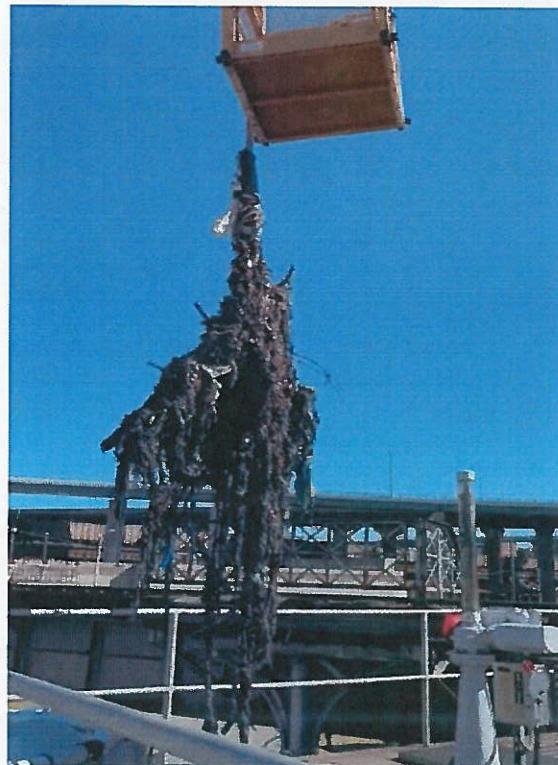
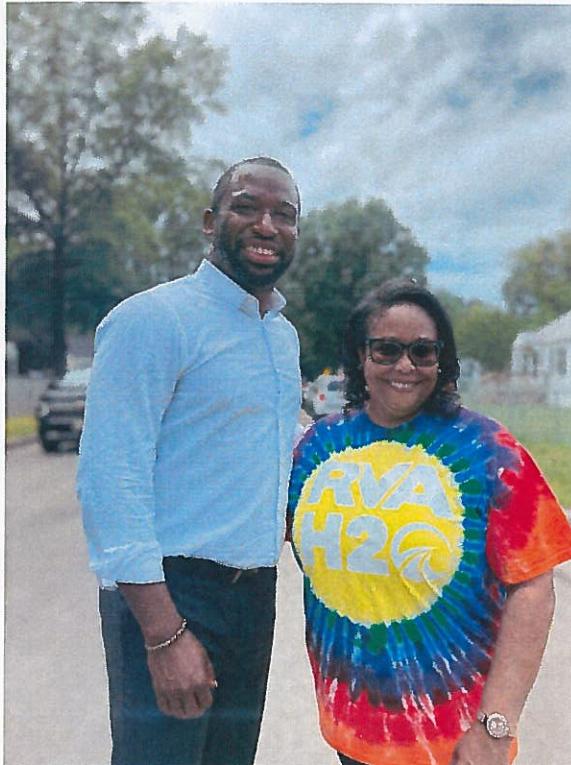


City of Richmond, Virginia
Department of Public Utilities
Integrated CSS and MS4
2021 Annual Report

March 30, 2022



Legend for Cover Photos:

1. Forest View Green Alley event – June 2021, Mayor Levar Stoney and April Bingham, Director, DPU
2. Sewer Monster from Shockoe 96-Inch Interceptor – 10/19/21
3. Keep Virginia Cozy Earth Day Clean-Up Event at Belle Isle – 4/25/21
4. Richmond DPU accepts “2021 National Environmental Achievement Award from the National Association of Clean Water Agencies, Public Information and Education E-Media” – 4/29/20, Jennifer Clarke, Public Information and Outreach Coordinator and Patrick Bradley, Deputy Director, DPU



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List of Abbreviations

| | |
|------|---------------------------------------|
| CSS | combined sewer system |
| DPU | Department of Public Utilities |
| DWF | dry weather flow |
| DWO | dry weather overflow |
| I/I | inflow and infiltration |
| MG | million gallons |
| MGD | million gallons per day |
| MS4 | Municipal Separate Storm Sewer System |
| NMC | nine minimum controls |
| SCM | six minimum controls |
| WWTP | Richmond Wastewater Treatment Plant |

Section 1

General Information

Permittee Name

City of Richmond

System Name

City of Richmond, Department of Public Utilities (DPU)

Richmond Wastewater Treatment Plant (WWTP), Richmond Combined Sewer System (CSS) and
Richmond Municipal Separate Storm Sewer System (MS4)

VPDES Permit No.

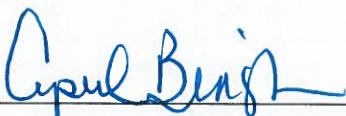
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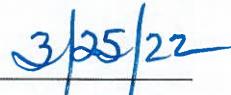
January 1, 2021 through December 31, 2021

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."



April Bingham, Director of Public Utilities



Date

Section 2

Combined Sewer System (CSS)

The metered results of the volume and number of overflows for each combined sewer overflow (CSO) outfall based on the measured storm event data for the 2021 reporting period is presented in Tables 2-1 and 2-2 below, respectively. A map of the CSS outfalls is presented in Appendix A.

Table 2-1. Modeled Overflow Volume (MG)

| CSO Outfall | Jan 2021 | Feb 2021 | Mar 2021 | Apr 2021 | May 2021 | Jun 2021 | Jul 2021 | Aug 2021 | Sep 2021 | Oct 2021 | Nov 2021 | Dec 2021 | Total FY21 |
|--|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------------|
| Hampton Street CSO Area | | | | | | | | | | | | | |
| 19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 33 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| McCloy Street CSO Area | | | | | | | | | | | | | |
| 20 | 0 | 0 | 0 | 0 | 0 | 0.11 | 0 | 0.14 | 0 | 0 | 0 | 0 | 0.3 |
| Northside James River Park CSO Area | | | | | | | | | | | | | |
| 7 | 0 | 0 | 0.01 | 0.01 | 0.07 | 1.12 | 0 | 0 | 0 | 0 | 0 | 0 | 1.2 |
| 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11 | 0.28 | 0.42 | 0.45 | 0.15 | 0.67 | 4.69 | 2.84 | 9.07 | 12.54 | 0.01 | 0 | 0 | 31.1 |
| Southside James River Park CSO Area | | | | | | | | | | | | | |
| 15 | 0.53 | 0 | 0.01 | 0 | 0.01 | 1.62 | 0 | 0 | 0 | 0 | 0 | 0 | 2.2 |
| 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17 | 0 | 0 | 0 | 0 | 0 | 1.46 | 0 | 2.76 | 0.15 | 0 | 0 | 0 | 4.4 |
| 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 40 | 3.31 | 7.64 | 4.69 | 0.32 | 4.18 | 16.84 | 5.25 | 15.94 | 1.99 | 0 | 0 | 0.2 | 60.4 |
| Shockoe Creek CSO Area | | | | | | | | | | | | | |
| 6 | 106.28 | 497.02 | 17.42 | 0 | 98.17 | 206.05 | 173.41 | 437.85 | 125.68 | 58.70 | 0.01 | 0.07 | 1720.7 |
| 34 | 1.91 | 1.15 | 10.55 | 7.47 | 2.03 | 9.04 | 7.91 | 6.64 | 9.53 | 1.62 | 0.05 | 0.37 | 58.2 |
| Wastewater Treatment Plant CSO Area | | | | | | | | | | | | | |
| 14 | 0.24 | 0.71 | 0.03 | 0 | 0.11 | 9.80 | 0.95 | 1.11 | 1.96 | 0.02 | 0 | 0 | 14.9 |
| 21 | 20.03 | 34.26 | 6.76 | 2.69 | 7.46 | 14.11 | 8.62 | 18.57 | 5.88 | 0.25 | 0.02 | 2 | 120.7 |
| Gillies Creek CSO Area | | | | | | | | | | | | | |
| 4 | 0.19 | 0.84 | 0.66 | 0.19 | 0.99 | 5.22 | 1.96 | 3.62 | 0 | 0 | 0 | 0.01 | 13.7 |
| 5 | 0 | 0.29 | 0.17 | 0 | 0.07 | 1.83 | 0.54 | 1.62 | 0.41 | 0.08 | 0 | 0 | 5.0 |
| 24 | 0 | 0.01 | 0 | 0 | 0 | 1.09 | 0.24 | 0.15 | 0.26 | 0 | 0 | 0 | 1.8 |
| 25 | 0 | 0 | 0 | 0 | 0 | 0.30 | 0 | 0.07 | 0 | 0 | 0 | 0 | 0.4 |
| 26 | 0.42 | 0.04 | 0 | 0 | 0 | 2.46 | 0.31 | 0.69 | 0.28 | 0.01 | 0 | 0 | 4.2 |
| 31 | 0 | 0.50 | 0 | 0.25 | 0.42 | 7.07 | 1.45 | 7.04 | 3.62 | 0 | 0 | 0 | 20.4 |
| 35 | 0.19 | 0.27 | 0.24 | 0.08 | 0.22 | 0.92 | 0.57 | 0.20 | 0 | 0 | 0 | 0.03 | 2.7 |
| 39 | 0.30 | 2.03 | 0.75 | 0.11 | 0.73 | 7.06 | 1.59 | 8.11 | 3.77 | 1.15 | 0.03 | 0.03 | 25.7 |
| Hilton Street CSO Area | | | | | | | | | | | | | |
| 12 | 0.02 | 0.06 | 0.03 | 0 | 0 | 1.25 | 0.12 | 0.29 | 0.32 | 0.05 | 0 | 0 | 2.1 |

Table 2-2. Modeled Number of Overflow Occurrences

| CSO Outfall | Jan 2021 | Feb 2021 | Mar 2021 | Apr 2021 | May 2021 | Jun 2021 | Jul 2021 | Aug 2021 | Sep 2021 | Oct 2021 | Nov 2021 | Dec 2021 | Total FY21 |
|--|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------------|
| Hampton Street CSO Area | | | | | | | | | | | | | |
| 19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 33 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| McCloy Street CSO Area | | | | | | | | | | | | | |
| 20 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 2 |
| Northside James River Park CSO Area | | | | | | | | | | | | | |
| 7 | 0 | 0 | 1 | 0 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11 | 3 | 1 | 4 | 2 | 4 | 5 | 4 | 10 | 2 | 0 | 0 | 0 | 35 |
| Southside James River Park CSO Area | | | | | | | | | | | | | |
| 15 | 2 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 1 | 0 | 0 | 0 | 4 |
| 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 40 | 5 | 9 | 4 | 5 | 3 | 5 | 6 | 8 | 3 | 0 | 0 | 3 | 51 |
| Shockoe Creek CSO Area | | | | | | | | | | | | | |
| 6 | 5 | 13 | 3 | 0 | 5 | 9 | 7 | 10 | 5 | 6 | 1 | 1 | 65 |
| 34 | 1 | 1 | 2 | 1 | 5 | 3 | 2 | 10 | 1 | 5 | 2 | 4 | 37 |
| Wastewater Treatment Plant CSO Area | | | | | | | | | | | | | |
| 14 | 1 | 2 | 1 | 0 | 3 | 5 | 3 | 6 | 3 | 1 | 0 | 0 | 25 |
| 21 | 6 | 7 | 4 | 10 | 12 | 8 | 4 | 4 | 6 | 8 | 1 | 5 | 75 |
| Gillies Creek CSO Area | | | | | | | | | | | | | |
| 4 | 3 | 6 | 4 | 3 | 3 | 5 | 5 | 9 | 0 | 0 | 0 | 0 | 38 |
| 5 | 0 | 3 | 2 | 0 | 1 | 3 | 3 | 3 | 1 | 1 | 0 | 0 | 17 |
| 24 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 2 | 1 | 0 | 0 | 0 | 7 |
| 25 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 3 |
| 26 | 2 | 1 | 0 | 0 | 0 | 3 | 2 | 2 | 1 | 0 | 0 | 0 | 11 |
| 31 | 0 | 1 | 0 | 1 | 1 | 4 | 2 | 5 | 1 | 0 | 0 | 0 | 15 |
| 35 | 3 | 6 | 4 | 3 | 4 | 5 | 6 | 3 | 0 | 0 | 0 | 1 | 35 |
| 39 | 2 | 6 | 3 | 3 | 4 | 4 | 3 | 7 | 4 | 3 | 0 | 1 | 40 |
| Hilton Street CSO Area | | | | | | | | | | | | | |
| 12 | 1 | 1 | 1 | 0 | 0 | 4 | 2 | 2 | 3 | 1 | 0 | 0 | 15 |

Section 3

CSS and MS4 Nine Minimum Controls (NMC) and Six Minimum Controls (MCM)

3.1 Operation and Maintenance of the CSS (NMC 1)

3.1.1 Inspection and Maintenance of CSS Control Structures and Pump Stations

The City follows a regular schedule for inspection and maintenance of regulators, CSO outfalls, and pump stations. The schedule of performance of the City's O&M program is summarized in Table 3-1 and 3-2 below. Equipment inspection, screen cleaning and debris removal are part of the regular activities.

Table 3-1. CSS Control Structure O&M Program

| CSO Control Structures | Inspection Interval | Maintenance | |
|-----------------------------|---------------------|-------------|--------------------------|
| | | Interval | Type |
| Dry Weather Regulators (29) | Monthly | Monthly | Preventative Maintenance |
| Wet Weather Regulators (10) | | | |
| CSO Outfalls (25) | Monthly | Monthly | Preventative Maintenance |

Table 3-2. CSS Pump Station O&M Program

| Pump Station | Capacity (MGD) | | Estimated Dry Weather Peak (MGD) | Inspection/Maintenance Interval |
|----------------|----------------|-----------|----------------------------------|---------------------------------|
| | Firm | Installed | | |
| Douglasdale | 7.5 | 13.0 | 2.2 | Daily |
| Hampton/Mccloy | 0.9 | 1.7 | 0.4 | Daily |
| Upham Brook | 8.6 | 13.0 | 0.3 | Daily |

If major repairs are deemed necessary at the inspection, a work order is initiated, and the repairs are scheduled. Major repairs may be handled by the City's maintenance department or by outside contractors.

3.1.2 Sewer Flushing and Cleaning

The City follows a regular schedule for routine sewer line flushing and cleaning. Maintenance activities performed on the collection system during the 2021 reporting period are summarized in Table 3-3 below.

Table 3-3. Sewer System Maintenance Activities

| Activity | Interval | Quantity |
|-----------------|----------|------------|
| Sewer Cleaning | Annually | 33.1 miles |
| CCTV Inspection | Annually | 33.8 miles |

3.1.3 Catch Basin Cleaning

The City follows a regular schedule for routine catch basin cleaning. The City cleaned 4,502 catch basins throughout the CSS during the 2021 reporting period.

3.2 Use of Collection System for Storage (NMC 2)

3.2.1 Information regarding storage at Shockoe Retention Basin and Hampton/McCloy Tunnel

Storage is provided in the Shockoe and Hampton/McCloy CSO areas through existing retention facilities.

- The Shockoe facilities serve about 8,000 acres of the CSS and comprise a 35 million gallon (MG) retention basin with upstream in-line storage of approximately 15 MG in diversion structures and arch and box sewers.
- The Hampton/McCloy tunnel serves about 1,012 acres of the CSS and comprises a 7.2 MG retention tunnel.

3.2.2 Sewer Re-lining Activities to reduce Inflow and Infiltration (I/I)

The City implements a sewer lining program annually to reduce I/I. The City lined 16,430 feet of sewer during the 2021 reporting period.

3.2.3 Operation of WWTP influent pumping to fill intercepting system

During wet weather events the Main Pumping Station is operated at 140 MGD to maximize flow to the WWTP. As the wet weather event continues, combined sewage is stored in the interceptor system before overflows occur. Portions of the intercepting sewers that convey flow to the WWTP are located at elevations below the lowest CSO outfall overflow elevation. The majority of these low-lying intercepting sewers are in the Shockoe CSO drainage area where the lowest overflow elevation is 1.00 feet. Table 3-4 below summarizes the intercepting sewers below the lowest CSO overflow elevation and the corresponding estimated storage capacity.

Table 3-4. Intercepting Sewers Below Lowest CSO Overflow Elevation

| Intercepting Sewer | Diameter (inches) | Length Below (El + 1.00 (feet)) | Storage Capacity (MG) |
|----------------------|-------------------|---------------------------------|-----------------------|
| Lower Goodes Creek | 72 | 10,905 | 2.61 |
| Twin River Crossings | 66 | 1,100 | 0.39 |
| Hull Street | 60 | 2,700 | 0.40 |
| Shockoe | 96 | 2,700 | 1.02 |
| Gillies Creek | 60 | 2,500 | 0.37 |

| Table 3-4. Intercepting Sewers Below Lowest CSO Overflow Elevation | | | |
|---|-------------------|------------------------------------|--------------------------|
| Intercepting Sewer | Diameter (inches) | Length Below (El + 1.00 (feet)) | Storage Capacity (MG) |
| Northside CSO Conveyance (1) | 96, 84, 60 | 2,850 | 0.89 |
| Total | | | 5.68 |
| (1) Northside CSO Conveyance stores CSS to an elevation of 16.0 feet | | | |

3.2.4 Tide Gate Inspections

The City routinely inspects and makes necessary repairs to tide gates to reduce tidal intrusion into the collection system. The City follows a regular schedule for inspection and maintenance of tide gates. The schedule of performance of the City's O&M program is summarized in Table 3-5 below. Equipment inspection, and debris removal are part of the regular activities.

| Table 3-5. Tide Gate O&M Program | | | |
|---|---------------------|-------------|-------------------------------------|
| Gates | Inspection Interval | Maintenance | |
| | | Interval | Type |
| CSO 04 (Bloody Run) Tide Gate | Monthly | Monthly | Preventative/Corrective Maintenance |
| CSO 05 (Peach Street) Tide Gate | Monthly | Monthly | Preventative/Corrective Maintenance |
| CSO 06 (Shockoe) Tide Gates (6) | Monthly | Monthly | Preventative Maintenance |
| CSO 14 (Stockton Street) Tide Gate | Monthly | Monthly | Preventative Maintenance |
| CSO 15 (Canoe Run) Tide Gate | Monthly | Monthly | Preventative Maintenance |
| CSO 16 (Woodland Heights) Tide Gate | Monthly | Monthly | Preventative Maintenance |
| CSO 17 (Reedy Creek) Tide Gate | Monthly | Monthly | Preventative Maintenance |
| CSO 18 (42 nd Street) Tide Gate | Monthly | Monthly | Preventative Maintenance |
| CSO 19 (Hampton) Flap Gate (2) | Monthly | Monthly | Preventative Maintenance |
| CSO 20 (McCloy) Flap Gate (3) | Monthly | Monthly | Preventative Maintenance |
| CSO 21 (Gordon Avenue) Tide Gate | Monthly | Monthly | Preventative/Corrective Maintenance |

3.2.5 Use of Public and Private Stormwater Facilities in the CSS Area

Local retention facilities provide additional stormwater storage in the CSS area. Examples of these types of facilities are shown in Table 3-6 below.

| Table 3-6. Local Stormwater Retention Facilities in the CSS Area | | |
|---|--------------|-------------|
| Site | Location | Owner |
| Brander St. Pump Station Holding Pond | Brander St. | City |
| Gordon Ave. Pump Station Holding Pond | Gordon Ave. | City |
| DPU Operations Parking Lot | Commerce Rd. | City |
| Sonoco Products Company | Commerce Rd. | Private (1) |
| BP Products North America | Commerce Rd. | Private (1) |



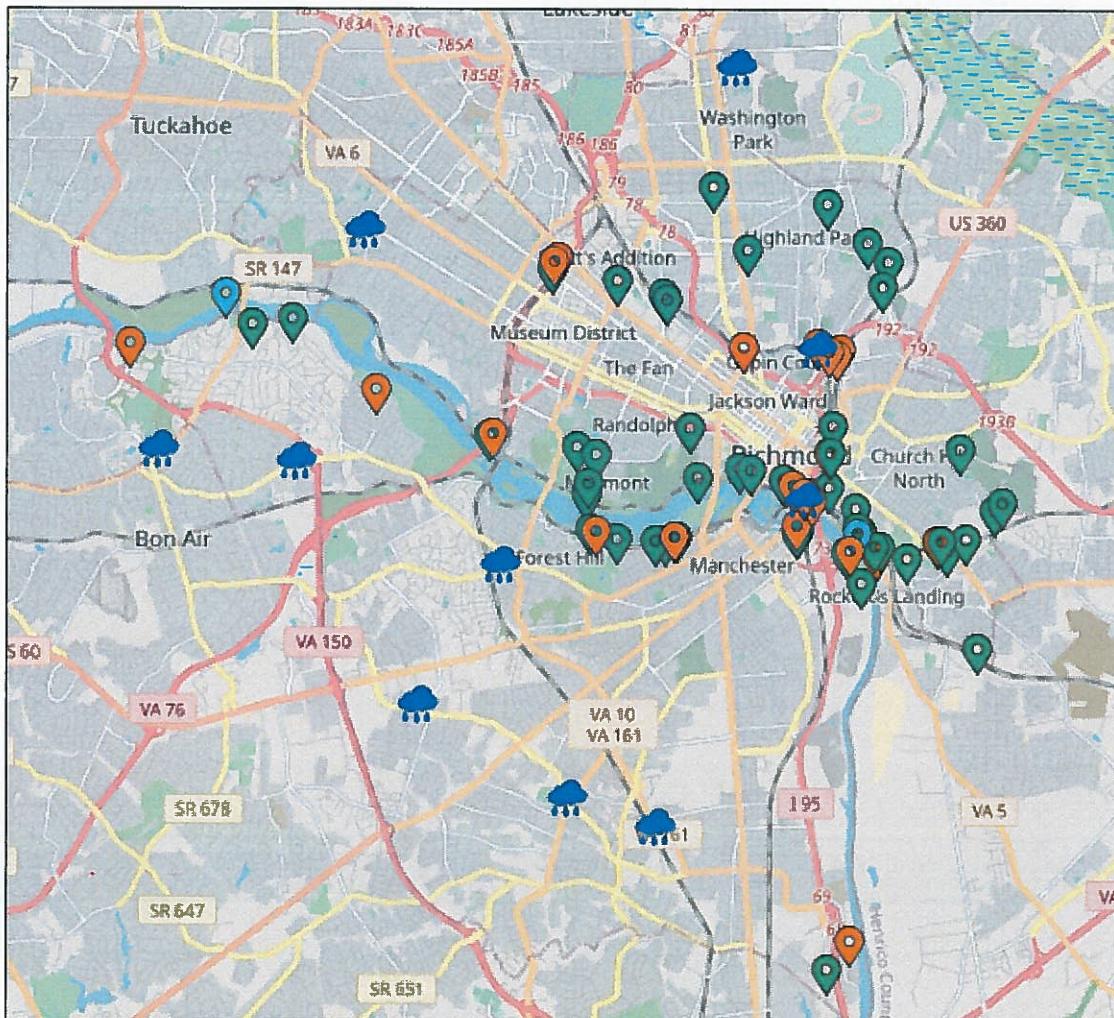
Table 3-6. Local Stormwater Retention Facilities in the CSS Area

| Site | Location | Owner |
|--|----------------|-------------|
| Citgo Petroleum Corporation | Maury St. | Private (1) |
| First Energy Corporation | Maury St. | Private (1) |
| Magellan Terminals Holdings, L.P. Richmond Terminal | East First St. | Private (1) |
| Transmontaigne Terminaling | Commerce Rd. | Private (1) |

(1) Industry that retains stormwater on-site during wet weather events and control releases to permit limits at the WWTP

3.2.6 Use of Real Time Decision Support System to manage flows during CSO Events

DPU utilizes 50 depth sensors, 23 flow meters, and 10 rain gauges (shown below in Figure 3-1) to monitor the collection system.

**Figure 3-1: Collection System Monitoring System**

The data can be displayed in real time, as shown below in Figure 3-2.

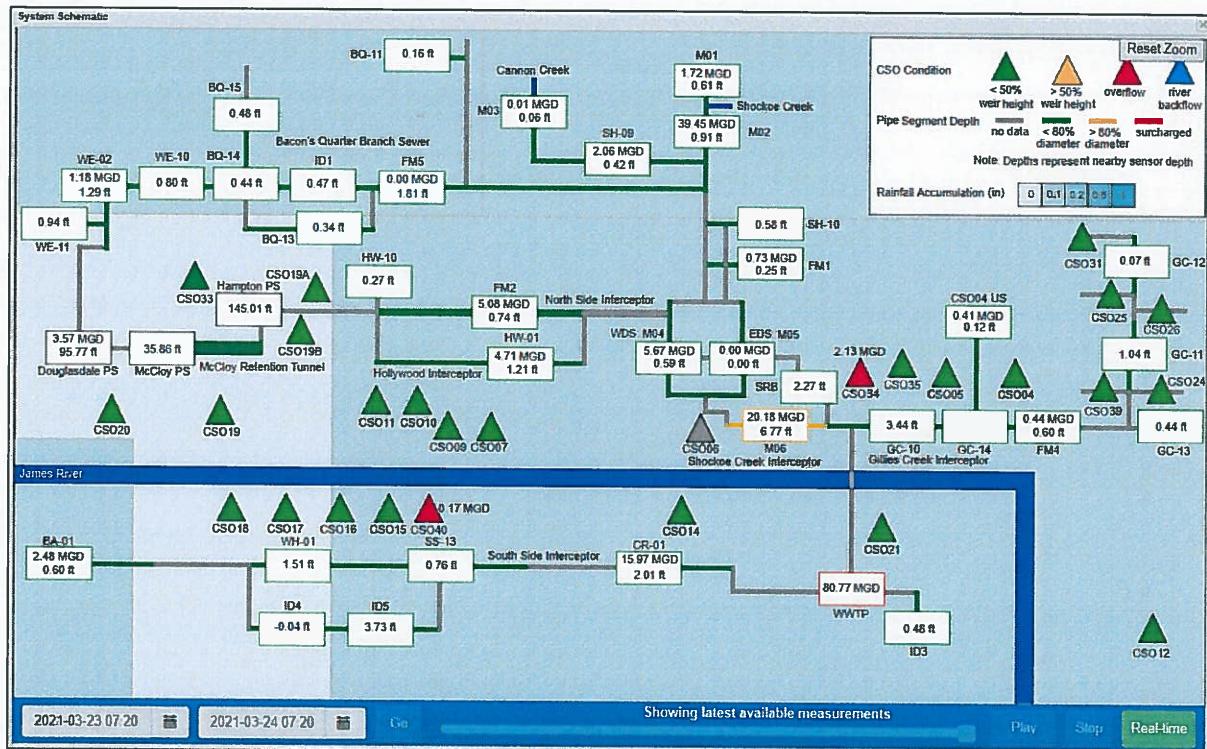


Figure 3-2: Real Time Collection System Data Display

The collected data is also utilized in the *Richmond CSO Map Notification*, which is available to the public (on the city's website) and displays outfalls that are currently overflowing or have overflowed in the past 48 hours.

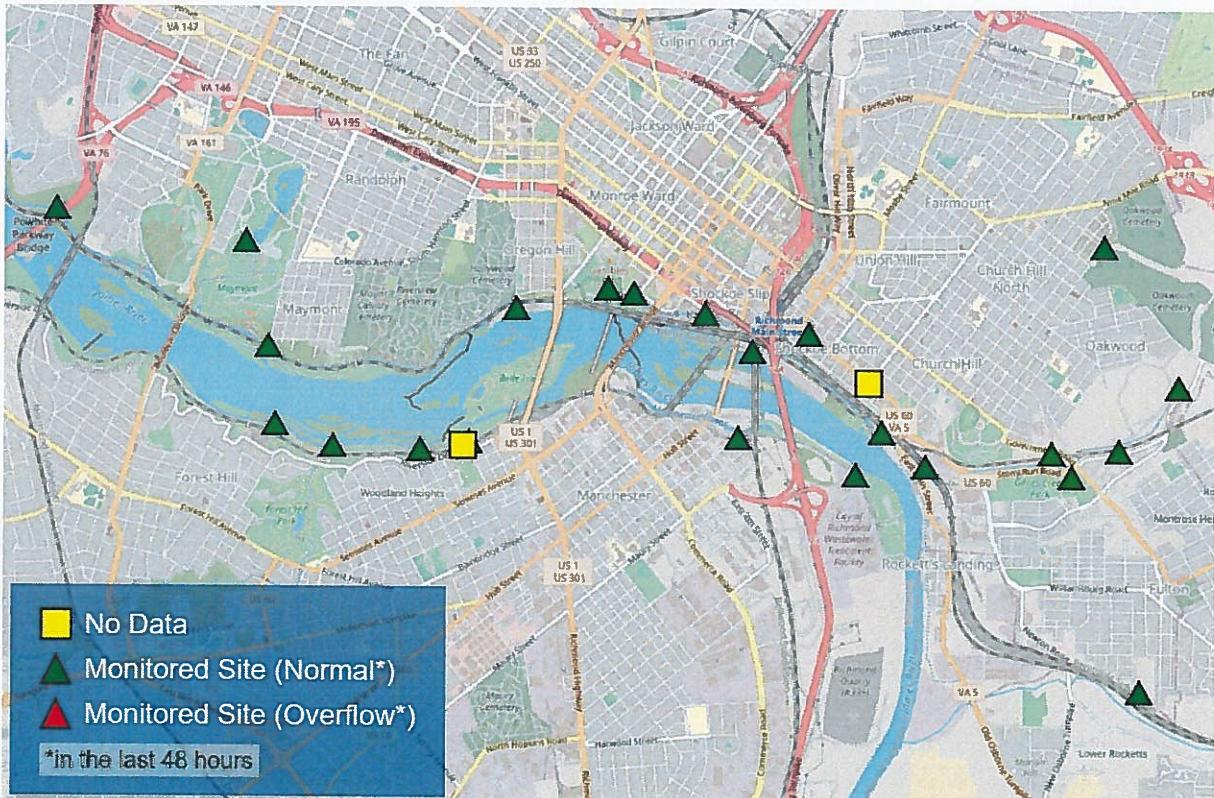


Figure 3-3: Richmond CSO Notification Map

3.3 Review of Pretreatment Program (NMC 3)

3.3.1 Changes or Use of Pretreatment Program Authority to minimize flows during CSO Events

The City administers an industrial pretreatment program as required by the VPDES permit. Industries discharging to the CSS retain stormwater on-site during wet weather events and control releases to permit limits at the WWTP. Information on individual industries which utilize retention facilities is summarized in Section 3.2.5 – Use of Public and Private Stormwater Facilities in the CSS Area. Each industry is issued an Industrial User Permit which includes a section on Discharge of Stormwater. The below statement was added to the Industrial User Permits:

E. Storm water runoff collected within the containment dike structure shall be released to the City's Treatment System in accordance with the following criteria:

1. There shall be no discharge of floating solids, visible foam or oily sheen in other than trace amounts; and
2. During storm events where the accumulation of rainfall is in excess of 2.2 inches; the permittee will use the installed precipitation gauge system to determine the volume of rainfall at the terminal; which would then trigger the terminal to call the City of Richmond's Department of Public Utilities Publicly Owned Treatment Works (POTW) at (804) 646-8721 to inform them of the level of rainwater retained in the diked area. It is at this time that the POTW will advise whether the plant is able to handle your facility's effluent. Nevertheless, neither your facility's nor the POTW's welfare will be jeopardized.
3. The Terminal Manager shall contact the City's Environmental Compliance Officer on 804.646.8661 and notify him/her of the intent to discharge, at least 24 hours prior to initiating any discharge other than in 2 above.

During this reporting period, there have been no additional changes to the program to minimize flow during a CSO event.

3.4 Maximize Flow to the WWTP for Treatment (NMC 4)

3.4.1 Operation of WWTP during Precipitation events to show Maximization of Treatment of Wet Weather Flows

The City maximizes flow to the WWTP during wet weather events by performing the following actions:

- Influent flow at the WWTP is increased to 140 MGD in wet weather conditions (see Figure 3-4).
- Flows up to 140 MGD are treated at the WWTP to permit limits.
 - 75 MGD receives Primary, Secondary, Tertiary and UV Disinfection
 - 65 MGD receives primary treatment and UV disinfection
- Combined sewage is stored in the Shockoe Retention Basin (see Figure 3-5), Hampton/McCloy Tunnel (see Figure 3-6) and the collection system prior to overflow.
- The Shockoe Retention Basin and Hampton/McCloy tunnel are drained as soon as possible once overflow conditions are concluded. During the draining process the WWTP continues to operate at 75 MGD.



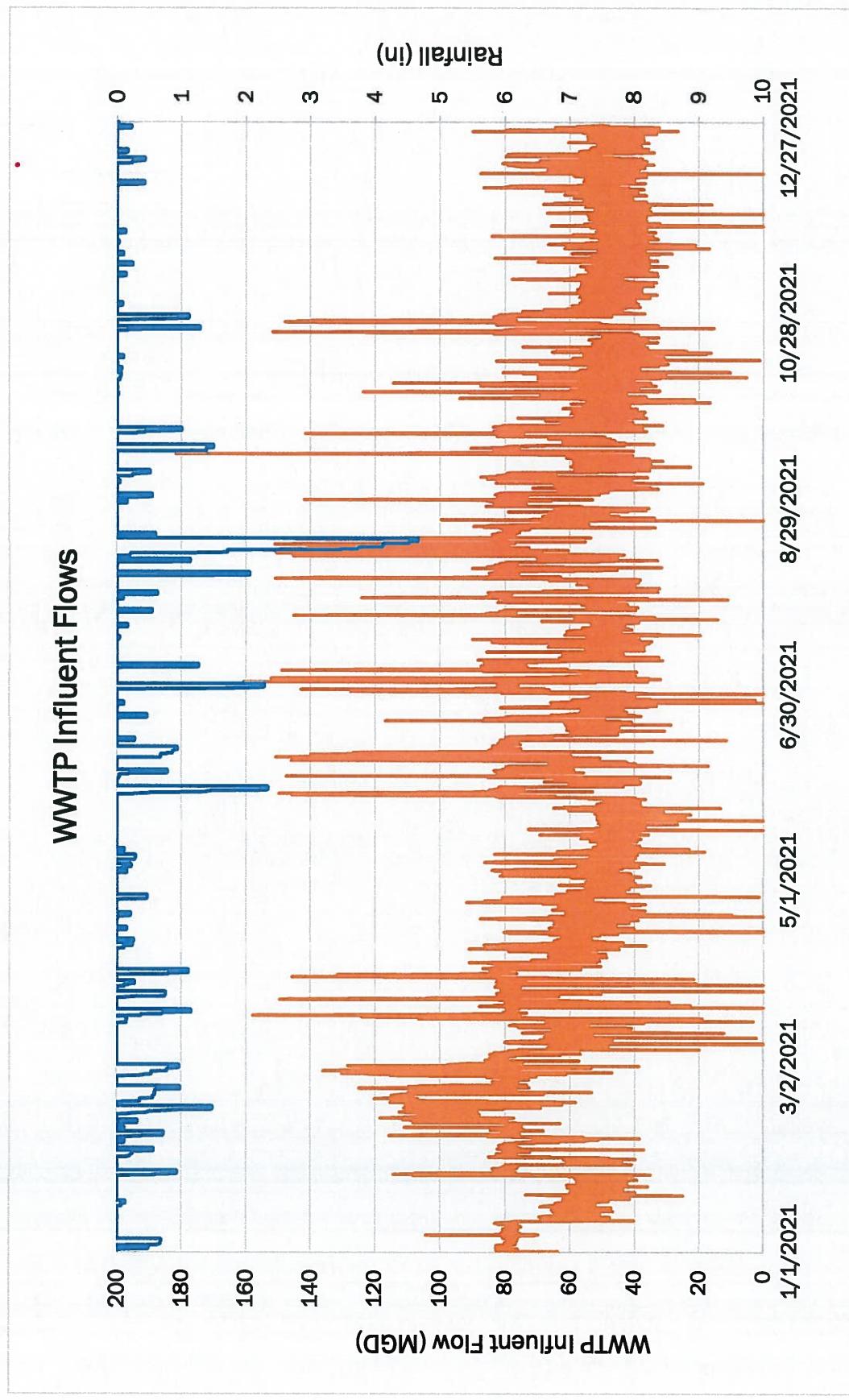


Figure 3-4: WWTP Influent Flows