Haverhill

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March 31, 2023

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, Kudarauskas.Beth@epa.gov

Subject: City of Haverhill, MA NPDES Permit #MA 0101621
Consent Decree Submittal (Civil Action No. 16-11698-IT)
2022 Annual Combined Sewer Overflow Report

Dear Ms. Kudarauskas:

In accordance with Part I.F. 1 through 5 of the City of Haverhill's NPDES Permit and Consent Decree item VII.M.51, we are providing this annual report for the 2022 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
DPW Director

Enclosure

cc: Chief, Environmental Enforcement Section, U.S. DOJ
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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
DPW Director
City of Haverhill

3/31/23
(date)

City of Haverhill

Department of Public Works
Wastewater Division

Annual Combined Sewer Overflow Report

Calendar Year 2022

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 (NDPES) 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 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 the following:

- 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 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 the 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 regulator structures located upstream from the CSO outfalls control CSO discharges from the 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.

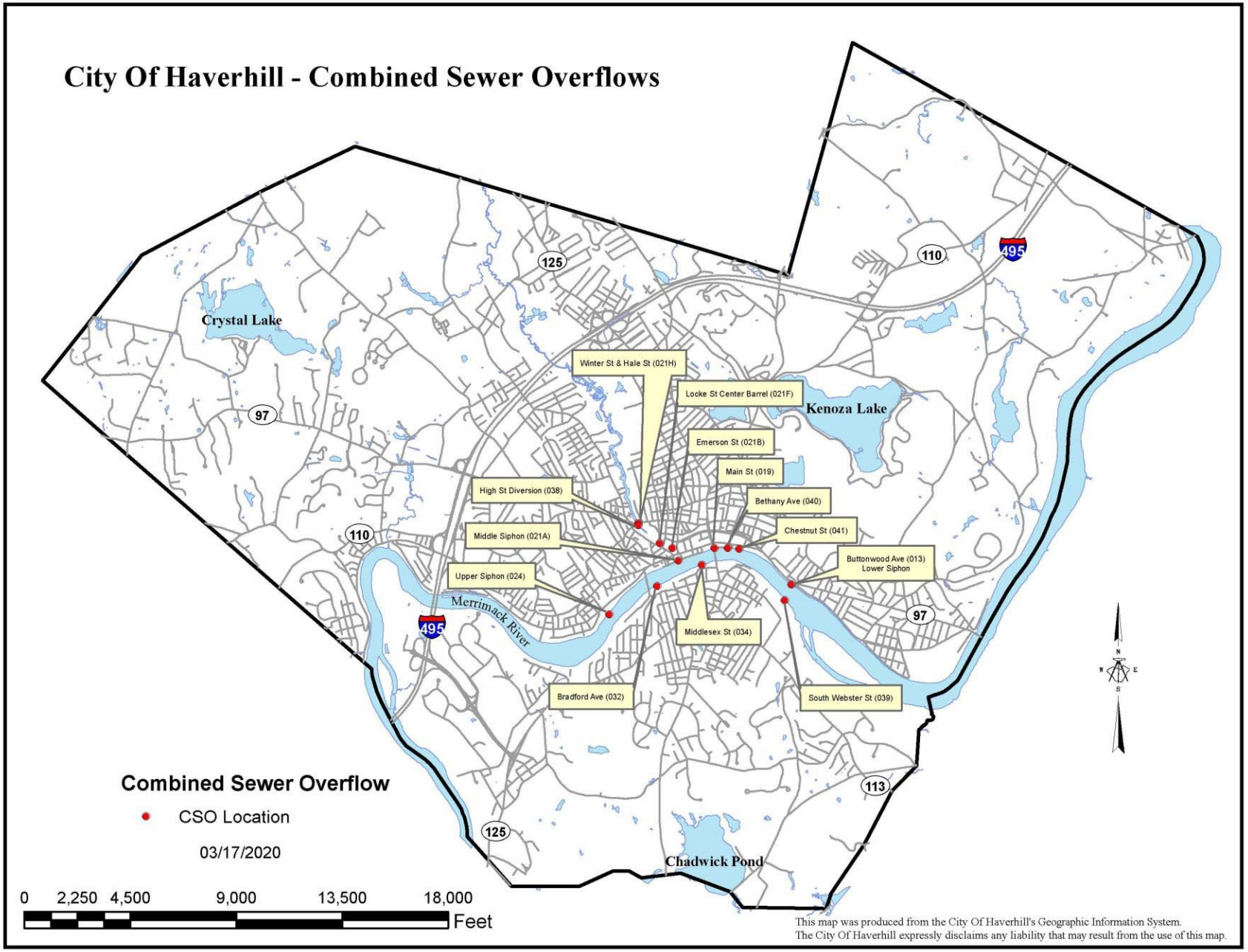
Haverhill has 15 CSO regulators/structures connected to thirteen active CSO outfalls. Of the 13 active outfalls, five discharge to the Little River and eight discharge to the Merrimack River. As part of Haverhill's CSO abatement program, the City closed 13 CSO outfalls. Table 1 lists Haverhill's CSO outfalls and regulators along with their open or closed status, and Figure 1 shows the outfall locations.

Two CSO outfalls have two regulator structures. The High Street Diversion outfall has regulator structures at Broadway and High Street, and the Winter Street and Hale Street outfall has regulator structures at 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 water 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. These sluice gates remain open unless the City is under a river flood condition.

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	Winter Street at Hale Street (021H) Winter Street (021G)	Little River	Open
038	High Street Diversion	Broadway (037) High Street (038)	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


City Of Haverhill - Combined Sewer Overflows
Crystal Lake
Kenoza Lake
Chadwick Pond
Merrimack River
125
110
495
97
113
Winter St & Hale St (021H)
Locke St Center Barrel (021F)
Emerson St (021B)
Main St (019)
High St Diversion (038)
Bethany Ave (040)
Middle Siphon (021A)
Chestnut St (041)
Buttonwood Ave (013) Lower Siphon
Upper Siphon (024)
Middlesex St (034)
Bradford Ave (032)
South Webster St (039)
Combined Sewer Overflow
CSO Location
03/17/2020
0 2,250 4,500 9,000 13,500 18,000
Feet
This map was produced from the City Of Haverhill's Geographic Information System.
The City Of Haverhill expressly disclaims any liability that may result from the use of this map.

CSO Discharge Monitoring

Since 2014, each of the City's CSO outfalls has been monitored to detect activations and measure volume discharged. Table 2 shows the monitoring and volume measurement method.

The flow metering equipment, except for Upper and Lower Siphons, 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 Assessment alert emails are sent to certain Haverhill Wastewater Staff when CSOs start and stop. FAS is responsible for analyzing the meter information to ensure accurate flow data is collected.

Table 2
CSO Outfalls and Regulators

Outfall ID	CSO Outfall Name	CSO Regulator Names (if more than 1)	CSO Monitoring and Volume Measurement Method
Upper Siphon System			
024	Upper Siphon –Varnum Street		Depth/Sluice Gate Opening - Orifice Equation
Middle Siphon System			
021H	Winter Street and Hale Street	Winter Street/Hale Street (021H) (F) Winter Street (021G) (F)	Depth at Weir Depth at Weir
038	High Street Diversion	Broadway (037) (F) High Street (038) (F)	Depth at Weir Depth at Weir
021B	Emerson Street	Emerson Street (21B) (F)	Depth at Weir
021F	Center Barrel - Locke Street		Depth at Weir
021A	Middle Siphon - Essex Street		Depth at Weir and Depth / Velocity in Outfall
Lower Siphon System			
019	Main Street North		Depth at Weir and Depth / Velocity in Outfall
040	Bethany Avenue		Depth at Weir and Depth / Velocity in Outfall
041	Chestnut Street		Depth at Weir and Depth / Velocity in Outfall
013	Lower Siphon – Buttonwoods Avenue		Depth/Sluice Gate Opening - Orifice Equation
Bradford System			
032	Bradford Avenue		Depth at Weir and Depth/Velocity in Outfall
034	Middlesex Street		Depth at Weir
039	South Webster Street	(042) Colby Street/ Salem Street	Depth at Weir and Depth/Velocity in Outfall

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

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 outfall are measured and reported under the Broadway and the High Street regulators. CSOs for the Winter Street and Hale Street outfall are measured and reported under the Winter Street/Hale Street and Winter Street regulators.

The City calculates CSO volumes at Upper and Lower Siphon outfalls 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 CSO gate positions are connected to the City's SCADA system. 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. The CSO flow calculations are stored in HachWims Historian database that is queried to produce this annual report.

In November 2020, the City redesigned the program that controls the CSO gates at the Upper and Lower Siphons. The new control strategy starts with the dry weather gates at a low open setpoint that allows for dry weather flow conveyance. Once the level upstream of the dry weather gate reaches its maximum level, it begins to open and modulates to maintain a predefined setpoint. When the upstream level reaches its maximum level, the lead/lag CSO gates open until a predefined set point is reached.

This change is dramatically different than the original program. Now if the CSO gates need to open, they are modulated to control a specified level. This modulation will reduce the volume of future CSO discharges should they occur. The City continues to monitor and adjust elevation setpoints using available data.

In November 2022, the City contracted with AutoMatech to acquire all Flow Assessment meter and rain gage data. This data will be imported into the City's Historian database. Once completed, City staff will design automated reports as required, using HachWIMS software. Automated Reporting is currently in the design phase.

2022 CSO Outfall Activations

As discussed above, the FAS meters measure activation frequency and flow characteristics. FAS provides monthly and yearly flow data, including volume, from their meters. Except for the Upper and Lower Siphon Outfalls, FAS analyzes flow data monthly to ensure accurate flow data is measured and reported. The City uses the data downloaded from the SCADA system for the Upper and Lower Siphons.

Table 3 summarizes the total CSO volume discharged and the number of activations for each outfall/regulator for 2022.

Table 3			
CSO Summary by Regulator 2022			
Outfall ID	CSO Name	Number of Activations	Total Volume (gals.)
13	Lower Siphon	2	1,270,512
19	Main Street North	0	-
021A	Middle Siphon	7	2,623,445
021B	Emerson Street	0	-
021F	Center Barrel Locke Street	33	2,968,163
021G	Winter Street	6	26,647
021H	Winter/ Hale Street	18	776,149
24	Upper Siphon	2	416,108
32	Bradford Avenue	0	-
34	Middlesex Street	9	2,670,934
37	Broadway	0	-
38	High Street	0	-
39	South Webster Street	1	819
40	Bethany Avenue	8	37,754
41	Chestnut Street	7	28,643
		Total	**10,819,174**

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, duration of overflow, and the number of discharges for the month.

Appendix C provides 2022 CSO activation information required by the Consent Decree, including start and stop times, the amount of precipitation, and overflow volume.

2022 Precipitation

The City collects rain data using three rain gauges: a tipping bucket rain gauge at the Wastewater Treatment Facility (WWTF) ASPW building, a NOAA-supplied rain gage at the Lawrence Municipal airport, and a tipping bucket rain gauge at the Marginal Pumping Station. The Marginal Pumping Station gauge is the closest to 11 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 HachWIMS 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 anytime.

We are also including rain data from the nearest National Weather Station, which is located at the Lawrence Municipal Airport. The current location is at elevation 149 feet.

The rainfall totals for 2022 for each gauge is shown in Table 4.

Table 4 Annual Rainfall	
Rain Gage Location	**Total Annual Rainfall (in.)**
Lawrence Municipal Airport National Weather Service	36.73
Tipping bucket rain gage at the Marginal Pumping Station	33.21
Tipping bucket rain gage at the WWTF ASPW building	43.74

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. Some storm durations continue overnight and into the next day.

Haverhill's CSO Abatement Program

Since 2002, the City has been implementing its CSO Long-Term Control Plan. Planning, design, and construction has been completed for various projects aimed at reducing CSO Volumes and occurrences. To view the City's progress over the last twenty years, please see the 2021 CSO Annual Report, available here.

- In 2022, the City continued to move forward with the preliminary design of the Locke Street Sewer Separation Project. The design will include sewer separation with infiltration rehabilitation and upsizing the storm drains and outfalls for the 10-year, 24-hour design storm.
- In July, the City started some of the Locke Street Sewer Separation project by including some storm drain and sewer separation work into the City's Phase III Water Main Project. The Water Main Replacement project is in the same corridor as the upcoming sewer separation phases. Existing drains have been replaced with a larger diameter pipe, necessary for future phases of sewer separation. This addition added more than $3 million to the project.
- In October, The City, in response to a MassDEP request for information, submitted the Preliminary Design Report for the Locke Street Sewer Separation project, including an implementation schedule. The City is awaiting comment from MassDEP. The project remains on schedule. At the end of 2022, the design of Phase 1 was approximately 60% complete.

Nine Minimum Controls (NMC)

The following is a summary of activities during the calendar year 2022 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) CityWorks, 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 recurring problems are added on a preventative maintenance schedule in CityWorks.
The City added cleaning and inspecting the Upper Siphon to Wright-Pierce's scope of service. The total project cost for 2019 and 2020 was $922,092. This included a condition assessment by Wright-Pierce. The City continued preventative maintenance cleaning of the siphons in 2022. The Upper Siphon pipes were cleaned in May of 2022. Lower and Middle Siphons are planned for the next reporting period.

In 2022, the City continued to upgrade the monitoring and alarm systems at sewer pumping stations. All 36 pump stations are equipped with Mission alarm and monitoring systems. The total project cost was $187,350, with an annual fee of $14,000.

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.

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

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. The City raised the Middle Siphon CSO weir in March 2021 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.

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

The Industrial Pretreatment Program (IPP) was established 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 ordinance prohibits any discharge to the collection system that may harm the wastewater treatment process or the receiving water. These regulations establish limits for pollutant loads discharged to the sewer system. City staff perform inspections of industrial discharges to the City's sewer system to ensure they adhere to the City's IPP Program requirements.

The WWTP influent fats, oil, and grease (FOG) has decreased significantly since improving its IPP program in 2017. Since reducing FOG loadings, WWTP staff have maintained low secondary blanket levels and exceptional sludge settling. Since September 2017, the WWTP secondary bypass has been activated on only one occasion totaling 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 follow 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 2022. To date, FOG has significantly decreased in the collection system and 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. The Local Limits study was completed by Hoyle and Tanner in June of 2021 and was submitted to the EPA. As of January 2022, the City is awaiting comments from 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 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 upper and lower siphon, including 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 corrective maintenance on the pumps as a high priority.

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

WWTP staff operate and maintain the plant process to ensure the plant can maximize wet weather flow and treatment during wet weather. During 2022, the bypass was activated on only one occasion totaling 1.65 mgd.

The City implemented artificial intelligence software that assists operations with important process decisions that help maximize flow to the WWTP.

In 2022, the City began secondary treatment/South Mill Pumping Station project evaluation. Maximizing flow to the treatment plant is considered with all upgrade recommendations. Piping replacement is planned for the station and the pump condition will be assessed. The total estimated construction cost is approximately $58 million, with more than $6 million in South Mill Pumping Station upgrades.

5. ***Prohibition of CSOs during dry weather overflows***

The City's NPDES permit prohibits dry weather overflows from the CSO discharge outfalls. Wastewater staff inspect all the CSO outfalls/regulators monthly. As discussed previously in this report, CSO regulators are continuously monitored and if there is a CSO activation during dry weather, collection system operators investigate and resolve the issue as quickly as possible. In 2022 there were no known dry weather overflows.

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 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 regularly cleaning catch basins and street sweeping as a preventive measure for reducing grit and floatables to its combined system and receiving waters. The City is increasing the frequency of catch basin cleaning and street sweeping, improving its floatables capture.

In 2022, the City continued placing out to bid catch basin cleaning. An outside contractor cleaned approximately 1,100 catch basins, and about 100 were cleaned in-house. The City removed approximately 275 tons of debris, some of which are floatables, at an approximate cost of $55,000. The City also uses its Vac-truck to clean debris from the sewer system and budgets $60,000 annually for street sweeping.

In 2022, the City's wastewater department implemented CityWorks CMMS software to increase the efficiency of catch basin cleaning. It is the City's intent to 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 prohibiting 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 reducing pollutants entering the combined sewer system. Additionally, the FOG program discussed in this document helps minimize contaminants in the City's CSOs.

The City has created 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 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 also operates a recycling and yard waste facility at the Highway garage.

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

The City maintains a CSO webpage on the City's website to provide information about to the public CSOs. The web page also has links to prior years' CSO reports.
Within two hours of discovering a CSO occurrence, an email notification is sent to downstream communities, local Boards of Health, Harbor Masters, local drinking water authorities, and any members of the public who subscribe to the notifications. Appendix D shows the current list of those notified within 2-hours of discovering a CSO occurrence.

Each CSO regulator and outfall has signage that identifies the CSO outfall in English and Spanish.

In 2022, as a requirement of 314 CMR 16, the City submitted a final CSO Public Notification Plan. The Plan is available on the City's website and features real-time notifications and preliminary CSO volumes displayed on a map on the City's website. The CSO map can be viewed here.

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 CSO regulator. This program is discussed previously in this report. The flow monitoring program continued throughout 2022.

End of Report

Appendix A

Appendix A - Summary of CSO Regulator Activations

									MIDDLE SIPHON SYSTEM							LOWER SIPHON SYSTEM				BRADFORD SYSTEM			
	Lawrence Airport Rain Gage		Marginal Pumping Station Rain Gage		ASPW Rain Gage		Max Flow WWTF	UPPER SIPHON Upper Siphon	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	TOTAL
Date	Total Rainfall	Peak Rainfall	Total Rainfall	Peak Rainfall	Total Rainfall	Peak Rainfall	(mgd)	24	021A	021B	021F	021G	021H	37	38	13	19	40	41	32	34	39	4,092,890
01/17/2022	1.65	0.22	1.01	0.24	0.16	0.28	61.47	77,997	1,366,395		549,276		13,541			176,833					1,908,848		4,092,890
02/03/2022	0.54	0.14	0.63	0.20	0.55	0.20	56.87				893												893
02/04/2022	1.30	0.16	0.66	0.20	0.82	0.20	59.24		21,918		115,794										187,033		324,744
02/18/2022	0.37	0.16	0.23	0.44	0.50	0.64	64.39				12,312		5,478										17,789
02/22/2022	0.53	0.13	0.47	0.16	0.58	0.20	58.85				1,058												1,058
03/07/2022	0.22	0.17	0.18	0.48	0.23	0.64	45.73				3,179												3,179
03/12/2022	0.30	0.14	0.35	0.24	0.37	0.20	55.23				6,923												6,923
03/19/2022	0.40	0.14	4.00	0.10	0.57	0.48	60.63				60,812		655										61,466
03/24/2022	0.49	0.10	0.69	0.48	0.63	0.16	24.37				3,313												3,313
03/25/2022	0.52	0.24	5.00	0.10	0.29	0.24	60.19				20,182												20,182
																							91,884
04/08/2022	0.54	0.29	7.00	0.08	0.52	0.40	48.63				60,714		1,480										62,194
04/09/2022	0.45	0.21	4.00	0.11	0.40	0.40	46.47				25,452												25,452
04/19/2022	1.35	0.48	6.00	0.23	1.25	0.48	57.50	338,110	973,471		350,850		108,965			1,093,680					395,389		3,260,465
																							3,348,110
05/15/2022	0.18	0.09	7.00	0.03	0.41	0.36	50.79				60,341												60,341
05/16/2022	0.67	0.40	4.00	0.17	0.37	0.68	50.00				62,909		41,558					4,476	3,111				112,054
05/28/2022	0.33	0.12	4.00	0.08	0.53	0.68	59.23				89,462	10,726	111,741					5,774			2,272		219,975
06/09/2022	0.01	0.01	1.00	0.01	0.69	0.48	55.55		31,674		70,253		59,881						475		10,233		172,516
07/06/2022	0.12	0.11	2.00	0.06	0.26	0.32	54.71				60,086	180	36,395					8,490	2,313				107,463
07/14/2022	0.30	0.20	4.00	0.08	0.38	0.24	52.53				58,601		33,949										92,549
07/19/2022	0.63	0.56	2.00	0.32	0.40	0.08	55.84				57,353	220	37,694					7,164	12,995		755	819	117,000
																							317,012
09/05/2022	1.21	0.23	21.00	0.06	1.29	0.60	43.5				40,347		1,018					958	1,344				0
09/13/2022	0.29	0.17	3.00	0.10	0.17	0.56	58.53				53,441	3,695	49,770										
09/19/2022	0.60	0.29	6.00	0.10	0.64	0.48	62.50				102,066		29,529										106,906
09/22/2022	1.22	0.52	7.00	0.17	1.25	1.52	61		3,042		194,781	8,720	82,849					7,482	3,197		13,911		131,595
																							313,982
10/13/2022	0.82	0.29	8.00	0.10	0.90	0.56	57.94				88,860		5,949					671					0
10/14/2022	1.15	0.33	12.00	0.10	0.74	0.40	55.56				52,705												95,480
10/17/2022	0.70	0.44	5.00	0.14	0.91	1.00	59.48		111,935		177,714	3,106	146,527					2,740	5,207		52,537		
10/24/2022	0.14	0.08	6.00	0.02	0.25	0.56	51.35				33,788		9,172										499,767
11/11/2022	0.50	0.16	7.00	0.07	0.50	0.28	53.69				21,476												42,960
11/27/2022	0.68	0.19	9.00	0.08	0.67	0.44	54.63				14,943												21,476
11/30/2022	0.52	0.11	7.00	0.07	0.52	0.44	60.84				31,612												14,943
12/07/2022	0.75	0.19	12.00	0.06	0.68	0.00	55.67				22,775												31,612
12/23/2022	1.87	0.27	17.00	0.11	1.39	0.04	65.00		115,011		463,893										99,956		
																							678,860
						Volume TOTALS		416,108	2,623,446	0	2,968,162	26,647	776,150	0	0	1,270,512	0	37,755	28,643	0	2,670,934	819	10,819,175
						Number of Activations for the Year		**2**	**7**	**0**	**33**	**6**	**18**	**0**	**0**	**2**	**0**	**8**	**7**	**0**	**9**	**1**	

Appendix B

Appendix B - Outfall Monthly Total Flow

Monthly Parameters		Upper Siphon System	MIDDLE SIPHON SYSTEM							LOWER SIPHON SYSTEM				BRADFORD SYSTEM			Monthly Total Volume
						Outfall 21H		Outfall 38									
	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	
	Latitude	42.76683934	42.77306431	42.77456839	42.77514354		42.77745193		42.7772297	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		71.088322	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 2022 Totals	Total Flows	77,997	1,366,395	ND	549,276	ND	13,541	ND	ND	176,833	ND	ND	ND	ND	1,908,848	ND	4,092,890
	Total Hrs	0.25	3.25		4.83		3.50			2.67					3.33		
	# Events	1	1		1		1			1					1		
February 2022 Totals	Total Flows	ND	21,918	ND	130,057	ND	5,478	ND	ND	ND	ND	ND	ND	ND	187,033	ND	344,485
	Total Hrs		0.33		5.00		0.08								0.58		
	# Events		1		4		1								1		
March 2022 Totals	Total Flows	ND	ND	ND	94,408	ND	655	ND	ND	ND	ND	ND	ND	ND	ND	ND	95,063
	Total Hrs				14.58		0.08										
	# Events				5		1										
April 2022 Totals	Total Flows	338,110	973,471	ND	437,015	ND	110,445	ND	ND	1,093,680	ND	ND	ND	ND	395,389	ND	3,348,110
	Total Hrs	0.79	2.33		6.83		1.92			1.09					2.33		
	# Events	1	1		3		2			1					1		
May 2022 Totals	Total Flows	ND	ND	ND	212,711	10,726	153,299	ND	ND	ND	ND	10,250	3,111	ND	2,272	819	393,188
	Total Hrs				1.92	0.08	0.58					0.16	0.08		0.08	0.08	
	# Events				3	1	2					2	1		1	1	
June 2022 Totals	Total Flows	ND	31,674	ND	70,253		59,881	ND	ND	ND	ND	ND	475	ND	10,233	ND	172,516
	Total Hrs		0.75		1.67		0.75						0.08		0.75		
	# Events																
July 2022 Totals	Total Flows	ND	ND	ND	176,040	400	108,037	ND	ND	ND	ND	15,654	15,308	ND	755	ND	316,194
	Total Hrs				1.42	0.16	0.83					0.16	0.17		0.08		
	# Events				3	2	3					2	2		1		
August 2022 Totals	Total Flows	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0
	Total Hrs																
	# Events																
September 2022 Totals	Total Flows	ND	3,042	ND	390,636	12,414	163,165	ND	ND	ND	ND	8,440	4,541	ND	13,911	ND	596,149
	Total Hrs		1.00		6.42	0.16	1.41					0.16	0.16		0.33		
	# Events		0.50		4	2	4					1	2		1		
October 2022 Totals	Total Flows	ND	111,935	ND	353,068	3,106	161,649	ND	ND	ND	ND	3,411	5,207	52,537	ND	ND	690,913
	Total Hrs		0.58		13.58	1.00	3					1.11	1.08	0.42			
	# Events		1		4	1	17.50					2	1	1			
November 2022 Totals	Total Flows	ND	ND	ND	68,031	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	68,031
	Total Hrs				2.28												
	# Events				3												
December 2022 Totals	Total Flows	ND	115,011	ND	486,667	ND	ND	ND	ND	ND	ND	ND	ND	ND	99,956	ND	701,634
	Total Hrs		0.58		15.42										0.58		
	# Events		1		2										1		
ND (No Discharge)																	10,819,174

Appendix C

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 Gage[1]			
							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.)
	Column1	Column2	Column3	Column4	Column5	Column6	Column7	Column8	Column9	Column10	Column11	Column12	Column13	Column14	Column15	Column16	Column17	Column18
01/17/2022	021H	Winter Street and Hale St	1/17/22 6:20	1/17/22 9:50	13,541	3.50	1.65	0.22	17.00	0.10	1.01	0.24	6.25	0.16	1.33	0.28	8.00	0.17
01/17/2022	13	Lower Siphon	1/17/22 7:10	1/17/22 9:50	176,833	2.67	1.65	0.22	17.00	0.10	1.01	0.24	6.25	0.16	1.33	0.28	8.00	0.17
01/17/2022	24	Upper siphon	1/17/22 9:40	1/17/22 9:55	77,997	0.25	1.65	0.22	17.00	0.10	1.01	0.24	6.25	0.16	1.33	0.28	8.00	0.17
01/17/2022	021F	Center Barrel - Locke St	1/17/22 5:15	1/17/22 10:05	549,276	4.83	1.65	0.22	17.00	0.10	1.01	0.24	6.25	0.16	1.33	0.28	8.00	0.17
01/17/2022	021A	Middle Siphon	1/17/22 7:05	1/17/22 10:20	1,366,395	3.25	1.65	0.22	17.00	0.10	1.01	0.24	6.25	0.16	1.33	0.28	8.00	0.17
01/17/2022	34	Middlesex Street	1/17/22 7:00	1/17/22 10:20	1,908,848	3.33	1.65	0.22	17.00	0.10	1.01	0.24	6.25	0.16	1.33	0.28	8.00	0.17
			STORM	**TOTALS:**	**4,092,890**													
02/03/2022	021F	Center Barrel - Locke St	2/3/22 21:25	2/3/22 21:30	893	0.08	0.54	0.14	8.00	0.07	0.63	0.20	5.00	0.13	0.55	0.20	7.00	0.08
			STORM	**TOTALS:**	**893**													
02/04/2022	021F	Center Barrel - Locke St	2/4/22 1:45	2/4/22 6:15	115,794	4.50	1.30	0.16	21.00	0.06	0.66	0.20	4.83	0.14	0.82	0.20	6.00	0.14
02/04/2022	021A	Middle Siphon	2/4/22 6:05	2/4/22 6:25	21,918	0.33	1.30	0.16	21.00	0.06	0.66	0.20	4.83	0.14	0.82	0.20	6.00	0.14
02/04/2022	34	Middlesex Street	2/4/22 5:55	2/4/22 6:30	187,033	0.58	1.30	0.16	21.00	0.06	0.66	0.20	4.83	0.14	0.82	0.20	6.00	0.14
			STORM	**TOTALS:**	**324,744**													
02/18/2022	021H	Winter Street and Hale St	2/18/22 8:10	2/18/22 8:10	5,478	0.08	0.37	0.16	7.00	0.05	0.23	0.44	1.17	0.20	0.50	0.64	4.25	0.12
02/18/2022	021F	Center Barrel - Locke St	2/18/22 8:10	2/18/22 8:30	12,312	0.33	0.37	0.16	7.00	0.05	0.23	0.44	1.17	0.20	0.50	0.64	4.25	0.12
			STORM	**TOTALS:**	**17,789**													
02/22/2022	021F	Center Barrel - Locke St	2/22/22 21:40	2/22/22 21:40	1,058	0.08	0.53	0.13	8.00	0.07	0.47	0.16	3.83	0.12	0.58	0.20	6.25	0.09
			STORM	**TOTALS:**	**1,058**													
03/07/2022	021F	Center Barrel - Locke St	3/7/22 22:40	3/7/22 22:45	3,179	0.08	0.22	0.17	6.00	0.04	0.18	0.48	0.75	0.24	0.23	0.64	2.00	0.12
			STORM	**TOTALS:**	**3,179**													
03/12/2022	021F	Center Barrel - Locke St	3/12/22 12:10	3/12/22 12:30	6,923	0.33	0.30	0.14	7.00	0.04	0.35	0.24	2.25	0.16	0.37	0.20	3.75	0.10
			STORM	**TOTALS:**	**6,923**													
03/19/2022	021H	Winter Street and Hale	3/19/22 9:30	3/19/22 9:30	655	0.08	0.40	0.14	4.00	0.10	0.57	0.48	2.42	0.24	0.48	0.32	3.75	0.13
03/19/2022	021F	Center Barrel - Locke St	3/19/22 9:15	3/19/22 22:55	60,812	13.67	0.40	0.14	4.00	0.10	0.57	0.48	2.42	0.24	0.48	0.32	3.75	0.13
			STORM	**TOTALS:**	**61,466**													
03/24/2022	021F	Center Barrel - Locke St	3/24/22 23:55	3/24/22 23:55	3,313	0.08	0.49	0.10	16.00	0.03	0.69	0.48	4.75	0.15	0.63	0.16	10.25	0.06
			STORM	**TOTALS:**	**3,313**													
03/25/2022	021F	Center Barrel - Locke St	3/25/22 0:00	3/25/22 0:25	20,182	0.42	0.52	0.24	5.00	0.10	0.29	0.24	2.00	0.15	0.56	0.52	3.75	0.15
			STORM	**TOTALS:**	**20,182**													
04/08/2022	021H	Winter Street and Hale St	4/8/22 4:20	4/8/22 4:30	1,480	0.17	0.54	0.29	7.00	0.08	0.52	0.40	2.67	0.19	0.63	1.48	5.25	0.12
04/08/2022	021F	Center Barrel - Locke St	4/8/22 2:50	4/8/22 5:15	60,714	2.42	0.54	0.29	7.00	0.08	0.52	0.40	2.67	0.19	0.63	1.48	5.25	0.12
			STORM	**TOTALS:**	**62,194**													
04/09/2022	021F	Center Barrel - Locke St	4/9/22 13:35	4/9/22 14:45	25,452	1.17	0.45	0.21	4.00	0.11	0.40	0.40	1.58	0.25	0.53	0.92	2.75	0.19
			STORM	**TOTALS:**	**25,452**													
04/19/2022	021H	Winter Street and Hale St	4/19/22 3:45	4/19/22 5:30	108,965	1.75	1.35	0.48	6.00	0.23	1.25	0.48	4.08	0.31	1.36	0.52	4.75	0.29
04/19/2022	021F	Center Barrel - Locke St	4/19/22 3:20	4/19/22 6:35	350,850	3.25	1.35	0.48	6.00	0.23	1.25	0.48	4.08	0.31	1.36	0.52	4.75	0.29
04/19/2022	021A	Middle Siphon	4/19/22 4:25	4/19/22 6:45	973,471	2.33	1.35	0.48	6.00	0.23	1.25	0.48	4.08	0.31	1.36	0.52	4.75	0.29
04/19/2022	34	Middlesex Street	4/19/22 4:25	4/19/22 6:45	395,389	2.33	1.35	0.48	6.00	0.23	1.25	0.48	4.08	0.31	1.36	0.52	4.75	0.29
04/19/2022	24	Upper siphon	4/19/22 5:55	4/19/22 6:50	338,110	0.92	1.35	0.48	6.00	0.23	1.25	0.48	4.08	0.31	1.36	0.52	4.75	0.29
04/19/2022	13	Lower Siphon	4/19/22 5:45	4/19/22 6:55	1,093,680	1.16	1.35	0.48	6.00	0.23	1.25	0.48	4.08	0.31	1.36	0.52	4.75	0.29
			STORM	**TOTALS:**	**3,260,465**													
05/15/2022	021F	Center Barrel - Locke St	5/15/22 20:35	5/15/22 21:25	60,341	0.83	0.18	0.09	7.00	0.03	0.41	0.36	1.17	0.35	0.20	0.20	2.00	0.10
			STORM	**TOTALS:**	**60,341**													
05/16/2022	40	Bethany Avenue	5/16/22 14:40	5/16/22 14:40	4,476	0.08	0.67	0.40	4.00	0.17	0.37	0.68	1.33	0.28	0.20	0.28	1.75	0.11
05/16/2022	41	Chestnut Street	5/16/22 14:40	5/16/22 14:40	3,111	0.08	0.67	0.40	4.00	0.17	0.37	0.68	1.33	0.28	0.20	0.28	1.75	0.11
05/16/2022	021H	Winter Street and Hale St	5/16/22 14:40	5/16/22 14:55	41,558	0.25	0.67	0.40	4.00	0.17	0.37	0.68	1.33	0.28	0.20	0.28	1.75	0.11
05/16/2022	021F	Center Barrel - Locke St	5/16/22 14:35	5/16/22 15:00	62,909	0.42	0.67	0.40	4.00	0.17	0.37	0.68	1.33	0.28	0.20	0.28	1.75	0.11
			STORM	**TOTALS:**	**112,054**													
05/28/2022	021G	Winter Street	5/28/22 14:45	5/28/22 14:50	10,726	0.08	0.33	0.12	4.00	0.08	0.53	0.68	1.42	0.37	0.16	0.08	3.25	0.05
05/28/2022	34	Middlesex Street	5/28/22 14:50	5/28/22 14:50	2,272	0.08	0.33	0.12	4.00	0.08	0.53	0.68	1.42	0.37	0.16	0.08	3.25	0.05
05/28/2022	40	Bethany Avenue	5/28/22 14:50	5/28/22 14:55	5,774	0.08	0.33	0.12	4.00	0.08	0.53	0.68	1.42	0.37	0.16	0.08	3.25	0.05
05/28/2022	021H	Winter Street and Hale St	5/28/22 14:50	5/28/22 15:10	111,741	0.33	0.33	0.12	4.00	0.08	0.53	0.68	1.42	0.37	0.16	0.08	3.25	0.05
05/28/2022	021F	Center Barrel - Locke St	5/28/22 14:45	5/28/22 15:25	89,462	0.67	0.33	0.12	4.00	0.08	0.53	0.68	1.42	0.37	0.16	0.08	3.25	0.05

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 Gage[1]			
							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.)
			STORM	**TOTALS:**	**219,975**													
06/09/2022	41	Chestnut Street	6/9/22 8:05	6/9/22 8:05	475	0.08	0.01	0.01	1.00	0.01	0.69	0.48	2.50	0.28	0.83	0.20	8.50	0.10
06/09/2022	021H	Winter Street and Hale St	6/9/22 7:35	6/9/22 8:20	59,881	0.75	0.01	0.01	1.00	0.01	0.69	0.48	2.50	0.28	0.83	0.20	8.50	0.10
06/09/2022	021A	Middle Siphon	6/9/22 8:10	6/9/22 8:55	31,674	0.75	0.01	0.01	1.00	0.01	0.69	0.48	2.50	0.28	0.83	0.20	8.50	0.10
06/09/2022	021F	Center Barrel - Locke St	6/9/22 7:15	6/9/22 8:55	70,253	1.67	0.01	0.01	1.00	0.01	0.69	0.48	2.50	0.28	0.83	0.20	8.50	0.10
06/09/2022	34	Middlesex Street	6/9/22 8:10	6/9/22 8:55	10,233	0.75	0.01	0.01	1.00	0.01	0.69	0.48	2.50	0.28	0.83	0.20	8.50	0.10
			STORM	**TOTALS:**	**172,516**													
07/06/2022	021G	Winter Street	7/6/22 0:30	7/6/22 0:30	180	0.08	0.12	0.11	2.00	0.06	0.26	0.32	1.08	0.24	0.20	0.28	1.25	0.16
07/06/2022	40	Bethany Avenue	7/6/22 0:30	7/6/22 0:30	8,490	0.08	0.12	0.11	2.00	0.06	0.26	0.32	1.08	0.24	0.20	0.28	1.25	0.16
07/06/2022	41	Chestnut Street	7/6/22 0:30	7/6/22 0:35	2,313	0.08	0.12	0.11	2.00	0.06	0.26	0.32	1.08	0.24	0.20	0.28	1.25	0.16
07/06/2022	021H	Winter Street and Hale St	7/6/22 0:30	7/6/22 0:45	36,395	0.25	0.12	0.11	2.00	0.06	0.26	0.32	1.08	0.24	0.20	0.28	1.25	0.16
07/06/2022	021F	Center Barrel - Locke St	7/6/22 0:30	7/6/22 1:00	60,086	0.50	0.12	0.11	2.00	0.06	0.26	0.32	1.08	0.24	0.20	0.28	1.25	0.16
			STORM	**TOTALS:**	**107,463**													
07/14/2022	021H	Winter Street and Hale	7/14/22 1:20	7/14/22 1:40	33,949	0.33	0.30	0.20	4.00	0.08	0.38	0.24	2.58	0.15	0.24	0.16	2.25	0.11
07/14/2022	021F	Center Barrel - Locke St	7/14/22 1:25	7/14/22 1:55	58,601	0.50	0.30	0.20	4.00	0.08	0.38	0.24	2.58	0.15	0.24	0.16	2.25	0.11
			STORM	**TOTALS:**	**92,549**													
07/19/2022	021G	Winter Street	7/19/22 0:35	7/19/22 0:35	220	0.08	0.63	0.56	2.00	0.32	0.40	0.08	3.33	0.12	0.65	0.64	2.25	0.29
07/19/2022	34	Middlesex Street	7/19/22 0:35	7/19/22 0:35	755	0.08	0.63	0.56	2.00	0.32	0.40	0.08	3.33	0.12	0.65	0.64	2.25	0.29
07/19/2022	40	Bethany Avenue	7/19/22 0:35	7/19/22 0:35	7,164	0.08	0.63	0.56	2.00	0.32	0.40	0.08	3.33	0.12	0.65	0.64	2.25	0.29
07/19/2022	39	South Webster Street	7/19/22 0:35	7/19/22 0:40	819	0.08	0.63	0.56	2.00	0.32	0.40	0.08	3.33	0.12	0.65	0.64	2.25	0.29
07/19/2022	41	Chestnut Street	7/19/22 0:35	7/19/22 0:40	12,995	0.08	0.63	0.56	2.00	0.32	0.40	0.08	3.33	0.12	0.65	0.64	2.25	0.29
07/19/2022	021H	Winter Street and Hale St	7/19/22 0:35	7/19/22 0:50	37,694	0.25	0.63	0.56	2.00	0.32	0.40	0.08	3.33	0.12	0.65	0.64	2.25	0.29
07/19/2022	021F	Center Barrel - Locke St	7/19/22 0:35	7/19/22 1:00	57,353	0.42	0.63	0.56	2.00	0.32	0.40	0.08	3.33	0.12	0.65	0.64	2.25	0.29
			STORM	**TOTALS:**	**117,000**													
09/05/2022	40	Bethany Avenue	9/5/22 3:45	9/5/22 3:45	958	0.08	1.21	0.23	21.00	0.06	1.29	0.60	8.25	0.16	1.58	0.60	15.00	0.11
09/05/2022	41	Chestnut Street	9/5/22 3:45	9/5/22 3:45	1,344	0.08	1.21	0.23	21.00	0.06	1.29	0.60	8.25	0.16	1.58	0.60	15.00	0.11
09/05/2022	021H	Winter Street and Hale	9/5/22 3:55	9/5/22 3:55	1,018	0.08	1.21	0.23	21.00	0.06	1.29	0.60	8.25	0.16	1.58	0.60	15.00	0.11
09/05/2022	021F	Center Barrel - Locke St	9/5/22 3:45	9/5/22 4:05	40,347	0.33	1.21	0.23	21.00	0.06	1.29	0.60	8.25	0.16	1.58	0.60	15.00	0.11
			STORM	**TOTALS:**	**43,666**													
09/13/2022	021G	Winter Street	9/13/22 21:00	9/13/22 21:05	3,695	0.08	0.29	0.17	3.00	0.10	0.17	0.56	0.25	0.68	0.18	0.52	0.50	0.36
09/13/2022	021H	Winter Street and Hale St	9/13/22 21:05	9/13/22 21:15	49,770	0.17	0.29	0.17	3.00	0.10	0.17	0.56	0.25	0.68	0.18	0.52	0.50	0.36
09/13/2022	021F	Center Barrel - Locke St	9/13/22 21:00	9/13/22 21:30	53,441	0.50	0.29	0.17	3.00	0.10	0.17	0.56	0.25	0.68	0.18	0.52	0.50	0.36
			STORM	**TOTALS:**	**106,906**													
09/19/2022	021H	Winter Street and Hale	9/19/22 19:40	9/19/22 20:30	29,529	0.83	0.60	0.29	6.00	0.10	0.64	0.48	2.83	0.23	0.61	0.36	4.50	0.14
09/19/2022	021F	Center Barrel - Locke St	9/19/22 19:40	9/19/22 20:45	102,066	1.08	0.60	0.29	6.00	0.10	0.64	0.48	2.83	0.23	0.61	0.36	4.50	0.14
			STORM	**TOTALS:**	**131,595**													
09/22/2022	021G	Winter Street	9/22/22 8:10	9/22/22 8:10	8,720	0.08	1.22	0.52	7.00	0.17	1.25	1.52	4.08	0.31	1.22	0.36	8.75	0.14
09/22/2022	40	Bethany Avenue	9/22/22 8:10	9/22/22 8:15	7,482	0.08	1.22	0.52	7.00	0.17	1.25	1.52	4.08	0.31	1.22	0.36	8.75	0.14
09/22/2022	41	Chestnut Street	9/22/22 8:10	9/22/22 8:15	3,197	0.08	1.22	0.52	7.00	0.17	1.25	1.52	4.08	0.31	1.22	0.36	8.75	0.14
09/22/2022	021H	Winter Street and Hale St	9/22/22 8:10	9/22/22 8:30	82,849	0.33	1.22	0.52	7.00	0.17	1.25	1.52	4.08	0.31	1.22	0.36	8.75	0.14
09/22/2022	34	Middlesex Street	9/22/22 8:10	9/22/22 8:30	13,911	0.33	1.22	0.52	7.00	0.17	1.25	1.52	4.08	0.31	1.22	0.36	8.75	0.14
09/22/2022	021A	Middle Siphon	9/22/22 8:30	9/22/22 9:00	3,042	0.50	1.22	0.52	7.00	0.17	1.25	1.52	4.08	0.31	1.22	0.36	8.75	0.14
09/22/2022	021F	Center Barrel - Locke St	9/22/22 8:15	9/22/22 12:45	194,781	4.50	1.22	0.52	7.00	0.17	1.25	1.52	4.08	0.31	1.22	0.36	8.75	0.14
			STORM	**TOTALS:**	**313,981**													
10/13/2022	40	Bethany Avenue	10/13/22 20:40	10/13/22 20:40	671	0.08	0.82	0.29	8.00	0.10	0.90	0.56	4.33	0.21	0.35	0.16	4.75	0.07
10/13/2022	021H	Winter Street and Hale St	10/13/22 20:40	10/13/22 20:50	5,949	0.17	0.82	0.29	8.00	0.10	0.90	0.56	4.33	0.21	0.35	0.16	4.75	0.07
10/13/2022	021F	Center Barrel - Locke St	10/13/22 20:35	10/13/22 22:50	88,860	2.25	0.82	0.29	8.00	0.10	0.90	0.56	4.33	0.21	0.35	0.16	4.75	0.07
			STORM	**TOTALS:**	**95,480**													
10/14/2022	021F	Center Barrel - Locke St	10/14/22 0:10	10/14/22 9:20	52,705	9.17	1.15	0.33	12.00	0.10	0.74	0.40	4.42	0.17	1.67	0.28	10.50	0.16
			STORM	**TOTALS:**	**52,705**													
10/17/2022	021G	Winter Street	10/17/22 22:05	10/17/22 23:05	3,106	1.00	0.70	0.44	5.00	0.14	0.91	1.00	2.58	0.35	0.19	0.12	2.75	0.07
10/17/2022	40	Bethany Avenue	10/17/22 22:00	10/17/22 23:05	2,740	1.08	0.70	0.44	5.00	0.14	0.91	1.00	2.58	0.35	0.19	0.12	2.75	0.07
10/17/2022	41	Chestnut Street	10/17/22 22:00	10/17/22 23:05	5,207	1.08	0.70	0.44	5.00	0.14	0.91	1.00	2.58	0.35	0.19	0.12	2.75	0.07
10/17/2022	021H	Winter Street and Hale St	10/17/22 22:00	10/17/22 23:25	146,527	1.42	0.70	0.44	5.00	0.14	0.91	1.00	2.58	0.35	0.19	0.12	2.75	0.07

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 Gage[1]			
							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.)
10/17/2022	34	Middlesex Street	10/17/22 23:05	10/17/22 23:30	52,537	0.42	0.70	0.44	5.00	0.14	0.91	1.00	2.58	0.35	0.19	0.12	2.75	0.07
10/17/2022	021A	Middle Siphon	10/17/22 23:10	10/17/22 23:40	111,935	0.50	0.70	0.44	5.00	0.14	0.91	1.00	2.58	0.35	0.19	0.12	2.75	0.07
10/17/2022	021F	Center Barrel - Locke St	10/17/22 21:55	10/17/22 23:40	177,714	1.75	0.70	0.44	5.00	0.14	0.91	1.00	2.58	0.35	0.19	0.12	2.75	0.07
			STORM	**TOTALS:**	**499,767**													
10/24/2022	021H	Winter Street and Hale St	10/24/22 13:10	10/24/22 13:20	9,172	0.17	0.14	0.08	6.00	0.02	0.25	0.56	0.92	0.27	0.35	0.48	2.75	0.13
10/24/2022	021F	Center Barrel - Locke St	10/24/22 13:10	10/24/22 13:35	33,788	0.42	0.14	0.08	6.00	0.02	0.25	0.56	0.92	0.27	0.35	0.48	2.75	0.13
			STORM	**TOTALS:**	**42,960**													
11/11/2022	021F	Center Barrel - Locke St	11/11/22 20:20	11/11/22 21:40	21,476	1.33	0.50	0.16	7.00	0.07	0.50	0.28	2.58	0.19	0.49	0.20	4.00	0.12
			STORM	**TOTALS:**	**21,476**													
11/27/2022	021F	Center Barrel - Locke St	11/27/22 22:25	11/27/22 22:40	14,943	0.25	0.68	0.19	9.00	0.08	0.67	0.44	3.83	0.17	0.68	0.44	6.00	0.11
			STORM	**TOTALS:**	**14,943**													
11/30/2022	021F	Center Barrel - Locke St	11/30/22 19:40	11/30/22 20:20	31,612	0.67	0.52	0.11	7.00	0.07	0.52	0.44	3.17	0.16	0.67	0.40	6.00	0.11
			STORM	**TOTALS:**	**31,612**													
12/07/2022	021F	Center Barrel - Locke St	12/7/22 3:45	12/7/22 4:50	22,775	1.08	0.75	0.19	12.00	0.06	0.68	0.00	4.92	0.14	0.95	0.24	8.75	0.11
			STORM	**TOTALS:**	**22,775**													
12/23/2022	021A	Middle Siphon	12/23/22 3:35	12/23/22 4:10	115,011	0.58	1.87	0.27	17.00	0.11	1.39	0.04	7.83	0.18	1.95	0.36	12.75	0.15
12/23/2022	34	Middlesex Street	12/23/22 3:35	12/23/22 4:10	99,956	0.58	1.87	0.27	17.00	0.11	1.39	0.04	7.83	0.18	1.95	0.36	12.75	0.15
12/23/2022	021F	Center Barrel - Locke St	12/23/22 0:50	12/23/22 15:10	463,893	14.33	1.87	0.27	17.00	0.11	1.39	0.04	7.83	0.18	1.95	0.36	12.75	0.15
			STORM	**TOTALS:**	**678,860**													
		STORM	**TOTALS:**		**10,819,174**													

Appendix D

Appendix D - Daily Rainfall

Date	Lawrence Airport (US W00094723) NOAA				Marginal Pumping Station Rain Gage				ASPW Rain Gage			
	Rain Total (in.)	Peak hour intensity (in/hr.)	Storm Duration (hrs.)	Daily Avg. Intensity (in/hr.)	Rain Total (in.)	Peak Hour Intensity (in./hr.)	Storm Duration (hrs.)	Daily Avg. Intensity (in./hr.)	Rain Total (in.)	Peak Hour Intensity (in./hr.)	Storm Duration (hrs.)	Daily Avg. Intensity (in./hr.)
01/01/2022	0.14	0.05	4.00	0.04	0.12	0.12	0.92	0.13	0.20	0.16	3.00	0.07
01/02/2022	0.36	0.04	21.00	0.02	0.15	0.04	1.25	0.12	0.23	0.08	3.75	0.06
01/03/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/04/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/05/2022	0.71	0.07	16.00	0.04	0.25	0.32	1.42	0.18	0.20	0.16	2.25	0.09
01/06/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/07/2022	0.74	0.09	27.00	0.03	0.00	0.00	0.00	0.00	0.43	0.12	7.75	0.06
01/08/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/09/2022	0.05	0.02	3.00	0.02	0.31	0.12	2.58	0.12	0.08	0.12	1.00	0.08
01/10/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/11/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/12/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/13/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/14/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/15/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/16/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/17/2022	1.65	0.22	17.00	0.10	1.01	0.24	6.25	0.16	1.33	0.28	8.00	0.17
01/18/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/19/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/20/2022	0.07	0.04	4.00	0.02	0.07	0.08	0.58	0.12	0.09	0.08	1.25	0.07
01/21/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/22/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/23/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/24/2022	0.02	0.02	1.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/25/2022	0.02	0.02	1.00	0.02	0.03	0.08	0.25	0.12	0.08	0.08	1.00	0.08
01/26/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/27/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/28/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/29/2022	0.24	0.06	15.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01/30/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.08	0.50	0.06
01/31/2022	0.00	0.00	0.00	0.00	0.02	0.04	0.17	0.12	0.01	0.04	0.25	0.04
02/01/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.04	0.50	0.04
02/02/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
02/03/2022	0.54	0.14	8.00	0.07	0.63	0.20	5.00	0.13	0.55	0.20	7.00	0.08
02/04/2022	1.30	0.16	21.00	0.06	0.66	0.20	4.83	0.14	0.82	0.20	6.00	0.14
02/05/2022	0.00	0.00	0.00	0.00	0.01	0.04	0.08	0.13	0.00	0.00	0.00	0.00
02/06/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.04	0.50	0.04
02/07/2022	0.30	0.12	7.00	0.04	0.80	0.20	6.33	0.13	0.65	0.20	9.00	0.07
02/08/2022	0.30	0.09	7.00	0.04	0.59	0.16	4.83	0.12	0.83	0.16	8.50	0.10
02/09/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
02/10/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.12	0.25	0.12
02/11/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
02/12/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
02/13/2022	0.09	0.03	6.00	0.02	0.00	0.00	0.00	0.00	0.05	0.12	0.75	0.07
02/14/2022	0.01	0.01	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
02/15/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
02/16/2022	0.00	0.00	0.00	0.00	0.01	0.04	0.08	0.13	0.04	0.08	0.75	0.05
02/17/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
02/18/2022	0.37	0.16	7.00	0.05	0.23	0.44	1.17	0.20	0.50	0.64	4.25	0.12
02/19/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
02/20/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
02/21/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
02/22/2022	0.53	0.13	8.00	0.07	0.47	0.16	3.83	0.12	0.58	0.20	6.25	0.09
02/23/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
02/24/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
02/25/2022	0.56	0.11	13.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
02/26/2022	0.00	0.00	0.00	0.00	0.08	0.08	0.67	0.12	0.19	0.16	2.00	0.10
02/27/2022	0.00	0.00	0.00	0.00	0.15	0.08	1.25	0.12	0.30	0.12	5.25	0.06
02/28/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
03/01/2022	0.08	0.04	3.00	0.03	0.13	0.08	1.08	0.12	0.19	0.12	3.50	0.05
03/02/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00
03/03/2022	0.03	0.02	2.00	0.02	0.03	0.04	0.25	0.12	0.06	0.12	1.00	0.06
03/04/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
03/05/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
03/06/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
03/07/2022	0.22	0.17	6.00	0.04	0.18	0.48	0.75	0.24	0.23	0.64	2.00	0.12
03/08/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
03/09/2022	0.25	0.06	8.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
03/10/2022	0.00	0.00	0.00	0.00	0.26	0.32	1.08	0.24	0.25	0.28	1.50	0.17
03/11/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
03/12/2022	0.30	0.14	7.00	0.04	0.35	0.24	2.25	0.16	0.37	0.20	3.75	0.10
03/13/2022	0.00	0.00	0.00	0.00	0.01	0.04	0.08	0.13	0.01	0.04	0.25	0.04
03/14/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
03/15/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
03/16/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
03/17/2022	0.01	0.01	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
03/18/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.04	0.25	0.04
03/19/2022	0.40	0.14	4.00	0.10	0.57	0.48	2.42	0.24	0.48	0.32	3.75	0.13
03/20/2022	0.01	0.01	1.00	0.01	0.00	0.00	0.00	0.00	0.02	0.04	0.50	0.04
03/21/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
03/22/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
03/23/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
03/24/2022	0.49	0.10	16.00	0.03	0.69	0.48	4.75	0.15	0.63	0.16	10.25	0.06
03/25/2022	0.52	0.24	5.00	0.10	0.29	0.24	2.00	0.15	0.56	0.52	3.75	0.15
03/26/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix D - Daily Rainfall

Date	Lawrence Airport (US W00094723) NOAA				Marginal Pumping Station Rain Gage				ASPW Rain Gage			
	Rain Total (in.)	Peak hour intensity (in/hr.)	Storm Duration (hrs.)	Daily Avg. Intensity (in/hr.)	Rain Total (in.)	Peak Hour Intensity (in./hr.)	Storm Duration (hrs.)	Daily Avg. Intensity (in./hr.)	Rain Total (in.)	Peak Hour Intensity (in./hr.)	Storm Duration (hrs.)	Daily Avg. Intensity (in./hr.)
03/27/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
03/28/2022	0.01	0.01	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
03/29/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
03/30/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
03/31/2022	0.07	0.05	2.00	0.04	0.03	0.08	0.25	0.12	0.03	0.08	0.50	0.06
04/01/2022	0.28	0.08	5.00	0.06	0.30	0.24	1.75	0.17	0.38	0.24	2.75	0.14
04/02/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.32	1.08	0.25	1.28
04/03/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
04/04/2022	0.05	0.02	4.00	0.01	0.10	0.04	0.83	0.12	0.16	0.12	2.75	0.06
04/05/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
04/06/2022	0.01	0.01	1.00	0.01	0.01	0.04	0.08	0.13	0.01	0.04	0.25	0.04
04/07/2022	0.03	0.03	1.00	0.03	0.05	0.04	0.42	0.12	0.04	0.04	0.50	0.08
04/08/2022	0.54	0.29	7.00	0.08	0.52	0.40	2.67	0.19	0.63	1.48	5.25	0.12
04/09/2022	0.45	0.21	4.00	0.11	0.40	0.40	1.58	0.25	0.53	0.92	2.75	0.19
04/10/2022	0.05	0.05	1.00	0.05	0.00	0.00	0.00	0.00	0.57	2.16	0.25	2.28
04/11/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
04/12/2022	0.13	0.03	8.00	0.02	0.16	0.08	1.33	0.12	0.21	0.12	3.75	0.06
04/13/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.44	0.25	0.56
04/14/2022	0.04	0.02	3.00	0.01	0.07	0.08	0.58	0.12	0.08	0.08	1.25	0.06
04/15/2022	0.02	0.01	2.00	0.01	0.01	0.04	0.08	0.13	0.09	0.12	0.25	0.36
04/16/2022	0.44	0.11	6.00	0.07	0.47	0.36	3.00	0.16	0.41	0.16	4.25	0.10
04/17/2022	0.01	0.01	1.00	0.01	0.00	0.00	0.00	0.00	0.44	0.00	0.00	0.00
04/18/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
04/19/2022	1.35	0.48	6.00	0.23	1.25	0.48	4.08	0.31	1.36	0.52	4.75	0.29
04/20/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.83	0.80	0.25	3.32
04/21/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
04/22/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
04/23/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
04/24/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
04/25/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
04/26/2022	0.45	0.12	6.00	0.08	0.40	0.16	2.83	0.14	0.44	0.20	4.75	0.09
04/27/2022	0.08	0.03	5.00	0.02	0.05	0.12	0.42	0.12	0.55	0.12	1.50	0.37
04/28/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
04/29/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
04/30/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
05/01/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
05/02/2022	0.06	0.03	3.00	0.02	0.16	0.16	1.17	0.14	0.16	0.12	2.00	0.08
05/03/2022	0.08	0.05	2.00	0.04	0.16	0.08	1.33	0.12	0.18	0.12	3.00	0.06
05/04/2022	0.23	0.13	6.00	0.04	0.19	0.20	1.33	0.14	0.22	0.16	2.75	0.08
05/05/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
05/06/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
05/07/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
05/08/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
05/09/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
05/10/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
05/11/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
05/12/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
05/13/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
05/14/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.08	0.25	0.08
05/15/2022	0.18	0.09	7.00	0.03	0.41	0.36	1.17	0.35	0.20	0.20	2.00	0.10
05/16/2022	0.67	0.40	4.00	0.17	0.37	0.68	1.33	0.28	0.20	0.28	1.75	0.11
05/17/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
05/18/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
05/19/2022	0.08	0.08	1.00	0.08	0.09	0.24	0.50	0.18	0.03	0.08	0.50	0.06
05/20/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.12	1.00	0.06
05/21/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
05/22/2022	0.22	0.17	2.00	0.11	0.18	0.40	0.67	0.27	0.23	0.12	2.50	0.09
05/23/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.08	1.50	0.07
05/24/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
05/25/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
05/26/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
05/27/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
05/28/2022	0.33	0.12	4.00	0.08	0.53	0.68	1.42	0.37	0.16	0.08	3.25	0.05
05/29/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.08	2.50	0.05
05/30/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.16	1.25	0.08
05/31/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
06/01/2022	0.43	0.26	5.00	0.09	0.31	0.00	1.58	0.20	0.40	0.16	6.75	0.06
06/02/2022	0.07	0.05	3.00	0.02	0.04	1.32	0.25	0.16	0.09	0.12	1.50	0.06
06/03/2022	0.03	0.02	2.00	0.02	0.06	0.28	0.50	0.12	0.09	0.08	1.50	0.06
06/04/2022	0.00	0.00	0.00	0.00	0.00	0.32	0.00	0.00	0.00	0.00	0.00	0.00
06/05/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
06/06/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
06/07/2022	0.06	0.05	2.00	0.03	0.03	0.00	0.25	0.12	0.01	0.04	0.25	0.04
06/08/2022	0.30	0.05	10.00	0.03	0.19	0.96	1.58	0.12	0.46	0.12	7.50	0.06
06/09/2022	0.01	0.01	1.00	0.01	0.69	0.48	2.50	0.28	0.83	0.20	8.50	0.10
06/10/2022	0.00	0.00	0.00	0.00	0.00	3.44	0.00	0.00	0.00	0.00	0.00	0.00
06/11/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
06/12/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
06/13/2022	0.00	0.00	0.00	0.00	0.03	0.20	0.25	0.12	0.03	0.12	0.25	0.12
06/14/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
06/15/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
06/16/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
06/17/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
06/18/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
06/19/2022	0.16	0.07	5.00	0.03	0.09	0.28	0.75	0.12	0.16	0.12	2.50	0.06

Appendix D - Daily Rainfall

Date	Lawrence Airport (US W00094723) NOAA				Marginal Pumping Station Rain Gage				ASPW Rain Gage			
	Rain Total (in.)	Peak hour intensity (in/hr.)	Storm Duration (hrs.)	Daily Avg. Intensity (in/hr.)	Rain Total (in.)	Peak Hour Intensity (in./hr.)	Storm Duration (hrs.)	Daily Avg. Intensity (in./hr.)	Rain Total (in.)	Peak Hour Intensity (in./hr.)	Storm Duration (hrs.)	Daily Avg. Intensity (in./hr.)
06/20/2022	0.00	0.00	0.00	0.00	0.00	0.32	0.00	0.00	0.00	0.00	0.00	0.00
06/21/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
06/22/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
06/23/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
06/24/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
06/25/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.08	0.25	0.08
06/26/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.08	0.25	0.08
06/27/2022	0.19	0.08	6.00	0.03	0.10	0.00	0.50	0.20	0.13	0.24	0.75	0.17
06/28/2022	0.00	0.00	0.00	0.00	0.00	0.56	0.00	0.00	0.00	0.00	0.00	0.00
06/29/2022	0.40	0.37	2.00	0.20	0.17	0.00	0.83	0.20	0.18	0.24	1.25	0.14
06/30/2022	0.00	0.00	0.00	0.00	0.00	0.72	0.00	0.00	0.05	0.00	0.00	0.00
07/01/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.08	0.25	0.08
07/02/2022	0.05	0.04	2.00	0.03	0.05	0.08	0.42	0.12	0.05	0.08	0.75	0.07
07/03/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.08	0.25	0.08
07/04/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
07/05/2022	0.13	0.07	5.00	0.03	0.11	0.12	0.83	0.13	0.19	0.16	2.25	0.08
07/06/2022	0.12	0.11	2.00	0.06	0.26	0.32	1.08	0.24	0.20	0.28	1.25	0.16
07/07/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
07/08/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
07/09/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
07/10/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
07/11/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
07/12/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.04	0.50	0.04
07/13/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.04	0.50	0.04
07/14/2022	0.30	0.20	4.00	0.08	0.38	0.24	2.58	0.15	0.24	0.16	2.25	0.11
07/15/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
07/16/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
07/17/2022	0.03	0.03	1.00	0.03	0.00	0.00	0.00	0.00	0.02	0.04	0.50	0.04
07/18/2022	0.15	0.05	5.00	0.03	0.11	0.08	0.92	0.12	0.16	0.08	2.75	0.06
07/19/2022	0.63	0.56	2.00	0.32	0.40	0.08	3.33	0.12	0.65	0.64	2.25	0.29
07/20/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.08	0.50	0.06
07/21/2022	0.06	0.06	1.00	0.06	0.00	0.00	0.00	0.00	0.03	0.08	0.50	0.06
07/22/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00
07/23/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.04	0.25	0.12
07/24/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.08	0.25	0.08
07/25/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.04	0.25	0.08
07/26/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00
07/27/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
07/28/2022	0.29	0.22	4.00	0.07	0.05	0.04	0.42	0.12	0.24	0.16	2.00	0.12
07/29/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.08	0.25	0.08
07/30/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.08	0.25	0.08
07/31/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.08	0.25	0.08
08/01/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.08	0.25	0.08
08/02/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.08	0.25	0.08
08/03/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.08	0.25	0.08
08/04/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.08	0.25	0.08
08/05/2022	0.16	0.16	1.00	0.16	0.05	0.12	0.17	0.29	0.28	0.68	0.75	0.37
08/06/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.08	0.25	0.08
08/07/2022	0.03	0.02	2.00	0.02	0.06	0.12	0.25	0.24	0.12	0.32	0.75	0.16
08/08/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.04	0.50	0.04
08/09/2022	0.01	0.01	1.00	0.01	0.02	0.08	0.08	0.25	0.01	0.00	0.00	0.00
08/10/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
08/11/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
08/12/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
08/13/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
08/14/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
08/15/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
08/16/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
08/17/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
08/18/2022	0.02	0.02	1.00	0.02	0.01	0.04	0.08	0.13	0.00	0.00	0.00	0.00
08/19/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.08	0.25	0.08
08/20/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.08	0.25	0.08
08/21/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.08	0.25	0.08
08/22/2022	0.23	0.12	5.00	0.05	0.26	0.28	1.58	0.16	0.19	0.12	3.50	0.05
08/23/2022	0.05	0.01	5.00	0.01	0.02	0.04	0.17	0.12	0.03	0.08	0.50	0.06
08/24/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
08/25/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.08	0.50	0.06
08/26/2022	0.06	0.06	1.00	0.06	0.08	0.08	0.67	0.12	0.13	0.12	1.50	0.09
08/27/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
08/28/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
08/29/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.08	0.25	0.08
08/30/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.04	0.25	0.04
08/31/2022	0.14	0.08	4.00	0.04	0.12	0.16	0.83	0.14	0.21	0.24	2.00	0.11
09/01/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09/02/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09/03/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09/04/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09/05/2022	1.21	0.23	21.00	0.06	1.29	0.60	8.25	0.16	1.58	0.60	15.00	0.11
09/06/2022	0.64	0.09	15.00	0.04	0.73	0.12	6.08	0.12	1.07	0.20	13.00	0.08
09/07/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.12	0.25	0.12
09/08/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09/09/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09/10/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09/11/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09/12/2022	0.01	0.01	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix D - Daily Rainfall

Date	Lawrence Airport (US W00094723) NOAA				Marginal Pumping Station Rain Gage				ASPW Rain Gage			
	Rain Total (in.)	Peak hour intensity (in/hr.)	Storm Duration (hrs.)	Daily Avg. Intensity (in/hr.)	Rain Total (in.)	Peak Hour Intensity (in./hr.)	Storm Duration (hrs.)	Daily Avg. Intensity (in./hr.)	Rain Total (in.)	Peak Hour Intensity (in./hr.)	Storm Duration (hrs.)	Daily Avg. Intensity (in./hr.)
09/13/2022	0.29	0.17	3.00	0.10	0.17	0.56	0.25	0.68	0.18	0.52	0.50	0.36
09/14/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09/15/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09/16/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09/17/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09/18/2022	0.09	0.08	2.00	0.05	0.11	0.24	0.50	0.22	0.10	0.16	1.25	0.08
09/19/2022	0.60	0.29	6.00	0.10	0.64	0.48	2.83	0.23	0.61	0.36	4.50	0.14
09/20/2022	0.01	0.01	1.00	0.01	0.02	0.04	0.17	0.12	0.02	0.04	0.50	0.04
09/21/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09/22/2022	1.22	0.52	7.00	0.17	1.25	1.52	4.08	0.31	1.22	0.36	8.75	0.14
09/23/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09/24/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09/25/2022	0.01	0.01	1.00	0.01	0.00	0.00	0.00	0.00	0.01	0.04	0.25	0.04
09/26/2022	0.05	0.02	4.00	0.01	0.01	0.04	0.08	0.13	0.04	0.08	0.75	0.05
09/27/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09/28/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09/29/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09/30/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/01/2022	0.02	0.01	2.00	0.01	0.00	0.00	0.00	0.00	0.01	0.04	0.25	0.04
10/02/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/03/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/04/2022	0.09	0.05	2.00	0.05	0.03	0.04	0.25	0.12	0.04	0.08	0.75	0.05
10/05/2022	0.14	0.05	7.00	0.02	0.10	0.08	0.83	0.12	0.20	0.12	3.50	0.06
10/06/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/07/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/08/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/09/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/10/2022	0.01	0.01	1.00	0.01	0.02	0.04	0.17	0.12	0.04	0.08	0.50	0.08
10/11/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/12/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/13/2022	0.82	0.29	8.00	0.10	0.90	0.56	4.33	0.21	0.35	0.16	4.75	0.07
10/14/2022	1.15	0.33	12.00	0.10	0.74	0.40	4.42	0.17	1.67	0.28	10.50	0.16
10/15/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/16/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/17/2022	0.70	0.44	5.00	0.14	0.91	1.00	2.58	0.35	0.19	0.12	2.75	0.07
10/18/2022	0.34	0.17	6.00	0.06	0.20	0.16	1.50	0.13	0.83	0.20	6.50	0.13
10/19/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/20/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/21/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/22/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/23/2022	0.06	0.02	4.00	0.02	0.05	0.04	0.42	0.12	0.11	0.12	1.75	0.06
10/24/2022	0.14	0.08	6.00	0.02	0.25	0.56	0.92	0.27	0.35	0.48	2.75	0.13
10/25/2022	0.07	0.03	3.00	0.02	0.03	0.04	0.25	0.12	0.03	0.04	0.75	0.04
10/26/2022	0.14	0.06	4.00	0.04	0.09	0.12	0.67	0.13	0.16	0.12	2.50	0.06
10/27/2022	0.00	0.00	0.00	0.00	0.01	0.04	0.08	0.13	0.00	0.00	0.00	0.00
10/28/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/29/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/30/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/31/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11/01/2022	0.03	0.03	1.00	0.03	0.00	0.00	0.00	0.00	0.01	0.04	0.25	0.04
11/02/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.08	0.25	0.08
11/03/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11/04/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11/05/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11/06/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11/07/2022	0.02	0.02	1.00	0.02	0.05	0.12	0.33	0.15	0.08	0.12	0.75	0.11
11/08/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11/10/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11/11/2022	0.50	0.16	7.00	0.07	0.50	0.28	2.58	0.19	0.49	0.20	4.00	0.12
11/12/2022	0.14	0.11	3.00	0.05	0.06	0.12	0.33	0.18	0.15	0.36	0.75	0.20
11/13/2022	0.29	0.11	7.00	0.04	0.30	0.20	2.17	0.14	0.31	0.16	4.25	0.07
11/14/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11/15/2022	0.08	0.04	2.00	0.04	0.05	0.04	0.42	0.12	0.03	0.04	0.75	0.04
11/16/2022	0.70	0.09	14.00	0.05	0.79	0.16	6.17	0.13	1.05	0.20	12.75	0.08
11/17/2022	0.02	0.01	2.00	0.01	0.01	0.04	0.08	0.13	0.01	0.04	0.25	0.04
11/18/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11/19/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11/20/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11/21/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11/22/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11/23/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11/24/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11/25/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11/26/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11/27/2022	0.68	0.19	9.00	0.08	0.67	0.44	3.83	0.17	0.68	0.44	6.00	0.11
11/28/2022	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.06	0.04	0.25	0.24
11/29/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11/30/2022	0.52	0.11	7.00	0.07	0.52	0.44	3.17	0.16	0.67	0.40	6.00	0.11
12/01/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/02/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/03/2022	0.24	0.07	6.00	0.04	0.16	0.00	1.33	0.12	0.26	0.20	3.75	0.07
12/04/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/05/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/06/2022	0.08	0.03	5.00	0.02	0.08	0.00	0.67	0.12	0.08	0.08	1.75	0.05
12/07/2022	0.75	0.19	12.00	0.06	0.68	0.00	4.92	0.14	0.95	0.24	8.75	0.11

Appendix D - Daily Rainfall

Date	Lawrence Airport (US W00094723) NOAA				Marginal Pumping Station Rain Gage				ASPW Rain Gage			
	Rain Total (in.)	Peak hour intensity (in/hr.)	Storm Duration (hrs.)	Daily Avg. Intensity (in/hr.)	Rain Total (in.)	Peak Hour Intensity (in./hr.)	Storm Duration (hrs.)	Daily Avg. Intensity (in./hr.)	Rain Total (in.)	Peak Hour Intensity (in./hr.)	Storm Duration (hrs.)	Daily Avg. Intensity (in./hr.)
12/08/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/09/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/10/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/11/2022	0.01	0.01	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/12/2022	0.00	0.00	0.00	0.00	0.01	0.00	0.08	0.13	0.02	0.08	0.25	0.08
12/13/2022	0.00	0.00	0.00	0.00	0.02	0.00	0.17	0.12	0.04	0.08	0.50	0.08
12/14/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/15/2022	0.19	0.05	8.00	0.02	0.22	0.00	1.83	0.12	0.18	0.16	4.25	0.04
12/16/2022	1.77	0.19	22.00	0.08	1.81	0.04	13.83	0.13	2.11	0.20	19.00	0.11
12/17/2022	0.25	0.08	9.00	0.03	0.16	0.04	1.33	0.12	0.29	0.12	4.25	0.07
12/18/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/19/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/20/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/21/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/22/2022	0.22	0.08	5.00	0.04	0.18	0.00	1.50	0.12	0.18	0.12	2.50	0.07
12/23/2022	1.87	0.27	17.00	0.11	1.39	0.04	7.83	0.18	1.95	0.36	12.75	0.15
12/24/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/25/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/26/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/27/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/28/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/29/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/30/2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12/31/2022	0.28	0.06	8.00	0.04	0.30	0.00	2.42	0.12	0.40	0.28	5.25	0.08
Total	**36.73**				**33.21**				**43.74**			
Average	**0.10**		**1.87**		**0.09**		**0.55**		**0.12**		**1.14**	
Maximum	**1.87**	**0.56**	**27.00**	**0.32**	**1.81**	**3.44**	**13.83**	**0.68**	**2.11**	**2.16**	**19.00**	**3.32**

Appendix E

Appendix E - Downstream Notification List

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