



Haverhill

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

March 22, 2022

Enforcement and Compliance Assurance Division
U.S. EPA New England – Region 1 (Mail Code: 04-4)
5 Post Office Square – Suite 100
Boston, MA 02109-3912
Attn: Ms. Elizabeth A. Kudarauskas

Subject: City of Haverhill, MA NPDES Permit No. MA 0101621
Consent Decree Submittal (Civil Action No. 16-11698-IT)
2021 Annual Combined Sewer Overflow Report

Dear Ms. Kudarauskas:

In accordance with Part I.F. 4 of the City of Haverhill's NPDES Permit and Paragraph VII.M.51 of our Consent Decree, we are providing this annual report for the 2021 calendar year.

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

Sincerely,

Robert E. Ward
Interim DPW Director

Enclosure

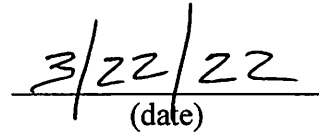
cc: Chief, Environmental Enforcement Section, U.S. DOJ
Susan Poswistilo, U.S. Attorney, MA District
Michael Wagner, EPA, wagner.michael@epa.gov
Kevin Brander, DEP, kevin.brande@state.ma.us
I. Andrew Goldberg, MA Assistant Attorney General, andy.goldberg@state.ma.us
Mayor James J. Fiorentini, City of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

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
Interim DPW Director
City of Haverhill


(date)



City of Haverhill

**Department of Public Works
Wastewater Division**

Annual Combined Sewer Overflow Report

Calendar Year 2021

NPDES Permit No. MA 0101621

Purpose

This report was prepared to meet the requirements of Part I, Section F.4 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 13 combined sewer overflow (CSO) outfalls located along the Merrimack and Little Rivers. The report also satisfies the requirements of Paragraph 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 CSOs and water quality.
- Daily precipitation information, including total precipitation, peak intensity, and average intensity.
- Certification that the City completed the monthly CSO outfall inspections, recorded the results, and maintained the records.
- 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 the following information related to each CSO event for each outfall:

- The date and time the overflow started and stopped.
- The volume of the overflow for each activation.
- The amount of precipitation associated with each overflow event.
- The total volume discharged from each outfall for the year.
- The total volume discharged for the year.

Background

This report is posted on the City's website to comply with Part I.F.3.g.(4) of the City's NPDES permit.

Haverhill has approximately 200 miles of separate and combined sewer pipes. The separate sewer area covers approximately 6,800 acres and the combined area covers approximately 1,500 acres with 13 active CSO outfalls which discharge to the Merrimack River or the Little River.

During dry weather all sewage is conveyed to the wastewater treatment plant for treatment prior to discharge to the Merrimack River. The treatment plant does not discharge untreated sewage at any time during dry weather or wet weather. Plant staff are proud of the high-quality effluent from the plant.

During wet weather, stormwater that exceeds the capacity of the combined system is diverted to one of the combined sewer overflows and discharged to the Merrimack River or the Little River. Without this overflow relief, the combined sewage and stormwater would back up into homes, businesses, streets, etc.

CSO Outfalls and Regulators

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

Haverhill currently has 15 CSO regulators structures connected to 13 active CSO outfalls. Of the 13 active outfalls, five discharge to the Little River and eight discharge to the Merrimack River. Outfalls 021H and 038 each have two regulator structures that discharge to them. Outfall 038 has regulator structures 037 and 038, and Outfall 021H has regulators 021H and 021G. Since the start of Haverhill's CSO abatement program, the City has closed 13 CSO outfalls. Table 1 lists Haverhill's CSO outfalls and regulators along with their open or closed status. Figure 1 shows the outfall locations.

When the Merrimack River and Little River levels are high, five CSO regulator structures function as flood diversion structures to protect downtown Haverhill from flooding. 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. These sluice gates remain fully open unless the City is under a river flood condition. Table 2 notes which outfalls and regulators are part of the flood control system.

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 are monitored by a depth gauge located at the weir (some are ultrasonic meters, and some have both ultrasonic and transducer gauges). Most of the CSO regulators also have a depth/velocity gauge in the outfall to measure the flow through the outfall pipe.

The flow monitoring equipment is maintained by a contractor, Flow Assessment Services (FAS), who also reports the CSO activations and volume estimates on a website accessible to the City. Flow alert emails are sent to specific Haverhill wastewater staff when activations start and stop.

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 Street		Merrimack River	Open
023	266 River Street		Merrimack River	Closed
022	Railroad Bridge		Merrimack River	Closed
Middle Siphon System				
021H	Winter Street and Hale Street	021H Winter Street at Hale Street 021G Winter Street	Little River	Open
038	High Street Diversion	037 Broadway 038 High Street	Little River	Open
021B	Emerson Street		Little River	Open
021E	Little River South (Locke Street South)		Little River	Closed
021M	Marginal Pump Station		Little River	Closed
021D	Little River North (Locke Street North)		Little River	Closed
021F	Center Barrel - Locke Street		Little River	Open
021A	Middle Siphon - Essex Street		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 Avenue		Merrimack River	Open
010	Boardman Street		Merrimack River	Closed
001	Bates Bridge		Merrimack River	Closed
Bradford System				
031	Front Street		Merrimack River	Closed
032	Bradford Avenue		Merrimack River	Open
033	South Prospect Street		Merrimack River	Closed
034	Middlesex Street		Merrimack River	Open
035	South Main Street		Merrimack River	Closed
036	Ferry Street		Merrimack River	Closed
039	South Webster Street	042 Colby Street/Salem Street	Merrimack River	Open

Figure 1

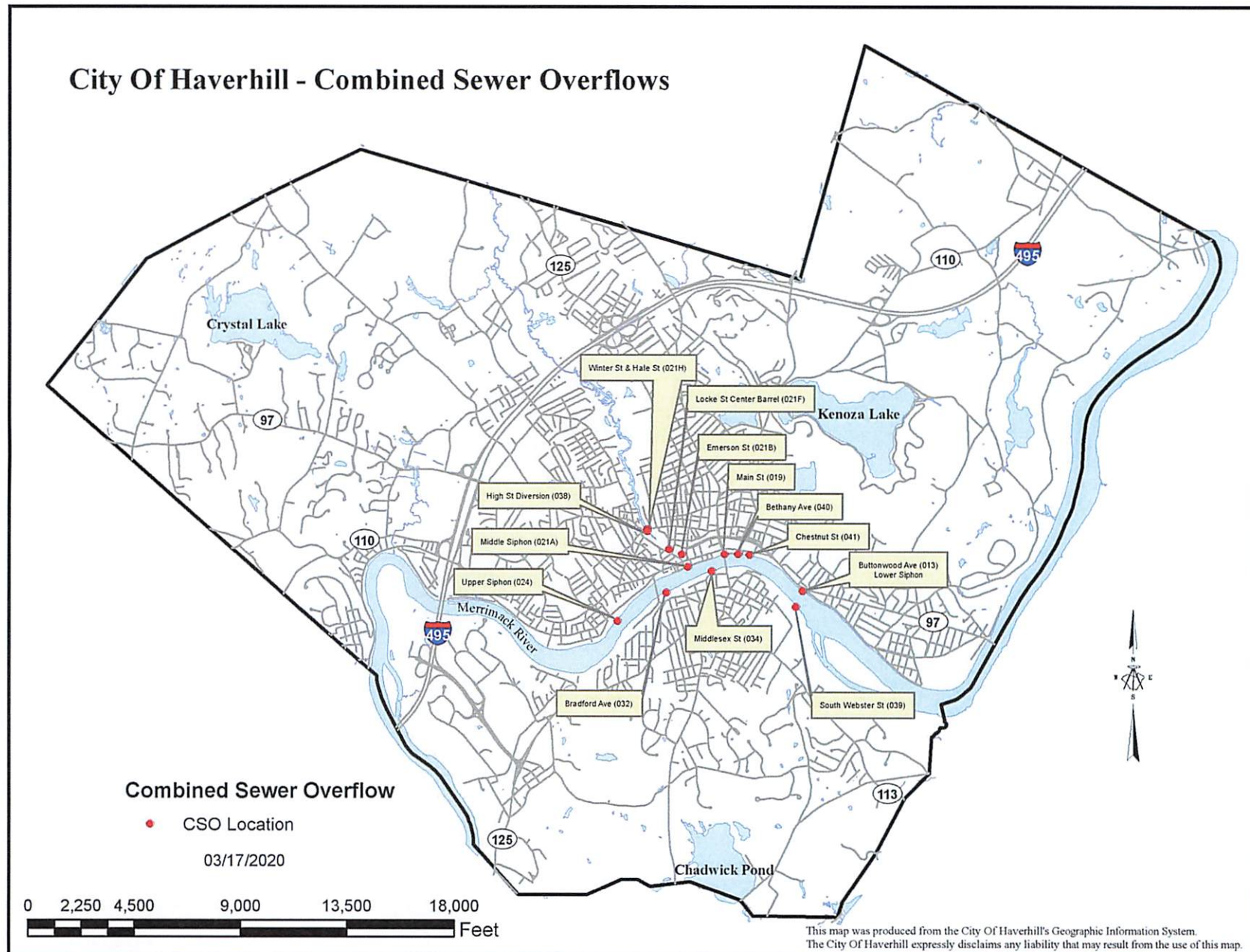


Table 2
CSO Outfalls and Regulators

Outfall ID	CSO Outfall Name	CSO Regulator Names (if more than 1)	CSO Monitoring and Volume Measurement Method
Upper Siphon System			
024	Upper Siphon –Varnum Street		Depth/Sluice Gate Opening- Orifice Equation in SCADA
Middle Siphon System			
021A	Middle Siphon –Essex Street		Depth at Weir and Depth/Velocity in Outfall
021H	Winter Street and Hale Street	021H Winter Street / Hale Street (F) 021G Winter Street (F)	Depth at Weir Depth at Weir and Depth/Velocity in Outfall
038	High Street Diversion	037 Broadway (F) 038 High Street (F)	Depth at Weir Depth at Weir
021B	Emerson Street (F)		Depth at Weir
021F	Center Barrel –Locke Street		Depth at Weir and Depth/Velocity in Outfall
Lower Siphon System			
019	Main Street North		Depth at Weir and Depth/Velocity in Outfall
040	Bethany Avenue		Depth at Weir and Depth/Velocity in Outfall
041	Chestnut Street		Depth at Weir and Depth/Velocity in Outfall
013	Lower Siphon – Buttonwood Avenue		Depth/Sluice Gate Opening- Orifice Equation in SCADA
Bradford System			
032	Bradford Avenue		Depth at Weir and Depth/Velocity in Outfall
034	Middlesex Street		Depth at Weir
039	South Webster Street	042 Colby Street/ Salem Street	Depth at Weir and Depth/Velocity in Outfall

(F) Also functions as a flood diversion structure.

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

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 Outfall 038 are measured and reported under Broadway 037 and High Street 038. CSOs for Outfall 021H are measured and reported under the Winter Street/Hale Street 021H 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. Under this project, the weirs at Outfall 024 and 013 were removed and a set of two modulating sluice gates were installed on each CSO outfall. These improvements enabled the City to temporarily store wet weather flow in the interceptor pipes upstream of each CSO. Now Outfall 024 and 013 activate by automated remote controls when the CSO discharge gates are opened.

CSO volumes at Outfalls 024 and 013 are calculated using an orifice equation that reflects the typically surcharged (but variable) CSO gate opening. Each regulator has radar units to 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 from Outfalls 024 and 013. CDM Smith added these flow calculations into the City's SCADA system in 2019. The City can now view real-time flows during storm events. The CSO gate positions are connected to the City's SCADA system. The CSO flow calculations are stored in Hach WIMS™ Historian database that is queried to produce this annual report.

2021 CSO Outfall Activations

As discussed above, the FAS meters measure activation frequency and flow characteristics and provides monthly and yearly flow data, including volume, from their meters. They analyze the flow data monthly to ensure that accurate flow data is being measured and reported. For Outfalls 024 and 013, the City uses the data downloaded from the City's SCADA system.

In 2021, Haverhill's CSO outfalls discharged 48 million gallons of combined sewer and stormwater compared to 15 million gallons in 2020. Haverhill received over 56 inches of rain in 2021 compared with 44 inches in 2020 causing the increased CSO volume. In July alone, Haverhill received over 11 inches (3.6 inches is average) of rain resulting in over 21 million gallons of CSO volume, 21% of the total.

Table 3 summarizes the total CSO volume discharged and the number of activations for each outfall/regulator for 2021.

Table 3
2021 CSO Summary by Regulator

Outfall ID	CSO Name	Number of Activations	Total Volume (gals.)
13	Lower Siphon	7	5,504,824
19	Main Street North	0	95,432
021A	Middle Siphon	13	12,706,772
021B	Emerson Street	1	4,906
021F	Center Barrel Locke Street	37	7,895,031
021G	Winter Street	10	124,943
021H	Winter/ Hale Street	30	3,667,737
24	Upper Siphon	6	3,343,575
32	Bradford Avenue	7	350,770
34	Middlesex Street	18	13,517,014
37	Broadway	0	-
38	High Street	1	240
39	South Webster Street	13	140,174
40	Bethany Avenue	13	436,637
41	Chestnut Street	18	295,215
		Total	48,083,269

Appendix A shows the date, rainfall, and CSO volumes for the days with CSO activations.

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 each month.

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

2021 Precipitation

The City collects rain data using three rain gauges: a tipping bucket rain gauge at the WWTP ASPW building, a NOAA-supplied rain gage at the WWTP 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 most of Haverhill's combined sewer areas.

The data from the tipping bucket rain gauge at the WWTP 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 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.

For this report, we are including rain data from the nearest National Weather Station, located at the Lawrence Municipal Airport. The current location is elevation 149 feet, Latitude 42.7172° N, Longitude 71.1239° W. This rain gage is approximately 4½ miles from the Marginal Pump Station rain gage and most of Haverhill's combined sewer areas.

The rainfall totals for 2021 for each gauge is shown in Table 4 along with the annual average rainfall from the City's rainfall records. This year 20201 is the 8th highest yearly rainfall since 1895. The 2021 monthly precipitation for February, April, May, July, August, September, and October was significantly higher than the average for those months.

Table 4
Annual Rainfall Totals

Rain Gauge Location	Total Annual Rainfall (inch)
Lawrence Municipal Airport National Weather Service	58.98
Tipping bucket rain gage at the Marginal Pumping Station	49.43
Tipping bucket rain gage at the WWTF ASPW building	56.61
City Rainfall Records - 1895 to 2021 Average (NOAA)	43.15
City Rainfall Records - 10-Year Average (NOAA)	44.92

Appendix D shows total daily rainfall, 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 the next day.

Haverhill's CSO Abatement Program

The following summarizes the City's progress on its CSO abatement program over the last 20 plus years.

- In August 2002, the City submitted its Phase I CSO Long Term Control Plan (LTCP) to the EPA and MassDEP. The recommended plan included improvements to increase treatment capacity at the WWTP, 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 in 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 the weirs at three 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 98 percent. The cost of the Phase II program was \$12 million.

- In 2014, as previously discussed in this report, the City began monitoring each CSO outfall and regulator structure for activations and discharge volumes. This equipment alerts us when an overflow occurs, how long it lasts, and the volume of the overflow. The ongoing annual cost is approximately \$50,000.
- In 2016, the City modified Outfall 032 and Outfall 021A to improve the flow capacity into its interceptor system to maximize flow to the WWTP.
- In February 2017, the City submitted to EPA and MassDEP an Integrated Final LTCP, an 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.
- The CPE identified all the processes, equipment, and infrastructure needs at the plant to keep the facility running reliably and to maximize treatment levels of wet weather flow conveyed to the WWTP. These facility improvements were prioritized, and an implementation plan was established to complete these improvements. These recommendations are included in the capital improvements program.
- In 2018, the City submitted its response to comments from EPA and MassDEP on the City's Integrated Final LTCP. The City's response 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, a green infrastructure demonstration project, and improvements to the Locke Street sewer area. The preliminary estimated cost for the Phase 3 CSO program is \$30 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.
- In 2019, the City hired Wright-Pierce to perform the planning, study, and preliminary design for the Phase 3 CSO program. The Phase 3 CSO work includes cleaning the Middle Siphon Interceptor from 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 021F and 021H. The cost of this ongoing work is \$2.5 million.

- In 2020, the City continued preliminary design of the Phase 3 CSO program. Wright-Pierce continued their analysis of the Locke Street CSO area. At the end of 2020 the analysis was 90% complete and Wright-Pierce was drafting a technical memo to summarize the results.
- The City continued to fine-tune the Wet Weather System Maximization control setpoints. In November 2020, the City completed a redesign of the system's control program. The new control strategy starts with the dry weather gates at a low open setpoint, allowing the dry weather flow. Once the level upstream of the dry weather gate reaches its maximum level, the dry weather gate opens and modulates to a predefined setpoint. When the upstream level reaches its maximum level, then the CSO gate modulates to minimize the overflow.
- In 2021, the City completed 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 was approximately \$1.4 million.
- In 2021, the City completed construction of the Dry Weather Connector Pipe Improvements project at a cost of \$1.5 million. The work included modifying the connector pipes at four CSO regulators and raising the Middle Siphon weir.
- In 2021, the City made the final determination to separate the Locke Street sewershed area which connects to Outfall 021F and 21H. Preliminary plans, 30% design level, are now being developed. The estimated project cost is \$30 million.

Nine Minimum Controls

The following is a summary of activities during calendar year 2021 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 continued to use its Computerized Maintenance Management System (CMMS) MaintStar and Utility Cloud 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.

The City flushed the Upper, Middle, and lower Siphons.

The City continued to upgrade the monitoring and alarm systems at sewer pumping stations. Another seven Mission systems were installed in 2021 by Weston & Sampson at a cost of \$45,500. There are now 23 pumping stations equipped with Mission alarm and monitoring systems.

The City continued to inspect its sewer pumping stations daily for stations with 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.

The City purchased a new sewer line cleaning truck with a vacuum unit. The truck has been in use since May 2021.

The City developed a written annual CCTV inspection plan which will be implemented in 2022 with the assistance of Weston & Sampson Engineers.

2. Maximize the use of the collection system for storage

Weirs at CSO regulators throughout the City 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. The City raised the Middle Siphon CSO weir in March 2021 as part of the Phase III CSO Improvements. Raising weirs any higher and closing more CSO outfalls will likely cause building and street flooding problems.

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 WWTP, 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.

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

One of the goals 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 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 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 WWTP influent fats, oil, and grease (FOG) has decreased significantly in recent years since the improvements to its IPP program. Since reducing FOG loadings, WWTP staff have been able to maintain low secondary blanket levels and improved sludge settling. The secondary bypass has been used only once since September 2017 resulting in a minimal bypass of 40,000 gallons.

The IPP Coordinator continues to maintain the FOG program via annual inspections. These inspections include checking pump out receipts of all grease traps and interceptors, inspecting and measuring FOG using a modified sludge judge in all 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 procedures and protocols established by the IPP Coordinator. These inspections continued through 2021. To date, FOG has significantly decreased in both the collection system and in the influent flow to the WWTP.

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. The City has been in contact with the EPA and kept them apprised of the progress of the Local Limit reevaluation. The Local Limits study was completed by Hoyle and Tanner in June of 2021 and submitted to the EPA.

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. This 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.

The City continues to implement measures to maximize flow to the WWTP, including raising weirs and adding CSO control gates that will allow real-time control to reduce CSO discharges. WWTP 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 monitor the influent pumps at South Mill Street Pumping Station, perform scheduled preventative maintenance, and perform any needed corrective maintenance on the pumps as a high priority.

The City cleaned the Middle Siphon, Upper Siphon, and the Lower Siphon to ensure the pipes are free of debris and obstructions to maximize flow to the WWTP.

WWTP staff operate and maintain the plant process to ensure the plant is capable of maximizing wet weather flow and treatment during wet weather.

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 the CSO outfalls/regulators monthly. As discussed previously in this report, CSO regulators are continuously monitored. 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 2021 there were no known dry weather overflows.

Locke Street Siphon barrels both North and South are on a semi-annual flushing schedule. Upper, Middle and Lower Siphons barrels are on a yearly flushing schedule to help prevent DWOs.

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 WWTP, 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 to reduce grit and floatables to the 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 2021, the City's contractor cleaned approximately 1,100 catch basins. City crews cleaned about 100 catch basins. The City removed 421 tons of debris, some of which are floatables, at a cost of \$39,680. City also uses its new Vac-truck to clean debris from the sewer system.

6. 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 as a preventive measure for the reduction of pollutants into the combined system. Additionally, the FOG program already discussed in this document helps minimize pollutants in the City's CSOs.

The City continued distributing brochures, including 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.

The City also holds household hazardous waste collection days twice a year, waste oil drop-offs once a month, curbside leaf/grass pickups twice a year, and electronics recycling twice a year. The City continued to operate its recycling and yard waste facility at the Highway garage.

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

The City maintains a CSO webpage to provide information about CSOs to the public. The web page also has links to the City's annual CSO reports.

The City developed and implemented a CSO Public Notification Plan as required by City's NPDES Permit. A copy of the Plan is included in Appendix D. As part of the Plan the City's website includes a link showing the activation status of the City's CSO outfalls in near real-time.

Each of the CSO regulators and outfalls has signage identifying the CSO outfall in English and Spanish.

As a requirement of 314 CMR 16, the City is implementing a new CSO notification plan. The new notification plan is scheduled to be available in May of 2022 and will include near real-time notifications and preliminary CSO volumes.

8. *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 its CSO regulators. This program is discussed previously in this report. The flow monitoring program continued throughout 2021.

End of Report

Appendix A

Summary of CSO of Regulator Activations 2021

APPENDIX A
SUMMARY OF CSO REGULATOR ACTIVATIONS FOR 2021

UPPER SIPHON								MIDDLE SIPHON SYSTEM							LOWER SIPHON SYSTEM				BRADFORD SYSTEM			
Activation by Storm Events (2021)								Middle Siphon	Emerson Street	Center Barrel Locke Street	Winter Street (Duncan Street)	Winter Street and Hale Street	Broadway Diversional	High Street Diversional	Lower Siphon	Main Street North	Bethany Avenue	Chestnut Street	Bradford Avenue	Middlesex Street	South Webster	
Date	Total Rainfall (in)	Peak Rainfall (in/hr)	Total Rainfall (in)	Peak Rainfall (in/hr)	Total Rainfall (in)	Peak Rainfall (in/hr)	Max Flow WWTF (mgd)	021A	021B	021F	021G	021H	37	38	13	19	40	41	32	34	39	Total
01/16/2021	1.19	0.30	1.21	0.36	1.25	0.36	55.04	1,040,496		329,202		6,844								815,278	8,531	
03/28/2021	0.59	0.14	0.61	0.24	0.69	0.32	54.60			1,768												1,768
03/31/2021	0.20	0.15	0.41	0.56	0.17	0.20	21.42			119,588		9,072										128,660
04/16/2021	1.82	0.15	1.92	0.28	1.98	0.28	60.22			21,040												21,040
04/29/2021	0.00	0.00	1.59	0.52	1.72	0.60	60.20			141,092											5,366	146,458
05/05/2021	0.00	0.00	0.99	0.40	1.12	0.44	63.39			173,454		21,538										194,992
06/08/2021	0.78	0.44	0.26	0.64	0.55	1.00	65.00			46,819		40,027					11,230	1,087	13,042	18,836	8,009	139,050
06/15/2021	0.53	0.16	6.00	0.09	0.93	1.36	62.54	52,369		124,342	4,724	114,895					17,994	23,860	3,562	59,937	6,689	408,372
06/30/2021	0.64	0.28	0.38	0.68	0.44	0.44	42.05			17,161		2,440										19,601
07/03/2021	1.54	0.43	13.00	0.12	1.42	0.56	6.58	246,200		370,064		34,044								215,084	3,336	868,727
07/07/2021	0.59	0.39	3.00	0.20	0.26	0.40	42.05			6,412		12,060					14,333	6,219				39,023
07/08/2021	0.68	0.52	6.00	0.11	0.48	0.68	65.00			18,660		109,029					1,963					129,652
07/09/2021	2.07	0.58	14.00	0.15	2.26	1.28	65.00	2,645,153		960,042	14,583	543,732			1,654,190	889	49,232	42,359	88,607	2,661,169	16,488	9,461,124
07/12/2021	1.30	0.53	10.00	0.13	1.38	1.00	62.11	746,586		515,188		230,325			18,484		10,589	17,427	7,811	933,874	4,107	2,535,423
07/13/2021	0.08	0.04	3.00	0.03	0.17	0.52	61.97			68,589		512										69,101
07/18/2021	0.58	0.27	8.00	0.07	0.57	0.36	17.07	176,026		100,743	14,504	123,787					103,744	18,371	17,130	86,967	8,033	649,303
07/20/2021	0.00	0.00	0.00	0.00	0.47	1.40	65.00					21,932			42,382							64,314
07/21/2021	0.05	0.05	1.00	0.05	0.00	0.00	42.44			10,964		481,434										492,398
07/25/2021	0.24	0.21	3.00	0.08	0.21	0.28	65.00			64,875	587			240			4,758	8,719		32,241		111,420
07/27/2021	0.40	0.29	2.00	0.20	0.43	0.84	65.00	1,621,096	4,906	668,269	60,727					94,544	206,575	106,412	165,293	1,331,030	27,542	4,286,396
07/29/2021	0.48	0.14	8.00	0.06	1.65	1.60	65.00								56,592							406,076
07/30/2021	0.56	0.42	3.00	0.19	0.01	0.04	65.00								1,787,769							1,940,698
08/05/2021	0.93	0.27	12.00	0.08	0.78	0.32	64.48			39,863		656										40,520
08/19/2021	1.09	0.46	7.00	0.16	0.89	0.60	62.29			185,327		37,991					3	1,784		1,441		226,546
08/22/2021	0.64	0.22	8.00	0.08	0.78	0.56	NA			146,070		68,710					2,208	3,735		20,235		240,958
09/01/2021	1.07	0.49	8.00	0.13	1.44	0.52	65.00	310,752		328,517		99,716								487,498		1,226,482
09/02/2021	2.50	0.62	7.00	0.36	1.90	0.68	65.00	2,997,290		1,282,129		638,325			1,420,000			11,531		2,934,589	9,546	9,293,410
09/09/2021	0.54	0.11	11.00	0.05	0.98	0.52	40.09			114,852		57,590										1,382,442
09/10/2021	0.25	0.20	3.00	0.08	0.04	0.28	64.28			45,450		1,578										47,028
09/13/2021	0.62	0.37	5.00	0.12	0.55	0.64	61.52			150,508		162,255					6,936	9,853		3,927		333,479
10/16/2021	0.16	0.09	4.00	0.04	0.25	0.84	51.72			12,213												12,213
10/26/2021	2.69	0.21	39.00	0.07	2.34	0.68	65.00	20,373		181,127		77,067						2,805		27,982		309,354
10/27/2021	0.54	0.08	19.00	0.03	0.43	0.24	46.99			13,773												13,773
10/30/2021	2.39	0.49	41.00	0.06	1.86	0.72	65.00	967,303		510,698	1,049	154,692						3,269		1,798,419	1,397	3,436,826
10/31/2021	2.55	0.22	21.00	0.12	0.77	0.76	65.00	154,175		281,514	1,191	122,281						9,299		274,881	5,364	848,705
11/12/2021	3.82	1.02	23.00	0.17	1.57	1.92	65.00	1,728,954		668,493	26,051	436,751			525,407		7,603	24,760	55,325	1,813,627	35,765	6,118,185
11/13/2021	0.44	0.20	4.00	0.11	0.18	0.24	60.93			16,113												16,113
12/11/2021	1.18	0.29	15.00	0.08	0.82	0.68	63.99			82,944	49	19,174										102,167
12/12/2021	0.84	0.21	4.00	0.21	0.01	0.92	60.12			54,462	1,479	32,389					1,431	1,762				91,524
						Volume TOTALS	3,343,575	12,706,773	4,906	7,872,326	124,943	3,660,846	0	240	5,504,824	95,433	436,636	295,215	350,769	13,517,014	140,174	48,053,673
Number of Activations for the Year								13	1	36	10	29	0	1	7	2	13	18	7	18	13	

Appendix B

Monthly Summary CSO Activations

APPENDIX B
MONTHLY SUMMARY CSO ACTIVATIONS

UPPER SIPHON SYSTEM			MIDDLE SIPHON SYSTEM							LOWER SIPHON SYSTEM				BRADFORD SYSTEM		
Monthly Parameters	Outfall#	024				Outfall 21H		Outfall 38								
	CSO Outfall Name	Upper Siphon - Varnum Street	021A	021B	021F	021G	21 H	037	038	013	019	040	041	032	034	039
			Middle Siphon	Emerson Street	Center Barrel Locke St	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
	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 2021 Totals	Total Flows	ND	1,040,496	ND	329,202	ND	6,844	ND	ND	ND	ND	ND	ND	ND	815,278	8,531
	Total Hrs		11.08		3.25		2.08									
	# Events		1		1		1								1	1
February 2021 Totals	Total Flows	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Total Hrs															
	# Events															
March 2021 Totals	Total Flows	ND	ND	ND	121,356	ND	9072	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Total Hrs				0.67		0.25									
	# Events				2		1									
April 2021 Totals	Total Flows	ND	ND	ND	162,132	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5,366
	Total Hrs				10.42											0.17
	# Events				2											1
May 2021 Totals	Total Flows	ND	ND	ND	173,454	ND	21,538	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Total Hrs				1.83		0.5									
	# Events				2		1									
June 2021 Totals	Total Flows	ND	ND	ND	52,369	ND	188,322	4,724	157,362	ND	ND	29,225	24,946	16,604	78,773	14,698
	Total Hrs				0.17		15.58	0.08	15.25			0.25	0.33	0.16	0.41	0.34
	# Events				1		3	1	3			2	2	2	2	2
July 2021 Totals	Total Flows	1,388,125	5,435,062	4,906	2,806,511	90,401	1,563,746	ND	240	3,559,417	95,432	389,231	201,469	278,841	5,260,365	59,506
	Total Hrs	2.71	9	0.08	22.92	1.08	9.75		0.8	5.02	0.25	1.66	3.49	1.00	8.58	2.00
	# Events	4	5	1	11	4	10		1	5	2	6	7	4	6	5
August 2021 Totals	Total Flows	ND	ND	ND	371,261	ND	107,357	ND	ND	ND	ND	2,211	5,519	ND	21,676	ND
	Total Hrs				3.83		1.50					0.16	0.17		0.16	
	# Events				3		3					2	2		2	
September 2021 Totals	Total Flows	1,210,000	3,308,041	ND	1,921,455		959,464	ND	ND	1,420,000	ND	6,936	21,384	ND	3,426,014	9,546
	Total Hrs	4.12	5.83		9.92					3.72		0.08	0.67		5.66	1.58
	# Events	1	1		5					1		1	2		3	1
October 2021 Totals	Total Flows	ND	1,141,850	ND	999,326	2,240	354,039	ND	ND	ND	ND	ND	15,373	ND	2,101,281	6,762
	Total Hrs		5.67		15.67	0.16	6.58						0.33		5.75	0.25
	# Events		3		35	1	3						3		3	2
November 2021 Totals	Total Flows	795,450	1,728,954	ND	684,605	26,051	436,751	ND	ND	525,407	ND	7,603	24,760	55,325	1,813,627	35,765
	Total Hrs	0.92	1.42		2.58	0.25	1.50			0.66		0.17	0.42	0.33	1.25	0.83
	# Events	1	1		2	1	1			1		1	1	1	1	1
December 2021 Totals	Total Flows	ND	ND	ND	137,407	1,528	51,564	ND	ND	ND	ND	1,431	1,762	ND	ND	ND
	Total Hrs				1.17	0.16	0.50					0.08	0.08			
	# Events				2	2	2					1	1			

ND (No Discharge)

Appendix C

CSO Activations

APPENDIX C
CSO Activations

Date	CSO Outfall No.	CSO Outfall Name	Overflow Start	Overflow End	Volume (gals.)	CSO Duration (hr.)	Lawrence Airport NOAA Rain Gage				Marginal Pumping Station Rain Gage				ASPW Rain Gage¹			
							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.)	Peak Hour Depth Intensity (in./hr.)	Storm Duration (hr.)	Daily Avg. Intensity (in./hr.)
01/16/2021	021F	Center Barrel - Locke Street	1/16/21 7:25	1/16/21 10:40	329,202	3.25	1.19	0.30	6.00	0.20	1.21	0.36	5.17	0.23	1.25	0.36	6.25	0.20
01/16/2021	021H	Winter Street and Hale Street	1/16/21 8:20	1/16/21 10:25	6,844	2.08	1.19	0.30	6.00	0.20	1.21	0.36	5.17	0.23	1.25	0.36	6.25	0.20
01/16/2021	39	South Webster Street	1/16/21 8:25	1/16/21 10:30	8,531	2.08	1.19	0.30	6.00	0.20	1.21	0.36	5.17	0.23	1.25	0.36	6.25	0.20
01/16/2021	021A	Middle Siphon	1/16/21 8:55	1/16/21 10:55	1,040,496	2.00	1.19	0.30	6.00	0.20	1.21	0.36	5.17	0.23	1.25	0.36	6.25	0.20
01/16/2021	34	Middlesex Street	1/16/21 9:00	1/16/21 10:40	815,278	1.67	1.19	0.30	6.00	0.20	1.21	0.36	5.17	0.23	1.25	0.36	6.25	0.20
		STORM	TOTALS:		2,200,351													
03/28/2021	021F	Center Barrel - Locke Street	3/28/21 14:25	3/28/21 14:30	1,768	0.08	0.59	0.14	11.00	0.05	0.61	0.24	4.25	0.14	0.69	0.32	6.75	0.10
		STORM	TOTALS:		1,768													
03/31/2021	021F	Center Barrel - Locke Street	3/31/21 23:00	3/31/21 23:35	119,588	0.58	0.20	0.15	4.00	0.05	0.41	0.56	2.00	0.21	0.17	0.20	2.00	0.09
03/31/2021	021H	Winter Street and Hale Street	3/31/21 23:05	3/31/21 23:20	9,072	0.25	0.20	0.15	4.00	0.05	0.41	0.56	2.00	0.21	0.17	0.20	2.00	0.09
		STORM	TOTALS:		128,660													
04/16/2021	021F	Center Barrel - Locke Street	4/16/21 7:50	4/16/21 8:20	21,040	0.50	1.82	0.15	24.00	0.08	1.92	0.28	11.25	0.17	1.98	0.28	17.25	0.11
		STORM	TOTALS:		21,040													
04/29/2021	021F	Center Barrel - Locke Street	4/29/21 12:40	4/29/21 22:35	141,092	9.92	0.00	0.00	0.00	0.00	1.59	0.52	8.83	0.18	1.72	0.60	11.50	0.15
04/29/2021	39	South Webster Street	4/29/21 12:45	4/29/21 12:55	5,366	0.17	0.00	0.00	0.00	0.00	1.59	0.52	8.83	0.18	1.72	0.60	11.50	0.15
		STORM	TOTALS:		146,458													
05/05/2021	021F	Center Barrel - Locke Street	5/5/21 2:20	5/5/21 4:40	173,454	2.33	0.00	0.00	0.00	0.00	0.99	0.40	4.75	0.21	1.12	0.44	9.25	0.12
05/05/2021	021H	Winter Street and Hale Street	5/5/21 2:55	5/5/21 3:25	21,538	0.50	0.00	0.00	0.00	0.00	0.99	0.40	4.75	0.21	1.12	0.44	9.25	0.12
		STORM	TOTALS:		194,992													
06/08/2021	32	Bradford Avenue	6/8/21 15:15	6/8/21 15:20	13,042	0.08	0.78	0.44	3.00	0.26	0.26	0.64	0.58	0.45	0.55	1.00	1.25	0.44
06/08/2021	34	Middlesex Street	6/8/21 15:15	6/8/21 15:20	18,836	0.08	0.78	0.44	3.00	0.26	0.26	0.64	0.58	0.45	0.55	1.00	1.25	0.44
06/08/2021	39	South Webster Street	6/8/21 15:15	6/8/21 15:25	8,009	0.17	0.78	0.44	3.00	0.26	0.26	0.64	0.58	0.45	0.55	1.00	1.25	0.44
06/08/2021	40	Bethany Avenue	6/8/21 15:20	6/8/21 15:20	11,230	0.08	0.78	0.44	3.00	0.26	0.26	0.64	0.58	0.45	0.55	1.00	1.25	0.44
06/08/2021	41	Chestnut Street	6/8/21 15:20	6/8/21 15:20	1,087	0.08	0.78	0.44	3.00	0.26	0.26	0.64	0.58	0.45	0.55	1.00	1.25	0.44
06/08/2021	021H	Winter Street and Hale Street	6/8/21 15:20	6/8/21 15:30	40,027	0.17	0.78	0.44	3.00	0.26	0.26	0.64	0.58	0.45	0.55	1.00	1.25	0.44
06/08/2021	021F	Center Barrel - Locke Street	6/8/21 15:20	6/8/21 15:40	46,819	0.33	0.78	0.44	3.00	0.26	0.26	0.64	0.58	0.45	0.55	1.00	1.25	0.44
		STORM	TOTALS:		139,051													
06/15/2021	34	Middlesex Street	6/15/21 2:20	6/15/21 2:40	59,937	0.33	0.53	0.16	6.00	0.09	0.93	1.36	2.83	0.33	1.17	1.64	5.25	0.22
06/15/2021	41	Chestnut Street	6/15/21 2:20	6/15/21 16:55	23,860	14.58	0.53	0.16	6.00	0.09	0.93	1.36	2.83	0.33	1.17	1.64	5.25	0.22
06/15/2021	40	Bethany Avenue	6/15/21 2:20	6/15/21 2:30	17,994	0.17	0.53	0.16	6.00	0.09	0.93	1.36	2.83	0.33	1.17	1.64	5.25	0.22
06/15/2021	32	Bradford Avenue	6/15/21 2:25	6/15/21 2:30	3,562	0.08	0.53	0.16	6.00	0.09	0.93	1.36	2.83	0.33	1.17	1.64	5.25	0.22
06/15/2021	39	South Webster Street	6/15/21 2:25	6/15/21 2:35	6,689	0.17	0.53	0.16	6.00	0.09	0.93	1.36	2.83	0.33	1.17	1.64	5.25	0.22
06/15/2021	021G	Winter Street	6/15/21 2:25	6/15/21 2:30	4,724	0.08	0.53	0.16	6.00	0.09	0.93	1.36	2.83	0.33	1.17	1.64	5.25	0.22
06/15/2021	021H	Winter Street and Hale Street	6/15/21 2:25	6/15/21 17:25	114,895	15.00	0.53	0.16	6.00	0.09	0.93	1.36	2.83	0.33	1.17	1.64	5.25	0.22
06/15/2021	021F	Center Barrel - Locke Street	6/15/21 2:25	6/15/21 17:30	124,342	15.08	0.53	0.16	6.00	0.09	0.93	1.36	2.83	0.33	1.17	1.64	5.25	0.22
06/15/2021	021A	Middle Siphon	6/15/21 2:30	6/15/21 2:40	52,369	0.17	0.53	0.16	6.00	0.09	0.93	1.36	2.83	0.33	1.17	1.64	5.25	0.22
		STORM	TOTALS:		408,370													
06/30/2021	021F	Center Barrel - Locke Street	6/30/21 17:00	6/30/21 17:10	17,161	0.17	0.64	0.28	7.00	0.09	0.38	0.68	1.83	0.21	0.44	0.44	4.25	0.10
06/30/2021	021H	Winter Street and Hale Street	6/30/21 17:05	6/30/21 17:05	2,440	0.08	0.64	0.28	7.00	0.09	0.38	0.68	1.83	0.21	0.44	0.44	4.25	0.10
		STORM	TOTALS:		19,601													
07/03/2021	021F	Center Barrel - Locke Street	7/3/21 18:10	7/3/21 23:25	370,064	5.25	1.54	0.43	13.00	0.12	1.42	0.56	6.58	0.22	1.39	0.52	9.00	0.15
07/03/2021	021H	Winter Street and Hale Street	7/3/21 21:45	7/3/21 22:25	34,044	0.67	1.54	0.43	13.00	0.12	1.42	0.56	6.58	0.22	1.39	0.52	9.00	0.15
07/03/2021	39	South Webster Street	7/3/21 21:50	7/3/21 22:25	3,336	0.58	1.54	0.43	13.00	0.12	1.42	0.56	6.58	0.22	1.39	0.52	9.00	0.15
07/03/2021	34	Middlesex Street	7/3/21 22:10	7/3/21 23:10	215,084	1.00	1.54	0.43	13.00	0.12	1.42	0.56	6.58	0.22	1.39	0.52	9.00	0.15
07/03/2021	021A	Middle Siphon	7/3/21 22:10	7/3/21 23:25	246,200	1.25	1.54	0.43	13.00	0.12	1.42	0.56	6.58	0.22	1.39	0.52	9.00	0.15
		STORM	TOTALS:		868,727													
07/07/2021	41	Chestnut Street	7/7/21 15:35	7/7/21 15:35	6,219	0.08	0.59	0.39	3.00	0.20	0.26	0.40	0.67	0.39	0.38	0.76	1.75	0.22
07/07/2021	40	Bethany Avenue	7/7/21 15:35	7/7/21 15:35	14,333	0.08	0.59	0.39	3.00	0.20	0.26	0.40	0.67	0.39	0.38	0.76	1.75	0.22
07/07/2021	021F	Center Barrel - Locke Street	7/7/21 15:40	7/7/21 15:50	6,412	0.17	0.59	0.39	3.00	0.20	0.26	0.40	0.67	0.39	0.38	0.76	1.75	0.22
07/07/2021	021H	Winter Street and Hale Street	7/7/21 15:40	7/7/21 15:45	12,060	0.08	0.59	0.39	3.00	0.20	0.26	0.40	0.67	0.39	0.38	0.76	1.75	0.22
		STORM	TOTALS:		39,024													
07/08/2021	021F	Center Barrel - Locke Street	7/8/21 3:35	7/8/21 4:05	18,660	0.50	0.68	0.52	6.00	0.11	0.48	0.68	2.00	0.24	0.50	0.56	3.25	0.15

Date	CSO Outfall No.	CSO Outfall Name	Overflow Start	Overflow End	Volume (gals.)	CSO Duration (hr.)	Lawrence Airport NOAA Rain Gage				Marginal Pumping Station Rain Gage				ASPW Rain Gage¹			
							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.)	Peak Hour Depth Intensity (in./hr.)	Storm Duration (hr.)	Daily Avg. Intensity (in./hr.)
07/08/2021	021H	Winter Street and Hale Street	7/8/21 3:35	7/8/21 3:55	109,029	0.33	0.68	0.52	6.00	0.11	0.48	0.68	2.00	0.24	0.50	0.56	3.25	0.15
07/08/2021	41	Chestnut Street	7/8/21 3:45	7/8/21 3:45	1,963	0.08	0.68	0.52	6.00	0.11	0.48	0.68	2.00	0.24	0.50	0.56	3.25	0.15
		STORM	TOTALS:		129,652													
07/09/2021	021F	Center Barrel - Locke Street	7/9/21 9:10	7/9/21 14:15	960,042	5.08	2.07	0.58	14.00	0.15	2.26	1.28	7.00	0.32	2.44	1.20	9.75	0.25
07/09/2021	41	Chestnut Street	7/9/21 9:50	7/9/21 11:50	42,359	2.00	2.07	0.58	14.00	0.15	2.26	1.28	7.00	0.32	2.44	1.20	9.75	0.25
07/09/2021	021H	Winter Street and Hale Street	7/9/21 10:00	7/9/21 13:55	543,732	3.92	2.07	0.58	14.00	0.15	2.26	1.28	7.00	0.32	2.44	1.20	9.75	0.25
07/09/2021	34	Middlesex Street	7/9/21 10:25	7/9/21 14:00	2,661,169	3.58	2.07	0.58	14.00	0.15	2.26	1.28	7.00	0.32	2.44	1.20	9.75	0.25
07/09/2021	021A	Middle Siphon	7/9/21 10:30	7/9/21 14:05	2,645,153	3.58	2.07	0.58	14.00	0.15	2.26	1.28	7.00	0.32	2.44	1.20	9.75	0.25
07/09/2021	40	Bethany Avenue	7/9/21 11:20	7/9/21 11:45	49,232	0.42	2.07	0.58	14.00	0.15	2.26	1.28	7.00	0.32	2.44	1.20	9.75	0.25
07/09/2021	13	Lower Siphon	7/9/21 11:29	7/9/21 12:58	1,654,190	1.48	2.07	0.58	14.00	0.15	2.26	1.28	7.00	0.32	2.44	1.20	9.75	0.25
07/09/2021	32	Bradford Avenue	7/9/21 11:35	7/9/21 11:50	88,607	0.25	2.07	0.58	14.00	0.15	2.26	1.28	7.00	0.32	2.44	1.20	9.75	0.25
07/09/2021	021G	Winter Street	7/9/21 11:35	7/9/21 11:40	14,583	0.08	2.07	0.58	14.00	0.15	2.26	1.28	7.00	0.32	2.44	1.20	9.75	0.25
07/09/2021	39	South Webster Street	7/9/21 11:35	7/9/21 12:00	16,488	0.42	2.07	0.58	14.00	0.15	2.26	1.28	7.00	0.32	2.44	1.20	9.75	0.25
07/09/2021	24	Upper Siphon	7/9/21 11:36	7/9/21 13:15	784,678	1.64	2.07	0.58	14.00	0.15	2.26	1.28	7.00	0.32	2.44	1.20	9.75	0.25
07/09/2021	19	Main Street North	7/9/21 11:45	7/9/21 11:45	889	0.08	2.07	0.58	14.00	0.15	2.26	1.28	7.00	0.32	2.44	1.20	9.75	0.25
		STORM	TOTALS:		9,461,124													
07/12/2021	021F	Center Barrel - Locke Street	7/12/21 6:00	7/12/21 9:40	515,188	3.67	1.30	0.53	10.00	0.13	1.38	1.00	4.75	0.29	1.42	0.80	6.75	0.21
07/12/2021	021H	Winter Street and Hale Street	7/12/21 6:00	7/12/21 9:00	230,325	3.00	1.30	0.53	10.00	0.13	1.38	1.00	4.75	0.29	1.42	0.80	6.75	0.21
07/12/2021	34	Middlesex Street	7/12/21 6:35	7/12/21 9:10	933,874	2.58	1.30	0.53	10.00	0.13	1.38	1.00	4.75	0.29	1.42	0.80	6.75	0.21
07/12/2021	40	Bethany Avenue	7/12/21 6:40	7/12/21 6:50	10,589	0.17	1.30	0.53	10.00	0.13	1.38	1.00	4.75	0.29	1.42	0.80	6.75	0.21
07/12/2021	41	Chestnut Street	7/12/21 6:40	7/12/21 6:55	17,427	0.25	1.30	0.53	10.00	0.13	1.38	1.00	4.75	0.29	1.42	0.80	6.75	0.21
07/12/2021	021A	Middle Siphon	7/12/21 6:45	7/12/21 9:35	746,586	2.83	1.30	0.53	10.00	0.13	1.38	1.00	4.75	0.29	1.42	0.80	6.75	0.21
07/12/2021	32	Bradford Avenue	7/12/21 6:50	7/12/21 6:50	7,811	0.08	1.30	0.53	10.00	0.13	1.38	1.00	4.75	0.29	1.42	0.80	6.75	0.21
07/12/2021	39	South Webster Street	7/12/21 6:50	7/12/21 6:55	4,107	0.08	1.30	0.53	10.00	0.13	1.38	1.00	4.75	0.29	1.42	0.80	6.75	0.21
07/12/2021	24	Upper Siphon	7/12/21 7:47	7/12/21 8:05	51,034	0.30	1.30	0.53	10.00	0.13	1.38	1.00	4.75	0.29	1.42	0.80	6.75	0.21
07/12/2021	13	Lower Siphon	7/12/21 8:01	7/12/21 8:05	18,484	0.07	1.30	0.53	10.00	0.13	1.38	1.00	4.75	0.29	1.42	0.80	6.75	0.21
		STORM	TOTALS:		2,535,424													
07/13/2021	021F	Center Barrel - Locke Street	7/13/21 11:20	7/13/21 11:35	22,706	0.25	0.08	0.04	3.00	0.03	0.17	0.52	0.58	0.29	0.32	0.52	1.25	0.26
07/13/2021	021H	Winter Street and Hale Street	7/13/21 11:20	7/13/21 11:25	6,891	0.08	0.08	0.04	3.00	0.03	0.17	0.52	0.58	0.29	0.32	0.52	1.25	0.26
07/18/2021	021F	Center Barrel - Locke Street	7/18/21 4:35	7/18/21 5:25	68,589	0.83	0.58	0.27	8.00	0.07	0.57	0.36	2.75	0.21	0.53	0.24	4.00	0.13
07/18/2021	021H	Winter Street and Hale Street	7/18/21 4:50	7/18/21 4:50	512	0.08	0.58	0.27	8.00	0.07	0.57	0.36	2.75	0.21	0.53	0.24	4.00	0.13
		STORM	TOTALS:		98,698													
07/20/2021	021G	Winter Street	7/20/21 23:20	7/20/21 23:30	14,504	0.17	0.00	0.00	0.00	0.00	0.47	1.40	0.33	1.42	0.00	0.00	0.00	0.00
07/20/2021	41	Chestnut Street	7/20/21 23:20	7/20/21 23:30	18,371	0.17	0.00	0.00	0.00	0.00	0.47	1.40	0.33	1.42	0.00	0.00	0.00	0.00
07/20/2021	021F	Center Barrel - Locke Street	7/20/21 23:20	7/20/21 23:50	100,743	0.50	0.00	0.00	0.00	0.00	0.47	1.40	0.33	1.42	0.00	0.00	0.00	0.00
07/20/2021	021H	Winter Street and Hale Street	7/20/21 23:20	7/20/21 23:40	123,787	0.33	0.00	0.00	0.00	0.00	0.47	1.40	0.33	1.42	0.00	0.00	0.00	0.00
07/20/2021	34	Middlesex Street	7/20/21 23:20	7/20/21 23:40	86,967	0.33	0.00	0.00	0.00	0.00	0.47	1.40	0.33	1.42	0.00	0.00	0.00	0.00
07/20/2021	40	Bethany Avenue	7/20/21 23:20	7/20/21 23:30	103,744	0.17	0.00	0.00	0.00	0.00	0.47	1.40	0.33	1.42	0.00	0.00	0.00	0.00
07/20/2021	32	Bradford Avenue	7/20/21 23:25	7/20/21 23:30	17,130	0.08	0.00	0.00	0.00	0.00	0.47	1.40	0.33	1.42	0.00	0.00	0.00	0.00
07/20/2021	021A	Middle Siphon	7/20/21 23:25	7/20/21 23:40	176,026	0.25	0.00	0.00	0.00	0.00	0.47	1.40	0.33	1.42	0.00	0.00	0.00	0.00
07/20/2021	39	South Webster Street	7/20/21 23:25	7/20/21 23:30	8,033	0.08	0.00	0.00	0.00	0.00	0.47	1.40	0.33	1.42	0.00	0.00	0.00	0.00
		STORM	TOTALS:		649,303													
07/21/2021	13	Lower Siphon	7/21/21 0:34	7/21/21 3:21	42,382	2.78	0.05	0.05	1.00	0.05	0.00	0.00	0.00	0.00	0.52	1.36	1.25	0.42
		STORM	TOTALS:		42,382													
07/25/2021	021F	Center Barrel - Locke Street	7/25/21 10:30	7/25/21 10:45	10,964	0.25	0.24	0.21	3.00	0.08	0.21	0.28	1.17	0.18	0.32	0.48	2.50	0.13
		STORM	TOTALS:		10,964													
07/27/2021	021G	Winter Street	7/27/21 18:05	7/27/21 18:05	587	0.08	0.40	0.29	2.00	0.20	0.43	0.84	1.42	0.30	0.41	0.76	2.75	0.15
07/27/2021	41	Chestnut Street	7/27/21 18:05	7/27/21 18:10	8,719	0.08	0.40	0.29	2.00	0.20	0.43	0.84	1.42	0.30	0.41	0.76	2.75	0.15
07/27/2021	34	Middlesex Street	7/27/21 18:05	7/27/21 18:10	32,241	0.08	0.40	0.29	2.00	0.20	0.43	0.84	1.42	0.30	0.41	0.76	2.75	0.15
07/27/2021	40	Bethany Avenue	7/27/21 18:05	7/27/21 18:10	4,758	0.08	0.40	0.29	2.00	0.20	0.43	0.84	1.42	0.30	0.41	0.76	2.75	0.15
07/27/2021	021F	Center Barrel - Locke Street	7/27/21 18:10	7/27/21 19:35	64,875	1.42	0.40	0.29	2.00	0.20	0.43	0.84	1.42	0.30	0.41	0.76	2.75	0.15
07/27/2021	021H	Winter Street and Hale Street	7/27/21 18:10	7/27/21 18:20	21,932	0.17	0.40	0.29	2.00	0.20	0.43	0.84	1.42	0.30	0.41	0.76	2.75	0.15
		STORM	TOTALS:		133,112													
07/29/2021	021F	Center Barrel - Locke Street	7/29/21 18:40	7/29/21 23:40	668,269	5.00	0.48	0.14	8.00	0.06	1.65	1.60	3.08	0.54	0.90	0.72	4.75	0.19
07/29/2021	021G	Winter Street	7/29/21 22:25	7/29/21 23:10	60,727	0.75	0.48	0.14	8.00	0.06	1.65	1.60	3.08	0.54	0.90	0.72	4.75	0.19
07/29/2021	41	Chestnut Street	7/29/21 22:25	7/29/21 23:15	106,412	0.83	0.48	0.14	8.00	0.06	1.65	1.60	3.08	0.54	0.90	0.72	4.75	0.19

Date	CSO Outfall No.	CSO Outfall Name	Overflow Start	Overflow End	Volume (gals.)	CSO Duration (hr.)	Lawrence Airport NOAA Rain Gage				Marginal Pumping Station Rain Gage				ASPW Rain Gage¹			
							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.)	Peak Hour Depth Intensity (in./hr.)	Storm Duration (hr.)	Daily Avg. Intensity (in./hr.)
07/29/2021	34	Middlesex Street	7/29/21 22:25	7/29/21 23:25	1,331,030	1.00	0.48	0.14	8.00	0.06	1.65	1.60	3.08	0.54	0.90	0.72	4.75	0.19
07/29/2021	021H	Winter Street and Hale Street	7/29/21 22:25	7/29/21 23:30	481,434	1.08	0.48	0.14	8.00	0.06	1.65	1.60	3.08	0.54	0.90	0.72	4.75	0.19
07/29/2021	40	Bethany Avenue	7/29/21 22:25	7/29/21 23:10	206,575	0.75	0.48	0.14	8.00	0.06	1.65	1.60	3.08	0.54	0.90	0.72	4.75	0.19
07/29/2021	021A	Middle Siphon	7/29/21 22:30	7/29/21 23:35	1,621,096	1.08	0.48	0.14	8.00	0.06	1.65	1.60	3.08	0.54	0.90	0.72	4.75	0.19
07/29/2021	39	South Webster Street	7/29/21 22:30	7/29/21 23:20	27,542	0.83	0.48	0.14	8.00	0.06	1.65	1.60	3.08	0.54	0.90	0.72	4.75	0.19
07/29/2021	32	Bradford Avenue	7/29/21 22:40	7/29/21 23:15	165,293	0.58	0.48	0.14	8.00	0.06	1.65	1.60	3.08	0.54	0.90	0.72	4.75	0.19
07/29/2021	38	High Street	7/29/21 23:00	7/29/21 23:00	240	0.08	0.48	0.14	8.00	0.06	1.65	1.60	3.08	0.54	0.90	0.72	4.75	0.19
07/29/2021	021B	Emerson Street	7/29/21 23:05	7/29/21 23:05	4,906	0.08	0.48	0.14	8.00	0.06	1.65	1.60	3.08	0.54	0.90	0.72	4.75	0.19
07/29/2021	19	Main Street North	7/29/21 23:05	7/29/21 23:15	94,544	0.17	0.48	0.14	8.00	0.06	1.65	1.60	3.08	0.54	0.90	0.72	4.75	0.19
07/29/2021	24	Upper Siphon	7/29/21 23:38	7/29/21 23:59	349,484	0.35	0.48	0.14	8.00	0.06	1.65	1.60	3.08	0.54	0.90	0.72	4.75	0.19
07/29/2021	13	Lower Siphon	7/29/21 23:48	7/29/21 23:59	56,592	0.20	0.48	0.14	8.00	0.06	1.65	1.60	3.08	0.54	0.90	0.72	4.75	0.19
		STORM	TOTALS:		5,174,146													
07/30/2021	24	Upper Siphon	7/30/21 0:00	7/30/21 0:25	152,929	0.42	0.56	0.42	3.00	0.19	0.01	0.04	0.08	0.13	0.41	0.12	1.00	0.41
07/30/2021	13	Lower Siphon	7/30/21 0:00	7/30/21 0:30	1,787,769	0.50	0.56	0.42	3.00	0.19	0.01	0.04	0.08	0.13	0.41	0.12	1.00	0.41
		STORM	TOTALS:		1,940,698													
08/05/2021	021F	Center Barrel - Locke Street	8/5/21 11:35	8/5/21 12:05	39,863	0.50	0.93	0.27	12.00	0.08	0.78	0.32	5.00	0.16	1.22	0.28	9.75	0.13
08/05/2021	021H	Winter Street and Hale Street	8/5/21 11:45	8/5/21 11:50	656	0.08	0.93	0.27	12.00	0.08	0.78	0.32	5.00	0.16	1.22	0.28	9.75	0.13
		STORM	TOTALS:		40,520													
08/19/2021	021F	Center Barrel - Locke Street	8/19/21 9:50	8/19/21 11:55	185,327	2.08	1.09	0.46	7.00	0.16	0.89	0.60	3.42	0.26	1.16	0.64	5.00	0.23
08/19/2021	021H	Winter Street and Hale Street	8/19/21 10:45	8/19/21 11:05	37,991	0.33	1.09	0.46	7.00	0.16	0.89	0.60	3.42	0.26	1.16	0.64	5.00	0.23
08/19/2021	40	Bethany Avenue	8/19/21 10:45	8/19/21 10:45	3	0.08	1.09	0.46	7.00	0.16	0.89	0.60	3.42	0.26	1.16	0.64	5.00	0.23
08/19/2021	41	Chestnut Street	8/19/21 10:45	8/19/21 10:50	1,784	0.08	1.09	0.46	7.00	0.16	0.89	0.60	3.42	0.26	1.16	0.64	5.00	0.23
08/19/2021	34	Middlesex Street	8/19/21 10:45	8/19/21 10:45	1,441	0.08	1.09	0.46	7.00	0.16	0.89	0.60	3.42	0.26	1.16	0.64	5.00	0.23
		STORM	TOTALS:		226,546													
08/22/2021	021F	Center Barrel - Locke Street	8/22/21 9:45	8/22/21 11:00	146,070	1.25	0.64	0.22	8.00	0.08	0.78	0.56	2.50	0.31	0.00	0.00	0.00	0.00
08/22/2021	021H	Winter Street and Hale Street	8/22/21 9:50	8/22/21 10:55	68,710	1.08	0.64	0.22	8.00	0.08	0.78	0.56	2.50	0.31	0.00	0.00	0.00	0.00
08/22/2021	41	Chestnut Street	8/22/21 10:35	8/22/21 10:40	3,735	0.08	0.64	0.22	8.00	0.08	0.78	0.56	2.50	0.31	0.00	0.00	0.00	0.00
08/22/2021	34	Middlesex Street	8/22/21 10:35	8/22/21 10:40	20,235	0.08	0.64	0.22	8.00	0.08	0.78	0.56	2.50	0.31	0.00	0.00	0.00	0.00
08/22/2021	40	Bethany Avenue	8/22/21 10:35	8/22/21 10:35	2,208	0.08	0.64	0.22	8.00	0.08	0.78	0.56	2.50	0.31	0.00	0.00	0.00	0.00
		STORM	TOTALS:		240,958													
09/01/2021	021F	Center Barrel - Locke Street	9/1/21 21:15	9/1/21 23:55	328,517	2.67	1.07	0.49	8.00	0.13	1.44	0.52	5.00	0.29	0.00	0.00	0.00	0.00
09/01/2021	021H	Winter Street and Hale Street	9/1/21 22:20	9/1/21 23:55	99,716	1.58	1.07	0.49	8.00	0.13	1.44	0.52	5.00	0.29	0.00	0.00	0.00	0.00
09/01/2021	34	Middlesex Street	9/1/21 23:10	9/1/21 23:55	487,498	0.75	1.07	0.49	8.00	0.13	1.44	0.52	5.00	0.29	0.00	0.00	0.00	0.00
09/01/2021	021A	Middle Siphon	9/1/21 23:10	9/1/21 23:55	310,752	0.75	1.07	0.49	8.00	0.13	1.44	0.52	5.00	0.29	0.00	0.00	0.00	0.00
		STORM	TOTALS:		1,226,482													
09/02/2021	021F	Center Barrel - Locke Street	9/2/21 0:00	9/2/21 5:20	1,282,129	5.33	2.50	0.62	7.00	0.36	1.90	0.68	5.08	0.37	0.00	0.00	0.00	0.00
09/02/2021	021H	Winter Street and Hale Street	9/2/21 0:00	9/2/21 4:45	638,325	4.75	2.50	0.62	7.00	0.36	1.90	0.68	5.08	0.37	0.00	0.00	0.00	0.00
09/02/2021	34	Middlesex Street	9/2/21 0:00	9/2/21 4:50	2,934,589	4.83	2.50	0.62	7.00	0.36	1.90	0.68	5.08	0.37	0.00	0.00	0.00	0.00
09/02/2021	021A	Middle Siphon	9/2/21 0:00	9/2/21 5:05	2,997,290	5.08	2.50	0.62	7.00	0.36	1.90	0.68	5.08	0.37	0.00	0.00	0.00	0.00
09/02/2021	24	Upper Siphon	9/2/21 0:40	9/2/21 4:47	1,210,000	4.12	2.50	0.62	7.00	0.36	1.90	0.68	5.08	0.37	0.00	0.00	0.00	0.00
09/02/2021	13	Lower Siphon	9/2/21 0:51	9/2/21 4:34	1,420,000	3.72	2.50	0.62	7.00	0.36	1.90	0.68	5.08	0.37	0.00	0.00	0.00	0.00
09/02/2021	41	Chestnut Street	9/2/21 1:55	9/2/21 2:30	11,531	0.58	2.50	0.62	7.00	0.36	1.90	0.68	5.08	0.37	0.00	0.00	0.00	0.00
09/02/2021	39	South Webster Street	9/2/21 2:00	9/2/21 3:35	9,546	1.58	2.50	0.62	7.00	0.36	1.90	0.68	5.08	0.37	0.00	0.00	0.00	0.00
		STORM	TOTALS:		10,503,409													
09/09/2021	021F	Center Barrel - Locke Street	9/9/21 23:05	9/9/21 23:55	114,852	0.83	0.54	0.11	11.00	0.05	0.98	0.52	5.75	0.17	0.69	0.20	9.00	0.08
09/09/2021	021H	Winter Street and Hale Street	9/9/21 23:25	9/9/21 23:55	57,590	0.50	0.54	0.11	11.00	0.05	0.98	0.52	5.75	0.17	0.69	0.20	9.00	0.08
		STORM	TOTALS:		172,442													
09/10/2021	021F	Center Barrel - Locke Street	9/10/21 0:00	9/10/21 0:20	45,450	0.33	0.25	0.20	3.00	0.08	0.04	0.28	0.33	0.12	0.37	0.52	2.25	0.16
09/10/2021	021H	Winter Street and Hale Street	9/10/21 0:00	9/10/21 0:00	1,578	0.08	0.25	0.20	3.00	0.08	0.04	0.28	0.33	0.12	0.37	0.52	2.25	0.16
		STORM	TOTALS:		47,028													
09/13/2021	021F	Center Barrel - Locke Street	9/13/21 4:35	9/13/21 5:20	150,508	0.75	0.62	0.37	5.00	0.12	0.55	0.64	2.25	0.24	0.58	1.08	3.50	0.17
09/13/2021	021H	Winter Street and Hale Street	9/13/21 4:35	9/13/21 5:10	162,255	0.58	0.62	0.37	5.00	0.12	0.55	0.64	2.25	0.24	0.58	1.08	3.50	0.17
09/13/2021	41	Chestnut Street	9/13/21 4:50	9/13/21 4:55	9,853	0.08	0.62	0.37	5.00	0.12	0.55	0.64	2.25	0.24	0.58	1.08	3.50	0.17
09/13/2021	40	Bethany Avenue	9/13/21 4:50	9/13/21 4:55	6,936	0.08	0.62	0.37	5.00	0.12	0.55	0.64	2.25	0.24	0.58	1.08	3.50	0.17
09/13/2021	34	Middlesex Street	9/13/21 4:55	9/13/21 4:55	3,927	0.08	0.62	0.37	5.00	0.12	0.55	0.64	2.25	0.24	0.58	1.08	3.50	0.17
		STORM	TOTALS:		333,480													

Appendix D

Calendar Year Rainfall Data

APPENDIX D

CALANDAR YEAR RAINFALL DATA

Date	Lawrence Airport (US W00094723) NOAA Rain				Marginal Pumping Station Rain Gage				ASPW Rain Gage			
	Rain Total (in.)	Peak hour intensity (in/hr.)	Storm Duration (hours)	Daily Avg. Intensity (in/hr.)	Rain Total (in.)	Peak Hour Intensity (in./hr.)	Storm Duration (hours)	Daily Avg. Intensity (in./hr.)	Rain Total (in.)	Peak Hour Intensity (in./hr.)	Storm Duration (hours)	Daily Avg. Intensity (in./hr.)
01/01/2021	0.11	0.11	1.00	0.11	0.00	0.00	0.00	0.00	0.04	0.12	0.50	0.08
01/02/2021	0.47	0.07	12.00	0.04	0.64	0.24	4.00	0.16	0.71	0.16	8.75	0.08
01/03/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/04/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/05/2021	0.01	0.01	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/06/2021	0.00	0.00	0.00	0.00	0.01	0.04	0.08	0.13	0.00	0.00	0.00	0.00
01/07/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/08/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/09/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/10/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/11/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/12/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/13/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/14/2021	0.06	0.02	4.00	0.02	0.05	0.04	0.42	0.12	0.07	0.08	1.25	0.06
01/15/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/16/2021	1.19	0.30	6.00	0.20	1.21	0.36	5.17	0.23	1.25	0.36	6.25	0.20
01/17/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/18/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/19/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/20/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/21/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/22/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/23/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/24/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/25/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/26/2021	0.12	0.04	4.00	0.03	0.00	0.00	0.00	0.00	0.09	0.08	1.75	0.05
01/27/2021	0.04	0.01	4.00	0.01	0.16	0.28	0.92	0.17	0.03	0.08	0.50	0.06
01/28/2021	0.04	0.02	3.00	0.01	0.03	0.04	0.25	0.12	0.02	0.04	0.50	0.04
01/29/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/30/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/31/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
02/01/2021	0.28	0.06	8.00	0.04	0.00	0.00	0.00	0.00	0.85	0.24	7.75	0.11
02/02/2021	0.20	0.05	8.00	0.03	0.01	0.04	0.08	0.13	0.91	0.20	7.00	0.13
02/03/2021	0.00	0.00	0.00	0.00	0.15	0.08	1.25	0.12	0.00	0.00	0.00	0.00
02/04/2021	0.00	0.00	0.00	0.00	0.04	0.04	0.33	0.12	0.00	0.00	0.00	0.00
02/05/2021	0.01	0.01	1.00	0.01	0.02	0.04	0.17	0.12	0.02	0.08	0.25	0.08
02/06/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
02/07/2021	0.29	0.05	8.00	0.04	0.00	0.00	0.00	0.00	0.45	0.16	6.50	0.07
02/08/2021	0.00	0.00	0.00	0.00	0.04	0.04	0.33	0.12	0.00	0.00	0.00	0.00
02/09/2021	0.10	0.03	6.00	0.02	0.03	0.04	0.25	0.12	0.11	0.16	1.75	0.06
02/10/2021	0.00	0.00	0.00	0.00	0.01	0.04	0.08	0.13	0.00	0.00	0.00	0.00
02/11/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
02/12/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
02/13/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
02/14/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
02/15/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
02/16/2021	0.80	0.18	9.00	0.09	0.44	0.28	2.50	0.18	0.90	0.28	7.00	0.13
02/17/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
02/18/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
02/19/2021	0.11	0.02	9.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
02/20/2021	0.00	0.00	0.00	0.00	0.16	0.12	1.17	0.14	0.00	0.00	0.00	0.00
02/21/2021	0.00	0.00	0.00	0.00	0.01	0.04	0.08	0.13	0.00	0.00	0.00	0.00
02/22/2021	0.18	0.05	5.00	0.04	0.18	0.08	1.50	0.12	0.25	0.12	3.75	0.07
02/23/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
02/24/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
02/25/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
02/26/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
02/27/2021	0.24	0.07	8.00	0.03	0.23	0.12	1.92	0.12	0.29	0.12	4.75	0.06
02/28/2021	0.01	0.01	1.00	0.01	0.01	0.00	0.08	0.13	0.01	0.04	0.25	0.04
03/01/2021	0.28	0.06	9.00	0.03	0.33	0.12	2.75	0.12	0.44	0.16	6.00	0.07
03/02/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
03/03/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
03/04/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
03/05/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
03/06/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
03/07/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
03/08/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
03/09/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
03/10/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
03/11/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
03/12/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
03/13/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
03/14/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
03/15/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
03/16/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
03/17/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
03/18/2021	0.62	0.11	11.00	0.06	0.60	0.12	5.00	0.12	0.64	0.20	7.00	0.09
03/19/2021	0.02	0.02	1.00	0.02	0.00	0.00	0.00	0.00	0.02	0.04	0.25	0.08
03/20/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
03/21/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
03/22/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
03/23/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
03/24/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
03/25/2021	0.17	0.07	7.00	0.02	0.26	0.24	1.75	0.15	0.29	0.20	3.00	0.10
03/26/2021	0.05	0.04	2.00	0.03	0.08	0.12	0.58	0.14	0.09	0.12	1.25	0.07
03/27/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
03/28/2021	0.59	0.14	11.00	0.05	0.61	0.24	4.25	0.14	0.69	0.32	6.75	0.10

03/29/2021	0.03	0.03	1.00	0.03	0.01	0.04	0.08	0.13	0.05	0.04	0.50	0.10
03/30/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
03/31/2021	0.20	0.15	4.00	0.05	0.41	0.56	2.00	0.21	0.17	0.20	2.00	0.09
04/01/2021	0.55	0.13	11.00	0.05	0.41	0.12	3.25	0.13	0.88	0.24	8.25	0.11
04/02/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
04/03/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
04/04/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
04/05/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
04/06/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
04/07/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
04/08/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
04/09/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
04/10/2021	0.02	0.02	1.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
04/11/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
04/12/2021	0.01	0.01	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
04/13/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
04/14/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
04/15/2021	0.04	0.02	3.00	0.01	0.12	0.08	1.00	0.12	0.22	0.36	2.25	0.10
04/16/2021	1.82	0.15	24.00	0.08	1.92	0.28	11.25	0.17	1.98	0.28	17.25	0.11
04/17/2021	0.07	0.03	4.00	0.02	0.12	0.08	1.00	0.12	0.10	0.12	1.50	0.07
04/18/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
04/19/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
04/20/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.12	0.25	0.12
04/21/2021	0.00	0.00	0.00	0.00	0.09	0.12	0.58	0.16	0.10	0.20	1.25	0.08
04/22/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
04/23/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
04/24/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
04/25/2021	0.00	0.00	0.00	0.00	0.05	0.08	0.42	0.12	0.09	0.12	1.25	0.07
04/26/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
04/27/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
04/28/2021	0.01	0.01	1.00	0.01	0.28	0.20	2.08	0.13	0.37	0.24	4.00	0.09
04/29/2021	0.00	0.00	0.00	0.00	1.59	0.52	8.83	0.18	1.72	0.60	11.50	0.15
04/30/2021	0.03	0.01	3.00	0.01	0.04	0.04	0.33	0.12	0.07	0.08	1.25	0.06
05/01/2021	0.01	0.01	1.00	0.01	0.00	0.04	0.00	0.00	0.02	0.04	0.25	0.08
05/02/2021	0.00	0.00	0.00	0.00	0.01	0.04	0.08	0.13	0.01	0.04	0.25	0.04
05/03/2021	0.00	0.00	0.00	0.00	0.03	0.04	0.25	0.12	0.02	0.08	0.25	0.08
05/04/2021	0.00	0.00	0.00	0.00	0.10	0.08	0.83	0.12	0.22	0.12	2.75	0.08
05/05/2021	0.00	0.00	0.00	0.00	0.99	0.40	4.75	0.21	1.12	0.44	9.25	0.12
05/06/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.16	0.25	0.16
05/07/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
05/08/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
05/09/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
05/10/2021	0.34	0.11	6.00	0.06	0.28	0.12	2.33	0.12	0.36	0.12	4.50	0.08
05/11/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
05/12/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
05/13/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
05/14/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
05/15/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
05/16/2021	0.00	0.00	0.00	0.00	0.01	0.04	0.08	0.13	0.00	0.00	0.00	0.00
05/17/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
05/18/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
05/19/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
05/20/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
05/21/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	No Data	No Data	0.00	0.00
05/22/2021	0.00	0.00	0.00	0.00	0.03	0.12	0.25	0.12	No Data	No Data	0.00	0.00
05/23/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	No Data	No Data	0.00	0.00
05/24/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	No Data	No Data	0.00	0.00
05/25/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	No Data	No Data	0.00	0.00
05/26/2021	0.27	0.09	5.00	0.05	0.20	0.20	1.42	0.14	0.23	0.16	2.75	0.08
05/27/2021	0.06	0.05	2.00	0.03	0.01	0.04	0.08	0.13	0.10	0.08	1.00	0.10
05/28/2021	0.49	0.11	7.00	0.07	0.45	0.12	3.58	0.13	0.43	0.20	5.00	0.09
05/29/2021	0.86	0.12	15.00	0.06	0.68	0.12	5.58	0.12	1.09	0.24	11.50	0.09
05/30/2021	0.79	0.11	14.00	0.06	0.91	0.24	6.58	0.14	1.09	0.28	10.25	0.11
05/31/2021	0.15	0.05	5.00	0.03	0.10	0.08	0.83	0.12	0.14	0.08	2.50	0.06
06/01/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.20	0.25	0.20
06/02/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
06/03/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
06/04/2021	0.00	0.00	0.00	0.00	0.04	0.16	0.17	0.24	0.02	0.08	0.25	0.08
06/05/2021	0.07	0.04	2.00	0.04	0.00	0.00	0.00	0.00	0.05	0.08	0.75	0.07
06/06/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.04	0.25	0.08
06/07/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00
06/08/2021	0.78	0.44	3.00	0.26	0.26	0.64	0.58	0.45	0.55	1.00	1.25	0.44
06/09/2021	0.04	0.03	2.00	0.02	0.02	0.04	0.17	0.12	0.05	0.08	0.75	0.07
06/10/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
06/11/2021	0.01	0.01	1.00	0.01	0.01	0.04	0.08	0.13	0.01	0.04	0.25	0.04
06/12/2021	0.47	0.17	6.00	0.08	0.45	0.20	2.83	0.16	0.49	0.28	4.00	0.12
06/13/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.08	0.50	0.06
06/14/2021	0.35	0.15	5.00	0.07	0.27	0.28	1.58	0.17	0.33	0.24	2.75	0.12
06/15/2021	0.53	0.16	6.00	0.09	0.93	1.36	2.83	0.33	1.17	1.64	5.25	0.22
06/16/2021	0.00	0.00	0.00	0.00	0.01	0.04	0.08	0.13	0.00	0.00	0.00	0.00
06/17/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
06/18/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
06/19/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.12	0.25	0.12
06/20/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.08	0.25	0.08
06/21/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.04	0.25	0.04
06/22/2021	0.30	0.07	7.00	0.04	0.24	0.16	1.75	0.14	0.38	0.16	5.50	0.07
06/23/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
06/24/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
06/25/2021	0.03	0.02	2.00	0.02	0.02	0.04	0.17	0.12	0.09	0.12	1.50	0.06
06/26/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
06/27/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.04	0.25	0.04
06/28/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.08	0.25	0.08
06/29/2021	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.08	0.25	0.12
06/30/2021	0.64	0.28	7.00	0.09	0.38	0.68	1.83	0.21	0.44	0.44	4.25	0.10
07/01/2021	0.34	0.14	5.00	0.07	0.41	0.32	2.92	0.14	0.38	0.16	4.00	0.10
07/02/2021	0.55	0.11	10.00	0.06	0.45	0.12	3.75	0.12	0.64	0.16	7.50	0.09

Appendix E

City of Haverhill CSO Public Notification Plan

CITY OF HAVERHILL CSO PUBLIC NOTIFICATION PLAN

Introduction

The City of Haverhill developed this public notification plan for combined sewer overflows (CSO) that may occur from the City's thirteen (13) CSO discharge outfalls located along the Little River and Merrimack River. The plan is required by the City's National Pollutant Discharge Elimination System (NPDES) Permit No. MA0101621 and Consent Decree (CD). The Permit and CD language is included in Appendix A for reference. The Plan describes how the City will provide notification to the public of CSO occurrences from the City's combined sewer system.

CSO Monitoring

The City contracts with Flow Assessment Services (FAS) to monitor their CSO's and maintain data utilizing flow monitoring equipment. FAS conducts monthly maintenance to verify that the equipment is functioning correctly. Once a month FAS sends their quality control CSO data, which is shown in the CSO annual report. The City has access to FAS website to view each CSO meter, along with the rain gage data. FAS developed an automated system to provide CSO information to the public through the City's website and email system.

Notification of CSO Activations

Initial and supplemental notification of a CSO activation will be provided through the City's website. A link on the City's website displays a map showing the CSOs and their activation status using color coded symbols. Figure 1 shows a sample of the map. If you click on the CSO icon on the map, a window (Figure 1) opens to show information about the CSO and recent activation data.

The CSO monitoring equipment communicates wirelessly with the FAS server to update the activation status of each CSO approximately every five (5) minutes.

CSO Email Notification

The CSO email notification will be an opt-in email notification system. Members of the public may sign up on the City's website. Once an individual signs up, an email will be sent identifying that one or more CSO activations have started. This email will contain a link to open the CSO map shown in Figure 1. When the CSO activations end, another email will be sent to notify recipients that the activations stopped.

This email sign up list is developed by EverBridge and maintained by City of Haverhill. The email list will include the email addresses in Appendix 4 of the Consent Decree.

CITY OF HAVERHILL CSO PUBLIC NOTIFICATION PLAN

Once FAS's CSO meters detect an activation, an email will be sent from FAS's system to EverBridge. Below is the language contained in the email:

The City of Haverhill is experiencing a combined sewer overflow (CSO) activation from one or more of its CSO regulators. For more information about this CSO activation go to the CSO map on the City's CSO Public Notification webpage at the following URL:

https://www.cityofhaverhill.com/departments/public_works_department/water_wastewater/wastewater/wastewater_collection_system/cso_public_notification.php.

Thank You

City Wastewater Personnel receive email notifications once FAS equipment detects a CSO activation. The difference is that we are now notifying everyone on the email list in Appendix B, directing recipients to view the City's CSO map.

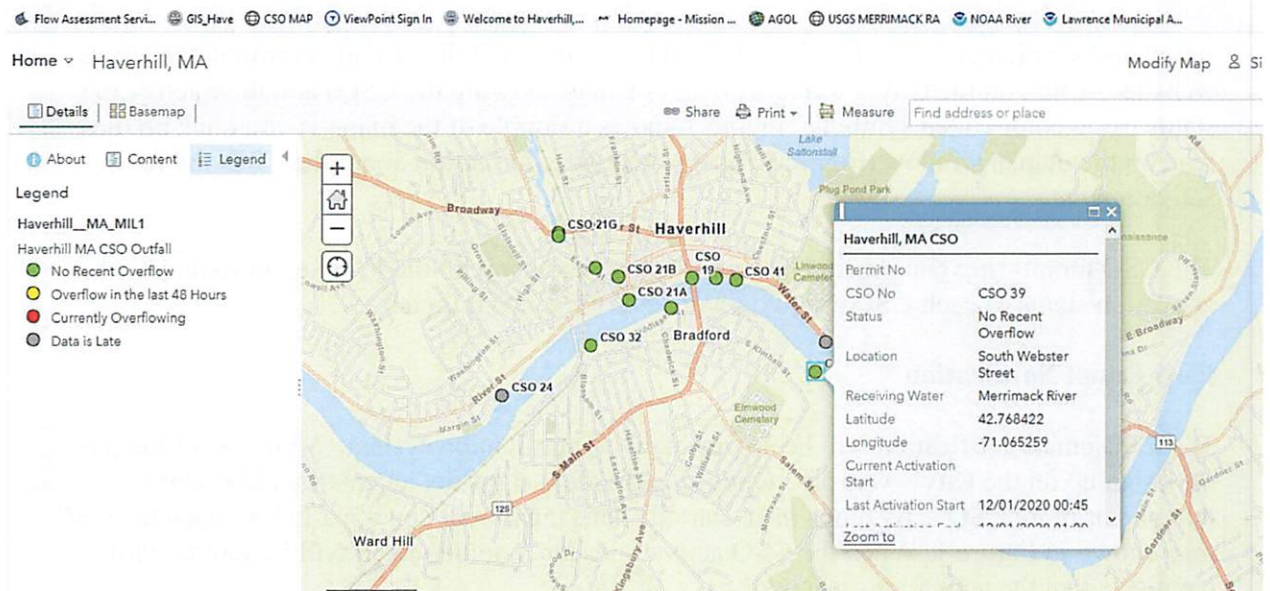


Figure 1 CSO Map

CITY OF HAVERHILL CSO PUBLIC NOTIFICATION PLAN

CSO Notification Plan Distribution to Existing Email Recipients

The City intends to send the CSO Public Notification Plan to all current email recipients in Appendix B, directing them to the City's website for all future CSO notifications.

Annual Notification

Annually, by March 31st, the City will post its annual CSO report on the City's website. The report will have information on the locations of the City's CSOs, a summary of CSO activations and volumes, status and progress of CSO abatement work, and contacts for additional information on CSOs and water quality.

Signage at CSO Outfall Locations

The City will install and maintain identification signs at or near all CSO outfall locations. The signs will be easily readable by the public from the land and water. These signs will be a minimum of 12 x 18 inches in size, with white lettering against a green background. The signs will display the following information in English and Spanish:

CITY OF HAVERHILL
WET WEATHER
SEWAGE DISCHARGE
OUTFALL (discharge serial number)

APPENDIX A: Regulatory Requirements

CITY OF HAVERHILL CSO PUBLIC NOTIFICATION PLAN

Regulatory Requirements

The next two sections are place here to document that the City has complied through the CSO public Notification Plan, satisfies these requirements.

National Discharge Elimination System (NPDES) No. MA0101621

g. Public Notification Plan

- (1) Within twelve (12) months of the effective date of the permit, the Permittee shall submit to EPA and MassDEP a Public Notification plan describing the measures that will be taken to meet NMC#8 in Part T.F.2 of this permit (NMC #8). The public notification plan shall include the means for disseminating information to the public, including communicating the initial and supplemental notifications required in Part LF.3.g. (2) and (3) of this permit, as well as procedures for communicating with public health departments, including downstream communities, whose waters may be affected by discharges from the Permittee's CSOs.
- (2) Initial notification of a probable CSO activation shall be provided to the public as soon as practicable, but no later than, four (4) hours after becoming aware by monitoring, modeling or other means that a CSO discharge has occurred. Notification may be made through electronic means, including posting to the Permittees website. The initial notification shall include the following information:
 - Date and time of probable CSO discharge
 - CSO number and location
- (3) Supplemental notification shall be provided to the public as soon as practicable, but no later than twenty-four (24) hours after becoming aware of the termination of any CSO discharge(s). Notification may be made through electronic means, including posting to the Permittee's website. The supplemental notification shall include the following information:
 - CSO number and location
 - Confirmation of CSO discharge
 - Date, start time and stop time of the CSO discharge

CITY OF HAVERHILL CSO PUBLIC NOTIFICATION PLAN

Consent Decree Civil Action No 16-11698-IT

The following paragraph is taken from the City's Consent Decree, which this Public notification plan shall satisfy as well.

50. Commencing on the Effective Date, the City shall submit email notification within twenty-four (24) hour of any CSO discharge to MassDEP, EPA, the Merrimack River Watershed Council, MA Division of Marine Fisheries, and Boards of Health agents for downstream communities, advising them of the discharge, and shall continue to issue email notification on successive days unless and until the discharges have ceased. The email notification shall, at a minimum, include identification of the CSO outfall which activated, and a map showing the location of the City's CSO outfalls. The email notifications distributed pursuant to this paragraph will be sent to the parties and other persons listed with their email addresses on Appendix 4, attached hereto.

APPENDIX B: CSO Email Notification List



CITY OF HAVERHILL CSO PUBLIC NOTIFICATION PLAN

Name	Email Address	Name	Email Address
Aditya Pophale	Apophale@BrwnCald.com	Kevin Brander	Kevin.Brande@state.ma.us
Alba Gouldthrope	boardofhealth@townofnewbury.org	Laurie Perkins	laurie.perkins@wright-pierce.com
Allana McOsker	ajmcosker@haverhillwater.com	Leonard Mirra	Leonard.mirra@mahouse.gov
Andrea Brouchu	abrochu@salisburyma.gov	Leslie Alexander	lesliealexander11@gmail.com
Belinda Stansbury	belinda.stansbury@state.ma.us	Lisa DeMeo	ldemeo@salisburyma.gov
Berni Angelo	BOH@townofmerrimack.com	Marc Moccio	marc.moccio@wright-pierce.com
Beth Buschini	buschininbpt@comcast.net	Maria Pinaud	maria.pinaud@mass.gov
Bethaley	bethaley@bu.edu	Matt Corbin	matthew.corbin@wright-pierce.com
Bonnie Dufresne	bdufresne@cityofhaverhill.com	Matt Juros	mjuros@fishbrook.com
Cheri R. Cousens	ccousens@qlsd.org	Matthew Thorne	matthew@merrimack.org
Chris Pratt	cpratt@cityofnewburyport.com	Maya Sterett	maya@merrimack.org
Christopher Hood	CHood@CityofNewburyport.com	Mayor Donna Holaday	DHoladay@CityofNewburyport.com
Colin Stokes	cstokes@grovelandma.com	Megan Desautels	Megan.Desautels@mahouse.gov
Connor Sullivan	Connor_Sullivan1@student.uml.edu	Micah Donahue	micahdonahue@gmail.com
David Roach	dave.roach@state.ma.us	Micheal Stein	michael.stein@wright-pierce.com
Dougan Sherwood	dougan@haverhillchamber.com	Mike Buzzell - Merrimack	mbuzzell@townofmerrimack.com
Eileen Hurley	boh@townofmerrimack.com	Mike Stankovich	mstankovich@cityofhaverhill.com
Elizabeth A. Kudarauskas	Kudarauskas.beth@epa.gov	Mike Vetz	vetsm@comcast.net
Executive Director	executivedirector@merrimack.org	Paul A. Seigny	pseigny@wnewbury.org
Frank Giacalone	fgiacalone@cityofnewburyport.com	Paul Hogg	phogg@cityofnewburyport.com
G. Porter	gporter77@gmail.com	Paul Jessel	pjessel@haverhillwater.com
Gary Field	fieldg@amesburyma.gov	Peter Doyle	peter.doyle@edwardjones.com
Gary Tuck	gtuck@townofmerrimack.com	Ray Pike	harbormaster@salisburyma.gov
Gregg Coyle	gcoyle@lowellma.gov	Robert Desmarais	rob@amesburyma.gov
Hamed Majidzadeh	hamed@merrimack.org	Robert Sinibaldi	dpwdir@townofmerrimack.com
Heather McMann	heather@mcmann.net	Robert Ward	rward@haverhillwater.com
I. Bensten	lbentsen@grovelandma.com	Salisbury WWTP	wwtp@salisburyma.gov
Isaiah Lewis	ilewis@haverhillwater.com	Sainath Palani	sainathp@bu.edu
Jack Morris	morisj@amesburyma.gov	Sam Marinez	smarinez@haverhillwater.com
James Conte	jconte@haverhillwater.com	Scott Kinter	scott_kinter@avalonbay.com
Jamie Tuccolo	JTuccolo@CityofNewburyport.com	Shaw, David	dshaw@cityofnewburyport.com
Jeff Mason	masonj@amesburyma.gov	shellfish.newburyport	shellfish.newburyport@state.ma.us
Jennifer Keegan	JKeegan@nla-ma.org	Solanch Pastrana-DeValle	pastrana-del-valle.solanch@epa.gov
John Macone	jmacone@merrimack.org	T Thomas	tthomas1359@comcast.net
John D'Aoust	jdaoust@haverhillwater.com	Thomas Connors	tmconnors@aol.com
John Sokol	jsokol@flowassessment.com	Tom Cusick	TCusick@CityofNewburyport.com
Keith Eddings	keddings@eagletribune.com	Tom Mitchell	tmitchell@flowassessment.com
Kevin Olsen	kevin.olson@wright-pierce.com	Tom Rickenbacker	tom@rickenbackerconsulting.com