



Haverhill

Robert E. Ward, Deputy DPW Director
Water/Wastewater Division
Phone: 978-374-2382 Fax: 978-521-4083
rward@haverhillwater.com

April 17, 2020

Enforcement and Compliance Assurance Division
U.S. EPA New England – Region 1 (Mail Code: 04-4)
5 Post Office Square
Boston, MA 02109-3912
Attn: Ms. Solanch S. Pastrana-Del Valle

Subject: City of Haverhill, MA NPDES Permit #MA 0101621
Consent Decree Submittal (Civil Action No. 16-11698-IT)
2019 Annual Combined Sewer Overflow Report

Dear Ms. Pastrana-Del Valle:

In accordance with Part I.F. 1 through 5 of the City of Haverhill's NPDES Permit and the Consent Decree item VII.M.51, we are providing this annual report for the 2019 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,

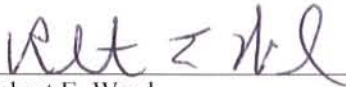
Robert E. Ward
Deputy DPW Director

Enclosure

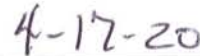
cc: Chief, Environmental Enforcement Section, U.S. DOJ
Susan Poswistilo, U.S. Attorney, MA District
Michael Wagner, EPA, wagner.michael@epa.gov
Kevin Brander, DEP, kevin.brander@state.ma.us
I. Andrew Goldberg, MA Assistant Attorney General, andy.goldberg@state.ma.us
Mayor James J. Fiorentini, City of Haverhill, mayor@cityofhaverhill.com
William Cox, City Solicitor, billcoxlaw@aol.com
Michael Leon, Nutter, McClennen & Fish LLP, MLeon@nutter.com
Mike Stankovich, DPW Director, mstankovich@cityofhaverhill.com
Paul Jessel, Wastewater, pjessel@haverhillwater.com
Isaiah Lewis, WWTP Facility Manager, ilewis@haverhillwater.com

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



(date)



City of Haverhill

**Department of Public Works
Wastewater Division**

Annual Combined Sewer Overflow Report

Calendar Year 2019

NPDES Permit No. MA 0101621

Purpose

This report was prepared to meet the requirements of Part I, Section F (1 to 5) of the National Pollutant Discharge Elimination System (NPDES) Permit No. MA0101621 issued to the City of Haverhill by the U.S. Environmental Protection Agency (EPA) and the Massachusetts Department of Environmental Protection (MassDEP). The permit authorizes the City to discharge stormwater/wastewater during wet weather from thirteen combined sewer overflow (CSO) 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 Department of Justice, EPA, the Commonwealth of Massachusetts, and the City of Haverhill.

As required by the NPDES permit, this report includes:

- Locations of CSO outfalls
- A summary of activities and volumes
- Status and progress of CSO abatement work
- Contacts for additional information on CSO's and water quality
- Daily precipitation information, including total precipitation, peak intensity, and average intensity.
- Certification that monthly inspections were completed, results recorded and records maintained
- Information related to compliance with the Nine Minimum Controls (NMC)
- Information pertaining to each combined sewer overflow outfall including the monthly total volume discharged, the total duration of discharges for each month, and the monthly number of CSO discharge events

The Consent Decree requires 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.

CSO Outfalls and Regulators

CSO discharges from the CSO outfalls are controlled by CSO regulator structures located upstream from the CSO outfalls. During dry weather, sanitary wastewater flow conveyed to CSO regulator structures is directed to the interceptor system and eventually to the WWTP for treatment. During wet weather events, the regulator structures divert the flow that exceeds the capacity of the downstream piping system from the collection system to a CSO outfall that discharges into the Little River or Merrimack River.

Haverhill currently has fifteen CSO regulators/structures which are connected to thirteen active CSO outfalls. Of the thirteen active outfalls, five discharge to the Little River, and eight discharge to the Merrimack River. As part of Haverhill's CSO abatement program, the City has closed thirteen CSO outfalls. Table 1 lists Haverhill's CSO outfalls and regulators along with their open or closed status. Figure 1 shows the outfall locations.

Two CSO outfalls have two regulator structures that discharge to them. High Street Diversion has regulator structures Broadway and High Street, and Winter Street and Hale Street has regulator structures Winter Street/Hale Street and Winter Street.

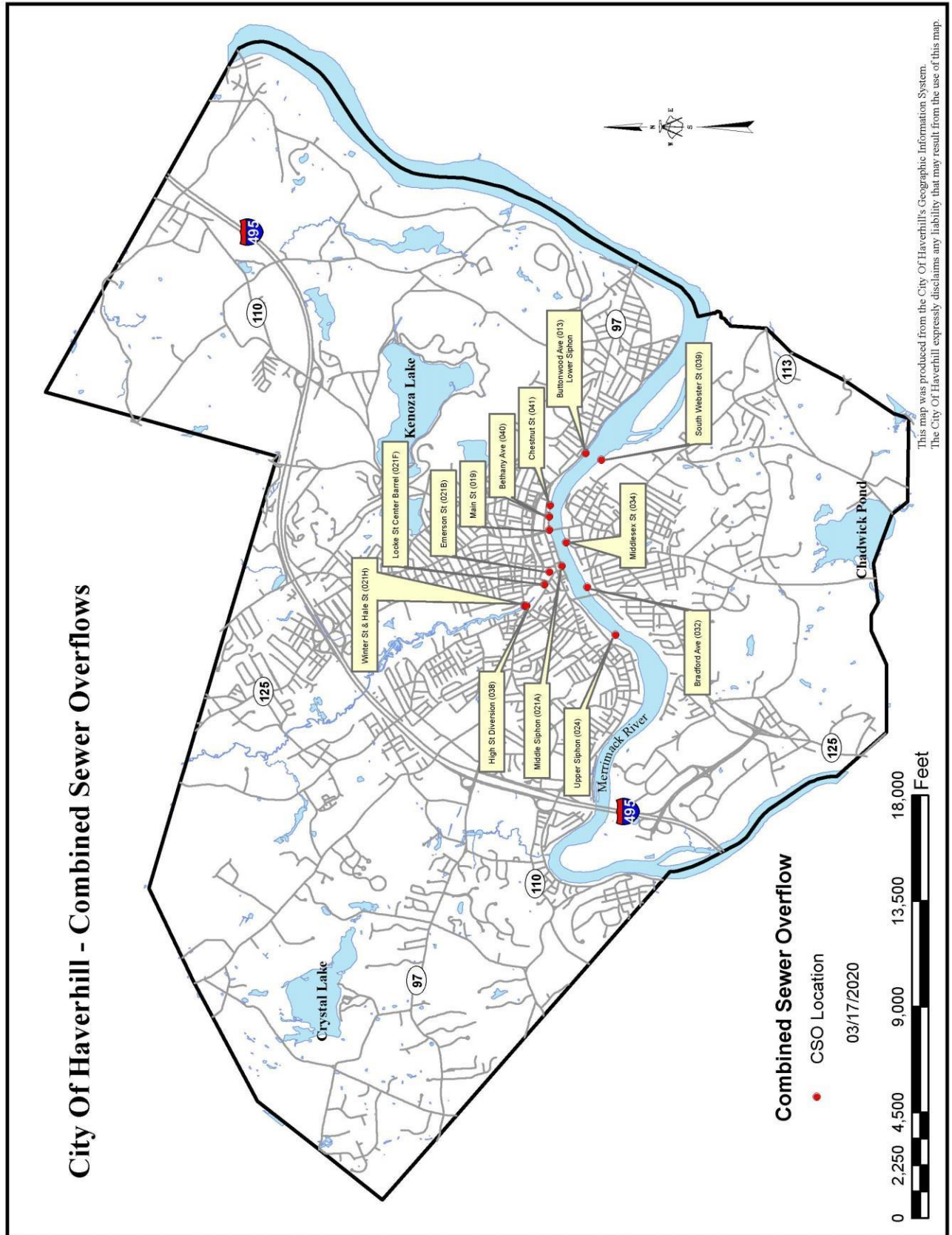
Some of Haverhill's CSO outfalls and regulators also function as part of a flood protection system for the downtown area. Table 2 notes which outfalls and regulators are part of the flood control system. During periods of high levels in the Merrimack River and Little River, five CSO regulator structures

function as flood diversion structures. To provide flood protection and emergency relief to the collection system, sluice gates within the regulator structures close to divert flow from the collection system to the associated CSO outfall. Unless the city is under a river flood condition, these sluice gates remain fully open.

Table 1
CSO Outfalls and Regulators

NPDES Outfall ID	CSO Outfall Name	CSO Regulator Names (if more than 1)	Receiving Waters	Status
Upper Siphon System				
025	Beach Street		Merrimack River	Closed
024	Upper Siphon - Varnum St.		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 St at Hale St. (021H) Winter Street (021G)	Little River	Open
038	High Street Diversion	Broadway (037) High St. (038)	Little River	Open
021B	Emerson Street		Little River	Open
021E	Little River So. (Locke St. So.)		Little River	Closed
021M	Marginal Pump Station		Little River	Closed
021D	Little River No. (Locke St. No.)		Little River	Closed
021F	Center Barrel - Locke Street		Little River	Open
021A	Middle Siphon - Essex Street		Little 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 - Buttonwoods Ave.		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 St.	(042) Colby St./ Salem St.	Merrimack River	Open

Figure 1



CSO Discharge Monitoring

Since 2014, each of the city's CSO outfalls has 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 some have both ultrasonic and transducer gauge). Most of the CSO regulators also have a depth/velocity gauge in the CSO outfall (measuring the depth and velocity of the CSO flow through the outfall pipe).

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			
025	Beach St.		Depth/Sluice Gate Opening - Orifice Equation
024	Upper Siphon –Varnum St.		Open
Middle Siphon System			
021H	Winter St. and Hale St. (F)	Winter St./Hale St. (021H) (F) Winter St. (021G) (F)	Depth at Weir Depth at Weir
038	High St. Diversion (F)	Broadway (037) (F) High St. (038) (F)	Depth at Weir Depth at Weir
021B	Emerson Street (F)		Depth at Weir
021E	Little River South (Locke St. South)		Depth at Weir
021M	Marginal Pump Station		Depth at Weir and Depth / Velocity in Outfall
021D	Little River North (Locke St. North)		Depth at Weir and Depth / Velocity in Outfall
Lower Siphon System			
019	Main St. North		Depth at Weir and Depth / Velocity in Outfall
040	Bethany Ave.		Depth at Weir and Depth / Velocity in Outfall
041	Chestnut St.		Depth at Weir and Depth / Velocity in Outfall
013	Lower Siphon – Buttonwoods Ave.		Depth/Sluice Gate Opening - Orifice Equation
Bradford System			
032	Bradford Ave.e		Depth at Weir and Depth/Velocity in Outfall
034	Middlesex St.		Depth at Weir
039	South Webster St.	(042) Colby St./ Salem St.	Depth at Weir and Depth/Velocity in Outfall

Note: (F) Indicates CSO regulators and outfalls used in the flood protection system.

The flow metering equipment is maintained by a contractor, Flow Assessment Services (FAS), who also reports the CSO activations and flow/volume estimates on a separate 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 the analysis of the meter information to make sure useful flow data is collected.

CSO flow computations at the CSO weir are estimated using a depth of flow over a weir calculation. The depth/velocity gauges utilize an area-velocity equation to estimate 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).

As previously mentioned, two CSO outfalls have two regulators that share the outfall. To accurately record CSO volumes, flow is measured at each regulator structure. CSOs for the High Street Diversion (NPDES Outfall ID 038) outfall are measured and reported under Broadway 037 and the High Street 038 regulators. CSOs for the Winter Street and Hale Street (NPDES Outfall ID 021H) outfall are measured and reported under the Winter Street/Hale Street 21H and Winter Street 021G regulators.

In early 2017, the city completed the 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 outfalls are monitored by city-maintained depth gauges. Under this project, the existing weirs at both stations were removed and a set of two modulating sluice gates were installed on each CSO outfall opening. These improvements enable 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.

CSO volumes at Upper and Lower Siphon outfalls are now calculated by the City using an orifice equation that reflects the typically surcharged (but variable) CSO gate opening. Each regulator has radar units 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. The City uses these equations to calculate CSO volumes discharged at the Upper and Lower Siphon outfalls. CDM Smith added these flow calculations into the City's SCADA system in 2019. The City can now view real-time flows from Upper and Lower Siphons during storm events.

2019 CSO Outfall Activations

Activation frequency and flow characteristics are measured by the meters, as discussed above. FAS provides monthly and yearly flow data, including volume, from the meters other than the Upper and Lower Siphon Outfalls. FAS analyzes flow data on a monthly bases to assure that accurate flow data is being measured and reported. For the Upper and Lower Siphons, the City uses the data downloaded from the SCADA system.

Table 3 summarizes the total CSO volume discharged and the number of activations for each outfall/regulator for 2019.

Table 3
2019 Summary of CSO Activations and Volume

NPDES Outfall ID	CSO/Regulator Name	Number of Activations	Total Volume (gallons)
013	Lower Siphon	5	6,822,275
019	Main Street North	2	44,864
021A	Middle Siphon	17	10,609,641
021B	Emerson Street	2	17,443
021F	Center Barrel Locke Street	44	5,625,201
021H	021G Winter Street	11	205,547
	021H Winter/ Hale Street	30	3,901,295
024	Upper Siphon	8	4,519,685
032	Bradford Avenue	6	592,810
034	Middlesex Street	25	9,204,424
038	037 Broadway Diversional	0	0
	038 High Street Diversional	3	6,180
039	South Webster Street	22	744,533
040	Bethany Avenue	33	945,831
041	Chestnut Street	26	408,835
		Total	43,648,566

Appendix A shows the Date, rainfall, and CSO volumes for the days with CSO activations. 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 reported CSO activations that did not occur, which was confirmed after the metering subcontractor evaluated the regulator data in the monthly reports.

Appendix B provides information required by the City's NPDES permit, including monthly total flow, the monthly total duration of flow, and the number of discharges for the month.

Appendix C provides 2019 CSO activation information required by the Consent Decree, including start and stop times, the amount of precipitation, and the volume released.

2019 Precipitation

The City collects rain data using three rain gauges: a tipping bucket rain gauge at the Wastewater Treatment Facility (WWTF) ASPW building, an NOAA supplied rain gage at the WWTF ASPW building, and a tipping bucket rain gauge at the Marginal Pumping Station. The gauge at the Marginal Pumping Station is the closest gauge to eleven of the CSO outfalls and their tributary areas. The other two outfalls, 013 and 039, and their tributary areas are closer to the gauges at the WWTF.

The data from the tipping bucket rain gauge 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 total daily rain in inches and 15-minute peak rain intensities.

The NOAA supplied rain gauge resembles a graduated cylinder that measures total rain in inches per day. A wastewater treatment operator reads this rain gauge at 7:00 am each day and records this total daily precipitation in Hach WIMS. The City reports these readings to NOAA.

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

We are also including rain data from the nearest National Weather Station, which is located at the Lawrence Municipal Airport. The current location is elevation 149 feet, Latitude 42.7172° W, Longitude - 71.1239° W.

The rainfall totals for 2019 for each gauge is shown in Table 4 along with annual average rainfall from the City's rainfall records. The NOAA gage total is the 19th highest annual rainfall since 1895. The 2019 monthly precipitation for April, June, August, October, and December was significantly higher than the average for those months.

Table 4
Annual Rainfall Totals

Rain Gauge Location	Total Annual Rainfall (inch)
Tipping bucket rain gauge at the WWTF ASPW building	53.81
NOAA supplied rain gauge at the WWTF ASPW	50.47
Tipping bucket rain gauge at the Marginal Pumping Station	46.48
Lawrence Municipal Airport (From NOAA)	40.53
City Rainfall Records - 1895 to 2019 Average	43
City Rainfall Records - 5-Year Average	45

Appendix D shows total daily rainfall (in inches), peak intensity (highest 15-minute sample multiplied by four to convert to inches per hour), storm duration, and average intensity. It should be noted that some storm durations continue overnight and into another day.

The lowest peak rainfall intensity that resulted in a CSO activation in 2019 was 0.12 inches per hour. A collapse in an upstream structure caused this overflow. The collapse was repaired and the debris removed.

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 EPA and 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 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 EPA and MassDEP. Based on EPA and MassDEP comments, the City revised its Phase II CSO LTCP and sent 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 upgrades were expected to reduce annual CSO volume to approximately 20 million gallons, eliminate or reduce the frequency of CSOs from some 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, which costs approximately \$50,000 per year to continue.

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 City's 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 preliminary 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, all estimated to cost \$45 million.

The City continued to fine-tune the Wet Weather System Maximization control setpoints by reviewing system performance after storm events to develop a control strategy to optimize the reduction of CSO discharges. Wastewater staff monitor upcoming storm events to determine what "mode" the CSO Maximization Program should be set to.

In 2019, the City hired an engineering firm to perform the planning, study, and preliminary design for the Phase 3 CSO program. The Phase 3 CSO work is ongoing and includes cleaning the Middle Siphon Interceptor starting at Locke Street to the Bradford Interceptor and 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 the Center Barrel and Winter Street and Hale Street CSOs. The cost of this ongoing work is \$2.5 million.

Nine Minimum Controls

The following is a summary of activities during the calendar year 2019 relating to compliance with the

Nine Minimum Controls (NMC).

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

The city continues to use its Computerized Maintenance Management System (CMMS) MainStar to track and manage the maintenance of their combined sewer system, including inspection and cleaning of sewers, drains, pumping stations, CSO regulators, and CSO outfalls. Sewer segments with frequent problems are added to a list in CMMS to receive more frequent maintenance.

In 2019, contractors hired by the City cleaned and CCTV inspected approximately 246,000 feet of sewer and drain including:

- The 50-inch to 54-inch sewer interceptor that runs from the intersection of Essex Street and Locke Street down Essex Street to Washington Square;
- The Middle Siphon which consists of two 30-inch diameter ductile iron pipes about 800 feet long that cross under the Merrimack River;
- The Bradford Interceptor which is a 66-inch pipe that runs from the downstream side of the Middle Siphon to the City's Main Wastewater Pump Station;
- Sewers within the Locke Street sewershed area totaling approximately 210,000 linear feet. About 7,000 linear feet is remaining to be CCTV inspected; and
- Approximately 37,000 feet of various sewer and drain mains throughout the City.

In September 2019, the City started the repair and replacement of various sewer pipes along Kenoza Street, Lawrence Street and several side streets between Main Street and Lawrence Street. The project cost is approximately \$2 million and is scheduled for completion by July 2021.

The City continues moving forward with the Phase II CSO LTCP Dry Weather Connector Pipe Improvements project. The City received and reviewed the 90% design plans and provided comments.

The CSO FLTCP Phase III Engineering was awarded to Wright-Pierce for \$2,572,200, of which \$156,622 was spent in 2019.

The City continues to upgrade the monitoring and alarm systems at sewer pumping stations. Seven Mission systems were installed last year by Weston & Sampson at the cost of \$37,450. There are now fifteen pumping stations equipped with Mission alarm and monitoring systems.

The City continued to inspect its sewer pumping stations daily for stations with a flow greater than 100,000 gallons per day 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 immediately dispatched to investigate and correct the problem.

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 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 2019. The City expects to raise the Middle Siphon CSO weir in 2020 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 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 continued to fine-tune this real-time flow control system to optimize 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 at the Middle Siphon Interceptor at Lock Street, the Middle Siphon, and the Bradford Interceptor ending at the South Mill Street Pumping Station. This project was 95% completed in 2019.

3. Review and modification of pretreatment program to assure CSO impacts are minimized

The purpose of the Industrial Pretreatment Program (IPP) is to help minimize the 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 Coordinator 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 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 fallen, the WWTP staff has been able to maintain low secondary blanket levels, which has allowed staff to avoid secondary bypassing for all of 2019.

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 the 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 2019. To date, FOG has significantly decreased 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 revised ordinance and ERP to EPA for approval.

The City implemented a new permitting software (ViewPoint) for all business occupancy permits, site plan applications, and Wastewater Discharge Permits. Wastewater employees (currently the Collection System Supervisor and Pretreatment Coordinator) review applications and issue permits as applicable. The system allows the City to improve tracking of non-residential wastewater discharged to the City's collection system.

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 upgrades 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 maximize flow to the WWTF further.

WWTF staff prioritize 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 monitors 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 Plant Evaluation (CPE) was completed that reviewed and assessed all of the processes, 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. These recommendations are included in the capital improvements program.

As discussed in NMC #1, a contractor hired by the City cleaned and inspected the Middle Siphon Interceptor at Lock Street, the Middle Siphon, and the Bradford Interceptor and removed all debris and obstructions in the pipes.

WWTP staff operate and maintain the plant process to ensure the plant is capable of maximizing wet weather flow and treatment during wet weather. During 2019, we were able to maximize wet weather flow through the plant without bypassing the secondary treatment process.

5. Prohibition of CSOs during dry weather overflows

Dry weather overflows (DWOs) from the CSO discharge outfalls are prohibited under the NPDES permit. Wastewater staff inspect all of the CSO outfalls/regulators monthly. As discussed previously in this report, CSO regulators are continuously monitored to ensure that if a DWO occurs, it is investigated and eliminated as soon as possible. If there is a CSO activation during dry weather, collection system operators are dispatched to investigate and resolve the issue as quickly as possible.

In 2019, there were five Sanitary Sewer Overflows (SSO) that resulted in a DWO. Table 6 shows the SSO ID, CSO outfall, and date. For each of these occurrences, wastewater staff responded quickly and resolved the issue causing the SSO.

Table 6
Dry Weather Overflows

SSO ID	CSO Outfall	Date
SSO-19-06	Bethany Avenue	6/6/2019
SSO-19-07	Bethany Avenue	7/23/2019
SSO-19-08	South Webster Street CSO	8/2/2019
SSO-19-09	South Webster Street CSO	8/5/2019
SSO-19-11	South Webster Street CSO	8/30/2019

6. Control of solid material and floatable materials 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 2019, the City continued placing out to bid catch basin cleaning. An outside contractor cleaned over 800 catch basins, 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 pollutants in the City's CSOs.

In 2017-2018, the IPP Coordinator hired a graphic designer to develop several 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. Flyers 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 Boards of Health, Harbor Masters, and local drinking water authorities. Appendix D is the current list of those 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 efficacy of CSO controls.*

In 2014, the City contracted with a flow metering company to install and maintain depth and depth/velocity meters at each of its CSO regulators. This program is discussed previously in this report. The flow monitoring program continued throughout 2019.

End of Report

Appendix A

APPENDIX A
DAILY CSO VOLUMES FOR 2019

UPPER SIPHON SYSTEM							MIDDLE SIPHON SYSTEM							LOWER SIPHON SYSTEM				BRADFORD SYSTEM			TOTAL	
Activation by Storm Events (2019)							Upper Siphon	Middle Siphon	Emerson Street	Center Barrel Locke Street	Winter Street (Duncan Street)	Winter and Hale Street	Broadway Diversional	High Street Diversional	Lower Siphon	Main Street North	Bethany Avenue	Chestnut Street	Bradford Avenue	Middlesex Street		South Webster
Date	Marginal Pumping Station Rain Gage		ASPW Rain Gage		ASPW Operator Observed NOAA Rain Gage 1																	
01/01/2019	0.48	0.32	0.54	0.20	0.00	59				136,886											98	136,984
01/24/2019	0.88	0.52	1.18	0.48	1.01	55	229,903	1,279,118		838,609		53,307			511,923		6,710	4,491	121	508,131	133,173	3,565,486
																						-
02/24/2019	0.49	0.24	0.63	0.24	0.55	59				41,915												41,915
																						-
03/15/2019	0.36	0.44	0.41	0.40	0.37	41		240,771		79,523		6,826					4,493	1,099		224,396	6,044	563,151
																						-
04/12/2019	0.33	0.44	0.05	0.12	0.47	53				47,487		824					2,225			3,015		53,550
04/15/2019*	0.88	0.48			0.79	13		94,394		145,241		6,677					4,324	1,099		89,202	7,678	348,616
04/20/2019*	0.22	0.24	0.28	0.24	0.32	54				2,112												2,112
04/22/2019	1.06	0.36	0.96	0.32	1.19	64				102,020		1,441										103,461
04/23/2019	0.16	0.32	0.34	0.40	0.10	64				12,807												12,807
04/26/2019	0.76	0.52	0.79	0.52	1.56	63		148		114,950		7,407					5,649	2,908		40,037	2,806	173,906
04/27/2019	0.68	0.56	0.85	0.56	0.02	64		551,791		197,798	1,180	129,827					16,852	10,518		333,341	26,743	1,268,051
																						-
05/02/2019	0.44	0.48	0.64	0.60	0.20	61				51,232		9,391					7,185	2,780		2,950	556	74,095
05/19/2019	0.20	0.68	0.16	0.40	0.17	56				38,926		13,923					11,592	6,989		34,938		106,368
05/26/2019	0.11	0.40	0.17	0.48	0.00	41				2							6,132					6,134
05/28/2019	0.53	0.24	0.67	0.28	0.62	39											1,181					1,181
																						-
06/02/2019	0.83	0.56	0.93	0.76	0.90	51		9,941		177,187		25,944					38,095	3,930		31,703	4,122	290,920
06/05/2019	0.49	0.64	0.11	0.16	0.93					21,957		20,963					13,409	2,295		63,432	11,705	133,761
06/06/2019	0.57	1.12	0.85	0.88	0.00	51	344,903	818,627		335,321	32,413	428,547			96,333		64,743	25,031		491,561	20,952	2,658,430
06/11/2019	0.76	0.44	0.74	0.28	0.31	60				43,823							8,199	651		22,208		74,881
06/13/2019	0.63	0.40	0.67	0.36	0.56	62				49,411		311					7,219	1,386				58,327
06/20/2019	0.54	0.48	0.78	0.60	0.83	58				55,677		10,347					7,482	5,027		52,011	1,310	131,854
06/30/2019	0.32	0.68	0.22	0.52	0.00	59				48,095		67,044					12,208	11,338		33,482	2,362	174,529
																						-
07/06/2019	0.14	0.12	0.37	0.76	0.34	36				3,579												3,579
07/11/2019	0.91	1.44	0.52	0.76	0.89	59	893,997	522,008		189,928	13,451	235,369		927			49,258	15,698	52,906	387,179	18,985	2,379,706
07/12/2019	0.40	0.28	0.45	0.28	0.05	56				20,277												20,277
07/17/2019	0.93	1.92	0.90	1.84	0.95	65	357,228	652,925	4,761	170,641	12,905	372,834		4,687	42,287		122,767	35,785	61,341	679,325	30,376	2,547,861
07/22/2019	0.64	0.32	0.60	0.24	1.01	59				32,894							8,358				47,009	88,262
07/23/2019	1.03	0.40	1.20	0.40	0.62	63				122,418		4,125					33,592	1,578			132,984	294,696
																						-
08/07/2019	1.79	1.80	1.73	1.44	2.25	53		1,068,693		373,379	26,110	674,095				6,810	200,767	98,110	206,349	1,447,080		4,101,393
08/08/2019	0.2	0.56	0.63	0.88	0.09	53		290,972		69,974		13,404					14,690	1,329		214,530		604,900
08/13/2019	0.35	0.84	0.24	0.64	0.24	53				58,715	281	88,495					7,562	3,496		45,358		203,907
08/17/2019	0.35	0.68	0.40	1.48	0.46	54	44,480	30,470		39,165	3,326	64,385					9,933	12,586		119,274		323,620
08/18/2019	0.37	1.36	0.11	0.16	0.08	57		36,841		58,222	6,638	157,550					24,827	11,377		153,994		449,451
08/21/2019	1.12	1.84	1.03	1.96	1.13	62	934,012	978,480	12,682	318,450	63,027	566,878		566		38,053	135,792	49,180	184,963	1,112,791	33,505	4,428,380
08/28/2019	0.95	0.44			1.03	54				73,164		613					4,214					77,991
																						-
09/26/2019	0.34	0.36	0.48	0.48	0.43	55				17,656												17,656
																						-
10/07/2019	0.72	0.32	0.59	0.28	0.68	60				32,947											16,559	49,506
10/16/2019	0.45	0.40	0.14	0.12	2.35	64				30,169		1,715					1,559					33,443
10/17/2019	1.71	1.52	2.38	1.56	0.14	62	1,318,355	2,138,560		592,789	29,327	663,685			2,766,201		86,818	81,005	87,131	1,655,979	87,268	9,507,118
10/23/2019	0.75	1.24			0.54	65		741		80,112	16,889	60,889					13,623	18,809		110,781		301,843
10/27/2019	1.01	0.24	1.38	0.32	1.19	65				59,558												59,558
10/31/2019	0.29	0.20	0.48	0.24	0.40	42				2,855											60,446	63,301
																						-
11/24/2019	1.05	0.52	1.16	0.52	1.15	63				109,845		2,197					3,448				961	116,451
																						-
12/09/2019	0.74	0.28	0.67	0.28	0.64	53				2,094												2,094
12/14/2019	1.72	0.48	2.11	0.52	1.00	62	396,807	1,895,164		625,389		212,280			3,405,531		10,923	340		1,347,726	98,893	8,036,934
VOLUME TOTALS						4,519,685	10,609,643	17,443	5,625,201	205,547	3,901,295		6,180	6,822,275	44,864	945,831	408,835	592,810	9,204,424	744,533		43,648,567

Downstream Notification originally noted that this CSO discharged but FAS did not show a discharge.

CSO volume reported from 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

²ASPW Operator Observed Rain Gage is measured and reported from 7:00am 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.

*Flow assessment server down. No email notifications sent to city regarding CSOs

Appendix B

Appendix B
Monthly Summary Of CSO Activations for 2019

		UPPER SIPHON SYSTEM	MIDDLE SIPHON SYSTEM							LOWER SIPHON SYSTEM				BRADFORD SYSTEM		
			Outfall 21H				Outfall 38									
Monthly Parameters	Outfall #	024	021A	021B	021F	021G	21 H	037	038	013	019	040	041	032	034	039
	CSO Outfall Name	Upper Siphon - Varnum Street	Middle Siphon	Emerson Street	Center Barrel Locke Street	Winter Street	Winter Street and Hale Street	Broadway Diversional	High Street Diversion	Lower Siphon Buttonwoods Avenue	Main Street North	Bethany Avenue	Chestnut Street	Bradford Avenue	Middlesex Street	South Webster Street
	Latitude	42.76683934	42.77306431	42.77456839	42.77514354		42.77745193		42.77722968	42.77022981	42.77451679	42.77451183	42.7684245	42.77012127	42.77258144	42.7684245
	Longitude	71.09305991	71.07831599	71.08299865	71.08499858		71.08832429		71.08832202	71.06418695	71.07634348	71.07424297	71.06525865	71.08543396	71.07832295	71.06525865
	Receiving Water	Merrimack River	Little River	Little River	Little River	Little River	Little River	Little River	Little River	Merrimack River	Merrimack River	Merrimack River	Merrimack River	Merrimack River	Merrimack River	Merrimack River
January	Total Flows	229,903	1,279,118	0	975,495	ND	53,307	ND	ND	511,923	ND	6,710	4,491	121	508,131	133,271
	Total Hrs	0.45	3.75	0	6.67	ND	0.92	ND	ND	5.38	ND	0.25	0.25	0.08	4.25	6.50
	# Events	1	1	1	2	ND	1	ND	ND	1	ND	1	1	1	1	2
February	Total Flows	ND	ND	ND	41,915	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Total Hrs	ND	ND	ND	0.50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	# Events	ND	ND	ND	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
March	Total Flows	ND	240,771	ND	79,523	ND	6,826	ND	ND	ND	ND	4,493	1,099	ND	224,396	6,044
	Total Hrs	ND	1.25	ND	1.25	ND	0.25	ND	ND	ND	ND	0.08	0.08	ND	1.50	0.50
	# Events	ND	1	ND	1	ND	1	ND	ND	ND	ND	1	1	ND	1	1
April	Total Flows	ND	646,333	ND	622,416	1,180	146,176	ND	ND	ND	ND	29,049	14,525	ND	465,595	37,228
	Total Hrs	ND	2.83	ND	9.00	0.08	2.17	ND	ND	ND	ND	0.67	0.50	ND	1.25	1.67
	# Events	ND	3	ND	7	1	5	ND	ND	ND	ND	4	3	ND	4	3
May	Total Flows	ND	ND	ND	90,159	ND	23,315	ND	ND	ND	ND	26,090	9,769	ND	37,888	556
	Total Hrs	ND	ND	ND	1.33	ND	0.42	ND	ND	ND	ND	0.67	0.25	ND	0.17	0.08
	# Events	ND	ND	ND	3	ND	2	ND	ND	ND	ND	3	2	ND	2	1
June	Total Flows	344,903	828,568	ND	731,470	32,413	553,156	ND	ND	96,333	ND	151,354	49,659	ND	694,397	40,450
	Total Hrs	0.27	1.67	ND	7.42	0.33	2.58	ND	ND	0.29	ND	2.75	1.08	ND	1.58	1.50
	# Events	1	2	ND	6	1	5	ND	ND	1	ND	6	6	ND	5	4
July	Total Flows	1,251,225	1,174,932	4,761	539,738	26,356	612,328	ND	5614	42,287	ND	213,976	53,061	114,247	1,066,503	229,354
	Total Hrs	1.28	2.08	0.08	5.67	0.33	1.83	ND	0.17	0.05	ND	2.83	0.83	0.42	1.42	21.25
	# Events	2	3	1	5	2	3	ND	2	1	ND	2	3	2	2	3
August	Total Flows	978,492	2,405,455	12,682	991,071	99,382	1,565,421	ND	566	ND	44,864	397,786	176,078	391,312	3,093,028	33,505
	Total Hrs	0.84	5.08	0.17	8.42	1.25	3.83	ND	0.17	ND	0.33	2.58	2.42	0.83	3.75	1.00
	# Events	2	4	1	6	5	6	ND	1	ND	2	6	5	2	5	1
September	Total Flows	ND	ND	ND	17,656	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Total Hrs	ND	ND	ND	0.50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	# Events	ND	ND	ND	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
October	Total Flows	1,318,355	2,139,301	ND	798,430	46,216	726,290	ND	ND	2,766,201	ND	102,000	99,814	87,130	1,766,760	164,273
	Total Hrs	1.03	3.00	ND	7.00	0.92	3.58	ND	ND	1.44	ND	1.42	1.50	0.58	2.67	4.67
	# Events	1	2	ND	7	2	2	ND	ND	1	ND	2	2	1	2	4
November	Total Flows	ND	ND	ND	109,845	ND	2,197	ND	ND	ND	ND	3,448	ND	ND	ND	961
	Total Hrs	ND	ND	ND	2.17	ND	0.17	ND	ND	ND	ND	0.08	ND	ND	ND	0.17
	# Events	ND	ND	ND	1	ND	1	ND	ND	ND	ND	1	ND	ND	ND	1
December	Total Flows	396,807	1,895,164	ND	627,483	ND	212,280	ND	ND	3,405,531	ND	10,923	340	ND	1,347,726	98,893
	Total Hrs	15.73	5.42	ND	8.75	ND	2.58	ND	ND	15.07	ND	1.75	1.67	ND	2.42	3
	# Events	1	1	ND	2	ND	1	ND	ND	1	ND	1	1	ND	1	1

ND (No Discharge)

Appendix C

**APPENDIX C
CSO ACTIVATIONS**

CSO Outfall No.	CSO Outfall Name	Overflow Start	Overflow End	Volume (gals.)	CSO Duration (hr.)	Marginal Pumping Station Rain Gage				ASPW Rain Gage1				ASPW Operator Observed NOAA Rain Gage
						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 St	01/01/19 00:30:00	01/01/19 01:55:00	136,886	1.42	0.48	0.32	2.58	0.19	0.54	0.20	3.50	0.15	0.00
39	South Webster St	01/01/19 01:00:00	01/01/19 01:10:00	98	0.17	0.48	0.32	2.58	0.19	0.54	0.20	3.50	0.15	0.00
			STORM TOTAL:	136,984	Gallons									
39	South Webster St	01/24/19 11:40:00	01/24/19 16:35:00	102,630	4.92	0.88	0.52	5.75	0.15	1.18	0.48	10.25	0.12	1.01
021F	Center Barrel - Locke St	01/24/19 12:10:00	01/24/19 12:40:00	10,179	0.50	0.88	0.52	5.75	0.15	1.18	0.48	10.25	0.12	1.01
021F	Center Barrel - Locke St	01/24/19 13:30:00	01/24/19 16:30:00	447,136	3.00	0.88	0.52	5.75	0.15	1.18	0.48	10.25	0.12	1.01
021A	Middle Siphon	01/24/19 14:10:00	01/24/19 14:50:00	58,580	0.67	0.88	0.52	5.75	0.15	1.18	0.48	10.25	0.12	1.01
34	Middlesex St	01/24/19 14:50:00	01/24/19 19:05:00	508,131	4.25	0.88	0.52	5.75	0.15	1.18	0.48	10.25	0.12	1.01
41	Chestnut St	01/24/19 15:20:00	01/24/19 15:25:00	261	0.08	0.88	0.52	5.75	0.15	1.18	0.48	10.25	0.12	1.01
021H	Winter and Hale	01/24/19 15:25:00	01/24/19 15:50:00	5,736	0.42	0.88	0.52	5.75	0.15	1.18	0.48	10.25	0.12	1.01
13	Lower Siphon	01/24/19 15:40:45	01/24/19 21:03:30	511,923	5.38	0.88	0.52	5.75	0.15	1.18	0.48	10.25	0.12	1.01
021A	Middle Siphon	01/24/19 16:40:00	01/24/19 19:45:00	1,220,537	3.08	0.88	0.52	5.75	0.15	1.18	0.48	10.25	0.12	1.01
021F	Center Barrel - Locke St	01/24/19 17:20:00	01/24/19 19:05:00	381,294	1.75	0.88	0.52	5.75	0.15	1.18	0.48	10.25	0.12	1.01
39	South Webster St	01/24/19 17:25:00	01/24/19 18:50:00	30,543	1.42	0.88	0.52	5.75	0.15	1.18	0.48	10.25	0.12	1.01
021H	Winter and Hale	01/24/19 17:35:00	01/24/19 18:05:00	47,571	0.50	0.88	0.52	5.75	0.15	1.18	0.48	10.25	0.12	1.01
40	Bethany Ave	01/24/19 17:35:00	01/24/19 17:50:00	6,710	0.25	0.88	0.52	5.75	0.15	1.18	0.48	10.25	0.12	1.01
41	Chestnut St	01/24/19 17:40:00	01/24/19 17:50:00	4,230	0.17	0.88	0.52	5.75	0.15	1.18	0.48	10.25	0.12	1.01
32	Bradford Ave	01/24/19 17:45:00	01/24/19 17:50:00	121	0.08	0.88	0.52	5.75	0.15	1.18	0.48	10.25	0.12	1.01
24	Upper siphon	01/24/19 17:47:00	01/24/19 18:14:00	229,903	0.45	0.88	0.52	5.75	0.15	1.18	0.48	10.25	0.12	1.01
			STORM TOTAL:	3,565,485	Gallons									
021F	Middle Barrel Radio Market	02/24/19 12:40:00	02/24/19 13:10:00	41,915	0.50	0.49	0.24	3.50	0.14	0.63	0.24	6.75	0.09	0.55
			STORM TOTAL:	41,915	Gallons									
021F	Center Barrel - Locke St	03/15/19 21:00:00	03/15/19 22:15:00	79,523	1.25	0.36	0.44	1.50	0.24	0.41	0.40	2.00	0.21	0.37
021H	Winter and Hale	03/15/19 21:05:00	03/15/19 21:20:00	6,826	0.25	0.36	0.44	1.50	0.24	0.41	0.40	2.00	0.21	0.37
40	Bethany Ave	03/15/19 21:05:00	03/15/19 21:10:00	4,493	0.08	0.36	0.44	1.50	0.24	0.41	0.40	2.00	0.21	0.37
41	Chestnut St	03/15/19 21:05:00	03/15/19 21:10:00	1,099	0.08	0.36	0.44	1.50	0.24	0.41	0.40	2.00	0.21	0.37
39	South Webster St	03/15/19 21:10:00	03/15/19 21:15:00	759	0.08	0.36	0.44	1.50	0.24	0.41	0.40	2.00	0.21	0.37
34	Middlesex St	03/15/19 21:15:00	03/15/19 21:45:00	89,665	0.50	0.36	0.44	1.50	0.24	0.41	0.40	2.00	0.21	0.37
39	South Webster St	03/15/19 21:35:00	03/15/19 22:00:00	5,284	0.42	0.36	0.44	1.50	0.24	0.41	0.40	2.00	0.21	0.37
021A	Middle Siphon	03/15/19 21:45:00	03/15/19 23:00:00	240,771	1.25	0.36	0.44	1.50	0.24	0.41	0.40	2.00	0.21	0.37
34	Middlesex St	03/15/19 21:50:00	03/15/19 22:50:00	134,731	1.00	0.36	0.44	1.50	0.24	0.41	0.40	2.00	0.21	0.37
			STORM TOTAL:	563,151	Gallons									
40	Bethany Ave	04/12/19 22:55:00	04/12/19 23:00:00	2,004	0.08	0.33	0.44	1.25	0.26	0.05	0.12	0.75	0.07	0.47
34	Middlesex St	04/12/19 23:00:00	04/12/19 23:05:00	3,015	0.08	0.33	0.44	1.25	0.26	0.05	0.12	0.75	0.07	0.47
40	Bethany Ave	04/12/19 23:05:00	04/12/19 23:10:00	220	0.08	0.33	0.44	1.25	0.26	0.05	0.12	0.75	0.07	0.47
021F	Center Barrel - Locke St	04/12/19 23:10:00	04/12/19 23:45:00	47,487	0.58	0.33	0.44	1.25	0.26	0.05	0.12	0.75	0.07	0.47
021H	Winter and Hale	04/12/19 23:15:00	04/12/19 23:25:00	824	0.17	0.33	0.44	1.25	0.26	0.05	0.12	0.75	0.07	0.47
			STORM TOTAL:	53,550	Gallons									
021F	Center Barrel - Locke St	04/15/19 05:25:00	04/15/19 07:15:00	119,222	1.83	0.88	0.48	3.67	0.24					0.79
021H	Winter and Hale	04/15/19 05:35:00	04/15/19 05:40:00	546	0.08	0.88	0.48	3.67	0.24					0.79
021H	Winter and Hale	04/15/19 05:45:00	04/15/19 06:00:00	6,088	0.25	0.88	0.48	3.67	0.24					0.79
34	Middlesex St	04/15/19 05:45:00	04/15/19 05:50:00	39,002	0.08	0.88	0.48	3.67	0.24					0.79
39	South Webster St	04/15/19 05:45:00	04/15/19 06:00:00	7,678	0.25	0.88	0.48	3.67	0.24					0.79
40	Bethany Ave	04/15/19 05:45:00	04/15/19 05:55:00	4,324	0.17	0.88	0.48	3.67	0.24					0.79
41	Chestnut St	04/15/19 05:45:00	04/15/19 05:50:00	1,099	0.08	0.88	0.48	3.67	0.24					0.79
021A	Middle Siphon	04/15/19 06:05:00	04/15/19 06:15:00	14,849	0.17	0.88	0.48	3.67	0.24					0.79

**APPENDIX C
CSO ACTIVATIONS**

CSO Outfall No.	CSO Outfall Name	Overflow Start	Overflow End	Volume (gals.)	CSO Duration (hr.)	Marginal Pumping Station Rain Gage				ASPW Rain Gage1				ASPW Operator Observed NOAA Rain Gage
						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	04/15/19 06:20:00	04/15/19 07:25:00	79,545	1.08	0.88	0.48	3.67	0.24					0.79
34	Middlesex St	04/15/19 06:25:00	04/15/19 06:35:00	50,201	0.17	0.88	0.48	3.67	0.24					0.79
021F	Center Barrel - Locke St	04/15/19 14:25:00	04/15/19 14:50:00	26,019	0.42	0.88	0.48	3.67	0.24					0.79
021H	Winter and Hale	04/15/19 14:25:00	04/15/19 14:30:00	44	0.08	0.88	0.48	3.67	0.24					0.79
			STORM TOTAL:	348,616	Gallons									
021F	Center Barrel - Locke St	04/20/19 10:25:00	04/20/19 10:40:00	2,112	0.25	0.22	0.24	1.25	0.18	0.28	0.24	3.00	0.09	0.32
			STORM TOTAL:	2,112	Gallons									
021F	Center Barrel - Locke St	04/22/19 14:40:00	04/22/19 14:55:00	13,557	0.25	1.06	0.36	5.67	0.19	0.96	0.32	6.75	0.14	1.19
021F	Center Barrel - Locke St	04/22/19 19:30:00	04/22/19 19:50:00	7,122	0.33	1.06	0.36	5.67	0.19	0.96	0.32	6.75	0.14	1.19
021F	Center Barrel - Locke St	04/22/19 20:55:00	04/22/19 21:40:00	55,478	0.75	1.06	0.36	5.67	0.19	0.96	0.32	6.75	0.14	1.19
021H	Winter and Hale	04/22/19 21:15:00	04/22/19 21:30:00	1,441	0.25	1.06	0.36	5.67	0.19	0.96	0.32	6.75	0.14	1.19
021F	Center Barrel - Locke St	04/22/19 23:15:00	04/23/19 00:05:00	31,184	0.83	1.06	0.36	5.67	0.19	0.96	0.32	6.75	0.14	1.19
021F	Center Barrel - Locke St	04/23/19 00:10:00	04/23/19 00:25:00	7,487	0.25	0.16	0.32	0.83	0.19	0.34	0.40	2.75	0.12	0.10
			STORM TOTAL:	116,268	Gallons									
021F	Center Barrel - Locke St	04/26/19 19:15:00	04/26/19 20:50:00	114,950	1.58	0.76	0.52	3.33	0.23	0.79	0.52	6.00	0.13	1.56
34	Middlesex St	04/26/19 19:15:00	04/26/19 19:20:00	40,037	0.08	0.76	0.52	3.33	0.23	0.79	0.52	6.00	0.13	1.56
40	Bethany Ave	04/26/19 19:15:00	04/26/19 19:20:00	5,649	0.08	0.76	0.52	3.33	0.23	0.79	0.52	6.00	0.13	1.56
41	Chestnut St	04/26/19 19:15:00	04/26/19 19:20:00	2,908	0.08	0.76	0.52	3.33	0.23	0.79	0.52	6.00	0.13	1.56
39	South Webster St	04/26/19 19:20:00	04/26/19 19:40:00	1,876	0.33	0.76	0.52	3.33	0.23	0.79	0.52	6.00	0.13	1.56
021H	Winter and Hale	04/26/19 19:25:00	04/26/19 19:45:00	6,283	0.33	0.76	0.52	3.33	0.23	0.79	0.52	6.00	0.13	1.56
021H	Winter and Hale	04/26/19 20:00:00	04/26/19 20:10:00	1,125	0.17	0.76	0.52	3.33	0.23	0.79	0.52	6.00	0.13	1.56
39	South Webster St	04/26/19 20:00:00	04/26/19 20:15:00	931	0.25	0.76	0.52	3.33	0.23	0.79	0.52	6.00	0.13	1.56
021A	Middle Siphon	04/26/19 20:10:00	04/26/19 20:15:00	148	0.08	0.76	0.52	3.33	0.23	0.79	0.52	6.00	0.13	1.56
021F	Center Barrel - Locke St	04/27/19 00:05:00	04/27/19 01:05:00	103,341	1.00	0.68	0.56	2.42	0.28	0.85	0.56	4.00	0.21	0.02
021H	Winter and Hale	04/27/19 00:15:00	04/27/19 00:40:00	75,359	0.42	0.68	0.56	2.42	0.28	0.85	0.56	4.00	0.21	0.02
34	Middlesex St	04/27/19 00:15:00	04/27/19 00:25:00	80,592	0.17	0.68	0.56	2.42	0.28	0.85	0.56	4.00	0.21	0.02
40	Bethany Ave	04/27/19 00:15:00	04/27/19 00:25:00	11,487	0.17	0.68	0.56	2.42	0.28	0.85	0.56	4.00	0.21	0.02
41	Chestnut St	04/27/19 00:15:00	04/27/19 00:25:00	7,532	0.17	0.68	0.56	2.42	0.28	0.85	0.56	4.00	0.21	0.02
39	South Webster St	04/27/19 00:15:00	04/27/19 00:35:00	12,871	0.33	0.68	0.56	2.42	0.28	0.85	0.56	4.00	0.21	0.02
021A	Middle Siphon	04/27/19 00:20:00	04/27/19 00:40:00	74,903	0.33	0.68	0.56	2.42	0.28	0.85	0.56	4.00	0.21	0.02
021F	Center Barrel - Locke St	04/27/19 01:40:00	04/27/19 02:35:00	94,457	0.92	0.68	0.56	2.42	0.28	0.85	0.56	4.00	0.21	0.02
021A	Middle Siphon	04/27/19 01:50:00	04/27/19 03:00:00	476,888	1.17	0.68	0.56	2.42	0.28	0.85	0.56	4.00	0.21	0.02
021H	Winter and Hale	04/27/19 01:50:00	04/27/19 02:15:00	54,468	0.42	0.68	0.56	2.42	0.28	0.85	0.56	4.00	0.21	0.02
34	Middlesex St	04/27/19 01:50:00	04/27/19 02:30:00	252,749	0.67	0.68	0.56	2.42	0.28	0.85	0.56	4.00	0.21	0.02
39	South Webster St	04/27/19 01:50:00	04/27/19 02:20:00	13,873	0.50	0.68	0.56	2.42	0.28	0.85	0.56	4.00	0.21	0.02
41	Chestnut St	04/27/19 01:50:00	04/27/19 02:00:00	2,987	0.17	0.68	0.56	2.42	0.28	0.85	0.56	4.00	0.21	0.02
021G	Winter St	04/27/19 01:55:00	04/27/19 02:00:00	1,180	0.08	0.68	0.56	2.42	0.28	0.85	0.56	4.00	0.21	0.02
40	Bethany Ave	04/27/19 01:55:00	04/27/19 02:00:00	5,365	0.08	0.68	0.56	2.42	0.28	0.85	0.56	4.00	0.21	0.02
			STORM TOTAL:	1,441,956	Gallons									
021F	Center Barrel - Locke St	05/02/19 01:05:00	05/02/19 01:50:00	51,232	0.75	0.44	0.48	2.50	0.18	0.64	0.60	6.00	0.11	0.20
40	Bethany Ave	05/02/19 01:05:00	05/02/19 01:15:00	7,185	0.17	0.44	0.48	2.50	0.18	0.64	0.60	6.00	0.11	0.20
41	Chestnut St	05/02/19 01:05:00	05/02/19 01:10:00	2,780	0.08	0.44	0.48	2.50	0.18	0.64	0.60	6.00	0.11	0.20
021H	Winter and Hale	05/02/19 01:10:00	05/02/19 01:20:00	9,391	0.17	0.44	0.48	2.50	0.18	0.64	0.60	6.00	0.11	0.20
34	Middlesex St	05/02/19 01:10:00	05/02/19 01:15:00	2,950	0.08	0.44	0.48	2.50	0.18	0.64	0.60	6.00	0.11	0.20
39	South Webster St	05/02/19 01:10:00	05/02/19 01:15:00	556	0.08	0.44	0.48	2.50	0.18	0.64	0.60	6.00	0.11	0.20
			STORM TOTAL:	74,095	Gallons									
40	Bethany Ave	05/19/19 09:50:00	05/19/19 10:05:00	11,592	0.25	0.20	0.68	0.50	0.40	0.16	0.40	1.00	0.16	0.17

**APPENDIX C
CSO ACTIVATIONS**

CSO Outfall No.	CSO Outfall Name	Overflow Start	Overflow End	Volume (gals.)	CSO Duration (hr.)	Marginal Pumping Station Rain Gage				ASPW Rain Gage1				ASPW Operator Observed NOAA Rain Gage
						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 St	05/19/19 09:55:00	05/19/19 10:25:00	38,926	0.50	0.20	0.68	0.50	0.40	0.16	0.40	1.00	0.16	0.17
34	Middlesex St	05/19/19 09:55:00	05/19/19 10:00:00	34,938	0.08	0.20	0.68	0.50	0.40	0.16	0.40	1.00	0.16	0.17
41	Chestnut St	05/19/19 09:55:00	05/19/19 10:05:00	6,989	0.17	0.20	0.68	0.50	0.40	0.16	0.40	1.00	0.16	0.17
021H	Winter and Hale	05/19/19 10:00:00	05/19/19 10:15:00	13,923	0.25	0.20	0.68	0.50	0.40	0.16	0.40	1.00	0.16	0.17
			STORM TOTAL:	106,368	Gallons									
40	Bethany Ave	05/26/19 00:40:00	05/26/19 00:50:00	6,132	0.17	0.11	0.40	0.25	0.44	0.17	0.48	0.75	0.23	0.00
021F	Center Barrel - Locke St	05/26/19 00:45:00	05/26/19 00:50:00	2	0.08	0.11	0.40	0.25	0.44	0.17	0.48	0.75	0.23	0.00
			STORM TOTAL:	6,134	Gallons									
40	Bethany Ave	05/28/19 17:25:00	05/28/19 17:30:00	1,181	0.08	0.53	0.24	4.17	0.13	0.67	0.28	8.25	0.08	0.62
			STORM TOTAL:	1,181	Gallons									
40	Bethany Ave	06/02/19 16:45:00	06/02/19 17:00:00	6,617	0.25	0.83	0.56	2.33	0.36	0.93	0.76	3.25	0.29	0.90
021F	Center Barrel - Locke St	06/02/19 16:50:00	06/02/19 17:45:00	68,240	0.92	0.83	0.56	2.33	0.36	0.93	0.76	3.25	0.29	0.90
021H	Winter and Hale	06/02/19 16:55:00	06/02/19 17:05:00	3,331	0.17	0.83	0.56	2.33	0.36	0.93	0.76	3.25	0.29	0.90
40	Bethany Ave	06/02/19 17:15:00	06/02/19 17:25:00	3,330	0.17	0.83	0.56	2.33	0.36	0.93	0.76	3.25	0.29	0.90
40	Bethany Ave	06/02/19 21:00:00	06/02/19 21:05:00	2,004	0.08	0.83	0.56	2.33	0.36	0.93	0.76	3.25	0.29	0.90
021F	Center Barrel - Locke St	06/02/19 21:20:00	06/02/19 22:30:00	108,947	1.17	0.83	0.56	2.33	0.36	0.93	0.76	3.25	0.29	0.90
40	Bethany Ave	06/02/19 21:20:00	06/02/19 21:35:00	8,528	0.25	0.83	0.56	2.33	0.36	0.93	0.76	3.25	0.29	0.90
41	Chestnut St	06/02/19 21:25:00	06/02/19 21:30:00	1,022	0.08	0.83	0.56	2.33	0.36	0.93	0.76	3.25	0.29	0.90
40	Bethany Ave	06/02/19 21:40:00	06/02/19 21:50:00	10,510	0.17	0.83	0.56	2.33	0.36	0.93	0.76	3.25	0.29	0.90
34	Middlesex St	06/02/19 21:40:00	06/02/19 21:45:00	31,703	0.08	0.83	0.56	2.33	0.36	0.93	0.76	3.25	0.29	0.90
39	South Webster St	06/02/19 21:40:00	06/02/19 21:50:00	4,121	0.17	0.83	0.56	2.33	0.36	0.93	0.76	3.25	0.29	0.90
41	Chestnut St	06/02/19 21:40:00	06/02/19 21:45:00	2,908	0.08	0.83	0.56	2.33	0.36	0.93	0.76	3.25	0.29	0.90
021H	Winter and Hale	06/02/19 22:00:00	06/02/19 22:20:00	22,613	0.33	0.83	0.56	2.33	0.36	0.93	0.76	3.25	0.29	0.90
40	Bethany Ave	06/02/19 22:00:00	06/02/19 22:10:00	7,105	0.17	0.83	0.56	2.33	0.36	0.93	0.76	3.25	0.29	0.90
021A	Middle Siphon	06/02/19 22:05:00	06/02/19 22:20:00	9,941	0.25	0.83	0.56	2.33	0.36	0.93	0.76	3.25	0.29	0.90
			STORM TOTAL:	290,920	Gallons									
40	Bethany Ave	06/05/19 22:30:00	06/05/19 22:35:00	951	0.08	0.49	0.64	1.33	0.37	0.11	0.16	1.00	0.11	0.93
021F	Center Barrel - Locke St	06/05/19 23:00:00	06/05/19 23:05:00	1,113	0.08	0.49	0.64	1.33	0.37	0.11	0.16	1.00	0.11	0.93
40	Bethany Ave	06/05/19 23:00:00	06/05/19 23:05:00	2,749	0.08	0.49	0.64	1.33	0.37	0.11	0.16	1.00	0.11	0.93
021F	Center Barrel - Locke St	06/05/19 23:40:00	06/06/19 01:30:00	356,165	1.83	0.49	0.64	1.33	0.37	0.11	0.16	1.00	0.11	0.93
34	Middlesex St	06/05/19 23:40:00	06/05/19 23:50:00	63,432	0.17	0.49	0.64	1.33	0.37	0.11	0.16	1.00	0.11	0.93
39	South Webster St	06/05/19 23:40:00	06/06/19 00:00:00	13,562	0.33	0.49	0.64	1.33	0.37	0.11	0.16	1.00	0.11	0.93
40	Bethany Ave	06/05/19 23:40:00	06/05/19 23:55:00	9,709	0.25	0.49	0.64	1.33	0.37	0.11	0.16	1.00	0.11	0.93
021H	Winter and Hale	06/05/19 23:45:00	06/06/19 00:05:00	37,417	0.33	0.49	0.64	1.33	0.37	0.11	0.16	1.00	0.11	0.93
41	Chestnut St	06/05/19 23:45:00	06/05/19 23:50:00	2,295	0.08	0.49	0.64	1.33	0.37	0.11	0.16	1.00	0.11	0.93
021H	Winter and Hale	06/06/19 00:15:00	06/06/19 01:00:00	366,760	0.75	0.57	1.12	1.25	0.46	0.85	0.88	3.00	0.28	0.00
34	Middlesex St	06/06/19 00:15:00	06/06/19 00:30:00	122,575	0.25	0.57	1.12	1.25	0.46	0.85	0.88	3.00	0.28	0.00
40	Bethany Ave	06/06/19 00:15:00	06/06/19 00:25:00	10,035	0.17	0.57	1.12	1.25	0.46	0.85	0.88	3.00	0.28	0.00
41	Chestnut St	06/06/19 00:15:00	06/06/19 00:25:00	6,292	0.17	0.57	1.12	1.25	0.46	0.85	0.88	3.00	0.28	0.00
021A	Middle Siphon	06/06/19 00:20:00	06/06/19 01:45:00	818,627	1.42	0.57	1.12	1.25	0.46	0.85	0.88	3.00	0.28	0.00
39	South Webster St	06/06/19 00:20:00	06/06/19 01:00:00	19,095	0.67	0.57	1.12	1.25	0.46	0.85	0.88	3.00	0.28	0.00
021G	Winter St	06/06/19 00:35:00	06/06/19 00:55:00	32,413	0.33	0.57	1.12	1.25	0.46	0.85	0.88	3.00	0.28	0.00
34	Middlesex St	06/06/19 00:35:00	06/06/19 01:20:00	368,986	0.75	0.57	1.12	1.25	0.46	0.85	0.88	3.00	0.28	0.00
40	Bethany Ave	06/06/19 00:35:00	06/06/19 00:55:00	54,708	0.33	0.57	1.12	1.25	0.46	0.85	0.88	3.00	0.28	0.00
41	Chestnut St	06/06/19 00:35:00	06/06/19 00:50:00	18,739	0.25	0.57	1.12	1.25	0.46	0.85	0.88	3.00	0.28	0.00
021H	Winter and Hale	06/06/19 01:05:00	06/06/19 01:20:00	45,332	0.25	0.57	1.12	1.25	0.46	0.85	0.88	3.00	0.28	0.00
24	Upper siphon	06/06/19 01:08:00	06/06/19 01:09:00	1,974	0.02	0.57	1.12	1.25	0.46	0.85	0.88	3.00	0.28	0.00
24	Upper siphon	06/06/19 01:42:00	06/06/19 01:57:15	342,929	0.25	0.57	1.12	1.25	0.46	0.85	0.88	3.00	0.28	0.00

**APPENDIX C
CSO ACTIVATIONS**

CSO Outfall No.	CSO Outfall Name	Overflow Start	Overflow End	Volume (gals.)	CSO Duration (hr.)	Marginal Pumping Station Rain Gage				ASPW Rain Gage1				ASPW Operator Observed NOAA Rain Gage
						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.)
13	Lower Siphon	06/06/19 01:47:45	06/06/19 02:05:15	96,333	0.29	0.57	1.12	1.25	0.46	0.85	0.88	3.00	0.28	0.00
			STORM TOTAL:	2,792,191	Gallons									
021F	Center Barrel - Locke St	06/11/19 01:25:00	06/11/19 02:05:00	28,331	0.67	0.76	0.44	4.25	0.18	0.74	0.28	7.75	0.10	0.31
40	Bethany Ave	06/11/19 01:25:00	06/11/19 01:30:00	4,058	0.08	0.76	0.44	4.25	0.18	0.74	0.28	7.75	0.10	0.31
021F	Center Barrel - Locke St	06/11/19 05:25:00	06/11/19 05:45:00	15,492	0.33	0.76	0.44	4.25	0.18	0.74	0.28	7.75	0.10	0.31
34	Middlesex St	06/11/19 05:25:00	06/11/19 05:30:00	22,208	0.08	0.76	0.44	4.25	0.18	0.74	0.28	7.75	0.10	0.31
40	Bethany Ave	06/11/19 05:25:00	06/11/19 05:30:00	4,140	0.08	0.76	0.44	4.25	0.18	0.74	0.28	7.75	0.10	0.31
41	Chestnut St	06/11/19 05:25:00	06/11/19 05:30:00	651	0.08	0.76	0.44	4.25	0.18	0.74	0.28	7.75	0.10	0.31
			STORM TOTAL:	74,881	Gallons									
021F	Center Barrel - Locke St	06/13/19 12:20:00	06/13/19 13:00:00	39,363	0.67	0.63	0.40	3.17	0.20	0.67	0.36	5.50	0.12	0.56
40	Bethany Ave	06/13/19 12:35:00	06/13/19 12:40:00	7,219	0.08	0.63	0.40	3.17	0.20	0.67	0.36	5.50	0.12	0.56
41	Chestnut St	06/13/19 12:35:00	06/13/19 12:40:00	1,386	0.08	0.63	0.40	3.17	0.20	0.67	0.36	5.50	0.12	0.56
021H	Winter and Hale	06/13/19 12:45:00	06/13/19 12:50:00	311	0.08	0.63	0.40	3.17	0.20	0.67	0.36	5.50	0.12	0.56
021F	Center Barrel - Locke St	06/13/19 15:05:00	06/13/19 15:25:00	10,047	0.33	0.63	0.40	3.17	0.20	0.67	0.36	5.50	0.12	0.56
			STORM TOTAL:	58,327	Gallons									
021F	Center Barrel - Locke St	06/20/19 11:45:00	06/20/19 11:55:00	3,605	0.17	0.54	0.48	2.58	0.21	0.78	0.60	4.75	0.16	0.83
021F	Center Barrel - Locke St	06/20/19 12:10:00	06/20/19 12:35:00	29,265	0.42	0.54	0.48	2.58	0.21	0.78	0.60	4.75	0.16	0.83
34	Middlesex St	06/20/19 12:10:00	06/20/19 12:15:00	45,905	0.08	0.54	0.48	2.58	0.21	0.78	0.60	4.75	0.16	0.83
40	Bethany Ave	06/20/19 12:10:00	06/20/19 12:15:00	4,086	0.08	0.54	0.48	2.58	0.21	0.78	0.60	4.75	0.16	0.83
41	Chestnut St	06/20/19 12:10:00	06/20/19 12:15:00	5,027	0.08	0.54	0.48	2.58	0.21	0.78	0.60	4.75	0.16	0.83
39	South Webster St	06/20/19 12:15:00	06/20/19 12:20:00	46	0.08	0.54	0.48	2.58	0.21	0.78	0.60	4.75	0.16	0.83
021H	Winter and Hale	06/20/19 12:20:00	06/20/19 12:25:00	77	0.08	0.54	0.48	2.58	0.21	0.78	0.60	4.75	0.16	0.83
40	Bethany Ave	06/20/19 16:05:00	06/20/19 16:15:00	3,396	0.17	0.54	0.48	2.58	0.21	0.78	0.60	4.75	0.16	0.83
021F	Center Barrel - Locke St	06/20/19 16:10:00	06/20/19 16:30:00	22,806	0.33	0.54	0.48	2.58	0.21	0.78	0.60	4.75	0.16	0.83
021H	Winter and Hale	06/20/19 16:10:00	06/20/19 16:25:00	10,270	0.25	0.54	0.48	2.58	0.21	0.78	0.60	4.75	0.16	0.83
34	Middlesex St	06/20/19 16:10:00	06/20/19 16:15:00	6,107	0.08	0.54	0.48	2.58	0.21	0.78	0.60	4.75	0.16	0.83
39	South Webster St	06/20/19 16:10:00	06/20/19 16:15:00	1,264	0.08	0.54	0.48	2.58	0.21	0.78	0.60	4.75	0.16	0.83
			STORM TOTAL:	131,854	Gallons									
021F	Center Barrel - Locke St	06/30/19 13:00:00	06/30/19 13:30:00	48,095	0.50	0.32	0.68	0.58	0.55	0.22	0.52	1.25	0.18	0.00
40	Bethany Ave	06/30/19 13:00:00	06/30/19 13:15:00	12,208	0.25	0.32	0.68	0.58	0.55	0.22	0.52	1.25	0.18	0.00
41	Chestnut St	06/30/19 13:00:00	06/30/19 13:10:00	11,338	0.17	0.32	0.68	0.58	0.55	0.22	0.52	1.25	0.18	0.00
021H	Winter and Hale	06/30/19 13:05:00	06/30/19 13:25:00	67,044	0.33	0.32	0.68	0.58	0.55	0.22	0.52	1.25	0.18	0.00
34	Middlesex St	06/30/19 13:05:00	06/30/19 13:10:00	33,482	0.08	0.32	0.68	0.58	0.55	0.22	0.52	1.25	0.18	0.00
39	South Webster St	06/30/19 13:10:00	06/30/19 13:20:00	2,362	0.17	0.32	0.68	0.58	0.55	0.22	0.52	1.25	0.18	0.00
			STORM TOTAL:	174,529	Gallons									
021F	Center Barrel - Locke St	07/06/19 15:15:00	07/06/19 15:25:00	3,579	0.17	0.14	0.12	1.00	0.14	0.37	0.76	2.50	0.15	0.34
			STORM TOTAL:	3,579	Gallons									
021A	Middle Siphon	07/11/19 14:15:00	07/11/19 14:55:00	374,610	0.67	0.91	1.44	1.75	0.52	0.52	0.76	2.50	0.21	0.89
021F	Center Barrel - Locke St	07/11/19 14:15:00	07/11/19 15:45:00	189,928	1.50	0.91	1.44	1.75	0.52	0.52	0.76	2.50	0.21	0.89
021G	Winter St	07/11/19 14:15:00	07/11/19 14:25:00	13,451	0.17	0.91	1.44	1.75	0.52	0.52	0.76	2.50	0.21	0.89
021H	Winter and Hale	07/11/19 14:15:00	07/11/19 14:45:00	181,402	0.50	0.91	1.44	1.75	0.52	0.52	0.76	2.50	0.21	0.89
32	Bradford Ave	07/11/19 14:15:00	07/11/19 14:30:00	52,906	0.25	0.91	1.44	1.75	0.52	0.52	0.76	2.50	0.21	0.89
34	Middlesex St	07/11/19 14:15:00	07/11/19 14:40:00	293,853	0.42	0.91	1.44	1.75	0.52	0.52	0.76	2.50	0.21	0.89
38	High St	07/11/19 14:15:00	07/11/19 14:20:00	927	0.08	0.91	1.44	1.75	0.52	0.52	0.76	2.50	0.21	0.89
39	South Webster St	07/11/19 14:15:00	07/11/19 14:45:00	18,985	0.50	0.91	1.44	1.75	0.52	0.52	0.76	2.50	0.21	0.89
40	Bethany Ave	07/11/19 14:15:00	07/11/19 14:35:00	41,134	0.33	0.91	1.44	1.75	0.52	0.52	0.76	2.50	0.21	0.89
41	Chestnut St	07/11/19 14:15:00	07/11/19 14:30:00	15,667	0.25	0.91	1.44	1.75	0.52	0.52	0.76	2.50	0.21	0.89
021H	Winter and Hale	07/11/19 15:10:00	07/11/19 15:35:00	53,967	0.42	0.91	1.44	1.75	0.52	0.52	0.76	2.50	0.21	0.89

**APPENDIX C
CSO ACTIVATIONS**

CSO Outfall No.	CSO Outfall Name	Overflow Start	Overflow End	Volume (gals.)	CSO Duration (hr.)	Marginal Pumping Station Rain Gage				ASPW Rain Gage1				ASPW Operator Observed NOAA Rain Gage
						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.)
34	Middlesex St	07/11/19 15:10:00	07/11/19 15:25:00	93,325	0.25	0.91	1.44	1.75	0.52	0.52	0.76	2.50	0.21	0.89
40	Bethany Ave	07/11/19 15:10:00	07/11/19 15:20:00	8,124	0.17	0.91	1.44	1.75	0.52	0.52	0.76	2.50	0.21	0.89
021A	Middle Siphon	07/11/19 15:10:00	07/11/19 15:40:00	147,398	0.50	0.91	1.44	1.75	0.52	0.52	0.76	2.50	0.21	0.89
41	Chestnut St	07/11/19 15:15:00	07/11/19 15:20:00	31	0.08	0.91	1.44	1.75	0.52	0.52	0.76	2.50	0.21	0.89
24	Upper siphon	07/11/19 15:22:16	07/11/19 16:23:04	893,997	1.01	0.91	1.44	1.75	0.52	0.52	0.76	2.50	0.21	0.89
			STORM TOTAL:	2,379,706	Gallons									
021F	Center Barrel - Locke St	07/12/19 02:05:00	07/12/19 02:40:00	20,277	0.58	0.40	0.28	2.33	0.17	0.45	0.28	4.00	0.11	0.05
			STORM TOTAL:	20,277	Gallons									
021A	Middle Siphon	07/17/19 15:05:00	07/17/19 15:55:00	650,840	0.83	0.93	1.92	1.42	0.66	0.90	1.84	3.25	0.28	0.95
021B	Emerson St	07/17/19 15:05:00	07/17/19 15:10:00	4,761	0.08	0.93	1.92	1.42	0.66	0.90	1.84	3.25	0.28	0.95
021F	Center Barrel - Locke St	07/17/19 15:05:00	07/17/19 15:45:00	170,641	0.67	0.93	1.92	1.42	0.66	0.90	1.84	3.25	0.28	0.95
021G	Winter St	07/17/19 15:05:00	07/17/19 15:15:00	12,905	0.17	0.93	1.92	1.42	0.66	0.90	1.84	3.25	0.28	0.95
021H	Winter and Hale	07/17/19 15:05:00	07/17/19 15:35:00	372,834	0.50	0.93	1.92	1.42	0.66	0.90	1.84	3.25	0.28	0.95
34	Middlesex St	07/17/19 15:05:00	07/17/19 15:50:00	679,325	0.75	0.93	1.92	1.42	0.66	0.90	1.84	3.25	0.28	0.95
38	High St	07/17/19 15:05:00	07/17/19 15:10:00	4,687	0.08	0.93	1.92	1.42	0.66	0.90	1.84	3.25	0.28	0.95
39	South Webster St	07/17/19 15:05:00	07/17/19 16:00:00	30,376	0.92	0.93	1.92	1.42	0.66	0.90	1.84	3.25	0.28	0.95
40	Bethany Ave	07/17/19 15:05:00	07/17/19 15:30:00	122,767	0.42	0.93	1.92	1.42	0.66	0.90	1.84	3.25	0.28	0.95
41	Chestnut St	07/17/19 15:05:00	07/17/19 15:30:00	35,785	0.42	0.93	1.92	1.42	0.66	0.90	1.84	3.25	0.28	0.95
32	Bradford Ave	07/17/19 15:20:00	07/17/19 15:30:00	61,341	0.17	0.93	1.92	1.42	0.66	0.90	1.84	3.25	0.28	0.95
24	Upper siphon	07/17/19 16:20:04	07/17/19 16:36:08	357,228	0.27	0.93	1.92	1.42	0.66	0.90	1.84	3.25	0.28	0.95
13	Lower Siphon	07/17/19 16:31:20	07/17/19 16:34:32	42,287	0.05	0.93	1.92	1.42	0.66	0.90	1.84	3.25	0.28	0.95
021A	Middle Siphon	07/17/19 16:55:00	07/17/19 17:00:00	2,085	0.08	0.93	1.92	1.42	0.66	0.90	1.84	3.25	0.28	0.95
			STORM TOTAL:	2,547,861	Gallons									
39	South Webster St	07/22/19 15:20:00	07/22/19 15:35:00	1,429	0.25	0.64	0.32	4.08	0.16	0.60	0.24	6.00	0.10	1.01
40	Bethany Ave	07/22/19 15:25:00	07/22/19 15:35:00	732	0.17	0.64	0.32	4.08	0.16	0.60	0.24	6.00	0.10	1.01
39	South Webster St	07/22/19 17:40:00	07/23/19 13:15:00	178,564	19.58	0.64	0.32	4.08	0.16	0.60	0.24	6.00	0.10	1.01
021F	Center Barrel - Locke St	07/22/19 21:35:00	07/22/19 22:20:00	32,894	0.75	0.64	0.32	4.08	0.16	0.60	0.24	6.00	0.10	1.01
40	Bethany Ave	07/22/19 21:40:00	07/22/19 22:05:00	7,626	0.42	0.64	0.32	4.08	0.16	0.60	0.24	6.00	0.10	1.01
40	Bethany Ave	07/23/19 02:05:00	07/23/19 02:15:00	1,462	0.17	1.03	0.40	5.42	0.19	1.20	0.40	9.50	0.13	0.62
021F	Center Barrel - Locke St	07/23/19 02:15:00	07/23/19 02:30:00	9,535	0.25	1.03	0.40	5.42	0.19	1.20	0.40	9.50	0.13	0.62
021F	Center Barrel - Locke St	07/23/19 03:25:00	07/23/19 03:45:00	21,207	0.33	1.03	0.40	5.42	0.19	1.20	0.40	9.50	0.13	0.62
41	Chestnut St	07/23/19 03:25:00	07/23/19 03:30:00	1,578	0.08	1.03	0.40	5.42	0.19	1.20	0.40	9.50	0.13	0.62
40	Bethany Ave	07/23/19 03:25:00	07/23/19 03:35:00	8,336	0.17	1.03	0.40	5.42	0.19	1.20	0.40	9.50	0.13	0.62
40	Bethany Ave	07/23/19 05:05:00	07/23/19 05:35:00	15,094	0.50	1.03	0.40	5.42	0.19	1.20	0.40	9.50	0.13	0.62
021F	Center Barrel - Locke St	07/23/19 05:10:00	07/23/19 05:50:00	47,796	0.67	1.03	0.40	5.42	0.19	1.20	0.40	9.50	0.13	0.62
021H	Winter and Hale	07/23/19 05:20:00	07/23/19 05:35:00	3,602	0.25	1.03	0.40	5.42	0.19	1.20	0.40	9.50	0.13	0.62
40	Bethany Ave	07/23/19 06:10:00	07/23/19 06:40:00	8,700	0.50	1.03	0.40	5.42	0.19	1.20	0.40	9.50	0.13	0.62
021F	Center Barrel - Locke St	07/23/19 06:15:00	07/23/19 07:00:00	43,880	0.75	1.03	0.40	5.42	0.19	1.20	0.40	9.50	0.13	0.62
021H	Winter and Hale	07/23/19 06:30:00	07/23/19 06:40:00	522	0.17	1.03	0.40	5.42	0.19	1.20	0.40	9.50	0.13	0.62
			STORM TOTAL:	382,958	Gallons									
40	Bethany Ave	08/07/19 20:40:00	08/07/19 20:45:00	654	0.08	1.79	1.80	3.42	0.52	1.73	1.44	3.25	0.53	2.25
41	Chestnut St	08/07/19 20:40:00	08/07/19 20:50:00	4,045	0.17	1.79	1.80	3.42	0.52	1.73	1.44	3.25	0.53	2.25
021F	Center Barrel - Locke St	08/07/19 20:45:00	08/07/19 23:05:00	370,965	2.33	1.79	1.80	3.42	0.52	1.73	1.44	3.25	0.53	2.25
40	Bethany Ave	08/07/19 20:50:00	08/07/19 20:55:00	3,448	0.08	1.79	1.80	3.42	0.52	1.73	1.44	3.25	0.53	2.25
021H	Winter and Hale	08/07/19 21:10:00	08/07/19 22:25:00	674,095	1.25	1.79	1.80	3.42	0.52	1.73	1.44	3.25	0.53	2.25
021G	Winter St	08/07/19 21:15:00	08/07/19 21:25:00	2,795	0.17	1.79	1.80	3.42	0.52	1.73	1.44	3.25	0.53	2.25
34	Middlesex St	08/07/19 21:15:00	08/07/19 22:35:00	1,397,249	1.33	1.79	1.80	3.42	0.52	1.73	1.44	3.25	0.53	2.25
41	Chestnut St	08/07/19 21:15:00	08/07/19 22:10:00	92,755	0.92	1.79	1.80	3.42	0.52	1.73	1.44	3.25	0.53	2.25

**APPENDIX C
CSO ACTIVATIONS**

CSO Outfall No.	CSO Outfall Name	Overflow Start	Overflow End	Volume (gals.)	CSO Duration (hr.)	Marginal Pumping Station Rain Gage				ASPW Rain Gage1				ASPW Operator Observed NOAA Rain Gage
						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	08/07/19 21:20:00	08/07/19 23:20:00	1,052,699	2.00	1.79	1.80	3.42	0.52	1.73	1.44	3.25	0.53	2.25
40	Bethany Ave	08/07/19 21:20:00	08/07/19 22:15:00	196,666	0.92	1.79	1.80	3.42	0.52	1.73	1.44	3.25	0.53	2.25
021G	Winter St	08/07/19 21:40:00	08/07/19 22:05:00	23,315	0.42	1.79	1.80	3.42	0.52	1.73	1.44	3.25	0.53	2.25
32	Bradford Ave	08/07/19 21:40:00	08/07/19 22:10:00	206,349	0.50	1.79	1.80	3.42	0.52	1.73	1.44	3.25	0.53	2.25
19	Main St North	08/07/19 21:55:00	08/07/19 22:05:00	6,810	0.17	1.79	1.80	3.42	0.52	1.73	1.44	3.25	0.53	2.25
34	Middlesex St	08/07/19 22:50:00	08/07/19 22:55:00	5,135	0.08	1.79	1.80	3.42	0.52	1.73	1.44	3.25	0.53	2.25
021A	Middle Siphon	08/07/19 23:50:00	08/08/19 01:15:00	306,965	1.42	1.79	1.80	3.42	0.52	1.73	1.44	3.25	0.53	2.25
021F	Center Barrel - Locke St	08/07/19 23:50:00	08/08/19 01:20:00	72,388	1.50	1.79	1.80	3.42	0.52	1.73	1.44	3.25	0.53	2.25
34	Middlesex St	08/07/19 23:50:00	08/08/19 00:35:00	259,227	0.75	1.79	1.80	3.42	0.52	1.73	1.44	3.25	0.53	2.25
41	Chestnut St	08/07/19 23:50:00	08/08/19 00:00:00	2,638	0.17	1.79	1.80	3.42	0.52	1.73	1.44	3.25	0.53	2.25
021H	Winter and Hale	08/07/19 23:55:00	08/08/19 00:15:00	13,404	0.33	1.79	1.80	3.42	0.52	1.73	1.44	3.25	0.53	2.25
40	Bethany Ave	08/07/19 23:55:00	08/08/19 00:15:00	14,690	0.33	1.79	1.80	3.42	0.52	1.73	1.44	3.25	0.53	2.25
STORM TOTAL:				4,706,293	Gallons									
021F	Center Barrel - Locke St	08/13/19 20:25:00	08/13/19 21:05:00	58,715	0.67	0.35	0.84	0.58	0.60	0.24	0.64	1.25	0.19	0.24
021G	Winter St	08/13/19 20:30:00	08/13/19 20:35:00	281	0.08	0.35	0.84	0.58	0.60	0.24	0.64	1.25	0.19	0.24
021H	Winter and Hale	08/13/19 20:30:00	08/13/19 20:55:00	88,495	0.42	0.35	0.84	0.58	0.60	0.24	0.64	1.25	0.19	0.24
34	Middlesex St	08/13/19 20:30:00	08/13/19 20:40:00	45,358	0.17	0.35	0.84	0.58	0.60	0.24	0.64	1.25	0.19	0.24
40	Bethany Ave	08/13/19 20:30:00	08/13/19 20:40:00	7,562	0.17	0.35	0.84	0.58	0.60	0.24	0.64	1.25	0.19	0.24
41	Chestnut St	08/13/19 20:30:00	08/13/19 20:40:00	3,496	0.17	0.35	0.84	0.58	0.60	0.24	0.64	1.25	0.19	0.24
STORM TOTAL:				203,907	Gallons									
021F	Center Barrel - Locke St	08/17/19 22:15:00	08/17/19 22:40:00	39,165	0.42	0.35	0.68	0.67	0.53	0.40	1.48	0.75	0.53	0.46
021G	Winter St	08/17/19 22:15:00	08/17/19 22:20:00	3,326	0.08	0.35	0.68	0.67	0.53	0.40	1.48	0.75	0.53	0.46
021H	Winter and Hale	08/17/19 22:15:00	08/17/19 22:35:00	64,385	0.33	0.35	0.68	0.67	0.53	0.40	1.48	0.75	0.53	0.46
34	Middlesex St	08/17/19 22:15:00	08/17/19 22:25:00	119,274	0.17	0.35	0.68	0.67	0.53	0.40	1.48	0.75	0.53	0.46
40	Bethany Ave	08/17/19 22:15:00	08/17/19 22:25:00	9,933	0.17	0.35	0.68	0.67	0.53	0.40	1.48	0.75	0.53	0.46
41	Chestnut St	08/17/19 22:15:00	08/17/19 22:25:00	12,586	0.17	0.35	0.68	0.67	0.53	0.40	1.48	0.75	0.53	0.46
021A	Middle Siphon	08/17/19 22:20:00	08/17/19 22:30:00	30,470	0.17	0.35	0.68	0.67	0.53	0.40	1.48	0.75	0.53	0.46
24	Upper siphon	08/17/19 23:25:06	08/17/19 23:28:04	44,480	0.05	0.35	0.68	0.67	0.53	0.40	1.48	0.75	0.53	0.46
STORM TOTAL:				323,620	Gallons									
34	Middlesex St	08/18/19 22:00:00	08/18/19 22:20:00	153,994	0.33	0.37	1.36	0.50	0.74	0.11	0.16	1.00	0.11	0.08
41	Chestnut St	08/18/19 22:00:00	08/18/19 22:20:00	11,377	0.33	0.37	1.36	0.50	0.74	0.11	0.16	1.00	0.11	0.08
021F	Center Barrel - Locke St	08/18/19 22:05:00	08/18/19 22:40:00	58,222	0.58	0.37	1.36	0.50	0.74	0.11	0.16	1.00	0.11	0.08
021A	Middle Siphon	08/18/19 22:10:00	08/18/19 22:25:00	36,841	0.25	0.37	1.36	0.50	0.74	0.11	0.16	1.00	0.11	0.08
021G	Winter St	08/18/19 22:10:00	08/18/19 22:15:00	6,638	0.08	0.37	1.36	0.50	0.74	0.11	0.16	1.00	0.11	0.08
021H	Winter and Hale	08/18/19 22:10:00	08/18/19 22:35:00	157,550	0.42	0.37	1.36	0.50	0.74	0.11	0.16	1.00	0.11	0.08
40	Bethany Ave	08/18/19 22:10:00	08/18/19 22:20:00	24,827	0.17	0.37	1.36	0.50	0.74	0.11	0.16	1.00	0.11	0.08
STORM TOTAL:				449,451	Gallons									
021F	Center Barrel - Locke St	08/21/19 13:40:00	08/21/19 14:50:00	318,450	1.17	1.12	1.84	1.08	1.03	1.03	1.96	1.75	0.59	1.13
021G	Winter St	08/21/19 13:40:00	08/21/19 14:00:00	58,771	0.33	1.12	1.84	1.08	1.03	1.03	1.96	1.75	0.59	1.13
021H	Winter and Hale	08/21/19 13:40:00	08/21/19 14:40:00	566,878	1.00	1.12	1.84	1.08	1.03	1.03	1.96	1.75	0.59	1.13
32	Bradford Ave	08/21/19 13:40:00	08/21/19 14:00:00	184,963	0.33	1.12	1.84	1.08	1.03	1.03	1.96	1.75	0.59	1.13
34	Middlesex St	08/21/19 13:40:00	08/21/19 14:35:00	1,112,791	0.92	1.12	1.84	1.08	1.03	1.03	1.96	1.75	0.59	1.13
38	High St	08/21/19 13:40:00	08/21/19 13:50:00	566	0.17	1.12	1.84	1.08	1.03	1.03	1.96	1.75	0.59	1.13
39	South Webster St	08/21/19 13:40:00	08/21/19 14:40:00	33,505	1.00	1.12	1.84	1.08	1.03	1.03	1.96	1.75	0.59	1.13
40	Bethany Ave	08/21/19 13:40:00	08/21/19 14:05:00	126,795	0.42	1.12	1.84	1.08	1.03	1.03	1.96	1.75	0.59	1.13
41	Chestnut St	08/21/19 13:40:00	08/21/19 14:05:00	43,482	0.42	1.12	1.84	1.08	1.03	1.03	1.96	1.75	0.59	1.13
021A	Middle Siphon	08/21/19 13:45:00	08/21/19 15:00:00	978,480	1.25	1.12	1.84	1.08	1.03	1.03	1.96	1.75	0.59	1.13
021B	Emerson St	08/21/19 13:50:00	08/21/19 14:00:00	12,682	0.17	1.12	1.84	1.08	1.03	1.03	1.96	1.75	0.59	1.13

**APPENDIX C
CSO ACTIVATIONS**

CSO Outfall No.	CSO Outfall Name	Overflow Start	Overflow End	Volume (gals.)	CSO Duration (hr.)	Marginal Pumping Station Rain Gage				ASPW Rain Gage1				ASPW Operator Observed NOAA Rain Gage
						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.)
19	Main St North	08/21/19 13:55:00	08/21/19 14:05:00	38,053	0.17	1.12	1.84	1.08	1.03	1.03	1.96	1.75	0.59	1.13
021G	Winter St	08/21/19 14:20:00	08/21/19 14:25:00	4,256	0.08	1.12	1.84	1.08	1.03	1.03	1.96	1.75	0.59	1.13
40	Bethany Ave	08/21/19 14:20:00	08/21/19 14:25:00	8,998	0.08	1.12	1.84	1.08	1.03	1.03	1.96	1.75	0.59	1.13
41	Chestnut St	08/21/19 14:20:00	08/21/19 14:25:00	5,699	0.08	1.12	1.84	1.08	1.03	1.03	1.96	1.75	0.59	1.13
24	Upper siphon	08/21/19 14:44:20	08/21/19 15:31:36	934,012	0.79	1.12	1.84	1.08	1.03	1.03	1.96	1.75	0.59	1.13
			STORM TOTAL:	4,428,380	Gallons									
021F	Center Barrel - Locke St	08/28/19 16:20:00	08/28/19 16:55:00	18,716	0.58	0.95	0.44	4.50	0.21					1.03
021F	Center Barrel - Locke St	08/28/19 20:30:00	08/28/19 20:55:00	16,814	0.42	0.95	0.44	4.50	0.21					1.03
40	Bethany Ave	08/28/19 20:30:00	08/28/19 20:35:00	394	0.08	0.95	0.44	4.50	0.21					1.03
021H	Winter and Hale	08/28/19 20:40:00	08/28/19 20:45:00	613	0.08	0.95	0.44	4.50	0.21					1.03
021F	Center Barrel - Locke St	08/28/19 22:50:00	08/28/19 23:35:00	37,634	0.75	0.95	0.44	4.50	0.21					1.03
40	Bethany Ave	08/28/19 23:10:00	08/28/19 23:15:00	3,819	0.08	0.95	0.44	4.50	0.21					1.03
			STORM TOTAL:	77,991	Gallons									
021F	Center Barrel - Locke St	09/26/19 17:00:00	09/26/19 17:30:00	17,656	0.50	0.34	0.36	1.75	0.19	0.48	0.48	2.75	0.17	0.43
			STORM TOTAL:	17,656	Gallons									
021F	Center Barrel - Locke St	10/07/19 19:15:00	10/07/19 20:10:00	32,947	0.92	0.72	0.32	3.92	0.18	0.59	0.28	4.75	0.12	0.68
39	South Webster St	10/07/19 22:55:00	10/07/19 23:10:00	8,945	0.25	0.72	0.32	3.92	0.18	0.59	0.28	4.75	0.12	0.68
39	South Webster St	10/07/19 23:30:00	10/07/19 23:40:00	7,614	0.17	0.72	0.32	3.92	0.18	0.59	0.28	4.75	0.12	0.68
			STORM TOTAL:	49,506	Gallons									
40	Bethany Ave	10/16/19 23:20:00	10/16/19 23:25:00	1,559	0.08	0.45	0.40	2.00	0.23	0.14	0.12	2.00	0.07	2.35
021F	Center Barrel - Locke St	10/16/19 23:25:00	10/17/19 03:15:00	622,958	3.83	0.45	0.40	2.00	0.23	0.14	0.12	2.00	0.07	2.35
021H	Winter and Hale	10/16/19 23:45:00	10/17/19 02:55:00	665,401	3.17	0.45	0.40	2.00	0.23	0.14	0.12	2.00	0.07	2.35
39	South Webster St	10/17/19 00:05:00	10/17/19 00:25:00	6,124	0.33	1.71	1.52	3.75	0.46	2.38	1.56	6.25	0.38	0.14
021A	Middle Siphon	10/17/19 00:30:00	10/17/19 03:25:00	2,138,560	2.92	1.71	1.52	3.75	0.46	2.38	1.56	6.25	0.38	0.14
34	Middlesex St	10/17/19 00:30:00	10/17/19 00:50:00	58,866	0.33	1.71	1.52	3.75	0.46	2.38	1.56	6.25	0.38	0.14
39	South Webster St	10/17/19 00:30:00	10/17/19 00:55:00	11,296	0.42	1.71	1.52	3.75	0.46	2.38	1.56	6.25	0.38	0.14
41	Chestnut St	10/17/19 00:30:00	10/17/19 00:35:00	167	0.08	1.71	1.52	3.75	0.46	2.38	1.56	6.25	0.38	0.14
34	Middlesex St	10/17/19 00:55:00	10/17/19 03:00:00	1,597,113	2.08	1.71	1.52	3.75	0.46	2.38	1.56	6.25	0.38	0.14
39	South Webster St	10/17/19 01:05:00	10/17/19 02:45:00	69,848	1.67	1.71	1.52	3.75	0.46	2.38	1.56	6.25	0.38	0.14
40	Bethany Ave	10/17/19 01:05:00	10/17/19 01:10:00	1,626	0.08	1.71	1.52	3.75	0.46	2.38	1.56	6.25	0.38	0.14
41	Chestnut St	10/17/19 01:05:00	10/17/19 01:10:00	1,022	0.08	1.71	1.52	3.75	0.46	2.38	1.56	6.25	0.38	0.14
40	Bethany Ave	10/17/19 01:20:00	10/17/19 02:25:00	85,192	1.08	1.71	1.52	3.75	0.46	2.38	1.56	6.25	0.38	0.14
41	Chestnut St	10/17/19 01:20:00	10/17/19 02:25:00	79,816	1.08	1.71	1.52	3.75	0.46	2.38	1.56	6.25	0.38	0.14
021G	Winter St	10/17/19 01:25:00	10/17/19 02:15:00	29,327	0.83	1.71	1.52	3.75	0.46	2.38	1.56	6.25	0.38	0.14
32	Bradford Ave	10/17/19 01:30:00	10/17/19 02:05:00	87,130	0.58	1.71	1.52	3.75	0.46	2.38	1.56	6.25	0.38	0.14
13	Lower Siphon	10/17/19 2:14:30	10/17/19 3:40:42	2,766,201	1.44	1.71	1.52	3.75	0.46	2.38	1.56	6.25	0.38	0.14
24	Upper siphon	10/17/19 2:29:48	10/17/19 3:31:26	1,318,355	1.03	1.71	1.52	3.75	0.46	2.38	1.56	6.25	0.38	0.14
			STORM TOTAL:	9,540,562	Gallons									
021F	Center Barrel - Locke St	10/23/19 05:40:00	10/23/19 06:20:00	80,112	0.67	0.75	1.24	2.75	0.27	-	-	-	-	0.54
021G	Winter St	10/23/19 05:40:00	10/23/19 05:45:00	16,889	0.08	0.75	1.24	2.75	0.27	-	-	-	-	0.54
021H	Winter and Hale	10/23/19 05:40:00	10/23/19 06:05:00	60,889	0.42	0.75	1.24	2.75	0.27	-	-	-	-	0.54
34	Middlesex St	10/23/19 05:40:00	10/23/19 05:55:00	110,781	0.25	0.75	1.24	2.75	0.27	-	-	-	-	0.54
40	Bethany Ave	10/23/19 05:40:00	10/23/19 05:50:00	13,623	0.17	0.75	1.24	2.75	0.27	-	-	-	-	0.54
41	Chestnut St	10/23/19 05:40:00	10/23/19 05:55:00	18,809	0.25	0.75	1.24	2.75	0.27	-	-	-	-	0.54
021A	Middle Siphon	10/23/19 05:50:00	10/23/19 05:55:00	741	0.08	0.75	1.24	2.75	0.27	-	-	-	-	0.54
			STORM TOTAL:	301,843	Gallons									
021F	Center Barrel - Locke St	10/27/19 12:55:00	10/27/19 13:25:00	21,904	0.50	1.01	0.24	6.83	0.15	1.38	0.32	11.25	0.12	1.19
021F	Center Barrel - Locke St	10/27/19 14:45:00	10/27/19 15:15:00	24,881	0.50	1.01	0.24	6.83	0.15	1.38	0.32	11.25	0.12	1.19

**APPENDIX C
CSO ACTIVATIONS**

CSO Outfall No.	CSO Outfall Name	Overflow Start	Overflow End	Volume (gals.)	CSO Duration (hr.)	Marginal Pumping Station Rain Gage				ASPW Rain Gage1				ASPW Operator Observed NOAA Rain Gage
						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 St	10/27/19 17:00:00	10/27/19 17:25:00	12,773	0.42	1.01	0.24	6.83	0.15	1.38	0.32	11.25	0.12	1.19
			STORM TOTAL:	59,558	Gallons									
021F	Center Barrel - Locke St	10/31/19 09:45:00	10/31/19 09:55:00	2,855	0.17	0.29	0.20	2.08	0.14	0.48	0.24	5.50	0.09	0.40
39	South Webster St	10/31/19 11:20:00	10/31/19 13:10:00	60,446	1.83	0.29	0.20	2.08	0.14	0.48	0.24	5.50	0.09	0.40
			STORM TOTAL:	63,301	Gallons									
021F	Center Barrel - Locke St	11/24/19 12:05:00	11/24/19 13:25:00	53,636	1.33	1.05	0.52	6.33	0.17	1.16	0.52	10.00	0.12	1.15
021F	Center Barrel - Locke St	11/24/19 14:40:00	11/24/19 15:30:00	56,209	0.83	1.05	0.52	6.33	0.17	1.16	0.52	10.00	0.12	1.15
40	Bethany Ave	11/24/19 14:40:00	11/24/19 14:45:00	3,448	0.08	1.05	0.52	6.33	0.17	1.16	0.52	10.00	0.12	1.15
021H	Winter and Hale	11/24/19 14:45:00	11/24/19 14:55:00	2,197	0.17	1.05	0.52	6.33	0.17	1.16	0.52	10.00	0.12	1.15
39	South Webster St	11/24/19 14:45:00	11/24/19 14:55:00	961	0.17	1.05	0.52	6.33	0.17	1.16	0.52	10.00	0.12	1.15
			STORM TOTAL:	116,451	Gallons									
021F	Center Barrel - Locke St	12/9/2019 12:25	12/9/2019 12:40	2,094	0.25	0.74	0.28	4.83	0.15	0.67	0.28	7.00	0.10	0.64
			STORM TOTAL:	2,094	Gallons									
13	Lower Siphon	12/14/2019 7:19	12/14/2019 23:03	3,405,531	15.73	1.72	0.48	8.25	0.21	2.11	0.52	11.75	0.18	1.00
021A	Middle Siphon	12/14/2019 5:05	12/14/2019 10:30	1,895,164	5.42	1.72	0.48	8.25	0.21	2.11	0.52	11.75	0.18	1.00
021F	Center Barrel - Locke St	12/14/2019 2:25	12/14/2019 10:55	625,389	8.50	1.72	0.48	8.25	0.21	2.11	0.52	11.75	0.18	1.00
021H	Winter and Hale	12/14/2019 5:05	12/14/2019 7:40	212,280	2.53	1.72	0.48	8.25	0.21	2.11	0.52	11.75	0.18	1.00
24	Upper siphon	12/14/2019 7:12	12/14/2019 22:16	396,807	15.07	1.72	0.48	8.25	0.21	2.11	0.52	11.75	0.18	1.00
34	Middlesex St	12/14/2019 5:10	12/14/2019 7:35	1,347,726	2.42									
39	South Webster St	12/14/2019 5:05	12/14/2019 8:00	98,893	2.92									
40	Bethany Ave	12/14/2019 5:05	12/14/2019 6:45	10,923	1.67									
41	Chestnut St	12/14/2019 5:10	12/14/2019 6:45	340	1.58	1.72	0.48	8.25	0.21	2.11	0.52	11.75	0.18	1.00
			STORM TOTAL:	7,993,053	Gallons									
			GRAND TOTAL:	43,648,566	Gallons									
			GRAND TOTAL:	43.65	MG									

¹ASPW Rain Gage malfunction on 4/15/2019, 8/28/2019, and 10/23/2019

Appendix D

APPENDIX D CALENDAR YEAR 2019 RAINFALL DATA

Storm Start	Lawrence Municipal Airport NOAA Rain Gage				Marginal Pumping Station Rain Gage				ASPW Rain Gage				ASPW Operator Observed NOAA Rain Gage
	Daily Inches	Peak hour intensity (in/hr)	Storm Duration (hours)	Daily Average Intensity (in/hr)	Rain Total (in.)	Peak Hour Intensity (in./hr.)	Duration (hr.)	Daily Avg. Intensity (in./hr.)	Rain Total (in.)	Peak Hour Intensity (in./hr.)	Duration (hr.)	Daily Avg. Intensity (in./hr.)	Rain Total (in.)
1/1/2019	0.24	0.14	2.00	0.07	0.48	0.32	2.58	0.19	0.54	0.20	3.50	0.15	0.76
1/2/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1/3/2019	0.01	0.01	1.00	0.01	0.05	0.12	0.33	0.15	0.06	0.16	0.75	0.08	
1/4/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1/5/2019	0.05	0.02	13.00	0.00	0.13	0.08	1.08	0.12	0.17	0.12	2.75	0.06	
1/6/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
1/7/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1/8/2019	0.02	0.01	14.00	0.00	0.17	0.20	1.25	0.14	0.12	0.16	1.25	0.10	
1/9/2019	0.17	0.10	2.00	0.05	0.25	0.16	1.92	0.13	0.26	0.20	2.75	0.09	0.27
1/10/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07
1/11/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1/12/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1/13/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1/14/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1/15/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1/16/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1/17/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1/18/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1/19/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.02	0.04	0.75	0.03	
1/20/2019	0.37	0.09	13.00	0.01	0	0.00	0.00	0.00	1.35	0.16	15.00	0.09	0.55
1/21/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.95
1/22/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1/23/2019	0.00	0.00	0.00	0.00	0.69	0.16	5.67	0.12	0.00	0.00	0.00	0.00	
1/24/2019	0.92	0.28	13.00	0.02	0.88	0.52	5.75	0.15	1.18	0.48	10.25	0.12	
1/25/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.01
1/26/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1/27/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1/28/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1/29/2019	0.08	0.07	1.00	0.07	0	0.00	0.00	0.00	0.11	0.16	2.00	0.06	
1/30/2019	0.04	0.02	2.00	0.01	0	0.00	0.00	0.00	0.41	0.16	4.75	0.09	0.45
1/31/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
2/1/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2/2/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2/3/2019	0.00	0.00	0.00	0.00	0.06	0.04	0.50	0.12	0.00	0.00	0.00	0.00	
2/4/2019	0.00	0.00	0.00	0.00	0.19	0.08	1.58	0.12	0.00	0.00	0.00	0.00	
2/5/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2/6/2019	0.34	0.10	4.00	0.03	0.38	0.16	2.92	0.13	0.27	0.16	3.50	0.08	
2/7/2019	0.02	0.02	1.00	0.02	0.12	0.12	1.00	0.12	0.24	0.16	2.00	0.12	0.47
2/8/2019	0.04	0.02	7.00	0.00	0.14	0.08	1.17	0.12	0.18	0.16	2.25	0.08	0.05
2/9/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
2/10/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2/11/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2/12/2019	0.42	0.07	8.00	0.01	0	0.00	0.00	0.00	0.71	0.24	8.25	0.09	
2/13/2019	0.26	0.10	4.00	0.03	1.22	0.44	6.25	0.20	0.69	0.24	5.00	0.14	1.27
2/14/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
2/15/2019	0.02	0.01	2.00	0.01	0.02	0.04	0.17	0.12	0.02	0.04	0.50	0.04	
2/16/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
2/17/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2/18/2019	0.02	0.02	1.00	0.02	0	0.00	0.00	0.00	0.10	0.08	1.75	0.06	0.02
2/19/2019	0.00	0.00	0.00	0.00	0.03	0.04	0.25	0.12	0.00	0.00	0.00	0.00	0.09
2/20/2019	0.02	0.01	1.00	0.01	0	0.00	0.00	0.00	0.03	0.04	1.25	0.02	
2/21/2019	0.30	0.10	4.00	0.03	0.59	0.32	3.42	0.17	0.60	0.16	7.00	0.09	0.12
2/22/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
2/23/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2/24/2019	0.26	0.11	8.00	0.01	0.49	0.24	3.50	0.14	0.63	0.24	6.75	0.09	
2/25/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.55
2/26/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2/27/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2/28/2019	0.00	0.00	0.00	0.00	0.09	0.16	0.67	0.14	0.14	0.12	2.25	0.06	0.10
3/1/2019	0.00	0.00	0.00	0.00	0.01	0.04	0.08	0.12	0.00	0.00	0.00	0.00	
3/2/2019	0.00	0.00	0.00	0.00	0.06	0.04	0.50	0.12	0.19	0.12	3.00	0.06	
3/3/2019	0.00	0.00	0.00	0.00	0.07	0.08	0.42	0.17	0.04	0.08	0.75	0.05	0.15

APPENDIX D CALENDAR YEAR 2019 RAINFALL DATA

Storm Start	Lawrence Municipal Airport NOAA Rain Gage				Marginal Pumping Station Rain Gage				ASPW Rain Gage				ASPW Operator Observed NOAA Rain Gage
	Daily Inches	Peak hour intensity (in/hr)	Storm Duration (hours)	Daily Average Intensity (in/hr)	Rain Total (in.)	Peak Hour Intensity (in./hr.)	Duration (hr.)	Daily Avg. Intensity (in./hr.)	Rain Total (in.)	Peak Hour Intensity (in./hr.)	Duration (hr.)	Daily Avg. Intensity (in./hr.)	Rain Total (in.)
3/4/2019	0.48	0.20	3.00	0.07	0.58	0.36	3.17	0.18	0.82	0.20	8.50	0.10	0.60
3/5/2019	0.00	0.00	0.00	0.00	0.01	0.04	0.08	0.12	0.00	0.00	0.00	0.00	0.16
3/6/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3/7/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3/8/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3/9/2019	0.00	0.00	0.00	0.00	0.08	0.04	0.67	0.12	0.00	0.00	0.00	0.00	
3/10/2019	0.54	0.17	5.00	0.03	0.75	0.40	4.42	0.17	0.89	0.20	9.25	0.10	0.75
3/11/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3/12/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3/13/2019	0.00	0.00	0.00	0.00	0.03	0.08	0.25	0.12	0.05	0.12	0.75	0.07	
3/14/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
3/15/2019	0.45	0.35	1.00	0.35	0.36	0.44	1.50	0.24	0.41	0.40	2.00	0.21	
3/16/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.37
3/17/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3/18/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3/19/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3/20/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3/21/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3/22/2019	0.19	0.06	19.00	0.00	0.39	0.12	3.17	0.12	0.39	0.12	4.75	0.08	0.01
3/23/2019	0.00	0.00	0.00	0.00	0.03	0.04	0.25	0.12	0.06	0.08	1.25	0.05	0.45
3/24/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3/25/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3/26/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3/27/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3/28/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3/29/2019	0.01	0.01	1.00	0.01	0.03	0.04	0.25	0.12	0.04	0.04	1.00	0.04	
3/30/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
3/31/2019	0.05	0.05	1.00	0.05	0.15	0.12	1.17	0.13	0.17	0.12	2.50	0.07	
4/1/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13
4/2/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
4/3/2019	0.03	0.02	2.00	0.01	0.18	0.08	1.50	0.12	0.22	0.12	3.75	0.06	0.15
4/4/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06
4/5/2019	0.06	0.03	2.00	0.02	0.11	0.08	0.92	0.12	0.11	0.16	1.50	0.07	
4/6/2019	0.04	0.02	2.00	0.01	0.1	0.04	0.83	0.12	0.20	0.12	3.25	0.06	0.25
4/7/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
4/8/2019	0.16	0.06	9.00	0.01	0.31	0.12	2.58	0.12	0.41	0.12	6.50	0.06	0.11
4/9/2019	0.12	0.08	2.00	0.04	0.16	0.20	1.08	0.15	0.17	0.16	1.75	0.10	0.25
4/10/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16
4/11/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
4/12/2019	0.18	0.11	1.00	0.11	0.33	0.44	1.25	0.26	0.05	0.12	0.75	0.07	
4/13/2019	0.04	0.02	5.00	0.00	0.14	0.08	1.17	0.12	0.59	0.40	4.25	0.14	0.47
4/14/2019	0.02	0.02	1.00	0.02	0.06	0.08	0.50	0.12	0.00	0.00	0.00	0.00	0.05
4/15/2019	0.86	0.35	15.00	0.02	0.88	0.48	3.67	0.24	0.00	0.00	0.00	0.00	0.15
4/16/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.79
4/17/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
4/18/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
4/19/2019	0.03	0.03	1.00	0.03	0.01	0.00	0.08	0.12	0.00	0.00	0.00	0.00	0.02
4/20/2019	0.19	0.11	14.00	0.01	0.22	0.24	1.25	0.18	0.28	0.24	3.00	0.09	0.03
4/21/2019	0.09	0.05	1.00	0.05	0.1	0.12	0.67	0.15	0.13	0.16	1.75	0.07	0.32
4/22/2019	0.93	0.17	10.00	0.02	1.06	0.36	5.67	0.19	0.96	0.32	6.75	0.14	
4/23/2019	0.07	0.05	22.00	0.00	0.16	0.32	0.83	0.19	0.34	0.40	2.75	0.12	1.19
4/24/2019	0.00	0.00	0.00	0.00	0.03	0.08	0.25	0.12	0.08	0.08	0.75	0.11	0.10
4/25/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
4/26/2019	0.48	0.31	15.00	0.02	0.76	0.52	3.33	0.23	0.79	0.52	6.00	0.13	
4/27/2019	0.34	0.17	4.00	0.04	0.68	0.56	2.42	0.28	0.85	0.56	4.00	0.21	1.56
4/28/2019	0.00	0.00	0.00	0.00	0.01	0.04	0.08	0.12	0.01	0.04	0.25	0.04	0.02
4/29/2019	0.00	0.00	0.00	0.00	0.01	0.04	0.08	0.12	0.00	0.00	0.00	0.00	0.02
4/30/2019	0.03	0.02	3.00	0.01	0.1	0.08	0.83	0.12	0.21	0.12	4.00	0.05	0.07
5/1/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07
5/2/2019	0.44	0.40	13.00	0.03	0.44	0.48	2.50	0.18	0.64	0.60	6.00	0.11	0.34
5/3/2019	0.10	0.07	8.00	0.01	0.15	0.20	1.08	0.14	0.18	0.16	2.50	0.07	0.20
5/4/2019	0.02	0.01	1.00	0.01	0.05	0.04	0.42	0.12	0.06	0.04	1.50	0.04	0.19

APPENDIX D CALENDAR YEAR 2019 RAINFALL DATA

Storm Start	Lawrence Municipal Airport NOAA Rain Gage				Marginal Pumping Station Rain Gage				ASPW Rain Gage				ASPW Operator Observed NOAA Rain Gage
	Daily Inches	Peak hour intensity (in/hr)	Storm Duration (hours)	Daily Average Intensity (in/hr)	Rain Total (in.)	Peak Hour Intensity (in./hr.)	Duration (hr.)	Daily Avg. Intensity (in./hr.)	Rain Total (in.)	Peak Hour Intensity (in./hr.)	Duration (hr.)	Daily Avg. Intensity (in./hr.)	Rain Total (in.)
5/5/2019	0.00	0.00	0.00	0.00	0.02	0.04	0.17	0.12	0.05	0.12	0.50	0.10	0.06
5/6/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5/7/2019	0.18	0.08	3.00	0.03	0.18	0.12	1.42	0.13	0.37	0.16	3.50	0.11	
5/8/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26
5/9/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5/10/2019	0.01	0.01	1.00	0.01	0.03	0.04	0.25	0.12	0.04	0.08	0.75	0.05	
5/11/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
5/12/2019	0.02	0.01	1.00	0.01	0	0.00	0.00	0.00	0.01	0.04	0.25	0.04	
5/13/2019	0.41	0.10	7.00	0.01	0.58	0.24	4.33	0.13	0.58	0.20	5.75	0.10	0.01
5/14/2019	0.03	0.02	2.90	0.01	0.15	0.04	1.25	0.12	0.29	0.12	5.00	0.06	0.65
5/15/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12
5/16/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5/17/2019	0.09	0.07	2.00	0.04	0.11	0.12	0.83	0.13	0.16	0.20	2.25	0.07	
5/18/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13
5/19/2019	0.15	0.11	1.00	0.11	0.2	0.68	0.50	0.40	0.16	0.40	1.00	0.16	
5/20/2019	0.01	0.01	1.00	0.01	0.03	0.04	0.25	0.12	0.06	0.12	0.75	0.08	0.17
5/21/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5/22/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5/23/2019	0.11	0.11	1.00	0.11	0.08	0.16	0.50	0.16	0.09	0.16	0.75	0.12	
5/24/2019	0.00	0.00	0.00	0.00	0.01	0.04	0.08	0.12	0.01	0.04	0.25	0.04	0.10
5/25/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5/26/2019	0.12	0.11	0.90	0.12	0.11	0.40	0.25	0.44	0.17	0.48	0.75	0.23	0.16
5/27/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5/28/2019	0.41	0.09	7.00	0.01	0.53	0.24	4.17	0.13	0.67	0.28	8.25	0.08	
5/29/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.01	0.04	0.25	0.04	0.62
5/30/2019	0.03	0.03	1.00	0.03	0.02	0.04	0.17	0.12	0.05	0.08	1.00	0.05	
5/31/2019	0.00	0.00	0.00	0.00	0.01	0.04	0.08	0.12	0.04	0.12	0.50	0.08	0.04
6/1/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
6/2/2019	1.08	0.46	6.00	0.08	0.83	0.56	2.33	0.36	0.93	0.76	3.25	0.29	
6/3/2019	0.03	0.03	1.00	0.03	0.03	0.04	0.25	0.12	0.07	0.16	0.75	0.09	0.90
6/4/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
6/5/2019	0.51	0.33	1.00	0.33	0.49	0.64	1.33	0.37	0.11	0.16	1.00	0.11	0.02
6/6/2019	0.47	0.40	6.00	0.07	0.57	1.12	1.25	0.46	0.85	0.88	3.00	0.28	0.93
6/7/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
6/8/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
6/9/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
6/10/2019	0.04	0.04	1.00	0.04	0.02	0.04	0.17	0.12	0.00	0.00	0.00	0.00	
6/11/2019	0.68	0.16	9.00	0.02	0.76	0.44	4.25	0.18	0.74	0.28	7.75	0.10	0.38
6/12/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31
6/13/2019	0.59	0.24	11.00	0.02	0.63	0.40	3.17	0.20	0.67	0.36	5.50	0.12	
6/14/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.56
6/15/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
6/16/2019	0.53	0.10	19.00	0.01	0.47	0.20	3.67	0.13	0.67	0.16	8.00	0.08	0.02
6/17/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.54
6/18/2019	0.01	0.01	1.00	0.01	0	0.00	0.00	0.00	0.03	0.12	0.25	0.12	
6/19/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
6/20/2019	0.85	0.30	10.00	0.03	0.54	0.48	2.58	0.21	0.78	0.60	4.75	0.16	
6/21/2019	0.11	0.06	11.00	0.01	0.02	0.04	0.17	0.12	0.09	0.12	1.50	0.06	0.83
6/22/2019	0.00	0.00	0.00	0.00	0.09	0.36	0.17	0.54	0.03	0.08	0.50	0.06	0.07
6/23/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
6/24/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
6/25/2019	0.15	0.04	8.00	0.01	0.13	0.08	1.08	0.12	0.26	0.12	3.00	0.09	
6/26/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16
6/27/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
6/28/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.02	0.08	0.25	0.08	
6/29/2019	0.08	0.07	1.00	0.07	0.01	0.04	0.08	0.12	0.04	0.12	0.50	0.08	
6/30/2019	0.60	0.49	8.00	0.06	0.32	0.68	0.58	0.55	0.22	0.52	1.25	0.18	0.04
7/1/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.08	0.32	0.25	0.32	
7/2/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.02	0.08	0.25	0.08	
7/3/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.02	0.08	0.25	0.08	
7/4/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.02	0.04	0.50	0.04	
7/5/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.03	0.12	0.25	0.12	

APPENDIX D CALENDAR YEAR 2019 RAINFALL DATA

Storm Start	Lawrence Municipal Airport NOAA Rain Gage				Marginal Pumping Station Rain Gage				ASPW Rain Gage				ASPW Operator Observed NOAA Rain Gage
	Daily Inches	Peak hour intensity (in/hr)	Storm Duration (hours)	Daily Average Intensity (in/hr)	Rain Total (in.)	Peak Hour Intensity (in./hr.)	Duration (hr.)	Daily Avg. Intensity (in./hr.)	Rain Total (in.)	Peak Hour Intensity (in./hr.)	Duration (hr.)	Daily Avg. Intensity (in./hr.)	Rain Total (in.)
7/6/2019	0.91	0.64	4.00	0.16	0.14	0.12	1.00	0.14	0.37	0.76	2.50	0.15	
7/7/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.02	0.04	0.50	0.04	0.34
7/8/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
7/9/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.02	0.08	0.25	0.08	
7/10/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.02	0.08	0.25	0.08	
7/11/2019	0.88	0.85	9.00	0.09	0.91	1.44	1.75	0.52	0.52	0.76	2.50	0.21	
7/12/2019	0.76	0.31	19.00	0.02	0.4	0.28	2.33	0.17	0.45	0.28	4.00	0.11	0.89
7/13/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.02	0.08	0.25	0.08	0.05
7/14/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.02	0.08	0.25	0.08	
7/15/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
7/16/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
7/17/2019	0.13	0.07	2.00	0.04	0.93	1.92	1.42	0.66	0.90	1.84	3.25	0.28	
7/18/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.95
7/19/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.02	0.08	0.25	0.08	
7/20/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.02	0.04	0.50	0.04	
7/21/2019	0.00	0.00	0.00	0.00	0.01	0.04	0.08	0.12	0.02	0.04	0.25	0.08	
7/22/2019	0.62	0.21	8.00	0.03	0.64	0.32	4.08	0.16	0.60	0.24	6.00	0.10	0.02
7/23/2019	1.10	0.22	10.00	0.02	1.03	0.40	5.42	0.19	1.20	0.40	9.50	0.13	1.01
7/24/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.01	0.04	0.25	0.04	0.62
7/25/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
7/26/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
7/27/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
7/28/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.01	0.04	0.25	0.04	
7/29/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.02	0.08	0.25	0.08	
7/30/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.02	0.04	0.50	0.04	
7/31/2019	0.11	0.06	1.00	0.06	0.08	0.16	0.58	0.14	0.14	0.16	1.25	0.11	
8/1/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.02	0.04	0.50	0.04	0.10
8/2/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
8/3/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
8/4/2019	0.14	0.12	1.00	0.12	0.01	0.04	0.08	0.12	0.05	0.12	0.50	0.10	
8/5/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
8/6/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
8/7/2019	1.64	1.03	10.00	0.10	1.79	1.80	3.42	0.52	1.73	1.44	3.25	0.53	
8/8/2019	0.19	0.18	1.00	0.18	0.2	0.56	1.17	0.17	0.63	0.88	2.25	0.28	2.25
8/9/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09
8/10/2019	0.01	0.01	1.00	0.01	0.09	0.28	0.17	0.54	0.18	0.72	0.25	0.72	
8/11/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19
8/12/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
8/13/2019	0.12	0.09	1.00	0.09	0.35	0.84	0.58	0.60	0.24	0.64	1.25	0.19	
8/14/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.01	0.04	0.25	0.04	0.24
8/15/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
8/16/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
8/17/2019	0.34	0.34	1.00	0.34	0.35	0.68	0.67	0.53	0.40	1.48	0.75	0.53	
8/18/2019	0.08	0.06	1.00	0.06	0.37	1.36	0.50	0.74	0.11	0.16	1.00	0.11	0.46
8/19/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.02	0.08	0.25	0.08	0.08
8/20/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.03	0.12	0.25	0.12	
8/21/2019	0.38	0.34	2.00	0.17	1.12	1.84	1.08	1.03	1.03	1.96	1.75	0.59	
8/22/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.02	0.08	0.25	0.08	1.13
8/23/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
8/24/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
8/25/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
8/26/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
8/27/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
8/28/2019	1.01	0.29	6.00	0.05	0.95	0.44	4.50	0.21	0.00	0.00	0.00	0.00	
8/29/2019	0.01	0.01	1.00	0.01	0.02	0.20	0.17	0.12	0.04	0.08	0.50	0.08	1.03
8/30/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
8/31/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
9/1/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
9/2/2019	0.03	0.01	2.00	0.01	0.02	0.04	0.17	0.12	0.01	0.04	0.25	0.04	
9/3/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
9/4/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
9/5/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

APPENDIX D CALENDAR YEAR 2019 RAINFALL DATA

Storm Start	Lawrence Muncipal Airport NOAA Rain Gage				Marginal Pumping Station Rain Gage				ASPW Rain Gage				ASPW Operator Observed NOAA Rain Gage
	Daily Inches	Peak hour intensity (in/hr)	Storm Duration (hours)	Daily Average Intensity (in/hr)	Rain Total (in.)	Peak Hour Intensity (in./hr.)	Duration (hr.)	Daily Avg. Intensity (in./hr.)	Rain Total (in.)	Peak Hour Intensity (in./hr.)	Duration (hr.)	Daily Avg. Intensity (in./hr.)	Rain Total (in.)
9/6/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
9/7/2019	0.01	0.01	1.00	0.01	0.01	0.04	0.08	0.12	0.00	0.00	0.00	0.00	
9/8/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
9/9/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
9/10/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
9/11/2019	0.15	0.15	1.00	0.15	0.05	0.08	0.33	0.15	0.02	0.08	0.25	0.08	0.09
9/12/2019	0.01	0.01	1.00	0.01	0.02	0.04	0.17	0.12	0.00	0.00	0.00	0.00	
9/13/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
9/14/2019	0.10	0.08	7.00	0.01	0.12	0.16	0.83	0.14	0.00	0.00	0.00	0.00	
9/15/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17
9/16/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
9/17/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
9/18/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
9/19/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
9/20/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
9/21/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
9/22/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
9/23/2019	0.02	0.02	1.00	0.02	0.01	0.04	0.08	0.12	0.00	0.00	0.00	0.00	
9/24/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
9/25/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
9/26/2019	0.36	0.18	2.00	0.09	0.34	0.36	1.75	0.19	0.48	0.48	2.75	0.17	
9/27/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.01	0.04	0.25	0.04	0.43
9/28/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
9/29/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
9/30/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
10/1/2019	0.11	0.06	1.00	0.06	0.12	0.12	1.00	0.12	0.18	0.20	2.00	0.09	0.01
10/2/2019	0.25	0.13	2.00	0.07	0.2	0.12	1.58	0.13	0.42	0.28	4.00	0.11	0.14
10/3/2019	0.06	0.05	1.00	0.05	0.12	0.24	0.75	0.16	0.01	0.04	0.25	0.04	0.30
10/4/2019	0.06	0.03	3.00	0.01	0.07	0.12	0.58	0.12	0.26	0.24	2.25	0.12	0.23
10/5/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
10/6/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
10/7/2019	0.42	0.18	4.00	0.05	0.72	0.32	3.92	0.18	0.59	0.28	4.75	0.12	
10/8/2019	0.07	0.03	4.00	0.01	0.07	0.04	0.58	0.12	0.19	0.16	2.25	0.08	0.68
10/9/2019	0.03	0.03	1.00	0.03	0.01	0.04	0.08	0.12	0.01	0.04	0.25	0.04	0.05
10/10/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
10/11/2019	0.10	0.02	10.00	0.00	0.09	0.04	0.75	0.12	0.23	0.12	4.00	0.06	
10/12/2019	0.03	0.01	6.00	0.00	0.04	0.04	0.33	0.12	0.18	0.12	2.75	0.07	0.23
10/13/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
10/14/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
10/15/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
10/16/2019	0.51	0.34	3.00	0.11	0.45	0.40	2.00	0.23	0.14	0.12	2.00	0.07	
10/17/2019	1.84	1.00	13.00	0.08	1.71	1.52	3.75	0.46	2.38	1.56	6.25	0.38	2.35
10/18/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14
10/19/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
10/20/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
10/21/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
10/22/2019	0.13	0.08	3.00	0.03	0.19	0.08	1.50	0.13	0.01	0.04	0.25	0.04	
10/23/2019	0.63	0.29	7.00	0.04	0.75	1.24	2.75	0.27	0.00	0.00	0.00	0.00	0.50
10/24/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.54
10/25/2019	0.01	0.01	1.00	0.01	0.02	0.04	0.17	0.12	0.01	0.04	0.25	0.04	
10/26/2019	0.03	0.02	1.00	0.02	0.03	0.04	0.25	0.12	0.04	0.04	0.75	0.05	0.05
10/27/2019	1.15	0.19	11.00	0.02	1.01	0.24	6.83	0.15	1.38	0.32	11.25	0.12	
10/28/2019	0.01	0.01	1.00	0.01	0.03	0.04	0.25	0.12	0.07	0.12	1.00	0.07	1.19
10/29/2019	0.04	0.01	19.00	0.00	0.04	0.04	0.33	0.12	0.06	0.08	1.25	0.05	0.08
10/30/2019	0.11	0.03	20.00	0.00	0.1	0.04	0.83	0.12	0.21	0.12	3.00	0.07	0.05
10/31/2019	0.33	0.12	18.00	0.01	0.29	0.20	2.08	0.14	0.48	0.24	5.50	0.09	0.09
11/1/2019	0.09	0.03	3.00	0.01	0.04	0.08	0.33	0.12	0.15	0.20	1.25	0.12	0.40
11/2/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
11/3/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11/4/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11/5/2019	0.09	0.06	3.00	0.02	0.09	0.24	0.42	0.22	0.12	0.20	2.00	0.06	
11/6/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.13

APPENDIX D CALENDAR YEAR 2019 RAINFALL DATA

Storm Start	Lawrence Municipal Airport NOAA Rain Gage				Marginal Pumping Station Rain Gage				ASPW Rain Gage				ASPW Operator Observed NOAA Rain Gage
	Daily Inches	Peak hour intensity (in/hr)	Storm Duration (hours)	Daily Average Intensity (in/hr)	Rain Total (in.)	Peak Hour Intensity (in./hr.)	Duration (hr.)	Daily Avg. Intensity (in./hr.)	Rain Total (in.)	Peak Hour Intensity (in./hr.)	Duration (hr.)	Daily Avg. Intensity (in./hr.)	Rain Total (in.)
11/7/2019	0.49	0.12	8.00	0.02	0.48	0.12	3.92	0.12	0.62	0.16	6.75	0.09	
11/8/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.53
11/9/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11/10/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11/11/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11/12/2019	0.02	0.02	1.00	0.02	0.02	0.04	0.17	0.12	0.00	0.00	0.00	0.00	
11/13/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
11/14/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11/15/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11/16/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11/17/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11/18/2019	0.22	0.07	8.00	0.01	0.22	0.08	1.83	0.12	0.27	0.16	3.25	0.08	
11/19/2019	0.23	0.08	6.00	0.01	0.2	0.12	1.67	0.12	0.20	0.16	2.50	0.08	0.25
11/20/2019	0.15	0.03	10.00	0.00	0.19	0.08	1.58	0.12	0.22	0.12	4.00	0.06	0.18
11/21/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19
11/22/2019	0.10	0.08	14.00	0.01	0.09	0.08	0.75	0.12	0.15	0.20	1.75	0.09	0.01
11/23/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07
11/24/2019	1.00	0.24	17.00	0.01	1.05	0.52	6.33	0.17	1.16	0.52	10.00	0.12	0.02
11/25/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.15
11/26/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
11/27/2019	0.22	0.11	3.00	0.04	0.21	0.24	1.33	0.16	0.26	0.28	2.50	0.10	
11/28/2019	0.33	0.06	9.00	0.01	0.39	0.12	3.25	0.12	0.48	0.16	5.75	0.08	0.36
11/29/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.24
11/30/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12/1/2019	0.50	0.15	6.00	0.03	0	0.00	0.00	0.00	0.41	0.24	5.75	0.07	
12/2/2019	0.31	0.07	22.00	0.00	0	0.00	0.00	0.00	1.20	0.24	10.00	0.12	0.80
12/3/2019	0.24	0.05	13.00	0.00	0	0.00	0.00	0.00	0.46	0.16	7.25	0.06	0.46
12/4/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06
12/5/2019	0.00	0.00	0.00	0.00	0.71	0.24	4.75	0.15	0.00	0.00	0.00	0.00	
12/6/2019	0.05	0.02	2.00	0.01	0	0.00	0.00	0.00	0.11	0.12	1.25	0.09	
12/7/2019	0.00	0.00	0.00	0.00	0.04	0.04	0.33	0.12	0.00	0.00	0.00	0.00	0.07
12/8/2019	0.00	0.00	0.00	0.00	0.01	0.04	0.08	0.12	0.00	0.00	0.00	0.00	
12/9/2019	0.60	0.18	14.00	0.01	0.74	0.28	4.83	0.15	0.67	0.28	7.00	0.10	
12/10/2019	0.17	0.04	23.00	0.00	0.18	0.08	1.50	0.12	0.26	0.12	4.50	0.06	0.64
12/11/2019	0.17	0.06	6.00	0.01	0.17	0.20	1.25	0.14	0.22	0.12	3.25	0.07	0.32
12/12/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
12/13/2019	0.10	0.07	3.00	0.02	0.15	0.08	1.25	0.12	0.08	0.12	1.75	0.05	
12/14/2019	1.58	0.29	16.03	0.02	1.72	0.48	8.25	0.21	2.11	0.52	11.75	0.18	0.92
12/15/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
12/16/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12/17/2019	0.29	0.08	9.00	0.01	0	0.00	0.00	0.00	0.45	0.16	7.00	0.06	
12/18/2019	0.01	0.01	1.00	0.01	0.24	0.20	1.75	0.14	0.00	0.00	0.00	0.00	0.36
12/19/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12/20/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12/21/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12/22/2019	0.00	0.00	0.00	0.00	0.06	0.04	0.50	0.12	0.00	0.00	0.00	0.00	
12/23/2019	0.00	0.00	0.00	0.00	0.01	0.04	0.08	0.12	0.00	0.00	0.00	0.00	
12/24/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12/25/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12/26/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
12/27/2019	0.01	0.01	1.00	0.01	0.01	0.04	0.08	0.12	0.02	0.04	0.50	0.04	
12/28/2019	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
12/29/2019	0.09	0.04	2.00	0.02	0.06	0.04	0.50	0.12	0.06	0.08	1.00	0.06	
12/30/2019	1.40	0.12	23.00	0.01	0.98	0.12	8.17	0.12	1.81	0.20	19.00	0.10	0.38
12/31/2019	0.19	0.03	8.00	0.00	0.85	0.20	6.33	0.13	0.40	0.08	5.75	0.07	1.50
Total	40.53		836.83		46.48		248.24		53.81		482.00		50.47
Average	0.11		2.29				0.67		0.15		1.31		0.34
Maximum	1.84	1.03	23.00	0.35		1.92	8.25	1.03	2.38	1.96	19.00	0.72	2.35
Miniumum	0.01	0.01	0.90	0.00		0.04	0.08	0.12	0.01	0.04	0.25	0.02	0.01

Appendix E

APPENDIX E
DOWNSTREAM NOTIFICATION LIST

Last Name	First Name	Job Title	City/Company	Address	City	Business Phone	E-mail
Angelakis	Ted	Water Superintendent	Newburyport	7 Spring Lane	Newburyport, MA 01950	(978) 465-4466	TAngelakis@cityofnewburyport.com
Angelo	Berni	Admin Asst Board of Health	Merrimac	4 School Street	Merrimac, MA 01860	(978) 346-4066	BOH@townofmerrimac.com
Bacon	Virginia	Board of Health	Newbury	12 Kent Way, Suite 101	Newbury, MA 01922	(978) 465-0862 x316	boardofhealth@townofnewbury.org
Bentsen	Lori	Board of Health	Groveland	183 Main Street	Groveland, MA 01834	(978) 556-7210	lbentsen@grovelandma.com
Beth	Buschini	Merrimac Board of Health	Merrimac	2 School Street	Merrimac, MA 01860	(978) 346-4066	BOH@townofmerrimac.com
Beth	Buschini						buschininbpt@comcast.net
Bethaley							bethaley@bu.edu
Brander	Kevin	Muni Services/WW Section	MASSDEP	205B Lowell Street	Wilmington, MA 01887	(978) 694-3236	Kevin.Brander@state.ma.us
Brouchu	Andrea	Public Health Secretary	Salisbury		Salisbury, MA 01952		abrochu@salisburyma.gov
Buzzell	Mike	Wastewater Chief Operator	Merrimac	Federal Way	Merrimac, MA 01860	(978) 346-7857	btmwwtf@comcast.net
Connors	Thomas						tmconnors@aol.com
Conte	James	Asset Management	Haverhill	40 South Porter Street	Haverhill, MA 01835	(978) 374-2382	jconte@Haverhillwater.com
Corbin	Matthew	Horizontal Infrastructure Assessment Group	Wright-Pierce	40 Shattuck Road Suite 305	Andover, MA 01810		matthew.corbin@wright-pierce.com
Cousens	Cheri	GLSD Executive Director	Lawrence	240 Charles Street	No Andover, MA 01845	(978) 685-1612	ccousens@glsd.org
Coyle	Greg	Lowell WW Engineer	Lowell	First Street Blvd (Rt. 110)	Lowell, MA 01850	(978) 674-1630	gcoyle@lowellma.gov
Cusick	Thomas	Water Superintendent	Newburyport	7 Spring Lane	Newburyport, MA	(978) 465-4466	TCusick@CityofNewburyport.com
D'Aoust	John	Water Facility Manager	Haverhill	131 Amesbury Road	Haverhill, MA 01830	(978) 374-2385	jdaoust@haverhillwater.com
DeMeo	Lisa	Director of Public Works	Salisbury	39 Lafayette Road	Salisbury, MA 01952	(978) 463-0656	ldemeo@salisburyma.gov
Desautelels	Megan	Legislative Aide	Mass State House	State House, Second Essex District Room 548	Boston, MA 02133-1054	(617) 722-2803 Ex: 8120	Megan.Desautels@mahouse.gov
DesMarais	Robert	Director Public Works	Amesbury	62 Friends Street	Amesbury, MA 01913	(978) 388-0853	rob@amesburyma.gov
Donahue	Micah						micahdonahue@gmail.com
Doyle	Peter						peter.doyle@edwardjones.com
Dufresne	Bonnie	Board of Health	Haverhill	4 Summer Street, Suite 214	Haverhill, MA 01830	(978) 374-2325	bdufresne@cityofhaverhill.com
Dugan	Sherwood	President/CEO	Haverhill Chamber	2 Merrimack Street	Haverhill, MA 01835	(978) 373-5663	dougan@haverhillchamber.com
Dugan	Joe	Wastewater Chief Operator	Newburyport	157 Water Street	Newburyport, MA 01950	(978) 465-4464	jdugan@CityofNewburyport.com
Eddings	Keith	Eagle Tribune Reporter	Haverhill		Haverhill, MA 01835		keddings@eagletribune.com
Gary	Field		Amesbury				fieldg@amesburyma.gov
Giacalone	Frank	Director of Public Health	Newburyport	60 Pleasant Street	Newburyport, MA 01950	(978) 465-4410	fgiacalone@cityofnewburyport.com
Gouldthorpe	Alba		Newbury	12 Kent Way Suite 101	Newbury, MA 01922	(978) 465-0862 x316	boardofhealth@townofnewbury.org
Haggs	J						jhaggs100@gmail.com
Hogg	Paul	Harbor Master	Newburyport	PO Box 550	Newburyport, MA 01950	(978) 462-3746	phogg@cityofnewburyport.com
Holaday	Donna	Mayor	Newburyport	60 Pleasant Street	Newburyport, MA 01950	(978) 465-4413	DHoladay@CityofNewburyport.com
Hood	Christopher	Sewer Superintendent	Newburyport	16 Perry Way	Newburyport, MA 01950		CHood@CityofNewburyport.com
Hurley	Eileen		Merrimack	2 School Street	Merrimac, MA 01860	(978) 346-4066	boh@townofmerrimac.com
Ingalls	Jeff	Chief Operator	Salisbury	P.O. Box 5221	Salisbury MA 01952	(978) 465-4058	wwtp@salisburyma.gov
Jessel	Paul	Collection System Supervisor	Haverhill	40 South Porter Street	Haverhill, MA 01835	(978) 374-2382	pjessel@haverhillwater.com
Kennedy	Jeff	North Shore Regional Supv.	Gloucester	Emerson Ave	Gloucester, MA 01930	(978) 282-0308 x165	jeff.kennedy@state.ma.us
Ketchen	Deborah	Board of Health	Merrimac	2 School Street	Merrimac, MA 01860	(978) 804-9534	Healthagent@townofmerrimac.com
Kinter	Scott	Avalon Communities	Peabody	51 Keyes Drive	Peabody, MA 01960	(866) 739-5141	Scott_kinter@avalonbay.com
Lewis	Isaiah	WW Facility Manager	Haverhill	40 South Porter Street	Haverhill, MA 01835	(978) 374-2382	ilewis@haverhillwater.com
Macone	John	MRWC	Lawrence	60 Island Street, Suite 211-E	Lawrence, MA 01840	(978) 376-1475	jmacone@merrimack.org
Marinez	Sam	WW Col Sr. Sys OP	Haverhill	40 South Porter Street	Haverhill, MA 01835	(978) 490-8294	smarinez@haverhillwater.com
Mason	Jeff	Water System Manager	Amesbury	62 Friends Street	Amesbury, MA 01913	(978) 388-0853	masonj@amesburyma.gov
McCarthy	Kevin						kevinmccarthy1@gmail.com
McMann	Heather						heather@mcmann.net
McOsker	Allana	WWTP Head Clerk	Haverhill	40 South Porter Street	Haverhill, MA 01835	(978) 374-2382	ajmcosker@haverhillwater.com

APPENDIX E
DOWNSTREAM NOTIFICATION LIST

Mirra	Leonard	State Representative Second Essex District	Mass State House	Second Essex District Room 548, State House	Boston, MA 02133-1054	(617) 722-2803 Ex: 8120	Leonard.mirra@mahouse.gov
Mitchell	Tom	Flow Assessment	Contractor	84 Daniel Plummer Rd, Suite 2	Goffstown, NH 03045	(603) 656-9799	tmitchell@flowassessment.com
Moccio	Marc	Lead Project Engineer	Wright-Pierce	40 Shattuck Road Suite 305	Andover, MA 01810		marc.moccio@wright-pierce.com
Mohanty	Nihar	DEP NERO	MASSDEP	205B Lowell Street	Wilmington, MA 01887	(978) 694-3237	nihar.mohanty@state.ma.us
Morris	Jack	Regional Health Director	Amesbury	9 School Street	Amesbury, MA 01913	(978) 388-8134 x 752	morris@amesburyma.gov
Morris	John	Board of Health	Salisbury	5 Beach Road	Salisbury, MA 01952	(978) 462-3430	jmorris@salisburyma.gov
Olsen	Kevin	Senior Project Engineer	Wright-Pierce	40 Shattuck Road Suite 305	Andover, MA 01810		kevin.olson@wright-pierce.com
Pastrana-DeValle	Solanch	Enforcement and Compliance Assurance Division	EPA	U.S. EPA New England – Region 1 (Mail Code: 04-4)	5 Post Office Square, Boston, MA 02109-3912	(617) 918-1746	pastrana-del-valle.solanch@epa.gov
Perkins	Laurie	Horizontal Infrastructure Assessment Group	Wright-Pierce	40 Shattuck Road Suite 305	Andover, MA 01810		laurie.perkins@wright-pierce.com
Pike	Ray	Harbor Master	Salisbury	181 Beach Road	Salisbury, MA 01952	(978) 420-7834	harbormaster@salisburyma.gov
Pinaud	Maria						maria.pinaud@mass.gov
Porter	G						gporter77@gmail.com
Pratt	Chris	Chief Operator	Newburyport	16 Perry Way	Newburyport, MA 01950		cpratt@cityofnewburyport.com
Regan	Diane	Shell Fish Purification	Newburyport	84 82nd Street	Newburyport, MA 01950	(978) 465-3553 x 312	diane.regan@mass.gov
Rickenbacker	Tom						tom@rickenbackerconsulting.com
Rogers	Tom	Assistant Chief Operator	Amesbury	19 Merrimack Street	Amesbury, MA 01913	(978) 388-1912	rogerst@amesburyma.gov
Sevigny	Paul	Health Agent	West Newbury	381 Main Street	W. Newbury, MA 01985	(978) 363-1100 ext 19	psevigny@town.west-newbury.ma.us
Shaw	David	Collection Superintendent	Newburyport	16 Perry Way	Newburyport, MA 01950	(978) 465-4464	dshaw@cityofnewburyport.com
Shell Fishery			Newburyport				shellfish.newburyport@state.ma.us
Sinibaldi	Robert	DPW Director	Merrimac	4 School Street	Merrimac, MA 01860	(978) 346-0612	dpwdir@townofmerrimac.com
Sokol	John	Flow Assessment	Contractor	84 Daniel Plummer Road, Suite 2	Goffstown, NH 03045	(603) 656-9799	jsokol@flowassessment.com
Stankovich	Mike	DPW Director	Haverhill	500 Primrose Street	Haverhill, MA 01830	(978) 374-2360	mstankovich@cityofhaverhill.com
Stein	Michael		Wright-Pierce	40 Shattuck Road Suite 305	Andover, MA 01810		michael.stein@wright-pierce.com
Stokes	Colin	Water Superintendent	Groveland	183 Main Street	Groveland, MA 01834	(978) 556-7200 x219	cstokes@grovelandma.com
T	Thomas						tthomas1359@comcast.net
Tuccolo	Jamie	Deputy Director	Newburyport	60 Pleasant Street	Newburyport, MA 01950	(978) 465-4464	jtuccolo@CityofNewburyport.com
Tuck	Gary	Water Foreman	Merrimac	4 School Street	Merrimac, MA 01860	(978) 346-8407	gtuck@townofmerrimac.com
Velonis	James	Harbor Master/Police Sargent	Newbury	25 High Road	Newbury, MA 01951	(978) 462-4440 x126	harbormaster@newburypolice.com
Vetz	Mike	Harbor Master	Haverhill	72 Coffin Avenue	Haverhill, MA 01835	(978) 374-2100	vetsm@comcast.net
Ward	Robert	Deputy DPW Director	Haverhill	40 South Porter Street	Haverhill, MA 01835	(978) 374-2382	rward@haverhillwater.com
WWTP	Salisbury		Salisbury	125 Elm Street	Salisbury, MA 01952	(978) 465-4058	wwtp@salisburyma.gov
	Jennifer						Jennifer@voteoccurunnion.com