PHILADELPHIA'S WET WEATHER MANAGEMENT PROGRAMS

COMBINED SEWER MANAGEMENT PROGRAM ANNUAL REPORT

National Pollutant Discharge Elimination System (NPDES) Permits
Nos. PA0026689, PA0026662, PA0026671

STORMWATER MANAGEMENT PROGRAM ANNUAL REPORT

National Pollutant Discharge Elimination System (NPDES) Permit
No. PA 0054712

Reporting Period July 1st 2018 to June 30th 2019

Submitted to:

PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL PROTECTION
Bureau of Water Quality Management

And

ENVIRONMENTAL PROTECTION AGENCY – REGION III
Water Protection Division

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Erratum

1. The erratum submitted on February 28th, 2020 includes the replacement of the data table of Appendix 1 of Appendix A – *Green City, Clean Waters* FY 2019 Annual Report.

Combined Sewer Management Program Annual Report

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I. Management and Control of CSOs

This report is submitted pursuant to meeting the requirements of NPDES Permits #'s PA0026662, PA0026671, and PA0026689; PART C, I. Other Requirements, Combined Sewer Overflows (CSOs), III. Implementation of the Long Term CSO Control Plan, C. Watershed-Based Management, IV. Monitoring and Assessment. This section requires that the permittee submit an Annual CSO Status Report. The purpose of this report is to document the status and changes made to programs implemented by the City of Philadelphia (City), during Fiscal Year 2019 (FY19), which encompasses the period of July 1st, 2018 through June 30th, 2019, to manage and reduce the CSOs permitted to discharge to waters of the Commonwealth of Pennsylvania.

II. Implementation of the Nine Minimum Controls

The Philadelphia Water Department (PWD) submitted an Updated Nine Minimum Control Report to the Department on June 1, 2013 to supplement the 1995 report and describe current activities as a result of new technology or practices. The nine minimum controls (NMCs) are low-cost actions or measures that can reduce CSO discharges and their effect on receiving waters, do not require significant engineering studies or major construction, and can be implemented in a relatively short time frame.

II.A NMC 1 - Proper Operation and Regular Maintenance Programs for the Sewer System and the CSOs

II.A.1 Implement a Comprehensive Geographic Information System (GIS) of the City Sewer System

To ensure PWD's investment in GIS is as accurate and up to date as possible, edits and improvements are made to data on a daily basis. PWD utilizes the GIS coverages as the foundation for many of its operations including maintenance management, capital improvements, and hydraulic modeling. During FY19, GIS layers were updated and maintained to ensure the accurate tracking and reporting of PWD assets and infrastructure. In addition, the GIS platform was updated to a newer version to take advantage of new functionality.

II.A.2 Implement a Comprehensive Sewer Assessment Program (SAP)

PWD continues to implement a comprehensive SAP to provide inspection of the collection system using closed circuit television (CCTV) and Sonar. The SAP is a critical tool for operations and maintenance as it provides information on existing pipe conditions and helps to locate where repairs are needed. The program is also used to guide the capital improvement program to ensure that the existing sewer systems are adequately maintained, rehabilitated, and reconstructed.

SAP inspections are conducted and managed by PWD. During FY19, 43.3 miles of sewer inspections were completed via CCTV and Sonar, averaging about 4.43 miles a month as shown in **Table II.A.2-1 Monthly TV Inspections.** In addition, the CCTV unit completed 750 post construction and 887 preventative maintenance inspections of green stormwater infrastructure assets during FY19.

Table II.A.2-1 Monthly TV Inspections

Date	Collector Systems (Miles Inspected)
Jul-18	3.85
Aug-18	5.24
Sep-18	3.70
Oct-18	3.42
Nov-18	3.15
Dec-18	4.10
Jan-19	4.13
Feb-19	3.04
Mar-19	3.04
Apr-19	3.16
May-19	3.67
Jun-19	2.80
Average	3.61
Total	**43.30**

II.B NMC 2 - Maximum Use of the Collection System for Storage

II.B.1 Continue to Institutionalize a Comprehensive Monitoring and Modeling Program

Monitoring

PWD maintains an extensive monitoring network throughout the combined sewer system including rain gages, pump stations and connections from adjacent outlying communities. Information on the monitoring network with an updated listing of the monitors, rain gages, and pumping stations can be found in **Appendix B - Flow Monitoring**.

Modeling

The hydrologic and hydraulic models will be updated as needed to support Nine Minimum Controls implementation and reporting.

II.B.2 Continue to Operate and Maintain a Network of Permanent and Temporary Flow Monitoring Equipment

PWD maintains a CSO permanent monitoring network and temporary monitoring programs to support planning for CSO control projects and to minimize dry weather overflows and tidal inflows.

Permanent Flow Monitoring Program

PWD uses a network of permanent flow monitors that are connected to a data acquisition system (TELOG) which uses cellular-based telemetry and improved enterprise data management software. As of FY19, the Collector System Monitoring Network is connected to over 320 sites at various locations including CSO Regulators, Rain Gauges, Pump Stations, Interceptors, Chemical Feed Tanks and Hydraulic Control Points which collect over 720 individual measurements with over a ninety percent operational status. All monitoring devices deployed throughout the PWD Collector System continually store data and periodically communicate monitoring information back for review and use by staff. The listing of permanent flow monitors can be found in **Appendix B – Flow Monitoring.**

Temporary Flow Monitoring Program

PWD maintains its temporary flow monitoring program, initiated in July 1999, which consists of deploying portable flow meters throughout targeted Philadelphia sewershed areas to quantify sanitary and combined flow from the sewer system and characterize the tributary sewersheds. During FY19, PWD monitored 88 sites for the purposes of model calibration, inflow/infiltration (I/I) identification and design support. The listing of all temporary flow monitors, their location, and the deployment projects can be found in **Appendix B – Flow Monitoring: Table 6 – Listing of all Temporary Flow Monitors Deployed by Projects.**

II.B.3 Continue to Evaluate the Collection System to Ensure Adequate Transport Capacity for Dry and Wet Weather Flow

Long Term Control Plan Update

System-wide hydrologic and hydraulic (H&H) models have been developed in support of the Long Term CSO Control Plan Update (LTCPU). Model evaluations have been performed to evaluate the system performance benefits of various system improvement scenarios.

The evaluations of the system-wide models were completed in FY08 to support the LTCPU. Since 2008 EPA's Stormwater Management Model (SWMM) has been updated to SWMM 5. PWD continues to update the H&H models as needed to support planning and regulatory reporting needs.

PC-30 Extreme Wet Weather Overflow

PWD continues to monitor PC-30. For additional information on other efforts conducted for this site, please refer to **Section III.B.2.: Table III.B.2-1** on page 35.

Flood Risk Management

PWD has a robust flood risk management program to analyze and reduce property damage from flooding and basement backups. Aspects of this program include sewer system inspection and maintenance, property data collection, implementing individual property solutions when appropriate, and sewer system H&H analysis to understand flood prone areas.

Flood Relief Project Summary

More recently, the focus of PWD's flood risk management efforts include: South Philadelphia, Northern Liberties, Germantown, and Eastwick. The goal of these efforts is to improve the conveyance of stormwater by targeting peak flow and volume reduction and reducing the potential for flooding. Hydrologic and hydraulic modeling indicates that sewer system improvements or source reduction can sometimes reduce the frequency and/or severity of flooding events. However, the potential benefits of structural improvements to the City's drainage infrastructure must always be counterbalanced by the financial, economic, and social impacts of implementation. PWD continues to refine and optimize mitigation solutions to minimize negative impacts to communities.

South Philadelphia

In FY19, PWD completed the Alternatives Evaluation and Recommended Outcome (AERO) Report for the Pennsport Storm Flood Relief Capital Planning Study. The EPA's SWMM was used to evaluate the performance of three sewer relief alternatives along Weccacoe Avenue, Mifflin Street, and Oregon Avenue over the expected lifespan of the assets. Sea level rise projections for the 2020s, 2050s, and 2080s were also factored into the analysis for the long-term performance.

Northern Liberties

Storm Flood Relief sewer projects were initiated in the Northern Liberties neighborhood to reduce flood risk in the combined sewer neighborhoods of Northern Liberties, Fishtown, Port Richmond and Lower Kensington. **Table II.B.3-1** demonstrates the status of the Northern Liberties SFR program at the end of FY19:

Table II.B.3-1 Northern Liberties SFR Sewer Improvement Projects

Project Name	Location	Project Status
Northern Liberties Phase 1	Delaware Avenue and Laurel Street	Construction Complete (2011)
Northern Liberties Phase 2	Canal Street Chamber	Construction Complete (2016)
Northern Liberties Phase 3	Delaware Ave to River (Undertaken by Sugar House)	Construction Complete (2016)
Northern Liberties Phase 4	Canal & Laurel Sts. to Germantown Ave. &Wildey St.	Construction Complete (2016)
Northern Liberties Phase 5	Germantown Ave. from Wildey St. to Girard Ave.	Construction was on hold in FY19
Northern Liberties Phase 6	Germantown Ave. & Thompson St. to Master & Randolph Sts.	In Design

Germantown

The East Germantown section of Philadelphia was impacted by flooding from intense rainstorms, such as Hurricane Irene (8/27/11) and Tropical Storm Lee (9/7/11). In FY19, PWD and its consultant completed the Alternative Identification Memorandum (AIM2) which analyzed 1600 different system improvement scenarios throughout the sewershed. Two high performing alternatives were moved into the Alternative Evaluation and Recommended Outcome (AERO) Report phase of capital planning. Over the fiscal year, multiple modeling scenarios were run to optimize the diversion chambers and refine the 2-dimensional routing. PWD also initiated the design of a sewer improvement project along Belfield Avenue.

Eastwick

The Eastwick neighborhood is located in a naturally low-lying area in southwest Philadelphia. The neighborhood has experienced severe riverine flooding from multiple storms including Hurricane Floyd, Hurricane Irene, and Tropical Storm Lee. The City of Philadelphia acting through PWD was given the Federal Interest Determination through the Continuing Authorities Program Section 205 in April 2018 to pursue a feasibility study. A Federal Cost Share Agreement between the City and USACE was signed in May 2019 to move forward with the feasibility study.

II.B.4 Fully Integrate the Real-Time Control Facility into the Operations of PWD

Real Time Control Evaluation

Several projects were previously evaluated for Real Time Control; for additional information on these projects, please refer to Section 2.1 Evaluate Real Time Control in LTCP on page 10 of the 1996 Annual CSO Status Report and Section II.B.3.4 Real Time Control Evaluation on page 26 of the CSO-Stormwater FY10 Annual Report. For details regarding the current operational statuses of the City's real time control CSO regulator sites, see **Section II.B.5** below.

There are currently two projects in the Department's design process that are being evaluated for the use of real-time control technology:

D-05 CSO Regulator (State Road and Magee Avenue)

The D05 regulator is being examined for additional CSO capture through the installation of a new, enlarged interceptor connection with a real-time controlled sluice gate. As of FY19, this project is in the design stage. This project is coupled to the Frankford Siphon replacement project, which is also in the design stage, and is expected to result in enhanced storage and conveyance of wet weather flows via modification to an existing computer controlled CSO.

Thomas Run Relief Sewer (R-01)

A capital construction project for the modification of the Thomas Run relief sewer has been initiated. The project is evaluating the potential for this system to be maximized for in-line storage during wet weather be creating a new interceptor connection and CSO regulator site at the outfall of this storm flood relief system and will consider the effectiveness of real-time control. This project is in the early stages of design as FY19.

II.B.5 Operate and Maintain In-Line Collection Storage System Projects Contained within the LTCP

Main Relief

The Main Relief project is operating as designed with a 7.5 foot static dam. The current configuration achieves an overflow reduction of approximately 30 MG annually.

Tacony Creek Park (T-14)

The T-14 storage sewer provides combined sewer overflow capture in the Northeast Drainage District (NEDD). The T-14 storage sewer system is operating under automated controls and reducing overflow volume during wet weather events. T14 is operating at the full design level.

Rock Run Relief (R-15)

The Rock Run Relief Sewer provides flood relief to combined sewer areas upstream of regulator T-8 in the NEDD. An inflatable dam was constructed in the Rock Run Relief Sewer to allow for utilization of in-system storage to retain combined flows during wet weather events. The Rock Run storage facility is operating under automated real time controls at the full design capacity.

Computer-Controlled CSO Regulators

PWD has eight computer-controlled CSO regulators that are configured to maximize storage during wet weather. All the computer controlled regulators are in the NEDD. Five of the eight computer controlled regulator sites had control upgrades installed in FY17. During FY19 one additional site had upgrades installed. The D-07 regulator is currently operating as a static dam regulated CSO as upgrades to computer and hydraulic controls and instrumentation are completed.

II.C NMC 3 - Review and Modification of Pretreatment Requirements to Assure CSO Impacts Are Minimized

II.C.1 Expand the Pretreatment Program to Include Significant Industrial Users (SIUs) Whose Facilities Contribute Runoff to the Combined Sewer System

The City of Philadelphia's Pretreatment Program regulates all significant industrial users (SIUs) that discharge into PWD's service area, which includes SIUs in both separate and combined sewer systems. The City continually reevaluates the Pretreatment Program to determine if improvements can be made. Through annual monitoring and inspection activities, PWD currently regulates 124 SIUs that discharge to the sanitary system. PWD conducts SIU program and inspections on a calendar year cycle, having inspected all 124 permitted facilities during the 2018 calendar year.

PWD also maintains a website to inform the public and industries of permitting regulations, requirements and other information that may benefit or impact industrial users. The responsible PWD group's website is located at the following web address: http://www.phila.gov/water/IWU.html.

II.C.2 Incorporate Guidance on BMPs for Industrial Stormwater Discharges into Stormwater Management Regulations Guidance

Regular updates are made to the Philadelphia Stormwater Management Guidance Manual. The manual assists developers in meeting the requirements of the Stormwater Regulations and can be updated when necessary to incorporate new information. The current version of the manual is available at http://www.pwdplanreview.org/manual/introduction.

Please refer to the MS4 Annual Report **Section F.5.g - Stormwater BMP Handbook and Construction Site BMP Sediment & Erosion Control Checklist** on page 32 for additional information on the updated manual.

II.C.3 Continue to Serve as a Member of the Philadelphia Inter-Governmental Scrap and Tire Yard Task Force

The Scrap Yard Task Force (SYTF) was created to address numerous complaints about the operation of scrap metal and auto salvage businesses, which may cause polluted runoff to enter the City's sewers, blight in City neighborhoods, and contribute to short dumping and other environmental hazards to area waterways.

The SYTF is in its eleventh year of operation since it was reorganized in September of 2008. Regular inspections and meetings occur, inspecting about 4 scrap facilities each month to bring businesses conducting these activities into compliance. The SYTF will occasionally inspect facilities that do not fit the strict definitions of either a junkyard or metal recycler but present potential for negative impact on the environment and surrounding area. Some of these sites include sites with tire accumulations, overflow lots, other recycling facilities, and shipping operations. The SYTF also responds to community complaints having to do with facilities or properties that are considered a nuisance or problematic in a given neighborhood.

The core agencies involved in the SYTF are PWD, PADEP's Solid Waste division, Department of License and Inspections (L&I), Philadelphia Police Auto Squad and the Philadelphia Fire Dept. Hazmat Administration Unit. Each attending agency performs specific tasks as dictated by their primary regulatory mission. For example, PWD inspects sites for water and sewer violations, as well as violations that may be referred to the PADEP Clean Water division. PWD is the coordinating entity that designates the facilities to be visited.

During FY19, the SYTF held 10 meetings resulting in 40 facility inspections. Facilities inspected are shown in **Table II.C.3-3: SYTF FY19 Inspections** on page 7, while locations are displayed in **Figure II.C.3: SYTF Sites Inspected in FY19** on page 9. The sites inspected in FY19 resulted in minor infractions such as improper labeling and storage, blocked fire lanes and missing business/special work licenses which typically are addressed shortly after identified. Any potential water quality concerns are referred to PWD. Five sites were discovered to be no longer active scrapyards, the SYTF will continue to monitor these sites as these areas often reestablish as new scrapyards as they change hands.

Table II.C.3-2: FY19 SYTF Inspections

Company Address	Company Name	Date Inspected
2069 E Silver St	Philadelphia Scrap Metal Exchange	7/12/2018
2160 Somerset St	K&A Auto Salvage	7/12/2018
2149-79 E Rush St	K&A	7/12/2018
2335 Wheatsheaf Ln	Green Dog	7/12/2018
6125 Passyunk Ave	4 A's	8/9/2018
3504 S 61st St	Omerta	8/9/2018
3508 S 61st St	Tangs II	8/9/2018
3506 S 61st St	Nice Guys	8/9/2018
3508 61st St	Tangs II	9/13/2018

Company Address	Company Name	Date Inspected
6145 W Passyunk Ave	Oscar's	9/13/2018
6219 W Passyunk Ave	Tangs	9/13/2018
6159 Passyunk Ave	Del. Valley	9/13/2018
6221 W Passyunk Ave	Bill's Auto Parts	10/4/2018
6255 W Passyunk Ave	A&H Auto Parts	10/4/2018
6223 W Passyunk Ave	C&N Auto Parts	10/4/2018
6221 W Passyunk Ave	East Coast Parts	10/4/2018
6257 W Passyunk Ave	Matthew's All Foreign	11/8/2018
6299 W Passyunk Ave	Jim's Auto	11/8/2018
3201 S 63rd St	American Auto Parts	11/8/2018
6125 Passyunk Ave	Auto Junk Yard LLC	11/8/2018
6110 W Passyunk Ave	Cartel Used Auto Parts	12/6/2018
6030 W Passyunk Ave	My Auto Store	12/6/2018
3215 S 63rd St	Jamison's Towing	12/6/2018
3221 S 63rd St	A Auto Parts	12/6/2018
6308 Passyunk Ave	C&C Auto Parts	2/7/2019
6544 Essington Ave	Atlantic Used Auto Parts	2/7/2019
6660 Essington Ave	Claudio's Auto Parts	2/7/2019
6330 Passyunk Ave	Cartel Auto Parts	3/7/2019
2501 S 28th St	Matthew's Auto Parts	3/7/2019
6770 Essington Ave	Essington Avenue Used Auto	3/7/2019
6800 Essington Ave	My Auto Store	3/7/2019
6796 Essington Ave	Elite Philly Auto Parts	3/7/2019
9200 James St	A&B Metal Recycling	4/4/2019
7342 James St	STO Auto Parts	4/4/2019
3611 Welsh Rd	J. Kairis Recycling	4/4/2019
4921 Cottman Ave	Cottman Auto	4/4/2019
7345 Milnor St	Morris Iron and Steel	5/9/2019
5247 Unruh Ave	Orthodox Auto	5/9/2019
6700 New State Rd	Venango Auto	5/9/2019
5240 Comly St	United Metal Traders	5/9/2019

Figure II.C.3: SYTF Sites Inspected in FY19

II.D NMC 4 - Maximization of Flow to the Publicly Owned Treatment Works (POTW) for Treatment

II.D.1 Continue to Analyze and Implement Non-Capital Intensive Steps to Maximize the Wet Weather Flow to the POTW

Modified Regulator Plan

The Modified Regulator Plan (MRP) was designed to deliver more flow to the WPCPs more frequently and enable greater pollutant removals. The projected flow increase associated with the MRP was completely implemented by the submission of the 1997 Annual Combined Sewer Overflow Status Report. Additional plan implementation efforts were included in the Updated Nine Minimum Controls Report which can be found online by accessing the following link: http://phillywatersheds.org/doc/Updated%20NMC%20Report.pdf.

Maximization of Wet Weather Treatment in the LTCPU

PWD completed and submitted a comprehensive Wet Weather Facility Plan on June 1, 2016, which provides details including schedule, cost and anticipated performance for each project presented in and supersedes the FCPs. More details on these plans can be accessed at the following link: http://phillywatersheds.org/what_were_doing/documents_and_data/cso_long_term_control_plan.

II.D.2 Continue the Program Which Requires Flow Reduction Plans in Agreements to Treat Wastewater Flows from Satellite Collection Systems Where Violations of Contractual Limits are Observed

PWD provides wastewater service to some of its neighboring communities. Communities that exceed their contractual limits must develop flow reduction plans, under PWD review. In FY19, there were no significant updates to the Wholesale Wastewater Customer contracts. The list of outlying community contracts can be found below in **Table II.D.2-1: Listing of Wholesale Wastewater Customer Contracts and Capacities.**

Table II.D.2-1 Listing of Wholesale Wastewater Customer Contracts and Capacities

Customers	Average Annual Daily Flow Maximum (MGD)	Maximum Daily Flow (MGD)	Instantaneous Maximum Rate (Cubic ft./sec)	Maximum Annual BOD Loadings (1,000's lbs.)	Maximum Annual SS Loadings (1,000's lbs.)
Northeast Plant					
Abington	2.97	4.45	9.54	2,102	2,481
Bensalem	6.13	-	11.74	5,340	3,734
Bucks	24	33.00	74.26	13,400	13,400
Cheltenham	-	-	26	-	-
Lower Moreland	1.90	2.85	5.88	729	966
Lower Southampton	7.14	9.28	15.79	5,500	6,000
Southwest Plant					
DELCORA	50.00	75.00	155.00	21,771	19,487
Lower Merion	14.50	-	31.57	6,871	7,250
Springfield (Erdenheim)	3.20	-	6.65	3,100	3,300
Upper Darby	17.00	-	35.00	6,831	7,348
Southeast Plant					
Springfield (Wyndmoor)	1.00	-	1.93	300	400

II.D.3 Use Comprehensive Monitoring and Modeling Program to Identify Suburban Communities where Excessive Rainfall-dependent I/I Appear to be Occurring

The US EPA's SWMM was used to develop the watershed-scale model for the combined and separate sewer systems. Suburban communities are modeled as separate sanitary sewersheds that load to the PWD sewer network. The rainfall response from these sheds is calibrated to flow monitoring data collected at each respective connection to PWD sewer network (if the sewershed is not monitored then a reference shed is used to obtain the rainfall response). Presently, permanent flow monitors are installed at 57 connections and 1 connection is unmonitored at this time. **Appendix B – Flow Monitoring: Table 2** contains the list of all known connections, their location and whether the connection is permanently monitored.

Since the FY18 annual report submission, some minor changes have been made to the SWMM 5 model to include operational and structural changes to the collection system. Modifications include the following:

- S22: The B&B regulator gate was set to fully open on 7/30/2018. A 6" stop log was added to the dam on 3/27/2019.
- R-07: 30" of stop logs were added to divert dry weather flow to the SWWPCP via the Main Relief sewer on 4/4/2019.

Appendix D – FY19 NPDES Annual CSO Status Report: Table 2 shows the CSO volume, duration, and frequency of overflow events per permitted outfall for the rainfall that fell in FY19 utilizing SWMM 5 model version 2017.B.02.04. Table 3 shows the same statistics as table 2 but for the typical year rainfall utilizing the SWMM model that support the 5-year Evaluation and Adaptation Plan (EAP) submitted in October 2016. Please note that FY18 table 2 has been corrected with an errata submitted to PADEP and US EPA. The report was uploaded to http://archive.phillywatersheds.org/doc/FY18_MS4_CSO_withAppendices.pdf.

II.E NMC 5 - Prohibition of CSOs during Dry Weather

II.E.1 Optimize the Real-Time Control Facility to Identify and Respond to Blockages and (non-chronic) Dry Weather Discharges

Regular inspections, reactive inspections, and maintenance of CSO regulators are performed throughout the City to ensure that sediment accumulations and/or blockages are identified and corrected immediately to avoid dry weather overflows. PWD utilizes a remote monitoring network system daily to help identify locations showing abnormal flow patterns.

CSO Regulator Inspection & Maintenance Program

PWD maintains 175 CSO regulator chambers with regulator devices that control the diversion of wastewater flow to the interceptor system and 26 storm relief diversion chambers that allow excess flow during storm events to be diverted to storm relief sewers. These chambers discharge through 164 NPDES permitted point sources which make up the CSO outfalls. The maintenance of the chambers is critical to the performance of the system in that they control the frequency, duration and quantity of CSO discharges. Annual summaries of the comprehensive and preventative maintenance activities completed in the combined sewer system over the past year are detailed in **Appendix D – FY19 NPDES Annual CSO Status Report** and any changes are discussed below.

PWD continues to implement its policy of conducting next day follow-up inspections at sites that experience a dry weather discharge. Ongoing assessment of all inspection scheduling continues to ensure that CSO regulators are inspected at the frequency required to ensure timely response to operational issues and minimize the likelihood of dry weather discharges. During FY19, PWD crews completed 4,929 inspections on 201 CSO regulator sites and storm relief diversion chambers. The crews cleared 153 CSO regulator blockages to prevent possible discharges from developing. There were 10 dry weather discharges total during this fiscal year. Details of the inspections during the past fiscal year can be found beginning on page 13 of **Appendix C – 2019 CSO Maintenance Program Annual Report.**

Tide Gate Inspection and Maintenance Program

Eighty-nine tide gates are located at approximately half of the CSO regulator chambers in the City's system and prevent tidal inflow into the combined sewer system from the estuary receiving water body. Maintenance of the gates is critical to system performance because inflow from the receiving water body can adversely affect the combined sewer system and treatment facilities by reducing system capacities, potentially causing dry weather discharges. In FY19, CSO tide gate preventative maintenance was completed at 26 of the tidally-affected CSO regulator sites. Summaries of the tide gate inspection and maintenance completed during the past fiscal year are on page 23 of **Appendix C – 2019 CSO Maintenance Program Annual Report**, which documents the locations of tide gate preventative maintenance performed in FY19.

Somerset Grit Chamber Cleaning

During FY14, the Somerset grit chamber was removed from service because the upstream regulator was being relocated. This relocation project was completed during FY16.

Central Schuylkill Pumping Station Grit Pocket Cleaning

During FY19, the two grit pockets at the CSPS siphon were cleaned two times, and a total of 60 cubic yards of grit with an approximate weight of 101 tons were removed to ensure proper functionality of the site. Additional information on the CSPS cleaning activities conducted in FY19 is available on page 24 of **Appendix C – FY19 CSO Maintenance Program Annual Report**.

Routine Grit Cleaning

PWD regularly inspects regulators, pump stations, junction chambers and sewers which are known to accumulate grit. These sites are scheduled for flushing and vacuuming on an as-needed basis.

II.F NMC 6 - Control of Solid and Floatable Materials in CSOs

II.F.1 Control the Discharge of Solids and Floatables by Cleaning Inlets and Catch Basins

PWD's Inlet Cleaning Unit (ICU) is responsible for inspecting and cleaning stormwater inlets within the City. When fully staffed, there are thirty-seven inlet cleaning crews whose primary duties include cleaning, removing and properly disposing of debris (solids and floatables) from inside City inlets as well as street level cleaning in the vicinity of inlets to prevent debris from entering the collection system and waterways. Other duties include inspection of inlet conditions and referral of structural defects to the Sewer Maintenance Unit for repair to ensure proper function. Crews are responsible for cleaning high volume traffic areas, retrieving and installing inlet covers, replacing missing inlet covers, installing locking covers, and unclogging choked inlet traps and outlet pipes so inlets can take water. A high level of focus is placed on responding to customer complaints of flooding, blockages, and foul odors.

During FY19, the ICU was responsible for maintenance of approximately 71,500 stormwater inlets connected to the City's combined and separate storm sewer systems (gray inlets). ICU is also responsible for cleaning of pretreatment on stormwater inlets connected to green stormwater infrastructure (green inlets). By the end of the year, ICU was responsible for preventative maintenance of approximately 780 green inlets monthly. Fiscal year totals for work on GSI-connected inlets included 8,845 inlet inspections and 8,435 pretreatment cleanings.

Statistics related to the ICU's work productivity during FY19 and the previous two fiscal years can be found in **Table II.F.1-1**, below. The quantities for inlets inspected, inlets cleaned, debris removed and pounds per inlet during FY19 include work conducted at both gray and green inlets. The process of dewatering debris at a central location has increased cleaning efficiency (higher number of inlets cleaned) and decreased the weight of materials taken for disposal.

Table II.F.1-1: Inlet Cleaning Statistics

	FY 16	FY 17	FY 18	FY 19
Total Inlets Inspected	129,218	134,256	132,699	138,226
Total Inlets Cleaned	98,147	107,638	106,796	111,979
Total Covers Replaced	64	103	124	59
Total Covers Retrieved	23	28	14	47
Total Covers Chained	6,180	3,106	2,685	2,987
Debris Removed (tons)	9,407	7,405	6,286	5,515
Avg. Lbs./ Inlet	192	138	118	121

II.F.2 Continue to Fund and Operate the Waterways Restoration Team (WRT)

PWD's Waterways Restoration Team (WRT) is a multi-crew force dedicated to performing stream examinations, infrastructure protection projects and cleanup work throughout the City including large trash and debris removal and restoration of eroded streambanks and streambeds. WRT's stream examinations consist of assessing a variety of field conditions including waterway, infrastructure, site access and sewage discharge assessments. WRT waterway maintenance work involves debris removal, stream restoration work, and assisting with sewer maintenance work to help provide a safe work environment while protecting stream ecosystems. WRT works in partnership with Philadelphia Parks and Recreation (PPR) staff and various Friends of the Parks groups to maximize resources and build positive relationships with our communities.

During FY19, WRT conducted 381 stream examinations and removed a total of 1,070 tons of debris from the City's waterways (**Table II.F.2-1**). Of the total debris removed, a majority of the weight can be attributed to large organic material (e.g. trees) that have fallen into the waterways and restricted flow, thus increasing the potential for bank erosion and/or damage to infrastructure.

Table II.F.2-1 Waterways Restoration Team – Annual Activity Summary FY09-FY18

Activity	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19
Total Tons Removed	1438	750	741	1416	710	918	1130	817	1582	1070
Cars Removed	12	11	14	4	4	9	2	2	1	0
Tires Removed	1062	1392	1256	4756	1428	427	1069	1153	859	1713
Shopping Carts Removed	102	89	50	27	20	67	38	87	74	203
# of Stream Site Cleanups	335	459	434	467	686	645	721	872	933	997
# of Stream Site Exams	*	*	*	*	438	369	378	374	272	381

*This metric was not available until FY14

II.F.3 Continue to Operate and Maintain a Floatables Skimming Vessel

The skimming vessels are used as a control measure, capable of managing debris at various locations in open water after the debris and floatables have bypassed static control methods (e.g., debris screens). Also, these traditionally large vessels provide increased public awareness and education of floatables impacts to Philadelphia receiving waterways. PWD currently has 3 skimming vessels: a large marine vessel (the R.E. Roy), a smaller pontoon vessel, and a small general workboat.

Large Floatables Skimming Vessel – R.E. Roy

The 39-foot skimmer vessel is operated approximately five days per week, for about 7 months per year, or more as appropriate conditions allows (i.e. weather). The vessel's main purpose is to perform general debris collection and removal on both these rivers, while also serving as a mechanism for public relations events. During the 129 days of on-water operation in FY19, a total 215 cubic yards of debris and floatables material were removed from the Delaware and Schuylkill Rivers (**Table II.F.3-1**). During the FY19 season, the R.E. Roy continued sorting and separating recyclable material, which equated to 6413 lbs. This recycling procedure on the R.E. Roy was significantly optimized during FY16 resulting in a nearly 4-fold improvement in amount collected in comparison to the previous year. In addition, the R.E. Roy initiated a partnership with Bridgestone through their Tires4Ward Program to recycle the tires collected from skimming operations to be reused for rubberized asphalt, construction materials, landscaping mulch, consumer products and as tire-derived fuel for energy.

Table II.F.3-1 Debris Collected and Days of Operation by R.E. Roy Skimming Vessel

Date	Total Tons Removed*	Cubic Yards Collected	Recyclables Collected (lbs.)	Days in Operation	Days on Schuylkill	Days on Delaware
July 2018	--	15	416	14	11	3
August 2018	--	35	1600	22	15	7
September 2018	--	25	960	23	15	3
October 2018	--	30	1184	21	14	7
November 2018	--	10	288	6	4	2
December 2018	R.E. Roy Out of Service (Dry-docked & Winterized) for Winter Season					
January 2019						
February 2019						
March 2019						
April 2019	--	10	320	6	4.5	1.5
May 2019	--	55	875	22	13.5	8.5
June 2019	--	35	770	20	15	5
FY19 Total	**--**	**215**	**6413**	**129**	**92**	**37**

* *Tons removed* is not a monthly metric and is only calculated when floatables/debris are removed from the shipyard and transported to the weigh station at the trash collection facility. Additional focus on the recycling of tires and wheels has decreased the total tons of debris removed.

Small Skimming Vessels

PWD also operates and maintains a small pontoon skimming vessel and recently added a small general workboat for use in the Schuylkill and Delaware Rivers within Philadelphia to retrieve floating trash and debris from the waterways. The smaller skimming vessels are effective because they can be utilized in tight spaces found in marinas, among piers, and in near shore (shallow) areas. During the boating season, the pontoon skimming vessel is normally docked at a municipal dock in the non-tidal portion of the Schuylkill where it is primarily used. With the addition of the general workboat in May 2016, PWD has begun to deploy skimming operations and other activities in the tidal portions of the Delaware and Schuylkill rivers, specifically in areas not desirable or accessible by the department's other skimming vessels. In both vessels, the marine flotsam and floatables are hand netted from the water surface by employees standing on the vessel deck. The nets are emptied into ten 44-gallon debris containers on the deck and the containers are then offloaded.

In FY19, the small skimming vessels were operational from July – October 2018 and April- June 2019, equating to 29 deployments. During this period, the small skimming vessels removed a total of 25.9 cubic yards (2.3 tons) of material, comprised of 14.2 cubic yards (0.77 tons) of recyclable material including bottles, plastic, paper; 11.7 cubic yards (1.6 tons) of mixed trash and 63 tires (1575 lbs.) (**Table II.F.3-2**). The small skimming vessels were in active operation for a total of 173.6 hours in FY19.

Due to dock repairs on the public dock on Schuylkill River along Kelly Drive, the pontoon vessel was not active from April to June 2019; the pontoon vessel or equivalent vessel shall return when repairs are completed.

Table II.F.3-2 FY19 Small Skimming Vessels Collection Metrics

Date	# of Collections Events	Total Volume Collected (gal)	Total Weight Collected (lbs.) not including tires	Total Volume of Recyclables (gal)	Total Volume of Mixed Trash (gal)	Tires Collected
July 2018	5	937	551	607	330	2
August 2018	2	352	189	176	176	0
September 2018	3	352	183	220	132	2
October 2018	3	396	209	242	154	1
November 2018	Skimming Vessel Dry-Docked for Winterization Period					
December 2018						
January 2019						
February 2019						
March 2019						
April 2019	7	1436.5	1167	816	620.5	11
May 2019	3	572.5	1453	280.5	292	22
June 2019	6	1192.5	875	535.5	657	25
Total	**29**	**5,238.5 Gal**	**4,660 lbs.**	**2,877 Gal**	**2,361.5 Gal**	**63 Tires**
Total Yd^3/Tons	**29 Events**	**25.9 Yds^3**	**2.3 tons**	**14.2 Yds^3**	**11.7 Yds^3**	**~1,575 lbs.**

II.F.4 Other Floatables Control Activities

Other activities practiced within the City are conducted with the intention of managing floatables. These initiatives provide integral components to ensure additional floatable and solids do not enter the City's waterways and surrounding areas. In FY19, these activities have resulted to over 199 events, 7,143 volunteers, 1,918 tires collected and 406.98 tons of trash and debris being removed. Some of these activities are described below.

Volunteer Water Adjacent Cleanups

The City has embraced the value of supporting and conducting volunteer water adjacent land-based cleanups with local partners and communities in areas in Philadelphia and surrounding region. These volunteer cleanup events provide an opportunity to make significant difference in a given area within a few hours with the help of people willing to volunteer their time. The cleanup events also serve as opportunities to provide important information and public outreach about PWD's and the City's programs and how the volunteers' efforts are beneficial not only on an environmental/ecological standpoint but also helps promote social behavior changes.

United By Blue Cleanups

In 2016, PWD began to partner with United By Blue (UBB), a Philadelphia-based sustainable outdoor apparel company who conducts annual stream cleanups programs. Part of the company's business model includes the amiable mission: "*For every product sold, United By Blue removes one pound of trash from oceans and waterways through company organized and hosted cleanups.*" PWD partners with UBB by recommending litter-prone locations that are adjacent to Philadelphia waterways, promoting and supporting volunteer based cleanup events hosted by UBB, and helping coordinate pick up of event collections by PWD's Waterways Restoration Team (WRT) or the Philadelphia Streets Department staff. Much of the work conducted by UBB are often in locations under the purview of PWD's floatables control and pollution prevention programs. In FY19, UBB conducted 9 clean up events in Philadelphia with over 1,371 volunteers collecting 524,502 lbs. of trash.

Schuylkill Scrub

The Schuylkill Scrub is a program that encourages and supports cleanup events taking place during the spring (from March 1st through May 31st) throughout the entire Schuylkill watershed- from the headwaters in Schuylkill County down to its confluence with the Delaware River in Philadelphia. The Schuylkill Action Network coordinates the initiative, along with multiple partners, with a shared goal of cleaning as many miles of road, stream, and parkland in the Schuylkill watershed. Their efforts help prevent trash from making its way into our drinking water sources and keep our land and waters clean, litter-free, and beautiful. In calendar year 2018, 819 cleanups were registered as part of the Schuylkill Scrub resulting in 20,744 volunteers, 431 miles of streams cleaned, 959,917 pounds of trash removed, and 338 tires collected. The statistics for the 2019 Schuylkill Scrub are still being tallied and are currently not available.

Tookany/Tacony-Frankford Trash Task Force

In recent years, more targeted efforts to focus on litter have been initiated in the corridors surrounding the Tacony Creek watershed. PWD gathered members of different City agencies including Streets and Philadelphia Parks and Recreation (PPR), as well as representatives from the TTF Watershed Partnership, SEPTA, United by Blue, and Keep Philadelphia Beautiful (KPB), to initiate discussions and coordinate efforts to alleviate the litter problem and its impact on Tacony Creek. The Task Force decided to invest into the T-04 outfall drainage area, due to its small area drainage and diverse land use.

The goal of the study is to establish trash resources and transport methods and then experiment with trash management practices which can then be applied to other drainage areas. The Task Force is continuing to research and explore methods for reducing the trash problem in the Tacony Watershed. During FY19, the TTF partnership continued with PowerCorpsPHL, as well as private employers including AstraZeneca, SCAA Insurance Group, and United By Blue and organizations including El Centro de Estudiantes and Latinas In Motion to host clean-up events including the annual clean-ups at Love Your Park fall and spring. In March, TTF hosted our largest clean-up of the year (87 volunteers and 209 trash bags), working with new partners from Temple University's Office of Sustainability and Born to Play Philly. In addition, TTF continued working with the Zero Waste and Litter Initiative, PDE and PWD on the Community Cans project in Juniata Park, which will reduce trash on the busy road, and help us make the clean water connection from the Cayuga Triangle along Castor Avenue to the Ferko Playground to Tacony Creek Park by adding much needed public right of way trash receptacles to the area. TTF also continued to partner with PowerCorpsPHL and the Alliance for Watershed Education to deploy Trail Ambassadors on a regular basis to walk the trail, clean the gateways and trail, and report dumping and other issues needing attention to Philly311. There were over 70 reports to Philly311 in the past year. The consistent presence and reporting have resulted in quicker resolution of trash issues and a cleaner, more welcoming park. During FY19, the TTF partnership engaged approximately 1,849 participants/volunteers through its 144 outreach events, 10 cleanups resulting in the collection of 362 bags of trash being removed from the park area.

Friends of the Wissahickon Cleanups

The Friends of the Wissahickon (FOW) has conducted park cleanups within the Wissahickon Valley Park for many years. The Wissahickon Creek is a treasure to many Philadelphians and visitors to the area, who are searching for an escape to nature, providing a stunning green space for hiking, biking, and fishing. Devil's Pool, in particular, is one of the most beautiful places in the park – an iconic spot along the Cresheim Creek, just before it flows into the Wissahickon. Due to the popularity of this location, an excess of trash is sadly left behind by many of its visitors. This not only looks terrible but is dangerous to the fish and other wildlife that live in our watershed. Each year, FOW volunteers work over 12,000 hours to help FOW perform duties and complete projects including park cleanups that are essential for the Wissahickon to thrive, and the skills they learn can be transferred to the work sector. In 2017, FOW started weighing the trash following every clean rather than collecting the standard metric (number of bags). The total trash removal from the park in 2018 was 8 ton from 72 volunteer events. To date in 2019, 9.65 tons of trash was removed from 71 volunteer events. The additional trash collected in 2019 is associated with increased efforts and awareness to do more clean ups. The FOW expects to conduct a greater number of cleanups in 2019 compared to previous years. This momentum is proving to show results: last year FOW removed 5 tons of trash from Devil's Pool, and this year just 2.5 tons was removed from Devil's Pool & Magargee Dam combined, which indicates a dramatic decrease in litter being left in the most popular areas.

Circular Free Program

Philadelphia residents or businesses that do not wish to receive hand delivered advertising circulars or handbills or local newspapers at their property can fill out a form for a "Circular Non-Delivery" decal to notify advertisement distributors to refrain from delivering advertisements to their property. Per Chapter 10-700 of the Philadelphia Code, the Department of Licenses and Inspections maintains a commercial handbill "Non-Delivery" list identifying all properties whose owners request non-delivery. If the property continues to receive circulars or advertisements from businesses, they can contact Department of Licenses and Inspections to fine violators. This helps prevent litter across the City by limiting the number of unwanted circulars from ending up in the street. The program continued during FY19; unfortunately, the exact number of households registered to receive a "Circular Non-Delivery" decal during the year is unavailable. Since the inception of the program, over 12,000 households have signed up for the Circular Free Program.

Bridgestone Tires4ward Partnership

In the summer of 2016, PWD established a partnership with Bridgestone, a tire manufacturer, to recycle tires collected from PWD-sponsored cleanup events including efforts conducted by the Waterways Restoration Team (WRT), Floatables Skimming Vessels and other cleanup activities. Bridgestone or one of its associated partners collects these tires at one of PWD's maintenance facilities as part of their Tires4ward program. This program was initiated to support Bridgestone's goals of ensuring that one spent tire or any tire been taken out of use goes on to another valuable purpose such as for "use as material in rubberized asphalt, construction materials, landscaping mulch and as tire-derived fuel for energy" for every tire sold. During FY19, a total of 1,918 tires were collected in Philadelphia for the Bridgestone Tires4ward program.

Repair, Rehabilitation, and Expansion of Outfall Debris Grills and Grit Cleanings

Debris grills are maintained regularly at sites where the tide introduces large floating debris into the outfall conduit. This debris can become lodged in a tide gate, causing inflow from the receiving water. Additionally, debris grills provide entry restriction and some degree of floatables control.

Standard operating procedures require the inspection of debris during all regulator inspections unless the outfall is submerged at the time of inspection. During FY19, 53 debris grill maintenance events were completed. The list of the debris grill preventative maintenance activities is available on page 24 of **Appendix C – 2019 CSO Maintenance Program Annual Report**.

II.G NMC 7 - Pollution Prevention

II.G.1 Continue to Develop and Share a Variety of Public Information Materials Concerning the CSO LTCP

The Public Outreach and Participation conducted in FY19 for the *Green City, Clean Waters* program has been provided in **Section 7.0 - Public Outreach and Participation** starting on page 22 of **Appendix A – Green City, Clean Waters FY19 Annual Report** and **Section II.G.3 Continue to Provide Annual Information to City Residents about Programs via Traditional PWD Publications** on page 24 of this report.

II.G.2 Continue to Maintain Watershed Management and Source Water Protection Partnership Websites

In May 2018, PWD incorporated watershed protection projects and program information onto the City of Philadelphia's official website at http://www.phila.gov/water/sustainability/protectingwaterways/. This provides an alternate channel for PWD customers and the public to learn about watershed protection initiatives. The website contains key plans and reports as well as detailed information on watershed partnerships, planning, public communication, and technology-based planning and assessment tools.

RiverCast

Philly RiverCast (http://www.phillyrivercast.org) is the first operable web-based recreational warning system in the United States. Using near real-time flow, precipitation, and turbidity data, the RiverCast algorithm translates predicted bacteria levels in the Schuylkill River into one of three ratings, each of which corresponds to suggested guidelines for safe recreation. RiverCast guidelines offer tools for the public to make informed decisions about recreation, and thus helps protect the public against illnesses caused by bacteria. Ultimately, RiverCast will help ensure continued safe recreational use of the Schuylkill River, while promoting public awareness of water quality concerns and indirectly engaging support for source water protection measures. More than 1.3 million users have visited the Philly RiverCast website since it launched in June 2005.

Schuylkill Action Network

The Schuylkill Action Network (SAN) was established as a permanent watershed-wide organization charged with identifying problems, prioritizing projects, and securing funding sources to bring about real water quality improvement in the Schuylkill River watershed. The SAN is organized into a number of focused workgroups. One of the workgroups, the SAN Stormwater workgroup was formed to identify a cost-effective approach to stormwater management through project prioritization and planning. The workgroup is a partnership of representatives from PWD, PADEP, EPA, DRBC, conservation districts, watershed organizations, municipalities, and other groups throughout the Schuylkill River watershed. The SAN website supports the SAN's Stormwater Workgroup by providing project and event information, SAN publications, and public messaging about restoring and protecting the Schuylkill River. The SAN Stormwater Workgroup's ultimate goal is to prevent or maximize reduction of stormwater runoff pollution. During its 15 years of existence, the workgroup has served as an advisory committee for state and local governments, an ordinance review board for municipalities, and a support group for large and small projects throughout the Schuylkill River watershed. During the last year, SAN projects have addressed important pollution sources including agriculture, abandoned mine drainage and stormwater. In FY18, the SAN Stormwater Workgroup has made Schuylkill Watershed-specific storm drain markers to prevent dumping and increase awareness of stormwater drainage. Efforts from SAN partners in the last calendar year are documented in the following table (**Table II.G.2-1**):

Table II.G.2-1: Schuylkill Action Network Partner Progress (2003-2019)

Agriculture	Abandoned Mine Drainage (AMD)	Stormwater
• Constructed 166 manure storage facilities • Completed 172 barnyard repairs or heavy use area construction • Installed 86 stream crossings • Planted 475 acres of riparian buffers on agricultural lands	• Received more than $14.3M an AMD workgroup funding • Reduced watershed loadings of iron, aluminum, and manganese by 88, 3, and 6 tons, respectively • Continued to improve water quality with maintenance and monitoring at existing treatment system sites • Hosted annual educational tours of AMD treatment systems with interested watershed partners and academic groups • Coordinated a week-long Schuylkill Acts and Impacts outreach program for high school students to foster interest in environmental and watershed-science related careers	• Engaged more than 25 schools in green stormwater infrastructure through Schuylkill Action Students • Hosted workshops for businesses and municipalities to learn about stormwater best management practices and available resources • Designed storm drain markers for municipalities and community organizations to use throughout the Schuylkill River Watershed to increase awareness of stormwater drainage into waterways • Preserved nearly 18% of land in the Schuylkill River Watershed Area

During its 16 years of existence, the SAN has grown to include nearly 350 organizational and individual partners working together to protect the Schuylkill River watershed. To communicate the accomplishments of the SAN Stormwater workgroup to stakeholders as well as other SAN workgroups, the SAN routinely updates their website, http://www.schuylkillwaters.org, with input from PWD, the SAN Planning Committee and Education and Outreach workgroup. The website was redesigned in February 2018 and includes an internal component that allows for improved communication among SAN workgroup members and facilitates on-the-ground work. The SAN website, together with http://phillywatersheds.org and http://www.phila.gov/water, provide data and reports from the source water assessments for the Schuylkill River.

Delaware Valley Early Warning System

The Delaware Valley Early Warning System (EWS) is an integrated monitoring, notification, and communication system designed to provide advanced warning of surface water contamination events to subscribing water suppliers, industrial surface water users and partner government agencies in the Schuylkill and Lower Delaware River Watersheds. The Delaware Valley EWS covers the entire length of the Schuylkill River as well as the Delaware River from the Delaware Water Gap to just below Wilmington, Delaware.

The EWS monitoring network is comprised of nearly 90 online water quality data stations throughout the watershed. Access to this real-time data allows EWS users to identify changes in water quality associated with both natural and accidental contamination events. The user can also access historical data from these stations with the data query wizard. Real-time and historic flow data are applied to a time of travel model that generates a range of estimated arrival times for each intake in the system. This time of travel model is also incorporated into a spill simulation tool that can be used for planning and training purposes.

When a responding agency reports a water quality event via the EWS website or telephone hotline, the entire user base is notified almost instantaneously via email. In the case of a high-risk event, supplemental phone notifications are placed using CodeRed technology, allowing all users to receive an automated telephone notification in less than three minutes. EWS users can log in to the secure website to view additional event details, spill routing, and predicted arrival times to their intakes. Additionally, a sophisticated tidal modeling component has been developed to better predict and communicate the arrival times of spills on the tidal Delaware River with a user-friendly spill trajectory animation. The EWS received the Governor's Award for Environmental Excellence and is nationally recognized for its use of stakeholder partnerships to meet regional source water protection objectives. In 2016, the EWS was featured as a case study in EPA's publication *Online Source Water Quality Monitoring: For Water Quality Surveillance and Response Systems*.

During FY19, a total of 22 unique water quality events were reported to the EWS. Additional outreach events throughout FY19 expanded the EWS user base, which is currently comprised of more than 300 individual users from 50 organizations.

Other PWD Related Websites and Social Media

PWD Main Web Site

www.phila.gov/water

The official website for PWD continued to be improved to provide more user-friendly and comprehensive resources. Resources span from the CSO LTCPU to helping the average customer understand the importance of stormwater management.

The pages at www.phila.gov/water/wu/stormwater had 25,085 active visitors during FY19 spending an average of about 2 minutes on the pages. Among these is our Stormwater Grants page with information for non-residential property owners interested in receiving grants to construct stormwater retrofit projects. This page saw content improvements, including an updated grants manual that received over 1300 downloads in FY19. The Stormwater Grants web page received 5163 unique page views with an average of 2 minutes spent on the page.

Furthermore, the stormwater parcel viewer (www.phila.gov/water/swmap) continues to be the most visited stormwater resource in the phila.gov web environment and one of the top 20 web applications in the City of Philadelphia. There were over 81,000 unique users of the application over 121,000 sessions in FY19. This map-based application shows the stormwater charges for every property in Philadelphia and links to helpful documents and forms regarding the stormwater fees. Customers are encouraged to explore and get more information about their stormwater charges and about PWD's Appeals, Credits or Credit Assistance Program (CAP). This information can help property owners reduce the amount of stormwater entering the sewer system and lower their stormwater bills.

Phillywatersheds.org

Watershed information was also housed on Phillywatersheds.org; however, it was archived on September 1st, 2019 and the content is in the process of being moved to www.phila.gov/water.

Phillywatersheds.org will remain an archived site that redirects to phila.gov/water until content is moved. More information about content available on the site is discussed below.

The website provides information to the public on issues that are currently problematic for the City's watersheds, what PWD is doing to address these issues, and what residents of Philadelphia can do to help improve watershed health. It also includes educational tools, public meeting materials, maps and reports generated by PWD or partners. According to Google Analytics, the website received more than 85,500 visitors in FY19.

The website features interactive mapping for green stormwater infrastructure projects, traditional infrastructure projects, waterways restoration projects, and community partnership projects. There are also maps for each of the seven major watersheds within Philadelphia. One of the main uses of the mapping system is the Combined Sewer Overflow Public Notification System, known as CSOcast. CSOcast shows CSO outfall overflow information retrieved from PWD's sewer monitoring network. More information on CSOcast is described in further detail in **Section II.H.2** of this report on page 28.

The website also hosts information for various PWD initiatives and programs related to Green Stormwater Infrastructure (GSI). The pages for the Soak It Up GSI Adoption Program, for example, allow Registered Community Organizations (RCO) to check if their organization is eligible to participate, complete the program applications, and schedule training. Additionally, once groups are active in the program they can report issues and log their adoption activities.

Development Review Program Website

https://www.pwdplanreview.org/

Since its deployment in FY16, the use of this site has grown and continues to be one of the most used websites in the City, a testament to its effectiveness in helping developers to meet Philadelphia's stormwater regulations. Nearly 30,000 users (29,953) accessed the site in FY19. In October 2018, the site introduced a new Online Technical Worksheet to replace the existing excel based worksheets. More improvements to the home page and overall user experience were scoped and planned in for future updates.

For more information on the activities conducted by the Development Review Program please refer to the MS4 Annual Report **Section F.5 – Monitor and Control Stormwater from Construction Activities** on page 23.

PWD Department on Social Media

Social Media is an essential tool for disseminating departmental messaging about stormwater management, pollution prevention, and programs that improve the City's water resources. Additionally, social media has expanded the reach of partner programming and strengthened PWD's connections with other institutions around the City. The sections below describe the City's social media:

@PhillyH2O Blog

In July 2018, PWD transitioned from the Watersheds Blog to the new @PhillyH20 Blog (water.phila.gov/blog/). Part of a larger digital strategy that is more focused on customer priorities and improved access to information, the new blog allows users to obtain information faster and more directly. Also, more mobile-friendly, the site simplifies customer outreach with features such as a dedicated Events page with a live feed updated by PWD social media calendars and an improved tagging function that puts related content alongside posts.

Posts promote a wide variety of topics, including community input meetings for GSI construction sites and other projects, updates about the progress of *Green City, Clean Waters*, and highlight current programs and events and relevant partner initiatives.

There was a total of 42 posts in FY19, with 20,704 visitors. The most popular post had 1,214 views and covered PWD's 2019 Spokesdog contest, a pet waste disposal best-practices campaign.

Facebook

PWD maintains two Facebook pages to keep residents informed on any news and events at or hosted by the Water Department. These pages can be accessed at: http://www.facebook.com/PhillyH2O and http://www.facebook.com/phillywatersheds.

Fairmount Water Works (FWW) also maintains a Facebook page that extends the reach of departmental messaging. The page can be accessed at https://www.facebook.com/28309557520. Between these three Facebook pages, the department reaches over 5,300 followers.

Twitter

Twitter is a valuable communications channel for resolving customer complaints, providing customer information, and delivering news concerning the Department, education and water in general. The PWD twitter is found at https://twitter.com/PhillyH2O. The @PhillyH2O account activity is consistent, averaging 45 tweets per month. The @PhillyH2O account now has over 8600 followers, up from 8113 in FY18.

PWD Department Videos

PWD hosts videos on Vimeo and YouTube which provide information and news on its programs and vision for Philadelphia. The videos can be accessed at the following links:

- http://www.vimeo.com/phillywatersheds
- http://www.youtube.com/pwdepartment

Between the two platforms, the videos have been viewed over 8,500 times between July 1, 2018 and June 30, 2019.

II.G.3 Continue to Provide Annual Information to City Residents about Programs via Traditional PWD Publications

PWD develops numerous publications for the public that are distributed throughout the City at advisory committee meetings, public meetings and other public events, in addition to being distributed through the water\sewer\stormwater bill to PWD customers. The following publications, meetings and events have been shared with and/or involved the public during FY19:

Billstuffers

- September, 2018 - Your Bill Will Reflect New Rates
  A billstuffer was distributed to customers in their water/sewer/stormwater bills that explains the first of a two-phase change to rates spread over a two-year period.
- November 2018 – Guide to Water Emergencies
  A billstuffer was distributed to customers in their water/sewer/stormwater bills to provide guidance on what to expect when there is a water or sewer emergency.
- December, 2018 - Act Now to Prevent Frozen Pipes
  A billstuffer was distributed to customers in their water/sewer/stormwater bills that provided tips for customers to prevent frozen pipes and steps to take in case their pipes were already frozen.
- January, 2019 – Tell Us What you Think! All participants have a chance to win a $100 gift card!
  A billstuffer was distributed to customers in their water/sewer/stormwater bills to get feedback from Philadelphia residents on PWD and the services it provides.
- March, 2019 - Keep your water service flowing!
  A billstuffer was distributed to customers in their water/sewer/stormwater bills to alert customers that the moratorium (or suspension) for water shutoffs ends on April 1, 2019; the different methods of payment, locations of approved WRB payment centers and customer's rights and responsibilities as water customers.

Publications

- May 2019 – Water Quality Report Postcard
  A postcard was created and distributed via mail to alert Philadelphia residents that the annual Water Quality Report was available electronically at phillyh2o.info/2018/water-quality and that hard copies of the report were available by request at waterquality@phila.gov or 215-685-6300.
- May, 2019 - 2018 Water Quality Report (published Spring 2019)
  Annual consumer confidence report mandated by the federal Safe Drinking Water Act is published each year and sent to PWD wholesale and retail account customers, and other consumers of the city's water. PWD makes this report available electronically on its website at phillyh2o.info/2018-water-quality. Hard copies are also available by request at waterquality@phila.gov. The report was also translated into Spanish and formatted like the English version and is available upon request.
- June, 2019 – A Guide for Customers
  This reference booklet was created to provide guidance to customers on how to access PWD programs and services and was updated in 2019 with additional programs and services. It is also available in Spanish.

Media Advisories

- October 8, 2018 – Groundbreaking: Green stormwater project tackles community concerns; Strawberry Mansion infrastructure investment protects waterways, and pedestrians
- April 22, 2019 – Philly Water Bar Opens with Free Pours at City Hall Courtyard; Philly Water Bar, a new pop-up serving free pours of local tap water in a fun, engaging setting launches at the City Hall Courtyard this week!

Press Releases

- October 23, 2018 – Mural Arts Philadelphia, Pennsylvania Horticultural Society and PWD Dedicate New Mural

- December 11, 2018 – PWD Announces Winter Schedule
- January 7, 2019 – PWD seeks groups for Mini-Grant Adoption Program
- January 31, 2019 – PWD Customers Can Win $100, Improve Services with Survey
- February 28, 2019 - #UtilityFairsPHL: Hands-on Help with Lowering Water and Other Philadelphia Utility Bills at Series of March Events
- April 12, 2019 – Pop-up Philly Water Bar Aims to Get People Drinking Tap

Events/Campaigns

- Delaware River Day Festival
  September 15, 2018 – A press conference was held to kick off the Delaware River Day Festival where the Partnership for the Delaware Estuary (PDE), PWD, the Center for Aquatic Sciences, representatives from Camden County and others gathered together to enjoy a variety of free activities for the whole family. Environmental exhibits, games, prizes, crafts for kids, face painting and boat rides were featured to celebrate and connect the public with the Delaware River.

- Berks & Sedgley Groundbreaking
  October 11, 2018 – PWD partnered with Council President Darrell Clarke, State Representative Donna Bullock and the Strawberry Mansion CDC to mark the beginning of construction of a green stormwater infrastructure project at the intersection of Berks Street, Sedgley Avenue and 30th Street, contributing stormwater management features as part of the Green City, Clean Waters Program.

- Councilwoman Blondell Reynolds Brown Senior Expo Series
  PWD participated in Councilwoman Blondell Reynolds Brown 2018 Senior Expo Series by providing a presentation on its programs and services and manning a table. There were six events held at different venues throughout the city during the fall: October 12, October 19, October 26, November 2, November 9 and November 16.

- Be Utility Wise Conference
  October 17, 2018: The Public Utility Commission held a professional development conference to promote consumer awareness, education and healthy living. Participants received information on utility assistance, conservation, family services and consumer protections. PWD served on the panel and manned an information table.

- Water Gives Life Mural Dedication
  October 23, 2018: City Councilmember Mark Squilla, then Water Commissioner Debra McCarty, Mural Arts Executive Director Jane Golden, Pennsylvania Horticultural Society President Matt Rate, Lead Artists Eurhi Jones and Dave McShane and others dedicated a water-themed mural at 13th & Arch Streets and recognized the eighth year of the City's Green City, Clean Waters Plan.

- Kensington Utility Fairs
  March 6 and March 9, 2019 - Councilmember Maria Quinones Sanchez along with customer service staff from PWD, Philadelphia Gas Works (PGW), and PECO joined other assistance experts to bring utility bill assistance to the constituents in the Kensington neighborhood of

Philadelphia. This pilot project aims to partner with City Council members bi-annually to bring utility bill assistance to all neighborhoods in Philadelphia and reduce shutoffs.

- Philly Water Bar Launch
  April 24, 2019 - City Councilman Mark Squilla, Deputy Managing Director for Transportation, Infrastructure, and Sustainability Michael Carroll, then acting PWD Commissioner Sarah Stevenson and other distinguished guests participated in the Philly Water Bar Launch and offered remarks and served as Water Bar-tenders. Philly Water Bar is a PWD campaign to bust myths about the safety and quality of local tap water and highlight Philadelphia's high-quality tap as a sustainable, affordable, safe and healthy beverage that's available in the home of every Philadelphia resident.

Advertisements

- April, 2019: A paid advertisement was placed in the Water Resources Association's Awards Program highlighting PWD's Mussel Hatchery.
  - Paid advertisements were placed in the following newspapers to alert the public that the 2018 Water Quality Report (published Spring 2019) was available electronically at phillyh2o.info/2018-water-quality: Philadelphia Daily News and the Philadelphia Metro – April 30, 2019
- Paid advertisements were placed in the following newspapers to alert customers that a technical hearing was being held on June 5, 2019 at 10 AM and a public hearing was being held on June 5, 2019 at 2 PM to discuss the annual adjustment to reconcile the cost of the PWD's assistance programs.
  1. Philadelphia Inquirer and Daily News – May 28, 2019
  2. Legal Intelligencer – May 28, 2019
  3. Philadelphia Tribune – May 28, 2019
  4. Al Dia – May 29, 2019

II.G.4 Continue to Support the Fairmount Water Works

As detailed in **Table II.G.4-1**, during FY19, more than 27,500 visitors attended the Fairmount Water Works which consisted of general visitors, adults and children, school groups, community groups, and attendees for special exhibits. Outreach numbers include an additional 1,457 teachers and students participating in UUW middle years curriculum project*.

Table II.G.4-1 Fairmount Water Works – FY19 Education Center Attendance

Types of Attendance	Number Attended
General FWW Visitors	12,751
School Groups, Camps and Recreational Center	7,969
Tours	1,200
Special Events	1,667
Outreach Efforts*	3,936
FY19 Total Visitors	**27,523**

II.H NMC 8 - Public Notification to Ensure that the Public Receives Adequate Notification of CSO Occurrences and CSO Impacts

PWD has developed and will continue to develop a series of informational brochures and other materials about its CSO discharges and the potential effects these discharges have on the receiving waters. In addition, PWD has enlisted watershed organizations and partnerships to assist in this endeavor to raise the level of citizen awareness about the function of CSO and stormwater outfalls through a variety of educational mediums.

II.H.1 Launch a Proactive Public Notification Program Using Numerous Media Sources

PWD is advancing a proactive public notification program that uses print, internet, outfall signage, and other media to distribute information on the locations of CSOs, information on hazards, and potential public actions.

CSO Outfall Signage

In summer 2007, PWD initiated a pilot project to install 13 signs at CSO outfalls throughout the City. During a follow-up survey in October 2007 it was found that 5 of the 13 signs had been either removed or vandalized. During FY19, a working group continued to analyze the feasibility of installing updated informational signage at the City's CSO outfalls. The working group has performed outfall assessments for outfalls accessible both by land and boat, which includes materials and mounting assessments for signage. Currently each CSO outfall location, except for 8 inaccessible locations, has an identification sign installed which helps the public to accurately identify an outfall when reporting a problem.

Other Notification Measures

PWD continues to develop informational materials and maintain websites to educate the public about its CSO discharges and the potential effect on receiving waters. PWD has found that one of the best ways for public notification of CSOs is through the traditional public outreach programs described in NMC7: Pollution Prevention Program, please refer **Section II.G – NMC 7- Pollution Prevention** on page 19.

II.H.2 Expand the Internet-Based Notification System (RiverCast) to the Tidal Section of the Lower Schuylkill River

In order to expand the web-based water quality forecasting system for the Schuylkill River, RiverCast, PWD developed another internet-based notification system called CSOcast in 2008, which reports on the overflow status of outfalls in every CSO shed.

The website is built using the Google Maps API which allows for the dynamic loading of geographically referenced data that can be viewed with a familiar and user-friendly interface. The map is available 24 hours a day and displays the most up-to-date data available. PWD is constantly updating and improving the notification system as well as the flow monitoring network to deliver the best information possible to the public. During FY19, CSOcast reported on the 164 CSO outfalls twice a day, with 2,783 unique page views. The CSOcast notification system can be accessed through: http://www.phillywatersheds.org/what_were_doing/documents_and_data/live_data/csocast.

II.I NMC 9 - Monitoring to Effectively Characterize CSO Impacts and the Efficacy of CSO Controls

II.I.1 Report on the Status and Effectiveness of Each of the NMCs in the Annual CSO Status Report

The CSO Annual Report, combined with the Stormwater Annual Report, will be submitted in September of each year, documenting the previous fiscal year activities.

III Implementation of the LTCP

Table III.B-1: Summary of 1997 CSO LTCP Capital Projects

Project	Status
Real Time Control (RTC) Program	
RTC - Main Relief Sewer Storage (R-7 through R-12)	Complete
RTC - Tacony Creek Park Storage (T-14)	Complete
RTC - Rock Run Relief Sewer Storage (R-15)	Complete
Establish RTC Center	Complete
RTC & Flow Optimization (Southwest Main Gravity Interceptor, Cobbs Creek Cut-Off, and Lower Schuylkill West Side)	Complete
Targeted Infiltration/Inflow Reduction Programs	On-Going
Solids & Floatables Control Program	On-Going
85% CSO Capture Pennypack Watershed (P1 through P5)	Complete
Eliminate Outfalls: Dobson's Run Phase I	Complete
Eliminate Outfalls: Dobson's Run Phase II & III	Complete
Eliminate Main & Shurs Overflow (R-20)	Complete
Eliminate 32nd & Thompson Outfall (R-19)	Complete
Collection System Improvements	
Upgrade Frankford Siphon	Complete
Somerset Interceptor Sewer Conveyance Improvements	Complete
Cobbs Creek Low Level Conveyance Improvements	Complete
Cobbs Creek Low Level Control Project	Complete
Water Pollution Control Plant (WPCP) Wet Weather Treatment Maximization Program	Complete

III.A CSO LTCP Update

The full Philadelphia Combined Sewer Overflow LTCPU report can be found at the following address: http://www.phillywatersheds.org/ltcpu.

Please refer to **Appendix A – Green City, Clean Waters FY19 Annual Report** for an update on implementation progress.

III.B Capital Improvement Projects

Table III.B.1-1 – Status updates for On-going Capital Improvement Projects

Project	Status	Update / Reference
Completion and Operation of the Real-time Control Center and Rehabilitate and Maintain the Monitoring Network	Completed in 2003	For details on FY16 maintenance of monitoring network please refer to Appendix C-FY19 Program Maintenance Annual Report.
WPCP Wet Weather Treatment Maximization (NE)	Evaluated and implemented options from the Jan. 2000 Stress Testing Report	Refer to Section III.B.1.2 WPCP Wet Weather Treatment Maximization (NE) on page 66 of the CSO-Stormwater FY 2012 Annual Report
Evaluate Stress Test Report Options in the LTCPU	Completed March 2009 (all three WPCPs)	Refer to Section III.B.1.2.1 Evaluate Stress Test Report Options in the LTCPU on page 69 of the CSO-Stormwater FY 2012 Annual Report
Implement Options 1, 2, and 4 from the Stress Test Report (NE)	Completed January 2006	Refer to Section III.B.1.3.2 Implement Options 1, 2, and 4 from the Stress Test Report on page 91 in the CSO-Stormwater FY 2010 Annual Report.
Plan, Design, and Construct Options 5 & 7 of the Stress Test Report to Increase the Secondary Plant Capacity to 435 MGD	Completed February and August 2012	Refer to Section III.B.1.2.3 Plan, Design, and Construct Options 2 & 6 from the Stress Test Report on page 70 in the CSO-Stormwater FY 2012 Annual Report.
Explore increasing the preliminary treatment, primary treatment, and final effluent disinfection treatment capacities in excess of the existing secondary treatment capacity at the NE WPCP	Plan was originally submitted to the PADEP on June 1, 2013. The NE Facility Concept Plan (FCP) was revised based on comments from PADEP and re-submitted on December 31, 2013.	A Wet Weather Facility plan was submitted on June 1, 2016 which supersedes the FCP. These plans are available on-line through the following website: http://phillywatersheds.org/what_were_doing/documents_and_data/cso_long_term_control_plan
Initiate the Facility Planning and Design for the By-pass Conduit	PADEP approved on April 1, 2009, the bypass of secondary treatment for 100 MGD of additional wet weather flow at NE WPCP	As described in the LTCPU, PWD committed to the expansion of the NE WPCP to include a 215 million gallon/day secondary treatment bypass. PWD proceeded with a design and the bypass of the plant secondary processes for total plant flows that exceed 435 MGD is currently under construction.

Project	Status	Update / Reference
Report to the DEP the Status of these Projects in the Annual Status Reports when Major Work Elements Are Completed	N/A	The CSO Annual Report continues to include information in the WPCP wet weather treatment maximization at the NE WPCP
85% Capture (NE) - 85% Flow Capture Technical Report	August 2008	Refer to Section III.B.1.3 85% Capture (NE) on page 71 of the CSO-Stormwater FY 2012 Annual Report.
In-Line System Storage Projects (NE)	N/A	Reported on in Section II.B.5 Operate and Maintain In-line Collection Storage System Projects Contained Within the LTCP of this report, starting on page 5.
Implementation of the Southwest Plant Stress Test Report Option 1	Option 1, to inspect and repair leaking weirs and concrete surfaces in the final sedimentation tanks at the Southwest Plant, was completed in April of 2002	Option 1 and other improvements were also discussed in further detail within the Facility Concept Plan for the Southwest Water Pollution Control Plant that was submitted to the PADEP on June 1, 2013. This plan is available on-line through the following website: http://phillywatersheds.org/doc/SW%20Facility%20Concept%20Plan%20-%20Final_FINAL.pdf.
Real Time Control (RTC) and Flow Optimization for the Southwest Drainage (SW) - Implementation of Projects for Real Time Control (RTC) and Flow Optimization for the Southwest Drainage District	Completed April 2010	Refer to Section III.B.1.8 Real Time Control and Flow Optimization for the Southwest Drainage on page 74 of the CSO-Stormwater FY12 Annual Report.
RTC/Main Relief Sewer Storage (SW) - Construction and Implementation of Main Relief Sewer Storage and Real-time Control		Refer to Section II.B.5 Main Relief on page 5 of this report
Eliminate CSO/Dobsons Run Project (SW) - Construction and Implementation of the Dobson's Run Project	Phases I completed in 1998; Phases II and III were completed by 2011.	Refer to Section III.B.1.10 Eliminate CSO/Dobsons Run Project on page 95 of the CSO-Stormwater FY11 Annual Report
Eliminate CSO/Main and Shurs Off-Line Storage (SW) - Construction and Implementation of the Main and Shurs Off-line Storage Project	In FY2019, the facility successfully captured 23 major storms storing a total of approximately 7.92 MG of sanitary wastewater. There were no overflows at R-20 during FY19.	Grit accumulation is a known USES issue that reduces interceptor capacity and the effectiveness of the Venice Island storage tank. PWD performs periodic grit surveys of the USES to better understand grit type and accumulation frequency. Cleanings are scheduled on an as needed basis.

III.B.1 On-going Capital Improvement Projects

Eliminate CSO/Main and Shurs Off-Line Storage (SW) - Construction and Implementation of the Main and Shurs Off-line Storage Project

The Upper Schuylkill East Side Interceptor Sewer (USES) is located along the Schuylkill River adjacent to the Manayunk Canal in the northwest section of Philadelphia. It conveys sewage from collection systems which serve the northwest section of the City. Previously, during extreme wet weather events, the USES exceeded its capacity and overflows occurred at relief point R-20 into a storm sewer upstream of storm water outfall S-052-5. To abate the hydraulic overload conditions in the USES, PWD constructed a four-million-gallon offline storage tank in May of 2013, which captures and stores excess flows. The tank serves to eliminate surcharges and prevent overflow conditions at the R-20 relief location.

The Venice Island Storage Facility is currently in service and operating as designed. In FY19, the facility took on water for 23 major storms storing a total of approximately 7.92 MG of sanitary wastewater. The weir elevation at the R20 relief window remained at 65 inches during FY19. There were no overflow events at R-20 during FY19.

Grit accumulation is a known USES issue that reduces interceptor capacity and the effectiveness of the Venice Island storage tank. PWD performs periodic grit surveys of the USES to better understand grit type and accumulation frequency. In FY19, PWD performed 1 sonar inspection on the lower reach of the USES interceptor. The results from this inspection are currently being reviewed and will be used to inform scheduling of future cleaning events along this interceptor.

Storm and sanitary sewer shed investigations are ongoing in areas found with high levels of infiltration and inflow.

III.B.2 New Capital Improvement Projects to be Included in LTCPU

PC-30 Parallel Relief Sewer

The project and all stipulations of the corrective actions and milestone events of the COA issued by PADEP on 9/26/2007 concerning the sanitary sewer overflows at manhole PC-30 were completed on 12/27/11. As of July 2013, the parallel relief sewer and all appurtenances have been operating as designed.

During FY19, there was one monitored overflow event at manhole PC-30. On 11/24/2018 in to 11/25/2018 the maximum water level in PC-0030 reached 184 inches; the overflow (top of manhole) is 174 inches. This event exceeded the parameters of the design storm intensities (April 2, 2005) utilized in the design of the PC-30 parallel relief sewer. The November 24-25, 2018 storm's accumulated rainfall volume are larger than the April 2, 2005 storm for the 3-, 6-, and 24-hour durations for the rain gages in Northeast Philadelphia (rain gages, 4, 20 and 24).

During the evaluation of the 11/24/2018 and 11/25/2018 wet weather event, the Department's documentation of the physical configuration at PC-30 and the elevation of overflow was found to be inaccurate, consequently the Department was not immediately aware of this overflow. Following notification by the PADEP of observations consistent with an overflow, the Department has undertaken several steps to ensure awareness of and swift response if future overflows occur:

1. *Updated site information and documentation*
   PWD's Survey group confirmed the rim elevation and manhole depth at PC-30. This work confirmed that flow depths in excess of 174 inches at PC-30 will result in an overflow through the manhole. This depth has been added to PWD documents related to this site and is now included in all SSO analyses and reporting moving forward.

2. *Inspection and verification of level sensor at PC-30*
   The Department continues to maintain a pressure transducer level sensor within the PC-30 manhole riser for understanding flow depths at this location. Upon notification of the possible overflow from the PADEP, the sensor was visited and calibrated to ensure accuracy. This sensor continues to be operated and regularly assessed for accuracy to ensure data collected is representative of sewer conditions.

3. *Installation of additional monitoring devices*
   Two float switches were added within the PC-0030 manhole riser to provide redundancy and serve as accuracy checks for the existing pressure transducer. The two floats were added at known elevations within the riser, including one just under the manhole cover. These allow for immediate verification of pressure transducer readings when flow depth trigger them. The addition of the second float under the manhole riser will provide for redundant verification if an overflow does occur in the future.

4. *Level Meter Utilized*
   At the time that PC-30 agreement was negotiated, a permanent water level monitor was already installed at manhole PC-10, at the junction of the Poquessing and Byberry Interceptors, about 660 feet downstream of PC-30. Based on the lack of reduction in velocity & flow rate during

overflow events, PWD assumed that there was no significant difference between the flow level at PC-10 and PC-30. The level at PC-10 was used as a surrogate for flow level at PC-30 for reporting to the PADEP. A monitor has since been installed and calibrated in PC-30 and PWD has switched to utilization of this monitor for more accurate regulatory reporting.

Table III.B.2-1 – Status updates for New Capital Improvement Projects to be included in LTCPU

Project	Status	Update / Reference
Asset and Capacity Management Program		
Geographic Information System	Ongoing	Refer to Section II.A.1 Implement a Comprehensive Geographic Information System (GIS) of the City sewer system on page 1
Sewer Assessment Program	Ongoing	Refer to Section II.A.2 Implement a Comprehensive Sewer Assessment Program (SAP) on page 1
Monitoring and Modeling Program	Ongoing	Refer to II.B.1 Continue to Institutionalize a Comprehensive Monitoring and Modeling Program on page 2
Inflow/Infiltration (I/I) Controls		
Tide Inflow	Completed in 1999	PWD continues to inspect and maintain all tide gates to ensure their correct performance. Refer to Section 2.1.2 Corrective Actions – Tide Inflow on page 28 of the 2001 CSO Annual Status Report
Sewer Assessment Program		Refer to Section II.A.2 Implement a Comprehensive Sewer Assessment Program (SAP) on page 1 of this report
Infrastructure Assessments	Completed in 2008; PWD continues to monitor and inspect for problem areas	Refer to Section III.B.2.2 Infrastructure Assessments on page 82 of the CSO-Stormwater FY 2008 Annual Report
Interceptor Relining	Planning and design is underway	Additional details on the progress of interceptor relining occurring in the Cobbs Creek and Tookany/Tacony-Frankford Watersheds are discussed in the Appendix A – Green City, Clean Waters FY19 Annual Report on page 5
PC-30 Parallel Relief Sewer	COA stipulations completed on 12/27/11. Operating as designed as of July 2013.	During FY19, there was one overflow event at manhole PC-0030. Please refer to page 39 of this report for more details.
Sewer Separation		
	Sewer separation was studied and modeled as one of the options in the LTCPU and deemed cost prohibitive. No sewer separation projects have been identified or implemented during the reporting period.	
New Storage Facilities		
	PWD is continuing to investigate opportunities to construct off-line CSO storage facilities to maximize existing sewer treatment capacity and increase the volume of CSO captured and treated. No new storage facility projects have been identified or implemented during the reporting period.	

III.C Watershed-Based Management - Continue to Apply the Watershed Management Planning Process and Produce and Update the Watershed Implementation Plans

Watershed Alliance of Southeastern Pennsylvania

In 2013, PWD and its designated watershed partnership facilitator, the Pennsylvania Environmental Council (PEC), initiated the Watershed Alliance of Southeastern PA to unite the watershed partnerships in the Philadelphia area. In FY19, PEC continued its support of the implementation of the Upstream Philadelphia Cluster. These efforts resulted in the award of $50,000 in National Fish and Wildlife Foundation funding (with another $136,828 in associated matching funds) for stormwater management at the Conklin Recreation Center in Cheltenham Township, PA (Tookany/Tacony-Frankford Watershed).

Tookany/Tacony-Frankford Watershed Partnership

In FY19, the TTF Watershed Partnership held 234 outreach events in Philadelphia County with approximately 3,609 participants in attendance. For more information on the activities conducted by TTF Watershed Partnership please refer to Section II.F.4 on page 17.

Darby – Cobbs Watershed Partnership

During the past fiscal year, the Partnership focused on outreach and education, to implement previously identified project opportunities through the William Penn Foundation's Delaware Watershed Protection Initiative. Also during FY19, the partnership continued work on implantation of projects funded through the Delaware River Watershed Initiative. Additionally, PWD utilized the partnership to aid in public outreach and municipal approval for ecological restoration projects along the Cobbs Creek including a partial removal of the Woodland Ave. Dam.

Pennypack Creek Watershed Partnership

The Partnership continues to organize activities to involve the community in improving the watershed. In FY19 the partnership continued education and outreach towards implementing the projects identified under the William Penn Foundation's Delaware Watershed Protection Initiative. The partnership also conducted workshops on rain gardens, citizen stream monitoring, Mowing to Meadows and municipal MS4 compliance.

Poquessing Creek Watershed Partnership

The Poquessing Creek Watershed Partnership holds a range of public education and outreach activities and events every year for residents. The Poquessing Partnership also participates in the Upstream Philadelphia Cluster of the William Penn Watershed Initiative developing programs for citizen monitoring and identification of stormwater projects in the watershed.

Delaware Direct Watershed Partnership

Throughout FY19, the Partnership continued its work acquiring grant funding to support restoration projects throughout the watershed. The Kensington and Tacony Trail, an abandoned riverfront rail line, continued to move forward in FY19 with the expansion of new trail segments. PWD also continued a successful partnership with sustainable retailer United by Blue (UBB). For more information, please refer to **Section II.F.4 United By Blue Cleanups** on page 17.

Wissahickon Creek Watershed Partnership

PWD continued its participation in the Wissahickon Partnership throughout FY19. A key component of these efforts was the continuation of an alternative TMDL program for phosphorous in the watershed. The City of Philadelphia is one of 16 regional municipalities cooperating in this program with assistance from the Pennsylvania Department of Environmental Protection, the Wissahickon Valley Watershed Association and the Pennsylvania Environmental Council (PEC). The Wissahickon Partnership is also actively participating in components of the Delaware River Watershed Initiative, including citizen monitoring as well as project identification and implementation.

Schuylkill River Watershed Partnership (Philadelphia-Based Partnership)

PWD continued to support the efforts of the Schuylkill Action Network (SAN), a regional watershed partnership dedicated to improving the water resources of the Schuylkill River Watershed through strategic implementation of protection measures. More information on the SAN can be found in **Section II.G.2** on page 20 of this Annual Report. Also in FY19, PWD continued to build on the successful partnership with the Schuylkill Navy of Philadelphia. This partnership led to the Head of the Schuylkill Regatta, becoming the first national rowing event to ban the use of plastic water bottles.

Implementation Planning - Development of Target Approach for Meeting Goals and Objectives

The culmination of the watershed management planning process often results in an Integrated Watershed Management Plan (IWMP), or a watershed-specific planning document. The process for developing watershed planning documents has evolved and depends on the interests of the partnerships. **Table III.C.1-2** contains the status of the various plans in each of Philadelphia's watersheds. Information on the each of the watersheds and the completed plans can be found at www.phillywatersheds.org/your_watershed. Many of the recommended management options in the TTF and Cobbs Creek IWMPs have been institutionalized a city-wide basis and continue to be implemented.

The watersheds in the MS4 section of the City have undergone a slightly different process. In these watersheds (Pennypack, Poquessing, and Wissahickon), the stakeholder goals and objectives were established through the development of Rivers Conservation Plans and Act 167 Plans. PWD has decided to work with the watershed partners through these existing watershed-based planning efforts. Details on the Act 167 Plans can be found in **Section III.C.3.7 Basin-Specific Stormwater Management Plans (ACT 167)** on page 47**.** The Act 167 process has met PWD's goal to have watershed-wide commitment to the watershed planning process and allows the process to be partner-driven and focus on implementation.

Table III.C.1-2 – Planning by Watershed

Watershed	Preliminary Reconnaissance	Watershed Monitoring Program	River Conservation Plan	Watershed Management Plan	Implementation Commitment Status
Delaware River (tidal, non-tidal)	Monitoring Only		Completed in 2011	PWD continues to work with watershed partners on implementing specific projects.	Philadelphia commitment documented in the LTCPU and its supplements.
Cobbs-Darby Creeks	2003	2003	Darby RCP completed in 2005 by Darby Creek Valley Association	Completed 2004	Philadelphia commitment documented in the LTCPU and its supplements.
Tacony-Frankford Creek	2000/2001	2004	Completed in 2004	Completed 2005	Philadelphia commitment documented in the LTCPU and its supplements.
Pennypack Creek	2002	2007-2008	Completed in 2005	Act 167 Stormwater Management Plan approved in July 2013	Philadelphia is implementing the Act 167 Plan through the Philadelphia Stormwater Management Regulations.
Schuylkill River (tidal, non-tidal)	Monitoring Only		Completed in 2001 by the Academy of Natural Sciences, Natural Lands Trust, and the Conservation Fund	PWD continues to work with watershed partners on implementing specific projects.	Documented in the LTCPU and its supplements.
Poquessing Creek	2001	2008-2009	Completed in 2007	Act 167 Stormwater Management Plan approved August 28, 2013.	Philadelphia is implementing the Act 167 Plan through the Philadelphia Stormwater Management Regulations.
Wissahickon Creek	2001	2005-2006	Completed in 2000 by FPC	Act 167 Stormwater Management Plan approved on July 10, 2015	A Wissahickon TMDL Implementation Plan was submitted in 2012. Implementation plan depends on watershed partnership support for a watershed-wide initiative.

III.C.1 LAND: Wet-Weather Source Control

Watershed management fosters the coordinated implementation of programs to control sources of pollution, reduce polluted runoff, and promote managed growth in the City and surrounding areas, while protecting the region's drinking water supplies, fishing and other recreational activities, and preserving sensitive natural resources such as parks and streams.

PWD is committed to a balanced "land-water-infrastructure" approach to achieve its watershed management and CSO control goals. Where appropriate, this method includes infrastructure-based approaches, but focuses on implementation of a range of land-based stormwater management techniques and physical reconstruction of aquatic habitats where appropriate. The ultimate goal of PWD's approach is to regain the resources in and around streams that have been lost due to urbanization, both within the City of Philadelphia and in the surrounding counties, while achieving regulatory compliance objectives in a cost-effective manner. Central to all of these planning programs is a commitment to greening, sustainability, open space, waterfront revitalization, outdoor recreation, and quality of life.

The wet-weather source controls have been formalized in the LTCPU and its supplements, including the Consent Order and Agreement signed on June 1, 2011, which formally approved the *Green City, Clean Waters* program. Detailed information on the land-based wet-weather source controls can be found in **Appendix A – Green City, Clean Waters FY19 Annual Report.**

III.C.1.1 Ordinance and Regulations Modifications - Continue to review and revise stormwater management regulations for development and redevelopment

PWD's Stormwater Management Regulations became effective in Philadelphia on January 1, 2006, which provided PWD with an opportunity to ensure development/redevelopment that protects our water resources, reduces neighborhood flooding, and improves the quality of life in our communities. The Stormwater Management Regulations are triggered when a project disturbs 15,000 or more square feet of earth. Effective July 1, 2015, the Stormwater Regulations were updated to improve and strengthen PWD's stormwater programs. For more information on PWD's Regulations, please see the MS4 Annual Report **Section F.5.b – Post-Construction Stormwater Management in New Development and Redevelopment** on page 29.

III.C.1.2 Conduct workshops on LID

PWD staff in charge of Stormwater Regulation implementation holds weekly walk-in hours, encouraging the development community to attend to discuss general and technical details regarding their projects. Guidance is provided by PWD staff as it relates to regulatory applicability as well as stormwater management implementation and approach without the need to schedule an appointment.

III.C.1.3 Implementation of Stormwater BMPs and LID - Continue to implement best management and LID demonstration

PWD continues to implement stormwater BMPs and LID, now referred to as Green Stormwater Infrastructure (GSI) through the Green City, Clean Waters program. Please refer to **Appendix A – Green**

City, Clean Waters FY19 Annual Report for a detailed description on the City's implementation of GSI during FY19.

III.C.1.4 Catch Basin Control Program - Continue to maintain the trapped inlets

PWD continues to maintain all City-owned inlets and catch basins to ensure they are clear and operating correctly. For a full description of the activities conducted by inlet cleaning programs during FY19, please refer to **Section II.F.1 Control the Discharge of Solids and Floatables by Cleaning Inlets and Catch Basins** on page 13.

III.C.1.5 Impervious Cover Disconnection - Evaluate the feasibility of separating the stormwater runoff from large impervious land tracts for management and direct discharge

PWD is working to separate stormwater runoff from large impervious tracts of land using incentives and regulatory-based approaches. Projects that apply for PWD's grant programs, Stormwater Management Incentives Program (SMIP) and Greened Acre Retrofit Program (GARP), are evaluated for disconnection potential and encouraged to construct connections to available separate storm sewer or private stormwater outfalls where feasible. To date, PWD has awarded a number of projects where this potential exists, and in the last year, three projects successfully disconnected from the combined sewer system.

III.C.1.6 Reforestation - Work to implement reforestation demonstration projects to provide additional tree canopy

Green Stormwater Infrastructure Projects

Community greening and tree planting is a key component of green stormwater infrastructure and the *Green City, Clean Waters* plan. PWD has been planting trees as part of the GSI projects. Please refer to **Appendix A – Green City, Clean Waters FY19 Annual Report** for information on trees planted as part of GSI projects implemented in the City.

Street Tree Planting

As part of supporting the City's GreenWorks goals, PWD has partnered with PPR to conduct street tree plantings. PPR contracted trees to be planted in the right-of-way in front of properties and on public lands. During FY19, 880 street trees were planted through this contract.

TreePhilly Yard Tree Program

TreePhilly is an urban forestry community engagement initiative led by PPR, in partnership with the Fairmount Park Conservancy. TreePhilly directly engages all Philadelphians in improving their communities by planting and maintaining trees. Through TreePhilly's Yard Tree Giveaway program, Philadelphia residents can sign up for free yard trees for their private property (front, back, and side yards). In the FY19 the Yard Tree Giveaway program distributed approximately 1,800 trees for residents to plant on their private property, and TreePhilly also engaged corporate and community volunteers to plant 4 large trees at Overington Park for Arbor Day.

Pennsylvania Horticultural Society's Tree Plantings

PWD is an active partner and supporter of *TreeVitalize* and PHS's other tree planting programs. TreeVitalize was developed by the Pennsylvania Department of Conservation and Natural Resources to increase the tree canopy in the five-county Philadelphia area. TreeVitalize partners with numerous community Tree Tenders groups throughout this area in order to plant trees in neighborhoods lacking sufficient tree canopy. During FY19, PHS tree planting events resulted in 1,542 trees planted in Philadelphia.

Table III.C.1.6 -1 Pennsylvania Horticultural Society's FY19 Tree Plantings in Philadelphia

# of Trees	Pennsylvania Horticultural Society's Tree Plantings
933	Philadelphia TreeVitalize/Tree Tenders street and yard trees (Liberty Lands Park, School of the Future, McClure Elementary, Hackett Elementary, H.A. Brown Elementary, Greenfield School, and Moffet Elementary; street tree plantings in many low/mod income areas and over 35 neighborhoods, including Poplar, Francisville, Spring Arts, Hunting Park, East Parkside, Cobbs Creek, and Lower Moyamensing)
513	TreeVitalize Watersheds riparian plantings (Schuylkill Navy, Schuylkill Center for Env. Education)
53	Philadelphia Public Landscapes (Navy Yard, Sports Complex District)
38	Arbor Day Foundation/TD Tree Days – Presby's Inspired Life campus
5	Philadelphia LandCare – Mt Moriah cemetery
1,542	**TOTAL TREES (FY19)**

III.C.2 Water Ecosystem Restoration and Aesthetics

III.C.2.1 Waterways Restoration Team - Continue the assignment of a dedicated clean-up team to remove cars, shopping carts, and other debris, from CSO receiving waters

During FY19, the Waterways Restoration Team has continued their program which includes removal of cars, shopping carts, and other debris from receiving waters. Please refer to **Section II.F.2 Continue to Fund and Operate the Waterways Restoration Team** on page 14 for information pertaining to the Waterways Restoration Team's activities during FY19.

III.C.2.2 Waterways Restoration Team - Evaluate the capabilities of this crew in performing minor stream bank and bed repair around outfall pipes and to remove debris at these outfalls

During FY19, the Waterways Restoration Team continued their program, which includes conducting minor stream bank and bed repairs around outfalls and removing debris around them. Please refer to **Section II.F.2 Continue to Fund and Operate the Waterways Restoration Team** on page 14 for information pertaining to the Waterways Restoration Team's activities during FY19.

III.C.2.3 Stream Habitat Restoration - Propose and implement demonstration projects to address habitat degradation by engineering the stream channels to modern day flows and directly reconstructing the aquatic habitat

PWD is currently employing natural stream channel design (NSCD) and associated stormwater management BMPs as a means to improve the health of aquatic communities in receiving waters with degraded flow and habitat alterations due to stormwater runoff.

Cobbs Creek Stream Restoration

This project has been placed on hold due to the property issues encountered along the City border. Cobbs Creek serves as the City border in this area and working out agreements with individual landowners has proved to be an obstacle in moving the project forward.

Tacony Creek Stream Restoration

During FY19, PWD has reviewed the design plan for the restoration of about a mile of Tacony Creek. The design was adjusted to address issues in the stream channel that have evolved during the design process. The new design will provide a more stable stream channel, protect trees along the stream bank, create sustainable aquatic and riparian habitat, provide more wetland area for stormwater management and baseflow recharge, and repair and protect critical water utility infrastructure to ensure better water quality for Tacony Creek.

Indian Creek Stream Daylighting & CSO Storage Project

During FY19, PWD continued to monitor the site. Biological studies of macro-invertebrates and fish species in the Indian Creek daylighted stream channel were conducted in FY17 to establish a baseline for comparison. PWD has provided the flow data for the Combined Sewer Overflow storage facility. PWD will continue to conduct monitoring research on this daylighted project site and enhance the stream corridor when possible.

Wissahickon TMDL Stream Restoration Projects

As part of the Wissahickon Sediment TMDL Implementation Plan, PWD implemented multiple stream restoration projects. These projects include:

- Cathedral Run (Construction Completed in 2006)
- Carpenter's Woods (Construction Completed in 2009)
- Hartwell Lane (Construction Completed in 2009)
- Rex Avenue (Construction Completed in 2010)
- Cresheim Creek at St. Martins (Construction Completed in 2011)
- Bells Mill Run (Construction Completed in 2012)
- Wises Mill Run (Construction Completed in 2012)
- Gorgas Run (Construction Completed in June 2018)

Because these projects were completed as part of the Wissahickon Sediment TMDL Implementation Plan, a more detailed description of PWD’s efforts have been provided in the **Section D – Sediment**

Wissahickon Sediment TMDL Monitoring plan implementation on page 1**.** A monitoring report was submitted to PADEP in FY18.

III.C.2.4 Wetland Enhancement and Construction

Three stormwater treatment wetlands facilities were designed and implemented to remove pollutants and mitigate peak flows, while providing aesthetic and ecological benefits. These projects are:

- Saylor's Grove (Construction Completed in 2006)
- Wise's Mill (Construction Completed in 2012)
- Cathedral Run (Construction Completed in 2012)

In total, these three facilities receive and treat stormwater from more than 300 acres of the MS4 service area. Because these projects were completed as part of PWD's Wissahickon Sediment TMDL Implementation Plan, a more detailed description of the Department's efforts has been provided in **Section D - Wissahickon Sediment TMDL Monitoring plan implementation** on page 2. PWD is working to maintain these project sites.

Watershed Mitigation Registry

PWD has continued investigating projects and partnerships that could potentially be suited for the state's mitigation banking program.

III.C.2.5 Fish Passage Projects

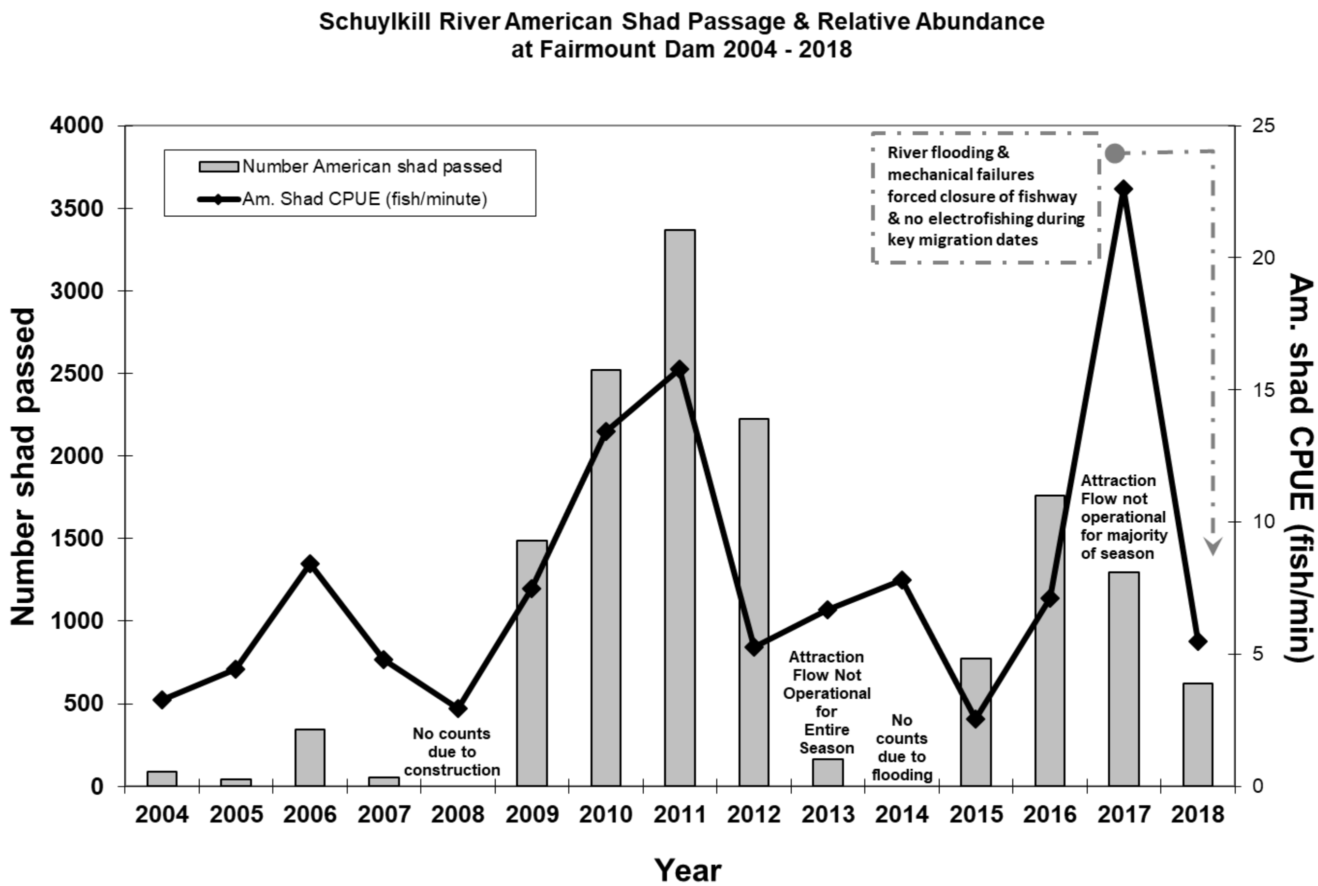
Schuylkill River: Fairmount Fishway

The Fairmount Dam Fishway located on the western side of the Fairmount Dam, was completed in 1979. In 2009, through a joint cooperative agreement with the United States Army Corps of Engineers (USACE), the City of Philadelphia upgraded many features of the fishway to improve hydraulics and overall fish passage efficiency.

Adult American Shad relative abundance (number of Shad per hour of electrofishing) in the Schuylkill River in 2018 ranked 9th overall in the time-series (2002-2018). The 2018 CPUE at Fairmount Dam (328.9 Shad/hour) was below the time series average (2002 – 2018). It should be noted that boat electrofishing surveys could not be conducted during peak migration dates for American Shad because of river flooding and high river flows, as well as excessive turbidity, which resulted in reduced overall catch of Shad. Similarly, river flooding forced complete closure of the Fairmount Fishway during key migration dates; and when we could operate the fishway, mechanical failure of the tide gate resulted in no attraction flow for the complete season. The 2018 American Shad passage at Fairmount Fishway (624 Shad) decreased from the previous year and fell well below the 15-year time series average (1053.5 Shad). The 2018 Shad passage at Fairmount was the 8th highest recorded in the time-series (2004 to 2018). River flooding, and overall high water flows and high turbidity conditions characterized the 2018 Shad season, which negatively impacted our ability to catch and video monitor Shad in the Schuylkill

River. Hatchery contribution for the Schuylkill River adult shad was 95% in 2018; a slight increase from the 92% observed in 2017 and greater than the 10-year average of 89%.

Figure III.C.2.5 -1 Catch-Per-Unit-Effort and Fish Passage of American Shad



Pennypack Creek: Rock Ramp Fishway at Sanitary Sewer Crossing

A rock ramp fishway was constructed in Pennypack Creek in 2007 in an attempt to alleviate the excessive drop in water surface elevation caused by the sanitary sewer crossing of the creek which prevented fish from moving upstream of this site. PWD electrofishing surveys of the tidal Pennypack Creek have documented a limited spawning population of anadromous Alewife and Blueback Herring several miles downstream of the rock ramp fishway. Both juvenile and adult Striped Bass have been collected in the tidal portion, but not above the rock ramp. No adult Hickory Shad have been collected above or below the rock ramp; no larvae were stocked 2016 to 2018 by PA Fish and Boat Commission, who had been stocking larvae for several years in an attempt to establish a self-sustaining wild population, which has yet to have been realized.

Dam Removal Projects

Juniata Golf Course Dam Removal

PWD completed the pre-dam removal monitoring of the site in December 2016. A field meeting was held in February 2017 to discuss the staging/storage areas, the limits of disturbance, and stream channel access. The construction access route and staging/storage areas will be revised for the 100% submission. Philadelphia Parks & Recreation (PP&R) conducted a structural inspection of the superstructure of the bridge and had concerns in a few areas. PP&R and PWD will be meeting to discuss the project path for the repairs either through interfund or a separate project before the dam removal. The Joint Permit application was submitted in October 2016.

Woodland Dam Removal

PWD has encountered significant property access barriers that have prevented this project from moving to construction. The Army Corps of Engineers has put this project on hold indefinitely and will pick up an alternative project (Boulevard Dam Removal) in its place.

Boulevard Dam Removal

PWD has developed a design to lower the dam upstream of the Roosevelt Boulevard (Route 1) Stream Crossing to address recurrent flooding of a sewer access trail. This design includes a rock ramp fishway to improve upstream and downstream habitat connectivity. PWD has preliminarily coordinated with the Army Corps of Engineers to fund the project through a cost-sharing program.

III.C.2.6 Riparian Buffer Creation and Enhancement

Environment, Stewardship & Education Division

PWD continues to support Philadelphia Parks and Recreation, which undertakes a broad range of environmental restoration activities throughout the park system. Restoration activities have been ongoing since 2008. These efforts have been discussed in previous years; for more details and a full list of these activities, please refer to Section III.C.2.6 Environment, Stewardship & Education Division on page 121 of the CSO-Stormwater FY12 Annual Report.

Riparian Buffer component of Stream Restorations

Riparian buffer enhancement will be evaluated in all stream restorations that are completed. Typically, riparian buffer enhancement activity includes invasive species management, live-stake planting, tree and shrub planting, and native seed mix application. Invasive species management usually begins one to two years prior to construction. Once the construction of the stream restoration project is complete, a landscaping plan is implemented which includes all of the applications mentioned above. Please refer to **Section III.C.2.3 Stream Habitat Restoration** on page 42 and **Section III.C.2.4 Wetland Enhancement and Construction** on page 43 in this report for more information on these topics.

Natural Lands Team

The Natural Lands Team, initiated in 2011, is a group comprised of members from PWD's Ecological Restoration Unit, Waterways Restoration Team, Public Affairs, PWD Design Branch and staff from Philadelphia's Department of Parks and Recreation. Bi-monthly meetings are held to coordinate a wide range of projects that affect the City's stream corridors and natural areas. Through centralizing the myriad of ongoing and upcoming projects, this group works to improve efficiency and communication. Projects include but are not limited to stream restoration, wetland creation, stormwater management, infrastructure protection and invasive species management. During FY19, the Natural Lands Team convened 6 times to discuss upcoming projects and potential issues that could be addressed by the team members.

III.C.3 Other Watershed Projects

III.C.3.1 River Conservation Plan - Continue to work in partnership with local partners to complete and implement River Conservation Plans (RCPs)

All River Conservation Plans (RCPs) are available for viewing at:
http://www.phillywatersheds.org/your_watershed/ under each respective watershed's key documents.

Table III.C.3-1: River Conservation Plan References

River Conservation Plans	Complete Date	Previous Reference
Darby Creek	2005	Page 121 of the CSO-Stormwater FY 2008 Annual Report.
Tacony-Frankford	2004	Page 74 of the FY 2005 Stormwater Annual Report.
Pennypack	2005	Page 122 of the CSO-Stormwater FY 2008 Annual Report.
Poquessing	2007	Page 155 of the CSO-Stormwater FY 2010 Report.
Delaware Direct	2011	Page 151 of the CSO-Stormwater FY 2011 Annual Report

III.C.3.2 Watershed Information Center - Create a website to serve as a Watershed Information and Technology Center

The City maintains several websites that provide information on our watersheds and activities within them, please refer to **Section II.G.2 Continue to Maintain Watershed Management and Source Water Protection Partnership Websites** on page 20 and **Section II.H.2 Expand the Internet-Based Notification System (River cast) to the Tidal Section of the Lower Schuylkill River** on page 28 for additional information on the websites.

III.C.3.3 Integrated Water Use Status Networks - Pilot a communication and water quality monitoring network that supports the identification and analysis of water quality events

PWD has two communication and water quality monitoring networks. RiverCast supports the identification and analysis of water quality events to support recreational water use status decisions (swimming, triathlons, rowing, etc.) and makes this information available in real time to the public. EWS is used to monitor water quality and notify water utilities about such events as hazardous substance spills or sudden changes in water quality.

Please refer to **Section II.G.2 Continue to Maintain Watershed Management and Source Water Protection Partnership Websites** on page 20 for details about these communication and water quality monitoring systems.

III.C.3.4 Integrated Water Use Status Networks - Evaluate the technical and fiscal needs to expand the network into additional receiving waters where recreational uses are taking place.

Please refer to Section II.H.2 **Expand the Internet-based Notification System (Rivercast) to the Tidal Section of the Lower Schuylkill River** on page 28 for information pertaining to this topic.

III.C.3.5 Interpretive Signage - Continue to implement interpretive signage

Green Stormwater Infrastructure and Restoration Locations Signage

Information on the *Green City, Clean Waters* Signage Program can be found within **Appendix A- Green City, Clean Waters FY19 Annual Report** on page 23.

III.C.3.6 Interpretive Centers - Continue to support existing educational interpretive centers to educate citizens about their community and the water environment

PWD supports several existing educational centers including FWW and many public outreach efforts conducted by partners. Please refer to **Section II.G.3 Continue to Provide Annual Information to City Residents about Programs via Traditional PWD Publications** on page 24 and **Section II.G.4 Continue to Support the Fairmount Water Works** on page 30 for more information on activities done in FY18 by the FWW and partner sponsored events.

III.C.3.7 Basin-Specific Stormwater Management Plans (Act 167) - Continue to support the State Act 167 Storm water Management Planning process and integrate the results of these efforts into the watershed management plans and implementation plans

As of July 10, 2015, all Act 167 plans have been approved. Please refer to **Table III.C.1-2 Planning by Watershed** on page 38 for more information.

III.C.3.8 Sewage Facility Planning - Continue to review sewage facility planning modules and downstream sewage conveyance and treatment facilities to ensure that adequate capacity exists within these systems to accommodate flow

During FY19, PWD reviewed 1,271 "Sewage Facilities Planning Module Application Mailers" for projects requiring building permits within Philadelphia County. During the same period, PWD issued 78 sanitary sewer capacity certifications for projects in tributary municipalities.

III.C.4 Monitoring and Assessment

III.C.4.1 NPDES – Quarterly Special Discharge Monitoring Report

PWD is committed to submitting the Quarterly Special Discharge Monitoring Report (DMR) documenting the Department's CSO discharges during the specified time periods. This report is due 45 days after the end of each quarter, and is submitted by February 15, May 15, August 15, and November 15 of each year. During FY19, three DMRs were submitted within the 45-day timeframe. Due to administrative oversight, the quarter 1 DMR was submitted on August 9, 2019. These reports are also referred to as Quarterly Combined Sewer Overflow Status Reports.

III.C.4.2 NPDES - Annual CSO Status Report

Monitoring and characterization of CSO impacts from a combined wastewater collection and treatment system are necessary to document existing conditions and to identify water quality benefits achievable by CSO mitigation measures. The tables included in **Appendix D** and other information provided within this annual report represent the average annual CSO overflow statistics for period July 1 2018 – June 30 2019 as required in the NPDES Permit. Please refer to **Table 1 in Appendix D – NPDES – FY19 CSO Status Report** on page 2 for a listing of all CSO permitted outfalls. The tables have been reorganized to present overflows by the specific receiving water into which the CSOs from a given interceptor system discharge. In order to be consistent, the column headings are presented in the same format found in the System Hydraulic Characterization (SHC) and NMC Documentation.

III.C.4.3 Rotating Basin Approach to Watershed Monitoring - Continue to implement a rotating basin approach to watershed monitoring in CSO receiving waters in order to characterize the impact of CSO discharges and other pollutant/pollution sources and the efficacy of CSO controls and watershed restoration practices.

The Rotating Basin Approach has been replaced with a "Comprehensive Watershed Monitoring Program," a monitoring strategy developed by PWD to comply with both the City's stormwater and CSO permit requirements and to assist with the Source Water Protection Program's objectives.

Please refer MS4 Annual Report **Section F.2.Step 1.b – Preliminary physical, chemical and biological quality assessment** on page 8 for information about Comprehensive Watershed Monitoring Program.

Stormwater Management Program Annual Report

National Pollutant Discharge Elimination System (NPDES) Permit No. PA 0054712
Reporting Period July 1, 2018 to June 30, 2019

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Section F

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Part I Permit Conditions

Section A Applicability and Limitation on Coverage

The City will comply with the permit language on what are authorized and unauthorized stormwater discharges.

Section B Legal Authority

In accordance with the National Pollutant Discharge Elimination System (NPDES) regulations contained in 40 C.F.R. Sections 122.26(d)(1)(ii) and (d)(2)(i), the City maintains adequate legal authority to enforce the Stormwater Management Program through the Philadelphia Code (Code) and the Water Department (PWD) Regulations.

Code Section 13-603 regulates discharges into the storm sewer system and includes penalties for violations. Code Section 13-603(4)(a) grants PWD and the Department of Licenses and Inspections (L&I) the authority to require compliance, including issuing regulations, and investigating, inspecting, and monitoring all premises. Under the City's zoning provisions in Code Sections 14-301(10) and 14-704(3), PWD has the authority to regulate stormwater management on a City-wide basis. Code Section 14-306(1) grants PWD and L&I specific enforcement authority for zoning violations. The Code can be accessed at http://www.amlegal.com/library/pa/philadelphia.shtml.

PWD Regulations further provide PWD legal authority to enforce the Stormwater Management Program. Section 500 prohibits cross connected sewer laterals and Chapter 6 implements the authority to regulate stormwater management for new and redevelopment in the City. PWD Regulations can be accessed at http://www.phila.gov/water/wu/ratesregulationsresp/Pages/Regulations.aspx.

This Annual Report is submitted to the Pennsylvania Department of Environmental Protection (PADEP) and the US EPA, in accordance with requirements of the City of Philadelphia's NPDES Stormwater Management Permit No. PA 0054712. The report documents the Fiscal Year 2019 (FY19) progress completed in order to comply with the requirements during the reporting period from July 1, 2018 to June 30, 2019.

Section D Sediment Total Maximum Daily Load (TMDL) for Wissahickon Creek

Wissahickon Sediment TMDL Monitoring Plan Implementation

PWD's commitment to meeting the Wissahickon Sediment TMDL was initiated in 2005 through detailed monitoring and assessment of the Wissahickon Creek Watershed. The goal of PWD's implementation is to reduce the amount of sediment reaching the Wissahickon Creek using a multi-faceted approach. In addition to implementing and strengthening stormwater management regulations, PWD has implemented three stormwater wetland facilities and seven stream restoration and stabilization projects. During FY14, PWD completed the Sediment TMDL Baseline Monitoring Report in November

2013 based on the previously submitted TMDL Monitoring Plan. This report was submitted with the FY14 CSO-MS4 Annual Report. The baseline monitoring report documents the data collected following the implementation of the stormwater wetland facilities and stream restoration projects. This information will be used to measure sediment reductions as a result of the implemented projects. The initial phase of this effort included baseline monitoring to measure the effectiveness of the stream restoration and stormwater treatment wetland facilities projects in meeting the targeted sediment reductions and H&H modeling and topographic survey monitoring to confirm sediment reduction estimates presented in PWD's Implementation Plan.

PWD submitted a Wissahickon Siltation TMDL Implementation Plan Update in March 2018. This document includes updates on the 2012 Siltation TMDL Implementation Plan’s four components: stream restoration, stormwater wetlands, inlet catch basin cleaning, City of Philadelphia Stormwater Regulations and the estimated sediment reduction associated with these activities. A more detailed Wissahickon Siltation TMDL Monitoring Report (with appendices) was also submitted in March 2018. The Monitoring report includes results from cross-sectional survey analysis of stream restoration projects, photo monitoring, in-stream evaluations of stream restoration structures and Hydraulic and Hydrologic modeling of stormwater wetlands.

Section E Pollutant Minimization Plan for Polychlorinated Biphenyls in the City’s MS4

During the twelfth year of the PCB PMP, the following tasks were accomplished:

- 85 of the 337 remaining sites listed by EPA or other agencies as housing PCB containing devices were inspected.
- Wet-weather PCB sampling and analysis of the three WPCPs effluent was performed as required by the WPCP NPDES permits.
- PWD continued monitoring outlying township connections using EPA Method 680.
- PWD continued monitoring of groundwater discharged from new construction and remediation sites to ensure compliance with PWD’s published PCB limit of “non-detection by EPA Method 608.” PWD issued 14 groundwater discharge permits in calendar year 2018. Every permit was compliant with PWD’s published PCB limit of “non-detection by EPA Method 608."
- PWD wet and dry weather WPCP effluent data have been entered into the DRBC PCB database.
- Significant reductions in WPCP effluent PCB loadings were seen over the course of the PMP.

Additionally, the following initiatives were undertaken:

- PWD’s PCB database was developed in 2017 and is now being populated. The database was utilized to track and report the 2018 inspections.
- Each location has been given a unique ID and has been geocoded in PWD’s GIS database. Maps of PCB sites inspected in 2018 were created to show inspections by water pollution control plant drainage area.
- Generation of interactive GIS maps to assist in identifying areas of concern and planning any additional efforts to identify potential sources.

Section F Stormwater Management

F.1. Source Identification

A description of PWD's MS4 Infrastructure, including: stormwater outfalls, lengths of sanitary sewer, and lengths of stormwater sewer within Philadelphia are shown in **Table 1-1**. The 205 "Non-PWD Owned" outfalls listed in the table are owned by other City agencies, private entities, or individuals. The PWD-owned stormwater outfall locations and MS4 areas are shown in **Figure F.1-1**.

Table F.1-1: Description of MS4 Infrastructure

Watershed	Drainage Area (Square Miles)	Miles of Pipe			MS4 Outfalls Count	
		Stormwater	Sanitary	Total MS4	PWD Owned	Non-PWD Owned
Darby-Cobbs	-	1.02	0.81	1.82	3	-
Delaware Direct	3.15	79.81	52.68	132.49	18	122
Pennypack	11.67	234.93	234.03	468.96	130	14
Poquessing	8	154.71	156.52	311.23	141	19
Schuylkill	8.48	153.43	156.82	310.26	45	47
Tacony	2.47	54.46	59.02	113.48	34	1
Wissahickon	5.79	95.18	104.86	200.03	63	2
Total	**39.56**	**773.53**	**764.74**	**1538.27**	**434**	**205**

GIS Data Layers have been submitted within a geodatabase, **PWD_Annual_Report_GIS_Data_2019.mdb** which can be found on the **Supplemental CD.** The GIS Data Feature class filenames within the geodatabase are provided in **Table F.1-2.**

Table F.1-2: GIS Data Feature Classes within Geodatabase named - PWD_Annual_Report_GIS_Data_2019.mdb

• All_PWD_Monitoring_FY19	• PCB_Locations_Known_Historical
• GSI_Monitored_Locations_FY19	• NPDES_Permitted_Dischargers_FY19
• Public_GSI_Projects_Completed_FY19	• Detention_Basins_Philadelphia
• Public_GSI_Projects_Planned_FY19	• Impervious_Surfaces_Planimetric_2004
• Pollution_Migration_Events_FY19	• Major_Watersheds_Full_Extent
• Active_Construction_Sites_FY19	• Major_Watersheds_Philadelphia_Clip
• Verified_Regulations_FY19	• Sewersheds_FY19
• Verified_Retrofits_FY19	• Census_Blocks_2010_Philadelphia
• New_Project_Submissions_FY19	• Stormwater_Outfalls
• Technical_Approvals_FY19	• Stormwater_Outfalls_with_DrainageArea_Summary
• Sanitary_Infiltration_Events_FY19	• Stormwatersheds_Pennypack
• Hydrology_Centerline	• Stormwatersheds_Poquessing
• Hydrology_Polygon	• Stormwatersheds_Wissahickon
• Land_Use_PCPC_2018Land_Use_PCPC_2019	• Point_Sources_Wissahickon
• PCB_Locations_Known_Historical	• Scrap_Yard_Inspections_FY19

Figure F.1-1 City of Philadelphia Stormwater Outfalls

Descriptions of the GIS layers referenced in **Table F.1-2** are provided below:

All_PWD_Monitoring_FY19
This layer presents the locations of PWD's chemical, fish, macroinvertebrate, and algae sampling sites. The contents of this feature class are discussed in **Section F.2.Step.1.b** on page 8.

GSI_Monitored_Locations_FY19
This layer presents the locations of existing green stormwater infrastructure projects actively monitored by PWD in Philadelphia County.

Public_GSI_Projects_Completed_FY19
This layer presents the locations of completed publicly implemented green stormwater infrastructure projects sorted by their current status within Philadelphia County.

Public_GSI_Projects_Planned_FY19
This layer presents the locations of planned publicly implemented green stormwater infrastructure projects sorted by their status within Philadelphia County.

Pollution_Migration_Events_FY19
This layer presents the locations of spills documented by PWD Industrial Waste Unit within Philadelphia in FY19. The contents of this layer are discussed in **Section F.7.a – Pollutant Migration/Infiltration to the MS4 System** on page 33.

Active_Construction_Sites_FY19
This layer presents the locations of active construction private development projects within Philadelphia in FY19. The contents of this layer are discussed in **Section F.5 – Monitor and Control Stormwater from Construction Activities** on page 23.

Verified_Regulations_FY19
This layer presents the locations of constructed and verified private development projects subjected to stormwater regulations within Philadelphia in FY17. The contents of this layer are discussed in **Section F.5 – Monitor and Control Stormwater from Construction Activities** on page 23.

Verified_Retrofits_FY19
This layer presents the locations of constructed and verified private retrofit development projects subjected to stormwater regulations within Philadelphia in FY19. The contents of this layer are discussed in **Section F.5 – Monitor and Control Stormwater from Construction Activities** on page 23.

New_Project_Submissions_FY19
This layer presents the locations of new project submissions for conceptual stormwater plan review in FY19. The contents of this layer are discussed in **Section F.5.b – Post-Construction Stormwater Management in New Development and Redevelopment** on page 29.

Technical_Approvals_FY19
This layer presents the locations of projects issued technical approvals by PWD in FY19. The contents of this layer are discussed in **Section F.5.b – Post-Construction Stormwater Management in New Development and Redevelopment** on page 29.

Sanitary_Infiltration_Events_FY19
This layer presents the locations of Sewage Pollution Incidents documented by PWD within Philadelphia in FY19. The contents of this layer are discussed in **Section F.8.g – Sanitary Infiltration Controls** on page 38.

Hydrology_Centerline
This layer presents the surrounding watershed hydrology in a polyline based feature class.

Hydrology_Polygon
This layer presents the surrounding watershed hydrology in a polygon based feature class.

Land_Use_PCPC_2019
This layer presents Philadelphia land use as ascribed to individual parcel boundaries or units of land. Land use is the type of activity occurring on the land such as residential, commercial or industrial. Each unit of land is assigned to one of nine major classifications of land use (2-digit codes) and where possible more narrowly defined into one of 70 sub-classifications (3-digit codes).

PCB_Locations_Known_Historical
This layer presents the location of all known and historical PCB locations within Philadelphia. The contents of this layer are discussed in **Section E – Pollutant Minimalization Plan for Polychlorinated Biphenyls in the City's MS4** on page 2.

NPDES_Permitted_Dischargers_FY19
This layer presents the location within Philadelphia of all NPDES Industrial Stormwater permitted Discharger. The contents of this layer are discussed in **Section F.2.Step 1.c** on page 8 and a list of permitted facilities can be found in **Appendix K – NPDES Industrial Stormwater Permitted Sites – Philadelphia County.**

Detention_Basins_Philadelphia
This layer presents the location of all stormwater detention basins within Philadelphia County.

Impervious_Surfaces_Planimetric_2004
This layer presents percent imperviousness and the amount of impervious area in Philadelphia County.

Major_Watersheds_Full_Extent
This layer presents the delineation of the Philadelphia County and surrounding counties' watershed boundaries including Darby-Cobbs, Delaware-Direct, Pennypack, Poquessing, Schuylkill, Tacony-Frankford, and Wissahickon watersheds.

Major_Watersheds_Philadelphia_Clip
This layer presents the delineation of the Philadelphia County's watershed boundaries including Darby-Cobbs, Delaware-Direct, Pennypack, Poquessing, Schuylkill, Tacony-Frankford, and Wissahickon watersheds.

Sewersheds_FY19
This layer presents the boundaries of the MS4, combined sewer, un-sewered, non-contributing, and stormwater only areas within Philadelphia County and the neighboring contributing areas.

Census_Blocks_2010_Philadelphia
This layer presents the results of the 2010 Census in Philadelphia County on a block level.

Stormwater_Outfalls
This layer presents locations of all permitted stormwater outfalls within Philadelphia County and the neighboring contributing areas.

Stormwater_Outfalls_with_DrainageArea_Summary
This layer presents locations of all permitted stormwater outfalls within Philadelphia County and the neighboring contributing areas. Drainage area analysis values are appended in the attribute table to display outfall metrics including total drainage area, total impervious drainage area, percent impervious, and runoff coefficient.

Stormwatersheds_Pennypack
This layer presents the stormwater drainage areas to receiving waterways and stormwater outfalls within the Pennypack Watershed.

Stormwatersheds_Poquessing
This layer presents the stormwater drainage areas to receiving waterways and stormwater outfalls within the Poquessing Watershed.

Stormwatersheds_Wissahickon
This layer presents the stormwater drainage areas to receiving waterways and stormwater outfalls within the Wissahickon Watershed.

Point_Sources_Wissahickon
This layer presents permitted Point source locations within the Wissahickon Watershed.

Scrap_Yard_Inspections_FY19
This layer presents locations of scrap yards inspected during the fiscal year.

GIS Stormwater Data Conversion Geodatabase Layers
The City has previously submitted additional GIS data layers that will not be included this year. These layers include outfalls, manholes, inlets, and various pipe as listed in **TABLE F.1-3**. The reason for their removal is the City's policy to not release these data layers to the general public due to security concerns. These data layers would be made available for viewing by PWD, should it be necessary.

Table F.1-3 GIS Data Feature Classes within Geodatabase named -StormwaterDataConversion.mdb

DataConv_GISAD_stBasin	DataConv_GISAD_stInletPipe
DataConv_GISAD_stBoring	DataConv_GISAD_stMeterChamber
DataConv_GISAD_stCasin	DataConv_GISAD_stOffsetAccess
DataConv_GISAD_stChamber	DataConv_GISAD_stOpenChannel
DataConv_GISAD_stCulvert	DataConv_GISAD_StormNetwork_Junctions
DataConv_GISAD_stDisconnectedInlet	DataConv_GISAD_stOutfall
DataConv_GISAD_stFitting	DataConv_GISAD_stPointFeature
DataConv_GISAD_stFlare	DataConv_GISAD_stPump
DataConv_GISAD_stForceMain	DataConv_GISAD_stRainGauges
DataConv_GISAD_stGravityMain	DataConv_GISAD_stStructure
DataConv_GISAD_stHostPipe	DataConv_GISAD_stTunnel
DataConv_GISAD_stManhole	DataConv_GISAD_stVentPipe
DataConv_GISAD_stManholeOther	DataConv_GISAD_stVirtualLink
DataConv_GISAD_stInlet	DataConv_GISAD_stVirtualNo

F.2. Discharge Management, Characterization, and Watershed-based Assessment and Management Program

Step 1. Preliminary Reconnaissance: Permit Issuance through end of Year 2

a. Land use and resource mapping

PWD has conducted extensive mapping of information relevant to stormwater management planning. Previously discussed in **Section F.1 – Source Identification** of this document on page 3, the GIS files include MS4 outfalls and contributing drainage areas, land use, population, monitoring locations, and other relevant layers. The maps and supporting GIS layers are included in the **Supplemental CD.**

b. Preliminary physical, chemical, and biological quality assessment

Comprehensive Watershed Monitoring Program

Comprehensive assessment of our waterways is integral to planning for the long-term health and sustainability of our water systems. By measuring all factors that contribute to supporting fishable, swimmable, and drinkable water uses, appropriate management strategies can be developed for each watershed land area that Philadelphia shares.

PWD has carried out extensive sampling and monitoring programs to characterize conditions in seven local watersheds**,** both within the county boundaries and outside counties/municipalities. From 1999 to 2019, PWD has implemented a comprehensive watershed assessment strategy, integrating biological, chemical and physical assessments to provide both quantitative and qualitative information regarding the aquatic integrity of the Philadelphia regional watersheds. This information is published in Comprehensive Characterization Reports (CCRs) and used to plan improvements to watersheds in the Southeast Region of Pennsylvania.

Monitoring Timeline Strategy

Prior to the creation of PWD's Comprehensive Watershed Monitoring Program, baseline assessments were conducted in all Philadelphia regional watersheds to assess the degree, location and type of impairments occurring within each system. Baseline assessments, encompassing benthic, fish, habitat and discrete water quality monitoring, were routinely completed on a watershed within one year. With the addition of continuous and wet-weather water quality monitoring, periphyton assessments, and specialized physical assessment programs (*e.g.*, FGM assessments), CCRs were typically accomplished on a two-year timeline.

As described in PWD's *Comprehensive Watershed Monitoring Program: Proposed Strategy 2010-2015*, the scale of watershed stressors is so expansive and the BMP program is still in its introductory phase that full implementation is limited but will increase once the program is established. Therefore, PWD is focusing its monitoring efforts at maintaining a "sentinel" monitoring presence in each of the City's watersheds rather than dedicating monitoring efforts to individual watersheds. This regional monitoring approach has been greatly enhanced through a partnership with USGS. Continuous water quality data are collected from 11 USGS gaging stations, and quarterly baseflow water samples are analyzed for microbial and nutrient parameters of concern **(Table F.2.Step 1.B-1)**. PWD also continues to assess performance of stormwater BMP projects as they are constructed.

Table F.2.Step 1.B-1 Overview of PWD Proposed Watershed Monitoring Activities 2010-2019

Watershed/Geographic Area	Activity	Period
PWD/USGS Gages	Continuous Water Quality Monitoring	2010-2019
PWD/USGS Gages	Quarterly Water Quality Grab Samples	2010-2019
Philadelphia Area Watersheds	Stormwater BMP Monitoring	2010-2019
Philadelphia Area Watersheds	Stream Restoration Project Monitoring	2010-2019
Cobbs Creek Watershed	Watershed-wide Comprehensive Assessment	2012-2013
Tookany-Tacony/Frankford Watershed	Watershed-wide Comprehensive Assessment	2013-2014
Wissahickon Creek Watershed	Tributary Assessment	2014-2015
Wissahickon Creek Watershed	Watershed-wide Comprehensive Assessment	2015-2016
Pennypack Creek Watershed	Tributary Assessment	2016-2017
Poquessing Creek Watershed	Watershed-wide Comprehensive Assessment	2018

Monitoring Timeline 2010-2018

Allowing 10 years before re-assessment will potentially allow for a greater number of projects to be implemented. It allows PWD to focus monitoring efforts on evaluating the performance of stormwater BMPs and restoration projects, as well as the tidal Schuylkill and Delaware rivers (which have not been assessed), as well as smaller wadeable streams. As described in the *Comprehensive Watershed Monitoring Program: Proposed Strategy 2010-2015*, PWD's current proposed strategy for watershed assessments also includes a less intense, but ongoing monitoring effort within each watershed, primarily through a partnership with the USGS. It should be noted that although the monitoring plan nominally covers 2010-2015, the assessments of the Wissahickon, Pennypack and Poquessing watersheds are continuations of that plan and are thus included here.

The proposed strategy for watershed assessments 2010-2019 includes resuming watershed-scale bioassessment activities at several stations within targeted watersheds **(Table F.2.Step 1.B-2 Proposed Watershed Monitoring Timeline 2008-2019).** These watershed scale reassessments should complement the "adaptive management" approach favored by the IWMP implementation process and allow for the locations and methods of assessment to be changed, depending upon the number of projects implemented and their spatial distribution within the watershed. It is hoped that these data will be useful as a long-term record of water quality changes in the region, more appropriate for assessing the goals of a City-wide distributed green infrastructure program than an approach that focuses on individual watersheds.

Table F.2.Step 1.B-2 Proposed Watershed Monitoring Timeline 2010-2019

Watershed	BMP Monitoring	Quarterly WQ Grab sampling	Continuous WQ Monitoring	Annual WQ Summary	Bioassessment	Bioassessment Data Analysis
Cobbs	2010-2019	2010-2019	2010-2019	2010-2019	2012	2012-2013
Tacony-Frankford	2010-2019	2010-2019	2010-2019	2010-2019	2013	2013-2014
Wissahickon	2010-2019	2010-2019	2010-2019	2010-2019	2014-2016	2014-2016
Pennypack	2010-2019	2010-2019	2010-2019	2010-2019	2016-2018	2016-2018
Poquessing	2010-2019	2010-2019	2010-2019	2010-2019	2018	2018-2019

Water Quality Sampling and Monitoring

Guiding Principles of Urban Water Chemistry Assessment

PWD's water quality assessment strategy has been designed to facilitate separate analyses of dry weather (i.e., baseflow) and wet weather water quality conditions. This program has evolved over time, as personnel and technological improvements have improved our abilities to collect more data from an increasing number of sampling locations in a more efficient manner. Automated sampling, in particular, has greatly increased the temporal resolution of stormwater sampling at multiple sampling locations for a single storm event.

In order to comply with the state-regulated stormwater permit obligations, PWD worked with USGS to record continuous water quality data at 10 gage stations in the Philadelphia region from July 2018 through November 2018 and March 2019 through June 2019. The sampling and monitoring sites are presented in **Appendix F – Monitoring Locations.** Four types of sampling were performed as discussed below. Parameters were chosen based on state water quality criteria, or because they are known or suspected to be important in urban watersheds.

Discrete Water Chemistry Assessment

Each USGS/PWD cooperative monitoring gage site was sampled once during the course of a few hours, to allow for travel time and sample processing/preservation. Samples are collected during dry weather and parameters were chosen based on the conclusions from baseline sampling that indicated dry weather problems are primarily related to bacteria and nutrients. Results of samples collected to date are presented in **Appendix G – PWD Quarterly Dry Weather Water Quality Monitoring Program**. Previous annual reports describe PWD's extensive surface water grab sampling efforts dating back to 2002.

Grab samples were also collected from three locations in the tidal Schuylkill River by boat in July and September 2018. PWD has collected 21 samples from the Schuylkill River and 49 samples from the

Delaware River by boat since 2011. Results from quarterly dry weather grab sampling thus far are generally similar to data collected during the CCR data collection periods.

Continuous Water Quality Assessment
Each USGS/PWD cooperative monitoring gage site records water quality data for dissolved oxygen, temperature, flow, pH, and specific conductance. Selected locations are also instrumented for turbidity, precipitation and photosynthetically active radiation (PAR). These data are made available to the public in near real-time on the internet at https://www.usgs.gov/centers/pa-water/science/philadelphia-water-resources-monitoring-program. The monitoring results from FY 2019 are presented in **Appendix H – PWD-USGS Cooperative Water Quality Monitoring Program Annual Summary.**

In addition to continuously monitoring water quality at USGS gaging stations, PWD continued deployment of an *in situ* self-contained data logging continuous water quality monitoring sonde (YSI Inc. Model EXO2) in the tidal Schuylkill River at SC048 (Schuylkill River at the Navy Yard) from March – November in 2018 and will be monitored between March and November in 2019.

Long-term continuous monitoring for TMDL compliance and building a long-term water quality data record for the aforementioned watersheds will be accomplished in 2010-2019 through a partnership with the USGS. Results from City-wide continuous monitoring thus far are generally similar to data collected during the CCR data collection periods. For this reason, PWD will re-evaluate whether additional water quality sampling is needed to characterize water quality in targeted watersheds on a case-by-case basis. Continuous water quality instruments will also be utilized in evaluating the performance of certain stormwater BMPs and assessing conditions in tidal portions of the Schuylkill and Delaware Rivers as well as Frankford Creek.

Groundwater Monitoring
A City-wide groundwater level monitoring network will provide long-term monthly data documenting current water levels and trends in groundwater elevations throughout the City, helping to track the impacts of widespread implementation of stormwater management practices (SMPs) and global climate change. Data from the groundwater monitoring network will also be used to calibrate a Philadelphia groundwater model and update the USGS groundwater contour map of Philadelphia (Paulachok 1984).

PWD and USGS identified existing wells that would be suitable for the network and obtained permission for site access. Once wells were identified and accessible, well condition and suitability for inclusion in the monitoring network were investigated by continuous water level monitoring and remote video camera inspection when accessible. Wells that met acceptance criteria were added to the monitoring network. After examining readily available information about existing wells, PWD elected to drill additional wells in order to provide better spatial distribution of wells in the monitoring network. Current status of the groundwater monitoring network and a summary of data collected through June 30, 2019 are presented in **Appendix I – PWD/USGS Groundwater Monitoring Program.**

Biological Monitoring
The biological monitoring protocols employed by PWD are based on methods developed by the US EPA (Barbour *et al*. 1999) and the PADEP. These procedures are as follows:

- Rapid Bioassessment Protocol III (Benthic Macroinvertebrate Sampling)
- Periphyton Assessment (Algae Monitoring)

Macroinvertebrate Assessments

As described in the PWD *Comprehensive Watershed Monitoring Program: Proposed Monitoring Strategy 2010-2015*, PWD's approach is intended to be a compromise, recognizing not only the benefits of collecting data from randomly selected sites but also the importance of maintaining a monitoring effort at consistent locations over time. This plan is based on a similar monitoring program that USGS has implemented in Chester County (Reif 2002, Reif 2004). The plan reflects the manpower constraints of collecting and processing samples with the PADEP ICE protocol. It is hoped that this approach will achieve some of the benefits of a randomized approach, while providing periodic re-evaluation of our watersheds required to inform the watershed planning process and comply with environmental mandates. Targeted watershed assessments resumed in the Poquessing Creek Watershed in spring 2018 (**Table F.2-3 Proposed Benthic Invertebrate Monitoring Timeline 2010-2019**).

Table F.2-3: Proposed Benthic Invertebrate Monitoring Timeline 2010-2019

Period	Monitoring Activity (number of samples*)
2010	Stream Restoration Monitoring (3)
2011	USGS gage samples (9); Randomly selected sites (16)
2012	Cobbs Creek (6**); USGS gage samples (9); Random (10)
2013	Tookany/Tacony Creek (10**) USGS gage samples (9); Random (6)
2014	Wissahickon Creek Tributaries (15); USGS gage samples (9); Random (1)
2015	Wissahickon Creek (10**); USGS gage samples (8); Random (4)
2016	Pennypack Creek Tributaries (11**); USGS gage samples (9); Random (5)
2017	Pennypack Creek (12**); USGS gage samples (9); Random (4)
2018	Poquessing Creek (12**); USGS gage samples (9); Random (4)
2019	USGS gage samples (9); Randomly selected sites (16)

* Number of samples estimated, actual number of samples may vary

** Number of monitoring sites excludes 2 USGS gage sites in target watershed

During March and April 2018, PWD conducted Rapid Bioassessment Protocols (RBP III) at 25 (n=25) locations within Philadelphia area watersheds. Sampling was conducted at 9 USGS gages in the PWD/USGS Cooperative Monitoring program, 12 sites in the Poquessing Creek Watershed, and 4 randomly selected sites. These data are presented in **Appendix J – PWD Wadeable Streams Benthic Macroinvetebrate and Physical Habitat Assessments**. In spring 2019, PWD sampled 9 USGS gages and 16 randomly chosen sites.

Fish Assessments

Fish were not assessed in 2017-2019 due to a shortage of resources and staffing (**Table F.2-4 Proposed Fish Monitoring Timeline 2010-2018**). All surveys were conducted using electrofishing gear as described in EPA RBP V (Barbour, et al. 1999).

Table F.2-4: Proposed Fish Monitoring Timeline 2010-2018

Period	Monitoring Activity (number of samples*)
2012	Cobbs Creek Watershed Assessment (4)
2013	Tookany/Tacony Creek Watershed Assessment (8)
2015	Wissahickon Creek Watershed Assessment (10)
2016	Fish not assessed; tributaries targeted in 2016.
2017	Fish not assessed
2018	Fish not assessed

* Number of samples estimated, actual number of samples may vary

Algae Assessments

Chlorophyll-a measurements may be used to provide information for the parameterization of water quality models. In spring 2016, PWD began a pilot effort to collect continuous chlorophyll-a data at three USGS stations along the Delaware River: 01467200 (Ben Franklin Bridge), 014670261 (Delaware River near Pennypack Woods), and 01463500 (Trenton). In addition, PWD deployed two buoys in the Delaware River (at Pea Patch Island and upstream of the confluence with the Schuylkill River) from March-November. Sondes attached to these buoys monitor continuous chlorophyll-a levels; the Woods Hole Group collects and analyzes bi-weekly grab samples at these locations to calibrate the sensors.

Physical Monitoring

Physical Habitat Assessments

Habitat assessments are conducted along with benthic macroinvertebrate monitoring and thus the habitat assessment strategy is described under the heading **Biological Monitoring – Macroinvertebrate Assessments,** above**.** PWD assesses stream physical habitat condition using PADEP Instream Comprehensive Evaluation (ICE) protocols. During 2018, PWD conducted physical habitat assessments at 25 locations within Philadelphia area watersheds. Sampling was conducted at 9 USGS gages in the PWD/USGS Cooperative Monitoring program, 12 tributary sites in the targeted Poquessing Creek Watershed, and 4 randomly selected sites. These data are presented in **Appendix J – PWD Wadeable Stream Benthic Macroinvertebrate and Physical Habitat Assessments.** In spring 2019, PWD sampled 9 USGS gages and 16 randomly chosen sites.

Habitat Suitability Index (HSI)

In addition to habitat assessments, Habitat Suitability Index (HSI) models, developed by the U.S. Fish and Wildlife Service (USFWS), have been incorporated into the monitoring program. Based on empirical data and supported by years of research and comprehensive review of scientific literature, these models present numerical relationships between various habitat parameters and biological resources, particularly gamefish species and species of special environmental concern. To date, HSI have applied to Darby-Cobbs, Tookany/Tacony-Frankford, Wissahickon, and Pennypack Creek Watersheds. The Poquessing Creek Watershed CCR approach attempted to simplify the application of fish habitat suitability analysis to generalized guilds.

Fluvial Geomorphologic (FGM) / Infrastructure Analysis

Fluvial Geomorphologic (FGM) studies establish the physical attributes of the stream, identify areas of concern, and provide recommendations for rehabilitation of the stream corridors and floodplains. To date, FGM analysis has been conducted on the Darby-Cobbs, Tookany/Tacony-Frankford, Wissahickon, Pennypack, and Poquessing Creeks. Analysis was conducted in order to characterize channel morphology, disturbance, stability, and habitat parameters as well as to provide a template for hydrologic and hydraulic modeling and serve as a baseline for assessing channel bank and bed changes. Data provided from the FGM analyses will also serve to develop reach rankings within each watershed in order to prioritize restoration strategies.

Summary of Monitoring Locations

Biological, physical and chemical monitoring locations are based on 3 criteria: 1) appropriate habitat heterogeneity; 2) access availability; and 3) proximity to USGS stream gaging stations and PADEP 305b monitoring sites. In general, the number of monitoring sites is proportional to the size of the drainage and the watershed's link magnitude (*i.e*., number of 1st order streams). Maps of assessment sites by watershed and program (biological, chemical, or physical) are available as GIS data.

Quality Assurance/Quality Control (QA/QC) and Data Evaluation

PWD has planned and carried out an extensive sampling and monitoring program to characterize conditions in Philadelphia's watersheds. Sampling and monitoring follow the Standard Operating Protocols (SOPs) and Quality Manual as maintained by PWD's BLS. These documents cover the elements of quality assurance, including field and laboratory procedures, chain of custody, holding times, collection of blanks and duplicates, and health and safety.

They are intended to help the program achieve a level of quality assurance and control that is acceptable to regulatory agencies. More information regarding Standard Operating Procedures (SOPs) for chemical and biological assessments is available from BLS.

c. Inventory of Point and Non-Point sources

At the end of FY19, there are 113 NPDES permitted dischargers in Philadelphia County, as shown in **Appendix K – NPDES Industrial Stormwater Permitted Sites – Philadelphia County**. This listing was downloaded from the PADEP Environment Facility Compliance Tracking System (eFACTS). The eFACTS website can be accessed through the following link:
http://www.ahs.dep.pa.gov/eFACTSWeb/default.aspx.

PWD is also actively involved in developing estimates of non-point source pollutants. The results of this analysis are described in the hydrologic models in **Section G - Assessment of Controls** on page 41.

d. Preliminary problem assessment

CCRs were completed for the Wissahickon (2007), Pennypack (2009) and the Poquessing (2010) Creek Watersheds. These reports include analysis of data collected over the monitoring period and present a characterization of problems within the watershed. The reports for each watershed are available to the public through the internet at the following address:
http://www.phillywatersheds.org/what_were_doing/documents_and_data/watershed_plans_reports.

Step 2. Watershed Plan Development: Permit issuance through end of Year 5

For information on the status of the Act 167 plans, please refer to the CSO Annual Report **Table III.C.1-2 - Planning by Watershed** on page 38 for more information.

Step 3. Watershed Plan Implementation and Performance Monitoring: Permit issuance through expiration

a. Dry Weather Water Quality and Aesthetics

Operate the Defective Lateral Program

Over the last fiscal year, PWD has continued to successfully operate its Defective Lateral Program. A detailed discussion of this program is provided within this report in **Section F.3 - Detection, Investigation, and Abatement of Illicit Connections and Improper Disposal** on page 20.

Debris removal from waterways impacted by storm water discharges

PWD continues to employ the Waterways Restoration Team (WRT) to remove debris and conduct small scale stream restoration projects within the City's waterways. Please refer the CSO Annual Report **Section II.F – NMC 6 - Control of Solid and Floatable Materials in CSOs** on page 13 for information about debris removal from waterways impacted by storm water discharges.

Lincoln Drive sewer relining

PWD completed the Lincoln Drive sewer relining in 2004. Additional information on this project was reported in previous reports; please refer to Section F.2.3.a.iii on page 261 of the FY10 CSO-Stormwater Annual Report.

Stormwater Outfall Dry Weather Inspections

The City maintains a stormwater outfall inspection program in compliance with the MS4 permit. All 434 of the City's permitted stormwater outfalls are scheduled to be inspected by the PWD at least once each permit cycle. Those with dry weather flow are sampled for fecal coliform and fluoride analysis. The results of these samples are reported on a quarterly basis and summarized in this annual report. Priority outfalls have been established through the 1998 Stormwater Consent Order and Agreement and internally, additional areas of focus have been added to maintain progress in the screening, testing and abating program and for efficient crew deployment. Priority Outfalls are sampled on a quarterly basis.

During FY19, 40 outfall inspections were conducted and 36 samples were taken due to observed dry weather flow as part of the Priority Outfall inspection program. During FY19, 123 outfall inspections were conducted and 70 samples were taken due to observed dry weather flow as part of the permit inspection program. The sample results are used on the Stormwater Outfall Priority Score list.

The full details of program accomplishments for FY19 can be found in **Appendix M – FY19 Defective Lateral Connection Quarterly Status Reports.**

Table F.2-5: Stormwater Outfall Inspection Program – 5 Year Summary

Fiscal Year	Permit Inspection Program		Priority Outfall Program	
	Inspections	Samples	Inspections	Samples
2015	4	4	47	43
2016	118	54	43	37
2017	171	91	44	37
2018	117	57	41	37
2019	123	70	40	36
Total	**533**	**276**	**215**	**190**

Defective Lateral Program - Priority Outfalls

7th & Cheltenham Avenue Outfall (T-088-01)

As of June 30, 2019, PWD performed 2,831 complete tests in this sewershed, identifying 134 cross-connections, all but one of which have been abated.

The locations of dry weather diversion devices, and the number of inspections, blockages, and discharges found by the Flow Control unit during FY19 are listed below.

Table F.2-6: 7th & Cheltenham Ave – Diversion Devices - FY19 Summary

Location	ID #	Inspections	Blockages	Discharges
Plymouth St. west of Pittsville St.	CFD-01	42	0	0
Pittsville St. south of Plymouth St.	CFD-02	44	1	0
Elston St. east of Bouvier St.	CFD-03	34	0	0
Ashley St. west of Bouvier St.	CFD-04	29	2	0
Cheltenham Ave. east of 19th St.	CFD-05	23	0	0
Verbena St. south of Cheltenham Ave.	CFD-06	34	0	0
Cheltenham Ave. east of 7th St.	CFD-07	89	6	1
7th St. south of Cheltenham Ave.	CFD-08	86	0	0

Inspections and fecal coliform sampling at this outfall continue quarterly. Results for the outfall samples during FY19 are listed below.

Table F.2-7: 7th & Cheltenham Ave - Fecal Coliform Results – FY19 Summary

Date	Fecal Count (MPN per 100 ml)
7/30/2018	2382
10/23/2018	2755
2/5/2019	1789
4/23/2019	7270

Monastery Avenue Outfall (W-060-01)

As of June 30, 2019, PWD performed 611 complete tests in this sewershed, identifying 16 cross-connections, all of which have been abated.

The locations of dry weather diversion devices and the number of inspections, blockages, and discharges found by the Flow Control unit during FY19 are listed below.

Table F.2-8: Monastery Ave - Diversion Devices - FY19 Summary

Location	ID#	Inspections	Blockages	Discharges
Jannette St. west of Monastery Ave.	MFD-01	24	0	0
Green La. North of Lawnton St.	MFD-02	24	0	0

Inspections and fecal coliform sampling at this outfall continue quarterly. Results for the outfall samples during FY19 are listed below.

Table F.2-9: Monastery Ave - Fecal Coliform Results – FY19 Summary

Date	Fecal Count (MPN per 100 ml)
7/10/2018	266
10/5/2018	404
1/23/2019	41
4/4/2019	19863

Monoshone Creek Outfalls (W-068-05)
Additional areas of focus: W-060-04, W-060-08, W-060-09, W-060-10, W-060-11, W-068-04

As of June 30, 2019, PWD performed 2,750 complete tests in these sewershed areas, identifying 94 cross-connections, all of which have been abated. The majority of the efforts have been in the W-068-05 sewershed area which is by far the largest in terms of drainage area and properties served.

Inspections and fecal coliform sampling at the W-068-05 outfall continue quarterly. Results for the outfall samples during FY19 are listed below.

Table F.2-10: Monoshone Creek (W-068-05 Outfall) - Fecal Coliform Results – FY19 Summary

Date	Fecal Count (MPN per 100 ml)
7/10/2018	10462
10/5/2018	6131
1/23/2019	5475
4/4/2019	52

Manayunk Canal Outfalls (S-051-06, S-058-01, S-059-01 through S-059-11)
As of June 30, 2019, DLC program activities have performed 2,479 complete tests in these sewershed areas, identifying 62 cross-connections, all of which have been abated. The majority of the efforts have been in the S-059-04 sewershed area.

Inspections and fecal coliform sampling at the following outfalls continue quarterly. Results for the outfall samples during FY19 are listed below.

Table F.2-11: Manayunk Canal - Fecal Coliform Results – FY19 Summary

Outfall	Fecal Count (MPN per 100 mL)			
	7/9/2018	10/2/2018	2/5/2019	4/8/2019
S-058-01	75	663	<1	214.3
S-059-01	20140	29870	92080	>2419.6
S-059-02	38730	2014	68670	686.7
S-059-03	1178	2064	77010	155310
S-059-04	620	262	1860	10462
S-059-05	213	3255	2046	>2419.6
S-059-09	NF*	NF*	NF*	NF*

Note: * NF indicates that no flow was observed

Sandyford Run Outfall (P-090-02)

As of June 30, 2019, PWD performed 5,834 complete tests in this sewershed, identifying 87 cross-connections, all of which have been abated. The location of the dry weather diversion device and the number of inspections, blockages, and discharges found by the Flow Control unit during FY19 are listed below.

Table F.2-12: Sandyford Run - Diversion Device - FY19 Summary

Location	ID#	Inspections	Blockages	Discharges
Brous and Lexington Aves.	PFD-01	96	3	2

Table F.2-13: Sandyford Run – Fecal Coliform Results – FY19 Summary

Date	Fecal Count (MPN per 100 ml)
7/10/2018	2723
10/19/2018	387.3
1/23/2019	10
4/4/2019	<1

Note: * NF indicates that no flow was observed

Defective Lateral Program - Other Important Outfalls

Outfalls are prioritized for investigative work by PWD using the Stormwater Outfall Priority Score list.

Franklin and Hasbrook Outfall (T-089-04)

As of June 30, 2018, PWD performed 1,017 complete tests in this sewershed, As of June 30, 2019, PWD performed 1,021 complete tests in this sewershed, identifying 46 cross-connections, all of which have been abated. The location of the dry weather diversion device and the number of inspections, blockages, and discharges found by the Flow Control unit during FY19 are listed below.

Table F.2-14: Franklin and Hasbrook - Diversion Device - FY19 Summary

Location	ID#	Inspections	Blockages	Discharges
Franklin and Hasbrook	CFD-01	100	6	3

Please refer to **Section F.3 - Detection, Investigation, and Abatement of Illicit Connections and Improper Disposal** on page 20 for additional information on activities conducted for the Defective Lateral Program.

Priority Outfall Closure Testing

Investigation will continue within each particular outfall area (sewershed) until the Priority outfall status may be closed. During FY19, none of the Priority outfalls were authorized to be removed from the list by PADEP.

Healthy Living Resources

Develop integrated storm water management plans

PWD developed integrated stormwater management plans for all of the City's watersheds. Please refer to the CSO Annual Report in **Section III.C.3.7 - Basin-Specific Stormwater Management Plans (ACT 167)** on page 47 for an explanation of the City's watersheds stormwater management plans.

Assess the benefits of implementing a Natural Stream Channel Design (NSCD) and effectiveness of the NSCD restoration approach

PWD has conducted several projects that have been designed with Natural Stream Channel Design concepts in mind. As each of PWD's NSCD projects are constructed, PWD realizes the importance of the extensive monitoring and O&M that accompanies such projects. Each project provides the opportunity to learn about what techniques do and do not work in their respective hydrologic and hydraulic regimes. In order to assess the effectiveness of these NSCD projects, PWD conducts post implementation monitoring at each site that includes the measurement of relevant biological, habitat, and physical parameters to be used in comparison to pre-construction conditions.

Wet Weather Water Quality and Quantity

Implement several BMP projects

PWD and its partners have implemented many BMP projects throughout the City including GSI, stream restoration, and wetland creation projects. For a complete listing of both completed and current GSI projects, please refer to the **Appendix A - Green City, Clean Waters FY19 Annual report.** For a description of activities conducted for PWD's stream restoration, and wetland creation projects, please refer to the CSO Annual Report **Sections III.C.2.3 Stream Habitat Restoration** on page 42 and **III.C.2.4 Wetland Enhancement and Construction** starting on page 43.

Monitor three demonstration BMPs

PWD is committed to ensuring stormwater BMPs owned and operated by the City are maintained. This commitment is often evaluated through monitoring of these sites. PWD is currently monitoring multiple stormwater BMP project types – for example, stormwater tree trenches, stormwater planters, and porous pavement – continue to develop and improve monitoring protocols. Monitoring activities for PWD's green stormwater infrastructure projects during FY19 are documented within **Appendix A: Green City, Clean Waters FY19 Annual Report Section-Appendix 4: GSI Monitoring Status Report.** PWD has detailed activities conducted during FY19 for PWD's stream restoration, and wetland creation; please refer to the CSO Annual Report **Sections III.C.2.3 Stream Habitat Restoration** on page 42 and **III.C.2.4 Wetland Enhancement and Construction** starting on page 43.

F.3 Detection, Investigation, and Abatement of Illicit Connection and Improper Disposal

a. Prevention of Illicit Discharges

Sewer and Lateral Inspections

The City requires plumbing permits for connections to the municipal sewer system. The permit affords the property owner an inspection of the plumbing work performed. Corrections of defective connections are confirmed to ensure that the ultimate discharge to the receiving waters does not contain sanitary waste. PWD reviewed 1853 new sewer and storm connections during FY19. This number includes all connections (storm, sanitary and/or combined sewers). A single project or permit may also have one connection or multiple connections.

b. Investigation of Illicit Discharge Sources

Rank the MS4 outfalls according to their priority for corrective actions

PWD maintains a stormwater outfall monitoring system in compliance with the MS4 permit issued by the PADEP. Samples are collected for outfalls that have dry weather flow and analyzed for fecal coliform and fluoride. Priority outfalls have been established through the 1998 Stormwater Consent Order and Agreement and internally, additional areas of focus have been added to maintain progress in the screening, testing and abating program and for efficient crew deployment. Priority Outfalls are sampled on a quarterly basis. Refer to page 16 of this report for FY19 priority outfall summaries.

Investigate dry weather flow to identify sewer lateral defects

During FY19, PWD performed 1,568 complete dye tests with 120 defective connections found and 65 abatements completed. Details of FY19 activities are listed below.

Table F.3-1: Defective Connections Program - FY19 Summary

Quarter	CY2018-3	CY2018-4	CY2019-1	CY2019-2	Total
Date Coverage	Jul1-Sep30	Oct1-Dec31	Jan1-Mar31	Apr1-Jun30	**FY19**
Completed Tests	517	446	303	302	1568
No Cross Connections	485	415	284	264	1448
Cross Connection Identified	32	31	19	38	120
Abatements *	36	15	6	8	65

Note: *Some cross connections abated may have been identified in prior fiscal years

Reports of potential dry weather discharge from the stormwater system are also investigated. primarily through the Industrial Waste and/or Sewer Maintenance units. During FY19, 37 incidents were investigated. For details, refer to **Appendix P – Sanitary Infiltration Events for Potential Sewage Discharges** during FY19.

PWD's Defective Connections Group Field Investigation SOP was updated in March 2017. A copy is available upon request.

d. Abatements

Written notice about sewer lateral defects

The Plumbing Repair Programs unit handles customer communications (through letters, telephone or site visits) and is responsible for the abatement of the defects identified.

Abatements of Cross Connections

Sixty-one abatements were completed during FY19. Details of abatement types and costs are listed below.

Table F.3-2 Defective Connection Abatement – 5 Year Summary

Fiscal Year	# Cross Connections Abated		Total Cost of Abatements
	Residential	Commercial	
2015	39	4	$357,289.12
2016	32	7	$247,514.90
2017	31	5	$317,851.00
2018	56	7	$562,747.33
2019	57	4	$555,933.30
Total	215	27	$2,041,335.65

Residential Properties Cross Connections Abatement

During FY19, 57 residential abatements were completed at a cost of $530,760.30.

Commercial and Industrial Properties Cross Connections Abatement

During FY19, 4 commercial abatements were completed at a cost of $25,173.

Defective Connections Abatement Schedule

All defective connections are required to be abated within 120 days of discovery, in compliance with the MS4 permit. Please view **Appendix P – FY19 Defective Lateral Quarterly Reports** for properties that exceeded the 120-day requirement in FY19. These properties are under administrative action.

Defective Connections Abatement Confirmation Tests

All abatements completed during FY19 were tested to confirm that the abatement was completed properly.

e. Defective Connection Program Reporting

Illicit connection program quarterly report

Defective Lateral Quarterly Reports are submitted four times per year to PADEP as part of the reporting requirements of the City of Philadelphia NPDES Storm Water Management Permit No. PA 0054712. The report covers three-month periods staring in January, April, July, and October which are submitted no later than 45 days from the end of the reporting period. The quarterly reports were submitted as required during FY19, and **Appendix P – FY19 Defective Lateral Quarterly Reports** contains all these reports.

Illicit connection program quarterly report contents

The report content within the illicit connection program quarterly reports has not changed in FY19.

F.4 Monitor and Control Pollutants from Industrial Sources

a. Applications/Permits

The City obtains NPDES permits/discharge information from industries if they contribute significant amounts of stormwater into the City's sewer system. Industries that contribute stormwater directly into a waterway or discharge non-industrial waste into the system usually coordinate directly with the PADEP. A list of NPDES permits that involve stormwater associated with industrial activities in the City were obtained from the PADEP's website and are listed in **Appendix K – NPDES Industrial Stormwater Permitted Sites**.

b. Inspections

Industrial inspections

The Philadelphia Local Emergency Planning Committee (PLEPC) is the entity tasked with meeting the responsibilities of SARA Title III. Under PLEPC, the Philadelphia Fire Department (PFD) Hazmat Administrative Unit (HMAU) representative is the individual that carries out the inspections. HMAU personnel inspect SARA facilities to ensure that information submitted in their Tier II report is accurate. The inspection includes a visual on-site inspection, verifying the facility has a Preparedness, Prevention, and Contingency (PPC) plan and reviewing any other information contained within the Tier II report. A total of 431 facilities submitted Tier II status reports. As of August 2019, 192 Tier II inspections have been performed in calendar year 2019. This effort varies each year depending on staffing and the number of SARA Tier II reports that are submitted.

As part of the 2017 EPA AOCC CWA-03-2017-0146DN, the City submitted a signed Memorandum of Understanding (MOU) to EPA on February 22, 2018 formalized and established coordination between the Philadelphia Fire Department and PWD to verify stormwater inspections at SARA Title III Tier II facilities located in the MS4. As part of the MS4 permit requirement, the City is required to inspect all SARA Title III facilities located in the MS4 each fiscal year. In FY19, of the 181 facilities located in the MS4 a stormwater inspection was verified at 54 facilities. To ensure that stormwater inspections are verified at all MS4 SARA Title III facilities in FY20, PWD will begin to conduct some of the inspections through the IWBC unit. Additionally, contract resources will be available to assist in completing the inspections.

Industrial waste inspection forms

The Industrial Waste Inspection Form was updated in 2006 to include a stormwater inspection section. A copy of the form can be found in previous reports; please refer to Appendix O of the CSO-Stormwater FY09 Annual Report**.**

c. Monitoring/Enforcement

Industrial DMR submission

When necessary, the City shall request DMRs or additional sampling from the PADEP for surrounding industries to ensure compliance with NPDES effluent limitations.

NPDES permits enforcement

Should PWD personnel observe a violation of NPDES permit terms and conditions, PWD will report the violation immediately and notify PADEP, on a case by case basis.

F.5 Monitor and Control Stormwater from Construction Activities

Stormwater runoff is a concern both during construction and post-construction. Integrated in the City's development review process, PWD is provided the authority to review and regulate the runoff from earth disturbance activities to improve water quality. Additionally, post-construction stormwater management plan review extends beyond peak rate control and encompasses water quality and water quantity technical requirements for more frequent storm events. Efforts continue to be focused on improving plan review for both Erosion & Sedimentation (E&S) as well as post-construction stormwater management. The following sections document the progress made so far in terms of stormwater runoff from construction activities including the collaboration between the Philadelphia development community, multiple City Departments, and State agencies.

During FY19, PWD performed numerous tasks in direct compliance with the NPDES Permit as well as tasks supporting continuance and improvement of a growing stormwater management program and watershed program. Some of the FY19 activities include the following:

- Continued coordination efforts with Philadelphia Licenses and Inspections (L&I) regarding permit review and issuance for private development projects applicable to the Stormwater Regulations. At a minimum, the L&I issuance of a Zoning, Demolition, Foundation, and Building permit was coordinated appropriately between the two agencies. In addition, L&I supported PWD in enforcement measures through the issuance of Stop Work Orders and withholding Certificate of Occupancy permits for sites that are non-compliant.
- Continued coordination with the PADEP Southeast Regional Office Waterways and Wetlands program through regular project communication and quarterly meetings with PADEP and

southeast region conservation district staff. The purpose of the quarterly meetings is to discuss regional and district updates, permitting services and projects, and other various topics. PWD also participated in applicant project meetings with PADEP staff to discuss upcoming projects and active projects.

- Scheduled and held coordination meetings with local universities and other large landowners to discuss upcoming or current development projects as well as identify ways to strengthen communication and streamline the review process.
- Continued to implement erosion and sediment (E&S) compliance as an element of all active construction inspections by ensuring appropriate controls are in place throughout construction activity. Potential E&S issues or violations are documented as part of an inspection report provided to the on-site representative. The reports identify the required corrective actions, and active construction inspectors will return to the site to verify compliance. E&S violations may trigger active construction enforcement actions such as a Stop Work Order, requiring continued coordination through L&I.
- Continued to update plan review website content, in an effort to provide clear and accessible resources to the applicant to support quality submittals and efficient reviews.
- Continued to review projects applying for Philadelphia's Green Roof Density Bonus, which was incorporated into the Zoning Code in 2015. This bonus offers exceptions to certain residential density rules for development projects that include a green roof. In calendar year 2018, the bonus was expanded to allow eligibility for existing buildings undergoing renovation or expansion. The green roof must meet PWD's requirements and be approved by PWD before the bonus can be awarded. In FY19, PWD approved 22 projects as eligible to apply for this bonus.
- Continued to attend bi-monthly Business Industry Association (BIA) meetings for the Government Affairs/Fix It Philly subcommittee. In these meetings, representatives from the development community including developers, architects, and engineers come together with City agency representatives from Water, L&I, Planning, and Streets to discuss policy and legislation impacting development in Philadelphia to ensure a transparent and efficient development process.
- Continued to hold Development Services Committee (DSC) meetings with representatives from the development community including developers, designers, large land owners, and attorneys to discuss ideas for improving the PWD stormwater regulatory review and inspections program to better streamline development in the City. In FY19, the DSC continued to discuss ideas to increase the amount of stormwater being managed on each site, including a new guaranteed grant funding option for development projects. In addition, PWD facilitated feedback from the DSC on the topic of post-construction compliance and began working on a new Maintenance Plan which details the SMPs on a project site for the future property owner. The committee continues to be a valuable resource for PWD to gather input on existing procedures as well as new policies and programs.
- PWD continued to conduct reviews of stormwater management plans, hold weekly walk-in hours for applicants and maintain the website to allow online submittal of plans.

A summary of all plan review activities City-wide in FY19 is presented in **Table F.5-1** on page 26.

a. Construction Site Runoff Control

PWD reviews and approves E&S Plans, along with Post-Construction Stormwater Management Plans, for all development sites disturbing more than 15,000 square feet of earth citywide. For E&S plans, PWD follows policies and practices as provided within the PADEP E&S Control Manual. PWD conducts coordinated reviews with the PADEP for projects disturbing more than one acre of earth.

Site inspections of E&S controls are conducted on a reoccurring basis and in response to any received complaints during active construction. The purpose of reoccurring inspections is to monitor E&S controls on projects where construction and earth moving activities are active, and to require site operators to maintain E&S controls as needed. PWD inspects controls such as, but not limited to, rock construction entrances, silt fencing, inlet protection, stockpile location and protection, and concrete washouts. During an inspection, the inspector communicates with the construction manager or site representative and requests to see a copy of the on-site E&S Plan. Photographs are taken documenting site conditions. An inspection report detailing any out-of-compliance items is generated and distributed to the site manager, and then maintained as part of PWD's electronic project file. Failure to adhere to the requirements in the inspection reports can result in a Notice of Violation or a Stop Work Order. For more information regarding enforcement actions, see **Section F.5.e** on page 31.

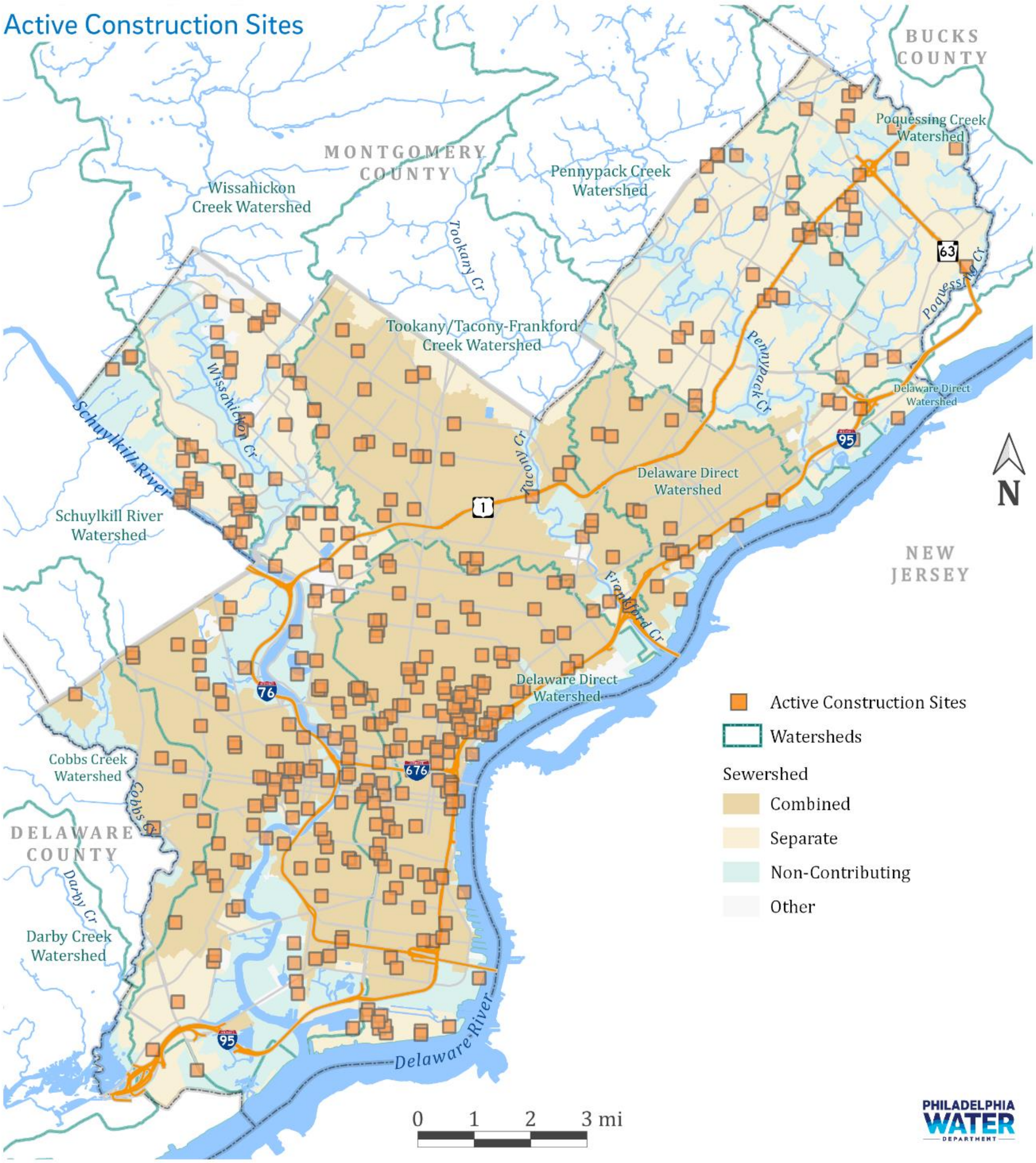
The sites visited cover all of Philadelphia including both separate storm sewer areas and combined sewer areas as depicted in **Figure F.5-1** on page 26.

Table F.5-1: FY19 Summary of Plan Review Activities

	Jul. '18	*Aug. '18*	*Sep. '18*	*Quarter Total*	*Oct. '18*	*Nov. '18*	*Dec. '18*	*Quarter Total*	*Jan. '19*	*Feb. '19*	*Mar. '19*	*Quarter Total*	*Apr. '19*	*May. '19*	*Jun. '19*	*Quarter Total*	*FY19 Total*
Conceptual Review Stage																	
Approvals	7	16	9	32	11	11	15	37	12	9	11	32	14	9	8	31	132
Rejections	43	61	42	146	57	54	49	160	48	47	59	154	61	65	70	196	656
Reviews	50	77	51	178	68	65	64	197	60	56	70	186	75	75	78	228	789
New Project Submittals	31	45	34	110	41	31	21	93	28	40	35	103	30	34	34	98	404
Average Review Time (days)	3.5	4.2	5.4	4.3	6.9	4.9	4.4	5.4	4.1	3.6	4.2	4.0	5.2	4.2	5.0	4.8	4.7
Post Construction Stormwater Management Plan Review Stage																	
Administrative Screenings	20	16	8	44	17	13	5	35	19	16	12	47	30	19	33	82	208
Technical Approvals Issued	11	5	8	24	7	10	7	24	7	7	15	29	11	5	9	25	102
Rejections	27	39	23	89	29	22	20	71	22	25	31	78	31	32	31	94	332
Full Technical Reviews	52	70	50	172	56	52	35	143	51	52	72	175	64	59	62	185	675
New Project Submittals Received	14	22	34	70	31	24	40	95	27	29	16	72	41	23	17	81	318
Average Number of Reviews per Approval	4.2	4.8	4.1	4.3	4.7	4.6	4.0	4.0	4.2	4.3	4.3	4.6	4.0	5.8	3.6	4.2	4.3
Average Approval Time (days)	114	111	137	121	125	125	153	136	157	179	253	207	222	234	75	176	162
Acres of Earth Disturbance Approved	100.5	32.9	18.8	152.3	92.8	12.0	31.0	135.8	28.2	11.6	43.3	83.1	17.2	7.7	29.0	53.9	425.2
Acres of Green Roofs Approved	0.5	0.0	0.0	0.5	0.0	1.1	3.6	4.6	0.5	0.2	0.5	1.2	2.4	0.0	2.1	4.5	10.8
Acres of Porous Pavement Approved	0.4	1.3	0.2	1.8	4.1	0.7	0.8	5.6	0.8	0.0	2.0	2.8	0.2	0.1	1.6	1.9	12.1
PADEP Reviews																	
New Coordinated Reviews	4	11	7	22	7	6	6	19	6	9	12	27	11	16	11	38	106
Erosion and Sedimentation Plan Review																	
Defer to PADEP	1	3	0	4	0	2	0	2	0	1	3	4	1	0	2	3	13
Approved	11	5	5	21	4	9	6	19	6	6	12	24	12	12	7	31	95
Rejected	9	16	9	34	11	9	5	25	9	10	18	37	13	11	14	38	134
Not Applicable	13	17	9	39	29	12	16	57	4	12	23	39	16	11	19	46	181
Total Inspections																	

	Jul. '18	*Aug. '18*	*Sep. '18*	*Quarter Total*	*Oct. '18*	*Nov. '18*	*Dec. '18*	*Quarter Total*	*Jan. '19*	*Feb. '19*	*Mar. '19*	*Quarter Total*	*Apr. '19*	*May. '19*	*Jun. '19*	*Quarter Total*	*FY19 Total*
New Sites Inspected	36	32	40	108	50	38	29	117	29	31	33	93	55	83	210	348	666
Total Inspections	589	565	495	1649	687	603	488	1778	594	470	511	1575	527	542	488	1557	6559
Active Construction Inspections at Project Sites with MS4 Sewers	119	81	86	286	154	137	102	393	156	125	132	413	143	136	136	415	1507
Post Construction Inspections at Project Sites with MS4 Sewers	9	11	7	27	3	12	15	30	13	7	12	32	7	6	4	17	106
Total Inspections at Project Sites with MS4 Sewers	128	92	93	313	157	149	117	423	169	132	144	445	150	142	140	432	1613
Active Construction Inspections at Project Sites with Combined Sewers	402	425	348	1175	449	396	317	1162	392	313	327	1032	302	314	291	907	4276
Post Construction Inspections at Project Sites with Combined Sewers	32	18	28	78	48	34	21	103	13	9	12	34	30	36	7	73	288
Total Inspections at Project Sites with Combined Sewers	434	443	376	1253	497	430	338	1265	405	322	339	1066	332	350	298	980	4564

Figure F.5-1: FY19 Active Construction Sites



b. Post-Construction Stormwater Management in New Development and Redevelopment

Adopted in January 2006, the Philadelphia Stormwater Regulations enabled PWD to review plans for both new and redevelopment sites throughout the City to ensure water quality and quantity were part of the proposed management plan. Since 2006, PWD has collected and synthesized feedback from the development community regarding improvements to the stormwater plan review program. With the signing of a Consent Order and Agreement with the PADEP in June 2011, PWD saw an opportunity to increase stormwater management from land development projects while simultaneously implementing business-friendly improvements to the program. Regular updates are made to the Stormwater Regulations to improve and strengthen PWD's stormwater programs and stay current in policy procedures. The Philadelphia Stormwater Management Regulations are available online at http://www.phila.gov/water/PDF/PWDregCH6.pdf.

c. Applications/Permits

Across the entire city during FY19, 404 unique projects were submitted to PWD for conceptual review through the program's website. PWD approved full technical plans for 102 projects during FY19 citywide. It should be noted that this number does not include plans re-submitted for review, some of them multiple times. The distribution of development projects that submitted post-construction stormwater management plans for review is presented in **Table F.5-2 & 3.**

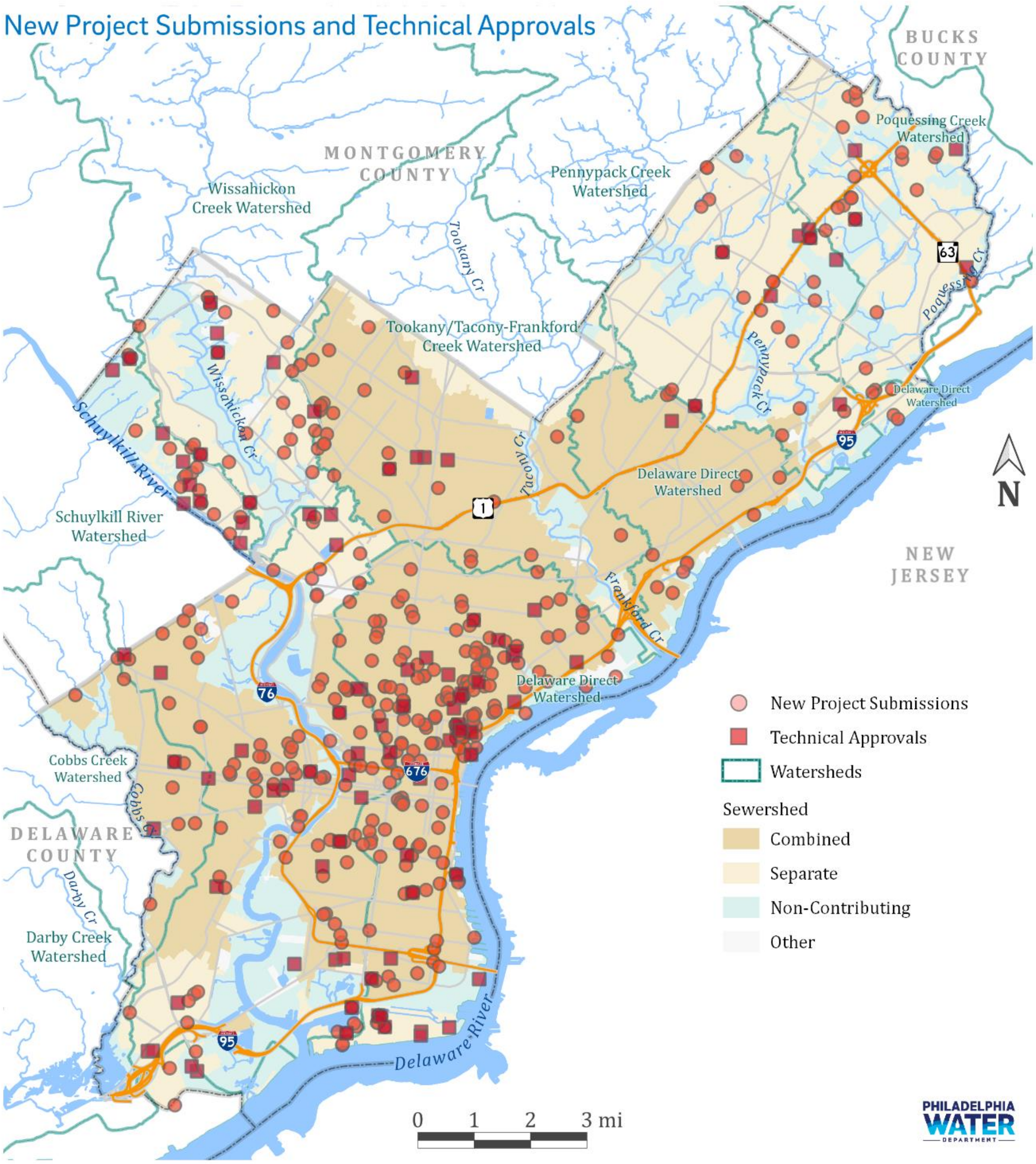
Table F.5-2: Approved Stormwater Plan Location Summary by Contributing Area

Drainage Type	Number of Locations
Combined Sewer Area	55
Non-Contributing Area	13
Separate Sewer Area	34
Total	**102**

Table F.5-3: Approved Stormwater Plan Location Summary by Watershed

Drainage Watershed	Number of Locations
Delaware River	36
Poquessing Creek	5
Pennypack Creek	7
Schuylkill River	37
Tacony/Frankford Creek	5
Wissahickon Creek	9
Darby-Cobbs Creek	3
Total	**102**

Figure F.5-2: Locations of New Project Submissions and Technical Approvals



d. Inspections

PWD requires a pre-construction meeting prior to commencement of earth moving activities for projects applicable to post-construction stormwater management requirements. In FY19, PWD conducted 115 pre-construction meetings citywide for development projects. During the pre-construction meeting, both the approved E&S Control Plan and the approved Post-Construction Stormwater Management Plan (PCSMP) are discussed with the construction manager and property owner representative. Post-Construction Stormwater Management inspections are discussed in **Section F.8** on page 35.

The inspection program continued in FY19 by conducting inspections of stormwater structural controls on land development sites. PWD stormwater inspectors conducted site visits for 387 active sites citywide during FY19. Technical plan review staff was also on-site, as needed, to verify construction of the SMPs was completed in accordance with the approved plan. In the case that concerns are identified regarding SMP installation during construction, the technical plan reviewer will discuss the necessary corrective actions for the project with the PWD inspector and the construction manager.

PWD stormwater inspectors monitor the installation of SMPs and erosion and sedimentation controls during active construction for private development sites. During FY19, PWD was able to maintain its presence in the field by conducting 1,507 active construction inspections on 104 sites in the separate sewered areas of the city. Many sites were visited multiple times to ensure compliance with appropriate requirements (**Table F.5-4**).

Table F.5-4: Active Construction Inspection Site Location Summary

Drainage Type	Number of Locations
Combined Sewer Area	248
Non-Contributing Area	35
Separate Sewer Area	104
Total	**387**

e. Monitoring/Enforcement

As part of the 2017 EPA AOCC CWA-03-2017-0146DN, PWD was required to develop an SOP to detail enforcement procedures for responding to E&S control issues when established enforcement methods do not result in compliance. In FY19, PWD continued to use the Repeat Offenders Standard Operation Procedure (SOP) as a guide when implementing enforcement action.

The SOP outlines Notice of Violations which includes a deadline for compliance and re-inspection. If a project remains out of compliance, PWD will coordinate with the L&I to issue a Stop Work Order. PWD also coordinates with L&I to hold the building Certificate of Occupancy for any projects where major issues are identified during the construction process. In some cases, projects may fall out of compliance after enforcement actions were previously taken during the construction period.

PWD issues a Notice of Violation to sites when significant or persistent issues with E&S controls or the installation of required SMPs are not addressed in a timely manner. In FY19, PWD issued a total of 27 Notice of Violations (NOVs) to projects under construction citywide. Four of those NOVs were associated with projects who had received a previous NOV in FY18. In addition, PWD issued a follow-up NOV notice to 12 of the 27 projects in order to ensure full compliance. Of the 27 active NOVs issued in FY19, 21 have been partially or fully resolved bringing the site back into compliance. The major compliance issues for active construction projects include improper installation or absence of E&S controls, contractor not following the onsite E&S Plan, incorrect SMP installation, and non-permitted construction activity.

f. NPDES Permit Requests

PWD continues to serve as the Conservation District for the City of Philadelphia for NPDES Construction Permitting Requirements and Chapter 102 Regulations relating to Erosion and Sedimentation Pollution Control. PWD continues to receive notifications and coordinate reviews for permitting. For more information and full details on this process described in previous reports; please refer to Section F.5.f NPDES Permit Requests on page 204 of the CSO-Stormwater FY12 Annual Report.

g. Stormwater BMP Handbook and Construction Site BMP Sediment & Erosion Control Checklist

The Stormwater Management Guidance Manual Version 3.0 represents a comprehensive revision released in conjunction with the updated Stormwater Regulations on July 1, 2015. On July 2, 2018 the Stormwater Management Guidance Manual Version 3.1 came into effect. Primarily a web-based resource, this version of the manual is organized to reflect the life cycle of a development project from initial submission through operation and maintenance. In addition to providing context on the regulatory framework for stormwater management in the city, the manual builds upon nearly a decade of program growth and technological advancements to streamline the technical design requirements and clearly document the plan review process for applicants. The PWD leveraged feedback from design engineers to clarify existing content, provide new resources and develop a fully searchable and accessible online manual. The manual is located on the web at https://www.pwdplanreview.org/manual/introduction.

F.6 Watershed, Combined Sewer Overflow (CSO), and Source Water Protection Programs

PWD, through the Planning and Environmental Services Division (PESD), strives to reduce the amount of point and non-point discharges entering regional waterways and improve the environmental health of the region so that all waters are fishable and swimmable. The main programs within PESD, in addition to the Stormwater Management Program, that work together to improve regional ecological health, water quality, and sustainability are: Delaware Valley Early Warning System (EWS), CSO Management Program, Watershed Planning, Source Water Protection Program, and Wetlands Mitigation Registry. The Watershed Planning Program is presently explained in detail throughout **Section III.C of the CSO Annual Report** on page 36.

Source Water Protection Program

PWD's Source Water Protection Program embodies PWD's multi-barrier approach to ensuring the safety and quality of Philadelphia's drinking water, whose sources consist of the Schuylkill and Delaware Rivers. The Source Water Protection Program staff work closely with PWD water treatment plant operators to anticipate and respond to emergencies and challenges to conventional treatment technology. PWD continues to implement the Source Water Protection Program and has discussed it in full detail in the past. For more information on this program, please refer to the following sections:

- Schuylkill Action Network
  Please refer the CSO Annual Report **Section II.G.2 – Schuylkill Action Network** on page 20 for information about this topic.
- Delaware Valley Early Warning System
  Please refer the CSO Annual Report **Section II.G.2 – Delaware Valley Early Warning System** on page 21 for information about this topic.
- RiverCast
  Please refer the CSO Annual Report **Section II.G.2 – RiverCast** on page 20 information about RiverCast.

Combined Sewer Overflow Management Program

The Combined Sewer Overflow management program works to implement technically viable, cost effective improvements and operational changes that mitigate the impacts of combined sewer overflows. Please refer to **Section I Management and Control of CSOs** on page 1 in the CSO Annual Report for additional information.

Watershed Mitigation Registry

Please refer to the CSO Annual Report **Section III.C.2.4 – Wetland Enhancement and Construction** on page 43 for information about the Watershed Mitigation Registry.

F.7 Miscellaneous Programs and Activities

a. Pollutant Migration/Infiltration to the MS4 System

PWD responds to all citizen complaints of liquid, solid, or gaseous pollutants within Philadelphia. A list of all pollutant migration events in the MS4 section of the City that occurred in FY19 is presented in **Appendix O – FY19 Pollutant Migration/Infiltration**.

b. Public Education and Awareness

Public Education Literature

The City takes an active role in providing information and education to the public and our community. Several events and programs are conducted each year in which the City provides numerous amounts of literature to the public. Please refer to the CSO Annual Report **Section II.G – Pollution Prevention** on page 19 for information about this topic.

c. Pesticides, Herbicides, and Fertilizer Controls

Integrated Pest Management protocol

The majority of the City does not use pesticides or conduct any practices that require the use of the Integrated Pest Management (IPM) protocol. The City is currently focusing on invasive plant management through the use of herbicide to remove invasive plants.

The Philadelphia Health Department uses larvicides, Bacillus Sphaericus (brand name Vectolex), Methoprene (Altosid), and Spinosad (Natular), to prevent mosquito breeding. These larvicides are approved for use in the stormwater catch basins and are applied as such. The IPM protocol is followed when using the larvicides by inspecting the catch basins before treatments, using the least toxic or non-toxic product, and submitting a request for repairs when necessary. PWD and the Department of Public Health work closely together. This collaboration has resulted in the Health Department receiving maps with locations of the City's storm water inlets and surface basins. This allows PWD improved access to refer concerns of pests in the water collections systems for treatment by Health Department staff.

All associated Philadelphia Health Department staff are certified pest control applicators in accordance with Pennsylvania Department of Agriculture. To maintain this certification, on-going training is required. The Philadelphia Health Department holds several on-site trainings per year for staff.

Education materials to private pesticide users

The Philadelphia Health Department provides educational materials to organizations, companies and/or individuals upon request. Often private exterminators, especially companies that handle pest control work for City facilities, request this information since most buildings in the City contract out for pest control work through the individual Departments. Health Department Sanitarians (Inspectors) have this information available to provide to the public.

d. Snow Management Plan

The City faces winter storms that bring potentially dangerous accumulations of ice, sleet, freezing rain, and snow. To mitigate the impact of these storms, the Streets Department has prepared a Snow and Ice Operations Plan which provides a detailed outline of the City's response to adverse winter weather conditions. The plan includes the salt storage locations at the six Highway Districts. Page 41 of the Plan describes the Streets Department salting policy. The updated Snow and Ice Removal Operations Plan for winter 2018-2019 is provided in **Appendix M - City of Philadelphia Snow and Ice Operations Plan Winter 2018-2019.**

e. Municipal/Hazardous Waste, Storage, Treatment, and Processing Facilities

The City's one waste transfer station, Northwest Transfer Station, is located at Domino Lane and Umbria Street. The site was inspected by EPA during the stormwater audit in 2015, and a City-led inspection in May 2017. The City cleaned and dye tested inlets and trench drains on site to verify proper connection to the storm and sanitary systems. During FY19, the City was in the design phase for a new waste facility to replace the one currently on the site. The design includes stormwater management best practices such as oil/water separators in the trench drains near the waste compactor and rain gardens to manage stormwater runoff on site.

F.8 Best Management Practices (BMPs)

a. Submit storm sewer discharge ordinance

The authority for PWD to adopt stormwater regulations is found within Title 14 Zoning and Planning Code under §14-704(3) Stormwater Management. PWD maintains Stormwater Regulations as Chapter 6 of PWD's regulations. These regulations were originally adopted in 2006 and were most recently updated in July of 2015. These regulations require stormwater management on development projects that exceed an earth disturbance threshold of 15,000 square feet. For more information regarding PWD's regulation updates within the last year, see **Section F.5.b. – Post-Construction Stormwater Management in New Development and Redevelopment** on page 29.

PWD has added documentation to a website (http://www.pwdplanreview.org) to provide the development community a means of accessing the most recent stormwater management information.

b. Commercial and Residential Source Controls

b.i. Mingo Creek Surge Basin

The Basin was last dewatered in August of 2012 to inspect the sediment levels. The basin sediment appeared to have not changed since its last inspection in 2009; therefore, no further accumulation had occurred. A bathymetric study of the basin is being planned and the results of this survey will be evaluated to determine if additional action is required for sedimentation control. For more information on this project, please refer to Section F.8.b.i on page 214 of the CSO-Stormwater FY12 Annual Report.

b.ii. Existing privately owned structural controls

To ensure ongoing SMP maintenance of private facilities, PWD continues to utilize three means: executing Operation & Maintenance Agreements, conducting post-construction maintenance inspections, and utilizing enforcement tools.

An Operation & Maintenance Agreement is executed by PWD and the property owner, notarized, and recorded to the property prior to the issuance of a Post-Construction Stormwater Management Plan Approval by PWD. These agreements outline the SMP(s) on the private site and stipulate maintenance requirements. The agreements also include language granting PWD the right to inspect on-site SMPs and even perform maintenance on behalf of the property owner if necessary. PWD also maintains a comprehensive operations and maintenance manual for SMPs geared toward private development users: http://www.phila.gov/water/PDF/Retrofit-O.M.Manual.pdf.

Post-construction maintenance inspections of private facilities were conducted through the reporting period. PWD utilizes both specialized inspection techniques as well as visual inspections to assess the performance of private SMPs. The inspections conducted to date have identified the most effective methods and technologies, including closed-circuit television, ground penetrating radar, surveys of critical system elevation points, confined space, pole-mounted camera photography, and visual and wet weather inspections. In FY19, PWD performed 414 post-construction inspections citywide. PWD will continue to evaluate and refine post-construction inspection protocols.

Utilizing **enforcement tools**, PWD will issue notification to the property owner if an SMP is found to be insufficiently maintained. This notification will include a description of any issues identified and a timeline for achieving compliance. The City is authorized to compel maintenance of SMPs on private property under the Philadelphia Code and PWD Regulations. Development sites that are subject to PWD's stormwater regulations are required to maintain the SMP(s) to function as designed. If this initial notification is unsuccessful at bringing action from the property owner, PWD can compel compliance through a number of enforcement tools, including issuance of notice of violations, fines, court action, and/or a nuisance abatement and lien by the City. For non-compliant projects, PWD will also suspend any applicable stormwater billing credits if the required maintenance is not performed.

In FY19, 69 projects were brought back into compliance citywide using the above-referenced protocols. PWD will continue to work with property owners to ensure that SMPs are inspected and maintained in accordance with Regulations and recorded O&M agreements.

c. Development plans review

PWD and the City Planning Commission provide review of drainage plans for new and redevelopment. The drainage plans address both flood control and potential stormwater pollutants under the authority of the Philadelphia Code. Please refer to **Section F.5 – Monitor and Control Stormwater from Construction Activities** on page 23 for additional information.

d. Street Cleaning Program

During FY19, the Streets Department continued its street cleaning programs that target street debris and litter. With its fleet of mechanical sweepers, the Streets Department provides daily street cleaning in Center City and on major arteries and commercial corridors throughout the city. Since FY14 the Streets Department has initiated monthly street sweeping operations on routes along the Tookany/ Tacony Frankford, Wissahickon, Cobbs Creek and Pennypack watersheds within the city.

In addition, the Center City District (CCD) and University City District (UCD) conduct sidewalk cleaning. Heavily-trafficked commercial streets and areas receive daily sweeping with pans and brooms and mechanical cleaning. Other areas with a high density are cleaned at least twice weekly with machines (some areas are cleaned daily). Sidewalks also get a monthly power washing, except in winter, to remove accumulated stains, gum and grime. In FY19 20,500 miles of streets were mechanically cleaned. Through a variety of fee-for-service arrangements, CCD crews clean several adjacent commercial and residential areas and provide a 24-hour deployment to clean the three and a half mile long underground subway concourse and Center City's two regional rail stations.

Public awareness of litter

The City promotes, develops, and implements litter reduction programs in an effort to increase public awareness of litter as a source of stormwater pollution. There are about 500 solar-powered, compaction litter receptacles in Center City, and another 460 in other commercial districts throughout the city. Over 600 standard wire baskets are also in place through the Philadelphia More Beautiful Committee (PMBC) Adopt-A-Basket program, which provides block captains with wire waste baskets to distribute and manage across city neighborhoods. PMBC also organizes neighborhood cleaning events citywide. Such cleaning efforts are bolstered every April by the Philly Spring Cleaning day, a citywide anti-litter event partnering various city agencies and neighborhood community groups, now in its twelfth year. This year's event included a total of 685 clean-up projects throughout the city. As a result of the overall clean-up efforts, a total of 294 tons of trash, 1.15 tons of tires and 55.43 tons of recycling material was removed from city streets, sidewalks and open areas. In addition, participants from Streets' Future Track program were featured as part of six clean-up projects in targeted areas of Southwest Philadelphia where they designed, planned and completed each project effort. These efforts are bolstered by Philadelphia's SWEEP program. SWEEP officers, employees of the Streets Department, work with residential communities to address locations with problematic amounts of litter and short dumping. In cases of non-compliance, SWEEP officers will issue warnings and citations to the appropriate individuals.

During FY17, the City of Philadelphia Mayor Kenney signed an Executive Order to create the Zero Waste and Litter Cabinet (Cabinet) to move the City towards a zero waste and litter-free future. To accomplish the goals of reducing waste and litter the Cabinet was created as an interdepartmental effort to combat litter, enhance cleanliness of streets and public spaces, and increase the waste diversion rate toward a long-term goal of Zero Waste entering landfills or conventional incinerators. A Zero Waste and Litter Cabinet Action Plan was released in summer 2017. Additionally, the 2018 Progress Report was released in spring 2019. Both documents are available here: http://cleanphl.org/.

e. Animal Waste and Code Enforcement

Educational material regarding control of animal waste

The Philadelphia Code and Charter Chapter 10.100 – Animals and Chapter 10.700 – Refuse and Littering address the proper clean-up of pet waste and applicable fines and penalties. In addition, signs advertising said penalties are displayed city-wide in an effort to prevent residents from violating this statute. The City of Philadelphia also provides the text of this code online at http://municipalcodes.lexisnexis.com/codes/philadelphia/.

PWD provides additional information on pet waste to the public including how it affects stormwater and why to pick it up through its website located at the following site: http://www.phillywatersheds.org/whats_in_it_for_you/residents/pet-waste/.

Dog Waste Control Program

PWD launched an innovative approach to address dog waste in targeted neighborhoods in July of 2010. Through a pilot project in the Delaware Watershed, the Partnership for the Delaware Estuary found that many dog-owners are unaware of the connection of dog waste to water pollution. Building on almost of decade of experience, PWD redeveloped the dog waste program in FY18 to more broadly appeal to dog owners across the City. The new program will expand outreach into community dog parks, City-owned parks and various events hosted by organizations across the city.

In FY19, PWD and PDE inaugurated a new partnership with Morris Animal Refuge to highlight shelter animals as contestants in the annual competition. This new approach allowed PWD to broaden our audience for pet messaging to new pet parents via the shelter. PWD hopes to expand this approach to additional shelters in the coming years. Our FY19 winner, Dolphina, was featured in multiple articles in local newspapers, magazines and on television, reaching tens of thousands of Philadelphians. Additionally, the Spokesdog is called upon to feature in media programs for large festivals and programs such as the Delaware River Festival. More information can be found at the following website: http://www.phillywatersheds.org/spokesdog.

f. Flood Management and Flood Control Devices

Structures built within the floodplain

All development within the Special Flood Hazard Area (SFHA), which is identified on FEMA's Flood Information Rate Maps (FIRM's), is reviewed and approved per the City's codes and regulations found in both Zoning and Building codes. L&I will identify all City parcels within the SFHA, and upon an application submission will determine whether the floodplain codes apply. If the development site itself is determined to be within the SFHA, structures built will be designed to an elevation of Base Flood Elevation (BFE) plus a safety factor of at least 18 inches. The L&I will maintain records of compliance for all development located with the SFHA. Licenses and Inspections issued 19 permits for new construction, addition, and alterations in FY19.

Evaluate new and existing structural drainage controls

Our evaluation of structural drainage controls was discussed in further detail in **Section F.8.b.ii - Existing privately owned structural controls** on page 35 of this report.

Work is being done on sections of the city that have chronic flooding to eliminate or reduce these occurrences; please refer to CSO Annual Report **Section II.B.3 – Flood Relief Project Summary** on page 3 for more information about the SFR projects and details on evaluating structural drainage controls.

Streambank Restoration and Wetland Enhancement

Please refer to the CSO Annual Report **Section III.C.2.3 – Stream Habitat Restoration** on page 42 for information pertaining to streambank restoration.

Please refer to the CSO Annual Report **Section III.C.2.4 – Wetland Enhancement and Construction** on page 43 for information pertaining to wetland enhancement.

g. Sanitary Infiltration Controls

Limit sanitary infiltration

As part of the Cross Connection Repair Program, PWD has conducted 1,544 abatements to correct cross connection in sewer laterals since 1994; 61 abatements were completed in FY19 alone. PWD also has in place 12 dry weather diversion devices which divert sanitary flow back into the sanitary sewer but still allow stormwater to pass through during wet weather events. PWD estimates that these abatements and dry weather diversion devices have prevented over 216.4 million gallons of contaminated flow from entering our waterways since the inception of the program and about 8.6 million gallons during FY19. Please refer to **Section F.3 – Detection, investigation and abatement of Illicit Discharges** on page 20 for more information on the Cross Connection Repair Program.

In addition, as part of PWD's Sewer Maintenance Program, sewer lining is routinely conducted on both sanitary and storm sewers. Lining sewers helps to reinforce, seal and rehabilitate the existing sewers, specifically preventing infiltration to allow the pipe capacity to be reserved for sanitary and storm flow.

Apart from those being done under consent orders, there are several sewer lining projects in the City that originate from sewer maintenance issues like street cave-ins, depressions, backups, as well as sewer assessment meetings.

As a part of PWD's commitment to improvement of water quality and aesthetics in dry weather, large sewer lining projects began on the entire length of intercepting sewers along the Tookany/Tacony-Frankford and Cobbs Creeks. Please refer to **Appendix A Green City, Clean Waters FY19 Annual Report Section 3.3 Interceptor Relining** on page 5 for more information on the interceptor relining project.

Construction of a storage tank upstream of relief sewer manhole R-20, located at Main Street and Shurs Lane, to capture and store excess flows was completed during November of 2013. The consent order requirement for sewer linings to be done around regulator R-20 in an effort to reduce inflow and infiltration has been completed. Please refer to CSO Annual Report **Section III.B.1– Eliminate COS/Main and Shurs Off-Line Storage (SW) - Construction and Implementation of the Main and Shurs Off-line Storage Project** on page 32 for more information on the Main and Shurs Off-line Storage Project and efforts to reduce inflow and infiltration at R-20.

PWD constructed a parallel relief sewer in December of 2011 to eliminate overflows at manhole PC-30 as per a consent order issued in 2007 by the DEP. The overflows at PC-30 were caused by a combination of various factors which influence the hydraulic carrying capacity of the Poquessing Creek Interceptor during wet weather events. There were also several sewer lining projects done under the consent order for PC-30 area in conjunction with the relief sewer being constructed. In FY19, PWD continued to monitor the effectiveness of this relief sewer. During FY19, there was one monitored overflow event at manhole PC-30 on 11/24/2018. Please refer to CSO Annual Report **Section III.B.2 – PC-30 Parallel Relief Sewer** on page 33 for more information on the PC-30 Relief Sewer.

Investigate, remediate, and report sanitary infiltration

PWD responds to all citizen complaints of liquid, solid, or gaseous pollutants within Philadelphia. A database called the Sewage Pollution Incident & Location Log (SPILL), which stores information about unintentional sanitary discharges including the date reported, problem location, spill type, description, and abatement date, is maintained. Detailed information on the events found on the SPILL database of reported sewage pollution incidents in FY19 are found within in **Appendix N – FY19 Sanitary Infiltration Events**.

The following locations have been identified by PWD as locations suffering from chronic discharges of sanitary sewage to the storm sewer system and/or waterways. A description of the specific site issues and the current status of remediation efforts is provided for each location.

Holme and Longford Avenue (MH P100-14-S0015)

During FY19, PWD experienced 4 discharges of sanitary sewage to the nearby Pennypack Creek tributary due to an accumulation of material and back up of flow at this manhole. These discharges were in addition to discharges observed during the previous two fiscal years. This location is particularly difficult to inspect, maintain and repair due to the almost 50-foot depth of the manhole. The PWD has increased inspection and maintenance at this location to prevent future discharges.

Navy Yard Force Main Discharges

During FY19, the PWD continued to respond to SSOs in the Navy Yard caused by extreme corrosion of the ductile iron components associated with Pump Stations 648 and 603. These issues have been known to PWD for some time and caused the initiation of a capital replacement project for the pumps, valve sand force main at pump station 648 and the pumps and valves at pump station 603. Construction activities associated with this project commenced during FY19.

On-lot septic/disposal system

During FY19, one complaint of malfunctioning on-lot sewage disposal systems were investigated and serviced. Also, during FY19, 10 applications were reviewed for the installation of on-lot sewage disposal systems. Of those applications, 8 permits were approved. In addition, 640 portable toilet permits were issued. PWD continues to support the inspection and remediation of these systems.

h. Spill Prevention and Response

The City's response plan to respond to and contain harmful spills that may discharge to the municipal separate storm sewer system is managed by the Office of Emergency Management. The City of Philadelphia Emergency Operations Plan – Annex F Hazardous Materials and PWD – Waterways Contamination Response Protocol, can be found in the Additional Documents folder on the **Supplemental CD**.

In order to protect PWD's structures and treatment processes, PWD staff respond to oil and chemical spills and other incidents that have the potential to threaten the water supply or impact the sewer system, twenty-four hours per day, seven days per week. PWD responds to all incidents that can impact the sewer system or endanger PWD employees. This includes both the sanitary sewer system and the storm sewer system. PWD supervises cleanup activities and assesses environmental impact. PWD inspectors also investigate various other types of complaints. In FY19, 33 pollution migration events occurred. A list of all pollutant migration events in the MS4 section of the City that occurred in FY19 is presented in **Appendix O – Pollutant Migration/Infiltration.**

i. Public Reporting of Illicit Discharges, Improper Disposal

The City encourages residents to report the occurrence of illicit discharges that may impact the sewer system and water bodies. To facilitate the timely reporting of such events, PWD operates a Municipal Dispatcher 24 Hours/Day, 7 Days/Week to handle reports from the public. In addition, a customer service hotline (215 686-6300) is also operated that provides the ability to connect to the Dispatcher. This information is distributed in mailings, as well as online at http://www.phila.gov/water/contact_us.html.

Upon the reporting of such an incident, a PWD inspector is immediately dispatched to the site to investigate and determine the source of the discharge, as well as the extent of impact on the receiving water body. Each incident is logged into an electronic database that enables tracking of the details of each occurrence.

PWD received 408,821 phone calls which led to 72,072 service requests being conducted during FY19. Currently PWD does not track phone calls specifically related to illicit discharges and improper disposals in the MS4 area, but instead tracks much broader topics including sewage backup, flooding, street cave-ins and water service disruptions.

Philly 311

Philly311 was created to help eliminate the need to sort through the numerous phone numbers and hotlines available to contact the City government. A customer service specialist will connect the user to the information and services they may need either by calling 3-1-1, asking a question on the website or through Twitter @philly311. A Philly 311 mobile app is available for iPhone, Android, or Blackberry devices to report issues such as graffiti, potholes, litter and more. For more information on uses of Philly311, please visit: http://www.phila.gov/311/. During FY19, Philly 311 transferred 1,593 non-emergency inlet and hydrant requests to Customer Service Call Center.

j. Used Oil and Toxic Material Disposal

The City continues to facilitate the proper disposal of used oil and other toxic materials. This program includes collections events, distribution of educational materials, the operation of a website, and a hotline accessible to the public. For more information on the hazardous waste program please visit: http://www.philadelphiastreets.com/hazardous-waste.

k. Storm Water Inlet Labeling/Stenciling

In September 2015, PWD released a refreshed storm drain marking program. This new iteration features watershed specific storm drain markers. Each of the seven new markers prominently features a unique color scheme and an animal native to that respective watershed. Educational materials provided with each kit better inform the public about how their actions on the street can reduce stormwater runoff pollution. In 2017, PWD launched a beta version of a new web-based storm drain marking app. This new app will allow participants to more accurately mark inlets on their blocks and public spaces. Inlets are color coded by watershed allowing participants to view the often hidden natural watershed boundaries of our city. The direct capture of information via the app will also allow PWD to more accurately track the placement of markers throughout the city. The app can be accessed here: https://markingapp.philadelphiawater.org/.

During FY19 PWD distributed 103 storm drain marking kits, totaling 1,545 individual stormwater inlet labels. PWD continues to encourage community organizations and citizens to get involved in storm drain marking projects. More information on this program has been provided in previous years; please refer to Section F.8.k on page 312 of the CSO-Stormwater FY10 Annual Report.

Section G Assessment of Controls

Annually estimate pollutant loadings & reductions from stormwater management plan

PWD selected a set of effective post-construction stormwater management controls to address problems identified in the waterways and documented these controls in the Stormwater Management Guidance Manual. Philadelphia's stormwater management regulation obligates all development and redevelopment projects subject to these regulations to implement the identified controls. The requirements of the stormwater regulations were developed through the Act 167 planning process in coordination with neighboring counties. The requirements are explained in detail in Section 1.2.1 of the Stormwater Management Guidance Manual and summarized below.

Water Quality

The Water Quality requirement focuses on the removal of both runoff volume and pollutants and is similar to requirements in surrounding states and other major cities across the country. Because flow rates and velocities were identified as significant causes of aquatic ecosystem impairment, infiltration is emphasized as the preferred water quality management practice unless evidence is provided that it is infeasible on a particular site. Additional water quality benefits are provided, in part, by slowing water down and allowing suspended solids and associated pollutants to settle.

The Water Quality requirement stipulates infiltration of the first 1.5 inches of runoff from all directly connected impervious area (DCIA) within the limits of earth disturbance. The initial 2006 regulations required 1.0 inch of runoff to be managed, based on water budget analyses and precedents for control of the 90th percentile event set by Maryland and other nearby states with similar climates. This requirement has been increased in 2015 to 1.5 inches based on evidence provided by simulations showing that this level of control will further reduce the volume and flow rate of runoff to waterways.

Channel Protection

Erosion of stream beds and banks caused by high volumes and velocities of urban runoff was identified as a significant contributing factor to aquatic ecosystem impairment in Philadelphia's stream systems. For this reason, a channel protection requirement was incorporated in the stormwater regulations. This requirement is based on the concept of effective channel forming discharge and is similar to precedents set by Maryland and other nearby states with similar climates and geology.

The Channel Protection requirement stipulates the detention and release of runoff from the one-year, 24-hour Natural Resources Conservation Service Type II design storm event for all DCIA within the limits of earth disturbance at a maximum rate of 0.24 cfs per acre of directly connected impervious drainage area in no more than 72 hours.

Flood Control

Act 167 Plans identified peak rates of runoff as a contributing factor to out-of-bank flooding events in Philadelphia and surrounding counties. To address peak rate control, geographically specific requirements were incorporated in Philadelphia's stormwater regulations and manual.

The Flood Control requirement stipulates that a development project meet or reduce peak rates of runoff, as determined by its Flood Management District, from predevelopment to post-development conditions during certain storm events.

There are approximately 20.7 square miles of impervious area in the portion of the City that falls under the MS4 permit. As of July 2019, approximately 1.06 square miles (679 acres) of directly connected impervious area are tributary to completed or approved green stormwater infrastructure. This is approximately 5.1% of the impervious area.

Section H Fiscal Resources

Maintain adequate program funding

During FY19, the City provided fiscal resources needed to support operation and maintenance of the Stormwater Management Program. The budget for the upcoming FY20 budget is available upon request.

Annually submit fiscal analysis

The conditions of the NPDES permit can be achieved through appropriate budget planning supporting the projects and assessments critical to a successful program. Any funding changes will be included as part of subsequent annual reports.

APPENDIX A

Green City, Clean Waters

FY 2019 Annual Report

Eighth Annual Report for the City of Philadelphia's Consent Order and Agreement on *Green City, Clean Waters*

Reporting period July 1, 2018 – June 30, 2019

Submitted to
The Commonwealth of Pennsylvania
Department of Environmental Protection
And
The United States Environmental Protection Agency

By the City of Philadelphia Water Department
September 30, 2019

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Glossary of Acronyms

AOCC	Administrative Order for Compliance on Consent
BMP	Best Management Practice
BOD	Biological Oxygen Demand
City	City of Philadelphia
CMP	Comprehensive Monitoring Plan
COA	Consent Order and Agreement
CSO	Combined Sewer Overflow
GA	Greened Acre
GARP	Greened Acre Retrofit Program
GIS	Geographic Information Systems
GSI	Green Stormwater Infrastructure
LTCPU	Long Term Control Plan Update
NPDES	National Pollutant Discharge Elimination System
PADEP	Pennsylvania Department of Environmental Protection
PCSMP	Post Construction Stormwater Management Plan
PennDOT	Pennsylvania Department of Transportation
PIDC	Philadelphia Industrial Development Corporation
PPR	Philadelphia Parks and Recreation
PSWMR	Philadelphia Stormwater Management Regulations
PWD	Philadelphia Water Department
SDP	School District of Philadelphia
SMIP	Stormwater Management Incentive Program
SMP	Stormwater Management Practice
SRT	Simulated Runoff Testing
US EPA	United States Environmental Protection Agency
WPCP	Water Pollution Control Plant
WQBEL	Water Quality-Based Effluent Limit

1.0 Introduction

The Consent Order and Agreement (COA) between the City of Philadelphia (City) and the Pennsylvania Department of Environmental Protection (PADEP), and the Administrative Order for Compliance on Consent (AOCC) between the City and the United States Environmental Protection Agency (US EPA), formalized the regulatory approval of the *Green City, Clean Waters* program and amended the 2009 CSO Long Term Control Plan Update (LTCPU).

This is the eighth Annual Report submitted under the requirements of the COA. Fiscal Year 2019 (FY19) covers the City's *Green City, Clean Waters* implementation progress activities that occurred between July 1, 2018 and June 30, 2019.

The Philadelphia Water Department (PWD) submitted the Year 5 Evaluation and Adaptation Plan (EAP) on October 30, 2016 to PADEP. The EAP focused on the cumulation of the first target in Year 5 (2016) and can be found at http://phillywatersheds.org/doc/Year5_EAPBody_website.pdf.

1.1 Water Quality Based Effluent Limit Performance Standards

The Water Quality-Based Effluent Limits (WQBEL) performance standards are broken into incremental targets that must be achieved by the City every five years of the 25-year program. The following report includes water pollution control plant and collection system improvements, interceptor lining, and greened acre (GA) interim progress towards the Year 10 WQBEL targets. Volume reduction and mass capture are only reported every 5 years and will be included in the Year 10 EAP. **Table 1-1: Water Quality-Based Effluent Limits** displays the cumulative progress towards meeting the Year 5 WQBEL target and includes the upcoming Year 10 (2021) WQBEL target.

Table 1-1: Water Quality-Based Effluent Limits

Metric	Units	Base Line Value	Year 5 WQBEL Target	Cumulative Amount as of Year 5 (2016)	Year 10 WQBEL Target
NE WPCP Improvements	*Percent Complete*	0	See Section 3.1.1		Progress update in FY21 Report
SE WPCP Improvements	*Percent Complete*	0	See Section 3.1.2		
SW WPCP Improvements	*Percent Complete*	0	See Section 3.1.3		
Miles of Interceptor Lined	*Miles*	0	2	**7.5**	6
Overflow Reduction Volume	*Million Gallons Per Year*	0	600	**1,710**	2,044
Total GAs	*GAs*	0	744	**837.7**	2,148
Equivalent Mass Capture (TSS)	*Percent*	62%	Report value	**70.5%**	Report value
Equivalent Mass Capture (BOD)	*Percent*	62%	Report value	**88.9%**	Report value
Equivalent Mass Capture (*Fecal Coliform*)	*Percent*	62%	Report value	**72.0%**	Report value

1.2 *Green City, Clean Waters* Greened Acres

Greened Acre (GA) progress is achieved through three implementation approaches: Public Investment, (Re)Development Regulations, and Incentivized Retrofits. **Table 1-2: Cumulative Greened Acres** displays the cumulative program progress towards meeting the total GAs at the end of Year 8.

Table 1-2: Cumulative Greened Acres

Implementation Approach	Cumulative Number of Projects (FY11-FY19)	Cumulative GAs (FY11-FY19)
Public Retrofits	191	295
Private Development	383	569
Incentivized Retrofits	104	577
Total	**676**	**1441**

2.0 Implementation Tracking and Reporting

2.1 *Green City, Clean Waters* Program Tracking System

Currently the existing databases and systems track program implementation and support data requests for internal and external reporting. The development of the *Green City, Clean Waters* program tracking system will integrate this data from the existing Water Department systems to streamline the process.

During FY19, milestones were achieved in the development of the *Green City, Clean Waters* program tracking system. This year, continued User Acceptance Testing was performed on the system to ensure proper programmatic alignment for metric calculations along with the finalizations of the Component Design Documents to memorialize the dashboards, data visualizations and calculations of metrics. Additionally, changes to the tracking system were scoped in FY19 to incorporate updated versions of two existing databases that feed the tracking system.

Table 2-1: FY19 Status Updates for Existing Databases and Systems

Existing Databases and Systems	Status
PlanIT	PWD's tracking system that stores information from site evaluations conducted on locations throughout Philadelphia. All sites must undergo an initial evaluation to determine the feasibility of green infrastructure before they can be transferred to CIPIT to begin design phase. In FY19, PWD repaired interoperability issues with CIPIT, geoprocessing issues and added project creation tools.
GreenIT	PWD's metrics tracking system for all public green stormwater infrastructure (GSI) projects. GreenIT tracks estimated, designed, built, and maintained compliance metrics. In FY19, PWD enhanced the data validation within the GreenIT Data Entry Application to further improve data quality. The Data Entry Application is used to create metrics reports by consultants and staff that are directly uploaded to the GreenIT database.
CIPIT	CIPIT is PWD's Capital Program Information Tracking System. In FY19, the Department completed Phase 2 enhancements including improved workflows, new fields, and back-end reporting capabilities.
Stormwater Plan Review Database	PWD's tracking system that stores metrics, including detailed stormwater management practice (SMP) data, related to private development project compliance with the Philadelphia Stormwater Regulations as well as voluntary stormwater management retrofit projects. The database is designed to track workflows related to reviews and inspections, including the status of conceptual and technical reviews, record drawing reviews, and active and post-construction inspections.
Geographic Information System (GIS) Asset Tracking	GIS is used to track the location of all PWD assets. This includes public retrofit, private development and incentivized retrofit SMPs.
Maintenance Management Systems	GSI maintenance activities have been fully incorporated into PWD's Cityworks work order management system, which is linked to the City's GIS and provides tools to track and manage work performed on PWD's assets such as fire hydrants, inlets, water mains, sewers, and GSI.

2.2 Reporting Metrics

Green Stormwater Infrastructure through Public Implementation

The information in GreenIT is used to produce compliance reporting outputs for the completed and planned public project tables in **Appendices 1** and **2** of this report. The Public Completed Projects reporting format and metric definitions are described in Table 1 and Table 2, respectively, in **Appendix 1**. The Public Planned Projects reporting format is described in Table 1 in **Appendix 2**.

Green Stormwater Infrastructure through Private Development

Information from the Stormwater Plan Review Database is used to produce reporting outputs for completed private redevelopment and incentives project tables in **Appendix 3**. The reporting format is described in Table 1 in **Appendix 3**.

Stormwater Management Types

SMP types used for public implementation are described in Table 3 of **Appendix 1** and SMP types used for private implementation are defined in Table 2 of **Appendix 3**.

3.0 Water Pollution Control Plant and Collection System Project Progress

3.1 Water Pollution Control Plant and Collection System Project Progress

Upgrades to increase the peak flow capacity at each of the City's Water Pollution Control Plants (WPCPs) were described in the Wet Weather Facility Plan, submitted on June 1, 2016. During FY19, PWD has continued working towards completing the projects committed to in the Wet Weather Facility Plan. Within the following sections, progress in FY19 on these projects is discussed. The *Green City, Clean Waters* Wet Weather Facility Plan can be referenced here: http://phillywatersheds.org/doc/Wet_Weather_Facility_Plan_website.pdf.

3.1.1 Northeast Water Pollution Control Plant

Within **Table 3-1**, the seven Northeast WPCP improvements committed to in the Wet Weather Facility Plan are listed with their required operation years, as approved by the PADEP. To date, five improvements have been completed and the remaining two improvements are on track for completion by the required operation date.

Table 3-1: Status of Northeast WPCP Improvements

Northeast WPCP Improvements	Required Operation	Project Status (FY19)
Facility Improvements		
Remove Double Deck Effluent Channel in Final Sedimentation Tanks Set 2	6/1/2016	Complete
New (4 x 48") conduits from Preliminary Treatment Building to Primary Sedimentation Tanks Set 1	6/1/2016	Complete
High Flow Management System	6/1/2021	Complete
Gravity Sludge Thickeners	6/1/2021	Complete
Preliminary Treatment Building #2	6/1/2031	In Design
New Influent Baffles in Primary Sedimentation Tanks Set 2	6/1/2031	In Design
Operational Improvements		
Operate with minimal sludge blanket when Gravity Sludge Thickeners in service	6/1/2021	Complete

3.1.2 Southeast Water Pollution Control Plant

All Southeast WPCP improvement commitments in the Wet Weather Facility Plan were completed in FY16, meeting the required operation date of June 1, 2016. For more detailed information, please see the *Green City, Clean Waters* Wet Weather Facility Plan or the Year 5 EAP.

3.1.3 Southwest Water Pollution Control Plant

Within **Table 3-2**, the Southwest WPCP improvement committed to in the Wet Weather Facility Plan is listed with its associated required operation year. The project has been completed prior to the required operation date.

Table 3-2: Status of Southwest WPCP Improvements

Southwest WPCP Improvements	Required Operation	Project Status (FY19)
Facility Improvements		
Additional Effluent Pump	6/1/2026	Complete

3.2 Philadelphia Collection System Improvements

Within **Table 3-3**, the three Collection System improvements committed to in the Wet Weather Facility Plan are listed with their required operation dates. Two of the improvements were completed, meeting the required deadlines. The other improvement identified is a study to evaluate CSO regulator capacities and identify improvements, if necessary. This study is ongoing and is anticipated to continue throughout the implementation of the LTCPU, as PWD is committed to maintaining and improving the efficiency of the collection system. For more Collection System improvements, please see the CSO Annual Report **Section II.B.4 – Fully Integrate the Real-Time Control Facility into the Operations of PWD** on page 5.

Table 3-3: Status of Collection System Improvements

Collection System Improvements	Required Operation	Project Status
Improvements		
NE Second 66" Frankford Grit Chamber Bypass In Service	6/1/2016	Complete
NE Frankford High Level Second Barrel Rehabilitation	6/1/2016	Complete
All Districts: Balancing CSO Regulator Wet Weather Capacities	Study - Ongoing	On Track

3.3 Interceptor Relining

FY19 Progress on Miles of Interceptor Lined

The WQBEL Performance Standards requires 6 miles of interceptor lining completed by the end of year 10 (2021). During FY19 the number of completed miles remained the same as FY18, but the City is well ahead of the Year 10 target with 7.5 miles completed. Additionally, there are 4.3 miles in construction or in contract management, and 3.3 miles in design (**Table 3-4**).

Table 3-4: Interceptor Relining FY19 Status

Project Name	Street Extents	Length (Miles)
Construction Complete		**7.5**
60th and Cobbs Creek Parkway to 75th and Wheeler Sewer Lining	60th and Cobbs Creek Parkway to 75th and Wheeler	2.2
Cobbs Creek Park to 63rd and Market Sewer Lining	Cobbs Creek Park to 63rd and Market	0.5
Cobbs Creek Interceptor Phase 1 CIPP Lining	63rd and Market to 62nd and Baltimore	1.6
Tacony Creek Intercepting Sewer Lining Phase 1	Chew & Rising Sun to I & Ramona	1.9
Tacony Creek Intercepting Sewer Lining Phase 2	2nd St & 64th Ave to Chew & Rising Sun; DRW Mascher to Tacony Interceptor; Cheltenham Ave to Crescentville & Godfrey	1.3
In Construction		**1.7**
Cobbs Creek Interceptor Lining Phase 3	City Avenue to D R/W in former 67th Street	1.7
In Contract Management		**2.6**
Cobbs Creek Intercepting Sewer Lining Phase 2	61st and Baltimore to 60th and Warrington	1
Cobbs Creek Intercepting Sewer Lining Phase 4 (Indian Creek Branch)	City Avenue to D R/W in former 67th Street	1.6
In Design		**3.3**
Tacony Creek Intercepting Sewer Lining Phase 3	I & Ramona to O & Erie	1
Upper Frankford LL Collector/Tacony Intercepting Sewer Lining Phase 4	Castor & Wyoming to Frankford/Hunting Park	1.1
Upper Frankford Creek LL Collector/Tacony Intercepting Sewer Lining Phase 5	Frankford/Hunting Park to Luzerne & Richmond	1.2
Total Anticipated Miles of Interceptor Lined		**15.1**

4.0 Green Stormwater Infrastructure through Public Implementation

The programmatic strategies for achieving public GAs are benchmarked in four phases: planning, design, construction, and post-construction maintenance. The following four subsections describe the progress made during FY19 for each of these phases. **Table 4-1** summarizes Public GSI projects and GAs for FY19. **Figure 4.2** displays the Planned and Completed Public GSI projects.

Table 4-1: FY19 Summary of Public Green Stormwater Infrastructure

	End of FY19			Cumulative
Project Phase	In Design	In Contract Development	In Construction	Completed
Number of Projects	162	72	64	**191**
Current Number of GAs	TBD*	291	242	**295**

*Current number of GAs is subject to change as projects go through the design process

4.1 Planning Approaches for Green Stormwater Infrastructure Implementation

PWD has continued to evaluate entire neighborhoods and specific sites to identify appropriate locations to site GSI footprints. During FY19, PWD continued to streamline a district-based approach to develop a diverse set of project types that range from smaller green street SMPs to larger systems on parcels. PWD staff strategically prioritize and package these projects for the design phase. In FY19, PWD developed planning strategies to ensure compliance with future implementation targets based on program type and implementation approach. Strategies included short-term and long-term policy recommendations for achieving maximum stormwater management.

Planning Outreach and Coordination

PWD works closely with a variety of partners to implement the *Green City, Clean Waters* program throughout all stages of a project. During the planning phase, PWD continued to coordinate the siting of GSI footprints with city agency partners, community groups, and other stakeholders via regular communication and meetings. This past year, the Mayor's initiative Rebuild Community Infrastructure (Rebuild) began implementation and PWD has coordinated closely with project users to incorporate stormwater management in Rebuild projects. PWD continues to maximize stormwater management on all types of GSI projects, beyond just PWD-led capital planning efforts. PWD provided recommendations for maximizing the amount of stormwater managed on private development sites that had potential to manage additional drainage or right of way (ROW) and recommended private properties with potential to manage large amounts of drainage areas to apply for stormwater retrofit grants.

4.2 Design Approaches

In FY19, PWD continued work on streamlining the design process through coordination and improvement of design guidance:

- Established coordination meetings within PWD to facilitate project reviews and improve feedback.
- Worked on improving coordination within PWD through regular coordination and establishment of new and updated procedures for joint projects.
- Released version 2.0 of the GSI Survey & Drawing Standards and CAD Templates. Updates will further improve the efficiency and standardization of PWD GSI drawings.
- Ongoing updates to existing procedures, standards, and guidance building on feedback from operations, monitoring, partner agencies, and other PWD units. Includes development of guidance when working around abandoned sewer laterals, updates to bumpout design guidance, impermeable liner standards, and revisions to designer review practices.

4.3 Construction

In FY19, PWD continued work on streamlining and improving the construction process through staffing, guidance updates, and coordination:

- Published annual updates to the GSI Master Specifications and Bid Item List/Engineering Estimate template.
- Implemented new on-call contract for small GSI sites and right-of-way connections to incentivized retrofits. Contract to increase the speed of system construction and retrofits and improve PWD's ability to work with partner agencies and private developers.
- First draft of the Field Inspectors Guide for construction staff to provide written direction to inspectors working on green stormwater projects.
- Development of staff augmentation contract for inspection services. Contracts expected to be conformed and start work in FY20.
- Development of pilot protocol for construction performance and acceptance testing of systems that are fully lined with impermeable geomembranes.
- Ongoing trainings for inspectors and contractors.

Figure 4-1: Public Green Stormwater Infrastructure Projects

4.4 Public Green Stormwater Infrastructure Maintenance Program

To ensure the function and sustainability of stormwater management infrastructure investments, PWD continues to implement a GSI maintenance program. **Table 4-2** provides a count of SMPs by type currently in PWD's maintenance program. These numbers include SMPs on quasi-public properties, such as the School District of Philadelphia where PWD has performed the maintenance during an initial two-year interim maintenance period. PWD implements post construction maintenance in accordance to the maintenance manual.

Table 4-2: FY19 PWD SMP Types in Maintenance

SMP Types	Total Number of SMPs
Stormwater Tree Trench	286
Rain Garden	101
Stormwater Planter	51
Stormwater Bump out	41
Infiltration/Storage Trench	180
Pervious Paving	9
Green Roof	1
Swale	25
Basin	4
Stormwater Tree	70
Drainage Well	4
Total Number of SMP	**772**

4.4.1 Inspections

While PWD has prescribed maintenance frequencies for GSI, practice and experience has determined that pre-maintenance inspections are the best method to determine the level of maintenance required. At each SMP that has surface features, PWD completed pre-maintenance surface inspections, while at each SMP with subsurface features, PWD completed pre-maintenance subsurface inspections.

Inspection of Surface Elements

In FY19, PWD conducted 3,728 pre-maintenance surface inspections. The condition of the site at the time of the pre-maintenance inspection determines whether maintenance is required. PWD also performs dry weather and wet weather inspections for a more comprehensive assessment. By the conclusion of FY19, PWD completed 2,769 dry weather inspections and 197 wet weather inspections. In FY19, PWD conducted a total of 6,694 inspections.

Inspection of Subsurface Elements

The objective of the pre-maintenance subsurface inspection program is to observe and assess all structural components of SMPs that exist below street level. Inspections are performed in dry weather conditions as capturing discernable video during wet weather conditions is difficult. Inspection staff is certified through the National Association of Sewer Service Companies' (NASSCO) Pipeline, Manhole, and Lateral Assessment Certification Program.

PWD completed a total of 1,727 subsurface inspection work orders which were associated with the inspection of 531 SMPs and a total of 20.8 miles of pipe during FY19. The conditions of each pipe run at the time of the inspection determined whether maintenance was completed. Of the total number of inspections, 889 were pre-maintenance inspections. Following a pre-maintenance inspection, maintenance was conducted when observed NASSCO-specified operational defects (i.e. sediment, debris, trash, roots) occluded ≥10% of a pipe’s cross-sectional area.

The remaining inspections consisted of 750 post-construction inspection of new SMPs and 88 “NASSCO” inspections at select SMPs. NASSCO inspections are used to track NASSCO-specified “Construction” or “Structural” defects to determine if defects remain stable over time.

4.4.2 Maintenance

PWD's GSI maintenance program operates through three types of maintenance activities to adequately address the maintenance needs of PWD's GSI. Maintenance events associated with surface maintenance, subsurface maintenance and porous maintenance are summarized in **Table 4-3**.

Table 4-3: FY19 Summary of Maintenance Events by Type

Maintenance Work Order Type	Number of FY19 Events
Surface	**15,487**
Surface Maintenance -Routine	4,280
Surface - Mulching	400
Surface - Pruning	209
Surface Maintenance -Watering	391
Tree Maintenance	457
Surface Inlet Protection Maintenance	8,845
Work Zone Protection	5
Aesthetic	401
Signage Repair	469
Snow Removal	30
Surface Maintenance - Reactive	**141**
Surface Vegetation Repair	110
Earthwork	1
Surface Structural Repair	29
Green Infrastructure Request	0
Drainage Modification	1
Subsurface	**2,086**
Subsurface Maintenance	797
Inlet Cleaning	871
Subsurface Inlet Protection Maintenance	396
Non-Standard Subsurface Inspection	20
Subsurface Structural Repair	2
Porous	**8**
Routine Porous Maintenance	8
Restorative Porous Maintenance	0
Total	**17,722**

PowerCorpsPHL

Over the past decade, the City and PWD have implemented new strategies to promote the economic and social growth of the City and meet environmental, ecological and business missions. In support of these initiatives, and to augment PWD's GSI aesthetic maintenance responsibilities, PWD entered into partnership with PowerCorpsPHL. PowerCorps is a City of Philadelphia AmeriCorps initiative designed to engage youth, ages 18-26, which transforms lives through service and workforce development. **Table 4-4** summarizes the type and amount of material collected by PowerCorps in FY19.

Table 4-4: PowerCorpsPHL Trash Removal in FY19

Type of material collected	Amount collected (in pounds)	Amount collected (in tons)
Trash	36,123	18.1
Leaves and Organic Debris	4,070	2.0
Total	**40,193**	**20.1**

5.0 Green Stormwater Infrastructure through Private Development

5.1 Philadelphia Stormwater Management Regulations

The Philadelphia stormwater management regulations (PSWMR) were revised in January of 2006 and July of 2015, providing the foundation of the private sector's role in stormwater management. In July 2018, the regulations were updated to change how streets are regulated. The City of Philadelphia requires stormwater management for land development projects in the City of Philadelphia with 15,000 or more square feet of earth disturbance. Plans for proposed projects must be submitted for conceptual review to pursue a zoning permit, while the submission of detailed stormwater management plans must receive a technical review and approval prior to obtaining a building permit. For the projects that proceed to construction, the installations of SMPs are inspected during construction. Active construction inspections are completed for both PSWMR and incentivized retrofits based on the inspection manual. During FY19, PWD conducted 4,276 inspections during active construction in the combined sewer area. **Figure 5.2** displays the completed green infrastructure installed through private development and incentivized retrofits. A full list of complete private development projects can be found in **Appendix 3**. A summary of constructed GAs through private development projects by watershed are listed below in **Table 5-1**.

Table 5-1: Cumulative Completed Greened Acres by Watershed through Private Development

	End of FY19					Cumulative
Watershed	Darby-Cobbs	Delaware	Pennypack	Tookany-Tacony/ Frankford	Schuylkill	Completed
Number of Projects	14	167	3	54	145	**383**
PSWMR GAs	13	250	6	69	231	**569**

Expedited Review

PWD offers a service level goal of no more than a fifteen-day review for all projects submitting for post-construction stormwater management plan review. However, projects that use preferred green stormwater management approaches are eligible for an expedited, five-day review. PWD offers two types of expedited review: 1) disconnection green review and 2) surface green review. The disconnection green review ensures redevelopment projects that disconnect 95% or more of the post-construction impervious area (DCIA) using features such as green roofs, porous pavement and new tree canopy will receive a review response within five days. The surface green review expands the number of eligible projects by including both new development and redevelopment projects that manage 100% of the post-construction DCIA through bioinfiltration and bioretention basins as well as the practices that qualify for the disconnection green review. In FY19, a total of twenty projects qualified for an expedited review in the combined sewer, with seventeen projects selecting the disconnection green review and three projects selecting the surface green review.

Green Roof Density Bonus

The Philadelphia Zoning Code offers incentives to projects citywide that install green roofs by providing exceptions to certain residential density rules. To be eligible for these exceptions, the project must be located in the designated zoning districts and propose to cover at least sixty-percent (60%) of the roof with green roof. In July 2018, the Zoning Code was amended to allow eligibility for existing buildings. New building construction must involve at least 5,000 square feet of disturbance and existing buildings must have a minimum footprint of 5,000 square feet. The green roofs are designed to PWD standards and inspected by PWD during construction. PWD also executes operation & maintenance agreements with the project owners, ensuring long-term maintenance and functionality of the green roof system. To date, the majority of projects submitting for this bonus were sized between 5,000 square feet and 15,000 square feet of disturbance, meaning the projects were not otherwise required to install stormwater management practices to comply with PSWMR. In FY19, a total of twenty-two projects took advantage of the green roof density bonus, twenty of which were located in the combined sewer.

Construction Verification Initiative

PWD continued to refine a construction verification process with the goal of assessing individual projects prior to counting GAs toward compliance totals. This process emphasizes communication efforts from the start of the development project so property owners can adequately plan for record drawing creation. Throughout construction and at the time of construction completion, PWD conducts inspections of the site to observe and document installation of the approved SMPs. PWD also continued to perform outreach at the close of construction to solicit record drawings from project engineers and owners. These record drawings allow PWD to verify SMP installation and function.

In addition to this process, PWD continued to pursue a verification initiative to gather documentation of approvals that have not otherwise been verified and create record drawings to document the constructed conditions. To date, 150 projects totaling 200 GAs have been inspected and verified through this supplemental approach.

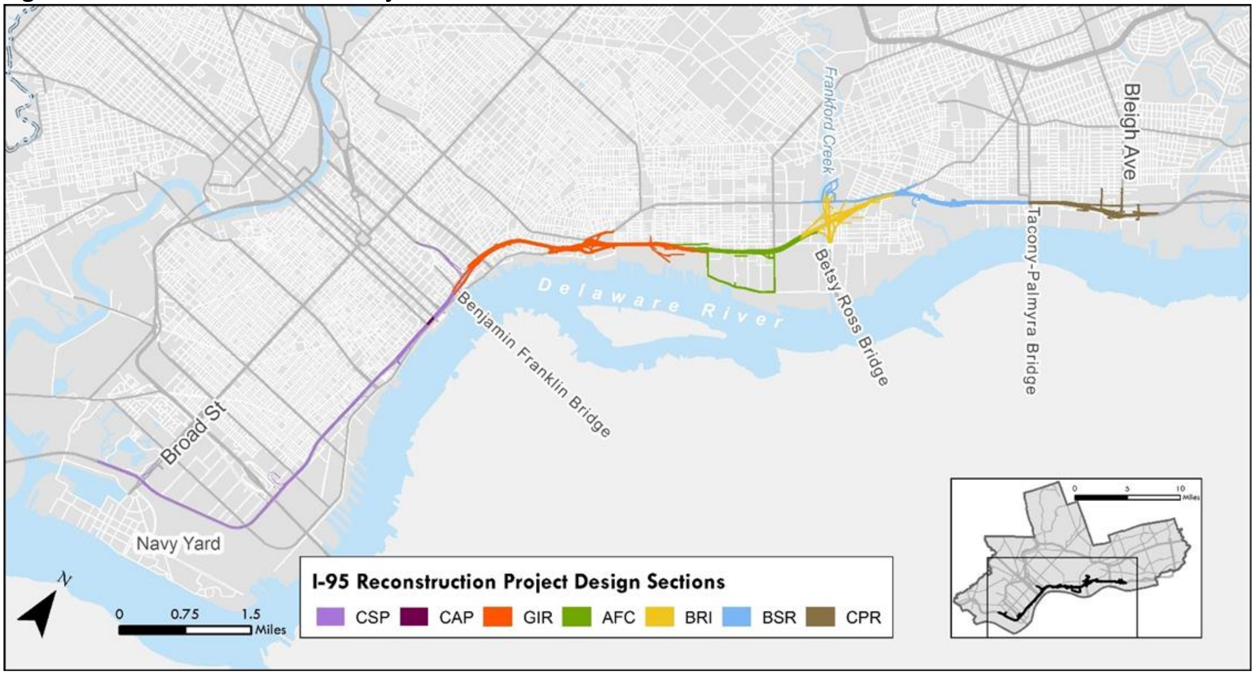
I-95 Reconstruction Project

Pennsylvania Department of Transportation (PennDOT) is performing reconstruction and expansion work on Interstate 95 (I-95) in Philadelphia. Three components of the I-95 reconstruction project support stormwater management: 1) disconnection of stormwater from the combined sewer system; 2) ensuring that redevelopment occurs in a manner consistent with the PSWMR; and 3) installation of GSI in the public right-of-way.

The work on I-95 in Philadelphia is broken into two sectors: Sector A and Sector B. The multi-phased work between Bleigh Avenue and Race Street is known collectively as Sector A. Sector A of the I-95 Reconstruction Project is divided into five major design sections, moving from north to south: CPR, BSR, BRI, AFC, and GIR. Each of these sections is further subdivided into a total of twenty-five construction subsections. Sector B encompasses the area from Race Street to Girard Point Bridge (airport side). At present, Sector B has two design sections delineated, Section CAP from Chestnut to Walnut, and Section CSP from Vine Street to Girard Point Bridge (stadium side). Some of the design and construction work for Sector B may be concurrent with the work in Sector A.

A graphic illustrating the I-95 Reconstruction Project sections is featured below in **Figure 5-1**.

Figure 5-1: I-95 Reconstruction Project Sections



Project updates for the construction subsections with significant design or construction progress in FY19 are summarized in **Table 5-2**.

Table 5.2: I-95 Construction Section FY19 Updates and Anticipated Let Dates

Section	Project Update	Estimated Project Timeline
Sector A – Between Bleigh Avenue and Race Street		
Section CPR (Cottman-Princeton Ramp Area)		
CP2	Six new separate stormwater outfalls have been completed in Cottman Avenue, Princeton Avenue, Magee Avenue, Disston Street, Unruh Avenue, and Bleigh Avenue. The stormwater pipes are designed to accept the drainage from the highway as well as the area in between the highway and the Delaware River as development occurs.	2019, completed
Section BSR (Bridge Street Ramp Area)		
BS1	This project has been approved. Work will include the construction of one bioretention system, one media filter, two vortech separators, and one new outfall in Levick Street will be constructed to treat stormwater from the mainline highway.	2019, anticipated let date
BS4	New PWD storm sewers, inlets, and new outfalls will be installed to covey the new Adams Street runoff. Three basins with amended soils and impervious liners are being constructed to treat stormwater from the new interchange ramps.	2021, estimated completion
Section BRI (Betsy Ross Interchange Area)		
BR0	PWD sanitary and storm sewer culverts were relocated. Stormwater runoff from the reconstructed portions of the highway and ramps was treated by under-drained bioretention and water quality units then directly discharged to the Frankford Creek, removing the drainage area from the CSO system.	2018, completed
BR2	Basins built in BR0 will be reused in BR2 and new basins will be installed. The new basins will be sized for future phases as well. All basins will have forebays, be non-infiltrating, and have amended soils and underdrains with a rock layer and liner. The PennDOT-owned outfall locations in BR2 will be reconstructed in the same locations as existing outfalls.	2019, anticipated let date
Section AFC (Ann to Frankford Creek Area)		
AF1	Streetscape work within the Richmond Street right-of-way between Allegheny and Westmoreland is not subject to the stormwater regulations. Improvements to Melvale Street will be managed by two infiltration trenches that will be owned and maintained by PWD.	2021, estimated completion

Section	Project Update	Estimated Project Timeline
Sector A – Between Bleigh Avenue and Race Street		
Section GIR (Girard Avenue Interchange Area)		
GR1	The reconstruction of Richmond Street was managed by street trees and a bioretention basin. A new separate sewer system was constructed and connected below the regulators in Dyott Street and Cumberland Street.	2019, completed
GR2	The mainline highway areas are managed by multiple bioretention basins along the side of the highway.	2017, completed
GR3/GR4	One separate sewer outfall was constructed in Cumberland Street, and PennDOT is evaluating whether a separate outfall can be constructed in Berks Street as part of GR4. In Dyott Street, a pipe was constructed and will tie in below the regulating chamber. A sewer was found in the old Lehigh Avenue right of way and rehabilitated to separate a portion of the highway drainage. Stormwater is managed in GR3 using bioretention basins, infiltration basins, and detention basins. The basins are designed to manage the water quality volume.	2019, GR3 Completed /2023, GR4 estimated completion
Sector B – Race Street to Girard Point Bridge (Airport Side)		**Planning Study Underway**
CAP - Bridge spanning I-95 between Chestnut and Walnut		**2021, estimated construction**
CAP - I-95 NB/SB between Race Street and Girard Point Bridge		**To be determined**

5.2 Incentives for Private Property Owners to Implement Green Stormwater Infrastructure

PWD offers incentives to private property owners to implement stormwater management practices on existing properties that reduce stormwater pollution to the City's sewers and surrounding waterways and enhance water quality in the region's watersheds. PWD, in partnership with the Philadelphia Industrial Development Corporation (PIDC), created the Stormwater Management Incentives Program (SMIP) in FY12 and Greened Acre Retrofit Program (GARP) in FY15 to reduce the cost for qualified non-residential PWD customers and contractors to design and install stormwater best management practices (BMP). **Figure 5-2** displays the completed green infrastructure installed through incentivized retrofits. A summary of completed GAs from incentivized retrofit projects by watershed are listed below in **Table 5-3.** A full list of completed incentivized retrofit projects is in Table 2 of **Appendix 3**.

Table 5-3: Cumulative Completed Greened Acres by Watershed through Incentivized Retrofits

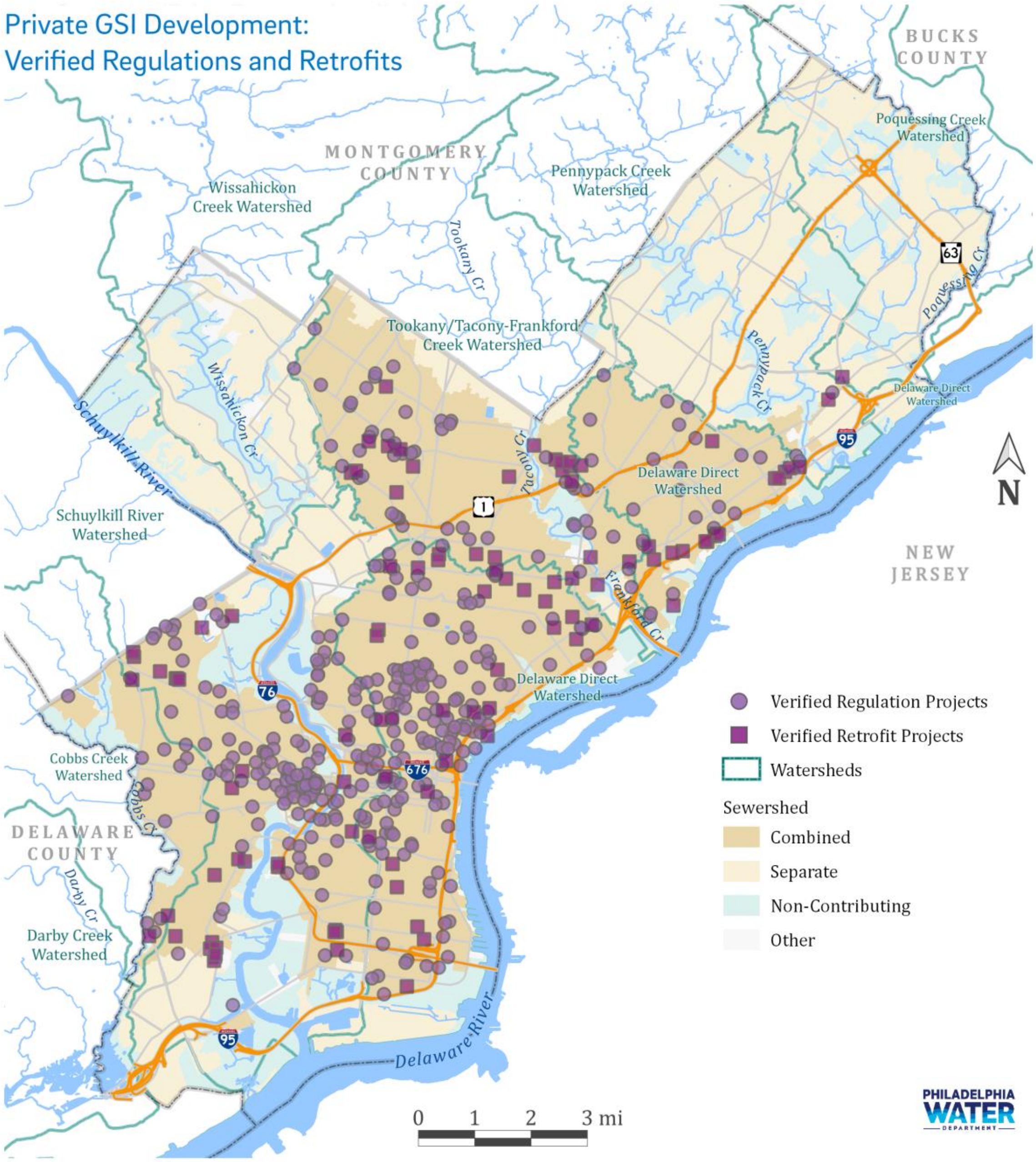
	End of FY19					Cumulative
Watershed	**Darby-Cobbs**	**Delaware**	**Pennypack**	**Tookany-Tacony/ Frankford**	**Schuylkill**	**Completed**
Number of Projects	1	41	4	23	34	**104**
Incentivized GAs	0.2	174	38	157	208	**577**

Stormwater Pioneers

In 2014, PWD started Stormwater Pioneers, a recognition program for excellence in design and construction of stormwater management practices on private property. In 2018, PWD honored its fourth Stormwater Pioneer, Historic Germantown. The Historic Germantown project was a recipient of a SMIP grant and converted an old asphalt courtyard into a green space that sits atop a stormwater detention basin. In addition, Historic Germantown built a rain garden in their parking lot to manage the runoff that formally drained to the street and PWD's combined sewer. PWD is in the process of selecting the next Stormwater Pioneer, to be awarded in Fall 2019.

The Stormwater Pioneers program brings elected officials, community members, private landowners and department officials together to recognize the importance of stormwater management on private property. In addition to coordinating a press event to celebrate each Stormwater Pioneer, PWD also creates a short video and written case study about each project to help other developers and business owners learn from these successful case studies. Visit http://phillywatersheds.org/stormwaterpioneers for more information.

Figure 5-2: Completed Regulations and Retrofit GSI projects



5.3 Post Construction Maintenance of Private Facilities

To ensure ongoing SMP maintenance of private facilities constructed through the stormwater management regulations, SMIP or GARP, PWD continues to use the following combination of tools: executing operation & maintenance agreements, conducting post-construction maintenance inspections, relying on enforcement, and administering stormwater credits.

In FY19, thirty-five projects were brought back into compliance in the combined sewer areas of the City using the protocols described below. PWD will continue to work with property owners to ensure that SMPs are inspected and maintained in accordance with regulations and recorded O&M agreements.

An operation & maintenance agreement between the property owner and PWD is executed and recorded against the property as part of the PWD post construction stormwater management plan process. These agreements outline the SMP(s) on the private site and stipulate maintenance requirements. The agreements also include language granting PWD the authority to inspect on-site SMPs and even perform maintenance on behalf of the property owner if necessary. PWD also maintains a comprehensive operations and maintenance manual for SMPs geared toward the private development community, available at: http://www.phila.gov/water/PDF/Retrofit-O.M.Manual.pdf.

Post-construction maintenance inspections of private facilities were conducted through the reporting period. PWD relies on specialized inspection techniques as well as visual inspections to assess the performance of private SMPs. The inspections conducted to date have identified the most effective methods and technologies, including closed-circuit television, ground penetrating radar, surveys of critical system elevation points, confined space, pole-mounted camera photography, and visual and wet weather inspections. In FY19, PWD performed 288 post-construction inspections in the combined sewer areas of the City. PWD will continue to evaluate and refine post-construction inspection protocols.

Turning to **enforcement**, PWD will issue notification to the property owner if a post construction stormwater management plan (PCSMP) is found to be insufficiently maintained. This notification includes a description of any issues identified and a timeline to achieve compliance. The City is authorized to compel maintenance of SMPs on private property under the Philadelphia Code and PWD Regulations. Development sites that are subject to PSWMR, as well as properties that have SMPs funded by SMIP and GARP, are required to maintain the SMP(s) to function as designed. If initial notification is unsuccessful at bringing action from the property owner, PWD can compel compliance through several enforcement tools, including notices of violation, fines, court action, and/or a nuisance abatement and lien by the City. For non-compliant projects, PWD will also suspend any applicable stormwater billing credits if the required maintenance is not performed.

Stormwater Credits

Non-residential property owners are eligible for stormwater credits, a direct reduction to the monthly stormwater charge, if they own and maintain stormwater management practices that reduce stormwater flows and volume to the City's sewer systems and surrounding waterways. Retrofit and development projects are eligible for credits against their stormwater charge upon completion of construction, and owners must renew their credits every four years. With the credits renewal application, owners may provide maintenance logs and/or PWD may perform an inspection to demonstrate that the SMPs continue to be functional. PWD approved or renewed 89 combined sewer area (264 citywide) stormwater billing credit applications during the reporting period.

6.0 Data Collection and Analysis

6.1 Green Stormwater Infrastructure Post-Construction Monitoring

Proposed methodologies for the *Green City, Clean Waters* monitoring program were outlined in a revised CMP that was submitted on January 10, 2014 and approved on May 28, 2014 by PADEP. PWD has updated methods through new standard operating procedures (SOPs) that better reflect current techniques. The updated SOPs can be found in Appendix 4.

Monitoring and testing green stormwater infrastructure is essential to evaluate its effectiveness in managing stormwater and reducing CSOs. PWD uses post-construction monitoring and post-construction testing at the SMP and system levels to ensure functionality, evaluate the performance of stormwater management practices and to provide information for improvements to design and maintenance. FY19 monitoring activities are described in detail in **Appendix 4 GSI Monitoring Status Report.** FY19 updates on non-green infrastructure components of the CMP can be referenced in **Section F.2 Step 1.b. of the Stormwater Management Program Annual Report.**

PWD has completed its 5-year green stormwater infrastructure pilot program and results were reported in the Year 5 Evaluation and Adaptation Plan. Information on the selected sites, associated variables and results are available here:
http://phillywatersheds.org/doc/Year5_EAPCombinedAppendices_website.pdf.

7.0 Public Outreach and Participation

PWD continues to enhance tools for engaging a broad range of stakeholders. In FY19, PWD engaged approximately 82,506 individuals through a variety of public education, outreach and participation initiatives. The following includes updates on current programs and projects.

7.1 Green Stormwater Infrastructure Notification & Outreach Process for Green Programs

Public education and outreach for GSI in Philadelphia's neighborhoods continued to facilitate the number of GSI projects going into the ground. During FY19, approximately 5,577 community members participated in 116 community meetings co-hosted with civic partners and events (such as tours, walks and festivals) to learn about green infrastructure projects, where one-on-one conversations or small gatherings occurred in neighborhoods across the city. Furthermore, annually 1,355 customers attended Rain Check workshops and 978 green stormwater infrastructure tools were installed on private properties through the residential program. Additionally, nineteen organizations participated in Soak It Up Adoption, where community representatives helped maintain the public green stormwater infrastructure at 130 sites and removed 72,456 lbs. of residential waste from these locations.

Furthermore, approximately 74,007 individuals participated in the following education and outreach events that featured *Green City, Clean Waters* and/or urban waters themed content:

- Environmental education programming offered by PWD educators and Fairmount Water Works educators
- Environmental education programming offered by Philadelphia Parks and Recreation (PPR) educators
- Environmental education and outreach programming offered in Philadelphia by the Tookany/Tacony-Frankford Watershed Partnership and Partnership for Delaware Estuary
- Environmental education and outreach by the Land Health Institute

It should be noted that the number of participants associated with Rain Check and Soak It Up Adoption are detailed in Section 7.2 of this report.

7.2 Public Education and Outreach Programs

Philadelphia Water Department Master List

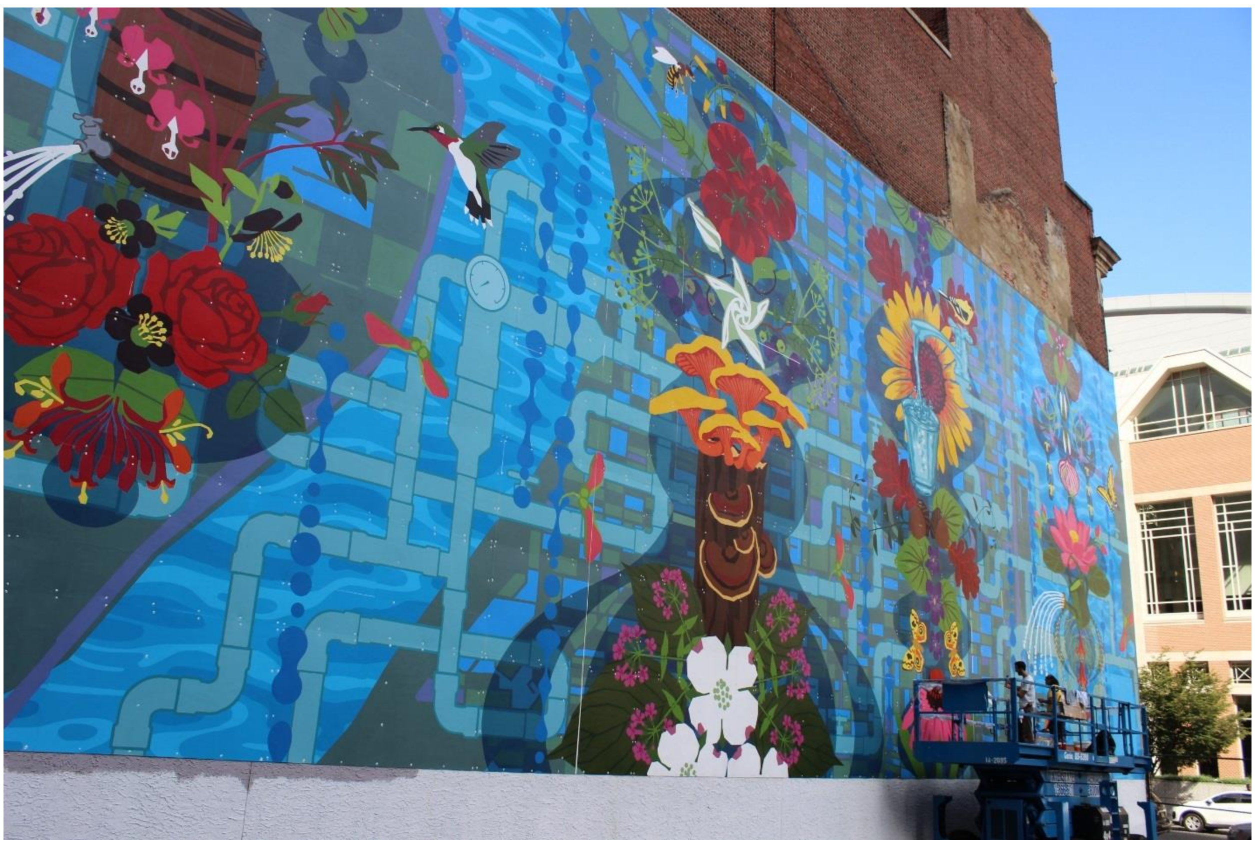
The Philadelphia Water Department master list is the previously referenced *Green City, Clean Waters* partners master list, which is a distribution list of email addresses that gets updated from collecting contact information at public events and meetings hosted by PWD. By the conclusion of FY19, there were 19,527 live entries on the list. This number reflects the number of individuals confirmed through the email management system as participants with accurate contact information and those specifically interested in receiving email updates and e-newsletters regarding PWD special initiatives and events. The master list gained 3,871 new subscribers. A total of 232 individual email bulletins were sent, resulting in 322,300 opened emails for FY19. Any contacts found to be redundant or nonresponsive are removed from the master list through use of the GovDelivery software or self-service unsubscribe features and are not represented in this number.

Green City, Clean Waters Signage

In FY19, PWD continued to develop the interpretive *Green City, Clean Waters* permanent signage, which included new designs, more fabrication and additional installation of the signage. This process also included site visits, coordination with property owners/partners, and promotion of the signage. To date, PWD has installed a total of 150 *Green City, Clean Waters* interpretive signs at 104 sites. For images of the installed signage, please visit:
https://www.flickr.com/photos/philadelphiawater/sets/72157654299547526.

Art & Design

Art and design are used to further communication and education with stakeholders and customers. Projects such as yarn bombing (temporary knitted yarn art) of stormwater tree trenches, rain barrel wrap original designs created by local students, and temporary public street art projects are examples of opportunities to engage residents through visual learning. In FY19, the installation of the mural "*Water Gives Life*" by Eurhi Jones and Dave McShane was completed as a result of the partnership with Mural Arts, PWD and PHS. The piece celebrates the connection between Philadelphia's rivers and local horticulture. Multiple paint days were held with residents across the City to educate about green infrastructure and water resources in the City. *Water Gives Life* is located at 1300 Arch Street.



Water Gives Life 1300 Arch Street, Philadelphia

Soak It Up Adoption

In FY19, two new organizations were accepted into the Soak It Up Adoption program (Mill Creek Farm & UC Green), creating a program comprised of 19 total organizations with 103 individuals acting as

Adoption representatives. Throughout the fiscal year, Adoption partners engaged residents and completed several community events highlighting their adopted infrastructure. These events included: guided tours, tabling sessions at local public events, and presentations at civic association meetings. The Adoption program also unveiled a new website this year (link below).

Information and/or photos from Soak It Up Adoption events are available at the following links:

- New Home Page - http://water.phila.gov/adoption/
- PWD SIUA Blog - http://water.phila.gov/blog/get-grants-soak-it-up
- Upper Roxborough History Walk & Talk - https://www.eventbrite.com/e/history-of-the-upper-roxborough-reservoir-preserve-tickets-60484436578#
- Philly Rowhome Magazine - https://issuu.com/philadelphiarowhomemagazine/docs/prh_spring2019v4

Table 7-1 Provides metrics used by PWD to track the Soak It Up Adoption program throughout FY19. These figures reflect the variety of adopted SMPs and the amount of trash collected.

Table 7-1: Soak It Up Adoption Metrics for FY19

Soak It Up Adoption Partner List	Number of SMPs Adopted in FY19	*Amount of Residential Waste Collected in FY19 (LBS)	Number of Residents Engaged in FY19
Asociacion Puertorriquenos en Marcha	14	3,735	1,100
Centennial Commons CDC	7	10,272	135
East Falls Development Corporation	6	804	264
Empowered CDC	1	3,080	105
Frankford CDC	2	11,180	240
Greensgrow-West	17	1,426	120
Greensgrow-Mill Creek Farm (MOU)	2	2,182	35
Make the World Better	2	2,722	340
New Kensington CDC	9	1,326	350
Newbold CDC	9	6,176	202
Northeast Treatment Center	6	9,779	114
Northern Liberties Neighbors Assoc.	11	266	90
Philadelphia Parks Alliance	2	4,565	1
Southwest CDC	14	2,172	515
TTF-Friends of Vernon Park	1	1,729	269
TTF-Carl Mackley Apts	4	719	0
UC Green	10	1,789	45
Upper Roxborough Conservancy	2	3,605	180
Urban Tree Connection	11	4,922	0
TOTALS:	**130 SMPs**	**72,449+ lbs**	**4,105 participants**

*All Adoption partners collected trash in 55-gallon bag for the 1st half of FY19 and then switched to 30-gallon paper bags for the 2nd half of FY19. The total weights are converted from this base unit (gallons).

Urban Waters Curriculum

Understanding the Urban Watershed is a cross-disciplinary curriculum, aligned with School District of Philadelphia core content and Education for Sustainability standards for 6th, 7th and 8th grades. Development and implementation has been a collaborative effort with School District of Philadelphia's (District) Offices of Curriculum, Instruction and Assessment, and Environmental Management and Services. Developed with major support from the William Penn Foundation and the Philadelphia Water Department.

It has been developed and piloted by School District of Philadelphia teachers and students. As of Fall 2018, the curriculum has been implemented by 54 teachers and more than 2,250 students. In June 2019, a week-long training, supported by the District, expanded the cohort to 9 new public schools, 13 teachers and exponentially more students.

The curriculum is locally based, experiential learning and standards driven.

The curriculum is an exemplar for goals and targets as outlined in the District's Sustainability Plan, GreenFutures and easily embedded into core curriculum because the Units are aligned with Academic (Science, ELA Math and SS) and Education for Sustainability Standards. All standards and performance indicators are assessed for using performance criteria.

The program provides online access to 6 Units. The units include links to videos and student materials, as well as engaging field trips and experiences for students that support differentiated learning.

Highlights of the curriculum:

- Provides Vertical articulation grades 6, 7, 8
- Provides opportunities for differentiated learning
- Learner centered/hands on; Place based; Project-Inquiry based
- Authentic, relevant to school community, neighborhood, creek, sub-watershed, public water system and infrastructure
- Experiences both inside the classroom and outside (from schoolyard, block, park)
- Interdisciplinary
- District teachers become teacher leaders and will train and mentor new teachers implementing the curriculum.
- Developed in partnership with District's GreenFutures Plan
- Aligned with the City's Greenworks Plan, District's GreenFutures Plan and the Philadelphia Water Department's Green City, Clean Waters Program
- Online and accessible to all through website *resourcewater.org*
- Continuing support during School Year 2019-20 includes coaching and content growth through classroom visit check-ins, monthly seminars, workshops and ongoing field experiences
- Active participation in developing an expanding learning community supporting education for sustainability in schools and communities
- Opportunity for teachers to participate and present at local, regional and national conferences (e.g. STEM GSK Workshop, National Green Schools Conference and NAAEE Conference)

The Curriculum offers students, teachers, schools and the community active learning experiences about the value of water, water systems, civic action and responsibility with meaning and context.

It connects students to the real world and the role they play in their own future and the future of the planet.

7.3 Green Homes Initiatives

Rain Check Program

In FY19, the number of participants in the Rain Check program was similar to FY18. PWD made significant improvements in program management, data tracking, and marketing.

More information on the program is available at: http://www.pwdraincheck.org.

Table 7-2: Rain Check Program Metrics

Rain Check Metrics	FY19
Workshops Hosted	77
Workshop Attendees*	1,355
Contractor Training Participants	15
Rain Barrel Installations**	738
Downspout Planter Installations**	162
Rain Garden Installations**	6
Permeable Paving Installations**	65
Depaving Projects	7

***Workshop Attendees**: This represents the total number of people who attended a Rain Check workshop. These hour-long educational workshops are mandatory for participation in Rain Check. Some FY19 attendees had their tools installed in FY19 but others will have their tools installed in FY20.
****Installations Completed**: PWD installed 738 rain barrels and 240 other stormwater tools by the end of FY19. For some participants who signed up this year, the installation of their tools is still in progress.

Appendix 1

Completed Public Green Stormwater Infrastructure Projects

Public Green Infrastructure Reporting Metrics

Table 1: Public Completed Project Tracking Metrics and Reporting Format

Public Completed Project Tracking Metrics											
Work Number	Project ID	Construction Completion Date	Storage Volume (cf)	New Trees	Drainage Area (acres)	Greened Acres (acre-inch)	SMP Type(s)	Program	Green Construction Cost**	Partner(s)	Watershed

Over the past year, PWD's new capital projects tracking system's (CIPIT) interaction with its GSI tracking system (GreenIT) has slightly changed. To accommodate this change, we have replaced Project Names with a Work Number and a Project ID. The Project ID is unique to individual projects and these projects can be bundled under one Work Number for bidding purposes. Moving forward, Work Numbers will have a 1:1 relationship with projects.

Table 2: Public Reporting Metric Definitions

Metric	Definition
Work Number	Work Number is a unique assigned identifier from the CIPIT program. A CIPIT work number is attached to construction proposals, bids, work orders, contracts and invoices.
Project ID	This is a unique number, which is assigned automatically by the system when the project is created.
Status	Current project status. Statuses include: In Design, In Projects Control (Under Contract Management), In Construction, and Construction Complete.
Storage Volume	The volume of runoff managed by the system. For all systems, the entire depth of the system is counted, except for detention/slow-release systems that are completely lined with an impermeable liner. For those systems, only the depth above the orifice is counted.
New Trees	Total number of new trees planted in association with a system. This number also includes non-SMP trees, which are trees planted as part of a project but are not part of a stormwater management system.
Drainage Area	Area, in square footage, of impervious and/or pervious surface(s) flowing into a system(s) and SMP(s).
Greened Acres (GAs)	Greened Acres is a metric that accounts for the conversion of a highly impervious urban landscape through the implementation of projects that reduce storm water runoff. A Greened Acre is described as an acre of impervious cover connected (tributary) to a combined sewer that subsequently is reconfigured to utilize green stormwater infrastructure to manage at least one inch of stormwater runoff. If storage is provided, systems can credit up to two inches of the storm water runoff from that acre. The best available Greened Acre value is pulled from the database for regulatory reporting.
Stormwater Management Practice (SMP) Type	A Stormwater Management Practice is a technique that controls the rate and volume of stormwater runoff and/or improves runoff water quality. Multiple SMP types can be grouped together in a larger GSI system. The SMP types were originally defined in Table 2-1 of the IAMP.
Program	Current public programs which a greened acre can be assigned to include: • Alleys/Driveways • Campuses

Metric	Definition
	• Facilities • Industry and Business • Open Space • Parking • Schools • Streets • Vacant Land
Construction Cost	Projects with a status of Construction Complete will have a finalized cost of construction provided.
Partner(s)	External entities involved in a project.
Watershed	The City of Philadelphia watershed where the project is located. Four of the City's seven watersheds fall at least partially within the combined sewer area. These watersheds are: • Cobbs Creek Watershed • Delaware Direct Watershed • Tookany/Tacony-Frankford Creek Watershed • Schuylkill River Watersheds

Table 3: Public SMP Definitions

Public SMP Type Definitions	
Field/Metric	**Definition/Purpose**
Basin*	A stormwater basin is a basin or depression that is vegetated with mowed grass. It is designed to detain and release stormwater runoff and/or infiltrate where feasible.
Blue Roof	A blue roof is a storage system designed into a roof surface such that the roof retains stormwater. Blue roofs are designed to reduce the rate of stormwater runoff.
Bump-out*	A stormwater bump-out is a vegetated curb extension that intercepts gutter flow. It is designed to detain and release stormwater runoff and/or infiltrate where feasible.
Cistern/Rain Barrel	A cistern/rain barrel is a tank or storage receptacle that captures and stores runoff and can thereby reduce runoff volume. The stored water may be used to serve a variety of non-potable water needs (e.g., irrigation).
Depaving	Depaving projects remove existing impervious pavement and restore the surface with grass, other types of vegetation, or loose materials (stone, mulch, etc.) such that the area can thereafter be considered pervious area. Depaving projects remove contributing impervious area from the sewer system.
Drainage Well	A stormwater drainage well is manhole structure designed to manage stormwater runoff by receiving stormwater from upstream collection and pretreatment systems and then discharging the stormwater into the surrounding soils through perforations in the manhole. It is designed to infiltrate stormwater.
Green Gutter	A green gutter is a narrow and shallow landscaped strip along a street's curb line. It is designed to manage stormwater runoff by placing the top of the planting media in the green gutter lower than the street's gutter elevation allowing stormwater runoff from both the street and sidewalk to flow directly into the green gutter. It is designed to slowly infiltrate stormwater.
Green Roof	A green roof is a vegetated surface installed over a roof surface.

Public SMP Type Definitions	
Infiltration/Storage Trench	An infiltration/storage trench is a subsurface structure designed to detain and release stormwater runoff and/or infiltrate where feasible.
Non-SMP Tree	A non-SMP tree is a planted tree that does not have stormwater directed to it.
Pervious Paving	Pervious paving is a hard permeable surface commonly composed of concrete, asphalt or pavers. It is designed to detain and release stormwater runoff and/or infiltrate where feasible.
Planter*	A stormwater planter is a structure filled with soil media and planted with vegetation or trees. It is designed to detain and release stormwater runoff and/or infiltrate where feasible. Planters often contain curb edging or fencing as barrier protection around the planter.
Rain Garden	A rain garden is a shallow vegetated area designed to detain and release stormwater runoff and/or infiltrate where feasible. Rain gardens may also be referred to as bio-infiltration basins and bio-retention basins. They are typically integrated into landscape features (e.g. median strips) and are non-mowed areas.
Stormwater Tree	A stormwater tree is planted in a specialized tree pit that has stormwater runoff directed to its pit. It is designed to manage stormwater by placing the top of the planting media in a tree pit lower than the street's gutter elevation and connecting the tree pit to an inlet which directs runoff from the street into the tree pit. It is designed to detain and release stormwater runoff and/or infiltrate where feasible.
Swale	A swale is a channel designed to convey stormwater. It can be designed to attenuate and/or infiltrate where feasible.
Tree Trench*	A stormwater tree trench is a subsurface infiltration/storage trench that is planted with trees. They are typically linear features that are constructed between the curb and the sidewalk. It is designed to detain and release stormwater runoff and/or infiltrate where feasible.
Wetland*	A stormwater wetland is a vegetated basin designed principally for pollutant removal. It typically holds runoff for periods longer than 72 hours and may include a permanent pool. Wetlands can also detain and release stormwater runoff.

*The word 'stormwater' was previously included in these types but was removed because it was redundant.

Work Number	Project ID	Construction Complete Date	Storage Volume (cf)	New Trees	Drainage Area (acres)	Greened Acre (acre-inches)	SMP Types	Program	Green Construction Cost**	Partner(s)	Watershed
50016	196	5/1/2006	360	4	0.32	0.10	Rain Garden, Swale	Streets	$57,850	Pennsylvania Department of Environmental Protection, Philadelphia Water Department, Pennsylvania Horticulture Society	Schuylkill
50013	208	7/1/2006	830	4	0.40	0.23	Pervious Pavement, Stormwater Tree Trench	Streets	$66,050	Pennsylvania Department of Environmental Protection, Pennsylvania Horticulture Society, Philadelphia Department of Recreation	Schuylkill
50014	181	4/1/2007	1260	7	0.44	0.35	Rain Garden	Vacant Land	$16,000	Pennsylvania Department of Environmental Protection, Pennsylvania Horticulture Society, University City Green	Schuylkill
50012	186	10/1/2007	4563	0	1.20	1.26	Rain Garden	Open Space	$175,000	Pennsylvania Department of Environmental Protection, Pennsylvania Horticulture Society, Philadelphia Department of Parks & Recreation	TTF
50015	185	11/1/2007	3080	0	0.75	0.85	Infiltration Storage Trench	Open Space	Cost Not Available	Pennsylvania Department of Environmental Protection, Pennsylvania Department of Conservation & Natural Resources, Philadelphia Department of Parks & Recreation	Schuylkill
50131	1131	6/1/2008	347	3	0.08	0.10	Rain Garden	Streets	Cost Not Available		Delaware

Work Number	Project ID	Construction Complete Date	Storage Volume (cf)	New Trees	Drainage Area (acres)	Greened Acre (acre-inches)	SMP Types	Program	Green Construction Cost**	Partner(s)	Watershed
40659	207	7/1/2008	1836	8	0.31	0.51	Pervious Pavement, Stormwater Planter, Stormwater Tree Trench	Streets	$50,000	Pennsylvania Horticulture Society, Philadelphia Department of Recreation	TTF
50011	194	6/1/2009	849	24	0.18	0.23	Rain Garden	Open Space	$22,236	Northern Liberties Neighborhood Association, Pennsylvania Department of Environmental Protection, Pennsylvania Horticulture Society, Philadelphia Department of Parks & Recreation	Delaware
40330	289*	1/27/2010	1601	17	0.63	0.44	Infiltration Storage Trench, Stormwater Tree	Streets	$209,000		Delaware
50006	187	5/26/2010	922	0	0.18	0.25	Infiltration Storage Trench, Stormwater Planter	Streets	$65,506	Department of Public Property, Department of Recreation, Friends of Columbus Square	Delaware
50024	170	10/10/2010	3033	6	0.40	0.81	Stormwater Tree Trench	Open Space	$50,000	New Kensington Community Development Corporation, Pennsylvania Horticulture Society, Philadelphia Department of Parks & Recreation	Delaware
50033	46	11/1/2010	6091	17	0.96	1.65	Stormwater Bump-out, Rain Garden, Swale, Stormwater Tree Trench	Streets	Partner-project, no capital investment by PWD	Environmental Protection Agency, Philadelphia Department of Commerce, Philadelphia Industrial Development Corporation	Schuylkill

Work Number	Project ID	Construction Complete Date	Storage Volume (cf)	New Trees	Drainage Area (acres)	Greened Acre (acre-inches)	SMP Types	Program	Green Construction Cost**	Partner(s)	Watershed
50005	1*	11/10/2010	3556	6	1.02	0.98	Stormwater Tree Trench	Streets	$402,396	Pennsylvania Horticulture Society	Delaware
	9*	11/10/2010	1273	5	0.21	0.34	Stormwater Tree Trench	Streets		New Kensington Community Development Corporation, Pennsylvania Horticulture Society	Delaware
	18*	11/10/2010	609	8	0.34	0.17	Stormwater Tree Trench	Streets			Schuylkill
40577	441*	4/8/2011	6520	26	4.38	1.80	Infiltration Storage Trench, Stormwater Tree	Streets	$924,000		TTF
50009	20*	5/14/2011	4423	13	1.20	0.37	Infiltration Storage Trench, Stormwater Planter, Stormwater Tree Trench	Streets	Cost Not Available		TTF
50035	45	6/1/2011	3561	0	0.68	0.98	Infiltration Storage Trench	Streets	$215,600	Fairmount Park Commission	Schuylkill
40224	240	7/18/2011	657	0	0.11	0.18	Pervious Pavement	Streets	$48,282		Delaware
50002	8	11/4/2011	3386	3	1.13	0.93	Rain Garden, Stormwater Tree Trench	Streets	$173,493	Department of Recreation, New Kensington Community Development Corporation, Pennsylvania Horticulture Society	Delaware
50032	180	11/5/2011	646	4	0.11	0.18	Stormwater Tree Trench	Streets	Partner-project, no capital investment by PWD	Pennsylvania Horticulture Society	Delaware
	324	11/5/2011	768	4	0.16	0.21	Stormwater Tree Trench	Streets		Pennsylvania Horticulture Society	Delaware
	325	11/5/2011	1088	4	0.22	0.30	Stormwater Tree Trench	Streets		Pennsylvania Horticulture Society	Delaware

Work Number	Project ID	Construction Complete Date	Storage Volume (cf)	New Trees	Drainage Area (acres)	Greened Acre (acre-inches)	SMP Types	Program	Green Construction Cost**	Partner(s)	Watershed
	326	11/5/2011	1047	6	0.41	0.29	Stormwater Tree Trench	Streets		Pennsylvania Horticulture Society	Delaware
	327	11/5/2011	1029	4	0.21	0.28	Stormwater Tree Trench	Streets		Pennsylvania Horticulture Society	Delaware
	342	11/5/2011	1292	4	0.29	0.36	Stormwater Tree Trench	Streets		Pennsylvania Horticulture Society	Delaware
50022	13	12/16/2011	402	13	0.16	0.11	Infiltration Storage Trench	Open Space	$99,412	City Play, Digsau, Northern Liberties Neighborhood Association, Philadelphia Department of Parks & Recreation	Delaware
50063	310	5/2/2012	10798	20	1.97	2.86	Rain Garden	Parking	All done in house by PWD; No bid costs.	Department of Public Property	Delaware
50046	243*	9/27/2012	3539	7	1.06	0.98	Infiltration Storage Trench, Rain Garden, Swale	Open Space	$540,071	Tookany/Tacony-Frankford Watershed Partnership, Philadelphia Department of Parks & Recreation, Frankford Civic Association	TTF
50023	192	10/2/2012	2689	12	0.33	0.52	Infiltration Storage Trench, Pervious Pavement, Rain Garden	Open Space	$190,959	Philadelphia Capital Program Office, Philadelphia Department of Parks & Recreation	Delaware
50027	59*	11/23/2012	3251	5	0.52	0.90	Stormwater Tree Trench	Streets	$951,600	Pennsylvania Environmental Council	Cobbs-Darby
	212*	11/23/2012	5179	15	0.79	1.43	Stormwater Tree Trench	Streets		Pennsylvania Environmental Council	Cobbs-Darby

Work Number	Project ID	Construction Complete Date	Storage Volume (cf)	New Trees	Drainage Area (acres)	Greened Acre (acre-inches)	SMP Types	Program	Green Construction Cost**	Partner(s)	Watershed
	213*	11/23/2012	5456	19	0.99	1.50	Stormwater Tree Trench	Streets		Department of Recreation, Pennsylvania Environmental Council	Cobbs-Darby
	214*	11/23/2012	2804	11	0.45	0.77	Stormwater Tree Trench	Streets			Cobbs-Darby
	215*	11/23/2012	6421	16	1.04	1.77	Stormwater Tree Trench	Streets		Pennsylvania Environmental Council	Cobbs-Darby
50043	279*	12/4/2012	2996	0	0.56	0.83	Stormwater Basin	Open Space	$474,000	Philadelphia Department of Parks & Recreation	TTF
	281*	12/4/2012	4567	0	0.89	1.26	Rain Garden	Open Space		Philadelphia Department of Parks & Recreation	TTF
50026	210*	12/13/2012	8296	42	1.49	2.29	Infiltration Storage Trench, Stormwater Tree Trench	Streets	$1,658,770	Pennsylvania Environmental Council	Cobbs-Darby
	211*	12/13/2012	9382	27	1.47	2.36	Stormwater Bump-out, Stormwater Planter, Stormwater Tree Trench	Streets		Pennsylvania Environmental Council	Schuylkill
	216*	12/13/2012	4551	14	1.02	1.25	Stormwater Tree Trench	Streets		Pennsylvania Environmental Council	Cobbs-Darby
	231*	12/13/2012	10310	39	1.82	2.84	Stormwater Bump-out, Stormwater Planter, Stormwater Tree Trench	Streets		Pennsylvania Environmental Council	Cobbs-Darby, Schuylkill
40599	233	12/20/2012	1263	1	0.34	0.35	Infiltration Storage Trench	Streets	$26,835		Delaware

Work Number	Project ID	Construction Complete Date	Storage Volume (cf)	New Trees	Drainage Area (acres)	Greened Acre (acre-inches)	SMP Types	Program	Green Construction Cost**	Partner(s)	Watershed
50028	175*	12/24/2012	5051	20	0.74	1.39	Stormwater Tree Trench	Streets	$611,200		Delaware
	176*	12/24/2012	2401	14	0.47	0.66	Stormwater Tree Trench	Streets			Delaware
	177*	12/24/2012	7189.8	10	0.97	1.63	Stormwater Tree Trench	Streets			Delaware
	178*	12/24/2012	4252	6	0.48	0.96	Stormwater Tree Trench	Streets		Fairmount Park Commission, Pennsylvania Horticulture Society	Delaware
40796	1086	12/27/2012	1006	35		0.28	Stormwater Tree	Streets	$149,827		Delaware
50031	123	1/15/2013	4911	7	1.06	1.35	Infiltration Storage Trench, Rain Garden, Stormwater Tree Trench	Streets	$368,321		Cobbs-Darby, Schuylkill
50003	12*	2/8/2013	2593	11	0.77	0.71	Infiltration Storage Trench, Stormwater Planter, Stormwater Tree Trench	Streets	$454,930	City Play, Mural Arts Program, Northern Liberties Neighborhood Association	Delaware
	91*	2/8/2013	1463	7	0.36	0.40	Stormwater Bump-out, Stormwater Tree Trench	Streets		Northern Liberties Neighborhood Association	Delaware
40662	218	3/5/2013	10468	0	1.30	1.02	Stormwater Bump-out	Streets	Cost Not Available	Philadelphia Streets Department	Schuylkill

Work Number	Project ID	Construction Complete Date	Storage Volume (cf)	New Trees	Drainage Area (acres)	Greened Acre (acre-inches)	SMP Types	Program	Green Construction Cost**	Partner(s)	Watershed
50020	2*	4/23/2013	1817	7	0.54	0.50	Infiltration Storage Trench, Rain Garden, Stormwater Tree Trench	Streets	$679,023	Pennsylvania Horticulture Society	Delaware
	157*	4/23/2013	3077	19	0.73	0.85	Stormwater Tree Trench	Streets		Department of Recreation	Delaware
	245*	4/23/2013	974	7	0.21	0.27	Stormwater Tree Trench	Streets		Pennsylvania Horticulture Society	Delaware
	296*	4/23/2013	1034	4	0.19	0.29	Stormwater Tree Trench	Streets		Pennsylvania Horticulture Society	Delaware
	312*	4/23/2013	2313	7	0.55	0.64	Stormwater Tree Trench	Streets		Department of Recreation	Delaware
50029	147*	5/10/2013	709	32	0.27	0.20	Infiltration Storage Trench	Streets	$1,151,670	Department of Recreation	TTF
	179*	5/10/2013	31170	80	5.27	8.58	Stormwater Tree Trench	Streets			TTF
50038	247*	5/16/2013	3566	7	0.52	0.98	Stormwater Tree Trench	Streets	$1,335,859	Department of Public Property	Schuylkill
	258*	5/16/2013	3728	23	0.68	1.03	Stormwater Tree Trench	Streets			Schuylkill
	259*	5/16/2013	8933	18	1.27	2.46	Stormwater Tree Trench	Streets			Schuylkill
	260*	5/16/2013	4471	20	0.74	1.23	Stormwater Tree Trench	Streets			Schuylkill
	261*	5/16/2013	1604	6	0.21	0.43	Stormwater Tree Trench	Streets			Schuylkill
	262*	5/16/2013	2029	4	0.38	0.56	Stormwater Tree Trench	Streets			Delaware

Work Number	Project ID	Construction Complete Date	Storage Volume (cf)	New Trees	Drainage Area (acres)	Greened Acre (acre-inches)	SMP Types	Program	Green Construction Cost**	Partner(s)	Watershed
50047	366	5/29/2013	6510	5	1.20	1.79	Infiltration Storage Trench, Stormwater Planter, Rain Garden	Streets	$357,687	Philadelphia Department of Parks & Recreation, Philadelphia Zoo	Schuylkill
50080	588	6/13/2013	2265	25	0.88	0.47	Rain Garden	Streets	Cost Not Available	DRWC	Delaware
50082	597	7/31/2013	481	0	0.09	0.13	Infiltration Storage Trench	Streets	Cost Not Available	Southeastern Transportation Authority	Schuylkill
50037	250*	9/9/2013	6497	29	1.10	1.79	Stormwater Tree Trench	Streets	$1,547,000		Schuylkill
	251*	9/9/2013	3614	13	0.56	1.00	Stormwater Tree Trench	Streets			Schuylkill
	252*	9/9/2013	2933	15	0.61	0.81	Stormwater Tree Trench	Streets			Schuylkill
	253*	9/9/2013	7095	39	1.31	1.93	Stormwater Tree Trench	Streets			Schuylkill
	254*	9/9/2013	3297	4	0.55	0.91	Stormwater Tree Trench	Streets			Schuylkill
	255*	9/9/2013	5776	9	0.97	1.59	Stormwater Tree Trench	Streets			Cobbs-Darby
	256*	9/9/2013	3189	3	0.61	0.88	Stormwater Tree Trench	Streets			Schuylkill
	257*	9/9/2013	2921	12	0.58	0.80	Stormwater Tree Trench	Streets			Schuylkill
50001	14*	9/17/2013	1977	0	0.45	0.54	Infiltration Storage Trench, Rain Garden	Streets	$873,261	Department of Recreation, Passyunk Square Civic Association	Delaware

Work Number	Project ID	Construction Complete Date	Storage Volume (cf)	New Trees	Drainage Area (acres)	Greened Acre (acre-inches)	SMP Types	Program	Green Construction Cost**	Partner(s)	Watershed
	15*	9/17/2013	1536	4	0.28	0.42	Stormwater Tree Trench	Streets		Passyunk Square Civic Association	Delaware
	16*	9/17/2013	1112	5	0.22	0.31	Stormwater Tree Trench	Streets		Department of Recreation, Passyunk Square Civic Association, South Philadelphia Older Adult Center	Delaware
	162*	9/17/2013	5197	13	0.96	1.42	Stormwater Bump-out, Stormwater Tree Trench	Streets		Department of Recreation	Delaware, Schuylkill
	313*	9/17/2013	1452	0	0.27	0.40	Infiltration Storage Trench, Stormwater Planter	Streets		Department of Recreation, Passyunk Square Civic Association, South Philadelphia Older Adult Center	Delaware
50034	10*	9/20/2013	3921	4	0.80	1.08	Stormwater Bump-out, Stormwater Tree Trench	Streets	$580,829	New Kensington Community Development Corporation, Pennsylvania Horticulture Society	Delaware
	88*	9/20/2013	3866	1	0.71	1.07	Infiltration Storage Trench, Rain Garden, Stormwater Tree Trench	Streets		New Kensington Community Development Corporation, Pennsylvania Horticulture Society	Delaware
50042	271*	9/30/2013	7709	3	1.19	1.96	Infiltration Storage Trench, Rain Garden, Stormwater Tree Trench	Streets	$1,786,000	Philadelphia Department of Parks & Recreation, Tacony Civic Association	Delaware
	272*	9/30/2013	12714	13	2.03	3.45	Infiltration Storage Trench, Stormwater Tree Trench	Streets		Tacony Civic Association	Delaware, TTF

Work Number	Project ID	Construction Complete Date	Storage Volume (cf)	New Trees	Drainage Area (acres)	Greened Acre (acre-inches)	SMP Types	Program	Green Construction Cost**	Partner(s)	Watershed
	273*	9/30/2013	5752	35	0.82	1.56	Stormwater Tree Trench	Streets		Tacony Civic Association	Delaware
	274*	9/30/2013	8439	6	1.27	2.22	Infiltration Storage Trench, Stormwater Planter, Stormwater Tree Trench	Streets		Roosevelt Playground Park Advisory Council, Tacony Civic Association	Delaware
	275*	9/30/2013	1968	2	0.27	0.54	Stormwater Tree Trench	Streets		Tacony Civic Association	Delaware
50010	19*	10/14/2013	16144	36	2.50	4.17	Stormwater Tree Trench	Streets	$975,008	Department of Recreation	Schuylkill
50025	223*	10/22/2013	3374	18	0.52	0.93	Stormwater Tree Trench	Streets	$1,128,504	Lower Moyamensing Civic Association	Delaware
	224*	10/22/2013	6569	12	1.10	1.81	Stormwater Tree Trench	Streets			Delaware
	226*	10/22/2013	2905	20	0.54	0.80	Stormwater Tree Trench	Streets			Schuylkill
	227*	10/22/2013	4723	19	0.97	1.30	Stormwater Tree Trench	Streets			Schuylkill
40368	234	10/24/2013	7215	35	1.44	1.99	Stormwater Tree Trench	Streets	$184,925		Delaware
50007	21*	10/31/2013	2066	12	0.60	0.57	Swale	Open Space	$278,349	Fairmount Park Commission, Pennsylvania Horticulture Society, Philadelphia Department of Parks & Recreation	Cobbs-Darby
50041	167*	1/13/2014	9885	33	1.74	2.72	Stormwater Tree Trench	Streets	$1,232,000	Snyderville Community Development Corporation	Schuylkill

Work Number	Project ID	Construction Complete Date	Storage Volume (cf)	New Trees	Drainage Area (acres)	Greened Acre (acre-inches)	SMP Types	Program	Green Construction Cost**	Partner(s)	Watershed
	264*	1/13/2014	4488	13	0.81	1.24	Stormwater Planter, Stormwater Tree Trench	Streets		Snyderville Community Development Corporation	Cobbs-Darby
	265*	1/13/2014	8480	12	1.45	2.32	Infiltration Storage Trench, Stormwater Tree Trench	Streets		Snyderville Community Development Corporation	Cobbs-Darby
	266*	1/13/2014	3312	6	0.77	1.55	Infiltration Storage Trench, Rain Garden	Streets		Snyderville Community Development Corporation	Cobbs-Darby
50036	50*	4/25/2014	3353	0	0.64	0.92	Stormwater Bump-out, Infiltration Storage Trench	Streets	$630,605	Philadelphia Department of Parks & Recreation	Delaware, Schuylkill
	228*	4/25/2014	1189	2	0.21	0.33	Stormwater Tree Trench	Streets		Philadelphia Department of Parks & Recreation	Delaware
	277*	4/25/2014	4880	11	0.84	1.34	Stormwater Tree Trench	Streets			Delaware
	278*	4/25/2014	4885	5	0.88	1.35	Stormwater Tree Trench	Streets			TTF
50075	479	6/13/2014	8738	0	1.50	2.41	Rain Garden	Schools	$207,000	Philadelphia School District, Philadelphia Department of Parks & Recreation, Trust for Public Land	Delaware
50057	417	7/8/2014	2326	0	0.28	0.57	Rain Garden	Streets	$34,123	Philadelphia Streets Department, Ogontz Avenue Revitalization Corporation, Mayors Office of Transportation & Utilities	TTF

Work Number	Project ID	Construction Complete Date	Storage Volume (cf)	New Trees	Drainage Area (acres)	Greened Acre (acre-inches)	SMP Types	Program	Green Construction Cost**	Partner(s)	Watershed
50039	268*	8/1/2014	4225	9	0.89	1.16	Infiltration Storage Trench, Stormwater Tree Trench	Streets	$883,110		Delaware
	269*	8/1/2014	7687	21	1.11	2.02	Stormwater Tree Trench	Streets			Delaware
	270*	8/1/2014	6641	11	0.61	1.22	Stormwater Tree Trench	Streets			Delaware
	283*	8/1/2014	1985	1	0.34	0.55	Stormwater Tree Trench	Streets		Philadelphia Housing Authority	Delaware
50019	17*	11/25/2014	3650	5	0.64	1.01	Stormwater Bump-out, Infiltration Storage Trench, Stormwater Tree Trench	Streets	$963,139	Department of Recreation, Friends of Dickinson Park, Southeastern Transportation Authority	Delaware
	79*	11/25/2014	619.48	1	0.10	0.17	Infiltration Storage Trench	Streets		Lower Moyamensing Civic Association	Delaware
	81*	11/25/2014	2980	2	0.56	0.82	Infiltration Storage Trench, Stormwater Tree Trench	Streets		Lower Moyamensing Civic Association	Delaware
	154*	11/25/2014	9882	15	1.67	2.71	Stormwater Tree Trench	Streets		Tookany/Tacony-Frankford Watershed Partnership	TTF
50044	280	1/21/2015	37176	69	5.21	10.24	Infiltration Storage Trench, Rain Garden, Swale	Open Space	$2,248,000	Philadelphia Department of Parks & Recreation	TTF
	282	1/21/2015	41165	7	4.77	9.53	Rain Garden	Open Space		Philadelphia Department of Parks & Recreation	TTF

Work Number	Project ID	Construction Complete Date	Storage Volume (cf)	New Trees	Drainage Area (acres)	Greened Acre (acre-inches)	SMP Types	Program	Green Construction Cost**	Partner(s)	Watershed
50051	392	2/3/2015	9534	8	1.69	2.63	Stormwater Tree Trench	Streets	$2,526,302		Cobbs-Darby, Schuylkill
	393	2/3/2015	17099	9	3.08	4.70	Infiltration Storage Trench, Rain Garden, Stormwater Tree Trench	Streets		Philadelphia Department of Parks & Recreation	Schuylkill
	394	2/3/2015	5490	6	0.94	1.51	Infiltration Storage Trench, Stormwater Tree Trench	Streets			Schuylkill
	396	2/3/2015	8973	17	1.63	2.47	Stormwater Tree Trench	Streets			Schuylkill
	397	2/3/2015	5678	8	1.13	1.56	Stormwater Tree Trench	Streets			Schuylkill
	398	2/3/2015	16467	18	2.59	4.27	Stormwater Tree Trench	Streets			Cobbs-Darby, Schuylkill
50065	367	5/14/2015	3770	8	0.85	1.04	Infiltration Storage Trench, Rain Garden	Open Space	$227,394	Department of Public Property, Philadelphia Department of Parks & Recreation	Delaware
40771	301	8/26/2015	4630	10	0.70	1.27	Pervious Pavement, Stormwater Tree Trench	Streets	$133,192		Delaware
50085	574	10/8/2015	1609	5	0.33	0.44	Infiltration Storage Trench, Rain Garden	Open Space	$152,300	Philadelphia Department of Parks & Recreation, Councilman Johnson, Urban Roots	Schuylkill

Work Number	Project ID	Construction Complete Date	Storage Volume (cf)	New Trees	Drainage Area (acres)	Greened Acre (acre-inches)	SMP Types	Program	Green Construction Cost**	Partner(s)	Watershed
50070	524	11/13/2015	1653	0	0.25	0.42	Infiltration Storage Trench, Pervious Pavement	Open Space	$177,128	Department of Public Property, Philadelphia Department of Parks & Recreation	Delaware
50062	470	12/14/2015	6732	15	1.41	1.85	Stormwater Tree Trench	Streets	$438,171	Philadelphia Streets Department	Cobbs-Darby, Schuylkill
50069	511	2/5/2016	272	10		0.08	Stormwater Tree	Streets	Cost Not Available	Philadelphia Streets Department	Delaware
40669	331	2/8/2016	1274	0	0.24	0.35	Pervious Pavement	Streets	$228,735		Delaware
50061	471	2/8/2016	2650	0	0.47	0.73	Infiltration Storage Trench	Streets	$174,320	Philadelphia Streets Department	Delaware
20422	517	5/6/2016	2410	5	0.50	0.66	Stormwater Tree Trench	Streets	$157,075		Schuylkill
40900	1058	5/31/2016	2473	0	0.50	0.68	Infiltration Storage Trench	Streets	$160,831		TTF
50091	589	7/6/2016	3033	15	0.62	0.84	Infiltration Storage Trench, Rain Garden	Open Space	$231,585	Philadelphia Department of Parks & Recreation	Schuylkill
40607	235	7/15/2016	2511	16	1.09	0.62	Stormwater Planter, Stormwater Tree Trench	Streets	$226,849		Delaware
20461	1066	8/22/2016	7757	0	1.54	2.14	Infiltration Storage Trench	Streets	$542,435		Delaware, TTF
50059	410	9/1/2016	12731	0	1.80	3.51	Rain Garden	Open Space	$772,155	Southeastern Transportation Authority, Philadelphia Department of Parks & Recreation	Delaware

Work Number	Project ID	Construction Complete Date	Storage Volume (cf)	New Trees	Drainage Area (acres)	Greened Acre (acre-inches)	SMP Types	Program	Green Construction Cost**	Partner(s)	Watershed
40903	656	9/7/2016	541	0	0.15	0.15	Infiltration Storage Trench	Streets	$71,290		Schuylkill
50077	322	9/16/2016	5574	10	1.15	1.54	Rain Garden, Swale, Stormwater Tree Trench	Vacant Land	$692,423		Schuylkill
	530	9/16/2016	1417	0	0.26	0.39	Infiltration Storage Trench, Rain Garden	Open Space		Philadelphia Department of Parks & Recreation	Schuylkill
	558	9/16/2016	3638	4	0.66	1.00	Infiltration Storage Trench, Rain Garden	Vacant Land		Department of Public Property, Philadelphia Department of Parks & Recreation	Schuylkill
50078	303	10/7/2016	3531	0	0.73	0.97	Infiltration Storage Trench, Rain Garden	Vacant Land	$866,242	Tookany/Tacony-Frankford Watershed Partnership	TTF
	642	10/7/2016	7685	13	1.41	2.12	Infiltration Storage Trench, Rain Garden, Stormwater Tree Trench	Open Space		Philadelphia Department of Parks & Recreation	TTF
50067	276	10/31/2016	8510	27	1.63	2.34	Swale, Stormwater Tree Trench	Streets	$937,258		Delaware
50068	244	11/8/2016	6056	17	0.69	1.37	Infiltration Storage Trench, Rain Garden, Swale	Open Space	$730,041	Community Ventures, Department of Public Property, Philadelphia Department of Parks & Recreation	Delaware
50083	151	12/9/2016	1181	9	0.31	0.43	Depaving, Infiltration Storage Trench, Rain Garden	Open Space	$118,707	Philadelphia Department of Parks & Recreation	Delaware

Work Number	Project ID	Construction Complete Date	Storage Volume (cf)	New Trees	Drainage Area (acres)	Greened Acre (acre-inches)	SMP Types	Program	Green Construction Cost**	Partner(s)	Watershed
50113	600	12/16/2016	2006	5	0.27	0.53	Infiltration Storage Trench, Rain Garden	Open Space	$72,439	Philadelphia Department of Parks & Recreation	Schuylkill
50150	1015	2/10/2017	4224	1	0.72	1.16	Infiltration Storage Trench, Rain Garden	Open Space	$259,585	Philadelphia Department of Parks & Recreation	Delaware
50045	292	3/16/2017	13098	0	1.94	3.48	Infiltration Storage Trench	Streets	Cost Not Available	Department of Public Property, Philadelphia Department of Parks & Recreation	Schuylkill
20400	306	3/24/2017	5445	9	0.95	1.50	Stormwater Tree Trench	Streets	$438,850		Delaware
40891	1062	5/25/2017	16511	13	2.94	4.50	Infiltration Storage Trench, Stormwater Tree Trench	Streets	$651,725		Schuylkill
40828	657	6/7/2017	1217	2	0.34	0.34	Stormwater Tree Trench	Streets	$112,670		Delaware, Schuylkill
50071	475	6/23/2017	5697	16	1.17	1.57	Infiltration Storage Trench, Rain Garden	Open Space	$352,915	Philadelphia School District, Philadelphia Department of Parks & Recreation, Trust for Public Land	Delaware
50049	291	9/27/2017	5961	3	0.95	1.64	Infiltration Storage Trench, Stormwater Tree Trench	Streets	$1,191,880	Community Design Collaborative	Delaware
	388	9/27/2017	5964	5	1.17	1.72	Infiltration Storage Trench, Stormwater Tree Trench	Streets			Delaware

Work Number	Project ID	Construction Complete Date	Storage Volume (cf)	New Trees	Drainage Area (acres)	Greened Acre (acre-inches)	SMP Types	Program	Green Construction Cost**	Partner(s)	Watershed
	389	9/27/2017	3483	3	0.75	0.96	Infiltration Storage Trench, Stormwater Tree Trench	Streets			Delaware
40918	1149	9/28/2017	1954	0	0.50	0.54	Infiltration Storage Trench	Streets	$131,760		TTF
50048	375	10/26/2017	6067	10	0.92	1.62	Stormwater Tree Trench	Streets	$1,101,200		TTF
	377	10/26/2017	1898	0	0.49	0.52	Infiltration Storage Trench, Rain Garden, Swale	Streets			TTF
	378	10/26/2017	3260	9	0.62	0.90	Stormwater Tree Trench	Streets			TTF
	379	10/26/2017	5370	11	1.00	1.48	Stormwater Tree Trench	Streets			TTF
20443	411	12/8/2017	53074	2	7.31	14.61	Infiltration Storage Trench, Rain Garden, Swale	Open Space	$2,658,620	Philadelphia Department of Parks & Recreation	TTF
20456	994	12/14/2017	6350	0	1.30	1.75	Infiltration Storage Trench	Streets	$541,420		TTF
50143	1195	1/19/2018	25668	0	2.59	5.17	Infiltration Storage Trench, Rain Garden	Streets	$1,163,250	Fairmount Park Conservancy	Schuylkill
40817	1293	1/29/2018	4096	0	0.96	1.13	Infiltration Storage Trench	Streets	$272,190		Delaware
50112	1055	2/9/2018	16811	50	2.48	3.75	Infiltration Storage Trench, Rain Garden	Streets	$500,000	Philadelphia Department of Parks & Recreation	Schuylkill

Work Number	Project ID	Construction Complete Date	Storage Volume (cf)	New Trees	Drainage Area (acres)	Greened Acre (acre-inches)	SMP Types	Program	Green Construction Cost**	Partner(s)	Watershed
50098	1007	2/15/2018	7040	25	1.58	1.94	Infiltration Storage Trench, Rain Garden	Open Space	$500,000	Philadelphia Department of Parks & Recreation	Delaware
50052	335	3/12/2018	6081	2	1.03	1.68	Stormwater Bump-out, Infiltration Storage Trench	Streets	$2,300,055	Southeastern Transportation Authority	TTF
	380	3/12/2018	29798	0	4.67	7.96	Stormwater Bump-out, Infiltration Storage Trench, Swale	Streets			TTF
	383	3/12/2018	6574	0	1.21	1.81	Infiltration Storage Trench	Streets			TTF
50053	314	3/28/2018	6144	16	1.48	1.69	Stormwater Tree Trench	Streets	$1,834,625		TTF
	384	3/28/2018	4170	9	0.66	1.15	Stormwater Tree Trench	Streets			Delaware
	385	3/28/2018	2959	7	0.50	0.82	Stormwater Tree Trench	Streets			Delaware
	386	3/28/2018	5569	8	0.79	1.49	Stormwater Tree Trench	Streets			Delaware
	413	3/28/2018	2458	0	0.41	0.68	Stormwater Bump-out, Infiltration Storage Trench	Streets		Department of Public Property	TTF
	439	3/28/2018	2770	3	0.38	0.76	Stormwater Tree Trench	Streets			Delaware

Work Number	Project ID	Construction Complete Date	Storage Volume (cf)	New Trees	Drainage Area (acres)	Greened Acre (acre-inches)	SMP Types	Program	Green Construction Cost**	Partner(s)	Watershed
20458	1006	4/23/2018	16131	10	2.66	4.40	Infiltration Storage Trench, Stormwater Tree Trench	Streets	$1,198,900		Delaware
50155	488	5/22/2018	10725	8	1.93	2.95	Infiltration Storage Trench, Rain Garden, Stormwater Tree Trench	Open Space	$678,000	Department of Public Property, Philadelphia Department of Parks & Recreation, Councilman Johnson, Urban Roots	Schuylkill
40773	469	6/13/2018	1312	5	0.19	0.36	Stormwater Tree Trench	Streets	$107,500		Delaware
50079	401	7/23/2018	15204	1	2.07	4.24	Depaving, Infiltration Storage Trench	Open Space	$1,019,045	Philadelphia Department of Parks & Recreation	Schuylkill
40713	288	8/15/2018	1079	6	0.21	0.30	Pervious Pavement	Streets	$145,625		Delaware
40865	1057	8/30/2018	5473	0	1.35	1.51	Infiltration Storage Trench	Streets	$526,525		TTF
50030	171	9/27/2018	5122	11	0.94	1.41	Stormwater Tree Trench	Streets	$1,428,730	Fairmount Park Commission, Pennsylvania Horticulture Society	Delaware
	172	9/27/2018	11055	14	1.85	3.03	Stormwater Bump-out, Infiltration Storage Trench, Stormwater Tree Trench	Streets		Fairmount Park Commission, Pennsylvania Horticulture Society	Delaware
	173	9/27/2018	2428	5	0.39	0.67	Stormwater Tree Trench	Streets			Delaware
40799	556	11/1/2018	4317	0	0.82	1.18	Infiltration Storage Trench	Streets	$293,888		TTF

Work Number	Project ID	Construction Complete Date	Storage Volume (cf)	New Trees	Drainage Area (acres)	Greened Acre (acre-inches)	SMP Types	Program	Green Construction Cost**	Partner(s)	Watershed
20439	584	11/7/2018	7512	10	1.20	2.04	Infiltration Storage Trench, Stormwater Tree Trench	Streets	$565,810		Delaware, Schuylkill
40821	504	12/19/2018	5239	2	0.84	1.44	Pervious Pavement, Stormwater Tree Trench	Streets	$782,150		Delaware
40816	554	1/7/2019	10995	4	1.62	2.71	Infiltration Storage Trench, Stormwater Tree, Stormwater Tree Trench	Streets	$638,040		Delaware
20490	1206	1/18/2019	3216	0	0.59	0.85	Infiltration Storage Trench	Streets	$309,780		Delaware
50179	1288	2/21/2019	20873	18	4.13	5.75	Stormwater Basin, Infiltration Storage Trench, Stormwater Planter, Rain Garden, Stormwater Tree Trench	Streets	$1,585,000		Schuylkill
20489	1136	2/26/2019	4248	0	0.87	1.17	Infiltration Storage Trench	Streets	$403,050		Cobbs-Darby
20444	563	3/26/2019	10624	0	2.05	2.93	Infiltration Storage Trench	Streets	$750,420		Delaware, Schuylkill

Work Number	Project ID	Construction Complete Date	Storage Volume (cf)	New Trees	Drainage Area (acres)	Greened Acre (acre-inches)	SMP Types	Program	Green Construction Cost**	Partner(s)	Watershed
40863	1010	6/3/2019	5127	3	0.98	1.41	Infiltration Storage Trench, Stormwater Tree Trench	Streets	$477,220		Delaware
Total Greened Acres						**294.6**					

* Pennvest project

** Reported Construction costs may vary from past fiscal years. As of FY 18, the specific Green Construction Costs associated with the project are reported.

Appendix 2

Planned Public Green Stormwater Infrastructure Projects

Table 1: Public Planned Project Tracking Metrics and Reporting Format

Public Project Tracking Metrics										
Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partners	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost

Over the past year, PWD's new capital projects tracking system's (CIPIT) interaction with its GSI tracking system (GreenIT) has slightly changed. To accommodate this change, we have replaced Project Names with a Work Number and a Project ID. The Project ID is unique to individual projects and these projects can be bundled under one Work Number for bidding purposes. Moving forward, Work Numbers will have a 1:1 relationship with projects.

Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partner(s)	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost
40736	236	Combined	Delaware	Streets	In Design	Stormwater Planter, Stormwater Tree Trench	Philadelphia Water Department	1.7	2022	TBD
20407	351	Combined	Cobbs-Darby	Streets	In Design	Infiltration Storage Trench	Philadelphia Water Department	0.3	2022	TBD
20407	492	Combined	Cobbs-Darby	Streets	In Design	Stormwater Bump-out, Stormwater Tree Trench	Philadelphia Water Department	0.3	2022	TBD
20464	1381	Combined, Separate	Schuylkill, TTF, Wissahickon	Streets	In Design	Stormwater Tree Trench	Philadelphia Water Department	2.3	2022	TBD
20468	1468	Combined	Cobbs-Darby	Streets	In Design	Stormwater Tree Trench		4.4	2022	TBD
20479	1451	Combined	Delaware, TTF	Streets	In Design	Infiltration Storage Trench, Stormwater Tree Trench		5.5	2022	TBD
20487	1133	Combined	Schuylkill	Streets	In Design	Stormwater Tree Trench	Philadelphia Water Department	0.9	2022	TBD
20496	1212	Combined	Schuylkill	Streets	In Design	Stormwater Tree Trench	Philadelphia Water Department	1.0	2022	TBD

Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partner(s)	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost
20517	1418	Combined, Separate	TTF	Streets	In Design	Stormwater Tree	Philadelphia Water Department	2.4	2022	TBD
20532	1417	Combined	Cobbs-Darby	Streets	In Design	Stormwater Bump-out, Stormwater Tree	Philadelphia Water Department	3.0	2022	TBD
20540	1422	Combined	Pennypack	Streets	In Design	Rain Garden	Philadelphia Water Department	0.4	2022	TBD
20552	1489	Combined	Delaware	Streets	In Design	Stormwater Tree Trench		5.1	2022	TBD
20558	1376	Combined	TTF	Streets	In Design	Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	1.1	2022	TBD
20559	1463	Combined	Delaware	Streets	In Design	Stormwater Bump-out, Stormwater Tree Trench		0.7	2022	TBD
20562	1395	Combined	Schuylkill	Streets	In Design	Infiltration Storage Trench	Philadelphia Water Department	0.7	2022	TBD
20564	1419	Combined	TTF	Streets	In Design	Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	4.8	2022	TBD

Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partner(s)	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost
20573	1479	Combined	Delaware	Streets	In Design	Stormwater Tree Trench		0.3	2022	TBD
20575	1465	Combined	TTF	Streets	In Design	Stormwater Bump-out, Infiltration Storage Trench, Stormwater Tree Trench		2.9	2022	TBD
20579	1466	Combined	Cobbs-Darby	Streets	In Design	Stormwater Bump-out, Infiltration Storage Trench		3.2	2022	TBD
20583	1470	Combined, Separate	TTF	Streets	In Design	Stormwater Bump-out, Stormwater Tree Trench		2.8	2022	TBD
20588	1487	Combined	TTF	Streets	In Design	Infiltration Storage Trench		1.2	2022	TBD
20601	1464	Combined	Delaware, Schuylkill	Streets	In Design	Stormwater Tree Trench		1.1	2022	TBD
20609	1484	Combined	Delaware	Streets	In Design	Infiltration Storage Trench, Stormwater Tree Trench		1.5	2022	TBD
20614	1494	Combined, Separate	Cobbs-Darby, Schuylkill	Streets	In Design	Stormwater Tree Trench		0.8	2022	TBD

Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partner(s)	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost
20619	1485	Combined, Separate	Delaware, Pennypack	Streets	In Design	Stormwater Bump-out		2.3	2022	TBD
40780	1496	Combined	Schuylkill	Streets	In Design	Stormwater Tree Trench		1.4	2022	TBD
40794	168	Combined, Separate, Non-Contributing	TTF	Open Space	In Design	Rain Garden	Philadelphia Water Department	13.3	2022	TBD
40826	1063	Combined	Schuylkill	Streets	In Design	Stormwater Tree Trench	Philadelphia Water Department	3.1	2022	TBD
40855	1400	Combined	Delaware	Streets	In Design	Pervious Pavement	Philadelphia Water Department	1.5	2022	TBD
40857	1008	Combined	Delaware, Schuylkill	Streets	In Design	Stormwater Tree Trench	Philadelphia Water Department	1.3	2022	TBD
40860	1443	Combined	Schuylkill	Streets	In Design	Stormwater Tree Trench		0.6	2022	TBD
40864	1132	Combined	Schuylkill	Streets	In Design	Stormwater Tree Trench	Philadelphia Water Department	0.6	2022	TBD

Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partner(s)	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost
40869	1289	Combined	TTF	Streets	In Design	Stormwater Tree Trench	Philadelphia Water Department	0.8	2022	TBD
40882	1245	Combined	Delaware	Streets	In Design	Stormwater Tree Trench	Philadelphia Water Department	1.5	2022	TBD
40904	1134	Combined	Delaware	Streets	In Design	Stormwater Planter, Stormwater Tree Trench	Philadelphia Water Department	0.4	2022	TBD
40923	1244	Combined	Delaware	Streets	In Design	Stormwater Planter, Stormwater Tree Trench	Philadelphia Water Department	3.2	2022	TBD
40926	1270	Combined	Delaware	Streets	In Design	Pervious Pavement	Philadelphia Water Department	0.7	2022	TBD
40935	1210	Combined	Delaware	Streets	In Design	Pervious Pavement	Philadelphia Water Department	1.3	2022	TBD
40951	1280	Combined	Schuylkill	Streets	In Design	Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	1.5	2022	TBD
40965	1369	Combined	Schuylkill	Streets	In Design	Stormwater Planter	Philadelphia Water Department	1.8	2022	TBD

Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partner(s)	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost
40975	1377	Combined	Schuylkill	Streets	In Design	Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	1.5	2022	TBD
40981	1344	Combined	Delaware	Streets	In Design	Pervious Pavement	Philadelphia Water Department	0.5	2022	TBD
40985	1375	Combined	Cobbs-Darby, Schuylkill	Streets	In Design	Pervious Pavement, Stormwater Tree Trench	Philadelphia Water Department	2.2	2022	TBD
40989	1340	Combined	Pennypack	Streets	In Design	Stormwater Tree Trench	Philadelphia Water Department	3.2	2022	TBD
40990	1355	Combined	Cobbs-Darby	Streets	In Design	Stormwater Tree Trench	Philadelphia Water Department	1.2	2022	TBD
40996	1366	Combined	Delaware	Streets	In Design	Stormwater Tree Trench	Philadelphia Water Department	0.7	2022	TBD
40998	1493	Combined	Schuylkill	Streets	In Design	Rain Garden		1.1	2022	TBD
40999	1391	Combined	Delaware, Schuylkill	Streets	In Design	Pervious Pavement, Stormwater Tree Trench	Philadelphia Water Department	2.2	2022	TBD

Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partner(s)	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost
41008	1402	Combined	Schuylkill	Streets	In Design	Stormwater Tree Trench	Philadelphia Water Department	0.4	2022	TBD
41025	1409	Combined	Delaware	Streets	In Design	Stormwater Tree Trench	Philadelphia Water Department	2.3	2022	TBD
41031	1432	Combined	TTF	Streets	In Design	Stormwater Tree Trench	Philadelphia Water Department	0.4	2022	TBD
41034	1399	Combined	Schuylkill	Streets	In Design	Stormwater Tree Trench	Philadelphia Water Department	0.4	2022	TBD
41039	1455	Combined	Delaware	Streets	In Design	Stormwater Tree Trench	Pennsylvania Department of Transportation	1.0	2022	TBD
41049	1398	Combined	Delaware	Streets	In Design	Stormwater Tree Trench	Philadelphia Water Department	1.5	2022	TBD
41064	1452	Combined	Delaware	Streets	In Design	Stormwater Tree Trench		0.5	2022	TBD
41068	1407	Combined	Cobbs-Darby	Streets	In Design	Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	0.5	2022	TBD

Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partner(s)	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost
41070	1435	Combined	Delaware, Schuylkill	Streets	In Design	Stormwater Tree Trench	Philadelphia Water Department	1.4	2022	TBD
41071	1471	Combined	Schuylkill	Streets	In Design	Stormwater Tree Trench		1.4	2022	TBD
41073	1426	Combined	Delaware	Streets	In Design	Stormwater Tree Trench	Philadelphia Water Department	1.2	2022	TBD
41090	1453	Combined	Schuylkill	Streets	In Design	Stormwater Tree Trench		1.0	2022	TBD
41094	1488	Combined	TTF	Streets	In Design	Infiltration Storage Trench		0.4	2022	TBD
41096	1457	Combined	Cobbs-Darby	Streets	In Design	Stormwater Tree Trench		1.1	2022	TBD
41103	1492	Combined	Schuylkill	Streets	In Design	Stormwater Tree Trench		0.8	2022	TBD
41105	1497	Combined	Cobbs-Darby	Streets	In Design	Stormwater Tree Trench		0.8	2022	TBD

Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partner(s)	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost
50081	408	Combined	Delaware	Open Space	In Design	Infiltration Storage Trench, Rain Garden, Swale	Department of Public Property	0.6	2022	TBD
50107	1052	Combined	Cobbs-Darby, Schuylkill	Streets	In Design	Stormwater Tree Trench	Philadelphia Water Department	14.3	2022	TBD
50126	1088	Combined	TTF	Streets	In Design	Stormwater Bump-out	Philadelphia Water Department	1.6	2022	TBD
50126	1089	Combined	Delaware	Streets	In Design	Stormwater Bump-out, Infiltration Storage Trench	Philadelphia Water Department	1.6	2022	TBD
50126	1262	Combined	Delaware	Streets	In Design	Stormwater Bump-out, Stormwater Tree Trench	Philadelphia Water Department	1.6	2022	TBD
50140	1148	Combined	Delaware	Streets	In Design	Stormwater Bump-out, Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	2.1	2022	TBD
50144	1165	Combined	Schuylkill	Streets	In Design	Stormwater Bump-out, Infiltration Storage Trench, Rain Garden, Swale	Department of Commerce	4.6	2022	TBD
50164	1258	Combined	TTF	Facilities	In Design	Infiltration Storage Trench, Rain Garden	Philadelphia Water Department	1.2	2022	TBD

Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partner(s)	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost
50168	1271	Combined	Cobbs-Darby	Streets	In Design	Stormwater Bump-out, Stormwater Tree Trench	Philadelphia Water Department	2.9	2022	TBD
50169	1365	Combined	Schuylkill	Streets	In Design	Stormwater Tree Trench	Philadelphia Water Department	65.3	2022	TBD
50171	1274	Combined	Delaware	Streets	In Design	Infiltration Storage Trench	Streets Department	2.3	2022	TBD
50172	1277	Combined	Schuylkill	Streets	In Design	Stormwater Bump-out, Green Gutter, Stormwater Planter, Rain Garden, Stormwater Tree	Philadelphia Water Department	7.0	2022	TBD
50180	1285	Combined	Schuylkill	Streets	In Design	Stormwater Bump-out, Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	5.7	2022	TBD
50181	1290	Combined	Schuylkill	Streets	In Design	Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	1.0	2022	TBD
50181	1291	Combined	Schuylkill	Facilities	In Design	Infiltration Storage Trench, Stormwater Planter, Swale	Philadelphia Water Department	1.0	2022	TBD

Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partner(s)	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost
50186	1301	Combined	Cobbs-Darby, Schuylkill	Streets	In Design	Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	9.7	2022	TBD
50192	1311	Combined	Delaware	Open Space	In Design	Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	10.9	2022	TBD
50196	1318	Combined, Separate	Schuylkill, TTF	Streets	In Design	Stormwater Bump-out, Infiltration Storage Trench, Stormwater Planter, Stormwater Tree Trench	Philadelphia Water Department	10.4	2022	TBD
50196	1319	Combined, Separate	Schuylkill, TTF	Open Space	In Design	Rain Garden, Swale, Stormwater Tree Trench	Philadelphia Water Department	10.4	2022	TBD
50197	1322	Combined	Delaware	Streets	In Design	Rain Garden, Stormwater Tree Trench	Philadelphia Water Department	2.0	2022	TBD
50198	1327	Combined	Schuylkill	Streets	In Design	Stormwater Planter, Stormwater Tree Trench	Philadelphia Water Department	10.9	2022	TBD
50199	1328	Combined	Schuylkill	Streets	In Design	Stormwater Bump-out, Stormwater Planter, Stormwater Tree Trench	Philadelphia Water Department	5.3	2022	TBD

Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partner(s)	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost
50200	1329	Combined	Schuylkill	Streets	In Design	Stormwater Bump-out, Stormwater Planter, Stormwater Tree Trench	Philadelphia Water Department	4.5	2022	TBD
50201	1335	Combined	TTF	Vacant Land	In Design	Infiltration Storage Trench, Rain Garden, Swale	Philadelphia Water Department	3.5	2022	TBD
50202	1333	Combined	TTF	Open Space	In Design	Infiltration Storage Trench, Rain Garden	Philadelphia Water Department	1.1	2022	TBD
50202	1334	Combined	TTF	Streets	In Design	Infiltration Storage Trench	Philadelphia Water Department	1.1	2022	TBD
50203	1336	Combined, Non-Contributing	Schuylkill	Streets	In Design	Infiltration Storage Trench, Rain Garden, Swale, Stormwater Tree Trench	Philadelphia Water Department	7.3	2022	TBD
50204	1339	Combined	Delaware	Open Space	In Design	Infiltration Storage Trench, Stormwater Planter, Rain Garden, Stormwater Tree Trench	Philadelphia Water Department	4.9	2022	TBD
50205	1341	Combined	Schuylkill	Streets	In Design	Stormwater Bump-out, Infiltration Storage Trench,	Philadelphia Water Department	11.8	2022	TBD

Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partner(s)	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost
						Stormwater Planter, Rain Garden, Stormwater Tree Trench				
50206	1343	Combined	Schuylkill	Streets	In Design	Stormwater Bump-out, Stormwater Planter, Stormwater Tree Trench	Philadelphia Water Department	7.9	2022	TBD
50207	1342	Combined	Schuylkill	Streets	In Design	Stormwater Bump-out, Stormwater Planter, Stormwater Tree Trench	Philadelphia Water Department	9.2	2022	TBD
50210	1345	Combined	Schuylkill	Streets	In Design	Infiltration Storage Trench, Rain Garden	Philadelphia Water Department	10.8	2022	TBD
50211	1346	Combined	Delaware	Open Space	In Design	Stormwater Planter	Philadelphia Water Department	1.5	2022	TBD
50211	1347	Combined	Delaware	Streets	In Design	Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	1.5	2022	TBD
50213	1351	Combined	Schuylkill	Streets	In Design	Stormwater Tree Trench	Philadelphia Water Department	2.1	2022	TBD

Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partner(s)	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost
50214	1353	Combined, Non-Contributing	Pennypack	Streets	In Design	Infiltration Storage Trench	Philadelphia Parks & Recreation	0.6	2022	TBD
50215	1354	Combined	Schuylkill	Streets	In Design	Stormwater Bump-out, Stormwater Tree Trench	Philadelphia Water Department	5.0	2022	TBD
50218	1357	Combined	Cobbs-Darby	Streets	In Design	Stormwater Bump-out, Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	9.2	2022	TBD
50219	1360	Combined	Delaware	Streets	In Design	Stormwater Bump-out, Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	8.9	2022	TBD
50220	1361	Combined	Cobbs-Darby, Schuylkill	Streets	In Design	Stormwater Bump-out, Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	10.6	2022	TBD
50222	1374	Combined	Cobbs-Darby, Schuylkill	Streets	In Design	Stormwater Bump-out, Infiltration Storage Trench, Rain Garden, Stormwater Tree	Philadelphia Water Department	2.4	2022	TBD
50226	1382	Combined	Delaware, TTF	Streets	In Design	Stormwater Bump-out, Infiltration Storage Trench,	Philadelphia Water Department	16.9	2022	TBD

Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partner(s)	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost
						Stormwater Tree Trench				
50229	1383	Combined	Delaware	Facilities, Open Space	In Design	Infiltration Storage Trench, Rain Garden	Philadelphia Water Department	3.5	2022	TBD
50231	1384	Combined	Delaware	Streets	In Design	Stormwater Tree Trench	Philadelphia Water Department	4.0	2022	TBD
50232	1387	Combined	Delaware	Open Space	In Design	Infiltration Storage Trench, Rain Garden, Stormwater Tree Trench	Philadelphia Industrial Development Corporation	1.6	2022	TBD
50233	1389	Combined	Cobbs-Darby	Streets	In Design	Stormwater Bump-out, Infiltration Storage Trench, Stormwater Planter, Rain Garden, Stormwater Tree Trench	Philadelphia Water Department	8.8	2022	TBD
50233	1390	Combined	Cobbs-Darby	Open Space	In Design	Rain Garden	Philadelphia Water Department	8.8	2022	TBD
50234	1388	Combined	Delaware	Streets	In Design	Stormwater Bump-out, Stormwater Planter,	Philadelphia Water Department	2.5	2022	TBD

Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partner(s)	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost
						Stormwater Tree Trench				
50236	1393	Combined	TTF	Parking, Streets, Vacant Land	In Design	Infiltration Storage Trench, Rain Garden	Philadelphia Water Department	0.4	2022	TBD
50238	1396	Combined	Delaware	Streets	In Design	Stormwater Bump-out, Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	5.6	2022	TBD
50240	1401	Combined	Cobbs-Darby	Open Space, Streets	In Design	Stormwater Bump-out, Stormwater Tree Trench	Philadelphia Water Department	12.7	2022	TBD
50241	1403	Combined	TTF	Open Space, Streets	In Design	Infiltration Storage Trench, Rain Garden, Swale	Philadelphia Water Department	4.7	2022	TBD
50242	1404	Combined	TTF	Open Space, Streets	In Design	Stormwater Basin, Stormwater Bump-out, Stormwater Planter, Swale	Philadelphia Water Department	9.3	2022	TBD
50243	1405	Combined	Schuylkill	Streets	In Design	Stormwater Bump-out, Stormwater Tree Trench	Philadelphia Water Department	7.9	2022	TBD
50245	1410	Combined	Delaware	Open Space	In Design	Infiltration Storage Trench	Philadelphia Water Department	3.4	2022	TBD

Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partner(s)	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost
50246	1412	Combined	Schuylkill	Streets	In Design	Stormwater Bump-out, Stormwater Planter, Stormwater Tree Trench	Philadelphia Water Department	12.3	2022	TBD
50247	1413	Combined, Separate	Delaware, TTF	Streets	In Design	Stormwater Bump-out, Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	7.2	2022	TBD
50248	1414	Combined	Schuylkill	Streets	In Design	Stormwater Bump-out, Stormwater Planter, Stormwater Tree Trench	Philadelphia Water Department	7.2	2022	TBD
50252	1420	Combined	TTF	Streets	In Design	Stormwater Bump-out, Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	7.6	2022	TBD
50253	1421	Combined	Schuylkill	Streets, Vacant Land	In Design	Stormwater Basin, Stormwater Bump-out, Stormwater Planter, Swale	Philadelphia Water Department	5.4	2022	TBD
50255	1425	Combined, Non-Contributing	Cobbs-Darby	Open Space, Streets	In Design	Stormwater Bump-out, Rain Garden, Stormwater Tree Trench	Philadelphia Water Department	11.4	2022	TBD

Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partner(s)	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost
50258	1429	Combined	Schuylkill	Streets	In Design	Stormwater Bump-out, Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	14.0	2022	TBD
50259	1431	Combined, Separate	Delaware, Pennypack	Streets	In Design	Infiltration Storage Trench	Streets Department	8.3	2022	TBD
50260	1433	Combined, Non-Contributing	Cobbs-Darby	Open Space, Streets	In Design	Rain Garden, Stormwater Tree Trench	Philadelphia Water Department	11.6	2022	TBD
50261	1434	Combined	Delaware	Open Space, Streets	In Design	Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Parks & Recreation	0.3	2022	TBD
50262	1436	Combined, Non-Contributing	Cobbs-Darby	Open Space, Streets	In Design	Stormwater Bump-out, Rain Garden, Stormwater Tree Trench	Philadelphia Water Department	9.6	2022	TBD
50263	1437	Combined, Separate	Delaware, Pennypack	Streets	In Design	Stormwater Bump-out, Stormwater Tree Trench	Philadelphia Water Department	18.2	2022	TBD
50264	1438	Combined	Delaware	Streets, Vacant Land	In Design	Infiltration Storage Trench, Rain Garden, Stormwater Tree Trench	Philadelphia Water Department	2.1	2022	TBD

Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partner(s)	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost
50265	1439	Combined	Cobbs-Darby	Open Space, Streets	In Design	Stormwater Bump-out, Rain Garden, Stormwater Tree Trench	Philadelphia Water Department	9.4	2022	TBD
50266	1440	Combined	TTF	Open Space, Streets	In Design	Stormwater Bump-out, Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	10.1	2022	TBD
50267	1441	Combined, Separate	Pennypack	Streets	In Design	Stormwater Bump-out, Stormwater Tree Trench	Philadelphia Water Department	8.0	2022	TBD
50268	1442	Combined, Non-Contributing	TTF	Streets	In Design	Stormwater Planter	Streets Department	3.2	2022	TBD
50269	1444	Combined	Delaware, Pennypack	Open Space, Streets	In Design	Infiltration Storage Trench	Philadelphia Water Department	7.6	2022	TBD
50270	1445	Combined	Delaware	Streets, Vacant Land	In Design	Rain Garden	Philadelphia Water Department	5.3	2022	TBD
50271	1446	Combined	Schuylkill	Streets	In Design	Stormwater Basin, Stormwater Bump-out, Stormwater Planter, Swale		16.6	2022	TBD
50272	1447	Combined	Delaware	Streets	In Design	Stormwater Bump-out, Rain Garden, Stormwater Tree	Philadelphia Water Department	5.0	2022	TBD

Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partner(s)	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost
50274	1449	Combined	Cobbs-Darby, Schuylkill	Streets	In Design	Stormwater Bump-out, Infiltration Storage Trench, Stormwater Tree Trench		14.8	2022	TBD
50275	1450	Combined, Separate	Pennypack	Streets	In Design	Infiltration Storage Trench, Stormwater Tree Trench		5.2	2022	TBD
50276	1454	Combined	Delaware, Pennypack	Streets	In Design	Stormwater Tree Trench	Philadelphia Water Department	6.0	2022	TBD
50277	1456	Combined	Delaware, Schuylkill	Streets	In Design	Rain Garden, Stormwater Tree Trench	Philadelphia Water Department	2.6	2022	TBD
50279	1459	Combined, Separate	TTF, Wissahickon	Streets, Vacant Land	In Design	Stormwater Basin	Philadelphia Water Department	5.5	2022	TBD
50281	1461	Combined	Cobbs-Darby, Schuylkill	Facilities, Streets	In Design	Rain Garden		7.6	2022	TBD
50282	1462	Combined	Delaware	Streets	In Design	Infiltration Storage Trench, Stormwater Tree Trench	Streets Department	21.5	2022	TBD
50283	1467	Combined, Separate, Non-Contributing	TTF	Open Space, Streets	In Design	Stormwater Bump-out, Infiltration Storage Trench,	Philadelphia Water Department	10.8	2022	TBD

Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partner(s)	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost
						Stormwater Tree Trench				
50284	1469	Combined	Delaware, Pennypack	Streets	In Design	Stormwater Bump-out, Stormwater Tree Trench	Philadelphia Water Department	5.9	2022	TBD
50286	1473	Combined	Cobbs-Darby	Streets	In Design	Stormwater Bump-out, Infiltration Storage Trench, Stormwater Tree Trench		8.3	2022	TBD
50287	1474	Combined	Schuylkill	Streets	In Design	Stormwater Tree Trench		5.1	2022	TBD
50288	1475	Combined	Delaware, Pennypack	Streets	In Design	Stormwater Bump-out, Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	4.6	2022	TBD
50289	1476	Combined	Schuylkill	Streets	In Design	Stormwater Bump-out, Infiltration Storage Trench, Stormwater Tree Trench		0.9	2022	TBD
50290	1477	Combined	Delaware	Streets	In Design	Stormwater Bump-out, Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	7.2	2022	TBD

Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partner(s)	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost
50292	1480	Combined	Cobbs-Darby, Schuylkill	Streets	In Design	Stormwater Bump-out, Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	10.5	2022	TBD
50293	1481	Combined	Delaware	Streets	In Design	Stormwater Bump-out, Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	9.2	2022	TBD
50294	1482	Combined	Cobbs-Darby, Schuylkill	Streets	In Design	Stormwater Bump-out, Swale, Stormwater Tree Trench	Philadelphia Water Department	12.7	2022	TBD
50295	1483	Combined	Delaware	Streets	In Design	Stormwater Tree Trench	HACE	2.6	2022	TBD
50296	1486	Combined	Schuylkill	Streets	In Design	Stormwater Bump-out, Stormwater Tree Trench	Philadelphia Water Department	7.4	2022	TBD
50297	1490	Combined	Delaware	Streets	In Design	Stormwater Bump-out, Stormwater Tree Trench	Philadelphia Water Department	8.9	2022	TBD
50298	1491	Combined	Delaware, TTF	Streets	In Design	Stormwater Tree Trench	Philadelphia Water Department	3.2	2022	TBD

Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partner(s)	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost
50299	1495	Combined	Cobbs-Darby, Schuylkill	Streets	In Design	Stormwater Bump-out, Stormwater Tree Trench	Philadelphia Water Department	10.2	2022	TBD
50110	242	Non-Contributing, Combined	Cobbs-Darby	Streets, Open Space	In PC	Infiltration Storage Trench, Rain Garden	Philadelphia Water Department	4.8	2021	TBD
50088	546	Combined	Delaware	Streets	In PC	Stormwater Bump-out, Infiltration Storage Trench, Stormwater Planter, Swale, Stormwater Tree Trench	Philadelphia Water Department	5.5	2021	TBD
50088	595	Combined	Delaware, Pennypack	Streets	In PC	Stormwater Bump-out, Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	5.5	2021	TBD
50088	596	Combined	Pennypack	Streets	In PC	Stormwater Bump-out, Infiltration Storage Trench	Philadelphia Water Department	5.5	2021	TBD
40839	995	Combined	Cobbs-Darby, Schuylkill	Streets	In PC	Infiltration Storage Trench	Philadelphia Water Department	1.3	2021	TBD
20472	1040	Combined	Schuylkill	Streets	In PC	Infiltration Storage Trench	Philadelphia Water Department	0.5	2021	TBD

Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partner(s)	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost
20475	1042	Combined	Schuylkill	Streets	In PC	Stormwater Tree Trench	Philadelphia Water Department	0.7	2021	TBD
50105	1051	Combined	Cobbs-Darby, Schuylkill	Streets	In PC	Stormwater Bump-out, Green Gutter, Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	16.1	2021	TBD
50108	1053	Combined	Delaware	Streets	In PC	Stormwater Bump-out, Infiltration Storage Trench, Stormwater Planter, Stormwater Tree Trench	Philadelphia Water Department	4.5	2021	TBD
50108	1054	Combined	Delaware	Open Space	In PC	Infiltration Storage Trench, Rain Garden	Philadelphia Water Department	4.5	2021	TBD
20391	1056	Combined	Delaware, Pennypack	Streets	In PC	Infiltration Storage Trench	Philadelphia Water Department	2.7	2021	TBD
50118	1059	Combined	Delaware	Streets	In PC	Stormwater Basin, Stormwater Bump-out, Stormwater Planter, Swale	Philadelphia Water Department	3.2	2021	TBD
40856	1060	Combined	Schuylkill	Streets	In PC	Stormwater Bump-out	Philadelphia Water Department	0.6	2021	TBD

Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partner(s)	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost
20417	1061	Combined	Delaware	Streets	In PC	Infiltration Storage Trench	Philadelphia Water Department	1.7	2021	TBD
40862	1064	Combined	Delaware	Streets	In PC	Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	1.0	2021	TBD
50120	1070	Combined	Delaware	Streets	In PC	Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	7.6	2021	TBD
50125	1087	Combined	Delaware, TTF	Streets	In PC	Stormwater Bump-out, Infiltration Storage Trench	Philadelphia Water Department	12.5	2021	TBD
50128	1090	Combined	Delaware	Streets	In PC	Stormwater Tree Trench	Philadelphia Water Department	4.6	2021	TBD
50128	1107	Combined	Delaware	Streets	In PC	Rain Garden, Stormwater Tree Trench	Philadelphia Water Department	4.6	2021	TBD
20437	1124	Combined	Delaware	Streets	In PC	Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	3.6	2021	TBD
20485	1126	Combined	Schuylkill	Streets	In PC	Stormwater Tree Trench	Philadelphia Water Department	2.4	2021	TBD

Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partner(s)	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost
50129	1127	Combined	Schuylkill	Vacant Land	In PC	Rain Garden, Stormwater Tree Trench	Philadelphia Water Department	1.5	2021	TBD
50129	1128	Combined	Schuylkill	Streets	In PC	Stormwater Bump-out, Stormwater Tree Trench	Philadelphia Water Department	1.5	2021	TBD
50129	1129	Combined	Schuylkill	Streets	In PC	Stormwater Bump-out, Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	1.5	2021	TBD
40898	1130	Combined	Schuylkill	Streets	In PC	Stormwater Tree Trench	Philadelphia Water Department	0.2	2021	TBD
50130	1135	Combined	Delaware	Streets	In PC	Stormwater Bump-out, Depaving, Infiltration Storage Trench, Stormwater Planter	Streets Department	0.8	2021	TBD
50133	1139	Combined	TTF	Streets	In PC	Stormwater Bump-out, Infiltration Storage Trench, Stormwater Tree, Stormwater Tree Trench	Philadelphia Water Department	17.6	2021	TBD
50139	1147	Combined	Cobbs-Darby, Schuylkill	Streets	In PC	Stormwater Bump-out, Infiltration Storage Trench,	Philadelphia Water Department	7.4	2021	TBD

Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partner(s)	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost
						Stormwater Planter, Rain Garden, Stormwater Tree Trench				
50145	1163	Combined	Delaware	Open Space	In PC	Infiltration Storage Trench, Rain Garden	Philadelphia Water Department	2.8	2021	TBD
50148	1200	Combined	Cobbs-Darby, Schuylkill	Streets	In PC	Infiltration Storage Trench, Rain Garden	Philadelphia Water Department	5.0	2021	TBD
50152	1209	Combined	Schuylkill	Streets	In PC	Infiltration Storage Trench, Stormwater Planter, Stormwater Tree Trench	Philadelphia Water Department	2.7	2021	TBD
20497	1215	Combined	Schuylkill	Streets	In PC	Stormwater Tree Trench	Philadelphia Water Department	0.4	2021	TBD
40899	1219	Combined	Delaware	Streets	In PC	Stormwater Tree Trench	Philadelphia Water Department	0.5	2021	TBD
50158	1221	Combined	Cobbs-Darby	Streets	In PC	Infiltration Storage Trench, Rain Garden	Streets Department	2.5	2021	TBD

Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partner(s)	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost
50157	1240	Combined	Delaware	Streets	In PC	Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	3.3	2021	TBD
50160	1242	Combined	Delaware	Streets	In PC	Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	4.5	2021	TBD
20474	1243	Combined	Delaware, TTF	Streets	In PC	Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	3.4	2021	TBD
20499	1248	Combined	Delaware	Streets	In PC	Infiltration Storage Trench	Philadelphia Water Department	0.3	2021	TBD
50166	1264	Combined	Delaware	Streets	In PC	Stormwater Bump-out, Infiltration Storage Trench, Stormwater Planter, Stormwater Tree Trench	Philadelphia Water Department	4.9	2021	TBD
50162	1265	Combined	Cobbs-Darby, Schuylkill	Streets	In PC	Stormwater Bump-out, Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	5.9	2021	TBD
20480	1266	Combined	Delaware	Streets	In PC	Stormwater Tree Trench	Philadelphia Water Department	0.8	2021	TBD

Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partner(s)	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost
50167	1267	Combined	Delaware	Open Space	In PC	Infiltration Storage Trench, Rain Garden, Stormwater Wetland	Philadelphia Water Department	41.7	2021	TBD
50128	1269	Combined	Delaware	Streets	In PC	Stormwater Tree Trench	Philadelphia Water Department	4.6	2021	TBD
50170	1272	Combined	Schuylkill	Streets	In PC	Stormwater Bump-out, Stormwater Tree Trench	Philadelphia Water Department	1.2	2021	TBD
50170	1273	Combined	Schuylkill	Streets	In PC	Infiltration Storage Trench, Rain Garden, Stormwater Tree Trench	Philadelphia Water Department	1.2	2021	TBD
50174	1279	Combined	Delaware	Streets	In PC	Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	6.0	2021	TBD
20486	1282	Combined	Delaware	Streets	In PC	Infiltration Storage Trench	Philadelphia Water Department	0.7	2021	TBD
50176	1283	Combined	Schuylkill	Streets	In PC	Stormwater Bump-out, Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	7.5	2021	TBD

Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partner(s)	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost
50177	1287	Combined	Schuylkill, TTF	Streets	In PC	Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	5.8	2021	TBD
20483	1294	Combined	Delaware	Streets	In PC	Infiltration Storage Trench	Philadelphia Water Department	0.7	2021	TBD
40946	1295			Streets	In PC	Pervious Pavement	Philadelphia Water Department	0.4	2021	TBD
50182	1296	Combined	TTF	Streets	In PC	Stormwater Basin, Stormwater Bump-out, Stormwater Planter, Swale	Philadelphia Water Department	5.6	2021	TBD
50133	1298	Combined	TTF	Streets	In PC	Infiltration Storage Trench	Philadelphia Water Department	17.6	2021	TBD
50184	1299	Combined	Delaware, TTF	Streets	In PC	Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	6.2	2021	TBD
50187	1302	Combined	Delaware	Streets	In PC	Infiltration Storage Trench	Philadelphia Water Department	0.7	2021	TBD
50187	1303	Combined	Delaware	Streets	In PC	Infiltration Storage Trench, Stormwater Planter,	Philadelphia Water Department	0.7	2021	TBD

Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partner(s)	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost
						Stormwater Tree Trench				
40902	1305			Streets	In PC	Pervious Pavement, Stormwater Tree Trench	Philadelphia Water Department	0.5	2021	TBD
50189	1307	Combined	Schuylkill	Streets	In PC	Stormwater Tree Trench	Philadelphia Water Department	3.3	2021	TBD
50190	1308	Combined	Schuylkill	Streets	In PC	Stormwater Bump-out, Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	5.4	2021	TBD
20525	1310	Combined	Delaware	Streets	In PC	Infiltration Storage Trench	Philadelphia Water Department	0.4	2021	TBD
50194	1315	Combined	Schuylkill	Streets	In PC	Stormwater Bump-out, Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	4.5	2021	TBD
40971	1316	Combined	Delaware	Streets	In PC	Infiltration Storage Trench	Philadelphia Water Department	0.3	2021	TBD

Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partner(s)	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost
20536	1330	Combined	TTF	Streets	In PC	Infiltration Storage Trench	Philadelphia Water Department	2.8	2021	TBD
40939	1331	Combined	Delaware	128	In PC	Infiltration Storage Trench	Philadelphia Water Department	1.3	2021	TBD
20513	1338	Combined	Delaware	Streets	In PC	Infiltration Storage Trench	Philadelphia Water Department	1.1	2021	TBD
50212	1348	Combined	Delaware, Schuylkill	Streets	In PC	Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	5.5	2021	TBD
20546	1350	Combined	TTF	Parking, Open Space	In PC	Infiltration Storage Trench	Philadelphia Water Department	0.6	2021	TBD
50217	1359	Combined	Delaware, TTF	Streets	In PC	Stormwater Bump-out, Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	5.4	2021	TBD
50221	1363	Combined	Delaware, TTF	Streets	In PC	Stormwater Bump-out, Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	5.8	2021	TBD

Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partner(s)	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost
40908	1370	Combined	Cobbs-Darby, Schuylkill	Streets	In PC	Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	1.4	2021	TBD
50235	1392	Combined	Delaware, TTF	Streets	In PC	Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	4.1	2021	TBD
50257	1428	Combined	Delaware	Facilities	In PC	Infiltration Storage Trench, Rain Garden	Philadelphia Parks & Recreation	0.8	2021	TBD
50040	153	Combined	Delaware	Streets	In Construction	Infiltration Storage Trench, Stormwater Planter	Philadelphia Water Department	2.4	2020	TBD
50055	246	Combined	Schuylkill	Streets	In Construction	Stormwater Tree Trench	Philadelphia Water Department	1.4	2020	TBD
50195	290	Combined	TTF	Streets	In Construction	Stormwater Bump-out, Infiltration Storage Trench	Philadelphia Water Department	2.7	2020	TBD
40750	304	Combined	TTF	Streets	In Construction	Infiltration Storage Trench, Stormwater Tree	Philadelphia Water Department	0.5	2020	TBD
40755	305	Combined	Delaware	Streets	In Construction	Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	0.8	2020	TBD

Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partner(s)	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost
50055	344	Combined	Schuylkill	Streets	In Construction	Stormwater Tree Trench	Philadelphia Water Department	1.4	2020	TBD
50111	376	Combined	TTF	Streets	In Construction	Stormwater Bump-out, Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	3.8	2020	TBD
50055	399	Combined	Cobbs-Darby, Schuylkill	Streets	In Construction	Stormwater Tree Trench	Philadelphia Water Department	1.4	2020	TBD
50055	400	Combined	Schuylkill	Streets	In Construction	Stormwater Bump-out, Infiltration Storage Trench, Swale	Philadelphia Water Department	1.4	2020	TBD
40784	406	Combined	Schuylkill	Streets	In Construction	Infiltration Storage Trench	Philadelphia Water Department	0.5	2020	TBD
50060	416	Combined	Delaware, TTF	Open Space	In Construction	Infiltration Storage Trench, Rain Garden	Philadelphia Water Department	12.7	2020	TBD
40795	443	Non-Contributing, Combined	Cobbs-Darby	Streets, Open Space	In Construction	Stormwater Basin, Stormwater Bump-out, Infiltration Storage Trench, Rain Garden, Stormwater Tree Trench	Philadelphia Water Department	12.6	2020	TBD

Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partner(s)	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost
50089	455	Combined	TTF	Streets	In Construction	Stormwater Bump-out, Infiltration Storage Trench, Stormwater Planter	Philadelphia Water Department	2.3	2020	TBD
50089	459	Combined	TTF	Streets	In Construction	Infiltration Storage Trench, Stormwater Planter, Stormwater Tree Trench	Philadelphia Water Department	2.3	2020	TBD
50097	483	Combined	Delaware	Open Space	In Construction	Infiltration Storage Trench	Philadelphia Water Department	0.7	2020	TBD
40735	484	Combined	Delaware	Streets	In Construction	Stormwater Tree Trench	Philadelphia Water Department	0.4	2020	TBD
50084	487	Combined	Delaware	Open Space	In Construction	Infiltration Storage Trench, Rain Garden, Stormwater Tree Trench	Philadelphia Water Department	4.8	2020	TBD
40800	502	Combined	Cobbs-Darby, Schuylkill	Streets	In Construction	Pervious Pavement, Stormwater Tree Trench	Philadelphia Water Department	1.2	2020	TBD
40819	503	Combined	Delaware	Streets	In Construction	Pervious Pavement	Philadelphia Water Department	1.5	2020	TBD

Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partner(s)	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost
40798	518	Combined		Streets	In Construction	Infiltration Storage Trench, Pervious Pavement	Philadelphia Water Department	1.4	2020	TBD
40824	525	Combined	Schuylkill	Streets	In Construction	Stormwater Tree Trench	Philadelphia Water Department	1.4	2020	TBD
64056	564	Combined	Schuylkill	Open Space	In Construction	Rain Garden	Philadelphia Water Department	0.5	2020	TBD
50104	578	Combined	TTF	Open Space	In Construction	Infiltration Storage Trench, Rain Garden, Stormwater Tree Trench	Philadelphia Water Department	6.4	2020	TBD
50084	580	Combined	Delaware, TTF	Open Space	In Construction	Infiltration Storage Trench, Rain Garden	Philadelphia Water Department	4.8	2020	TBD
50089	586	Combined	TTF	Streets	In Construction	Infiltration Storage Trench, Stormwater Planter, Stormwater Tree Trench	Philadelphia Water Department	2.3	2020	TBD
50101	608	Combined	Schuylkill	Open Space	In Construction	Infiltration Storage Trench, Rain Garden	Philadelphia Water Department	9.4	2020	TBD

Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partner(s)	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost
50097	634	Combined	Delaware	Streets	In Construction	Stormwater Tree Trench	Philadelphia Water Department	0.7	2020	TBD
50097	636	Combined		Streets	In Construction	Infiltration Storage Trench	Philadelphia Water Department	0.7	2020	TBD
50097	637	Combined	Delaware	Streets	In Construction	Stormwater Tree Trench	Philadelphia Water Department	0.7	2020	TBD
50097	638	Combined	Delaware	Streets	In Construction	Stormwater Tree Trench	Philadelphia Water Department	0.7	2020	TBD
40844	989	Combined	Schuylkill	Streets	In Construction	Infiltration Storage Trench	Philadelphia Water Department	1.2	2020	TBD
40829	990	Combined	Delaware	Streets	In Construction	Infiltration Storage Trench	Philadelphia Water Department	0.5	2020	TBD
50097	993	Combined	Delaware	Streets	In Construction	Stormwater Tree Trench	Philadelphia Water Department	0.7	2020	TBD
40888	1011	Combined	Schuylkill	Streets	In Construction	Infiltration Storage Trench, Stormwater Tree Trench	Pennsylvania Department of Transportation	2.9	2020	TBD

Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partner(s)	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost
50109	1023	Combined	Schuylkill	Streets	In Construction	Stormwater Tree	Philadelphia Water Department	0.1	2020	TBD
50103	1024	Combined	Cobbs-Darby	Streets	In Construction	Drainage Well	Philadelphia Water Department	0.3	2020	TBD
50103	1025	Combined	Delaware	Streets	In Construction	Drainage Well	Philadelphia Water Department	0.3	2020	TBD
50103	1029	Combined	Delaware	Streets	In Construction	Drainage Well	Philadelphia Water Department	0.3	2020	TBD
50101	1049	Combined	Cobbs-Darby, Schuylkill	Streets	In Construction	Stormwater Tree Trench	Philadelphia Water Department	9.4	2020	TBD
50104	1050	Combined	TTF	Streets	In Construction	Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	6.4	2020	TBD
40866	1065	Combined	Cobbs-Darby	Streets	In Construction	Infiltration Storage Trench	Philadelphia Water Department	0.4	2020	TBD
50119	1067	Combined	Delaware	Parking, Streets	In Construction	Infiltration Storage Trench, Stormwater Planter, Rain Garden	Philadelphia Water Department	2.7	2020	TBD

Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partner(s)	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost
50119	1068	Combined	Delaware	Streets	In Construction	Infiltration Storage Trench, Stormwater Planter	Philadelphia Water Department	2.7	2020	TBD
50122	1077	Combined	Delaware, TTF	Open Space, Vacant Land	In Construction	Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	2.1	2020	TBD
50122	1083	Combined	Delaware, TTF	Streets	In Construction	Stormwater Bump-out, Infiltration Storage Trench, Stormwater Planter, Swale, Stormwater Tree Trench	Philadelphia Water Department	2.1	2020	TBD
50123	1084	Combined	Delaware	Streets	In Construction	Infiltration Storage Trench, Rain Garden	Pennsylvania Department of Transportation	3.1	2020	TBD
50124	1085	Combined	Delaware	Open Space	In Construction	Infiltration Storage Trench	Philadelphia Water Department	15.2	2020	TBD
40858	1123	Combined		Streets	In Construction	Infiltration Storage Trench	Philadelphia Water Department	0.0	2020	TBD
50132	1137	Combined	Delaware	Streets, Open Space	In Construction	Stormwater Bump-out, Infiltration Storage Trench, Stormwater Planter, Rain	Philadelphia Water Department	12.9	2020	TBD

Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partner(s)	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost
						Garden, Swale, Stormwater Tree Trench				
50132	1138	Combined	Delaware	Streets	In Construction	Stormwater Bump-out, Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	12.9	2020	TBD
50134	1140	Combined	Schuylkill	Open Space	In Construction	Infiltration Storage Trench, Rain Garden, Stormwater Tree Trench	Philadelphia Water Department	6.2	2020	TBD
50135	1142	Combined	Schuylkill	Streets	In Construction	Stormwater Bump-out, Infiltration Storage Trench, Stormwater Planter	Philadelphia Housing Authority	3.0	2020	TBD
50138	1145	Combined	Schuylkill	Streets	In Construction	Stormwater Bump-out, Infiltration Storage Trench, Stormwater Tree Trench	Philadelphia Water Department	6.1	2020	TBD
50138	1146	Combined	Schuylkill	Open Space	In Construction	Stormwater Bump-out, Infiltration Storage Trench, Rain Garden	Philadelphia Water Department	6.1	2020	TBD
50146	1197	Combined	Schuylkill	Vacant Land	In Construction	Infiltration Storage Trench, Rain Garden	Philadelphia Water Department	0.5	2020	TBD

Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partner(s)	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost
50146	1198	Combined	Schuylkill	Streets	In Construction	Stormwater Basin, Stormwater Bump-out, Stormwater Planter, Swale	Philadelphia Water Department	0.5	2020	TBD
50149	1202	Combined, Separate	Delaware	Streets	In Construction	Infiltration Storage Trench, Stormwater Planter, Stormwater Tree Trench	Philadelphia Water Department	4.9	2020	TBD
50151	1204	Combined	Delaware	Streets	In Construction	Stormwater Bump-out, Infiltration Storage Trench	Center City District	0.3	2020	TBD
40906	1246	Combined	TTF	Streets	In Construction	Infiltration Storage Trench	Philadelphia Water Department	0.2	2020	TBD
40928	1275	Combined	TTF	Streets	In Construction	Stormwater Tree Trench	Pennsylvania Department of Transportation	4.4	2020	TBD
50175	1281	Combined	Delaware	Streets	In Construction	Stormwater Bump-out, Infiltration Storage Trench, Stormwater Planter, Rain Garden, Swale, Stormwater Tree Trench	Streets Department	50.8	2020	TBD

Work Number	Project ID	Sewer Type	Watershed	Program	Status	Estimated SMP Type(s)	Potential Partner(s)	Greened Acre (acre-inches)	Completion Date Estimate	Estimated Construction Cost
40945	1292	Combined	Schuylkill	Streets	In Construction	Infiltration Storage Trench	Private Developer	2.2	2020	TBD
50149	1379	Combined	Delaware	Open Space	In Construction	Infiltration Storage Trench, Rain Garden	Philadelphia Water Department	4.9	2020	TBD
40938	1423	Combined	Delaware	Streets	In Construction	Infiltration Storage Trench	Pennsylvania Department of Transportation	1.1	2020	TBD

Appendix 3

Complete Redevelopment and Incentivized Green Stormwater Infrastructure Projects

Table 1: Private Project Tracking Metrics and Reporting Format

Private Project Tracking Metrics						
Tracking Number	**Sewer Type**	**Category**	**Watershed**	**Zip Code**	**SMP Type (s)**	**Greened Acres (acre-inch)**

Table 2: Private/Incentives SMP Type Definitions

Private / Incentives SMP Type Definitions	
Basin	A surface basin or depression that is vegetated with mowed grass. It is designed to detain and release stormwater runoff and/or infiltrate where feasible.
Bioinfiltration / Bioretention	A bioinfiltration/bioretention basin is a vegetated basin or depression designed to either infiltrate or release stormwater runoff.
Blue Roof	A blue roof is a storage system designed into a roof surface such that the roof retains stormwater. Blue roofs are designed to reduce the rate of stormwater runoff.
Cistern	Cisterns are storage tanks, located either above or below ground, that captures and stores runoff and can thereby reduce runoff volume. Stored water may drain by gravity or be pumped to its ultimate end use for a variety of non-potable water needs.
Depaving	Depaving projects remove existing impervious pavement and restore the surface with grass, other types of vegetation, or loose materials (stone, mulch, etc.) such that the area can thereafter be considered pervious area. Depaving projects remove contributing impervious area from the sewer system. Categorized as a Disconnection and logged in square feet.
Green Roof	A green roof is a vegetated surface installed over a roof surface. Green roofs are effective in reducing the volume and rates of stormwater runoff.
Planters	At or above grade planter area and number of planters tracked as "Disconnection" practice. Do not contribute to water quality.
Porous Pavement	Porous pavement is a hard permeable surface commonly composed of concrete, asphalt or pavers. It is designed to detain and release stormwater runoff and/or infiltrate where feasible.
Total Rooftop Area Disconnected	Tracked as the square footage of roof runoff directed to a pervious area.
Total Pavement Disconnections	Tracked as the square footage of runoff from impervious surfaces directed to a pervious area.
Tree Credit	Tracked as either "existing" or "new" tree credits, where each tree is credited with 100 square feet of management per tree.

Table 3: Complete Private Development Green Stormwater Infrastructure

Tracking Number	Sewer Type	Category	Watershed Type	Zip	SMP Types	Greened Acres
2005-0052-01	Combined	Verified	Lower Schuylkill River	19139	Subsurface Infiltration	2.5
2005-0099-01	Combined	Verified	Lower Schuylkill River	19131	Surface Detention	37.4
2006-0017-01	Combined	Verified	Lower Schuylkill River	19142	Subsurface Infiltration, Porous Pavement	1.2
2006-0057-01	Combined	Verified	Delaware Direct	19123	Subsurface Detention	0.0
2006-0063-01	Combined	Verified	Delaware Direct	19122	Subsurface Infiltration	1.9
2006-0074-01	Combined	Verified	Lower Schuylkill River	19145	Subsurface Infiltration	0.7
2006-0084-01	Combined	Verified	Delaware Direct	19121	Subsurface Infiltration	2.5
2006-0110-01	Combined	Verified	Delaware Direct	19140	Subsurface Infiltration, Subsurface Detention	0.7
2006-129-01	Combined	Verified	Lower Schuylkill River	19104	Subsurface Detention, Green Roof	0.5
2006-132-01	Combined	Verified	Delaware Direct	19133	Subsurface Detention	0.2
2006-30TH-236-01	Combined	Verified	Lower Schuylkill River	19104	Surface Infiltration	0.6
2006-777L-326-01	Combined	Verified	Delaware Direct	19147	Subsurface Infiltration, Porous Pavement	2.0
2006-9349-349-01	Combined	Verified	Delaware Direct	19123	Subsurface Detention	0.1
2006-94-01	Combined	Verified	Delaware Direct	19148	Subsurface Detention	2.3
2006-96-01	Combined	Verified	Lower Schuylkill River	19140	Subsurface Detention	0.1
2006-ANGE-268-01	Combined	Verified	Lower Schuylkill River	19104	Subsurface Infiltration	0.8
2006-ANNE-209-01	Combined	Verified	Lower Schuylkill River	19104	Subsurface Detention	0.2
2006-BCRC-246-01	Combined	Verified	Delaware Direct	19134	Subsurface Infiltration	0.2
2006-BEAZ-250-01	Combined	Verified	Delaware Direct	19134	Subsurface Detention	1.6
2006-BOOT-310-01	Combined	Verified	Cobbs Creek	19139	Subsurface Infiltration, Subsurface Detention	0.7
2006-BRID-200-01	Combined	Verified	Delaware Direct	19137	Subsurface Infiltration, Disconnected Impervious Area	0.7

Tracking Number	Sewer Type	Category	Watershed Type	Zip	SMP Types	Greened Acres
2006-CCPO-276-01	Combined	Verified	Delaware Direct	19122	Surface Infiltration, Surface Detention	4.5
2006-CINT-431-01	Combined	Verified	Lower Schuylkill River	19131	Surface Detention	9.5
2006-COMM-328-01	Combined	Verified	Cobbs Creek	19139	Subsurface Detention, Cistern, Porous Pavement	0.9
2006-EDWI-215-01	Combined	Verified	Delaware Direct	19136	Subsurface Detention, Disconnected Impervious Area	0.8
2006-FAIR-175-01	Combined	Verified	Delaware Direct	19123	Subsurface Infiltration	1.2
2006-FEDE-409-01	Combined	Verified	Delaware Direct	19106	Subsurface Detention, Green Roof, Disconnected Impervious Area	0.3
2006-FRON-290-01	Combined	Verified	Delaware Direct	19140	Subsurface Infiltration	0.5
2006-GENE-192-01	Combined	Verified	Delaware Direct	19123	Subsurface Detention, Disconnected Impervious Area	0.3
2006-HESS-267-01	Combined	Verified	Lower Schuylkill River	19146	Subsurface Detention	0.6
2006-HOPE-447-01	Combined	Verified	Delaware Direct	19122	Porous Pavement	0.5
2006-HUNT-445-01	Combined	Verified	Delaware Direct	19133	Subsurface Infiltration, Porous Pavement	1.4
2006-LAWT-291-01	Combined	Verified	Delaware Direct	19135	Subsurface Detention	1.2
2006-LE22-460-01	Combined	Verified	Delaware Direct	19123	Subsurface Infiltration, Porous Pavement	0.7
2006-MANT-306-01	Combined	Verified	Lower Schuylkill River	19104	Subsurface Infiltration, Porous Pavement	0.5
2006-MARS-381-01	Combined	Verified	Lower Schuylkill River		Subsurface Detention	0.1
2006-MARS-407-01	Combined	Verified	Lower Schuylkill River		Subsurface Detention	0.0
2006-MICH-419-01	Combined	Verified	Delaware Direct	19125	Subsurface Infiltration, Porous Pavement	0.4
2006-MOOR-320-01	Combined	Verified	Delaware Direct	19148	Surbsurface Infiltration, Subsurface Detention	0.3
2006-NATI-441-01	Combined	Verified	Delaware Direct	19106	Subsurface Detention	0.5
2006-NEWF-343-01	Combined	Verified	Pennypack Creek	19136	Subsurface Infiltration	2.5
2006-OVER-462-01	Combined	Verified	Lower Schuylkill River	19151	Subsurface Infiltration	1.8

Tracking Number	Sewer Type	Category	Watershed Type	Zip	SMP Types	Greened Acres
2006-PASQ-416-01	Combined	Verified	Tacony-Frankford Creek	19124	Subsurface Detention	0.3
2006-PENN-421-01	Combined	Verified	Lower Schuylkill River	19107	Subsurface Detention	2.3
2006-PHIL-205-01	Combined	Verified	Delaware Direct	19123	Subsurface Detention, Porous Pavement	0.1
2006-PILG-444-01	Combined	Verified	Delaware Direct	19111	Subsurface Infiltration	1.1
2006-PIZZ-242-01	Combined	Verified	Tacony-Frankford Creek	19138	Subsurface Infiltration, Disconnected Impervious Area	0.2
2006-PREF-176-01	Combined	Verified	Delaware Direct	19148	Subsurface Detention	1.6
2006-PROG-400-01	Combined	Verified	Delaware Direct	19122	Subsurface Infiltration	3.7
2006-PROP-233-01	Combined	Verified	Lower Schuylkill River	19146	Subsurface Infiltration	1.0
2006-REBA-275-01	Combined	Verified	Lower Schuylkill River	19143	Subsurface Infiltration	2.1
2006-SAFE-234-01	Combined	Verified	Delaware Direct	19134	Subsurface Detention, Bioretention	0.6
2006-SOLI-300-01	Combined	Verified	Delaware Direct	19149	Subsurface Infiltration, Bioretention	2.0
2006-STHE-171-01	Combined	Verified	Lower Schuylkill River	19130	Subsurface Infiltration	0.4
2006-STJO-273-01	Combined	Verified	Lower Schuylkill River	19131	Subsurface Infiltration, Porous Pavement	1.1
2006-TACO-337-01	Combined	Verified	Delaware Direct	19149	Subsurface Infiltration	0.2
2006-TEMP-197-01	Combined	Verified	Tacony-Frankford Creek	19138	Subsurface Detention, Porous Pavement	0.2
2006-TEMP-210-01	Combined	Verified	Delaware Direct	19122	Subsurface Detention, Porous Pavement	0.6
2006-TEMP-245-01	Combined	Verified	Delaware Direct	19122	Subsurface Infiltration	1.1
2006-UNIO-235-01	Combined	Verified	Lower Schuylkill River	19104	Surface Infiltration, Subsurface Detention, Porous Pavement, Disconnected Impervious Area	1.1
2006-VAUX-338-01	Combined	Verified	Lower Schuylkill River	19121	Subsurface Detention	1.3
2006-WALN-251-01	Combined	Verified	Lower Schuylkill River	19104	Subsurface Detention, Green Roof, Porous Pavement, Disconnected Impervious Area	0.7

Tracking Number	Sewer Type	Category	Watershed Type	Zip	SMP Types	Greened Acres
2007-1615-544-01	Combined	Verified	Lower Schuylkill River	19121	Subsurface Infiltration, Porous Pavement	0.6
2007-4839-625-01	Combined	Verified	Lower Schuylkill River	19131	Subsurface Detention	1.0
2007-AROU-626-01	Combined	Verified	Tacony-Frankford Creek	19144	Subsurface Infiltration	0.5
2007-CECI-556-01	Combined	Verified	Delaware Direct	19121	Subsurface Detention	1.1
2007-CECI-561-01	Combined	Verified	Delaware Direct	19121	Subsurface Infiltration, Subsurface Detention	0.8
2007-DREX-669-01	Combined	Verified	Lower Schuylkill River	19104	Cistern, Porous Pavement, Disconnected Impervious Area	0.8
2007-EYEI-616-01	Combined	Verified	Tacony-Frankford Creek	19141	Subsurface Detention	0.4
2007-GAMB-624-01	Combined	Verified	Tacony-Frankford Creek	19124	Porous Pavement	0.1
2007-GAMB-701-01	Combined	Verified	Tacony-Frankford Creek	19124	Bioinfiltration, Porous Pavement	1.5
2007-GERM-647-01	Combined	Verified	Tacony-Frankford Creek	19144	Subsurface Detention, Bioinfiltration, Bioretention, Cistern, Green Roof, Disconnected Impervious Area	0.8
2007-GUIO-721-01	Combined	Verified	Lower Schuylkill River	19131	Subsurface Detention, Porous Pavement, Disconnected Impervious Area	1.4
2007-HACE-731-01	Combined	Verified	Delaware Direct	19140	Subsurface Infiltration, Disconnected Impervious Area	0.5
2007-HERR-690-01	Combined	Verified	Delaware Direct	19147	Porous Pavement, Disconnected Impervious Area	0.6
2007-HOWI-498-01	Combined	Verified	Delaware Direct	19123	Subsurface Detention, Disconnected Impervious Area	0.3
2007-LASA-593-01	Combined	Verified	Tacony-Frankford Creek	19144	Subsurface Infiltration, Porous Pavement, Disconnected Impervious Area	10.6
2007-MCDO-558-01	Combined	Verified	Delaware Direct	19133	Subsurface Detention	0.5
2007-MCDO-560-01	Combined	Verified	Delaware Direct	19135	Subsurface Detention	0.1
2007-MTTA-480-01	Combined	Verified	Delaware Direct	19123	Green Roof, Porous Pavement	0.3

Tracking Number	Sewer Type	Category	Watershed Type	Zip	SMP Types	Greened Acres
2007-PASH-524-01	Combined	Verified	Cobbs Creek	19142	Subsurface Infiltration	0.8
2007-POWE-679-01	Combined	Verified	Lower Schuylkill River	19104	Disconnected Impervious Area	0.4
2007-PRAD-489-01	Combined	Verified	Delaware Direct	19122	Subsurface Infiltration	1.5
2007-SAIN-553-01	Combined	Verified	Lower Schuylkill River	19131	Porous Pavement, Disconnected Impervious Area	3.6
2007-SIMO-496-01	Combined	Verified	Tacony-Frankford Creek	19138	Bioinfiltration, Porous Pavement	0.5
2007-SOUT-557-01	Combined	Verified	Delaware Direct	19148	Subsurface Detention	0.1
2007-THEC-538-01	Combined	Verified	Cobbs Creek	19143	Green Roof, Porous Pavement	0.6
2007-THEL-606-01	Combined	Verified	Tacony-Frankford Creek	19119	Subsurface Detention	0.5
2007-THEM-495-01	Combined	Verified	Lower Schuylkill River	19131	Surface Detention, Subsurface Detention	6.4
2007-UNIV-633-01	Combined	Verified	Lower Schuylkill River	19104	Subsurface Infiltration, Bioinfiltration, Disconnected Impervious Area	0.4
2007-WARN-646-01	Combined	Verified	Delaware Direct	19133	Subsurface Infiltration	2.1
2007-WARN-651-01	Combined	Verified	Delaware Direct	19133	Subsurface Infiltration	2.7
2007-WASH-642-01	Combined	Verified	Delaware Direct	19146	Subsurface Infiltration	1.0
2007-WEST-684-01	Combined	Verified	Cobbs Creek	19139	Subsurface Detention	0.0
2007-WILL-699-01	Combined	Verified	Delaware Direct	19134	Subsurface Detention, Bioretention	5.0
2008-1600-898-01	Combined	Verified	Delaware Direct	19122	Bioretention	0.5
2008-20UN-767-01	Combined	Verified	Lower Schuylkill River	19104	Green Roof, Porous Pavement	0.4
2008-2116-992-01	Combined	Verified	Lower Schuylkill River	19103	Surface Detention, Bioretention, Green Roof, Disconnected Impervious Area	0.5
2008-2552-873-01	Combined	Verified	Delaware Direct	19134	Subsurface Infiltration	0.7
2008-4014-979-01	Combined	Verified	Delaware Direct	19123	Subsurface Infiltration, Disconnected Impervious Area	0.5

Tracking Number	Sewer Type	Category	Watershed Type	Zip	SMP Types	Greened Acres
2008-BARN-986-01	Combined	Verified	Lower Schuylkill River	19130	Subsurface Infiltration, Green Roof, Disconnected Impervious Area	3.5
2008-CAST-875-01	Combined	Verified	Delaware Direct	19149	Subsurface Detention	0.0
2008-CLAS-765-01	Combined	Verified	Lower Schuylkill River	19104	Subsurface Infiltration, Porous Pavement, Disconnected Impervious Area	0.3
2008-COMM-763-01	Combined	Verified	Lower Schuylkill River	19130	Subsurface Infiltration, Green Roof, Porous Pavement, Disconnected Impervious Area	2.3
2008-DREX-788-01	Combined	Verified	Lower Schuylkill River	19104	Subsurface Infiltration, Bioinfiltration, Porous Pavement	1.5
2008-DREX-950-01	Combined	Verified	Lower Schuylkill River	19104	Subsurface Detention, Green Roof, Disconnected Impervious Area	0.2
2008-FRAN-921-01	Combined	Verified	Lower Schuylkill River	19104	Porous Pavement	0.3
2008-FRAN-994-01	Combined	Verified	Delaware Direct	19130	Subsurface Infiltration, Porous Pavement	0.7
2008-MART-980-01	Combined	Verified	Delaware Direct	19147	Subsurface Infiltration	0.6
2008-NAVA-893-01	Combined	Verified	Lower Schuylkill River	19146	Subsurface Infiltration	5.7
2008-NEWK-958-01	Combined	Verified	Delaware Direct	19122	Subsurface Detention, Bioinfiltration, Green Roof, Porous Pavement	5.2
2008-NEWL-778-01	Combined	Verified	Delaware Direct	19140	Subsurface Infiltration	0.5
2008-NEWL-839-01	Combined	Verified	Delaware Direct	19140	Subsurface Infiltration	0.5
2008-NORT-1012-01	Combined	Verified	Lower Schuylkill River	19104	Subsurface Infiltration, Disconnected Impervious Area	0.4
2008-PROP-824-01	Combined	Verified	Lower Schuylkill River	19139	Subsurface Infiltration, Porous Pavement, Disconnected Impervious Area	5.4
2008-ROLA-813-01	Combined	Verified	Tacony-Frankford Creek	19141	Subsurface Infiltration, Green Roof	0.2
2008-ROTE-960-01	Combined	Verified	Delaware Direct	19148	Subsurface Detention, Bioretention, Porous Pavement	1.6

Tracking Number	Sewer Type	Category	Watershed Type	Zip	SMP Types	Greened Acres
2008-SCHM-902-01	Combined	Verified	Delaware Direct	19123	Subsurface Infiltration, Green Roof, Porous Pavement, Disconnected Impervious Area	4.4
2008-SHER-926-01	Combined	Verified	Delaware Direct	19122	Green Roof, Porous Pavement	0.2
2008-STRA-799-01	Combined	Verified	Lower Schuylkill River	19121	Subsurface Infiltration, Porous Pavement	0.4
2008-STRA-802-01	Combined	Verified	Lower Schuylkill River	19121	Subsurface Infiltration, Porous Pavement	0.3
2008-THEC-806-01	Combined	Verified	Delaware Direct	19103	Subsurface Detention, Green Roof	0.2
2008-WALG-838-01	Combined	Verified	Delaware Direct	19146	Subsurface Detention, Bioretention	0.5
2008-WOOD-864-01	Combined	Verified	Lower Schuylkill River	19104	Porous Pavement	0.5
2009-GLOB-1016-01	Combined	Verified	Lower Schuylkill River	19131	Subsurface Detention, Bioretention	1.8
2009-PENN-1019-01	Combined	Verified	Lower Schuylkill River	19104	Subsurface Detention, Bioretention	3.9
2009-IATS-1023-01	Combined	Verified	Delaware Direct	19148	Subsurface Detention, Green Roof	0.8
2009-PRES-1037-01	Combined	Verified	Tacony-Frankford Creek	19150	Subsurface Infiltration, Bioretention, Porous Pavement	1.9
2009-DORA-1041-01	Combined	Verified	Lower Schuylkill River	19131	Subsurface Infiltration, Porous Pavement	0.4
2009-STRA-1050-01	Combined	Verified	Lower Schuylkill River	19121	Subsurface Infiltration	0.2
2009-STRA-1055-01	Combined	Verified	Lower Schuylkill River	19121	Subsurface Infiltration	0.3
2009-MANT-1033-01	Combined	Verified	Lower Schuylkill River	19104	Subsurface Infiltration	3.6
2009-LAWR-1044-01	Combined	Verified	Delaware Direct	19140	Subsurface Infiltration, Porous Pavement	3.0
2009-SIST-1062-01	Combined	Verified	Lower Schuylkill River	19103	Disconnected Impervious Area	0.2
2009-NEWH-1079-01	Combined	Verified	Lower Schuylkill River	19139	Subsurface Infiltration, Disconnected Impervious Area	0.3
2009-TEMP-1077-01	Combined	Verified	Delaware Direct	19122	Subsurface Detention, Bioretention, Porous Pavement	0.9
2009-TDBA-1072-01	Combined	Verified	Delaware Direct	19149	Subsurface Infiltration, Bioinfiltration, Disconnected Impervious Area	1.1

Tracking Number	Sewer Type	Category	Watershed Type	Zip	SMP Types	Greened Acres
2009-2007-1090-01	Combined	Verified	Delaware Direct	19148	Subsurface Detention	17.7
2009-PHIL-1101-01	Combined	Verified	Lower Schuylkill River	19102	Subsurface Detention, Bioretention	0.3
2009-TEMP-1096-01	Combined	Verified	Delaware Direct	19122	Porous Pavement	1.5
2009-FRAN-1130-01	Combined	Verified	Delaware Direct	19137	Subsurface Infiltration, Disconnected Impervious Area	4.1
2009-PECO-1133-01	Combined	Verified	Lower Schuylkill River	19146	Subsurface Infiltration	2.8
2009-SIST-1131-01	Combined	Verified	Lower Schuylkill River	19103	Subsurface Infiltration, Green Roof, Disconnected Impervious Area	0.4
2009-HELP-1138-01	Combined	Verified	Lower Schuylkill River	19153	Subsurface Infiltration	3.7
2009-NICE-1136-01	Combined	Verified	Tacony-Frankford Creek	19140	Subsurface Detention, Bioretention	0.4
2009-JANN-1141-01	Combined	Verified	Lower Schuylkill River	19104	Green Roof, Porous Pavement, Disconnected Impervious Area	0.3
2009-PRIN-1147-01	Combined	Verified	Lower Schuylkill River	19121	Subsurface Infiltration, Green Roof	0.5
2009-CANC-1145-01	Combined	Verified	Tacony-Frankford Creek	19124	Surface Detention, Bioretention	6.1
2009-HAWT-1102-01	Combined	Verified	Delaware Direct	19147	Porous Pavement, Disconnected Impervious Area	0.3
2009-SCHU-1140-01	Combined	Verified	Lower Schuylkill River	19103	Disconnected Impervious Area	0.7
2009-THEM-1167-01	Combined	Verified	Delaware Direct	19121	Green Roof, Porous Pavement	0.4
2009-NEWP-1166-01	Combined	Verified	Delaware Direct	19140	Subsurface Infiltration, Disconnected Impervious Area	0.7
2009-WOLC-1169-01	Combined	Verified	Tacony-Frankford Creek	19138	Subsurface Detention, Bioinfiltration	1.7
2009-PENN-1144-01	Combined	Verified	Lower Schuylkill River	19104	Subsurface Detention, Green Roof, Porous Pavement, Disconnected Impervious Area	0.4
2009-RODI-1176-01	Combined	Verified	Lower Schuylkill River	19130	Subsurface Infiltration	0.2
2009-THEC-1174-01	Combined	Verified	Delaware Direct	19135	Bioretention, Green Roof, Disconnected Impervious Area	0.6

Tracking Number	Sewer Type	Category	Watershed Type	Zip	SMP Types	Greened Acres
2009-THEP-1173-01	Combined	Verified	Lower Schuylkill River	19140	Green Roof	0.1
2009-WALM-1045-01	MS4	Verified	Delaware Direct	19148	Direct Discharge	8.0
2009-7149-1186-01	Combined	Verified	Delaware Direct	19135	Subsurface Infiltration, Disconnected Impervious Area	0.4
2009-PARK-1197-01	Combined	Verified	Lower Schuylkill River	19104	Bioinfiltration, Disconnected Impervious Area	0.1
2009-PHIL-1205-01	Combined	Verified	Delaware Direct	19148	Porous Pavement	14.6
2009-WEST-1222-01	Combined	Verified	Lower Schuylkill River	19139	Green Roof, Porous Pavement, Disconnected Impervious Area	1.4
2009-CONG-1210-01	Combined	Verified	Delaware Direct	19133	Subsurface Infiltration, Porous Pavement	2.8
2009-PASC-1226-01	Combined	Verified	Cobbs Creek	19142	Subsurface Infiltration, Porous Pavement	3.3
2010-BRID-1233-01	Combined	Verified	Delaware Direct	19137	Subsurface Infiltration, Porous Pavement	1.1
2010-PSDC-1234-01	Combined	Verified	Delaware Direct	19147	Subsurface Infiltration	1.1
2010-PASC-1238-01	Combined	Verified	Cobbs Creek	19142	Subsurface Infiltration, Porous Pavement, Disconnected Impervious Area	2.2
2010-STJO-1239-01	Combined	Verified	Lower Schuylkill River	19131	Subsurface Infiltration, Bioinfiltration, Green Roof	1.0
2010-THEF-1254-01	Combined	Verified	Lower Schuylkill River	19103	Subsurface Detention, Bioretention, Disconnected Impervious Area	0.4
2010-ESPE-1288-01	Combined	Verified	Tacony-Frankford Creek	19140	Subsurface Infiltration	1.1
2010-1800-1260-01	Combined	Verified	Lower Schuylkill River	19146	Subsurface Infiltration, Disconnected Impervious Area	0.8
2010-4109-1277-01	Combined	Verified	Lower Schuylkill River	19104	Green Roof, Porous Pavement	0.2
2010-MOYE-1306-01	Combined	Verified	Delaware Direct	19125	Green Roof, Porous Pavement	0.6
2010-411W-1300-01	Combined	Verified	Delaware Direct	19122	Subsurface Detention, Bioretention	0.2
2010-UNIV-1312-01	Combined	Verified	Lower Schuylkill River	19104	Subsurface Detention, Green Roof	0.7

Tracking Number	Sewer Type	Category	Watershed Type	Zip	SMP Types	Greened Acres
2010-TEMP-1302-01	Combined	Verified	Delaware Direct	19122	Subsurface Infiltration, Cistern, Disconnected Impervious Area	2.9
2010-8828-1321-01	Combined	Verified	Pennypack Creek	19136	Subsurface Infiltration	1.2
2010-3737-1331-01	Combined	Verified	Lower Schuylkill River	19104	Subsurface Detention, Green Roof	0.3
2010-WATE-1343-01	Combined	Verified	Delaware Direct	19123	Disconnected Impervious Area	0.1
2010-BROA-1347-01	Combined	Verified	Tacony-Frankford Creek	19141	Subsurface Infiltration	0.9
2010-PSPH-1353-01	Combined	Verified	Lower Schuylkill River	19131	Subsurface Infiltration, Green Roof	8.4
2010-PNKW-1360-01	Combined	Verified	Tacony-Frankford Creek	19140	Subsurface Infiltration, Porous Pavement	2.3
2010-HUNT-1351-01	Combined	Verified	Tacony-Frankford Creek	19140-2107	Disconnected Impervious Area	0.1
2010-PHIL-1362-01	Combined	Verified	Delaware Direct	19148	Surface Detention, Bioretention	0.9
2010-CHOP-1367-01	Combined	Verified	Lower Schuylkill River	19104	Surface Detention, Green Roof, Disconnected Impervious Area	2.6
2010-GEST-1346-01	Combined	Verified	Lower Schuylkill River	19131	Subsurface Detention	1.1
2010-PROP-1376-01	Combined	Verified	Delaware Direct	19141	Subsurface Infiltration, Bioinfiltration	2.4
2010-ARCH-1393-01	Combined	Verified	Delaware Direct	19122	Green Roof	0.2
2010-WIST-1397-01	Combined	Verified	Lower Schuylkill River	19104	Subsurface Detention, Green Roof	0.4
2010-DREX-1399-01	Combined	Verified	Lower Schuylkill River	19104	Subsurface Detention, Green Roof	1.5
2010-DICK-1410-01	Combined	Verified	Delaware Direct	19148	Porous Pavement, Disconnected Impervious Area	0.7
2010-1940-1435-01	Combined	Verified	Delaware Direct	19140	Subsurface Infiltration, Porous Pavement	0.6
2010-5526-1348-01	Combined	Verified	Darby Creek	19139	Subsurface Infiltration, Porous Pavement	0.5
2010-CREA-1427-01	Combined	Verified	Delaware Direct	19125	Green Roof, Porous Pavement	0.3
2010-NORT-1449-01	Combined	Verified	Tacony-Frankford Creek	19124-3024	Subsurface Infiltration	0.9
2010-EARL-1460-01	Combined	Verified	Lower Schuylkill River	19146	Subsurface Infiltration, Disconnected Impervious Area	0.5

Tracking Number	Sewer Type	Category	Watershed Type	Zip	SMP Types	Greened Acres
2010-PLEA-1444-01	Combined	Verified	Tacony-Frankford Creek	19119	Subsurface Detention, Green Roof, Disconnected Impervious Area	0.2
2010-PHIL-1469-01	Combined	Verified	Delaware Direct	19148	Subsurface Detention, Bioretention, Disconnected Impervious Area	3.4
2010-NORR-1475-01	Combined	Verified	Delaware Direct	19122	Subsurface Infiltration, Disconnected Impervious Area	2.1
2010-4FRA-1464-01	Combined	Verified	Lower Schuylkill River	19103	Subsurface Detention, Green Roof	0.9
2010-AGIL-1461-01	Combined	Verified	Delaware Direct	19121	Subsurface Infiltration, Disconnected Impervious Area	1.4
2010-UNIV-1385-01	Combined	Verified	Lower Schuylkill River	19104	Subsurface Detention, Bioretention, Disconnected Impervious Area	1.4
2011-PROP-1483-01	Combined	Verified	Tacony-Frankford Creek	19144	Surface Infiltration, Porous Pavement	1.6
2011-CANC-1485-01	Combined	Verified	Tacony-Frankford Creek	19124	Green Roof	0.2
2011-LOCU-1503-01	Combined	Verified	Lower Schuylkill River	19104	Disconnected Impervious Area	0.2
2011-CONV-1491-01	Combined	Verified	Lower Schuylkill River	19107	Subsurface Detention, Green Roof	0.3
2011-STMA-1508-01	Combined	Verified	Delaware Direct	19147	Subsurface Infiltration, Subsurface Detention, Green Roof, Porous Pavement	0.5
2011-KARA-1505-01	Combined	Verified	Lower Schuylkill River	19139	Subsurface Infiltration, Porous Pavement, Disconnected Impervious Area	4.0
2011-HAMI-1518-01	Combined	Verified	Lower Schuylkill River	19104	Subsurface Infiltration, Cistern, Green Roof, Disconnected Impervious Area	1.9
2011-FAIR-1488-01	Combined	Verified	Delaware Direct	19130	Subsurface Detention, Green Roof	0.4
2011-MONT-1516-01	Combined	Verified	Delaware Direct	19122	Subsurface Infiltration	2.8
2011-CHRI-1545-01	Combined	Verified	Delaware Direct	19147	Subsurface Infiltration, Green Roof, Porous Pavement	1.0
2010-GRAN-1432-01	Combined	Verified	Lower Schuylkill River	19130	Subsurface Detention, Green Roof	0.6

Tracking Number	Sewer Type	Category	Watershed Type	Zip	SMP Types	Greened Acres
2011-4240-1543-01	Combined	Verified	Lower Schuylkill River	19104	Subsurface Infiltration	0.7
2011-CCTD-1535-01	Combined	Verified	Lower Schuylkill River	19139	Subsurface Infiltration	1.0
2011-HAGE-1562-01	Combined	Verified	Delaware Direct	19125	Subsurface Infiltration, Porous Pavement	1.5
2011-SAMU-1569-01	Combined	Verified	Delaware Direct	19111	Porous Pavement	0.4
2011-HOME-1571-01	Combined	Verified	Delaware Direct	19107	Subsurface Detention, Bioretention, Green Roof	0.2
2011-TOLL-1586-01	Combined	Verified	Lower Schuylkill River	19146	Subsurface Infiltration, Green Roof, Disconnected Impervious Area	2.4
2011-THEB-1594-01	Combined	Verified	Tacony-Frankford Creek	19124	Surbsurface Infiltration, Subsurface Detention, Bioretention, Disconnected Impervious Area	0.8
2011-DIAM-1617-01	Combined	Verified	Delaware Direct	19140	Subsurface Detention, Green Roof	0.4
2011-NEWN-1620-01	Combined	Verified	Delaware Direct	19123	Subsurface Infiltration, Green Roof, Porous Pavement	0.9
2011-DOLL-1636-01	Combined	Verified	Tacony-Frankford Creek	19144	Subsurface Infiltration	0.3
2011-TEMP-1622-01	Combined	Verified	Delaware Direct	19122	Subsurface Infiltration, Green Roof, Blue Roof, Porous Pavement	1.9
2011-DREX-1638-01	Combined	Verified	Lower Schuylkill River	19104	Bioretention, Green Roof, Disconnected Impervious Area	0.8
2011-3343-1653-01	Combined	Verified	Tacony-Frankford Creek	19144	Subsurface Infiltration, Porous Pavement	0.7
2011-8318-1655-01	Combined	Verified	Lower Schuylkill River	19121	Green Roof, Porous Pavement	0.2
2011-BOTT-1646-01	Combined	Verified	Tacony-Frankford Creek	19124	Subsurface Detention, Bioretention	2.7
2011-PHIL-1596-01	Combined	Verified	Lower Schuylkill River	19104	Surface Infiltration, Bioretention, Porous Pavement, Disconnected Impervious Area	3.2
2011-PROP-1662-01	Combined	Verified	Lower Schuylkill River	19130	Surface Infiltration, Subsurface Infiltration	3.7
2011-JWSD-1674-01	Combined	Verified	Delaware Direct	19122	Subsurface Infiltration, Disconnected Impervious Area	1.8
2011-33RD-1697-01	Combined	Verified	Lower Schuylkill River	19132	Bioretention, Green Roof	0.1

Tracking Number	Sewer Type	Category	Watershed Type	Zip	SMP Types	Greened Acres
2011-I95S-1699-01	Combined	Verified	Delaware Direct	19125	Surface Detention, Bioinfiltration, Bioretention	4.7
2011-GREE-1706-01	Combined	Verified	Tacony-Frankford Creek	19138	Surface Infiltration, Subsurface Detention, Porous Pavement	1.9
2011-PENN-1664-01	Combined	Verified	Lower Schuylkill River	19104	Porous Pavement	0.2
2011-TEMP-1739-01	Combined	Verified	Delaware Direct	19122	Subsurface Infiltration, Subsurface Detention, Bioretention, Cistern, Porous Pavement	2.1
2011-NICE-1728-01	Combined	Verified	Tacony-Frankford Creek	19140	Subsurface Infiltration, Porous Pavement	0.3
2011-NICE-1729-01	Combined	Verified	Tacony-Frankford Creek	19140	Subsurface Detention, Porous Pavement	0.5
2011-NICE-1730-01	Combined	Verified	Tacony-Frankford Creek	19140	Subsurface Infiltration, Porous Pavement	1.1
2012-1900-1754-01	Combined	Verified	Lower Schuylkill River	19145	Green Roof, Porous Pavement	0.6
2012-CARP-1765-01	Combined	Verified	Delaware Direct	19146	Bioretention, Green Roof, Porous Pavement	0.4
2012-SOUT-1782-01	Combined	Verified	Delaware Direct	19102	Subsurface Detention, Green Roof	0.8
2012-CENT-1791-01	Combined	Verified	Delaware Direct	19122	Porous Pavement	1.3
2012-BUIL-1807-01	Combined	Verified	Tacony-Frankford Creek	19111	Disconnected Impervious Area	0.1
2012-CANC-1770-01	Combined	Verified	Tacony-Frankford Creek	19124	Bioinfiltration, Green Roof	0.6
2012-SPRU-1813-01	Combined	Verified	Delaware Direct	19107	Subsurface Detention, Green Roof, Disconnected Impervious Area	0.1
2012-1426-1805-01	Combined	Verified	Lower Schuylkill River	19102	Green Roof, Blue Roof	0.3
2012-RODE-1835-01	Combined	Verified	Delaware Direct	19130	Subsurface Infiltration	0.7
2012-2549-1840-01	Combined	Verified	Delaware Direct	19125	Porous Pavement	1.0
2012-INGE-1798-01	Combined	Verified	Delaware Direct	19121	Subsurface Infiltration, Disconnected Impervious Area	0.9
2012-412N-1844-01	Combined	Verified	Delaware Direct	19123	Subsurface Infiltration, Green Roof, Porous Pavement	1.2

Tracking Number	Sewer Type	Category	Watershed Type	Zip	SMP Types	Greened Acres
2012-SPAR-1850-01	Combined	Verified	Delaware Direct	19148	Bioinfiltration, Porous Pavement, Disconnected Impervious Area	0.7
2012-HUNT-1764-01	Combined	Verified	Tacony-Frankford Creek	19140-2107	Porous Pavement, Disconnected Impervious Area	1.8
2012-915N-1854-01	Combined	Verified	Delaware Direct	19123	Subsurface Infiltration, Porous Pavement	0.8
2012-UNIV-1848-01	Combined	Verified	Lower Schuylkill River	19104	Subsurface Detention, Bioinfiltration, Green Roof, Porous Pavement, Disconnected Impervious Area	1.6
2012-PROP-1883-01	Combined	Verified	Tacony-Frankford Creek	19138	Subsurface Infiltration	1.0
2012-WISS-1891-01	Combined	Verified	Tacony-Frankford Creek	19138	Bioretention, Disconnected Impervious Area	1.3
2012-EPIS-1888-01	Combined	Verified	Lower Schuylkill River	19104	Subsurface Detention, Green Roof	0.2
2012-TOLL-1898-01	Combined	Verified	Delaware Direct	19147	Green Roof, Disconnected Impervious Area	1.2
2012-1220-1913-01	Combined	Verified	Delaware Direct	19123	Green Roof, Porous Pavement	0.4
2012-THEM-1892-01	Combined	Verified	Delaware Direct	19106	Cistern, Green Roof, WQ Treatment Device, Disconnected Impervious Area	0.2
2012-SENI-1900-01	Combined	Verified	Lower Schuylkill River	19145	Subsurface Detention, Bioretention, Disconnected Impervious Area	0.4
2012-PENN-1774-01	Combined	Verified	Lower Schuylkill River	19104	Subsurface Detention, Bioinfiltration	0.9
2012-1919-1929-01	Combined	Verified	Lower Schuylkill River	19103	Subsurface Detention, Green Roof, Disconnected Impervious Area	1.2
2012-1213-1925-01	Combined	Verified	Delaware Direct	19107	Subsurface Detention, Cistern, Green Roof	0.3
2012-SYSC-1931-01	Combined	Verified	Delaware Direct	19148	Bioretention	3.9
2012-ESPE-1947-01	Combined	Verified	Tacony-Frankford Creek	19140	Subsurface Detention, Porous Pavement, Disconnected Impervious Area	3.7
2012-INGL-1949-01	Combined	Verified	Lower Schuylkill River	19131	Subsurface Infiltration, Bioretention, Porous Pavement, Disconnected Impervious Area	2.6

Tracking Number	Sewer Type	Category	Watershed Type	Zip	SMP Types	Greened Acres
2012-810A-1974-01	Combined	Verified	Delaware Direct	19107	Subsurface Detention, Bioretention	0.2
2011-NORT-1700-01	Combined	Verified	Tacony-Frankford Creek	19124	Subsurface Detention, Porous Pavement	0.9
2012-STFR-1986-01	Combined	Verified	Delaware Direct	19125	Subsurface Detention, Bioretention, Disconnected Impervious Area	0.3
2012-LINC-2012-01	Combined	Verified	Delaware Direct	19148	Bioinfiltration, Porous Pavement	1.8
2012-TDBA-2047-01	Combined	Verified	Delaware Direct	19149	Subsurface Infiltration, Bioinfiltration, Disconnected Impervious Area	0.8
2012-3601-2053-01	Combined	Verified	Lower Schuylkill River	19104	Subsurface Detention, Bioretention	0.4
2012-RIVE-2027-01	Combined	Verified	Lower Schuylkill River	19104	Porous Pavement, Disconnected Impervious Area	3.3
2012-SCHU-2065-01	Combined	Verified	Lower Schuylkill River	19146	Subsurface Detention, Bioretention, Disconnected Impervious Area	4.1
2013-2012-2072-01	Combined	Verified	Lower Schuylkill River	19121	Green Roof, Porous Pavement	0.2
2013-9THS-2075-01	Combined	Verified	Delaware Direct	19123	Subsurface Infiltration	4.6
2013-DREX-2081-01	Combined	Verified	Lower Schuylkill River	19104	Surface Detention, Subsurface Detention	1.3
2013-SETT-2085-01	Combined	Verified	Tacony-Frankford Creek	19144	Subsurface Detention, Bioinfiltration, Porous Pavement, Disconnected Impervious Area	2.1
2013-COBB-2080-01	Combined	Verified	Cobbs Creek	19143	Subsurface Detention, Bioretention, Disconnected Impervious Area	0.8
2013-STCH-2103-01	Combined	Verified	Delaware Direct	19134	Bioinfiltration, Bioretention, Disconnected Impervious Area	4.6
2013-1901-2109-01	Combined	Verified	Lower Schuylkill River	19146	Subsurface Infiltration, Green Roof, Porous Pavement	0.6
2013-8268-2116-01	Combined	Verified	Delaware Direct	19123	Subsurface Infiltration	0.4
2012-GARY-1938-01	Combined	Verified	Lower Schuylkill River	19146	Subsurface Detention, Bioinfiltration, Bioretention, Disconnected Impervious Area	1.3
2013-HALP-2134-01	Combined	Verified	Lower Schuylkill River	19121	Subsurface Infiltration	1.6

Tracking Number	Sewer Type	Category	Watershed Type	Zip	SMP Types	Greened Acres
2013-NEUR-2140-01	Combined	Verified	Lower Schuylkill River	19104	Bioinfiltration, Bioretention, Green Roof, Porous Pavement, Disconnected Impervious Area	0.4
2013-STCH-2149-01	Combined	Verified	Delaware Direct	19134	Bioretention, Disconnected Impervious Area	3.8
2013-CECI-2157-01	Combined	Verified	Lower Schuylkill River	19121	Subsurface Infiltration, Green Roof, Disconnected Impervious Area	0.9
2013-900S-2174-01	Combined	Verified	Delaware Direct	19147	Subsurface Infiltration, Bioinfiltration, Porous Pavement, Disconnected Impervious Area	1.2
2013-THES-2177-01	Combined	Verified	Delaware Direct	19123	Subsurface Infiltration	1.2
2013-PROP-2163-01	Combined	Verified	Tacony-Frankford Creek	19141	Subsurface Infiltration	0.9
2013-RESI-2173-01	Combined	Verified	Cobbs Creek	19143	Green Roof, Disconnected Impervious Area	0.1
2013-TEMP-2178-01	Combined	Verified	Delaware Direct	19140	Subsurface Detention, Bioretention	1.1
2013-2413-2183-01	Combined	Verified	Delaware Direct	19132	Surbsurface Infiltration, Green Roof	0.8
2013-NEWC-2114-01	Combined	Verified	Lower Schuylkill River	19104	Bioinfiltration, Green Roof, Porous Pavement, Disconnected Impervious Area	1.3
2013-TACO-2197-01	Combined	Verified	Delaware Direct	19135	Subsurface Detention, Bioinfiltration, Disconnected Impervious Area	2.1
2013-FIRS-2202-01	Combined	Verified	Delaware Direct	19124	Bioinfiltration, Disconnected Impervious Area	4.9
2013-2300-2240-01	Combined	Verified	Lower Schuylkill River	19146	Subsurface Detention, Bioretention	0.9
2013-HELP-2241-01	Combined	Verified	Lower Schuylkill River	19153	Surface Infiltration	1.8
2013-1118-2248-01	Combined	Verified	Delaware Direct	19107	Surface Detention, Green Roof, Porous Pavement	0.8
2013-23RD-2272-01	Combined	Verified	Lower Schuylkill River	19140	Subsurface Infiltration, Disconnected Impervious Area	0.4
2013-1601-2261-01	Combined	Verified	Delaware Direct	19148	Subsurface Infiltration, Disconnected Impervious Area	0.9
2013-CHOP-2288-01	Combined	Verified	Delaware Direct	19145	Subsurface Detention, Bioretention, Porous Pavement	1.2

Tracking Number	Sewer Type	Category	Watershed Type	Zip	SMP Types	Greened Acres
2013-EDBE-2293-01	Combined	Verified	Delaware Direct	19122	Subsurface Infiltration	4.2
2013-TAJD-2286-01	Combined	Verified	Delaware Direct	19122	Surbsurface Infiltration, Subsurface Detention, Bioretention, Green Roof, Disconnected Impervious Area	1.3
2013-MAST-2259-01	Combined	Verified	Lower Schuylkill River	19121	Disconnected Impervious Area	0.6
2013-ONER-2304-01	Combined	Verified	Lower Schuylkill River	19103	Subsurface Detention, Green Roof	0.3
2013-708N-2316-01	Combined	Verified	Delaware Direct	19123	Surbsurface Infiltration, Bioinfiltration	0.3
2013-ALDI-2287-01	Combined	Verified	Darby Creek	19151	Bioretention	0.3
2013-4783-2339-01	Combined	Verified	Pennypack Creek	19136	Subsurface Detention, Porous Pavement	1.8
2013-MUSE-2346-01	Combined	Verified	Lower Schuylkill River	19130	Surbsurface Infiltration, Porous Pavement, Disconnected Impervious Area	3.6
2013-TALL-2349-01	Combined	Verified	Delaware Direct	19133	Surbsurface Infiltration, Bioinfiltration	2.9
2013-3541-2376-01	Combined	Verified	Delaware Direct	19147	Subsurface Infiltration, Disconnected Impervious Area	0.6
2013-CIRA-2405-01	Combined	Verified	Lower Schuylkill River	19104	Subsurface Detention, Green Roof, Disconnected Impervious Area	0.6
2014-LASA-2425-01	Combined	Verified	Tacony-Frankford Creek	19144	Surbsurface Infiltration, Bioinfiltration, Porous Pavement	2.2
2014-STJO-2424-01	Combined	Verified	Delaware Direct	19122	Subsurface Infiltration, Disconnected Impervious Area	5.6
2014-GSTR-2443-01	Combined	Verified	Tacony-Frankford Creek	19124	Subsurface Infiltration	1.1
2014-ALLE-2455-01	Combined	Verified	Delaware Direct	19125	Green Roof, Porous Pavement, Disconnected Impervious Area	0.4
2014-DOLL-2453-01	Combined	Verified	Delaware Direct	19135-4408	Subsurface Detention, Bioretention	1.5
2014-PHAO-2459-01	Combined	Verified	Lower Schuylkill River	19132	Subsurface Detention, Bioretention, Porous Pavement	0.4
2014-DREX-2457-01	Combined	Verified	Lower Schuylkill River	19104	Porous Pavement	2.6

Tracking Number	Sewer Type	Category	Watershed Type	Zip	SMP Types	Greened Acres
2014-1325-2469-01	Combined	Verified	Delaware Direct	19121	Subsurface Detention, Bioretention	0.8
2014-PERE-2472-01	Combined	Verified	Lower Schuylkill River	19104	Subsurface Detention, Disconnected Impervious Area	0.6
2014-PHAM-2476-01	Combined	Verified	Lower Schuylkill River	19121	Subsurface Detention, Bioretention	1.3
2014-5800-2463-01	Combined	Verified	Lower Schuylkill River	19131	Surface Infiltration, Disconnected Impervious Area	1.0
2014-63RD-2502-01	Combined	Verified	Cobbs Creek	19139	Surbsurface Infiltration	1.9
2014-4525-2505-01	Combined	Verified	Lower Schuylkill River	19139	Green Roof	0.3
2014-ALLE-2522-01	Combined	Verified	Delaware Direct	19133	Surbsurface Infiltration	0.7
2014-PHAG-2547-01	Combined	Verified	Lower Schuylkill River	19132	Subsurface Detention, Bioretention	0.3
2014-5454-2552-01	Combined	Verified	Tacony-Frankford Creek	19144	Subsurface Detention, Bioretention, Porous Pavement	0.9
2014-420F-2574-01	Combined	Verified	Delaware Direct	19123	Surbsurface Infiltration, Disconnected Impervious Area	0.7
2014-INDE-2590-01	Combined	Verified	Delaware Direct	19106	Disconnected Impervious Area	0.0
2014-TRUE-2595-01	Combined	Verified	Delaware Direct	19123	Surbsurface Infiltration	0.9
2014-SEPT-2614-01	Combined	Verified	Delaware Direct	19124	Green Roof, Disconnected Impervious Area	0.3
2014-WEST-2612-01	Combined	Verified	Lower Schuylkill River	19121	Subsurface Infiltration, Porous Pavement, Disconnected Impervious Area	1.9
2014-1350-2658-01	Combined	Verified	Delaware Direct	19122	Surbsurface Infiltration, Bioretention	0.9
2014-2201-2677-01	Combined	Verified	Lower Schuylkill River	19145	Surbsurface Infiltration, WQ Treatment Device	1.2
2014-ENVI-2646-01	Combined	Verified	Delaware Direct	19148-5607	Surface Infiltration, Subsurface Detention, Bioretention	2.0
2014-NORT-2603-01	Combined	Verified	Delaware Direct	19123	Subsurface Detention, Bioretention	0.5
2014-VERN-2690-01	Combined	Verified	Tacony-Frankford Creek	19144	Porous Pavement, Disconnected Impervious Area	0.6

Tracking Number	Sewer Type	Category	Watershed Type	Zip	SMP Types	Greened Acres
2014-2322-2715-01	Combined	Verified	Lower Schuylkill River	19130	Subsurface Infiltration, Porous Pavement	0.4
2014-BLUM-2711-01	Combined	Verified	Lower Schuylkill River	19121	Surbsurface Infiltration, Porous Pavement	1.8
2014-TEMP-2699-01	Combined	Verified	Delaware Direct	19121	Disconnected Impervious Area	0.4
2014-UNIV-2747-01	Combined	Verified	Lower Schuylkill River	19104	Porous Pavement	0.5
2014-2013-2751-01	Combined	Verified	Delaware Direct	19125	Subsurface Infiltration, Porous Pavement	0.4
2014-CHIC-2755-01	Combined	Verified	Tacony-Frankford Creek	19124	Subsurface Infiltration	0.5
2015-CAMD-2769-01	Combined	Verified	Delaware Direct	19134	Surface Infiltration	3.4
2015-WAYN-2771-01	Combined	Verified	Tacony-Frankford Creek	19144	Subsurface Infiltration, Porous Pavement, Disconnected Impervious Area	1.2
2014-PAND-2762-01	Combined	Verified	Delaware Direct	19134	Subsurface Infiltration	0.3
2015-4050-2828-01	Combined	Verified	Lower Schuylkill River	19104	Subsurface Detention, Bioretention, Disconnected Impervious Area	0.4
2015-TEMP-2829-01	Combined	Verified	Delaware Direct	19122	Subsurface Infiltration, Porous Pavement	0.2
2015-LANI-2871-01	Combined	Verified	Lower Schuylkill River	19145	Porous Pavement, Disconnected Impervious Area	0.3
2015-2338-2915-01	Combined	Verified	Delaware Direct	19125	Surbsurface Infiltration	0.5
2015-UCHS-2939-01	Combined	Verified	Lower Schuylkill River	19104	Subsurface Infiltration, Subsurface Detention, Bioretention, Disconnected Impervious Area	2.2
2015-ROYA-2911-01	Combined	Verified	Tacony-Frankford Creek	19124	Surbsurface Infiltration, Surface Infiltration, Surface Detention, Disconnected Impervious Area	4.2
2015-LASA-2848-01	Combined	Verified	Tacony-Frankford Creek	19144	Bioinfiltration, Porous Pavement	1.1
2015-GAUD-2962-01	Combined	Verified	Lower Schuylkill River	19140	Subsurface Detention, Bioretention, Porous Pavement	0.6
2015-JFKP-2951-01	Combined	Verified	Lower Schuylkill River	19102	Subsurface Detention, Disconnected Impervious Area	1.0

Tracking Number	Sewer Type	Category	Watershed Type	Zip	SMP Types	Greened Acres
2015-TEMP-2964-01	Combined	Verified	Delaware Direct	19122	Surbsurface Infiltration, Porous Pavement	6.2
2015-WYNN-2986-01	Combined	Verified	Lower Schuylkill River	19131	Surbsurface Infiltration, Porous Pavement, Disconnected Impervious Area	0.7
FY16-FAIR-4011-01	Combined	Verified	Delaware Direct	19123	Surbsurface Infiltration	1.2
FY16-HELP-4027-01	Combined	Verified	Delaware Direct	19123	Surbsurface Infiltration, Disconnected Impervious Area	0.2
FY16-FIVE-4029-01	Combined	Verified	Tacony-Frankford Creek	19124	Subsurface Infiltration, Bioretention	1.1
FY16-HANO-4040-01	Combined	Verified	Lower Schuylkill River	19107	Subsurface Detention	2.1
FY16-BARI-4074-01	Combined	Verified	Lower Schuylkill River	19104	Surbsurface Infiltration, Disconnected Impervious Area	0.4
FY16-FRAN-4076-01	Combined	Verified	Tacony-Frankford Creek	19124	Disconnected Impervious Area	0.0
FY16-SMIT-4151-01	Combined	Verified	Lower Schuylkill River	19146	Porous Pavement, Disconnected Impervious Area	3.7
FY16-TEMP-4178-01	Combined	Verified	Delaware Direct	19121	Subsurface Detention, Bioretention, Porous Pavement	4.2
FY16-KENS-4216-01	Combined	Verified	Delaware Direct	19125	Bioinfiltration, Porous Pavement	0.7
FY16-ADAM-4220-01	Combined	Verified	Tacony-Frankford Creek	19120	Bioinfiltration	1.0
FY16-TEMP-4277-01	Combined	Verified	Delaware Direct	19122	Porous Pavement	0.4
FY16-DREX-4244-01	Combined	Verified	Lower Schuylkill River	19104	Porous Pavement, Disconnected Impervious Area	1.0
FY16-LINC-4309-01	Combined	Verified	Delaware Direct	19146	Surbsurface Infiltration, Green Roof, Porous Pavement, Disconnected Impervious Area	2.9
FY16-LASA-4354-01	Combined	Verified	Tacony-Frankford Creek	19141	Porous Pavement, Disconnected Impervious Area	0.2
FY17-CAMP-4378-01	Combined	Verified	Lower Schuylkill River	19140	Subsurface Infiltration, Disconnected Impervious Area	0.7

Tracking Number	Sewer Type	Category	Watershed Type	Zip	SMP Types	Greened Acres
FY17-SENI-4411-01	Combined	Verified	Lower Schuylkill River	19145	Subsurface Detention, Porous Pavement, WQ Treatment Device, Disconnected Impervious Area	1.0
FY17-STPI-4413-01	Combined	Verified	Cobbs Creek	19143	Bioinfiltration, Disconnected Impervious Area	0.2
FY17-THAN-4446-01	Combined	Verified	Lower Schuylkill River	19146	Subsurface Detention	0.8
FY17-PESS-4511-01	Combined	Verified	Lower Schuylkill River	19145	Surface Detention	9.3
FY17-WEND-4527-01	Combined	Verified	Cobbs Creek	19139	Surbsurface Infiltration	1.3
FY17-WGOD-4567-01	Combined	Verified	Tacony-Frankford Creek	19141	Subsurface Infiltration, Porous Pavement, Disconnected Impervious Area	1.1
FY18-PEAB-4939-01	Combined	Verified	Delaware Direct	19122	Porous Pavement	0.2
Total Greened Acres:						**568.6**

Table 4: Complete SMIP and GARP Green Stormwater Infrastructure Projects

Tracking Number	Sewer Type	Category	Watershed Type	Zip	SMP Types	Greened Acres
FY16-PECO-4145-01	Combined	Verified	Lower Schuylkill River	19103	Green Roof	0.8
2011-RETR-001-01	Combined	Verified	Lower Schuylkill River	19142	Disconnected Impervious Area	0.3
FY16-USGS-4133-01	Combined	Verified	Delaware Direct	19106	Green Roof	0.4
2011-2150-1616-01	Combined	Verified	Delaware Direct	19134	Subsurface Infiltration	1.4
2012-ROOF-1869-01	Combined	Verified	Delaware Direct	19125	Direct Discharge	0.9
2012-THEE-1746-01	Combined	Verified	Lower Schuylkill River	19139	Green Roof	0.1
2012-NEWM-1776-01	Combined	Verified	Delaware Direct	19135	Cistern	1.0
FY16-FRIE-4238-01	Combined	Verified	Lower Schuylkill River	19102	Green Roof	0.2
2012-GSFS-2028-01	Combined	Verified	Tacony-Frankford Creek	19144	Bioretention, Depave	1.0
2010-COMM-1370-01	Combined	Verified	Delaware Direct	19140	Green Roof	0.1
2012-6225-1857-01	Combined	Verified	Delaware Direct	19135	Bioinfiltration	0.3
2013-CARD-2076-01	Combined	Verified	Delaware Direct	19124	Surface Detention, Subsurface Detention	53.0
2013-SITE-2401-01	Combined	Verified	Lower Schuylkill River	19131	Subsurface Infiltration	3.4
2013-SITE-2387-01	Combined	Verified	Lower Schuylkill River	19131	Subsurface Infiltration	5.2
2014-SITE-2501-01	Combined	Verified	Lower Schuylkill River	19131	Bioinfiltration	35.5
2013-6225-2400-01	Combined	Verified	Delaware Direct	19135	Subsurface Infiltration	3.0
2014-SITE-2550-01	Combined	Verified	Delaware Direct	19135	Subsurface Infiltration	1.7
2013-1148-2105-01	Combined	Verified	Delaware Direct	19147	Surface Infiltration, Subsurface Infiltration, Green Roof	0.7
2013-CARD-2220-01	Combined	Verified	Tacony-Frankford Creek	19124	Surface Detention	15.4
2013-METH-2117-01	Combined	Verified	Lower Schuylkill River	19131	Bioinfiltration	1.7
2011-1518-1561-01	Combined	Verified	Delaware Direct	19130	Subsurface Infiltration	0.2
2014-SITE-2682-01	Combined	Verified	Lower Schuylkill River	19131	Surface Infiltration, Subsurface Detention	7.4
2015-MINK-2844-01	Combined	Verified	Lower Schuylkill River	19145	Surface Infiltration	0.7
FY16-PHIL-4130-01	Combined	Verified	Darby Creek	19142	Depave	0.2
2015-LUTH-2836-01	Combined	Verified	Delaware Direct	19125	Depave	0.1
FY16-PHIL-4134-01	Combined	Verified	Lower Schuylkill River	19130	Green Roof	0.1
2012-WOLF-1792-01	Combined	Verified	Delaware Direct	19137	Direct Discharge	11.7

Tracking Number	Sewer Type	Category	Watershed Type	Zip	SMP Types	Greened Acres
2014-SITE-2666-01	Combined	Verified	Lower Schuylkill River	19153	Subsurface Infiltration	2.7
2014-SITE-2592-01	Combined	Verified	Lower Schuylkill River	19153	Subsurface Infiltration	9.1
2014-GLOB-2467-01	Combined	Verified	Tacony-Frankford Creek	19124	Surface Detention	0.6
2015-LEAE-2888-01	Combined	Verified	Lower Schuylkill River	19036	Subsurface Infiltration, Bioinfiltration, Porous Pavement	2.0
2014-SITE-2549-01	Combined	Verified	Lower Schuylkill River	19145	Subsurface Infiltration	3.3
2014-SITE-2665-01	Combined	Verified	Lower Schuylkill River	19145	Subsurface Infiltration, Subsurface Detention	8.9
2015-SITE-2810-01	Combined	Verified	Lower Schuylkill River	19153	Subsurface Detention	9.9
2015-SITE-2809-01	Combined	Verified	Tacony-Frankford Creek	19120	Subsurface Infiltration, Subsurface Detention	21.9
FY16-SITE-4039-01	Combined	Verified	Delaware Direct	19148	Surface Detention, Subsurface Detention	5.7
2015-LASA-2865-01	Combined	Verified	Tacony-Frankford Creek	19141	Surface Detention	7.4
2015-NORT-2977-01	Combined	Verified	Tacony-Frankford Creek	19124	Subsurface Infiltration, Subsurface Detention	17.6
FY16-ADAM-4101-01	Combined	Verified	Tacony-Frankford Creek	19124	Surface Detention, Disconnected Impervious Area	1.8
FY16-SITE-4016-01	Combined	Verified	Lower Schuylkill River	19145	Subsurface Detention	6.4
2015-LIGH-2907-01	Combined	Verified	Delaware Direct	19140	Surface Detention	0.7
2015-FRAN-2954-01	Combined	Verified	Delaware Direct	19130	Surface Detention	0.6
2015-MAYF-2796-01	Combined	Verified	Delaware Direct	19149	Bioretention	4.8
2014-WARR-2757-01	Combined	Verified	Tacony-Frankford Creek	19124	Bioretention	3.1
2015-TAGG-2931-01	Combined	Verified	Delaware Direct	19148	Subsurface Infiltration, Bioinfiltration, Depave, Disconnected Impervious Area	0.9
FY16-WAKE-4282-01	Combined	Verified	Delaware Direct	19137	Subsurface Detention	8.1
FY16-SITE-4189-01	Combined	Verified	Tacony-Frankford Creek	19120	Surface Detention, Subsurface Detention	12.9
FY17-FSFA-4510-01	Combined	Verified	Delaware Direct	19122	Green Roof	0.1
FY16-GAUL-4273-01	Combined	Verified	Delaware Direct	19134	Subsurface Infiltration	1.2
2015-MART-2832-01	Combined	Verified	Tacony-Frankford Creek	19138	Subsurface Infiltration, Bioinfiltration	3.8
FY16-CHES-4233-01	Combined	Verified	Lower Schuylkill River	19146	Surface Infiltration, Subsurface Infiltration, Porous Pavement, Depave	1.0

Tracking Number	Sewer Type	Category	Watershed Type	Zip	SMP Types	Greened Acres
FY16-STHS-4226-01	Combined	Verified	Lower Schuylkill River	19145	Subsurface Detention, Bioretention	4.5
FY16-ESSI-4357-01	Combined	Verified	Lower Schuylkill River	19153	Subsurface Detention	8.0
2015-STJA-2895-01	Combined	Verified	Tacony-Frankford Creek	19120	Surface Infiltration, Surface Detention, Subsurface Detention	0.5
FY16-NAME-4323-01	Combined	Verified	Tacony-Frankford Creek	19140	Subsurface Detention	7.5
2014-WILL-2541-01	Combined	Verified	Delaware Direct	19140	Depave	0.2
FY17-EERI-4396-01	Combined	Verified	Tacony-Frankford Creek	19124	Subsurface Detention	3.6
FY16-LASA-4274-01	Combined	Verified	Tacony-Frankford Creek	19144	Surface Detention, Subsurface Detention	9.5
2015-SITE-2812-01	Combined	Verified	Pennypack Creek	19136	Subsurface Detention	10.8
FY16-SITE-4020-01	Combined	Verified	Delaware Direct	19136	Subsurface Infiltration	1.5
FY17-EDMU-4680-01	Combined	Verified	Pennypack Creek	19136	Subsurface Infiltration	4.3
FY16-ADAI-4164-01	Combined	Verified	Delaware Direct	19125	Depave	2.3
FY17-STEN-4469-01	Combined	Verified	Tacony-Frankford Creek	19144	Subsurface Detention	3.9
FY17-OVER-4682-01	Combined	Verified	Lower Schuylkill River	19151	Subsurface Infiltration, Bioinfiltration	2.1
FY17-HIST-4671-01	Combined	Verified	Tacony-Frankford Creek	19144	Subsurface Detention, Bioretention, Depave	0.6
FY16-JMPA-4286-01	Combined	Verified	Lower Schuylkill River	19142	Bioinfiltration, Depave	0.8
FY16-EMST-4198-01	Combined	Verified	Delaware Direct	19146	Depave	0.1
FY16-MIDA-4019-01	Combined	Verified	Delaware Direct	19123	Surface Infiltration, Depave	1.4
FY16-JOMA-4143-01	Combined	Verified	Tacony-Frankford Creek	19124	Surface Detention	1.3
FY16-NFRA-4325-01	Combined	Verified	Delaware Direct	19125	Porous Pavement	0.1
FY17-ELUZ-4412-01	Combined	Verified	Tacony-Frankford Creek	19124	Subsurface Infiltration	8.1
FY16-SITE-4025-01	Combined	Verified	Pennypack Creek	19136	Subsurface Detention	13.7
FY16-ISTR-4292-01	Combined	Verified	Delaware Direct	19134	Blue Roof	1.3
FY17-STHS-4442-01	Combined	Verified	Lower Schuylkill River	19145	Subsurface Detention	14.7
FY17-BAKE-4685-01	Combined	Verified	Delaware Direct	19134	Subsurface Infiltration	2.7
FY17-CAST-4743-01	Combined	Verified	Delaware Direct	19134	Subsurface Detention	7.1
FY17-EADO-4760-01	Combined	Verified	Delaware Direct	19137	Subsurface Infiltration	5.3
FY17-SAIN-4765-01	Combined	Verified	Delaware Direct	19148	Bioinfiltration	0.3
FY17-POSE-4687-01	Combined	Verified	Pennypack Creek	19136	Subsurface Detention	5.2
FY17-ESSI-4628-01	Combined	Verified	Lower Schuylkill River	19153	Subsurface Detention	7.7

Tracking Number	Sewer Type	Category	Watershed Type	Zip	SMP Types	Greened Acres
FY17-TACO-4444-01	Combined	Verified	Delaware Direct	19137	Subsurface Detention	7.4
FY17-GRAY-4520-01	Combined	Verified	Lower Schuylkill River	19143	Subsurface Detention	13.5
FY17-PASC-4472-01	Combined	Verified	Lower Schuylkill River	19143	Subsurface Infiltration, Subsurface Detention	7.2
FY17-BSTR-4742-01	Combined	Verified	Delaware Direct	19134	Subsurface Detention	8.9
FY18-TALM-4904-01	Combined	Verified	Lower Schuylkill River	19131	Subsurface Detention	0.9
FY16-SITE-4104-01	Combined	Verified	Tacony-Frankford Creek	19120	Subsurface Infiltration	9.5
FY17-NTHS-4620-01	Combined	Verified	Delaware Direct	19140	Subsurface Detention	13.3
FY18-TALM-4995-01	Combined	Verified	Lower Schuylkill River	19131	Subsurface Detention	1.4
FY17-WHEA-4544-01	Combined	Verified	Tacony-Frankford Creek	19124	Subsurface Infiltration, Disconnected Impervious Area	14.0
FY18-ACAD-4999-01	Combined	Verified	Pennypack Creek	19114	Subsurface Detention	3.5
FY18-EERI-4992-01	Combined	Verified	Delaware Direct	19124	Subsurface Infiltration	9.1
2015-3560-2776-01	Combined	Verified	Delaware Direct	19134	Subsurface Infiltration	0.6
FY18-LASA-4980-01	Combined	Verified	Tacony-Frankford Creek	19144	Subsurface Detention	2.7
FY18-WHIT-5066-01	Combined	Verified	Tacony-Frankford Creek	19124	Subsurface Infiltration, Subsurface Detention	7.2
FY18-COML-4942-01	Combined	Verified	Delaware Direct	19135	Subsurface Detention	1.4
FY18-WBUL-4819-01	Combined	Verified	Delaware Direct	19140	Subsurface Infiltration, Subsurface Detention	6.0
FY18-GRAY-4905-01	Combined	Verified	Lower Schuylkill River	19143	Subsurface Detention	2.0
FY18-BALA-5159-01	Combined	Verified	Lower Schuylkill River	19131	Surface Detention	24.4
FY17-ESSI-4624-01	Combined	Verified	Lower Schuylkill River	19153	Subsurface Detention	12.0
FY18-OREG-5175-01	Combined	Verified	Delaware Direct	19148	Subsurface Detention	6.2
FY19-WGLE-5243-01	Combined	Verified	Lower Schuylkill River	19132	Subsurface Detention	6.3
FY18-NORT-4846-01	Combined	Verified	Lower Schuylkill River	19140	Subsurface Detention	3.7
FY17-ECHE-4667-01	Combined	Verified	Tacony-Frankford Creek	19144	Subsurface Detention	3.4
FY19-WGLE-5241-01	Combined	Verified	Delaware Direct	19132	Subsurface Detention	2.7
FY17-ESSI-4624-01	Combined	Verified	Lower Schuylkill River	19153	Subsurface Detention	12.0
FY18-OREG-5175-01	Combined	Verified	Delaware Direct	19148	Subsurface Detention	6.2
FY19-WGLE-5243-01	Combined	Verified	Lower Schuylkill River	19132	Subsurface Detention	6.3
Total Greened Acres:						**576.8**

Appendix 4

Green Stormwater Infrastructure Monitoring Status Report

1.0 Introduction

During the reporting period of July 1, 2018 to June 30, 2019, the City's *Green City, Clean Waters* program addressed stormwater runoff reductions in urbanized areas using a combination of traditional infrastructure and green stormwater infrastructure (GSI). GSI systems vary in size, complexity, and interconnectedness to the existing drainage system, but the objective is to infiltrate, evapotranspire, reuse, and/or detain stormwater rather than to convey it directly to the sewer system. Monitoring and testing GSI systems is therefore essential to determine the effectiveness of various SMP types in managing stormwater and reducing combined sewer overflows.

The focus of the *Green City, Clean Waters* monitoring program is post-construction performance monitoring and testing. The primary goal of GSI monitoring and testing is to measure the performance of GSI systems for reducing stormwater runoff volume. Secondary goals include providing information to inform improvements to GSI design, construction practices, maintenance and developing appropriate monitoring methods for the variety of GSI projects installed city-wide.

Project characteristics such as contributing drainage area, storage volume, inlet capture efficiency, and (when present) slow release discharge parameters can be observed, allowing for a more complete view of a system's functionality. The comprehensive understanding of GSI through monitoring and testing allows the Water Department to make informed decisions for current and future projects regarding the GSI design standards, type and frequency of maintenance activities, and program optimization.

From July 1, 2018 to June 30, 2019, the Water Department performed monitoring and testing of GSI stormwater management practices (SMPs) using methods described in the Comprehensive Monitoring Plan (CMP) submitted January 10, 2014 and approved by PADEP May 28, 2014,while also updating those methods to create new standard operating procedures (SOPs) that better reflect today's GSI performance monitoring and investigative testing techniques. In selecting monitoring locations, the Water Department has attempted to allocate monitoring effort roughly according to the types of SMPs that are being constructed for the *Green City, Clean Waters* program (Table 1-1).

Table 1-1: Monitored SMPs by Type

SMP Type	Monitored SMPs During FY19	Total Constructed Public SMPs
Stormwater Tree Trench	211	254
Rain Garden	62*	100
Stormwater Planter	14	55
Stormwater Bump out	3	26
Infiltration/Storage Trench	112**	176
Pervious Paving	2	14
Green Roof	0	1
Swale	5	24
Basin	1	4
Drainage Well	4***	0
Total	414	654

*Number contains 15 privately constructed SMPs classified as rain gardens

**Number contains 14 privately constructed SMPs classified as subsurface trenches

***Drainage wells are being monitored as part of the construction process.

2.0 Data Tracking

The data tracking mechanism for *Green City, Clean Waters* GSI monitoring data has evolved significantly since the inception of the program. Raw data are stored on an SMP-by-SMP basis in a filesystem directory tree that is backed up periodically. Derived data from quality assurance calculations are stored in spreadsheets and relational databases, to be used by various data analysis groups. System metrics and design characteristics are stored in other relational databases managed by PWD.

3.0 Comprehensive Monitoring Plan Implementation Status

Proposed methods for performance monitoring were outlined in both the draft Comprehensive Monitoring Plan submitted December 1, 2012 and in a response sent to PADEP and the EPA on July 31, 2013. A revised CMP was submitted on January 10th, 2014 and approved by PADEP on May 28, 2014. The following sections summarize the status of monitoring activities described in the CMP for July 1, 2018 through June 30, 2019. While these activities follow the approved CMP, the methods employed have been updated to better reflect today's GSI performance monitoring and investigative testing techniques through standard operating procedures (SOPs), listed below.

Updated SOPs include:

- Capture Efficiency Testing of Green Stormwater Infrastructure
- Continuous Water Level Monitoring of Green Stormwater Infrastructure
- QAQC of Green Stormwater Infrastructure Monitoring Data
- Simulated Runoff Testing of Green Stormwater Infrastructure
- Surface Infiltration Rate Testing of Pervious and Porous Paving Materials

These updated monitoring procedures are attached at the end of this appendix.

3.1 Green Stormwater Infrastructure Performance Monitoring

Continuous water level and storage volume monitoring of GSI systems is the primary method that the Water Department is evaluating performance of constructed SMPs. During FY19, the Water Department has deployed 201 unique HOBO pressure transducers (Onset Computer Corp, Bourne MA) through its GSI monitoring program. Individual sensors can be deployed in various locations throughout their useful life and are often used to monitor multiple SMPs. Of these sensors, 27 were deployed as barometric pressure sensors during FY19.

Table 3-1: Continuous Water Level Monitoring Sensors

Sensor Type	Number Deployed during FY19
Barometric Pressure Sensor	27
Water Level Sensor	174
Total Unique Sensors	201

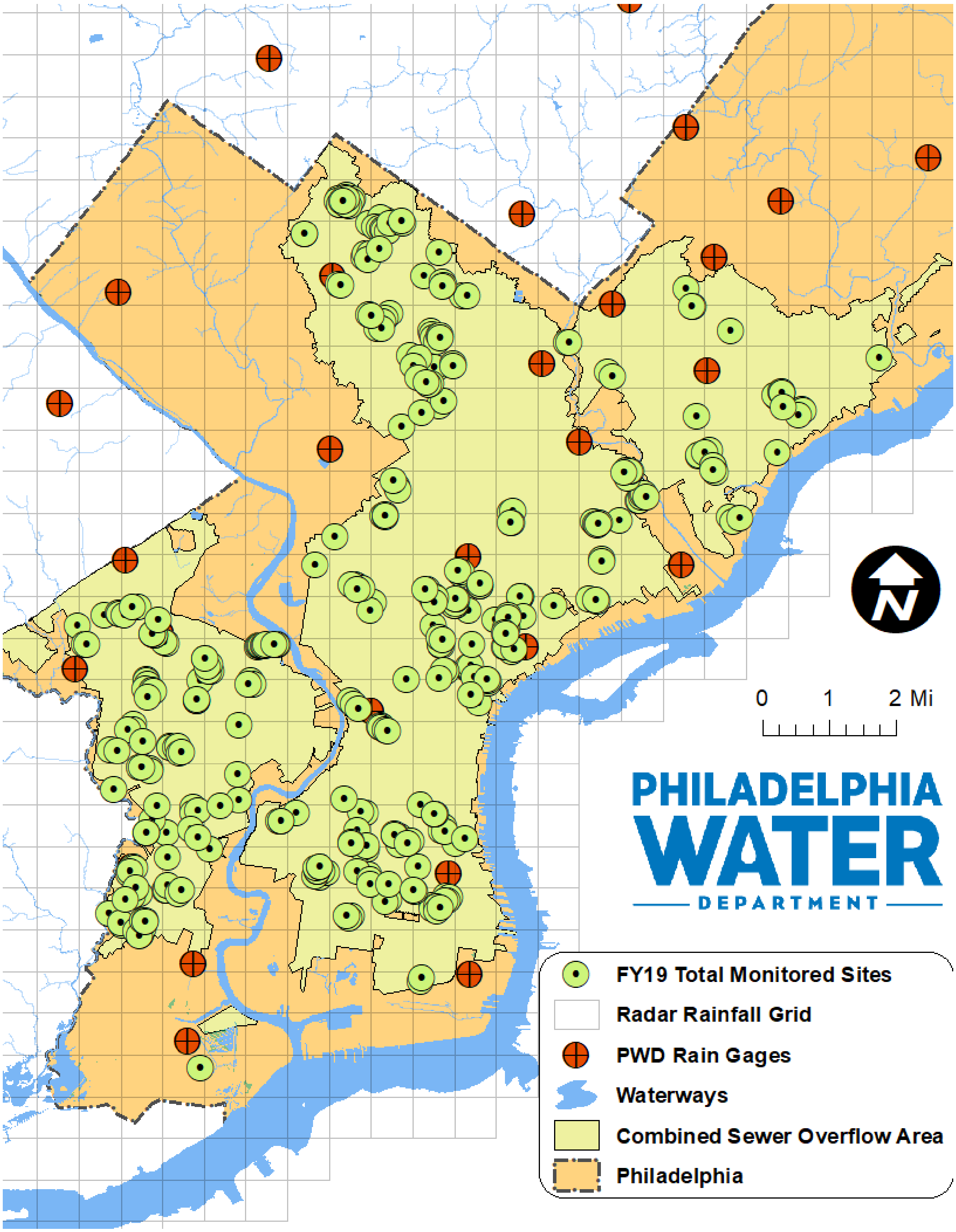


Figure 3-1: Continuous Water Level Monitoring Project Locations and Combined Sewer Area

3.2 Green Stormwater Infrastructure Performance Testing

The Water Department uses two Sensus Water Meter Testers, a WL-1250[1] and Omni V-2[1], for measuring flow applied to an SMP during simulated runoff tests (SRTs). The water meter is capable of estimating flows from 0.04 CFM to 167 CFM (WL-1250[1]) and 0.67 CFM to 66 CFM (Omni V2[1]). 39 SRTs were performed for 30 GSI systems in FY19. Monitoring locations are shown in **Table 3-2**, **Table 3-3** and **Figure 3-2**.

Table 3-2: SRTs Performed by Type in FY19

SRT Type	Number of SRTs Performed
Construction Acceptance Test	4
CCTV Dye Test	10
SRT Performance Test	8
Pre-Inspection Test	17

Table 3-3: SMP Attributes for SMPs tested with SRT in FY19

SMP Type	Number of SRTs Performed
Bumpout	3
Drainage Well	3
Infiltration/Storage Trench	2
Rain Garden	4
Tree Trench	18

3.3 Permeable Pavement Surface Infiltration Rate Testing

The Water Department uses ASTM Standards (ASTM Committee D18, ASTM C1701/C1701M-09 Standard Test method for Infiltration Rate of In Place Pervious Concrete, 2009) (ASTM Committee C15, 2013), with minor modifications for pervious paving infiltration testing. Development of these procedures was completed in FY13 and refinement of the methods is ongoing. See the latest revised

[1] Reference in this document to any specific commercial product, process, or service, or the use of any trade, firm or corporation name is for the information and convenience of the public, and does not constitute endorsement, recommendation, or favoring by PWD.

SOPs at the end of this appendix. Two 12" diameter sections of Schedule 60 PVC pipe are used as infiltration rings to allow for performing multiple tests simultaneously. Modifications were made to the test calculations to compensate for the different infiltration ring diameter compared to the ring diameter specified in the method. Nine SMPs have been selected for surface infiltration rate testing in FY19. Monitoring locations are shown in **Table 3-4** and **Figure 3-2**.

Table 3-4: Permeable Pavement SMPs Selected for Surface Infiltration Rate Testing

SMP ID	Project Name	Surface Type	Number of Test Locations	Number of Tests Performed per Location
207-1-3	McMahon St (Waterview Recreation Center)	Pervious Concrete	3	3
240-1-1	Percy St from Catharine St to Christian St	Porous Asphalt	3	3
288-1-1	16th and Webster	Porous Asphalt	3	5
301-1-1	Collins Street	Porous Asphalt	5	3
301-3-1	Gordon Street	Porous Asphalt	3	3
329-1-1	Hope St (Master to Jefferson)	Porous Asphalt	3	3
331-1-1	Hope St (Berks to Norris)	Porous Asphalt	3	3
58912	777 Lofts	Porous Asphalt	3	1
60080	Philly RoRo	Porous Asphalt	13	1

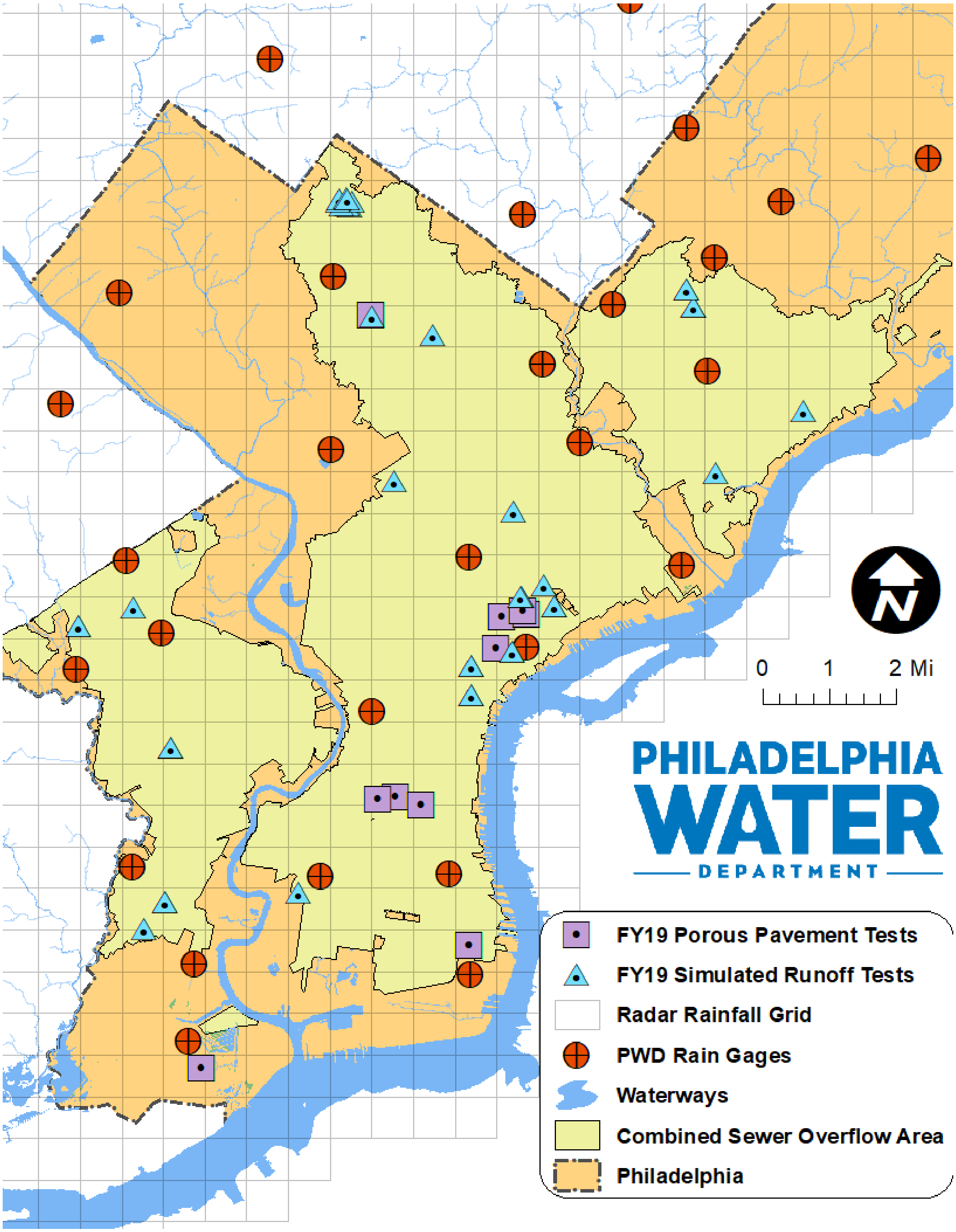


Figure 3-2: Simulated Runoff Testing and Surface Infiltration Testing Locations

3.4 Lateral Groundwater Mounding

The Water Department installed groundwater monitoring wells near seven SMPs, and control wells near three SMPs to assess the effect of infiltrating SMPs on the water table. Monitoring locations are shown in **Table 3-5** and **Figure 3-2**.

Table 3-5: SMP Attributes for SMPs Selected for Lateral Groundwater Mounding Monitoring

SMP Type	Project Name	Number of wells
Stormwater Tree Trench	Bodine High School	3
Rain Garden	Bridesburg Recreation Center	4
Stormwater Planter	Roosevelt Playground	4
Stormwater Tree Trench	21st and Venango Streets	2
Drainage Well	Malvern and Atwood Streets	4
Drainage Well	Algon and Glenview Streets	3
Drainage Well	Unruh and Frontenac Streets	3

3.5 Sewer System Monitoring

The Water Department continues to perform sewer system monitoring per the methods outlined in the CMP. More information is available in **Appendix B of the CSO/MS4 FY19 Annual Report**.

3.6 Meteorological Monitoring

The Water Department continues to perform meteorological monitoring, including operation and maintenance of a rain gauge network, as described in the CMP. More information is available in **Appendix B of the CSO/MS4 FY19 Annual Report.**

3.7 Groundwater Level Monitoring

The Water Department is monitoring groundwater levels in the Philadelphia region in partnership with the U.S. Geological Survey. As of July 2019, 25 wells have been established from which water level measurements are made monthly. Results of groundwater monitoring are presented in **Appendix I PWD-USGS Cooperative Groundwater Monitoring Program**. Well PH1043, located in the Germantown section of the City, is equipped with continuous water level recording and telemetry equipment making the data available in near-real time.

4.0 CMP Implementation Successes and Challenges Encountered

The PWD has been successful in acquiring additional equipment and support staff, deploying water level sensors to GSI systems, and performing simulated runoff and permeable pavement infiltration tests. During FY19, we achieved our goal of monitoring new SMPs and performing SRT's at the same frequency as in FY18. PWD increased the number of porous pavement tests compared to FY18.

The GSI monitoring team has continued providing monitoring assistance to the GSI Implementation and Operations programs to collect data from systems where challenges have been observed to help interpret cause(s) and verify remediation measures.

PWD has provided support to the recipient of the EPA STAR grant since FY13. This has provided PWD with valuable insight and productive academic partnerships. To continue these partnerships PWD has invested resources into developing academic research contracts with Villanova University and Drexel University.

Capture Efficiency Testing of Green Stormwater Infrastructure – Standard Operating Procedure

1. Introduction

This document outlines the Philadelphia Water Department's (PWD) Standard Operating Procedures (SOPs) for performing Capture Efficiency Testing (CET) of Green Stormwater Infrastructure (GSI) Stormwater Management Practices (SMPs) inflow structures. Capture efficiency is defined based on percent capture, or the estimated percent of the total flow applied that is captured by the inflow structure. The primary goal of this document is to outline a process and provide information about the capture efficiency of GSI inflow structures to other groups within PWD, such as GSI Implementation, Green Stormwater Operations (GSO), and Construction units.

2. Office Tasks and Preparation

2.1. Office Tasks

1) Synchronize laptop and camera clocks with official U.S. Eastern Standard Time (EST) (http://www.time.gov). **Make sure the laptop time is not corrected for daylight savings; it should be in standard time**. The sensors are all deployed using U.S. EST.
2) Check battery levels and verify SD storage card is in camera.
3) Select a group of SMPs that have not been tested for capture efficiency.
    a. Group SMPs by geographic area by using Google Maps (http://www.maps.google.com). Plan daily field visits based on geographic area to enhance efficiency when possible.
4) Plan route to monitoring sites, create a route map, and make a list of all systems to be visited. Print maps and directions or save to the field laptop, if necessary.
5) Contact site representative and inform them of your estimated time of arrival (ETA), if necessary. This step typically applies to private sites.
6) Collect plan sets (as-builts, if available) from the Green Infrastructure projects drive and maintenance maps. Save the plan(s) in the 'Supplementary Documents' folder for the respective site on the MARS drive.
7) Create a folder on the laptop for the daily field visit schedule. Transfer plan sets, maintenance maps, and a copy of the Current Monitoring Sites spreadsheet into this folder.

2.2. Equipment Checklist

Equipment is organized into two separate lists. Sensitive electronic equipment should be stored separately from hand tools. Hydrant testing apparatuses can be found at the OOW storage shed.

1) Clean bag
    - Camera with extra batteries
    - Laptop with plan sets, maintenance maps, and site list (print-out as alternate).

- Pen
- Field notebook

2) Hydrant testing apparatuses
    - Hydrant wrench and center compression lock (CCL) Key – Dependent on hydrant type. All wrenches and keys can be obtained from a PWD storeroom.
    - Multiple sections of 25 FT, 2 ½-inch-diameter fire hose
    - Backflow preventer
    - Hydrant to 2 ½-inch thread hose adapter
    - Water tank
    - Ratchet straps

2.3. Logistics: Personnel Safety and Site Appropriateness

1) Post “no parking” signs the day before testing, if necessary to access SMP components or to ensure safety of the field crew.
2) Make sure each participant is familiar with the procedure and knows the specific tasks they will be responsible for. If three people are participating, it is recommended to use the following division of tasks:
    a. Personnel 1: Hydrant/Tank operator – in charge of flushing and operating fire hydrants when filling the water tank and regulates flow from the water tank while performing test.
    b. Personnel 2: Documenter – Takes pictures and/or videos of the inlets, showing the water entering the inlet and any bypass that occurs. Records time, date, and capture efficiency of inlets.
    c. Personnel 3: Safety Watch – Sets up cones and ensures proper safety protocol is followed.
3) Do not perform test during the following conditions:
    a. Rain is expected during the planned test date.
    b. Atmospheric temperature is forecasted at or below 0°C/32°F for 3 hours preceding or following the planned test date.
    c. Presence of excessive sediment near the site of flow application that cannot be removed (e.g. improperly stored soil or aggregate for construction sites).
    d. Any other condition that may be deemed unsafe or considered to significantly impact the results of the test.

2.4. Fire Hydrant Preparation

1) Review all SOP documents related to hydrant- and flow-testing equipment.
    a. Hydrant Operating Procedure
    b. Flow Measurement Equipment Details & Procedures
        i. Includes information on the backflow preventer, diffuser, and flow meter.
2) Ensure proper training of all field crew members on hydrant operation prior to test.

3. CET Procedures

3.1. Filling the Tank

1) Load the tank into the bed of the truck with at least two personnel.
2) Secure tank in place using ratchet straps (see Appendix A).
3) When arriving on site, make sure to park in accordance with the City of Philadelphia parking laws. Park the truck with the tank close to the hydrant.
4) Set up work zone traffic control equipment, as necessary.
5) Use Hydrant Operating Procedure (see Section 2.4) to begin operation of nearby hydrant. When flushing the hydrant, ensure no water flows into the inflow structure to be tested. Discharge water into grey inlet or downstream of SMP.
6) Place the discharge end of the hose into the tank, making sure to hold it securely in place.
7) Check the load capacity of truck before filling tank. Make sure to only fill the tank with water that is within the load capacity of the vehicle in use. Keep in mind that the crew members and field equipment also contribute to the load on the truck. Therefore, it is best to make sure the tank is not filled beyond half of its storage volume.
8) Slowly turn on the hydrant per Hydrant Operating Procedure. Make sure the hose remains securely in place. Do not over-fill the tank.
9) Close hydrant slowly and replace cap.
10) Place the hose and any tools securely into the truck.

3.2. Testing Inflow Structure Capture Efficiency

1) Drive to the inflow structure to be tested. Park upstream from the inlet with the tailgate facing the inlet.
2) If there is a vehicle obstructing access where "No Parking" signs were put up, you can contact the towing service and indicate that you are with PWD requesting a vehicle be relocated. Provide an exact address or nearest intersection and be on site to direct the tow truck.
3) Attach the small hose to the tank and point the end along the curb, toward the mouth of the inlet. Make sure the water discharge is at least 10 FT upstream of inlet.
4) Open tank valve fully. Discharge water so a significant flow will reach the inlet in a manner sufficient to observe capture efficiency.
5) Take a picture of the inlet by orienting the camera perpendicular to the direction of flow. Note the direction that water is flowing.
6) Record the date, time, capture efficiency (estimated percent of water captured by the inlet; see Appendix B) and any observations relevant to the inflow capture efficiency.
7) Close tank valve fully. Disconnect hose from the tank. Place the hose and any tools securely into the truck.

4. Record Keeping

To ensure the integrity of records for field activities, it is imperative that reporting procedures are followed as stated in this SOP. For CET activities, there are three main reporting locations, including the GSI Monitoring Resources Microsoft (MS) Access database, the Field Testing Master Record MS Excel spreadsheet, and the "Capture_Efficiency" folder within the SMP project directory. A fourth reporting location is the GSO Coordination MS Excel spreadsheet. Below are the necessary steps for entering field data into the respective locations.

4.1. GSI Monitoring Resources MS Access database

One table within the MS Access database, "Capture Efficiency Testing", hosts data relating to CET parameters and results. Descriptions of each column are provided for clarity.

1) Test Date/Time – [MM/DD/YY HH:MM AM/PM]
2) GreenIT ID – Unique identifier for the SMP, found in GreenIT (ex. 1-1-1)
3) Component ID – Unique identifier for the inflow structure (ex. G00010301-14-05), found on maintenance maps or in ERV2
4) Low Flow Bypass Observed – Low flow bypass observed during the CET using the truck water tank (i.e., Y if capture efficiency < 100%) [Y/N]
5) Low Flow Efficiency - Capture efficiency of inflow structure at low flow (i.e. using the truck water tank), calculated by subtracting percent bypass from 100. Do not add percentage sign. For example, 75% bypass would result in an estimated efficiency of 25.
6) Potential High Flow Efficiency – Estimated high flow efficiency when capture efficiency test is only conducted at low flow- categorized as: low, moderate, or high efficiency.
7) High Flow Efficiency - Capture efficiency of inflow structure at high flow (i.e. using a fire hydrant), calculated by subtracting percent bypass from 100. Do not add percentage sign. For example, 75% bypass would result in an estimated efficiency of 25.
8) Notes – Brief text description of any observations relevant to the inflow capture efficiency.

The capture efficiency testing table records are updated via the "Capture Efficiency Testing" form (see Figure 4-1), found in the navigation pane. Only submit records via the Capture Efficiency Testing form to ensure all relevant data is entered properly.

4.2. Field Testing Master Record

The Field Testing Master Record MS Excel spreadsheet hosts data pertaining to all field testing procedures, such as CETs, simulated runoff tests (SRTs), and surface infiltration rate tests (SIRTs), with tabs separating each type of test. Record notes from CET in the "CET" tab. Descriptions of column headers are provided for clarity.

1) Date – [MM/DD/YY], (ex. 07/07/2016)
2) Time (EST) – Start time of flow release to SMP [MM: HH], (ex. 09:30). Use Eastern Standard Time 12-hr clock. Do not account for daylight savings.
3) SMP ID – GreenIT ID, (ex. 1-1-1)

4) Inlet Component ID – Unique identifier for the inflow structure (ex. G00010301-14-05), found on maintenance maps or in ERV2.
5) Low Flow Bypass Observed – Low flow bypass observed during the CET using truck water tank (i.e., Y if capture efficiency < 100) [Y/N].
6) Low Flow Efficiency - Capture efficiency of inflow structure at low flow (i.e. using truck water tank), calculated by subtracting percent bypass from 100. Do not add percentage sign. For example, 75% bypass would result in an estimated efficiency of 25.
7) Potential High Flow Efficiency – Estimated high flow efficiency when capture efficiency test is only conducted at low flow- categorized as: low, moderate, or high efficiency.
8) High Flow Efficiency - Capture efficiency of inflow structure at high flow (i.e. using fire hydrant), calculated by subtracting percent bypass from 100. Do not add percentage sign. For example, 75% bypass would result in an estimated efficiency of 25.
9) Notes – Brief text description of any relevant information *not already covered in the previous columns.*

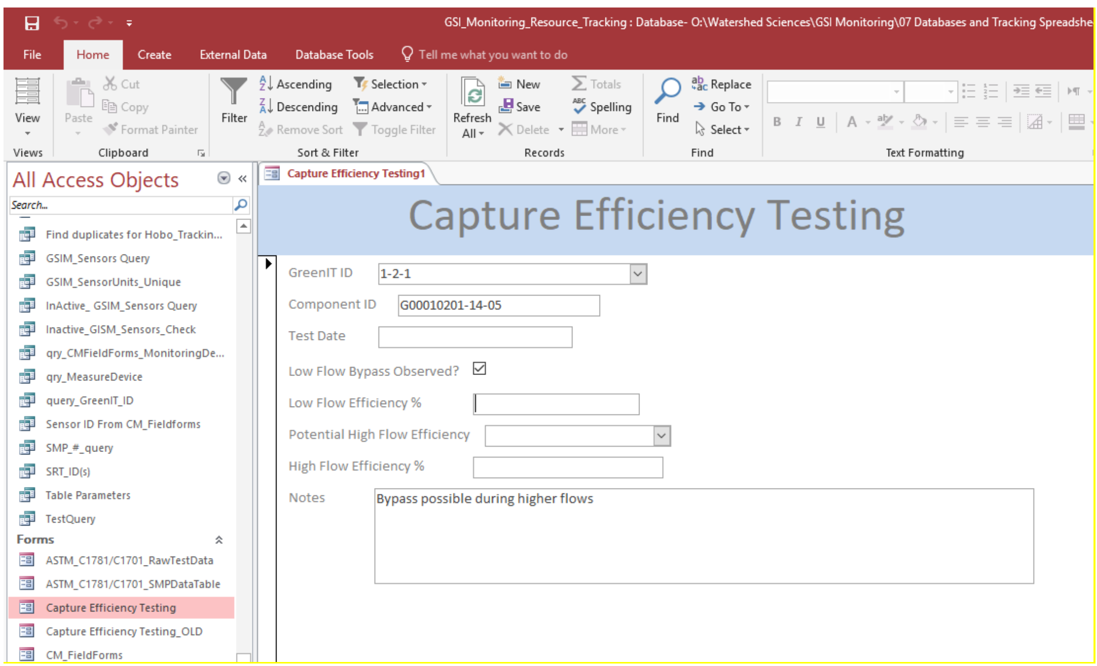


Figure 4-1 – Capture Efficiency Testing Form

4.3. Project Directory

The project directory for each site hosts a "Capture_Efficiency" folder used to store image results of the CET. Upload images off the camera using the following methods:

1) Navigate to the "Capture_Efficiency" folder within the SMP project directory.
2) Create a new folder for each individual SMP.
3) Upload images from CET into this site folder. Edit each photo by drawing an arrow indicating the direction of flow. Name the file **[GreenIT ID]_[Site Name]_[Component ID].PNG** (ex. 1-2-1_Hartranft_G00010201-14-05.PNG).

4.4. GSO Coordination – MS Excel

This spreadsheet is meant to inform GSO of 1) the sites we monitor so they can take care when performing maintenance at these locations and 2) any GSI issues we observe so they can be remedied.

If an issue is encountered that would involve GSO input, follow the GSO Coordination SOP to document and notify GSO of field findings. See GSO SOP for a list of field findings and how to address them as well.

5. Health and Safety Precautions

General information on PWD's safety policies can be found on the PWD Intranet Safety Unit website. The Watersheds Safety Committee maintains files pertaining to information on official City of Philadelphia Safety Policy located on the OOW server.

- When working in the public ROW, adhere to PWD Work Zone Traffic Control Guidelines and the Pennsylvania Work Zone Pocket Guide for Municipalities & Utilities (found in all OOW vehicles). Utilize road cones, signs, and safety tape to properly identify and isolate work areas and possible hazards.
- Use hard hats, safety shoes, safety gloves and protective eye wear, where applicable.
- During extreme heat events, ensure field crew members stay fully hydrated, and seek shade & rest to avoid heat exhaustion. Wear sun protection such as sunscreen, wide brimmed hats, and light-fitted clothing covering exposed skin.

Review safety policies prior to performing field work, inform supervisor of the work plan anticipated for the day, and ensure communication mechanisms between field and office staff are functional.

6. Public Relations Guidelines

While working in the field, you may be approached by residents or other members of the public. Remember that when working in the field you are representing PWD, and always conduct yourself appropriately. Residents may express concerns about basement flooding, safety, project aesthetics, or perhaps even PWD issues unrelated to the *Green City, Clean Waters* program.

Do:

- Find a time and place where you can appropriately have a conversation
- Explain what you are doing
- Assume a friendly position and body language
- Provide the appropriate phone numbers for PWD questions
- Listen to what the public has to say
- Make eye contact
- Be safe! Move away from traffic, tripping hazards, monitoring equipment, etc. Use appropriate safety equipment and adhere to all field safety guidelines

Don't:

- Jeopardize your safety, public safety or data quality
- Talk to the public at length
- Allow yourself to be distracted
- Engage a person who is hostile
- Provide your contact information
- Make promises about what PWD will or won't do, even if it relates to the site you are working on or *Green City, Clean Waters*

Appendix

Appendix A: Capture Efficiency Examples

Blue arrow indicates direction of flow.

Figure A.1 – Efficiency = 0

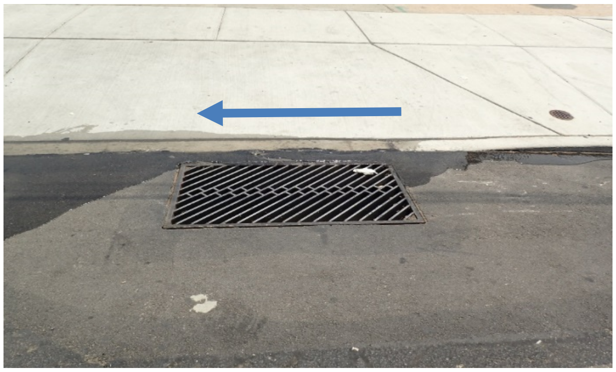


Figure A.2 – Efficiency = 0-25

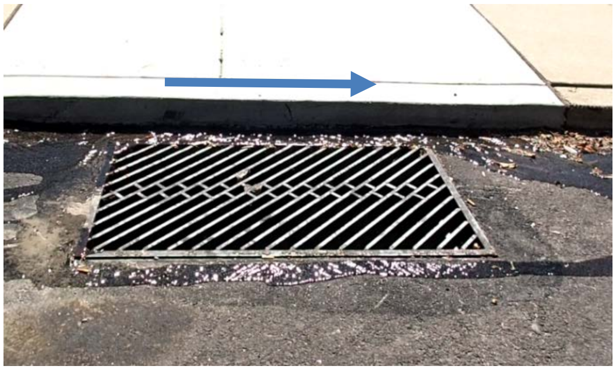


Figure A.3 – Efficiency = 25-50

Figure A.4 – Efficiency = 50-75

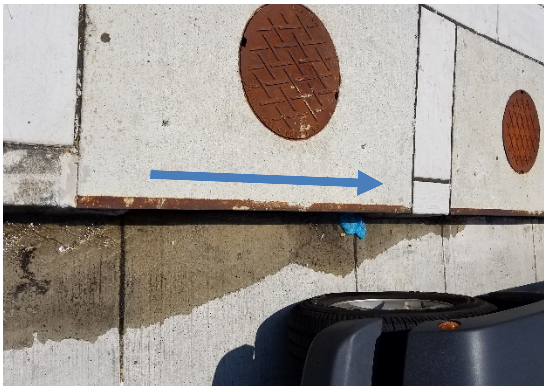


Figure A.5 – Efficiency = 75-100

Figure A.6 – Efficiency = 100

Continuous Water Level Monitoring of Green Stormwater Infrastructure - Standard Operating Procedure

1. Introduction

This document describes the Philadelphia Water Department's (PWD) procedures for short-term and long-term monitoring of stormwater management practices (SMPs), specifically green stormwater infrastructure (GSI), as employed by the Office of Watersheds (OOW) Monitoring, Analysis, and Research Support (MARS) program. This document is an updated version of the previous Continuous Water Level (CWL) Monitoring Standard Operating Procedure (SOP), which was developed during the first 5 years of implementation of the Combined Sewer Overflow (CSO) Long-Term Control Plan (LTCPU)[1]. This section provides the SOPs for CWL logger deployment in SMPs as described in the Green City, Clean Waters Comprehensive Monitoring Plan[2]. This document will be updated as monitoring and data analysis methods are improved and refined.

PWD performs a variety of additional monitoring activities specifically related to GSI.

- Simulated runoff testing (SRT)
- Surface infiltration rate testing (SIRT)
- Capture efficiency testing (CET)

2. Short-Term Monitoring Goals

2.1 Short-Term Deployment Cycle Length

During the first five years of the program, GSI monitoring was oriented towards performance monitoring of a small subset of the constructed GSI, using a variety of observation and testing methods as described in the Green City, Clean Waters Comprehensive Monitoring Plan[2]. Monitoring performed using the previous methods involved installing a water level sensor within an observation well or shallow well in an SMP and collecting data at five-minute intervals.

Performance analysis conducted as part of the Green City, Clean Waters Evaluation and Adaptation Program[3] plan revealed that capturing a design storm of at least one inch of rainfall could supply enough data to demonstrate system function. Given a sensor data storage amount of 75 days, and the typical Philadelphia rainfall record, a two-month deployment period (or deployment until at least a one-inch

[1] The Philadelphia Water Department. 2009. *The City of Philadelphia's Program for Combined Sewer Overflow Control.*
[2] The Philadelphia Water Department. 2014. *Green City, Clean Waters Comprehensive Monitoring Plan: City of Philadelphia Combined Sewer Overflow Control Long Term Control Plan Update.*
[3] The Philadelphia Water Department. 2012. *Green City, Clean Waters Evaluation and Adaptation Plan: City of Philadelphia Combined Sewer Overflow Control Long Term Control Plan Update.*

rainfall event has occurred), was recommended and officially implemented by the MARS program team in December 2016, outlined in the memo: MARS Program: The Future of Monitoring.

Beginning in December 2017, the MARS group piloted the use of a longer data logging interval to reduce data collection frequency and increase the number of active monitoring sites. Water level and barometric compensation sensors were deployed at 15-minute intervals in tandem with five-minute intervals at eight monitoring sites for approximately three 60-day deployment cycles. After data processing, analysis, and interpretation were conducted on the subsequent data sets, it was determined that no statistically significant difference existed between SMP performance metrics (See Section 2.2) determined using either collection interval. In August 2018, the MARS program team officially adopted the 15-minute data collection interval for all succeeding short-term deployments.

2.2 Performance Metrics

CWL monitoring enables MARS to monitor the following performance metrics:

- **Water level response**: The water level increase in the system in response to precipitation events.
- **Drain-down duration:** The drain-down duration is the length of time it takes a system to drain water from the storage volume. It is assessed using largest observed event of the short-term monitoring period.
- **Recession rate**: The recession rate is the rate of water level decline in the bottom six inches of storage of the system during the drain-down duration period, as observed from the recession limb of the hydrograph.
- **Overflow**: Overflow occurs when a system is filled, and storm water bypasses the GSI and flows into the sewer.
- **Loss of infiltration capacity**: Determined through the apparent loss of infiltration capacity of the soils surrounding the system, evaluated for the 0 to 6-inch hydraulic head portion of the recession limb of the hydrograph.
- **Surface infiltration rate:** The rate at which water infiltrates through porous pavement, soil, or other media.
- **Capture efficiency:** The efficiency of an inlet or other inflow structure. Qualitative assessment of the amount of water captured during natural or synthetic storms of varying intensity.
- **Drainage area discrepancy:** The drainage area discrepancy is the difference between the as-built drainage area and the field-estimated drainage area based on observations during a wet-weather event.
- **GSI short-circuit**: Instances where water is conveyed via unintentional, preferential flow paths into the combined sewer system (CSS) observed during SRTs.

Each performance criterion is described in more detail in Table 2-1, showing which performance metric can be evaluated using the different performance tests. A green “x” indicates that the test method will inform the performance metric, while a yellow “?” signifies uncertainty. For example, CWL monitoring could show water ponding within the surface but not the subsurface, which may indicate the inflow structure is impaired or that the infiltration rates of the subsurface system are much higher than the rates used during design.

Table 2-1 Monitoring Methods and Performance Metrics Matrix

Monitoring Method/ Performance Metric	Routine CWL Monitoring	Simulated Runoff Test	Capture Efficiency Test	Wet Weather Inspection	Surface Infiltration Test (Porous and Soil)
Water Level Response	x	x			
Drain-down Duration	x	x			
Recession Rate	x	x			
Overflow	x	x		?	
Loss of Infiltration Capacity	x	x			x
Surface Infiltration Rate	x	x			x
Capture Efficiency (Inlet or Curb Cut)	?	x	x	x	
Capture Efficiency (Domed Riser)	?	x		?	
Drainage area Discrepancy		?		?	
Clogging of subsurface	x	x			
GSI Short Circuit into Gray		x			

2.3 Deployment Cycle Overview

The typical short-term deployment cycle includes the following steps:

1) Collect CWL data for one routine 225-day deployment period.
2) Perform an SRT if criteria for the performance metrics are not met with the collection of routine CWL monitoring data and uncertainty remains regarding the factor(s) contributing to low performance (see Table 2-1).
3) After analysis of SRT data (see Quality Assurance & Quality Control (QAQC) SOP), assess the application of additional monitoring methods (dye testing or other specialized tasks).
4) Convene with PWD staff members of the Retrofit Evaluation Team (RET) and consider an action plan for the SMP through the RET Decision Process.
5) Collect CWL data for an additional deployment cycle after actions determined via the RET Decision Process have been implemented.

3. Long-Term Monitoring Goals

Long-term monitoring sites are monitored over the timespan of the Green City, Clean Waters Program to monitor and assess long-term performance of different types of SMPs. The basis of site selections is to ensure representation for SMPs of various types, design parameters, and city districts.

The continuous monitoring of 21 long-term systems, shown in Table 3-1, is assessed every 12 months using the following methods:

- CWL monitoring and data analysis for performance metrics in Table 2-1
- CET of inflow structures

Table 3-1 Current Long-Term Monitoring Sites

SMP ID	Site Name	Description
326-1	**Front St & Wharton St**	Tree Trench (1)
20-8	**Bureau of Laboratory Services (BLS)**	Infiltration/Storage Trench (1)
88-1	**Trenton Ave and Norris St**	Infiltration/Storage Trench (1) & Rain Garden (1)
231-2	**Universal Daroff Charter School**	Tree Trench (1), Planter (1) & Bumpout (1)
9-1	**Shissler Playground (Palmer St)**	Tree Trench (1)
9-2	**Shissler Playground (Palmer St)**	Tree Trench (1)
8-1-1	**Shissler Playground (Montgomery Ave)**	Tree Trench (1)
179-5	**Hill Freedman World Academy (former Morris Leeds Middle School)**	Tree Trench (1)
1-1	**John F. Hartranft School**	Tree Trench (1)
1-2	**John F. Hartranft School**	Tree Trench (1)

SMP ID	Site Name	Description
1-3	**John F. Hartranft School**	Tree Trench (1)
187-3	**Columbus Square Park**	Infiltration/Storage Trench (1) & Planter (2)
12-5	**William W. Bodine High School for International Affairs**	Tree Trench (1)
366-2	**The Philadelphia Zoo**	Infiltration/Storage Trench (1) & Rain Garden (1)
271-1	**Bridesburg Recreation Center**	Infiltration/Storage Trench (1) & Rain Garden (1)
274-4	**Roosevelt Playground**	Infiltration/Storage Trench (1) & Planter (4)
398-1	**St. James Episcopal Church of Kingsessing**	Tree Trench (1)
19-5-1	**Barry Playground**	Tree Trench (1)
250-1	**Belmont Charter School**	Tree Trench (1)
250-2	**Belmont Charter School**	Tree Trench (1)
250-3	**Belmont Charter School**	Tree Trench (1)

4. CWL Monitoring Procedure Overview

The short-term and long-term CWL monitoring procedure includes the following steps:

1) Office tasks and preparation
2) Sensor installation and field procedures
3) Record keeping
4) Data processing
5) Data analysis & interpretation
6) Reporting

This SOP covers activities related to steps 1-3 in addition to health, safety, and public relations information. Whereas the succeeding steps for short-term and long-term monitoring procedures are largely the same, data analysis differences are explained in more detail in the QAQC SOP.

A typical workflow of the CWL monitoring procedure is summarized below:

1) Compile a list of potential monitoring sites from the Current Monitoring Sites matrix. For planning purposes, it's good practice to create a field visit schedule on a weekly basis. For each day, attempt to select a subset of sites in the same area of the city to reduce the amount of travel time.
2) Install water level sensors at selected systems for one routine 225-day deployment period.
3) Return to site, download data, and redeploy or remove sensors.
4) Transfer collected data files to the MARS server.
5) Perform QAQC procedure on raw data.
6) Analyze the largest rainfall event and flag each system for anomalous performance parameters as necessary.
7) If any of the metrics are not met, perform an SRT on the system. If the SRT results show poor performance, perform further testing (dye tests, etc.) and relay the results to the RET for a final decision.
8) If a system needs modification, remove sensors, and re-monitor for another deployment cycle after modifications or repairs are made.

5. Preparation, Site Installation, and Monitoring Procedures

5.1 Office Tasks and Preparation

5.1.1 Observation and Shallow Well

5.1.1.1 Site Selection

Before performing monitoring activities on site, the following tasks need to be completed:

1) Select a group of SMPs that have not been monitored or are flagged for redeployment.
2) Group SMPs by geographic area. Plan daily field visits based on geographic area to enhance efficiency when possible.
3) Determine if a long-term barometric compensation sensor exists in the vicinity. This is achieved using an ArcGIS map document and geoprocessing tools.
    a. Open the Barometric Sensor Map file.
    b. In the Table of Contents (TOC), locate the *Complete SMP Layer*. Right-click and select "Open Attribute Table".
    c. In the Attribute Table, select the "Select by Attributes" button. Apply the following Structured Query Language (SQL) statement: `"Baro" <> ''`
    d. Navigate to the geoprocessing drop-down menu. Select the "Buffer" geoprocessing tool.

e. Provide inputs to the Buffer geoprocessing tool window with the Output Feature Class (Figure 5-1).

f. The new buffer layer generated by the buffer tool should now appear in the TOC. Click

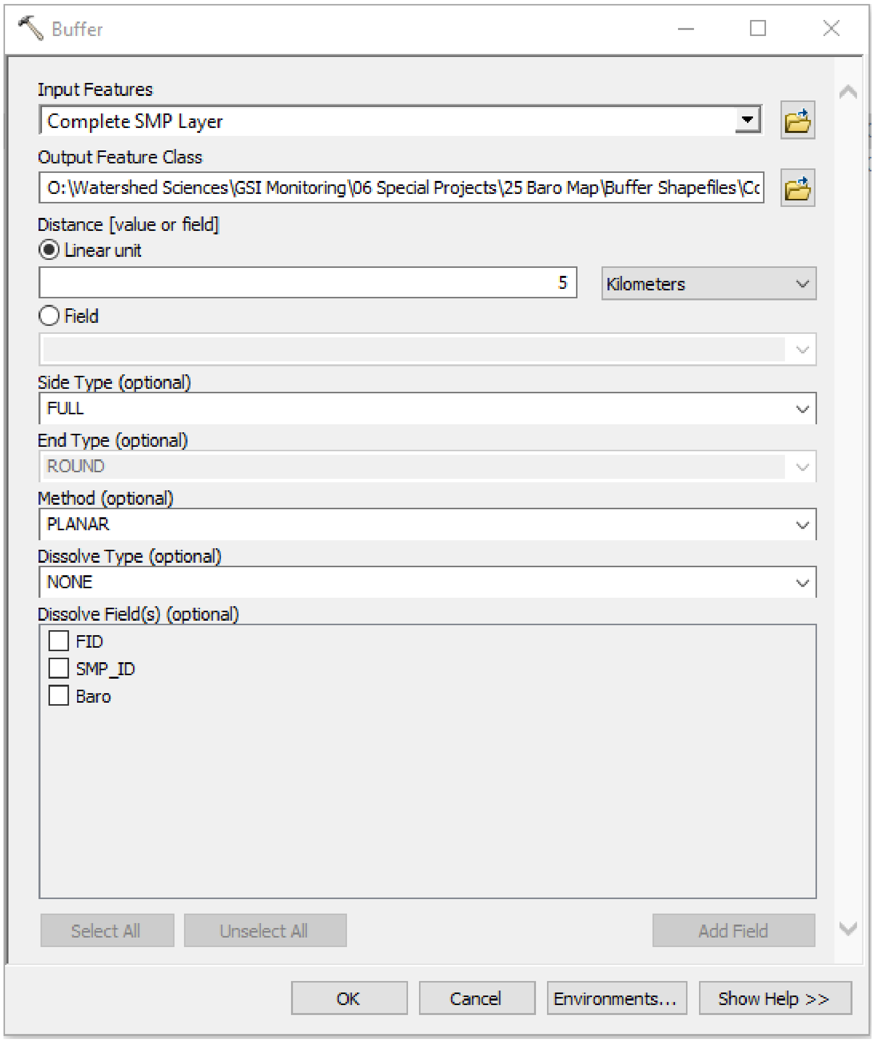


Figure 5-1 – Buffer Geoprocessing Tool

and drag the new buffer layer below the Complete SMP Layer.

g. Return to the Attribute Table of the *Complete SMP Layer*, select the "Select by Attributes" button and apply the following SQL Query statement: `"SMP_ID" =` **`'[SMPID]'`**. For example, `"SMP_ID" = '179-5-1'`.

h. Close the "Select by Attributes" window.

i. Shift the Attribute Table view to "Show selected records" and select the "Zoom to Selected" button.

j. If the *Complete SMP Layer* record for the selected SMP overlaps with the new buffer layer, then a barometric compensation sensor exists within the acceptable range. Otherwise, plan to install a new barometric compensation sensor at the selected SMP.

4) If installing a new barometric compensation sensor at a long-term site, update the Complete SMP Layer to reflect this addition.
    a. Locate the *Complete SMP Layer* in the TOC. Right-click and select "Edit Features" > "Start Editing". Right-click again and select "Open Attribute Table".
    b. Select the "Select by Attributes" button. Apply the following SQL query statement: `"SMP_ID" = '`**`[SMPID]`**`'`, where **`[SMPID]`** is the SMP ID for the new barometric sensor. For example, `"SMP_ID" = '179-5-1'`.
    c. Shift the Attribute Table view to "Show selected records".
    d. In the "Baro" attribute field, update the record with the monitoring location of the new barometric sensor (ex. "OW1", "CO1", "GW1", etc.).
    e. In the Editor toolbar drop-down menu, select "Save Edits", then "Stop Editing".

5.1.1.2 Preparation

1) Create a project directory for each system on the daily field visit schedule. Use the project and system folder template to create the requisite files. Populate the files with system metrics (project number, name, etc.) where appropriate.
2) Collect plan sets (as-builts, if available) from the Green Infrastructure projects drive and maintenance maps. Save the plan(s) in the 'Supplementary Documents' folder for the respective site on the MARS drive.
3) Determine if "No Parking" signs are needed to access the site. If signs are needed, put them up at least 24 hours prior to arriving to the site.
4) Plan route to monitoring sites by creating a route map and a list of all systems to be visited. Print maps and directions or save to the field laptop, if necessary.
5) Contact site representative and inform them of your estimated time of arrival (ETA), if necessary. This step typically applies to sites with private access.
6) Create a folder on the laptop for the daily field visit schedule. Transfer plan sets, maintenance maps, and a copy of the Current Monitoring Sites spreadsheet into this folder.
7) Synchronize laptop and camera clocks with Eastern Standard Time (EST). **Make sure the laptop time is not corrected for daylight saving time; it should be in standard time**, as the sensors are deployed using the time on the field laptop.
8) Check batteries in all equipment; verify SD storage card is in camera.
9) Review equipment checklist and ensure all equipment is available and in good condition.

5.1.1.3 Equipment Checklist

Equipment is organized in two separate lists. Sensitive electronic equipment should be stored separately from hand tools.

1) "Clean Bag"
    - Laptop with HOBOware software
    - Onset HOBO optical USB shuttle and USB cable
    - Onset HOBO couplers (U20L and U20)

- Backup Onset HOBO Data Loggers (8 total; 4 Hobo U20-L and 4 U20)
- Plan sets, maintenance maps, and Current Monitoring Site spreadsheet files
- Digital camera with SD card
- Informational resources for residents

2) “Tool Bag”
    - First aid kit
    - Water level meter with extra battery
    - Personal protective equipment (PPE)
        - Safety vest or high-visibility shirt
        - Eye protection
        - Work gloves
        - Protective footwear (safety-toe boots, high rain boots, waders, etc.)
    - Traffic cones
    - Flashlight
    - Soil core sampler (if installing shallow well)
    - Toolbox
        - Ruler or solid metal bar for horizontal reference measuring point
        - Steel tape measure (preferably in feet, with 1/10 and 1/100ths of a foot)
        - Key(s) for storage shed, well access, control structure, etc.
        - Ratchet and full socket set
        - Hammer
        - Small pry bar or chisel
        - 2 flathead screwdrivers
        - Stainless steel cable (1/16" diameter)
        - Wire cutter and crimping tool
        - Carabiners or D-rings
        - Stainless steel crimps/ferrules
        - Work gloves
        - Shop rags
        - Bottle brush or pipe cleaners
        - Vinegar
        - Rag
        - Duct tape
        - Eye-bolts
        - Various sized zip ties
        - Pliers
        - WD-40
        - PVC cap wrench
        - Drill with full bit set

5.1.2 Groundwater Well

5.1.2.1 Site Selection

1) When arriving on site, make sure to park in accordance with City of Philadelphia parking laws.
2) Inspect the site for any unusual conditions and establish appropriate safety measures such as cones or pedestrian barriers.
3) Ensure all field crew members are wearing the appropriate PPE.
4) Coordinate with GSI design and consultant to determine the best location for groundwater well(s). If located at a park or recreation center, coordinate with PPR.
5) Permanent groundwater wells should be located about 10 feet from the basin edge, so they are not damaged during construction. Temporary wells can go in the footprint of the basin as needed.
6) For a large site (1 city block), more than one groundwater well (most often two wells) should be installed.
7) Ensure the contractor is familiar with the process and possesses the most up-to-date site information and well construction details.
8) Wells are monitored for 1 year and the data is shared with GSI contact as data is collected and quality-assured. The complete data set is shared at the end of the year.

5.2 Sensor Installation and Field Procedures

5.2.1 Observation and Shallow Well

5.2.1.1 General

1) When arriving on site, make sure to park in accordance with City of Philadelphia parking laws.
2) If there is a vehicle obstructing access where “No Parking” signs were put up, you can contact the towing service and indicate that you are with PWD requesting a vehicle be relocated. Provide an exact address or nearest intersection and be on site to direct the tow truck.
3) Inspect the site for any unusual conditions and establish appropriate safety measures such as cones or pedestrian barriers.
4) Ensure all field personnel are wearing the appropriate PPE.
5) Check that the distribution pipe does not have a cap on the end. If the distribution pipe is not visible from street level or you are unsure if a cap exists, fill the basin with water using the CET tank. Open the nearest clean out to the distribution pipe and see if it is dry. If the basin holds water and the clean out is dry, then the distribution pipe is likely plugged, and the SMP is offline.

Figure 5-2 – Example of Distribution Pipe Plug

6) Check that the underdrain pipe has a cap on the end. If the design calls for an orifice on the PVC cap, check if a small hole is visible. Take a photo and save it in the site folder under “Supplementary Documents”.
7) Perform a capture efficiency test (CET). Refer to the CET SOP for details.

5.2.1.2 Observation Well Sensor Installation Field Procedure

1) Remove observation well cap (Figure 5-6) or otherwise gain access to the monitoring location.
2) Drill a hole into the inside of the PVC that will accommodate available eye hooks.
3) Affix an eye-hook to the hole, then attach a carabiner or zip tie loop to the eye-hook.
4) Using a steel measuring tape, measure the distance from the top of the well casing to the bottom of the well (well depth, Figure 5-6). Note this value in the field notebook.
5) Attach the cable to the sensor cap using to the stainless-steel cable. This can be achieved by using two zip ties and duct tape (short-term monitoring sites) or using metal crimps (long-term sites, groundwater observation wells, or where well depth exceeds 10 feet) (Figure 5-3).

Figure 5-3 – Sensor and stainless-steel cable attachment

NOTE: Use intuition and personal discretion to decide whether to use metal crimps and carabiners versus zip ties. Some situations may require more secure cable fashioning.

6) Gently lower the sensor into the well. When the sensor is just above the bottom of the well, mark where the eye hook, carabiner, or zip tie loop lines up with the cable.
7) Pull the cable and sensor out of the well. Fold the cable over the mark and through the eye-hook, carabiner or zip tie loop, forming a loop in the cable.
8) Close the loop with metal crimps or zip ties. Secure any extra cable with duct tape (Figure 5-4).

Figure 5-4 – Sensor and stainless-steel cable attachment

9) Use steel measuring tape to measure from the sensor's pressure sensor port (the part that sits deeper in the well, i.e. opposite side from the cap) to the top of the steel cable (referred to as hook to sensor, or HTS). Then use the steel tape to measure from the top of the well casing (lay a flat object across the top and measure from there) to the top of the steel cable (referred to as cap to hook, or CTH) (Figure 5-5). Note these values in the field notebook.

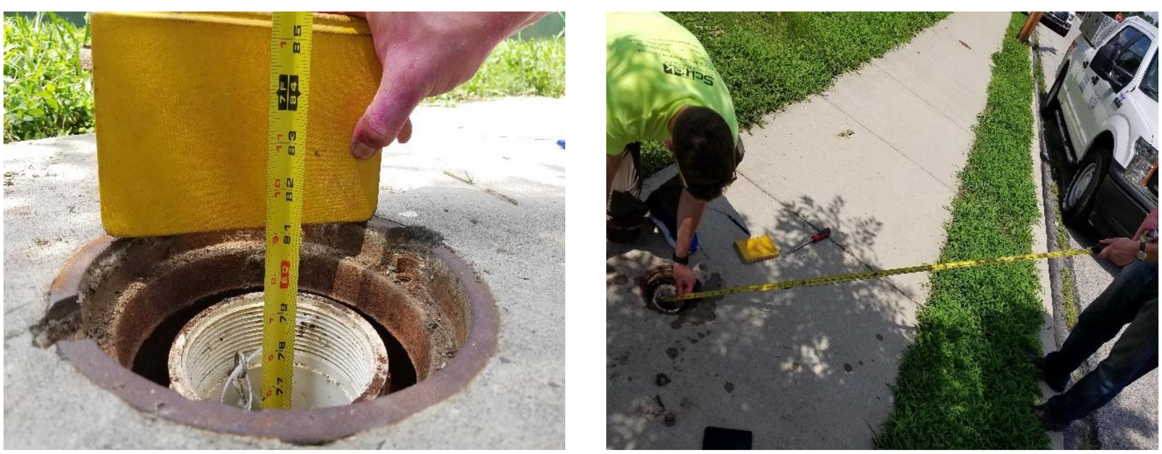


Figure 5-5 – CTH (left) and HTS (right) measurement techniques

10) Wipe the sensor clean using a cloth and distilled white vinegar. Inspect the pressure sensor port for any debris. Carefully clean the port with a bottle brush or pipe cleaner dipped in vinegar.
11) Proceed to Section 5.2.1.4.

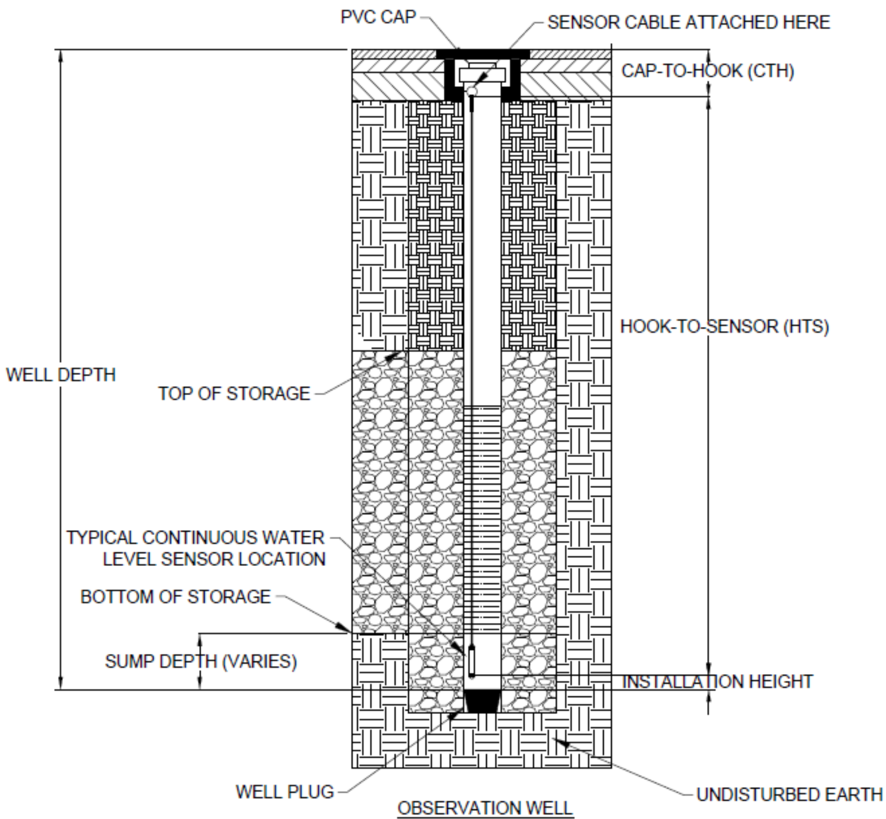


Figure 5-6 - Observation Well

5.2.1.3 Shallow Well Installation Field Procedure

1) Using the soil core sampler, dig a hole in the ground approximately the diameter of the shallow well and depth of the solid portion of the well screen (Figure 5-).
2) Insert PVC shallow well so the holes on the side of the PVC are just above the dirt.
3) Hammer rebar into the ground to the same depth as the well (Figure 5-).
4) Using large zip ties, attach the well to the rebar.
5) Replace any dirt from the hole around the PVC, stopping at the holes on the side.
6) Tamp the disturbed soil around the well.
7) Remove the cap from the well and proceed to Section 5.2.1.4.
8) Before placing sensor in well, insert a bolt or zip tie through the lower hole (closest to the ground level) for the sensor to rest on (Figure 5-).
9) Replace the PVC cap. Ensure the cap is attached snugly, but still easily removable.
10) Take a photograph of the shallow well location with identifying site features such as trees, road signs, inlets, or other objects to facilitate location of well during the next site visit.

Figure 5-7 – Using soil core sampler (left) to dig shallow well hole (right)

Figure 5-8 – Shallow Well & Rebar Alignment

Figure 5-9 - Zip tie used as sensor perch

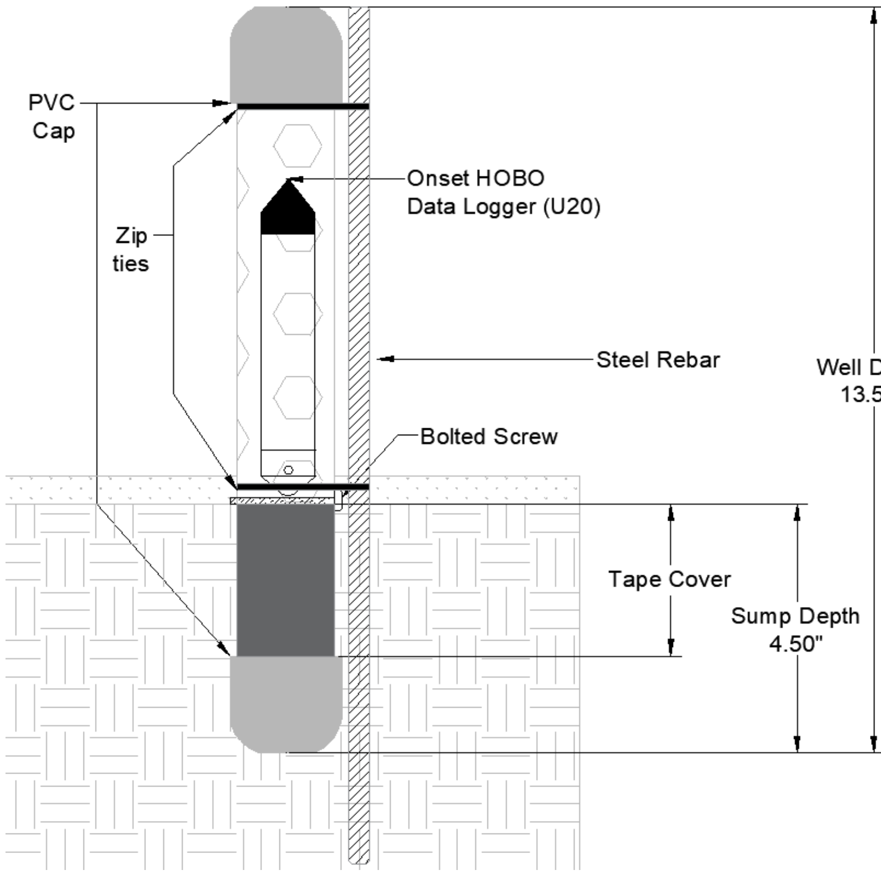


Figure 5-7 – Shallow Well

5.2.1.4 Water Level Sensor Deployment

Note for deployments at new sites: do not download old data from the sensor when deploying the sensor to a new location. Data from another sensor deployment and site that has already been logged creates duplicate data files. Please only download data from sensors as part of the data collection as outlined below. There is an exception to this, however: when launching, a warning may appear stating that the sensor has not yet been read out. If this occurs, click "No" to cancel the launch setup, download the data currently on the sensor, and launch as planned. Otherwise, the data currently on the sensor will be permanently erased.

1) Prior to beginning field activities, make an entry in the field notebook. Each site visit should include the site name, site SMP ID, date visited, field procedure(s), and initials of field crew members present. Create column headers for the monitoring location, type of sensor, sensor serial number (SN), depth to water (observation well) or water depth (shallow well) reading, time of reading and redeployment confirmation (Figure 5-11).

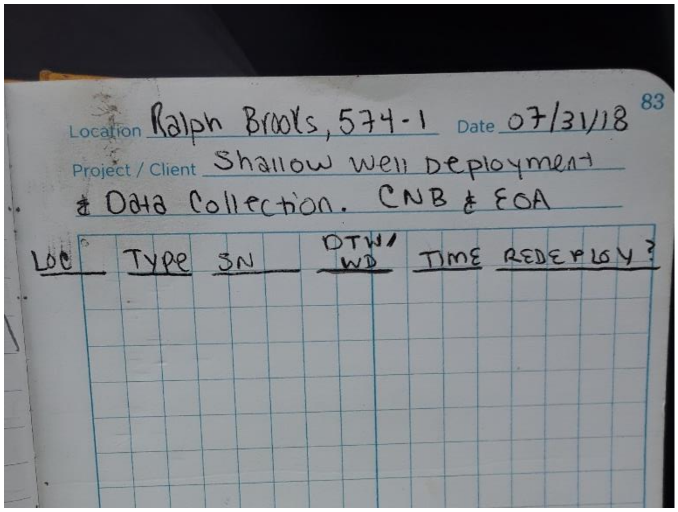


Figure 5-8 – Field Notebook Layout

2) Gain access to the monitoring location, such as an observation well, PVC shallow well, overflow control structure, etc. If deploying for the first time to an observation well, refer to Section 5.2.1.2. If deploying for the first time to a shallow well, refer to Section 5.2.1.3. If site is listed as a barometric site, refer to Section 5.2.1.5.
3) If you're not deploying for the first time, take a manual water level reading just before removing the water level sensor, and record the depth to water (or, in the case of shallow wells, water depth, using a tape measure), time, units, and measurement device (for example, Sensor ID 6082 "Water Mark Electric 75' Water Tape") in the field notebook. Refer to Section 5.2.1.6.
4) If redeploying a sensor, remove the sensor from the well. Wipe the sensor clean using a cloth and distilled white vinegar. Inspect the pressure sensor port for any debris. Carefully clean the port with a bottle brush or pipe cleaner dipped in vinegar.
5) Start HOBOware Pro software.
6) Disconnect the sensor body from its plastic cap and connect the sensor to the optical USB shuttle. Record the optical USB shuttle SN. Align the flat threading on U20 sensor with "flat" arrow on the U20 coupler or align the notch on the U20L sensor body with the "align" arrow on the U20L coupler.
7) Connect optical USB shuttle to laptop USB port.
8) Verify the sensor's serial number in lower left-hand corner of HOBOware interface.
9) Check device status (Device > Status). Verify system time is accurate and the battery level is above 3.1 volts; if battery reading is lower, replace the sensor after downloading the data. Verify that the system states "Coupler Attached" and the percentage of storage used does not fluctuate (this indicates that the sensor has a stable connection with the optical USB shuttle). If the connection seems unstable, there are a few possible causes and solutions to these issues, namely:
    a. <u>Issue</u>: Moisture and/or debris on sensor or the optical USB shuttle connections
       <u>Solution</u>: Wipe off moisture and/or debris using a soft cloth or paper towel
    b. <u>Issue</u>: The coupler on the optical USB shuttle is too loose
       <u>Solution</u>: Tighten the coupler to the shuttle

c. Issue: Direct sunlight on the optical USB shuttle disrupting communication
Solution: Cover the sensor and shuttle or move to a shaded area
d. Issue: The cable for the optical USB shuttle is crimped or damaged.
Solution: Gently straighten out the cable and check that it is fully inserted in the computer's USB port, or use a different optical USB shuttle.

10) If redeploying a sensor, download the data (Device > Readout).
11) If prompted that sensor is still logging data, select "Stop".
12) Save the data files. Create new folder for the current day and initials, i.e. **20141114_NM**. Then save as **[SMP_ID]_[Sensor_ID]_[Monitoring Device ID].hobo** in the folder. For example, **187-3-3_OW1_9951601.hobo**
13) Plot sensor data and events in HOBOware. Inspect the plot for expected patterns (Remember - these are uncorrected data subject to atmospheric pressure fluctuation). Sudden spikes and severe oscillation of pressure readings could indicate malfunctions and should be investigated before redeployment. If necessary, replace the existing sensor with a new sensor.
14) Default HOBOware settings should be set to create a CSV file in addition to the HOBO file. Otherwise, export the data as a CSV (File > Export as CSV file). Save using the naming convention from Step 12 and in the same folder. For example, **187-3-3_OW1_9951601.csv**
15) Use a flashlight, or sound the bottom of the well if possible, to determine if there is debris accumulation. If debris is present, record this information in the field notebook.
16) Launch the sensor (Device > Launch) with a 15-minute logging interval (recorded "At interval") recording absolute pressure (psi) and temperature (F°). Name the deployment **[SMP_ID]_[Sensor_ID]_[Monitoring Device ID]**. For example, **187-3-3_9951601_OW1**. If you are not sure if the launch was successful, check device status (Device > Status). The display should read "Device Launched", "Interval: 15 min" and "Awaiting Delayed Start".
    a. NOTE: It is imperative that all sensors are recording at the same time interval. For example: Both sensors recorded a data point for the time 12:00:00 AM, not one at 12:00:00 and the other at 12:01:30. To avoid this conflict, always launch at interval, using EST, and make sure the interval is set to 15-minute.
17) Reinstall the sensor in the well by slowly lowering the sensor. Avoid any obstructions such as rebar that may be present within the well. The sensor should be hanging freely (for example, not resting on the bottom of the well) and there should be no cable slack when the sensor is properly deployed.
18) Reinstall the well cap, ensuring well cap is vented to the atmosphere to allow for proper barometric pressure compensation.

5.2.1.5 Barometric Pressure Deployment

Barometric pressure monitoring is conducted using similar equipment and monitoring procedures to those described in Section 5.2.1.4, with the exception that no water level readings are necessary for barometric pressure monitoring.

1) If deploying for the first time, find a location at the highest possible elevation in the monitoring location. For example, attached to the carabiner or D-ring with the pressure sensor port facing up (Figure 5-12).
2) Refer to Section 5.2.1.4.
    a. For steps 13-15, save monitoring device ID files for local barometric pressure compensation sensors as **[SMP_ID]_[Sensor_ID]_BARO_[Monitoring Device ID].[extension].** For example, **187-3-3_9951601_BARO_OW1.hobo** or **187-3-3_9951601_BARO_OW1.csv**
3) Reinstall the well cap, ensuring ventilation to the atmosphere to allow for proper barometric pressure compensation.

Figure 5-9 – Acceptable Barometric Sensor Locations

5.2.1.6 Water Level Measurement

Manual water level readings should be taken with the sensor installed in the well. Water level readings are either taken as depth-to-water or water depth, for observation wells and shallow wells, respectively. For new deployments, take a water level reading after the sensor is first deployed. When visiting existing sites, record a level reading just before removing the sensor. Record this information in the field notebook.

Depth-to-Water Measurement with Water Level Meter

1) Refer to the monitoring device information to determine the vertical reference elevation for water level readings (for example, well cap, overflow control structure grate, etc.). The vertical reference elevation should be a level surface. Watch for uneven pavement or debris.
2) Place a vertical reference object (for example, ruler or solid metal bar) across the opening of the vertical reference. The horizontal reference should be placed perpendicular to curb line of nearest street if possible.
3) Measure depth-to-water at the center of the opening (Figure 5-10).
4) Repeat the measurement, adjusting the sensitivity of the instrument as required, to determine the exact distance to the air/water interface in 1/100 of a foot.

5) Record the monitoring device ID, water level, time, units, and measurement device (for example, water level meter) in the field notebook.

Figure 5-10 – Observation Well Depth-to-Water Measurement

Water Depth Measurement with Steel Measuring Tape

1) Access the shallow well location using PPE for wading in standing water (for example, high rain boots or waders). Proceed with caution when stepping in murky waters where the bottom is not visible. Attempt to limit disturbance to the water surface, if possible.
2) Once water surface has settled, insert the steel measuring tape into the water until it reaches the bottom directly adjacent to the shallow well.
3) Measure water depth at the water surface interface.
4) Record the monitoring device ID, water level, time, units, and measurement device (for example, water level meter) in the field notebook.

5.2.2 Groundwater Well

5.2.2.1 General

Refer to steps 1-4 of Section 5.1.2.1

5.2.2.2 Groundwater Well Installation Field Procedure

Prior to installing sensors within groundwater wells, ensure that you are using sensors calibrated for a depth range of 0 – 30 feet, and not 0 – 13 feet.

1) Remove the groundwater well cap (Figure 5-6) or otherwise gain access to the monitoring location.
2) Remove expansion plug from PVC well and drill a hole through it to prevent pressure buildup within the well.
3) Using a steel measuring tape, measure the distance from the top of the well casing to the bottom of the well (well depth, Figure 5-6). Note this value in the field notebook. If the well depth exceeds the measuring tape's maximum length of 25 feet, use the water level meter instead.
4) Attach a braided stainless steel cable to the sensor cap. This can be achieved by using two zip ties and duct tape (short-term monitoring sites) or metal crimps (long-term sites, groundwater wells, or where well depth exceeds 10 feet). Refer to Figure 5-3 in section 5.2.1.

NOTE: Use intuition and personal discretion to decide whether to use metal crimps and carabiners versus zip ties. Some situations may require more secure cable fashioning.

5) *Measure the distance from the top of the PVC to the bottom of the well. This measurement will be used to determine the length of cable required.*
6) *Using a procedure similar to that in step 4, affix the stainless steel cable to the bottom hole in the PVC expansion plug. Adjust the length so that the distance from the bottom of the expansion plug gasket to the top of the sensor port is 3-6 inches shorter than the measurement recorded in step 5. Measure this length and record it in the field book as the "hook to sensor" length.*
7) Secure the cable with metal crimps or zip ties. Secure any extra cable with duct tape (Figure 5-4).

Figure 5-14 – Surface view of groundwater well

8) Measure the distance from the top of the well casing to the top of the PVC. Record this measurement as the “cap to hook” length.
9) Wipe the sensor clean using a cloth and distilled white vinegar. Inspect the pressure sensor port for any debris. Carefully clean the port with a bottle brush or pipe cleaner dipped in vinegar.
10) Gently lower the sensor into the well, and firmly place the expansion plug in the PVC well. Close the well when finished.

5.2.2.3 Water Level Sensor Deployment

Refer to Section 5.2.1.4

5.2.2.4 Water Level Measurement

Refer to Section 5.2.1.6

6. Record Keeping

To ensure the integrity of records for field activities, it’s imperative that reporting procedures are followed as stated in this SOP. For CWL monitoring field activities, there are two main reporting locations, including the Current Monitoring Field Forms hosted within the GSI Monitoring Resources Microsoft (MS) Access database and the Current Monitoring Sites MS Excel spreadsheet. A third reporting location is the GSO Coordination MS Excel spreadsheet. Finally, create a monitoring location map showing the location of all monitoring equipment. Below are the necessary steps for entering field activity information into the respective locations. This record keeping procedure apply to observation, shallow, and groundwater wells.

6.1 Current Monitoring Field Forms – MS Access

1) Navigate to the GSI Monitoring Resources Tracking database (see link above).
2) Locate and open the “CM_FieldForm” form in the Navigation Pane on the left side of the screen.
3) Complete the field form entries, one for each sensor deployed (see example - Figure 6-1).
4) To check for rainfall within the past 24 hours, go to the PWD Flow Control Home website, and under “Monitoring Maintenance”, click “Rain Gauge Thiessen Map”. Locate the rain gauge that is closest to the site in question. Go back to “Monitoring Maintenance” and click “Rainfall Calendar”. From the dropdown menu, select the closest rain gauge. This will provide a calendar of total rainfall for each calendar day. If rainfall fell the day before at a depth greater than 0.1 inches, check the “Rain Within 24 hours?” box.

5) Save and close the GSI Monitoring Resources MS Access database.

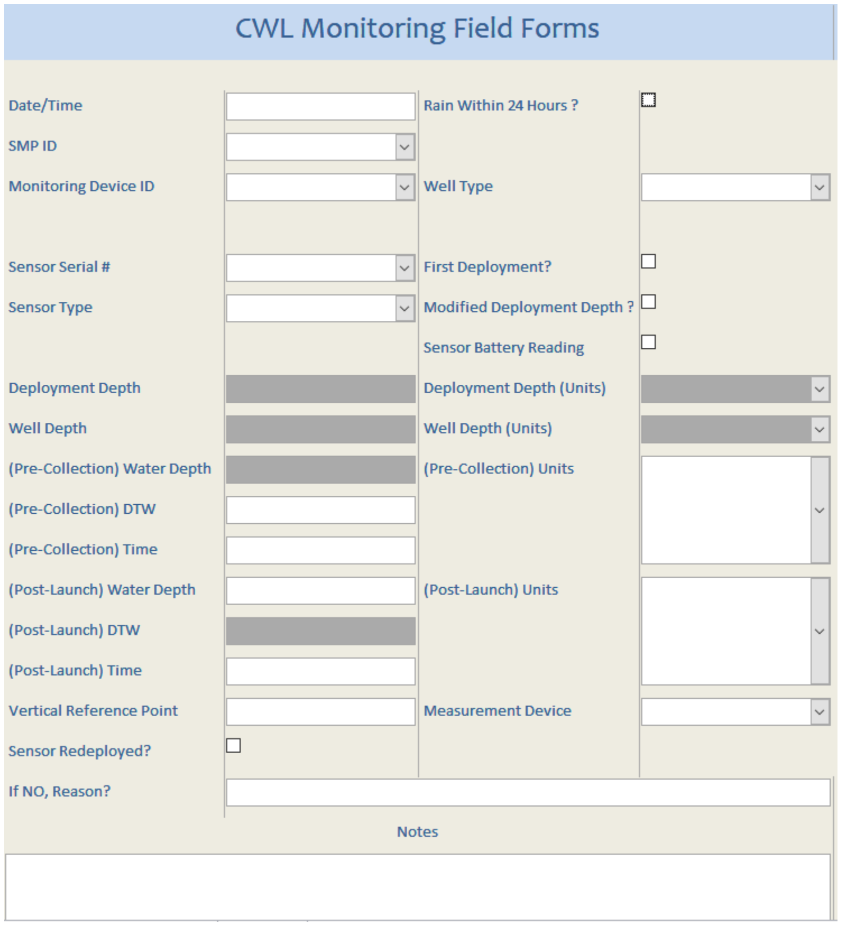


Figure 6-1 – MS Access CM_FieldForm Example

6.2 Current Monitoring Sites – MS Excel

Before updating records, navigate to the file location of the Current Monitoring Sites spreadsheet (see link above), copy the file into the “archive” folder and rename it as **Current Monitoring Sites_[YYYYMMDD].xlsx**

6.2.1 Short-Term Monitoring Sites

1) Return to the file location of the Current Monitoring Sites spreadsheet and open the file. Select the “Short-term deployed” tab.
2) For new installations, create a new row entry for each sensor installed during the field visit (water level and barometric compensation sensors).
3) Complete entries for the column headers listed below. Descriptions of each column are provided for clarity, if need be.
    - SMP ID - Unique identifier for SMP, written as **[SITE ID]_[SYSTEM ID]_[SMP ID]**. This information can be found on the GreenIT project page or the Site Maintenance Map.
    - Site Name

- SMP Type - The type of GSI system being monitored. (ex. Tree Trench, Infiltration Trench, Rain Garden). This information can be found on the GreenIT project page or the Site Maintenance Map.
- Monitoring Location - Abbreviated description of the sensor location (ex. OW1, GW1, CO1).
- Sensor SN - Unique identifier for each sensor found on the side of the sensor body.
- Sensor Type - Abbreviated description of the type of data being logged.
    - BARO – Barometric compensation
    - LEVEL – Water level
    - RG – Rain gauge
- Well Depth (ft) – Depth of monitoring location, measured in feet.
- Cap to Hook (ft) – Distance from the top of the well to the point of the hook that contacts the carabineer or zip tie, measured in feet.
- Hook to Sensor (ft) – Distance from the top of the hole in the sensor opposite the cap (the part that sits deeper in the well) to point where the carabineer or zip tie contacts the hook, measured in feet.
- Installation Height (ft) – Distance from the bottom of the monitoring location to the top of the hole in the sensor opposite the cap, measured in feet.
- Initial Water Level (ft) – Either the depth-to-water or water depth, depending on the type of monitoring location, measured in feet.
- Water Level Time – Time of depth-to-water or water level reading.
- 1st Deploy Date - The date the sensor was initially deployed at the SMP.
- Current Deploy Date - The most recent date the sensor was deployed at the SMP. *NOTE: For recurring deployment cycles, only the "Current Deployment Date" needs to be updated with every record entry.*
- Sensor Removed – The date sensor was removed, if applicable.

6) Use the MS Excel auto-fill tool to generate dates for the "Download Data" and "Data Full" columns, representing the ideal collection date and the date the sensor memory will be full, respectively.
7) Locate the "Last Edit Date" & "Last Editor" cells (top-left) and update the entries.
8) Save and close the spreadsheet.

6.2.2 *Long-Term Monitoring Sites*

1) Return to the file location of the Current Monitoring Sites spreadsheet and open the spreadsheet. Select the "Long-term deployments" tab.
2) For new installations, create a new row entry for each sensor installed during the field visit (water level and barometric compensation sensors).
3) Complete entries for the column headers listed below. Descriptions of each column are provided for clarity, if need be.
    - SMP ID - Unique identifier for SMP, written as **[SITE ID]_[SYSTEM ID]_[SMP ID]**. This information can be found on the GreenIT project page or the Site Maintenance Map.

- Site Name
- SMP Type - The type of GSI system being monitored. (ex. Tree Trench, Infiltration Trench, Rain Garden). This information can be found on the GreenIT project page or the Site Maintenance Map.
- Monitoring Location - Abbreviated description of the sensor location (ex. OW1, GW1, CO1).
- Sensor Type - Abbreviated description of the type of data being logged.
    - BARO – Barometric compensation
    - LEVEL – Water level
    - RG – Rain gauge
- Sensor SN - Unique identifier for each sensor found on the side of the sensor body.
- 1st Deploy Date - The date the sensor was initially deployed at the SMP.
- Current Deploy Date - The date the sensor was most recently deployed at the SMP.
- Sensor Removed – The date sensor was removed, if applicable.
- Notes – Any additional information about the site (ex. site contact, equipment needed for site access, etc.).

  NOTE: For recurring deployment cycles, only the "Current Deployment Date" needs to be updated with every record entry.

4) Use the MS Excel auto-fill tool to generate dates for the "Download Data" and "Data Full" columns, representing the ideal collection date and the date the sensor memory will be full, respectively.
5) Locate the "Last Edit Date" & "Last Editor" cells (top-left) and update the entries.
6) Save and close the spreadsheet.

6.3 MARS Fieldwork Tracking Database

The MARS Fieldwork Tracking Database is a simplified system for tracking active deployments.

6.3.1 Add Monitoring Location

To add a new monitoring location or to add a monitoring location that is not on the active deployment list, follow these steps:

1) Click the "Add Monitoring Location" button at the top. Alternatively, you can get to the same location by clicking "Add Monitoring Location" button in the "Deploy Sensor" window.
2) Select the SMP ID either from the drop-down menu or by typing. This will auto-populate the SMP's Facility ID and SMP Type.
3) Select the Component ID associated with the monitoring location. Refer to the maintenance map of the site for this ID. This will auto-populate the Component Facility ID and Asset Type.
4) A suggested name for the monitoring location will be entered where it says, "Monitoring Location Suffix". You may manually change this name if you need to.
5) When finished, click "Add Monitoring Location".

6.3.2 Add/Edit Sensor in Inventory

The serial number for new HOBO sensors must be entered into the database in order to select them for deployment. To do this, follow these steps:

1) Click the “Add/Edit Sensor in Inventory” button at the top. *Alternatively, you can get to the same location by clicking “Add Sensor in Inventory” button in the “Deploy Sensor” window.*
    a. Add Sensor in Inventory
        i. Enter the serial number and model number
        ii. Enter the date purchased
        iii. Select “No” for Sensor Retired?
        iv. Click Add
    b. Edit Sensor in Inventory
        i. Enter the serial number and the model number will auto-populate
        ii. You may edit the model number, date purchased, and/or the sensor retired selection.
        iii. Click Edit
        iv. Alternatively, you can click delete to remove the sensor entirely

6.3.3 Deploy Sensor

After creating the monitoring location and adding the sensor to the inventory, you can deploy the sensor following these steps:

1) Click the “Deploy Sensor” button at the top
2) Select the SMP ID (drop-down menu or by typing)
3) Select the Well Name (drop-down menu or by typing)
4) Select the Sensor ID (drop-down menu or by typing)
5) Select the Sensor Purpose (drop-down menu or by typing)
6) Select the Measurement Interval (min) (drop-down menu or by typing)
7) Type the Deployment Date (no time needed)
8) Click “Deploy Sensor”

6.3.4 Edit Active Deployments

For actively deployed sensors, you can edit the deployment using the following steps:

1) Click the “Edit” button to the right of the sensor you wish to edit.
2) In the “Edit Sensor” window, you can modify the sensor ID, sensor purpose, measurement interval (min), deployment date, etc.
3) Once you have made the changes, click “Save Edits”.

6.3.5 Download Active Deployments

For actively deployed sensors that you wish to redeploy, you can simply click the “Redeploy” button to the right of the sensor you wish to redeploy. *Note: If any modifications were made to the deployment* *before redeployment (such as: measurement interval, serial number, sensor purpose), then you must use the following steps:*

1) Click the “Collect” button to the right of the sensor you wish to download.
2) In the “Collect Sensor” window, type the collection date.
3) If you did not redeploy the sensor, then click “Collect Sensor”.
4) If you wish to redeploy the sensor, then select “Redeploy Sensor?” and click “Collect Sensor”.

6.4 GSO Coordination – MS Excel

This spreadsheet is meant to inform GSO of 1) the sites we monitor so they can take care when performing maintenance at these locations and 2) any GSI issues we observe so they can be remedied.

If an issue is encountered that would involve GSO input, follow the GSO Coordination SOP to document and notify GSO of field findings. See GSO SOP for a list of field findings and how to address them as well.

6.5 Monitoring Location Maps

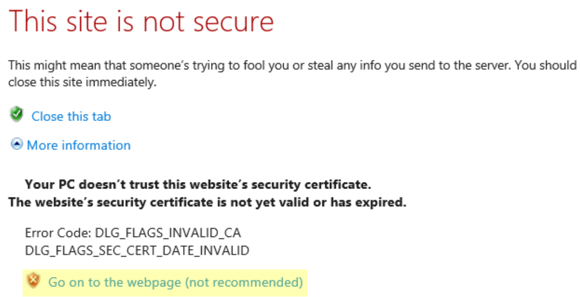
- In the site’s supplementary documents folder, create a ‘Monitoring Locations’ folder if there is not one already there.
- Copy the maintenance map(s) for the SMP into the Monitoring Locations folder. In the case of groundwater wells where an SMP hasn’t been constructed, utilize any planning documents or drawings to mark the monitoring locations.
- Open map using Adobe Acrobat and label the monitoring location(s) by inserting an arrow pointing towards the structure, and a textbox with the well name. Name locations from north to south and east to west. For example, if there are 4 observation wells, OW1 would be the northern-most well.

6.6 SMP Field Inspection Forms (Private Sites Only)

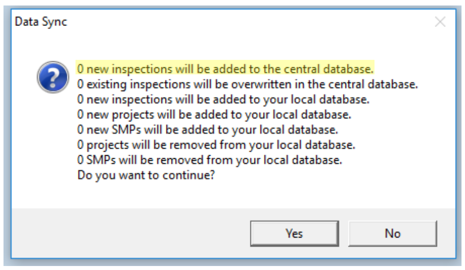
The Private SMP Program tracks their site inspections using the “PWD SMP Field Inspection Dashboard”. To share information and track MARS’s efforts, an inspection form should be filled out for each private site that is visited by the MARS group. Use the following instructions to fill out the forms and share photos/videos from the field.

- Open either one of the field laptops and click the orange bell icon labeled “SMP Field Inspection Dashboard”

- Select the Inspector
- Inspection form for each private site
    - Search for the private site using its associated tracking number which can be found in the site folder name, i.e. 2015-NORT-2977-01 for Northeast Towers. When you find the correct site, select view on the far right
    - Click "Create New Inspection".
    - Select Stephen White as the Inspector, type in the date of the inspection.
    - Inspection Type – Select O&M
    - Inspection Stage – Auto-selects Post Construction
    - Initial SMP Grouping – Select "Group Each SMP Individually", if the most recent inspection was done by MARS, then you can select "Copy Groups From Previous Inspection"
    - Click "Continue to Grouping", then click Save
      Note: All comments and settings are copied over from the previous inspection no matter what. So be sure to check both the General Information and SMP List sections and undo anything that may not apply to the field inspection.
    - Overall Site Status – Do not select anything for this field
    - General Inspection → Internal Comments – List who was inspecting, state it is a MARS inspection, specific SMPs inspected, overall comments, any issues you want to flag
    - SMP List → SMP → Overall → Overall Comments – Summarize any notes made about the SMP in the above sections, i.e. basin, drainage area, site issues, location of photos/videos in inspection folder, etc.
    - Photos
        - Do not upload to inspection form (does not work)
        - Upload to Project Folder
        - Go to "Project folder" → Post-Con → Inspections
        - Add new folder with date of inspection
    - Contacts – If you encounter someone related to the site, document their full name, title, phone and/or email
- Uploading inspection forms to private site database
    - Once all forms are complete, the forms need to be shared with the private site database.
    - Connect to the CITYWATER network
        - Click CITYWATER and internet explorer should popup with a login page
        - Type water and a pre-existing login and password will populate. Select login.
        - A security warning will pop-up, click "More Information" and select "Go on to the webpage (not recommended)", you should now have internet access.



- In the dashboard main page, click “Data Transfer” in the top left and select “Database Synchronization”.
- Click “Test Connection and Sync” and select “Sync Data”.
- A pop-up will show. Check that the number of new inspections matches the number of new inspection forms you completed. If they match, select yes.



- A text file will pop up when the data transfer is complete.

7. Health and Safety Information

General information on PWD’s safety policies can be found on the PWD Intranet Safety Unit website. The Watersheds Safety Committee maintains files pertaining to information on official City of Philadelphia Safety Policy located on the OOW server).

- When working in the right-of-way, adhere to PWD Work Zone Traffic Control Guidelines and the Pennsylvania Work Zone Pocket Guide for Municipalities & Utilities (found in all OOW vehicles). Utilize road cones, signs, and safety tape to properly identify and isolate work areas and possible hazards.
- Use hard hats, safety shoes, safety gloves, and protective eye wear, where applicable.
- During extreme heat events, ensure field personnel stay hydrated, and seek shade & rest to avoid heat exhaustion. Wear sun protection such as sunscreen, wide brimmed hats, and light-fitted clothing covering exposed skin.

Review safety policies prior to performing field work, inform supervisor of the work plan anticipated for the day, and ensure communication mechanisms between field and office staff are functional.

8. Public Relations Guidelines

While working in the field, you may be approached by residents or other members of the public. Remember that when working in the field you are representing PWD, and always conduct yourself appropriately. Residents may express concerns about basement flooding, safety, project aesthetics, or perhaps even PWD issues unrelated to the *Green City, Clean Waters* program.

Do:

- Find a time and place where you can appropriately have a conversation
- Explain what you are doing
- Assume a friendly position and body language
- Provide the appropriate phone numbers for PWD questions
- Listen to what the public has to say
- Make eye contact
- Be safe! Move away from traffic, tripping hazards, monitoring equipment, etc. Use appropriate safety equipment and adhere to all field safety guidelines

Don’t:

- Jeopardize your safety, public safety or data quality
- Talk to the public at length
- Allow yourself to be distracted
- Engage a person who is hostile
- Provide your contact information
- Make promises about what PWD will or won’t do, even if it relates to the site you are working on or *Green City, Clean Waters*

QAQC of Green Stormwater Infrastructure Monitoring Data– Standard Operating Procedure

1. Introduction

This section describes PWD standard operating procedures (SOPs) for performing QAQC action on raw data collected from observation wells and other monitoring devices located within green stormwater infrastructure (GSI) stormwater management practices (SMPs). The primary goal or objective of this document is to outline a process that provides meaningful and accurate hydrologic data to inform design, modeling, and performance estimates working in conjunction with other groups within PWD, such as GSI Maintenance, GSI Planning and Design, and Hydrologic and Hydraulic Modeling. This document will be updated as monitoring and data analysis methods are refined.

2. Data Processing Procedures

2.1 Data Preparation

Prior to beginning the actual QAQC procedure, it is important to create a copy of the raw data. Due to the file format of the raw data, it can easily be rendered unusable, and creating a copy helps prevent data loss if this were to happen. This is done with the following procedure:

1. All collected data will be located in the Raw Data Dropbox. The names of the folders within the dropbox indicate the date on which the data within their respective folders was collected, as well as the person by whom the data was collected. These folders are referred to as the collection folders.
2. Locate the collection folder containing the data to undergo the QAQC procedure, and copy the folder to the site's raw data folder. Any raw data not associated with the site can be removed from the copy of the collection folder. For now, do not remove any data from the raw data dropbox folder.
   - Alternatively, you can make a new folder within the site's raw data folder, and name it the same as the collection folder. Then, copy the site's raw data from the collection folder to the new folder. This may be easier for collection folders with raw data from many different sites. Whichever method you choose, be sure to copy the CSV ***and*** hobo files.

Site folders are named with the following naming convention: [site name]_[project number]. If you don't know the name of the site, search for "_[project number]" within the GSI Monitoring Sites folder. For example, to go to the folder for SMP ID 9-2-1, search for "_9", and you will find the site folder titled Palmer_9.

2.2 QAQC Workbook Preparation

Data for each SMP is divided into quarters of the year – for example, data for January through March of 2018 is entered into the 18Q1 QAQC workbook, April through June of 2018 is entered into the 18Q2 QAQC workbook, and so on. If a Microsoft Excel workbook already exists for the quarter during which the data undergoing QAQC action was recorded, proceed to section 2.3. Data will often be spread over more than one quarter, so multiple QAQC workbooks may be used when performing QAQC action.

1. Locate the appropriate template for the data to undergo the QAQC procedure. There are several different templates for different years, well types, and time intervals. The template that Hartranft 1-1-1 OW1 currently uses is the 15-minute observation well template, but data from other SMPs, such as those at SMIP/GARP sites, may be recorded at 5-minute intervals.
2. Copy the correct template to the project's QAQC folder. There is only one observation well at Hartranft 1-1-1, but some SMPs have multiple wells being monitored. The QAQC procedure must be performed separately for every water level sensor.
3. Rename the template using the following naming convention: *[SMP ID]_[Sensor Serial Number]_[OW name]_[YearQuarter]_[Date Created (YYYYMMDD)]_[Initials]* (e.g. *1-1-1_10217762_OW1_18Q2_QAQC_20180606_RGS.xlsx)*

Although there are workbooks for different types of wells being monitored, the process for entering data is the same for each QAQC workbook.

2.3 Updating the QAQC Workbook for Observation and Shallow Wells

1. Fill out the information in the Site Info tab. In the cells next to the created and last modified dates should be the initials of the person(s) to whom those dates apply.
   - "RG" in cell A8 refers to the rain gauge closest to the SMP undergoing QAQC action. This can be found using the rainfall data downloader script, which is explained in step 5 of this section.
2. Open the raw water level data CSV file. Copy the data from the Date Time, Abs Pres, and Temp columns (B, C, and D, respectively) into columns D, E, and F in the Data tab of the QAQC workbook. Make sure the dates and times match up with those in column A.
   - Sensors may unintentionally be deployed using Eastern Daylight Time instead of Eastern Standard Time. You can check for this looking at cell B2 in the raw data file. If it says GMT-05:00, the data is in Eastern Standard Time, and does not need to be corrected. If it says GMT-04:00, the data is in Eastern Daylight Time and needs to be corrected. Refer to **Appendix A** for the procedure on correcting timestamps.
   - When you close the raw data file, you may be prompted to save the file. ***<u>Do not save the file</u>***, because doing so changes the formatting in a way that renders the data unusable. If this happens prior to copying the data to the site folder, there multiple ways the data can be recovered, which are explained in **Appendix B**.
3. Open the raw barometric data file, which should be indicated by the "BARO" in its file name (i.e. *1-1-1_BARO(OW1)_11013531.csv*). Copy the data from the Date Time and Abs Pres columns, and paste into columns B and C of the QAQC workbook's raw data tab,

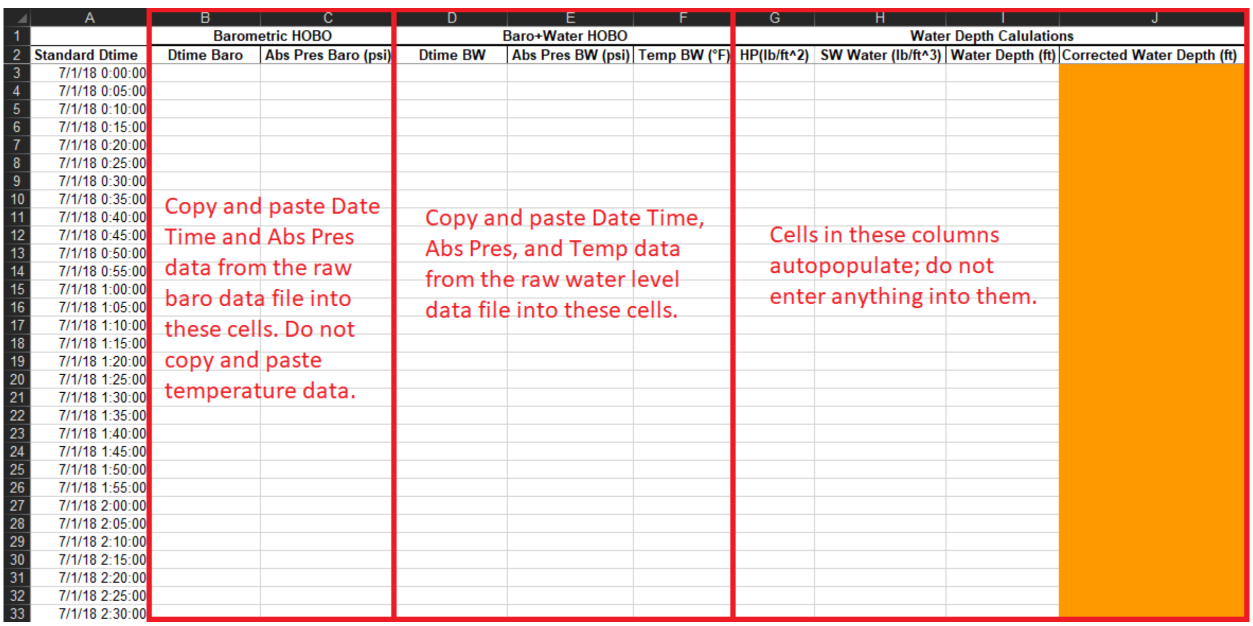
starting with the correct timestamp. Make sure the timestamps match up with those in column A. Do not copy temperature from the barometric data file.

- Some SMPs have their own barometric sensors deployed, making it easy to select the correct barometric sensor data. Most SMPs, however, do not have barometric sensors, and an R script has been created to locate data from the barometric sensor(s) closest to the SMP. This script also fills in any gaps in barometric data, and should be used to do so if there is any water level data for which corresponding baro data does not exist. A tutorial for using this script is attached as **Appendix C**.

4. Once the barometric and water level data have been entered, columns G through J will autopopulate. Column J will be used for plotting the data, and the resulting plots will be used for performing qualitative analysis in the Qualitative Checklist tab, which is explained in section 3.

   - If these cells do not autopopulate, ensure that the deployment measurements have been entered into their corresponding cells in the Site Info tab.

   See the following image for a visual explanation of steps 2, 3, and 4.

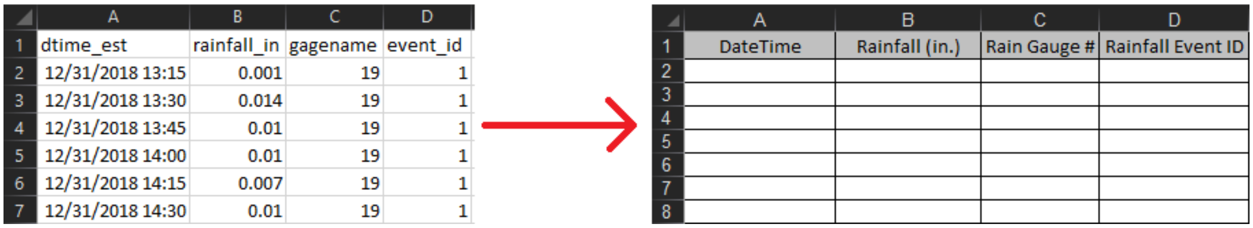


	A	B	C	D	E	F	G	H	I	J
1		Barometric HOBO		Baro+Water HOBO			Water Depth Calulations			
2	Standard Dtime	Dtime Baro	Abs Pres Baro (psi)	Dtime BW	Abs Pres BW (psi)	Temp BW (°F)	HP(lb/ft^2)	SW Water (lb/ft^3)	Water Depth (ft)	Corrected Water Depth (ft)
3	7/1/18 0:00:00									
4	7/1/18 0:05:00									
5	7/1/18 0:10:00									
6	7/1/18 0:15:00									
7	7/1/18 0:20:00									
8	7/1/18 0:25:00									
9	7/1/18 0:30:00									
10	7/1/18 0:35:00									
11	7/1/18 0:40:00									
12	7/1/18 0:45:00									
13	7/1/18 0:50:00									
14	7/1/18 0:55:00									
15	7/1/18 1:00:00									
16	7/1/18 1:05:00									
17	7/1/18 1:10:00									
18	7/1/18 1:15:00									
19	7/1/18 1:20:00									
20	7/1/18 1:25:00									
21	7/1/18 1:30:00									
22	7/1/18 1:35:00									
23	7/1/18 1:40:00									
24	7/1/18 1:45:00									
25	7/1/18 1:50:00									
26	7/1/18 1:55:00									
27	7/1/18 2:00:00									
28	7/1/18 2:05:00									
29	7/1/18 2:10:00									
30	7/1/18 2:15:00									
31	7/1/18 2:20:00									
32	7/1/18 2:25:00									
33	7/1/18 2:30:00									

5. Enter rainfall data in the “Rainfall Data” tab. Rainfall data can be obtained using a script similar to the barometric data script mentioned above in step 3. Copy data from columns A, B, C, and D from the CSV file created by the script, and paste to columns A, B, C, and D of the Rainfall Data tab of the QAQC workbook. Column D contains what are referred to as event IDs. Each event ID corresponds to a specific rainfall event. The sum of the rainfall amounts from a given event ID is the total rainfall amount for that event, measured in inches.

   Refer to **Appendix C** for more information on how to use this script. See the following image for a visual explanation of step 5.

Data from rainfall script — "Rainfall Data" tab in QAQC workbook



	A	B	C	D
1	dtime_est	rainfall_in	gagename	event_id
2	12/31/2018 13:15	0.001	19	1
3	12/31/2018 13:30	0.014	19	1
4	12/31/2018 13:45	0.01	19	1
5	12/31/2018 14:00	0.01	19	1
6	12/31/2018 14:15	0.007	19	1
7	12/31/2018 14:30	0.01	19	1

	A	B	C	D
1	DateTime	Rainfall (in.)	Rain Gauge #	Rainfall Event ID
2				
3				
4				
5				
6				
7				
8				

6. Once all the data for the quarter has been entered, copy all the *complete* data from the Data tab into the Final_Import_Site# tab, and ***right click > "paste special" as values***. Complete data refers to data points containing water level *and* barometric data. **It is important to paste special as values, because normal copying and pasting results in the formulas being pasted, and not the actual values calculated by those formulas.**

7. Save the workbook when finished and update the tracking spreadsheet to reflect the QAQC action performed. **Section 4** provides a more detailed explanation on how to use the tracking spreadsheet.

8. When the QAQC process has been completed for a given set of data, ensure that a copy of the raw data CSV file exists within the site folder, and that the data is in a usable format. Once this is confirmed, delete the data from the raw data dropbox.

2.4 Updating the QAQC Workbook for Groundwater Wells

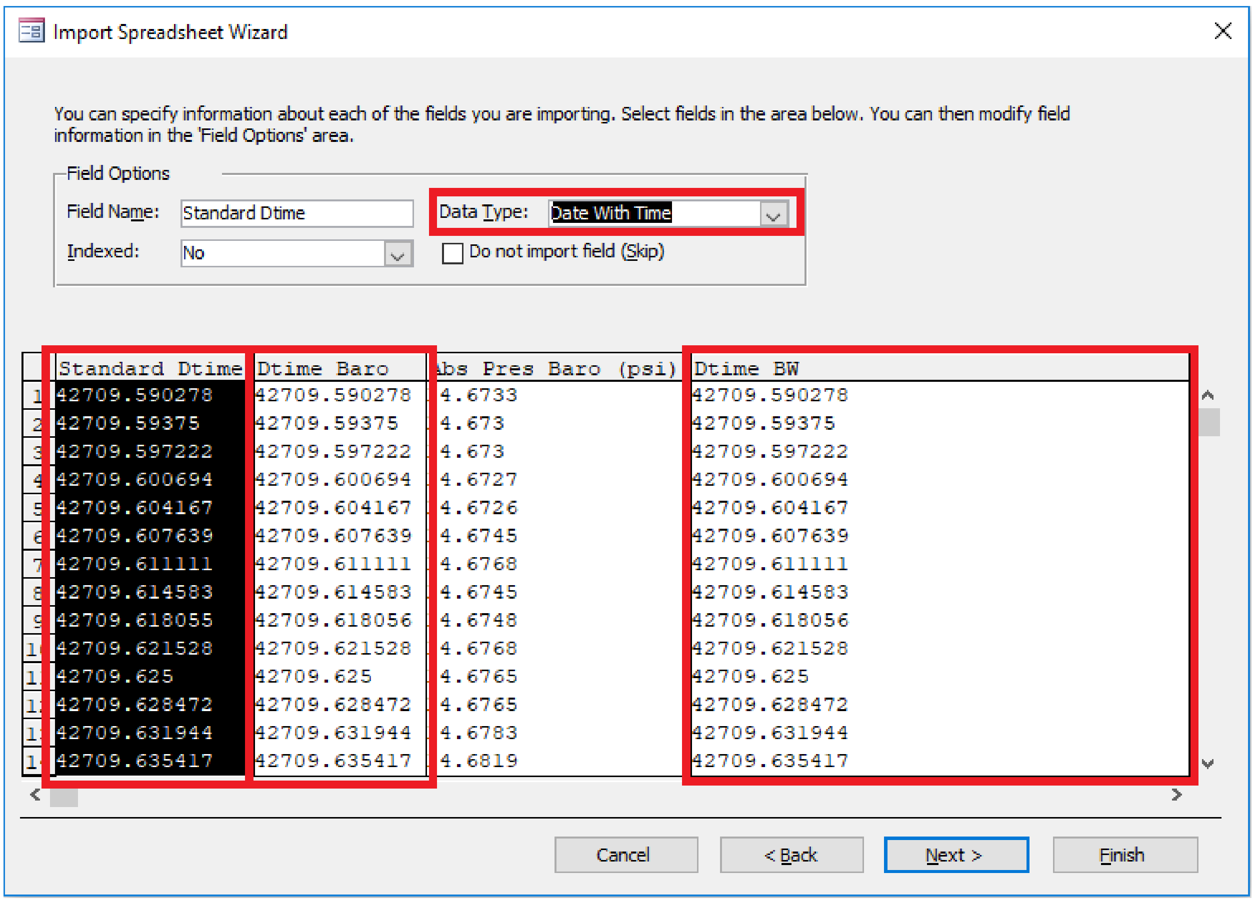
Follow the steps of the previous section, as the format of the spreadsheet remains the same. The only difference is that groundwater wells are designed for monitoring distance to water, as opposed to water depth. Therefore, the final column that gets auto populated shows the distance from the top of the well to the surface of the water, instead of the corrected water depth for observation and shallow wells.

2.5 Importing Data to Access

Access databases are repositories for data on which informative analysis can be performed. **Therefore, unusable data, such as that from a faulty sensor (i.e. the sensor recorded impossibly high or low pressure measurements) should not be imported to Access. Data from an SMP that fails any of the qualitative checklist metrics must still be imported, as such data still provides useful insight on the SMP's performance.** Data should only be imported after the QAQC workbook for that quarter is complete (including the qualitative checklist), and no further data will be collected or entered for that quarter. The format of the Access database is the same for all types of wells, with only the naming of the last column differing as it was described in section 2.4 above. Import data to Access using the following procedure:

1. Locate the appropriate Access database within the main site folder. There may be multiple Access databases, depending on how many wells are being monitored at the site.
   - If there is no Access database for that well, a new one must be prepared. The procedure for this is attached as **Appendix D**.
2. Open the database and click "Enable Content" in the yellow band, if it appears.

3. In the External Data tab along the top of the window, select New Data Source > From File > Excel.
4. Locate and open the QAQC workbook containing the data being imported, choose “Import the source data into a new table in the current database”, and click OK.
5. Make sure “Show Worksheets” is selected, and choose “Final_Import_Site#”. In the following window, make sure “First Row Contains Column Headings” is checked.
6. Select the correct data types for each column. The data types for all three “Dtime” columns (Standard Dtime, Dtime Baro, and Dtime BW) will need to be changed to “Date With Time”. The other columns should default to the correct data type (Double). Click on the columns in the table below to select a different column. See the following image for a visual example of which columns need to have their data type changed:

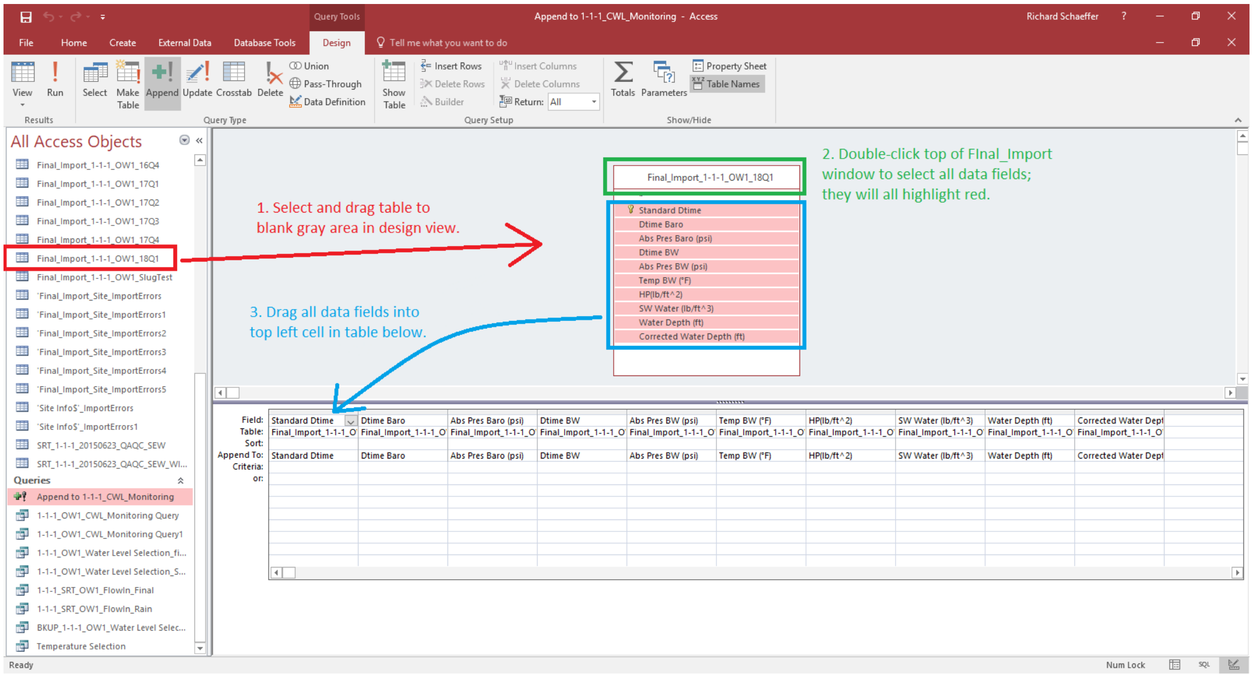


7. In the next window, select “Choose my own primary key”, and choose Standard Dtime.
8. Name the table with the following naming convention: *Final_Import_SMP ID_OW Name_YearQuarter* (e.g. *Final_Import_1-1-1_OW1_18Q1*). Click Finish to import the table.
   - 5- and 15-minute QAQC workbooks may exist for a given quarter, as MARS began recording data in 15-minute intervals in 18Q2 and 18Q3. If this is the case, the

Final_Import_Site data from both workbooks must be imported. Name the 5-minute table exactly as described above. Name the 15-minute table as described above, and add "_15min" to the end of the name.

9. Right-click the "Append to" query and select Design View. There may already be a Final_Import window there from a previous quarter, or if the database was newly-created, there may be a table named "Final_Import_blanktable". In either scenario, right-click the top of the table, and remove the table.
10. Drag the new Final_Import table into the blank window.
11. Double-click the top of the Final_Import window to select all the data fields, from Standard Dtime to Corrected Water Depth (ft). They should all highlight red. On some computers, Ctrl+A also selects all the data fields.
12. Drag the selected data fields into the top left cell in the table below. Close out of the design view, and save when prompted.
13. Run the query, and make sure the data has been correctly appended to the main table (e.g. *1-1-1_OW1_CWL_Monitoring*). Two windows may appear confirming that you want to run the query, and how many new rows will be appended. Click Yes for both windows. If there are no subsequent error messages, proceed to the next step.
    - One cause of error messages is duplicate entries for a given timestamp. Choosing the Standard Dtime column as the primary key means no duplicate entries can exist for that column. If the database reports duplicate entries, check to make sure you are appending from the latest quarter of data and try again. If the database still reports duplicate entries, check if any of the data for that quarter has already been appended to the main CWL Monitoring table.
14. Make sure the data has been correctly appended by opening the CWL_Monitoring table, and cross-referencing the latest records with the data in the QAQC workbook.
15. Close out of Access, and mark the data as imported into Access in the QAQC tracking spreadsheet by using green fill for that quarter's cell (columns I-L). **Section 4** provides a more detailed explanation on how to use the tracking spreadsheet.

Refer to the image below for a visual understanding of how to perform steps 11, 12, and 13.



3. Qualitative QAQC Checklist

In the QAQC workbook, there is a tab named "Qualitative Checklist". The purpose of the qualitative checklist is to allow for analysis and interpretation of the data collected from that SMP. Based on the results of the qualitative checklist, it will be determined either that the SMP is functioning properly, or that it is not functioning properly. In the case of the latter, further testing will be performed to determine the source of the issue.

There are up to four metrics upon which SMPs are evaluated: water level response, drain-down duration, recession rate, and water detained by liner (if the system is lined; does not apply to shallow wells). The criteria for evaluating each of these metrics are explained in the Qualitative Checklist tab of the QAQC workbook. When completing the qualitative checklist, be sure to use the corrected water level plots, which are indicated by the "CORR" in their tab names.

Cells B1 and B2 will auto-populate based on the info entered in the Site Info tab; in cells B3 and B4, enter the date the spreadsheet was last updated, with the initials of the last person to update it. Groundwater monitoring wells do not currently require qualitative analysis, as they are not used for monitoring SMPs.

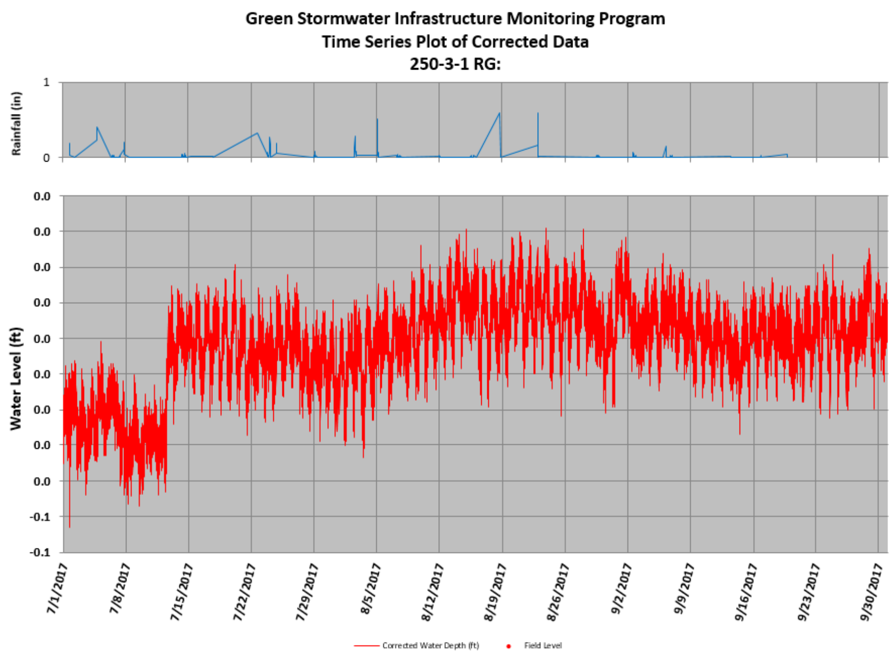
See the following image for a layout of the qualitative checklist in its current form. The cells outlined in red are the only cells in which any information should be entered.

	A	B	C	D	E	F	G
1	SMP ID						
2	Monitoring Location						
3	Last Updated						
4	By						
5	Project Directory:	\\pwdoows\oows\Watershed Sciences\GSI Monitoring\07 Databases and Tracking Spreadsheets\04 QAQC\01 GSI_QAQC_Database_Templates\CWL_Templates\2018\Observation w					
6	Notes:	Add any field notes or other anecdotal references here.					
7	QA Files used to analyze:	SMPID_SNSN#_OW1_18Q3_QAQC_EOA.xlsx					
8	**Metric**	**Decription**	**Criteria**	**SMP response**	**Red Flags**		
9	Water Level response	Does the water level change in response to precipitation events.	Water level changes greater than the value of the sump depth.	*yes or no*	no level response for events greater than 1"		
10	Draindown Duration	The water level of the GSI should return to the level observed prior to precipitation event	System fully drains in 72 hours or less	*Drain down time to the nearest 5 minute interval*	Draindown time exceeds 96 hours		
11	Recesssion Rate	Change in water level between end of storm to bottom of storage divided by change in time between end of storm and bottom storage.	>0.25"/hr	*estimated recession rate*	Recession rate is greater than 5 "/hr		
12	Water detained by liner	If GSI has an impermeable liner, does the water level equilize at the approximate orifice elevation?	Water level plateaus + or - 2" near the recorded orifice elevation	*yes or no*	System fully drains or drains faster than "X" in/hr. Where "X" is the time the system would drain through only orifice flow.		
13							
14						date and time	water level
15					final peak of storm		
16					6" above top of sump		
17					top of sump		
18					***draindown duration***	***0:00:00***	
19					***recession rate (inches/hour)***	***#DIV/0!***	
20							
21							

... Jul TS | Jul TS CORR | Aug TS | Aug TS CORR | Sep TS | Sep TS CORR | All TS | All TS CORR | **Qualitative Checklist** | SpecificWeight_1 ...

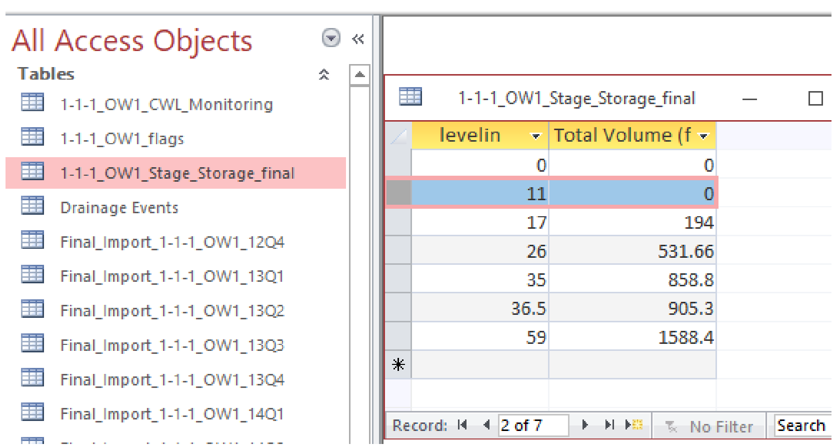
3.1 Water Level Response

Water level response can sometimes be determined by observing the corrected water level plots and comparing them to the rainfall plots. If there is little-to-no response to precipitation events, especially those of over one inch of rain, then it is not possible to calculate the SMP's draindown duration and recession rate, and the SMP will be flagged. See the image below for an example of an SMP not responding to precipitation events.



Note how the water level never even reaches 0.1 feet, despite there being multiple significant rainfall events during that quarter.

Other times, however, the sump depth must be known, as the criterion for this metric requires not only response to a precipitation event, but a response great enough that the water level exceeds the sump depth. For some SMPs, the sump depth of an SMP can be found in the "[SMP ID]_[OW_name]_Stage_Storage_final" table of that well's Access database. The sump depth will be the greatest value in the "levelin" column with a corresponding value of 0 in the "Total Volume" volumn. In the image below, the sump depth can be found in the highlighted and outlined section, and is 11 inches. For newer SMPs, however, stage storage tables do not exist, and this information must be found elsewhere, typically in the well specification section of the as-built design document.

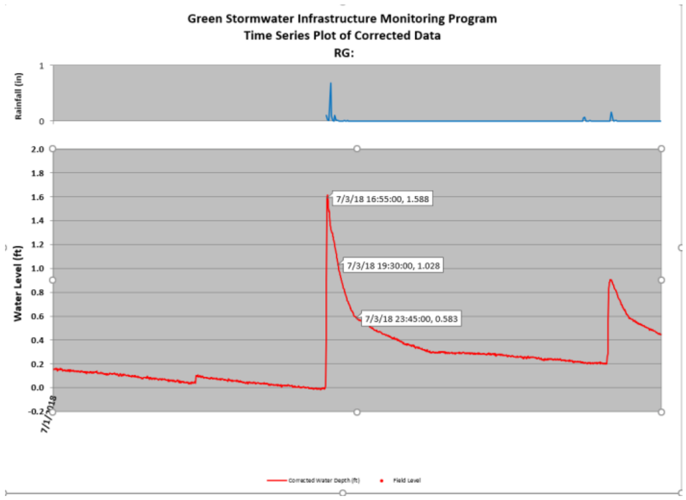


3.2 Draindown Duration

Draindown duration is the time it takes the SMP to drain down to the top of the observation well's sump, and is calculated using the storm that generated the largest response in the SMP.

When completely full, the SMP should drain within 72 hours, but up to 96 hours is acceptable. Please note that shallow wells require a draindown duration of 24 hours. Because that storm often does not completely fill the SMP, the percent of the SMP that was filled during the storm needs to be determined, and then compared to the 96-hour criterion. For example, if the storage height of an SMP is 48 inches, and a storm filled it to 32 inches (ergo the system is 67% full), the system would have to drain within 64 hours, which is 67% of 96 hours. While this is not entirely accurate, as it assumes a linear recession rate, it is a simple way of determining whether or not the system drains within an acceptable timeframe.

1. To calculate draindown duration, use the storm that generated the largest response within the SMP. Once that storm is identified, make a copy of the tab with the corrected plot containing that storm, and rename it to [recession rate calcs].
2. Edit the date range of this plot to just before and after the storm for a better visual representation of the storm, and to get more accurate water levels and timestamps.
   - Although Excel will show a numerical value instead of an actual date and time, with the time of day being represented by a decimal (e.g. 43101.25 instead of 1/1/2018 6:00 AM), the values can be changed using a MM/DD/YYYY format. If a date is entered without a time, the time of day for that date will default to 12:00 AM.
3. Identify the ***final peak*** of the storm. The time at this point will be used in calculating draindown duration, and the water level will be used to determine how much of the system was filled at this time.
4. Identify the time at which the water level drains down to the top of the sump.
   - The top of the sump can be identified by an inflection point in the water level plot. An example of this is shown in the image below.
   - Identifying the top of the sump can be difficult, as the water level plot does not always show a clear inflection point. It is generally assumed that the sump depth is 12 inches below the bottom of the SMP, but there are instances in which the observation well does not have a sump. If you are having trouble identifying the top of the sump, discuss the matter with other members of the MARS group.
5. When identifying the points such as the high point of the storm, 6 inches above the top of the sump, and the top of the sump, use the data call out feature on MS Excel. You do this by selecting a point, which a blue box should appear around, then right clicking. Select add data label from the drop-down menu, then select add data callout. This callout will include the date, time, and water level.



6. Calculate the draindown duration using the time elapsed from when the water level was at the final peak, to when it drained down to the top of the sump.
7. Determine the percent of the SMP that was filled at the top of the final peak. To do this, divide the final peak's water level by the storage depth of the SMP. This will require the final peak's water level from step 3, and the storage height of the SMP, which can be obtained two different ways.
   - The first method of obtaining the storage height requires the information to be entered into the Access database for that SMP's well. If the information is entered, it will be contained within a table named [SMP ID]_[Well Name]_Stage_Storage_Final. In the "levelin" column, subtract the sump depth from the top of storage. The top of storage will be the largest number, and the top of the sump will be the largest number with a corresponding "0" in the "Total Volume" column. The storage height for most SMPs will not be obtainable using this method; therefore, it would be useful to familiarize oneself with the following method.
   - The second method is to find the SMP on GreenIT, and within the "As Built" specifications, find the value for "Primary Storage Depth (ft)". This is the value to use when calculating the percent of storage that was filled. See Appendix E for a more detailed explanation on how to use GreenIT for the QAQC procedure. If the "As Built" tab does not contain any info for the SMP, use the information from the "As Designed" tab instead.
8. If the site undergoing the QAQC procedure is a private site, site information, including photos and site drawings, are obtained using the Private Property Database.
9. Multiply the percent storage filled (as a decimal) from step 6 by 96 to determine the maximum allowable draindown duration for the storm being used. If the draindown duration from step 5 exceeds this, then the SMP must be flagged.

It is important to note that shallow wells require a draindown duration within 24 hours, not 96.

Refer to the image at the end of section 3.3 for a visual understanding of where on the plot the values used to calculate draindown duration can be located.

3.3 Recession Rate

Recession rate is the rate at which the water leaves the SMP. Only the six inches above the top of the sump are used in this calculation, or the top of the final peak if it's within six inches above the top of the sump. The image below shows the point relative to the top of the sump from which the recession rate is calculated.

1. Locate the water level and its corresponding time closest to the six-inch point above the top of the sump. If there are multiple peaks within the storm, use the final peak. See the following image for an example of a plot showing where to calculate draindown duration and recession rate from.
   - Observation wells in lined systems typically do not have sumps. Therefore, for the "top of sump" value, use the approximate orifice elevation instead. This can be estimated by subtracting the bottom of storage elevation from the orifice elevation on the SMP's as-built drawings. To calculate the orifice invert elevation, add the underdrain radius (in feet) to the underdrain invert elevation, and subtract the orifice radius (also in feet) from that. The orifice invert is often between 0.5 feet and 1 foot above the bottom of storage.
2. Enter the time and water level in cells F17 and G17 of the Qualitative Checklist tab, respectively.
3. The recession rate will be displayed in cell F20, and is calculated based on the data entered in cells F15-G19. Enter this value in column D's cell that corresponds to recession rate (cell D12). Flag if the recession rate does not meet the criteria explained in the qualitative checklist.

To facilitate the calculation of the draindown duration and recession rate, there is a table from cells E15 to G19. Draindown duration only requires cells F16 and F18 to be filled in, using the same date and time format that the Data tab uses. Recession rate requires F17, F18, G17, and G18 to be filled in.

In the event that any of these metrics triggers a red flag, document the flagged SMP in the tracking spreadsheet discussed in section 4.2, so that the proper course of action may be discussed by the MARS group.

3.4 Water Detained by Liner

Some SMPs are surrounded by an impermeable liner, which does not allow water to infiltrate into the ground. Instead, the water is slowly released into the sewer through an orifice in the SMP's underdrain cap. The height of the orifice in the underdrain cap should be slightly above the bottom of the SMP's liner, allowing a small amount of water to remain in the SMP. The purpose of this metric is to determine whether or not the water level remains steady at or near the orifice elevation.

1. Determine the height of the bottom of the orifice relative to the bottom of the trench. The SMP's design or as-built plans, as well as GreenIT, may be required. See step 1 in section 3.3 for a more detailed explanation on how to calculate this.
   - To find the SMP's orifice diameter, search for the SMP in GreenIT. You will find the orifice diameter in the "as built" or "as designed" tabs for that SMP. Refer to Appendix E for a more detailed explanation on how to use GreenIT. The SMP's as-built plans usually state the orifice diameter, as well.
2. Determine the depth of the sump of the observation well. If there is a sump, this depth will need to be added to the height calculated in step 1.
3. Compare the standing water level (i.e. when it "plateaus" outside of a rainfall event) to the height between the sump and the bottom of the orifice. These values should be within two inches of each other. A water level greater than two inches below the approximate elevation of the orifice invert indicates a leak somewhere in the liner below the orifice elevation.
4. If these values are not within two inches of each other, or if the water level does not level off, flag the SMP and discuss the matter with other members of the MARS group.

4. QAQC Tracking

There are currently two tracking spreadsheets used in the QAQC procedure. One is used for tracking if and when data for an SMP has undergone the QAQC procedure and has been imported to its Access database (referred to as the "QAQC tracking spreadsheet"), and the other is used for tracking SMPs that have been flagged for failing any of the qualitative metrics (referred to as the "flagged SMPs tracking spreadsheet").

4.1 QAQC Tracking Spreadsheet

The QAQC tracking spreadsheet is used for documenting the most recent date of QAQC action performed for a given well, the latest data in each quarter to undergo QAQC action for that well, and whether or not that well has been flagged. The tracking spreadsheet should be updated whenever QAQC action is performed, regardless of whether or not QAQC action for that quarter is complete. Review the following procedure for a more detailed explanation on how to update the QAQC tracking spreadsheet.

Updated on: Thursday, July 11, 2019

1. Update columns E-H to reflect the date of the most recent data to undergo the QAQC procedure. When no more data for that quarter will undergo the QAQC procedure, fill in the cell for that quarter with the appropriate color, as explained in cells E1-F3. See the following image for a visual example, outlining the cells described in this step.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Last Updated	8/3/2018				Indicates QAQC action is complete for that quarter									
2	By	RGS				Indicates QAQC action is complete for that quarter, but needs an edit/check									
3						Indicates QAQC action is complete for that quarter, but has encountered an unsolved problem.									
4					DNE	Indicates sensor was not deployed or (Did Not Exist) during the quarter									
5					Date QAQC Spreadsheet is Complete to				Data imported into Access Database						
6															
7	SMP ID #	Well #	Location	DATE	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Comments		
8	1-1-1	OW1	Hartranft	7/20/2018	3/4/2018	6/5/2018							Data missing from 3/4/18 - 4/6/18		
9	1-2-1	OW1	Hartranft	7/20/2018	3/4/2018	6/5/2018							Data missing from 3/4/18 - 4/6/18		
10	1-2-1	OW2	Hartranft	7/20/2018	3/4/2018	6/5/2018							Data missing from 3/4/18 - 4/6/18		
11	1-3-1	OW1	Hartranft	7/20/2018	3/30/2018	6/5/2018							Data missing from 12/19/17 - 3/9/18		

2. Update columns I-L to reflect whether or not that quarter's data has been imported into the Access database for that specific well. This is done by filling the cell with green fill. Leave the cell blank with no fill if that quarter's data has not been imported to Access.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Last Updated	8/3/2018				Indicates QAQC action is complete for that quarter									
2	By	RGS				Indicates QAQC action is complete for that quarter, but needs an edit/check									
3						Indicates QAQC action is complete for that quarter, but has encountered an unsolved problem.									
4					DNE	Indicates sensor was not deployed or (Did Not Exist) during the quarter									
5					Date QAQC Spreadsheet is Complete to				Data imported into Access Database						
6															
7	SMP ID #	Well #	Location	DATE	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Comments		
8	1-1-1	OW1	Hartranft	7/20/2018	3/4/2018	6/5/2018							Data missing from 3/4/18 - 4/6/18		
9	1-2-1	OW1	Hartranft	7/20/2018	3/4/2018	6/5/2018							Data missing from 3/4/18 - 4/6/18		
10	1-2-1	OW2	Hartranft	7/20/2018	3/4/2018	6/5/2018							Data missing from 3/4/18 - 4/6/18		
11	1-3-1	OW1	Hartranft	7/20/2018	3/30/2018	6/5/2018							Data missing from 12/19/17 - 3/9/18		

3. If necessary, make any noteworthy comments about the well in column M. Such comments may include significant data gaps, or why the well was flagged.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Last Updated	8/3/2018				Indicates QAQC action is complete for that quarter									
2	By	RGS				Indicates QAQC action is complete for that quarter, but needs an edit/check									
3						Indicates QAQC action is complete for that quarter, but has encountered an unsolved problem.									
4					DNE	Indicates sensor was not deployed or (Did Not Exist) during the quarter									
5					Date QAQC Spreadsheet is Complete to				Data imported into Access Database						
6															
7	SMP ID #	Well #	Location	DATE	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Comments		
8	1-1-1	OW1	Hartranft	7/20/2018	3/4/2018	6/5/2018							Data missing from 3/4/18 - 4/6/18		
9	1-2-1	OW1	Hartranft	7/20/2018	3/4/2018	6/5/2018							Data missing from 3/4/18 - 4/6/18		
10	1-2-1	OW2	Hartranft	7/20/2018	3/4/2018	6/5/2018							Data missing from 3/4/18 - 4/6/18		
11	1-3-1	OW1	Hartranft	7/20/2018	3/30/2018	6/5/2018							Data missing from 12/19/17 - 3/9/18		

Update column D, and cells B1-B2. Column D reflects the date on which the most recent QAQC action was performed for a given well. Cells B1-B2 reflect the date on which the spreadsheet was last updated, and the initials of the person to last update

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Last Updated	8/3/2018				Indicates QAQC action is complete for that quarter									
2	By	RGS				Indicates QAQC action is complete for that quarter, but needs an edit/check									
3						Indicates QAQC action is complete for that quarter, but has encountered an unsolved problem.									
4					DNE	Indicates sensor was not deployed or (Did Not Exist) during the quarter									
5					Date QAQC Spreadsheet is Complete to				Data imported into Access Database						
6															
7	SMP ID #	Well #	Location	DATE	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Comments		
8	1-1-1	OW1	Hartranft	7/20/2018	3/4/2018	6/5/2018							Data missing from 3/4/18 - 4/6/18		
9	1-2-1	OW1	Hartranft	7/20/2018	3/4/2018	6/5/2018							Data missing from 3/4/18 - 4/6/18		
10	1-2-1	OW2	Hartranft	7/20/2018	3/4/2018	6/5/2018							Data missing from 3/4/18 - 4/6/18		
11	1-3-1	OW1	Hartranft	7/20/2018	3/30/2018	6/5/2018							Data missing from 12/19/17 - 3/9/18		

4.2 Flagged SMPs Tracking Spreadsheet

The flagged SMPs tracking spreadsheet is used for tracking SMPs that have failed any metric of the qualitative checklist. If an SMP is determined to be flagged, make sure it is not already entered into the tracking spreadsheet. **Please note that when sorting the spreadsheet, every column (A - M) must be included in the sorting, otherwise some of the information will be attributed to the incorrect SMP.** If it is not flagged, enter the SMP into the spreadsheet, directly below the last entry, using the following procedure:

1. Site information is to be entered in columns A, B, and C. In column B, only enter the flagged well(s).
   - If an SMP is already entered into the checklist, ***do not add it again***. Modify flagged metrics accordingly.
2. Column D should contain the date on which it was determined through QAQC action that the SMP failed the qualitative checklist.
3. Column E should contain the year and quarter in which the SMP first failed the qualitative checklist. For example, if an SMP passed the qualitative checklist in 18Q1 and 18Q2, but failed in 18Q3, then 18Q3 should be entered.
4. Columns F through J are for describing the reason(s) for which the SMP was flagged, with each column describing a different issue for which an SMP should be flagged. Cells in these columns should only be filled in with a light red/salmon color ***(use the same exact color that is currently being used)***; no text should be entered. Only fill in cells in the columns that describe the issue(s) observed with the SMP during the QAQC process.
   - Rows 5 through 9 define the metrics for which an SMP may be flagged for failing. Hovering the cursor over the column headers will also display definitions for each of these metrics.
   - SMPs flagged for limited response, high recession rate and/or liner issues may be suspect for short-circuiting. If MARS determines an SMP is suspect, a CCTV dye test should be scheduled to identify the source of short-circuiting.
5. Column K denotes whether or not that SMP is on the short-circuit prioritization list.
6. Column L is for entering any next steps that should be performed to further evaluate any anomalous performance parameters observed during the QAQC process, such as performing an SRT/dye test. Update the “Field Testing Master Record.xls” spreadsheet to include future SRTs needed for further evaluation of SMPs.
7. Column M is for any other notes that may be relevant to the SMP’s anomalous performance parameters, such as water-in-cellar complains from an adjacent property, or any construction issues observed in the field.
8. Cells B1 and B2 should be updated every time the tracking spreadsheet is updated. Cell B1 should contain the date the spreadsheet was last updated, and cell B2 should contain the initials of the person who most recently updated the spreadsheet.

Cell A11 shows the number of SMPs currently entered into the checklist. This is done using a function, so do not edit the cell’s contents. Similarly, cells F11-K11 contain functions that count the number of cells in each column that are shaded pink. These cells do not automatically refresh when a new cell within their respective ranges is shaded. Pressing the F9 key will refresh them.

Appendix A – Timestamp Correction Procedure

HOBOware synchronizes its time settings with the field laptop's time, which should always be in Eastern Standard Time (GMT-5). While uncommon, the clock settings on the field laptops may revert back to Daylight Saving Time, and HOBOware will launch sensors using Eastern Daylight Time (GMT-4) instead of Eastern Standard Time. Use the following procedure to correct any downloaded data that was recorded with the incorrect time offset.

1. Open the raw data file, and copy its contents to a new Excel workbook, starting with cell A1.
2. In the new workbook, go to cell B3, which should be the first timestamp of that set of data.
3. Change the time of day by however much the time is offset. For example, if the sensor was launched in Eastern Daylight Time (GMT-4), the time will need to be shifted back one hour.
   - Times should be entered in a 24-hour format. For example, if the time is 14:30 and needs to be moved back an hour, it should be entered as 13:30, and not as 1:30 PM.
4. Enter the following formula in the cell containing the timestamp of the next data measurement (cell B4): *=B3+TIME(0,minute,0)*, where "minute" will be the time interval used in recording data. Without quotation marks, replace "minute" with "5" for data recorded in five-minute intervals, "15" for 15-minute intervals, and so on. When entered properly, the formula should look similar to this: *=B3+TIME(0,5,0)*. If entered correctly, the time for this cell should be the appropriate time interval after cell B3. Copy the cell with the formula when finished.
5. With the cell in step 4 copied (indicated by the rotating dotted line around the cell), select the cell below and press Ctrl+Shift+Down arrow on your keyboard. This will select the timestamped cells from the next timestamp to the final recorded timestamp. Once the remaining cells in the Date Time column are selected, right-click anywhere in the highlighted region, and paste special as formulas. Compare the times to those in the original raw data file. The only difference in times should be that the times in the new workbook are one hour earlier.
6. When finished, save the new workbook as an Excel worksheet file (.xlsx) in the appropriate collection folder within the site's raw data folder, using the following naming convention: *[SMP ID]_[OW name]_[Sensor serial number]_CORRECTED.xlsx*. For example, if Hartranft 1-1-1's data were being corrected, the new file would be saved as *1-1-1_OW1_10217762_CORRECTED.xlsx*. Do not save the raw data file.
7. When finished, proceed to step 2 of section 2.3. When copying and pasting the corrected data to the QAQC workbook, paste special as values.

Appendix B – Data Recovery

When data logging sensors are read out, HOBOware converts the data into a file called a comma-separated values (CSV) file. Although a CSV file appears similar to a normal spreadsheet when opened in Excel, the data is formatted differently within the file itself, and Excel must process it differently to present it in a usable format. The biggest issue surrounding this occurs when the raw data files are accidentally saved. This causes all the columns of data to merge into a single column, making the data unusable in that state. Fortunately, there are multiple ways to recover the data if this happens.

The first method of recovering this data is to open the .hobo file with HOBOware, and simply export the data as a CSV file. This is both the fastest and easiest way to recover data, as all data sets should contain both a CSV and .hobo file.

The second method of recovering this data is to change the way Excel reads data from that file. This is done with the following procedure:

1. Open the raw data CSV file that was accidentally saved.
2. Go to the Data tab at the top of the Excel window.
3. Click on Get Data > From File > From Text/CSV
4. Navigate to the location of the saved CSV file. Open the CSV file.
5. In the window that pops up, make sure the following settings are chosen: for File Origin, choose “1252: Western European (Windows)”; for Delimiter, choose “Tab”; for Data Type Detection, choose “Based on first 200 rows”.
   a. These settings should be chosen by default, but if they are not, change the current settings to the ones described above.
6. Click Load. A spreadsheet with data properly separated by columns should appear. Save the file, and close out.
7. Re-open the file. It should look like a normal raw data spreadsheet, except for the first row, which should have several cells in that row saying “Column[Number]”. Delete this row and continue with the QAQC procedure.

Please note that the above procedure only applies to the file that was accidentally saved. Saving any other raw data CSV files will result in having to repeat the process for each file that was saved.

The second method of recovering data is simpler, but may be more time-consuming. The raw data file should still be located on the field laptop and/or flash drive used to transfer data from the field laptops to the raw data dropbox. Once the file is located, replace the file in the raw data dropbox with the file from the field laptop or flash drive.

Appendix C – Using the Barometric and Rainfall Scripts

The following procedure is for setting up your computer to be able to run the scripts. While the baro script is referenced in step 6, that step will need to be done with the rainfall script as well.

1. Go to this link and install this driver: https://ftp.postgresql.org/pub/odbc/versions/msi/psqlodbc_09_06_0500.zip. If you don't have permission, ask IT to install it for you. Restart your computer afterwards.
2. Go to your start menu and search for "ODBC". You should find an entry called "ODBC Data Sources". Click that entry to open the ODBC control panel app.
3. Create a new User DSN with the PostgreSQL Unicode driver. Fill the form out with the following info:

   # Data Source: mars

   # Description: MARS database

   # Database: mars

   # SSL Mode: Disable

   # Server: 28-ARATHEFFE2.water.gov

   # username: mars_readonly

   # password: ihatepostgrespermissions

   # port: 5432
4. Click the "Test" button to test the connection. A window should pop up that says, "Connection Successful!"
5. Go to rstudio.com and install RStudio Desktop for Windows on your PC. If you do not have the R language installed, click the link provided under the RStudio download section of the website. Follow the prompts to install R. Once R is installed, under “Installers for Supported Platforms”, click the RStudio Installer for Windows. You do not need to download the RStudio Zip/Tar for Windows. Note: If you already have RStudio, re-installing it in this way will update it.
6. Open RStudio and click the Open icon. Go to the barometric data downloader script folder, and open mars-barodata.r. Alternatively, you can go directly to the mars-barodata.r file and open it. It should automatically open the file in RStudio. If your computer prompts you to select a program to open the file and RStudio is not shown as an option, your computer may have installed RStudio under “Documents” which is restricted to your username, instead of “Programs Files” which is for all users on your computer. To check if this is the case, select Browse and search for RStudio under Libraries > Documents > RStudio > bin > rstudio.
7. Run the "install.packages" line on line 2 of the script. That should install/update the packages on your PC. Highlight the line and press CTRL+Enter to run it. If there is a # symbol at the beginning of line 2, this means that the line was changed to a comment and therefore will not run. Delete the # symbol and then run line 2. Once the packages are successfully installed (the red stop sign

in the “Console” window of RStudio will no longer be showing), add back the # symbol in line 2 of the script.

Once the script is set up, a few values will need to be changed each time the script is used – the SMP ID in step 1 (for baro script there is a data_interval input for either 5 mins or 15 mins), and the date range in step 2. The dates and times will range from 00:00 of the start date, to 23:55 of the end date. Once these are changed to the appropriate SMP ID and date range, run the script by highlighting all (CTRL+A) and running the script (CTRL+Enter). If there are no errors, the script will save a CSV file to the script’s folder. Both scripts operate the same way.

Appendix D – Preparing the Access Template

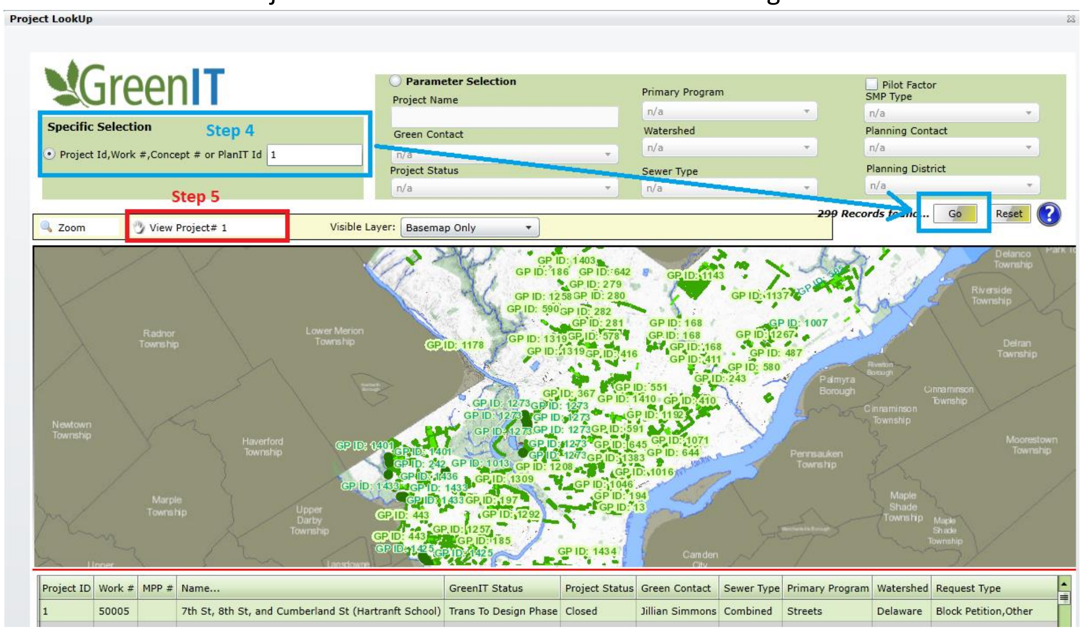
If there is no existing Access database for the well undergoing the QAQC procedure, a new one will need to be prepared. Use the following procedure to prepare a new Access database:

1. Copy the correct template to the main site folder, and rename it with the following naming convention, without brackets or parentheses: [SMP ID]_[OW Name]_[Site Name]_GSI_Monitoring_Database_[Date Created (YYYYMMDD)]_[Initials].mdb (e.g. 1-1-1_OW1_Hartranft_GSI_Monitoring_Database_20130403_sw.mdb). Do not make any modifications to the Access database templates.
    a. The groundwater template should only be used for data that measures distance to water (typically, groundwater and control wells). The observation well template should be used for water level data, including, but not limited to, data from observation wells, cleanouts, and shallow wells.
2. After renaming the Access database, open it and click “Enable Content” within the yellow band, if it appears.
3. The Access database will contain two tables and one query. Rename the “SMPID_OWname_CWL_Monitoring” to reflect the SMP ID and well name for which the template is being prepared. For example, the table for Palmer 9-2-1 OW1 would be renamed to 9-2-1_OW1_CWL_Monitoring. Do not rename or delete the query or other table. Proceed to section 2.4 when finished.

Appendix E – Using GreenIT

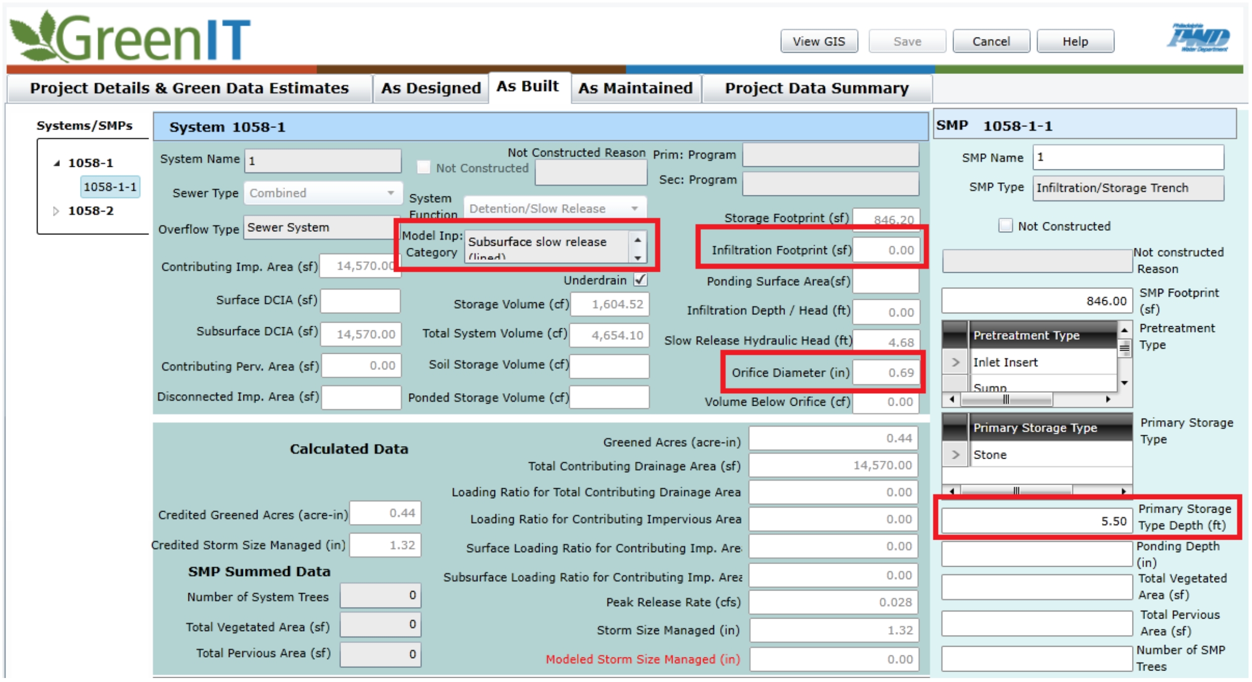
GreenIT is useful for the qualitative checklist portion of the QAQC procedure, as it provides information such as the SMP's storage depth, whether or not the SMP is lined, and the orifice diameter of the SMP if it is lined. GreenIT can be accessed and used with the following procedure:

1. Go to the Intranet, and in the Application section on the left side of the page, click "More applications", and select GreenIT. Enter the login credentials in the window that appears.
2. Click the OK button next to Project Lookup on the right.
3. In the Specific Selection field, enter the site ID (for example, if the SMP you want information on is 9-2-1, enter 9). Click Go at the bottom right.
4. Check "View Project# [site ID]", shown in the following image. It should default to the correct Site ID; if not, it should appear in the list at the bottom of the window. Select the correct SMP, and click on "View Project# X" outlined in the red box in the image below.



5. In the window that appears, go to the As Built tab, and select the appropriate SMP on the left. If there is no information shown, try the As Designed tab instead. Make sure the SMP is selected; no information will be shown if no SMP is selected. The outlined sections in the image below will inform you of the storage depth, orifice diameter, and whether or not the system is lined. In addition to the "Model Inp: Category" section, an infiltration footprint of 0.00 also indicates that the system is lined, as water stored within the system is not intended to infiltrate into the ground.

Updated on: Thursday, July 11, 2019



Simulated Runoff Testing of Green Stormwater Infrastructure – Standard Operating Procedure

1. Introduction

This document describes the Philadelphia Water Department's (PWD) standard operating procedure (SOP) for performing simulated runoff tests (SRTs) for green stormwater infrastructure (GSI) stormwater management practices (SMPs). The primary goal or objective of this document is to outline a process that provides meaningful and accurate hydrologic data to inform design, modeling, and performance estimates working in conjunction with other groups within PWD such as Green Stormwater Operations, GSI Planning and Design, and Hydraulic and Hydrologic (H&H) Modeling. It is suggested that at least three people participate in this procedure due to the frequency of manual water level readings required, equipment used, and safety concerns when operating in the public right of way (ROW). This document will be updated as monitoring and data analysis methods are refined. The most up-to-date version of this document is available on the PWD OOW server.

PWD performs a variety of monitoring activities specifically related to GSI.

- Continuous water level (CWL) monitoring SOP
- Surface infiltration rate testing (SIRT)
- Capture efficiency testing (CET)

2. SRT Procedures

2.1 Office Tasks and Preparation

2.1.1 Field Equipment and Site Verification Preparation

1) Synchronize laptop and camera clocks to Eastern Standard Time (EST).
2) Check batteries in all equipment and verify SD storage card is in camera
3) Use the contributing impervious drainage area (IC) from GreenIT (**Error! Reference source not found.** - **Error! Reference source not found.**) to calculate the target storm volume using rational method and determine the target flow rate to be applied to the SMP in question.

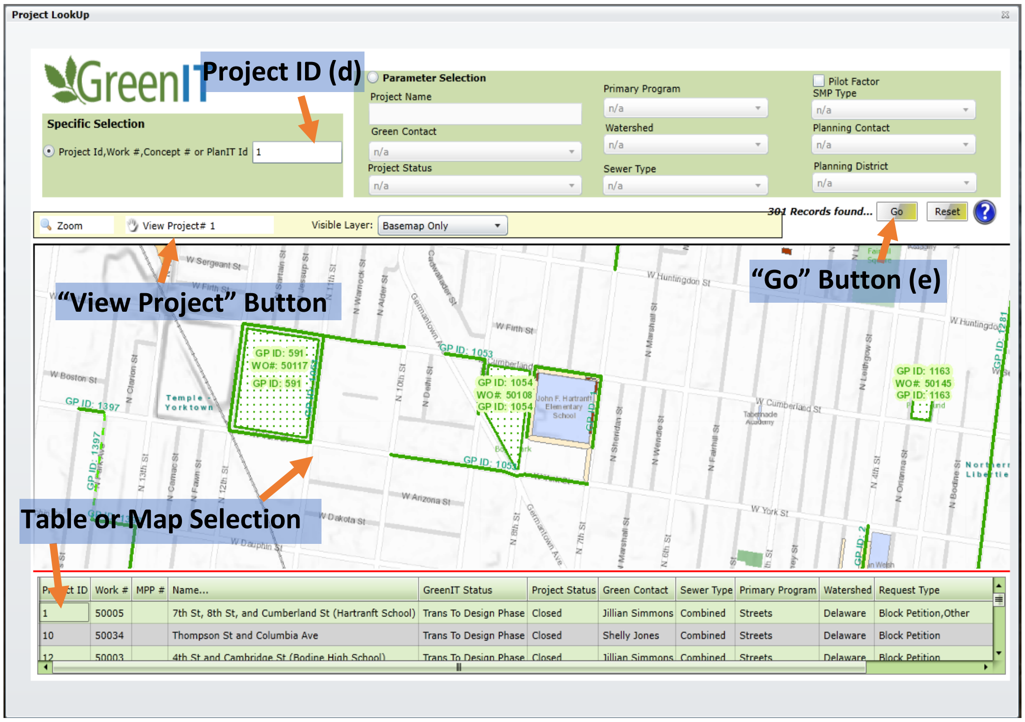


Figure 2-2 – GreenIT Project Look-Up

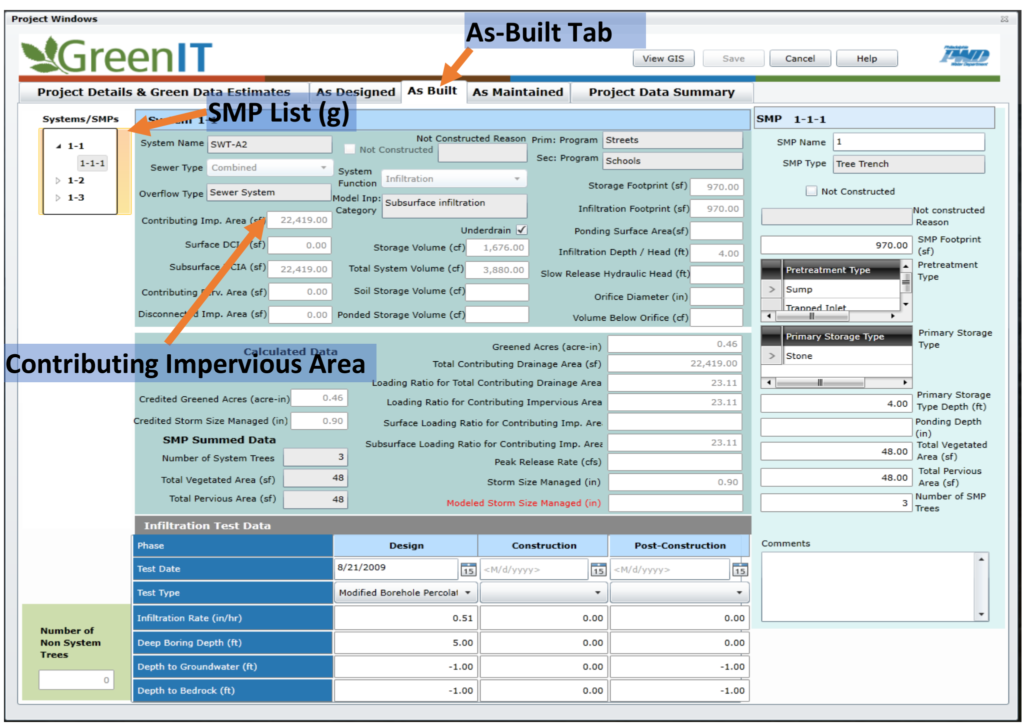


Figure 2-2 – GreenIT As-Built Details

a. Navigate to the GreenIT web application log-in page
b. Log in with credentials
c. Next, click “Project Lookup”, and click the “OK” button.
d. Enter the Project Identification (ID) in the “Specific Selection” window. The Project ID is the first number of the GreenIT ID. For example, for GreenIT ID “9-2-1”, enter “9”.
e. Click “Go”.
f. Select the project in the table at the bottom of the screen or select it on the map. Click the “View Project” button.
g. Select the “As Built” tab for the project. If multiple SMPs exist for the project/system, use the expanded list on the left side to select a specific SMP.
h. Locate the “Contributing Imp. Area (sf)” value for the system. Use this value for the storm volume and flow rate calculations.

4) Review nearby infrastructure using the Engineering Records Viewer (ERV2) in Internet Explorer
    a. Turn on hydrant layer under PWD→Water→Hydrants. Locate the nearest hydrant and determine the length of hose required to transport flow to the SMP inlet location.
    b. Turn on the following layers in ERV to look for nearby sewers and infrastructure that may cause short-circuiting.
        i. PWD→GSWI→GSWI Active
            - If the SMP does not appear, try GSWI Proposed.
            - Note: Some private SMPs do not delineate the SMP footprint so you will have to superimpose the as-built drawing onto ERV.
        ii. PWD→Waste Water→Waste Water Active & Inactive
            - Turn on the Waste Water Proposed and Waste Water Abandoned layers to see if new or abandoned infrastructure is a factor.
        iii. PWD→Storm Water→Storm Water Active
            - Turn on the Storm Water Proposed and Storm Water Abandoned layers to see if new or abandoned infrastructure is a factor.
        iv. Streets & Misc→Ortho Photos→2018 Ortho Photo City (or more recent)
    c. Double click sewers and review sewer plans under “Sticker Number” for suspected stubbed out laterals or other infrastructure that may cause short-circuiting.
    d. Review the ‘Supplementary Documents’ folder for the respective site on the MARS drive
    e. Transfer all documents to the field laptop and/or print out to have available onsite.
5) Review record of water-in-cellar (WIC) complaints near GSI developed by MARS. If SMP has a WIC nearby, it is imperative that Customer Field Services (CFS) be notified of MARS’ intention to perform an SRT at this SMP. Call CFS and provide address of WIC property. At this point, CFS will lead the investigation. CFS will contact the property owner to determine if they would allow PWD to test the nearby GSI and have access to the property. If they agree, CFS will coordinate the test with MARS. CFS will be on-site during the test and cleaning crew will either be on-call or on-site. The SRT will proceed as the remainder of this SOP states. No dye should be added to the SMP during the SRT.
6) If dye testing and there is potential for water to flow into a nearby stream, you MUST notify the appropriate group so they are aware and able to field any 311 calls that come in. For tests that may discharge dye to a stream, notify the Head of Industrial Waste at least the day before the SRT.

7) Verify that the portable water meter to be used in procedure (see Section 2.2) will accommodate the target flows. Typical attainable flow rates are about 40 cfm.
8) Prepare Onset HOBO Data Loggers (water level and barometric compensation) for all monitoring locations (see Section 2.3.2).

2.1.2 Logistics: Personnel Safety and Professional Conduct

1) Plan a route to the site and print maps or directions, if necessary.
2) Post "no parking" signs the day before or day of testing, if necessary to access SMP components or to ensure safety of the field crew.
3) Make sure each participant is familiar with the procedure and knows the specific tasks they will be responsible for. If three people are participating, it is recommended to use the following division of tasks:
    a. Personnel 1- Taking manual water level readings at monitoring location(s).
    b. Personnel 2- Taking manual flow readings at flow meter and keeping master time record.
    c. Personnel 3- Photo documenting site, observing short-circuiting locations, interacting with public and other PWD staff (equipment operators, inspectors, design engineers, etc.) and safety watch.
4) If any of the following conditions are true, the SRT can be cancelled at the discretion of MARS staff:
    a. Rain is expected during the planned test date.
    b. Rain is forecasted 24 hours following the planned test date when recession and/or infiltration rates are being observed.
    c. Rain is forecasted 24 hours preceding the planned test date when testing SMP for short-circuiting into private property.
    d. Heavy rain (>1.5") is forecasted 24 hours preceding the planned test date when testing SMP for short-circuiting into public infrastructure.
    e. Atmospheric temperature is forecasted at or below 0°C/32°F for 3 hours preceding or following the planned test date.
    f. Unsafe field conditions are identified by personnel administering the SRT.
    g. Presence of excessive sediment near the site of flow application that cannot be removed (e.g. improperly stored soil or aggregate for construction sites).
    h. Any other condition that may be deemed unsafe or considered to significantly impact the results of the test.

2.1.3 Fire Hydrant Preparation

1) Review all SOP documents related to hydrant & flow testing equipment
    a. Hydrant operating procedure
    b. Flow measurement equipment details & procedures
        i. Includes information on the backflow preventer, diffuser, and flow meter.
2) Ensure proper training of all field crew members on hydrant operation prior to test.
3) Verify that hydrant can produce necessary flows to replicate the target storm volume. Visually check the estimated pressure at the hydrant and corresponding flow rate.

2.1.4 Closed Circuit Television & Dye Test

SMPs where short-circuiting is suspected will undergo a series of tests to investigate concerns.

PWD utilizes closed-circuit television (CCTV) cameras to determine the location of short-circuiting. Prior to CCTV testing, SMPs will undergo a "pre-inspection" SRT in which biodegradable dye is used to better understand flow routing from the system. During this test, downstream manholes, grey inlets, and other checkpoints in the combined sewer system (CSS) will be observed from the ground surface. If the results of the pre-inspection SRT show that flow prematurely enters the CSS, a second test will be administered using a CCTV camera to visually inspect the adjacent sewer during an SRT. Refer to Section 3.4 for how to initiate a CCTV Dye Test.

2.2 Equipment Checklist

Equipment is organized in three separate lists. Sensitive electronic equipment should be stored separately from hand tools. Hydrant testing apparatuses can be found at the OOW storage trailer.

1) Clean bag
   - Laptop with HOBOware software
   - Onset HOBO optical USB shuttle and USB cable
   - Onset HOBO couplers (U20-L and U20)
   - Backup Onset HOBO Data Loggers (8 total; 4 Hobo U20-L and 4 U20)
   - Plan sets, maintenance maps, and Current Monitoring Site spreadsheet files
   - Digital camera with SD card
   - USB drive, for copying over CCTV and push camera files
   - Information resources for residents

2) Tool bag
   - First aid kit
   - Water cooler
   - Water level meter with extra battery
   - Personal protective equipment (PPE)
     - Safety vest or high-visibility shirt
     - Safety goggles
     - Work gloves
     - Protective footwear (steel-toe boots, high rain boots, waders, etc.)
   - Traffic cones
   - Flashlight
   - Two manhole hooks
   - Sledge hammer
   - Soil core sampler (if installing shallow well)
   - Toolbox
     - Ruler or solid metal bar for horizontal reference measuring point
     - Steel tape measure

- Key(s) for storage trailer, well access, control structure, etc.
- Ratchet and full socket set
- Hammer
- Small pry bar or chisel
- Two flathead screwdrivers
- Stainless steel cable (1/16" diameter)
- Wire cutter and crimping tool
- Carabiners or D-rings
- Stainless steel crimps/ferrules
- Work gloves
- Shop rags
- Bottle brush or pipe cleaners
- Vinegar
- Rag
- Duct tape
- Eye-bolts
- Various sized zip ties
- Pliers
- WD-40
- PVC cap wrench
- Drill with full bit set

3) Hydrant testing apparatuses

- Sand bags
- Biodegradable dye
- Hose ramps
- Hydrant wrench and center compression lock (CCL) key- dependent on hydrant type (All wrenches and keys can be obtained at the Distribution Stores Warehouse at 29th St and Cambria St)
- Pipe fittings - Hydrant reducer, couplings, Y-connectors, and backflow prevention valve
- Multiple sections of 2 ½ -inch diameter fire hose, 50-foot and 25-foot sections
- Portable meter test equipment - Sensus W-1250 or Sensus OMNI V2
- Diffuser and associated pipe fittings to be attached to flow meter outflow

2.3 SRT Field Procedures

SRT field procedures are broken down by personnel activities relating to 1) data logger setup and monitoring, and 2) hydrant, flow meter, and inflow controls. Logistically, it is ideal to assign one person to each procedure, and have one additional person performing photo-documentation, ensuring safe operation of equipment, and interacting with the public (See 2.1.1). Use intuition to assist other personnel in field procedures when appropriate.

If there is a vehicle obstructing access where “No Parking” signs were put up, you can contact the towing service and indicate that you are with PWD requesting a vehicle be relocated. Provide an exact address or nearest intersection and be on site to direct the tow truck.

Record-keeping activities are bolded.

2.3.1 Data Logger Setup & Monitoring (Personnel 1)

2.3.1.1 Data Logger Set-up

1) When arriving on site, make sure to park in accordance with City of Philadelphia parking laws.
2) Locate the monitoring location(s) and inspect the site for any unusual conditions. Establish appropriate safety measures such as placing cones or barricades. Ensure all field crew members are wearing the appropriate PPE.
3) If the site has NOT been monitored previously, perform the following tasks:
    a. If a distribution pipe exists that connects to the green inlet, check that the distribution does not have a cap on the end. If the distribution pipe is not visible from street level or you are unsure if a cap exists, fill the basin with water using the CET tank. Open the nearest clean out for the distribution pipe and see if it is dry. If the basin holds water and the clean out is dry, then the distribution pipe is likely plugged and offline.

Figure 2-3 – Example of Distribution Pipe Plug

    b. If an underdrain pipe exists that connects to a green-gray inlet, check that the underdrain has a cap on the end. If the design calls for an orifice on the PVC cap, check if a small hole is visible. Take a photo and save it in the site folder under “Supplementary Documents”.
    c. Perform a capture efficiency test (CET). Refer to the CET SOP for details.
4) If the site is currently being monitored, follow procedure in Section 4.4 of the CWL Monitoring SOP to download data and redeploy water level logger and/or barometric compensation sensor(s). Additional data loggers should be installed specific to the SRT at all monitoring

locations (observation wells, control structures, inlets, etc.) as appropriate. One barometric compensation sensor should be deployed specific to the SRT.

5) Remove cap from observation well or otherwise gain access to the monitoring location. **Take manual measurement of well depth using steel measuring tape. Record well depth in the field book.**
6) **Take a manual depth-to-water (observation well) or water depth (shallow well) measurement before beginning any flow testing, pre-wetting, or removing any sensors** (see Section 4.4 of the CWL Monitoring SOP).
7) Wipe the data logger clean and inspect the pressure sensor port for any debris. Carefully clean the port with a bottle brush or pipe cleaner if necessary.
8) Disconnect the data logger sensor body from its plastic cap and connect to the optical USB shuttle, observing the correct alignment of flat threading on the sensor.
9) Start HOBOware Pro software.
10) Connect optical USB shuttle to laptop USB port.
11) Verify serial number (SN) in lower left-hand corner of HOBOware interface.
12) Use a flashlight to inspect or sound the bottom of the well if possible to determine if there is debris accumulation. **Note any observations regarding functionality of well in the field notebook.**
13) Launch the data logger (Device>Launch) with a 5-minute logging interval, recorded at the next interval, recording absolute pressure (psi) and temperature (°F). Name the deployment [SMP ID]_[Monitoring Location ID]_[SRT]_[SN], (ex. 180-1-1_OW1_SRT_9951601).

    NOTE: It is imperative that all sensors are recording at the same time interval. For example, all sensors recorded a data point for the time 12:00:00, not one at 12:00:00 and the other at 12:01:30.

14) Reinstall the data logger in the monitoring location per Section 4.4 of the CWL Monitoring SOP. Avoid any obstructions such as rebar that may be present within the well. The data logger should be hanging freely (i.e., not resting on the bottom of the well) and there should be no cable slack when the data logger is properly deployed.
    Take a manual water level reading just after installing the data logger sensor. Record the monitoring location, data logger SN, sensor USB shuttle SN, depth-to-water (observation well) or water depth (shallow well) reading, time, units, and measurement device ID in the field book. See Section 4.5 of CWL Monitoring SOP for installation of barometric compensation sensor.

2.3.1.2 Monitoring Procedures

1) **Take manual depth-to-water (observation well) or water depth (shallow well) readings at each monitoring location every 15 minutes during the application of flow (at the same timestamp as flow meter readings) and for the 30 minutes following cessation of flow to the SMP to validate the observation well readings.**
2) **Take manual readings at monitoring locations where sensors are installed (inlets, observation wells, etc.) as soon as possible after overflow conditions are observed. Record the time, location, and depth of measurements as well as the overflow condition the measurement corresponds to.**

3) **Take another reading in the monitoring location immediately after stopping flow (independent of the readings taken every 15 minutes). Note on field form time, location, and depth-to-water (observation well) or water depth (shallow well).**
4) Allow data loggers to remain in place for 72 hours, or until complete drain-down has occurred.
5) Using the procedure in Section 4.4 of the CWL Monitoring SOP, collect the data from the site when the water level sensors are ready to be removed.
6) Use the following naming convention for data files: [SMP ID]_[Monitoring Location ID]_[SRT]_[SN].[extension], (ex. 180-1-1_OW1_SRT_9951597.csv)

2.3.2 Hydrant, Flow Meter & Inflow Operations (Personnel 2)

1) Use hydrant operating procedure from (see Section 2.1.3) to begin operation of nearby hydrant. When flushing the hydrant, ensure no water flows into SMP to be tested. Discharge water into grey inlet or downstream of SMP.
2) Once hydrant is ready (inspected, flushed, etc.), install backflow preventer, Sensus WL 1250 portable water meter, and associated hose and fittings.
3) Place metered flow discharge in a suitable location as determined by test objectives. For example, if the test seeks to eliminate inlet bypass from the mass balance, direct all metered flow to the green inlet(s) (or curb cut(s), etc.) serving the SMP. Install flow diffuser when indicated by field conditions.
4) The best location for discharge or diffuser installation will vary depending on testing objectives and field conditions. Install discharge flow (and diffuser, if equipped) according to the following guidelines:
    a. For general performance testing, it is recommended that the diffuser be placed so that metered flow discharge reaches the inlet (or curb cut, etc.) at approximately steady-state flow conditions (i.e., slightly upstream of inlet to allow turbulence to dissipate). Use sand bags to minimize inlet bypass. If sand bags are used to minimize inlet bypass, ensure that they are safely arranged at the inlet.
    b. If it is not feasible to place the diffuser as described above, or as required for certain testing objectives, it may be necessary to direct metered flow discharge directly into the green inlet(s).
        i. If necessary to remove highway grate inlet, have two personnel carefully use two manhole hooks to slide the grate up and out, pulling in the direction parallel to the curb.
        NOTE: Grates can fall into inlet and are extremely difficult to remove. Proceed with caution.
        ii. Weight end of hose with a valve fitting and place directly into green inlet filter bag.
    c. For surface infiltration SMPs, place the diffuser so that metered flow discharges directly into the SMP. Minimize scouring and surface damage by directing flow up-gradient or within an area of the SMP that is resistant to scouring.
    d. For some testing objectives, it may be necessary to discharge metered flow directly into distribution pipe or underdrain clean-out(s). Coordinate with GSI Maintenance staff for access to these clean out ports and any subsurface maintenance procedures that may be required before or after administration of the test.

5) Before applying flow, make sure enough time has elapsed from the installation of the data loggers to allow for thermal equilibrium (typically 10 minutes for Hobo (U20-001-04)
6) Open backflow preventer valves while flow meter valve is closed, allowing the hose leading up the flow meter to charge completely. Straighten out any kinks in the hoses prior to opening the flow meter valve.
7) Release the bleed valve on the flow meter to release any possible air bubbles.
8) Slowly open the flow meter valve and target flow to the system. Straighten out any kinks in the hoses leading to inflow point. **Record the start time of flow into the SMP on in the field book (See 2.3.4 Hydrant & Flow Meter Set-up, Step 8).**
9) Check flow meter every 15 minutes of the test, beginning when flow meter valve is opened. **Record time, flow rate, and total volume readings in the field book.**
10) Visually observe flow around inlet and adjust sandbags and diffuser position as needed.
11) If executing a pre-inspection SRT or CCTV & dye test, place dye directly into the green inlet(s). Dye should be administered to maintain sufficient color to inflow. Re-administer dye every 10-15 minutes, as needed. **Record time dye was administered and color of dye.**
12) During application of flow, be sure to note observations of SMP performance. For example, if the inlet is experiencing what appears to be 25% flow bypass (estimate visually) note on the field form when it is noticed and if it changes or stops. If bypass occurs and is unable to be eliminated, reduce flow rate as necessary to eliminate bypass.
13) **Record if and when the green inlet(s) or inflow point(s) to the SMP is overtopped or if any other hydraulic structures such as domed risers overflow during the test.**
14) Once the target storm volume has been applied, stop the flow from the hydrant.
15) Once flow from the hydrant has stopped, dismantle hydrant testing apparatuses and clean up tools and equipment.

2.3.3 Photo-Documentation and Support (Personnel 3)

1) **Photo-document the site prior to testing and periodically during the testing procedure. Document from consistent locations. Make sure to document the meter location, green inlet(s) or other inflow point(s), and any point of interest where SMP function can be observed, including nearby buildings that could be impacted.**

   <u>Important Note</u>*: If water is identified in a nearby building basement during the test, stop testing immediately. Do not add dye. Take photos of water in cellar. Notify PWD's Water Customer Field Services of water-in-cellar due to GSI testing. Ask Customer Field Services for name and email of the claims supervisor of that region. Email the exact address where water was identified, building contact name and number, and your name and number. Email water-in-cellar claim to the Claims Department within PWD's Customer Field Services and CC the claims regional supervisor.*

2) **Video document the procedure when applicable, particularly to emphasize flow routing**.
3) **Photo-document hydrant testing apparatus locations prior to and after applying flow to the system.**
4) **Mark-up design drawings layout showing equipment locations, SMP inlet points, and measurement points.** Note any site condition that impedes flow to the SMP such as parked cars, improper street grading (adjacent to inlets, street crown, etc.), and SMP structural elevations.

5) If executing a pre-inspection SRT or CCTV & dye test, check the green and grey inlet(s) and/or other infrastructure in which short-circuiting could be observed every 15 minutes. **Record flow observations, dye color, time of observation, infrastructure component ID, and any other relevant information.**
6) If executing a CCTV & dye test, observe live CCTV footage during the test. **Record the time observed, distance from the manhole, type and size of the affected infrastructure, NASSCO flow rate (stain, weeper, dripper, runner, gusher), if dye is observed infiltrating into the sewer, manhole riser, and/or grey inlet(s), and any other relevant information**.
7) If dye is observed infiltrating into the sewer through a lateral, **note whether or not the lateral has a vent, and if the lateral was "active" prior to administering the SRT**. Administer an alternate dye color in the vent to verify lateral, as needed. Note any infrastructure that may be connected to the sewer and causing the short-circuiting.
8) At the completion of a CCTV & dye test, **request that the CCTV Operator furnish a copy of the CCTV video, photos and CCTV Report on a USB.** Provide them with a USB to copy files onto.
9) Similarly, if performing an SRT with a push camera, **request that the Push Camera Operator furnish a copy of the push camera footage on a USB.**
10) Act as liaison with the public, private property owners, and other PWD staff (equipment operators, inspectors, design engineers, etc.).

3. Record Keeping & Reporting

3.1 Record Keeping

To ensure the integrity of records for field activities, it is imperative that reporting procedures are followed as stated in this SOP. For SRT field activities, there are two main reporting locations, including the GSI Monitoring Resources Microsoft (MS) Access database and the Field Testing Master Record MS Excel spreadsheet. A third reporting location is the GSO Coordination MS Excel spreadsheet. Below are the necessary steps for entering field data into the respective locations.

3.1.1 GSI Monitoring Resources MS Access Database

Three tables within the MS Access database host data relating to SRT parameters and manual measurements.

1) "SRT_Manual_WaterLevel" – Manually collected water level measurements from monitoring locations (see Section 2.3.2). Refer to Appendix A for instructions uploading measurements to Access. Descriptions of each column are provided for clarity.
    - *Date/Time* – Time of manual water level measurement [MM/DD/YYYY HH:MM:SS AM/PM] (ex. 5/30/2013 10:15:00 AM). Use 12-hour clock.
    - *SRT Test ID* – GreenIT ID_ YYYYMMDD (ex. 180-1-1_20130530)
    - *Water Surface* – Depth-to-water (observation well) or water depth (shallow well) measurements. Do not include units.
    - *Units* – Units of water surface reading (ex. FT)
    - *Sensor_ID_(Serial#)* – SN of data logger installed in monitoring location

- *Monitoring Location* – Location of data logger (ex. OW1, SW1, CO, CS1)
- *Notes* – Any notes pertaining to the manually collected measurements (ex. "Vertical reference – Top of well casing", "Bend at cleanout begins 3.5' from well cap")

2) "SRT_Manual_Flow_Data" - Manually collected flow data, including time, flow rate, and total volume (see Section 2.3.2). Refer to Appendix B for instructions uploading measurements to Access. Descriptions of each column are provided for clarity.
    - *Date/Time* – Time of manual flow rate or total volume measurement [MM/DD/YYYY HH:MM:SS AM/PM] (ex. 5/30/2013 10:15:00 AM). Use 12-hour clock.
    - *SRT Test ID* – GreenIT ID_ YYYYMMDD (ex. 180-1-1_20130530)
    - *Instantaneous Flow* – Flow rate. Do not include units.
    - *Instantaneous Flow Units* – Units of flow rate measurement (ex. CFM)
    - *Totalizer Readout* – Total volume output since beginning of test. Do not include units.
    - *Totalizer Readout Units* – Units of total volume output measurement (ex. CF)
    - *Notes 1, Notes 2, Notes 3* – Any notes pertaining to the manually collected flow data or observations (ex. "Flow on", "Flow rate reduced immediately prior to reading", "Flow off", "Orifice flow observed", "Dye observed in Manhole ID XXXX")
3) "SRT_Parameters" – General information pertaining to SRT. Descriptions of each column are provided for clarity.
    - *Date/Time* – Start time of flow release to SMP [MM/DD/YYYY HH:MM:SS AM/PM] (ex. 5/30/2013 10:15:00 AM). Use 12-hour clock.
    - *SMP Number* – GreenIT ID
    - *Monitoring Location* – All monitoring locations observed during the test, regardless of sensor deployment (ex. OW1, SW1, CO, CS1)
    - *SRT Test ID* – GreenIT ID_ YYYYMMDD (ex. 180-1-1_20130530)
    - *Time Keeper* – Typically Personnel 2 (see Section 2.1.2)
    - *Safety Watch* – Typically Personnel 3 (see Section 2.1.2)
    - *Photo Documentarian* – Typically Personnel 3 (see Section 2.1.2)
    - *Manual Water Level Measurer* – Typically Personnel 1 (see Section 2.1.2)
    - *Manual Flow Rate Reader* – Typically Personnel 2 (see Section 2.1.2)
    - *Recorder* – Typically Personnel 3 (see Section 2.1.2)
    - *Rain forecasted 48 hours after test?* – Yes/No
    - *Rain within 24 Hours preceding test?* – Yes/No
    - *Temperature forecasted to be below 32°F or 0°C* – Yes/No
    - *Unsafe Field Conditions* – Yes/No. Check yes for any unsafe field conditions, including any near -miss scenarios.
    - *Documentation of Unsafe Field Conditions* – Brief text description (ex. "Thunderstorms during test", "Ladder almost fell on personnel during test", "Unsteady rip rap leading in forebay at shallow well location")
    - *Other conditions that could inhibit application of SRT* – Brief text description (ex. "Car parked on top of inflow point", "Hydrant could not provide flow rate > 10 CFM", "Underdrain pipe missing orifice-controlled cap")

- *Site Hydrology Description* – Brief description of site hydrology (ex. "Flow bypassing green inlet into highway grate inlet (component ID XXXX)", "Well defined street crown", "Minor ponding at inflow point but subsides after flow is ceased")
- *1" Storm Volume* – Volume of inflow associated with a 1" storm (i.e. 1/12 FT * IC SF), measured in CF/IN
- *Flow rate 1"/hour storm* (CFM) – Flow rate needed to achieve 1" storm volume within a one-hour period (i.e. 1" storm volume/60 min), measured in CFM
- *Photo Checklist Overview Site, Photo Checklist Testing Setup, Photo Checklist Outflow Point if Visible, Photo Checklist Hydrant, Photo Checklist SMP Inflow Point, Photo Checklist SMP Outflow Point* – Yes/No to confirm minimum photo-documentation of points of interest
- *Public interaction record* – Brief text description of any public interaction
- *Description of results* – Brief text summary of result of SRT (ex. "Design volume achieved", "Dye observed in downstream manholes and grey highway grate inlet joints", "Underdrain orifice-control cap leaking around threads", "No water level response in OW2")
- *Misc Notes* – Any other pertinent information to site *not already covered in other fields*.

3.1.2 Field Testing Master Record

The Field Testing Master Record MS Excel spreadsheet hosts data pertaining to all field-testing procedures, including SRTs, capture efficiency tests (CETs), and surface infiltration testing, with tabs separating each type of test. Descriptions of each column in the SRT tab are provided for clarity.

- Test Type – The testing objective is one of the following:
  - Performance SRT – SRTs designed to evaluate the performance of an SMP based on credited storm size managed. Dye may be used to check for short-circuiting as well.
    - If dye observed, change test to Pre-Inspection Test and add to Short-Circuit Prioritization list maintained by the Compliance Team. Instructions for adding an SMP to the Short-Circuit Prioritization list is described in the QAQC SOP.
    - If no dye observed, keep test labeled as Performance Test.
  - Pre-inspection SRT – An SRT is called a Pre-Inspection Test if it is on the Short-Circuit Prioritization List maintained by the Compliance Team. SRTs using biodegradable dye that are designed to observe flow routing to determine if flow prematurely enters the CSS. Performed prior to CCTV & dye SRTs (see Section 2.1.4).
  - CCTV & dye SRT – SRTs using CCTV camera and biodegradable dye that are designed to determine where flow prematurely enters the CSS.
  - Construction Acceptance Test - SRT designed to test a SMP prior to the completion of construction.
  - *Note: All tests of SMPs under construction must be labeled as Construction Acceptance Tests.*
- FYQ – Fiscal year and quarter (FY18Q1 begins July 1st, 2018)
- Date – [MM/DD/YY], (ex. 07/07/2016)
- Time (EST) – Start time of flow release to SMP [MM:HH], (ex. 09:30). Use 12-hour clock.
- SMP ID – GreenIT ID

- Test Volume (CF) – Total volume output for flow meter at end of test. Measured in CF.
- 1" Volume (CF/IN) – Volume of inflow associated with a 1” storm (i.e. 1/12 FT * Drainage Area SF), measured in CF/IN.
- Storm Size (in) – Storm size associated with test volume (i.e. Test Volume/1” Volume). Measured in IN.
- Flow Data in Access Tables? - Confirmation of data entry in “SRT_Manual_Flow_Data” MS Access Table (See section 3.1.1), Yes/No.
- Water Level Data in Access Tables? - Confirmation of data entry in “SRT_Manual_WaterLevel_Measurements” MS Access Table (see Section 3.1.1), Yes/No.
- SRT Parameters in Access Tables? - Confirmation of data entry in “SRT_Parameters” MS Access Table (see Section 3.1.1), Yes/No.
- Photos Uploaded? – Confirmation that photos from test are in the SRT folder
- Sensor Collection Date – Date data logger(s) from SRT were collected [MM/DD/YY], (ex. 07/07/2016)
- QAQC Complete? – Confirmation that QAQC of data is complete
- SRT Summary Report Sent? – Confirmation that SRT Summary Report has been sent to the appropriate people
- Notes - Brief text summary of result of SRT, notes about infrastructure malfunctions, CCTV observations, etc.

3.1.3 GSO Coordination – MS Excel

This spreadsheet is meant to inform GSO of 1) the sites we monitor so they can take care when performing maintenance at these locations and 2) any GSI issues we observe so they can be remedied.

If an issue is encountered that would involve GSO input, follow the GSO Coordination SOP to document and notify GSO of field findings. See GSO SOP for a list of field findings and how to address them as well.

3.2 Data Processing Procedures

3.2.1 Data Preparation

Retrieve the water level sensors a few days following the SRT once the water level has sufficiently receded. Prior to beginning the actual QAQC procedure, it is important to create a copy of the raw data. Due to the file format of the raw data, it can easily be rendered unusable, and creating a copy helps prevent data loss if this were to happen. This is done with the following procedure:

1) All collected data will be located in the Raw Data Dropbox. The names of the folders within the dropbox indicate the date on which the data within their respective folders was collected, as well as the person by whom the data was collected. These folders are referred to as the collection folders.
2) Locate the collection folder containing the data to undergo the QAQC procedure and copy the folder to the site’s raw data folder. Any raw data not associated with the site can be removed from the copy of the collection folder. For now, do not remove any data from the raw data dropbox folder.

- Alternatively, you can make a new folder within the site's raw data folder, and name it the same as the collection folder. Then, copy the site's raw data from the collection folder to the new folder. This may be easier for collection folders with raw data from many different sites. Whichever method you choose, be sure to copy the CSV ***and*** hobo files.

Site folders are named with the following naming convention: [Site name]_[Project number]. If you don't know the name of the site, search for the project number within the above-referenced folder. For example, to go to the folder for SMP ID 9-2-1, search for "9", and you will find the site folder titled Palmer_9.

3.2.2 QAQC SRT Workbook Preparation

1) All sensor water level data for an SRT is placed into a single spreadsheet. Templates for the QAQC Excel workbooks can be found at the following file pathIf not already created, add a new folder to the site's SRT folder entitled [SRT Date (YYYYMMDD)]_SRT.
2) Copy the QAQC SRT template to the specific SRT folder.
3) Rename the template using the following naming convention: *QAQC_SRT_SMP#_YYYYMMDD(SRT_Date)__initials_[TemplateUpdated_20170908_JFW]*

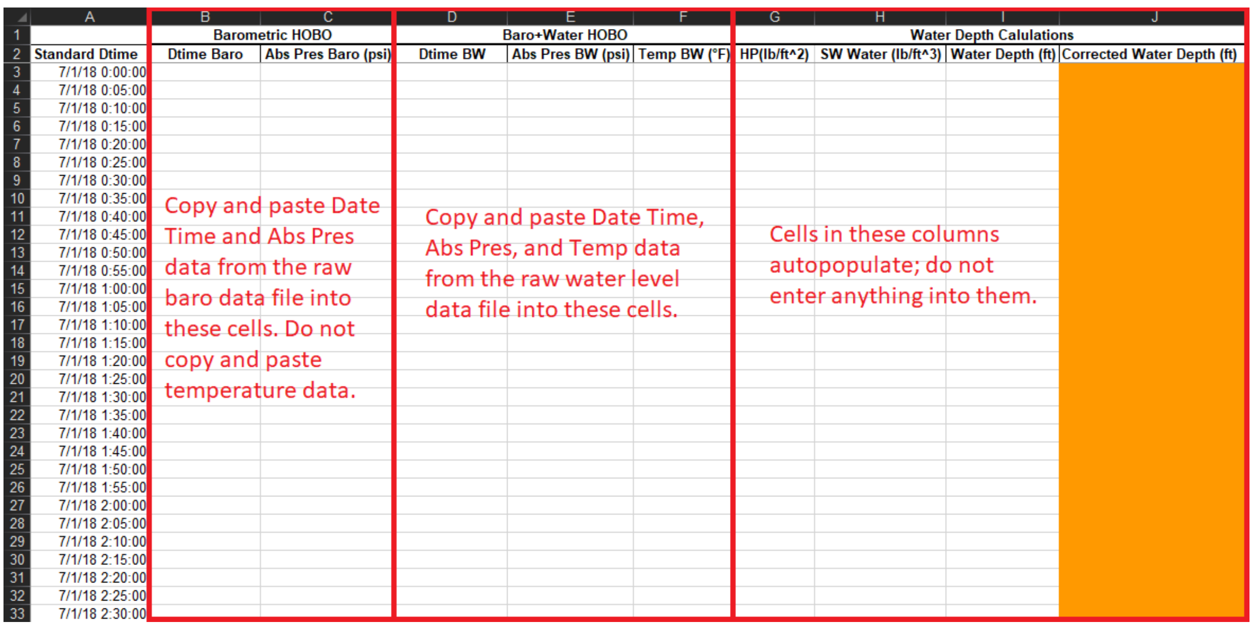
3.2.3 Updating the QAQC SRT Workbook

1) Fill out the information in the Site Info tab. In the cells next to "Date Created" and "Last Modified", place the appropriate date and next to that the initials of the appropriate person.
   - "RG" in cell A8 refers to the rain gauge closest to the SMP undergoing QAQC action. This can be found using the rainfall data downloader script, which is explained in step 5 of this section.
2) The QAQC SRT template includes a tab for sensor water level data (OW1_Data) and a tab for manual water level readings (OW1_Man_WL). Create a copy of these two tabs for each observation well monitored during the SRT and rename them.
3) For each observation well monitored, open the SRT_Manual_WaterLevel excel file in the SRT folder. Copy the rows of data and paste it into the respective manual water level tab in the QAQC SRT workbook.
4) Open the SRT_Manual_Flow_Data excel file in the SRT folder. Copy the rows of data and paste it into the "Simulated Runoff Flow Data" tab in the QAQC SRT workbook.
5) For each observation well monitored, open the raw water level data CSV file. Copy the data from the Date Time, Abs Pres, and Temp columns (B, C, and D, respectively) into columns E, F and G in the associated data tab of the QAQC SRT workbook. Make sure the dates and times match up with those in column A.
   - Sensors may unintentionally be deployed using Eastern Daylight Time instead of Eastern Standard Time. You can check for this looking at cell B2 in the raw data file. If it says GMT-05:00, the data is in Eastern Standard Time, and does not need to be corrected. If it says GMT-04:00, the data is in Eastern Daylight Time and needs to be corrected. Refer to **Appendix A** in the QAQC SOP for the procedure on correcting timestamps.
   - When you close the raw data file, you may be prompted to save the file. ***<u>Do not save the file</u>***, because doing so changes the formatting in a way that renders the data unusable. If this

happens prior to copying the data to the site folder, there multiple ways the data can be recovered, which are explained in **Appendix B** of the QAQC SOP.

6) Open the raw barometric data file, which should be indicated by the "BARO" in its file name (i.e. *1-1-1_ OW1_BARO_11013531.csv*). Copy the data from the Date Time and Abs Pres columns, and paste into columns C and D of the QAQC SRT workbook's data tab, starting with the correct timestamp. Make sure the timestamps match up with those in column A. Do not copy temperature from the barometric data file.
7) Once the barometric and water level data have been entered, columns H through K will auto populate. Column K will be used for plotting the data, and the resulting plots will be used for performing qualitative analysis in the Qualitative Checklist tab, which is explained in Section 3.3.
   - If these cells do not auto populate, ensure that the deployment measurements have been entered into their corresponding cells in the Site Info tab.

See the following image for a visual explanation of steps 3, 4 and 5.



8) Once all the data for the SRT has been entered, view the data in the "SRT Water Level Plot" and the "Recession Rate Plot". Adjust the X and Y axes as needed to view the data effectively. The SRT Water Level Plot is intended to view the SRT only whereas the Recession Rate Plot should extend a few days past the SRT to calculate the recession rate of the system.
9) Save the workbook when finished.

When the QAQC process has been completed for a given set of data, ensure that a copy of the raw data CSV file exists within the site folder, and that the data is in a usable format. Once this is confirmed, delete the data from the raw data dropbox.

3.3 Qualitative QAQC Checklist

In the QAQC SRT workbook, there is a tab named "Qualitative Checklist". The purpose of the qualitative checklist is to allow for analysis and interpretation of the data collected from that SMP. Based on the results of the qualitative checklist, it will be determined either that the SMP is functioning properly, or that it is not functioning properly. In the case of the latter, further testing will be performed to determine the source of the issue. There are up to four metrics upon which SMPs are evaluated: water level response, drain-down duration, recession rate, and water detained by liner (if the system is lined; does not apply to shallow wells). The criteria for evaluating each of these metrics are explained in the Qualitative Checklist tab of the QAQC SRT workbook.

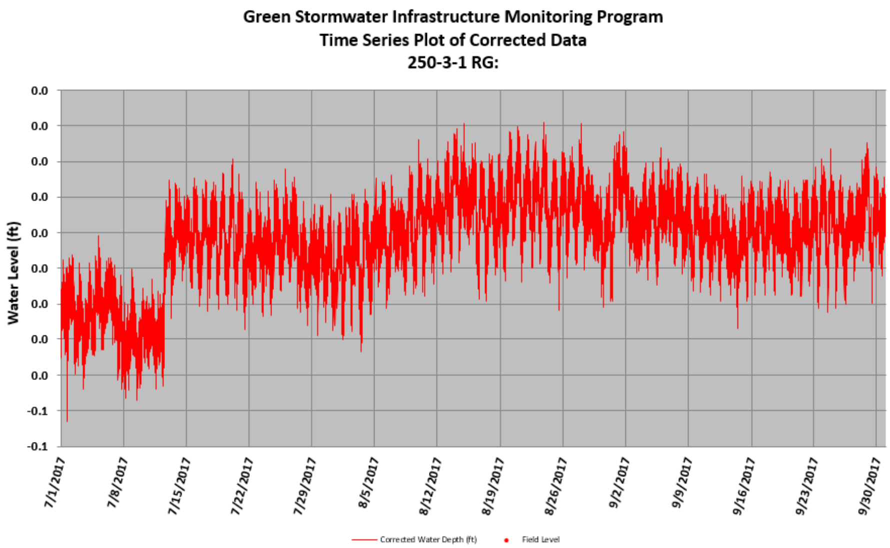
Cells B1 and B2 will auto-populate based on the info entered in the Site Info tab; in cells B3 and B4, enter the date the spreadsheet was last updated, with the initials of the last person to update it. See the following image for a layout of the qualitative checklist in its current form. The cells outlined in red are the only cells in which any information should be entered.

	A	B	C	D	E	F	G
1	SMP ID						
2	Monitoring Location						
3	Last Updated						
4	By						
5	Project Directory:	\\pwdoows\oows\Watershed Sciences\GSI Monitoring\07 Databases and Tracking Spreadsheets\04 QAQC\01 GSI_QAQC_Database_Templates\CWL_Templates\2018\Observation w					
6	Notes:	Add any field notes or other anecdotal references here.					
7	QA Files used to analyze:	SMPID_SNSN#_OW1_18Q3_QAQC_EOA.xlsx					
8	**Metric**	**Decription**	**Criteria**	**SMP response**	**Red Flags**		
9	Water Level response	Does the water level change in response to precipitation events.	Water level changes greater than the value of the sump depth.	*yes or no*	no level response for events greater than 1"		
10	Draindown Duration	The water level of the GSI should return to the level observed prior to precipitation event	System fully drains in 72 hours or less	*Drain down time to the nearest 5 minute interval*	Draindown time exceeds 96 hours		
11	Recesssion Rate	Change in water level between end of storm to bottom of storage divided by change in time between end of storm and bottom storage.	>0.25"/hr	*estimated recession rate*	Recession rate is greater than 5 "/hr		
12	Water detained by liner	If GSI has an impermeable liner, does the water level equilize at the approximate orifice elevation?	Water level plateaus + or - 2" near the recorded orifice elevation	*yes or no*	System fully drains or drains faster than "X" in/hr. Where "X" is the time the system would drain through only orifice flow.		
13							
14						date and time	water level
15					final peak of storm		
16					6" above top of sump		
17					top of sump		
18					***draindown duration***	***0:00:00***	
19					***recession rate (inches/hour)***	***#DIV/0!***	
20							
21							

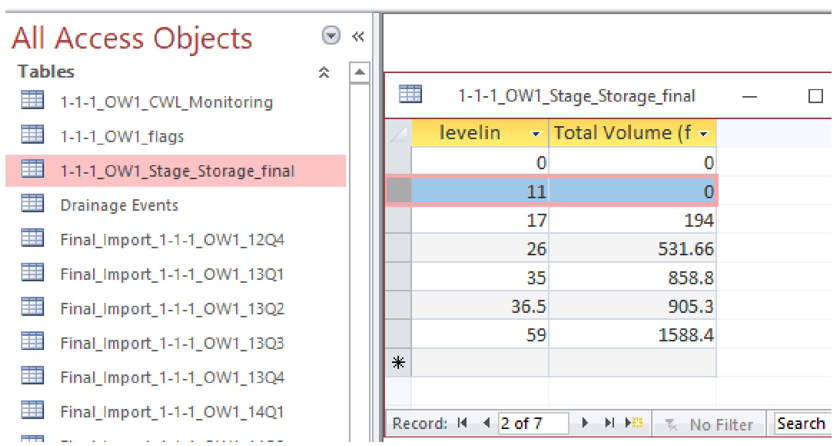
... | Jul TS | Jul TS CORR | Aug TS | Aug TS CORR | Sep TS | Sep TS CORR | All TS | All TS CORR | Qualitative Checklist | SpecificWeight_1 ...

3.3.1 Water Level Response

Water level response can sometimes be determined by observing the water level plots and comparing them to the simulated runoff flow. If there is little-to-no response to the hydrant flow, especially if the simulated runoff flow was over one inch of "rain", then it is not possible to calculate the SMP's draindown duration and recession rate, and the SMP will be flagged. See the image below for an example of an SMP not responding to simulated runoff flow. Note how the water level never even reaches 0.1 feet, despite there being flow added during the SRT.



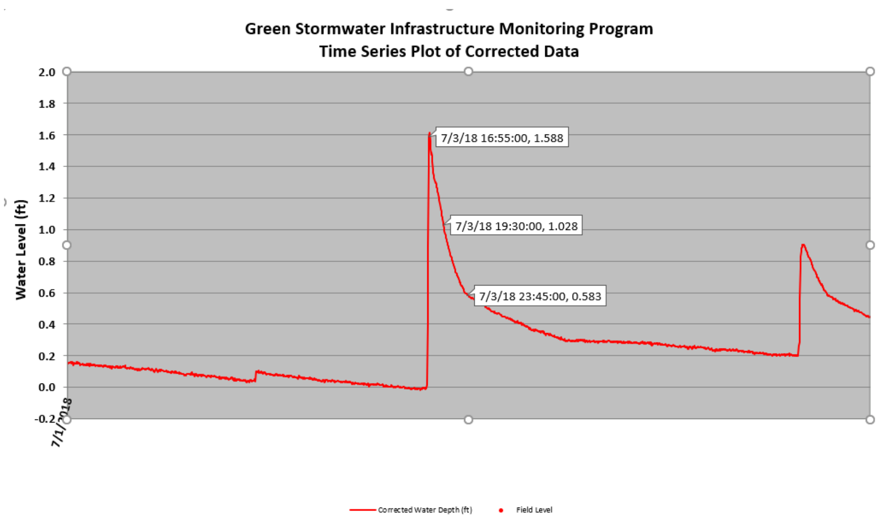
Other times, however, the sump depth must be known, as the criterion for this metric requires not only response to a precipitation event, but a response great enough that the water level exceeds the sump depth. For some SMPs, the sump depth of an SMP can be found in the "[SMP ID]_[OW_name]_Stage_Storage_final" table of that well's Access database. The sump depth will be the greatest value in the "levelin" column with a corresponding value of 0 in the "Total Volume" volumn. In the image below, the sump depth can be found in the highlighted and outlined section, and is 11 inches. For newer SMPs, however, stage storage tables do not exist, and this information must be found elsewhere, typically in the well specification section of the as-built design document.



3.3.2 Draindown Duration

Draindown duration is the time it takes the SMP to drain down to the top of the observation well's sump. When completely full, the SMP should drain within 72 hours, but up to 96 hours is acceptable. Please note that shallow wells require a draindown duration of 24 hours. Because an SRT may not completely fill the SMP, the percent of the SMP that was filled during the SRT needs to be determined, and then compared to the 96-hour criterion. For example, if the storage height of an SMP is 48 inches, and a storm filled it to 32 inches (ergo the system is 67% full), the system would have to drain within 64 hours, which is 67% of 96 hours. While this is not entirely accurate, as it assumes a linear recession rate, it is a simple way of determining whether or not the system drains within an acceptable timeframe.

1) To calculate draindown duration, use the "Recession Rate Plot" tab. Edit the date range as needed to better visualize the recession limb following the SRT.
   - Although Excel will show a numerical value instead of an actual date and time, with the time of day being represented by a decimal (e.g. 43101.25 instead of 1/1/2018 6:00 AM), the values can be changed using a MM/DD/YYYY format. If a date is entered without a time, the time of day for that date will default to 12:00 AM.
2) Identify the ***final peak*** of the SRT. The time at this point will be used in calculating draindown duration, and the water level will be used to determine how much of the system was filled at this time.
3) Identify the time at which the water level drains down to the top of the sump.
   - The top of the sump can be identified by an inflection point in the water level plot. An example of this is shown in the image below.
   - Identifying the top of the sump can be difficult, as the water level plot does not always show a clear inflection point. It is generally assumed that the sump depth is 12 inches below the bottom of the SMP, but there are instances in which the observation well does not have a sump. If you are having trouble identifying the top of the sump, discuss the matter with other members of the MARS group.



4) When identifying the points such as the high point of the storm, 6 inches above the top of the sump, and the top of the sump, use the data call out feature on MS Excel. You do this by selecting a point, which a blue box should appear around, then right clicking. Select add data label from the drop-down menu, then select add data callout. This callout will include the date, time, and water level.
5) Calculate the draindown duration using the time elapsed from when the water level was at the final peak, to when it drained down to the top of the sump.
6) Determine the percent of the SMP that was filled at the top of the final peak. To do this, divide the final peak's water level by the storage depth of the SMP. This will require the final peak's

water level from step 3, and the storage height of the SMP, which can be obtained two different ways.

- The first method of obtaining the storage height requires the information to be entered into the Access database for that SMP's well. If the information is entered, it will be contained within a table named [SMP ID]_[Well Name]_Stage_Storage_Final. In the "levelin" column, subtract the sump depth from the top of storage. The top of storage will be the largest number, and the top of the sump will be the largest number with a corresponding "0" in the "Total Volume" column. The storage height for most SMPs will not be obtainable using this method; therefore, it would be useful to familiarize oneself with the following method.
- The second method is to find the SMP on GreenIT, and within the "As Built" specifications, find the value for "Primary Storage Depth (ft)". This is the value to use when calculating the percent of storage that was filled. See **Appendix E** of the QAQC SOP for a more detailed explanation on how to use GreenIT. If the "As Built" tab does not contain any info for the SMP, use the information from the "As Designed" tab instead.

7) Multiply the percent storage filled (as a decimal) from step 6 by 96 to determine the maximum allowable draindown duration for the storm being used. If the draindown duration from step 5 exceeds this, then the SMP must be flagged.
Note: Shallow wells require a draindown duration within 24 hours, not 96.

Refer to the image at the end of Section 3.3.3 for a visual understanding of where on the plot the values used to calculate draindown duration can be located.

3.3.3 Recession Rate

Recession rate is the rate at which the water leaves the SMP. Only the six inches above the top of the sump are used in this calculation, or the top of the final peak if it's within six inches above the top of the sump. The image below shows the point relative to the top of the sump from which the recession rate is calculated.

1) Locate the water level and its corresponding time closest to the six-inch point above the top of the sump. If there are multiple peaks within the SRT, use the final peak. See the following image for an example of a plot showing where to calculate draindown duration and recession rate.
2) To facilitate the calculation of the draindown duration and recession rate, there is a table from cells E15 to G19. Draindown duration only requires cells F15 and F17 to be filled in, using the same date and time format that the Data tab uses. Recession rate requires F16, F17, G16, and G17 to be filled in.
3) The recession rate will be displayed in cell F19, and is calculated based on the data entered in cells F16-G17. Enter this value in column D's cell that corresponds to recession rate (cell D11). Flag if the recession rate does not meet the criteria explained in the qualitative checklist.

3.3.4 Water Detained by Liner

Some SMPs are surrounded by an impermeable liner, which does not allow water to infiltrate into the ground. Instead, the water is slowly released into the sewer through an orifice in the SMP's underdrain cap. The height of the orifice in the underdrain cap should be slightly above the bottom of the SMP's liner, allowing a small amount of water to remain in the SMP. The purpose of this metric is to determine whether or not the water level remains steady at or near the orifice elevation.

1) Determine the height of the bottom of the orifice relative to the bottom of the trench. The SMP's design or as-built plans, as well as GreenIT, may be required.
    - To find the SMP's orifice diameter, search for the SMP in GreenIT. You will find the orifice diameter in the "as built" or "as designed" tabs for that SMP. Refer to **Appendix E** in the QAQC SOP for a more detailed explanation on how to use GreenIT.
2) Determine the depth of the sump of the observation well. If there is a sump, this depth will need to be added to the height calculated in Step 1.
3) Compare the standing water level (i.e. when it "plateaus" outside of a rainfall event) to the height between the sump and the bottom of the orifice. These values should be within two inches of each other.
4) If these values are not within two inches of each other, or if the water level does not level off, flag the SMP.

Once all data procession and QAQC is complete, update the "Simulated Runoff Test" tab in the "Field Testing Master Record". In the row for the specific SRT, mark "Yes" in the column "QAQC Complete?". In the event that any of these metrics triggers a red flag, document the finding in the "Flagged SMPs Tracking Spreadsheet", note a course of action and discuss at the next MARS meeting.

3.4 Reporting

3.4.1 Performance, Pre-Inspection and Construction Acceptance SRTs

If an SRT was initiated internally by the MARS Group, then no notification is required as the SRT is a part of the normal workflow of the MARS Group. If the SRT was conducted in conjunction with another group, a summary of the results should be sent to the group in an email attach a PDF which includes plan and section views of the SMP, and other records as necessary.

Plan View (ERV):
Take a snapshot (snipping tool) from ERV using the following layers.

- PWD→GSWI→GSWI Active
  - If the SMP does not appear, try GSWI Proposed.
  - Note: Some private SMPs do not delineate the SMP footprint so you will have to superimpose the as-built drawing onto ERV.
- PWD→Waste Water→Waste Water Active & Inactive
  - Turn on the Waste Water Proposed and Waste Water Abandoned layers to see if new or abandoned infrastructure is a factor.
- PWD→Storm Water→Storm Water Active
  - Turn on the Storm Water Proposed and Storm Water Abandoned layers to see if new or abandoned infrastructure is a factor.
- Streets & Misc→Ortho Photos→2018 Ortho Photo City (or more recent)
  - Take a snapshot of the SMP with the ortho layer on and off

Plan and Section View (As-Built):

- To access the as-built in ERV, go to PWD→GSWI→GSWI Active and double-click the SMP. Click the Sticker Number hyperlink in the top left of the ERV window. Save the as-built to the site folder under Supplemental Documents→Design Drawings.
- Open the as-built drawing and take a snapshot (snipping tool) of the plan view and a snapshot of the section view. Save these images to the site folder under Supplemental Documents→Design Drawings.

Open a new PowerPoint file and insert the plan view from ERV and the plan and section views from the as-built drawing. Label all three views with the following information:

1) Date of test
2) GreenIT ID
3) System name
4) Type of SRT, i.e. performance, pre-inspection, construction acceptance
5) Nearby sewer size and type, if inspected during test
6) Nearby manhole IDs, if inspected during test
7) Description of observations, i.e. inlet capture efficiency, system response, dye in sewer

For future reference, save the final email in the site folder.

3.4.2 CCTV Dye SRT

A summary of the results from SRTs performed in conjunction with CCTV Unit should be detailed in an email to the Retrofit Evaluation Team (RET) and attach a PDF which includes plan and section views of the SMP, CCTV photos and other records as necessary.

Plan View (ERV):

- Take a snapshot (snipping tool) from ERV using the following layers:
    - PWD→GSWI→GSWI Active
        - If the SMP does not appear, try GSWI Proposed.
        - Note: Some private SMPs do not delineate the SMP footprint so you will have to superimpose the as-built drawing onto ERV.
    - PWD→Waste Water→Waste Water Active & Inactive
        - Turn on the Waste Water Proposed and Waste Water Abandoned layers to see if new or abandoned infrastructure is a factor.
    - PWD→Storm Water→Storm Water Active
        - Turn on the Storm Water Proposed and Storm Water Abandoned layers to see if new or abandoned infrastructure is a factor.
    - Streets & Misc→Ortho Photos→2018 Ortho Photo City (or more recent)
        - Take a snapshot of the SMP with the ortho layer on and off

Plan and Section View (As-Built):

- To access the as-built in ERV, go to PWD→GSWI→GSWI Active and double-click the SMP. Click the Sticker Number hyperlink in the top left of the ERV window. Save the as-built to the site folder under Supplemental Documents→Design Drawings.
- Open the as-built drawing and take a snapshot (snipping tool) of the plan view and a snapshot of the section view. Save these images to the site folder under Supplemental Documents→Design Drawings.

Open a new PowerPoint file and insert the plan view from ERV and the plan and section views from the as-built drawing. Label all three views with the following information:

1) Date of test
2) GreenIT ID
3) System name
4) Best System GA (Order of preference: As-Maintained → As-Built → As-Designed)
5) Sewer size and type inspected
6) Manhole IDs used to access sewer
7) Color of dye used and component used (i.e. inlet, cleanout) to convey water into the infrastructure (i.e. system, fresh air inlet (FAI), sinkhole)
8) Description for each short-circuit observation
    a. Distance from manhole
    b. Type of infrastructure [i.e. lateral (private, abandoned, or stubbed), brick and mortar joints]
    c. Type of infiltration using NASSCO terminology, refer to the NASSCO Pipeline Assessment Certification Program (PACP) Section 5 Operation and Maintenance Coding for more details.
        i. Infiltration Weeper (IW): The presence of moisture on the pipe wall or interior of manhole components through a defect or faulty joint, where water slowly seeps into the main. Typically, no flow will be visible with this observation.

ii. Infiltration Dripper (ID): Water dripping through a defect or faulty joint, pipe wall or manhole component. This will not have a continuous flow stream but will typically be seen as a slow but steady drip or seeping down the pipe wall.
iii. Infiltration Runner (IR): A continuous water flow into the pipe through a defect faulty joint, pipe wall or manhole component.
iv. Infiltration Gusher (IG): Water entering the pipe "under pressure" through a defect or faulty joint in a pipe or manhole component.

d. For short-circuiting into laterals, provide the following information:
   i. Depth of lateral in the field (measuring depth of lateral vent pipe) or estimate from plan evaluation if lateral depth cannot be determined in the field. If depth cannot be determined by either means, assume a depth of 7 feet below grade.
   ii. Distance from nearest portion of lateral to edge of the trench.
   iii. Elevation of the top of trench from plan evaluation.
   iv. Determination of who is responsible for repair of short-circuiting laterals by calculating the 1:1 ratio from the top edge of trench closest to the lateral. *Note: If any portion of the lateral is within 1:1 ratio, it is referred to GSO for repair. If entire portion of lateral is outside 1:1 ratio, it is referred to Collectors to issue NOD.*

In addition to the plan and section views of the SMP, append the following as supplemental information to the PDF:

1) CCTV photo of each short-circuit observation, and provide the following so it can be easily referenced from the plan view of the SMP:
   a. Distance from manhole
   b. Type of infrastructure
   c. Type of infiltration
2) Sewer plans, as necessary
3) Design drawings, as necessary
4) As-built drawings, as necessary
5) SMP superimposed onto sewer plans, as necessary
6) Construction photos, as necessary
7) Post-construction photos, as necessary

For future reference, save the final email in the site folder.

3.4.3 Short-Circuiting System Tracking

When a CCTV Dye Test identifies that a system is short-circuiting, use the following procedure to record the findings in the RET Short Circuit Project List maintained in conjunction with the Compliance Group. The RET Short Circuit Project List should be updated as progress is made to remediate short-circuiting. MARS should update the tracking database no less than after each quarter (monthly suggested). MARS is responsible for updating the database with SRT findings only. Compliance is responsible for updating the database with action items and notes that come out of the RET meetings. *Note: This does not include construction acceptance SRTs because short-circuiting issues found during construction should be addressed within the construction contract.*

1) Add/Modify SMP in the RET Short Circuit Project List:
    a. Open the Access Database link above
    b. Under “RET Short-Circuiting Tracking”, click >> Project List.
       Note: Do NOT open the following reports.
       - GSI Public In Construction Maintained Projects
       - GSI PC/Construction Forecasting Report
       - GSI Projects Watchlist << Add Compliance Watchlist Comments
       - GSI Construction Management Report
    c. For existing systems on the list:
        i. Using the filter/sort button at the top right, search for the SMP in question and click “Edit” on the far right of the row for that SMP.
        ii. The RET Short Circuit Form window will pop up.
        iii. To add a new short-circuit observation that is different than the types listed already, click “Add NEW Shortcircuit” next to the SMP ID at the very top of the form. Use the dropdown windows to populate the observation form. For “Refer to Date”, put the date that the CCTV Dye Test summary email was sent to RET. Click the “Add RET Short Circuit Notes” button to write a description. Click “Add” to add the observation to the list.
             Note: Following each RET meeting, action items and notes for each SMP is summarized by Compliance in the “Notes” column of each Short Circuit Observation. This is to serve as a reference for the latest news on the progress of each SMP.
        iv. Enter edits and click “Save.”
        v. Click “Close” to return back to the RET Short Circuit Project List view.
    d. For systems not on the list:
        i. Click “Add NEW Entry”.
        ii. Choose the SMP ID from the drop-down list.
        iii. Click “Add New Short Circuit.”
        iv. The Short Circuit Form window will pop up.
        v. The CIPIT information for this SMP will auto-populate. Fill out the remaining fields in the RET Short Circuit Form.
        vi. Click “Add” to add the entry to the RET Short Circuit Project List

4. Health and Safety Information

General information on PWD’s safety policies can be found on the PWD Intranet Safety Unit website. The Watersheds Safety Committee maintains files pertaining to information on official City of Philadelphia Safety Policy located on the OOW server.

- When working in the public ROW, adhere to PWD Workzone Traffic Control Guidelines and the Pennsylvania Work Zone Pocket Guide for Municipalities & Utilities (found in all OOW vehicles). Utilize road cones, signs, and safety tape to properly identify and isolate work areas and possible hazards.
- Use hard hats, safety shoes, safety gloves and protective eye wear, where applicable.

- During extreme heat events, ensure field crew members stay fully hydrated, and seek shade & rest to avoid heat exhaustion. Wear sun protection such as sunscreen, wide brimmed hats, and light-fitted clothing covering exposed skin.

Review safety policies prior to performing field work, inform supervisor of the work plan anticipated for the day, and ensure communication mechanisms between field and office staff are functional.

5. Public Relations Guidelines

While working in the field, you may be approached by residents or other members of the public. Remember that when working in the field you are representing PWD, and always conduct yourself appropriately. Residents may express concerns about basement flooding, safety, project aesthetics, or perhaps even PWD issues unrelated to the *Green City, Clean Waters* program. If a water enters a nearby building basement during an SRT, refer to Section 2.3.3 for instructions.

Do:

- Find a time and place where you can appropriately have a conversation
- Explain what you are doing
- Assume a friendly position and body language
- Provide the appropriate phone numbers for PWD questions.
- Listen to what the public has to say
- Make eye contact
- Be safe! Move away from traffic, tripping hazards, monitoring equipment, etc. Use appropriate safety equipment and adhere to all field safety guidelines

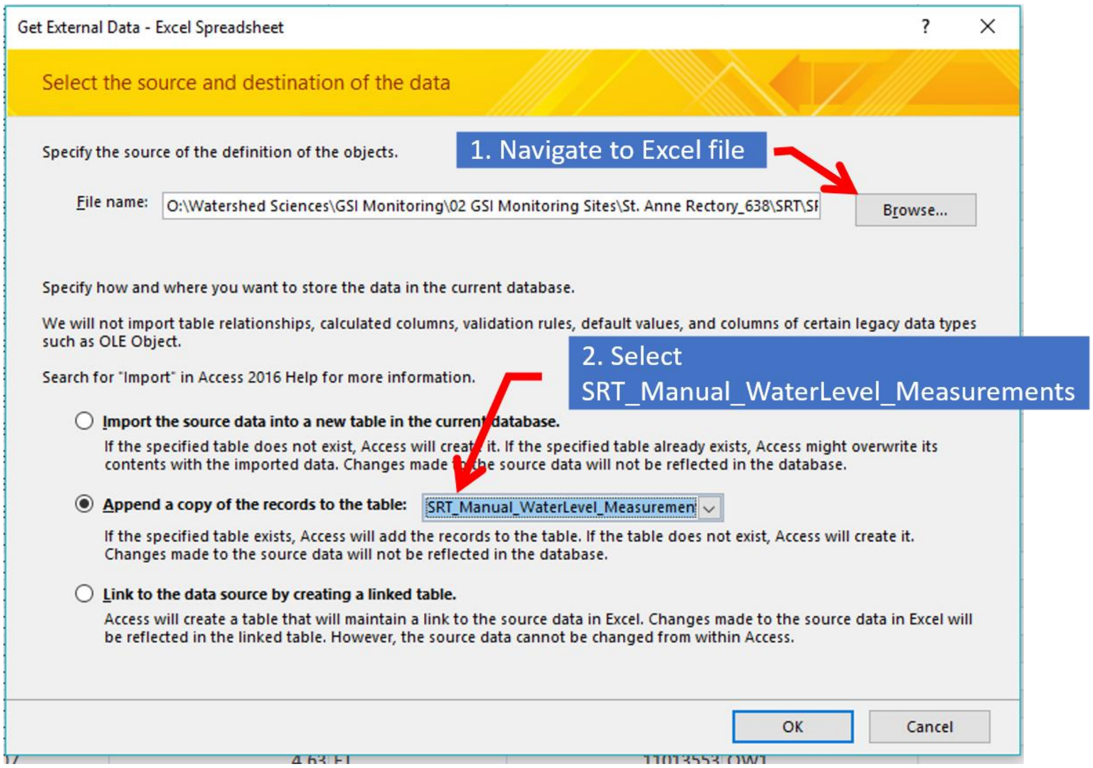
Don't:

- Jeopardize your safety, public safety or data quality
- Talk to the public at length
- Allow yourself to be distracted
- Engage a person who is hostile
- Provide your contact information
- Make promises about what PWD will or won't do, even if it relates to the site you are working on or *Green City, Clean Waters*

Appendix

Appendix A: Uploading Manual Water Level Measurements to Access

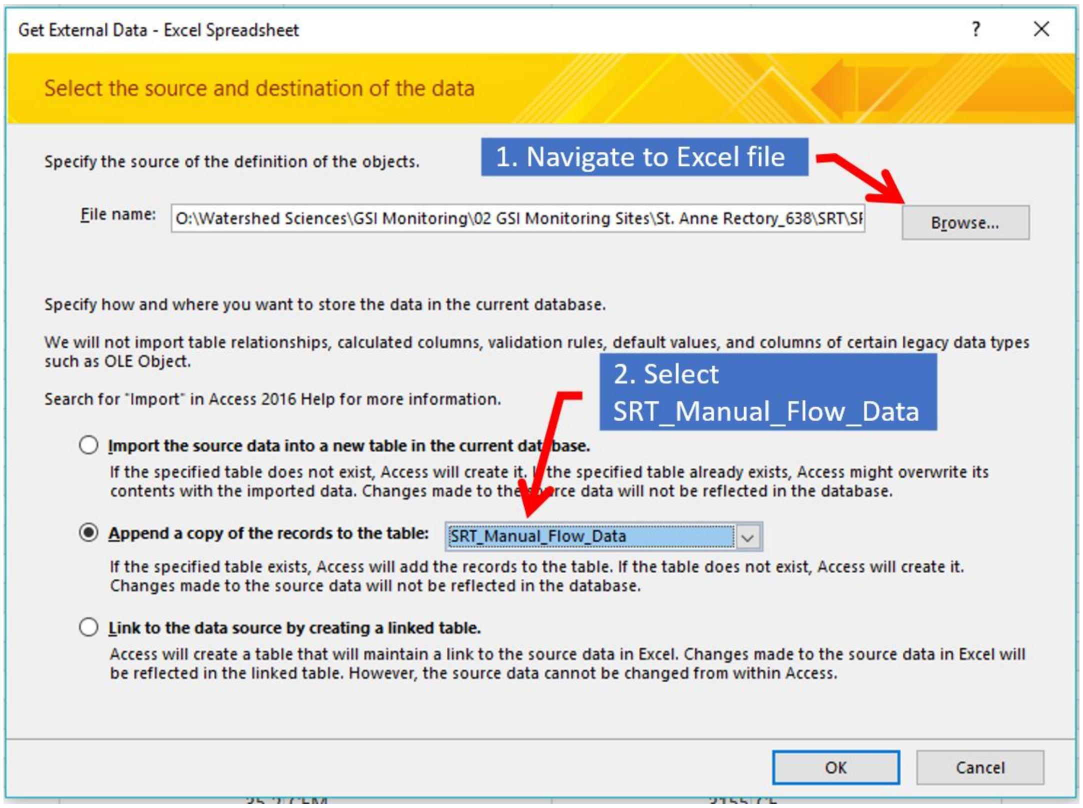
1) Open the template SRT_Manual_WaterLevel_Measurements_SMP#_YYYYMMDD_initials, and save a new file with the SMP ID, date of SRT and your initials and save in the SMP's SRT folder.
2) Populate the table.
    - Each row must be fully populated except for the Notes cell (this is optional). If an observation is noted at a time that is not associated with a manual reading, then add the note to the previous manual reading and note the time of the observation (i.e. 11:15am – leak identified in combined sewer inlet, etc.).
    - Rows will be rearranged in Access based on the Date/Time column; therefore, each Date/Time value must be unique. Many readings will be taken at about the same time. In this instance, stagger the Date/Time by one second so that the Date/Time values are unique, i.e. 9/19/2018 10:00:00 AM, 9/19/2018 10:00:01 AM, 9/19/2018 10:00:02 AM, etc.
    - Because Access will rearrange based on Date/Time, the rows in Excel do not need to follow a chronological order. For example, say you measured water level in two wells every 10 minutes for 100 minutes, you can enter the 10 measurements for OW1 in rows 1-10 and then enter the measurements for OW2 in rows 11-20. Access will then rearrange these measurements chronologically for you.
    - If a water level reading was skipped, just skip that time and list the next water level reading and time.
    - *Note: Do not modify the top row of this spreadsheet. This is the title row which Access uses to determine where to put the data.*
3) Save the file and close out.
   Note: It is important that you close out of the Excel file so that Access can fully read the Excel file in the next steps.
4) Open the GSI Monitoring Resources Microsoft (MS) Access database.
5) Under "All Access Objects" on the left column, right click the "SRT_Manual_WaterLevel_Measurements" Table. Select Import, select Excel.
6) In the pop-up window, navigate to the Excel you just created. Select "Append a copy of the records to the table:" and click the drop down and select "SRT_Manual_WaterLevel_Measurements". See image below.
   Note: If you have the SRT_Manual_WaterLevel_Measurements Access Table open, it will ask you "do you want to save the changes and close the table?". Select "No" if you did not make changes.



7) Access will automatically recognize the top row as the title row, hit “Next”. And then hit “Finish”.
8) Open SRT_Manual_WaterLevel_Measurements Access table. The rows you imported should now show up in this Access table.

Appendix B: Uploading Manual Flow Data to Access

1) Open the template SRT_Manual_Flow_Data_SMP#_YYYYMMDD_initials, and save a new file with the SMP ID, date of SRT and your initials and save in the SMP's SRT folder which can be found under and then navigate to the SMP folder.
2) Populate the table.
   - Each row must be fully populated except for the Notes cell (this is optional). If an observation is noted at a time that is not associated with a manual reading, then add the note to the previous manual reading and note the time of the observation (i.e. 11:15am – leak identified in combined sewer inlet, etc.).
   - Rows will be rearranged in Access based on the Date/Time column; therefore, each Date/Time value must be unique. Many readings will be taken at about the same time. In this instance, stagger the Date/Time by one second so that the Date/Time values are unique, i.e. 9/19/2018 10:00:00 AM, 9/19/2018 10:00:01 AM, 9/19/2018 10:00:02 AM, etc.
   - Because Access will rearrange based on Date/Time, the rows in Excel do not need to follow a chronological order. For example, say you measured water level in two wells every 10 minutes for 100 minutes, you can enter the 10 measurements for OW1 in rows 1-10 and then enter the measurements for OW2 in rows 11-20. Access will then rearrange these measurements chronologically for you.
   - If a flow meter reading was skipped, just skip that time and list the next reading and time.
   - *Note: Do not modify the top row of this spreadsheet. This is the title row which Access uses to determine where to put the data.*
3) Save the file and close out.
   Note: It is important that you close out of the Excel file so that Access can fully read the Excel file in the next steps.
4) Open the GSI Monitoring Resources Microsoft (MS) Access database.
5) Under "All Access Objects" on the left column, right click the "SRT_Manual_Flow_Data" Table. Select Import, select Excel.
6) In the pop-up window, navigate to the Excel you just created. Select "Append a copy of the records to the table:" and click the drop down and select "SRT_Manual_Flow_Data". See image below.
   Note: If you have the SRT_Manual_Flow_Data Access Table open, it will ask you "do you want to save the changes and close the table?". Select "No" if you did not make changes.



7) Access will automatically recognize the top row as the title row, hit “Next”. And then hit “Finish”.
8) Open SRT_Manual_Flow_Data Access table. The rows you imported should now show up in this Access table.

Surface Infiltration Rate Testing of Pervious and Porous Paving Materials – Standard Operating Procedure

1. Introduction

This document describes the Philadelphia Water Department's (PWD) standard operating procedure (SOP) for surface infiltration rate testing (SIRT) of green stormwater infrastructure (GSI) stormwater management practices (SMPs), particularly pervious and porous paving (PPP). The primary goal or objective of this document is to outline a process that provides meaningful and accurate hydrologic data to inform design, modeling, and performance estimates working in conjunction with other groups within PWD such as Green Stormwater Operations (GSO), GSI Planning and Design, and Hydraulic and Hydrologic (H&H) Modeling. This document largely uses ASTM standards ASTM C1701/C1701M-17 Standard Test Method for Infiltration Rate of In Place Pervious Concrete[1] and ASTM C1781/C1781M-15 Standard Test Method for Surface Infiltration Rate of Permeable Unit Pavement Systems[2] due to the method's replicability and ease of implementation.

> *"This procedure is intended to be a rapid, replicable method for measuring the infiltration performance of in-place pervious material" (ASTM Committee D18, 2009) (ASTM Committee C15, 2013).*

> *"The reported coefficient of variation for tests conducted in the same location by a single operator each day over 10 days is 4.7%. The multi-operator variability data has not been developed. The reproducibility of this test method is being determined and will be available on or before October 1, 2014" (ASTM Committee D18, 2009) (ASTM Committee C15, 2013).*

SIRTs can inform several inquiries regarding PPP effectiveness as SMPs, including:

1) Trends in surface infiltration rate over project lifecycle
2) Temperature effects on PPP performance
3) Maintenance requirements (inform new or evaluate existing)
4) Site-specific investigations

NOTE: Only infiltration performance is addressed. Structural performance metrics such as durability and longevity are not addressed.

> *"Tests performed at the same location across a span of years may be used to detect a reduction of infiltration rate of the pervious concrete, thereby identifying the need for remediation," (ASTM Committee D18, 2017).*

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[1] ASTM Standard C1701/1701M-17a, 2017, "Standard Test Method for Infiltration Rate of In Place Pervious Concrete," ASTM International, West Conshohocken, PA

[2] ASTM Standard C1781/C1781M-15, 2015, " Standard Test Method for Surface infiltration Rate of Permeable Unit Pavement Systems," ASTM International, West Conshohocken, PA

Infiltration rates for freshly installed PPP are on the order of hundreds of inches per hour (Tennis et al. 2004[3], Schaus 2007[4]), greatly exceeding storm intensities for Southeastern Pennsylvania (Bonnin et al. 2004[5]). To conduct tests most efficiently, it is necessary to define a range of infiltration rates that will be subject to testing. Specifically, it is desirable to limit the maximum test duration when identifying portions of porous surfaces that have reduced infiltration performance.

> *"The infiltration rate obtained by this method is valid only for the localized area of the pavement where the test is conducted. To determine the infiltration rate of the entire pervious pavement multiple locations must be tested and the results averaged."* *(ASTM Committee D18, 2017) (ASTM Committee C15, 2015).*

Although identifying infiltration rates on the order of 10 in/hr is important, small differences within this range are of no practical importance. It is a more efficient use of monitoring resources to conduct multiple tests and better spatially define the area of reduced permeability than to obtain precise infiltration rate estimates for areas of the pavement that are obviously inhibited. Therefore, PWD has made the following modifications regarding test timing and reporting:

1) If the pre-wet infiltration (see Section 3.3) time is less than 10 min, continue with the procedure for surface infiltration rate measurement. If pre-wet infiltration rate exceeds 10 min, stop adding water and remove the infiltration ring. Do not replicate the test. Record test result as < 13 in/hr.
2) If the initial volume of water (infiltration ring filled to maintain 0.5 inch of head at approximately 1.9 lbs) is not observed to decrease in 5 min, the test will be terminated, and the infiltration rate shall be recorded as less than 6 in/hr.

These guidelines are subject to change if the design engineer, project manager, or maintenance staff determines that exact infiltration rates are needed. For example, allowing duration of 20 min will allow infiltration rates as low as 7 in/hr to be measured. Officially, this standard method is not designed to measure zero infiltration, so results for tests ending prematurely due to low pre-wetting infiltration times are presented as "less than" values. Given enough time, some water may eventually move into surfaces that would not be considered porous. Statistical methods exist for the interpretation of "left censored" data (Helsel 2005[6]). Other users of the data may also choose to consider these values as zero if it suits their purpose.

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[3] Tennis, P., M. L. Leming, and D. J. Akers. 2004. Pervious Concrete Pavements. Engineering Bulletin 302.02. Portland Cement Association, Skokie, IL, and National Ready Mixed Concrete Association, Silver Spring, MD.

[4] Kathryn Schaus, Lori. (2007). Porous Asphalt Pavement Designs: Proactive Design for Cold Climate Use.

[5] Bonnin, Geoffrey & Martin, D & Lin, B & Parzybok, T & Yekta, M & Riley, D. (2011). NOAA Atlas 14 Point Precipitation Frequency Estimates.

[6] Helsel, Dennis R., (2005) Insider Censor: Distortion of Data with Nondetects. Human and Ecological Risk Assessment: An International Journal.

Additional modifications to ASTM Standard Test Methods are indicated throughout the SOP to give a central location for testing procedures for the PWD staff.

2. Office Tasks & Preparation

2.1 Office Tasks

1) Synchronize laptop and camera clocks with Eastern Standard Time.
2) Check battery levels and verify SD storage card is in camera.
3) Select a group of SMPs to be tested.
    a. Group SMPs by geographic area by using Google Maps (http://www.maps.google.com). Plan daily field visits based on geographic area to enhance efficiency when possible.
4) Plan route to monitoring sites, and create a list of all systems to be visited. Print maps and directions or save to the field laptop, if necessary.
5) Contact site representative and inform them of your estimated time of arrival (ETA), if necessary. This step typically applies to grant program sites with private access.
6) Collect plan sets (as-builts, if available) from the Green Infrastructure projects drive (and maintenance maps. Save the plan(s) in the “Supplementary Documents” folder for the respective site on the MARS drive.
7) If the site has been previously tested, identify previous test locations by reviewing documentation in the “Surface Infiltration Rate Testing” folder for the respective site on the MARS drive. Use the same testing locations from the last SIRT. Otherwise, mark-up as-built drawings with proposed testing locations. Create a folder in the site folder entitled “Surface Infiltration Rate Testing” and save the test location map here. Use the following guidelines to select testing locations:
    a. Three test locations for areas up to 2,500 m^2 [25,000 ft^2]
    b. Add one test location for each additional 1,000 m^2 [10,000 ft^2] or fraction thereof (ASTM Committee D18, 2009) (ASTM Committee C15, 2013).
    c. Additional locations can be added at the discretion of the test administrator. At least four locations should be used for large areas such as basketball courts.
    d. Provide at least 1 m [3 ft] clear distance between test locations, unless at least 24 hours have elapsed between tests (ASTM Committee D18, 2017) (ASTM Committee C15, 2015).
    e. Test locations used for porous paver systems (masonry block systems with permeable joints) should be representative of the porous paver system and the paver pattern. For example, do not place the infiltration ring on the surface such that only one paver joint will be infiltrating the mass of water when the system on average has three joints to infiltrate water for the area of the infiltration ring and vice versa. Test administrators should provide photo documentation of surface pattern and brief analysis in the appropriate section on the field form (ASTM Committee C15, 2015).
8) Create a folder on the laptop for the daily field visit schedule. Transfer plan sets, maintenance maps, testing locations, and a copy of the Field Testing Master Record spreadsheet into this folder.

2.2 Logistics: Personnel Safety and Site Appropriateness

1) Post "No Parking" signs or place down cones the day before testing if necessary, to access SMP components or to ensure safety of the field crew.
2) Make sure each participant is familiar with the procedure and knows the specific tasks they will be responsible for.
3) Do not perform test during the following conditions:
    a. Rain is expected during the planned test date.
    b. Surface temperature >100ºF (plumber's putty may not adhere) or surface or air temperature <32ºF (freezing). Test operators should be aware that surface temperature may be higher than air temperature, particularly for darker colored surfaces (ASTM Committee D18, 2017) (ASTM Committee C15, 2015).
    c. Presence of excessive sediment near the site of flow application that cannot be removed (e.g. improperly stored soil or aggregate for construction sites).
    d. Do not test if there is standing water on top of the pervious pavement surface. Do not test within 24 h of the last precipitation (ASTM Committee D18, 2017) (ASTM Committee C15, 2015).
    e. Any other condition that may be deemed unsafe or may significantly impact the results of the test.

2.3 Fire Hydrant Preparation

1) Review all SOP documents related to hydrant and flow testing equipment.
2) Ensure proper training of all field crew members on hydrant operation prior to test.

2.4 Equipment Checklist

Equipment is organized in two separate lists. Sensitive electronic equipment and field forms should be stored separately from hand tools.

1) Clean bag
    - Laptop with field report forms
    - Notebook and writing utensils
    - Digital camera
    - Information resources for residents
    - Stopwatch

2) Tool bag
    - Personal protective equipment (PPE)
        - Safety vest or high-visibility shirt
        - Safety goggles
        - Work gloves
        - Protective footwear (safety toe boots, high rain boots, waders, etc.)

- Hand sanitizer
- First aid kit
- Traffic cones
- Infiltration ring –A cylindrical ring, open at both ends. The ring must be watertight, sufficiently rigid to retain its form when filled with water, and conform to ASTM Designation: C1701/C1701M – 17
- Plastic water container conforming to ASTM designation: C1701/C1701M – 17
- Plumber's putty (non-hardening) meeting specification C920 or federal specification A-A-3110.
- Toolbox
    - Tape measure or ruler
    - Flashlight
    - Key(s) for control structure, padlocks etc. needed to access facilities
    - Hammer
    - Small pry bar or chisel
    - Flathead screwdriver
- Brush
- Dustpan
- Shop rags

3) Hydrant testing apparatuses
    - Hydrant wrench and center compression lock (CCL) Key – dependent on hydrant type
    - 2 ½-inch diameter fire hose, one 50-foot or two 25-foot sections
    - Backflow preventer
    - Hydrant to 2 ½-inch thread hose reducer
    - Water tank
    - Ratchet straps

3. SIRT Procedures

3.1 Filling the Tank

1) Load the tank into the bed of the truck with at least two personnel.
2) Secure tank in place using ratchet straps.
3) When arriving on site make sure to park in accordance with the City of Philadelphia parking laws. Park the truck with the tank close to the hydrant.
4) Set up work zone traffic control equipment, as necessary.
5) Use Hydrant Operating Procedure (see Section 2.4) to begin operation of nearby hydrant. When flushing the hydrant, ensure no water flows into the inflow structure to be tested. Discharge water into grey inlet or downstream of SMP.
6) Place the discharge end of the hose into the tank making sure to hold it securely in place.
7) Check the load capacity of truck before filling tank. Make sure to only fill the tank with water that is within the weight capacity of the vehicle in use. Keep in mind that the crew members and

field equipment also contribute to the load on the truck. Therefore, it is best to make sure the tank is not filled beyond half of its storage volume.

8) Slowly turn on the hydrant per Hydrant Operating Procedure. Make sure the hose remains securely in place. Do not over-fill the tank.
9) Close hydrant slowly and replace cap.
10) Place the hose and any tools securely into the truck.
11) Fill at least two five-gallon water tanks and set aside for easy pouring during SIRT.

3.2 Infiltration Ring Installation

1) Clean the surface by sweeping off trash, debris, and other non-seated material with a dustpan and brush.
2) Apply plumber's putty around the bottom edge (inside and outside) of the ring and place the ring onto the surface being tested. Press the putty into the surface and around the bottom edge of the ring to create a watertight seal. Place additional putty as needed.
3) Measure distances from clear benchmarks to the test location and record on either the maintenance map or as-built drawing.
4) Take a photograph of the testing location with identifying features such as nearby poles, trees, fences, signs, etc.

3.3 Pre-Wetting Procedure

1) Pour water into the infiltration ring at a rate sufficient to maintain a head between the ¼ inch and ½ inch lines. Use a total of 3.6 +/- 0.05 kg (8.0 +/- 0.1 lb) or approximately 3.8 L (1 G) of water (***ASTM methods modified due to equipment and field constraints***).
    a. When testing permeable unit pavers, take care to pour water on the paver and avoid the paver joints (ASTM Committee C15, 2015).
    b. If the ring is on a slope, read the side that gives the lower head reading.
2) Begin timing as soon as the water impacts the surface. Stop timing when free water is no longer present on the surface. Record the amount of elapsed time to the nearest 0.1 s in the appropriate location on the field form (ASTM Committee D18, 2017) (ASTM Committee C15, 2015).
3) In order to manage monitoring resources and time with the utmost efficiency, use the following guidelines and the pre-wet infiltration time to determine whether to move forward with SIRT (see Section 1) (***ASTM methods modified to enhance efficiency of monitoring resources***).
    a. If the pre-wetting duration is less than 10 minutes, continue with the procedure for surface infiltration rate measurement.
    b. If pre-wetting duration exceeds 10 minutes, stop adding water and remove the infiltration ring. Do not replicate the test. Record test result as < 13 in/hr.
    c. If the initial volume of water (infiltration ring filled to maintain 0.5 in head at approximately 1.9 lbs) is not observed to decrease in 5 min, stop adding water and remove the infiltration ring. Do not replicate the test. Record test result as < 6 in/hr.

3.4 SIRT Procedure

1) The test shall be started within two minutes of the completion of the pre-wetting procedure.
2) Use the following guidelines to determine the volume of water used for the SIRT (***modification to the mass of water in ASTM methods used due to equipment and field constraints***):
    a. If the pre-wetting duration is less than 30 seconds, use a total of 18.0 +/- 0.25 kg [40 +/- 0.5 lb] or approximately 18 L (5 gal) of water. Record the volume of water used.
    b. If the pre-wetting duration is greater than or equal to 30 seconds, use a total of 3.6 +/- 0.05 kg [8.0 +/- 0.1 lb] or approximately 3.6 L (1 gal) of water. Record the volume of water used.
3) Pour the water into the infiltration ring at a rate sufficient to maintain a head between the ¼- and ½-inch lines, and until the measured amount of water has infiltrated into the surface being tested.
4) Begin timing as soon as the water impacts the surface. Stop timing when free water is no longer present on the surface. Record the testing duration (t) to the nearest 0.1 seconds (ASTM Committee D18, 2009) (ASTM Committee C15, 2013).
5) Repeat the test and calculate the average infiltration rate from the two tests as the final result.

    " If a test is repeated at the same location, the repeat test does not require pre-wetting if conducted within 5 min after completion of the first test. If two tests are conducted at a location on a given day, the infiltration rate at that location on that day shall be calculated as the average of the two tests. No more than two tests shall be conducted at the same location on the same day.," (ASTM Committee D18, 2017) (ASTM Committee C15, 2015).

4. Record Keeping

To ensure the integrity of records for field activities, it is imperative that reporting procedures are followed as stated in this SOP. For SIRT field activities, there are two main reporting locations, including the GSI Monitoring Resources Microsoft (MS) Access database and the Field Testing Master Record MS Excel spreadsheet. A third reporting location is the GSO Coordination MS Excel spreadsheet. Below are the necessary steps for entering field data into the respective locations.

Finally, create a test location map using distances from clear benchmarks at the sites. Use either a maintenance map or as-built drawing. Save the map to the site folder under "Surface Infiltration Rate Testing".

4.1 GSI Monitoring Resources MS Access Database

Three tables within the MS Access database host data relating to SIRT parameters, raw data and infiltration results. Below are their descriptions of each and how to fill them out.

1) “SIRT_PorousPavement_RawData” – Manually-collected infiltration times from monitoring locations (see Sections 3.3 and 3.4). **Input raw data using the “SIRT_PorousPavement_RawData” Form in the “Forms” section of the “GSI_Monitoring_Resource_Tracking” database.** Descriptions of each column are provided.
    - *Test Application Date* – Time of infiltration measurement [MM/DD/YYYY HH:MM:SS AM/PM] (ex. 5/30/2013 10:15:00 AM). Use 12-hour clock.
    - *Method Application Date* – This date is the unique identifier used to link the raw data and parameters tables together [MM/DD/YYYY HH:MM:SS AM/PM] (ex. 5/30/2013 10:15:00 AM). Use 12-hour clock.
    - *SMP Number* – GreenIT ID (ex. 180-1-1)
    - *Test Location* – Name of test location (ex. 1 for test location 1).
    - *Prewet Time (sec)* – Time recorded from prewet. Do not include units.
    - *Test 1 “M” (lbs)* – Weight of water used for Test 1. Do not include units.
    - *Test 1 “t” (sec)* – Time recorded for Test 1. Do not include units.
    - *Test 2 “M” (lbs)* – Weight of water used for Test 2. Do not include units.
    - *Test 2 “t” (sec)* – Time recorded for Test 2. Do not include units.
    - *Notes* - Any notes pertaining to the manually collected infiltration measurements.
    - *Operator* – Person performing the test
    - *Time Keeper* – Person keeping the time
    - *Recorder* – Person documenting test in field book
    - *Photo Documenter* – Person taking photos of test
2) “SIRT_PorousPavement_Results” – **Once raw data is input, run the “SIRT_PorousPavement_Append Results” query**. This will calculate infiltration rates using raw data and place the results in the “SIRT_PorousPavement_Results” table. Descriptions of each column are provided.
   Note: Do not manually populate this table.
    - *Test Application Date* – Time of infiltration measurement [MM/DD/YYYY HH:MM:SS AM/PM] (ex. 5/30/2013 10:15:00 AM). Use 12-hour clock.
    - *SMP Number* – GreenIT ID (ex. 180-1-1)
    - *Test Location* – Name of test location (ex. 1 for test location 1).
    - *Test 1 “I” (in/hr)* – Infiltration rate for Test 1. Do not include units.
    - *Test 2 “I” (in/hr)* – Infiltration rate for Test 2. Do not include units.
    - *Avg Rate (in/hr)* – Average of Tests 1 and 2. Do not include units.
3) “SIRT_PorousPavement_Parameters” – General information pertaining to SIRT. **Input information using the “SIRT_PorousPavement_Parameters” Form in the “Forms” section of the “GSI_Monitoring_Resource_Tracking” database.** Descriptions of each column are provided.
    - *Method Application Date* – This date is the unique identifier used to link the raw data and parameters tables together [MM/DD/YYYY HH:MM:SS AM/PM] (ex. 5/30/2013 10:15:00 AM). Use 12-hour clock.
    - *SMP Number* – GreenIT ID (ex. 180-1-1)
    - *Temp (Deg F)* – Temperature of pavement
    - *Cloud Cover* - Cloud cover during test, refer to “Estimating_CLOUD COVERAGE” pdf

- *Other Weather Conditions* – Humidity and wind speed, refer to “Estimating wind speed_NOAA” pdf
- *Time Testing Started* – Time testing was started
- *Time Testing Completed* – Time testing was completed
- *Photos Uploaded* – Yes/No to confirm minimum photo-documentation of points of interest

4.2 Field Testing Master Record

The Field Testing Master Record MS Excel spreadsheet hosts data pertaining to all field-testing procedures, including SRTs, capture efficiency tests (CETs), and surface infiltration testing, with tabs separating each type of test. In the porous pavement testing tab, general information about the tests is provided. Descriptions of each column are provided for clarity.

- *Date (MM/DD/YYYY)* – Date the test was performed
- *SMP Number* – GreenIT ID
- *SMP Label* – General name of SMP or site*Surface Type* – Type of surface tested
- *Test Location* – Name of test location
- *Notes* – Brief description of results and any additional information worth mentioning
- *SIRT Parameters in Access* – Confirmation of data entry in “SIRT_Parameters” MS Access Table, Yes/No.
- *SIRT Raw Data in Access* – Confirmation of data entry in raw data MS Access Table, Yes/No.
- *SIRT Results in Access* – Confirmation that the SIRT query was run which pulls the raw data and calculates infiltration rates into the SIRT results MS Access Table, Yes/No.
- *Test Locations Map in Site Folder* – Confirmation that test locations were documented with distances on the site maintenance map or as-built drawing.

4.3 GSO Coordination – MS Excel

This spreadsheet is meant to inform GSO of 1) the sites we monitor so they can take care when performing maintenance at these locations and 2) any GSI issues we observe so they can be fixed.

If an issue is encountered that would involve GSO input, follow the GSO Coordination SOP to document and notify GSO of field findings. See GSO SOP for a list of field findings and how to address them as well.

5. Health and Safety Information

General information on PWD’s safety policies can be found on the PWD Intranet Safety Unit website. The Watersheds Safety Committee maintains files pertaining to information on official City of Philadelphia Safety Policy located on the OOW server.

- When working in the public right-of-way, adhere to PWD Workzone Traffic Control Guidelines and the Pennsylvania Work Zone Pocket Guide for Municipalities & Utilities (found in all OOW vehicles). Utilize road cones, signs, and safety tape to properly identify and isolate work areas and possible hazards.
- Use hard hats, safety shoes, safety gloves, and protective eye wear, where applicable.
- During extreme heat events, ensure field crew members stay fully hydrated, and seek shade & rest to avoid heat exhaustion. Wear sun protection such as sunscreen, wide brimmed hats, and light-fitted clothing covering exposed skin.

Review safety policies prior to performing field work, inform supervisor of the work plan anticipated for the day, and ensure communication mechanisms between field and office staff are functional.

6. Public Relations Guidelines

While working in the field, you may be approached by residents or other members of the public. Remember that when working in the field you are representing PWD, and always conduct yourself appropriately. Residents may express concerns about basement flooding, safety, project aesthetics, or perhaps even PWD issues unrelated to the *Green City, Clean Waters* program.

Do:

- Find a time and place where you can appropriately have a conversation
- Explain what you are doing
- Assume a friendly position and body language
- Provide the appropriate phone numbers for PWD questions (PWD Customer Service 215-685-6300 or 3-1-1)
- Listen to what the public has to say
- Make eye contact
- Be safe! Move away from traffic, tripping hazards, monitoring equipment, etc. Use appropriate safety equipment and adhere to all field safety guidelines

Don't:

- Jeopardize your safety, public safety or data quality
- Talk to the public at length
- Allow yourself to be distracted
- Engage a person who is hostile
- Provide your contact information
- Make promises about what PWD will or won't do, even if it relates to the site you are working on or *Green City, Clean Waters*

Appendix B – Flow Monitoring

APPENDIX B – FLOW MONITORING

Page

Table 1 - Summary of All Monitors

	# of Permanent Monitors	# of Temporary Monitors
Combined/Separate Sewer Monitors	469	88
Outlying Community Monitors	63	-
Pumping Stations	82	-
Rain Gages	37	-
Total	651	88

Table 2 - Listing of Monitored Outlying Community Connections

Site ID	Connection Type	Township	Measurement Name	Measurement Type
MA_1	STD	Abington	TEMPORARY	FLOW
MA_2	MTR	Abington	METERING CHAMBER FLOW	FLOW
MA_3	STD	Abington	TEMPORARY	FLOW
MA_4	STD	Abington	TEMPORARY	FLOW
MAx1	STD	Abington	TEMPORARY	FLOW
MB_1	MTR	Bucks Co.	METERING CHAMBER FLOW	FLOW
MBE_01	MTR	Bensalem	METERING CHAMBER FLOW	FLOW
MBE_02	MTR	Bensalem	METERING CHAMBER FLOW	FLOW
MBE_03	MTR	Bensalem	METERING CHAMBER FLOW	FLOW
MBE_04	MTR	Bensalem	METERING CHAMBER FLOW	FLOW
MBE_05	MTR	Bensalem	METERING CHAMBER FLOW	FLOW
MBE_06	MTR	Bensalem	METERING CHAMBER FLOW	FLOW
MBE_07	MTR	Bensalem	METERING CHAMBER FLOW	FLOW
MBE_08	MTR	Bensalem	METERING CHAMBER FLOW	FLOW
MBE_09	MTR	Bensalem	METERING CHAMBER FLOW	FLOW
MBE_10	MTR	Bensalem	METERING CHAMBER FLOW	FLOW
MBE_11	MTR	Bensalem	METERING CHAMBER FLOW	FLOW
MBE_12	MTR	Bensalem	METERING CHAMBER FLOW	FLOW
MBE_13	MTR	Bensalem	METERING CHAMBER FLOW	FLOW
MBE_14	MTR	Bensalem	METERING CHAMBER FLOW	FLOW
MBE_15		Bensalem	UNMONITORED	
MBE_16	MTR	Bensalem	METERING CHAMBER FLOW	FLOW
MBE_17	MTR	Bensalem	METERING CHAMBER FLOW	FLOW
MC_1	MTR	Cheltenham	METERING CHAMBER FLOW	FLOW
MC_2	MTR	Cheltenham	METERING CHAMBER FLOW	FLOW
MC_3	MTR	Abington	METERING CHAMBER FLOW	FLOW
MCx_1	MTR	Cheltenham	METERING CHAMBER FLOW	FLOW
MCx_2	MTR	Cheltenham	METERING CHAMBER FLOW	FLOW
MCx_3	MTR	Cheltenham	METERING CHAMBER FLOW	FLOW
MCx_4	MTR	Cheltenham	METERING CHAMBER FLOW	FLOW
MCx_5	MTR	Cheltenham	METERING CHAMBER FLOW	FLOW
MCx_6	MTR	Cheltenham	METERING CHAMBER FLOW	FLOW
MCx_7	MTR	Cheltenham	METERING CHAMBER FLOW	FLOW
MD_1	MTR	Delaware Co.	METERING CHAMBER FLOW	FLOW
ML_1	MTR	Lower Merion	METERING CHAMBER FLOW	FLOW
ML_2	STD	Lower Merion	TEMPORARY	FLOW
ML_3	MTR	Lower Merion	METERING CHAMBER FLOW	FLOW
ML_4	MTR	Lower Merion	METERING CHAMBER FLOW	FLOW

Site ID	Connection Type	Township	Measurement Name	Measurement Type
ML_5	MTR	Lower Merion	METERING CHAMBER FLOW	FLOW
ML_6	MTR	Lower Merion	METERING CHAMBER FLOW	FLOW
ML_7	MTR	Lower Merion	METERING CHAMBER FLOW	FLOW
MLM_1	MTR	Lower Moreland	METERING CHAMBER FLOW	FLOW
MLM_2	MTR	Lower Moreland	METERING CHAMBER FLOW	FLOW
MLM_3	STD	Lower Moreland	TEMPORARY	FLOW
MLM_4	STD	Lower Moreland	TEMPORARY	FLOW
MLM_5	STD	Lower Moreland	TEMPORARY	FLOW
MLM_6	STD	Lower Moreland	TEMPORARY	UNKNOWN
MLM_7	STD	Lower Moreland	TEMPORARY	UNKNOWN
MS_1	STD	Springfield	TEMPORARY	FLOW
MS_2	MTR	Springfield	METERING CHAMBER FLOW	FLOW
MS_3	MTR	Springfield	METERING CHAMBER FLOW	FLOW
MS_4	STD	Springfield	TEMPORARY	FLOW
MS_5	STD	Springfield	TEMPORARY	FLOW
MS_6	MTR	Springfield	METERING CHAMBER FLOW	FLOW
MS_7	STD	Springfield	TEMPORARY	UNKNOWN
MS_8	STD	Springfield	TEMPORARY	FLOW
MSH_1	MTR	Southampton	METERING CHAMBER FLOW	FLOW
MSH_2	STD	Southampton	TEMPORARY	FLOW
MSHX_1	STD	Southampton	TEMPORARY	FLOW
MSHX_2	STD	Southampton	TEMPORARY	FLOW
MUD_1N	MTR	Upper Darby	METERING CHAMBER FLOW	FLOW
MUD_1S	MTR	Upper Darby	METERING CHAMBER FLOW	FLOW
MUD_1O	MTR	Upper Darby	METERING CHAMBER FLOW	FLOW

*STD – temporary flow monitor

**MTR – Permanent monitor

Table 3 - Listing of Combined/Separate Sewer Monitors

Site Name	Interceptor	Waterbody	Measurement Name	Measurement Type
C_01	Cobbs Creek High Level	Cobbs Creek	SWO LEVEL	LEVEL
C_01	Cobbs Creek High Level	Cobbs Creek	TRUNK LEVEL	LEVEL
C_02	Cobbs Creek High Level	Cobbs Creek	SWO LEVEL	LEVEL
C_02	Cobbs Creek High Level	Cobbs Creek	TRUNK LEVEL	LEVEL
C_04	Cobbs Creek High Level	Cobbs Creek	SWO LEVEL	LEVEL
C_04	Cobbs Creek High Level	Cobbs Creek	TRUNK LEVEL	LEVEL
C_05	Cobbs Creek High Level	Cobbs Creek	SWO LEVEL	LEVEL
C_05	Cobbs Creek High Level	Cobbs Creek	TRUNK LEVEL	LEVEL
C_06	Cobbs Creek High Level	Cobbs Creek	SWO LEVEL	LEVEL
C_06	Cobbs Creek High Level	Cobbs Creek	TRUNK LEVEL	LEVEL
C_07	Cobbs Creek High Level	Cobbs Creek	SWO LEVEL	LEVEL
C_07	Cobbs Creek High Level	Cobbs Creek	TRUNK LEVEL	LEVEL
C_09	Cobbs Creek High Level	Cobbs Creek	SWO LEVEL	LEVEL
C_09	Cobbs Creek High Level	Cobbs Creek	TRUNK LEVEL	LEVEL
C_10	Cobbs Creek High Level	Cobbs Creek	SWO LEVEL	LEVEL
C_10	Cobbs Creek High Level	Cobbs Creek	TRUNK LEVEL	LEVEL
C_11	Cobbs Creek High Level	Cobbs Creek	SWO LEVEL	LEVEL
C_11	Cobbs Creek High Level	Cobbs Creek	TRUNK LEVEL	LEVEL
C_12	Cobbs Creek High Level	Cobbs Creek	SWO LEVEL	LEVEL
C_12	Cobbs Creek High Level	Cobbs Creek	TRUNK LEVEL	LEVEL
C_14	Cobbs Creek High Level	Cobbs Creek	SWO LEVEL	LEVEL
C_14	Cobbs Creek High Level	Cobbs Creek	TRUNK LEVEL	LEVEL
C_15	Cobbs Creek High Level	Cobbs Creek	SWO LEVEL	LEVEL
C_15	Cobbs Creek High Level	Cobbs Creek	TRUNK LEVEL	LEVEL
C_17	Cobbs Creek High Level	Cobbs Creek	SWO LEVEL	LEVEL
C_17	Cobbs Creek High Level	Cobbs Creek	TRUNK LEVEL	LEVEL
C_18	Cobbs Creek High Level	Cobbs Creek	SWO LEVEL	LEVEL
C_18	Cobbs Creek High Level	Cobbs Creek	TRUNK LEVEL	LEVEL
C_19	Cobbs Creek Low Level	Cobbs Creek	SWO LEVEL	LEVEL
C_19	Cobbs Creek Low Level	Cobbs Creek	TRUNK LEVEL	LEVEL
C_20	Cobbs Creek Low Level	Cobbs Creek	SWO LEVEL	LEVEL
C_20	Cobbs Creek Low Level	Cobbs Creek	TRUNK LEVEL	LEVEL
C_21	Cobbs Creek Low Level	Cobbs Creek	SWO LEVEL	LEVEL
C_21	Cobbs Creek Low Level	Cobbs Creek	TRUNK LEVEL	LEVEL
C_22	Cobbs Creek Low Level	Cobbs Creek	SWO LEVEL	LEVEL
C_22	Cobbs Creek Low Level	Cobbs Creek	TRUNK LEVEL	LEVEL
C_23	Cobbs Creek Low Level	Cobbs Creek	SWO LEVEL	LEVEL
C_23	Cobbs Creek Low Level	Cobbs Creek	TRUNK LEVEL	LEVEL
C_24	Cobbs Creek Low Level	Cobbs Creek	SWO LEVEL	LEVEL
C_24	Cobbs Creek Low Level	Cobbs Creek	TRUNK LEVEL	LEVEL
C_26	Cobbs Creek Low Level	Cobbs Creek	SWO LEVEL	LEVEL
C_26	Cobbs Creek Low Level	Cobbs Creek	TRUNK LEVEL	LEVEL
C_28A	Cobbs Creek Low Level	Cobbs Creek	SWO LEVEL	LEVEL
C_28A	Cobbs Creek Low Level	Cobbs Creek	TRUNK LEVEL	LEVEL

Site Name	Interceptor	Waterbody	Measurement Name	Measurement Type
C_29	Cobbs Creek Low Level	Cobbs Creek	SWO LEVEL	LEVEL
C_29	Cobbs Creek Low Level	Cobbs Creek	TRUNK LEVEL	LEVEL
C_30	Cobbs Creek Low Level	Cobbs Creek	SWO LEVEL	LEVEL
C_30	Cobbs Creek Low Level	Cobbs Creek	TRUNK LEVEL	LEVEL
C_31	Cobbs Creek High Level	Cobbs Creek	SWO LEVEL	LEVEL
C_31	Cobbs Creek High Level	Cobbs Creek	TRUNK LEVEL	LEVEL
C_32	Cobbs Creek High Level	Cobbs Creek	SWO LEVEL	LEVEL
C_32	Cobbs Creek High Level	Cobbs Creek	TRUNK LEVEL	LEVEL
C_33	Cobbs Creek High Level	Cobbs Creek	SWO LEVEL	LEVEL
C_33	Cobbs Creek High Level	Cobbs Creek	TRUNK LEVEL	LEVEL
C_34	Cobbs Creek High Level	Cobbs Creek	SWO LEVEL	LEVEL
C_34	Cobbs Creek High Level	Cobbs Creek	TRUNK LEVEL	LEVEL
C_35	Cobbs Creek High Level	Cobbs Creek	SWO LEVEL	LEVEL
C_35	Cobbs Creek High Level	Cobbs Creek	TRUNK LEVEL	LEVEL
C_36	Cobbs Creek High Level	Cobbs Creek	SWO LEVEL	LEVEL
C_36	Cobbs Creek High Level	Cobbs Creek	TRUNK LEVEL	LEVEL
C_37	Cobbs Creek High Level	Cobbs Creek	SWO LEVEL	LEVEL
C_37	Cobbs Creek High Level	Cobbs Creek	TRUNK LEVEL	LEVEL
CSPS	Central Schuylkill	Schuylkill River	INTERCEPTOR LEVEL N	LEVEL
CSPS	Central Schuylkill	Schuylkill River	INTERCEPTOR LEVEL S	LEVEL
D_02	Upper Delaware Low Level	Delaware River	DWO GATE POSITION	POSITION
D_02	Upper Delaware Low Level	Delaware River	DWO LEVEL	LEVEL
D_02	Upper Delaware Low Level	Delaware River	SWO GATE POSITION	POSITION
D_02	Upper Delaware Low Level	Delaware River	SWO LEVEL	LEVEL
D_02	Upper Delaware Low Level	Delaware River	TRUNK LEVEL	LEVEL
D_03	Upper Delaware Low Level	Delaware River	DWO GATE POSITION	POSITION
D_03	Upper Delaware Low Level	Delaware River	DWO LEVEL	LEVEL
D_03	Upper Delaware Low Level	Delaware River	SWO GATE POSITION	POSITION
D_03	Upper Delaware Low Level	Delaware River	SWO LEVEL	LEVEL
D_03	Upper Delaware Low Level	Delaware River	TRUNK LEVEL	LEVEL
D_04	Upper Delaware Low Level	Delaware River	DWO GATE POSITION	POSITION
D_04	Upper Delaware Low Level	Delaware River	DWO LEVEL	LEVEL
D_04	Upper Delaware Low Level	Delaware River	SWO GATE POSITION	POSITION
D_04	Upper Delaware Low Level	Delaware River	SWO LEVEL	LEVEL
D_04	Upper Delaware Low Level	Delaware River	TRUNK LEVEL	LEVEL
D_05	Upper Delaware Low Level	Delaware River	DWO GATE POSITION	POSITION
D_05	Upper Delaware Low Level	Delaware River	DWO LEVEL	LEVEL
D_05	Upper Delaware Low Level	Delaware River	SWO GATE POSITION	POSITION
D_05	Upper Delaware Low Level	Delaware River	SWO LEVEL	LEVEL
D_05	Upper Delaware Low Level	Delaware River	TRUNK LEVEL	LEVEL
D_06	Upper Delaware Low Level	Delaware River	DWO LEVEL	LEVEL
D_06	Upper Delaware Low Level	Delaware River	SWO LEVEL	LEVEL
D_06	Upper Delaware Low Level	Delaware River	TRUNK LEVEL	LEVEL
D_07	Upper Delaware Low Level	Delaware River	DWO GATE POSITION	POSITION
D_07	Upper Delaware Low Level	Delaware River	DWO LEVEL	LEVEL

Site Name	Interceptor	Waterbody	Measurement Name	Measurement Type
D_07	Upper Delaware Low Level	Delaware River	SWO GATE POSITION 1	POSITION
D_07	Upper Delaware Low Level	Delaware River	SWO GATE POSITION 2	POSITION
D_07	Upper Delaware Low Level	Delaware River	SWO LEVEL	LEVEL
D_07	Upper Delaware Low Level	Delaware River	TRUNK LEVEL	LEVEL
D_08	Upper Delaware Low Level	Delaware River	SWO LEVEL	LEVEL
D_08	Upper Delaware Low Level	Delaware River	TRUNK LEVEL	LEVEL
D_09	Upper Delaware Low Level	Delaware River	DWO GATE POSITION	POSITION
D_09	Upper Delaware Low Level	Delaware River	DWO LEVEL	LEVEL
D_09	Upper Delaware Low Level	Delaware River	SWO GATE POSITION	POSITION
D_09	Upper Delaware Low Level	Delaware River	SWO LEVEL	LEVEL
D_09	Upper Delaware Low Level	Delaware River	TRUNK LEVEL	LEVEL
D_11	Upper Delaware Low Level	Delaware River	DWO GATE POSITION	POSITION
D_11	Upper Delaware Low Level	Delaware River	DWO LEVEL	LEVEL
D_11	Upper Delaware Low Level	Delaware River	SWO GATE POSITION	POSITION
D_11	Upper Delaware Low Level	Delaware River	SWO LEVEL	LEVEL
D_11	Upper Delaware Low Level	Delaware River	TRUNK LEVEL	LEVEL
D_12	Upper Delaware Low Level	Delaware River	SWO LEVEL	LEVEL
D_12	Upper Delaware Low Level	Delaware River	TRUNK LEVEL	LEVEL
D_13	Upper Delaware Low Level	Delaware River	SWO LEVEL	LEVEL
D_13	Upper Delaware Low Level	Delaware River	TRUNK LEVEL	LEVEL
D_15	Upper Delaware Low Level	Delaware River	DWO GATE POSITION	POSITION
D_15	Upper Delaware Low Level	Delaware River	DWO LEVEL	LEVEL
D_15	Upper Delaware Low Level	Delaware River	SWO GATE POSITION	POSITION
D_15	Upper Delaware Low Level	Delaware River	SWO LEVEL	LEVEL
D_15	Upper Delaware Low Level	Delaware River	TRUNK LEVEL	LEVEL
D_17	Somerset	Delaware River	SWO LEVEL	LEVEL
D_17	Somerset	Delaware River	TRUNK LEVEL	LEVEL
D_18	Somerset	Delaware River	SWO LEVEL	LEVEL
D_18	Somerset	Delaware River	TRUNK LEVEL	LEVEL
D_19	Somerset	Delaware River	SWO LEVEL	LEVEL
D_19	Somerset	Delaware River	TRUNK LEVEL	LEVEL
D_20	Somerset	Delaware River	SWO LEVEL	LEVEL
D_20	Somerset	Delaware River	TRUNK LEVEL	LEVEL
D_21	Somerset	Delaware River	SWO LEVEL	LEVEL
D_21	Somerset	Delaware River	TRUNK LEVEL	LEVEL
D_22	Somerset	Delaware River	SWO LEVEL	LEVEL
D_22	Somerset	Delaware River	TRUNK LEVEL	LEVEL
D_23	Somerset	Delaware River	SWO LEVEL	LEVEL
D_23	Somerset	Delaware River	TRUNK LEVEL	LEVEL
D_24	Somerset	Delaware River	SWO LEVEL	LEVEL
D_24	Somerset	Delaware River	TRUNK LEVEL	LEVEL
D_25	Somerset	Delaware River	SWO LEVEL	LEVEL
D_25	Somerset	Delaware River	TRUNK LEVEL	LEVEL
D_37	Lower Delaware Low Level	Delaware River	SWO LEVEL	LEVEL
D_37	Lower Delaware Low Level	Delaware River	TRUNK LEVEL	LEVEL

Site Name	Interceptor	Waterbody	Measurement Name	Measurement Type
D_38	Lower Delaware Low Level	Delaware River	SWO LEVEL	LEVEL
D_38	Lower Delaware Low Level	Delaware River	TRUNK LEVEL	LEVEL
D_39	Lower Delaware Low Level	Delaware River	SWO LEVEL	LEVEL
D_39	Lower Delaware Low Level	Delaware River	TRUNK LEVEL	LEVEL
D_40	Lower Delaware Low Level	Delaware River	SWO LEVEL	LEVEL
D_40	Lower Delaware Low Level	Delaware River	TRUNK LEVEL	LEVEL
D_41	Lower Delaware Low Level	Delaware River	SWO LEVEL	LEVEL
D_41	Lower Delaware Low Level	Delaware River	TRUNK LEVEL	LEVEL
D_42	Lower Delaware Low Level	Delaware River	SWO LEVEL	LEVEL
D_42	Lower Delaware Low Level	Delaware River	TRUNK LEVEL	LEVEL
D_43	Lower Delaware Low Level	Delaware River	SWO LEVEL	LEVEL
D_43	Lower Delaware Low Level	Delaware River	TRUNK LEVEL	LEVEL
D_47	Lower Delaware Low Level	Delaware River	SWO LEVEL	LEVEL
D_47	Lower Delaware Low Level	Delaware River	TRUNK LEVEL	LEVEL
D_48	Lower Delaware Low Level	Delaware River	SWO LEVEL	LEVEL
D_48	Lower Delaware Low Level	Delaware River	TRUNK LEVEL	LEVEL
D_49	Lower Delaware Low Level	Delaware River	SWO LEVEL	LEVEL
D_49	Lower Delaware Low Level	Delaware River	TRUNK LEVEL	LEVEL
D_50	Lower Delaware Low Level	Delaware River	SWO LEVEL	LEVEL
D_50	Lower Delaware Low Level	Delaware River	TRUNK LEVEL	LEVEL
D_51	Lower Delaware Low Level	Delaware River	SWO LEVEL	LEVEL
D_51	Lower Delaware Low Level	Delaware River	TRUNK LEVEL	LEVEL
D_51A	Lower Delaware Low Level	Delaware River	TRUNK LEVEL	LEVEL
D_52	Lower Delaware Low Level	Delaware River	SWO LEVEL	LEVEL
D_52	Lower Delaware Low Level	Delaware River	TRUNK LEVEL	LEVEL
D_53	Lower Delaware Low Level	Delaware River	SWO LEVEL	LEVEL
D_53	Lower Delaware Low Level	Delaware River	TRUNK LEVEL	LEVEL
D_54	Lower Delaware Low Level	Delaware River	SWO LEVEL	LEVEL
D_54	Lower Delaware Low Level	Delaware River	TRUNK LEVEL	LEVEL
D_58	Lower Delaware Low Level	Delaware River	SWO LEVEL	LEVEL
D_58	Lower Delaware Low Level	Delaware River	TRUNK LEVEL	LEVEL
D_61	Lower Delaware Low Level	Delaware River	SWO LEVEL	LEVEL
D_61	Lower Delaware Low Level	Delaware River	TRUNK LEVEL	LEVEL
D_63	Lower Delaware Low Level	Delaware River	SWO LEVEL	LEVEL
D_63	Lower Delaware Low Level	Delaware River	TRUNK LEVEL	LEVEL
D_64	Lower Delaware Low Level	Delaware River	SWO LEVEL	LEVEL
D_64	Lower Delaware Low Level	Delaware River	TRUNK LEVEL	LEVEL
D_65	Lower Delaware Low Level	Delaware River	SWO LEVEL	LEVEL
D_65	Lower Delaware Low Level	Delaware River	TRUNK LEVEL	LEVEL
D_66	Lower Delaware Low Level	Delaware River	SWO LEVEL	LEVEL
D_66	Lower Delaware Low Level	Delaware River	TRUNK LEVEL	LEVEL
D_67	Lower Delaware Low Level	Delaware River	SWO LEVEL	LEVEL
D_67	Lower Delaware Low Level	Delaware River	TRUNK LEVEL	LEVEL
D_68	Lower Delaware Low Level	Delaware River	SWO LEVEL	LEVEL
D_68	Lower Delaware Low Level	Delaware River	TRUNK LEVEL	LEVEL

Site Name	Interceptor	Waterbody	Measurement Name	Measurement Type
D_69	Lower Delaware Low Level	Delaware River	SWO LEVEL	LEVEL
D_69	Lower Delaware Low Level	Delaware River	TRUNK LEVEL	LEVEL
D_70	Lower Delaware Low Level	Delaware River	SWO LEVEL	LEVEL
D_70	Lower Delaware Low Level	Delaware River	TRUNK LEVEL	LEVEL
D_72	Lower Delaware Low Level	Delaware River	SWO LEVEL	LEVEL
D_72	Lower Delaware Low Level	Delaware River	TRUNK LEVEL	LEVEL
D_73	Lower Delaware Low Level	Delaware River	SWO LEVEL	LEVEL
D_73	Lower Delaware Low Level	Delaware River	TRUNK LEVEL	LEVEL
F_03	Lower Frankford Low Level	Frankford Creek	SWO LEVEL	LEVEL
F_03	Lower Frankford Low Level	Frankford Creek	TRUNK LEVEL	LEVEL
F_04	Lower Frankford Low Level	Frankford Creek	SWO LEVEL	LEVEL
F_04	Lower Frankford Low Level	Frankford Creek	TRUNK LEVEL	LEVEL
F_05	Lower Frankford Low Level	Frankford Creek	SWO LEVEL	LEVEL
F_05	Lower Frankford Low Level	Frankford Creek	TRUNK LEVEL	LEVEL
F_06	Lower Frankford Low Level	Frankford Creek	SWO LEVEL	LEVEL
F_06	Lower Frankford Low Level	Frankford Creek	TRUNK LEVEL	LEVEL
F_07	Lower Frankford Low Level	Frankford Creek	SWO LEVEL	LEVEL
F_07	Lower Frankford Low Level	Frankford Creek	TRUNK LEVEL	LEVEL
F_08	Lower Frankford Low Level	Frankford Creek	SWO LEVEL	LEVEL
F_08	Lower Frankford Low Level	Frankford Creek	TRUNK LEVEL	LEVEL
F_09	Lower Frankford Low Level	Frankford Creek	SWO LEVEL	LEVEL
F_09	Lower Frankford Low Level	Frankford Creek	TRUNK LEVEL	LEVEL
F_10	Lower Frankford Low Level	Frankford Creek	SWO LEVEL	LEVEL
F_10	Lower Frankford Low Level	Frankford Creek	TRUNK LEVEL	LEVEL
F_11	Lower Frankford Low Level	Frankford Creek	SWO LEVEL	LEVEL
F_11	Lower Frankford Low Level	Frankford Creek	TRUNK LEVEL	LEVEL
F_12	Lower Frankford Low Level	Frankford Creek	SWO LEVEL	LEVEL
F_12	Lower Frankford Low Level	Frankford Creek	TRUNK LEVEL	LEVEL
F_13	Lower Frankford Creek	Frankford Creek	DWO LEVEL	LEVEL
F_13	Lower Frankford Creek	Frankford Creek	SWO LEVEL	LEVEL
F_13	Lower Frankford Creek	Frankford Creek	TRUNK LEVEL	LEVEL
F_14	Lower Frankford Creek	Frankford Creek	SWO LEVEL	LEVEL
F_14	Lower Frankford Creek	Frankford Creek	TRUNK LEVEL	LEVEL
F_23	Lower Frankford Creek	Frankford Creek	SWO LEVEL	LEVEL
F_23	Lower Frankford Creek	Frankford Creek	TRUNK LEVEL	LEVEL
F_24	Lower Frankford Creek	Frankford Creek	SWO LEVEL	LEVEL
F_24	Lower Frankford Creek	Frankford Creek	TRUNK LEVEL	LEVEL
F_25	Lower Frankford Creek	Frankford Creek	DWO GATE POSITION	POSITION
F_25	Lower Frankford Creek	Frankford Creek	SWO GATE POSITION 1	POSITION
F_25	Lower Frankford Creek	Frankford Creek	SWO GATE POSITION 2	POSITION
F_25	Lower Frankford Creek	Frankford Creek	SWO LEVEL	LEVEL
F_25	Lower Frankford Creek	Frankford Creek	TRUNK LEVEL	LEVEL
H_29		Schuylkill River	DWO LEVEL	LEVEL
H_29		Schuylkill River	SWO LEVEL	LEVEL
H_29		Schuylkill River	TRUNK LEVEL	LEVEL

Site Name	Interceptor	Waterbody	Measurement Name	Measurement Type
H_35		Schuylkill River	BLOWER 1 RUN	EVENT
H_35		Schuylkill River	BLOWER 2 RUN	EVENT
H_35		Schuylkill River	DAM AIR PRESSURE	PSI
H_35		Schuylkill River	DWO GATE POSITION	POSITION
H_35		Schuylkill River	INTERCEPTOR LEVEL	LEVEL
H_35		Schuylkill River	SWO GATE POSITION	POSITION
H_35		Schuylkill River	SWO LEVEL	LEVEL
H_35		Schuylkill River	TRUNK LEVEL	LEVEL
I_BYH09		Byberry Creek	INTERCEPTOR LEVEL	LEVEL
I_CCHLC07	Cobbs Creek High Level	Cobbs Creek	INTERCEPTOR LEVEL	LEVEL
I_CCHLC12	Cobbs Creek High Level	Cobbs Creek	INTERCEPTOR LEVEL	LEVEL
I_CCHLC13	Cobbs Creek High Level	Cobbs Creek	INTERCEPTOR LEVEL	LEVEL
I_CCHLC14	Cobbs Creek High Level	Cobbs Creek	INTERCEPTOR LEVEL	LEVEL
I_CCHLC17	Cobbs Creek High Level	Cobbs Creek	INTERCEPTOR LEVEL	LEVEL
I_CCHLC18	Cobbs Creek High Level	Cobbs Creek	INTERCEPTOR LEVEL	LEVEL
I_CCHLC34	Cobbs Creek High Level	Cobbs Creek	INTERCEPTOR LEVEL	LEVEL
I_CCHLH18	Cobbs Creek High Level	Cobbs Creek	INTERCEPTOR LEVEL	LEVEL
I_CCLLC19	Cobbs Creek Low Level	Cobbs Creek	INTERCEPTOR LEVEL	LEVEL
I_CCLLC20	Cobbs Creek Low Level	Cobbs Creek	INTERCEPTOR LEVEL	LEVEL
I_CCLLC22	Cobbs Creek Low Level	Cobbs Creek	INTERCEPTOR LEVEL	LEVEL
I_CCLLC24	Cobbs Creek Low Level	Cobbs Creek	INTERCEPTOR LEVEL	LEVEL
I_CCLLC26	Cobbs Creek Low Level	Cobbs Creek	INTERCEPTOR LEVEL	LEVEL
I_CCLLH01	Cobbs Creek Low Level	Cobbs Creek	INTERCEPTOR LEVEL	LEVEL
I_COHOH16		Schuylkill River	INTERCEPTOR LEVEL	LEVEL
I_CSESH11	Central Schuylkill East Side	Schuylkill River	INTERCEPTOR LEVEL	LEVEL
I_CSESH15	Central Schuylkill East Side	Schuylkill River	INTERCEPTOR LEVEL	LEVEL
I_CSESS09	Central Schuylkill East Side	Schuylkill River	INTERCEPTOR LEVEL	LEVEL
I_CSESS14	Central Schuylkill East Side	Schuylkill River	INTERCEPTOR LEVEL	LEVEL
I_CSESS17	Central Schuylkill East Side	Schuylkill River	INTERCEPTOR LEVEL	LEVEL
I_CSESS26	Central Schuylkill East Side	Schuylkill River	INTERCEPTOR LEVEL	LEVEL
I_CSSSH15	Central Schuylkill	Schuylkill River	INTERCEPTOR LEVEL	LEVEL
I_CVBH08		Schuylkill River	INTERCEPTOR LEVEL	LEVEL
I_FHLH03	Frankford High Level	Frankford Creek	INTERCEPTOR LEVEL	LEVEL
I_FHLTT08	Frankford High Level	Frankford Creek	INTERCEPTOR LEVEL	LEVEL
I_FHLTT15	Frankford High Level	Frankford Creek	INTERCEPTOR LEVEL	LEVEL
I_FLLH03	Frankford Low Level	Frankford Creek	INTERCEPTOR LEVEL	LEVEL
I_LDLLD43	Lower Delaware Low Level	Delaware River	INTERCEPTOR LEVEL	LEVEL
I_LDLLD45	Lower Delaware Low Level	Delaware River	INTERCEPTOR LEVEL	LEVEL
I_LDLLD47	Lower Delaware Low Level	Delaware River	INTERCEPTOR LEVEL	LEVEL
I_LDLLD53	Lower Delaware Low Level	Delaware River	INTERCEPTOR LEVEL	LEVEL
I_LDLLD62	Lower Delaware Low Level	Delaware River	INTERCEPTOR LEVEL	LEVEL
I_LDLLD69	Lower Delaware Low Level	Delaware River	INTERCEPTOR LEVEL	LEVEL
I_LDLLD70	Lower Delaware Low Level	Delaware River	INTERCEPTOR LEVEL	LEVEL
I_LFCH07	Lower Frankford Creek	Frankford Creek	INTERCEPTOR LEVEL	LEVEL
I_LFCH19	Lower Frankford Creek	Frankford Creek	INTERCEPTOR LEVEL	LEVEL

Site Name	Interceptor	Waterbody	Measurement Name	Measurement Type
I_LFLLF08	Lower Frankford Low Level	Frankford Creek	INTERCEPTOR LEVEL	LEVEL
I_LFLLF10	Lower Frankford Low Level	Frankford Creek	INTERCEPTOR LEVEL	LEVEL
I_LSESH15	Lower Schuylkill East Side	Schuylkill River	INTERCEPTOR LEVEL	LEVEL
I_LSESS36	Lower Schuylkill East Side	Schuylkill River	INTERCEPTOR LEVEL	LEVEL
I_LSWSH01	Lower Schuylkill West Side	Schuylkill River	INTERCEPTOR LEVEL	LEVEL
I_LSWSS33	Lower Schuylkill West Side	Schuylkill River	INTERCEPTOR LEVEL	LEVEL
I_LSWSS38	Lower Schuylkill West Side	Schuylkill River	INTERCEPTOR LEVEL	LEVEL
I_LSWSS45	Lower Schuylkill West Side	Schuylkill River	INTERCEPTOR LEVEL	LEVEL
I_MRH21	Main Relief Sewer	Schuylkill River	INTERCEPTOR LEVEL	LEVEL
I_OH12		Schuylkill River	INTERCEPTOR LEVEL	LEVEL
I_PASYH13		Schuylkill River	INTERCEPTOR LEVEL	LEVEL
I_PDRLH01		Schuylkill River	INTERCEPTOR LEVEL	LEVEL
I_PDRLH02		Schuylkill River	INTERCEPTOR LEVEL	LEVEL
I_PENRH02		Schuylkill River	INTERCEPTOR LEVEL	LEVEL
I_PH04	Pennypack	Pennypack Creek	INTERCEPTOR LEVEL	LEVEL
I_PH05	Pennypack	Pennypack Creek	INTERCEPTOR LEVEL	LEVEL
I_PH06	Pennypack	Pennypack Creek	INTERCEPTOR LEVEL	LEVEL
I_PH10	Pennypack	Pennypack Creek	INTERCEPTOR LEVEL	LEVEL
I_PMPFH03		Schuylkill River	INTERCEPTOR LEVEL	LEVEL
I_PP02	Pennypack	Pennypack Creek	INTERCEPTOR LEVEL	LEVEL
I_PP04	Pennypack	Pennypack Creek	INTERCEPTOR LEVEL	LEVEL
I_PP05	Pennypack	Pennypack Creek	INTERCEPTOR LEVEL	LEVEL
I_PQH09	Poquessing	Poquessing Creek	INTERCEPTOR LEVEL	LEVEL
I_PRH10		Schuylkill River	INTERCEPTOR LEVEL	LEVEL
I_SD19	Somerset	Delaware River	INTERCEPTOR LEVEL	LEVEL
I_SD21	Somerset	Delaware River	INTERCEPTOR LEVEL	LEVEL
I_SD25	Somerset	Delaware River	INTERCEPTOR LEVEL	LEVEL
I_SH03	Somerset	Delaware River	INTERCEPTOR LEVEL	LEVEL
I_SRH05		Schuylkill River	INTERCEPTOR LEVEL	LEVEL
I_SWMGCHLH01	Southwest Main Gravity	Schuylkill River	INTERCEPTOR LEVEL	LEVEL
I_SWMGEHLH01	Southwest Main Gravity	Schuylkill River	INTERCEPTOR LEVEL	LEVEL
I_SWMGH17	Southwest Main Gravity	Schuylkill River	INTERCEPTOR LEVEL	LEVEL
I_SWMGH20	Southwest Main Gravity	Schuylkill River	C GATE POSITION	POSITION
I_SWMGH20	Southwest Main Gravity	Schuylkill River	E GATE POSITION	POSITION
I_SWMGH20	Southwest Main Gravity	Schuylkill River	INTERCEPTOR LEVEL	LEVEL
I_SWMGH20	Southwest Main Gravity	Schuylkill River	W GATE POSITION	POSITION
I_SWMGS28	Southwest Main Gravity	Schuylkill River	INTERCEPTOR LEVEL	LEVEL
I_SWMGS34	Southwest Main Gravity	Schuylkill River	INTERCEPTOR LEVEL	LEVEL
I_SWMGS43	Southwest Main Gravity	Schuylkill River	INTERCEPTOR LEVEL	LEVEL
I_SWMGS47	Southwest Main Gravity	Schuylkill River	INTERCEPTOR LEVEL	LEVEL
I_SWMGS50	Southwest Main Gravity	Schuylkill River	INTERCEPTOR LEVEL	LEVEL
I_SWMGWHLH01	Southwest Main Gravity	Schuylkill River	INTERCEPTOR LEVEL	LEVEL

Site Name	Interceptor	Waterbody	Measurement Name	Measurement Type
I_UDLLD04	Upper Delaware Low Level	Delaware River	INTERCEPTOR LEVEL	LEVEL
I_UDLLD08	Upper Delaware Low Level	Delaware River	INTERCEPTOR LEVEL	LEVEL
I_UDLLH03	Upper Delaware Low Level	Delaware River	INTERCEPTOR LEVEL	LEVEL
I_UDLLH04	Upper Delaware Low Level	Delaware River	INTERCEPTOR LEVEL	LEVEL
I_UDLLH07	Upper Delaware Low Level	Delaware River	INTERCEPTOR LEVEL	LEVEL
I_UDLLH14	Upper Delaware Low Level	Delaware River	INTERCEPTOR LEVEL	LEVEL
I_WBH06		Wissahickon Creek	INTERCEPTOR LEVEL	LEVEL
I_WHLH08	Wissahickon High Level	Wissahickon Creek	INTERCEPTOR LEVEL	LEVEL
I_WLLH11	Wissahickon Low Level	Wissahickon Creek	INTERCEPTOR LEVEL	LEVEL
P_01	Pennypack	Pennypack Creek	SWO LEVEL	LEVEL
P_01	Pennypack	Pennypack Creek	TRUNK LEVEL	LEVEL
P_02	Pennypack	Pennypack Creek	SWO LEVEL	LEVEL
P_02	Pennypack	Pennypack Creek	TRUNK LEVEL	LEVEL
P_03	Pennypack	Pennypack Creek	SWO LEVEL	LEVEL
P_03	Pennypack	Pennypack Creek	TRUNK LEVEL	LEVEL
P_04	Pennypack	Pennypack Creek	SWO LEVEL	LEVEL
P_04	Pennypack	Pennypack Creek	TRUNK LEVEL	LEVEL
P_05	Pennypack	Pennypack Creek	SWO LEVEL	LEVEL
P_05	Pennypack	Pennypack Creek	TRUNK LEVEL	LEVEL
R_06	Cobbs Creek High Level	Cobbs Creek	SWO LEVEL	LEVEL
R_06	Cobbs Creek High Level	Cobbs Creek	TRUNK LEVEL	LEVEL
R_07	Main Relief Sewer	Schuylkill River	SWO LEVEL	LEVEL
R_07	Main Relief Sewer	Schuylkill River	TRUNK LEVEL	LEVEL
R_12	Central Schuylkill East Side	Schuylkill River	SWO LEVEL	LEVEL
R_12	Central Schuylkill East Side	Schuylkill River	TRUNK LEVEL	LEVEL
R_13	Upper Delaware Low Level	Delaware River	SWO LEVEL	LEVEL
R_13	Upper Delaware Low Level	Delaware River	TRUNK LEVEL	LEVEL
R_14	Upper Delaware Low Level	Delaware River	SWO LEVEL	LEVEL
R_14	Upper Delaware Low Level	Delaware River	TRUNK LEVEL	LEVEL
R_15	Frankford High Level	Tacony Creek	SWO LEVEL	LEVEL
R_15	Frankford High Level	Tacony Creek	TRUNK LEVEL	LEVEL
R_18	Frankford High Level	Tacony Creek	INTERCEPTOR LEVEL	LEVEL
R_18	Frankford High Level	Tacony Creek	SWO LEVEL	LEVEL
R_20	Central Schuylkill East Side	Schuylkill River	INTERCEPTOR LEVEL	LEVEL
R_20	Central Schuylkill East Side	Schuylkill River	STORMWATER LEVEL	LEVEL
R_24	Cobbs Creek High Level	Cobbs Creek	SWO LEVEL	LEVEL
R_24	Cobbs Creek High Level	Cobbs Creek	TRUNK LEVEL	LEVEL
S_01	Central Schuylkill West Side	Schuylkill River	SWO LEVEL	LEVEL
S_01	Central Schuylkill West Side	Schuylkill River	TRUNK LEVEL	LEVEL
S_03	Central Schuylkill West Side	Schuylkill River	SWO LEVEL	LEVEL
S_03	Central Schuylkill West Side	Schuylkill River	TRUNK LEVEL	LEVEL
S_04	Central Schuylkill West Side	Schuylkill River	SWO LEVEL	LEVEL
S_04	Central Schuylkill West Side	Schuylkill River	TRUNK LEVEL	LEVEL
S_05	Central Schuylkill East Side	Schuylkill River	SWO LEVEL	LEVEL
S_05	Central Schuylkill East Side	Schuylkill River	TRUNK LEVEL	LEVEL

Site Name	Interceptor	Waterbody	Measurement Name	Measurement Type
S_06	Central Schuylkill East Side	Schuylkill River	SWO LEVEL	LEVEL
S_06	Central Schuylkill East Side	Schuylkill River	TRUNK LEVEL	LEVEL
S_07	Central Schuylkill East Side	Schuylkill River	SWO LEVEL	LEVEL
S_07	Central Schuylkill East Side	Schuylkill River	TRUNK LEVEL	LEVEL
S_08	Central Schuylkill East Side	Schuylkill River	SWO LEVEL	LEVEL
S_08	Central Schuylkill East Side	Schuylkill River	TRUNK LEVEL	LEVEL
S_09	Central Schuylkill East Side	Schuylkill River	SWO LEVEL	LEVEL
S_09	Central Schuylkill East Side	Schuylkill River	TRUNK LEVEL	LEVEL
S_10	Central Schuylkill East Side	Schuylkill River	SWO LEVEL	LEVEL
S_10	Central Schuylkill East Side	Schuylkill River	TRUNK LEVEL	LEVEL
S_11	Central Schuylkill West Side	Schuylkill River	SWO LEVEL	LEVEL
S_11	Central Schuylkill West Side	Schuylkill River	TRUNK LEVEL	LEVEL
S_12	Central Schuylkill West Side	Schuylkill River	SWO LEVEL	LEVEL
S_12	Central Schuylkill West Side	Schuylkill River	TRUNK LEVEL	LEVEL
S_12A	Central Schuylkill East Side	Schuylkill River	SWO LEVEL	LEVEL
S_12A	Central Schuylkill East Side	Schuylkill River	TRUNK LEVEL	LEVEL
S_13	Central Schuylkill East Side	Schuylkill River	SWO LEVEL	LEVEL
S_13	Central Schuylkill East Side	Schuylkill River	TRUNK LEVEL	LEVEL
S_15	Central Schuylkill East Side	Schuylkill River	SWO LEVEL	LEVEL
S_15	Central Schuylkill East Side	Schuylkill River	TRUNK LEVEL	LEVEL
S_17	Central Schuylkill East Side	Schuylkill River	SWO LEVEL	LEVEL
S_17	Central Schuylkill East Side	Schuylkill River	TRUNK LEVEL	LEVEL
S_18	Central Schuylkill East Side	Schuylkill River	SWO LEVEL	LEVEL
S_18	Central Schuylkill East Side	Schuylkill River	TRUNK LEVEL	LEVEL
S_19	Central Schuylkill East Side	Schuylkill River	SWO LEVEL	LEVEL
S_19	Central Schuylkill East Side	Schuylkill River	TRUNK LEVEL	LEVEL
S_22	Central Schuylkill West Side	Schuylkill River	SWO LEVEL	LEVEL
S_22	Central Schuylkill West Side	Schuylkill River	TRUNK LEVEL	LEVEL
S_23	Central Schuylkill East Side	Schuylkill River	SWO LEVEL	LEVEL
S_23	Central Schuylkill East Side	Schuylkill River	TRUNK LEVEL	LEVEL
S_25	Central Schuylkill East Side	Schuylkill River	SWO LEVEL	LEVEL
S_25	Central Schuylkill East Side	Schuylkill River	TRUNK LEVEL	LEVEL
S_26	Central Schuylkill East Side	Schuylkill River	SWO LEVEL	LEVEL
S_26	Central Schuylkill East Side	Schuylkill River	TRUNK LEVEL	LEVEL
S_27	Central Schuylkill East Side	Schuylkill River	DWO LEVEL	LEVEL
S_27	Central Schuylkill East Side	Schuylkill River	SWO LEVEL	LEVEL
S_27	Central Schuylkill East Side	Schuylkill River	TRUNK LEVEL	LEVEL
S_28	Central Schuylkill East Side	Schuylkill River	SWO LEVEL	LEVEL
S_28	Central Schuylkill East Side	Schuylkill River	TRUNK LEVEL	LEVEL
S_30	Southwest Main Gravity	Schuylkill River	SWO LEVEL	LEVEL
S_30	Southwest Main Gravity	Schuylkill River	TRUNK LEVEL	LEVEL
S_31	Lower Schuylkill East Side	Schuylkill River	SWO LEVEL	LEVEL
S_31	Lower Schuylkill East Side	Schuylkill River	TRUNK LEVEL	LEVEL
S_32	Lower Schuylkill West Side	Schuylkill River	SWO LEVEL	LEVEL
S_32	Lower Schuylkill West Side	Schuylkill River	TRUNK LEVEL	LEVEL

Site Name	Interceptor	Waterbody	Measurement Name	Measurement Type
S_33	Lower Schuylkill West Side	Schuylkill River	SWO LEVEL	LEVEL
S_33	Lower Schuylkill West Side	Schuylkill River	TRUNK LEVEL	LEVEL
S_34	Lower Schuylkill West Side	Schuylkill River	SWO LEVEL	LEVEL
S_34	Lower Schuylkill West Side	Schuylkill River	TRUNK LEVEL	LEVEL
S_35	Lower Schuylkill West Side	Schuylkill River	SWO LEVEL	LEVEL
S_35	Lower Schuylkill West Side	Schuylkill River	TRUNK LEVEL	LEVEL
S_36	Lower Schuylkill West Side	Schuylkill River	SWO LEVEL	LEVEL
S_36	Lower Schuylkill West Side	Schuylkill River	TRUNK LEVEL	LEVEL
S_36A	Lower Schuylkill East Side	Schuylkill River	SWO LEVEL	LEVEL
S_36A	Lower Schuylkill East Side	Schuylkill River	TRUNK LEVEL	LEVEL
S_37	Lower Schuylkill East Side	Schuylkill River	SWO LEVEL	LEVEL
S_37	Lower Schuylkill East Side	Schuylkill River	TRUNK LEVEL	LEVEL
S_38	Lower Schuylkill West Side	Schuylkill River	SWO LEVEL	LEVEL
S_38	Lower Schuylkill West Side	Schuylkill River	TRUNK LEVEL	LEVEL
S_39	Lower Schuylkill West Side	Schuylkill River	SWO LEVEL	LEVEL
S_39	Lower Schuylkill West Side	Schuylkill River	TRUNK LEVEL	LEVEL
S_40	Lower Schuylkill West Side	Schuylkill River	SWO LEVEL	LEVEL
S_40	Lower Schuylkill West Side	Schuylkill River	TRUNK LEVEL	LEVEL
S_42	Lower Schuylkill East Side	Schuylkill River	SWO LEVEL	LEVEL
S_42	Lower Schuylkill East Side	Schuylkill River	TRUNK LEVEL	LEVEL
S_42A	Lower Schuylkill East Side	Schuylkill River	SWO LEVEL	LEVEL
S_42A	Lower Schuylkill East Side	Schuylkill River	TRUNK LEVEL	LEVEL
S_43	Lower Schuylkill East Side	Schuylkill River	SWO LEVEL	LEVEL
S_43	Lower Schuylkill East Side	Schuylkill River	TRUNK LEVEL	LEVEL
S_44	Lower Schuylkill East Side	Schuylkill River	SWO LEVEL	LEVEL
S_44	Lower Schuylkill East Side	Schuylkill River	TRUNK LEVEL	LEVEL
S_45	Lower Schuylkill West Side	Schuylkill River	DWO LEVEL	LEVEL
S_45	Lower Schuylkill West Side	Schuylkill River	SWO LEVEL	LEVEL
S_45	Lower Schuylkill West Side	Schuylkill River	TRUNK LEVEL	LEVEL
S_46	Lower Schuylkill East Side	Schuylkill River	SWO LEVEL	LEVEL
S_46	Lower Schuylkill East Side	Schuylkill River	TRUNK LEVEL	LEVEL
S_47	Lower Schuylkill East Side	Schuylkill River	SWO LEVEL	LEVEL
S_47	Lower Schuylkill East Side	Schuylkill River	TRUNK LEVEL	LEVEL
S_50	Southwest Main Gravity	Schuylkill River	SWO LEVEL	LEVEL
S_50	Southwest Main Gravity	Schuylkill River	TRUNK LEVEL	LEVEL
S_51	Southwest Main Gravity	Schuylkill River	SWO LEVEL	LEVEL
S_51	Southwest Main Gravity	Schuylkill River	TRUNK LEVEL	LEVEL
T_01	Frankford High Level	Tacony Creek	SWO LEVEL	LEVEL
T_01	Frankford High Level	Tacony Creek	TRUNK LEVEL	LEVEL
T_03	Frankford High Level	Tacony Creek	SWO LEVEL	LEVEL
T_03	Frankford High Level	Tacony Creek	TRUNK LEVEL	LEVEL
T_04	Frankford High Level	Tacony Creek	SWO LEVEL	LEVEL
T_04	Frankford High Level	Tacony Creek	TRUNK LEVEL	LEVEL
T_05	Frankford High Level	Tacony Creek	SWO LEVEL	LEVEL
T_05	Frankford High Level	Tacony Creek	TRUNK LEVEL	LEVEL

Site Name	Interceptor	Waterbody	Measurement Name	Measurement Type
T_06	Frankford High Level	Tacony Creek	SWO LEVEL	LEVEL
T_06	Frankford High Level	Tacony Creek	TRUNK LEVEL	LEVEL
T_07	Frankford High Level	Tacony Creek	SWO LEVEL	LEVEL
T_07	Frankford High Level	Tacony Creek	TRUNK LEVEL	LEVEL
T_08	Frankford High Level	Tacony Creek	SWO LEVEL	LEVEL
T_08	Frankford High Level	Tacony Creek	TRUNK LEVEL	LEVEL
T_09	Frankford High Level	Tacony Creek	SWO LEVEL	LEVEL
T_09	Frankford High Level	Tacony Creek	TRUNK LEVEL	LEVEL
T_10	Frankford High Level	Tacony Creek	SWO LEVEL	LEVEL
T_10	Frankford High Level	Tacony Creek	TRUNK LEVEL	LEVEL
T_11	Frankford High Level	Tacony Creek	SWO LEVEL	LEVEL
T_11	Frankford High Level	Tacony Creek	TRUNK LEVEL	LEVEL
T_12	Frankford High Level	Tacony Creek	SWO LEVEL	LEVEL
T_12	Frankford High Level	Tacony Creek	TRUNK LEVEL	LEVEL
T_13	Frankford High Level	Tacony Creek	SWO LEVEL	LEVEL
T_13	Frankford High Level	Tacony Creek	TRUNK LEVEL	LEVEL
T_14	Frankford High Level	Tacony Creek	DWO GATE 1	POSITION
T_14	Frankford High Level	Tacony Creek	DWO GATE 2	POSITION
T_14	Frankford High Level	Tacony Creek	SWO CREST GATE	POSITION
T_14	Frankford High Level	Tacony Creek	SWO LEVEL	LEVEL
T_14	Frankford High Level	Tacony Creek	TRUNK LEVEL	LEVEL
T_15	Frankford High Level	Tacony Creek	SWO LEVEL	LEVEL
T_15	Frankford High Level	Tacony Creek	TRUNK LEVEL	LEVEL

Table 4 - Listing of all Rain Gages (7/1/2018 - 6/30/2019)

Rain Gage	Location	Percent Working
RG_1	70th and Essington Ave	70.28%
RG_2	66th and Regent St	87.17%
RG_3	Fox Chase Rd. and Castor Ave	99.82%
RG_4	State Rd and Pennypack St	96.70%
RG_5	3rd and Mifflin St	76.34%
RG_6	Cardinal Ave and City Line Ave	74.95%
RG_7	G St. and E Annsbury St	88.71%
RG_8	N Water St. and E Clarkson Ave	96.44%
RG_9	54th and Lancaster Ave	95.61%
RG_10	Pine Rd and Susquehanna Rd	85.00%
RG_11	Rising Sun Ave and Lardner St	98.42%
RG_12	Pattison Ave and Columbus Blvd	96.33%
RG_13	Glendale Ave and Algon Ave	89.35%
RG_14	Delaware Ave and Lewis St	89.68%
RG_15	E Montgomery Ave and Thompson St	70.90%
RG_16	19th and Wood St	99.56%
RG_17	Saul St. and Benner St	82.14%
RG_18	Fox St. and Roosevelt Blvd	95.52%
RG_19	Chew Ave and Sharpnack St	47.89%
RG_20	Woodhaven Rd and Knights Rd	78.08%
RG_21	Shawmont Ave and Eva St	96.30%
RG_22	N 67th and Callowhill St	76.61%
RG_23	Penrose Ave and Mingo Ave	90.69%
RG_24	Lockart Rd and Lockart Ln	97.41%
RG_25	24th and Wolf St	61.14%
RG_26	621 Lehigh Ave	61.19%
RG_27	Grant Ave and Ashford Rd	84.81%
RG_28	1350 Southampton Rd	94.59%
RG_29	Springfield Way and PaperMill Rd	76.78%
RG_30	7609 Montgomery Ave	88.58%
RG_31	Valley Rd and Old Valley Rd	69.96%
RG_32	Rozel Ave and Crushmore Rd	96.79%
RG_33	Jackson St and E Broadway Ave	96.49%
RG_34	Lawrence Rd and Chester Ave	81.92%
RG_35	Hagysford Rd and Tower Lane	96.67%
RG_36	Schuylkill Canal and Lock St	68.44%
RG_37	S 13 St and Normandy Pl	94.43%

Table 5 - Listing of All Pumping Station Monitors

Monitor ID	Type of Pumping Station	Measurement Name	Measurement Type	Address
PS_26VA	Storm Water	PUMP 1 RUN	EVENT	26th and Vare Ave
PS_26VA	Storm Water	PUMP 2 RUN	EVENT	27th and Vare Ave
PS_26VA	Storm Water	WET WELL LEVEL	LEVEL	28th and Vare Ave
PS_42ST	Waste Water	PUMP 1 RUN	EVENT	761 S 43rd St
PS_42ST	Waste Water	PUMP 2 RUN	EVENT	762 S 43rd St
PS_42ST	Waste Water	PUMP 3 RUN	EVENT	763 S 43rd St
PS_42ST	Waste Water	WET WELL LEVEL	LEVEL	764 S 43rd St
PS_BANK	Waste Water	PUMP 1 RUN	EVENT	15 S Bank St (Bank & Elbow Ln)
PS_BANK	Waste Water	PUMP 2 RUN	EVENT	16 S Bank St (Bank & Elbow Ln)
PS_BANK	Waste Water	WET WELL LEVEL	LEVEL	17 S Bank St (Bank & Elbow Ln)
PS_BELD	Waste Water	PUMP 1 RUN	EVENT	751 S Manatawna St (Belfry & Steeple)
PS_BELD	Waste Water	PUMP 2 RUN	EVENT	752 S Manatawna St (Belfry & Steeple)
PS_BELD	Waste Water	WET WELL LEVEL	LEVEL	753 S Manatawna St (Belfry & Steeple)
PS_BLVD	Storm Water	PUMP 1 RUN	EVENT	4251 N Broad St (Broad & Roosevelt Blvd)
PS_BLVD	Storm Water	PUMP 2 RUN	EVENT	4252 N Broad St (Broad & Roosevelt Blvd)
PS_BLVD	Storm Water	PUMP 3 RUN	EVENT	4253 N Broad St (Broad & Roosevelt Blvd)
PS_BLVD	Storm Water	PUMP 4 RUN	EVENT	4254 N Broad St (Broad & Roosevelt Blvd)
PS_BLVD	Storm Water	WET WELL LEVEL	LEVEL	4255 N Broad St (Broad & Roosevelt Blvd)
PS_CSPS	Waste Water	N GATE POSITION	POSITION	600 University Ave (34th St Bridge & University)
PS_CSPS	Waste Water	N SIPHON LEVEL	LEVEL	601 University Ave (34th St Bridge & University)
PS_CSPS	Waste Water	N SIPHON LEVEL	LEVEL	602 University Ave (34th St Bridge & University)
PS_CSPS	Waste Water	N WET WELL LEVEL	LEVEL	603 University Ave (34th St Bridge & University)
PS_CSPS	Waste Water	PUMP 1 RUN	EVENT	604 University Ave (34th St Bridge & University)
PS_CSPS	Waste Water	PUMP 2 RUN	EVENT	605 University Ave (34th St Bridge & University)

Monitor ID	Type of Pumping Station	Measurement Name	Measurement Type	Address
PS_CSPS	Waste Water	PUMP 3 RUN	EVENT	606 University Ave (34th St Bridge & University)
PS_CSPS	Waste Water	PUMP 4 RUN	EVENT	607 University Ave (34th St Bridge & University)
PS_CSPS	Waste Water	PUMP 5 RUN	EVENT	608 University Ave (34th St Bridge & University)
PS_CSPS	Waste Water	PUMP 6 RUN	EVENT	609 University Ave (34th St Bridge & University)
PS_CSPS	Waste Water	S GATE POSITION	POSITION	610 University Ave (34th St Bridge & University)
PS_CSPS	Waste Water	S WET WELL LEVEL	LEVEL	611 University Ave (34th St Bridge & University)
PS_FORD	Waste Water	PUMP 1 RUN	EVENT	3800 Ford Rd (Across from West Park Hospital)
PS_FORD	Waste Water	PUMP 2 RUN	EVENT	3801 Ford Rd (Across from West Park Hospital)
PS_FORD	Waste Water	WET WELL LEVEL	LEVEL	3802 Ford Rd (Across from West Park Hospital)
PS_HOGI	Waste Water	PUMP 1 RUN	EVENT	3 Hog Island Rd (east of Airport control tower)
PS_HOGI	Waste Water	PUMP 2 RUN	EVENT	4 Hog Island Rd (east of Airport control tower)
PS_HOGI	Waste Water	WET WELL LEVEL	LEVEL	5 Hog Island Rd (east of Airport control tower)
PS_LIND	Waste Water	PUMP 1 RUN	EVENT	5200 Linden Ave (Linden & Milnor)
PS_LIND	Waste Water	PUMP 2 RUN	EVENT	5201 Linden Ave (Linden & Milnor)
PS_LIND	Waste Water	WET WELL LEVEL	LEVEL	5202 Linden Ave (Linden & Milnor)
PS_LOCK	Waste Water	PUMP 1 RUN	EVENT	10778 Lockart Rd (Lockart St & Locart Ln)
PS_LOCK	Waste Water	PUMP 2 RUN	EVENT	10779 Lockart Rd (Lockart St & Locart Ln)
PS_LOCK	Waste Water	WET WELL LEVEL	LEVEL	10780 Lockart Rd (Lockart St & Locart Ln)
PS_MILN	Waste Water	PUMP 1 RUN	EVENT	9647 Milnor St (between Grant Ave & Eden St)
PS_MILN	Waste Water	PUMP 2 RUN	EVENT	9648 Milnor St (between Grant Ave & Eden St)
PS_MILN	Waste Water	PUMP 3 RUN	EVENT	9649 Milnor St (between Grant Ave & Eden St)
PS_MILN	Waste Water	WET WELL LEVEL	LEVEL	9650 Milnor St (between Grant Ave & Eden St)
PS_MING	Storm Water	BASIN LEVEL	LEVEL	7000 Penrose Ave (Schuylkill River under Platt Bridge)
PS_MING	Storm Water	PUMP 1 RUN	EVENT	7001 Penrose Ave (Schuylkill River under Platt Bridge)
PS_MING	Storm Water	PUMP 2 RUN	EVENT	7002 Penrose Ave (Schuylkill River under Platt Bridge)
PS_MING	Storm Water	PUMP 3 RUN	EVENT	7003 Penrose Ave (Schuylkill River under Platt Bridge)

Monitor ID	Type of Pumping Station	Measurement Name	Measurement Type	Address
PS_MING	Storm Water	PUMP 4 RUN	EVENT	7004 Penrose Ave (Schuylkill River under Platt Bridge)
PS_MING	Storm Water	PUMP 5 RUN	EVENT	7005 Penrose Ave (Schuylkill River under Platt Bridge)
PS_MING	Storm Water	PUMP 6 RUN	EVENT	7006 Penrose Ave (Schuylkill River under Platt Bridge)
PS_NEIL	Waste Water	PUMP 1 RUN	EVENT	4000 Neill Dr (Neill Dr & Falls Rd)
PS_NEIL	Waste Water	PUMP 1 RUN	EVENT	4001 Neill Dr (Neill Dr & Falls Rd)
PS_NEIL	Waste Water	PUMP 3 RUN	EVENT	4002 Neill Dr (Neill Dr & Falls Rd)
PS_NEIL	Waste Water	WET WELL LEVEL	LEVEL	4003 Neill Dr (Neill Dr & Falls Rd)
PS_P603	Waste Water	PUMP 1 RUN	EVENT	2000 Langley Ave (PNBC)
PS_P603	Waste Water	PUMP 2 RUN	EVENT	2001 Langley Ave (PNBC)
PS_P603	Waste Water	WET WELL LEVEL	LEVEL	2002 Langley Ave (PNBC)
PS_P648	Waste Water	PUMP 1 RUN	EVENT	PNBC
PS_P648	Waste Water	PUMP 2 RUN	EVENT	PNBC
PS_P648	Waste Water	WET WELL LEVEL	LEVEL	PNBC
PS_P796	Waste Water	PUMP 1 RUN	EVENT	4801 S 13th St (PNBC)
PS_P796	Waste Water	PUMP 2 RUN	EVENT	4802 S 13th St (PNBC)
PS_P796	Waste Water	PUMP 3 RUN	EVENT	4803 S 13th St (PNBC)
PS_P796	Waste Water	WET WELL LEVEL	LEVEL	4804 S 13th St (PNBC)
PS_POLI	Waste Water	PUMP 1 RUN	EVENT	
PS_POLI	Waste Water	PUMP 2 RUN	EVENT	
PS_POLI	Waste Water	WET WELL LEVEL	LEVEL	
PS_RENN	Waste Water	PUMP 1 RUN	EVENT	11064 Rennard St (Philmont Shopping Center)
PS_RENN	Waste Water	PUMP 2 RUN	EVENT	11065 Rennard St (Philmont Shopping Center)
PS_RENN	Waste Water	WET WELL LEVEL	LEVEL	11066 Rennard St (Philmont Shopping Center)
PS_SPLA	Waste Water	PUMP 1 RUN	EVENT	9021 Buttonwood Pl (Spring Lane Meadows)
PS_SPLA	Waste Water	PUMP 2 RUN	EVENT	9022 Buttonwood Pl (Spring Lane Meadows)
PS_SPLA	Waste Water	WET WELL LEVEL	LEVEL	9023 Buttonwood Pl (Spring Lane Meadows)

Table 6 - Listing of all Temporary Flow Monitors Deployed by Projects

Site Name	Start	End	Project
F21-000025	8/2/2017	8/6/2018	CSO Model Calibration
D73-000400	9/1/2017	9/5/2018	CSO Model Calibration
D08-000020	11/2/2017	9/5/2018	CSO Model Calibration
S50-010470	7/26/2017	9/26/2018	CSO Model Calibration
P090-02-0010	3/28/2018	10/1/2018	Stormwater Monitoring
CSE-0030	7/18/2014	10/2/2018	CSO Model Calibration
UFLL-0010	5/29/2014	10/3/2018	CSO Model Calibration
SWMG-0065	7/20/2014	10/3/2018	CSO Model Calibration
OA-0020	3/12/2015	10/3/2018	CSO Model Calibration
LDLL-B0200	3/30/2016	10/3/2018	CSO Model Calibration
S052-05-S0030	4/26/2016	10/4/2018	I/I
BC-B0755	12/10/2012	10/8/2018	I/I
P090-02-S0590	12/10/2012	10/8/2018	I/I
D47-000065	12/12/2012	10/8/2018	CSO Model Calibration
USE-0020	8/13/2013	10/8/2018	I/I
PP-0065	1/24/2014	10/8/2018	I/I
LFLL-0015	5/28/2014	10/8/2018	CSO Model Calibration
LSE-0015	5/30/2014	10/8/2018	CSO Model Calibration
SOM-0040	5/30/2014	10/8/2018	CSO Model Calibration
SOM-0220	6/26/2014	10/8/2018	CSO Model Calibration
IALL-0230	3/2/2015	10/8/2018	CSO Model Calibration
IALL-0210	3/3/2015	10/8/2018	CSO Model Calibration
IALL-0195	3/12/2015	10/8/2018	CSO Model Calibration
LSW-0077	3/13/2015	10/8/2018	CSO Model Calibration
OA-B0145	7/18/2017	10/8/2018	CSO Model Calibration
P090-02-0330	3/28/2018	10/8/2018	Stormwater Monitoring
P091-02-0010	3/28/2018	10/8/2018	Stormwater Monitoring
P091-03-0015	4/2/2018	10/8/2018	Stormwater Monitoring
P099-03-0090	4/13/2018	10/8/2018	Stormwater Monitoring
P099-03-0125	4/13/2018	10/8/2018	Stormwater Monitoring
P099-03-0010	4/26/2018	10/8/2018	Stormwater Monitoring
P091-01-0010	4/28/2018	10/8/2018	Stormwater Monitoring
ABN-000035	6/21/2018	10/8/2018	Stormwater Monitoring
W095-01-S0015	6/25/2018	10/8/2018	I/I

Site Name	Start	End	Project
WLL-0028	11/29/2016	11/1/2018	I/I
USE-0235	12/14/2016	11/2/2018	I/I
Yeadon	4/27/2015	11/7/2018	I/I
CCHL-0065	11/16/2016	11/7/2018	CSO Model Calibration
IALL-0008	6/25/2015	11/9/2018	CSO Model Calibration
T14-025815	10/5/2017	1/8/2019	CSO Model Calibration
D25-013160	10/17/2017	1/8/2019	CSO Model Calibration
S50-000180	7/31/2017	1/9/2019	CSO Model Calibration
S50-009135	8/1/2017	1/9/2019	CSO Model Calibration
P01-000080	10/17/2017	1/9/2019	CSO Model Calibration
S50-000230	8/22/2017	1/10/2019	CSO Model Calibration
T08-000015	1/24/2014	2/18/2019	CSO Model Calibration
FCHL-0175	3/16/2015	2/19/2019	CSO Model Calibration
S45-000315	10/4/2017	2/19/2019	CSO Model Calibration
S38-000247	10/26/2017	2/19/2019	CSO Model Calibration
F21-000145	12/12/2012	2/20/2019	CSO Model Calibration
D17-000060	10/27/2017	2/20/2019	CSO Model Calibration
P116-02-S0025	3/27/2019	6/26/2019	I/I
P116-02-S0080	3/27/2019	6/26/2019	I/I
S05-000012	3/18/2011	Present	CSO Model Calibration
P083-03-S0050	10/11/2011	Present	I/I
S45-001110	10/13/2011	Present	CSO Model Calibration
D63-000035	10/14/2011	Present	CSO Model Calibration
BC-0055	12/1/2011	Present	I/I
IALL-B0355	12/12/2011	Present	I/I
C17-003360	12/13/2011	Present	CSO Model Calibration
T14-013875	2/28/2012	Present	CSO Model Calibration
M005-09-0140	9/27/2012	Present	Stormwater Monitoring
WLL-0565	3/7/2013	Present	I/I
PC-0040	1/21/2014	Present	I/I
D45-000015	5/14/2014	Present	CSO Model Calibration
UDLL-0045	5/29/2014	Present	CSO Model Calibration
USE-0365	5/29/2014	Present	I/I
USE-0400	5/29/2014	Present	I/I
SWMG-B0265	6/24/2014	Present	CSO Model Calibration
UDLL-0085	6/25/2014	Present	CSO Model Calibration

Site Name	Start	End	Project
UDLL-0275	9/15/2014	Present	I/I
WLL-0650	3/10/2015	Present	I/I
WLL-0675	3/13/2015	Present	I/I
THL-0085	4/14/2015	Present	CSO Model Calibration
UDLL-0120	7/30/2015	Present	I/I
S059-02-S0010	4/22/2016	Present	I/I
S051-08-S0015	4/28/2016	Present	I/I
S051-08-S0180	4/29/2016	Present	I/I
S059-04-S0027	5/4/2016	Present	I/I
S051-05-S0015	5/13/2016	Present	I/I
CV-0145	6/24/2016	Present	I/I
S50-011230	8/29/2017	Present	CSO Model Calibration
THL-0045	11/23/2017	Present	CSO Model Calibration
T14-000252	12/6/2018	Present	CSO Model Calibration
T14-000115	1/10/2019	Present	CSO Model Calibration
T14-000140	1/10/2019	Present	CSO Model Calibration
Yeadon	2/6/2019	Present	I/I
LDLL-0010	2/22/2019	Present	CSO Model Calibration

Table 7 - Listing of Outlying Community Contract Limits

Metered	Contract Limits					
Standardized	Instantaneous		Daily Max	Township Total		
Site ID	CFS	MGD	MGD	Inst. CFS	Inst. MGD	Daily Max MGD
MA1						
MA2						
MA3						
MA4						
MAx1						
Abington Total				9.542	6.168	4.453
MB1				74.26	47.996	33
Bucks Total						
MBE1						
MBE2						
MBE3						
MBE4						
MBE5						
MBE6						
MBE7						
MBE8						
MBE9						
MBE10						
MBE11						
MBE12						
MBE13						
MBE14						
MBE15						
MBE16						
Bensalem Total				11.74	7.588	6.133
MC1	2.75	1.777				
MC2	18	11.634				
MC3	0.480	0.31				
MCx1	8	5.171	Combined total for all the MCx#			
MCx2						
MCx3						
MCx4						
MCx5						
MCx6						
MCx7						

Metered	Contract Limits					
Standardized	Instantaneous		Daily Max	Township Total		
Site ID	CFS	MGD	MGD	Inst. CFS	Inst. MGD	Daily Max MGD
Cheltenham Total				20.75	13.411	13.380
MD1	155	100.179	50	155	100	50
DELCORA Total				155	100	50
ML1			5.474			
ML2			1.48			
ML3						
ML4			10.264			
ML5			1.848			
ML6			0.252			
ML7			0.84			
Lower Merion Total				31.57	20.404	14.5
MLM1						
MLM2	3.71	2.4	1.8			
MLM3						
MLM4						
MLM5						
MLM6						
MLM7						
Lower Moreland Total				5.88	3.80	2.85
MS1						
MS2						
MS3						
MS4						
MS5						
MS6						
MS7						
MS8						
Springfield Total				8.58	5.55	4.2
MSH1						
MSH2						
MSHX_1						
MSHX_2						
Southampton Total				15.79	10.205	7.14
MUD-N						
MUD-S						
MUD-O						
MUD-1						

Metered	Contract Limits					
Standardized	Instantaneous		Daily Max	Township Total		
Site ID	CFS	MGD	MGD	Inst. CFS	Inst. MGD	Daily Max MGD
Upper Darby Total				35	22.621	17

Appendix C – FY19 CSO Program Maintenance Annual Report

PWD COLLECTOR SYSTEMS - FLOW CONTROL UNIT

FY 2019 CSO Program Maintenance – Annual Report

PHILADELPHIA WATER DEPARTMENT

FLOW CONTROL

FLOW CONTROL UNIT

The Collector System Flow Control Unit's primary responsibilities are divided into four groups; Combined Sewer Overflow (CSO) Regulator Maintenance, Pumping Station Operation & Maintenance, Collector System Instrumentation and CCTV Technical Inspections. The Wastewater Pumping Group main office is located at 5202 Pennypack Street in the Torresdale Raw Water Pumping Station. The WWP Group assembles at this facility, which also has a maintenance machine shop, storage garage, and workshop to handle maintenance assignments. The other three groups have maintenance shops and assemble at the Fox Street Headquarters Facility. Brief descriptions of each group's responsibilities and their FY2019 fiscal year highlights follow.

CSO REGULATOR MAINTENANCE GROUP

Inspecting and servicing the combined sewer overflow regulating and diversion chambers are completed by 19 Interceptor maintenance personnel. This group is responsible for the operations, maintenance, inspections and cleaning of 175 combined sewer-regulating chambers, 89 tide gate chambers, 26 storm relief chambers, 12 sanitary flow diversions, several siphons and other related wastewater control devices throughout the collection system.

Currently the Philadelphia Water Department Flow Control Unit maintains ten types of CSO regulators and storage systems:

- Brown & Brown (B&B) mechanical
- Computer Controlled Sluice Gates
- Computer Controlled B&B Shutter Gates
- Static Dams
- Slot type regulators
- Mechanical Sluice Gates
- Side Overflow Weirs
- Inflatable Rubber Dam
- Water Hydraulic Sluice Gates
- Computer Controlled Crest Gates

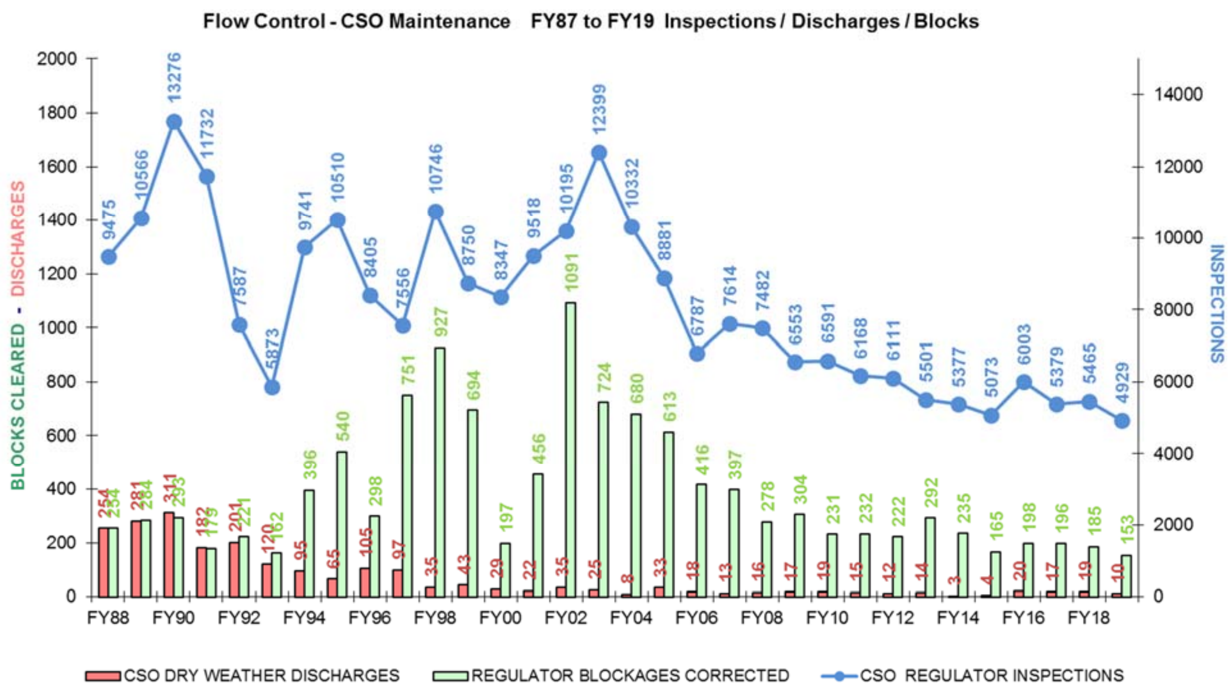
Mechanical or operational malfunctions of regulators and tide gates can cause dry weather discharges and stream and river inflow. These types of events can have a major impact on the Wastewater and Fresh Water Treatment Plant’s performance and the quality of stream water. They can also affect the recreational use of our local waterways. Thus, the combined sewer regulator systems are closely monitored for potential blockages and when identified the problems are corrected quickly. CSO chamber Inspections and clearing of any regulator blockages prior to causing a dry weather discharge are the primary responsibilities of this group and are key areas in assessing the group’s overall performance.

By continually tracking and analyzing Dry Weather Discharges it can be determined if new or modified maintenance procedures would help to prevent them from occurring. Although our established procedures have greatly reduced the number and duration of these discharges, the combined system picks up all manner of trash and debris that is unpredictable in its pattern of causing flow disruptions. Despite incorporating best management practices such as having all inlets trapped and cleaned, preventative maintenance schedules for sewer flushing and cleaning of the regulators, CCTV inspection of DWO pipes, etc., it is virtually impossible to eliminate all blockages before they occur.

The PWD Flow Control Unit continues to aggressively control and minimize these dry weather overflows by utilizing the latest technology-based controls including our Collector System Remote Monitoring Network that currently includes over 320 sites with over 720 individual level and/or flow measurements. Training the CSO maintenance personnel in the use of the system’s computer programs for analyzing the trend data has developed a comprehensive understanding of individual CSO sites and their distinctive flow patterns. This familiarity helps them recognize abnormal conditions quickly at a location so that they can respond before the conditions develop into a dry weather CSO blockage or discharge.

The CSO Maintenance Group performed 4929 inspections of the regulating chambers in FY2019. The work includes frequent visual inspections of the equipment and flow patterns to make sure everything is operating properly. The more comprehensive work such as the cleaning and lubricating of the mechanical equipment is scheduled during lower flow periods between rain events.

In FY2019, the crews cleared 153 regulator blockages before they developed into a CSO dry weather discharge. There were ten CSO dry weather discharges for this fiscal year.



Many discharges are a result of debris such as rags, sticks, stones and other debris that become lodged in the CSO regulator diversion or the dry weather outlet pipe during dry weather periods. These types of blockages are virtually unpredictable so frequent inspections and closely observing the monitoring trend data is essential to our prevention program. Following moderate to heavy rain events the CSO regulators can have grit, sticks, rags and other debris caught at various places in and around the regulator that could eventually result in a discharge. The CSO maintenance crews perform quick topside inspections of the CSO sites throughout the City for several days following these events to remove or clear away any of this storm debris. The work schedule will then revert to the more comprehensive maintenance such as cleaning, lubricating, adjusting equipment and performing minor repairs to the mechanical regulators.

CSO Regulator Group with the help of Sewer maintenance and Mobile Dredging Vactoring Services, cleaned and removed approximately 100 tons of debris and grit from the D-25 regulating chamber.

WASTEWATER PUMPING STATION MAINTENANCE GROUP

The Wastewater Pumping Station Maintenance Group consisting of 35 maintenance personnel are located at the 5202 Pennypack St. Maintenance Shop. They are responsible for the operations and maintenance of 16 wastewater-pumping stations, 3 stormwater pumping stations, 2 sodium hypochlorite dosing stations, 11 computer controlled CSO storage regulators and several in-line and offline wastewater-storage facilities among other duties.

Many of the pumping stations provide for only one running pump and one reserve pump. This arrangement means that pump breakdowns are responded to immediately and that overhauls need to be completed in a minimum amount of time. The main pump availability statistic is a good indicator of the Maintenance Group's performance in this area. The main pumping units were in service 97% of the time in FY2019. The WWP Group completed twelve main wastewater pump overhauls at the stations. These overhauls consist of repair and replacement of the worn pump and motor components to bring the equipment's performance up to new operating condition.

The Wastewater Pumping Station Maintenance Group had no main pumps out of service during fiscal year 2019 because of failures or breakdowns. The reason for this is that during pump maintenance and overhauls the in-service pump was rotated out of activity and replaced by the spare pump for the station. This accomplishes two things, one the station always has its full complement of pumps available and the spare pump for the station gets used. The only pump station that did have a pump out or was not at full capacity was the Central Schuylkill Pump station which is going through a Capital Project of replacing all pumps. Pump #5 and Pump #4 were out of service for 8 weeks while the replacement was being completed. The pumps were back in service in April and the project is continuing with the next pumps being replaced in the next fiscal year.

In addition to the pumping station maintenance, the group maintains a variety of other equipment throughout the Collector System. They are responsible for the operations and maintenance of the two sodium hypochlorite dosing stations. The stations are located next to the Queen Lane Raw Water pumping station, which injects hypo into the Upper Schuylkill East Interceptor, and at the Totem Rd. pumping station, which injects hypo into the Bucks County force main. The group is responsible for maintaining adequate supply of the chemical, over 1,051,436 gallons in FY 2019, for monitoring the downstream hydrogen sulfide levels and adjusting the dosage levels in addition to the maintenance and repair of the equipment.

The group also fabricates and repairs bar screens, debris grills and other equipment for the Collector System and performs major maintenance of the CSO mechanical regulators such as installation of tide gates, overflow gates and servicing of the Brown & Brown regulators.

COLLECTOR SYSTEM INSTRUMENTATION MAINTENANCE GROUP

The fourteen Instrument and Electronic Technicians located at the Fox Street facility are primarily responsible for installing, calibrating and maintaining the electronic and instrumentation equipment in the Collector System monitoring and control network. They also repair, calibrate and certify the hazardous gas detection meters for the Department as well as install temporary flow and level monitors for various units in the Water Department.

One of the primary responsibilities of the CS Instrumentation Group is to maintain the network of level sensors, flow meters, and rain gauges and keep them up and running with a minimum of downtime while maintaining accurate and reliable data. The network currently consists of 258 level and flow monitoring locations in the NE, SE, and SW Drainage Districts, 35 gauges in the citywide rain gauge network, 56 Township flow-metering stations, and a number of additional monitors at various control sites. It is crucial that the remote site equipment is communicating and downloading data to the server so that the information is available for trend chart viewing and analysis for the users. The CSO maintenance group relies heavily on these charts to monitor the performance of all the CSO regulators while paying special attention to the sites that have had recent or a history of discharges. The monitoring data is used for a wide variety of other purposes such as calibrating the Collector System's hydraulic model, generating township sewage flows for billing and for various Planning and Engineering studies.

The CS Instrumentation Maintenance group performed 2268 maintenance inspections in FY 2019. The data collections used by Flow Control are TELOG units and 261 outdated 3G modems were updated to 4G modems with 50 modems still needing to be upgraded by end of year 2019 as the 3G modems will not longer be supported.

CCTV TECHNICAL INSPECTIONS GROUP

The CCTV Technical Inspections group consists of one Supervisor, two group leaders, and sixteen technicians who operate and maintain the seven closed circuit TV camera trucks and Green Storm Infrastructure inspection cameras. The seven CCTV trucks and CCTV Contractor logged 43.30 miles of sewer inspections in FY 2019. The CCTV GSI Unit completed 750 Post Construction Inspections and 887 Pre-Maintenance Inspections and 88 NASSCO PACP Inspections in FY 2019.

The CCTV group has several primary functions which include inspections of sewers turned in for sewer complaints, special inspection requests from the Water/ Sewer Design group and the post construction inspection program which involves videoing the sewer at the completion of all sewer construction work. Another function of the group is to work with the Defective Connection Program group to identify the defective lateral connections.

SERVICE LEVEL GOALS

The goal of the Flow Control Unit is to maintain and exceed the service level goals. One area that directly affects the service level of the Flow Control Unit is personnel vacancies.

Month	CSO Discharges per 100 Inspections	% Metering Chambers Operational	% CSO Level Meters Operational	CCTV Inspections	Main Pump Availability
Goal -->	**0**	**95% or Higher**	**90% or Higher**	**2.8 Miles**	**95% or Higher**
July - 2018	0.6	90.0%	92.1%	3.85	98.30%
August - 2018	0	89.0%	90.7%	5.24	97.50%
September - 2018	0	89.0%	90.5%	3.70	98.60%
October - 2018	0	91.0%	94.6%	3.42	98.40%
November - 2018	0.3	96.0%	93.4%	3.15	94.90%
December - 2018	0	97.0%	94.0%	4.10	96.40%
January - 2019	0	89.0%	94.0%	4.13	97.40%
February - 2019	0	96.0%	93.8%	3.04	97.30%
March - 2019	0.2	98.0%	97.5%	3.04	96.40%
April - 2019	0.7	98.0%	93.9%	3.16	96.40%
May - 2019	0.3	99.0%	94.8%	3.67	96.70%
June - 2019	0.3	90.0%	93.3%	2.80	98.80%
Totals FY 2019	**0.20**	**93.50%**	**93.55%**	**43.30**	**97.26%**

FLOW CONTROL PERSONNEL SUMMARY

The Flow Control Unit makes every effort to fill all 95 approved positions in order to maintain the service level goals.

95 Flow Control Positions [95 Listed]	Active	Vacant	Total
Clerk III	1	0	1
Clerk Typist II	1	1	2
Data Services Support Clerk	1	0	1
Electrician 1	2	1	3
Electronic Equipment Supervisor	2	0	2
Electronic Technician 1	8	2	10
Electronic Technician 2	13	1	14
Electronic Technician Grp. Leader	3	1	4
Electronic Technician Trainee	9	0	9
Ind. Process Mach. Mech. Grp. Leader	2	0	2
Industrial Electrician 1	2	0	2
Industrial Electrician Group Leader	1	0	1
Industrial Process Mach. Mech.	5	0	5
Interceptor Service Worker I	4	3	7
Interceptor Service Worker II	7	1	8
Interceptor Services Supervisor	2	0	2
Mach. & Equipment Mech.	10	1	11
Public Works Maintenance Trainee	6	0	6
Sewer Maintenance Inspector	1	0	1
Water Conveyance Sys. Asst. Supt. (P)	2	0	2
Water Conveyance Sys. Supt.	1	0	1
Water Operations Repair Helper	1	0	1
Totals	**84**	**11**	**95**

APPENDICES

- Appendix A - FY 2019 Annual CSO Report Spreadsheets
- Appendix B - FY 2019 Annual CSO Miscellaneous Site & Maintenance Reports
- Appendix C - FY 2019 Main Pump Availability Chart
- Appendix D - Historical CSO Charts

Appendix A

FY 2019 Annual CSO Spreadsheets

PART 1	PHILADELPHIA WATER DEPARTMENT	Section 1
DRY WEATHER STATUS	WASTE AND STORM WATER COLLECTION	
REPORT	FLOW CONTROL UNIT	July 2018 - June 2019

COLLECTOR	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Totals
UPPER PENNYPACK - 5 UNITS													
INSPECTIONS	15	10	14	10	10	10	10	10	21	12	10	10	142
DISCHARGES	0	0	0	0	0	0	0	0	0	0	0	0	0
BLOCKS CLEARED	0	0	0	0	0	0	0	0	0	1	0	0	1
UPPER DELAWARE LOW LEVEL - 12 UNITS													
INSPECTIONS	20	25	41	36	30	24	28	28	43	15	16	29	335
DISCHARGES	0	0	0	0	0	0	0	0	0	0	0	0	0
BLOCKS CLEARED	2	2	3	2	1	0	1	1	1	0	0	4	17
LOWER FRANKFORD CREEK - 6 UNITS													
INSPECTIONS	7	15	20	31	23	14	18	18	20	12	16	29	223
DISCHARGES	0	0	0	0	0	0	0	0	0	0	0	0	0
BLOCKS CLEARED	0	0	2	2	3	1	0	0	0	3	1	3	15
LOWER FRANKFORD LOW LEVEL - 10 UNITS													
INSPECTIONS	23	42	27	40	21	31	20	20	21	16	30	23	314
DISCHARGES	0	0	0	0	0	0	0	0	0	0	0	0	0
BLOCKS CLEARED	2	1	2	0	0	0	0	0	0	1	2	1	9
FRANKFORD HIGH LEVEL - 14 UNITS													
INSPECTIONS	28	29	32	55	36	31	40	40	56	16	32	38	433
DISCHARGES	0	0	0	0	1	0	0	0	0	0	1	1	3
BLOCKS CLEARED	1	2	0	0	0	0	1	1	1	0	0	0	6
SOMERSET - 9 UNITS													
INSPECTIONS	13	26	21	21	24	21	22	22	37	37	18	9	271
DISCHARGES	0	0	0	0	0	0	0	0	0	0	0	0	0
BLOCKS CLEARED	0	3	0	0	1	0	0	0	0	1	0	0	5
LOWER DELAWARE LOW LEVEL - 33 UNITS													
INSPECTIONS	77	58	79	69	38	78	72	72	76	21	62	34	736
DISCHARGES	0	0	0	0	0	0	0	0	0	0	0	0	0
BLOCKS CLEARED	12	6	4	1	2	0	0	0	1	2	5	1	34
CENTRAL SCHUYLKILL EAST - 18 UNITS													
INSPECTIONS	42	40	37	47	53	35	37	37	41	23	28	36	456
DISCHARGES	0	0	0	0	0	0	0	0	0	0	0	0	0
BLOCKS CLEARED	1	1	4	3	1	0	0	0	0	0	2	2	14
LOWER SCHUYLKILL EAST - 9 UNITS													
INSPECTIONS	15	21	12	19	18	15	18	18	22	14	20	19	211
DISCHARGES	0	0	0	0	0	0	0	0	0	0	0	0	0
BLOCKS CLEARED	3	2	1	0	1	0	0	0	0	2	1	1	11
CENTRAL SCHUYLKILL WEST - 9 UNITS													
INSPECTIONS	19	22	25	26	11	18	20	20	22	17	15	19	234
DISCHARGES	1	0	0	0	0	0	0	0	1	2	0	0	4
BLOCKS CLEARED	2	0	2	0	0	1	0	0	1	1	0	0	7
SOUTHWEST MAIN GRAVITY - 10 UNITS													
INSPECTIONS	26	28	20	31	25	17	39	39	24	18	20	31	318
DISCHARGES	0	0	0	0	0	0	0	0	0	0	0	0	0
BLOCKS CLEARED	2	3	0	1	0	0	1	1	1	0	0	4	13
LOWER SCHUYLKILL WEST - 4 UNITS													
INSPECTIONS	8	9	9	10	5	8	8	8	10	7	4	8	94
DISCHARGES	0	0	0	0	0	0	0	0	0	0	0	0	0
BLOCKS CLEARED	1	0	1	2	0	0	0	0	2	0	1	0	7
COBBS CREEK HIGH LEVEL - 23 UNITS													
INSPECTIONS	27	40	54	66	43	54	49	49	66	24	26	46	544
DISCHARGES	1	0	0	0	0	0	0	0	0	0	0	0	1
BLOCKS CLEARED	1	1	0	0	0	1	1	1	2	1	0	3	11
COBBS CREEK LOW LEVEL - 13 UNITS													
INSPECTIONS	13	14	24	29	12	24	24	24	26	24	5	12	231
DISCHARGES	0	0	0	0	0	0	0	0	0	2	0	0	2
BLOCKS CLEARED	0	1	0	0	0	0	0	0	2	0	0	0	3
RELIEF SEWERS - 26 UNITS													
INSPECTIONS	8	13	45	60	17	53	37	37	58	25	9	25	387
DISCHARGES	0	0	0	0	0	0	0	0	0	0	0	0	0
BLOCKS CLEARED	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS / MONTH for 201 REGULATOR UNITS													Totals
TOTAL INSPECTIONS	341	392	460	550	366	433	442	442	543	281	311	368	4929
TOTAL DISCHARGES	2	0	0	0	1	0	0	0	1	4	1	1	10
TOTAL BLOCKS CLEARED	27	22	19	11	9	3	4	4	11	12	12	19	153
AVER. # of INSP. / BC	13	18	24	50	41	144	111	111	49	23	26	19	52
DISC / 100 INSPECTIONS	0.6	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.2	1.4	0.3	0.3	0.2

I certify under penalty of law that this document was prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for Knowing violations. See 18 Pa. C.S. § 4904 (relating to unsworn falsification).

CSO REGULATING CHAMBER MONTHLY INSPECTION

SITE	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL	AVER	DTR
UPPER PENNYPACK 5 NEWPC UNITS															
P01	3	2	3	2	2	2	2	2	4	2	2	2	28	2.3	13.0
P02	3	2	2	2	2	2	2	2	4	2	2	2	27	2.3	13.5
P03	3	2	3	2	2	2	2	2	5	3	2	2	30	2.5	12.2
P04	4	2	3	2	2	2	2	2	4	3	2	2	30	2.5	12.2
P05	2	2	3	2	2	2	2	2	4	2	2	2	27	2.3	13.5
UPPER DELAWARE LOW LEVEL 12 NEWPC UNITS															
D02	3	2	4	2	3	2	3	3	5	1	2	2	32	2.7	11.4
D03	3	3	4	3	3	2	3	3	6	2	2	3	37	3.1	9.9
D04	3	2	4	3	2	2	3	3	6	1	4	3	36	3.0	10.1
D05	2	2	4	3	2	2	3	3	5	2	2	2	32	2.7	11.4
D06	2	2	3	3	2	2	2	2	4	2	1	2	27	2.3	13.5
D07	2	2	4	3	2	2	2	2	3	1	1	2	26	2.2	14.0
D08	2	2	4	3	3	2	2	2	3	1	1	2	27	2.3	13.5
D09		2	3	3	3	2	2	2	3	1	1	6	28	2.5	13.0
D11		2	3	3	2	2	2	2	2	1	1	1	21	1.9	17.4
D12	1	2	3	6	4	2	2	2	2	1		2	27	2.5	13.5
D13	1	2	3	2	2	2	2	2	2	1		2	21	1.9	17.4
D15	1	2	2	2	2	2	2	2	2	1	1	2	21	1.8	17.4
LOWER FRANKFORD CREEK 6 NEWPC UNITS															
F13	1	2	5	5	4	3	3	3	3	2	1	7	39	3.3	9.4
F14	1	2	6	6	3	3	4	4	3	2	2	7	43	3.6	8.5
F21	1	2	2	4	3	1	2	2	3	2	2	2	26	2.2	14.0
F23	1	4	3	6	4	3	3	3	4	3	3	5	42	3.5	8.7
F24	1	3	2	5	4	2	4	4	3	2	2	6	38	3.2	9.6
F25	2	2	2	5	5	2	2	2	4	1	6	2	35	2.9	10.4
LOWER FRANKFORD LOW LEVEL 10 NEWPC UNITS															
F03	1	2	3	4	2	3	2	2	2	2	1	2	26	2.2	14.0
F04	2	2	3	3	2	3	2	2	2	1	1	2	25	2.1	14.6
F05	2	2	3	3	2	3	2	2	2	1	2	2	26	2.2	14.0
F06	2	7	5	5	3	5	2	2	2	1	5	2	41	3.4	8.9
F07	2	4	1	4	2	3	2	2	2	1	1	2	26	2.2	14.0
F08	2	4	2	4	2	2	2	2	2	1	7	2	32	2.7	11.4
F09	5	5	2	4	2	3	2	2	2	3	4	2	36	3.0	10.1
F10	2	7	2	3	2	3	2	2	2	1	3	2	31	2.6	11.8
F11	2	4	4	5	2	3	2	2	3	3	4	3	37	3.1	9.9
F12	3	5	2	5	2	3	2	2	2	2	2	4	34	2.8	10.7
FRANKFORD HIGH LEVEL 14 NEWPC UNITS															
T01	2	2	2	4	2	2	2	2	6	1	4	2	31	2.6	11.8
T03	2	3	2	4	4	3	3	3	6	2	4	4	40	3.3	9.1
T04	2	2	2	4	3	3	4	4	5	2	2	4	37	3.1	9.9
T05	2	2	2	3	2	2	2	2	4	1	2	2	26	2.2	14.0
T06	2	2	2	4	3	3	3	3	4	1	2	3	32	2.7	11.4
T07	2	2	2	4	3	2	2	2	4	1	1	3	28	2.3	13.0
T08	3	2	3	4	2	2	3	3	4	1	5	2	34	2.8	10.7
T09	2	3	2	4	2	2	3	3	3	1	1	5	31	2.6	11.8
T10	2	2	3	4	3	2	4	4	5	1	2	3	35	2.9	10.4
T11	2	2	3	4	3	2	4	4	5	1	2	3	35	2.9	10.4
T12	3	2	2	5	2	2	4	4	2	1	2	2	31	2.6	11.8
T13	2	3	3	5	3	2	2	2	3	1	3	3	32	2.7	11.4
T14	1	1	2	3	2	2	2	2	2	1	1	1	20	1.7	18.2
T15	1	1	2	3	2	2	2	2	3	1	1	1	21	1.8	17.4

SITE	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL	AVER	DTR
SOMERSET LOW LEVEL 9 NEWPC UNITS															
D17	1	2	3	2	2	2	3	3	3	1	1	1	24	2.0	15.2
D18	1	2	3	2	3	2	3	3	3	1	1	1	25	2.1	14.6
D19	1	2	2	2	2	2	3	3	3	1	1	1	23	1.9	15.9
D20	1	2	2	2	2	2	2	2	3	1	1	1	21	1.8	17.4
D21	1	4	2	3	1	2	2	2	3	2	3	1	26	2.2	14.0
D22	2	1	2	2	2	2	2	2	3	1	1	1	21	1.8	17.4
D23	1	2	2	2	2	3	2	2	3	3	1	1	24	2.0	15.2
D24	1	2	2	2	2	2	2	2	3	2	2	1	23	1.9	15.9
D25	4	9	3	4	8	4	3	3	13	25	7	1	84	7.0	4.3
LOWER DELAWARE LOW LEVEL 33 SEWPC UNITS															
D37	2	2	3	2	1	2	2	2	6	3	8	2	35	2.9	10.4
D38	17	1	2	2	1	2	3	3	3		3	1	38	3.5	9.6
D39	2	1	4	2	1	3	2	2	3		1	1	22	2.0	16.6
D40	2	1	2	2	1	2	2	2	2		3	1	20	1.8	18.2
D41	2	1	2	3	1	2	2	2	2		1	1	19	1.7	19.2
D42	1	1	2	2	1	2	2	2	2		1	1	17	1.5	21.5
D43	1	1	2	2	1	2	2	2	2		1	1	17	1.5	21.5
D44	1	1	2	3	1	2	2	2	2		1	1	18	1.6	20.3
D45	4	3	3	3	1	2	2	2	2		6	1	29	2.6	12.6
D46	2	1	2	2	1	2	2	2	2		1	1	18	1.6	20.3
D47	2	1	2	2	1	2	2	2	2		1	1	18	1.6	20.3
D48	3	3	2	2	1	2	3	3	2		1	1	23	2.1	15.9
D49	2	1	2	2	1	2	2	2	2		1	1	18	1.6	20.3
D50	2	1	2	2	1	2	2	2	2		1	1	18	1.6	20.3
D51	2	1	2	2	1	2	3	3	2		1	1	20	1.8	18.2
D52	3	1	2	2	1	2	2	2	2	1	1	1	20	1.7	18.2
D53	2	3	2	2	2	3	2	2	2	2	4	1	27	2.3	13.5
D54	2	6	6	2	2	3	2	2	2	2	2	1	32	2.7	11.4
D58	3	1	2	2	1	2	3	3	3	1	1	2	24	2.0	15.2
D61	2	2	2	2	1	2	2	2	2		1	2	20	1.8	18.2
D62	2	2	2	2	1	2	2	2	2		1	1	19	1.7	19.2
D63	2	1	2	2	1	2	2	2	2		1	1	18	1.6	20.3
D64	2	1	2	2	1	2	2	2	2	1	1	1	19	1.6	19.2
D65	2	1	2	2	1	2	2	2	2	1	1	1	19	1.6	19.2
D66	2	1	2	1	1	4	3	3	4	4	1	1	27	2.3	13.5
D67	2	2	2	3	2	4	3	3	2	1	2	1	27	2.3	13.5
D68	1	4	3	3	3	4	2	2	3	1	5	1	32	2.7	11.4
D69	1	4	3	2	2	4	2	2	3	1	2	1	27	2.3	13.5
D70	1	2	5	2	2	3	2	2	3		2	1	25	2.3	14.6
D71	1	3	1	3		3	2	2	2		1		18	2.0	20.3
D72	1	2	3	1		2	2	2	1	2	2		18	1.8	20.3
D73	1	2	2	1		2	2	2	1		2	1	16	1.6	22.8
	2		2	2	2	1	2	2	2	1	1	1			
TOTAL	183	205	234	262	182	209	210	210	274	129	184	172	2454		
I/D/C	3.0	3.4	3.8	4.3	3.0	3.4	3.5	3.5	4.5	2.1	3.0	2.8			
UP	15	10	14	10	10	10	10	10	21	12	10	10	142	2.4	12.9
UDLL	20	25	41	36	30	24	28	28	43	15	16	29	335	2.4	13.5
LFC	7	15	20	31	23	14	18	18	20	12	16	29	223	3.1	10.1
LFLL	23	42	27	40	21	31	20	20	21	16	30	23	314	2.6	11.9
FHL	28	29	32	55	36	31	40	40	56	16	32	38	433	2.6	12.2
SLL	13	26	21	21	24	21	22	22	37	37	18	9	271	2.5	14.4
LDLL	77	58	79	69	38	78	72	72	76	21	62	34	718	2.0	17.2

3 TOTAL DISCHARGES FOR NE & SE DISTRICTS

0.3 AVERAGE DISCHARGES PER MONTH

13.1 AVER. DAYS BEFORE RETURNING TO SITE

3.4 AVER. INSPECTIONS PER DAY PER CREW

DTR = DAYS TO RETURN TO SITE

I/D/C = INSPECTIONS PER DAY PER CREW

I/D = INSPECTIONS PER DISCHARGE

CSO REGULATING CHAMBER DISCHARGE **NEWPC & SEWPC PLANT REGULATORS**

SITE	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
UPPER PENNYPACK 5 NEWPC UNITS													
P01													0
P02													0
P03													0
P04													0
P05													0
UPPER DELAWARE LOW LEVEL 12 NEWPC UNITS													
D02													0
D03													0
D04													0
D05													0
D06													0
D07													0
D08													0
D09													0
D11													0
D12													0
D13													0
D15													0
LOWER FRANKFORD CREEK 6 NEWPC UNITS													
F13													0
F14													0
F21													0
F23													0
F24													0
F25													0
LOWER FRANKFORD LOW LEVEL 10 NEWPC UNITS													
F03													0
F04													0
F05													0
F06													0
F07													0
F08													0
F09													0
F10													0
F11													0
F12													0
FRANKFORD HIGH LEVEL 14 NEWPC UNITS													
T01													0
T03													0
T04													0
T05													0
T06													0
T07													0
T08													0
T09												1	1
T10													0
T11													0
T12													0
T13					1						1		2
T14													0
T15													0

SITE	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
SOMERSET LOW LEVEL 9 NEWPC UNITS													
D17													0
D18													0
D19													0
D20													0
D21													0
D22													0
D23													0
D24													0
D25													0
LOWER DELAWARE LOW LEVEL 33 SEWPC UNITS													
D37													0
D38													0
D39													0
D40													0
D41													0
D42													0
D43													0
D44													0
D45													0
D46													0
D47													0
D48													0
D49													0
D50													0
D51													0
D52													0
D53													0
D54													0
D58													0
D61													0
D62													0
D63													0
D64													0
D65													0
D66													0
D67													0
D68													0
D69													0
D70													0
D71													0
D72													0
D73													0
D75													0
													TOTAL DISC
	0	0	0	0	1	0	0	0	0	0	1	1	3

													TOTAL
UP	0	0	0	0	0	0	0	0	0	0	0	0	0
UDLL	0	0	0	0	0	0	0	0	0	0	0	0	0
LFC	0	0	0	0	0	0	0	0	0	0	0	0	0
LFLL	0	0	0	0	0	0	0	0	0	0	0	0	0
FHL	0	0	0	0	1	0	0	0	0	0	1	1	3
SLL	0	0	0	0	0	0	0	0	0	0	0	0	0
LDLL	0	0	0	0	0	0	0	0	0	0	0	0	0

	NO OF UNITS IN DISTRICT BLOCKED												TOTAL
UP	0	0	0	0	0	0	0	0	0	0	0	0	0
UDLL	0	0	0	0	0	0	0	0	0	0	0	0	0
LFC	0	0	0	0	0	0	0	0	0	0	0	0	0
LFLL	0	0	0	0	0	0	0	0	0	0	0	0	0
FHL	0	0	0	0	1	0	0	0	0	0	1	1	3
SLL	0	0	0	0	0	0	0	0	0	0	0	0	0
LDLL	0	0	0	0	0	0	0	0	0	0	0	0	0

CSO REGULATING CHAMBER MONTHLY BLOCKS CLEARED

SITE	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
UPPER PENNYPACK 5 NEWPC UNITS													
P01													0
P02													0
P03										1			1
P04													0
P05													0
UPPER DELAWARE LOW LEVEL 12 NEWPC UNITS													
D02													0
D03	1	1	2										4
D04	1		1										2
D05													0
D06													0
D07													0
D08													0
D09				1								3	4
D11													0
D12				1									1
D13													0
D15		1			1		1	1	1			1	6
LOWER FRANKFORD CREEK 6 NEWPC UNITS													
F13												1	1
F14			2							1		1	4
F21													0
F23				2	1	1				1			5
F24					1							1	2
F25					1					1	1		3
LOWER FRANKFORD LOW LEVEL 10 NEWPC UNITS													
F03													0
F04													0
F05													0
F06			1										1
F07													0
F08											2		2
F09	2	1								1			4
F10												1	1
F11			1										1
F12													0
FRANKFORD HIGH LEVEL 14 NEWPC UNITS													
T01													0
T03													0
T04													0
T05													0
T06													0
T07													0
T08													0
T09									1				1
T10		1											1
T11													0
T12													0
T13	1	1					1	1					4
T14													0
T15													0

7.25 AVERAGE BLOCKAGES PER MONTH

SITE	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
SOMERSET LOW LEVEL 9 NEWPC UNITS													
D17													0
D18		1											1
D19													0
D20													0
D21													0
D22													0
D23										1			1
D24													0
D25		2			1								3
LOWER DELAWARE LOW LEVEL 33 SEWPC UNITS													
D37											2	1	3
D38	10												10
D39													0
D40											1		1
D41													0
D42													0
D43													0
D44													0
D45		2		1									3
D46													0
D47													0
D48		2											2
D49													0
D50													0
D51	1		1		1								3
D52										1			1
D53	1										2		3
D54													0
D58													0
D61			1										1
D62		1	1										2
D63													0
D64													0
D65		1											1
D66									1				1
D67			1										1
D68					1								1
D69													0
D70													0
D71													0
D72										1			1
D73													0
D75													0
													TOTAL
	17	14	11	5	7	1	2	2	3	8	8	9	87

UP	0	0	0	0	0	0	0	0	0	1	0	0	1
UDLL	2	2	3	2	1	0	1	1	1	0	0	4	17
LFC	0	0	2	2	3	1	0	0	0	3	1	3	15
LFLL	2	1	2	0	0	0	0	0	0	1	2	1	9
FHL	1	2	0	0	0	0	1	1	1	0	0	0	6
SLL	0	3	0	0	1	0	0	0	0	1	0	0	5
LDLL	12	6	4	1	2	0	0	0	1	2	5	1	34

SITE	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL	AVER	DTR
CENTRAL SCHUYLKILL EAST SIDE 18 SWWPC UNITS															
S05	3	2	2	4	3	2	2	2	3	1	1	2	27	2.3	13.5
S06	3	2	2	3	2	2	2	2	3	1	1	2	25	2.1	14.6
S07	4	2	2	3	2	2	2	2	3	2	1	1	26	2.2	14.0
S08	3	5	4	3	4	3	2	2	3	1	4	1	35	2.9	10.4
S09	3	2	2	3	3	1	2	2	3	1	1	1	24	2.0	15.2
S10	2	2	2	3	3	2	2	2	2	1	1	4	26	2.2	14.0
S12	2	2	1	3	5	2	2	2	2	1	1	1	24	2.0	15.2
S12A	2	2	2	3	4	1	1	1	2	1	2	2	23	1.9	15.9
S13	2	2	2	3	5	2	3	3	2	2	2	2	30	2.5	12.2
S15	4	2	2	3	4	2	1	1	2	1	4	2	28	2.3	13.0
S16	2	2	2	2	3	2	2	2	2	1	1	2	23	1.9	15.9
S17	2	2	2	2	2	2	2	2	2	1	2	2	23	1.9	15.9
S18	2	2	2	2	2	2	4	4	2	2	1	2	27	2.3	13.5
S19	2	2	2	2	3	2	2	2	2	1	1	2	23	1.9	15.9
S21	2	3	1	2	2	2	2	2	2	1	2	2	23	1.9	15.9
S23	2	3	2	2	2	2	2	2	2	3	1	2	25	2.1	14.6
S25	1	2	2	2	2	2	2	2	2	1	1	4	23	1.9	15.9
S26	1	1	3	2	2	2	2	2	2	1	1	2	21	1.8	17.4
LOWER SCHUYLKILL EAST SIDE 9 SWWPC UNITS															
S31	2	2	1	2	1	1	1	1	2	3	1	1	18	1.5	20.3
S35	2	2	2	2	1	2	1	1	2	1	2	1	19	1.6	19.2
S36	1	1	1	1		1			1				6	1.0	60.8
S36A	2	2	2	2	2	1	1	1	2		2	2	19	1.7	19.2
S37	1	1	1	1		1			1				6	1.0	60.8
S42	2	3	2	3	6	5	7	7	6	6	8	9	64	5.3	5.7
S42A	2	3	2	3	2	2	3	3	3	1	4	3	31	2.6	11.8
S44	1	1	1	1					1				5	1.0	73.0
S46	2	6		4	6	2	5	5	4	3	3	3	43	3.9	8.5
CENTRAL SCHUYLKILL WEST 9 SWWPC UNITS															
S01	2	2	4	2	2	2	2	2	2	1	2	3	26	2.2	14.0
S02	2	2	2	2	1	2	2	2	3	8	2	3	31	2.6	11.8
S03	1	2	4	4		4	2	2	2	1	2	3	27	2.5	13.5
S04	2	4	3	4	1	1	2	2	2	1	1	2	25	2.1	14.6
S11	2	2	2	2	2	1	1	1	3	1	4	3	24	2.0	15.2
S14	2	1	2	3	1	2	2	2	2	1	1	1	20	1.7	18.2
S20	2	3	2	2	2	1	2	2	2		1	2	21	1.9	17.4
S22	4	3	3	4	1	2	4	4	4	3	1	1	34	2.8	10.7
S24	2	3	3	3	1	3	3	3	2	1	1	1	26	2.2	14.0
SOUTHWEST MAIN GRAVITY 10 SWWPC UNITS															
S27	2	3	2	3	1	2	2	2	2	1	1	2	23	1.9	15.9
S28	2	2	2	3	2	2	2	2	2	2	1	2	24	2.0	15.2
S30	2	3	2	3	2	2	2	2	2	2	1	2	25	2.1	14.6
S34	2	2	2	2	2	1	2	2	2		1	2	20	1.8	18.2
S39	2	2	2	3	2	1	2	2	2	1	1	2	22	1.8	16.6
S40	2	2	2	3	2	1	2	2	2	1	2	1	22	1.8	16.6
S43	2	2	2	3	2	2	2	2	2	1	2	1	23	1.9	15.9
S47	2	1	1	3	2	1	2	2	2	1	2	1	20	1.7	18.2
S50	6	9	4	5	7	3	18	18	6	7	8	16	107	8.9	3.4
S51	4	2	1	3	3	2	5	5	2	2	1	2	32	2.7	11.4
LOWER SCHUYLKILL WEST SIDE 4 SWWPC UNITS															
S32	2	2	2	2	1	2	2	2	2	2	1	2	22	1.8	16.6
S33	2	2	2	2	1	2	2	2	3	2	2	2	24	2.0	15.2
S38	2	3	2	3	1	2	2	2	2	1	1	2	23	1.9	15.9
S45	2	2	3	3	2	2	2	2	3	2		2	25	2.3	14.6

7 TOTAL DISCHARGES IN SW DISTRICT

0.6 AVERAGE DISCHARGES PER MONTH

18.0 AVER. DAYS BEFORE RETURNING TO SITE

1.9 AVER. INSPECTIONS PER DAY PER CREW

DTR = DAYS TO RETURN TO SITE

I/D/C = INSPECTIONS PER DAY PER CREW

I/D = INSPECTIONS PER DISCHARGE

SITE	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL	AVER	DTR
COBBS CREEK HIGH LEVEL 24 SWWPC UNITS															
C01	2	2	4	3	2	2	2	2	4	1	1	2	27	2.3	13.5
C02	2	2	4	3	2	2	2	2	3	1	1	2	26	2.2	14.0
C04	1	2	2	2	2	2	2	2	3	1	1	2	22	1.8	16.6
C04A	1	2	2	2	3	2	2	2	3	1	1	2	23	1.9	15.9
C05	1	2	2	2	3	3	2	2	3	1	1	2	24	2.0	15.2
C06	2	2	2	3	3	3	2	2	3	1	1	2	26	2.2	14.0
C07	2	4	2	3	3	3	2	2	3	2	2	2	30	2.5	12.2
C09	2	2	2	3	3	2	2	2	3	1	1	1	24	2.0	15.2
C10	1	1	2	2	2	2	2	2	2	1	2	2	21	1.8	17.4
C11	1	2	3	3	2	3	3	3	3	1	1	2	27	2.3	13.5
C12		1	2	2	1	2	2	2	2	1	1	2	18	1.6	20.3
C13		1	2	2	1	2	2	2	2		1	2	17	1.7	21.5
C14	1	2	2	3	1	2	2	2	2	1	1	2	21	1.8	17.4
C15	1	2	2	3	1	2	2	2	2	1	1	3	22	1.8	16.6
C16	1	2	2	3	1	2	2	2	2	1	1	3	22	1.8	16.6
C17	1	2	2	3	1	2	2	2	2	1	1	1	20	1.7	18.2
C18	1	3	2	3	1	2	2	2	2	1	1	1	21	1.8	17.4
C31	1	1	2	3	2	3	2	2	4	1	1	2	24	2.0	15.2
C32	1		2	3	1	2	2	2	2	1	1	2	19	1.7	19.2
C33	1	1	2	3	2	3	2	2	4	1	1	2	24	2.0	15.2
C34	1	1	2	3	3	2	2	2	4	1	1	2	24	2.0	15.2
C35	1	1	3	3	1	2	2	2	3	1	1	2	22	1.8	16.6
C36	1	1	2	3	1	2	2	2	3	1	1	2	21	1.8	17.4
C37	1	1	2	3	1	2	2	2	2	1	1	1	19	1.6	19.2
COBBS CREEK LOW LEVEL 12 SWWPC UNITS															
C19	1	2	2	3	1	2	2	2	2	2	1	1	21	1.8	17.4
C20	1	1	2	3	1	2	2	2	2	1	1	1	19	1.6	19.2
C21	1	1	2	3	1	2	2	2	2	1	1	1	19	1.6	19.2
C22	1	1	2	3	1	2	2	2	2	3	1	1	21	1.8	17.4
C23	1	1	2	2	1	2	2	2	3	2		1	19	1.7	19.2
C24	1	1	2	3	1	2	2	2	2	2		1	19	1.7	19.2
C25	2	2	2	2	1	2	3	3	3	3	1	1	25	2.1	14.6
C26	1	1	2	2	1	2	2	2	2	2		1	18	1.6	20.3
C27	1	1	2	2	1	2	2	2	2	2		1	18	1.6	20.3
C28A	1	1	2	2	1	2	1	1	2	3		1	17	1.5	21.5
C29	1	1	2	2	1	2	2	2	2	2		1	18	1.6	20.3
C30	1	1	2	2	1	2	2	2	2	1		1	17	1.5	21.5
TOTAL	150	174	181	228	167	171	195	195	211	127	118	171	2088		
I/D/C	1.6	1.9	2.0	2.5	1.8	1.9	2.1	2.1	2.3	1.4	1.3	1.9			
CSES	42	40	37	47	53	35	37	37	41	23	28	36	456	2.1	14.6
LSES	15	21	12	19	18	15	18	18	22	14	20	19	211	2.2	31.0
CSW	19	22	25	26	11	18	20	20	22	17	15	19	234	2.2	14.4
SWMG	26	28	20	31	25	17	39	39	24	18	20	31	318	2.7	14.6
LSW	8	9	9	10	5	8	8	8	10	7	4	8	94	2.0	15.6
CCHL	27	40	54	66	43	54	49	49	66	24	26	46	544	1.9	16.4
CCLL	13	14	24	29	12	24	24	24	26	24	5	12	231	1.7	19.2

CSO REGULATING CHAMBER DISCHARGE SWWPC PLANT REGULATORS

SITE	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
CENTRAL SCHUYLKILL EAST SIDE 18 SWWPC UNITS													
S05													0
S06													0
S07													0
S08													0
S09													0
S10													0
S12													0
S12A													0
S13													0
S15													0
S16													0
S17													0
S18													0
S19													0
S21													0
S23													0
S25													0
S26													0
LOWER SCHUYLKILL EAST SIDE 9 SWWPC UNITS													
S31													0
S35													0
S36													0
S36A													0
S37													0
S42													0
S42A													0
S44													0
S46													0
CENTRAL SCHUYLKILL WEST 9 SWWPC UNITS													
S01													0
S02										2			2
S03													0
S04													0
S11													0
S14													0
S20													0
S22	1								1				2
S24													0
SOUTHWEST MAIN GRAVITY 10 SWWPC UNITS													
S27													0
S28													0
S30													0
S34													0
S39													0
S40													0
S43													0
S47													0
S50													0
S51													0
LOWER SCHUYLKILL WEST SIDE 4 SWWPC UNITS													
S32													0
S33													0
S38													0
S45													0

SITE	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COBBS CREEK HIGH LEVEL 24 SWWPC UNITS													
C01													0
C02													0
C04													0
C04A													0
C05													0
C06													0
C07													0
C09	1												1
C10													0
C11													0
C12													0
C13													0
C14													0
C15													0
C16													0
C17													0
C18													0
C31													0
C32													0
C33													0
C34													0
C35													0
C36													0
C37													0
COBBS CREEK LOW LEVEL 12 SWWPC UNITS													
C19													0
C20													0
C21													0
C22										2			2
C23													0
C24													0
C25													0
C26													0
C27													0
C28A													0
C29													0
C30													0
													TOTAL DISC
	2	0	0	0	0	0	0	0	1	4	0	0	7

	NO OF UNITS IN DISTRICT BLOCKED												TOTAL
CSE	0	0	0	0	0	0	0	0	0	0	0	0	0
LSE	0	0	0	0	0	0	0	0	0	0	0	0	0
CSW	1	0	0	0	0	0	0	0	1	1	0	0	3
SWG	0	0	0	0	0	0	0	0	0	0	0	0	0
LSW	0	0	0	0	0	0	0	0	0	0	0	0	0
CCHL	1	0	0	0	0	0	0	0	0	0	0	0	1
CCLL	0	0	0	0	0	0	0	0	0	1	0	0	1

	NO OF DISCHARGES IN DISTRICT												TOTAL
CSE	0	0	0	0	0	0	0	0	0	0	0	0	0
LSE	0	0	0	0	0	0	0	0	0	0	0	0	0
CSW	1	0	0	0	0	0	0	0	1	2	0	0	4
SWG	0	0	0	0	0	0	0	0	0	0	0	0	0
LSW	0	0	0	0	0	0	0	0	0	0	0	0	0
CCHL	1	0	0	0	0	0	0	0	0	0	0	0	1
CCLL	0	0	0	0	0	0	0	0	0	2	0	0	2

CSO REGULATING CHAMBER MONTHLY BLOCKS CLEARED

SITE	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
CENTRAL SCHUYLKILL EAST SIDE 18 SWWPC UNITS													
S05													0
S06			1	1									2
S07													0
S08		1	1								1		3
S09													0
S10													0
S12	1												1
S12A													0
S13													0
S15											1		1
S16				1									1
S17													0
S18												1	1
S19					1								1
S21			1										1
S23													0
S25			1	1								1	3
S26													0
LOWER SCHUYLKILL EAST SIDE 9 SWWPC UNITS													
S31										1			1
S35													0
S36													0
S36A	1										1	1	3
S37													0
S42	2	2	1		1					1			7
S42A													0
S44													0
S46													0
CENTRAL SCHUYLKILL WEST 9 SWWPC UNITS													
S01			1										1
S02													0
S03			1			1							2
S04													0
S11													0
S14													0
S20													0
S22	2								1	1			4
S24													0
SOUTHWEST MAIN GRAVITY 10 SWWPC UNITS													
S27													0
S28													0
S30												1	1
S34												1	1
S39												1	1
S40													0
S43									1				1
S47													0
S50	2	3		1			1	1				1	9
S51													0
LOWER SCHUYLKILL WEST SIDE 4 SWWPC UNITS													
S32													0
S33				1					1		1		3
S38	1		1	1									3
S45									1				1

5.5 AVERAGE BLOCKAGES PER MONTH

SITE	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
COBBS CREEK HIGH LEVEL 24 SWWPC UNITS													
C01													0
C02													0
C04													0
C04A													0
C05													0
C06													0
C07		1								1			2
C09													0
C10													0
C11													0
C12									1				1
C13													0
C14	1												1
C15													0
C16													0
C17													0
C18													0
C31						1						1	2
C32													0
C33									1			2	3
C34													0
C35													0
C36													0
C37							1	1					2
COBBS CREEK LOW LEVEL 12 SWWPC UNITS													
C19													0
C20													0
C21													0
C22									1				1
C23													0
C24													0
C25		1											1
C26									1				1
C27													0
C28A													0
C29													0
C30													0
													TOTAL
	10	8	8	6	2	2	2	2	8	4	4	10	66

CSE	1	1	4	3	1	0	0	0	0	0	2	2	14
LSE	3	2	1	0	1	0	0	0	0	2	1	1	11
CSW	2	0	2	0	0	1	0	0	1	1	0	0	7
SWG	2	3	0	1	0	0	1	1	1	0	0	4	13
LSW	1	0	1	2	0	0	0	0	2	0	1	0	7
CCHL	1	1	0	0	0	1	1	1	2	1	0	3	11
CCLL	0	1	0	0	0	0	0	0	2	0	0	0	3

RELIEF SEWER MONTHLY INSPECTION

SITE	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
THOMAS RUN RELIEF SEWER													
R01	1	1	2	2	1	3	2	2	3	2	1	1	21
R02	1	1	2	2	1	3	2	2	3	2	1	1	21
R03	1	1	2	2	1	3	2	2	3	2	1	1	21
R04	1	1	2	2	1	3	2	2	3	3		1	21
R05	1	1	2	2	1	3	2	2	3	2		1	20
R06	1	1	2	2	1	3	2	2	3	2		1	20
MAIN RELIEF SEWER													
R07		1	2	3	1	4	2	2	3		1	2	21
R08		1	2	3	1	4	2	2	3	1	1	1	21
R09		1	2	3	1	4	2	2	3	1	1	1	21
R10			2	3	1	3	2	2	2	1	1	1	18
R11			2	4	1	2	1	1	2	1		1	15
R11A			1	3	1	2	1	1	2	1		1	13
R12		1	1	2	1	2	1	1	2	1		1	13
WAKLING RELIEF SEWER													
R13			2	3		1	2	2	2			1	13
R14			2	3		1	2	2	2			1	13
ROCK RUN STORM FLOOD RELIEF SEWER													
R15			3	3		1	1	1	2	1		1	13
OREGON AVE RELIEF SEWER													
R16			1	2	1	1	1	1	2		1	1	11
R17			1	2	1	1	1	1	2		1	1	11
FRANKFORD HIGH LEVEL RELIEF SEWER													
R18		1	2	3		1	1	1	2	1		1	13
32ND ST RELIEF SEWER													
R19			1	1		2	1	1	2	1		1	10
MAIN STREET RELIEF SEWER													
R20			2	2		1	1	1	2	1		1	11
SOMERSET SYSTEM DIVERSION CHAMBER													
R21													0
TEMPORARY REGULATOR CHAMBER													
R22													
R23			2	2		1	1	1	2	1		1	11
ARCH ST RELIEF SEWER													
R24	1	1	2	2	1	2	1	1	2			1	14
16TH & SNYDER													
R25	1	1	1	2	1	1	1	1	2	1		1	13
GRANT & STATE RD. RELIEF													
R26			2	2		1	1	1	1				8
TOTAL	8	13	45	60	17	53	37	37	58	25	9	25	387
AVER	0.3	0.5	1.7	2.2	0.6	2.0	1.4	1.4	2.1	0.9	0.3	0.9	1.2

RELIEF SEWER MONTHLY DISCHARGE

SITE	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
THOMAS RUN RELIEF SEWER													
R01													0
R02													0
R03													0
R04													0
R05													0
R06													0
MAIN RELIEF SEWER													
R07													0
R08													0
R09													0
R10													0
R11													0
R11A													0
R12													0
WAKLING RELIEF SEWER													
R13													0
R14													0
ROCK RUN STORM FLOOD RELIEF SEWER													
R15													0
OREGON AVE RELIEF SEWER													
R16													0
R17													0
FRANKFORD HIGH LEVEL RELIEF SEWER													
R18													0
32ND ST RELIEF SEWER													
R19													0
MAIN STREET RELIEF SEWER													
R20													0
SOMERSET SYSTEM DIVERSION CHAMBER													
R21													0
TEMPORARY REGULATOR CHAMBER													
R22													0
R23													0
ARCH ST RELIEF SEWER													
R24													0
16TH & SNYDER													
R25													0
GRANT & STATE RD. RELIEF													
R26													0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0
UNITS	0	0	0	0	0	0	0	0	0	0	0	0	

RELIEF SEWER MONTHLY BLOCKS CLEARED

SITE	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
THOMAS RUN RELIEF SEWER													
R01													0
R02													0
R03													0
R04													0
R05													0
R06													0
MAIN RELIEF SEWER													
R07													0
R08													0
R09													0
R10													0
R11													0
R11A													0
R12													0
WAKLING RELIEF SEWER													
R13													0
R14													0
ROCK RUN STORM FLOOD RELIEF SEWER													
R15													0
OREGON AVE RELIEF SEWER													
R16													0
R17													0
FRANKFORD HIGH LEVEL RELIEF SEWER													
R18													0
32ND ST RELIEF SEWER													
R19													0
MAIN STREET RELIEF SEWER													
R20													0
SOMERSET SYSTEM DIVERSION CHAMBER													
R21													0
TEMPORARY REGULATOR CHAMBER													
R22													0
R23													0
ARCH ST RELIEF SEWER													
R24													0
16TH & SNYDER													
R25													0
GRANT & STATE RD. RELIEF													
R26													0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0
AVER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

FY18 CSO Dry Weather Discharge Listing

Discharge Observed		Discharge Stopped		Last Inspection						
Date	**Time**	**Date**	**Time**	**Date**	**Time**	**Site ID**	**Collector**	**Type Unit**	**Location**	**Comment**
7/5/18	8:40	7/5/18	9:00	6/28/18	9:00	S-22	CSW	B & B	660 ft S of South St E of Penn Field	SHUTTER GATE STUCK. SHUTTER GATE CLOSED.
7/21/18	9:30	7/21/18	10:10	7/18/18	13:40	C-09	CCHL	SLOT	64th St. & Cobbs Creek	SLOT BLOCKAGE. GRIT IN SLOT.
11/17/18	13:00	11/17/18	13:30	11/13/18	11:10	T-13	FHL	SLOT	Whitaker Ave. W of Tacony Creek	SLOT BLOCKAGE. GRIT IN SLOT.
3/26/19	14:20	3/26/19	14:30	3/15/19	9:00	S-22	CSW	B & B	660 ft S of South St E of Penn Field	OTHER. SUDDEN SURGE IN TRUNK SEWER
4/5/19	11:10	4/5/19	13:20	3/21/19	13:50	S-02	CSW	B & B	Haverford Ave. & West River Dr.	REGULATOR INLET BLOCKAGE. DEBRIS,BRICKS,MOPHEADS AND WOOD BLOCKING REGULATOR INLET.
4/16/19	11:00	4/16/19	11:20	4/8/19	11:50	C-22	CCLL	SLOT	70th St. & Cobbs Creek Parkway	SLOT BLOCKAGE. THREE BUNDLES OF SHOPPING CIRCULARS IN SLOT.
5/18/19	12:10	5/18/19	12:50	5/9/19	13:50	T-13	FHL	SLOT	Whitaker Ave. W of Tacony Creek	SLOT BLOCKAGE. DEBRIS IN SLOT.
6/24/19	12:00	6/24/19	12:30	6/7/19	9:20	T-09	FHL	SLOT	Roosevelt Blvd. W of Tacony Creek	DWO PIPE BLOCKAGE. DEBRIS IN DWO PIPE.

Dry Weather Discharges are continually tracked and analyzed to determine if new or modified maintenance procedures would help to prevent them from occurring. Although our established procedures have greatly reduced the number and duration of these discharges, the combined system picks up all manner of trash and debris that is unpredictable in its pattern of causing flow disruptions. Despite incorporating best management practices including; having all inlets trapped and cleaned; preventative maintenance schedules for sewer flushing and cleaning or the regulators; CCTV inspection of DWO pipes; etc., it is virtually impossible to eliminate all blockages before they occur.

The City continues to aggressively control and minimize these dry weather overflows by utilizing the latest technology-based controls including our Collector System Remote Monitoring Network that currently includes over 320 sites with over 720 individual level and/or flow measurements. The CSO maintenance personnel are trained in the use of the system's computer programs for analyzing the data and have developed a comprehensive understanding of individual CSO site's distinct flow patterns. This familiarity allows them to quickly recognize abnormal conditions that may indicate accumulating debris so that they can respond before developing into a dry weather CSO blockage.

Appendix B

FY 2019 Annual CSO Miscellaneous Site & Maintenance Reports

MISCELLANEOUS SITE INSPECTIONS

SITE	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
P-090-02-PFD-01 SANDY RUN CREEK DIVERSION REGULATOR													
	7	6	9	9	7	5	9	9	8	7	9	12	97
T-088-01-CFD-01 PLYMOUTH ST. WEST OF PITTVILLE													
	2	2	3	6	4	3	3	3	5	4	2	4	41
T-088-01-CFD-02 PITTVILLE ST. SOUTH OF PLYMOUTH ST.													
	2	2	3	6	4	3	3	3	5	4	2	5	42
T-088-01-CFD-03 ELSTON ST. E. OF BOUVIER ST.													
	2	2	2	4	5	3	2	2	5	3	1	3	34
T-088-01-CFD-04 ASHLEY ST. W. OF BOUVIER ST.													
	2	1	1	2	2	3	4	4	3	4	1	3	30
T-088-01-CFD-05 CHELTENHAM AVE. E. OF 19TH ST.													
	1	2	2	2	3	3	2	2	3	2		2	24
T-088-01-CFD-06 VERBENA ST. S. OF CHELTENHAM AVE.													
	2	2	2	5	4	3	4	4	4	3	1	3	37
W-060-01-MFD-01 JANNETTE ST. WEST OF MONASTERY AVE.													
	3	2	2	2	2	2	2	2	2	2	1	2	24
W-060-01-MFD-02 GREEN LANE NORTH OF LAWNTON ST.													
	3	2	2	2	2	2	2	2	2	2	1	2	24
T-089-04-CFD-01 FRANKLIN & HASBROOK													
	8	6	10	9	10	5	8	8	7	7	10	12	100
T-088-01-CFD-07 CHELTENHAM E. OF 7 TH ST.													
	8	6	9	7	8	3	7	7	8	7	6	12	88
T-088-01-CFD-08 7 TH ST. S. OF CHELTENHAM													
	8	6	9	7	7	2	7	7	8	6	6	12	85
Totals	48	39	54	61	58	37	53	53	60	51	40	72	626

MISCELLANEOUS SITE DISCHARGES

SITE	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
P-090-02-PFD-01 SANDY RUN CREEK DIVERSION REGULATOR													
											2		2
T-088-01-CFD-01 PLYMOUTH ST. WEST OF PITTVILLE													
													0
T-088-01-CFD-02 PITTVILLE ST. SOUTH OF PLYMOUTH ST.													
													0
T-088-01-CFD-03 ELSTON ST. E. OF BOUVIER ST.													
													0
T-088-01-CFD-04 ASHLEY ST. W. OF BOUVIER ST.													
													0
T-088-01-CFD-05 CHELTENHAM AVE. E. OF 19TH ST.													
													0
T-088-01-CFD-06 VERBENA ST. S. OF CHELTENHAM AVE.													
													0
W-060-01-MFD-01 JANNETTE ST. WEST OF MONASTERY AVE.													
													0
W-060-01-MFD-02 GREEN LANE NORTH OF LAWNTON ST.													
													0
T-089-04-CFD-01 FRANKLIN & HASBROOK													
	1										2		3
T-088-01-CFD-07 CHELTENHAM E. OF 7 TH ST.													
	1										1		2
T-088-01-CFD-08 7 TH ST. S. OF CHELTENHAM													
													0
Totals	2	0	0	0	0	0	0	0	0	0	5	0	7

MISCELLANEOUS SITE BLOCKAGES CLEARED

SITE	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
P-090-02-PFD-01 SANDY RUN CREEK DIVERSION REGULATOR													
				1			1			1		1	4
T-088-01-CFD-01 PLYMOUTH ST. WEST OF PITTVILLE													
													0
T-088-01-CFD-02 PITTVILLE ST. SOUTH OF PLYMOUTH ST.													
												1	1
T-088-01-CFD-03 ELSTON ST. E. OF BOUVIER ST.													
													0
T-088-01-CFD-04 ASHLEY ST. W. OF BOUVIER ST.													
										1			1
T-088-01-CFD-05 CHELTENHAM AVE. E. OF 19TH ST.													
													0
T-088-01-CFD-06 VERBENA ST. S. OF CHELTENHAM AVE.													
													0
W-060-01-MFD-01 JANNETTE ST. WEST OF MONASTERY AVE.													
													0
W-060-01-MFD-02 GREEN LANE NORTH OF LAWNTON ST.													
													0
T-089-04-CFD-01 FRANKLIN & HASBROOK													
	1		1	1	2	1							6
T-088-01-CFD-07 CHELTENHAM E. OF 7 TH ST.													
		1			1		1			2			5
T-088-01-CFD-08 7 TH ST. S. OF CHELTENHAM													
													0
Totals	1	1	1	2	3	1	2	0	0	4	0	2	17

Chapter 94 Year End Report - July 2018 through June 2019

SOMERSET GRIT D-25 CHAMBER & DWO CLEANINGS

DATE	TONS
8/4/2018	5.10
8/30/2018	5.02
9/5/2018	4.83
9/6/2018	3.95
3/14//19	6.43
3/27/2019	11.13
3/29/2019	5.89
4/3/2019	1.57
4/4/2019	3.00
4/5/2019	3.16
4/8/2019	2.62
4/9/2019	4.03
4/10/2019	3.43
4/11/2019	3.25
5/7/2019	9.37
5/8/2019	8.28
5/14/2018	7.27
6/1/2018	11.25

CSPS SIPHON GRIT POCKET CLEANINGS

DATE	CU. YARDS
9/20/2018	30 Cu. Yrds.
2/15/2019	30 Cu. Yrds.

CSO B&B REGULATOR MAINTENANCE

DATE	SITE
7/7/2018	D-50
7/7/2018	D-51
7/21/2018	D-52
7/21/2018	D-55
7/21/2018	D-61
8/41/2018	D-62
8/41/2018	D-63
8/41/2018	D-64
10/9/2018	D-70
12/8/2018	D-39
12/8/2018	D-47
12/8/2018	D-48
12/8/2018	S-8
12/8/2018	S-16
12/8/2018	S-18
1/17/2019	D-58
5/7/2019	S-42
1/12/2019	D-4
1/12/2019	D-49
1/12/2019	D-50
1/12/2019	S-22
1/12/2019	S-23
1/12/2019	S-24
1/12/2019	S-25
1/26/2019	D-51
1/26/2019	D-58
1/26/2019	S-42
1/26/2019	D-52
2/2/2019	S-36A
2/2/2019	S-38
2/2/2019	S-42A
2/9/2019	D-61
2/9/2019	S-46
2/9/2019	D-62
2/9/2019	S-43
2/9/2019	S-47
2/9/2019	D-65

CSO TIDE GATE MAINTENANCE

DATE	SITE	DATE	SITE	DATE	SITE
7/2/2018	D-5	11/16/2018	D-11	3/11/2019	F-25
7/5/2018	D-9	11/19/2018	Fish Ladder	3/11/2019	D-11
7/5/2018	D-15	11/19/2018	H-29	3/13/2019	D-5
7/7/2018	D-11	12/3/2018	Rock run	3/13/2019	D-7
7/7/2018	F-25	12/7/2018	D-11	3/14/2019	T-14
7/16/2018	Fish Ladder	12/8/2018	D-39	3/18/2019	D-2
7/18/2018	D-2	12/8/2018	S-8	3/18/2019	D-3
7/18/2018	D-3	12/10/2018	F-25	3/22/2019	D-9
7/18/2018	T-14	12/10/2018	D-11	3/25/2019	State Road
7/19/2018	H-29	12/10/2018	R-13/14	4/4/2019	Fish Ladder
7/20/2018	Fish Ladder	12/10/2018	D-15	4/5/2019	F-25
7/21/2018	Fish Ladder	12/10/2018	D-24	4/5/2019	D-11
7/27/2018	Fish Ladder	12/10/2018	D-25	4/10/2019	D-3
7/30/2018	Fish Ladder	12/11/2018	D-2	4/12/2019	T-14
7/31/2018	Fish Ladder	12/12/2018	D-5	4/12/2019	Rock Run
8/1/2018	D-3	12/12/2018	D-7	4/15/2019	Venice
8/1/2018	D-2	12/12/2018	D-9	4/17/2019	D-2
8/3/2018	D-15	12/12/2018	D-15	4/17/2019	D-3
8/3/2018	D-11	12/12/2018	D-5	4/18/2019	D-9
8/9/2018	T-14	12/12/2018	D-7	4/18/2019	D-15
8/9/2018	D-5	12/12/2018	D-9	5/8/2019	D-2
8/10/2018	Fish Ladder	12/12/2018	D-15	5/8/2019	D-3
8/11/2018	D-7	12/13/2018	H-29	5/13/2019	D-7
9/5/2018	D-9	12/13/2018	T-14	5/13/2019	D-9
9/5/2018	D-7 out of	12/13/2018	H-29	5/15/2019	D-5
9/5/2018	T-14	12/13/2018	T-14	5/15/2019	D-11
9/5/2018	Rock run	12/14/2018	Venice	5/15/2019	D-11
9/6/2018	D-2	12/14/2018	Fish Ladder	5/16/2019	D-15
9/6/2018	D-3	12/27/2018	D-3	5/16/2019	D-7
9/6/2018	D-68	12/27/2018	D-2	5/20/2019	Fish Ladder
9/7/2018	D-15	1/1/2019	T-14	5/22/2019	T-14
9/11/2018	F-25	1/4/2019	D-15	5/23/2019	D-9
9/11/2018	D-11	1/9/2019	F-25	5/3/2019	F-25
9/14/2018	H-29	1/9/2019	D-11	5/31/2019	Rock Run
9/17/2018	D-5	1/10/2019	D-5	6/7/2019	F-25
9/20/2018	Fish Ladder	1/10/2019	D-7	6/10/2019	Fish Ladder
9/25/2018	D-7	1/11/2019	H-29	6/12/2019	State Road
10/1/2018	T-14	1/14/2019	D-2	6/13/2019	D-9
10/1/2018	Fish Ladder	1/14/2019	D-3	6/19/2019	D-15
10/3/2018	D-5	1/16/2019	D-9	6/24/2019	D-2
10/3/2018	F-25	1/16/2019	Fish Ladder	6/24/2019	D-3
10/4/2018	D-2	1/26/2019	D-38	6/24/2019	Rock Run
10/4/2018	D-3	1/26/2019	S-42	6/24/2019	T-14
10/5/2018	Rock run	2/2/2019	S-42A	6/26/2019	D-7
10/12/2018	Venice	2/9/2019	S-46	6/26/2019	D-5
10/15/2018	D-11	2/9/2019	D-61	6/26/2019	D-11
10/15/2018	D-15	2/2/2019	F-25	6/27/2019	Fish Ladder
10/16/2018	D-7 out of	2/4/2019	F-23	6/27/2019	F-25
10/16/2018	D-9	2/5/2019	Fish Ladder		
10/17/2018	T-14	2/5/2019	D-15		
10/24/2018	State Road	2/6/2019	Fish Ladder		
10/25/2018	Fish Ladder	2/6/2019	D-15		
10/25/2018	H-29	2/6/2019	Fish Ladder		
11/7/2018	D-2	2/11/2019	D-15		
11/8/2018	D-15	2/15/2019	D-11		
11/8/2018	F-25	2/20/2019	D-5		
11/14/2018	D-5	2/20/2019	D-7		
11/14/2018	D-3	2/21/2019	T-14		
11/15/2018	T-14	2/22/2019	State Road		
11/16/2018	D-7	2/22/2019	D-2		
11/16/2018	D-9	2/22/2019	D-3		
		2/28/2019	Fish Ladder		
		3/9/2019	Fish Ladder		

COMPUTER CONTROL CHAMBER PREVENTATIVE MAINTENANCE

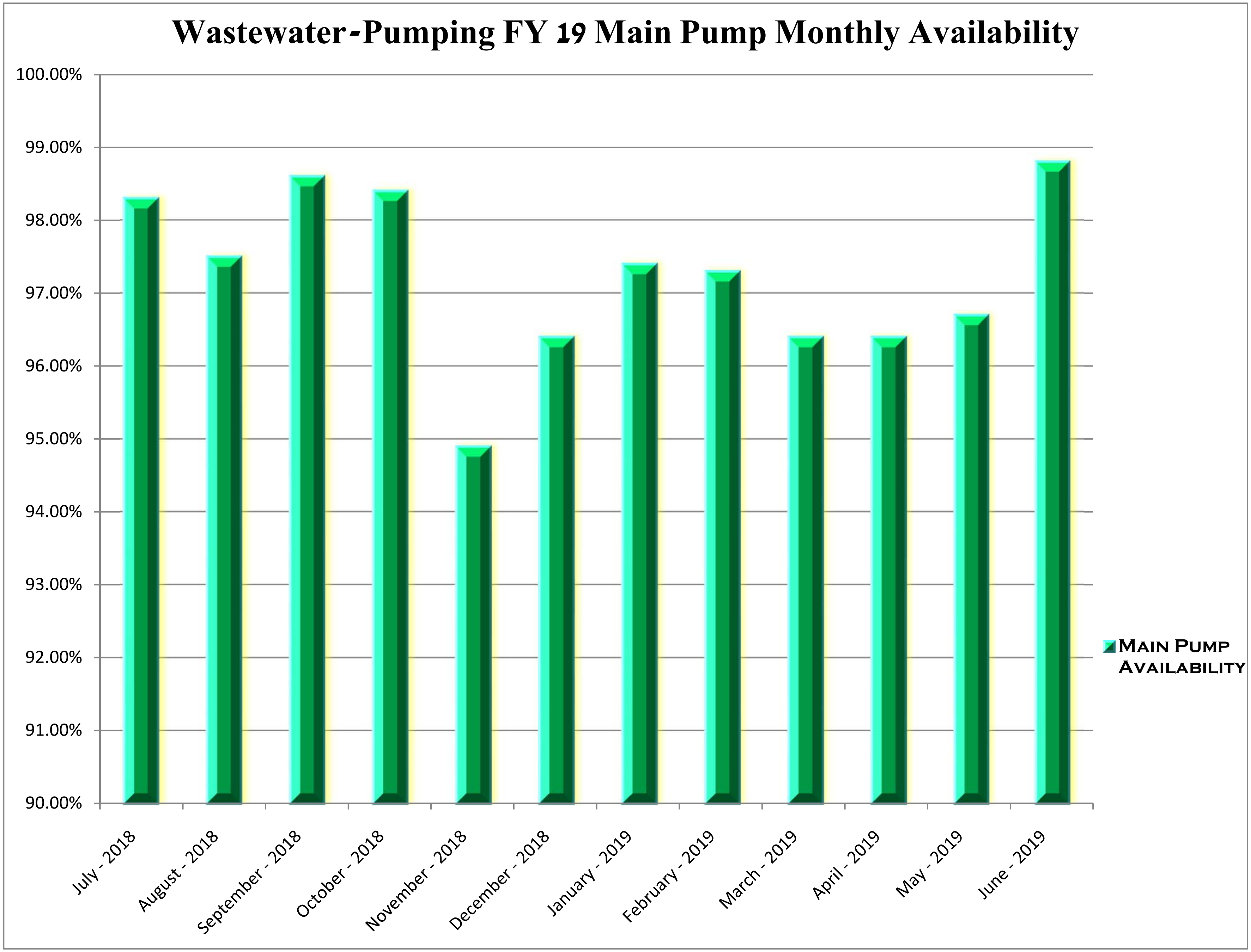
DATE	SITE	DATE	SITE	DATE	SITE
7/2/2018	D-5	11/16/2018	D-7	4/10/2019	D-7
7/5/2018	D-9	11/16/2018	D-9	4/12/2019	T-14
7/5/2018	D-15	11/16/2018	D-11	4/12/2019	Rock Run
Service	D-7 out of	11/19/2018	Fish Ladder	4/15/2019	Venice
7/7/2018	D-11	11/19/2018	H-29	4/17/2019	D-2
7/7/2018	F-25	11/21/2018	State Road	4/17/2019	D-3
7/9/2018	Rock Run	12/3/2018	Rock run	4/18/2019	D-9
7/12/2018	Venice	12/7/2018	D-11	4/18/2019	D-15
7/16/2018	Fish Ladder	12/10/2018	F-25	4/22/2019	State Road
7/18/2018	D-2	12/12/2018	D-5	5/3/2019	F-25
7/18/2018	D-3	12/12/2018	D-7	5/3/2019	State Road
7/18/2018	T-14	12/12/2018	D-9	5/6/2019	Venice
7/19/2018	H-29	12/12/2018	D-15	5/8/2019	D-2
7/19/2018	State Road	12/13/2018	H-29	5/8/2019	D-3
8/1/2018	D-3	12/13/2018	T-14	5/13/2019	D-7
8/1/2018	D-2	12/13/2018	State Road	5/13/2019	D-9
8/3/2018	D-15	12/14/2018	Venice	5/15/2019	D-5
8/3/2018	D-11	12/14/2018	Fish Ladder	5/15/2019	D-11
8/6/2018	Venice	12/27/2018	D-3	5/16/2019	D-15
8/6/2018	Rock Run	12/27/2018	D-2	5/16/2019	D-7
Service	D-7 out of	1/3/2019	Rock Run	5/20/2019	Fish Ladder
8/8/2018	F-25	1/3/2019	T-14	5/22/2019	T-14
8/8/2018	D-9	1/4/2019	D-15	5/31/2019	Rock Run
8/9/2018	T-14	1/9/2019	F-25	6/7/2019	F-25
8/9/2018	D-5	1/9/2019	D-11	6/10/2019	Fish Ladder
8/10/2018	Fish Ladder	1/10/2019	D-5	6/12/2019	State Road
8/14/2018	State Road	1/10/2019	D-7	6/13/2019	D-9
9/5/2018	D-9	1/11/2019	Venice	6/14/2019	Venice
9/5/2018	D-7 out of	1/11/2019	H-29	6/19/2019	D-15
9/5/2018	T-14	1/14/2019	D-2	6/24/2019	D-2
9/5/2018	Rock run	1/14/2019	D-3	6/24/2019	D-3
9/6/2018	D-2	1/16/2019	D-9	6/24/2019	Rock Run
9/6/2018	D-3	1/16/2019	Fish Ladder	6/24/2019	T-14
9/7/2018	D-15	1/23/2019	State Road	6/26/2019	D-7
9/10/2018	Venice	2/2/2019	F-25	6/26/2019	D-5
9/11/2018	F-25	2/7/2019	Rock Run	6/26/2019	D-11
9/11/2018	D-11	2/11/2019	D-15	6/27/2019	Fish Ladder
9/14/2018	H-29	2/15/2019	D-11	6/27/2019	F-25
9/17/2018	D-5	2/20/2019	D-5		
9/19/2018	State Road	2/20/2019	D-7		
9/20/2018	Fish Ladder	2/21/2019	T-14		
10/1/2018	T-14	2/22/2019	State Road		
10/3/2018	D-5	2/22/2019	D-2		
10/3/2018	F-25	2/22/2019	D-3		
10/5/2018	Rock run	2/25/2019	Venice		
10/5/2018	Rock run	2/28/2019	Fish Ladder		
10/12/2018	Venice	3/9/2019	Fish Ladder		
10/15/2018	D-11	3/11/2019	F-25		
10/15/2018	D-15	3/11/2019	D-11		
10/16/2018	D-7 out of	3/13/2019	D-5		
10/16/2018	D-9	3/13/2019	D-7		
10/17/2018	T-14	3/14/2019	T-14		
10/24/2018	State Road	3/15/2019	Rock Run		
10/25/2018	Fish Ladder	3/18/2019	D-2		
10/25/2018	H-29	3/18/2019	D-3		
11/1/2018	Venice	3/20/2019	Venice		
11/5/2018	Rock run	3/22/2019	D-15		
11/7/2018	D-2	3/22/2019	D-9		
11/8/2018	D-15	3/25/2019	State Road		
11/8/2018	F-25	4/4/2019	Fish Ladder		
11/14/2018	D-5	4/5/2019	F-25		
11/14/2018	D-3	4/5/2019	D-11		
11/15/2018	T-14	4/10/2019	D-5		

CSO OUTFALL - DEBRIS GRILL MAINTENANCE

DATE	SITE
7/9/2018	D-63
7/9/2018	D-61
7/13/2018	D-11
7/13/2018	R-13/14
8/7/2018	R-13/14
8/7/2018	Linden Outfall
8/7/2018	D-5
8/7/2018	D-11
8/7/2018	D-57
8/7/2018	D-58
8/7/2018	D-60
8/7/2018	D-61
8/7/2018	D-62
8/7/2018	D-63
8/8/2018	F-25
8/8/2018	D-9
10/4/2018	D-2
10/4/2018	D-3
11/2/2018	T-6
11/2/2018	T-8
11/2/2018	Sandy Run
11/2/2018	D-2
11/2/2018	D-3
11/2/2018	D-5
11/2/2018	D-7
11/2/2018	D-9
11/2/2018	D-11
11/2/2018	R-13/14
11/2/2018	D-57
11/2/2018	D-58
11/2/2018	D-60
11/2/2018	D-61
11/2/2018	D-62
11/2/2018	D-63
11/2/2018	D-25
12/10/2018	D-11
12/10/2018	R-13/14
12/10/2018	D-15
12/10/2018	D-24
12/10/2018	D-25
1/25/2019	D-58
3/15/2019	D-5
4/8/2019	D-5
4/16/2019	D-5
4/17/2019	D-2
4/17/2019	D-3
6/5/2019	D-5
6/5/2019	D-11
6/5/2019	R-13/14
6/6/2019	D-5
6/6/2019	D-11
6/7/2019	D-58
6/7/2019	Linden Outfall

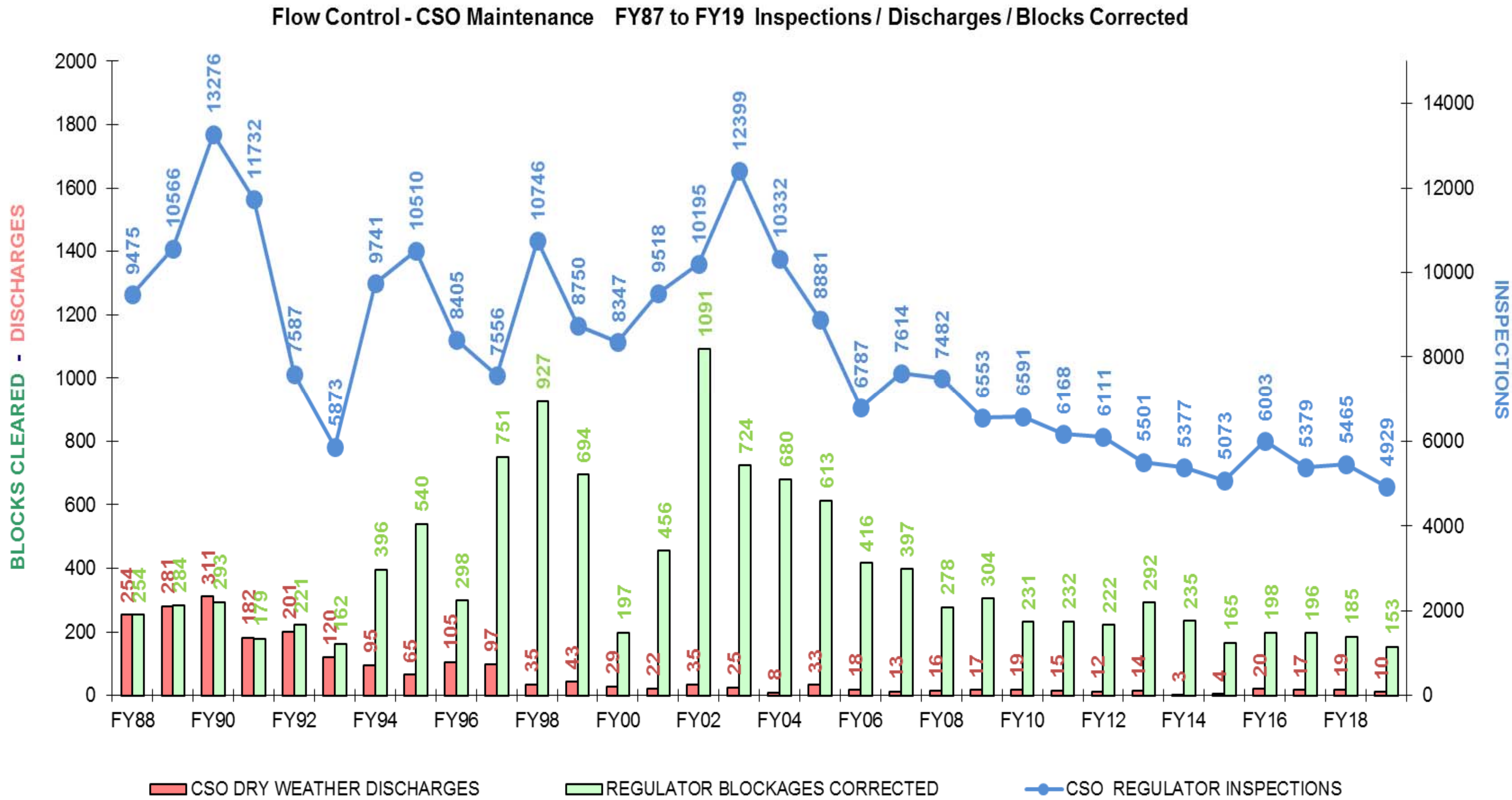
CS-Instrumentation Maintenance											
Site	Inspect & Maint.	Site	Inspect & Maint.	Site	Inspect & Maint.	Site	Inspect & Maint.	Site	Inspect & Maint.	Site	Inspect & Maint.
C-01	1	D-25	6	H-01	6	S-12A	1	MA-2	20	RG-01	9
C-04	3	D-37	4	H-02	2	S-13	5	MB-1	12	RG-02	8
C-04A	11	D-38	3	H-04	30	S-15	22	MBE-1	13	RG-03	10
C-05	4	D-39	8	H-05	9	S-17	8	MBE-10	23	RG-04	10
C-06	4	D-40	8	H-06	1	S-18	5	MBE-11	14	RG-05	13
C-07	8	D-41	11	H-07	1	S-19	2	MBE-12	19	RG-06	17
C-09	3	D-42	1	H-08	6	S-22	5	MBE-13	10	RG-07	6
C-10	9	D-43	7	H-09	12	S-23	14	MBE-14	12	RG-08	3
C-11	4	D-44	5	H-10	15	S-25	4	MBE-15	22	RG-09	8
C-12	9	D-45	15	H-11	3	S-26	5	MBE-16	14	RG-10	14
C-14	15	D-46	1	H-12	8	S-27	2	MBE-17	17	RG-11	9
C-15	14	D-47	2	H-13	4	S-28	4	MBE-2	16	RG-12	5
C-16	1	D-48	12	H-14	1	S-30	4	MBE-3	13	RG-13	14
C-17	15	D-49	3	H-15	4	S-31	3	MBE-4	20	RG-14	20
C-18	5	D-50	1	H-16	2	S-32	2	MBE-5	14	RG-15	15
C-19	25	D-51	2	H-17	3	S-33	3	MBE-6	12	RG-16	6
C-20	11	D-52	2	H-18	5	S-34	10	MBE-7	25	RG-17	12
C-21	4	D-53	5	H-19	11	S-35	1	MBE-8	19	RG-18	6
C-22	4	D-54	6	H-21	4	S-36	9	MBE-9	20	RG-19	12
C-23	4	D-58	19	I-02	18	S-36A	8	MC-1	26	RG-20	9
C-24	29	D-61	2	P-01	8	S-37	1	MC-2	14	RG-21	4
C-26	6	D-63	6	P-02	8	S-38	14	MC-3	13	RG-22	13
C-28A	9	D-64	2	P-03	3	S-39	6	MCx-1	11	RG-23	8
C-29	4	D-65	2	P-04	5	S-40	8	MCx-2	10	RG-24	30
C-30	5	D-66	2	P-05	12	S-42	11	MCx-3	16	RG-25	9
C-31	2	D-67	3	R-06	4	S-42A	3	MCx-4	15	RG-26	11
C-32	2	D-68	13	R-07	5	S-43	11	MCx-5	15	RG-27	9
C-33	14	D-69	5	R-12	9	S-44	3	MCx-6	12	RG-28	6
C-34	14	D-70	3	R-13	6	S-45	4	MCx-7	11	RG-29	8
C-35	1	D-71	1	R-14	4	S-46	13	MD-1	6	RG-30	6
C-36	8	D-72	3	R-15	2	S-47	7	ML-1	14	RG-31	10
C-37	4	D-73	4	R-18	4	S-50	20	ML-3	25	RG-32	5
D-04	4	F-03	2	R-20	27	S-51	2	ML-4	12	RG-33	6
D-06	4	F-04	4	R-24	9	T-01	7	ML-5	30	RG-34	9
D-08	5	F-05	3	S-01	3	T-03	6	ML-6	14	RG-35	5
D-11	4	F-06	4	S-02	1	T-04	9	ML-7	19		
D-12	5	F-07	7	S-03	4	T-05	12	MLM-1	19		
D-13	4	F-08	8	S-04	16	T-06	14	MLM-2	6		
D-17	5	F-09	10	S-05	4	T-07	6	MP-796	9		
D-18	2	F-10	4	S-06	2	T-08	4	MS-2	18		
D-19	8	F-11	12	S-07	11	T-09	10	MS-3	20		
D-20	3	F-12	4	S-08	6	T-11	8	MS-6	13		
D-21	3	F-13	11	S-09	4	T-12	3	MSH-1	14		
D-22	11	F-14	5	S-10	5	T-13	12	MUD-1	20		
D-23	15	F-23	8	S-11	6	T-15	14				
D-24	3	F-24	4	S-12	7						

Appendix C
FY 2018 Main Pump Availability Chart

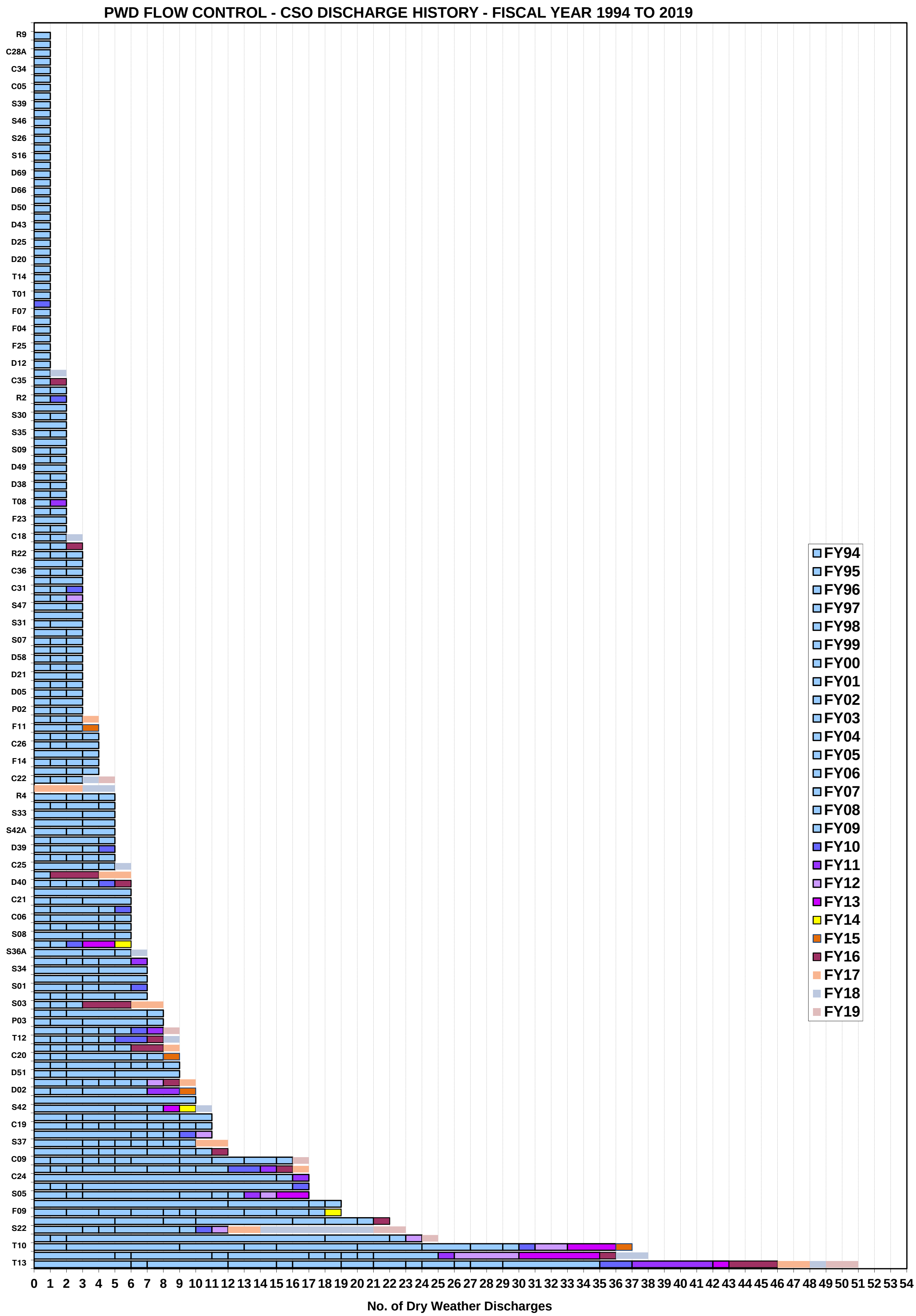


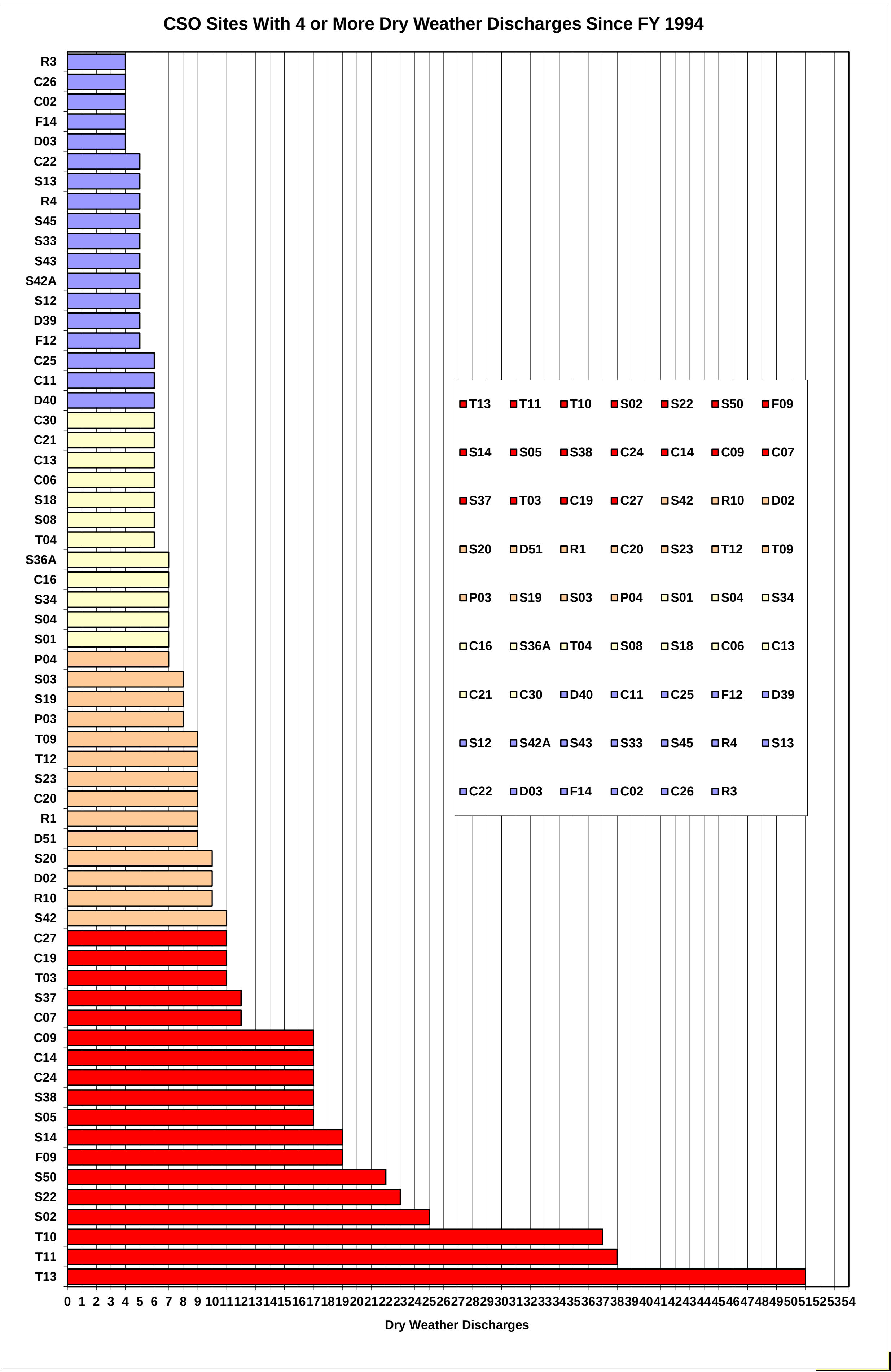
Wastewater-Pumping FY 19 Main Pump Monthly Availability
100.00%
99.00%
98.00%
97.00%
96.00%
95.00%
94.00%
93.00%
92.00%
91.00%
90.00%
July - 2018
August - 2018
September - 2018
October - 2018
November - 2018
December - 2018
January - 2019
February - 2019
March - 2019
April - 2019
May - 2019
June - 2019
Main Pump Availability

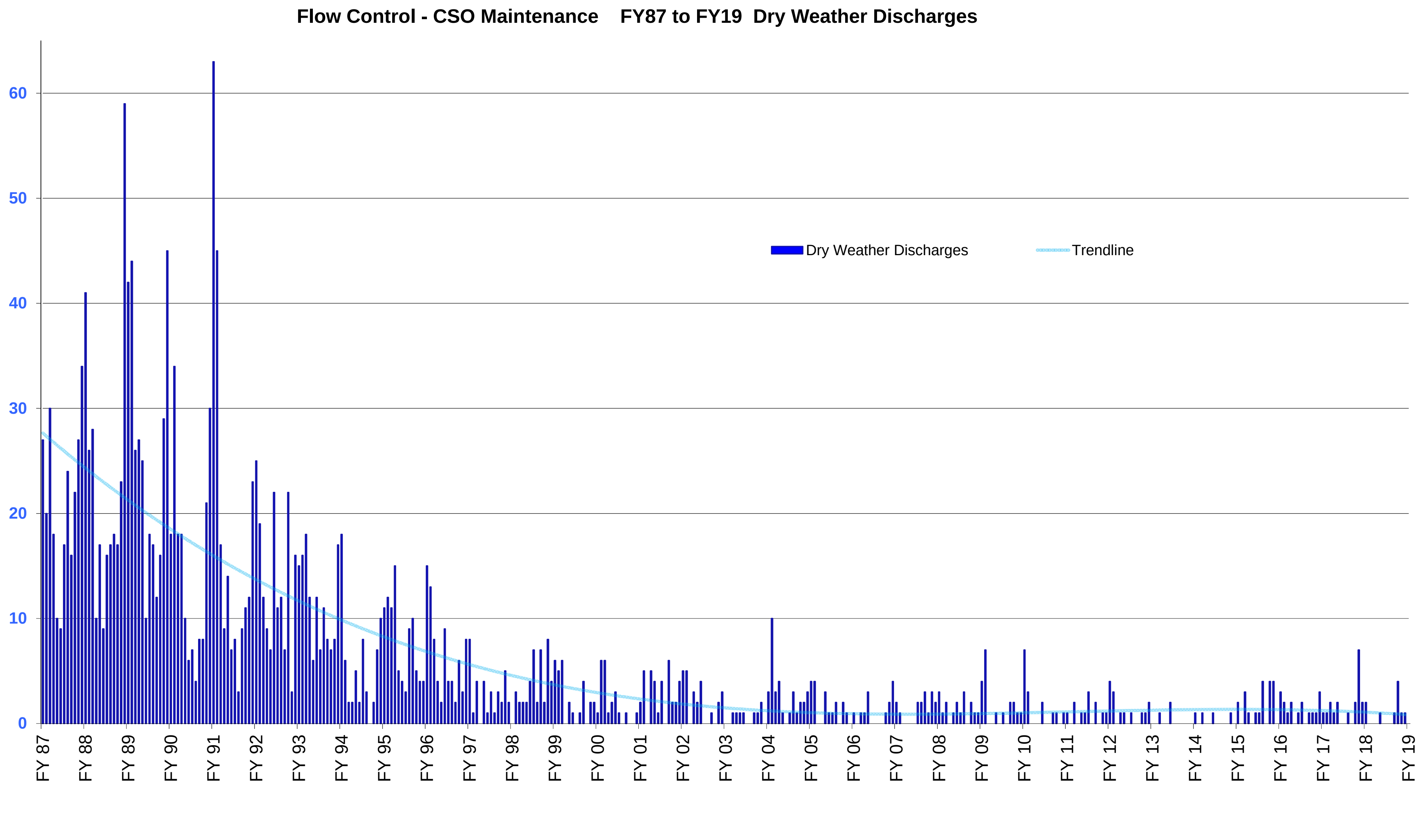
Appendix D
Historical CSO Charts



Flow Control - CSO Maintenance FY87 to FY19 Inspections / Discharges / Blocks Corrected
BLOCKS CLEARED - DISCHARGES
INSPECTIONS
FY88
FY90
FY92
FY94
FY96
FY98
FY00
FY02
FY04
FY06
FY08
FY10
FY12
FY14
FY16
FY18
CSO DRY WEATHER DISCHARGES
REGULATOR BLOCKAGES CORRECTED
CSO REGULATOR INSPECTIONS


PWD FLOW CONTROL - CSO DISCHARGE HISTORY - FISCAL YEAR 1994 TO 2019
R9
C28A
C34
C05
S39
S46
S26
S16
D69
D66
D50
D43
D25
D20
T14
T01
F07
F04
F25
D12
C35
R2
S30
S35
S09
D49
D38
T08
F23
C18
R22
C36
C31
S47
S31
S07
D58
D21
D05
P02
F11
C26
F14
C22
R4
S33
S42A
D39
C25
D40
C21
C06
S08
S36A
S34
S01
S03
P03
T12
C20
D51
D02
S42
C19
S37
C09
C24
S05
F09
S22
T10
T13
FY94
FY95
FY96
FY97
FY98
FY99
FY00
FY01
FY02
FY03
FY04
FY05
FY06
FY07
FY08
FY09
FY10
FY11
FY12
FY13
FY14
FY15
FY16
FY17
FY18
FY19
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54
No. of Dry Weather Discharges


CSO Sites With 4 or More Dry Weather Discharges Since FY 1994
R3
C26
C02
F14
D03
C22
S13
R4
S45
S33
S43
S42A
S12
D39
F12
C25
C11
D40
C30
C21
C13
C06
S18
S08
T04
S36A
C16
S34
S04
S01
P04
S03
S19
P03
T09
T12
S23
C20
R1
D51
S20
D02
R10
S42
C27
C19
T03
S37
C07
C09
C14
C24
S38
S05
S14
F09
S50
S22
S02
T10
T11
T13
T13 T11 T10 S02 S22 S50 F09
S14 S05 S38 C24 C14 C09 C07
S37 T03 C19 C27 S42 R10 D02
S20 D51 R1 C20 S23 T12 T09
P03 S19 S03 P04 S01 S04 S34
C16 S36A T04 S08 S18 C06 C13
C21 C30 D40 C11 C25 F12 D39
S12 S42A S43 S33 S45 R4 S13
C22 D03 F14 C02 C26 R3
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54
Dry Weather Discharges



Flow Control - CSO Maintenance FY87 to FY19 Dry Weather Discharges
Dry Weather Discharges
Trendline
0
10
20
30
40
50
60
FY 87
FY 88
FY 89
FY 90
FY 91
FY 92
FY 93
FY 94
FY 95
FY 96
FY 97
FY 98
FY 99
FY 00
FY 01
FY 02
FY 03
FY 04
FY 05
FY 06
FY 07
FY 08
FY 09
FY 10
FY 11
FY 12
FY 13
FY 14
FY 15
FY 16
FY 17
FY 18
FY 19

Appendix D – NPDES Annual CSO Report Status FY19

APPENDIX D –
NPDES ANNUAL CSO STATUS REPORT FY19

Page

Table 1 - Listing of all CSO permitted outfalls

Point Source #	Outfall Latitude	Outfall Longitude	Regulator Location	Discharges to:	Interceptor	Outfall Name
NPDES Permit #0026689 - Northeast						
2	39d 58m 50s	75d 4m 58s	Castor Ave. and Balfour St.	Delaware River	Somerset	D_17
3	39d 58m 45s	75d 5m 6s	Venango St. NW of Casper St.	Delaware River	Somerset	D_18
4	39d 58m 41s	75d 5m 15s	Tioga St. NW of Casper St.	Delaware River	Somerset	D_19
5	39d 58m 43s	75d 5m 28s	Ontario St. NW of Casper St.	Delaware River	Somerset	D_20
6	39d 58m 44s	75d 5m 41s	Westmoreland St. NW of Balfour St.	Delaware River	Somerset	D_21
7	39d 58m 42s	75d 5m 53s	Allegheny Ave. SE of Bath St.	Delaware River	Somerset	D_22
8	39d 58m 38s	75d 6m 12s	Indiana Ave. SE of Allen St.	Delaware River	Somerset	D_23
10	39d 58m 38s	75d 6m 28s	Cambria St. E of Melvale St.	Delaware River	Somerset	D_25
11	40d 1m 18s	75d 1m 44s	Cottman St. SE of Milnor St.	Delaware River	Upper Delaware Low Level	D_02
12	40d 1m 14s	75d 2m 0s	Princeton Ave SE of Milnor St.	Delaware River	Upper Delaware Low Level	D_03
13	40d 1m 8s	75d 2m 13s	Disston St. SE of Wissinoming St.	Delaware River	Upper Delaware Low Level	D_04
14	40d 0m 58s	75d 2m 34s	Magee St. SE of Milnor St.	Delaware River	Upper Delaware Low Level	D_05
15	40d 0m 53s	75d 2m 46s	Levick St. SE of Milnor St.	Delaware River	Upper Delaware Low Level	D_06
16	40d 0m 44s	75d 3m 5s	Lardner St. SE of Milnor St.	Delaware River	Upper Delaware Low Level	D_07
17	40d 0m 38s	75d 3m 13s	Comly St. SE of Milnor St.	Delaware River	Upper Delaware Low Level	D_08
18	40d 0m 34s	75d 3m 18s	Dark Run La and Milnor St.	Delaware River	Upper Delaware Low Level	D_09

Point Source #	Outfall Latitude	Outfall Longitude	Regulator Location	Discharges to:	Interceptor	Outfall Name
19	40d 0m 21s	75d 3m 28s	Sanger St. SE of Milnor St.	Delaware River	Upper Delaware Low Level	D_11
20	40d 0m 2s	75d 3m 43s	Bridge St. Se of Garden St.	Delaware River	Upper Delaware Low Level	D_12
21	39d 59m 53s	75d 3m 47s	Kirkbride St. and Delaware Ave.	Delaware River	Upper Delaware Low Level	D_13
22	39d 59m 24s	75d 4m 4s	Orthodox St. and Delaware Ave.	Delaware River	Upper Delaware Low Level	D_15
23	40d 2m 36s	75d 1m 15s	Frankford Avenue & Ashburner Street	Pennypack Creek	Pennypack	P_01
24	40d 2m 36s	75d 1m 16s	Frankford Avenue & Holmesburg St.	Pennypack Creek	Pennypack	P_02
25	40d 2m 13s	75d 1m 19s	Torresdale Ave. NW of Pennypack Ck.	Pennypack Creek	Pennypack	P_03
26	40d 2m 23s	75d 1m 21s	Cottage Avenue & Holmesburg Avenue	Pennypack Creek	Pennypack	P_04
27	40d 2m 2s	75d 1m 21s	Holmesburg Ave SE of Hegerman St	Pennypack Creek	Pennypack	P_05
28	40d 4m 34s	75d 9m 44s	Williams Avenue SE of Sedgewick	Tacony Creek	Frankford High Level	T_01
29	40d 2m 28s	75d 6m 56s	Complost Ave West of Tacony Creek	Tacony Creek	Frankford High Level	T_03
30	40d 2m 11s	75d 6m 48s	Rising Sun Ave East of Tacony Creek	Tacony Creek	Frankford High Level	T_04
31	40d 2m 9s	75d 6m 48s	Rising Sun Ave West of Tacony Creek	Tacony Creek	Frankford High Level	T_05
32	40d 2m 3s	75d 6m 41s	Bingham Street East of Tacony Creek	Tacony Creek	Frankford High Level	T_06
33	40d 1m 51s	75d 6m 43s	Tabor Road West of Tacony Creek	Tacony Creek	Frankford High Level	T_07
34	40d 1m 42s	75d 6m 47s	Ashdale Street West of Tacony Creek	Tacony Creek	Frankford High Level	T_08

Point Source #	Outfall Latitude	Outfall Longitude	Regulator Location	Discharges to:	Interceptor	Outfall Name
35	40d 1m 37s	75d 6m 48s	Roosevelt Blvd. West of Tacony Creek	Tacony Creek	Frankford High Level	T_09
36	40d 1m 37s	75d 6m 47s	Roosevelt Blvd. East of Tacony Creek	Tacony Creek	Frankford High Level	T_10
37	40d 1m 29s	75d 6m 43s	Ruscomb Street East of Tacony Creek	Tacony Creek	Frankford High Level	T_11
38	40d 1m 23s	75d 6m 41s	Whitaker Avenue East of Tacony Creek	Tacony Creek	Frankford High Level	T_12
39	40d 1m 22s	75d 6m 42s	Whitaker Avenue West of Tacony Ck	Tacony Creek	Frankford High Level	T_13
40	40d 0m 59s	75d 6m 28s	I Street & Ramona Ave.	Tacony Creek	Frankford High Level	T_14
41	40d 0m 57s	75d 6m 20s	J Street & Juniata Park	Tacony Creek	Frankford High Level	T_15
42	40d 0m 57s	75d 5m 51s	Castor Avenue at Unity Street Circle	Frankford Creek	Upper Frankford Low Level	F_03
43	40d 0m 52s	75d 5m 42s	Wingohocking St East of Adams Ave	Frankford Creek	Upper Frankford Low Level	F_04
44	40d 0m 41s	75d 5m 41s	Bristol Street West of Adams Avenue	Frankford Creek	Upper Frankford Low Level	F_05
45	40d 0m 25s	75d 5m 33s	Worrel Street East of Frankford Creek	Frankford Creek	Upper Frankford Low Level	F_06
46	40d 0m 26s	75d 5m 34s	Worrel Street West of Frankford Creek	Frankford Creek	Upper Frankford Low Level	F_07
47	40d 0m 21s	75d 5m 36s	Torresdale Ave & Hunting Park Ave	Frankford Creek	Upper Frankford Low Level	F_08
48	40d 0m 19s	75d 5m 34s	Frankford Ave North of Frankford Ck	Frankford Creek	Upper Frankford Low Level	F_09
49	40d 0m 19s	75d 5m 35s	Frankford Ave South of Frankford Ck	Frankford Creek	Upper Frankford Low Level	F_10

Point Source #	Outfall Latitude	Outfall Longitude	Regulator Location	Discharges to:	Interceptor	Outfall Name
50	40d 0m 15s	75d 5m 26s	Orchard Street South of Vandyke Creek	Frankford Creek	Upper Frankford Low Level	F_11
51	39d 59m 56s	75d 5m 14s	Sepviva Street North of Butler Street	Frankford Creek	Upper Frankford Low Level	F_12
52	39d 59m 49s	75d 5m 3s	Duncan Street Under Delaware Exp.	Frankford Creek	Lower Frankford Low Level	F_13
54	40d 0m 16s	75d 4m 15s	Wakeling Street NW of Creek Basin	Frankford Creek	Lower Frankford Low Level	F_21
55	40d 0m 19s	75d 4m 5s	Bridge Street NW of Creek Basin	Frankford Creek	Lower Frankford Low Level	F_23
56	40d 0m 18s	75d 4m 5s	Bridge Street SE of Creek Basin	Frankford Creek	Lower Frankford Low Level	F_24
57	40d 0m 15s	75d 4m 15s	Ash Street West of Creek Basin	Frankford Creek	Lower Frankford Low Level	F_25
58	40d 0m 30s	75d 3m 20s	Levick St. & Everett Ave.	Delaware River	Wakling Relief Sewer	D_FRW
59	40d 2m 16s	75d 6m 53s	Nedro Ave & 7th St.	Tacony Creek	Rock Run Flood Relief Sewer	T_FRRR
60	40d 0m 36s	75d 5m 44s	Castor Ave. & East Hunting Park Ave.	Frankford Creek	Frankford High Level Relief Sewer	F_FRFG
NPDES Permit # 0026662 – Southeast						
2	39d 58m 9s	75d 7m 19s	Dyott Street & Delaware Ave.	Delaware River	Lower Delaware Low Level	D_38
3	39d 58m 7s	75d 7m 23s	Susquehanna Ave. East of Beach Street	Delaware River	Lower Delaware Low Level	D_39
4	39d 58m 5s	75d 7m 26s	Berks Street East of Beach Street	Delaware River	Lower Delaware Low Level	D_40
5	39d 58m 3s	75d 7m 37s	Palmer Street East of Beach Street	Delaware River	Lower Delaware Low Level	D_41

Point Source #	Outfall Latitude	Outfall Longitude	Regulator Location	Discharges to:	Interceptor	Outfall Name
6	39d 57m 54s	75d 7m 42s	Columbia Avenue East of Beach Street	Delaware River	Lower Delaware Low Level	D_42
7	39d 57m 56s	75d 7m 48s	Marlborough Street & Delaware Ave	Delaware River	Lower Delaware Low Level	D_43
8	39d 57m 53s	75d 7m 54s	Shackamaxon St East of Delaware Ave	Delaware River	Lower Delaware Low Level	D_44
9	39d 57m 48s	75d 8m 0s	Laurel Street & Delaware Avenue	Delaware River	Lower Delaware Low Level	D_45
10	39d 57m 41s	75d 8m 11s	Penn Street & Delaware Avenue	Delaware River	Lower Delaware Low Level	D_46
11	39d 57m 37s	75d 8m 9s	Fairmont Ave West of Delaware Ave	Delaware River	Lower Delaware Low Level	D_47
12	39d 57m 28s	75d 8m 13s	Willow Street West of Delaware Ave	Delaware River	Lower Delaware Low Level	D_48
13	39d 57m 24s	75d 8m 20s	Callowhill Street & Delaware Avenue	Delaware River	Lower Delaware Low Level	D_49
14	39d 57m 21s	75d 8m 13s	Delaware Avenue North of Vine Street	Delaware River	Lower Delaware Low Level	D_50
15	39d 57m 11s	75d 8m 17s	Race Street West of Delaware Avenue	Delaware River	Lower Delaware Low Level	D_51
16	39d 57m 7s	75d 8m 25s	Delaware Avenue & Arch Street	Delaware River	Lower Delaware Low Level	D_52
17	39d 56m 57s	75d 8m 23s	Market Street & Front Street	Delaware River	Lower Delaware Low Level	D_53
20	39d 56m 50s	75d 8m 24s	Front Street South of Chestnut Street	Delaware River	Lower Delaware Low Level	D_54
21	39d 56m 26s	75d 8m 32s	South Street & Delaware Avenue	Delaware River	Lower Delaware Low Level	D_58

Point Source #	Outfall Latitude	Outfall Longitude	Regulator Location	Discharges to:	Interceptor	Outfall Name
22	39d 56m 12s	75d 8m 33s	Catharine Street East of Swanson Street	Delaware River	Lower Delaware Low Level	D_61
23	39d 56m 10s	75d 8m 32s	Queen Street East of Swanson Street	Delaware River	Lower Delaware Low Level	D_62
24	39d 56m 5s	75d 8m 33s	Christian St West of Delaware Avenue	Delaware River	Lower Delaware Low Level	D_63
25	39d 55m 59s	75d 8m 35s	Washington Ave East of Delaware Ave	Delaware River	Lower Delaware Low Level	D_64
26	39d 55m 45s	75d 8m 29s	Reed Street East of Delaware Avenue	Delaware River	Lower Delaware Low Level	D_65
27	39d 55m 37s	75d 8m 28s	Tasker Street East of Delaware Avenue	Delaware River	Lower Delaware Low Level	D_66
28	39d 55m 26s	75d 8m 21s	Moore Street East of Delaware Avenue	Delaware River	Lower Delaware Low Level	D_67
33	39d 54m 6s	75d 8m 12s	Pattison Avenue & Swanson Street	Delaware River	Lower Delaware Low Level	D_73
36	39d 58m 21s	75d 6m 58s	Cumberland St East of Richmond St	Delaware River	Lower Delaware Low Level	D_37
37	39d 57m 12s	75d 8m 24s	Race Street West of Delaware Avenue, North of D-51	Delaware River	Lower Delaware Low Level	D_51A
29	39d 55m 13s	75d 8m 20s	Snyder Avenue & Delaware Avenue	Delaware River	Oregon	D_68
30	39d 54m 60s	75d 8m 13s	Delaware Ave North of Porter Street	Delaware River	Oregon	D_69
31	39d 54m 44s	75d 8m 15s	Oregon Avenue & Delaware Avenue	Delaware River	Oregon	D_70
32	39d 54m 33s	75d 7m 59s	Bigler Street & Delaware Avenue	Delaware River	Oregon	D_71
34	39d 54m 24s	75d 8m 8s	Packer Avenue East of Delaware Ave	Delaware River	Oregon	D_72
NPDES Permit # 0026671 - Southwest						

Point Source #	Outfall Latitude	Outfall Longitude	Regulator Location	Discharges to:	Interceptor	Outfall Name
2	39d 56m 17s	75d 12m 17s	Reed Street & Schuylkill Avenue	Schuylkill River	Lower Schuylkill East Side	S_31
3	39d 55m 54s	75d 12m 28s	35th St. and Mifflin St.	Schuylkill River	Lower Schuylkill East Side	S_36A
4	39d 55m 41s	75d 12m 38s	Vare Avenue & 29th Street	Schuylkill River	Lower Schuylkill East Side	S_37
5	39d 55m 12s	75d 12m 5s	Passyunk Avenue & 29th Street	Schuylkill River	Lower Schuylkill East Side	S_42
6	39d 55m 12s	75d 12m 5s	Passyunk Avenue & 28th Street	Schuylkill River	Lower Schuylkill East Side	S_42A
7	39d 54m 57s	75d 12m 16s	26th Street 700’ North of Hartranft St	Schuylkill River	Lower Schuylkill East Side	S_44
8	39d 53m 53s	75d 12m 39s	Penrose Avenue & 26th Street	Schuylkill River	Lower Schuylkill East Side	S_46
9	39d 57m 38s	75d 10m 50s	24th Street 155’ South of Parktown Pl	Schuylkill River	Central Schuylkill East Side	S_05
10	39d 57m 39s	75d 10m 49s	24th Street 350’ South of Parktown Pl	Schuylkill River	Central Schuylkill East Side	S_06
11	39d 57m 39s	75d 10m 50s	24th Street East of Schuylkill River	Schuylkill River	Central Schuylkill East Side	S_07
12	39d 57m 29s	75d 10m 43s	Race Street & Bonsall Street	Schuylkill River	Central Schuylkill East Side	S_08
13	39d 57m 30s	75d 10m 45s	Arch Street West of 23rd Street	Schuylkill River	Central Schuylkill East Side	S_09
14	39d 57m 16s	75d 10m 49s	Market Street 25’ East of 24th Street	Schuylkill River	Central Schuylkill East Side	S_10
15	39d 57m 11s	75d 10m 51s	24th St. N of Chestnut St. Bridge	Schuylkill River	Central Schuylkill East Side	S_12A
16	39d 57m 7s	75d 10m 52s	Sansom Street West of 24th Street	Schuylkill River	Central Schuylkill East Side	S_13

Point Source #	Outfall Latitude	Outfall Longitude	Regulator Location	Discharges to:	Interceptor	Outfall Name
17	39d 57m 5s	75d 10m 53s	Walnut Street West of 24th Street	Schuylkill River	Central Schuylkill East Side	S_15
18	39d 57m 1s	75d 10m 56s	Locust Street & 25th Street	Schuylkill River	Central Schuylkill East Side	S_16
19	39d 56m 57s	75d 11m 0s	Spruce Street & 25th Street	Schuylkill River	Central Schuylkill East Side	S_17
20	39d 56m 52s	75d 11m 5s	Pine Street West of Taney Street	Schuylkill River	Central Schuylkill East Side	S_18
21	39d 56m 49s	75d 11m 9s	Lombard Street West of 27th Street	Schuylkill River	Central Schuylkill East Side	S_19
22	39d 56m 47s	75d 11m 12s	South Street East of 27th Street	Schuylkill River	Central Schuylkill East Side	S_21
23	39d 56m 44s	75d 11m 18s	Schuylkill Avenue & Bainbridge Street	Schuylkill River	Central Schuylkill East Side	S_23
24	39d 56m 34s	75d 11m 28s	Schuylkill Avenue & Christian Street	Schuylkill River	Central Schuylkill East Side	S_25
25	39d 56m 29s	75d 11m 35s	Ellsworth St West of Schuylkill Avenue	Schuylkill River	Central Schuylkill East Side	S_26
26	39d 58m 1s	75d 11m 17s	Mantua Avenue & West River Drive	Schuylkill River	Central Schuylkill West Side	S_01
27	39d 57m 54s	75d 11m 7s	Haverford Avenue & West River Drive	Schuylkill River	Central Schuylkill West Side	S_02
28	39d 57m 51s	75d 11m 4s	Spring Garden St W of Schuylkill Expy	Schuylkill River	Central Schuylkill West Side	S_03
29	39d 57m 53s	75d 11m 4s	Powelton Ave W of Schuylkill Expy	Schuylkill River	Central Schuylkill West Side	S_04
30	39d 57m 16s	75d 10m 53s	Market St West of Schuylkill Expy	Schuylkill River	Central Schuylkill West Side	S_11

Point Source #	Outfall Latitude	Outfall Longitude	Regulator Location	Discharges to:	Interceptor	Outfall Name
31	39d 57m 5s	75d 10m 58s	Schuylkill Expressway & Walnut Street	Schuylkill River	Central Schuylkill West Side	S_14
32	39d 56m 51s	75d 11m 14s	440' Northwest of South Street	Schuylkill River	Central Schuylkill West Side	S_20
33	39d 56m 46s	75d 11m 22s	660' South of South St E of Pennfield	Schuylkill River	Central Schuylkill West Side	S_22
34	39d 56m 43s	75d 11m 26s	1060' South of South St E of Pennfield	Schuylkill River	Central Schuylkill West Side	S_24
35	39d 56m 32s	75d 12m 27s	46th Street & Paschall Avenue	Schuylkill River	Southwest Main Gravity	S_30
36	39d 56m 36s	75d 12m 18s	43rd St. and Locust St.	Schuylkill River	Southwest Main Gravity	S_50
37	39d 56m 13s	75d 12m 23s	49th Street South of Botanic Street	Schuylkill River	Lower Schuylkill West Side	S_32
38	39d 56m 8s	75d 12m 24s	51st Street South of Botanic Street	Schuylkill River	Lower Schuylkill West Side	S_33
39	39d 55m 43s	75d 12m 45s	56th Street East of P&R Railroad	Schuylkill River	Lower Schuylkill West Side	S_38
40	39d 54m 39s	75d 12m 55s	64th St. and Buist Ave.	Schuylkill River	Lower Schuylkill West Side	S_45
41	39d 56m 10s	75d 14m 6s	60th Street & Cobbs Creek Parkway	Cobbs Creek	Cobbs Creek High Level	C_18
51	39d 58m 51s	75d 16m 4s	City Line Avenue & 73rd Street	Cobbs Creek	Cobbs Creek High Level	C_01
52	39d 58m 51s	75d 16m 1s	City Line Ave 100' South Side of Creek	Cobbs Creek	Cobbs Creek High Level	C_02
54	39d 58m 30s	75d 15m 26s	Lebanon Ave Southwest of 73rd Street	Cobbs Creek	Cobbs Creek High Level	C_05
55	39d 58m 31s	75d 15m 25s	Lebanon Avenue & 68th Street	Cobbs Creek	Cobbs Creek High Level	C_06

Point Source #	Outfall Latitude	Outfall Longitude	Regulator Location	Discharges to:	Interceptor	Outfall Name
56	39d 58m 26s	75d 15m 26s	Lansdowne Avenue & 69th Street	Cobbs Creek	Cobbs Creek High Level	C_07
57	39d 57m 51s	75d 14m 56s	54th Street & Cobbs Creek	Cobbs Creek	Cobbs Creek High Level	C_09
58	39d 57m 50s	75d 14m 53s	Gross Street & Cobbs Creek	Cobbs Creek	Cobbs Creek High Level	C_10
59	39d 57m 43s	75d 14m 53s	Cobbs Creek Pky South of Market St	Cobbs Creek	Cobbs Creek High Level	C_11
60	39d 57m 27s	75d 14m 60s	Spruce Street & Cobbs Creek	Cobbs Creek	Cobbs Creek High Level	C_12
61	39d 56m 45s	75d 14m 58s	62nd Street & Cobbs Creek	Cobbs Creek	Cobbs Creek High Level	C_13
62	39d 56m 36s	75d 14m 50s	Baltimore Avenue & Cobbs Creek	Cobbs Creek	Cobbs Creek High Level	C_14
63	39d 56m 31s	75d 14m 26s	59th Street & Cobbs Creek Parkway	Cobbs Creek	Cobbs Creek High Level	C_15
64	39d 56m 26s	75d 14m 23s	Thomas Avenue & Cobbs Creek	Cobbs Creek	Cobbs Creek High Level	C_16
65	39d 56m 13s	75d 14m 6s	Beaumont Street & Cobbs Creek	Cobbs Creek	Cobbs Creek High Level	C_17
66	39d 58m 29s	75d 16m 48s	Cobbs Creek Pky S of City Line Ave	Cobbs Creek	Cobbs Creek High Level	C_31
67	39d 58m 12s	75d 15m 56s	Brockton Road & Farrington Road	Cobbs Creek	Cobbs Creek High Level	C_33
68	39d 58m 40s	75d 15m 44s	Woodcrest Avenue & Morris Park	Cobbs Creek	Cobbs Creek High Level	C_34
69	39d 58m 47s	75d 15m 54s	Morris Park West of 72nd Street & Sherwood Road	Cobbs Creek	Cobbs Creek High Level	C_35
70	39d 58m 49s	75d 15m 35s	Woodbine Ave South of Brentwood Rd	Cobbs Creek	Cobbs Creek High Level	C_36

Point Source #	Outfall Latitude	Outfall Longitude	Regulator Location	Discharges to:	Interceptor	Outfall Name
71	39d 57m 55s	75d 15m 15s	Cobbs Creek Parkway South of 67th & Callowhill Streets	Cobbs Creek	Cobbs Creek High Level	C_37
72	39d 58m 22s	75d 16m 11s	Cobbs Creek Parkway & 77th Street	Cobbs Creek	Cobbs Creek High Level	C_32
82	39d 58m 38s	75d 15m 28s	Malvern Ave. and 68th St.	Cobbs Creek	Cobbs Creek High Level	C_04A
42	39d 55m 57s	75d 14m 19s	Mount Moriah Cemetary & 62nd Street	Cobbs Creek	Cobbs Creek Low Level	C_19
43	39d 55m 46s	75d 14m 39s	65th Street & Cobbs Creek Parkway	Cobbs Creek	Cobbs Creek Low Level	C_20
44	39d 55m 37s	75d 14m 40s	68th Street & Cobbs Creek Parkway	Cobbs Creek	Cobbs Creek Low Level	C_21
45	39d 55m 27s	75d 14m 46s	70th Street & Cobbs Creek Parkway	Cobbs Creek	Cobbs Creek Low Level	C_22
46	39d 55m 15s	75d 14m 52s	Upland Street & Cobbs Creek Parkway	Cobbs Creek	Cobbs Creek Low Level	C_23
47	39d 55m 1s	75d 14m 49s	Woodland Avenue East of Island Ave.	Cobbs Creek	Cobbs Creek Low Level	C_25
49	39d 54m 44s	75d 14m 56s	Claymont Street & Grays Avenue	Cobbs Creek	Cobbs Creek Low Level	C_29
50	39d 54m 34s	75d 15m 1s	77th Street West of Elmwood Avenue	Cobbs Creek	Cobbs Creek Low Level	C_30
78	39d 54m 49s	75d 14m 50s	Island Ave. Southeast of Glenmore Ave	Cobbs Creek	Cobbs Creek Low Level	C_28A
75	39d 57m 59s	75d 11m 3s	16th St. & Clearfield St.	Schuylkill River	Main Relief Sewer	S_FRM
83	39d 56m 31s	75d 14m 25s	56th St. & Locust	Cobbs Creek	Thomas Run Relief Sewer	C_FRTR
84	39d 57m 49s	75d 14m 53s	Arch Street & Cobbs Creek	Cobbs Creek	Arch Street Relief Sewer	C_FRA

Table 2 - Overflow Summary for 7/1/2018 – 6/30/2019

District	Permitted Outfall	Frequency	Duration (hours)	Volume (ft^3)
Northeast	D_FRW	75	251	53,517,386
Northeast	D02	40	83.5	13,094,366
Northeast	D03	42	74	3,344,116
Northeast	D04	24	36.25	686,290
Northeast	D05	67	309	84,253,011
Northeast	D06	21	25.25	944,804
Northeast	D07	70	257.75	36,831,363
Northeast	D08	22	27.5	436,374
Northeast	D09	14	11.5	406,879
Northeast	D11	29	47	6,001,440
Northeast	D12	69	138	520,737
Northeast	D13	21	27.75	1,212,828
Northeast	D15	25	47	2,863,157
Northeast	D17	70	241.25	16,393,522
Northeast	D18	58	149	8,417,633
Northeast	D19	70	281	9,024,848
Northeast	D20	51	90.5	4,816,197
Northeast	D21	67	215.25	13,296,712
Northeast	D22	95	521	41,543,944
Northeast	D23	67	108.25	632,793
Northeast	D25	83	468.75	155,860,021
Northeast	F_FRFG	0	0	0
Northeast	F03	51	75.5	3,480,476
Northeast	F04	77	277.75	9,768,090
Northeast	F05	79	241	1,392,829
Northeast	F06	36	41.75	1,425,048
Northeast	F07	56	123.5	3,764,791
Northeast	F08	56	111.75	2,823,219
Northeast	F09	81	310.5	2,027,829
Northeast	F10	44	78.25	2,585,266
Northeast	F11	80	427	19,425,088
Northeast	F12	49	61.75	977,372
Northeast	F13	67	163	2,206,074
Northeast	F21	86	581	160,940,941
Northeast	F23	75	222.25	2,862,316

District	Permitted Outfall	Frequency	Duration (hours)	Volume (ft^3)
Northeast	F24	72	151	1,339,189
Northeast	F25	17	23.75	5,242,192
Northeast	P01	25	31	1,337,704
Northeast	P02	70	181.5	4,847,593
Northeast	P03	39	55.75	988,916
Northeast	P04	21	56	2,722,174
Northeast	P05	48	137.75	8,561,454
Northeast	T_FRRR	41	187.25	22,686,466
Northeast	T01	81	356.25	5,810,605
Northeast	T03	80	244.25	5,753,625
Northeast	T04	75	300.25	5,837,933
Northeast	T05	64	125.25	2,646,667
Northeast	T06	60	148.5	17,099,019
Northeast	T07	20	16.75	427,841
Northeast	T08	81	289.75	55,578,380
Northeast	T09	55	71.5	1,338,256
Northeast	T10	75	348.25	5,259,860
Northeast	T11	66	140.75	1,424,565
Northeast	T12	9	8.75	86,271
Northeast	T13	62	207	6,848,814
Northeast	T14	42	211.75	179,359,784
Northeast	T15	70	212.25	9,682,083
Southeast	D37	71	366.75	26,708,055
Southeast	D38	61	228.25	27,146,655
Southeast	D39	71	326.5	43,866,247
Southeast	D40	83	342	2,367,295
Southeast	D41	61	199	2,518,989
Southeast	D42	19	21.5	150,274
Southeast	D43	21	30.5	200,461
Southeast	D44	36	69	5,552,197
Southeast	D45	55	184.5	78,570,425
Southeast	D46	36	66.75	1,065,212
Southeast	D47	86	326.5	9,295,677
Southeast	D48	58	104.5	15,593,914
Southeast	D49	11	8.75	47,849
Southeast	D50	14	15	143,073
Southeast	D51	75	225.5	1,528,346

District	Permitted Outfall	Frequency	Duration (hours)	Volume (ft^3)
Southeast	D51A	67	161	1,547,105
Southeast	D52	44	52.25	496,485
Southeast	D53	18	23.25	3,378,626
Southeast	D54	31	46.25	12,068,984
Southeast	D58	34	45.75	1,300,575
Southeast	D61	63	108.75	1,005,281
Southeast	D62	43	50.5	377,562
Southeast	D63	51	72.75	13,243,577
Southeast	D64	63	109.5	699,395
Southeast	D65	55	127.5	14,574,928
Southeast	D66	79	285.75	18,695,032
Southeast	D67	64	250.75	10,792,747
Southeast	D68	64	246.75	34,415,074
Southeast	D69	45	96.5	11,165,722
Southeast	D70	41	76.25	15,233,671
Southeast	D71	44	73.5	8,354,992
Southeast	D72	22	38	7,819,775
Southeast	D73	78	340.75	41,937,387
Southwest	C_FRA	11	10.75	1,341,019
Southwest	C_FRTR	100	627	31,006,952
Southwest	C01	20	20	422,166
Southwest	C02	3	1.25	6,007
Southwest	C04A	8	9	527,371
Southwest	C05	3	1.5	55,975
Southwest	C06	58	87.75	3,559,718
Southwest	C07	34	32.5	697,346
Southwest	C09	42	60.5	1,861,270
Southwest	C10	38	62.5	490,287
Southwest	C11	51	121	15,061,079
Southwest	C12	51	104	1,878,988
Southwest	C13	44	66	1,128,702
Southwest	C14	46	75.25	2,321,003
Southwest	C15	7	7	73,648
Southwest	C16	2	1	714
Southwest	C17	66	190.25	27,867,367
Southwest	C18	55	61	2,556,971
Southwest	C19	25	20.5	606,292

District	Permitted Outfall	Frequency	Duration (hours)	Volume (ft^3)
Southwest	C20	22	21.75	337,287
Southwest	C21	7	7.25	198,269
Southwest	C22	48	75.5	1,734,381
Southwest	C23	8	14.75	152,681
Southwest	C25	15	19.75	713,099
Southwest	C28A	57	78.75	461,021
Southwest	C29	44	144.5	2,662,442
Southwest	C30	37	104.75	712,368
Southwest	C31	44	68	1,130,016
Southwest	C32	51	60.75	1,477,296
Southwest	C33	29	27.25	495,436
Southwest	C34	15	12.25	299,811
Southwest	C35	11	8.5	50,199
Southwest	C36	9	6.5	58,146
Southwest	C37	19	17.75	123,621
Southwest	S_FRM	33	51	16,125,788
Southwest	S01	62	208.75	19,802,626
Southwest	S01T	61	156	11,205,327
Southwest	S02	70	174.5	1,498,341
Southwest	S03	2	1	5,266
Southwest	S04	85	306.75	3,009,333
Southwest	S05	98	532.75	58,881,139
Southwest	S06	82	248	18,841,373
Southwest	S07	48	78.75	3,400,409
Southwest	S08	58	79.75	318,097
Southwest	S09	62	132	12,462,458
Southwest	S10	90	439.5	5,560,443
Southwest	S11	85	300.5	2,154,594
Southwest	S12A	65	111.5	942,934
Southwest	S13	26	23.75	461,327
Southwest	S14	88	367.75	3,981,083
Southwest	S15	42	45	416,932
Southwest	S16	80	202	1,542,348
Southwest	S17	43	49.75	868,039
Southwest	S18	77	230	10,064,550
Southwest	S19	43	45	442,639
Southwest	S20	81	482.25	26,917,385

District	Permitted Outfall	Frequency	Duration (hours)	Volume (ft^3)
Southwest	S21	50	61.75	276,984
Southwest	S22	77	189	4,172,401
Southwest	S23	86	307.25	3,043,345
Southwest	S24	59	77.25	527,184
Southwest	S25	63	140.75	3,174,918
Southwest	S26	85	406.25	21,916,027
Southwest	S30	11	8	78,819
Southwest	S31	66	141.5	3,637,282
Southwest	S32	23	18.75	190,538
Southwest	S33	89	481.25	23,566,015
Southwest	S36A	93	406.25	10,113,238
Southwest	S37	86	316	4,205,355
Southwest	S38	39	46	4,334,768
Southwest	S42	73	273.25	25,994,740
Southwest	S42A	91	550.5	30,720,470
Southwest	S44	65	204	15,442,299
Southwest	S45	50	82	20,739,744
Southwest	S46	52	112.25	3,768,765
Southwest	S50	89	530.25	258,112,234

Table 3 - Overflow Summary for Typical Year Precipitation (based on Year-5 EAP submission)

District	Permitted Outfall	Frequency	SWO Duration (hrs)	Overflow Volume (MG)
Northeast	D_FRW	44	117.75	96.0
Northeast	D02	26	0	45.3
Northeast	D03	26	61.75	13.3
Northeast	D04	10	21.75	1.7
Northeast	D05	49	251	360.7
Northeast	D06	9	11	1.3
Northeast	D07	54	204.75	135.9
Northeast	D08	40	92.5	3.3
Northeast	D09	5	3.5	0.5
Northeast	D11	21	56.75	24.6
Northeast	D12	46	114.5	1.6
Northeast	D13	9	12.25	1.3
Northeast	D15	15	30	8.0
Northeast	D17	45	169	64.8
Northeast	D18	52	180.25	53.6
Northeast	D19	53	223.75	48.0
Northeast	D20	36	114.5	28.7
Northeast	D21	45	184.75	65.9
Northeast	D22	71	512	251.7
Northeast	D23	42	72	1.6
Northeast	D25	66	422.75	963.3
Northeast	F_FRFG	5	2.5	0.3
Northeast	F03	33	55.75	18.8
Northeast	F04	63	239.25	63.5
Northeast	F05	69	272	8.1
Northeast	F06	20	36.75	5.5
Northeast	F07	40	94.75	20.4
Northeast	F08	39	76.25	11.0
Northeast	F09	59	231	9.2
Northeast	F10	63	322.25	26.5
Northeast	F11	71	431.75	133.7
Northeast	F12	31	53.25	5.8
Northeast	F13	46	130.25	14.0
Northeast	F21	67	385.5	800.2
Northeast	F23	44	113.75	11.6
Northeast	F24	47	99.75	5.1
Northeast	F25	15	32	28.5
Northeast	P01	15	16.25	3.2
Northeast	P02	49	115.75	14.9
Northeast	P03	20	26.25	2.0

District	Permitted Outfall	Frequency	SWO Duration (hrs)	Overflow Volume (MG)
Northeast	P04	9	30.25	11.5
Northeast	P05	27	56.75	22.3
Northeast	T_FRRR	37	274.5	281.9
Northeast	T01	64	262.5	45.1
Northeast	T03	61	158	22.8
Northeast	T04	59	154.25	15.9
Northeast	T05	42	64.25	7.6
Northeast	T06	39	72	55.3
Northeast	T07	9	8.5	1.0
Northeast	T08	62	234.75	257.0
Northeast	T09	44	68.25	5.7
Northeast	T10	63	258.5	22.3
Northeast	T11	59	165.75	10.1
Northeast	T12	8	7	0.2
Northeast	T13	63	191.75	31.4
Northeast	T14	37	356.5	1546.5
Northeast	T15	54	158	42.1
Southeast	D37	54	282	184.0
Southeast	D38	43	169.75	178.9
Southeast	D39	54	270.75	276.7
Southeast	D40	57	282	14.4
Southeast	D41	42	153.75	17.7
Southeast	D42	18	22	1.5
Southeast	D43	19	31.75	1.3
Southeast	D44	23	55	23.8
Southeast	D45	36	121	357.6
Southeast	D46	19	30.75	3.9
Southeast	D47	56	215	46.3
Southeast	D48	40	94.25	112.3
Southeast	D49	6	4.5	0.4
Southeast	D50	14	12.5	1.5
Southeast	D51	56	372	11.4
Southeast	D51A	49	174	12.5
Southeast	D52	22	31	2.7
Southeast	D53	7	7.5	9.6
Southeast	D54	19	30	48.3
Southeast	D58	18	26.5	5.1
Southeast	D61	46	94.75	6.2
Southeast	D62	20	23.25	1.8
Southeast	D63	31	65.25	73.9
Southeast	D64	27	41.75	1.5
Southeast	D65	29	66.25	52.4

District	Permitted Outfall	Frequency	SWO Duration (hrs)	Overflow Volume (MG)
Southeast	D66	37	105.75	58.8
Southeast	D67	31	80.75	28.0
Southeast	D68	41	183.75	156.0
Southeast	D69	24	70.75	47.2
Southeast	D70	20	45.5	48.3
Southeast	D71	24	63	45.5
Southeast	D72	18	34.75	29.2
Southeast	D73	51	236	159.2
Southwest	C_FRA	11	9.5	5.2
Southwest	C_FRTR	83	500.5	161.8
Southwest	C01	15	15.25	1.7
Southwest	C02	6	4.25	0.2
Southwest	C04A	19	28	12.6
Southwest	C05	2	2.75	0.4
Southwest	C06	61	195.75	40.1
Southwest	C07	19	39.25	10.2
Southwest	C09	33	65	13.6
Southwest	C10	16	36.5	1.6
Southwest	C11	42	122.75	97.1
Southwest	C12	39	100	16.7
Southwest	C13	30	68.25	11.0
Southwest	C14	30	80.5	22.1
Southwest	C15	18	40.75	2.7
Southwest	C16	5	4.75	0.2
Southwest	C17	55	266.5	294.4
Southwest	C18	29	64.75	21.0
Southwest	C19	18	21.75	4.6
Southwest	C20	14	22	2.5
Southwest	C21	15	26.25	3.5
Southwest	C22	37	78.75	14.5
Southwest	C23	12	25	1.7
Southwest	C25	22	61	19.5
Southwest	C28A	36	58.5	2.1
Southwest	C29	48	189.25	16.2
Southwest	C30	30	118.5	8.4
Southwest	C31	40	90.25	10.3
Southwest	C32	31	56.25	9.8
Southwest	C33	20	24.25	3.1
Southwest	C34	13	11.75	1.7
Southwest	C35	10	11.25	0.7
Southwest	C36	10	9.25	0.6
Southwest	C37	15	17.5	0.9

District	Permitted Outfall	Frequency	SWO Duration (hrs)	Overflow Volume (MG)
Southwest	S_FRM	8	10.75	41.9
Southwest	S01	41	122	86.4
Southwest	S02	49	142	7.4
Southwest	S03	11	8	0.6
Southwest	S04	72	385.5	19.8
Southwest	S05	71	338.25	236.5
Southwest	S06	65	281.5	98.6
Southwest	S07	16	22.75	9.1
Southwest	S08	36	64.25	1.3
Southwest	S09	39	78	42.8
Southwest	S10	56	185.25	18.9
Southwest	S11	53	153	4.9
Southwest	S12A	44	80.5	4.9
Southwest	S13	17	12.75	2.0
Southwest	S14	62	263.5	16.4
Southwest	S15	22	27.75	1.7
Southwest	S16	67	238.75	9.1
Southwest	S17	25	32.75	3.8
Southwest	S18	51	188.25	45.1
Southwest	S19	29	33.5	1.8
Southwest	S20	78	517.5	145.6
Southwest	S21	22	22	1.0
Southwest	S22	40	85	15.5
Southwest	S23	59	182.25	10.7
Southwest	S24	41	81.25	5.3
Southwest	S25	45	113.5	12.6
Southwest	S26	69	376.25	133.5
Southwest	S30	7	5.5	0.4
Southwest	S31	57	175	32.4
Southwest	S32	14	14	1.3
Southwest	S33	70	349.75	132.0
Southwest	S36A	66	323	59.8
Southwest	S37	60	239	24.1
Southwest	S38	28	48.75	30.1
Southwest	S42	50	185.25	97.9
Southwest	S42A	74	530.25	177.8
Southwest	S44	43	125	59.4
Southwest	S45	41	104.25	139.0
Southwest	S46	25	48	13.5
Southwest	S50	61	326.75	1067.6

Table 4 - July 2018 PWD Rain Gage Records

Date/RG	RG1	RG2	RG3	RG4	RG5	RG6	RG7	RG8	RG9	RG10	RG11	RG12	RG13	RG14	RG15	RG16	RG17	RG18
7/1/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/2/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/3/2018	0.192	0.57	0.58	1	0.82	1.09	0.646	0.73	1.32	0.61	0.94	1.32	0.89	0.27	0.03	0.76	0.4	0.1
7/4/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/5/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/6/2018	0.11	0.08	0.23	0.11	0.16	0.53	0.15	0.25	0.45	0.51	0.24	0.09	0.21	0.2	0.16	0.25	0.12	0.29
7/7/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/8/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/9/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/10/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/11/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/12/2018	0.486	0.32	0	0	0.01	0	0.64	0	0	0	0	0	0	0.34	0.28	0.03	0	0
7/13/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.26	0	0	0
7/14/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/15/2018	0.476	0.37	0.68	0.59	0.55	0.63	0.45	0.5	0.46	0.76	0.538	0.33	0.58	0.53	0.44	0.48	0.49	0.38
7/16/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/17/2018	0.044	0.09	0.7	0.2	0.16	0.24	0.21	0.59	0.14	0.66	0.485	0.22	0.56	0.26	0.14	0.14	0.23	0.43
7/18/2018	0	0.1	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0
7/19/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/20/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/21/2018	0.67	1.18	0.98	1.08	1.06	0.93	0.84	0.88	0.92	0.92	0.82	0.36	0.98	0.84	0.64	0.82	0.81	0.7
7/22/2018	0.191	0.18	0.24	0.37	0.19	0.24	0.08	0.14	0.19	0.27	0.12	0.13	0.14	0.06	0.11	0.17	0.12	0.19
7/23/2018	0.006	0.02	0.03	0.05	0.1	0	0.03	0.02	0	0.01	0.04	0.08	0.01	0.02	0	0.02	0.01	0.13
7/24/2018	0.12	0.12	0.06	0.13	0.14	0.06	0.05	0.08	0.11	0.05	0.09	0.1	0.01	0.1	0	0.11	0.02	0.17
7/25/2018	1.02	1.2	0.86	0.6	1.38	0.57	1.54	1.48	0.93	1.28	1.46	1.21	1.18	1.3	0.68	1.31	1.15	0.9
7/26/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/27/2018	0.13	0.22	1.08	0.16	0.2	0.13	0.32	0.33	0.26	0.17	0.32	0.26	0.64	0.25	0.13	0.21	0.3	0.16
7/28/2018	0	0	0	0	0	0	0	0.01	0	0	0	0	0	0	0	0	0	0
7/29/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

7/30/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/31/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 5 - July 2018 PWD Rain Gage Records

Date/RG	RG19	RG20	RG21	RG22	RG23	RG24	RG25	RG26	RG27	RG28	RG29	RG30	RG31	RG32	RG33	RG34	RG35	RG36	RG37
7/1/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
7/2/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
7/3/2018	0.489	0.16	0.17	1.58	0.03	0.16	1.47	0.02	0.55	0.08	0.03	1.22	0.7	0.13	0.2	0.44	0.63		
7/4/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
7/5/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
7/6/2018	0.294	0.32	0.39	0.25	0.06	0.81	0.12	0.18	0.17	1.2	0.38	0.24	0.8	1.28	0.11	0.42	0.5		
7/7/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
7/8/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
7/9/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
7/10/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
7/11/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
7/12/2018	0.031	0	0	0	0.57	0	0.04	0.2	0	0	0	0	0	0	0.12	0	0		
7/13/2018	0.002	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
7/14/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
7/15/2018	0.555	0.68	0.69	0.26	0.5	0.66	0.481	0.451	0.64	0.8	0.81	0.64	0.95	0.52	0.38	0.5	0.52		
7/16/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
7/17/2018	0.429	0.34	0.2	0.1	0.02	0.62	0.19	0.1	0.42	0.5	0.76	0.5	0.79	1.45	0.22	0.1	0.17		

7/18/2018	0.005	0	0.01	0	0	0.01	0	0	0	0	0	0	0	0	0	0	0		
7/19/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
7/20/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
7/21/2018	0.803	0.84	0.84	0.53	0.56	0.6	0.66	0.87	0.86	1	0.9	0.75	0.91	0.95	0.76	0.772	0.96		
7/22/2018	0.183	0.17	0.24	0.13	0.2	0.22	0.09	0.13	0.46	0.23	0.22	0.17	0.31	0.26	0.25	0.198	0.28		
7/23/2018	0.067	0.15	0.08	0.02	0	0.08	0.06	0.04	0.04	0.16	0.15	0	0.01	0.17	0.01	0.11	0.01		
7/24/2018	0.127	0.06	0.22	0.09	0.12	0.13	0.13	0.16	0.63	0.06	0.13	0.07	0.11	0.11	0.23	0.55	0.21		
7/25/2018	1.036	1.4	0.45	0.25	1.14	0.93	1.26	1.12	0.64	0.99	1.13	1.28	1.61	1.1	0.43	0.44	0.42		
7/26/2018	0.001	0	0.01	0.01	0	0	0	0	0	0	0	0	0	0.01	0	0	0		
7/27/2018	0.187	0.5	0.11	0.13	0.11	0.18	0.16	0.28	1.25	0.26	0.09	0.13	0.13	0.15	0.18	0.11	0.11		
7/28/2018	0.001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
7/29/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
7/30/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
7/31/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		

Table 6 – August 2018 PWD Rain Gage Records

Date/RG	RG1	RG2	RG3	RG4	RG5	RG6	RG7	RG8	RG9	RG10	RG11	RG12	RG13	RG14	RG15	RG16	RG17	RG18
8/1/2018	0.34	0.36	0.25	0.43	0.45	0.21	0.262	0.26	0.23	0.2	0.24	0.48	0.24	0.41	0.35	0.34	0.25	0.22
8/2/2018	0.04	0.02	0.04	0.01	0.06	0.11	0.01	0.06	0.11	0.05	0.07	0.14	0.03	0.04	0.034	0.02	0.02	0.03
8/3/2018	0.36	0.88	0.19	0.21	0.28	0.54	0.25	0.16	0.99	0.77	0.27	0.56	0.29	0.21	0.31	0.34	0.44	0.47
8/4/2018	0.13	0.36	0.03	0.2	0.13	0.14	0.06	0.03	0.09	0.05	0.03	0.18	0.02	0.13	0.153	0.25	0.07	0.08
8/5/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8/6/2018	0.1	0.58	0	0	0.77	0.04	0	0	0.11	0	0	0	0	0	0.064	0	0	0
8/7/2018	0.06	0.08	0.03	0.13	0.05	0.07	0.079	0.06	0.07	0.04	0.06	0.04	0.04	0.07	0.059	0.05	0.05	0.06
8/8/2018	0.01	0.02	0	0	0.01	0.01	0	0.01	0.01	0	0	0.01	0	0	0.006	0.01	0	0
8/9/2018	0.07	0.06	0.03	0.05	0.08	0.05	0.041	0.04	0.06	0.03	0.04	0.06	0.03	0.07	0.065	0.07	0.04	0.05
8/10/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8/11/2018	0.59	1.2	1.5	0.76	0.72	1.09	1.656	1.78	0.93	1.97	1.91	0.46	1.56	0.68	0.82	0.68	1.26	0.98
8/12/2018	0	0.99	0.01	0	0	0.94	0.015	0.01	1.25	0.02	0.01	0	0.09	0	0.067	0.03	0.01	0.26
8/13/2018	0.93	1.75	1.66	1.65	1.75	2.38	2.346	2.46	2.18	1.71	1.86	1.83	1.54	2.86	2.117	1.66	1.97	2.31
8/14/2018	0.15	0.04	0.44	0.3	0.28	0.72	0.636	0.66	0.49	0.29	0.58	0.55	0.58	0.77	0.463	0.21	0.56	0.67
8/15/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8/16/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8/17/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8/18/2018	0.27	0.32	0.22	0.22	0.42	0.23	0.23	0.24	0.63	0.35	0.23	0.34	0.25	0.33	0.365	0.48	0.26	0.23
8/19/2018	1.08	1.5	0.62	0.16	0.74	0.33	0.21	0.49	0.33	0.03	0.46	0.46	0.37	0.24	0.452	0.63	0.2	0.59
8/20/2018	0.02	0.02	0	0	0	0	0	0	0	0	0	0.04	0.01	0	0	0	0	0
8/21/2018	0.04	0.58	0.09	0.1	0.01	0.22	0.05	0.08	0.1	0.117	0.08	0.01	0.06	0.02	0.05	0.05	0.05	0.13
8/22/2018	0.04	0.04	0.03	0.04	0.06	0.02	0.05	0.03	0.03	0.032	0.04	0.06	0.03	0.05	0.045	0.04	0.05	0.03
8/23/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8/24/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8/25/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8/26/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8/27/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8/28/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8/29/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8/30/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8/31/2018	0.16	0.13	0.92	0.78	0.18	0.307	2.19	1.39	0.28	1.013	1.63	0.22	1.03	0.38	0.747	0.53	1.45	0.76

Table 7 - August 2018 PWD Rain Gage Records

Date/RG	RG19	RG20	RG21	RG22	RG23	RG24	RG25	RG26	RG27	RG28	RG29	RG30	RG31	RG32	RG33	RG34	RG35	RG36	RG37
8/1/2018	0.194	0.271	0.15	0.23	0.44	0.227	0.402	0.284	0.3	0.23	0.11	0.16	0.205	0.14	0.23	0.16	0.18		
8/2/2018	0.056	0.113	0.08	0.104	0.04	0.112	0.057	0.032	0.07	0.17	0.08	0.05	0.054	0.29	0.07	0.06	0.18		
8/3/2018	0.432	0.301	0.5	0.838	0.42	0.39	0.405	0.332	0.4	0.22	0.27	0.59	0.634	0.68	0.49	0.2	0.54		
8/4/2018	0.107	0.09	0.13	0.115	0.14	0.105	0.168	0.105	0.02	0.14	0.3	0.08	0.058	0.24	0.17	0.26	0.24		
8/5/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
8/6/2018	0.016	0	0.09	0.101	0	0	0.378	0.02	0	0	0	0	0	0	0.01	0	0		
8/7/2018	0.057	0.155	0.06	0.071	0.06	0.025	0.055	0.064	0.15	0.19	0.06	0.05	0.045	0.01	0.09	0.08	0.06		
8/8/2018	0.005	0.004	0.009	0.011	0.01	0	0.011	0.005	0.01	0	0.01	0.01	0.001	0	0.02	0.03	0.02		
8/9/2018	0.041	0.023	0.059	0.057	0.06	0.026	0.071	0.055	0.02	0.02	0.05	0.02	0.03	0.04	0.06	0.05	0.06		
8/10/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
8/11/2018	1.414	0.987	1.81	0.991	0.71	1.148	0.718	1.054	0.97	0.96	1.64	1.46	1.771	0.46	1.24	1.17	1.75		
8/12/2018	0.193	0.008	0.48	1.111	0	0	0.119	0.144	0.01	0	0.02	0	0.027	0.34	0.8	0.11	0.5		
8/13/2018	1.955	1.269	1.35	2.211	0.65	1.343	1.552	2.151	1.14	1.262	1.53	1.78	1.684	0.78	1.97	3.56	1.93		
8/14/2018	0.462	0.459	0.43	0.51	0.64	0.17	0.28	0.524	0.52	0.281	0.08	0.26	0.307	0.11	0.03	0.19	0.24		

8/15/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
8/16/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
8/17/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
8/18/2018	0.241	0.234	0.21	0.504	0.26	0.16	0.374	0.295	0.24	0.189	0.19	0.27	0.29	0.11	0.37	0.23	0.19		
8/19/2018	0.403	0.146	0.27	0.402	0.43	0.02	0.796	0.421	0.12	0.089	0.07	0.37	0.127	0.05	1.1	1.32	0.52		
8/20/2018	0	0.001	0	0.001	0.01	0.01	0.011	0	0	0.006	0	0	0.001	0	0.02	0	0.01		
8/21/2018	0.137	0.131	0.23	0.143	0.04	0.1	0.076	0.073	0.1	0.17	0.21	0.12	0.11	0.17	0.16	0.26	0.22		
8/22/2018	0.027	0.034	0.02	0.027	0.05	0.03	0.049	0.04	0.04	0.03	0.02	0.03	0.031	0.02	0.04	0.04	0.02		
8/23/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
8/24/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
8/25/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
8/26/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
8/27/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
8/28/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
8/29/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
8/30/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		

8/31/2018	0.921	0.87	0.72	0.31	0.11	0.45	0.233	1.176	1.03	0.77	0.5	1.03	0.872	0.84	0.85	0.73	0.53		

Table 8 – September 2018 PWD Rain Gage Records

Date/RG	RG1	RG2	RG3	RG4	RG5	RG6	RG7	RG8	RG9	RG10	RG11	RG12	RG13	RG14	RG15	RG16	RG17	RG18
9/1/2018	0.04	0	0.03	0.08	0.02	0.001	0.04	0.09	0	0.036	0.05	0.1	0.03	0.09	0.045	0	0.13	0.09
9/2/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9/3/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9/4/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9/5/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9/6/2018	0.05	0.11	0	0	0.037	0.011	0	0	0	0	0	0.04	0	0	0.004	0	0	0
9/7/2018	2.52	1.72	0.93	1.34	2.175	1.099	0.76	0.35	1.25	0.38	0.5	2.25	1.31	0.75	1.147	1.8	0.48	0.53
9/8/2018	0.9	1.23	0.88	0.77	0.755	1.384	1.66	1.42	1.45	1.14	1.15	0.7	1.06	1.04	1.197	1.07	1.25	1.81
9/9/2018	1.68	1.75	1.36	1.46	1.147	1.482	1.39	1.34	1.6	1.47	1.33	1.07	1.48	1.4	1.494	1.69	1.29	1.42
9/10/2018	0.29	0.32	0.33	0.46	0.234	0.288	0.32	0.34	0.32	0.37	0.32	0.22	0.41	0.36	0.344	0.37	0.3	0.37
9/11/2018	0	0.01	0.01	0.01	0.002	0.29	0	0	0.01	0.01	0.01	0	0.01	0.01	0.01	0.01	0	0.01
9/12/2018	0	0.12	0.22	0.1	0.039	3.056	0.66	0.68	3.57	0.16	0.54	0.05	0.3	0.04	0.303	0.17	0.3	0.85
9/13/2018	0	0	0	0	0	0	0	0	0	0.01	0	0	0.01	0	0.001	0	0	0.02
9/14/2018	0	0.01	0	0.01	0	0	0	0.01	0.01	0.01	0.01	0	0	0	0.003	0.01	0.01	0
9/15/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9/16/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9/17/2018	0.04	0.1	0.19	0.21	0.017	0.098	0.13	0.17	0.1	0.159	0.12	0.01	0.11	0.06	0.078	0.05	0.08	0.1
9/18/2018	0.16	0.25	1.39	1.14	0.266	0.621	0.92	1.52	0.63	1.255	1.46	0.13	1.3	1.6	1.315	1.44	1.31	1.1
9/19/2018	0	0	0	0	0	0	0	0	0	0.001	0.01	0	0	0.001	0.001	0	0	0.01
9/20/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9/21/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9/22/2018	0	0	0	0	0.018	0.009	0	0	0.01	0	0	0.02	0	0	0.004	0.01	0	0
9/23/2018	0.69	0.82	0.56	0.75	0.67	0.696	0.66	0.61	0.76	0.47	0.59	0.65	0.62	0.75	0.756	0.88	0.6	0.62
9/24/2018	0.07	0.07	0.07	0.07	0.034	0.083	0.08	0.06	0.09	0.05	0.06	0.03	0.07	0.06	0.065	0.07	0.06	0.07
9/25/2018	0.82	0.64	1.74	1.99	1.041	1.005	1.25	1.48	1.07	2.25	1.58	1.07	1.7	1.68	1.27	0.89	1.43	1.55
9/26/2018	0.17	0.31	0.32	0.29	0.228	0.476	0.42	0.45	0.49	0.361	0.43	0.2	0.37	0.395	0.407	0.43	0.35	0.38
9/27/2018	0.04	0.03	0.06	0.04	0.031	0.061	0.05	0.08	0.06	0.059	0.07	0.03	0.05	0.04	0.045	0.04	0.03	0.08
9/28/2018	0.88	1.02	1.33	1.31	0.803	1.116	1.13	1.32	1.13	1.295	1.32	0.77	1.29	1.05	1.063	1.02	1.13	1.06
9/29/2018	0	0.01	0.01	0	0	0	0	0	0	0.008	0.01	0	0.01	0	0	0	0	0.01
9/30/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 9 - September 2018 PWD Rain Gage Records

Date/RG	RG19	RG20	RG21	RG22	RG23	RG24	RG25	RG26	RG27	RG28	RG29	RG30	RG31	RG32	RG33	RG34	RG35	RG36	RG37
9/1/2018	0.05	0.029	0	0	0.02	0.01	0.028	0.052	0.06	0	0.01	0.04	0.029	0	0	0	0.01		
9/2/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
9/3/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
9/4/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
9/5/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
9/6/2018	0.001	0	0	0.06	0.02	0.01	0.046	0.002	0	0	0	0	0.001	0	0.39	0.11	0		
9/7/2018	0.488	0.769	0.71	0.51	2.95	0.62	2.119	0.862	0.74	0.74	0.23	0.18	0.486	0.21	0.73	0.23	0.63		
9/8/2018	1.554	1.041	1.87	0.93	0.51	0.93	0.946	1.445	0.78	1.3	1.52	1.26	1.109	0.92	1.51	1.96	1.76		
9/9/2018	1.357	1.384	1.4	0.88	1.41	1.15	1.535	1.44	1.3	1.46	1.32	1.22	1.396	1.42	1.66	1.52	1.48		
9/10/2018	0.331	0.366	0.3	0.18	0.21	0.27	0.289	0.338	0.37	0.36	0.27	0.34	0.348	0.4	0.31	0.32	0.28		
9/11/2018	0.013	0.015	0.03	0.01	0	0.01	0.006	0.009	0.01	0.02	0.01	0	0.008	0.02	0	0.06	0.02		
9/12/2018	0.543	0.919	0.11	1.16	0	0.842	0.142	0.569	0.36	1.58	0.68	0.14	0.24	0.63	1.19	0.23	0.2		
9/13/2018	0.012	0.005	0.01	0	0	0.008	0	0.004	0	0.01	0.02	0.01	0.008	0.02	0.01	0.01	0.01		
9/14/2018	0.004	0.001	0	0.01	0	0.007	0.002	0.003	0	0	0	0.01	0.007	0.04	0	0.01	0.01		
9/15/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
9/16/2018	0.001	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0		

9/17/2018	0.106	0.332	0.09	0.1	0.03	0.23	0.047	0.103	0.27	0.43	0.07	0.11	0.178	0.29	0.15	0.15	0.08		
9/18/2018	0.846	1.217	0.34	0.617	0.19	0.74	0.474	1.166	1.26	1.23	0.43	0.45	0.939	0.77	0.65	0.47	0.41		
9/19/2018	0.004	0	0.01	0	0	0	0	0.002	0	0	0	0	0.001	0.01	0	0	0		
9/20/2018	0	0	0	0	0	0.01	0	0	0	0	0	0	0.001	0.02	0	0	0		
9/21/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
9/22/2018	0	0	0	0.01	0.03	0	0.009	0.002	0	0	0	0	0	0	0	0	0		
9/23/2018	0.557	0.495	0.47	0.44	0.69	0.42	0.736	0.685	0.53	0.43	0.52	0.44	0.482	0.33	0.79	0.65	0.54		
9/24/2018	0.057	0.056	0.04	0.06	0.06	0.03	0.058	0.066	0.06	0.05	0.051	0.04	0.049	0.09	0.09	0.07	0.06		
9/25/2018	1.541	2.02	1.46	0.52	0.41	2.09	0.827	1.328	1.68	2.33	1.582	1.73	2.079	2.4	0.68	1.053	1.4		
9/26/2018	0.388	0.251	0.4	0.45	0.19	0.25	0.267	0.408	0.291	0.24	0.382	0.35	0.326	0.2	0.48	0.42	0.4		
9/27/2018	0.078	0.065	0.1	0.057	0.03	0.05	0.035	0.056	0.052	0.07	0.08	0.08	0.063	0.11	0.03	0	0.1		
9/28/2018	1.103	1.385	0.97	1.095	0.85	1.44	0.916	1.109	1.328	1.4	1.093	1.08	1.307	1.49	0.96	0	1.06		
9/29/2018	0.004	0.001	0.01	0	0.01	0	0.002	0.002	0.004	0	0.006	0	0.004	0.01	0	0	0		
9/30/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		

Table 10 - October 2018 PWD Rain Gage Records

Date/RG	RG1	RG2	RG3	RG4	RG5	RG6	RG7	RG8	RG9	RG10	RG11	RG12	RG13	RG14	RG15	RG16	RG17	RG18
10/1/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10/2/2018	0.53	0.44	0.31	0.3	0.335	0.506	0.33	0.26	0.53	0.278	0.18	0.32	0.26	0.32	0.35	0.42	0.25	0.22
10/3/2018	0	0.01	0	0	0.001	0	0	0	0	0.006	0	0	0	0	0.004	0.01	0.01	0
10/4/2018	0.11	0.18	0.08	0.08	0.128	0.22	0.1	0.28	0.23	0.191	0.34	0.12	0.31	0.04	0.139	0.19	0.42	0.05
10/5/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10/6/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10/7/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10/8/2018	0.02	0.05	0.04	0.02	0.015	0.051	0.04	0.06	0.05	0.044	0.04	0.01	0.05	0.02	0.043	0.06	0.03	0.06
10/9/2018	0	0	0.02	0.02	0.052	0	0.03	0.03	0	0.023	0.03	0.06	0.02	0.024	0.015	0	0.03	0.01
10/10/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10/11/2018	0.63	0.97	0.94	0.77	1.207	1.218	1.027	1.03	1.23	0.922	1.16	1.22	0.89	1.05	1.129	1.23	0.87	1.21
10/12/2018	0.36	0.32	0.35	0.49	0.314	0.296	0.339	0.34	0.3	0.333	0.32	0.31	0.33	0.39	0.347	0.34	0.33	0.24
10/13/2018	0.06	0.06	0.07	0.06	0.069	0.071	0.068	0.07	0.07	0.07	0.07	0.07	0.07	0.06	0.063	0.06	0.06	0.08
10/14/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10/15/2018	0.13	0.16	0.16	0.12	0.114	0.123	0.156	0.16	0.12	0.162	0.16	0.11	0.15	0.12	0.137	0.15	0.14	0.12
10/16/2018	0	0.01	0	0	0	0.01	0.008	0.01	0.01	0.001	0	0	0	0.01	0.004	0	0	0.01
10/17/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10/18/2018	0	0	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10/19/2018	0	0	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10/20/2018	0.09	0.11	0.09	0.09	0.074	0.108	0.098	0.1	0.11	0.1	0.09	0.07	0.09	0.102	0.103	0.11	0.11	0.09
10/21/2018	0.01	0	0	0	0.014	0.01	0	0	0.01	0	0	0.01	0	0.002	0.04	0.06	0	0.02
10/22/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10/23/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10/24/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10/25/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10/26/2018	0.285	0.29	0.19	0.2	0.171	0.269	0.209	0.21	0.29	0.2	0.2	0.16	0.19	0.207	0.25	0.27	0.2	0.26
10/27/2018	1.199	1.23	1.22	1.2	0.544	1.195	1.188	1.21	1.3	1.35	1.18	0.46	1.25	1.123	1.143	1.19	1.05	1.08
10/28/2018	0.009	0.01	0.01	0.01	0	0.01	0.009	0.01	0.01	0.02	0.01	0	0.01	0.009	0.002	0	0.01	0.01
10/29/2018	0.009	0.01	0	0	0.01	0	0.009	0.01	0	0	0.01	0.01	0.01	0.009	0.009	0.01	0.01	0
10/30/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10/31/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 11 - October 2018 PWD Rain Gage Records

Date/RG	RG19	RG20	RG21	RG22	RG23	RG24	RG25	RG26	RG27	RG28	RG29	RG30	RG31	RG32	RG33	RG34	RG35	RG36	RG37
10/1/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
10/2/2018	0.248	0.293	0.19	0.513	0.525	0.19	0.44	0.312	0.289	0.3	0.249	0.3	0.256	0.41	0.35	0.352	0.19		
10/3/2018	0.003	0.065	0.01	0	0	0.08	0.004	0.002	0.016	0.08	0.008	0.01	0.034	0.08	0.01	0.006	0		
10/4/2018	0.16	0.044	0.05	0.222	0.113	0	0.145	0.141	0.096	0.03	0.169	0.31	0.149	0.02	0.19	0.169	0.12		
10/5/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.004	0		
10/6/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
10/7/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
10/8/2018	0.055	0.031	0.05	0.048	0.02	0.03	0.034	0.045	0.031	0.03	0.056	0.06	0.042	0.05	0.06	0.057	0.07		
10/9/2018	0.025	0.028	0.06	0	0	0.03	0.012	0.017	0.021	0.03	0.033	0.03	0.029	0.05	0	0.006	0.01		
10/10/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
10/11/2018	1.053	0.913	1.05	1.205	0.646	0.78	0.969	1.132	0.868	0.94	0.989	0.81	0.866	0.8	1	1.04	1.02		
10/12/2018	0.264	0.377	0.23	0.298	0.358	0.32	0.336	0.31	0.391	0.37	0.266	0.25	0.318	0.38	0.25	0.266	0.22		
10/13/2018	0.076	0.069	0.1	0.069	0.06	0.07	0.064	0.069	0.065	0.07	0.08	0.07	0.069	0.08	0.08	0.08	0.1		
10/14/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
10/15/2018	0.15	0.173	0.21	0.124	0.129	0.24	0.135	0.136	0.157	0.23	0.173	0.16	0.194	0.36	0.16	0.159	0.18		

10/16/2018	0.008	0	0.01	0.009	0	0	0.002	0.006	0.001	0.01	0.009	0.01	0.003	0.01	0	0.008	0.02		
10/17/2018	0.001	0	0.01	0	0	0	0	0	0	0	0.003	0	0	0	0	0.001	0		
10/18/2018	0	0	0	0	0	0	0	0	0.002	0	0	0	0	0	0	0	0		
10/19/2018	0	0	0	0	0	0	0	0	0.002	0	0	0	0	0	0	0	0		
10/20/2018	0.087	0.09	0.08	0.109	0.08	0.08	0.092	0.098	0.09	0.09	0.087	0.08	0.093	0.1	0.12	0.108	0.1		
10/21/2018	0.016	0	0.05	0.009	0	0	0.017	0.025	0	0	0.019	0	0	0.01	0	0.01	0.02		
10/22/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
10/23/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
10/24/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
10/25/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
10/26/2018	0.236	0.18	0.25	0.16	0.275	0.16	0.239	0.244	0.19	0.19	0.227	0.21	0.195	0.21	0.34	0.252	0.28		
10/27/2018	1.116	1.1	1.11	0.69	1.12	1.01	0.972	1.141	1.179	1.29	1.137	1.07	1.256	1.36	1.18	1.019	1.2		
10/28/2018	0.01	0.01	0.02	0.01	0.008	0.01	0.003	0.006	0.011	0.01	0.014	0.01	0.016	0.02	0.01	0.009	0.01		
10/29/2018	0.002	0	0	0	0.009	0	0.009	0.006	0.002	0.01	0.003	0	0.001	0	0.01	0.005	0.01		
10/30/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
10/31/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		

Table 12 - November 2018 PWD Rain Gage Records

Date/RG	RG1	RG2	RG3	RG4	RG5	RG6	RG7	RG8	RG9	RG1	RG1	RG1	RG1	RG1	RG1	RG1	RG1	RG1
11/1/2018	0.02	0	0	0	0.01	0	0	0	0	0	0	0.02	0	0	0.00	0	0	0
11/2/2018	0.66	0.68	0.26	0.12	0.27	0.65	0.33	0.5	0.68	0.41	0.46	0.24	0.31	0.32	0.36	0.54	0.25	0.69
11/3/2018	0.29	0.3	0.55	0.49	0.29	0.26	0.43	0.42	0.3	0.52	0.46	0.29	0.54	0.4	0.36	0.34	0.39	0.3
11/4/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11/5/2018	0.52	0.53	0.55	0.6	0.39	0.59	0.49	0.55	0.56	0.53	0.52	0.37	0.55	0.51	0.53	0.58	0.48	0.6
11/6/2018	1.07	1.09	1.1	1.57	1.41	0.82	1.04	1.1	0.91	1.01	1.08	1.46	1.05	1.00	1.35	1.15	1.14	0.87
11/7/2018	0.00	0.01	0.01	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0
11/8/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11/9/2018	0.72	0.83	0.88	0.88	0.66	0.87	0.78	0.8	0.93	0.91	0.8	0.64	0.82	0.76	0.75	0.87	0.76	0.79
11/10/201	0	0	0	0	0	0.01	0	0	0	0	0	0	0	0.01	0	0	0.01	0
11/11/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11/12/201	0.19	0.23	0.19	0.17	0.17	0.23	0.21	0.21	0.23	0.22	0.2	0.17	0.21	0.2	0.20	0.21	0.18	0.2
11/13/201	0.99	1.1	0.96	1.09	0.84	1.05	0.97	0.95	1.06	0.98	0.94	0.81	0.96	0.97	1.01	1.1	0.92	0.99
11/14/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11/15/201	0.66	0.72	1.14	0.99	1.03	1.03	1.16	1.17	1.04	1.05	1.18	0.88	1.14	1.11	1.07	1.08	1.16	1.08
11/16/201	0.27	0.27	0.43	0.38	0.31	0.31	0.32	0.32	0.31	0.44	0.32	0.29	0.39	0.33	0.32	0.32	0.33	0.32
11/17/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11/18/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11/19/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11/20/201	0.00	0	0	0	0	0	0	0	0	0	0	0.01	0	0	0	0	0	0
11/21/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11/22/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11/23/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11/24/201	1.82	1.99	2.42	2.59	2.28	2.22	2.26	2.24	2.34	2.37	2.21	1.91	2.38	2.37	2.30	2.4	2.26	2
11/25/201	0.01	0.01	0.42	0.49	0.05	0.01	0.14	0.12	0	0.35	0.18	0.02	0.35	0.16	0.09	0.03	0.27	0.01
11/26/201	0.88	0.86	0.86	0.89	0.87	0.96	0.81	0.88	0.94	0.9	0.84	0.72	0.93	0.78	0.87	1	0.8	0.84
11/27/201	0	0	0	0	0	0	0	0	0	0	0.01	0	0	0	0	0	0	0
11/28/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.05	0	0	0
11/29/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11/30/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0	0	0

Table 13 - November 2018 PWD Rain Gage Records

Date/RG	RG19	RG20	RG21	RG22	RG23	RG24	RG25	RG26	RG27	RG28	RG29	RG30	RG31	RG32	RG33	RG34	RG35	RG36	RG37
11/1/2018	0.001	0	0	0.1	0	0	0.011	0.001	0	0	0.001	0	0	0	0	0	0		
11/2/2018	0.632	0.2	0.8	0.32	0.592	0.31	0.483	0.411	0.233	0.22	0.622	0.66	0.58	0.51	0.5	0.546	0.91		
11/3/2018	0.321	0.49	0.25	0.15	0.291	0.56	0.305	0.363	0.52	0.62	0.346	0.26	0.51	0.63	0.25	0.238	0.23		
11/4/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
11/5/2018	0.546	0.53	0.58	0.32	0.514	0.42	0.498	0.534	0.539	0.5	0.536	0.46	0.55	0.48	0.58	0.499	0.59		
11/6/2018	0.871	1.37	0.72	0.48	1.078	0.95	1.185	1.212	1.24	0.98	0.847	0.72	0.81	0.79	0.88	0.717	0.71		
11/7/2018	0.001	0	0	0	0	0	0.002	0.004	0.002	0	0.001	0	0	0	0	0	0		
11/8/2018	0	0	0	0	0	0	0	0	0.1	0	0.001	0	0	0	0	0.01	0		
11/9/2018	0.808	0.87	0.88	0.49	0.7	0.81	0.77	0.782	0.82	0.84	0.834	0.77	0.91	0.93	0.84	0.749	0.86		
11/10/2018	0.001	0.01	0.01	0	0	0.01	0	0	0	0	0.003	0	0	0	0	0.01	0.01		
11/11/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
11/12/2018	0.197	0.17	0.2	0.13	0.19	0.18	0.203	0.206	0.18	0.19	0.194	0.17	0.18	0.18	0.24	0.23	0.21		
11/13/2018	0.93	0.95	0.9	0.58	0.97	0.76	0.988	0.987	0.89	0.89	0.913	0.82	0.94	0.94	1	0.83	0.91		
11/14/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		

11/15/2018	1.109	0.93	1.027	0.972	0.66	0.05	0.954	1.087	0.936	0.621	0.969	1.168	0.484	0.182	0.742	0.889	1.02		
11/16/2018	0.343	0.27	0.353	0.312	0.27	0.71	0.304	0.32	0.383	0.439	0.403	0.327	0.578	0.657	0.279	0.307	0.332		
11/17/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
11/18/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
11/19/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
11/20/2018	0	0	0	0	0.01	0	0.002	0	0	0	0	0	0	0	0	0	0		
11/21/2018	0.002	0	0	0	0	0	0	0	0	0	0.02	0	0	0	0	0	0		
11/22/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
11/23/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
11/24/2018	2.099	2.28	2.25	1.27	1.82	2.08	2.194	2.226	2.08	2.24	2.05	1.9	2.3	2.31	2.22	1.78	2.32		
11/25/2018	0.067	0.52	0.01	0	0.01	0.44	0.038	0.094	0.44	0.57	0.03	0.07	0.37	0.48	0	0.24	0.01		
11/26/2018	0.818	0.87	0.86	0.53	0.81	0.76	0.866	0.857	1.02	0.85	0.75	0.71	0.83	0.83	0.97	0.74	0.81		
11/27/2018	0	0	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0		
11/28/2018	0	0	0	0	0	0	0.001	0.029	0	0	0	0	0	0	0	0	0		
11/29/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
11/30/2018	0	0	0	0	0	0	0	0.006	0	0	0	0	0	0	0	0	0		

Table 14 – December 2018 PWD Rain Gage Records

Date/RG	RG1	RG2	RG3	RG4	RG5	RG6	RG7	RG8	RG9	RG10	RG11	RG12	RG13	RG14	RG15	RG16	RG17	RG18
12/1/2018	0.059	0.084	0.12	0.09	0.07	0.12	0.08	0.11	0.1	0.14	0.12	0.06	0.13	0.06	0.03	0.07	0.09	0.13
12/2/2018	0.5	0.541	0.63	0.63	0.6	0.58	0.55	0.65	0.62	0.66	0.6	0.41	0.62	0.53	0.34	0.63	0.56	0.61
12/3/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0	0	0	0
12/4/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12/5/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12/6/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12/7/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12/8/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12/9/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12/10/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12/11/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12/12/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12/13/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12/14/2018	0.08	0.077	0.08	0.07	0.1	0.1	0.08	0.09	0.08	0.11	0.08	0.09	0.08	0.08	0.04	0.08	0.07	0.09
12/15/2018	0.361	0.329	0.16	0.21	0.45	0.27	0.16	0.15	0.29	0.17	0.16	0.3	0.16	0.25	0.17	0.32	0.15	0.19
12/16/2018	0.783	0.901	1.04	1.01	1.26	1.13	0.79	0.96	1.17	1.08	1.01	0.58	1.09	0.9	0.61	1.12	0.97	0.85
12/17/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12/18/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12/19/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12/20/2018	0.454	0.472	0.43	0.43	0.6	0.53	0.44	0.47	0.55	0.46	0.44	0.42	0.44	0.43	0.27	0.51	0.39	0.57
12/21/2018	1.014	0.986	1.02	0.68	1.16	0.99	1.1	1.12	1.2	1.15	1.09	1.01	1.05	1.03	0.67	1.28	1.04	1.27
12/22/2018	0.08	0.088	0.04	0.03	0.03	0.08	0.03	0.06	0.1	0.04	0.05	0.03	0.04	0.04	0.02	0.09	0.04	0.08
12/23/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12/24/2018	0.02	0.026	0.02	0.02	0.02	0.03	0.04	0.04	0.04	0.05	0.04	0.02	0.04	0.04	0.02	0.03	0.03	0.03
12/25/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12/26/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12/27/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12/28/2018	1.596	1.58	1.83	1.75	1.85	1.53	1.76	1.71	1.78	1.64	1.64	1.55	1.78	1.86	1.11	1.82	1.72	1.69
12/29/2018	0.009	0.005	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

12/30/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12/31/2018	0.683	0.713	0.92	0.89	0.81	0.88	0.85	0.84	0.87	0.88	0.81	0.66	0.85	0.85	0.48	0.83	0.82	0.89

Table 15 - December 2018 PWD Rain Gage Records

Date/RG	RG19	RG20	RG21	RG22	RG23	RG24	RG25	RG26	RG27	RG28	RG29	RG30	RG31	RG32	RG33	RG34	RG35	RG36	RG37
12/1/2018	0.122	0.15	0.15	0.06	0.06	0.12	0.068	0.057	0.15	0.14	0.12	0.117	0.14	0.11	0.1	0.14	0.14		
12/2/2018	0.568	0.64	0.55	0.36	0.5	0.55	0.561	0.437	0.67	0.65	0.42	0.612	0.65	0.62	0.62	0.47	0.49		
12/3/2018	0	0	0	0	0	0.01	0	0	0	0	0	0	0	0	0	0	0.01		
12/4/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
12/5/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
12/6/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
12/7/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
12/8/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
12/9/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
12/10/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
12/11/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
12/12/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
12/13/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
12/14/2018	0.092	0.08	0.1	0.04	0.08	0.11	0.08	0.07	0.08	0.09	0.11	0.087	0.11	0.13	0.08	0.08	0.1		
12/15/2018	0.176	0.15	0.2	0.18	0.36	0.13	0.38	0.24	0.15	0.17	0.13	0.157	0.15	0.17	0.37	0.29	0.25		
12/16/2018	0.977	1.02	1.14	0.62	0.76	1	1.06	1.14	0.94	1.15	1.05	1.001	1.11	1.19	0.9	0.78	1.13		
12/17/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		

12/18/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
12/19/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
12/20/2018	0.5	0.42	0.55	0.3	0.45	0.41	0.49	0.5	0.41	0.45	0.49	0.43	0.48	0.5	0.51	0.53	0.53		
12/21/2018	1.174	0.75	1.26	0.57	1.01	1.06	1.09	1.08	0.88	0.9	1.42	1.01	1.32	1.18	0.97	0.97	1.16		
12/22/2018	0.073	0.05	0.1	0.05	0.08	0.04	0.08	0.05	0.04	0.04	0.1	0.06	0.06	0.06	0.12	0.13	0.13		
12/23/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
12/24/2018	0.036	0.03	0.05	0.01	0.02	0.04	0.02	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05		
12/25/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
12/26/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
12/27/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
12/28/2018	1.566	1.78	1.55	0.68	1.59	1.58	1.7	1.65	1.76	1.59	1.31	1.35	1.53	1.41	1.78	1.34	1.52		
12/29/2018	0	0	0	0	0.01	0	0	0	0	0	0	0	0	0	0.01	0.01	0		
12/30/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
12/31/2018	0.839	0.9	0.91	0.47	0.68	0.92	0.72	0.75	0.85	0.89	0.83	0.74	0.94	0.98	0.75	0.75	0.9		

Table 16 - January 2019 PWD Rain Gage Records

Date/RG	RG1	RG2	RG3	RG4	RG5	RG6	RG7	RG8	RG9	RG10	RG1	RG12	RG13	RG14	RG15	RG1	RG17	RG18
1/1/2019	0.08	0.07	0.09	0.1	0.09	0.09	0.1	0.09	0.11	0.08	0.08	0.08	0.09	0.1	0.06	0.09	0.09	0.09
1/2/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1/3/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1/4/2019	0.02	0.01	0.03	0	0.02	0.04	0.01	0.02	0.02	0.06	0.02	0.02	0.03	0	0	0	0.01	0.03
1/5/2019	0.50	0.57	0.5	0.58	0.86	0.52	0.74	0.78	0.58	0.66	0.69	0.56	0.6	0.66	0.46	0.68	0.6	0.57
1/6/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1/7/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1/8/2019	0.23	0.3	0.26	0.22	0.25	0.26	0.23	0.23	0.25	0.28	0.24	0.21	0.23	0.22	0.11	0.24	0.22	0.12
1/9/2019	0.01	0.01	0	0.01	0.02	0.01	0.01	0.01	0	0	0	0.01	0	0.01	0	0	0	0
1/10/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1/11/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1/12/201	0.04	0.03	0	0	0.03	0.02	0	0	0.02	0	0	0.03	0	0.00	0.02	0.03	0	0.00
1/13/201	0.05	0.04	0.05	0.03	0.05	0.03	0.05	0.06	0.04	0.05	0.06	0.05	0.05	0.04	0.04	0.05	0.05	0.01
1/14/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1/15/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1/16/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1/17/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1/18/201	0.04	0.03	0.04	0.02	0.04	0.03	0.04	0.05	0.03	0.04	0.05	0.04	0.04	0.04	0.03	0.04	0.04	0.03
1/19/201	0.54	0.62	0.58	0.66	0.73	0.65	0.55	0.58	0.64	0.62	0.58	0.44	0.63	0.59	0.35	0.62	0.55	0.64
1/20/201	0.63	0.74	0.83	0.82	0.9	0.8	0.7	0.74	0.82	0.77	0.75	0.67	0.76	0.76	0.44	0.7	0.73	0.76
1/21/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1/22/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1/23/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1/24/201	1.25	1.25	1.3	0.66	1.22	1.38	1.25	1.29	1.46	1.27	1.27	1.01	1.25	1.11	0.71	1.26	1.14	1.06
1/25/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1/26/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1/27/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1/28/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1/29/201	0.17	0.17	0.19	0.2	0.19	0.18	0.21	0.21	0.19	0.21	0.19	0.19	0.2	0.2	0.1	0.18	0.2	0.17
1/30/201	0	0	0	0.01	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0
1/31/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 17 - January 2019 PWD Rain Gage Records

Date/RG	RG19	RG20	RG21	RG22	RG23	RG24	RG25	RG26	RG27	RG28	RG29	RG30	RG31	RG32	RG33	RG34	RG35	RG36	RG37
1/1/2019	0.04	0.1	0.08	0.06	0.08	0.08	0.09	0.09	0.09	0.09	0.07	0.07	0.07	0.08	0.07	0.08	0.09	0.086	0.08
1/2/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1/3/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1/4/2019	0.03	0.03	0.06	0.01	0.03	0.07	0.01	0.01	0.02	0.06	0.05	0.05	0.08	0.1	0.02	0.05	0.05	0.06	0.04
1/5/2019	0.34	0.62	0.73	0.32	0.48	0.47	0.56	0.88	0.47	0.6	0.53	0.62	0.77	0.65	0.62	0.57	0.78	0.57	0.7
1/6/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1/7/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1/8/2019	0.15	0.29	0.3	0.11	0.22	0.28	0.23	0.2	0.24	0.25	0.27	0.21	0.29	0.28	0.25	0.24	0.26	0.252	0.24
1/9/2019	0	0.01	0.01	0	0.01	0	0.01	0.01	0	0	0.01	0	0	0.02	0.02	0.01	0.02	0.01	0.02
1/10/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1/11/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1/12/2019	0	0	0	0.026	0.04	0	0.033	0.024	0	0	0	0	0	0	0.038	0.021	0.006	0.003	0.039
1/13/2019	0	0	0	0.041	0.05	0.05	0.05	0.046	0.025	0.02	0.006	0.049	0.047	0.046	0.05	0.039	0.017	0.007	0.05
1/14/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1/15/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1/16/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1/17/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

1/18/2019	0.03	0	0.027	0.036	0.04	0.06	0.04	0.04	0.022	0.024	0.035	0.046	0.049	0.054	0.04	0.037	0.034	0.03	0.04
1/19/2019	0.35	0.6	0.7	0.36	0.52	0.55	0.59	0.6	0.6	0.6	0.63	0.54	0.66	0.66	0.6	0.61	0.67	0.64	0.57
1/20/2019	0.44	0.802	0.8	0.45	0.61	0.78	0.63	0.73	0.78	0.82	0.75	0.63	0.82	0.85	0.76	0.72	0.76	0.755	0.78
1/21/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1/22/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1/23/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1/24/2019	0.69	1.152	1.72	0.85	1.16	1.18	1.22	1.24	1.17	1.19	1.56	1.14	1.33	1.32	1.42	1.58	1.79	1.461	1.21
1/25/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1/26/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1/27/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1/28/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1/29/2019	0.1	0.21	0.17	0.1	0.15	0.22	0.16	0.18	0.21	0.22	0.16	0.18	0.2	0.23	0.19	0.16	0.19	0.173	0.19
1/30/2019	0	0.01	0	0	0	0	0.01	0	0	0	0.01	0	0.01	0	0	0.01	0	0.01	0
1/31/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 18 – February 2019 PWD Rain Gage Records

Date/RG	RG1	RG2	RG3	RG4	RG5	RG6	RG7	RG8	RG9	RG10	RG1	RG12	RG13	RG14	RG15	RG1	RG17	RG18
2/1/2019	0	0	0.01	0	0	0	0	0	0	0	0.02	0	0	0	0	0.02	0	0
2/2/2019	0.03	0	0	0	0.03	0.06	0.03	0.04	0.01	0.03	0	0.03	0.01	0.01	0.01	0	0	0.01
2/3/2019	0	0.04	0	0.02	0.02	0	0	0	0	0.01	0	0.01	0.02	0	0	0	0.02	0.03
2/4/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2/5/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2/6/2019	0.24	0.26	0.28	0.29	0.28	0.29	0.3	0.3	0.3	0.29	0.28	0.24	0.3	0.23	0.14	0.26	0.25	0.28
2/7/2019	0.07	0.08	0.09	0.11	0.07	0.1	0.1	0.08	0.1	0.1	0.09	0.07	0.1	0.07	0.05	0.08	0.09	0.09
2/8/2019	0.03	0.04	0.01	0.05	0.04	0.04	0.03	0.04	0.04	0.06	0.04	0.04	0.03	0.05	0.03	0.05	0.03	0.04
2/9/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2/10/201	0.05	0.04	0.03	0.01	0.05	0.03	0.02	0.02	0.04	0.02	0.03	0.04	0.03	0.03	0.04	0.05	0.02	0.00
2/11/201	0.27	0.24	0.17	0.17	0.20	0.18	0.19	0.20	0.19	0.17	0.2	0.23	0.17	0.18	0.2	0.2	0.19	0.13
2/12/201	0.91	0.92	1.08	1.10	1.08	0.82	1.02	1.04	1.00	1.07	1.07	1.00	1.07	1.00	1.08	1.11	1.06	0.30
2/13/201	0.04	0.04	0.04	0.05	0.04	0.06	0.05	0.05	0.04	0.04	0.05	0.04	0.04	0.05	0.04	0.04	0.04	0.11
2/14/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2/15/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2/16/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2/17/201	0.19	0.2	0.15	0.16	0.23	0.16	0.16	0.15	0.18	0.15	0.15	0.21	0.16	0.17	0.11	0.19	0.15	0.18
2/18/201	0.14	0.16	0.08	0.13	0.18	0.12	0.12	0.11	0.14	0.09	0.1	0.15	0.1	0.14	0.08	0.14	0.11	0.12
2/19/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2/20/201	0.57	0.57	0.63	0.47	0.63	0.50	0.59	0.6	0.58	0.61	0.61	0.60	0.62	0.57	0.62	0.64	0.60	0.25
2/21/201	0.03	0.02	0.03	0.18	0.03	0.08	0.02	0.02	0.04	0.02	0.02	0.03	0.02	0.04	0.03	0.03	0.02	0.17
2/22/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2/23/201	0.04	0.05	0.03	0.04	0.08	0.05	0.04	0.04	0.06	0.04	0.04	0.02	0.04	0.04	0.03	0.06	0.04	0.05
2/24/201	0.33	0.4	0.38	0.41	0.46	0.43	0.38	0.4	0.4	0.45	0.4	0.3	0.4	0.39	0.24	0.41	0.38	0.41
2/25/201	0	0	0	0	0	0.11	0	0.01	0	0	0	0	0	0	0	0	0	0
2/26/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2/27/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2/28/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 19 - February 2019 PWD Rain Gage Records

Date/RG	RG19	RG20	RG21	RG22	RG23	RG24	RG25	RG26	RG27	RG28	RG29	RG30	RG31	RG32	RG33	RG34	RG35	RG36	RG37
2/1/2019	0	0	0	0	0.02	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2/2/2019	0.02	0.02	0.03	0.03	0.01	0	0.02	0.05	0.02	0.02	0.02	0.04	0.03	0.03	0.07	0.04	0.07	0.01	0.07
2/3/2019	0	0.01	0.02	0.01	0	0	0.01	0	0	0	0.01	0	0	0	0	0.01	0	0	0.03
2/4/2019	0	0	0	0	0	0	0	0	0	0	0	0.04	0	0	0	0	0	0	0
2/5/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2/6/2019	0.15	0.24	0.25	0.17	0.24	0.21	0.24	0.26	0.25	0.27	0.23	0.26	0.26	0.33	0.26	0.17	0.28	0.267	0.26
2/7/2019	0.06	0.09	0.12	0.06	0.07	0.05	0.07	0.1	0.09	0.08	0.07	0.1	0.06	0.06	0.08	0.18	0.11	0.102	0.07
2/8/2019	0.03	0.04	0.05	0.02	0.05	0.06	0.04	0.04	0.04	0.05	0.06	0.05	0.07	0.09	0.04	0.05	0.07	0.049	0.04
2/9/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2/10/2019	0	0	0.002	0.043	0.05	0	0.05	0.043	0.013	0	0.003	0.024	0.011	0.002	0.049	0.037	0.013	0.007	0.05
2/11/2019	0.12	0.16	0.12	0.2	0.27	0.15	0.221	0.192	0.159	0.157	0.126	0.185	0.16	0.153	0.256	0.202	0.143	0.133	0.263
2/12/2019	0.08	1.17	0.169	0.957	0.91	1.05	1.049	1.01	1.116	1.126	0.219	0.931	1.025	1.053	0.93	0.813	0.362	0.269	0.93
2/13/2019	0.13	0.06	0.122	0.049	0.04	0.07	0.04	0.049	0.053	0.064	0.119	0.061	0.063	0.068	0.043	0.061	0.105	0.114	0.04
2/14/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2/15/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2/16/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2/17/2019	0.09	0.13	0.16	0.1	0.19	0.12	0.2	0.15	0.14	0.12	0.13	0.14	0.13	0.09	0.2	0.07	0.16	0.27	0.21

2/18/2019	0.05	0.11	0.09	0.08	0.15	0.07	0.15	0.13	0.1	0.1	0.08	0.09	0.09	0.09	0.14	0.18	0.11	0.17	0.17
2/19/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2/20/2019	0.15	0.22	0.19	0.572	0.57	0.56	0.619	0.591	0.432	0.354	0.215	0.546	0.558	0.538	0.576	0.501	0.283	0.238	0.577
2/21/2019	0.21	0.44	0.191	0.047	0.03	0.02	0.03	0.047	0.224	0.273	0.189	0.042	0.036	0.053	0.033	0.068	0.156	0.172	0.03
2/22/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2/23/2019	0.02	0.03	0.03	0.04	0.03	0.03	0.05	0.05	0.04	0.03	0.03	0.03	0.04	0.04	0.05	0.05	0.03	0.039	0.05
2/24/2019	0.25	0.4	0.46	0.23	0.36	0.38	0.37	0.41	0.39	0.4	0.41	0.38	0.48	0.5	0.39	0.39	0.44	0.417	0.35
2/25/2019	0	0	0	0.02	0	0	0	0	0	0	0	0	0	0	0	0	0.26	0	0
2/26/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2/27/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2/28/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0	0	0	0	0

Table 20 – March 2019 PWD Rain Gage Records

Date/RG	RG1	RG2	RG3	RG4	RG5	RG6	RG7	RG8	RG9	RG10	RG1	RG12	RG13	RG14	RG15	RG1	RG17	RG18
3/1/2019	0.35	0.35	0.23	0.26	0.39	0.29	0.25	0.26	0.32	0.24	0.25	0.35	0.27	0.26	0.29	0.34	0.26	0.20
3/2/2019	0.29	0.35	0.39	0.48	0.38	0.4	0.38	0.39	0.41	0.4	0.38	0.26	0.44	0.34	0.23	0.36	0.40	0.33
3/3/2019	0.86	0.86	0.87	0.65	0.93	0.71	0.86	0.88	0.86	0.83	0.91	0.89	0.87	0.84	0.92	0.95	0.89	0.31
3/4/2019	0.12	0.11	0.23	0.41	0.09	0.18	0.12	0.12	0.12	0.24	0.11	0.10	0.19	0.16	0.10	0.09	0.12	0.34
3/5/2019	0.01	0	0	0	0	0	0	0	0	0.01	0	0	0	0	0	0	0	0
3/6/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3/7/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3/8/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3/9/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3/10/201	0.85	0.94	0.92	1.19	1.12	0.91	0.93	0.89	0.9	0.93	0.91	0.85	0.96	1.11	0.6	1	0.91	0.99
3/11/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3/12/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3/13/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3/14/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3/15/201	0.07	0.09	0.14	0.12	0.05	0.22	0.1	0.17	0.17	0.28	0.18	0.02	0.12	0.16	0.08	0.15	0.1	0.14
3/16/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3/17/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3/18/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3/19/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3/20/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3/21/201	0.78	0.82	1.02	0.95	0.96	1.1	0.88	1.03	1.00	1.15	0.98	0.59	1.06	0.84	0.55	0.97	0.84	1.2
3/22/201	0.36	0.38	0.36	0.6	0.42	0.54	0.48	0.53	0.44	0.39	0.49	0.14	0.36	0.33	0.17	0.49	0.48	0.28
3/23/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3/24/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3/25/201	0.14	0.18	0.08	0.1	0.15	0.2	0.11	0.11	0.17	0.12	0.11	0.14	0.09	0.09	0.06	0.14	0.09	0.13
3/26/201	0	0	0	0	0	0	0.01	0.01	0	0	0	0	0	0.01	0	0	0	0
3/27/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3/28/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3/29/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3/30/201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3/31/201	0.09	0.11	0.11	0.1	0.1	0.08	0.09	0.1	0.1	0.1	0.1	0.1	0.10	0.1	0.05	0.14	0.11	0.07

Table 21 - March 2019 PWD Rain Gage Records

Date/RG	RG19	RG20	RG21	RG22	RG23	RG24	RG25	RG26	RG27	RG28	RG29	RG30	RG31	RG32	RG33	RG34	RG35	RG36	RG37
3/1/2019	0.15	0.23	0.178	0.327	0.35	0.19	0.366	0.297	0.237	0.218	0.171	0.243	0.213	0.201	0.363	0.309	0.228	0.216	0.372
3/2/2019	0.21	0.41	0.297	0.405	0.28	0.34	0.37	0.4	0.37	0.384	0.268	0.373	0.367	0.35	0.37	0.38	0.385	0.369	0.294
3/3/2019	0.13	0.36	0.202	0.843	0.86	0.53	0.923	0.866	0.603	0.435	0.23	0.796	0.639	0.54	0.853	0.725	0.348	0.276	0.868
3/4/2019	0.41	0.7	0.379	0.129	0.12	0.44	0.099	0.126	0.467	0.595	0.38	0.168	0.352	0.444	0.126	0.186	0.325	0.352	0.117
3/5/2019	0	0	0	0	0	0	0	0	0	0	0.01	0	0	0.01	0	0	0	0	0
3/6/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3/7/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3/8/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3/9/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3/10/2019	0.52	0.9	0.92	0.51	0.86	0.91	0.93	0.85	0.9	0.96	0.84	0.78	0.98	0.97	0.87	0.75	0.89	0.894	0.86
3/11/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3/12/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3/13/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3/14/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3/15/2019	0.11	0.12	0.21	0.11	0.03	0.27	0.08	0.16	0.1	0.29	0.34	0.25	0.2	0.28	0.18	0.19	0.16	0.31	0.03
3/16/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

3/17/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3/18/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3/19/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3/20/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3/21/2019	0.75	0.99	1.21	0.57	0.741	0.91	0.83	1.02	0.96	1.1	1.26	0.97	1.25	1.14	0.82	0.855	1.16	1.126	0.72
3/22/2019	0.23	0.52	0.53	0.29	0.353	0.32	0.41	0.53	0.41	0.56	0.46	0.45	0.43	0.45	0.45	0.439	0.79	0.531	0.19
3/23/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3/24/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3/25/2019	0.07	0.07	0.17	0.1	0.139	0.07	0.14	0.13	0.08	0.09	0.1	0.11	0.11	0.08	0.19	0.154	0.18	0.163	0.16
3/26/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.001	0.01	0	0
3/27/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3/28/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3/29/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3/30/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3/31/2019	0.04	0.09	0.11	0.06	0.09	0.09	0.09	0.1	0.1	0.09	0.09	0.09	0.08	0.09	0.1	0.11	0.13	0.14	0.1

Table 22 - April 2019 PWD Rain Gage Records

Date/RG	RG1	RG2	RG3	RG4	RG5	RG6	RG7	RG8	RG9	RG10	RG11	RG12	RG13	RG14	RG15	RG16	RG17	RG18
4/1/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/2/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/3/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/4/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/5/2019	0.12	0.16	0.16	0.16	0.14	0.21	0.14	0.18	0.2	0.22	0.19	0.07	0.174	0.12	0.07	0.13	0.17	0.2
4/6/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/7/2019	0.02	0.02	0.01	0	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.03	0.01	0.01	0.01	0.02	0.009	0
4/8/2019	0.19	0.19	0.23	0.22	0.2	0.12	0.18	0.18	0.15	0.26	0.18	0.15	0.22	0.2	0.13	0.22	0.189	0.16
4/9/2019	0	0	0.2	0.08	0	0	0	0	0	0.07	0	0	0.127	0	0	0	0.019	0
4/10/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/11/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/12/2019	0.207	0.27	0.32	0.27	0.26	0.2	0.29	0.26	0.22	0.25	0.27	0.28	0.297	0.27	0.15	0.27	0.272	0.19
4/13/2019	0.068	0.1	0.06	0.04	0.06	0.08	0.08	0.06	0.08	0.1	0.05	0.07	0.062	0.05	0.04	0.11	0.06	0.06
4/14/2019	0.021	0.03	0.03	0.01	0.01	0.01	0.02	0.03	0.02	0.03	0.03	0.01	0.028	0.01	0.01	0.03	0.025	0.02
4/15/2019	0.553	0.9	0.97	0.81	0.82	0.52	0.66	0.8	0.93	0.96	0.81	0.65	0.916	0.88	0.33	0.72	0.79	0.65
4/16/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/17/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/18/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/19/2019	0.392	0.41	0.42	0.35	0.46	0.35	0.38	0.4	0.37	0.41	0.38	0.44	0.4	0.41	0.24	0.39	0.39	0.37
4/20/2019	0.74	0.62	0.89	0.78	0.97	0.6	0.9	0.83	0.64	0.91	0.87	0.87	0.97	0.86	0.56	0.77	0.896	0.81
4/21/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/22/2019	0	0.01	0.01	0.01	0	0.01	0	0	0.01	0.01	0	0	0.01	0	0	0	0.004	0
4/23/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/24/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/25/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/26/2019	0.82	0.81	1.2	1.09	0.99	0.88	1.04	1.04	0.88	1.12	1.1	0.96	1.22	1.15	0.65	0.47	1.125	0.91
4/27/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/28/2019	0.01	0.02	0	0.01	0.01	0.01	0.02	0.02	0.01	0	0.01	0	0.01	0.01	0.01	0.02	0.011	0.02
4/29/2019	0.03	0.03	0.03	0.04	0.05	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.02	0.03	0.032	0.03

4/30/2019	0.01	0.01	0.03	0.02	0	0.02	0.02	0.02	0.01	0.04	0.03	0.01	0.03	0.02	0.01	0.01	0.026	0.03

Table 23 – April 2019 PWD Rain Gage Records

Date/RG	RG19	RG20	RG21	RG22	RG23	RG24	RG25	RG26	RG27	RG28	RG29	RG30	RG31	RG32	RG33	RG34	RG35	RG36	RG37
4/1/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/2/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/3/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/4/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/5/2019	0.12	0.17	0.2	0.11	0.11	0.17	0.12	0.15	0.19	0.19	0.22	0.18	0.25	0.24	0.18	0.16	0.2	0.192	0.1
4/6/2019	0	0	0	0	0	0	0	0	0	0	0	0.01	0	0.01	0	0	0	0	0
4/7/2019	0	0.01	0.01	0.01	0.02	0.02	0.01	0.01	0	0.01	0.01	0.01	0.01	0.03	0.03	0.02	0.01	0.01	0.03
4/8/2019	0.13	0.25	0.22	0.09	0.15	0.28	0.2	0.15	0.24	0.28	0.32	0.25	0.3	0.4	0.16	0.13	0.2	0.3	0.16
4/9/2019	0	0.05	0	0	0	0	0	0	0.07	0.01	0.03	0.03	0.02	0.01	0	0	0	0	0
4/10/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/11/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/12/2019	0.13	0.36	0.3	0.12	0.19	0.333	0.21	0.27	0.37	0.31	0.3	0.2	0.4	0.44	0.21	0.23	0.3	0.38	0.29
4/13/2019	0.04	0.06	0.14	0.05	0.06	0.066	0.07	0.08	0.06	0.05	0.1	0.08	0.09	0.08	0.1	0.13	0.12	0.16	0.06
4/14/2019	0	0.01	0	0	0.02	0.018	0.02	0.02	0.02	0.02	0	0.02	0.01	0.01	0.02	0	0	0.01	0.02
4/15/2019	0.41	0.84	0.51	0.46	0.46	0.866	0.67	0.63	0.86	0.93	0.72	0.78	0.73	0.8	0.81	0.35	0.6	0.6	0.71
4/16/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/17/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/18/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

4/19/2019	0.18	0.42	0.28	0.22	0.34	0.34	0.39	0.36	0.42	0.4	0.3	0.35	0.43	0.48	0.33	0.27	0.27	0.57	0.45
4/20/2019	0.41	0.96	0.75	0.35	0.51	0.86	0.76	0.75	0.84	0.93	0.75	0.7	0.91	0.91	0.61	0.56	0.79	1.22	0.83
4/21/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/22/2019	0	0	0.01	0	0	0	0	0	0.03	0.02	0.01	0	0	0	0.01	0.01	0.01	0.03	0
4/23/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/24/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/25/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/26/2019	0.53	1.13	1.05	0.47	0.76	1.2	0.85	0.83	1.29	1.14	1.14	1.04	0.92	1.14	0.72	0.672	0.85	1.095	0.99
4/27/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/28/2019	0	0	0.01	0.01	0	0	0.01	0.01	0	0	0	0.01	0	0	0.02	0.01	0.02	0.014	0
4/29/2019	0.02	0.03	0.02	0.02	0.03	0.01	0.03	0.03	0.04	0.03	0.02	0.03	0.03	0.02	0.03	0.03	0.03	0.031	0.03
4/30/2019	0.01	0.04	0.03	0.01	0.01	0.04	0.01	0.02	0.03	0.04	0.03	0.03	0.04	0.04	0.01	0.01	0.03	0.026	0.01

Table 24 – May 2019 PWD Rain Gage Records

Date/RG	RG1	RG2	RG3	RG4	RG5	RG6	RG7	RG8	RG9	RG10	RG11	RG12	RG13	RG14	RG15	RG16	RG17	RG18
5/1/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5/2/2019	0	0	0	0.01	0	0	0	0	0	0.01	0	0	0	0	0	0	0	0
5/3/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5/4/2019	0	0	0.01	0	0	0.01	0	0	0	0.01	0.01	0	0.01	0	0	0	0	0.01
5/5/2019	1.32	1.38	1.44	1.42	1.46	1.36	1.13	1.29	1.36	1.46	1.3	0.76	1.43	1.35	0.84	1.165	1.326	1.28
5/6/2019	0	0	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5/7/2019	0.21	0.21	0.55	0.59	0.16	0.1	0.56	0.65	0.16	0.68	0.73	0.2	0.61	0.67	0.17	0.25	0.632	0.42
5/8/2019	0.36	0.37	0.02	0.24	0.31	0.19	0.3	0.1	0.23	0.01	0.11	0.35	0.07	0.15	0.12	0.25	0.115	0.17
5/9/2019	0.01	0.02	0.02	0.01	0.02	0.03	0.02	0.03	0.04	0.02	0.03	0.02	0.03	0.01	0	0.02	0.025	0.03
5/10/2019	0.03	0.03	0.04	0.01	0.04	0.02	0	0.03	0.02	0.01	0.02	0.02	0.03	0	0	0.02	0.02	0.01
5/11/2019	0.12	0.13	0.12	0.09	0.13	0.14	0.11	0.13	0.13	0.13	0.128	0.1	0.15	0.11	0.06	0.12	0.133	0.13
5/12/2019	1.26	1.12	1.39	1.52	1.58	1.259	1.13	1.19	1.22	1.27	1.215	0.67	1.41	1.25	0.76	1.31	1.302	1.2
5/13/2019	0.9	0.92	0.92	0.96	1.06	0.78	0.87	0.92	0.85	0.9	0.87	0.7	0.88	0.87	0.53	1.04	0.875	0.84
5/14/2019	0.05	0.02	0.03	0.06	0.03	0.05	0.03	0.03	0.04	0.03	0.032	0.03	0.04	0.03	0.02	0.06	0.035	0.03
5/15/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5/16/2019	0	0	0	0.05	0	0	0	0.01	0	0	0.03	0	0.06	0	0	0	0.031	0
5/17/2019	0	0.01	0.2	0.11	0.01	0.04	0.07	0.19	0.02	0.32	0.1	0	0.05	0.04	0.03	0.04	0.093	0.04
5/18/2019	0	0	0	0	0	0	0	0	0	0	0.01	0	0	0	0	0	0.003	0
5/19/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5/20/2019	0	0.01	0	0.03	0	0.02	0.03	0.03	0.1	0	0.01	0	0.01	0.02	0	0	0.014	0.02
5/21/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5/22/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5/23/2019	0.31	0.33	0.31	0.19	0.19	0.1	0.26	0.28	0.2	0.24	0.24	0.31	0.33	0.14	0.1	0.33	0.273	0.37
5/24/2019	0.01	0.02	0	0.01	0.01	0.11	0.06	0.02	0.01	0	0.01	0.01	0	0.23	0.02	0	0.022	0.05
5/25/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5/26/2019	0.04	0.07	0.02	0.02	0.02	0.02	0.02	0.03	0.04	0.04	0.03	0.06	0.03	0.01	0	0.03	0.026	0.02
5/27/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5/28/2019	0.4	0.53	0.35	0.25	0.33	0.37	0.47	0.49	0.47	0.34	0.44	0.33	0.36	0.44	0.18	0.44	0.405	0.36
5/29/2019	0.46	0.53	2.29	2.26	0.5	0.83	1.18	1.35	0.75	2.34	1.69	0.33	2.05	1.18	0.35	0.61	1.73	0.79
5/30/2019	0.1	0.2	0.56	1.73	0.1	1.16	1.07	0.84	0.97	0.49	0.66	0.09	0.6	1.11	0.38	0.62	0.712	1.04
5/31/2019	0	0	0	0	0	0	0	0	0.001	0	0	0	0	0	0	0	0	0

Table 25 - May 2019 PWD Rain Gage Records

Date/RG	RG19	RG20	RG21	RG22	RG23	RG24	RG25	RG26	RG27	RG28	RG29	RG30	RG31	RG32	RG33	RG34	RG35	RG36	RG37
5/1/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5/2/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5/3/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5/4/2019	0.01	0.02	0.01	0	0	0.01	0	0	0	0	0.01	0.02	0.02	0	0	0.03	0.03	0	0
5/5/2019	1.055	1.36	1.46	0.8	0.94	1.17	1.12	1.29	1.42	1.59	1.35	1.07	1.52	1.44	1.27	1.37	1.47	1.366	1.06
5/6/2019	0.002	0	0	0	0	0	0	0	0	0	0	0.01	0	0	0	0	0	0	0
5/7/2019	0.45	0.64	0.2	0.16	0.12	0.42	0.15	0.5	0.42	0.49	0.3	0.4	0.43	0.55	0.15	0.21	0.192	0.255	0.14
5/8/2019	0.04	0.04	0.12	0.12	0.34	0.01	0.29	0.24	0.01	0	0	0.03	0	0	0.27	0.17	0.17	0.161	0.38
5/9/2019	0.02	0	0.02	0.02	0.02	0	0	0.02	0.01	0.01	0.02	0.02	0.01	0.01	0.04	0.01	0.01	0	0.02
5/10/2019	0	0.01	0	0.02	0.03	0.02	0.03	0	0.04	0.01	0	0.02	0	0.06	0.03	0.02	0.02	0	0.02
5/11/2019	0.137	0.09	0.17	0.08	0.14	0.09	0.12	0.1	0.09	0.11	0.17	0.13	0.15	0.14	0.16	0.15	0.19	0.139	0.14
5/12/2019	1.168	1.33	1.3	0.73	0.96	0.94	1	1.22	1.43	1.4	1.05	1.02	1.32	1.2	1.11	1.33	1.37	1.27	0.97
5/13/2019	0.786	0.83	0.73	0.46	0.84	0.75	0.83	0.85	0.79	0.86	0.66	0.7	0.81	0.84	0.78	0.75	0.75	0.772	0.88
5/14/2019	0.03	0.06	0.03	0.02	0.01	0.05	0.04	0.03	0.04	0.09	0.03	0.04	0.04	0.09	0.03	0.01	0.04	0.035	0.04
5/15/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5/16/2019	0.008	0	0.03	0	0	0	0	0	0	0	0.01	0.01	0	0	0	0	0.01	0.009	0

5/17/2019	0	0.42	0	0.01	0.05	0.29	0	0.06	0.35	0.38	0.17	0.12	0.35	0.1	0.03	0	0.07	0.08	0.02
5/18/2019	0	0	0	0	0	0.01	0	0	0.01	0	0	0.01	0	0.01	0	0	0	0	0
5/19/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5/20/2019	0	0	0	0.07	0	0	0	0.06	0	0	0	0	0	0	0	0	0	0	0
5/21/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5/22/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5/23/2019	0.22	0.15	0.48	0.21	0.48	0.19	0.25	0.12	0.22	0.24	0.2	0.35	0.16	0.32	0.36	0.2	0.38	0.321	0.35
5/24/2019	0	0	0.01	0.01	0.01	0	0.01	0.14	0	0	0	0.01	0.01	0	0.01	0.01	0.01	0.035	0.01
5/25/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0	0	0	0
5/26/2019	0.02	0.02	0.04	0.02	0.12	0.01	0.05	0	0.01	0.03	0.05	0.04	0.06	0.05	0.13	0.07	0.07	0.04	0.08
5/27/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5/28/2019	0.16	0.4	0.27	0.29	0.38	0.33	0.35	0.26	0.33	0.32	0.22	0.37	0.19	0.17	0.66	0.5	0.3	0.321	0.39
5/29/2019	0.84	1.74	1.43	0.41	0.21	2.24	0.51	0.84	1.96	2.16	1.28	1.611	2	1.99	0.48	0.648	1.11	1.008	0.24
5/30/2019	0.18	1.3	0.14	0.51	0.08	0.39	0.1	1.1	0.8	0.63	0.36	0.19	0.38	0.67	0.35	0.535	0.25	0.604	0.1
5/31/2019	0	0	0.01	0	0	0	0.01	0	0	0.01	0	0.01	0.01	0	0	0	0	0.002	0

Table 26 - June 2019 PWD Rain Gage Records

Date/RG	RG1	RG2	RG3	RG4	RG5	RG6	RG7	RG8	RG9	RG10	RG11	RG12	RG13	RG14	RG15	RG16	RG17	RG18
6/1/2019	0	0	0	0	0	0.059	0	0	0.024	0	0	0	0	0.03	0.03	0.03	0	0
6/2/2019	0.05	0.08	0.06	0.16	0.04	0.072	0.14	0.1	0.087	0.06	0.05	0.25	0.06	0.25	0.07	0.05	0	0.13
6/3/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/4/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/5/2019	0.43	0.31	0.54	0.73	0.59	0.416	0.26	0.54	0.42	0.36	0.59	0.96	0.6	0.43	0.23	0.26	0.527	0.38
6/6/2019	0.01	0.01	0.24	0.06	0	0.033	0.05	0.06	0.03	0.33	0.08	0	0.09	0.01	0.01	0.01	0.086	0.04
6/7/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/8/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/9/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/10/2019	0.32	0.34	0.53	0.39	0.3	0.59	0.36	0.37	0.42	0.48	0.36	0.19	0.49	0.39	0.21	0.47	0.36	0.41
6/11/2019	0.07	0.05	0.07	0.14	0.18	0.03	0.04	0.02	0.03	0.1	0.04	0.09	0.03	0.05	0.02	0.05	0.05	0.01
6/12/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/13/2019	1.78	2.17	2.51	2.13	1.94	2.28	2.19	2.12	2.17	2.09	2.22	1.66	2.57	1.71	0.94	1.94	2.09	1.86
6/14/2019	0	0	0	0	0	0	0	0	0	0.01	0	0	0	0	0	0	0	0
6/15/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/16/2019	0.28	0.34	0.28	0.23	0.31	0.43	0.19	0.25	0.42	0.46	0.34	0.26	0.25	0.24	0.19	0.33	0.22	0.34
6/17/2019	0.49	0.28	0.02	0.04	0.43	0.01	0	0.03	0.11	0.03	0.02	0.72	0.01	0.05	0.06	0.02	0.01	0.01
6/18/2019	0	0.01	0.01	0	0	0.01	0.01	0	0	0.16	0	0	0	0	0	0.01	0	0.01
6/19/2019	0.393	0.21	1.21	0.65	0.56	0.112	0.32	0.26	0.09	0.79	0.33	0.9	0.64	0.43	0.27	0.24	1.12	0.09
6/20/2019	2.89	2.3	0.96	0.96	2.92	1.506	1.02	1.03	1.35	1.13	0.95	4.34	0.83	1.48	1.07	1.93	1.02	1.21
6/21/2019	0.1	0.1	0.16	0.13	0.1	0.05	0.07	0.16	0.04	0.1	0.12	0.08	0.15	0.21	0.08	0.06	0.28	0.08
6/22/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/23/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/24/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/25/2019	0	0	0.08	0	0	0.08	0.01	0.27	0	0.36	0.24	0	0.12	0	0	0	0	0.19
6/26/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/27/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/28/2019	0.16	0	0	0.02	0.74	0	0	0	0	0	0	0.49	0	0.01	0.12	0.19	0	0
6/29/2019	0.36	0.21	0.07	0.05	0.65	0.12	0.06	0.07	0.04	0.1	0.07	0.14	0.07	0.12	0.09	0.19	0.05	0.06
6/30/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 27 - June 2019 PWD Rain Gage Records

Date/RG	RG19	RG20	RG21	RG22	RG23	RG24	RG25	RG26	RG27	RG28	RG29	RG30	RG31	RG32	RG33	RG34	RG35	RG36	RG37
6/1/2019	0.01	0	0.14	0.017	0.02	0	0	0	0	0	0	0	0	0	0	0.03	0.1	0.072	0
6/2/2019	0.01	0.04	0.02	0.086	0.31	0.22	0.04	0.2	0.12	0.26	0.22	0	0.27	0.25	0.1	0.04	0.05	0.065	0.45
6/3/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/4/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/5/2019	0.15	0.55	0.4	0.409	0.33	0.35	0.5	0.33	0.48	0.29	0.44	0.491	0.34	0.31	0.31	0.25	0.38	0.374	0.99
6/6/2019	0.07	0.41	0.13	0.029	0	0.34	0.01	0.03	0.24	0.34	0.39	0.121	0.37	0.18	0.01	0.05	0.07	0.074	0
6/7/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/8/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/9/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/10/2019	0.37	0.36	0.85	0.645	0.2	0.52	0.22	0.3	0.38	0.43	0.496	0.394	0.51	0.75	0.33	0.503	0.77	0.64	0.22
6/11/2019	0.04	0.11	0.1	0.031	0.12	0.06	0.03	0.03	0.07	0.07	0.053	0.042	0.05	0.04	0.04	0.047	0.08	0.04	0.2
6/12/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/13/2019	1.18	2.25	1.21	1.85	1.51	1.72	1.67	1.8	2.22	2.23	1.547	2.099	1.67	1.31	1.63	1.849	1.42	2.38	1.61
6/14/2019	0	0.01	0	0	0	0	0	0	0	0	0	0.001	0	0	0.01	0.002	0	0	0
6/15/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/16/2019	0.15	0.38	0.22	0.31	0.05	0.27	0.3	0.31	0.33	0.31	0.245	0.299	0.32	0.5	0.35	0.348	0.42	0.4	0.11

6/17/2019	0.01	0.01	0.02	0.07	0.29	0.02	0.42	0.02	0	0.02	0.025	0.021	0.05	0	0.06	0.087	0.06	0.03	0.59
6/18/2019	0	0.13	0.01	0	0	0.32	0.01	0.01	0.03	0.66	0.029	0.024	0.24	0.14	0.01	0.006	0.01	0	0
6/19/2019	0.04	1.4	0.07	0.09	0.42	1.42	0.33	0.03	1.3	1.49	0.47	0.21	0.88	1.7	0.17	0.116	0.14	0.12	1
6/20/2019	0.74	0.75	1.68	1.539	3.01	0.93	2.93	1.34	0.79	0.72	2.327	1.44	1.28	1.41	1.71	1.93	1.77	1.72	4.39
6/21/2019	0.07	0.11	0.14	0.046	0.08	0.05	0.1	0.06	0.15	0.05	0.103	0.2	0.05	0.07	0.1	0.05	0.08	0.05	0.1
6/22/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/23/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/24/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/25/2019	0.07	0.22	0	0.02	0	0.41	0	0.01	0.14	0.1	0.108	0.27	0.18	0.23	0	0	0	0	0
6/26/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/27/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/28/2019	0	0	0.01	0	0.18	0	0.14	0	0	0	0.007	0	0	0.09	0	0	0	0	0.19
6/29/2019	0.19	0.07	0.26	0.03	0.06	0.06	0.45	0.09	0.08	0.08	0.153	0.09	0.1	0.19	0.13	0.04	0.29	0.01	0.21
6/30/2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0	0

Table 28 - Rain Gage records by year and month for FY19

Date/RG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Jul18	3.445	4.45	5.44	4.29	4.77	4.42	4.956	5.01	4.78	5.24	5.153	4.1	5.2	4.17	2.87	4.3	3.65
Aug18	4.39	8.93	6.06	5.04	5.99	7.407	8.085	7.76	7.89	6.672	7.51	5.44	6.17	6.26	6.167	5.39	6.68
Sep18	8.35	8.52	9.43	10.03	7.517	11.776	9.47	9.92	12.55	9.494	9.56	7.34	10.13	9.326	9.552	9.95	8.75
Oct18	3.442	3.85	3.48	3.38	3.048	4.087	3.611	3.78	4.26	3.7	3.79	2.93	3.63	3.486	3.778	4.1	3.52
Nov18	8.159	8.641	9.77	10.27	8.645	9.024	8.954	9.266	9.311	9.693	9.2	7.841	9.644	9.043	9.311	9.62	8.964
Dec18	5.639	5.802	6.29	5.81	6.95	6.24	5.88	6.2	6.8	6.38	6.04	5.13	6.28	6.08	3.76	6.78	5.88
Jan19	3.59	3.867	3.87	3.324	4.401	4.036	3.909	4.06	4.182	4.044	3.93	3.315	3.886	3.747	2.342	3.89	3.639
Feb19	2.94	3.093	3.027	3.208	3.439	3.053	3.075	3.121	3.159	3.183	3.1	3.032	3.137	3	2.725	3.28	3.037
Mar19	3.932	4.212	4.35	4.873	4.602	4.639	4.233	4.5	4.519	4.7	4.42	3.459	4.483	4.252	3.066	4.63	4.215
Apr19	3.181	3.58	4.56	3.89	3.99	3.06	3.78	3.87	3.58	4.42	3.96	3.57	4.504	4.02	2.23	3.19	4.018
May19	5.58	5.9	8.27	9.57	5.95	6.589	7.31	7.61	6.611	8.3	7.665	3.98	8.15	7.61	3.56	6.305	7.772
Jun19	7.333	6.41	6.74	5.69	8.76	5.798	4.72	5.28	5.231	6.56	5.41	10.08	5.91	5.41	3.39	5.78	5.813
Total	**42.711**	**46.317**	**52.189**	**49.22**	**48.73**	**47.802**	**51.146**	**52.806**	**48.426**	**53.425**	**51.355**	**45.311**	**53.151**	**46.936**	**46.92**	**49.87**	**53.42**

Date/RG	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
Jul18	4.21	4.62	3.41	3.35	3.31	4.4	4.661	3.551	5.66	5.28	4.6	5	6.32	6.13	2.89	3.64	3.81
Aug18	6.661	5.096	6.598	7.737	4.07	4.316	5.755	6.775	5.14	4.727	5.14	6.28	6.247	4.28	7.72	8.45	7.19
Sep18	9.038	10.351	8.33	7.089	7.61	9.117	8.484	9.651	9.095	11.65	8.274	7.48	9.061	9.38	9.63	7.263	8.45
Oct18	3.51	3.373	3.48	3.466	3.343	3	3.473	3.69	3.411	3.68	3.522	3.38	3.521	3.94	3.77	3.551	3.55
Nov18	8.746	9.46	8.84	5.664	7.915	8.04	8.804	9.119	9.383	8.96	8.52	8.035	9.042	8.919	8.501	7.785	8.922
Dec18	6.123	5.97	6.56	3.34	5.6	5.97	6.249	6.004	5.96	6.11	6.02	5.604	6.53	6.39	6.25	5.53	6.41
Jan19	2.17	3.824	4.597	2.363	3.39	3.74	3.633	4.05	3.627	3.874	4.081	3.535	4.326	4.29	4.078	4.127	4.667
Feb19	1.36	3.12	2.004	2.628	2.99	2.77	3.159	3.122	3.067	3.044	1.911	2.919	3.013	3.107	3.117	2.822	2.592
Mar19	2.62	4.39	4.206	3.344	3.823	4.07	4.238	4.479	4.227	4.722	4.149	4.23	4.621	4.555	4.322	4.099	4.606
Apr19	1.98	4.33	3.53	1.92	2.66	4.203	3.35	3.31	4.46	4.36	3.95	3.72	4.14	4.61	3.24	2.582	3.43
May19	5.126	8.41	6.45	3.94	4.73	6.92	4.86	6.83	7.93	8.33	5.88	6.181	7.46	7.64	5.87	6.013	6.442
Jun19	3.1	6.8	5.26	5.172	6.58	6.69	7.15	4.56	6.33	7.05	6.613	5.702	6.31	7.17	4.96	5.348	5.65
Total	**54.644**	**69.744**	**63.265**	**50.013**	**56.021**	**63.236**	**63.816**	**65.141**	**68.29**	**71.787**	**62.66**	**62.066**	**70.591**	**70.411**	**64.348**	**61.21**	**65.71**

Table 29 - SSO Statistics for Period July 1 2018 – June 30 2019

Main & Shurs					
Event No.	**Start of Overflow Date Time**	**End of Overflow Date Time**	**Event Duration (hours:mins)**	**Flow Volume (ft^3)**	**Flow Volume (Millions of gallons)**
0			0	0	0

PC-30					
Event No.	**Start of Overflow Date**	**End of Overflow Date**	**Event Duration (hours:mins)**	**Flow Volume (ft^3)**	**Flow Volume (Millions of gallons)**
1	11/24/18 23:35	11/25/18 3:37	4:02	167987	1.257

Appendix E – PCB PMP 12th Annual Report

PCB

Pollutant Minimization Plan

Twelfth Annual Report

Calendar Year 2018

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1 PMP Achievement Executive Summary

The Philadelphia Water Department (PWD) submitted its PCB Pollutant Minimization Plan (PCB PMP) on September 30, 2005 and was issued a Completeness Determination letter on January 12, 2006. PWD initiated the actions called for in its PCB PMP on March 4, 2006.

PWD's PCB PMP set out the following approaches to achieving PCB minimization:

- Sample three Water Pollution Control Plants' effluent every two years and analyze using Method 1668A.

- Visit and inspect three hundred ninety-nine (399) sites listed by either EPA or other agencies as housing PCB-containing devices and report the number of devices that have been removed from each site, both prior to our inspection and subsequent to it.

- Visit and inspect thirty-one (31) sites listed by the Philadelphia Department of Public Health as having previously undergone some type of PCB remediation activity and report the number of sites removed from the list as posing no threat of PCB discharge to PWD's sewer system.

- Report any reductions in PCB concentrations in the wastestreams from our three Water Treatment Plants by measuring PCBs in the ferric chloride used in the treatment process as well as reductions of PCBs in the source water (Delaware River or Schuylkill River).

- Continue the sewershed PCB trackdown sampling program for each of our three Water Pollution Control Plants.

Revisions to the original PMP have been made over the years. Refer to the First through the Eleventh Annual Reports for specific information on PMP efforts during Years 1 - 11. No changes to the PMP were made in Year 12 (2018). Year 12 efforts are detailed in the attached report.

During the twelfth year of PWD's PCB PMP, the following activities occurred:

- ❖ Wet-weather PCB sampling and analysis of the three Water Pollution Control Plants' (WPCPs') effluent was performed as required by PWD's NPDES permits. See Section 7, "Tabular Summary", for data. In 2018, PWD began using a new laboratory, Suburban Testing Labs, for this analysis.

- ❖ PWD inspected 85 of the 337 sites remaining on list identified by EPA or other agencies as housing PCB-containing devices. This exceeds the goal of 70 site inspections per year. (In 2016, PWD increased its goal of 50 site inspections per year to 70 inspections per year, and a schedule was developed to plan site inspections through calendar year 2020.) These inspections identified 5 locations where transformers and/or capacitors had been removed from the site. Historical information for these sites will be retained, but they will be removed from the schedule for future inspection.

- ❖ PWD worked with USEPA, Philadelphia Department of Licenses & Inspections, Philadelphia Fire Department Hazmat, Philadelphia Police Department and PECO to address PCB issues in 2018. These issues are detailed in Section 5.

- ❖ PWD's PCB database was developed in 2017 and is now being populated. The database was utilized to track and report the 2018 inspections. Going forward, the database will allow us to track "active" sites (where LCEE devices are still located on site) versus "inactive" sites (where LCEE devices were previously located but have been removed). Each location has been given a unique ID and has been geocoded in PWD's GIS database. Maps of PCB sites, inspected in 2018, by water pollution control plant drainage area and those in separate sewer areas were developed and can be found in Attachment B of this report.

- ❖ In 2018, PWD continued to monitor outlying township connection points for PCBs using EPA Method 680. Results for the locations sampled were below the detection limit, and are presented in Attachment C.

- ❖ PWD issued 14 new groundwater discharge permits in 2018. Every permit was compliant with PWD's regulatory PCB limit of "non-detectable by EPA Method 608".

- PWD wet weather and dry weather WPCP effluent data have been entered into the DRBC PCB database.

- Significant reductions in WPCP effluent PCB loadings have been observed over the course of the PMP (see “Tabular Summary”).

2 Facility and Contact Information

Facility Name and Address:	Philadelphia Water Department 1101 Market Street Philadelphia, PA 19107
Water Pollution Control Plants:	Northeast WPCP 3899 Richmond St. Philadelphia, PA 19137 Southeast WPCP 25 Pattison Ave. Philadelphia, PA 19148 Southwest WPCP 8200 Enterprise Ave. Philadelphia, PA 19153
Contact Person:	Nicole Charlton Manager, Industrial Waste & Backflow Compliance 1101 Market St., 6th Floor Philadelphia, PA 19107 Phone: 215-685-8093 Email: nicole.charlton@phila.gov
Date of Submittal of PMP:	September 30, 2005
Date of Completeness Determination:	January 12, 2006
Date of Initiation of PMP:	March 4, 2006
Reporting Period:	Year 12 (Calendar Year 2018)

3 Revisions to PMP

During Year 12, no revisions were made to the PMP.

4 Material and Process Modifications

During Year 12 of the PMP, there were no material or process modifications made relevant to PCB minimization.

5 Measures to Address Known, Probable and Potential Sources

5.1 Known and Probable Sources

Two known sources of PCBs were identified in PWD's PCB PMP. These were the source water for PWD's Water Treatment Plants (Delaware and Schuylkill Rivers) and the ferric chloride supplied to PWD by DuPont and used in the water treatment process. A change of ferric chloride supplier in Year 5 resulted in a 95% reduction in PCB content of the product used by PWD in its water treatment process.

Sludge stored in lagoons at both NEWPCP and SWWPCP is a probable source of PCBs listed in PWD's PCB PMP is. Trackdown efforts conducted in the sewersheds of both NEWPCP and SWWPCP included sampling of the lagoons. The data are available in Attachment B of the Year 5 report.

PWD collaborated with numerous entities in 2018 to identify and reduce PCB contamination:

❖ In January 2018, Philadelphia Department of Licenses & Inspections discovered an abandoned warehouse that contained numerous transformers in various states of disrepair, and informed USEPA. The warehouse was located at 2818 Belgrade Street, in the Northeast water pollution control plant drainage district. PWD was informed in April 2018. The site was repeatedly vandalized by scrappers, leading to discharge of PCB-laden oils on the property. It is possible that PCBs migrated to the combined sewer system in this area. USEPA managed removal of the material in the warehouse and associated cleanup activities. This included collecting samples, sealing of drains and laterals, cleaning and epoxy coating the floor, and replacement of sidewalk concrete. PWD assisted in these efforts where appropriate. USEPA maintains contact with the property owner. Cleanup activities are now complete. USEPA is currently working with the property owner's attorney to attach PCB results from soil and concrete sampling, along with the site geophysical report, to the property deed.

❖ In July 2018, PWD responded to a citizen complaint of oil dumping to an inlet at Ann & Thompson streets. This location is also in the Northeast drainage district, not far from the Belgrade Street ware house site. PWD confirmed the presence of oil staining at the inlet in question. Interviews with the complainant and several neighbors were conducted. Neighbors alleged that inhabitants of a house on Ann Street were stealing transformers and dumping the oil into inlets nearby. PWD investigators found what appeared to be oil-soaked parts from a dismantled transformer in the trash outside of the same residence on Ann Street. PWD immediately contacted Fire Department Hazmat, who contracted with an environmental cleanup firm. PWD also filed a police report, and Philadelphia Police Department (PPD) took incident command. Both PPD and PWD informed USEPA Criminal Investigative Division.

PWD erred on the side of caution and had all six of the potentially impacted inlets cleaned before sample results were available. A total of 42 drums containing wastewater and solid materials were removed from the site. Prior to cleaning, PWD collected samples of water from the potentially impacted inlets, as well as inlets upstream and downstream of those locations, a downstream regulating chamber, and its associated CSO outfall. A wipe sample was also taken from the grate covering the inlet where oil staining was observed. All samples were analyzed by a contract lab using EPA method 8082. Analysis showed 8.92 µg/L total PCB in one inlet water sample (where oil staining was observed), and 64.7 µg/L total PCB in the downstream regulating chamber. Both contained Aroclor 1260. All other samples were below the detection limit. PWD also cleaned the regulating chamber; this is done on a periodic basis for maintenance purposes.

❖ Also, in July 2018, a 4-alarm scrap yard fire occurred at the intersection of Tulip and Somerset streets. PWD Industrial Waste responded and collected PCB samples of the fire runoff water. Results showed 4.78, 7.5, and 1.17 µg/L of Aroclor 1016, 1248 and 1260, respectively. Runoff from this site could have potentially gone to either Northeast or Southeast water pollution control plant. EPA and Philadelphia Department of Licenses and Inspections were working to bring the site into compliance following the event.

❖ Two industrial permitees reported PCB detections in 2018. Veolia reported 2.2 µg/L in a sample at 13th & Chancelor on July 11th. PECO had a result of 0.62 µg/L Aroclor total at their Oregon Avenue location on 11/6. Both locations are in the SEWPCP drainage district. Both parties will receive a notice of violation as the reported results were above the detection limit. If these locations continue to show detections in 2019, additional enforcement action will be pursued.

❖ On October 13, 2018 PECO informed PWD that approximately 2 gallons of non-PCB transformer oil entered a storm drain near C Street and Rising Sun Avenue. The oil was from a pole transformer damaged by a vehicle collision. Sample results from Test America lab, contracted by PECO, showed 6900 µg/kg Aroclor 1260 in the oil sample. PECO had the affected inlet cleaned.

5.2 Potential Sources

5.2.1 Historical Potential Sources:

Numerous potential sources of PCBs were identified in PWD's PCB PMP. These were identified from databases supplied by EPA, the Philadelphia Fire Department, the Philadelphia Department of Public Health and others. The thirty-one (31) potential sources supplied by the Philadelphia Department of Public Health were identified as sites at which some form of prior PCB remediation had taken place. All thirty-one (31) of these sites were inspected during Year 1 of the PMP.

The remaining potential sources of PCBs, taken from information supplied by EPA and others, were identified as sites on which PCB devices were believed to be present. These sites were separated into three groups by sewershed (NEWPCP, SEWPCP or SWWPCP). Approximately one hundred sixty-seven (167), seventy-three (73) and one hundred fifty-seven (157) sites were listed for NEWPCP, SEWPCP and SWWPCP, respectively. During 2018 (Year 12 of the PMP), PWD's Industrial Waste group inspected forty (40) of the NEWPCP-related sites, thirteen (13) of the SEWPCP-related sites and thirty-two (32) of the SWWPCP-related sites. Details of these inspections are summarized in the Tables, "Inspections of Potential Source Sites" in Attachment B of this report.

Inspections confirmed that 5 of these sites have had transformers and/or capacitors removed from the site. Historical information for these sites will be retained, but the sites will be removed from the schedule for future inspection.

5.2.2 New Construction and Groundwater Remediation Sites:

In an effort to minimize the amount of PCBs entering the City's sewer system, PWD requires PCB monitoring in all Groundwater Discharge Permits. These permits are used to regulate specific pollutants of concern from groundwater discharges to the City sewer. Generally, these permits are for remediation sites with groundwater contaminated with petroleum products, such as former gasoline stations. However, all temporary discharges from construction activities are permitted under the Groundwater Discharge Permit Program. The Groundwater Discharge Permits require all Contractors and/or Subcontractors to monitor their discharges monthly for PCBs via sampling and to report their activities and results. All Groundwater Discharge Permits include PWD's regulatory PCB limit of "non-detectable by EPA Method 608" limitation. All PCB detections require additional monitoring by the contractor or subcontractor to show compliance with the permit limitation. In 2018, 14 new groundwater permits were issued. All permittees reported non-detectable results for PCBs.

5.2.3 Township Connections

PWD has agreements with the surrounding townships to convey and treat township wastewater, which is ultimately discharged at NEWPCP and SWWPCP. Part of the agreement includes sampling the respective township's wastewater at the connection to the City's sewer system (i.e. near Philadelphia border). In 2018, PWD sampled twelve connection points in Bensalem Township, and one connection point in Springfield Township. The samples were analyzed using EPA Method 680 to determine if there are PCB loadings entering the City through the surrounding township connections. Results of this sampling, presented in Attachment C, were all below the detection limit. PWD plans on sampling additional township connections in 2019.

6 Incremental and Cumulative Changes from the Baseline Loading

6.1 Loading Baseline

PWD's PCB PMP provides the following baseline loadings (see Section 7 for current loading values):

WPCP	Baseline Loading (mg/day)
NEWPCP	11,510
SEWPCP	7,559
SWWPCP	10,970

These loadings differ from those found in the TMDL. This is because the data are from different sampling events, the PMP baseline loadings are weighted by wet versus dry weather results, the analyses are for different numbers of congeners and there is a difference in analytical methods.

6.2 Baseline Loading Reduction – Direct Measurement

During Year 12, wet-weather effluent sampling for PCBs was performed at each of PWD's three Water Pollution Control Plants (WPCPs), as required by PWD's NPDES permits. An additional wet weather sample was collected at SWWPCP, as requested by DRBC. These data are presented in Section 7, Tables 7.1 through 7.4 In 2018, PWD updated the presentation of the tabular summary to make it easier to read and interpret information. This data is presented in graphical form in Appendix A, Figures A7 through A9.

It can be seen that the loadings calculated from samples collected during March and April 2018 were higher than recent history for Southwest WPCP and were above the baseline values at Northeast and Southeast WPCPs. PWD contracted with engineering consultant HDR to examine possible causes of this increase. Possible contributors to the change included a new contract laboratory, very wet weather patterns, and additional unknown/new sources. HDR provided PWD with a draft report that is still in review.

HDR calculated the annual range and median effluent total PCB concentrations for each WPCP from 2009 through 2018 (See Section 7, Table 7.5. HDR's analysis concluded that between 2009 and 2017, overall median effluent total PCB concentrations declined at all three WPCPs. With the 2018 data added, this held true for NEWPCP and SWWPCP. However, including the 2018 data caused the pattern to shift at SEWPCP, leading to an increasing trend over time. There also appeared to be more variability between wet-weather and dry-weather samples at SE as compared to NE and SW. This could potentially indicate a wet-weather source impacting SEWPCP.

HDR also compared 2017 data (analyzed by Eurofins Lancaster Laboratories) with 2018 data (analyzed by Suburban Water Testing Laboratories) to determine whether the change in laboratory contributed to the unusually high results. Both labs were properly certified, and lab reports from both labs showed no systemic issues. HDR did note that in 2018, samples with high PCB concentrations usually contained a flag with an EMPC qualifier, meaning that the reported value represented an “estimated maximum concentration possible.” However, further analysis showed that the EMPC corrections to the congeners were small, and that the overall conclusion that 2018 PCB concentrations were elevated held water. While it cannot be ruled out with absolute certainty, the change in laboratory did not appear to affect the overall results.

It should be noted that the March samples were collected under the influence of snowfall in addition to rain, and the April samples were collected during a storm in which 2.84” of rain fell. PWD provided HDR with effluent flow data and precipitation data for each of the three WPCPs, to investigate the possible correlation between elevated concentrations and snow/rainfall. This data showed that 2018 precipitation was the highest on record at NE and SE WPCPs, and the second highest at SWWPCP. There were no obvious correlations between elevated total PCB concentration and WPCP discharge or rainfall data when averaged annually, monthly, or even daily. But there was an indication of a relationship between rainfall and daily peak flow at the WPCPs. HDR concluded that although this correlation is not perfect, there is a tendency for elevated total PCB concentrations to co-occur with the highest 10-15% of rainfall at the WPCPs. Plots demonstrating this correlation are shown in Attachment A, Figures A1 through A6.

Two possible explanations were conceived. The first is that during high rainfall events, PCBs that are sorbed to solids that have accumulated over time in the sewer system erode and are transported to the WPCP. The second is that elevated PCB concentrations get transported to the sewer system along with elevated flow. With sufficient rainfall, PCBs that are typically retained locally become mobilized and enter the sewer system and get transported to the WPCP. It is also possible that both of these phenomena are occurring simultaneously in the sewershed.

PWD also explored the PCB homolog contribution for wet and dry weather samples. The average percent contribution by homolog for both dry and wet weather samples collected between 2008 and 2017 was compared to that in 2018 for each plant. These data are presented in Attachment A, Figures A10 through A12. Both Northeast and Southwest tend to have the highest contribution from the di- through hepta- homologs. Southeast, however, tends to have the highest contribution from di- through tetra- homologs. Northeast and Southwest also tend to have similar patterns in wet and dry weather, whereas at Southeast the data showed more variability between samples. PWD plans to continue to explore these types of patterns in the 2019 data to see if the trends continue or if others emerge.

6.3 Baseline Loading Reduction – Other Measures of Progress

See Attachment B ("Potential Sources and Inspection Findings") for details from the 2018 inspections. PWD continues working to identify missing information and update its PCB database with the findings. In total, 85 inspections were performed. All PCB data locations have been geocoded so that they can be included on GIS Maps. Maps detailing the 2018 PCB inspection sites are also included in Attachment B. These include an overall site inspection map, as well as inspections broken down by water pollution control plant drainage area and those conducted in separate sewer areas.

7 Tabular Summary

On the following pages, a summary of the PCB loading calculations for NEWPCP, SEWPCP and SWWPCP is presented, along with the total and penta-pcb concentration results for each of the treatment plant effluents.

Table 7.1
Summary of PCB Loadings
Northeast Water Pollution Control Plant
NPDES # PA0026689

Year 2005 Baseline Loading (mg/day): 11,510

Date	Calculated Loading (mg/day)	Estimated Reduction From Baseline (mg/day)	Cumulative Reduction From Baseline (%)
12/3/07	8,594	2,916	25.3
3/27/09	5,846	5,664	49.2
10/16/09	6,571	4,939	42.9
4/21/10	5,490	6,020	52.3
12/13/10	4,615	6,895	59.9
9/6/11	6,224	5,286	45.9
11/17/11	3,745	7,765	67.5
6/13/12	11,189	321	2.8
10/16/12	2,542	8,968	77.9
4/20/13	2,849	8,661	75.2
10/8/13	2,349	9,161	79.6
4/16/14	2,315	9,195	79.9
9/25/14	1,552	9,958	86.5
5/28/15	3,157	8,353	72.6
10/10/15	2,291	9,219	80.1
5/14/16	1,755	9,755	84.8
10/23/16	1,479	10,031	87.1
5/6/17	1,749	9,761	84.8
10/9/17	972	10,538	91.6
3/2/18	17,293	-5,783	-50.2
10/12/18	4,219	7,291	63.3

Measure	Date Initiated	Date Completed
NEWPCP Phase 1 Trackdown	November 3, 2010	November 4, 2010
NEWPCP Phase 2 Trackdown	January 26, 2012	January 27, 2012

Table 7.2
Summary of PCB Loadings
Southeast Water Pollution Control Plant
NPDES # PA0026662

Year 2005 Baseline Loading (mg/day): 7,559

Date	Calculated Loading (mg/day)	Estimated Reduction From Baseline (mg/day)	Cumulative Reduction From Baseline (%)
12/3/07	4,595	2,964	39.2
3/27/09	3,435	4,124	54.6
10/16/09	4,287	3,272	43.3
4/21/10	2,155	5,404	71.5
12/2/10	2,736	4,823	63.8
9/6/11	4,135	3,424	45.3
11/17/11	1,368	6,191	81.9
6/13/12	5,659	1,900	25.1
10/16/12	1,296	6,263	82.9
4/20/13	2,803	4,756	62.9
11/27/13	2,599	4,960	65.6
4/16/14	6,370	1,189	15.7
9/25/14	1,827	5,732	75.8
5/28/15	2,744	4,815	63.7
10/10/15	2,795	4,764	63.0
5/14/16	1,525	6,034	79.8
10/28/16	1,058	6,501	86.0
5/6/17	2,762	4,797	63.5
10/9/17	1,212	6,347	84.0
Aprl 16, 2018	21,681	-14,122	-186.8
10/12/18	9,543	-1,984	-26.2

Measure	Date Initiated	Date Completed
SEWPCP Phase 2 Trackdown	October 17, 2006	October 20, 2006

Table 7.3
Summary of PCB Loadings
Southwest Water Pollution Control Plant
NPDES # PA0026671

Year 2005 Baseline Loading (mg/day): 10,970

Date	Calculated Loading (mg/day)	Estimated Reduction From Baseline (mg/day)	Cumulative Reduction From Baseline (%)
12/3/07	6,369	4,601	41.9
3/27/09	7,334	3,636	33.1
10/16/09	5,690	5,280	48.1
4/21/10	2,948	8,022	73.1
12/2/10	5,027	5,943	54.2
9/6/11	10,270	700	6.4
11/17/11	4,280	6,690	61.0
6/13/12	5,766	5,204	47.4
10/16/12	2,663	8,307	75.7
4/20/13	3,673	7,297	66.5
10/8/13	3,040	7,930	72.3
4/16/14	2,939	8,031	73.2
9/25/14	2,882	8,088	73.7
8/12/15	4,265	6,705	61.1
10/10/15	3,610	7,360	67.1
5/14/16	3,662	7,308	66.6
10/23/16	1,416	9,554	87.1
5/6/17	3,273	7,697	70.2
10/9/17	3,294	7,676	70.0
3/2/18	6,015	4,955	45.2
4/16/18	7,183	3,787	34.5
10/12/18	4,870	6,100	55.6

Measure	Date Initiated	Date Completed
SWWPCP Phase 1 Trackdown	October 12, 2011	October 13, 2011
SWWPCP Phase 2 Trackdown	February 23, 2012	February 24, 2012

Table 7.4

Summary of Water Pollution Control Plant Effluent PCB Concentration (pg/L)

NEWPCP			SEWPCP			SWWPCP		
Date	Total PCBs (pg/L)	Penta-PCBs (pg/L)	Date	Total PCBs (pg/L)	Penta-PCBs (pg/L)	Date	Total PCBs (pg/L)	Penta-PCBs (pg/L)
12/3/07	13,709	2340	12/3/07	13,580	2233	12/3/07	7,362	1,314
3/27/09	4,047	850	3/27/09	1,593	373	3/27/09	8,866	1,474
10/16/09	5,924	1,238	10/16/09	3,797	711	10/16/09	4,612	886
4/21/10	6,746	1,629	4/21/10	5,322	1,114	4/21/10	3,623	729
12/13/10	5,671	1,379	12/2/10	6,755	1,348	12/2/10	6,177	1,110
9/6/11	7,646	1,624	9/6/11	10,206	1,723	9/6/11	12,385	1,911
11/17/11	4,600	1,159	11/17/11	3,376	635	11/17/11	5,162	997
6/13/12	13,745	2,057	6/13/12	13,968	2,954	6/13/12	6,954	1,331
10/16/12	3,123	791	10/16/12	3,198	595	10/16/12	3,211	558
4/20/13	3,500	806	4/20/13	6,918	1,566	4/20/13	4,429	932
10/8/13	2,886	669	11/27/13	6,414	1,204	10/8/13	3,666	757
4/16/14	2,844	622	4/16/14	15,722	3,182	4/26/14	3,544	737
9/26/14	1,907	458	9/25/14	4,510	912	9/25/14	3,476	745
8/12/15	3,157	963	8/12/15	2,744	1,411	5/28/15	4,265	1,338
10/10/15	2,291	584	10/10/15	2,795	1,516	10/10/15	3,610	790
5/14/16	2,156	488	5/14/16	3,765	847	5/14/16	4,416	979
10/23/16	1,817	377	10/28/16	2,612	452	10/23/16	1,708	307
5/6/17	2,149	455	5/6/17	6,817	1,044	5/6/17	3,948	634
10/9/17	1,194	263	10/9/17	2,993	257	10/9/17	3,972	681
3/2/18	21,243	4,786	--	--	--	3/2/18	5,873	1,044
--	--	--	4/16/18	53,514	15,559	4/16/18	8,662	1,810
10/12/18	5,183	1,059	10/12/18	23,555	3,176	10/12/18	7,254	1,155

Table 7.5
Range and Median PCB Concentration (pg/L)

Year	NE WPCP	SE WPCP	SW WPCP
2009	2,994-7,280 (4561)	1,364-9,375 (3667)	2,994-10,696 (7587)
2010	1,769-109,201 (6528	1,399-6,755 (3474)	1,399-6,177 (4197)
2011	1,790-7,646 (3319)	1,493-10,206 (2672)	3,363-12,385 (4621)
2012	1,708-13,745 (2479)	1,493-13,988 (3369)	2,850-6,954 (3801)
2013	1,440-3,500 (2165)	2,229-6,918 (4741)	3,582-4,429 (3674)
2014	1,387-15,722 (1657)	1,392-4,510 (1752)	2,801-3,544 (3223)
2015	2,814-3,878 (2968)	2,103-6,898 (4472)	3,328-5,143 (4080)
2016	1,108-2,498 (1817)	1,390-3,765 (2103)	1,708-4,422 (3538)
2017	1,173-2,149 (1421)	1,065-6,817 (2414)	2,784-3,972 (3854)
2018	1,073-21,243 (5268)	3,836-53,514 (12934)	4,943-8,662 (5705)
Note: Annual median is presented in parentheses.			

Attachment A

Data Graphs

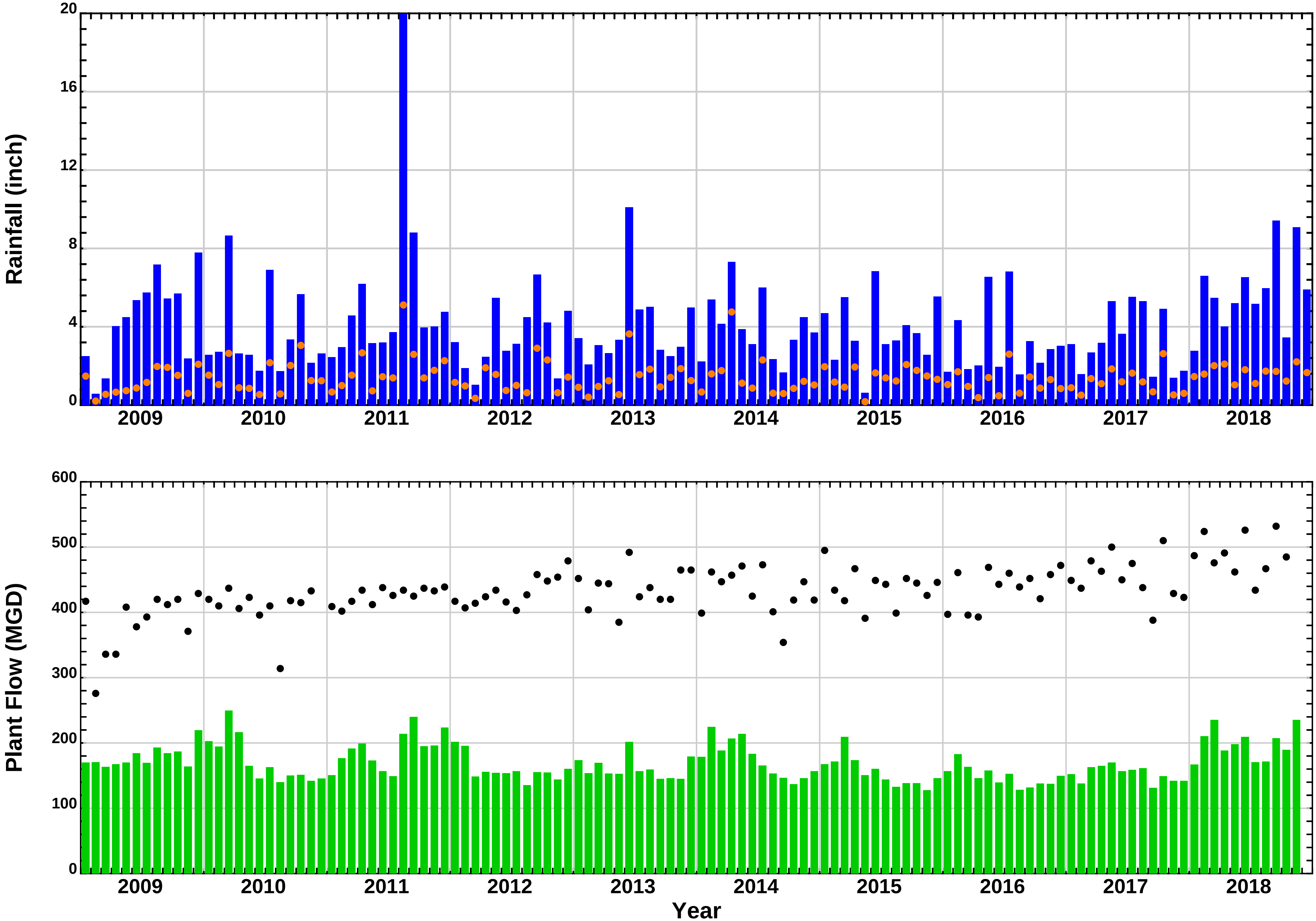

Figure A1. NEWPCP Rainfall & Effluent Flow Data (2009-2018)

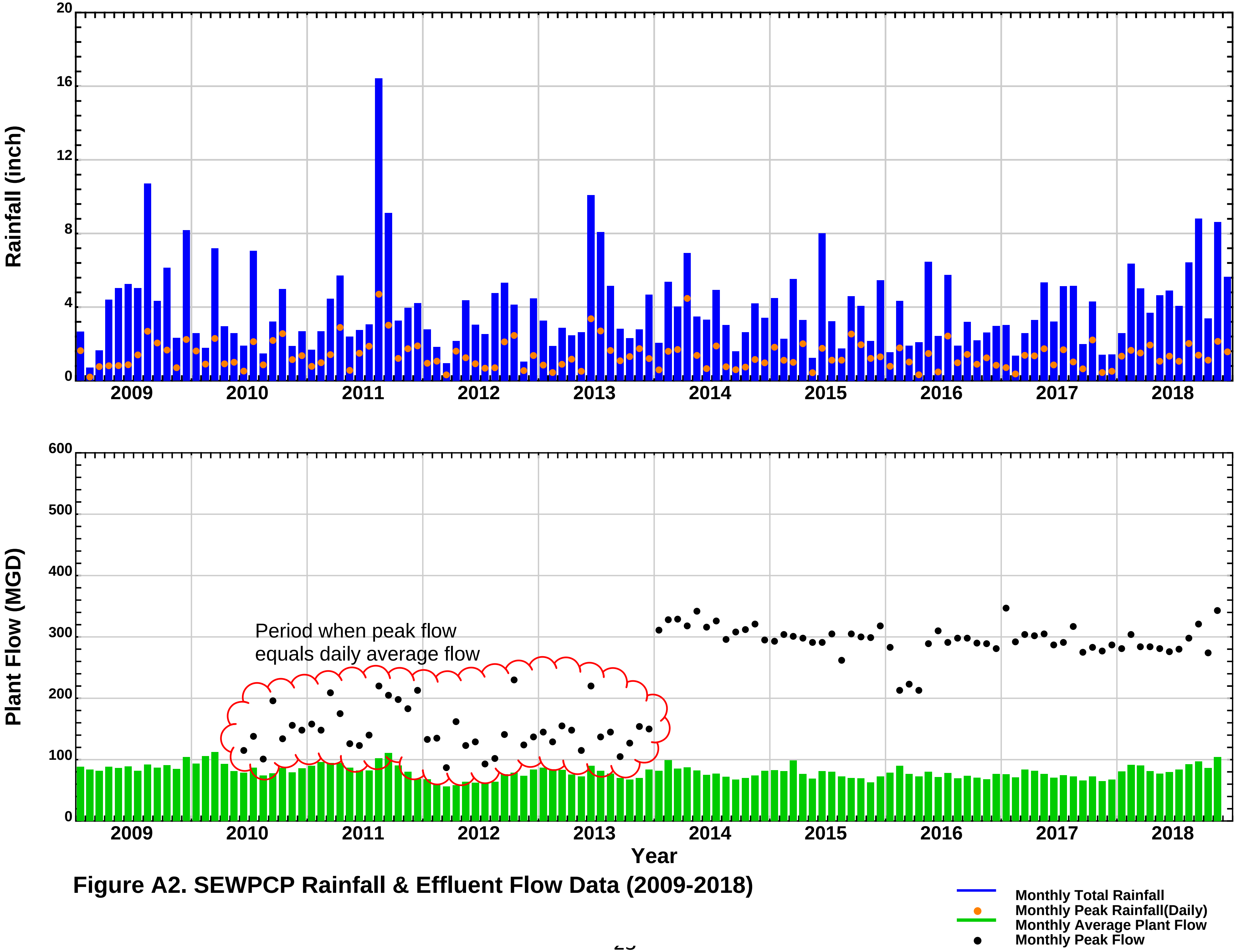

Figure A2. SEWPCP Rainfall & Effluent Flow Data (2009-2018)

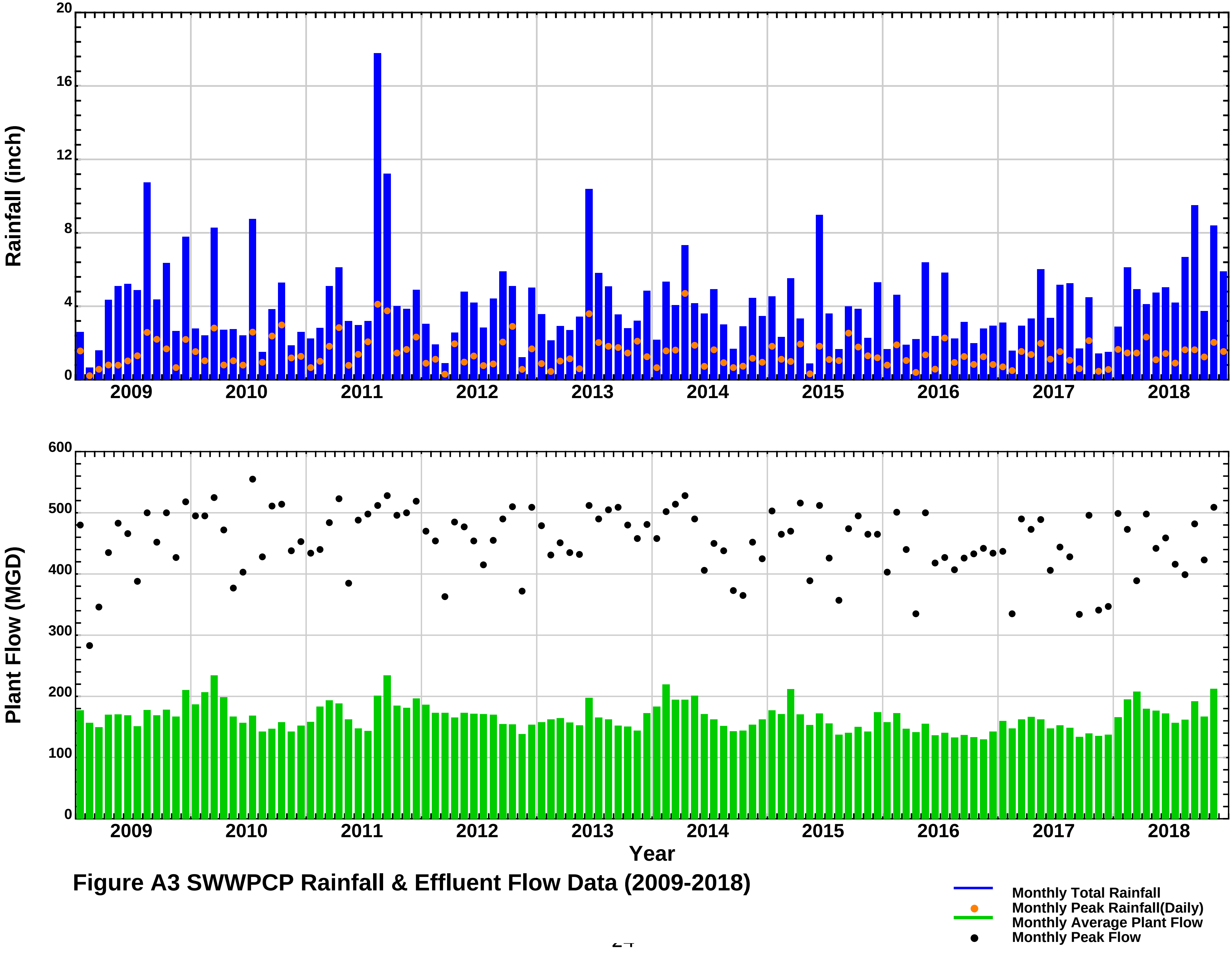

Figure A3 SWWPCP Rainfall & Effluent Flow Data (2009-2018)

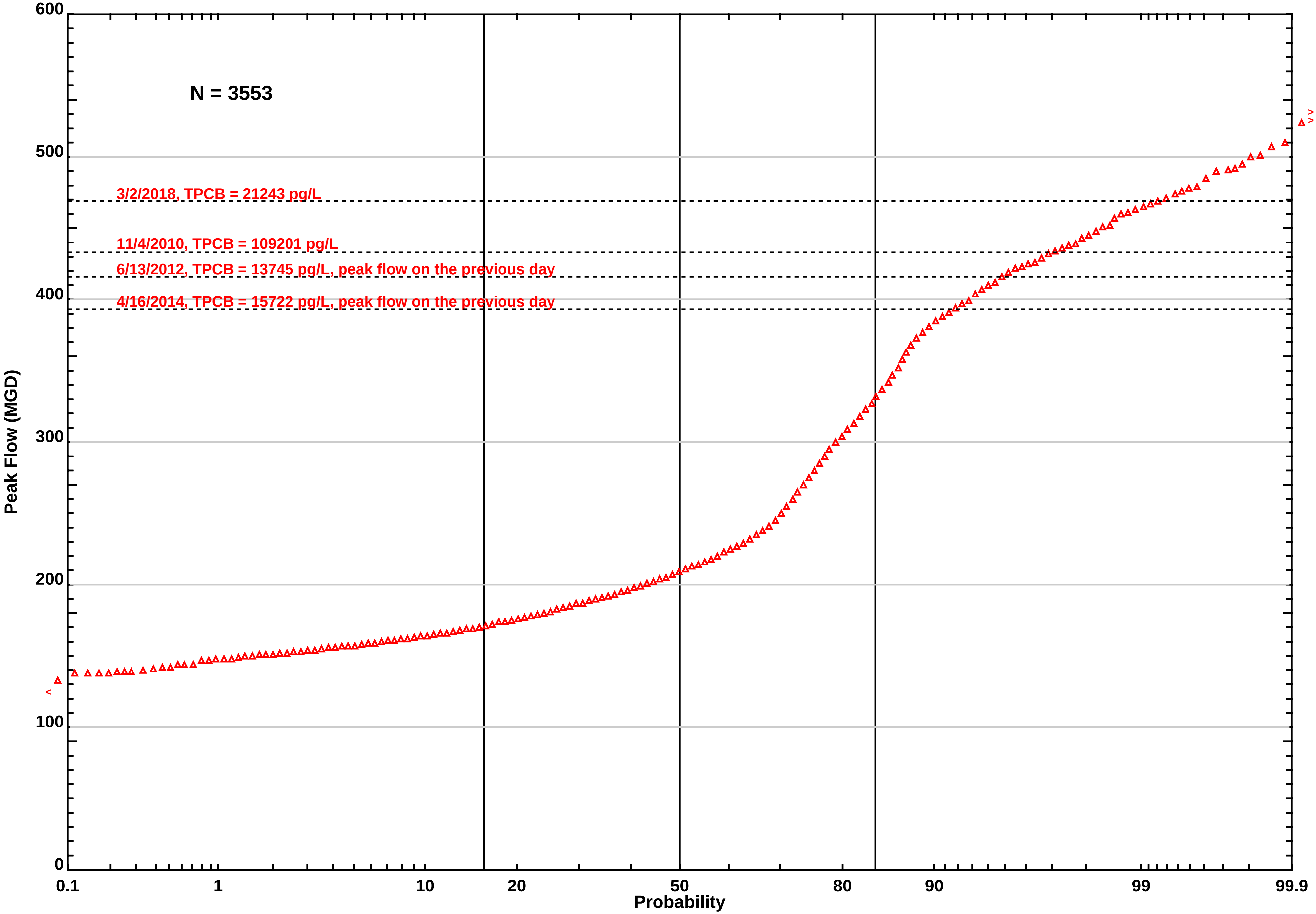

Figure A4. NEWPCP Peak Flow Probability Distribution (2009-2018)

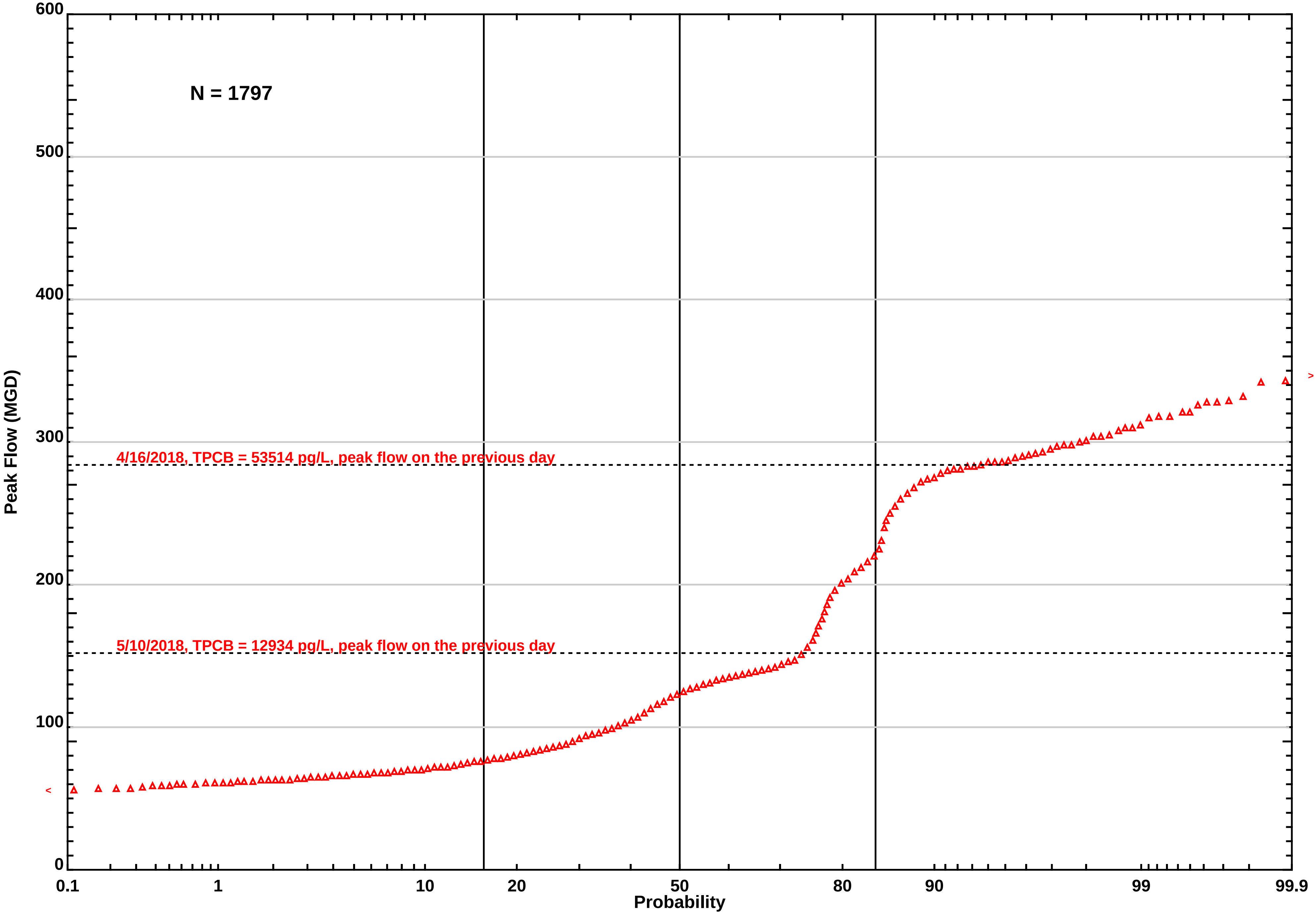

Figure A5. SEWPCP Peak Flow Probability Distribution (2014-2018)

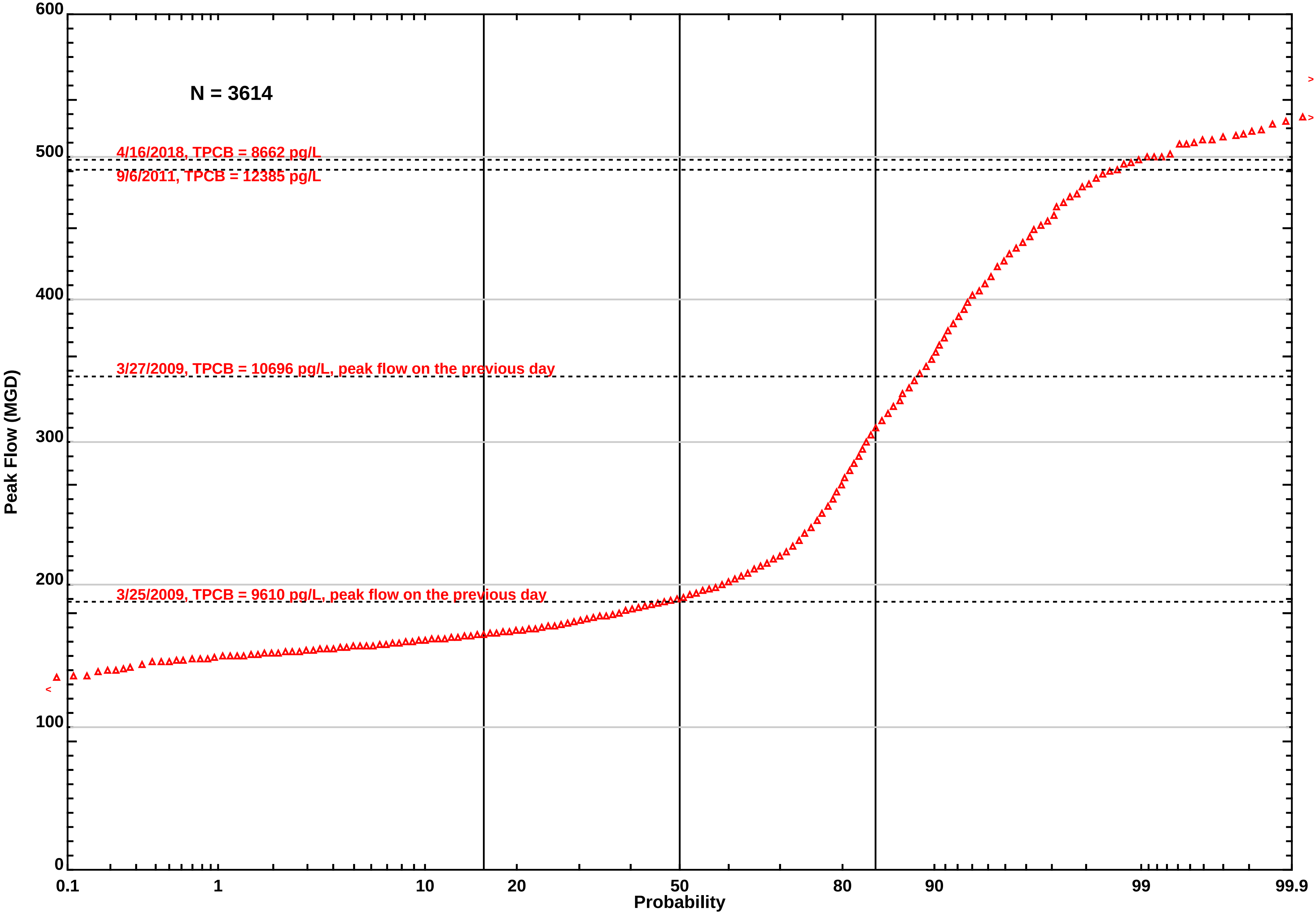

Figure A6. SWWPCP Peak Flow Probability Distribution (2009-2018)

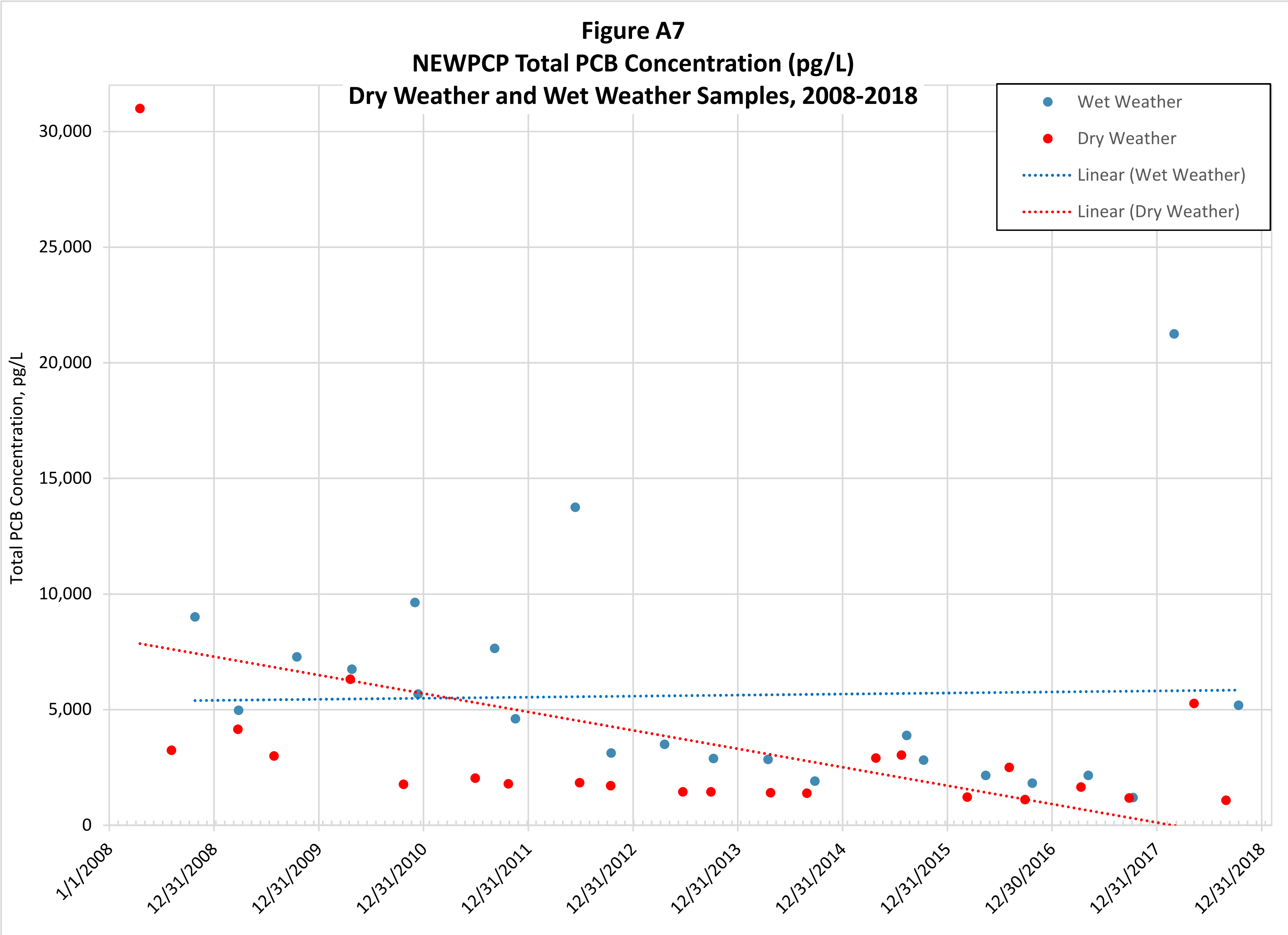
Figure A7
NEWPCP Total PCB Concentration (pg/L)
Dry Weather and Wet Weather Samples, 2008-2018
Wet Weather
Dry Weather
Linear (Wet Weather)
Linear (Dry Weather)
Total PCB Concentration, pg/L
30,000
25,000
20,000
15,000
10,000
5,000
0
1/1/2008
12/31/2008
12/31/2009
12/31/2010
12/31/2011
12/31/2012
12/31/2013
12/31/2014
12/31/2015
12/30/2016
12/31/2017
12/31/2018

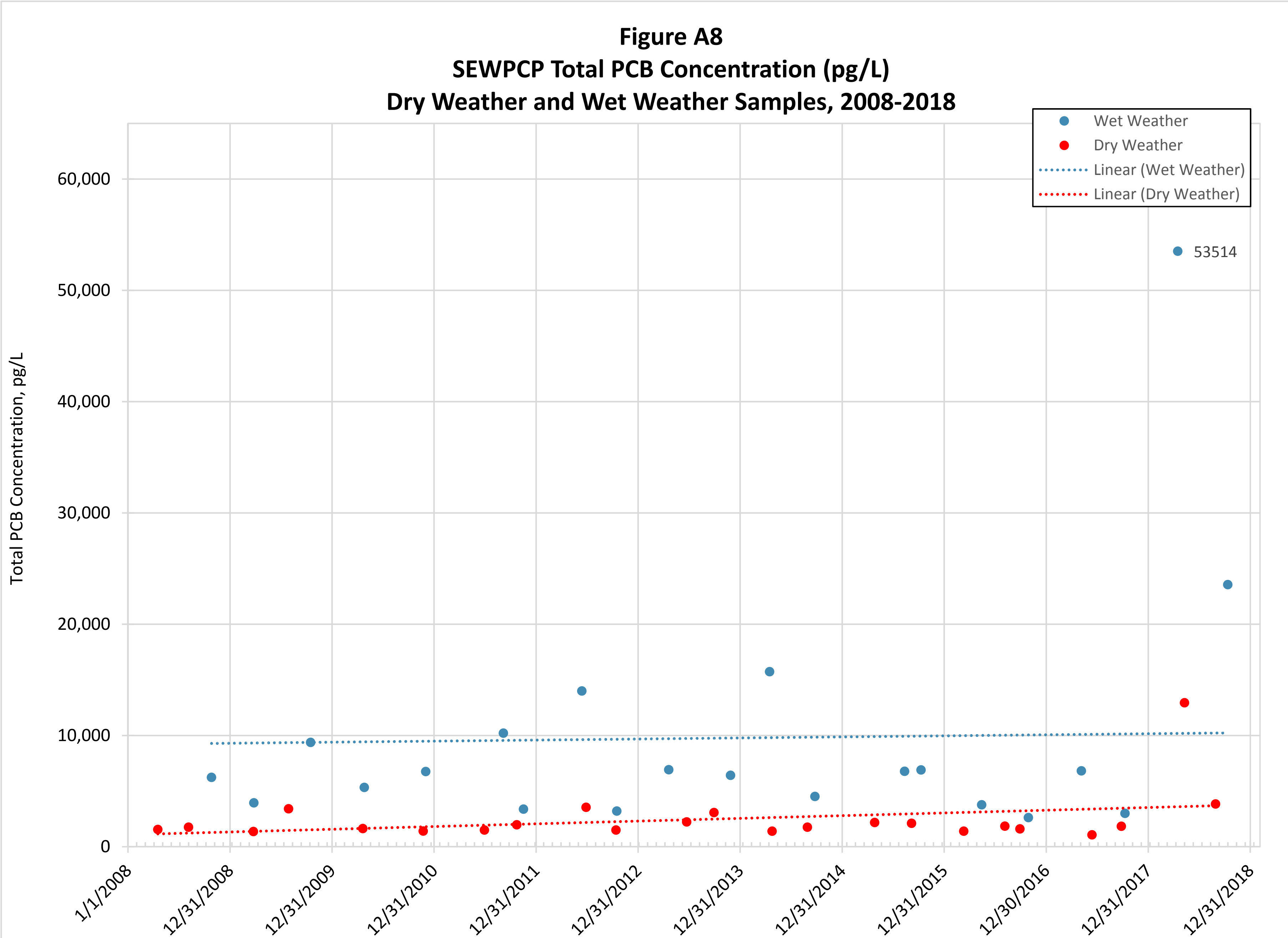
Figure A8
SEWPCP Total PCB Concentration (pg/L)
Dry Weather and Wet Weather Samples, 2008-2018
Wet Weather
Dry Weather
Linear (Wet Weather)
Linear (Dry Weather)
53514
Total PCB Concentration, pg/L
60,000
50,000
40,000
30,000
20,000
10,000
0
1/1/2008
12/31/2008
12/31/2009
12/31/2010
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12/31/2017
12/31/2018

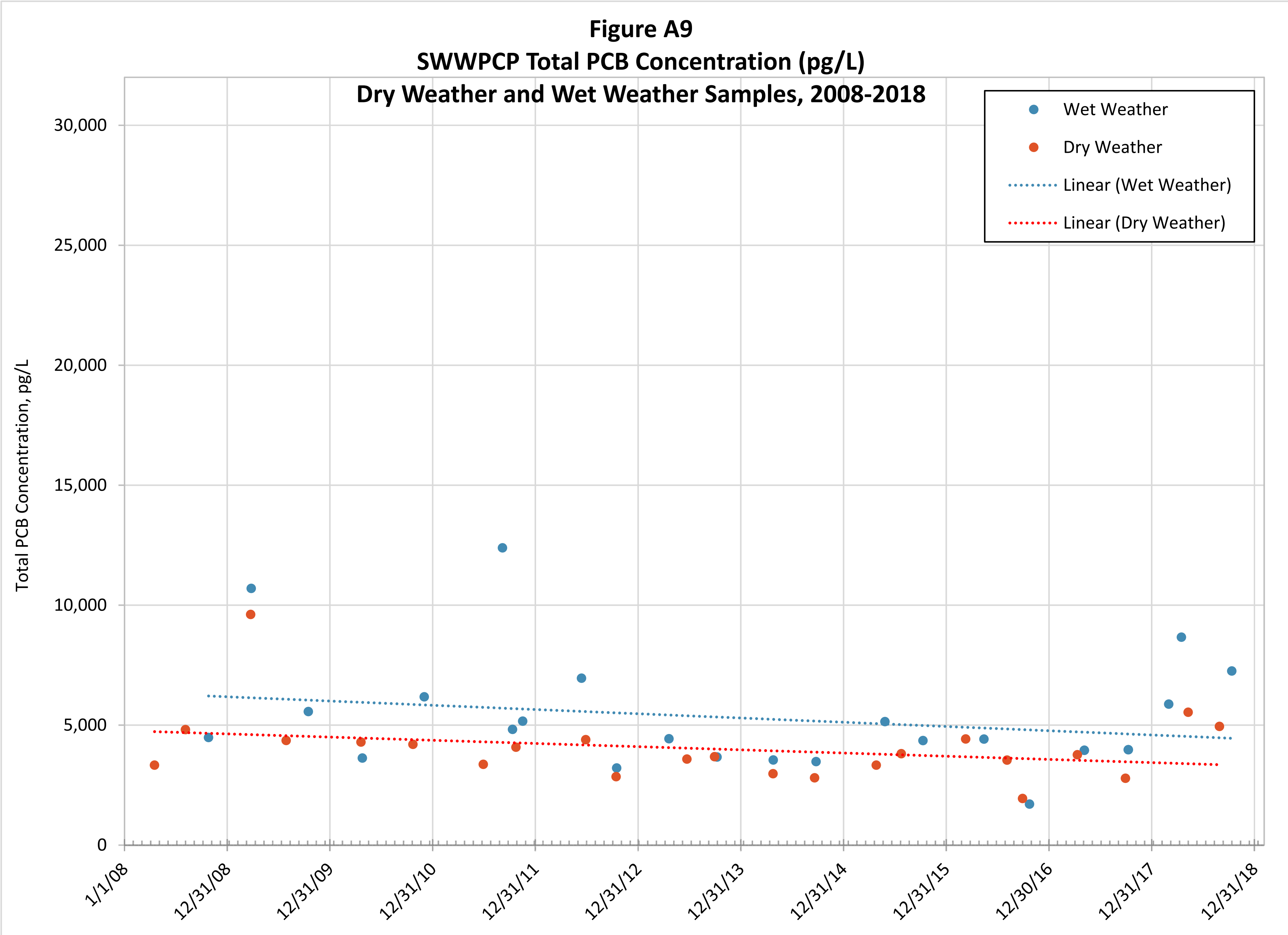


Figure A9
SWWPCP Total PCB Concentration (pg/L)
Dry Weather and Wet Weather Samples, 2008-2018
Wet Weather
Dry Weather
Linear (Wet Weather)
Linear (Dry Weather)
Total PCB Concentration, pg/L
30,000
25,000
20,000
15,000
10,000
5,000
0
1/1/08
12/31/08
12/31/09
12/31/10
12/31/11
12/31/12
12/31/13
12/31/14
12/31/15
12/30/16
12/31/17
12/31/18

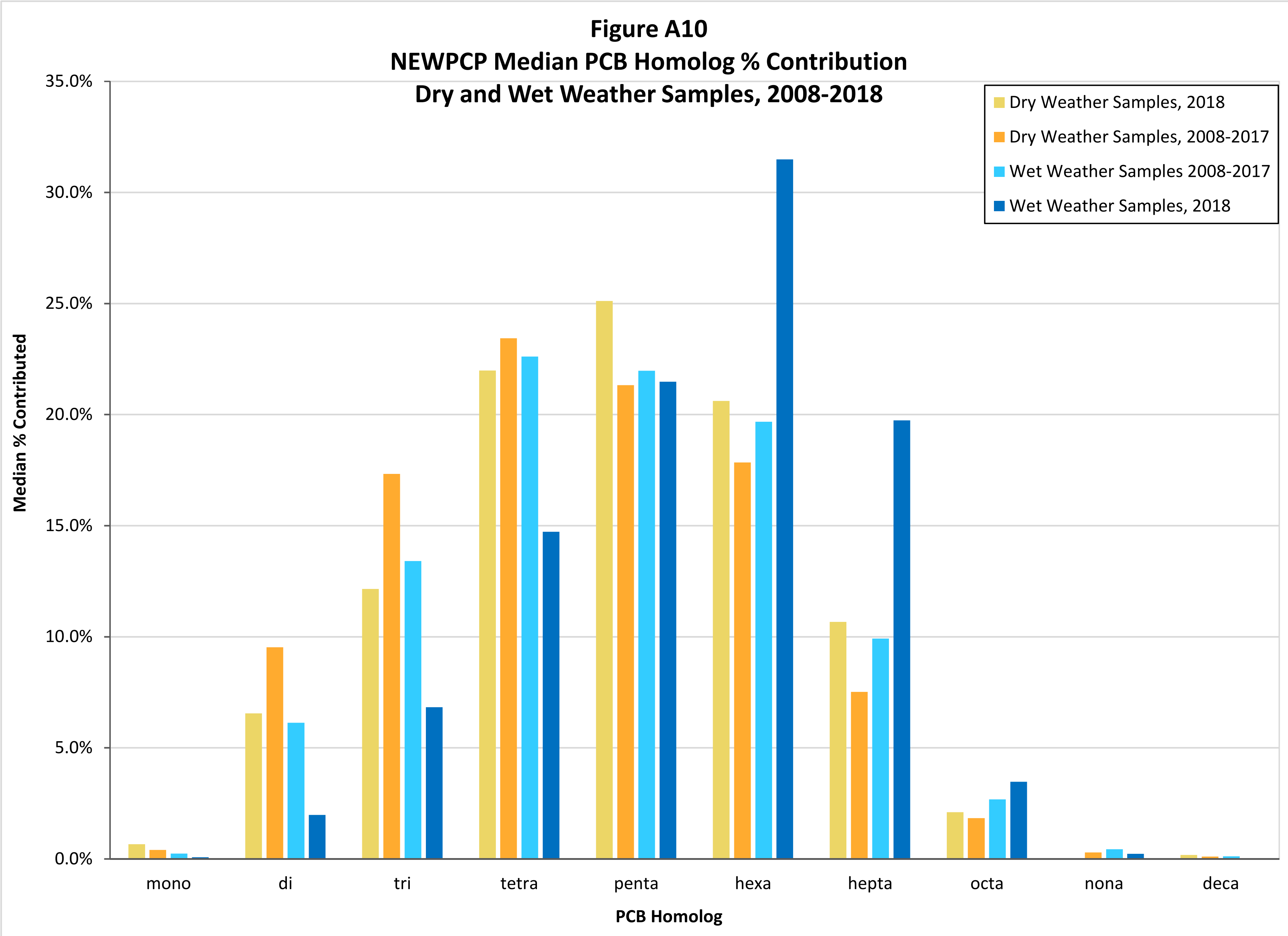


Figure A10
NEWPCP Median PCB Homolog % Contribution
Dry and Wet Weather Samples, 2008-2018
Dry Weather Samples, 2018
Dry Weather Samples, 2008-2017
Wet Weather Samples 2008-2017
Wet Weather Samples, 2018
Median % Contributed
35.0%
30.0%
25.0%
20.0%
15.0%
10.0%
5.0%
0.0%
mono
di
tri
tetra
penta
hexa
hepta
octa
nona
deca
PCB Homolog

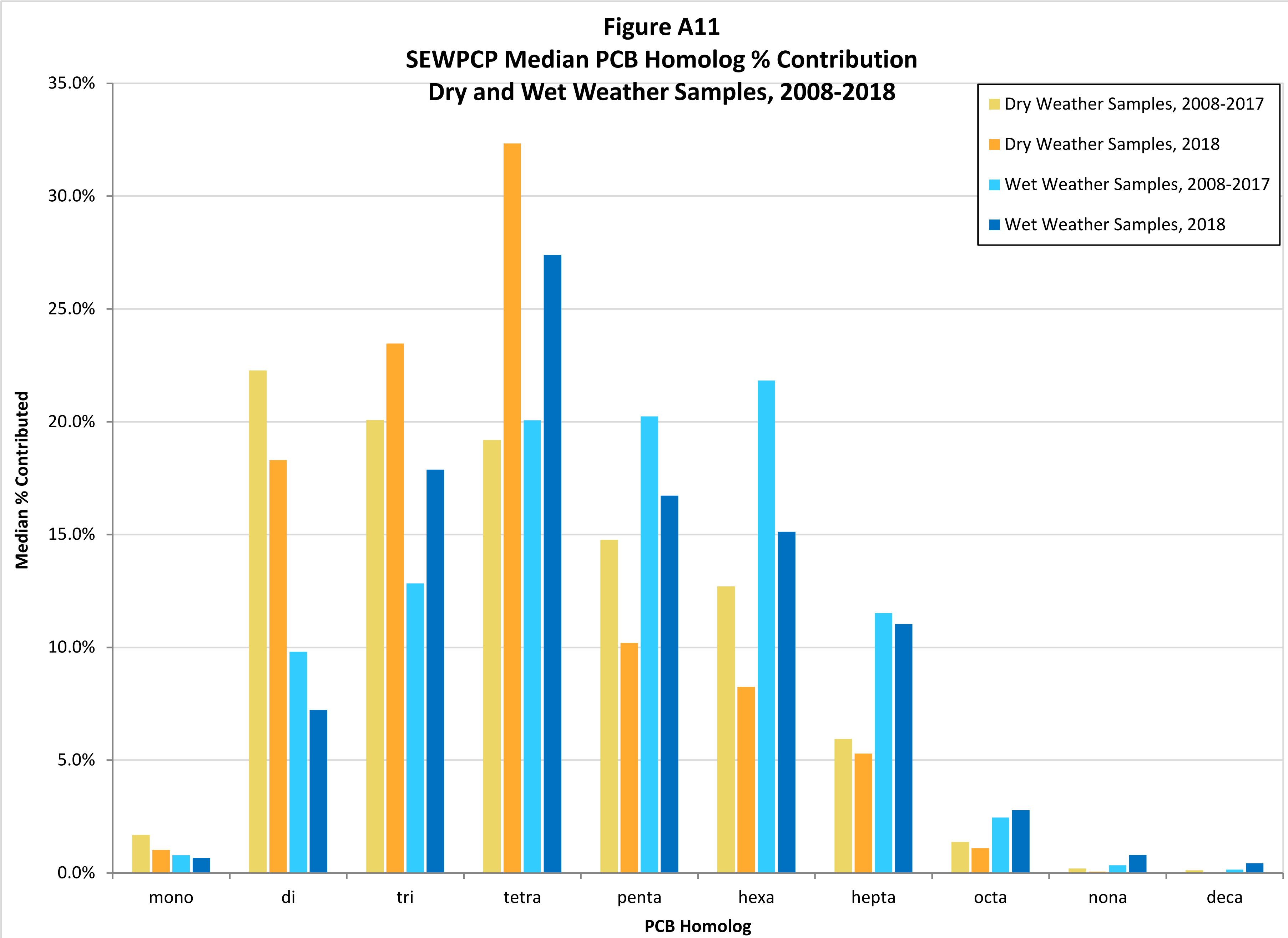


Figure A11
SEWPCP Median PCB Homolog % Contribution
Dry and Wet Weather Samples, 2008-2018
Dry Weather Samples, 2008-2017
Dry Weather Samples, 2018
Wet Weather Samples, 2008-2017
Wet Weather Samples, 2018
Median % Contributed
35.0%
30.0%
25.0%
20.0%
15.0%
10.0%
5.0%
0.0%
mono
di
tri
tetra
penta
hexa
hepta
octa
nona
deca
PCB Homolog


Figure A12
SWWPCP Median PCB Homolog % Contribution
Dry and Wet Weather Samples, 2008-2018
Dry Weather Samples, 2008-2017
Dry Weather Samples, 2018
Wet Weather Samples, 2008-2017
Wet Weather Samples, 2018
Median % Contributed
35.0%
30.0%
25.0%
20.0%
15.0%
10.0%
5.0%
0.0%
mono
di
tri
tetra
penta
hexa
hepta
octa
nona
deca
PCB Homolog

Attachment B

Potential Sources and Inspection Findings

Table B1 - Known, Probable and Potential Sources and Measures to Address Sources

Source	Source Type: Known	Source Type: Probable	Source Type: Potential	Measure to Address Source
Water Supply (Delaware and Schuylkill Rivers)	X			PCB PMP and action by others
Ferric Chloride used in Water Treatment	X			Switched ferric chloride suppliers
Sludge Lagoons (NEWPCP and SWWPCP)		X		Trackdown for each WPCP calls for sampling and analysis
PCB Device sites in sewershed of each WPCP (see Attachment B, "Inspections of Potential Source Sites")			X	Site inspections, evaluation and followup
Significant Industrial Users			X	Modify permits as warranted
Electric Company (PECO) customers			X	Undetermined. PECO will not share customer information.
Township Connections			X	Sample points of connections for PCBs
Groundwater Discharges			X	Require PCB monitoring

Philadelphia Water Department

Inspections by Treatment Plant

01/1/2018 - 12/31/2018

LocID	NAME:	ADDRESS:	LOCATION	CONTACT	EQUIPMENT	NUMBER	CONC (PPM)	GALLONS	LEAKS?	INSP DATE	STATUS
Receiving Plant: NEWPCP											
PCB-NE020	AdvanSix Resins & Chemicals, LLC	2501 Margaret Street 19137-1193	Cooling Tower 3	Paul Persing	Transformer	2	<50	4	No	11/01/18	In Use
PCB-NE022	GE International, Inc.	1040 E. Erie Avenue 19124	Outside (West and South)	Ana M. Adorno	Transformer	4	<50	220	No	05/09/18	In Use
PCB-NE023	GE International, Inc.	1040 E. Erie Avenue 19124	Test balcony	Ana Adorno	Capacitor & Transformer	8	<1	16	No	05/09/18	In Use
PCB-NE024	GE International, Inc.	1040 E. Erie Avenue 19124	Loc. W Indoor Undercar test cage	Ana Adorno	Transformer	3	<50	511	No	05/09/18	In Use
PCB-NE025	GE International, Inc.	1040 E. Erie Avenue 19124	Low Bay [Col. H PCB Storage Area]	Ana Adorno	Other	1	<2	40	Yes	05/09/18	In Use
PCB-NE032	PECO	2800 Trenton Ave 19134	Somerset Substation	Andrew Robinson	Transformer	8	20	N/A	Yes	12/17/18	In Use
PCB-NE141	PECO	4125 Longshore Ave 19135	substation	Andrew Robinson	Transformer	6	23	N/A	Yes	05/30/18	In Use
PCB-NE142	PECO	7549 Thouron St 19150	Substation	Andrew Robinson	Regulator	5	15	N/A	Yes	07/17/18	In Use
PCB-NE153	PECO	6106 N. 5th St. 19120	Spencer Substation	Andrew Robinson	Transformer	10	<50	89	Yes	05/30/18	In Use
PCB-NE154	PECO	6425 New State Road 19135	Tacony Substation	Andrew Robinson	Transformer	7	<50	N/A	Yes	05/30/18	In Use
PCB-NE155	PECO	3440 Richmond Street 19134	Salmon Substation	Andrew Robinson	Transformer	13	<50	N/A	Yes	05/30/18	In Use
PCB-NE164	PECO	651 Foulkrod St 19120	Crecentville Substation	Andrew Robinson	Transformer	8	<50	N/A	Yes	05/30/18	In Use
PCB-NE166	PECO	4601 Rhawn St 19136	Holmesburg Substation	Andrew Robinson	Transformer	9	37	6075	Yes	05/30/18	In Use
PCB-NE207	Domestic Uniform Rental	4100 Frankford Avenue 19124	Transformer Room	Philip G. Tannian	Transformer	0	0	0	No	04/18/18	Removed From Site
PCB-NE221	Abbey Color Incorporated	400 E. Tioga Street 19134	Transformer Vault	Brian Nielson	Transformer	2	N/A	102	No	08/28/18	In Use
PCB-NE226	Domestic Uniform Rental	4100 Frankford Avenue 19124	outside	Jerry Tannian	Transformer	1	N/A	N/A	No	04/18/18	In Use
PCB-NE260	Michel's Bakery, Inc.	5698 Rising Sun Avenue 19120	Electrical Room	Anthony Battle	Capacitor & Transformer	2	<50	N/A	Yes	07/20/18	In Use
PCB-NE261	Dietz & Watson, Inc.	5701 Tacony St. 19135	Boiler Room	Wes Sweany	Transformer	2	N/A	705	No	04/25/18	In Use
PCB-NE262	Dietz & Watson, Inc.	5701 Tacony St. 19135	Electrical Room	Wes Sweany	Capacitor	10	N/A	N/A	No	04/25/18	In Use
PCB-NE278	J.P. Cerini Technologies, Inc.	4600 N. Fairhill Street 19140	Electrical Room in Basement	John Dietzel	Transformer	2	6	N/A	No	04/10/18	Out of Use
PCB-NE284	GE International, Inc.	1040 E. Erie Avenue 19124	Col. 10 H	Ana Adorno	Other	1	<50	37	No	05/09/18	In Use

Table B2

LocID	NAME:	ADDRESS:	LOCATION	CONTACT	EQUIPMENT	NUMBER	CONC (PPM)	GALLONS	LEAKS?	INSP DATE	STATUS

Receiving Plant: NEWPCP

Receiving Plant: NEWPCP
Drainage Area: COMBINED **Total Number of Inspections completed: 21**

LocID	NAME:	ADDRESS:	LOCATION	CONTACT	EQUIPMENT	NUMBER	CONC (PPM)	GALLONS	LEAKS?	INSP DATE	STATUS
PCB-NE045	Mutual Industries	707 W. Grange Ave. 19120	Exterior front	J. Paulba	Transformer	1	9070	175	No	08/06/18	In Use
PCB-NE140	PECO	3901 N. Delaware Ave 19137	Power Station	Andrew Robinson	Transformer	9	<50	N/A	Yes	05/30/18	In Use
PCB-NE162	PECO	4960 Pennypack St. 19136	State Substation	Andrew Robinson	Transformer	4	16	N/A	Yes	05/30/18	In Use
PCB-NE163	PECO	1100 Ivy Hill Rd 19150	Cedarbrook Substation	Andrew Robinson	Transformer	6	<50	N/A	Yes	07/17/18	In Use
PCB-NE165	PECO	7738 Tabor Ave 19111	Fox Chase Substation	Andrew Robinson	Capacitor & Transformer	4	<50	N/A	Yes	05/30/18	In Use
PCB-NE210	Cintas Corporation	10080 Sandmeyer Lane 19116	Rear Parking Lot	Luis Puig	Transformer	1	<50	2590	No	07/05/18	In Use
PCB-NE211	Delavau, LLC	10101 Roosevelt Blvd. 19154	Building Rear	Jack Walter	Transformer	1	<50	258	No	08/08/18	In Use
PCB-NE225	Pepsi Beverages Company	11701 Roosevelt Blvd. 19154	Outside	Kelly Conwell	Transformer	2	<50	465	No	04/12/18	In Use
PCB-NE259	Zentis North America, LLC	1741 Tomlinson Road 19116	Bld read by waste tank	Jennifer Fitzgerald	Transformer	1	0	428	No	06/13/18	In Use
PCB-NE268	Medical Products Laboratories	490 Red Lion Road 19115	Large parking lot between the 2 facilities in a cage	Shashi Raju	Transformer	1	N/A	N/A	No	08/23/18	In Use
PCB-NE275	Premier Medical	10090 Sandymeyer La. 19116	Bld. Rear	Joe Rutherford	Transformer	1	N/A	N/A	No	03/28/18	In Use
PCB-NE277	Computer Components	2751 Southampton Rd. 19154	Loading Dock	Frank Cettina	Transformer	1	<50	N/A	No	04/11/18	In Use
PCB-NE280	Agusta	3050-3076 Red Lion Road 19114	IFO Building 3050	Laurence Smith	Transformer	1	N/A	N/A	No	04/04/18	In Use
PCB-NE281	Agusta	3076 Red Lion Rd. 19114	IFO Bld. 3076	Laurence Smith	Transformer	2	N/A	N/A	No	04/04/18	In Use
PCB-NE283	Custom Powder Coating	8451 Hegerman Street 19136	Behind Admin. Bld.	Lawrence Brennan	Transformer	1	N/A	N/A	No	05/30/18	In Use

Receiving Plant: NEWPCP
Drainage Area: MS4 **Total Number of Inspections completed: 15**

LocID	NAME:	ADDRESS:	LOCATION	CONTACT	EQUIPMENT	NUMBER	CONC (PPM)	GALLONS	LEAKS?	INSP DATE	STATUS
PCB-NE030	PECO	900 Big Oak Road 19067	Big Oak Substation	Andrew Robinson	Transformer	6	6	35	No	12/17/18	In Use
PCB-NE034	PECO	2331 Philmont Ave 19006	Betharyes Substation	Andrew Robinson	Transformer	4	4	N/A	Yes	05/30/18	In Use
PCB-NE167	PECO	LeGrande Avenue 19047	Langhorne Substation	Andrew Robinson	Transformer	2	20	28	No	12/17/18	In Use
PCB-NE209	C. Lever Colors, Inc.	736 Dunks Ferry Road 19020	Outside	Kila Estes	Transformer	1	<50	N/A	No	04/04/18	In Use

Receiving Plant: NEWPCP
Drainage Area: Township **Total Number of Inspections completed: 4**

Receiving Plant: NEWPCP **Total Number of Inspections completed: 40**

Table B2

LocID	NAME:	ADDRESS:	LOCATION	CONTACT	EQUIPMENT	NUMBER	CONC (PPM)	GALLONS	LEAKS?	INSP DATE	STATUS
Receiving Plant: SEWPCP											
PCB-SE011	PECO	2650 S. 13th St 19148	Substation	Andrew Robinson	Regulator	11	16	N/A	No	11/26/18	In Use
PCB-SE032	Zeigler and Sons	6215 Ardsleigh 19138	Loading Dock	Steve Henry	Transformer	1	<50	N/A	No	08/06/18	In Use
PCB-SE033	PECO	267 E. Johnson St 19144	Substation	Andrew Robinson	Regulator	5	<50	N/A	Yes	07/17/18	In Use
PCB-SE073	PECO	1146 Noble st 19123	Callowhill Substation	Andrew Robinson	Capacitor	11	<50	N/A	No	11/26/18	In Use
PCB-SE203	Simons Brothers Co.	2438 Sergeant Street 19125	By front door	Nelson Kaiser	Capacitor	1	>50	N/A	No	06/21/18	In Use
PCB-SE204	Inolex Chemical Company	2101 South Swanson Street 19148	Jackson St.	Marc Brown	Transformer	1	<50	N/A	No	09/13/18	In Use
PCB-SE205	Ashland Chemical Company	2801 Christopher Columbus Blvd. 19148	By Nitrogen	Jill Kuestner	Transformer	1	<50	N/A	No	12/10/18	In Use
PCB-SE208	Inolex Chemical Company	2101 South Swanson Street 19148	Reactor Dock	Marc Brown	Transformer	3	<50	N/A	No	09/13/18	In Use
PCB-SE209	Inolex Chemical Company	2101 South Swanson Street 19148	Waccocoe Street	Marc Brown	Transformer	1	<50	N/A	No	09/13/18	In Use
PCB-SE210	Inolex Chemical Company	2101 South Swanson Street 19148	Railroad/Swanson Street	Marc Brown	Transformer	1	<50	N/A	No	09/13/18	Out of Use
PCB-SE213	PECO	3305 S. 10th St 19148	Substation	Andrew Robinson	Transformer	3	<50	N/A	No	11/26/18	In Use
PCB-SE243	National Chemical Laboratories, Inc.	401 N. 10th Street 19123	Transformer Room	Harry Pollack	Transformer	4	<50	410	No	07/19/18	In Use
Receiving Plant: SEWPCP											
Drainage Area: COMBINED		**Total Number of Inspections completed: 12**									
PCB-SE245	PECO	7735 Germantown Ave 19118	Chestnut Hill Substation	Andrew Robinson	Regulator	27	<50	69	Yes	07/17/18	In Use
Receiving Plant: SEWPCP											
Drainage Area: MS4		**Total Number of Inspections completed: 1**									
Receiving Plant: SEWPCP		**Total Number of Inspections completed: 13**									

Table B2

LocID	NAME:	ADDRESS:	LOCATION	CONTACT	EQUIPMENT	NUMBER	CONC (PPM)	GALLONS	LEAKS?	INSP DATE	STATUS
Receiving Plant: SWWPCP											
PCB-SW013	PECO	2600 Christian St 19146	Schuykill Substation	Andrew Robinson	Transformer	4	<50	N/A	No	11/26/18	In Use
PCB-SW018	PECO	2129-59 N. 62nd st 19151	Overbrook Substation	Andrew Robinson	Transformer	16	6	N/A	No	11/26/18	In Use
PCB-SW019	PECO	380 Long Lane 19082	Upper Darby Substation	Andrew Robinson	Transformer	5	<50	N/A	No	07/17/18	In Use
PCB-SW039	Carbonator Rental Service	6510 Eastwick Avenue 19142	Electrical Room	Tom Moreno	Transformer	0	0	0	No	05/03/18	Removed From Site
PCB-SW069	Atlantic Building	258-262 S. Broad St 19102	Sub Basement	Sarina Rose	Capacitor	0	0	0	No	11/01/18	Removed From Site
PCB-SW118	PECO	1835 Oxford St. 19121	Substations	Andrew Robinson	Transformer	0	0	0	No	11/26/18	Removed From Site
PCB-SW119	Atlantic Building	260 S. Broad St. 19107	Subbasement	Sarina Rose	Transformer	0	0	0	No	11/01/18	Removed From Site
PCB-SW153	PECO	1122 W. Sedgley Ave 19133	Substation	Andrew Robinson	Capacitor & Transformer	8	<50	N/A	No	12/17/18	In Use
PCB-SW155	PECO	2340 Washington Ave 19146	Taylor Substation	Andrew Robinson	Transformer	2	26	1365	No	05/30/18	In Use
PCB-SW156	PECO	1155 S. 57th St 19143	Angora Substation	Andrew robinson	Regulator	10	2	N/A	Yes	11/26/18	In Use

Receiving Plant: SWWPCP

Drainage Area: COMBINED **Total Number of Inspections completed: 10**

Table B2

LocID	NAME:	ADDRESS:	LOCATION	CONTACT	EQUIPMENT	NUMBER	CONC (PPM)	GALLONS	LEAKS?	INSP DATE	STATUS
Receiving Plant: SWWPCP											
PCB-SW048	PECO	2600 Hunting Park Ave 19129	Sub station	Andrew Robinson	Regulator	27	<50	N/A	Yes	07/17/18	In Use
PCB-SW156	PECO	7509 Ridge Ave 19128	Wigard Substation	Andrew Robinson	Transformer	4	181	180	Yes	07/17/18	In Use
PCB-SW157	PECO	7200 Umbria St 19128	Roxborough Station	Andrew Robinson	Transformer	3	<50	180	Yes	07/17/18	In Use
PCB-SW212	G.J. Littlewood & Son, Inc.	4045 Main Street 19127	Vault	Robert Littlewood	Transformer	5	<50	60	No	04/13/18	In Use
PCB-SW230	Atlantic City Linen Supply, LLC	7831 Bartram Avenue 19153	Parking Lot	Michael Greico	Transformer	1	<50	N/A	No	08/09/18	In Use
PCB-SW231	Penn Fishing Tackle Mfg. Co	3028 W. Hunting Park Avenue 19132	Anodizing Room	David Shanks	Capacitor	2	<50	2.18	No	05/23/18	In Use
PCB-SW232	Penn Fishing Tackle Mfg. Co	3028 W. Hunting Park Avenue 19132	Waste Treatment Area	David Shanks	Capacitor	1	<50	1.03	No	05/23/18	In Use
PCB-SW233	Penn Fishing Tac kle Mfg. Co.	3028 W. Hunting Park Avenue 19132	Lube Pack Area	David Shanks	Capacitor	1	<50	1.03	No	05/23/18	In Use
PCB-SW234	Penn Fishing Tac kle Mfg. Co.	3028 W. Hunting Park Avenue 19132	Light Machine Area	David Shanks	Capacitor	1	<50	1.39	No	05/23/18	In Use
PCB-SW235	Penn Fishing Tac kle Mfg. Co.	3028 W. Hunting Park Avenue 19132	Basement Electrical	David Shanks	Transformer	2	<50	140	No	05/23/18	In Use
PCB-SW236	Penn Fishing Tac kle Mfg. Co.	3028 W. Hunting Park Avenue 19132	Outside Fenced Area	David Shanks	Transformer	2	<50	700	No	05/23/18	In Use
PCB-SW244	PECO	2600 W. Westmoreland St. 19107	Westmoreland Sub	Andrew Robinson	Transformer	7	<50	N/A	Yes	07/17/18	In Use

Receiving Plant: SWWPCP

Drainage Area: MS4 **Total Number of Inspections completed: 12**

Table B2

LocID	NAME:	ADDRESS:	LOCATION	CONTACT	EQUIPMENT	NUMBER	CONC (PPM)	GALLONS	LEAKS?	INSP DATE	STATUS
Receiving Plant: SWWPCP											
PCB-SW007	PECO	West Chester Pike & Ashton Rd 19083	West Gate Substation	Andrew Robinson	Transformer	1	<50	N/A	No	11/26/18	In Use
PCB-SW009	PECO	E. Wynnewood Road, SW/O Lancaster Pike 19096	Wynnewood Substation	Andrew Robinson	Regulator	12	15	N/A	Yes	11/26/18	In Use
PCB-SW157	PECO	2230 Township Line Road 19083	Llenarch Substation	Andrew Robinson	Capacitor & Transformer	12	36	N/A	Yes	07/17/18	In Use
PCB-SW204	Starlite Industries, Inc.	1111 Lancaster Avenue 19010	1st Floor transformer room	Jay Rosenbluth	Transformer	1	N/A	N/A	No	12/13/18	In Use
PCB-SW208	Johnson & Johnson Consumer Inc.	7050 Camp Hill Road 19034	WWTP	Deb Heucheroth	Transformer	1	<50	135	No	08/02/18	In Use
PCB-SW213	Astra Foods, Inc.	6430 Market St. 19082	Boiler Room T1	Dimitry Poulimenos	Transformer	1	N/A	N/A	No	08/29/18	In Use
PCB-SW214	Astra Foods, Inc.	6430 Market St. 19082	South Building T4	Demitri Poulmentous	Transformer	1	N/A	N/A	No	08/29/18	In Use
PCB-SW215	Astra Foods, Inc.	6430 Market St. 19082	East Building T5	Demitri Poulmentous	Transformer	1	N/A	N/A	No	08/29/18	In Use
PCB-SW216	Astra Foods, Inc.	6430 Market St. 19082	Centrifudge Building West of T4	Demitri Poulmentous	Transformer	1	N/A	N/A	No	08/29/18	In Use

Receiving Plant: SWWPCP

Drainage Area: Township **Total Number of Inspections completed: 9**

Receiving Plant: SWWPCP **Total Number of Inspections completed: 31**

Total Inspections: 84

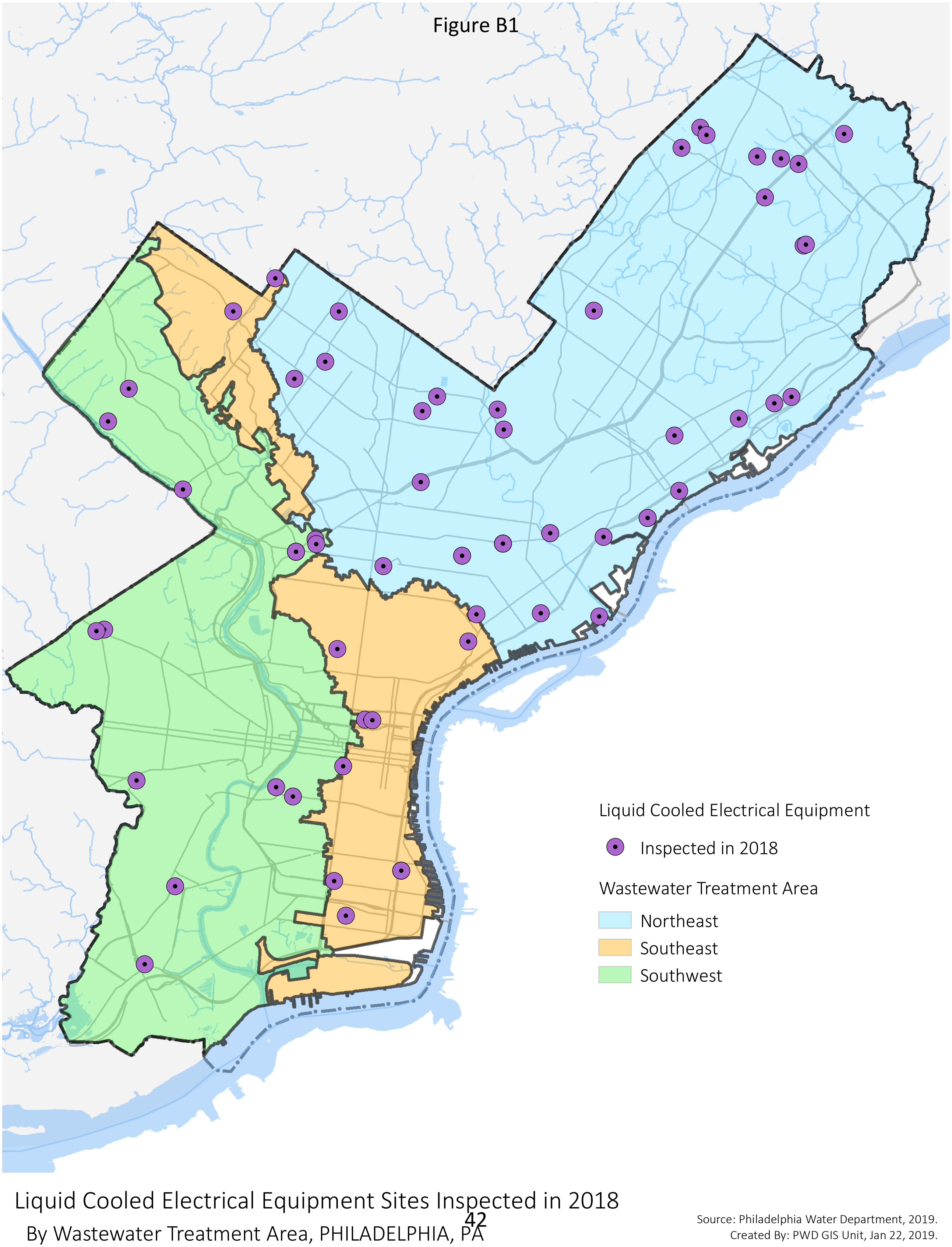
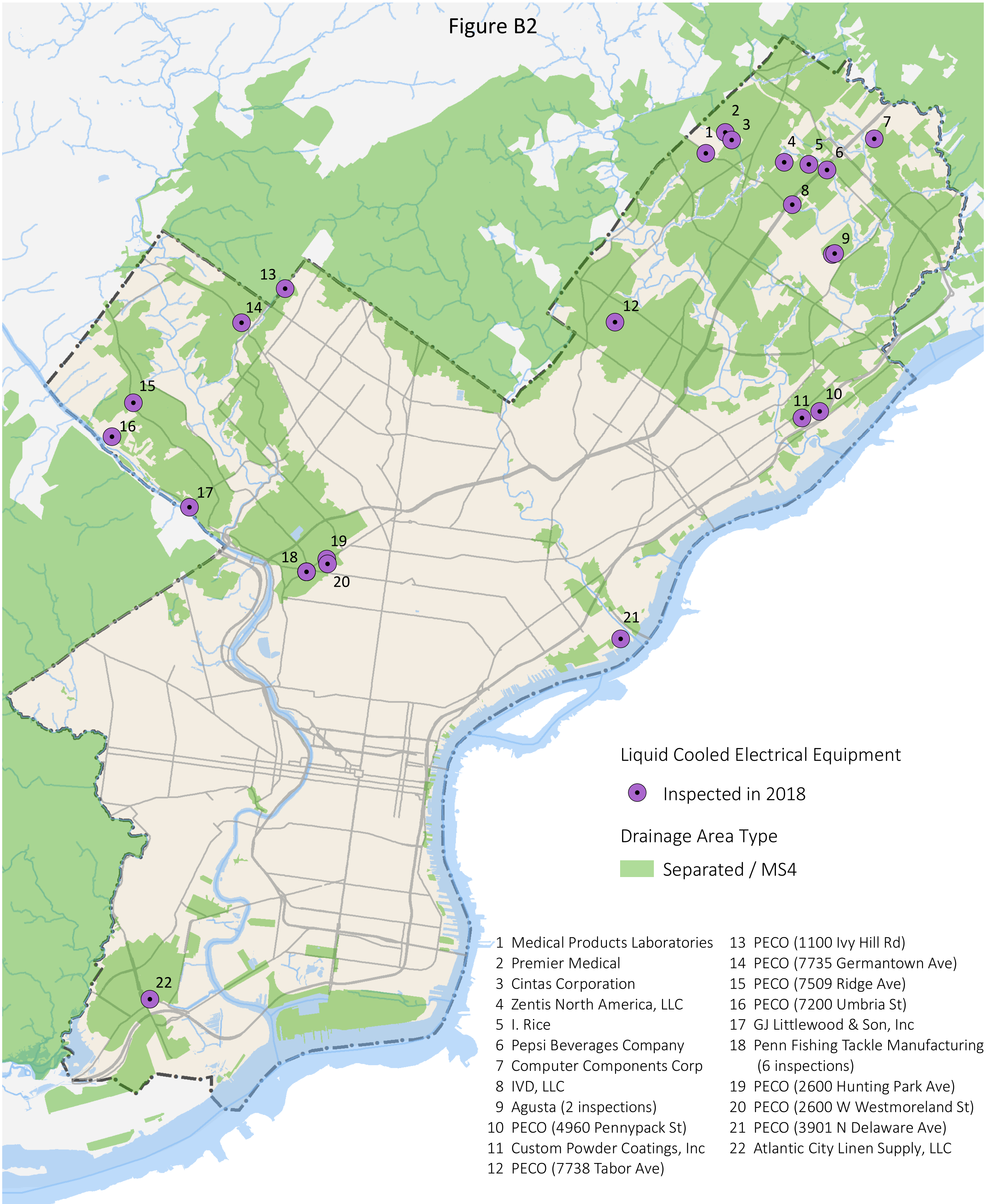
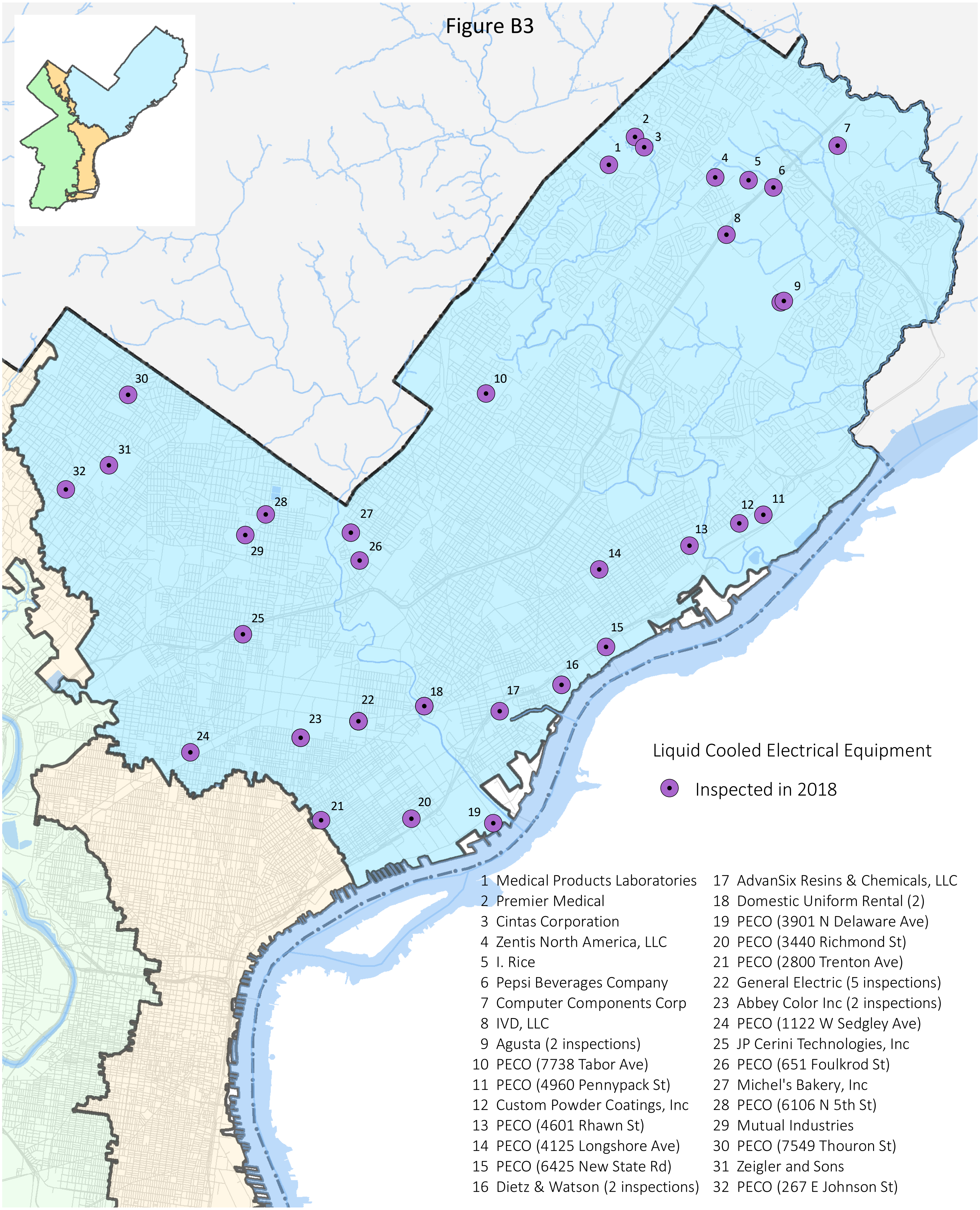


Figure B1
Liquid Cooled Electrical Equipment
Inspected in 2018
Wastewater Treatment Area
Northeast
Southeast
Southwest
Liquid Cooled Electrical Equipment Sites Inspected in 2018
By Wastewater Treatment Area, PHILADELPHIA, PA
Source: Philadelphia Water Department, 2019.
Created By: PWD GIS Unit, Jan 22, 2019.



Liquid Cooled Electrical Equipment Sites Inspected in 2018
In MS4 Areas, PHILADELPHIA, PA

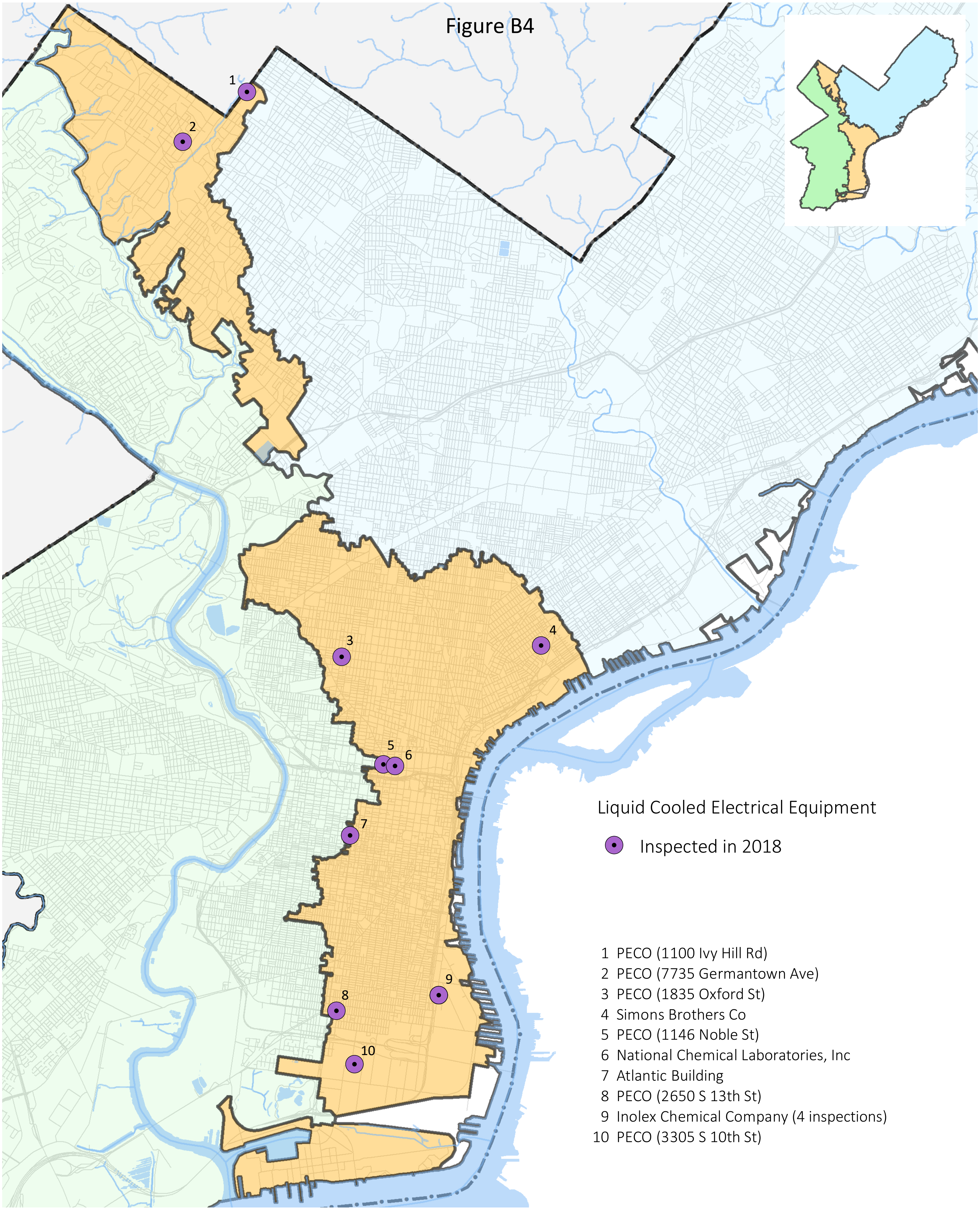
Source: Philadelphia Water Department, 2019.
Created By: PWD GIS Unit, Jan 22, 2019.



Liquid Cooled Electrical Equipment Sites Inspected in 2018

Northeast Treatment Area, PHILADELPHIA, PA

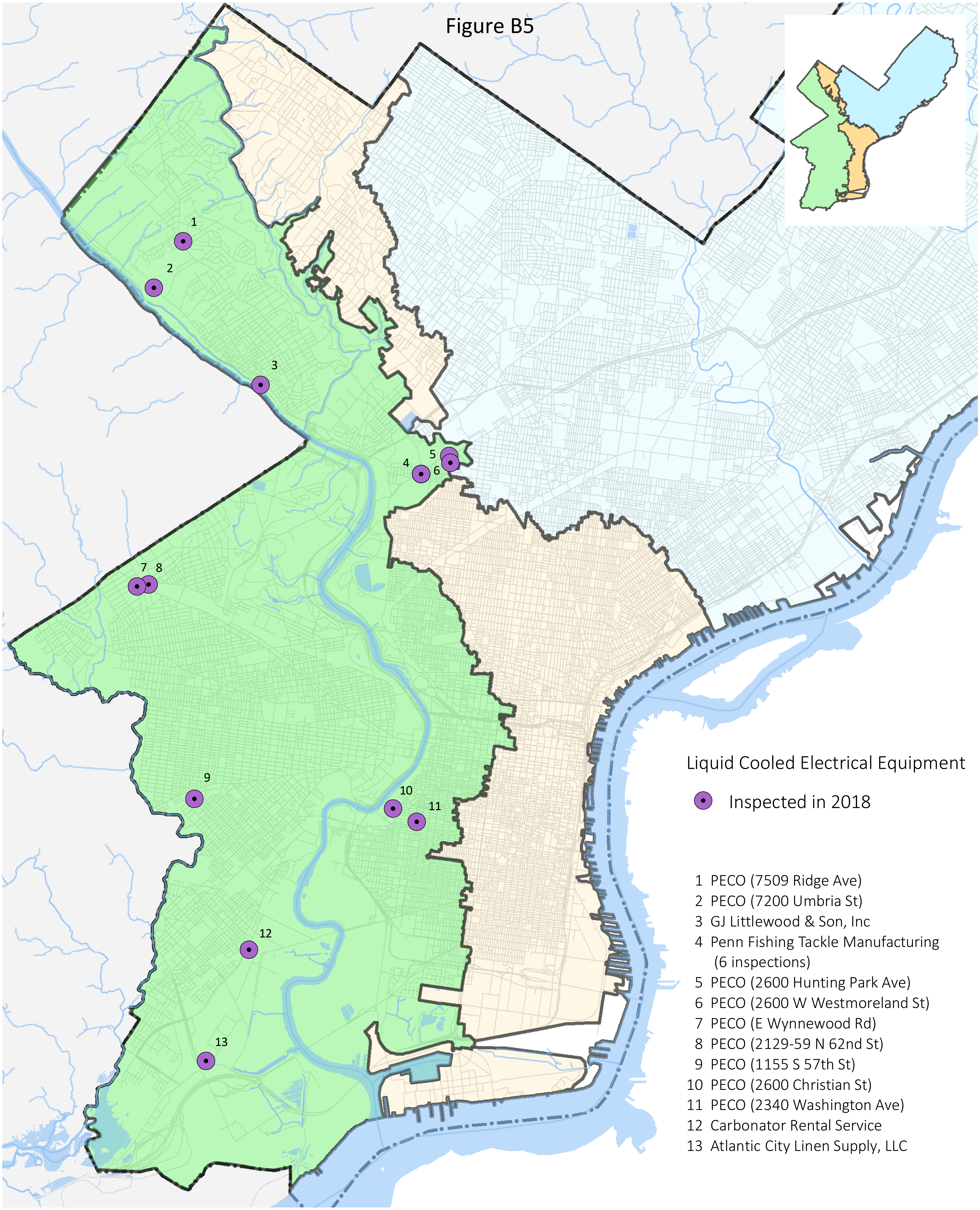
Source: Philadelphia Water Department, 2019.
Created By: PWD GIS Unit, Jan 22, 2019.



Liquid Cooled Electrical Equipment Sites Inspected in 2018
Southeast Treatment Area, PHILADELPHIA, PA

Source: Philadelphia Water Department, 2019.
Created By: PWD GIS Unit, Jan 22, 2019.

Figure B5



Liquid Cooled Electrical Equipment Sites Inspected in 2018
Southwest Treatment Area, PHILADELPHIA, PA

Source: Philadelphia Water Department, 2019.
Created By: PWD GIS Unit, Jan 22, 2019.

Attachment C

2018 Township Connection Samples

Table C1

2018 Township Connection Summary

PCB Homolog Concentration (µg/L)

Township	Mon. Pt.	Date	Mono	Di	Tri	Tetra	Penta	Hexa	Hepta	Octa	Nona	Deca
Bensalem	KNIGHTS	22-Feb-18	<0.10	<0.10	<0.10	<0.20	<0.20	<0.20	<0.30	<0.30	<0.50	<0.50
Bensalem	COLONIAL	21-Feb-18	<0.10	<0.10	<0.10	<0.20	<0.20	<0.20	<0.30	<0.30	<0.50	<0.50
Bensalem	BENSHOP	16-Apr-18	<0.1	<0.1	<0.1	<0.20	<0.20	<0.20	<0.30	<0.3	<0.50	<0.5
Bensalem	BETZ	25-Jun-18	<0.10	<0.10	<0.10	<0.20	<0.20	<0.20	<0.30	<0.30	<0.50	<0.50
Bensalem	DORALAPT	19-Apr-18	<0.20	<0.2	<0.20	<0.40	<0.40	<0.40	<0.60	<0.6	<1.0	<1.0
Bensalem	DUNKS	25-Apr-18	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2	<0.3	<0.3	<0.5	<0.5
Bensalem	EANDE	20-Mar-18	<0.10	<0.10	<0.10	<0.20	<0.20	<0.20	<0.30	<0.30	<0.50	<0.50
Bensalem	ELMWOOD	24-May-18	<0.10	<0.10	<0.10	<0.20	<0.20	<0.20	<0.30	<0.30	<0.50	<0.50
Bensalem	GRAVELPK	20-Mar-18	<0.10	<0.10	<0.10	<0.20	<0.20	<0.20	<0.30	<0.30	<0.50	<0.50
Bensalem	KAY	25-Jun-18	<0.10	<0.10	<0.10	<0.20	<0.20	<0.20	<0.30	<0.30	<0.50	<0.50
Bensalem	TOWNSEND	21-May-18	<0.10	<0.10	<0.10	<0.20	<0.20	<0.20	<0.30	<0.30	<0.50	<0.50
Bensalem	BEECHWOOD	23-Jul-18	<0.10	<0.10	<0.10	<0.21	<0.21	<0.21	<0.31	<0.31	<0.52	<0.52
Springfield	THOMAS	24-May-18	<0.10	<0.10	<0.10	<0.20	<0.20	<0.20	<0.30	<0.30	<0.50	<0.50

Appendix F – Monitoring Locations

APPENDIX F –

MONITORING LOCATIONS

Page

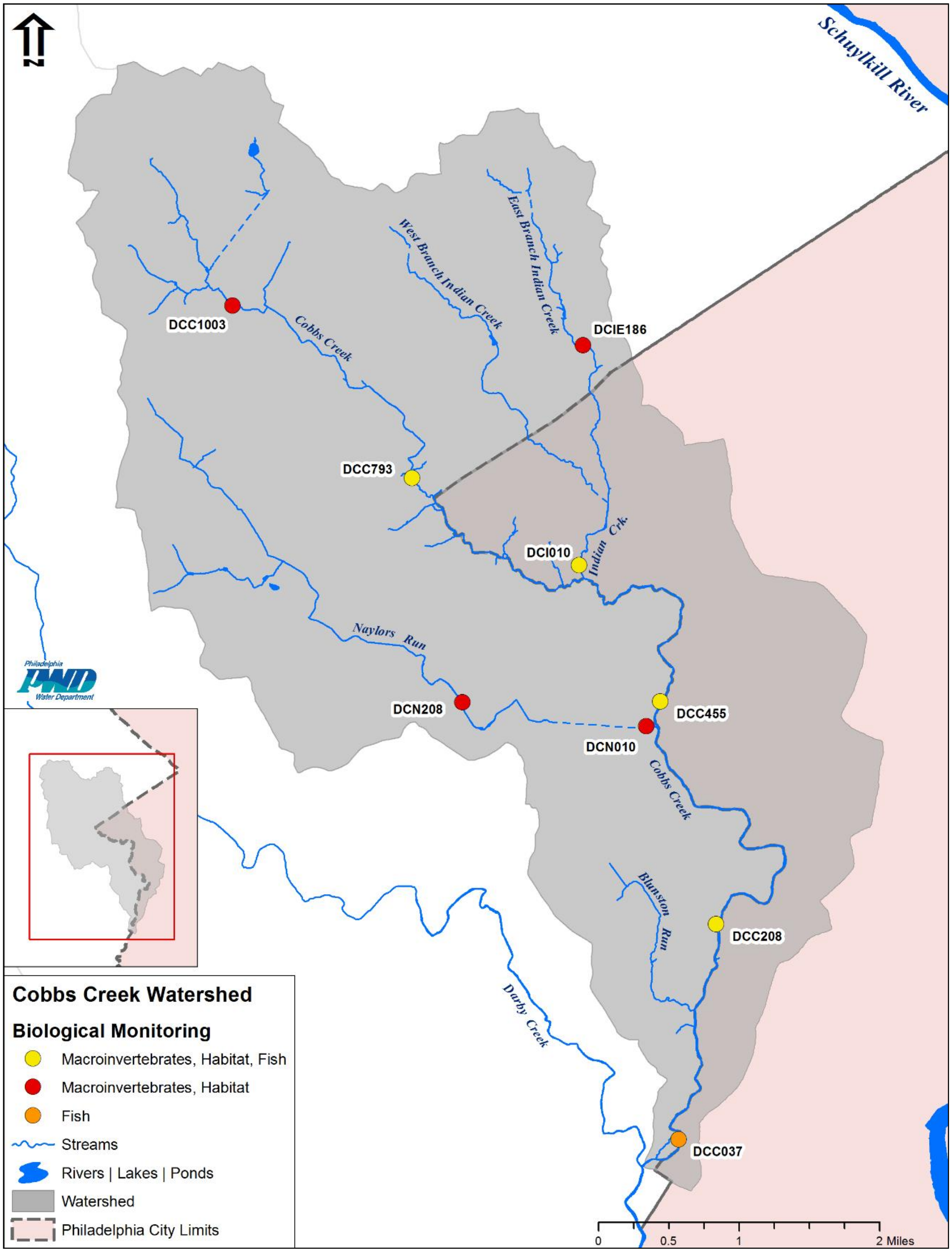


Figure - 1 Biological and Physical assessment locations in Cobbs Creek Watershed

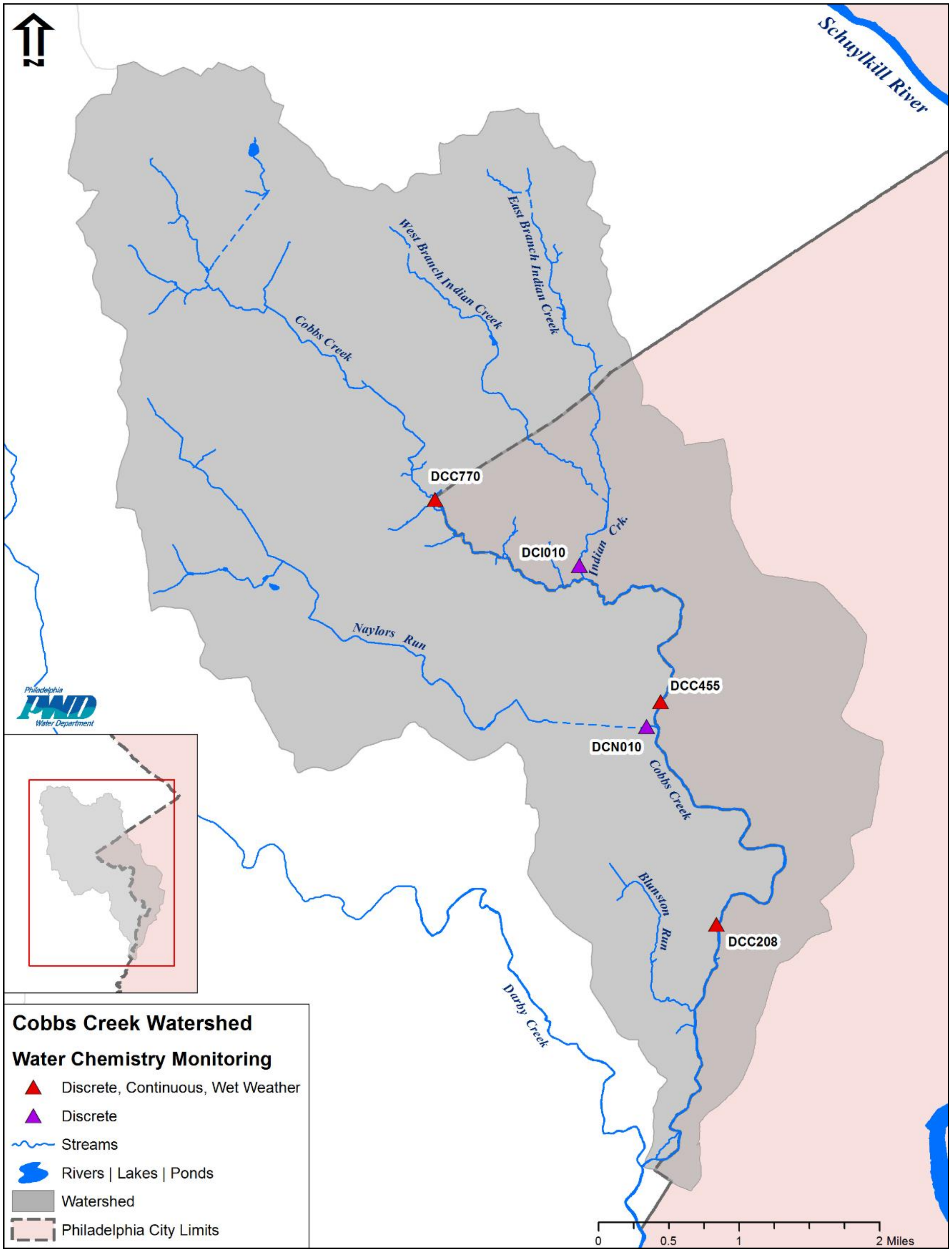


Figure - 2 Chemical monitoring locations in Cobbs Creek Watershed

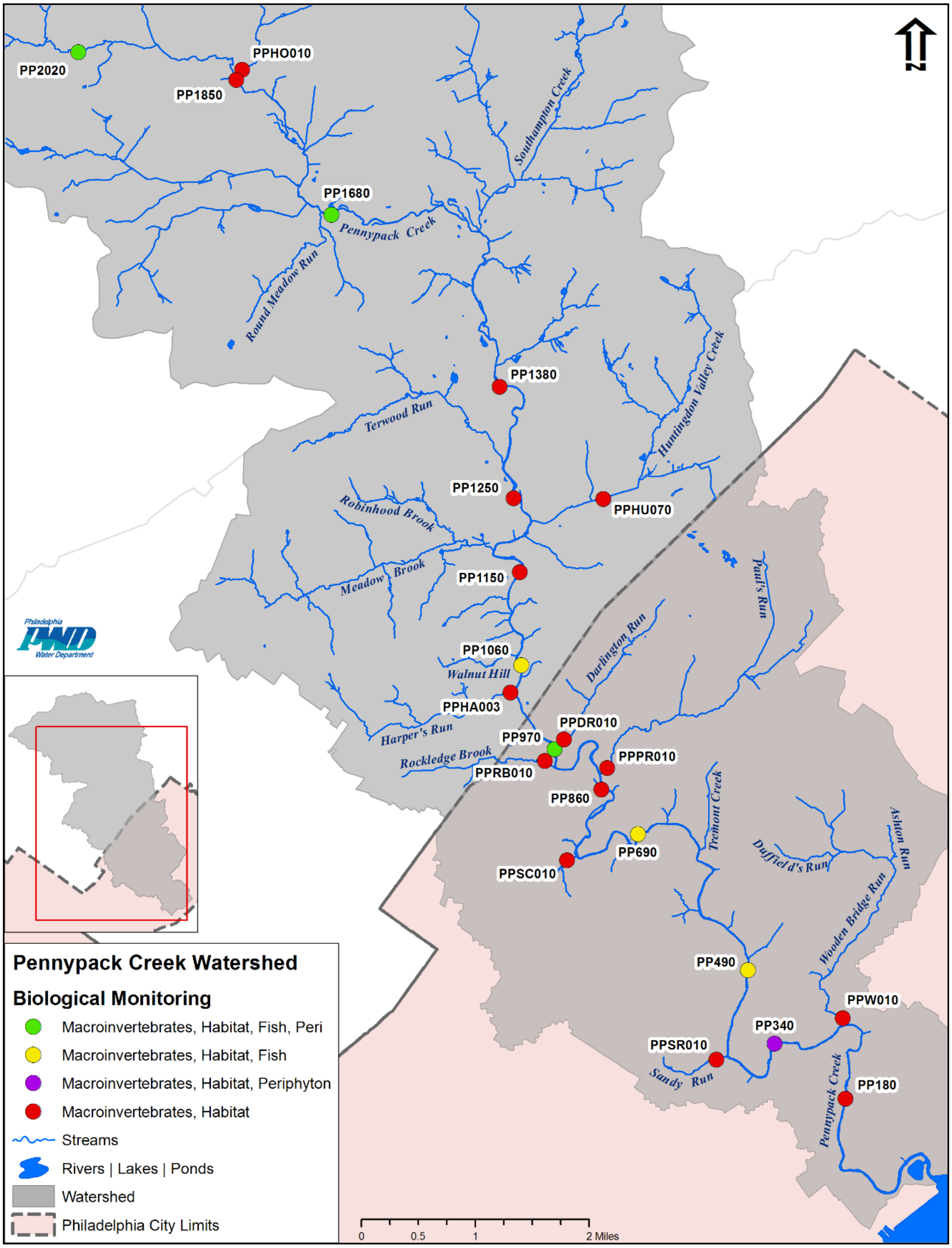


Figure - 3 Biological and Physical assessment locations in Pennypack Watershed

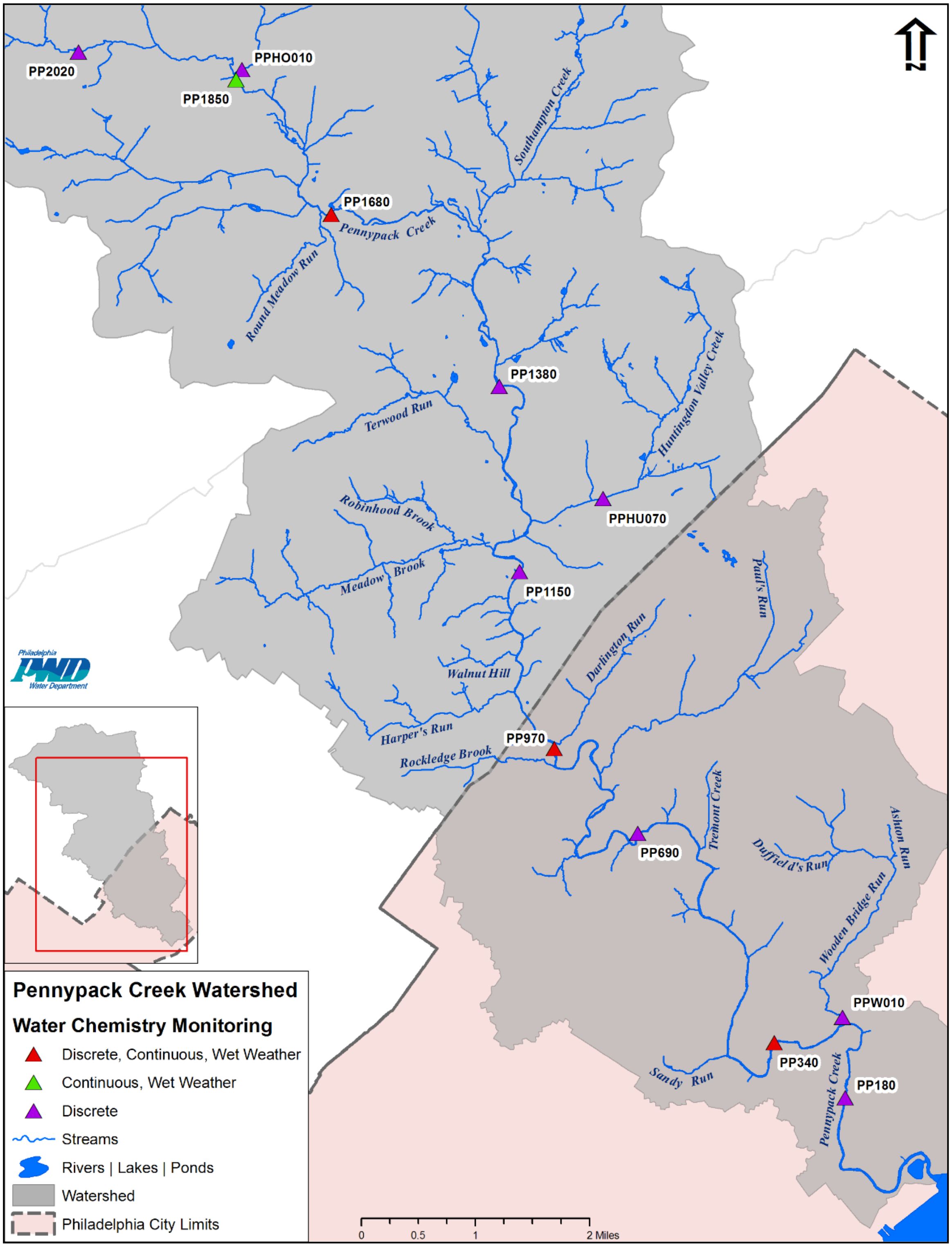


Figure - 4 Chemical monitoring locations in Pennypack Watershed

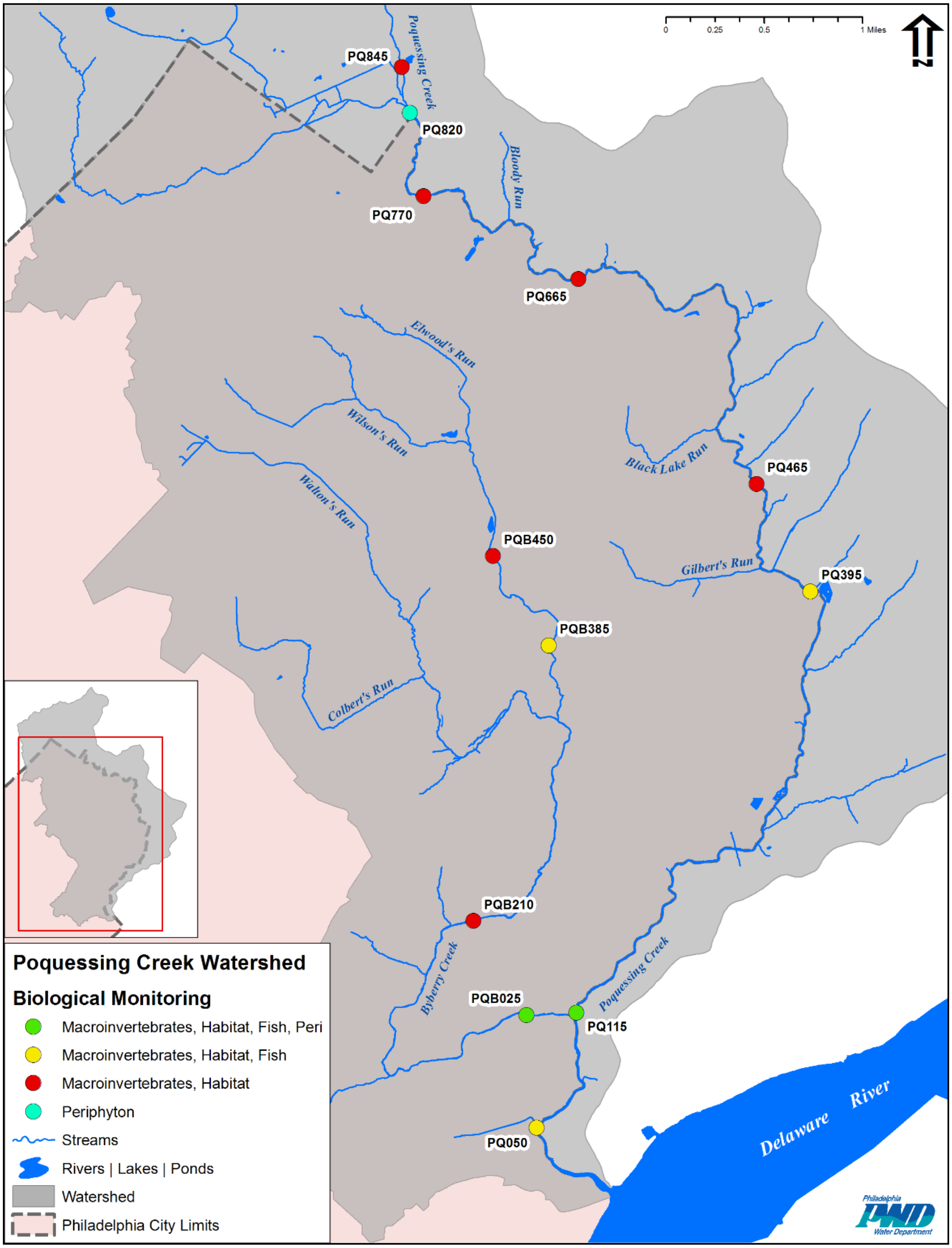


Figure - 5 Biological and Physical assessment locations in Poquessing-Byberry Watershed

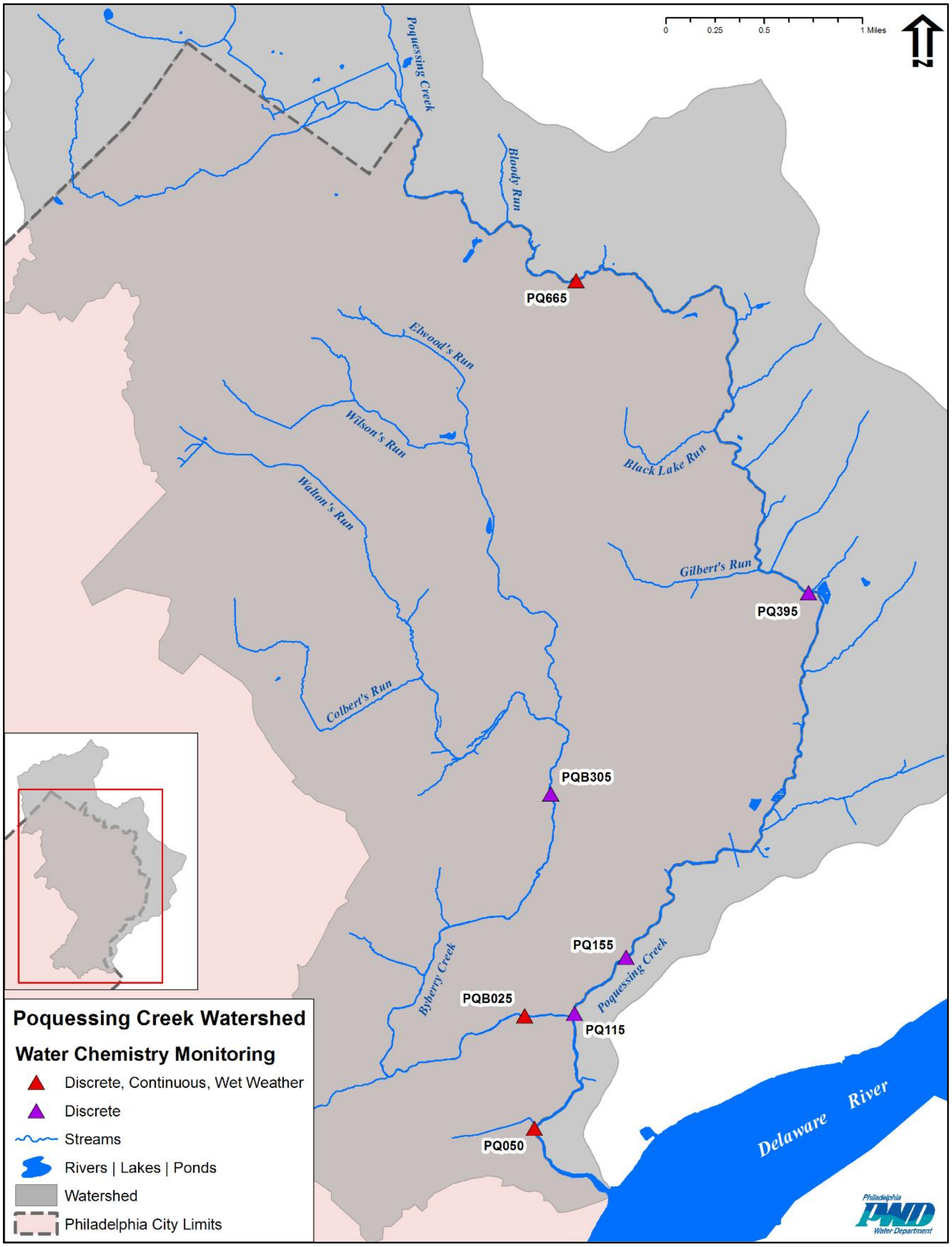


Figure - 6 Chemical monitoring locations in Poquessing-Byberry Watershed

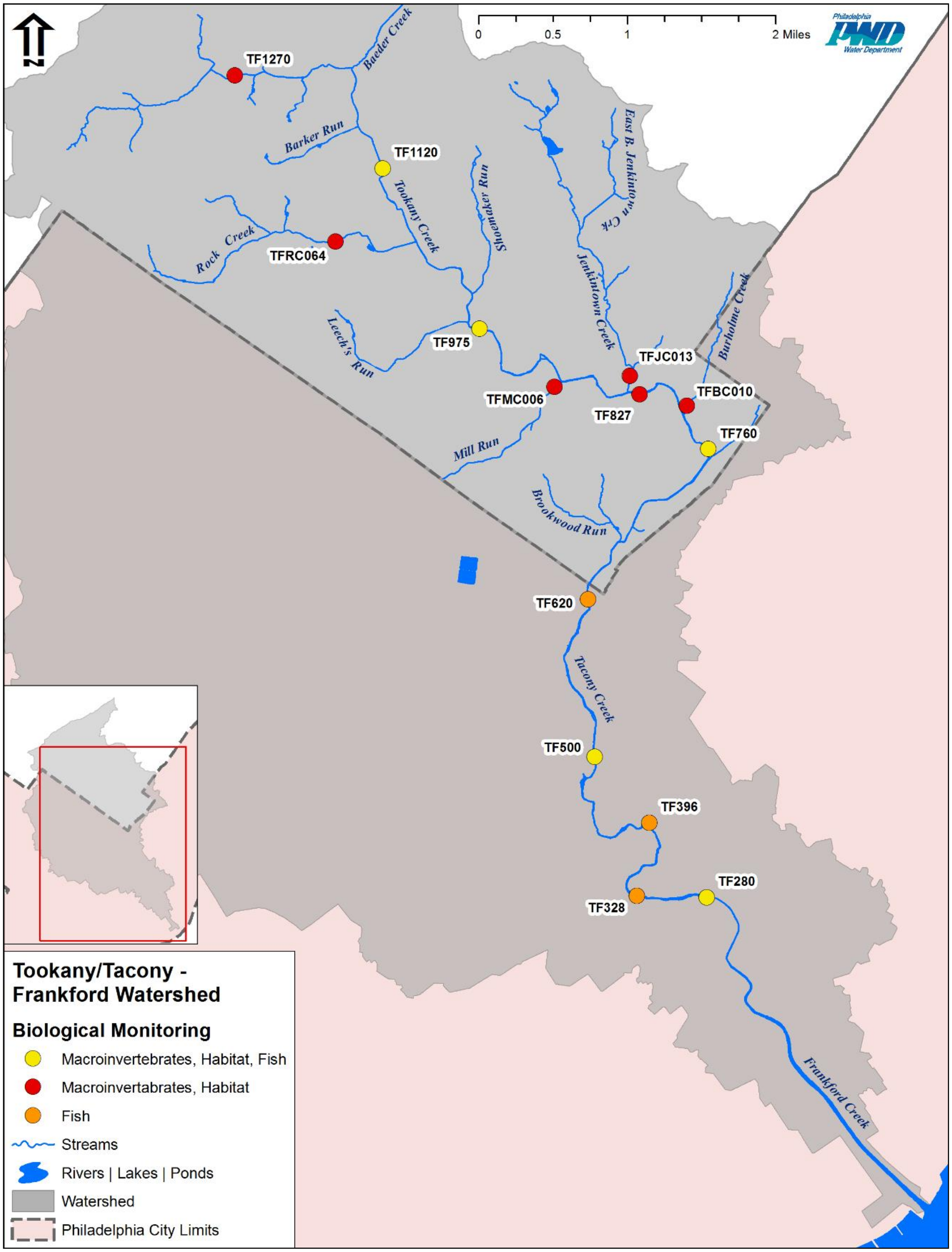


Figure - 7 Biological and Physical assessment locations in Tacony-Frankford Watershed

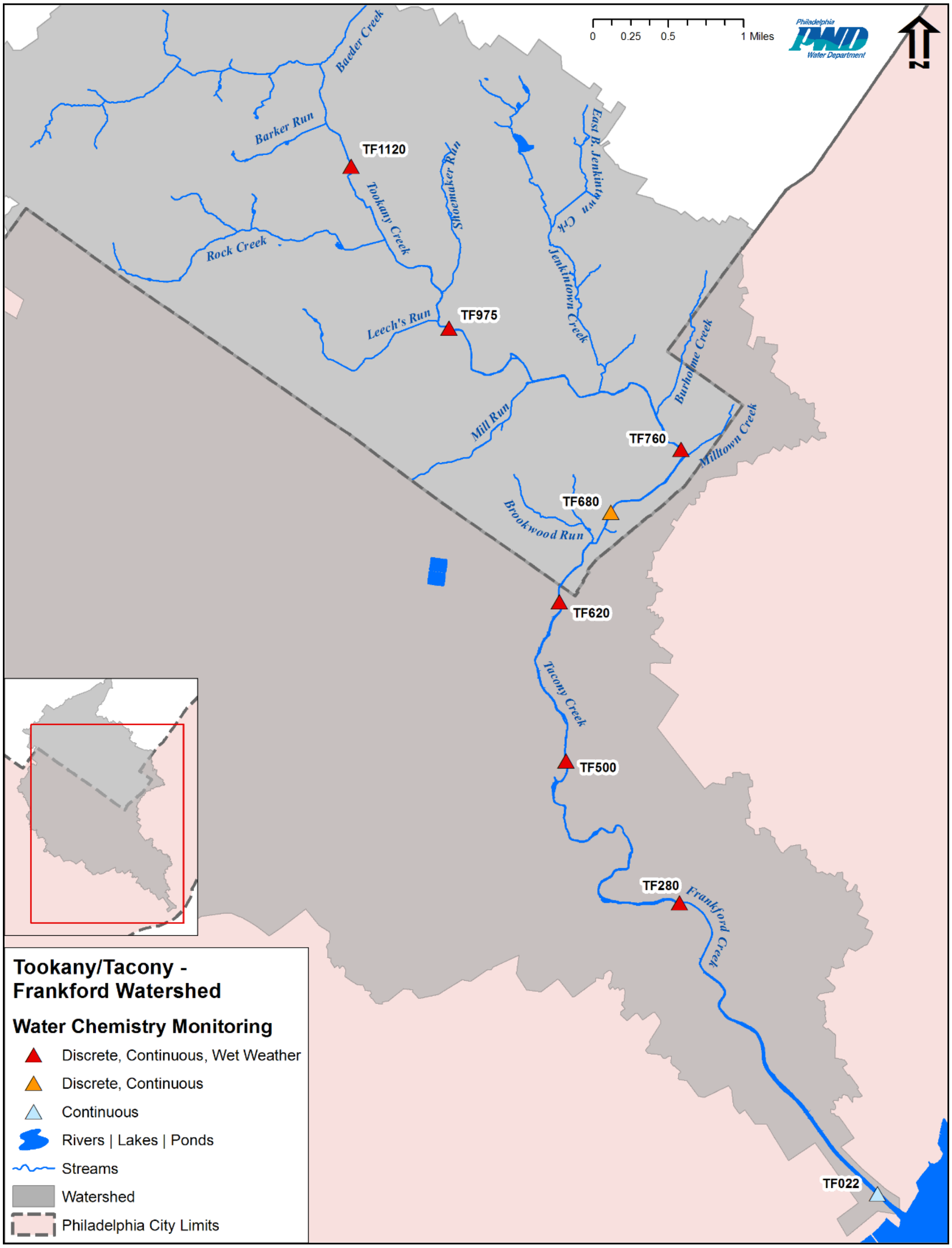


Figure - 8 Chemical monitoring locations in Tacony-Frankford Watershed

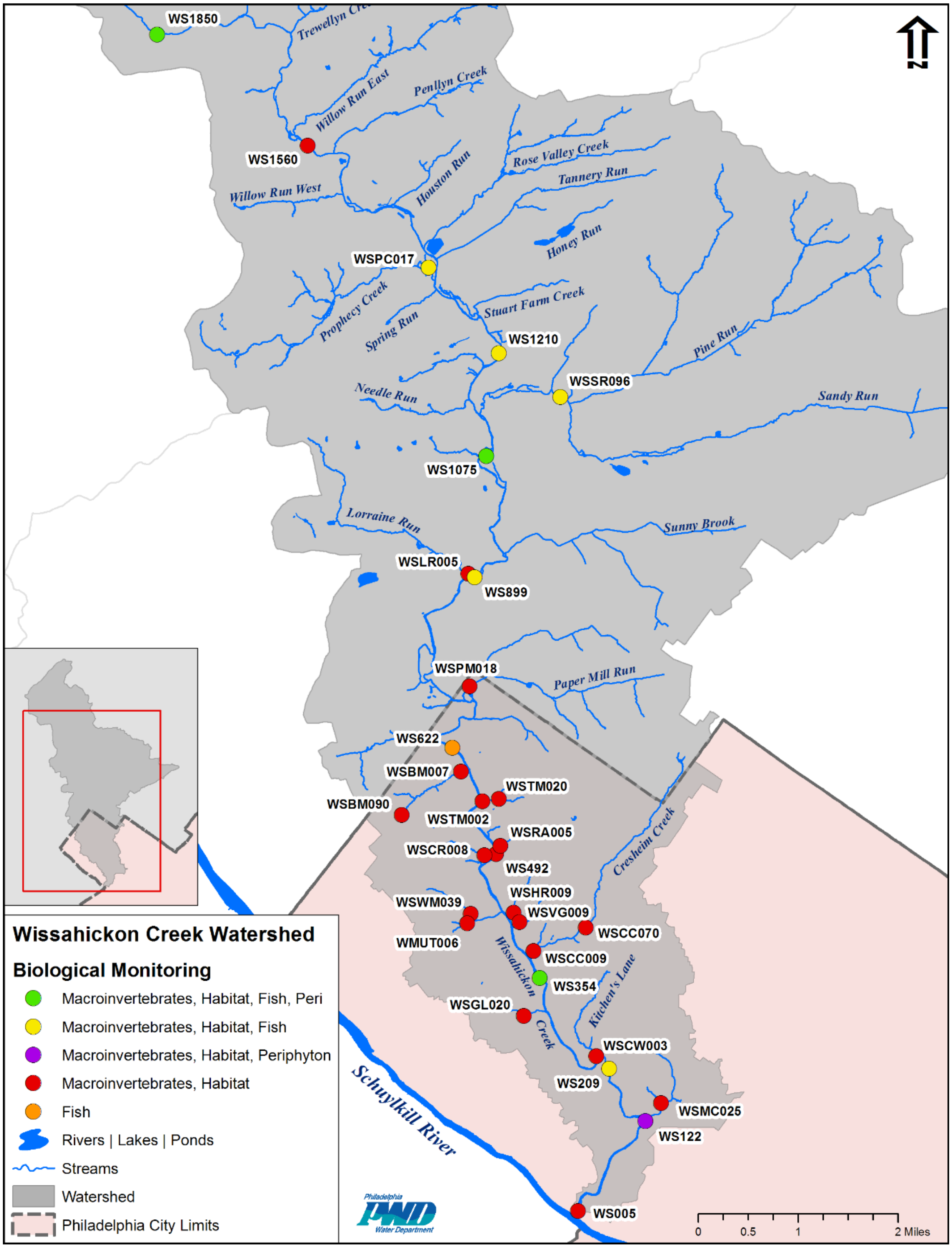


Figure - 9 Biological and Physical assessment locations in Wissahickon Watershed

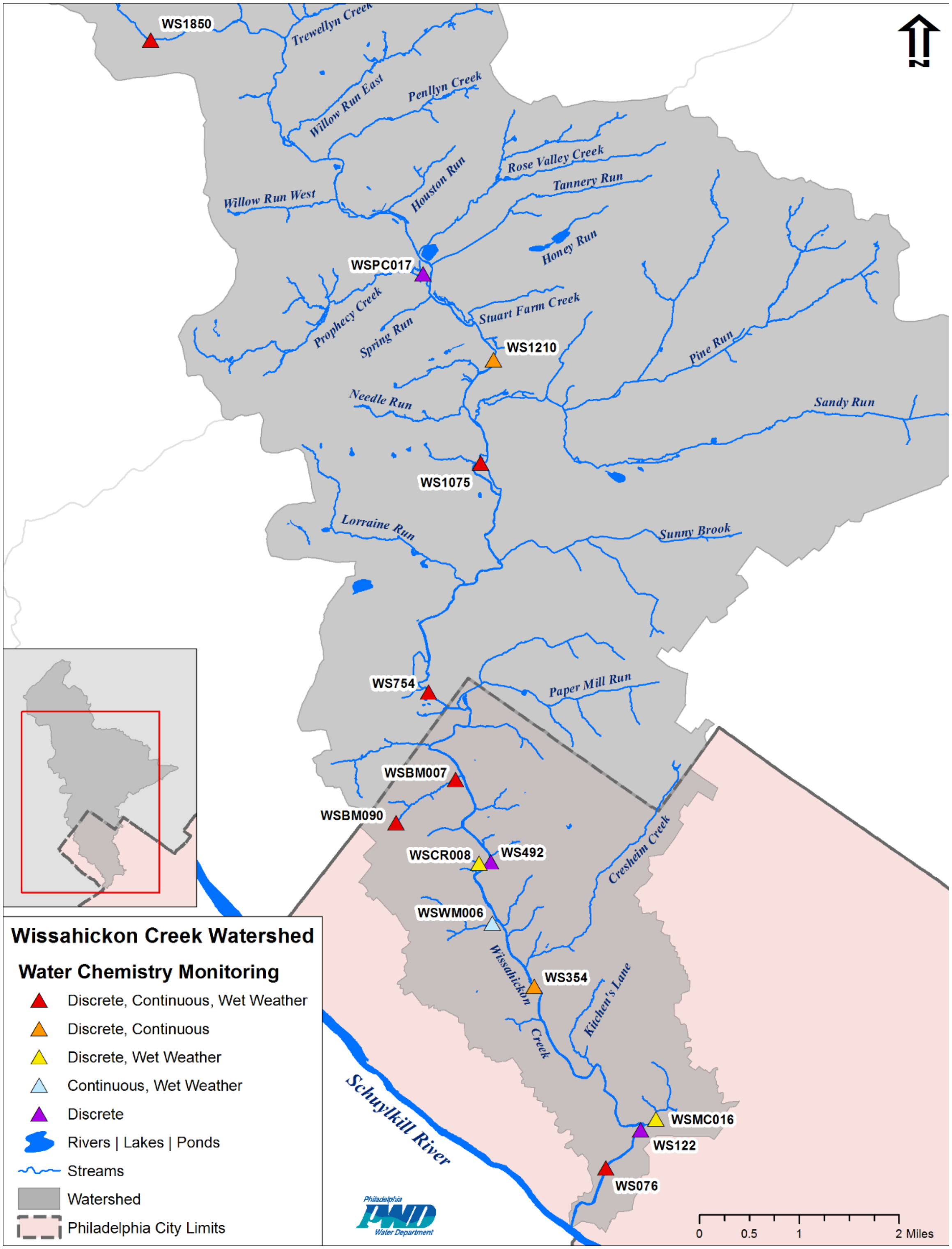


Figure - 10 Chemical monitoring locations in Wissahickon Watershed

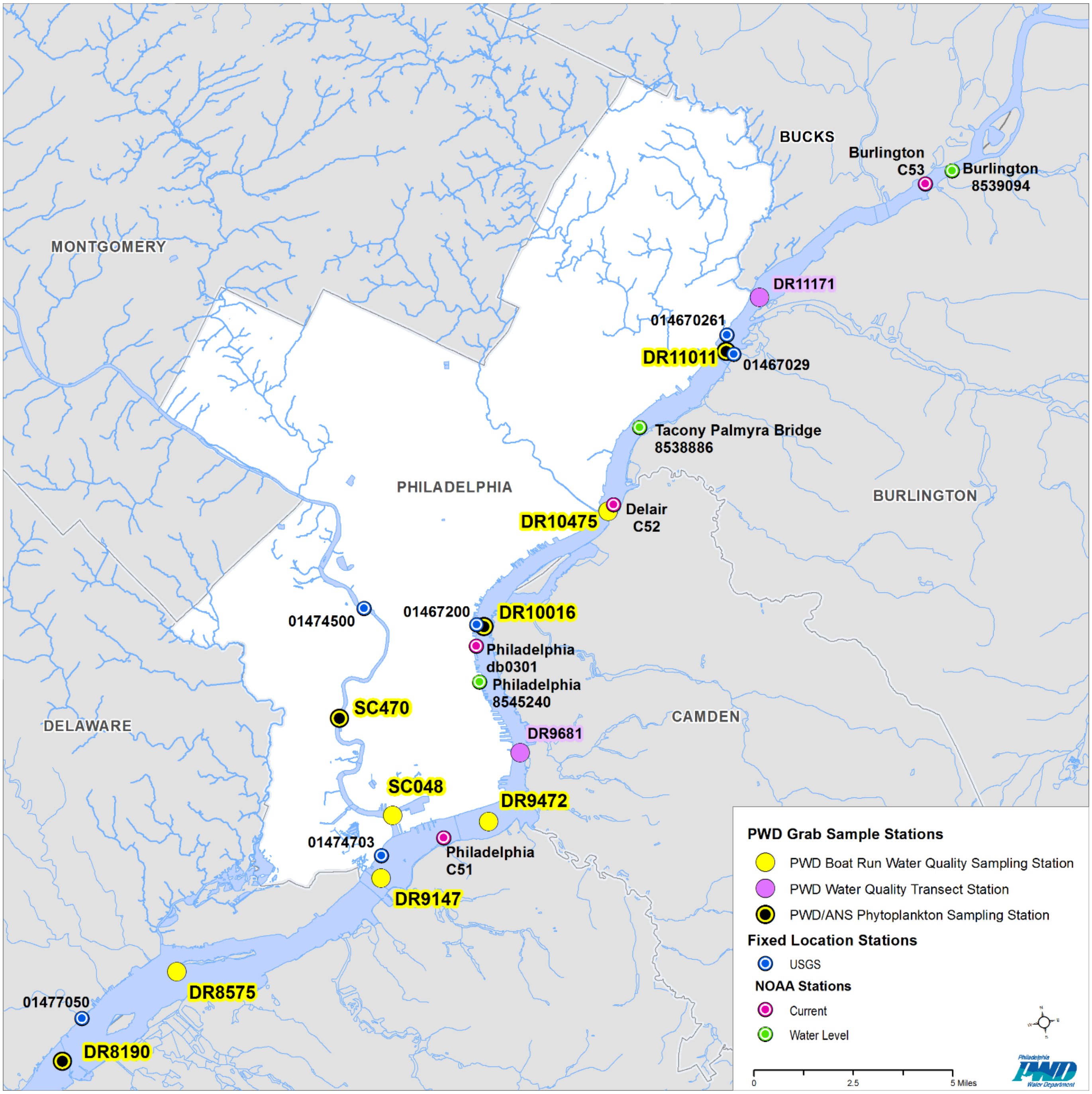


Figure - 11 Chemical monitoring locations in Delaware Estuary and Lower Schuylkill River Watershed

Appendix G – PWD Quarterly Dry Weather Water Quality Monitoring Program

Background

In 2009, the Philadelphia Water Department (PWD) initiated a dry weather water quality sampling program designed to work in tandem with the continuous data collection efforts of the PWD/USGS Cooperative Continuous Water Quality Monitoring Program. Grab samples are collected from 10 sites covering all six of Philadelphia County's watersheds on a quarterly basis by the staff of PWD's Bureau of Laboratory Services (BLS). Data collected through this program are most pertinent to Target A (Dry Weather Water Quality & Aesthetics) of PWD's Integrated Watershed Management Plan (IWMP) Strategy, as outlined in the following section.

The IWMP Target Strategy

IWMPs are designed to meet the goals and objectives of numerous water resources-related regulations and programs. Each IWMP results in a series of implementation recommendations that utilize adaptive management approaches to achieve measurable, watershed-wide benefits. By working with stakeholder groups to prioritize goals and evaluate options, PWD has learned that stakeholder priorities can at times differ from those identified by the data-driven problem identification process. This can present challenges in development and approval of a management alternative for watershed implementation. PWD has developed an approach that addresses what often emerges as a set of high-priority stakeholder concerns while simultaneously addressing the scientifically defined priorities.

By defining three distinct targets to meet the overall plan objectives, priorities identified by stakeholders can be addressed simultaneously with those identified through scientific data. Two of the targets were defined so they could be fully met through implementation of a limited set of options, while the third target would be best addressed through an adaptive management approach. In addition to the three targets, a fourth category has been developed to capture the more programmatic implementation options related to planning, outreach, reporting and continuation of the Watershed Partnership.

Targets are defined here as groups of objectives that each focus on a different problem related to the urban stream system. They can be thought of as different parts of the ultimate goal of fishable and swimmable waters through improved water quality, more natural flow patterns and restored aquatic and riparian habitat. Targets are specifically designed to help focus plan implementation. By defining these targets and designing alternatives and an implementation plan to address the targets simultaneously, the plan will have a greater likelihood of success. It also achieves some of the objectives within a relatively short time frame, providing incentives to the communities and agencies involved in the restoration, as well as immediate benefits to the people living in the watershed. PWD's IWMP

3 Targets of the IWMP

- Aesthetically appealing, accessible streams during dry weather
- Improved stream habitat for fish and macroinvertebrates
- Wet weather water quality that meets fishable and swimmable criteria

planning targets are defined below:

Program Support

A number of implementation options deemed appropriate for a given watershed are "programmatic" in nature. While these options may support achievement of Targets A, B, and/or C, implementation of these options alone would not result in achievement of a particular target. These "Program Support" associated options include items such as monitoring, reporting, feasibility studies, outreach/education, and continuation of the Watershed Partnership.

Target A: Dry Weather Water Quality and Aesthetics

Streams should be aesthetically appealing (look and smell good), accessible to the public, and an amenity to the community. Target A was defined with a focus on eliminating sources of sewage discharge and other pollution during dry weather, along with trash removal and litter prevention. Access and interaction with the stream during dry weather has the highest priority, because dry weather flows occur about 60-65% of the time during the course of a year. These are also the times when the public is most likely to be near or in contact with the stream. In dry weather, stream water quality should be similar to background concentrations in groundwater, particularly with respect to bacteria.

Figure 1. Eroded stream bank at Poquessing Creek

Target B: Healthy Living Resources

Improvements to the number, health, and diversity of benthic macroinvertebrate and fish species need to focus on habitat improvement and the creation of refuges for organisms to avoid high velocities during storms. Fluvial geomorphological studies, wetland and streambank restoration/creation projects, and stream modeling should be combined with continued biological monitoring to ensure that correct procedures are implemented to increase habitat heterogeneity within the aquatic ecosystem.

Improving the ability of an urban stream to support viable habitat and fish populations focuses primarily on the elimination or remediation of the more obvious impacts of urbanization on the stream. These include loss of riparian habitat, eroding and undercut banks, scoured streambed or excessive sediment deposits, channelized and armored stream sections, trash buildup, and invasive species. Thus, the primary tool to accomplish Target B is stream restoration.

Target C: Wet Weather Water Quality and Quantity

The third target is to restore water quality to meet fishable and swimmable criteria during wet weather. Improving water quality and flow conditions during and after storms is the most difficult target to meet in the urban environment. During wet weather, extreme increases in streamflow are common, accompanied by short-term changes in water quality. Where water quality and quantity problems exist, options may be identified that address both. Any stormwater management practice that increases infiltration or detains flow will help decrease the frequency of damaging floods; however, the size of such structures may need to be increased in areas where flooding is a major concern. (Reductions in the frequency of erosive flows and velocities will also help protect the investment in stream restoration made as part of Target B.)

Target C must be approached somewhat differently from Targets A and B. Full achievement of this target means meeting all water quality standards during wet weather, as well as elimination of flood-related issues.

Meeting these goals will be difficult. It will be expensive and requires a long-term effort. A rational approach to achieve this target includes stepped implementation with interim goals for reducing wet weather pollutant loads and stormwater flows, along with monitoring for the efficacy of control measures.

Monitoring Locations

Water quality samples are taken at 10 USGS gage sites in the USGS/PWD Cooperative Monitoring Program (Figure 2). Site identification codes used by PWD's Bureau of Laboratory Services (BLS) and rivermile-based site ID codes are presented

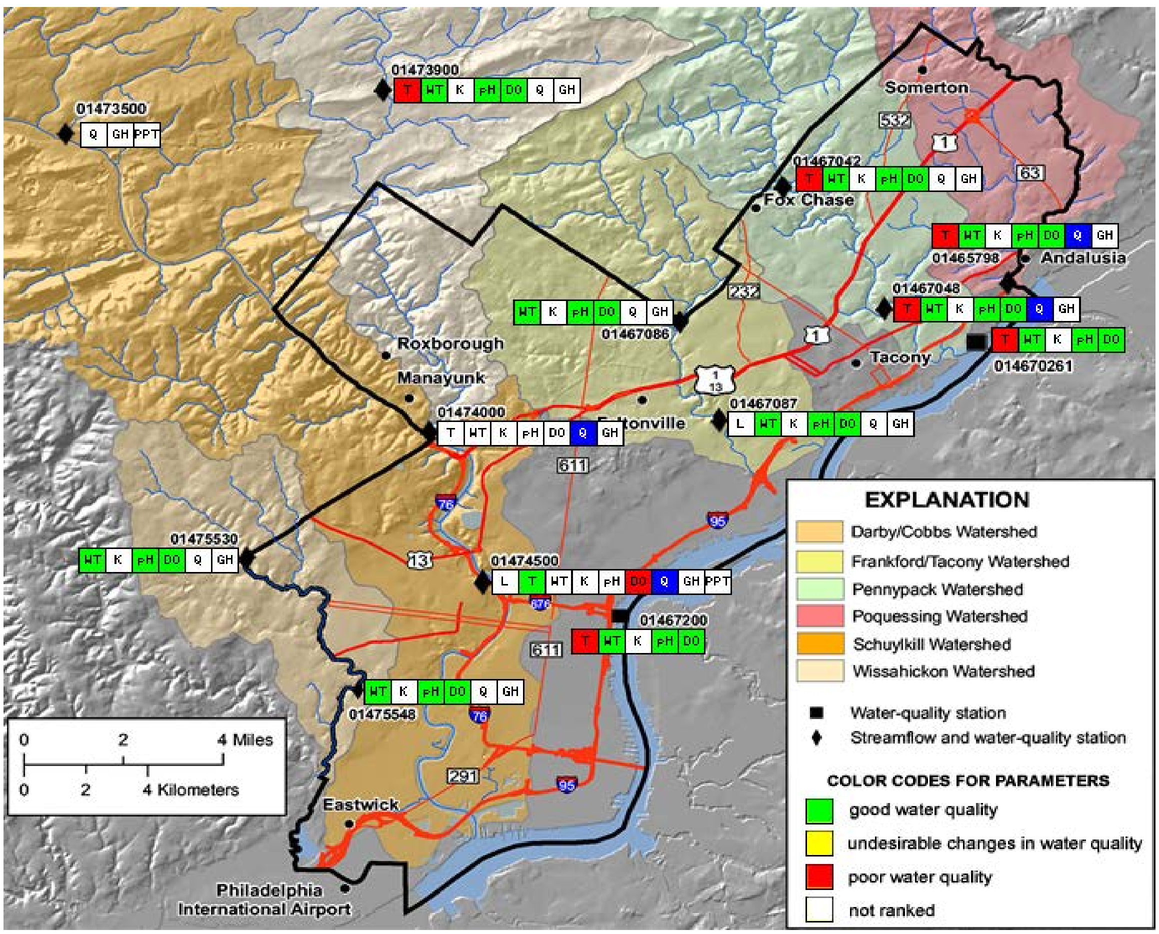


Figure 2. Philadelphia Water Quality Gage Stations as Viewed on Cooperative USGS-PWD Website (https://www.usgs.gov/centers/pa-water/science/philadelphia-water-resources-monitoring-program)

alongside USGS gage station numbers in Table 1. USGS stream gaging stations are ideal monitoring points as they allow discrete sample data to be coupled with continuous discharge data being collected year-round at these sites for loading estimate purposes. Furthermore, grab sample results and field meter readings taken at the time of grab sampling may be invaluable when evaluating continuous water quality data from these USGS gages.

PWD is implementing a City-wide approach to dry weather water quality monitoring, rather than focusing on an individual watershed. Because a number of Green Stormwater Infrastructure (GSI) and other stormwater management projects are in the early stages of implementation, water quality benefits will only be observable over a period of several years.

Gauging the success of such projects on a more immediate scale is best accomplished solely by hydrological analysis. Therefore, the strategic value of the widespread sampling approach is that as more GSI projects are completed over the coming years, the water quality data should gradually begin to reflect their positive environmental impacts.

Table 1. Monitoring Locations in the PWD/USGS Cooperative Program with Location IDs used by PWD Bureau of Laboratory Services and River Mile-Based Site IDs

Description	**USGS Gage #**	**BLS Location ID**	**Site ID**
Cobbs Creek at US Rte. 1 (City Line Ave.)	01475530	COBB700	DCC770
Cobbs Creek at Mt. Moriah Cemetery	01475548	COBB355	DCC251
Schuylkill River at Fairmount Dam	01474500	SCHU154	SC825
Wissahickon Creek at Ft Washington (Rte. 73)	01473900	WISS500	WS1075
Wissahickon Creek at Ridge Ave.	01474000	WISS130	WS076
Tacony Creek at Castor Ave.	01467087	TACO250	TF280
Tacony Creek at Adams Ave.	01467086	TACO435	TF597
Pennypack Creek at Pine Rd.	01467042	PENN407	PP993
Pennypack Creek at Rhawn St.	01467048	PENN175	PP340
Poquessing Creek at Grant Ave.	01465798	POQU150	PQ050

Table 2. PWD/USGS Quarterly Dry Weather Grab Sample Dates

Sample Date	Season	Recreational Use Season
30-Jun-09	summer	Swimming
02-Oct-09	fall	Non-Swimming
17-Dec-09	winter	Non-Swimming
11-Mar-10	spring	Non-Swimming
22-Jun-10	summer	Swimming
15-Sep-10	fall	Swimming
20-Dec-10	winter	Non-Swimming
29-Mar-11	spring	Non-Swimming
27-Jun-11	summer	Swimming
15-Sep-11	fall	Swimming
13-Dec-11	winter	Non-Swimming
20-Mar-12	spring	Non-Swimming
18-Jun-12	summer	Swimming
26-Sep-12	fall	Swimming
02-Jan-13	winter	Non-Swimming
04-Apr-13	spring	Non-Swimming
17-Jul-13	summer	Swimming
26-Sep-13	fall	Swimming
17-Jan-14	winter	Non-Swimming
26-Mar-14	spring	Non-Swimming
17-Jun-14	summer	Swimming
23-Sep-14	fall	Swimming
19-Dec-14	winter	Non-Swimming
18-Mar-15	spring	Non-Swimming
23-Jun-15	summer	Swimming
6-Oct-15	fall	Non-Swimming
6-Jan-16	winter	Non-Swimming
20-Apr-16	spring	Non-Swimming
12-Jul-16	summer	Swimming
22-Sep-16	fall	Swimming
10-Jan-17	winter	Non-Swimming
20-Apr-17	spring	Non-Swimming
11-Jul-17	summer	Swimming
13/22-Sep-17	fall	Swimming
28-Feb-18	winter	Non-Swimming
02-May-18	spring	Swimming
10-Jul-18	summer	Swimming
24-Oct-18	fall	Non-Swimming
17-Jan-19	winter	Non-Swimming
20-Mar-19	spring	Non-Swimming

Quarterly Dry Weather Monitoring July 2009 – June 2019

Sample Collection Dates

This report summarizes cumulative results from 40 sets of quarterly grab samples that were collected from June 2009 through March 2019. Samples were categorized by season (winter, spring, summer, fall) as well as according to PA DEP seasonal recreational use water quality criteria for interpretation of microbial sample results (Non-Swimming season or Swimming season) (Table 2). Weather conditions delayed the summer dry-weather sample normally collected during June 2019; the sampling event instead occurred in July and results will be included in next year's report.

Nutrient Analysis

The macronutrients phosphorus and nitrogen are essential to the growth and overall survival of all plants. However, when occurring in surplus they can be extremely detrimental to aquatic ecosystems, and in turn to the human population that utilizes these water bodies for drinking water and recreational activities such as fishing, boating, and swimming. Elevated nutrient concentrations in rivers and streams can most often be attributed to anthropogenic pollution sources. In these situations, the most common sources of both nutrients are runoff from fertilized lawns/farmland and wastewater discharge.

The most immediate result of excessive nutrient concentrations in any natural water body is excessive plant growth, seen in a variety of growth forms from suspended algae to aquatic macrophytes. As the first step in the process of eutrophication, this unnatural acceleration of aquatic plant growth can start a chain reaction leading to highly adverse effects to that ecosystem. For example, in small shallow streams, unnaturally high densities of algal periphyton can cause pronounced fluctuations in dissolved oxygen and pH and also adversely affect aquatic habitat by forming thick mats of filamentous algae or algal scums on stream substrates. Moreover, alteration of the algal community structure can lead to the proliferation of nuisance taxa, taste and odor problems in the drinking water supply, increased water treatment costs and, in rare cases, production of toxins (*e.g.*, from cyanobacteria blooms). As a result of these direct and indirect responses, streams and rivers can suffer severe impacts to both aquatic biodiversity and human recreational use.

It should be noted that several phosphorus-containing compounds, known as polyphosphates, can be found in the region's waterways, but they are naturally occurring and are present due to the geologic composition of the area. Furthermore, these polyphosphates pose little ecological threat as they are not present in a biologically available form. Only over long periods of time can these compounds be broken down into orthophosphates, which plants and algae can absorb and utilize for growth. Therefore, aside from the relatively minor contributions of the region's geology, the most significant source of orthophosphates in rivers and streams is human-generated pollution. It is for this reason that orthophosphates, along with nitrates, are included as components of this water quality monitoring program. These forms of N and P are readily available to stream producers.

Ammonia, present in surface waters as un-ionized ammonia gas (NH_3) or as ammonium ion (NH_4^+), is produced by deamination of organic nitrogen-containing compounds such as proteins, and also by hydrolysis of urea. In the presence of oxygen, ammonia is converted to nitrate (NO_3^-) by a pair of bacteria-mediated reactions, together known as the process of nitrification. Nitrification occurs quickly in oxygenated waters with sufficient densities of nitrifying bacteria, effectively reducing ammonia concentration, although at the expense of increased NO_3^- concentration. Ammonia is a primary form of nitrogen produced from excretory waste products and other organic material in sewage. Thus, presence of ammonia can be an indicator of sewage pollution. As ammonia is converted to nitrate in oxygenated streams, ammonia is a non-conservative pollution indicator that tends to decrease in concentration with increasing distance from the source of pollution. PA DEP water quality criteria for NH_3 reflect the relationship between stream pH, temperature, and ammonia dissociation. Ammonia toxicity is inversely related to hydrogen ion [H^+] concentration (*e.g.*, an increase in pH from 7 to 8 increases NH_3 toxicity by approximately an order of magnitude). At pH 9.5 and above, even background concentrations of NH_3 may be considered potentially toxic.

Ammonia may be introduced to streams through fertilizers, breakdown of natural organic material, stables and livestock operations, stormwater runoff, and in some cases from more serious anthropogenic sources of untreated sewage such as defective laterals, crossed/illicit connections, and sanitary sewer overflows (SSOs). PWD has established intensive field infrastructure trackdown, infrared photography, sewer camera monitoring, and dye testing programs to identify and correct these problems where and when they occur.

Nutrient Results

Nutrient data collected thus far at each of the sites are generally consistent with the data collected for Comprehensive Characterization Reports (CCRs) prepared for each of the respective watersheds. Five of 10 sites are not affected by treated wastewater discharges and usually had orthophosphate concentration less than the reporting limit. The reporting limit for the majority of samples was 0.05 mg/L, but limits of 0.1 mg/L and 0.09 mg/L were also in effect at various times during the quarterly grab sampling program (Table 3). Conversely, Pennypack and Wissahickon creeks had multiple instances of elevated orthophosphate concentration, which is likely attributable to point source discharge of treated wastewater. Dilution effects were seen between upstream and downstream gages, particularly in the cases of Pennypack and Wissahickon creeks.

Though the Schuylkill River sampling station is downstream from several discharges of treated wastewater, nutrient concentrations are generally smaller than those observed from the Pennypack and Wissahickon creeks, perhaps reflecting the Schuylkill station's much larger overall watershed size and dilution capacity.

Summary statistics for the orthophosphate samples, including results from the application of the PA DEP Chemistry Statistical Assessments protocol (PA DEP, 2007), are shown in Table 3. Exceedances were evaluated relative to the US EPA (2000) Subecoregion 64 guideline for orthophosphate of 0.02625 mg/L, *i.e.*, the median of the 25th percentile seasonal concentrations. Since the detection limit is greater than the guideline, all non-detected samples were considered "possible exceedances." The nonparametric statistical assessment results show that the locations at Pennypack and Wissahickon creeks, and the Schuylkill River, failed to attain water quality consistent with this guideline. The other locations are classified as needing further evaluation due to the predominance of samples below the detection limit that are all possible exceedances.

Similar examples of wastewater discharge impacts and upstream/downstream dilution have also begun to emerge with regard to the nitrate data that have been collected. The data seem to indicate a trend toward decreased nitrate

Table 3. Orthophosphate Summary Statistics and Assessments. (Concentrations in mg/L)

Gage	Mean	Median	Std. dev.	Min.	Max.	n	n, non-detects	Exceedances	Possible Exceedances	Assessment
1465798	0.055	0.050	0.022	0.014	0.100	40	34	3	34	Needs more evaluation
1467042	0.341	0.242	0.226	0.099	0.953	38	0	35	0	Non-attaining
1467048	0.236	0.174	0.172	0.053	0.852	40	0	36	0	Non-attaining
1467086	0.061	0.050	0.055	0.000	0.363	39	31	2	31	Needs more evaluation
1467087	0.059	0.050	0.030	0.011	0.177	40	29	5	29	Needs more evaluation
1473900	0.280	0.259	0.124	0.050	0.723	40	1	36	1	Non-attaining
1474000	0.162	0.157	0.062	0.050	0.414	39	3	33	3	Non-attaining
1474500	0.142	0.117	0.083	0.050	0.367	40	5	32	5	Non-attaining
1475530	0.054	0.050	0.023	0.019	0.100	40	33	0	33	Needs more evaluation
1475548	0.057	0.050	0.028	0.000	0.152	40	33	2	33	Needs more evaluation

concentrations during warmer months, which would correspond to the increased uptake of nutrients by plant life during those growing seasons (Table 4 and Figure 4). The only exceptions are the Pennypack and Wissahickon Creek gage sites, which as previously stated are directly impacted by treated wastewater discharge. It should be noted, however, that these statements and observations are in no way conclusive given that the dataset is still relatively limited in size. As this dataset grows in subsequent years, further statistical analysis can be carried out and any apparent patterns or phenomena can be explored.

Summary statistics for the nitrate samples, including results from application of the PA DEP Chemistry Statistical Assessment protocol (PA DEP, 2007), are shown in Table 4. Exceedances were evaluated relative to a) the PA DEP water quality standard for nitrite and nitrate of 10 mg/L, and b) the US EPA (2000) subecoregion 64 guideline for nitrite and nitrate of 0.995 mg/L, *i.e.*, the median of the 25th percentile seasonal concentrations. The nonparametric statistical assessment results show that with respect to the PA DEP standard, all locations were in attainment except the upstream Wissahickon gage. One exceedance at 12 mg/L was observed at that site, and more data is needed to make an evaluation. All sites failed to attain water quality consistent with the US EPA subecoregion-based guideline.

Quarterly dry-weather analysis of ammonia began in the fall of 2011, limiting the size of the current dataset to 27 results per location. PWD laboratory reporting limits for ammonia fluctuated based on the performance of lab analytical equipment with spiked and blank samples. Ammonia concentration detection limits were 0.5 mg/L for the fall 2011 sample set, and the subsequent sample set results had detection limits of 0.1 mg/L. Ammonia concentration exceeded the detection limit in only 30 of the 270 samples: The downstream Tacony site (01467087) most often exceeded the detection limit, where a maximum concentration of 0.4 mg/L was observed in both fall 2014 and summer 2015. Results are shown in Table 5 and Figure 5.

There were no observed violations of ammonia water quality criteria at any site during this period of dry-weather monitoring. With 217 of the 270 sample results characterized as non-detects due to laboratory reporting limits, ammonia criteria was calculated with corresponding temperature and pH values to determine if possible exceedances existed (i.e., the criteria fell below the detection limit). None of the non-detect samples had the potential to violate water quality criteria.

Table 4. Nitrate Summary Statistics and Assessments. Concentrations are in mg/L.

Gage	Mean	Median	Std. dev.	Min.	Max.	n	n, non-detects	Exceedances, PADEP	Exceedances, Subecoregion	PADEP Assessment	EPA Subecoregion Assessment
1465798	1.774	1.707	0.576	0.797	3.750	38	0	0	38	Attaining	Non-attaining
1467042	4.483	4.062	0.992	3.200	7.943	36	0	0	36	Attaining	Non-attaining
1467048	3.509	3.318	1.036	1.209	6.326	38	0	0	38	Attaining	Non-attaining
1467086	2.526	2.363	1.283	1.510	9.740	37	0	0	37	Attaining	Non-attaining
1467087	1.854	1.817	0.721	0.505	3.373	39	0	0	37	Attaining	Non-attaining
1473900	5.885	5.420	1.975	2.690	12.039	37	0	1	38	Needs more evaluation	Non-attaining
1474000	3.939	3.892	0.951	1.288	6.180	38	0	0	37	Attaining	Non-attaining
1474500	2.975	2.950	0.436	2.141	3.960	39	0	0	39	Attaining	Non-attaining
1475530	2.991	3.070	0.329	2.489	3.521	39	0	0	39	Attaining	Non-attaining
1475548	2.524	2.612	0.528	1.395	3.500	39	0	0	39	Attaining	Non-attaining

Table 5. Ammonia Summary Statistics and Assessments. Concentrations are in mg/L.

Gage	Mean	Median	Std. dev.	Min.	Max.	n	n, non-detects	Exceedances
1465798	0.116	0.100	0.076	0.041	0.500	31	24	0
1467042	0.121	0.100	0.082	0.027	0.500	31	27	0
1467048	0.119	0.100	0.083	0.043	0.500	31	26	0
1467086	0.112	0.100	0.075	0.020	0.500	31	28	0
1467087	0.162	0.104	0.108	0.028	0.500	31	15	0
1473900	0.112	0.100	0.075	0.023	0.500	31	29	0
1474000	0.111	0.100	0.076	0.024	0.500	31	29	0
1474500	0.126	0.100	0.076	0.075	0.500	31	23	0
1475530	0.111	0.100	0.075	0.030	0.500	31	29	0
1475548	0.112	0.100	0.075	0.040	0.500	31	27	0

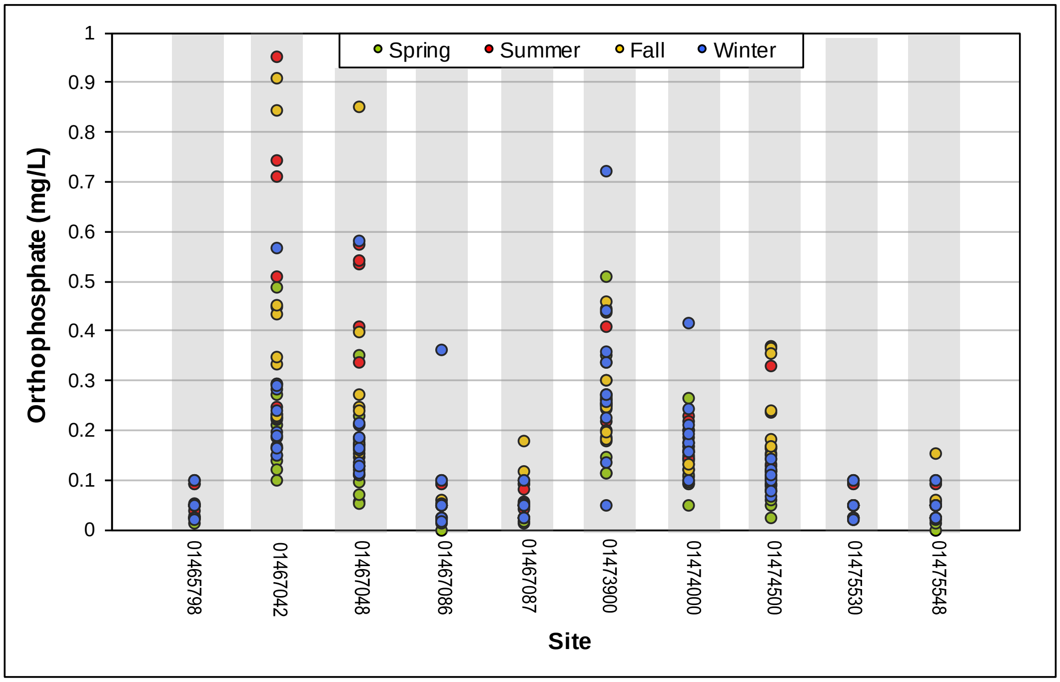


Figure 3. Orthophosphate concentration at 10 USGS gage stations, July 2009-June 2019

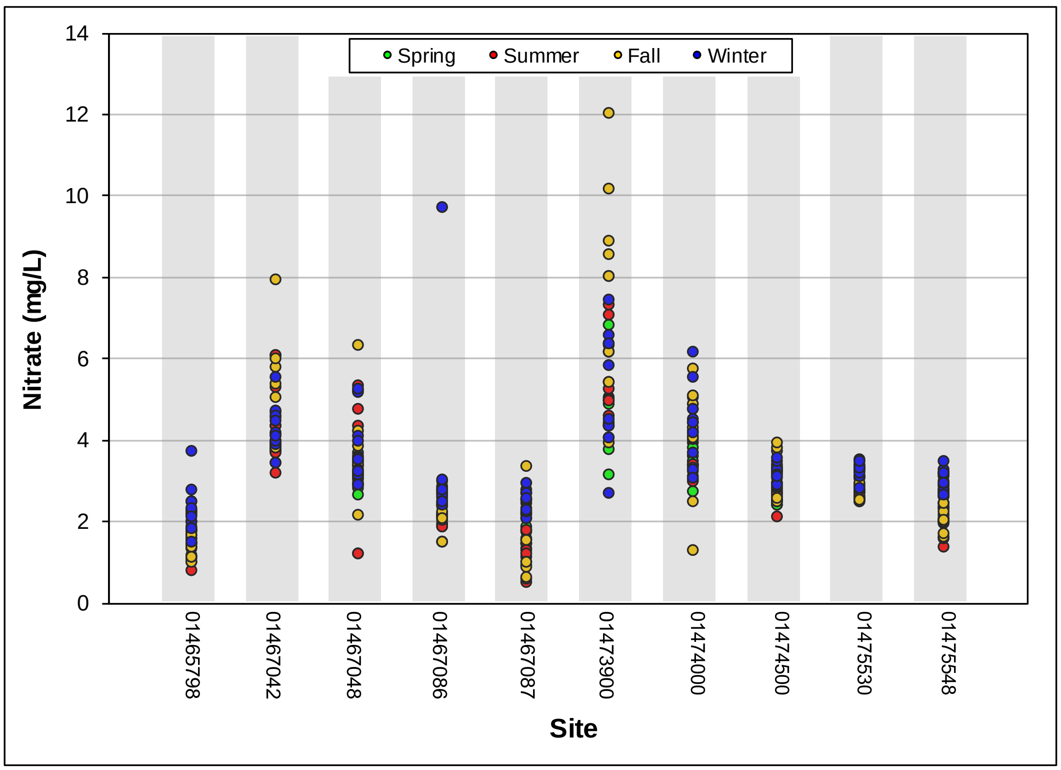


Figure 4. Nitrate concentration at 10 USGS gage stations, July 2009-June 2019

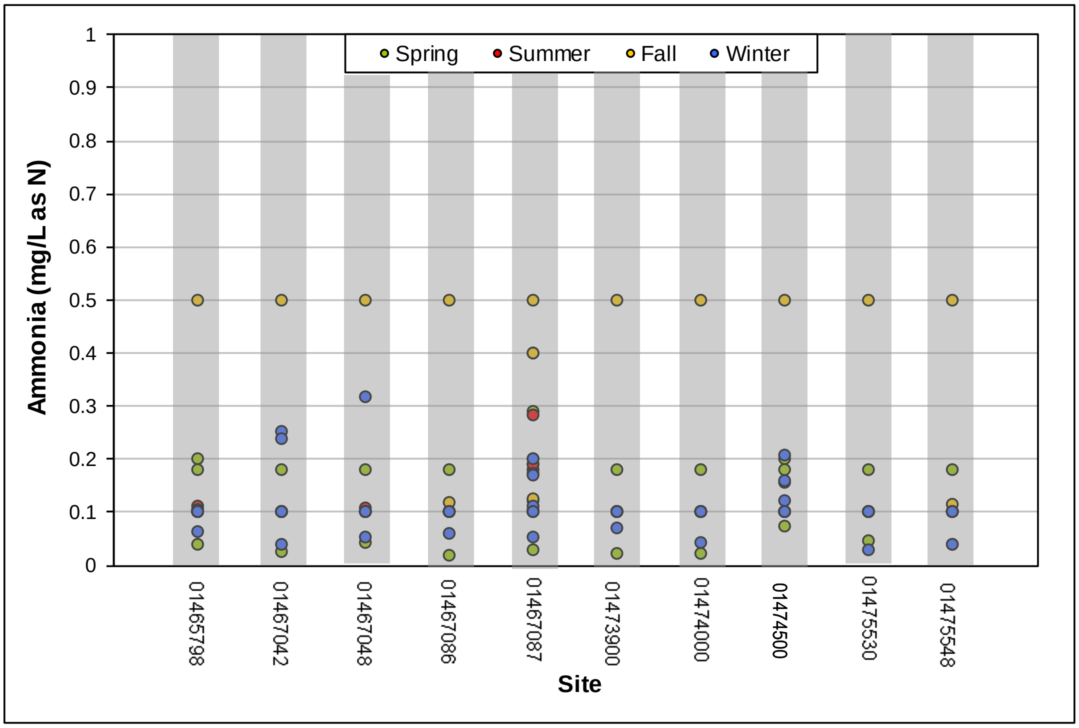


Figure 5. Ammonia concentration at 10 USGS gage stations, September 2011-June 2019

Microbial Analysis

Fecal indicator bacteria, found naturally in the gut of warm-blooded animals, can be used in the detection of human or animal waste contamination in a body of water. While these bacteria themselves are generally harmless to humans, they are considered to be very reliable indicators of the presence of other, more serious fecal-borne pathogens such as viruses, protozoa and other bacteria. The extent to which a water body is contaminated with fecal indicator bacteria can indicate the likelihood that the water has been contaminated by human or animal wastes. In urban environments, the most likely dry weather pollution sources are domestic animals, wildlife and untreated sewage from improperly connected or leaking sanitary sewers.

PWD performs fecal indicator bacteria tests for fecal coliform and *E. coli*. The fecal coliform test covers a relatively wide subgroup of fecal-specific bacteria; however, it does include some species that are not necessarily fecal in origin. *E. coli*, on the other hand, is a single coliform species that is noteworthy due to the fact that it occurs only in the fecal matter of humans and other warm-blooded animals. This qualifies *E. coli* as an excellent indicator of human waste.

Microbial Analysis Results

PA DEP has established seasonal bacteria water quality criteria that are more stringent in warmer months, or the "swimming season." For the period May 1 through September 30, water quality standards require that the geometric mean of a group of at least five samples collected on non-consecutive days over a 30-day period not exceed 200 fecal coliform CFU (colony forming unit) per 100mL. During the non-swimming season, this value increases to 2000 CFU/100mL.

While samples were collected on a quarterly basis and not within a 30-day period as required by PA DEP water quality criteria, results of microbial analyses from the seven swimming season samples generally indicate fecal coliform geometric means greater than 200CFU/100mL (Table 6). The only exceptions were the downstream Wissahickon Creek and Schuylkill River gage sites, which each had fecal coliform geometric means less than 200 CFU/100mL, based on 14 samples each. The 2000 CFU/100mL geometric mean standard for non-swimming season samples was not exceeded at any of the 10 sites, based on 18 samples at each site.

US EPA recommended water quality criteria (1986) were used as guidelines for evaluation of sample results for other microbial parameters, as PA DEP does not have recreational use water quality criteria for *E. coli*. The guideline used for *E. coli* was the geometric mean of 126 CFU/100mL. The *E. coli* geometric mean guideline was exceeded at eight of the 10 sites (Table 7).

Table 6. Fecal Coliform Geometric Mean Results and PA DEP Water Quality Recreational Use Criteria Achievement Status by Season

Gage	n	n, non-detects	Geometric mean (CFU/100 mL)	Season	Attaining Standard
1465798	22	1	85	non-swimming	Yes
1465798	18	0	444	swimming	No
1467042	22	1	47	non-swimming	Yes
1467042	18	0	291	swimming	No
1467048	22	0	299	non-swimming	Yes
1467048	18	1	968	swimming	No
1467086	22	0	180	non-swimming	Yes
1467086	18	0	915	swimming	No
1467087	22	0	291	non-swimming	Yes
1467087	18	0	516	swimming	No
1473900	22	0	60	non-swimming	Yes
1473900	18	0	265	swimming	No
1474000	22	1	31	non-swimming	Yes
1474000	18	0	109	swimming	Yes
1474500	22	1	26	non-swimming	Yes
1474500	18	2	45	swimming	Yes
1475530	22	1	78	non-swimming	Yes
1475530	18	0	303	swimming	No
1475548	22	0	143	non-swimming	Yes
1475548	18	0	777	swimming	No

Table 7. *E. Coli* Geometric Mean Results and US EPA Recreational Use Water Quality Guideline Achievement

Gage	n	n, non-detects	Geometric mean (CFU/100 mL)	Attaining Guideline
01465798	39	1	225	No
01467042	39	1	125	Yes
01467048	39	0	601	No
01467086	39	1	421	No
01467087	38	1	377	No
01473900	39	0	147	No
01474000	39	1	61	Yes
01474500	39	4	35	Yes
01475530	39	1	155	No
01475548	39	1	308	No

Results for both microbial parameters exhibited similar seasonal patterns, with samples collected during spring and winter generally having smaller concentrations than fall and summer samples (Figures 6-7). Bacteria samples collected from 2009-2019 indicate a fair correlation between fecal coliform and *E. coli* (r = 0.78) (Figure 8).

In 2018, PWD ceased collection of Enterococci samples as the scientific consensus has built toward examining *E. coli* as a primary indicator of pollution.

The number of samples limits further conclusive statements for microbial parameters at this time, particularly in the case of fecal coliform where the number of results is further reduced by categorization according to swimming vs. non-swimming season. Furthermore, US EPA is currently revising recommended recreational use water quality criteria for microbial parameters. As the quarterly dry weather monitoring program continues, more samples will be obtained, allowing for more rigorous statistical analyses in the future.

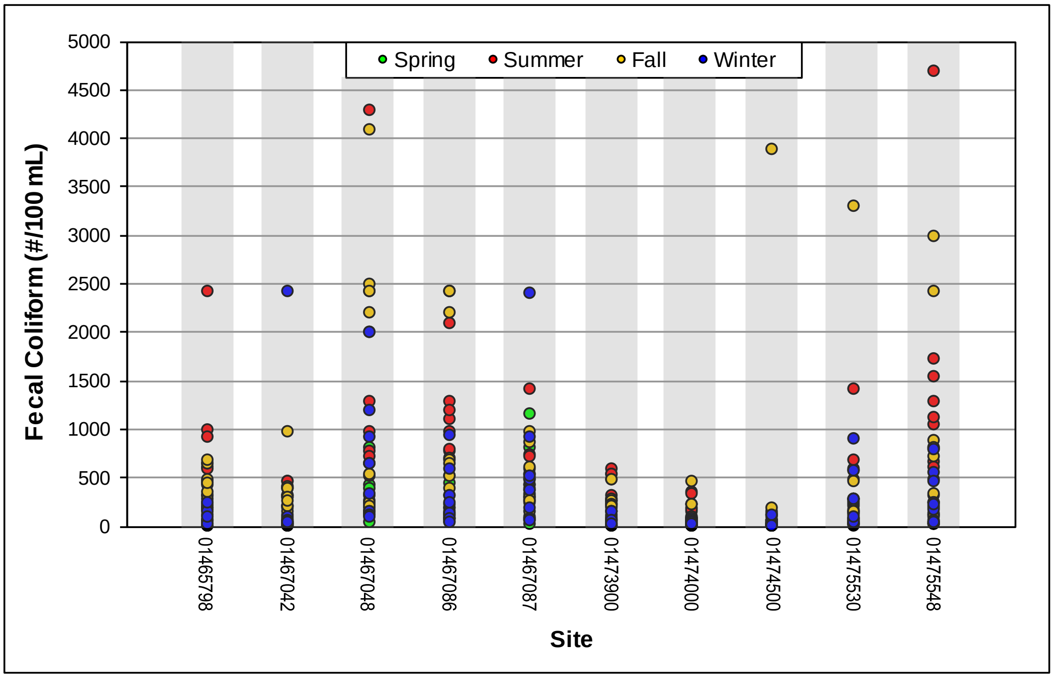


Figure 6. Fecal Coliform results at 10 USGS gage stations, July 2009-June 2019

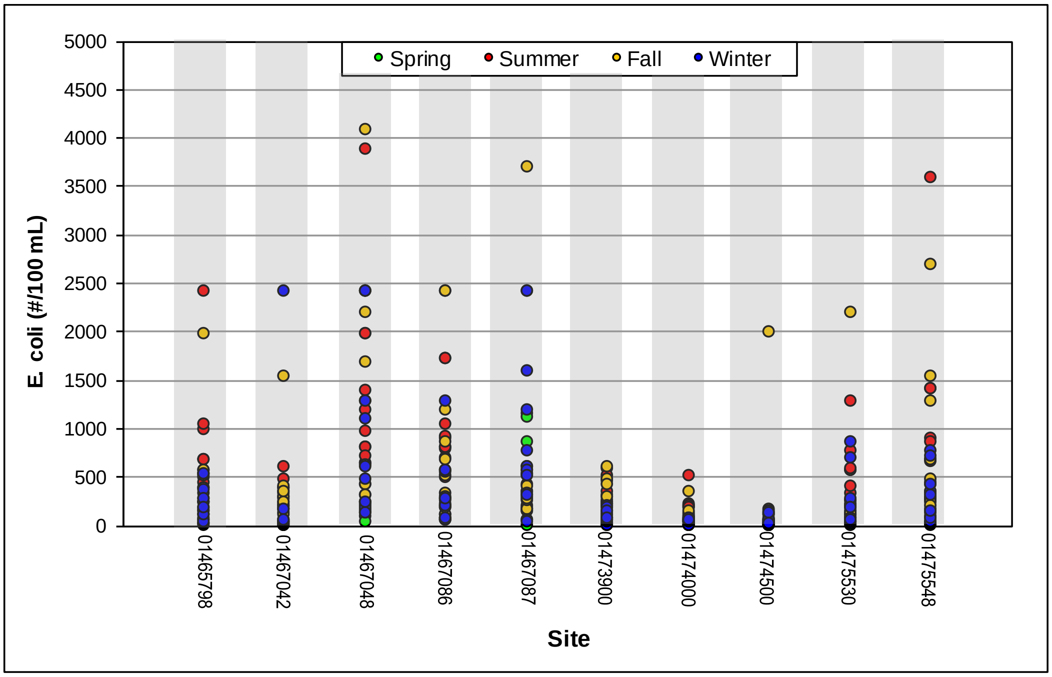


Figure 7. E. coli results at 10 USGS gage stations, July 2009-June 2019

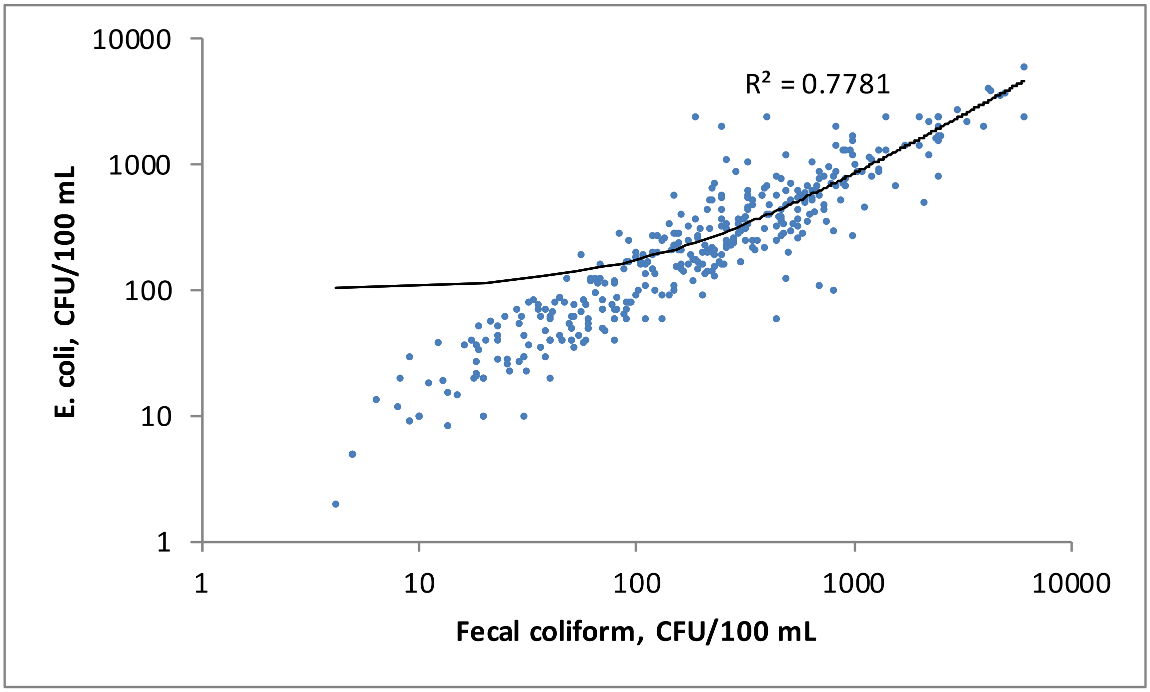


Figure 8. Scatterplot of 2009-2019 Correlating E. coli and Fecal coliform (x-y axes plotted in log10 scale)

Physicochemical Analysis

In addition to nutrient and microbial analyses, a basic set of physicochemical parameters were also monitored as part of the discrete quarterly sampling program. These parameters (dissolved oxygen, pH, temperature, and specific conductance) were specifically chosen to coincide with those being measured by the USGS continuous water quality monitoring gages. These data can then be utilized as valuable field checks when analyzing continuous water quality data from USGS gages. The physicochemical data are summarized by parameter in Figures 9-12.

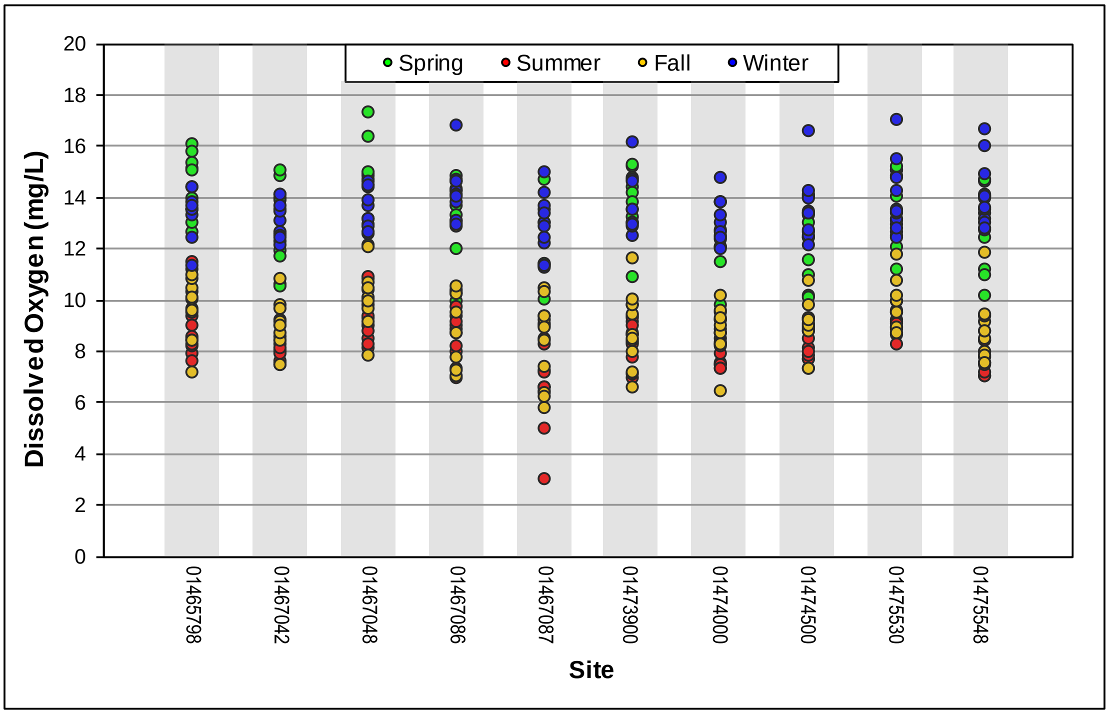


Figure 9. Dissolved oxygen results at 10 USGS gage stations, July 2009-June 2019

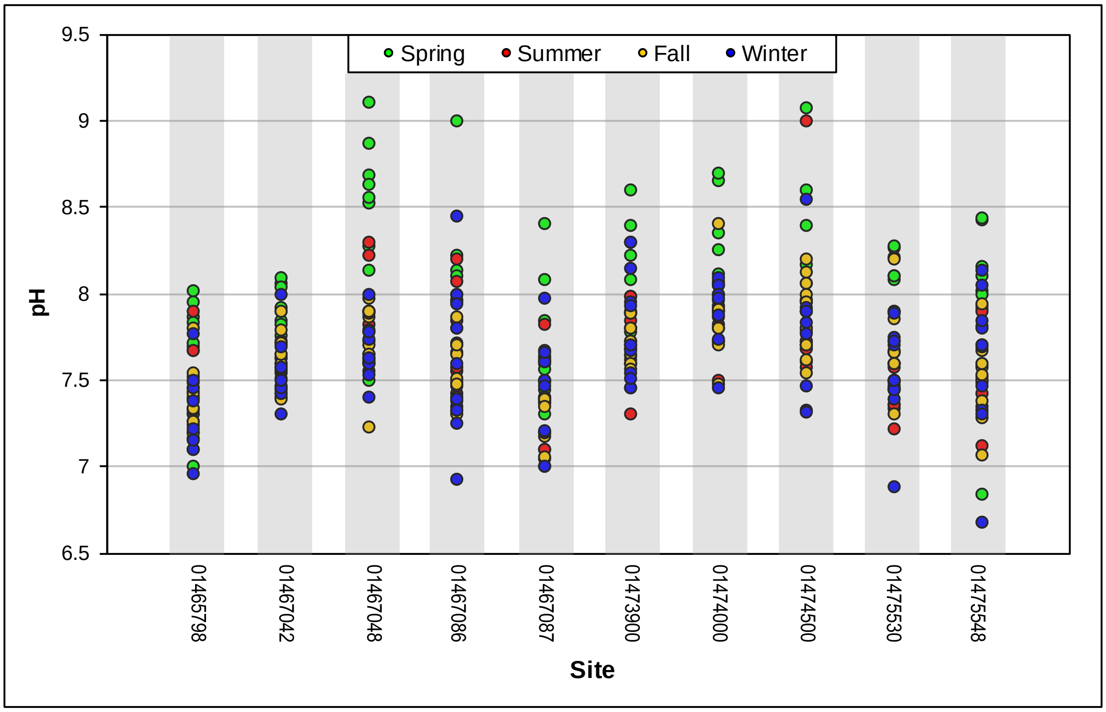


Figure 10. pH results at 10 USGS gage stations, July 2009-June 2019

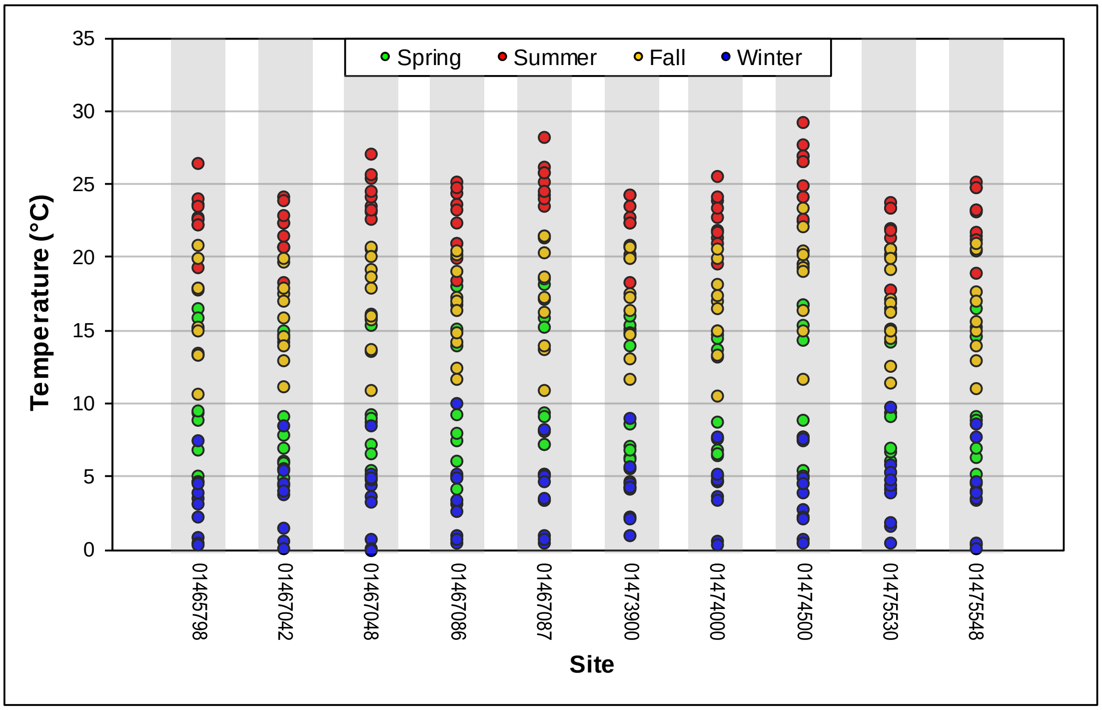


Figure 11. Temperature results at 10 USGS gage stations, July 2009-June 2019

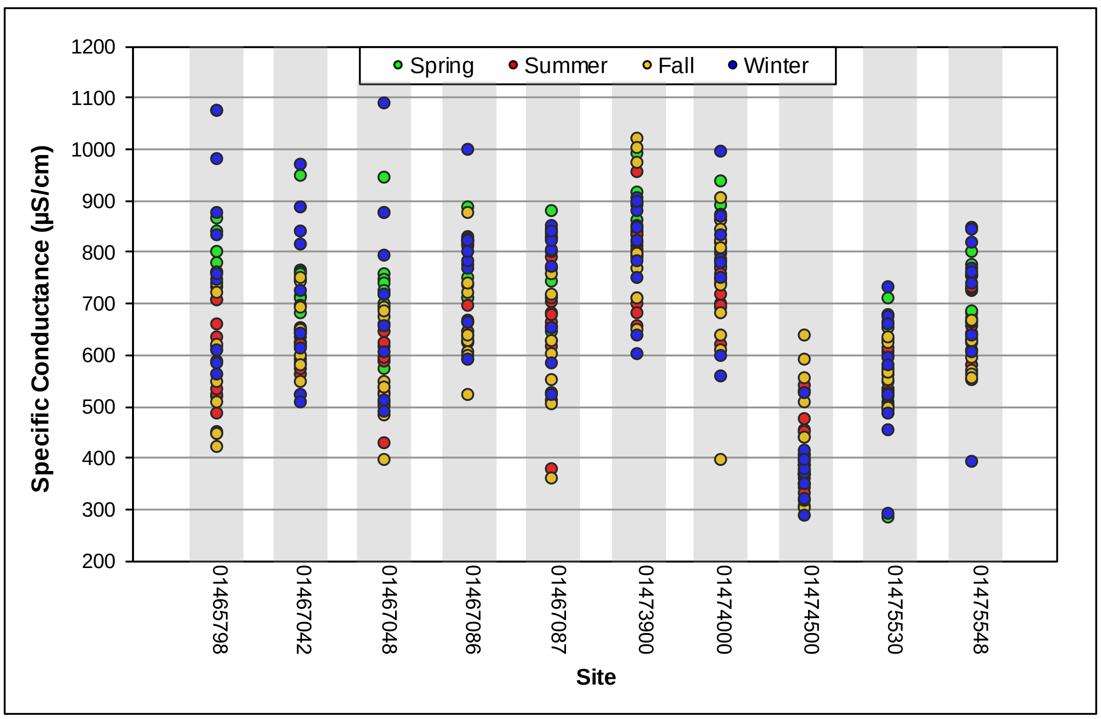


Figure 12. Specific conductance results at 10 USGS gage stations July 2009-June 2019

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Appendix H – PWD-USGS Cooperative Water Quality Monitoring Program Annual Summary

Background

PWD and the United States Geological Survey (USGS) have constructed and/or refurbished gaging stations in 10 locations throughout Philadelphia's watersheds. USGS staff is responsible for construction and maintenance of the gage structure, stream stage monitoring instruments, data communications, maintaining and verifying stage-discharge rating curves and pumping apparatus. PWD staff is responsible for installation and maintenance of continuous water quality instrumentation. Data collected through the PWD/USGS cooperative water quality monitoring program are disseminated through the USGS National Water Information System (NWIS) Web Interface (https://pa.water.usgs.gov/apps/pwd/), as well as a website specifically dedicated to Philadelphia's watersheds (Figure 1).

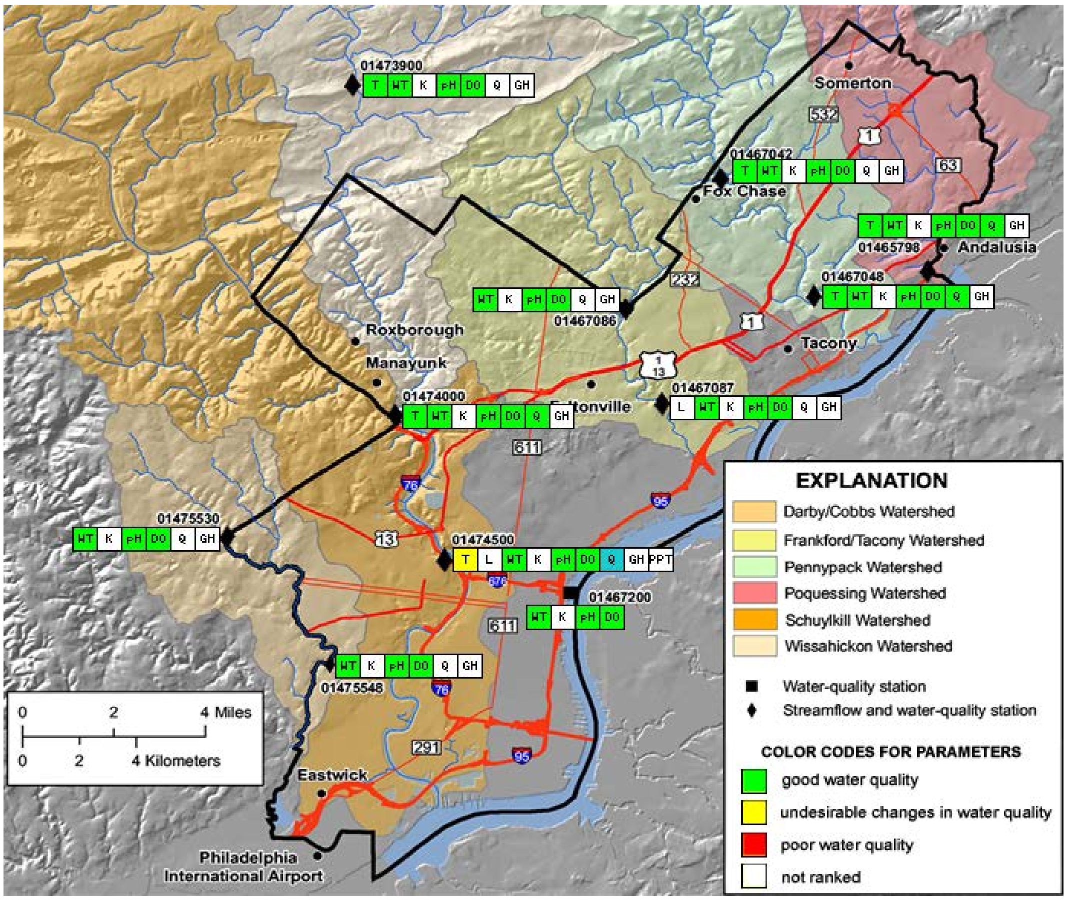


Figure 1. Philadelphia Water Quality Gauge Stations as Viewed on Cooperative USGS-PWD Website (https://usgs.gov/centers/pa-water/science/philadelphia-water-resources-monitoring-program).

Monitoring Locations

The PWD/USGS Cooperative Monitoring Program builds upon the widespread network of USGS gages that were formerly operated throughout Philadelphia. These gages are logically situated and/or have a continuous period of record, making them ideal for water quality monitoring purposes. Within a given watershed, downstream-most historic stations were chosen to represent water quality, as these streams flow through Philadelphia into the receiving waters (*i.e.*, the Schuylkill and Delaware rivers).

Regarding upstream stations, three gages (Pennypack Creek at Pine Rd, Tacony Creek at Adams Ave, and Cobbs Creek at US Rte. 1) are strategically located to monitor water quality of the streams as they enter Philadelphia (Figure 1). The upstream Wissahickon Creek monitoring station is located at Rte. 73 in Fort Washington, which is approximately 3.7 river miles upstream of the City. This location was chosen due to its extensive period of record (Table 1). Upstream water quality is not measured in the Poquessing-Byberry Creek Watershed. The Schuylkill River gage is in an ideal location to provide data related to the Schuylkill River Fairmount Dam Fish Ladder Renovation Project and was equipped with water quality monitoring instrumentation upon project completion in early 2009.

This annual report summarizes water quality data from July 1, 2018 – June 30, 2019, excluding the period of December 2018 through February 2019, during which time monitoring probes were not deployed in order to protect the equipment from cold temperatures. Water quality data at the Delaware River gage 014670261 was collected year-round. Due to routine maintenance such as cleaning and calibration, gages are periodically taken offline, usually for no more than the span of two hours, and do not collect data. Significant gaps in data collection due to gage malfunction, repair, vandalism, etc. are noted in the Monthly Results section.

In order to summarize hydrologic conditions during the monitoring period, daily mean discharge was plotted along with the median of all daily flows for USGS gage 01474000 (Wissahickon Creek at Ridge Ave.). The period of record for this gage is 53 years. The influence of severe storms can be observed in Figure 2; approved daily mean discharge data was available only until May 13, 2019 at the time of this writing.

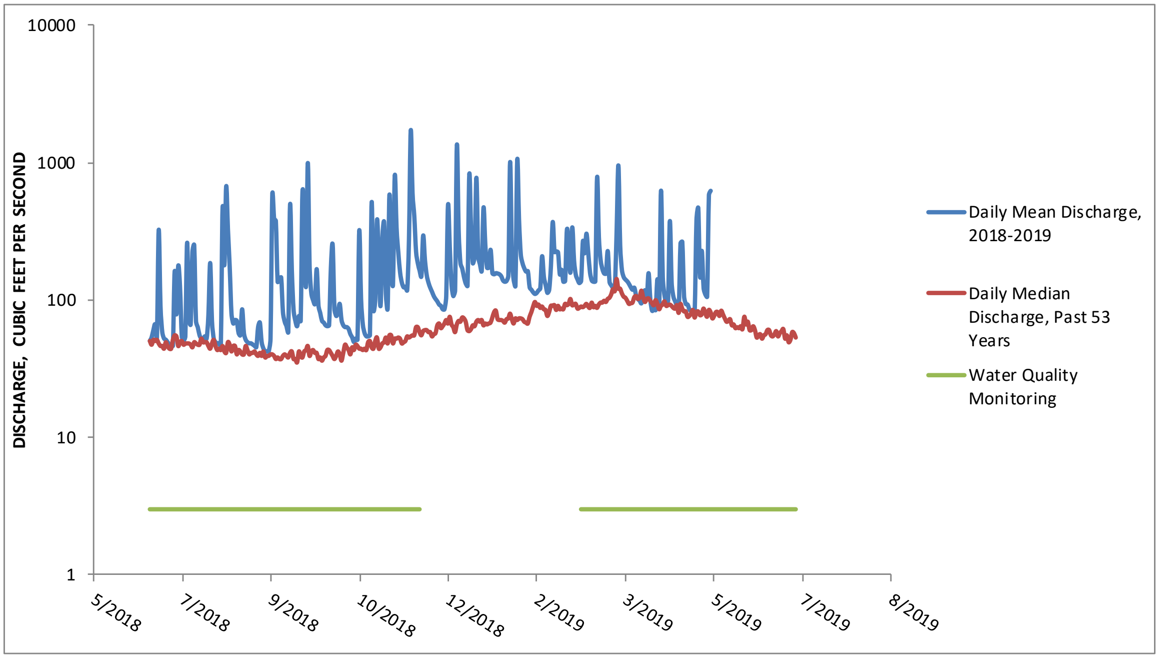


Figure 2. Daily mean flow July 1, 2018 - May 13, 2019 and daily median flow for 53 years of record at USGS gage 01474000 (Wissahickon Creek at Ridge Ave.).

Table 1. PWD/USGS Cooperative Water Quality Monitoring Program Gages

Gage Number	Gage name	Flow Data Record
01465798	Poquessing Creek at Grant Avenue, Philadelphia, PA	July 1965 to Present
01467042	Pennypack Creek at Pine Road, Philadelphia, PA	August 1964 to September 1974; September 2007 to Present
01467048	Pennypack Creek at Lower Rhawn St Br., Philadelphia, PA	June 1965 to Present
01467086	Tacony Creek at County Line, Philadelphia, PA	October 1965 to September 1986; September 2005 to Present
01467087	Frankford Creek at Castor Ave, Philadelphia, PA	July 1982 to Present
014670261	Delaware River near Pennypack Woods, PA	February 2011 to Present
01467200*	Delaware River at Ben Franklin Bridge, Philadelphia, PA	August 1949 to Present
01473900**	Wissahickon Creek at Ft. Washington, PA	September 1961 to September 1968; June 2000 to Present
01474000	Wissahickon Creek at Mouth, Philadelphia, PA	June 1897 to September 1903; January 1905 to July 1906; October 1965 to Present
01474500	Schuylkill River at Philadelphia, PA	October 1931 to Present
01475530	Cobbs Creek at U.S. Highway No. 1, Philadelphia, PA	October 1964 to September 1981; September 2004 to Present
01475548	Cobbs Creek at Mt. Moriah Cemetery, Philadelphia, PA	October 2005 to Present

*Funding for the operation of this gage is provided by USGS and the Delaware River Basin Commission (DRBC)
**Funding for the operation of this gage is provided by DRBC

USGS Gage Data Processing & Analysis Procedures

With 10 USGS gages collecting data for multiple water quality parameters at half-hour or 15-minute intervals, a large amount of data are produced. PWD Office of Watersheds (OOW) staff have developed procedures for the processing and analysis of these data using Microsoft Excel and Access software, as well as R, a free software environment for statistical computing and graphics. Most aspects of the data processing and analysis have been automated with custom Visual Basic and R code.

OOW independently maintains databases of water quality and streamflow via automated regular retrievals of these data from USGS NWIS. On a monthly basis, the databases are queried and results for each gage are imported into MS Excel workbooks. If available, any field data collected during that period (*e.g.*, hand meter readings from field maintenance checks, water quality grab samples, etc.) are also imported. Once all required data have been entered, separate plots are produced for each parameter (dissolved oxygen, turbidity, pH, specific conductance, and temperature) to enable a subjective review of data quality.

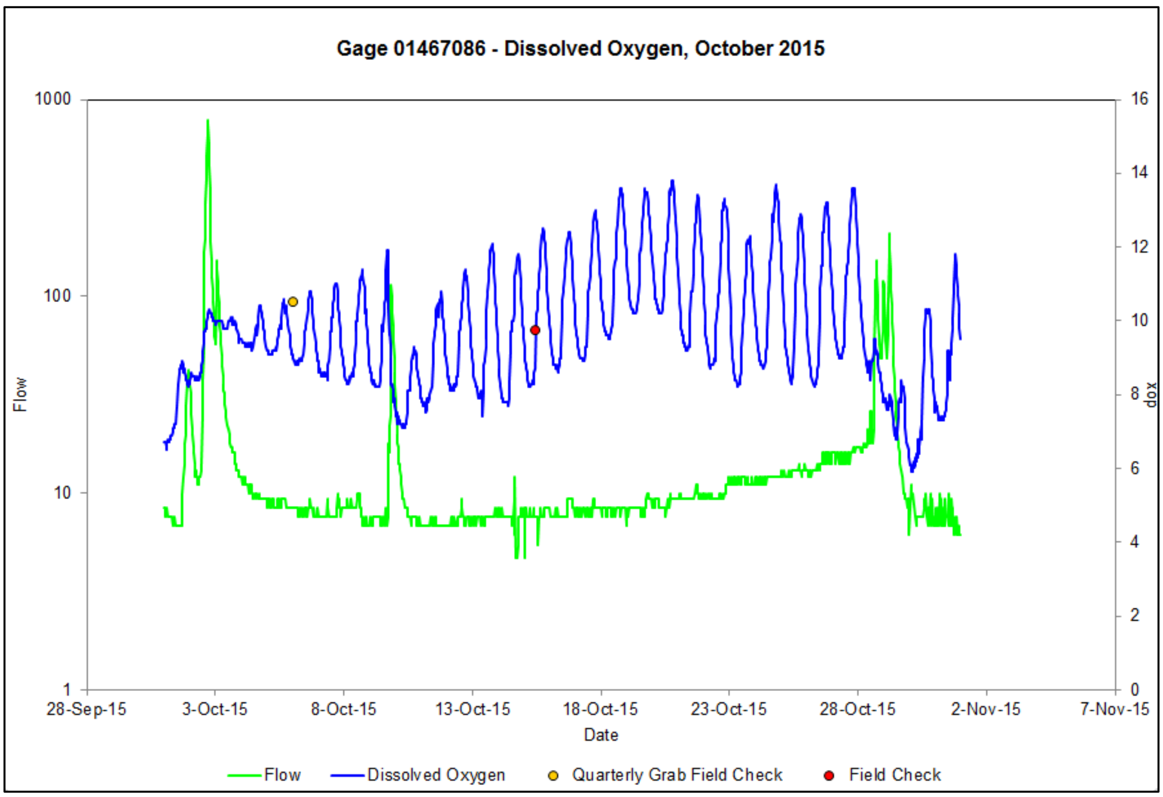


Figure 3. Example of an Excel-generated data processing/analysis plot; Gage 0146786, Dissolved Oxygen, October 2015.

These plots are examined and are the primary basis for the selection of good vs. questionable data for a given month. Intervals of questionable data are located and added to a table of “flagged” data for that particular parameter, which is then used to update the water quality database. Logs of field meter readings taken by PWD staff inform the flagging process, along with email records containing field notes and observations whenever water quality instrumentation is cleaned, calibrated, or otherwise maintained.

The final step of the procedure utilizes R, a statistical programming language and software environment. The R software code developed by OOW staff analyzes all of the water quality data in a database, as well as the good and questionable flags, and generates statistical and graphic results in a variety of forms. These include monthly plots for all data parameters for each site, showing accepted and questionable data, water quality criteria, grab sample data, and streamflow (Figure 4); assorted statistics including accepted and questionable data comparisons, monthly attainment percentages, and comparisons of wet and dry weather periods; and additional plots, including average dissolved oxygen (DO), percent DO saturation, and pH/percent DO saturation.

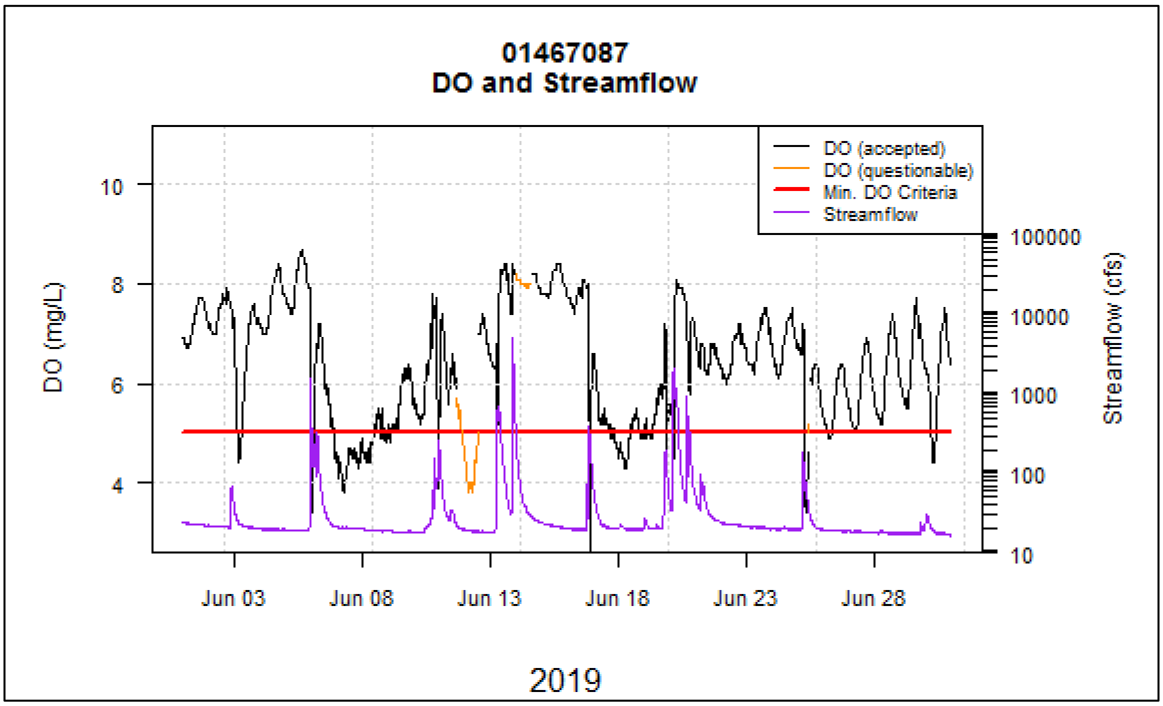


Figure 4. Example of an R-generated plot showing accepted and questionable data, and minimum water quality criteria; Gage 01467087, Dissolved Oxygen, June 2019.

Continuous Water Quality Monitoring Results Annual Summary, July 2018 - June 2019

Dissolved Oxygen

Background

Dissolved oxygen concentrations are a concern in several of Philadelphia's watersheds. Dissolved oxygen concentration is suppressed by high temperatures, respiratory activity of stream organisms, and nitrification and other oxidation reactions. Streams generally develop problems with dissolved oxygen due to water column BOD, sediment oxygen demand (SOD) and eutrophication due to increased nutrient concentration. These processes are inter-related, and physical conditions can also affect dissolved oxygen concentrations.

Designated Uses

Streams in the Philadelphia region are affected by ambient temperatures, which can be quite warm in the spring and summer months. For this reason, these streams cannot support natural self-sustaining populations of cold water fish. Different water quality criteria for dissolved oxygen and temperature are applied to different stream segments. Of the sites that were instrumented for water quality, the Wissahickon and Pennypack Creek gages (*i.e.*, 01473900, 01474000, 01467042, and 01467048) are each designated as a Trout Stocking Fishery (TSF) with conditions appropriate for maintenance of stocked trout over the period February 15 to July 31. Water quality criteria for dissolved oxygen are more stringent for these sites, with a daily instantaneous minimum criterion of 5 mg/L and a 7-day average of 6 mg/L from February 15 to July 31 and 5.5 mg/L the remainder of the year. Dissolved oxygen criteria for Warm Water Fisheries (WWF) are an instantaneous minimum of 5 mg/L and a 7-day average of 5.5 mg/L.

The 7-day average criteria were introduced in 2014 by PA DEP. Prior to 2014, DEP specified daily average criteria for dissolved oxygen (5.0 mg/L for WWF waters; 6.0 mg/L for TSF waters from February 15 to July 31, 5.0 mg/L the remainder of the year). For informational and comparative purposes, this report continues to calculate a daily average as well as the 7-day average. It is also noted that the instantaneous minimum DO criterion for WWF waters became more stringent in 2014; it was previously 4.0 mg/L.

The Delaware River gage 01467200 dissolved oxygen criteria are defined by the Delaware River Basin Commission (DRBC) criteria for Zone 3 (DRBC, 2007) with a daily mean of 3.5 mg/L and a seasonal mean (April 1 to June 15, and September 16 to December 31) of 6.5 mg/L. The same seasonal criteria apply to Delaware River gage 014670261 (Zone 2), but there is a more stringent daily mean guideline of 5.0 mg/L (Table 2).

Table 2. PADEP Dissolved Oxygen Water Quality Criteria

Gage number	Designated Use	Minimum Criterion	7-Day Average Criterion	Daily Average Criterion
01465798	WWF	5.0 mg/L	5.5 mg/L	None
014670261	DRBC**	None	None	5.0 mg/L
01467042	TSF*	5.0 mg/L	6.0 mg/L	None
01467048	TSF*	5.0 mg/L	6.0 mg/L	None
01467086	WWF	5.0 mg/L	5.5 mg/L	None
01467087	WWF	5.0 mg/L	5.5 mg/L	None
01467200	DRBC**	None	None	3.5 mg/L
01473900	TSF*	5.0 mg/L	6.0 mg/L	None
01474000	TSF*	5.0 mg/L	6.0 mg/L	None
01474500	WWF	5.0 mg/L	5.5 mg/L	None
01475530	WWF	5.0 mg/L	5.5 mg/L	None
01475548	WWF	5.0 mg/L	5.5 mg/L	None

*TSF criteria for DO only apply from February 15 - July 31. WWF criteria are applicable from August 1 – January 31.
**A seasonal mean criterion of 6.5 mg/L also applies from April 1 - June 15 and September 16 - December 31.

Results

Results were processed as follows for Table 3. The "total hours accepted data" are the total hours of data that were not flagged; that quantity divided by 24 yields the "total days accepted data." The remainder of the table lists the percent of total hours of data that was flagged, and the percentages of accepted data that attained or failed to attain water quality standards were calculated.

Results were processed as follows for Table 4. If a single day contained at least one flagged measurement, the entire day was considered flagged for calculating the daily mean. Thus the "percent days flagged data" corresponds to the percentage of total days of data that contained at least one flag in a single day. Conversely, if none of the measurements in a single day were flagged, that day was considered one day of accepted data, and the total amount of accepted days was calculated. Finally, the percentages of accepted data that attained or failed to attain water quality standards were calculated.

Results were processed as follows for Tables 5 and 6. If more than 25% of the data in the 7-day window was flagged as questionable, the data point was considered questionable. The 7-day average was calculated as a two-sided moving average. During data processing and analysis, output files are split by calendar year; thus, statistics for 2018 and 2019 appear in separate tables.

Water quality at the downstream Tacony Creek site (gage 01467087) was most likely to exceed DO minimum and 7-day average criteria. A more in-depth discussion of potential causes of DO problems at gage 01467087 is presented in the Monthly Results section. A notable portion of flagged data at 01467087 and other sites is related to the fouling of sonde pipes due to sediment and debris that inhibit data collection. The DO probes are particularly susceptible to the effects of trapped sediment; when routine cleaning of the sonde pipes show that low DO readings were affected by fouling, the questionable data prior to cleaning is flagged.

Table 3. USGS Gage July 2018 - June 2019 Dissolved Oxygen Minimum Criterion Summary Results

Gage number	Designated Use	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	% hrs. non-attaining	% hrs. attaining
01465798	WWF	6147.5	256.1	3.1	0.8	99.2
014670261*	DRBC	NA	NA	NA	NA	NA
01467042	TSF	6332.0	263.8	0.2	0.0	100.0
01467048	TSF	5815.8	242.3	7.7	0.0	100.0
01467086	WWF	6389.0	266.2	0.8	0.8	99.2
01467087	WWF	5410.3	225.4	13.8	5.7	94.3
01467200*	DRBC	NA	NA	NA	NA	NA
01473900	TSF	6427.0	267.8	0.2	0.0	100.0
01474000	TSF	6218.5	259.1	0.9	0.0	100.0
01474500	WWF	6264.0	261.0	0.2	0.0	100.0
01475530	WWF	6381.0	265.9	0.6	0.0	100.0
01475548	WWF	6386.0	266.1	0.5	2.7	97.3

*No minimum DO criterion applies at gages 01467200 and 014670261

Table 4. USGS Gage July 2018 - June 2019 Dissolved Oxygen Daily Mean Summary Results

Gage number	Designated Use	Total days accepted data	% days flagged data*
01465798	WWF	237.0	10.4
014670261	DRBC	356.0	2.5
01467042	TSF	246.0	7.0
01467048	TSF	207.0	21.1
01467086	WWF	249.0	7.2
01467087	WWF	200.0	23.5
01467200	DRBC	221.0	19.6
01473900	TSF	249.0	7.2
01474000	TSF	241.0	7.8
01474500	WWF	251.0	4.0
01475530	WWF	250.0	6.5
01475548	WWF	256.0	4.3

*Small data gaps prevent the calculation of a daily mean and are classified as flagged.

Table 5. USGS Gage July 2018 - November 2018 Dissolved Oxygen 7-Day Average Criterion Summary Results

Gage number	Designated Use	Total hours accepted data	% hours flagged data	% hours non-attaining	% hours attaining
01465798	WWF	3504.5	0	0	100
014670261	DRBC	NA	NA	NA	NA
01467042	TSF	3504.5	0	0	100
01467048	TSF	3504.5	0	0	100
01467086	WWF	3504.5	0	1.3	98.7
01467087	WWF	2678.0	23.6	9.6	90.4
01467200	DRBC	NA	NA	NA	NA
01473900	TSF	3504.5	0	0	100
01474000	TSF	3504.5	0	0	100
01474500	WWF	3504.5	0	0	100
01475530	WWF	3504.5	0	0	100
01475548	WWF	3504.5	0	1.8	98.2

Table 6. USGS Gage March 2019 - June 2019 Dissolved Oxygen 7-Day Average Criterion Summary Results

Gage number	Designated Use	Total hours accepted data	% hours flagged data	% hours non-attaining	% hours attaining
01465798	WWF	2505.5	0	0	100
014670261	DRBC	NA	NA	NA	NA
01467042	TSF	2505.5	0	0	100
01467048	TSF	2459.5	0	0	100
01467086	WWF	2601.5	0	0	100
01467087	WWF	2310.5	5.2	0	100
01467200	DRBC	NA	NA	NA	NA
01473900	TSF	2603.0	0	0	100
01474000	TSF	2434.5	0	0	100
01474500	WWF	2435.5	0	0	100
01475530	WWF	2578.0	0	0	100
01475548	WWF	2579.0	0	0	100

Table 7. USGS Gage 01467200 and 014670261 Dissolved Oxygen Seasonal Mean Criterion Summary Result

Gage number	Designated Use	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	Seasonal mean	Attained Standard?
01467200	DRBC	1783.0	74.3	2.2	8.9	Yes
014670261	DRBC	1824.0	76.0	0	9.1	Yes

pH

Background

pH has been identified as a parameter of potential concern for some of Philadelphia's watersheds, primarily because of algal effects on the dissolved inorganic carbon (DIC) composition of stream water. Algae take up CO_2 during photosynthesis and shift the composition of DIC toward the alkaline carbonates, resulting in occasional failure to attain maximum pH criteria at some sites (Table 8). pH fluctuations are typically observed concomitant with pronounced dissolved oxygen fluctuations, as detailed in the Monthly Results section.

At gages 01467200 and 014670261, pH criteria (regulated by DRBC) are bounded by 6.5 and 8.5. At all other gages, pH criteria are bounded by daily minima and maxima of 6.0 and 9.0, respectively, as defined by PA DEP water quality standards.

Results

Results were processed as follows for Table 8. The "total hours accepted data" are the total hours of data that were not flagged; that quantity divided by 24 yields the "total days accepted data." The remainder of the table lists the percentage of total hours of data that was flagged, the percentages of accepted hours that attained or failed to attain criteria, and the percentages of daily minima and maxima that attained or failed to attain criteria.

Minimum pH criteria were attained at all gages for the reporting time frame. Algal blooms may be responsible for daily maximum pH criterion exceedance at several sites during March and April. Significant (greater than 10%) daily exceedances occurred at the Schuylkill site and upstream Tacony site.

Table 8. USGS Gage July 2018 - June 2019 pH Criteria Summary Results

Gage number	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	% hrs. max. non-attaining	% days max. non-attaining	% hrs. min. non-attaining	% days min. non-attaining	% hrs. attaining	% days attaining
01465798	6329.5	263.7	0.2	0.0	0.0	0.0	0.0	100.0	100.0
014670261	8746.0	364.5	0.1	0.2	0.5	0.0	0.0	99.8	99.5
01467042	6334.3	263.9	0.2	0.2	1.1	0.0	0.0	99.8	98.9
01467048	5814.3	242.3	7.7	0.9	4.2	0.0	0.0	99.1	95.8
01467086	6410.5	267.1	0.5	1.6	7.1	0.0	0.0	98.4	92.9
01467087	5611.5	233.8	10.6	0.0	0.0	0.0	0.0	100.0	100.0
01467200	6397.0	266.5	3.1	0.0	0.0	0.0	0.0	100.0	100.0
01473900	6393.0	266.4	0.8	1.0	5.9	0.0	0.0	99.0	94.1
01474000	6199.5	258.3	1.2	0.9	5.4	0.0	0.0	99.1	94.6
01474500	6223.5	259.3	0.8	0.0	0.0	0.0	0.0	100.0	100.0
01475530	6314.3	263.1	1.6	0.1	0.8	0.0	0.0	99.9	99.2
01475548	6357.3	264.9	0.9	0.6	3.4	0.0	0.0	99.4	96.6

Turbidity

Background

Turbidity in Philadelphia's streams increases with increased flow as inorganic sediment and additional constituents of stormwater runoff are introduced to the stream or scoured/eroded from the stream channel. There are no numeric PA DEP water quality criteria for turbidity, so PWD watershed management plans used a reference value for turbidity that was derived from EPA Guidance document EPA 822-B-00-023 (*i.e.*, 2.825 NTU). This value is surpassed more often in wet weather than in dry weather (Tables 84-85). Turbidity data has also been used to help investigate sediment loading and transport in the Wissahickon Creek Watershed for the Wissahickon Creek Sediment TMDL.

Results

Results were processed as follows for Table 9. The "total hours accepted data" are the total hours of data that were not flagged; that quantity divided by 24 yields the "total days accepted data." The remainder of the table lists the percentage of total hours of data that was flagged, and the percentages of accepted hours that either surpassed or fell below the maximum guideline.

Among the tributary sites, the maximum guideline was most frequently surpassed at the Schuylkill gage, and least frequently surpassed at the downstream Wissahickon gage.

Table 9. USGS Gage July 2018 - June 2019 Turbidity Summary Results

Gage number	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	% hrs. above max. guideline	% hrs. below max. guideline
01465798	6180.3	257.5	2.6	38.5	61.5
014670261	8747.5	364.5	0.1	97.9	2.1
01467042	6218.5	259.1	2.0	37.3	62.7
01467048	5543.3	231.0	12.0	59.2	40.8
01467086*	NA	NA	NA	NA	NA
01467087*	NA	NA	NA	NA	NA
01467200*	NA	NA	NA	NA	NA
01473900	6287.0	262.0	2.4	57.0	43.0
01474000	6219.5	259.1	0.9	35.8	64.2
01474500	6262.0	260.9	0.2	87.0	13.0
01475530*	NA	NA	NA	NA	NA
01475548*	NA	NA	NA	NA	NA

*Turbidity is not continuously monitored at these locations

Specific Conductance

Background

Specific conductance is a measure of the ability of water to conduct electricity over a given distance, expressed as microsiemens/cm (corrected to 25ºC). Conductivity in Philadelphia streams is extremely sensitive to changes in flow, as stormwater (diluent) usually contains smaller concentrations of dissolved ions than stream baseflow. Stormwater runoff typically lowers conductivity in streams; an exception sometimes occurs in winter and early spring, when road salt applied prior to snowstorms enters the stream in runoff or during snowmelt. Data collected in the report timeframe were generally consistent with earlier observations. When significant changes in conductivity are observed during dry weather, it can be an indicator of anthropogenic influence or pollution in the stream; stations receiving inputs of treated wastewater generally had greater conductivity.

Results

There is no water quality standard for specific conductance. Table 10 merely illustrates the total hours of data that was not flagged and considered “accepted,” the equivalent quantity in day-units, and the percentage of total hours of data that was flagged. More detailed results at each site are described in the Monthly Results section.

Table 10. USGS Gage July 2018 - June 2019 Specific Conductance Summary Results

Gage number	Total hrs. accepted data	Total days accepted data	% hrs. flagged data
01465798	6239.0	260.0	1.7
014670261	8745.5	364.4	0.2
01467042	6307.3	262.8	0.6
01467048	5813.0	242.2	7.7
01467086	6423.0	267.6	0.3
01467087	5668.3	236.2	9.7
01467200	6532.5	272.2	1.0
01473900	6379.5	265.8	1.0
01474000	6214.0	258.9	1.0
01474500	6263.0	261.0	0.2
01475530	6175.3	257.3	3.8
01475548	6362.8	265.1	0.9

Temperature

Background

Streams in the Philadelphia region are designated Warm Water Fisheries (WWF) or Trout Stocking Fisheries (TSF), with separate corresponding temperature criteria (Table 11). These criteria are "stepped" (remaining constant for 15- or 30-day intervals), while streams tend to warm up and cool down more gradually due primarily to changes in ambient temperature. (Gages 01467200 and 014670261 are the exceptions and are subject to a DRBC criterion of 30°C maximum). Stream temperatures were observed to exceed these criteria, somewhat frequently in springtime. These exceedances are generally natural, as there are no major sources of heated wastes. It is possible that baseflow diminution is partially responsible for a lack of buffering against temperature increases.

Table 11. PA DEP Temperature Water Quality Criteria

Date range start	Date range end	WWF maximum (°C)	WWF maximum (°F)	TSF maximum (°C)	TSF maximum (°F)
1/1	1/31	4	40	4	40
2/1	2/29	4	40	4	40
3/1	3/31	8	46	8	46
4/1	4/15	11	52	11	52
4/16	4/30	14	58	14	58
5/1	5/15	18	64	18	64
5/16	5/31	22	72	20	68
6/1	6/15	27	80	21	70
6/16	6/30	29	84	22	72
7/1	7/31	31	87	23	74
8/1	8/15	31	87	27	80
8/16	8/30	31	87	31	87
9/1	9/15	29	84	29	84
9/16	9/30	26	78	26	78
10/1	10/15	22	72	22	72
10/16	10/31	19	66	19	66
11/1	11/15	14	58	14	58
11/16	11/30	10	50	10	50
12/1	12/31	6	42	6	42

Results

Results were processed in the same manner as the parameters described above. The highest exceedance rate occurred at the downstream Pennypack Creek gage. Aside from the Delaware River gages, the lowest exceedance rates were observed at the Poquessing, both Cobbs, both Tacony Creek, and the Schuylkill River gages (Table 12). Those six gages are all designated as WWF and have less stringent criteria.

Table 12. USGS Gage July 2018 - June 2019 Temperature Maximum Criteria Summary Results

Gage number	Designated Use	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	% hrs. exceedance	% hrs. attaining
01465798	WWF	6313.5	263.0	0.5	15.7	84.3
014670261	DRBC	6597.5	274.9	24.7	0.0	100.0
01467042	TSF	6335.8	264.0	0.1	24.7	75.3
01467048	TSF	5817.3	242.4	7.7	28.8	71.2
01467086	WWF	6423.5	267.6	0.3	14.8	85.2
01467087	WWF	5696.3	237.3	9.2	19.7	80.3
01467200	DRBC	6571.5	273.8	0.4	0.0	100.0
01473900	TSF	6364.5	265.2	1.2	23.8	76.2
01474000	TSF	6143.5	256.0	2.1	26.2	73.8
01474500	WWF	6264.0	261.0	0.2	13.1	86.9
01475530	WWF	6265.3	261.1	2.4	15.6	84.4
01475548	WWF	6387.0	266.1	0.5	16.7	83.3

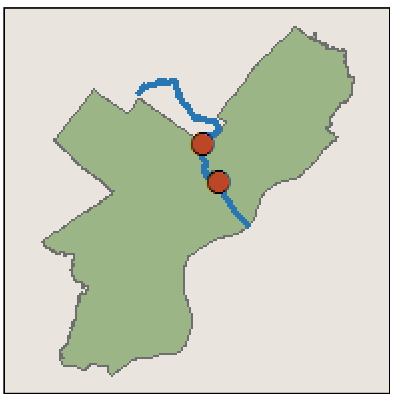
Monthly Results, July 2018 - June 2019

This section summarizes results at the monthly time scale. Results were processed in the same manner as in the previous section. Gages are grouped according to the type of sewer system that impacts water quality at the site.

Gages in Combined Sewer System Watersheds

The combined sewer system serves more than three-quarters of Philadelphia's residents and covers the oldest and densest parts of the city. Combined sewer outfalls affect the Tookany/Tacony-Frankford and Darby-Cobbs watersheds. (The Delaware and Schuylkill rivers also contain combined sewer outfalls but are detailed in a later section focused on large watersheds.) The gages in this section are subject to the deleterious effects of periodic combined sewer overflows during wet weather and snowmelt.

Tookany/Tacony-Frankford Creek (Gages 01467086 and 01467087)



Dissolved oxygen and pH

Dissolved oxygen concentrations were markedly worse between the upstream and downstream Tacony Creek gages. The monthly minima, percentage of hours the minimum criterion was not attained, exceedance of the 7-day average guideline, and percentage of days the daily mean criteria was not attained were typically much worse at the downstream gage (Tables 13-16, Figures 5-8). For example, DO was poor at the downstream Tacony Creek gage during August 2018 (Figure 9). However, the minimum criterion was attained at gage 01467086 during that same month (Figure 10). This difference likely reflects the additional stormwater runoff and sewage overflows that entered the creek between the two gages.

The lowest DO concentrations are typically seen in the period after storm events, reflecting both the immediate and lingering, oxygen-depleting effects of stormwater runoff and biochemical oxygen demand (BOD) entering the stream. Diel DO fluctuations are suppressed for a few days following a storm event because the event either scours away algae or temporarily inhibits their growth. As dry weather continues, the algae recover and diel DO and pH fluctuations typically increase, sometimes resulting in non-attainment of pH maximum criteria, as observed at the upstream gage in March 2019 (Figure 11). Percent DO saturation of more than 150% in daylight were also observed at gage 01467086 in March 2019, indicating high levels of algal activity (Figure 12; PAR is defined as photosynthetically active radiation). Diel DO fluctuations tended to increase with prolonged periods of sunlight, further indicating high levels of algal activity.

A lower monthly mean pH was usually observed at gage 01467087, along with generally less pronounced diel pH fluctuations, probably due to an increased buffering capacity at the downstream gage and a lesser degree of algal growth (Tables 17-18).

Table 13. Gage 01467086 Dissolved Oxygen Minimum Criterion Summary Results by Month

Month	Des. Use	total hrs. accepted data	Total days accepted data	% hrs. flagged data	% hrs. non-attaining	% hrs. attaining	Min	Max	Mean
Jul-18	WWF	743.0	31.0	0.1	0.1	99.9	4.9	12.6	7.5
Aug-18	WWF	741.5	30.9	0.3	0.0	100.0	5.2	14.4	8.0
Sep-18	WWF	701.5	29.2	2.6	6.3	93.7	0.4	10.6	7.4
Oct-18	WWF	722.0	30.1	3.0	0.0	100.0	7.0	15.5	9.8
Nov-18	WWF	718.5	29.9	0.2	0.0	100.0	8.0	13.7	10.7
Mar-19	WWF	582.0	24.3	0.3	0.0	100.0	8.1	17.0	12.0
Apr-19	WWF	718.5	29.9	0.2	1.2	98.8	3.1	15.7	9.6
May-19	WWF	743.5	31.0	0.1	0.0	100.0	5.7	13.0	8.4
Jun-19	WWF	718.5	29.9	0.2	0.0	100.0	5.5	11.9	8.0

Table 14. Gage 01467087 Dissolved Oxygen Minimum Criterion Summary Results by Month

Month	Des. Use	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	% hrs. non-attaining	% hrs. attaining	Min	Max	Mean
Jul-18	WWF	262.5	10.9	64.7	25.9	74.1	0.4	8.5	5.6
Aug-18	WWF	649.0	27.0	12.8	15.3	84.7	2.4	10.2	6.4
Sep-18	WWF	655.0	27.3	9.1	3.0	97.0	1.4	9.0	6.9
Oct-18	WWF	742.3	30.9	0.2	0.6	99.4	3.3	11.6	8.7
Nov-18	WWF	658.8	27.4	8.5	0.0	100.0	5.1	12.8	9.9
Mar-19	WWF	386.8	16.1	0.5	0.0	100.0	5.0	13.7	10.4
Apr-19	WWF	658.3	27.4	8.6	0.7	99.3	4.0	13.4	8.9
May-19	WWF	715.8	29.8	3.6	4.3	95.7	3.3	10.5	7.2
Jun-19	WWF	682.0	28.4	2.3	12.1	87.9	2.5	8.7	6.4

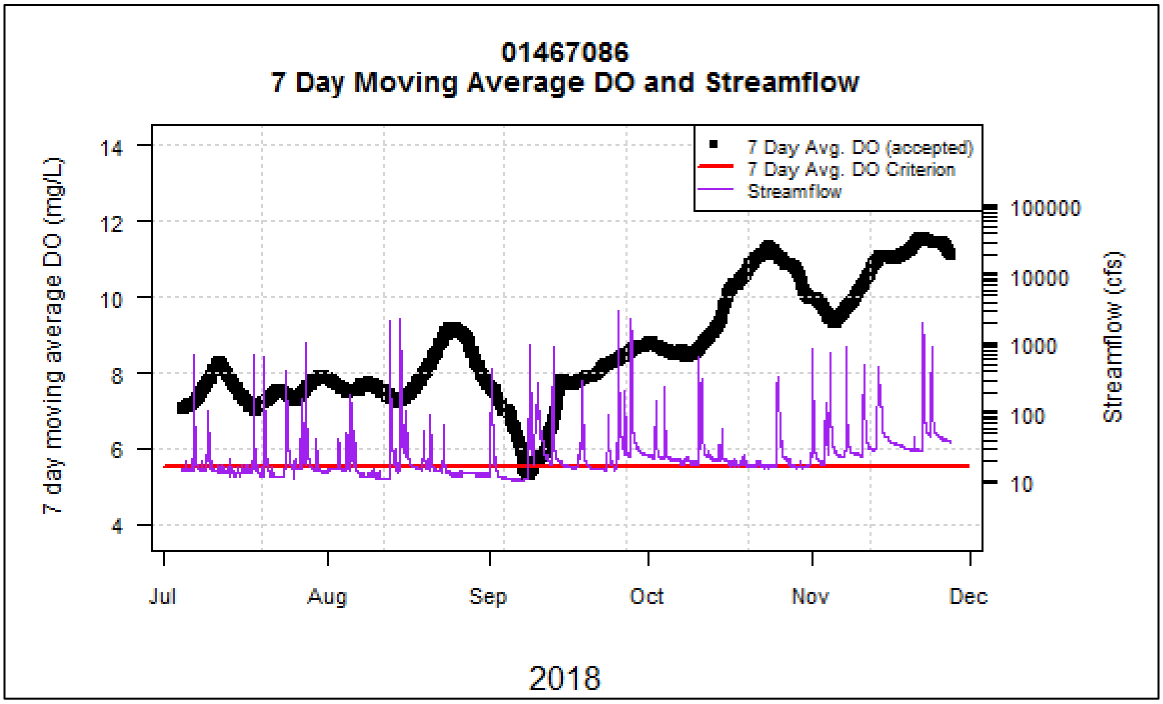


Figure 5. Gage 01467086, 7 Day Average Dissolved Oxygen and Streamflow, Jul-Dec 2018.

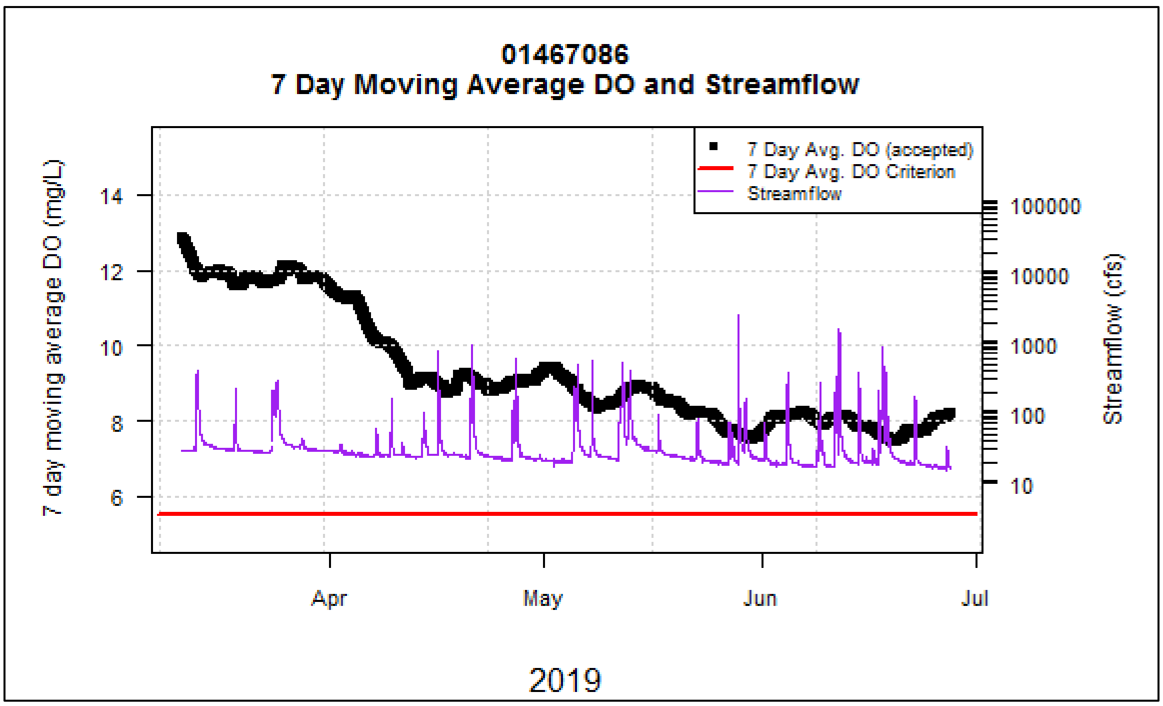


Figure 6. Gage 01467086, 7 Day Average Dissolved Oxygen and Streamflow, Mar-Jun 2019.

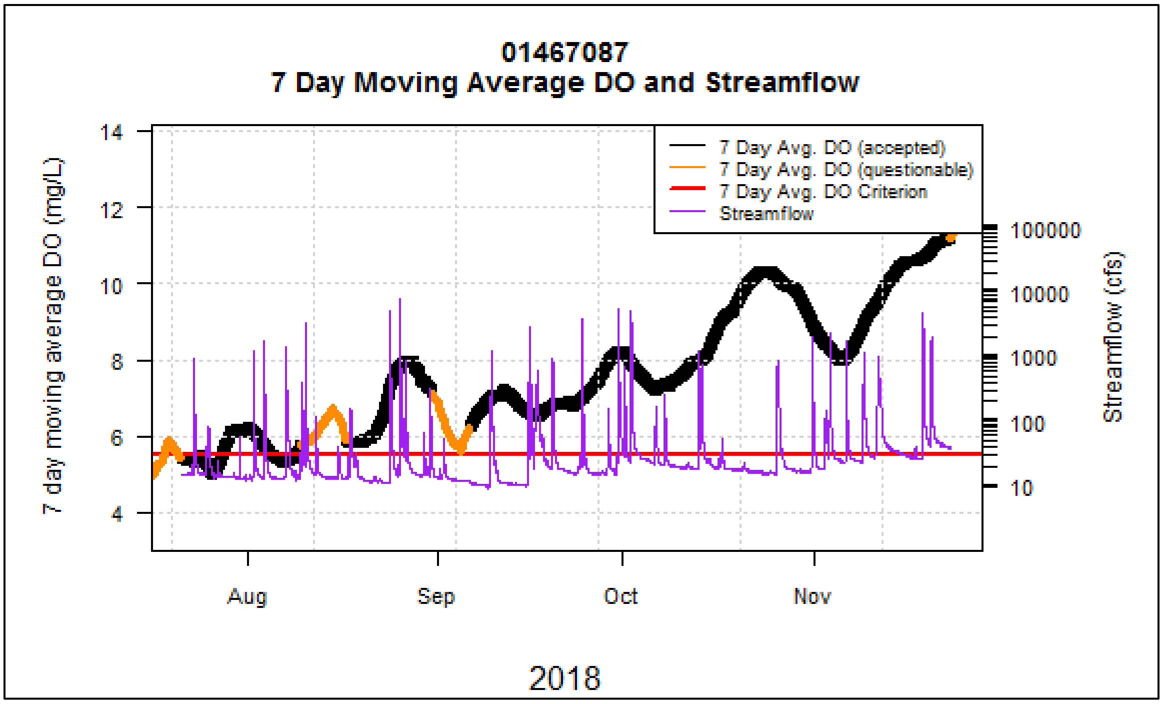


Figure 7. Gage 01467087, 7 Day Average Dissolved Oxygen and Streamflow, Jul-Dec 2018.

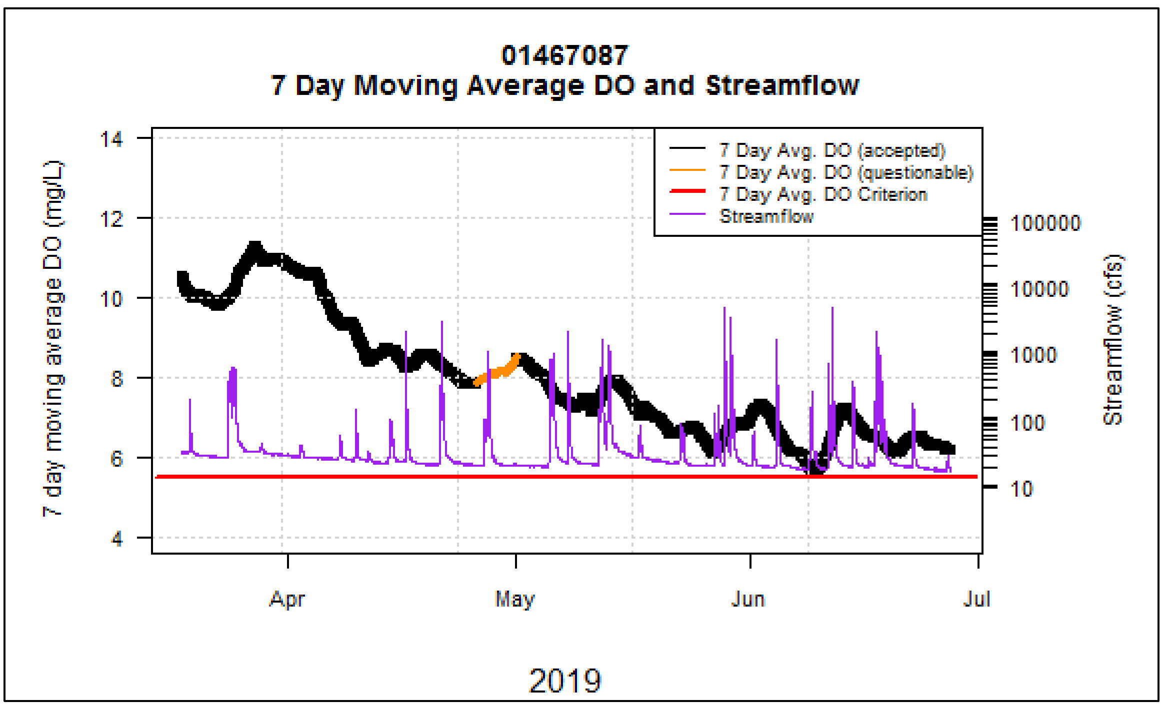


Figure 8. Gage 01467087, 7 Day Average Dissolved Oxygen and Streamflow, Mar-Jun 2019.

Table 15. Gage 01467086 Dissolved Oxygen Daily Mean Criterion Summary Results by Month

Month	Des. Use	Total days accepted data	% days flagged data	Min.	Max.	Mean
Jul-18	WWF	29.0	6.5	6.3	8.7	7.5
Aug-18	WWF	28.0	9.7	6.7	9.6	8.0
Sep-18	WWF	26.0	13.3	4.5	9.1	7.6
Oct-18	WWF	29.0	6.5	7.5	12.1	9.7
Nov-18	WWF	28.0	6.7	8.7	12.9	10.6
Mar-19	WWF	21.0	13.7	10.0	14.3	12.1
Apr-19	WWF	29.0	3.3	6.2	12.1	9.6
May-19	WWF	30.0	3.2	7.3	9.8	8.4
Jun-19	WWF	29.0	3.3	6.8	9.0	8.0

Table 16. Gage 01467087 Dissolved Oxygen Daily Mean Criterion Summary Results by Month

Month	Des. Use	Total days accepted data	% days flagged data	Min.	Max.	Mean
Jul-18	WWF	11.0	64.5	4.6	7.2	5.6
Aug-18	WWF	24.0	9.7	4.0	8.5	6.4
Sep-18	WWF	22.0	6.7	5.7	8.8	6.9
Oct-18	WWF	28.0	0.0	6.4	10.9	8.7
Nov-18	WWF	27.0	10.0	7.0	12.4	9.9
Mar-19	WWF	15.0	14.4	8.5	11.9	10.3
Apr-19	WWF	24.0	13.3	6.5	11.5	9.1
May-19	WWF	27.0	3.2	5.6	9.2	7.2
Jun-19	WWF	25.0	0.0	4.4	8.0	6.4

Table 17. Gage 01467086 pH Criteria Summary Results by Month

Month	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	% hrs. max. non-attaining	% days max. non-attaining	% hrs. min. non-attaining	% days min. non-attaining	% hrs. attaining	% days attaining	Min.	Max.	Mean
Jul-18	743.0	31.0	0.1	0.0	0.0	0.0	0.0	100.0	100.0	6.9	8.5	7.5
Aug-18	741.5	30.9	0.3	0.0	0.0	0.0	0.0	100.0	100.0	6.3	9.0	7.7
Sep-18	702.5	29.3	2.4	0.0	0.0	0.0	0.0	100.0	100.0	6.7	8.0	7.4
Oct-18	743.0	31.0	0.1	0.0	0.0	0.0	0.0	100.0	100.0	6.8	8.9	7.7
Nov-18	718.5	29.9	0.2	0.0	0.0	0.0	0.0	100.0	100.0	6.8	8.0	7.6
Mar-19	582.0	24.3	0.3	16.4	64.0	0.0	0.0	83.6	36.0	7.3	9.8	8.5
Apr-19	718.5	29.9	0.2	0.6	10.0	0.0	0.0	99.4	90.0	6.9	9.1	8.0
May-19	743.5	31.0	0.1	0.0	0.0	0.0	0.0	100.0	100.0	7.0	8.7	7.9
Jun-19	718.0	29.9	0.3	0.0	0.0	0.0	0.0	100.0	100.0	7.0	8.5	7.8

Table 18. Gage 01467087 pH Criteria Summary Results by Month

Month	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	% hrs. max. non-attaining	% days max. non-attaining	% hrs. min. non-attaining	% days min. non-attaining	% hrs. attaining	% days attaining	Min.	Max.	Mean
Jul-18	298.0	12.4	60.0	0.0	0.0	0.0	0.0	100.0	100.0	6.8	7.5	7.2
Aug-18	649.5	27.1	12.8	0.0	0.0	0.0	0.0	100.0	100.0	6.7	7.9	7.3
Sep-18	718.3	29.9	0.3	0.0	0.0	0.0	0.0	100.0	100.0	6.6	7.5	7.1
Oct-18	742.3	30.9	0.2	0.0	0.0	0.0	0.0	100.0	100.0	6.8	7.6	7.4
Nov-18	659.0	27.5	8.5	0.0	0.0	0.0	0.0	100.0	100.0	6.7	7.5	7.3
Mar-19	380.3	15.8	0.5	0.0	0.0	0.0	0.0	100.0	100.0	7.1	8.2	7.7
Apr-19	719.0	30.0	0.2	0.0	0.0	0.0	0.0	100.0	100.0	6.1	8.4	7.5
May-19	727.0	30.3	0.4	0.0	0.0	0.0	0.0	100.0	100.0	6.5	7.5	7.2
Jun-19	718.3	29.9	0.1	0.0	0.0	0.0	0.0	100.0	100.0	6.5	7.5	7.2

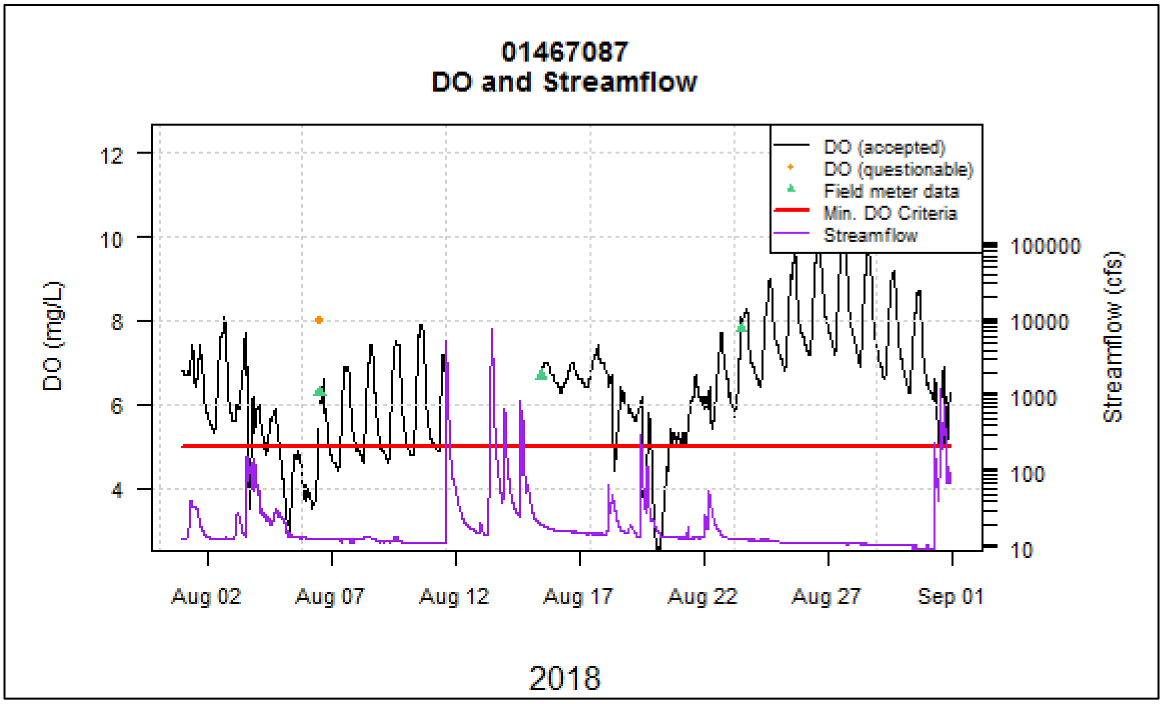


Figure 9. Gage 01467087, Dissolved Oxygen and Streamflow, August 2018.

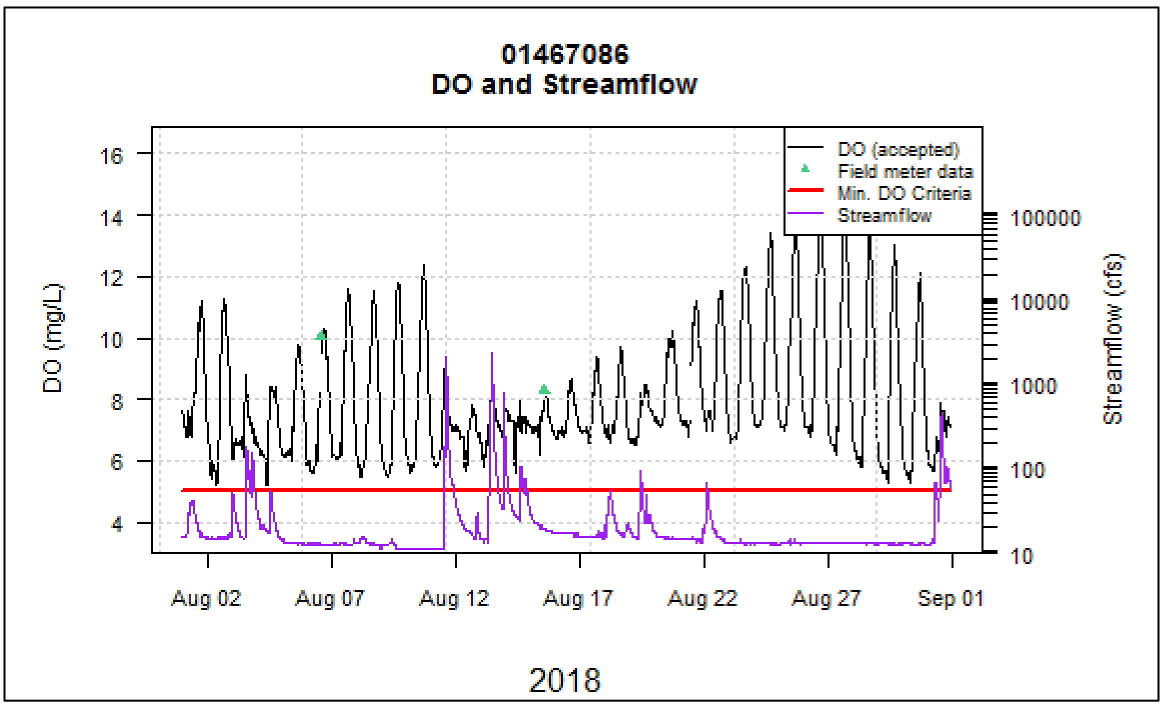


Figure 10. Gage 01467086, Dissolved Oxygen and Streamflow, August 2018.

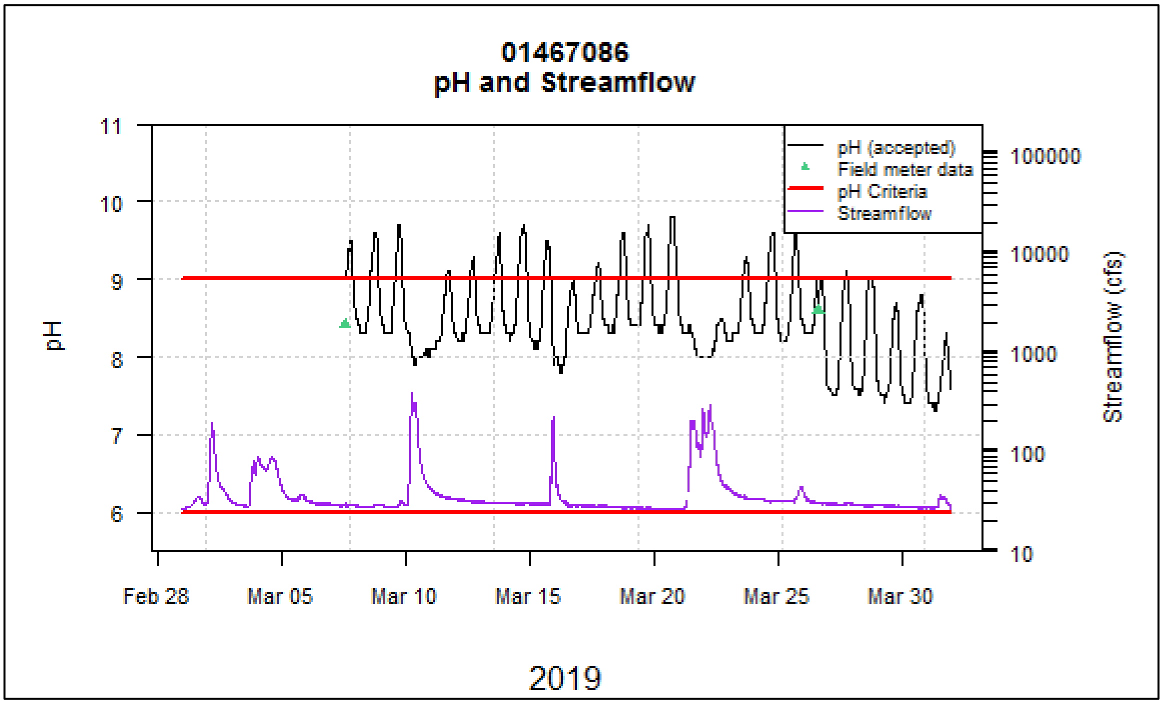


Figure 11. Gage 01467086, pH and Streamflow, March 2019.

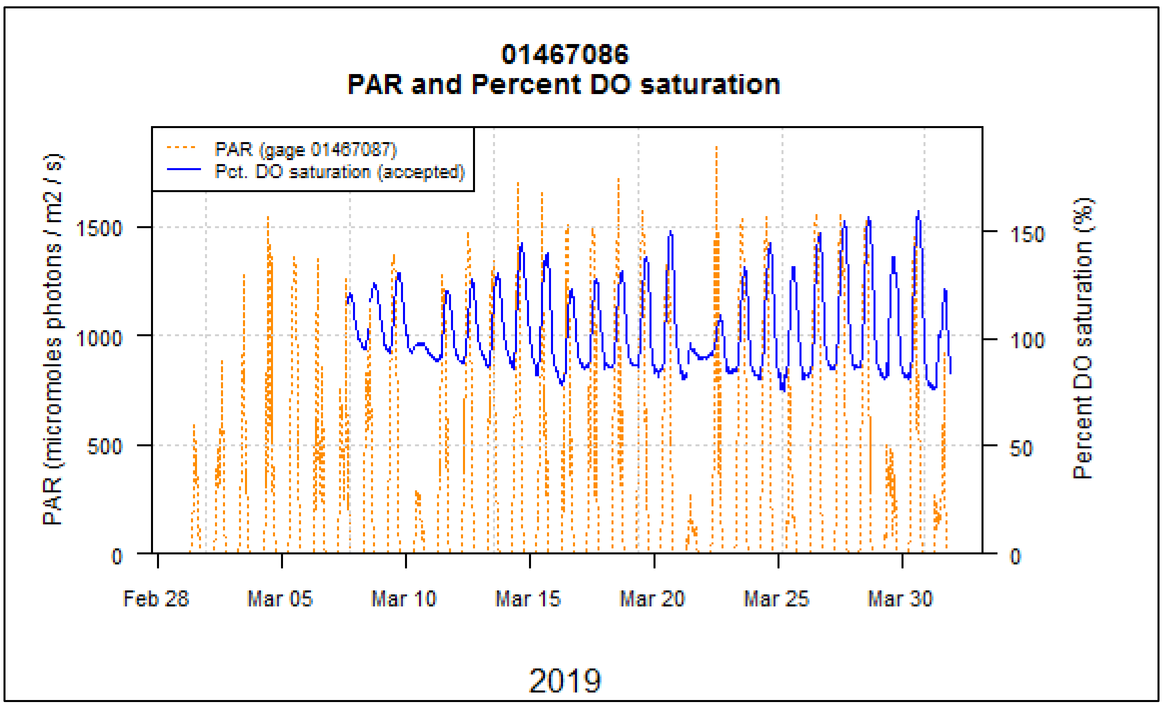


Figure 12. Gage 01467086, PAR and Percent Dissolved Oxygen Saturation, March 2019.

Figure 13. Gage 01467086, Tacony Creek at Adams Ave.

Figure 14. Gage 01467087, Frankford Creek at Castor Ave., looking downstream

Specific Conductance

Specific conductance observations were usually consistent between the two gage sites (Tables 19-20). Elevated levels of specific conductance were observed in November and are likely due to the effects of road salt entering the stream.

Table 19. Gage 01467086 Specific Conductance Summary Results by Month

Month	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	Min.	Max.	Mean
Jul-18	743.0	31.0	0.1	103.0	845.0	646.4
Aug-18	741.5	30.9	0.3	57.0	851.0	664.4
Sep-18	716.5	29.9	0.5	70.0	868.0	606.8
Oct-18	743.0	31.0	0.1	145.0	813.0	691.0
Nov-18	718.5	29.9	0.2	97.0	2500.0	636.3
Mar-19	580.0	24.2	0.7	258.0	919.0	703.4
Apr-19	718.5	29.9	0.2	121.0	851.0	661.5
May-19	743.5	31.0	0.1	94.0	779.0	612.4
Jun-19	718.5	29.9	0.2	87.0	773.0	599.0

Table 20. Gage 01467087 Specific Conductance Summary Results by Month

Month	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	Min.	Max.	Mean
Jul-18	336.0	14.0	54.9	77.0	831.0	513.0
Aug-18	648.8	27.0	12.9	163.0	882.0	694.3
Sep-18	715.3	29.8	0.7	64.0	876.0	532.1
Oct-18	741.5	30.9	0.3	173.0	853.0	683.9
Nov-18	659.3	27.5	8.5	93.0	1260.0	559.3
Mar-19	419.5	17.5	9.6	245.0	810.0	713.9
Apr-19	710.3	29.6	1.9	123.0	777.0	634.3
May-19	727.0	30.3	3.0	79.0	772.0	585.6
Jun-19	710.8	29.6	2.1	63.0	767.0	523.8

Temperature

Monthly mean temperatures observed at the downstream gage were usually higher than at the upstream gage. Consequently, a higher rate of temperature criteria exceedance was typically observed at the downstream gage (Tables 21-22).

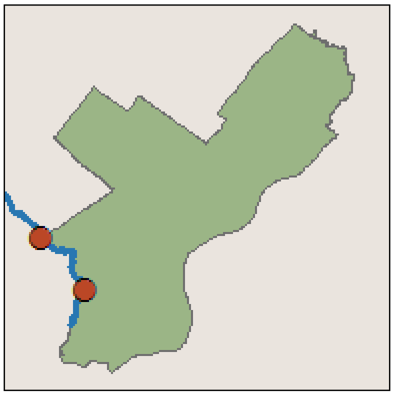
Table 21. Gage 01467086 Temperature Summary Results by Maximum Criteria Period

Designated Use	Date range start	Date range end	% hrs. exceedance	% hrs. attaining	% hrs. flagged data	Total hrs. accepted data	Total days accepted data	Min.	Max.	Mean
WWF	1-Jul	31-Jul	0.0	100.0	0.1	743.0	31.0	18.7	27.1	23.2
WWF	1-Aug	15-Aug	0.0	100.0	0.4	358.5	14.9	19.1	26.8	23.3
WWF	16-Aug	31-Aug	0.0	100.0	0.3	383.0	16.0			
WWF	1-Sep	15-Sep	0.0	100.0	0.3	359.0	15.0	15.9	26.6	20.7
WWF	16-Sep	30-Sep	0.0	100.0	0.6	358.0	14.9			
WWF	1-Oct	15-Oct	1.9	98.1	0.0	360.0	15.0	8.4	22.7	14.6
WWF	16-Oct	31-Oct	0.0	100.0	0.3	383.0	16.0			
WWF	1-Nov	15-Nov	11.7	88.3	0.0	360.0	15.0	2.1	17.0	8.9
WWF	16-Nov	30-Nov	1.4	98.6	0.4	358.5	14.9			
WWF	1-Mar	31-Mar	60.1	39.9	22.0	580.0	24.2	2.1	16.2	8.8
WWF	1-Apr	15-Apr	68.2	31.8	0.4	358.5	14.9	5.8	20.1	14.1
WWF	16-Apr	30-Apr	70.7	29.3	0.0	360.0	15.0			
WWF	1-May	15-May	9.3	90.7	0.0	360.0	15.0	10.6	22.6	16.9
WWF	16-May	31-May	3.3	96.7	0.1	383.5	16.0			
WWF	1-Jun	15-Jun	0.0	100.0	0.0	360.0	15.0			
WWF	16-Jun	30-Jun	0.0	100.0	0.4	358.5	14.9	14.9	25.0	20.3

Table 22. Gage 01467087 Temperature Summary Results by Maximum Criteria Period

Designated Use	Date range start	Date range end	% hrs. exceedance	% hrs. attaining	% hrs. flagged data	Total hrs. accepted data	Total days accepted data	Min.	Max.	Mean
WWF	1-Jul	31-Jul	0.0	100.0	7.7	343.5	28.6	20.8	28.2	24.4
WWF	1-Aug	15-Aug	0.0	100.0	25.9	266.8	11.1	21.8	28.9	25.0
WWF	16-Aug	31-Aug	0.0	100.0	0.3	383.0	16.0			
WWF	1-Sep	15-Sep	0.0	100.0	0.3	359.0	15.0	16.0	28.3	21.7
WWF	16-Sep	30-Sep	0.0	100.0	0.3	359.0	15.0			
WWF	1-Oct	15-Oct	3.9	96.1	0.1	359.5	15.0	9.4	22.7	15.2
WWF	16-Oct	31-Oct	0.0	100.0	0.3	382.8	15.9			
WWF	1-Nov	15-Nov	11.4	88.6	0.1	359.8	15.0	2.6	17.6	9.1
WWF	16-Nov	30-Nov	0.2	99.8	16.9	299.0	12.5			
WWF	1-Mar	31-Mar	92.3	7.7	43.6	419.5	17.5	6.9	15.0	10.1
WWF	1-Apr	15-Apr	77.5	22.5	0.1	359.5	15.0	8.6	19.7	15.0
WWF	16-Apr	30-Apr	92.8	7.2	0.3	358.8	14.9			
WWF	1-May	15-May	9.2	90.8	0.1	359.5	15.0	11.8	23.2	17.9
WWF	16-May	31-May	9.3	90.7	4.1	368.3	15.3			
WWF	1-Jun	15-Jun	0.0	100.0	0.0	360.0	15.0			
WWF	16-Jun	30-Jun	0.0	100.0	0.4	358.5	14.9	17.8	26.6	21.9

Cobbs Creek (Gages 01475530 and 01475548)



Dissolved oxygen and pH

The upstream Cobbs Creek site (01475530) almost always met the minimum dissolved oxygen criterion and never exceeded the 7-day average guideline (Table 23, Figures 15, 16, 19). Dissolved oxygen at the downstream site (01475548) did not always attain the minimum, particularly during the warmer months. The downstream site mostly attained the 7-day average guideline. The daily mean values are presented in Tables 25-26 for informational purposes.

The pattern of dissolved oxygen and pH values between the upstream and downstream Cobbs Creek gages is likely due to greater algal activity at the downstream gage. During the spring—key months for algal growth—pH exceeded the maximum guideline at both gage sites (Tables 27-28). Algae remove CO_2 during photosynthesis, raising pH by shifting the dissolved inorganic carbon (DIC) balance toward alkaline carbonates. Furthermore, the diel fluctuations in DO were more pronounced at the downstream gage during these months (Figures 19-20).

A third indicator of increased algal activity in Cobbs Creek is the supersaturation of oxygen caused by photosynthesis. During April, the downstream gage recorded peak DO saturation levels greater than 150% during the day in dry weather conditions (Figures 21-22).

Table 23. Gage 01475530 Dissolved Oxygen Minimum Criterion Summary Results by Month

Month	Des. Use	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	% hrs. non-attaining	% hrs. attaining	Min	Max	Mean
Jul-18	WWF	718.3	29.9	3.4	0.0	100.0	6.4	10.9	8.1
Aug-18	WWF	742.5	30.9	0.2	0.2	99.8	0.7	12.0	7.9
Sep-18	WWF	718.3	29.9	0.3	0.0	100.0	5.9	10.4	8.3
Oct-18	WWF	743.0	31.0	0.1	0.0	100.0	7.2	13.8	9.7
Nov-18	WWF	720.0	30.0	0.0	0.0	100.0	8.1	13.8	10.9
Mar-19	WWF	560.5	23.4	0.1	0.0	100.0	8.4	16.0	11.6
Apr-19	WWF	719.0	30.0	0.1	0.0	100.0	7.3	15.0	9.7
May-19	WWF	742.5	30.9	0.2	0.0	100.0	5.0	10.4	8.8
Jun-19	WWF	717.0	29.9	0.4	0.0	100.0	7.2	10.7	8.4

Table 24. Gage 01475548 Dissolved Oxygen Minimum Criterion Summary Results by Month

Month	Des. Use	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	% hrs. non-attaining	% hrs. attaining	Min	Max	Mean
Jul-18	WWF	742.3	30.9	0.2	9.2	90.8	3.9	9.7	6.4
Aug-18	WWF	744.0	31.0	0.0	10.8	89.2	3.2	12.5	6.9
Sep-18	WWF	718.8	29.9	0.2	1.2	98.8	3.8	9.8	7.9
Oct-18	WWF	743.8	31.0	0.0	0.0	100.0	5.2	14.8	9.5
Nov-18	WWF	718.5	29.9	0.3	0.0	100.0	6.5	13.7	10.9
Mar-19	WWF	538.5	22.4	4.3	0.0	100.0	6.6	16.7	11.7
Apr-19	WWF	719.0	30.0	0.1	0.0	100.0	6.2	17.6	10.0
May-19	WWF	742.5	30.9	0.2	0.0	100.0	5.2	11.2	8.1
Jun-19	WWF	718.5	29.9	0.1	2.3	97.7	3.4	11.6	7.5

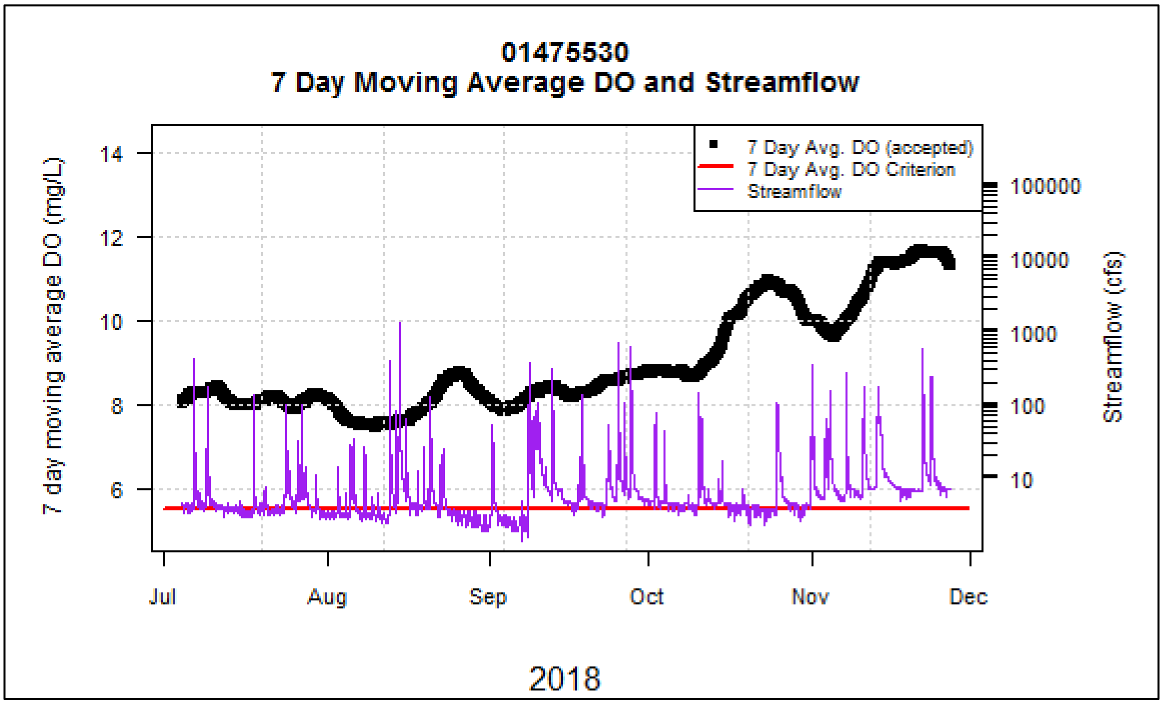


Figure 15. Gage 01475530, 7 Day Average Dissolved Oxygen and Streamflow, Jul-Dec 2018.

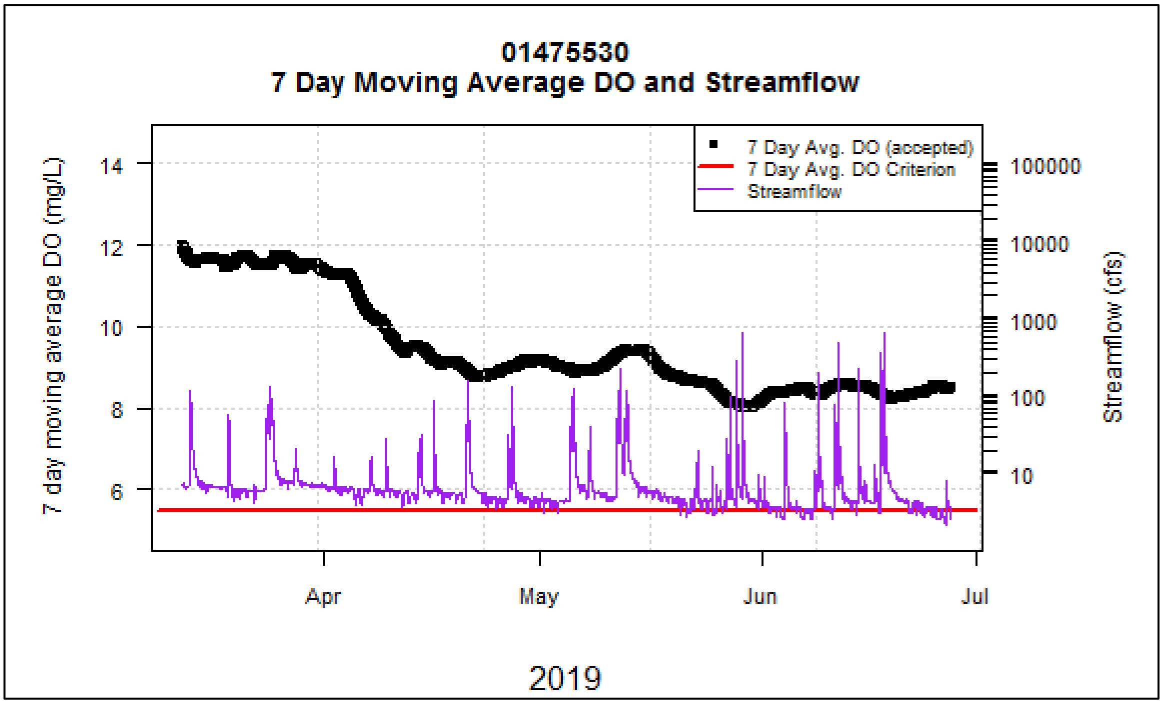


Figure 16. Gage 01475530, 7 Day Average Dissolved Oxygen and Streamflow, Mar-Jun 2019.

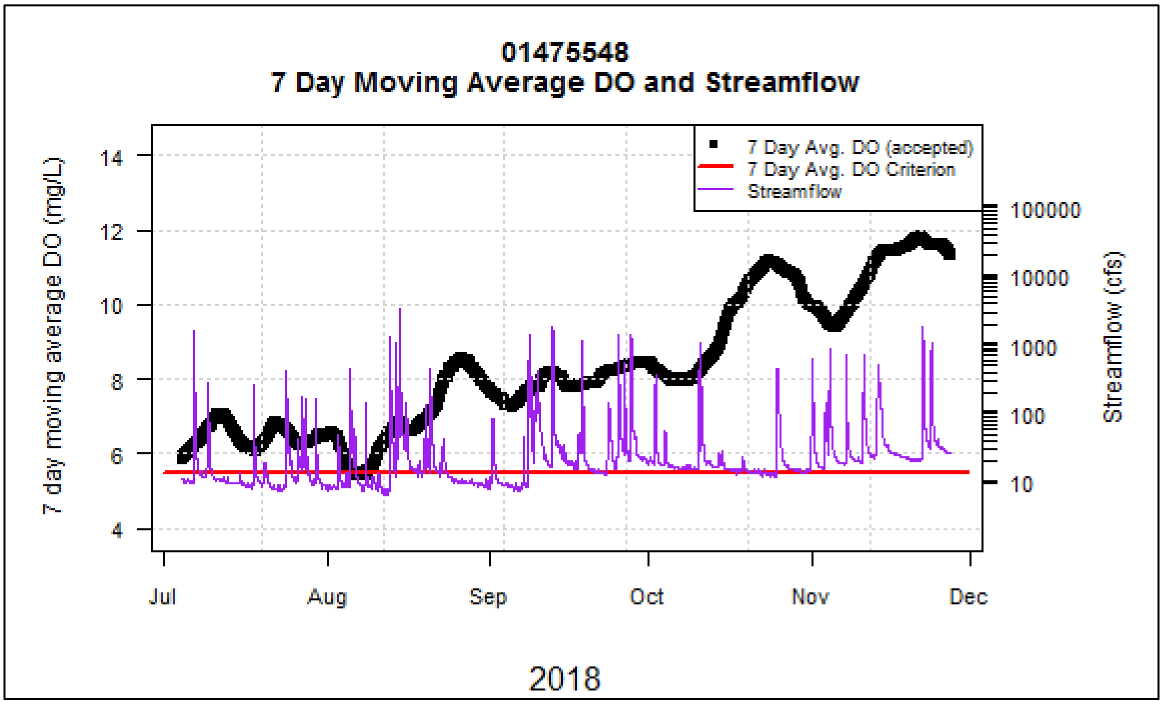


Figure 17. Gage 01475548, 7 Day Average Dissolved Oxygen and Streamflow, Jul-Dec 2018.

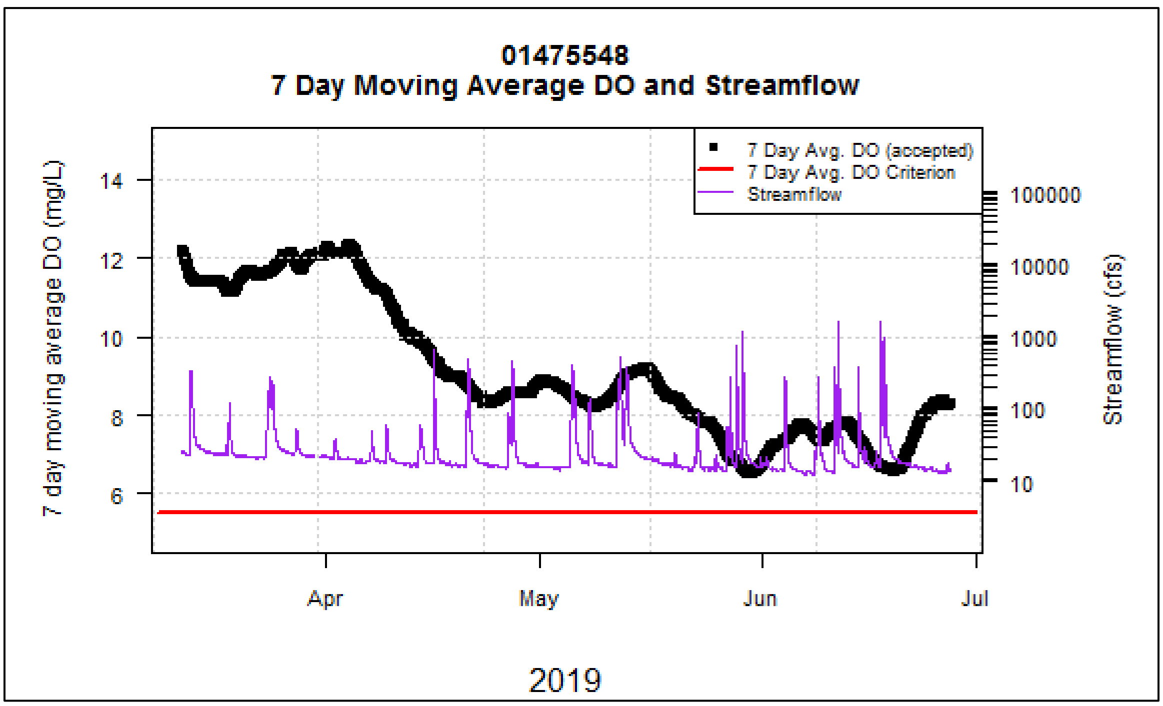


Figure 18. Gage 01475548, 7 Day Average Dissolved Oxygen and Streamflow, Mar-Jun 2019.

Table 25. Gage 01475530 Dissolved Oxygen Daily Mean Criterion Summary Results by Month

Month	Des. Use	Total days accepted data	% days flagged data	Min.	Max.	Mean
Jul-18	WWF	24.0	3.2	7.6	8.8	8.2
Aug-18	WWF	29.0	0.0	7.2	9.0	8.0
Sep-18	WWF	28.0	0.0	7.6	9.0	8.3
Oct-18	WWF	30.0	0.0	7.8	11.5	9.7
Nov-18	WWF	30.0	0.0	9.2	12.9	10.9
Mar-19	WWF	22.0	1.6	10.3	12.4	11.6
Apr-19	WWF	29.0	0.0	8.5	11.9	9.7
May-19	WWF	30.0	0.0	7.7	9.9	8.8
Jun-19	WWF	28.0	0.0	7.7	9.0	8.4

Table 26. Gage 01475548 Dissolved Oxygen Daily Mean Criterion Summary Results by Month

Month	Des. Use	Total days accepted data	% days flagged data	Min.	Max.	Mean
Jul-18	WWF	30.0	0.0	5.4	7.4	6.4
Aug-18	WWF	31.0	0.0	4.6	9.1	6.9
Sep-18	WWF	29.0	0.0	5.7	8.9	7.9
Oct-18	WWF	30.0	0.0	7.2	11.5	9.4
Nov-18	WWF	28.0	0.0	8.8	13.1	11.0
Mar-19	WWF	20.0	6.0	9.5	13.2	11.7
Apr-19	WWF	29.0	0.0	7.5	12.9	10.0
May-19	WWF	30.0	3.2	5.8	9.7	8.1
Jun-19	WWF	28.0	0.0	5.2	8.6	7.5

Table 27. Gage 01475530 pH Criteria Summary Results by Month

Month	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	% hrs. max. non-attaining	% days max. non-attaining	% hrs. min. non-attaining	% days min. non-attaining	% hrs. attaining	% days attaining	Min.	Max.	Mean
Jul-18	741.5	30.9	0.3	0.0	0.0	0.0	0.0	100.0	100.0	7.1	8.5	7.5
Aug-18	743.0	31.0	0.1	0.0	0.0	0.0	0.0	100.0	100.0	6.7	8.8	7.5
Sep-18	719.3	30.0	0.1	0.0	0.0	0.0	0.0	100.0	100.0	7.0	8.2	7.5
Oct-18	742.8	30.9	0.1	0.0	0.0	0.0	0.0	100.0	100.0	7.2	8.6	7.6
Nov-18	720.0	30.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	6.7	7.8	7.3
Mar-19	560.5	23.4	0.9	0.9	8.3	0.0	0.0	99.1	91.7	7.2	9.2	7.8
Apr-19	718.5	29.9	0.2	0.0	0.0	0.0	0.0	100.0	100.0	7.0	8.9	7.4
May-19	742.3	30.9	0.2	0.0	0.0	0.0	0.0	100.0	100.0	6.9	7.6	7.3
Jun-19	626.5	26.1	12.9	0.0	0.0	0.0	0.0	100.0	100.0	7.0	8.3	7.4

Table 28. Gage 01475548 pH Criteria Summary Results by Month

Month	total hrs. accepted data	Total days accepted data	% hrs. flagged data	% hrs. max. non-attaining	% days max. non-attaining	% hrs. min. non-attaining	% days min. non-attaining	% hrs. attaining	% days attaining	Min.	Max.	Mean
Jul-18	742.8	30.9	0.0	0.0	0.0	0.0	0.0	100.0	100.0	6.8	8.1	7.4
Aug-18	744.0	31.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	6.8	8.9	7.5
Sep-18	718.8	29.9	0.0	0.0	0.0	0.0	0.0	100.0	100.0	7.0	8.3	7.5
Oct-18	743.8	31.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	6.8	8.8	7.6
Nov-18	688.8	28.7	4.4	0.0	0.0	0.0	0.0	100.0	100.0	6.2	8.0	7.4
Mar-19	538.5	22.4	4.2	0.7	4.2	0.0	0.0	99.3	95.8	7.2	9.1	7.8
Apr-19	719.0	30.0	0.1	4.9	26.7	0.0	0.0	95.1	73.3	7.1	9.3	7.9
May-19	742.8	30.9	0.2	0.0	0.0	0.0	0.0	100.0	100.0	6.8	8.2	7.5
Jun-19	718.8	29.9	0.1	0.0	0.0	0.0	0.0	100.0	100.0	6.9	8.6	7.5

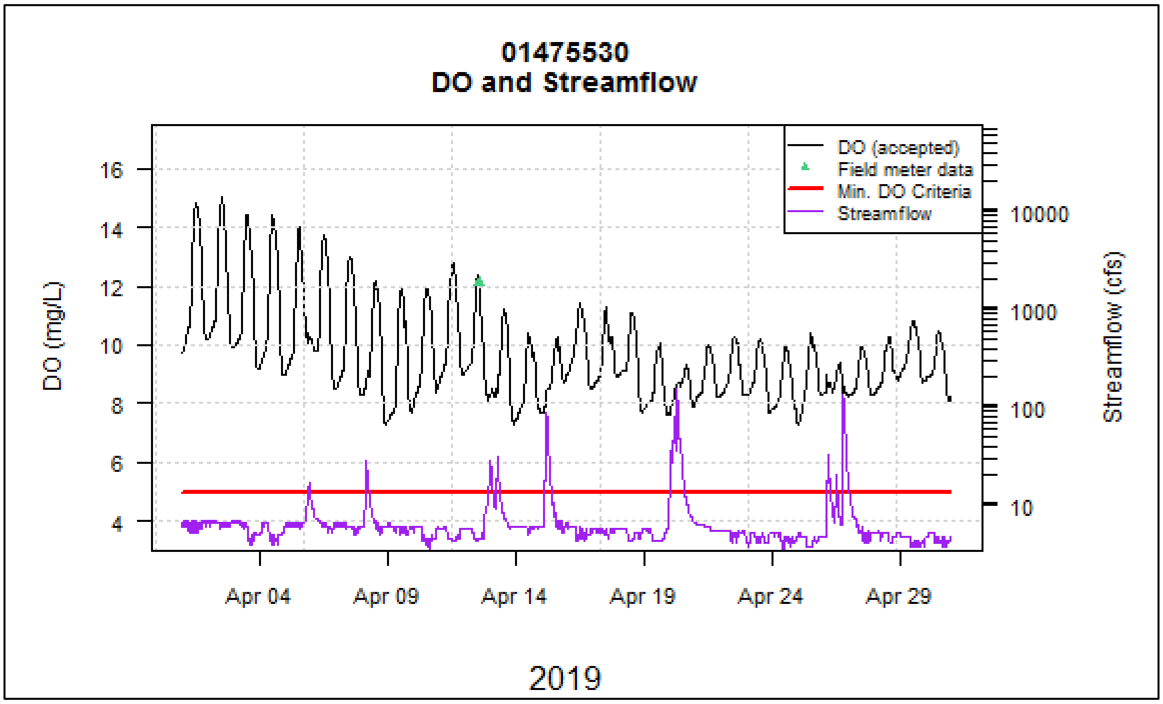


Figure 19. Gage 01475530, Dissolved Oxygen and Streamflow, April 2019.

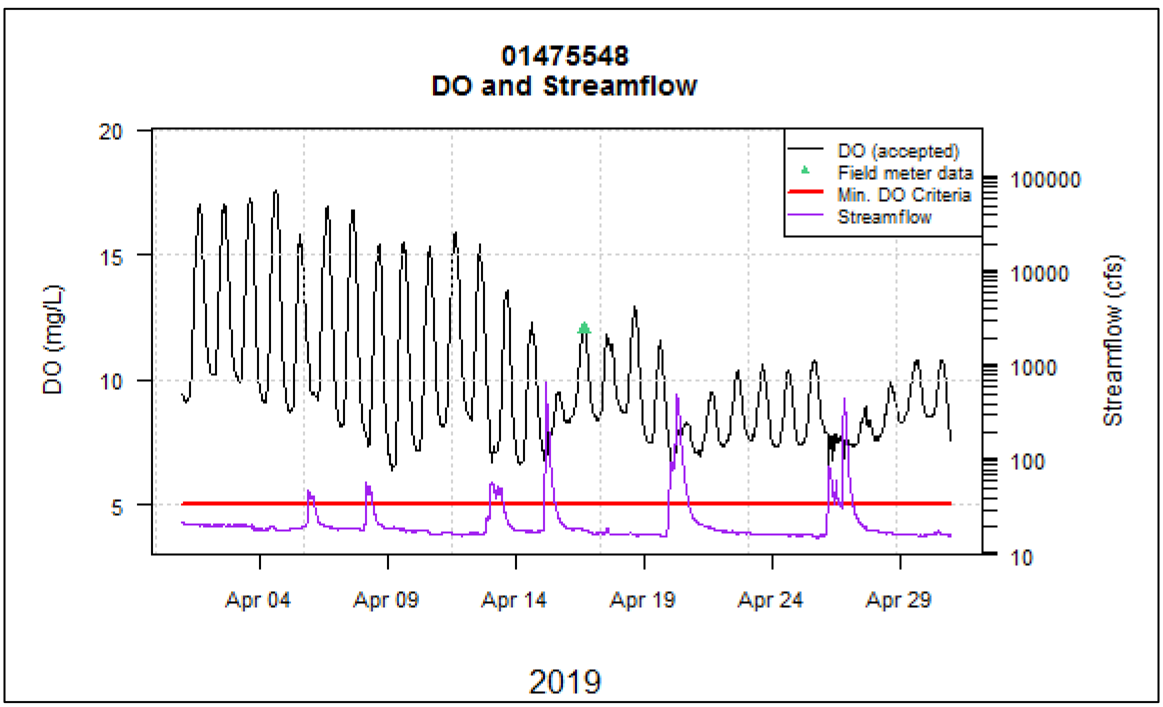


Figure 20. Gage 01475548, Dissolved Oxygen and Streamflow, April 2019.

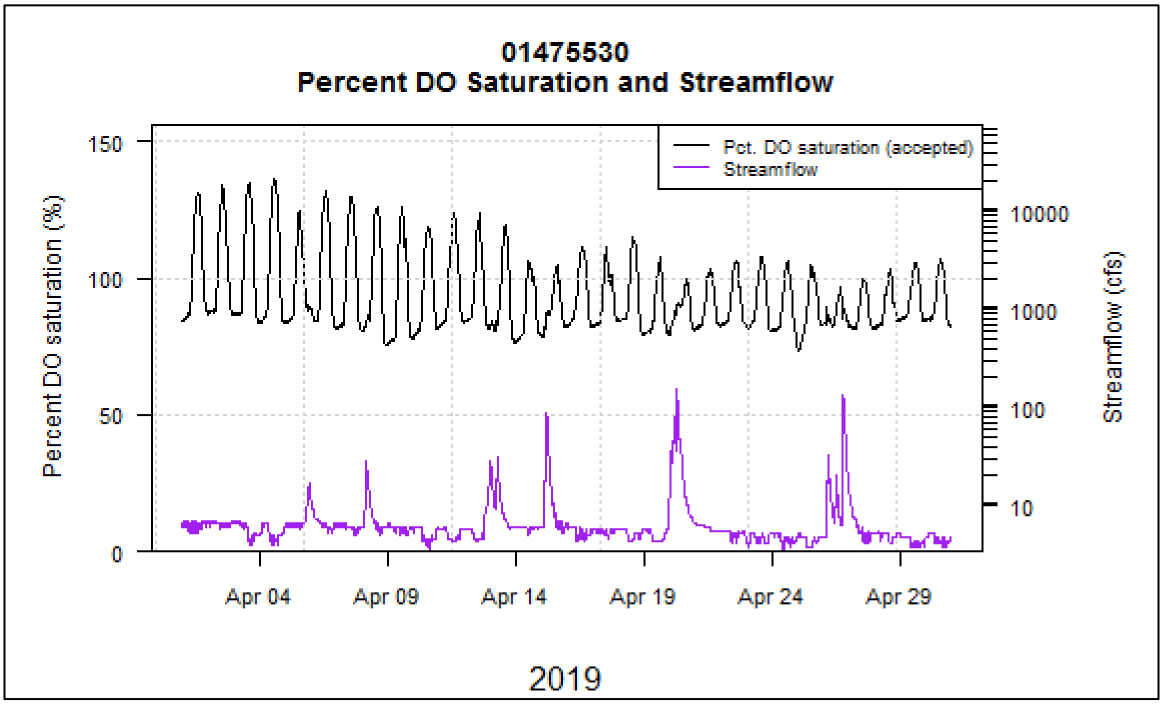


Figure 21. Gage 01475530, Percent DO Saturation and Streamflow, April 2019.

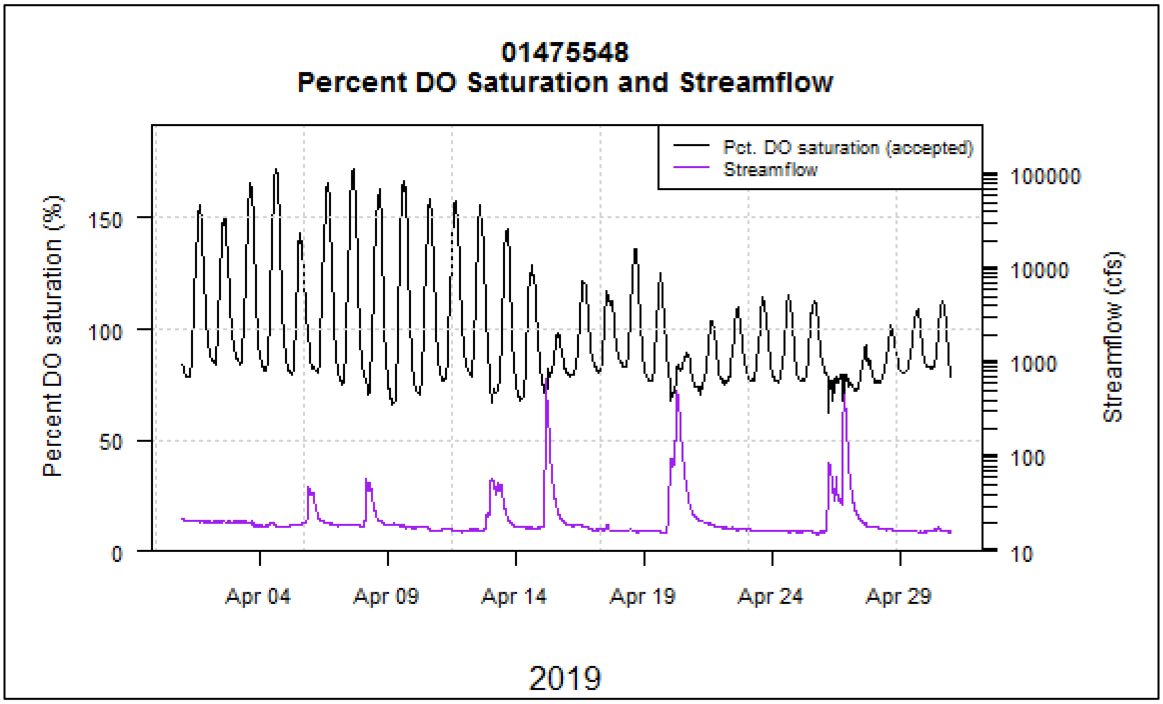


Figure 22. Gage 01475548, Percent DO Saturation and Streamflow, April 2019.

Figure 23. Gage 01475530, Cobbs Creek at Rte. 1, looking upstream

Figure 24. Gage 01475548, Cobbs Creek at Mt. Moriah Cemetery

Specific Conductance

Specific conductance observations were similar to those observed in Tacony Creek (Tables 29-30). Road salt may have had some impact on conductance at both gages in November. However, the typical pattern of stormwater lowering conductance levels in the stream is well-observed during the storms that occurred in June (Figures 25-26).

Table 29. Gage 01475530 Specific Conductance Summary Results by Month

Month	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	Min.	Max.	Mean
Jul-18	602.3	25.1	19.1	112.0	676.0	576.5
Aug-18	743.0	31.0	0.1	56.0	657.0	530.7
Sep-18	719.3	30.0	0.1	70.0	670.0	507.4
Oct-18	743.0	31.0	0.1	132.0	652.0	577.1
Nov-18	720.0	30.0	0.0	66.0	3340.0	543.9
Mar-19	560.5	23.4	0.1	187.0	902.0	639.9
Apr-19	719.0	30.0	0.1	110.0	687.0	586.7
May-19	712.5	29.7	4.3	57.0	640.0	542.5
Jun-19	655.8	27.3	8.9	62.0	655.0	537.6

Table 30. Gage 01475548 Specific Conductance Summary Results by Month

Month	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	Min.	Max.	Mean
Jul-18	742.3	30.9	0.2	117.0	773.0	549.7
Aug-18	744.0	31.0	0.0	70.0	743.0	540.2
Sep-18	718.8	29.9	0.2	80.0	767.0	475.9
Oct-18	743.8	31.0	0.0	132.0	765.0	544.4
Nov-18	718.5	29.9	0.3	118.0	2250.0	528.6
Mar-19	538.5	22.4	4.3	226.0	846.0	681.3
Apr-19	715.5	29.8	0.6	185.0	856.0	632.2
May-19	735.3	30.6	1.2	138.0	919.0	594.8
Jun-19	706.0	29.4	1.9	116.0	665.0	525.2

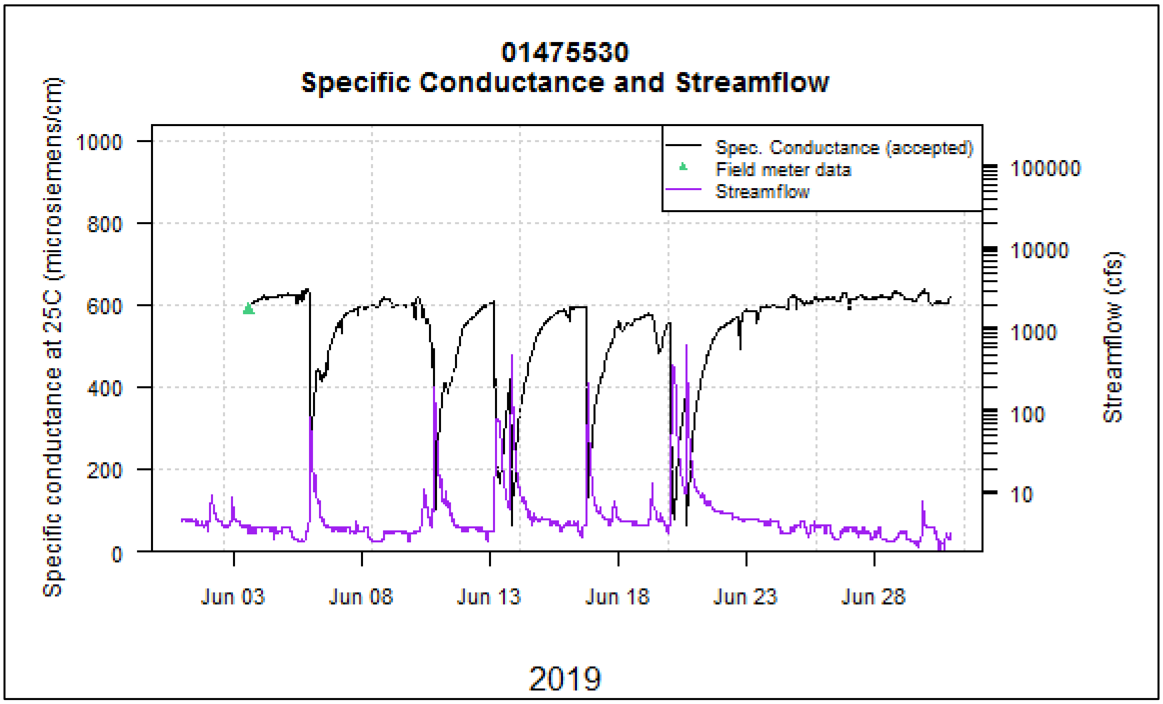


Figure 25. Gage 01475530, Specific Conductance and Streamflow, June 2019.

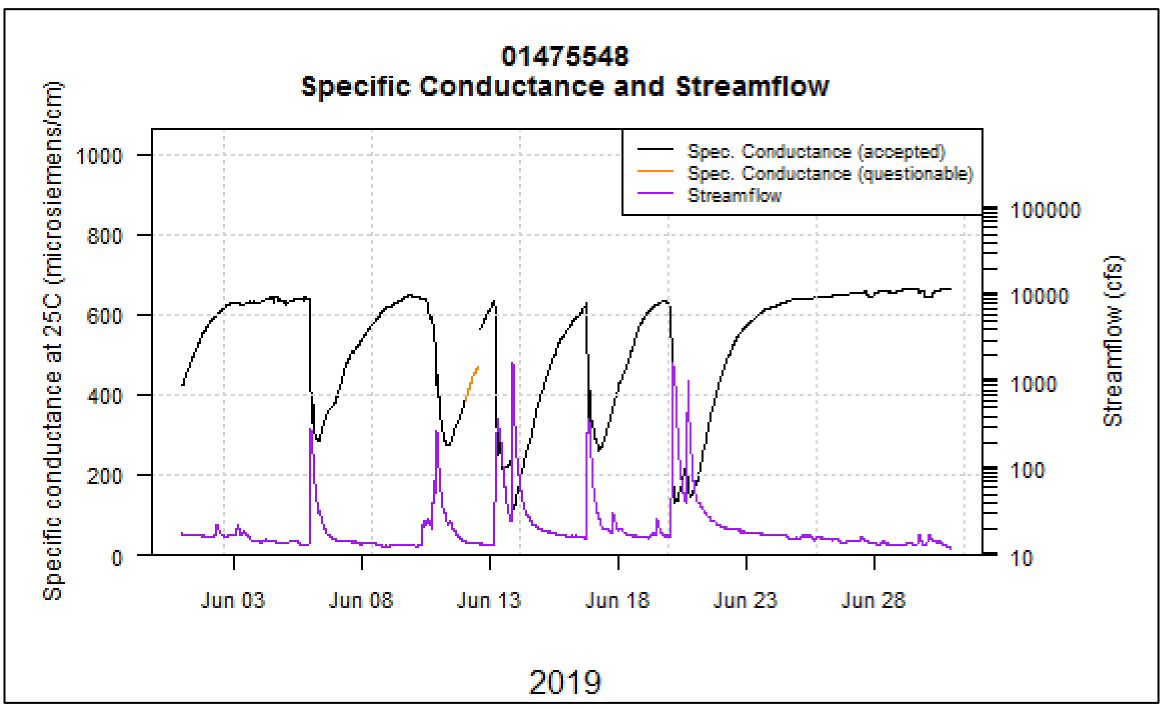


Figure 26. Gage 01475548, Specific Conductance and Streamflow, June 2019.

Temperature

Both Cobbs Creek gages showed exceedances of temperature maximum criteria during the fall and spring seasons, when temperature criteria are more stringent (Tables 31-32).

Table 31. Gage 01475530 Temperature Summary Results by Maximum Criteria Period

Designated Use	Date range start	Date range end	% hrs. exceedance	% hrs. attaining	% hrs. flagged data	Total hrs. accepted data	Total days accepted data	Min.	Max.	Mean
WWF	1-Jul	31-Jul	0.0	100.0	19.1	601.8	25.1	19.6	26.8	22.4
WWF	1-Aug	15-Aug	0.0	100.0	0.3	359.0	15.0	18.6	28.1	22.8
WWF	16-Aug	31-Aug	0.0	100.0	0.0	384.0	16.0			
WWF	1-Sep	15-Sep	0.0	100.0	0.0	360.0	15.0	16.1	26.4	20.5
WWF	16-Sep	30-Sep	0.0	100.0	0.2	359.3	15.0			
WWF	1-Oct	15-Oct	1.5	98.5	0.0	360.0	15.0	9.0	22.5	14.8
WWF	16-Oct	31-Oct	0.0	100.0	0.3	383.0	16.0			
WWF	1-Nov	15-Nov	14.0	86.0	0.0	360.0	15.0	2.5	17.2	9.1
WWF	16-Nov	30-Nov	3.5	96.5	0.0	360.0	15.0			
WWF	1-Mar	31-Mar	64.8	35.2	24.7	560.5	23.4	4.8	16.2	9.3
WWF	1-Apr	15-Apr	69.9	30.1	0.3	358.8	14.9	5.9	19.7	14.1
WWF	16-Apr	30-Apr	72.8	27.2	0.0	360.0	15.0			
WWF	1-May	15-May	6.0	94.0	0.0	360.0	15.0	11.0	23.4	16.8
WWF	16-May	31-May	3.4	96.6	0.4	382.5	15.9			
WWF	1-Jun	15-Jun	0.0	100.0	0.6	358.0	14.9			
WWF	16-Jun	30-Jun	0.0	100.0	0.4	358.5	14.9	14.8	25.1	19.9

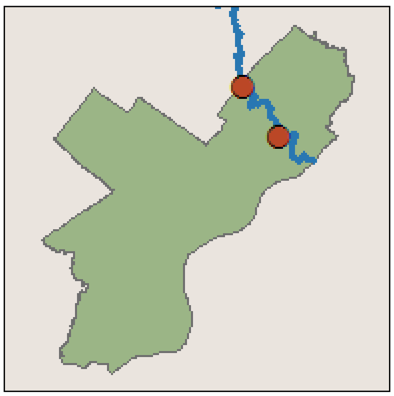
Table 32. Gage 01475548 Temperature Summary Results by Maximum Criteria Period

Designated Use	Date range start	Date range end	% hrs. exceedance	% hrs. attaining	% hrs. flagged data	Total hrs. accepted data	Total days accepted data	Min.	Max.	Mean
WWF	1-Jul	31-Jul	0.0	100.0	0.0	744.0	31.0	19.8	28.7	24.3
WWF	1-Aug	15-Aug	0.0	100.0	0.3	358.8	15.0	18.1	26.8	22.4
WWF	16-Aug	31-Aug	0.0	100.0	24.2	291.0	12.2			
WWF	1-Sep	15-Sep	0.0	100.0	0.0	360.0	15.0	15.9	23.9	19.9
WWF	16-Sep	30-Sep	0.0	100.0	14.4	308.0	12.9			
WWF	1-Oct	15-Oct	6.5	93.5	0.0	360.0	15.0	11.0	23.0	16.4
WWF	16-Oct	31-Oct	2.1	97.9	0.2	383.3	16.0			
WWF	1-Nov	15-Nov	17.6	82.4	0.3	359.0	15.0	4.1	15.8	8.7
WWF	16-Nov	30-Nov	2.8	97.2	0.3	359.0	15.0			
WWF	1-Mar	31-Mar	24.6	75.4	14.7	634.5	26.5	2.2	14.3	6.8
WWF	1-Apr	15-Apr	31.8	68.2	0 .0	360.0	15.0	6.8	20.6	11.6
WWF	16-Apr	30-Apr	32.5	67.5	0.2	359.3	15.0			
WWF	1-May	15-May	43.8	56.2	0.0	360.0	15.0	10.7	23.6	18.5
WWF	16-May	31-May	6.8	93.2	0.1	383.8	16.0			
WWF	1-Jun	15-Jun	0.0	100.0	6.2	337.8	14.1			
WWF	16-Jun	30-Jun	0.0	100.0	0.0	360.0	15.0	15.5	26.7	20.9

Gages in Separate Sewer System Watersheds

Gages in the Pennypack, Wissahickon and Poquessing watersheds are situated in the separate sewer system areas of Philadelphia. Although these sites are not affected by combined sewer overflows, discharge of untreated stormwater runoff from stormwater outfalls can negatively affect water quality.

Pennypack Creek (Gages 01467042 and 01467048)



Dissolved oxygen and pH

Both the upstream (01467042) and downstream (01467048) gages of Pennypack Creek showed pronounced diel fluctuations in dissolved oxygen and pH as a result of algal activity. These patterns are most evident during dry weather periods, when algal growth is able to excel because of abundant sunshine and a lack of storm events that might otherwise scour the algal population.

At both upstream and downstream Pennypack Creek gages, periods of dry weather in warm months are conducive to excessive algal growth. During these periods, algal populations seemed to flourish, with large daily DO amplitudes during April (Figures 31-32).

In April, maximum daily pH fluctuations of approximately 1.25 units were observed (Figures 33-34). Maximum pH criteria exceedance occurred at both gages in the spring. It would be reasonable to conclude that if not for periodic interruptions of algal activity due to rainfall, those extreme fluctuations and chronic pH criteria exceedance would likely occur through the entire season.

Algal communities in the area of both gages recover quickly after storm events, as seen in Figures 33-34. Prior to a series of small storms occurring in April 2019, both DO and pH showed the typical pronounced fluctuations indicative of strong algal activity. This pattern diminished with the storms, when much of the algae was likely scoured away and overcast conditions likely inhibited further growth, as indicated by the PAR data at 01467042 for April 2019 (Figure 35). However, within 2-3 days of the conclusion of the rainfall and the return of sunny conditions, fluctuations of DO and pH resumed, indicative of high algal density. This not only demonstrates the resilience of the algal population in this ecosystem, but also a likely abundance of nutrients that allows regrowth to occur so quickly.

Table 33. Gage 01467042 Dissolved Oxygen Minimum Criterion Summary Results by Month

Month	Des. Use	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	% hrs. non-attaining	% hrs. attaining	Min	Max	Mean
Jul-18	TSF	742.8	30.9	0.0	0.0	100.0	5.9	11.3	7.8
Aug-18	TSF	743.0	31.0	0.0	0.0	100.0	5.9	12.1	8.0
Sep-18	TSF	719.5	30.0	0.0	0.0	100.0	5.7	10.7	8.1
Oct-18	TSF	742.5	30.9	0.0	0.0	100.0	7.3	13.8	9.6
Nov-18	TSF	719.3	30.0	0.0	0.0	100.0	8.0	12.7	10.4
Mar-19	TSF	489.0	20.4	0.0	0.0	100.0	8.3	18.4	12.1
Apr-19	TSF	719.5	30.0	0.0	0.0	100.0	6.4	17.6	9.8
May-19	TSF	741.5	30.9	0.0	0.0	100.0	7.2	11.9	8.9
Jun-19	TSF	715.0	29.8	0.0	0.0	100.0	6.8	9.6	8.1

Table 34. Gage 01467048 Dissolved Oxygen Minimum Criterion Summary Results by Month

Month	Des. Use	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	% hrs. non-attaining	% hrs. attaining	Min	Max	Mean
Jul-18	TSF	739.5	30.8	0.6	0.0	100.0	6.2	12.0	7.9
Aug-18	TSF	741.0	30.9	0.4	0.0	100.0	5.9	13.2	8.2
Sep-18	TSF	718.8	29.9	0.0	0.0	100.0	6.0	11.2	8.3
Oct-18	TSF	742.5	30.9	0.0	0.0	100.0	7.7	14.6	9.9
Nov-18	TSF	717.3	29.9	0.0	0.0	100.0	8.3	13.5	11.0
Mar-19	TSF	442.0	18.4	0.0	0.0	100.0	8.6	17.5	12.5
Apr-19	TSF	700.0	29.2	0.0	0.4	99.6	1.6	17.9	9.8
May-19	TSF	743.5	31.0	0.0	0.0	100.0	7.3	12.0	8.9
Jun-19	TSF	718.3	29.9	0.0	0.0	100.0	7.3	10.1	8.5

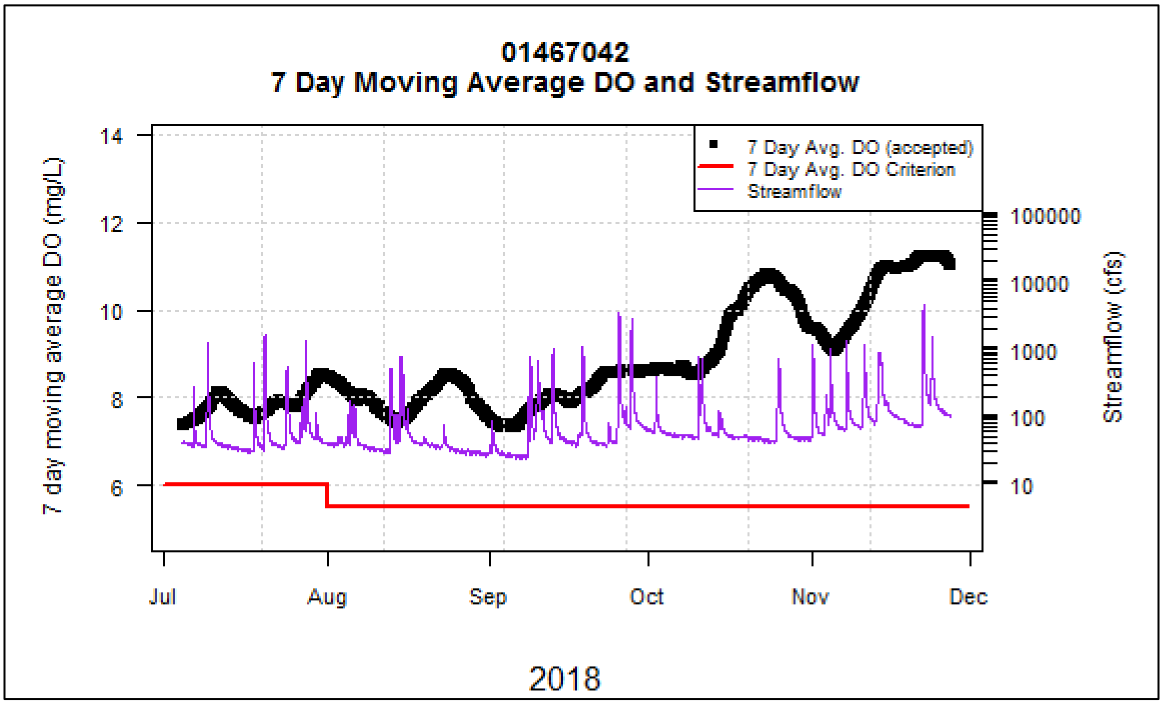


Figure 27. Gage 01467042, 7 Day Average Dissolved Oxygen and Streamflow, Jul-Dec 2018.

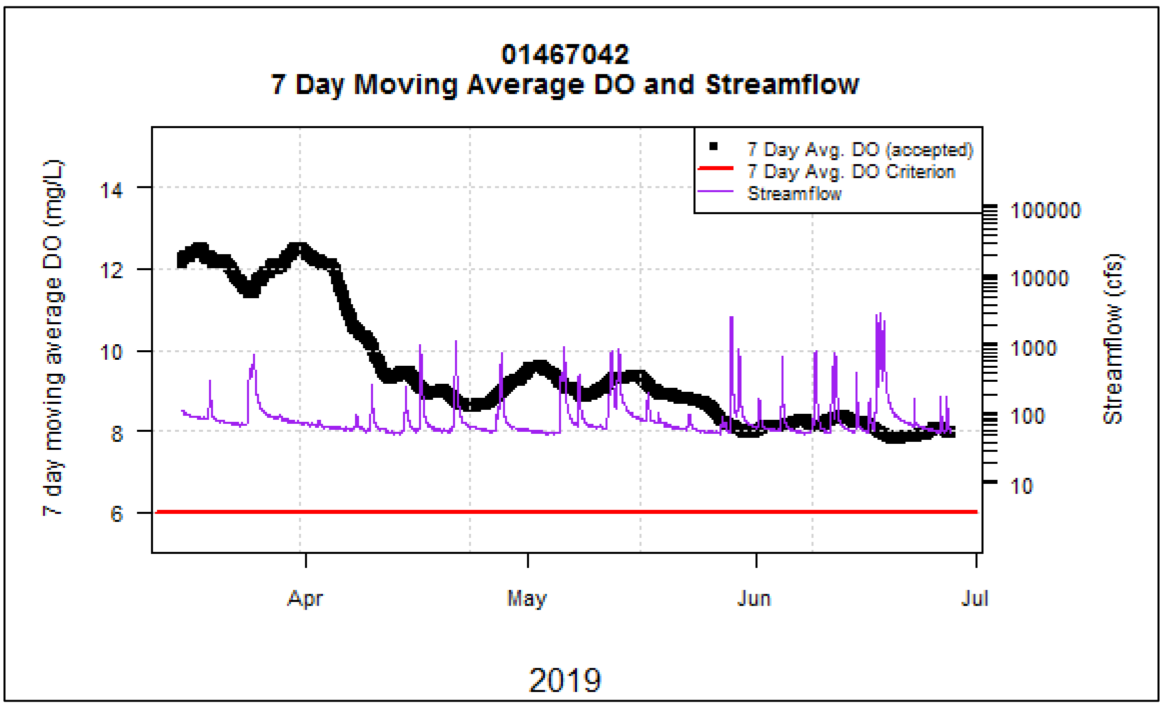


Figure 28. Gage 01467042, 7 Day Average Dissolved Oxygen and Streamflow, Mar-Jun 2019.

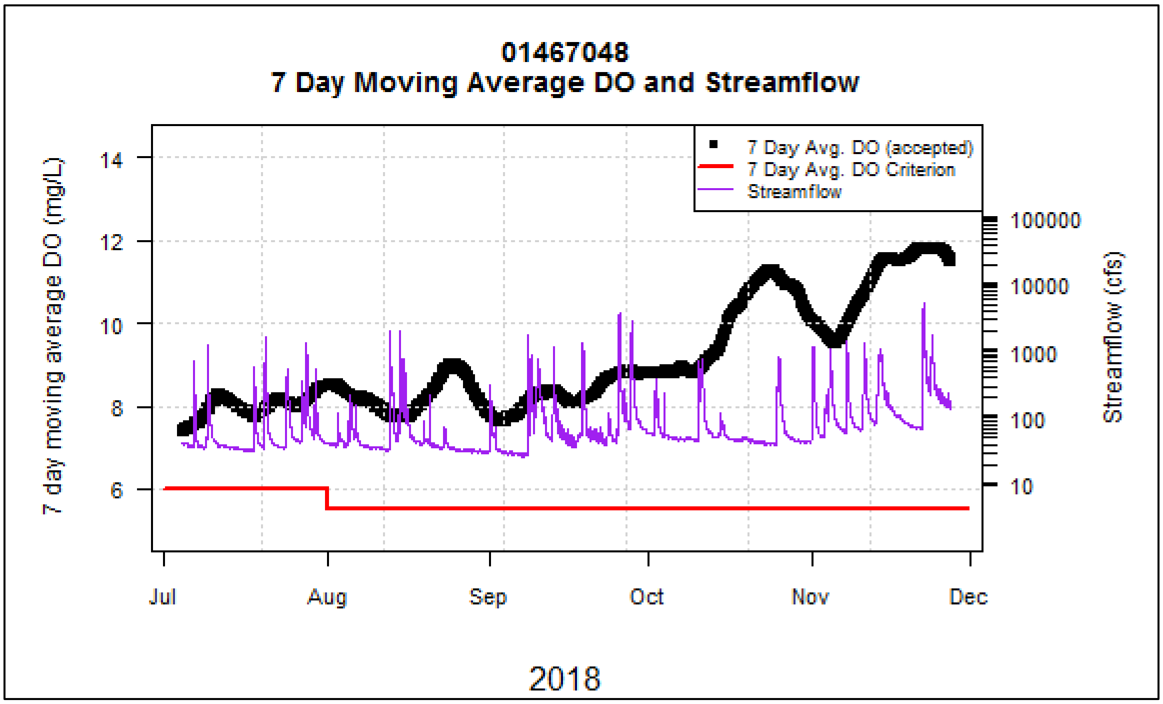


Figure 29. Gage 01467048, 7 Day Average Dissolved Oxygen and Streamflow, Jul-Dec 2018.

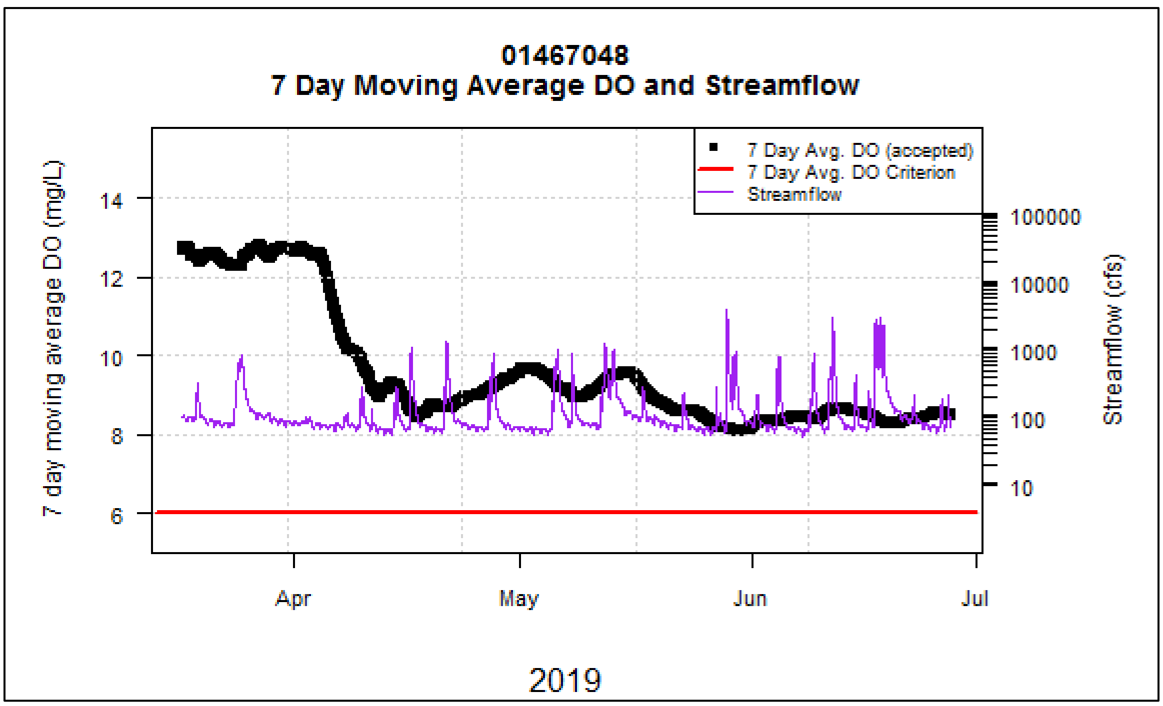


Figure 30. Gage 01467048, 7 Day Average Dissolved Oxygen and Streamflow, Mar-Jun 2019.

Table 35. Gage 01467042 Dissolved Oxygen Daily Mean Criterion Summary Results by Month

Month	Des. Use	Total days accepted data	% days flagged data	Min.	Max.	Mean
Jul-18	TSF	29.0	6.5	7.0	8.7	7.8
Aug-18	TSF	30.0	3.2	6.7	9.0	8.0
Sep-18	TSF	29.0	3.3	7.1	9.3	8.1
Oct-18	TSF	28.0	9.7	7.6	11.4	9.6
Nov-18	TSF	29.0	3.3	8.5	12.3	10.4
Mar-19	TSF	19.0	6.8	10.8	13.4	12.1
Apr-19	TSF	29.0	3.3	7.9	13.0	9.7
May-19	TSF	28.0	9.7	7.6	9.9	8.9
Jun-19	TSF	25.0	16.7	7.6	8.7	8.0

Table 36. Gage 01467048 Dissolved Oxygen Daily Mean Criterion Summary Results by Month

Month	Des. Use	Total days accepted data	% days flagged data	Min.	Max.	Mean
Jul-18	TSF	29.0	6.5	6.9	8.8	7.9
Aug-18	TSF	28.0	9.7	6.8	9.4	8.2
Sep-18	TSF	29.0	3.3	7.6	9.4	8.3
Oct-18	TSF	29.0	6.5	8.1	12.0	9.9
Nov-18	TSF	28.0	6.7	8.9	13.1	11.0
Mar-19	TSF	16.0	13.4	11.0	13.6	12.5
Apr-19	TSF	26.0	13.3	7.7	13.3	9.6
May-19	TSF	30.0	3.2	7.8	10.1	9.0
Jun-19	TSF	27.0	10.0	7.9	8.9	8.5

Table 37. Gage 01467042 pH Criteria Summary Results by Month

Month	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	% hours max. non-attaining	% days max. non-attaining	% hrs. min. non-attaining	% days min. non-attaining	% hrs. attaining	% days attaining	Min.	Max.	Mean
Jul-18	742.8	30.9	0.0	0.0	0.0	0.0	0.0	100.0	100.0	7.1	8.5	7.6
Aug-18	743.0	31.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	7.2	8.7	7.8
Sep-18	719.5	30.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	7.0	8.0	7.5
Oct-18	742.5	30.9	0.0	0.0	0.0	0.0	0.0	100.0	100.0	7.3	8.4	7.6
Nov-18	718.5	29.9	0.0	0.0	0.0	0.0	0.0	100.0	100.0	7.0	7.8	7.4
Mar-19	489.3	20.4	0.0	2.6	14.3	0.0	0.0	97.4	85.7	7.4	9.3	7.9
Apr-19	719.5	30.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	7.3	9.0	7.7
May-19	741.0	30.9	0.0	0.0	0.0	0.0	0.0	100.0	100.0	7.0	8.2	7.5
Jun-19	718.3	29.9	0.0	0.0	0.0	0.0	0.0	100.0	100.0	6.9	7.8	7.5

Table 38. Gage 01467048 pH Criteria Summary Results by Month

Month	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	% hrs. max. non-attaining	% days max. non-attaining	% hrs. min. non-attaining	% days min. non-attaining	% hrs. attaining	% days attaining	Min.	Max.	Mean
Jul-18	739.5	30.8	0.6	0.0	0.0	0.0	0.0	100.0	100.0	7.0	8.6	7.6
Aug-18	741.5	30.9	0.3	0.0	0.0	0.0	0.0	100.0	100.0	7.0	8.8	7.8
Sep-18	718.8	29.9	0.0	0.0	0.0	0.0	0.0	100.0	100.0	7.0	8.6	7.6
Oct-18	742.5	30.9	0.0	0.0	0.0	0.0	0.0	100.0	100.0	7.3	8.6	7.8
Nov-18	717.8	29.9	0.0	0.0	0.0	0.0	0.0	100.0	100.0	7.0	8.0	7.6
Mar-19	441.5	18.4	0.0	5.0	26.3	0.0	0.0	95.0	73.7	7.4	9.4	8.1
Apr-19	699.5	29.1	0.0	4.1	20.0	0.0	0.0	95.9	80.0	7.1	9.3	7.7
May-19	742.8	30.9	0.0	0.0	0.0	0.0	0.0	100.0	100.0	6.8	8.1	7.4
Jun-19	717.5	29.9	0.0	0.0	0.0	0.0	0.0	100.0	100.0	6.9	8.2	7.5

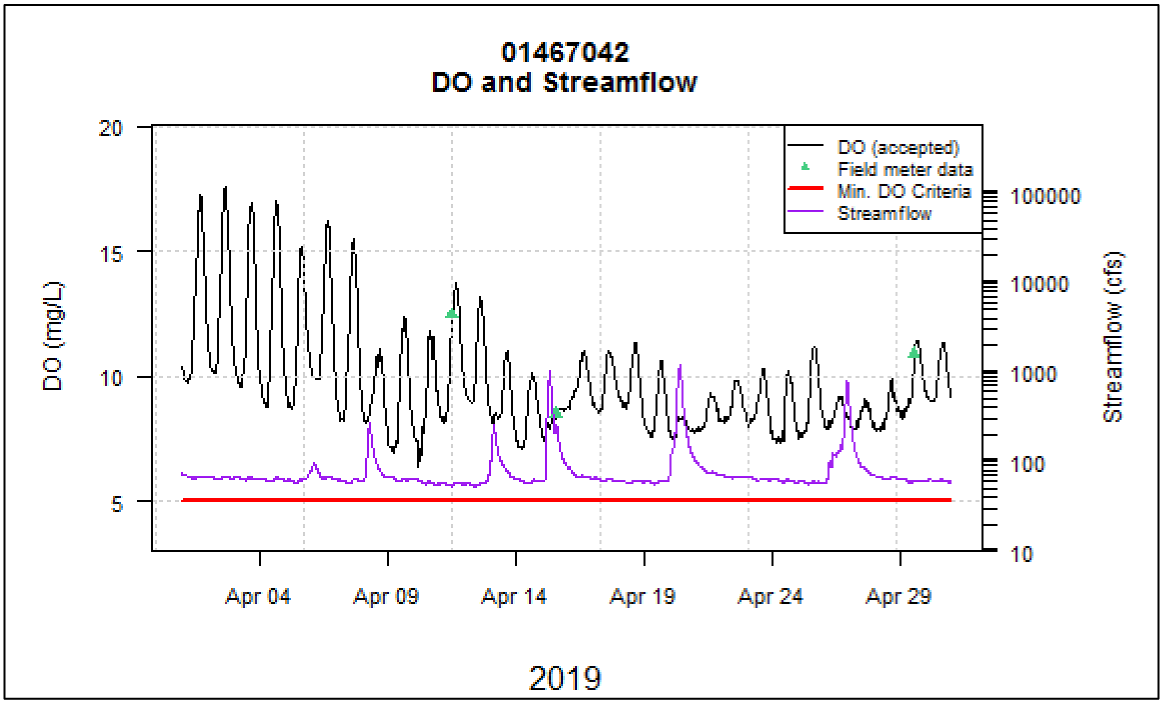


Figure 31. Gage 01467042, Dissolved Oxygen and Streamflow, April 2019.

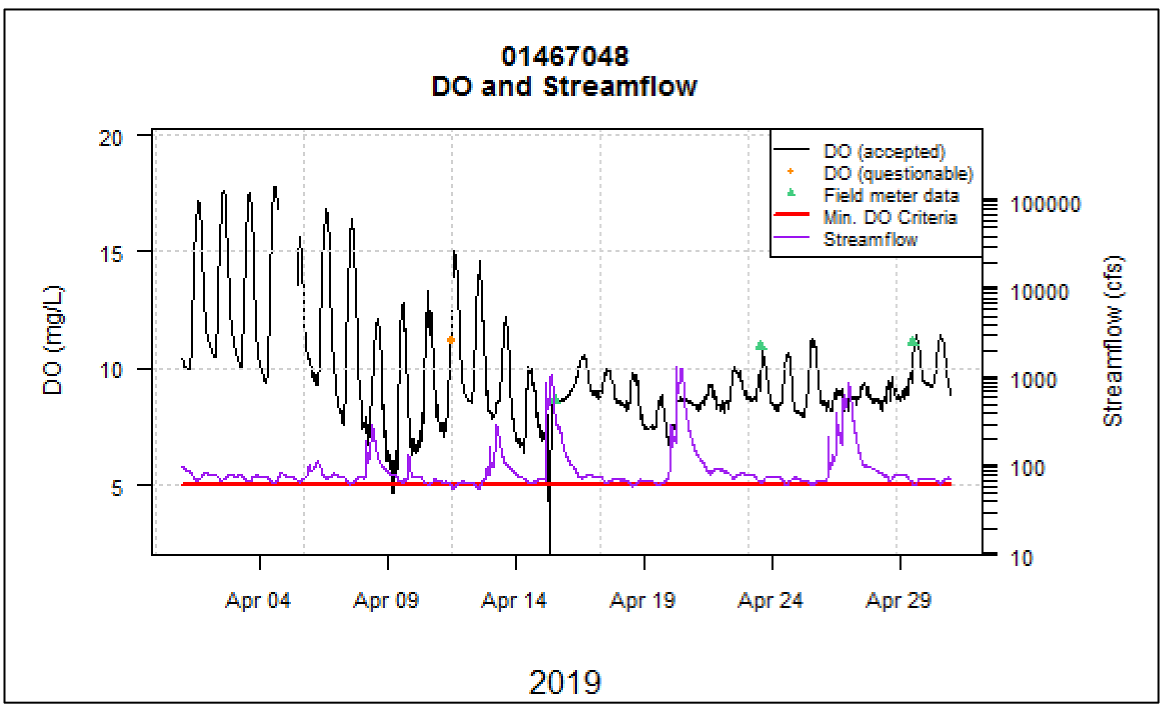


Figure 32. Gage 01467048, Dissolved Oxygen and Streamflow, April 2019.

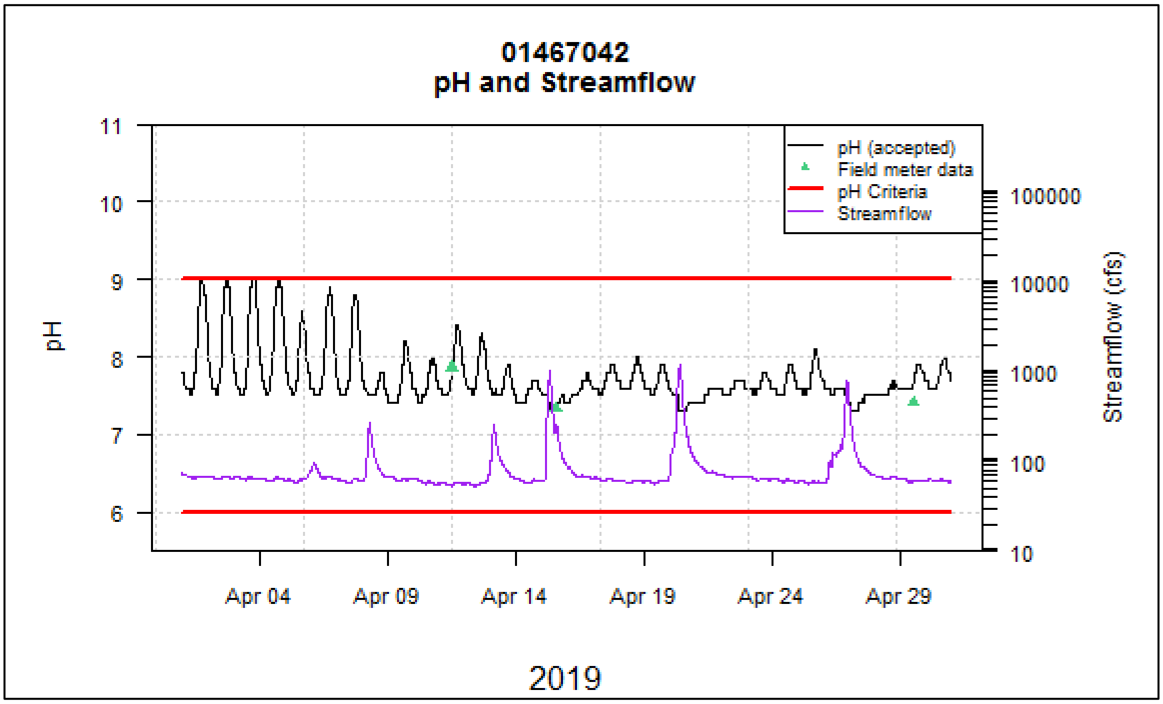


Figure 33. Gage 01467042, pH and Streamflow, April 2019.

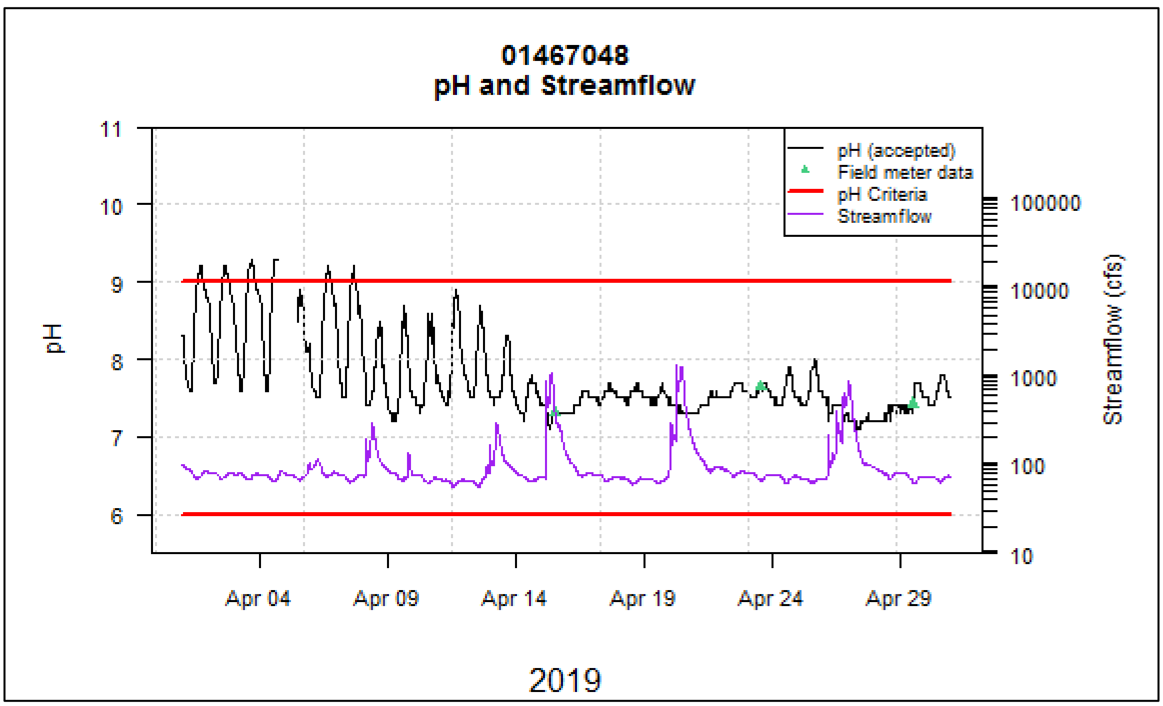


Figure 34. Gage 01467048, pH and Streamflow, April 2019.

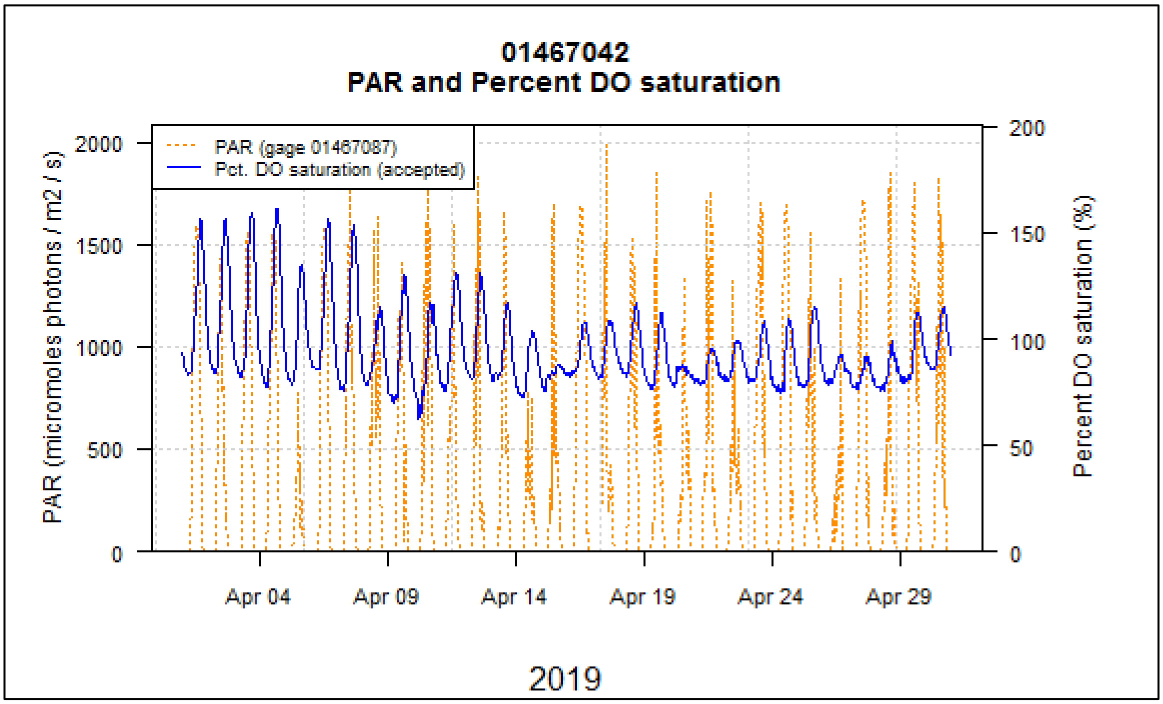


Figure 35. Gage 01467042, PAR and Percent Dissolved Oxygen Saturation, April 2019.

Figure 36. Gage 01467042, Pennypack Creek at Pine Rd., looking upstream

Figure 37. Gage 01467048, Pennypack Creek at Lower Rhawn St. Bridge, looking upstream

Turbidity

Turbidity data at the Pennypack Creek gages tend to reflect streamflow conditions. When there is high flow (*i.e.*, during and after storms), increases in turbidity are common and expected, as sediment in the creek bed is resuspended and particles present in runoff enter the stream (Figure 38). The downstream gage generally exhibited higher turbidity values throughout the year (Tables 39-40).

Flagged data are often due to periods during the month when sondes report high turbidity values that were corrected after the instrumentation was cleaned. After a storm, optical sensors such as those used to detect dissolved oxygen and turbidity can return inaccurate readings due to the sonde pipe becoming clogged with sediment and other debris. When turbidity readings come down after a cleaning, it is typical procedure to flag data back to the end of a storm, when the sonde pipe likely became clogged and did not reflect actual conditions in the stream.

Table 39. Gage 01467042, Turbidity Summary Results by Month

Month	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	% hrs. above max. guideline	% hrs. below max. guideline	Min.	Max.	Mean
Jul-18	742.5	30.9	0.0	42.9	57.1	0.0	354.0	8.8
Aug-18	700.5	29.2	0.0	20.0	80.0	0.0	1120.0	9.8
Sep-18	719.5	30.0	0.0	36.9	63.1	0.0	391.0	9.6
Oct-18	741.0	30.9	0.0	14.3	85.7	0.0	97.7	3.2
Nov-18	714.3	29.8	0.0	42.9	57.1	0.0	246.0	10.4
Mar-19	488.8	20.4	0.0	21.4	78.6	1.2	174.0	4.5
Apr-19	687.0	28.6	0.0	40.7	59.3	0.9	381.0	12.8
May-19	740.5	30.9	0.0	65.0	35.0	-0.2	850.0	14.0
Jun-19	679.3	28.3	0.0	46.3	53.7	-0.3	363.0	13.4

Table 40. Gage 01467048, Turbidity Summary Results by Month

Month	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	% hrs. above max. guideline	% hrs. below max. guideline	Min.	Max.	Mean
Jul-18	739.5	30.8	0.6	81.2	18.8	0.4	525.0	15.8
Aug-18	716.5	29.9	3.7	22.8	77.2	0.1	290.0	7.9
Sep-18	717.5	29.9	0.0	47.5	52.5	0.2	1100.0	17.0
Oct-18	712.8	29.7	0.0	28.6	71.4	0.4	1380.0	9.2
Nov-18	703.5	29.3	0.0	75.2	24.8	0.5	1350.0	21.8
Mar-19	352.3	14.7	0.0	42.0	58.0	0.9	19.0	3.8
Apr-19	642.5	26.8	0.0	64.0	36.0	0.5	1060.0	20.2
May-19	743.3	31.0	0.0	84.4	15.6	0.7	647.0	19.5
Jun-19	662.5	27.6	0.0	86.8	13.2	0.8	473.0	21.1

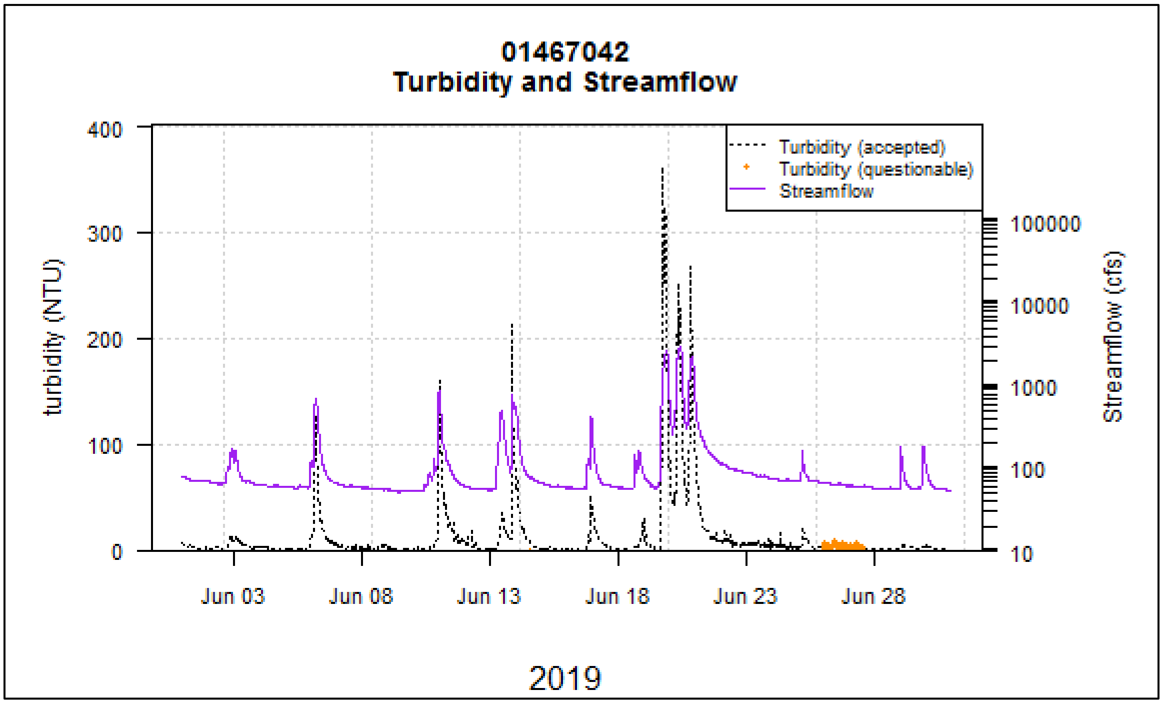


Figure 38. Gage 01467042, Turbidity and Streamflow, June 2019.

Specific Conductance

Specific conductance data were similar to other Philadelphia area streams. Elevated mean and maximum conductance values at both gages in November may be evidence of the effects of stormwater runoff and snowmelt containing road salt.

Table 41. Gage 01467042 Specific Conductance Summary Results by Month

Month	Total hours accepted data	Total days accepted data	% hours flagged data	Min.	Max.	Mean
Jul-18	742.8	30.9	0.0	141.0	758.0	568.2
Aug-18	743.0	31.0	0.0	213.0	802.0	636.0
Sep-18	719.3	30.0	0.0	100.0	798.0	558.4
Oct-18	742.3	30.9	0.0	201.0	716.0	601.0
Nov-18	719.0	30.0	0.0	113.0	1490.0	523.5
Mar-19	488.8	20.4	0.0	339.0	846.0	695.9
Apr-19	693.8	28.9	0.0	222.0	778.0	599.8
May-19	740.5	30.9	0.0	156.0	693.0	554.8
Jun-19	718.0	29.9	0.0	105.0	653.0	500.8

Table 42. Gage 01467048 Specific Conductance Summary Results by Month

Month	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	Min.	Max.	Mean
Jul-18	739.5	30.8	0.6	108.0	769.0	524.4
Aug-18	741.0	30.9	0.4	71.0	793.0	603.0
Sep-18	718.5	29.9	0.0	97.0	773.0	498.8
Oct-18	742.3	30.9	0.0	187.0	717.0	574.5
Nov-18	717.8	29.9	0.0	110.0	1240.0	486.9
Mar-19	442.0	18.4	0.0	336.0	798.0	660.9
Apr-19	699.5	29.1	0.0	209.0	721.0	560.6
May-19	742.3	30.9	0.0	104.0	661.0	517.8
Jun-19	717.0	29.9	0.0	93.0	697.0	473.4

Temperature

Temperature data showed variable attainment of maximum temperature criteria (Tables 43-44). Spring and early summer months are always subject to major air temperature fluctuations, and reliably predicting average stream temperatures during these periods is difficult at best. Maximum criteria for the summer months, for example, do not take into account natural summer temperature peaks. Above normal air temperatures are the likely cause of high stream temperature exceedance rates in Spring 2019 (Figures 39-40).

Table 43. Gage 01467042 Temperature Summary Results by Maximum Criteria Period

Des. Use	Date range start	Date range end	Percent hours exceedance	Percent hours attaining	Percent hours flagged data	Total hours accepted data	Total days accepted data	Min.	Max.	Mean
TSF	1-Jul	31-Jul	54.2	45.8	0.2	742.8	30.9	19.3	26.9	23.2
TSF	1-Aug	15-Aug	0.0	100.0	0.0	360.0	15.0	19.5	26.7	23.4
TSF	16-Aug	31-Aug	0.0	100.0	0.2	383.3	16.0			
TSF	1-Sep	15-Sep	0.0	100.0	0.1	359.5	15.0	16.6	26.8	20.9
TSF	16-Sep	30-Sep	0.0	100.0	0.0	360.0	15.0			
TSF	1-Oct	15-Oct	2.1	97.9	0.2	359.3	15.0	9.0	22.4	15.0
TSF	16-Oct	31-Oct	0.0	100.0	0.1	383.5	16.0			
TSF	1-Nov	15-Nov	13.4	86.6	0.2	359.3	15.0	3.5	16.5	9.4
TSF	16-Nov	30-Nov	2.2	97.8	0.0	360.0	15.0			
TSF	1-Mar	31-Mar	72.0	28.0	34.2	489.3	20.4	5.4	14.9	9.4
TSF	1-Apr	15-Apr	70.4	29.6	0.1	359.5	15.0	7.0	19.3	14.2
TSF	16-Apr	30-Apr	75.2	24.8	0.0	360.0	15.0			
TSF	1-May	15-May	4.2	95.8	0.3	359.0	15.0	11.3	21.9	16.9
TSF	16-May	31-May	22.9	77.1	0.5	382.0	15.9			
TSF	1-Jun	15-Jun	11.2	88.8	0.2	359.3	15.0			
TSF	16-Jun	30-Jun	22.1	77.9	0.2	359.3	15.0	15.8	24.3	20.1

Table 44. Gage 01467048, Temperature Summary Results by Maximum Criteria Period

Designated Use	Date range start	Date range end	% hrs. exceedance	% hrs. attaining	% hrs. flagged data	Total hrs. accepted data	Total days accepted data	Min.	Max.	Mean
TSF	1-Jul	31-Jul	77.6	22.4	0.5	740.0	30.8	20.6	28.4	24.2
TSF	1-Aug	15-Aug	9.2	90.8	0.6	280.8	11.7	21.0	28.3	24.3
TSF	16-Aug	31-Aug	0.0	100.0	0.1	383.5	16.0			
TSF	1-Sep	15-Sep	0.0	100.0	0.0	360.0	15.0	17.2	28.6	21.5
TSF	16-Sep	30-Sep	0.0	100.0	0.2	359.3	15.0			
TSF	1-Oct	15-Oct	2.4	97.6	0.1	359.5	15.0	8.9	22.2	15.1
TSF	16-Oct	31-Oct	0.0	100.0	0.3	383.0	16.0			
TSF	1-Nov	15-Nov	9.6	90.4	0.6	357.8	14.9	2.8	16.3	8.9
TSF	16-Nov	30-Nov	0.0	100.0	0.0	360.0	15.0			
TSF	1-Mar	31-Mar	77.9	22.1	40.6	442.0	18.4	6.6	14.1	9.6
TSF	1-Apr	15-Apr	73.8	26.2	5.2	341.3	14.2	7.7	20.2	14.8
TSF	16-Apr	30-Apr	86.4	13.6	0.5	358.3	14.9			
TSF	1-May	15-May	5.6	94.4	0.0	360.0	15.0	11.6	23.1	17.5
TSF	16-May	31-May	37.7	62.3	0.2	383.3	16.0			
TSF	1-Jun	15-Jun	26.6	73.4	0.3	359.0	15.0			
TSF	16-Jun	30-Jun	42.9	57.1	0.1	359.8	15.0	17.2	25.2	21.0

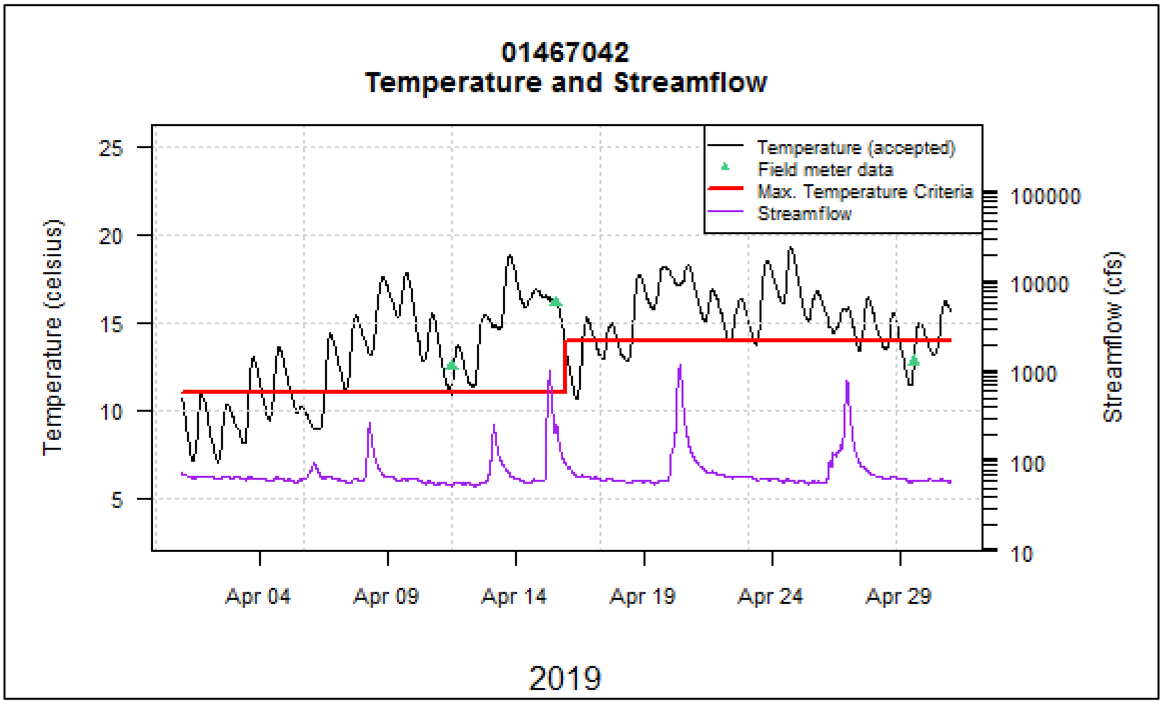


Figure 39. Gage 01467042, Temperature and Streamflow, April 2019.

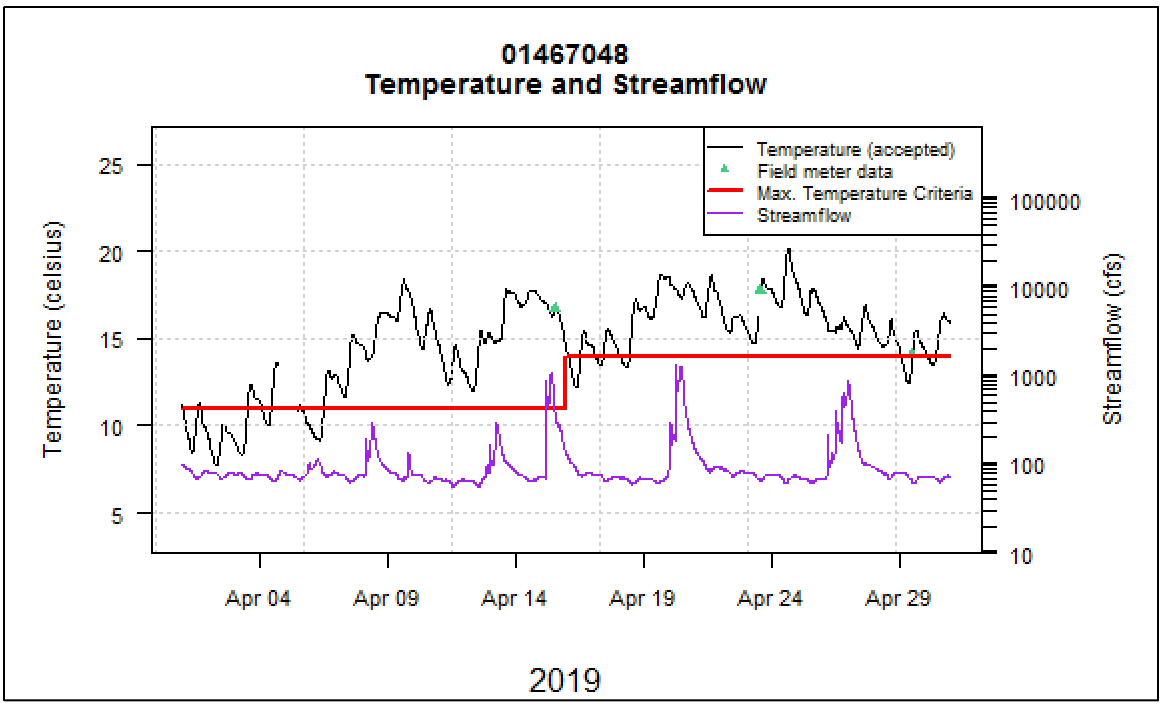
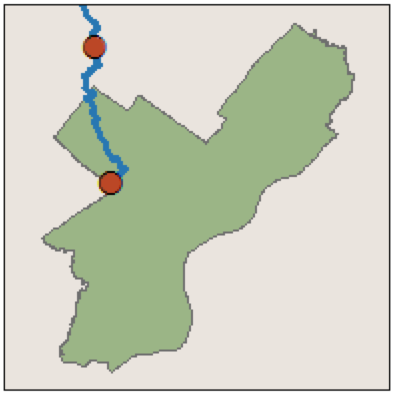


Figure 40. Gage 01467048, Temperature and Streamflow, April 2019.

Wissahickon Creek (Gages 01473900 and 01474000)



Dissolved oxygen and pH

Dissolved oxygen and pH data collected from the Wissahickon Creek gages also show signs of strong algal activity in the form of diel fluctuations. Although these two sites never exceeded the 7-day average guideline for dissolved oxygen, the upper gage (01473900) exhibits some of the most dramatic diel fluctuations of any of the Philadelphia USGS gage sites. In April 2019, dissolved oxygen can be observed to fluctuate by approximately 13 mg/L in a single day/night period (Figure 45), with pH ranging from approximately 7.8 to 9.2 at the same time (Figure 46). The pH maxima were exceeded in spring, a direct result of algal activity (Table 49).

Table 45. Gage 01473900 Dissolved Oxygen Minimum Criterion Summary Results by Month

Month	Des. Use	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	% hrs. non-attaining	% hrs. attaining	Min	Max	Mean
Jul-18	TSF	743.0	31.0	0.1	0.0	100.0	6.0	13.2	8.1
Aug-18	TSF	742.5	30.9	0.2	0.1	99.9	4.9	12.4	7.8
Sep-18	TSF	719.0	30.0	0.1	0.0	100.0	5.5	10.8	8.0
Oct-18	TSF	741.0	30.9	0.4	0.0	100.0	6.6	16.2	9.5
Nov-18	TSF	719.5	30.0	0.1	0.0	100.0	7.3	13.4	10.5
Mar-19	TSF	584.5	24.4	0.2	0.0	100.0	7.3	20.4	12.4
Apr-19	TSF	718.5	29.9	0.2	0.0	100.0	5.1	20.3	10.2
May-19	TSF	741.5	30.9	0.3	0.0	100.0	6.9	11.7	8.7
Jun-19	TSF	718.0	29.9	0.3	0.0	100.0	6.6	11.8	8.1

Table 46. Gage 01474000 Dissolved Oxygen Minimum Criterion Summary Results by Month

Month	Des. Use	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	% hrs. non-attaining	% hrs. attaining	Min	Max	Mean
Jul-18	TSF	741.5	30.9	0.3	0.0	100.0	6.8	13.0	8.6
Aug-18	TSF	741.5	30.9	0.3	0.0	100.0	6.6	14.0	8.7
Sep-18	TSF	718.5	29.9	0.2	0.0	100.0	6.7	11.3	8.7
Oct-18	TSF	740.5	30.9	0.5	0.0	100.0	8.0	13.8	10.2
Nov-18	TSF	719.5	30.0	0.1	0.0	100.0	9.1	13.6	11.3
Mar-19	TSF	418.0	17.4	0.0	0.0	100.0	9.3	17.5	12.5
Apr-19	TSF	680.0	28.3	5.6	0.0	100.0	7.9	17.1	10.2
May-19	TSF	741.0	30.9	0.4	0.0	100.0	7.7	11.3	9.2
Jun-19	TSF	718.0	29.9	0.3	0.0	100.0	7.6	10.8	8.7

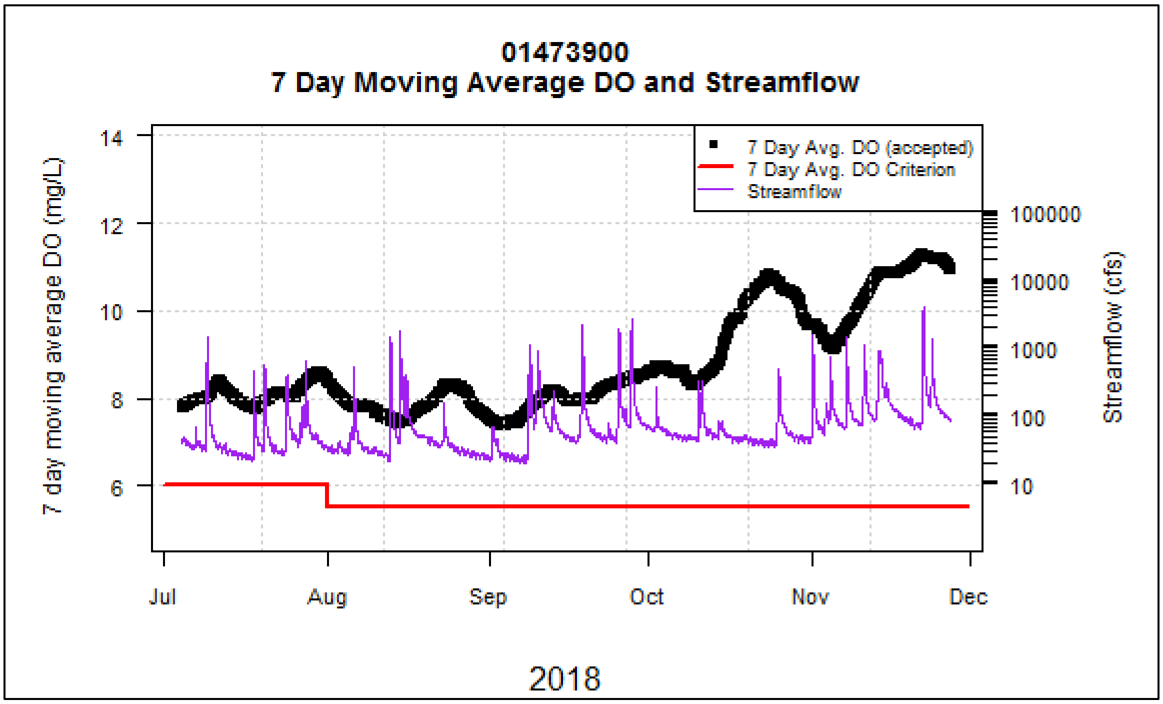


Figure 41. Gage 01473900, 7 Day Average Dissolved Oxygen and Streamflow, Jul-Dec 2018.

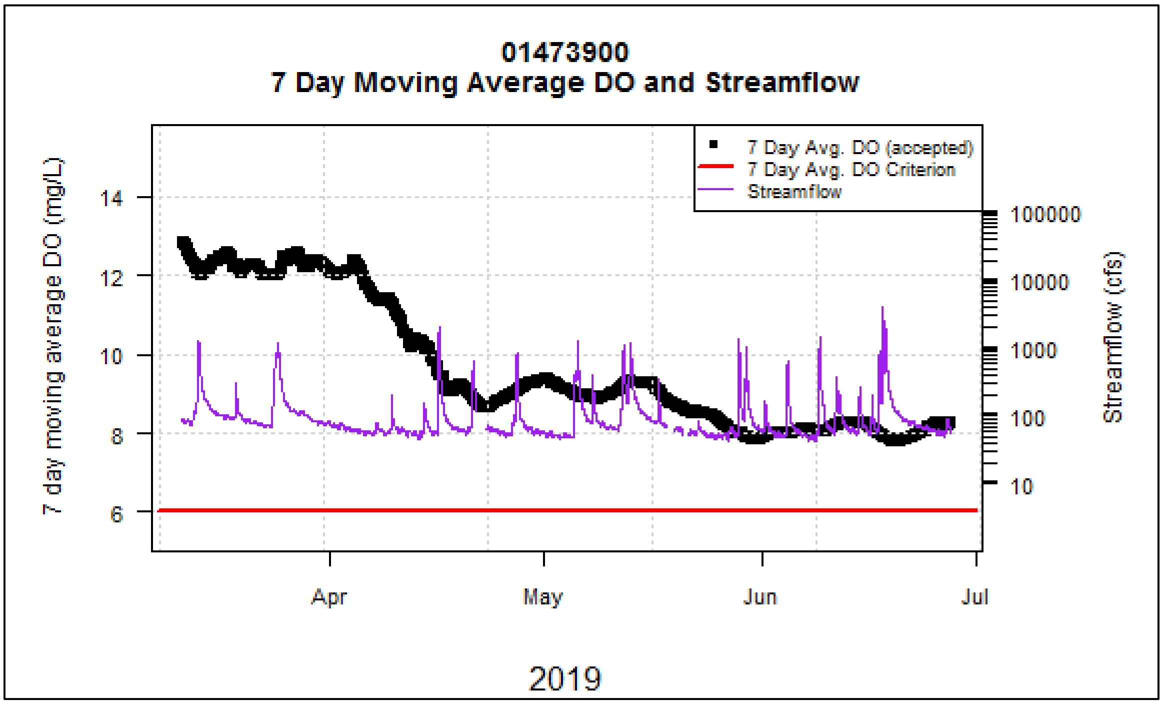


Figure 42. Gage 01473900, 7 Day Average Dissolved Oxygen and Streamflow, Mar-Jun 2019.

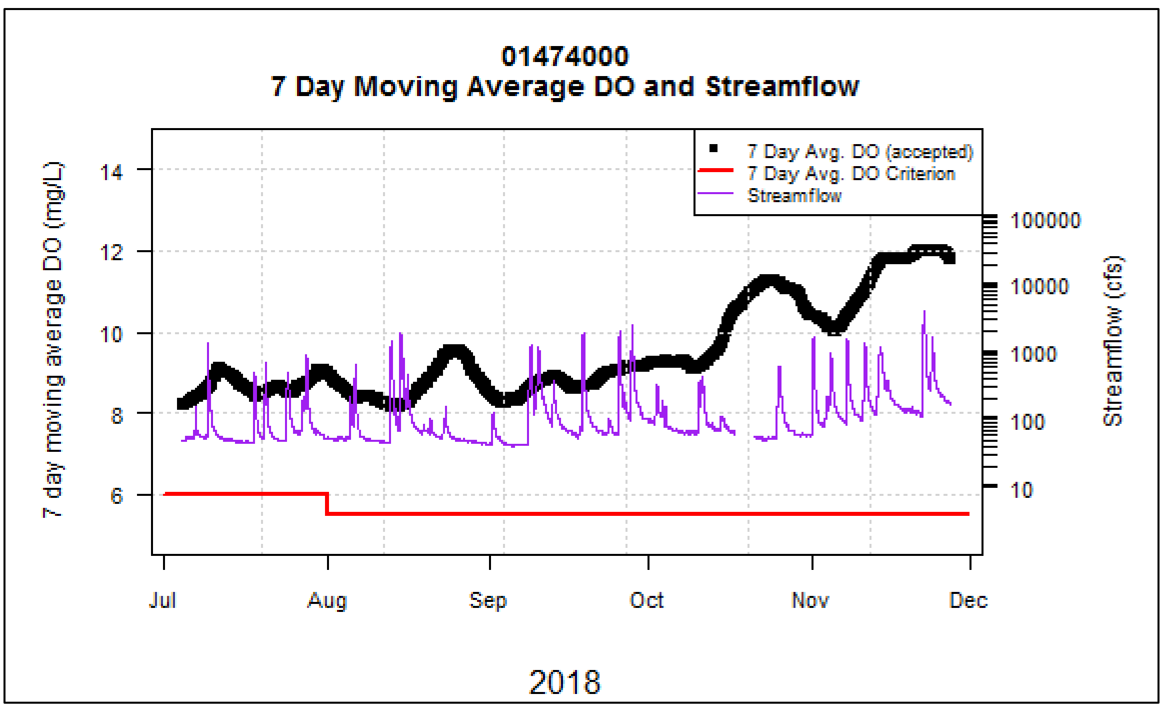


Figure 43. Gage 01474000, 7 Day Average Dissolved Oxygen and Streamflow, Jul-Dec 2018.

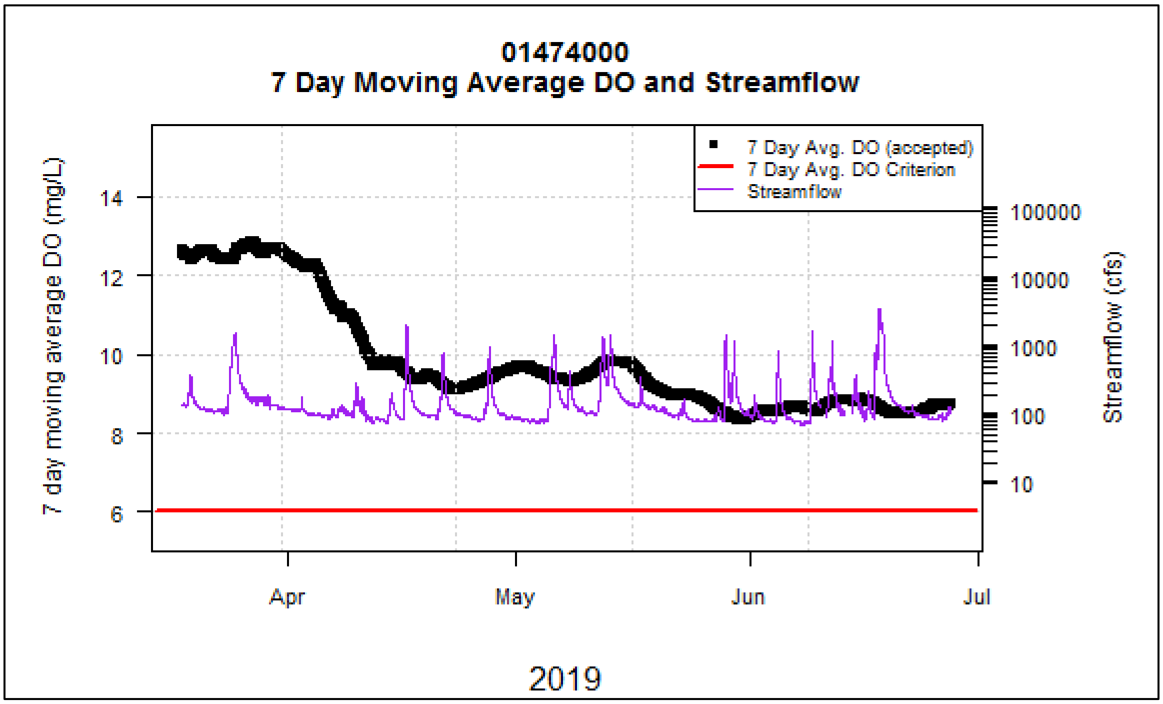


Figure 44. Gage 01474000, 7 Day Average Dissolved Oxygen and Streamflow, Mar-Jun 2019.

Table 47. Gage 01473900 Dissolved Oxygen Daily Mean Criterion Summary Results by Month

Month	Des. Use	Total days accepted data	% days flagged data	Min.	Max.	Mean
Jul-18	TSF	30.0	3.2	7.0	8.9	8.1
Aug-18	TSF	28.0	9.7	6.4	8.6	7.8
Sep-18	TSF	29.0	3.3	7.0	9.0	8.0
Oct-18	TSF	28.0	9.7	7.1	11.7	9.5
Nov-18	TSF	29.0	3.3	8.6	12.3	10.4
Mar-19	TSF	22.0	9.8	10.0	14.4	12.3
Apr-19	TSF	29.0	3.3	7.9	13.0	10.1
May-19	TSF	28.0	9.7	7.5	9.7	8.7
Jun-19	TSF	27.0	10.0	7.3	8.7	8.1

Table 48. Gage 01474000 Dissolved Oxygen Daily Mean Criterion Summary Results by Month

Month	Des. Use	Total days accepted data	% days flagged data	Min.	Max.	Mean
Jul-18	TSF	28.0	9.7	7.6	9.6	8.6
Aug-18	TSF	28.0	9.7	7.3	9.9	8.7
Sep-18	TSF	28.0	6.7	8.1	9.7	8.8
Oct-18	TSF	29.0	6.5	8.3	11.9	10.2
Nov-18	TSF	29.0	3.3	9.3	12.9	11.2
Mar-19	TSF	17.0	2.4	11.1	13.5	12.5
Apr-19	TSF	25.0	16.7	8.6	13.1	10.1
May-19	TSF	29.0	6.5	8.3	10.3	9.2
Jun-19	TSF	28.0	6.7	8.2	9.5	8.8

Table 49. Gage 01473900 pH Criteria Summary Results by Month

Month	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	% hrs. max. non-attaining	% days max. non-attaining	% hrs. min. non-attaining	% days min. non-attaining	% hrs. attaining	% days attaining	Min.	Max.	Mean
Jul-18	742.5	30.9	0.2	0.0	0.0	0.0	0.0	100.0	100.0	7.3	8.7	7.9
Aug-18	742.5	30.9	0.2	0.0	0.0	0.0	0.0	100.0	100.0	7.2	8.6	7.8
Sep-18	719.0	30.0	0.1	0.0	0.0	0.0	0.0	100.0	100.0	7.1	8.3	7.7
Oct-18	740.0	30.8	0.5	0.0	0.0	0.0	0.0	100.0	100.0	7.3	8.6	7.7
Nov-18	688.0	28.7	4.4	0.0	0.0	0.0	0.0	100.0	100.0	7.1	8.3	7.6
Mar-19	584.0	24.3	0.3	3.9	24.0	0.0	0.0	96.1	76.0	7.4	9.2	8.1
Apr-19	719.0	30.0	0.1	5.6	33.3	0.0	0.0	94.4	66.7	7.2	9.2	7.9
May-19	741.5	30.9	0.3	0.0	0.0	0.0	0.0	100.0	100.0	7.2	8.0	7.6
Jun-19	717.0	29.9	0.4	0.0	0.0	0.0	0.0	100.0	100.0	7.0	8.4	7.6

Table 50. Gage 01474000 pH Criteria Summary Results by Month

Month	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	% hrs. max. non-attaining	% days max. non-attaining	% hrs. min. non-attaining	% days min. non-attaining	% hrs. attaining	% days attaining	Min.	Max.	Mean
Jul-18	724.0	30.2	2.7	0.0	0.0	0.0	0.0	100.0	100.0	7.5	8.8	8.1
Aug-18	740.5	30.9	0.5	0.0	0.0	0.0	0.0	100.0	100.0	7.4	8.9	8.2
Sep-18	718.0	29.9	0.3	0.0	0.0	0.0	0.0	100.0	100.0	7.4	8.6	8.0
Oct-18	740.5	30.9	0.5	0.0	0.0	0.0	0.0	100.0	100.0	7.8	8.7	8.2
Nov-18	719.5	30.0	0.1	0.0	0.0	0.0	0.0	100.0	100.0	7.3	8.5	7.9
Mar-19	418.0	17.4	0.0	9.3	55.6	0.0	0.0	90.7	44.4	7.7	9.3	8.5
Apr-19	680.0	28.3	5.6	2.1	13.8	0.0	0.0	97.9	86.2	7.3	9.2	8.1
May-19	741.0	30.9	0.4	0.0	0.0	0.0	0.0	100.0	100.0	7.5	8.5	8.0
Jun-19	718.0	29.9	0.3	0.0	0.0	0.0	0.0	100.0	100.0	7.3	8.5	8.0

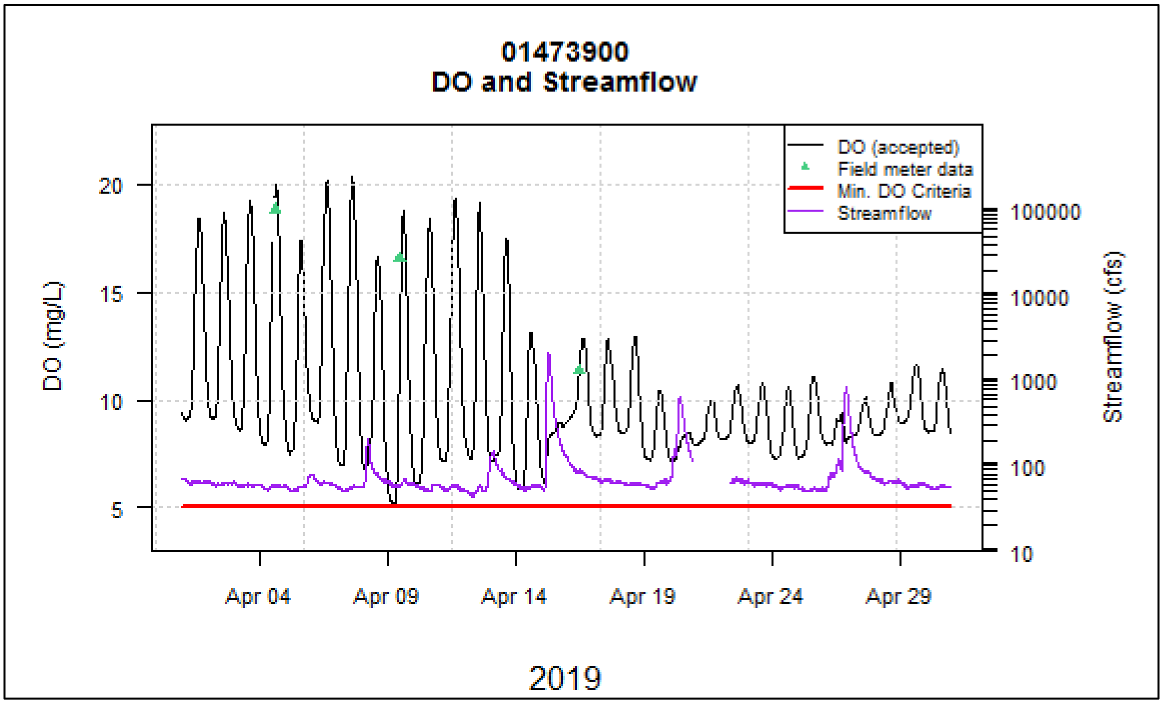


Figure 45. Gage 01473900, Dissolved Oxygen and Streamflow, April 2019.

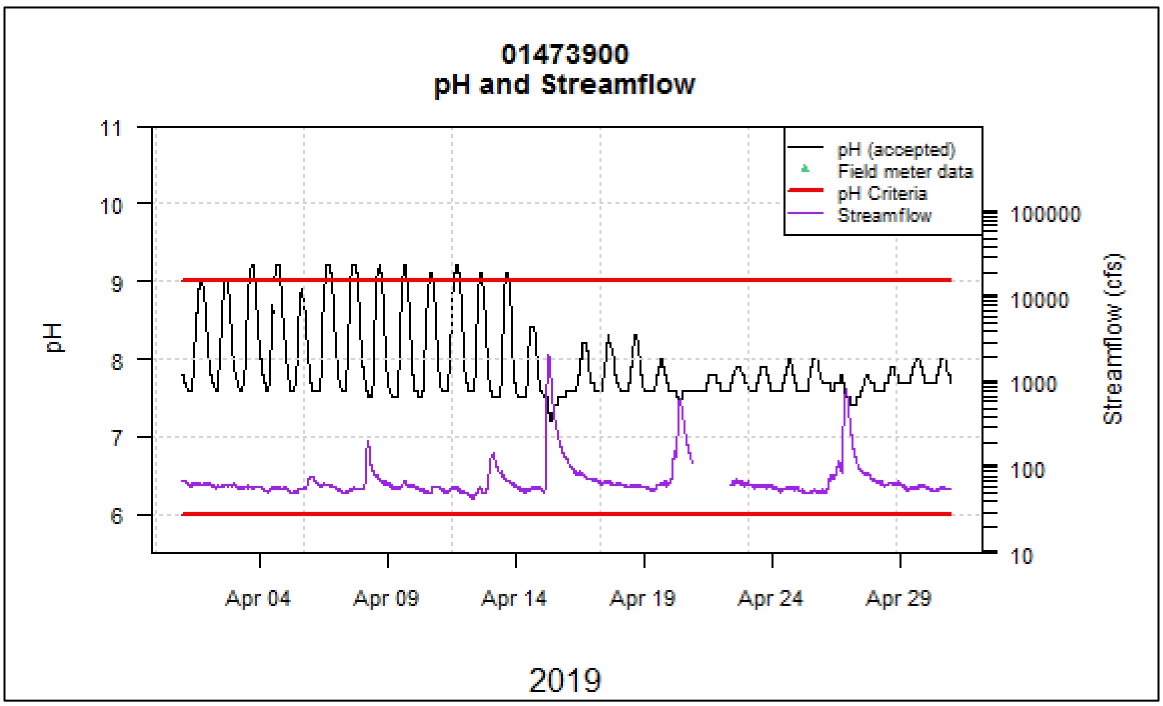


Figure 46. Gage 01473900, pH and Streamflow, April 2019.

Figure 47. Gage 01473900, Wissahickon Creek at Ft. Washington, looking downstream

Figure 48. Gage 01474000, Wissahickon Creek at mouth, looking downstream

Turbidity

Turbidity in the Wissahickon, as with most of Philadelphia's streams, increases drastically with increased flow from rainfall (Tables 51-52). It is possible that these spikes represent a temporarily fouled sensor (i.e., sediment or debris obscures the optical probe for turbidity), but the general rule in QAQC procedures is not to flag turbidity spikes that recede to normal levels on their own. If the sensor remains fouled after a storm or a field check confirms aberrant values, the data is flagged as in Figure 49.

Table 51. Gage 01473900 Turbidity Summary Results by Month

Month	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	% hrs. above max. guideline	% hrs. below max. guideline	Min.	Max.	Mean
Jul-18	728.0	30.3	2.2	43.4	56.6	0.7	169.0	6.3
Aug-18	725.0	30.2	0.1	25.9	74.1	0.0	261.0	6.2
Sep-18	717.0	29.9	0.4	51.2	48.8	0.4	365.0	9.9
Oct-18	633.5	26.4	14.9	39.0	61.0	0.2	140.0	7.1
Nov-18	719.5	30.0	0.1	71.4	28.6	0.2	252.0	21.8
Mar-19	584.5	24.4	0.2	77.1	22.9	1.3	376.0	14.1
Apr-19	702.0	29.3	2.5	79.1	20.9	1.4	493.0	11.4
May-19	742.0	30.9	0.3	64.4	35.6	1.2	205.0	12.2
Jun-19	718.0	29.9	0.3	65.3	34.7	1.4	473.0	14.9

Table 52. Gage 01474000 Turbidity Summary Results by Month

Month	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	% hrs. above max. guideline	% hrs. below max. guideline	Min.	Max.	Mean
Jul-18	741.0	30.9	0.4	25.9	74.1	0.2	248.0	4.7
Aug-18	741.5	30.9	0.3	21.6	78.4	0.4	337.0	7.5
Sep-18	719.5	30.0	0.1	44.7	55.3	0.3	506.0	14.4
Oct-18	740.0	30.8	0.5	16.4	83.6	0.4	116.0	2.8
Nov-18	719.5	30.0	0.1	62.3	37.7	0.4	263.0	15.0
Mar-19	418.0	17.4	0.0	29.4	70.6	1.0	141.0	6.5
Apr-19	680.0	28.3	5.6	29.6	70.4	0.8	379.0	9.6
May-19	741.0	30.9	0.4	42.9	57.1	0.8	258.0	12.8
Jun-19	719.0	30.0	0.1	47.1	52.9	0.6	401.0	15.3

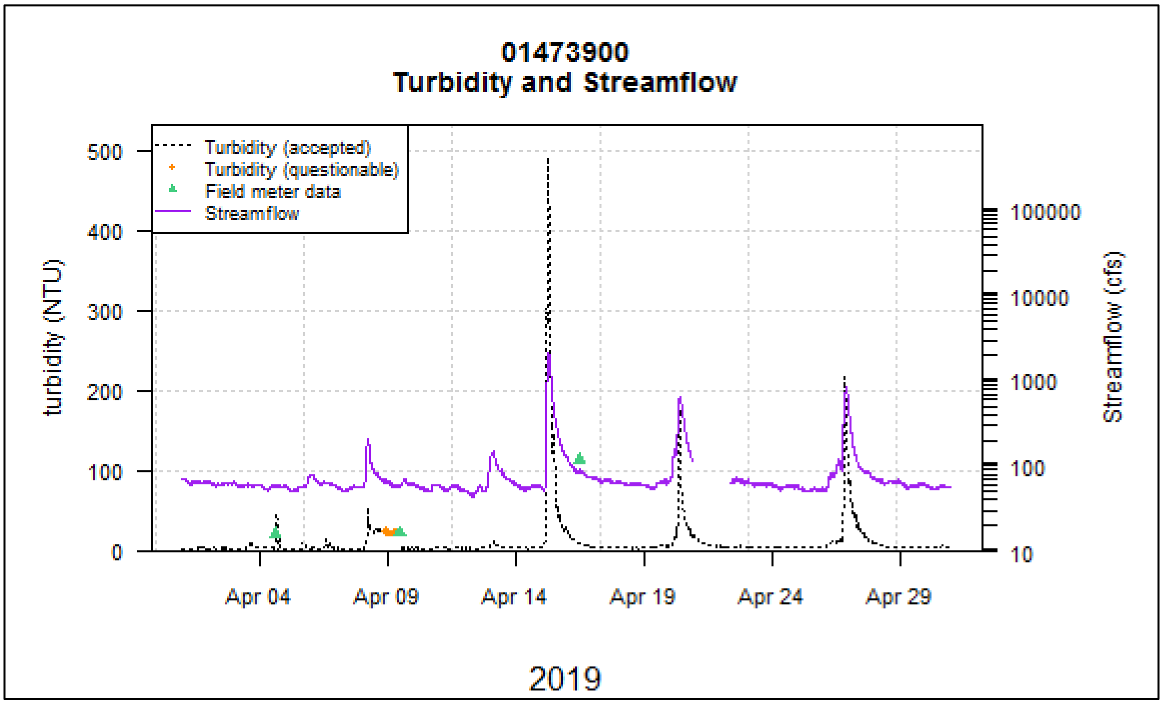


Figure 49. Gage 01473900, Turbidity and Streamflow, April 2019.

Specific Conductance

Specific conductance data at the Wissahickon Creek gage sites generally follow the established pattern in other Philadelphia streams: Runoff from rain events dilutes the stream and decreases conductivity. However, a reversal in this trend sometimes occurs during winter storms, when it is presumed that the application of road salt (sodium chloride) prior to the storm washes into Wissahickon Creek and causes conductivity to increase in conjunction with streamflow. This pattern is observed at the upstream gage when a snowstorm occurs in mid-November 2018 (Figure 50).

Table 53. Gage 01473900 Specific Conductance Summary Results by Month

Month	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	Min.	Max.	Mean
Jul-18	742.5	30.9	0.2	187.0	966.0	736.7
Aug-18	742.5	30.9	0.2	172.0	916.0	737.7
Sep-18	719.0	30.0	0.1	122.0	921.0	653.9
Oct-18	740.0	30.8	0.5	350.0	902.0	733.9
Nov-18	719.0	30.0	0.1	116.0	1500.0	583.3
Mar-19	584.0	24.3	0.3	299.0	1710.0	752.6
Apr-19	718.5	29.9	0.2	195.0	824.0	700.5
May-19	742.0	30.9	0.3	213.0	791.0	614.6
Jun-19	672.5	28.0	6.6	113.0	770.0	588.4

Table 54. Gage 01474000 Specific Conductance Summary Results by Month

Month	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	Min.	Max.	Mean
Jul-18	741.5	30.9	0.3	272.0	888.0	659.7
Aug-18	741.0	30.9	0.4	195.0	887.0	695.2
Sep-18	719.0	30.0	0.1	153.0	868.0	600.0
Oct-18	736.0	30.7	1.1	288.0	842.0	691.1
Nov-18	719.5	30.0	0.1	136.0	1180.0	530.3
Mar-19	418.0	17.4	0.0	323.0	794.0	699.3
Apr-19	680.0	28.3	5.6	220.0	797.0	678.4
May-19	741.0	30.9	0.4	253.0	805.0	621.2
Jun-19	718.0	29.9	0.3	113.0	753.0	583.3

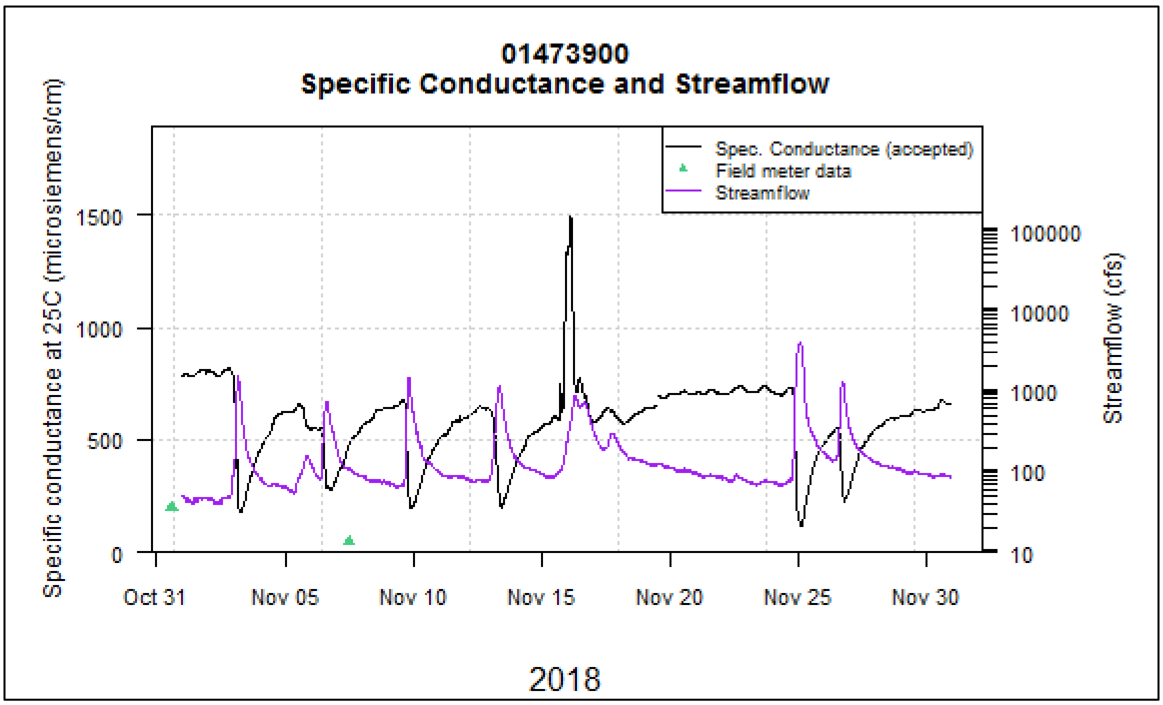


Figure 50. Gage 01473900, Specific Conductance and Streamflow, November 2018.

Temperature

Temperature trends and exceedance rates in Wissahickon Creek Watershed were similar to those observed in Pennypack Creek, with frequent exceedances during the spring in conjunction with higher ambient air temperatures (Tables 55-56, Figures 51-52).

Table 55. Gage 01473900 Temperature Summary Results by Month by Maximum Criteria Period

Designated Use	Date range start	Date range end	% hrs. exceedance	% hrs. attaining	% hrs. flagged data	Total hrs. accepted data	Total days accepted data	Min.	Max.	Mean
TSF	1-Jul	31-Jul	52.7	47.3	0.7	739.0	30.8	19.4	26.9	23.2
TSF	1-Aug	15-Aug	0.0	100.0	1.0	356.5	14.9	19.6	26.3	23.3
TSF	16-Aug	31-Aug	0.0	100.0	0.8	381.0	15.9			
TSF	1-Sep	15-Sep	0.0	100.0	1.3	355.5	14.8	16.7	26.6	21.0
TSF	16-Sep	30-Sep	0.0	100.0	1.1	356.0	14.8			
TSF	1-Oct	15-Oct	1.8	98.2	1.4	355.0	14.8	9.4	22.4	15.3
TSF	16-Oct	31-Oct	0.0	100.0	1.7	377.5	15.7			
TSF	1-Nov	15-Nov	14.4	85.6	1.0	356.5	14.9	3.4	17.0	9.4
TSF	16-Nov	30-Nov	5.0	95.0	1.0	356.5	14.9			
TSF	1-Mar	31-Mar	60.6	39.4	21.9	581.0	24.2	2.9	14.7	8.7
TSF	1-Apr	15-Apr	71.6	28.4	0.8	357.0	14.9	6.9	19.4	14.1
TSF	16-Apr	30-Apr	75.4	24.6	2.8	350.0	14.6			
TSF	1-May	15-May	2.7	97.3	2.2	352.0	14.7	11.2	21.6	16.9
TSF	16-May	31-May	21.0	79.0	1.3	379.0	15.8			
TSF	1-Jun	15-Jun	4.3	95.7	0.8	357.0	14.9	15.7	23.7	20.0
TSF	16-Jun	30-Jun	20.3	79.7	1.3	355.5	14.8			

Table 56. Gage 01474000 Temperature Summary Results by Month by Maximum Criteria Period

Designated Use	Date range start	Date range end	% hrs. exceedance	% hrs. attaining	% hrs. flagged data	Total hrs. accepted data	Total days accepted data	Min.	Max.	Mean
TSF	1-Jul	31-Jul	65.6	34.4	1.7	731.5	30.5	20.4	27.2	23.6
TSF	1-Aug	15-Aug	0.0	100.0	1.4	355.0	14.8	20.2	26.8	23.5
TSF	16-Aug	31-Aug	0.0	100.0	1.7	377.5	15.7			
TSF	1-Sep	15-Sep	0.0	100.0	2.6	350.5	14.6	17.0	26.5	21.0
TSF	16-Sep	30-Sep	0.0	100.0	1.4	355.0	14.8			
TSF	1-Oct	15-Oct	0.0	100.0	1.3	355.5	14.8	9.1	21.4	14.8
TSF	16-Oct	31-Oct	0.0	100.0	1.6	378.0	15.8			
TSF	1-Nov	15-Nov	8.6	91.4	1.0	356.5	14.9	3.3	15.8	8.8
TSF	16-Nov	30-Nov	0.0	100.0	1.0	356.5	14.9			
TSF	1-Mar	31-Mar	75.8	24.2	45.0	409.5	17.1	6.9	13.6	9.5
TSF	1-Apr	15-Apr	67.5	32.5	11.1	320.0	13.3	8.0	19.3	14.4
TSF	16-Apr	30-Apr	80.3	19.7	1.4	355.0	14.8			
TSF	1-May	15-May	1.1	98.9	1.8	353.5	14.7	11.7	22.2	17.2
TSF	16-May	31-May	28.1	71.9	1.4	378.5	15.8			
TSF	1-Jun	15-Jun	18.5	81.5	1.5	354.5	14.8	16.8	24.8	20.7
TSF	16-Jun	30-Jun	31.8	68.2	1.0	356.5	14.9			

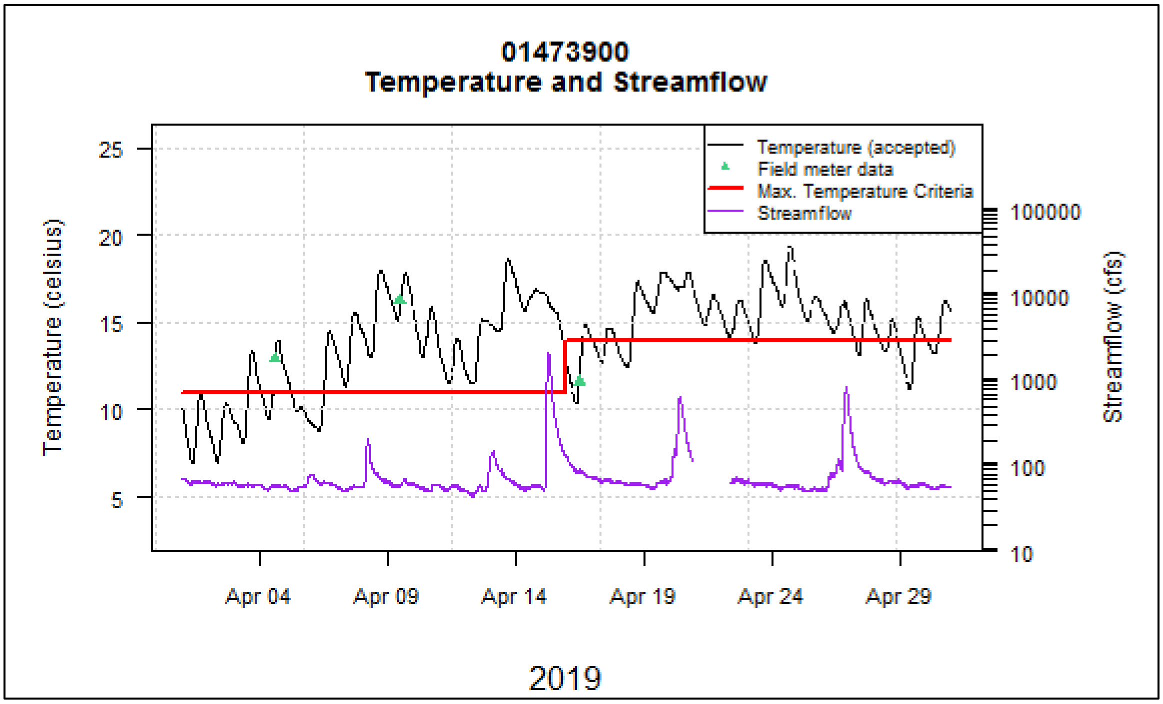


Figure 51. Gage 01473900, Temperature and Streamflow, April 2019.

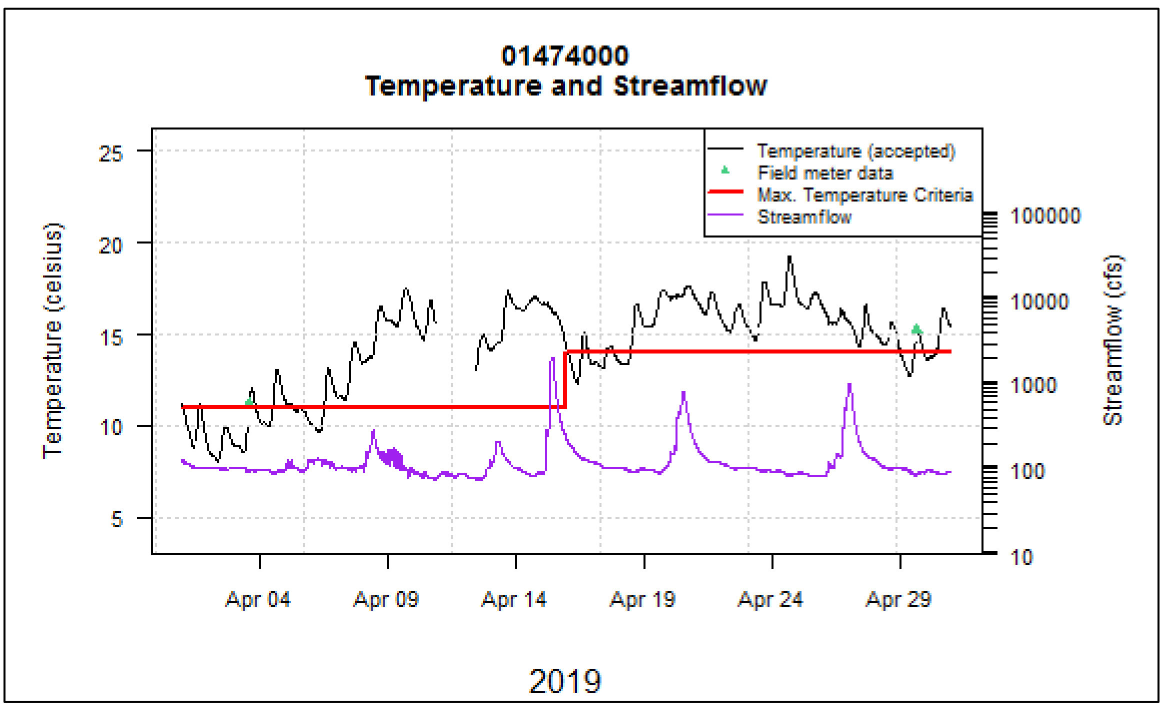
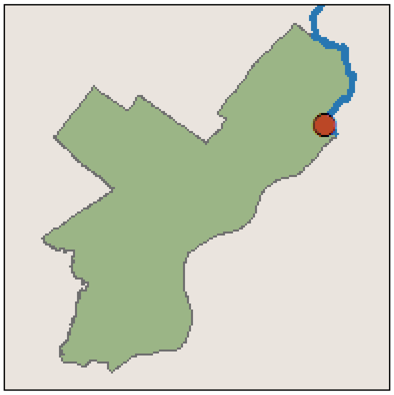


Figure 52. Gage 01474000, Temperature and Streamflow, April 2019.

Poquessing Creek (Gage 01465798)



Dissolved oxygen and pH

Dissolved oxygen and pH at this gage site were usually within acceptable ranges and only occasionally fell below the minimum DO criterion. The site never exceeded the pH maximum criterion (Tables 57-59, Figures 53-54). Data collected from Poquessing Creek did exhibit classic signs of algal activity, as indicated by diel fluctuations in both DO and pH.

As seen with previous sites, the algal activity and related diel fluctuations in DO and pH are only suppressed by storm events. These suppressions, however, are only very temporary. Given an adequate period of uninterrupted algal growth, such as occurred in the beginning of April 2019 (Figures 55-56), one can expect increased DO and pH fluctuations.

Table 57. Gage 01465798 Dissolved Oxygen Min. Criteria Summary Results by Month

Month	Des. Use	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	% hrs. non-attaining	% hrs. attaining	Min	Max	Mean
Jul-18	WWF	743.3	31.0	0.0	3.3	96.7	3.6	13.2	7.3
Aug-18	WWF	742.8	30.9	0.0	1.3	98.7	4.4	14.6	7.6
Sep-18	WWF	692.8	28.9	0.0	1.6	98.4	2.9	11.9	7.6
Oct-18	WWF	713.3	29.7	0.0	0.3	99.7	4.7	14.9	8.8
Nov-18	WWF	690.3	28.8	0.0	0.0	100.0	7.0	13.6	10.3
Mar-19	WWF	487.0	20.3	0.0	0.0	100.0	8.4	15.5	11.7
Apr-19	WWF	657.5	27.4	0.0	0.0	100.0	6.0	16.1	9.9
May-19	WWF	718.0	29.9	0.0	0.0	100.0	5.3	13.4	8.6
Jun-19	WWF	702.8	29.3	0.0	0.0	100.0	5.6	12.0	8.1

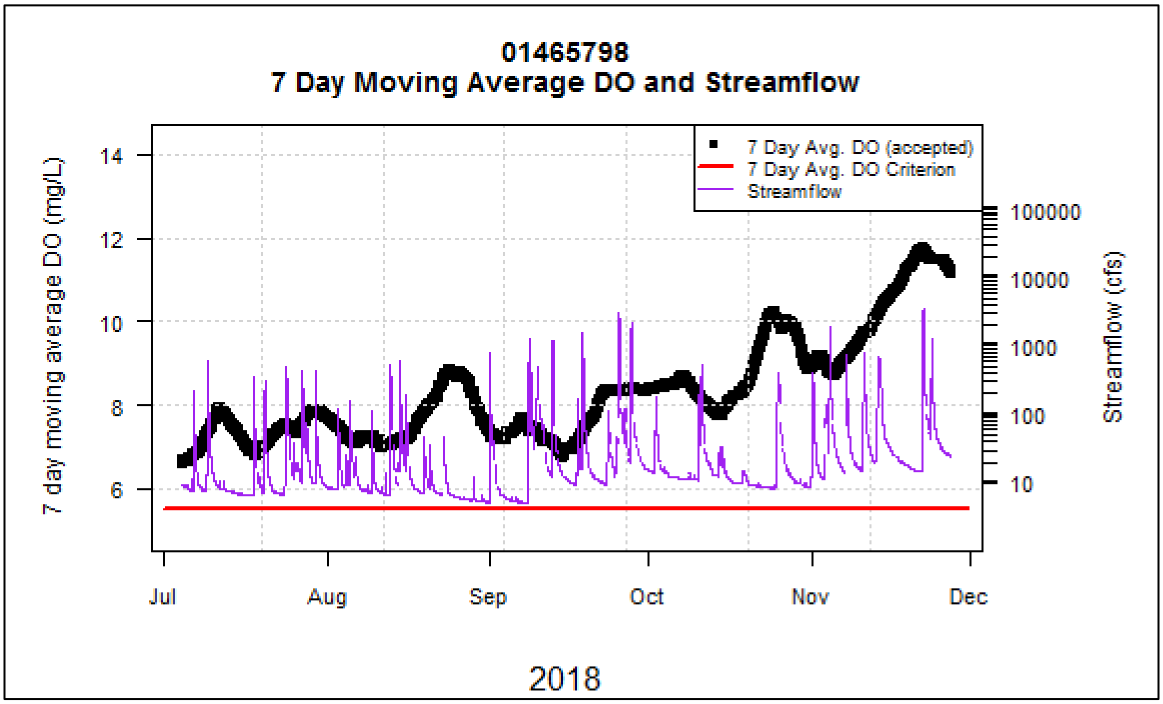


Figure 53. Gage 01465798, 7 Day Average Dissolved Oxygen and Streamflow, Jul-Dec 2018.

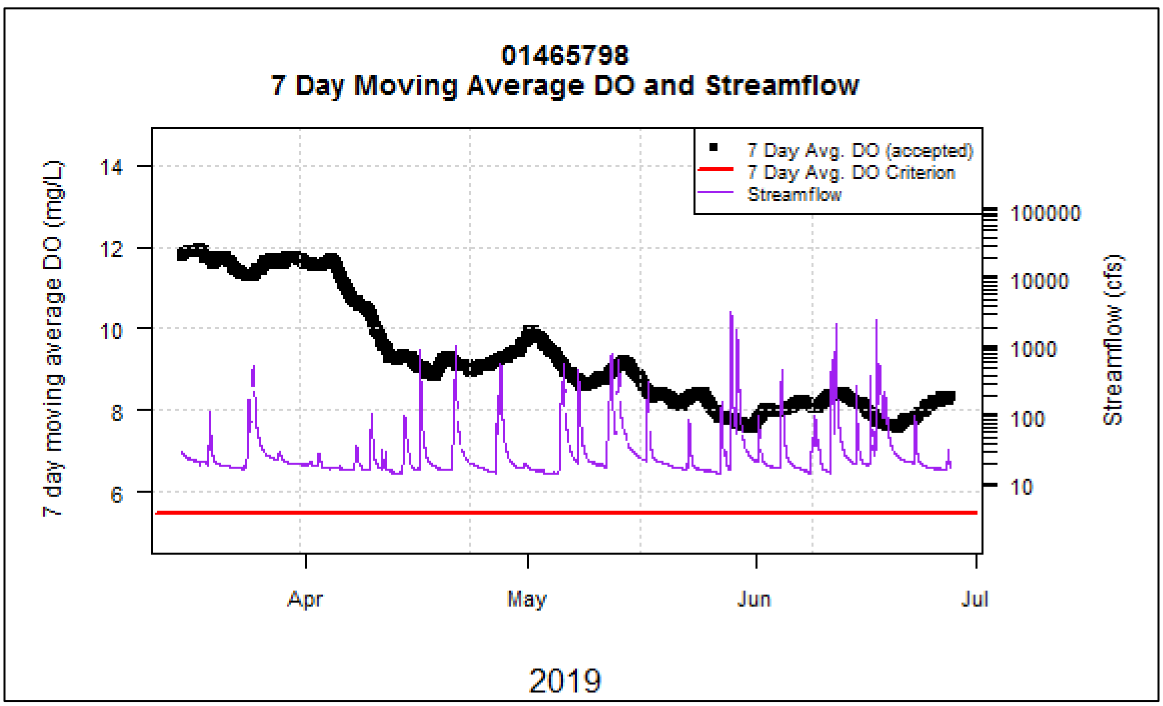


Figure 54. Gage 01465798, 7 Day Average Dissolved Oxygen and Streamflow, Mar-Jun 2019.

Table 58. Gage 01465798 Dissolved Oxygen Mean Criteria Summary Results by Month

Month	Des. Use	Total days accepted data	% days flagged data	Min.	Max.	Mean
Jul-18	WWF	30.0	3.2	5.8	9.0	7.3
Aug-18	WWF	30.0	3.2	6.5	9.3	7.6
Sep-18	WWF	25.0	16.7	6.6	8.7	7.7
Oct-18	WWF	27.0	12.9	7.4	11.9	8.8
Nov-18	WWF	26.0	13.3	8.2	13.1	10.4
Mar-19	WWF	18.0	11.7	10.5	12.6	11.7
Apr-19	WWF	26.0	13.3	7.2	12.1	9.9
May-19	WWF	27.0	12.9	7.1	10.2	8.6
Jun-19	WWF	28.0	6.7	7.0	8.9	8.1

Table 59. Gage 01465798 pH Criteria Summary Results by Month

Month	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	% hrs. max. non-attaining	% days max. non-attaining	% hrs. min. non-attaining	% days min. non-attaining	% hrs. attaining	% days attaining	Min.	Max.	Mean
Jul-18	742.5	30.9	0.0	0.0	0.0	0.0	0.0	100.0	100.0	6.8	8.8	7.2
Aug-18	742.8	30.9	0.0	0.0	0.0	0.0	0.0	100.0	100.0	6.8	9.0	7.4
Sep-18	717.3	29.9	0.0	0.0	0.0	0.0	0.0	100.0	100.0	6.8	8.5	7.3
Oct-18	742.3	30.9	0.0	0.0	0.0	0.0	0.0	100.0	100.0	6.8	8.0	7.3
Nov-18	718.5	29.9	0.0	0.0	0.0	0.0	0.0	100.0	100.0	6.5	7.3	7.0
Mar-19	487.0	20.3	0.0	0.0	0.0	0.0	0.0	100.0	100.0	7.0	8.6	7.4
Apr-19	718.8	29.9	0.0	0.0	0.0	0.0	0.0	100.0	100.0	6.8	8.8	7.3
May-19	741.8	30.9	0.0	0.0	0.0	0.0	0.0	100.0	100.0	6.8	8.0	7.2
Jun-19	718.8	29.9	0.0	0.0	0.0	0.0	0.0	100.0	100.0	6.8	8.4	7.3

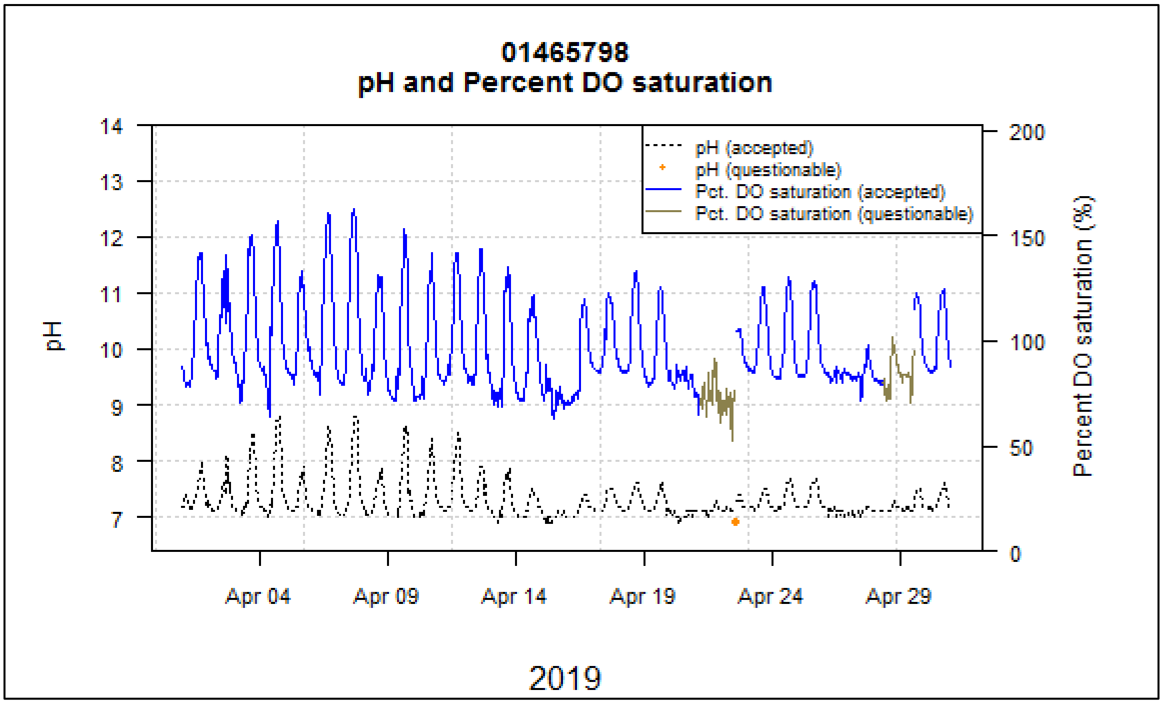


Figure 55. Gage 01465798, pH and Percent DO Saturation, April 2019.

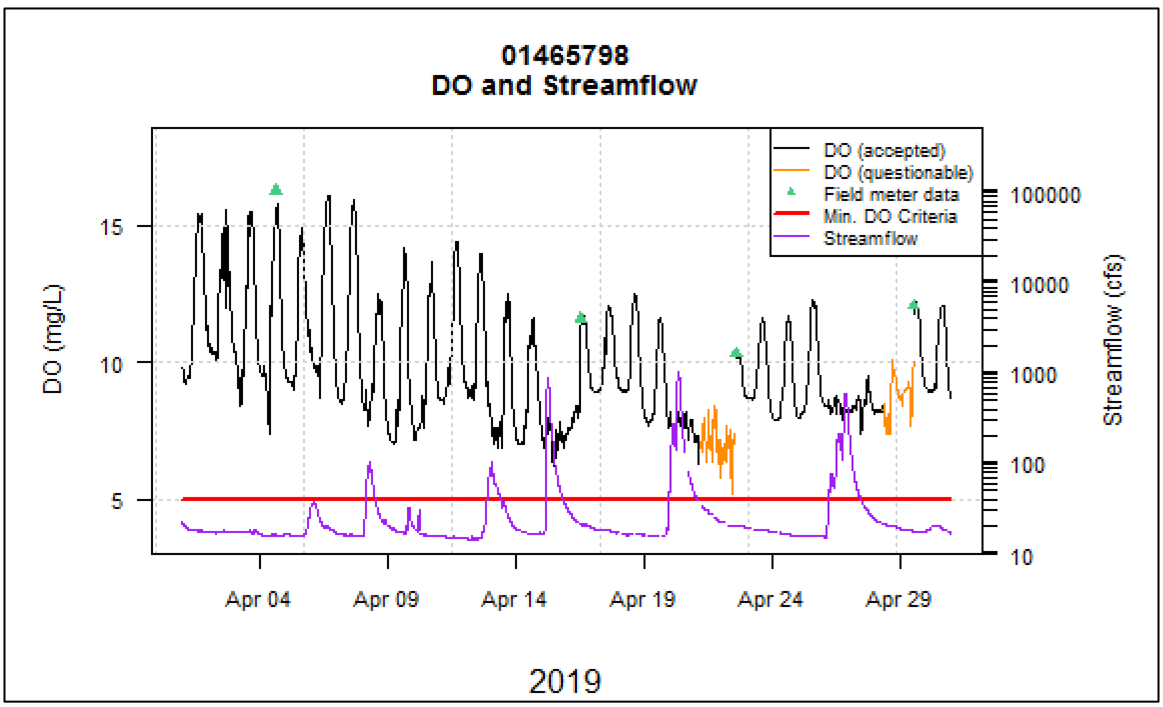


Figure 56. Gage 01465798, DO and Streamflow, April 2019.

Figure 57. Gage 01465798, Poquessing Creek at Grant Ave., looking upstream

Turbidity

As in other Philadelphia streams, high turbidity levels accompanied storm events and increased streamflow.

Table 60. Gage 01465798 Turbidity Summary Results by Month

Month	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	% hrs. above max. guideline	% hrs. below max. guideline	Min.	Max.	Mean
Jul-18	743.0	31.0	0.0	34.7	65.3	0.3	242.0	6.0
Aug-18	743.0	31.0	0.0	29.9	70.1	0.1	234.0	6.7
Sep-18	672.0	28.0	0.0	68.3	31.7	0.8	892.0	18.7
Oct-18	740.8	30.9	0.0	15.1	84.9	0.1	88.0	2.5
Nov-18	718.0	29.9	0.0	49.0	51.0	0.2	1720.0	13.0
Mar-19	486.8	20.3	0.0	43.1	56.9	1.2	196.0	6.0
Apr-19	656.0	27.3	0.0	28.6	71.4	0.9	496.0	13.2
May-19	720.0	30.0	0.0	46.6	53.4	0.6	1640.0	16.1
Jun-19	700.8	29.2	0.0	35.3	64.7	0.3	1350.0	11.6

Specific Conductance

Specific conductance data were similar to other Philadelphia streams, with evidence of road salt causing spikes in specific conductance in November 2018.

Table 61. Gage 01465798 Specific Conductance Summary Results by Month

Month	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	Min.	Max.	Mean
Jul-18	743.0	31.0	0.0	144.0	794.0	502.9
Aug-18	742.5	30.9	0.0	87.0	834.0	539.7
Sep-18	716.8	29.9	0.0	68.0	810.0	450.4
Oct-18	742.0	30.9	0.0	130.0	786.0	613.7
Nov-18	712.8	29.7	0.0	72.0	1360.0	509.6
Mar-19	448.3	18.7	0.0	255.0	966.0	761.7
Apr-19	706.8	29.4	0.0	125.0	795.0	619.0
May-19	722.5	30.1	0.0	83.0	751.0	533.0
Jun-19	704.5	29.4	0.0	78.0	736.0	518.5

Temperature

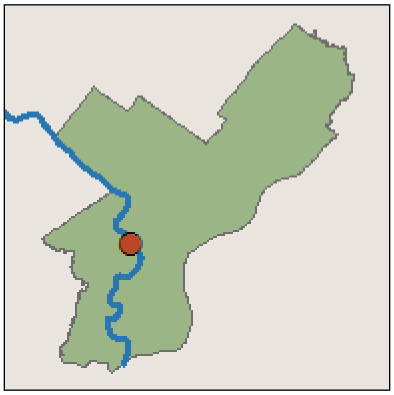
Temperature exceedance rates observed in Poquessing Creek were similar to those in other WWF designated-use creeks (*e.g.*, Tacony and Cobbs Creeks).

Table 62. Gage 01465798 Temperature Summary Results by Maximum Criteria Period

Designated Use	Date range start	Date range end	% hrs. exceedance	% hrs. attaining	% hrs. flagged data	Total hrs. accepted data	Total days accepted data	Min.	Max.	Mean
WWF	1-Jul	31-Jul	0.0	100.0	0.1	743.3	31.0	19.7	29.2	24.1
WWF	1-Aug	15-Aug	0.0	100.0	0.0	360.0	15.0	20.0	29.0	24.4
WWF	16-Aug	31-Aug	0.0	100.0	0.3	383.0	16.0			
WWF	1-Sep	15-Sep	0.0	100.0	0.0	360.0	15.0	16.9	28.7	21.6
WWF	16-Sep	30-Sep	0.0	100.0	0.4	358.5	14.9			
WWF	1-Oct	15-Oct	4.0	96.0	0.0	360.0	15.0	8.6	22.7	15.1
WWF	16-Oct	31-Oct	0.0	100.0	0.5	382.3	15.9			
WWF	1-Nov	15-Nov	12.8	87.2	0.0	360.0	15.0	1.2	16.6	8.7
WWF	16-Nov	30-Nov	0.0	100.0	0.4	358.5	14.9			
WWF	1-Mar	31-Mar	68.3	31.7	34.5	487.0	20.3	4.7	15.6	9.3
WWF	1-Apr	15-Apr	71.6	28.4	0.0	360.0	15.0	6.4	20.8	14.5
WWF	16-Apr	30-Apr	79.0	21.0	0.3	359.0	15.0			
WWF	1-May	15-May	8.9	91.1	0.0	360.0	15.0	11.0	23.3	17.2
WWF	16-May	31-May	7.7	92.3	5.4	363.3	15.1			
WWF	1-Jun	15-Jun	0.0	100.0	0.3	358.8	14.9			
WWF	16-Jun	30-Jun	0.0	100.0	0.0	360.0	15.0	15.9	26.2	20.9

Gages in Large Watersheds

Schuylkill River (Gage 01474500)



Dissolved oxygen and pH

DO water quality criteria were not exceeded at this location (Table 63, Figures 58-59), and pH criteria were exceeded only in April 2018 (Table 65). The Schuylkill gage attained pH criteria, even during dry stretches of spring when algal activity is usually greatest (Figure 60).

Table 63. Gage 01474500 Dissolved Oxygen Minimum Criterion Summary Results by Month

Month	Des. Use	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	% hrs. non-attaining	% hrs. attaining	Min	Max	Mean
Jul-18	WWF	741.5	30.9	0.3	0.0	100.0	6.5	9.5	7.7
Aug-18	WWF	744.0	31.0	0.0	0.0	100.0	6.6	8.9	8.2
Sep-18	WWF	719.0	30.0	0.1	0.0	100.0	7.6	9.6	8.8
Oct-18	WWF	743.0	31.0	0.1	0.0	100.0	8.5	11.3	9.9
Nov-18	WWF	719.5	30.0	0.1	0.0	100.0	8.9	13.2	11.8
Mar-19	WWF	419.0	17.5	25.4	0.0	100.0	11.0	13.3	12.2
Apr-19	WWF	718.0	29.9	0.3	0.0	100.0	8.8	12.7	10.3
May-19	WWF	742.0	30.9	0.3	0.0	100.0	8.0	10.6	9.2
Jun-19	WWF	718.0	29.9	0.3	0.0	100.0	7.4	9.4	8.4

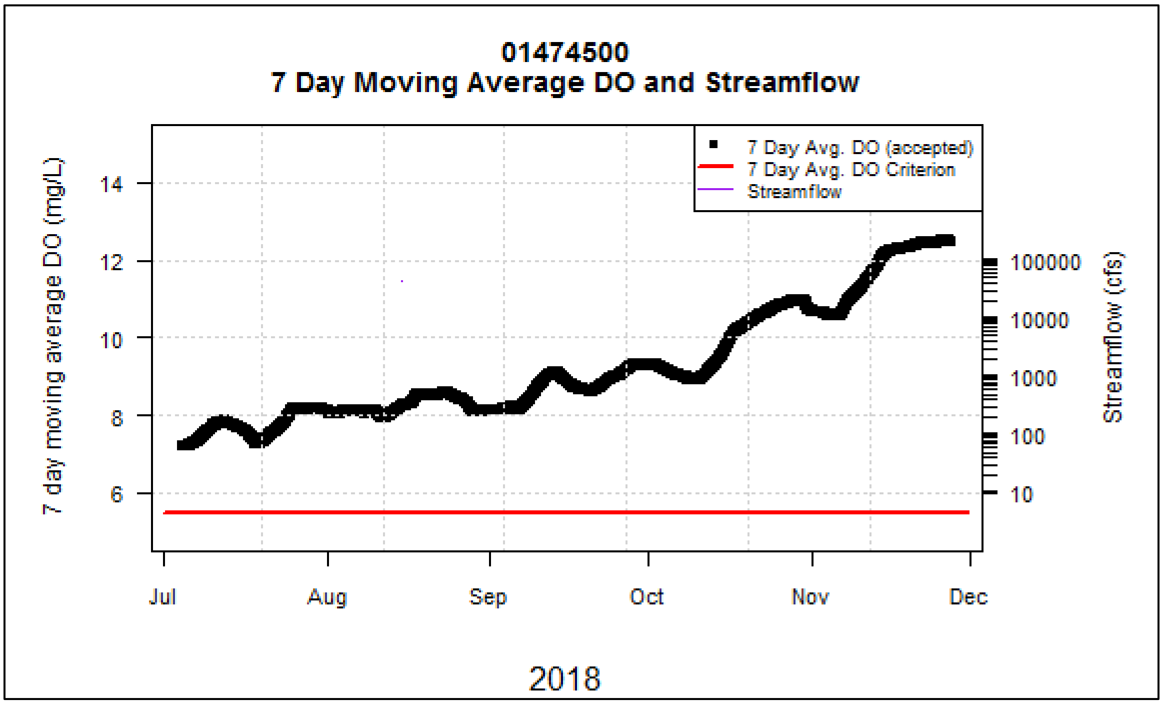


Figure 58. Gage 01474500, 7 Day Average Dissolved Oxygen and Streamflow, Jul-Dec 2018.

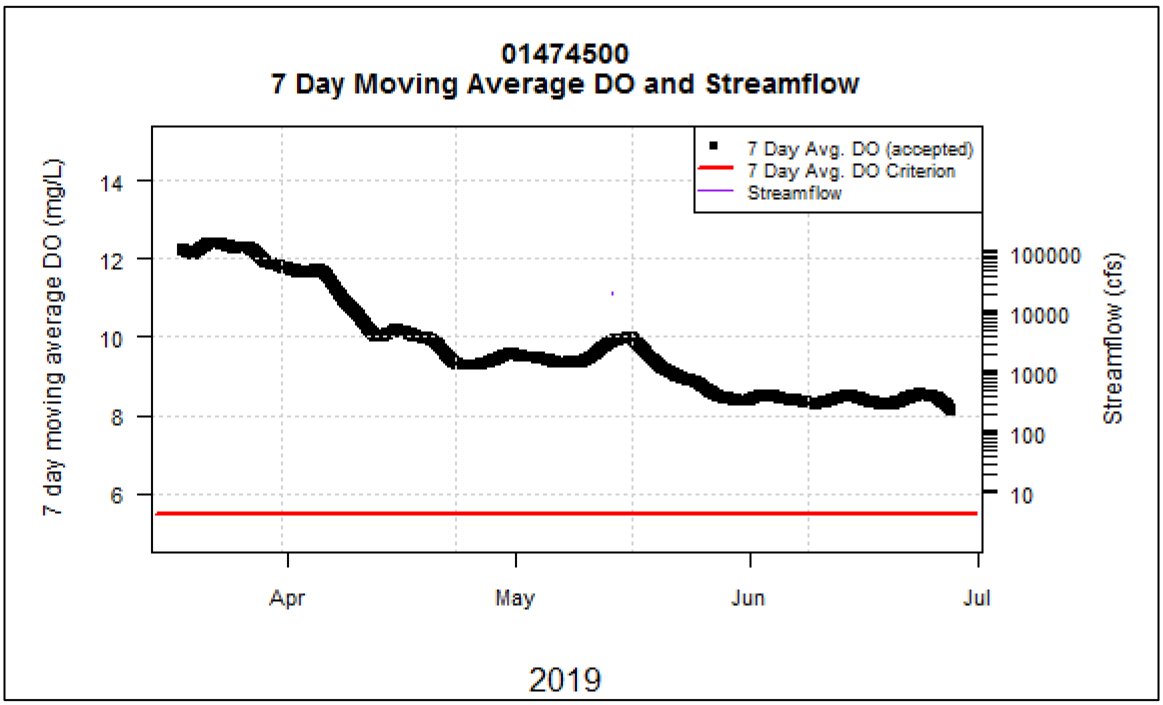


Figure 59. Gage 01474500, 7 Day Average Dissolved Oxygen and Streamflow, Mar-Jun 2019.

Table 64. Gage 01474500 Dissolved Oxygen Daily Mean Criterion Summary Results by Month

Month	Des. Use	Total days accepted data	% days flagged data	Min.	Max.	Mean
Jul-18	WWF	29.0	6.5	6.8	8.3	7.6
Aug-18	WWF	31.0	0.0	7.6	8.8	8.2
Sep-18	WWF	29.0	3.3	7.8	9.6	8.8
Oct-18	WWF	30.0	3.2	8.7	11.1	9.9
Nov-18	WWF	29.0	3.3	9.6	12.8	11.7
Mar-19	WWF	17.0	27.4	11.2	12.7	12.1
Apr-19	WWF	28.0	6.7	9.0	11.9	10.3
May-19	WWF	30.0	3.2	8.2	10.5	9.2
Jun-19	WWF	28.0	6.7	7.6	8.9	8.4

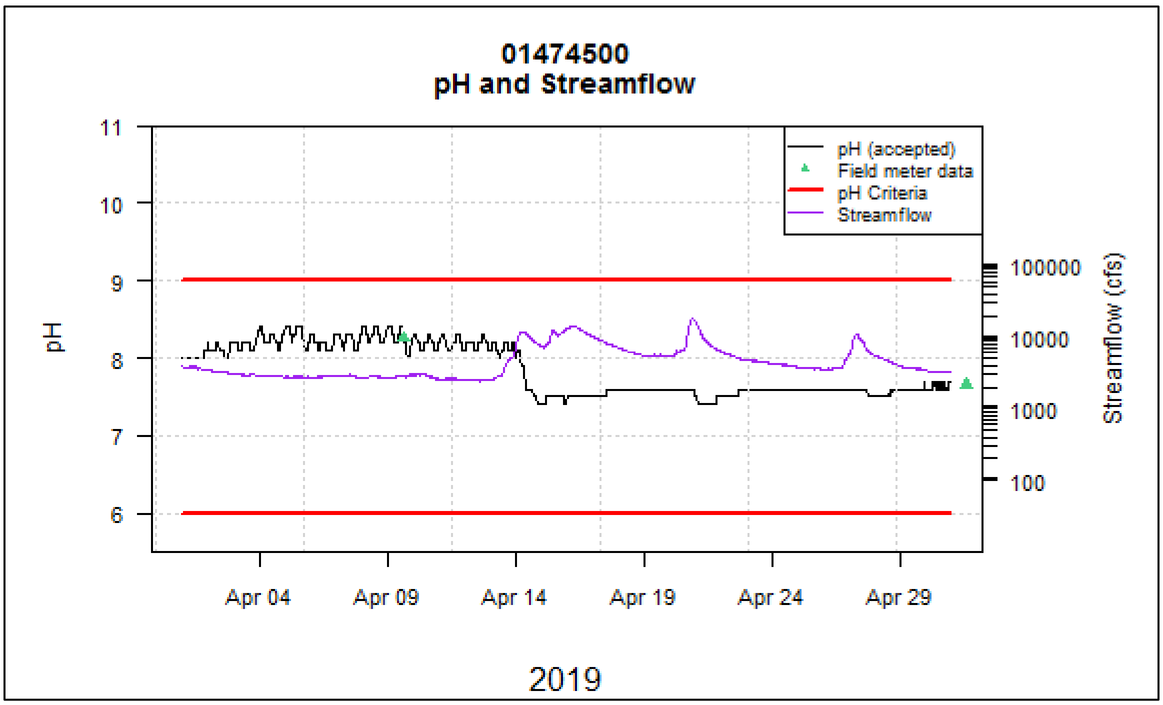


Figure 60. Gage 01474500, pH and Streamflow, April 2019.

Table 65. Gage 01474500 pH Criteria Summary Results by Month

Month	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	% hrs. max. non-attaining	% days max. non-attaining	% hrs. min. non-attaining	% days min. non-attaining	% hrs. attaining	% days attaining	Min.	Max.	Mean
Jul-18	741.5	30.9	0.3	0.0	0.0	0.0	0.0	100.0	100.0	7.4	8.4	7.7
Aug-18	744.0	31.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	7.2	7.9	7.7
Sep-18	679.5	28.3	5.6	0.0	0.0	0.0	0.0	100.0	100.0	7.4	8.0	7.7
Oct-18	743.0	31.0	0.1	0.0	0.0	0.0	0.0	100.0	100.0	7.7	8.2	7.9
Nov-18	719.5	30.0	0.1	0.0	0.0	0.0	0.0	100.0	100.0	7.3	8.2	7.8
Mar-19	419.0	17.5	25.4	0.0	0.0	0.0	0.0	100.0	100.0	7.6	8.4	7.9
Apr-19	718.0	29.9	0.3	0.0	0.0	0.0	0.0	100.0	100.0	7.4	8.4	7.8
May-19	742.0	30.9	0.3	0.0	0.0	0.0	0.0	100.0	100.0	7.3	7.7	7.6
Jun-19	717.0	29.9	0.4	0.0	0.0	0.0	0.0	100.0	100.0	7.4	8.0	7.7

Temperature

Table 66. Gage 01474500 Temperature Summary Results by Maximum Criteria Period

Designated Use	Date range start	Date range end	% hrs. exceedance	% hrs. attaining	% hrs. flagged data	Total hrs. accepted data	Total days accepted data	Min.	Max.	Mean
WWF	1-Jul	31-Jul	0.0	100.0	0.3	741.5	30.9	22.6	30.2	25.7
WWF	1-Aug	15-Aug	0.0	100.0	0.0	360.0	15.0	20.9	26.2	23.1
WWF	16-Aug	31-Aug	0.0	100.0	0.0	384.0	16.0			
WWF	1-Sep	15-Sep	0.0	100.0	0.0	360.0	15.0	17.6	25.8	20.7
WWF	16-Sep	30-Sep	0.0	100.0	0.3	359.0	15.0			
WWF	1-Oct	15-Oct	0.0	100.0	0.0	360.0	15.0	10.3	21.1	15.4
WWF	16-Oct	31-Oct	0.0	100.0	0.3	383.0	16.0			
WWF	1-Nov	15-Nov	2.8	97.2	0.0	360.0	15.0	3.8	14.7	8.3
WWF	16-Nov	30-Nov	0.0	100.0	0.1	359.5	15.0			
WWF	1-Mar	31-Mar	49.0	51.0	24.6	561.0	23.4	2.8	11.4	7.7
WWF	1-Apr	15-Apr	65.5	34.5	0.6	358.0	14.9	9.2	17.6	14.2
WWF	16-Apr	30-Apr	78.1	21.9	0.0	360.0	15.0			
WWF	1-May	15-May	0.0	100.0	0.6	358.0	14.9	12.5	22.4	17.8
WWF	16-May	31-May	4.6	95.4	0.0	384.0	16.0			
WWF	1-Jun	15-Jun	0.0	100.0	0.6	358.0	14.9			
WWF	16-Jun	30-Jun	0.0	100.0	0.0	360.0	15.0	19.8	26.8	22.1

Figure 61. Gage 01474500, Schuylkill River at the Fairmount Dam, looking upstream

Turbidity

Turbidity levels at the Schuylkill gage were less susceptible to extreme peaks due to storms and increased flow.

Table 67. Gage 01474500 Turbidity Summary Results by Month

Month	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	% hrs. above max. guideline	% hrs. below max. guideline	Min.	Max.	Mean
Jul-18	741.5	30.9	0.3	80.2	19.8	1.1	46.8	8.8
Aug-18	743.5	31.0	0.1	98.7	1.3	2.2	344.0	28.6
Sep-18	718.5	29.9	0.2	100.0	0.0	3.1	243.0	17.8
Oct-18	743.0	31.0	0.1	57.3	42.7	1.0	19.7	3.7
Nov-18	719.5	30.0	0.1	93.2	6.8	1.5	257.0	21.1
Mar-19	419.0	17.5	25.4	90.0	10.0	2.2	96.0	11.5
Apr-19	718.0	29.9	0.3	65.6	34.4	1.4	79.2	10.3
May-19	742.0	30.9	0.3	99.9	0.1	2.8	119.0	18.0
Jun-19	717.0	29.9	0.4	100.0	0.0	4.0	231.0	15.0

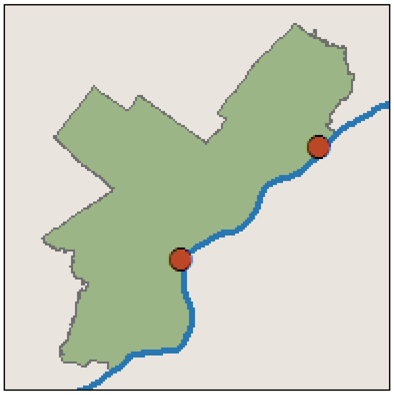
Specific Conductance

The Schuylkill River generally exhibits intermediate conductance, lower than the small Philadelphia tributary streams described elsewhere in this report, but greater than that observed in the Delaware River. Observed differences are likely due to geology and preponderance of anthropogenic sources in the respective watersheds.

Table 68. Gage 01474500 Specific Conductance Summary Results by Month

Month	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	Min.	Max.	Mean
Jul-18	741.5	30.9	0.3	236.0	544.0	373.3
Aug-18	744.0	31.0	0.0	155.0	417.0	310.9
Sep-18	719.0	30.0	0.1	188.0	423.0	324.4
Oct-18	742.5	30.9	0.2	298.0	439.0	373.4
Nov-18	719.5	30.0	0.1	158.0	467.0	301.3
Mar-19	562.0	23.4	0.0	249.0	574.0	380.1
Apr-19	718.0	29.9	0.3	222.0	462.0	352.0
May-19	742.0	30.9	0.3	226.0	442.0	318.1
Jun-19	717.5	29.9	0.3	187.0	448.0	359.2

Delaware River (Gages 01467200 and 014670261)



Dissolved oxygen and pH

The DRBC DO daily mean and pH criteria for Zone 3 was attained at Gage 01467200 for the entire reporting period (Tables 69 and 71). The Zone 2 DO daily mean and pH criteria were also attained at Gage 014670261, with the exception of pH exceedance in March 2019 (Tables 70 and 72). Data is collected year-round at 014670261. From December 6, 2018 to February 27, 2019, water quality monitoring equipment used to measure pH, DO and turbidity was removed from site 01467200 in order to protect it from ice.

Figure 62. Delaware River at Ben Franklin Bridge, near Gage 01467200

Table 69. Gage 01467200 Dissolved Oxygen Daily Mean Criterion Summary Results by Month

Month	Des. Use	Total days accepted data	% days flagged data	% days non-attaining	% days attaining	Daily Avg. Min.	Daily Avg. Max.	Daily Avg. Mean	Min.	Max
Jul-18	DRBC	24.0	22.6	0.0	100.0	4.6	6.5	5.4	3.8	6.8
Aug-18	DRBC	22.0	29.0	0.0	100.0	6.0	7.4	6.6	5.6	7.6
Sep-18	DRBC	20.0	33.3	0.0	100.0	5.6	7.9	6.7	5.0	8.1
Oct-18	DRBC	25.0	19.4	0.0	100.0	7.9	10.6	9.1	7.4	10.7
Nov-18	DRBC	30.0	0.0	0.0	100.0	9.5	12.5	11.4	9.3	12.7
Mar-19	DRBC	26.0	16.0	0.0	100.0	11.8	14.2	13.1	11.4	14.5
Apr-19	DRBC	22.0	26.7	0.0	100.0	8.7	12.2	10.1	8.5	12.3
May-19	DRBC	27.0	12.9	0.0	100.0	6.8	9.8	8.6	6.6	10.0
Jun-19	DRBC	25.0	16.7	0.0	100.0	6.1	7.4	6.7	5.9	7.9

Table 70. Gage 014670261 Dissolved Oxygen Daily Mean Criterion Summary Results by Month

Month	Des. Use	Total days accepted data	% days flagged data	% days non-attaining	% days attaining	Daily Avg. Min.	Daily Avg. Max.	Daily Avg. Mean	Min.	Max
Jul-18	DRBC	30.0	3.2	0.0	100.0	6.3	7.3	6.8	5.8	8.0
Aug-18	DRBC	31.0	0.0	0.0	100.0	6.7	7.8	7.2	6.4	8.0
Sep-18	DRBC	29.0	3.3	0.0	100.0	6.6	8.5	7.5	6.0	8.7
Oct-18	DRBC	30.0	3.2	0.0	100.0	8.1	10.6	9.2	8.0	10.7
Nov-18	DRBC	30.0	0.0	0.0	100.0	9.6	12.5	11.4	9.2	12.7
Dec-18	DRBC	30.0	3.2	0.0	100.0	11.7	13.2	12.4	11.5	13.3
Jan-19	DRBC	28.0	9.7	0.0	100.0	12.0	13.9	13.1	11.7	14.0
Feb-19	DRBC	27.0	3.6	0.0	100.0	12.8	14.1	13.4	12.7	14.2
Mar-19	DRBC	30.0	3.1	0.0	100.0	11.9	13.9	12.9	11.5	14.2
Apr-19	DRBC	30.0	0.0	0.0	100.0	9.0	11.9	10.2	8.6	12.1
May-19	DRBC	31.0	0.0	0.0	100.0	7.1	10.0	8.8	6.9	10.1
Jun-19	DRBC	30.0	0.0	0.0	100.0	6.8	7.8	7.2	6.3	8.1

Table 71. Gage 01467200 pH Criteria Summary Results by Month

Month	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	% hrs. max. non-attaining	% days max. non-attaining	% hrs. min. non-attaining	% days min. non-attaining	% hrs. attaining	% days attaining	Min.	Max.	Mean
Jul-18	720.5	30.0	3.2	0.0	0.0	0.0	0.0	100.0	100.0	7.0	7.5	7.2
Aug-18	737.5	30.7	0.9	0.0	0.0	0.0	0.0	100.0	100.0	7.0	7.3	7.2
Sep-18	699.5	29.1	2.8	0.0	0.0	0.0	0.0	100.0	100.0	7.1	7.4	7.3
Oct-18	630.0	26.3	15.3	0.0	0.0	0.0	0.0	100.0	100.0	6.9	7.5	7.2
Nov-18	720.0	30.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	7.2	7.5	7.4
Mar-19	740.0	30.8	0.4	0.0	0.0	0.0	0.0	100.0	100.0	7.3	8.2	7.6
Apr-19	697.5	29.1	3.1	0.0	0.0	0.0	0.0	100.0	100.0	7.1	7.7	7.4
May-19	740.0	30.8	0.5	0.0	0.0	0.0	0.0	100.0	100.0	7.1	7.3	7.2
Jun-19	712.0	29.7	1.1	0.0	0.0	0.0	0.0	100.0	100.0	7.0	7.4	7.1

Table 72. Gage 014670261 pH Criteria Summary Results by Month

Month	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	% hrs. max. non-attaining	% days max. non-attaining	% hrs. min. non-attaining	% days min. non-attaining	% hrs. attaining	% days attaining	Min.	Max.	Mean
Jul-18	743.0	31.0	0.1	0.0	0.0	0.0	0.0	100.0	100.0	6.9	7.6	7.3
Aug-18	744.0	31.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	6.9	7.3	7.2
Sep-18	720.0	30.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	6.9	7.4	7.2
Oct-18	742.5	30.9	0.2	0.0	0.0	0.0	0.0	100.0	100.0	7.1	7.5	7.3
Nov-18	720.0	30.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	7.2	7.7	7.4
Dec-18	743.5	31.0	0.1	0.0	0.0	0.0	0.0	100.0	100.0	7.2	7.5	7.4
Jan-19	735.5	31.0	1.1	0.0	0.0	0.0	0.0	100.0	100.0	7.3	7.6	7.5
Feb-19	671.5	28.0	0.1	0.0	0.0	0.0	0.0	100.0	100.0	7.4	7.7	7.5
Mar-19	743.0	31.0	0.0	2.4	6.5	0.0	0.0	97.6	93.5	7.4	8.7	7.8
Apr-19	720.0	30.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	7.0	8.2	7.5
May-19	744.0	31.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	7.1	7.4	7.2
Jun-19	719.0	30.0	0.1	0.0	0.0	0.0	0.0	100.0	100.0	6.8	7.5	7.2

Temperature

Temperature criteria for the Delaware River were not exceeded at either gage.

Table 73. Gage 01467200 Temperature Summary Results by Maximum Criteria Period

Designated Use	Date range start	Date range end	% hrs. exceedance	% hrs. attaining	% hrs. flagged data	Total hrs. accepted data	Total days accepted data	Min.	Max.	Mean
DRBC	1-Jul	31-Jul	0.0	100.0	1.1	735.5	30.6	24.3	27.7	26.7
DRBC	1-Aug	31-Aug	0.0	100.0	0.3	742.0	30.9	22.4	25.9	24.3
DRBC	1-Sep	30-Sep	0.0	100.0	0.6	715.5	29.8	17.8	26.7	22.3
DRBC	1-Oct	31-Oct	0.0	100.0	0.1	743.5	31.0	10.2	19.2	15.5
DRBC	1-Nov	30-Nov	0.0	100.0	0.1	719.0	30.0	4.3	12.8	7.9
DRBC	31-Mar	31-Mar	0.0	100.0	0.3	741.0	30.9	3.0	8.9	5.8
DRBC	1-Apr	30-Apr	0.0	100.0	0.7	715.0	29.8	8.1	14.9	12.3
DRBC	1-May	31-May	0.0	100.0	0.5	740.0	30.8	12.4	21.4	16.3
DRBC	1-Jun	30-Jun	0.0	100.0	0.0	720.0	30.0	20.3	24.2	21.8

Table 74. Gage 014670261 Temperature Summary Results by Maximum Criteria Period

Designated Use	Date range start	Date range end	% hrs. exceedance	% hrs. attaining	% hrs. flagged data	Total hrs. accepted data	Total days accepted data	Min.	Max.	Mean
DRBC	1-Jul	31-Jul	0.0	100.0	0.1	743.0	31.0	23.9	28.6	26.9
DRBC	1-Aug	31-Aug	0.0	100.0	0.0	744.0	31.0	22.0	26.0	23.9
DRBC	1-Sep	30-Sep	0.0	100.0	0.0	720.0	30.0	17.3	26.8	21.9
DRBC	1-Oct	31-Oct	0.0	100.0	0.1	743.5	31.0	9.6	19.4	14.8
DRBC	1-Nov	30-Nov	0.0	100.0	0.0	720.0	30.0	4.4	13.2	7.7
DRBC	1-Dec	31-Dec	0.0	100.0	0.1	743.5	31.0	2.5	7.4	4.7
DRBC	1-Jan	31-Jan	0.0	100.0	1.1	736.0	31.0	0.2	7.0	2.7
DRBC	1-Feb	28-Feb	0.0	100.0	0.1	671.0	28.0	0.0	4.7	2.5
DRBC	1-Mar	31-Mar	0.0	100.0	0.0	743.0	31.0	2.4	9.5	5.9
DRBC	1-Apr	30-Apr	0.0	100.0	0.0	720.0	30.0	7.8	15.7	12.5
DRBC	1-May	31-May	0.0	100.0	0.0	744.0	31.0	11.9	21.4	16.3
DRBC	1-Jun	30-Jun	0.0	100.0	0.0	720.0	30.0	19.8	24.8	21.6

Specific Conductance

The Delaware River exhibits much lower conductivity than the small Philadelphia tributary streams described elsewhere in this report. This is likely caused by differences in geology and proportionally fewer anthropogenic sources in the less-developed Delaware River watershed.

Table 75. Gage 01467200 Specific Conductance Summary Results by Month

Month	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	Min.	Max.	Mean
Jul-18	723.5	30.1	2.8	168.0	350.0	304.8
Aug-18	738.0	30.8	0.8	156.0	209.0	178.0
Sep-18	707.0	29.5	1.8	142.0	250.0	204.6
Oct-18	741.5	30.9	0.3	148.0	230.0	182.6
Nov-18	719.0	30.0	0.1	133.0	235.0	188.0
Mar-19	738.5	30.8	0.6	206.0	382.0	299.5
Apr-19	708.5	29.5	1.6	131.0	248.0	199.0
May-19	741.0	30.9	0.4	155.0	224.0	187.4
Jun-19	715.5	29.8	0.6	171.0	254.0	210.5

Table 76. Gage 014670261 Specific Conductance Summary Results by Month

Month	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	Min.	Max.	Mean
Jul-18	743.0	31.0	0.1	152.0	330.0	274.4
Aug-18	744.0	31.0	0.0	146.0	235.0	178.4
Sep-18	719.5	30.0	0.1	128.0	260.0	198.0
Oct-18	743.5	31.0	0.1	142.0	280.0	187.1
Nov-18	720.0	30.0	0.0	142.0	450.0	196.2
Dec-18	743.5	31.0	0.1	138.0	274.0	197.4
Jan-19	736.0	31.0	1.1	155.0	479.0	218.9
Feb-19	670.5	27.9	0.2	188.0	512.0	285.0
Mar-19	742.5	30.9	0.1	201.0	560.0	306.5
Apr-19	720.0	30.0	0.0	126.0	309.0	198.4
May-19	744.0	31.0	0.0	151.0	282.0	191.3
Jun-19	719.0	30.0	0.1	156.0	275.0	208.4

Turbidity

Turbidity guidelines at 014670261 were almost always exceeded throughout the year. Turbidity is not continuously measured at 01467200.

Table 77. Gage 014670261 Turbidity Summary Results by Month

Month	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	% hrs. above max. guideline	% hrs. below max. guideline	Min.	Max.	Mean
Jul-18	743.0	31.0	0.1	98.8	1.2	2.3	34.7	7.8
Aug-18	744.0	31.0	0.0	99.7	0.3	2.7	120.0	9.9
Sep-18	719.5	30.0	0.1	99.2	0.8	2.4	121.0	8.9
Oct-18	743.5	30.9	0.2	100.0	0.0	3.3	91.9	8.9
Nov-18	720.0	30.0	0.0	100.0	0.0	3.2	100.0	13.4
Dec-18	744.0	31.0	0.0	97.5	2.5	0.9	42.2	8.2
Jan-19	736.5	31.0	1.0	99.9	0.1	2.3	58.6	11.1
Feb-19	671.0	28.0	0.1	99.8	0.2	2.8	41.2	6.8
Mar-19	742.5	30.9	0.1	91.4	8.6	2.0	15.1	5.5
Apr-19	720.0	30.0	0.0	88.5	11.5	1.4	49.2	7.6
May-19	744.0	31.0	0.0	100.0	0.0	3.1	69.0	11.8
Jun-19	719.0	30.0	0.1	100.0	0.0	4.7	101.0	16.3

Wet Weather and Dry Weather Results

Annual Summary, July 2018 - June 2019

Water quality data was also categorized as wet or dry for the purpose of evaluating weather effects on water quality, and specifically the incidence of non-attainment of water quality criteria. A wet weather condition was defined as rainfall greater than 0.05 inches in the preceding 72 hours, as measured at the nearest PWD rain gage.

In general, more frequent non-attainment of DO criteria was observed in wet weather due to the tendency of storm events to decrease DO via the introduction of stormwater runoff and BOD (Tables 78-79). The turbidity maximum guideline was also usually more frequently surpassed in wet weather (Tables 84-85). The pH maximum criterion was exceeded in both wet and dry weather (Tables 82-83). Temperature criteria were more likely to be exceeded at Trout Stocking Fishery (TSF) gages due to more stringent seasonal criteria (Tables 88-89).

Table 78. USGS Gage July 2018 - June 2019 Dissolved Oxygen Minimum Criterion Summary Results During Wet Weather

Gage number	Designated Use	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	% hrs. non-attaining	% hrs. attaining
01465798	WWF	4747.0	197.8	3.8	0.9	99.1
01467042	TSF	4952.0	206.3	0.2	0.0	100.0
01467048	TSF	4879.5	203.3	0.3	0.1	99.9
01467086	WWF	4971.0	207.1	0.8	0.9	99.1
01467087	WWF	4089.0	170.4	15.1	7.2	92.8
01467200*	DRBC	NA	NA	NA	NA	NA
01473900	TSF	4928.0	205.3	0.2	0.0	100.0
01474000	TSF	4806.5	200.3	0.4	0.0	100.0
01474500	WWF	4657.0	194.0	0.1	0.0	100.0
01475530	WWF	4732.0	197.2	0.6	0.0	100.0
01475548	WWF	4850.0	202.1	0.2	3.2	96.8
014670261*	DRBC	NA	NA	NA	NA	NA

*No minimum DO criterion applies at these locations.

Table 79. USGS Gage July 2018 - June 2019 Dissolved Oxygen Minimum Criterion Summary Results During Dry Weather

Gage number	Designated Use	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	% hrs. non-attaining	% hrs. attaining
01465798	WWF	1401.5	58.4	0.5	0.2	99.8
01467042	TSF	1379.5	57.5	0.2	0.0	100.0
01467048	TSF	1384.0	57.7	1.5	0.0	100.0
01467086	WWF	1418.0	59.1	0.7	0.5	99.5
01467087	WWF	1320.5	55.0	9.7	1.1	98.9
01467200*	DRBC	NA	NA	NA	NA	NA
01473900	TSF	1499.0	62.5	0.4	0.0	100.0
01474000	TSF	1412.0	58.8	2.5	0.0	100.0
01474500	WWF	1607.0	67.0	0.3	0.0	100.0
01475530	WWF	1649.0	68.7	0.3	0.0	100.0
01475548	WWF	1536.0	64.0	0.0	1.1	98.9
014670261*	DRBC	NA	NA	NA	NA	NA

*No minimum DO criterion applies at these locations.

Table 80. USGS Gage July 2018 - June 2019 Dissolved Oxygen Daily Mean Criterion Summary Results During Wet Weather

Gage number	Designated Use	Total days accepted data	% days flagged data
01465798	WWF	208.0	6.2
01467042	TSF	212.0	0.0
01467048	TSF	206.0	0.0
01467086	WWF	195.0	1.0
01467087	WWF	179.0	18.6
01467200	DRBC	188.0	2.1
01473900	TSF	194.0	0.0
01474000	TSF	189.0	0.0
01474500	WWF	184.0	0.0
01475530	WWF	204.0	1.1
01475548	WWF	203.0	0.0
014670261	DRBC	231.0	0.0

Table 81. USGS Gage July 2018 - June 2019 Dissolved Oxygen Daily Mean Criterion Summary Results During Dry Weather

Gage number	Designated Use	Total days accepted data	% days flagged data
01465798	WWF	65.0	2.1
01467042	TSF	64.0	0.0
01467048	TSF	59.0	6.4
01467086	WWF	46.0	2.1
01467087	WWF	60.0	6.4
01467200	DRBC	57.0	3.4
01473900	TSF	51.0	0.0
01474000	TSF	44.0	4.3
01474500	WWF	55.0	0.0
01475530	WWF	77.0	0.0
01475548	WWF	70.0	0.0
014670261	DRBC	99.0	0.0

Table 82. USGS Gage July 2018 - June 2019 pH Criteria Summary Results During Wet Weather

Gage number	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	% hrs. max. non-attaining	% days max. non-attaining	% hrs. min. non-attaining	% days min. non-attaining	% hrs. attaining	% days attaining
01465798	4925.0	205.2	0.2	0.0	0.0	0.0	0.0	100.0	100.0
01467042	4954.0	206.4	0.2	0.0	0.4	0.0	0.0	100.0	99.6
01467048	4877.0	203.2	0.3	0.6	2.7	0.0	0.0	99.4	97.3
01467086	4986.0	207.8	0.5	0.7	3.4	0.0	0.0	99.3	96.6
01467087	4289.0	178.7	10.9	0.0	0.0	0.0	0.0	100.0	100.0
01467200	4727.5	197.0	2.9	0.0	0.0	0.0	0.0	100.0	100.0
01473900	4896.0	204.0	0.8	0.7	3.9	0.0	0.0	99.3	96.1
01474000	4805.5	200.2	0.4	0.5	3.1	0.0	0.0	99.5	96.9
01474500	4625.0	192.7	0.8	0.0	0.0	0.0	0.0	100.0	100.0
01475530	4668.5	294.5	2.0	0.0	0.0	0.0	0.0	100.0	100.0
01475548	4821.0	200.9	0.8	0.4	2.2	0.0	0.0	99.6	97.8
014670261	5927.0	247.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0

Table 83. USGS Gage July 2018 - June 2019 pH Criteria Summary Results During Dry Weather

Gage number	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	% hrs. max. non-attaining	% days max. non-attaining	% hrs. min. non-attaining	% days min. non-attaining	% hrs. attaining	% days attaining
01465798	1404.5	58.5	0.3	0.0	0.0	0.0	0.0	100.0	100.0
01467042	1379.5	57.5	0.2	0.8	2.3	0.0	0.0	99.2	97.7
01467048	1383.5	57.6	1.5	2.0	6.1	0.0	0.0	98.0	93.9
01467086	1424.5	59.4	0.2	4.4	12.8	0.0	0.0	95.6	87.2
01467087	1322.5	55.1	9.6	0.0	0.0	0.0	0.0	100.0	100.0
01467200	1669.5	69.6	2.2	0.0	0.0	0.0	0.0	100.0	100.0
01473900	1497.0	62.4	0.5	1.8	7.9	0.0	0.0	98.2	92.1
01474000	1394.0	58.1	3.7	2.1	8.1	0.0	0.0	97.9	91.9
01474500	1598.5	66.6	0.9	0.0	0.0	0.0	0.0	100.0	100.0
01475530	1646.0	68.6	0.5	0.3	2.1	0.0	0.0	99.7	97.9
01475548	1536.0	64.0	0.0	1.2	4.5	0.0	0.0	98.8	95.5
014670261	2819.0	117.5	0.1	0.5	1.3	0.0	0.0	99.5	98.7

Table 84. USGS Gage July 2018 - June 2019 Turbidity Summary Results During Wet Weather

Gage number	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	% hrs. above max. guideline	% hrs. below max. guideline
01465798	4777.5	199.1	3.2	48.9	51.1
01467042	4838.5	201.6	2.5	46.1	53.9
01467048	4649.5	193.7	5.0	66.7	33.3
01467086*	NA	NA	NA	NA	NA
01467087*	NA	NA	NA	NA	NA
01467200*	NA	NA	NA	NA	NA
01473900	4796.5	199.9	2.8	66.4	33.6
01474000	4806.5	200.3	0.4	44.2	55.8
01474500	4655.0	194.0	0.2	89.4	10.6
01475530*	NA	NA	NA	NA	NA
01475548*	NA	NA	NA	NA	NA
014670261	5927.5	247.0	0.0	98.3	1.7

*Turbidity not continuously monitored at this location

Table 85. USGS Gage July 2018 - June 2019 Turbidity Summary Results During Dry Weather

Gage number	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	% hrs. above max. guideline	% hrs. below max. guideline
01465798	1404.0	58.5	0.3	3.4	96.6
01467042	1378.0	57.4	0.3	6.3	93.7
01467048	1342.5	55.9	4.4	32.4	67.7
01467086*	NA	NA	NA	NA	NA
01467087*	NA	NA	NA	NA	NA
01467200*	NA	NA	NA	NA	NA
01473900	1490.5	62.1	0.9	26.8	73.2
01474000	1413.0	58.9	2.4	7.1	92.9
01474500	1607.0	67.0	0.3	80.2	19.8
01475530*	NA	NA	NA	NA	NA
01475548*	NA	NA	NA	NA	NA
014670261	2820.0	117.5	0.1	97.1	2.9

*Turbidity not continuously monitored at this location

Table 86. USGS Gage July 2018 - June 2019 Specific Conductance Summary Results During Wet Weather

Gage number	Total hrs. accepted data	Total days accepted data	% hrs. flagged data
01465798	4838.5	201.6	1.9
01467042	4926.5	205.3	0.7
01467048	4875.5	203.1	0.3
01467086	5000.5	208.4	0.2
01467087	4344.0	181.0	9.8
01467200	4835.5	201.5	0.7
01473900	4883.5	203.5	1.1
01474000	4801.5	200.1	0.5
01474500	4656.5	194.0	0.1
01475530	4526.5	188.6	5.0
01475548	4826.0	201.1	0.7
014670261	5926.0	246.9	0.1

Table 87. USGS Gage July 2018 - June 2019 Specific Conductance Summary Results During Dry Weather

Gage number	Total hrs. accepted data	Total days accepted data	% hrs. flagged data
01465798	1401.5	58.4	0.5
01467042	1379.5	57.5	0.2
01467048	1383.0	57.6	1.6
01467086	1422.5	59.3	0.4
01467087	1323.5	55.1	9.5
01467200	1697.0	70.7	0.6
01473900	1496.0	62.3	0.6
01474000	1412.5	58.9	2.5
01474500	1606.5	66.9	0.4
01475530	1647.5	68.6	0.4
01475548	1536.0	64.0	0.0
014670261	2819.5	117.5	0.1

Table 88. USGS Gage July 2018 - June 2019 Temperature Maximum Criteria Summary Results During Wet Weather

Gage number	Designated Use	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	% hrs. exceedance	% hrs. attaining
01465798	WWF	4910.0	204.6	0.5	15.6	84.4
01467042	TSF	4955.5	206.5	0.2	23.6	76.4
01467048	TSF	4880.5	203.4	0.2	28.0	72.0
01467086	WWF	5001.0	208.4	0.2	12.6	87.4
01467087	WWF	4368.0	182.0	9.3	17.8	82.2
01467200	DRBC	4865.0	202.7	0.1	0.0	100.0
01473900	TSF	4877.0	203.2	1.2	21.1	78.9
01474000	TSF	4750.5	197.9	1.6	24.3	75.7
01474500	WWF	4657.0	194.0	0.1	12.9	87.1
01475530	WWF	4616.5	192.4	3.1	14.1	85.9
01475548	WWF	4851.0	202.1	0.1	16.2	83.8
014670261	DRBC	4108.5	171.2	30.7	0.0	100.0

Table 89. USGS Gage July 2018 - June 2019 Temperature Maximum Criteria Summary Results During Dry Weather

Gage number	Designated Use	Total hrs. accepted data	Total days accepted data	% hrs. flagged data	% hrs. exceedance	% hrs. attaining
01465798	WWF	1404.5	58.5	0.3	16.4	83.6
01467042	TSF	1379.5	57.5	0.2	28.5	71.5
01467048	TSF	1384.5	57.7	1.5	31.9	68.1
01467086	WWF	1422.5	59.3	0.4	22.4	77.6
01467087	WWF	1327.0	55.3	9.3	25.8	74.2
01467200	DRBC	1706.5	71.1	0.1	0.0	100.0
01473900	TSF	1487.5	62.0	1.1	32.4	67.6
01474000	TSF	1393.0	58.0	3.8	32.8	67.2
01474500	WWF	1607.0	67.0	0.3	13.4	86.6
01475530	WWF	1648.0	68.7	0.3	19.9	80.1
01475548	WWF	1536.0	64.0	0.0	18.3	81.7
014670261	DRBC	1712.5	71.4	39.3	0.0	100.0

References

Delaware River Basin Commission, 2007. Delaware River Basin Water Code: 18 CFR Part 410 (With Amendments Through September 27, 2006). West Trenton, NJ.

Appendix I – PWD/USGS Groundwater Monitoring Program

Background

The basis of PWD's CSO LTCPU wet weather source control strategy is the "capture" and infiltration of as much rainwater as possible with green stormwater infrastructure (GSI). The direct benefits of such an effort are a reduction of stormwater discharged directly to streams, as well as the increased recharge of stormwater to supplement groundwater resources. Increased infiltration, though advantageous in several respects, must be carefully planned and closely monitored to avoid unwanted impacts. Increasing groundwater levels in areas where the depth to water is shallow could result in the saturation of soils close to the surface, potentially causing basement flooding. In addition, building foundations could be impacted by rising groundwater levels.

The adaptive management approach being employed for the LTCPU is an iterative process strongly dependent on monitoring. In order to quantify the impact of this long-term effort on groundwater resources, it is necessary to monitor groundwater levels in Philadelphia. PWD has partnered with USGS to increase the geographic scope and frequency of groundwater monitoring in the Philadelphia region. A City-wide groundwater level monitoring network will provide long-term monthly data documenting current water levels and trends in groundwater elevations throughout the City, helping to track the impacts of widespread implementation of stormwater management practices (SMPs) and global climate change.

Data from the groundwater monitoring network will also be used to calibrate a Philadelphia groundwater model and update the USGS groundwater contour map of Philadelphia (Paulachok 1984). In addition to this City-wide, long term groundwater monitoring program, PWD is conducting site-scale monitoring to address the effectiveness of individual SMPs. The City-wide groundwater monitoring network and site-scale monitoring at GSI facilities provide complementary information regarding the effects of stormwater management practices at different spatial and temporal scales.

Methods

PWD and USGS identified existing wells that would be suitable for the network and obtained permission for site access. Once wells were identified and accessible, well condition and suitability for inclusion in the monitoring network were investigated by continuous water level monitoring and remote video camera inspection when accessible. Wells that met acceptance criteria were added to the monitoring network. After examining readily available information about existing wells, PWD elected to drill additional wells in order to provide better spatial distribution of wells in the monitoring network. USGS staff conduct groundwater observations monthly and upload water level data to the NWIS web server. PWD staff periodically download water level data from NWIS and summarize these data annually.

Well Network Establishment

Existing wells in the Philadelphia area were identified by USGS and PWD through digital and paper archives as well as through contacting representatives of other City agencies and large institutional landowners (*e.g.*, Philadelphia Fire Department, Philadelphia Department of Parks and Recreation, Philadelphia Gas Works, Southeastern Pennsylvania Transportation Authority, etc.). Priority was given to wells on publicly-owned or large institutional land uses in order to help ensure that wells would remain accessible in the future. The primary goal was to develop a network of wells with a spatial distribution and density sufficient to assess groundwater levels throughout the City of

Philadelphia. Other criteria for establishment of the well network were:

- Sufficient density of wells in critical areas with a shallow water table
- No bias given to combined-sewered or separate-sewered areas
- Denser distribution of monitoring wells in the Northern Piedmont Ecoregion to reflect its more varied groundwater contours.

Wells that met acceptance criteria were assigned USGS location codes and added to the USGS well monitoring network and National Water Information System (NWIS) database. The well monitoring network contains 29 active sites that are monitored monthly. Additional sites are expected to be added once landowner access agreements are finalized or new wells are drilled.

Video Camera Inspection

The availability of well attribute information varied from well to well and in most cases the physical characteristics and condition of candidate wells to be added to the network was unknown. USGS staff perform remote video camera inspection, when possible, to determine physical characteristics such as screened intervals, total depth, depth to bottom of casing, and the location of potential water-bearing zones within the bore hole. Wells narrower than 4" diameter and wells with pumps or other plumbing could not accommodate the camera equipment and were not inspected with this method.

Continuous Water Level Monitoring

Monthly measurements are appropriate for monitoring long term trends in groundwater levels. However, it is important to verify that these monthly observations are representative of the unconfined aquifer and not influenced by anthropogenic activity or other conditions. USGS staff used data logging pressure transducers (LevelTroll model 500, In-Situ, Inc.) to conduct continuous water level monitoring in candidate wells. These sensors are vented to the surface of the well to provide atmospheric pressure correction. Continuous monitoring was carried out across all wells in the network to identify any aberrant trends, such as those that might be caused by local pumping operations. Sensors were deployed for three-month periods on a rotating schedule with five wells actively monitored at a time. Wells that appear to be influenced by permanent pumping operations will be removed from the monitoring network (*e.g.*, permanent wells dewatering the stadiums). Wells that are temporarily affected by local, dewatering operations (*e.g.*, a short term construction site), will remain in the system, but data collected during the period when dewatering operations affected the well will not be used in estimates of current water levels and water level trends.

Routine Groundwater Observations

USGS staff conduct groundwater observations monthly at each well using a water sensor and graduated tape. Equipment is sterilized in 10% bleach solution prior to and after measurements are taken in order to prevent introducing or transferring contamination between wells. Well level measurements are converted to elevation above the North American Vertical Datum of 1988 (NAVD88) based upon the known elevation correction factor for each well. Water level data are recorded on site in field notebooks along with any pertinent field notes and then uploaded to the NWIS web server. PWD periodically downloads data from NWIS and summarizes these data annually.

Monitoring Well Locations

Currently the well monitoring network contains 29 active sites that are monitored monthly. (Table 1, Figure 1). PWD is in the process of drilling additional wells on City-owned property in order to meet spatial distribution and other well network criteria. Of the 29 active wells, 11 are located within the

Middle Atlantic Coastal Plain Ecoregion, while the remaining 18 wells are located in the Northern Piedmont (Omernik 1987). As stated above, higher well density is required in the latter region to reflect the more complex geology and interactions with groundwater.

Table 1. PWD-USGS Groundwater Monitoring Well Network Locations.

Site ID	Site Name	Lat.	Long.	Established	Observations
USGS-395342075102101	PH 12	39.895	-75.172	10/22/1978	132
USGS-395353075151501	PH 1052	39.898	-75.254	3/7/2011	88
USGS-395408075104001	PH 63	39.902	-75.177	9/14/1954	104
USGS-395416075150301	PH 1053	39.904	-75.251	4/24/2003	86
USGS-395459075140501	PH 797	39.916	-75.259	10/15/1980	27
USGS-395516075113901	PH 1051	39.921	-75.194	--	67
USGS-395611075091301	PH 1059	39.936	-75.154	8/14/2014	57
USGS-395656075100401	PH 136	39.949	-75.167	12/6/1978	66
USGS-395656075104401	PH 1064	39.948	-75.178	6/5/2015	28
USGS-395705075135901	PH 1061	39.951	-75.232	6/5/2015	28
USGS-395849075134201	PH 1063	39.98	-75.228	6/5/2015	28
USGS-395859075085401	PH 1042	39.983	-75.148	2/14/2011	71
USGS-395942075144301	MG 2164	39.995	-75.245	2/14/2011	99
USGS-400001075040301	PH 1057	40	-75.068	8/14/2014	57
USGS-400016075102801	PH 1062	39.004	-75.174	6/5/2015	28
USGS-400038075094601	PH 1058	40.011	-75.163	8/14/2014	57
USGS-400055075122501	PH 1060	39.015	-75.206	6/5/2015	28
USGS-400132075031001	PH 1056	40.026	-75.053	8/14/2014	57
USGS-400211075093701	PH 1050	40.036	-75.16	--	99
USGS-400217075142101	PH 540	40.038	-75.239	3/29/1948	89
USGS-400229075104601	PH 1043*	40.041	-75.179	2/14/2011	95
USGS-400308074592201	PH 397	40.052	-74.989	1/4/1979	103
USGS-400311075101301	PH 1040	40.053	-75.17	2/17/2011	101
USGS-400327075152201	PH 1044	40.057	-75.256	3/16/2011	94
USGS-400424075104901	PH 550	40.073	-75.18	--/--/1906	94
USGS-400512075033401	PH 1045	40.087	-75.059	7/18/2011	95
USGS-400516075033201	PH 1046	40.088	-75.059	7/18/2011	87
USGS-400524075042601	MG 2195	40.09	-75.074	--	10
USGS-400527075042801	MG 2193	40.091	-75.074	--	88
USGS-400527075042802	MG 2194	40.091	-75.074	--	94
USGS-400644074590801	PH 1041	40.112	-74.986	2/17/2011	99

* Philadelphia County observation well

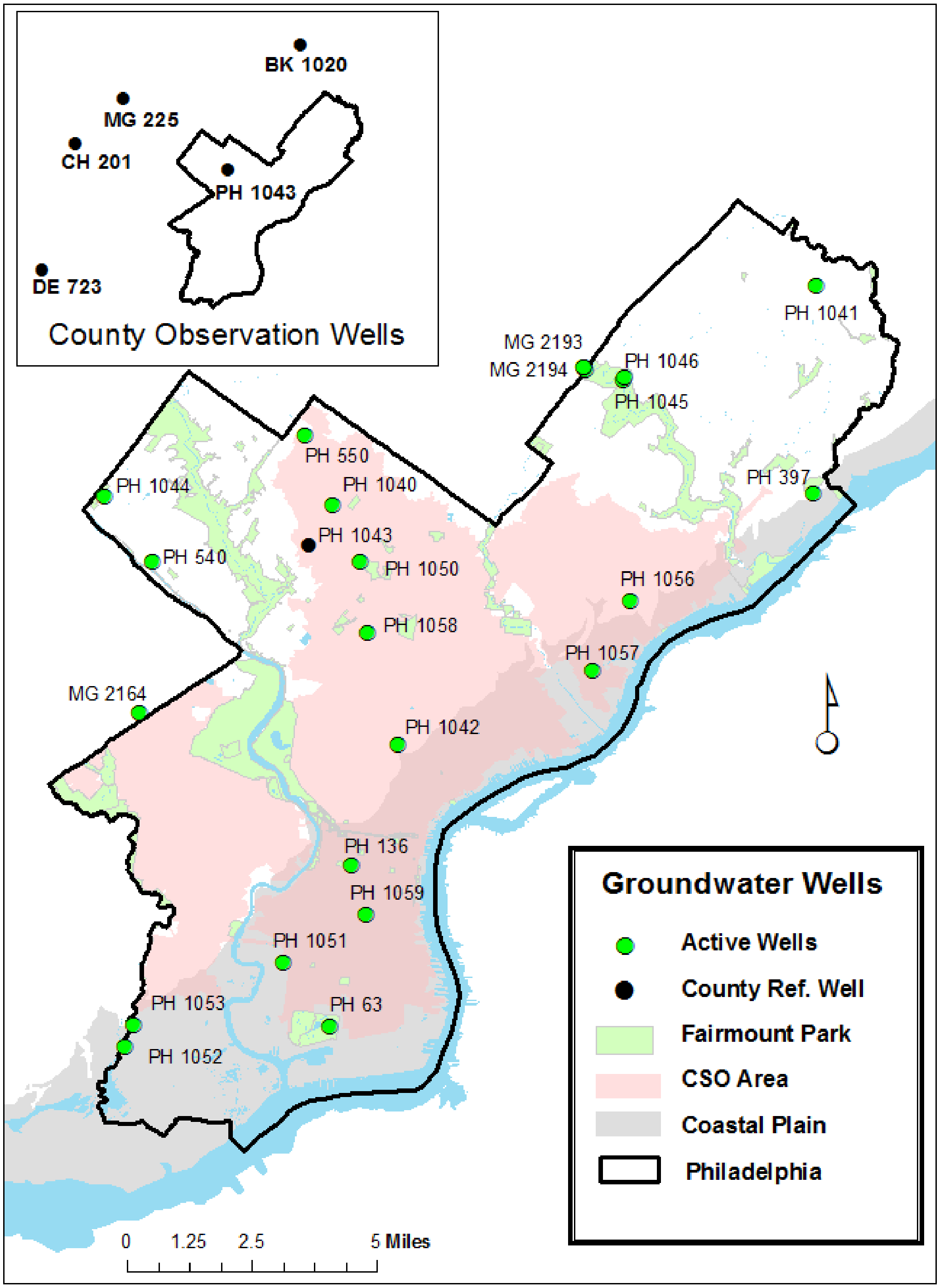


Figure 1. PWD-USGS Groundwater Monitoring Well Network Locations and (inset) County Reference Well Locations.

We lls wer e also classified according to predominant underlying geology and type of sewer system, *i.e.*, CSO or separate-sewered (Table 2, Figure 1). Another consideration for siting new wells was the potential influence of buried utilities and historic creek beds. During the period of rapid expansion of Philadelphia's grid-like network of streets, historic streams were encased in large brick sewers and buried in order to level and prepare land for development. Recent groundwater mapping and modeling work suggests that these brick sewers strongly influence local groundwater elevations (Paulachok 1991, Maimone et al. 2011).

Table 2. PWD-USGS Groundwater Well Geology and Sewer System Type Classification.

Site ID	Site Name	Sewer Type	Geology
USGS-395353075151501	PH 1052	Separate	Trenton Gravel
USGS-395408075104001	PH 63	Separate	Trenton Gravel
USGS-395416075150301	PH 1053	Separate	Trenton Gravel
USGS-395516075113901	PH 1051	CSO	Magothy Raritan Potomac
USGS-395656075100401	PH 136	CSO	Trenton Gravel
USGS-395859075085401	PH 1042	CSO	Pennsauken and Bridgeton Formation
USGS-395942075144301	MG 2164	Separate	Granitic Gneiss and Granite
USGS-400211075093701	PH 1050	CSO	Wissahickon Formation
USGS-400217075142101	PH 540	Separate	Wissahickon Formation
USGS-400229075104601	PH 1043	CSO	Wissahickon Formation
USGS-400308074592201	PH 397	Separate	Trenton Gravel
USGS-400311075101301	PH 1040	CSO	Wissahickon Formation
USGS-400327075152201	PH 1044	Separate	Wissahickon Formation
USGS-400424075104901	PH 550	CSO	Wissahickon Formation
USGS-400512075033401	PH 1045	Separate	Granitic Gneiss and Granite
USGS-400516075033201	PH 1046	Separate	Granitic Gneiss and Granite
USGS-400527075042801	MG 2193	Separate	Wissahickon Formation
USGS-400527075042802	MG 2194	Separate	Wissahickon Formation
USGS-400644074590801	PH 1041	Separate	Wissahickon Formation
USGS-400132075031001	PH 1056	CSO	Wissahickon Formation
USGS-400001075040301	PH 1057	CSO	Trenton Gravel
USGS-400038075094601	PH 1058	CSO	Pennsauken Formation
USGS-395611075091301	PH 1059	CSO	Trenton Gravel
USGS-395459075140501	PH 797	CSO	Trenton Gravel
USGS-395656075104401	PH 1064	CSO	Trenton Gravel
USGS-395705075135901	PH 1061	CSO	Wissahickon Formation
USGS-395849075134201	PH 1063	CSO	Wissahickon Formation
USGS-400016075102801	PH 1062	Separate	Pennsauken Formation
USGS-400055075122501	PH 1060	Separate	Wissahickon Formation

USGS maintains at least one reference well in most Pennsylvania counties. Reference wells located in neighboring counties (Figure 1, Table 3) may be used as regional reference wells for data analyses. Continuous hourly data are collected at well DE 723 in Delaware County. Reference wells in Chester, Bucks and Montgomery counties are not monitored continuously.

Table 3. Regional County Observation Wells.

Site ID	Site Name	Lat.	Long.	Est.	Observations
USGS-400453075255601	CH 201 Chester County Observation Well	40.136	-75.351	06/19/1978	486
USGS-400808075210401	MG 225 Montgomery County Observation Well	40.199	-75.052	08/15/1956	185
USGS-401157075032001	BK 1020 Bucks County Observation Well	40.081	-75.432	04/13/1968	182
USGS-395512075293701	DE 723 Delaware County Observation Well	39.920	-75.493	1983	208

Data Analysis

USEPA (2009) published detailed guidance on statistical analysis of groundwater contaminant concentrations. In many of the examples, the same logic and techniques could apply to analysis of groundwater levels. In the case of the Philadelphia groundwater monitoring network, the goal is to understand if groundwater levels are changing over time, at either a single well or group of wells. The main statistical tests to be utilized are a) Seasonal Kendall Test, and b) ANOVA. The tests are briefly described below.

The Seasonal Kendall test performs the Mann-Kendall (MK) trend test for individual seasons of the year, where season is defined by the user. It then combines the individual results into one overall test for whether the dependent variable (*i.e.*, groundwater level) changes in a consistent direction (monotonic trend) over time. The magnitude (*i.e.*, slope) of the trend is also determined. The test is nonparametric, therefore non-normal data can be analyzed (Helsel *et al.* 2006). USEPA (2009) advises that at least 10-12 measurements are needed, whereas Helsel and Hirsch (2002) recommends that the product of number of years and number of seasons be greater than 25. Helsel *et al.* (2006) further caution that with more than 10 years of data, adjusted p-values should be calculated to account for the possibility of serial correlation. The Seasonal Kendall test can be applied to data from a single well, not multiple wells. To examine seasonal trends across multiple wells, the Covariance-Sum test is used (Lettenmaier 1988), which is essentially the execution of multiple seasonal Kendall tests and calculation of the covariances between them. To analyze regional trends over time from a group of wells, the Regional Kendall test can be applied. The Regional Kendall test essentially functions the same way as the Seasonal Kendall test, except the data is categorized by region rather than season.

An alternate method to analyze temporal trends on either a single well or group of wells is the analysis of variance (ANOVA). For a single well or group of wells with data subdivided by season, a one-way ANOVA would examine the significance of seasonality as a statistical factor. A two-way ANOVA would be applied to include location or region as a statistical factor. Either form of ANOVA assumes that the datasets are normally distributed with constant variance. Group residuals should be tested for normality and for equality of variance. If the data cannot be transformed to a normal distribution, the nonparametric Kruskal-Wallis test can be used

Table 4. PWD-USGS Groundwater Monitoring Well Data 7/2018-6/2019, Depth to Water Level (Feet below Land Surface).

Site ID	J	A	S	O	N	D	J	F	M	A	M	J
395353075151501	14.94	14.78	14.25	15.50	15.15	14.18		13.29	12.80	13.62	13.36	14.04
395408075104001	4.74	5.01	4.44	4.99	4.61	4.02		4.71	4.55	4.54	4.47	4.83
395416075150301	8.76	9.35	8.95	9.64	7.74	8.34		6.58	6.56	6.94	6.56	7.02
395459075140501	13.76	13.50	13.48	13.62	13.12			13.59	13.60	13.80	13.30	13.42
395516075113901												
395611075091301	25.98	25.91	25.83	25.94	26.04	25.64		25.66	25.57		25.56	25.68
395656075100401												
395656075104401	20.00	12.15	18.53	19.86	16.86	10.66		20.12	18.05	20.09	19.56	20.17
395705075135901	14.29	13.94	12.95	13.30	10.21	12.84		13.50	13.13	13.99	13.11	14.02
395849075134201	13.13	12.78	12.30	12.69	12.44	12.48		12.56	12.57	12.92	12.74	12.81
395859075085401												
395942075144301	14.72	15.61	13.36	12.74	12.41	11.36		10.72	10.49	12.56	12.36	12.60
400001075040301	14.58	15.07	15.14	14.58	14.50	14.02		14.39	14.04	14.71	14.31	14.47
400016075102801	10.90	10.73	10.72	10.76	10.71	10.81		10.84	10.79	10.78	10.66	10.71
400038075094601	19.76	19.59	19.37	19.47	19.40	19.37		19.43	19.22	19.53	19.29	19.41
400055075122501	15.18	14.66	14.79	14.51	12.64	13.45		15.20	14.77	15.26	15.09	15.46
400132075031001	19.46	20.22	20.33	19.81	19.49	18.48		18.99	18.81	19.15	19.40	19.21
400211075093701	13.49	13.55	13.16	13.53	13.54	13.43		14.69	13.67	13.70	13.64	13.43
400217075142101	27.19	27.85	27.83	27.55	27.98	26.54		23.96	22.45	20.67	20.23	20.56
400229075104601		15.48	14.71	14.67	13.14	14.41			14.45	15.48	14.09	14.64
400308074592201	3.54	4.04	3.97	3.10	2.18	1.98		1.99	2.00	2.10	1.99	2.06
400311075101301	10.77	10.42	9.66	9.45	8.25	8.63		8.63	8.62	9.14	8.49	9.04
400327075152201	62.05	72.45	73.61	65.71	63.55	58.27		58.06	57.12	58.37	57.63	59.95
400424075104901	17.11	17.82	17.62	16.62	16.24	15.04		15.12	14.97	15.82	16.07	16.84
400512075033401	35.38	34.92	35.06	34.71	33.20	33.78		33.54	33.28	34.35	32.76	34.05
400516075033201		28.50	29.52	29.53	29.75	26.04		25.20	24.16	25.65	25.93	26.13
400527075042801	20.25	20.05	20.25	19.74	19.02	19.05		19.40	19.21	19.86	19.21	19.69
400527075042802	18.87	18.72	18.97	16.37	14.75	14.97		15.42	15.07	16.59	15.16	16.12
400644074590801	17.05	17.10	16.94	16.39	16.13	15.48		15.23	14.79	15.47	14.85	15.50

instead to detect significance of the specified statistical factor (USEPA 2009).

Well Monitoring Data Summary

Well monitoring data were summarized from July 2018 to June 2019 (Tables 4-5). These data are presented as an update of the program status. Additional data analysis will be completed as part of the groundwater model calibration and groundwater map update reports. Groundwater trends will be analyzed further once a sufficient amount of data has been collected (See Data Analysis section).

Table 5. Regional County Observation Well Data 7/2018 - 6/2019.

Site ID	J	A	S	O	N	D	J	F	M	A	M	J
400453075255601	20.77	18.75	17.88	18.89	16.91	18.32		18.39	18.04	19.04	18.32	16.14
400808075210401		8.67, 8.97			10.43	8.37		8.06	6.81		7.63	
401157075032001		30.93			30.04	27.24		27.6	26.96		26.1	
395512075293701	6.79	6.39		6.32		5.18		4.74	5.23		5.5	

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Appendix J – PWD Wadeable Streams Benthic Macroinvertebrate and Physical Habitat Assessments

PWD Wadeable Streams Benthic Macroinvertebrate and Physical Habitat Assessments

Background

Since 1999, the Philadelphia Water Department (PWD) has been using benthic macroinvertebrate sampling and instream physical habitat assessments in order to characterize watershed conditions and track trends in watershed health. Assessments are performed by the staff of PWD's Bureau of Laboratory Services (BLS) using PADEP Instream Comprehensive Evaluation (ICE) methods. As benthic invertebrates may be exposed to both short and long-duration stressors, data collected through this program are pertinent to all targets of PWD's Integrated Watershed Management Plan (IWMP) Strategy.

Common Acronyms Used in This Report

IBI - Index of Biotic Integrity, a biological assessment tool to indicate the capability of a stream to support a healthy aquatic community.
ICE - Instream Comprehensive Evaluation, a protocol to survey and evaluate wadeable streams.
PTV - Pollution Tolerance Values, a numeric measure of an organism's ability to withstand environmental degradation.
EPT - Ephemeroptera + Plecoptera + Trichoptera, the common names for pollution-sensitive mayflies, stoneflies and caddisflies.

Assessment Study Design

In recent years, agencies tasked with evaluating water quality have attempted to incorporate statistical sampling designs, or a "probabilistic" approach, to selecting sampling sites (Paulsen 2008, Borsuk *et al*. 2001) rather than relying on fixed sites. Statistical sampling design is particularly important when the goal of monitoring is to make an estimate of the percentage of waters affected by pollution. Another advantage of probabilistic study design is that the assessment units are distributed over a larger geographic area. When monitoring efforts are directed at individual watersheds on a rotating basis, as has been the case with PWD programs, the possibility arises that larger scale patterns may be missed. For example, the effects of floods or drought conditions are widespread, but only the watershed that is being monitored within the same time period will have data reflecting these effects. Disadvantages of a probabilistic approach include the technical demands of establishing and randomly selecting from geographic data sets containing all possible sampling locations as well as additional field reconnaissance work when conduct the actual monitoring.

The current PWD monitoring strategy is intended to be a compromise, recognizing the benefits of collecting data from randomly selected sites but also the importance of maintaining a consistent monitoring effort at selected locations over time. This plan is based on a similar monitoring program implemented by USGS in Chester County (Reif 2002, Reif 2004). The plan also reflects the manpower constraints of collecting and processing samples with the PADEP ICE protocol. It is hoped that this compromise approach (Table 1) will achieve some of the benefits of a randomized approach, while providing periodic re-evaluation of our watersheds required to inform the watershed planning process and comply with environmental mandates.

Stream Conditions

This report summarizes results from samples that were collected between March 15 and April 11, 2018. PWD is not aware of any spills, discharges or unusual conditions that would tend to cause misleading results.

Methods

Table 1. PWD Proposed Wadeable Streams Assessments Schedule

Period	Monitoring Activity (number of samples)
2011	USGS gage samples (8); Randomly selected sites (16)
2012	Cobbs Creek Assessment (6*); USGS gage samples (9); Random (10)
2013	Tookany/Tacony Creek (10*); USGS gage samples (8); Random (7)
2014	Wissahickon Creek Tributaries (11); USGS gage samples (9); Random (5)
2015	Wissahickon Creek (12*); USGS gage samples (8); Random (2)
2016	Pennypack Creek Tributaries (11); USGS gage samples (9); Random (5)
2017	Pennypack Creek (12*); USGS gage samples (9); Random (4)
2018	Poquessing Creek (12*); USGS gage samples (9); Random (4)
2019	USGS gage samples (9); Randomly selected sites (16)

* Number of monitoring sites excludes USGS gage sites in target watershed

Benthic Macroinvertebrate Sample Collection

Using the PADEP Instream Comprehensive Evaluation (ICE) protocol (PADEP 2009), macroinvertebrate samples were collected by placing a handheld D-frame net (500µm) at the downstream portion of a riffle. Stream substrate directly upstream of the D-frame net was then disturbed for approximately one minute to a depth of approximately 10 cm as substrate allowed. This procedure was repeated at other riffle locations of variable flow within the 100-m reach such that the sample at each station was a composite of six riffle samples. Composited samples from each biological monitoring location were then preserved in 95% ETOH (ethyl alcohol) and returned to the laboratory in polyethylene containers.

Benthic Macroinvertebrate Laboratory Procedures

Benthic macroinvertebrate samples were processed according to PADEP ICE protocols (PADEP 2009). Each composited sample was placed into an 18 x 12 x 3.5-inch pan marked with 28 four-square-inch grids. Four grids were randomly selected by drawing numbers. All material was extracted from the selected grids using a four-square-inch circular "cookie cutter," and placed into another identical empty pan. From this second pan, organisms were picked from randomly selected grids or “plugs” until a minimum of 200, but not more than 240, individuals were subsampled. This procedure was a misinterpretation of the actual technique, which stipulates a count of 200 (+/- 20%) individuals. When picking either the four initial "plugs" or additional plugs results in subsampling more than 240 individuals, the PADEP ICE protocol outlines a procedure for redistributing the subsample into a clean, gridded pan and "back counting" grids until a subsample consisting of 200 (+/-20%) is obtained. Invertebrates were identified under magnification, with taxonomic classification following PADEP 2009 guidelines.

Habitat Assessment

After collecting benthic invertebrates, biologists surveyed habitat features within the monitoring station and recorded scores for 12 habitat attributes according to the PADEP ICE protocol (Table 2). Biologists completed the survey independently and then discussed the interpretation of individual habitat attribute scores, averaging individual scores when necessary.

Table 2. PA DEP ICE Protocol Habitat Metrics

Habitat Parameter	Description
Instream Cover (Fish)	Mix of boulder, cobble or other stable habitat
Epifaunal Substrate	Length/width of riffles; characterization of boulders, gravel, cobble
Embeddedness	Presence/absence of fine sediment around boulders, gravel, cobble
Velocity/Depth Regimes	Presence/absence of four velocity/depth regimes
Channel Alteration	Degree of channelization or dredging
Sediment Deposition	Measure of sediment deposits, degree of change at the bottom
Frequency of Riffles	Occurrence of riffles and distance between riffles
Channel Flow Status	Degree to which water fills the available channel
Condition of Banks	Stability of streambanks and presence of erosion or bank failure
Bank Vegetative Protection	Percentage of streambank surface covered by vegetation
Grazing or Other Disruptive Pressure	Degree to which vegetation disrupted by grazing or mowing
Riparian Vegetative Zone Width	Width of riparian zone and determination of impact on vegetation by human activities

Data Analysis

Benthic macroinvertebrate and habitat data were compiled in a Microsoft Access database and queries were used to calculate scoring metrics. Individual metric standardized scores and the PADEP Index of Biotic Integrity (IBI) were calculated using the ICE protocol (Table 3).

Table 3. PADEP ICE Protocol Metrics and Metric Standardization Values

Metric	Standardization Value
Total Taxa Richness	33
EPT Taxa Richness (PTV 0-4)	19
Beck's Index, version 3	38
Hilsenhoff Biotic Index	1.89
Shannon Diversity	2.86
Percent Sensitive Individuals (PTV 0-3)	84.5

Monitoring Locations

Assessments were performed at 9 USGS gage sites, 12 sites in the targeted Poquessing watershed, and 4 randomly chosen sites from PWD's watershed assessment site network between 3/15/2018 and 4/11/2018 (Figure 1, Tables 4-5). USGS stream gaging stations are used as long-term monitoring points at which streamflow and continuous water chemistry data are collected (refer to PWD-USGS Cooperative Water Quality Monitoring appendix). Water chemistry grab sampling for nutrient and bacterial parameters is also conducted at these USGS gage stations on a quarterly basis (refer to PWD Quarterly Dry Weather Water Quality Monitoring appendix). Combining different forms of monitoring at the same station allows for better integration of information and may enable more sophisticated analyses in the future.

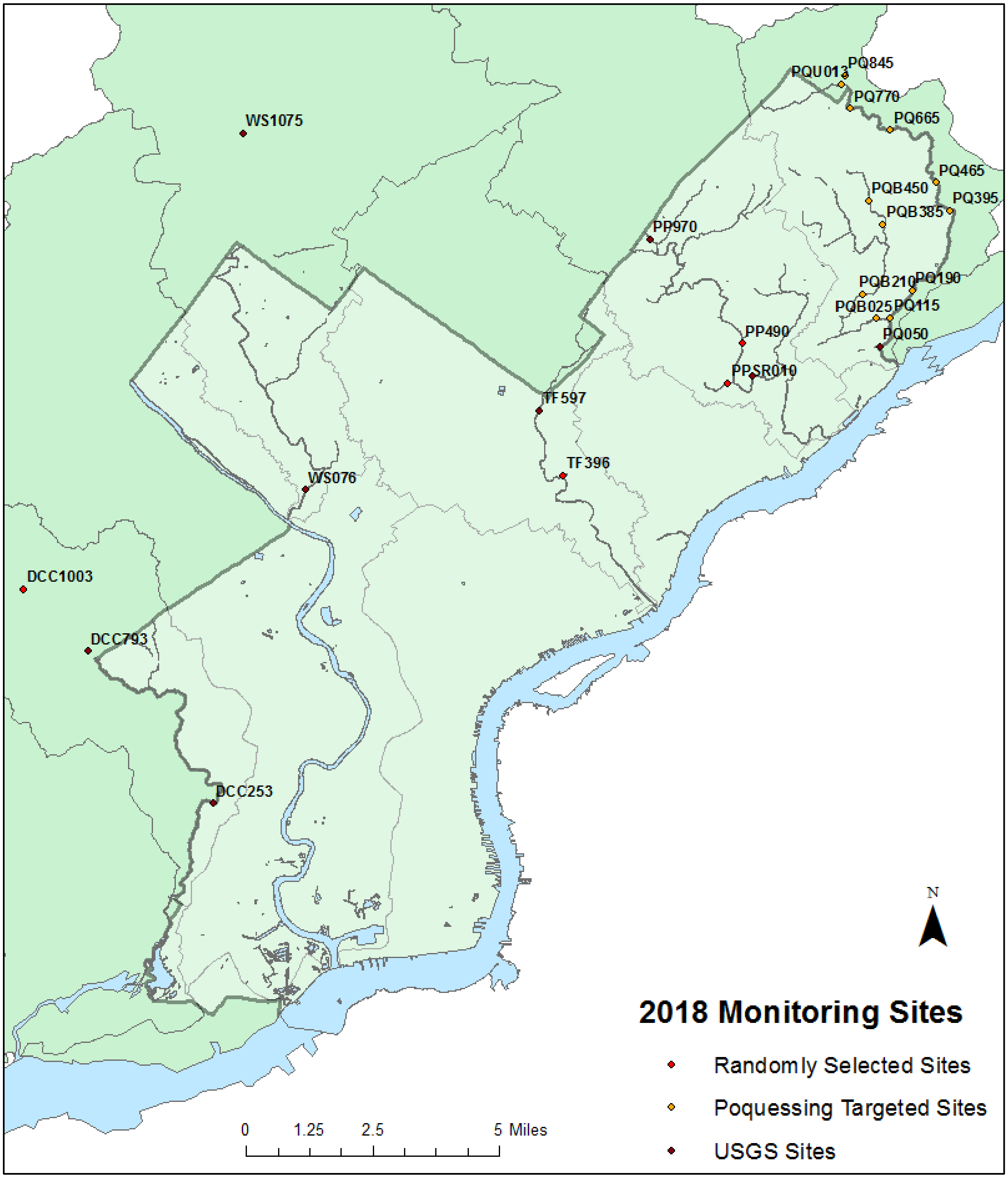


Figure 1. PWD Wadeable Streams Assessment Locations - Spring 2018

Table 4. PWD-USGS Cooperative Monitoring Program Sites

Site ID	USGS Gage	Site Description	Drainage Area (mi^2)
DCC253	01475548	Cobbs Creek at Mount Moriah Cemetery	19.78
DCC793	01475530	Cobbs Creek at City Line Ave.	4.60
PP340	01467048	Pennypack Creek at Lower Rhawn St bridge	49.84
PP970	01467042	Pennypack Creek at Pine Rd.	39.34
PQ053	01465798	Poquessing Creek at Holy Family College	21.67
TF324	01467087	Frankford Creek at Castor Ave.	29.69
TF597	01467086	Tacony Creek below Adams Ave. Bridge	16.25
WS076	01474000	Wissahickon Creek at Ridge Ave.	63.22
WS1075	01473900	Wissahickon Creek at Ft. Washington	40.44

Table 5. Pennypack Mainstem and Random Monitoring Sites, Spring 2018

Site ID	Site Description	Drainage Area (mi^2)
PQ115	Red Lion Rd bridge, US of Byberry conflu.	13.5
PQ190	3300 ft DS of Route 63 bridge; at end of Wickley Rd	13.2
PQ395	600 ft DS of Knights Rd bridge (Franklin Mills Mall)	10.2
PQ465	250 ft US of Dunks Ferry Rd bridge	8.9
PQ665	500 ft DS of Roosevelt Blvd. bridge	6.4
PQ770	700 ft US of railroad bridge; at end of Kallaste St	5.5
PQ845	500 ft DS of Philmont Rd bridge	1.5
PQB025	700 ft US of Knights Rd bridge (behind Crestmont Ave houses)	7.4
PQB210	700 ft DS of Morrell Ave bridge (adj. to Churchill Rd)	5.8
PQB385	250 ft US of Academy Rd bridge	2.0
PQB450	100 ft US of Thornton Rd bridge	1.6
PQU013	700 ft US of Trevose Rd bridge	1.8
TF396	1000 ft US of Fishers Ln bridge (behind Friends Hospital)	21.0
PP490	650 ft US of Holme Ave bridge	46.2
DCC1003	Hathaway bridge off Hathaway Ln	2.4
PPSR010	500 ft US of Pennypack conflu.	2.7

Benthic Macroinvertebrate Monitoring Results - Spring 2018

A total of 5,333 benthic macroinvertebrates from 43 taxa were collected from the 25 sampling sites. When compared to PADEP ICE protocol metric reference conditions, all assessment sites were classified as impaired. Not one of the sites achieved 63% comparability of the reference IBI for attaining the designated use (Figure 2). All sites fell below 50% comparability, meaning that they are not meeting the Aquatic Life Use (ALU) designation. Percent comparability with the standard reference IBI score ranged from 14.1% to 31.7%. All sites were characterized by low taxa richness, low or absent modified EPT taxa, and elevated Hilsenhoff Biotic Index scores (Table 6, Figures 2-5).

Table 6. PADEP ICE Metric Scores

Site ID	Taxa Richness	EPT richness (PTV 0-4)	% Sensitive individuals	Beck's Index	HBI	Shannon Index	IBI score
PQ054	16	1	0.917	0	6.09	1.479	25.8
PQ115	14	1	1.370	1	5.82	0.941	22.7
PQ190	11	1	0.472	0	5.95	0.676	18.8
PQ395	13	1	0.418	1	6.00	0.444	18.8
PQ465	15	1	1.826	0	5.65	1.314	25.4
PQ665	14	2	4.000	4	5.58	1.402	28.6
PQ770	9	1	1.667	0	5.90	0.571	17.5
PQ845	10	2	3.382	3	5.56	1.164	24.7
PQU013	8	1	0.990	0	5.80	0.830	18.6
PQB025	13	1	1.408	0	5.91	1.108	22.6
PQB210	11	1	1.835	0	5.78	1.103	21.9
PQB385	11	0	0.418	1	5.94	1.214	21.5
PQB450	9	0	0	0	5.90	0.665	16.8
TF324	14	0	0	0	7.77	1.338	19.5
TF396	15	0	0.493	1	6.80	1.801	25.2
TF597	11	1	1.951	0	5.96	1.212	22.2
WS076	14	1	0.562	1	6.17	1.458	24.9
WS1075	7	0	0	0	7.50	0.928	14.1
PP340	18	2	1.255	1	5.78	1.421	28.5
PP490	14	1	0.901	1	5.75	1.056	23.5
PP970	12	2	0.976	3	5.83	1.092	24.3
DCC253	17	1	0.5	0	7.85	1.788	24.4
DCC793	13	1	4.036	1	5.68	1.084	23.9
DCC1003	20	2	2.358	3	5.84	1.629	31.7
PPSF010	7	0	0	0	6.54	0.926	16

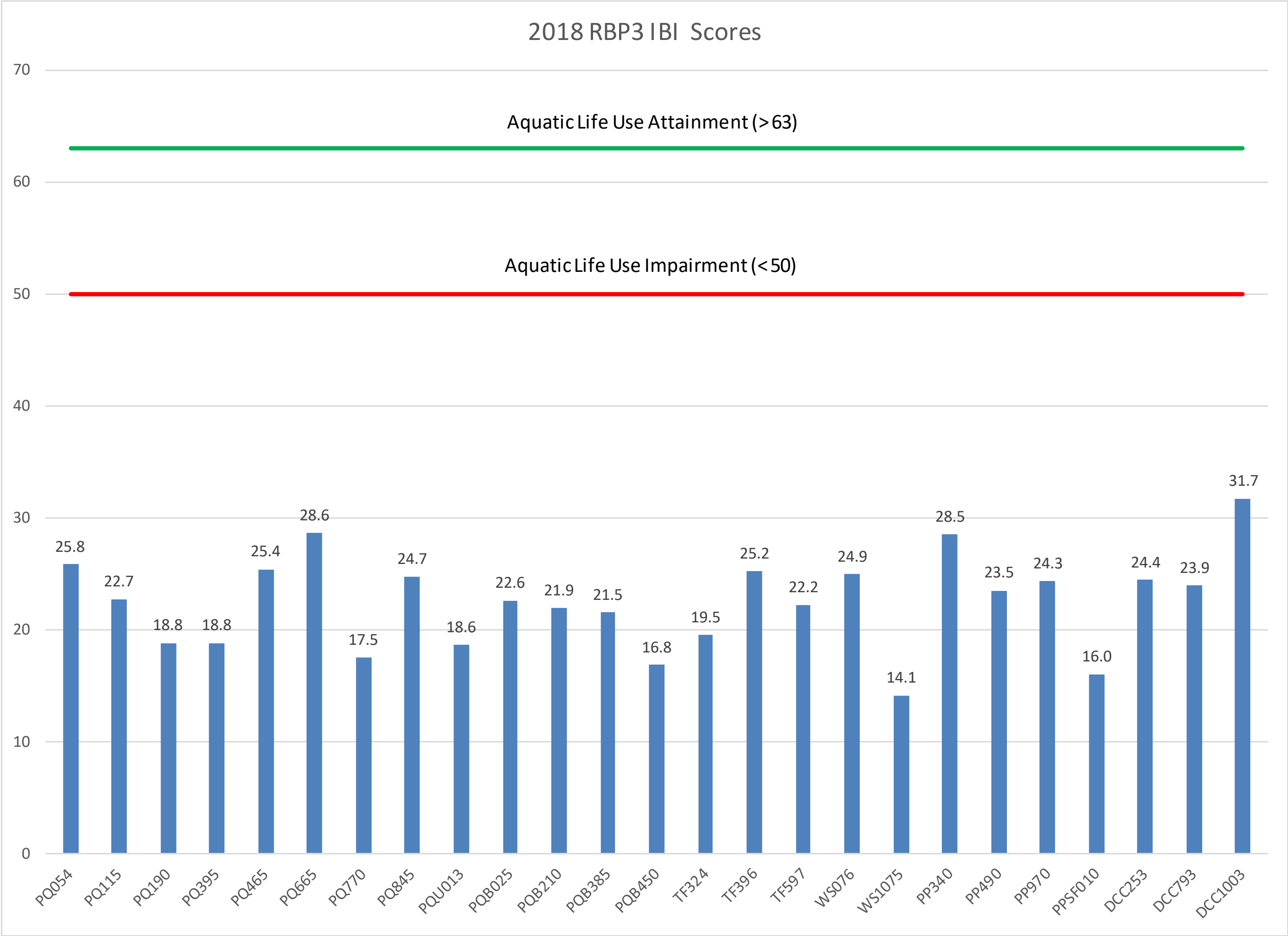


Figure 2. Macroinvertebrate IBI Scores - Spring 2018

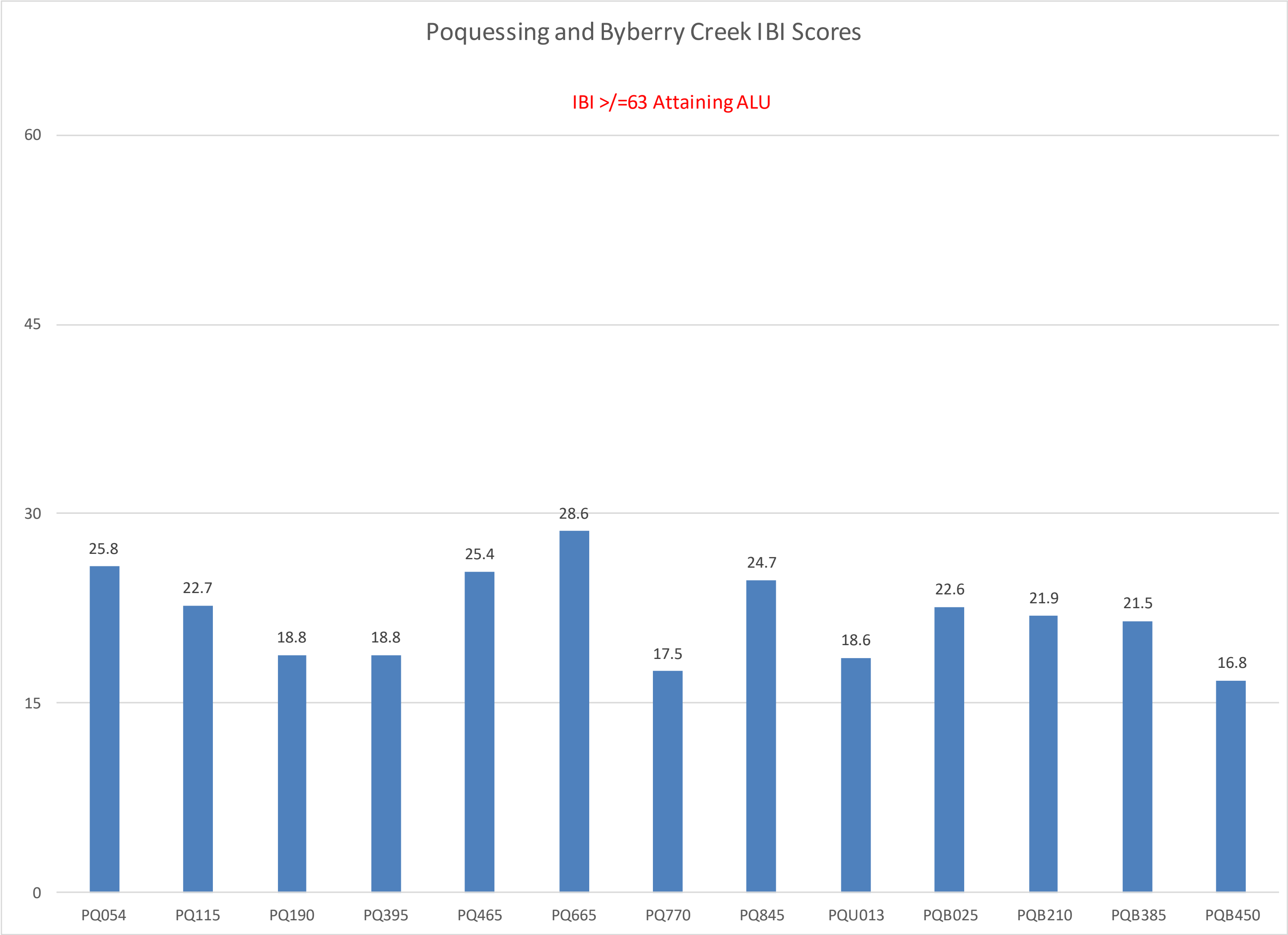


Figure 3. Poquessing and Byberry Creek IBI Scores – Spring 2018

Very sensitive taxa (pollution tolerance value ≤ 2) were present at 11 of the 25 sites assessed in spring 2018. Poquessing Creek site PQ665 had the highest Beck's Index score (n=4) and included two taxa: *Glossosoma* (Trichoptera; Glossosomatidae) and *Ancyronyx* (Coleoptera; Elmidae). All sites fell below the PADEP reference standard for Percent Intolerant Taxa metric (PTV = 0 to 3) of 84.5%.

Overall diversity was low among all sites. The Shannon Diversity Index scores for all sites ranged from 0.444 to 1.801, compared to the reference metric value of 2.86. The site with the greatest diversity was the Tacony Creek site TF396 (SDI=1.801), with a taxa richness (n=15), EPT taxa richness (n=0), and HBI (25.2).

The Hilsenhoff Biotic Index (HBI) is a metric used to determine the overall pollution tolerance of a site's benthic macroinvertebrate community. This community composition and tolerance metric generally increases with increasing ecosystem stress, resulting in increasing dominance of pollution-tolerant organisms. Oriented toward the detection of organic pollution, HBI scores can range from 0 (very sensitive) to 10 (very tolerant). The average HBI for all sites was 6.13, and scores at the 25 assessment sites ranged from 5.56 to 7.85 (Figure 4).

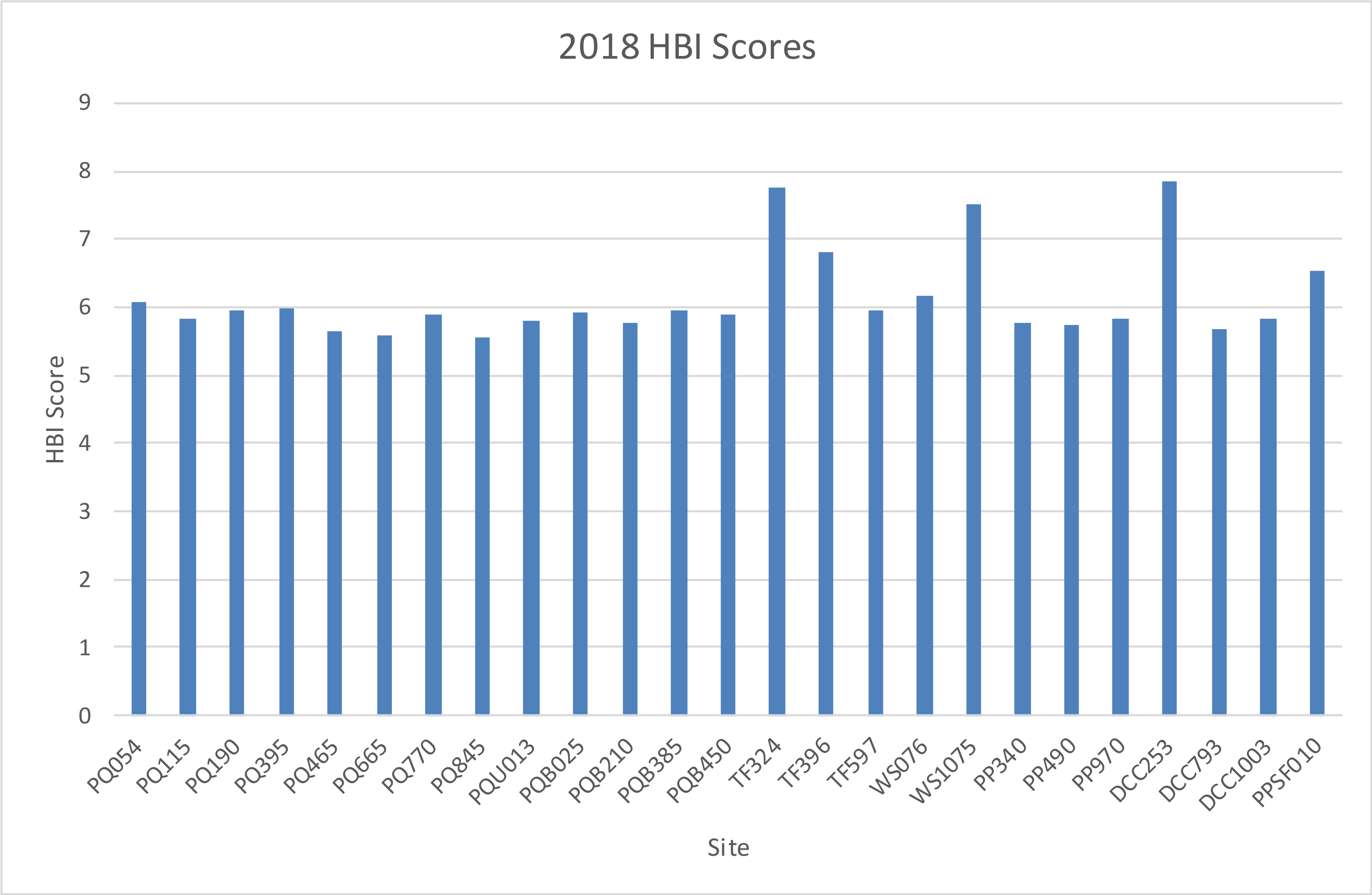


Figure 4. HBI Scores - Spring 2018

In addition to metrics used to classify sites as being impaired with respect to regional or statewide reference conditions, additional attributes of macroinvertebrate community structure were also considered at the Poquessing sites. With regard to trophic structure (*i.e.*, the distribution of feeding strategies), generalist feeders (79.49%) dominated at all Poquessing assessment sites (Figure 5).

Specialized feeders—a group that is generally more sensitive to perturbation than generalist feeders—were absent or found in low abundance. Scrapers comprised 7.54% of all taxa. The scrapers in question were usually not sensitive insect larvae but rather aquatic snails and *Stenelmis* (Coleoptera; Elmidae). Other functional feeding groups, predators (3.51%) and shredders (0.03%), were observed in the macroinvertebrate assessment but to a much lesser extent. Analysis of the aquatic trophic structure can indicate potential stressors such as sedimentation/siltation and eutrophication, and it may identify food resource limitations. However, it cannot distinguish between the interactions of the two factors.

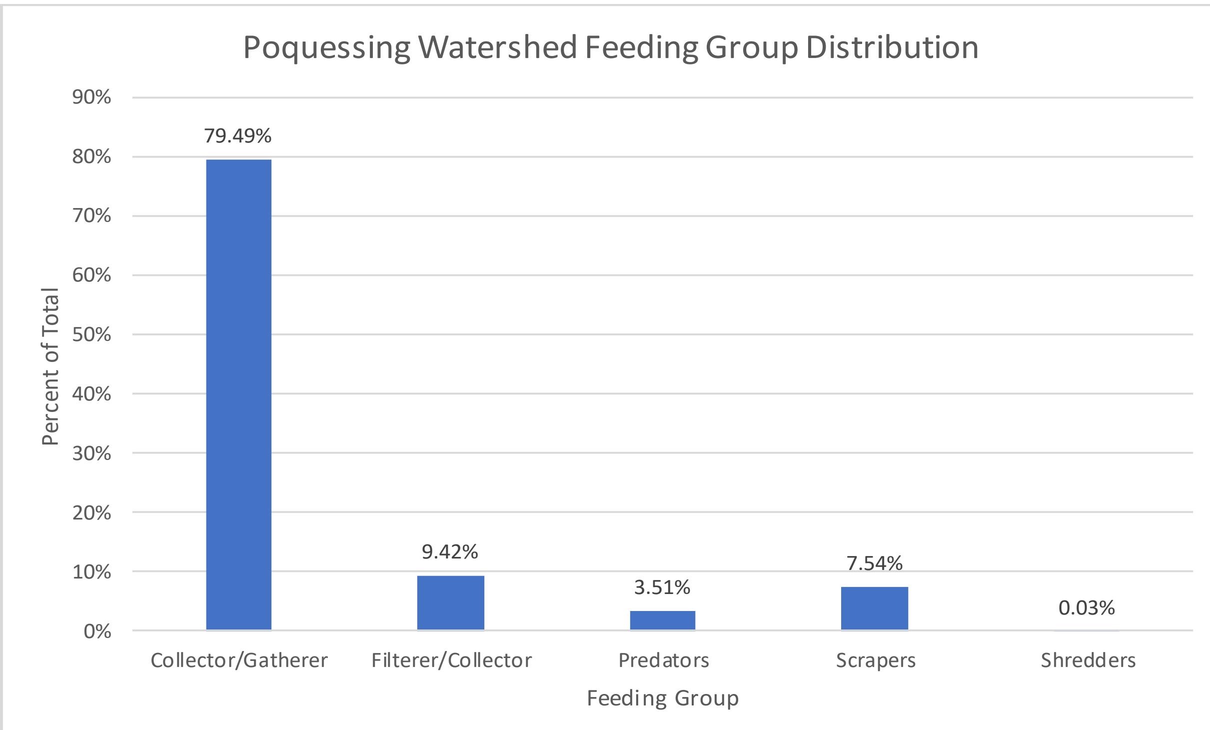


Figure 5. Feeding Group Percent Distribution - Spring 2018

Tolerance/intolerance measures are intended to be representative of relative sensitivity to perturbation and may include numbers of pollution tolerant and intolerant taxa or percent composition (Barbour *et al*., 1999). The proportion of moderately tolerant individuals at all sites averaged 86.61%, with a range of 51.42% to 97.79%. The site with the greatest proportion of moderately tolerant taxa was PQB450, with 97.79% dominance directly related to a high number of Chironomidae (n=193) found within the sorted sample (n=226). Overall, Chironomids (Figure 6) were the dominant taxon at all of the assessment locations. The proportional dominance of Chironomids is evidence of increasingly homogenous community assemblages within the selected monitoring sites. Chironomids and other pollution-tolerant, generalist species increase in proportional dominance with increased disturbance due to the loss of optimal habitat conditions for less tolerant, more specialized species.

Figure 6. Chironomid, or non-biting midge
Photo: Simon Johnston

Tolerant taxa accounted for an average of 8.27% of all taxa, and the proportion of tolerant taxa at each monitoring site ranged from 0% to 46.23%. Intolerant taxa were also poorly represented, averaging 5.11% of all taxa collected at the sites. The proportion of intolerant taxa at each site ranged from 0.48% to 12.89%.

Sensitive taxa (pollution tolerance values ≤ 3) were collected at 21 of the 25 sites (Table 7). The rarity of sensitive taxa suggests a response to watershed-wide perturbation, such as water quality degradation. Other potential explanations for the rarity of sensitive taxa are habitat degradation caused by fine sediment delivered to the stream channel via bank erosion or stormwater runoff and changes in seasonal base flow and temperature that tend to accompany urbanization. *Antocha* (Diptera; Tipulidae, pollution tolerance value n=3) were found at 17 sites and were the most commonly collected sensitive taxa.

Table 7. Sensitive Taxa Collected

Site	Order	Family	Genus	HBI
PQ054	Diptera	Tipulidae	*Antocha*	3
PQ115	Diptera	Tipulidae	*Antocha*	3
PQ115	Coleoptera	Elmidae	*Ancyronyx*	2
PQ190	Diptera	Tipulidae	*Antocha*	3
PQ395	Coleoptera	Elmidae	*Ancryonyx*	2
PQ465	Diptera	Tipulidae	*Antocha*	3
PQ665	Trichoptera	Glossosomatidae	*Glossosoma*	0
PQ665	Diptera	Tipulidae	*Antocha*	3
PQ665	Coleoptera	Elmidae	*Ancyronyx*	2
PQ770	Diptera	Tipulidae	*Antocha*	3
PQ845	Trichoptera	Glossosomatidae	*Glossosoma*	0
PQ845	Diptera	Tipulidae	*Antocha*	3
PQU013	Diptera	Tipulidae	*Antocha*	3
PQB025	Diptera	Tipulidae	*Antocha*	3
PQB210	Diptera	Tipulidae	*Antocha*	3
PQB385	Coleoptera	Elmidae	*Ancryonyx*	2
TF396	Coleoptera	Elmidae	*Ancyronyx*	2
TF597	Diptera	Tipulidae	*Antocha*	3
WS076	Coleoptera	Elmidae	*Ancyronyx*	2
PP340	Diptera	Tipulidae	*Antocha*	3
PP340	Coleoptera	Elmidae	*Ancyronyx*	2
PP490	Diptera	Tipulidae	*Antocha*	3
PP490	Coleoptera	Elmidae	*Macronychus*	2
PP970	Trichoptera	Glossosomatidae	*Glossosoma*	0
PP970	Diptera	Tipulidae	*Antocha*	3
DCC253	Diptera	Tipulidae	*Antocha*	3
DCC793	Diptera	Tipulidae	*Antocha*	3
DCC793	Coleoptera	Elmidae	*Ancyronyx*	2
DCC1003	Trichoptera	Glossosomatidae	*Glossosoma*	0
DCC1003	Diptera	Tipulidae	*Antocha*	3

Table 8. 2018 Benthic Macroinvertebrate Taxa List

Order	Family	Genus
Amphipoda	Crangonyctidae	*Crangonyx*
Amphipoda	Gammaridae	*Gammarus*
Bivalvia	Corbiculidae	*Corbicula*
Bivalvia	Sphaeriidae	*sp*
Coleoptera	Elmidae	*Ancyronyx*
Coleoptera	Elmidae	*Dubiraphia*
Coleoptera	Elmidae	*Macronychus*
Coleoptera	Elmidae	*Optioservus*
Coleoptera	Elmidae	*Oulimnius*
Coleoptera	Elmidae	*Stenelmis*
Coleoptera	Psephenidae	*Psephenus*
Collembola	Onychiuridae	*sp*
Decapoda	Cambaridae	*sp*
Diptera	Ceratopogonidae	*Culicoides*
Diptera	Chironomidae	*spp*
Diptera	Empididae	*Chelifera*
Diptera	Empididae	*Hemerodromia*
Diptera	Psychodidae	*Pericoma*
Diptera	Psychodidae	*Psychoda*
Diptera	Simuliidae	*Simulium*
Diptera	Tipulidae	*Antocha*
Diptera	Tipulidae	*Tipula*
Ephemeroptera	Baetidae	*Baetis*
Ephemeroptera	Heptageniidae	*Stenacron*
Gastropoda	Ancylidae	*sp*
Gastropoda	Lymnaeidae	*sp*
Hirudinea		
Hydracarina		
Isopoda	Asellidae	*Caecidotea*
Oligochaeta		
Trichoptera	Glossosomatidae	*Glossosoma*
Trichoptera	Hydropsychidae	*Cheumatopsyche*
Trichoptera	Hydropsychidae	*Hydropsyche*
Trichoptera	Hydroptilidae	*Hydroptila*
Trichoptera	Hydroptilidae	*Leucotrichia*
Trichoptera	Philopotamidae	*Chimarra*
Trichoptera	Polycentropodidae	*Nyctiophylax*
Turbellaria	Nematoda	
Turbellaria	Nemertea	
Turbellaria	Planariidae	*sp*
Zygoptera	Calopterygidae	*Calopteryx*
Zygoptera	Coenagrionidae	*Argia*
Zygoptera	Coenagrionidae	*Enallagma*

Physical Habitat Monitoring Results - Spring 2018

Habitat impairments such as hydrologic extremes (*i.e.*, low base flow and accentuated flow during storm events), physical obstructions, and sedimentation/siltation appear to be the major environmental stressors on the aquatic ecosystem. Accumulation of sediment in the interstitial spaces of riffles has been shown to limit available habitat and possibly smother benthic invertebrate life stages (Runde and Hellenthal, 2000). Only one site (PQB450) received an optimal score for embeddedness, and no sites received optimal status for sediment deposition for habitat (Table 9). The Poquessing tributary site PQB025 (Byberry Creek) had the worst total habitat scores of all sites, while Cobbs Creek mainstem site DCC793 had the best scores for all sites (Table 9, Figure 7).

Table 9. Physical Habitat Scores at All Monitoring Sites - Spring 2018

Site ID	Instream	Epifaunal	Embed	Veldep	Chanalt	Seddep	Riffreq	Chanflo	Bankcond	Vegpro	Graze	Ripveg	Total Score
DCC253	7.5	7.5	5	9	13	8	8	14.5	11	14.5	16	14	128
DCC793	16.5	15	13	17	16.5	13	15	11.5	12.5	17	18.5	17.5	183
WS076	13.5	12.5	9.5	16.5	9	12	8	14.5	11.5	9.5	14	8	138.5
WS1075	11	9.5	11.5	13.5	15	10	8.5	16	13	17	18	16	159
PP340	12	11.5	12.5	12.5	15	12.5	16.5	14	13	17	17	17	170.5
PP970	14.5	14	13	16.5	18	6.5	14.5	9.5	9.5	10.5	9.5	15	151
PQ054	10	11.5	10	12	16	9	9	13	6.5	14.5	16.5	10.5	138.5
TF324	11	6	5	12	10	9.5	13.5	9.5	7	10.5	7	9.5	110.5
TF597	7	10.5	6	10	10.5	9.5	7	11	11.5	12	16	15	126
PQB025	4.5	5	6	8	11	3.5	5	13	6	11	12	7	92
PQB210	5	5	5	8	13.5	4.5	8.5	13	8.5	11	12	7.5	101.5
PQB385	10	11.5	7.5	13	16	11	9	13	7.5	14	13.5	10.5	136.5
PQB450	9	9	16	9	13.5	14	16	13.5	15	17.5	17	11.5	161
POU013	9	8.5	9.5	14.5	17	8.5	7.5	9	5	17	17	17	139.5
PQ115	15	13.5	16	16.5	14	12	16.5	10	11.5	17	13.5	9.5	165
PQ190	10	11	9	12.5	14	9.5	7.5	11.5	10	13.5	11.5	11	131
PQ395	15	12	8	13.5	16	8	12	10	5.5	11.5	14.5	15	141
PQ465	14.5	13.5	11.5	14.5	16	14.5	14.5	15	14	16	11.5	9	164.5
PQ665	10	10	8	11	11.5	12	11.5	13.5	6.5	9	11	9	123
PQ770	8.5	11.5	11	12	14.5	10	14.5	13.5	7.5	14.5	17	14.5	149
PQ845	9	11.5	13	12	14.5	9.5	13	10	5.5	16	15.5	16	145.5
TF396	14.5	13.5	9.5	15.5	8.5	7	9	9	10	13	16	14	139.5
PP490	11	9	9	16	14	13	7.5	14.5	5	9.5	16	15	139.5
DCC1003	10.5	12	12	12	12	11.5	12	11.5	10	11.5	9.5	8.5	133
PPSF010	4.5	4	3	3.5	12	9.5	4	4.5	5	15	16	16	97

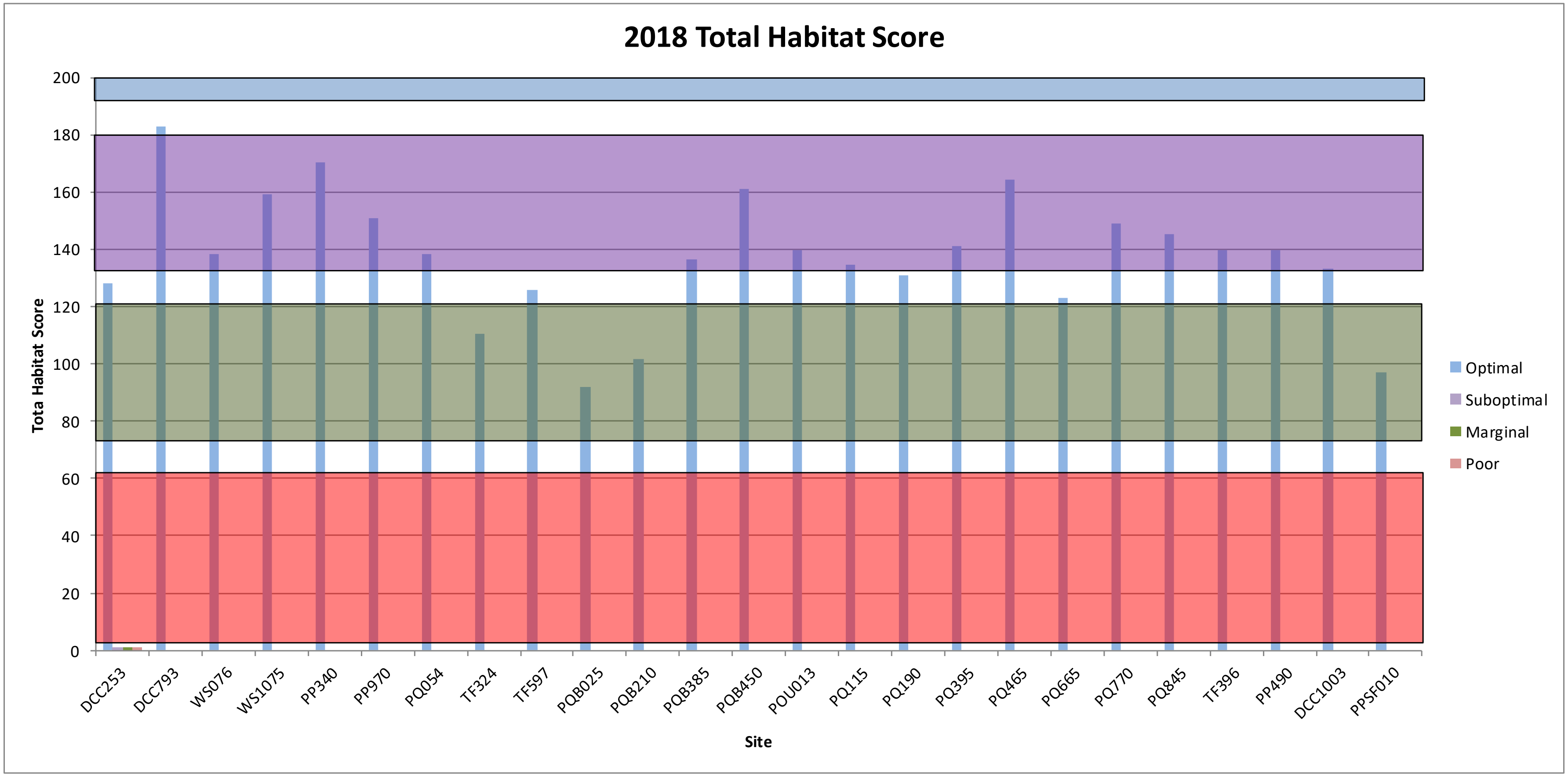
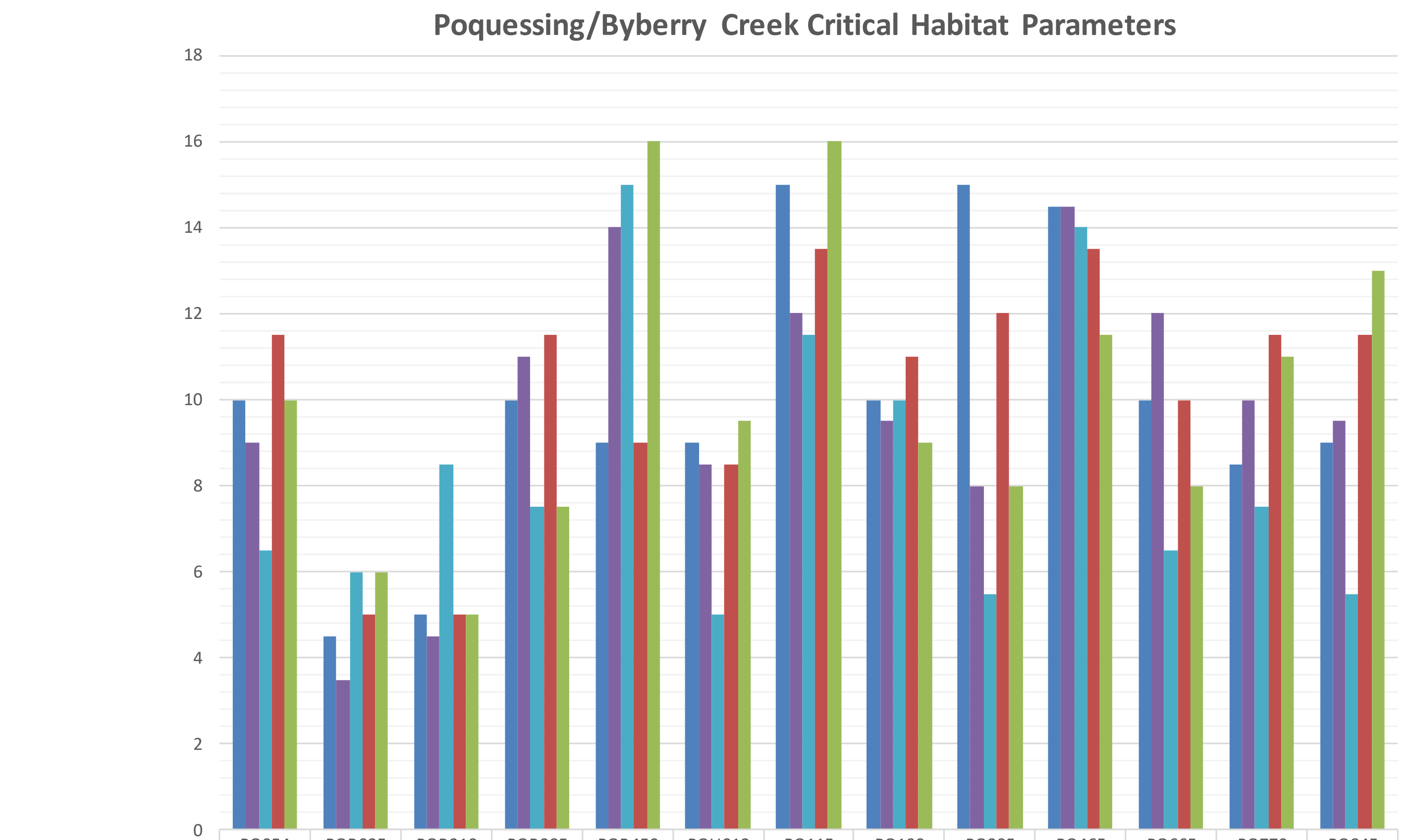


Figure 7. Habitat Scores, Spring 2018



	PQ054	PQB025	PQB210	PQB385	PQB450	POU013	PQ115	PQ190	PQ395	PQ465	PQ665	PQ770	PQ845
Instream Cover	10	4.5	5	10	9	9	15	10	15	14.5	10	8.5	9
Sediment Deposition	9	3.5	4.5	11	14	8.5	12	9.5	8	14.5	12	10	9.5
Condition of Banks	6.5	6	8.5	7.5	15	5	11.5	10	5.5	14	6.5	7.5	5.5
Epifaunal substrate	11.5	5	5	11.5	9	8.5	13.5	11	12	13.5	10	11.5	11.5
Embeddedness	10	6	5	7.5	16	9.5	16	9	8	11.5	8	11	13

Figure 8. Poquessing/Byberry Creek Critical Habitat Parameters, Spring 2018

Although it is much too early to draw conclusions regarding trends at the eight long-term PWD-USGS cooperative monitoring sites, embeddedness and sediment deposition results are shown below (Figures 8-9). Many factors contribute to interannual variability in the data, and it is hoped that future work will provide some insight into long-term trends.

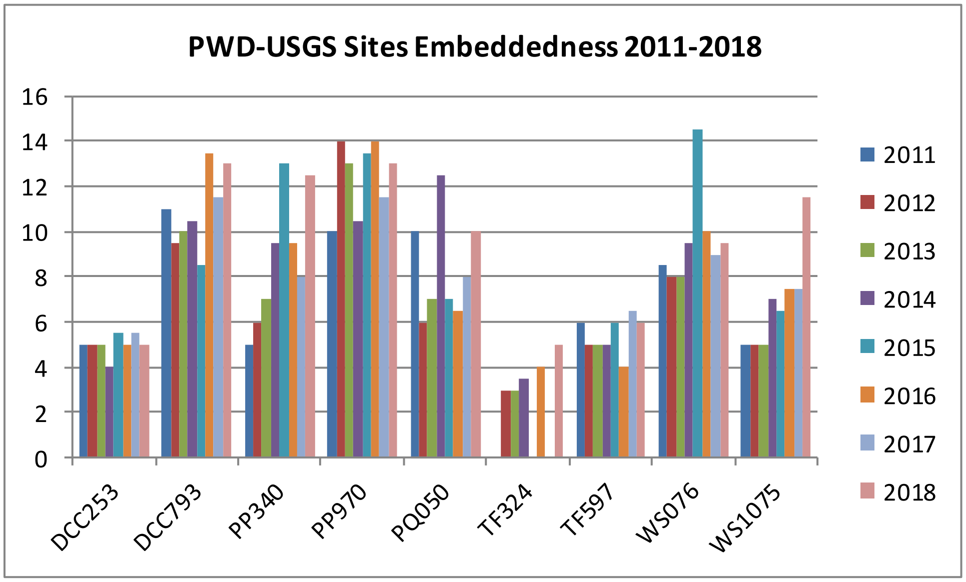


Figure 9. Comparison of PWD-USGS Sites Embeddedness Scores, 2011-2018*

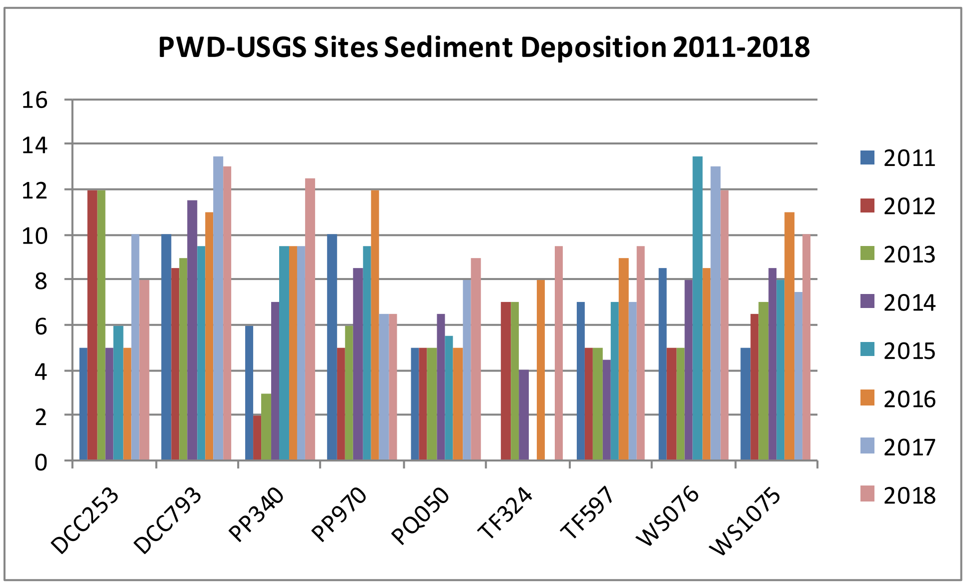


Figure 10. Comparison of PWD-USGS Sites Sediment Deposition Scores, 2011-2018*

*In 2013, samples for TF324 were taken from nearby site TF328. TF324 was not sampled in 2015 and 2017.

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Appendix K – NPDES Industrial Stormwater Permitted Sites – Philadelphia County

Authority ID	Permit Type	Site Name	Program Description	Site Address
PAG-03 General				
961161	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	ABF FREIGHT SYS	Clean Water	4000 RICHMOND ST PHILADELPHIA, PA 19137
1154204	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	ADVANSIX INC	Clean Water	MARGARET & BERMUDA STS PHILADELPHIA, PA 19137-1193
1100082	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	ALLEGHENY IRON & METAL TACONY ST FAC	Clean Water	TACONY ST & ADAMS AVE PHILADELPHIA, PA 19124
329442	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	AMER AUTO PARTS 61ST STREET FAC	Clean Water	3501 S 61ST ST PHILADELPHIA, PA 19153
878137	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	ARDEX LAB	Clean Water	2050 BYBERRY RD PHILADELPHIA, PA 19116
1016261	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	ATLANTIC AVIATION ENTERPRISE AVE FAC	Clean Water	8375 ENTERPRISE AVE PHILADELPHIA, PA 19153
1032035	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	ATLANTIC USED AUTO PARTS ESSINGTON AVE FAC	Clean Water	6544 ESSINGTON AVE PHILADELPHIA, PA 19153
1041802	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	B & L AUTO PARTS 61ST STREET FAC	Clean Water	3404 S 61ST ST PHILADELPHIA, PA 19153
1039992	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	BIG HEAD AUTO SALVAGE CORP	Clean Water	3511 S 61ST ST PHILADELPHIA, PA 19153
1081872	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	BILL'S AUTO PARTS PASSYUNK AVE FAC	Clean Water	6235 PASSYUNK AVE PHILADELPHIA, PA 19153
856840	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	BRITTON IND INC	Clean Water	8901 TORRESDALE AVE PHILADELPHIA, PA 19154
325198	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	BUDD PHILA PLT	Clean Water	2450 HUNTINGPARK AVE PHILADELPHIA, PA 19129
1041005	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	C&E AUTO PARTS ESSINGTON AVE	Clean Water	6796 ESSINGTON AVE PHILADELPHIA, PA 19153
1137392	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	CARTEL AUTO PARTS W PASSYUNK AVE FAC	Clean Water	6330 W PASSYUNK AVE PHILADELPHIA, PA 19153
1102641	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	CLEAN EARTH OF PHILA FAC	Clean Water	3201 S 61ST ST PHILADELPHIA, PA 19153-3502

Authority ID	Permit Type	Site Name	Program Description	Site Address
1100654	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	CONRAIL - ANN STREET YARD	Clean Water	2801 E ANN STREET PHILADELPHIA, PA 19134
1100667	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	CONRAIL - FRANKFORD JUNCTION YARD	Clean Water	2110 E BUTLER ST PHILADELPHIA, PA 19124
1100662	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	CONRAIL - SOUTH PHILLY YARD	Clean Water	11TH ST & TERMINAL RD PHILADELPHIA, PA 19112
1165282	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	CONTANDA TERMINALS	Clean Water	2900 E ALLEGHENY AVE PHILADELPHIA, PA 19134-6302
1002506	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	CSX INTERMODAL CHRISTOPHER COLUMBUS AVE FAC	Clean Water	3400 S CHRISTOPHER COLUMBUS BLVD PHILADELPHIA, PA 19148
1020028	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	DAVE'S DELAWARE VALLEY TOWING PASSYUNK AVE FAC	Clean Water	6159 PASSYUNK AVE PHILADELPHIA, PA 19153
577993	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	DHL EXPRESS COLUMBUS BLVD FAC	Clean Water	1101 N CHRISTOPHER COLUMBUS BLVD PHILADELPHIA, PA 19125
973172	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	DHL EXPRESS HOLSTEIN AVE FAC	Clean Water	7600 HOLSTEIN AVE PHILADELPHIA, PA 19153
1161694	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	DUFFEY OIL TERM	Clean Water	2700 ROBERTS AVE PHILADELPHIA, PA 19129
1086796	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	ECO ENERGY PHILLY	Clean Water	3400 S CHRISTOPHER COLUMBUS BLVD PHILADELPHIA, PA 19148-5110
1033602	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	ESSINGTON AVE AUTO PARTS FAC	Clean Water	6746 ESSINGTON AVE PHILADELPHIA, PA 19153
1138130	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	EXELON RICHMOND GENERATING STA	Clean Water	3901 N DELAWARE AVE PHILADELPHIA, PA 19137
970846	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	FC HAAB SCHUYLKILL AVE TERM	Clean Water	SCHUYLKILL AVE & MORRIS ST PHILADELPHIA, PA 19145
1029239	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	FEDEX TOWNSEND RD FAC	Clean Water	14300 TOWNSEND RD PHILADELPHIA, PA 19154
329466	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	FIORES AUTO PARTS 61ST STREET FAC	Clean Water	3300 S 61ST ST PHILADELPHIA, PA 19153
1222888	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	FIRST TRANSIT	Clean Water	2500 WHEATSHEAF LN PHILADELPHIA, PA 19137

Authority ID	Permit Type	Site Name	Program Description	Site Address
1008654	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	GREENWICH TERM S COLUMBUS BLVD FAC	Clean Water	3301 S COLUMBUS BLVD PHILADELPHIA, PA 19148
813532	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	HAROLDS USED AUTO PARTS WHITBY AVE FAC	Clean Water	5347 WHITBY AVE PHILADELPHIA, PA 19143
1240915	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	IVD LLC	Clean Water	10101 ROOSEVELT BLVD PHILADELPHIA, PA 19154
1047066	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	JACK'S AUTO PARTS S 61ST ST FAC	Clean Water	3517-3555 S 61ST ST PHILADELPHIA, PA 19153
1033629	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	JIM'S AUTO RECYCLING W PASSYUNK AVE FAC	Clean Water	6299 W PASSYUNK AVE PHILADELPHIA, PA 19153
1056063	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	KANCO METALS INC	Clean Water	4601 BATH ST PHILADELPHIA, PA 19137-2216
1137723	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	KINDER MORGAN POINT BREEZE TERM	Clean Water	6310 W PASSYUNK AVE PHILADELPHIA, PA 19153-3517
1035983	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	LKQ VENICE AUTO PARTS	Clean Water	3350 SOUTH 61ST STREET PHILADELPHIA, PA 19153
21593	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	METRO MACH OF PA SHIP REPAIR FAC	Clean Water	FOOT OF MORTON AVE CHESTER, PA 19013
1043263	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	NAVAL FOUNDRY AND PROPELLER CTR	Clean Water	1701 KITTY HAWK AVE PHILADELPHIA, PA 19112-5087
1133700	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	NORTHEAST PHILADELPHIA AIRPORT (PNE)	Clean Water	9800 ASHTON RD PHILADELPHIA, PA 19114
1088603	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	ORTHODOX AUTO UNRUH AVE FAC	Clean Water	5247 UNRUH AVE PHILADELPHIA, PA 19135
1070573	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	OSCAR'S AUTO PARTS PASSYUNK AVE FAC	Clean Water	6145 W PASSYUNK AVE PHILADELPHIA, PA 19153
326557	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	PAARNG FT MIFFLIN FAC	Clean Water	BLDG 56 FORT MIFFLIN PHILADELPHIA, PA 19153
326472	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	PAARNG OGONTZ OMS 14A	Clean Water	5350 OGONTZ AVE PHILADELPHIA, PA 19141
326466	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	PAARNG SOUTHAMPTON FAC	Clean Water	2734 SOUTHAMPTON RD PHILADELPHIA, PA 19154

Authority ID	Permit Type	Site Name	Program Description	Site Address
887155	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	PASCO PASCHALL AVE FAC	Clean Water	7250 PASCHALL AVE PHILADELPHIA, PA 19142
1135947	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	PEPSI BOTTLING ROOSEVELT BLVD PLT	Clean Water	11701 ROOSEVELT BLVD PHILADELPHIA, PA 19154-2108
1101644	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	PHILA GAS WORKS PASSYUNK AVE PLT	Clean Water	3100 PASSYUNK AVE PHILADELPHIA, PA 19145
459823	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	PHILA WATER DEPT NE WPCP	Clean Water	3895 RICHMOND ST PHILADELPHIA, PA 19137-1418
459790	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	PHILA WATER DEPT SE WPCP	Clean Water	25 PATTISON AVE PHILADELPHIA, PA 19148-5607
459812	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	PHILA WATER DEPT SW WPCP	Clean Water	8200 ENTERPRISE AVE PHILADELPHIA, PA 19153-3813
1223833	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	RECLEIM PA LLC PHILA PLT	Clean Water	4301 N DELAWARE AVE PHILADELPHIA, PA 19137
929399	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	REPUBLIC SVC OF PA PORT RICHMOND HAULING FAC	Clean Water	3000 E HEDLEY ST PHILADELPHIA, PA 19137
931796	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	REPUBLIC SVC QUICKWAY TRANSFER STATION	Clean Water	2960 ORTHODOX ST PHILADELPHIA, PA 19137
1218996	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	RHOADS BUILDING 1028	Clean Water	4703 BASIN BRIDGE ROAD PHILADELPHIA, PA 19112
1084018	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	RICHARDSAPEX MAIN ST FAC	Clean Water	4202-24 MAIN ST PHILADELPHIA, PA 19127
1102712	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	S D RICHMAN SONS WHEATSHEAF LN FAC	Clean Water	2435 WHEATSHEAF LANE PHILADELPHIA, PA 19137
1021396	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	SEPTA ROBERTS AVE FAC	Clean Water	2705 ROBERTS AVE PHILADELPHIA, PA 19129
1044986	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	STEVE'S AUTO PARTS II S 61ST ST FAC	Clean Water	3331 S 61ST ST PHILADELPHIA, PA 19153
1081910	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	SUN CHEM HUNTING PARK AVE PLT	Clean Water	3301 HUNTING PARK AVE PHILADELPHIA, PA 19132
1107170	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	SWEET OVATIONS TOMLINSON RD FAC	Clean Water	1741 TOMLINSON RD PHILADELPHIA, PA 19116-3847

Authority ID	Permit Type	Site Name	Program Description	Site Address
1107531	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	TASTYKAKE	Clean Water	2801 HUNTING PARK AVE PHILADELPHIA, PA 19129
1017690	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	THE VANE BROTHERS CO PHILLY LAUNCH	Clean Water	4700 BASIN BRIDGE RD PHILADELPHIA, PA 19112
1008765	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	TJ COPE NORCOM RD FAC	Clean Water	11500 NORCOM RD PHILADELPHIA, PA 19154
944198	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	TRANSFLO TERM SVC MOORE ST FAC	Clean Water	36TH & MOORE ST PHILADELPHIA, PA 19145
1032066	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	UNITED METAL TRADERS COMLY ST FAC	Clean Water	5240 COMLY ST PHILADELPHIA, PA 19135-4315
921671	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	US POSTAL SVC LINDBERGH BLVD FAC	Clean Water	7500 LINDBERGH BLVD PHILADELPHIA, PA 19176-9998
1011743	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	VANE LINE BUNKERING FT MIFLIN RD FAC	Clean Water	4925 FT MIFLIN RD PHILADELPHIA, PA 19153
1152621	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	WASTE MGMT BLEIGH AVE FAC	Clean Water	5109 BLEIGH AVE PHILADELPHIA, PA
1084122	PAG-03 Discharge of Stormwater Assoc w Industrial Activities	WASTE MGMT OF PA GRAYS FERRY AVE FAC	Clean Water	3605 GREYS FERRY AVE PHILADELPHIA, PA 19146
No Exposure				
1109160	No Exposure Certification, Discharge of Stormwater Assoc w Ind Activities, PAG-03	API TECH CORP - PHILA OPS	Clean Water	2707 BLACK LAKE PLACE PHILADELPHIA, PA 19154-1008
1257040	No Exposure Certification, Discharge of Stormwater Assoc w Ind Activities, PAG-03	ARCA RECYCLING INC	Clean Water	2000 BENNETT RD PHILADELPHIA, PA 19116
1108533	No Exposure Certification, Discharge of Stormwater Assoc w Ind Activities, PAG-03	COILPLUS BLEIGH AVE FAC	Clean Water	5135 BLEIGH AVE PHILADELPHIA, PA 19136
1256809	No Exposure Certification, Discharge of Stormwater Assoc w Ind Activities, PAG-03	DIETZ & WATSON	Clean Water	5701 TACONY ST PHILADELPHIA, PA 19135-4311
1142051	No Exposure Certification, Discharge of Stormwater Assoc w Ind Activities, PAG-03	EFORCE COMPLIANCE	Clean Water	3115 WHARTON ST PHILADELPHIA, PA 19146
1145223	No Exposure Certification, Discharge of Stormwater Assoc w Ind Activities, PAG-03	EXELON GENERATION CO DELAWARE STA	Clean Water	1325 N BEACH ST PHILADELPHIA, PA 19125

Authority ID	Permit Type	Site Name	Program Description	Site Address
1098231	No Exposure Certification, Discharge of Stormwater Assoc w Ind Activities, PAG-03	FIBREFLEX PACKING & MFG UMBRIA ST FAC	Clean Water	5101 UMBRIA ST PHILADELPHIA, PA 19128-4345
1249111	No Exposure Certification, Discharge of Stormwater Assoc w Ind Activities, PAG-03	HILLOCK ANODIZING MFG FAC	Clean Water	5101 COMLY ST PHILADELPHIA, PA 19135
1078315	No Exposure Certification, Discharge of Stormwater Assoc w Ind Activities, PAG-03	INNOVATION PRINTING & COMMUNICATION	Clean Water	11601 CAROLINE RD PHILADELPHIA, PA 19154
1228873	No Exposure Certification, Discharge of Stormwater Assoc w Ind Activities, PAG-03	JOWITT & RODGERS STATE RD FAC	Clean Water	9400 STATE RD PHILADELPHIA, PA 19114
1147383	No Exposure Certification, Discharge of Stormwater Assoc w Ind Activities, PAG-03	LANNETT	Clean Water	9000 STATE ROAD PHILADELPHIA, PA 19136-1615
1147387	No Exposure Certification, Discharge of Stormwater Assoc w Ind Activities, PAG-03	LANNETT CO INC	Clean Water	9001 TORRESDALE AVE PHILADELPHIA, PA 19136-1586
1147388	No Exposure Certification, Discharge of Stormwater Assoc w Ind Activities, PAG-03	LANNETT CO INC	Clean Water	13200 TOWNSEND RD PHILADELPHIA, PA 19154
1160143	No Exposure Certification, Discharge of Stormwater Assoc w Ind Activities, PAG-03	LSC COMMUNICATIONS INC ROOSEVELT BLVD FAC	Clean Water	11311 ROOSEVELT BLVD PHILADELPHIA, PA 19154
1081311	No Exposure Certification, Discharge of Stormwater Assoc w Ind Activities, PAG-03	MEDIMMUNE LLC	Clean Water	3001 RED LION RD PHILADELPHIA, PA 19114-1123
1078748	No Exposure Certification, Discharge of Stormwater Assoc w Ind Activities, PAG-03	MUTUAL PHARM CO INC	Clean Water	7722 DUNGAN RD PHILADELPHIA, PA 19111-2733
1078353	No Exposure Certification, Discharge of Stormwater Assoc w Ind Activities, PAG-03	PACKAGING COORDINATORS INC	Clean Water	3001 RED LION RD PHILADELPHIA, PA 19114
591838	No Exposure Certification, Discharge of Stormwater Assoc w Ind Activities, PAG-03	PEARL PRESSMAN LIBERTY	Clean Water	7625 SUFFOLK AVE PHILADELPHIA, PA 19153-3020
1259135	No Exposure Certification, Discharge of Stormwater Assoc w Ind Activities, PAG-03	PENN MAID DUTTON RD PLT	Clean Water	10975 DUTTON RD PHILADELPHIA, PA 19154-3288
1235957	No Exposure Certification, Discharge of Stormwater Assoc w Ind Activities, PAG-03	PURE FISHING	Clean Water	3028 W HUNTING PARK AVE PHILADELPHIA, PA 19132
1210830	No Exposure Certification, Discharge of Stormwater Assoc w Ind Activities, PAG-03	RR DONNELLEY GANTRY RD FAC	Clean Water	9985 GANTRY RD PHILADELPHIA, PA 19115
1023590	No Exposure Certification, Discharge of Stormwater Assoc w Ind Activities, PAG-03	SANDMEYER STEEL	Clean Water	10060 SANDMEYER LN PHILADELPHIA, PA 19116

Authority ID	Permit Type	Site Name	Program Description	Site Address
1144476	No Exposure Certification, Discharge of Stormwater Assoc w Ind Activities, PAG-03	SMITH EDWARDS DUNLAP	Clean Water	2867 E ALLEGHENY AVE PHILADELPHIA, PA 19134-5994
874849	No Exposure Certification, Discharge of Stormwater Assoc w Ind Activities, PAG-03	SPECTRUM MICROWAVE PHILADELPHIA OPERATIONS	Clean Water	2707 BLACK LAKE PLACE PHILADELPHIA, PA 19154-1008
1086399	No Exposure Certification, Discharge of Stormwater Assoc w Ind Activities, PAG-03	USPS PHILA VEHICLE MAINTENANCE FACILITY	Clean Water	3201 SOUTH 74TH ST PHILADELPHIA, PA 19153-9996
1049958	No Exposure Certification, Discharge of Stormwater Assoc w Ind Activities, PAG-03	USPS VEHICLE MAINTENANCE FAC	Clean Water	1900 BYBERRY RD PHILADELPHIA, PA 19116-9997
711143	No Exposure Certification, Discharge of Stormwater Assoc w Ind Activities, PAG-03	VEOLIA ENERGY SCHUYLKILL GEN STA	Clean Water	2800 CHRISTIAN ST PHILADELPHIA, PA 19146
1027714	No Exposure Certification, Discharge of Stormwater Assoc w Ind Activities, PAG-03	VEOLIA ENV SVC HEDLEY ST FAC	Clean Water	3100 HEDLEY ST PHILADELPHIA, PA 19135-1540
1135081	No Exposure Certification, Discharge of Stormwater Assoc w Ind Activities, PAG-03	WUXI APPTEC	Clean Water	4751 LEAGUE ISLAND BLVD PHILADELPHIA, PA 19112
1137663	No Exposure Certification, Discharge of Stormwater Assoc w Ind Activities, PAG-03	WUXI APPTEC INC	Clean Water	4000 S 26TH ST PHILADELPHIA, PA 19112
Individual				
1201124	NPDES Pmt Stormwater Industrial Site Runoff (Individual)	AMTRAK 30TH STREET STATION	Clean Water	2955 MARKET ST PHILADELPHIA, PA 19104
1131042	NPDES Pmt Stormwater Industrial Site Runoff (Individual)	JDM MATERIALS CO BARTRAM BATCH PLT	Clean Water	PENROSE FERRY RD PHILADELPHIA, PA 19153
1131054	NPDES Pmt Stormwater Industrial Site Runoff (Individual)	JDM MATERIALS GRANT AVE PLT	Clean Water	2750 GRANT AVE PHILADELPHIA, PA 19114
1259320	NPDES Pmt Stormwater Industrial Site Runoff (Individual)	PBF LOGISTICS PRODUCTS TERMINALS LLC	Clean Water	1630 S 51ST ST PHILADELPHIA, PA 19154
1129339	NPDES Pmt Stormwater Industrial Site Runoff (Individual)	PBF LOGISTICS PRODUCTS TERMINALS LLC	Clean Water	6850 ESSINGTON AVE PHILADELPHIA, PA 19153-3413
1192681	NPDES Pmt Stormwater Industrial Site Runoff (Individual)	PHILA INTL AIRPORT	Clean Water	DIV AVIATION/INTL AIRPORT PHILADELPHIA, PA 19153
901759	NPDES Pmt Stormwater Industrial Site Runoff (Individual)	PHILLY SHIPYARD INC	Clean Water	2100 KITTY HAWK AVE PHILADELPHIA, PA 19112-1808

Authority ID	Permit Type	Site Name	Program Description	Site Address
963494	NPDES Pmt Stormwater Industrial Site Runoff (Individual)	ROHM & HAAS PHILADELPHIA PLT	Clean Water	5000 RICHMOND ST PHILADELPHIA, PA 19137
18834	NPDES Pmt Stormwater Industrial Site Runoff (Individual)	SEPTA VICTORY AVE TERM	Clean Water	110 & 103 VICTORY AVE UPPER DARBY, PA 19082
1072512	NPDES Pmt Stormwater Industrial Site Runoff (Individual)	SUNOCO PARTNERS MKT & TERM FT MIFFLIN TERM	Clean Water	HOG ISLAND RR 4 PHILADELPHIA, PA 19153
985409	NPDES Pmt Stormwater Industrial Site Runoff (Individual)	WHITE PINES PARTNERS GC	Clean Water	1 RED LION RD PHILADELPHIA, PA 19115

Appendix L – Defective Connections Group FY19 Report

Sewer Maintenance Unit

Defective Connections Group

Fiscal Year 2019 Annual Report

I. BACKGROUND INFORMATION

A. Phase I Stormwater Regulations

In 1990, the Environmental Protection Agency (EPA) promulgated Stormwater Regulations that required National Pollutant Discharge Elimination System (NPDES) permits for stormwater discharges from large (populations in excess of 250,000) and medium-sized (populations between 100,000 and 250,000) municipalities with separate storm sewer systems, (MS4)[1]. The City of Philadelphia with a 1990 population of 1.4 million was one of two NPDES Stormwater Phase I permittees in Pennsylvania. The other permittee was the City of Allentown.

B. NPDES Permit for Stormwater

The City of Philadelphia received its first NPDES Stormwater Permit under the 1990 Federal Regulations as issued by the Pennsylvania Department of Environmental Protection (PA DEP) in September 29, 1995. This permit had a 5-year term. Among other requirements, the permit required the city to reduce stormwater based pollution of local streams, creeks and rivers, from (1) residential and commercial areas, (2) construction sites, (3) industrial sites and (4) defective lateral connections.

The renewal of the NPDES Stormwater Permit that expired in September 2000 was approved by the PA DEP on September 30, 2005. The new permit provides for the same scope and requirements for the Defective Laterals Detection and Abatement Program as the previous permit and incorporates some provisions from the Consent Order and Agreement (COA) of July 1998 although the COA was successfully completed on March 18, 2004.

With the Water Department's internal reorganization and creation of the Office of Watersheds (OOW) in January 1999, the responsibilities numbered (1) through (3) above, along with the periodic reporting thereon was transferred to the OOW. The Defective Connections group (DCG) continues to pursue the 4th objective of NPDES Permit, namely the detection of defective laterals that cause sanitary wastewater to be carried to the local streams and rivers.

DCG field investigations began in March 1994.

II. DEFECTIVE LATERALS DETECTION AND ABATEMENT PROGRAM

A. Scope of Investigations

The MS4 impacts the areas of the city where there are two separate sewers in the street. The sanitary sewer system, which consists of a network of pipes of smaller diameter, carries domestic wastewater to the City's three Water Pollution Control Plants located in the Northeast, Southeast and Southwest sections. The storm sewer system consists of pipes of larger diameter but significantly shorter lengths and transports the stormwater to the nearest natural waterways. In general, the relatively newer sections of the city in the northeast, northwest and southwest are served by a MS4.

[1] Municipal Separate Storm Sewer System

Due to problems generally attributed to improper installation or lack of oversight during construction, sanitary wastewater from some properties can be transported into the storm sewers and from there, to the streams and rivers. This intrusion of sanitary wastewater causes pollution of the streams and rivers, which are the source of city's water supply. The polluted streams and rivers also endanger the physical health and safety of residents and users of the streams. The NPDES Permit requires the city to identify and abate the plumbing connections (defective laterals) that cause the sanitary wastewater to drain into the streams.

The **investigations** of stream pollution are triggered by the presence of a dry weather discharge from the storm sewer outfalls into the streams. There are over 400 stormwater outfalls in city's MS4 system of which some 220 have exhibited some dry weather flow.

It should be mentioned however, that not all dry weather discharge from an outfall comes from sanitary wastewater incursion; some may come from underground natural streams or from groundwater inflow. Additional testing of chemical and biochemical composition of samples collected from the outfalls determines whether or not stream pollution may be caused by defective laterals.

B. Outfall Inspections and Sampling

A systematic sampling of the quality of dry weather flow from the 200 plus wet outfalls was performed in 1991 as part of the initial NPDES permit application process. This program attempted to document the amount of flow (gph) and in many cases, fecal coliform count (number of fecal colonies per ml of water). The outfall sampling results were updated in 1998 when additional observations of fluoride levels (mg/l) were included to provide some indication of the origin of water seen in the outfalls. This is based on the fact that the natural water coming from streams or ground water seepage does not contain any significant fluorides, but the City water contains 0.7 mg/l of fluorides.

The more likely outcomes of fluoride and fecal count analyses are interpreted as follows:

i. **High fluoride level with high fecal count:** possible intrusion of sanitary wastewater into the storm sewer
ii. **Low fluoride level with high fecal count:** possible transport of surface contamination in the non-domestic discharge
iii. **High fluoride with low fecal count**: possible drinking water source

As a part of the MS4 permit, all stormwater outfalls are to be inspected once every five years. If there is dry-weather flow present then the outfall is to be sampled and tested for fecal presence and fluoride levels. In addition, the priority outfalls of the watersheds are to be sampled on a quarterly basis. Outfall inspections and sampling are handled by the Industrial Waste unit. Laboratory analysis is completed by the Bureau of Laboratory Services.

During FY2019, 40 outfall inspections were conducted and 36 samples were taken due to observed dry-weather flow as part of the Priority Outfall Sampling program. During FY2019, 123 outfall inspections were conducted and 70 samples were taken due to observed dry-weather flow as part of the Permit Inspection program.

C. Field Screening

The object of **field screening** is to identify the areas in a sewershed that are suspected of contributing to stream pollution through defective laterals. The field screening begins systematically at an outfall that shows a dry weather flow[2].

Proceeding upstream from the outfall, the storm sewer manholes are successively opened and observed for the presence of flow. The term "**flow**" has been widened to include "**wet**" stormwater manholes on the assumption that the wetness was caused by earlier active flow. These observations are continued upstream along a specified sewer line and stop when a stormwater manhole no longer exhibits any flow or wetness. The field screening is then continued along another tributary sewer and eventually through the entire sewershed of the outfall.

D. Identification of Defective Laterals

1) Dye Tests

Dye testing is a process by which a cross-connected lateral at a property that carries sanitary wastewater to a storm sewer is identified.

(a) Initial Dye Test

Before a test is conducted, the fresh air inlets (FAIs) located at the curbside of the property are identified as being the sanitary or storm FAIs. In Philadelphia, the sanitary lateral is located downstream of the stormwater lateral in relation to the flow of the main sewer[3]. The dye test protocol adopted by the City requires the presence of two properly functioning FAIs for successful initial tests. If one or no FAI is seen at a property or one or both of the FAIs are clogged or damaged, the initial dye test is aborted with a notation "**Inconclusive**".

During the initial dye test, a water-soluble fluorescent dye is placed in the fresh air inlets (FAIs). The dye is then washed down with water.

In the case of a ***"Camera Assisted Dye Test"*** the emergence of the dye is observed in the **storm sewer** by a closed circuit television camera positioned in the storm sewer in front of the stormwater lateral connection of the property. Possible observations include:

(i) Green dye placed in storm FAI is seen in the storm sewer
(ii) Green dye paced in storm FAI is not seen in the storm sewer
(iii) Red dye placed in the sanitary FAI is seen in the storm sewer
(iv) Red dye placed in the sanitary FAI is not seen in the storm sewer.

The above observations are interpreted as follows:

1) Combination of (i) and (iv): **Proper Connection**
2) Combination of (i) and (iii): **Probable Cross Connection**
3) Combination of (ii) and (iv): **Inconclusive**
4) Combination of (ii) and (iii): **Probable Cross Connection**

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[2] A dry weather flow is defined as one that is detected after an elapse of 72 hours of a continuous dry spell from the previous rainfall event.
[3] As discussed in Section D. House Lateral Design, pages 5-3 and 5-4, in the PWD Water and Sewer Design Manual (2nd Edition) 2011.

In certain cases, the use of the closed circuit television camera is not possible. In such cases, the initial tests are conducted with a **"Manual Dye Test"**. Possible observations include:

In a **"Manual Dye Test"**, a green dye is placed in the storm FAI and observed in the **storm sewer**. At the same time, a red dye is placed in the sanitary FAI and observed in the **sanitary sewer**. If the red dye appears in the sanitary sewer, whether or not the green dye appears in the storm sewer, the conclusion arrived at is "**Proper Connection**".

If the red dye is not seen in the sanitary sewer, the test is repeated by placing more red dye in the sanitary FAI and observed in the **storm sewer**. If the red dye appears in the storm sewer, this result signifies the presence of a "**Probable Cross Connection**".

If dye is not seen in the sanitary and storm sewers the observation is "**Inconclusive**".

The initial dye tests, whether conducted manually or by a camera are intended to be least intrusive to the water customers. During these initial tests, no entry into the home is involved. In order to provide water for dye tests at the FAIs, field crews use portable water equipment. The Defective Connections group has two vehicles each retrofitted with water supply tanks.

(b) Confirmation Dye Test

A confirmation dye test is conducted in case of an Inconclusive test or a Probable cross connection. This test is conducted after a second notification to the customer has been sent. This test is **intrusive**; admission inside the home is required to conduct the testing.

The confirmation dye test is conducted **manually** by placing and flushing the fluorescent dye in household plumbing fixtures, such as a toilet[4]. The emergence of the dye is then observed in the **sanitary sewer**.

If the dye does appear only in the sanitary sewer, it is concluded that the property tested has a "**Proper Connection**." If the dye from the household plumbing does not appear in the sanitary sewer, then observation is made in the storm sewer. The presence of the dye in the storm sewer confirms the existence of a "**Cross Connection.**"

(c) Notification of Defective Lateral

When a confirmation dye test indicates that there exists a cross connection at the subject property, the property owner is advised that if the property qualifies as a residential property (with no more than 4 units in one of which the owner has his/her residence), the city will make repairs to the defective lateral(s) at no cost to the property owner. If later on it is discovered that the property does not fall within this category, the customer is informed by a follow up notice of his responsibility to repair the defect at their cost.

The Plumbing Repair Programs unit handles customer communications and is responsible for the abatement of these defects.

2) Customer Notifications

[4] This step was modified in CY2001 to conduct the tests from all plumbing fixtures, including any in the basement in order to identify the existence of an internal cross connection, where all fixtures but one are properly connected to the sanitary sewer, with one offending connection to the storm sewer.

(a) Initial Notification

The identification of the defective laterals begins after delineating the parts of a sewershed suspected of contributing dry weather flow to the MS4 system, after field screening. All property holders in the specified area receive an initial notification letter, generated through the Oracle-based DLS computer program. The notification provides an introduction of the program and requests the customer's cooperation in enabling **dye tests** at their property. A dye test is conducted after an initial notification is sent out to a customer. There are three possible outcomes of a dye test:

(i) A test is conducted and no cross connection is found. In this case, a result of "No Cross Connection" is entered in the database and the case is closed.

(ii) A test is conducted and it is concluded that there might exist a cross connection that results in the transport of sanitary wastewater into the storm sewer. This condition requires additional tests to confirm the existence of a cross connection.

(iii) A test cannot be conducted due to any of a variety of reasons, such as FAIs were not conclusively identified, were clogged, etc. This situation also warrants additional tests to conclude whether or not a cross connection exists.

(b) Confirmation Notification

In either of case (ii) or (iii) above, a follow up notification is sent out to the customer, informing them of the results of the previous attempt and requesting them to be available at a specified date for additional "Confirmation" tests at their property. Of course, if the date provided by the City is not suitable to the customer, they can schedule an alternative appointment that suits them.

Dye tests are then conducted at the property from within the customer's premises as described earlier. The results of the tests, (a) a Proper Connection or (b) a Cross Connection, are entered in the DLS computer program.

(c) Water Shutoff Notification

Not all dye tests are completed as a result of confirmation notifications. Some customers ignore the scheduled date and fail to make an alternative appointment. In such cases an informatory note is left at the property and a follow up attempt for tests is made. If this also results in no test, another notification is sent out informing the customer that if they do not make a firm appointment by a specified date (usually within two calendar weeks of the notification date), their water service would be scheduled to be turned off by the Customer Service unit. Of course if the customers do respond and make an appointment for dye tests, the service shutoff is withdrawn and tests are completed as soon as possible.

(d) Miscellaneous Closures

In some cases, where there was no response to dye test requests or water service shutoff notifications due to properties being vacant or abandoned, the cases were closed with a notation "**Miscellaneous Closure**". A miscellaneous closure is activated because of any of the following reasons:

- No active water service to the premises
- Property abandoned, empty or unoccupied
- No billing to the property per Revenue Department
- No sewer connection

From time to time, the miscellaneously closed accounts are revisited. If we find that the reason that caused the account to be originally closed is no longer valid, a dye test is conducted and the property is then re-classified according to the test results.

III. PRIORITY SCORE LIST OUTFALLS

The emphasis of the Defective Laterals Detection and Abatement program is on outfalls on the Priority Score List. The Priority Score List ranks all outfalls sampled with dry-weather flow based on a preset formula that includes the fecal coliform results, the estimated volume of flow, whether the outfall discharges to a drinking water source water, and a complaint factor. The Priority Score List is periodically updated based on the results of the (Permit) Outfall Inspection and Sampling Program described earlier. This list was updated in July 2013.

IV. SUMMARY OF DYE TESTS AND ABATEMENTS

Table 1 provides a summary of the work performed in detecting and abating defective laterals. It shows the cumulative numbers since the inception of the project in 1994, and the progress that was attained during FY2019.

Table 1.
Updated Progress on Dye Tests in Philadelphia MS4 Area

	Since Inception of the Program	**During Fiscal 2019**
Dye Tests Initiated	64,431	1,506
No Cross Connections Found	61,654	1,448
Cross Connections Identified	1,696	120
Completed Tests	63,350	1,568
Abatements Completed	1,544	61

Of the 61 abatements above (in FY2019), 57 were residential properties, and the cost for these abatements was $530,760.3. Additionally, 4 commercial properties were abated at a cost of $25,173.

V. MISCELLANEOUS

Estimates of Pollution Removed

The following data provides a rough measure of the effectiveness of the Defective Connections group's positive contribution to improving the local environment:

- Number of Cross Connections Abated

Since Inception of the Program	1,544
During FY2019	61

- Estimated gallons of Polluted Water Prevented from entering the stormwater outfalls[5]

Since Inception of the Program	216.4 million gallons per year
During FY2019	8.6 million gallons per year

VI. STAFF LEVELS

Because of the high priority assigned to the Defective Connections group, the availability of manpower is extremely important. The sanctioned personnel for the unit is as follows:

One **Water Conveyance Supervisor**

Two **Field Representative Supervisors**

Four **SM Crew Chief Is / Science Technicians**

Eight **Utility Representatives**
Two positions vacant

One **Data Services Support Clerk**

The above field and office staffs are organized under the Water Conveyance Supervisor. This position is responsible for all aspects of the unit. The two Field Representative Supervisors are each responsible for two field crews, four crews in all. Each crew is led by a SM Crew Chief I / Science Technician and has two Utility Representatives.

In addition to the field staff, the Defective Connections group has the following position which provides general support:

Data Services Support Clerk: The DSSC handles the intricacies of the DLS database, creation of various correspondences related to dye tests, and follows-up with the field staff.

The DSSC also handles a variety of communications with the customers, makes appointments, and follows-up with delinquent customers. They also maintain the record of water shutoff warnings and miscellaneous closures.

At the end of FY2019, 14 of the 16 approved positions in the Defective Connections group were filled.

[5] Based on an average use of 110 gallons per capita per day, over a family size of 3.5 persons.

Appendix M – City of Philadelphia Snow and Ice Operations Plan Winter 2018-2019

STREETS
PHILADELPHIA

Streets Department
1401 JFK Blvd, 7th Floor
Philadelphia, PA 19102
(215) 686-5460

City of Philadelphia

Streets Department
Winter 2018 – 2019

Snow and Ice Operations Plan

PHILADELPHIA MANETO

December 10, 2018

Honorable James S. Kenney, Mayor
Michael DiBeradinis, Managing Director
Carlton Williams, Streets Commissioner
Michael S. Carroll, Deputy Managing Director, OTIS
Keith Warren, Deputy Commissioner Sanitation
Christopher Newman, Deputy Commissioner Administration
Richard Montanez, Deputy Commissioner Transportation
Stephen Lorenz, Chief Highway Engineer

Section 1
Snow & Ice Removal Operations Plan

Snow & Ice Removal Operations Plan

Plan Summary

Philadelphia, like many other northeastern cities in the United States, often faces winter storms that bring potentially dangerous accumulations of ice, sleet, freezing rain, and snow.

In order to provide roadway conditions that are safe for traffic on primary, secondary, and tertiary (residential) streets throughout the entire City of Philadelphia, the Streets Department has prepared a Snow and Ice Removal Operations Plan outlining the City's response to adverse winter weather conditions. This document outlines procedures and responsibilities for responding to winter weather emergencies.

The goal of the Plan is to ensure a continuity of City services by reducing, if not eliminating, the occasions when the City government will have to close or reduce City services due to severe winter weather, particularly with regards to curbside trash & recycling collection. The chief objective for the City in all severe winter weather is to allow all Philadelphians to return to their normal daily activities as quickly as possible.

The Plan prioritizes route systems, indicates the appropriate distribution of resources, and identifies the duties and responsibilities of all personnel engaged in the response. Also, the Plan delineates necessary linkages with other City departments and agencies including but not limited to, the Office of Fleet Management and the Office of Emergency Management.

In addition, the Plan outlines areas requiring planning before, during, and after a winter weather event, understanding that the severity of storms and the resulting conditions vary depending on many environmental factors, the plan allows for flexibility in the department's response. A matrix (see: Chart A, page 3) indicating the storm type with a brief description and resources required to respond to the emergency is provided. An in depth description of resources required to respond to each storm type is provided in subsequent sections of the plan.

Chart A - RESOURCE DEPLOYMENT WINTER Event

POST STORM FORECAST: ABOVE FREEZING TEMPERATURES

	STORM TYPE	HIGHWAY DIVISION	SANITATION DIVISION	NEIGHBORHOOD OPERATIONS	BRINE APPLICATION*	CONTRACTORS	LIFT SETS*
1	SLEET / FREEZING RAIN LESS THAN 1 INCH OF SNOW	X			X		
2	1 - 3 INCHES OF SNOW	X		Partial clearing focusing on higher terrain (15 routes)	X	X	
3	3 - 5 INCHES OF SNOW	X		Partial clearing focusing on higher terrain	X	X	
4	ABOVE 5 INCHES OF SNOW	X	X	Full Deployment (135 routes)	X	X	X

POST STORM FORECAST: BELOW FREEZING TEMPERATURES

	STORM TYPE	HIGHWAY DIVISION	SANITATION DIVISION	NEIGHBORHOOD OPERATIONS	BRINE APPLICATION*	CONTRACTORS	LIFT SETS*
5	SLEET / FREEZING RAIN LESS THAN 1 INCH OF SNOW	X		Partial clearing focusing on higher terrain (15 routes)			
6	1 - 3 INCHES OF SNOW	X		Partial clearing focusing on higher terrain	X	X	
7	3 - 5 INCHES OF SNOW	X	X	Partial clearing focusing on higher terrain	X	X	
8	ABOVE 5 INCHES OF SNOW	X	X	Full Deployment (135 routes)	X	X	X

* For pre-storm forecasts of rain to snow, brine will not be pre-applied. It will wash away.

* Lift sets are generally in Center City.

* Full Deployment may be deployed when the National Weather Service issues a winter storm warning.

Essential Staff

A. Purpose

The Streets Department is the primary response agency for the City in winter weather events such as snow and ice storms. As such, it is essential the Department maintain an adequate workforce in such emergencies.

B. Definitions

Weather Event – Includes all weather emergencies as declared by the Managing Director's Office through the Office of Emergency Management, in consultation with the Mayor's Office, and any weather event that requires the mobilization of staff to maintain clear roadways.

***Essential Staff* – All Department employees and any employees assigned to Streets Department Operations during a weather event are deemed essential, and must report to work unless otherwise instructed by the appropriate supervisor. (see: Streets Order No. 100 – Change #6, page 6)**

C. Policy Statement

When a weather emergency occurs, all personnel, as determined essential by the appropriate supervisor, will be required to report to their assigned functions. Since there are significant differences in the size and severity of weather events, those employees required to report may vary from event to event. When possible, employees will be notified by the appropriate supervisor/manager as to their status prior to an event. However, since such notification is not feasible in all situations, employees should report for duty unless otherwise instructed.

During weather events all employees should monitor local news broadcasts for information, and should contact their work location to obtain direction on their work status.

Employees who are not instructed to report for duty during a weather event shall be authorized to utilize accrued vacation, comp, or AL leave during weather events. Employees not engaged in storm operations may be required to report to work, at the discretion of their supervisor, if the nature of their regular work assignments has become critical.

Employees may be assigned shift work as required by the event response plan.

D. Responsibilities

Streets Commissioner: The Commissioner will serve as incident commander for snow and ice operations. These duties include supervising the logistical response of the Streets Department to winter storm events, and consulting with the Managing Director regarding the declaration of a Snow Event, the declaration of a Snow Emergency, and the activation of the Emergency Operations Center (EOC).

The decision to activate the EOC will be made by the Managing Director's Office.

The Streets Commissioner, MDO, and the EOC will coordinate with the Philadelphia School District and the Philadelphia Archdiocese regarding winter storm events.

Chief Highway Engineer: will develop and maintain a comprehensive snow plan that defines required staffing levels during weather events, and identifies specific job positions and functions. Direct all field operations during winter weather events. In addition, will coordinate (or delegate) with all other support Departments and external partners (ie: SEPTA, PPA, PennDOT)

Supervisors: will maintain a list of employees and phone numbers, and notify those employees assigned to snow operations as required by this policy. Supervisors are to grant leave time only as prescribed in this policy statement, or in the event of extraordinary circumstances.

Human Resource Division: will communicate the Essential Staff Policy to all employees prior to the winter season.

Residential Snow Coordinator: under direction of the Chief Highway Engineer, coordinate all residential snow activity.

Snow Contractor Liaison: will maintain a list of contracted snow and ice removal vendors and order their services when necessary. The liaison also monitors contractors' performance and services rendered and authorizes payment for services.

Field Staff: All personnel, including all supporting departments, will be under the direction of the Streets Department personnel. In the interest of public safety, all personnel will report directly to Streets Department supervisors, and will not be released until directed by the Chief Highway Engineer. All are expected to be in place, on time, and ready to perform the duties for which they have been trained. Exceptions will be at the Streets Commissioner's or Managing Director's discretion through the Chief Highway Engineer.

Department of Streets
Office of the Commissioner
City of Philadelphia

October 2, 2006

Streets Order No. 100 – Change #6

Subject: Essential Staff Policy

General

The City of Philadelphia Streets Department's mission is to maintain clean and safe streets. The Department delivers a number of City services that are critical to maintaining public health and safety in our communities. These essential services include, but are not limited to, maintaining all traffic control devices and street lighting, the safe operation and maintenance of our roads and bridges, timely and consistent removal of trash and debris, and during winter weather events the plowing and salting of City streets. In the performance of such functions, it is essential that employees of the Department report to work on time when scheduled to provide services to the public. Since each division has varying needs, each division head is responsible for implementing staffing policies to effectively manage the number of employees required for duty on a mandatory basis, to insure that these essential services are delivered and that public health and safety are maintained in communities at all times.

To maintain the essential services identified above, employee leave may be cancelled as determined necessary by the division head. In addition, employees assigned to essential services are required to continue their assignments until properly relieved.

Winter Weather Events

During a winter weather event, all Streets Department employees are expected to report to work at their regularly scheduled time unless notified to report to a different location and/or at a different time. All employees with a valid Pennsylvania Commercial Driver's License (CDL) shall be considered essential during a winter weather event. Any employee holding a valid Pennsylvania Driver's License will be considered essential if notified of such by the Department. During an event, the times and location of reporting may vary significantly depending upon the nature of the event. The Department will notify, in a timely manner, essential employees whose starting time and location are modified. However, all employees should monitor weather conditions and are expected to report for duty during winter weather events or snow emergencies.

Since there are significant variations in the time, nature and intensity of events, the assignments of employees will vary. Some employees may be excused from reporting during an event. Those employees excluded from reporting shall be granted exemptions on a case by case basis provided their assigned function will not be
required as dictated by the event, and if the Department Head, or designee, grants such exception.

Compliance

The Streets Department cannot successfully deliver core services without the participation of its entire team. Due to the critical nature and importance of the work to be performed, an employee who does not work his or her assigned hours may be subject to disciplinary action up to and including discharge.

CITY OF PHILADELPHIA

DEPARTMENT OF STREETS
ADMINISTRATION DIVISION
730 Municipal Services Building
1401 John F. Kennedy Blvd.
Philadelphia, PA 19102-1676

DAVID J. PERRI, P.E.
Streets Commissioner

TO : Streets Department Deputies and Division Directors

FROM : David J. Perri, P.E, Commissioner, Streets Department DJP

DATE : November 27, 2015

SUBJECT : Directive Prohibiting Preferential Snow/Ice Removal Activities

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The Streets Department's mission is to maintain clean, green and safe streets. A critical component of this mission includes our snow and ice removal operations in order to maintain clear roadways and provide safe traffic flow for citizens and businesses. This is an essential public function that must be performed in a comprehensive, efficient and effective manner without any appearance of impropriety.

In that regard, Streets Department employees must perform all snow and ice removal activities consistent with operational standards and planning requirements. Employees are strictly prohibited from performing preferential snow and/or ice removal activities for their own benefit or for the benefit any departmental staff, including line employees, supervisors, managers, division directors, deputy commissioners and the commissioner. Examples of this prohibited activity include the plowing of private driveways or parking spaces or the plowing or salting of streets in a manner that is not consistent with the overall snow fighting plan for City streets.

Please ensure you communicate this directive to your staff and that you make them aware that failure to abide by this requirement will be considered gross insubordination and subject to disciplinary action.

Goals

The Streets Department is the lead City agency for development and implementation of Philadelphia's snow and ice removal (de-icing) program. The goal of the program is to maintain safe egress for citizens throughout the duration of a storm and to return the City to normal operations as soon as possible after the event has ceased. The Department works closely with other City & external agencies to clear and make safe more than 2,500 miles of streets and roadways. This allows businesses, SEPTA and City agencies to maintain their normal operations during most events. Significant resources in the form of vehicles, materials, and staff are dedicated to the operation. As in similar emergency response plans, priority is given to major thoroughfares, the primary route system; however, the plan also addresses the needs of all streets within the City limits.

Sanitation service is a critical function for the citizens of Philadelphia; as such an important component of the plan is to maintain trash and recycling collections. To minimize the need to mobilize the Sanitation fleet, and the subsequent cessation of this service, the current plan augments the Streets Department's current resources with a partnership of snow fighting fleet of vehicles from various departments. The Streets Department and supporting agencies are committed to providing the most efficient and effective snow and ice removal operations as possible and are continually evaluating new methods and processes.

Scope

The Roadway System

There is a network of approximately 2,575 miles of City and State roads within the boundaries of the City of Philadelphia. The responsibility for maintaining these roadways during winter storms is split among the Pennsylvania Department of Transportation (PennDOT), the Streets Department, and the Department of Parks & Recreation. Of the 360 miles of state roads, PennDOT maintains 50 miles of limited access state highways. These include I-95, the Schuylkill Expressway(I-76), The Vine Street Expressway (I-676), Roosevelt Blvd Extension (Rt-1), Woodhaven Rd extension (Rt-63), all on & off ramps, and Gustine Lakes interchange. 310 miles are state roads that PennDOT contracts with the City for snow and ice removal. This amounts to a total of 2,525 miles of City and State roads that the City maintains.

The Department of Parks & Recreation de-ices 35 miles of Park roads, including but not limited to B.F. Parkway Lincoln Drive, Kelly Drive and Martin Luther King Drive. Snow and ice removal on the remaining 2,490 miles of City streets is the responsibility of the

Streets Department. The Highway Division maintains general responsibility for the organization and deployment of City forces during winter storm operations. In storms of large accumulation, the Sanitation Division will be mobilized to supplement the snow removal effort with vehicles outfitted with plows. Finally, private contractors supplement City forces in storms of significant magnitude.

In order to provide effective service during winter storms, the City's street system is divided into primary, secondary, and tertiary route systems. The primary route system encompasses 665 miles, including 110 miles of Snow Emergency Routes. The secondary route system includes another 700 miles of streets (both systems exclude the roadway maintained by the Department of Parks & Recreation). The balance of City streets falls into the tertiary street system, covering approximately 1,125 miles of streets, 25 miles of which are private streets where the residents or Home Ownwer Associations contract for private snow removal.

Route Priority

When a Snow Emergency is declared, Snow Emergency *and Primary* Routes become the first priority for snow removal efforts. *The Snow Emergency route System is clearly marked and consists of the major street network within the City.* Primary routes include major access roads through the central business district, and in and out of neighborhoods. The majority of primary routes encompass major and minor arterials, which serve the highest traffic volumes and distribute traffic throughout the City.

The secondary route system, which includes other streets that primarily convey traffic within neighborhoods, is the second focus of snow removal efforts. Most SEPTA routes fall within the boundaries of the primary and secondary route system.

The tertiary system includes most local residential streets. These streets are cleared based upon storm type as defined in this document.

The primary and secondary route systems are salted as soon as significant moisture has accumulated on roadways, thereby minimizing travel conditions that are potentially dangerous. Certain roads may also be pre-treated with salt brine when conditions warrant. Plowing begins when there is such a sufficient build-up of snow that salting is no longer effective. Plowing and salting will occur on local and residential streets as defined in this document.

Residential streets that are inaccessible for snow and ice removal efforts due to illegally parked or abandoned vehicles cannot be treated until those vehicles are removed by the owner, or ticketed and subsequently towed.

Snow Emergency Declaration

The Mayor, Managing Director, Deputy Managing Director of Emergency Management (DMD-EM) and the Commissioner of Streets will consult to determine if a declaration of a Snow Emergency is necessary.

A snow emergency declaration allows curb to curb plowing on designated snow emergency routes (see: Section 2 for Snow Emergency Route Listings). No parking is allowed on snow emergency routes during a snow emergency. The Philadelphia Parking Authority and Police Department are responsible for ticketing and towing vehicles parked on snow emergency routes.

Signs are posted on the Snow Emergency Routes by the Traffic Engineering Division. The signs are MUTCD approved accept for the 686-SNOW phone number. This number is answered by the Police Communications. 311 is also notified.

Winter Weather Action Outline

Snow and ice removal operations are divided into three elements:

Planning

The Deputy Commissioner for Transportation, the Chief Highway Engineer and the Deputy Commissioner of Sanitation, under direction of the Streets Commissioner, are responsible for developing a comprehensive winter response plan. The planning activity will include all other support departments such as Fleet, Parks and Recreation, Water and others. Planning will encompass continuing communications with the Office of Fleet Management to ensure that vehicles are properly maintained and outfitted for salting and snow removal. Further, the plan includes periodic reviews of the Snow and Ice Operations and the route structures.

During this phase, responsibilities are outlined, key positions are identified, and crews are trained. In addition, materials are requisitioned, received, and stockpiled; equipment is repaired and readied, and snow routes and route maps are reviewed and revised as needed.

Operations

The operations phase begins when the forecast is for temperatures consistent with snow, ice, sleet or freezing rain, with at least a 50 percent chance of precipitation. The Highway Division supervisors, the Residential Snow Coordinator, Fleet Management, Water Dept, & Dept of Parks & Rec are notified of the possibility of precipitation and possible plan.

The Chief Highway Engineer is made aware of "Special Events" and major closures. The De-icing crews will be forwarded this information so the appropriate actions can be taken.

The Highway Division directs all anti-icing and de-icing efforts undertaken by the Streets Department. The Division operates under the supervision of the Chief Highway Engineer, and is divided into six regional Highway Districts, supervised by District Highway Engineers. The District Highway Engineers and the Residential Snow Coordinator, in consultation with the Snow Headquarters, located at the Bridge Maintenance Office at Whitaker Avenue and Luzerne Street, direct the winter weather operations.

The 6 Highway District yards are at the following locations:

Highway District 1 --	48th Street and Parkside Avenue
Highway District 2 --	63rd Street and Essington Avenue
Highway District 3 --	22nd Street and York Street
Highway District 4 --	Stenton Avenue and Sylvania Street
Highway District 5 --	Whitaker Avenue and Luzerne Street
Highway District 6 --	State Road and Ashburner Street

The 6 Residential District Headquarters are at the following locations:

District 1 --	Belmont & Concourse Dr. – Carousel house
District 2 --	3033 63rd St. (63rd St & Essington). Trailer next to dome
District 3 --	Gustine Lakes Rec. Center 4700 Ridge Ave.
District 4 --	4501 G St. (G & Ramona Ave.) Street Lighting Shop
District 5 --	4040 Whitaker Ave. (Whitaker & Luzerne) 2nd Floor
District 6 --	8401 State Road (State & Ashburner) – Training Center

Resources are deployed as needs dictate, however, operations generally follow a set pattern. Once the storm arrives and precipitation is falling creating icy or snow-covered streets, salting operations begin. Certain roads may also be pre-treated with salt brine when conditions warrant. In additions, some trucks are equipped with a pre-wet system that will brine the salt before it is spread Salt trucks are deployed to cover the route structure. Salting will continue until it is no longer necessary or has become ineffective.

As snow continues to fall and build up on the streets, plows are deployed to the routes. Plowing will continue until the streets are passable and safe for use by vehicular traffic.

Once this is complete, individual complaints are addressed. 311 is notified by the Streets Dept, Public Relations Unit as to how to handle snow & ice complaints.

Cleanup and Assessment

Following each storm, the snow removal equipment is cleaned (including the brine equipment); spreaders and plows are removed and stored; personnel are released from snow duty; and final reports are submitted. At this time, after action reviews are undertaken. If contractors are used, all paperwork will be submitted and prepared for billing before the shift is over and Managers are released. All vehicles are post-checked and reported to Fleet for repairs.

All Highway Districts shall notify the Assistant Chief Highway Engineer as to how much salt so replenishment orders can be made following the event. An assessment of the salt dome at Domino Lane will also be done.

Participating Organizations – Assignments & Responsibilities

Assignments and Reporting Structure

All personnel involved in winter weather operations will be under the direction of Streets Department. ***Once deployed to snow operations, they will be relieved from their respective daily assignments and will not be released, except for emergency, to their respective operating departments without approval of Streets Department snow headquarters. It is the responsibility of the employee to notify their supervisor that they will be working snow operations.***

Streets Department

The Streets Commissioner is the incident commander for all winter weather operations The Highway Division coordinates the citywide program for snow removal from the City street system and is directly responsible for salting and plowing the primary, secondary, and tertiary route structures. In addition, the Chief Highway Engineer is responsible for the supervision and organization of all de-icing efforts. With the approval of the Streets Commissioner, the Chief Highway Engineer is responsible for mobilizing necessary plowing and lifting operations. These operations may require the suspension of normal Sanitation Division operations under certain conditions, and the conversion of Sanitation vehicles for plow operations. However, the Department's goal is to minimize the impact on Sanitation operations and avoid the delay or interruption of curbside collection services. In addition, private contractors may be called in to supplement the efforts as conditions dictate. Sanitation personnel, Highway personnel, other Departmental personnel and contractors are responsible for de-icing under the direction of the Highway Division.

Department of Parks and Recreation

The Department of Parks and Recreation maintains a portion of the roadways in and around the Park system. The Benjamin Franklin Parkway, Kelly Dr, MLK Dr, Lincoln Dr., & Strawberry Mansion Bridge are the primary routes that are de-iced in all events. When full residential is deployed, they are assigned some residential grids. In addition, they are responsible for the trail system and for treating the sidewalks and parking lots at parks and recreation centers. The Leadership of the Dept of Parks & Rec will decide the priorities. In the event equipment has to be taken from the de-icing operation, the Parks & Rec Coordinator will communicate with the Chief Highway engineer. Since the residential program uses two of their facilities (Carousel House and Gustine Lakes), the residential manager will have those parking lots treated. The Chief Highway Engineer & the Parks & Rec winter coordinator will discuss and communicate throughout the event.

If a circumstance occurs where the winter event may cause trees to or limbs to fall and block roadways, the Chief Highway Engineer and Parks & Rec winter coordinator will communicate the concerns and report back to the appropriate staffing (both field and administrative)

Office of Fleet Management

The Office of Fleet Management is responsible for the maintenance and repair of all vehicles in the City's fleet is responsible for opening fuel sites (see: Fuel Site Locations Table) during winter weather events, providing and installing chains, and where necessary, assisting with the installation of plows, with the exception of the Sanitation Division, which installs chains and plows on compactors. The Chief Highway Engineer and Fleet Management Liaison will discuss the event. This discussion will include Brine Salt, Plow, shifts, shop openings, and post event issues.

Fuel Site Location

Site #	Operating Hours	Departments	Site Name	Street Address	ZIP	Contact #	Fuel Type	UNLEADED TANK CAP	DIESEL TANK CA
02	24 / 7	Police Department	24th & Wolf	2301 S. 24th Street	19145	686-3010	U	10,000	N/A
03	24 / 7	Police Department	11th & Wharton	1100 Wharton Street	19147	686-3030	U	10,000	N/A
05	MON - FRI 7:30-3:00	Philadelphia Water Department	8200 Enterprise	8200 Enterprise Avenue	19153	685-4047	U / D	2500	2500
06	MON - FRI 7:30-3:00	Commerce / Division Of Aviation	International Airport	8500 Essington Avenue	19153	492-3056	U / D	8,000	8,000

07	24 / 7	Streets Department	51st & Grays	5014 Grays Avenue	19143	685-2612	D	N/A	10,000
08	24 / 7	Police Department	55th & Pine	5524-30 Pine Street	19143	686-3180	U	10,000	N/A
09	24 / 7	Police Department	61st & Thompson	6059 Haverford Avenue	19151	686-3190	U	6,000	N/A
11	MON - FRI 7:00 /3:30	Office of Fleet Management	25th & Tasker	2500 Tasker Street	19145	952-6201	U / D	20,000	10,000
13	24 / 7	Police Department	Girard & Montgomery	611-17 E. Girard Avenue	19125	686-3260	U	10,000	N/A
14	24 / 7	Police Department	21st & Pennsylvania	401 N. 21st Street	19130	686-3090	U	10,000	N/A
15	MON - FRI 7:00 - 10:00	Streets Department	26th & Glenwood	2601 Glenwood Avenue	19121	685-3978	U / D	10,000	10,000
17	MON - FRI 7:00 -3:00	Philadelphia Water Department	7800 Penrose	7800 Penrose Ferry Road	19145	685-4068	U / D	10,000	20,000
18	MON - FRI 7:00 -3:00	Philadelphia Water Department	3900 Richmond	3899 Richmond Street	19137	685-1336	U / D	6,000	4,000
19	MON - FRI 7:00 -3:00	Streets Department	Delaware & Wheatsheaf	3101 Castor Avenue	19134	685-1364	U / D	2EA/1,500	10,000
21	24 / 7	Office of Fleet Management	Front & Hunting Park	100 East Hunting Park Avenue	19124	685-9100	U / D	10,000	10,000
23	MON - FRI 8:00 - 4:30	Philadelphia Water Department	29th & Cambria	2900 N. 29th Street	19132	685-9633	U / D	20,000	10,000
24	24 / 7	Police Department	22nd Hunting Park	2201 W. Hunting Park Avenue	19124	686-3390	U	10,000	N/A
25	24 / 7	Police Department	Harbison & Levick	2809 Levick Street	19149	686-3150	U	10,000	N/A
26	24 / 7	Police Department	Broad & Champlost	5960 N. Broad Street	19141	685-2862	U	10,000	N/A
28	24 / 7	Police Department	Germantown & Haines	39-43 Haines Street	19126	686-3140	U	10,000	N/A
29	24 / 7	Police Department	Ridge & Cinnaminson	6666 Ridge Avenue	19128	686-3050	U	6,000	N/A
31	MON - FRI 7:00 - 11:00	Streets Department	Domino & Umbria	200 Domino Lane	19128	685-2580	U / D	10,000	10,000
32	MON - FRI 7:00 - 11:00	Office of Fleet Management	State & Ashburner	8401 State Road	19136	685-8977	U / D	10,000	20,000

38	24 / 7	Fire Department	Germantown & Carpenter	6800 Germantown Avenue	19119	685-2225	U / D	600	2,500
39	24 / 7	Fire Department	3rd & Spring Garden	276 Spring Garden Street	19123	686-1372	U	6,000	N/A
40	MON - FRI 7:00 - 5:00	Philadelphia Water Department	Fox & Abbottsford	3201 Fox Street	19129	685-2054 685-2024	U / D	10,000	10,000
41	MON - FRI 6:00 - 11:00	Streets Department	4040 Whitaker	4040 Whitaker	19124	685-9800	U / D	6,000	10,000
43	24 / 7	Fire Department	28th & Thompson	1301 N. 28th Street	19121	685-3889	D	N/A	1,000
44	24 / 7	Fire Department	Cottman & Loretta	1900 Cottman Avenue	19111	685-0591	D	N/A	1,000
45	24 / 7	Fire Department	Pennypack Circle	8205 Roosevelt Blvd	19152	685-8891	D	N/A	1,000
46	24 / 7	Fire Department	Broad & Fitzwater	711 S. Broad Street	19147	685-6897	D	N/A	1,000
47	24 / 7	Fire Department	4th & Snyder	414 Snyder	19148	685-1792	D	N/A	1,000
48	MON - FRI 7:00 - 3:30	Parks and Recreations	Chamounix (Parks/Recreati on)	715 Chamounix Drive	19131	685-0110	U / D	10,000	10,000
49	24 / 7	Fire Department	63rd & Lancaster	1913 N. 63rd Street	19151	685-0068	D	N/A	1,000
50	MON - FRI 7:00 -6:00	Streets Department	48th & Parkside	4804-48 Parkside Avenue	19131	685-0164	D	N/A	2,000
51	24 / 7	Fire Department	10th& Cherry	133 N. 10th Street	19107	686-1350	D	N/A	1,000
52	24 / 7	Fire Department	4th & Girard	400-08 Girard Avenue	19123	686-1349	D	N/A	1,000
53	24 / 7	Fire Department	82nd & Tinicum	8201 Tinicum	19153	492-3393	D	N/A	1,000
54	24 / 7	Fire Department	52nd & Willows	783 S. 52nd Street	19143	685-1987	D	N/A	2,000
56	24 / 7	Fire Department	Foulkrod & Darrah	1652-54 Foulkrod Street	19124	685-1295	D	N/A	1,000
57	24 / 7	Fire Department	Bustleton & Bowler	1701 Bowler Street	19115	685-0387	D	N/A	3,000
58	24 / 7	Fire Department	Bustleton & Hendrix	812 Hendrix Street	19116	685-0388	D	N/A	1,000

59	24 / 7	Fire Department	Chelten & Baynton	300 E. Chelten Avenue	19144	685-2227	D	N/A	1,000
60	24 / 7	Fire Department	30th & Grays Ferry	3023-45 Grays Ferry Avenue	19146	685-1790	D	N/A	1,000
61	24 / 7	Fire Department	Belgrade & Ontario	2520 E. Ontario Street	19134	685-9849	D	N/A	1,000
62	24 / 7	Fire Department	13th & Shunk	2600 S. 13th Street	19148	685-1783	D	N/A	1,000
65	24 / 7	Fire Department	24th & Ritner	2301 S. 24th Street	19145	685-1793	D	N/A	600
67	MON - FRI 7:00 - 3:30	Commerce / Division Of Aviation	Northeast Airport	3001 Grant Avenue	19114	685-0311	D	N/A	4,000
68	24 / 7	Fire Department	Academy & Comly	11650 Academy Road	19154	685-9374	D	N/A	600
69	24 / 7	Fire Department	Ridge & Cinnaminson	6666 Ridge Avenue	19128	685-2555	D	N/A	600
70	24 / 7	Police Department	Dungan Road	7790 Dungan Road	19111	685-5101	U	8,000	N/A
71	24 / 7	Fire Department	Park & Cambria	1325 W. Cambria Street	19132	685-9773	D	N/A	600
72	24 / 7	Fire Department	Old York Road	5931 Old York Road	19141	685-2881	D	N/A	600
73	24 / 7	Fire Department	43rd & Market	4299 Market Street	19104	685-7699	D	N/A	600
74	24 / 7	Fire Department	Belgrade & Huntington	2601 Belgrade Street	19125	685-9847	D	N/A	600
75	24 / 7	Fire Department	Rising Sun	5332 Rising Sun Avenue	19120	685-9197	D	N/A	600
80	24 / 7	Office of Fleet Management	3033 S. 63RD	3033 South 63rd Street	19125	685-4250	D	N/A	10,000
95	MON – FRI 6:00- 3:00	School District of Philadelphia	Shallcross	Byberry & Woodhaven	19154	281-2617	D	N/A	10,000
96	MON – FRI 6:00- 3:00	School District of Philadelphia	Broad & Lehigh	2600 N. Broad Street	19132	215-227-4430	D	N/A	10,000

TOTAL NUMBER OF SITES IS SIXTY TWO
"R"= RESTRICTED TO VEHICLES ASSIGNED TO THE DEPARTMENT ONLY!!!!

Managing Director's Office

The Managing Director, in consultation with the Mayor, has the authority to declare a snow emergency and if necessary, close City offices. This plan should limit, if not eliminate, the need to enforce any closures during snow events.

When a snow emergency is declared the Managing Director's Office is responsible for coordinating the citywide response to the emergency. Streets Department personnel, along with personnel from other departments, participate in the staffing of the Emergency Operations Center, located at 3rd and Spring Garden Streets in the Fire Administration Building, and in other coordinated efforts as necessary.

Police Department

Police Department support is required to support existing parking regulations. Police will ticket vehicles identified as impeding snow removal efforts including, but not limited to, vehicles parked on corner radii and double-parked vehicles. Police officers will stop all private entities placing snow in previously cleared streets. During declared snow emergencies, Police support will ensure snow emergency routes are clear. The Police Department is responsible for performing de-icing activities in their facilities. The Police Department will coordinate with the Philadelphia Parking Authority for towing.

As Routes are cleared of vehicles, the Police will notify both the EOC and Snow Headquarters so the appropriate de-icing can occur.

Other City Departments

The tertiary route structure is maintained by the following City Departments under the direction of the Residential Snow Coordinator.

Streets Department
Water Department
Public Property
Parks & Recreation
Managing Director's Office (CLIP)
Licenses & Inspections
Prisons Department
Revenue Department
Free Library
Health Dept

Snow Fighting Equipment Inventory

Streets Department 2018/2019 Fleet Summary

Listed below is the Streets Department's fleet inventory for snow operations. Due to the age of the fleet and the challenges facing the Office of Fleet Management, we (the City) have concerns about the reliability of the equipment. Winter operations place a great strain on aging vehicles, and equipment availability will have a significant impact on the Department's ability to effectively respond to weather events. With projected downtime, the City will be challenged to field a full complement of equipment to cover all routes.

The result of insufficient equipment will be slow response time, particularly on residential streets. To address this issue, in part, the Streets Department has snow contract agreements to provide supplemental equipment for both large and residential streets. The Department also continues to work closely with the Managing Director's Office to identify interdepartmental equipment that can supplement the inventory.

All departments are required to provide a full complement of necessary vehicles for snow operations for clearing the roadway system.

Streets Dept. Snow Vehicles	
Highway Salt	80
Loaders, Highway, Backhoe	24
Loaders, Highway, Articulated	13
Sanitation Skid Steer	14
Compactors	120
Brine, Highway	3
Brine, flusher trucks Sanitation	4
Brine, CLIP	1
Snow trailers for Roosevelt Blvd	2
Total	261

All Departmental Snow Vehicles	
Assigned to Residential	129
Total	129

Route Designations and Treatment

The primary and secondary route systems are divided into 148 specific routes. Salting and/or plowing of these routes will continue until the routes are deemed passable and safe for vehicular traffic.

The tertiary street system is covered in a grid pattern determined by each District Highway Engineer and the Residential Snow Coordinator. These streets are salted/plowed as storm type dictates (see Chart A, page 3). Grids are assigned and the plows attempt to clear all streets in that grid. Streets that are blocked by parked cars or other obstructions will not be treated until the obstruction is removed. Double-parked vehicles or vehicles parked on corner radii will be ticketed and towed by Police to permit snow removal efforts.

All tertiary grids will not be treated during every storm. The City's topography will primarily dictate the specific areas that will be treated during every storm type. Storm severity will dictate the expansion of treatment in the tertiary network. Regional commerce, public health, mass transit issues, sporting & special events and time of year will guide these decisions.

Snow and ice on the tertiary street system will be cleared to provide one passable lane for each direction that the specific streets can accommodate. Residential efforts are designed to allow access to the primary and secondary route system and mass transit.

Use of Salt and Other De-icing Materials

Salt (sodium chloride) or a brine solution of the same chemical, or in extreme situations, sand or other abrasives, will be spread on Philadelphia's roadway network to ensure safety for the traveling public.

Salt brine is a liquid containing a 23 per cent sodium chloride solution. Applied at rates of 30 gallons per lane mile, this treatment should effectively melt the first 2 inches of snow before re-application is necessary. The treatment can also be applied before storms begin. The Department will utilize this program in the Northwest and Northeast sections of the city, areas that typically have higher evaluations. In addition, the department may Brine the sports complex if there is an event. This should provide greater service delivery at a reduced cost, especially in the higher elevation areas of the City. The decision to Brine will be made 72 hours in advance. Brine is primarily used to pre-treat the roadway so snow does not bind to roadway. As conditions permit, brine trucks may be re-filled and used on some routes or parking lots if conditions permit. This is effective when there is less then 2 inches of snow.

Storm Types and Response

There are eight (8) basic storm types that require different responses as outlined below.

POST STORM FORECAST: Above Freezing Temperatures

Storm Type	Deployment of Fleet
1 Sleet/Freezing Rain	City salt truck deployment and primary and secondary routes only.
2 1 to 3 inches of snow	City salt truck deployment on primary and secondary routes. Partial residential deployment in limited areas of higher elevation. If cold temperatures are forecast, limited plowing may occur. (No contractors).
3 3 to 5 inches of snow	City and contractor salt truck deployment on primary and secondary Routes. Partial residential deployment in limited areas of higher elevation. A snow lifting may be deployed in the central business district.
4 Above 5 inches of snow*	As above, plus the declaration of a "snow emergency." Sanitation compactors will plow the primary and secondary route system. Additional contractor equipment will be deployed. Full residential will be deployed.

POST STORM FORECAST: Borderline and Below Freezing Temperatures

Storm Type	Deployment of Fleet
5 Sleet/Freezing Rain	City salt trucks deployed on primary and secondary routes only. Possible partial residential deployment in limited areas of higher elevation.
6 1 to 3 inches of snow	City salt truck contractor deployment on primary and secondary routes. Salting Operation for tertiary streets may occur once the primary and secondary network is complete. This operation will be performed by primary and secondary route vehicles that can navigate smaller streets. Partial residential deployment in limited areas of higher elevation. If cold temperatures are forecast, limited plowing may occur.
7 3 to 5 inches of snow	As above, plus a snow lifting may be deployed in the central business district.
8 Above 5 inches of snow*	As above, plus the declaration of a snow emergency. Sanitation compactors will plow the primary and secondary route system. Additional contractor vehicles will help clear snow. Full residential will be deployed.

*Full deployment may be deployed when the National Weather Service issues a winter storm warning. Lifting snow from other sections of the City will only occur when directed by the Chief Highway Engineer.

Weather Forecasting Services

The City of Philadelphia will, in addition to monitoring local national weather forecasts for our metropolitan region, contracts with an independent private weather service to ensure that forecasts are made specific to our needs. The City recognizes that there are unique geographic differences within our boundaries, and expects detail in our contracted services to assist in deployment decisions.

Storm Operations

Storm Conditions

Philadelphia's geographic position contributes substantially to the forecasting uncertainties that it faces. Due to our location, with the mountains to our west and the Atlantic Ocean to our east, forecasters usually must watch storm systems for as long as possible before determining if they are going to hit Philadelphia or be deflected to the east or west. In addition, there are literally thousands of types of winter storms - each storm combines a number of factors that lends to its uniqueness.

The Streets Department must be prepared to deal with these planning uncertainties, as well as uncertainties that occur during the storm. For example, the Blizzard of March 1993 was originally forecasted as a 3" storm. It mushroomed into a major storm of upwards of 12 inches, including sleet and freezing rain. In early December 2013, a forecasted 1" storm during an Eagles game turned into a 9 inch winter event. The unexpected changes in forecasts made it more difficult for the Streets Department to mobilize the most effective response to react to a storm of such magnitude. The Blizzard of January 2016 (Winter Storm Jonas) was supposed to start at 10PM and started at 7PM. In March 2017 (Winter Storm Stella) was forecasted for over 12 inches of snow, about 4 inches of snow fell followed by a couple of inches of sleet and below freezing temperatures.

In March 2018, 3 different Nor-Easter storms effected the City of Philadelphia with temperatures at freezing. This caused many trees to block the roadways and parks. These storms had all available equipment to remove trees and de-ice the streets so crews can perform the necessary work.

There are several other variables that affect the Department's timely response to storm events. These variables are briefly outlined below. Each of the variables listed may have a significant impact on the Department's response. Proper planning and the development of appropriate procedures, combined with some level of operational flexibility is a priority to develop the most appropriate, effective response possible, given the existing conditions. Communication through Snow Headquarters is the key to success.

- Storms may fail to materialize at the forecasted hour. Conversely, storms may stall, thereby increasing the duration of the event and the amount of accumulation. These factors increase the expense associated with responding to a storm and the chance of work force fatigue.
- During a storm, the type of precipitation may change. Different types of precipitation require different responses. For example, plowing may be hampered as ice accumulates on the top of the snow, creating a hard crust.
- The time of the year also impacts the Department's response to storms. In the late fall and early spring months when the temperature is warmer, it may be possible to fight a storm of four to five inch accumulation with salt alone. In colder months, plowing would be necessary.
- If two or more severe storms occur in rapid succession, the Department's response may be affected. Response to the initial event may be expanded in anticipation of the subsequent storm. For example, in 2015, we had 2 storms within 36 hours at accumulations of 12 inches and 5 inches respectively with 8 hours in between.
- Low temperatures increase the amount of salt necessary to melt off precipitation.
- Winds can create havoc during storms. Although light breezes help to dry roadways following storms, stronger winds may hamper snow fighting efforts by drifting snow across cleared roadways.
- Significant elevation differences exist between the southern portion of the City and the areas in the northeast and northwest. In the northeast and northwest, snow frequently accumulates to greater depths.
- The city has developed micro-climates along the rivers creating black ice.
- Other Department's core services may impact equipment and personnel (ie: Water main breaks or down trees due to ice and wind)

The Department's Snow and Ice Operations Plan presents a flexible framework providing effective response to all types of storms.

It is the goal of the City of Philadelphia that for the majority of the winter weather events that typically affect this city, that we will have, depending on storm type and response protocol, all routes identified in these response protocols passable within 24 to 48 hours of the fall of the last flake. Storms outside of the protocol upper limits may lead to significant adjustments in this time line.

Storm Types 1, 2 & 3

Deployment

Streets Department

Chief Highway Engineer

- Will develop the operations plan for approval by the Streets Commissioner
- Once the plan is approved, The Chief & Assistant Chief Highway Engineers will notify as listed below:
    - Notifies District Highway Engineers, Central Maintenance Unit (CMU), Bridge Maintenance Unit (BMU) of mobilization time and plan
    - Notifies Residential Snow Coordinator of mobilization time
    - Notifies Highway Division Snow Headquarters, located at the Bridge Maintenance Yard – 4040 Whitaker Avenue, personnel to report at specified deployment time
    - Notifies OIT
    - Notifies Office of Fleet Management of mobilization decision
    - Notifies SEPTA
    - Notifies Sanitation
    - Notifies maintenance supervisors
    - Notifies Parks and Recreations
    - Notifies Unified Dispatch
    - Notifies Water Department
    - Notifies the Streets Department, Public Affairs
        - Will coordinate with 311
    - An E.mail notification will be sent out to all involved. The Streets Commissioner will be included so it can be shared with the MDO or Mayor's Office at his discretion. This is a follow-up to phone calls.
    - Establish communication with the EOC if activated.

Highway District Engineers

- Notify Maintenance Supervisors to assemble salting staff
- Notify spotters to report at specified deployment time

Highway District Maintenance Supervisors

- Notify personnel to report at specified deployment time

Residential Snow Coordinator

- Notifies residential snow operations personnel of partial residential deployment

(if needed)

Office of Fleet Management

- Will determine which garages for Fleet maintenance support and fueling sites for duration of event at determined times. This will be coordinated with Snow Headquarters

Parks and Recreation

- Responsible to activate operation for salting Park road system including Benjamin Franklin Parkway, MLK, Kelly, Lincoln Drive.

Operations

Highway Districts

Spotters monitor street conditions. Salt trucks are loaded and positioned at the start of an assigned route. As street surfaces accumulate sufficient moisture for effective salting, spotters notify Maintenance Supervisors to begin salting activity. Spotters will provide route condition reports to their district headquarters on intervals as directed. District headquarters will compile this data and forward to Highway Division Snow Headquarters.

The Highway Districts will work with the Sanitation yards to ensure the Citizen Drop off centers are de-iced.

Residential Districts

Spotters monitor street conditions. Trucks are positioned at the start of an assigned route. Treatment of the street surface begins upon notification from the Residential Snow Coordinator. Spotters will provide route condition reports to their district headquarters on three (3) hour intervals. District headquarters will compile this data and forward it to the Residential Snow Coordinator, who in turn summarizes the information and forwards it to Highway Division headquarters.

Highway Division Snow Headquarters

Snow Headquarters will:

- Inform Highway Districts of weather forecasts
- Monitor, through Highway Districts, the status of all salting operations
- Maintain a log of all service calls for snow and ice related activities
- Monitor weather conditions and forecasts
- Analyze the data and forward it to the appropriate parties
- Analyze reports from the field and make changes to future operations where required
- Forward emergency calls from Police and Fire Departments to Highway Districts
- Maintain Snow Route Status Report
- Order commodities as required to maintain an adequate supply at all Districts
- Take calls from the EOC

- View PennDOT, Police and Streets Department cameras.

Office of Fleet Management

- Repair vehicles as necessary
- Report vehicle down time to Snow Headquarters

Parks and Recreation

- Treat Park road system, trails, and recreation facilities

Cessation of Operations

Highway Districts

- District Engineers release spotters to regularly assigned duties.
- District Engineers collect route inspection information

Residential Districts

- Release spotters and drivers to their respective departments
- Forward all reports to Residential Snow Coordinator who, in turn, forwards them to Highway Division Snow Headquarters
- Supervise the cleaning and redeployment of residential snow equipment

Highway Division Snow Headquarters

- Compile final report on personnel, equipment utilized and material usage and forward to Streets Commissioner.
- Estimate cost of event

Office of Fleet Management

- Compile final report on equipment costs and return to normal Fleet repair activities
- Prepare for the next event

Parks and Recreation

- Compile final report on personnel and equipment utilized
- Return to normal Park maintenance activities

Storm Types 6, 7, & 8

Same as response 1, 2 & 3, except the following additions:

Deployment

Streets Department

Chief Highway Engineer

- Notifies District Highway Engineers and Residential Snow Coordinator of decision to salt/plow tertiary system (Note: Storm type 6 only, partial to full residential deployment depending on event specifics).
- Will advise everyone for potential of multiple shifts

Residential Snow Coordinator

- Notifies residential snow operations personnel of partial to full residential deployment

Storm Types 4 & 9

Deployment

Streets Department (same as 1, 2, 3 but also includes):

Chief Highway Engineer:

- Notifies District Highway Engineers of initial mobilization time for salting operations and subsequent mobilization time for plowing operation
- Advises district that Sanitation, contractor equipment and residential roadway treatment will occur
- Notifies Highway Division Snow Headquarters, personnel to report at specified deployment time
- Notifies Snow Contractor Liaison to order contractor support equipment at specified time
- Notifies Residential Snow Coordinator of mobilization time
- Notifies Deputy Commissioner for Sanitation for full deployment of Sanitation resources, both for plowing primary and secondary routes
- Notifies Office of Fleet Management of mobilization decisions
- Advises all involved of anticipated number of shifts
- Notifies SEPTA
- Notifies Sanitation
- Notifies Water

Snow Contractor Liaison:

- Contact private sector vendors and orders equipment for each highway district.
- Advises of deployment time and likelihood of deployment duration
- Advises contractors of lifting set (if any) requirements

Highway District Engineers:

- Notify Maintenance Supervisors to deploy their staff at specified time
- Notify spotters to report at specified time
- Notify inspection staff for contracted equipment to report at specified time
- Are advised that residential street system snow removal has been activated

Residential Snow Coordinator:

- Notifies residential snow operations personnel of residential deployment

Highway District Maintenance Supervisors:

- Notify personnel to report at specified deployment time

Streets Department - Sanitation Division

Deputy Commissioner-Sanitation

- Mobilizes plows for primary/secondary route system at six Sanitation yards at specified time.
- Notify Chief of Operations to designate a Sanitation representative for Highway Division Snow Headquarters
- Notify division management of deployment times and subsequent suspension of curbside collections

Office of Fleet Management

- Will deploy sufficient resources to support fleet maintenance activities for duration of winter weather event
- Will open fuel sites and staff appropriate garages for duration of event
- Will support Sanitation Division of Streets Department during plow and chain mounting for Sanitation compactors and support equipment

Parks and Recreation

- Responsible to activate operations for salting/plowing road system and trail system. The Leadership of Parks & Rec will create a plan for treating the trails and recreation centers

Office of the Managing Director

- Will issue declaration of snow emergency
- Will activate the city's Emergency Operations Center located at the Fire Administration Building 3rd and Spring Garden Streets.

Operations

Streets Department

Highway Division

- Spotters monitor street conditions
- District Highway Engineers assign inspection staff to contact salting vehicles
- Salt trucks are loaded & positioned at the start of an assigned route. As street conditions accumulate sufficient moisture for salt to be effective, spotters notify districts to begin salting operation. Salt will be applied prior to plowing operations or until no longer effective

- Plowing operations will begin at 2"-3" accumulation and continue until routes are clear
- Chief Highway Engineer directs Residential Snow Coordinator to begin Tertiary Street plowing/salting when needed
- Highway District Engineers direct Sanitation plowing commencement
- All spotters & inspectors will provide route condition reports on three (3) hour intervals. Each district headquarters will compile this information & forward to Highway Division Snow Headquarters
- Highway District Engineers will insure that all routes are salted upon completion of plowing efforts
- Highway District Engineers will direct snow lifting/melting operations within their respective district

Residential Snow Districts

- Spotters monitor street conditions. Trucks are positioned at the start of an assigned route. Treatment of the street surface begins upon notification from the Residential Snow Coordinator
- Spotters will provide route condition reports to their district headquarters on three (3) hour intervals. District headquarters will compile this data and forward it to the Residential Snow Coordinator, who in turn summarizes
  the information and forwards it to Highway Division Snow Headquarters

Sanitation Division

- Sanitation Assistant Chiefs of Operation and District Managers direct Sanitation Operations and report progress to Highway District Engineers
- At the Highway District Engineers direction, they will adjust on-street operations for specified route assignments
- Progress reports are to be provided at two (2) hour intervals to Highway District Sanitation Coordinator
- Managers will insure that all vehicles are manned at shift change
- Personnel will not be released without replacement
- Sanitation and Highway Yard Liaison will coordinate completion of the routes so a salt truck can follow behind.
  - Sanitation will support the Residential program by treating the small streets with the skid steers.

Highway Division Snow Headquarters

Snow Headquarters will:

- Inform Highway Districts of weather forecasts
- Monitor, through Highway Districts, the status of all salting operations
- Maintain a log of all service calls for snow and ice related activities
- Monitor weather conditions & forecasts. Analyze the data & forward it to the appropriate parties
- Analyze reports from the field & make changes to future operations where required
- Forward emergency calls from Police and Fire Departments to Highway Districts
- Maintain Snow Route Status Report
- Order commodities as required to maintain an adequate supply at all Districts
- Provide Emergency Operations Center (EOC) reports route conditions, weather updates and identified trouble spots

Office of Watersheds (Division of PWD)

- Office of Watersheds will de-ice the porous streets when a conditional deployment is called. During a full deployment, they will appropriately treat those streets. If they are not treated by the Office of Watersheds, then the residential program will treat the porous streets. As of November 2018, there are 10 porous blocks within the City.

Office of Fleet Management (OFM)

- OFM will provide necessary manpower & garage space as need to support storm type
- OFM will supply vehicle status reports to Highway Division Snow Headquarters, the Managing Director's Office and Emergency Operations Center on an hourly basis

Parks and Recreation

- Treat Park road system and Benjamin Franklin Parkway as required by conditions
- Clear all sidewalks around recreation centers
- All trails will be treated

Cessation of Operations

Streets Department

Highway Division

- Highway District Engineers will release all equipment to their respective departments for regularly assigned duties
- Highway District Engineers will release all personnel to their regularly assigned duties
- District Maintenance Supervisors will insure salt truck operators return unused material to stockpiles and wash truck beds, augers and spinners.
- Highway District Engineers will compile final contractor billing information
- All storm related information on personnel, equipment deployed, contract support & material used will be compiled by each district and forwarded to Snow Headquarters

Residential Districts

- Release spotters and drivers to their respective departments.
- Forward all reports to Residential Snow Coordinator who in turn forwards them to Highway Division Snow Headquarters
- Supervise the cleaning and redeployment of residential snow equipment

Sanitation Division

- Sanitation Division will dismount plows, remove chains and ready fleet for return to normal collection/cleaning activities

Highway Division Snow Headquarters

- Compile final report on all elements deployed for specific storm type
- Forward report to Streets Commissioner and EOC
- Compile cost estimate for event
- Direct highway districts post storm clean up deployment

Office of Fleet Management (OFM)

- OFM to compile final report on equipment repair costs and vehicle status and return to normal fleet repair activities
- Prepare for next event

Parks and Recreation

- Compile final report on personnel and equipment utilized
- Return to normal Park maintenance activities

Office of the Managing Director

- End snow emergency declaration and close EOC
- Effective in 2015, the 686-SNOW phone number has been permanently changed to inform citizens of their responsibilities of parking on a Snow Emergency Route

De-icing Support Personnel Assignments

The following functions will be performed by Streets Department and other City agencies personnel not directly involved with the operation of snow fighting equipment:

Bridge Maintenance Unit

The Bridge Maintenance Unit will perform anti-icing activities on the sidewalks of the City's bridges & pedestrian bridges as well as removing snow from the 15 stairways in Manayunk. Highway maintenance district yard personnel and Sanitation area personnel will be called to assist with this effort as dictated by storm type.

Highway Maintenance District Personnel and Sanitation area personnel

Highway maintenance district personnel and Sanitation area personnel, as dictated by storm type, will be provided hand snow removal equipment and will clear snow from curb ramps and open city inlets. This is to allow melting snow access to the drainage system and provide pedestrian accessibility. Snow may also be cleared from areas surrounding fire hydrants. Efforts will be made to keep select bike lanes clear of snow & ice. All bike lanes will be attempted to receive de-icing treatment.

SWEEP Support (Streets & Walkways Education and Enforcement Program)

SWEEP Officers will, beginning in commercial corridors, enforce sidewalk clearance - Ordinance 10-719. Upon completion, enforcement will expand to schools, hospitals, etc., culminating in residential inspection.

All City Departments

- Dry salting Will NOT be practiced.
- Sidewalks & ADA ramps: All City departments will be responsible for removing snow on the sidewalks abutting their facilities. Salt can be requested through snow HQ. In addition, bagged salt & Calcium Chloride is available on a City Wide contract for all Departments to Purchase
- Parking Lots: All Departments are responsible for treating & salting their respective parking lots.
  - The Police Department will coordinate with the Chief Highway Engineer for salt needed to salt all Police parking lots & driveways. The Streets Dept will treat the Round House ramp and the Traffic Police ramp on Erie Ave.
  - No Department will be supplied salt for the purposes of dry salting

- Dilworth Park is the responsibility of Center City District
- Dilworth Plaza is the responsibility of Public Property. Note: It is not recommended to drive heavy equipment on Dilworth Plaza.
- Sanitation will provide salting & plowing vehicles to treat the citizen's drop off areas.

Highway Division Support Personnel

Highway Division support personnel will continue snow removal support functions as part of their daily work activities after Sanitation workers return to regular trash collection. Snow removal equipment will supplement these efforts as it becomes available.

Small Streets

As part of the City's responsibility of making streets passable, the Sanitation Division will be de-icing several miles of streets that are less then 10 feet in width. These are known as Gator Routes. These will be treated when a full deployment is called. The crew chief in charge of this operation will report to the residential manager.

PWD Support (Philadelphia Water Department)

During major events, PWD crews will be dispatched to clear snow at inlets to prevent intersection flooding (if appropriate)

Bus Stops

OTIS has contracted with Intersection to de-ice all bus stops. This contract includes access to the bus stops and ADA ramp. In addition they will be clearing the snow at the Direct Bus Stops along Roosevelt Blvd.

Police Department Support

The Philadelphia Police Department will enforce existing ordinance/regulations prohibiting the discharge of snow back onto city streets. Private plow contractors caught in the act of plowing snow from private property onto city streets risk fine and/or forfeiture of equipment.

Bicycle Facilities

The City of Philadelphia is becoming one of the most bicycle friendly City in the United States. As doing so, a de-icing plan shall include bike facilities:

- The City (OTIS) has permitted bicycle corrals to be installed within the parking lanes. The private sponsor of the bike corral is responsible for clearing snow and de-icing. Note, throwing snow into the travel lane is not permitted. The City does not take on any responsibility for damage done by de-icing operations.
- No bike corrals are permitted on snow emergency routes during winter months.
- The INDIGO bike share program is privately owned and coordinated with OTIS. INDIGO is responsible for snow removal and de-icing. Snow shall not be placed in the treated street.
- As part of the Streets Department's Deicing and snow removal program, an effort will be placed on bike lanes where it is feasible.
  - Salting the bike lanes can occur with the salting of the travel lanes.
  - If the bike lane is next to the curb, efforts will be made to push the snow as close to the curb as possible. As the snow begins to melt, additional plowing and salting may be performed to expedite the snow melting
  - The City will be treating protected bike lanes. Each protected bike lane will be treated in a different manner:
    - The bike lanes in the 5th St Tunnel are being treated by DRWC. Since most of it is in the tunnel, salt should be applicable.
    - Frankford Ave, south of Ashburner. The Streets Department will be removing the delineators prior to the first plowable event and then returned in April. This will allow Streets Department crews to push the snow to the curb.
    - Ryan Ave from Rowland to Lexington has a protected bike lane with over 100 delineators. This was installed in the fall of 2016. The Highway Division has determined a method to treat the bike lane with plows.
    - South St, west of 27th. As of this update to the snow manual, the protected bike lane has been installed but not maintained by CHOP. Once installed, the Highway Division will treat.
    - Chestnut St from 44th to 33rd has a protected bike lane with over 150 delineators. In addition, some of the intersections delineators in the crosswalk that provide protection to pedestrians. This was installed in the summer of 2017. The Highway Division has determined the most effective way of treating the bike lane is manually. Snow blower will be used when salt is not effective. Part of the challenge is the property owners placing the snow from the parking lots and sidewalks in the bike lane. UCD has committed not to do this. Other property owners will be asked to remove the snow prior

to the City removing and send a fine.

- Parkside Ave from Girard/40th to 52nd St. A proposed protected bike lane has not yet been installed. It was striped in November 2017. The time of this publication, the physical protected bike lane has not been installed, when it is, the Highway Division will experiment with different methods of treating. This includes the islands installed at 42nd St. During the winter of 2017-18, it was determined standard plow trucks cannot maneuver through the island at 42nd St. Therefore, a smaller truck (F-350) will need to plow Parkside Ave at the island. Once completed, the 1st Highway will deploy staff to clear the ADA ramps.
- Market & JFK from 15th to 20th had protected bike lanes during the Summer of 2018. Different types of practices will be tried during the winter of 2018 and 19 to see what is the best method. It is unclear as to how the lifting operation will affect this protected bike lane.
- 22nd St from BF Parkway to Spring Garden St had a protected bike lane installed in September 2018. Different types of practices will be tried during the winter of 2018 and 19 to see what is the best method.
- Proposed bike lanes that maybe installed after this publication are 13th St near Temple, 27th from Lombard to South, South 27th to 21st. It is unclear as to how the protected bike lanes will be treated.

Public Relations and Education

Major Media Notification

The City will use the local major media and community newspapers to ensure that notification of the Department's plan is timely as well as effective.

Key communications tools include:

- Issuing of press releases/advisories. This will be done by or coordinated with the Mayor's press office.
- Posting information on Streets Department's website including list of FAQs, snow tips and status of departmental services as appropriate. Suggested snow tips will include:
  - "Park car as far away from the corner as possible. Cars parked too close to the corner limit the turning radius of snow equipment."
  - "Obstructions, such as, illegally parked cars affect our ability to plow effectively."

  - For effective snow and ice management partnership, City and citizens need to work together.
- Posting information on community websites/list serves
- Posting information on the City's Government Access Cable Channel 64
- Utilizing OIT to distribute announcements email

Notification System

The Department uses a voice mail messaging system to reach out to residents to inform them of important updates during snow events. The system is used when needed for this purpose. Through OEM, The ReadyPhilly system may also be utilized

311/Streets Department Communication Protocols for Snow Events

During storm events, all snow related inquiries will be accepted by 311, however, formal service requests will not be taken until 311 is notified by the Streets Department Public Relations that the event is officially declared over. During the event, 311 will advise the public of the level of deployment and let citizens know if their street is to be serviced depending on the level of service. After the event is ended, 311 will resume taking complaints from the public and the requests will be forwarded to the Streets Department for response within a reasonable time.

Customer Affairs

Residents are also able to call the Streets Department's Customer Affairs Unit at 215-686-5560 for information. When appropriate, "updated" advisories regarding the status of services will be pre-recorded on the Customer Affairs' voice mail system. The 686-SNOW tow number will be answered by the Police Communications

Responding to Citizens' Complaints

- Delegation – Service requests are, as always, delegated from the centralized system to operational units for appropriate action.
- Tabulation – Information can be gathered from the Customer Affairs Unit's computerized system to provide a post-storm picture of complaints.
- Planning – This information can be further utilized to plan appropriately and change plans for future snow events.

School Closure Policy

When inclement weather is present or anticipated that may impact schools opening or closing early, Streets, SDP, Arch Dioses, MDO, and MDO/OEM will conference to determine appropriate action relating to storm conditions.

Post Season Survey/Spring Maintenance

Beginning on or about March 1 of each year and continuing through April 30th, weather conditions permitting, sweeps will be made of Philadelphia road network, identifying defects for the upcoming spring repair season. Streets Department personnel, as well as those involved with residential inspection, may be asked to perform this task.

Operational Guidelines – Fighting Snow & Ice in Philadelphia

Material Resources

Salt inventory is dictated by several factors: storage capacity (including salt domes at secure, satellite locations throughout the city), availability of product, and environmental concerns. A salt dome is located at the six Highway District Yards and Domino Lane, Area 4. The City has the capacity to store over 50,000 tons of salt. Note, Anti-skid may be added to the salt if the inventory starts to run low or if the temperatures are cold where the salt may not be as effective. The Sanitation will sweep the street as conditions permit.

The Department orders salt as the inventory is depleted to maintain maximum capacity throughout the winter. Initial salt orders are placed against purchase orders cut from a blanket purchase order under the Commonwealth of Pennsylvania's contract. The City of Philadelphia has a secondary salt contract in place

Subsequent product is obtained from the City of Philadelphia's citywide rock salt contract. This contract provides for a primary and secondary vendor, and has language that includes the product specification, testing procedures, delivery locations, quantities and requirements, and weight certifications, and liquidated damages.

Requisitioning

The District Supervisor keeps an up-to-date inventory of the materials used for snow and ice removal during the winter months. S/he notifies the Administrative Officer (AO) and Assistant Chief Highway Engineer as orders need to be placed. An overall salt inventory for all six Districts & Domino Lane is maintained by the Assistant Chief Highway Engineer.

At the end of the winter season, the Chief Highway Engineer, AO, the Director of Planning & Analysis, and the Budget Officer review the remaining salt inventory to determine the necessary amount of salt needed to meet the following year's requirements. Accordingly, the State is notified of our estimated quantities, as is the Procurement Department for use in developing contracts for the following year.

Salting Policy

The Highway Division endeavors to maximize every application of de-icing in order to maintain the safest roads possible in the most economical way while protecting the environment. This also puts the City of Philadelphia in compliance with the MS-4 permit, this is maintained by PWD. The policy includes:

DRY SALTING WILL NOT BE PRACTICED. This is not an effective way of treating streets and is a waste of material.

Personnel Training: The Streets Department is committed to providing continuing personnel training to ensure that staff is well equipped to perform their jobs effectively.

Equipment: The Streets Department and Office of Fleet Management should update and replace equipment in an economically responsible manner.

Calibration of Spreaders: Regardless of whether automatic or manual controls are used, they should be calibrated before the snow season starts. Poorly maintained and un-calibrated controls are responsible for excessive salt use.

Use of Automatic Controls: The use of automatic controls is recommended for spreaders to make sure the correct amount of salt is being spread at all times.

Adequate Covered Storage: Storage facilities are vital to any winter operation. They must have sufficient capacity and good cover preferably under roof. Stock piles that are stored unprotected should be covered to prevent loss of materials and to protect the environment.

Proper maintenance procedures should be followed around storage areas. Outside stockpiles should be properly shaped and should be on impermeable pads. There must also be proper drainage to keep the salt dry and protect the surrounding area. A method for disposal or retention of the leached salt should be in place. Any salt that is stored outside of a protected area, may be temporarily tarped. This shall occur not only while deliveries are being made, but also if it is stored in areas outside of the designated salt storage areas (i.e.: Parking lots)

The 7 salt storage locations are domes or sheds. This will protect the salt from the weather.

The Street's Department is committed to work with the MDO & Water Dept Clean Water & GSI initiatives

Safeguarding the Environment: Salt and de-icing materials should be used in a manner that safeguards the environment. If misused, de-icing can pollute. If improperly used or stored it can get into wells or ground water. Excessive salt use can be damaging to certain plants and trees when runoff leaves sodium chloride in the soil. This practice makes the City of Philadelphia in compliance with the MS-4 permit.

Application: The application of salt alone depends on the type of precipitation, temperature, and snowfall intensity. When there is adequate frozen precipitation on the pavement (non plowable depth), and the temperature is above 25 degrees Fahrenheit, straight salt is optimized. Below 25 degrees Fahrenheit, a mixture of salt and abrasives will be used. The initial treatment of the roadway before plowing operations begin is to reduce ice or snow bonding to the pavement. Salt application rates range from 200 to 800 pounds per two-lane mile, depending on the storm conditions. Salt can be applied in a windrow or full width, which is sometimes necessary. Brine, formed by salt and water, will run to other parts of the road and be spread by traffic. Plowing operations should be timed to allow maximum melting. Salt reaction time is usually 20 to 30 minutes. (Reaction time increases as temperature decreases.)

Operation of equipment:

Within the City of Philadelphia, there are many bridges with weight restrictions. The drivers are not to drive crew cabs or tri-axles loaded with salt over bridges with low weight restrictions. These bridges include but not limited to:

- Falls Bridge
- Martin Luther King Drive
- 15th St, North of Callowhill
- Montgomery Ave, between 29th and 31st
- Calumet, east of Wissahickon

In addition, drivers who are responsible for driving vehicles with "dumps" need to be aware of the height restrictions so to avoid low clearance bridges, wires and tree limbs.

Equipment Resources

Certain specialized equipment is required to support the snow and ice removal plan; specifically, snow plows, salt spreaders, and snow loaders. Much of this equipment is available within the Department. Additional equipment is obtained through contract and is provided by other operating departments.

- Spreaders: Spreaders including tailgate and V-box spreaders are used to apply salt or sand, which are the primary de-icing chemicals used for fighting winter storms. Application rates are set for various conditions following Salt Institute guidelines.

- Plows: Plows are mounted on Highway Division trucks and Sanitation Division compactors of the Streets Department, as well as equipment in supporting departments for residential plowing once accumulation predictions are for 4" or more snow (or as conditions permit)

- Contract Equipment: City equipment is supplemented by the use of private sector contracted equipment for significant weather events. This equipment is used to assist clearing snow and ice from the primary/secondary network, as well as hauling snow from the CBD to a predetermined snow field.

- Footbridge/Sidewalk Clearance Protocol: Bridge Maintenance employees of the Streets Department are dispatched after each event ends to clear snow and de-ice from pre-determined footbridges and from the sidewalks of bridges. Other personnel may be asked to clear of sidewalks as conditions permit.

- Bus Stops & Kios: In 2017 and 2018, OTIS entered into a contract with Intersection to maintain the Bus Stops and Wi-Fi Kios. As part of the maintenance agreement, they are to shovel and treat the sidewalks around the bus stops and Wi-Fi Kios. This also includes the upgraded bus stops along Blvd Connect.

- Communication: All vehicles will be equipped with either radios or cell phones for communication during the events.

- Winter Maintenance Facilities: The six Highway Division maintenance facilities serve, along with Snow Headquarters, located in the Bridge Maintenance Yard, as the bases
- of all de-icing operations. During significant events, they are supplemented by Sanitation area and residential facilities. Salt is stored at the six Highway Division yards and Domino Lane.

- Operation and Safety: Equipment will be operated in a safe, effective manner by trained, properly licensed, operators. Winter is the season when equipment fails to start, personnel take shortcuts, traction is poor, visibility is poor, and other motorists
- may not see the operators of other vehicles. All drivers and crews should make required checks prior to and during the use of equipment to ensure safe operations are maintained. Pre and post trip inspections are mandatory.

Usage of Snow Melters

In the event that the amount of snow in a single event or multiple events combine warrant a large-scale removal, the City may invest in the rental of snow melting equipment. The Streets Dept will work with Fleet Management and the Airport in arranging for this equipment to be delivered to a pre-determined location. The location will be approved by the Water Dept so that MS-4 permit will not be violated. In addition, the inlets will be cleared so not to produce flooding from a choked inlet.

Personnel Resources

All Streets Department personnel are subject to reporting to duty during snow and ice storms. Failure to notify the supervisor of the inability to work during a storm is grounds for disciplinary action. Please see the Essential Staff Policy in Section 1, page 6.

The Highway Division is responsible for overall coordination of snow and ice control preparations. Supervisors are responsible for providing the direction required for effective snow and ice control.

Clothing: The lack of proper clothing is a direct cause of most frostbite occurrences, falls, and in many cases, is a factor in equipment accidents. All crews are urged to dress for the possibility that they may be stranded without heat for several hours. It is contemplated that within two hours assistance will be provided to any crew having trouble.

Communications: On street communications are maintained by inspectors and spotters, who are in constant communication with the Highway and Sanitation Districts and Snow Headquarters.

Personnel Notification Lists (and equipment and other assignments) will be provided to required personnel. Phone trees are to be initiated as necessary at the beginning of a snow alert.

Reporting Procedures

Status Reports: District Highway Engineers will be responsible for maintaining contact with all supervisors and operators in their districts and reporting on the progress of the field personnel to the Snow Headquarters. District Highway Engineers or their designee will make their first report one hour after notification of the snow alert and will continue to make reports as needed throughout the duration of the snow removal operations.

Accident Reports: The following are the responsibilities of the driver if an accident should occur during snow removal operations:

- Check for injury to persons, never admit liability, call 911 immediately for medical emergencies and state that there is a medical emergency;

- Obtain identification of the other vehicle and driver;

- Notify Police immediately either through radio dispatcher or by telephone. Do not leave the scene of an accident except in cases where physical harm is threatened. If physical harm is threatened, relocate then notify the police;

- Notify supervisor by radio or telephone immediately. All accident should be reported to Snow Headquarters.

- Forms 77-501 (Employee Accident/Incident Information) and 77-502 (Citizen Accident Information) should be carried in every vehicle and thoroughly completed at the scene of any accident then forwarded to either a supervisor or directly onto Form 82-S-87 (Traffic Accident Report);

- Employee should not sign statements, suggest any settlement or volunteer information about the accident except as noted above. All other requests for statements or signatures should be forwarded to the City of Philadelphia's Risk Management Department;

- The Safety Office shall be notified. Also, Email sent to the Safety Office.

Non-Municipal Employees contracted for snow removal operations should follow all of the directives listed above except completion of Form 82-S-7 which should be completed by the City on duty supervisor. The contractor is responsible for their own equipment.

Training

Requirements and Timelines: Training will be held for all personnel involved in snow removal as needs determine. Snow plow training for Highway Division and Sanitation Division personnel is part of on-going CDL training. Residential training is an intensive effort that will take place in November of each year for required personnel.

Field Inspection Procedure

Spotters/inspectors- will report on actual roadway condition. Reports will include surface condition, material application, plow progress, and problem locations. Conditions which have prevented the removal of snow and ice, such as illegally parked cars, abandoned cars, vehicles stuck in snow, etc. will be noted for follow-up removal efforts. Spotters/inspectors will file field reports with their respective coordinators after each event.

- Primary/Secondary - Spotters/inspectors are to report on the condition of the network, with a focus on identifying areas that are particularly troublesome for immediate follow- up.

- Residential - Spotters/inspectors, as well as the residential navigators, are to report on residential conditions, noting streets that will require follow-up work due to problems encountered during the initial effort.

- Frequency of Report & Detail - Reports are to be made as needed to the district managers and forwarded to Snow Headquarters. Detail to include whether road is
- passable, snow covered, salted, plowed or bare pavement. Conditions are coded and
- noted on inspector's reports.

- Expectations - It is the City's expectation that the road network be passable,
- no longer than 12 hours after the last flake has fallen. Additionally, it is the City's goal to have all routes identified in this manual's response protocolsclear within 24 hours of the fall of the last flake.

Policy on Snow Plowed into Street

As noted in the Philadelphia Code, Chapter 9, Section 601 (4) (f), Chapter 9, Section 404 and Chapter 10, Section 720, snow is not permitted to be plowed or shoveled onto City streets. Enforcement and penalties are described in the respective chapters.

Police Department Responsibility - Police Department personnel are to stop private contractors from plowing snow off of parking lots and driveways into city streets.

Streets Department Responsibility - SWEEP Officers will be dispatched to warn residents about throwing snow in the streets, as well as enforcing the 6-hour timeline to have your sidewalk shoveled to a minimum of a 36-inch path.

Communication

Internal - Communication of on-street activity during winter weather events will occur as needed. Spotters and inspectors will report to their respective coordinators route conditions and any identified trouble spots on their assigned routes. Operators will report any mechanical problems to both their headquarters and the Office of Fleet Management. All district coordinators will forward the updates to Highway Division Snow Headquarters, where the information will be compiled.

External - Highway Division Snow Headquarters will disseminate all information concerning winter weather events to external sources. Route progress reports, street conditions, equipment and personnel deployed, and materials used will be included in these reports. For major events, this information will be forwarded to the Streets Commissioner. He will then forward this information. Snow Headquarters will communicate to the Emergency Operations Center.

Section 2
Snow Emergency Routes

2. - Snow Emergency Routes

2.1 Snow Declaration

The Mayor, through the Managing Director, has the authority to issue a Snow Emergency Declaration for significant events. This declaration implements parking regulations on dedicated snow emergency routes.

2.2 Citizen Responsibility

Citizens are required to remove their vehicles from snow emergency routes.

2.3 Inspector Responsibility

Inspectors are required to report locations where cars have not been moved and to ensure that designated routes are plowed completely curb to curb.

2.4 Police / Parking Authority Support and Timelines

Police Tow Squad and Parking Authority tow vehicles will remove vehicles from snow emergency routes. Towing will begin at the designated snow emergency starting time and continue as necessary until the declaration is lifted.

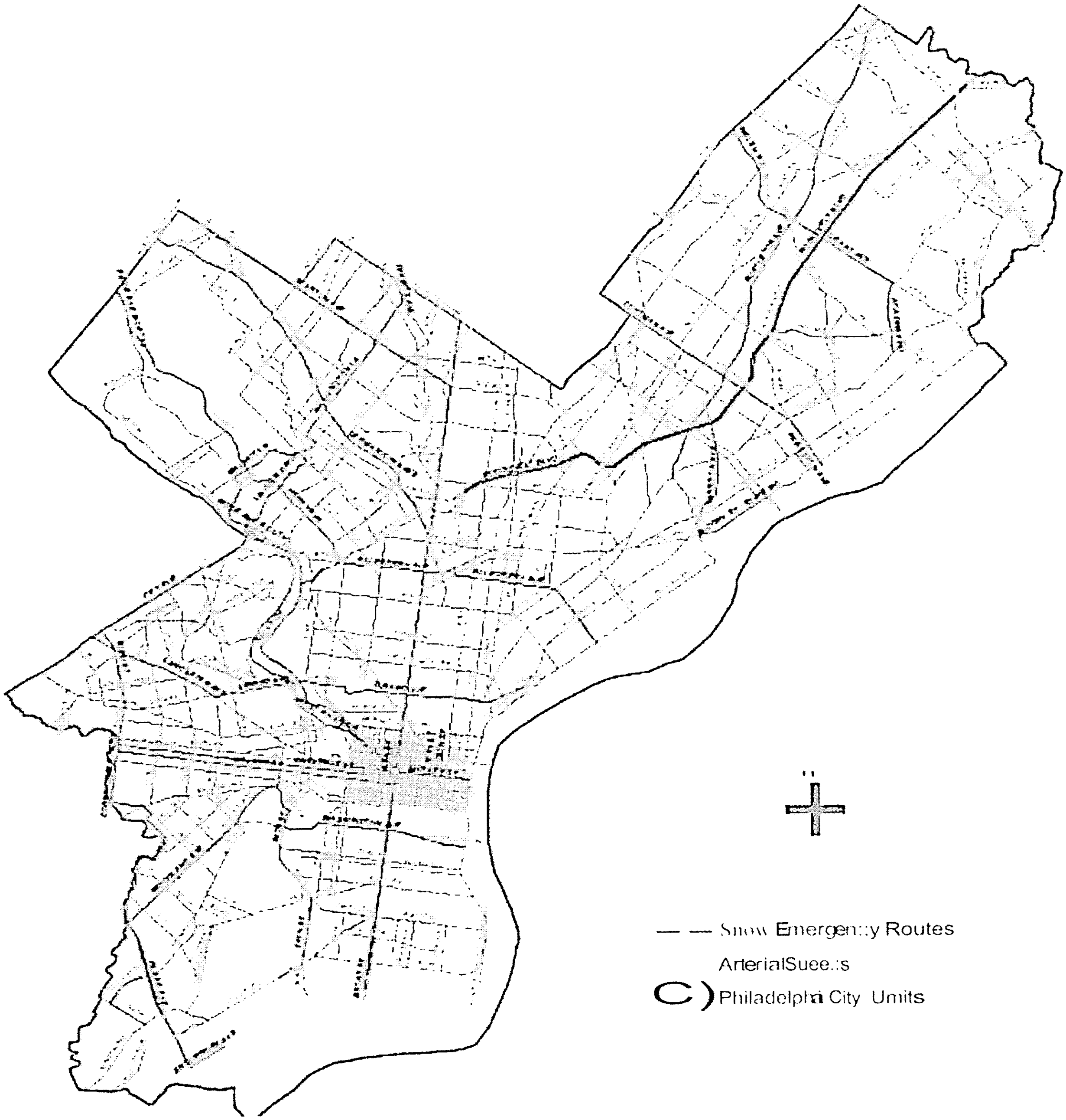
2.5 Record Keeping

Police Department and the Parking Authority personnel will keep records of the location of the relocated vehicles.

2.6 Snow Emergency Routes

Reference Map and Route Table

CITY OF PHILADELPHIA
Snow Emergency Routes



City of Philadelphia
Snow Emergency Routes

ON	FROM	FROM_HUNDRED	TO	TO_HUNDRED
06TH ST	I-676 OFF RAMP	300 N	MARKET ST	UNIT BLOCK
07TH ST	MARKET ST	UNIT BLOCK	I-676 ON RAMP	300 N
15TH ST	I-676 OFF RAMP	300 N	MARKET ST	UNIT BLOCK
16TH ST	MARKET ST	UNIT BLOCK	I-676 ON RAMP	300 N
20TH ST	CHESTNUT ST	UNIT BLOCK	MARKET ST	UNIT BLOCK
26TH ST	I-676 ON/OFF RAMPS	2500 S	PENROSE AVE	3800 S
34TH ST	UNIVERSITY AVE	1100 S	GRAYS FERRY AVE	1100 S
38TH ST	WALNUT ST	200 S	UNIVERSITY AVE	200 S
63RD ST	CITY AVE	2100 N	WALNUT ST	100 S
ACADEMY RD	FRANKFORD AVE	9100	GRANT AVE	9400
ALLEGHENY AVE	HUNTING PARK AVE	2900 W	I-95 ON/OFF RAMPS	2800 E
BEN FRANKLIN PKWY	ART MUSEUM CIRCLE	2300	16TH ST	1600
BRIDGE ST	HARBISON AVE	2100	I-95 ON RAMP	2300
BROAD ST	CHELTENHAM AVE	7200 N	I-95 ON/OFF RAMPS	3800 S
BUSTLETON AVE	FRANKFORD AVE	5200	ROOSEVELT BLVD	6300
BUSTLETON AVE	ROOSEVELT BLVD	UNIT BLOCK	COUNTY LINE	UNIT BLOCK
CHESTNUT ST	COBBS CREEK PKWY	6200	20TH ST	2000
CITY AVE	CITY BOUNDARY	7700	I-76 ON RAMPS	3800
COBBS CREEK PKWY	WALNUT ST	200	WOODLAND AVE	2100
COTTMAN AVE	I-95 OFF RAMP	5000	FILLMORE ST	UNIT BLOCK
ENTERPRISE AVE	ISLAND AVE	8400	I-95 ON/OFF RAMPS	8200
GIRARD AVE	LANCASTER AVE	4700W	I-95 ON/OFF RAMPS	800 E
GERMANTOWN AVE	BROAD ST	UNIT BLOCK	NORTHWESTERN	UNIT BLOCK
GRANT AVE	WELSH RD	1300 E	ACADEMY RD	3000 E
GRAYS FERRY AVE	34TH ST	3300	WASHINGTON AVE	2600
HARBISON AVE	BRIDGE ST	5200	ROOSEVELT BLVD	6500
HENRY AVE	CATHEDRAL RD	8500	HUNTING PARK AVE	3000
HUNTING PARK AVE	HENRY AVE	3000 W	KELLY DR	3300
ISLAND AVE	WOODLAND AVE	2200	ENTERPRISE AVE	4000
KELLY DR	LINCOLN DR	4600	ART MUSEUM CIRCLE	2300
LANCASTER AVE	CITY AVE	6300	GIRARD AVE	4800
LINCOLN DRIVE	RIDGE AVE	3600	WISSAHICKON AVE	5900
MARKET ST	SCHUYLKILL AVE	2300	I-95 ON RAMP	100
OGONTZ AVE	WASHINGTON LN	7400	CHELTENHAM AVE	8000
POPLAR ST	WEST COLLEGE AVE	2500	GIRARD AVE	2400
PRINCETON AVE	TORRESDALE AVE	4700	I-95 ON/OFF RAMPS	5000
RIDGE AVE (NORTH)	NORTHWESTERN AVE	9100	CATHEDRAL RD	8600
RIDGE AVE (SOUTH)	WALNUT LN	5600	CITY AVE ON RAMP	4500
ROOSEVELT BLVD	09TH ST	800 W	CITY BOUNDARY	16000 E
SCHUYLKILL AVE	MARKET ST	UNIT BLOCK	WALNUT ST	100
SEDGLEY AVE	ALLEGHENY AVE	1000 W	ALLEGHENY AVE	900 W
STENTON AVE	NORTHWESTERN AVE	9600	BROAD ST	1400
TACONY ST/STATE RD	BRIDGE ST	5200	TACONY-PALMYRA BRIDGE	6300
TORRESDALE AVE	COTTMAN AVE	7200	PRINCETON AVE	7100
UNIVERSITY AVE	38TH/39TH ST	300/400	34TH ST	600
WALNUT LN	WAYNE AVE	400 W	RIDGE AVE	500
WALNUT ST	BROAD ST	1400	COBBS CREEK PKWY	6200

WASHINGTON AVE	GRAYS FERRY AVE	2600	CHRISTOPHER COLUMBUS BLVD	UNIT BLOCK
WASHINGTON LN	WAYNE AVE	200 W	OGONTZ AVE	2000 E
WAYNE AVE	WALNUT LN	6100	WASHINGTON LN	6200
WELSH RD	CITY BOUNDARY	UNIT BLOCK	GRANT AVE	1100
WEST COLLEGE AVE	POPLAR ST	900	GIRARD AVE	900
WEST RIVER DRIVE	ART MUSEUM CIRCLE	2300	FALLS BRIDGE	2700
WISSAHICKON AVE	LINCOLN DR	6000	WALNUT LN	6000
WOODLAND AVE	COBBS CREEK PKWY	7200	UNIVERSITY AVE	3800

Section 3
Snow/Plow Routes

3. - Snow / Plow Routes

Highway Snow Operations (Map Location)

Go to the Streets Department's intranet site
http://streetsweb.city.phila.local/

Select "Streets GIS"
http://streetsweb.city.phila.local/streets_gis.html

Select "Divisional Maps"
ftp://streetsweb.city.phila.local/Maps/

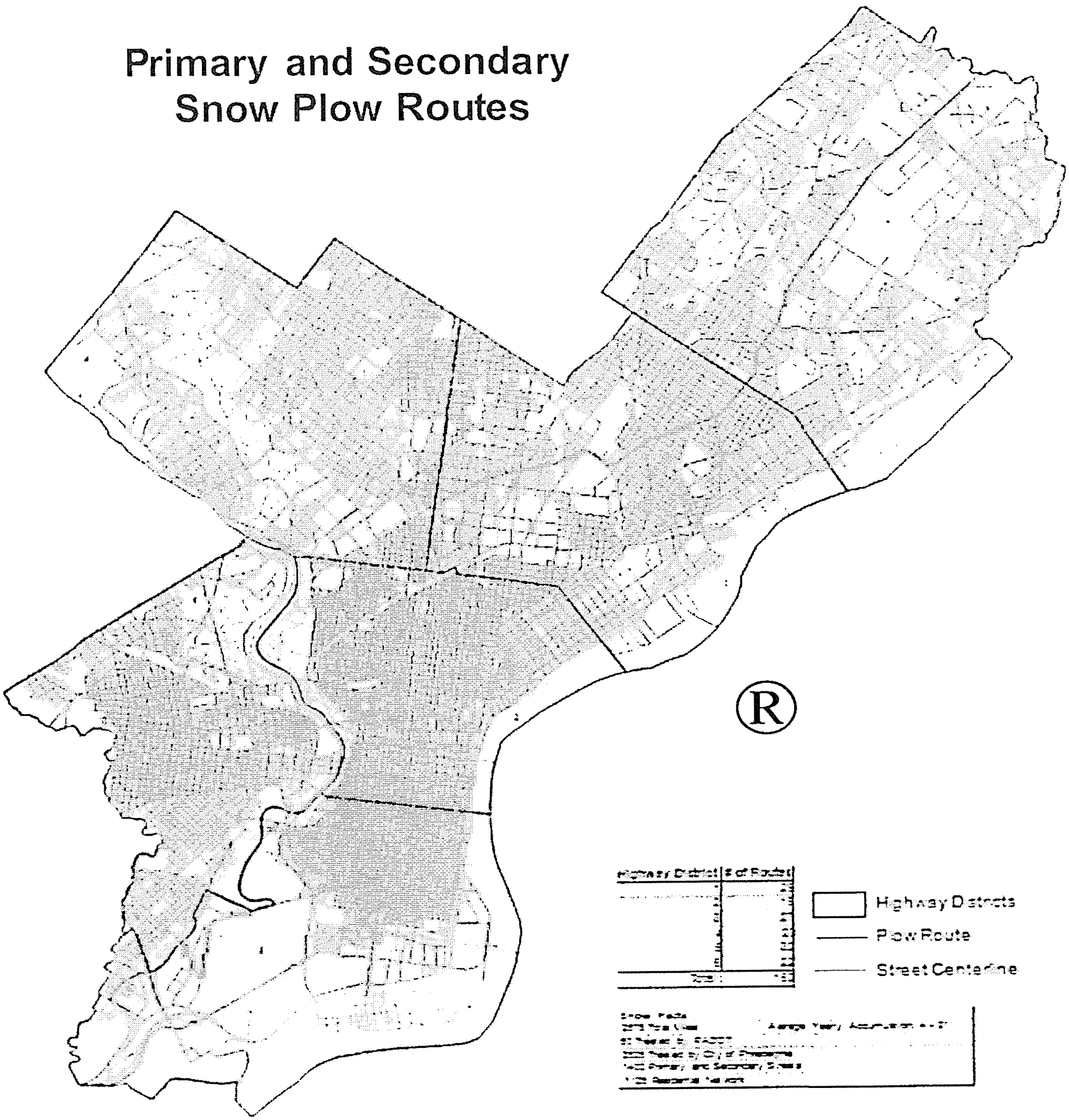
Select "Highways"
ftp://streetsweb.city.phila.local/Maps/Highways/

Select "Snow"
ftp://streetsweb.city.phila.local/Maps/Highways/Snow/

Select "Snow Maps"
ftp://streetsweb.city.phila.local/Maps/Highways/Snow/Snow%20Maps/

Select:
"Directory Overviews"
"Directory Plow Trip Packs"

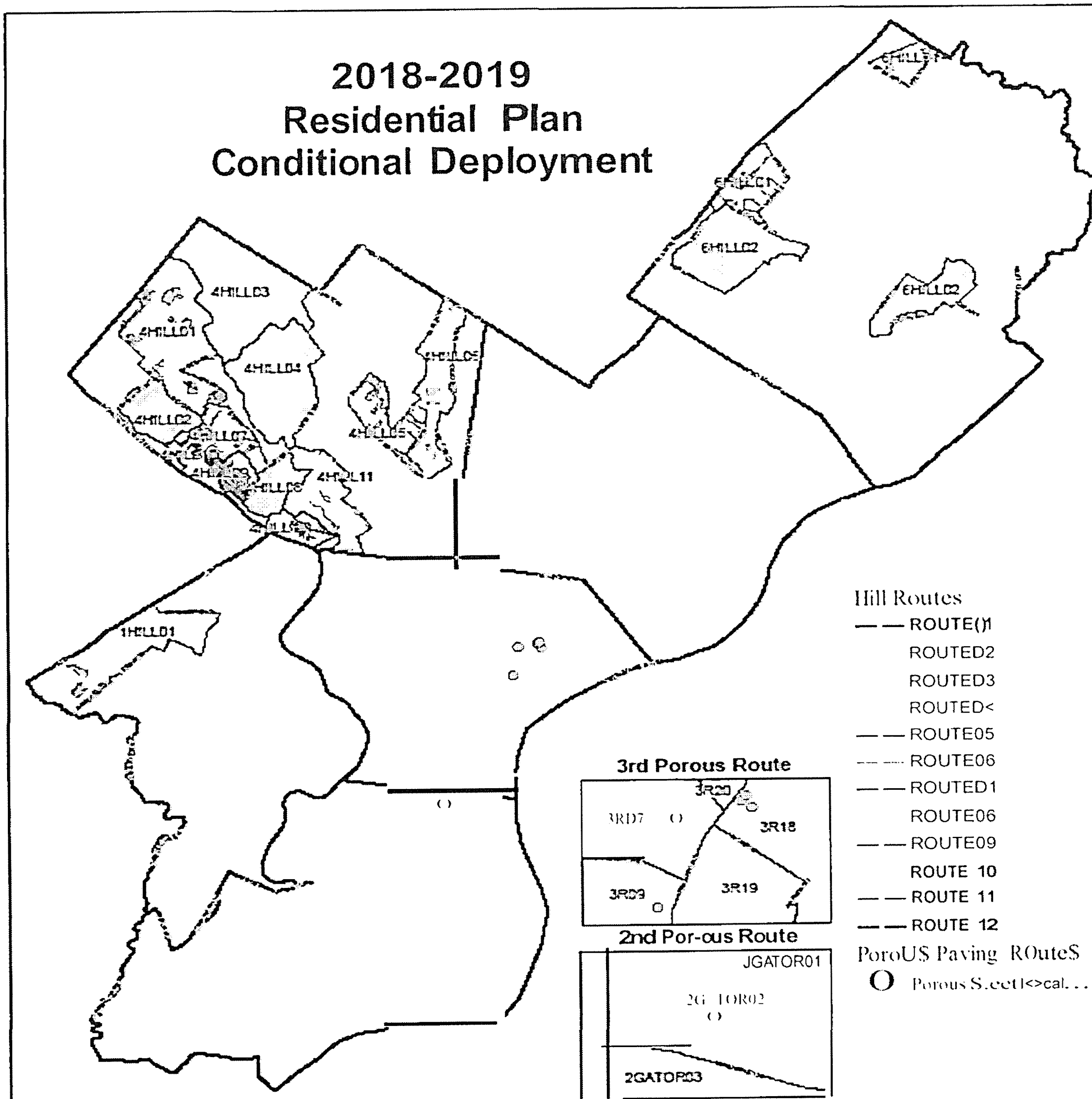
Primary and Secondary Snow Plow Routes



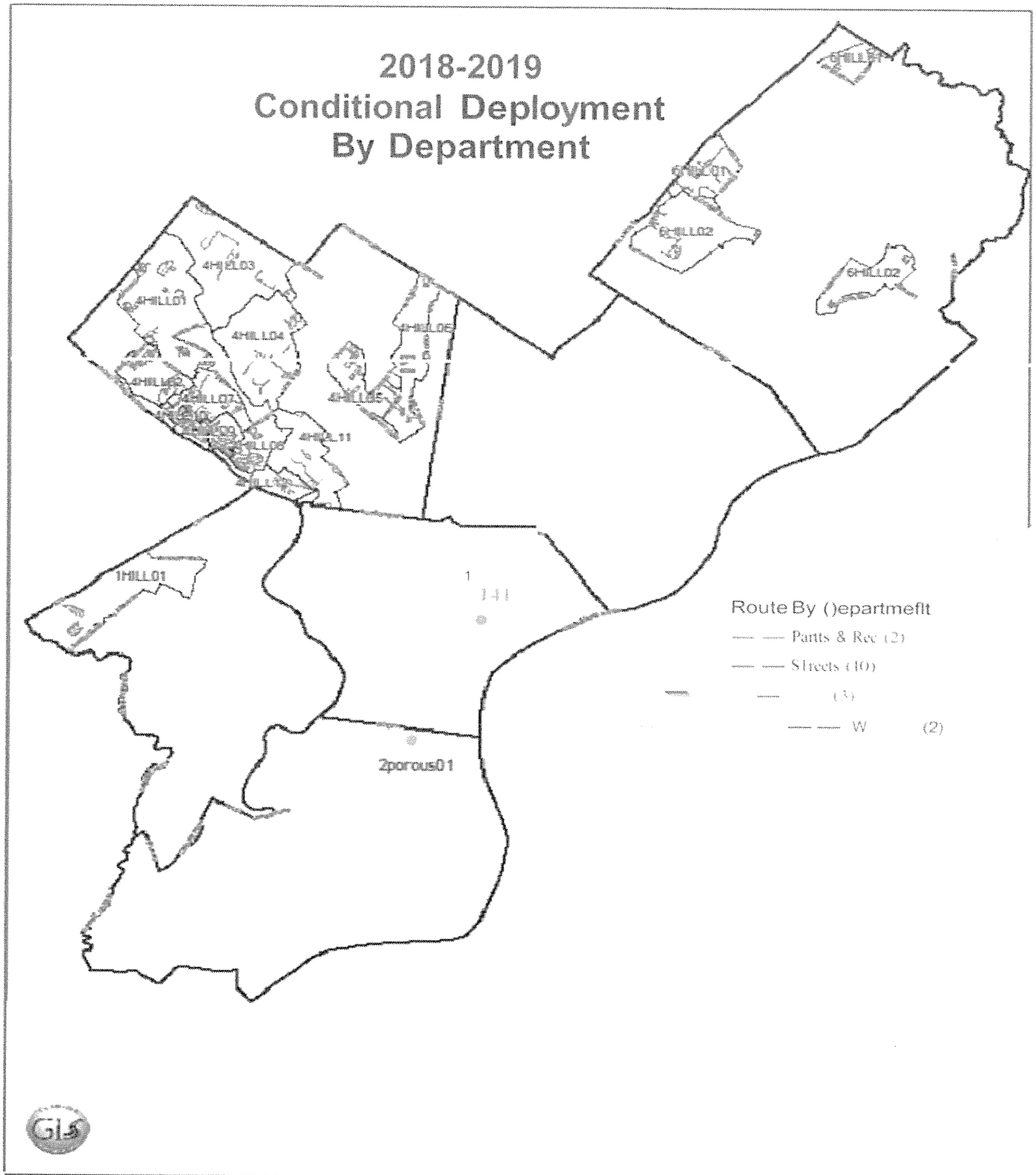
Section 4
Key Information

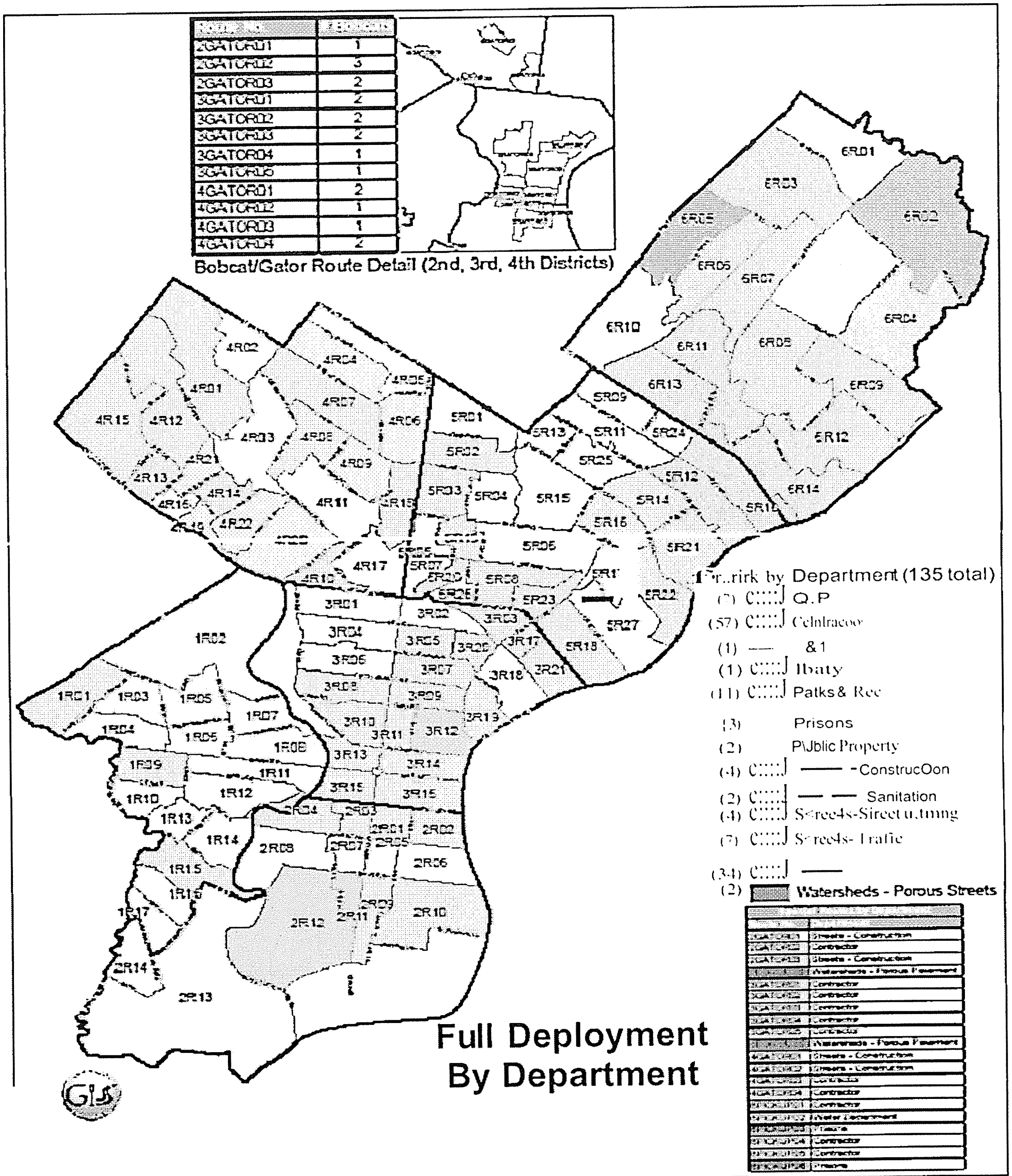
Section 5
Residential Street System

- Deployment Maps
  - Conditional Hill
  - Full
- Office Location & Phone List
- Support Departments-Manager Contacts
- Office Support Staff
- Residential Spotters



	District	Deployment	Miles Ser	
Hill	1st	1 Route	2.42	
	4th	12 Routes	59.53	72
	6th	2 Routes	10.11	
Porous Streets	2nd	1 Route	0.04	1131
	3rd	1 Route	0.27	


2018-2019
Conditional Deployment
By Department
4HILL03
4HILL01
4HILL04
4HILL06
4HILL05
4HILL11
6HILL02
1HILL01
2porous01
Route By ()epartmeflt
Parks & Rec (2)
Streets (10)
(3)
W (2)


Bobcat/Gator Route Detail (2nd, 3rd, 4th Districts)
2GATOR03 2
3GATOR02 2
3GATOR04 1
4GATOR01 2
4GATOR03 1
Department (135 total)
Q.P
&1
Patks & Rec
Prisons
P\Jblic Property
-ConstrucOon
Sanitation
Watersheds - Porous Streets
Full Deployment
By Department

Section 6
Snow Lifting Accounting Procedures

6. - Snow Lifting Accounting Procedures

Snow Lifting Records

1. **Forms Required**
   a. Streets Department Spreadsheet 77-298

2. **Snow Equipment Rental Form (77-298)**
   a. The District Engineer will be responsible for recording the following information for each piece of equipment assigned to their location.
      1. Highway District
      2. Contractor
      3. Who notified you
      4. Day of the week
      5. Time called
      6. Type of equipment ordered
      7. Operation to be performed by the equipment
      8. Where the equipment is to be assigned

   b. The contractor will assign the equipment and the operator as directed by the Streets Department, and record the license number of the equipment, and the name and address of the operator on the 77-298 form. The form will be given to the contractor operator to be used as his assignment and time record.
   c. The District Engineer will give the 77-298 form to his inspector assigned to the operation. The inspector will be told to report at the designated time and location for the start of operations. The inspector will sign-in the equipment assigned to him on the 77-298 form, recording the following information:
      1. Equipment license number
      2. Contractor's employee name
      3. Contractor's employee address
      4. Starting time
      5. Phone number

   The contractor's operator will indicate on the 77-298 form the <u>Time Started.</u>

   d. The inspector will call his District Engineer at hourly intervals and inform him of the progress being made. When the assignment is completed the inspector and the contractor's operator will each note Time Stopped on their form.

e. The City of Philadelphia will pay only for the operating time for the contractor's equipment. Stand-by time or lost time will be entered under "Penalty Time" and an explanation of the cause under "Penalty Remarks". When additional assignments are given to the inspector, he will complete "Location From To" on form 77-298. He will give this information to the contractor's operator, who will note this added assignment on his copy of form 77-298.

f. Whenever the contractor replaces a piece of equipment, or replaces an operator, the contractor will initiate a new form 77-298. The inspector at the worksite will then prepare a new form 77-298 to cover the replacement. Procedures will then proceed as previously outlined.

g. When a form 77-298 is completed, the city inspector will sign his copy and the contractor's operator copy. The inspector's copy of the form will be returned at the end of his tour of duty to his District Engineer.

h. When a form 77-298 is completed, the contractor's operator will sign his copy and the city inspector's copy. The operator's copy of the form will be returned to his employer.

i. The reverse side of form 77-298 can be used for remarks or explanations of unusual situations. On forms 77-298 containing the time record for dump trucks the city inspector will note on the reverse side the following information:

1. The time the dump truck leaves the work location to unload
2. The time the dump truck returns to the work location from unloading.

j. When the District Engineer receives the city inspector's forms, his personnel will enter on each line the "Total Working Hours". This is the number of hours at the site (start-finish) less the "penalty time" lost. Appropriate travel time will be added for each piece of equipment.

k. The District Engineer will check the city inspector's form and will then forward them to the Snow Contractor Liaison of Department of Streets. The contractor will use his copies of the form 77-298 to prepare his invoice, in triplicate, will be drawn on the Accounting Division, Office of the Director of Finance, Room 1330 Municipal Services Building, and sent directly to Administrative Office, Highway Division, Department of Streets for pre-auditing. The invoice will contain the following information and will be submitted for each 24 hour period:

1. Contractor's name and address
2. Snow Event
3. Number of pieces, kind and class of equipment in operation
4. Location of operations, i.e.: streets on which equipment operated
5. Dates and hours of work at specified rate per hour for
    a. Equipment with operator
        Regular time
        Premium Time

b. Foreman Regular time Premium Time

c. Laborers Regular time Premium Time

d. Travel time for equipment only (rate times the standard level travel time allowed)

l. The Snow Contractor Liaison, Highway Division, Department of Streets will summarize the form 77-298 and prepare a receiving report (form 71-20) in the usual manner for each 24 hour period. The receiving report and supporting form 77-298 will be forwarded to the Accounting Division.

m. Time calculations for equipment and personnel will be based on full 15-minute periods. For example, a piece of equipment operating for 4 hours and 27 minutes will be paid for 4 ½ hours.

3. Contractor Labor-Snow Emergency Form (77-298)

a. Procedures applicable to "Snow Equipment Rental", form 77-298 are also applicable to "Contract Labor – Snow Emergency", form 77-298 except as indicated below.

b. The contractor's foreman will maintain the contractor's time record for the foreman and the labor crew.

4. The Chief Highway Engineer will terminate Snow lifting operations.

5. This procedure will also be included with the rental of loaders for the salt domes if needed.

Section 7
Snow Removal Cost Accounting Procedure

7. Snow Removal Cost Accounting Procedures

Snow and Salting Cost Accounting Procedures

A. Purpose

The Purpose of this procedure is to (1) provide a means for determining the cost of plowing and salting city streets and legislative routes within the city street system, and (2) provide a method for allocating these costs to both legislative routes and city streets. Most of this data is kept in the SSIS. Hard copies are not necessary to be kept.

B. Scope

The use of the forms described in this procedure shall apply to ALL agencies involved during snow and salting operations. Since the methods of attaching snow and ice storms vary, the accounting for costs will be compiled separately. The Department of Parks & Recreation shall report to the Department of Streets the cost of plowing and salting the Kelly Drive (Legislative Route #67292).

C. Definitions

1. Light snow requiring only de-icing techniques shall be considered Salting Operations
2. Snow operations shall include storms of such magnitude that plowing and de-icing operations are necessary.
3. The Snow Season will extend from October to April of the following year.

D. Cost Accounting Policies

1. The cost of snow emergency headquarters and agencies outside the Department of Streets (other than Department of Parks & Recreation) shall be allocated to snow. Snow headquarters is normally opened when storm conditions require plowing operations. Even though there is preliminary salting, the entire cost will be allocated to Snow Operations. However, if only salting is required, the cost of snow headquarters and that of other agencies will be allocated to Salting Operations.

2. The ratio of State and City costs shall be calculated by comparing the sum of the City and State plow miles in Snow Operations. For salting, the ratio shall be computed by applying the percentage of City and State salt route miles to the tons of salt required for each route. Plow miles and salt route miles shall be the product of the linear mileage and the number of cuts or passes made by the vehicle.

3. For Streets Department, the labor cost will be the actual hourly labor cost for each employee. The vehicle cost will be the average hourly operational cost of a vehicle by type as determined by PennDOT/FEMA. Fleet Managements will supply these costs.

4. Standby time prior to plowing or salting will be charged at the district City - State ratio of the actual storm.

   a. In the event that standby personnel are not used, the cost will be shared in the ratio of existing City-State miles or roadway.

   b. For snow, this ratio shall be City 58.6%, State 41.4%; for salting operations City 66.5%, State 33.5%. These ratios are subject to change when snow and salt routes are revised.

5. The cost of snow removal on legislative routes is not chargeable to PennDOT since $2.5 million is paid to the City on an annual basis for this service.

E. Forms

The following forms will be used in conjunction with this procedure. Instructions for the use of these forms are described in the body of the procedures.

77-307 Rev. 4/71, 77-307A - Report on Snow Plowing / Salting
77-360 = Salting Report

Time and Costing Snow and Salting Operations, formerly recorded on forms 77-308 Rev. 8/98 and 77-308A, are now recorded in the Snow Storm Information System (SSIS), a MS Access database designed by the IT unit of the Streets Department.

F. Snow Operations

All personnel reporting for snow duty will sign in on the approved time sheet for their department or agency. Prior to leaving the yard the inspector will receive Form # 77-307 Rev. 4/71 which will delineate the route.

Each District prior to the snow season will type on Form 77-307 Rev. 4/71 the following information:

1. Legislative route number if the street segment is part of the State highway system.
2. The street that is to be plowed or salted.
3. The “from – to” limits of plowing or salting.
4. The mileage of the street segment.
5. The route number or letter.

The inspector (plowing) or the truck driver (salting) will complete the following items:

6. The date and day of the week.
7. The operation, plowing or salting, day or night
8. Driver's name
9. Truck number
10. The number of cuts or passes required
11. Time reported for duty
12. Time started plowing/salting
13. Time finished plowing/salting

If the inspector/driver works on more than one route, items (12) and (13) are to be completed for the time spent on the route – NOT THE TOTAL TIME. Item (11) is time reported for duty and will not change even though the route may change.

14. Any delays in route
15. Cause of delay
16. The inspector/driver will sign his name to the report

The inspector supervisor in district will calculate item (17) Total Miles plowed for each segment, total all miles plowed and determine the City and State shares, item (18).

19. Will be used during salting operations

The Highway district office will then determine the ratio of City and State plow miles for each route, and by summing the routes, the district ratio.

The time of ALL personnel combating a storm will be accounted for in the SSIS (previously tracked on form 77-308 rev. 8/72).
The District or Area Office completes this information as follows:

1. Organization – 5th Highway, Area 2, Water Department, etc.
2. Condition
3. Date personnel called in and released
4. Time personnel called in and released
5. Employee name
6. Employee number
7. Function – the particular function the person was performing (e.g.: plow driver, inspector plow, auto repair, install chains, etc.)
8. Vehicle number – if applicable
9. Hours – the district office will enter the actual number of hours worked in the appropriate column (regular, time and a half, double time)

10. Vehicle cost – the hourly operating cost multiplied by the operating hours. The Accounting Section will supply these costs.

The Sanitation Area office will complete items #1 through #10.

During severe storms when contractor personnel are called to augment City personnel, it is the responsibility of the Highway District Engineers to insure that the contractors submit the following necessary information required when invoicing the City:

1. Number of pieces, kind and class of equipment in operation
2. Number of foremen, operators, laborers, regular hours worked, premium hours worked, hourly rates
3. Location of operations (e.g.: streets on which equipment operated)
4. Dates and hours of work at specified hourly rates

At the time invoices are received by Highway District Offices it will be the responsibility of each Highway District Engineer to call and discuss with the Snow Contractor Liaison cost applicable to the State as per existing agreements between the Commonwealth of Pennsylvania and the City of Philadelphia with respect to snow plowing and salting operations.

G. Salting Operations

Since the rate of salt expended on a street varies by such factors as the type of spreader and size and speed of vehicle, the use of miles salted by itself is not an indication of the labor required to complete a route. Therefore, for Salting Operations, the City - State ratio will be used and defined in Section "D".

Personnel called-in to combat an ice storm will sign in on the authorized sign-in sheet for the Highway yard. The streets repair supervisor will issue the salt truck operator Form # 77-307 rev. 4/71, which delineates the route. The equipment operator will complete the form as described under Snow Operations, and will note in column (10) the number of passes necessary for each street segment. Upon completion of the route the operator will sign the form and return it to the streets repair supervisor.

The streets repair supervisor will perform the following tasks:

1. Complete SSIS information as described under Snow Plowing for each person in his district.

H. Responsibilities

1. Accounting Section Streets Department

a. The Accounting Section will determine the average fringe rates to be applied to labor, retrieve PennDOT vehicle rates, and distribute the information to all divisions of the Streets Department.

b. SSIS will accumulate the cost of each snow and ice storm. The Accounting Section will prepare any cost reports required by PennDOT on a schedule determined by PennDOT.

2. **Sanitation Division Streets Department**

a. Each Sanitation District will be responsible for accurately entering all necessary data in SSIS and marking the storm data complete. All data must be in the system within 24 hours of the close of each storm.

b. Time sheets and supporting data will be kept in the Area office. These will be filed chronologically by date of storm for every snow season. Records will be kept for four (4) years after the snow season.

c. Sanitation Headquarters will summarize the payroll cost of each storm and submit these costs to the Budget Officer within two (2) days after the storm.

3. **Highway District Offices**

a. For Snow Operations the Highway district office will calculate the plow miles for each route on Form # 77-307 rev. 4/71 and determine the City / State ratio for each route and the district as a whole.

b. For Snow Operations the District Office and Yards will be responsible for accurately entering all necessary data in SSIS and marking the storm data complete. All data must be in the system within 24 hours of the close of each storm.

c. For Salting Operations the street repair supervisor will forward form 77-360 and form 77-307 to the office of the Assistant Chief Engineer Maintenance.

d. After Salting Operations the office of the Assistant Chief Engineer will be responsible for making sure all data is entered into SSIS and marking the storm data complete. All data must be in the system within 24 hours of the close of each storm, and inform the Chief Highway Engineer and the Accounting Officer of the information available.

e. The Assistant Chief Engineer will submit the report out of the SSIS system

4. **Other Agencies**

a. When other agencies are involved in snow or salting operations, they will submit the required SSIS information to the Chief Highway Engineer immediately after the storm. The labor cost for these agencies will be the actual wage rates for the employees assigned to snow duty. SSIS will add fringe benefits and overhead.

Conclusion

The system described herein provides a standard system for allocating the cost of snow and salting operations. Deviations from the system will be authorized only when the Chief Highway Engineer, the Accounting Officer and Budget Officer agree to the change.

Appendix N – Sanitary Infiltration Events

Report Date	Report Time	Problem Location	Spill Notes	Affected Outfall	Abatement Date	Abatement Time	Abatement
6/5/2019	3:30 PM	HOLME & LONGFORD AVE	Sanitary sewer on Holme Ave choked.	P100-14	6/5/2019	6:00 PM	Flushed open choked sewer with flusher truck & removed debris.
5/9/2019	12:20 PM	400 RITTENHOUSE ST.	Found sanitary sewer up at Wayne & Rittenhouse.	W060-10	5/9/2019	3:30 PM	Used vactor truck to relieve choked sewer(flushed).
4/26/2019	11:00 AM	2100 DOUGLAS	Sewage on footway & sewage in basement 2117 N 33 Rd.	N/A	4/26/2019	5:00 PM	Removed debris from sewer with vactor & combo to relieve choke.
4/24/2019	1:20 PM	7810 WINSTON RD	Found choked sanitary sewer with sewage coming from vents 7810 & 7808 Winston onto street.	N/A	4/24/2019	7:00 PM	Used vactor to flush & clean sewer to relieve choke.
4/10/2019	1:30 PM	4874 SMICK ST	Sewage coming from ground 1/2 gal/min down trail in woods.	N/A	4/10/2019	8:00 PM	Used flusher to relieve choked sewer.
4/5/2019	5:00 PM	7TH & ARCH ST	Found choked sewer on 100 N.7th.	N/A	4/6/2019	10:40 AM	Flushed sewer with vactor truck to relieve choked sewer.
4/4/2019	7:30 AM	5700 WAYNE	Choked sanitary sewer discharge into storm and 5700 Wayne basement.	W060-10	4/4/2019	11:40 AM	Flush sewer with vactor to relieve choke.
4/2/2019	9:04 AM	GOLF COURSE, 7400 LANSDOWNE AVENUE	Discharge was observed by PWD construction personnel and constructions lining contractor (SAK), estimated discharge rate of 5 gpm.	N/A	4/2/2019	11:20 AM	Installed bypass pump.
3/27/2019	1:40 PM	12339 DUNKSFERRY RD	Found choked sewer.	Q115-01	3/27/2019	2:40 PM	Flushed open choked sewer & removed debris from sanitary sewer.

Report Date	Report Time	Problem Location	Spill Notes	Affected Outfall	Abatement Date	Abatement Time	Abatement
3/7/2019	3:50 PM	2035 S 66TH ST	Found 6" sewer on sidewalk choked and W/C at 2035 also 2033, 35, 37, 39 FAI's all up.	N/A	3/7/2019	7:00 PM	Flusher broke choke relieved W/C.
2/28/2019	3:30 PM	HOLME AVE & LONGFORD	Found choked sewer.	P100-14	2/28/2019	9:30 PM	Flushed open choked sewer & removed debris with flusher truck. Flushed storm sewer open with water @ dechlorination tablets. No fish kill & no clean up needed.
1/23/2019	9:30 AM	CITY AND PRESIDENTIAL	Sewer discharge from manhole S50.	N/A	1/23/2019	11:40 AM	Cleared choked sewer with flusher.
1/17/2019	1:00 PM	HOLME AVE & LONGFORD	Choked sewer on Holme Ave.	P100-14	1/17/2019	1:30 PM	Relieved choked sewer with flusher truck & removed debris (grease & rags).
12/27/2018	12:10 PM	3200 FOX ST.	Sewage coming from eye of sanitary manhole cover onto street.	N/A	12/27/2018	7:00 PM	Used vactor to vac down manhole to stop discharge, used vactor with root cutter to clear roots and relieve choke.
12/6/2018	4:00 PM	525 ROXBOROUGH AVE	1/2 gallon/min into storm sewer.	W060-01	12/6/2018	6:10 PM	Used flusher to relieve choked sewer.

Report Date	Report Time	Problem Location	Spill Notes	Affected Outfall	Abatement Date	Abatement Time	Abatement
11/30/2018	11:10 AM	NON-SEWER SPILL - PNBC 603	Called sewer maintenance crew w/ vactor to meet at the PNBC_603 pumping station. The leak was minimal, could be contained easily and monitored.	N/A	11/30/2018	12:00 PM	Sewer maintenance sand bagged the closest storm drain, isolated the leak, monitor it and ran vactors the weekend.
11/24/2018	11:08 PM	NON-SEWER SPILL - NEILL DRIVE PUMP STATION	SSO was not identified until 11/26/18 when telog charts were checked as there was a power outage. No debris or gray water was detected in the stream on 11/26/2018.	N/A	11/24/2018	11:10 PM	Power was restored to the pump station and the wet well was pumped out and levels went down.
11/6/2018	11:00 AM	7800 CITY AVE	M/H cover was cocked with no current discharge or solids topside. Still raining but no obvious signs of the discharge.	N/A	11/6/2018	1:10 PM	Possible overtaxed sewer heavy rain event.
11/2/2018	3:00 PM	1522 W. FIRTH	Choked sewer with discharge into basements-grease choke.	N/A	11/2/2018	6:40 PM	Used vactor to relieve choke-vacuumed grease.
11/1/2018	12:22 PM	PHILADELPHIA NAVY YARD	4' section of force main was broken during excavation conducted by Miller Bros, working in the navy yard to relay electrical conduit. No sewage was observed in contractors excavation at time of response.	N/A	11/1/2018	12:22 PM	During time period between PWD response and repair, pump station was bypassed via use of sewer flush/vac machines.
10/27/2018	4:30 PM	3064 JOYCE	W/C sewage in basement @ 3064 Joyce - sewer choked.	N/A	10/27/2018	9:30 PM	Flushed & vacuumed sewer to relieve choke.

Report Date	Report Time	Problem Location	Spill Notes	Affected Outfall	Abatement Date	Abatement Time	Abatement
10/24/2018	1:00 PM	26TH AND LANGLEY	2 broken sections in force main again no discharge to water. Used flushers to keep flow from street jpc group made repairs.	N/A	10/26/2018	2:00 PM	Flusher was used to control sewage flow.
10/19/2018	8:30 AM	4555 PECHIN	Sewage discharging from inlet at loading dock of 4555 Pechin (inlet connected to sanitary sewer).	N/A	10/19/2018	9:30 AM	Relieved sewer obstruction with push rods and removed debris.
10/15/2018	9:40 AM	16TH & WALNUT	Choked sewer with discharge of sewage into basements 122 S.16th & 1529 Walnut.	N/A	10/16/2018	6:30 PM	Used flusher & degreaser to relive choke.
10/5/2018	11:00 AM	200 BENNER ST.	Found choke sewer on 200 Blk of Benner St.	T080-02	10/5/2018	1:30 PM	Flushed open sewer with vactor & vacuum grease & debris.
10/3/2018	12:50 PM	4600 SILVERWOOD	Sewer choked on 4600 Silverwood-manhole up & report of sewage in basement of 300 Leverington.	N/A	10/3/2018	1:10 PM	Flushed sewer to relieve choke.
10/2/2018	7:40 AM	ON TRAIL LINCOLN & WISSAHICKON	At time of arrival no discharge.	N/A	10/2/2018	8:10 AM	Flushed sewer placed degreaser.
9/14/2018	8:00 AM	5950 RIDGE AVE	Sewage discharged from choked sanitary on 5900 Ridge into storm sewer.	S051-08	9/14/2018	12:40 PM	Relieved choked sewer with flusher.
9/5/2018	8:00 AM	3281 FOX ST	Found choked sewer with grease & roots.	N/A	9/5/2018	10:00 AM	Relieved choked sewer with flusher.
8/23/2018	1:40 PM	6012 RIDGE AVE	Found choked sewer discharge into storm.	S051-08	8/23/2018	3:20 PM	Broke choke with flusher.

Report Date	Report Time	Problem Location	Spill Notes	Affected Outfall	Abatement Date	Abatement Time	Abatement
8/10/2018	1:30 PM	5100 ROCHELLE	Found choked sanitary sewer discharging out manhole onto street.	S052-05	8/10/2018	4:40 PM	Relieved choke sewer with flusher cleaned sanitary sewer removed debris from manhole.
7/26/2018	2:00 PM	441 KRAMS AVE	Found sanitary sewer discharge into storm sewer.	S059-04	7/26/2018	5:00 PM	Relieved choked sewer with flusher & excavation crew. Replace & repaired sanitary sewer.
7/24/2018	12:00 PM	NON-SEWER SPILL -	Found sewage coming from manhole on trail 1/2 gallon/min. Private sewer.	N/A	7/24/2018	2:00 PM	Broke choke in private sewer with flusher.
7/23/2018	1:50 PM	437 KRAMS	1 gallon/min from FAI at 437 Krams.	S059-04	7/23/2018	2:50 PM	Broke choke sewer with flusher.
7/20/2018	9:00 AM	35TH W ALLEGHENY AVE	Found discharge into storm system.	S046-06	7/20/2018	2:10 PM	Broke choke with flusher in sanitary sewer.
7/20/2018	1:50 PM	5101 ROCHELLE	Discharged sewage into basement 5101 Rochelle.	N/A	7/20/2018	2:30 PM	Broke choke with flusher in sanitary sewer.
7/10/2018	3:30 PM	HOLME AVE & LONGFORD AVE	Choked manhole @ P100-14-S0015.	P100-14	7/10/2018	8:30 PM	Flushed open choked sewer with flusher truck.

Appendix O – Pollution Migration / Infiltration

Date	Location	Pollutant	Drainage Type	Follow-up Actions
7/11/2018	Four Alarm Junkyard	Junkyard Fire	Combined	PWD'S Industrial Waste and Backflow Compliance (IWBC) was requested on-site. The runoff appeared to mostly go to the Somerset Collector. Any water on the Lehigh Ave side would go to SE. Both plants were notified by the IWBC manager of the fire. A report of a 4 alarm fire was forwarded to the IWBC manager. IWBC arrived on the scene at 23:54. IWBC checked into the command center at 00:20. They notified the PWD representative that was on scene. The walk to the command center required traveling through thick smoke. Samples collected for PCBs (1:05) and VOC screen (00:45) at Trenton and Somerset. The water sampled was runoff in the street. The following day IWBC was notified that D 25 discharged due to the fire. Samples were delivered to BLS refrigerator at 2:14 and follow-up later that morning with updated COC. IWBC was advised that the VOC sample could not be used for regulatory purposes due to preservative issues. They advised that was fine as they needed to know what was in the discharge. Air samples collected by the Clean Air Council were reported later in the media to be high in arsenic and lead.
7/19/2018	1500 block of Alter St.	Illegal Chemical Discharge	Combined	A 311 referral came through the Dispatcher concerning an illegal chemical discharge on the 1500 block of Alter Street. The complainant has an auto repair shop across from where the discharge occurred. After speaking with the complainant, IWBC visited Marble Works, Inc. The discharge was a backup from their FAI of a gray material with a slurry like consistency. The owner of Marble Works showed us the drain inside the shop. There is a solids interceptor prior to the FAI. The solids interceptor was almost completely full. IWBC instructed him to clean the pit and have his lateral cleared. IWBC told him to call me when the work was complete, or a NOV would be issued. His sister called to advise me that the line and pit had been cleared. IWBC explained the importance of more frequently cleaning. The material was from the use of wet saws to cut marble for counter tops. The sewer did not appear to have been impacted by the discharge.
7/23/2018	1427 N. Front St.	Wastewater Pumping to Street	Combined	IWBC arrived at 1427 N. Front street at 10:30 on 7/23/2018 regarding wastewater being pumped from the residence to the street. Upon arrival, a hose was observed emerging from the basement window. There was no active discharge. IWBC talked to the owner at 10:45. Owner admitted that her sewage pipe was broken in the basement, and that wastewater was flooding into her basement. She was periodically pumping the sewage in the basement to the street, which then lead to a storm inlet at Front and Jefferson. No impacts were observed at the storm inlet. IWBC instructed her that pumping to the street was prohibited and could lead to fines. Owner stated that she could not afford a plumber to fix the issue. I left the site at 11:15. IWBC followed up with the owner via phone call at 15:04 that day and informed her of the HELP program to help resolve her plumbing issues.

Date	Location	Pollutant	Drainage Type	Follow-up Actions
8/27/2018	Orthodox Auto Company Fire	Burning pile of wires, insulation, and automobile parts	Combined	IWBC met with the Fire HMAU representative. He advised the fire was in a pile of wire, mostly burnt insulation, with some automobile parts on the lot of Orthodox Auto Company. The fire was about 200 ft from the river. The cause of the fire is unknown. Upon my arrival the fire was out. They were spraying the area with water. They planned on spraying all night. No water department structures are in the area. It is unknown if there are storm drains. The area has a French drain, which was overflowing. The fire water traveled to the parking lot behind 6801 State Road. There were cars parked at 60 ft from the river for about 400 ft upstream. The water was ponding. There was a light sheen in sections of the standing water. There was a slight petroleum odor by the pooling water. An unknown amount of the fire water may have made it to the river, but IWBC did not observe a direct discharge to the river or observe any sheen on the river downstream at Unruh St. Coast Guard was notified by the Fire Department and the PADEP. The chief of Fire HazMat took samples of the fire water for overall petroleum products. Air management was on site to take air samples. August 28, 2018, 1100 AM. The fire department quit spraying down the site at 730 PM last night. The area behind 3801R State Rd. stores cars for about 4 days. The cement pad located in the corner of 2801R State Rd that is visible in the 2015 ortho pictures is buckled and has cement barrier in front of it. That area is dry and looks like no run off occurred at the cement pad. The cars along the bank of the river are about 20 ft.-60 ft from the river. There is a natural berm which the water would have had to flow over. IWBC spoke to the owner of Orthodox Recycling. She informed the back area where they work on the cars has no storm drains. They did not see any storm drains in either parking lot. The fire was confined to piles of wire. IWBC did not observe a sheen at the river at Unruh. IWBC am sure some water may of made it to the river but I could not see an obvious pathway.
8/28/2018	9200 block of Blue Grass Road	Odor Detected at Blue Grass Rd	Separate	Residents of Fountain Pointe at the 9200 block of Blue Grass Road called a City Councilman's office to complain about a foul smell & potential pollution to a runoff system/creek behind their building. The precise location of where the water system is unknown. The residents also made the councilman know that the polluters could potentially be a nearby auto-shop. IWBC checked the outfall (P-105-01 Roosevelt and Goodnaw St.) upstream of the location. The outfall is partially submerged. A slight flow was observed. The plunge pool was clear. There was stagnant water next to the outfall that look cloudy when the sun hit a certain angle. The creek is behind 9200 Bluegrass. There was no evidence of sewage in the creek. There were no foul odors along the creek. The creek is visible from a bridge on Marshall St. before the swimming pool. This is downstream of the site and upstream of Bluegrass Rd. The creek pools after

Date	Location	Pollutant	Drainage Type	Follow-up Actions
				the bridge. In sunlight there is a slight scum layer. The creek flows into an area with lots of vegetation. No foul odors were in this area the three times I checked. IWBC visited the site at Louis Ct. IWBC smelled no foul odors in the area the three times I checked it. There is a sanitary manhole on the road. There were no open pick holes and no odors in the area. IWBC spoke to a resident of 213 Louis Ct. He told me the foul odor was strong in the AM. He did not currently smell it. He said it smelled like mulch. IWBC looked around the area and did not notice any new mulch being put down. IWBC told him they would check the area in the AM. IWBC told him that the creek looked good and that they could not smell anything unusual. They told him that they would add the outfall to our scheduled inspection list for this year. 8/30/2018 0735--IWBC checked the outfall and the creek from behind Louis Ct. No unusual discharge was observed, and no foul odors were detected. August 30, 2018, 5:15pm -- IWBC checked the auto body shop on Bluegrass which is downstream and on the other side of the tracks. There is a storm manhole in the parking lot that could flow to the creek. There was stagnant water in the manhole and no foul odors in the area. There was no evidence of illegal dumping around the building. The creek is overgrown with vegetation and is inaccessible from Bluegrass Rd. IWBC checked the outfall and the creek from behind Louis Ct. No unusual discharge was observed, and no foul odors were detected.
8/31/2018	Rosehill St. and E Ontario St.	Transformer Spill	Combined	Wire burned and damaged a transformer. 20 gallons of oil spilled with about 5 gallons made it to a storm drain. The storm drain has lots of leaves and trash in it. PCB test kit showed no PCBs. PECO will follow the oil protocol and take additional test. IWBC met with a representative from PECO at site. He explained that around 10 AM a wire burned out on top of the pole and landed on the transformer fin causing oil to spill to the asphalt on the 300 block of E. Ontario St. When he arrived, it had been raining. There is sheen from the road and from the transformer. The field test showed non-PCB. He also took a sample of the oil from the transformer. He will forward the results. He treated the cleanup of site as if the PCB test was positive.

Date	Location	Pollutant	Drainage Type	Follow-up Actions
				They looked at the six inlets on the 300 block of E Ontario. The rain made it difficult to determine the impact on the inlets from the transformer oil. The two inlets on NE and NW corner of Ormes St. are across the street from the spill. There was no evidence of transformer oil on the street or in the inlet. Normal sheen from road run off was observed. There are four inlets at the intersection of Rosehill and E Ontario. There was no evidence that the two inlets across the street were impacted. There were many cars on the street. One was on a jack. Normal sheen from road run off was observed. The inlet on the SEC of Rosehill and E. Ontario was blocked and not taking any water. (PWD emergency desk was called.) They determined that the most probable inlet that was impacted was the inlet on the SWC of Rosehill and E. Ontario. PECOs contractor PSC cleaned the S curb line of 310 E Ontario St. 165' down to the inlet with a water and Simple Green solution then the street was sprayed with Global cleaner. An adsorbent boom was placed around the inlet. A vac truck sucked out the debris from the inlet and captured the cleaning water. PSC sucked out the debris and water in the inlet. 2 cleaning runs were made. A sheen was still on the street. Speedi Dry was spread and cleaned up. The inlet was cleaned with Simple green and Global. Once clean a wipe test was done on the inlet walls.
9/28/2018	C. Lever Colors, Inc.	Caustic and Dye Spill	Separate	Reporting a spill of caustic and dye from C. Lever Colors, Inc. Some is outside on driveway. No drains are known to be in the area. There is red dye in the area. She is going to call NRC. IWBC arrived on the scene and met a representative from C. Lever Colors. She showed me the area of the spill. It occurred when a chemical reaction became uncontrolled. The process was making cyclobright red 12, a dye. The chemical feed pump did not add the proper amount of formic acid. When the remaining formic was added the resulting increase in pressure caused a frangible disc to rupture spewing the dye in the process room and to an air scrubber outside. The scrubber leaked and workers were bleaching the color out with hypo. Pigs had been placed on the ground to prevent any runoff. At that point no release other than airborne was observed inside as there are numerous drain plugs throughout the facility. IWBC could not confirm their presence inside the process room and received conflicting reports as to whether they were in use. However, no color was observed in sewer. Additional cleanup will be conducted inside the facility.
10/9/2018	148 E Duval St.	Vehicle Fluid Leak	Combined	Caller reported vehicle leaking antifreeze and oil to inlets. IWBC arrived at 148 E Duval St. at 16:40. IWBC identified an abandoned pickup truck as the source of greenish puddle. However, the slight depression in the street prevented it from draining causing algae to grow as well. IWBC did not see any leaking oil. The Dodge Ram 1500 had a flat tire and expired inspection stickers. PA Truck tag #ZVH-8161. IWBC contacted the complainant and advised her to report the truck as an abandoned vehicle through 311. IWBC also advised her that she could contact the District's Community Relation Officer who should be able to assist.

Date	Location	Pollutant	Drainage Type	Follow-up Actions
				The antifreeze that leaked out appeared to be less than a gallon and had mixed with other standing water. The area is a combined system.
10/22/2018	Cescaphe Restaurant	Kitchen waste water hose discharging sewage	Non-contributing	Kitchen waste water hose discharging sewage to the Schuylkill River from Cescaphe restaurant at the Water Work. IWBC met with PWD employee and a Water Works Building Manager who showed me the area of concern. The large tent set-up used by Cescaphe for larger events has a wash station for dining ware and utensils used at the tent location. The washer discharge is a pipe which runs through the tent and into the building next to the tent. The discharge is into a screening device. The screening device was formerly hard piped to a capped off drainage system that would cause sewage to build up in the basement of the Water Works. To combat the sewage build-up, the screening device was disconnected from the hard piping, and the hard piping was replaced by a 2" diameter black corrugated hose. This hose runs through the building, down the steps to the basement area, and continues along the basement floor to a depression that leads to a balcony overlooking the Schuylkill River. In the depression, there was a PWD saw horse barricade and on the saw horse, there was a blue plastic rectangular tray. The black corrugate hose terminated in the tray. The Water Works building manager stated that the black hose had been used to discharge the wastewater run through the screening device into a pit. The pit was mostly filled with a stagnant gray scum material that had a septic odor. After the pit had been filled and could no longer hold any more fluid, the hose end had been positioned to its current location at the depression next to the balcony. The manager could not state that any discharge that may have occurred would impact the river, as he had never seen the hose discharging to that location. Based on the use frequency of the tent for events, and the use of the washer, the likelihood was great that water would discharge from the hose into the depression. The manager provided contact information for Cescaphe's manager. IWBC followed up with phone calls to Cescaphe on 10/23/2018 and 10/26/2018 and left voice messages. My call was returned on 10/26/2018 and left a voice message stating that she is referring me to an individual who works for the City of Philadelphia, and handles matters related to complaints. IWBC spoke to the Deputy Commissioner of Parks and Recreation, who assured me that the black corrugated pipe had been disconnected, and that the items requiring washing were now being transported to the Cescaphe restaurant main building and washed there. There is an existing and functioning connection to the City sewer at the restaurant. As a result, there are no longer any discharges inside or around the Water Works.

Date	Location	Pollutant	Drainage Type	Follow-up Actions
10/23/2018	Ice Cream Express	Oil Tank Leak	Combined	Home heating oil being discharged to the ground. The complainant is a property owner next to Ice Cream Express, and they share a common cinderblock wall. According to complainant, the oil storage tank that is next to the wall is actually on his property, as the wall is built 2 feet inside the property line. He does not own the tank. He stated that the tank is leaking oil to the ground and contaminating what is essentially his property. IWBC met with an Ice Cream Express employee who showed the tank to me. There was no sign of leaking from the tank to the ground. There was weepage on the top of the tank at fittings on the tank, but nothing that was evidence of having resulted in spillage to the ground. IWBC spoke to an Ice Cream Express manager via telephone, and he explained that there were no leaking tanks. He had never used the tank and he was not sure if there was any material in the tank. The tank provides fuel for an oil burning heater inside Ice Cream Express. IWBC pointed out that there was oil staining on the inside of the Ice Cream Express's garage, in proximity to the tank, but he stated that the oil on the floor was the result of a forklift leak, which has since been repaired. He said that there is no drainage to the city and thought that the drainage in the garage, which was in the area of a depression in the floor covered with metal plates, went to a French drain. I explained the French drains are not permissible drainage, as they allow contamination to impact the soil beneath them, and that he should clean up any residual oil to prevent any rain water than can enter the garage under the garage door from carrying the oil into the drain.
11/3/2018	Daisy Field at 5000 Hermit Lane	Diesel Fuel Spill	Non-contributing	An anonymous caller report to unified dispatcher that a crew from Parks and Recreation spilled 5-10 gallons of diesel fuel gasoline mixture on the gravel road near 5000 Hermit Lane leading to Daisy Field. When IWBC arrived, the complainant showed me where on the Daisy Field access road the spill occurred. He explained that a Parks and Recreation crew was working the road. On Sunday, Daisy field is going to be dedicated the David P Montgomery Field. The mayor is going to be on site. Someone on the crew placed gasoline into the Green John Deere front end loader and blower instead of diesel fuel. An unknown amount of the bad mixture was poured on the ground. Complainant confronted the foreman. Complainant then called his wife, who works for PWD Watersheds. Unified Dispatch and NRC was called. The spill occurred on the side to the gravel road. After Mike reported the spill and before my arrival a Parks and Recreation crew returned and placed sand on the area. The area is 4' by 2' on the north side of the road across from the slope leading to a drainage swale. There is sand over the area. There is a very faint diesel oil smell close to the ground. The area is 40 ft. away from the Fairmont Park storm drain which drains to an outfall on the other side of the road. The spill area is across the road from the drainage area for storm water. IWBC called Unified Dispatch who put me through to Parks and Recreation on call. IWBC spoke to an employee who stated he would contact the ground supervisor who will take of the situation.

Date	Location	Pollutant	Drainage Type	Follow-up Actions
				No PWD structures were affected. No oil was in the storm drain or impacted the outfall or drainage swale.
11/7/2018	Stenton Ave. and Woodbrook Ln.	Metering Crew Substance Report	Separate	An email from a sewer maintenance employee reported that a metering crew at MS_6 (Woodbrook and Stenton) and MS_3 (Erdenheim and Stenton yesterday (11/6/2018 9AM to 11 AM) reported to have a "dark slimy substance" in the water. Sewer maintenance employee requested IWBC to investigate and take a sample. IWBC met the metering crew and MS_6 (Woodbrook and Stenton). They said that yesterday (11/6) the crew member who cleaned the chamber noticed a dark greyish slimy substance that he never saw before. The crew member is off today. IWBC took a jar sample of the flow. The sample did not have any oily substance and looked like a typical sewage sample. The crew went in chamber and grabbed a sample of the grit lining the pipes. This sample also looked like grit and was not oily. There were no unusual odors in chamber. We then went to Ms_3 (Erdenheim and Stenton). There no unusual areas in the chamber. The crew grabbed a sample from the pipe. It was blackish but not oily. IWBC took both samples to BLS for Qual test. IWBC let the crew to call their supervisor when they notice something unusual so that we can get called earlier. The sampled black substance is a mixture of iron oxide(s), possibly rust, silica/silicate minerals, and organic (possibly natural) matter. More analyses are being performed.
11/9/2018	Navy Yardat 51 Mustin St.	Manhole Installations	Separate	A project in the Navy Yard is currently excavating for and installing manholes near the Delaware River at 51 Mustin St. Per this work, they are pumping ground water into filter bags (3 locations) within the surrounding parking lot. This filtered water is then flowing into existing unprotected inlets within the lot. Upon arrival IWBC met with a representative from Gilbane. He explained that they are installing 4 storm water manholes. During high tide, they have to pump groundwater out of the excavation. The water is pumped through a bladder filter to the concrete tarmac then drains to a storm inlet. Any ground water in the excavation of Stormwater MH#1 and MH #2 is being pumped through a filter bladder. (MH#1 one 2" pump [500 gpm] and one 4" pump on standby. MH#2 one 2" pump). The bladder drains to the tarmac and the water flows to an inlet approximately 50 ft from the Delaware River. This inlet has stone berm around it to further prevent any sediment from entering the drain. During my

Date	Location	Pollutant	Drainage Type	Follow-up Actions
				inspection, IWBC observed flow on the influent side of the excavation. It is theorized that source of the water could be the groundwater being pumped out MH#3. Any ground water in the excavation of Stormwater MH#3 is being pumped through a filter bladder. The bladder drains to the tarmac and the water flows to an inlet approximately 400 ft. upstream of the inlet near the river. This is the inlet that was reported to IWBC. There is no additional protection the inlet. The bladder is about 20 ft. away from the inlet. Water is flowing to the inlet. The flow is clear with no sediment. IWBC called the Pennsylvania Department of Environmental Protection and explained the situation. IWBC asked if Gilbane needed a pump to pump river water back to river through an inlet. He said no as long they have E &S measures in place. Gilbane employee is going to install stone around the unprotected inlet. The measures were in place on 11/9/2018.
12/14/2018	Southwest Water Treatment Plant	Petroleum odor in the pretreatment influent	Non-contributing	The Wastewater standby, advised the Southwest Water Treatment Plant crew chief at 8200 Enterprise Ave. reported a strong petroleum odor in the pretreatment influent. The operator took samples. Upon arrival IWBC met with the SW crew chief, TP. There were no ambient petroleum odors in the area. He said he smelled strong petroleum to odors around 445 PM. The odors in the plant influent, specifically the grit basin and primary sedimentation tanks. He took sample at 5 PM. We walked around the grit basin and sedimentation tanks. IWBC could not smell any petroleum odors. TP said they we faint and not as strong as they were one hour earlier. No petroleum odors were detected. No LEL and PID readings were below 1.5 ppm. There was no floating layer or sheen in the grit basin or primary sedimentation tanks. IWBC took several jar samples at both sites. IWBC detected no odors in the samples. There was no sheen or floating layer. A sample was collected by TP at 5:00 PM. At 7:00 PM, IWBC forwarded updates with my findings. IWBC dropped the samples at BLS for a qual test. Results received 12/18/2018. No odors were detected and GC analysis did not show any traces of petroleum or fuel.

Date	Location	Pollutant	Drainage Type	Follow-up Actions
12/30/2018	Reading Waste Water Treatment	Sewage Spill to Schuylkill River	Outside of municipal boundary	Early Warning System (EWS) report of 5000 gallons sewage spill to Schuylkill River at Reading, Pa. because of a temporary power outage around 5:00 AM at the Reading Waste Water Treatment. Power was restored by the time EWS sent. Low priority. No action needed. Partially treated sewage.
12/31/2018	Baxter Water Treatment Plant	Diesel Odor	Separate	Caller states diesel odors detected at bar screen 8, FHL inside the Baxter Water Treatment Plant at 9001 State Rd. Odors had dissipated prior to my arrival. PID readings max 5 ppm at Bar screen and PST Set bldg. No unusual readings on gas meter. A sample was collected at the FHL by the operator and delivered to BLS for Qual test.
1/2/2019	Cresheim Valley Dr. between manholes CV-0140 and 0145.	Abandoned Drum	Non-contributing	Blue plastic drum of unknown contents alongside Cresheim Valley and Lincoln Drives. between manholes CV-0140 and 0145. The Waterways Restoration Supervisor requested IWBC's assistance in getting a blue drum of an unknown substance off of the side of Cresheim Valley Drive. His concern was if it spilled it could impact the creek. IWBC located the sealed blue drum. It was smaller and it contained between 5 and 10 gallons of liquid. It was not leaking. Per protocol IWBC contacted 911 and requested a PFD response. Police Car 1424 arrived and assisted with blocking traffic. HMAU was contacted by the Engine Company that arrived later. Prior to the HMAU arrival, the PPD Counter Terrorism Taskforce arrived to assess any potential threats. They took some readings around the drum and they were reported as normal. HMAU arranged for CVCC/ARV to over pack and remove the drum. This was completed on 1/2/18.
1/4/2019	W Thompson St. and N 30th St.	Concrete Dumping Report	Combined	Municipal Dispatch reports a resident is reporting concrete dumping to the sewer system at 30th & West Thompson Sts. Company onsite named is STAMM is working on an apartment building. They have a tool set-up at the storm drain to allow the concrete from the site to go directly to the drain. On Friday, January 4, 2019 at 5:05pm while on another response, IWBC was notified about concrete dumping to the sewer at 30th and Thompson. The site has a name STAMM working in the area. IWBC arrived at the site on a rainy Saturday morning. IWBC saw concrete staining on and around the drain. Because of the rain, construction debris were washed down into the drain. The drain should have been protected by a filter bag and silt sock but it was not. IWBC did not see any construction debris at the outfall S-05.

Date	Location	Pollutant	Drainage Type	Follow-up Actions
				On Monday, I revisited to site to speak to someone but no one spoke English. IWBC left my card there. This site is a project by STAMM Development Group. IWBC called and left a voice mail and have not heard back for them. Also, IWBC forwarded this information to PWD's Green Stormwater Infrastructure.
1/4/2019	5336-46 Lindbergh Blvd.	Paint Spray from Auto Shop	Combined	NRC Report to PWD-IWBC. An anonymous caller reported an auto shop is painting vehicles without insulation which is causing the paint to get offsite. Arrived at 5336-46 Lindbergh Blvd (Southwest Metal), IWBC spoke with the site manager about paint runoff from the auto shop. The auto shop is a tenant of the scrap metal yard. They are an auto repair shop and not an auto body shop. IWBC did not see any paint related material on site.
2/12/2019	Kentucky Fried Chicken on 6114 Lancaster Ave.	Kentucky Fried Chicken Sewage	Combined	Report from GSI about sewage entering green infrastructure from the Kentucky Fried Chicken franchise located at 6114 Lancaster Ave. Sewage was observed by IWBC backing up from parking lot area drain next to sidewalk and to street. It was also observed in videos taken by Tag/Notary service next door, IWBC spoke with the manager, who contacted the area coach. She indicated someone would be out in 2 hours. Re-inspection by Customer Service confirmed issue with dye test.
2/13/2019	3818 Patrician Dr.	Transformer Spill	Separate	Pole transformer spill to storm inlet. Approximately 15 gallons to street and inlet during rain event. PSC to perform cleanup. PECO Energy Corporation reported a transformer on a pole failed at 3818 Patrician Drive in Philadelphia City, Philadelphia County. The failure released approximately 15 gallons of non-PCB mineral oil onto the ground and into a storm drain. A contractor, PSI, is onsite performing clean-up. The vac truck is cleaning the inlet. Creek checked for impact non-observed, however it rained during event.
2/14/2019	106 S. 13th St.	Gray Water Dumping in Alley	Combined	The IWBC inspector reported gray water dumping in alley way flowing to inlet. The alley way where the gray water dumping took place is behind 3 food establishments. Lolita which is at 106 S. 13th Street and which also own Barboza. An employee from Lolita said he would inform the staff of both restaurants. An empty mop bucket was just inside the doorway of Lolita. "Bar" at 1309 Sansom Street does not open until after 5 PM. IWBC left my card in the door and a voicemail. The gray water can flow to an inlet on Sansom but did not make it that far during my visit.
3/25/2019	6801 Cottage St.	Oil Spill To Drain	Combined	Oil spill to drain from leaking tank at 6801 Cottage St. IWBC arrived on the scene and was met by two members from Hazmat. Apparently, there is a leak from either of the two 8000 #2 fuel oil tanks. The leak has worked its way through the cinder blocks and impacted a floor drain. We determined the floor drain flowed to a sump which pumps down about every 5 minutes. Hazmat had blocked the drain prior to my arrival. IWBC checked the sewers. Cottage Street south of the school did have a slight fuel oil odor. The VOC reading was 3 ppm. No sheen was visible. IWBC stayed on scene until the sump was vacuumed out. IWBC estimate 25 gallons of oil maximum was in the sump. It is unknown how much made it to the

Date	Location	Pollutant	Drainage Type	Follow-up Actions
				sewer. It is suspected the leak started after the last tank fill which was approximately 2 weeks prior. The Crossing Guard related that she had periodically smelled an unusual odor that corresponded to this episode. Lewis Environmental remained onsite to finish cleaning up the oil from the floor. Inspector conducted a follow-up contact with the School District's Fire and Safety Specialist. The specialist indicated the tanks would require removal. All oil had been pumped from the tanks by Allied Transport. The only oil still leaking from the enclosure was from the contaminated fill. This is being managed with absorbents.
3/26/2019	1320 N Hancock St.	Dumpster Containing Chemicals on Fire	Combined	Report from Hazmat of runoff from a dumpster fire. Chemicals were in dumpster. Storm drain impacted. IWBC was requested to respond to 1320 N Hancock St by PFD Hazmat. There was a milky discharge which was part of the fire runoff from the dumpster fire. Further investigation revealed that the dumpster contained cans of latex paint as well as construction debris. There were also two drums off to the side that contained a Roofing Resin. The constituents of the resin (UN 1866) included methanol and styrene. It could not be determined how much product was initially present in the drums as the material was consumed in the fire. IWBC met the owner of the properties undergoing renovation. He stated that he hired a company to empty the construction debris and other trash. The placed everything in a dumpster. The ignition source was unknown at the time of investigation. The Developer/Owner resides at 831 N. 19th Street. 215-913-4032. L&I issued a work stop permit until the owner could provide proof of proper disposal for the chemicals. Other citations also issued.
3/29/2019	2425 S. Swanson St.	Automotive Fluid Spill To Drain	Combined	PADEP reported spills to drain of automotive fluids at 2425 S. Swanson St. An inspection was done in response to a referral from a representative of the PADEP storage tank program. During his site inspection he noticed various automotive fluids that had either been discharges or leaked to area drains. IWBC visited the site on 3/29/19. IWBC was given a tour by the facility operator. The following issues were observed: IWBC addressed issues with owner. 1. Sump pump from under vehicle pit to area drain without oil/water separator. IWBC advised them to remove or cut pipe. 2. Housekeeping issues with some oily material to combined storm drain on their property. IWBC advised them to clean up through housekeeping 3. Not necessarily an issue but tour bus garages empty the bus lavatory into an inside drain with screens. 2-3 gallons per bus IWBC is told. IWBC did not address this since it is common practice.

Date	Location	Pollutant	Drainage Type	Follow-up Actions
				Notice of violation needed for discharging without an oil\water separator.
4/11/2019	700 Arch St.	Garment and debris discharge	Combined	Garment and debris discharge from Prison causing interference in Sewer System. Investigation of sewer choke caused by material from 700 Arch Street Federal Detention center. IWBC met with the facility manager after the attempt to meet with the facility general foreman failed because of the latter's departure for the day. Inspector received information that the material that resulted in the sewer choke on Friday 4/5/19 was from the detention center. He stated that it was a common occurrence for inmates to flush items down the toilets, up to and including entire prison jumpsuits and shoes. He also stated that inmates would shred articles of clothing and bed sheets into strips in order to pass material/items back and forth from floor to floor using the plumbing as conduits. It was his contention that the sewers around the facility were undersized to receive prison wastewater, as regulations for prisons mandate a minimum of 36". He stated that they became aware of issues when they experienced plumbing back-ups in the facility. Their first thoughts was that the footer valve at the lift station had failed, but it checked out as working properly. Their contract plumber alerted the facility management that the lateral from the facility to the City sewer was not obstructed, but there was a problem in the system. Neighboring properties also experienced back-ups and basements flooded with sewage. He stated that the inmates had to be enlisted to transport sewage from the areas of the flooding to the other side of the facility using rolling bins, where the sewage could be discharged through the other sewer connection that was not impacted. He also stated that the facility was not pleased with PWD response, as the person taking the call was not helpful and seemed reluctant to pass information on to superiors who could motivate a response for a sewer cleaning (the call taker said the sewer cleaning had to be scheduled.) Also, he stated that the automated customer service system was circuitous and required several attempts through the menus in order to speak to a live person. He had contacted the mayor's office and was instructed by voice recording to call 911 for an emergency, which he was reluctant to do since it wasn't a law enforcement type of emergency. Much of his displeasure was that the slow response may at some point have necessitated a water service shut down to prevent additional flooding, and prison facilities cannot maintain a state of having no water. The Federal Detention Center will receive regulatory information on sewer size mandates around prison facilities that he stated require minimum 36" receiving sewers. Regarding the facility: it discharges to Filbert Street (south) and Arch Street (north). Both sewers are less than 36" (which is the size stated as required for discharges from prison facilities). Both are gravity, with the south side having a lift station for the basement area and the north side having a lift station for

Date	Location	Pollutant	Drainage Type	Follow-up Actions
				basement and sub-basement. Only the north side has a sub-basement. The south side has a grease trap servicing the 2nd floor kitchen. The grease trap is in the basement. It is cleaned every two months. The size is unknown but was described as being large. The facility serves approximately 5000 meals per day. The facility had five hoods in the kitchen but is down to two. Deep fat frying is not done as much any longer. Prisons use National Menu meals these days, which favors healthier meals. The inmate population is at 950-1020, with a maximum capacity of 1200. Inmate residence is usually days to months. Inmates are either on trial or awaiting trial and the facility is used as a stop-over for the night if prisoners are being transported to other facilities.
4/23/2019	4255 Main St.	Chemical Dumping To Inlet	Separate	The PWD public affairs officer received a call from Channel 6 News requesting PWD's response to a video given to Channel 6 news from a resident showing brown liquid being dumped in to an inlet by employees of the restaurant at 4255 Main St. They requested that IWBC investigate the dumping. Channel 6 New was site on site when IWBC arrived. A Roto Rooter truck was parked in front of the restaurant. IWBC met with the owner of Hot Pot Gourmet, the restaurant at 4255 Main St. The restaurant has been open for three weeks. IWBC explained that a citizen sent a video that he took on Monday of employees from his restaurant dumping orange liquid to Channel 6 news. IWBC gave him the Grease handout and the Ins and Outs of Inlet handout. IWBC explained the inlet drains to the river and the sewer and that the outfall is above the drinking water intakes. The owner explained that the drains in the kitchen are clogged. He had floor wash water that could not be discharged in the kitchen due to the clogged drain. The orange color is from spices. Owner informed that oil is not used in cooking. The food is cooked in hot water like Ramen noodles. Hot spices are used. The employees do use some cooking oil to cook their own food. There was a sink aerator that he said they are looking to replace. The sink on the left has a square grease trap. He said they were also looking to replace that. The three-compartment sink on the right was filled with water and food particles floating on the top. The water on floor was clear. There were no signs of heavy grease build up in the kitchen or signs of sewage. The inlet (#56516) in question is located on NW corner on Roxborough Street across from the back alley. It is a storm inlet and drains to outfall S-051-03 on Cotton Street and the Schuylkill River. The inlet had

Date	Location	Pollutant	Drainage Type	Follow-up Actions
				liquid similar to the liquid in the sink of the restaurant. IWBC grabbed a sample. The jar was not greasy or oily. The liquid was orange. The sample had no discernable odor. IWBC checked the storm manhole (S051-03-0010) on Cotton St. which is 95' upstream of the outfall. The manhole had no flow. There was some clear water in the between the bricks in the sewer. IWBC checked the river in the area of the outfall (S-051-03) and observed no evidence of the material that was in inlet. FOLLOWUP--4/24/2019--11:46 AM PWD crew was on site. They vacuumed inlet and flushed the inlet. They are also cleaning the two inlets at the intersection of Roxborough and Main St. The manhole has clear flow from the flushing. There was no evidence of the food waste on the river at the outfall or downstream at Rector St.
4/26/2019	Academy Rd. and Red Lion Rd.	Ruptured Saddle Tank Leak	Separate	At 1317 hrs, IWBV received an email from OEM-RIC that reported that at 1255hrs PFD responded to a spill response, involving a food delivery truck, with its left side saddle tank punctured. The truck is storing approximately 150 gallons of fuel, and it is leaking into a storm drain. Battalion 13 requested a company to absorb the spill clean-up. Approx. 20 gallons of fuel are reported to be on the ground. The remaining fuel is going to be pumped out of the saddle tank and stored in a recovery tank. Hazmat unit was requested. The total amount of fuel in the drain is unknown. At 1332, IWBC also received a call from HMAU requesting IWBC at the site. It was raining for prior to the accident. Upon IWBC's arrival, the rain was letting up. There was runoff on the street. IWBC met the on-site HMAU representative who explained that the truck was travelling north on Academy Rd and something struck the underside of his truck at Red Lion Rd. He drove approx. 950' and stopped his truck at Chalfont. The left side saddle tank was leaking. The tank holds 150 gallons. The driver was unsure how much was in the tank. An unknown amount leaked on the street during travel and when he parked. Fire Department put sand around the truck. An unknown amount migrated to the other side of the street towards the inlets. There was a rainbow sheen on Academy Rd from Chalfont towards Red Lion. No product was visible in the gutters that were on the other side of the street from the truck. IWBC inspected five inlets on Academy Rd. and Amity Rd. There was sheen around the inlets and a diesel fuel odor in the area. The

Date	Location	Pollutant	Drainage Type	Follow-up Actions
				inlet at the NEC of Academy and Amity had the most product. IWBC requested that all 5 inlets be cleaned by AVC. IWBC inspected Outfall Q-110-06 on a tributary to Walton's Run. There was flow consistent with the runoff from the earlier rain. There was no visible sheen or diesel fuel odors in the area. The creek was also clear. AVC swept up the oil dry in the area that the truck stopped. The intersection of Academy Rd. and Chalfont was power washed. The water was collected. AVC used sweeps in the inlets to determine if there was product. There was product in all 4 of the inlets at the intersection of Academy Rd. and Amity. All four inlets were vacuumed and cleaned. As they were working on the last inlet, very heavy rain began to fall. They finished cleaning the last inlet. There was runoff in the gutter that was carrying the residual sheen. No product was in the run off. The site was determined to be cleaned.
5/8/2019	3500 N Delaware Ave.	Transmission Leak	Separate	Report via Unified Dispatch that Hazmat requests IWBC to 3500 N. Delaware Ave. Tractor trailer leaking transmission fluid to inlet. Hazmat had an on-site representative. Approximately 5 gallons of fuel leaked into inlet from parked tractor trailer. PFD had diked inlet. Approximately 5 gallons reached the inlet. The PFD HAZMAT representative contacted CVCC / ACV to clean up street and inlet. Work was completed to IWBC's satisfaction. No oil escaped to river, OF D17. Truck owned by Transpro Intermodal Tucking, Bensalem, PA. The driver returned to move truck.
5/8/2019	4600 Roosevelt Blvd.	Area Drain Oil Intake	Combined	The Stormwater Post-Construction Inspector reported a black oily substance in an area drain in the rear of the optical store. The store is located in the NE Tower Center at 4600 Roosevelt Blvd. Rained between receipt of report and initial observation. IWBC located the area drain and placed some oil absorbent wipes in it. The wipes turned black from what appeared to be waste oil. There was no staining leading up to the area drain. The drain is located in an area of the parking lot that has a large contingent of day laborers. IWBC contacted the roaming security guard in attempt to reach mall management. She was unable to provide any contact information. IWBC contacted complainant who had already contacted mall management about having their structure cleaned.
6/4/2019	Giant Food Store at Grant Ave.	Overtruned Truck Spill	Separate	Inspector arrived on site at the Giant Food Store at Grant Ave. and Krewstown Rd. at 10:50am. A construction dump truck filled with soil overturned into a storm water catch basin just off the parking lot

Date	Location	Pollutant	Drainage Type	Follow-up Actions
	and Krewstown Rd.			area. Inspector observed a minor amount of fuel on the grass nearby but no additional leaks from the truck. No fuel appeared to advance toward a nearby MS4 inlet. The truck recovery crew advised they would bring a digger crew on-site to remove the fuel affected soil. The crew successfully removed the truck without any additional chemical spillage. Inspector departed the site at 12:45am
6/6/2019	North Croskey St. and West Lippincott St.	Inlet With Oil & Gasoline Report	Combined	A crew chief from Inlet Cleaning reported the presence of oil and gasoline in a combined inlet located at north Croskey St. and west Lippincott St. at 8:41am. His crew cleaned the trash from the inlet. Inspector arrived at 9:51am. Odors evidently dissipated before inspector's arrival. An absorbent wipe placed on top of the brownish oily fluid in the inlet did not result in the detection of petroleum. Inspector departed the site at 10:40am.
6/24/2019	2700 block of Magee Av.	Motor Oil To Inlet	Combined	The Southeast Regional Office of the Pennsylvania Department of Environmental Protection (PADEP) forwarded a citizen's complaint at 2:58pm about a trucker dumping oil into an inlet. IWBC inspector arrived on site near the 2700 block of Magee Ave. at 3:30pm Inspector observed oil trailing along the curb line to the combined inlet. The oil did not collect into a puddle but formed a large and sticky stain. The trail extended and appeared to stop before reaching the inlet. Inspector detected a small amount of oil with the water collected in a Mason jar. The complainant advised PADEP they observed a trucker from CJK Transport dumping. Inspector returned to the site on June 24th for further observations and departed the site at noon.

Appendix P – Defective Lateral Quarterly Report FY19

STORM WATER MANAGEMENT PROGRAM
NPDES PERMIT NO. PA0054712

DEFECTIVE LATERAL CONNECTION STATUS REPORT
(Covering Period from July 1, 2018 to September 30, 2018)

Submitted to

PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF WATER QUALITY MANAGEMENT

By

CITY OF PHILADELPHIA
PHILADELPHIA, PA

November 14, 2018

DLC Program Update
3rd Quarter 2018

I. INTRODUCTION

This Defective Lateral Connection Status Report is submitted to the Pennsylvania Department of Environmental Protection (PADEP) as part of the reporting requirements of the City of Philadelphia NPDES Storm Water Management Permit No. PA 0054712. The report covers the three-month period beginning July 1, 2018 and ending September 30, 2018.

The body of this report will describe the recent activities of the City during the past quarter within the 1998 COA Priority Outfall areas and at other significant outfalls on the Stormwater Outfall Priority Score list. Additionally, goals for the next quarter will be listed.

Table 1 provides a summary of the program with respect to Complete tests, Cross-connections identified, and Abatements performed. Table 2 provides a listing of all laboratory analyses of samples taken at stormwater outfalls or within the stormwater system during the previous quarter. Table 3 provides a listing of properties with cross-connections outstanding greater than 120 days. Finally, Table 4 provides a listing of reported wastewater spills to the stormwater system or receiving streams.

II. PAST QUARTER REVIEW

A. Priority Outfalls

1. 7th & Cheltenham Outfall (T-088-01)

DLC program activities have performed 2,831 Complete tests in this sewershed, identifying 134 Cross-connections, all but one of which have been Abated.

Eight (8) sites intercepting flow are listed below.

1. CFD-01 Plymouth St. west of Pittsville St.
2. CFD-02 Pittsville St. south of Plymouth St.
3. CFD-03 Elston St. east of Bouvier St.
4. CFD-04 Ashley St. west of Bouvier St.
5. CFD-05 Cheltenham Ave. east of 19th St.
6. CFD-06 Verbena St. south of Cheltenham Ave.
7. CFD-07 Cheltenham Ave. east of 7th St.
8. CFD-08 7th St. south of Cheltenham Ave.

The number of inspections, blockages cleared and discharges noted during this quarter are listed below.

Flap Gate	Inspections	Blockages	Discharges
CFD-01	7	0	0
CFD-02	7	0	0
CFD-03	6	0	0
CFD-04	4	0	0
CFD-05	5	0	0
CFD-06	6	0	0
CFD-07	23	1	1
CFD-08	23	0	0

The most recent fecal sample value was 2382 MPN per 100 ml. at the outfall on July 30, 2018.

2. Monastery Ave. Outfall (W-060-01)

DLC program activities have performed 611 Complete tests in this sewershed, identifying 16 Cross-connections, all of which have been Abated.

Two (2) sites intercepting flow are listed below.

1. MFD-01 Jannette St. west of Monastery Ave.
2. MFD-02 Green La. north of Lawnton St.

The number of inspections, blockages cleared and discharges noted during this quarter are listed below.

Flap Gate	Inspections	Blockages	Discharges
MFD-01	7	0	0
MFD-02	7	0	0

The most recent fecal sample value was 266 MPN per 100 ml. at the outfall on July 10, 2018.

3. Monoshone Creek Outfalls (W-060-04, W-060-08, W-060-09, W-060-10, W-060-11, W-068-04 and W-068-05)

DLC program activities have performed 2,748 Complete tests in these sewershed areas, identifying 94 Cross-connections, all of which have been Abated. The majority of the efforts have been in the W-068-05 sewershed area which is by far the largest in terms of drainage area and properties served.

The most recent fecal sample value was 10462 MPN per 100 ml. at the W-068-05 outfall on July 10, 2018.

4. Manayunk Canal Outfalls (S-051-06, S-058-01, S-059-01 through S-059-11)

DLC program activities have performed 2,479 Complete tests in these sewershed areas, identifying 62 Cross-connections, all of which have been Abated. The majority of the efforts have been in the S-059-04 sewershed area.

The most recent fecal sample value was 75 MPN per 100 ml. at the S-058-01 outfall, 20140 MPN per 100 ml. at the S-059-01 outfall, 38730 MPN per 100 ml. at the S-059-02 outfall, 1178 MPN per 100 ml. at the S-059-03 outfall, 620 MPN per 100 ml. at the S-059-04 outfall, 213 MPN per 100 ml. at the S-059-05 outfall and the S-059-09 outfall was wet but not sampled, all on July 9, 2018.

B. Other Outfalls

1. Sandyford Run Outfall (P-090-02)

DLC program activities have performed 5,832 Complete tests in this sewershed, identifying 87 Cross-connections, all of which have been Abated.

One (1) site intercepting flow is listed below.

1. PFD-01 Sandyford Run (Brous and Lexington Aves.)

The number of inspections, blockages cleared and discharges noted during this quarter are listed below.

Flap Gate	Inspections	Blockages	Discharges
PFD-01	22	0	0

The most recent fecal sample value was 2723 MPN per 100 ml. at the outfall on July 10, 2018.

2. Franklin and Hasbrook Outfall (T-089-04)

DLC program activities have performed 1,019 Complete tests in this sewershed, identifying 46 Cross-connections, all of which have been Abated.

One (1) site intercepting flow is listed below.

1. CFD-01 Franklin and Hasbrook Aves.

The number of inspections, blockages cleared and discharges noted during this quarter are listed below.

Flap Gate	Inspections	Blockages	Discharges
CFD-01	24	2	1

The outfall was found dry on July 30, 2018.

3. A current summary of additional outfalls from the Stormwater Outfall Priority Score list that the City has performed complete testing or abatements this quarter is as follows.

Outfall #	Complete Tests	Cross-Connections	Abatements
P-083-03	40	0	0
P-091-06	1	0	0
P-091-07	2	0	0
P-091-10	1	0	0
P-099-02	1	0	0
P-100-04	1	1	0
P-100-11	0	0	3
P-100-14	1	0	0
P-109-04	1	0	0
P-116-01	(2)	0	0
P-116-02	289	0	0
Q-101-03	1	0	0
Q-101-04	1	0	0
Q-102-04	1	0	0
Q-109-07	2	0	0
Q-110-09	33	1	0
Q-110-13	1	0	0
Q-114-10	1	0	0
Q-117-02	1	0	0
Q-120-11	1	0	0
Q-121-05	1	1	0
S-046-06	5	0	0
S-046-09	1	0	0
S-051-03	1	0	0
S-051-08	0	0	1
S-052-03	20	7	0
S-052-04	106	22	31
S-052-05	2	0	0
T-01	1	0	0
W-086-01	1	0	0
W-086-02	0	0	1

III. NEXT QUARTER GOALS

A. Priority Outfalls

1. 7th & Cheltenham Outfall (T-088-01)

Goals for the Quarter

- Continue to monitor the operation of the diversion apparatuses.
- Continue sampling at the outfall with dry-weather flow.

2. Monastery Ave. Outfall (W-060-01)

Goals for the Quarter

- Continue to monitor the operation of the diversion apparatuses.
- Continue sampling at the outfall with dry-weather flow.

3. Monoshone Creek Outfalls (W-060-04, W-060-08, W-060-09, W-060-10, W-060-11, W-068-04 and W-068-05)

Goals for the Quarter

- Continue sampling at outfall W-068-05 with dry-weather flow.

4. Manayunk Canal Outfalls (S-051-06, S-058-01, S-059-01 through S-059-11)

Goals for the Quarter

- Continue sampling at the outfalls with dry-weather flow.

B. Other Outfalls

1. Sandyford Run Outfall (P-090-02)

Goals for the Quarter

- Continue to monitor the operation of the diversion apparatus.

2. Franklin and Hasbrook Outfall (T-089-04)

Goals for the Quarter

- Continue to monitor the operation of the diversion apparatus.

3. Continue to perform abatements of identified cross-connections within the following outfalls.

- P-100-04
- P-100-11
- Q-109-07
- Q-110-09
- Q-121-05
- S-052-03
- S-052-04
- S-052-05
- T-088-01
- W-067-01

- W-077-02
- W-086-02

4. Continue to perform property testing within the following outfalls.

- P-083-03
- P-091-02
- P-116-02
- Q-101-03
- Q-110-09
- S-052-03
- S-052-04

Table 1
DLC Program Summary
July 1, 2018 to September 30, 2018

Complete Tests:

- 62,299 Complete tests have been performed under the DLC program
- **517 Complete tests were performed this past quarter**
- 40 Complete tests were performed in outfall P-083-03
- 1 Complete test was performed in outfall P-091-06
- 2 Complete tests were performed in outfall P-091-07
- 1 Complete test was performed in outfall P-091-10
- 1 Complete test was performed in outfall P-099-02
- 1 Complete test was performed in outfall P-100-04
- 1 Complete test was performed in outfall P-100-14
- 1 Complete test was performed in outfall P-109-04
- (2) Complete tests were performed in outfall P-116-01
- 289 Complete tests were performed in outfall P-116-02
- 1 Complete test was performed in outfall Q-101-03
- 1 Complete test was performed in outfall Q-101-04
- 1 Complete test was performed in outfall Q-102-04
- 2 Complete tests were performed in outfall Q-109-07
- 33 Complete tests were performed in outfall Q-110-09
- 1 Complete test was performed in outfall Q-110-13
- 1 Complete test was performed in outfall Q-114-10
- 1 Complete test was performed in outfall Q-117-02
- 1 Complete test was performed in outfall Q-120-11
- 1 Complete test was performed in outfall Q-121-05
- 5 Complete tests were performed in outfall S-046-06
- 1 Complete test was performed in outfall S-046-09
- 1 Complete test was performed in outfall S-051-03
- 20 Complete tests were performed in outfall S-052-03
- 106 Complete tests were performed in outfall S-052-04
- 2 Complete tests were performed in outfall S-052-05
- 2 Complete tests were performed in outfall T-089-04
- 1 Complete test was performed in outfall T-01
- 1 Complete test was performed in outfall W-086-01

Cross-Connections Found:

- 1,608 Cross-connections have been identified under the DLC program
- **32 Cross-connections were identified this past quarter**
- 1 Cross-connection was identified in outfall P-100-04
- 1 Cross-connection was identified in outfall Q-110-09
- 1 Cross-connection was identified in outfall Q-121-05
- 7 Cross-connections were identified in outfall S-052-03
- 22 Cross-connections were identified in outfall S-052-04

Abatements:

- 1,515 Abatements have been performed under the DLC program
- **36 Abatements were performed this past quarter**
- 3 Abatements were performed in outfall P-100-11
- 1 Abatement was performed in outfall S-051-08
- 31 Abatements were performed in outfall S-052-04
- 1 Abatement was performed in outfall W-086-02

Outfall/Manhole Screening and Sampling:

- 10 outfall inspections were made as part of the **Priority Outfall Inspection Program** this past quarter
- 9 outfall samples were taken due to observed dry-weather flow during the above inspections

- 19 outfall inspections were made as part of the **Permit Inspection Program** this past quarter
- 8 outfall samples were taken due to observed dry-weather flow during the above inspections

Table 2
Lab Analysis of Water at Outfalls and/or in the Storm Sewers
July 1, 2018 to September 30, 2018

Outfall	Date	Time	Location	Sewer Size (in)	Flow (gph)	Fluoride (mg/l)	Fecal Count (MPN per 100 ml)	Comments
A. Priority Outfalls								
T-088-01	7/30/2018	10:58	Outfall: 7th & Cheltenham	84	NR	0.22	2382	
W-060-01	7/10/2018	10:55	Outfall: Monastery Lane	5'-0" x 4'-4"	30	<0.10	266	clear, no sheen or odor
W-068-05	7/10/2018	11:20	Outfall: Lincoln & Morris	90	7200	0.21	10462	clear, no sheen or odor
S-058-01	7/9/2018	12:00	Outfall: Domino Lane	54	4500	0.32	75	river influence, no odor
S-059-01	7/9/2018	12:15	Outfall: Parker	60	3000	0.27	20140	flow appears higher than in past, slightly cloudy, no odor
S-059-02	7/9/2018	12:25	Outfall: Fountain	42	2580	<0.10	38730	earthy musty odor
S-059-03	7/9/2018	12:35	Outfall: Wright	42	3600	0.15	1178	clear
S-059-04	7/9/2018	12:42	Outfall: Leverington	51	NR	0.36	620	river influence, flow higher than in past, cloudy
S-059-05	7/9/2018	12:45	Outfall: Leverington (east)	4'-0" x 2'-8"	NR	0.21	213	river influence, clear
S-059-09	7/9/2018	12:55	Outfall: Green Lane	36	515	NS	NS	flow higher than in past
B. Permit Inspection Program								
P-090-02	7/10/2018	10:10	Outfall: Brous & Lexington (Sandyford)	156	720	0.15	2723	clear, no sheen, musty odor
T-089-04	7/30/2018	10:45	Outfall: W of Franklin Ave & County Line	3'-0" x 5'-6"	NF	NS	NS	no flow from city side
S-052-05	7/10/2018	11:45	Manhole: Sumac & Rochelle	42	NR	0.31	19863	manhole S-052-05-0015
P-100-09	8/27/2018	10:30	Manhole: Ashton Rd & Jenny Pl	15	NF	NS	NS	manhole P-100-09-0015
P-100-10	8/27/2018	10:35	Manhole: Ashton Rd & Jenny Pl	21	NF	NS	NS	manhole P-100-10-0010
P-100-11	8/27/2018	10:40	Manhole: Ashton Rd & Jenny Pl	42	NF	NS	NS	manhole P-100-11-0010
P-100-12	8/27/2018	10:45	Manhole: Ashton Rd & Jenny Pl	15	NF	NS	NS	manhole P-100-12-0010
Q-106-13	8/24/2018	10:49	Outfall: Red Lion & Waldemire	42	NF	NS	NS	
Q-106-14	8/24/2018	10:53	Outfall: Red Lion & Waldemire	30	NF	NS	NS	
Q-106-15	8/24/2018	10:55	Outfall: Red Lion & Waldemire	42	<60	0.25	857	no odor
Q-106-16	8/24/2018	11:15	Outfall: Waldemire & Green Acres	30	NF	NS	NS	
Q-106-17	8/24/2018	11:30	Outfall: Rayland & Helmer	36	<6	0.17	6488	trickle flow, no odor
Q-106-18	8/24/2018	11:05	Outfall: Waldemire & Inwood	30	NF	NS	NS	
Q-106-19	8/24/2018	10:50	Outfall: Waldemire & Dorchester	24	NF	NS	NS	
Q-106-20	8/24/2018	10:43	Outfall: Waldemire & Oakhill	18	<6	0.15	4611	trickle flow, clear, no sheen or odor
Q-106-21	8/24/2018	11:05	Outfall: Morrell & Calera	66	4800	0.36	315	
Q-106-22	8/24/2018	11:50	Outfall: Morrell & Ashfield	30	<60	0.12	111990	
T-056-03	7/12/2018	13:00	Outfall: Aramingo & Ashland	5'0" X 4'0"	NR	NS	NS	creek influence
T-056-03	7/20/2018	12:20	Outfall: Aramingo & Ashland	5'0" X 4'0"	180	0.18	3448	

Table 3
Residential Cross Connections Not Abated Within 120 Days

A. Properties Abated & Confirmed Prior to Reporting:

Address			Outfall Code	Complete Date	Admin. Action	Abatement Confirmation Date	Comments
06925	Shelbourne	St	T-089-03	10-28-2017		05-03-2018	
03347	Ainslie	St	S-052-04	11-14-2017		06-07-2018	
03302	Ainslie	St	S-052-04	11-14-2017		05-29-2018	
03438 W	Coulter	St	S-052-04	11-15-2017		06-18-2018	
03344	Ainslie	St	S-052-04	11-17-2017		07-19-2018	
03415 W	Coulter	St	S-052-04	11-28-2017		06-15-2018	
10122	Clark	St	Q-109-07	11-30-2017		05-11-2018	
03314	Ainslie	St	S-052-04	11-30-2017		05-29-2018	
03340	Ainslie	St	S-052-04	12-01-2017		07-12-2018	
03357	Ainslie	St	S-052-04	12-02-2017		08-17-2018	
03308	Ainslie	St	S-052-04	12-04-2017		04-23-2018	
03329	Ainslie	St	S-052-04	12-05-2017		04-12-2018	
06018	Newtown	Ave	T-080-02	12-20-2017		05-25-2018	
02860	Welsh	Rd	P-100-11	12-22-2017		07-19-2018	
03310	Ainslie	St	S-052-04	12-27-2017		08-02-2018	
03531	Vaux	St	S-052-04	01-24-2018		06-13-2018	
03434	Osmond	St	S-052-04	01-29-2018		07-24-2018	
02017	Foster	St	Q-109-07	01-29-2018		06-12-2018	
03453 W	Penn	St	S-052-04	02-05-2018		08-07-2018	
00116	Roumfort	Rd	W-086-02	02-17-2018		07-31-2018	
03436 W	Penn	St	S-052-04	02-21-2018		08-07-2018	
03426 W	Penn	St	S-052-04	02-21-2018		08-15-2018	
03465 W	Penn	St	S-052-04	02-23-2018		08-30-2018	
03431 W	Penn	St	S-052-04	02-24-2018		07-19-2018	
03336 W	Penn	St	S-052-04	02-24-2018		08-21-2018	
03432 W	Penn	St	S-052-04	02-26-2018		09-26-2018	

Table 3
Residential Cross Connections Not Abated Within 120 Days

Address				Outfall Code	Complete Date	Admin. Action	Abatement Confirmation Date	Comments
03300	W	Penn	St	S-052-04	02-26-2018		08-15-2018	
03337	W	Penn	St	S-052-04	02-28-2018		07-16-2018	
03443	W	Penn	St	S-052-04	03-03-2018		07-27-2018	
03330	W	Penn	St	S-052-04	03-06-2018		08-06-2018	
03310	W	Penn	St	S-052-04	03-08-2018		08-20-2018	
02774		Tolbut	St	P-100-11	03-10-2018		10-01-2018	
03349		Tilden	St	S-052-04	03-10-2018		07-09-2018	
03540		Conrad	St	S-052-04	03-10-2018		08-17-2018	
03353		Tilden	St	S-052-04	03-12-2018		07-20-2018	
03310		Tilden	St	S-052-04	03-15-2018		07-26-2018	
03309	W	Penn	St	S-052-04	04-21-2018		09-04-2018	

B. Properties Active As Of Reporting:

Address				Outfall Code	Complete Date	Admin. Action	Comments
03425	W	Coulter	St	S-052-04	11-18-2017		
07028	N	Broad	St	T-088-01	11-22-2017		
00116	W	Mermaid	La	W-077-02	12-06-2017		
00015		Osborn	St	S-052-05	01-17-2018		
01942		King Arthur	Rd	Q-109-07	01-19-2018		
01941		Kentwood	St	Q-109-07	01-19-2018		
03525		Vaux	St	S-052-04	01-24-2018		
03411	W	Penn	St	S-052-04	02-13-2018		
03344	W	Penn	St	S-052-04	02-14-2018		
03400	W	Penn	St	S-052-04	02-16-2018		
03313	W	Penn	St	S-052-04	02-16-2018		
03423	W	Penn	St	S-052-04	02-17-2018		

Table 3
Residential Cross Connections Not Abated Within 120 Days

Address				Outfall Code	Complete Date	Admin. Action	Comments
03424	W	Penn	St	S-052-04	02-17-2018		
03404	W	Penn	St	S-052-04	02-17-2018		
03433	W	Penn	St	S-052-04	02-21-2018		
03334	W	Penn	St	S-052-04	02-21-2018		
03338	W	Penn	St	S-052-04	02-24-2018		
03324	W	Penn	St	S-052-04	02-24-2018		
03331	W	Penn	St	S-052-04	02-24-2018		
03333	W	Penn	St	S-052-04	02-26-2018		
03332	W	Penn	St	S-052-04	02-26-2018		
03363		Tilden	St	S-052-04	03-01-2018		
03425		Conrad	St	S-052-04	03-01-2018		
03530		Henry	Ave	S-052-04	03-03-2018		
03340	W	Penn	St	S-052-04	03-03-2018		
03359		Tilden	St	S-052-04	03-10-2018		
03412	W	Penn	St	S-052-04	03-10-2018		
03418		Sunnyside	Ave	S-052-04	03-14-2018		
03434		Tilden	St	S-052-04	03-16-2018		
03301	W	Penn	St	S-052-04	03-16-2018		
03424		Osmond	St	S-052-04	03-17-2018		
03311		Tilden	St	S-052-04	03-19-2018		
03411		Sunnyside	Ave	S-052-04	03-22-2018		
03426		Sunnyside	Ave	S-052-04	03-23-2018		
03345		Tilden	St	S-052-04	03-24-2018		
03305		Tilden	St	S-052-04	03-24-2018		
03313		Tilden	St	S-052-04	03-24-2018		
03329		Tilden	St	S-052-04	03-27-2018		

Table 3
Residential Cross Connections Not Abated Within 120 Days

Address			Outfall Code	Complete Date	Admin. Action	Comments
03331	Tilden	St	S-052-04	03-28-2018		
03316	Tilden	St	S-052-04	03-28-2018		
03333	Tilden	St	S-052-04	03-29-2018		
03314	Tilden	St	S-052-04	03-31-2018		
03308 W	Penn	St	S-052-04	03-31-2018		
03461	Sunnyside	Ave	S-052-04	04-02-2018		
03438	Sunnyside	Ave	S-052-04	04-06-2018		
03447 W	Penn	St	S-052-04	04-07-2018		
03434 W	Penn	St	S-052-04	04-07-2018		
03414	Ainslie	St	S-052-04	04-21-2018		
03453	Bowman	St	S-052-04	04-25-2018		
03411	Osmond	St	S-052-04	04-28-2018		
03448	Crawford	St	S-052-04	04-30-2018		
03452	Crawford	St	S-052-04	05-02-2018		
03449 W	Penn	St	S-052-04	05-03-2018		
03323	Conrad	St	S-052-04	05-09-2018		
03446	Crawford	St	S-052-04	05-17-2018		
03467	Indian Queen	La	S-052-04	05-26-2018		
03433	Crawford	St	S-052-04	05-26-2018		

Table 4
Spills to Storm Sewers and/or Receiving Waters
July 1, 2018 to September 30, 2018

Date	Outfall	Address	Source Code	Material Involved	Completion Date	Remarks
07/10/18	P-100-14	Holme Avenue and Longford Street Wooden Bridge Run	3009	Sewage	07/10/18	Sewer Maintenance unit flushed 10" diameter sanitary sewer causing approximate 4 gpm discharge. Storm sewer flushed with dechlorinated water.
07/20/18	S-046-06	W. Allegheny Avenue and N. 35th Street Schuylkill River	3009	Sewage	07/20/18	Sewer Maintenance unit flushed 12" diameter sanitary sewer causing approximate <1 gpm discharge. Storm sewer cleaned.
07/20/18	S-052-05	5101 Rochelle Avenue Schuylkill River	3008	Sewage	07/20/18	Sewer Maintenance unit flushed 10" diameter sanitary sewer causing W/C due to approximate 3 gpm discharge.
07/23/18	S-059-04	437 Krams Avenue Manayunk Canal	3008	Sewage	07/23/18	Sewer Maintenance unit flushed 8" diameter sanitary sewer causing W/C due to approximate 1 gpm discharge through FAI.
07/24/18		7401-11 McCallum Street	3008	Sewage	07/24/18	Sewer Maintenance unit flushed 8" diameter private sanitary sewer causing approximate <1 gpm discharge through manhole. Affected area cleaned.
07/26/18	S-059-04	441 Krams Avenue Manayunk Canal	3008 3009	Sewage	07/26/18	Sewer Maintenance unit flushed 8" diameter sanitary sewer causing W/C due to approximate <1 gpm discharge. Damaged sections of sanitary and storm sewers repaired.
08/10/18	S-052-05	Rochelle Avenue and Sumac Street Schuylkill River	3008	Sewage	08/10/18	Sewer Maintenance unit flushed 8" diameter sanitary sewer causing approximate 3 gpm discharge through manhole. Debris removed from manhole. Affected area cleaned. Storm sewer flushed with dechlorinated water.
08/23/18	S-051-08	Ridge Avenue and Martin Street Schuylkill River	3009	Sewage	08/23/18	Sewer Maintenance unit flushed 8" diameter sanitary sewer causing approximate <1 gpm discharge. Storm sewer flushed with dechlorinated water. Repaired damaged section of sanitary sewer.
08/24/18	Q-106-21	Morrell Avenue and Warfield Place Byberry Creek	3009	Fresh water	08/24/18	Industrial Waste unit identified a discharge during a routine outfall inspection. Source traced to a leaking fire hydrant. Hydrant repaired by Distribution Unit.
09/05/18	S-046-06	Fox Street and W. Abbottsford Avenue Schuylkill River	3008	Sewage	09/05/18	Sewer Maintenance unit flushed 10" diameter sanitary sewer causing approximate 1 gpm discharge through manhole to nearby inlet. Affected inlet cleaned.
09/14/18	S-051-08	5950 Ridge Avenue Schuylkill River	3009	Sewage	09/14/18	Flow Control unit identified a discharge during a routine CCTV inspection. Sewer Maintenance unit flushed 8" diameter sanitary sewer causing approximate 2 gpm discharge. Storm sewer flushed with dechlorinated water.

Source Codes:
3008 - Spill to Ground Only
3009 - Spill to Storm Sewer
3010 - Spill to Sanitary Sewer
3011 - Spill to Receiving Stream

STORM WATER MANAGEMENT PROGRAM
NPDES PERMIT NO. PA0054712

DEFECTIVE LATERAL CONNECTION STATUS REPORT
(Covering Period from October 1, 2018 to December 31, 2018)

Submitted to

PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF WATER QUALITY MANAGEMENT

By

CITY OF PHILADELPHIA
PHILADELPHIA, PA

February 14, 2019

DLC Program Update
4th Quarter 2018

I. INTRODUCTION

This Defective Lateral Connection Status Report is submitted to the Pennsylvania Department of Environmental Protection (PADEP) as part of the reporting requirements of the City of Philadelphia NPDES Storm Water Management Permit No. PA 0054712. The report covers the three-month period beginning October 1, 2018 and ending December 31, 2018.

The body of this report will describe the recent activities of the City during the past quarter within the 1998 COA Priority Outfall areas and at other significant outfalls on the Stormwater Outfall Priority Score list. Additionally, goals for the next quarter will be listed.

Table 1 provides a summary of the program with respect to Complete tests, Cross-connections identified, and Abatements performed. Table 2 provides a listing of all laboratory analyses of samples taken at stormwater outfalls or within the stormwater system during the previous quarter. Table 3 provides a listing of properties with cross-connections outstanding greater than 120 days. Finally, Table 4 provides a listing of reported wastewater spills to the stormwater system or receiving streams.

II. PAST QUARTER REVIEW

A. Priority Outfalls

1. 7th & Cheltenham Outfall (T-088-01)

DLC program activities have performed 2,831 Complete tests in this sewershed, identifying 134 Cross-connections, all but one of which have been Abated.

Eight (8) sites intercepting flow are listed below.

1. CFD-01 Plymouth St. west of Pittsville St.
2. CFD-02 Pittsville St. south of Plymouth St.
3. CFD-03 Elston St. east of Bouvier St.
4. CFD-04 Ashley St. west of Bouvier St.
5. CFD-05 Cheltenham Ave. east of 19th St.
6. CFD-06 Verbena St. south of Cheltenham Ave.
7. CFD-07 Cheltenham Ave. east of 7th St.
8. CFD-08 7th St. south of Cheltenham Ave.

The number of inspections, blockages cleared and discharges noted during this quarter are listed below.

Flap Gate	Inspections	Blockages	Discharges
CFD-01	13	0	0
CFD-02	13	0	0
CFD-03	12	0	0
CFD-04	7	1	0
CFD-05	8	0	0
CFD-06	12	0	0
CFD-07	18	1	0
CFD-08	16	0	0

The most recent fecal sample value was 2755 MPN per 100 ml. at the outfall on October 23, 2018.

2. Monastery Ave. Outfall (W-060-01)

DLC program activities have performed 611 Complete tests in this sewershed, identifying 16 Cross-connections, all of which have been Abated.

Two (2) sites intercepting flow are listed below.

1. MFD-01 Jannette St. west of Monastery Ave.
2. MFD-02 Green La. north of Lawnton St.

The number of inspections, blockages cleared and discharges noted during this quarter are listed below.

Flap Gate	Inspections	Blockages	Discharges
MFD-01	6	0	0
MFD-02	6	0	0

The most recent fecal sample value was 404 MPN per 100 ml. at the outfall on October 5, 2018.

3. Monoshone Creek Outfalls (W-060-04, W-060-08, W-060-09, W-060-10, W-060-11, W-068-04 and W-068-05)

DLC program activities have performed 2,748 Complete tests in these sewershed areas, identifying 94 Cross-connections, all of which have been Abated. The majority of the efforts have been in the W-068-05 sewershed area which is by far the largest in terms of drainage area and properties served.

The most recent fecal sample value was 6131 MPN per 100 ml. at the W-068-05 outfall on October 5, 2018.

4. Manayunk Canal Outfalls (S-051-06, S-058-01, S-059-01 through S-059-11)

DLC program activities have performed 2,479 Complete tests in these sewershed areas, identifying 62 Cross-connections, all of which have been Abated. The majority of the efforts have been in the S-059-04 sewershed area.

The most recent fecal sample value was 663 MPN per 100 ml. at the S-058-01 outfall, 29870 MPN per 100 ml. at the S-059-01 outfall, 2014 MPN per 100 ml. at the S-059-02 outfall, 2064 MPN per 100 ml. at the S-059-03 outfall, 262 MPN per 100 ml. at the S-059-04 outfall, 3255 MPN per 100 ml. at the S-059-05 outfall and the S-059-09 outfall was wet but not sampled, all on October 2, 2018.

B. Other Outfalls

1. Sandyford Run Outfall (P-090-02)

DLC program activities have performed 5,834 Complete tests in this sewershed, identifying 87 Cross-connections, all of which have been Abated.

One (1) site intercepting flow is listed below.

1. PFD-01 Sandyford Run (Brous and Lexington Aves.)

The number of inspections, blockages cleared and discharges noted during this quarter are listed below.

Flap Gate	Inspections	Blockages	Discharges
PFD-01	21	1	0

The most recent fecal sample value was 387.3 MPN per 100 ml. at the outfall on October 19, 2018.

2. Franklin and Hasbrook Outfall (T-089-04)

DLC program activities have performed 1,021 Complete tests in this sewershed, identifying 46 Cross-connections, all of which have been Abated.

One (1) site intercepting flow is listed below.

1. CFD-01 Franklin and Hasbrook Aves.

The number of inspections, blockages cleared and discharges noted during this quarter are listed below.

Flap Gate	Inspections	Blockages	Discharges
CFD-01	24	4	0

The outfall was found dry on October 23, 2018.

3. A current summary of additional outfalls from the Stormwater Outfall Priority Score list that the City has performed complete testing or abatements this quarter is as follows.

Outfall #	Complete Tests	Cross-Connections	Abatements
D-056-09	35	3	0
D-093-01	44	0	0
P-083-03	201	10	0
P-091-06	1	0	0
P-091-07	1	0	0
P-099-01	1	0	0
P-100-11	0	0	1
P-112-05	1	0	0
P-113-04	1	0	0
P-116-01	1	1	0
P-116-02	21	0	0
Q-101-03	1	0	0
Q-101-04	1	0	0
Q-101-09	(2)	0	0
Q-106-12	1	0	0
Q-109-07	0	0	1
Q-110-09	21	3	0
Q-110-11	1	0	0
Q-113-09	1	0	0
Q-115-10	1	0	0
R-18	2	2	0
S-046-06	1	0	0
S-052-03	91	10	0
S-052-04	15	2	13
T-089-03	1	0	0

III. NEXT QUARTER GOALS

A. Priority Outfalls

1. 7th & Cheltenham Outfall (T-088-01)

Goals for the Quarter

- Continue to monitor the operation of the diversion apparatuses.
- Continue sampling at the outfall with dry-weather flow.

2. Monastery Ave. Outfall (W-060-01)

Goals for the Quarter

- Continue to monitor the operation of the diversion apparatuses.
- Continue sampling at the outfall with dry-weather flow.

3. Monoshone Creek Outfalls (W-060-04, W-060-08, W-060-09, W-060-10, W-060-11, W-068-04 and W-068-05)

Goals for the Quarter

- Continue sampling at outfall W-068-05 with dry-weather flow.

4. Manayunk Canal Outfalls (S-051-06, S-058-01, S-059-01 through S-059-11)

Goals for the Quarter

- Continue sampling at the outfalls with dry-weather flow.

B. Other Outfalls

1. Sandyford Run Outfall (P-090-02)

Goals for the Quarter

- Continue to monitor the operation of the diversion apparatus.

2. Franklin and Hasbrook Outfall (T-089-04)

Goals for the Quarter

- Continue to monitor the operation of the diversion apparatus.

3. Continue to perform abatements of identified cross-connections within the following outfalls.

- D-056-09
- P-083-03
- P-100-04
- P-116-01
- Q-109-07
- Q-110-09
- Q-121-05
- R-18
- S-052-03
- S-052-04
- S-052-05
- T-088-01
- W-067-01
- W-077-02
- W-086-02

4. Continue to perform property testing within the following outfalls.

- D-056-09
- D-093-01
- P-083-03
- P-116-02
- R-18
- S-053-03

Table 1
DLC Program Summary
<u>October 1, 2018 to December 31, 2018</u>

Complete Tests:

- 62,745 Complete tests have been performed under the DLC program
- **446 Complete tests were performed this past quarter**
- 35 Complete tests were performed in outfall D-056-09
- 44 Complete tests were performed in outfall D-093-01
- 201 Complete tests were performed in outfall P-083-03
- 2 Complete tests were performed in outfall P-090-02
- 1 Complete test was performed in outfall P-091-06
- 1 Complete test was performed in outfall P-091-07
- 1 Complete test was performed in outfall P-099-01
- 1 Complete test was performed in outfall P-112-05
- 1 Complete test was performed in outfall P-113-04
- 1 Complete test was performed in outfall P-116-01
- 21 Complete tests were performed in outfall P-116-02
- 1 Complete test was performed in outfall Q-101-03
- 1 Complete test was performed in outfall Q-101-04
- (2) Complete tests were performed in outfall Q-101-09
- 1 Complete test was performed in outfall Q-106-12
- 21 Complete tests were performed in outfall Q-110-09
- 1 Complete test was performed in outfall Q-110-11
- 1 Complete test was performed in outfall Q-113-09
- 1 Complete test was performed in outfall Q-115-10
- 2 Complete tests were performed in outfall R-18
- 1 Complete test was performed in outfall S-046-06
- 91 Complete tests were performed in outfall S-052-03
- 15 Complete tests were performed in outfall S-052-04
- 1 Complete test was performed in outfall T-089-03
- 2 Complete tests were performed in outfall T-089-04

Cross-Connections Found:

- 1,639 Cross-connections have been identified under the DLC program
- **31 Cross-connections were identified this past quarter**
- 3 Cross-connections were identified in outfall D-056-09
- 10 Cross-connections were identified in outfall P-083-03
- 1 Cross-connection was identified in outfall P-116-01
- 3 Cross-connections were identified in outfall Q-110-09
- 2 Cross-connections were identified in outfall R-18
- 10 Cross-connections were identified in outfall S-052-03
- 2 Cross-connections were identified in outfall S-052-04

Abatements:

- 1,530 Abatements have been performed under the DLC program
- **15 Abatements were performed this past quarter**
- 1 Abatement was performed in outfall P-100-11
- 1 Abatement was performed in outfall Q-109-07
- 13 Abatements were performed in outfall S-052-4

Outfall/Manhole Screening and Sampling:

- 10 outfall inspections were made as part of the **Priority Outfall Inspection Program** this past quarter
- 9 outfall samples were taken due to observed dry-weather flow during the above inspections

- 32 outfall inspections were made as part of the **Permit Inspection Program** this past quarter
- 16 outfall samples were taken due to observed dry-weather flow during the above inspections

Table 2
Lab Analysis of Water at Outfalls and/or in the Storm Sewers
October 1, 2018 to December 31, 2018

Outfall	Date	Time	Location	Sewer Size (in)	Flow (gph)	Fluoride (mg/l)	Fecal Count (MPN per 100 ml)	Comments
A. Priority Outfalls								
T-088-01	10/23/2018	11:00	Outfall: 7th & Cheltenham	84	NR	0.11	2755	
W-060-01	10/5/2018	11:00	Outfall: Monastery Lane	5'-0" x 4'-4"	1200	0.12	404	clear, no sheen or odor
W-068-05	10/5/2019	11:25	Outfall: Lincoln & Morris	90	1	0.18	6131	clear, no sheen or odor
S-058-01	10/2/2018	11:08	Outfall: Domino Lane	54	NR	0.22	663*	river influence
S-059-01	10/2/2018	11:30	Outfall: Parker	60	40	0.24	29870*	tan color, slight floral sweet odor
S-059-02	10/2/2018	11:45	Outfall: Fountain	42	20	<0.10	2014*	slight musty odor
S-059-03	10/2/2018	11:55	Outfall: Wright	42	900	0.12	2064*	
S-059-04	10/2/2018	12:05	Outfall: Leverington	51	NR	0.13	262*	
S-059-05	10/2/2018	12:10	Outfall: Leverington (east)	4'-0" x 2'-8"	NR	0.13	3255*	very low flow
S-059-09	10/2/2018	12:15	Outfall: Green Lane	36	<0.1	NS	NS	flow too low to sample
B. Permit Inspection Program								
P-090-02	10/19/2018	11:00	Outfall: Brous & Lexington (Sandyford)	156	1	0.20	387.3	no odor
T-089-04	10/23/2018	10:35	Outfall: W of Franklin Ave & County Line	3'-0" x 5'-6"	NF	NS	NS	no flow from city side
S-051-08	10/2/2018	10:30	Manhole: Main & Shurs	9'-0" x 7'-0"	1	0.23	18720*	manhole S-051-08-0010, no suspended solids
S-052-05	10/5/2018	10:35	Manhole: Sumac & Rochelle	42	1	0.17	650	manhole S-052-05-0015, clear
P-082-01	10/25/2018	10:48	Outfall: Enfield & Torresdale	27	<0.1	<0.10	41	trickle flow
P-082-02	10/25/2018	10:40	Outfall: Holmesburg & Cottage	48	NF	NS	NS	
P-083-01	10/25/2018	11:40	Outfall: State & Rhawn	18	NF	NS	NS	
P-083-02	10/25/2018	11:45	Outfall: State & Rhawn	18	NF	NS	NS	
P-083-03	10/25/2018	11:20	Outfall: Ashburner & State	9'0" x 11'11"	1	0.45	697	very low flow, creek influence
P-083-04	10/25/2018	12:23	Outfall: Ashburner & State	102	3600	0.10	31	large flow
P-091-01	11/1/2018	9:38	Outfall: Sandyford & Brous	36	600	0.61	>241960	scum in plunge pool
P-091-02	11/1/2018	9:50	Outfall: Sandyford & Ryan	42	<5	0.25	3076	
P-091-03	11/1/2018	10:03	Outfall: Sandyford & Ryan	27	NF	NS	NS	
P-091-04	11/1/2018	10:24	Outfall: Rhawn & Lexington	36	NF	NS	NS	
P-091-05	11/1/2018	10:38	Outfall: Winchester & Albion	42	NF	NS	NS	
P-091-06	11/2/2018	9:45	Manhole: Holme & Winchester	3'0" x 7'7"	1800	0.15	98040	manhole P-091-06-0010, no sheen or odor
P-091-07	11/1/2018	10:52	Outfall: Holme & Winchester	54	NF	NS	NS	
P-091-08	12/5/2018	9:55	Outfall: Rowland & Hartel	54	60	<0.10	10	
P-091-09	12/5/2018	10:37	Outfall: NW Welsh & Rowland	36	180	0.67	10	slight musty odor
P-091-10	12/5/2018	10:46	Outfall: Welsh & Rowland	42	720	0.17	990	
P-091-11	12/5/2018	10:22	Outfall: Winthrop & Droper	30	NF	NS	NS	
P-091-12	12/5/2018	11:15	Outfall: Narvon & Arthur	30	15	<0.10	487	
P-091-13	12/5/2018	11:35	Outfall: Longford & Holme	21	NF	NS	NS	
P-092-01	12/12/2018	10:35	Manhole: Pennypack & Crispin	18	NF	NS	NS	manhole P-092-01-0010
P-092-02	12/12/2018	10:25	Manhole: Pennypack & Crispin	20	180	<0.10	10	manhole P-092-02-0010
P-092-03	12/12/2018	10:50	Manhole: Pennypack & Crispin (near Harvard Pl)	18	NF	NS	NS	manhole P-092-03-0010
P-092-04	12/12/2018	11:11	Manhole: Pennypack & Crispin (near Harvard Pl)	18	NF	NS	NS	manhole P-092-04-0010
P-099-01	12/27/2018	10:47	Outfall: Solly & Tabor	5'0" x 6'6"	30	<0.10	243	
P-099-02	12/27/2018	11:10	Outfall: Solly Pl	72	30	<0.10	9208	
P-099-04	12/27/2018	11:30	Outfall: Evarts	36	60	<0.10	10	
P-099-05	12/27/2018	11:43	Outfall: Horrocks & Strahle	42	NF	NS	NS	
P-099-06	12/27/2018	12:30	Outfall: Peachtree & Cherry Blossom	30	30	0.14	10	

Note: *Lab not accredited from Oct. 1 to Oct 3 due to renewal fee not received in time. QC for the samples was acceptable.

Table 3
Residential Cross Connections Not Abated Within 120 Days

A. Properties Abated & Confirmed Prior to Reporting:

Address				Outfall Code	Complete Date	Admin. Action	Abatement Confirmation Date	Comments
03425	W	Coulter	St	S-052-04	11-18-2017		10-18-2018	
03357		Ainslie	St	S-052-04	12-02-2017		08-17-2018	
03310		Ainslie	St	S-052-04	12-27-2017		08-02-2018	
01942		King Arthur	Rd	Q-109-07	01-19-2018		10-26-2018	
03453	W	Penn	St	S-052-04	02-05-2018		08-07-2018	
03344	W	Penn	St	S-052-04	02-14-2018		10-24-2018	
03313	W	Penn	St	S-052-04	02-16-2018		10-26-2018	
03436	W	Penn	St	S-052-04	02-21-2018		08-07-2018	
03426	W	Penn	St	S-052-04	02-21-2018		08-15-2018	
03465	W	Penn	St	S-052-04	02-23-2018		08-30-2018	
03336	W	Penn	St	S-052-04	02-24-2018		08-21-2018	
03432	W	Penn	St	S-052-04	02-26-2018		09-26-2018	
03300	W	Penn	St	S-052-04	02-26-2018		08-15-2018	
03443	W	Penn	St	S-052-04	03-03-2018		07-27-2018	
03330	W	Penn	St	S-052-04	03-06-2018		08-06-2018	
03310	W	Penn	St	S-052-04	03-08-2018		08-20-2018	
02774		Tolbut	St	P-100-11	03-10-2018		10-01-2018	
03349		Tilden	St	S-052-04	03-10-2018		07-09-2018	
03540		Conrad	St	S-052-04	03-10-2018		08-17-2018	
03412	W	Penn	St	S-052-04	03-10-2018		10-25-2018	
03353		Tilden	St	S-052-04	03-12-2018		07-20-2018	
03418		Sunnyside	Ave	S-052-04	03-14-2018		10-12-2018	
03310		Tilden	St	S-052-04	03-15-2018		07-26-2018	
03434		Tilden	St	S-052-04	03-16-2018		08-03-2018	
03311		Tilden	St	S-052-04	03-19-2018		10-12-2018	
03426		Sunnyside	Ave	S-052-04	03-23-2018		10-24-2018	

Table 3
Residential Cross Connections Not Abated Within 120 Days

Address			Outfall Code	Complete Date	Admin. Action	Abatement Confirmation Date	Comments
03331	Tilden	St	S-052-04	03-28-2018		12-20-2018	
03438	Sunnyside	Ave	S-052-04	04-06-2018		10-19-2018	
03447 W	Penn	St	S-052-04	04-07-2018		11-01-2018	
03309 W	Penn	St	S-052-04	04-21-2018		09-04-2018	
03448	Crawford	St	S-052-04	04-30-2018		10-26-2018	
03310	Arnold	St	S-052-04	06-02-2018		01-07-2019	

B. Properties Active As Of Reporting:

Address			Outfall Code	Complete Date	Admin. Action	Comments
07028 N	Broad	St	T-088-01	11-22-2017		
00015	Osborn	St	S-052-05	01-17-2018		
01941	Kentwood	St	Q-109-07	01-19-2018		
03525	Vaux	St	S-052-04	01-24-2018		
03411 W	Penn	St	S-052-04	02-13-2018		
03400 W	Penn	St	S-052-04	02-16-2018		
03423 W	Penn	St	S-052-04	02-17-2018		
03404 W	Penn	St	S-052-04	02-17-2018		
03424 W	Penn	St	S-052-04	02-17-2018		
03433 W	Penn	St	S-052-04	02-21-2018		
03334 W	Penn	St	S-052-04	02-21-2018		
03338 W	Penn	St	S-052-04	02-24-2018		
03331 W	Penn	St	S-052-04	02-24-2018		
03324 W	Penn	St	S-052-04	02-24-2018		
03333 W	Penn	St	S-052-04	02-26-2018		
03332 W	Penn	St	S-052-04	02-26-2018		
03363	Tilden	St	S-052-04	03-01-2018		

Table 3
Residential Cross Connections Not Abated Within 120 Days

Address			Outfall Code	Complete Date	Admin. Action	Comments
03425	Conrad	St	S-052-04	03-01-2018		
03530	Henry	Ave	S-052-04	03-03-2018		
03340 W	Penn	St	S-052-04	03-03-2018		
03359	Tilden	St	S-052-04	03-10-2018		
03301 W	Penn	St	S-052-04	03-16-2018		
03424	Osmond	St	S-052-04	03-17-2018		
03411	Sunnyside	Ave	S-052-04	03-22-2018		
03345	Tilden	St	S-052-04	03-24-2018		
03313	Tilden	St	S-052-04	03-24-2018		
03305	Tilden	St	S-052-04	03-24-2018		
03329	Tilden	St	S-052-04	03-27-2018		
03316	Tilden	St	S-052-04	03-28-2018		
03333	Tilden	St	S-052-04	03-29-2018		
03314	Tilden	St	S-052-04	03-31-2018		
03308 W	Penn	St	S-052-04	03-31-2018		
03461	Sunnyside	Ave	S-052-04	04-02-2018		
03434 W	Penn	St	S-052-04	04-07-2018		
03414	Ainslie	St	S-052-04	04-21-2018		
03411	Osmond	St	S-052-04	04-28-2018		
03452	Crawford	St	S-052-04	05-02-2018		
03449 W	Penn	St	S-052-04	05-03-2018		
03323	Conrad	St	S-052-04	05-09-2018		
03446	Crawford	St	S-052-04	05-17-2018		
03467	Indian Queen	La	S-052-04	05-26-2018		
03433	Crawford	St	S-052-04	05-26-2018		
03317 W	Penn	St	S-052-04	06-02-2018		

Table 3
Residential Cross Connections Not Abated Within 120 Days

Address				Outfall Code	Complete Date	Admin. Action	Comments
03448	W	Queen	La	S-052-04	06-23-2018		
00032	W	Gowen	Ave	W-086-02	06-28-2018		
03419	W	Queen	La	S-052-04	07-02-2018		
03459	W	Penn	St	S-052-04	07-02-2018		
03335	W	Queen	La	S-052-04	07-02-2018		
03417	W	Queen	La	S-052-04	07-05-2018		
03326	W	Queen	La	S-052-04	07-12-2018		
03452	W	Queen	La	S-052-04	07-13-2018		
03467	W	Queen	La	S-052-04	07-16-2018		
03469	W	Queen	La	S-052-04	07-17-2018		
03414	W	Queen	La	S-052-04	07-20-2018		
03440	W	Queen	La	S-052-04	07-21-2018		
03474		Tilden	St	S-052-04	07-21-2018		
03333	W	Queen	La	S-052-04	07-21-2018		
03435	W	Queen	La	S-052-04	07-30-2018		
03464	W	Queen	La	S-052-04	07-30-2018		
03463	W	Queen	La	S-052-04	08-02-2018		
03429	W	Queen	La	S-052-04	08-02-2018		
01340		Downs	Pl	Q-121-05	08-14-2018		
03459	W	Queen	La	S-052-04	08-16-2018		
03434	W	Queen	La	S-052-04	08-17-2018		
03460	W	Queen	La	S-052-04	08-24-2018		

Table 4

Spills to Storm Sewers and/or Receiving Waters

October 1, 2018 to December 31, 2018

Date	Outfall	Address	Source Code	Material Involved	Completion Date	Remarks
10/02/18		Historic Rittenhouse Town Lincoln and Forbidden Drives Monoshone Creek	3008	Sewage	10/02/18	Sewer Maintenance unit flushed 10" diameter sanitary sewer causing approximate <1 gpm discharge. Affected area cleaned.
10/03/18	S-059-04	Silverwood Street and Leverington Avenue Manayunk Canal	3008	Sewage	10/03/18	Sewer Maintenance unit flushed 8" diameter sanitary sewer causing W/C due to approximate 3 gpm discharge (W/C at 300 Leverington Street).
10/05/18	T-080-02	200 block of Benner Street Tacony Creek	3009	Sewage	10/05/18	Sewer Maintenance unit flushed 10" diameter sanitary sewer causing approximate 3 gpm discharge. Storm sewer flushed with dechlorinated water.
10/15/18	S-18	S. 16th and Walnut Streets Schuylkill River	3008	Sewage	10/16/18	Sewer Maintenance unit flushed 12" diameter combined sewer causing W/C due to discharge (W/C at 122 S. 16th Street and 1529 Walnut Street).
10/19/18	S-059-04	4555 Pechin Street Manayunk Canal	3008	Sewage	10/19/18	Sewer Maintenance unit flushed 8" diameter sanitary sewer causing approximate <1 gpm discharge through area drain. Affected area cleaned.
10/24/18		PNBC Pump Station #648 Philadelphia Naval Business Center S. 26th Street and Langley Avenue	3008	Sewage	10/26/18	Sewer Maintenance unit investigated an approximate <1 gpm discharge due to a leak in a 6" diameter DI force main. Vactor truck remained on-site to handle sewage and clean affected area until repairs were made by contractor (JPC).
10/27/18	D-22	3064 Joyce Street Delaware River	3008	Sewage	10/27/18	Sewer Maintenance unit flushed 12" diameter combined sewer causing W/C due to approximate <1 gpm discharge (W/C at 3060, 3062, 3063, 3064 and 3067 Joyce Street).
11/01/18		PNBC Pump Station #648 Philadelphia Naval Business Center S. 26th Street and Langley Avenue	3008	Sewage	11/01/18	Sewer Maintenance and Flow Control units investigated a discharge due to contractor caused damage to a 6" diameter DI force main. Vactor truck remained on-site to handle sewage and clean affected area until repairs were made by contractor (Miller Brothers).
11/02/18	D-39	1522 W. Firth Street Delaware River	3008	Sewage	11/02/18	Sewer Maintenance unit flushed 12" diameter combined sewer causing W/C due to approximate <1 gpm discharge (W/C at 1516, 1522 and 1523 W. Firth Street).
11/06/18		Cobbs Creek Golf Club 7800 City Avenue Cobbs Creek	3008	Combined Sewage	11/06/18	Sewer Maintenance unit investigated a reported discharge from a manhole during a rain event. No active overflow observed.

Table 4

Spills to Storm Sewers and/or Receiving Waters

October 1, 2018 to December 31, 2018

Date	Outfall	Address	Source Code	Material Involved	Completion Date	Remarks
11/24/18	S-046-03	Neill Drive Pumping Station 4000 Neill Drive unnamed tributary of Schuylkill River	3011	Sewage	11/24/18	Flow Control unit identified an approximate 834 gpm discharge due to a power failure during a rain event. Power restored and station placed back into operation.
11/30/18		PNBC Pump Station #603 Philadelphia Naval Business Center 2000 Langley Avenue	3008	Sewage	12/08/18	Sewer Maintenance and Flow Control units investigated an approximate <1 gpm discharge due to a leak in pump #2 45 degree elbow. Vactor truck remained on-site to handle sewage and clean affected area until repairs were made by contractor (JPC).
12/06/18	W-060-01	525 Roxborough Avenue Wissahickon Creek	3009	Sewage	12/06/18	Sewer Maintenance unit flushed 10" diameter sanitary sewer causing approximate <1 gpm discharge. Storm sewer flushed with dechlorinated water.
12/27/18	S-046-06	3200 block of Fox Street Schuylkill River	3008	Sewage	12/27/18	Sewer Maintenance unit flushed 10" diameter sanitary sewer causing approximate <1 gpm discharge thru manhole cover. Storm sewer flushed with dechlorinated water.

Source Codes:

3008 - Spill to Ground Only

3009 - Spill to Storm Sewer

3010 - Spill to Sanitary Sewer

3011 - Spill to Receiving Stream

STORM WATER MANAGEMENT PROGRAM
NPDES PERMIT NO. PA0054712

DEFECTIVE LATERAL CONNECTION STATUS REPORT
(Covering Period from January 1, 2019 to March 31, 2019)

Submitted to

PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF WATER QUALITY MANAGEMENT

By

CITY OF PHILADELPHIA
PHILADELPHIA, PA

May 15, 2019

DLC Program Update
1st Quarter 2019

I. INTRODUCTION

This Defective Lateral Connection Status Report is submitted to the Pennsylvania Department of Environmental Protection (PADEP) as part of the reporting requirements of the City of Philadelphia NPDES Storm Water Management Permit No. PA 0054712. The report covers the three-month period beginning January 1, 2019 and ending March 31, 2019.

The body of this report will describe the recent activities of the City during the past quarter within the 1998 COA Priority Outfall areas and at other significant outfalls on the Stormwater Outfall Priority Score list. Additionally, goals for the next quarter will be listed.

Table 1 provides a summary of the program with respect to Complete tests, Cross-connections identified, and Abatements performed. Table 2 provides a listing of all laboratory analyses of samples taken at stormwater outfalls or within the stormwater system during the previous quarter. Table 3 provides a listing of properties with cross-connections outstanding greater than 120 days. Finally, Table 4 provides a listing of reported wastewater spills to the stormwater system or receiving streams.

II. PAST QUARTER REVIEW

A. Priority Outfalls

1. 7th & Cheltenham Outfall (T-088-01)

DLC program activities have performed 2,831 Complete tests in this sewershed, identifying 134 Cross-connections, all but one of which have been Abated.

Eight (8) sites intercepting flow are listed below.

1.	CFD-01	Plymouth St. west of Pittsville St.
2.	CFD-02	Pittsville St. south of Plymouth St.
3.	CFD-03	Elston St. east of Bouvier St.
4.	CFD-04	Ashley St. west of Bouvier St.
5.	CFD-05	Cheltenham Ave. east of 19th St.
6.	CFD-06	Verbena St. south of Cheltenham Ave.
7.	CFD-07	Cheltenham Ave. east of 7th St.
8.	CFD-08	7th St. south of Cheltenham Ave.

The number of inspections, blockages cleared and discharges noted during this quarter are listed below.

Flap Gate	Inspections	Blockages	Discharges
CFD-01	12	0	0
CFD-02	13	0	0
CFD-03	9	0	0
CFD-04	10	0	0
CFD-05	6	0	0
CFD-06	9	0	0
CFD-07	23	1	0
CFD-08	23	0	0

The most recent fecal sample value was 1789 MPN per 100 ml. at the outfall on February 5, 2018.

2. Monastery Ave. Outfall (W-060-01)

DLC program activities have performed 611 Complete tests in this sewershed, identifying 16 Cross-connections, all of which have been Abated.

Two (2) sites intercepting flow are listed below.

1. MFD-01 Jannette St. west of Monastery Ave.
2. MFD-02 Green La. north of Lawnton St.

The number of inspections, blockages cleared and discharges noted during this quarter are listed below.

Flap Gate	Inspections	Blockages	Discharges
MFD-01	6	0	0
MFD-02	6	0	0

The most recent fecal sample value was 41 MPN per 100 ml. at the outfall on January 23, 2019.

3. Monoshone Creek Outfalls (W-060-04, W-060-08, W-060-09, W-060-10, W-060-11, W-068-04 and W-068-05)

DLC program activities have performed 2,750 Complete tests in these sewershed areas, identifying 94 Cross-connections, all of which have been Abated. The majority of the efforts have been in the W-068-05 sewershed area which is by far the largest in terms of drainage area and properties served.

The most recent fecal sample value was 5475 MPN per 100 ml. at the W-068-05 outfall on January 23, 2019.

4. Manayunk Canal Outfalls (S-051-06, S-058-01, S-059-01 through S-059-11)

DLC program activities have performed 2,479 Complete tests in these sewershed areas, identifying 62 Cross-connections, all of which have been Abated. The majority of the efforts have been in the S-059-04 sewershed area.

The most recent fecal sample value was <1 MPN per 100 ml. at the S-058-01 outfall, 92080 MPN per 100 ml. at the S-059-01 outfall, 68670 MPN per 100 ml. at the S-059-02 outfall, 77010 MPN per 100 ml. at the S-059-03 outfall, 1860 MPN per 100 ml. at the S-059-04 outfall, 2046 MPN per 100 ml. at the S-059-05 outfall and the S-059-09 outfall was wet but not sampled, all on February 5, 2019.

B. Other Outfalls

1. Sandyford Run Outfall (P-090-02)

DLC program activities have performed 5,834 Complete tests in this sewershed, identifying 87 Cross-connections, all of which have been Abated.

One (1) site intercepting flow is listed below.

1. PFD-01 Sandyford Run (Brous and Lexington Aves.)

The number of inspections, blockages cleared and discharges noted during this quarter are listed below.

Flap Gate	Inspections	Blockages	Discharges
PFD-01	25	0	0

The most recent fecal sample value was 10 MPN per 100 ml. at the outfall on January 23, 2019.

2. Franklin and Hasbrook Outfall (T-089-04)

DLC program activities have performed 1,021 Complete tests in this sewershed, identifying 46 Cross-connections, all of which have been Abated.

One (1) site intercepting flow is listed below.

1. CFD-01 Franklin and Hasbrook Aves.

The number of inspections, blockages cleared and discharges noted during this quarter are listed below.

Flap Gate	Inspections	Blockages	Discharges
CFD-01	23	0	0

The outfall was found dry on February 5, 2019.

3. A current summary of additional outfalls from the Stormwater Outfall Priority Score list that the City has performed complete testing or abatements this quarter is as follows.

Outfall #	Complete Tests	Cross-Connections	Abatements
D-056-09	22	2	0
D-093-01	55	1	0
P-083-03	52	4	0
P-100-11	1	0	0
P-108-09	1	0	0
P-116-02	11	0	0
Q-106-12	1	0	0
Q-106-21	1	0	0
Q-109-07	18	0	0
Q-113-09	1	0	0
Q-115-01	1	0	0
R-18	125	9	1
S-046-06	1	0	0
S-052-03	10	3	0
S-052-04	2	1	5
T-080-01	(21)	0	0
T-080-02	18	(1)	(1)
W-077-02	0	0	1
W-086-01	2	0	0

III. NEXT QUARTER GOALS

A. Priority Outfalls

1. 7th & Cheltenham Outfall (T-088-01)

Goals for the Quarter

- Continue to monitor the operation of the diversion apparatuses.
- Continue sampling at the outfall with dry-weather flow.

2. Monastery Ave. Outfall (W-060-01)

Goals for the Quarter

- Continue to monitor the operation of the diversion apparatuses.
- Continue sampling at the outfall with dry-weather flow.

3. Monoshone Creek Outfalls (W-060-04, W-060-08, W-060-09, W-060-10, W-060-11, W-068-04 and W-068-05)

Goals for the Quarter

- Continue sampling at outfall W-068-05 with dry-weather flow.

4. Manayunk Canal Outfalls (S-051-06, S-058-01, S-059-01 through S-059-11)

Goals for the Quarter

- Continue sampling at the outfalls with dry-weather flow.

B. Other Outfalls

1. Sandyford Run Outfall (P-090-02)

Goals for the Quarter

- Continue to monitor the operation of the diversion apparatus.

2. Franklin and Hasbrook Outfall (T-089-04)

Goals for the Quarter

- Continue to monitor the operation of the diversion apparatus.

3. Continue to perform abatements of identified cross-connections within the following outfalls.

- D-056-09
- D-093-01
- P-083-03
- P-100-04
- P-116-01
- Q-109-07
- Q-110-09
- Q-121-05
- R-18
- S-052-03
- S-052-04
- S-052-05
- T-088-01
- W-067-01
- W-086-02

4. Continue to perform property testing within the following outfalls.

- D-056-09
- D-093-01
- P-083-03

- P-116-02
- R-18
- T-080-02

Table 1
DLC Program Summary
January 1, 2019 to March 31, 2019

Complete Tests:

- 63,048 Complete tests have been performed under the DLC program
- **303 Complete tests were performed this past quarter**
- 22 Complete tests were performed in outfall D-056-09
- 55 Complete tests were performed in outfall D-093-01
- 52 Complete tests were performed in outfall P-083-03
- 1 Complete test was performed in outfall P-100-11
- 1 Complete test was performed in outfall P-108-09
- 11 Complete tests were performed in outfall P-116-02
- 1 Complete test was performed in outfall Q-106-12
- 1 Complete test was performed in outfall Q-106-21
- 18 Complete tests were performed in outfall Q-109-07
- 1 Complete test was performed in outfall Q-113-09
- 1 Complete test was performed in outfall Q-115-01
- 125 Complete tests were performed in outfall R-18
- 1 Complete test was performed in outfall S-046-06
- 10 Complete tests were performed in outfall S-052-03
- 2 Complete tests were performed in outfall S-052-04
- (21) Complete tests were performed in outfall T-080-01
- 18 Complete tests were performed in outfall T-080-02
- 1 Complete test was performed in outfall W-060-10
- 1 Complete test was performed in outfall W-068-05
- 2 Complete tests were performed in outfall W-086-01

Cross-Connections Found:

- 1,658 Cross-connections have been identified under the DLC program
- **19 Cross-connections were identified this past quarter**
- 2 Cross-connections were identified in outfall D-056-09
- 1 Cross-connection was identified in outfall D-093-01
- 4 Cross-connections were identified in outfall P-083-03
- 9 Cross-connections were identified in outfall R-18
- 3 Cross-connections were identified in outfall S-052-03
- 1 Cross-connection was identified in outfall S-052-04
- (1) Cross-connection was identified in outfall T-080-02

Abatements:

- 1,536 Abatements have been performed under the DLC program
- **6 Abatements were performed this past quarter**
- 1 Abatement was performed in outfall R-18
- 5 Abatements were performed in outfall S-052-04
- (1) Abatement was performed in outfall T-080-02
- 1 Abatement was performed in outfall W-077-02

Outfall/Manhole Screening and Sampling:

- 10 outfall inspections were made as part of the **Priority Outfall Inspection Program** this past quarter
- 9 outfall samples were taken due to observed dry-weather flow during the above inspections

- 49 outfall inspections were made as part of the **Permit Inspection Program** this past quarter
- 33 outfall samples were taken due to observed dry-weather flow during the above inspections

Table 2
Lab Analysis of Water at Outfalls and/or in the Storm Sewers
January 1, 2019 to March 31, 2019

Outfall	Date	Time	Location	Sewer Size (in)	Flow (gph)	Fluoride (mg/l)	Fecal Count (MPN per 100 ml)	Comments
A. Priority Outfalls								
T-088-01	2/5/2019	11:00	Outfall: 7th & Cheltenham	84	10800	0.12	1789	
W-060-01	1/23/2019	12:35	Outfall: Monastery Lane	5'-0" x 4'-4"	3600	0.21	41	
W-068-05	1/23/2019	13:00	Outfall: Lincoln & Morris	90	7200	0.50	5475	
S-058-01	2/5/2019	11:08	Outfall: Domino Lane	54	4500	0.26	<1	river influence
S-059-01	2/5/2019	11:30	Outfall: Parker	60	3600	0.32	92080	moderate musty odor
S-059-02	2/5/2019	11:45	Outfall: Fountain	42	1800	0.31	68670	clear
S-059-03	2/5/2019	11:55	Outfall: Wright	42	3600	0.19	77010	
S-059-04	2/5/2019	12:05	Outfall: Leverington	51	NR	0.20	1860	river influence
S-059-05	2/5/2019	12:10	Outfall: Leverington (east)	4'-0" x 2'-8"	NR	0.24	2046	river influence, musty iron odor
S-059-09	2/5/2019	12:15	Outfall: Green Lane	36	<60	NS	NS	flow too low to sample
B. Permit Inspection Program								
P-090-02	1/23/2019	11:55	Outfall: Brous & Lexington (Sandyford)	156	60	0.11	10	slight musty odor, slight suspended solids
T-089-04	2/5/2019	10:35	Outfall: W of Franklin Ave & County Line	3'-0" x 5'-6"	NF	NS	NS	no flow from city side
S-051-08	2/5/2019	10:30	Manhole: Main & Shurs	9'-0" x 7'-0"	NR	0.38	563	manhole S-051-08-0010
S-052-05	2/5/2019	10:35	Manhole: Sumac & Rochelle	42	<60	0.54	644	manhole S-052-05-0015
A-004-01	3/25/2019	10:30	Outfall: 84th & Lindbergh	20	NF	NS	NS	
C-032-01	3/20/2019	11:50	Manhole: 69th & Haverford	54	300	0.29	<10	manhole C-032-01-0010
C-032-02	3/20/2019	11:16	Outfall: Penwood & Brockton	18	300	0.75	8664	slight musty odor, slight surface scum
P-090-01	1/23/2019	11:50	Outfall: Brous & Lexington	42	60	<0.10	<10	
P-100-08	1/10/2019	13:00	Outfall: Maxwell St & Maxwell Pl	72	NR	0.56	399	
P-100-13	2/28/2019	13:03	Outfall: Holme & Longford	18	NF	NS	NS	
P-101-01	2/28/2019	12:25	Outfall: Woodbridge & Saxton	24	30	<0.10	4352	
P-101-02	2/28/2019	12:33	Outfall: Annapolis & Brookdale	42	1	0.11	14139	light flow
P-104-10	2/6/2019		Outfall: Bustleton & Benton	36	NF	NS	NS	
Q-101-06	2/27/2019	9:55	Outfall: Grant & Fordham	21	NF	NS	NS	
Q-101-07	2/28/2019	11:00	Manhole: Grant & Leon	36	10	<0.10	<1	manhole Q-101-07-0050
Q-101-08	2/27/2019	10:35	Outfall: Grant & Leon	21	NF	NS	NS	
Q-101-10	2/27/2019	11:05	Outfall: Torresdale & Fitler	27	NF	NS	NS	
Q-101-11	2/27/2019	11:20	Outfall: Grant & Torresdale	36	6	0.66	<1	clear
Q-101-12	2/27/2019	11:17	Outfall: Grant & Torresdale	18	6	0.65	<1	
Q-102-01	2/27/2019	12:25	Outfall: Frankford & Hegerman	36	NF	NS	NS	
Q-102-02	2/27/2019	12:35	Outfall: St. Denis & Hegerman	48	5	0.58	17329	trickle flow
Q-102-03	2/27/2019	12:46	Outfall: Tulip & Stevenson	48	NF	NS	NS	
Q-102-04	2/27/2019	11:40	Manhole: Grant & James	30	1	0.12	46110	manhole Q-102-04-0010
Q-102-05	2/27/2019	12:00	Outfall: State Road & Grant	24	NF	NS	NS	
Q-117-05	2/28/2019	11:35	Outfall: Byberry & Trina	48	3	0.13	10	slight river influence, light flow
S-010-01	3/25/2019	11:40	Outfall: Broad & Pattison	36	NF	NS	NS	
S-010-02	3/25/2019	11:30	Outfall: Broad & Pattison	6'0" x 6'6"	3600	0.24	20	
S-046-02	3/29/2019	10:51	Outfall: Conshohocken & Country Club	36	1800	0.16	235.9	
S-046-03	3/29/2019	10:38	Outfall: Conshohocken & Country Club	24	720	<0.10	<1	
S-046-05	3/29/2019	11:19	Outfall: Schuylkill & Falls	24	NF	NS	NS	
S-046-07	3/29/2019	11:31	Outfall: Neill & Presidential	18	1200	0.12	6.3	
S-046-08	3/29/2019	12:30	Outfall: City Ave & Presidential	30	60	0.17	16	
S-046-09	3/29/2019	12:00	Outfall: Ford & Wentworth	42	60	0.29	6867	

Table 2
Lab Analysis of Water at Outfalls and/or in the Storm Sewers
January 1, 2019 to March 31, 2019

Outfall	Date	Time	Location	Sewer Size (in)	Flow (gph)	Fluoride (mg/l)	Fecal Count (MPN per 100 ml)	Comments
T-050-01	2/26/2019	12:10	Outfall: Delaware & Lewis	42	NR	0.36	52	river influence
T-050-02	2/26/2019	12:40	Outfall: Bath & Hedley	48	NF	NS	NS	
T-055-01	3/13/2019		Outfall: Deal & Kensington	24	NF	NS	NS	
T-056-01	3/13/2019		Manhole: Adams & Ashland	36	60	0.20	<10	manhole T-056-01-0020
T-056-05	3/13/2019		Outfall: Almond & Luzerne	48	60	0.63	2247	river influence
T-056-06	3/21/2019		Outfall: Thompson & Roxborough	30	NF	NS	NS	
T-056-07	2/26/2019	12:25	Outfall: Richmond & Roxborough	36	2	0.34	<1	
T-063-02	3/14/2019		Outfall: I & Wyoming	36	NF	NS	NS	
T-063-03	3/14/2019		Outfall: Castor & Wyoming	21	15	0.18	20	
T-063-04	3/13/2019		Outfall: Wingohocking & O	30	30	0.44	573	
T-063-05	3/13/2019		Outfall: Cayuga & Potter	30	NF	NS	NS	
T-063-06	3/13/2019		Outfall: Bristol & Potter	27	NF	NS	NS	
T-071-01	3/14/2019		Outfall: Tabor & Olney	24	NF	NS	NS	
T-089-01	1/29/2019	11:45	Outfall: Passmore & Newtown	36	NF	NS	NS	
T-098-02	1/29/2019	10:49	Outfall: Fillmore & Shelmire	36	720	NS	NS	no sheen or odor
W-077-02	3/14/2019		Outfall: Lincoln & Cresheim Valley	66	1800	0.29	20	

Table 3
Residential Cross Connections Not Abated Within 120 Days

A. Properties Abated & Confirmed Prior to Reporting:

Address				Outfall Code	Complete Date	Admin. Action	Abatement Confirmation Date	Comments
00116	W	Mermaid	La	W-077-02	12-06-2017		01-03-2019	
03363		Tilden	St	S-052-04	03-01-2018		03-06-2019	
03331		Tilden	St	S-052-04	03-28-2018		12-20-2018	
03314		Tilden	St	S-052-04	03-31-2018		03-13-2019	
03308	W	Penn	St	S-052-04	03-31-2018		02-05-2019	
03447	W	Penn	St	S-052-04	04-07-2018		11-01-2018	
03414		Ainslie	St	S-052-04	04-21-2018		02-06-2019	
03310		Arnold	St	S-052-04	06-02-2018		01-07-2019	

B. Properties Active As Of Reporting:

Address				Outfall Code	Complete Date	Admin. Action	Comments
07028	N	Broad	St	T-088-01	11-22-2017		
00015		Osborn	St	S-052-05	01-17-2018		
01941		Kentwood	St	Q-109-07	01-19-2018		
03525		Vaux	St	S-052-04	01-24-2018		
03411	W	Penn	St	S-052-04	02-13-2018		
03400	W	Penn	St	S-052-04	02-16-2018		
03423	W	Penn	St	S-052-04	02-17-2018		
03424	W	Penn	St	S-052-04	02-17-2018		
03404	W	Penn	St	S-052-04	02-17-2018		
03433	W	Penn	St	S-052-04	02-21-2018		
03334	W	Penn	St	S-052-04	02-21-2018		
03338	W	Penn	St	S-052-04	02-24-2018		
03331	W	Penn	St	S-052-04	02-24-2018		
03324	W	Penn	St	S-052-04	02-24-2018		
03333	W	Penn	St	S-052-04	02-26-2018		

Table 3
Residential Cross Connections Not Abated Within 120 Days

Address				Outfall Code	Complete Date	Admin. Action	Comments
03332	W	Penn	St	S-052-04	02-26-2018		
03425		Conrad	St	S-052-04	03-01-2018		
03530		Henry	Ave	S-052-04	03-03-2018		
03340	W	Penn	St	S-052-04	03-03-2018		
03359		Tilden	St	S-052-04	03-10-2018		
03301	W	Penn	St	S-052-04	03-16-2018		
03424		Osmond	St	S-052-04	03-17-2018		
03411		Sunnyside	Ave	S-052-04	03-22-2018		
03345		Tilden	St	S-052-04	03-24-2018		
03305		Tilden	St	S-052-04	03-24-2018		
03313		Tilden	St	S-052-04	03-24-2018		
03329		Tilden	St	S-052-04	03-27-2018		
03316		Tilden	St	S-052-04	03-28-2018		
03333		Tilden	St	S-052-04	03-29-2018		
03461		Sunnyside	Ave	S-052-04	04-02-2018		
03434	W	Penn	St	S-052-04	04-07-2018		
03411		Osmond	St	S-052-04	04-28-2018		
03452		Crawford	St	S-052-04	05-02-2018		
03449	W	Penn	St	S-052-04	05-03-2018		
03323		Conrad	St	S-052-04	05-09-2018		
03446		Crawford	St	S-052-04	05-17-2018		
03467		Indian Queen	La	S-052-04	05-26-2018		
03433		Crawford	St	S-052-04	05-26-2018		
03317	W	Penn	St	S-052-04	06-02-2018		
03448	W	Queen	La	S-052-04	06-23-2018		
00032	W	Gowen	Ave	W-086-02	06-28-2018		

Table 3
Residential Cross Connections Not Abated Within 120 Days

Address				Outfall Code	Complete Date	Admin. Action	Comments
03419	W	Queen	La	S-052-04	07-02-2018		
03459	W	Penn	St	S-052-04	07-02-2018		
03335	W	Queen	La	S-052-04	07-02-2018		
03417	W	Queen	La	S-052-04	07-05-2018		
03326	W	Queen	La	S-052-04	07-12-2018		
03452	W	Queen	La	S-052-04	07-13-2018		
03467	W	Queen	La	S-052-04	07-16-2018		
03469	W	Queen	La	S-052-04	07-17-2018		
03414	W	Queen	La	S-052-04	07-20-2018		
03440	W	Queen	La	S-052-04	07-21-2018		
03474		Tilden	St	S-052-04	07-21-2018		
03333	W	Queen	La	S-052-04	07-21-2018		
03435	W	Queen	La	S-052-04	07-30-2018		
03464	W	Queen	La	S-052-04	07-30-2018		
03463	W	Queen	La	S-052-04	08-02-2018		
03429	W	Queen	La	S-052-04	08-02-2018		
01340		Downs	Pl	Q-121-05	08-14-2018		
03459	W	Queen	La	S-052-04	08-16-2018		
03434	W	Queen	La	S-052-04	08-17-2018		
03460	W	Queen	La	S-052-04	08-24-2018		
02612		Woodward	St	P-100-04	09-12-2018		
04437		Riverview	La	S-052-03	09-19-2018		
03227		Comly	Pl	Q-110-09	09-21-2018		
04456		Riverview	La	S-052-03	09-26-2018		
04423		Driftwood	Dr	S-052-03	09-27-2018		
04433		Riverview	La	S-052-03	09-29-2018		

Table 3
Residential Cross Connections Not Abated Within 120 Days

Address				Outfall Code	Complete Date	Admin. Action	Comments
04439		Riverview	La	S-052-03	09-29-2018		
04433		Driftwood	Dr	S-052-03	09-29-2018		
04406		Driftwood	Dr	S-052-03	09-29-2018		
04520		Aberdale	Rd	P-083-03	10-06-2018		
03235		Comly	Pl	Q-110-09	10-06-2018		
04410		Driftwood	Dr	S-052-03	10-06-2018		
04425		Aberdale	Rd	P-083-03	10-09-2018		
04415		Driftwood	Dr	S-052-03	10-12-2018		
04433		Aberdale	Rd	P-083-03	10-13-2018		
04402		Driftwood	Dr	S-052-03	10-13-2018		
04423		Aberdale	Rd	P-083-03	10-16-2018		
04312		Ashburner	St	P-083-03	10-20-2018		
03454	W	Penn	St	S-052-04	10-24-2018		
04425		Driftwood	Dr	S-052-03	10-27-2018		
04431		Driftwood	Dr	S-052-03	10-27-2018		
04404		Driftwood	Dr	S-052-03	10-31-2018		
04412		Driftwood	Dr	S-052-03	11-09-2018		
04417		Driftwood	Dr	S-052-03	11-17-2018		
08731		Cottage	St	P-083-03	11-27-2018		
04436		Carwithan	Rd	P-083-03	11-30-2018		

Table 4

Spills to Storm Sewers and/or Receiving Waters

January 1, 2019 to March 31, 2019

Date	Outfall	Address	Source Code	Material Involved	Completion Date	Remarks
01/17/19	P-100-14	Holme Avenue and Longford Street Wooden Bridge Run	3009	Sewage	01/17/19	Sewer Maintenance unit flushed 10" diameter sanitary sewer causing approximate 5 gpm discharge. Contractor vacuumed debris from manhole and adjacent sewer.
01/23/19	S-046-01	City Avenue and Presidential Boulevard unnamed tributary of Schuylkill River	3008	Sewage	01/23/19	Sewer Maintenance unit flushed 15" diameter sanitary sewer causing approximate 5 gpm discharge through manhole. Affected area cleaned.
01/29/19		1070 Livezey Lane Wissahickon Creek	3011	Fresh Water	02/05/19	Industrial Waste unit investigated a reported leak from a 20" diameter water main which crosses under the creek. Discharge was approximately <1 gpm. Distribution unit confirmed leak and repaired the joint.
02/28/19	P-100-14	Holme Avenue and Longford Street Wooden Bridge Run	3009	Sewage	02/28/19	Sewer Maintenance unit flushed 10" diameter sanitary sewer causing approximate 5 gpm discharge. Storm sewer flushed with dechlorinated water.
03/07/19	C-22	Greenway Avenue and S. 66th Street	3008	Sewage	03/07/19	Sewer Maintenance unit flushed 21" diameter combined sewer causing approximate <1 gpm discharge (W/C at 2033, 2035, 2037, 2039 S. 66th Street).
03/14/19		4351 Byberry Road Poquessing Creek	3008	Sewage	03/16/19	Industrial Waste unit investigated a reported approximate <1 gpm discharge from a private sewer / manhole serving the Philadelphia Mills mall complex. Referred to facility management for repair and cleanup.
03/27/19	Q-115-01	12339 Dunksferry Road unnamed tributary of Poquessing Creek	3009	Sewage	03/27/19	Sewer Maintenance unit flushed 10" diameter sanitary sewer causing approximate 5 gpm discharge. Storm sewer flushed with dechlorinated water. Affected area cleaned.

Source Codes:

3008 - Spill to Ground Only

3009 - Spill to Storm Sewer

3010 - Spill to Sanitary Sewer

3011 - Spill to Receiving Stream

STORM WATER MANAGEMENT PROGRAM
NPDES PERMIT NO. PA0054712

DEFECTIVE LATERAL CONNECTION STATUS REPORT
(Covering Period from April 1, 2019 to June 30, 2019)

Submitted to

PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF WATER QUALITY MANAGEMENT

By

CITY OF PHILADELPHIA
PHILADELPHIA, PA

July 31, 2019

DLC Program Update
2nd Quarter 2019

I. INTRODUCTION

This Defective Lateral Connection Status Report is submitted to the Pennsylvania Department of Environmental Protection (PADEP) as part of the reporting requirements of the City of Philadelphia NPDES Storm Water Management Permit No. PA 0054712. The report covers the three-month period beginning April 1, 2019 and ending June 30, 2019.

The body of this report will describe the recent activities of the City during the past quarter within the 1998 COA Priority Outfall areas and at other significant outfalls on the Stormwater Outfall Priority Score list. Additionally, goals for the next quarter will be listed.

Table 1 provides a summary of the program with respect to Complete tests, Cross-connections identified, and Abatements performed. Table 2 provides a listing of all laboratory analyses of samples taken at stormwater outfalls or within the stormwater system during the previous quarter. Table 3 provides a listing of properties with cross-connections outstanding greater than 120 days. Finally, Table 4 provides a listing of reported wastewater spills to the stormwater system or receiving streams.

II. PAST QUARTER REVIEW

A. Priority Outfalls

1. 7th & Cheltenham Outfall (T-088-01)

DLC program activities have performed 2,831 Complete tests in this sewershed, identifying 134 Cross-connections, all but one of which have been Abated.

Eight (8) sites intercepting flow are listed below.

1. CFD-01 Plymouth St. west of Pittsville St.
2. CFD-02 Pittsville St. south of Plymouth St.
3. CFD-03 Elston St. east of Bouvier St.
4. CFD-04 Ashley St. west of Bouvier St.
5. CFD-05 Cheltenham Ave. east of 19th St.
6. CFD-06 Verbena St. south of Cheltenham Ave.
7. CFD-07 Cheltenham Ave. east of 7th St.
8. CFD-08 7th St. south of Cheltenham Ave.

The number of inspections, blockages cleared and discharges noted during this quarter are listed below.

Flap Gate	Inspections	Blockages	Discharges
CFD-01	10	0	0
CFD-02	11	1	0
CFD-03	7	0	0
CFD-04	8	1	0
CFD-05	4	0	0
CFD-06	7	0	0
CFD-07	25	3	0
CFD-08	24	0	0

The most recent fecal sample value was 7270 MPN per 100 ml. at the outfall on April 23, 2019.

2. Monastery Ave. Outfall (W-060-01)

DLC program activities have performed 611 Complete tests in this sewershed, identifying 16 Cross-connections, all of which have been Abated.

Two (2) sites intercepting flow are listed below.

1. MFD-01 Jannette St. west of Monastery Ave.
2. MFD-02 Green La. north of Lawnton St.

The number of inspections, blockages cleared and discharges noted during this quarter are listed below.

Flap Gate	Inspections	Blockages	Discharges
MFD-01	5	0	0
MFD-02	5	0	0

The most recent fecal sample value was 19863 MPN per 100 ml. at the outfall on April 4, 2019.

3. Monoshone Creek Outfalls (W-060-04, W-060-08, W-060-09, W-060-10, W-060-11, W-068-04 and W-068-05)

DLC program activities have performed 2,750 Complete tests in these sewershed areas, identifying 94 Cross-connections, all of which have been Abated. The majority of the efforts have been in the W-068-05 sewershed area which is by far the largest in terms of drainage area and properties served.

The most recent fecal sample value was 52 MPN per 100 ml. at the W-068-05 outfall on April 4, 2019.

4. Manayunk Canal Outfalls (S-051-06, S-058-01, S-059-01 through S-059-11)

DLC program activities have performed 2,479 Complete tests in these sewershed areas, identifying 62 Cross-connections, all of which have been Abated. The majority of the efforts have been in the S-059-04 sewershed area.

The most recent fecal sample values on April 8, 2019 at each outfall were:

- 214.3 MPN per 100 ml. at the S-058-01 outfall.
- >2419.6 MPN per 100 ml. at the S-059-01 outfall.
- 686.7 MPN per 100 ml. at the S-059-02 outfall.
- 155310 MPN per 100 ml. at the S-059-03 outfall.
- 10462 MPN per 100 ml. at the S-059-04 outfall.
- >2419.6 MPN per 100 ml. at the S-059-05 outfall.
- S-059-09 outfall was wet but not sampled.

B. Other Outfalls

1. Sandyford Run Outfall (P-090-02)

DLC program activities have performed 5,834 Complete tests in this sewershed, identifying 87 Cross-connections, all of which have been Abated.

One (1) site intercepting flow is listed below.

1. PFD-01 Sandyford Run (Brous and Lexington Aves.)

The number of inspections, blockages cleared and discharges noted during this quarter are listed below.

Flap Gate	Inspections	Blockages	Discharges
PFD-01	28	2	2

The most recent fecal sample value was <1 MPN per 100 ml. at the outfall on April 4, 2019.

2. Franklin and Hasbrook Outfall (T-089-04)

DLC program activities have performed 1,021 Complete tests in this sewershed, identifying 46 Cross-connections, all of which have been Abated.

One (1) site intercepting flow is listed below.

1. CFD-01 Franklin and Hasbrook Aves.

The number of inspections, blockages cleared and discharges noted during this quarter are listed below.

Flap Gate	Inspections	Blockages	Discharges
CFD-01	29	0	2

The outfall was found dry on February 5, 2019.

3. A current summary of additional outfalls from the Stormwater Outfall Priority Score list that the City has performed complete testing or abatements this quarter is as follows.

Outfall #	Complete Tests	Cross-Connections	Abatements
D-056-09	7	0	2
D-093-01	4	0	0
P-083-03	15	2	1
P-091-07	1	0	0
P-116-01	0	0	1
P-116-02	2	0	0
Q-109-07	6	1	0
Q-110-09	0	0	1
Q-113-09	1	0	0
Q-115-12	1	0	0
R18	258	31	0
S-052-04	1	0	3
T-080-02	6	4	0

III. NEXT QUARTER GOALS

A. Priority Outfalls

1. 7th & Cheltenham Outfall (T-088-01)

Goals for the Quarter

- Continue to monitor the operation of the diversion apparatuses.
- Continue sampling at the outfall with dry-weather flow.

2. Monastery Ave. Outfall (W-060-01)

Goals for the Quarter

- Continue to monitor the operation of the diversion apparatuses.
- Continue sampling at the outfall with dry-weather flow.

3. Monoshone Creek Outfalls (W-060-04, W-060-08, W-060-09, W-060-10, W-060-11, W-068-04 and W-068-05)

Goals for the Quarter

- Continue sampling at outfall W-068-05 with dry-weather flow.

4. Manayunk Canal Outfalls (S-051-06, S-058-01, S-059-01 through S-059-11)

Goals for the Quarter

- Continue sampling at the outfalls with dry-weather flow.

B. Other Outfalls

1. Sandyford Run Outfall (P-090-02)

Goals for the Quarter

- Continue to monitor the operation of the diversion apparatus.

2. Franklin and Hasbrook Outfall (T-089-04)

Goals for the Quarter

- Continue to monitor the operation of the diversion apparatus.

3. Continue to perform abatements of identified cross-connections within the following outfalls.

- D-056-09
- D-093-01
- P-083-03
- P-100-04
- Q-109-07
- Q-110-09
- Q-121-05
- R18
- S-052-03
- S-052-04
- S-052-05
- T-080-02
- W-067-01
- W-086-02

3. Continue to perform property testing within the following outfalls.

- D-056-09
- D-093-01
- P-083-03
- P-113-06
- Q-109-07
- Q-113-09

- R18
- S-052-04
- T-080-02

Table 1
DLC Program Summary
April 1, 2019 to June 30, 2019

Complete Tests:

- 63350 Complete tests have been performed under the DLC program
- **302 Complete tests were performed this past quarter**
- 7 Complete tests were performed in outfall D-056-09
- 4 Complete tests were performed in outfall D-093-01
- 15 Complete tests were performed in outfall P-083-03
- 1 Complete test was performed in outfall P-091-07
- 2 Complete tests were performed in outfall P-116-02
- 6 Complete tests were performed in outfall Q-109-07
- 1 Complete test was performed in outfall Q-113-09
- 1 Complete test was performed in outfall Q-115-12
- 258 Complete tests were performed in outfall R-18
- 1 Complete test was performed in outfall S-052-04
- 6 Complete tests were performed in outfall T-080-02

Cross-Connections Found:

- 1,696 Cross-connections have been identified under the DLC program
- **38 Cross-connections were identified this past quarter**
- 2 Cross-connections were identified in outfall P-083-03
- 1 Cross-connection was identified in outfall Q-109-07
- 31 Cross-connections were identified in outfall R-18
- 4 Cross-connection was identified in outfall T-080-02

Abatements:

- 1,544 Abatements have been performed under the DLC program
- **8 Abatements were performed this past quarter**
- 2 Abatements were performed in outfall D-056-09
- 1 Abatement was performed in outfall P-083-03
- 1 Abatement was performed in outfall P-116-01
- 1 Abatement was performed in outfall Q-110-09
- (1) Abatement was performed in outfall R-18
- 3 Abatements were performed in outfall S-052-04
- 1 Abatement was performed in outfall T-088-01

Outfall/Manhole Screening and Sampling:

- 10 outfall inspections were made as part of the **Priority Outfall Inspection Program** this past quarter
- 9 outfall samples were taken due to observed dry-weather flow during the above inspections

- 23 outfall inspections were made as part of the **Permit Inspection Program** this past quarter
- 13 outfall samples were taken due to observed dry-weather flow during the above inspections

Table 2

Lab Analysis of Water at Outfalls and/or in the Storm Sewers

April 1, 2019 to June 30, 2019

Outfall	Date	Time	Location	Sewer Size (in)	Flow (gph)	Fluoride (mg/l)	Fecal Count (MPN per 100 ml)	Comments
A. Priority Outfalls								
T-088-01	4/23/2019	0:00	Outfall:Cheltenham Ave. & 7th St.	84	NR	7270	0.14	Clear; fish swimming
W-060-01	4/4/2019	0:00	Outfall: Monastery & Jannette	5'0" x 4' 0"	3600	19863	0.104	Looks a little blue in plunge pool
W-068-05	4/4/2019	0:00	Outfall: Lincoln & Morris	90	7200	52	0.195	Grey Bacteria in Stream
S-058-01	4/8/2019	11:15	Outfall:Umbria St. & Domino Lane	54	6000	214.3	0.23	Orange sediments, submerged outfall
S-059-01	4/8/2019	11:50	Outfall:Towpath & Parker Ave.	60	5400	>2419.6	0.295	Moderate sudsing - looks biological
S-059-02	4/8/2019	12:00	Outfall:Towpath & Fountain St.	42	600	686.7	0.103	Clear Flow
S-059-03	4/8/2019	12:05	Outfall:Towpath & Wright St.	42	2400	155310	0.183	Green & Grey algae / bacteria
S-059-04	4/8/2019	12:15	Outfall:Towpath & Leverington Ave.	51	7200	10462	0.167	Submerged outfall, visible tan plume coming from OF. Unable to determine exact flow
S-059-05	4/8/2019	12:20	Outfall:Towpath & Leverington Ave.	4'0" x 2'8"	60	>2419.6	0.221	Flow influence from N. Leverington (S-059-05)
S-059-09	4/8/2019	12:30	Outfall:Main St. & Green Lane	36	120	NS	NS	Unable to sample - flow under boardwalk
B. Permit Inspection Program								
P-090-02	4/4/2019	0:00	Outfall:Brous & Lexington Aves.	156	60	<1	0.49	Slight Musty Odor
S-051-08	4/11/2019	10:45	Manhole: Main & Shurs	9 x 7	NR	>2419.6	0.367	Sampled from manhole S-051-08-0010
S-052-05	4/11/2019	10:30	Manhole: Sumac & Rochelle	42	NR	2419.6	0.574	Sampled from manhole S-052-05-0015
S-059-03	4/11/2019	11:05	Outfall: Wright & Towpath	42	2400	120330	0.279	Grey & Green bacteria / algae. Choke debris & concrete in upstream manholes.
	4/25/2019	12:40	Outfall: Wright and Towpath	42	2700	107.1	0.13	Grey and Green algae bacteria - Followup inspection after choke cleared.
D-092-05	4/12/2019	12:25	Manhole: Delaware & Linden	6' x 8'8"	300	>2419.6	0.147	Sampled from manhole D-092-02-0010. Outfall submerged tidal flow, cannot access
D-093-01	4/12/2019	12:50	Manhole: State & Convent	6' x 8'8'	0	NS	NS	Manhole D-093-01-0010 - Dry. Outfall submerged - tidal flow.
W-086-03	4/24/2019	0:00	Outfall: Devon & Rumford	42	0	NS	NS	Severe Erosion around bricks.
W-086-05	4/24/2019	0:00	Outfall: Anderson & Woodbrook	48	0	NS	NS	Dry, No flow.
W-086-04	4/24/2019	0:00	Outfall: Anderson & Woodbrook	42	60	>241960	0.593	Dead fish at edge of outfall apron, copntacted A.Sinclair of PADEP. Source tracked back to MH W-086-04-0015 (flow) and 0025. Sewer maintenance notified. Reinspection scheduled.
W-086-07	4/24/2019	0:00	Outfall: Cresheim Valley & Crittendon	60	600	20	0.308	Clear flow.
D-056-09	4/24/2019	11:35	Outfall: Belgrade & Pratt	24	<0.1	NS	NS	Inspected MH's D-056-0020 & 0010. 0020 = Dry. 0010 = less than trickle flow, could not get liquid into jar. Outfall inaccessible and unsafe to access.
S-075-03	4/25/2019	11:50	Outfall: Steeple & Belfry	36	0	NS	NS	No flow from outfall. Dry at MH's. Apron has wet stain and plunge pool is stagnant & scum. Rest of creek bed is dry.
S-075-04	4/25/2019	12:05	Outfall: Hagy's Mill & Cathedral	48	0	NS	NS	No flow. Outfall and channel dry with soil & rock.
D-037-01	4/29/2019	10:45	Outfall: Beach & Dyott	20	0	NS	NS	Outfall submerged. No manholes along sewer line/shed. Nearby storm manholes are for D38 combined system. 450' of a 20"CI pipe connected to one storm drain.
S-046-08	4/29/2019	11:05	Outfall: Cranston & Conshohocken	54	NR	1299.7	0.381	Reinspection--Correct Name (Incorrect name City Ave & Presidential) Near Birth Shalom House.
S-046-06	4/29/2019	11:25	Outfall: Kelly Dr and Roosevelt Expy	6'11" x 10'6"	NR	727	0.161	Submerged. All suspended solids and scum were a result of typical river water.
S-046-04	4/29/2019	11:45	Outfall: Hunting Park and Kelly Dr	4'6" x 5'5"	NR	1553.1	0.107	Couldn't determine flow because could not reach mouth of outfall.
S-066-01	4/29/2019	11:51	Outfall: Shawmont & Nixon	24	6	15531	0.629	Trickle flow from OF inside culvert.
D-026-06	5/3/2019	10:40	Outfall: Lombard Circle	24	0	NS	NS	Not Permitted. Observed from first upstream manhole (no ID in SERV). No access to outfall on river.
D-026-05	5/3/2019	10:50	Manhole: D-026-05-0010	24	0	NS	NS	No access to outfall on river.
S-011-01	6/27/2019	11:00	Outfall: Broad and Government St	48	0	NR	NR	Outfall does not exist at location. Not in SERV.
S-014-01	6/28/2019	11:50	Manhole: 61st & Passyunk	7" x 12'12"	NR	167	0.104	Manhole S014-01-0010 - Sheen "pieces" floating by in flow.

Table 3
Residential Cross Connections Not Abated Within 120 Days

A. Properties Abated & Confirmed Prior to Reporting:

Address	Outfall Code	Complete Date	Admin. Action	Abatement Confirmation Date	Comments

B. Properties Active As Of Reporting:

Address	Outfall Code	Complete Date	Admin. Action	Comments
00015 Osborn St	S-052-05	01-17-2018		
01941 Kentwood St	Q-109-07	01-19-2018		
03411 W Penn St	S-052-04	02-13-2018		
03400 W Penn St	S-052-04	02-16-2018		
03423 W Penn St	S-052-04	02-17-2018		
03424 W Penn St	S-052-04	02-17-2018		
03404 W Penn St	S-052-04	02-17-2018		
03433 W Penn St	S-052-04	02-21-2018		
03334 W Penn St	S-052-04	02-21-2018		
03338 W Penn St	S-052-04	02-24-2018		
03324 W Penn St	S-052-04	02-24-2018		
03331 W Penn St	S-052-04	02-24-2018		
03333 W Penn St	S-052-04	02-26-2018		
03332 W Penn St	S-052-04	02-26-2018		
03425 Conrad St	S-052-04	03-01-2018		
03530 Henry Ave	S-052-04	03-03-2018		
03340 W Penn St	S-052-04	03-03-2018		
03301 W Penn St	S-052-04	03-16-2018		
03424 Osmond St	S-052-04	03-17-2018		
03411 Sunnyside Ave	S-052-04	03-22-2018		
03345 Tilden St	S-052-04	03-24-2018		
03313 Tilden St	S-052-04	03-24-2018		
03305 Tilden St	S-052-04	03-24-2018		

Table 3
Residential Cross Connections Not Abated Within 120 Days

Address			Outfall Code	Complete Date	Admin. Action	Comments
03329	Tilden	St	S-052-04	03-27-2018		
03316	Tilden	St	S-052-04	03-28-2018		
03333	Tilden	St	S-052-04	03-29-2018		
03461	Sunnyside	Ave	S-052-04	04-02-2018		
03434 W	Penn	St	S-052-04	04-07-2018		
03411	Osmond	St	S-052-04	04-28-2018		
03452	Crawford	St	S-052-04	05-02-2018		
03449 W	Penn	St	S-052-04	05-03-2018		
03323	Conrad	St	S-052-04	05-09-2018		
03446	Crawford	St	S-052-04	05-17-2018		
03467	Indian Queen	La	S-052-04	05-26-2018		
03433	Crawford	St	S-052-04	05-26-2018		
03317 W	Penn	St	S-052-04	06-02-2018		
03448 W	Queen	La	S-052-04	06-23-2018		
00032 W	Gowen	Ave	W-086-02	06-28-2018		
03419 W	Queen	La	S-052-04	07-02-2018		
03335 W	Queen	La	S-052-04	07-02-2018		
03417 W	Queen	La	S-052-04	07-05-2018		
03326 W	Queen	La	S-052-04	07-12-2018		
03452 W	Queen	La	S-052-04	07-13-2018		
03467 W	Queen	La	S-052-04	07-16-2018		
03469 W	Queen	La	S-052-04	07-17-2018		
03414 W	Queen	La	S-052-04	07-20-2018		
03440 W	Queen	La	S-052-04	07-21-2018		
03333 W	Queen	La	S-052-04	07-21-2018		
03474	Tilden	St	S-052-04	07-21-2018		

Table 3
Residential Cross Connections Not Abated Within 120 Days

Address				Outfall Code	Complete Date	Admin. Action	Comments
03435	W	Queen	La	S-052-04	07-30-2018		
03464	W	Queen	La	S-052-04	07-30-2018		
03463	W	Queen	La	S-052-04	08-02-2018		
03429	W	Queen	La	S-052-04	08-02-2018		
01340		Downs	Pl	Q-121-05	08-14-2018		
03459	W	Queen	La	S-052-04	08-16-2018		
03434	W	Queen	La	S-052-04	08-17-2018		
03460	W	Queen	La	S-052-04	08-24-2018		
02612		Woodward	St	P-100-04	09-12-2018		
04437		Riverview	La	S-052-03	09-19-2018		
04456		Riverview	La	S-052-03	09-26-2018		
04423		Driftwood	Dr	S-052-03	09-27-2018		
04433		Riverview	La	S-052-03	09-29-2018		
04406		Driftwood	Dr	S-052-03	09-29-2018		
04433		Driftwood	Dr	S-052-03	09-29-2018		
04439		Riverview	La	S-052-03	09-29-2018		
04520		Aberdale	Rd	P-083-03	10-06-2018		
04410		Driftwood	Dr	S-052-03	10-06-2018		
03235		Comly	Pl	Q-110-09	10-06-2018		
04425		Aberdale	Rd	P-083-03	10-09-2018		
04415		Driftwood	Dr	S-052-03	10-12-2018		
04433		Aberdale	Rd	P-083-03	10-13-2018		
04402		Driftwood	Dr	S-052-03	10-13-2018		
04423		Aberdale	Rd	P-083-03	10-16-2018		
04312		Ashburner	St	P-083-03	10-20-2018		
03454	W	Penn	St	S-052-04	10-24-2018		

Table 3
Residential Cross Connections Not Abated Within 120 Days

Address			Outfall Code	Complete Date	Admin. Action	Comments
04425	Driftwood	Dr	S-052-03	10-27-2018		
04431	Driftwood	Dr	S-052-03	10-27-2018		
04404	Driftwood	Dr	S-052-03	10-31-2018		
04412	Driftwood	Dr	S-052-03	11-09-2018		
04417	Driftwood	Dr	S-052-03	11-17-2018		
08731	Cottage	St	P-083-03	11-27-2018		
04435	Aberdale	Rd	P-083-03	12-04-2018		
03413	Osmond	St	S-052-04	12-07-2018		
03005	Comly	Rd	Q-110-09	12-10-2018		
03700	Falls	Cir	S-052-03	12-15-2018		
04256	Neilson	St	R18	12-22-2018		
03021	Comly	Rd	Q-110-09	12-22-2018		
08726	Cottage	St	P-083-03	12-22-2018		
03702	Falls	Cir	S-052-03	12-24-2018		
04702	Almond	St	D-056-09	12-26-2018		
04714	Mercer	St	D-056-09	12-29-2018		
03482	Tilden	St	S-052-04	01-07-2019		
04611	Ashburner	St	P-083-03	01-16-2019		
09524	State	Rd	D-093-01	01-16-2019		
03704	Falls	Cir	S-052-03	01-17-2019		
04408	Driftwood	Dr	S-052-03	01-19-2019		
03706	Falls	Cir	S-052-03	01-19-2019		
04712	Ashburner	St	P-083-03	01-22-2019		
02629	Pratt	St	D-056-09	01-26-2019		
04416	Ashburner	St	P-083-03	02-02-2019		

Table 4
Spills to Storm Sewers and/or Receiving Waters
April 1, 2019 to June 30, 2019

Date	Outfall	Address	Source Code	Material Involved	Completion Date	Remarks
04/02/19		7400 Lansdowne Avenue Golf Course	3008	Sewage	04/02/19	Sewer Maintenance unit installed bypass pump causing apporximate 8 gpm discharge. Lining contractor vaccumed up as much material as possible and appiled pelletized lime impacted areas.
04/04/19	W060-10	5700 Wayne Monoshone Creek	3009	Sewage	04/04/19	Sewer Maintenance unit flushed 12" diameter sanitary sewer causing approximate <1 gpm discharge through manhole. Minnimal clean up was done in Monoshone Creek.
04/05/19	D51	100 N. 7th & Arch St	3008	Sewage	04/06/19	Sewer Maintenance unit used vactor truck to flush 24" diameter combined sewer causing approximate <1 gpm discharge through manhole. Cleaned sewer removed devris and sent basement clean up to customer service 718 & 720 Arch.
04/08/19	P-100-14	Holme Ave & Longford St Pennypack Creek	3009	Sewage	04/08/19	Industrial Waste unit investigated a reported apporximate 280 gpm sewage discharge from the outfall. Sewer maintenance flushed the sewer.
04/09/19	Q-110-05	3001 Red Lion Rd Poquessing Creek	3009	Sewage	04/09/19	Industrial Waste unit investigated a reported discharge to storm drains. Facility to perform additional investiations and report findings to PWD-IWBC
04/10/19	S059-01	4874 Smick St	3008	Sewage	04/10/19	Sewer Maintenance unit flushed 10" diameter sanitary sewer causing approximate <1 gpm discharge. Removed 12,000 lbs of dirt, limed and topped with wood chips.
04/24/19	W-086-01	7810 Winston Rd	3008	Sewage	04/24/19	Sewer Maintenance unit used vactor to flush 10" diameter sanitary sewer causing approximate <1 gpm discharge. Street and inlets were cleaned.
04/26/19	D39	2100 Douglas	3008	Sewage	04/26/19	Sewer Maintenance unit used vactor and combo to flush 12" diameter combined sewer causing approximate <1 gpm discharge. Customer service cleaned basement 2117 N 33 Rd and sewage was removed from street.
05/09/19	W060-10	400 Rittenhouse St Monoshone Creek	3009	Sewage	05/09/19	Sewer Maintenance unit used vactor truck to flush 12" diameter sanitary sewer causing approximate <1 gpm discharge.
06/05/19	P-100-14	Holme Ave & Longford St Pennypack Creek	3009	Sewage	06/06/19	Industrial Waste unit investigated a reported apporximate 3 gpm sewage discharge from the outfall. Sewer maintenance flushed the sewer and the water was clean.
06/11/19	W-060-10	5500 Wissahickon Ave Wissahickon Creek	3009	Sewage	06/26/19	Industrial Waste unit investigated a reported leaking cooling unit water to storm inlet. Issue followup November.

Source Codes:

3008 - Spill to Ground Only	**3010 - Spill to Sanitary Sewer**
3009 - Spill to Storm Sewer	**3011 - Spill to Receiving Stream**