

Water, Sewer, and August 24, 2023 Rain Event

City Commission Workshop

Engineering
Department

Date: September 11, 2023



Water, Sewer, and August 24, 2023 Rain Event

Introduction:

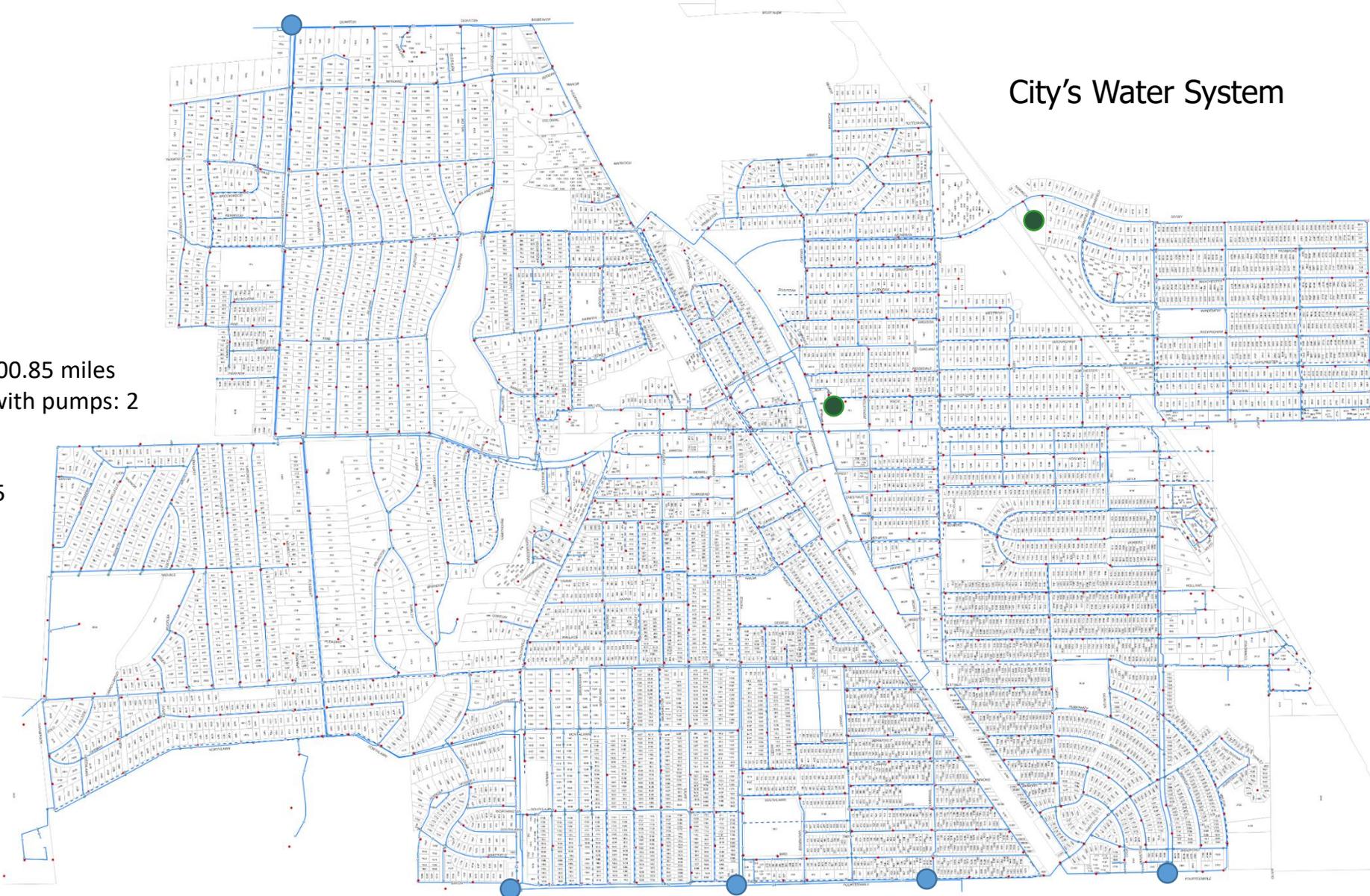
- City's Water System
- City's Sewer System
 - Information about the sewer system
 - How the sewer system works
 - Where does our sewer drain to
- August 24, 2023 Rain Event
 - Data Information
 - Next Steps
- Sewer Backup Claim Process



City's Water System

- Water Main
- Hydrants
- SOCWA Connection
- Water Tanks

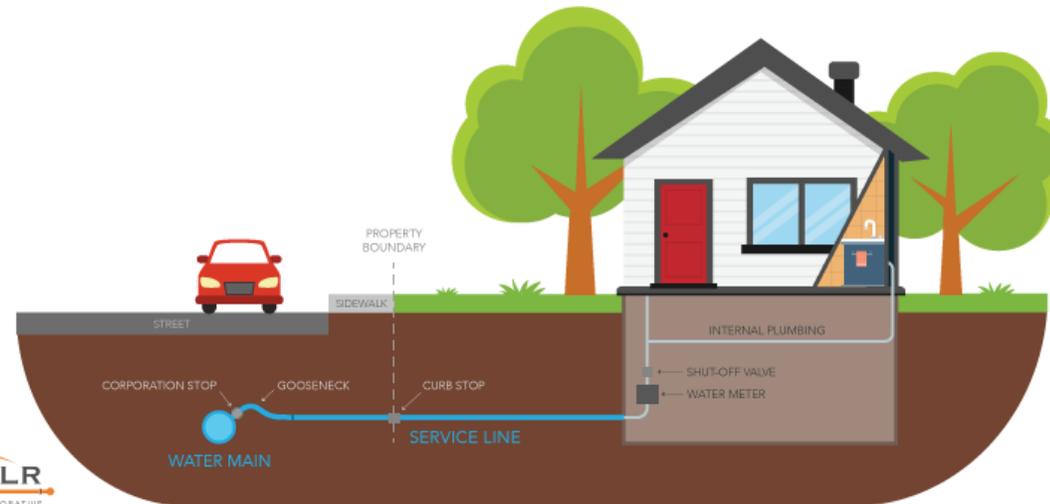
Customers: 9,007
Meters: 8,751
Water Main, 4"-16": 100.85 miles
500,000 Water Tanks with pumps: 2
Fire Hydrants: 862
Gate Valves: 1,289
SOWCA Connections: 5



City's Water System

Water System – How the water systems works

- Pressurized City Water Main
 - SOCWA Connections
 - Water Towers
- City Water Main to Properties via Water Services

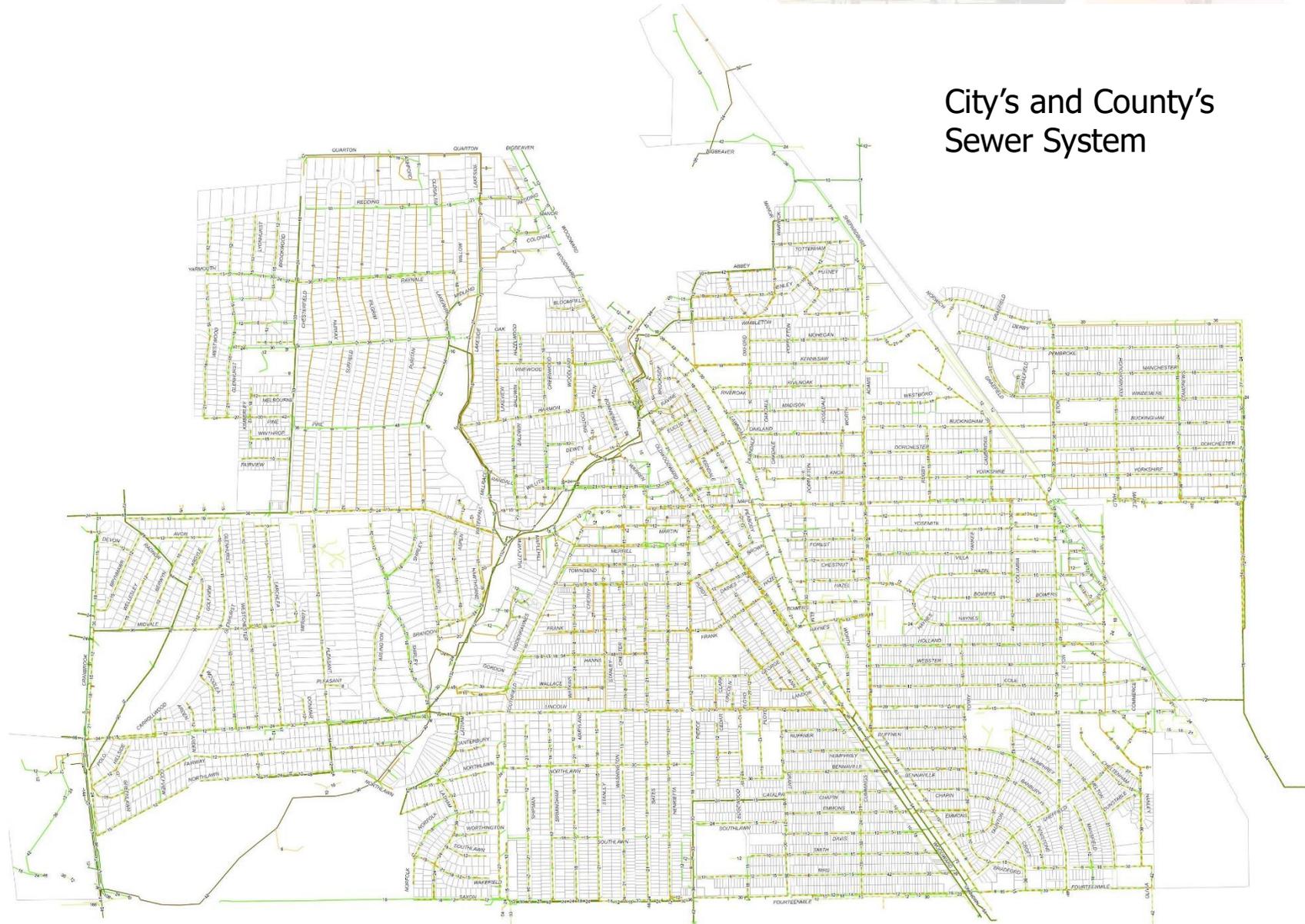


Sewer System – Information

- Storm Sewer: Rain Water
- Sanitary Sewer: Waste Water
- Combined Sewer: Both Rain Water and Waste Water
- Total City Sewers, 6"-72": 116 miles
- City's sewers are all gravity with **no pump stations or lifts**
- Design Standards for Sewers: 10-year storm event
 - Storm Event: Probability of being equaled or exceed.
 - 10-year Storm Event: 1/10, 0.10, 10% probability
 - 100-year Storm Event: 1/100, 0.01, 1% probability
 - 500-year Storm Event: 1/500, 0.002, 0.2% probability

City and County's Sewer System

City's and County's Sewer System

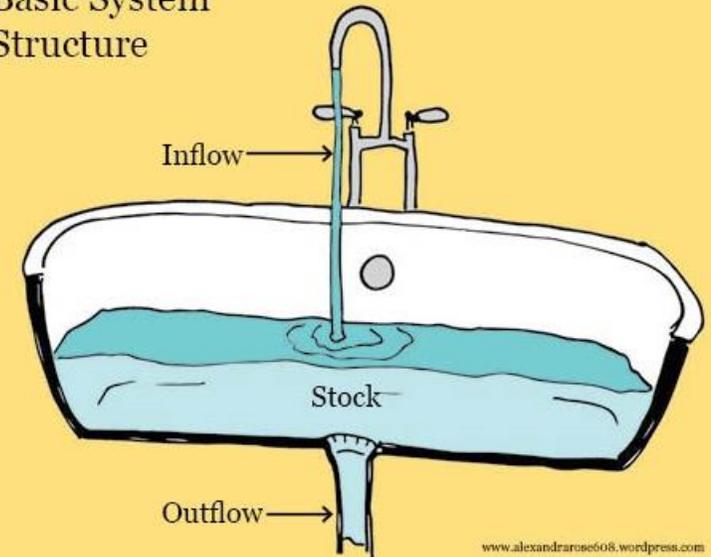


Storm Sewer System

- Catch Basins drain via Gravity to Storm Sewer
- City's Storm Outlets: Either Rouge River or Combined Sewer
- Restrictive Covers: Reduce Runoff Into System

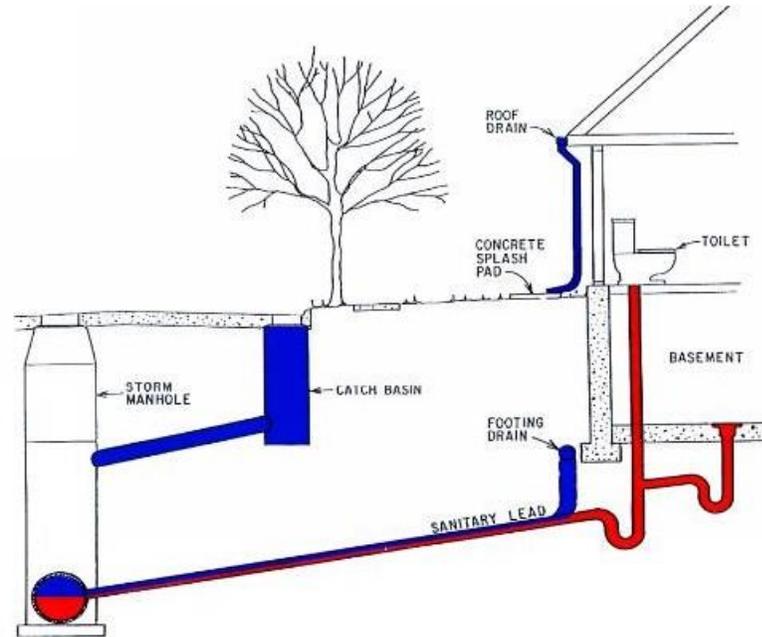


Basic System Structure



Combined Sewer System

- Properties to City Sewer via Sewer Lead
- City Sewer to Oakland County Water Resources Commission (OCWRC) System via Gravity



COMBINED SEWER SYSTEM

Sewer System – Where does our sewer drain to

City of Birmingham



Evergreen-Farmington
Sanitary District (EFSD)

Birmingham RTB

Bloomfield Village RTB

Acacia Park RTB

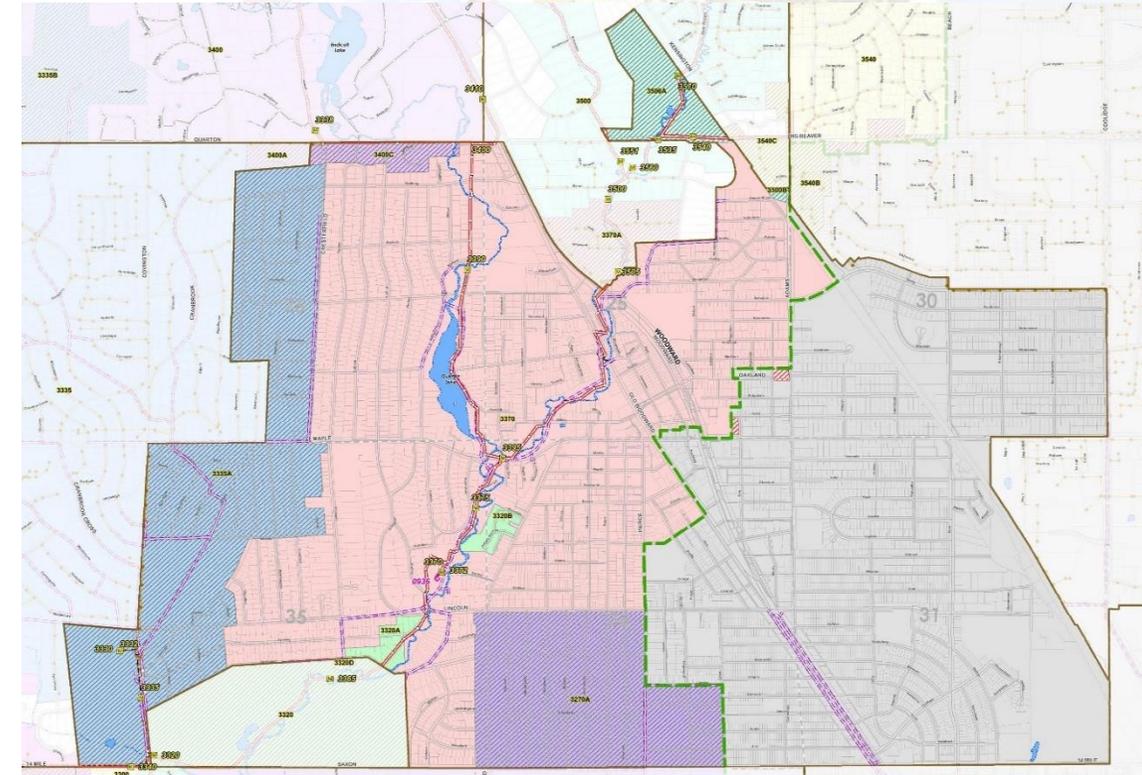
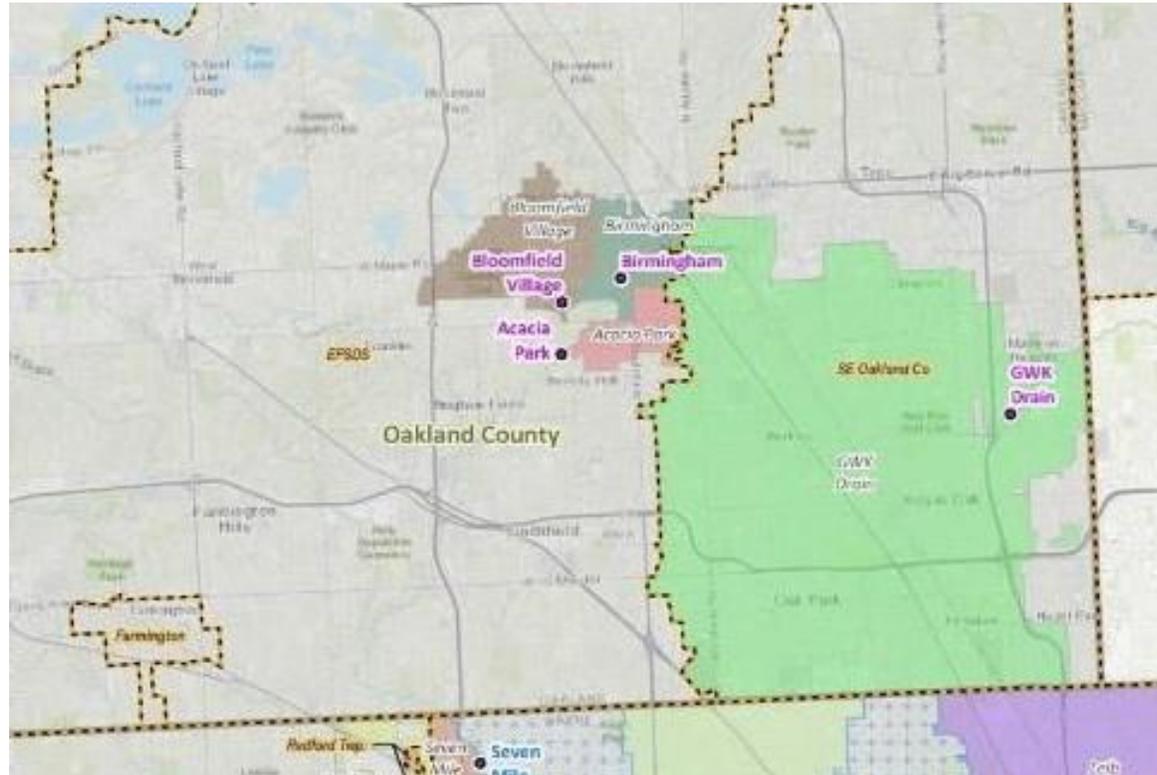
Southeast-Oakland District/
George W. Kuhn Drainage (GWK)

George W. Kuhn RTB



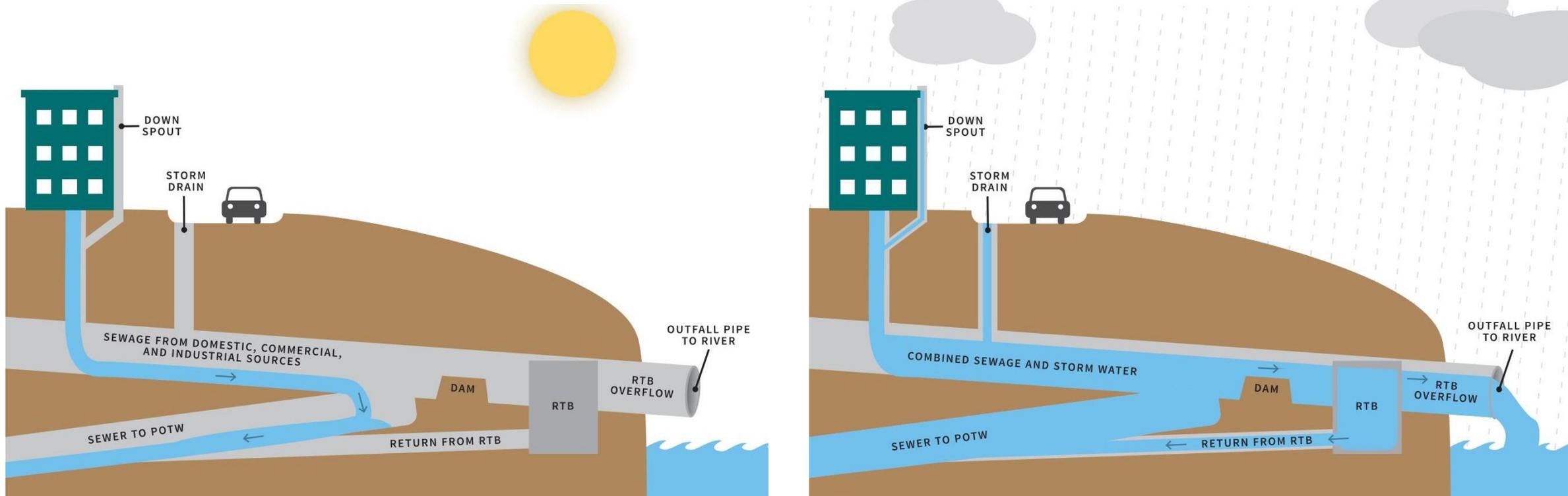
Detroit Wastewater Treatment Plant (GLWA)

Sewer System – Where does our sewer drain to



Sewer System – Where does our sewer drain to

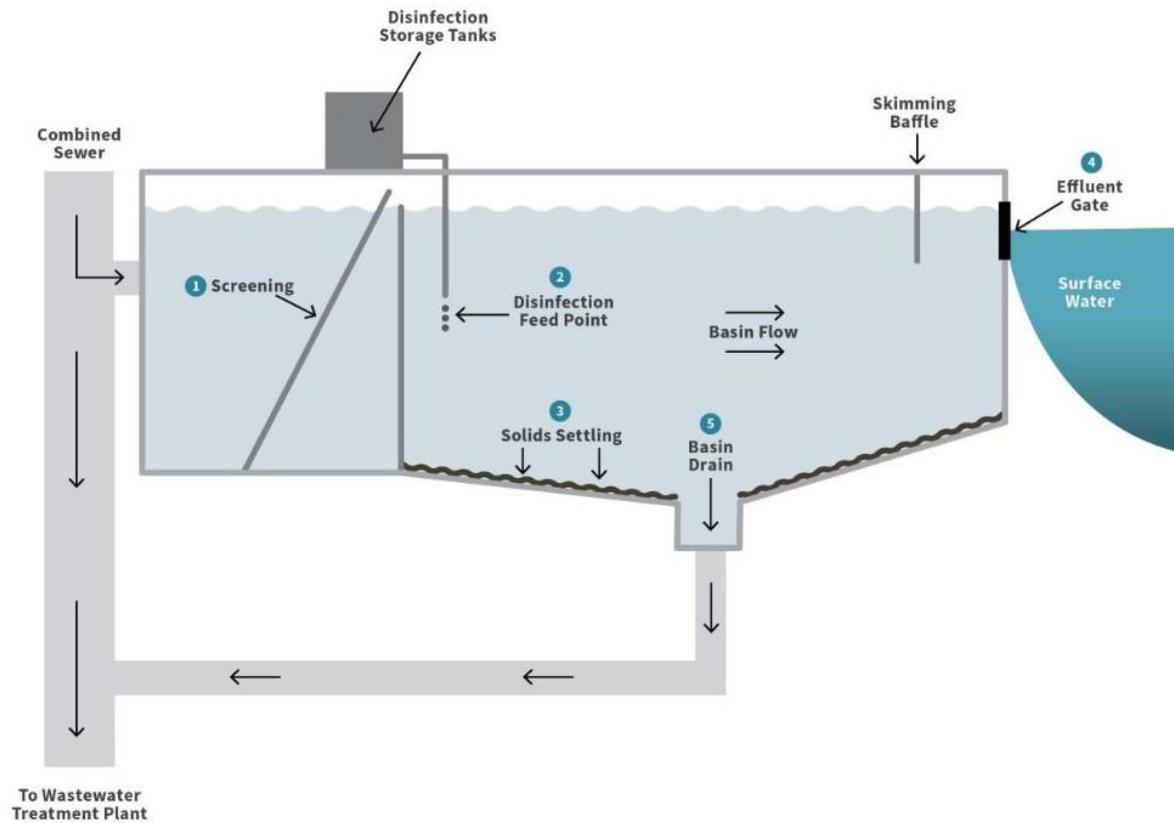
How It Works



RTB: Retention Treatment Basins

Sewer System – Where does our sewer drain to

RTB: Retention Treatment Basins



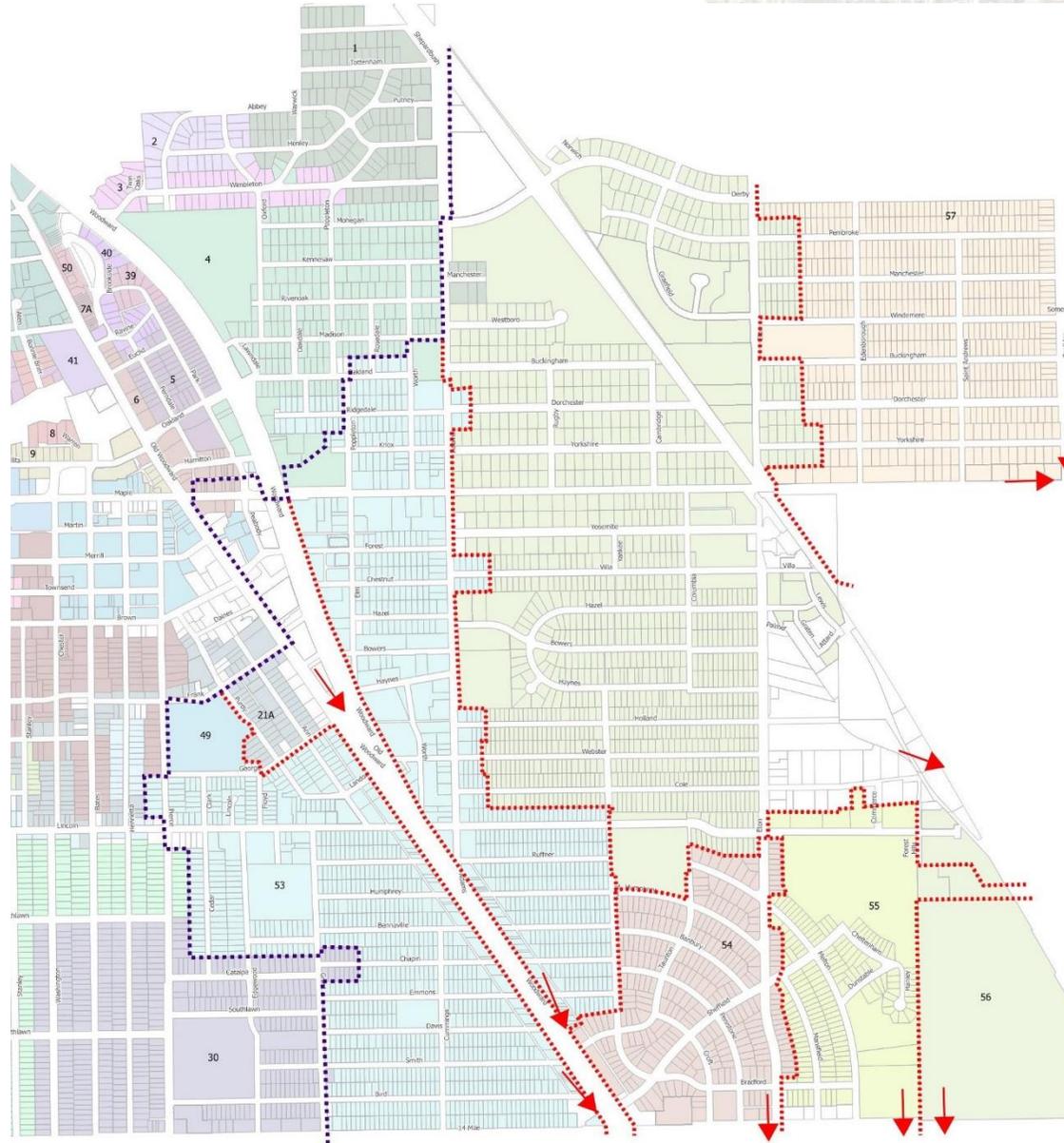
Sewer System – Where does our sewer drain to Evergreen-Farmington Sanitary District (EFSD)

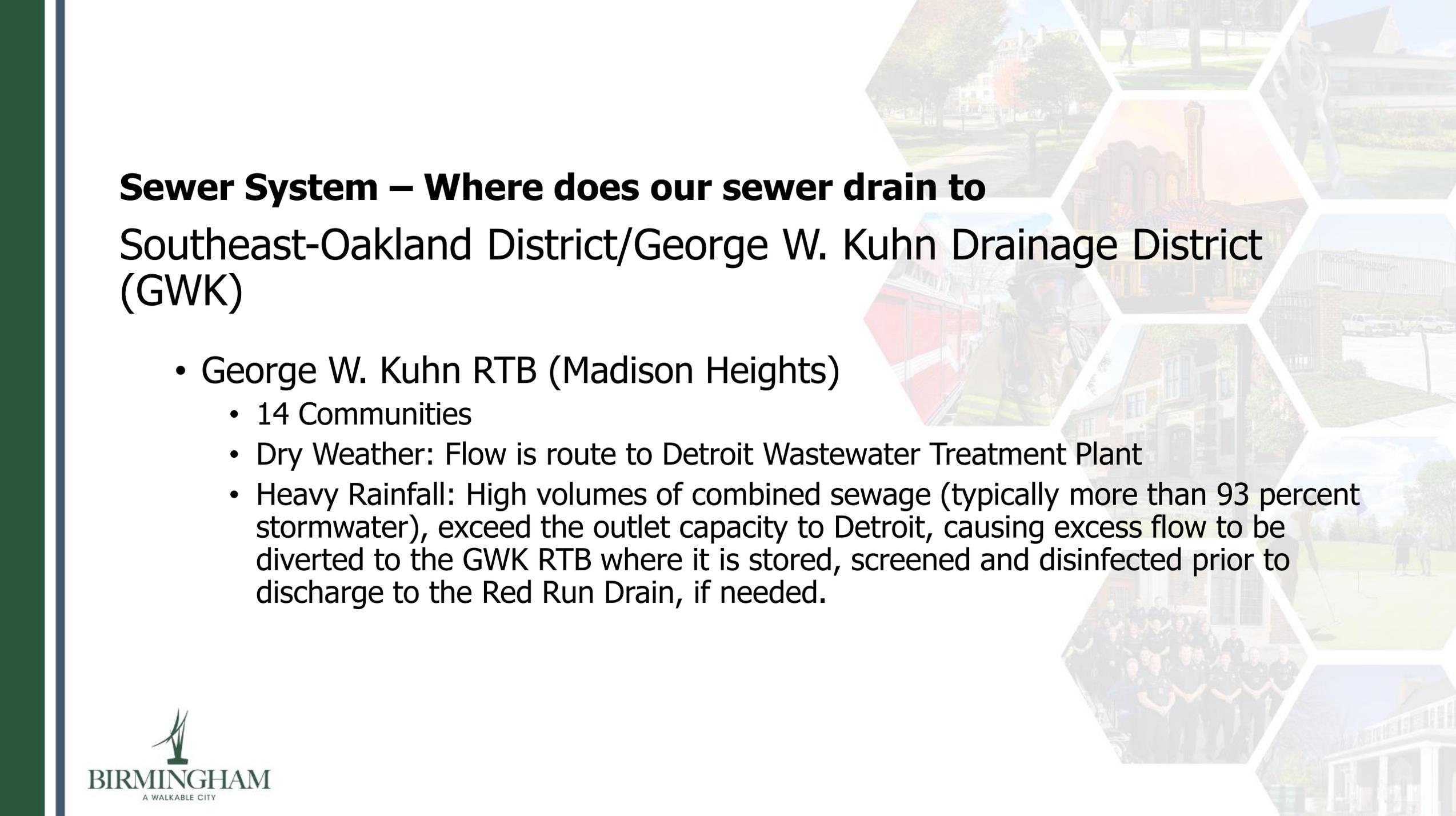
- Birmingham RTB (Linden Park)
 - Birmingham
 - Basin and Tunnel: 5.5 million gallons capacity
 - Treats 71 millions gallons annually
- Bloomfield Village RTB (Lincoln Hill Golf Course)
 - Birmingham and Bloomfield Village
 - Basin: 10 million gallons capacity
 - Treats 122 million gallons annually
- Acacia Park RTB (Beverly Hills)
 - Birmingham and Beverly Hills
 - Basin: 4 million gallon capacity
 - Treats 70 million gallons annually

RTB Design For: 30 minutes of detention for one-year, one-hour storm



Southeast-Oakland District/George W. Kuhn Drainage District (GWK)



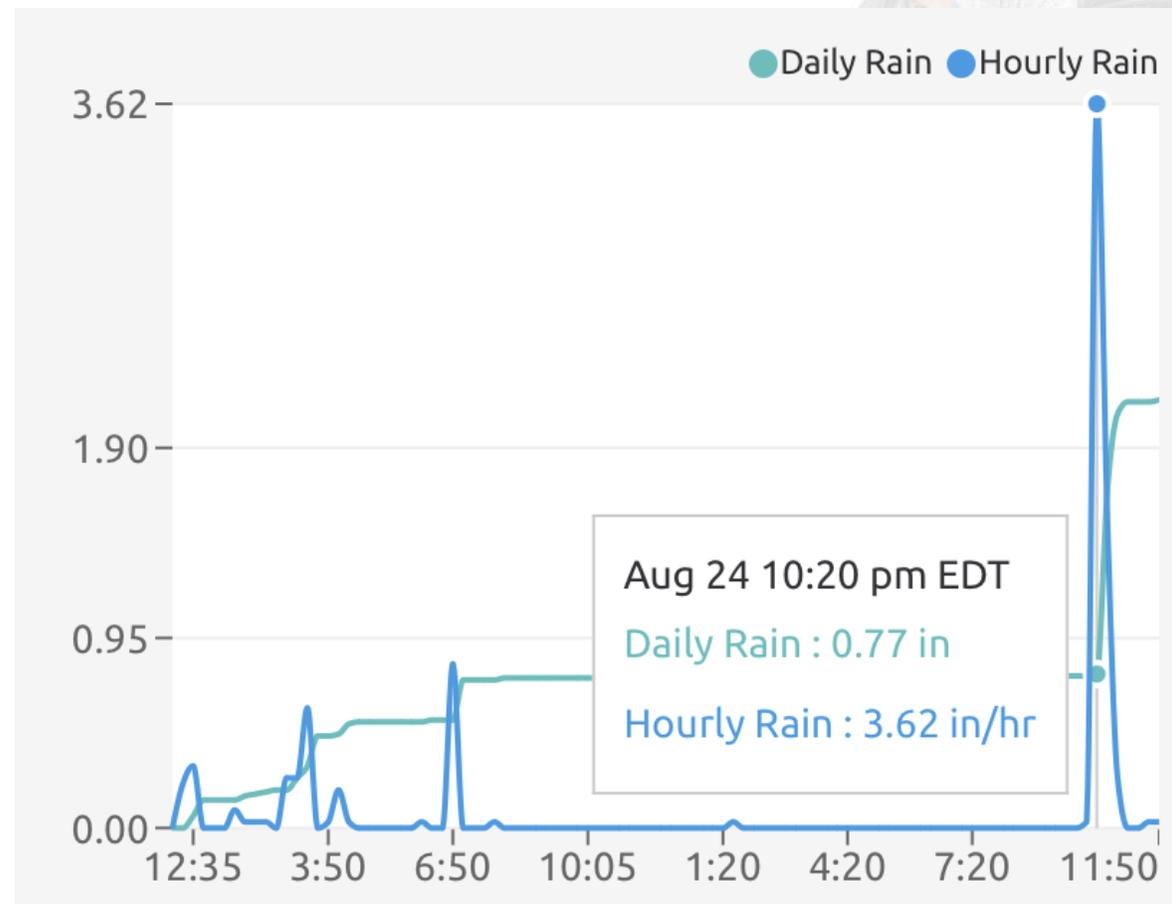


Sewer System – Where does our sewer drain to Southeast-Oakland District/George W. Kuhn Drainage District (GWK)

- George W. Kuhn RTB (Madison Heights)
 - 14 Communities
 - Dry Weather: Flow is route to Detroit Wastewater Treatment Plant
 - Heavy Rainfall: High volumes of combined sewage (typically more than 93 percent stormwater), exceed the outlet capacity to Detroit, causing excess flow to be diverted to the GWK RTB where it is stored, screened and disinfected prior to discharge to the Red Run Drain, if needed.

August 24, 2023 Rain Event

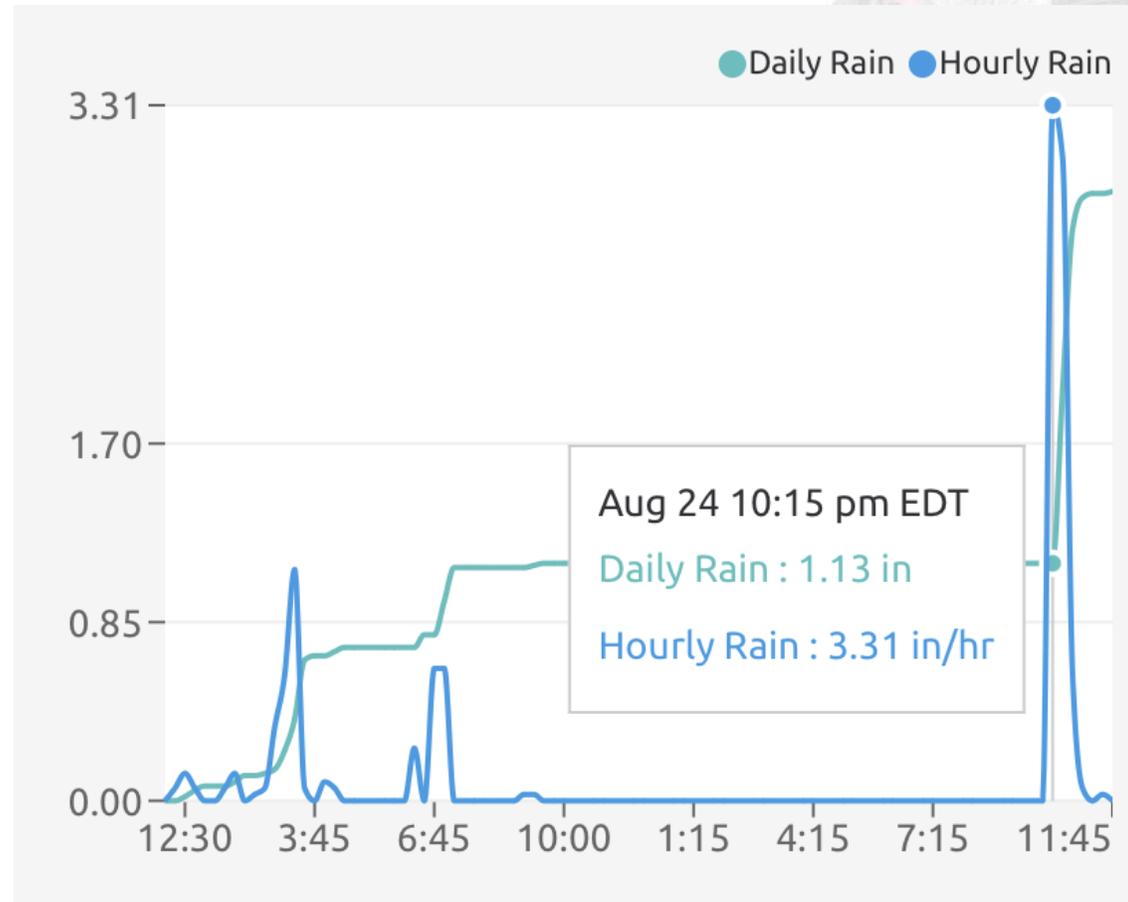
Fire Station No. 1, 8/24/23 Rainfall Data:



Time	Rain (inches)	Measured Intensity (in/hr)
10:05 PM	0.76	0.03
10:20 PM	0.77	3.62
10:35 PM	1.68	1.57
10:50 PM	2.07	0.25
11:05 PM	2.13	0
11:20 AM	2.13	0
11:35 PM	2.13	0.03
11:50 PM	2.14	0.03

August 24, 2023 Rain Event

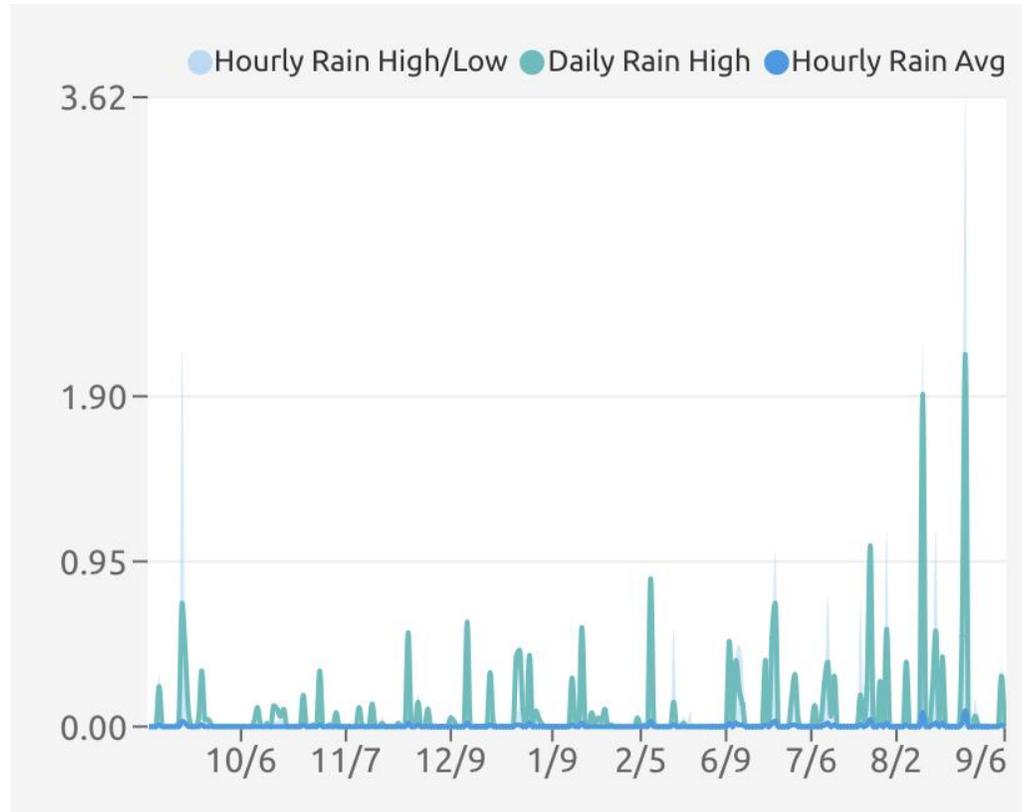
Fire Station No. 2, 8/24/23 Rainfall Data:



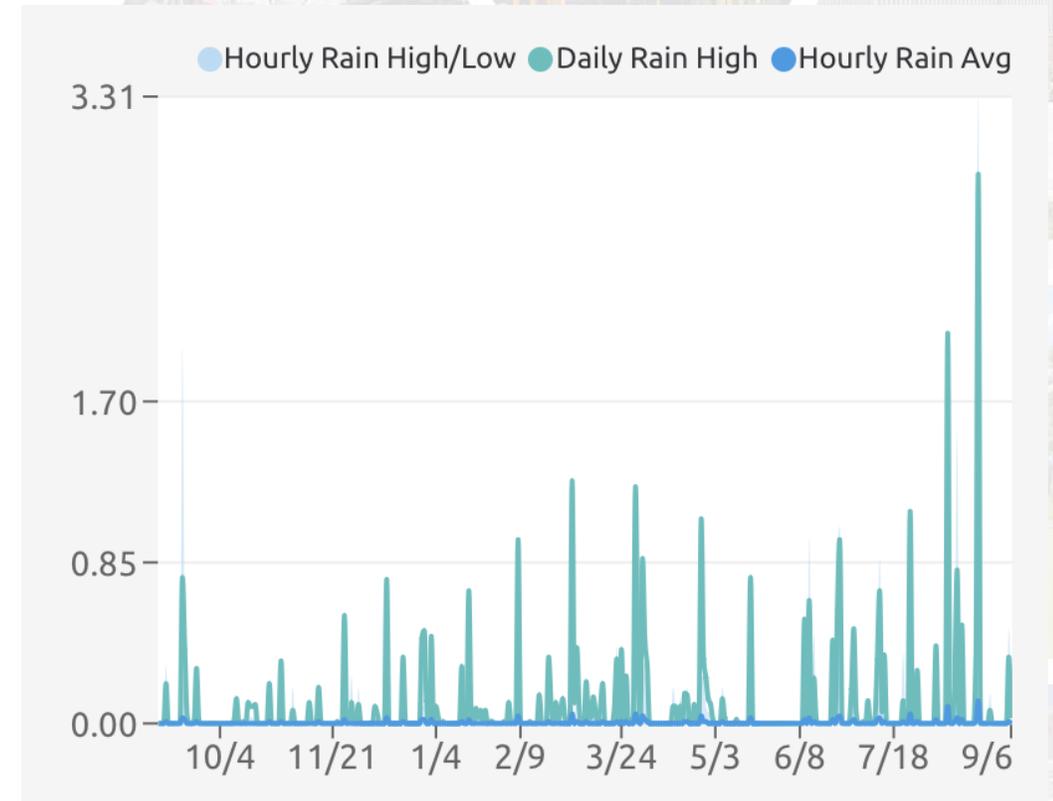
Time	Rain (inches)	Measured Intensity (in/hr)
10:00 PM	1.13	0
10:15 PM	1.13	3.31
10:30 PM	1.96	3.06
10:45 PM	2.72	0.6
11:00 PM	2.87	0.06
11:15 PM	2.89	0
11:30 PM	2.89	0.03
11:45 PM	2.9	0

August 24, 2023 Rain Event

Yearly Rainfall Data:



Fire Station No. 1



Fire Station No. 2

August 24, 2023 Rain Event

Storm Event:

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches) ¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.303 (0.244-0.382)	0.360 (0.290-0.455)	0.455 (0.365-0.576)	0.535 (0.427-0.680)	0.648 (0.501-0.844)	0.736 (0.557-0.968)	0.826 (0.606-1.11)	0.919 (0.648-1.26)	1.04 (0.709-1.46)	1.14 (0.756-1.61)
10-min	0.443 (0.357-0.559)	0.527 (0.424-0.666)	0.666 (0.534-0.843)	0.784 (0.625-0.995)	0.948 (0.734-1.24)	1.08 (0.816-1.42)	1.21 (0.887-1.62)	1.34 (0.949-1.84)	1.53 (1.04-2.13)	1.67 (1.11-2.35)
15-min	0.540 (0.435-0.682)	0.642 (0.517-0.812)	0.812 (0.652-1.03)	0.956 (0.763-1.21)	1.16 (0.895-1.51)	1.32 (0.995-1.73)	1.48 (1.08-1.98)	1.64 (1.16-2.24)	1.86 (1.27-2.60)	2.04 (1.35-2.87)
30-min	0.742 (0.598-0.937)	0.883 (0.711-1.12)	1.12 (0.897-1.42)	1.32 (1.05-1.67)	1.60 (1.24-2.08)	1.82 (1.37-2.39)	2.04 (1.50-2.73)	2.27 (1.60-3.10)	2.58 (1.76-3.60)	2.82 (1.87-3.98)
60-min	0.947 (0.763-1.20)	1.13 (0.909-1.43)	1.44 (1.15-1.82)	1.70 (1.36-2.16)	2.07 (1.61-2.71)	2.37 (1.80-3.12)	2.67 (1.96-3.58)	2.99 (2.11-4.09)	3.42 (2.33-4.78)	3.76 (2.49-5.29)
2-hr	1.15 (0.933-1.44)	1.38 (1.11-1.73)	1.76 (1.42-2.21)	2.08 (1.67-2.63)	2.55 (1.99-3.31)	2.92 (2.23-3.83)	3.31 (2.44-4.41)	3.71 (2.64-5.04)	4.17 (2.92-5.91)	4.63 (3.13-6.57)
3-hr	1.28 (1.04-1.60)	1.53 (1.24-1.91)	1.95 (1.58-2.44)	2.31 (1.86-2.90)	2.84 (2.22-3.68)	3.26 (2.50-4.26)	3.70 (2.75-4.93)	4.17 (2.97-5.65)	4.81 (3.31-6.66)	5.32 (3.56-7.42)
6-hr	1.53 (1.25-1.90)	1.79 (1.46-2.22)	2.25 (1.83-2.80)	2.66 (2.15-3.32)	3.26 (2.58-4.22)	3.76 (2.90-4.90)	4.29 (3.20-5.68)	4.85 (3.48-6.54)	5.63 (3.90-7.76)	6.26 (4.22-8.67)
12-hr	1.80 (1.48-2.22)	2.06 (1.69-2.55)	2.53 (2.07-3.13)	2.96 (2.41-3.67)	3.60 (2.87-4.64)	4.14 (3.22-5.37)	4.72 (3.56-6.23)	5.35 (3.88-7.19)	6.24 (4.36-8.56)	6.96 (4.73-9.59)
24-hr	2.08 (1.72-2.55)	2.36 (1.95-2.90)	2.87 (2.36-3.52)	3.32 (2.72-4.09)	4.02 (3.22-5.13)	4.60 (3.60-5.91)	5.22 (3.96-6.84)	5.90 (4.30-7.87)	6.85 (4.82-9.33)	7.63 (5.21-10.4)
2-day	2.36 (1.96-2.88)	2.71 (2.25-3.30)	3.31 (2.73-4.03)	3.84 (3.15-4.69)	4.61 (3.70-5.82)	5.24 (4.11-6.68)	5.91 (4.50-7.66)	6.62 (4.85-8.76)	7.61 (5.38-10.3)	8.40 (5.78-11.4)
3-day	2.59 (2.15-3.13)	2.95 (2.45-3.57)	3.58 (2.96-4.34)	4.13 (3.40-5.03)	4.93 (3.97-6.19)	5.59 (4.40-7.08)	6.27 (4.79-8.09)	7.00 (5.15-9.22)	8.02 (5.69-10.8)	8.82 (6.09-11.9)
4-day	2.78 (2.32-3.36)	3.15 (2.63-3.81)	3.79 (3.15-4.59)	4.36 (3.60-5.29)	5.18 (4.17-6.48)	5.84 (4.61-7.38)	6.54 (5.00-8.41)	7.29 (5.37-9.56)	8.32 (5.91-11.1)	9.14 (6.33-12.3)
7-day	3.28 (2.75-3.94)	3.68 (3.08-4.42)	4.36 (3.64-5.25)	4.96 (4.12-5.98)	5.82 (4.71-7.23)	6.52 (5.16-8.18)	7.25 (5.57-9.26)	8.02 (5.94-10.5)	9.08 (6.49-12.1)	9.93 (6.91-13.3)
10-day	3.73 (3.13-4.46)	4.15 (3.48-4.97)	4.88 (4.08-5.85)	5.50 (4.58-6.62)	6.41 (5.20-7.92)	7.13 (5.66-8.90)	7.89 (6.08-10.0)	8.68 (6.45-11.3)	9.78 (7.01-13.0)	10.6 (7.44-14.2)
20-day	5.04 (4.26-5.99)	5.56 (4.69-6.60)	6.41 (5.39-7.63)	7.14 (5.97-8.52)	8.16 (6.65-9.99)	8.98 (7.16-11.1)	9.81 (7.60-12.4)	10.7 (7.97-13.7)	11.8 (8.54-15.6)	12.8 (8.98-17.0)
30-day	6.20 (5.25-7.33)	6.81 (5.76-8.06)	7.81 (6.59-9.26)	8.65 (7.26-10.3)	9.80 (7.99-11.9)	10.7 (8.54-13.1)	11.6 (8.98-14.5)	12.5 (9.34-16.0)	13.7 (9.89-17.9)	14.6 (10.3-19.3)
45-day	7.72 (6.56-9.09)	8.50 (7.21-10.0)	9.73 (8.24-11.5)	10.7 (9.04-12.7)	12.1 (9.84-14.5)	13.0 (10.4-15.9)	14.0 (10.9-17.4)	14.9 (11.2-18.9)	16.1 (11.7-20.9)	17.0 (12.1-22.4)
60-day	9.06 (7.72-10.6)	10.0 (8.51-11.7)	11.5 (9.73-13.5)	12.6 (10.7-14.9)	14.1 (11.5-16.9)	15.2 (12.2-18.4)	16.2 (12.6-20.0)	17.1 (12.9-21.6)	18.3 (13.3-23.6)	19.1 (13.6-25.1)

¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

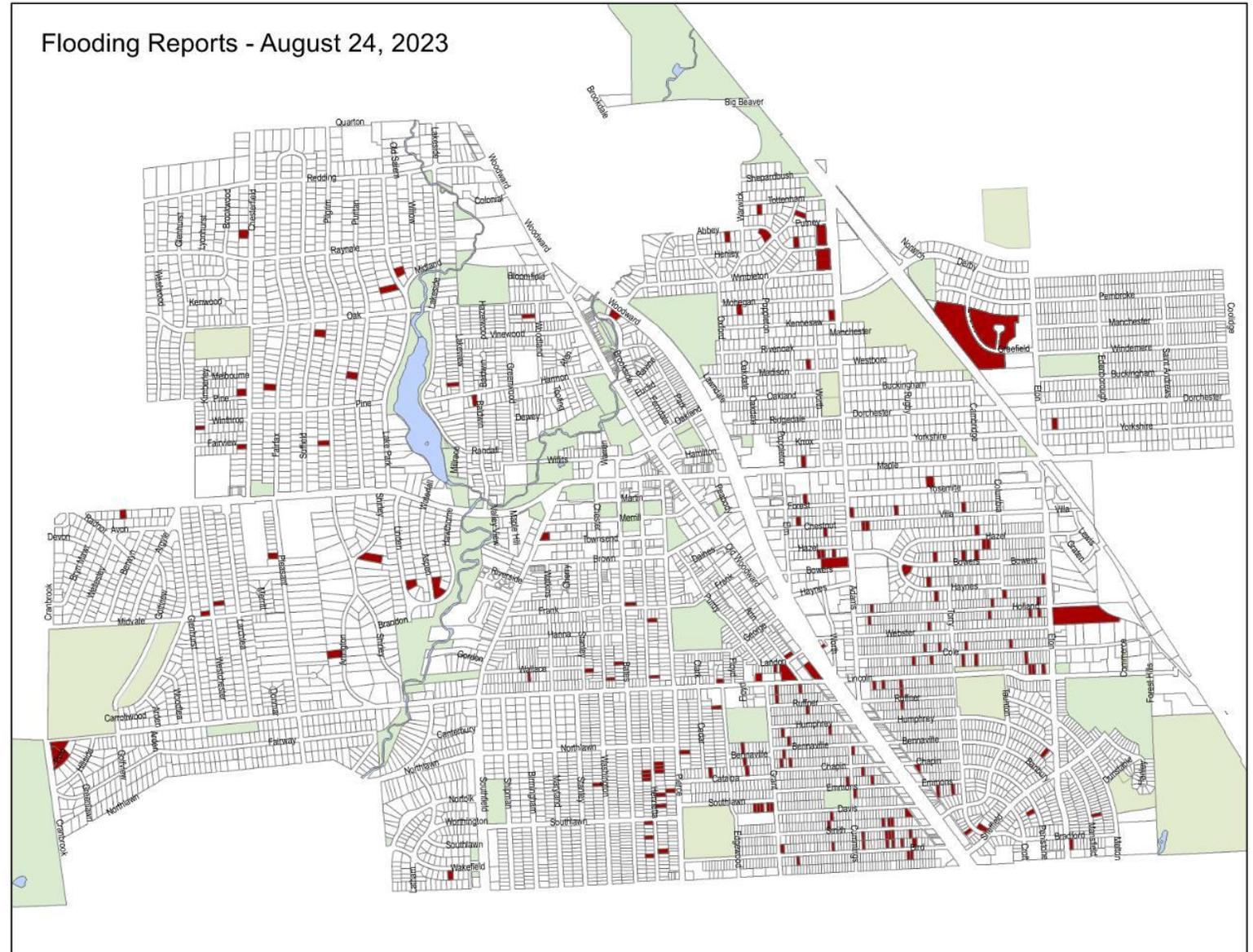
August 24, 2023 Rain Event

Flooding Reports: 178

EFSD: 67

GWK: 111

Flooding Reports - August 24, 2023



Recent Steps

City:

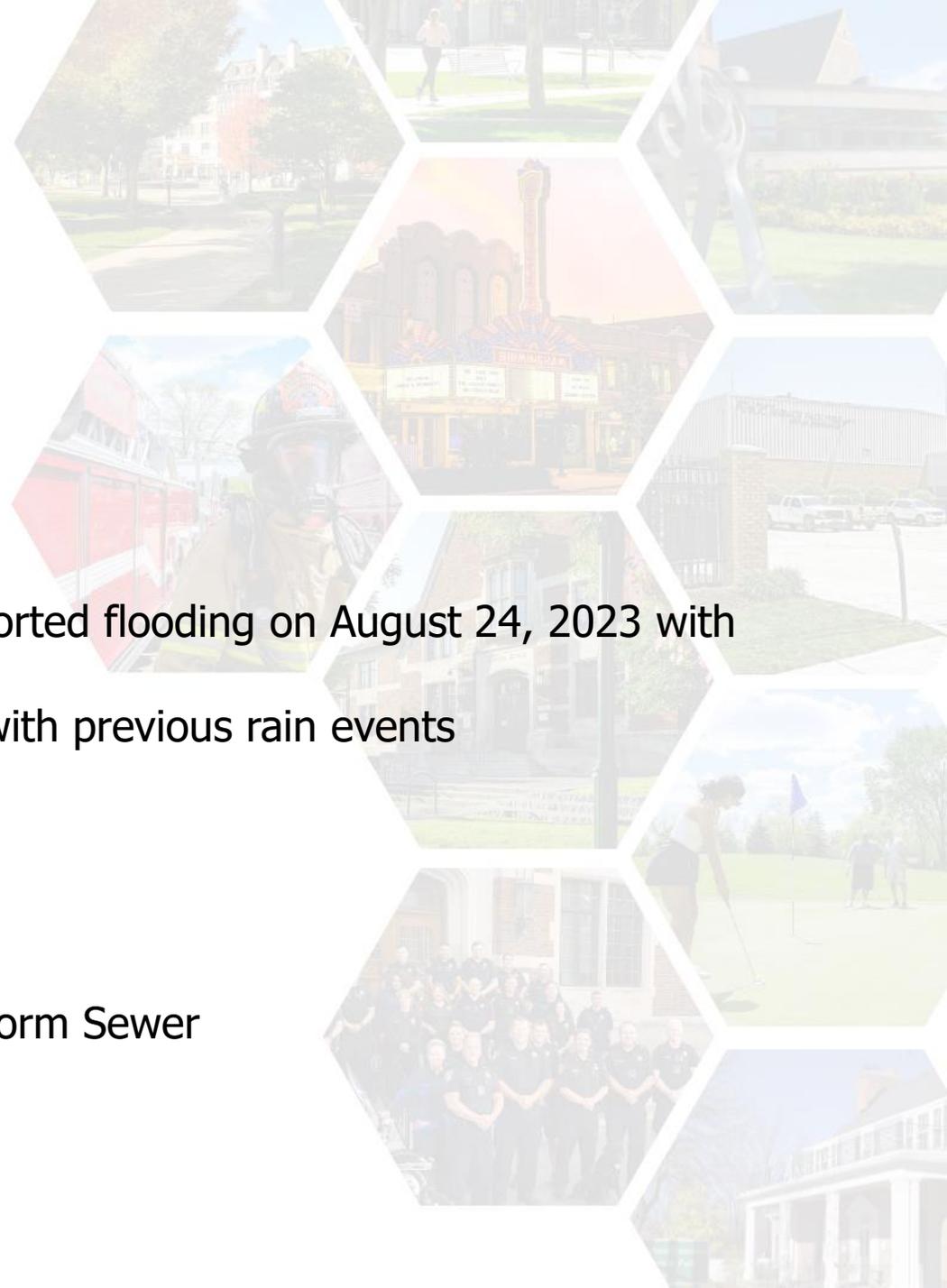
- Road Reconstruction:
 - Review Existing Sewer and Check Capacity of Sewer
 - Replace Sewer or Construct Separate Storm Sewer
 - Incorporate Green Infrastructure:
 - Bio-swale/Rain Garden
- Maintenance
 - Cleaning sewer
 - Cleaning catch basins



Next Steps

City:

- Review Types of Flooding
- Investigation of Basement Flooding Areas
 - Televisе City's sewer system with houses that reported flooding on August 24, 2023 with DPS Equipment
 - Review Properties impacted on August 24, 2023 with previous rain events
 - Review installing restrictor covers on catch basins
- Study options
 - Stormwater Management Features
 - Sewer Relief
 - Separating Combined Sewer to Sanitary Sewer/Storm Sewer
- Public Education



Next Steps

Residents:

- Fill out Flood Tracking Form (City's website)
- Know where your sewer lead is and televise sewer lead
- Ensuring roof downspouts are not connected to the sewer lead and extend at least six feet from the building
- Surface grade surrounding your home to slope away from the building
- Avoid storing valuable items on the floor or near floor drains in your basement
- Consider installing backflow preventor and/or sump pump(s)
- Don't:
 - Pour fats, oils or grease (FOG) down drains
 - Flush Wipes, Diapers or Products
 - Remove Catch Basin covers or clear covers during rain events

Sewer Backup Claims

- All sewer backup claims are subject to Michigan Public Act 222 of 2001 which requires claimants to show that:
 - the City's sewage-disposal system had a defect;
 - the City knew, or reasonably should have known, about the defect;
 - the City did not remedy the defect in a reasonable time;
 - the defect caused the event and the property damage or physical injury;
 - the claimant owns, and has shown the value of, any damaged personal property;
 - and the claimant notified the City within 45 days of the backup being discovered
 - August 11, 2023 backup claim deadline: **September 25, 2023**
 - August 24, 2023 backup claim deadline: **October 8, 2023**

Claims Process

- Sewer backup claim form & additional information can be found at: bhamgov.org/riskmanagement
- Submit your claim to the City Manager's Office by mail, email or at City Hall within 45 days of discovering the backup
- The Engineering Department will oversee videoing of the city sewer lines that service the claimants' property to investigate the claims
- Claimants will receive determination letters from the City following the investigation