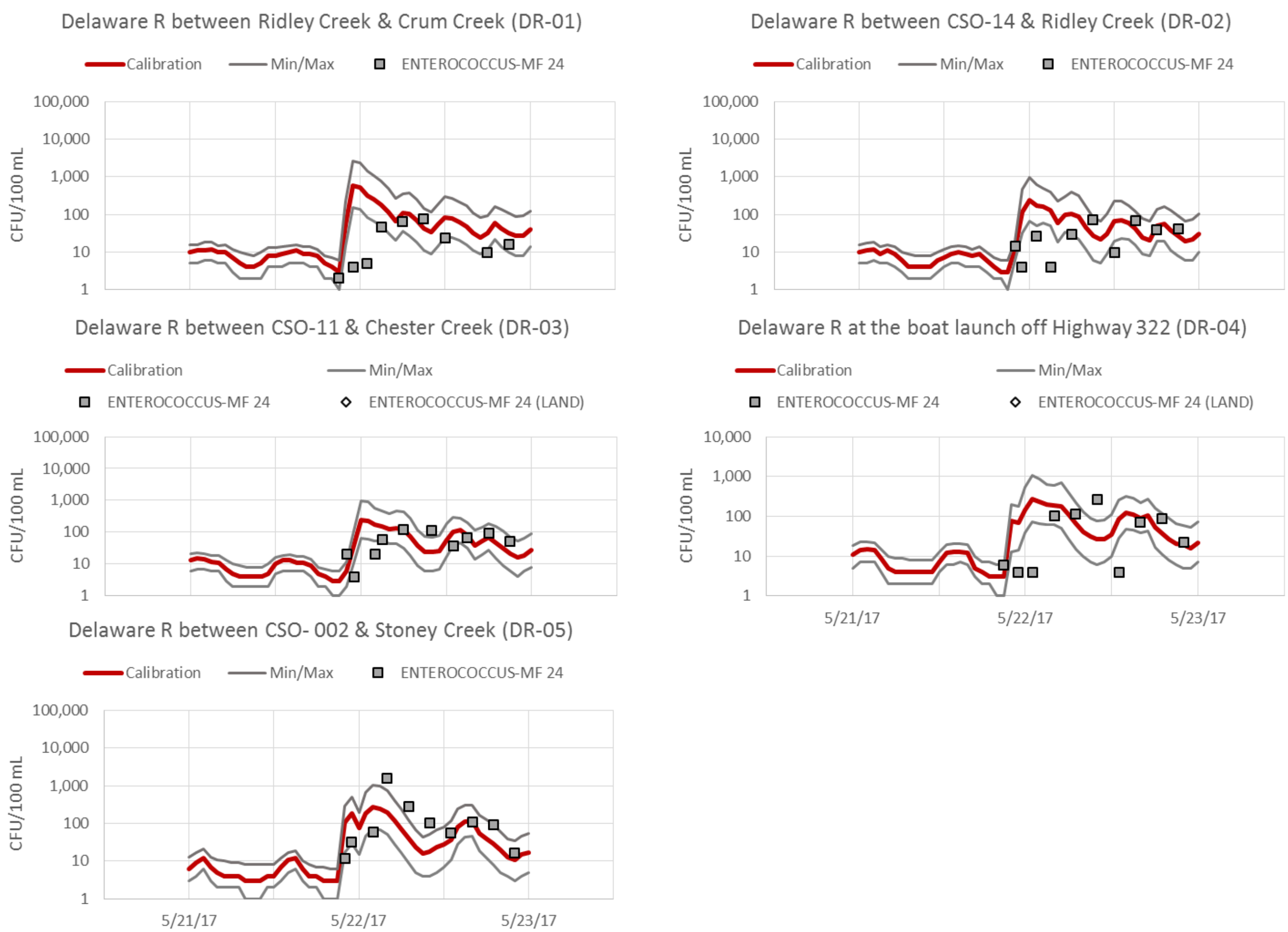

Figure 43. Enterococcus Calibration at Delaware River Stations (Wet Weather Event #3, 5/22/17-5/23/17)

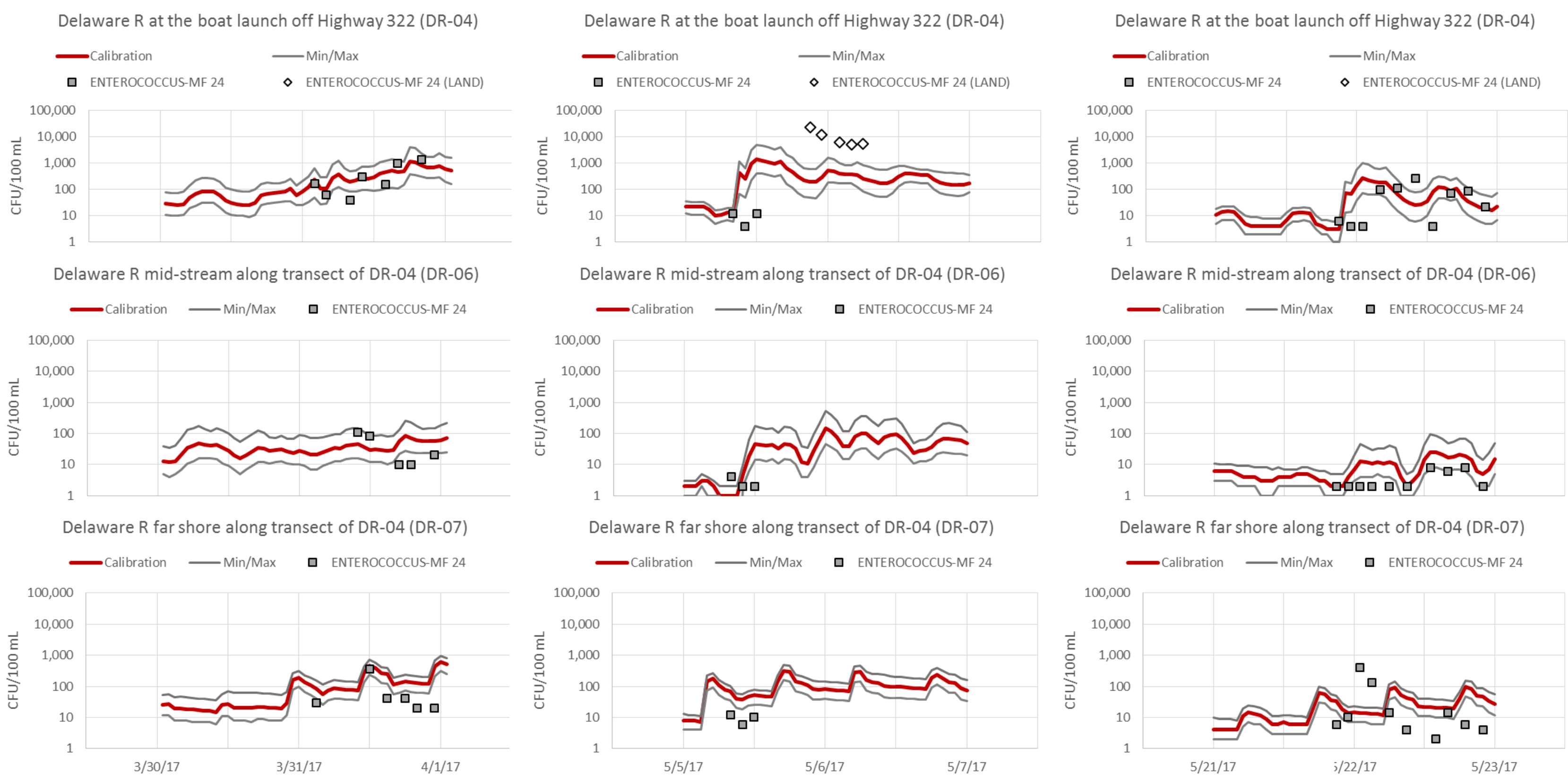

Figure 44. Enterococcus Calibration at Delaware River Cross Section (Wet Weather Events #1-3)

Enterococcus—2012 Model Validation

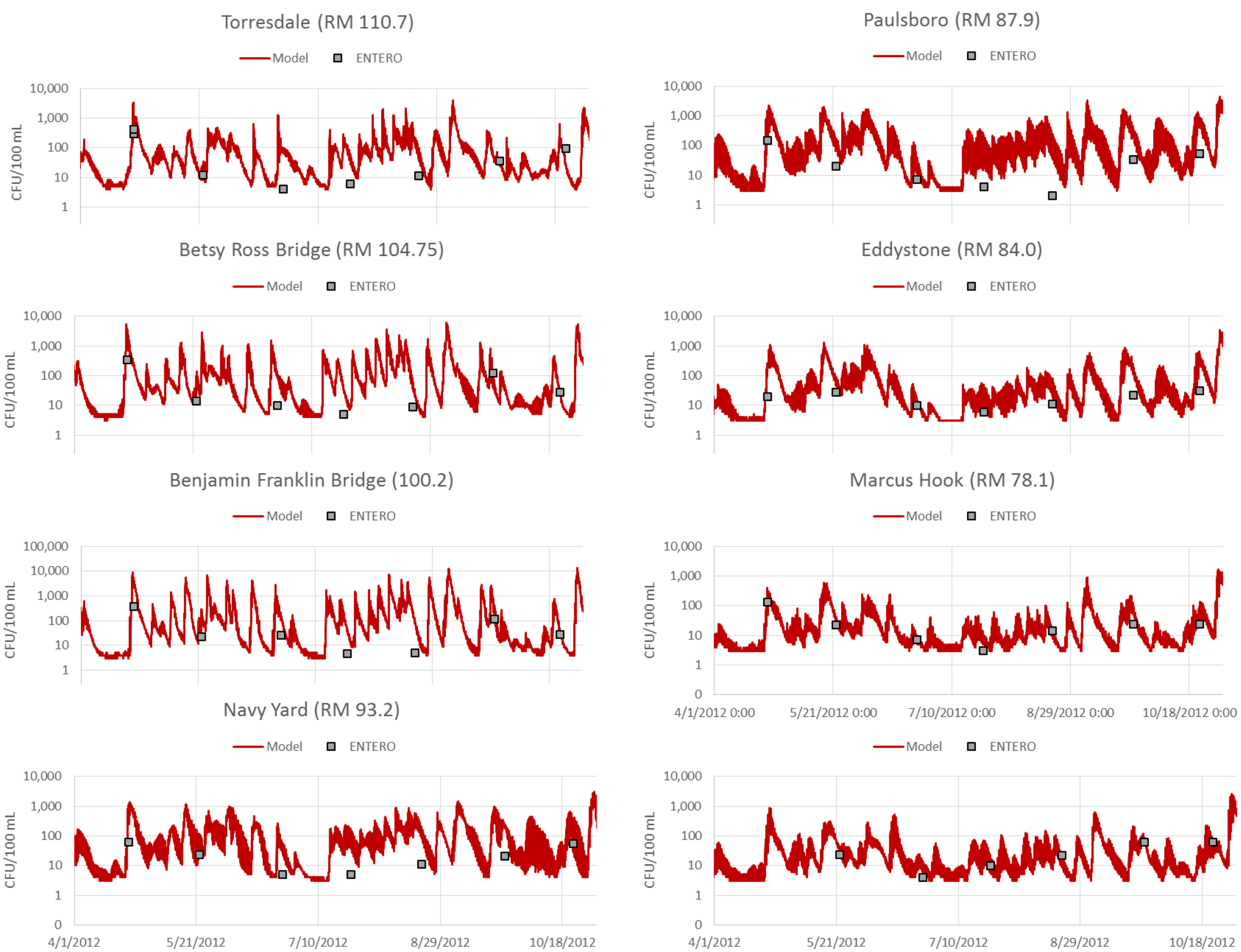

Figure 45. Enterococcus Model Validation at DRBC Delaware River Sampling Stations (2012)

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