Haverhill

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April 23, 2019

Water Technical Unit (OES04-3)
U.S. EPA – New England, Region 1
5 Post Office Square, Suite 100
Boston, MA 02109-3912
Attn: Joy Hilton

Subject: City of Haverhill, MA NPDES Permit #MA 0101621
Consent Decree (Civil Action No. 16-11698-IT)
Combined Sewer Overflow Annual Report 2018

Dear Ms. Hilton:

In accordance with Part I.D.3 of the City of Haverhill's NPDES Permit and the Consent Decree item VII.M.51, we are providing this annual report for the 2018 calendar year.

Enclosed is the certification statement required by paragraph 99 of the Consent Decree.

If you require additional information, please call me at (978) 374-2382.

Sincerely,

Robert E. Ward
Deputy DPW Director

Enclosure(s)

cc: Chief, Environmental Enforcement Section, U.S. DOJ
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Certification Statement

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly 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.

Robert E. Ward
Deputy DPW Director
City of Haverhill

4/22/19
(date)

City of Haverhill

Department of Public Works
Wastewater Division

Annual Combined Sewer Overflow Report

Calendar Year 2018

NPDES Permit No. MA 0101621

Purpose

This report was prepared in accordance with Part I, Section D of NPDES Permit No. MA0101621 issued to the City of Haverhill effective February 1, 2008. The permit authorizes the City to discharge stormwater/wastewater during wet weather from 20 combined sewer overflow outfalls located along the Merrimack and Little Rivers. The report also satisfies the requirements of Item VII.M.51 of the Consent Decree (Civil Action No. 16-11698-IT) between the United States, Commonwealth of Massachusetts and the City of Haverhill.

As required by the NPDES permit and Consent Decree this report includes:

- Information related to each combined sewer overflow event for each outfall including date and time the overflow started and stopped, the volume of the overflow for each event, the amount of precipitation associated with each overflow event, the total volume discharged from each outfall for the year, and the total volume discharged for the year,
- Daily precipitation information including total precipitation, peak intensity, and average intensity,
- Certification that monthly inspections were completed,
- Information related to the Nine Minimum Controls.

As defined in the Consent Decree, a Combined Sewer Overflow (CSO) is any overflow or other discharge from the City's combined sewer system which results from wet weather flows more than the carrying capacity of the combined sewer system.

CSO Outfalls

Of the original 20 CSO outfalls listed in the City's 2008 NPDES permit, 13 of them are currently open. The City has closed 13 outfalls over the years. Table 1 below lists the CSO outfalls and regulators along with their open or closed status. Two CSO outfalls have two sets of 2 regulators each that share an outfall: Broadway and High Street regulators share the High Street (038) outfall, and Winter Street/Hale Street and Winter Street regulators share the Winter Street (021H) outfall. Of the 13 outfalls, five outfalls discharge to the Little River, and eight outfalls discharge to the Merrimack River. Figure 1 shows the outfall locations.

Five of the CSO regulator structures also function as flood protection structures (Broadway, High Street, Emerson Street, Winter Street, and Winter Street/Hale Street). There are sluice gates within the structures to provide flood protection for downtown Haverhill and emergency relief to the collection system under extreme high river flood conditions. Each sluice gate remains fully open unless the city is under a river flood condition. Although the Broadway, High Street, and Emerson Street regulators are open, they rarely activate under typical storm conditions. Table 2 lists Haverhill's open CSO outfalls and regulators and identifies which are part of the flood control system.

CSO Discharge Monitoring

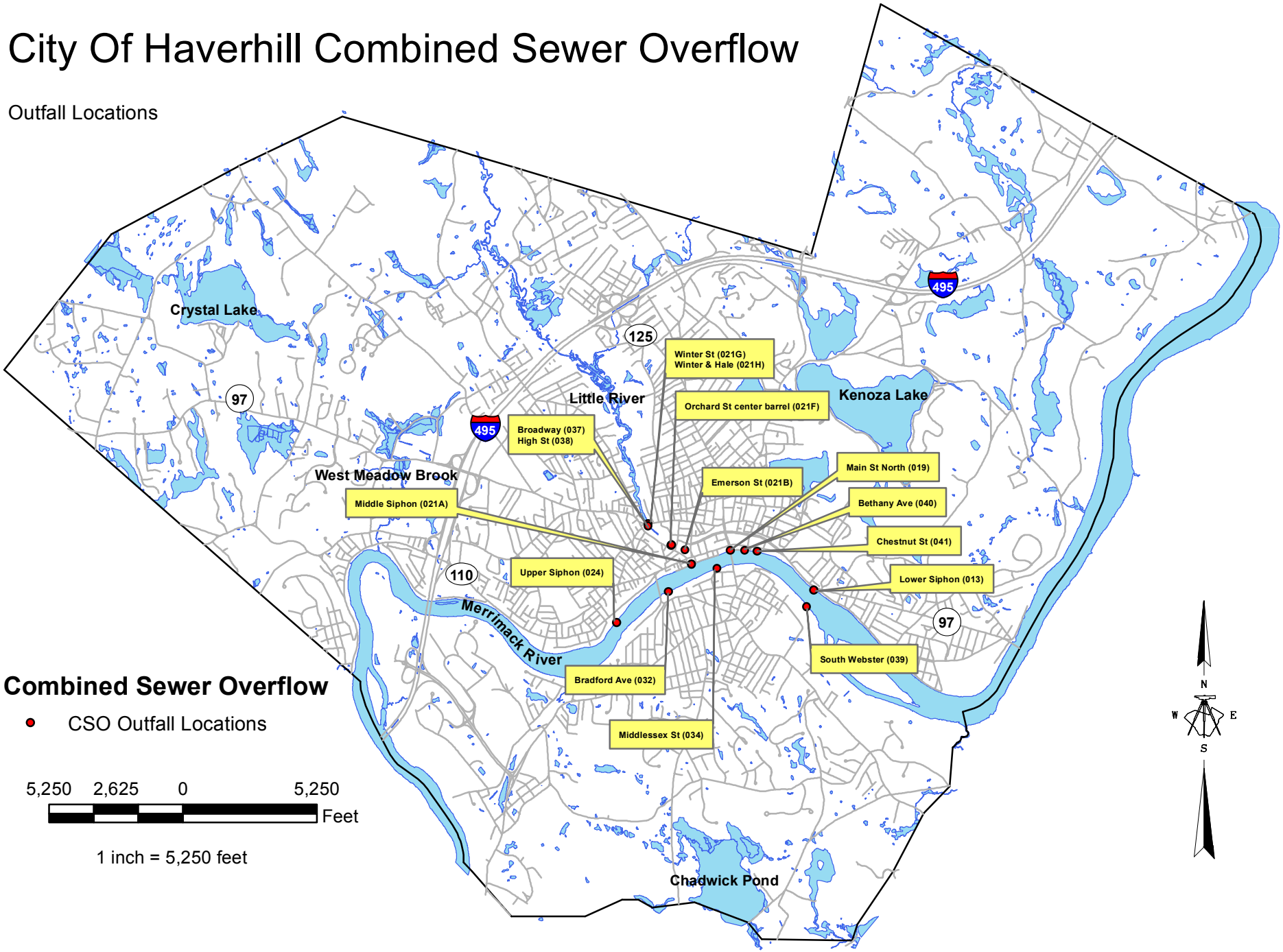
Since 2014, each of the City's CSO outfalls and regulators have been monitored by a depth measuring device at the weir and/or a depth/velocity meter in the CSO outfall pipe, as indicated in Table 2. All CSO regulators were monitored by a depth gauge located at the CSO weir (some are ultrasonic meters and

Table 1 CSO Outfalls and Regulators

Outfall ID	CSO Outfall Name	CSO Regulator Names (if more than 1)	Receiving Water	Activity Status
Upper Siphon System				
025	Beach Street		Merrimack River	Closed
024	Upper Siphon – Varnum Street		Merrimack River	Open
023	266 River Street		Merrimack River	Closed
022	Railroad Bridge		Merrimack River	Closed
Middle Siphon System				
021H	Winter Street and Hale Street	Winter Street/Hale Street (021H)	Little River	Open
		Winter Street (021G)	Little River	Open
038	High Street Diversion	High Street (038)	Little River	Open
		Broadway (037)	Little River	Open
021B	Emerson Street		Little River	Open
021E	Little River South (Locke Street South)		Little River	Closed
021M	Marginal Pump Station		Little River	Closed
021D	Little River North (Locke Street North)		Little River	Closed
021F	Center Barrel – Locke Street		Little River	Open
021A	Middle Siphon – Essex Street		Merrimack River	Open
Lower Siphon System				
019	Main Street North		Merrimack River	Open
016	Fire Station		Merrimack River	Closed
040	Bethany Avenue		Merrimack River	Open
041	Chestnut Street		Merrimack River	Open
013	Lower Siphon – Buttonwood Avenue		Merrimack River	Open
010	Boardman Street		Merrimack River	Closed
001	Bates Bridge		Merrimack River	Closed
Bradford System				
031	Front Street		Merrimack River	Closed
032	Bradford Avenue		Merrimack River	Open
033	South Prospect Street		Merrimack River	Closed
034	Middlesex Street		Merrimack River	Open
035	South Main Street		Merrimack River	Closed
036	Ferry Street		Merrimack River	Closed
039	South Webster Street	(042) Colby Street/ Salem Street	Merrimack River	Open

City Of Haverhill Combined Sewer Overflow

Outfall Locations



Combined Sewer Overflow

- CSO Outfall Locations

5,250 2,625 0 5,250

Feet

1 inch = 5,250 feet

11/16/2016

This map was produced from The City of Haverhill's Geographic Information System.
The City of Haverhill expressly disclaims any liability that may result from the use of this map.

Table 2
CSO Outfalls and Regulators

Outfall ID	CSO Outfall Name	CSO Regulator Names (if more than 1)	CSO Monitoring and Volume Measurement Method
Upper Siphon System			
024	Upper Siphon – Varnum Street		Depth/Sluice Gate Opening – Orifice Equation
Middle Siphon System			
021H	Winter Street and Hale Street	Winter Street/Hale Street (021H) (F)	Depth at Weir
		Winter Street (021G) (F)	Depth at Weir, and Depth/ Velocity in Outfall
038	High Street Diversion	High Street (038) (F)	Depth at Weir
		Broadway (038) (F)	Depth at Weir
021B	Emerson Street (F)		Depth at Weir
021F	Center Barrel – Locke Street		Depth at Weir, and Depth/ Velocity in Outfall
021A	Middle Siphon – Essex Street		Depth at Weir, and Depth/ Velocity in Outfall
Lower Siphon System			
019	Main Street North		Depth at Weir, and Depth/ Velocity in Outfall
040	Bethany Avenue		Depth at Weir, and Depth/ Velocity in Outfall
041	Chestnut Street		Depth at Weir, and Depth/ Velocity in Outfall
013	Lower Siphon – Buttonwood Avenue		Depth/Sluice Gate opening – Orifice Equation
Bradford System			
032	Bradford Avenue		Depth at Weir, and Depth/ Velocity in Outfall
034	Middlesex Street		Depth at Weir
039	South Webster Street	(042) Colby Street/Salem Street	Depth at Weir, and Depth/ Velocity in Outfall

NOTE: (F) = indicates CSO regulators used in the flood protection system

some have both ultrasonic and transducer gauges). Most of the CSO regulators have a depth/velocity gauge in the CSO outfall (measuring the depth and velocity of the CSO flow through the outfall pipe).

The flow metering equipment is maintained by a contractor, Flow Assessment Services (FAS), who also reports the CSO activations and flow/volume measurements on a website accessible to the City. Flow alert emails are sent to certain Haverhill Wastewater Staff when CSOs start and stop. The subcontractor is

responsible for analysis of the metered information to make sure accurate flow data is collected.

CSO flow volumes at the CSO weirs are measured using a depth of flow over a weir calculation. The depth/velocity gauges utilize area-velocity equations to measure flow in the outfall pipe. In some cases, the depth/velocity meters could not be installed on the outfall pipe because flow measurements were hydraulically affected by river backwater conditions and/or downstream backwater gates (gravity flap gates).

In early 2017, the City completed construction of the Wet Weather Maximization and CSO Structure Modification project, which is discussed later in this report. Since completing this project, CSO discharges at the Upper and Lower Siphon are monitored by city-maintained depth gauges. Under this project, the existing weirs at both locations were removed and two modulating sluice gates were installed at each CSO outfall opening. The purpose of these improvements is to allow the City to store wet weather flow in the interceptor pipes upstream of each CSO regulator. Now the CSOs are only activated by automated or remote controls when the CSO discharge gates are opened.

Flow measurements at Upper and Lower Siphon are now calculated, by the City, based on an orifice equation that reflects the typically surcharged (but variable) CSO gate opening. Each regulator has radar units that record the depths in the influent sewer, downstream of the CSO gates (river conditions), and downstream of the flow inlet gate to the siphons (to evaluate the backwater condition of the Bradford Interceptor).

Working with CDM Smith, the City developed appropriate computations to calculate flow through the variable orifice sluice gate openings. These equations have been used to calculate the volume of CSOs at the Upper and Lower Siphon CSO Structures beginning in January 2017. CDM Smith added these flow calculations into the City's SCADA system in 2018. The City can now view real-time flows from Upper and Lower Siphons during storm events.

2018 CSO Outfall Activation Statistics

Activation frequency, duration, and flow characteristics are measured by the meters as discussed above. FAS provides monthly and yearly flow data, including volume, from all outfalls other than Upper and Lower Siphon outfalls. FAS analyzes flow data on a monthly basis to assure that accurate flow data is being measured and reported. For the Upper and Lower Siphons, the City uses the flow data downloaded from the SCADA system. Table 3 summarizes the total volume discharged and number of activations for each CSO outfall for 2018.

Appendix A provides a summary of CSO regulator activations for 2018. Appendix B provides more detailed information for each individual CSO regulator activation including start and stop times and the rainfall characteristics for each storm event in 2018.

In Appendix A, the City has noted where the downstream CSO notification may not have included all appropriate information because of communication and gauge issues. In some cases, FAS did not report individual CSO activations to the City during a storm event but identified later during its internal data trends analysis (completed during its monthly reports) that the regulator activated. In other cases, activations were noted by FAS but this information was inadvertently left off the CSO notification. Finally, for several instances, the City apparently reported CSO activations that did not actually occur, which was confirmed after the metering subcontractor evaluated the regulator data in the monthly reports.

Table 3
CSO Summary by Regulator

Outfall ID	CSO Name	Number of Activations	Total Volume (gallons)
013	Lower Siphon	6	10,128,525
019	Main Street North	1	45,388
021A	Middle Siphon	14	15,788,237
021B	Emerson Street	2	15,012
021F	Center Barrel Locke Street	48	8,752,645
021G	Winter Street	8	147,580
021H	Winter Street/Hale Street	23	3,276,193
024	Upper Siphon	9	5,360,071
032	Bradford Avenue	5	301,088
034	Middlesex Street	16	3,469,151
037	Broadway	1	45,388
038	High Street	2	4,174
039	South Webster Street	25	1,036,219
040	Bethany Avenue	19	826,351
041	Chestnut Street	18	327,404
		Total	49,523,425

2018 Precipitation

Rain data was collected using three rain gages: a tipping bucket rain gage at the Wastewater Treatment Facility (WWTF) ASPW building, a NOAA supplied rain gage at the WWTF ASPW building, and a tipping bucket rain gage at the Marginal Pumping Station. The City began analyzing rain data from all three rain gages to get more accurate rain intensities for each storm event. The three gages also show the variation in rainfall at the different locations.

The data from the tipping bucket rain gage at the WWTF ASPW building is connected to SCADA and Hach WIMS and is automatically pulled into a report created by the City. This report summarizes daily total rain in inches and 15-minute peak rain intensities.

The NOAA supplied rain gage resembles a graduated cylinder that measure total rain in inches per day. A wastewater treatment operator reads this rain gage at 7:00 am each day and records the total rain in a Hach WIMS input sheet.

The tipping bucket rain gage at the Marginal Pumping Station is owned and maintained by FAS. Rain data from this gage, such as daily totals and 15-minute peak intensities, is transmitted instantaneously onto the FAS website where wastewater staff can view it at any time.

Rain data for 2018 from all three rain gages is shown in Appendix C including total rainfall (in inches), peak intensity (highest 15-minute sample multiplied by four to convert to inches per hour), and average intensity. It should be noted that some storm durations continue overnight and into another day. For example, the storm on April 16th and 17th lasted for 15 hours.

The rainfall totals for 2018 are shown in Table 4. The rainfall totals for 2018 are significantly higher than an average year. The NOAA gage total is the 11th highest annual rainfall since 1895.

Table 4
Annual Rainfall

Rain Gage Location	Total Annual Rainfall (inch)
Tipping bucket rain gage at the WWTF ASPW building	59.25
NOAA supplied rain gage at the WWTF ASPW	54.78
Tipping bucket rain gage at the Marginal Pumping Station	48.71

For 2018, 0.04 inches per hour was the lowest peak rainfall intensity that resulted in a CSO activation. This was caused by a collapsing upstream structure which has been repaired and the debris cleaned out of the line.

It should also be noted that the Marginal Pumping Station rain gage was blocked by pollen in mid-June and was cleaned and recalibrated in July. Also, the tipping bucket rain gage at the ASPW building was blocked by pollen and grass near the end of June and was cleaned and recalibrated in July.

Haverhill's CSO Program Progress

The following is a summary of the City's progress on its CSO abatement program over the last 20 years.

- In August 2002, the City submitted a Phase I CSO Long Term Control Plan (LTCP) to the USEPA and the Massachusetts Department of Environmental Protection (MassDEP). The recommended plan included improvements to increase treatment capacity at the Wastewater Treatment Facility (WWTF), influent pump station upgrades to handle additional wet weather flow, and regulator modifications to the Bradford side CSOs on the south bank of the Merrimack River. These improvements were all implemented by 2006 and cost $22 million.

- The benefits of the Phase I CSO LTCP improvements included a modeled reduction of annual CSO volume from 70 million to 30 million gallons and an increase of the percent capture of wet weather flow from 92 to 97 percent.

- In July 2011, the City submitted its Phase II CSO LTCP to the USEPA and MassDEP. Based on EPA and MassDEP comments, the City revised its Phase II CSO LTCP and submitted it to the EPA and MassDEP in June 2013. The revised plan included the permanent closure of 13 CSOs, raising of weirs at 3 CSO regulators, and implementation of the Wet Weather System Maximization/ CSO Structure Modifications project which included CSO regulator modifications, a new CSO sewer, and installation of a real-time automated flow system to further increase CSO discharge control. These system improvements were completed by early 2017. The improvements were expected to reduce annual CSO volume to approximately 20 million gallons, eliminate or reduce the frequency of CSOs from a number of outfalls, and increase the percent capture of wet weather flow to about 98 percent. The cost of the Phase II program was $12 million.

- As previously discussed in this report, the City monitors each CSO outfall and regulator structure so that we know when an overflow occurs, how long it lasts and the volume of the overflow. The City started this program in 2014 and spends approximately $57,420 per year to continue it.

- In February 2017, the City completed and submitted to EPA and MassDEP an Integrated Final LTCP, and updated implementation program that encompassed Capacity Maintenance Operation Management (CMOM) for the collection system; a Wastewater Comprehensive Plant Evaluation (CPE); Infiltration Inflow Assessment (I/I); Green Infrastructure; and a Phase 3 CSO LTCP. The cost to prepare this plan was approximately $2.8 million.

- In 2018, the City submitted its response to comments from EPA and MassDEP on the City's Integrated Final LTCP. In the response, the City proposed a more aggressive schedule for the Phase 3 CSO program. The program includes system conveyance improvements, CSO structure dry weather connector pipe improvements, raising the Middle Siphon weir, post construction monitoring and system optimization, green infrastructure demonstration projects, and improvements to the Locke Street sewer area. The estimated cost for the Phase 3 CSO program is $20 million. In addition to the CSO program, the Integrated Final LTCP includes improvements to the wastewater treatment plant, sewer collection system and stormwater program estimated to cost an additional $45 million.

- The City continued to fine-tune the Wet Weather System Maximization control set points by reviewing system performance after storm events to develop a control strategy that will reduce CSO discharges to the maximum extent possible. Wastewater Staff monitor upcoming storm events to determine what "mode" the CSO Maximization Program should be set to.

- In 2018, the City issued a Request for Qualifications to hire an engineering firm to perform planning, study, and design on the Phase 3 CSO program. The Phase 3 CSO work includes cleaning the Middle Siphon Interceptor starting at Locke Street to the Bradford Interceptor ending at the South Mill Street Pumping Station, modifying the connector pipes at four CSO regulators, raising the Middle Siphon weir, post-construction monitoring and system optimization, implementing a green infrastructure demonstration project, and Locke Street Interceptor area design and construction to reduce CSOs at Center Barrel and Winter Street and Hale Street CSOs. The City has selected an engineering firm and is now in the process of finalizing the contract and obtaining funds for the work. These Phase III CSO Improvement Projects are expected to begin within the next few months.

Nine Minimum Controls

Haverhill continues to implement all aspects of its Nine Minimum Control (NMC) program submitted to the EPA in 1996.

1. Proper operation and regular maintenance programs for the sewer system and CSO

The City continues to use it Computerized Maintenance Management System (CMMS) MaintStar to track and manage the maintenance of the combined sewer system including inspection and cleaning of sewers, drains, pumping stations, CSO regulators and outfalls. Collection system inspection and cleaning is periodically done by outside contractors for the City. Sewer segments with frequent problems are added to a list in CMMS to receive more frequent maintenance.

In 2018, the City cleaned and inspected about 16,000 feet of sewer and drain including:

- The Lower Siphons which consist of about 800 feet each of 18-inch, 20-inch, and 30-inch pipe;
- The Locke Street Siphon from Center Barrel Regulator to Essex Street which is 418 feet of 12-inch pipe;
- The cross country line between Locust Street and Locke Street, approximately 207 feet of 18-inch, that discharges to the 12-inch Locke Street Siphon. This line was full of debris and sediment from a collapsed upstream sewer segment. The collapsed line was replaced from manhole to manhole, a distance of approximately 300 feet. The 18-inch Locke Street Siphon is expected to be cleaned this summer. Due to high ground water levels, this Siphon could not be cleaned during the time when the 12-inch Locke Street Siphon was cleaned.
- The sewer lines in the area bounded by Kenoza Street, Lawrence Street, Brockton Avenue, and Main Street which is part of the Locke Street sewer catchment area. This area is included in the Phase II Water Main Replacement Project and sewer excavation repairs and replacement will be included in this bid. This project is expected to be bid within the next few months. This entire area was inspected, cleaned, and protruding taps were cut.

The City continued to inspect its sewer pumping stations: daily for stations with daily flow greater than 100,000 gallons and weekly for all the other stations. The City completes preventive maintenance quarterly at each of the stations.

Collection system personnel perform monthly inspections of the CSO regulators and outfalls. In addition, CSO regulators are monitored by flow meters that notify wastewater staff when activations occur. If an activation notice is received during dry weather, collection system operators are dispatched to investigate immediately.

Over the next reporting period, the City will continue to evaluate opportunities to revise its inspection and maintenance programs to minimize CSO discharges.

2. Maximize the use of the collection system for storage

The City's CSO regulators are controlled by weirs and by automatically controlled sluice gates at the Upper and Lower Siphon CSO structures. Weirs at the regulators have also been raised periodically to reduce CSO discharges based on recommendations in the LTCPs. The City has closed 13 CSO outfalls, which effectively increases the use of the collection system for wet weather storage. No weirs were raised or CSOs sealed in 2018 but the City expects to raise the Middle Siphon CSO weir in 2019 as part of the Phase III CSO Improvements.

The automated real-time control system (instrumentation, depth monitoring, and modulated flow control gates operated by automated programming) installed at the Upper and Lower Siphon CSO structures is designed to utilize the interceptor storage upstream of each regulator structure to allow more flow from the Middle Siphon CSO to be conveyed to the Bradford Interceptor, and ultimately to the WWTF, to maximize the use of interceptor storage for wet weather flows and to reduce CSO discharges.

The City will continue to fine-tune this real-time flow control system to maximize the use of the interceptor piping system for wet weather storage.

Phase III CSO Improvements include maximizing storage in siphons and interceptors by cleaning debris starting at the Middle Siphon Interceptor at Locke Street, the Middle Siphon, and the Bradford Interceptor ending at the South Mill Street Pumping Station.

3. Review and modification of pretreatment requirements to ensure the CSO impacts are minimized

The purpose of the Industrial Pretreatment Program (IPP) is to help minimize impacts of discharges in the combined sewer system from non-domestic sources during wet weather events. The City engaged a consultant and hired a new IPP Coordinator to review and implement an enhanced IPP program in 2016. The IPP monitors significant industrial users (SIU) that discharge to the City's sewer system.

The City's sewer use regulations prohibit any discharge to the collection system that may be detrimental to the wastewater treatment process or to the receiving water. These regulations establish limits for the amount of pollutant loads that can be discharged to the sewer system. All industrial discharges to the City's sewer system are required to adhere to the requirements of the City's IPP Program. Inspections of these dischargers are performed by City staff.

The WWTF influent organic loadings have decreased significantly since the improvements to its IPP program. Since loadings have decreased, the WWTP staff has been able to maintain low secondary blanket levels, which has allowed staff to avoid secondary bypassing for all of 2018.

The new IPP Coordinator has also begun developing and implementing a new Fats, Oils, and Grease (FOG) program. In 2016-2017, the IPP Coordinator began inspecting all food service establishments. These inspections included checking pump out receipts of all grease traps and interceptors, inspecting and measuring FOG using a modified sludge judge in all of grease traps and interceptors, ensuring owners have the proper maintenance schedules, and ensuring proper waste grease disposal. The City hired a contractor to inspect all food service establishments using the same procedures and protocols established by the IPP Coordinator. These inspections continued through 2018. To date, there has been a significant decrease of FOG in both the collection system and in the influent flow to the WWTF.

In 2018, the City hired Hoyle and Tanner to review and revise the City's Local Limits. A sampling plan was submitted to EPA and approved by EPA. To date, all sampling for the Local Limits reevaluation has been completed and data is being analyzed.

In 2017, the City hired Tighe and Bond to review and revise the City's Pretreatment Ordinance, Emergency Response Plan (ERP), and to develop a new FOG ordinance with the help of the new IPP Coordinator. Once the new Local Limits are approved, the City will submit the new ordinances and ERP to EPA for approval.

The City will continue to enhance the implementation and enforcement of this program over the next reporting period

4. Maximization of flow to the publicly owned treatment works (POTW) for treatment

In 2006, the City completed improvements to increase the wet weather flow to the WWTF to reduce CSO discharges. The improvements included increasing influent pumping capacity and adding a secondary bypass pipe to provide for primary treatment and disinfection of wet weather flow when it exceeds the capacity of the secondary treatment system.

The City continues to implement measures to maximize flow to the WWTF, including raising weirs and adding CSO control gates that will allow real time control to minimize CSO discharge. In 2016, the City also modified the Bradford Avenue CSO and the Middle Siphon Inlet Structure to improve the flow capacity into its interceptor system to further maximize flow to the WWTF.

WWTF staff prioritizes the maintenance and repair of equipment at the plant and South Mill Street Pumping Station to maximize flow to the plant during wet weather. For example, staff monitor the influent pumps at South Mill Street Pumping Station, perform scheduled preventative maintenance, and perform any needed corrective maintenance on the pumps as a high priority.

In 2017, a Comprehensive Plan Evaluation (CPE) was completed that reviewed and assessed all of the process, equipment, and infrastructure needs at the plant to keep the facility running reliably and to maximize treatment levels of the flow conveyed to the WWTF. These facility improvements were prioritized and an implementation plan was established to complete these improvements.

5. Elimination of overflows during dry weather

Dry weather overflows (DWOs) from the CSO discharge outfalls are prohibited under the NPDES permit. The City's CSO regulators are monitored to ensure DWOs are detected and eliminated. Flow meters in the regulators notify wastewater staff when an activation occurs. If an activation notice is received during dry weather, collection system operators are dispatched to investigate. Wastewater Collection Staff also inspect all of the CSO outfalls/regulators on a monthly basis.

On October 16, 2018, there was a DWO at the South Webster CSO. Debris from a collapsing structure upstream caused wastewater to backup over the South Webster CSO weir. An email alert of the overflow notified wastewater staff and staff were sent immediately to remove the debris.

6. Control of solid material and floatable material in CSOs

Under the Wet Weather System Maximization/CSO Structure Modifications project, the City is maximizing its capture of wet weather flow for eventual treatment at the WWTF, which maximizes floatables control. The City has also raised weirs to capture more wet weather flow, and floatables in the first flush, during storm events.

As part of the Integrated LTCP, CDM Smith evaluated other potential solids and floatables controls options that could be implemented at the CSO regulators. It was determined that there are no cost-effective approaches to capturing solids and floatables at the City's CSO regulators for a variety of reasons including the constrained space within the regulators to install new screens, trash racks, or baffles, the lack of available land (most of the outfalls are situated directly on the river with no reasonable room for inline screens along the outfall pipe), and river/flow conditions that would preclude outfall technologies (like booms or netting systems).

The City relies on regular cleaning of catch basins and street sweeping near CSO regulators as a preventive measure for the reduction of grit and floatables to its combined system and receiving waters. The City is increasing the frequency of catch basin cleaning and street sweeping which will improve its floatables capture.

In 2018, the City put out to bid catch basin cleaning. Over 800 catch basins were cleaned by an outside contractor and about 100 catch basins were cleaned in-house. The City's wastewater department is in the process of implementing a new Computerized Maintenance Management System (CMMS) software (Utility Cloud) to increase the efficiency of catch basin cleaning. It will include inspections of all catch

basins to ensure that they are less than 50 percent full and will also be used to determine problem areas where catch basins fill up with grit quickly. Over time the goal is to determine catch basin cleaning schedules for all catch basins.

7. Pollution prevention programs to reduce contaminants in CSOs

Haverhill has adopted City ordinances that prohibit litter and debris from being deposited on the street and within the watershed areas. The City also performs regular cleaning of catch basins and street sweeping near CSO regulators as a preventive measure for the reduction of pollutants into the combined system. Finally, the City has an IPP program and is developing an enhanced FOG control program that will help to minimize the amount of pollutants in the City's CSOs.

In 2017-2018, the IPP Coordinator hired a graphic designer to develop a number of educational brochures. Brochures included stormwater pollution prevention for residents, FOG education for residents, FOG education for businesses, pet waste education, and education about flushable wipes for residents.

These brochures are located on the City's website and available to the public at multiple City owned buildings. Brochures are also distributed to problem areas. Also, in 2018 the Collection System Supervisor and the IPP Coordinator began sampling and monitoring sewer lift stations for grease and trash buildup.

The City also holds household hazardous waste days twice a year, waste oil drop-offs once a month, curbside leaf/grass pickups twice a year, and electronics recycling twice a year.

8. Public notification to ensure that the public receives adequate notification of CSO occurrences and CSO impacts

Each of the CSO regulators and outfalls has signage that identifies the CSO outfall. Within 24-hours of a CSO occurrence, an email notification is sent to downstream communities, local Board of Health, Harbor Master, and local drinking water authorities. Appendix D is the current list of those that are notified within 24-hours of a CSO occurrence. Residents and businesses are added to the notification list upon request.

9. Monitoring to effectively characterize CSO impacts and the efficiency of CSO controls

In 2014, the City contracted with a flow metering contractor to install and maintain depth and depth/velocity meters at each of its CSO regulators. These gauges monitor overflow activations and measure CSO flow rates and volumes. The results of the 2018 monitoring program are discussed above.

End of Report

Appendix A

Appendix A
Summary of CSO Regulator Activations for 2018

Date	Lower Siphon 13	Street North 19	Middle Siphon 021A	Emerson Street 021B	Center Barrel Locke Street 021F	(Duncan Street) 021G	Winter and Hale Street 021H	Upper Siphon 24	Bradford Avenue 32	Middlesex Street 34	Broadway Diversional 37	High Street Diversional 38	South Webster 39	Bethany Avenue 40	Chestnut Street 41	TOTAL
1/12/2018					32,017		2,185									**34,202**
1/13/2018					32,414								968			**33,382**
1/23/2018			270,345		119,248					38,548			9,296			**437,437**
2/5/2018					40,980								104			**41,084**
2/10/2018					67,346								9,760			**77,106**
2/11/2018					47,020								14,827			**61,847**
3/2/2018			19,075		81,222											**100,297**
4/16/2018[1]	997,020		4,257,421		780,843	4,645	248,677	535,708		317,049			154,659	101,250	84,661	**7,481,933**
4/25/2018					147,827		4,487							1,392		**153,706**
4/26/2018					75,673		5,717									**81,390**
4/27/2018					14,192											**14,192**
5/3/2018					10,007		44									**10,051**
5/6/2018					15,501											**15,501**
5/15/2018					32,588											**32,588**
6/4/2018					38,434											**38,434**
6/5/2018					8,086										57	**8,143**
6/18/2018					83,012		92,801			25,479				15,479	7,489	**224,260**
6/24/2018					21,557											**21,557**
6/25/2018					132,964		10,711							754	74	**144,503**
6/28/2018					100,463									733	65	**101,261**
7/6/2018					55,466		26,760			9,491				7,473	5,986	**105,176**
7/17/2018			240,879	14,622	335,759	24,001	323,050	105,511	16,794	105,820			24,645	74,867	27,602	**1,293,550**
7/22/2018					10,084											**10,084**
7/26/2018			16,823		236,629		112,708			52,374			18,139	29,016	10,567	**476,256**
7/27/2018					85,256		108,697			2,652				4,047	2,499	**203,151**
8/2/2018					38,017		9,142							42		**47,201**
8/4/2018					10,933											**10,933**
8/7/2018					47,097		11,737							2,264		**61,098**
8/11/2018	619,906		1,513,630		354,477	2,402	144,976	730,458	18,854	415,957			53,425	72,278	19,707	**3,946,070**
8/14/2018			682,278		442,619	31,820	236,605	865,090	69,746	185,126		1,099	21,965	99,921	24,074	**2,660,343**
8/18/2018					37,130		46,281							364	6,677	**90,452**
8/22/2018			187,474		235,153		181,031	117,523		81,991			28,551	58,383	24,462	**914,568**
9/10/2018					135,830								106,606			**242,436**
9/18/2018	8,014,944	45,388	4,091,489	390	1,802,527	46,838	1,112,644	2,250,879	171,731	1,307,186	45,388	3,075	148,408	265,416	63,925	**19,370,228**
9/26/2018			125,901		251,293	17,453	135,231	7,797		62,471			17,346	36,520	14,640	**668,652**
10/11/2018	431,761		1,006,057		488,029	7,814	337,809	693,473	23,963	228,672			70,494	50,730	29,495	**3,368,297**
10/13/2018													2,242			**2,242**
10/16/2018													2,553			**2,553**
10/23/2018					76,088											**76,088**
10/27/2018					67,843											**67,843**
10/29/2018					81,317											**81,317**
11/2/2018-11/3/2018	37,457		2,691,476		857,031	12,607	118,592	53,632		548,593			78,914	5,422	4,817	**4,408,541**
11/6/2018					42,056								4,946		607	**47,609**
11/9/2018-11/10/2018			26,490		219,981								47,933			**294,404**
11/13/2018			309		186,804								110,259			**297,372**
11/16/2018					35,193								50,087			**85,280**
11/26/2018-11/27/2018	27,437		658,590		526,656		1,868			72,213			46,400			**1,333,164**
12/2/2018					65,840		4,440			15,529			13,279			**99,087**
12/16/2018					55,435											**55,435**
12/21/2018					90,708								413			**91,121**
	10,128,525	45,388	15,788,237	15,012	8,752,645	147,580	3,276,193	5,360,071	301,088	3,469,151	45,388	4,174	1,036,219	826,351	327,404	**49,523,425**
	6	1	14	2	48	8	23	9	5	16	1	2	25	19	18	

Downstream Notification originally noted that this CSO discharged but FAS did not show a discharge.
CSO volume reportedfrom FAS but no Downstream Notification that this CSO discharged.
CSO activation that was reported to city but not included on Downstream Notification.

NOTE: 021D, 021E, and 021M Eliminated in 2016

Appendix B

Appendix B
CSO Flow Meter Summary

Outfall Number	Outfall Description	Activation Start	Activation End	Total Volume Per Event (gallons)	CSO Duration (hr.)	Marginal Pumping Station Rain Gage[3]				ASPW Rain Gage[3]				ASPW Operator Observed NOAA Rain Gage[2]
						Rain Total (in.)	Peak Hour Depth Intensity (in./hr.)	Storm Duration (hr.)	Daily Avg. Intensity (in./hr.)	Rain Total (in.)	Peak Hour Depth Intensity (in./hr.)	Storm Duration (hr.)	Daily Avg. Intensity (in./hr.)	Rain Total (in.)
021H	Winter and Hale	01/12/18 22:35:00	01/12/18 22:45:00	2,185	0.17	0.33	0.48	2.42	0.10	0.26	0.44	2.00	0.13	0.56
021F	Center Barrel - Locke Street	01/12/18 22:35:00	01/12/18 22:55:00	32,017	0.33	0.33	0.48	2.42	0.10	0.26	0.44	2.00	0.13	0.56
			STORM TOTAL:	**34,202**										
021F	Center Barrel - Locke Street	01/13/18 03:50:00	01/13/18 03:55:00	3,779	0.08	0.32	0.24	2.17	0.09	0.47	0.44	1.75	0.27	0.07
021F	Center Barrel - Locke Street	01/13/18 05:55:00	01/13/18 06:25:00	28,635	0.50	0.32	0.24	2.17	0.09	0.47	0.44	1.75	0.27	0.07
039	South Webster Street	01/13/18 06:05:00	01/13/18 06:15:00	968	0.17	0.32	0.24	2.17	0.09	0.47	0.44	1.75	0.27	0.07
			STORM TOTAL:	**33,382**										
021F	Center Barrel - Locke Street	01/23/18 11:25:00	01/23/18 13:00:00	119,248	1.58	0.78	0.60	2.92	0.12	0.71	0.48	2.50	0.28	0.89
021A	Middle Siphon	01/23/18 12:10:00	01/23/18 13:50:00	270,345	1.67	0.78	0.60	2.92	0.12	0.71	0.48	2.50	0.28	0.89
034	Middlesex Street	01/23/18 12:15:00	01/23/18 12:35:00	13,374	0.33	0.78	0.60	2.92	0.12	0.71	0.48	2.50	0.28	0.89
034	Middlesex Street	01/23/18 12:45:00	01/23/18 12:50:00	3,963	0.08	0.78	0.60	2.92	0.12	0.71	0.48	2.50	0.28	0.89
034	Middlesex Street	01/23/18 13:05:00	01/23/18 13:20:00	21,211	0.25	0.78	0.60	2.92	0.12	0.71	0.48	2.50	0.28	0.89
039	South Webster Street	01/23/18 11:40:00	01/23/18 12:40:00	9,296	1.00	0.78	0.60	2.92	0.12	0.71	0.48	2.50	0.28	0.89
			STORM TOTAL:	**437,437**										
021F	Center Barrel - Locke Street	02/05/18 00:50:00	02/05/18 01:40:00	40,980	0.83	0.23	0.36	1.42	0.06	0.30	0.44	0.75	0.40	0.43
039	South Webster Street	02/05/18 00:50:00	02/05/18 00:55:00	104	0.08	0.23	0.36	1.42	0.06	0.30	0.44	0.75	0.40	0.43
			STORM TOTAL:	**41,085**										
021F	Center Barrel - Locke Street	02/10/18 22:30:00	02/10/18 23:35:00	67,346	1.08	0.70	0.24	5.17	0.22	0.15	0.40	1.50	0.10	0.37
039	South Webster Street	02/10/18 22:30:00	02/10/18 23:45:00	9,760	1.25	0.70	0.24	5.17	0.22	0.15	0.40	1.50	0.10	0.37
			STORM TOTAL:	**77,107**										
021F	Center Barrel - Locke Street	02/11/18 12:30:00	02/11/18 12:35:00	982	0.08	0.79	0.24	6.33	0.26	0.87	0.40	4.25	0.20	0.76
039	South Webster Street	02/11/18 12:15:00	02/11/18 12:45:00	1,949	0.50	0.79	0.24	6.33	0.26	0.87	0.40	4.25	0.20	0.76
039	South Webster Street	02/11/18 13:05:00	02/11/18 13:15:00	491	0.17	0.79	0.24	6.33	0.26	0.87	0.40	4.25	0.20	0.76
039	South Webster Street	02/11/18 14:55:00	02/11/18 16:40:00	12,387	1.75	0.79	0.24	6.33	0.26	0.87	0.40	4.25	0.20	0.76
021F	Center Barrel - Locke Street	02/11/18 15:15:00	02/11/18 16:30:00	46,038	1.25	0.79	0.24	6.33	0.26	0.87	0.40	4.25	0.20	0.76
			STORM TOTAL:	**61,848**										
021A	Middle Siphon	03/02/18 14:55:00	03/02/18 15:10:00	19,075	0.25	1.32	0.24	9.58	0.40	1.29	0.48	4.25	0.30	1.2
021F	Center Barrel - Locke Street	03/02/18 13:20:00	03/02/18 15:05:00	81,222	1.75	1.32	0.24	9.58	0.40	1.29	0.48	4.25	0.30	1.2
			STORM TOTAL:	**100,297**										
039	South Webster Street	04/16/18 08:00:00	04/16/18 18:35:00	154,659	10.58	2.24	1.68	10.25	0.43	2.42	0.84	15.00	0.16	2.23
021F	Center Barrel - Locke Street	04/16/18 11:10:00	04/16/18 11:40:00	39,856	0.50	2.24	1.68	10.25	0.43	2.42	0.84	15.00	0.16	2.23
021F	Center Barrel - Locke Street	04/16/18 13:05:00	04/16/18 13:25:00	15,467	0.33	2.24	1.68	10.25	0.43	2.42	0.84	15.00	0.16	2.23
021F	Center Barrel - Locke Street	04/16/18 13:45:00	04/16/18 16:20:00	366,513	2.58	2.24	1.68	10.25	0.43	2.42	0.84	15.00	0.16	2.23
021A	Middle Siphon	04/16/18 14:25:00	04/16/18 16:35:00	2,786,676	2.17	2.24	1.68	10.25	0.43	2.42	0.84	15.00	0.16	2.23
040	Bethany Avenue	04/16/18 14:25:00	04/16/18 14:30:00	13,526	0.08	2.24	1.68	10.25	0.43	2.42	0.84	15.00	0.16	2.23
021H	Winter and Hale	04/16/18 14:25:00	04/16/18 14:45:00	17,399	0.33	2.24	1.68	10.25	0.43	2.42	0.84	15.00	0.16	2.23
034	Middlesex Street	04/16/18 14:30:00	04/16/18 14:35:00	8,084	0.08	2.24	1.68	10.25	0.43	2.42	0.84	15.00	0.16	2.23
034	Middlesex Street	04/16/18 15:10:00	04/16/18 16:05:00	138,525	0.92	2.24	1.68	10.25	0.43	2.42	0.84	15.00	0.16	2.23
021H	Winter and Hale	04/16/18 15:20:00	04/16/18 16:00:00	42,630	0.67	2.24	1.68	10.25	0.43	2.42	0.84	15.00	0.16	2.23
040	Bethany Avenue	04/16/18 15:20:00	04/16/18 15:40:00	13,909	0.33	2.24	1.68	10.25	0.43	2.42	0.84	15.00	0.16	2.23
013	Lower Siphon	4/16/18 16:20:30	4/16/18 16:52:15	411,369	0.53	2.24	1.68	10.25	0.43	2.42	0.84	15.00	0.16	2.23
024	Upper siphon	4/16/18 16:29:00	4/16/18 17:06:30	303,468	0.63	2.24	1.68	10.25	0.43	2.42	0.84	15.00	0.16	2.23
021F	Center Barrel - Locke Street	04/16/18 17:25:00	04/16/18 19:35:00	359,007	2.17	2.24	1.68	10.25	0.43	2.42	0.84	15.00	0.16	2.23
021A	Middle Siphon	04/16/18 17:30:00	04/16/18 19:40:00	1,470,745	2.17	2.24	1.68	10.25	0.43	2.42	0.84	15.00	0.16	2.23
021H	Winter and Hale	04/16/18 17:40:00	04/16/18 18:25:00	188,648	0.75	2.24	1.68	10.25	0.43	2.42	0.84	15.00	0.16	2.23
034	Middlesex Street	04/16/18 17:40:00	04/16/18 18:30:00	170,440	0.83	2.24	1.68	10.25	0.43	2.42	0.84	15.00	0.16	2.23
040	Bethany Avenue	04/16/18 17:50:00	04/16/18 18:10:00	73,815	0.33	2.24	1.68	10.25	0.43	2.42	0.84	15.00	0.16	2.23

Appendix B
CSO Flow Meter Summary

Outfall Number	Outfall Description	Activation Start	Activation End	Total Volume Per Event (gallons)	CSO Duration (hr.)	Marginal Pumping Station Rain Gage[3]				ASPW Rain Gage[3]				ASPW Operator Observed NOAA Rain Gage[2]
						Rain Total (in.)	Peak Hour Depth Intensity (in./hr.)	Storm Duration (hr.)	Daily Avg. Intensity (in./hr.)	Rain Total (in.)	Peak Hour Depth Intensity (in./hr.)	Storm Duration (hr.)	Daily Avg. Intensity (in./hr.)	Rain Total (in.)
041	Chestnut Street	04/16/18 17:50:00	04/17/18 07:25:00	78,186	13.58	2.24	1.68	10.25	0.43	2.42	0.84	15.00	0.16	2.23
021G	Winter street	04/16/18 18:00:00	04/16/18 18:05:00	4,645	0.08	2.24	1.68	10.25	0.43	2.42	0.84	15.00	0.16	2.23
013	Lower Siphon	4/16/18 18:53:30	4/16/18 19:17:00	585,651	0.39	2.24	1.68	10.25	0.43	2.42	0.84	15.00	0.16	2.23
024	Upper siphon	4/16/18 19:01:00	4/16/18 19:17:30	232,240	0.28	2.24	1.68	10.25	0.43	2.42	0.84	15.00	0.16	2.23
041	Chestnut Street[1]	04/17/18 07:45:00	04/17/18 08:30:00	3,034	0.75	2.24	1.68	10.25	0.43	2.42	0.84	15.00	0.16	2.23
041	Chestnut Street[1]	04/17/18 10:10:00	04/17/18 10:40:00	3,441	0.50	2.24	1.68	10.25	0.43	2.42	0.84	15.00	0.16	2.23
			STORM TOTAL:	**7,481,932**										
021F	Center Barrel - Locke Street	04/25/18 16:45:00	04/25/18 17:25:00	71,969	0.67	0.93	0.48	5.58	0.23	1.14	0.40	10.75	0.11	1.01
021H	Winter and Hale	04/25/18 16:55:00	04/25/18 17:05:00	4,487	0.17	0.93	0.48	5.58	0.23	1.14	0.40	10.75	0.11	1.01
021F	Center Barrel - Locke Street	04/25/18 21:00:00	04/25/18 21:10:00	6,031	0.17	0.93	0.48	5.58	0.23	1.14	0.40	10.75	0.11	1.01
021F	Center Barrel - Locke Street	04/25/18 21:40:00	04/25/18 22:30:00	69,827	0.83	0.93	0.48	5.58	0.23	1.14	0.40	10.75	0.11	1.01
040	Bethany Avenue	04/25/18 21:55:00	04/25/18 22:00:00	1,392	0.08	0.93	0.48	5.58	0.23	1.14	0.40	10.75	0.11	1.01
			STORM TOTAL:	**153,706**										
021F	Center Barrel - Locke Street	04/26/18 06:55:00	04/26/18 07:35:00	75,673	0.67	0.22	0.24	1.58	0.07	0.19	0.16	2.50	0.08	0.13
021H	Winter and Hale	04/26/18 07:10:00	04/26/18 07:20:00	5,717	0.17	0.22	0.24	1.58	0.07	0.19	0.16	2.50	0.08	0.13
			STORM TOTAL:	**81,390**										
021F	Center Barrel - Locke Street	04/27/18 15:05:00	04/27/18 15:20:00	9,949	0.25	0.32	0.36	2.33	0.10	0.40	0.20	3.50	0.11	0.34
021F	Center Barrel - Locke Street	04/27/18 17:00:00	04/27/18 17:10:00	4,243	0.17	0.32	0.36	2.33	0.10	0.40	0.20	3.50	0.11	0.34
			STORM TOTAL:	**14,192**										
021F	Center Barrel - Locke Street	05/03/18 13:10:00	05/03/18 13:20:00	10,007	0.17	0.06	0.48	0.25	0.01	0.11	0.36	0.75	0.15	0.11
021H	Winter and Hale	05/03/18 13:10:00	05/03/18 13:15:00	44	0.08	0.06	0.48	0.25	0.01	0.11	0.36	0.75	0.15	0.11
			STORM TOTAL:	**10,051**										
021F	Center Barrel - Locke Street	05/06/18 22:10:00	05/06/18 22:30:00	15,501	0.33	0.57	0.36	4.00	0.02	0.74	0.36	7.25	0.10	0.65
			STORM TOTAL:	**15,501**										
021F	Center Barrel - Locke Street	05/15/18 17:30:00	05/15/18 18:20:00	32,588	0.83	0.37	0.36	2.25	0.02	0.43	0.28	3.50	0.12	0.40
			STORM TOTAL:	**32,588**										
021F	Center Barrel - Locke Street	06/04/18 09:35:00	06/04/18 10:10:00	38,434	0.58	0.37	0.12	3.08	0.12	0.69	0.32	7.00	0.10	0.61
			STORM TOTAL:	**38,434**										
041	Chestnut Street	06/05/18 16:55:00	06/05/18 17:00:00	57	0.08	0.28	0.12	2.33	0.12	0.19	0.28	2.00	0.10	0.20
021F	Center Barrel - Locke Street	06/05/18 17:00:00	06/05/18 17:15:00	8,086	0.25	0.28	0.12	2.33	0.12	0.19	0.28	2.00	0.10	0.20
			STORM TOTAL:	**8,143**										
034	Middlesex Street	06/18/18 17:35:00	06/18/18 17:45:00	25,479	0.17	0.13	0.12	1.08	0.12	0.50	0.56	2.00	0.25	0.50
040	Bethany Avenue	06/18/18 17:35:00	06/18/18 17:45:00	15,479	0.17	0.13	0.12	1.08	0.12	0.50	0.56	2.00	0.25	0.50
041	Chestnut Street	06/18/18 17:35:00	06/18/18 17:45:00	7,489	0.17	0.13	0.12	1.08	0.12	0.50	0.56	2.00	0.25	0.50
021H	Winter and Hale	06/18/18 17:35:00	06/18/18 17:55:00	92,801	0.33	0.13	0.12	1.08	0.12	0.50	0.56	2.00	0.25	0.50
021F	Center Barrel - Locke Street	06/18/18 17:35:00	06/18/18 18:05:00	83,012	0.50	0.13	0.12	1.08	0.12	0.50	0.56	2.00	0.25	0.50
			STORM TOTAL:	**224,260**										
021F	Center Barrel - Locke Street	06/24/18 18:40:00	06/24/18 19:00:00	21,557	0.33	0.00	0.00	0.00	0.00	0.25	0.20	2.50	0.10	0.99
			STORM TOTAL:	**21,557**										
040	Bethany Avenue	06/25/18 00:10:00	06/25/18 00:15:00	754	0.08	0.00	0.00	0.00	0.00	0.74	0.20	6.25	0.12	0.00
041	Chestnut Street	06/25/18 00:10:00	06/25/18 00:15:00	74	0.08	0.00	0.00	0.00	0.00	0.74	0.20	6.25	0.12	0.00
021H	Winter and Hale	06/25/18 00:15:00	06/25/18 00:30:00	10,711	0.25	0.00	0.00	0.00	0.00	0.74	0.20	6.25	0.12	0.00
021F	Center Barrel - Locke Street	06/25/18 00:05:00	06/25/18 01:25:00	132,964	1.33	0.00	0.00	0.00	0.00	0.74	0.20	6.25	0.12	0.00
			STORM TOTAL:	**144,503**										

Appendix B
CSO Flow Meter Summary

Outfall Number	Outfall Description	Activation Start	Activation End	Total Volume Per Event (gallons)	CSO Duration (hr.)	Marginal Pumping Station Rain Gage[3]				ASPW Rain Gage[3]				ASPW Operator Observed NOAA Rain Gage[2]
						Rain Total (in.)	Peak Hour Depth Intensity (in./hr.)	Storm Duration (hr.)	Daily Avg. Intensity (in./hr.)	Rain Total (in.)	Peak Hour Depth Intensity (in./hr.)	Storm Duration (hr.)	Daily Avg. Intensity (in./hr.)	Rain Total (in.)
021F	Center Barrel - Locke Street	06/28/18 02:35:00	06/28/18 03:00:00	17,729	0.42	0.00	0.00	0.00	0.00	0.61	0.16	9.50	0.06	0.95
021F	Center Barrel - Locke Street	06/28/18 08:00:00	06/28/18 08:15:00	17,854	0.25	0.00	0.00	0.00	0.00	0.61	0.16	9.50	0.06	0.95
041	Chestnut Street	06/28/18 09:25:00	06/28/18 09:30:00	65	0.08	0.00	0.00	0.00	0.00	0.61	0.16	9.50	0.06	0.95
021F	Center Barrel - Locke Street	06/28/18 08:50:00	06/28/18 09:55:00	50,662	1.08	0.00	0.00	0.00	0.00	0.61	0.16	9.50	0.06	0.95
040	Bethany Avenue	06/28/18 13:15:00	06/28/18 13:20:00	733	0.08	0.00	0.00	0.00	0.00	0.61	0.16	9.50	0.06	0.95
021F	Center Barrel - Locke Street	06/28/18 13:20:00	06/28/18 13:35:00	14,218	0.25	0.00	0.00	0.00	0.00	0.61	0.16	9.50	0.06	0.95
			STORM TOTAL:	**101,261**										
021F	Center Barrel - Locke Street	07/06/18 14:10:00	07/06/18 14:40:00	55,466	0.50	0.25	1.20	0.75	0.33	0.16	0.12	1.75	0.09	0.43
021H	Winter and Hale	07/06/18 14:15:00	07/06/18 14:30:00	26,760	0.25	0.25	1.20	0.75	0.33	0.16	0.12	1.75	0.09	0.43
034	Middlesex Street	07/06/18 14:15:00	07/06/18 14:20:00	9,491	0.08	0.25	1.20	0.75	0.33	0.16	0.12	1.75	0.09	0.43
040	Bethany Avenue	07/06/18 14:15:00	07/06/18 14:20:00	7,473	0.08	0.25	1.20	0.75	0.33	0.16	0.12	1.75	0.09	0.43
041	Chestnut Street	07/06/18 14:15:00	07/06/18 14:20:00	5,986	0.08	0.25	1.20	0.75	0.33	0.16	0.12	1.75	0.09	0.43
			STORM TOTAL:	**105,176**										
021F	Center Barrel - Locke Street	07/17/18 12:15:00	07/17/18 12:55:00	273,493	0.67	1.20	3.60	4.67	0.26	1.24	1.20	6.50	0.19	1.21
021G	Winter street	07/17/18 12:15:00	07/17/18 12:30:00	24,001	0.25	1.20	3.60	4.67	0.26	1.24	1.20	6.50	0.19	1.21
040	Bethany Avenue	07/17/18 12:15:00	07/17/18 12:30:00	71,346	0.25	1.20	3.60	4.67	0.26	1.24	1.20	6.50	0.19	1.21
041	Chestnut Street	07/17/18 12:15:00	07/17/18 12:30:00	22,677	0.25	1.20	3.60	4.67	0.26	1.24	1.20	6.50	0.19	1.21
034	Middlesex Street	07/17/18 12:20:00	07/17/18 12:30:00	89,817	0.17	1.20	3.60	4.67	0.26	1.24	1.20	6.50	0.19	1.21
032	Bradford Avenue	07/17/18 12:20:00	07/17/18 12:25:00	16,794	0.08	1.20	3.60	4.67	0.26	1.24	1.20	6.50	0.19	1.21
021A	Middle Siphon	07/17/18 12:20:00	07/17/18 13:00:00	240,879	0.67	1.20	3.60	4.67	0.26	1.24	1.20	6.50	0.19	1.21
021B	Emerson Street	07/17/18 12:20:00	07/17/18 12:25:00	14,622	0.08	1.20	3.60	4.67	0.26	1.24	1.20	6.50	0.19	1.21
039	South Webster Street	07/17/18 12:20:00	07/17/18 12:45:00	15,781	0.42	1.20	3.60	4.67	0.26	1.24	1.20	6.50	0.19	1.21
021H	Winter and Hale	07/17/18 12:20:00	07/17/18 12:45:00	313,283	0.42	1.20	3.60	4.67	0.26	1.24	1.20	6.50	0.19	1.21
024	Upper siphon	7/17/18 13:31:15	7/17/18 13:34:45	105,511	0.06	1.20	3.60	4.67	0.26	1.24	1.20	6.50	0.19	1.21
021F	Center Barrel - Locke Street	07/17/18 15:15:00	07/17/18 15:45:00	60,663	0.50	1.20	3.60	4.67	0.26	1.24	1.20	6.50	0.19	1.21
034	Middlesex Street	07/17/18 15:15:00	07/17/18 15:25:00	16,003	0.17	1.20	3.60	4.67	0.26	1.24	1.20	6.50	0.19	1.21
021H	Winter and Hale	07/17/18 15:20:00	07/17/18 15:35:00	9,767	0.25	1.20	3.60	4.67	0.26	1.24	1.20	6.50	0.19	1.21
040	Bethany Avenue	07/17/18 15:15:00	07/17/18 15:25:00	3,521	0.17	1.20	3.60	4.67	0.26	1.24	1.20	6.50	0.19	1.21
041	Chestnut Street	07/17/18 15:15:00	07/17/18 15:25:00	4,925	0.17	1.20	3.60	4.67	0.26	1.24	1.20	6.50	0.19	1.21
039	South Webster Street	07/17/18 15:20:00	07/17/18 15:35:00	8,864	0.25	1.20	3.60	4.67	0.26	1.24	1.20	6.50	0.19	1.21
021F	Center Barrel - Locke Street	07/17/18 17:40:00	07/17/18 17:50:00	1,603	0.17	1.20	3.60	4.67	0.26	1.24	1.20	6.50	0.19	1.21
			STORM TOTAL:	**1,293,549**										
021F	Center Barrel - Locke Street	07/22/18 07:20:00	07/22/18 07:35:00	10,084	0.25	0.35	1.08	1.58	0.22	0.37	0.16	5.25	0.07	0.43
			STORM TOTAL:	**10,084**										
040	Bethany Avenue	07/26/18 03:40:00	07/26/18 03:50:00	2,320	0.17	0.99	0.96	3.75	0.26	1.40	1.08	7.75	0.18	0.83
034	Middlesex Street	07/26/18 03:40:00	07/26/18 03:50:00	6,349	0.17	0.99	0.96	3.75	0.26	1.40	1.08	7.75	0.18	0.83
021F	Center Barrel - Locke Street	07/26/18 03:45:00	07/26/18 04:05:00	30,660	0.33	0.99	0.96	3.75	0.26	1.40	1.08	7.75	0.18	0.83
021H	Winter and Hale	07/26/18 03:50:00	07/26/18 03:55:00	981	0.08	0.99	0.96	3.75	0.26	1.40	1.08	7.75	0.18	0.83
021F	Center Barrel - Locke Street	07/26/18 05:20:00	07/26/18 06:05:00	95,682	0.75	0.99	0.96	3.75	0.26	1.40	1.08	7.75	0.18	0.83
021H	Winter and Hale	07/26/18 05:35:00	07/26/18 05:55:00	47,111	0.33	0.99	0.96	3.75	0.26	1.40	1.08	7.75	0.18	0.83
034	Middlesex Street	07/26/18 05:35:00	07/26/18 05:45:00	27,936	0.17	0.99	0.96	3.75	0.26	1.40	1.08	7.75	0.18	0.83
040	Bethany Avenue	07/26/18 05:35:00	07/26/18 05:45:00	9,443	0.17	0.99	0.96	3.75	0.26	1.40	1.08	7.75	0.18	0.83
041	Chestnut Street	07/26/18 05:35:00	07/26/18 05:45:00	6,401	0.17	0.99	0.96	3.75	0.26	1.40	1.08	7.75	0.18	0.83
039	South Webster Street	07/26/18 05:40:00	07/26/18 05:50:00	4,100	0.17	0.99	0.96	3.75	0.26	1.40	1.08	7.75	0.18	0.83
021A	Middle Siphon	07/26/18 05:40:00	07/26/18 05:50:00	2,962	0.17	0.99	0.96	3.75	0.26	1.40	1.08	7.75	0.18	0.83
040	Bethany Avenue	07/26/18 14:25:00	07/26/18 14:45:00	17,253	0.33	0.99	0.96	3.75	0.26	1.40	1.08	7.75	0.18	0.83
041	Chestnut Street	07/26/18 14:25:00	07/26/18 14:45:00	4,166	0.33	0.99	0.96	3.75	0.26	1.40	1.08	7.75	0.18	0.83

Appendix B
CSO Flow Meter Summary

Outfall Number	Outfall Description	Activation Start	Activation End	Total Volume Per Event (gallons)	CSO Duration (hr.)	Marginal Pumping Station Rain Gage[3]				ASPW Rain Gage[3]				ASPW Operator Observed NOAA Rain Gage[2]
						Rain Total (in.)	Peak Hour Depth Intensity (in./hr.)	Storm Duration (hr.)	Daily Avg. Intensity (in./hr.)	Rain Total (in.)	Peak Hour Depth Intensity (in./hr.)	Storm Duration (hr.)	Daily Avg. Intensity (in./hr.)	Rain Total (in.)
021F	Center Barrel - Locke Street	07/26/18 14:30:00	07/26/18 15:05:00	110,287	0.58	0.99	0.96	3.75	0.26	1.40	1.08	7.75	0.18	0.83
021H	Winter and Hale	07/26/18 14:30:00	07/26/18 14:55:00	64,616	0.42	0.99	0.96	3.75	0.26	1.40	1.08	7.75	0.18	0.83
034	Middlesex Street	07/26/18 14:30:00	07/26/18 14:45:00	18,089	0.25	0.99	0.96	3.75	0.26	1.40	1.08	7.75	0.18	0.83
039	South Webster Street	07/26/18 14:30:00	07/26/18 14:55:00	14,039	0.42	0.99	0.96	3.75	0.26	1.40	1.08	7.75	0.18	0.83
021A	Middle Siphon	07/26/18 14:40:00	07/26/18 14:50:00	13,861	0.17	0.99	0.96	3.75	0.26	1.40	1.08	7.75	0.18	0.83
			STORM TOTAL:	**476,257**										
021F	Center Barrel - Locke Street	07/27/18 19:35:00	07/27/18 20:05:00	85,256	0.50	0.19	1.08	0.50	0.38	0.05	0.12	0.50	0.10	0.04
021H	Winter and Hale	07/27/18 19:35:00	07/27/18 19:55:00	108,697	0.33	0.19	1.08	0.50	0.38	0.05	0.12	0.50	0.10	0.04
034	Middlesex Street	07/27/18 19:35:00	07/27/18 19:40:00	2,652	0.08	0.19	1.08	0.50	0.38	0.05	0.12	0.50	0.10	0.04
040	Bethany Avenue	07/27/18 19:35:00	07/27/18 19:45:00	4,047	0.17	0.19	1.08	0.50	0.38	0.05	0.12	0.50	0.10	0.04
041	Chestnut Street	07/27/18 19:35:00	07/27/18 19:40:00	2,499	0.08	0.19	1.08	0.50	0.38	0.05	0.12	0.50	0.10	0.04
			STORM TOTAL:	**203,151**										
021F	Center Barrel - Locke Street	08/02/18 18:20:00	08/02/18 18:45:00	38,017	0.42	0.18	0.84	0.50	0.36	0.17	0.24	1.00	0.17	0.15
040	Bethany Avenue	08/02/18 18:20:00	08/02/18 18:25:00	42	0.08	0.18	0.84	0.50	0.36	0.17	0.24	1.00	0.17	0.15
021H	Winter and Hale	08/02/18 18:25:00	08/02/18 18:35:00	9,142	0.17	0.18	0.84	0.50	0.36	0.17	0.24	1.00	0.17	0.15
			STORM TOTAL:	**47,200**										
021F	Center Barrel - Locke Street	08/04/18 10:55:00	08/04/18 11:10:00	10,933	0.25	0.29	0.36	1.50	0.19	0.43	0.28	2.50	0.17	0.35
			STORM TOTAL:	**10,933**										
021F	Center Barrel - Locke Street	08/07/18 19:20:00	08/07/18 19:50:00	47,097	0.50	0.20	0.84	0.42	0.48	0.11	0.28	0.75	0.15	0.10
040	Bethany Avenue	08/07/18 19:20:00	08/07/18 19:25:00	2,264	0.08	0.20	0.84	0.42	0.48	0.11	0.28	0.75	0.15	0.10
021H	Winter and Hale	08/07/18 19:25:00	08/07/18 19:40:00	11,737	0.25	0.20	0.84	0.42	0.48	0.11	0.28	0.75	0.15	0.10
			STORM TOTAL:	**61,098**										
021F	Center Barrel - Locke Street	08/11/18 12:35:00	08/11/18 12:55:00	12,775	0.33	1.48	1.32	4.42	0.34	2.15	2.00	5.75	0.37	2.38
040	Bethany Avenue	08/11/18 13:25:00	08/11/18 13:30:00	1,526	0.08	1.48	1.32	4.42	0.34	2.15	2.00	5.75	0.37	2.38
039	South Webster Street	08/11/18 13:30:00	08/11/18 14:10:00	27,299	0.67	1.48	1.32	4.42	0.34	2.15	2.00	5.75	0.37	2.38
034	Middlesex Street	08/11/18 13:35:00	08/11/18 15:55:00	415,957	2.33	1.48	1.32	4.42	0.34	2.15	2.00	5.75	0.37	2.38
040	Bethany Avenue	08/11/18 13:35:00	08/11/18 14:05:00	60,804	0.50	1.48	1.32	4.42	0.34	2.15	2.00	5.75	0.37	2.38
041	Chestnut Street	08/11/18 13:35:00	08/11/18 14:00:00	19,516	0.42	1.48	1.32	4.42	0.34	2.15	2.00	5.75	0.37	2.38
021F	Center Barrel - Locke Street	08/11/18 13:40:00	08/11/18 15:50:00	341,702	2.17	1.48	1.32	4.42	0.34	2.15	2.00	5.75	0.37	2.38
021H	Winter and Hale	08/11/18 13:40:00	08/11/18 14:15:00	111,491	0.58	1.48	1.32	4.42	0.34	2.15	2.00	5.75	0.37	2.38
032	Bradford Avenue	08/11/18 13:40:00	08/11/18 13:45:00	5,127	0.08	1.48	1.32	4.42	0.34	2.15	2.00	5.75	0.37	2.38
021G	Winter street	08/11/18 13:40:00	08/11/18 13:50:00	2,402	0.17	1.48	1.32	4.42	0.34	2.15	2.00	5.75	0.37	2.38
021A	Middle Siphon	08/11/18 13:45:00	08/11/18 16:15:00	1,513,630	2.50	1.48	1.32	4.42	0.34	2.15	2.00	5.75	0.37	2.38
032	Bradford Avenue	08/11/18 13:50:00	08/11/18 13:55:00	152	0.08	1.48	1.32	4.42	0.34	2.15	2.00	5.75	0.37	2.38
040	Bethany Avenue	08/11/18 14:30:00	08/11/18 15:00:00	9,562	0.50	1.48	1.32	4.42	0.34	2.15	2.00	5.75	0.37	2.38
041	Chestnut Street	08/11/18 14:30:00	08/11/18 14:35:00	6	0.08	1.48	1.32	4.42	0.34	2.15	2.00	5.75	0.37	2.38
021H	Winter and Hale	08/11/18 14:35:00	08/11/18 15:00:00	33,485	0.42	1.48	1.32	4.42	0.34	2.15	2.00	5.75	0.37	2.38
041	Chestnut Street	08/11/18 14:40:00	08/11/18 14:45:00	185	0.08	1.48	1.32	4.42	0.34	2.15	2.00	5.75	0.37	2.38

Appendix B
CSO Flow Meter Summary

Outfall Number	Outfall Description	Activation Start	Activation End	Total Volume Per Event (gallons)	CSO Duration (hr.)	Marginal Pumping Station Rain Gage[3]				ASPW Rain Gage[3]				ASPW Operator Observed NOAA Rain Gage[2]
						Rain Total (in.)	Peak Hour Depth Intensity (in./hr.)	Storm Duration (hr.)	Daily Avg. Intensity (in./hr.)	Rain Total (in.)	Peak Hour Depth Intensity (in./hr.)	Storm Duration (hr.)	Daily Avg. Intensity (in./hr.)	Rain Total (in.)
032	Bradford Avenue	08/11/18 14:40:00	08/11/18 14:55:00	13,575	0.25	1.48	1.32	4.42	0.34	2.15	2.00	5.75	0.37	2.38
039	South Webster Street	08/11/18 14:40:00	08/11/18 15:25:00	26,126	0.75	1.48	1.32	4.42	0.34	2.15	2.00	5.75	0.37	2.38
024	Upper siphon	8/11/18 14:51:30	8/11/18 15:10:15	266,839	0.31	1.48	1.32	4.42	0.34	2.15	2.00	5.75	0.37	2.38
013	Lower Siphon	8/11/18 14:54:00	8/11/18 15:14:15	292,750	0.34	1.48	1.32	4.42	0.34	2.15	2.00	5.75	0.37	2.38
040	Bethany Avenue	08/11/18 15:10:00	08/11/18 15:15:00	386	0.08	1.48	1.32	4.42	0.34	2.15	2.00	5.75	0.37	2.38
024	Upper siphon	8/11/18 15:35:30	8/11/18 16:04:30	404,024	0.48	1.48	1.32	4.42	0.34	2.15	2.00	5.75	0.37	2.38
013	Lower Siphon	8/11/18 15:45:30	8/11/18 16:11:30	327,156	0.43	1.48	1.32	4.42	0.34	2.15	2.00	5.75	0.37	2.38
024	Upper siphon	8/11/18 16:20:45	8/11/18 16:27:00	59,595	0.10	1.48	1.32	4.42	0.34	2.15	2.00	5.75	0.37	2.38
			STORM TOTAL:	**3,946,070**										
021F	Center Barrel - Locke Street	08/14/18 14:50:00	08/14/18 15:40:00	442,619	0.83	0.74	2.28	1.00	0.74	0.56	1.20	2.00	0.28	0.57
021G	Winter street	08/14/18 14:50:00	08/14/18 15:10:00	31,820	0.33	0.74	2.28	1.00	0.74	0.56	1.20	2.00	0.28	0.57
021H	Winter and Hale	08/14/18 14:50:00	08/14/18 15:35:00	236,605	0.75	0.74	2.28	1.00	0.74	0.56	1.20	2.00	0.28	0.57
034	Middlesex Street	08/14/18 14:50:00	08/14/18 15:20:00	185,126	0.50	0.74	2.28	1.00	0.74	0.56	1.20	2.00	0.28	0.57
040	Bethany Avenue	08/14/18 14:50:00	08/14/18 15:15:00	99,921	0.42	0.74	2.28	1.00	0.74	0.56	1.20	2.00	0.28	0.57
021A	Middle Siphon	08/14/18 14:55:00	08/14/18 15:40:00	682,278	0.75	0.74	2.28	1.00	0.74	0.56	1.20	2.00	0.28	0.57
039	South Webster Street	08/14/18 14:55:00	08/14/18 15:30:00	21,965	0.58	0.74	2.28	1.00	0.74	0.56	1.20	2.00	0.28	0.57
041	Chestnut Street	08/14/18 14:55:00	08/14/18 15:15:00	24,074	0.33	0.74	2.28	1.00	0.74	0.56	1.20	2.00	0.28	0.57
032	Bradford Avenue	08/14/18 15:00:00	08/14/18 15:15:00	69,746	0.25	0.74	2.28	1.00	0.74	0.56	1.20	2.00	0.28	0.57
038	High Street	08/14/18 15:00:00	08/14/18 15:05:00	1,099	0.08	0.74	2.28	1.00	0.74	0.56	1.20	2.00	0.28	0.57
024	Upper siphon	8/14/18 15:59:00	8/14/18 16:19:30	865,090	0.34	0.74	2.28	1.00	0.74	0.56	1.20	2.00	0.28	0.57
			STORM TOTAL:	**2,660,343**										
040	Bethany Avenue	08/18/18 11:25:00	08/18/18 11:30:00	364	0.08	0.26	1.08	1.42	0.18	0.36	0.40	3.00	0.12	0.37
041	Chestnut Street	08/18/18 11:25:00	08/18/18 11:30:00	6,677	0.08	0.26	1.08	1.42	0.18	0.36	0.40	3.00	0.12	0.37
021F	Center Barrel - Locke Street	08/18/18 11:25:00	08/18/18 11:50:00	37,130	0.42	0.26	1.08	1.42	0.18	0.36	0.40	3.00	0.12	0.37
021H	Winter and Hale	08/18/18 11:30:00	08/18/18 11:45:00	46,281	0.25	0.26	1.08	1.42	0.18	0.36	0.40	3.00	0.12	0.37
			STORM TOTAL:	**90,452**										
040	Bethany Avenue	08/22/18 07:55:00	08/22/18 08:30:00	58,383	0.58	0.61	1.08	1.42	0.43	0.66	1.12	2.75	0.24	0.63
041	Chestnut Street	08/22/18 08:00:00	08/22/18 08:30:00	24,462	0.50	0.61	1.08	1.42	0.43	0.66	1.12	2.75	0.24	0.63
034	Middlesex Street	08/22/18 08:00:00	08/22/18 08:35:00	81,991	0.58	0.61	1.08	1.42	0.43	0.66	1.12	2.75	0.24	0.63
039	South Webster Street	08/22/18 08:00:00	08/22/18 08:40:00	28,551	0.67	0.61	1.08	1.42	0.43	0.66	1.12	2.75	0.24	0.63
021F	Center Barrel - Locke Street	08/22/18 08:00:00	08/22/18 08:50:00	235,153	0.83	0.61	1.08	1.42	0.43	0.66	1.12	2.75	0.24	0.63
021H	Winter and Hale	08/22/18 08:05:00	08/22/18 08:45:00	181,031	0.67	0.61	1.08	1.42	0.43	0.66	1.12	2.75	0.24	0.63
021A	Middle Siphon	08/22/18 08:10:00	08/22/18 08:45:00	187,474	0.58	0.61	1.08	1.42	0.43	0.66	1.12	2.75	0.24	0.63
024	Upper siphon	8/22/18 9:28:15	8/22/18 9:34:30	117,523	0.10	0.61	1.08	1.42	0.43	0.66	1.12	2.75	0.24	0.63
			STORM TOTAL:	**914,568**										
039	South Webster Street	09/10/18 20:20:00	09/11/18 06:25:00	106,606	10.08	0.80	0.60	4.58	0.17	0.82	0.40	5.75	0.14	1.57

Appendix B
CSO Flow Meter Summary

Outfall Number	Outfall Description	Activation Start	Activation End	Total Volume Per Event (gallons)	CSO Duration (hr.)	Marginal Pumping Station Rain Gage[3]				ASPW Rain Gage[3]				ASPW Operator Observed NOAA Rain Gage[2]
						Rain Total (in.)	Peak Hour Depth Intensity (in./hr.)	Storm Duration (hr.)	Daily Avg. Intensity (in./hr.)	Rain Total (in.)	Peak Hour Depth Intensity (in./hr.)	Storm Duration (hr.)	Daily Avg. Intensity (in./hr.)	Rain Total (in.)
021F	Center Barrel - Locke Street	09/10/18 20:45:00	09/10/18 21:35:00	59,392	0.83	0.80	0.60	4.58	0.17	0.82	0.40	5.75	0.14	1.57
021F	Center Barrel - Locke Street	09/10/18 23:55:00	09/11/18 00:20:00	14,632	0.42	0.80	0.60	4.58	0.17	0.82	0.40	5.75	0.14	1.57
021F	Center Barrel - Locke Street	09/11/18 01:00:00	09/11/18 01:25:00	25,997	0.42	0.80	0.60	4.58	0.17	0.82	0.40	5.75	0.14	1.57
021F	Center Barrel - Locke Street	09/11/18 01:40:00	09/11/18 02:00:00	18,103	0.33	0.80	0.60	4.58	0.17	0.82	0.40	5.75	0.14	1.57
021F	Center Barrel - Locke Street	09/11/18 02:25:00	09/11/18 02:45:00	17,706	0.33	0.80	0.60	4.58	0.17	0.82	0.40	5.75	0.14	1.57
			STORM TOTAL:	**242,434**										
021F	Center Barrel - Locke Street	09/18/18 03:25:00	09/18/18 05:35:00	333,822	2.17	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
021H	Winter and Hale	09/18/18 04:05:00	09/18/18 04:50:00	104,411	0.75	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
039	South Webster Street	09/18/18 04:10:00	09/18/18 04:40:00	8,549	0.50	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
041	Chestnut Street	09/18/18 04:15:00	09/18/18 04:20:00	253	0.08	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
040	Bethany Avenue	09/18/18 04:15:00	09/18/18 04:40:00	14,868	0.42	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
034	Middlesex Street	09/18/18 04:20:00	09/18/18 04:35:00	9,025	0.25	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
021A	Middle Siphon	09/18/18 04:25:00	09/18/18 04:50:00	81,194	0.42	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
041	Chestnut Street	09/18/18 04:30:00	09/18/18 04:35:00	1,329	0.08	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
021A	Middle Siphon	09/18/18 05:05:00	09/18/18 05:40:00	113,414	0.58	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
021H	Winter and Hale	09/18/18 05:10:00	09/18/18 05:30:00	27,353	0.33	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
034	Middlesex Street	09/18/18 05:10:00	09/18/18 05:25:00	23,915	0.25	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
040	Bethany Avenue	09/18/18 05:10:00	09/18/18 05:15:00	586	0.08	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
041	Chestnut Street	09/18/18 05:10:00	09/18/18 05:15:00	773	0.08	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
039	South Webster Street	09/18/18 05:15:00	09/18/18 05:20:00	568	0.08	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
021F	Center Barrel - Locke Street	09/18/18 06:20:00	09/18/18 11:35:00	1,468,705	5.25	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
040	Bethany Avenue	09/18/18 06:25:00	09/18/18 06:30:00	2,264	0.08	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
034	Middlesex Street	09/18/18 06:25:00	09/18/18 07:35:00	221,317	1.17	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
021A	Middle Siphon	09/18/18 06:25:00	09/18/18 12:10:00	3,896,881	5.75	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
021H	Winter and Hale	09/18/18 06:35:00	09/18/18 08:20:00	467,648	1.75	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
039	South Webster Street	09/18/18 06:45:00	09/18/18 10:25:00	139,291	3.67	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
040	Bethany Avenue	09/18/18 06:45:00	09/18/18 07:25:00	42,767	0.67	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
041	Chestnut Street	09/18/18 06:45:00	09/18/18 07:00:00	2,764	0.25	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
041	Chestnut Street	09/18/18 07:10:00	09/18/18 07:25:00	10,825	0.25	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
041	Chestnut Street	09/18/18 07:40:00	09/18/18 07:50:00	13,106	0.17	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
034	Middlesex Street	09/18/18 07:40:00	09/18/18 08:15:00	137,118	0.58	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
040	Bethany Avenue	09/18/18 07:40:00	09/18/18 08:05:00	49,046	0.42	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
013	Lower Siphon	9/18/18 7:50:00	9/18/18 8:45:00	8,014,944	0.92	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
041	Chestnut Street	09/18/18 07:55:00	09/18/18 08:05:00	6,544	0.17	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
024	Upper siphon	9/18/18 8:04:00	9/18/18 11:15:45	2,250,879	0.42	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
034	Middlesex Street	09/18/18 08:25:00	09/18/18 10:00:00	822,905	1.58	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92

Appendix B
CSO Flow Meter Summary

Outfall Number	Outfall Description	Activation Start	Activation End	Total Volume Per Event (gallons)	CSO Duration (hr.)	Marginal Pumping Station Rain Gage[3]				ASPW Rain Gage[3]				ASPW Operator Observed NOAA Rain Gage[2]
						Rain Total (in.)	Peak Hour Depth Intensity (in./hr.)	Storm Duration (hr.)	Daily Avg. Intensity (in./hr.)	Rain Total (in.)	Peak Hour Depth Intensity (in./hr.)	Storm Duration (hr.)	Daily Avg. Intensity (in./hr.)	Rain Total (in.)
021H	Winter and Hale	09/18/18 08:40:00	09/18/18 10:20:00	513,232	1.67	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
040	Bethany Avenue	09/18/18 08:40:00	09/18/18 08:55:00	34,441	0.25	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
041	Chestnut Street	09/18/18 08:40:00	09/18/18 08:50:00	4,030	0.17	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
040	Bethany Avenue	09/18/18 09:00:00	09/18/18 09:50:00	121,444	0.83	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
041	Chestnut Street	09/18/18 09:00:00	09/18/18 09:15:00	3,438	0.25	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
021G	Winter street	09/18/18 09:30:00	09/18/18 09:45:00	46,838	0.25	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
032	Bradford Avenue	09/18/18 09:30:00	09/18/18 09:50:00	171,731	0.33	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
038	High Street	09/18/18 09:30:00	09/18/18 09:35:00	3,075	0.08	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
041	Chestnut Street	09/18/18 09:30:00	09/18/18 09:50:00	20,863	0.33	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
019	Main Street North	09/18/18 09:40:00	09/18/18 09:50:00	45,388	0.17	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
021B	Emerson Street	09/18/18 09:40:00	09/18/18 09:45:00	390	0.08	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
037	Broadway	09/18/18 09:40:00	09/18/18 09:50:00	45,388	0.17	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
034	Middlesex Street	09/18/18 10:05:00	09/18/18 11:15:00	92,906	1.17	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
			STORM TOTAL:	**19,370,225**										
021F	Center Barrel - Locke Street	09/26/18 21:30:00	09/26/18 23:20:00	251,293	1.83	0.70	2.28	2.25	0.31	0.60	0.84	2.00	0.30	0.74
021G	Winter street	09/26/18 21:45:00	09/26/18 21:55:00	17,453	0.17	0.70	2.28	2.25	0.31	0.60	0.84	2.00	0.30	0.74
021H	Winter and Hale	09/26/18 21:45:00	09/26/18 22:10:00	135,231	0.42	0.70	2.28	2.25	0.31	0.60	0.84	2.00	0.30	0.74
034	Middlesex Street	09/26/18 21:45:00	09/26/18 22:00:00	62,471	0.25	0.70	2.28	2.25	0.31	0.60	0.84	2.00	0.30	0.74
039	South Webster Street	09/26/18 21:45:00	09/26/18 22:20:00	17,027	0.58	0.70	2.28	2.25	0.31	0.60	0.84	2.00	0.30	0.74
040	Bethany Avenue	09/26/18 21:45:00	09/26/18 22:00:00	36,520	0.25	0.70	2.28	2.25	0.31	0.60	0.84	2.00	0.30	0.74
041	Chestnut Street	09/26/18 21:45:00	09/26/18 21:55:00	14,640	0.17	0.70	2.28	2.25	0.31	0.60	0.84	2.00	0.30	0.74
021A	Middle Siphon	09/26/18 21:50:00	09/26/18 22:20:00	110,547	0.50	0.70	2.28	2.25	0.31	0.60	0.84	2.00	0.30	0.74
021A	Middle Siphon	09/26/18 22:55:00	09/26/18 23:20:00	15,354	0.42	0.70	2.28	2.25	0.31	0.60	0.84	2.00	0.30	0.74
024	Upper siphon	9/26/18 22:55:00	9/26/18 23:00:00	7,797	0.08	0.70	2.28	2.25	0.31	0.60	0.84	2.00	0.30	0.74
039	South Webster Street	09/26/18 23:00:00	09/26/18 23:15:00	319	0.25	0.70	2.28	2.25	0.31	0.60	0.84	2.00	0.30	0.74
			STORM TOTALS:	**668,651**										
039	South Webster Street	10/11/18 14:35:00	10/11/18 17:35:00	70,494	3.00	1.17	1.04	2.83	0.41	1.20	0.88	4.50	0.27	1.21
021F	Center Barrel - Locke Street	10/11/18 14:55:00	10/11/18 16:45:00	488,029	1.83	1.17	1.04	2.83	0.41	1.20	0.88	4.50	0.27	1.21
021H	Winter and Hale	10/11/18 15:10:00	10/11/18 16:30:00	337,809	1.33	1.17	1.04	2.83	0.41	1.20	0.88	4.50	0.27	1.21
040	Bethany Avenue	10/11/18 15:15:00	10/11/18 15:35:00	7,727	0.33	1.17	1.04	2.83	0.41	1.20	0.88	4.50	0.27	1.21
041	Chestnut Street	10/11/18 15:20:00	10/11/18 15:30:00	1,941	0.17	1.17	1.04	2.83	0.41	1.20	0.88	4.50	0.27	1.21
034	Middlesex Street	10/11/18 15:20:00	10/11/18 15:35:00	16,025	0.25	1.17	1.04	2.83	0.41	1.20	0.88	4.50	0.27	1.21
021A	Middle Siphon	10/11/18 15:25:00	10/11/18 17:00:00	1,006,057	1.58	1.17	1.04	2.83	0.41	1.20	0.88	4.50	0.27	1.21
034	Middlesex Street	10/11/18 15:40:00	10/11/18 16:40:00	212,647	1.00	1.17	1.04	2.83	0.41	1.20	0.88	4.50	0.27	1.21
041	Chestnut Street	10/11/18 15:45:00	10/11/18 16:15:00	27,554	0.50	1.17	1.04	2.83	0.41	1.20	0.88	4.50	0.27	1.21
040	Bethany Avenue	10/11/18 15:45:00	10/11/18 16:15:00	43,003	0.50	1.17	1.04	2.83	0.41	1.20	0.88	4.50	0.27	1.21

Appendix B
CSO Flow Meter Summary

Outfall Number	Outfall Description	Activation Start	Activation End	Total Volume Per Event (gallons)	CSO Duration (hr.)	Marginal Pumping Station Rain Gage[3]				ASPW Rain Gage[3]				ASPW Operator Observed NOAA Rain Gage[2]
						Rain Total (in.)	Peak Hour Depth Intensity (in./hr.)	Storm Duration (hr.)	Daily Avg. Intensity (in./hr.)	Rain Total (in.)	Peak Hour Depth Intensity (in./hr.)	Storm Duration (hr.)	Daily Avg. Intensity (in./hr.)	Rain Total (in.)
021G	Winter street	10/11/18 15:55:00	10/11/18 16:05:00	7,814	0.17	1.17	1.04	2.83	0.41	1.20	0.88	4.50	0.27	1.21
032	Bradford Avenue	10/11/18 15:55:00	10/11/18 16:10:00	23,963	0.25	1.17	1.04	2.83	0.41	1.20	0.88	4.50	0.27	1.21
024	Upper siphon	10/11/18 16:50:15	10/11/18 17:25:30	693,473	0.59	1.17	1.04	2.83	0.41	1.20	0.88	4.50	0.27	1.21
013	Lower Siphon	10/11/18 17:03:45	10/11/18 17:23:00	431,761	0.32	1.17	1.04	2.83	0.41	1.20	0.88	4.50	0.27	1.21
			STORM TOTAL:	**3,368,295**										
039	South Webster Street	10/13/18 08:25:00	10/13/18 09:40:00	2,242	1.25	0.13	0.12	1.08	0.12	0.17	0.16	2.50	0.07	0.13
			STORM TOTAL:	**2,242**										
039	South Webster Street[4]	10/16/18 07:20:00	10/16/18 07:55:00	2,553	0.58	0.01	0.04	0.08	0.12	0.03	0.04	0.50	0.06	0.12
			STORM TOTAL:	**2,553**										
021F	Center Barrel - Locke Street	10/23/18 17:35:00	10/23/18 18:25:00	76,088	0.83	0.31	0.36	0.92	0.34	0.33	0.52	1.50	0.22	0.35
			STORM TOTAL:	**76,088**										
021F	Center Barrel - Locke Street	10/27/18 14:50:00	10/27/18 15:35:00	26,463	0.75	1.34	0.24	9.50	0.14	1.82	0.28	13.75	0.13	1.65
021F	Center Barrel - Locke Street	10/27/18 15:50:00	10/27/18 16:45:00	41,380	0.92	1.34	0.24	9.50	0.14	1.82	0.28	13.75	0.13	1.65
			STORM TOTAL:	**67,843**										
021F	Center Barrel - Locke Street	10/29/18 08:35:00	10/29/18 09:50:00	81,317	1.25	0.40	0.28	2.17	0.18	0.42	0.32	3.50	0.12	0.41
			STORM TOTAL:	**81,317**										
041	Chestnut Street	11/02/18 23:30:00	11/02/18 23:45:00	4,359	0.25	0.67	1.00	2.83	0.24	0.31	0.12	5.00	0.06	1.36
039	South Webster Street	11/02/18 23:35:00	11/03/18 00:05:00	16,234	0.50	0.67	1.00	2.83	0.24	0.31	0.12	5.00	0.06	1.36
040	Bethany Avenue	11/02/18 23:35:00	11/02/18 23:45:00	3,461	0.17	0.67	1.00	2.83	0.24	0.31	0.12	5.00	0.06	1.36
034	Middlesex Street	11/02/18 23:35:00	11/02/18 23:55:00	21,693	0.33	0.67	1.00	2.83	0.24	0.31	0.12	5.00	0.06	1.36
021F	Center Barrel - Locke Street	11/02/18 23:25:00	11/03/18 00:20:00	152,386	0.92	0.67	1.00	2.83	0.24	0.31	0.12	5.00	0.06	1.36
021G	Winter street	11/02/18 23:35:00	11/02/18 23:45:00	12,607	0.17	0.67	1.00	2.83	0.24	0.31	0.12	5.00	0.06	1.36
021H	Winter and Hale	11/02/18 23:35:00	11/03/18 00:05:00	104,180	0.50	0.67	1.00	2.83	0.24	0.31	0.12	5.00	0.06	1.36
021A	Middle Siphon	11/02/18 23:40:00	11/03/18 00:10:00	68,432	0.50	0.67	1.00	2.83	0.24	0.31	0.12	5.00	0.06	1.36
040	Bethany Avenue	11/03/18 00:35:00	11/03/18 00:40:00	1,961	0.08	1.52	0.40	6.42	0.24	1.95	0.80	9.75	0.20	0.85
039	South Webster Street	11/03/18 00:35:00	11/03/18 00:55:00	3,829	0.33	1.52	0.40	6.42	0.24	1.95	0.80	9.75	0.20	0.85
034	Middlesex Street	11/03/18 00:35:00	11/03/18 00:45:00	6,781	0.17	1.52	0.40	6.42	0.24	1.95	0.80	9.75	0.20	0.85
021F	Center Barrel - Locke Street	11/03/18 00:35:00	11/03/18 03:35:00	386,976	3.00	1.52	0.40	6.42	0.24	1.95	0.80	9.75	0.20	0.85
021A	Middle Siphon	11/03/18 00:40:00	11/03/18 04:15:00	1,807,083	3.58	1.52	0.40	6.42	0.24	1.95	0.80	9.75	0.20	0.85
034	Middlesex Street	11/03/18 00:50:00	11/03/18 03:50:00	374,394	3.00	1.52	0.40	6.42	0.24	1.95	0.80	9.75	0.20	0.85
021H	Winter and Hale	11/03/18 00:50:00	11/03/18 00:55:00	947	0.08	1.52	0.40	6.42	0.24	1.95	0.80	9.75	0.20	0.85
041	Chestnut Street	11/03/18 01:15:00	11/03/18 01:20:00	458	0.08	1.52	0.40	6.42	0.24	1.95	0.80	9.75	0.20	0.85
039	South Webster Street	11/03/18 01:15:00	11/03/18 02:50:00	26,439	1.58	1.52	0.40	6.42	0.24	1.95	0.80	9.75	0.20	0.85
021H	Winter and Hale	11/03/18 01:20:00	11/03/18 01:25:00	178	0.08	1.52	0.40	6.42	0.24	1.95	0.80	9.75	0.20	0.85
021H	Winter and Hale	11/03/18 02:15:00	11/03/18 03:00:00	9,979	0.75	1.52	0.40	6.42	0.24	1.95	0.80	9.75	0.20	0.85
013	Lower Siphon	11/3/18 2:26:45	11/3/18 2:30:45	27,281	0.07	1.52	0.40	6.42	0.24	1.95	0.80	9.75	0.20	0.85

Appendix B
CSO Flow Meter Summary

Outfall Number	Outfall Description	Activation Start	Activation End	Total Volume Per Event (gallons)	CSO Duration (hr.)	Marginal Pumping Station Rain Gage[3]				ASPW Rain Gage[3]				ASPW Operator Observed NOAA Rain Gage[2]
						Rain Total (in.)	Peak Hour Depth Intensity (in./hr.)	Storm Duration (hr.)	Daily Avg. Intensity (in./hr.)	Rain Total (in.)	Peak Hour Depth Intensity (in./hr.)	Storm Duration (hr.)	Daily Avg. Intensity (in./hr.)	Rain Total (in.)
024	Upper siphon	11/3/18 3:25:15	11/3/18 3:29:30	53,632	0.07	1.52	0.40	6.42	0.24	1.95	0.80	9.75	0.20	0.85
021F	Center Barrel - Locke Street	11/03/18 04:50:00	11/03/18 07:45:00	289,305	2.92	1.52	0.40	6.42	0.24	1.95	0.80	9.75	0.20	0.85
039	South Webster Street	11/03/18 05:05:00	11/03/18 06:55:00	32,347	1.83	1.52	0.40	6.42	0.24	1.95	0.80	9.75	0.20	0.85
021A	Middle Siphon	11/03/18 05:05:00	11/03/18 07:50:00	815,961	2.75	1.52	0.40	6.42	0.24	1.95	0.80	9.75	0.20	0.85
034	Middlesex Street	11/03/18 05:15:00	11/03/18 06:55:00	145,725	1.67	1.52	0.40	6.42	0.24	1.95	0.80	9.75	0.20	0.85
021H	Winter and Hale	11/03/18 05:50:00	11/03/18 06:15:00	3,164	0.42	1.52	0.40	6.42	0.24	1.95	0.80	9.75	0.20	0.85
021H	Winter and Hale	11/03/18 06:40:00	11/03/18 06:45:00	144	0.08	1.52	0.40	6.42	0.24	1.95	0.80	9.75	0.20	0.85
013	Lower Siphon	11/3/18 6:55:15	11/3/18 6:58:45	10,176	0.06	1.52	0.40	6.42	0.24	1.95	0.80	9.75	0.20	0.85
021F	Center Barrel - Locke Street	11/03/18 09:05:00	11/03/18 09:45:00	28,364	0.67	1.52	0.40	6.42	0.24	1.95	0.80	9.75	0.20	0.85
039	South Webster Street	11/03/18 09:10:00	11/03/18 09:15:00	65	0.08	1.52	0.40	6.42	0.24	1.95	0.80	9.75	0.20	0.85
			STORM TOTAL:	**4,408,541**										
021F	Center Barrel - Locke Street	11/06/18 12:50:00	11/06/18 13:25:00	42,056	0.58	0.59	0.40	3.75	0.16	0.79	0.36	9.00	0.09	0.52
039	South Webster Street	11/06/18 12:50:00	11/06/18 13:15:00	4,946	0.42	0.59	0.40	3.75	0.16	0.79	0.36	9.00	0.09	0.52
041	Chestnut Street	11/06/18 12:55:00	11/06/18 13:00:00	607	0.08	0.59	0.40	3.75	0.16	0.79	0.36	9.00	0.09	0.52
			STORM TOTAL:	**47,609**										
039	South Webster Street	11/09/18 21:55:00	11/10/18 02:20:00	47,933	4.42	0.68	0.24	4.00	0.17	0.48	0.28	4.50	0.11	1.10
021F	Center Barrel - Locke Street	11/09/18 22:00:00	11/10/18 00:40:00	162,896	2.67	0.68	0.24	4.00	0.17	0.48	0.28	4.50	0.11	1.10
021F	Center Barrel - Locke Street	11/10/18 00:50:00	11/10/18 01:50:00	57,085	1.00	0.35	0.28	2.08	0.17	0.68	0.40	3.50	0.19	0.04
021A	Middle Siphon	11/10/18 00:50:00	11/10/18 01:10:00	26,490	0.33	0.35	0.28	2.08	0.17	0.68	0.40	3.50	0.19	0.04
			STORM TOTAL:	**294,404**										
039	South Webster Street	11/13/18 04:45:00	11/13/18 13:45:00	110,259	9.00	1.23	0.24	8.58	0.14	1.44	0.28	12.00	0.12	1.13
021F	Center Barrel - Locke Street	11/13/18 05:40:00	11/13/18 05:45:00	664	0.08	1.23	0.24	8.58	0.14	1.44	0.28	12.00	0.12	1.13
021F	Center Barrel - Locke Street	11/13/18 09:15:00	11/13/18 09:25:00	1,810	0.17	1.23	0.24	8.58	0.14	1.44	0.28	12.00	0.12	1.13
021F	Center Barrel - Locke Street	11/13/18 10:45:00	11/13/18 13:20:00	184,330	2.58	1.23	0.24	8.58	0.14	1.44	0.28	12.00	0.12	1.13
021A	Middle Siphon	11/13/18 12:55:00	11/13/18 13:00:00	309	0.08	1.23	0.24	8.58	0.14	1.44	0.28	12.00	0.12	1.13
			STORM TOTALS:	**297,372**										
039	South Webster Street	11/16/18 07:25:00	11/16/18 13:00:00	50,087	5.58	1.38	0.40	5.08	0.27	1.20	0.24	10.00	0.12	0.44
021F	Center Barrel - Locke Street	11/16/18 08:30:00	11/16/18 09:20:00	35,193	0.83	1.38	0.40	5.08	0.27	1.20	0.24	10.00	0.12	0.44
			STORM TOTALS:	**85,281**										
021F	Center Barrel - Locke Street	11/26/18 19:05:00	11/26/18 19:15:00	879	0.17	0.88	0.20	5.92	0.15	0.76	0.20	7.75	0.10	1.55
021F	Center Barrel - Locke Street	11/26/18 19:30:00	11/26/18 20:40:00	44,612	1.17	0.88	0.20	5.92	0.15	0.76	0.20	7.75	0.10	1.55
021F	Center Barrel - Locke Street	11/26/18 21:20:00	11/26/18 21:45:00	19,610	0.42	0.88	0.20	5.92	0.15	0.76	0.20	7.75	0.10	1.55
021F	Center Barrel - Locke Street	11/26/18 22:35:00	11/27/18 01:30:00	111,017	2.92	0.88	0.20	5.92	0.15	0.76	0.20	7.75	0.10	1.55
021F	Center Barrel - Locke Street	11/27/18 02:25:00	11/27/18 08:40:00	350,538	6.25	0.98	0.20	6.67	0.15	1.30	0.32	8.25	0.16	0.44
039	South Webster Street	11/27/18 04:40:00	11/27/18 05:35:00	8,548	0.92	0.98	0.20	6.67	0.15	1.30	0.32	8.25	0.16	0.44
039	South Webster Street	11/27/18 05:50:00	11/27/18 08:20:00	37,852	2.50	0.98	0.20	6.67	0.15	1.30	0.32	8.25	0.16	0.44

Appendix B
CSO Flow Meter Summary

Outfall Number	Outfall Description	Activation Start	Activation End	Total Volume Per Event (gallons)	CSO Duration (hr.)	Marginal Pumping Station Rain Gage[3]				ASPW Rain Gage[3]				ASPW Operator Observed NOAA Rain Gage[2]
						Rain Total (in.)	Peak Hour Depth Intensity (in./hr.)	Storm Duration (hr.)	Daily Avg. Intensity (in./hr.)	Rain Total (in.)	Peak Hour Depth Intensity (in./hr.)	Storm Duration (hr.)	Daily Avg. Intensity (in./hr.)	Rain Total (in.)
021A	Middle Siphon	11/27/18 06:00:00	11/27/18 09:05:00	658,590	3.08	0.98	0.20	6.67	0.15	1.30	0.32	8.25	0.16	0.44
034	Middlesex Street	11/27/18 06:35:00	11/27/18 07:50:00	72,213	1.25	0.98	0.20	6.67	0.15	1.30	0.32	8.25	0.16	0.44
021H	Winter and Hale	11/27/18 06:40:00	11/27/18 06:55:00	1,135	0.25	0.98	0.20	6.67	0.15	1.30	0.32	8.25	0.16	0.44
013	Lower Siphon	11/27/18 6:48:30	11/27/18 6:54:45	27,437	0.10	0.98	0.20	6.67	0.15	1.30	0.32	8.25	0.16	0.44
021H	Winter and Hale	11/27/18 07:10:00	11/27/18 07:25:00	733	0.25	0.98	0.20	6.67	0.15	1.30	0.32	8.25	0.16	0.44
			STORM TOTAL:	**1,333,163**										
021F	Center Barrel - Locke Street	12/02/18 11:05:00	12/02/18 11:25:00	8,208	0.33	0.94	0.36	6.75	0.14	1.00	0.36	10.75	0.09	0.87
021F	Center Barrel - Locke Street	12/02/18 12:15:00	12/02/18 13:00:00	57,632	0.75	0.94	0.36	6.75	0.14	1.00	0.36	10.75	0.09	0.87
039	South Webster Street	12/02/18 12:15:00	12/02/18 12:45:00	13,279	0.50	0.94	0.36	6.75	0.14	1.00	0.36	10.75	0.09	0.87
021H	Winter and Hale	12/02/18 12:20:00	12/02/18 12:35:00	4,440	0.25	0.94	0.36	6.75	0.14	1.00	0.36	10.75	0.09	0.87
034	Middlesex Street	12/02/18 12:20:00	12/02/18 12:25:00	15,529	0.08	0.94	0.36	6.75	0.14	1.00	0.36	10.75	0.09	0.87
			STORM TOTAL:	**99,087**										
021F	Center Barrel - Locke Street	12/16/18 20:10:00	12/16/18 20:40:00	55,435	0.50	0.44	0.40	2.67	0.17	0.39	0.32	3.50	0.11	0.50
			STORM TOTAL:	**55,435**										
021F	Center Barrel - Locke Street	12/21/18 07:30:00	12/21/18 07:35:00	111	0.08	0.57	0.20	4.17	0.14	0.86	0.20	10.00	0.09	0.75
021F	Center Barrel - Locke Street	12/21/18 17:15:00	12/21/18 18:10:00	90,597	0.92	0.57	0.20	4.17	0.14	0.86	0.20	10.00	0.09	0.75
039	South Webster Street	12/21/18 17:25:00	12/21/18 17:35:00	413	0.17	0.57	0.20	4.17	0.14	0.86	0.20	10.00	0.09	0.75
			STORM TOTAL:	**91,121**										
			GRAND TOTAL:	**49,523,420**										
			GRAND TOTAL:	**49.52**	**Million Gallons**									

Notes:

[1]Storm event with 2.24" of rain on 4/16/18 caused a blockage of debris at CSO-041. Blockage was removed early 4/17/18. This CSO event at CSO-041 is included in the event on 4/16/18.

[2]ASPW Operator Observed Rain Gage is measured and reported from 7:00 am to 7:00 am. For example 0.56 inches of rain reported in this spreadsheet on 1/12/2018 is from 1/12/2018 7:00 am to 1/13/2018 7:00 am.

[3]Marginal Pumping Station Rain Gage was blocked by pollen in mid-June and was cleaned/recalibrated July. ASPW Rain Gage was blocked by pollen/grass near the end of June and was cleaned/recalibrated July.

[4]On 10/16/2018, CSO-039 had a blockage caused by bricks from a collapsing CB upstream. CB has been replaced and upstream sewer of CSO-039 has been cleaned.

Appendix C

Appendix C
Calendar Year 2018 Rainfall Data

Start Date	Marginal Pumping Station				ASPW Rain Gage				ASPW Operator Observed NOAA Rain Gage
	Rain Total (in.)	Peak Hour Intensity (in./hr.)	Duration (hours)	Daily Average Intenstiy (in./hr.)	Rain Total (in.)	Peak Hour Intensity (in./hr.)	Duration (hours)	Daily Average Intenstiy (in./hr.)	Rain Total (in.)
1/1/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/2/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/3/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/4/2018	0.00	0.00	0.00	0.00	1.18	0.48	4.00	0.30	1.08
1/5/2018	0.00	0.00	0.00	0.00	0.01	0.04	0.25	0.04	0.00
1/6/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/7/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/8/2018	0.01	0.12	0.08	0.00	0.00	0.00	0.00	0.00	0.00
1/9/2018	0.14	0.12	1.17	0.05	0.00	0.00	0.00	0.00	0.00
1/10/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/11/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/12/2018	0.33	0.48	2.42	0.10	0.26	0.44	2.00	0.13	0.56
1/13/2018	0.32	0.24	2.17	0.09	0.47	0.44	1.75	0.27	0.07
1/14/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/15/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/16/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13
1/17/2018	0.00	0.00	0.00	0.00	0.29	0.20	3.00	0.10	0.23
1/18/2018	0.05	0.12	0.42	0.02	0.00	0.00	0.00	0.00	0.00
1/19/2018	0.04	0.12	0.33	0.01	0.00	0.00	0.00	0.00	0.00
1/20/2018	0.15	0.12	1.25	0.05	0.00	0.00	0.00	0.00	0.00
1/21/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/22/2018	0.13	0.12	1.08	0.05	0.10	0.16	1.75	0.06	0.10
1/23/2018	0.78	0.60	2.92	0.12	0.71	0.48	2.50	0.28	0.89
1/24/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/25/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/26/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/27/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
1/28/2018	0.01	0.12	0.08	0.00	0.02	0.04	0.50	0.04	0.00
1/29/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/30/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/31/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2/1/2018	0.07	0.12	0.58	0.02	0.02	0.04	0.75	0.03	0.34
2/2/2018	0.28	0.12	2.33	0.10	0.26	0.32	1.75	0.15	0.00
2/3/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2/4/2018	0.23	0.12	1.92	0.08	0.08	0.32	1.00	0.08	0.43
2/5/2018	0.23	0.36	1.42	0.06	0.30	0.44	0.75	0.40	0.00
2/6/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2/7/2018	0.19	0.36	1.42	0.06	0.69	0.44	2.75	0.25	0.72
2/8/2018	0.12	0.12	1.00	0.04	0.00	0.00	0.00	0.00	0.00
2/9/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2/10/2018	0.70	0.24	5.17	0.22	0.15	0.40	1.50	0.10	0.37
2/11/2018	0.79	0.24	6.33	0.26	0.87	0.40	4.25	0.20	0.76
2/12/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2/13/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2/14/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2/15/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2/16/2018	0.07	0.12	0.58	0.02	0.07	0.08	1.25	0.06	0.02
2/17/2018	0.00	0.00	0.00	0.00	0.06	0.24	0.50	0.12	0.00
2/18/2018	0.51	0.36	1.92	0.08	0.42	0.28	1.75	0.24	0.00
2/19/2018	0.09	0.12	0.75	0.03	0.08	0.24	0.50	0.16	0.22
2/20/2018	0.09	0.24	0.67	0.03	0.12	0.44	0.50	0.24	0.00

Appendix C
Calendar Year 2018 Rainfall Data

Start Date	Marginal Pumping Station				ASPW Rain Gage				ASPW Operator Observed NOAA Rain Gage
	Rain Total (in.)	Peak Hour Intensity (in./hr.)	Duration (hours)	Daily Average Intenstiy (in./hr.)	Rain Total (in.)	Peak Hour Intensity (in./hr.)	Duration (hours)	Daily Average Intenstiy (in./hr.)	Rain Total (in.)
2/21/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2/22/2018	0.01	0.12	0.08	0.00	0.09	0.24	0.75	0.12	0.09
2/23/2018	0.16	0.24	1.17	0.05	0.05	0.08	1.00	0.05	0.04
2/24/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2/25/2018	0.46	0.24	3.75	0.16	0.43	0.32	2.75	0.16	0.49
2/26/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2/27/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2/28/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3/1/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17
3/2/2018	1.32	0.24	9.58	0.40	1.29	0.48	4.25	0.30	1.20
3/3/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3/4/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
3/5/2018	0.05	0.24	0.33	0.01	0.02	0.04	0.50	0.04	0.00
3/6/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3/7/2018	0.56	0.24	4.25	0.18	0.94	0.48	3.75	0.25	0.00
3/8/2018	0.48	0.24	3.83	0.16	1.04	0.48	3.25	0.32	0.15
3/9/2018	0.10	0.12	0.83	0.03	0.00	0.00	0.00	0.00	0.00
3/10/2018	0.62	0.24	5.08	0.21	0.00	0.00	0.00	0.00	0.00
3/11/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3/12/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3/13/2018	0.05	0.12	0.42	0.02	1.33	0.44	4.75	0.28	1.44
3/14/2018	0.63	0.48	3.17	0.13	0.07	0.08	1.25	0.06	0.00
3/15/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3/16/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3/17/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3/18/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3/19/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3/20/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3/21/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3/22/2018	0.26	0.48	1.17	0.05	0.18	0.16	1.75	0.10	0.24
3/23/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3/24/2018	0.04	0.12	0.33	0.01	0.00	0.00	0.00	0.00	0.09
3/25/2018	0.04	0.12	0.33	0.01	0.00	0.00	0.00	0.00	0.00
3/26/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3/27/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
3/28/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3/29/2018	0.02	0.12	0.17	0.01	0.02	0.04	0.50	0.04	0.02
3/30/2018	0.05	0.12	0.42	0.02	0.06	0.08	1.00	0.06	0.02
3/31/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4/1/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4/2/2018	0.03	0.12	0.25	0.01	0.01	0.04	0.25	0.04	0.01
4/3/2018	0.28	0.12	2.33	0.10	0.34	0.20	5.00	0.07	0.35
4/4/2018	0.30	0.36	2.17	0.09	0.45	0.28	4.50	0.10	0.29
4/5/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4/6/2018	0.23	0.12	1.92	0.08	0.23	0.12	4.25	0.05	0.43
4/7/2018	0.19	0.12	1.58	0.07	0.28	0.12	4.00	0.07	0.00
4/8/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4/9/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4/10/2018	0.02	0.12	0.17	0.01	0.00	0.00	0.00	0.00	0.01
4/11/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4/12/2018	0.09	0.24	0.67	0.03	0.11	0.12	1.50	0.07	0.14

Appendix C
Calendar Year 2018 Rainfall Data

Start Date	Marginal Pumping Station				ASPW Rain Gage				ASPW Operator Observed NOAA Rain Gage
	Rain Total (in.)	Peak Hour Intensity (in./hr.)	Duration (hours)	Daily Average Intenstiy (in./hr.)	Rain Total (in.)	Peak Hour Intensity (in./hr.)	Duration (hours)	Daily Average Intenstiy (in./hr.)	Rain Total (in.)
4/13/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4/14/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4/15/2018	0.03	0.12	0.25	0.01	0.08	0.12	1.00	0.08	0.20
4/16/2018	2.24	1.68	10.25	0.43	2.42	0.84	15.00	0.16	2.23
4/17/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4/18/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4/19/2018	0.16	0.12	1.33	0.06	0.20	0.12	3.00	0.07	0.18
4/20/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4/21/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4/22/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4/23/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4/24/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4/25/2018	0.93	0.48	5.58	0.23	1.14	0.40	10.75	0.11	1.01
4/26/2018	0.22	0.24	1.58	0.07	0.19	0.16	2.50	0.08	0.13
4/27/2018	0.32	0.36	2.33	0.10	0.40	0.20	3.50	0.11	0.34
4/28/2018	0.00	0.00	0.00	0.00	0.01	0.04	0.25	0.04	0.00
4/29/2018	0.24	0.60	1.42	0.06	0.24	0.12	3.00	0.08	0.19
4/30/2018	0.07	0.12	0.58	0.02	0.05	0.08	0.75	0.07	0.06
5/1/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/2/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/3/2018	0.06	0.48	0.25	0.00	0.11	0.36	0.75	0.15	0.11
5/4/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
5/5/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/6/2018	0.57	0.36	4.00	0.02	0.74	0.36	7.25	0.10	0.65
5/7/2018	0.00	0.00	0.00	0.00	0.02	0.08	0.25	0.08	0.00
5/8/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/9/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/10/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/11/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/12/2018	0.03	0.12	0.25	0.00	0.05	0.08	1.00	0.05	0.11
5/13/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/14/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/15/2018	0.37	0.36	2.25	0.02	0.43	0.28	3.50	0.12	0.40
5/16/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/17/2018	0.00	0.00	0.00	0.00	0.06	0.24	0.25	0.24	0.00
5/18/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/19/2018	0.28	0.12	2.33	0.01	0.33	0.24	5.00	0.07	0.32
5/20/2018	0.04	0.12	0.33	0.00	0.08	0.12	1.25	0.06	0.01
5/21/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/22/2018	0.03	0.12	0.25	0.00	0.06	0.12	1.00	0.06	0.05
5/23/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/24/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/25/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/26/2018	0.04	0.12	0.33	0.00	0.06	0.12	0.75	0.08	0.11
5/27/2018	0.06	0.12	0.50	0.00	0.09	0.12	1.00	0.09	0.02
5/28/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/29/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/30/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5/31/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6/1/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6/2/2018	0.05	0.12	0.42	0.12	0.02	0.08	0.25	0.08	0.02

Appendix C
Calendar Year 2018 Rainfall Data

Start Date	Marginal Pumping Station				ASPW Rain Gage				ASPW Operator Observed NOAA Rain Gage
	Rain Total (in.)	Peak Hour Intensity (in./hr.)	Duration (hours)	Daily Average Intenstiy (in./hr.)	Rain Total (in.)	Peak Hour Intensity (in./hr.)	Duration (hours)	Daily Average Intenstiy (in./hr.)	Rain Total (in.)
6/3/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6/4/2018	0.37	0.12	3.08	0.12	0.69	0.32	7.00	0.10	0.61
6/5/2018	0.28	0.12	2.33	0.12	0.19	0.28	2.00	0.10	0.20
6/6/2018	0.00	0.00	0.00	0.00	0.03	0.12	0.25	0.12	0.00
6/7/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6/8/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6/9/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6/10/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6/11/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6/12/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6/13/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6/14/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6/15/2018	0.01	0.12	0.08	0.12	0.01	0.04	0.25	0.04	0.02
6/16/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6/17/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6/18/2018	0.13	0.12	1.08	0.12	0.50	0.56	2.00	0.25	0.50
6/19/2018	0.09	0.12	0.75	0.12	0.00	0.00	0.00	0.00	0.00
6/20/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6/21/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6/22/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6/23/2018	0.01	0.12	0.08	0.12	0.14	0.28	1.00	0.14	0.12
6/24/2018	0.00	0.00	0.00	0.00	0.25	0.20	2.50	0.10	0.99
6/25/2018	0.00	0.00	0.00	0.00	0.74	0.20	6.25	0.12	0.00
6/26/2018	0.01	0.12	0.08	0.12	0.00	0.00	0.00	0.00	0.00
6/27/2018	0.00	0.00	0.00	0.00	0.04	0.12	0.50	0.08	0.40
6/28/2018	0.00	0.00	0.00	0.00	0.61	0.16	9.50	0.06	0.95
6/29/2018	0.00	0.00	0.00	0.00	0.11	0.08	2.00	0.06	0.00
6/30/2018	0.00	0.00	0.00	0.00	0.05	0.08	1.00	0.05	0.00
7/1/2018	0.00	0.00	0.00	0.00	0.06	0.08	1.00	0.06	0.00
7/2/2018	0.00	0.00	0.00	0.00	0.04	0.08	0.50	0.08	0.00
7/3/2018	0.00	0.00	0.00	0.00	0.02	0.08	0.25	0.08	0.00
7/4/2018	0.00	0.00	0.00	0.00	0.02	0.08	0.25	0.08	0.00
7/5/2018	0.00	0.00	0.00	0.00	0.02	0.08	0.25	0.08	0.00
7/6/2018	0.25	1.20	0.75	0.33	0.16	0.12	1.75	0.09	0.43
7/7/2018	0.00	0.00	0.00	0.00	0.05	0.20	0.25	0.20	0.00
7/8/2018	0.00	0.00	0.00	0.00	0.04	0.16	0.25	0.16	0.00
7/9/2018	0.00	0.00	0.00	0.00	0.02	0.08	0.25	0.08	0.00
7/10/2018	0.00	0.00	0.00	0.00	0.22	0.44	1.00	0.22	0.00
7/11/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/12/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/13/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/14/2018	0.03	0.12	0.25	0.12	0.04	0.12	0.50	0.08	0.03
7/15/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/16/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/17/2018	1.20	3.60	4.67	0.26	1.24	1.20	6.50	0.19	1.21
7/18/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/19/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/20/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/21/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/22/2018	0.35	1.08	1.58	0.22	0.37	0.16	5.25	0.07	0.43
7/23/2018	0.21	0.60	1.00	0.21	0.31	0.36	3.00	0.10	0.14

Appendix C
Calendar Year 2018 Rainfall Data

Start Date	Marginal Pumping Station				ASPW Rain Gage				ASPW Operator Observed NOAA Rain Gage
	Rain Total (in.)	Peak Hour Intensity (in./hr.)	Duration (hours)	Daily Average Intenstiy (in./hr.)	Rain Total (in.)	Peak Hour Intensity (in./hr.)	Duration (hours)	Daily Average Intenstiy (in./hr.)	Rain Total (in.)
7/24/2018	0.00	0.00	0.00	0.00	0.03	0.12	0.25	0.12	0.01
7/25/2018	0.08	0.12	0.67	0.12	0.11	0.24	1.00	0.11	0.61
7/26/2018	0.99	0.96	3.75	0.26	1.40	1.08	7.75	0.18	0.83
7/27/2018	0.19	1.08	0.50	0.38	0.05	0.12	0.50	0.10	0.04
7/28/2018	0.00	0.00	0.00	0.00	0.04	0.08	0.75	0.05	0.00
7/29/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/30/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7/31/2018	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00
8/1/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8/2/2018	0.18	0.84	0.50	0.36	0.17	0.24	1.00	0.17	0.15
8/3/2018	0.00	0.00	0.00	0.00	0.07	0.12	1.00	0.07	0.04
8/4/2018	0.29	0.36	1.50	0.19	0.43	0.28	2.50	0.17	0.35
8/5/2018	0.00	0.00	0.00	0.00	0.02	0.08	0.25	0.08	0.00
8/6/2018	0.00	0.00	0.00	0.00	0.02	0.04	0.50	0.04	0.00
8/7/2018	0.20	0.84	0.42	0.48	0.11	0.28	0.75	0.15	0.10
8/8/2018	0.08	0.24	0.58	0.14	0.11	0.16	1.25	0.09	0.12
8/9/2018	0.18	1.20	0.58	0.31	0.23	0.56	1.75	0.13	0.15
8/10/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8/11/2018	1.48	1.32	4.42	0.34	2.15	2.00	5.75	0.37	2.38
8/12/2018	0.15	0.48	0.92	0.16	0.35	0.36	2.75	0.13	0.19
8/13/2018	0.18	0.36	1.17	0.15	0.33	0.20	3.75	0.09	0.27
8/14/2018	0.74	2.88	1.00	0.74	0.56	1.20	2.00	0.28	0.57
8/15/2018	0.01	0.12	0.08	0.12	0.00	0.00	0.00	0.00	0.00
8/16/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8/17/2018	0.18	0.48	0.92	0.20	0.11	0.24	1.00	0.11	0.37
8/18/2018	0.26	1.08	1.42	0.18	0.36	0.40	3.00	0.12	0.07
8/19/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8/20/2018	0.00	0.00	0.00	0.00	0.01	0.04	0.25	0.04	0.00
8/21/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8/22/2018	0.61	1.08	1.42	0.43	0.66	1.12	2.75	0.24	0.63
8/23/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8/24/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8/25/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8/26/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8/27/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8/28/2018	0.00	0.00	0.00	0.00	0.01	0.04	0.25	0.04	0.00
8/29/2018	0.00	0.00	0.00	0.00	0.02	0.08	0.25	0.08	0.00
8/30/2018	0.00	0.00	0.00	0.00	0.03	0.08	0.50	0.06	0.00
8/31/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9/1/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9/2/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9/3/2018	0.00	0.00	0.00	0.00	0.02	0.08	0.25	0.08	0.00
9/4/2018	0.00	0.00	0.00	0.00	0.02	0.08	0.25	0.08	0.00
9/5/2018	0.00	0.00	0.00	0.00	0.01	0.04	0.25	0.04	0.00
9/6/2018	0.04	0.12	0.33	0.12	0.08	0.08	1.25	0.06	0.06
9/7/2018	0.00	0.00	0.00	0.00	0.02	0.08	0.25	0.08	0.00
9/8/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9/9/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9/10/2018	0.80	0.60	4.58	0.17	0.82	0.40	5.75	0.14	1.57
9/11/2018	0.57	0.60	2.92	0.20	0.77	0.44	5.25	0.15	0.08
9/12/2018	0.06	0.24	0.42	0.14	0.16	0.12	2.00	0.08	0.08

Appendix C
Calendar Year 2018 Rainfall Data

Start Date	Marginal Pumping Station				ASPW Rain Gage				ASPW Operator Observed NOAA Rain Gage
	Rain Total (in.)	Peak Hour Intensity (in./hr.)	Duration (hours)	Daily Average Intenstiy (in./hr.)	Rain Total (in.)	Peak Hour Intensity (in./hr.)	Duration (hours)	Daily Average Intenstiy (in./hr.)	Rain Total (in.)
9/13/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9/14/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9/15/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9/16/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9/17/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.42
9/18/2018	3.29	3.36	9.08	0.36	3.13	2.00	10.75	0.29	2.92
9/19/2018	0.00	0.00	0.00	0.00	0.01	0.04	0.25	0.04	0.02
9/20/2018	0.00	0.00	0.00	0.00	0.03	0.12	0.25	0.12	0.01
9/21/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9/22/2018	0.00	0.00	0.00	0.00	0.01	0.04	0.25	0.04	0.00
9/23/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9/24/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9/25/2018	0.50	0.24	4.08	0.12	0.73	0.20	9.00	0.08	0.65
9/26/2018	0.70	2.28	2.25	0.31	0.60	0.84	2.00	0.30	0.74
9/27/2018	0.01	0.12	0.08	0.12	0.09	0.12	0.75	0.12	0.00
9/28/2018	0.02	0.12	0.17	0.12	0.08	0.12	1.25	0.06	0.00
9/29/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9/30/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/1/2018	0.11	0.08	0.92	0.12	0.10	0.08	2.00	0.05	0.24
10/2/2018	0.55	0.24	3.75	0.15	0.59	0.24	7.00	0.08	0.57
10/3/2018	0.07	0.12	0.58	0.12	0.17	0.16	2.00	0.09	0.02
10/4/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/5/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/6/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/7/2018	0.02	0.04	0.17	0.12	0.08	0.12	1.00	0.08	0.05
10/8/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
10/9/2018	0.00	0.00	0.00	0.00	0.01	0.04	0.25	0.04	0.00
10/10/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/11/2018	1.17	1.04	2.83	0.41	1.20	0.88	4.50	0.27	1.21
10/12/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
10/13/2018	0.13	0.12	1.08	0.12	0.17	0.16	2.50	0.07	0.13
10/14/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/15/2018	0.05	0.08	0.42	0.12	0.11	0.16	1.25	0.09	0.12
10/16/2018	0.01	0.04	0.08	0.12	0.03	0.04	0.50	0.06	0.00
10/17/2018	0.01	0.04	0.08	0.12	0.02	0.04	0.50	0.04	0.02
10/18/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/19/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/20/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/21/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/22/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/23/2018	0.31	0.36	0.92	0.34	0.33	0.52	1.50	0.22	0.35
10/24/2018	0.10	0.08	0.83	0.12	0.14	0.12	1.75	0.08	0.12
10/25/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/26/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/27/2018	1.34	0.24	9.50	0.14	1.82	0.28	13.75	0.13	1.65
10/28/2018	0.03	0.04	0.25	0.12	0.03	0.08	0.50	0.06	0.05
10/29/2018	0.40	0.28	2.17	0.18	0.42	0.32	3.50	0.12	0.41
10/30/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/31/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11/1/2018	0.29	0.20	2.17	0.13	0.32	0.16	4.00	0.08	0.33
11/2/2018	0.67	1.00	2.83	0.24	0.31	0.12	5.00	0.06	1.36

Appendix C
Calendar Year 2018 Rainfall Data

Start Date	Marginal Pumping Station				ASPW Rain Gage				ASPW Operator Observed NOAA Rain Gage
	Rain Total (in.)	Peak Hour Intensity (in./hr.)	Duration (hours)	Daily Average Intenstiy (in./hr.)	Rain Total (in.)	Peak Hour Intensity (in./hr.)	Duration (hours)	Daily Average Intenstiy (in./hr.)	Rain Total (in.)
11/3/2018	1.52	0.40	6.42	0.24	1.95	0.80	9.75	0.20	0.85
11/4/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11/5/2018	0.31	0.12	2.42	0.13	0.34	0.16	4.25	0.08	0.47
11/6/2018	0.59	0.40	3.75	0.16	0.79	0.36	9.00	0.09	0.52
11/7/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11/8/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11/9/2018	0.68	0.24	4.00	0.17	0.48	0.28	4.50	0.11	1.10
11/10/2018	0.35	0.28	2.08	0.17	0.68	0.40	3.50	0.19	0.04
11/11/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11/12/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.24
11/13/2018	1.23	0.24	8.58	0.14	1.44	0.28	12.00	0.12	1.13
11/14/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11/15/2018	0.00	0.00	0.00	0.00	0.13	0.20	2.50	0.05	0.84
11/16/2018	1.38	0.40	5.08	0.27	1.20	0.24	10.00	0.12	0.44
11/17/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11/18/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
11/19/2018	0.31	0.08	2.58	0.12	0.40	0.16	6.50	0.06	0.38
11/20/2018	0.49	0.12	4.08	0.12	0.76	0.20	10.00	0.08	0.52
11/21/2018	0.10	0.04	0.83	0.12	0.00	0.00	0.00	0.00	0.00
11/22/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11/23/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11/24/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11/25/2018	0.17	0.12	1.42	0.12	0.23	0.16	4.00	0.06	0.15
11/26/2018	0.88	0.20	5.92	0.15	0.76	0.20	7.75	0.10	1.55
11/27/2018	0.98	0.20	6.67	0.15	1.30	0.32	8.25	0.16	0.44
11/28/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11/29/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11/30/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/1/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10
12/2/2018	0.94	0.36	6.75	0.14	1.00	0.36	10.75	0.09	0.87
12/3/2018	0.00	0.00	0.00	0.00	0.03	0.12	0.25	0.12	0.00
12/4/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/5/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/6/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/7/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/8/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/9/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/10/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/11/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/12/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/13/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/14/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/15/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/16/2018	0.44	0.40	2.67	0.17	0.39	0.32	3.50	0.11	0.50
12/17/2018	0.08	0.04	0.67	0.12	0.07	0.04	1.50	0.05	0.00
12/18/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/19/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/20/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/21/2018	0.57	0.20	4.17	0.14	0.86	0.20	10.00	0.09	0.75
12/22/2018	0.02	0.04	0.17	0.12	0.07	0.08	0.75	0.09	0.00
12/23/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix C
Calendar Year 2018 Rainfall Data

Start Date	Marginal Pumping Station				ASPW Rain Gage				ASPW Operator Observed NOAA Rain Gage
	Rain Total (in.)	Peak Hour Intensity (in./hr.)	Duration (hours)	Daily Average Intenstiy (in./hr.)	Rain Total (in.)	Peak Hour Intensity (in./hr.)	Duration (hours)	Daily Average Intenstiy (in./hr.)	Rain Total (in.)
12/24/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/25/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/26/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/27/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
12/28/2018	0.41	0.16	3.17	0.13	0.45	0.16	7.25	0.06	0.38
12/29/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/30/2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/31/2018	0.21	0.08	1.50	0.14	0.23	0.16	3.50	0.07	0.76
Total	48.71		275.25		59.25		457.50		55.54
Average	0.13		0.75		0.16		1.25		0.15
Maximum	3.29	3.60	10.25	0.74	3.13	2.00	15.00	0.40	2.92
Minimum	0.01	0.04	0.08	0.00	0.01	0.04	0.25	0.03	0.01

Appendix D

Appendix D
Downstream Notification List

First Name	Last Name	Job Title	Company	Address	City	Business Phone	E-mail
Robert	DesMarais	Director Public Works	Amesbury	62 Friends Street	Amesbury, MA 01913	(978) 388-0853	**rob@amesburyma.gov**
Tom	Rogers	Assistant Chief Operator	Amesbury	19 Merrimack Street	Amesbury, MA 01913	(978) 388-1912	rogerst@amesburyma.gov
Jeff	Mason	Water System Manager	Amesbury	62 Friends Street	Amesbury, MA 01913	(978) 388-0853	**masonj@amesburyma.gov**
Jack	Morris	Regional Health Director	Amesbury	9 School Street	Amesbury, MA 01913	(978) 388-8134	**morrisj@amesburyma.gov**
Joy	Hilton	Eng, Water Technical Unit	EPA	5 Post Office Square, Suite 100	Boston, MA 02109-3912	(617) 918-1877	**hilton.joy@epa.gov**
Jeff	Kennedy	North Shore Regional Supervisor	Gloucester	Emerson Ave	Gloucester, MA 01930	(978) 282-0308	**jeff.kennedy@state.ma.us**
Lori	Bentsen	Board of Health	Groveland	183 Main Street	Groveland, MA 01834	(978) 556-7210	lbentsen@grovelandma.com
Tom	Cusick	Water Superintendent	Groveland	183 Main Street	Groveland, MA 01834	(978) 556-7200	**Tcusick@grovelandma.com**
Mike	Stankovich	DPW Director	Haverhill	500 Primrose Street	Haverhill, MA 01830	(978) 374-2360	**mstankovich@cityofhaverhill.com**
John	D'Aoust	Water Facility Manager	Haverhill	131 Amesbury Road	Haverhill, MA 01830	(978) 374-2385	**jdaoust@haverhillwater.com**
Bonnie	Dufresne	Board of Health	Haverhill	4 Summer street	Haverhill MA 01830	(978) 374-2325	**bdufresne@cityofhaverhill.com**
Isaiah	Lewis	WW Facility Manager	Haverhill	40 South Porter Street	Haverhill MA 01835	(978) 374-2382	ilewis@haverhillwater.com
Carrie	Prescott	Collection System Supervisor	Haverhill	40 South Porter Street	Haverhill MA 01835	(978) 374-2382	cprescott@haverhillwater.com
Sam	Marinez	WW Collection System Operator	Haverhill	40 South Porter Street	Haverhill, MA 01835	(978) 490-8294	**smarinez@haverhillwater.com**
David	Shaw	SR Collection System Operator	Haverhill	40 South Porter Street	Haverhill MA 01835	(978) 374-2382	dshaw@haverhillwater.com
Mike	Vetz	Harbor Master	Haverhill	72 Coffin Avenue	Haverhill, MA 01830	(978) 374-2100	**vetsm@comcast.net**
Robert	Ward	Deputy DPW Director	Haverhill	40 South Porter Street	Haverhill MA 01835	(978) 374-2382	rward@haverhillwater.com
Brett	Baron	Asset Management	Haverhill	40 South Porter Street	Haverhill, MA 01835	(978) 374-2382	**bbaron@Haverhillwater.com**
Cheri	Cousens	GLSD Executive Director	Lawrence	240 Charles Street	N Andover, MA 01845	(978) 685-1612	**ccousens@glsd.org**
Nihar	Mohanty	DEP NERO	MASSDEP	205B Lowell Street	Wilmington, MA 01887	(978) 694-3237	**nihar.mohanty@state.ma.us**
Kevin	Brander	Muni Services/WW Section	MASSDEP	205B Lowell Street	Wilmington, MA 01887	(978) 694-3236	**Kevin.Brander@state.ma.us**
Berni	Angelo	Admin Asst Board of Health	Merrimac	4 School Street	Merrimac, MA 01860	(978) 346-4066	BOH@townofmerrimac.com
Mike	Buzzell	Wastewater Chief Operator	Merrimac	Federal Way	Merrimac, MA 01860	(978) 346-7857	btmwwtf@comcast.net
Robert	Sinibaldi	DPW Director	Merrimac	4 School Street	Merrimac, MA 01860	(978) 346-0612	dpwdir@townofmerrimac.com
Gary	Tuck	Water Foreman	Merrimac	4 School Street	Merrimac, MA 01860	(978) 346-8407	gtuck@townofmerrimac.com
Deborah	Ketchen	Board of Health	Merrimac	2 School Street	Merrimac, MA 01860	(978) 804-9534	Healthagent@townofmerrimac.com
Alba	Gouldthrope	Board of Health	Newbury	25 High Road	Newbury MA 01951	(978) 499-3898	**boardofhealth@townofnewbury.org**
Michael	Reilly	Harbor Master	Newbury	25 High Road	Newbury MA 01951	(978) 462-4440	
Joe	Dugan	Wastewater Chief Operator	Newburyport	157 Water Street	Newburyport, MA 01950	(978) 465-4464	**jdugan@CityofNewburyport.com**
Frank	Giacalone	Director of Public Health	Newburyport	60 Pleasant Street	Newburyport, MA 01950	(978) 465-4410	fgiacalone@cityofnewburyport.com
Donna	Holaday	Mayor	Newburyport	60 Pleasant Street	Newburyport MA 01950	(978) 465-4413	**DHoladay@CityofNewburyport.com**
Paul	Hogg	Harbor Master	Newburyport	PO Box 550	Newburyport MA 01950	(978) 462-3746	**phogg@cityofnewburyport.com**
Diane	Regan	Shell Fish Purification	Newburyport	84 82nd Street	Newburyport, MA 01950	(978) 465-3553	**diane.regan@mass.gov**
Ted	Angelakis	Water Superintendent	Newburyport	7 Spring Lane	Newburyport, MA 0195	(978) 465-4466	**TAngelakis@cityofnewburyport.com**
Jamie	Tuccolo	Deputy Director	Newburyport		Newburyport, MA	(978) 465-4464	**jtuccolo@CityofNewburyport.com**
John	Morris	Board of Health	Sailsbury	5 Beach Road	Sailsbury, MA 01952	(978) 462-3430	**jmorris@salisburyma.gov**
Jeff	Ingalls	Chief Operator	Sailsbury	P.O. Box 5221	Salisbury MA 01952	(978) 465-4058	wwtp@sailsburyma.gov
Lisa	DeMeo	Director of Public Works	Sailsbury	39 Lafayette Road	Salisbury, MA 01952	(978) 463-0656	ldemeo@salisburyma.gov
Ray	Pike	Harbor Master	Sailsbury	181 Beach Road	Sailsbury, MA 01952	(978) 420-7834	harbormaster@salisburyma.gov
Paul	Sevigny	Health Agent	W Newbury	381 Main Street	W Newbury, MA 01985	(978) 363-1100	**psevigny@town.west-newbury.ma.us**
Rusty	Russell	MRWC		60 Island Street, Suite	Lawrence, MA 01840	(978) 655-4742	**rrussell@merrimack.org**

Appendix D
Downstream Notification List

First Name	Last Name	Job Title	Company	Address	City	Business Phone	E-mail
				211-E			
Keith	Eddings	Eagle Tribune Reporter	Haverhill		Haverhill, MA 01835		keddings@eagletribune.com
Tom	Mitchell	Flow Assessment	Contractor	84 Daniel Plummer Rd, Suite 2	Goffstown, NH 03045	(603) 656-9799	tmitchell@flowassessment.com
Scott	Kinter	Avalon Communities					Scott_kinter@avalonbay.com
							Jennifer@voteoccorunnion.com
Greg	Coyle	Lowell WW Engineer	Lowell		Lowell, MA 01850	(978) 674.1630	gcoyle@lowellma.gov
John	Sokol	Flow Assessment	Contractor	84 Daniel Plummer Road, Suite 2	Goffstown, NH 03045	(603) 656-9799	jsokol@flowassessment.com
Thomas	Connors						tmconnors@aol.com