

AGENDA

DATE: Monday, October 17, 2022

TIME: 5:30 PM

PLACE: By Video Conference and Teleconference

To facilitate access, members of the public may join a meeting by telephone, Zoom, and/or the City of Norwalk YouTube channel. Specific instructions and links can be found at www.norwalkct.org/meetings.



Members of the public can call in and listen to a meeting. They will not be able to speak or see any of the meeting participants. Each meeting will use a unique Meeting/Webinar ID. Please find the information using the link above.



Members of the public who wish to provide "live comments" will need to register in advance and use the Zoom meeting platform. All participants will be muted upon entering the meeting. To speak, click the "raise your hand indicator" and you will be called on by the host of the meeting during the public comment section. Please find the information using the link above.



Members of the public who wish to view the meeting, but are not participating, can view a live stream on the City of Norwalk YouTube channel. This stream is delayed by approximately 20 seconds. Please find the information using the link above. The meeting recording and minutes will be posted on the City of Norwalk website within seven (7) days after the meeting.



Members of the public who wish to provide public comment are encouraged to submit those via email in advance of the meeting. For these comments to be read into the record, they should be submitted at least three hours in advance of the meeting start time. Please email Dilene Byrd at dbyrd@norwalkct.org to provide written public comment prior to a meeting.

WPCA Regular Meeting:

1. Call to Order
2. Approve the minutes from WPCA Meeting held on September 19, 2022. (copy included)
3. Authorize the Chairman or Vice Chairman of the Water Pollution Control Authority to execute an amendment to the January 27, 2016 Agreement with Arcadis U.S., Inc. in the amount of \$3,000,000 and extend the term of the agreement by three (3) years to provide additional on-call professional engineering services in accordance with scope of services letter dated October 5, 2022. (copy included)

Account No. 09174062-5777-C0545 and 091840620-5777-C0545

4. Authorize the Chairman or Vice Chairman of the Water Pollution Control Authority to execute an amendment to the March 3, 2021 Agreement with Brown and Caldwell, Inc. in the amount of \$3,000,000 and extend the term of the agreement by three (3) years to provide additional on-call professional engineering services in accordance with scope of services letter dated October 14, 2022. (copy included)

Account No. 09234062-5777-C0361

5. Authorize the Interim Chief of Operations and Public Works to issue orders on contract with Kovacs Construction Corporation for the Aeration Tanks Electrical Infrastructure Improvements Project (WPCA 2021-4) for an amount not to exceed \$150,000.
Account No. 09174062-5777-C0545
6. Discussion on WPCF Facility Plan Update (presentation by Arcadis U.S., Inc.)
7. Contract Operations Report:
 - a. Veolia Monthly Operating Report – September 2022 (copy included)
 - b. Orchard Street Sanitary Sewer Improvements Update
 - c. Major Repair or Replacement / Out of Scope Items: None
8. Reports:
 - a. FY21/22 and FY22/23 Revenues/Expenditures MUNIS Report (copies included)
 - 1) Transfer of Veolia balance (account no. 224062-5258) set aside in FY2021-22 to FY2022-23 in the amount of \$1,091,314.03 was completed
 - b. Collection System Master Plan Update (copy included)
 - c. Financial Model Update (copy included)
 - d. Discussion on WPCA Projects:
 - 1) Collection – Wall Street / 2 Knight Street Relocation and Improvements
 - 2) Collection – Sanitary Sewer System Rehabilitation – Various Locations
 - 3) PS - Five Mile, Old Trolley Way, Karen Dr., and Woodward Ave. Rehabilitation
 - 4) PS – Bell Island PS Improvements
 - 5) WWTP – Aeration Tanks Electrical Infrastructure Improvements
 - 6) SCADA Upgrade Phase III (copy included)
 - e. Sewer Use Bill Appeals/Adjustments Update
 - 1) Appeal status
 - f. Information Copies:
 - 1) CWF Application Submitted (letters included)
9. Adjournment

Next WPCA Meeting: **Monday, November 21, 2022, 5:30 PM**
By Video Conference and Teleconference

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**CITY OF NORWALK
WATER POLLUTION CONTROL AUTHORITY VIA ZOOM VIRTUAL
VIDEOCONFERENCE AND TELECONFERENCE
REGULAR MEETING
September 19, 2022**

Attendance: Darren Oustafine, Chairman
Barbara Smyth
John Bove
Chris Mannella
Neil Konstantin

Staff: Vanessa Valadares, Interim Chief of Operations and Public Works
Ralph Kolb, WPCA Senior Environmental Engineer
Neyla Bauer, Wastewater Systems Manager

Others: John Marcin, Project Manager, Veolia
Attorney Mathew Todaro, Verrill Dana, LLP
Kelsey McCutcheon, Verrill Dana, LLP
Eric Muir, Brown & Caldwell

1. CALL TO ORDER

Chairman Oustafine called the meeting to order at 5:31PM.

2. INTRODUCTION OF NELYA BAUER, WASTEWATER SYSTEMS MANAGER

Mr. Kolb introduced Ms. Bauer and said she is the new Wastewater Systems Manager. The WPCA board welcomed Ms. Bauer.

3. APPROVE THE MINUTES FROM WPCA SPECIAL MEETING HELD ON SEPTEMBER 1, 2022. (COPY INCLUDED)

**** MS. SMYTH MOVED TO APPROVE THE MINUTES AS SUBMITTED.**

**** THE MOTION PASSED UNANIMOUSLY.**

4. AUTHORIZE THE INTERIM CHIEF OF OPERATIONS AND PUBLIC WORKS TO SUBMIT THE COLLECTION SYSTEM MASTER PLAN UPDATE TO CTDEEP (PRESENTATION)

Ms. Valadares introduced the team and said this item is in regard to the Collection System Master Plan update that will be submitted to the DEEP by the deadline of September 30, 2022 and is also in response to the Consent Order.

Attorney Todaro presented the Collection System Master Plan update and said the Clean Water Act prohibits discharges into waters of the United States unless a National Pollutant Discharge Elimination System (NPDES) permit has been issued, and that permit has been issued to the Norwalk WPCA. He said the NPDES permits are issued on a 5-year rolling basis and the permittee must apply for the permit prior to the expiration of their current permit and that is the process that started the process that led to the Consent Order. In Connecticut, the authority to issue and oversee the NPDES program is delegated by the US EPA to the CT DEEP and they have a 7-step process for the renewal and reissuance of the NPDES permit. The first step in that process is that the permittee submits the application for the renewal of their permit 180 days before the expiration date. The second step in the process is DEEP reviews the application for sufficiency and provides notice to the permittee and then DEEP provides a technical review of the application and drafts a permit and provides a 30-day public comment period on the draft permit. During that 30-day public comment period, DEEP will review any comments that they have received and decides if a public hearing is necessary or requested and if it is necessary or requested the DEEP will hold a public hearing. The final step in the process is that the DEEP provides a final decision on the NPDES permit renewal.

Attorney Todaro said Norwalk went through that process beginning in September 2018, where the WPCA submitted the NPDES renewal application and DEEP issued a notice of sufficiency about one month later and it took two years for DEEP to review the draft permit but in early September 2020 issued a notice of tentative determination to approve the renewal application and a draft NPDES permit with terms substantially similar to prior version of the permit. DEEP then notified the public about the NPDES

permit renewal process and solicited public comments for 30 days and an environmental organization that was involved in the process requested an extension of that 30-day period based on COVID parameters and were granted that extension and shortly thereafter, the environmental organization requested a public hearing on the permit and during that public comment period five comments were submitted to the DEEP, one from the US EPA, one from the WPCA, one from the Mayor's Waters Control Committee and two from Save the Sound. Save the Sound had requested a public hearing in which the DEEP proceeded to hold on January 14, 2021, and due to COVID was held virtually and Ralph Kolb and Anthony Carr presented on behalf of the City and the WPCA and Ann Strout presented on behalf of DEEP. The public was able to provide comments and were also able to submit comments on the public hearing and thirteen comments were received and a few months later after considering the comments that had been received from the public and others, DEEP renewed the NPDES permit which went into effect with the terms that were substantially similar to the prior permit that started this process back in the fall of 2020.

Attorney Todaro noted that initially some of the public comments that were going to be included within the NPDES permit were later transitioned into the Consent Order and the parties involved with the reissuance of the permit all agreed that a compliance agreement or a Consent Order rather than the permit itself would be the best way to encapsulate and include the conditions going forward. Through 2021 and the early part of 2022, the WPCA and the DEEP negotiated the terms of the Consent Order addressing key collection system and facility upgrades and in April of 2022, the WPCA unanimously approved the Consent Order, and the mayor signed the order on May 5, 2022. The Consent Order has two primary components, one is a Collections System Master Plan update and noted that the WPCA had previously formed a Collection System Master Plan back in 2009 and had already intended on moving forward with a Collections System Master Plan regardless of the Consent Order. The master plan is designed to evaluate two items that are seen in the consent order, and one is to remove excess flow to the collection system and the second item is to eliminate the Ann Street siphon emergency overflow and per the Consent Order the WPCA had to retain a consultant and the WPCA had retained Brown and Caldwell and the master plan is due to the state at the end of this month. Per the Consent Order recommendations from the master plan update addressing excess flow removal and the elimination of the Ann Street siphon must be completed within five years of the approval.

Attorney Todaro said there is a second component to the Consent Order the first being the master plan and the second facilities plan update which is a process that starts later in the Consent Order cycle and is due to the DEEP on June 30, 2023. Finally, in addition the master plan and the facilities plan update, the Consent Order requires the WPCA to submit annual progress reports to the DEEP on an annual basis describing actions taken to comply with the order, and the first progress report was submitted to the DEEP at the end of June 2022 and they have not commented on that report.

Mr. Muir presented the master plan development and said the master plan development started 1 ½ years ago with data collection and 40 flow meters were installed in the collection system and they built a hydraulic model which becomes a tool for different alternatives to meet the Consent Orders requirements. He said what they had found during the flow meter campaign, model development and alternatives analysis is that the collection system performs exceptionally well with nominal systemwide sanitary sewer overflows during one- and two-year storm events. The model approximates that 30 manholes flood during a 25-year storm event and the majority are located in three areas and found that the Ann Street emergency overflow does not activate until the 100-year, 24-hour storm event which is exceptional compared to other Connecticut municipalities. The Wall Street outfall activates at the two-year, six-hour storm event, and outfall 002 activates at the one year, six-hour storm event and is for flows exceeding 30 MGD at the wastewater treatment plant that are diverted to Outfall 002, where is historically received primary treatment before being discharged.

Mr. Muir presented a heat map of the infiltration/inflow (I/I) metered basins that are significant contributors of I/I to the collection system and found the meter closer to the interceptors generally show higher I/I rates, particularly in the areas north of the Moody's Lane siphon which matches up with the age of the system.

Mr. Muir presented the master plan recommendations and said the Consent Order recommendations need to be completed in the next five years and in order to meet the Consent Order and developed measures that include:

- Operations and Maintenance- Incorporates aspects of EPA control standards and is generally a good practice.
- Hubbell's Lane-Relieves hydraulic stress and mitigates SSO's along Wall Street and Smith Street.
- Disconnection of catch basins identified as significant inflow reduction.
- Ann Street emergency overflow elimination- provides a physical barrier to eliminate overflows at the structure.

Mr. Muir said the master plan will continue after the Consent Order measures and the long-term recommendations for 20 years are:

- Long term measures to continue to improve collection system performance.
- Excess flow reductions reduce stress on collection system and improve its performance.
- Inflow and Infiltration reductions- Targets cost effective from areas of significance excess flow.
- Disconnection of remaining catch basins- Continued separation of the collection system

Mr. Muir said the engineering estimate for the measures to meet the consent order that were laid out total \$16,550,000 and the long-term master plan recommendations total \$ 36,400,000 for a total cost of \$52,950,000.

Mr. Muir said the next steps are to submit a master plan update to the DEEP by September 30th, the WPCA will update its financial model to include report recommendations, The WPCA will continue to update the board about the status of the master plan and discussions with the DEEP, begin implementing Consent Order and long-term recommendations, and the Consent Order requires a progress report that is due annually to the DEEP on June 30th.

Mr. Konstantin asked if these expenditures are in line with cities of our size. Mr. Muir said that are in line with normal asset renewals that are needed for a collection system of this size and age.

Ms. Smyth asked how the \$53,000,000 over five years breaks down annually. Mr. Kolb said it would be \$16.5 million dollars over five years, and over a 20-year period would be \$53 million dollars and will be front loaded for the first five years so as they go to design and construction the money will be available.

Mr. Manella asked if in the Consent Order has a required reduction or amount that will need to be met for I/I. Attorney Todaro said there is not, and the language is to remove excess flow into the collection system.

Mr. Oustafine said he expects the DEEP wants to eliminate all overflow points and if we were to eliminate I/I to the point where to say a 500-year storm the DEEP would still find the Ann Street siphon objectionable. Mr. Kolb said it comes down to level of service and Norwalk is one of six communities

that has a combined system and when compared to other communities Norwalk is doing very well during the large storm events. The goal is to target the catch basins and continue to invest in the infrastructure to reduce long term SSO's in the system. Mr. Oustafine said the Ann Street siphon will not be closed unless it will not cause an issue somewhere else in the system. Mr. Muir said that is correct and that they don't want to close something that will cause ill effects somewhere else, and the objective is to remove extraneous flows and meet the Consent Order and have measures around the elimination of the Ann Street siphon and not to make an impact worse.

**** MR. KONSTANTIN MOVED TO APPROVE THE ITEM.**

**** THE MOTION PASSED UNANIMOUSLY.**

5. CONTRACT OPERATIONS REPORT:

- a. Veolia Monthly Operating Report – July and August 2022 (copies included)

Mr. Marcin reported and said the wastewater treatment plant ran very well over the summer but did have two incidences that they had a daily bacteria exceedance and were both isolated instances and they did a lot of investigation on the two instances. He went on to say that the sample regiment is very prescriptive, and they have zero flexibility on when and what time the samples can be taken per the permit.

Mr. Marcin reported on the collection system and said the team did a lot of work and in July and did 3 ½ miles of TV inspections and 2 ½ miles of sewer jetting and in August did 5.8 miles of TV inspections and almost 8 miles of sewer cleaning.

- b. Smart Covers – 14 online

Mr. Marcin said the installation of all of the smart covers is complete and now have 14 smart covers located throughout the collection system and have been very helpful in evaluating the collection system.

- c. Annual Meeting and Leadership Updates

Mr. Marcin provided an overview of the merger between Veolia and SUEZ and said there will be a northeast project managers conference and Norwalk has been selected as the host city and will be held the third week of October and will be held at Lakota Oaks facility and he will provide more information as they move closer.

- d. Orchard Street Sanitary Sewer Improvements Update

Mr. Marcin said they are continuing to put the final plans and is scheduled for November implementation of that project.

- e. Major Repair or Replacement / Out of Scope Items: None

6. REPORTS:

- a. FY21/22 Revenues/Expenditures MUNIS Report (copy included)
- b. Discussion on EPA AOC (copy included)

Mr. Kolb said that the EPA had sent a letter stating that effective immediately that they do not have to submit a monthly report or annual CMOM report, so Norwalk is doing a good job. Attorney Todaro said he represents a number of entities that are involved with the US EPA and it is not often that a letter like this is received, so the fact that Norwalk is receiving a letter like this is a nice indication that the team over the span of the Administrative Order on Consent Order has done a fantastic job and gave a kudos to the team for putting themselves in a position where the US EPA would issue a letter like this.

Ms. Smyth said she would like to commend the whole team for the great work they have been doing and from everything she has learned Norwalk is way ahead of the game in terms of maintenance and moving forward and the Consent Order may have raised a few eyebrows and understands through the presentation that this is good for the city and good for Long Island Sound

- c. Discussion on WPCF Facility Plan Update

Mr. Kolb said next month the ARCADIS team will be invited to attend the WPCA meeting and there is a kickoff meeting scheduled for this Wednesday for the project and will be asking the board members if anyone is interested to part of a sub-committee for the Facility Plan.

- d. Open House – 10/1/2022 (copy included)

Mr. Kolb said that the DPW/Fire Department/ Police Department open house is scheduled for October 1, 2022, at the Public Works Center between the hours of 9:00AM and 12:00PM, and the Veolia team will be giving tours of the Wastewater Treatment Plant.

- e. Sewer Use Bill Appeals/Adjustments Update

1) Appeal status

Mr. Kolb said the appeals to date are \$39,341.00

- f. Information Copies: None

7. ADJOURNMENT

**** MR. BOVE MOVED TO ADJOURN.**

**** THE MOTION PASSED UNANIMOUSLY**

The meeting adjourned at 6:17PM.

Respectfully submitted,
Dilene Byrd



Mr. Ralph Kolb, PE
Senior Environmental Engineer
City of Norwalk
Water Pollution Control Authority
15 S. Smith Street
Norwalk, CT 06855

Arcadis U.S., Inc.
213 Court Street, Suite 700
Middletown
Connecticut 06457
www.arcadis.com

Subject:
Request for WPCF On-Call Engineering Services Contract Amendment

Dear Mr. Kolb:

In 2020, Arcadis and the WPCA amended the Contract for On-Call Engineering Services at the Norwalk Water Pollution Control Facility (WPCF). The current Contract is set to expire on January 26, 2023.

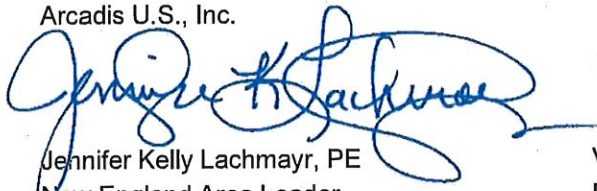
A Task Order was recently executed to update the WPCF Facility Plan, which will include recommendations for Capital Improvements focused on Secondary Treatment, Final Settling Tanks and Wet Weather. This work is driven by a Consent Order with Connecticut Department of Energy and Environmental Protection. Design and implementation of the proposed Capital Improvements will be completed under subsequent Task Orders once the scope is defined.

It is anticipated that the Task Orders being considered by the WPCA will exceed the current term of this agreement. In addition, the not-to exceed cost of the Agreement should be increased to reflect upcoming assignments. Therefore, Arcadis respectfully requests that the Norwalk WPCA extend the current On-Call Agreement for a period of three additional years and that the not-to-exceed cost for this Agreement be increased by \$3,000,000.00.

Should you have any questions or wish to discuss this request in detail, please do not hesitate to contact me. We are proud of the work we have accomplished together to date and look forward to continuing to support the WPCA and the improvement projects at the WPCF.

Sincerely,

Arcadis U.S., Inc.


Jennifer Kelly Lachmayr, PE
New England Area Leader


Vanessa McPherson, PE
Project Manager

Resilience Water

Date:
October 5, 2022

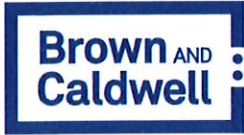
Contact:
Vanessa McPherson, PE

Phone:
914-641-2418

Email:
vanessa.mcpherson
@arcadis.com

Our ref:
66000867.0000





Brown and Caldwell
175 Capital Boulevard
Rocky Hill, CT 06067

T: 860.462.8255

October 14, 2022

Norwalk Water Pollution Control Authority
15 South Smith Street
Norwalk, CT 06855

Attn: Ralph Kolb, PE,
Sr. Environmental Engineer

Re: On-call Engineering Services for Wastewater Collection System

Dear Ralph:

Brown and Caldwell (BC) entered into an agreement with the City of Norwalk Water Pollution Control Authority (WPCA) dated March 3rd, 2021 with a term of three years and a not-to-exceed cost of \$1,000,000

We are currently on Task Order No. 5. The total value of task orders 1 through 5 is \$959,412. Additional task order requests are anticipated following the recent completion of Task Order 1 – Sanitary Sewer Master Plan that identified several consent order driven projects/programs. These projects include:

- Hubbells Lane Relief Sewer
- Elimination of Ann Street Emergency Overflow
- Catch Basin Disconnect Program
- Targeted Rainfall-Derived Infiltration and Inflow Reduction

These Projects represent \$53 million worth of capital improvements. We are approaching the not-to-exceed cost of this agreement. Therefore, to provide the additional services, Brown and Caldwell respectfully requests the Norwalk WPCA to increase the not-to-exceed cost by an additional \$3,000,000.

We appreciate the opportunity to provide services to the Norwalk WPCA. Should you have any questions or require additional information, please call me at (860) 303-3917.

Very truly yours,

Brown and Caldwell

Eric J. Muir, PE
Principle in Charge
Emuir@brwnncald.com

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10/06/2022 10:09
2882dbyrd

City of Norwalk LIVE - 11.3.
YEAR-TO-DATE BUDGET REPORT



1
P
glytdbud

FY21/22

FOR 2022 99

ACCOUNTS FOR:
22 WATER POLLUTION CONTROL

ORIGINAL
APPROP

TRANSFRS/
ADJUSTMTS

REVISED
BUDGET

YTD EXPENDED

ENCUMBRANCES

AVAILABLE
BUDGET

PCT
USED

040 PUBLIC WORKS

224062 WATER POLLUTION CONTROL

224062 4051 INTEREST	-65,000	0	-65,000	-125,703.20	.00	60,703.20	193.4%
224062 4121 NITROGEN	-525,000	0	-525,000	-108,830.81	.00	-416,169.19	20.7%
224062 4451 SEWER PERM	-1,500	0	-1,500	-4,000.00	.00	2,500.00	266.7%
224062 4453 SEPTIC LIC	-1,500	0	-1,500	-500.00	.00	-1,000.00	33.3%
224062 4513 SEWER CHRG	-16,505,000	0	-16,505,000	-16,563,219.58	.00	58,219.58	100.4%
224062 4516 SPT DIS FE	-175,000	0	-175,000	-218,980.00	.00	43,980.00	125.1%
224062 4521 WILTON SU	-600,000	0	-600,000	-567,829.55	.00	-32,170.45	94.6%
224062 4522 SEWER USE	-45,000	0	-45,000	-46,998.00	.00	1,998.00	104.4%
224062 452C INDUSTRIAL	-200,000	0	-200,000	65,420.30	.00	-265,420.30	-32.7%
224062 452D SEWER CONN	-125,000	0	-125,000	-347,410.01	.00	222,410.01	277.9%
224062 452E IPP INTERE	-5,000	0	-5,000	-12,788.55	.00	7,788.55	255.8%
224062 4807 REIMB EXP	-1,000	0	-1,000	.00	.00	-1,000.00	0%
224062 489F REIMB GF	-115,860	0	-115,860	-115,860.00	.00	.00	100.0%
224062 4901 INV INCOME	-110,000	0	-110,000	-7,085.37	.00	-102,914.63	6.4%
TOTAL WATER POLLUTION CONTROL	-18,474,860	0	-18,474,860	-18,053,784.77	.00	-421,075.23	97.7%
TOTAL PUBLIC WORKS	-18,474,860	0	-18,474,860	-18,053,784.77	.00	-421,075.23	97.7%
TOTAL WATER POLLUTION CONTROL	-18,474,860	0	-18,474,860	-18,053,784.77	.00	-421,075.23	97.7%
TOTAL REVENUES	-18,474,860	0	-18,474,860	-18,053,784.77	.00	-421,075.23	97.7%

8.9

10/06/2022 10:08
2882dbyr

City of Norwalk LIVE - 11.3.
YEAR-TO-DATE BUDGET REPORT

1
glytdbud

FY 21/22

FOR 2022 99

ACCOUNTS FOR:
22 WATER POLLUTION CONTROL

ORIGINAL APPROP TRANSFERS/ ADJUSTMENTS REVISED BUDGET YTD EXPENDED ENCUMBRANCES AVAILABLE BUDGET PCT USED

040 PUBLIC WORKS

224062 WATER POLLUTION CONTROL

224062 5110 WAGES & SA	416,753	0	416,753	317,306.42	.00	99,446.58	76.1%
224062 5120 WAGES & SA	75,000	0	75,000	16,944.84	.00	58,055.16	22.6%
224062 5140 WAGES & SA	30,000	0	30,000	912.00	.00	29,088.00	3.0%
224062 5150 LONGEVITY	1,100	0	1,100	1,130.00	.00	-30.00	102.7%
224062 5175 RETRO WAGE	0	0	0	4,060.28	.00	-4,060.28	100.0%
224062 5235 MEMBERSHIP	10,000	0	10,000	7,980.00	.00	2,020.00	79.8%
224062 5241 ELECTRIC	1,484,761	0	1,484,761	1,489,631.34	.00	-4,870.34	100.3%
224062 5245 TELEPHONE	2,000	0	2,000	.00	.00	2,000.00	.0%
224062 5252 LEGAL SERV	150,000	0	150,000	193,436.29	.00	-43,436.29	129.0%
224062 5258 OMI	8,722,480	1,220,138	9,942,618	8,851,303.97	.00	1,091,314.03	89.0%
224062 5286 BUSINESS E	32,000	0	32,000	11,568.53	.00	20,431.47	36.2%
224062 5295 SEMINAR&CO	10,000	0	10,000	2,883.82	.00	7,116.18	28.8%
224062 5298 OTHER	250,000	237,447	487,447	281,794.41	.00	205,652.59	57.8%
224062 5323 FOOD	0	0	0	30.00	.00	-30.00	100.0%
224062 5418 INSURANCE	84,848	0	84,848	84,848.00	.00	.00	100.0%
224062 5428 BENEFITS	222,129	0	222,129	222,128.71	.00	.29	100.0%
224062 5521 PRINCIPAL	1,786,860	0	1,786,860	1,786,860.26	.00	-.26	100.0%
224062 5522 INTEREST	1,492,670	0	1,492,670	1,492,670.24	.00	-.24	100.0%
224062 5651 TO G/F	638,410	0	638,410	638,410.00	.00	.00	100.0%
224062 5741 IT HARDWAR	60,000	0	60,000	21,000.00	.00	39,000.00	35.0%
224062 5777 CONSTRUCT	0	0	0	5,676,638.08	.00	-5,676,638.08	100.0%
224062 5789 RESERVE	3,005,849	0	3,005,849	.00	.00	3,005,849.00	.0%
TOTAL WATER POLLUTION CONTROL	18,474,860	1,457,585	19,932,445	21,101,537.19	.00	-1,169,092.19	105.9%
TOTAL PUBLIC WORKS	18,474,860	1,457,585	19,932,445	21,101,537.19	.00	-1,169,092.19	105.9%
TOTAL WATER POLLUTION CONTROL	18,474,860	1,457,585	19,932,445	21,101,537.19	.00	-1,169,092.19	105.9%
TOTAL EXPENSES	18,474,860	1,457,585	19,932,445	21,101,537.19	.00	-1,169,092.19	105.9%

10/06/2022 10:10
2282dbvrd

City of Norwalk LIVE - 11.3.
YEAR-TO-DATE BUDGET REPORT

1
glytdbud

FY22/23

FOR 2023 99

ACCOUNTS FOR:
22 WATER POLLUTION CONTROL

ORIGINAL APPROP TRANFRS/ ADJSTMTS REVISED BUDGET YTD EXPENDED ENCUMBRANCES AVAILABLE BUDGET PCT USED

040 PUBLIC WORKS

224062 WATER POLLUTION CONTROL

224062 4051 INTEREST	-65,000	0	-65,000	-20,533.46	.00	-44,466.54	31.6%
224062 4121 NITROGEN	-100,000	0	-100,000	-79,077.00	.00	-20,923.00	79.1%
224062 4451 SEWER PERM	-1,500	0	-1,500	-600.00	.00	-900.00	40.0%
224062 4453 SEPTIC LIC	-1,000	0	-1,000	-1,400.00	.00	400.00	140.0%
224062 4513 SEWER CHRG	-17,044,000	0	-17,044,000	-17,621,522.46	.00	577,522.46	103.4%
224062 4516 SPT DIS FE	-175,000	0	-175,000	-35,800.00	.00	-139,200.00	20.5%
224062 4521 WILTON SU	-600,000	0	-600,000	.00	.00	-600,000.00	.0%
224062 4522 SEWER USE	-45,000	0	-45,000	-9,393.00	.00	-35,607.00	20.9%
224062 452C INDUSTRIAL	-175,000	0	-175,000	-190,133.05	.00	15,133.05	108.6%
224062 452D SEWER CONN	-150,000	0	-150,000	-50,530.00	.00	-99,470.00	33.7%
224062 452E IPP INTERE	-5,000	0	-5,000	-1,199.47	.00	-3,800.53	24.0%
224062 4807 REIMB EXP	-1,000	0	-1,000	.00	.00	-1,000.00	.0%
224062 489F REIMB GF	-143,560	0	-143,560	.00	.00	-143,560.00	.0%
224062 4901 INV INCOME	-110,000	0	-110,000	.00	.00	-110,000.00	.0%
TOTAL WATER POLLUTION CONTROL	-18,616,060	0	-18,616,060	-18,010,188.44	.00	-605,871.56	96.7%
TOTAL PUBLIC WORKS	-18,616,060	0	-18,616,060	-18,010,188.44	.00	-605,871.56	96.7%
TOTAL WATER POLLUTION CONTROL	-18,616,060	0	-18,616,060	-18,010,188.44	.00	-605,871.56	96.7%
TOTAL REVENUES	-18,616,060	0	-18,616,060	-18,010,188.44	.00	-605,871.56	96.7%

8.a.

10/06/2022 10:09
2882dburd

City of Norwalk LIVE - 11.3.
YEAR-TO-DATE BUDGET REPORT



1
glytdbud

FY22/23

FOR 2023 99

ACCOUNTS FOR:
22 WATER POLLUTION CONTROL

040 PUBLIC WORKS

224062 WATER POLLUTION CONTROL

	ORIGINAL APPROP	TRANSFRS/ ADJUSTMTS	REVISED BUDGET	YTD EXPENDED	ENCUMBRANCES	AVAILABLE BUDGET	PCT USED
224062 5110 WAGES & SA	413,270	0	413,270	91,607.14	.00	321,662.86	22.2%
224062 5120 WAGES & SA	100,000	0	100,000	1,731.14	.00	98,268.86	1.7%
224062 5140 WAGES & SA	36,000	0	36,000	.00	.00	36,000.00	0%
224062 5150 LONGEVITY	1,150	0	1,150	.00	.00	1,150.00	0%
224062 5235 MEMBERSHIP	10,000	0	10,000	.00	.00	10,000.00	0%
224062 5241 ELECTRIC	1,500,000	0	1,500,000	130,105.75	.00	1,369,894.25	8.7%
224062 5245 TELEPHONE	2,000	0	2,000	.00	.00	2,000.00	0%
224062 5252 LEGAL SERV	250,000	0	250,000	12,049.50	.00	237,950.50	4.8%
224062 5258 OMI	9,882,606	0	9,882,606	17,859.08	8,000,000.00	1,864,746.92	81.1%
224062 5286 BUSINESS E	32,000	0	32,000	400.00	.00	31,600.00	1.3%
224062 5295 SEMINAR&CO	10,000	0	10,000	.00	.00	10,000.00	0%
224062 5298 OTHER	250,000	0	250,000	116.90	.00	249,883.10	0%
224062 5418 INSURANCE	115,372	0	115,372	.00	.00	115,372.00	0%
224062 5428 BENEFITS	220,273	0	220,273	.00	.00	220,273.00	0%
224062 5521 PRINCIPAL	3,253,588	0	3,253,588	2,350,767.12	.00	902,820.88	72.3%
224062 5522 INTEREST	1,101,898	0	1,101,898	492,178.99	.00	609,719.01	44.7%
224062 5651 TO G/F	669,688	0	669,688	.00	.00	669,688.00	0%
224062 5741 IT HARDWAR	60,000	0	60,000	32,770.67	.00	27,229.33	54.6%
224062 5789 RESERVE	708,215	0	708,215	.00	.00	708,215.00	0%
TOTAL WATER POLLUTION CONTROL	18,616,060	0	18,616,060	3,129,586.29	8,000,000.00	7,486,473.71	59.8%
TOTAL PUBLIC WORKS	18,616,060	0	18,616,060	3,129,586.29	8,000,000.00	7,486,473.71	59.8%
TOTAL WATER POLLUTION CONTROL	18,616,060	0	18,616,060	3,129,586.29	8,000,000.00	7,486,473.71	59.8%
TOTAL EXPENSES	18,616,060	0	18,616,060	3,129,586.29	8,000,000.00	7,486,473.71	

PROFESSIONAL SERVICES TASK ORDER

Task Order Number: 04
Task Order Date: September 12, 2022

Subject to the AGREEMENT FOR ON-CALL ENGINEERING SERVICES BY AND BETWEEN WATER POLLUTION CONTROL AUTHORITY OF THE CITY OF NORWALK AND Woodard and Curran, Inc., (hereinafter referred to as the "Agreement"), WPCA hereby directs ENGINEER to perform the professional engineering services specified in this Task Order in accordance with the Agreement.

1. Project Description:

Project Number: 214728.00
Project Name: WPCA Utility Rate Study
Description: Updates to the WPCA's financial model based on Collection System Master Plan

2. Scope of Work:

The Scope of Work to be performed hereunder consists of updating the WPCA's financial model to incorporate future collection system rehabilitation costs and long-term WWTP costs, and is more fully described in the document entitled Norwalk WPCA – Financial Model Update Scope of Work dated September 12, 2022 attached hereto as Exhibit A.

3. Time Schedule:

Engineer shall complete the work required by this Task Order on or before December 31, 2022.

4. Compensation:

Engineer shall be paid for the proper performance of services described in this Task Order in an amount not to exceed Thirteen thousand, eight hundred and 00/100 (\$13,800) Dollars. Invoices shall be submitted monthly on time and materials basis. Compensation per tasks shall be as listed below:

Task Item	Fee
1. Model Updates	\$8,800
2. Meetings	\$5,000
Total	\$13,800

5. Special Conditions:

This Task Order is subject to the special provisions stated in Exhibit B, attached and incorporated herein as if fully set forth herein.

6. Amendment: NA

ISSUED AND AUTHORIZED BY:
WPCA

By: Ralph J. Koltz

Title: Sr. Environmental Engineer

ACCEPTED AND AGREED TO BY:
ENGINEER

By: Ken Kohlbrenner, PE

Title: Regional Manager

8.C.

PROFESSIONAL SERVICES TASK ORDER

Task Order Number: 04

Exhibit A: Scope of Work

Exhibit B: Special Conditions

EXHIBIT A: SCOPE OF WORK



BACKGROUND

Woodard & Curran prepared a financial model for the WPCA to plan capital projects and project future rates. The model incorporates anticipated capital projects to create an accurate projection of future needs. The WPCA is in the process of completing a Collection System Master plan that will identify rehabilitation needs. In addition, long-term WWTP capital projects are needed for consent order compliance. This scope will update the model accordingly and present the findings to the WPCA.

SCOPE OF SERVICES

In order to meet the scope of services, Woodard & Curran proposes the following tasks to complete the Task Order:

Task 1 – Report Updates

1. Collect and review latest annual report, budget documents and new consent decree
2. Update model for with FY22 actuals and FY23 budget numbers
 - a. Operations and Maintenance costs,
 - b. Debt Service projections,
 - c. Capital Improvement Plan,
3. Collect and review latest year of billing data
 - a. Update consumption data with latest year of annual billing data
 - b. Update projection for future sales/billings
4. Update rates in model to reflect newly approved fee structure
5. Recommend future rates/fee structure to cover new costs expectations

Task 2 – Meetings and Presentations

Woodard & Curran anticipates up to two (2) meetings with the WPCA and City finance team to review progress and findings of the model updates. In addition, one (1) meeting and presentation to the WPCA Board is anticipated.

SCHEDULE

The milestone schedule is listed below assuming a contract start date of September 30, 2022, and a maximum contract date of November 30, 2022.

Task 1: Report Updates	9/30/2022 – 11/15/2022
Task 2: Meetings and Presentations	10/14/2022 – 11/30/2022

800 Westchester Avenue
Suite N507
Rye Brook, New York 10573
www.woodardcurran.com

T 800.426.4262
T 914.448.2266
F 914.448.0147

EXHIBIT B: SPECIAL CONDITIONS



In reference to the Agreement between WPCA and ENGINEER, Section 5 Insurance, Article A (2), the requirement for ENGINEER to provide pollution and environmental insurance coverage is waived for this Task Order 04.

PROFESSIONAL SERVICES TASK ORDER

Task Order Number: 07B

Task Order Date: October 3, 2022

Subject to the AGREEMENT FOR ON-CALL ENGINEERING SERVICES BY AND BETWEEN WATER POLLUTION CONTROL AUTHORITY OF THE CITY OF NORWALK AND ARCADIS U.S., INC. (hereinafter referred to as the "Agreement"), WPCA hereby directs ENGINEER to perform the professional engineering services specified in this Task Order in accordance with the Agreement.

1. Project Description:

Project Number: 30001742 (Legacy Number 00867606.0000)

Project Name: SCADA Upgrade at the Norwalk WPCF

Description: Engineering services. Part-Time Resident Project Representation and System Integration Services to implement high priority items for Phase III of the Plantwide SCADA Upgrade.

2. Scope of Work:

The Scope of Work to be performed hereunder consists of continuation of Engineering Services to implement the SCADA Upgrade and is more fully described in the Letter Proposal from Arcadis dated September 29, 2022 attached hereto as Exhibit A.

3. Time Schedule:

Engineer shall complete the work required by this Task Order within 180 calendar days of the date of this Task Order first written above.

4. Compensation:

Engineer shall be paid for the proper performance of services described in this Task Order in an amount not to exceed Seven Hundred Nine Thousand Nine Hundred Seventy-Five and 00/100 (\$709,975.00) Dollars. This represents an increase in Seventy Thousand Four Hundred Fifty and 00/100 (\$70,450.00) Dollars from the amended Task Order value.

5. Special Conditions:

None

6. Amendment: This Task Order amends a previously executed Task Order.

Previous Task Order Number: 7A

Previous Task Order Date: July 29, 2020

ISSUED AND AUTHORIZED BY:
WPCA

ACCEPTED AND AGREED TO BY:
ARCADIS US, INC.

By: Ralph J. Zolt

By: Vanessa McPherson

Title: Senior Environmental Engineer

Title: Associate Vice President

8.2.6

PROFESSIONAL SERVICES TASK ORDER
Task Order Number: 07B

Exhibit A: Letter Proposal (consisting of 2 pages)

Exhibit B: Special Conditions - None



Ralph Kolb, P.E.
Senior Environmental Engineer
Norwalk Water Pollution Control Authority
15 South Smith Street
Norwalk, CT 06855

Arcadis U.S., Inc.
44 South Broadway
9th Floor
White Plains
New York 10601
Tel 914 694 2100
Fax 914 694 9286
www.arcadis.com

Subject:

Norwalk Water Pollution Control Facility
On-Call Contract Task Order #7 - SCADA Upgrade
Amendment Request for Phase IIIA

Water

Date:
September 29, 2022

Dear Mr. Kolb:

Contact:
Vanessa McPherson

An Allowance was included in Phase IIIA to cover additional SCADA items identified by the Team during the project. An Allowance Authorization was requested in January 2022 to incorporate additional SCADA items which lowered the remaining Allowance to \$33,650. Since that time, a new set of SCADA items has been identified by the Team. The cost associated with these new items exceeds the remaining balance of the originally approved Allowance by \$70,450. The table on the following page summarizes a list of the new SCADA requests and their associated cost.

Phone:
914.641.2418

Email:
vanessa.mcpherson
@arcadis.com

In order to complete the additional Phase IIIA items listed below, Arcadis respectfully requests an Amendment under this project in the amount of \$70,450.

Our ref:
00867606.0000

Should you have any questions or wish to discuss any aspect of this request in more detail, please do not hesitate to contact me. We appreciate the opportunity to continue to assist with the implementation of this important project for the WPCA.

Mr. R. Kolb. PE
Norwalk WPCA
September 29, 2022

Item	SCADA Item Description	Total Cost	Notes
1	Filtrate Wet Well Level System	\$ 59,800	Objectives: 1. Upgrade existing Bubbler System to pressure system 2. Upgrade Filtrate Pumps controls 3. Integrate Level and Pumps with Plantwide SCADA and network 4. Incorporate backup float pump controls external to PLC
2	Chlor/Dechlor Chemical Storage Valve Closed Alarm	\$ 6,400	Objectives: 1. Verify Chlor and Dechlor Tanks Valve and Leak Detection PLC I/O, status, and alarms 2. Program Valve Closed Alarm for 2 Chlor and 2 Dechlor Feed Valves
3	Implementation of Remote TWAS Pump Control	\$ 10,800	Objectives: 1. Incorporate remote monitoring and control of the TWAS pumps
4	Upgrade of Secondary Lift Wet Well to Submersible Pressure system	\$ 5,700	Objectives: 1. Install new submersible pressure system to replace existing bubbler system at Secondary Lift Wet Well
5	Development of Third Party Electrical Work Package	\$ 10,800	Prepare third party packages for the following SCADA items: 1. Filtrate Wet Well Level 2. Thickened Sludge Tank Level 3. Remote Control of WAS 4. Sludge Optimization Controls 5. Reed Street Generator I/O 6. Remote TWAS Control 7. Submersible Pressure Level System @ Secondary Wet Well
6	Engineer Onsite Support for Electrical Work and Control Startup	\$ 10,600	Part time as needed (assumes 60 hours total)
Total (Items 1 through 6)		\$ 104,100	
*	Phase III Allowance Item Balance	\$ (33,650)	Current Balance of Allowance in Phase IIIA
*	Total Amendment Request	\$ 70,450	

Sincerely,

Arcadis U.S., Inc.

Vanessa McPherson, PE
Principal Engineer



**Norwalk Water
Pollution Control
Authority**

www.wpcanorwalk.org

September 29, 2022

***VIA FEDERAL EXPRESS
AND ELECTRONIC MAIL***

Ms. Lindsay Williams, Supervising Accountant
Department of Energy and Environmental Protection
Bureau of Financial and Support Services, 1st Floor
79 Elm Street
Hartford, CT 06106-5127

Subject: City of Norwalk, CT – WPCF Facility Plan Update Project
Clean Water Fund Assistance Application

Dear Ms. Williams:

The Water Pollution Control Authority (WPCA) for the City of Norwalk is applying for financial assistance in the form of a Clean Water Fund 55% planning grant to update its Water Pollution Control Facility (WPCF) Facility Plan.

Please find attached two (2) copies of the subject Clean Water Fund Assistance Application. This package includes the information for the CT DEEP/ Bureau of Water Protection and Land Reuse requested in the instructions of Part I of the application. Two copies of the information for the Office of the State Treasurer requested in the instructions for Part 2 of the application have been forwarded to Ms. Marie Moylan Hoadley at the Office of the Treasurer.

Should you have any questions, please feel free to contact me at 203-854-3242.

Sincerely,

Ralph K. Kolb
Sr. Environmental Engineer

Copy: WPCA Board of Directors
Vanessa Valadares, DPW (*via Electronic Mail*)
Chris Torre, DPW (*via Electronic Mail*)
Rita Nigri, Norwalk (*via Electronic Mail*)
Vanessa McPherson, Arcadis (*via Electronic Mail*)



**Norwalk Water
Pollution Control
Authority**

www.wpcanorwalk.org

September 29, 2022

***VIA FEDERAL EXPRESS
AND ELECTRONIC MAIL***

Ms. Marie Moylan
Clean Water Fund Financial Administrator Office of the Treasurer
55 Elm Street
Hartford, CT 06106-1773

Subject: City of Norwalk, CT – WPCF Facility Plan Update Project
Clean Water Fund Assistance Application
CWFNo.TBD

Dear Ms. Moylan:

The Water Pollution Control Authority (WPCA) for the City of Norwalk is applying for financial assistance in the form of a Clean Water Fund 55% planning grant to update its Water Pollution Control Facility (WPCF) Facility Plan. Based on the State's current program, the Connecticut Department of Energy and Environmental Protection (CT DEEP) has indicated that this project is eligible for a 55% grant, totaling \$261,966.65. The City of Norwalk will be funding the remaining project cost, totaling \$214,336.35.

Please find attached two (2) copies of the subject Clean Water Fund Assistance Application. This package includes the information for the CT DEEP/ Bureau of Water Protection and Land Reuse requested in the instructions of Part 2 of the application. Also note that two copies of the information for the ST DEEP requested in the instructions for Part 1 of the application have been forwarded to Ms. Susan Hawkins.

The WPCF Facility Plan update will be performed under Engineering Agreement Task Order No. 10 dated May 19, 2022, between the City of Norwalk and Arcadis U.S., Inc, which was approved by the CT DEEP on July 11, 2022.

Should you have any questions, please feel free to contact me at 203-854-3242.

Sincerely,

A handwritten signature in black ink that reads "Ralph K. Kolb".

Ralph K. Kolb
Sr. Environmental Engineer

Copy: WPCA Board of Directors
Vanessa Valadares, DPW (*via Electronic Mail*)
Chris Torre, DPW (*via Electronic Mail*)
Rita Nigri, Norwalk (*via Electronic Mail*)
Vanessa McPherson, Arcadis (*via Electronic Mail*)

A handwritten number "8.2.1" inside a hand-drawn circle.



September 30, 2022

VIA ELECTRONIC MAIL

Ms. Ann Straut
Sanitary Engineer 3
Department of Energy and Environmental Protection
Bureau of Water Protection and Land Reuse
Water Planning & Management Division
79 Elm Street
Hartford, CT 06106-5127

Subject: City of Norwalk, CT, Consent Order
(# COWRMU22001)
Sanitary Sewer Collection System Master Plan Update

Dear Ms. Straut:

Please find attached a copy of the Sanitary Sewer Collection System Master Plan Update that is due on or before September 30th in accordance with Section B.3 of the above referenced Consent Order.

Should you have any questions, please feel free to contact me at 203-854-3242.

Sincerely,

A handwritten signature in black ink that reads "Ralph K. Kolb". The signature is written in a cursive, flowing style.

Ralph K. Kolb
Sr. Environmental Engineer

Copy: Vanessa Valadares, DPW (*via Electronic Mail*)
Chris Torre, DPW (*via Electronic Mail*)
WPCA Board of Directors
John Marcin, SUEZ (*via Electronic Mail*)
Mathew Todaro, Verrill (*via Electronic Mail*)

2022 Norwalk Master Plan

Prepared for
City of Norwalk and its Water Pollution Control Authority
September 30, 2022



175 Capital Boulevard, 4th Floor
Rocky Hill, CT, 06067

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List of Abbreviations

City	City of Norwalk
CTECO	CT Environmental Conditions Line
CSO	combined sewer overflow
DEM	digital elevation model
DWF	dry weather flow
GIS	Geographical Information System
gpd/in-mi	gallons per day per inch-mile
GPAD	gallons per acre per day
GPD	gallons per day
GWI	groundwater infiltration
HGL	hydraulic grade line
I/I	infiltration and inflow
MG	million gallons
MGD	million gallons per day
MH	manhole
O&M	operations and maintenance
RDII	Rainfall-derived inflow and infiltration
SSO	sanitary sewer overflow
SWMM	Storm Water Management Model
SWWTF	Supplemental Wet Weather Treatment Facility
WEF	Water Environment Federation
WERF	Water Environment Research Foundation
WPCA	Water Pollution Control Authority
WPCF	water pollution control facility

Executive Summary

This Collection System Master Plan (Master Plan) was prepared for the City of Norwalk (City) and its Water Pollution Control Authority (WPCA). The purpose of the Master Plan is to evaluate the existing characteristics, identify limiting constraints, and develop a long-term system-wide approach to enhance the performance of the City's collection system. This Master Plan was also prepared in satisfaction of the City's Consent Order, dated May 6, 2022.

The City's collection system includes 206 miles of gravity mains, 24 miles of gravity interceptors, 22 pump stations, and 7.4 miles of forcemains. The City's contract operator, Veolia Water Contract Operations USA, Inc. (Veolia), inspects, maintains, and operates the City's collection system.

Since development of the City's original Collection System Master Plan which was finalized in 2009, the WPCA has been diligently planning and implementing numerous enhancements to its collection system. Some key enhancements include: multiple lining and rehabilitation projects; several inflow and infiltration initiatives; various targeted sewershed rehabilitation projects; a system-wide pumpstation assessment and upgrade initiative; and a retooled contract operations service agreement that includes a comprehensive operation, maintenance, and management program. To further enhance its efforts to optimize performance of the City's collection system, the WPCA initiated this update to the original 2009 Collection System Master Plan.

Summary of Findings

In general, the Master Plan concluded that the City's collection system currently performs well. To develop the 2022 Master Plan, and the analysis that informed that conclusion, a temporary flow monitoring campaign and a collection system model, representing the collection system interceptors and critical trunk sewers, pump stations, and forcemains, were developed. Both the flow monitoring data and the collection system model were integral components of the evaluation that were used to assess and characterize the collection system conditions and performance under both existing and proposed improved future conditions.

- **Flow Metering:** A city-wide twenty-week metering campaign was conducted from March 15 to August 1, 2021. The temporary flow metering program was augmented by the collection of rainfall data and flow and level data at Norwalk's Water Pollution Control Facility (WPCF). Flow metering data collected under the city-wide program was used to characterize flow conditions during both dry and wet weather conditions at 40 discrete points within the collection system. Flow data from the WPCF was used to characterize flows into the plant under both dry and wet weather flow conditions. Flow metering data from both sources were used to calibrate the collection system model.
 - Five wet weather flow events were selected for model calibration. The rainfall events used for calibration ranged from sub-1-year to 10-year return frequencies.
- **Collection System Model:** The collection system model network includes approximately 25 percent of the total collection system pipe length and 9 of the 22 pump stations. The collection system model was developed primarily from the City's GIS datasets, augmented by field data collection where required. The collection system model network captures the interceptor system and critical trunk sewers. The collection system model provides a tool that can be used for the following:

- Characterizing the existing conditions and behavior of the collection system. The collection system model was calibrated using rainfall data collected during the flow metering campaign. The calibrated model was used to assess the collection system performance and identify system constraints.
- Predicting hydrologic inflows and hydraulic conditions in response to a specified rainfall event. The calibrated model was simulated using a range of synthetic rainfall events to characterize the system performance and benchmark its level of service.
- Assessing the impacts of change within the collection system. Proposed future conditions, representing reductions in extraneous flow entering the collection system or improvements in the collection system capacity were simulated to evaluate their benefits to the collection system performance.

The analysis of the flow metering data and application of the collection system model supported the characterization of the City's collection system and the identification of its limiting components. The relief of hydraulic bottlenecks and the reduction of extraneous flows entering the collection system are the most important areas identified for improvement of collection system performance. Prioritizing conveyance capacity improvements that relieve hydraulic bottlenecks provides an immediate reduction in the hydraulic grade line (HGL) and maximizes the volume of wastewater conveyed to the WPCF. Targeted reduction of extraneous flows entering the collection system provides a pathway for long-term improvements in the collection system's level of service.

Summary of Recommendations

The analysis performed as part of this Master Plan resulted in two categories of recommendations:

1. Consent Order Recommendations; and
2. Long-Term Recommendations

Consent Order Recommendations are recommendations made to specifically address and satisfy paragraphs B.3 and B.5 of Norwalk's Consent Order. Long-Term Recommendations are recommendations made specifically to further enhance and optimize performance of the City's collection system. Both recommendation categories are discussed further below and within the Master Plan.

Consent Order Recommendations

- Continue Prioritized Collection System Inspection and Maintenance: Analysis of flow metering data and the collection system model results indicate that some portions of the collection system perform at a level below their design conveyance capacity. In these locations, it is assumed that there is reduction in the available flow area of the sewer main, typically caused by debris accumulation or the presence of root balls. As such, the Master Plan recommends inspection and maintenance be prioritized in these areas. The inspection, maintenance, and operational recommendations have been identified as feasible to implement in a 1- to 3-year timeframe.
- Periodic Level Monitoring: Some of the sewers identified as performing below their design capacity have previously been identified by the City's contract operator as being subject to increased maintenance needs. Periodic level monitoring and trend analysis is recommended to assist in predicting when maintenance activities are necessary to restore the conveyance capacity in the sewer reach.
- Modification of the WPCF Influent Pumping Operations: The WPCF Influent Pumping Station is operated to maintain a constant wet well level. The maintained wet well level imposes a backwater condition on a significant portion of the interceptor system. Under backwater



conditions, velocities decrease, and the sewer becomes more susceptible to sediment aggradation. Lowering the wet well-set point would reduce the backwater influence and potentially improve the self-cleaning properties of the interceptor system.

- **Catch Basin Disconnection Program:** Directly connected catch basins capture and convey stormwater to the collection system. Directly connected catch basins are often significant sources of extraneous inflow. Disconnection of the directly connected catch basins identified as significant inflow contributors is included as a Consent Order Recommendation to specifically address paragraph B.3's objective of removing excess flow from the collection system. To implement this recommendation, the City and WPCA will develop a Catch Basin Disconnection Program. The program will confirm catch basin drainage areas, perform disconnection feasibility analyses, develop detailed design and disconnection specifications, and carry out project bidding, construction management, and project close out tasks. This program is necessary as the Master Plan recommendations are based on the assumption that the storm drain system has sufficient conveyance capacity to accept the additional flows and that construction of new storm drain assets required for catch basin disconnection are feasible. Both of these assumptions will need to be further verified through more detailed engineering analyses as part of the Consent Order recommended Catch Basin Disconnection Program. The estimated cost of the catch basin disconnections included in the Consent Order measures recommendation is approximately \$10.6 million.
- **Hubbells Lane Relief Sewer:** Modeling has indicated that rerouting flows from the East Wall Street trunk sewer to the East Interceptor downstream of the Moodys Lane Siphon, via a Hubbells Lane Relief Sewer, would lower the HGL in portions of the East Interceptor historically prone to significant surcharge. The model results indicate the Hubbells Lane Relief Sewer effectively mitigates the significant surcharging and prevents manhole overflows up to the 25-year, 6-hour return frequency event. Further, the model results show that with the Hubbells Lane Relief Sewer in service, the Wall Street Overflow outfall can be permanently closed and eliminated from the City's collection system. The estimated cost of the Hubbells Lane Relief Sewer project is approximately \$5.4 million and has been identified as feasible to implement in a 3- to 5-year timeframe.
- **Elimination of Ann Street Emergency Overflow:** The Ann Street Emergency Overflow (Emergency Overflow) has historically provided hydraulic relief to the Norwalk interceptor system, acting as a controlled point of discharge during emergency events such as periods of extreme weather or catastrophic infrastructure failure. Recently, the WPCA implemented additional engineering and administrative controls further reducing the likelihood of discharge from the Emergency Overflow. As a result of these controls and other collection system enhancements, discharges from the Emergency Overflow are incredibly rare events that have effectively been eliminated already. Further, the additional modeling analysis performed for the Master Plan predicts that, following completion of both Consent Order and Long-Term Recommendations, the Emergency Overflow will not discharge even under the 100 year, 24-hour return frequency event. For perspective, other CSO communities in Connecticut generally attempt to control overflows for much smaller events.

To comply with paragraph B.3 of the Consent Order, the Master Plan develops and discusses three viable and cost-effective measures or alternatives to accomplish elimination of the Emergency Overflow. Following the analysis presented in Sections 4 and 7 of the Master Plan, Alternative 2, which includes implementation of the Consent Order Recommendations and installation of a physical barrier functioning as an operational flow elimination structure, was selected as the recommended measure. Alternative 1, which includes implementation of the Consent Order Recommendations, was excluded given the potential for additional enhancement.



Alternative 3, which includes Consent Order Recommendations and removal of outlet pipes preventing discharges in all conditions, was excluded given the unacceptable level of risk posed to the health and safety of the public by the more than 1,000 parcels likely impacted by wastewater backups into basements under this alternative. The estimated cost of the Emergency Overflow Elimination project is approximately \$0.8 million and has been identified as feasible to implement in a 2- to 5-year timeframe.

Long-Term Recommendations

- **Targeted Rainfall-Derived Infiltration and Inflow Reduction:** Eighteen meter-areas with significant rainfall-derived infiltration and inflow (RDII) rates were identified. These meter areas represent where cost-effective infiltration and inflow reductions can be achieved through the administration of a long-term infiltration and inflow reduction program. Reduction of such flows preserves and improves the performance in the collection system. The estimated total cost of the RDII and inflow reduction projects is approximately \$36.4 million. Due to the number of metered areas showing significant RDII and the nature of sewer investigations and infrastructure rehabilitation work, completion of the recommended RDII reductions is expected to be a multi-decade effort, estimated to require up to 20-years to effectively complete.

Summary of System Performance

Based on results from the calibrated model, the collection system performance, under existing conditions, is shown in Table ES - 1, as discharge volumes throughout the system for various design events. Discharge volumes in Table ES - 1 are expressed in million gallon (MG) units. Under existing conditions, the system generally performs well, with nominal systemwide SSO volumes for the 1- and 2-year return frequency events. Starting at the 1-year return frequency event, peak flows conveyed to the WPCF are predicted to exceed 30 million gallons per day (MGD), the secondary treatment capacity at the plant. As designed, flows at the WPCF greater than 30 MGD are diverted to the Supplemental Wet Weather Treatment Facility (SWWTF) where they receive primary treatment (or equivalent) and disinfection/dechlorination before being discharged from Outfall 002. The Emergency Overflow is not predicted to discharge for any return frequency events shown in the table.

Table ES - 1. CSO Volumes by Design Storm - Existing Conditions (MG)					
6-Hour	1-Year	2-Year	5-Year	10-Year	25-Year
Systemwide SSO	0.0	0.1	0.7	1.4	3.0
Ann Street Emergency Overflow	-	-	-	-	-
Outfall 002	1.4	8.5	14.9	19.1	31.0
12-Hour	1-Year	2-Year	5-Year	10-Year	25-Year
Systemwide SSO	0.1	0.5	1.6	3.0	6.1
Ann Street Emergency Overflow	-	-	-	-	-
Outfall 002	11.4	13.5	23.3	31.3	42.4
24-Hour	1-Year	2-Year	5-Year	10-Year	25-Year
Systemwide SSO	0.1	0.5	2.0	4.1	8.8
Ann Street Emergency Overflow	-	-	-	-	-
Outfall 002	13.9	19.4	28.1	46.2	67.7



To evaluate the projected future performance of the collection system, the model was run with the full set of design storms while incorporating all the recommended improvements, including both Consent Order and Long-Term Recommendations. Table ES - 2 shows the systemwide CSO and SSO volume reduction for every design storm from the 1-year, 6-hour event through the 25-year, 24-hour event.

Table ES - 2. CSO Volumes by Design Storm - Future Conditions (MG)					
6-Hour	1-Year	2-Year	5-Year	10-Year	25-Year
Systemwide SSO	0.0	0.0	0.1	0.3	1.1
Ann Street Emergency Overflow	-	-	-	-	-
Outfall 002	0.2	0.4	1.8	3.2	6.4
12-Hour	1-Year	2-Year	5-Year	10-Year	25-Year
Systemwide SSO	0.0	0.0	0.4	1.2	3.3
Ann Street Emergency Overflow	-	-	-	-	-
Outfall 002	0.8	1.9	4.2	7.3	12.3
24-Hour	1-Year	2-Year	5-Year	10-Year	25-Year
Systemwide SSO	0.0	0.1	0.7	1.9	5.6
Ann Street Emergency Overflow	-	-	-	-	-
Outfall 002	1.0	2.5	6.1	10.8	19.8

Based on the future conditions model results, the Master Plan recommended improvements are predicted to yield a significant further enhancement of the overall performance of the City's collection system.

Section 1

Introduction

The purpose of this Master Plan update is to assess the existing conditions and performance of the collection system and to develop a system-wide approach that enhances the level of service provided by the collection system.

1.1 Regulatory Requirements

Prior to the execution of the Consent Order, the City retained Brown and Caldwell (BC) to update the City's Collection System Master Plan (Master Plan). The Master Plan update was authorized by the WPCA to better understand and assess the collection system performance and needs for future enhancements.

This Master Plan update has been developed in satisfaction of the City's Consent Order, dated May 6, 2022, with the Connecticut Department of Energy and Environmental Protection. The Consent Order, in its entirety, is provided in Appendix A.

In accordance with Paragraph B.3 of the Consent Order, this Master Plan update has evaluated a range of viable and cost-effective measures to 1) remove excess flows, such as inflow/infiltration, from entering the collection system; and 2) eliminate the Ann Street Emergency Overflow (Emergency Overflow) from the collection system.

Section 2

Baseline Conditions

The City's collection system was originally constructed as a combined system, designed to convey both sanitary sewage and storm water during wet weather flow events. Prior to 1931, both sanitary and storm water flows were conveyed to a number of outfalls located along the Norwalk River and Harbor. In 1931, a Water Pollution Control Facility (WPCF) was constructed at South Smith Street, near Liberty Point, and flows were conveyed to the WPCF for treatment and discharge to the Norwalk River. As a designed combined system, the conveyance capacity of the collection system was regularly exceeded during wet weather flow events. During these events, the old outfalls served as high flow outfalls, providing hydraulic relief to the collection system.

As the City continued to expand, new sewers were designed and constructed as separated sanitary and storm water collection systems. Over time, the City separated portions of the existing combined collection system by constructing parallel storm drain sewers. In 1973 there was approximately 900 acres of combined sewer service area in the City. By 1979 the combined sewer service area was reduced to approximately 525 acres. Throughout the 1980s and 1990s, large scale sewer separation projects separated most of the remaining system. In 2021, 81 storm water catch basins, with a cumulative tributary drainage area of approximately 101 acres, were identified as still being directly connected to the sanitary sewer collection system.

The City's WPCF's influent pumping station (IPS) has a capacity of 95 million gallons per day (MGD), and the plant's secondary treatment train has a peak hydraulic capacity of 30 MGD. Flows in excess of 30 MGD are diverted to an on-site supplemental wet weather treatment facility (SWWTF). As designed, excess wet weather flows are diverted to the SWWTF and are discharged through Outfall 002 after receiving primary treatment (or equivalent) and disinfection/dechlorination.

2.1 Overview

Norwalk's collection system serves an approximate area of 10,625 acres and is comprised of approximately 206 miles of gravity mains, 22 pump stations, and seven miles of force mains owned by the City. The gravity mains range in size from 6 inches through 72 inches in diameter. Table 2-1 provides a list of the pump stations owned by the City and their respective pumping capacities. The locations listed in Table 2-1 represent the street address of the parcel nearest the pump station. The extent of the collection system assets is shown in Figure 2-1. During dry days, the collection system conveys an average of 12.4 MGD of wastewater to the WPCF for treatment.

Table 2-1. Sanitary Sewer Collection System Pump Station Locations and Capacities

Pump Station Name	Location	Rated Capacity (MGD)
Bell Island	33 S. Beach Drive	0.58
Bethel Street	12 Branford Street	0.26
Bouton Street	0 Bouton Street	0.92
Calf Pasture	0 Calf Pasture Beach Road	0.43
Erin Court	0 Erin Court	0.43
Five Mile River	770 Connecticut Avenue	2.59
Fort Point	10 Seaview Avenue	3.6
Fox Run	228 Fillow Street	0.14
Howard Avenue	68 Howard Avenue	1.15
Huckleberry Drive	3 Huckleberry Drive	1.73
Karen Drive	0 Karen Drive	2.59
Keeler Brook	473 Connecticut Avenue	5.33
Marvin Beach	9 River Drive	1.79
Old Trolley Way	0 Wilson Avenue	10.08
Perry Avenue	25 Perry Avenue	3.3
Red Oak Lane	9 Red Oak Lane	0.29
Sammis Street	0 Sammis Street	5.18
Shore Haven	25 Calf Pasture Beach Road	1.76
Strathmore Lane	11 Strathmore Lane	0.29
Westport Avenue	0 Westport Avenue	2.45
Winfield Street	152 Winfield Street	0.26
Woodward Avenue	167 Woodward Avenue	3.46

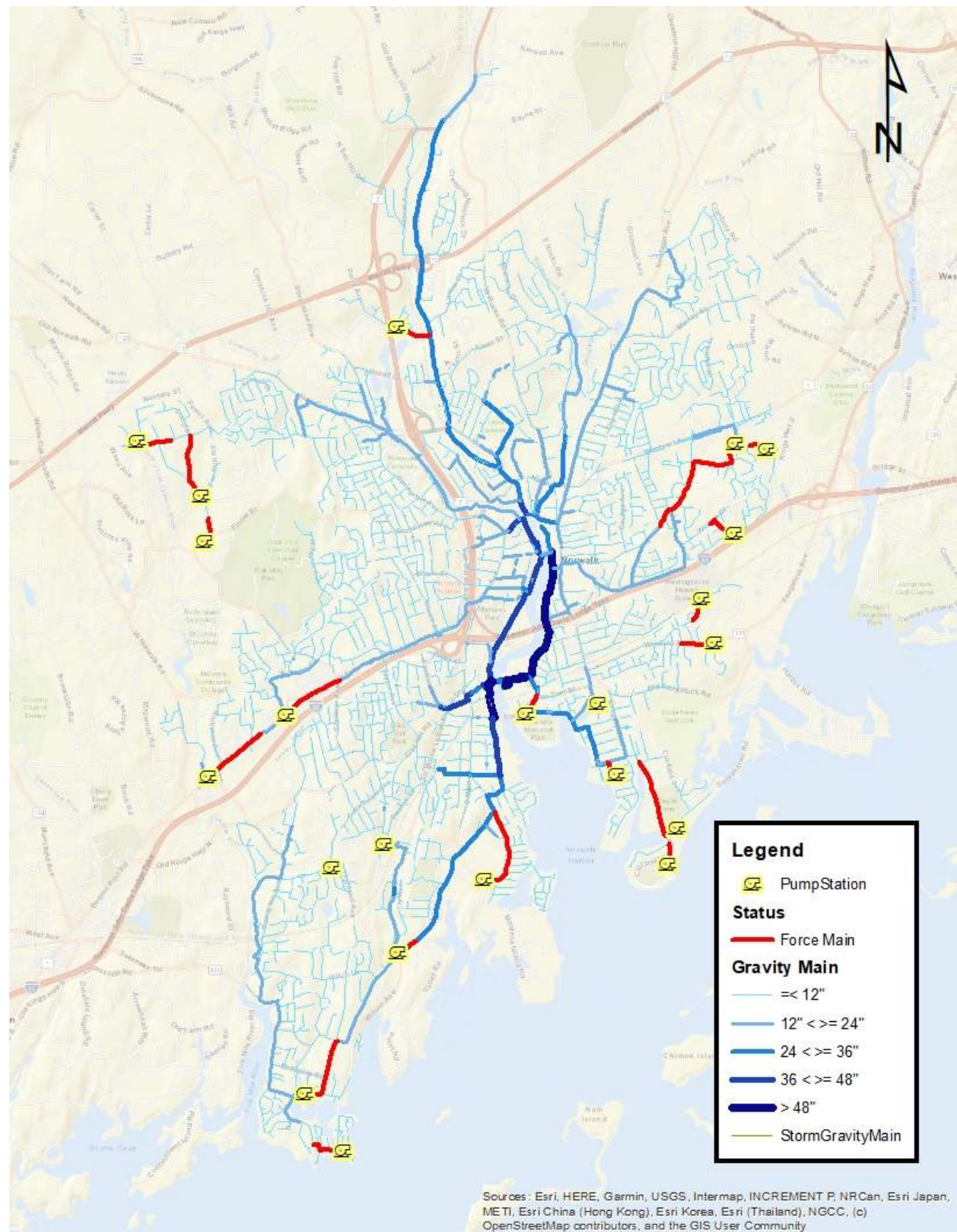


Figure 2-1. Norwalk Sanitary Sewer Collection System

2.2 Operations and Maintenance

On September 16, 2019, the City of Norwalk and Veolia Water Contract Operations USA, Inc. (Veolia) entered into a 10-year Wastewater Treatment System Service Agreement for operations, maintenance, and management of the City's wastewater treatment system. Veolia began operating the system on May 17, 2020.

Under the agreement, Veolia is responsible for the O&M of the sanitary sewer collection system, including pump stations, forcemains, pipes, siphons, and related manholes (MHs) and collection system appurtenances. Maintenance activities include TV inspection of all collection system components on a 10-year minimum cycle.

2.3 Recent Collection System Rehabilitation

In 2006, a draft Sanitary Sewer Collection System Master Plan (Original Plan) was issued for the WPCA by consultant Malcolm Pirnie, Inc. In 2009, this Original Plan was finalized using a number of new dynamic tools which allowed Malcolm Pirnie to characterize the City's collection system and identify its critical components. The WPCA used the Original Plan and its findings as a guide to address priority locations to reduce extraneous flows, alleviate capacity issues, reduce transport and treatment costs, and implement future enhancements. Beginning in 2006 and continuing through today, the WPCA has addressed a number of the recommendations in the Original Plan including interceptor rehabilitation projects and infiltration and inflow (I/I) and SSES rehabilitation projects. Some of these projects include the following:

- Fort Point (36-inch) Interceptor Replacement
- Seaview Ave (36-inch) and Cove Ave (30-inch) Interceptor CIPP Lining
- Norwalk River (48-inch) Interceptor CIPP Lining
- Beacon Street (15-inch) Interceptor CIPP Lining
- Orchard Street (24-inch) Interceptor Replacement and CIPP Lining
- Keeler Brook PS Sewer shed
- Wilton Avenue Sewer Separation
- Ann Street Siphon Chamber Rehabilitation & Tide Gates
- Beacon Street Service Area Sewer System
- Pine Point Sewer Replacement

These projects and their benefits are discussed more fully in Appendix B which discusses the diligent efforts made by the WPCA to plan and implement numerous enhancements to its collection system and infrastructure on a consistent basis over time.

2.4 Physical Characteristics of the Collection System

The City's existing Geographical Information System (GIS) was queried to assess the physical characteristics of the collection system. The collection system includes approximately 206 miles of gravity mains, 24 miles of gravity interceptors, and 6.7 miles of forcemains.

It is noted that the physical attributes of a sewer asset, including sewer pipes and MHs, such as age or material, are not necessarily an indicator of the asset's physical condition or its performance.



2.4.1 Pipe Size

Table 2-2 below shows the distribution of pipe sizes throughout the collection system. Over 88 percent of the system consists of pipes smaller than 24 inches in diameter.

Table 2-2. Pipe Size Distribution			
Diameter (in)	Length (ft)	Length (mi)	Percent of Total
6	6,431	1.2	0.6%
8	586,738	111.1	53.9%
10	115,040	21.8	10.6%
12	170,521	32.3	15.7%
14	1,568	0.3	0.1%
15	45,937	8.7	4.2%
18	36,852	7.0	3.4%
19.5	1,033	0.2	0.1%
20	7,271	1.4	0.7%
21	970	0.2	0.1%
24	33,207	6.3	3.1%
30	26,919	5.1	2.5%
31	1,243	0.2	0.1%
32	75	0.0	0.0%
36	12,010	2.3	1.1%
40	261	0.0	0.0%
41	209	0.0	0.0%
42	1,080	0.2	0.1%
43	146	0.0	0.0%
45	1,500	0.3	0.1%
45.5	518	0.1	0.0%
48	7,935	1.5	0.7%
51	28	0.0	0.0%
54	1,396	0.3	0.1%
60	5,647	1.1	0.5%
66	145	0.0	0.0%
68	81	0.0	0.0%
72	5,695	1.1	0.5%
Unknown	18,247	3.5	1.7%
Total:	1,088,703	206	100%

2.4.2 Pipe Material

Table 2-3 below shows the distribution of pipe material throughout the collection system. Most of the City's collection system consists of vitrified clay, along with large percentages of asbestos cement, PVC, and concrete pipes.

Table 2-3. Pipe Material Distribution

Material	Length (ft)	Length (mi)	Percent of Total
ACP	240,796	45.6	22.1%
Brick	8,305	1.6	0.8%
CI	693	0.1	0.1%
Concrete	149,771	28.4	13.8%
DI	7,466	1.4	0.7%
LP	11,783	2.2	1.1%
Other	67	0.0	0.0%
PVC	186,322	35.3	17.1%
VCP	460,808	87.3	42.3%
Unknown	22,692	4.3	2.1%
Total:	1,088,703	206	100%

2.4.3 Pipe Age

Table 2-4 shows a summary of pipe age and length of sewer mains that have been rehabilitated by pipe lining since 2005 throughout the collection system. The oldest sewers are generally located along the banks of the Norwalk River. These pre-1930 pipes represent 16.9 percent of the City's collection system. The majority of the collection system, 68.4 percent, was installed between 1950 and 1989. Sewer mains 50-years or older (installed prior to 1973) represent 69.3 percent of the total collection system length. Over 67,000 feet of sewer mains representing approximately 6.2 percent of the total collection system, have been lined by the WPCA.

Table 2-4. Pipe Age Distribution

Date Installed	Length (ft)	Length (mi)	Percent of Total	Lined Length (ft)	Percent Lined
1880-1889	46,007	8.7	4.2%	350	0.8%
1890-1899	23,703	4.5	2.2%	256	1.1%
1900-1909	34,240	6.5	3.1%	3,935	11.5%
1910-1919	7,224	1.4	0.7%	0	0.0%
1920-1929	40,103	7.6	3.7%	11,028	27.5%
1930-1939	45,435	8.6	4.2%	3,855	8.5%
1940-1949	34,646	6.6	3.2%	1,206	3.5%
1950-1959	207,757	39.3	19.1%	15,221	7.3%
1960-1969	176,025	33.3	16.2%	24,027	13.6%
1970-1979	194,337	36.8	17.9%	1,821	0.9%
1980-1989	117,455	22.2	10.8%	1,494	1.3%
1990-1999	27,131	5.1	2.5%	354	1.3%
2000-2009	6,369	1.2	0.6%	539	8.5%
2010-2019	2,239	0.4	0.2%	2,136	95.4%
Unknown	125,968	23.9	11.6%	818	0.6%
Total:	1,088,638	206	100%	67,040	6.2%

Section 3

Flow Metering Data

A twenty-week metering campaign was conducted from March 15 to August 1, 2021 in the City's collection system. The flow metering program was conducted to characterize dry weather flow (DWF) conditions and the flow response during wet weather flow events at various points within the collection system. The flow metering data was also used to calibrate the collection system model, described further in Section 4.

The temporary flow metering program included the installation and maintenance of a rain gage at the Broad River Fire Station and 40 flow meters at various locations throughout the collection system. Site sketches detailing the characteristics for each flow meter installation are provided in Appendix C. Locations of the flow meters are shown in Figure 3-1 and a flow meter schematic, showing the relationship between the flow meters is presented in Figure 3-2.

The temporary flow metering program was augmented by the collection of flow and level data collected at the WPCF. Flow data from a meter representing flow to the secondary treatment train was provided by the City. Flow discharged through Outfall 002 is monitored via level sensor at the WPCF grit chamber overflow weir.

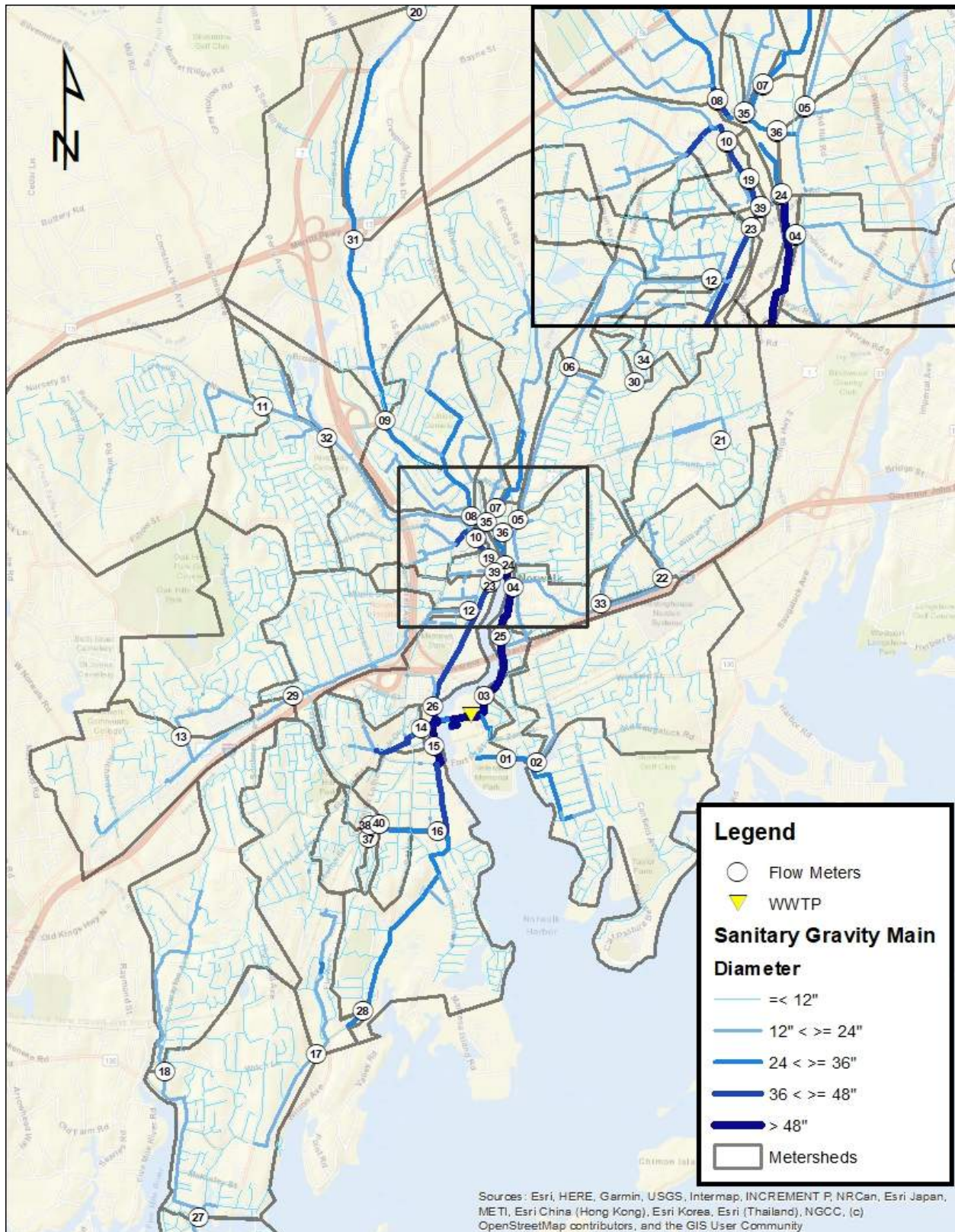


Figure 3-1. Flow Meter Locations

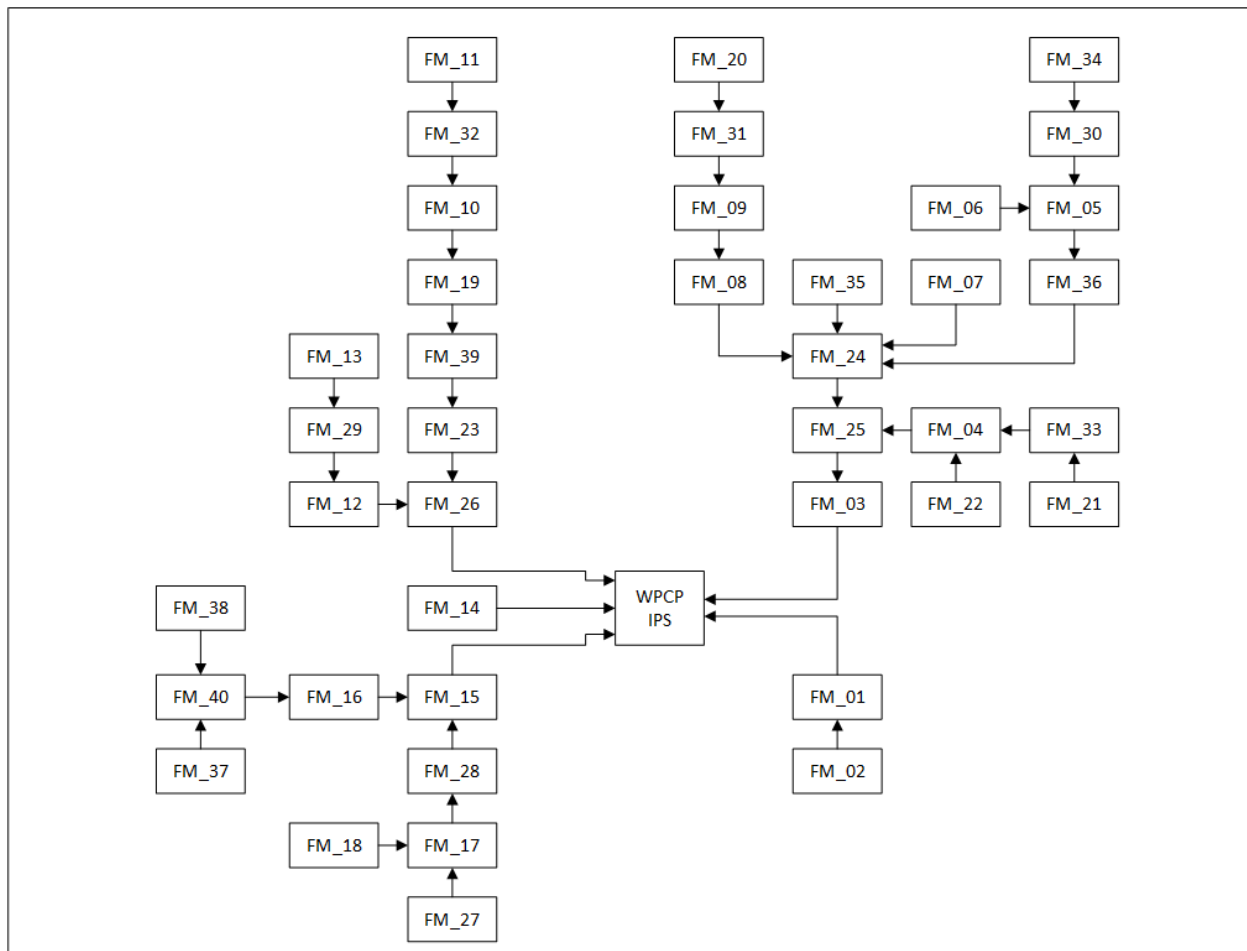


Figure 3-2. Flow Meter Schematic

3.1 Rainfall Metering Data

Rainfall was monitored using a tipping bucket rain gage capable of recording one hundredth of an inch of rain with each bucket tip. Rainfall depths were reported at a 5-minute increment timestep. Flow metering was performed using a continuously operating area-velocity flow meter. Each flow meter recorded a depth and velocity measurement at a five-minute interval. Based on the geometry of the pipe where the flow meter was installed, the depth reading is used to compute the flow area. Using the continuity equation, the flow area is multiplied by the measured velocity to calculate a flow rate at the flow meter location.

Eighteen rainfall events were identified as occurring during the metering period. A summary of the rainfall events is presented in Table 3-1. Of the identified rainfall events from the metering period, five were selected to be used as primary calibration events in the collection system model calibration.

Table 3-1. Rainfall Event Summary

Rainfall Event	Date	Duration (HRS:MIN)	Calibration Event	Total Rainfall Depth (in)	Maximum Intensity (in/hr)
1	03/18/2021	15:45	No	0.85	0.24
2	03/24/2021	08:35	No	0.65	0.24
3	03/28/2021	12:30	No	0.84	1.08
4	03/31/2021	13:10	No	0.49	0.24
5	04/11/2021	07:30	No	0.76	0.36
6	04/15/2021	12:10	Yes	1.35	0.48
7	04/25/2021	06:55	No	0.56	0.24
8	05/03/2021	02:20	No	1.54	0.84
9	05/09/2021	11:25	No	0.82	0.24
10	05/28/2021	08:50	Yes	2.77	0.48
11	06/03/2021	19:45	No	0.31	0.24
12	06/14/2021	03:30	No	0.41	1.68
13	06/19/2021	16:40	No	0.59	0.48
14	06/22/2021	04:50	No	0.49	0.96
15	06/30/2021	15:15	Yes	3.44	2.04
16	07/08/2021	08:35	Yes	5.24	2.76
17	07/12/2021	02:45	No	0.26	0.72
18	07/29/2021	07:05	Yes	1.60	4.68

The return frequency for the July 8, 2021 event (event 16) is approximately ten-years based on the Norwalk NOAA Atlas 14 precipitation frequency estimates. The return frequency of the other primary calibration rainfall events was less than 1-year. The depth-duration plots for the NOAA Atlas 14 precipitation frequency estimates and the five primary calibration rainfall events are shown in Figure 3-3.

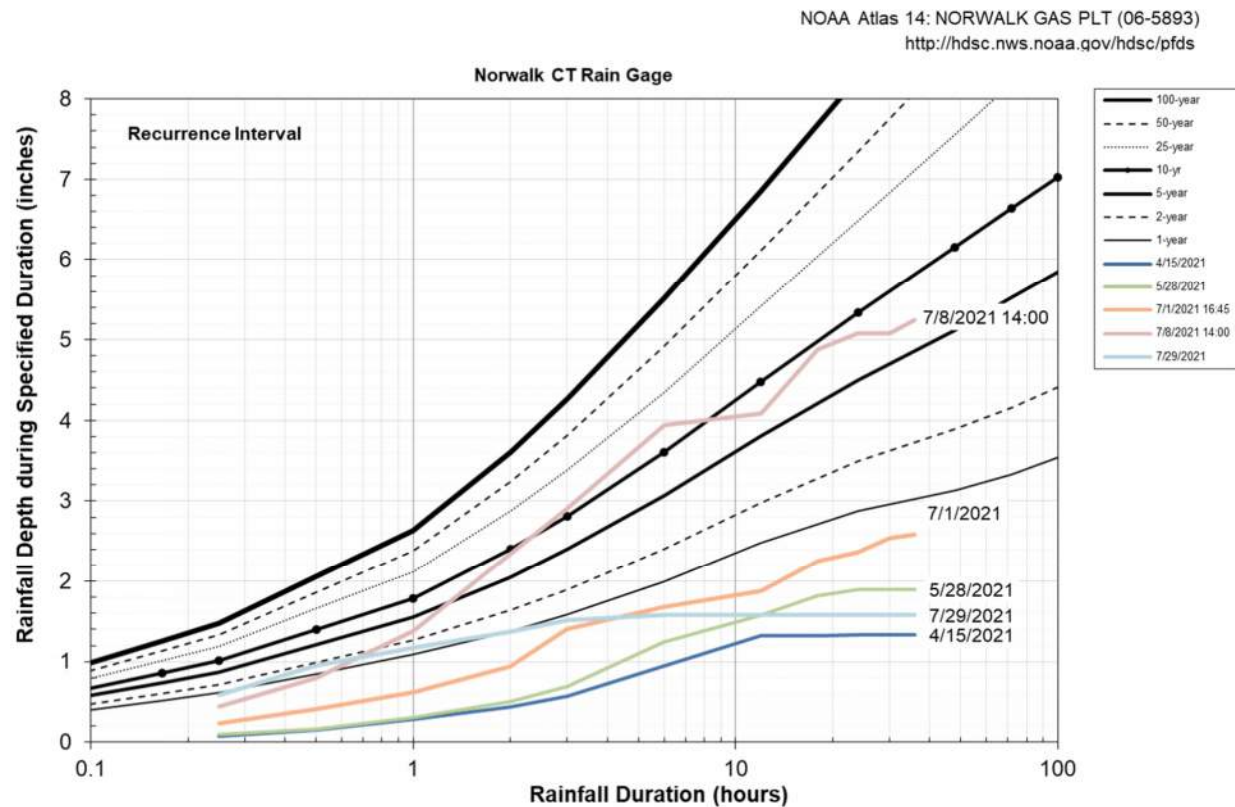


Figure 3-3. NOAA Atlas 14 and Calibration Rainfall Event Depth Duration Curves

3.2 Flow Metering Data Analysis

The collected flow metering data was reviewed and analyzed to determine average daily flow volumes, diurnal patterns, and assess infiltration and inflow response to rainfall in each metershed. A summary of the observed flows at the WPCF are presented in Table 3-2.

Table 3-2. Norwalk WPCF Flow Summary

Rainfall Event	Date	Total Rain (in)	Maximum Flow (MGD)	Minimum Flow (MGD)	Average Flow (MGD)
Average DWF	6/24/2021	0.06	14.19	5.19	10.0
1	3/18/2021	0.78	18.64	6.96	12.5
2	3/24/2021	0.48	18.91	6.82	11.7
3	3/28/2021	0.81	25.69	7.13	14.1
4	3/31/2021	0.39	19.73	8.34	12.9
5	4/11/2021	0.3	16.78	6.99	12.0
6	4/15/2021	1.32	25.35	7.71	15.3
7	4/25/2021	0.66	17.83	7.35	13.1
8	5/3/2021	0.72	15.45	6.83	11.2

Table 3-2. Norwalk WPCF Flow Summary

Rainfall Event	Date	Total Rain (in)	Maximum Flow (MGD)	Minimum Flow (MGD)	Average Flow (MGD)
9	5/9/2021	0.63	19.21	7.49	12.7
10	5/28/2021	2.85	23.14	6.12	13.4
11	6/3/2021	0.27	15.67	7.29	12.1
12	6/14/2021	0.39	20.89	6.66	11.5
13	6/19/2021	0.39	22.54	5.45	11.3
14	6/22/2021	0.45	17.97	5.37	11.0
15	7/1/2021	2.85	40.41	4.67	13.6
16	7/8/2021	5.22	76.53	5.62	27.3
17	7/12/2021	0.39	22.59	15.18	20.8
18	7/29/2021	1.14	29.99	7.46	14.0

During several wet weather flow events, surcharged conditions at some of the flow monitors were present in the flow meter data. Areas where surcharged conditions were observed in the flow monitoring data are presented in Table 3-3. Pipe surcharging during wet weather conditions provides inline storage that can reduce peak flows in the downstream portions of the system near the WPCF and Outfall 002, potentially reducing the frequency and volume of discharges from Outfall 002. During the July 8, 2021 rainfall event, the bar screens at the WPCF were blinded, and as a consequence, portions of the interceptor system experienced prolonged backwater conditions that were not induced by the flow in the collection system exceeding the conveyance capacity of the interceptor system.

Table 3-3. Flow Meter Surge Analysis

Metershed ID	Pipe Size (in)	Date	Total Rain (in)	Duration (HRS)	Maximum Depth (in)
FM_02	18	7/8/2021	5.24	11.5	40.4
FM_03	60	7/8/2021	5.24	293.9	140.6
		7/29/2021	1.60	3.1	84.5
FM_05	18	7/8/2021	5.24	0.43	29.6
FM_06	18	7/8/2021	5.24	5.5	73.1
FM_07	30	7/8/2021	5.24	1.4	43.6
FM_12	19.5	7/8/2021	5.24	0.9	21.2
FM_13	18	7/8/2021	5.24	15.1	114.8
FM_14	36	7/8/2021	5.24	1.0	53.22
FM_15	51	7/1/2021	3.44	0.1	52.0
		7/8/2021	5.24	48.9	126.2
FM_16	30	7/8/2021	5.24	1.6	64.9
FM_17	24	7/8/2021	5.24	8.1	71.5

Table 3-3. Flow Meter Surge Analysis

Metershed ID	Pipe Size (in)	Date	Total Rain (in)	Duration (HRS)	Maximum Depth (in)
FM_19	48	7/8/2021	5.24	0.6	57.2
FM_21	15	7/8/2021	5.24	6.3	81.4
		7/29/2021	1.60	0.1	16.1
FM_23	48	7/8/2021	5.24	3.8	109.9
FM_25	60	7/8/2021	5.24	254.1	152.4
		7/29/2021	1.60	0.6	66.3
FM_26	48	7/3/2021	3.44	3.4	65.2
		7/8/2021	5.24	246.6	141.12
		7/29/2021	1.60	1.6	56.5
FM_27	14	7/8/2021	5.24	36.22	123.6
FM_28	30	7/8/2021	5.24	10.2	84.8
FM_29	18	7/8/2021	5.24	19.0	24.2
FM_30	10	7/3/2021	3.44	0.3	11.8
		7/8/2021	5.24	15.7	74.6
		7/29/2021	1.60	0.8	25.4
FM_32	18	7/8/2021	5.24	5.1	79.3
FM_33	15	7/8/2021	5.24	2.2	17.1
FM_35	15	7/8/2021	5.24	1.0	21.7
		7/29/2021	1.60	0.2	22.0
FM_38	12	6/18/2021	0.59	0.1	13.1
		7/8/2021	5.24	1.6	15.4
FM_39	46	7/8/2021	5.24	3.3	103.7

3.2.1 Infiltration

Infiltration processes introduce extraneous flows from the soil column into the collection system. Water held in the soil column or pipe trench can enter the collection system through defects in MHs and sewer pipes. Peak infiltration typically occurs in spring, when the soil column is saturated and groundwater levels are highest. Peak infiltration was calculated as approximately ninety percent of the minimum nightly flow on April 18, 2021, a period in the flow monitoring record that exhibited dry weather and high groundwater conditions. Peak infiltration rates for each metershed were calculated. To allow for a more direct comparison between metersheds, the peak infiltration rates were normalized by the metershed area and by the inch-miles of sanitary sewer within the metershed area. The peak infiltration rates are presented in Table 3-4. The distribution of peak infiltration rates by metershed are shown in Figure 3-4.

It is noted that FM_23 was installed in the inlet MH to the Moodys Lane siphon which is a location subjected to turbulent flows. Review of the flow metering data indicated that data from flow meter FM_23 showed significant variations in reported flow. Data from flow meter FM_23 was deemed

invalid and was not used to assess the meter area infiltration rates and is therefore excluded from Table 3-4 and Table 3-5.

Table 3-4. Flow Meter Area Infiltration Rates

Metershed ID	Tributary Flow Meter Areas	Total Metered Flow (MGD)	Total Tributary Flow (MGD)	Metershed Area Flow (MGD)	Peak Metershed Area Infiltration (MGD)	Metershed Area Inch-Mile (in-mi)	Metershed Area Peak Infiltration Rate (gpd/in-mi)	Metershed Area (acres)	Metershed Area Peak Infiltration Rate (gpd/ac)
FM_01	FM_02	1.156	0.412	0.744	0.690	94.40	7,309	535	1,290
FM_02	--	0.412	0	0.412	0.262	81.64	3,209	546	480
FM_03	FM_25	3.412	3.021	0.391	0.098	33.35	2,939	27	3,630
FM_04	FM_22, FM_33	1.326	0.455	0.871	0.127	42.14	3,014	120	1,058
FM_05	FM_06, FM_30	0.443	0.3	0.143	0.067	88.18	760	312	215
FM_06	--	0.242	0	0.242	0.273	74.43	3,668	376	726
FM_07	--	0.257	0	0.257	0.316	96.46	3,276	648	488
FM_08	FM_09	1.412	1.076	0.336	0.005	122.07	41	356	14
FM_09	FM_31	1.076	1.014	0.062	0.187	107.81	1,735	787	238
FM_10	FM_32	0.804	0.529	0.274	0.010	91.23	110	352	28
FM_11	--	0.315	0	0.315	0.502	86.75	5,787	939	535
FM_12	FM_29	0.902	0.663	0.239	0.029	99.49	291	315	92
FM_13	--	0.610	0	0.61	0.514	81.54	6,304	452	1,137
FM_14	--	0.402	0	0.402	0.128	42.47	3,014	120	1,067
FM_15	FM_16, FM_28	2.636	1.367	1.269	1.283	159.84	8,027	601	2,135
FM_16	FM_40	0.371	0.191	0.18	0.101	27.93	3,616	50	2,020
FM_17	FM_18, FM_27	0.534	0.414	0.12	0.173	121.37	1,425	527	328
FM_18	--	0.258	0	0.258	0.174	97.34	1,788	508	343
FM_19	FM_10	0.897	0.804	0.094	0.107	20.21	5,294	21	5,095
FM_20	--	0.520	0	0.52	0.308	121.21	2,541	195	1,579
FM_21	--	0.334	0	0.334	0.170	53.55	3,175	278	612
FM_22	--	0.074	0	0.074	0.028	30.97	904	144	194
FM_24	FM_07, FM_08, FM_35, FM_36	2.659	2.634	0.025	0.310	24.65	12,576	21	14,762
FM_25	FM_04, FM_24	3.021	3.985	-0.964	0.047	21.34	2,202	15	3,133
FM_26	FM_12, FM_23	2.585	1.863	0.722	0.784	74.78	10,484	239	3,280
FM_27	--	0.156	0	0.156	0.065	28.23	2,303	141	461
FM_28	FM_17	0.996	0.534	0.462	0.043	95.20	452	410	105
FM_29	FM_13	0.663	0.61	0.053	0.085	55.27	1,538	396	215
FM_30	FM_34	0.058	0.025	0.033	0.022	9.40	2,340	35	629

Table 3-4. Flow Meter Area Infiltration Rates

Metershed ID	Tributary Flow Meter Areas	Total Metered Flow (MGD)	Total Tributary Flow (MGD)	Metershed Area Flow (MGD)	Peak Metershed Area Infiltration (MGD)	Metershed Area Inch-Mile (in-mi)	Metershed Area Peak Infiltration Rate (gpd/in-mi)	Metershed Area (acres)	Metershed Area Peak Infiltration Rate (gpd/ac)
FM_31	FM_20	1.014	0.52	0.494	0.311	64.22	4,843	334	931
FM_32	FM_11	0.529	0.315	0.214	0.007	81.04	86	360	19
FM_33	FM_21	0.381	0.334	0.047	0.086	29.48	2,917	146	589
FM_34	--	0.025	0	0.025	0.046	15.52	2,964	80	575
FM_35	--	0.304	0	0.304	0.034	25.52	1,332	120	283
FM_36	FM_05	0.661	0.443	0.218	0.235	53.83	4,366	201	1,169
FM_37	--	0.039	0	0.039	0.029	5.88	4,932	13	2,231
FM_38	--	0.045	0	0.045	0.023	6.00	3,833	19	1,211
FM_39	FM_19	0.705	0.897	0	0.000	0.92	0	2	0
FM_40	FM_37, FM_38	0.191	0.084	0.107	0.117	20.27	5,772	76	1,539

During the peak infiltration period, a total peak infiltration rate across all metershed areas was calculated at 7.9 MGD. During the same period, the average peak infiltration rate for the entire system was 3,845 gallons per day per inch-mile (gpd/in-mi). A priority ranking of peak infiltration rates, by metershed area, is shown in Table 3-5.

Table 3-5. Flow Meter Area Infiltration Rates

Priority Ranking	Metershed ID	Tributary Flow Meter Areas	Metershed Area Inch-Miles (in-mi)	Metershed Area Peak Infiltration Rate (gpd/in-mi)	Metershed Area (acres)	Metershed Area Peak Infiltration Rate (gpd/ac)
1	FM_24	FM_07, FM_08, FM_35, FM_36	24.65	12,576	21	14,762
2	FM_26	FM_12, FM_23	74.78	10,484	239	3,280
3	FM_15	FM_16, FM_28	159.84	8,027	601	2,135
4	FM_01	FM_02	94.40	7,309	535	1,290
5	FM_13	--	81.54	6,304	452	1,137
6	FM_11	--	86.75	5,787	939	535
7	FM_40	FM_37, FM_38	20.27	5,772	76	1,539
8	FM_19	FM_10	20.21	5,294	21	5,095
9	FM_37	--	5.88	4,932	13	2,231
10	FM_31	FM_20	64.22	4,843	334	931
11	FM_36	FM_05	53.83	4,366	201	1,169
12	FM_38	--	6.00	3,833	19	1,211
13	FM_06	--	74.43	3,668	376	726

Table 3-5. Flow Meter Area Infiltration Rates

Priority Ranking	Metershed ID	Tributary Flow Meter Areas	Metershed Area Inch-Miles (in-mi)	Metershed Area Peak Infiltration Rate (gpd/in-mi)	Metershed Area (acres)	Metershed Area Peak Infiltration Rate (gpd/ac)
14	FM_16	FM_40	27.93	3,616	50	2,020
15	FM_07	--	96.46	3,276	648	488
16	FM_02	--	81.64	3,209	546	480
17	FM_21	--	53.55	3,175	278	612
18	FM_04	FM_22, FM_33	42.14	3,014	120	1,058
19	FM_14	--	42.47	3,014	120	1,067
20	FM_34	--	15.52	2,964	80	575
21	FM_03	FM_25	33.35	2,939	27	3,630
22	FM_33	FM_21	29.48	2,917	146	589
23	FM_20	--	121.21	2,541	195	1,579
24	FM_30	FM_34	9.40	2,340	35	629
25	FM_27	--	28.23	2,303	141	461
26	FM_25	FM_04, FM_24	21.34	2,202	15	3,133
27	FM_18	--	97.34	1,788	508	343
28	FM_09	FM_31	107.81	1,735	787	238
29	FM_29	FM_13	55.27	1,538	396	215
30	FM_17	FM_18, FM_27	121.37	1,425	527	328
31	FM_35	--	25.52	1,332	120	283
32	FM_22	--	30.97	904	144	194
33	FM_05	FM_06, FM_30	88.18	760	312	215
34	FM_28	FM_17	95.20	452	410	105
35	FM_12	FM_29	99.49	291	315	92
36	FM_10	FM_32	91.23	110	352	28
37	FM_32	FM_11	81.04	86	360	19
38	FM_08	FM_09	122.07	41	356	14
39	FM_39	FM_19	0.92	0	2	0

Flow meter area FM_24 exhibits the highest peak infiltration rate at 12,576 gpd/in-mi. FM_24 measures flow from an area of approximately 21.4 acres and exhibits a significant increase in minimum nightly flows as compared to the cumulative minimum nightly flows measured at its upstream meters (FM_07, FM_08, FM_35, and FM_36).

Figure 3-4 shows the distribution of peak infiltration rates by metershed with an overlay of delineated wetland areas. The GIS feature class of Connecticut wetlands was obtained from the U.S. Fish and Wildlife Service website. The majority of the metersheds experiencing significant infiltration are located adjacent to or along either the Norwalk River or Norwalk Harbor. These areas are among the oldest parts of the city and have aged sewer assets. FM_11 and FM_13, located in the

northwestern portion of Norwalk, are noted as having a significant amount of wetland area in close proximity to the sanitary sewer.

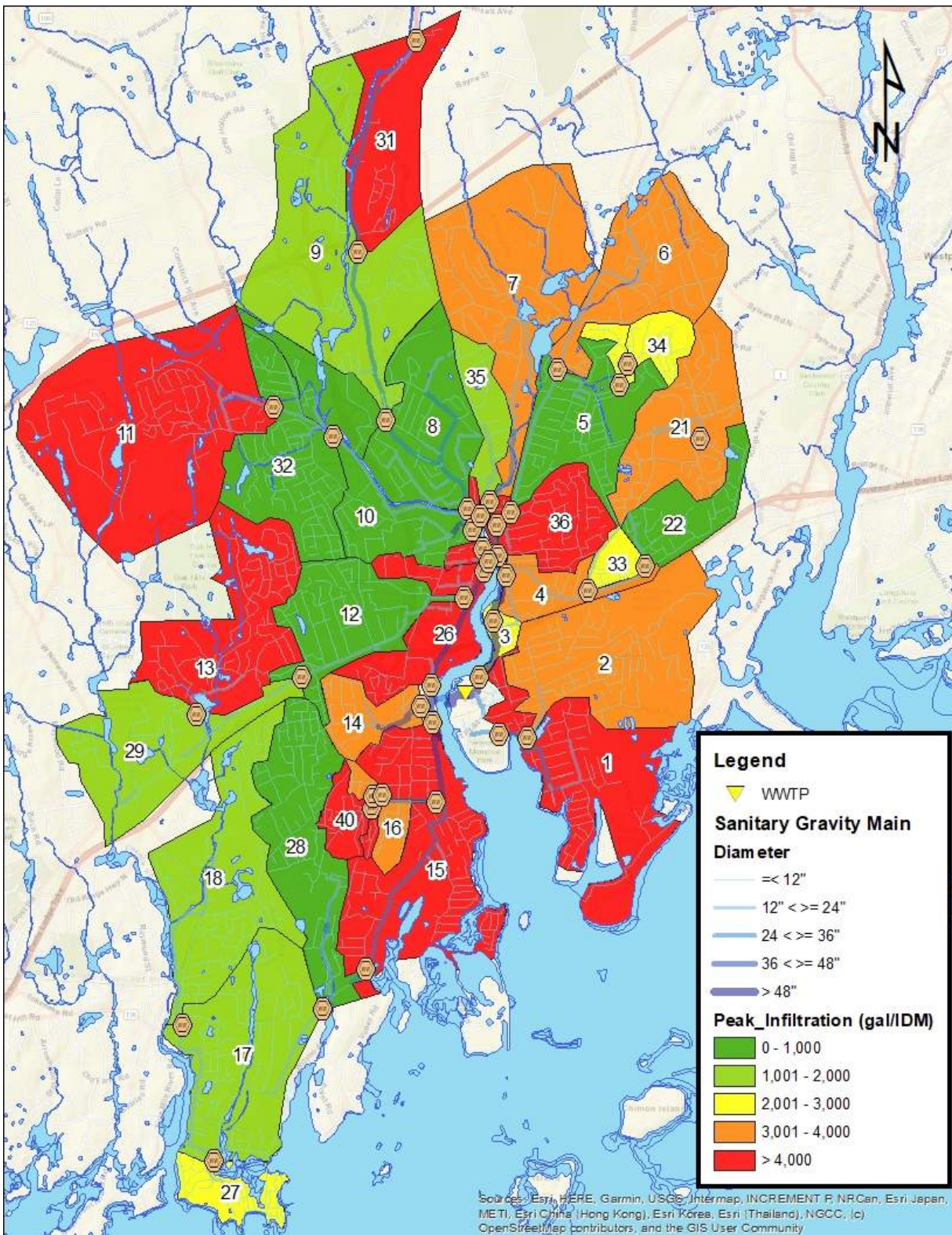


Figure 3-4. Metershed Peak Infiltration Rates

3.2.2 Rainfall Derived Inflow and Infiltration

Rainfall-derived inflow and infiltration (RDII) is extraneous stormwater, surface water, or groundwater flows which enter the sanitary collection system. Rainfall derived inflow enters the sanitary collection system through direct connections with stormwater catch basins, roof leaders, sump pumps and foundation drains, or through inundation from surface water bodies. Rainfall derived infiltration is the short-term increase in infiltration that is the direct result of rainfall. As rainfall percolates into the soil column, it may enter the pipe trench and enter the collection system through defects in sanitary sewer pipes and MHs.

Direct inflow volume was calculated as the difference between the typical DWF and the flow measured during a rainfall event. Indirect inflow volume was calculated as the difference between typical DWF and the measured flow from the end of the rainfall event until flow returns to dry weather conditions. The peak inflow rate is defined as the largest measured flow value during a rainfall event. A typical DWF pattern and volume, representing the baseflow conditions, were derived from the measured flow data for each flow meter area. The baseflow hydrograph was subtracted from the measured flow during rainfall events to determine the direct, indirect and total inflow volumes. Peaking factors for each rainfall event were calculated by dividing the peak inflow rate by the average daily DWF.

Total, direct, indirect inflow volumes, peak flow rates, and peaking factors were calculated for the five rainfall events used as the primary calibration events in the collection system model and are shown in Table 3-6, Table 3-7, Table 3-8, Table 3-9, and Table 3-10, respectively.

The April 15, 2021 rainfall event, which had a less than 1-year return frequency, produced peaking factors that ranged from a minimum of 1.3 to a maximum of 11.0 and a total inflow volume of 57.7 million gallons (MG). The May 28, 2021 rainfall event, which also had a less than 1-year return frequency, produced peaking factors that ranged from a minimum of 1.3 to a maximum of 10.0 and a total inflow volume of 47.7 MG. The June 30, 2021 rainfall event, which had a return frequency approaching a 1-year rainfall event, produced peaking factors that ranged from a minimum of 1.4 to a maximum of 24.3 and a total inflow volume of 44.0 MG. The July 8, 2021 rainfall event, the remnants of Hurricane Elsa, had a 10-year return frequency and produced peaking factors that ranged from a minimum of 2.1 to a maximum of 57.9 and a total inflow volume of 216.9 MG. The July 29, 2021 rainfall was a short duration high-intensity rainfall, having an approximate 2-year return frequency at a 30-minute duration. This event produced peaking factors ranged from a minimum of 1.7 to a maximum of 17.7 and a total inflow volume of 20.5 MG.

Table 3-6. Metershed Inflow Rates for the April 15, 2021 Rainfall Event

Metershed ID	Peak Inflow Rate (MGD)	Peaking Factor	Total Inflow (MG)	Direct Inflow Volume (MG)	Indirect Inflow Volume
FM_01	3.37	2.9	1.57	0.24	1.33
FM_02	1.49	3.6	0.66	0.15	0.50
FM_03	9.22	2.7	5.47	1.06	4.41
FM_04	1.67	1.3	0.92	0.23	0.69
FM_05	1.93	4.4	1.80	0.30	1.50
FM_06	0.54	2.2	0.69	0.01	0.68
FM_07	0.82	3.2	1.10	0.14	0.97
FM_08	3.79	2.7	1.62	0.47	1.15
FM_09	2.58	2.4	1.82	0.30	1.51
FM_10	2.72	3.4	1.67	0.50	1.17
FM_11	--	--	--	--	--
FM_12	2.16	2.4	1.45	0.32	1.13
FM_13	1.16	1.9	0.99	0.11	0.88
FM_14	1.35	3.3	0.13	0.12	0.01
FM_15	6.46	2.4	4.80	0.86	3.93
FM_16	1.18	3.2	0.80	0.13	0.66
FM_17	1.76	3.3	1.72	0.25	1.47
FM_18	0.56	2.1	0.15	0.08	0.07
FM_19	3.26	3.6	1.56	0.52	1.05
FM_20	1.05	2.0	0.50	0.00	0.50
FM_21	0.91	2.7	0.45	0.23	0.22
FM_22	0.16	2.2	0.23	0.06	0.17
FM_23	3.01	3.1	1.78	0.54	1.25
FM_24	8.26	3.1	5.02	1.95	3.08
FM_25	9.67	3.2	6.31	2.23	4.08
FM_26	6.80	2.6	3.64	0.74	2.90
FM_27	0.29	1.9	0.18	0.00	0.18
FM_28	2.26	2.3	2.40	0.48	1.92
FM_29	1.35	2.0	1.52	0.40	1.12
FM_30	0.29	5.0	0.28	0.10	0.18
FM_31	2.41	2.4	1.38	0.01	1.37
FM_32	1.74	3.3	0.66	0.16	0.49
FM_33	0.77	2.0	0.12	0.00	0.12
FM_34	0.28	11.0	0.10	0.00	0.10
FM_35	0.58	1.9	0.22	0.10	0.12
FM_36	2.62	4.0	2.05	0.42	1.62
FM_37	0.14	3.5	0.12	0.02	0.10
FM_38	0.24	5.4	0.04	0.03	0.01
FM_39	4.20	5.9	1.37	0.93	0.44
FM_40	0.76	4.0	0.50	0.15	0.35

Table 3-7. Metershed Inflow Rates for the May 28, 2021 Rainfall Event

Metershed ID	Peak Inflow Rate (MGD)	Peaking Factor	Total Inflow (MG)	Direct Inflow Volume (MG)	Indirect Inflow Volume
FM_01	3.02	2.6	3.04	0.87	2.17
FM_02	1.28	3.1	0.53	0.08	0.45
FM_03	4.45	1.3	4.02	0.58	3.44
FM_04	1.69	1.3	0.42	0.12	0.30
FM_05	1.78	4.0	1.70	0.19	1.51
FM_06	--	--	--	--	--
FM_07	0.62	2.4	0.77	0.01	0.76
FM_08	3.32	2.4	0.95	0.32	0.63
FM_09	1.93	1.8	0.21	0.00	0.21
FM_10	2.92	3.6	1.97	0.62	1.34
FM_11	0.90	2.9	0.78	0.12	0.66
FM_12	--	--	--	--	--
FM_13	1.03	1.7	0.59	0.03	0.56
FM_14	1.62	4.0	0.45	0.19	0.26
FM_15	6.12	2.3	5.12	0.69	4.44
FM_16	1.26	3.4	0.94	0.19	0.75
FM_17	1.31	2.4	1.12	0.02	1.10
FM_18	0.44	1.7	0.40	0.03	0.37
FM_19	2.74	3.1	1.29	0.43	0.86
FM_20	1.10	2.1	0.31	0.10	0.22
FM_21	0.74	2.2	0.28	0.09	0.19
FM_22	0.10	1.4	0.20	0.02	0.18
FM_23	2.85	3.0	1.77	0.73	1.04
FM_24	7.47	2.8	4.06	0.57	3.49
FM_25	8.49	2.8	4.36	0.89	3.47
FM_26	6.38	2.5	2.88	0.47	2.40
FM_27	0.35	2.2	0.37	0.00	0.37
FM_28	2.01	2.0	2.18	0.23	1.95
FM_29	1.15	1.7	1.32	0.23	1.10
FM_30	0.19	3.3	0.16	0.02	0.14
FM_31	1.78	1.8	0.42	0.22	0.21
FM_32	1.60	3.0	0.91	0.14	0.77
FM_33	0.65	1.7	0.10	0.00	0.10
FM_34	0.16	6.3	0.17	0.02	0.15
FM_35	0.63	2.1	0.22	0.15	0.07
FM_36	2.41	3.6	1.77	0.35	1.42
FM_37	0.19	4.7	0.13	0.02	0.12
FM_38	0.45	10.0	0.13	0.09	0.04
FM_39	5.13	7.3	1.05	0.37	0.69
FM_40	0.61	3.2	0.41	0.04	0.37

Table 3-8. Metershed Inflow Rates for the June 30, 2021 Rainfall Event

Metershed ID	Peak Inflow Rate (MGD)	Peaking Factor	Total Inflow (MG)	Direct Inflow Volume (MG)	Indirect Inflow Volume
FM_01	3.12	2.7	2.02	0.16	1.86
FM_02	3.03	7.4	1.02	0.25	0.77
FM_03	16.24	4.8	3.45	0.97	2.48
FM_04	1.80	1.4	0.22	0.18	0.03
FM_05	3.27	7.4	1.43	0.24	1.20
FM_06	--	--	--	--	--
FM_07	0.67	2.6	0.58	0.03	0.55
FM_08	6.15	4.4	1.12	0.41	0.71
FM_09	1.96	1.8	0.06	0.00	0.06
FM_10	3.97	4.9	1.51	0.65	0.86
FM_11	1.42	4.5	0.65	0.45	0.20
FM_12	2.99	3.3	1.38	0.19	1.19
FM_13	1.35	2.2	0.91	0.04	0.87
FM_14	3.56	8.9	0.75	0.46	0.29
FM_15	14.78	5.6	6.35	0.96	5.38
FM_16	2.75	7.4	1.09	0.30	0.79
FM_17	1.46	2.7	1.14	0.07	1.07
FM_18	0.63	2.4	0.49	0.02	0.47
FM_19	5.04	5.6	1.42	0.63	0.79
FM_20	0.83	1.6	0.05	0.03	0.02
FM_21	1.34	4.0	0.37	0.13	0.24
FM_22	0.19	2.5	0.14	0.02	0.12
FM_23	4.71	4.9	1.08	0.48	0.60
FM_24	--	--	--	--	--
FM_25	15.03	5.0	3.76	1.08	2.68
FM_26	11.04	4.3	2.04	0.67	1.37
FM_27	0.44	2.8	0.51	0.02	0.49
FM_28	3.61	3.6	2.78	0.35	2.43
FM_29	1.46	2.2	1.12	0.10	1.02
FM_30	0.46	7.9	0.14	0.02	0.12
FM_31	1.73	1.7	0.26	0.11	0.15
FM_32	1.69	3.2	1.32	0.11	1.22
FM_33	1.03	2.7	0.06	0.05	0.01
FM_34	0.24	9.4	0.13	0.02	0.11
FM_35	1.87	6.2	0.17	0.14	0.03
FM_36	4.97	7.5	1.86	0.49	1.37
FM_37	0.39	9.8	0.22	0.03	0.19
FM_38	1.09	24.3	0.21	0.15	0.06
FM_39	7.72	10.9	1.51	0.76	0.75
FM_40	1.71	8.9	0.64	0.17	0.47

Table 3-9. Metershed Inflow Rates for the July 8, 2021 Rainfall Event

Metershed ID	Peak Inflow Rate (MGD)	Peaking Factor	Total Inflow (MG)	Direct Inflow Volume (MG)	Indirect Inflow Volume
FM_01	--	--	--	--	--
FM_02	4.65	11.3	5.13	1.65	3.47
FM_03	40.67	11.9	20.17	5.55	14.63
FM_04	2.83	2.1	2.80	0.20	2.60
FM_05	5.29	11.9	7.71	0.90	6.80
FM_06	--	--	--	--	--
FM_07	3.28	12.7	4.11	0.45	3.66
FM_08	12.72	9.0	6.19	1.99	4.19
FM_09	5.17	4.8	2.84	0.60	2.23
FM_10	8.34	10.4	6.57	0.65	5.92
FM_11	3.91	12.4	4.22	0.41	3.80
FM_12	6.13	6.8	5.81	0.73	5.09
FM_13	3.11	5.1	5.99	0.17	5.82
FM_14	17.60	43.8	2.61	1.26	1.35
FM_15	18.68	7.1	23.01	6.04	16.97
FM_16	7.76	20.9	3.65	1.19	2.46
FM_17	4.13	7.7	6.27	1.44	4.84
FM_18	2.84	11.0	3.31	0.56	2.76
FM_19	11.17	12.5	6.86	1.07	5.78
FM_20	1.68	3.2	1.12	0.60	0.52
FM_21	--	--	--	--	--
FM_22	1.00	13.5	1.10	0.11	0.99
FM_23	5.04	5.2	1.93	0.82	1.11
FM_24	--	--	--	--	--
FM_25	38.23	12.7	19.64	5.52	14.12
FM_26	18.50	7.2	18.90	3.13	15.77
FM_27	--	--	--	--	--
FM_28	6.95	7.0	14.75	2.20	12.55
FM_29	3.80	5.7	7.10	0.54	6.56
FM_30	0.83	14.3	1.14	0.21	0.93
FM_31	4.34	4.3	2.06	0.48	1.58
FM_32	10.84	20.5	8.30	0.56	7.74
FM_33	3.46	9.1	2.15	0.63	1.51
FM_34	--	--	--	--	--
FM_35	3.66	12.1	0.76	0.50	0.26
FM_36	11.08	16.8	8.18	1.74	6.44
FM_37	--	--	--	--	--
FM_38	2.61	57.9	0.63	0.45	0.18
FM_39	17.81	25.2	9.48	2.70	6.78
FM_40	4.39	23.0	2.41	0.78	1.64

Table 3-10. Metershed Inflow Rates for the July 29, 2021 Rainfall Event

Metershed ID	Peak Inflow Rate (MGD)	Peaking Factor	Total Inflow (MG)	Direct Inflow Volume (MG)	Indirect Inflow Volume
FM_01	--	--	--	--	--
FM_02	2.81	6.8	0.33	0.07	0.25
FM_03	14.93	4.4	0.98	0.66	0.32
FM_04	2.83	2.1	3.10	0.20	2.90
FM_05	4.00	9.0	0.97	0.26	0.71
FM_06	--	--	--	--	--
FM_07	2.05	8.0	0.37	0.07	0.31
FM_08	11.14	7.9	0.98	0.38	0.59
FM_09	2.21	2.1	0.04	0.04	0.00
FM_10	5.58	6.9	0.92	0.25	0.66
FM_11	2.46	7.8	0.43	0.07	0.36
FM_12	2.82	3.1	0.37	0.10	0.26
FM_13	1.70	2.8	0.29	0.05	0.24
FM_14	3.74	9.3	0.46	0.13	0.33
FM_15	6.96	2.6	1.55	0.21	1.34
FM_16	2.23	6.0	0.19	0.05	0.14
FM_17	1.01	1.9	0.17	0.01	0.15
FM_18	0.48	1.9	0.20	0.05	0.15
FM_19	7.53	8.4	0.78	0.46	0.32
FM_20	1.04	2.0	0.14	0.07	0.07
FM_21	2.23	6.7	0.26	0.07	0.18
FM_22	0.16	2.1	0.10	0.01	0.08
FM_23	6.22	6.5	1.08	0.35	0.73
FM_24	--	--	--	--	--
FM_25	22.05	7.3	1.67	0.61	1.06
FM_26	9.81	3.8	1.23	0.36	0.87
FM_27	0.27	1.8	0.11	0.01	0.10
FM_28	1.74	1.7	0.92	0.00	0.92
FM_29	1.91	2.9	0.49	0.08	0.41
FM_30	0.68	11.7	0.14	0.04	0.10
FM_31	--	--	--	--	--
FM_32	1.95	3.7	0.41	0.13	0.28
FM_33	1.70	4.5	0.07	0.04	0.04
FM_34	0.31	12.3	0.08	0.02	0.06
FM_35	5.38	17.7	0.09	0.07	0.03
FM_36	8.76	13.2	0.89	0.31	0.58
FM_37	0.11	2.7	0.02	0.01	0.02
FM_38	0.56	12.4	0.03	0.01	0.02
FM_39	7.17	10.2	0.57	0.20	0.36
FM_40	1.41	7.4	0.07	0.02	0.05

Table 3-11 presents the priority ranking of each metershed area based on the average peak RDII inflow rates normalized by metershed area.

Table 3-11. Metershed RDII Priority Ranking						
Priority Rank	Metershed ID	Metershed Area (ac)	Average of Peak RDII Flow Rates (MGD)	Cumulative RDII Inflow Rate (MGD)	Average of Peak RDII Inflow Rates (GPAD)	Cumulative Inflow Contribution
1	FM_39 ¹	2	0.13	0.13	64,877	0.2%
2	FM_38 ¹	19	1.12	1.25	60,398	2.3%
3	FM_03 ¹	27	1.19	2.44	43,614	4.5%
4	FM_19 ¹	21	0.75	3.19	35,538	5.9%
5	FM_25 ¹	15	0.50	3.69	34,004	6.8%
6	FM_14 ¹	120	3.06	6.76	25,552	12.5%
7	FM_35 ¹	120	2.42	9.18	20,126	17.0%
8	FM_24 ¹	21	0.40	9.57	18,536	17.8%
9	FM_08 ¹	356	6.43	16.00	18,080	29.7%
10	FM_37	13	0.22	16.23	16,876	30.1%
11	FM_28 ¹	410	6.40	22.62	15,621	42.0%
12	FM_16 ¹	50	0.73	23.35	14,539	43.3%
13	FM_36 ¹	201	2.85	26.20	14,217	48.6%
14	FM_26 ¹	239	2.46	28.67	10,301	53.2%
15	FM_23	2	0.02	28.69	9,877	53.2%
16	FM_05 ¹	312	2.87	31.56	9,195	58.5%
17	FM_33 ¹	146	1.23	32.79	8,410	60.8%
18	FM_30 ¹	35	0.26	33.05	7,495	61.3%
19	FM_32	360	2.11	35.16	5,851	65.2%
20	FM_22 ¹	144	0.78	35.94	5,418	66.6%
21	FM_12	315	1.37	37.31	4,353	69.2%
22	FM_02 ¹	546	2.29	39.60	4,206	73.4%
23	FM_21 ¹	278	1.16	40.76	4,165	75.6%
24	FM_15	601	2.41	43.17	4,017	80.1%
25	FM_20	195	0.60	43.77	3,058	81.2%
26	FM_13	452	1.31	45.08	2,904	83.6%
27	FM_18	508	1.25	46.33	2,468	85.9%
28	FM_27	141	0.35	46.68	2,459	86.6%
29	FM_11	939	2.24	48.92	2,381	90.7%
30	FM_29	396	0.90	49.82	2,282	92.4%
31	FM_10	352	0.73	50.55	2,064	93.7%
32	FM_34	80	0.16	50.70	1,955	94.0%
33	FM_07	648	1.11	51.82	1,718	96.1%
34	FM_31	334	0.47	52.28	1,396	97.0%
35	FM_06	376	0.49	52.77	1,305	97.9%
36	FM_01	535	0.62	53.40	1,168	99.0%
37	FM_04	120	0.11	53.51	898	99.2%

Table 3-11. Metershed RDII Priority Ranking

Priority Rank	Metershed ID	Metershed Area (ac)	Average of Peak RDII Flow Rates (MGD)	Cumulative RDII Inflow Rate (MGD)	Average of Peak RDII Inflow Rates (GPAD)	Cumulative Inflow Contribution
38	FM_09	787	0.34	53.84	429	99.9%
39	FM_17	527	0.07	53.92	142	100.0%
40	FM_40	76	0.00	53.92	0	100.0%

¹Metershed area is included in the 80 percent source group for all five rainfall events analyzed.

The average peak RDII inflow rates were calculated from the peak RDII inflow rate determined from the five rainfall events used in the calibration of the collection system model. An 80 percent source level is a commonly used threshold in considering significant inflow in sanitary collection systems. 24 of the 40 metershed areas account for 80.1 percent of the cumulative peak RDII flow from the rainfall events analyzed. 19 flow meter areas, denoted in Table 3-11, are included in the 80 percent source group for all five rainfall events that were analyzed.

Figure 3-5 shows the percent of the total peak RDII flow rate generated from the percent cumulative sewered area. Plotting the percent of the total RDII peak flow against the cumulative percent of sewered area shows that 80 percent of the peak RDII flow rate is generated from approximately 40 percent of the collection system tributary area.

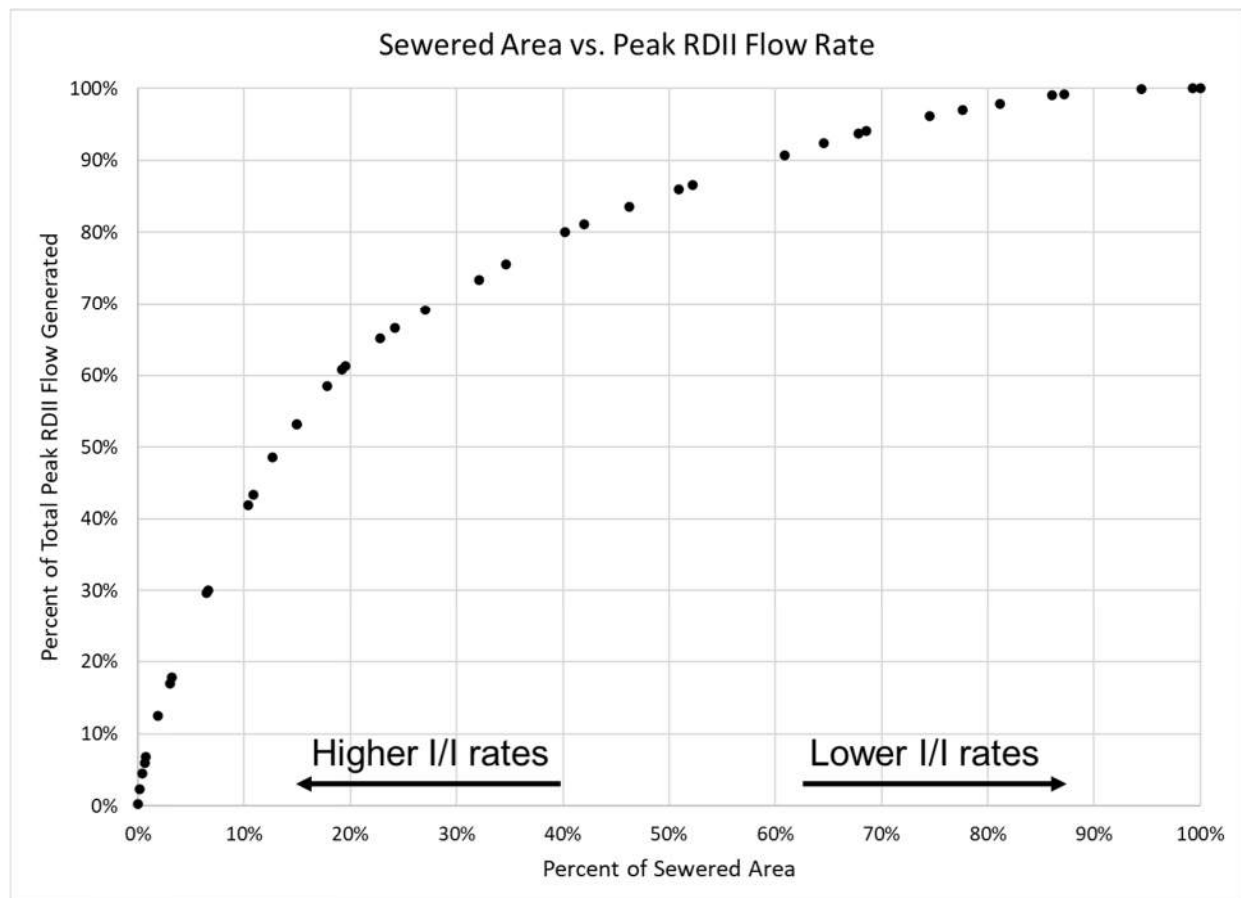


Figure 3-5. Cumulative Sewered Area vs. Cumulative Peak RDII Flow Rate

Section 4

Collection System Model

The hydraulic model represents the collection system as a series of nodes (MHs, wet wells, and outfalls) connected by links (pipes, weirs, and pumps). The model includes the east and west interceptors as well as the major trunk sewers that feed into them. The model does not contain the smaller local sewer branches that are tributary to the trunk sewers. Locations where these smaller sewers connect into the modeled pipes were generally used as flow loading locations.

Pump stations, wet wells, and forcemains were included within the hydraulic model network. Wet well dimensions, pump capacity, and start/stop set points were added using drawings and information provided by the WPCA.

Dry weather and wet weather inflows are incorporated into the model. DWFs, representative of the sanitary sewage and persistent groundwater infiltration (GWI) volumes are represented as inflows at the subcatchment outlet nodes. Temporally varying GWI was modeled as a subcatchment outflow using modeled aquifers. A total of 121 subcatchments were created within the model, generally delineating areas in the collection system where local sewers connect into the main trunk and interceptor sewers as noted above.

As noted in Section 3, several rain events from the flow monitoring period were chosen as calibration events. The observed rainfall was applied to the model subcatchments and hydrologic parameters within the model were adjusted until a good fit between the observed meter data and modeled flows and levels were achieved. Targeted calibration goals for each rainfall event are noted below:

- Peak modeled flows within +/-30% of peak observed flows
- Volume of modeled flows within +/-30% of observed volume
- Peak depth of modeled flows within +/-30% of peak depth of observed flows
- Good visual fit (timing of peak, shape of hydrograph)

The calibration targets were generally achieved for a majority of the calibration events for nearly all 40 flow meter areas. Data from flow meter FM_04 showed increases in flow between it and the upstream meters FM_33 and FM_22 which is unlikely to be accurate due to the amount of sewered area between FM_04 and the upstream meters. Calibration targets for FM_04 were unable to be achieved due to this erroneous flow meter data.

4.1 Collection System Model

A computer model of the City's wastewater collection system was developed using the PCSWMM software, developed by Computational Hydraulics, Inc. The collection system model was developed and used for analysis of existing conditions and to support modeling of potential sewer improvement alternatives and future conditions. The collection system model includes both the east and west side interceptors and their major tributary sewers, the siphons at Moodys Lane and Ann Street, the Emergency Overflow, and all major pump stations. The model's downstream boundary is the Norwalk WPCF IPS which includes the wet well storage and pumping operations at the WPCF.

Table 4-1 summarizes the statistics of the modeled collection system relative to the City's entire sanitary collection system.

Table 4-1. Summary of Hydraulic Model Components

System Parameters	Existing Sanitary System	Model Network	Percent of Total System Included in the Model Network
Length of Collection System (ft)	1,088,703	237,874	21.8%
Pipe Diameter Range (in.)	8 - 72	8 - 72	-
Number of Pump Stations	22	11	50%

4.1.1 Hydraulic Model Development

Hydraulic model assets including pipes, MHs, pump stations, and forcemains were imported from the City's GIS dataset into the modeling software. MHs that were missing a defined rim elevation value in the City's sewer GIS dataset and were critical in the development of the hydraulic model, were identified. Rim elevation values for these MHs were assigned from a digital elevation model (DEM) obtained from the CT Environmental Conditions Line (CTECO website). MHs that were missing a defined invert elevation in the City's sewer GIS dataset and were critical in the development of the hydraulic model were marked for additional field investigation and surveying. The invert elevations for these MHs were calculated by subtracting the measured MH depth from the rim elevation. Figure 4-1 below shows the locations of MHs identified for field investigations.

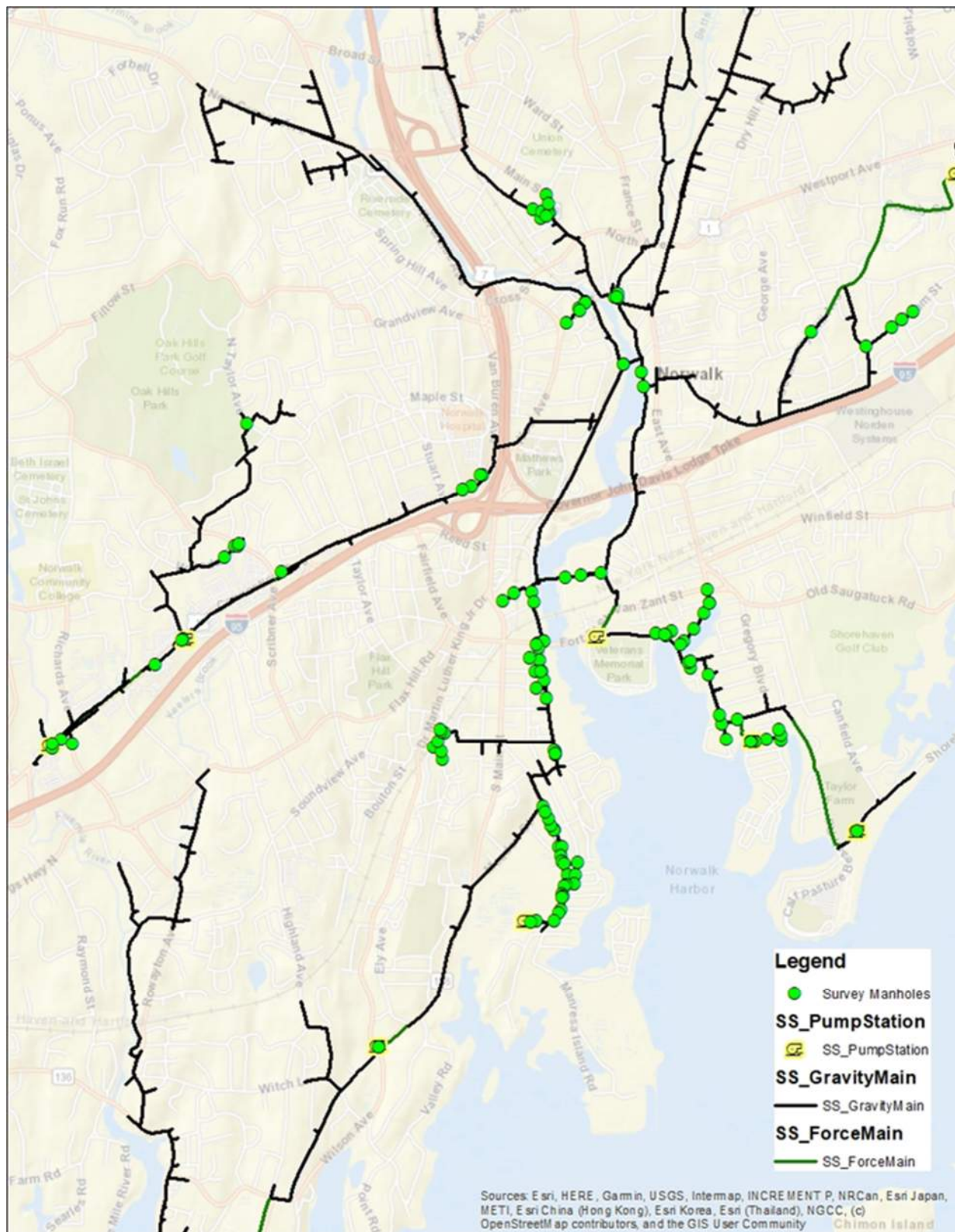


Figure 4-1. Manholes Identified for Field Survey

Missing elevation data for MHs that were located between two MHs with known elevations was assigned using length-weight interpolation, LIDAR/contour data, or a combination of the two.

4.1.2 Model Catchment Delineation

As described in Section 3 of this report, the collection system was divided into 40 metershed basins based on the location of the flow meters. A majority of these 40 flow meter basins were further divided into smaller subcatchments within the collection system model for a total of 121 subcatchments. The subdivision of the metershed basins was performed to increase the spatial resolution of flow loading to the collection system model network. Table 4-2 provides a summary of the model subcatchments.

Flow Meter Area	Number of Subcatchments	Total Area (acres)
FM_01	5	534.7
FM_02	1	545.6
FM_03	1	27.3
FM_04	2	120.0
FM_05	9	312.3
FM_06	5	375.6
FM_07	4	648.2
FM_08	4	355.6
FM_09	4	787.1
FM_10	3	351.7
FM_11	4	939.1
FM_12	7	314.7
FM_13	7	451.7
FM_14	1	119.9
FM_15	8	600.8
FM_16	1	50.0
FM_17	8	527.3
FM_18	6	507.7
FM_19	1	21.0
FM_20	1	1.0
FM_21	2	277.8
FM_22	2	143.9
FM_23	1	2.4
FM_24	1	21.4
FM_25	1	14.7
FM_26	3	239.1
FM_27	2	141.4
FM_28	1	409.6
FM_29	10	396.2
FM_30	1	34.6
FM_31	1	334.2
FM_32	4	360.3

Table 4-2. Model Subcatchment Summary

Flow Meter Area	Number of Subcatchments	Total Area (acres)
FM_33	2	146.0
FM_34	1	79.7
FM_35	1	120.3
FM_36	2	200.6
FM_37	1	13.2
FM_38	1	18.6
FM_39	1	2.1
FM_40	1	75.7
Total:	121	10,623

4.1.3 Dry Weather Flow Calibration

A dry weather period, between June 25 and June 30, 2021, was identified in the flow meter record. The dry weather period was selected because it was removed in time from rainfall events and the spring GWI rates had receded to the baseline persistent GWI rates. Flows during the period were used to determine the average daily DWF volume for each meter area. These average values were broken down further into the subcatchment loading nodes based on the proportional sewer length for that subcatchment. Diurnal patterns, for both weekday and weekend days, were derived from the flow metering data for each flow monitor metershed. The metershed specific diurnal patterns and average daily DWF volumes, inclusive of persistent GWI, were assigned to each model catchment area.

An initial model simulation was performed under DWF conditions. The results from the initial model simulation were compared against the measured flow data to assess how well the model results represented the measured flows. Where discrepancies between the modeled and measured flows were identified, the model was calibrated to improve the agreement with measured flows. The DWF calibration process involved adjusting the applied DWF volumes until a reasonable fit was achieved between the observed and modeled hydrographs for the selected DWF period.

Figure 4-1 shows an example comparison between the observed DWF meter data and the calibrated model at flow meter FM-05.

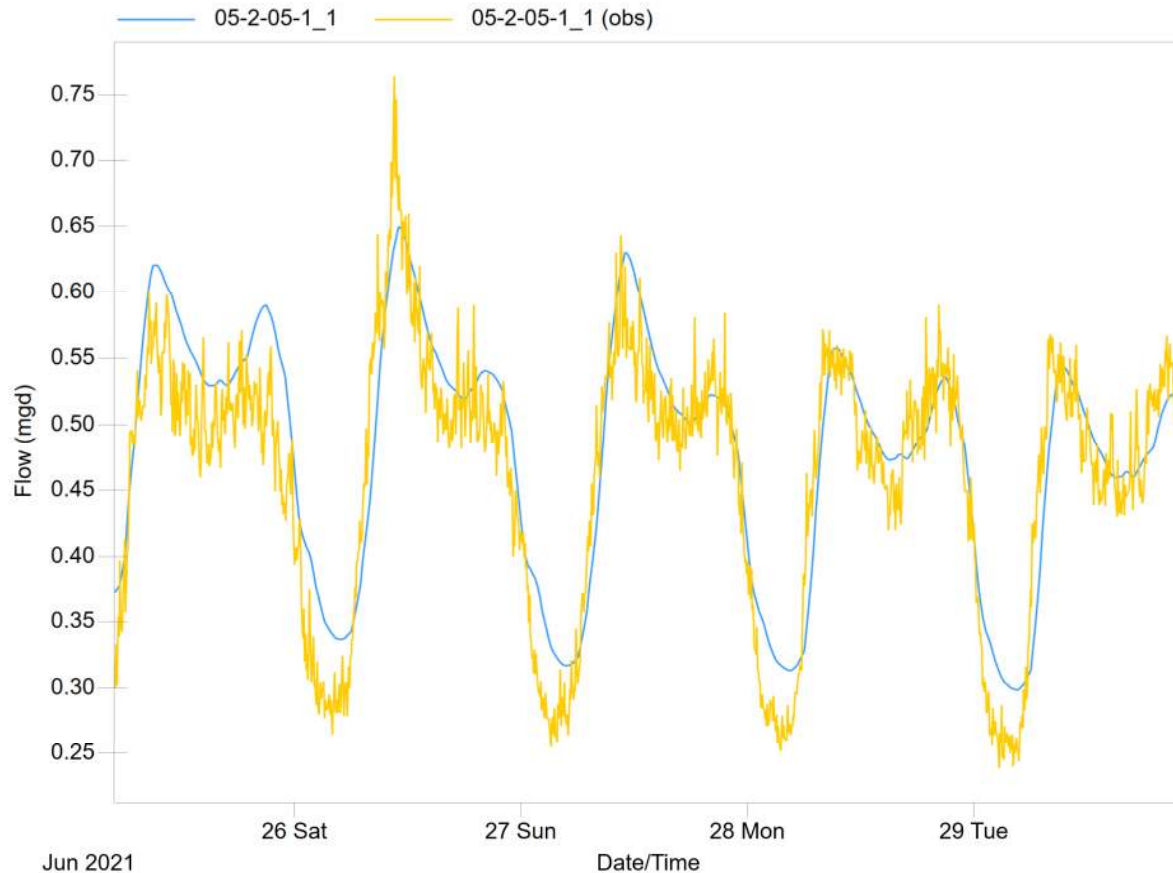


Figure 4-1. Observed vs Modeled DWF at FM-05

4.1.4 Groundwater Infiltration Calibration

In addition to the persistent base GWI that is present during both dry weather and wet weather flow periods, GWI may also increase and slowly recede back to base levels in response to rainfall events. In general, the flow meter data showed some degree of GWI increase following large rain events in almost all metersheds. This temporally varying GWI response was modeled using the SWMM groundwater routine.

Metershed specific aquifer and groundwater parameter groups were created within the model. These parameter groups were initially populated with the SWMM default parameter values and were assigned to their corresponding subcatchments within the model. A continuous simulation from March 11 to September 10, 2021 was performed. The model simulated flows, inclusive of both DWF and temporally varying GWI, were compared against measured flows during periods after rainfall events. Where discrepancies between the modeled and measured flows were identified, the model was calibrated to improve the agreement with measured flows. The GWI calibration process involved adjusting the subcatchment groundwater A1 coefficient and B1 exponent parameter values and multiple aquifer parameter values until a reasonable fit was achieved between the observed and modeled hydrographs. Figure 4-2 below shows observed flow meter data compared to modeled flows at flow meter FM_11 both with and without groundwater flows included for the July 8, 2021 calibration event. The groundwater response can be seen in the receding limb of the hydrographs, affecting both the peak and total volume of flows produced during rain events.

In general, all subcatchments within a flow meter basin were given the same groundwater parameters, though some subcatchments within certain meter basins were assigned individual parameters based on differing land use and model calibration.

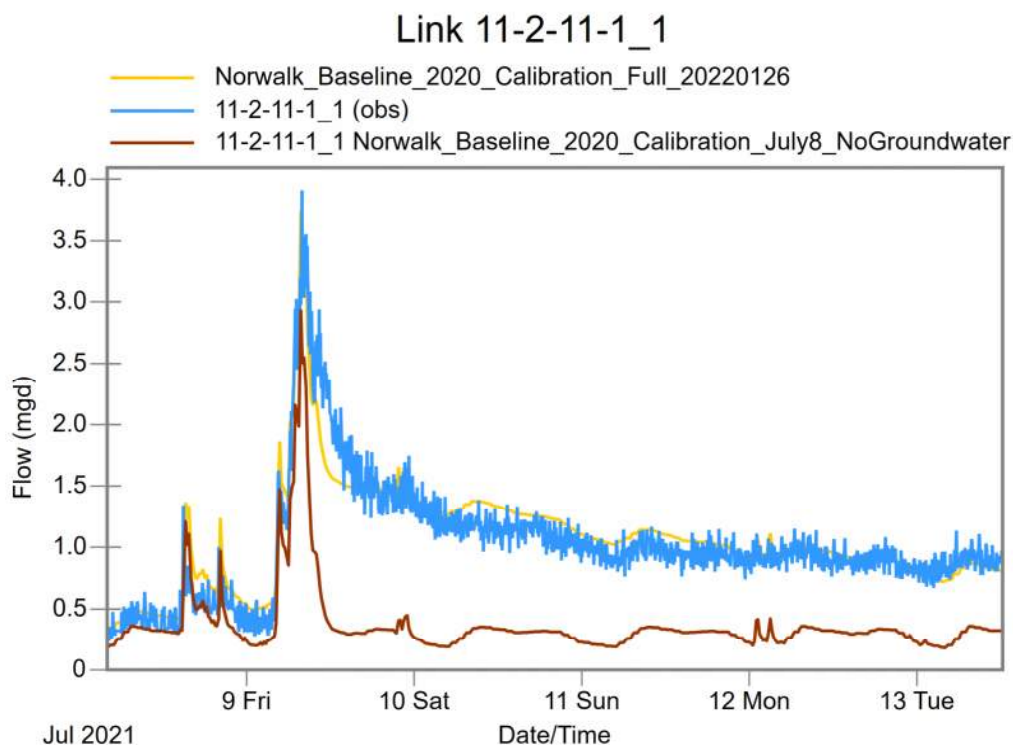


Figure 4-2. Model Flow Comparison – With and Without Groundwater Input at FM_11

4.1.5 Rainfall Derived Infiltration and Inflow Calibration

RDII is the extraneous flow that enters the sanitary collection system through either direct or indirect connections in response to rainfall. Infiltration is the extraneous flow that enters the collection system through cracks, breaks, or defects in sewer pipes, joints, or MHs. Inflow is the extraneous flow that enters the collection system through direct connections, such as directly connected catch basins or cross-connections with the storm drain system.

RDII responds directly to rainfall and peaks within minutes or hours of when the rain occurs. The model simulated RDII hydrograph volume and shape are computed using the RTK unit hydrograph approach available in SWMM. The RTK approach uses a tri-triangular unit hydrograph formulation, the parameters of which are shown in Figure 4-3.

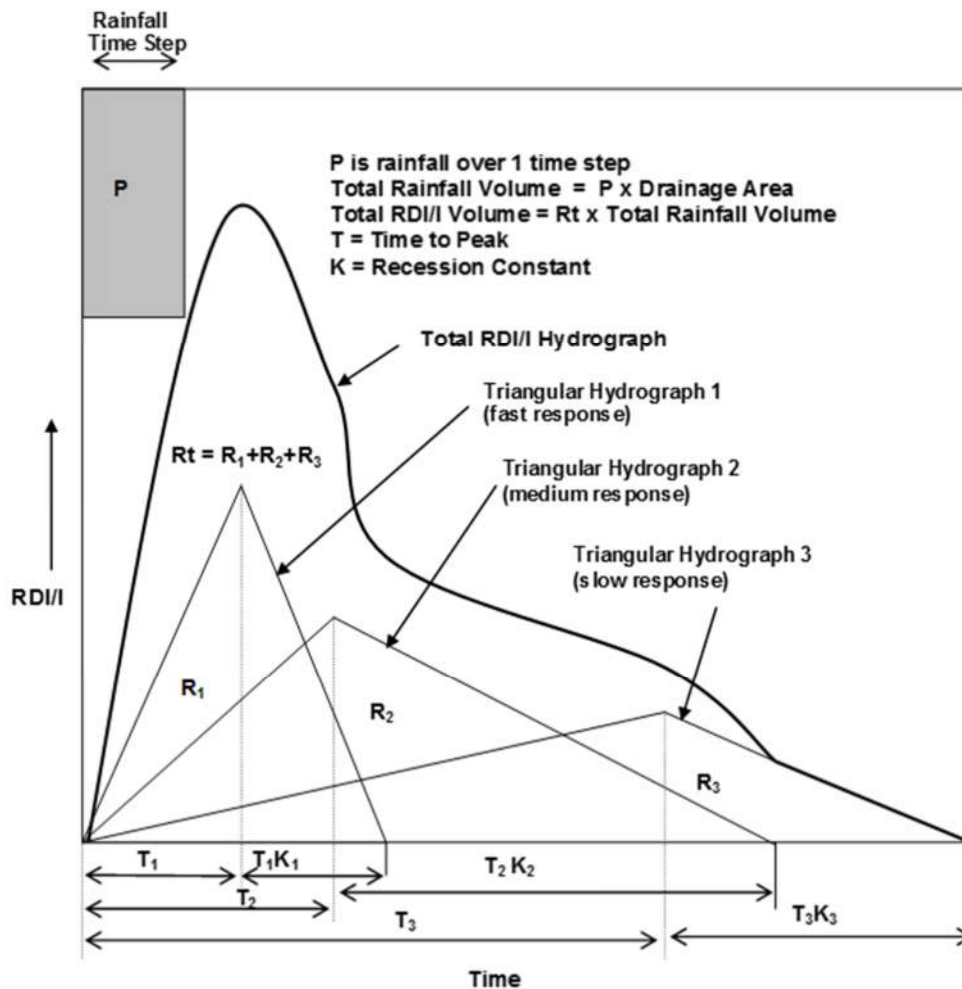


Figure 4-3. RTK Unit Hydrographs

The RTK unit hydrograph is the sum of three separate hydrographs. The R_1 , R_2 , and R_3 triangular hydrographs respectively depict the fast, medium, and slow response of RDI/I entering a collection system. The fast response hydrograph typically represents inflow components and direct connections to the sanitary system and typically have short timing parameters. The medium and slow response hydrographs typically represent the rainfall derived infiltration flow components and have longer timing parameters. Definitions for the RTK parameters are shown below:

- R – RDI/I volume
- T – Time to hydrograph peak
- K – Time to recession

RTK parameters with subscripts of 1, 2, and 3 correspond to the fast, medium, and slow response hydrographs, respectively. Figure 4-3 depicts the construction of the overall RTK hydrograph with the fast, medium, and slow response hydrographs as well.

The model simulated RDI/I flows were assigned to the loading nodes for each flow meter catchment area and were calibrated to the observed flows at their corresponding flow meter. For wet weather calibration, the rainfall hyetographs created from the precipitation monitoring data were applied

across the modeled system to generate wet weather inflows at each load point. Comparisons between the observed and simulated flow response at each meter basin for each rainfall event were made and adjustments were made to the RTK parameters until a single set of RTK parameter values for each flow meter basin produced an acceptable fit to the observed flows across all calibration events.

Figure 4-4 shows a typical modeled vs observed comparison within the collection system for a wet weather flow event. Appendix D includes the model calibration plots for all 40 flow meters.

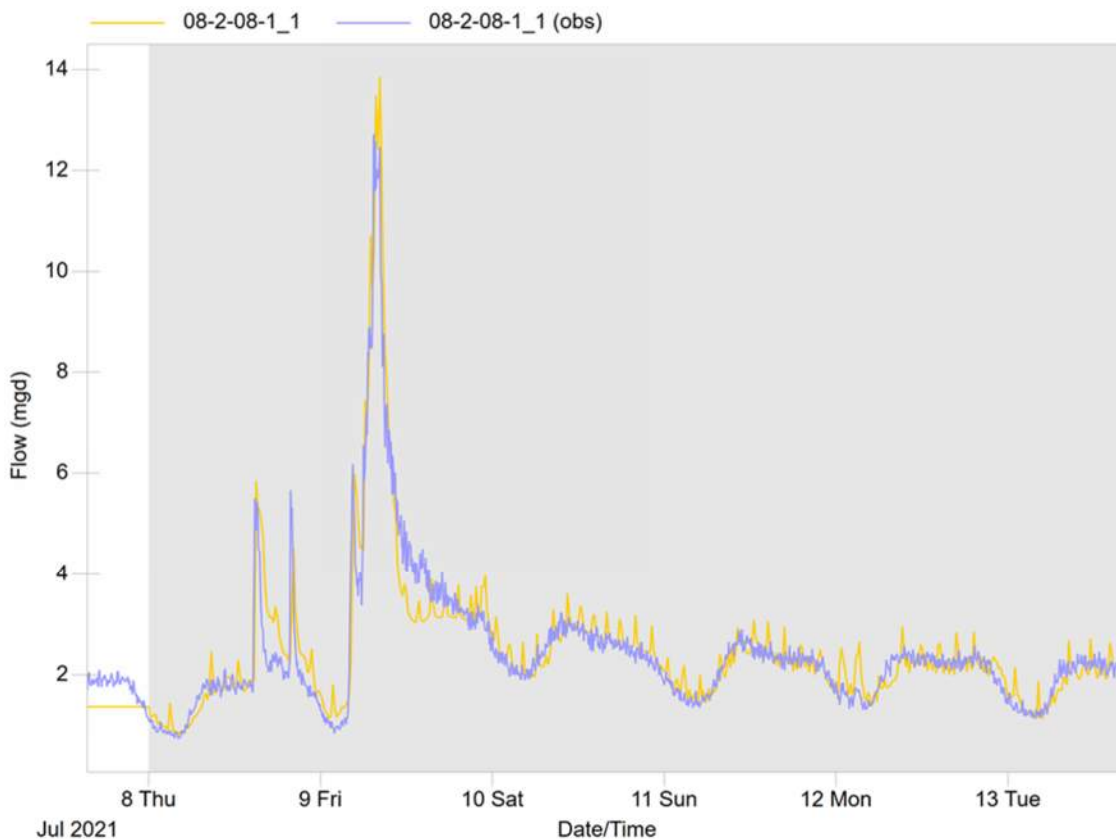


Figure 4-4. WWF Model Calibration – Modeled vs Observed Flows

4.1.6 Collection System Hydraulic Calibration

The hydrologic calibration of the model is detailed in the sections above, covering DWF, groundwater, and wet weather flow calibrations. Hydrologic calibration is concerned with flow generation within the model and the timing and volume of those flows.

Hydraulic calibration is concerned with replicating the flow routing and observed water levels and velocities that correspond to different flow rates within the collection system. Hydraulic calibration considers the following:

- System operations – e.g., pump stations, flow diversions, gates, siphons
- Flow routing – flow through the collection system network
- System head losses – minor losses as pipe friction and energy loss at MHs

- System conditions – presence of debris accumulation or flow obstructions that induce energy losses above normal expected conditions

The hydraulic calibration used the same dry weather and wet weather flow event periods as the hydrologic calibration. The DWF calibration period took place between June 25, 2021, and June 30, 2021. Five rain events were chosen as wet weather flow calibration events during the 2021 monitoring period – April 15, May 28, June 30, July 8, and July 29. These events varied in rainfall depth from 1.35 inches to 5.24 inches, and varied in peak rainfall intensity from 0.48 in/hr to 4.68 in/hr.

The following hydraulic components were added to the model and adjusted during calibration include:

- Flow control structures – siphons, weirs, flow diversions, etc.
- Pump stations and forcemains – including wet well geometry, pump curves, pump on/off levels, and forcemain roughness
- System head losses – pipe roughness factors and application of sediment/blockages

These components were added to the model using data provided by the City including GIS data, record/as-built drawings, and operations and maintenance data and manuals.

The only adjustment/addition made to the flow control structures within the model during hydraulic calibration was the addition of a flow restriction orifice directly upstream of the Old Trolley Way pump station wet well. No other flow control locations needed adjustment during calibration.

Pump curves and set points and wet well geometries were added to the model and were not changed during hydraulic calibration. Pump station flows were calibrated by adjusting the forcemain roughness parameters to match the system curve to the pump curves until a good fit between observed and modeled data was achieved.

In areas where the modeled flow depths were lower than the observed meter data, system head losses were added to the model. These head losses consisted of increased pipe roughness factors to account for the condition of the pipes and the addition of sediment or blockages to the modeled pipes to account for the higher depths present in the observed flow data. Figure 4-5 shows the locations where debris and root balls were added to model conduits during hydraulic calibration.

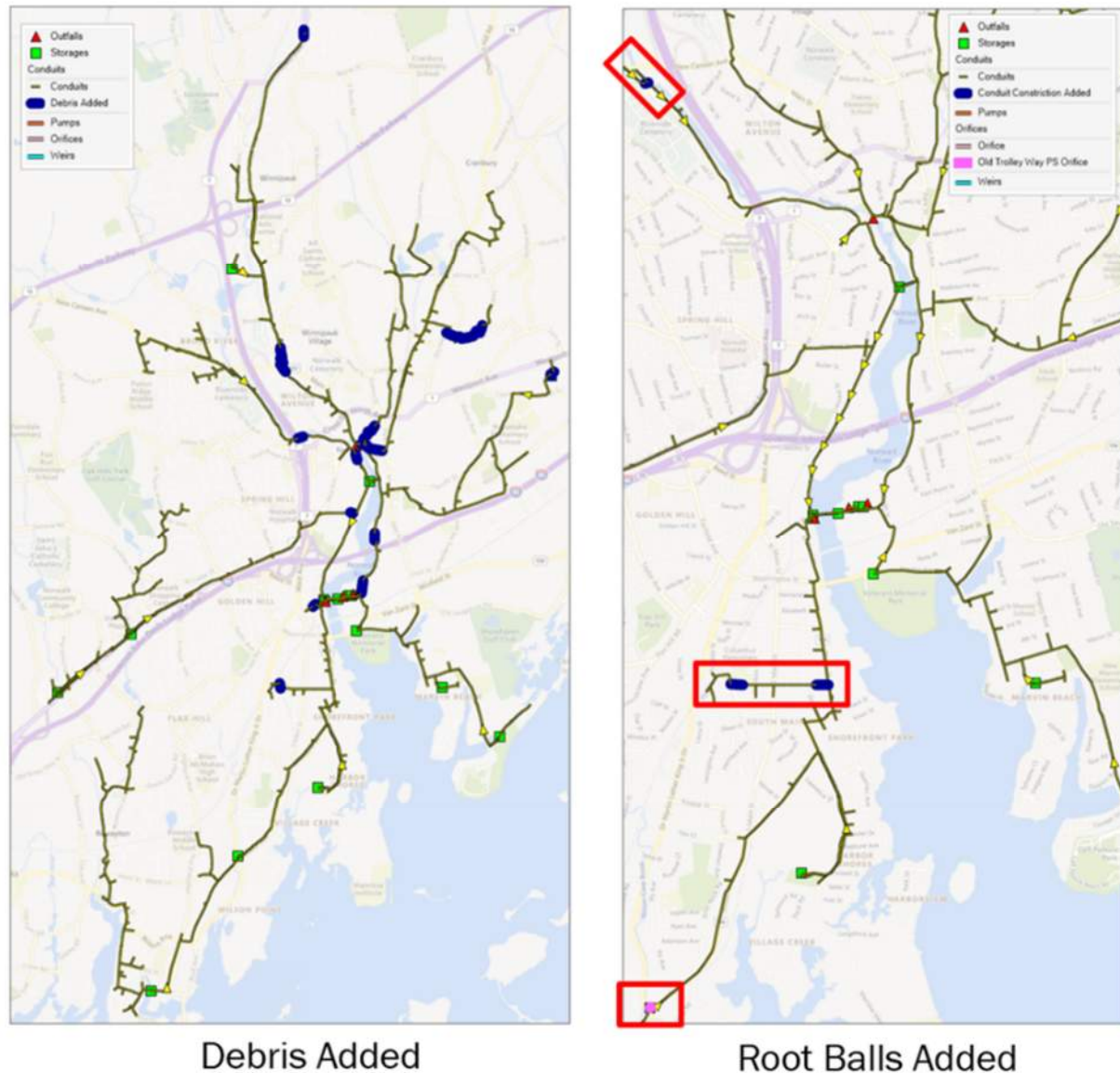


Figure 4-5. Location of Debris and Root Balls Added to Model Conduits

There were two locations/instances in which these standard hydraulic calibration adjustments were not able to provide a strong fit between observed and modeled data.

Flow meter FM_04 showed virtually no increase in flow between itself and the upstream flow meters, FM_22 and FM_33, even though there are approximately 120 acres of sewered area between the meters. Therefore, adding any wet weather flow to the FM_04 metershed during calibration would cause disagreement between the modeled and observed data. Since having no additional flow increases within 120 sewered acres is unrealistic, it was assumed that the FM_04 meter data was faulty, and RTK parameters were assigned using nearby meter areas as a general estimate.

The remnants of Hurricane Elsa impacted the system area starting July 8. During the event, a large volume of debris in the collection system was mobilized and transported to the WPCF, causing the bar screens at the WPCF to become blinded. In turn, the blinded screens backed up flows and

caused an elevated hydraulic grade line (HGL) upstream into the collection system interceptors. This hydraulic operations issue was incorporated into the model by using WPCF IPS wet well level data as the hydraulic boundary condition. This allowed the model to accurately account for the induced backwater conditions experienced within the collection system during the event.

4.1.7 Norwalk Baseline Model Summary

As described in Section 3, 40 flow meters were installed throughout the City's collection system and were installed for RDII characterization and model calibration. The calibration effort was limited to primarily large trunk sewers and major pump stations to understand the system operating levels at a planning scale.

Overall, the calibrated systemwide model results match well with the observed data from flow meter data. This calibrated model was the baseline for assessing the existing performance of the collection system and evaluating improvements to the collection system performance resulting from I/I reduction and flow management strategies.

4.2 Baseline Collection System Performance

To assess the baseline collection system performance, the model was simulated under a range of SCS Type II synthetic design storm return frequencies and durations, ranging from the 1-year, 6-hour storm to the 25-year, 24-hour storm event.

The model results were interrogated to assess system surcharge and CSO/SSO discharge characteristics. The model results from the 5-year, 6-hour design rainfall were used to characterize the RDII production rates from each flow monitored metershed. The RDII production rates were used to prioritize and evaluate the improvements in collection system performance resulting from RDII reductions as presented in Section 5.2.4 of this report.

4.2.1 Collection System Surcharging

The model results from each design storm simulation were evaluated to assess system surcharge characteristics. The percent of the model network surcharged during the peak water levels predicted by the calibrated model are presented in Table 4-3.

Table 4-3. Percent of Model Network Surcharging - Existing Conditions					
Design Storm Duration	Design Storm Return Frequency				
	1-Year	2-Year	5-Year	10-Year	25-Year
6-Hour	27%	33%	38%	45%	48%
12-Hour	32%	36%	45%	48%	53%
24-Hour	32%	38%	46%	50%	55%

During model calibration, comparison of model-simulated depth against the observed flow monitor depth indicated that the depths at some locations were consistently greater than the design conditions depth of flow based on the diameter and slope of the sewer gravity main. At these locations, debris was added to conduits during model calibration to decrease the available conveyance area and calibrate the model to better agree with the measured depth. Under the design storm simulations, pipes in these areas were predicted to surcharge during the 1-year design event,

suggesting that the blockage within the pipes could be the cause of the surcharging. Locations where debris was added to model conduits are noted below:

- From the intersection of Newton Ave. and Carlin St to the intersection of Thorn Apple Way and Assisi Way
- From the intersection of Wall St. and King St. to the intersection of Brook St. and King St.
- From the intersection of Concord St. and Chestnut St. to the intersection of Ely Ave. and Lexington Ave.

Additionally, the model shows consistent surcharging in both the local lines and interceptor in the Wall St./Smith St. area. The diameter of the interceptor here is 36-inches and it receives flow from three upstream trunk sewer lines – two 36-inch diameter lines and a 15-inch diameter line. The interceptor here appears to be undersized for the amount of upstream flow it receives.

4.2.2 Collection System Overflow Characterization

After model calibration was complete, SCS Type II synthetic design storms of different durations and return frequencies were modeled to evaluate the collection system's existing conditions level of service and quantify the model predicted overflow volumes under existing conditions. This analysis provides baseline performance data points that can be compared against alternatives that represent potential improved future conditions. Table 4-4 below shows the CSO and SSO overflow volumes for the 6-, 12-, and 24-hour rainfall duration design storms for the 1-, 2-, 5-, 10-, and the 25-year return frequency events.

Table 4-4. CSO and SSO Volumes by Design Storm - Existing Conditions (MG)					
6-Hour	1-Year	2-Year	5-Year	10-Year	25-Year
Systemwide SSO	0.002	0.1	0.7	1.4	3.0
Ann Street Emergency Overflow	-	-	-	-	-
Outfall 002	1.4	8.5	14.9	19.1	31.0
12-Hour	1-Year	2-Year	5-Year	10-Year	25-Year
Systemwide SSO	0.1	0.5	1.6	3.0	6.1
Ann Street Emergency Overflow	-	-	-	-	-
Outfall 002	11.4	13.5	23.3	31.3	42.4
24-Hour	1-Year	2-Year	5-Year	10-Year	25-Year
Systemwide SSO	0.1	0.5	2.0	4.1	8.8
Ann Street Emergency Overflow	-	-	-	-	-
Outfall 002	13.9	19.4	28.1	46.2	67.7

As shown in Table 4-4, the calibrated model does not predict discharges from the Emergency Overflow until a rainfall larger than the 25-year return frequency design event. Two of the three most recent discharges from the Emergency Overflow (August 22, 2016 and July 8, 2021) have been caused by mechanical equipment failures and were likely not caused solely by the flows in the interceptor system grossly exceeding its conveyance capacity. The reported discharges at the Emergency Overflow that occurred for approximately 2.5-hours on September 1, 2021 to September 2, 2021 were associated with the historic rainfalls from Hurricane Ida. The rainfall depths in Norwalk associated with the Ida rainfall event exceed the 200-year return frequency. The calibrated model

predicts discharges at Outfall 002, located at the WPCF, starting with the 1-year return frequency design events indicating that flows conveyed to the WPCF exceed the secondary treatment capacity of 30 MGD during these events.

4.2.3 Ann Street Emergency Overflow Performance

Prior to the WPCA efforts to separate the collection system, when a larger percentage of the Norwalk collection system was a combined sewer service area, the Emergency Overflow provided hydraulic relief to the Norwalk interceptor system and acted as a controlled point of discharge. With the significant amounts of sewer separation Norwalk has accomplished since the 1970s, a reduced hydraulic load is placed on the interceptor system. With this reduced hydraulic load, the calibrated existing conditions model does not predict the Emergency Overflow to activate at the 25-year return frequency event. To evaluate when the Emergency Overflow would activate, additional model runs were conducted with the 50- and 100-year, 24-hour return frequency events. Model results showing the HGL at the Emergency Overflow for the 25-, 50-, and 100-year, 24-hour return frequency events are shown in Figure 4-6 below.

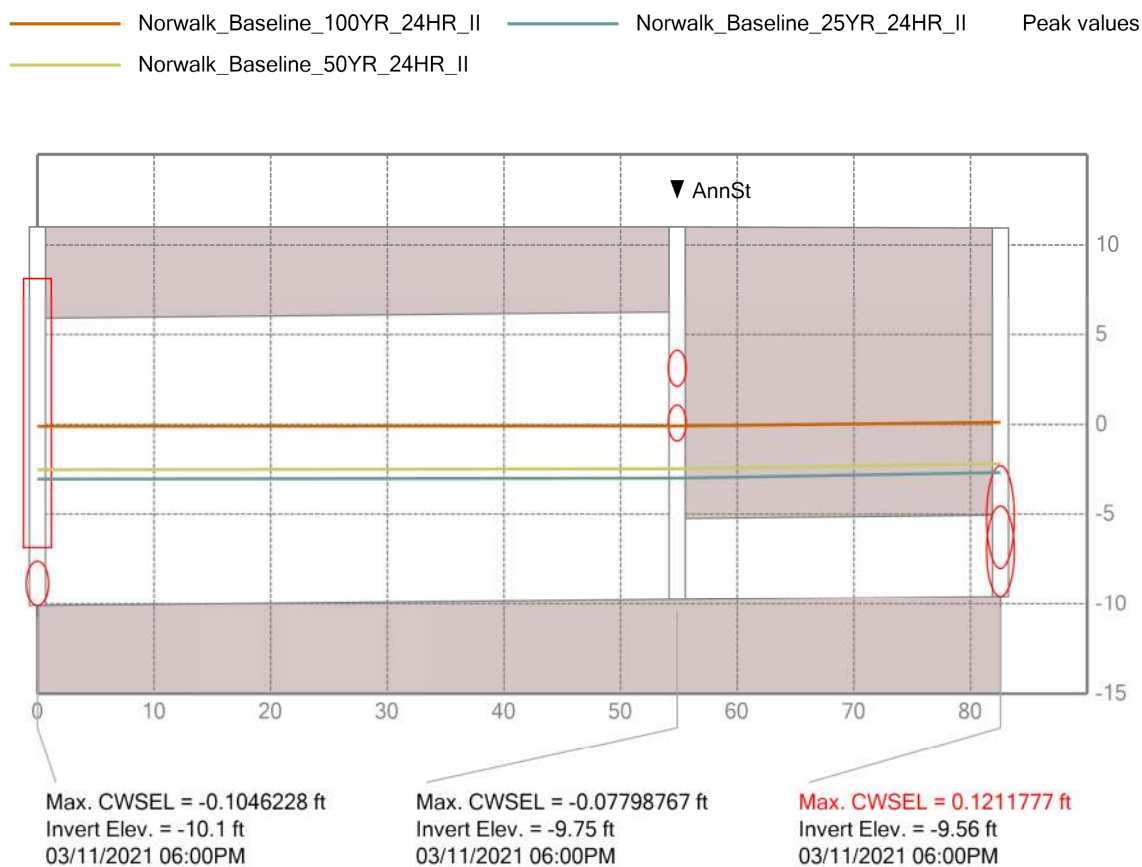


Figure 4-6. Ann Street Emergency Overflow Performance

The model predicts that under existing conditions, the collection system and the WPCF IPS has the capacity to convey and treat flows up to and including the 50-year, 24-hour return frequency events without discharging from the Emergency Overflow. During the 100-year, 24-hour event, the model

predicts that the water level in the interceptor system adjacent to the Emergency Overflow would result in a discharge from the facility to the Norwalk River.

In addition to providing the historical hydraulic relief during wet weather conditions, the Emergency Overflow has also provided hydraulic relief to the interceptor during periods of catastrophic infrastructure failure. Examples of catastrophic infrastructure failure that have been recently experienced by Norwalk include decreased pumping capacity at the WPCF IPS, gate opening failure due to operator error on the east side of the Ann Street Siphon, and blinding of the WPCF headworks bar screens. In each of these scenarios, the conveyance to the WPCF has been limited, resulting in surcharging of the interceptor system, and eventually, a discharge from the Emergency Overflow. Recently, the WPCA implemented additional engineering and administrative controls further reducing the likelihood of discharge from the Emergency Overflow. To evaluate the impacts of a permanent closure of the Emergency Overflow in the event of a catastrophic infrastructure failure, calibrated model simulations were performed using the 25-year, 6-hour return frequency rainfall event for the following conditions:

- Influent Control Gate at 42-inch barrel of Ann Street Siphon in closed position during wet weather flow event
- WPCF IPS operating at reduced capacity (4 of 6 pumps simulated as operating)
- Influent Control Gate at 42-inch barrel of Ann Street Siphon in closed position during wet weather flow event and WPCF IPS operating at reduced capacity (4 of 6 pumps simulated as operating)

Under these conditions, it was determined that the available conveyance capacity of the Ann Street Siphon, which conveys flows across the Norwalk River, from the west side of the City to the WPCF, essentially controls the HGL in the west side interceptor. Model simulations with the WPCF IPS operating at reduced capacity did not result in discharges at Emergency Overflow up to and including the 25-year, 6-hour event, but simulations with the influent control gate at the 42-inch barrel of the Ann Street Siphon modeled in the closed position, the HGL in the west side interceptor increased until an uncontrolled SSO was predicted at MH 23-7, located in Oyster Shell Park, south of I-95. The rim elevation at MH 23-7 is approximately 4.4 feet higher than the invert elevation of the lower relief conduits at the Emergency Overflow, meaning the west side interceptor would experience a significant increase in surcharge in the event of an operational disruption. The increased surcharging also places a significant number of properties at risk for basement backup and poses an increased health and safety risk to the public. The properties identified as being at an increased risk of basement backup due to the elimination of the Emergency Overflow are shown in red in Figure 4-7.

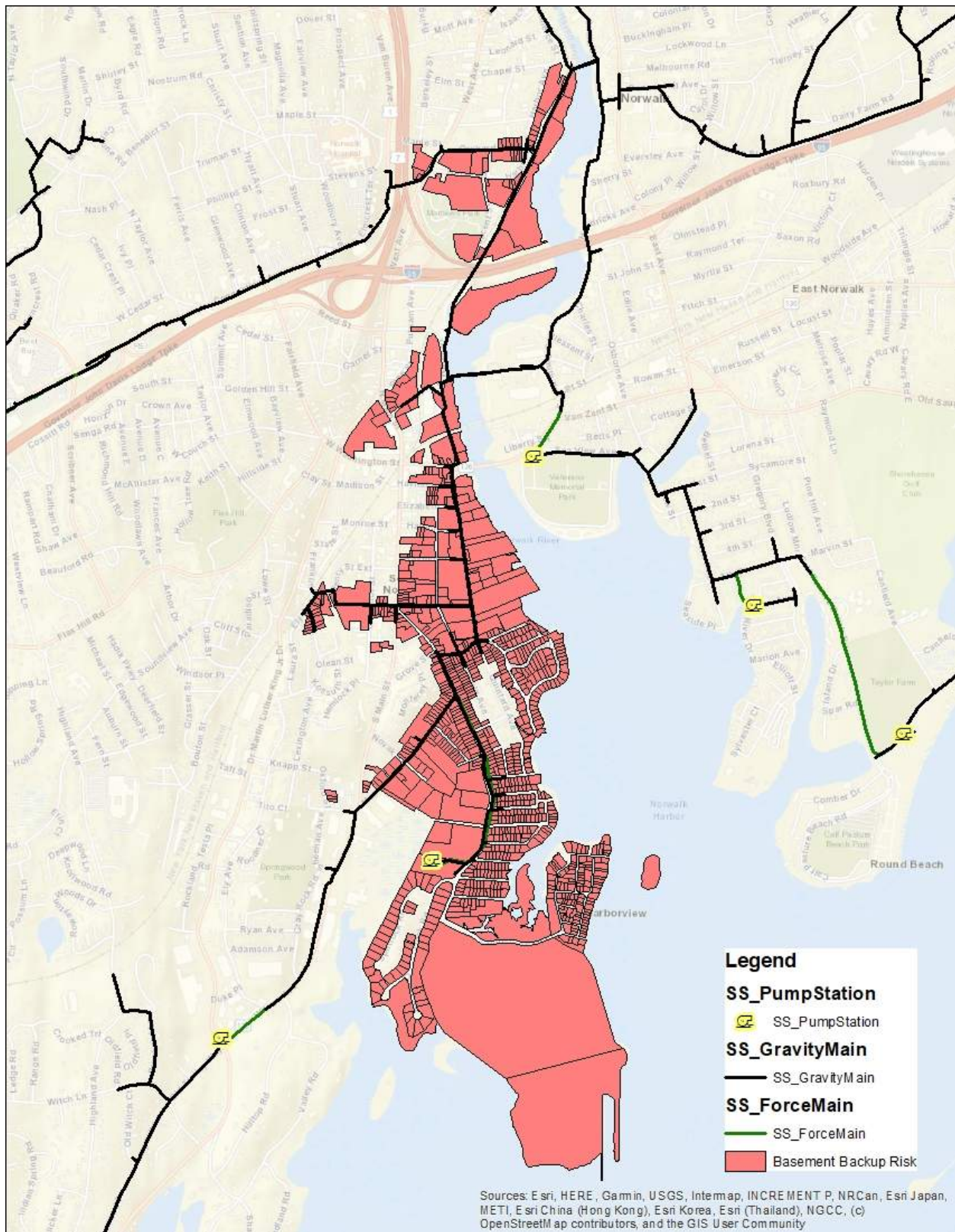


Figure 4-7. Properties at Increased Risk of Basement Backup with Ann Street Emergency Overflow Closure

4.2.4 RDII Production Rate Characterization

To assess the existing performance of the collection system and to set a baseline for comparison to any future conditions, the model was run with the 25-year 6-hour design event with all DWF generation turned off, so that only the RDII flows would be simulated. The model results were used to quantify the peak RDII flow rates from each metershed, in millions of gallons per day. These RDII flow rates were normalized by metershed area to facilitate the comparison and prioritization of RDII production rates across the collection system. Figure 4-8 shows the normalized RDII production rates by metershed in gallons per acre per day (GPAD).



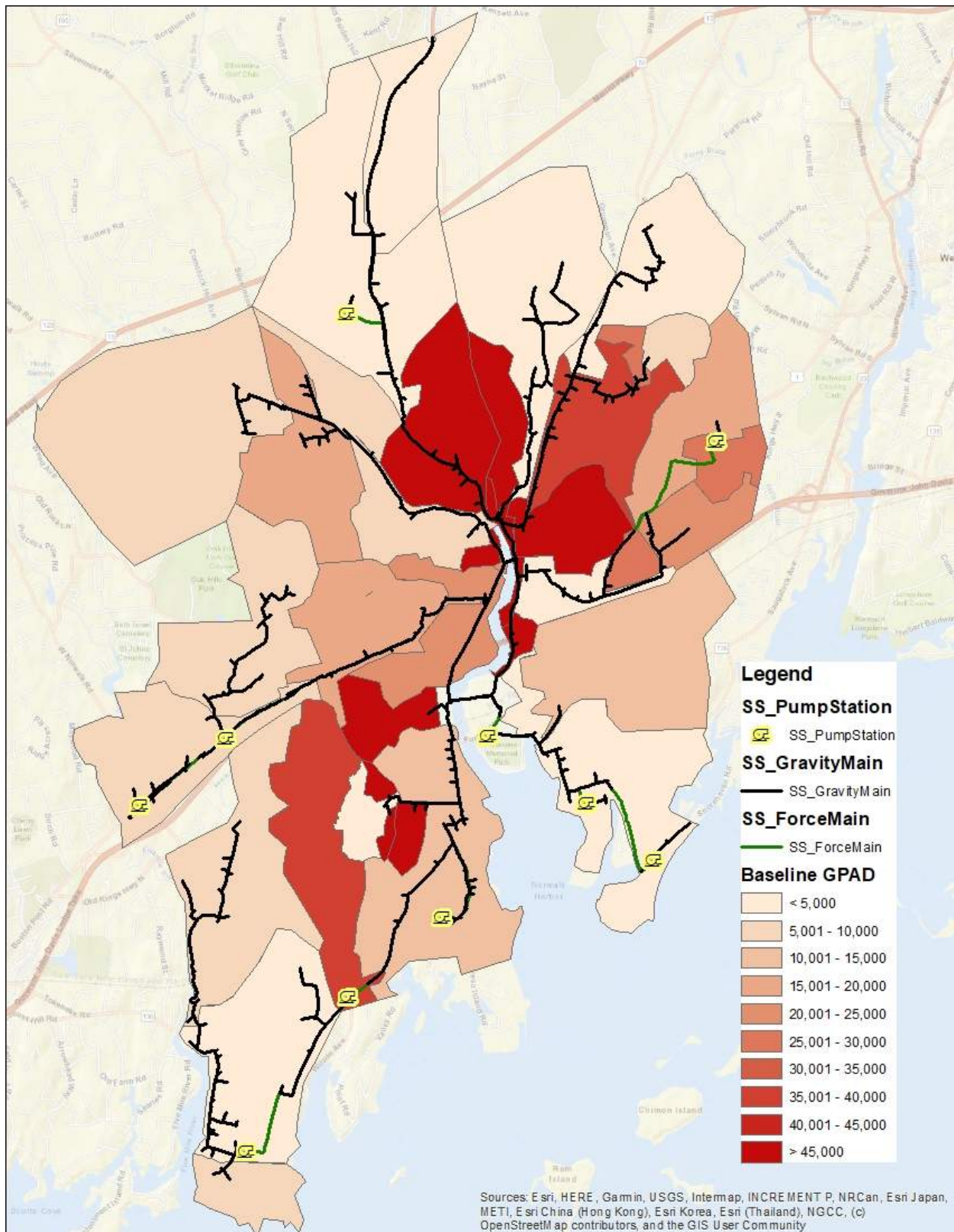


Figure 4-8. Existing Conditions RDII Production Rate by Metershed

Section 5

Collection System Flow Reduction and Flow Management Evaluation

5.1 Overview

The calibrated existing conditions model described in Section 4 was used as the starting point for the evaluation of all projected future conditions. In the modeling of all projected future conditions, it was assumed that the implementation of primary treatment, or its equivalent, at the WPCF as required by the City's May 6, 2022 Consent Order, would result in a negligible change in the hydraulics and conveyance capacity of the City's collection system.

Multiple strategies to improve the performance of the collection system and reduce SSO frequencies and volume of discharge from the collection system were evaluated. Strategies to reduce the volume of extraneous flows entering the collection system included disconnection of directly connected catch basins and the reduction of I/I from prioritized metersheds. These strategies seek to reduce the peak flows entering the collection system to levels that can be conveyed without resulting in excessive surcharging in the system.

Consistent with the current operation of the system and objectives of the City's CMOM Program, evaluated conveyance capacity improvements continued to consider allowing surcharge in the collection system to maximize storage and reduce discharges from Outfall 002. Conveyance capacity improvements to either convey or attenuate the peak flows were considered. Increased conveyance capacity through relief sewers and attenuation of peak flows using flow equalization storage at the WPCF were evaluated. Each strategy is discussed further in this section.

5.2 I/I and CSO Management Strategies

Under the existing collection system conditions, the conveyance capacity of the City's wastewater collection system is exceeded during certain wet weather flow events, leading to surcharging, MH flooding, and CSO discharges. Multiple strategies to improve the performance of the collection system and reduce the frequency and volume of SSO discharges from the collection system were evaluated. Strategies to reduce the volume of extraneous flows entering the collection system included disconnection of directly connected catch basins and the reduction of I/I from prioritized metersheds. These strategies seek to reduce the peak flows entering the collection system to levels that can be conveyed without resulting in excessive surcharging in the system. In addition to the flow reduction methods, strategies to either convey or attenuate the peak flows were also considered.

The following management strategies were evaluated, as listed below.

- Existing System Management – cleaning and maintenance in prioritized locations to maximize conveyance of wastewater to the WPCF
- Sewer Conveyance Capacity Improvements – increased conveyance capacity upgrades that alleviate identified hydraulic constrictions in the collection system at critical locations
- Storm Drainage Catch Basin Disconnection – disconnection of directly connected inflow sources to reduce excess flows from entering the collection system

- Targeted RDII Reduction – system rehabilitation in prioritized locations to reduce excess flows from entering the collection system
- Storage – use of storage at the WPCF to attenuate peak wet weather flow volumes and maximize the volume of wastewater receiving full secondary treatment

5.2.1 Existing System Management

The existing system management strategy looked at areas within the collection system where hydraulic performance could be improved by maintenance activities such as debris and root ball removal.

Using both observed flow meter data and a maintenance list provided by the City’s contract collection system operator Veolia, areas where hydraulic capacity was limited (likely due to the presence of debris or flow obstructions), were identified and incorporated into the calibrated model. As discussed in Section 4.1.6, and shown in Figure 4-5, sewer mains exhibiting limited hydraulic capacities were modeled using constricted pipe shapes, and elevated pipe roughness values. In areas of the collection system where debris and/or root balls significantly reduce the capacity of the sewer pipes, localized elevated HGLs, surcharging, and MH overflows can occur, especially during wet weather flow events.

To evaluate the improvements in collection system performance provided by removing debris and blockages from the identified pipes, the model was updated to restore the constricted pipes to their original design size and roughness values. Roughness values were changed from 0.02-0.03 to 0.01-0.013, depending on the observed hydraulic conditions.

Table 5-1 shows the change in MH overflows during the 25-year, 6-hour design event with maintenance improvements. Table 5-2 shows the differences in overflow volumes at various discharge locations during the 25-year, 6-hour design event with maintenance improvements. While performing system maintenance by removing pipe constrictions does not significantly reduce CSO volumes, it does increase system capacity and reduce MH overflows upstream of the constriction.

Table 5-1. Manhole Overflow with Maintenance Improvements

Asset ID	Baseline Overflow Volume (MG)	Overflow Volume with Maintenance (MG)	Change (MG)	Change (%)	Comment
03-109	0.01	0	-0.010	-100%	Eliminated
03-30	0.015	0	-0.015	-100%	Eliminated
03-31	0.014	0	-0.014	-100%	Eliminated
05-10	0.002	0	-0.002	-100%	Eliminated
05-264	0.001	0	-0.001	-100%	Eliminated
10-29	0.006	0	-0.006	-100%	Eliminated
16-306	0.005	0	-0.005	-100%	Eliminated
16-331.1	0.005	0	-0.005	-100%	Eliminated
16-4	0.011	0	-0.011	-100%	Eliminated
03-242	0.134	0.17	0.032	24%	Increased
05-36	0.037	0.06	0.024	65%	Increased
03-165.2	0.059	0.05	-0.005	-8%	Minor Reduction
05-110	0.018	0.02	-0.001	-6%	Minor Reduction

Table 5-1. Manhole Overflow with Maintenance Improvements

Asset ID	Baseline Overflow Volume (MG)	Overflow Volume with Maintenance (MG)	Change (MG)	Change (%)	Comment
05-257	0.014	0.013	-0.001	-7%	Minor Reduction
03-22	0.244	0.252	0.008	3%	No Change
04-94	0.044	0.044	0.000	0%	No Change
05-265	0.012	0.012	0.000	0%	No Change
08-179.1	0.015	0.015	0.000	0%	No Change
11-18	0.007	0.007	0.000	0%	No Change
12-155	0.164	0.161	-0.003	-2%	No Change
13-27	0.194	0.195	0.001	1%	No Change
15-115	1.828	1.832	0.004	0%	No Change
15-55	0.001	0.001	0.000	0%	No Change
22-3	0.004	0.004	0.000	0%	No Change
05-157	0.165	0.136	-0.029	-18%	Reduced
05-43	0.04	0.014	-0.026	-65%	Reduced
15-34	0.011	0.009	-0.002	-18%	Reduced
16-280.1	0.011	0.007	-0.004	-36%	Reduced
16-294	0.043	0.035	-0.008	-19%	Reduced
21-4	0.031	0.026	-0.005	-16%	Reduced
Total	3.15	3.06	-0.084	-3%	

Table 5-2. CSO Volume Comparison with Maintenance Improvements

	Peak Flow (MGD)			24HR Volume (MG)		
	Baseline	Existing Sewer Management	% Change	Baseline	Existing Sewer Management	% Change
Ann Street Emergency Overflow	0	0	-	0	0	-
Outfall 002	46.9	50.0	6%	30.9	31.6	2%
WPCF Total Inflow	76.9	80.0	4%	35.8	35.8	0%

5.2.2 Sewer Conveyance Capacity Improvements

As noted in Section 4.2.1 of this report, the calibrated model shows consistent surcharging in both the local lines and interceptor in the Wall St./Smith St. area. The diameter of the interceptor here is 36-inches and receives flow from three upstream trunk sewer lines – two 36-inch diameter lines and a 15-inch diameter line. The interceptor here appears to be undersized for the amount of upstream flow it receives.

The east side interceptor in the vicinity of Wall Street, Hubbells Lane, and Moodys Lane was identified as a potential area for sewer capacity improvements. At Wall Street, a large volume of flow is conveyed to the east side interceptor from the East Wall Street trunk sewer. The interceptor is 36-

inches in diameter at this location and continues at that diameter downstream to the confluence of the east side interceptor and the Moodys Lane siphon, where it increases to 60-inches in diameter. Figure 5-1 shows the existing layout of the sewer in this area.



Figure 5-1. Sewer Layout Near Hubbells Lane

The calibrated model shows MH overflows in the interceptor between Wall Street and the Moodys Lane siphon. Overflow in this location was also noted by the City in the Five Day Report for the July 8, 2021 storm event, providing further confidence in the calibration of the model. The interceptor downstream of the Moodys Lane siphon has an increased conveyance capacity due to the increased

size of the sewer pipe. The local trunk sewer on East Avenue that turns onto East Wall Street and then drops into the interceptor has the potential to be rerouted down Hubbells Lane and connected to the interceptor just downstream of the Moodys Lane siphon where the interceptor gains additional conveyance capacity due to the increase in pipe diameter at this location. The reconfiguration of the sewer in the model to evaluate this is shown in Figure 5-2.

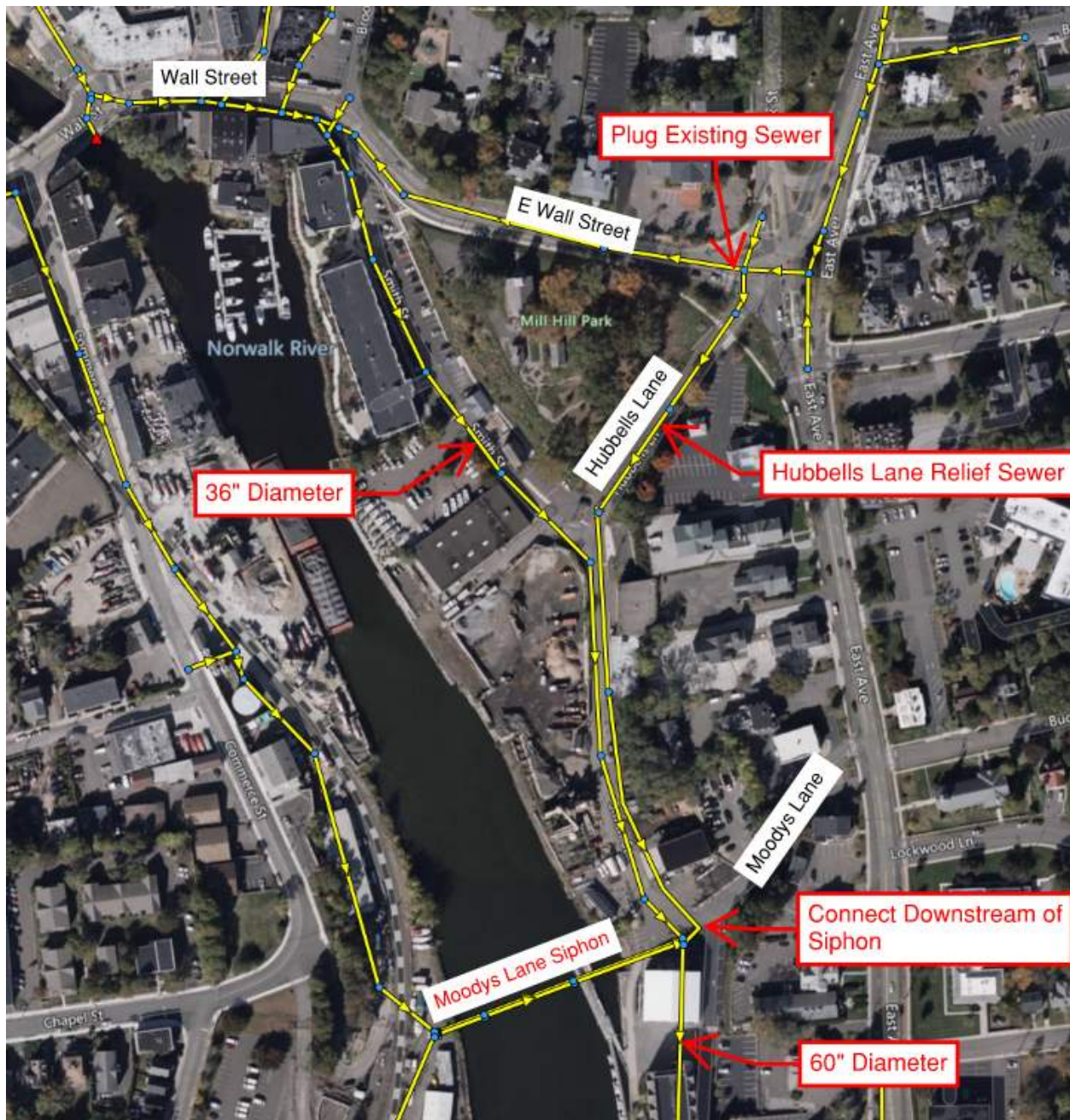


Figure 5-2. Hubbells Lane Relief Sewer Layout

The 25-year, 6-hour design storm, with the Hubbells Lane Relief Sewer included, was simulated using both the existing and future flow conditions models. The future flow conditions model includes the anticipated flow reductions resulting from the disconnection of directly connected catch basins and RDII reductions from public sewer rehabilitation. The model results, with the Hubbells Lane Relief Sewer, showed a reduction in the HGL along the east-side interceptor and elimination of MH overflow. The model predicted maximum water elevations for the existing conditions, existing flow conditions with the Hubbells Lane Relief Sewer, and future flow conditions with the Hubbells Lane Relief Sewer, are shown in Figure 5-3. As seen in Figure 5-3, the HGL reduction upstream of the siphon does not result in a significant increase in the HGL downstream of the siphon.

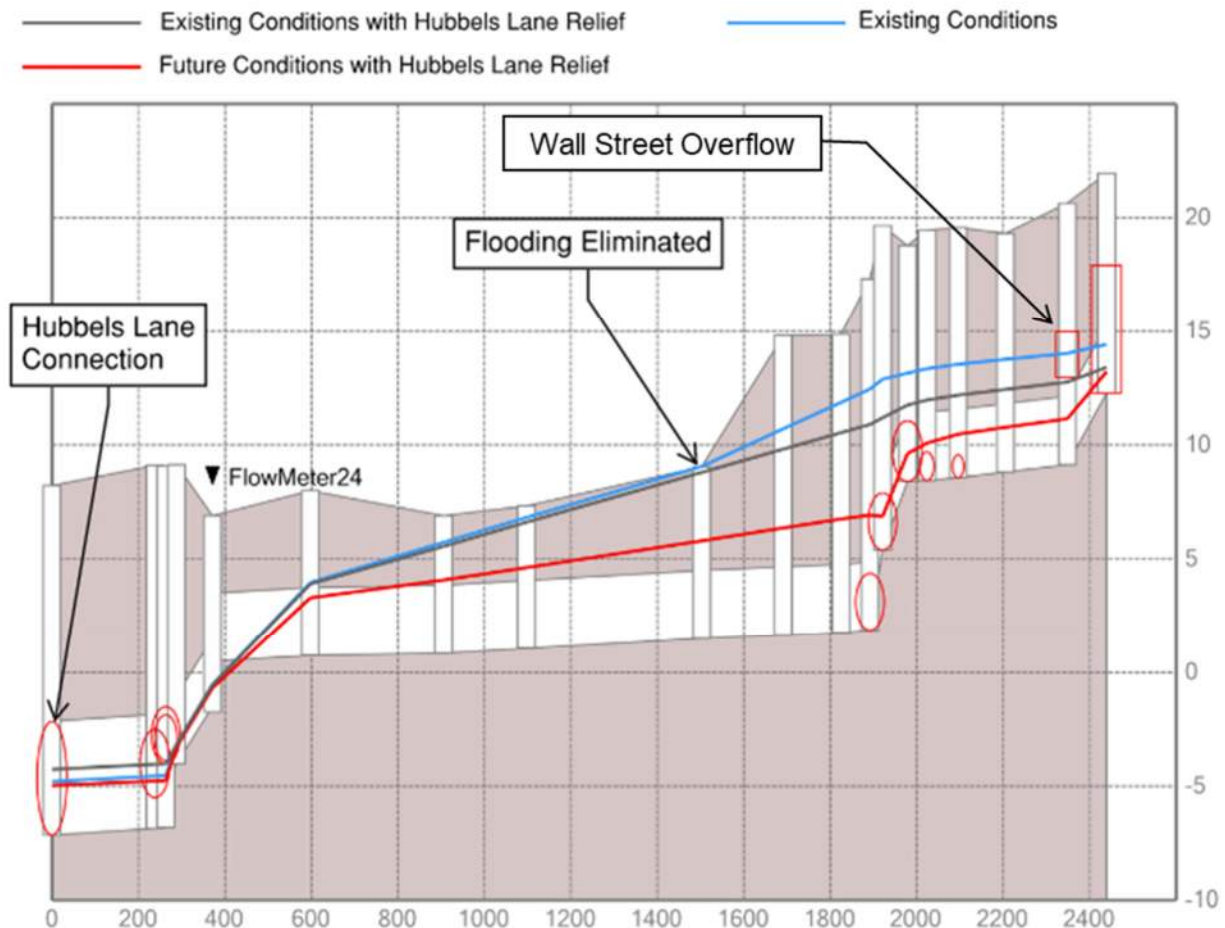


Figure 5-3. System Improvements After Hubbells Lane Relief Sewer Constructed for the 25-year, 6-hour Return Frequency Event

From Figure 5-3 it is evident that the Hubbells Lane Relief Sewer provides an immediate reduction to the HGL between MH 03-239 and MH 03-22 in the East Interceptor. This area has historically been prone to significant surcharge and SSOs. The reduction in HGL provided by the Hubbells Lane Relief Sewer reduces the amount of surcharging and the risk of an SSO event. Under the simulated future conditions, where RDII reductions are projected, the decrease in the HGL provided by the Hubbells Lane Relief Sewer further reduces surcharging. Modeling results under existing flow conditions, with the Hubbells Lane relief sewer implemented, indicate discharges at the Wall St. overflow structure

are eliminated for return frequency events up to and including the 25-year, 6-hour event. Modeling results with I/I reductions and the Hubbells Lane relief sewer implemented indicate discharges at the Wall St. overflow structure are eliminated for return frequency events up to and including the 100-year, 6-hour event.

5.2.3 Storm Drainage Catch Basin Disconnection

Through the large-scale sewer separation projects Norwalk completed in the 1970s and 1980s, the City's collection system is largely separated. While the collection system is primarily separated, 81 catch basins known to be directly connected to the wastewater collection system were identified at the outset of the development of this Master Plan. These directly connected catch basins are significant inflow sources that contribute high peak flows and RDII volumes that enter the sanitary system in very short periods of time. Inflow from these directly connected catch basins can overwhelm the conveyance capacity of the collection system adjacent to the catch basin and contribute to the high peak flows that reach the interceptor system. Disconnecting catch basins can be cost-effective relative to the amount of inflow removed, therefore identifying and prioritizing catch basins to disconnect was the second management strategy evaluated.

Figure 5-4 below shows the 81 catch basins that were identified as being directly connected to the collection system as of July 2021.

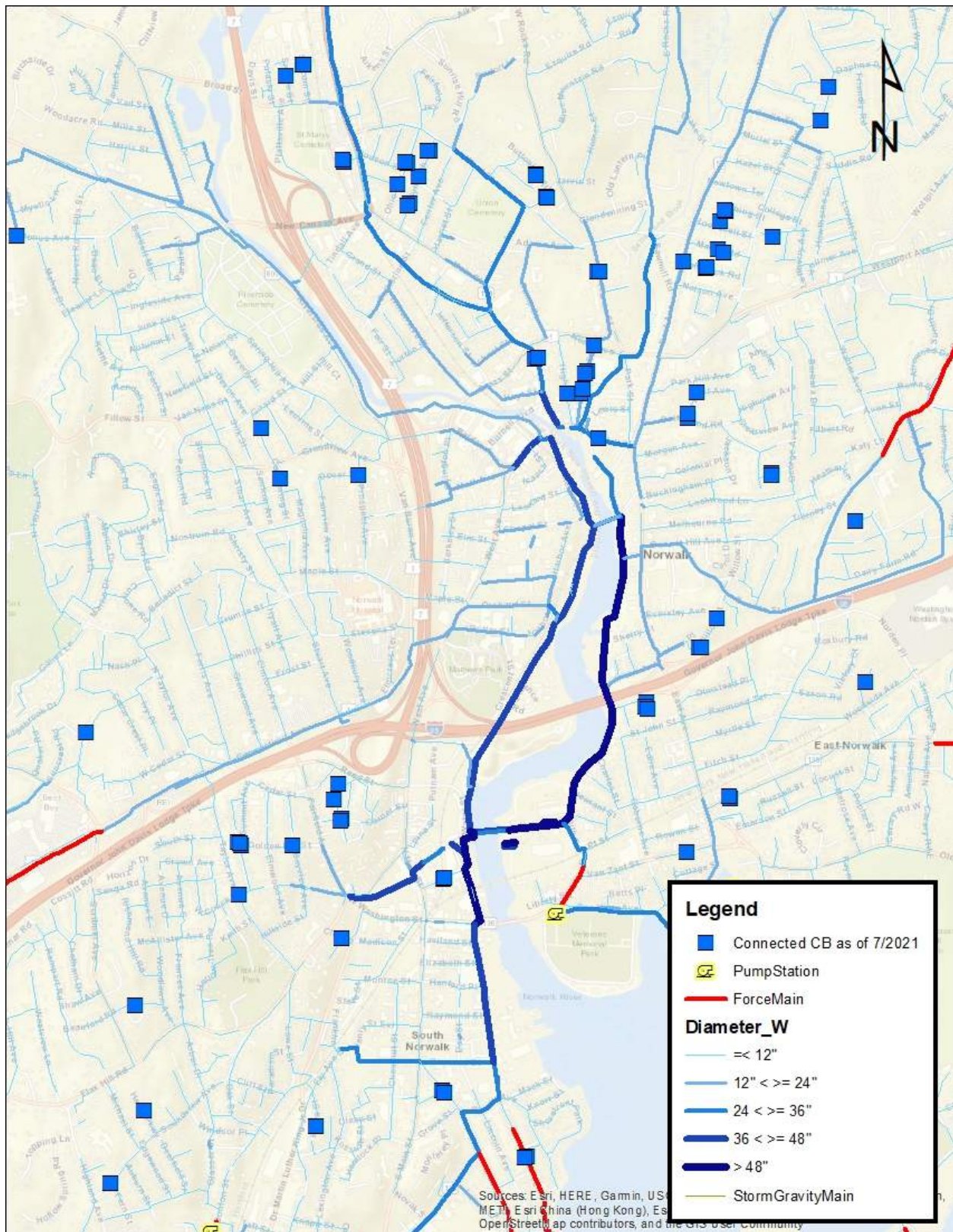


Figure 5-4. Directly Connected Catch Basin Locations

In a previously prepared *Inflow and Infiltration Control Plan*, completed in 2017 and revised in 2018 by Jacobs (CH2M Hill), 60 of the 81 catch basins identified in the City's GIS dataset as being directly connected to the collection system were evaluated for disconnection. In this study, the drainage areas for each catch basin were delineated using topographic and planimetric mapping provided by the City in GIS. Once the total drainage area was determined for each basin, contributing portions of impervious and pervious surface area were delineated using the City of Norwalk's most current impervious surface GIS layer. Subsequently, 25-year peak flows were calculated for each catch basin inlet.

Following the approach described in the Jacobs prepared *Inflow and Infiltration Control Plan*, drainage areas for the 21 additional directly connected catch basins identified between 2019 and 2022 were delineated using elevation data and satellite imagery. Following the methodology described in the *Inflow and Infiltration Control Plan*, peak flows from each catch basin were estimated using the rational method.

Further investigation of the magnitude of the peak flows estimated to arrive at the catch basin via overland flow, it was noted that the potential peak flows generated by the catch basin drainage areas were generally larger than the maximum capacity of the downstream sanitary sewer pipe the catch basin was connected to. In many cases, the downstream sanitary sewer pipe acts as a constriction point that limits the amount of flow that could realistically enter the collection system. To account for this, the estimated peak flows generated by the catch basins were restricted to the downstream pipe capacity if those flows were greater than the pipe capacity.

Catch basins where the estimated 25-year return frequency peak flow was 0.5 MGD or greater and where the downstream sanitary sewer capacity was also greater than 0.5 MGD were identified as significant inflow contributors to the collection system. Catch basins identified as significant inflow contributors to the collection system are shown in Table 5-3. After the start of this study in July of 2021, and prior to the submission of this report, 13 of the 81 known directly connected catch basins have already been disconnected by the City. Of these 13, four have been identified as significant inflow contributors and were disconnected by the City as of July 1, 2022 as shown in Table 5-3 below. The effective peak flow estimated to be eliminated from entering the collection system by disconnecting these four significant inflow sources is approximately 3.6 MGD.

Table 5-3. Catch Basins Identified as Significant Inflow Contributors			
Catch Basin Asset ID	Metershed ID	Q25-yr Rational Method (MGD)	Downstream Sewer Pipe Capacity (MGD)
1004	FM_02	9.1	0.5
7657	FM_02	1.7	0.6
7682	FM_02	1.5	0.6
15900	FM_02	1.6	0.8
2868	FM_04	1.4	0.5
7067	FM_05	2.4	0.6
7069	FM_05	6.1	5.2
7070	FM_05	6.9	0.6
33392	FM_05	8.7	0.6
33393	FM_05	1.8	0.6
5366*	FM_08	5.0	0.8

Table 5-3. Catch Basins Identified as Significant Inflow Contributors			
Catch Basin Asset ID	Metershed ID	Q25-yr Rational Method (MGD)	Downstream Sewer Pipe Capacity (MGD)
15286	FM_08	3.2	3.8
15287	FM_08	3.6	3.8
15569*	FM_08	3.0	0.8
15570*	FM_08	5.1	0.8
1001	FM_09	0.6	0.8
1002	FM_09	0.4	0.6
1003	FM_09	1.4	0.6
1006	FM_10	7.8	0.5
10955*	FM_10	3.9	1.2
10960	FM_10	10.2	0.5
1564	FM_13	3.2	1.2
1005	FM_14	2.4	0.8
10707	FM_14	5.2	0.8
1765	FM_15	1.7	0.6
1766	FM_15	11.4	0.6
10345	FM_15	6.7	0.8
8497	FM_24	9.5	1.2
10673	FM_26	2.1	0.6
48652	FM_26	3.9	0.6
9937	FM_28	2.1	0.5
9963	FM_28	3.4	0.5
49214	FM_28	14.2	0.5
7298	FM_35	9.8	0.9
7299	FM_35	3.6	0.9
3932	FM_36	6.5	0.6
3933	FM_36	6.5	0.6
3934	FM_36	7.4	0.6
Total		185.2	36.1

* Disconnected as of July 1, 2022

As shown in Table 5-3, 38 catch basins representing 47 percent of the known directly connected catch basins were identified as significant inflow contributors to the collection system. The sum of the sanitary sewer pipe capacities downstream of all 81 known directly connected catch basins was calculated as 46.9 MGD, whereas the sum of the sanitary sewer pipe capacities downstream of the 38 catch basins identified as significant inflow contributors was calculated as 36.1 MGD. By disconnecting 48 percent of the known directly connected catch basins, it is estimated that 77



percent of the peak flow contributions are removed. Further disconnection of additional catch basins beyond the 38 identified as significant inflow contributors removes relatively little peak inflow at a significant additional capital cost to the City. As cost-effectiveness of removal of excess flow from the collection system is an important consideration, only the catch basins identified as significant inflow contributors are identified for prioritized disconnection.

To model the flow reduction that disconnecting these catch basins would provide, the sum of the estimated catch basin peak flows, grouped by flow meter area, was compared to the total peak RDII flow rate for that entire meter area. The percentage of peak flow reduction the disconnections would provide was applied to the peak of the RTK unit hydrographs used to represent the RDII within the model. Table 5-4 shows the percentage of peak flow reduction for each meter area predicted after disconnection of the 38 catch basins identified as significant inflow contributors.

Metershed ID	Existing Conditions Peak 5yr-6hr RDII Flow Rate (MGD)	Post Catch Basin Disconnection Peak 5yr-6hr RDII Flow Rate (MGD)	Percent Peak RDII Flow Rate Reduction
FM_02	5.6	4.6	-19%
FM_04	0.2	0.2	0%
FM_05	8.5	4.7	-45%
FM_08	17.3	10.1	-41%
FM_09	0.9	0.9	0%
FM_10	2.1	2.1	0%
FM_13	2.4	1.8	-24%
FM_14	8.1	5.1	-36%
FM_15	2.6	2.5	-1%
FM_24	2.8	1.9	-31%
FM_26	4.4	3.7	-15%
FM_28	11.0	11.0	0%
FM_35	7.4	4.8	-35%
FM_36	8.1	5.9	-27%
Total	81.2	59.4	-27%

In some instances, the sum of predicted inflow removal in the metershed was greater than the existing conditions peak modeled inflow. While catch basins in these metersheds are still identified as significant inflow contributors, the model parameters for these areas were not adjusted since it is impossible to remove more flow than was measured during the temporary flow monitoring campaign described in Section 3. The peak flow reduction in these cases is zero percent. Any future projects related to disconnecting these identified catch basins should first verify the connection to the sanitary sewer. In addition to the peak RDII flow reduction, the model results also indicate catch basin disconnection reduces local MH overflow and SSO discharges. Figure 5-5 shows the reduction in MH overflow achieved by disconnecting these prioritized catch basins.

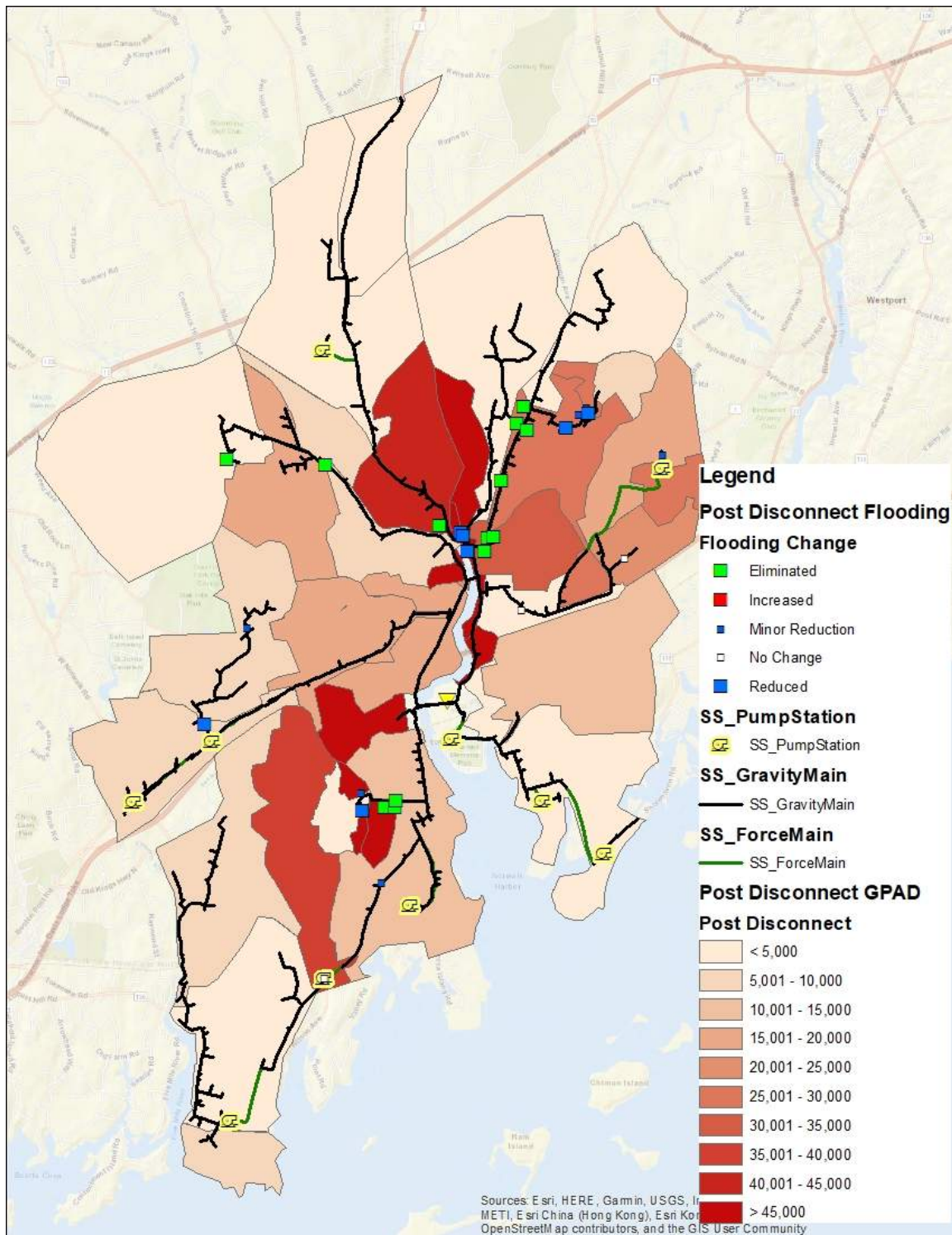


Figure 5-5. Reduction in Manhole Overflow After Catch Basin Disconnection

Figure 5-6 shows the post-catch basin disconnection percentage reduction in peak RDII flowrates rate by metershed.

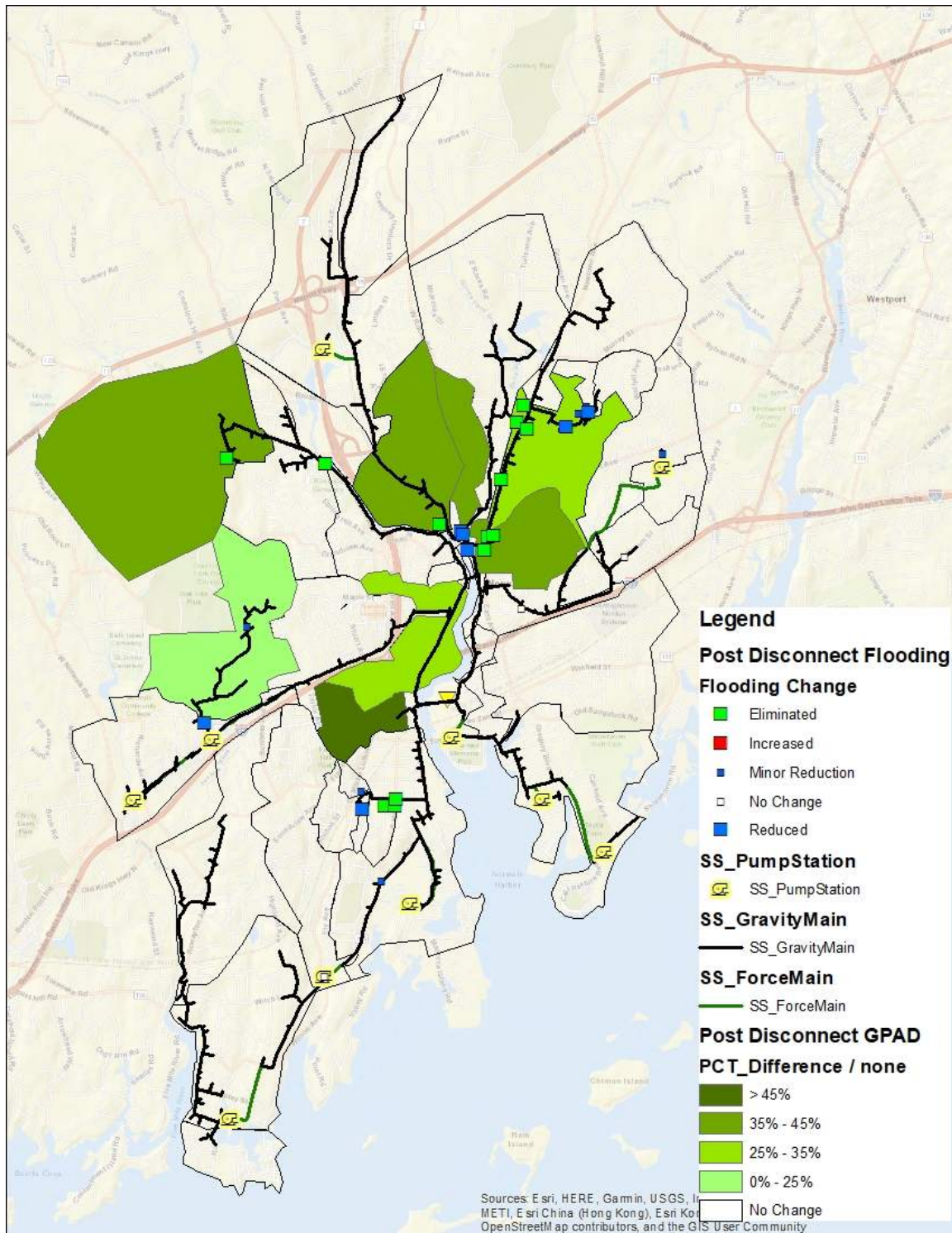


Figure 5-6. Percent Peak RDII Reduction After Catch Basin Disconnection

Disconnecting the prioritized directly connected catch basins improved system performance and reduced MH overflow and CSO volumes. Table 5-5 shows the estimated reduction in SSO volumes during the 25-year, 6-hour design event achieved by disconnecting the 38 priority catch basins.

Table 5-5. Manhole Flood Reduction Post-Catch Basins Disconnection					
MH ID	Baseline Flood Volume (MG)	Flood Volume Priority Disconnections (MG)	Change (MG)	Change (%)	Comment
03-109	0.01	0	-0.010	-100%	Eliminated
03-30	0.015	0	-0.015	-100%	Eliminated
03-31	0.014	0	-0.014	-100%	Eliminated
05-10	0.002	0	-0.002	-100%	Eliminated
05-257	0.014	0	-0.014	-100%	Eliminated
05-264	0.001	0	-0.001	-100%	Eliminated
05-265	0.012	0	-0.012	-100%	Eliminated
08-179.1	0.015	0	-0.015	-100%	Eliminated
10-29	0.006	0	-0.006	-100%	Eliminated
11-18	0.007	0	-0.007	-100%	Eliminated
16-306	0.005	0	-0.005	-100%	Eliminated
16-331.1	0.005	0	-0.005	-100%	Eliminated
16-4	0.011	0	-0.011	-100%	Eliminated
05-110	0.018	0.017	-0.001	-6%	Minor Reduction
05-157	0.165	0.134	-0.031	-19%	Minor Reduction
13-27	0.194	0.192	-0.002	-1%	Minor Reduction
15-34	0.011	0.009	-0.002	-18%	Minor Reduction
16-294	0.043	0.035	-0.008	-19%	Minor Reduction
21-4	0.031	0.026	-0.005	-16%	Minor Reduction
04-94	0.044	0.044	0.000	0%	No Change
15-115	1.828	1.828	0.000	0%	No Change
15-55	0.001	0.001	0.000	0%	No Change
22-3	0.004	0.004	0.000	0%	No Change
03-165.2	0.059	0.005	-0.054	-92%	Significant Reduction
03-22	0.244	0.140	-0.104	-43%	Significant Reduction
03-242	0.134	0.006	-0.128	-96%	Significant Reduction
05-36	0.037	0.023	-0.014	-38%	Significant Reduction
05-43	0.04	0.014	-0.026	-65%	Significant Reduction
12-155	0.164	0.130	-0.034	-21%	Significant Reduction
16-280.1	0.011	0.007	-0.004	-36%	Significant Reduction
Total	3.1	2.6	-0.530	-17%	

The catch basin disconnection analysis performed for this Master Plan assumed that the Storm Drain system has sufficient conveyance capacity to accept the additional flows and that construction of new storm drain assets required for catch basin disconnection are feasible. Both assumptions will need to be further verified through more detailed engineering analysis under a City-administered Catch Basin Disconnection Program. The Catch Basin Disconnection Program would serve to accomplish the following:

- Confirm the catch basin drainage area, land use, and peak flow reduction estimates calculated in either the *Inflow and Infiltration Control Plan* or this Master Plan.
- Perform catch basin disconnection feasibility analysis
 - Determine catch basin connection point to the City's Storm Drain system
 - Perform Storm Drain capacity assessment to confirm the existing Storm Drain system has capacity to convey the additional flow
 - Perform underground utility survey to identify potential conflicts and assess constructability of catch basin disconnection project
 - Determine sizing and perform preliminary design
- Perform detailed design and develop catch basin disconnection project specifications.
- Perform project bidding, construction management, and catch basin disconnection project close out.

5.2.4 Targeted RDII Reduction

Following system maintenance and catch basin disconnection, the next I/I and CSO management strategy evaluated was targeted RDII reductions that may be accomplished through system rehabilitation and renewal projects such as sewer main and MH lining and point repairs.

The amount of RDII that can be removed from a sewershed is largely dependent on the quantity and quality of sewer rehabilitation or renewal that are completed in the sewershed. While comprehensive rehabilitation in a sewershed can achieve significant RDII reduction, it is not always affordable or necessary, as non-defective sewer assets are rehabilitated in the same manner as defective ones. A more cost-effective approach to RDII reduction can be achieved through the targeted investigation and rehabilitation of prioritized sewersheds that exhibit high rates of RDII production.

The following activities are commonly included as part of the I/I reduction plan and are performed prior to the development of specific I/I reduction projects:

- Perform temporary flow monitoring within the metersheds prioritized for targeted RDII flow reduction to further identify specific areas within the metershed that exhibit the highest RDII production rates.
- Perform collection system condition assessment work to identify assets with significant defects that may act as I/I sources.
- Perform field investigations to identify specific inflow sources for disconnection. Examples of field investigation activities include, but are not limited to, smoke testing and dye testing.
- Perform field investigations, such as flow isolation studies, to identify areas with high infiltration rates.

Based on results of collection system inspections and field investigation activities, I/I reduction plans may be developed and customized to correct the specific types of defects and I/I sources identified, such as the disconnection of identified illicit cross-connections or comprehensive rehabilitation in



concentrated areas of the metershed where the highest I/I production rates have been identified. The I/I reduction plan should establish a methodology for the prioritization of I/I reduction projects and indicate an anticipated schedule for implementation.

The Water Environment Research Foundation (WERF) published report, *WERF 99-WWF-8: Reducing Peak Rainfall-Derived Infiltration/Inflow Rates – Case Studies and Protocol*, was designed to assist utilities confronted with the need to reduce peak RDII flows. The report discusses analytical methods used for quantifying RDII, approaches for determining reduction in peak and average RDII flows following sewer rehabilitation, provides an effectiveness evaluation reporting protocol, and compared case study projects to assess the cost-effectiveness of RDII removal. An update to the WERF report, *Update on a Nationwide I/I Reduction Project Database*, increasing the number of case study projects evaluated was published as part of the Water Environment Federation (WEF) 2007 Collection Systems Conference proceedings.

From both documents, the cost of RDII removal, expressed in dollars per gallon per day, increased as the RDII production rates, expressed as GPAD, decreased. This inverse relationship suggests that the cost-effectiveness of RDII removal diminishes as the peak RDII flow rates decrease. This may be due to the increasing amounts of sewer rehabilitation that are necessary to continuously remove RDII flows from the collection system.

Based on the diminishing cost-effectiveness of removing RDII from the collection system as peak RDII flow rates decrease, a peak area-flow rate of 15,000 GPAD during the 5-year design storm was set as a target goal for each meter area. The 15,000 GPAD target was established based on the cost effectiveness shown by the WERF study discussed further in Section 6 of this report. Additionally, the 15,000 GPAD RDII production threshold targets RDII reduction to 43 percent of the service area, which produces approximately 80 percent of the peak RDII flows entering the collection system. These metersheds represent the largest RDII contributors and offer the greatest chance to accomplish meaningful flow reductions.

While 15,000 GPAD was identified as the goal, studies have shown that approximately 50 percent of the RDII produced in a collection system may originate from private property. For this evaluation, it is assumed that rehabilitation work will only take place within the public right of way, leaving the private property sewer assets unrehabilitated.

Table 5-6 shows the subcatchments with peak flows greater than 15,000 GPAD identified for I/I reduction. Additionally, it shows the estimated peak flow reduction achievable by targeting only the 50 percent of total RDII peak flow that is estimated to originate from public sewer sources, calculated as 50 percent of the difference between the peak flow after catch basin disconnection and the targeted 15,000 GPAD.

Metershed ID	Sewered Area	5-yr I/I only (mgd)	Sewershed I/I Rate per Unit Area (GPAD)	Target GPAD
FM_38	18.6	5.0	269,114	142,057
FM_37	13.2	1.3	95,793	55,396
FM_24	21.4	1.9	89,524	52,262
FM_19	21.0	2.1	100,646	57,823
FM_03	27.3	2.5	93,223	54,112
FM_25	14.7	1.1	74,087	44,544

Table 5-6. Residual RDII Reductions - Public Only

Metershed ID	Sewered Area	5-yr I/I only (mgd)	Sewershed I/I Rate per Unit Area (GPAD)	Target GPAD
FM_14	119.9	5.1	42,873	28,936
FM_35	120.3	4.8	39,936	27,468
FM_08	355.6	10.1	28,465	21,732
FM_36	200.6	5.9	29,553	22,276
FM_16	50.0	1.8	35,037	25,019
FM_05	312.3	4.7	14,964	14,964
FM_28	409.6	11.0	26,885	20,943
FM_30	34.6	0.6	18,420	16,710
FM_33	146.0	2.6	17,599	16,300
FM_26	239.1	3.7	15,678	15,339
FM_23	2.4	0.0	18,108	16,554
FM_22	143.9	2.4	16,713	15,857

Similar to how the RDII flows were reduced for the catch basin disconnections, the percentage decrease in estimated peak flows were applied to the unit hydrographs of the respective meter areas, and the full range of design storms were modeled to evaluate the improved collection system performance.

Figure 5-7 shows the reduction in MH overflow achieved by performing public-side rehabilitation on the identified meter areas for the 25-year, 6-hour design event, along with the updated RDII production rates by metershed.

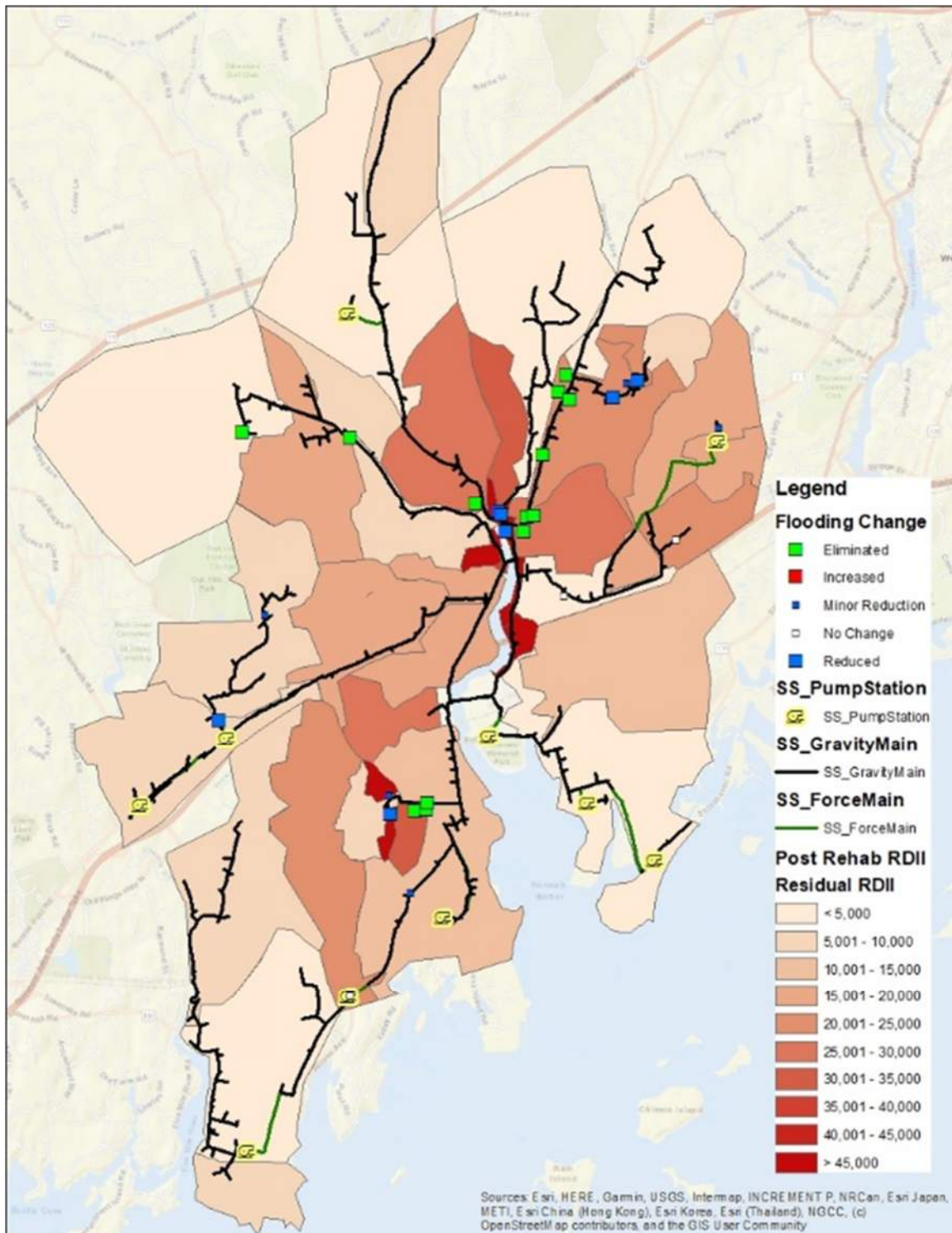


Figure 5-7. Reduction in Manhole Overflow After Residual I/I Management

Table 5-7 below shows the estimated reduction in CSO volumes achieved by performing public-side rehabilitation on the identified meter areas.

Table 5-7. CSO Volume Comparison						
	Peak Flow (MGD)			24-HR Volume (MG)		
	Baseline	I/I Management	% Change	Baseline	I/I Management	% Change
MH Overflow	-	-	-	3.1	2.6	-18%
Ann Street Emergency Overflow	0	0	-	0	0	-
Outfall 002	46.9	46.9	0%	30.9	28.2	-9%
WPCF Total Inflow	76.9	76.9	0%	35.8	33.4	-7%

5.2.5 Storage

While the previously detailed I/I and CSO management strategies significantly improved system performance and reduced CSO overflow volumes, there is still a significant amount of flow conveyed to the WPCF during storm events that exceeds the secondary treatment capacity at the WPCF. Flows above 30 MGD are diverted to the SWWTF for primary screening and disinfection/dechlorination. Flows from the SWWTF are discharged to the Norwalk River through Outfall 002. Table 5-8 shows the discharge volumes at Outfall 002, under the predicted future flow conditions, for various design storms.

Table 5-8. CSO Volumes by Design Storm - Future Conditions (MG)					
6-Hour	1-Year	2-Year	5-Year	10-Year	25-Year
Ann Street Emergency Overflow	-	-	-	-	-
Outfall 002	-	1.3	2.7	3.5	6.3
12-Hour	1-Year	2-Year	5-Year	10-Year	25-Year
Ann Street Emergency Overflow	-	-	-	-	-
Outfall 002	0.4	1.5	3.7	6.3	10.9
24-Hour	1-Year	2-Year	5-Year	10-Year	25-Year
Ann Street Emergency Overflow	-	-	-	-	-
Outfall 002	-	2.7	5.4	7.1	13.2

The use of storage at the WPCF was evaluated as a method to equalize flow during wet weather flow events. Wet weather volumes stored in a flow equalization tank could be re-introduced to the secondary treatment train at the WPCF after the wet weather flows subside. The residual storage volumes, representative of storage requirements that remain after other flow reduction activities would be completed, were assessed to determine the feasibility of flow equalization at the WPCF. The total potential storage volume at the plant is limited by the amount of available space. It is estimated that a storage tank with a maximum volume of 2.4 MG could reasonably be constructed on the current SWWTF footprint, which would temporarily store wet weather flows before being sent

to secondary treatment after the peak of the storm event. As seen in Table 5-8, the estimated constructable storage volume of 2.4 MG is exceeded at the 2-year, 24-hour, the 5-year, 12-hour, and the 5-year, 6-hour rainfall events. As the SWWTF is able to provide primary treatment for flows well beyond the level of service of flow equalization, storage was determined not to be viable or cost-effective.



Section 6

Capital Cost Estimates

6.1 Overview

This section provides a summary of the cost-benefit analysis conducted as part of this report. The overall goal was to identify the best course of action to improve system performance while minimizing costs and constructability issues.

6.1.1 Existing System Management

Portions of the collection system are currently underperforming due to maintenance issues such as accumulation of debris and presence of root balls, causing increased surcharging and MH overflows upstream of the location of the hydraulic constriction. The City currently contracts with Veolia to perform inspection and maintenance in the collection system. As part of this contract, it is recommended that inspection and maintenance be performed in the areas identified in Section 5.2.1 and Section 7.3.1. There are no additional capital costs associated with the inspection and maintenance activities recommended as part of this Master Plan.

6.1.2 Conveyance Capacity Improvements

Based on the alignment and profile of the Hubbells Lane Relief Sewer developed during the modeling evaluation, a Class 5 estimate of probable construction cost for this project was developed. The cost estimate details are included in Appendix E. The estimated capital costs for the Hubbells Lane Relief Sewer are \$5.4 million.

6.1.3 Catch Basin Disconnection

At the outset of the Master Plan development, there were 81 catch basins identified as being directly connected to the collection system. Of these 81, 38 are identified as significant inflow contributors and are recommended for disconnection as shown in Table 6-1. The associated estimated cost to disconnect is also shown in Table 6-1. A number of these catch basins were identified in a previous *Inflow and Infiltration Control Plan*, completed in 2017 and revised in 2018 by Jacobs (CH2M Hill). Where catch basins recommended for disconnection are located in close proximity to others, these were grouped together and are identified in Table 6-1 by the disconnection group identification number. It is envisioned that disconnection of catch basins in each disconnection group will be performed as a discrete construction project administered by the City under a Catch Basin Disconnection Program.

Cost estimates for catch basin disconnection projects from the Jacobs report were used for this cost analysis where they were developed for the 2018 report. These project costs were escalated to 2022 prices. For catch basins that were recommended for disconnection in this report but not included in the Jacobs study, an average cost per disconnection was determined from the previous project and applied to the catch basins included in this report.

Table 6-1. Catch Basins Recommended for Disconnection

Disconnection Group ID	CB Asset ID	Metershed ID	Q25-yr Rational Method (MGD)	DS Sewer Max Pipe Capacity (MGD)	Cost to Disconnect
1	1004	FM_02	9.1	0.5	\$563,000
2	7657	FM_02	1.7	0.6	\$318,000
	7682	FM_02	1.5	0.6	
3	15900	FM_02	1.6	0.8	\$269,000
4	2868	FM_04	1.4	0.5	\$340,000
5	7067	FM_05	2.4	0.6	\$823,000
	7070	FM_05	6.9	0.6	
6	7069	FM_05	6.1	5.2	\$381,000
7	33392	FM_05	8.7	0.6	\$406,000
	33393	FM_05	1.8	0.6	
8	5366	FM_08	5	0.8	\$747,000
9	15286	FM_08	3.2	3.8	\$552,000
	15287	FM_08	3.6	3.8	
10	15569	FM_08	3	0.4	\$392,000
	15570	FM_08	5.1	0.4	
11	1001	FM_09	0.6	0.8	\$227,000
12	1002	FM_09	0.4	0.6	\$102,000
	1003	FM_09	1.4	0.6	
13	1006	FM_10	7.8	0.5	\$234,000
14	10955	FM_10	3.9	1.2	\$300,000
15	10960	FM_10	10.2	0.5	\$706,000
16	1564	FM_13	3.2	1.2	\$6,000
17	1005	FM_14	2.4	0.8	\$340,000
18	10707	FM_14	5.2	0.8	\$737,000
19	1765	FM_15	1.7	0.6	\$264,000
	1766	FM_15	11.4	0.6	
20	10345	FM_15	6.7	0.8	\$491,000
21	8497	FM_24	9.5	1.2	\$276,000
22	10673	FM_26	2.1	0.6	\$275,000
	48652	FM_26	3.9	0.6	
23	9937	FM_28	2.1	0.5	\$276,000
24	9963	FM_28	3.4	0.5	\$276,000
25	49214	FM_28	14.2	0.5	\$276,000
26	7298	FM_35	9.8	0.9	\$552,000
	7299	FM_35	3.6	0.9	
27	3932	FM_36	6.5	0.6	\$486,000
	3933	FM_36	6.5	0.6	
	3934	FM_36	7.4	0.6	
Total			185.2	36.3	\$10,609,000

6.1.4 Targeted RDII Reduction

As stated in Section 5.2.3, flow meter areas with 5-year peak I/I production rates greater than 15,000 GPAD were identified as areas where cost effective I/I reduction could be accomplished. This Master Plan update analysis assumed that only public-side rehabilitation will take place, which was assumed to account for 50 percent of the total peak RDII flows entering the system. It is assumed that the other 50 percent of the RDII peak flow enters the system via infiltration and inflow that originates on private property. Therefore, the targeted I/I reduction for each meter area was half the difference between the existing conditions I/I rate and 15,000 GPAD.

While performing system maintenance and disconnecting catch basins are relatively inexpensive for the amount of flow removed from the system, a significant fraction of extraneous flows that enter the collection system are through defective sewers and unknown direct connections. Reducing these RDII sources through the administration of a comprehensive inspection and rehabilitation plan is necessary to reduce the peak RDII flows to levels that achieve the targeted I/I reductions necessary to improve collection system performance.

It is generally necessary to complete a sewer system evaluation survey (SSES) and multiple collection system rehabilitation projects to achieve a desired I/I reduction. An SSES generally consists of the following items:

- Physical inspection of collection system – Includes visual inspection of MHs and pipes.
- Rainfall and flow metering data collection – Includes analysis to delineate and prioritize portions of the collection system where cost-effective reductions are feasible.
- RDII Source Identification – Collection system testing that may include smoke testing, dye testing, and flow isolation studies.
- Final report and maps – Includes analysis and discussion on cost-effectiveness of rehabilitation alternatives.

The costs for these multi-step projects were accounted for in this analysis by performing a step-wise approach to I/I reduction where each step reduces I/I by 20 percent of the targeted reduction, finishing with the final I/I rate previously identified. The capital costs associated with the targeted rehabilitation of the public sewer infrastructure followed the methodology described in the *WERF 99-WWF-8: Reducing Peak Rainfall-Derived Infiltration/Inflow Rates – Case Studies and Protocol*, updated with additional case studies. The cost-effectiveness curve used to develop the capital costs associated with the targeted RDII reductions is shown in Figure 6-1.

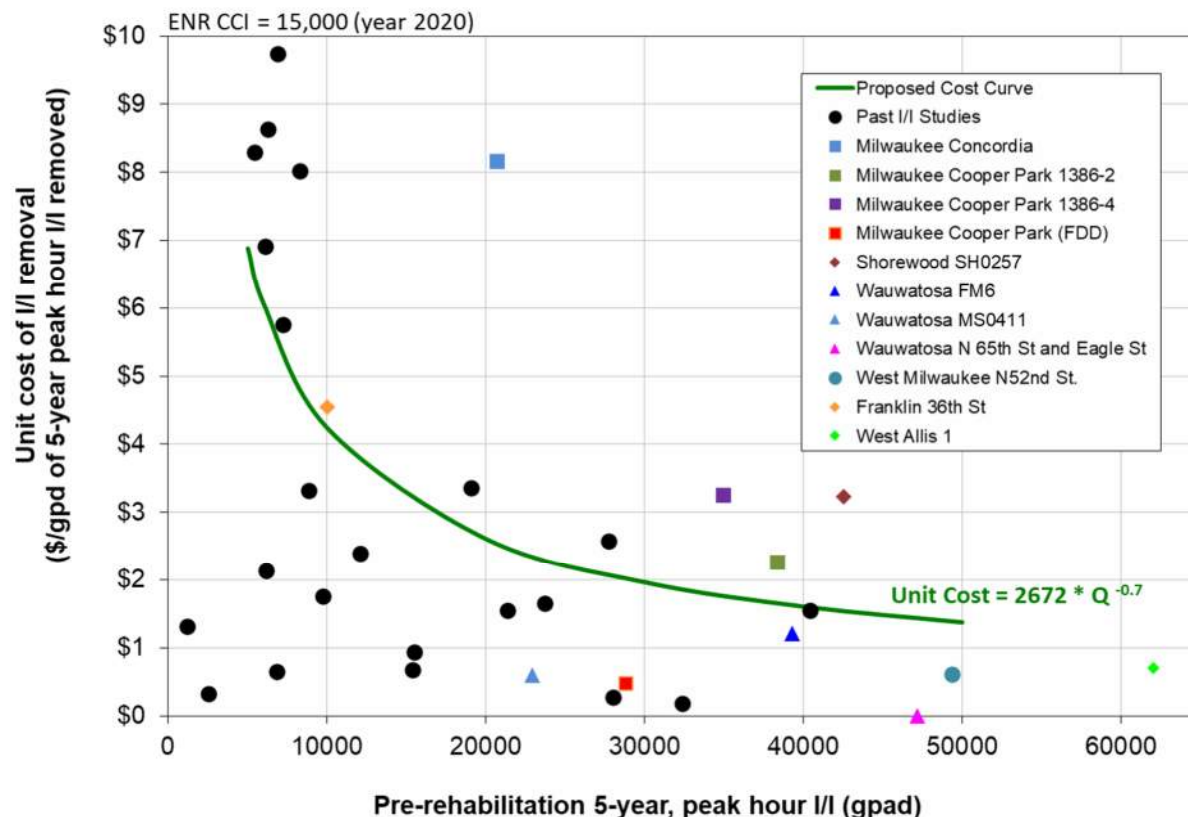


Figure 6-1. Unit Cost Curve - \$/Gal Removed

Using this curve and the step-wise approach, flow reduction unit costs were applied to the flow meter areas that exceeded the 15,000 GPAD, with each step removing approximately 5.5 MG of flow. Table 6-2 shows the cost breakdown of each step.

Step	Flow Removed (MG)	Cost to Remove (\$M)	Cost To Remove (\$/GPD)	Cumulative Flow Removed (MG)	Cumulative Cost to Remove (\$M)	Cumulative Cost to Remove (\$/GPD)
1	3.3	5.24	1.59	3.3	5.24	1.59
2	3.3	5.39	1.63	6.6	10.63	1.61
3	3.3	5.56	1.69	9.9	16.20	1.64
4	3.3	5.79	1.75	13.2	21.99	1.67
5	3.3	6.06	1.83	16.5	28.05	1.70

Including a 30 percent contingency associated with anticipated SSES, field investigations, and design of sewer rehabilitation projects, the total sewer rehabilitation costs to reduce 5-year peak flows to the target I/I rate is estimated at approximately \$36.4 million.

Section 7

Summary and Recommendations

7.1 Summary of Findings

The analysis of data collected under the temporary flow metering campaign, coupled with the development and calibration of a collection system model, supported the characterization of the City's collection system performance.

Based on results from the calibrated model, under existing conditions, the collection system generally performs well. Collection system performance is shown in Table 7-1 as discharge volumes throughout the system for various design events. Currently, the collection system experiences nominal systemwide SSO volumes for the 1- and 2-year return frequency events. Starting at the 1-year return frequency event, peak flows conveyed to the WPCF are predicted to exceed 30 MGD, the secondary treatment capacity at the WPCF. As designed, flows at the WPCF greater than 30 MGD are diverted to the SWWTF where it receives primary treatment (or equivalent) and disinfection/dechlorination before being discharged from Outfall 002. The Emergency Overflow is not predicted to discharge for any return frequency events as shown in the table. As discussed in Section 4.2.3, additional model runs performed with the 50- and 100-year, 24-hour return frequency events show that the Emergency Overflow does not discharge up to and including the 50-year event. Systemwide SSOs and discharges from Outfall 002 show an expected trend of increasing as the return frequency events get larger.

Table 7-1. CSO Volumes by Design Storm - Existing Conditions (MG)					
6 Hour	1 Year	2 Year	5 Year	10 Year	25 Year
Systemwide SSO	0.0	0.1	0.7	1.4	3.0
Ann Street Emergency Overflow	-	-	-	-	-
Outfall 002	1.4	8.5	14.9	19.1	31.0
12 Hour	1 Year	2 Year	5 Year	10 Year	25 Year
Systemwide SSO	0.1	0.5	1.6	3.0	6.1
Ann Street Emergency Overflow	-	-	-	-	-
Outfall 002	11.4	13.5	23.3	31.3	42.4
24 Hour	1 Year	2 Year	5 Year	10 Year	25 Year
Systemwide SSO	0.1	0.5	2.0	4.1	8.8
Ann Street Emergency Overflow	-	-	-	-	-
Outfall 002	13.9	19.4	28.1	46.2	67.7

There are approximately 30 MHs, shown in Figure 7-1, that are predicted by the model to overflow during the 25-year, 6-hour design event. The model also suggests that it is possible to reduce MH overflows by approximately 30 percent by performing basic system maintenance in key areas.

MH overflows are predicted to be eliminated in the following locations when maintenance is conducted:

- East Avenue between Morgan Avenue and Nelson Avenue
- Concord Street between Chestnut Street and Woodward Avenue
- Riverside Avenue at Ponus Avenue

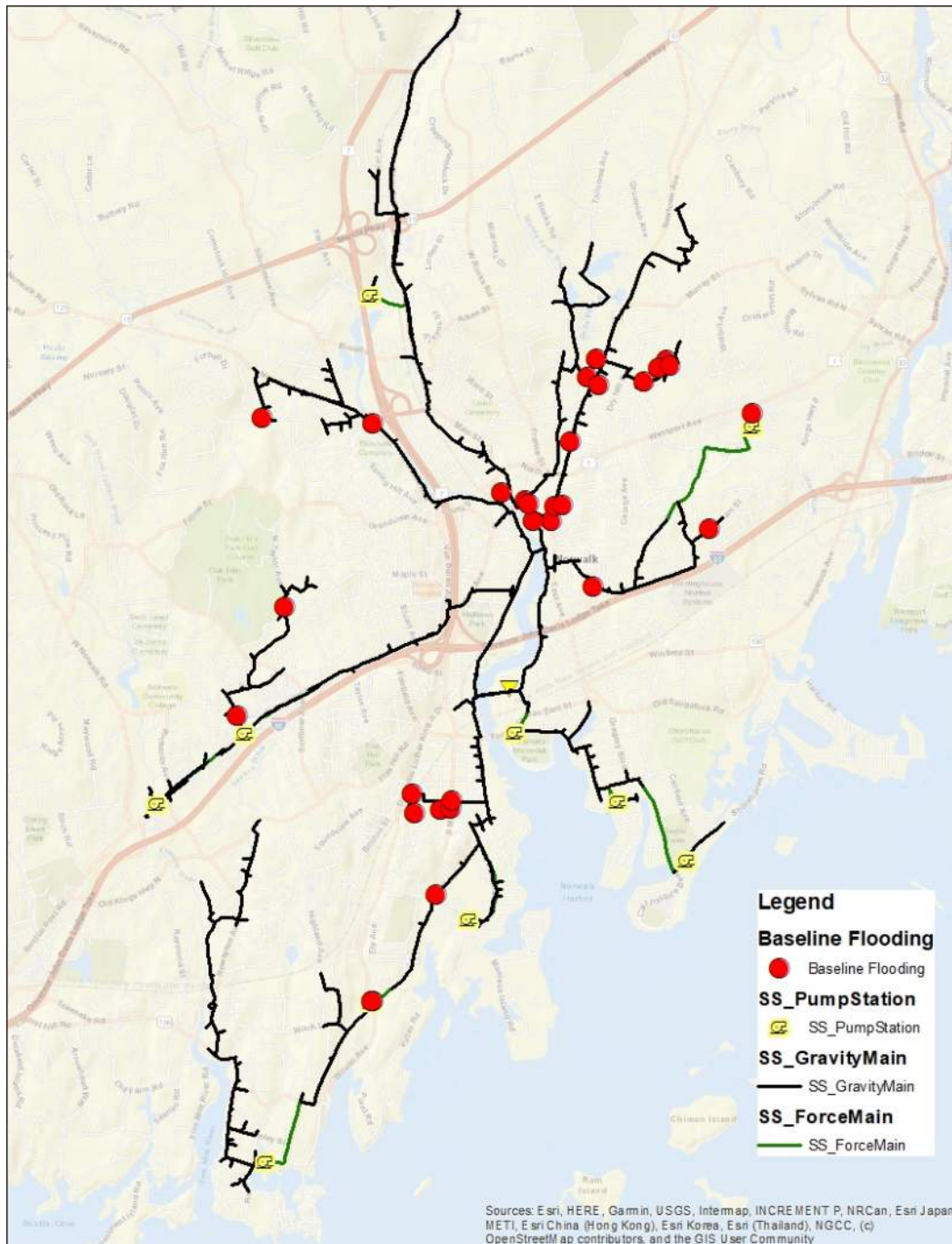


Figure 7-1. Locations of Predicted Manhole Overflow Under Existing Conditions During the 25-Year, 6-Hour Event

Under existing conditions, Outfall 002 discharge volumes range between 1.4 and 67.7 MG for the 1-year, 6-hour and 25-year, 24-hour events, respectively.

Completing all of the recommendations detailed within this Master Plan would reduce MH overflow volume and locations as well as overflow volumes at Outfall 002.

The number of MH overflows during the 25-year, 6-hour event would be reduced by approximately 60 percent. The total overflow volume throughout the system would be reduced from 3 MG to 1.1 MG for the same event.

Peak flows into the WPCF would be significantly reduced, resulting in a decrease in overflow volumes from Outfall 002. Overflows from Outfall 002 would range from 0.2 MG to 19.8 MG for the 1-year, 6-hour and 25-year, 24-hour events, respectively.

Analysis of the flow monitoring data indicated 12 of the 40 flow meter areas show a peak GWI rate of 4,000 gpd/in-mi or greater. The peak RDII flows, derived by subtracting the DWF pattern from the measured flow timeseries, was averaged for 5 rainfall events for each flow meter. Analysis of the average peak RDII flows show that 80 percent of the peak RDII flows entering the collection system are generated from approximately 40 percent of the flow monitored areas (24 of the 40 flow meter areas).

Development and calibration of a hydraulic model allowed the system performance to be referenced against specific design rainfall events. Analysis of the calibrated model results show significant portions of the service area contribute significant amounts of extraneous flows, which can exceed the conveyance capacity of the collection system during larger rainfall events. Analysis of the calibrated model simulation results from the 5-year, 6-hour design storm show high peak RDII inflows (greater than 15,000 GPAD) in 19 of the 40 flow metered areas. These high peak RDII flows are indicative of sewer deficiencies or direct inflow connections that act as RDII sources in the collection system.

Review of the calibrated model results also show that the performance of the collection system may be limited in specific locations by the accumulation of debris or development of flow blockages within the sewer pipes. Both conditions result in a decreased cross-sectional area in the sewer main available for flow conveyance and can act as critical hydraulic bottlenecks during wet weather flow events.

Under the modeled reduced inflow conditions, representative of post-catch basin disconnection and completion of the targeted RDII reductions, a segment of the east interceptor near Smith St. was found to still have insufficient capacity to convey the flows from three upstream trunk sewers. The addition of a relief sewer to redirect flows from East Wall Street down Hubbells Lane to the East Interceptor downstream of the Moodys Lane Siphon resulted in relieving a hydraulic overload and significantly decreasing the HGL in the East Interceptor between Burnell Boulevard and Moodys Lane.

7.2 Projected Performance of Collection System

The model was run with the full set of design storms while incorporating all the Long-Term Master Plan Recommendations, including improvements from system maintenance, priority catch basin disconnection, and RDII reduction via sewer rehabilitation. CSO and SSO volumes are significantly reduced throughout the system, and the volume of flow entering the plant to be treated is reduced as well. Table 7-2 shows the peak flow and volume reduction seen at the system CSO outfalls as well as the WPCF total inflow for the 25-year, 6-hour design event.



Table 7-2. CSO and SSO Volume Comparison (25-year, 6-hour Design Event)

	Peak Flow (MGD)			Volume (MG)		
	Baseline	I/I Management	% Change	Baseline	I/I Management	% Change
Ann Street Emergency Overflow	0	0	-	0	0	-
Outfall 002	46.9	15.8	-66%	31.0	6.4	-79%
WPCF Total Inflow	76.9	44.9	-42%	77.6	61.9	-20%

Table 7-3 shows the model-predicted CSO and SSO discharge volumes from simulations of return frequency design storm events ranging from the 1-year, 6-hour event through the 25-year, 24-hour event.

Table 7-3. CSO and SSO Volumes by Design Storm - Future Conditions (MG)

6 Hour	1 Year	2 Year	5 Year	10 Year	25 Year
Systemwide SSO	0.0	0.0	0.1	0.3	1.1
Ann Street Emergency Overflow	-	-	-	-	-
Outfall 002	0.2	0.4	1.8	3.2	6.4
12 Hour	1 Year	2 Year	5 Year	10 Year	25 Year
Systemwide SSO	0.0	0.0	0.4	1.2	3.3
Ann Street Emergency Overflow	-	-	-	-	-
Outfall 002	0.8	1.9	4.2	7.3	12.3
24 Hour	1 Year	2 Year	5 Year	10 Year	25 Year
Systemwide SSO	0.0	0.1	0.7	1.9	5.6
Ann Street Emergency Overflow	-	-	-	-	-
Outfall 002	1.0	2.5	6.1	10.8	19.8

Table 7-4 shows the model-predicted CSO and SSO discharge volume percent reductions for return frequency design storm events ranging from the 1-year, 6-hour event through the 25-year, 24-hour event, as compared to the existing conditions discharge volumes presented earlier in Table 4-4 from the same storm events.

Table 7-4. CSO and SSO Volumes Percent Reductions by Design Storm - Future Conditions (MG)					
6 Hour	1 Year	2 Year	5 Year	10 Year	25 Year
Systemwide SSO	100%	100%	86%	79%	63%
Ann Street Emergency Overflow	-	-	-	-	-
Outfall 002	86%	95%	88%	83%	79%
12 Hour	1 Year	2 Year	5 Year	10 Year	25 Year
Systemwide SSO	100%	100%	75%	60%	46%
Ann Street Emergency Overflow	-	-	-	-	-
Outfall 002	93%	86%	82%	77%	71%
24 Hour	1 Year	2 Year	5 Year	10 Year	25 Year
Systemwide SSO	100%	80%	65%	54%	36%
Ann Street Emergency Overflow	-	-	-	-	-
Outfall 002	93%	87%	78%	77%	71%

As shown in Table 7-4, under the future projected conditions, with all the Long-Term Master Plan Recommendations implemented, there is a significant reduction in discharge volume from Outfall 002 and a significant reduction in MH overflows throughout the system as evidenced from the change in Systemwide SSO volume reductions.

7.2.1 Ann Street Emergency Overflow Future Performance

Prior to the WPCA efforts to separate the collection system, when a significant portion of the Norwalk collection system was a combined sewer service area, the Emergency Overflow provided hydraulic relief to the Norwalk interceptor system and acted as a controlled point of discharge that prevented uncontrolled MH overflows from the west side interceptor. With the significant amounts of sewer separation Norwalk has accomplished since the 1970s, a reduced hydraulic load is placed on the interceptor system. With this reduced hydraulic load, the calibrated existing conditions model shows the Emergency Overflow is effectively eliminated, as it is not predicted to activate until a storm event larger than the 50-year, 24-hour return frequency.

In addition to the historical point of relief the Emergency Overflow provided when the Norwalk collection system was predominantly a combined sewer system, the Emergency Overflow continues to provide hydraulic relief, preventing excessive surcharge and uncontrolled SSOs from occurring, during periods of catastrophic infrastructure failure.

To comply with paragraph B.3 of the Consent Order, three viable and cost-effective measures or alternatives were developed and tested using the hydraulic model to evaluate the impacts of eliminating the Emergency Overflow. Each alternative was simulated under the projected 2027 conditions. The projected future 2027 conditions model implements all projected reductions in excess flow estimated to be achieved by the Consent Order Recommendations from this Master Plan. The Consent Order Recommendations are presented in Section 7.4.5. The projected 2027 conditions include the following system improvements incorporated into all three alternatives:

- System Conditions – improved conditions, recommended maintenance and cleaning measures are modeled

- System Conveyance – improved conditions, planned pump station capacity improvements and the Hubbells Lane Relief sewer are modeled
- System Flows – reduction in excess flow from disconnection of directly connected catch basins identified as significant inflow contributors is modeled

For each alternative, a different simulated configuration of the Emergency Overflow structure for each alternative was represented and is described below.

- Alternative 1 represents the projected 2027 conditions in the collection system with the following Emergency Overflow conditions:
 - Existing conditions, no modifications
- Alternative 2 represents the projected 2027 conditions in the collection system with the following Emergency Overflow conditions:
 - Flow elimination represented with an operational flow elimination structure (flow elimination structure) that acts as a physical barrier to flow.

In the Alternative 2 model, during Force Majeure events such as extreme rainfall events or instances of catastrophic infrastructure failure, the Emergency Overflow flow elimination structure can be opened to control the HGL in the west interceptor. Excessive surcharging that may occur in the west interceptor during Force Majeure events places a significant number of properties at risk for basement backup and poses an unacceptable health and safety risk to the public. The risk to the public created by Emergency Overflow Elimination is previously discussed in Section 4.2.3.

- Alternative 3 represents the projected 2027 conditions in the collection system with the following Emergency Overflow conditions:
 - Flow elimination conditions, outlet pipes are removed from the model preventing discharge under all conditions.

In the Alternative 3 model, discharge from the Emergency Overflow is not possible under any conditions, creating the possibility for excessive surcharging in the west interceptor during Force Majeure events such as extreme rainfall events or instances of catastrophic infrastructure failure. Excessive surcharging places a significant number of properties at risk for basement backup and poses an increased health and safety risk to the public. Increased risk to the public created by Emergency Overflow Elimination is discussed previously in Section 4.2.3.

Simulations for each alternative were performed using the 5-, 10-, 25-, 50-, 100-, and 200-Year, 24-Hour return frequency synthetic rainfall events. Table 7-5 presents a model simulation matrix describing the modifications and flow conditions simulated in the analysis.

Table 7-5. Ann Street Emergency Overflow Alternatives Analysis – Model Description

Alternative ID	Maintenance to Restore Conveyance Capacity	Hubbells Lane Relief Sewer	Pump Station Upgrades	Catch Basin Disconnection	Ann Street Emergency Overflow Elimination
Alternative 1	•	•	•	•	No modifications
Alternative 2	•	•	•	•	Flow Elimination Structure
Alternative 3	•	•	•	•	Structural removal of overflow pipes

Table 7-6 presents the model simulated discharge volumes from the Emergency Overflow and from MHs located along North Water Street for each alternative condition.

Table 7-6. Ann Street Emergency Overflow Alternatives Performance

Alternative ID	Facility ID	Rain Event Return Frequency					
		5-YR, 24-HR	10-YR, 24-HR	25-YR, 24-HR	50-YR, 24-HR	100-YR, 24-HR	200-YR, 24-HR
Alternative 1	Ann Street Emergency Overflow	0.00	0.00	0.00	0.02	0.72	1.96
	North Water Street MHs	0.00	0.00	0.00	0.00	0.00	0.00
	Basement Backup	0.00	0.00	0.00	0.00	0.00	0.00
Alternative 2	Ann Street Emergency Overflow	0.00	0.00	0.00	0.00	0.51	1.61
	North Water Street MHs	0.00	0.00	0.00	0.00	0.00	0.00
	Basement Backup	0.00	0.00	0.00	0.00	0.00	0.00
Alternative 3	Ann Street Emergency Overflow	0.00	0.00	0.00	0.00	0.00	0.00
	North Water Street MHs	0.00	0.00	0.00	0.00	0.00	1.05
	Basement Backup	0.00	0.00	0.00	0.00	IR ¹	IR ¹

1. IR denotes an increased risk of basement backup associated with the alternative and return frequency storm event. The increased risk of basement backup is caused by the increased HGL in the interceptor system associated with the alternative. While the model predicts basement backups are likely to occur, the volume of wastewater is not quantifiable from the Master Plan model.

Under the projected 2027 conditions, the Alternative 1 model results predict that, without any modifications to the Emergency Overflow structure, discharges would occur starting at the 50-year, 24-hour return frequency event. In the Alternative 1 model, the hydraulic relief provided by the Emergency Overflow effectively controls the water level in the west interceptor and prevents MH overflows along North Water Street from occurring during all the return frequency events simulated.

Under the projected 2027 conditions, the Alternative 2 model results show that the Emergency Overflow is predicted to activate at the 100-Year, 24-Hour return frequency. In the Alternative 2 model, the flow elimination structure reduces the activation frequency of the Emergency Overflow, as compared to Alternative 1, and also effectively controls the water level in the west interceptor, preventing MH overflows along North Water Street and significantly reduces the risk of basement flooding shown in Figure 4-7. At the 100-Year, 24-Hour and larger return frequency rainfall events, the flow elimination structure was predicted to open, providing hydraulic relief to maintain a maximum HGL in the interceptor system that reduces the risk of basement backups and is protective of public health and safety.

Under the projected 2027 conditions, the Alternative 3 model results show that no discharges occur from the Emergency Overflow for any return frequency event. Without the hydraulic relief provided by the Emergency Overflow structure, the HGL in the west interceptor is predicted to increase to a level that induces MH overflows along North Water Street at the 200-Year, 24-Hour return frequency event. The Alternative 3 model results indicate that elimination of the Emergency Overflow moves the point of hydraulic relief from a controlled point of discharge at the Emergency Overflow to uncontrolled discharges from low lying MHs located along North Water Street and increases the risk of basement flooding for properties served by the west interceptor. Given the greater than 1,000 parcels identified as likely to be impacted by basement backups under this alternative, starting at the 100-year, 24-hour return frequency, this level of risk to the City and the health and safety of the public is without parallel within the State. For additional perspective, other CSO communities in the state of Connecticut generally attempt to control overflows for return frequency events much smaller than the 25-year event.

As noted in Section 4.2.2, two of three the most recent discharges from the Emergency Overflow (August 22, 2016 and July 8, 2021) have been caused by catastrophic infrastructure failures and were likely not caused solely by the flows in the interceptor system grossly exceeding its conveyance capacity. The modeling results presented in Table 7-6 indicate that when all aspects of the collection system are working properly, the collection system currently provides the conveyance capacity to prevent a discharge from the Emergency Overflow that exceeds the level of control provided by other CSO communities in the state of Connecticut.

7.3 Consent Order Recommendations

The Consent Order Recommendations, to be completed within five years from the date of approval of the measure(s) required by paragraph B.3 of the Norwalk Consent Order, recommended in this Master Plan include the following:

- All Operations and Maintenance Recommendations from Section 7.3.1,
- Hubbells Lane Relief Sewer from Section 7.3.2.1,
- Catch Basin Disconnection Program from Section 7.3.2.2, and
- Emergency Overflow Elimination Measures from Section 7.3.2.3.

Additional details regarding each Consent Order Recommendation follow below.

7.3.1 Operations and Maintenance Recommendations

7.3.1.1 Priority Sewer Inspection and Maintenance

Veolia, as the City's collection system contract operator, continues to inspect and clean critical locations within the collection system. In addition, it is recommended that locations within the collection system identified during the model calibration receive priority inspection and maintenance going forward. The areas recommended for priority inspection and maintenance are provided in Table 7-7.

Table 7-7. Recommended Sewer Inspection Locations

Area ID	Area Description	Upstream Manhole ID	Downstream Manhole ID
1	East Interceptor, North of I-95	03-9	03-15
2	East Interceptor, South of I-95	03-6	23-1.9

Table 7-7. Recommended Sewer Inspection Locations

Area ID	Area Description	Upstream Manhole ID	Downstream Manhole ID
3	Knight Steet	03-168	03-237
4	East Wall Street	03-27	03-23
5	Brook Street	07-2	03-241
6	Margaret Street to Saddle Road	05-45	05-30
7	Main Street	09-6	08-133
8	Danbury Road/Main Avenue	Wilton Meter Chamber	09-77
9	North of Belden Avenue	10-14	10-11
10	Ann Street	14-3	23-96
11	Arthur J. Perschino Way	16-9.1	16-5
12	Commerce Street	19-24	19-5
13	Westport Ave PS	21-6.1	21-1
14	Orchard Street	12-3	23-12
15	Riverside Avenue	10-325	10-24
16	Concord Street	16-4	15-12

7.3.1.2 Periodic Level Monitoring for Predictive Maintenance

Periodic review of the depth of flow near MH locations presented in Table 7-7 is recommended to assist in proactive identification of cleaning or maintenance activities to maintain conveyance capacity within the collection system. Table 7-8 presents the associated DWF velocities at locations recommended for periodic depth of flow survey.

Table 7-8. Locations Recommended for Periodic Depth of Flow Survey

Manhole ID	Minimum Dry Weather Flow Velocity (fps)	Average Dry Weather Flow Velocity (fps)	Maximum Dry Weather Flow Velocity (fps)
03-1	0.5	0.8	1.1
03-11	1.1	1.7	2.0
03-164	0.3	0.7	1.0
03-25	1.0	1.5	2.0
05-42	0.2	0.5	0.7
09-1	0.8	1.2	1.7
14-1.1	0.7	1.4	1.8
16-1	1.5	1.7	2.1
16-8	0.3	0.5	0.7
19-23	1.1	1.7	2.3
21-1	1.2	1.7	2.2

7.3.1.3 WPCF IPS Setpoint Modification

During the July 8, 2021 wet weather event, the remnants of Hurricane Elsa resulted in a large increase in flows in the collection system. During this event, a large volume of debris was mobilized and conveyed to the WPCF, where it blinded the screens at the plant headworks. The operational setpoint of the WPCF IPS has historically maintained a depth of 15.5 feet in the IPS wet well. This depth results in a portion of the interceptor system being under a continuous backwater condition, where decreased velocities may increase the accumulation of debris in the backwatered portions of the interceptor system. Lowering the operational setpoint to maintain a lower water surface elevation at the WPCF IPS should reduce the backwater conditions and increase velocities in the interceptor system. In turn, the increase in flow velocity should help in maintaining self-cleaning velocities in the interceptor system for longer periods of time and reduce sediment accumulation. If feasible, it is recommended that the operational setpoint of the WPCF IPS be decreased to reduce the backwater conditions imposed on the interceptor system.

7.3.2 Capital Improvement Recommendations

7.3.2.1 Hubbells Lane Relief Sewer

The Hubbells Lane Relief Sewer project can provide immediate benefits to the collection system performance. Modeling has indicated that rerouting flows from the East Wall Street trunk sewer to the Hubbells Lane Relief Sewer and directing those flows to the East Interceptor downstream of the Moodys Lane Siphon, lowers the HGL in portions of the East Interceptor between the Main Street and Burnell Street and the Smith Street and Moodys Lane intersections. This reach of the East Interceptor, and the lower portion of the connected trunk sewer along Brook Street have historically been prone to significant surcharge. The model results indicate the Hubbells Lane Relief Sewer effectively mitigates the significant surcharging and prevents MH overflows up to the 25-year, 6-hour return frequency event.

The design and construction of the Hubbells Lane Relief Sewer project is recommended to alleviate significant surcharging in the East Interceptor, maximize flows conveyed to the WPCF, and improve the overall performance of the collection system during wet weather flow events.

7.3.2.2 Catch Basin Disconnection Program

There are 81 known directly connected catch basins identified in the City's GIS dataset. The inflow contributions from each catch basin varied due to differences in the tributary areas, land uses, and capacity of the sanitary collection system downstream of the catch basin connection point. The peak flows that can enter the collection system through these directly connected catch basins were estimated using the rational method and the capacity of the sanitary sewer conduit directly downstream of the catch basin. Catch basins where the peak flow rate from the 1-year return frequency rainfall event and the sanitary collection system capacity downstream of the catch basin exceeded 0.5 MGD were identified as significant inflow contributors.

Of the 81 directly connected catch basins, 38 were identified as significant inflow contributors. Disconnection of these 38 catch basins was estimated to remove 77 percent of the total peak inflows from the known direct inflow connections.

Based on the relative cost effectiveness of catch basin disconnection, it is recommended that the 38 catch basins identified in Table 6-1 as significant inflow contributors are targeted for disconnection through a Catch Basin Disconnection Program.

The Catch Basin Disconnection Program would serve to accomplish the following:

- Confirm the catch basin drainage area, land use, and peak flow reduction estimates calculated in either the *Inflow and Infiltration Control Plan* or this Master Plan.
- Perform catch basin disconnection feasibility analysis
 - Determine catch basin connection point to the City's Storm Drain system
 - Perform Storm Drain capacity assessment to confirm the existing Storm Drain system has capacity to convey the additional flow
 - Conduct underground utility survey to identify potential conflicts and assess constructability of catch basin disconnection project
 - Determine sizing and perform preliminary design
- Perform detailed design and develop catch basin disconnection project specifications.
- Perform project bidding, construction management, and catch basin disconnection project close out.

It is noted that the catch basin disconnection analysis performed for this Master Plan assumed that the storm drain system has sufficient conveyance capacity to accept the additional flows and that construction of new storm drain assets required for catch basin disconnection are feasible. Both assumptions will need to be further verified through more detailed engineering analyses as part of the Catch Basin Disconnection Program.

The additional analysis of the storm drainage system, performed under the Catch Basin Disconnection Program, is designed to determine if the catch basin disconnection is constructable and whether additional improvements to the storm drainage system are necessary to accept the additional flow from the catch basin drainage area will be required. Where either assumption is found to be false, the disconnection of the directly catch basin may not be constructable due to conflicts or constraints not considered as part of the Master Plan analysis or may not be economically feasible due to significant storm drain improvement requirements. Design and construction phases for each catch basin disconnection project will also be required to be administered by the City.

7.3.2.3 Ann Street Emergency Overflow Elimination

The Emergency Overflow has historically provided relief to the interceptor system when it is hydraulically overloaded as a result of significant rainfall events and during periods of catastrophic infrastructure failure. Examples of catastrophic infrastructure failure that have been recently experienced by Norwalk include: decreased pumping capacity at the WPCF IPS; gate opening failure on the second barrel of the Ann Street Siphon; and blinding of the WPCF headworks bar screens. In each of these scenarios, the conveyance to the WPCF has been decreased, resulting in surcharging of the interceptor system and, eventually, a discharge from the Emergency Overflow.

From Table 7-2, it can be seen that the calibrated model does not predict discharges from the Emergency Overflow to occur as a result of the 25-year, 6-hour return frequency rainfall event in either the baseline conditions or the future reduced inflow conditions. From this perspective, discharges from the Emergency Overflow have been essentially eliminated already. For additional perspective, other CSO communities in the state of Connecticut generally attempt to control overflows for return frequency events much smaller than the 25-year event. Put another way, in its current configuration, the Emergency Overflow already discharges much less frequently than most, if not all, similarly situated assets within the State.



To comply with paragraph B of the Consent Order, three alternatives for the Emergency Overflow elimination were tested under the projected 2027 system conditions and are discussed in Section 7.2.1. Alternative 1 represented the current configuration of the Emergency Overflow structure. Alternative 2 represented elimination of the Emergency Overflow through a flow elimination structure that provides a physical barrier to discharge from the structure during wet weather flow events. Alternative 3 represented elimination of the Emergency Overflow by a permanent physical closure of the overflow conduits. Under Alternative 3, no ability to control the water level in the west interceptor during either extreme wet weather flow events or during periods of catastrophic infrastructure failure (Force Majeure events) is available to the WPCA.

The consequence of the loss of ability to control the HGL in the west interceptor under Alternative 3 is that during Force Majeure events, the HGL in the west interceptor can continue to increase until an uncontrolled SSO occurs. Under the elevated surcharge conditions, the risk of basement flooding for more than 1,000 properties, shown in Figure 4-7, is significantly elevated. Conversely, under Alternative 2, the retained ability to control the HGL in the west interceptor during these extreme conditions provides a critical mechanism for the prevention of uncontrolled SSO events and potential basement flooding for more than 1,000 properties connected to the west interceptor.

Due to the unacceptable risk of basement backup and increased risk to the health and safety of the public associated with Alternative 3, it is recommended that the elimination of the Emergency Overflow be accomplished through the installation of the flow elimination structure from Alternative 2 and permanent level monitoring at the overflow structure. This approach provides a physical barrier to flow that eliminates the potential for discharges from the Emergency Overflow while maintaining a controlled point of hydraulic relief that protects the general health and safety of the public.

7.4 Long-Term Master Plan Recommendations

The targeted rehabilitation of public sewer assets is recommended as a long-term strategy to reduce the volume of extraneous flows entering the collection system that must be conveyed to and treated at the WPCF. Targeted RDII reduction is intended to address sources of extraneous flows entering the collection system originating from sources other than the known directly connected catch basins.

Reduction of extraneous flows, beyond what is projected to be achieved from the disconnection of directly connected catch basins, can be approached by either performing comprehensive sewer rehabilitation across large sewershed areas or by a more targeted RDII reduction approach. The comprehensive rehabilitation approach can achieve significant RDII reduction, however, it is not always cost-effective or necessary, as non-defective sewer assets are rehabilitated in the same manner as defective ones. A more cost-effective approach to RDII reduction can be achieved through the targeted investigation and rehabilitation of prioritized sewersheds that exhibit high rates of RDII production.

It is recommended that the City implement a long-term RDII reduction and flow management plan. The following activities are commonly included as part of a targeted RDII reduction plan and are performed prior to the development of specific I/I reduction projects:

- Perform temporary flow monitoring within the metersheds prioritized for targeted RDII flow reduction to further identify specific areas within the metershed that exhibit the highest RDII production rates.
- Perform collection system condition assessment work to identify assets with significant defects that may act as I/I sources.

- Perform targeted field investigations where supported by data to identify specific inflow sources for disconnection. Examples of field investigation activities include, but are not limited to, smoke testing and dye testing.
- Perform field investigations, such as flow isolation studies, to identify areas with high infiltration rates.

Based on results of collection system inspections and field investigation activities, I/I reduction plans may be developed and customized to correct the specific types of defects and I/I sources identified, such as the disconnection of identified illicit cross-connections or comprehensive rehabilitation in concentrated areas of the metershed where the highest I/I production rates have been identified. The I/I reduction plan should establish a methodology for the prioritization of I/I reduction projects and indicate an anticipated schedule for implementation.

Based on the RDII reduction cost-effectiveness curves, presented in Figure 6-1, the costs for I/I removal are shown to increase significantly when the RDII production rate in the sewershed is less than 15,000 GPAD. Using the RDII production rate of 15,000 GPAD as a threshold, 19 metershed areas were identified where targeted RDII reductions can be cost-effective to achieve. The 19 metershed areas recommended for targeted RDII reductions are shown in Figure 7-1.

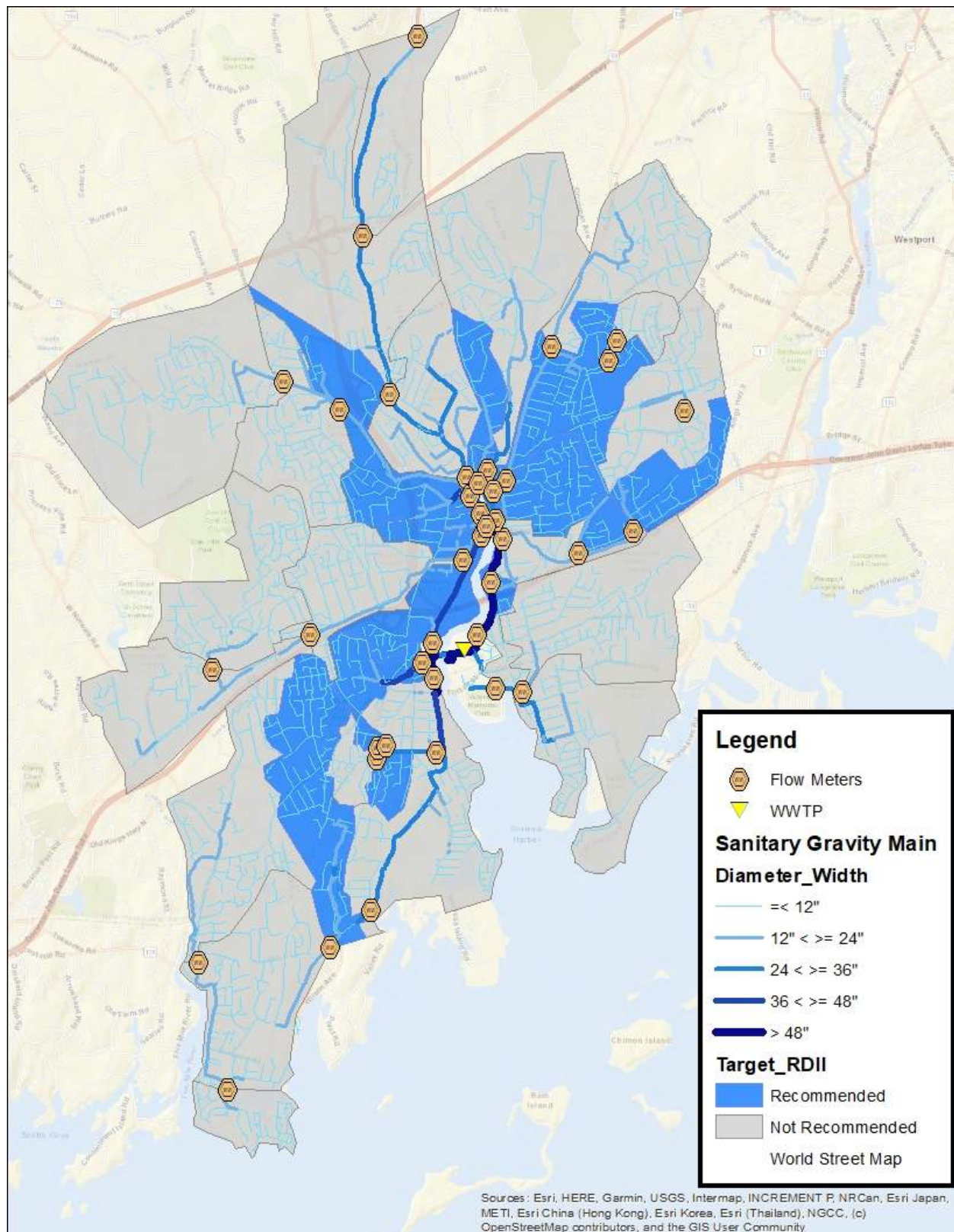


Figure 7-1. Metershed Areas Recommended for Targeted RDII Reduction

7.5 Implementation

The estimated costs associated with the recommended Consent Order Recommendations identified in this Master Plan are presented in Table 7-10.

Table 7-9. Consent Order Recommendations Cost Estimate

Consent Order Recommendation Name	Construction Costs	Engineering and Contingencies	Total Cost
Hubbells Lane Relief Sewer	\$4,500,000	\$900,000	\$5,400,000
Ann Street Emergency Overflow Elimination	\$700,000	\$100,000	\$800,000
Catch Basin Disconnections	\$8,800,000	\$1,800,000	\$10,600,000
Total Costs	\$14,000,000	\$2,800,000	\$16,800,000

The total estimated costs associated with both the Consent Order and the longer-term Master Plan recommended projects and improvements are presented in Table 7-10.

Table 7-10. Long-Term Master Plan Recommendations

Capital Project Name	Construction Costs	Engineering and Contingencies	Total Cost
Consent Order Recommendations	\$14,000,000	\$2,800,000	\$16,800,000
Targeted Collection System Rehabilitation	\$28,000,000	\$8,400,000	\$36,400,000
Total Program Costs	\$42,000,000	\$11,200,000	\$53,200,000

With an estimated total cost in excess of \$53 million to complete the recommended collection system capacity improvements, catch basin disconnections, and sewer rehabilitation work necessary to reduce RDII flows from entering the collection system, a multi-year effort will be required. Measures identified as Consent Order Recommendations can be designed and constructed within the next five years. Completion of the catch basin disconnections, beyond those identified as a Consent Order Recommendation, cannot be reasonably expected to be implemented within a five-year timespan. Disconnection of the remaining directly connected catch basins recommended for disconnection will require a multi-year effort to design and construct the discrete construction projects required. The targeted RDII reductions will need to be completed as part of a longer-term I/I reduction program administered by the City. The work completed as part of this Master Plan identified metersheds where cost-effective RDII reductions can be achieved and established a targeted post-rehabilitation RDII associated with an improved performance of the collection system. The nature and locations of RDII sources, and the specific types and quantities of sewer rehabilitation required to achieve the targeted RDII reductions will need to be identified and further developed as part of future engineering studies and design projects.

An implementation schedule for the activities recommended in this Master Plan update are provided in Figure 7-2.

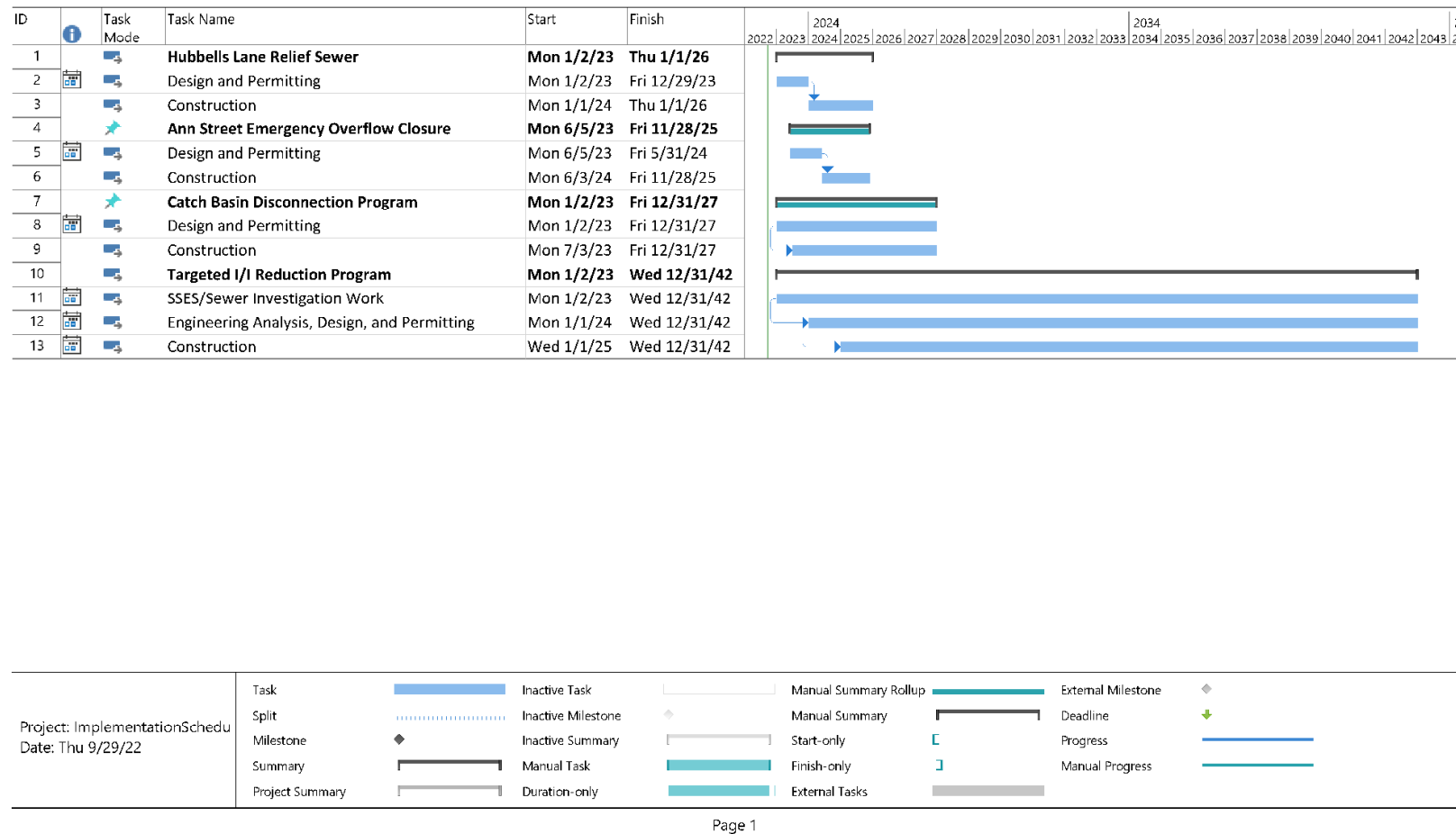


Figure 7-2. Master Plan Recommendation Implementation Schedule

Section 8

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Appendix A: Norwalk Consent Order



STATE OF CONNECTICUT
V.
CITY OF NORWALK

CONSENT ORDER

A. The Commissioner of Energy and Environmental Protection (“the Commissioner”) finds:

1. The City of Norwalk (“Respondent”) owns and operates a sanitary sewer collection system comprised of approximately 200 miles of pipe, 22 pump stations, more than 6,000 manholes, and a sewage treatment facility, hereafter referred to as the Norwalk Water Pollution Control Facility (“WPCF”), which discharges treated sanitary sewage under the terms and conditions of National Pollution Discharge Elimination System (“NPDES”) Permit No. CT0101249 (“Permit”).
2. The Norwalk WPCF has a design flow of 18 million gallons per day (“MGD”) and a secondary treatment capacity of 30 MGD. Flows up to 30 MGD must receive preliminary treatment, primary treatment and advanced treatment with denitrification followed by sodium hypochlorite disinfection and sodium bisulfite dechlorination prior to discharge to the Norwalk River through outfall number 001-1. The permit allows Respondent to direct flows above 30 MGD through the secondary bypass treatment system.
3. Flows above 30 MGD are required to receive either full treatment, or preliminary treatment followed by microscreen treatment, sodium hypochlorite disinfection and sodium bisulfite dechlorination prior to discharge to the Norwalk River through the Permit’s outfall number 002-1. In the 1970s, the Department approved the use of microscreens as the equivalent of primary treatment at the Norwalk WPCF.
4. On April 25, 2017, microscreens 1 and 3 were reported to DEEP as out of service by Respondent. On May 17, 2017, microscreens 2 and 4 were similarly reported as out of service. For both reports, the repair time was noted as “Long term repairs are being evaluated.” As a result, since May 17, 2017, Respondent has caused wet weather bypasses to occur without the equivalent of primary treatment. See Attachment A (entitled *NORWALK Permitted Outfall 002-1 Bypasses*) for a list of the discharges reported by Respondent since 2017 which received no or inadequate primary treatment or its equivalent.

5. The City of Norwalk's collection system is physically divided into two segments by the Norwalk River and the Norwalk Harbor: a western and eastern portion. The collection system's two segments are connected in two locations by siphons at Moody's Lane and Ann Street. The Ann Street siphon inlet chamber also includes an emergency outfall to the Norwalk River that may activate during weather events (as an Emergency Overflow) with extreme volume serving as the last controlled emergency relief point before wastewater enters the WPCF. On August 22, 2016, Respondent's Ann Street Siphon (Siphon) was activated due to a mechanical equipment failure discharging raw sewage directly to the Norwalk River. On June 28, 2018, Respondent's Siphon also activated allowing raw sewage to discharge directly to the Norwalk River. This Emergency Overflow is not metered so the amount of overflow cannot be quantified. The discharge is not authorized in the Respondent's permit. Respondent uses the Siphon, on an as-needed basis in cases of extreme flows in the sewage collection system from high precipitation events and the resulting infiltration/inflow of water and has activated the Siphon to alleviate excess flows from such system by discharging untreated domestic sewage.
6. By agreeing to the issuance of this Consent Order, the Respondent makes no admission as to the Commissioner's findings of fact or law with respect to the matters addressed herein except for those findings detailed in paragraphs A.1. to A.3, inclusive, of this Consent Order.
7. By virtue of the above, the Respondent is causing pollution of the waters of the state and is maintaining facilities or conditions that can reasonably be expected to create a source of pollution to the waters of the state.

B. The Commissioner, acting under §22a-6, §22a-424, §22a-425, §22a-427, §22a-428, §22a-430, and §22a-431 of the Connecticut General Statutes, orders the Respondent as follows:

1. Respondent shall retain one or more qualified consultants acceptable to the Commissioner to prepare the update of the City's Sanitary Sewer Collection System Master Plan and shall notify the Commissioner in writing of the identity of such consultants. The Respondent has retained Brown and Caldwell as the primary on-call collection system consultant and Woodard and Curran as the secondary on-call collection system consultant to prepare the documents and implement of oversee the actions required by paragraph B.3 of this Consent Order. Respondent shall retain one or more qualified consultants acceptable to the Commissioner until the actions required by this consent order have been completed, and within ten (10) days after retaining any consultant other than the one originally identified under this paragraph, Respondent shall notify the Commissioner in writing of the identity of such other consultant. The consultant(s) retained to perform the studies and oversee any remedial measures required pursuant to paragraph B.3. of this Consent Order shall be a qualified professional engineer licensed to practice in Connecticut. Respondent shall submit to the Commissioner a description of a consultant's education, experience and training which is relevant to the work required by this consent order within ten days after a request for such a description. Nothing in this paragraph shall preclude the Commissioner from finding a previously acceptable consultant unacceptable.

2. Respondent shall retain one or more qualified consultants acceptable to the Commissioner to prepare the update to the City's Wastewater Treatment Plant Facilities Plan and shall notify the Commissioner in writing of the identity of such consultants. The Respondent has retained Arcadis US, Inc. to prepare the documents and implement or oversee the actions required by paragraph B.4. of this Consent Order. Respondent shall retain one or more qualified consultants acceptable to the Commissioner until the actions required by this consent order have been completed, and within ten (10) days after retaining any consultant other than the one originally identified under this paragraph, Respondent shall notify the Commissioner in writing of the identity of such other consultant. The consultant(s) retained to perform the studies and oversee any remedial measures required pursuant to paragraph B.4 of this Consent Order shall be a qualified professional engineer licensed to practice in Connecticut. Respondent shall submit to the Commissioner a description of a consultant's education, experience and training which is relevant to the work required by this consent order within ten days after a request for such a description. Nothing in this paragraph shall preclude the Commissioner from finding a previously acceptable consultant unacceptable.
3. On or before September 30, 2022, Respondent shall submit, for the Commissioner's review and written approval, a comprehensive and thorough engineering report updating the Sanitary Sewer Collection System Master Plan which describes and evaluates a range of viable and cost-effective measures to 1) remove excess flow (such as infiltration/inflow) from the sewage collection system, and 2) eliminate the Ann Street Siphon Emergency Overflow from the sewage collection system. Such report shall:
 - a. Evaluate a range of viable and cost-effective measures to achieve compliance with paragraph B.3 of this Consent Order,
 - b. State in detail the most expeditious schedule for performing each measure,
 - c. List all permits and approvals required for each measure, including but not limited to any permits required under Sections 22a-32, 22a-42a, 22a-342, 22a-361, 22a-368 or 22a-430 of the CGS,
 - d. Propose a preferred measure or combination of measures with supporting justification therefore, and
 - e. Propose a detailed program and schedule to perform all actions required to implement the preferred measure(s), including but not limited to, a schedule for submission of engineering plans and specifications for any new equipment, the start and completion of any construction activities and applying for and obtaining all permits and approvals required for such actions.
4. On or before June 30, 2023, Respondent shall submit, for the Commissioner's review and written approval, a comprehensive and thorough engineering report which updates the Wastewater Treatment Plant Facilities Plan and describes and evaluates a range of viable and cost-effective measures to provide Outfall 002-1 with primary treatment or its

equivalent, or to eliminate Outfall 002-1. Such report shall:

- a. Evaluate a range of viable and cost-effective measure to achieve compliance with paragraph B.4 of this Consent Order,
 - b. State in detail the most expeditious schedule for performing each measure,
 - c. List all permits and approvals required for each measure, including but not limited to any permits required under Sections 22a-32, 22a-42a, 22a-342, 22a-361, 22a-368 or 22a-430 of the CGS,
 - d. Propose a preferred measure or combination of measures with supporting justification therefore, and
 - e. Propose a detailed program and schedule to perform all actions required to implement the preferred measure(s), including but not limited to a schedule for submission of engineering plans and specifications for any new equipment, the start and completion of any construction activities and applying for and obtaining all permits and approvals required for such actions.
5. Within sixty (60) days of the Commissioner's approval of the each of the reports required by paragraphs B.3 and B.4 above, Respondent shall begin to implement the preferred measure(s) described therein. Unless otherwise approved by the Commissioner in writing, in no event shall the implementation schedule of the proposed measure or combination of measures to complete those actions required by paragraphs B.3 and B.4 exceed a length of five (5) years from the date of approval of the measure(s) required by paragraph B.3 and ten (10) years from the date of approval of the measure(s) required by Paragraph B.4.
6. Progress Reports. On or before the last day of June of each year after the date of issuance of this Consent Order and continuing until all actions required by this consent order have been completed as approved and to the Commissioner's satisfaction, Respondent shall submit a progress report to the Commissioner describing the actions which Respondent has taken to date to comply with this consent order.
7. Full compliance. Respondent shall not be considered in full compliance with this consent order until all actions required by this consent order have been completed as approved and to the Commissioner's satisfaction.
8. Approvals. Respondent shall use best efforts to submit to the Commissioner all documents required by this consent order in a complete and approvable form. If the Commissioner notifies Respondent that any document or other action is deficient, and does not approve it with conditions or modifications, it is deemed disapproved, and Respondent shall correct the deficiencies and resubmit it within the time specified by the Commissioner or, if no time is specified by the Commissioner, within 30 days of the Commissioner's notice of deficiencies. In approving any document or other action under this consent order, the Commissioner may approve the document or other action as submitted or performed or

with such conditions or modifications as the Commissioner deems necessary to carry out the purposes of this Consent Order. Nothing in this paragraph shall excuse noncompliance or delay.

9. Definitions. As used in this consent order, "Commissioner" means the Commissioner or a representative of the Commissioner.
10. Dates. The date of "issuance" of this Consent Order is the date the consent order is deposited in the U.S. mail or personally delivered, whichever is earlier. The date of submission to the Commissioner of any document required by this consent order shall be the date such document is received by the Commissioner. The date of any notice by the Commissioner under this consent order, including but not limited to notice of approval or disapproval of any document or other action, shall be the date such notice is deposited in the U.S. mail, sent via email, or is personally delivered, whichever is earlier. Notwithstanding the foregoing, due to the COVID-19 pandemic, the following shall apply. The date of "issuance" of this Consent Order is the date the Consent Order is sent to the Respondent via electronic mail. In addition, for documents to be submitted to the Commissioner, until such time as the Commissioner notifies the Respondent that documents must be submitted via U.S. mail or by personal delivery, the Respondent may submit documents to the Commissioner electronically and the date of submission of any such document shall be the date such document is received by electronic mail. Nothing in the foregoing is intended preclude the Commissioner from requiring that a document submitted electronically also be submitted via U.S. mail or by personal delivery within the timeframe specified by the Commissioner. With respect to notices from the Commissioner under this Consent Order, until such time as the Commissioner notifies the Respondent that notices will be provided via U.S. mail or by personal delivery, such notices may be sent electronically and the date of any notice by the Commissioner under this Consent Order, including but not limited to notice of approval or disapproval of any document or other action, shall be the date such notice is sent via electronic mail. Except as otherwise specified in this consent order, the word "day" as used in this consent order means calendar day. Any document or action which is required by this consent order to be submitted or performed by a date which falls on a Saturday, Sunday or a Connecticut or federal holiday shall be submitted or performed by the next day which is not a Saturday, Sunday or Connecticut or federal holiday.
11. Certification of documents. Any document, including but not limited to any notice, which is required to be submitted to the Commissioner under this consent order shall be signed by Respondent or, if Respondent is not an individual, by Respondent's chief executive officer or a duly authorized representative of such officer, as those terms are defined in §22a-430-3(b)(2) of the Regulations of Connecticut State Agencies, and by the individual(s) responsible for actually preparing such document, and each such individual shall certify in writing as follows:

"I have personally examined and am familiar with the information submitted in this document and all attachments thereto, and I certify, based on reasonable investigation, including my inquiry of those individuals responsible for obtaining the information, that

the submitted information is true, accurate and complete to the best of my knowledge and belief. I understand that any false statement made in the submitted information may be punishable as a criminal offense under §53a-157b of the Connecticut General Statutes and any other applicable law.”

12. False statements. Any false statement in any information submitted pursuant to this consent order may be punishable as a criminal offense under §53a-157b of the Connecticut General Statutes and any other applicable law.
13. Notice of transfer; liability of Respondent. Until Respondent has fully complied with this consent order, Respondent shall notify the Commissioner in writing no later than 15 days after transferring all or any portion of the facility, the operations, the site or the business which is the subject of this Consent Order or after obtaining a new mailing or location address. Respondent's obligations under this consent order shall not be affected by the passage of title to any property to any other person or municipality.
14. Commissioner's powers. Nothing in this consent order shall affect the Commissioner's authority to institute any proceeding or take any other action to prevent or abate violations of law, prevent or abate pollution, recover costs and natural resource damages, and to impose penalties for past, present, or future violations of law. If at any time the Commissioner determines that the actions taken by Respondent pursuant to this consent order have not successfully corrected all violations by successfully completing all approved measures in accordance with paragraph B.5. of this Consent Order, fully characterized the extent or degree of any pollution, or successfully abated or prevented pollution, the Commissioner may institute any proceeding to require Respondent to undertake further investigation or further action to prevent or abate violations or pollution.
15. Respondent's obligations under law. Nothing in this consent order shall relieve Respondent of other obligations under applicable federal, state and local law.
16. No assurance by Commissioner. No provision of this Consent Order and no action or inaction by the Commissioner shall be construed to constitute an assurance by the Commissioner that the actions taken by Respondent pursuant to this consent order will result in compliance or prevent or abate pollution.
17. Access to site. Any representative of the Department of Energy and Environmental Protection may enter the facility without prior notice for the purposes of monitoring and enforcing the actions required or allowed by this consent order.
18. No effect on rights of other persons. This consent order neither creates nor affects any rights of persons or municipalities that are not parties to this consent order.
19. Notice to Commissioner of changes. Within 15 days of the date Respondent becomes aware of a change in any information submitted to the Commissioner under this consent order, or that any such information was inaccurate or misleading or that any relevant

information was omitted, Respondent shall submit the correct or omitted information to the Commissioner.

20. Notification of noncompliance. In the event that Respondent becomes aware that it did not or may not comply, or did not or may not comply on time, with any requirement of this Consent Order or of any document required hereunder, Respondent shall immediately notify by telephone or electronic mail the individual identified in the next paragraph and shall take all reasonable steps to ensure that any noncompliance or delay is avoided or, if unavoidable, is minimized to the greatest extent possible. Within five (5) days of the initial notice, Respondent shall submit in writing the date, time, and duration of the noncompliance and the reasons for the noncompliance or delay and propose, for the review and written approval of the Commissioner, dates by which compliance will be achieved, and Respondent shall comply with any dates which may be approved in writing by the Commissioner. Notification by Respondent shall not excuse noncompliance or delay, and the Commissioner's approval of any compliance dates proposed shall not excuse noncompliance or delay unless specifically so stated by the Commissioner in writing.
21. Submission of documents. Any document required to be submitted to the Commissioner under this consent order shall, unless otherwise specified in this consent order or in writing by the Commissioner, shall be provided in an electronic format, and be directed to:

Ann Straut, Sanitary Engineer 3
Department of Energy and Environmental Protection
Bureau of Water Protection and Land Reuse
Water Planning and Management Division
79 Elm Street
Hartford, Connecticut 06106-5127
ann.straut@ct.gov

Respondent consents to the issuance of this Consent Order without further notice.

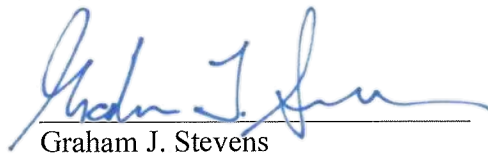
The undersigned certifies that he/she is fully authorized to enter into this consent order and to legally bind the Respondent to the terms and conditions of the consent order.

City of Norwalk

BY: Harry W. Rilling
Harry W. Rilling
Mayor

5/5/22
Date

Issued as a final order of the Commissioner of Energy and Environmental Protection.



Graham J. Stevens
Bureau Chief
Water Planning and Management Division

May 6, 2022

Date

COWRMU22001

ATTACHMENT A

NORWALK Permitted Outfall 002-1 Bypasses

YEAR	DATE	Duration (HRS:MIN)	Max Flow (MGD)	Total Volume (MG)	Rainfall (IN)	Comment
2017	4/4/2017	8:15	17.5	2.1	2.08	Partial primary treatment
2017	4/6/2017	1:55	0.58	0.1	1.03	Partial primary treatment
2017	5/5/2017	2:00	15.22	0.6	2.18	Partial primary treatment
2017	7/7/2017	2:00	16.2	0.8	2.17	No primary treatment
2017	10/29/2017	2:10	14.7	0.8	3.57	No primary treatment
2018	3/2/2018	8:55	14.8	1.9	2.15	No primary treatment
2018	4/16/2018	9:30	37	5	3.93	No primary treatment
2018	6/28/2018	2:30	37.3	2.1	2.32	No primary treatment
2018	9/6/2018	1:20	18.1	0.4	1.47	No primary treatment
2018	9/25/2018	6:45	42.2	7.9	5.7	No primary treatment
2018	9/26/2018	4:50	9	0.82	0	No primary treatment
2018	10/2/2018	3:50	44.3	3.7	4.08	No primary treatment
2018	10/3/2018	22:25	29	4.5	0.14	No primary treatment
2019	1/24/2019	6:05	10.16	0.88	1.75	No primary treatment
2019	7/18/2019	4:25	9.4	0.32	5.04	No primary treatment
2019	7/22/2019	1:12	4.2	0.11	1.55	No primary treatment
2019	10/27/2019	4:41	37.6	3.01	3.04	No primary treatment
2019	12/14/2019	13:40	14.11	2.1	2.68	No primary treatment
2020	7/1/2020	0:49	0.53	0.08	1.18	No primary treatment

Appendix B: Recent Collection System Enhancement Projects and Initiatives



The Original Sanitary Sewer Collection System Master Plan

In 2005, the WPCA executed an agreement with Malcolm Pirnie, Inc. to provide professional engineering services to develop a Sanitary Sewer Collection System Master Plan (Original Plan) with the purpose of developing a long-term system-wide approach for effective preservation of the City's collection system. The development of the Original Plan involved the creation of several dynamic tools, including a geographic information system (GIS) database to map the collection system, a hydraulic model of important interceptors, pump stations and force mains, and an interactive financial model.

In the spring of 2006, a city-wide flow metering program was implemented to identify areas of high inflow and infiltration and to provide data for developing and calibrating the hydraulic model.

The Original Plan was issued as a draft in 2006 with preliminary findings and recommendations to provide direction to the WPCA team for the purpose of accelerating collection system rehabilitation. The Original Plan continued to be updated using the dynamic tools developed and then issued as Final in December 2009. The analysis of existing data and the development of several dynamic tools enabled Malcolm Pirnie to characterize the City's collection system and identify its critical components. Structural deficiencies were identified as the most significant concern related to preserving the City's collection system. Addressing priority structural deficiencies alleviates health, safety, and cost concerns associated with disruption of service and emergency repairs, reduces extraneous flows, alleviates capacity issues, reduces transport and treatment costs, and prevents future deficiencies.

Based on the recommendations and findings of the Original Report, the WPCA proceeded with interceptor rehabilitation and completed multiple projects from 2006 through today including the following.

- Fort Point (36-inch) Interceptor Replacement
- Seaview Ave (36-inch) and Cove Ave (30-inch) Interceptor CIPP Lining
- Norwalk River (48-inch) Interceptor CIPP Lining
- Beacon Street (15-inch) Interceptor CIPP Lining
- Orchard Street (24-inch) Interceptor Replacement and CIPP Lining

In addition, the WPCA performed several I/I and SSES Rehabilitation projects including Keeler Brook pump station sewershed, Wilton Avenue Sewer Separation, Ann Street Siphon Chamber Rehabilitation and Tide Gates, Beacon Street Service Area Sewer System, Pine Point Sewer Replacement, Sanitary Sewer Rehabilitation (Various Priority), and other smaller areas.

Collection System Assessment for Rehabilitation

In 2016, the WPCA executed an agreement with CH2M Hill Engineers, Inc. (CH2M) to provide on-call professional engineering services related to the wastewater collection systems. CH2M was tasked with developing a basis of design report for system-wide collection system construction improvements.

In 2017, a preliminary engineering report was prepared by the WPCA's on-call collection system consultant, CH2M, to identify the major areas within the existing collection system that would benefit from rehabilitation or replacement. A risk assessment was defined for the level and consequence of individual pipe failure and preliminary planning was conducted for suggested pipe improvements such as replacement, CIPP lining, and permitting. Proposed improvements included deformed pipes with a high likelihood and consequence of failure, hot spot areas that could be removed from the list

by conducting sewer repairs, gravity mains downstream of force mains, and East Avenue Interceptor review.

Rehabilitation Projects and Upgrades

Beacon Street Interceptor Rehabilitation: In July 2014, the WPCA entered into a contract for construction with Heitkamp, Inc. to provide all materials, equipment, labor, and supervision for sanitary sewer system rehabilitation of the Beacon St. Interceptor Service Area, including trenchless rehabilitation in 8-inch through 18-inch diameter sewer pipe, cleaning and pre- and post-rehabilitation closed circuit television inspection; grinding of service connections; testing and chemical sealing of pipe joints; chemical sealing of service connections; cured-in-place spot repairs (CIPSR); cured-in-place pipe lining (CIPPL); reinstatement of service connection (post-CIPPL); and MH rehabilitation. MH rehabilitation includes cleaning, plugging covers, reset/replace frames and covers, chimney repair and sealing, monolithic and epoxy lining, chemical sealing of walls, joints, pipe connections, benches/inverts, and rebuilding of benches/inverts.

The work was completed in 2017 and consisted of CIPP lining of approximately 26,000 feet of 8-inch to 18-inch diameter gravity sewers, approximately 190 feet of cured-in-place spot repairs (CIPSR), testing and chemical sealing of approximately 700 service connections, and 295 MH rehabilitations.

Marvin Beach Pump Station Upgrade: In May 2018, the WPCA entered into a contract for construction with C. H. Nickerson & Co., Inc. to provide all materials, equipment, labor, and supervision for the comprehensive upgrade to the Marvin Beach pump station and was completed in December 2018. The upgrade project included installation of piping, site work, equipment systems, structures, instrumentation, control and electrical systems, two (2) new dry-pit submersible pumps, piping, valves and appurtenances, new pump controls, new fence, new electrical enclosure, and abatement of any hazardous materials. Renovation of concrete surfaces including concrete repairs and epoxy coatings of wet well and critical concrete areas. A new force main was installed as a change order to this project.

Bethel Street Pump Station Upgrade: A new force main was installed at the Bethel Street pump station in 2019.

Westport Pump Station Upgrade: The Westport pump station upgrade was finalized in May 2019. The upgrade project included installation of bypass connection, two (2) new dry-pit submersible pumps, piping, valves and appurtenances, new pump controls and VFDs, new flow meter. Renovation of concrete surfaces including concrete repairs and epoxy coatings of wet well and critical concrete areas.

Fort Point Pump Station Upgrade: The Fort Point pump station upgrade was finalized in May 2019. The upgrade project included installation of channel grinder in influent channel, piping and appurtenances, renovation of concrete surfaces including concrete repairs, and epoxy coatings of wet well and critical concrete areas.

Shady Beach Pump Station Upgrade: In February 2019, the Shady Beach pump station was upgraded that included the installation of two (2) new pumps, piping and valves, and bypass connection.

Various Other Sanitary Sewer Rehabilitation Projects: In April 2019, the WPCA entered into a contract for construction with Green Mountain Pipeline Services to provide all materials, equipment, labor, and supervision for collection system rehabilitation, including trenchless rehabilitation in 8-inch through 24-inch diameter sewer pipe, cleaning and pre and post-rehabilitation closed circuit

television inspection; grinding of service connections; traditional dig and replace point repairs; cured-in-place pipe lining (CIPP); reinstatement of service connection (post-CIPP); and MH rehabilitation. MH rehabilitation includes cleaning, plugging covers, reset/replace frames and covers, chimney repair and sealing, monolithic and epoxy lining, chemical sealing of walls, joints, pipe connections, benches/inverts, and rebuilding of benches/inverts.

To further enhance the collection system, the WPCA continued to add additional work and time extension (through the end of 2022) to the original contract that included additional CIPP lining and excavation replacement of gravity mains, and CIPP lining of 1,400 feet of Smith Street 36-inch interceptor between Wall Street and Moodys Lane. The final work consisted of over 50,000 feet of CIPP lining of 8-inch to 36-inch diameter gravity sewers, approximately 1,600 feet of traditional dig and replace point repairs, and approximately 400 vertical feet of MH rehabilitations with epoxy or cement.

Wastewater Treatment Plant Upgrades

In January 2019, the 30-inch and 42-inch sluice gates (at the WWTP) were automated to facilitate management of wet weather operations by maximizing storage within the collection system, reducing discharges from outfall 002, and significantly reducing the likelihood of the Ann Street Emergency Overflow discharging.

Improvements include a dedicated point to point radio connection from the Ann Street siphon chamber to the WWTP for instantaneous live monitoring of wastewater level and flow and automation of the 42-inch sluice gate to be controlled by SCADA with the following set points:

- 5.0 feet or below – gate is fully closed
- 6.0 feet – gate opens to 25%
- 7.0 feet – gate opens to 50%
- 7.5 feet – gate opens to 65%
- 7.7 feet – gate opens to 85%
- 8.0 feet – gate opens to 100% (fully open above 8.0 feet)

As the sewage level depth fluctuates (increases or decreases) within the Ann Street siphon chamber, the 42-inch sluice gate position changes (opens or closes) based on the pre-defined set points to increase/decrease flow to the WWTP. The 30-inch sluice gate is 100% open at all times.

Pump Stations Asset Management Plan

In April 2019, a Pump Stations Asset Management Plan was finalized by Wright-Pierce, the WPCA's pump station on-call consultant. The WPCA engaged Wright-Pierce to prepare this plan in order to protect the WPCA's investment in the collection system, to be able to strategically plan for expected maintenance/replacements of all 22 wastewater pumping stations, and to identify long-term capital needs including the need for upgrading aging equipment and structures, increasing capacity, energy efficiency improvements, flood protection, and resiliency improvements. This plan will be used to determine the basis, and probable timing, of future expenditures on the system and be used as a tool to comply with EPA requirements for Capacity, Management, Operation, and Maintenance (CMOM) regulations.

This plan includes an assessment of existing process equipment, building structures, electrical equipment, controls, and heating/ventilation equipment systems at each pump station. Flood



protection and resiliency requirements at each of the stations was also considered. Each pump station was assessed for its capacity, along with necessary pump redundancy and the capability of handling flows in the future. A review of existing drainage areas and plans for future sewer growth within them was conducted. Existing wet weather flows and the number of pumps running under peak flow conditions were noted.

New Chlorination and Dechlorination Dosing System

In November 2019, the WPCA entered into a contract for construction with C. H. Nickerson & Co., Inc. to provide all labor, materials, and equipment required to construct a new chlorination (sodium hypochlorite) and dechlorination (sodium bisulfite) dosing system for treatment of wet weather flows at the Norwalk Water Pollution Control Facility. The system included chemical feed pumps, controls, and sample systems complete with piping and appurtenances as well as modifications to the existing Wet Weather Chlorine Contact Tank.

Relocation of Westport Avenue Discharge

In September 2020, the WPCA relocated the Westport Avenue force main discharge location. The project included the installation of several isolation valves and approximately 50 feet of new force main. This improvement will prevent surcharging of the gravity system.

WPCA Website Updates

The WPCA website was updated to include new webpages and printable reference documents to assist with public education. The enhanced documents include the following.

- Additional information on the WPCA's Fats, Oil, and Grease program for both residential and commercial users.
- Additional information on the WPCA's Private Inflow/Infiltration efforts including background material.

Catch Basin Disconnections

In 2020, the City disconnected two catch basins on Woodward Avenue from the sanitary sewer and connected them to the storm drain system: one at the intersection of Meadow Street (Asset 8097) and one at the intersection of Sheridan Ct (Asset 8113).

In 2020, the CTDOT disconnected one catch basin (Asset 1946) on Osborne Avenue from the sanitary sewer and converted it to a dry well.

In 2022, the WPCA partnered with the City of Norwalk Department of Public Works to complete a Sanitary Sewer Separation Project in the Ohio Avenue, Plymouth Avenue, Prospect Street, Buttonball Trail, and Jarvis Street areas. The purpose of the project was to reduce flow from entering the sanitary sewer system and reduce stormwater flooding. The City's contractor, M. Rondano, Inc., disconnected thirteen (13) catch basins from the sanitary sewer and reconnected them to the City's stormwater system.

GIS Updates



In January 2021, SUEZ hired a GIS technician to assist with regularly updating the collection system GIS data and applications. The GIS technician worked closely with field crews and City GIS staff to ensure high quality data standards are met.

Remote Viewing of SCADA System

In early 2021, a mobile application was developed for remote viewing of the facilities Supervisory Control and Data Acquisition (SCADA) system. This system provides management 24/7 monitoring capabilities of the WWTP, Pump Stations, and the Ann Street Siphon Chamber to carefully monitor equipment on/off, flows, levels, chemical feed rates, pump stations, and alarms on any mobile device. The system also includes full visibility of the wet weather operations and Outfall 002 so that the operations team can monitor storm events from any location.

New Service Agreement with SUEZ

In September 2019, the WPCA and SUEZ Water Environmental Services Inc. (SUEZ) executed a new service agreement for the operation, maintenance, and management of its wastewater treatment system (Service Agreement). The Service Agreement includes an initial 10-year term with two additional five-year renewal options. The new contract went into effect on May 18, 2020.

As part of its operator transition plan, the WPCA worked collaboratively with the existing contract operator Operations Management International, Inc. (OMI) to complete a system-wide upgrade of critical equipment. In total, the WPCA invested \$600,000 in the upgrade while OMI contributed installation obligations. Equipment specifically related to the collection system included upgrading the Woodward Avenue Pump Station (installation of two (2) new dry-pit submersible pumps, new pump controls, VFD's, new pump station bypass connection, piping, valves, new flow meter, and appurtenances, upgrading the Fox Run Pump Station (installation of two (2) new dry-pit submersible pumps piping, valves and appurtenances, and new wet well), and upgrading the Bouton Street Pump Station (installation of two (2) new dry-pit submersible pumps, piping, valves and appurtenances). Replacement of generators to ensure operation of pump stations and to avoid bypasses potentially related to power outages. Generators, automatic transfer switches, venting, and wiring were replaced at the following pump stations: Bell Island, Bethel Street, Bouton Street, Fox Run, Howard Avenue, Karen Drive, Shady Beach, Strathmore Lane, and Westport Avenue. In addition, the WPCA purchased extra spare pumps for use at 17 of the 22 stations which are currently stored at the maintenance shop and can be deployed during an emergency to further limit the extent of a pump station release.

On May 18, 2020, the WPCA facilitated a smooth transition of its system operator from OMI, Inc. (OMI) to SUEZ. In addition to the SUEZ team's industry-leading experience operating and maintaining collections systems, the updated Service Agreement between the parties prioritizes asset preservation, enhanced operations, and high quality effluent.

As part of the new Service Agreement, SUEZ purchased approximately \$1.0 million in new equipment to assist with maintaining the collection system. This included a new CCTV Truck (with ITpipes software), a new combination Jet/Vactor Truck, and a utility vehicle equipped with tools and a six thousand pound crane. In addition, SUEZ has purchased and implemented SL RAT technology for the rapid assessment of sewer line conditions. A pole camera was also purchased along with various sewer jetting nozzles and cleaning tools.

In addition to the above purchases, the WPCA is pleased to report that its new Service Agreement with SUEZ includes a number of important provisions that will further enhance operation of its collection system. The provisions include the following highlights.

- Cleaning, CCTV and PACP scoring of collection system assets at a minimum of 2 miles per month.
- Acoustical inspections of the collection system to be performed using specialized equipment called Sewer Line Rapid Assessment Tool (SL-RAT). This innovative technology allows the collections team to receive a score, and based on that score, immediately determine if the pipe has any obstructions or sags. This tool is critical in reducing the amount of SSO's throughout the collection system. SL RAT technology is used to assess all 24-inch diameter and smaller gravity pipes within 5 years.
- Deployment of a minimum of 6 Smart Covers within the collection system.
- Access to the Collection System Major Repair and Replacement fund which is replenished on an annual basis.
- Deployment of a dedicated full time employee to perform FOG/IPP inspection and sampling. The employee must perform 475 inspections on an annual basis.
- Enzymes– biological enzymes are added to breakdown grease buildup in gravity mains and MHs. These enzymes are applied through multiple applications including spray foaming of the gravity sewer lines and slow release blocks located in MHs.
- Environmental guarantees that trigger fee assessments for a number of events such as releases, leaks or spills. More specifically, bypasses at pump stations and the Ann Street Siphon trigger the fee assessment.

As part of its transition agreement, SUEZ conducted an equipment baseline evaluation which included all assets (approximately 3,200) in the wastewater treatment facility and pump stations. As part of this evaluation a series of workshops were held to evaluate risks and consequences of failure of the individual assets. Through this evaluation, critical assets were identified and flagged in the computerized maintenance management system.

Through the asset condition evaluation completed in 2020, critical assets have been identified and flagged in the CMMS. Critical spare parts were identified for these assets and procured and stocked in-house where feasible. Maintenance tasks have been developed for all assets and are continuously optimized through feedback from the field staff and analysis of equipment.

Through this program the team is able to ensure consistent, reliable operation of the pumping stations and associated equipment to prevent backups and SSOs. This program includes comprehensive evaluation and preventative and predictive maintenance of the pump station emergency generators.

Important highlights in 2021 by the SUEZ Team include:

- SUEZ took delivery of their new vector truck to replace the rental unit utilized in 2020. The new vector truck was enhanced with a FOG system, which deploys degreasing and root-killing agents while jetting lines. SUEZ piloted several experimental new jetting nozzles to improve the effectiveness of sewer cleaning activities. The team purchased two new nozzles which were both highly successful in the piloting. SUEZ crew participated in an 8 hour training course on proper use and technique for the new vector nozzles.
- The team purchased an additional high definition CCTV camera and transporter for better access into smaller diameter pipes and to serve other challenges encountered in the field.
- SUEZ team installed carsonite MH markers for easy identification of MHs in easements.



- To increase data quality, accuracy, and efficiency, SUEZ purchased an SXBlue GPS receiver from Geneq Inc., to be implemented into daily workflows in early Report year 2022.
- Two pairs of aircraft grade wireless communication headsets were purchased to enhance hands-free communication between the vactor truck and CCTV truck crews while conducting operations.
- SUEZ and WPCA staff continued to use ITpipes software within the collection system. Staff continues to utilize this software to generate PACP scoring of pipeline video inspections. This software transmits video inspections from the camera truck to the ITpipes cloud to allow access from support staff.

In January 2022, the WPCA Board executed its First Amendment to the SUEZ contract for the purpose of providing consent to SUEZ's merger with Veolia Water Contract Operations USA, Inc. (Veolia) that occurred on March 17, 2022. In addition, the WPCA increased its base contract value with Veolia, staffing was increased to 27 persons from 24 to add additional collection system staffing, purchase of a second jet/vac truck, utility van, and additional smart covers (for a total of 14), weather stations, and monthly cleaning was increased to 3 miles.

Update to Collection System Master Plan

In October 2020, the WPCA launched the initial phase of a significant system-wide collection system engineering assessment. The WPCA requested qualification statements for professional services related to collection system on-call engineering services. In November 2020, the WPCA Board of Directors approved entry into two contracts to provide on-call professional engineering services for the wastewater collection system. In March 2021, the WPCA signed a \$1.0 million agreement with BC as the primary consultant and a \$250,000 agreement with Woodard & Curran as the secondary consultant.

The primary objective for BC is to update the WPCA's Sanitary Sewer Master Plan. The task includes assessing and updating the WPCA's collection system hydraulic model by conducting system-wide flow monitoring. The updated Master Plan will identify long-term capital improvement projects and estimated costs for planning and implementation. Among other improvements, the assessment should be a critical tool helping the WPCA achieve even greater reductions of overflows going forward.

Woodard & Curran was selected as secondary consultant to provide the WPCA with additional resources on current and future projects. The first task order (no. 1) signed with Woodard & Curran is to conduct a financial review of the WPCA and develop a dynamic financial model.

The second task order (no. 2) signed with Woodard & Curran is to conduct a Preliminary Analysis and Design of Sanitary Sewer Improvements for the Dreamy Hollow Area.

In July 2021, the WPCA signed task order (no. 2) with BC to conduct a Sanitary Sewer Evaluation and Design of sewer piping tributary to Sammis Street Pump Station and Bell Island Pump Station. This task order also includes evaluation and design of sewer piping in low lying areas, known areas of concern, and development of bid documents for the rehabilitation of selected sewer piping. Also in July 2021, the WPCA signed Task order (no. 3) with BC to provide site development review, coordination of data collection and analysis of data to determine hydraulic impacts of new developments on the City's sanitary sewer collection system.

In 2021, the WPCA's consultant, Woodard & Curran, developed a Dynamic Financial Model to be used as a financial planning tool for preparation of its capital and operating budgets. This model covers a forecast period of five years, from FY2023 through FY2027, and emphasizes the FY23

budget. The planning model can also be used by the Finance team to for future bonding and cash spending of capital projects. The WPCA anticipates updating the model at least annually for future financial planning and budget preparation.

New and Ongoing Rehabilitation Projects and Upgrades

Ongoing Pump Station Upgrades: In May 2021, the WPCA entered into a construction contract with Kovacs Construction Corporation to provide all materials, equipment, labor and supervision for Comprehensive Upgrades to the Five Mile, Old Trolley Way, Woodward Avenue and Karen Drive Pump Stations. The notice to proceed was issued on July 1, 2021. Once complete, these major pump station upgrades will extend the useful life of the stations and minimize the risk for failure and sewage overflows.

Ongoing Sewer Main Extension Installation: In July 2021, the WPCA entered into a contract for construction with A. Vitti Excavators, LLC to provide all materials, equipment, labor and supervision for the installation of approximately 260 feet of sewer main extension to redirect commercial customer sewer laterals on Belden Avenue to the existing sewer main on Burnell Boulevard to eliminate a hot spot in the collection system.

In July 2021, the WPCA entered into a contract for construction with L. Holzner Electric Company to provide all materials, equipment, labor and supervision for sanitary sewer system rehabilitation, including relocation of the existing 30" sanitary sewer from beneath the building footprint at 2 Knight Street and installation of a permanent high-flow bypass chamber with access MHs. The project includes bypass pumping and grouting the annular space in the tunnel beneath Wall Street to abandon the 30" sanitary sewer from 2 Knight Street.

Dreamy Hollow/Betts Brook Area Improvements: In 2022, the WPCA authorized the expenditure of approximately \$2.5 million to Colonna Concrete & Asphalt Paving LLC as part of the City of Norwalk's Dreamy Hollow/Betts Brook Area Drainage, Sanitary Sewer & Water Main Improvements Project being administered by the Department of Public Works for the purpose of relocating and improving conveyance within the sanitary sewer. This project aims to improve collection system conveyance for multiple homes.



Appendix C: Flow Meter Installation Site Sketches





RAIN GAUGE SITE INFORMATION FIELD LOG

PROJECT: Norwalk, CT

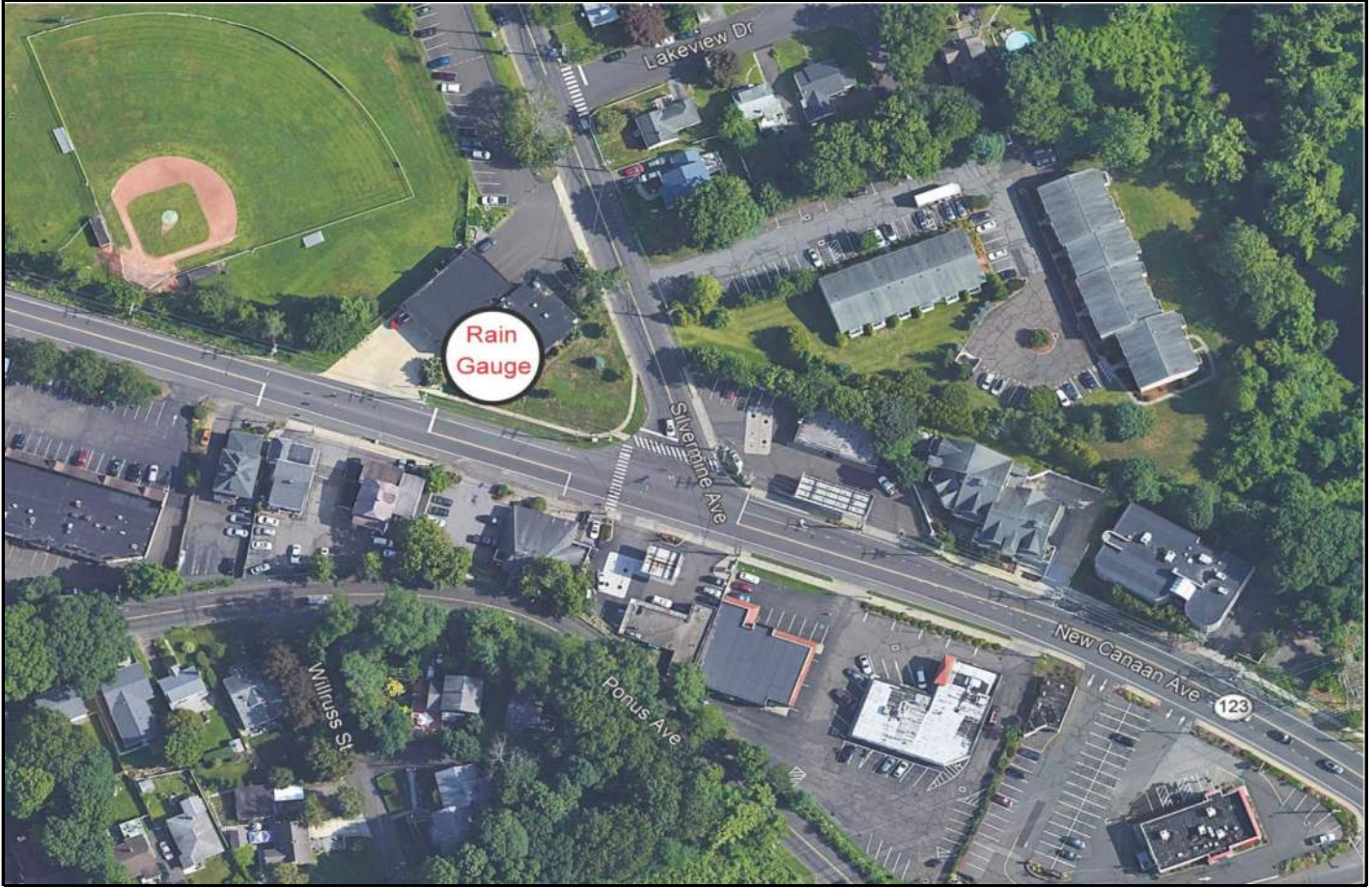
DATE: March 12, 2021

JOB#: 21026

LOCATION: 90 New Canaan Avenue

COMMENTS: 41.127431, -73.432287

LOCATION



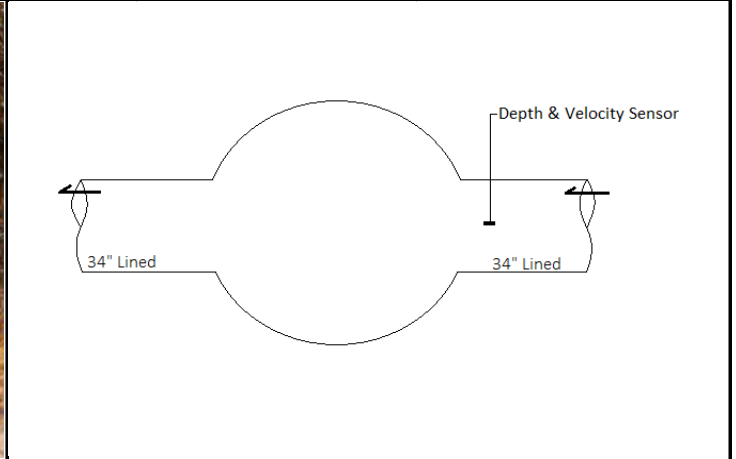


METER SITE INFORMATION FIELD LOG

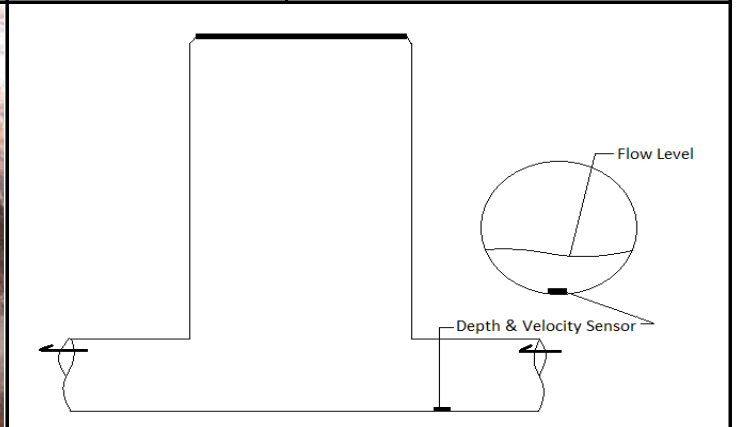
PROJECT: Norwalk, CT	DATE: March 12, 2021	JOB#: 21026
LOCATION: 39 Seaview Avenue	MH#:	METER SITE: 01
GPS/COMMENTS: 41.099476, -73.408710		



	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	34	Lined	8.5	0	Circular	13' 04"
Incoming						
Incoming						
Outgoing	34	Lined	8.5	0	Circular	13' 05"



SURCHARGE INFORMATION		WEIR INFORMATION	
SURCHARGE NONE EVIDENT:	LENGTH:	HEIGHT ABOVE WEIR:	
SURCHARGED MARKS TO: 13'	BREADTH:	OVERFLOW OCCURS AT:	
SURCHARGE CURRENTLY TO:	LEVEL:		



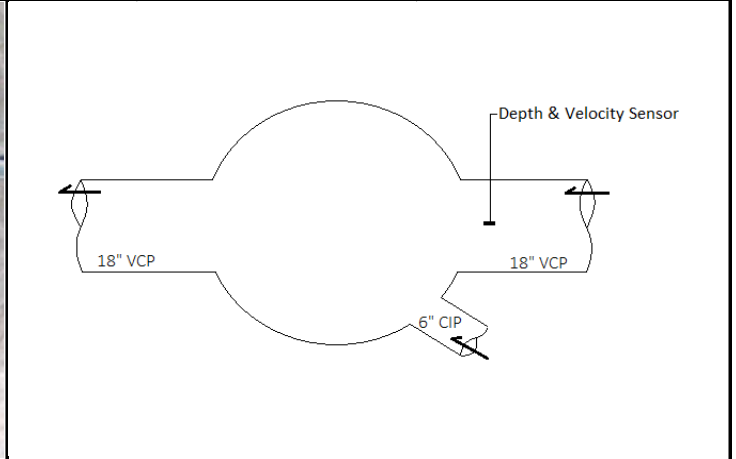


METER SITE INFORMATION FIELD LOG

PROJECT: Norwalk, CT	DATE: March 12, 2021	JOB#: 21026
LOCATION: East Avenue at Goodrow Street	MH#:	METER SITE: 02
GPS/COMMENTS: 41.099158, -73.405479		



	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	18	VCP	3.8	0	Circular	10' 00"
Incoming	6	CIP	0	0	Circular	04' 09"
Incoming						
Outgoing	18	VCP	3.8	0	Circular	10' 02"

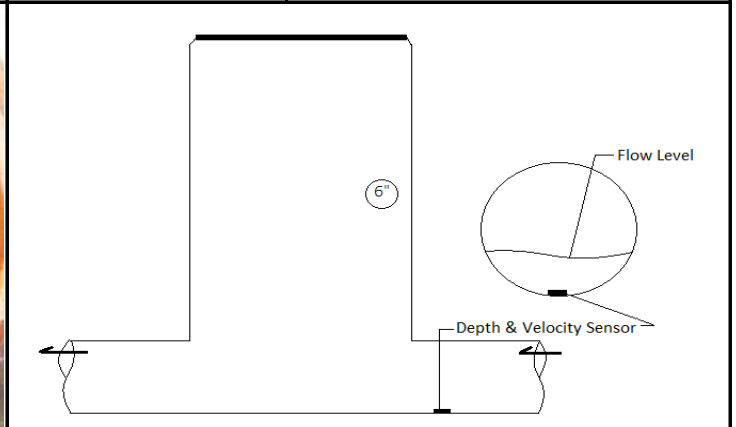


SURCHARGE INFORMATION

SURCHARGE NONE EVIDENT: X
SURCHARGED MARKS TO:
SURCHARGE CURRENTLY TO:

WEIR INFORMATION

LENGTH:	HEIGHT ABOVE WEIR:
BREADTH:	OVERFLOW OCCURS AT:
LEVEL:	



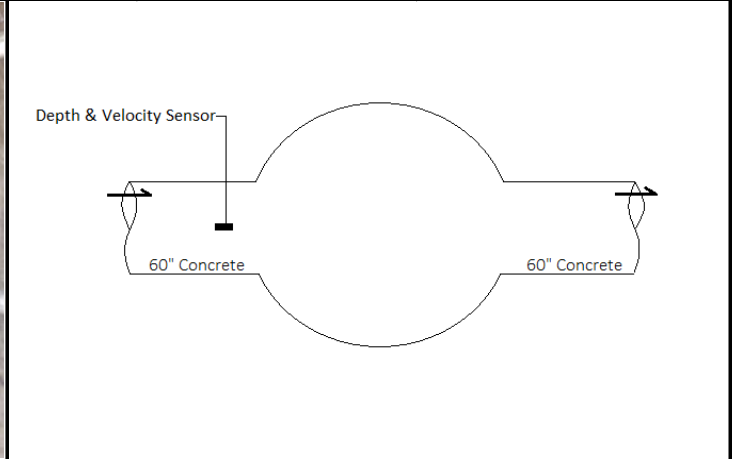


METER SITE INFORMATION FIELD LOG

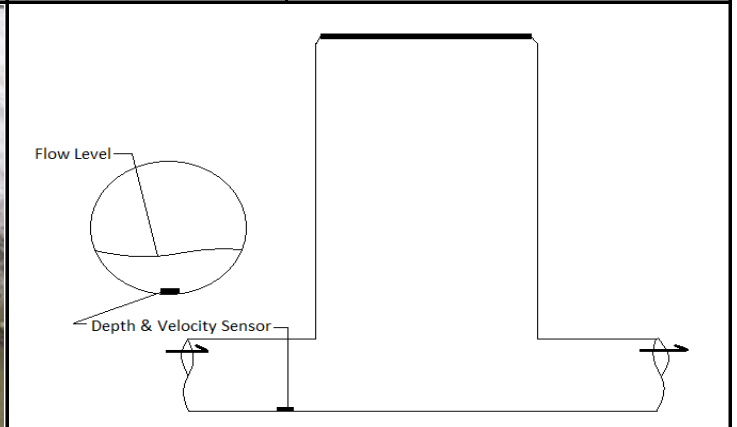
PROJECT: Norwalk, CT	DATE: March 11, 2021	JOB#: 21026
LOCATION: 15 South Smith Street	MH#:	METER SITE: 03
GPS/COMMENTS: 41.104482, -73.411104		



	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	60	Concrete	20	4	Circular	20' 02"
Incoming						
Incoming						
Outgoing	60	Concrete	20	4	Circular	20' 03"



SURCHARGE INFORMATION		WEIR INFORMATION	
SURCHARGE NONE EVIDENT:	LENGTH:	HEIGHT ABOVE WEIR:	
SURCHARGED MARKS TO: Top	BREADTH:	OVERFLOW OCCURS AT:	
SURCHARGE CURRENTLY TO:	LEVEL:		



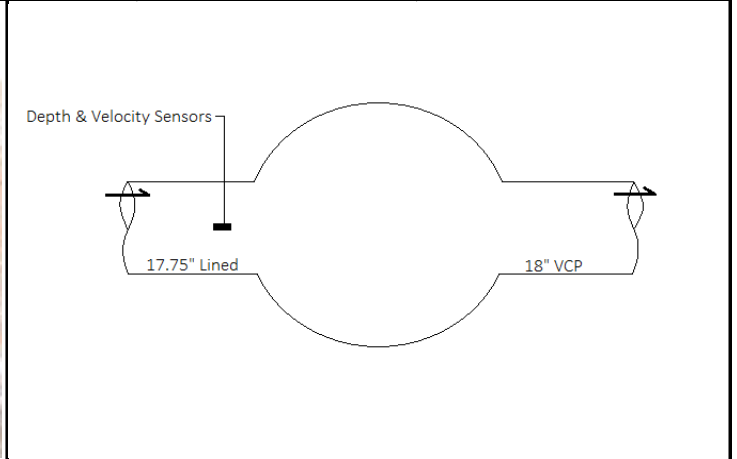


METER SITE INFORMATION FIELD LOG

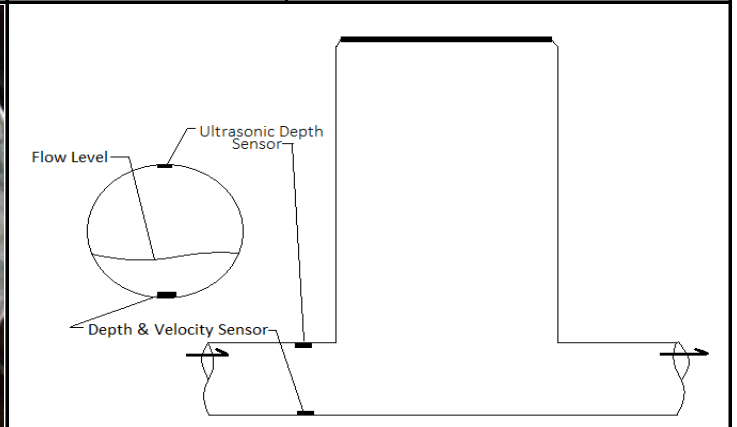
PROJECT: Norwalk, CT	DATE: March 11, 2021	JOB#: 21026
LOCATION: 124 East Avenue on Daskams Lane	MH#:	METER SITE: 04
GPS/COMMENTS: 41.113465, -73.408015		



	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	17.75	Lined	3	0	Circular	13' 08"
Incoming						
Incoming						
Outgoing	18	VCP	3	0	Circular	13' 09"



SURCHARGE INFORMATION		WEIR INFORMATION	
SURCHARGE NONE EVIDENT: X	LENGTH:	HEIGHT ABOVE WEIR:	
SURCHARGED MARKS TO:	BREADTH:	OVERFLOW OCCURS AT:	
SURCHARGE CURRENTLY TO:	LEVEL:		



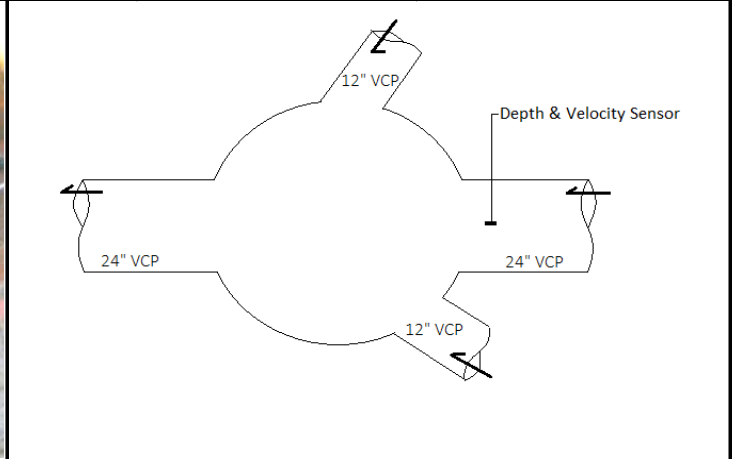


METER SITE INFORMATION FIELD LOG

PROJECT: Norwalk, CT	DATE: March 10, 2021	JOB#: 21026
LOCATION: 75 East Avenue	MH#:	METER SITE: 05
GPS/COMMENTS: 41.118954, -73.407665		



	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	24	VCP	5.4	0	Circular	07' 09"
Incoming	12	VCP	2	0	Circular	07' 06"
Incoming	12	VCP	2	0	Circular	07' 06"
Outgoing	24	VCP	5.4	0	Circular	07' 10"

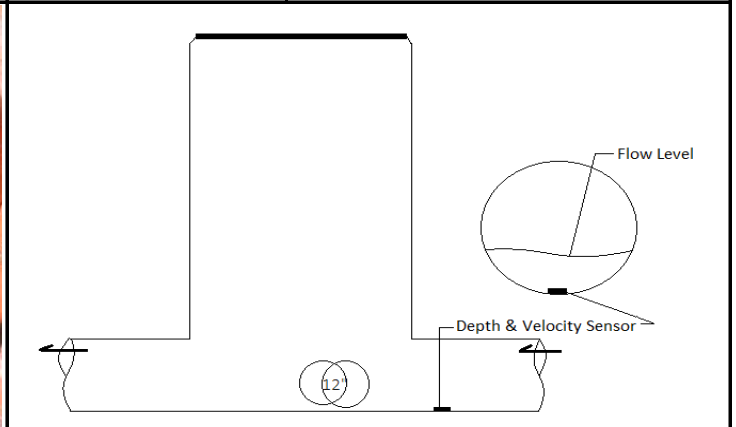


SURCHARGE INFORMATION

SURCHARGE NONE EVIDENT: X
SURCHARGED MARKS TO:
SURCHARGE CURRENTLY TO:

WEIR INFORMATION

LENGTH:	HEIGHT ABOVE WEIR:
BREADTH:	OVERFLOW OCCURS AT:
LEVEL:	



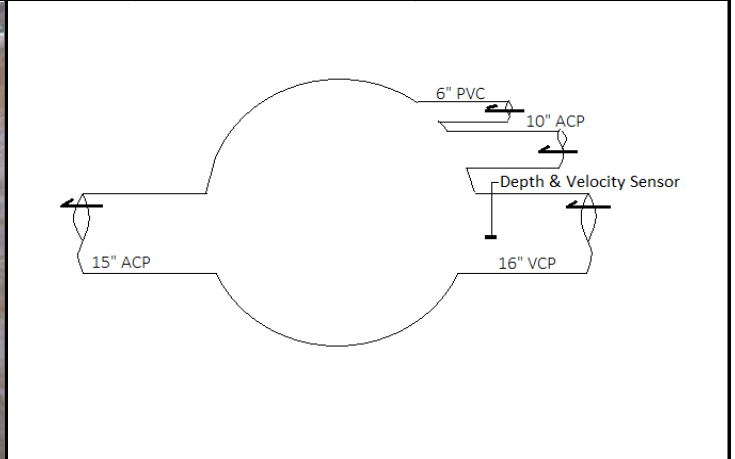


METER SITE INFORMATION FIELD LOG

PROJECT: Norwalk, CT	DATE: March 10, 2021	JOB#: 21026
LOCATION: 106 Newtown Avenue	MH#:	METER SITE: 06
GPS/COMMENTS: 41.131384, -73.402288		



	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	15	ACP	4	0	Circular	08' 09"
Incoming	10	ACP	4	0.5	Circular	08' 09"
Incoming	6	PVC	0	0	Circular	07' 10"
Outgoing	16	VCP	4	0	Circular	08' 10"

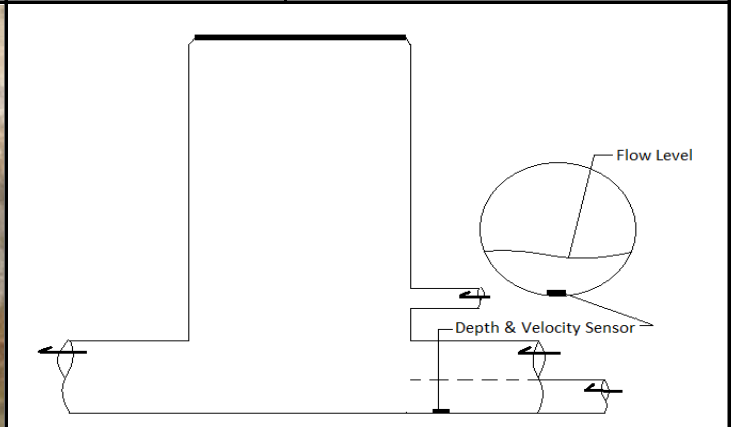


SURCHARGE INFORMATION

SURCHARGE NONE EVIDENT: X
SURCHARGED MARKS TO:
SURCHARGE CURRENTLY TO:

WEIR INFORMATION

LENGTH:	HEIGHT ABOVE WEIR:
BREADTH:	OVERFLOW OCCURS AT:
LEVEL:	



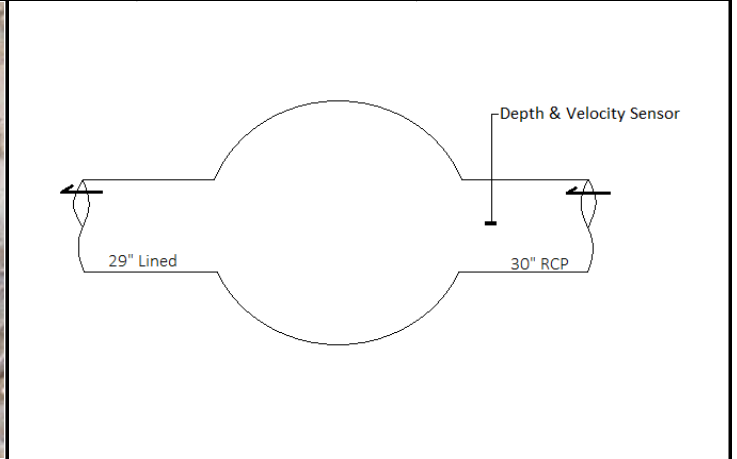


METER SITE INFORMATION FIELD LOG

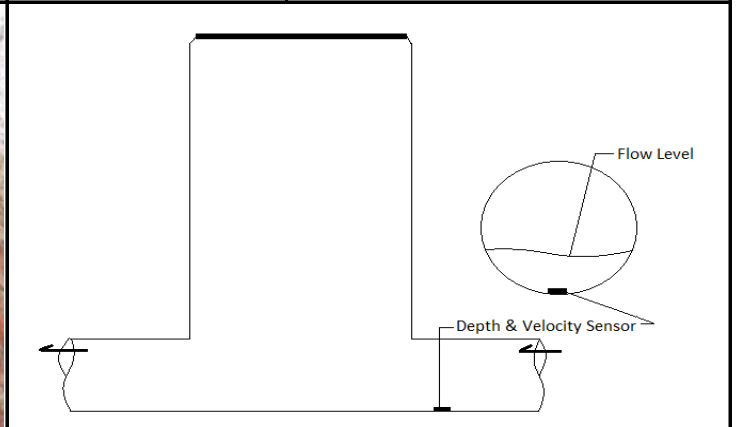
PROJECT: Norwalk, CT	DATE: March 10, 2021	JOB#: 21026
LOCATION: 28 Knight Street	MH#:	METER SITE: 07
GPS/COMMENTS: 41.119896, -73.410028		



	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	30	RCP	8	0.5	Circular	06' 11"
Incoming						
Incoming						
Outgoing	29	Lined	8	0.5	Circular	07' 00"



SURCHARGE INFORMATION		WEIR INFORMATION	
SURCHARGE NONE EVIDENT: X	LENGTH:	HEIGHT ABOVE WEIR:	
SURCHARGED MARKS TO:	BREADTH:	OVERFLOW OCCURS AT:	
SURCHARGE CURRENTLY TO:	LEVEL:		



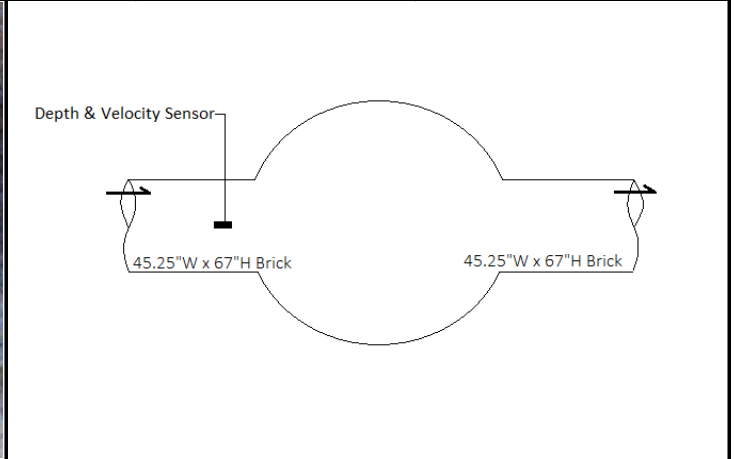


METER SITE INFORMATION FIELD LOG

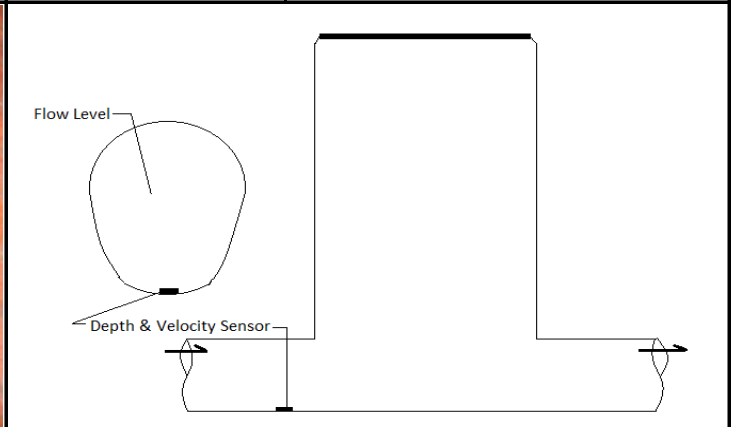
PROJECT: Norwalk, CT	DATE: March 11, 2021	JOB#: 21026
LOCATION: Main Street at Burnell Boulevard	MH#:	METER SITE: 08
GPS/COMMENTS: 41.119214, -73.412629		



	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	67x42.25	Brick	11.9	0	Inverted Egg	11' 07"
Incoming						
Incoming						
Outgoing	67x42.25	Brick	11.9	0	Inverted Egg	11' 08"



SURCHARGE INFORMATION		WEIR INFORMATION	
SURCHARGE NONE EVIDENT: X	LENGTH:	HEIGHT ABOVE WEIR:	
SURCHARGED MARKS TO:	BREADTH:	OVERFLOW OCCURS AT:	
SURCHARGE CURRENTLY TO:	LEVEL:		



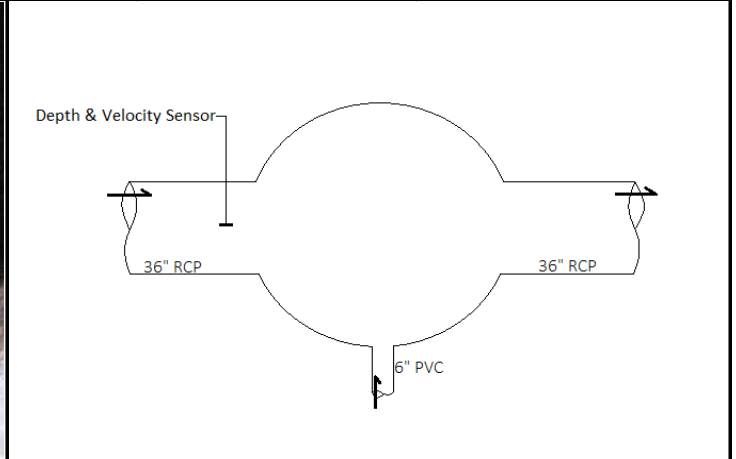


METER SITE INFORMATION FIELD LOG

PROJECT: Norwalk, CT	DATE: March 11, 2021	JOB#: 21026
LOCATION: 195 Main Street (in grass)	MH#:	METER SITE: 09
GPS/COMMENTS: 41.126948, -73.422138		

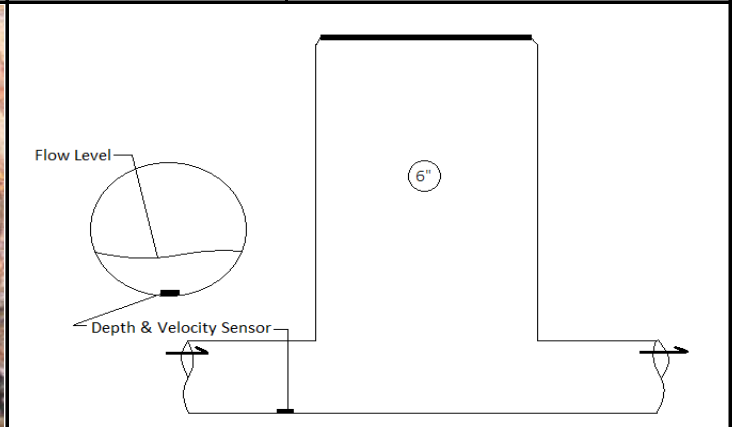


	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	36	RCP	11	4	Circular	12' 11"
Incoming	6	PVC	0.75	0	Circular	06' 00"
Incoming						
Outgoing	36	RCP	11	5	Circular	13' 00"



SURCHARGE INFORMATION

SURCHARGE NONE EVIDENT:	LENGTH:	HEIGHT ABOVE WEIR:
SURCHARGED MARKS TO: 12'	BREADTH:	OVERFLOW OCCURS AT:
SURCHARGE CURRENTLY TO:	LEVEL:	



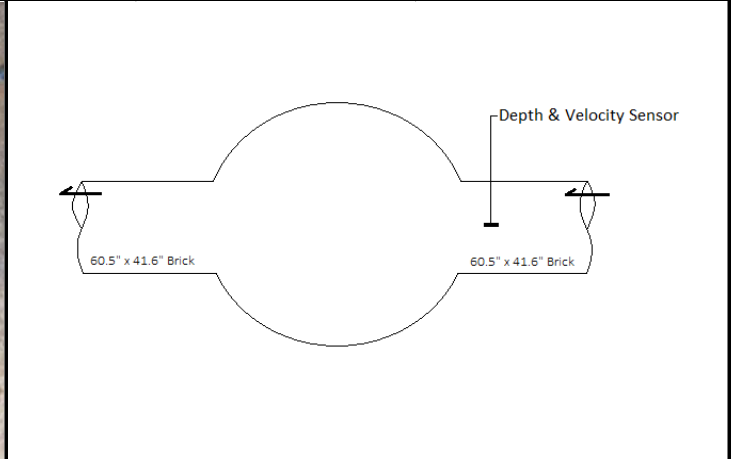


METER SITE INFORMATION FIELD LOG

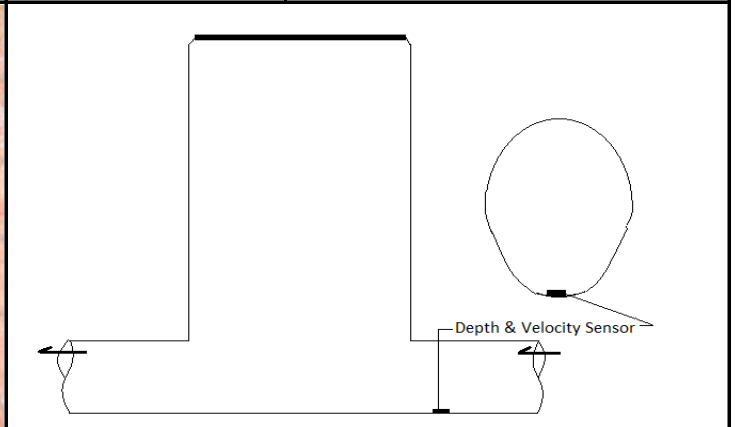
PROJECT: Norwalk, CT	DATE: March 10, 2021	JOB#: 21026
LOCATION: 12 Commerce Street	MH#:	METER SITE: 10
GPS/COMMENTS: 41.117708, -73.412244		



	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	60.5" x 41.6"	Brick	6.2	0	Egg	11' 09"
Incoming						
Incoming						
Outgoing	60.5" x 41.6"	Brick	6.2	0	Egg	12' 00"



SURCHARGE INFORMATION		WEIR INFORMATION	
SURCHARGE NONE EVIDENT: X	LENGTH:	HEIGHT ABOVE WEIR:	
SURCHARGED MARKS TO:	BREADTH:	OVERFLOW OCCURS AT:	
SURCHARGE CURRENTLY TO:	LEVEL:		



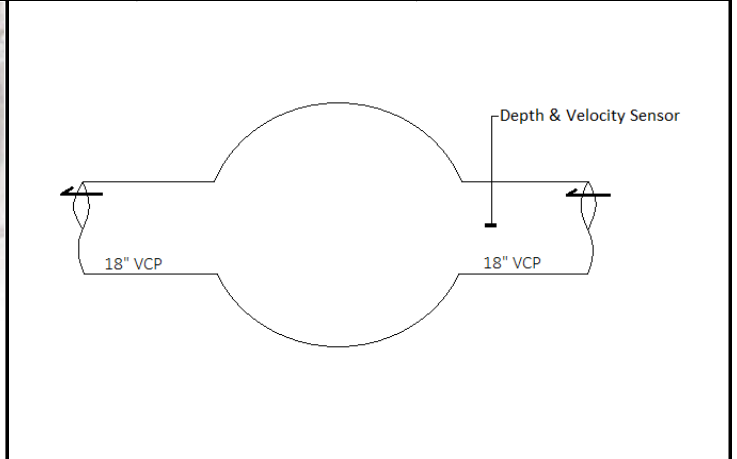
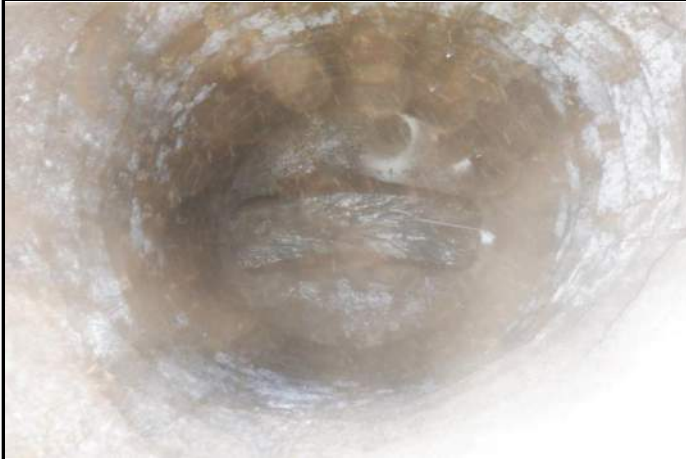


METER SITE INFORMATION FIELD LOG

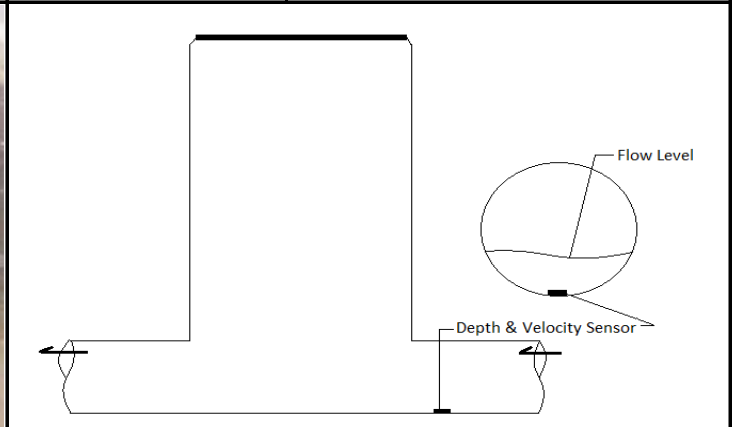
PROJECT: Norwalk, CT	DATE: March 10, 2021	JOB#: 21026
LOCATION: 120 New Canaan Avenue	MH#:	METER SITE: 11
GPS/COMMENTS: 41.128022, -73.435403		



	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	18	VCP	3	0	Circular	09' 10"
Incoming						
Incoming						
Outgoing	18	VCP	3	0	Circular	10' 02"



SURCHARGE INFORMATION		WEIR INFORMATION	
SURCHARGE NONE EVIDENT: X	LENGTH:	HEIGHT ABOVE WEIR:	
SURCHARGED MARKS TO:	BREADTH:	OVERFLOW OCCURS AT:	
SURCHARGE CURRENTLY TO:	LEVEL:		



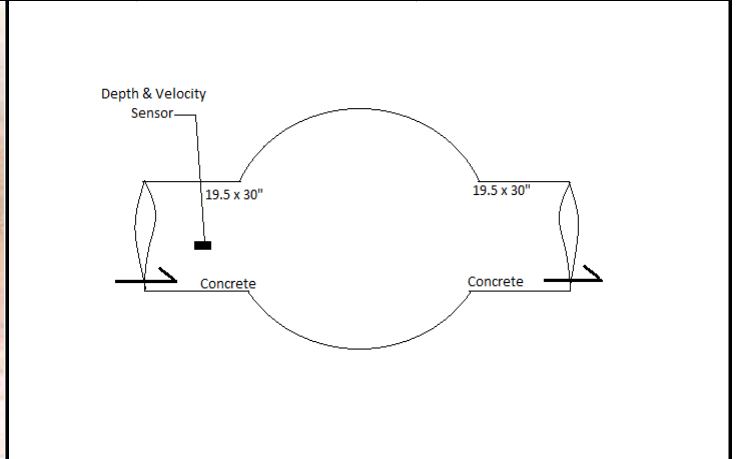


METER SITE INFORMATION FIELD LOG

PROJECT: Norwalk, CT	DATE: March 10, 2021	JOB#: 21026
LOCATION: 44 Orchard Street	MH#:	METER SITE: 12
GPS/COMMENTS: 41.111481, -73.412778		



	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	30H x 19.5W	Concrete	11	0	Egg	08' 03"
Incoming						
Incoming						
Outgoing	30H x 19.5W	Concrete	11	0	Egg	08' 05"

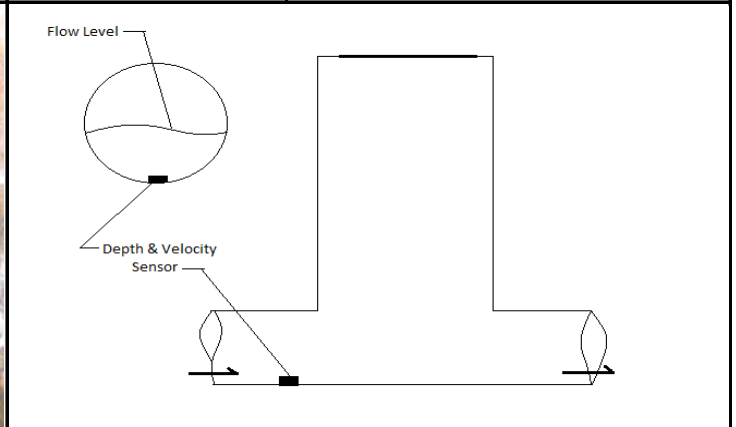


SURCHARGE INFORMATION

SURCHARGE NONE EVIDENT: X
SURCHARGED MARKS TO:
SURCHARGE CURRENTLY TO:

WEIR INFORMATION

LENGTH:	HEIGHT ABOVE WEIR:
BREADTH:	OVERFLOW OCCURS AT:
LEVEL:	



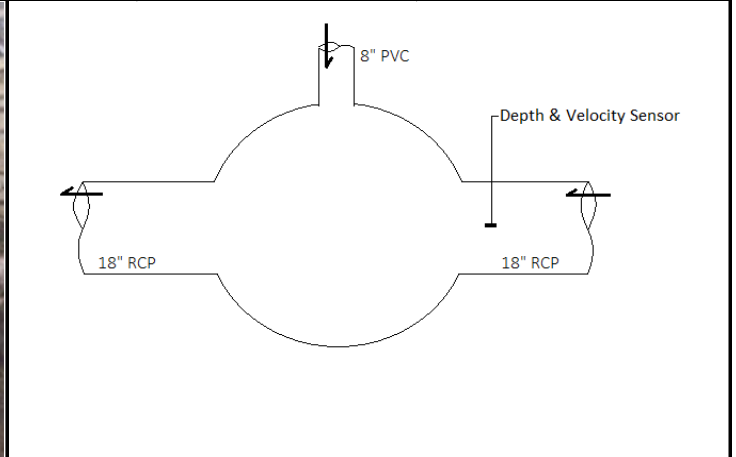


METER SITE INFORMATION FIELD LOG

PROJECT: Norwalk, CT	DATE: March 18, 2021	JOB#: 21026
LOCATION: Olive Lane R.O.W.	MH#:	METER SITE: 13
GPS/COMMENTS: 41.1009642, -73.4438865		

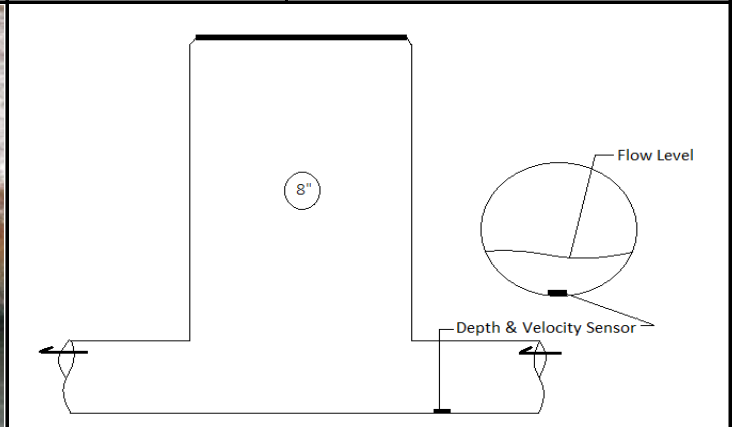


	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	18	RCP	5.75	0	Circular	14' 05"
Incoming	8	RCP	0.5	0	Circular	10' 00"
Incoming						
Outgoing	18	RCP	5.75	0	Circular	14' 06"



SURCHARGE INFORMATION

SURCHARGE NONE EVIDENT:	LENGTH:	HEIGHT ABOVE WEIR:
SURCHARGED MARKS TO: 7'	BREADTH:	OVERFLOW OCCURS AT:
SURCHARGE CURRENTLY TO:	LEVEL:	



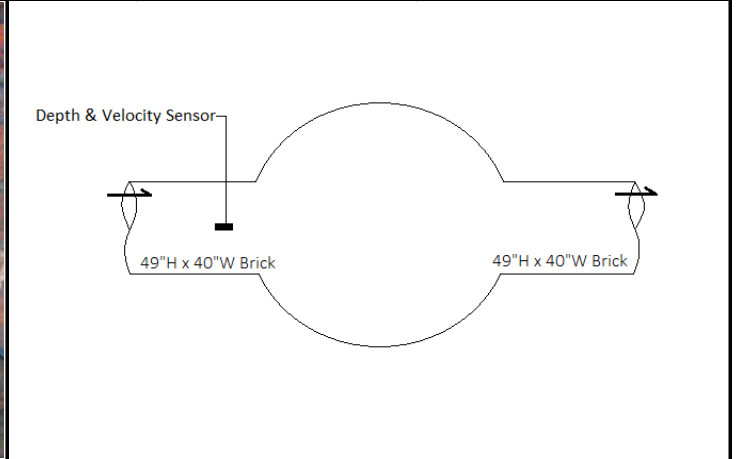


METER SITE INFORMATION FIELD LOG

PROJECT: Norwalk, CT	DATE: March 10, 2021	JOB#: 21026
LOCATION: 11 North Water Street	MH#:	METER SITE: 14
GPS/COMMENTS: 41.101867, -73.417831		

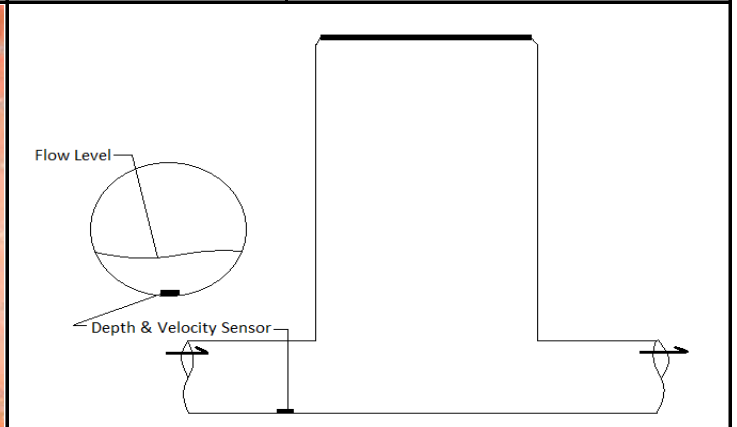


	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	44H x 40W	Brick	7.5	4	Inverted Egg	13' 09"
Incoming						
Incoming						
Outgoing	44H x 40W	Brick	7.5	4	Inverted Egg	13' 10"



SURCHARGE INFORMATION

SURCHARGE NONE EVIDENT: X	LENGTH:	HEIGHT ABOVE WEIR:
SURCHARGED MARKS TO:	BREADTH:	OVERFLOW OCCURS AT:
SURCHARGE CURRENTLY TO:	LEVEL:	



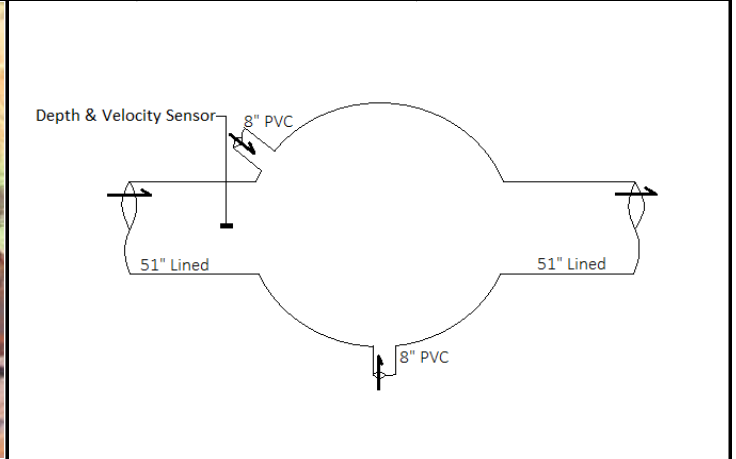


METER SITE INFORMATION FIELD LOG

PROJECT: Norwalk, CT	DATE: March 10, 2021	JOB#: 21026
LOCATION: 10 North Water Street	MH#:	METER SITE: 15
GPS/COMMENTS: 41.100361, -73.416479		



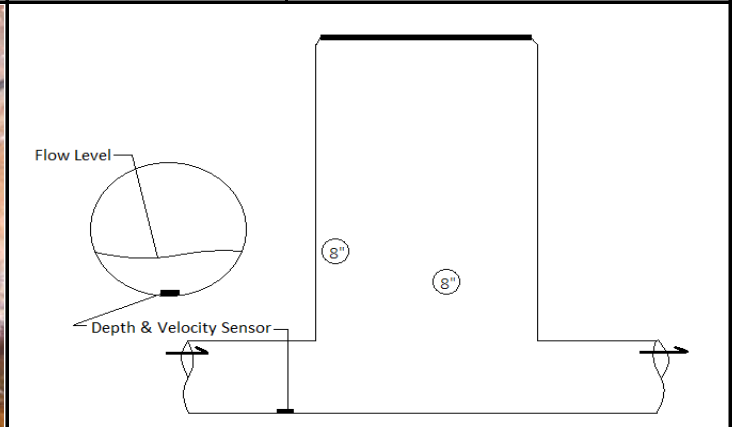
	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	51	Lined	12	0	Circular	13' 10"
Incoming	8	PVC	0.25	0	Circular	07' 01"
Incoming	8	PVC	0	0.5	Circular	06' 07"
Outgoing	51	Lined	12	0	Circular	13' 11"



SURCHARGE INFORMATION

SURCHARGE NONE EVIDENT:	LENGTH:	HEIGHT ABOVE WEIR:
SURCHARGED MARKS TO: 8'	BREADTH:	OVERFLOW OCCURS AT:
SURCHARGE CURRENTLY TO:	LEVEL:	

WEIR INFORMATION



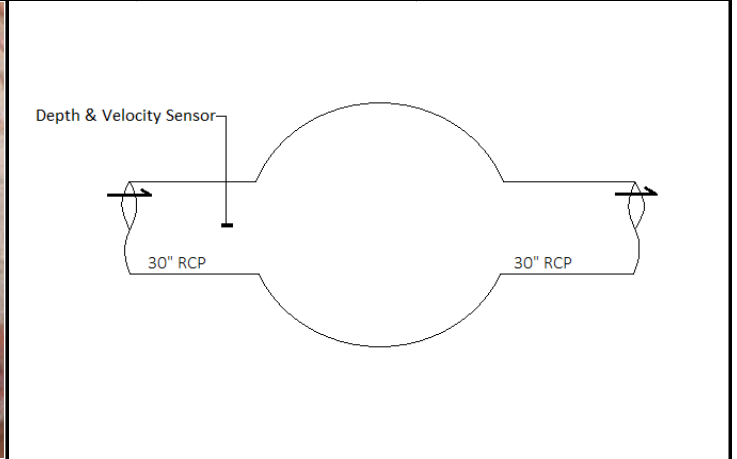


METER SITE INFORMATION FIELD LOG

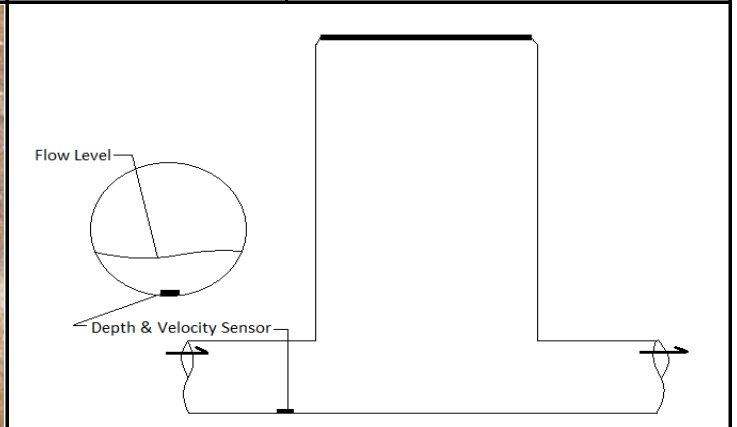
PROJECT: Norwalk, CT	DATE: March 16, 2021	JOB#: 21026
LOCATION: 149 Water Street	MH#:	METER SITE: 16
GPS/COMMENTS: 41.093422, -73.415999		



	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	30	RCP	4.2	0	Circular	07' 08"
Incoming						
Incoming						
Outgoing	30	RCP	4.2	0	Circular	07' 09"



SURCHARGE INFORMATION		WEIR INFORMATION	
SURCHARGE NONE EVIDENT: X	LENGTH:	HEIGHT ABOVE WEIR:	
SURCHARGED MARKS TO:	BREADTH:	OVERFLOW OCCURS AT:	
SURCHARGE CURRENTLY TO:	LEVEL:		



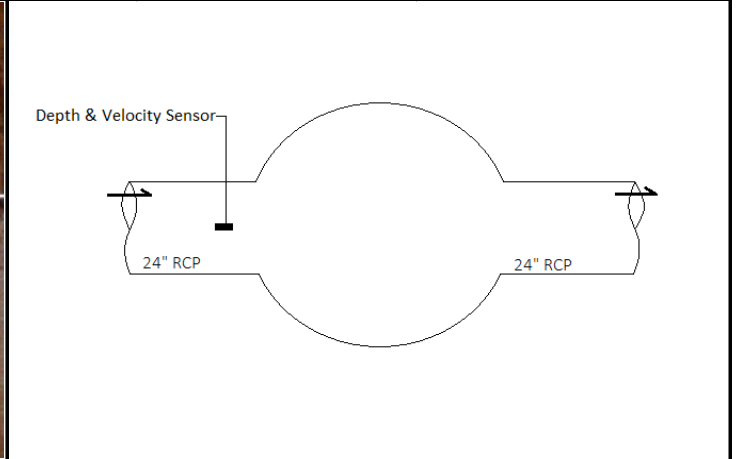


METER SITE INFORMATION FIELD LOG

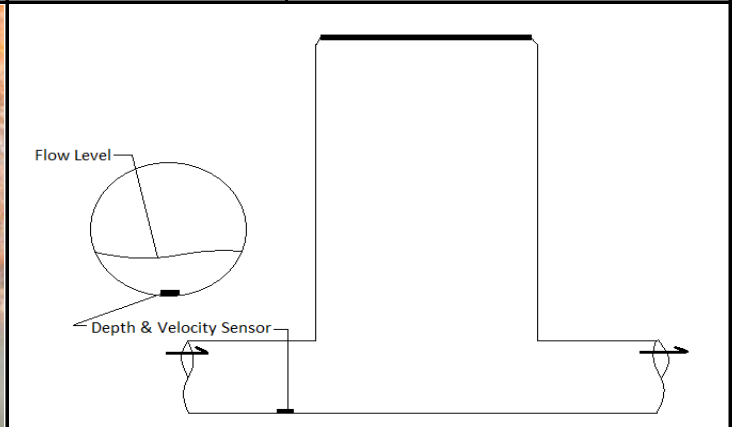
PROJECT: Norwalk, CT	DATE: March 11, 2021	JOB#: 21026
LOCATION: 21 Old Trolley Way	MH#:	METER SITE: 17
GPS/COMMENTS: 41.075095, -73.429074		



	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	24	RCP	9.2	6	Circular	06' 05"
Incoming						
Incoming						
Outgoing	24	RCP	9.2	6	Circular	06' 06"



SURCHARGE INFORMATION		WEIR INFORMATION	
SURCHARGE NONE EVIDENT:	LENGTH:	HEIGHT ABOVE WEIR:	
SURCHARGED MARKS TO: 2'	BREADTH:	OVERFLOW OCCURS AT:	
SURCHARGE CURRENTLY TO:	LEVEL:		



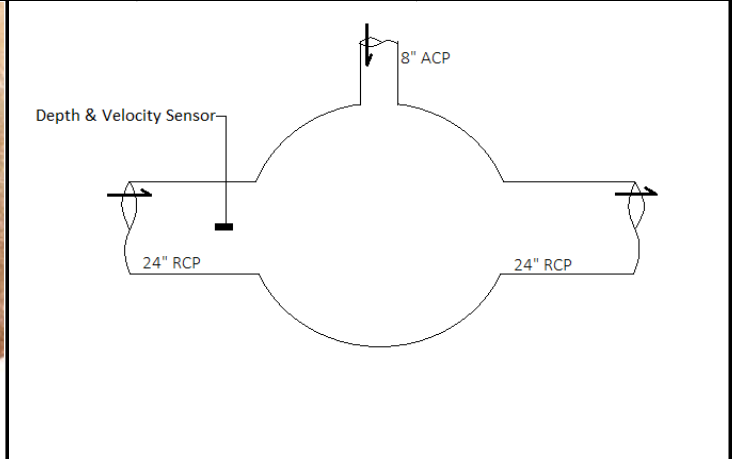


METER SITE INFORMATION FIELD LOG

PROJECT: Norwalk, CT	DATE: March 11, 2021	JOB#: 21026
LOCATION: Rowayton Avenue at Dibble Street	MH#:	METER SITE: 18
GPS/COMMENTS: 41.073613, -73.445317		



	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	24	RCP	3.75	0	Circular	16' 05"
Incoming	8	ACP	0	0	Circular	07' 08"
Incoming						
Outgoing	24	RCP	3.75	0	Circular	16' 06"

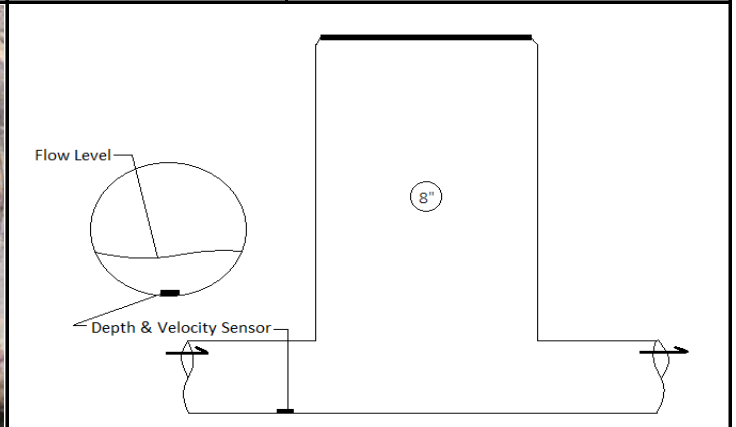


SURCHARGE INFORMATION

SURCHARGE NONE EVIDENT: X
SURCHARGED MARKS TO:
SURCHARGE CURRENTLY TO:

WEIR INFORMATION

LENGTH:	HEIGHT ABOVE WEIR:
BREADTH:	OVERFLOW OCCURS AT:
LEVEL:	



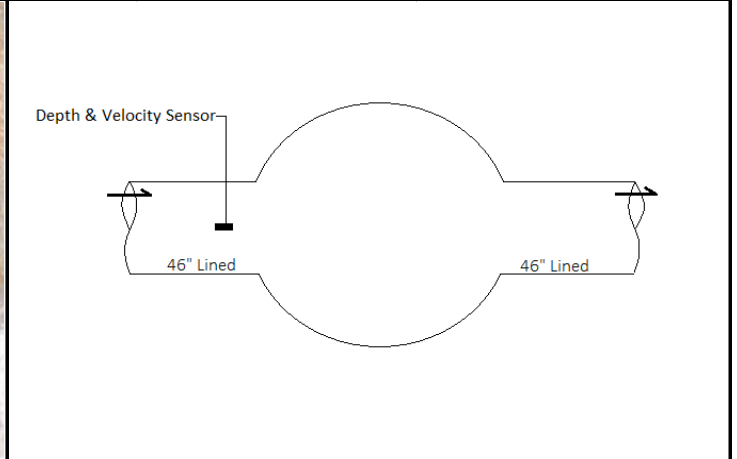


METER SITE INFORMATION FIELD LOG

PROJECT: Norwalk, CT	DATE: March 11, 2021	JOB#: 21026
LOCATION: 41 Commerce Street	MH#:	METER SITE: 19
GPS/COMMENTS: 41.116045, -73.411047		



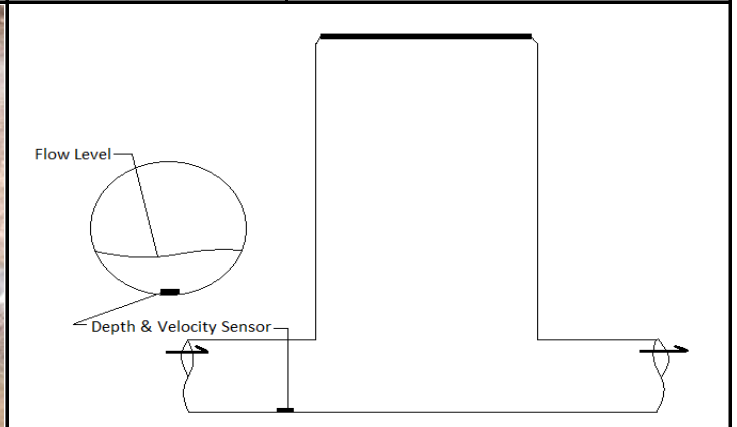
	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	46	Lined	8	0	Circular	11' 11"
Incoming						
Incoming						
Outgoing	46	Lined	8	0	Circular	12' 00"



SURCHARGE INFORMATION

SURCHARGE NONE EVIDENT: X	LENGTH:	HEIGHT ABOVE WEIR:
SURCHARGED MARKS TO:	BREADTH:	OVERFLOW OCCURS AT:
SURCHARGE CURRENTLY TO:	LEVEL:	

WEIR INFORMATION



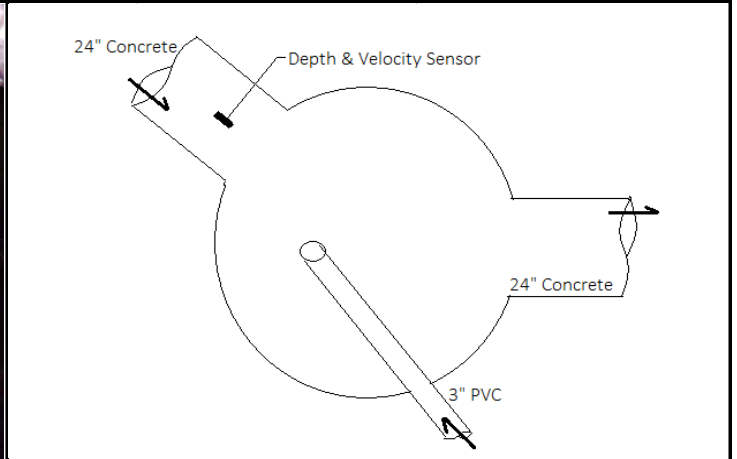


METER SITE INFORMATION FIELD LOG

PROJECT: Norwalk, CT	DATE: March 11, 2021	JOB#: 21026
LOCATION: 1 Danbury Road	MH#:	METER SITE: 20
GPS/COMMENTS: 41.160531, -73.419127		



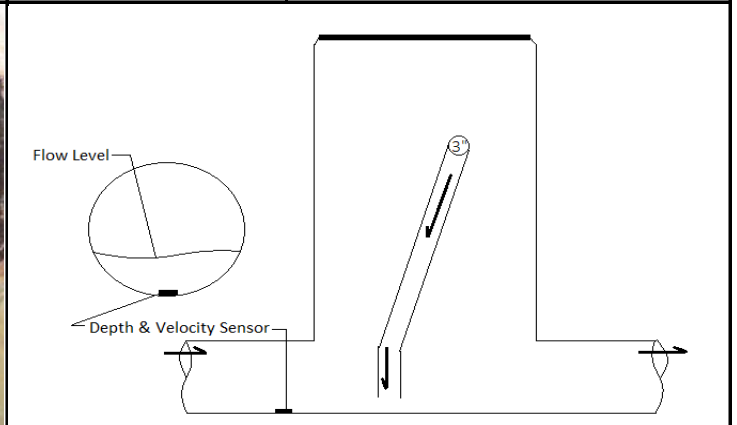
	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	24	Concrete	8	2	Circular	10' 09"
Incoming	3	PVC	0	0	Circular	03' 10"
Incoming						
Outgoing	24	Concrete	8	2	Circular	10' 10"



SURCHARGE INFORMATION

SURCHARGE NONE EVIDENT:	LENGTH:	HEIGHT ABOVE WEIR:
SURCHARGED MARKS TO: 3'	BREADTH:	OVERFLOW OCCURS AT:
SURCHARGE CURRENTLY TO:	LEVEL:	

WEIR INFORMATION



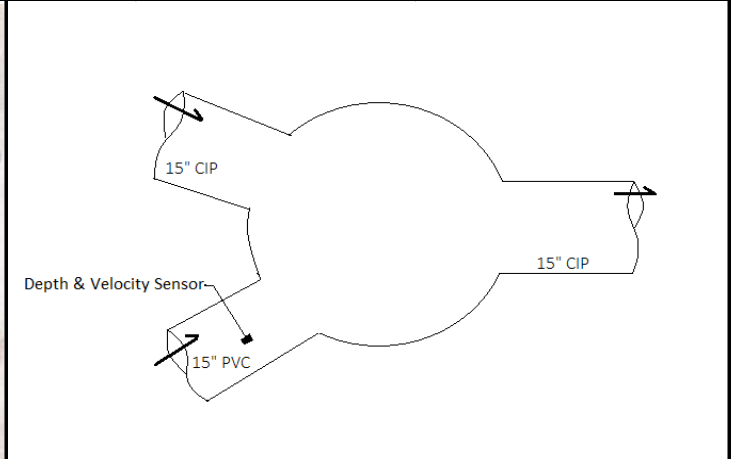


METER SITE INFORMATION FIELD LOG

PROJECT: Norwalk, CT	DATE: March 16, 2021	JOB#: 21026
LOCATION: 16 Leann Drive (Westport Avenue PS)	MH#:	METER SITE: 21
GPS/COMMENTS: 41.125505, -73.385687		



	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	15	PVC	3.75	0	Circular	07' 04"
Incoming	15	CIP	4	0.5	Circular	07' 04"
Incoming						
Outgoing	15	CIP	3.75	0	Circular	07' 05"

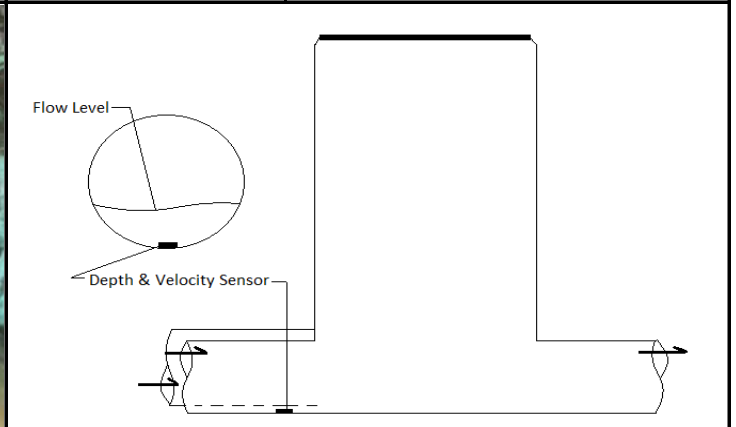


SURCHARGE INFORMATION

SURCHARGE NONE EVIDENT: X
SURCHARGED MARKS TO:
SURCHARGE CURRENTLY TO:

WEIR INFORMATION

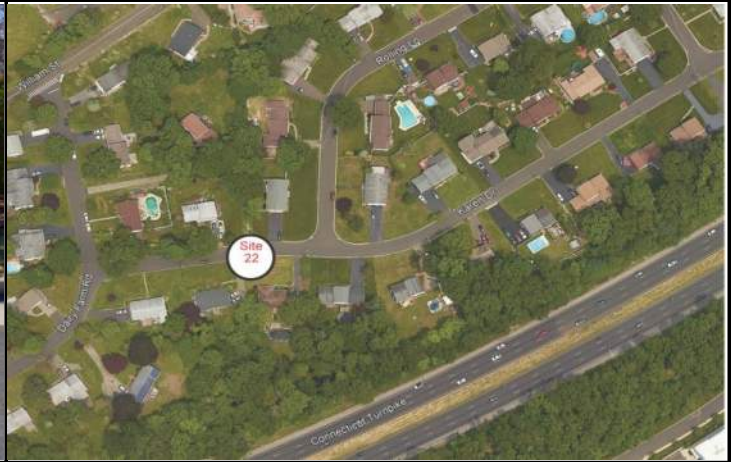
LENGTH:	HEIGHT ABOVE WEIR:
BREADTH:	OVERFLOW OCCURS AT:
LEVEL:	



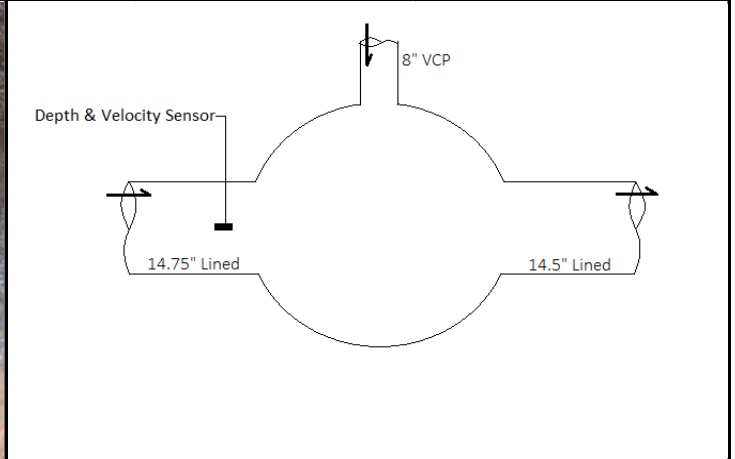


METER SITE INFORMATION FIELD LOG

PROJECT: Norwalk, CT	DATE: March 12, 2021	JOB#: 21026
LOCATION: 9 Karen Drive	MH#:	METER SITE: 22
GPS/COMMENTS: 41.114291, -73.391950		



	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	14.75	Lined	2.5	0	Circular	06' 00"
Incoming	8	VCP	0.5	0	Circular	05' 05"
Incoming						
Outgoing	14.5	Lined	2.5	0	Circular	06' 01"

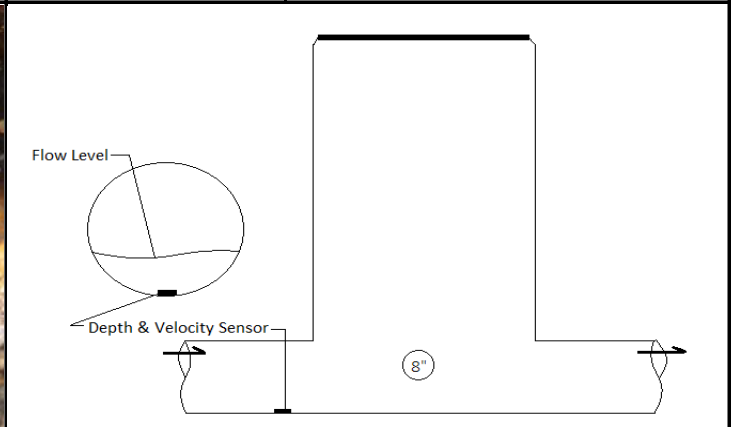


SURCHARGE INFORMATION

SURCHARGE NONE EVIDENT: X
SURCHARGED MARKS TO:
SURCHARGE CURRENTLY TO:

WEIR INFORMATION

LENGTH:	HEIGHT ABOVE WEIR:
BREADTH:	OVERFLOW OCCURS AT:
LEVEL:	



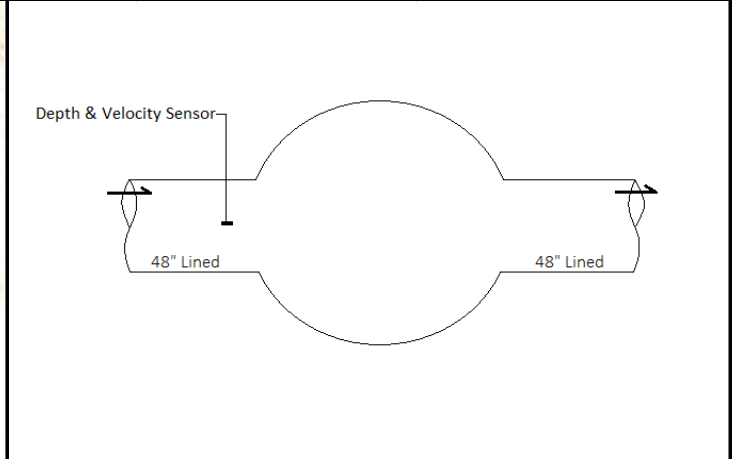


METER SITE INFORMATION FIELD LOG

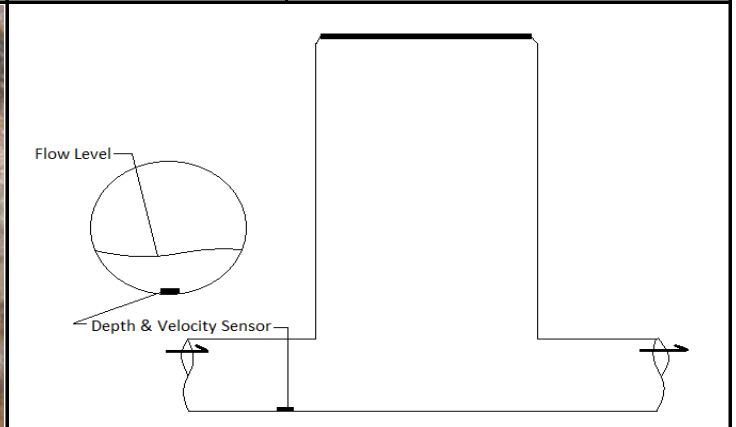
PROJECT: Norwalk, CT	DATE: March 9, 2021	JOB#: 21026
LOCATION: Railroad Place (marina)	MH#:	METER SITE: 23
GPS/COMMENTS: 41.113627, -73.410637		



	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	48	Lined	7	0	Circular	11' 08"
Incoming						
Incoming						
Outgoing	48	Lined	7	0	Circular	11' 09"



SURCHARGE INFORMATION		WEIR INFORMATION	
SURCHARGE NONE EVIDENT: X	LENGTH:	HEIGHT ABOVE WEIR:	
SURCHARGED MARKS TO:	BREADTH:	OVERFLOW OCCURS AT:	
SURCHARGE CURRENTLY TO:	LEVEL:		



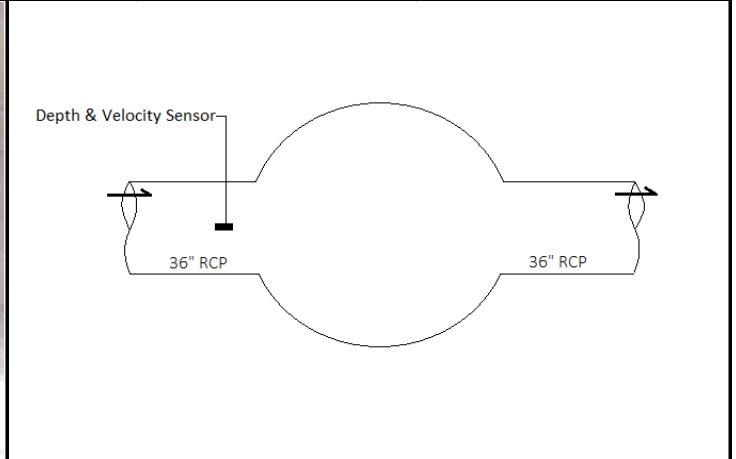


METER SITE INFORMATION FIELD LOG

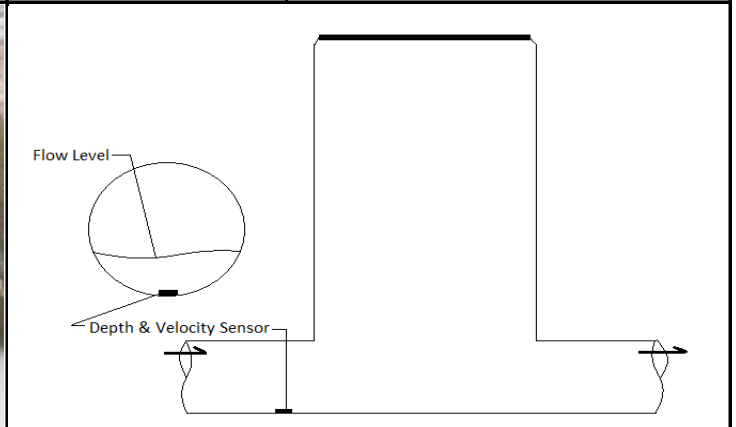
PROJECT: Norwalk, CT	DATE: March 11, 2021	JOB#: 21026
LOCATION: 34 Smith Street	MH#:	METER SITE: 24
GPS/COMMENTS: 41.115753, -73.409300		



	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	36	RCP	14	0	Circular	09' 00"
Incoming						
Incoming						
Outgoing	36	RCP	14	0	Circular	09' 00"



SURCHARGE INFORMATION		WEIR INFORMATION	
SURCHARGE NONE EVIDENT:	LENGTH:	HEIGHT ABOVE WEIR:	
SURCHARGED MARKS TO: 8'	BREADTH:	OVERFLOW OCCURS AT:	
SURCHARGE CURRENTLY TO:	LEVEL:		



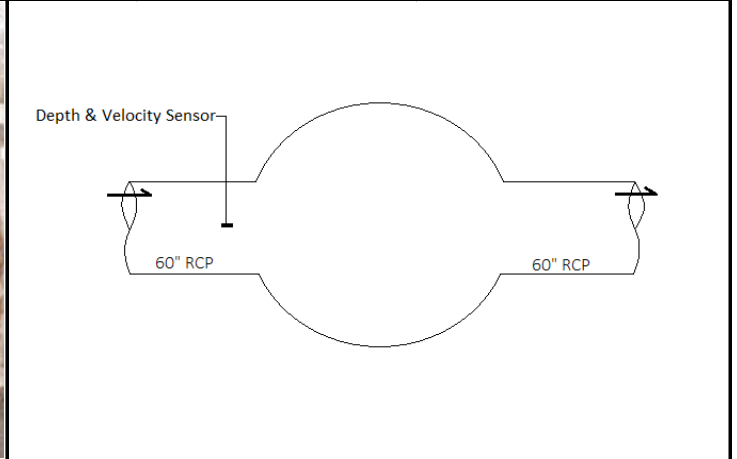


METER SITE INFORMATION FIELD LOG

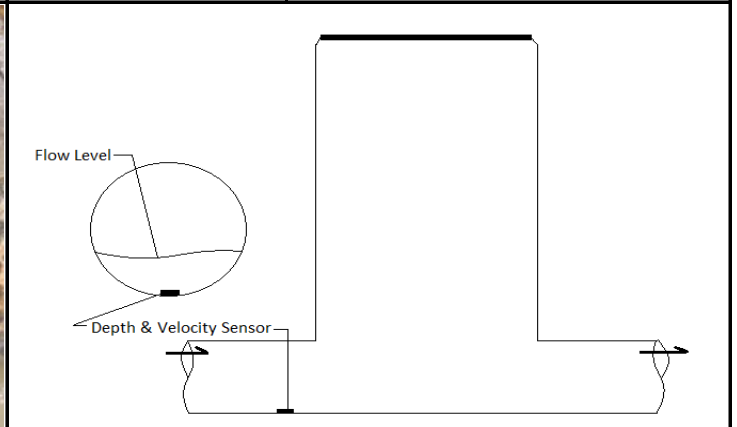
PROJECT: Norwalk, CT	DATE: March 16, 2021	JOB#: 21026
LOCATION: 148 East Avenue	MH#:	METER SITE: 25
GPS/COMMENTS: 41.109357, -73.409683		



	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	60	RCP	16.5	5	Circular	19' 08"
Incoming						
Incoming						
Outgoing	60	RCP	16.5	5	Circular	19' 09"



SURCHARGE INFORMATION		WEIR INFORMATION	
SURCHARGE NONE EVIDENT:	LENGTH:	HEIGHT ABOVE WEIR:	
SURCHARGED MARKS TO: 11'	BREADTH:	OVERFLOW OCCURS AT:	
SURCHARGE CURRENTLY TO:	LEVEL:		



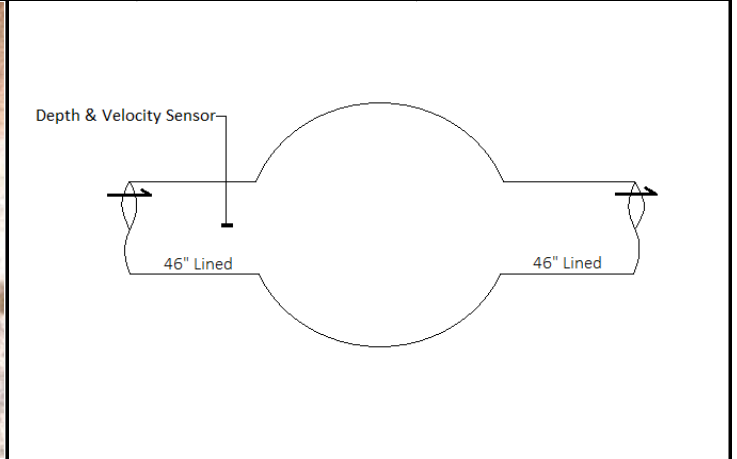


METER SITE INFORMATION FIELD LOG

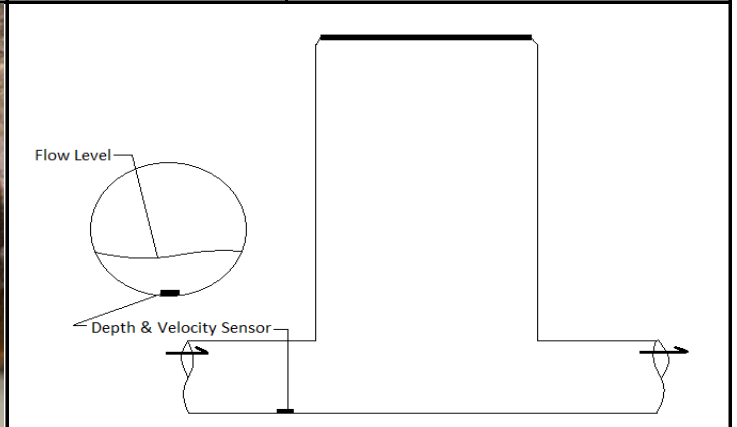
PROJECT: Norwalk, CT	DATE: March 16, 2021	JOB#: 21026
LOCATION: 77 North Water Street	MH#:	METER SITE: 26
GPS/COMMENTS: 41.103611, -73.416712		



	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	46	Lined	15.5	0	Circular	20' 00"
Incoming						
Incoming						
Outgoing	46	Lined	15.5	0	Circular	20' 01"



SURCHARGE INFORMATION		WEIR INFORMATION	
SURCHARGE NONE EVIDENT:	LENGTH:	HEIGHT ABOVE WEIR:	
SURCHARGED MARKS TO: 12'	BREADTH:	OVERFLOW OCCURS AT:	
SURCHARGE CURRENTLY TO:	LEVEL:		



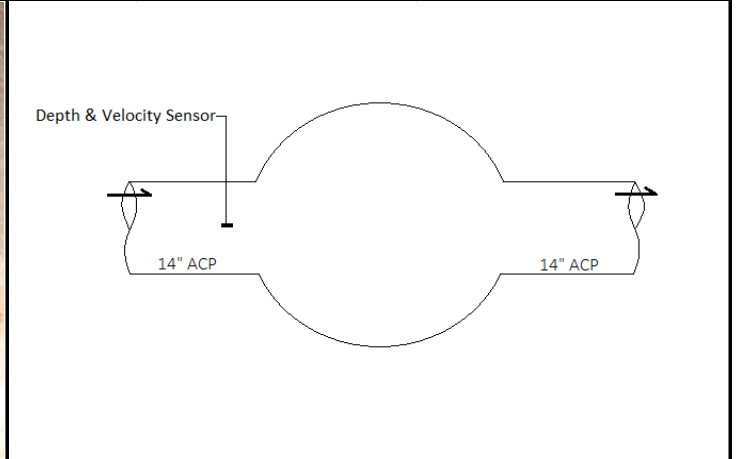


METER SITE INFORMATION FIELD LOG

PROJECT: Norwalk, CT	DATE: March 11, 2021	JOB#: 21026
LOCATION: 69 Roton Avenue	MH#:	METER SITE: 27
GPS/COMMENTS: 41.061753, -73.441546		



	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	14	ACP	4	0.4	Circular	10' 11"
Incoming						
Incoming						
Outgoing	14	ACP	4	0.4	Circular	11' 00"

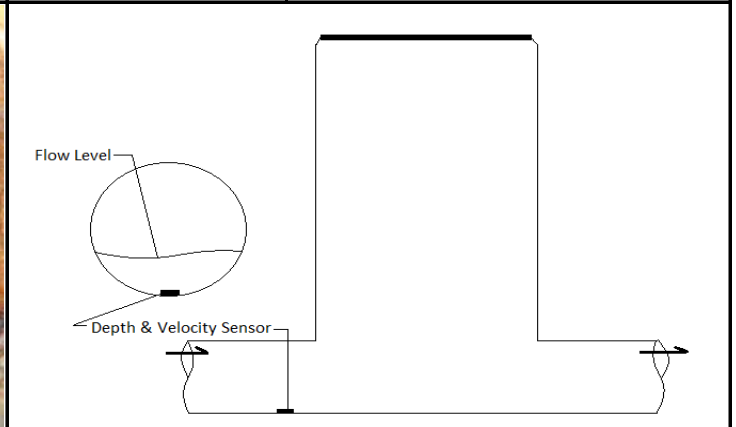


SURCHARGE INFORMATION

SURCHARGE NONE EVIDENT:
SURCHARGED MARKS TO: 3'
SURCHARGE CURRENTLY TO:

WEIR INFORMATION

LENGTH:	HEIGHT ABOVE WEIR:
BREADTH:	OVERFLOW OCCURS AT:
LEVEL:	



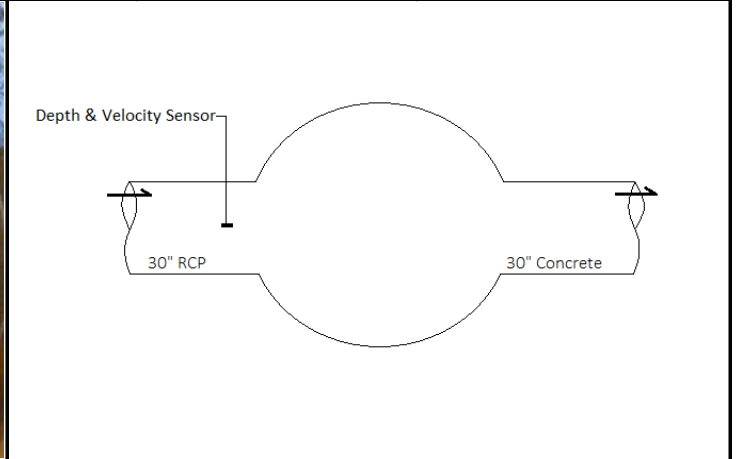


METER SITE INFORMATION FIELD LOG

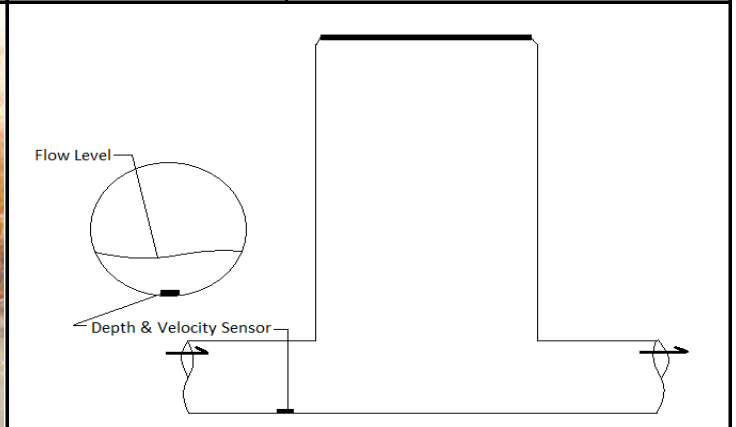
PROJECT: Norwalk, CT	DATE: March 11, 2021	JOB#: 21026
LOCATION: Wilson Avenue at Gray Rock Road	MH#:	METER SITE: 28
GPS/COMMENTS: 41.078689, -73.424029		



	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	30	RCP	10	0	Circular	10' 00"
Incoming						
Incoming						
Outgoing	30	Concrete	10	0	Circular	10' 01"



SURCHARGE INFORMATION		WEIR INFORMATION	
SURCHARGE NONE EVIDENT:	LENGTH:	HEIGHT ABOVE WEIR:	
SURCHARGED MARKS TO: 5'	BREADTH:	OVERFLOW OCCURS AT:	
SURCHARGE CURRENTLY TO:	LEVEL:		



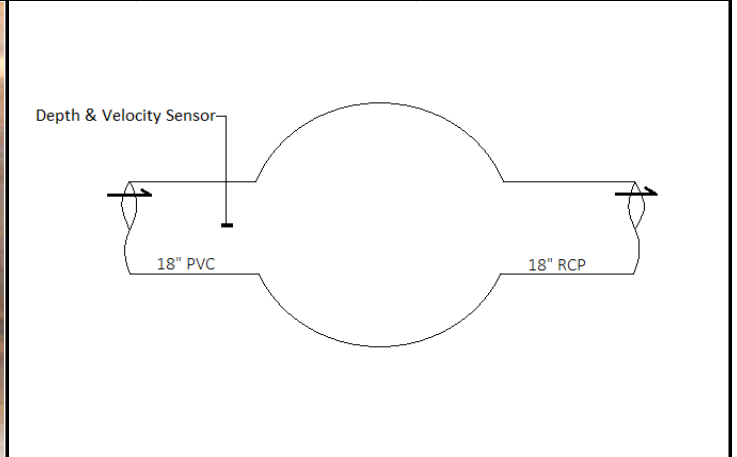


METER SITE INFORMATION FIELD LOG

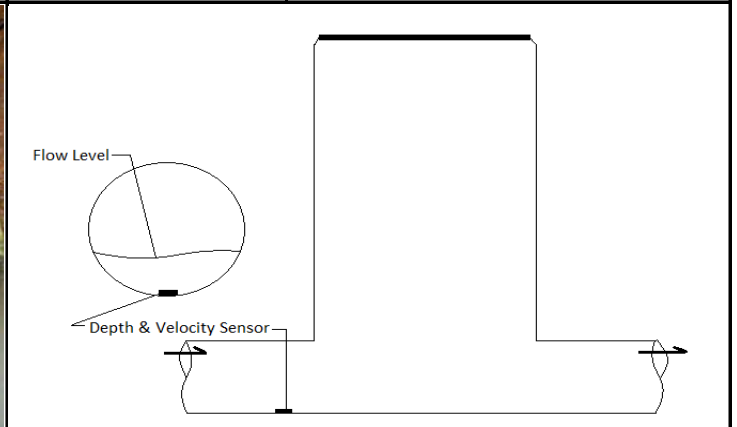
PROJECT: Norwalk, CT	DATE: March 11, 2021	JOB#: 21026
LOCATION: 178 Connecticut Avenue	MH#:	METER SITE: 29
GPS/COMMENTS: 41.104447, -73.431477		



	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	18	PVC	11.5	0	Circular	13' 00"
Incoming						
Incoming						
Outgoing	18	RCP	11.5	0	Circular	13' 01"



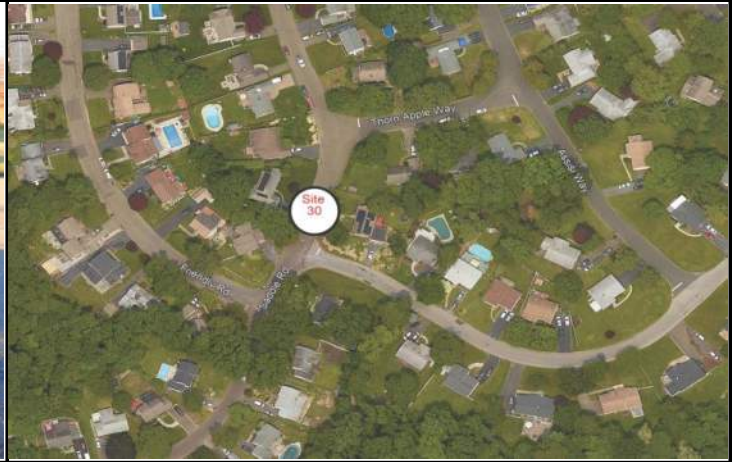
SURCHARGE INFORMATION		WEIR INFORMATION	
SURCHARGE NONE EVIDENT: X	LENGTH:	HEIGHT ABOVE WEIR:	
SURCHARGED MARKS TO:	BREADTH:	OVERFLOW OCCURS AT:	
SURCHARGE CURRENTLY TO:	LEVEL:		



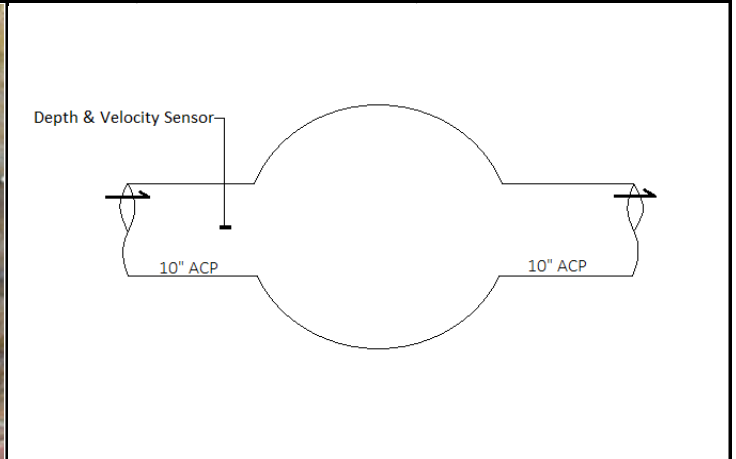


METER SITE INFORMATION FIELD LOG

PROJECT: Norwalk, CT	DATE: March 9, 2021	JOB#: 21026
LOCATION: 40 Saddle Road	MH#:	METER SITE: 30
GPS/COMMENTS: 41.130283, -73.395100		



	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	10	ACP	6.2	2	Circular	06' 07"
Incoming						
Incoming						
Outgoing	10	ACP	6.2	2	Circular	06' 08"

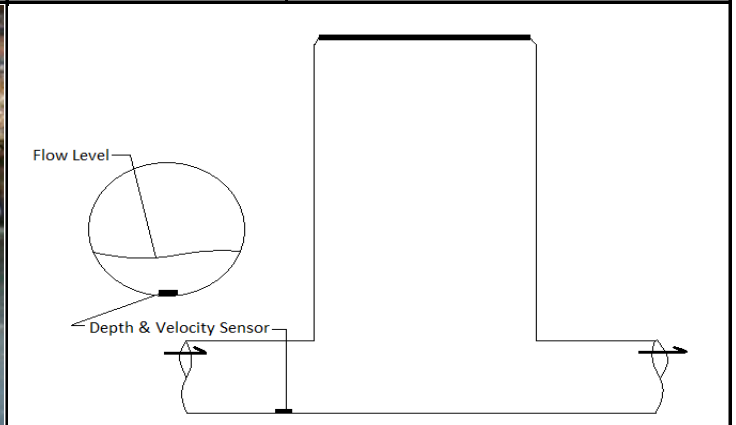


SURCHARGE INFORMATION

SURCHARGE NONE EVIDENT: X
SURCHARGED MARKS TO:
SURCHARGE CURRENTLY TO:

WEIR INFORMATION

LENGTH:	HEIGHT ABOVE WEIR:
BREADTH:	OVERFLOW OCCURS AT:
LEVEL:	



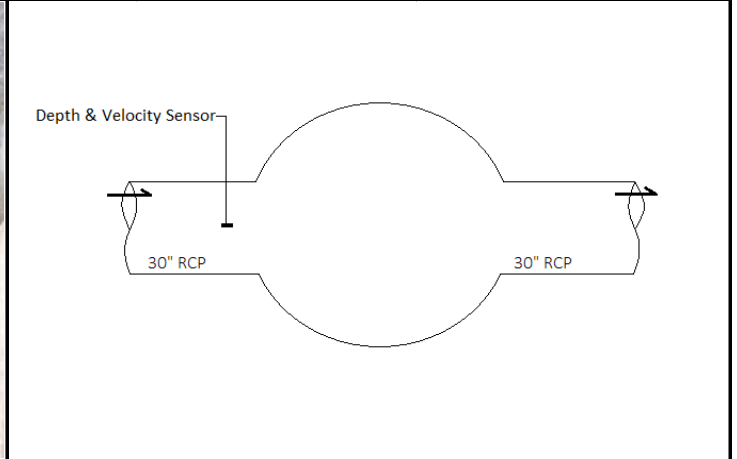


METER SITE INFORMATION FIELD LOG

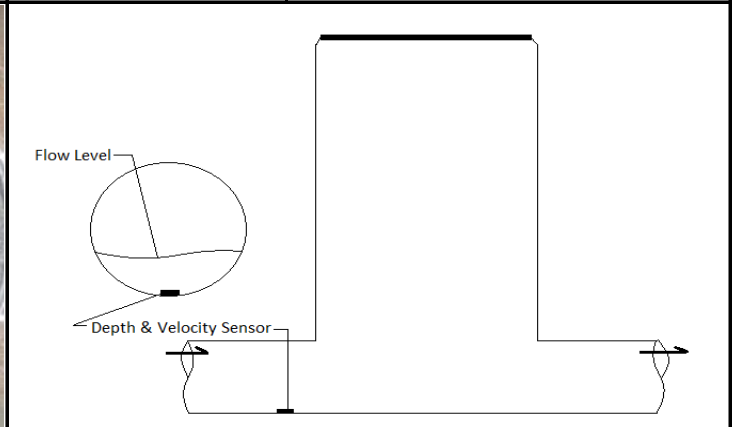
PROJECT: Norwalk, CT	DATE: March 10, 2021	JOB#: 21026
LOCATION: Main Avenue near on ramp	MH#:	METER SITE: 31
GPS/COMMENTS: 41.141555, -73.425640		



	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	30	RCP	8	2.5	Circular	16' 01"
Incoming						
Incoming						
Outgoing	30	RCP	8	2.5	Circular	16' 02"



SURCHARGE INFORMATION		WEIR INFORMATION	
SURCHARGE NONE EVIDENT: X	LENGTH:	HEIGHT ABOVE WEIR:	
SURCHARGED MARKS TO:	BREADTH:	OVERFLOW OCCURS AT:	
SURCHARGE CURRENTLY TO:	LEVEL:		



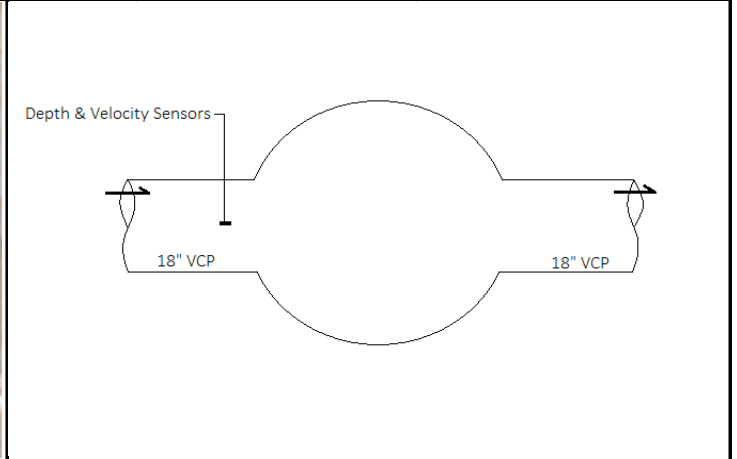


METER SITE INFORMATION FIELD LOG

PROJECT: Norwalk, CT	DATE: March 10, 2021	JOB#: 21026
LOCATION: Riverside Avenue R.O.W.	MH#:	METER SITE: 32
GPS/COMMENTS: 41.125394, -73.428150		



	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	18	VCP	4	0	Circular	10' 04"
Incoming						
Incoming						
Outgoing	18	VCP	4	0	Circular	10' 11"

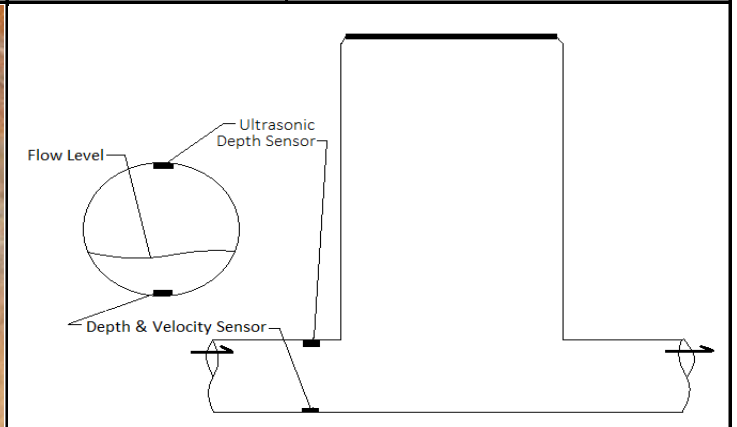


SURCHARGE INFORMATION

SURCHARGE NONE EVIDENT: X
SURCHARGED MARKS TO:
SURCHARGE CURRENTLY TO:

WEIR INFORMATION

LENGTH:	HEIGHT ABOVE WEIR:
BREADTH:	OVERFLOW OCCURS AT:
LEVEL:	



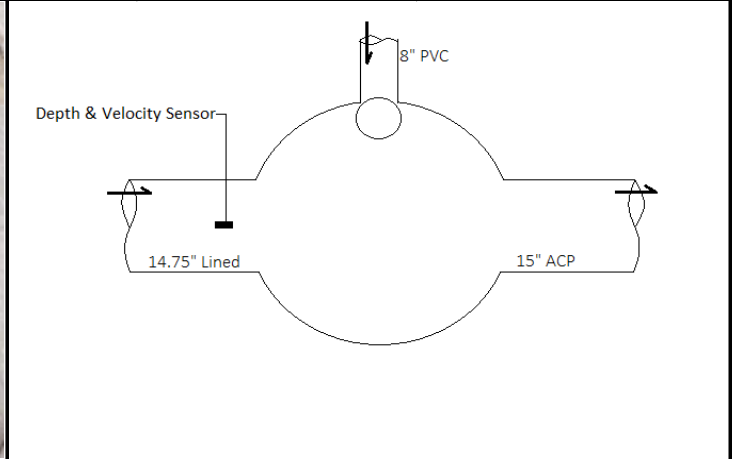


METER SITE INFORMATION FIELD LOG

PROJECT: Norwalk, CT	DATE: March 10, 2021	JOB#: 21026
LOCATION: 109 Strawberry Hill Avenue	MH#:	METER SITE: 33
GPS/COMMENTS: 41.112126, -73.398626		



	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	14.75	Lined	4	0	Circular	10' 00"
Incoming	8	PVC	0	0	Circular	04' 07"
Incoming						
Outgoing	15	ACP	4	0	Circular	10' 01"

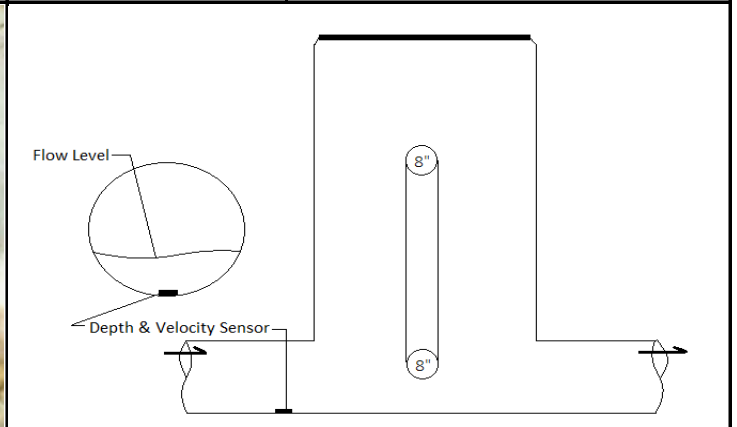


SURCHARGE INFORMATION

SURCHARGE NONE EVIDENT: X
SURCHARGED MARKS TO:
SURCHARGE CURRENTLY TO:

WEIR INFORMATION

LENGTH:	HEIGHT ABOVE WEIR:
BREADTH:	OVERFLOW OCCURS AT:
LEVEL:	



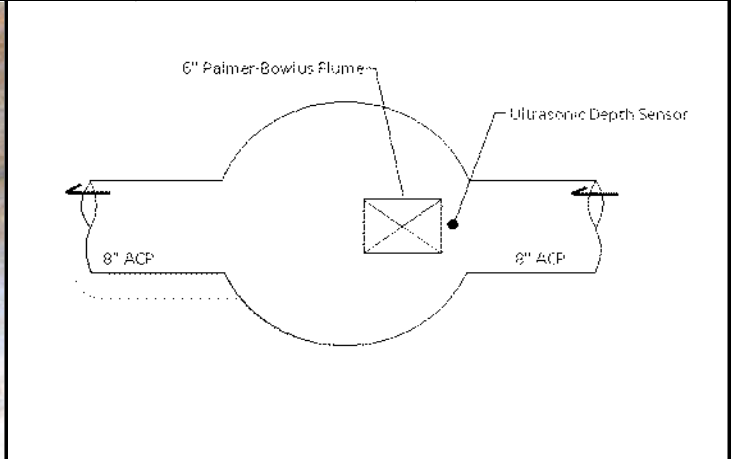


METER SITE INFORMATION FIELD LOG

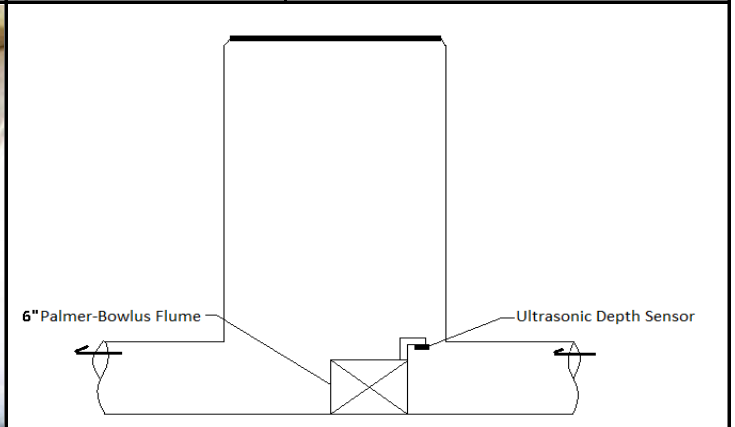
PROJECT: Norwalk, CT	DATE: March 9, 2021	JOB#: 21026
LOCATION: 29 Assisi Way	MH#:	METER SITE: 34
GPS/COMMENTS: 41.132030, -73.394164		



	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	8	ACP	2	0	Circular	06' 06"
Incoming						
Incoming						
Outgoing	8	ACP	2	0	Circular	06' 07"



SURCHARGE INFORMATION		WEIR INFORMATION	
SURCHARGE NONE EVIDENT: X	LENGTH:	HEIGHT ABOVE WEIR:	
SURCHARGED MARKS TO:	BREADTH:	OVERFLOW OCCURS AT:	
SURCHARGE CURRENTLY TO:	LEVEL:		



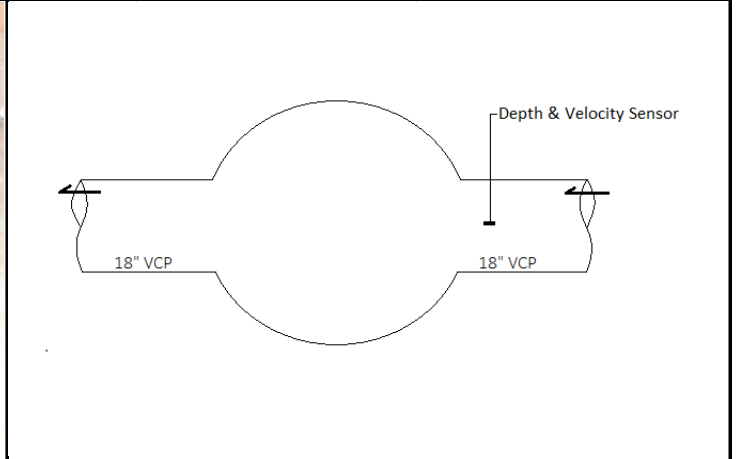


METER SITE INFORMATION FIELD LOG

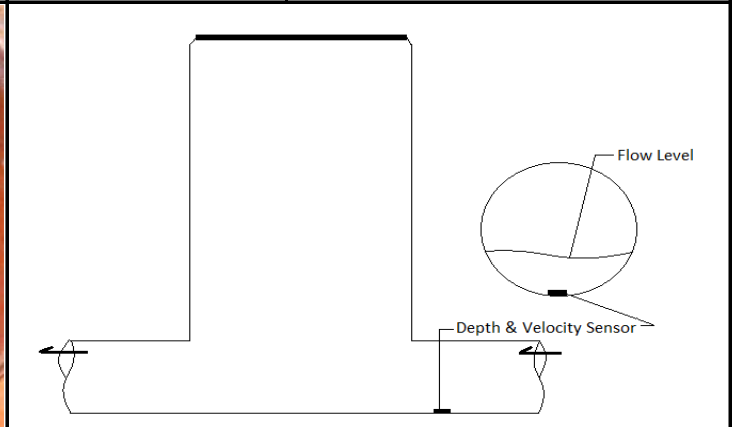
PROJECT: Norwalk, CT	DATE: March 10, 2021	JOB#: 21026
LOCATION: 2 Knight Street	MH#:	METER SITE: 35
GPS/COMMENTS: 41.118689, -73.411099		



	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	18	VCP	2	0	Circular	06' 02"
Incoming						
Incoming						
Outgoing	18	VCP	2	0	Circular	06' 03"



SURCHARGE INFORMATION		WEIR INFORMATION	
SURCHARGE NONE EVIDENT: X	LENGTH:	HEIGHT ABOVE WEIR:	
SURCHARGED MARKS TO:	BREADTH:	OVERFLOW OCCURS AT:	
SURCHARGE CURRENTLY TO:	LEVEL:		



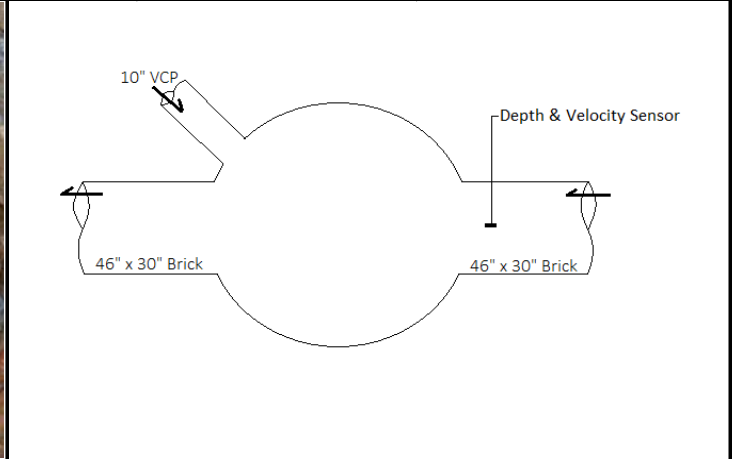


METER SITE INFORMATION FIELD LOG

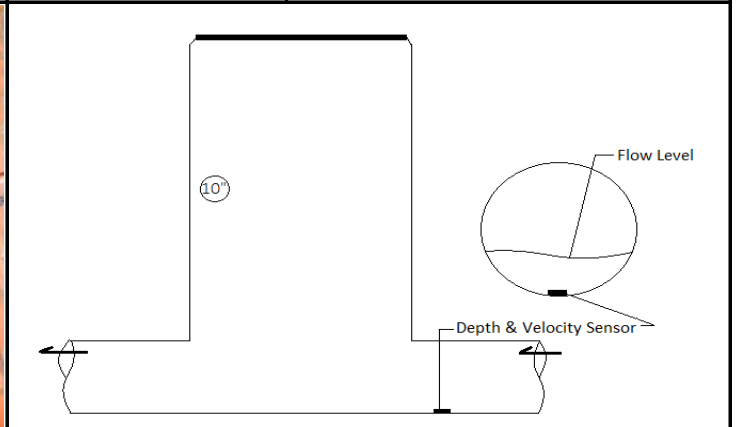
PROJECT: Norwalk, CT	DATE: March 10, 2021	JOB#: 21026
LOCATION: 5 East Wall Street	MH#:	METER SITE: 36
GPS/COMMENTS: 41.117864, -73.409162		



	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	46x30	Brick	11.5	0	Elliptical	10' 10"
Incoming	10	VCP	0	0	Circular	03' 09"
Incoming						
Outgoing	46x30	Brick	11.5	0	Elliptical	10' 10"



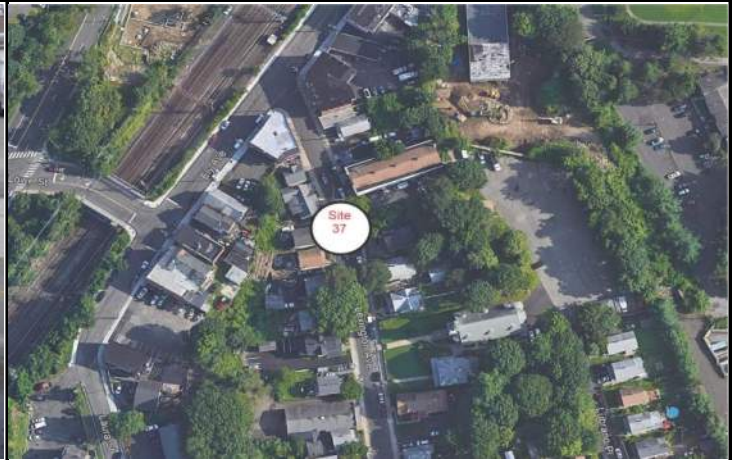
SURCHARGE INFORMATION		WEIR INFORMATION	
SURCHARGE NONE EVIDENT: X	LENGTH:	HEIGHT ABOVE WEIR:	
SURCHARGED MARKS TO:	BREADTH:	OVERFLOW OCCURS AT:	
SURCHARGE CURRENTLY TO:	LEVEL:		



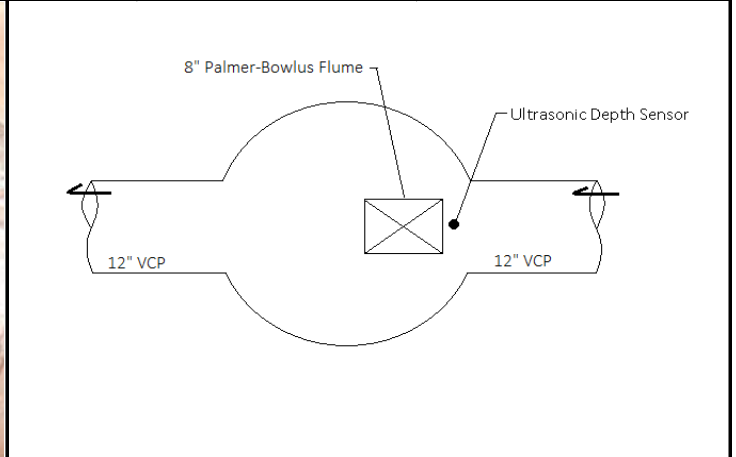


METER SITE INFORMATION FIELD LOG

PROJECT: Norwalk, CT	DATE: March 17, 2021	JOB#: 21026
LOCATION: 7 Lexington Avenue	MH#:	METER SITE: 37
GPS/COMMENTS: 41.0927611, -73.4234467		



	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	12	VCP	2	0	Circular	05' 11"
Incoming						
Incoming						
Outgoing	12	VCP	2	0	Circular	06' 00"

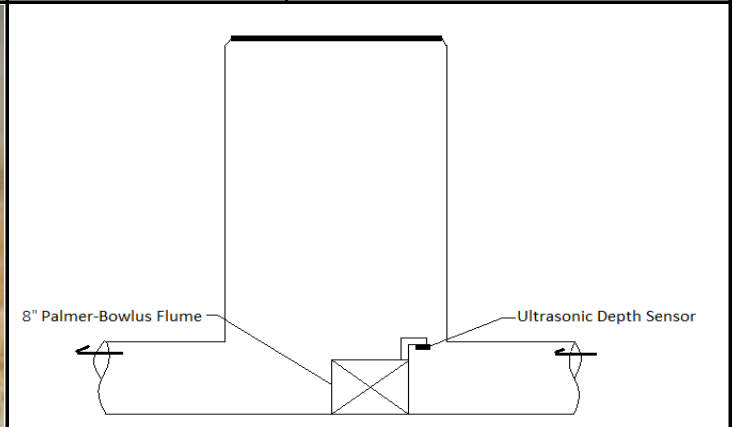


SURCHARGE INFORMATION

SURCHARGE NONE EVIDENT: X
SURCHARGED MARKS TO:
SURCHARGE CURRENTLY TO:

WEIR INFORMATION

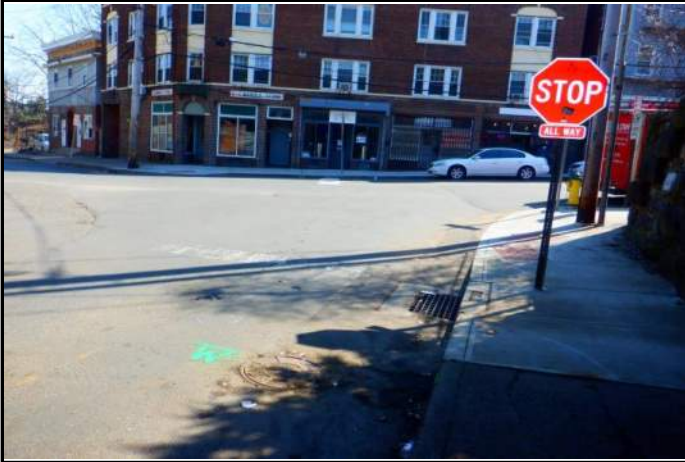
LENGTH:	HEIGHT ABOVE WEIR:
BREADTH:	OVERFLOW OCCURS AT:
LEVEL:	



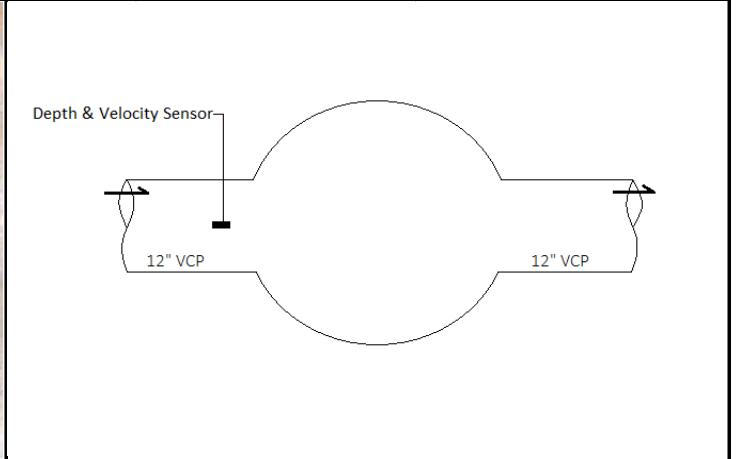


METER SITE INFORMATION FIELD LOG

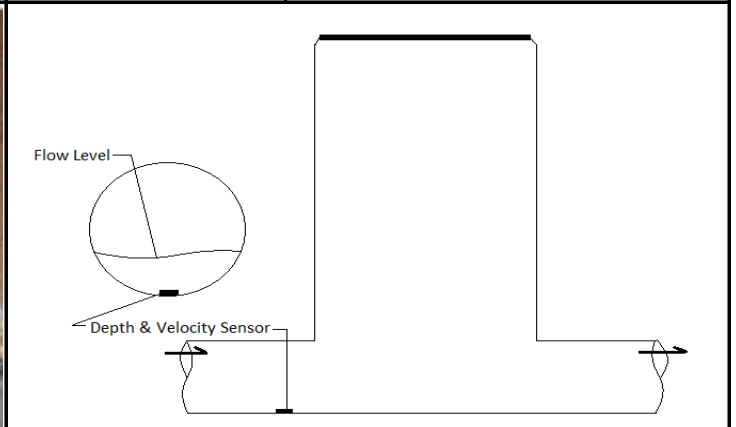
PROJECT: Norwalk, CT	DATE: March 11, 2021	JOB#: 21026
LOCATION: Franklin Street at Ely Avenue	MH#:	METER SITE: 38
GPS/COMMENTS: 41.093919, -73.423415		



	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	12	VCP	3	0	Circular	05' 06"
Incoming						
Incoming						
Outgoing	12	VCP	3	0	Circular	05' 07"



SURCHARGE INFORMATION		WEIR INFORMATION	
SURCHARGE NONE EVIDENT: X	LENGTH:	HEIGHT ABOVE WEIR:	
SURCHARGED MARKS TO:	BREADTH:	OVERFLOW OCCURS AT:	
SURCHARGE CURRENTLY TO:	LEVEL:		



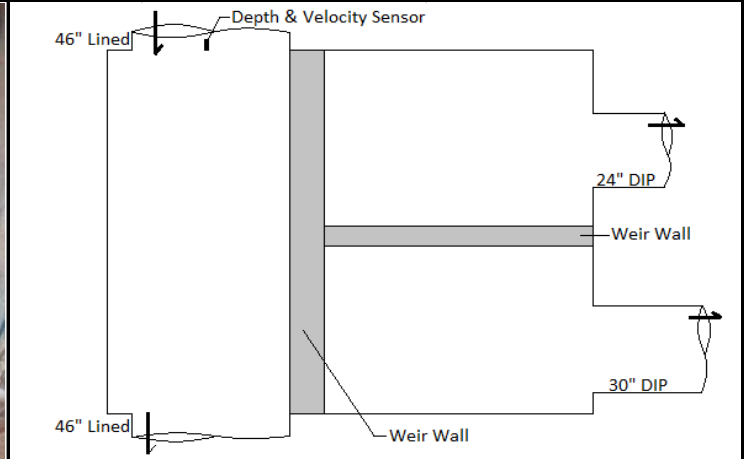


METER SITE INFORMATION FIELD LOG

PROJECT: Norwalk, CT	DATE: March 11, 2021	JOB#: 21026
LOCATION: 99 Commerce Street	MH#:	METER SITE: 39
GPS/COMMENTS: 41.114619, -73.410176		

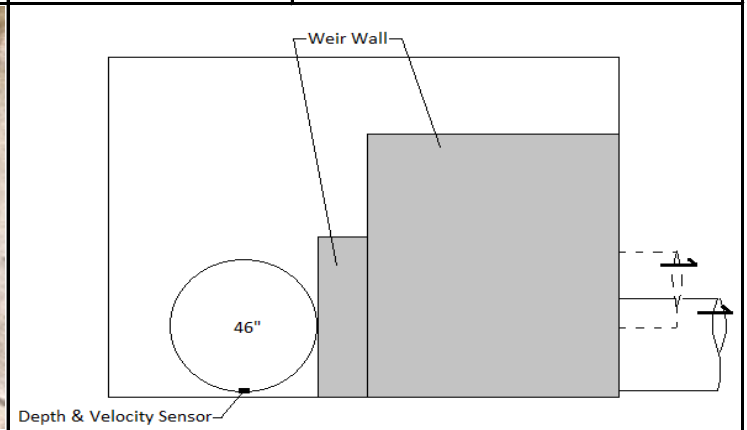


	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	46	Lined	9	0	Circular	
Outgoing	24	DIP	0	0	Circular	13' 00"
Outgoing	30	DIP	0.25	0	Circular	12' 08"
Outgoing	46	Lined	7	3	Circular	



SURCHARGE INFORMATION

SURCHARGE NONE EVIDENT: X	LENGTH: 16' 2"	HEIGHT ABOVE WEIR:
SURCHARGED MARKS TO:	BREADTH: 18"	OVERFLOW OCCURS AT: 29.5"
SURCHARGE CURRENTLY TO:	LEVEL: No	



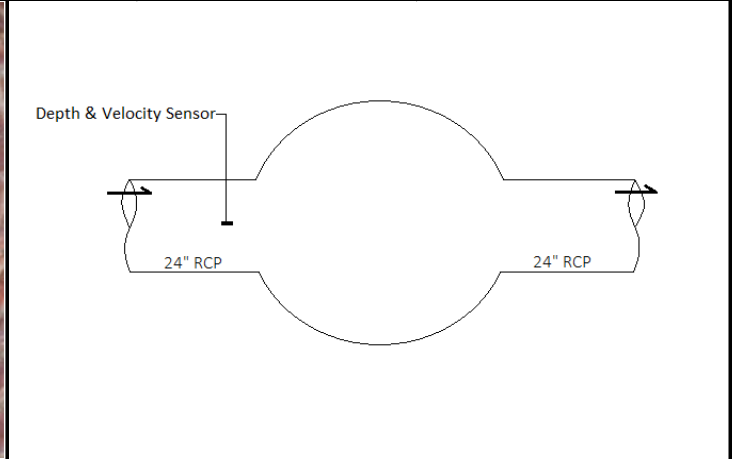


METER SITE INFORMATION FIELD LOG

PROJECT: Norwalk, CT	DATE: March 17, 2021	JOB#: 21026
LOCATION: Mulvoy Street at Henry Street (sidewalk)	MH#:	METER SITE: 40
GPS/COMMENTS: 41.0939122, -73.4224151		



	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	24	RCP	6.5	1.5	Circular	08' 04"
Incoming						
Incoming						
Outgoing	24	RCP	6.5	1.5	Circular	08' 05"

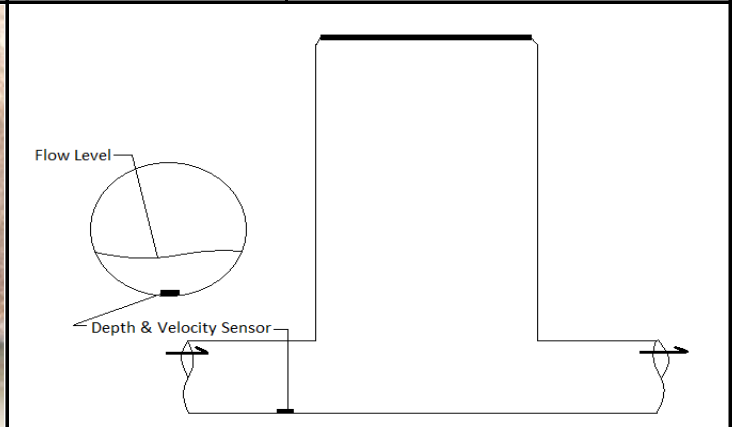


SURCHARGE INFORMATION

SURCHARGE NONE EVIDENT: X
SURCHARGED MARKS TO:
SURCHARGE CURRENTLY TO:

WEIR INFORMATION

LENGTH:	HEIGHT ABOVE WEIR:
BREADTH:	OVERFLOW OCCURS AT:
LEVEL:	

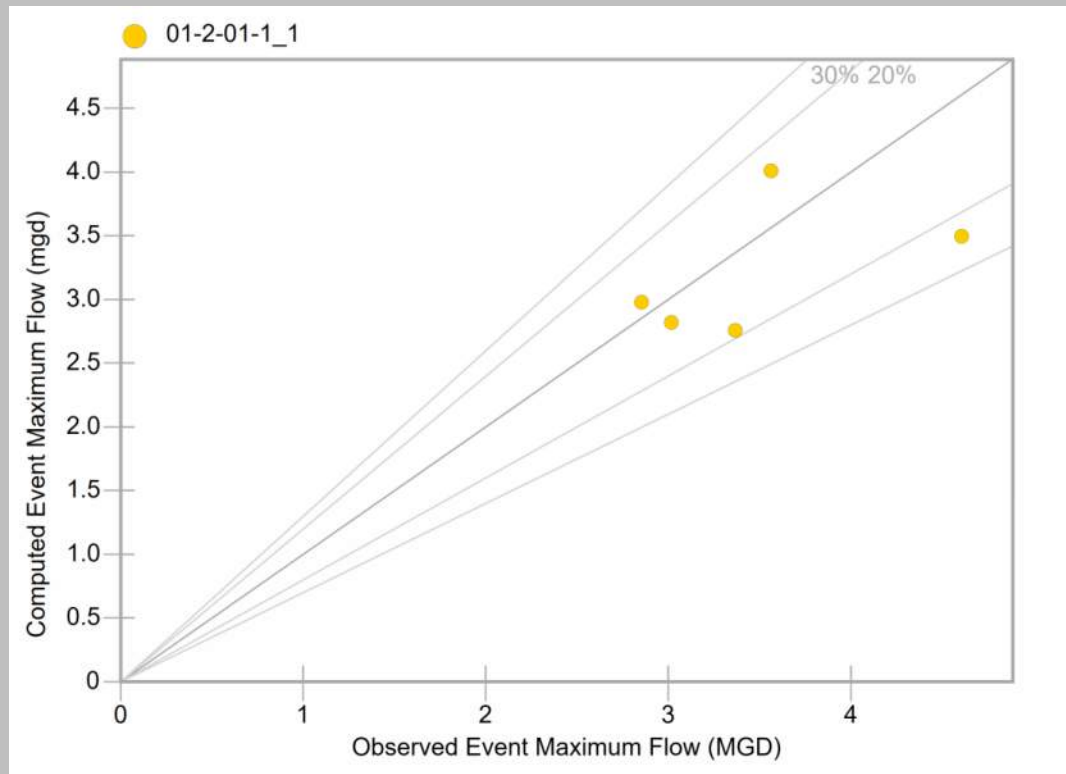


Appendix D: Hydraulic Model Calibration Plots

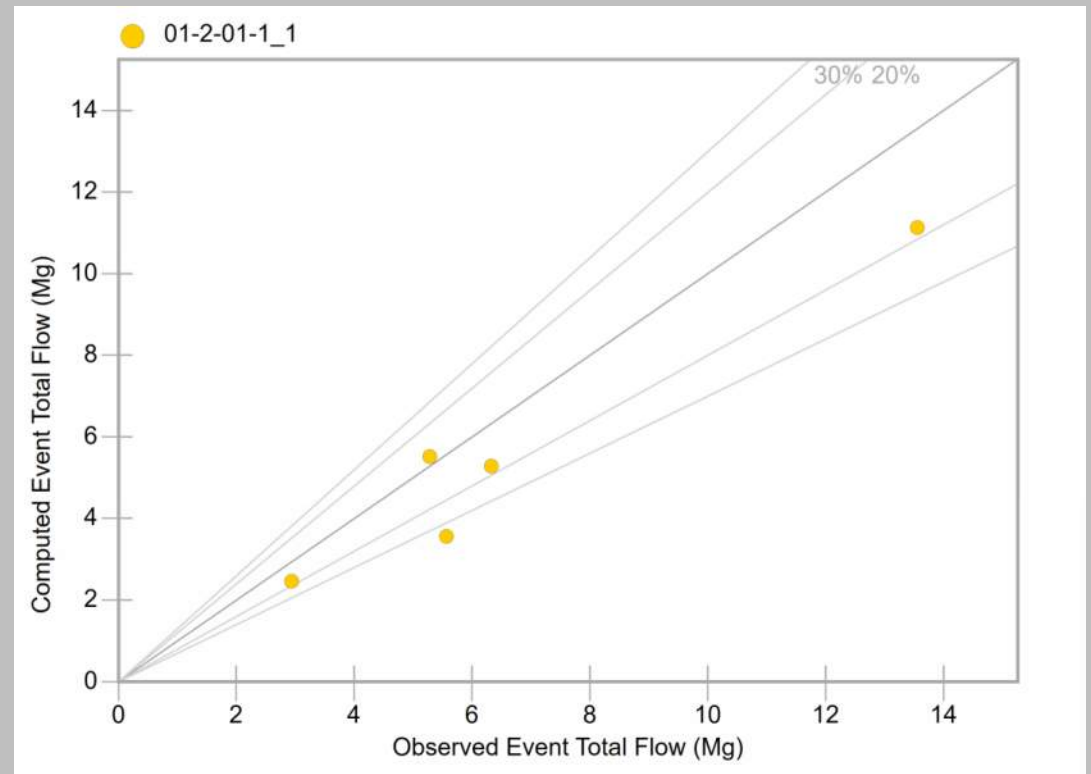


FM_01

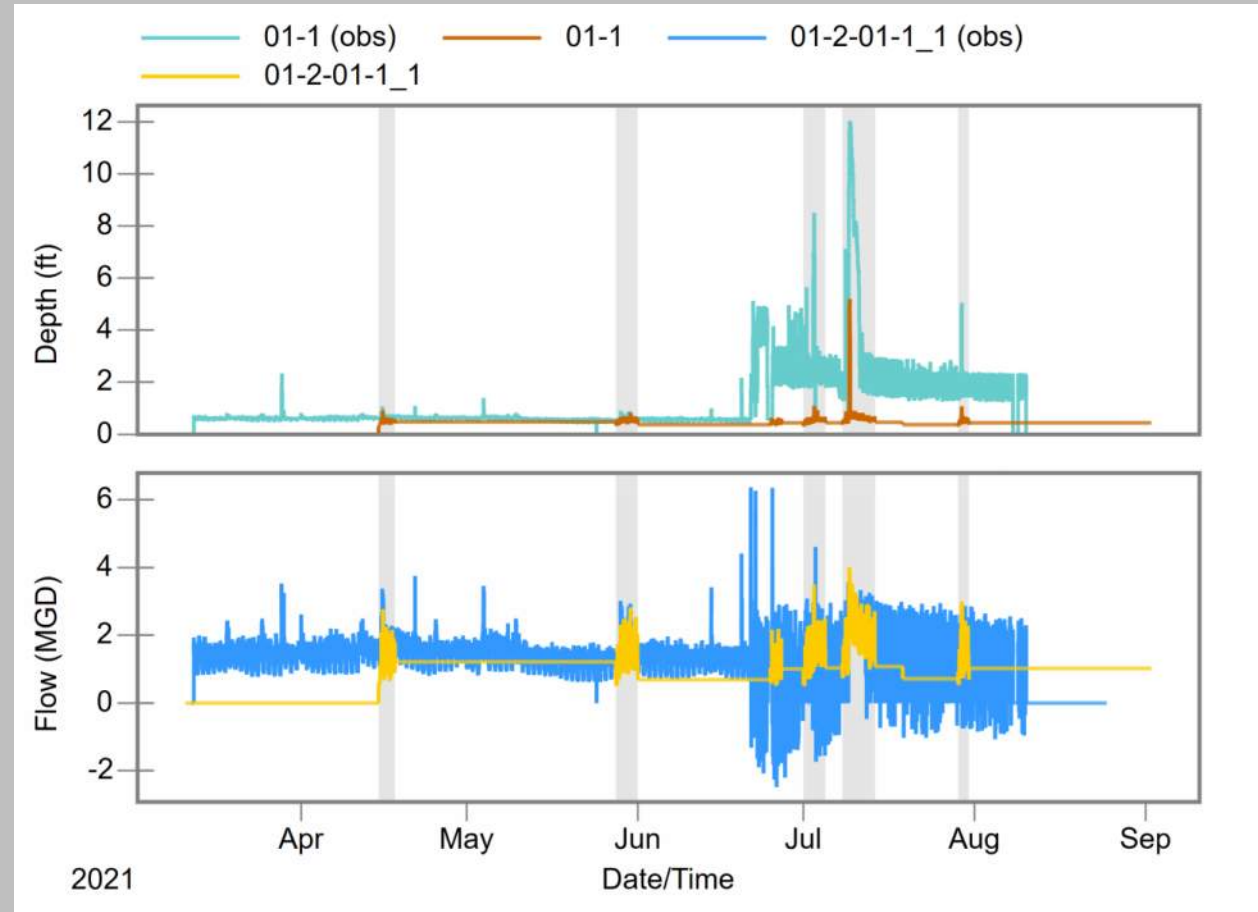
Peaks



Volumes

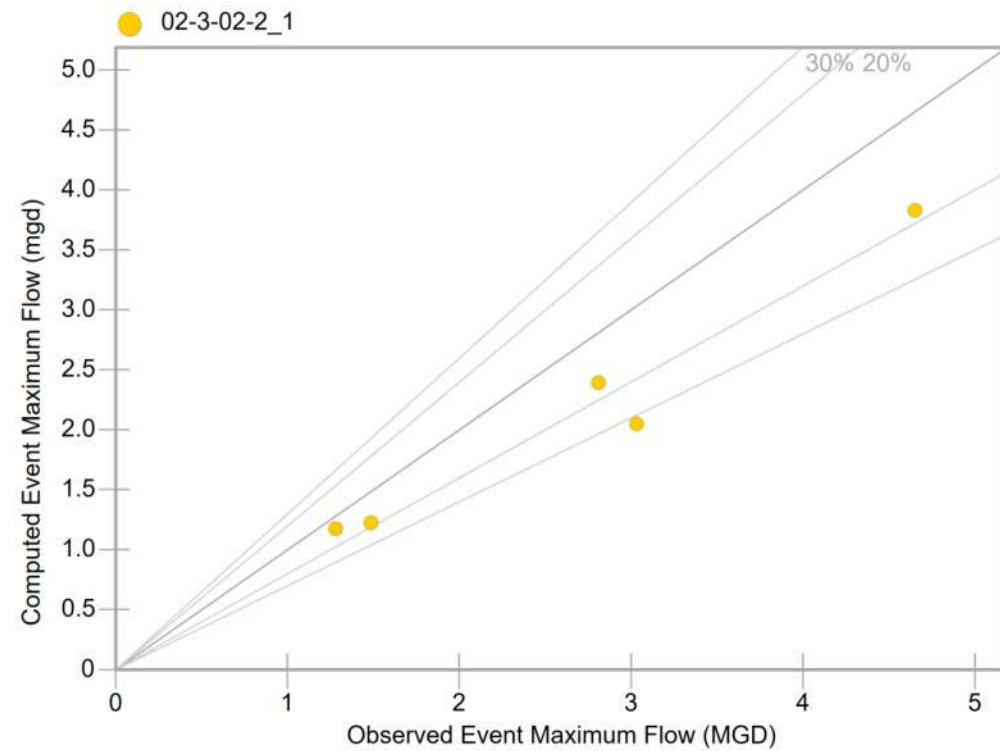


FM_01

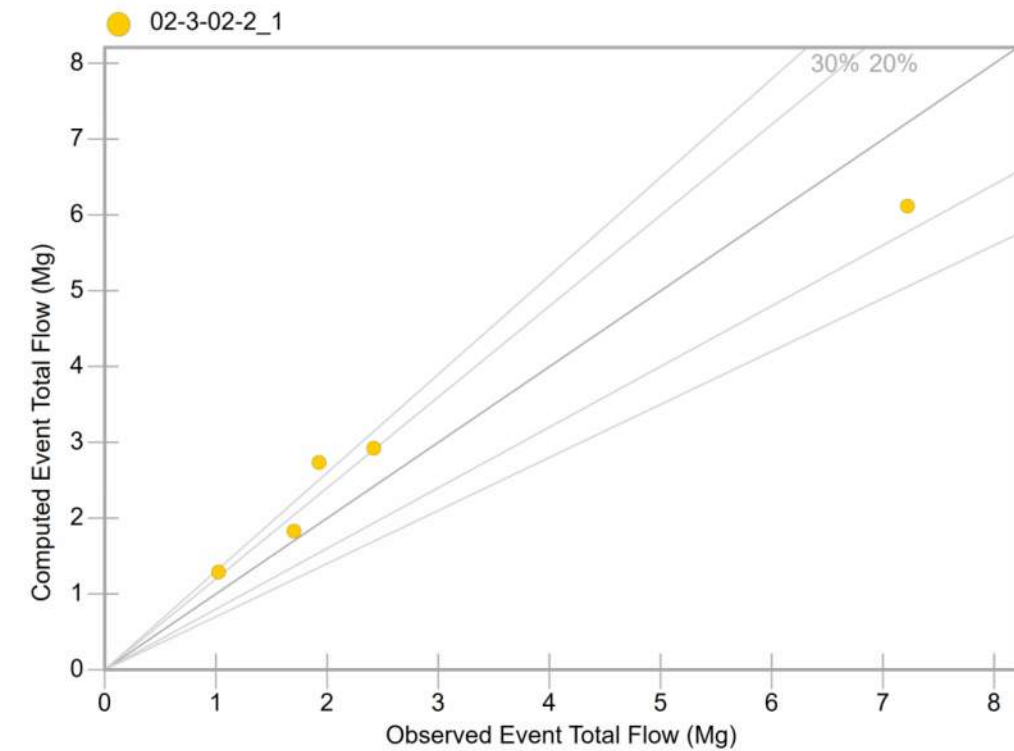


FM_02

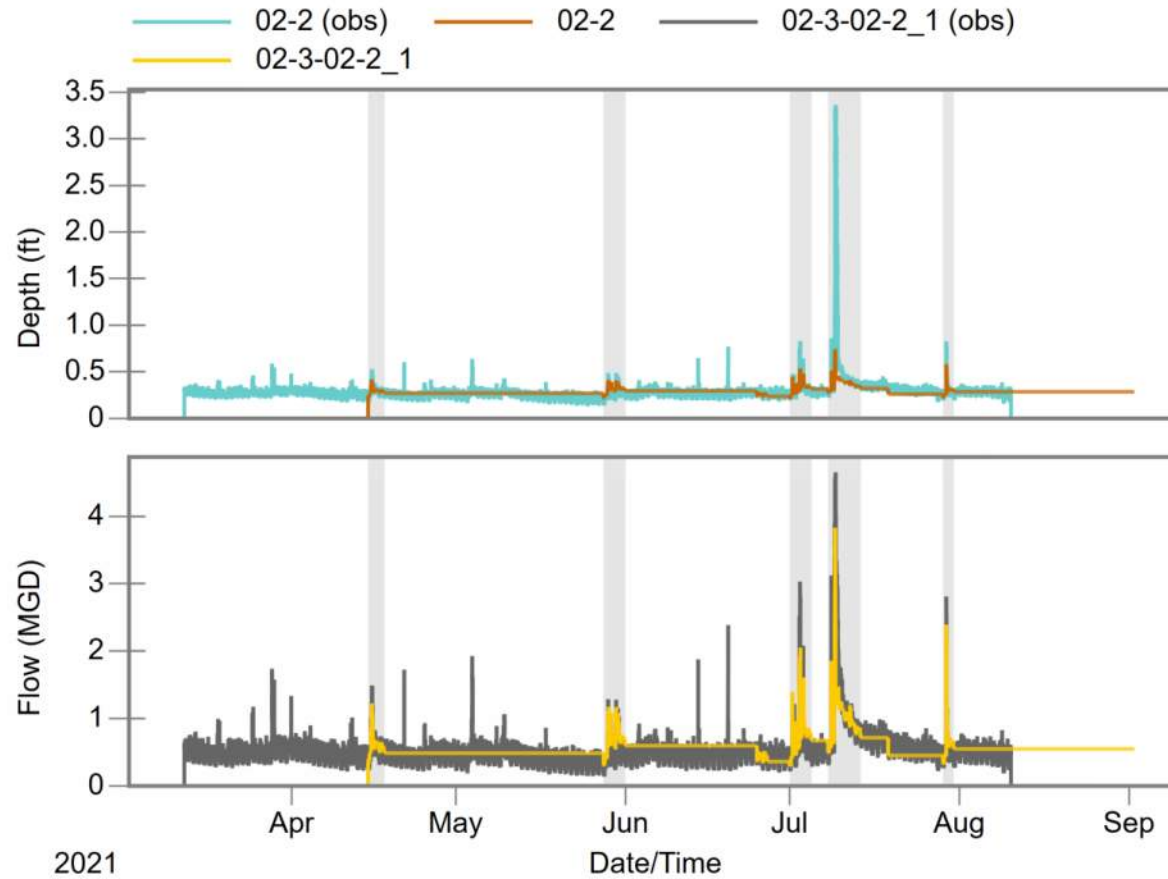
Peaks



Volumes

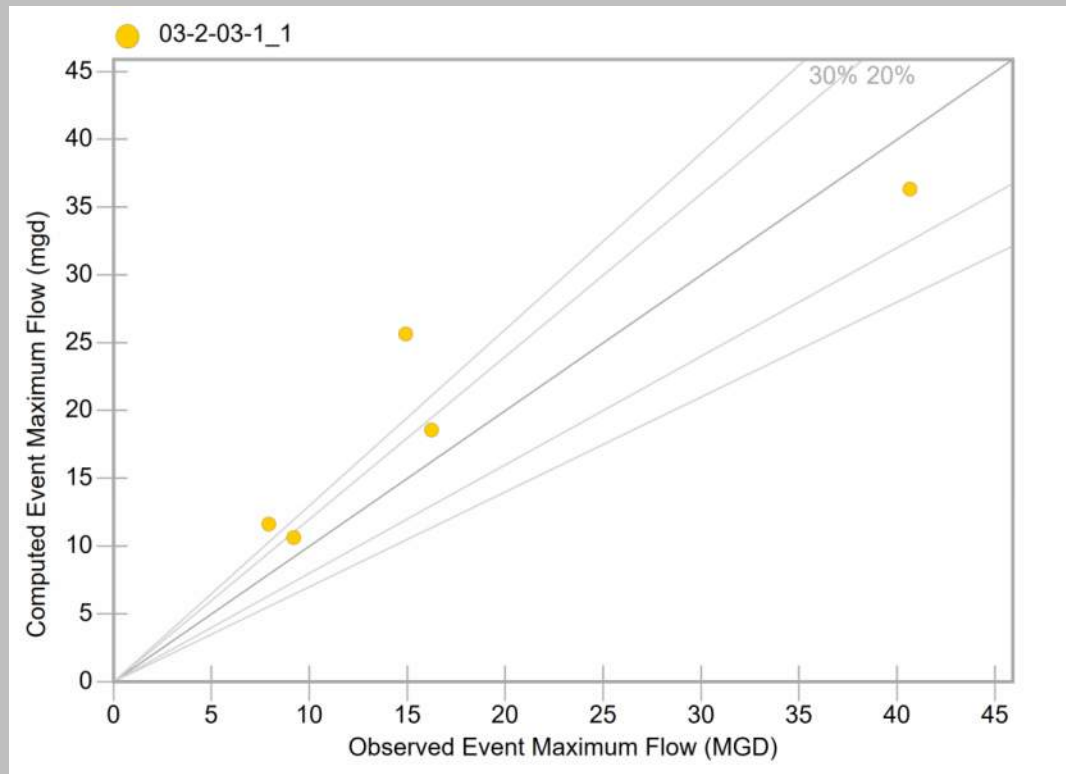


FM_02

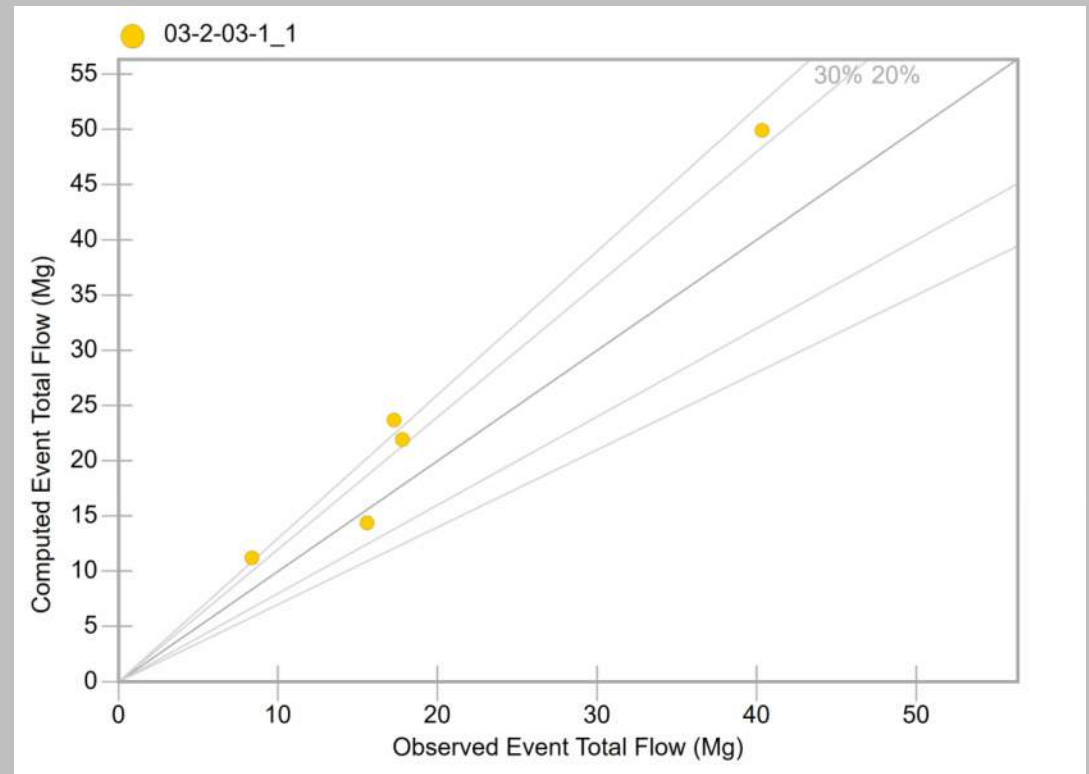


FM_03

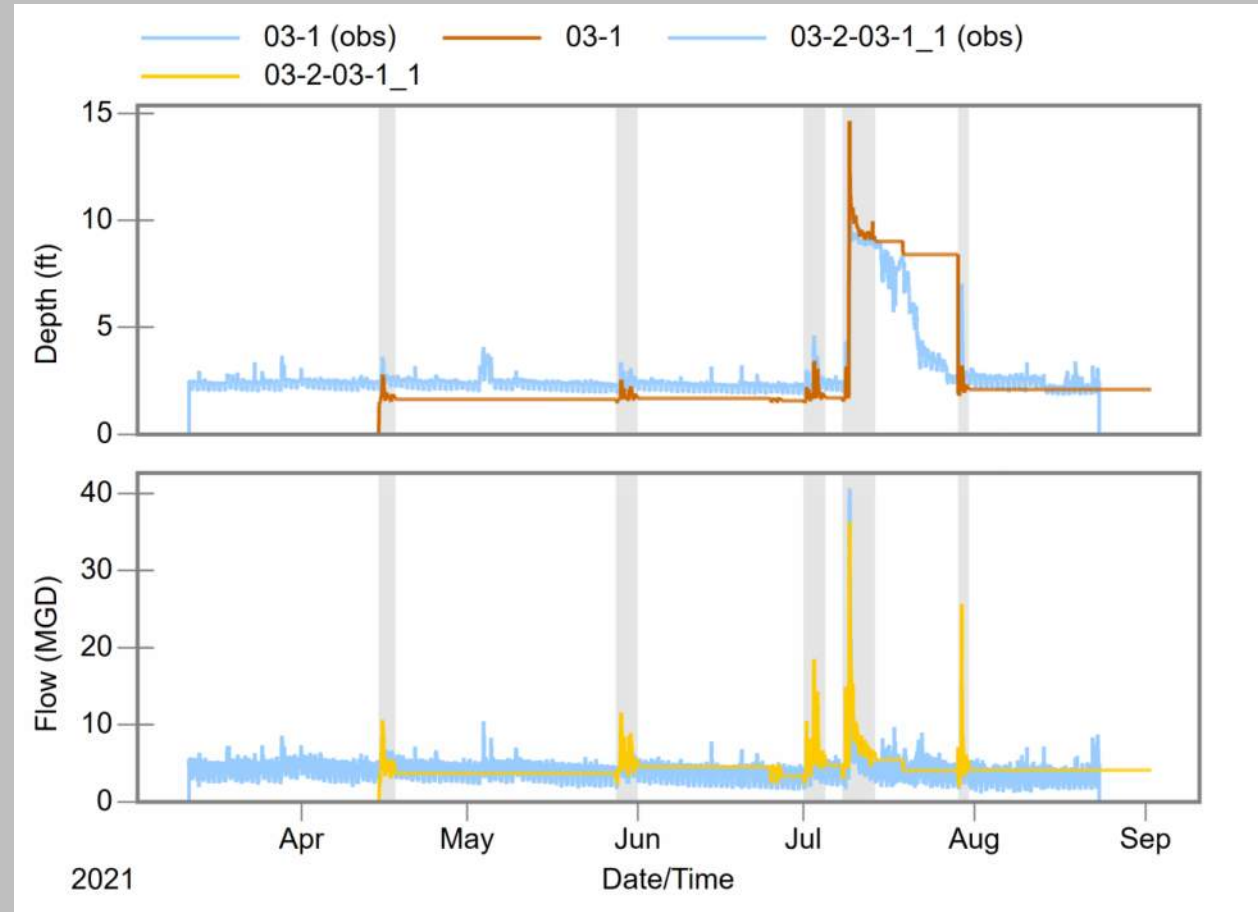
Peaks



Volumes

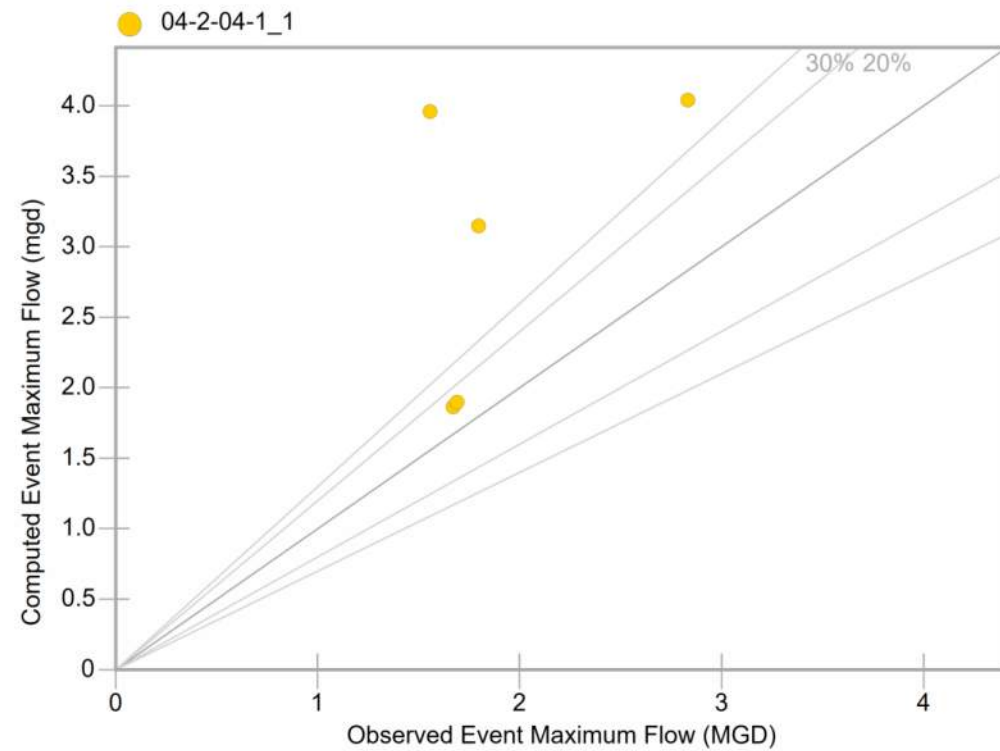


FM_03

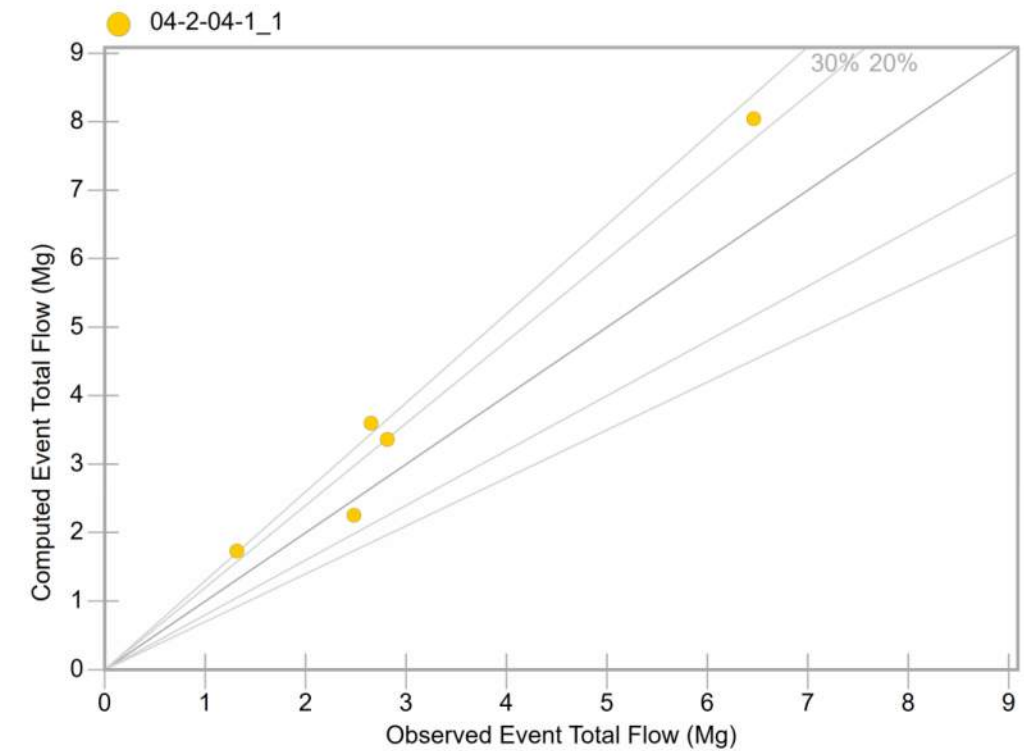


FM_04

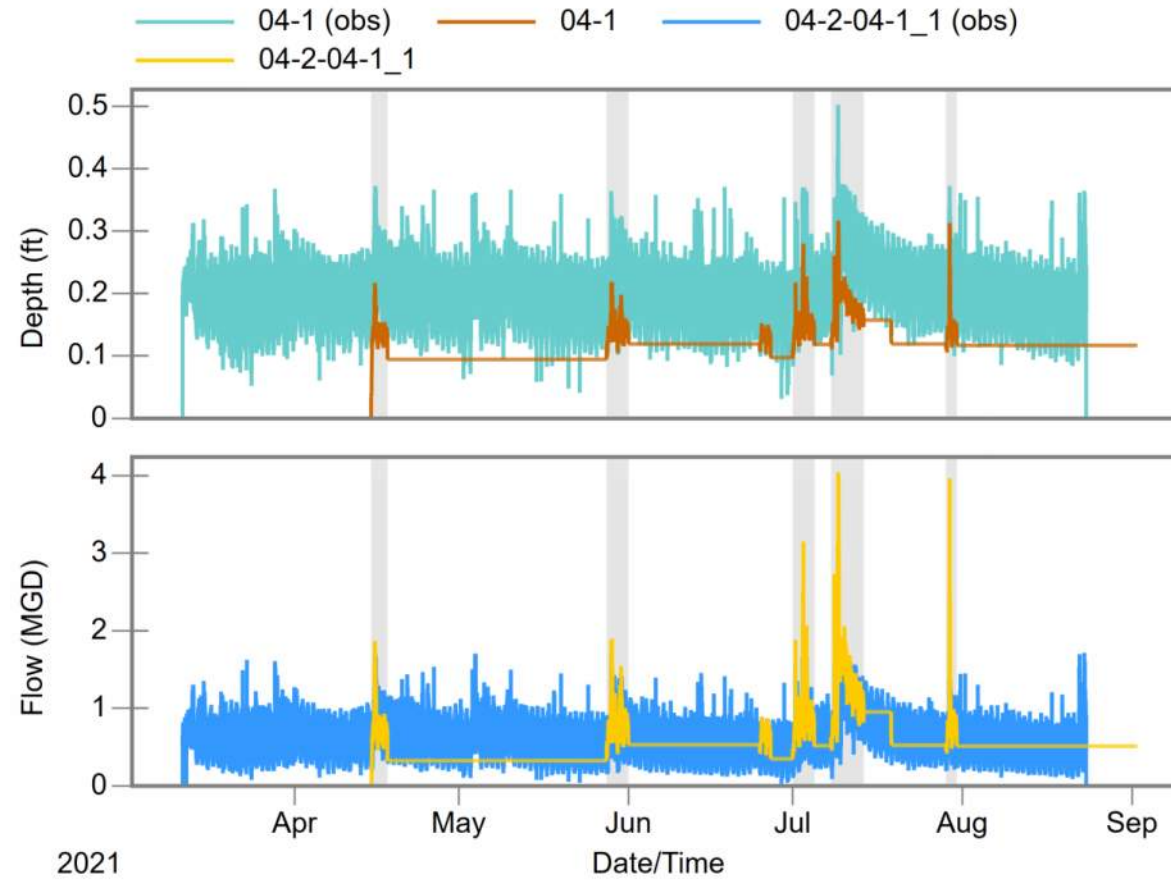
Peaks



Volumes

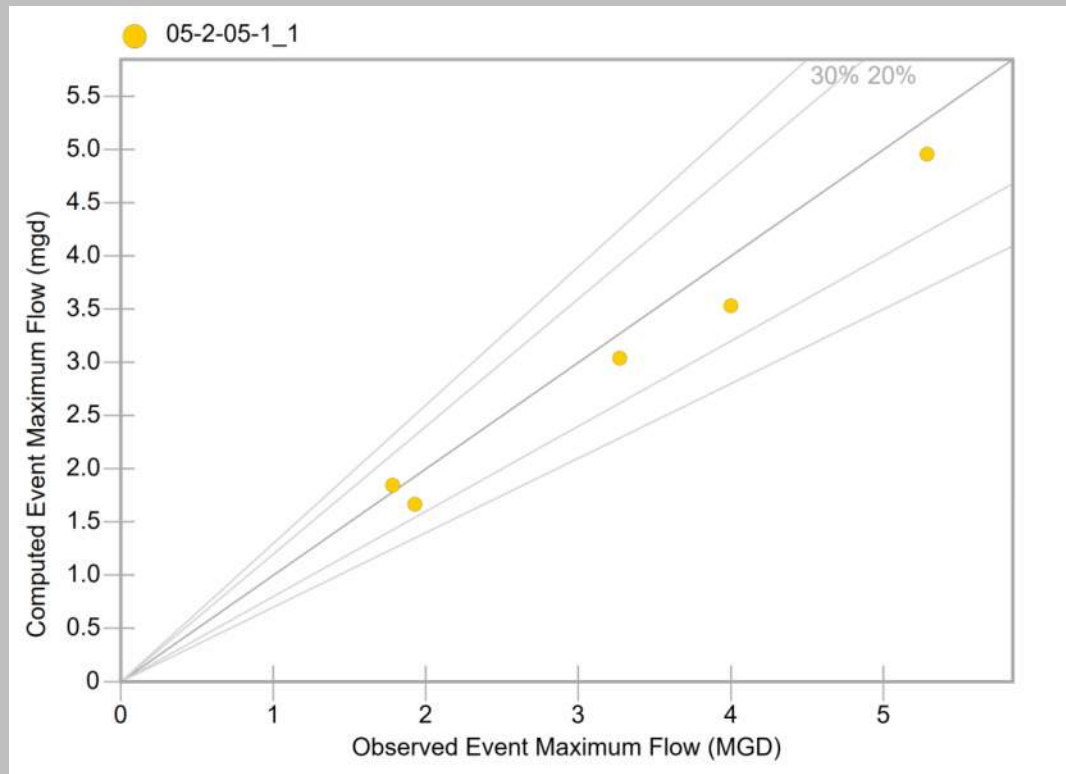


FM_04

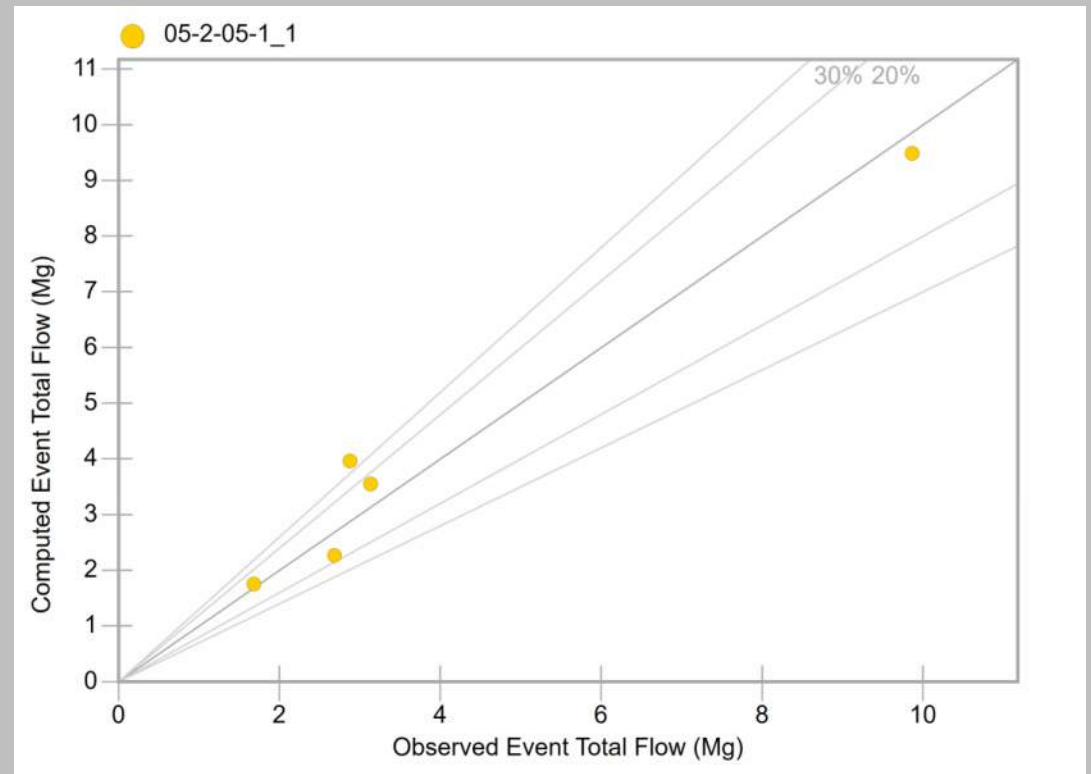


FM_05

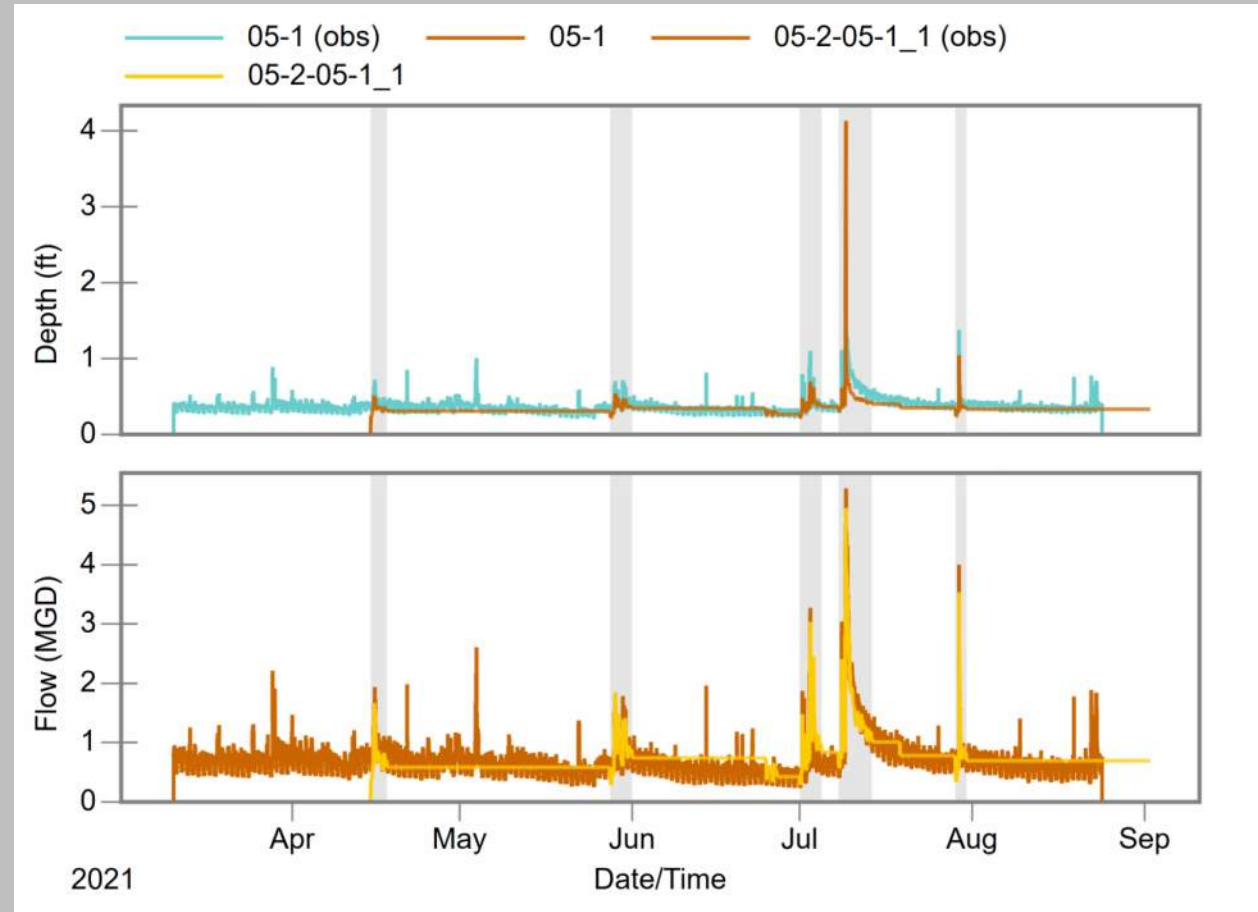
Peaks



Volumes

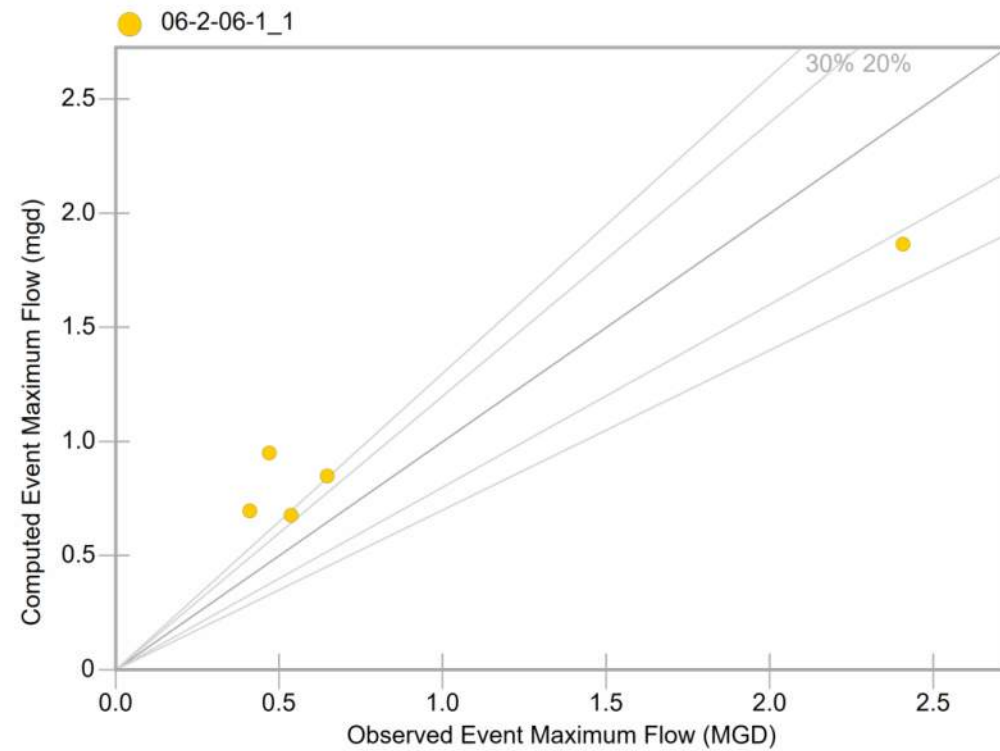


FM_05

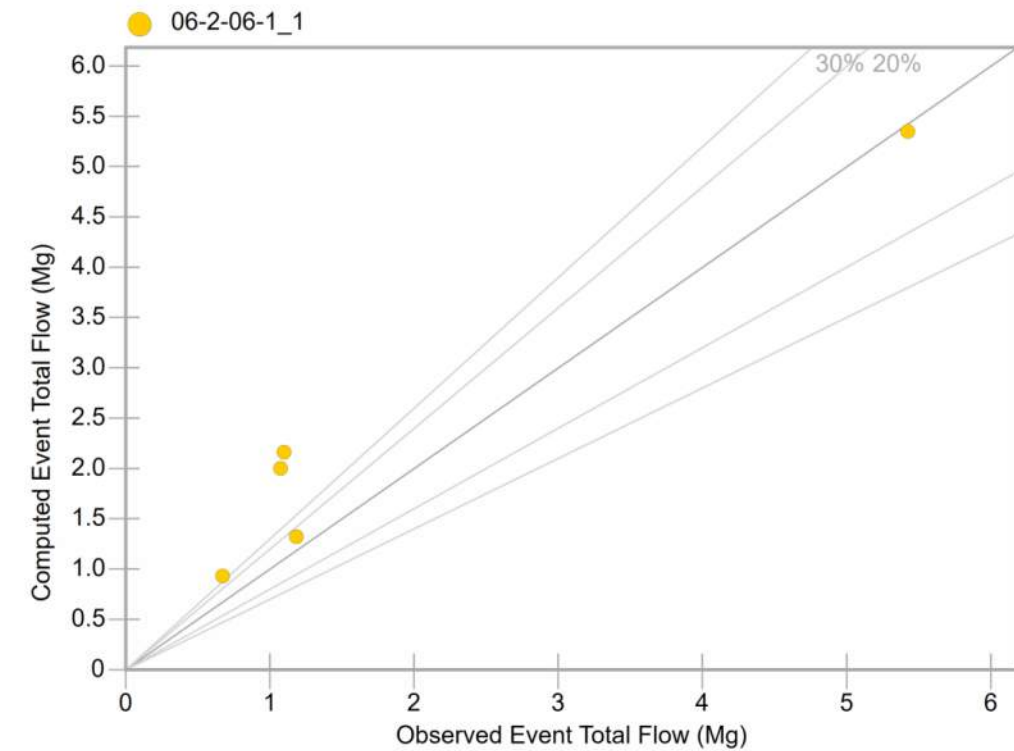


FM_06

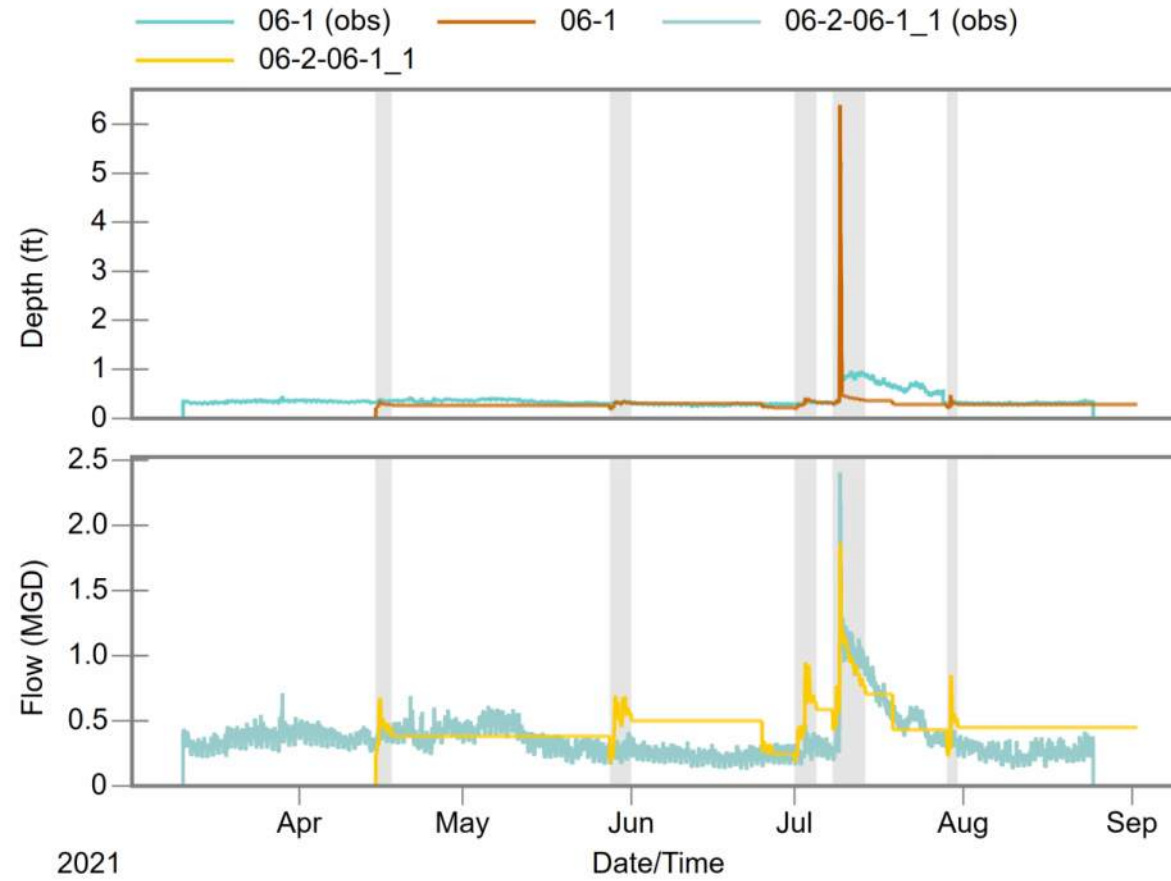
Peaks



Volumes

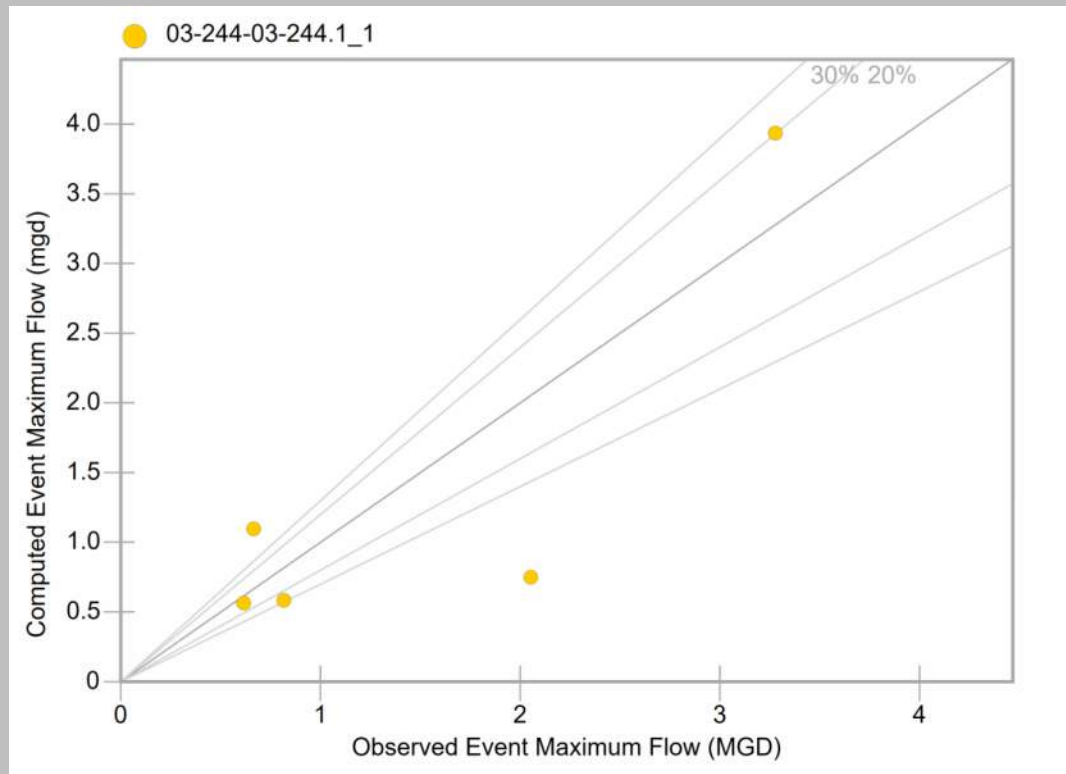


FM_06

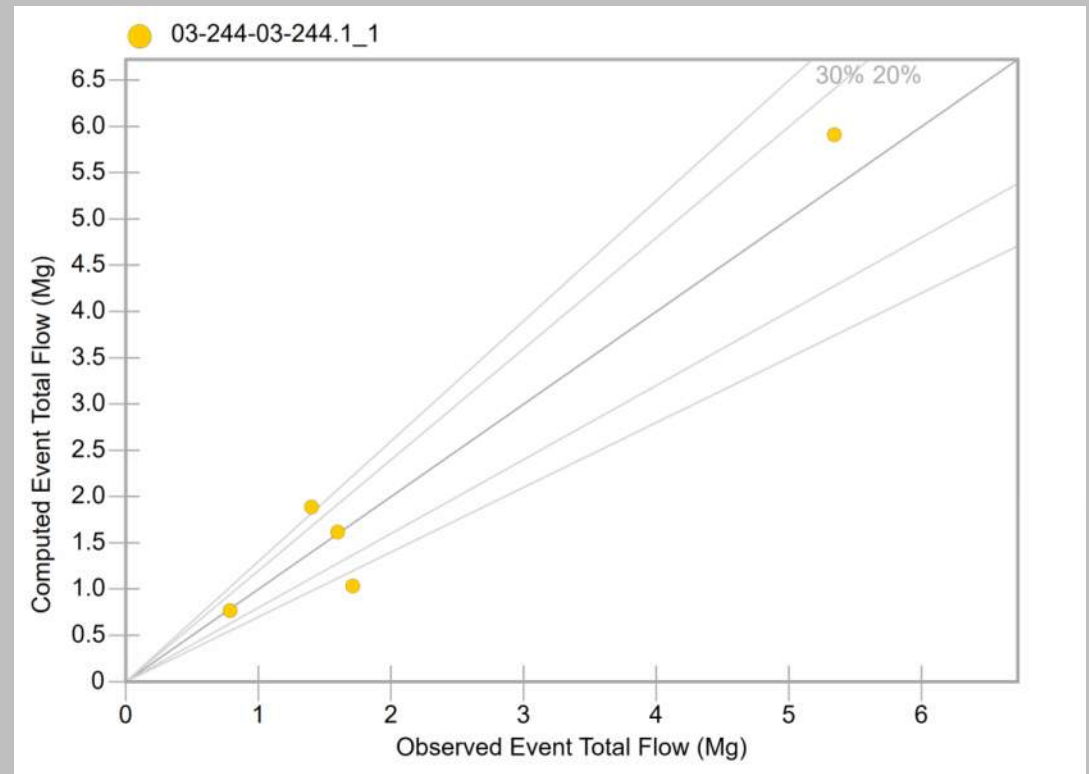


FM_07

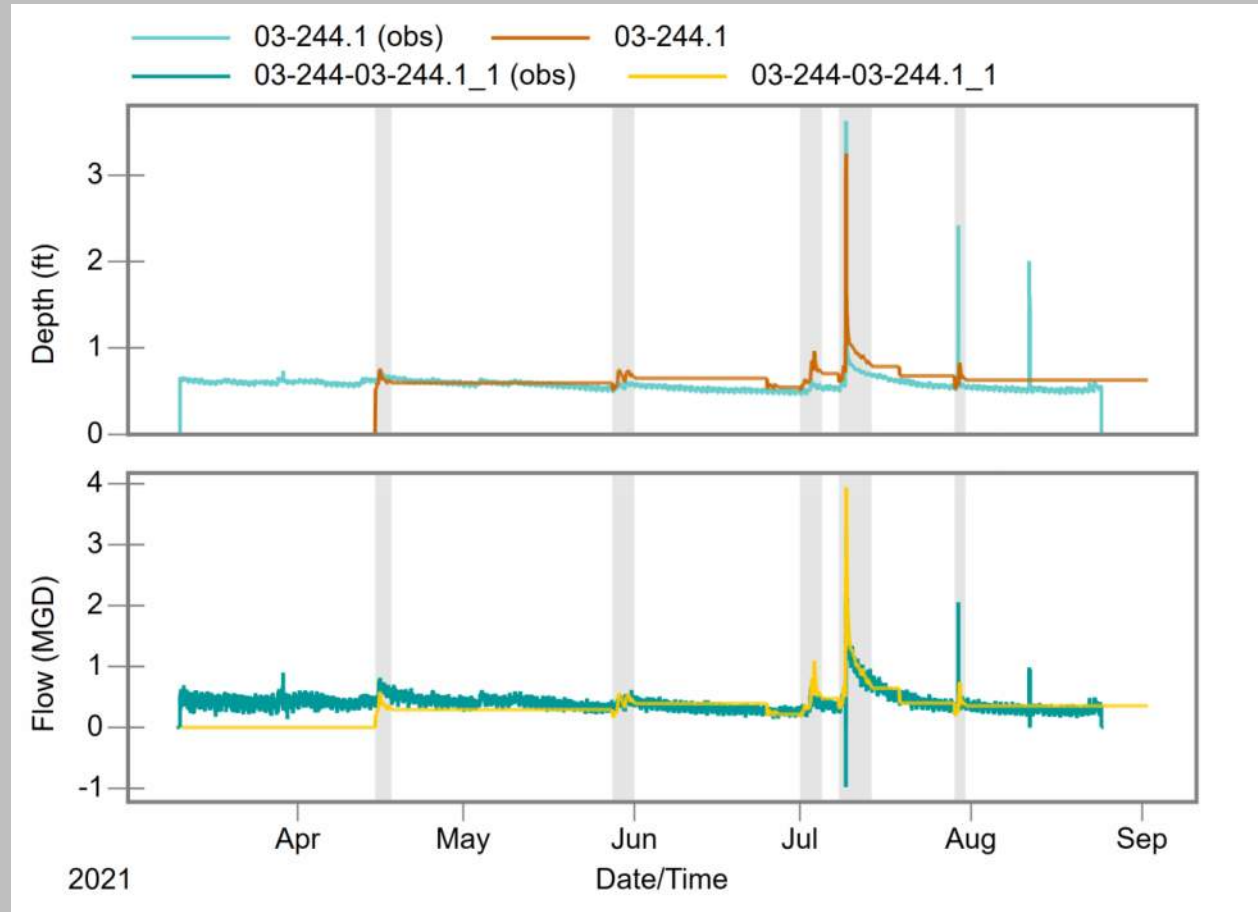
Peaks



Volumes

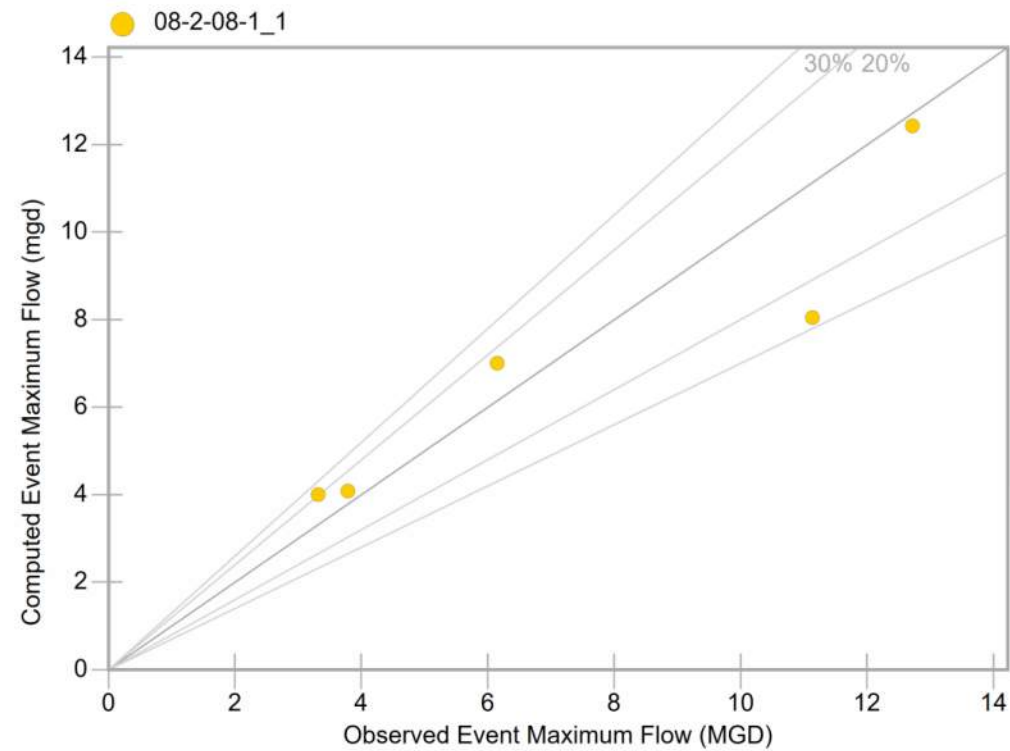


FM_07

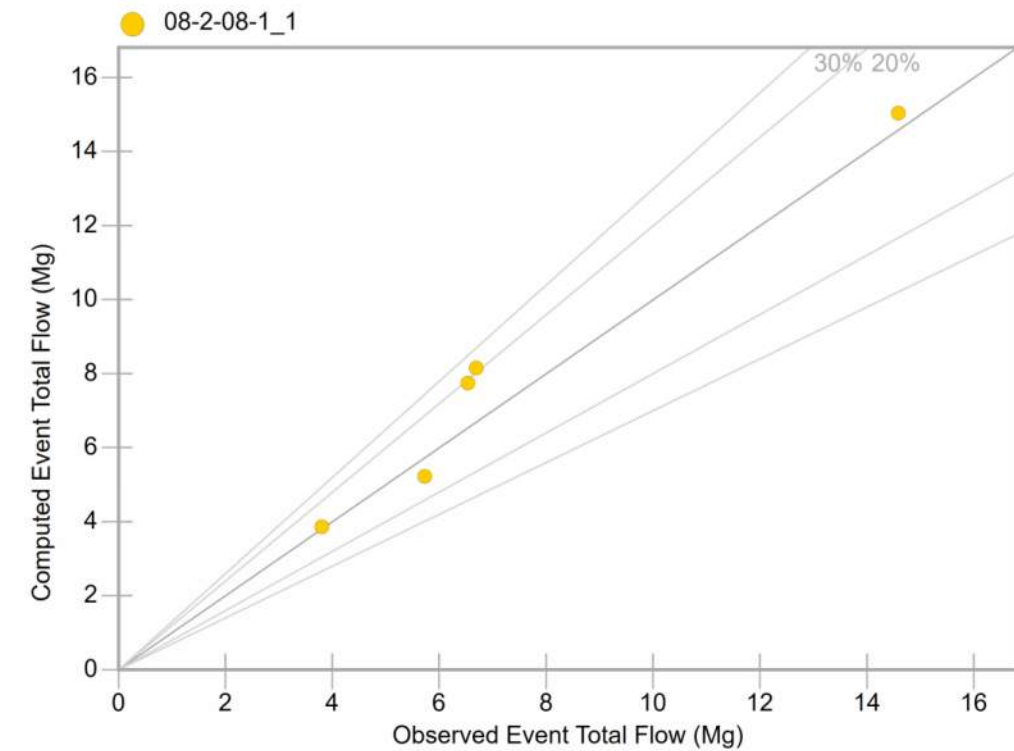


FM_08

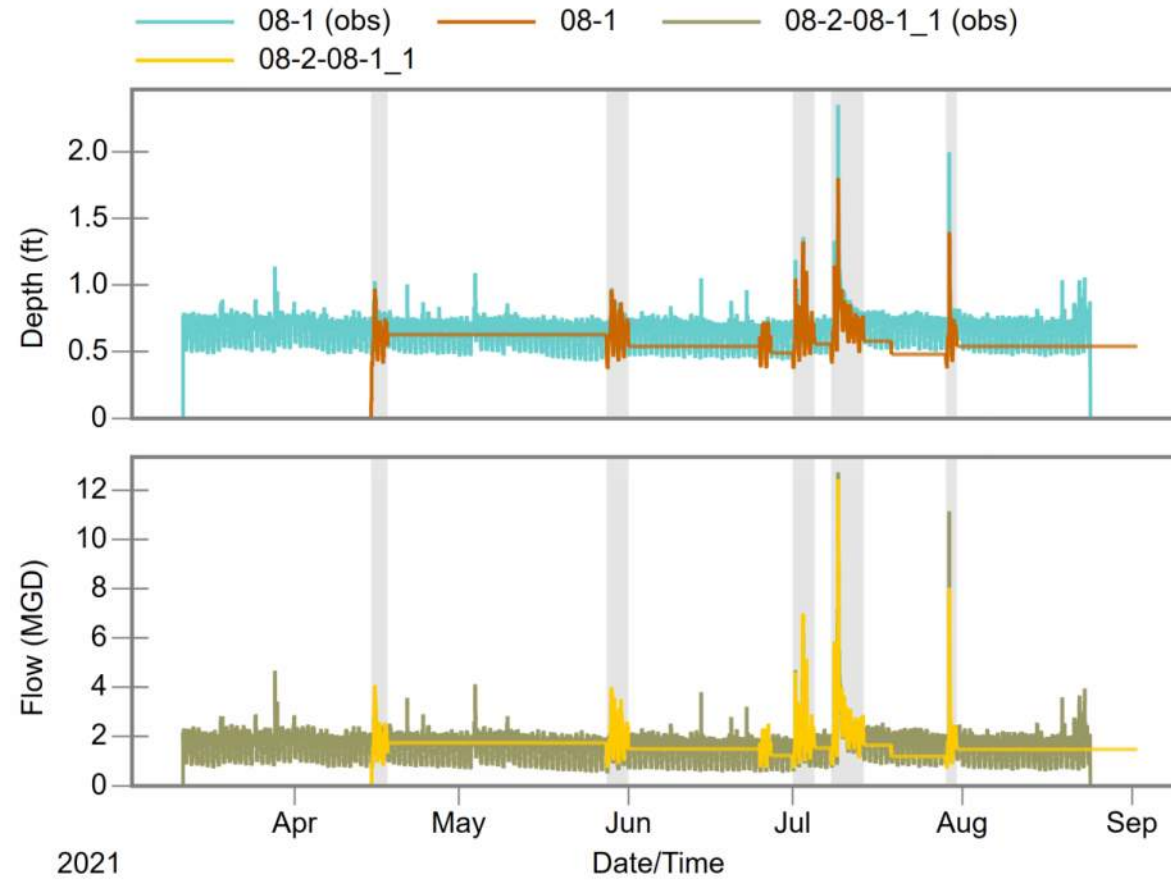
Peaks



Volumes

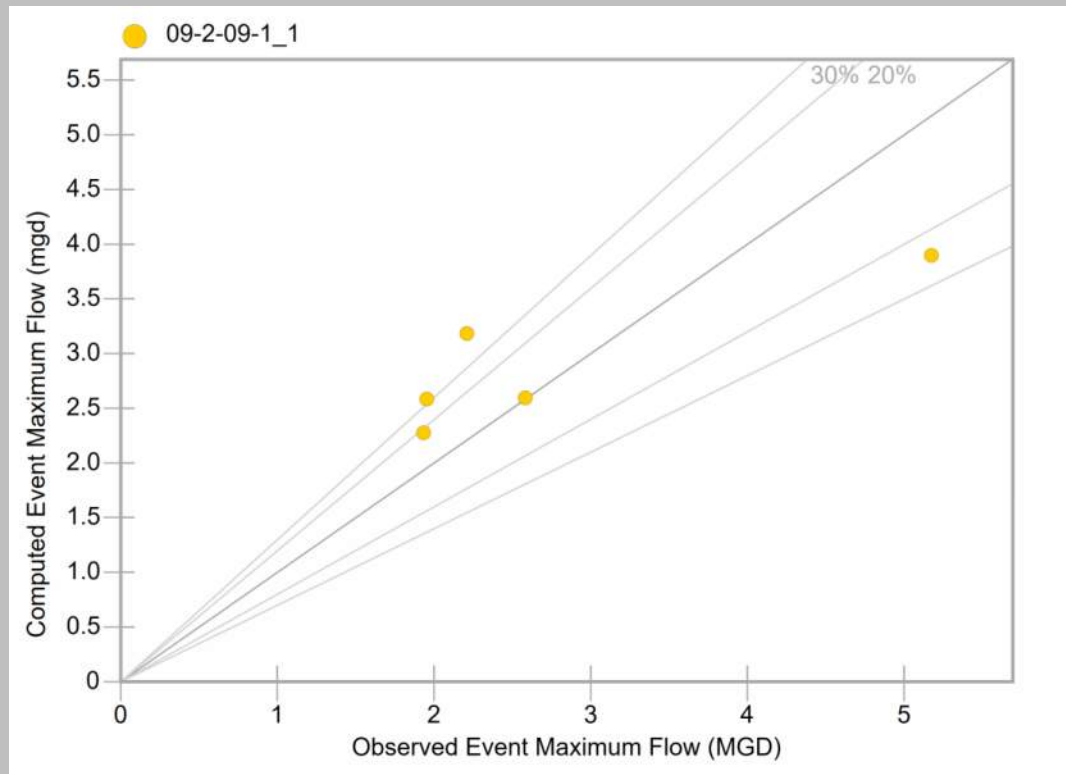


FM_08

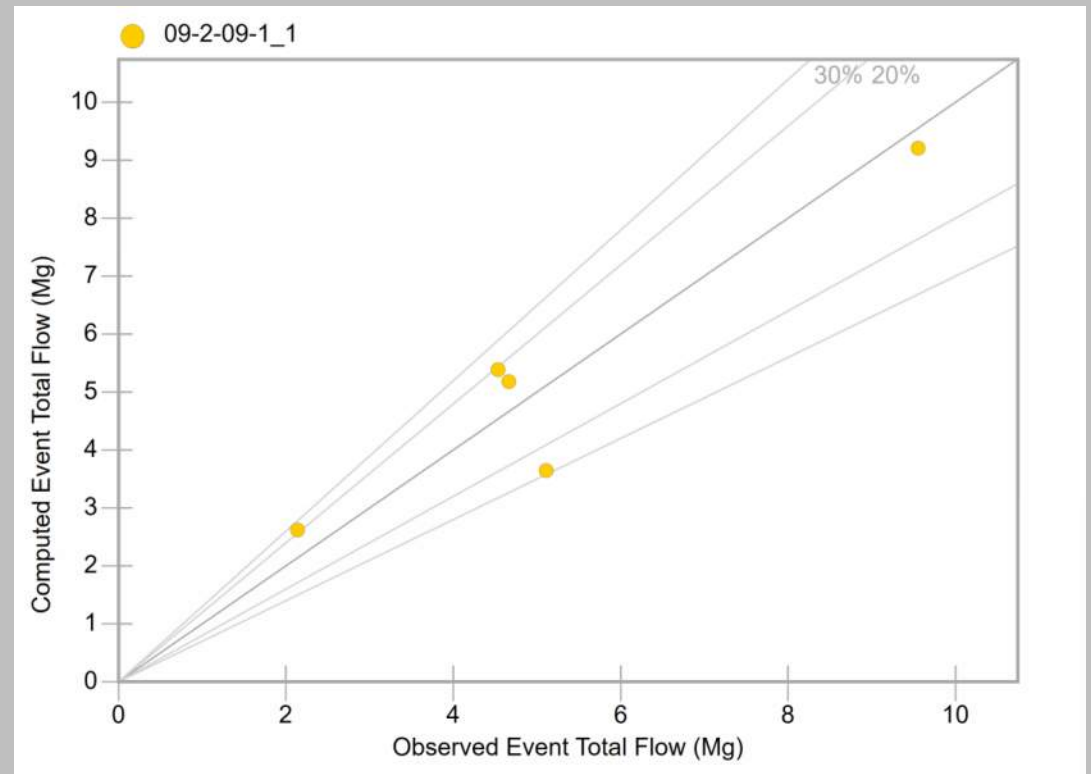


FM_09

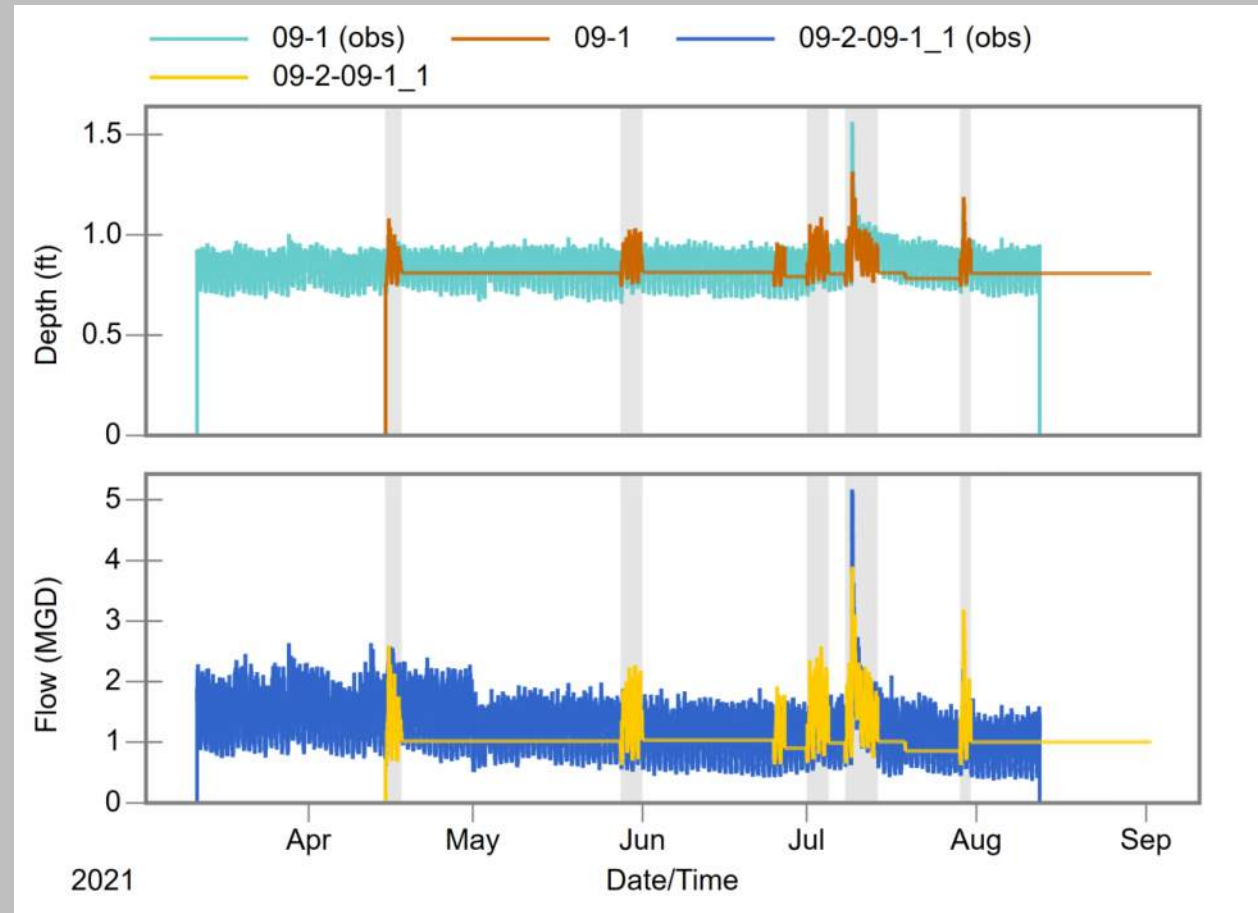
Peaks



Volumes

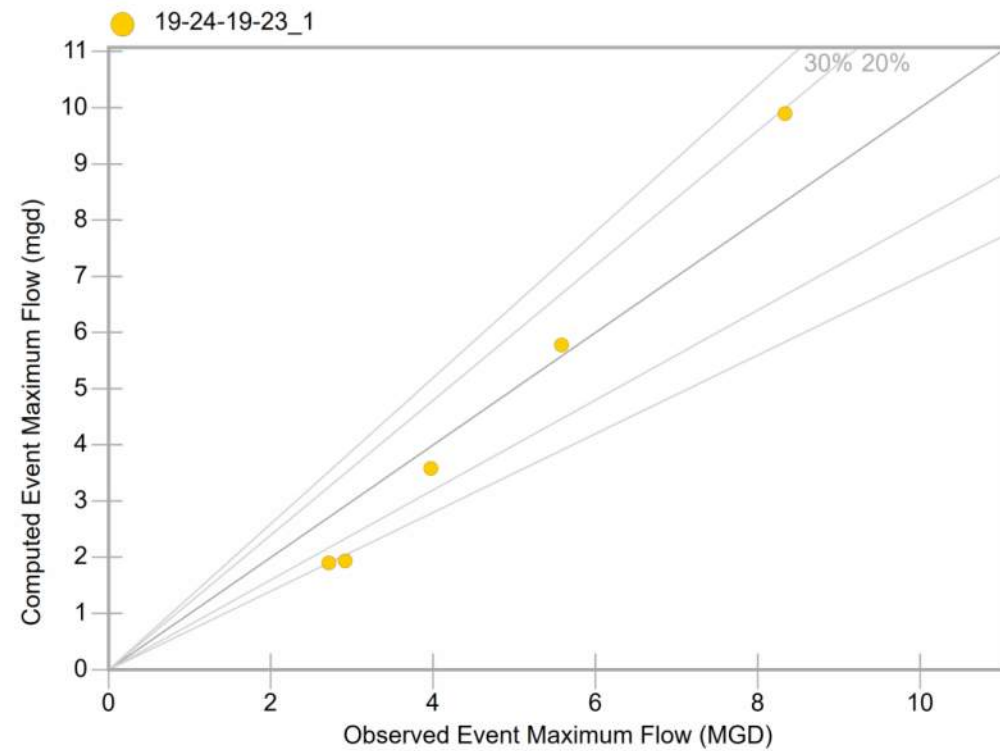


FM_09

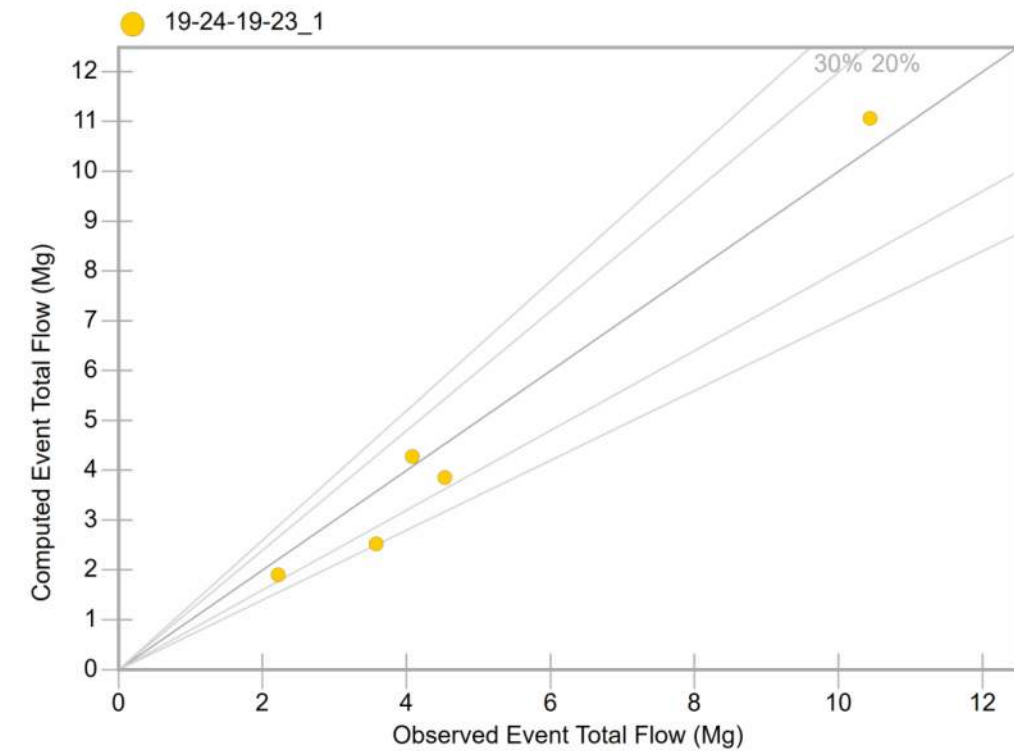


FM_10

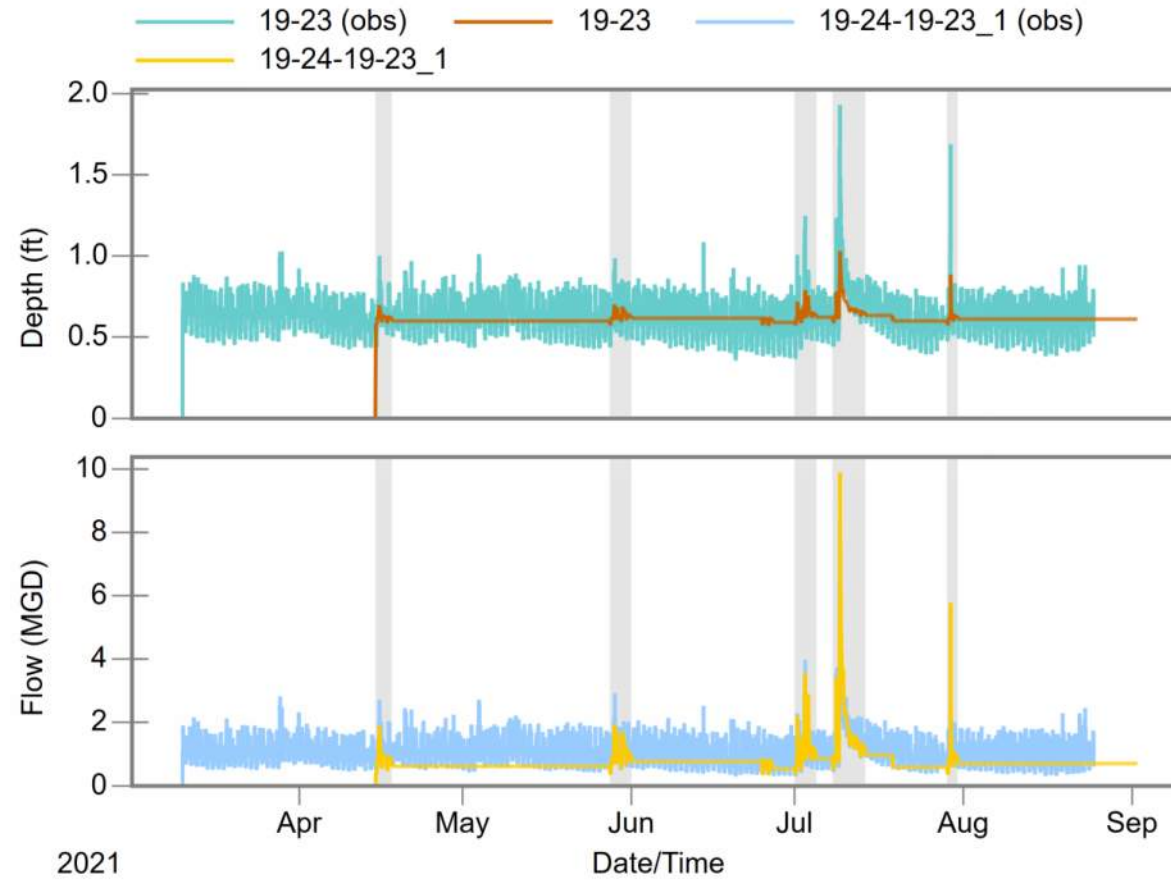
Peaks



Volumes

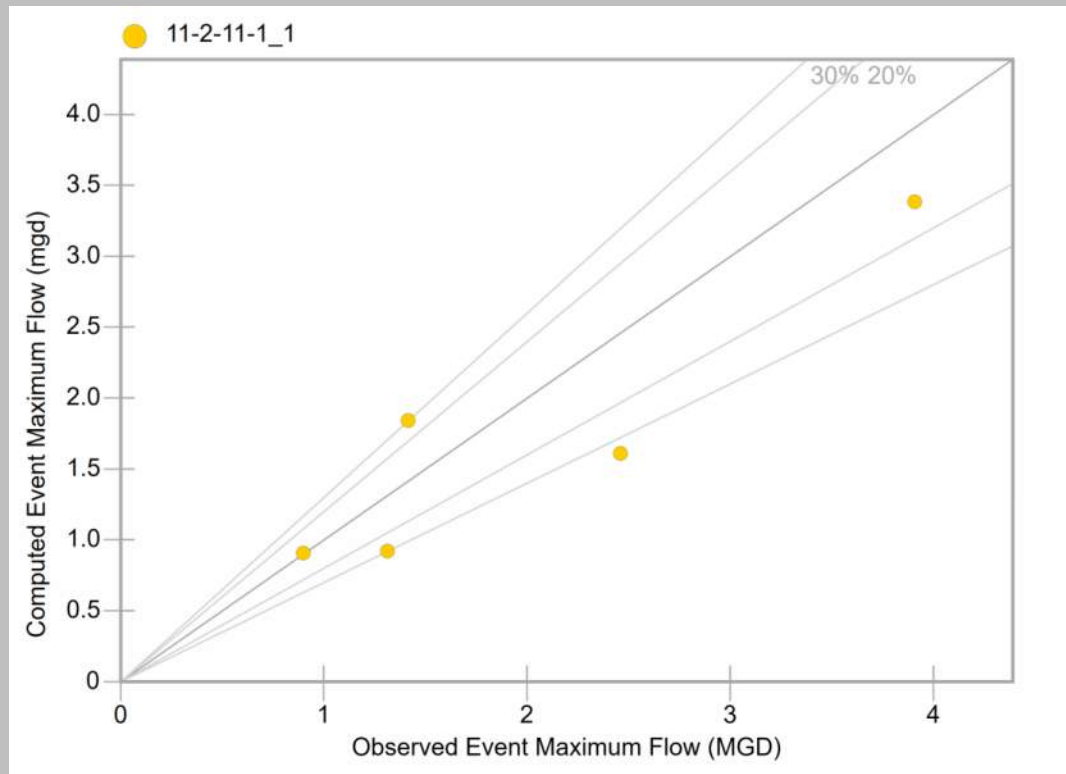


FM_10

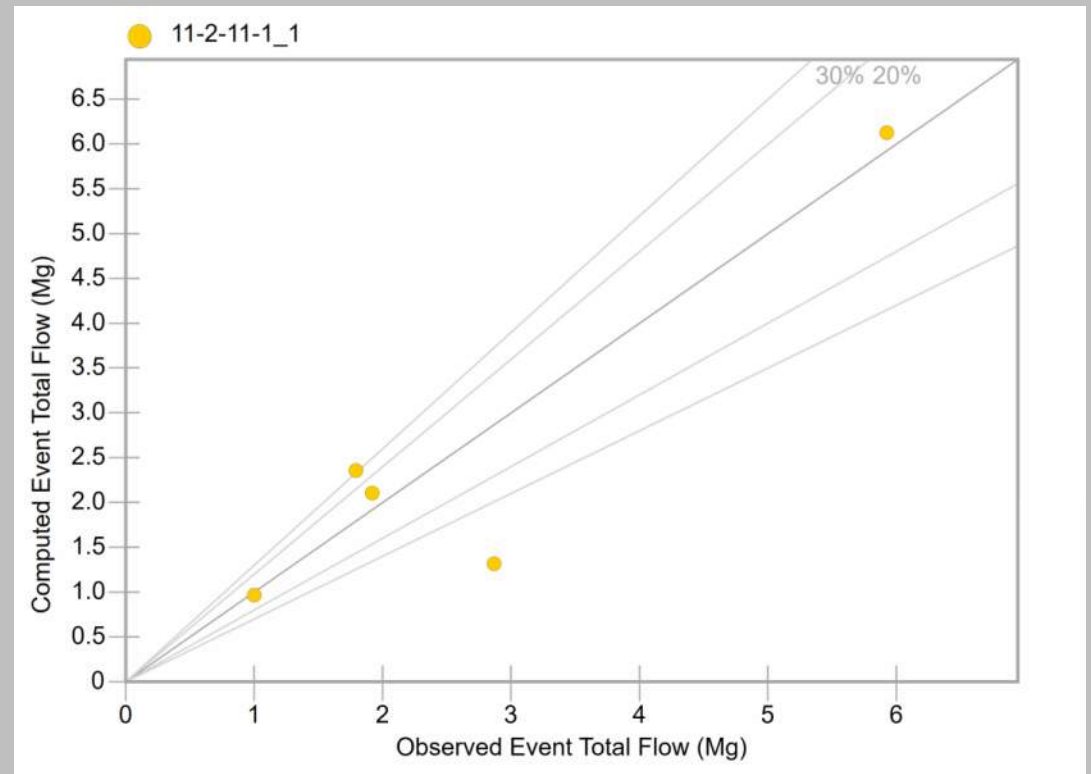


FM_11

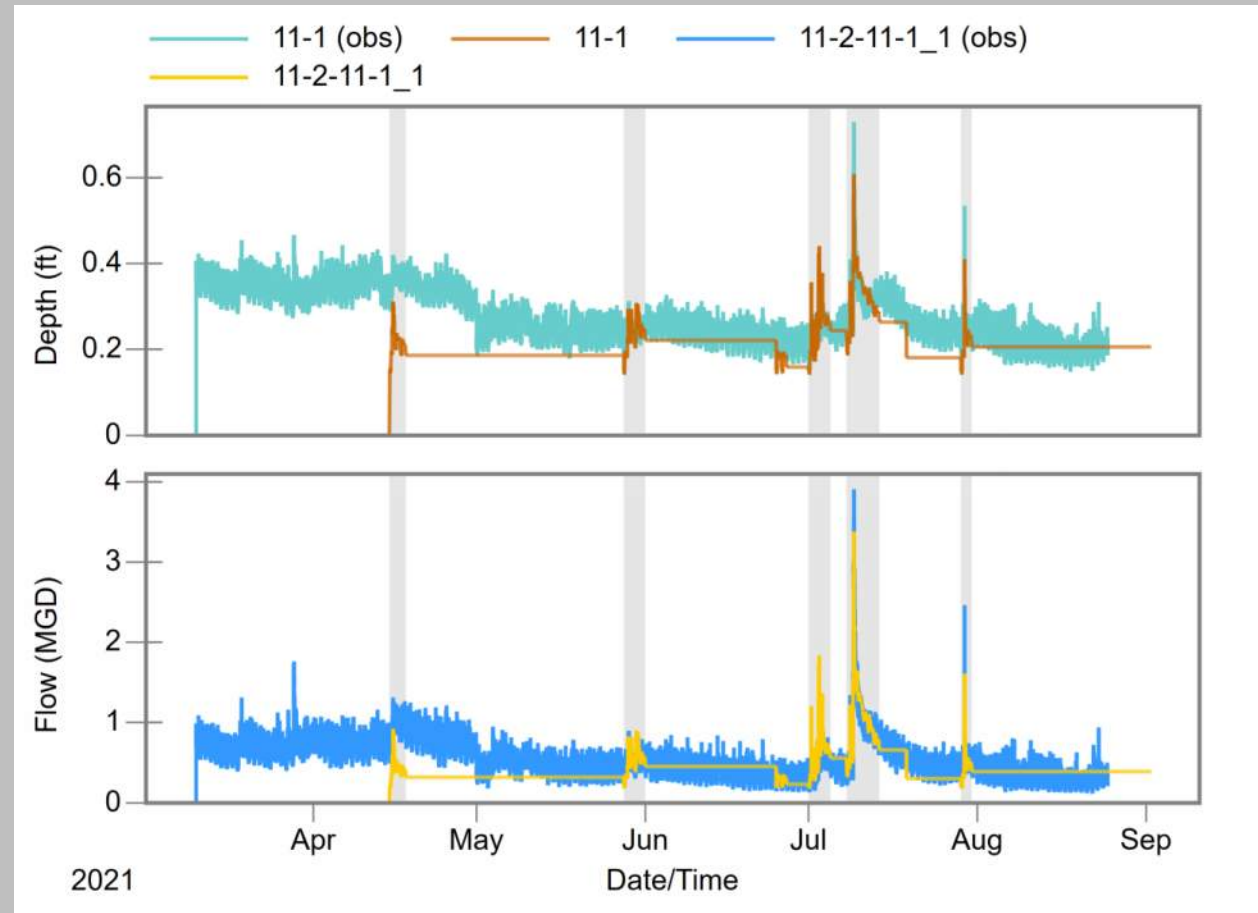
Peaks



Volumes

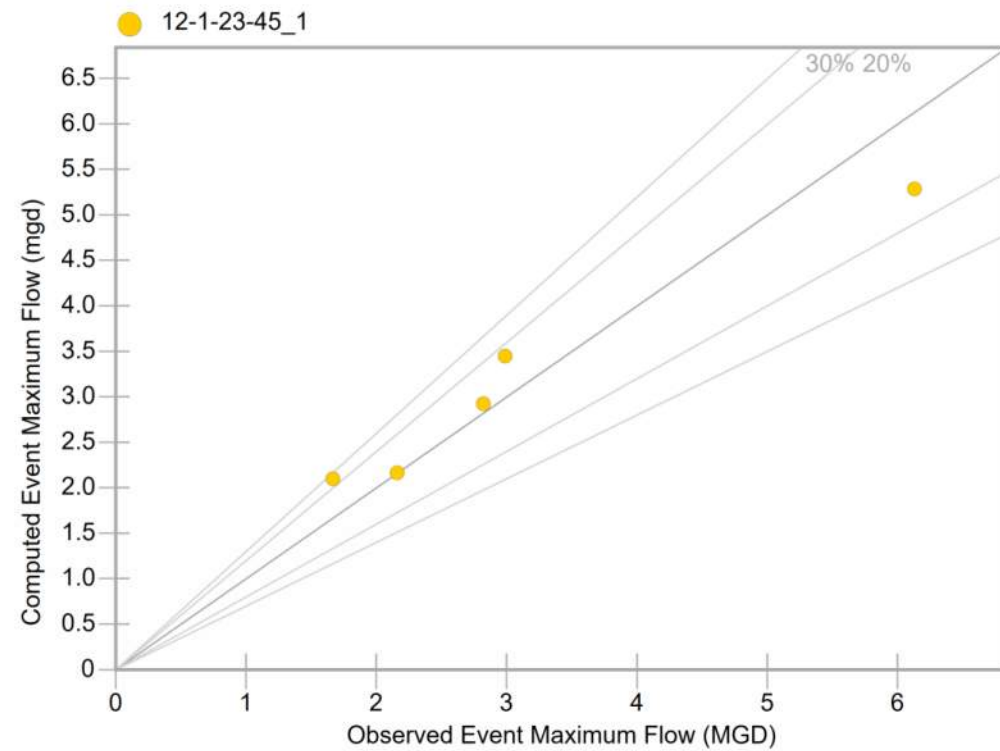


FM_11

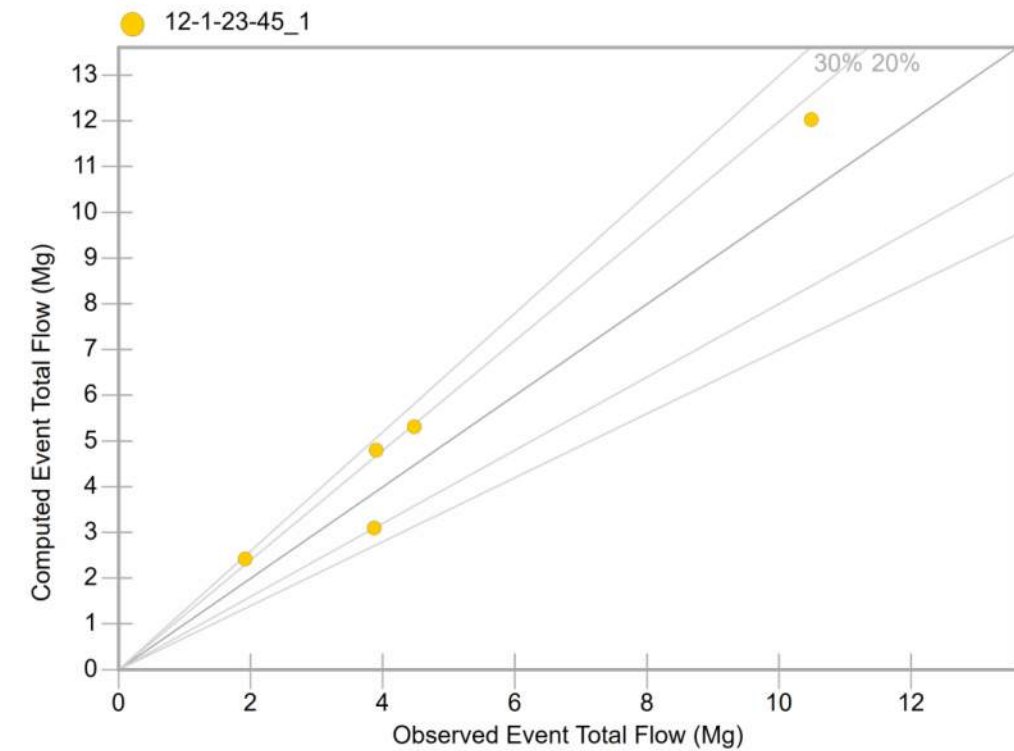


FM_12

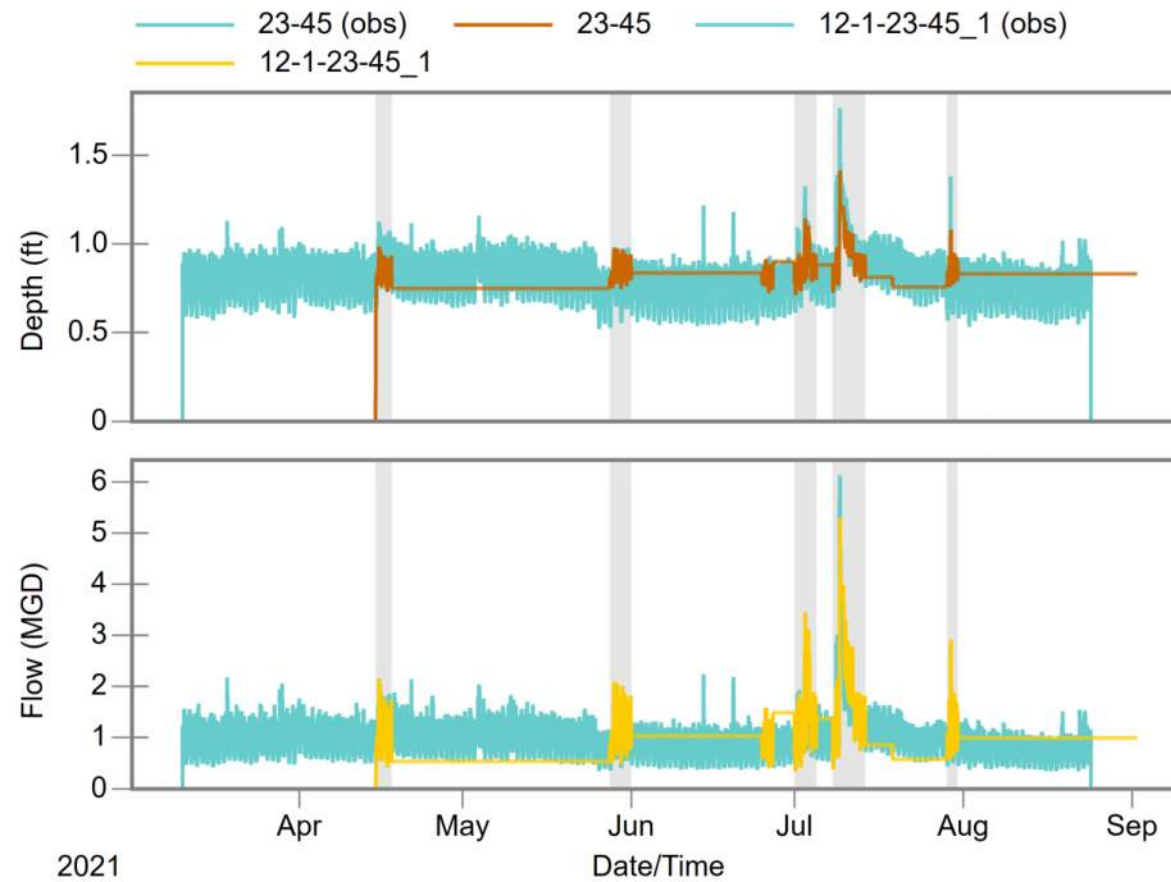
Peaks



Volumes

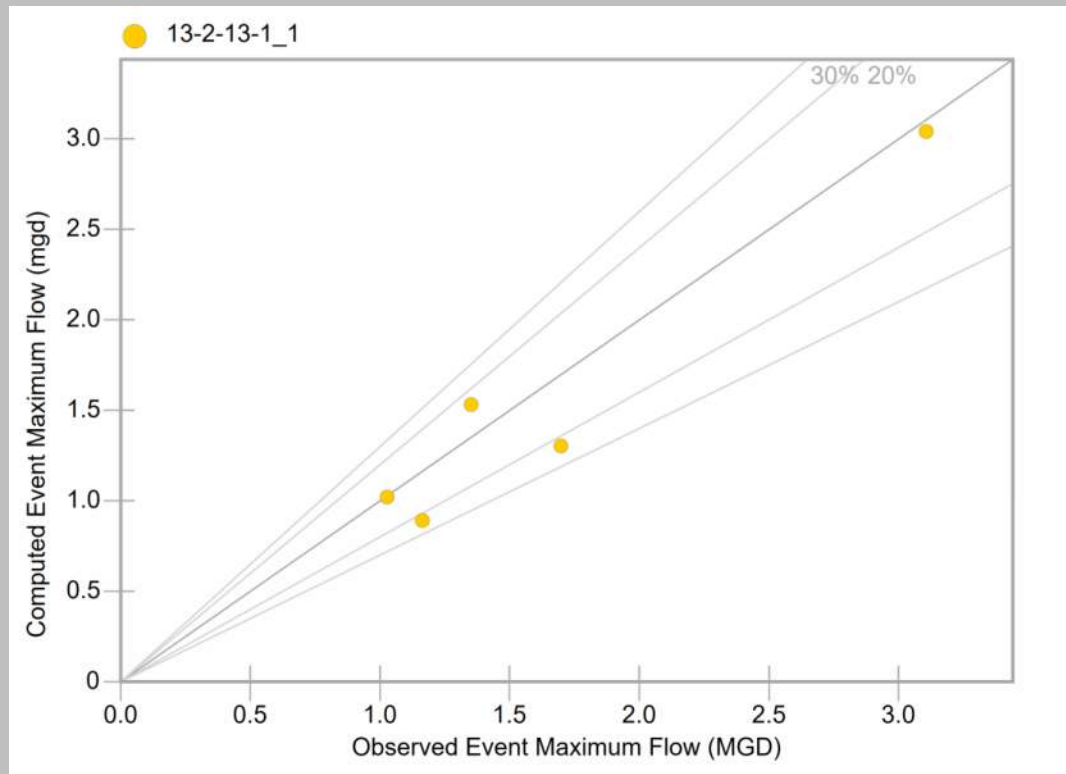


FM_12

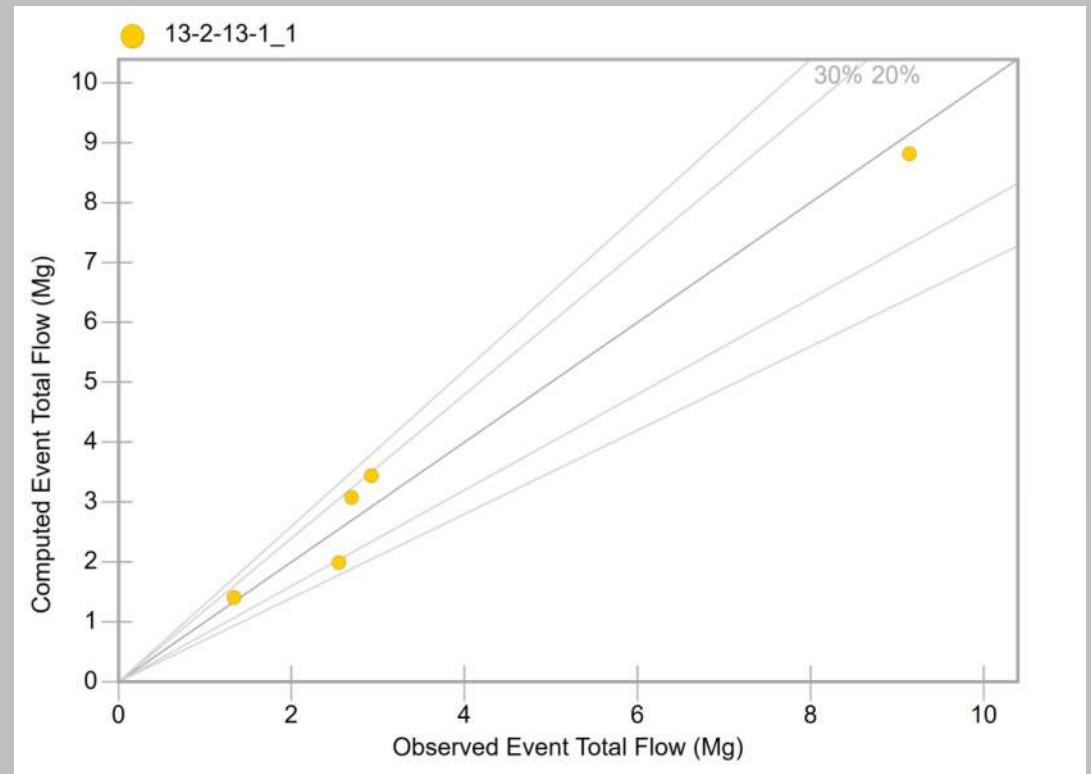


FM_13

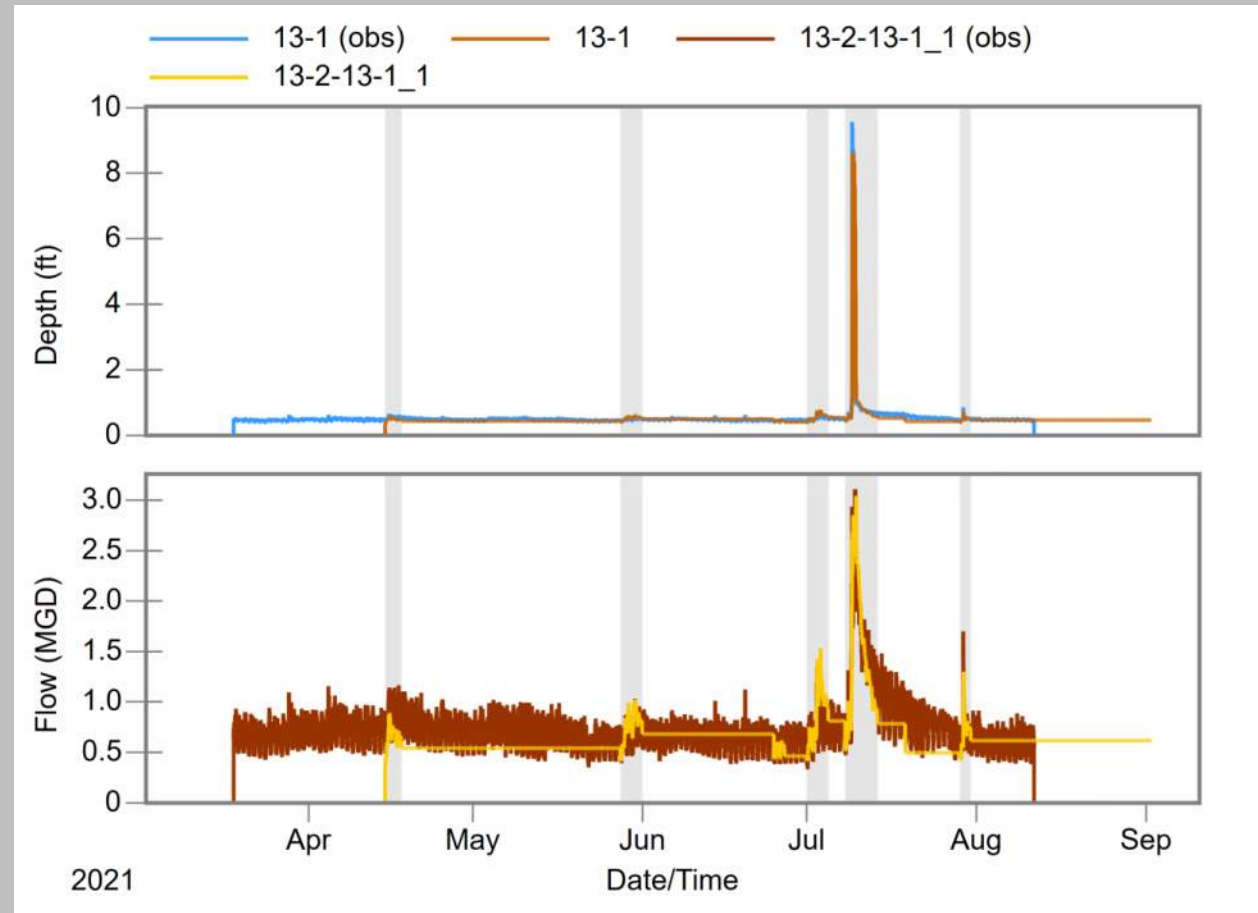
Peaks



Volumes

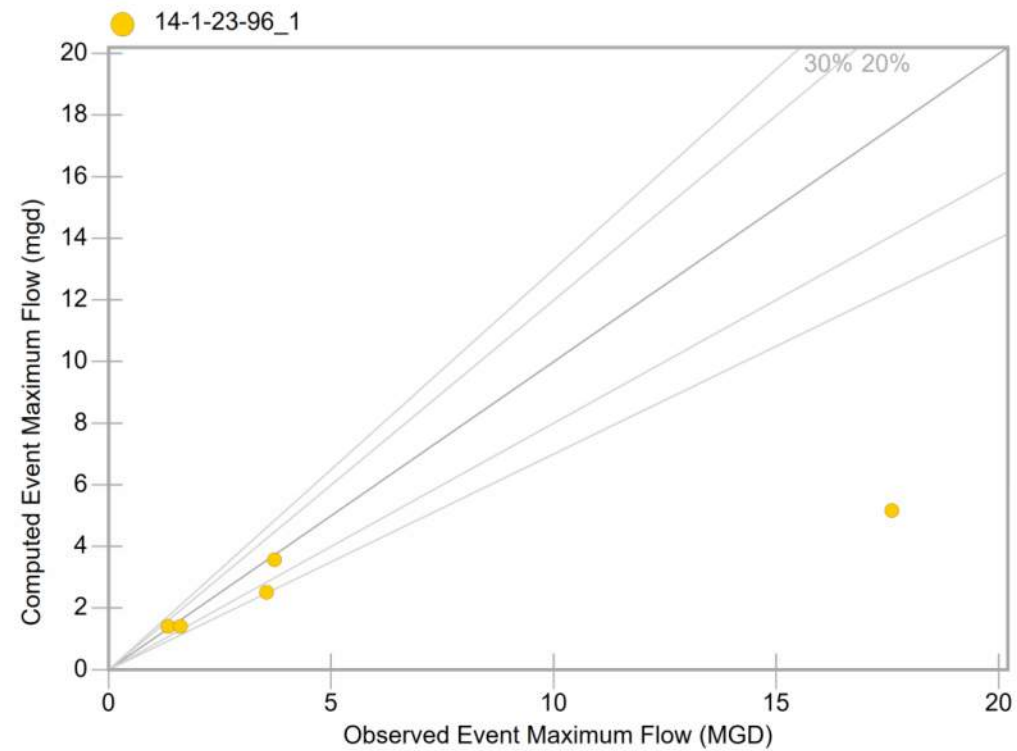


FM_13

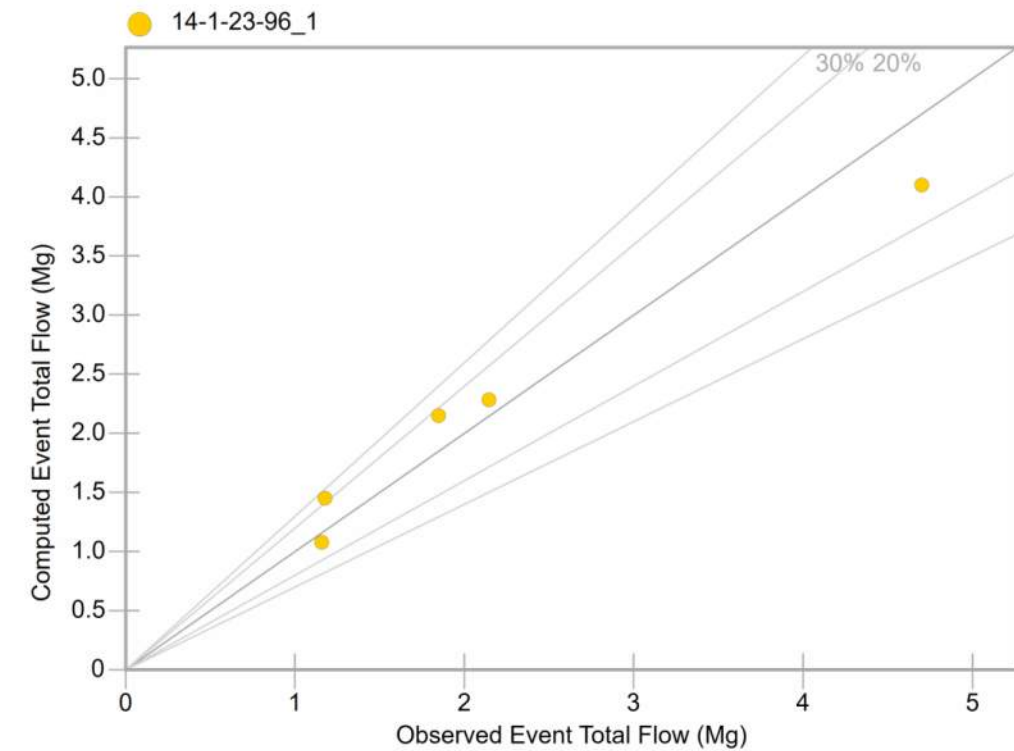


FM_14

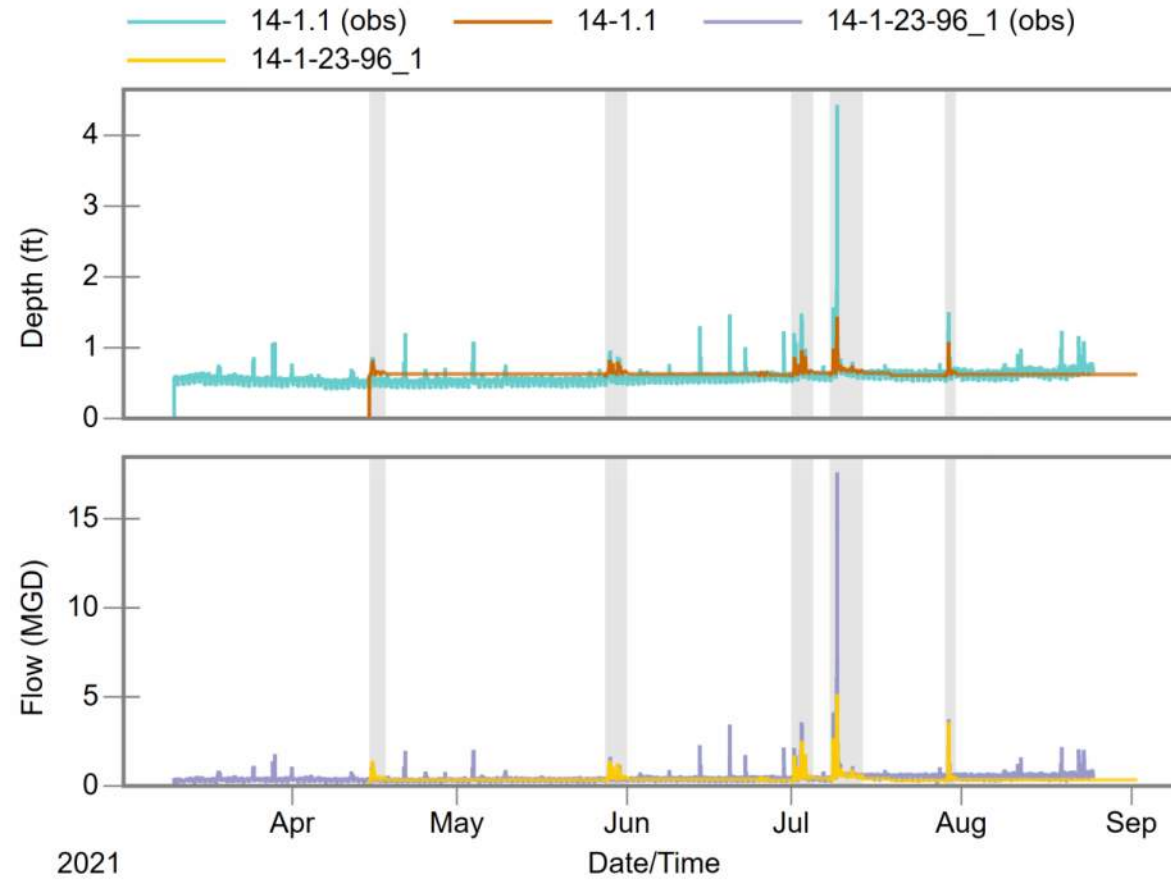
Peaks



Volumes

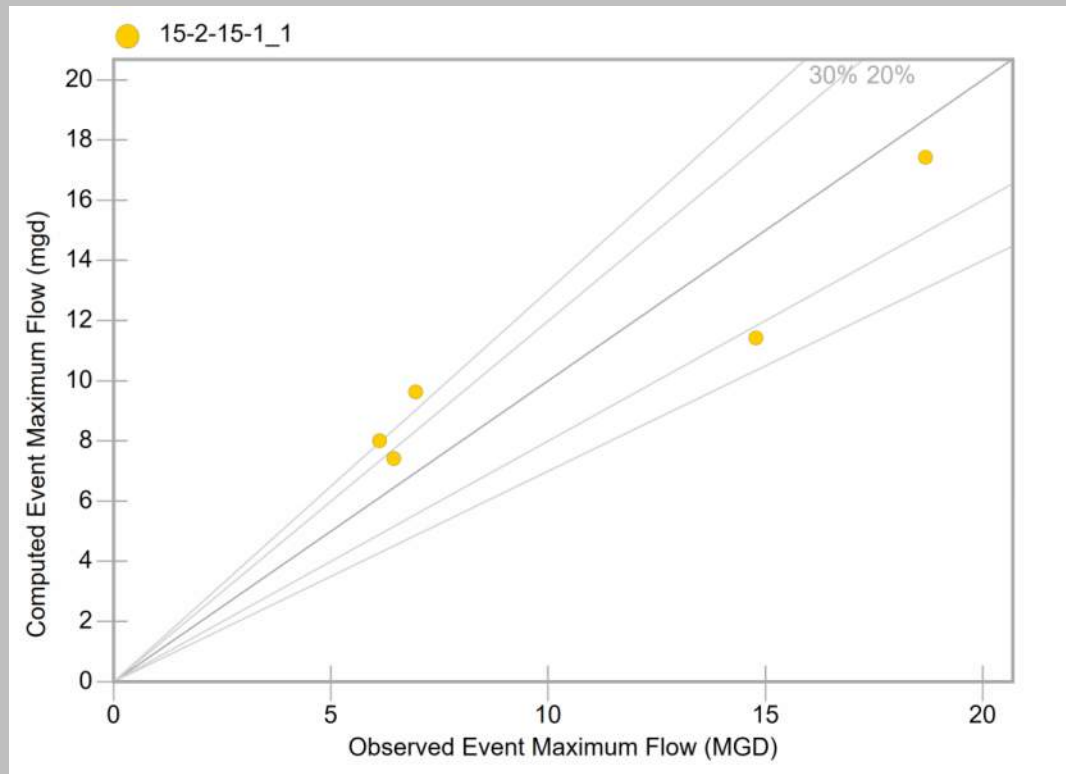


FM_14

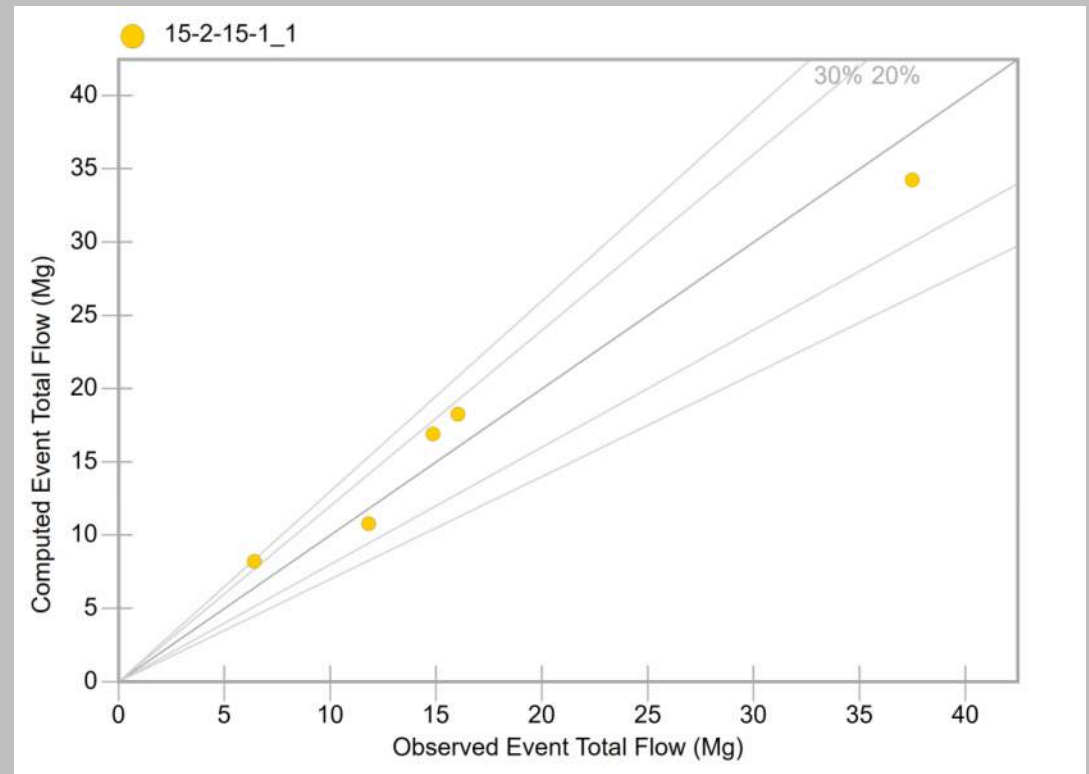


FM_15

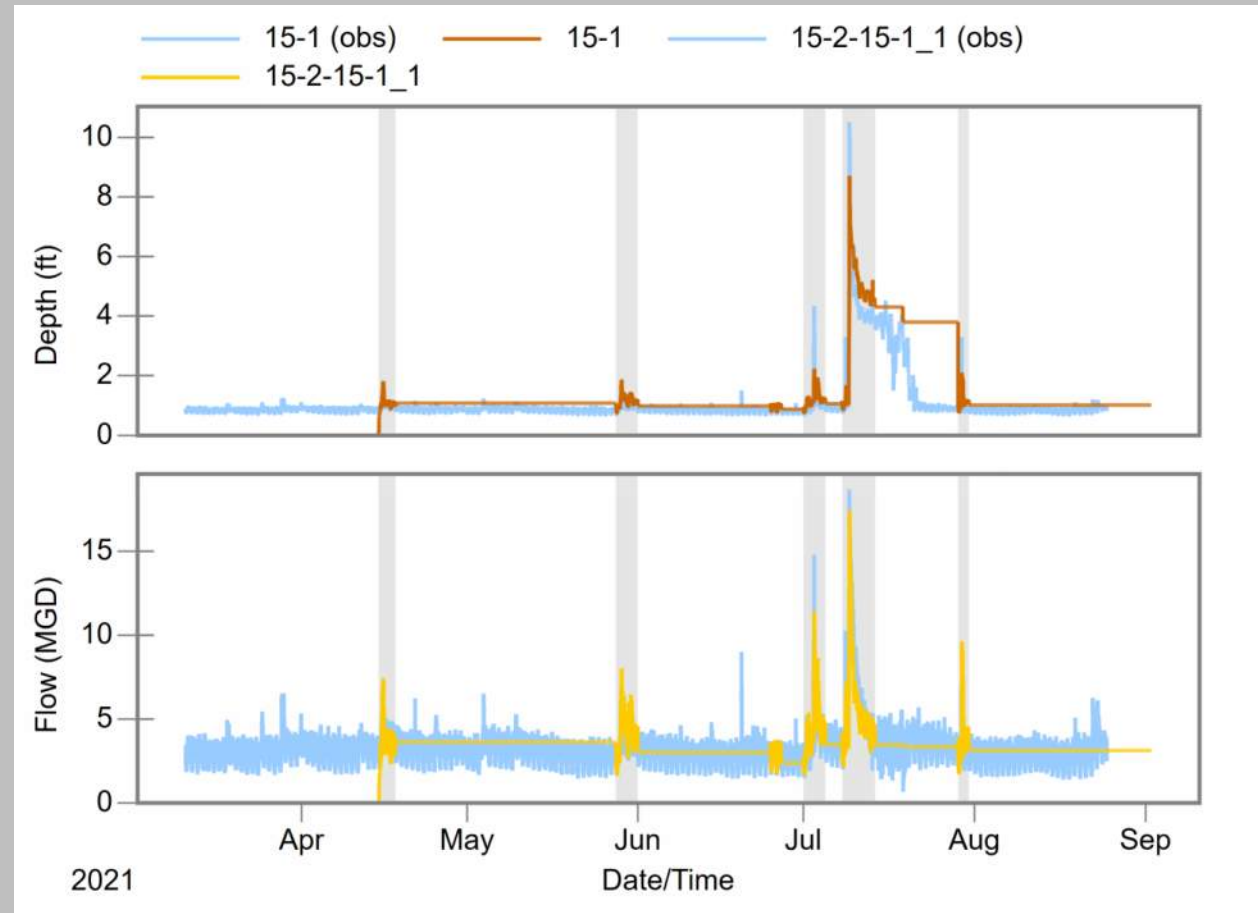
Peaks



Volumes

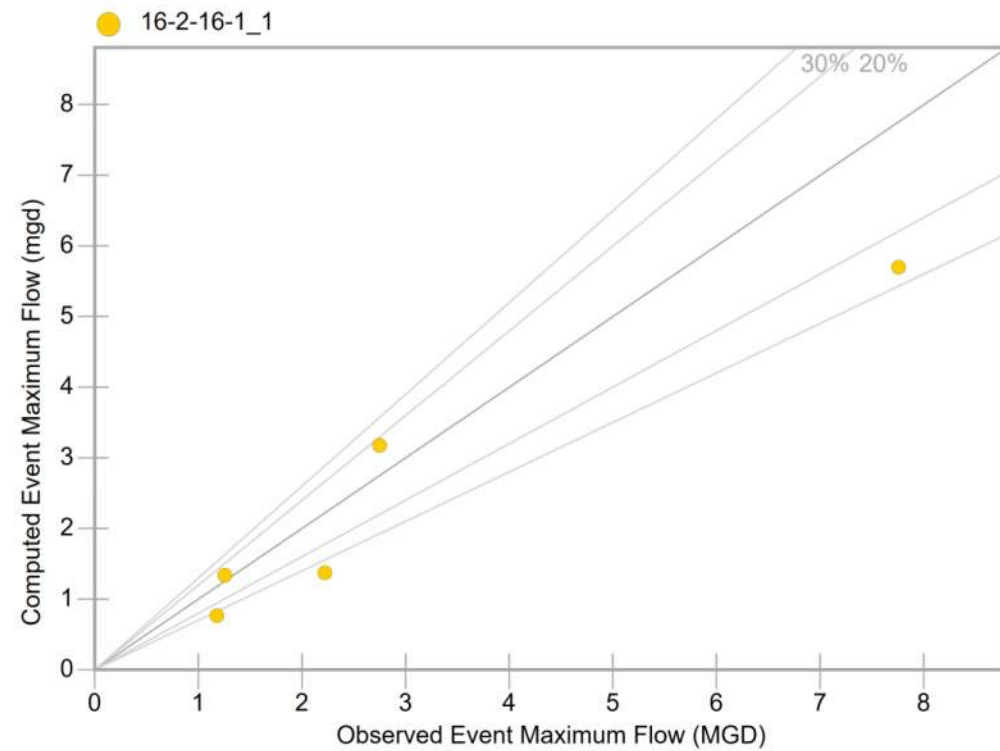


FM_15

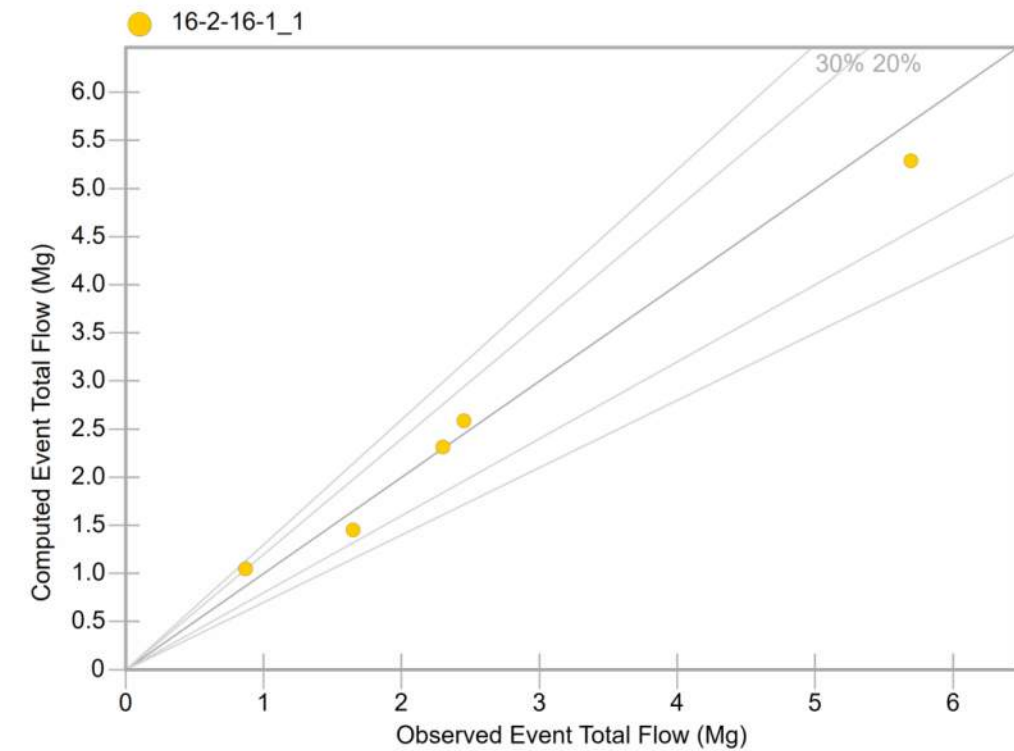


FM_16

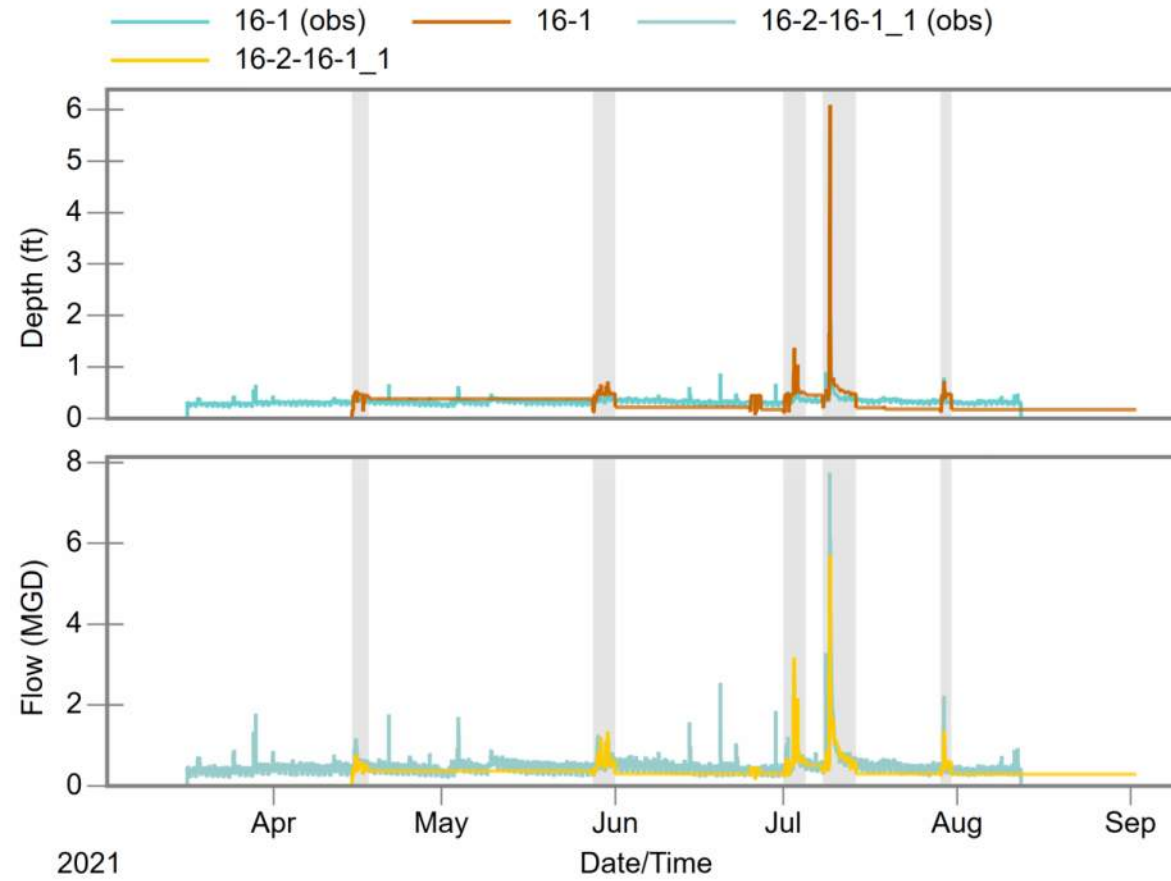
Peaks



Volumes

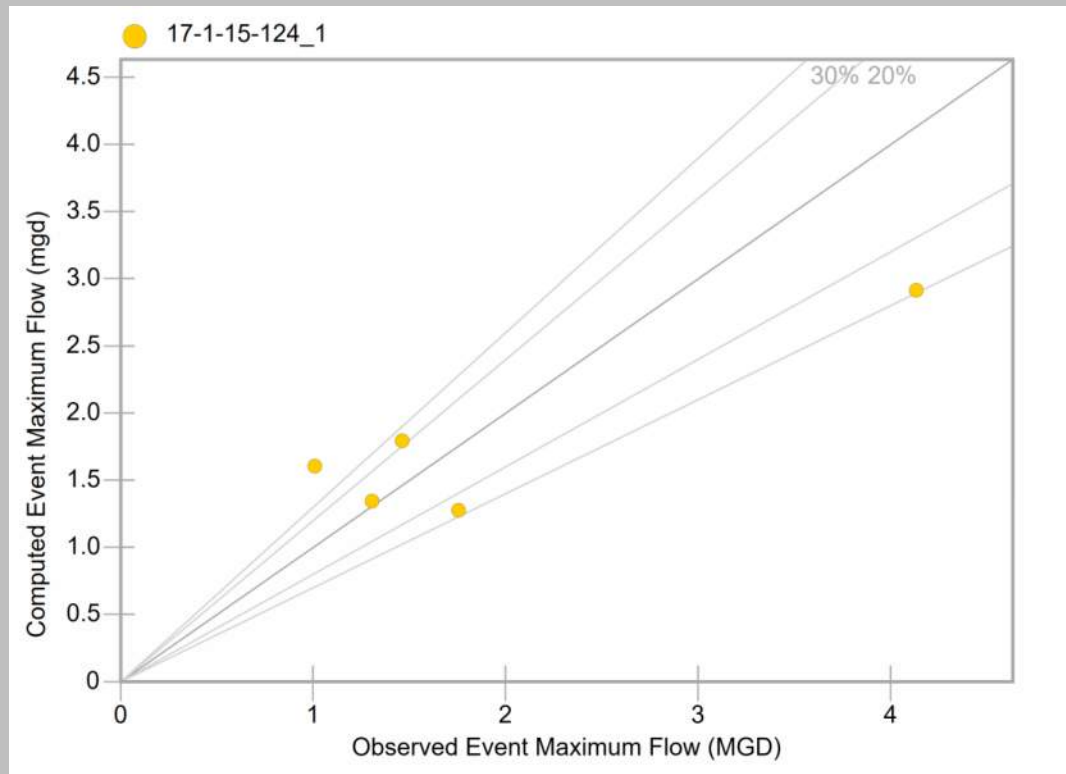


FM_16

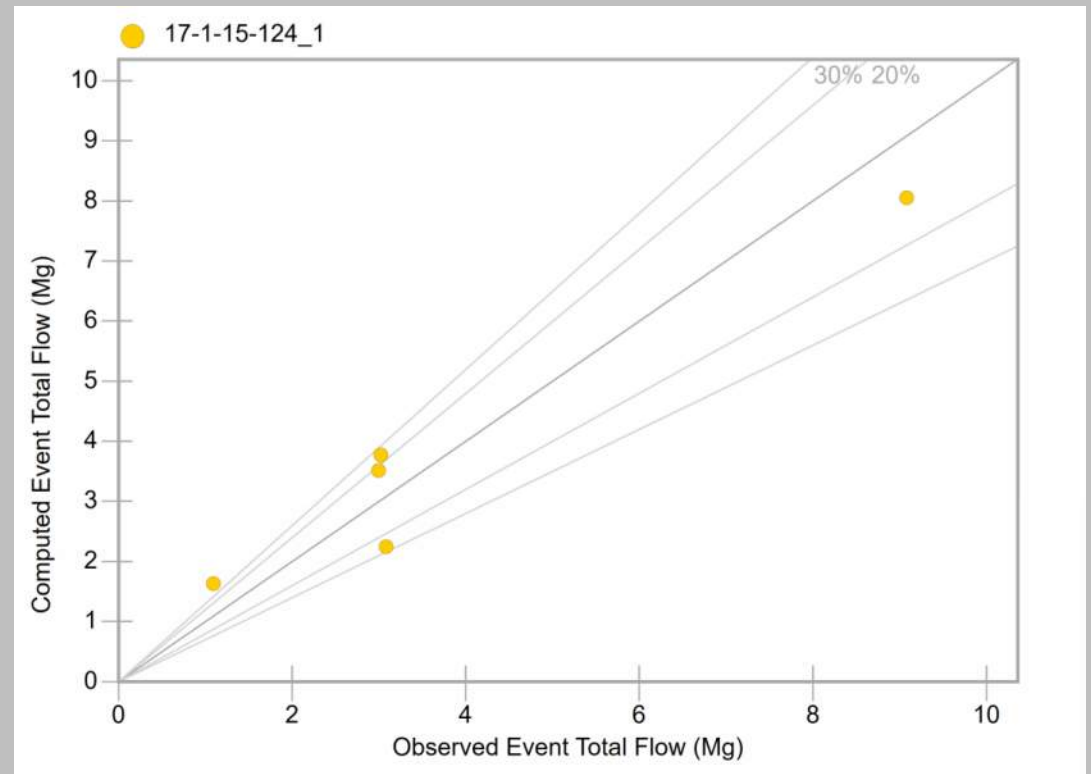


FM_17

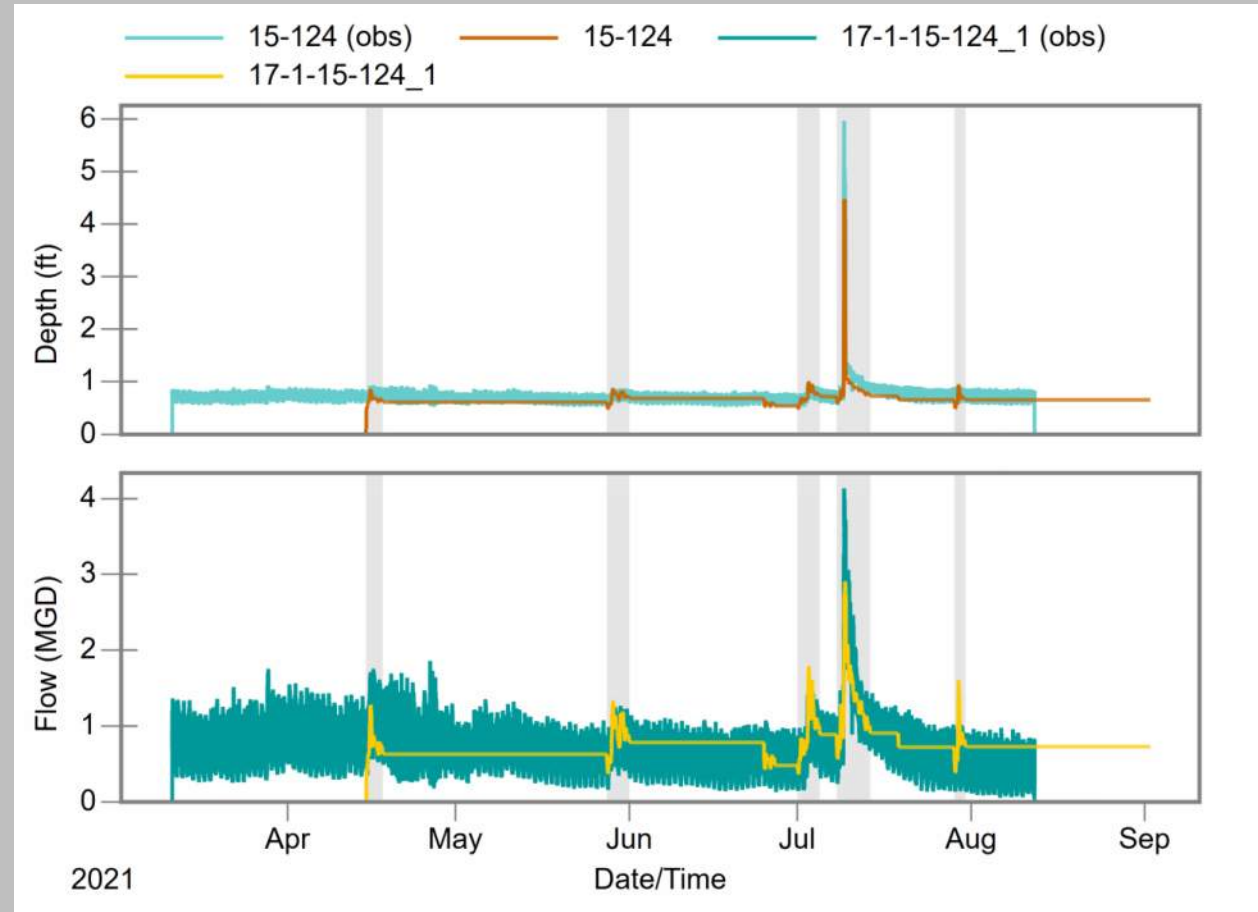
Peaks



Volumes

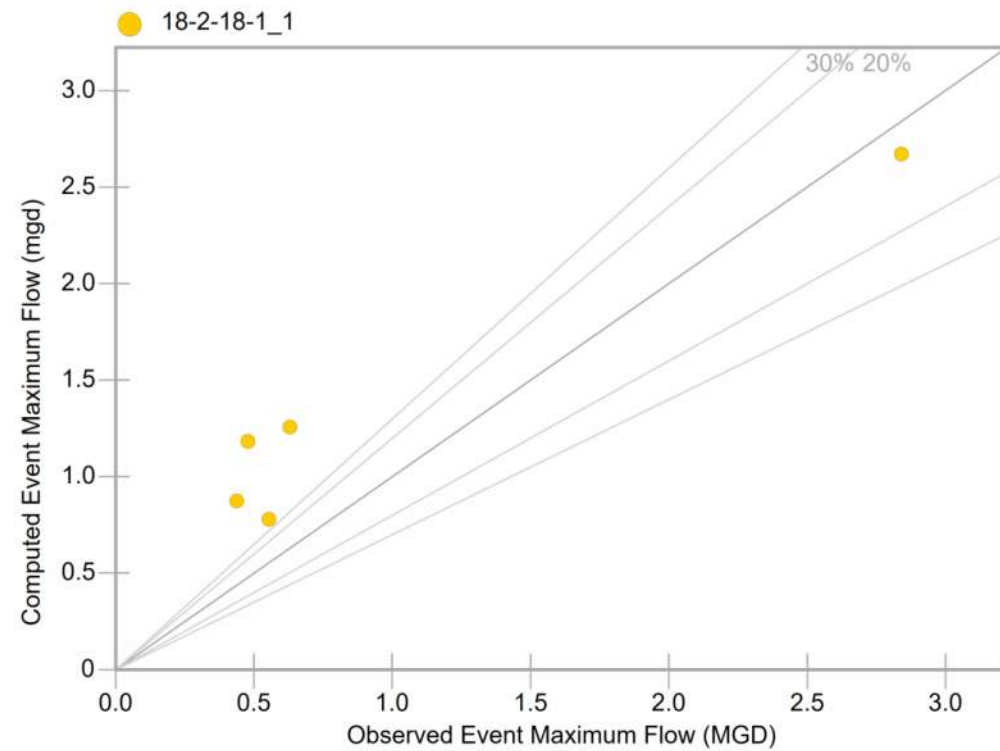


FM_17

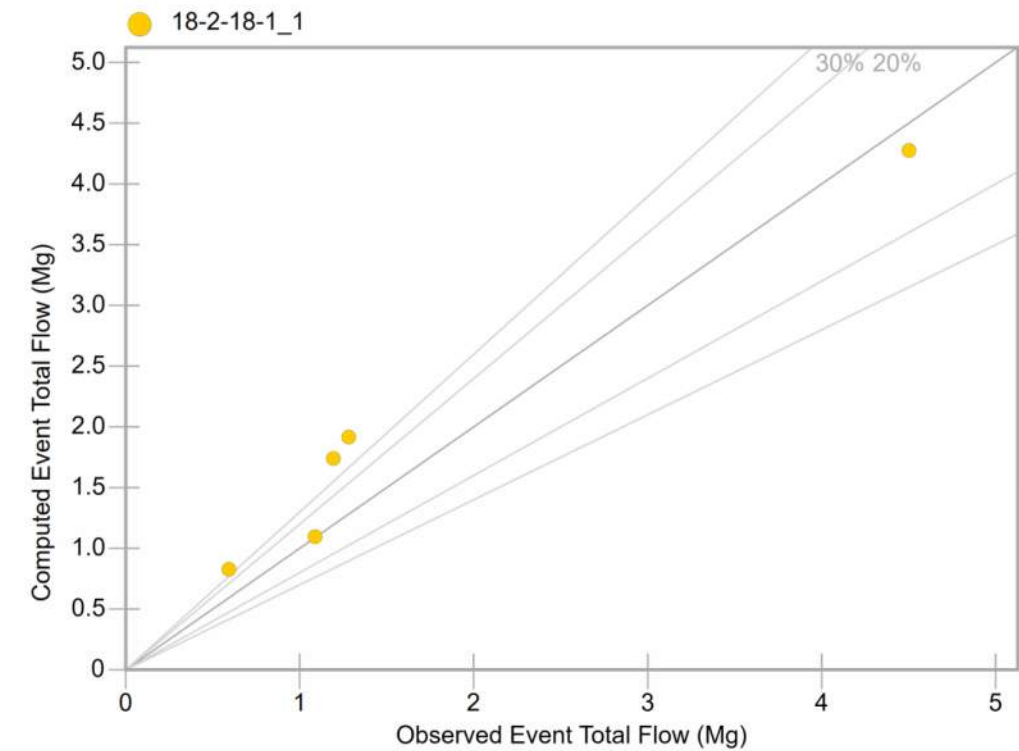


FM_18

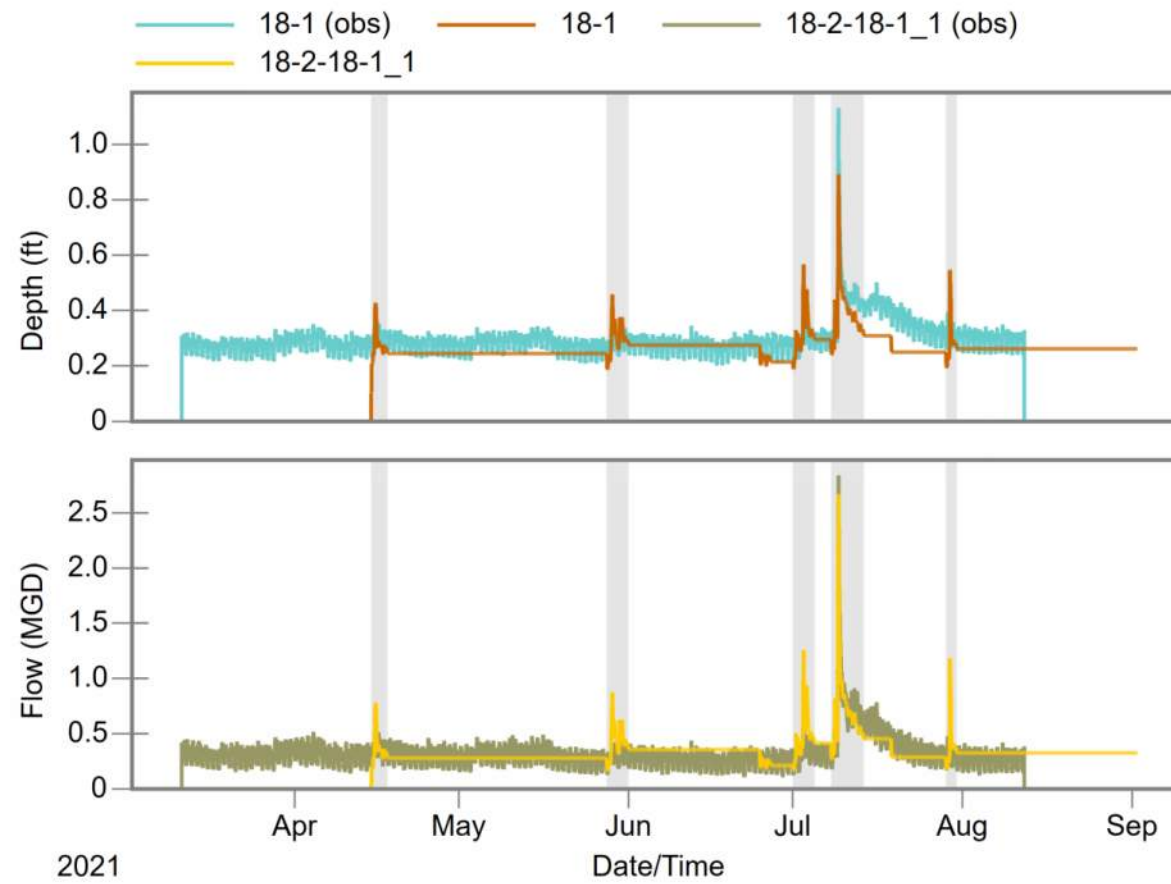
Peaks



Volumes

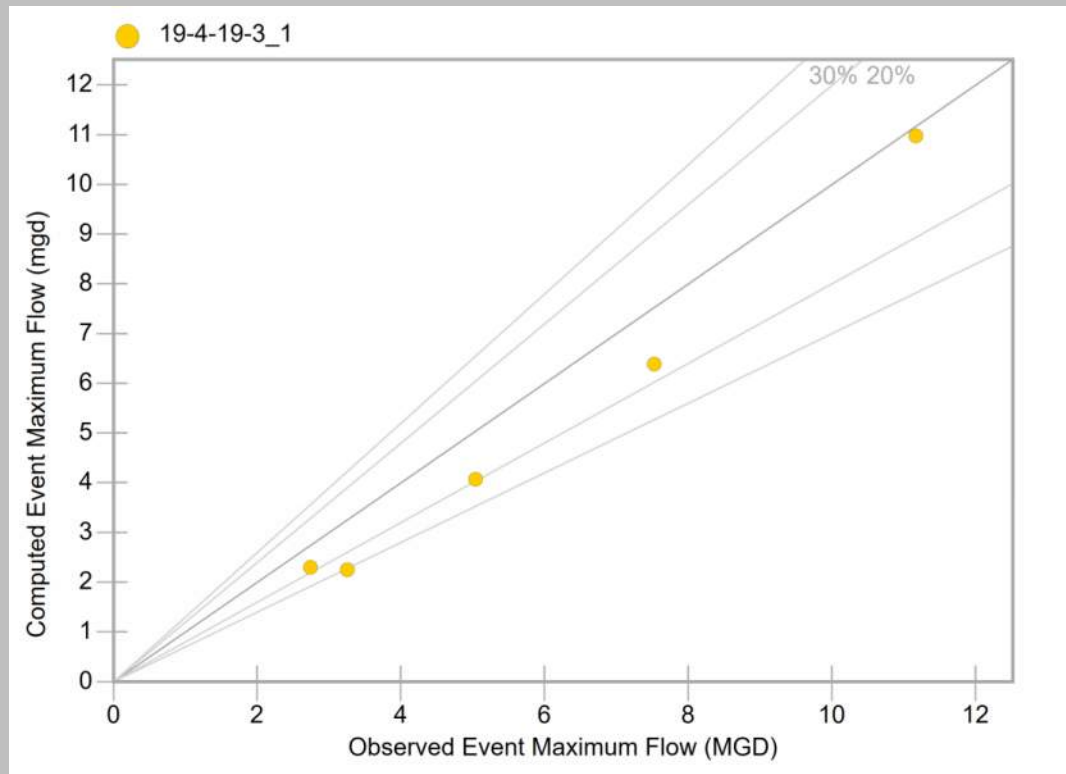


FM_18

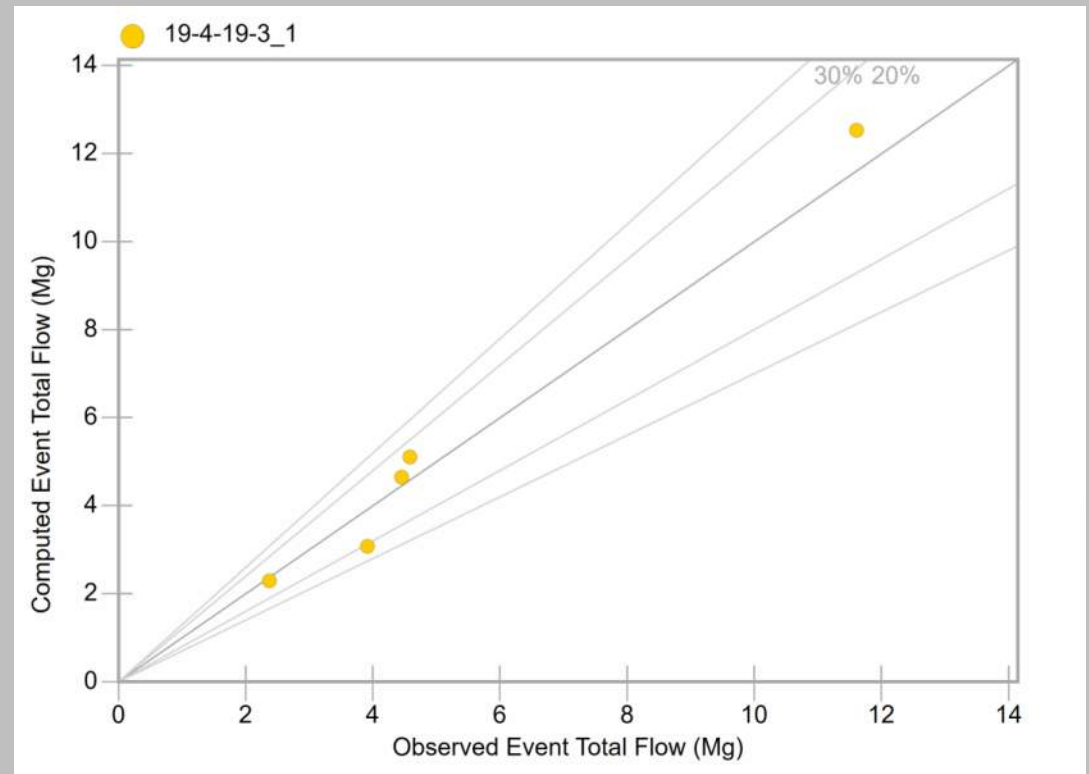


FM_19

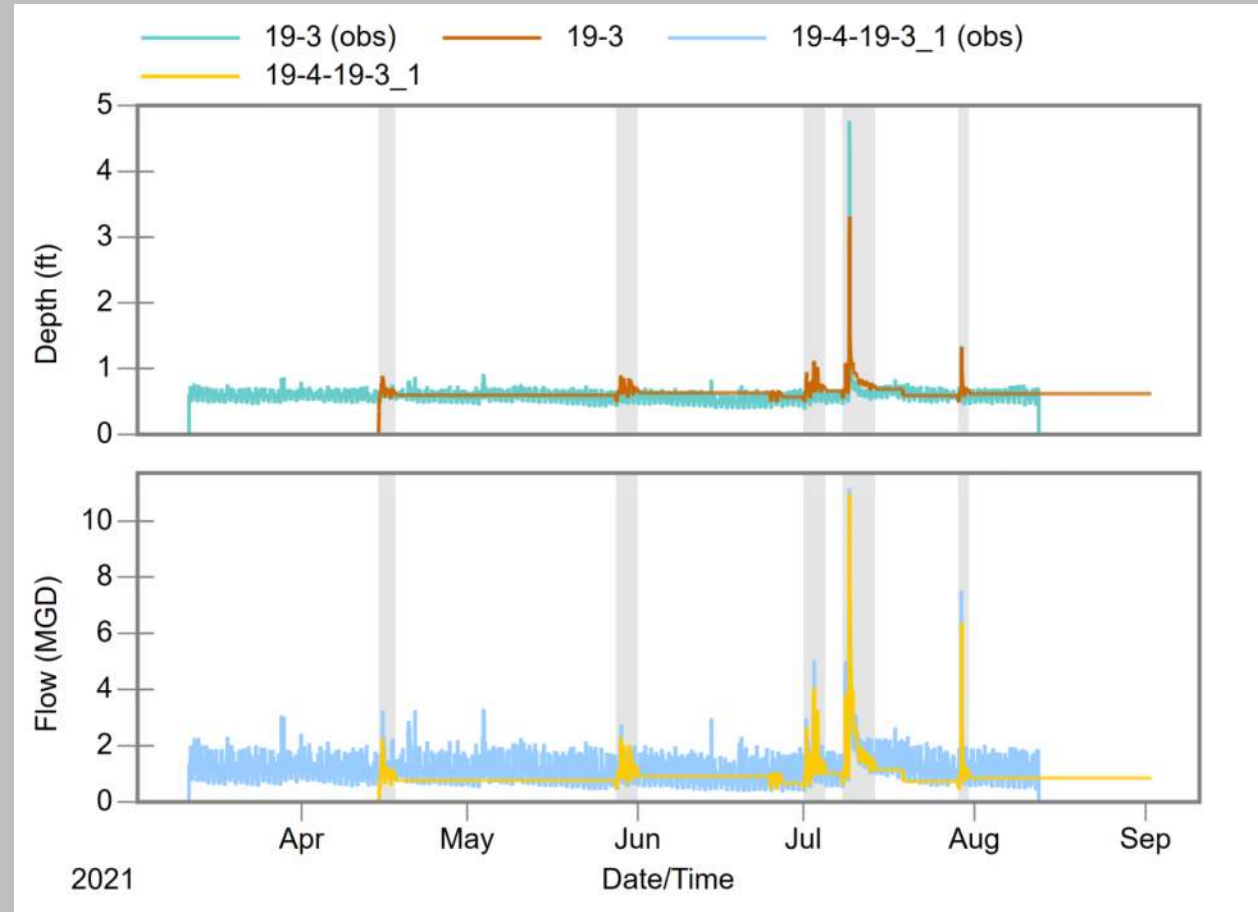
Peaks



Volumes

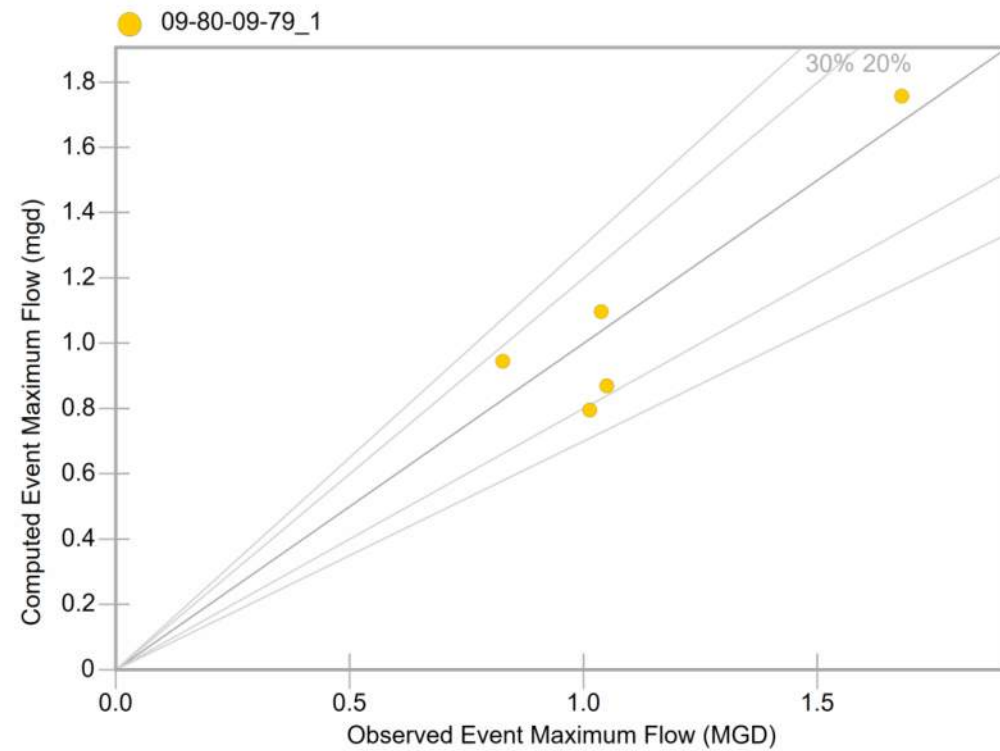


FM_19

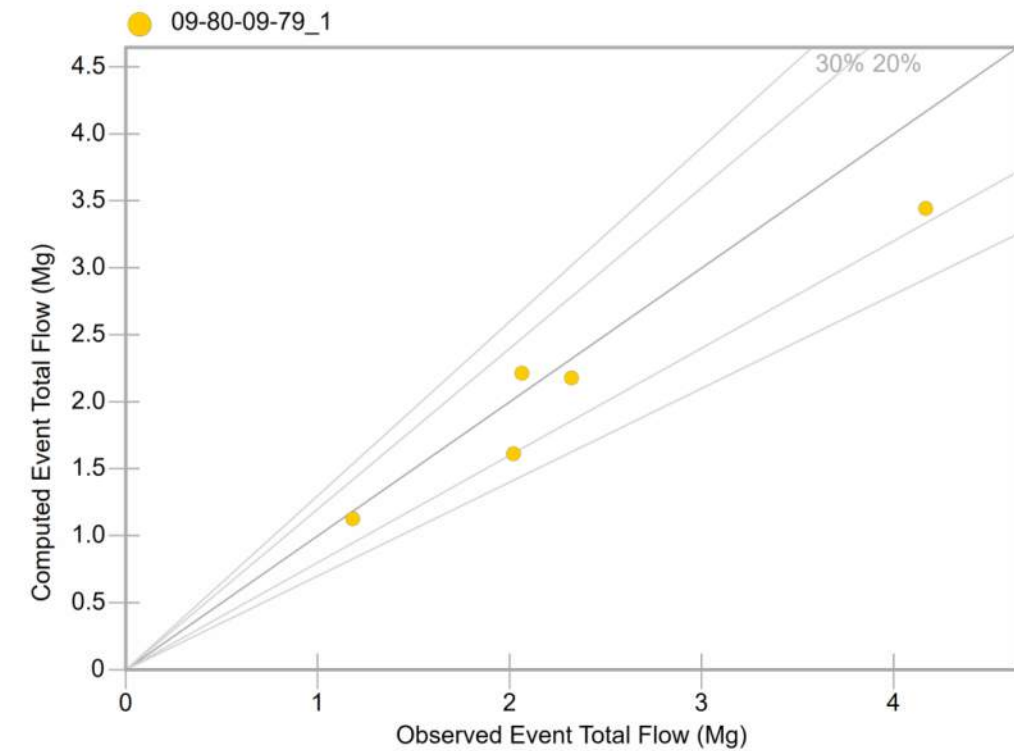


FM_20

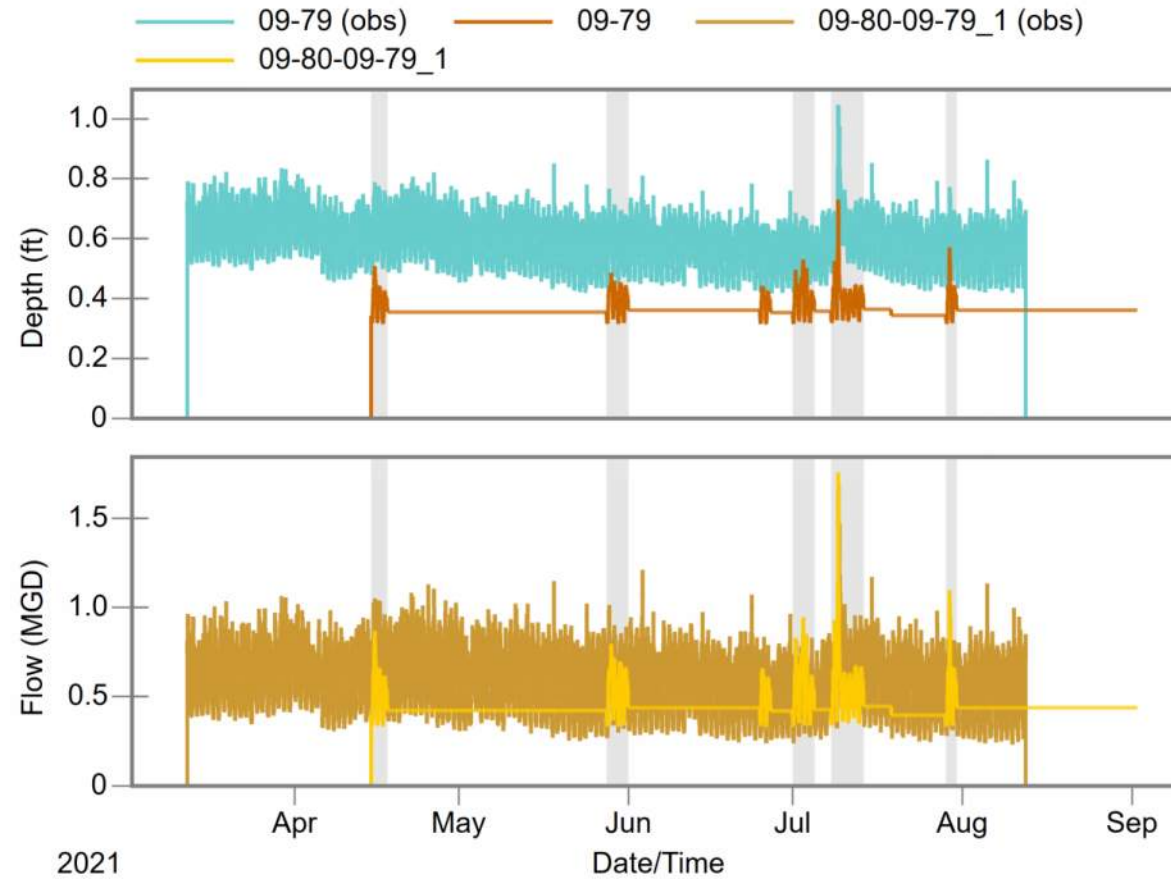
Peaks



Volumes

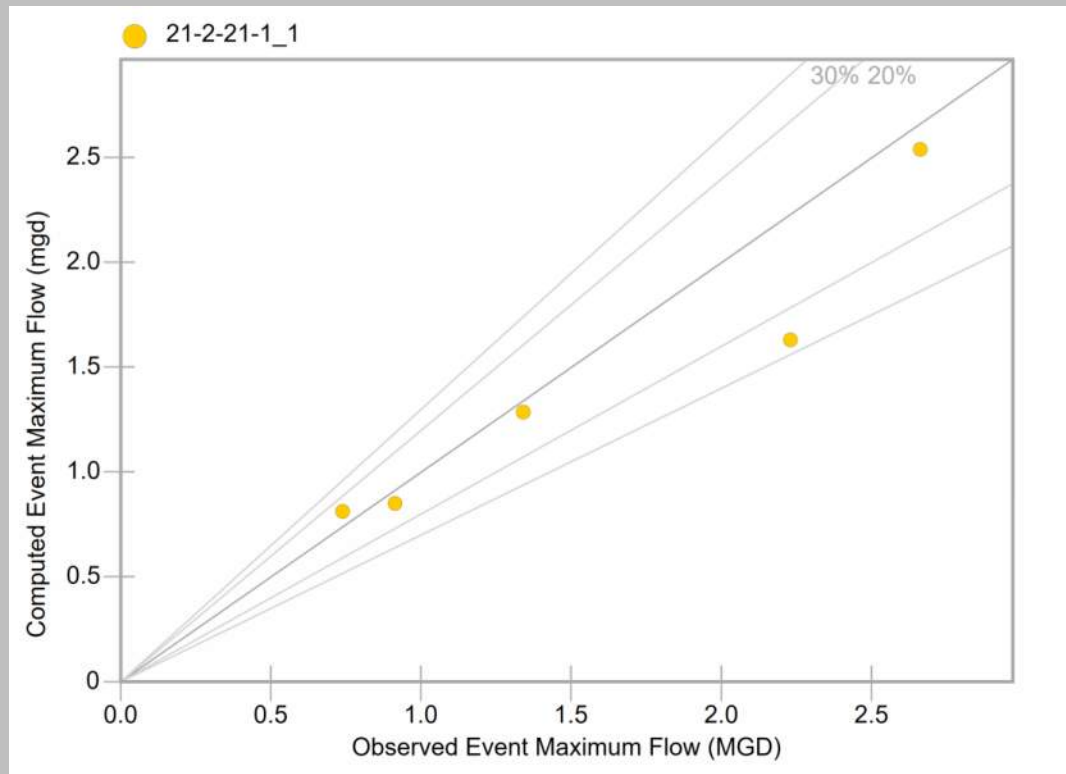


FM_20

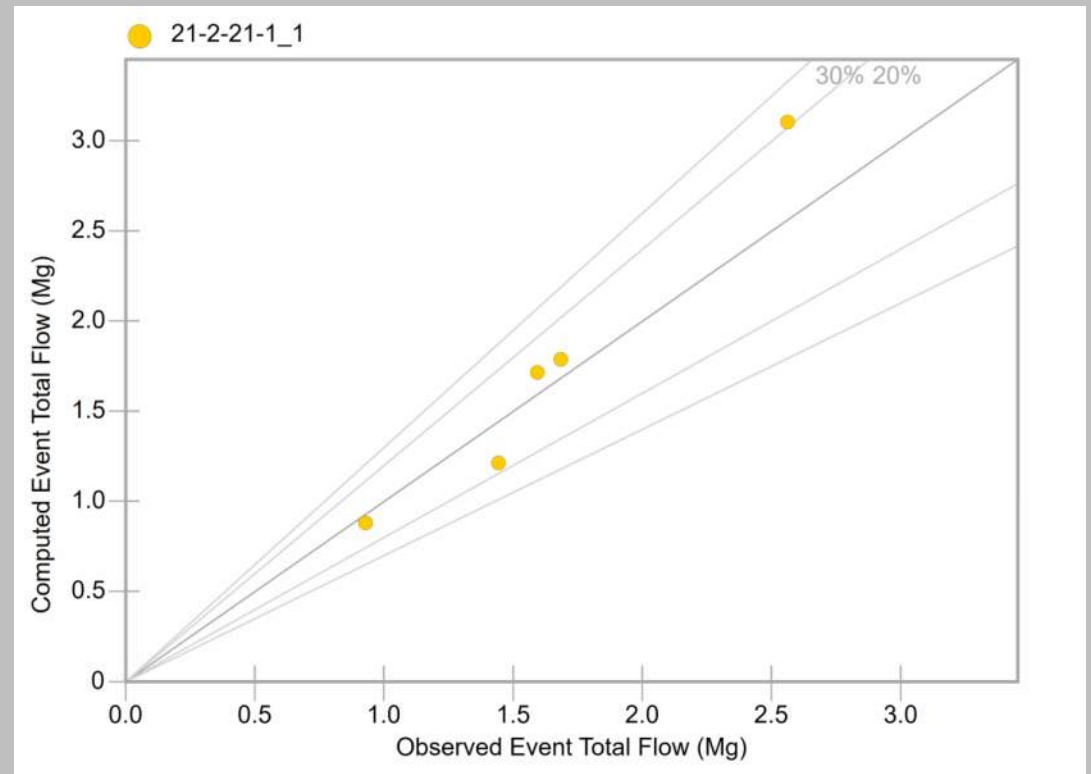


FM_21

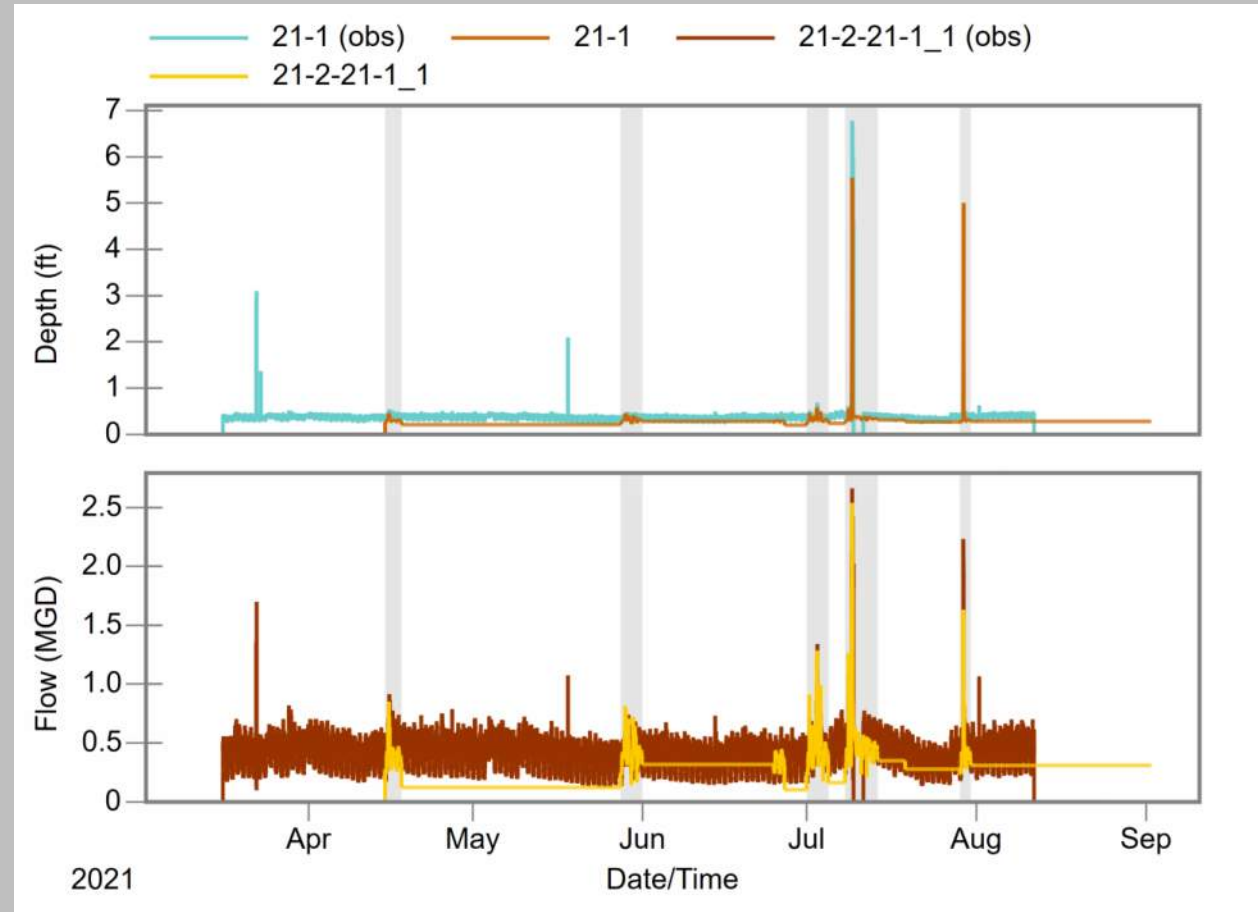
Peaks



Volumes

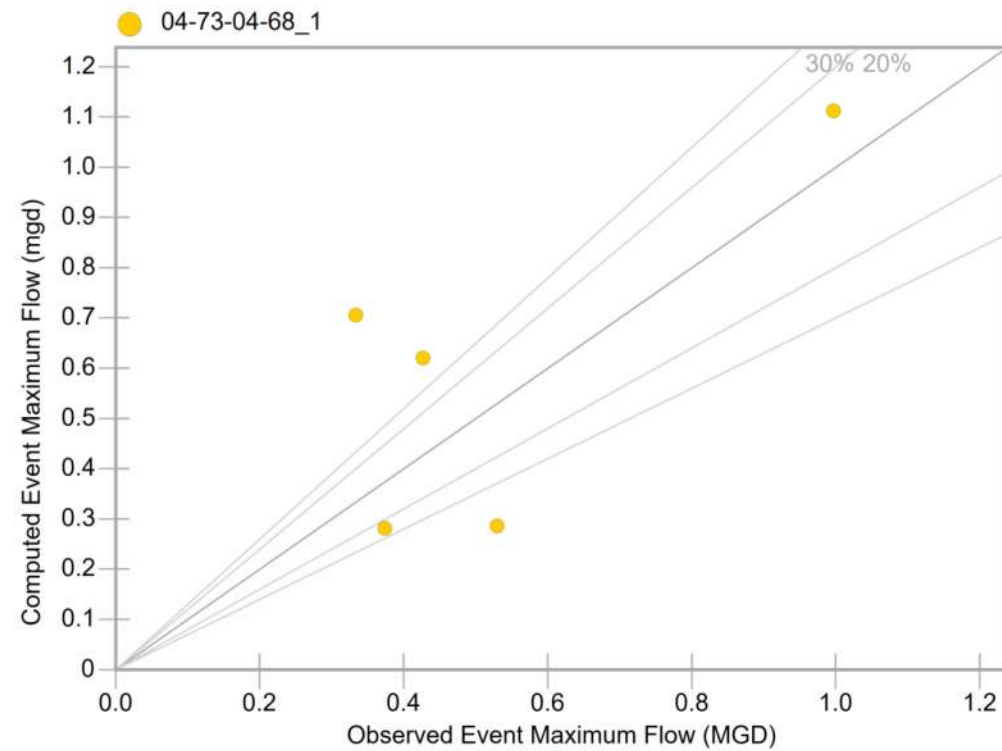


FM_21

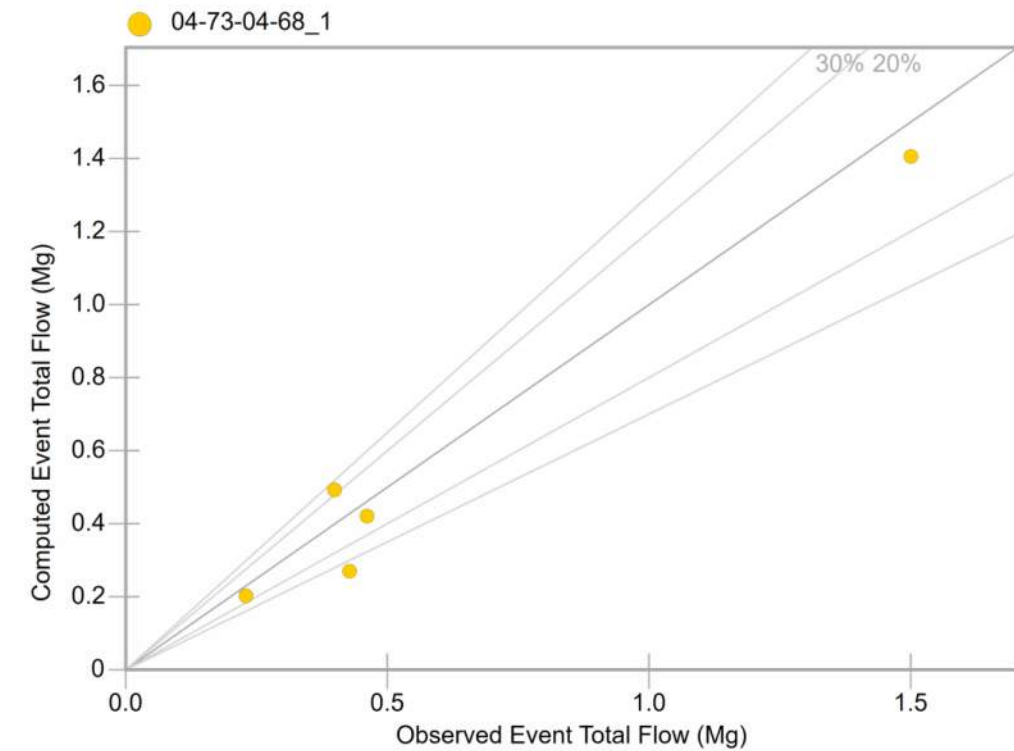


FM_22

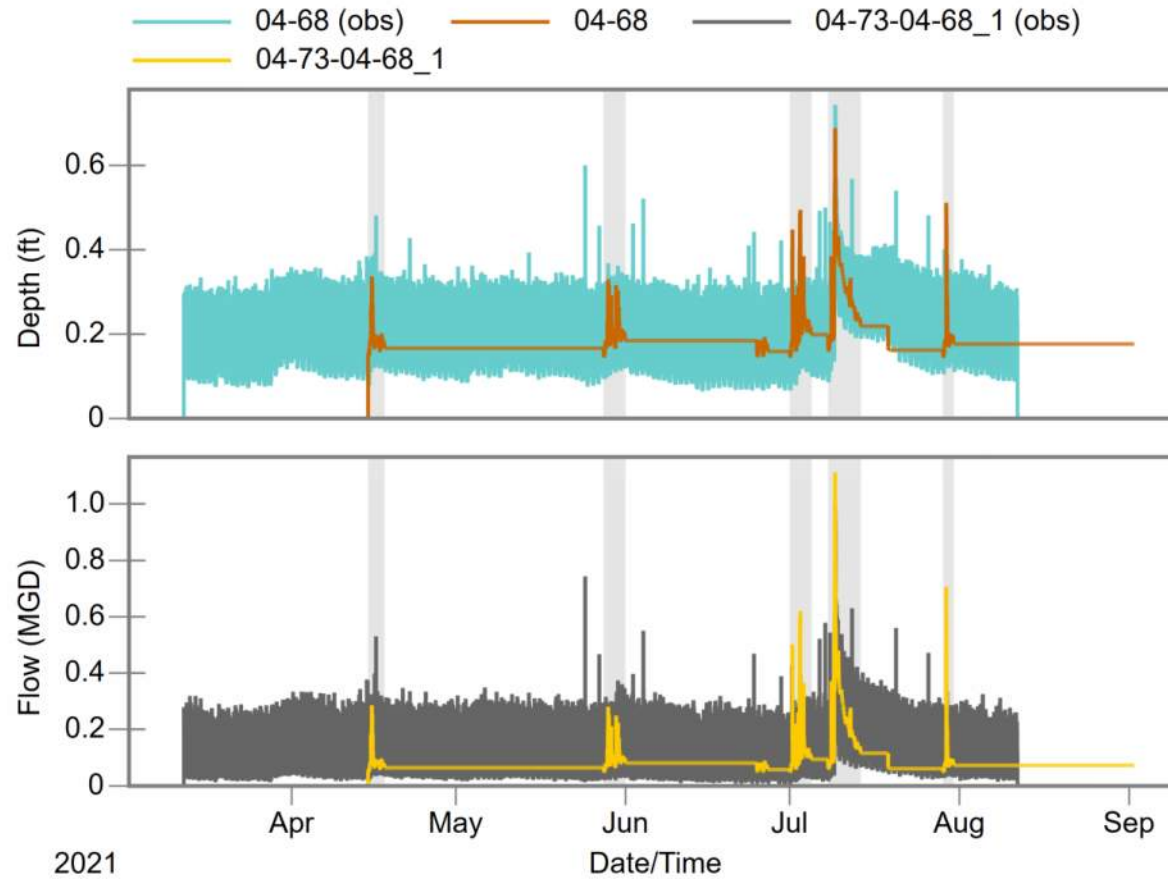
Peaks



Volumes

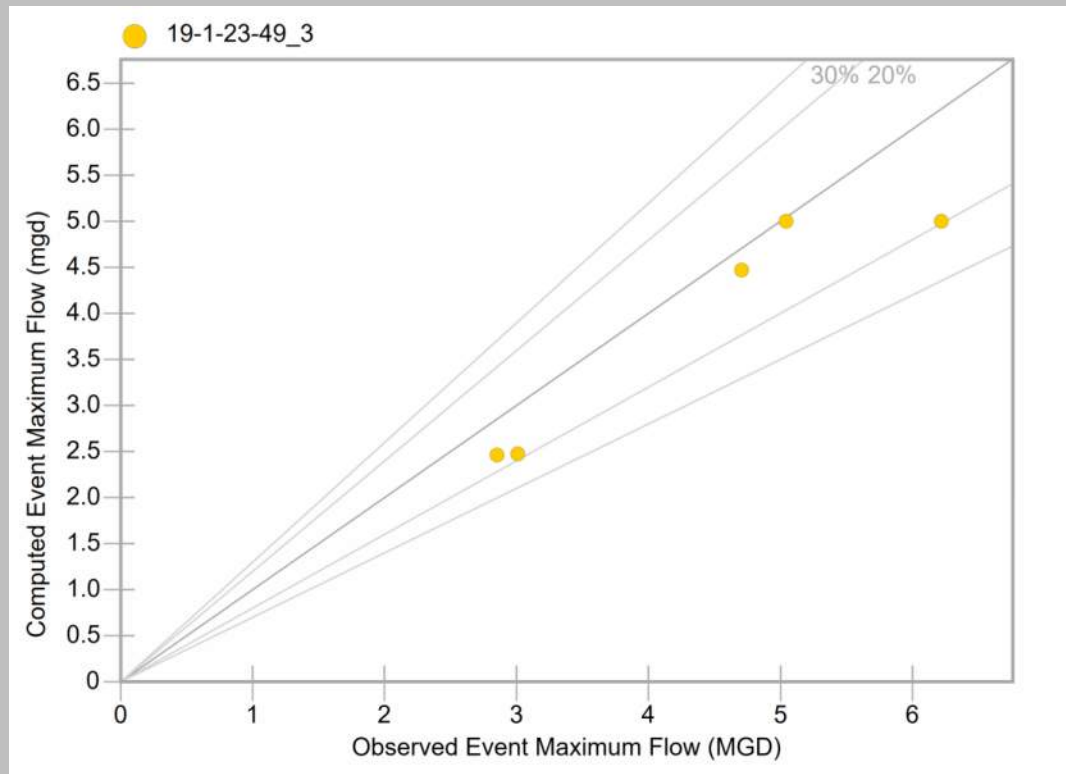


FM_22

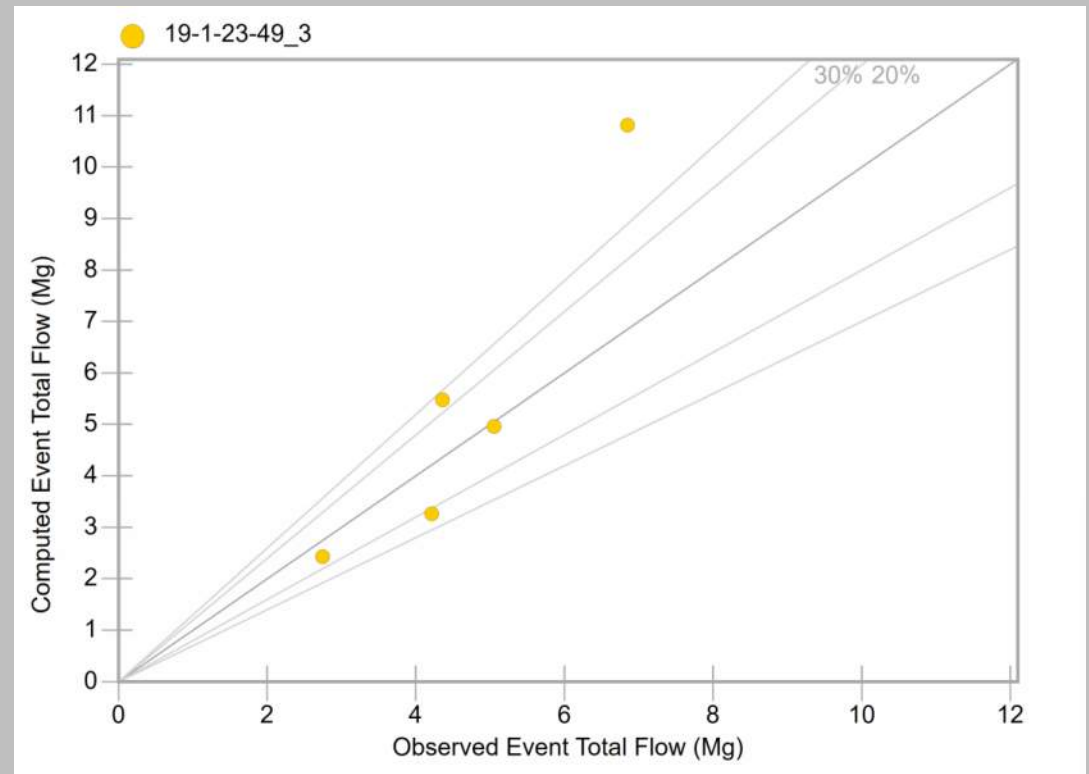


FM_23

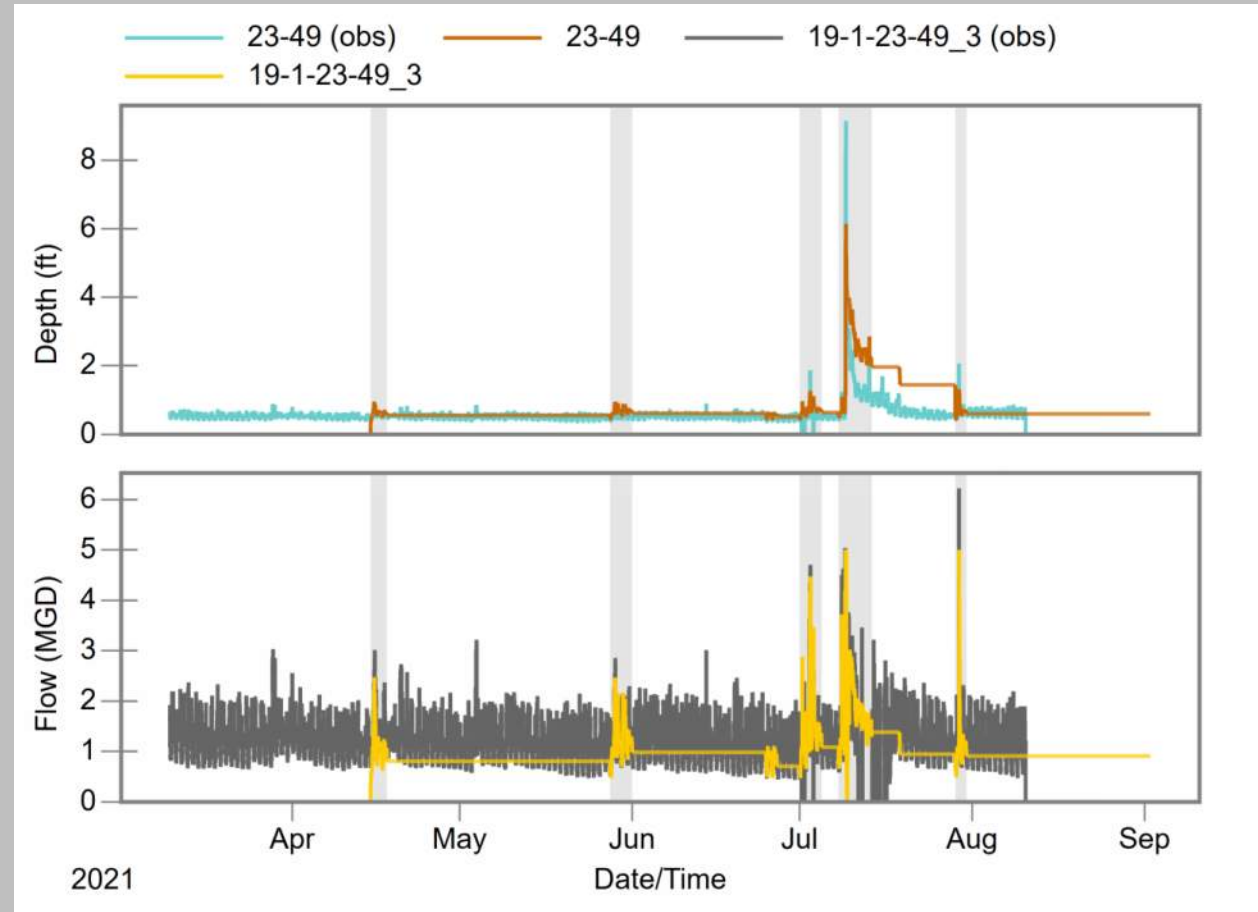
Peaks



Volumes

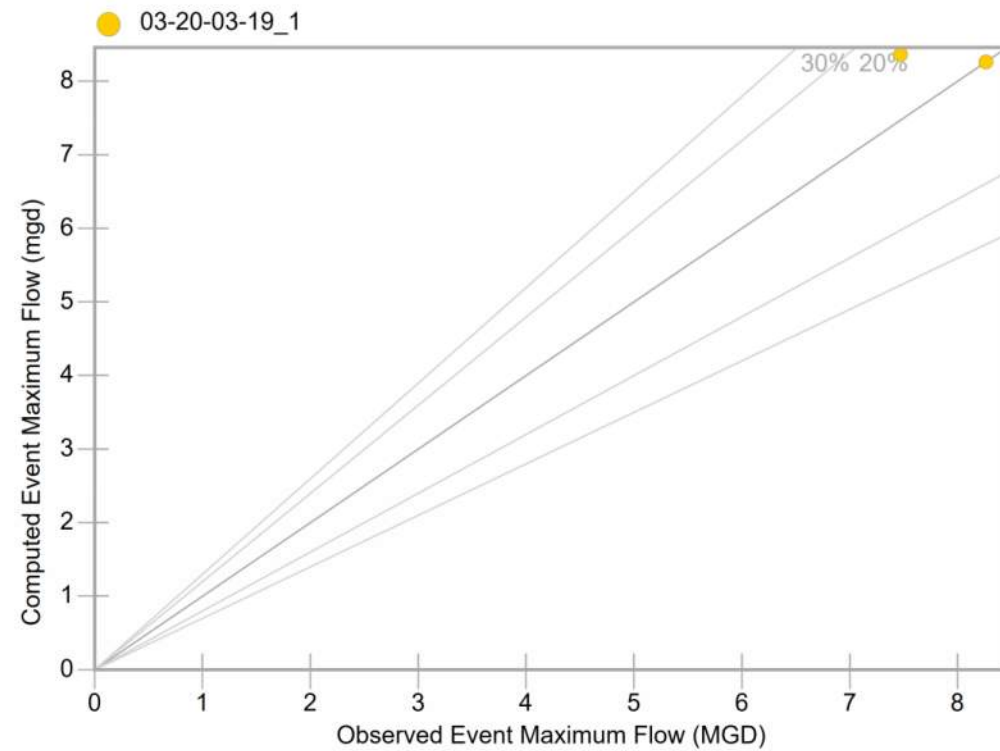


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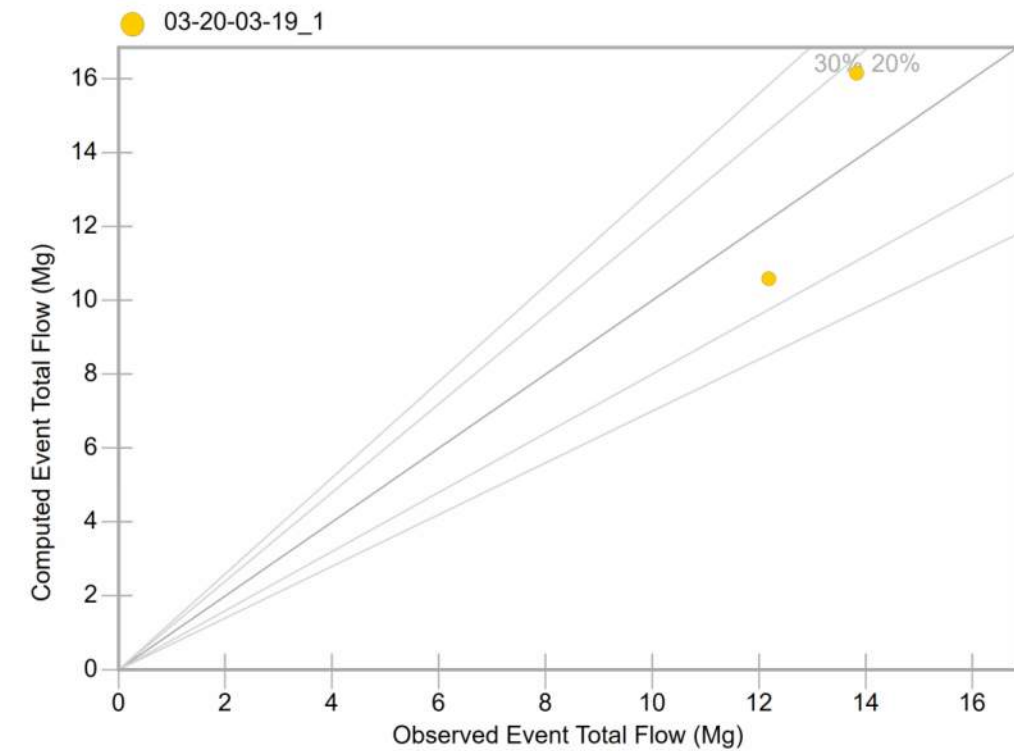


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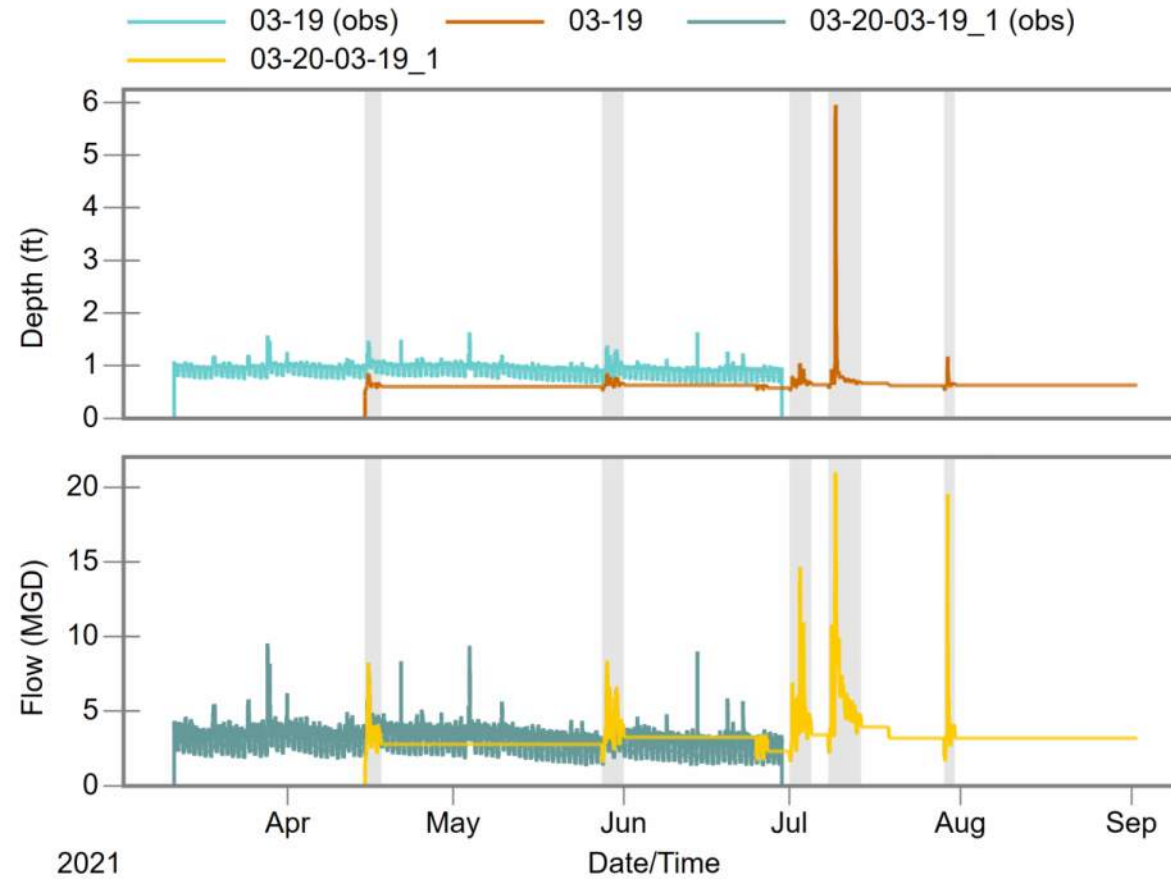
Peaks



Volumes

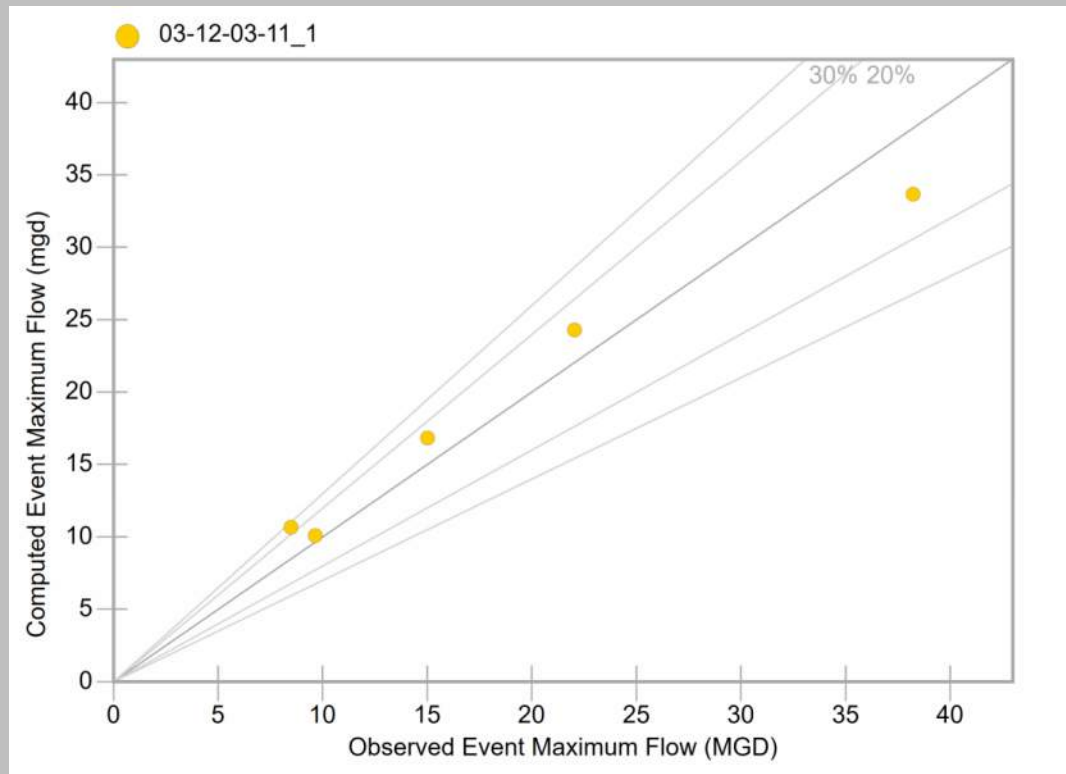


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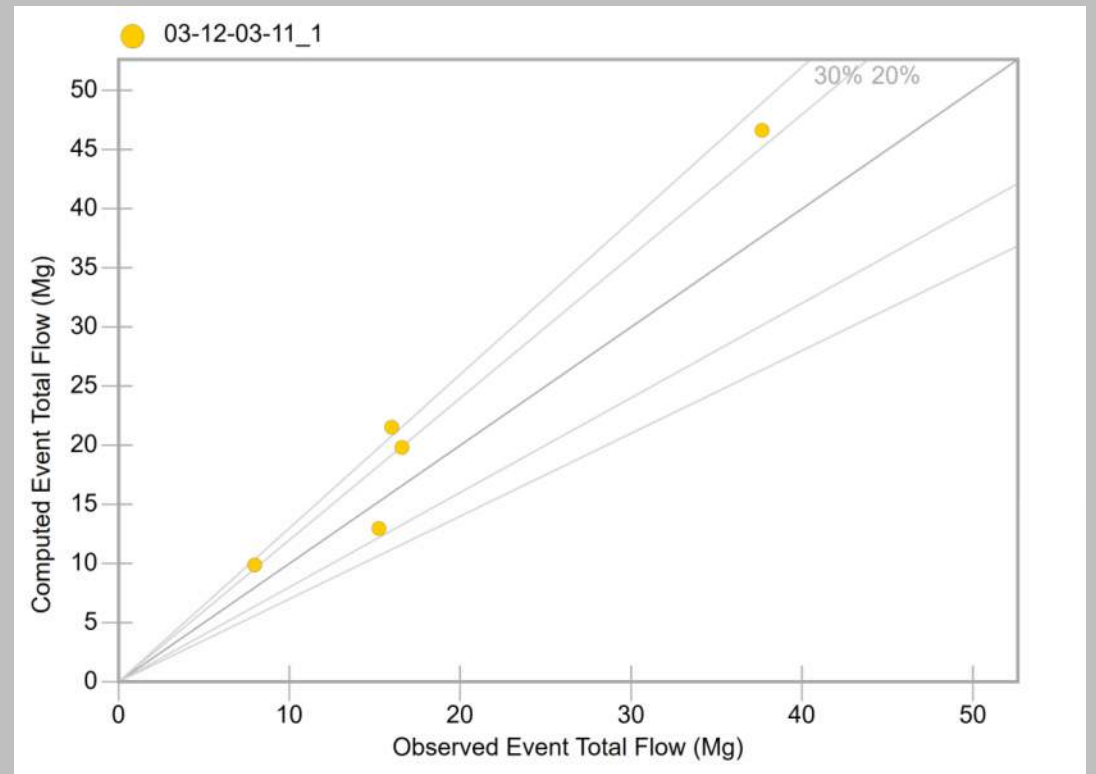


FM_25

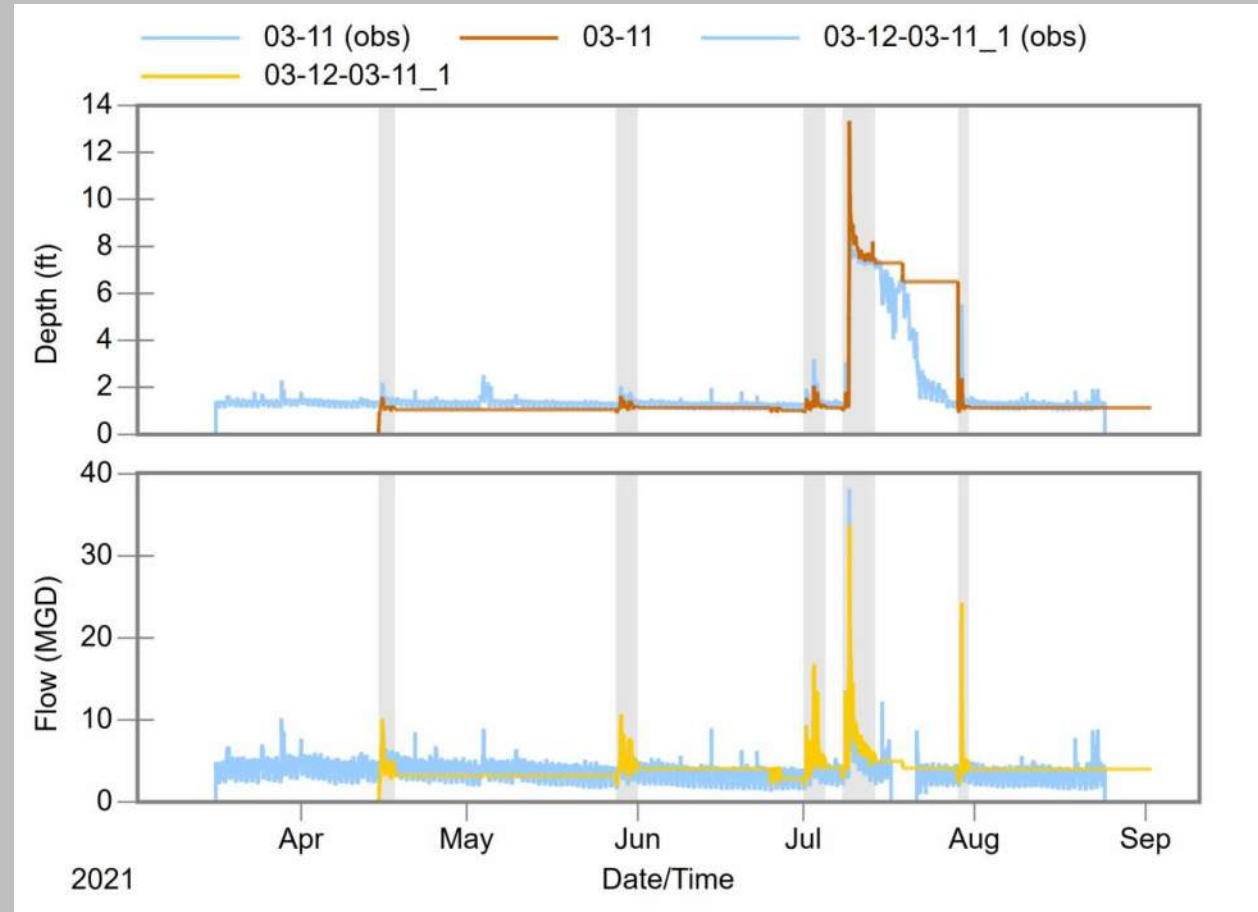
Peaks



Volumes

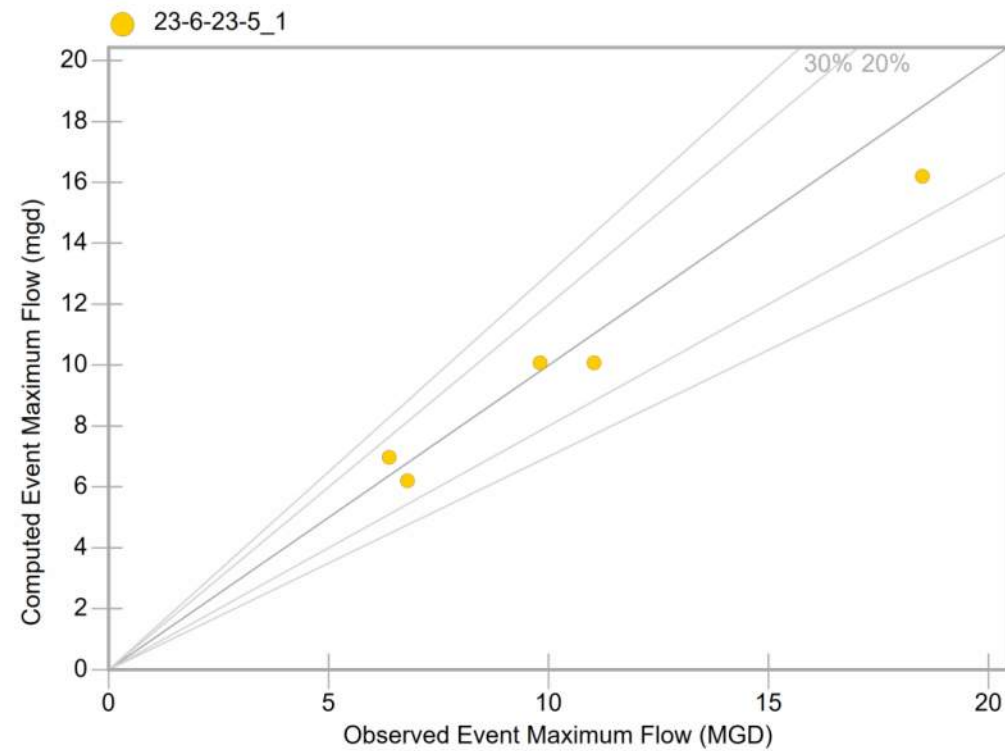


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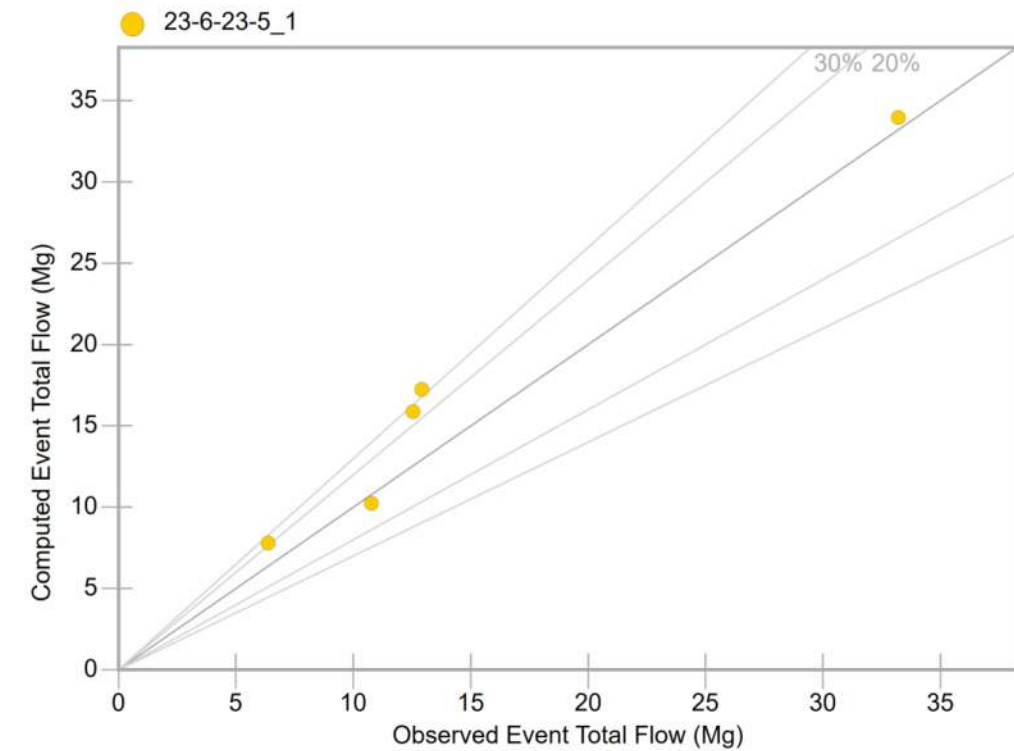


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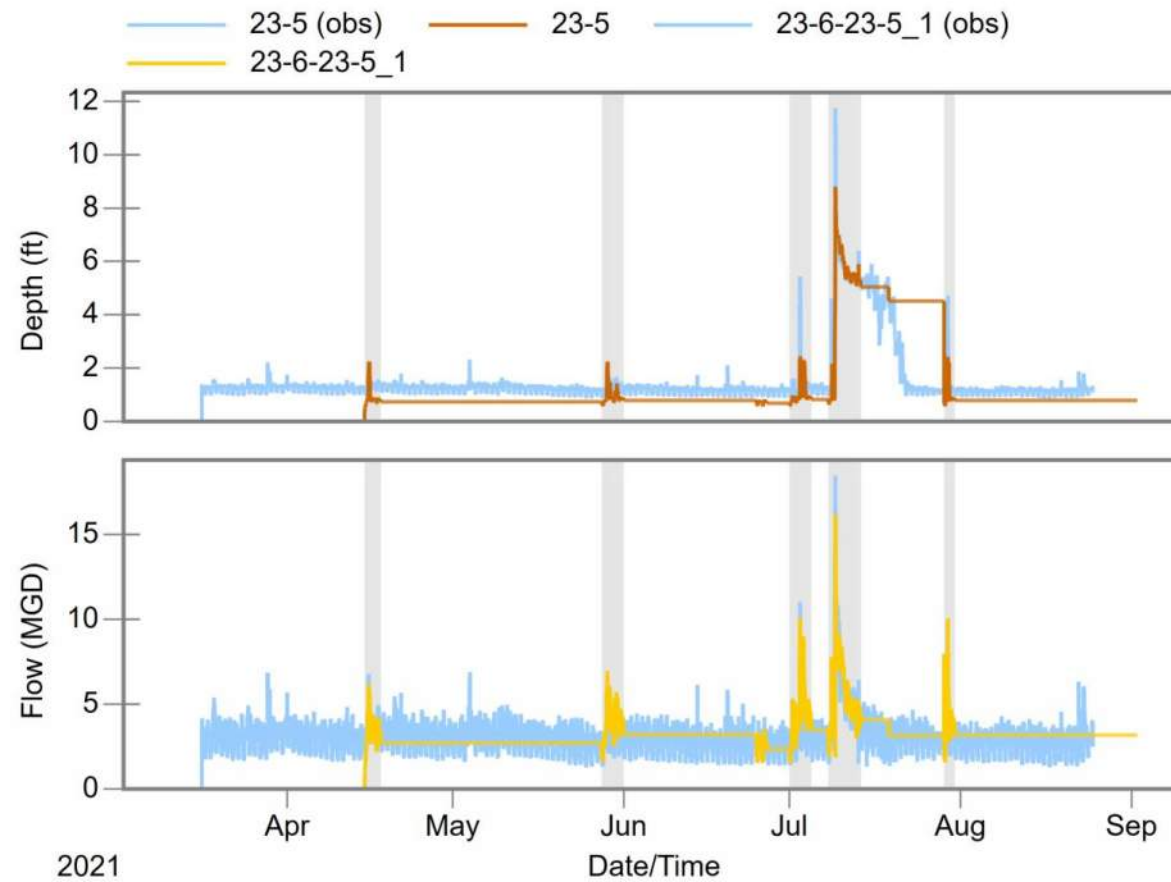
Peaks



Volumes

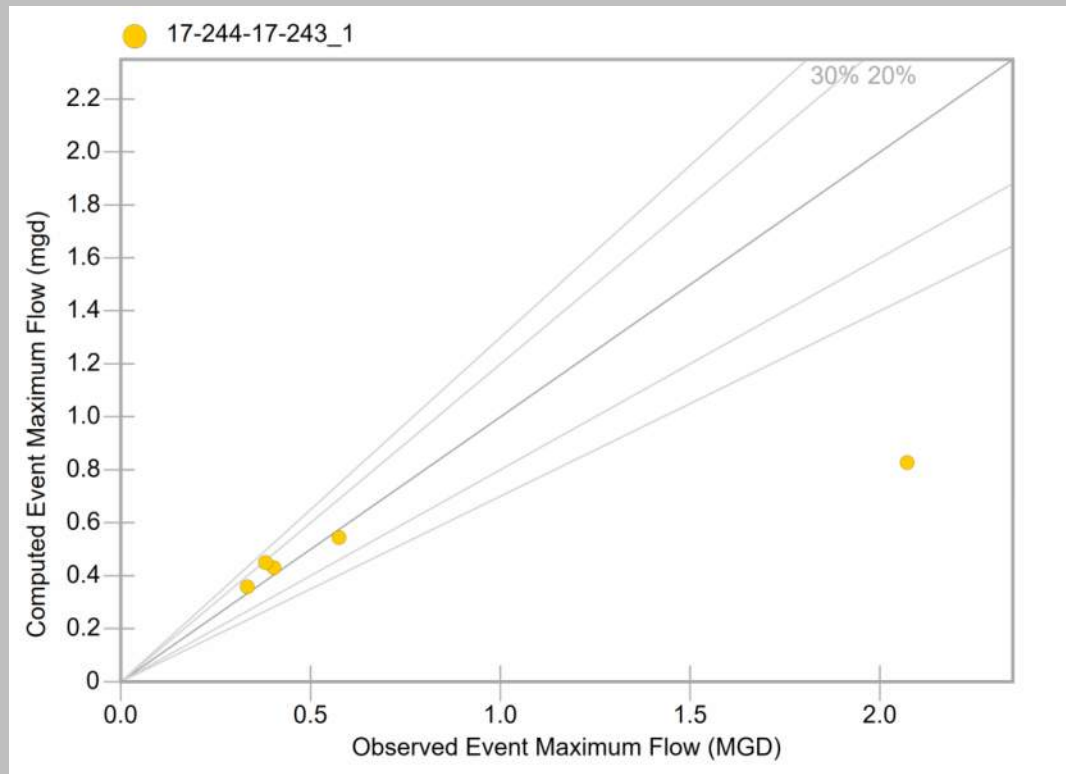


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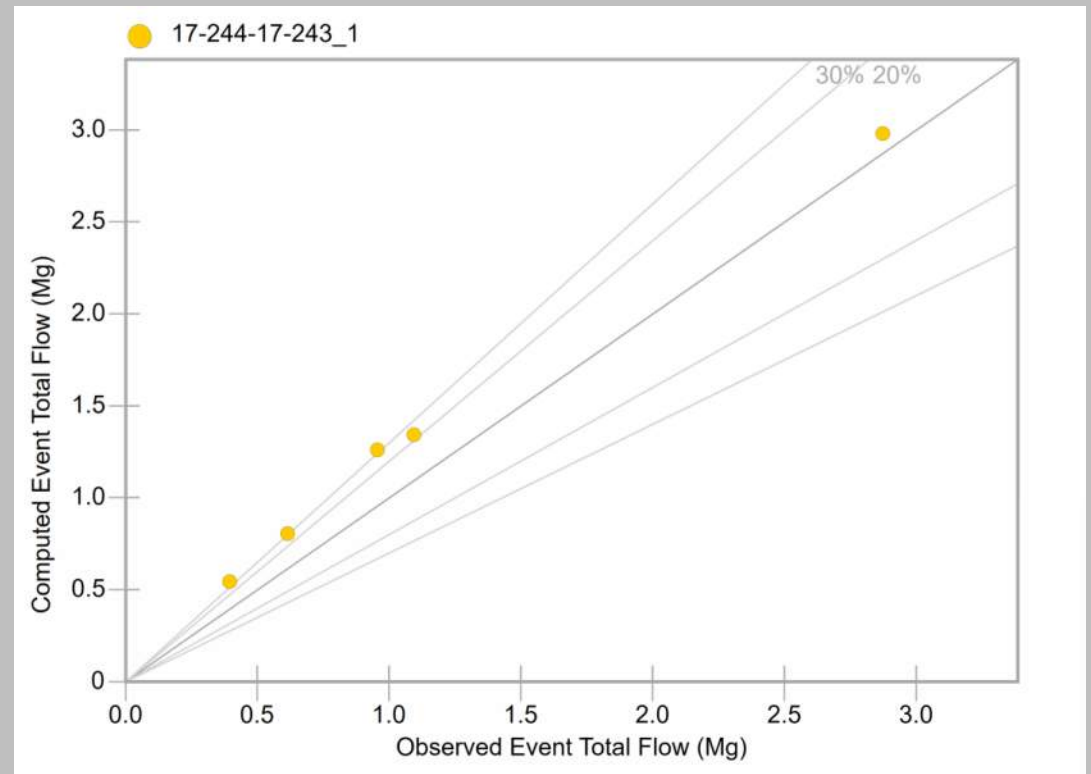


FM_27

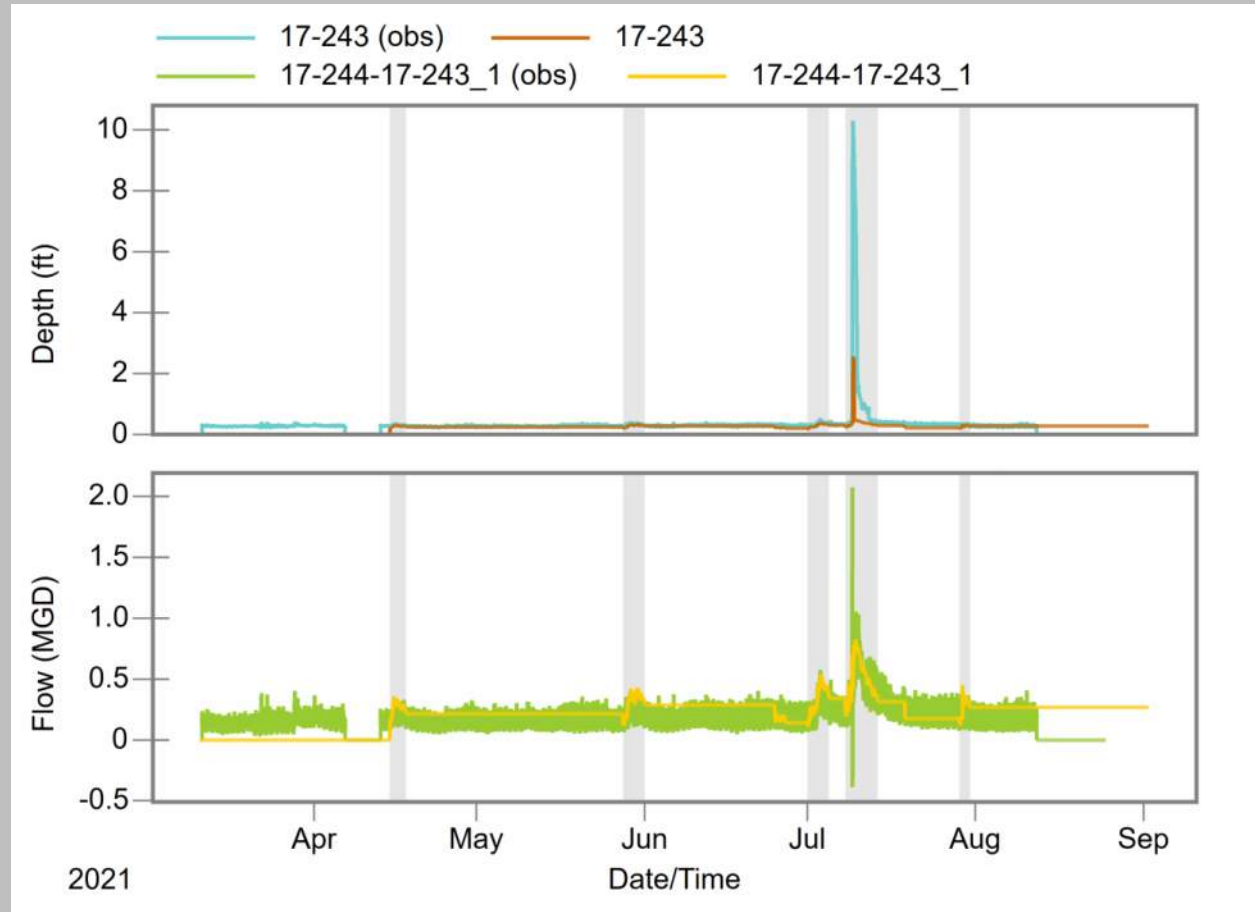
Peaks



Volumes

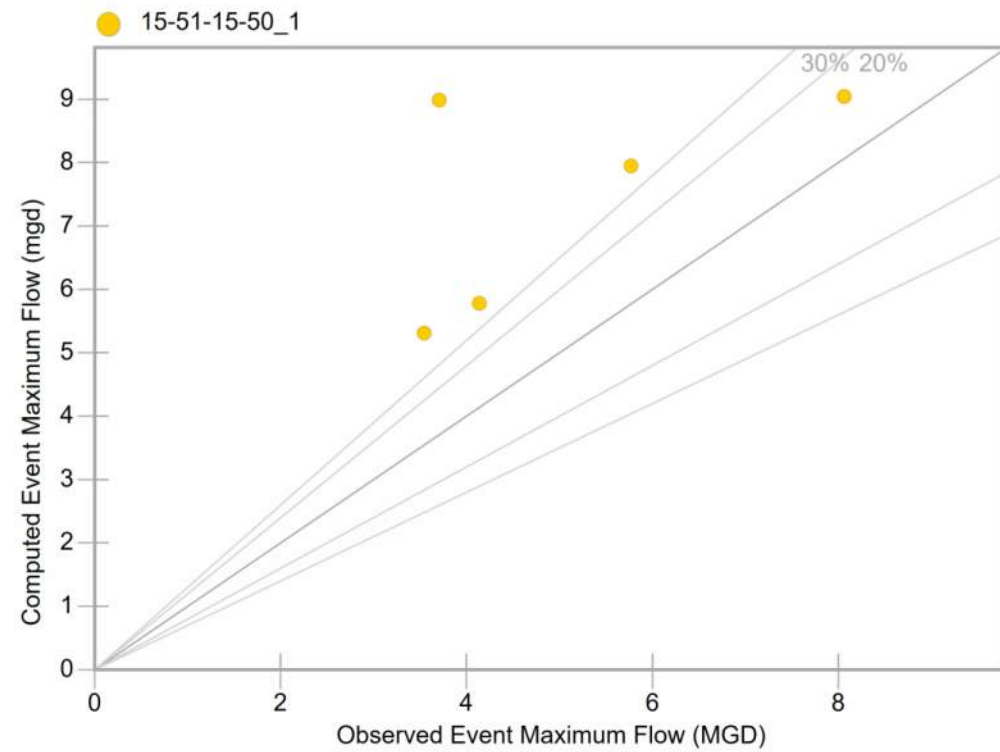


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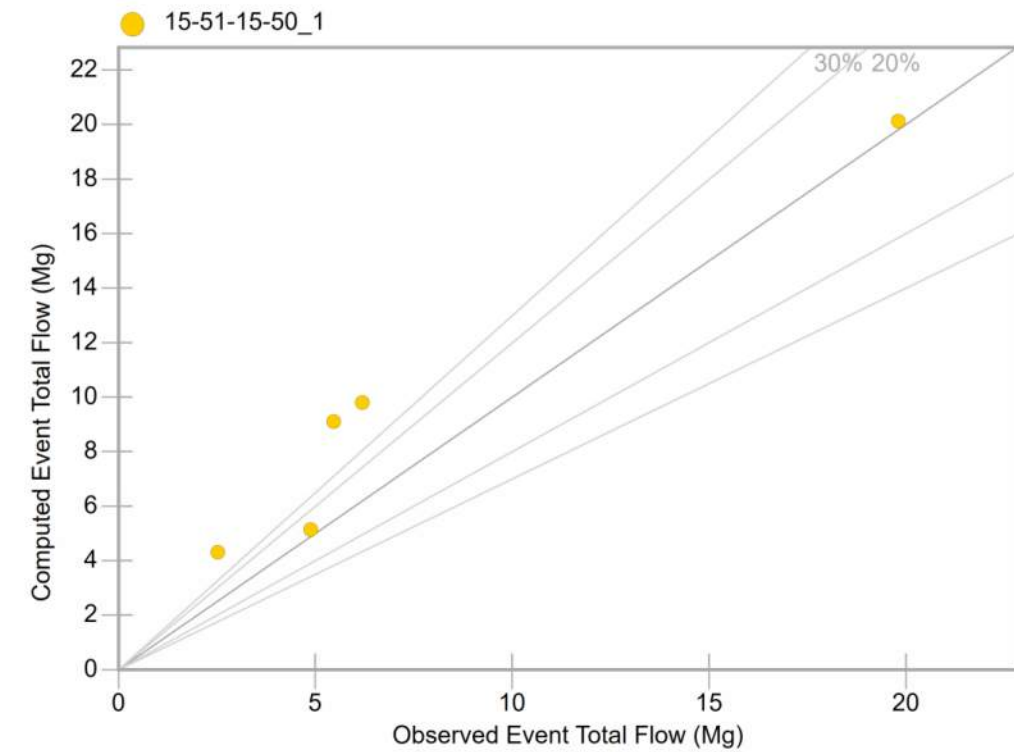


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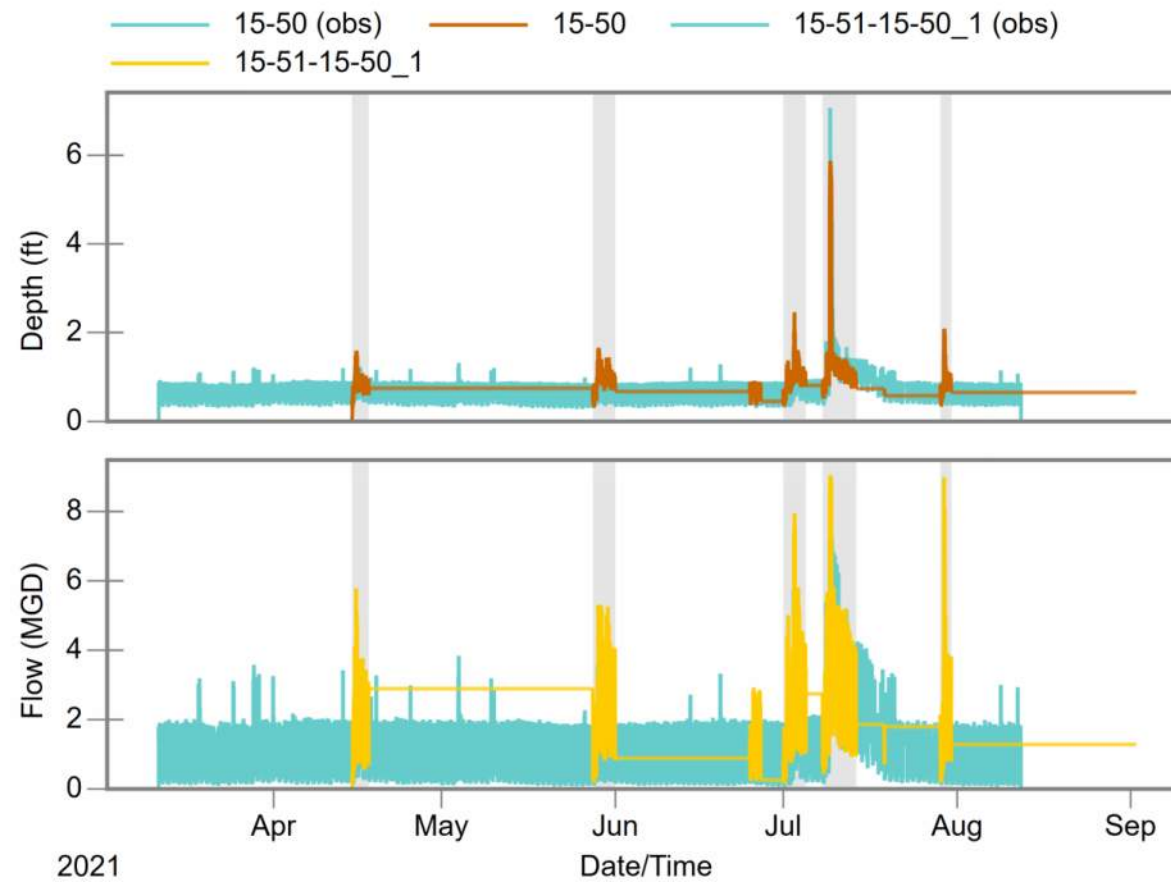
Peaks



Volumes

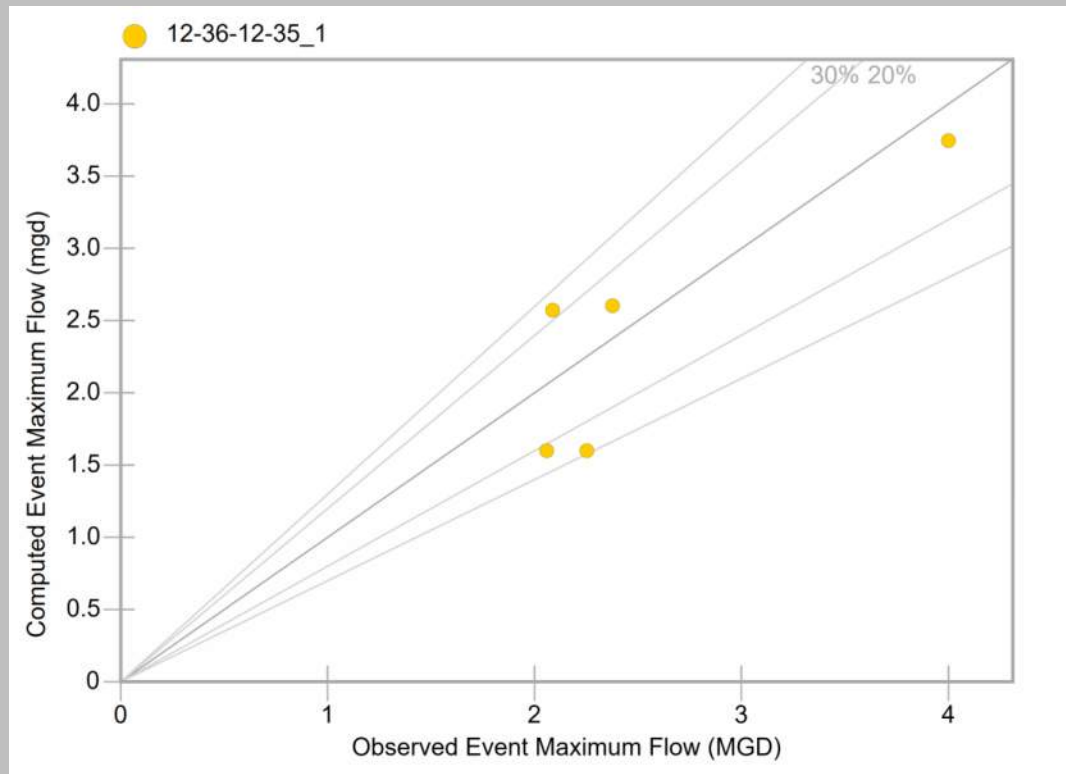


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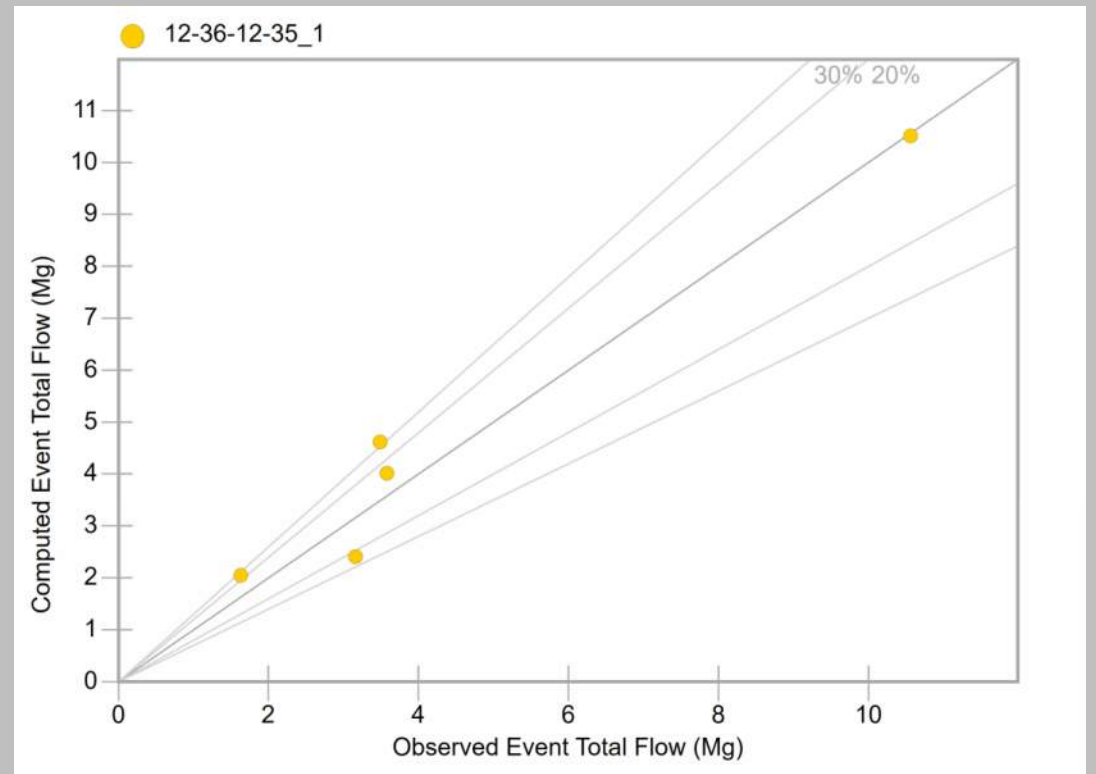


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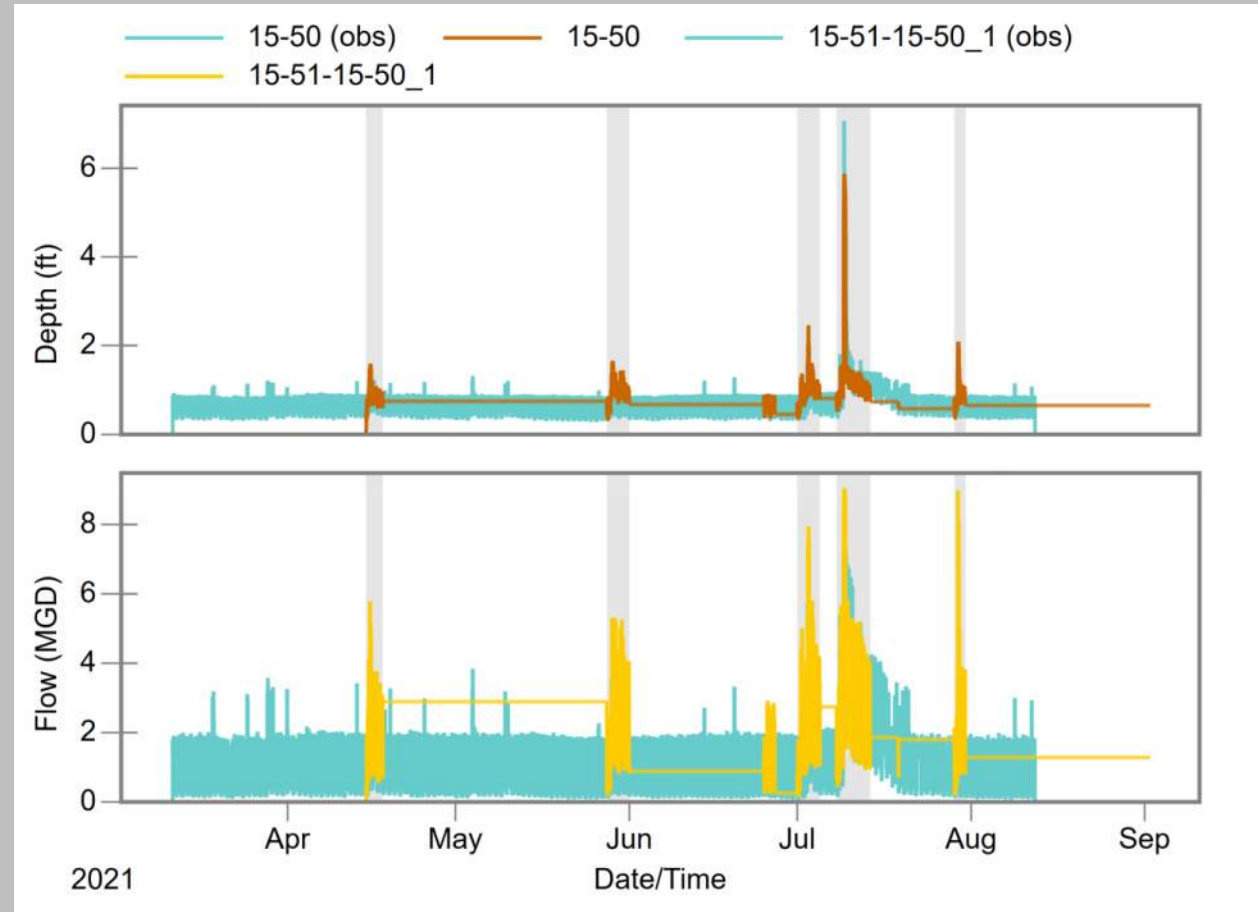
Peaks



Volumes

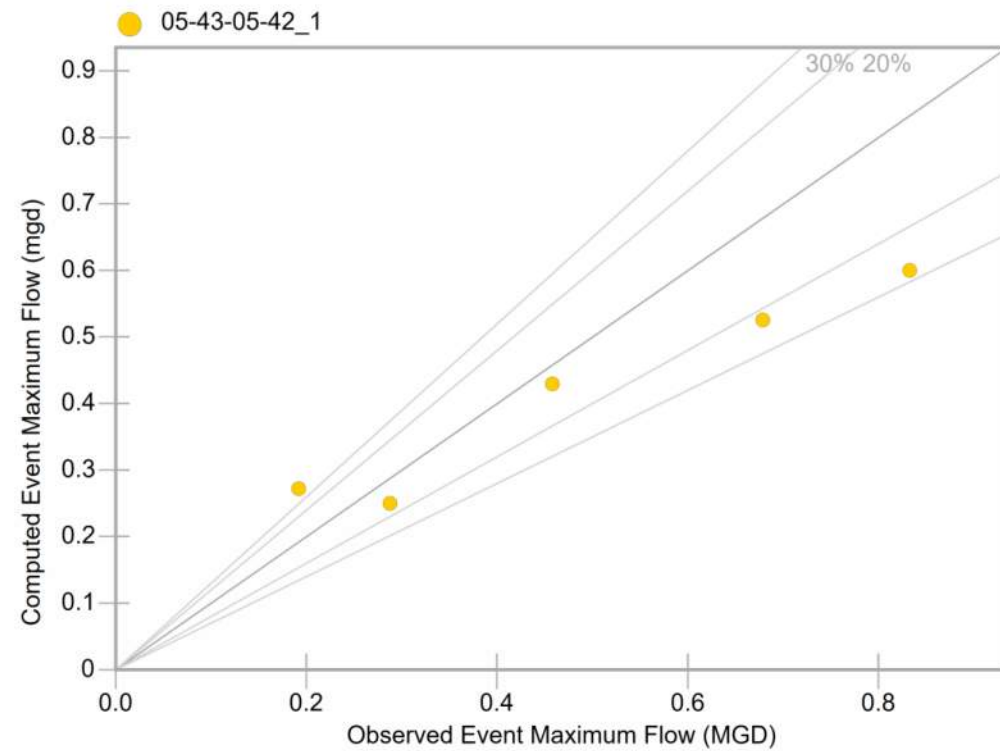


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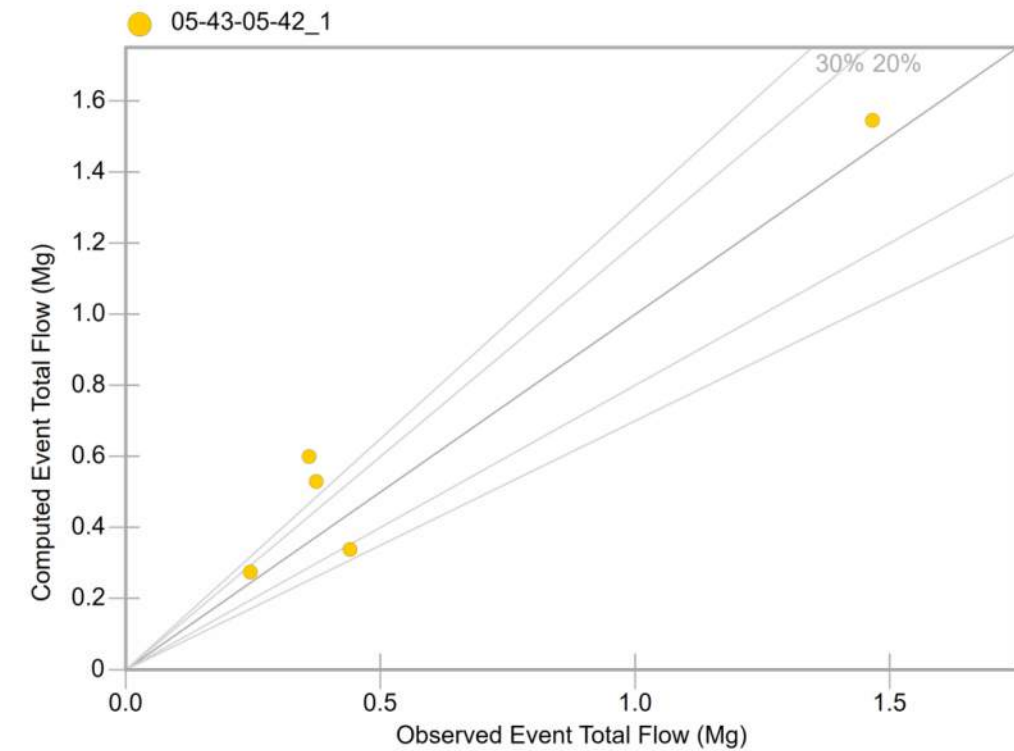


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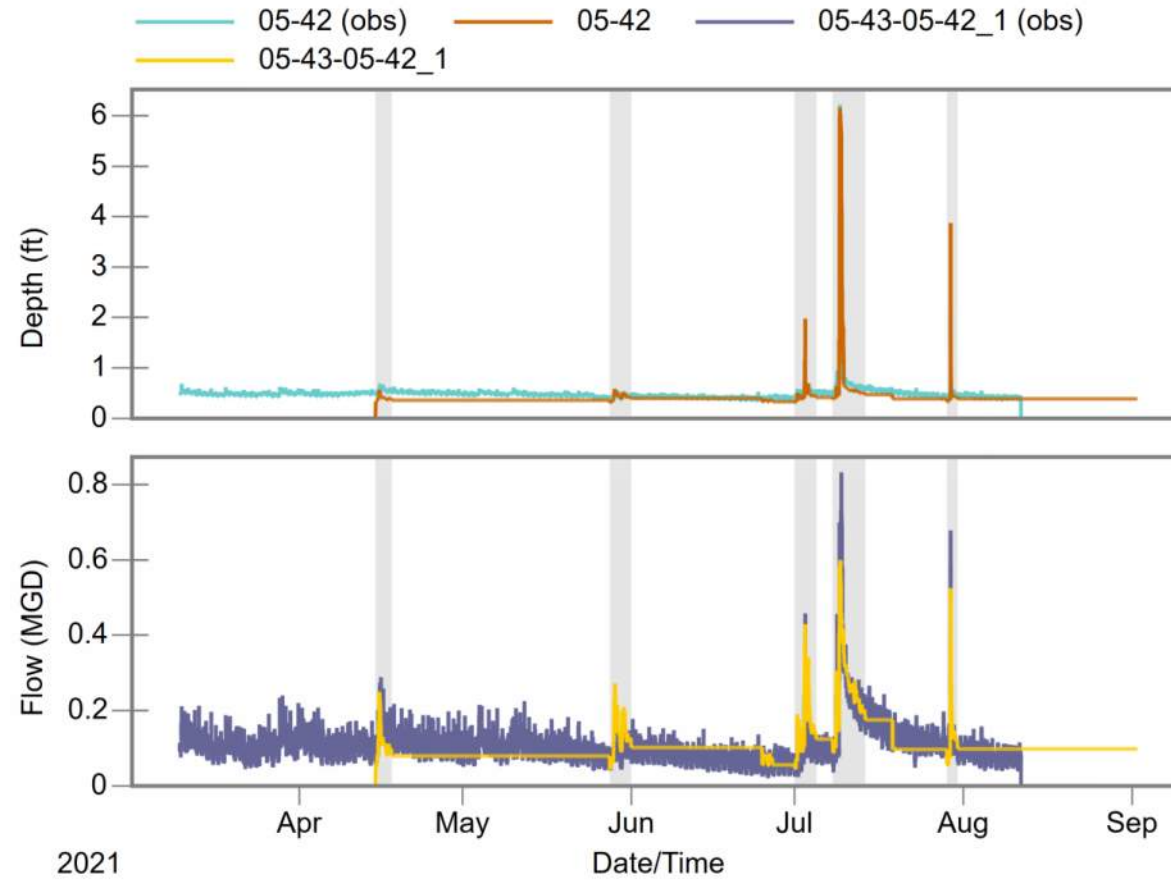
Peaks



Volumes

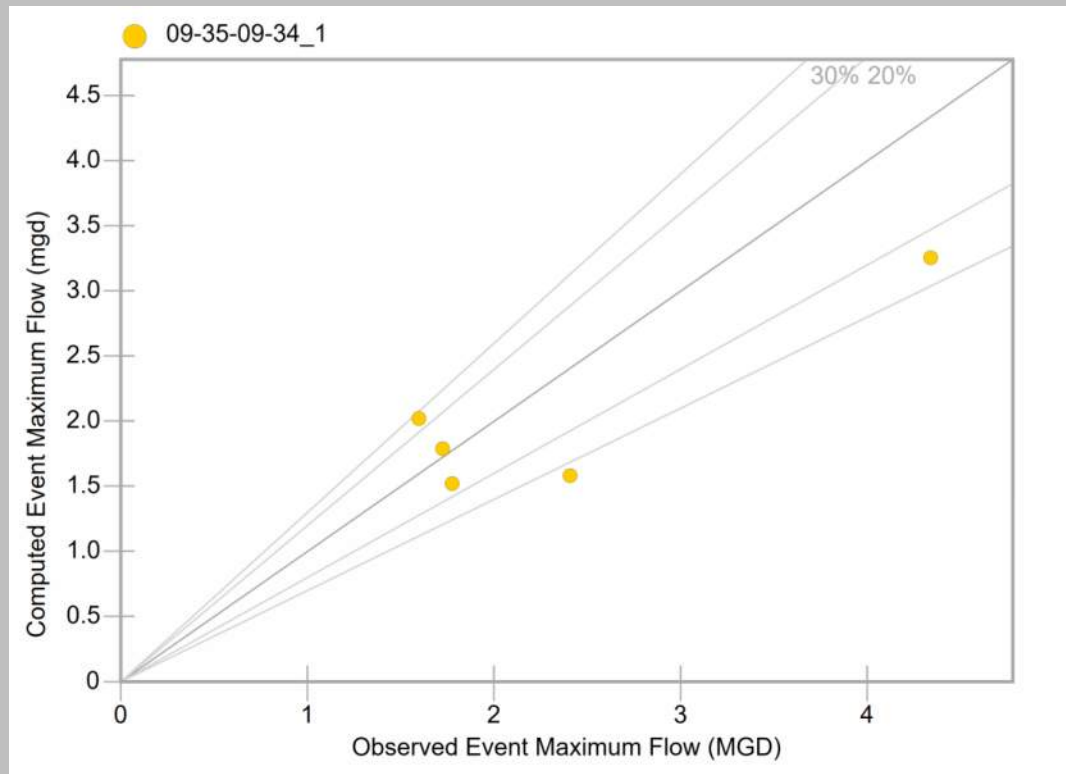


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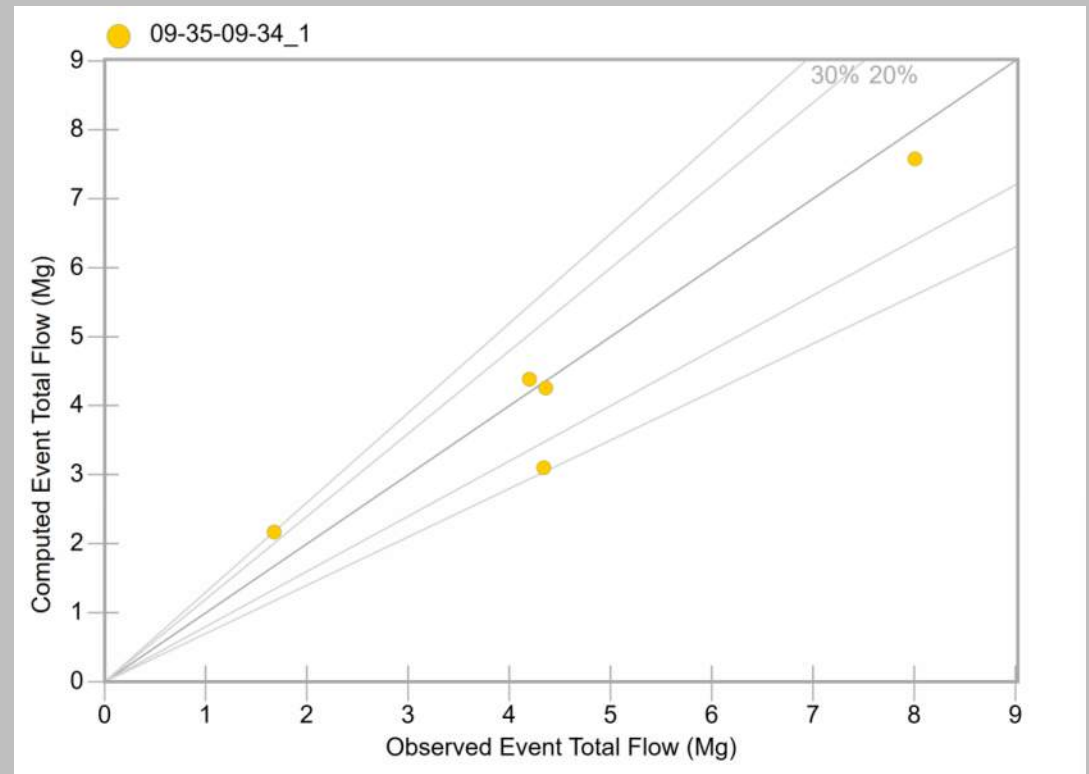


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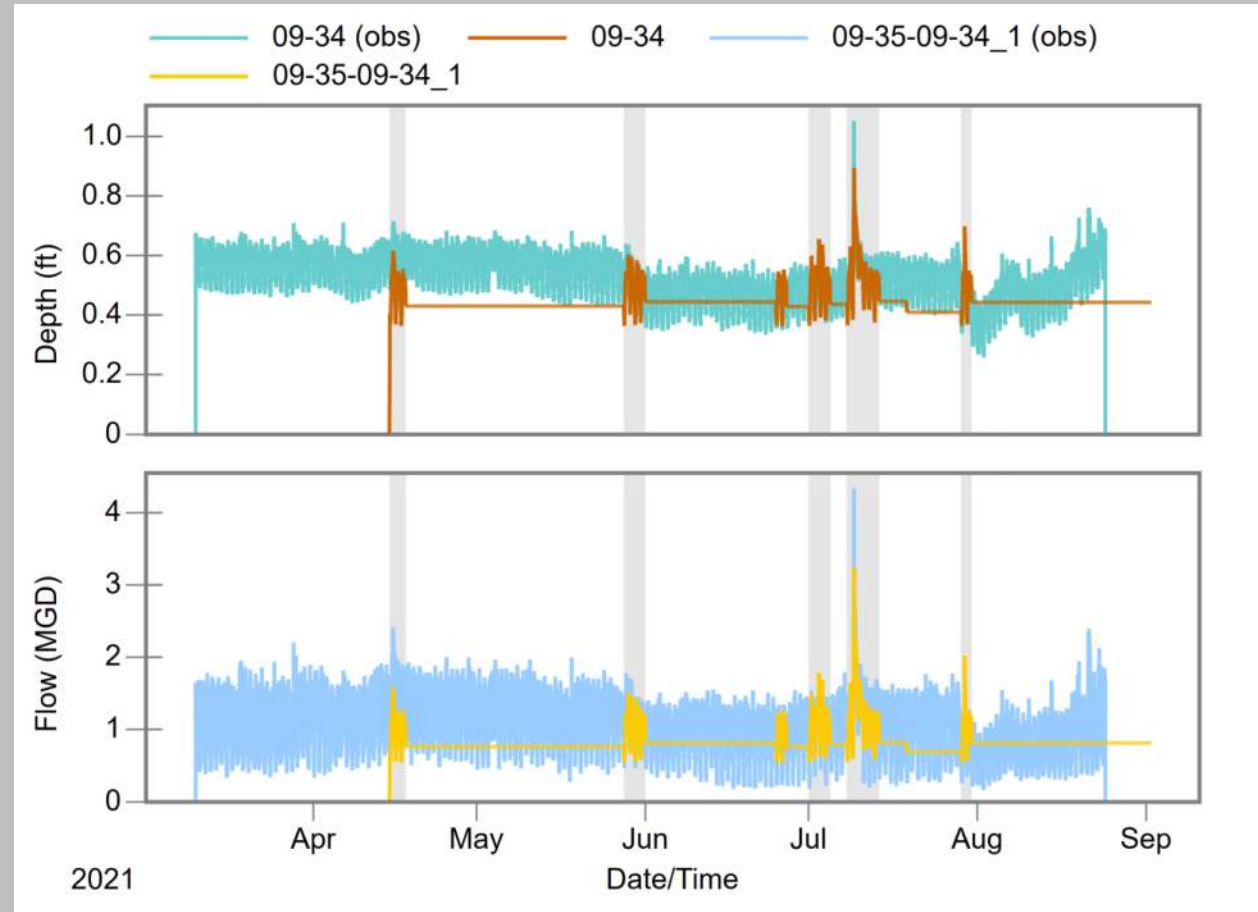
Peaks



Volumes

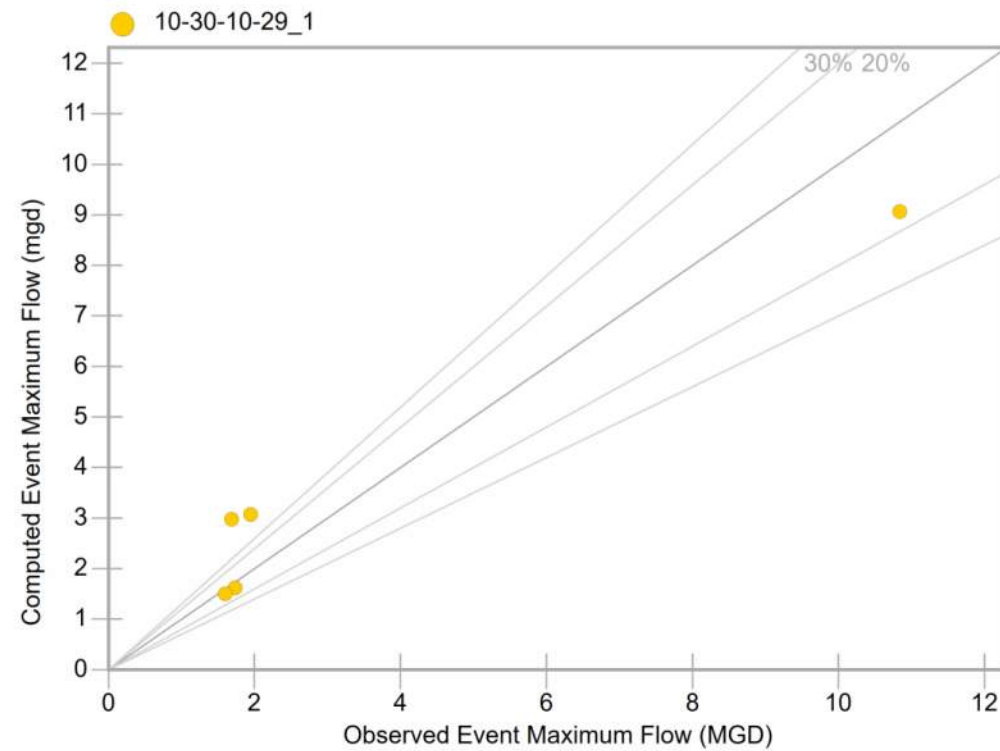


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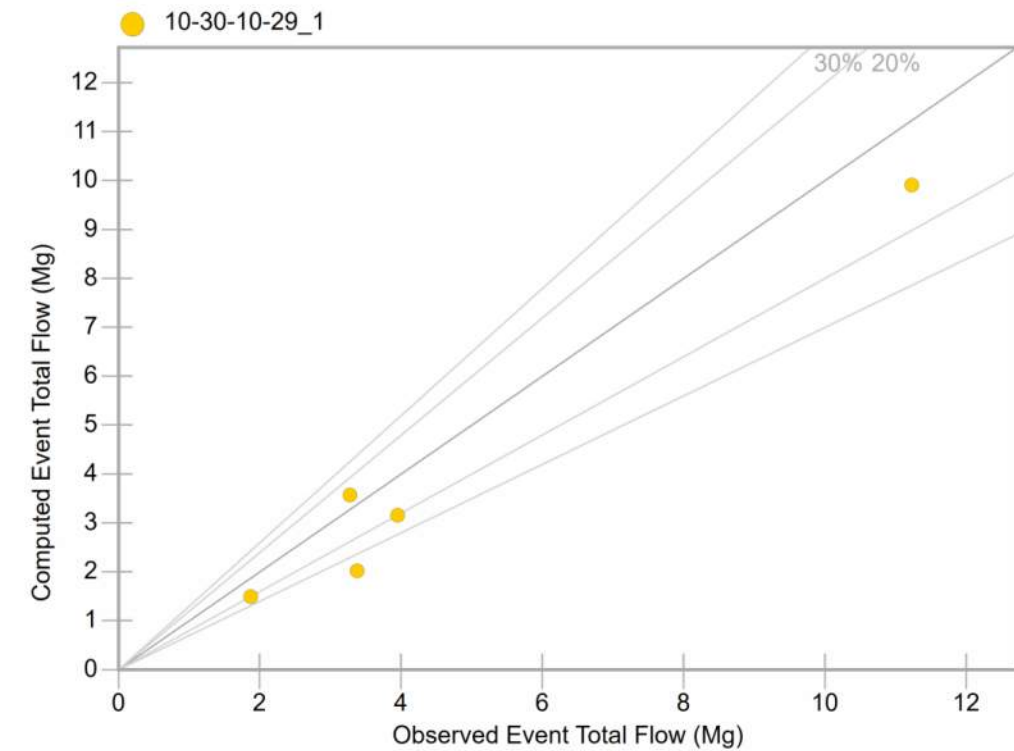


FM_32

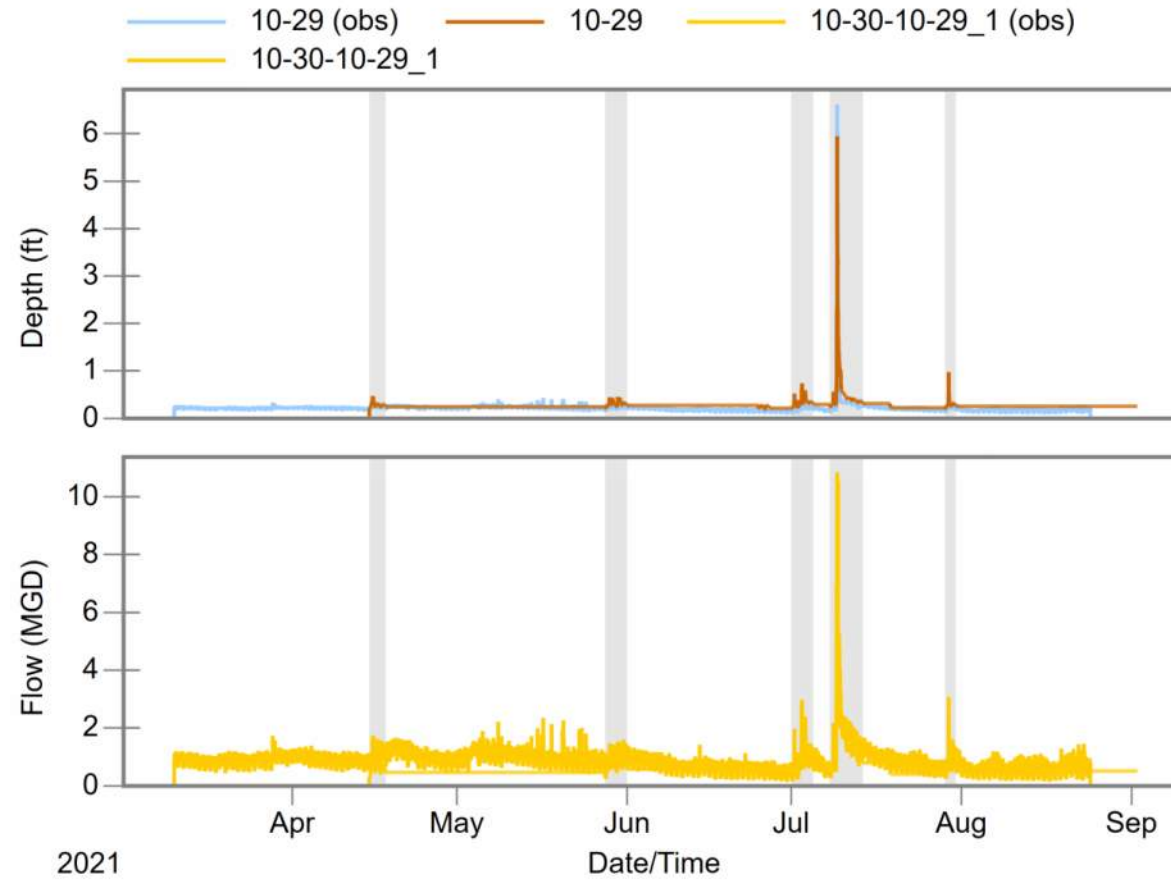
Peaks



Volumes

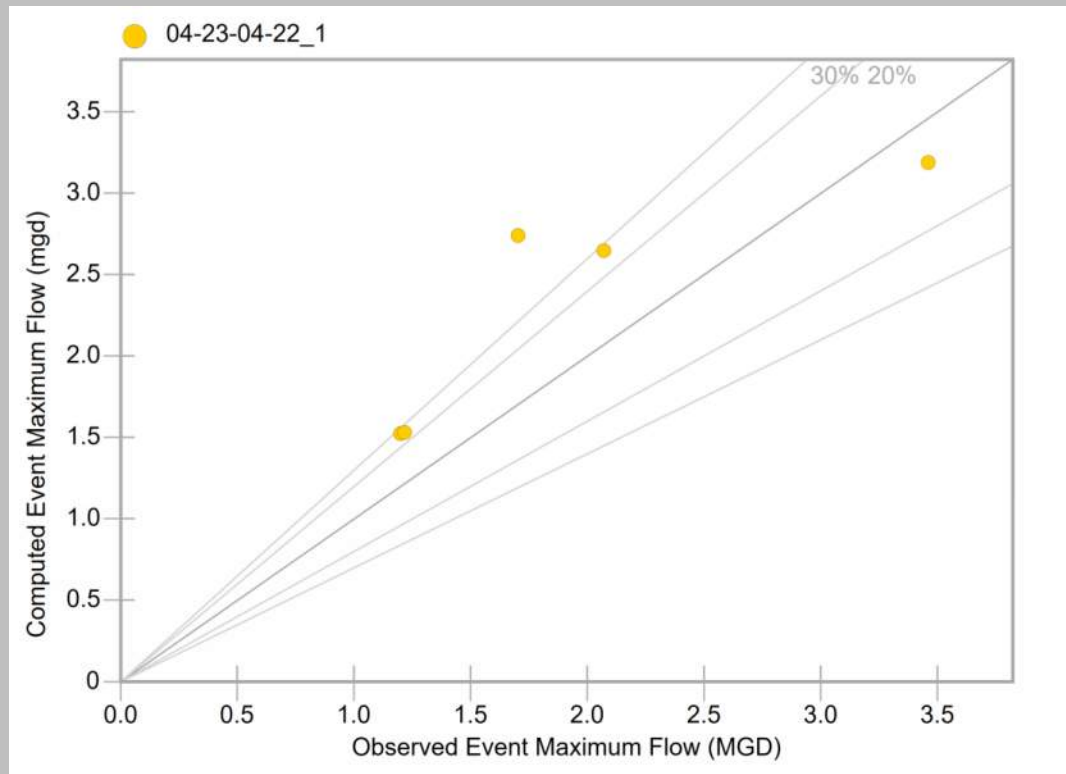


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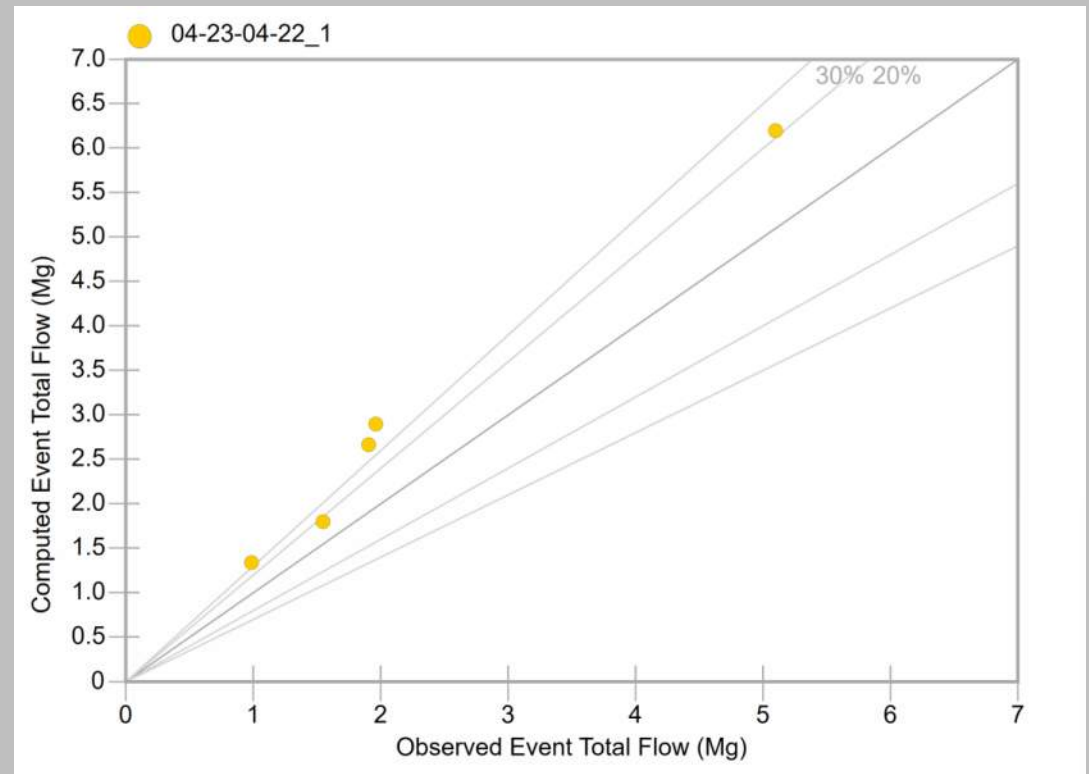


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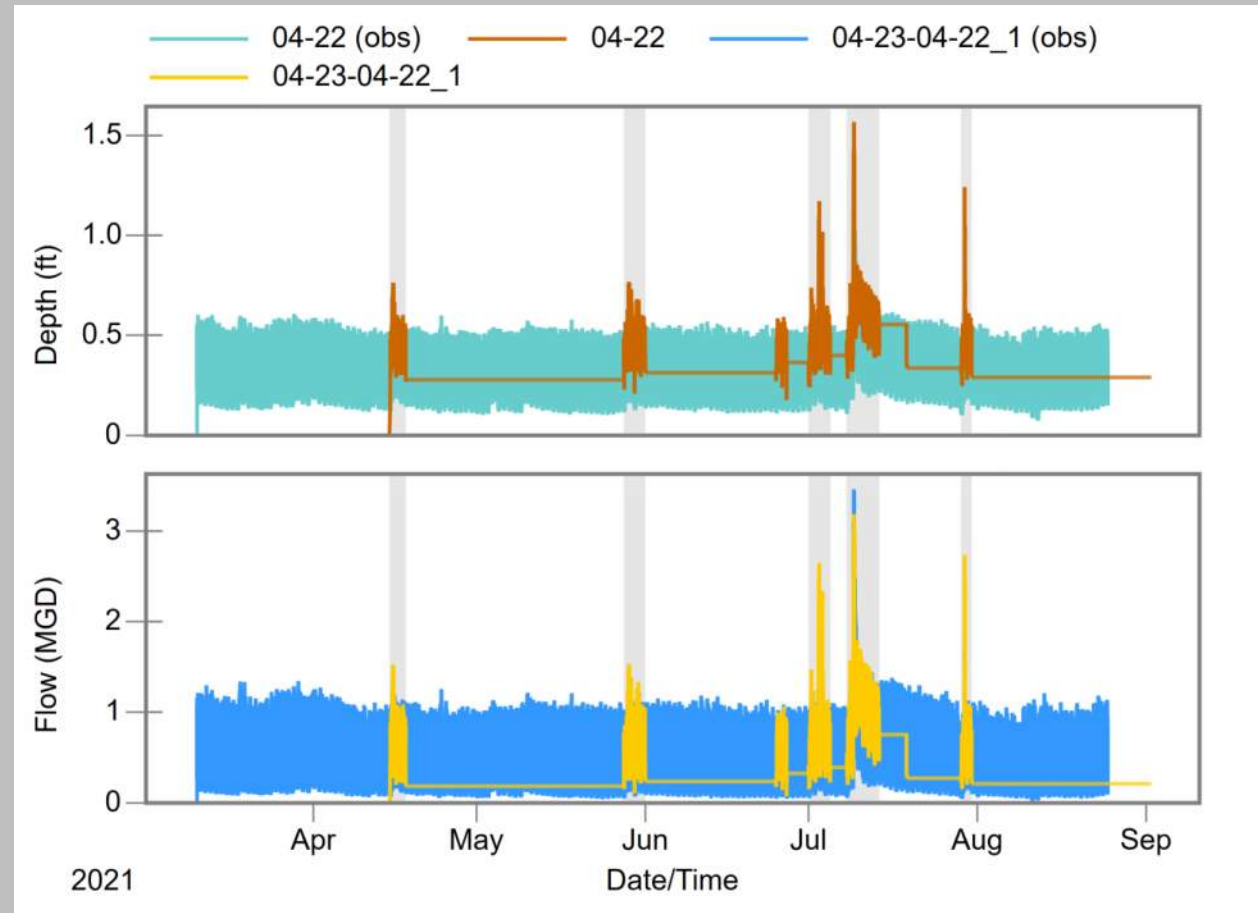
Peaks



Volumes

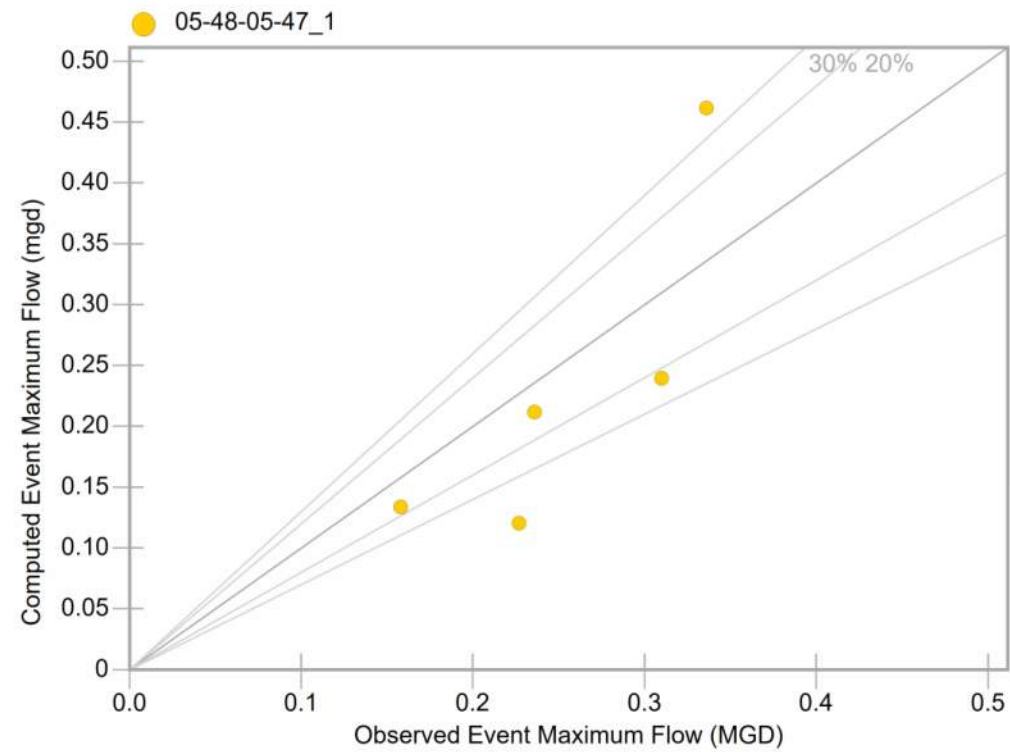


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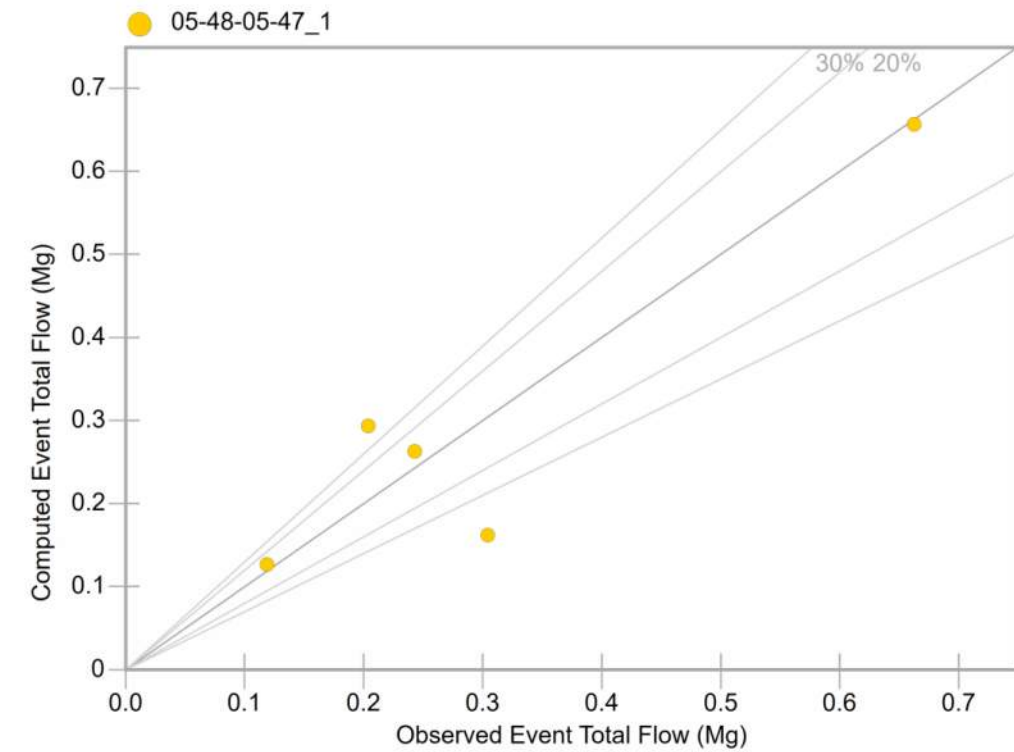


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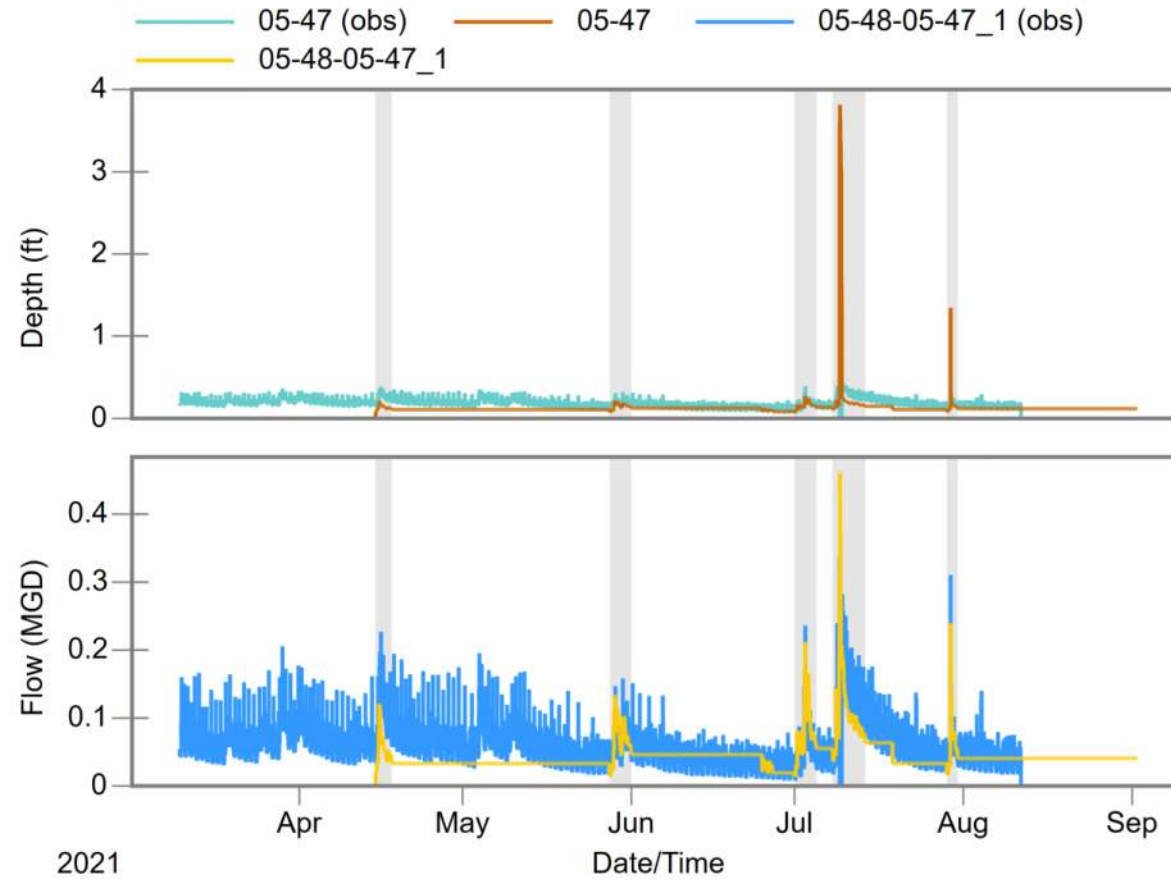
Peaks



Volumes

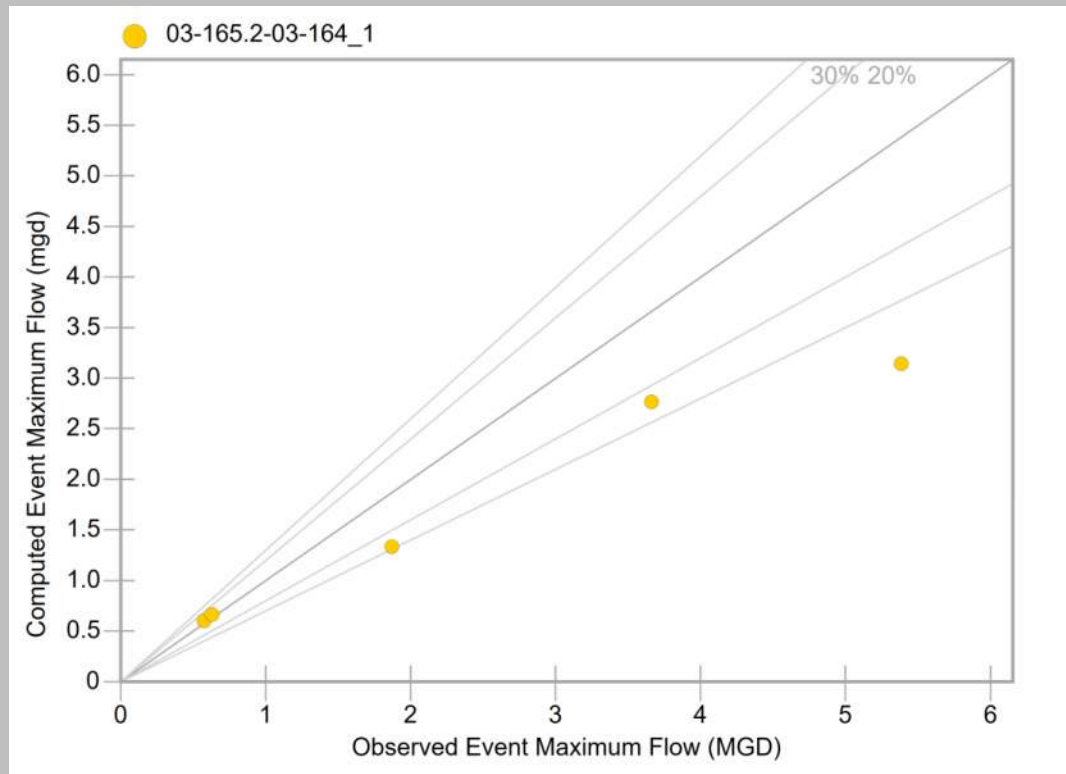


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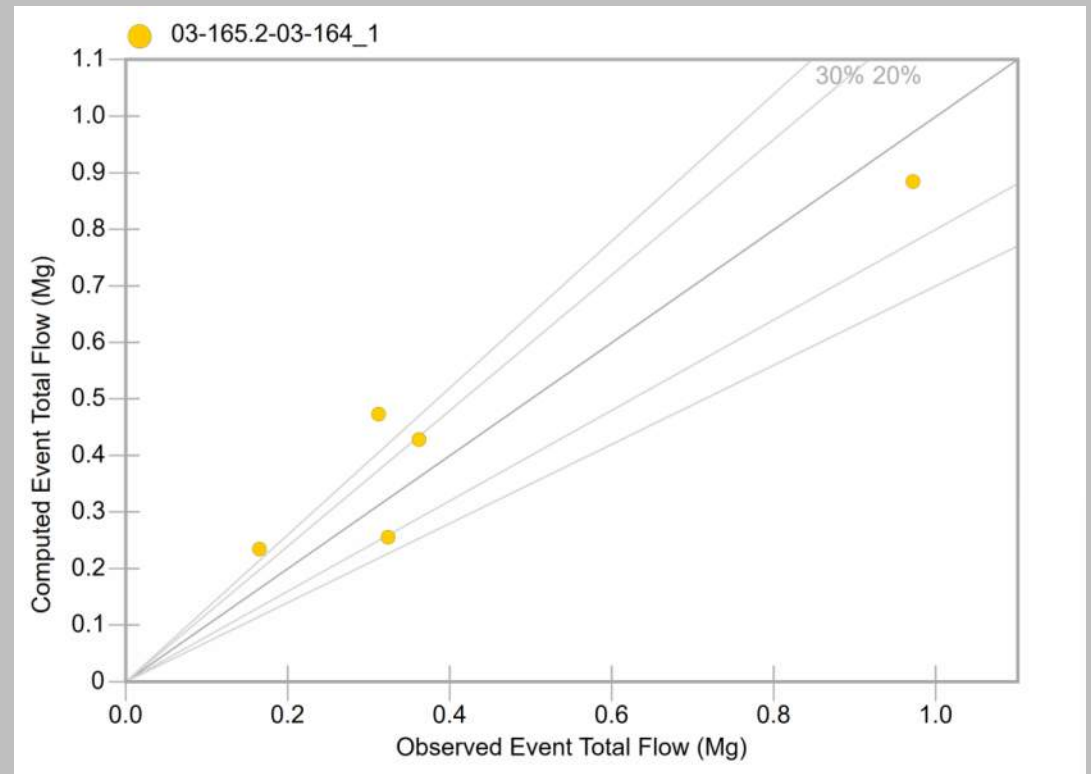


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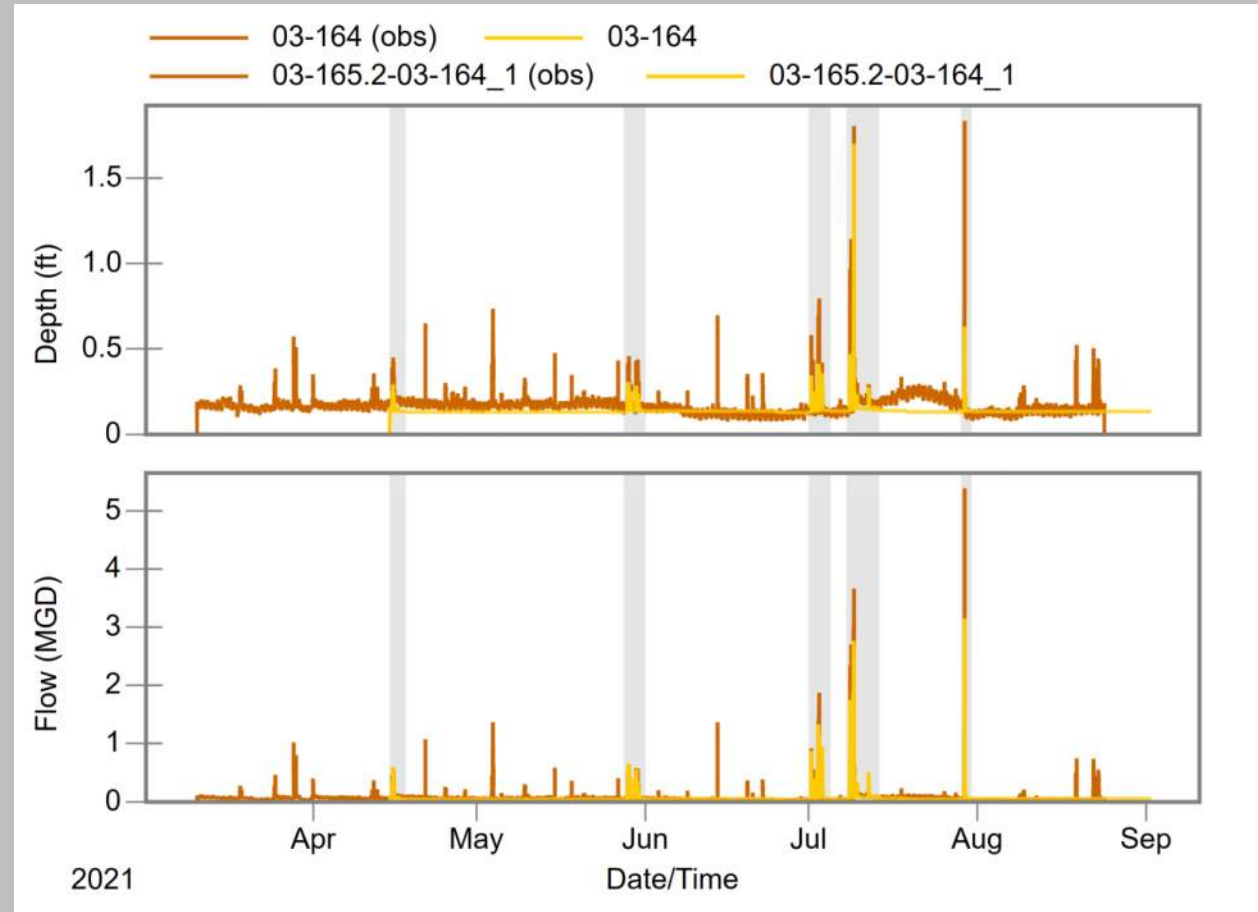
Peaks



Volumes

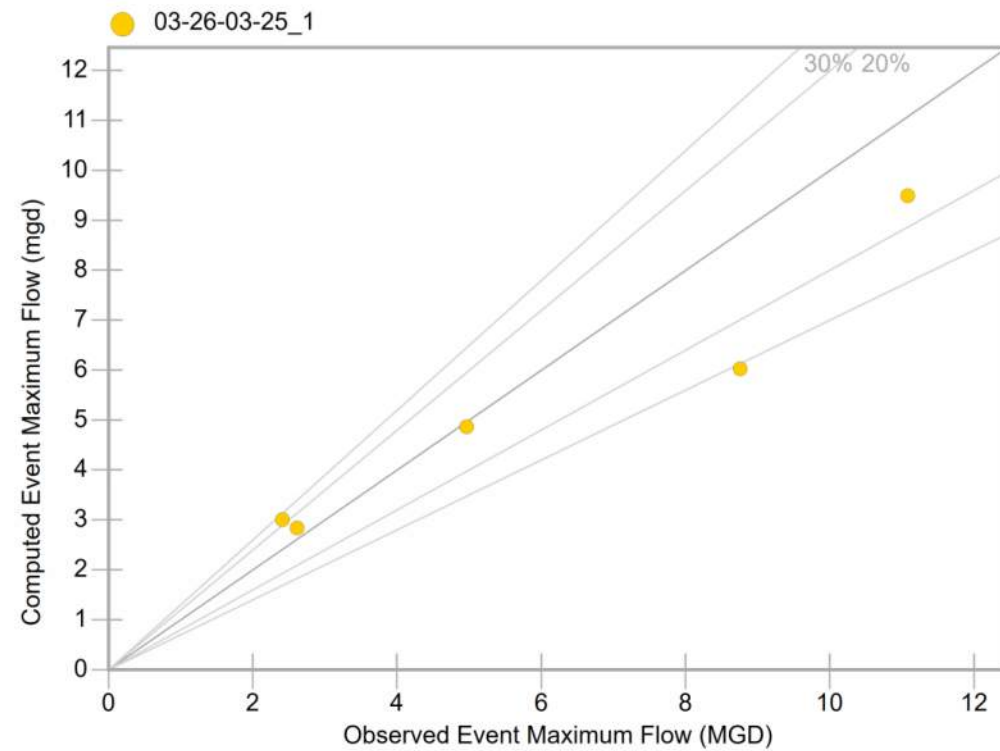


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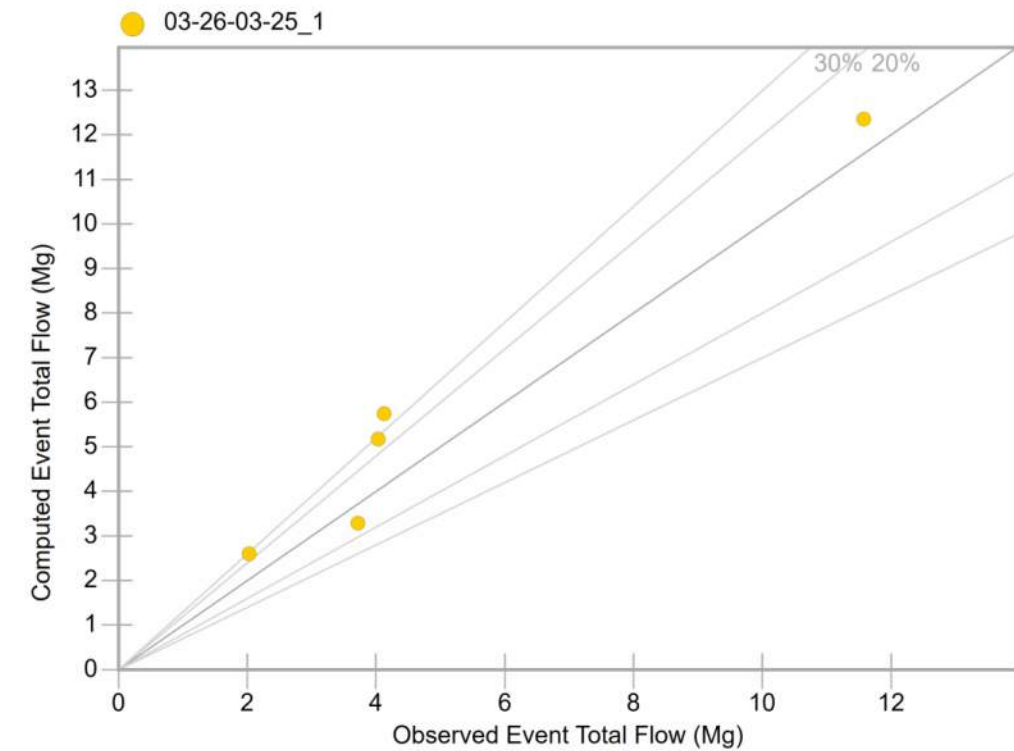


FM_36

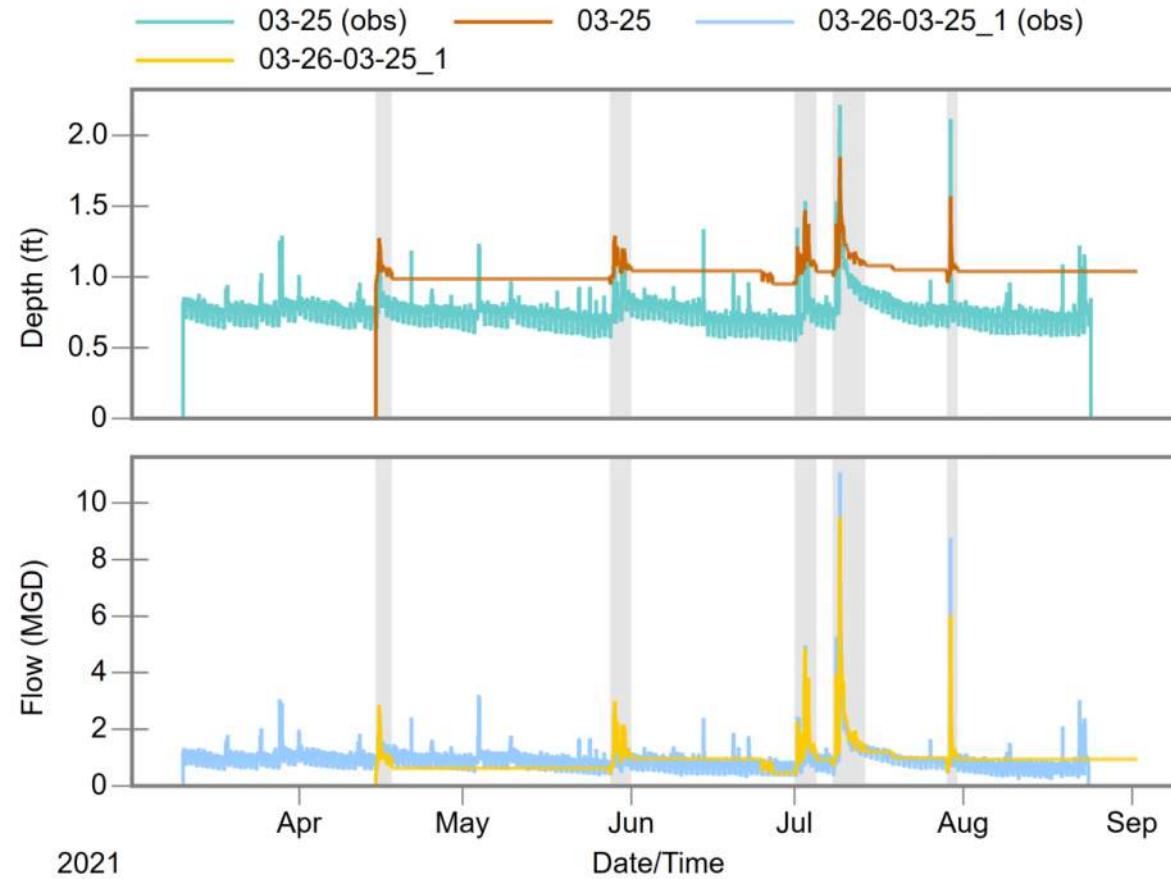
Peaks



Volumes

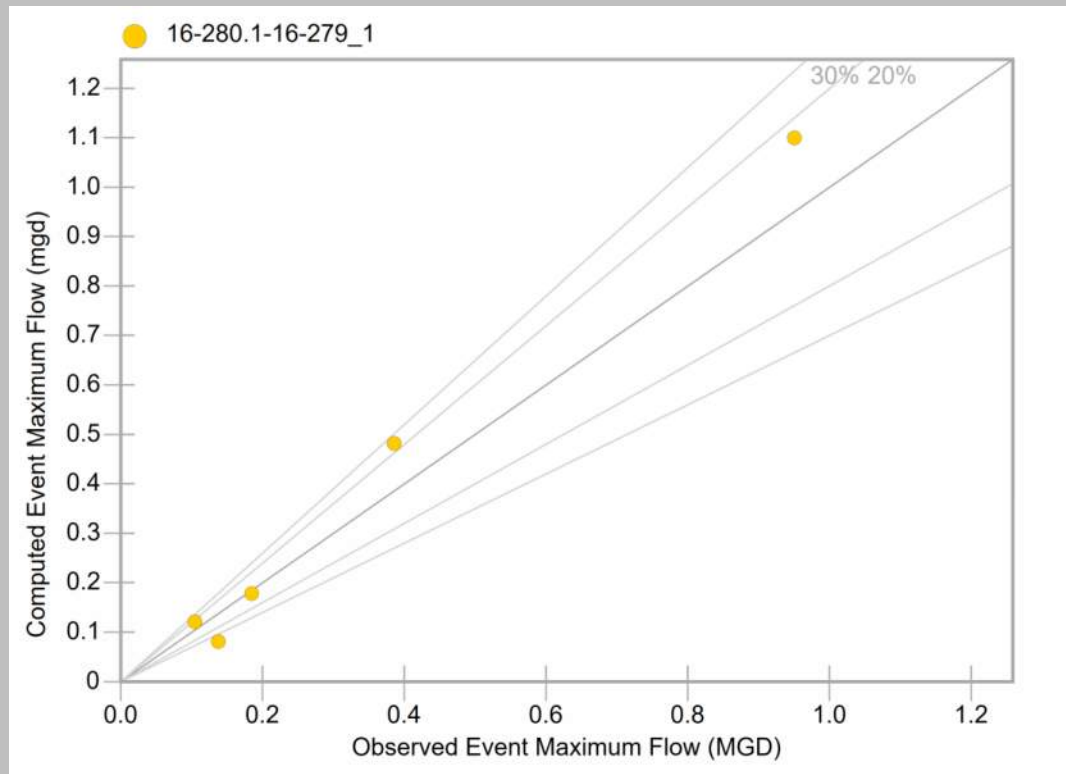


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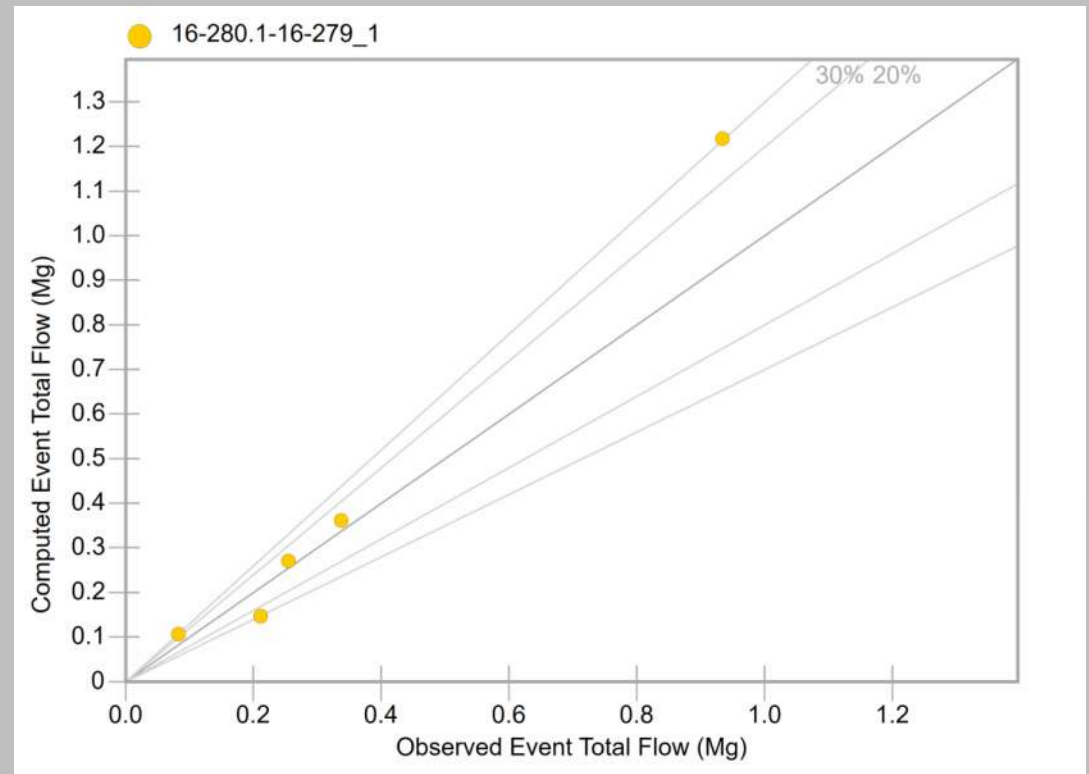


FM_37

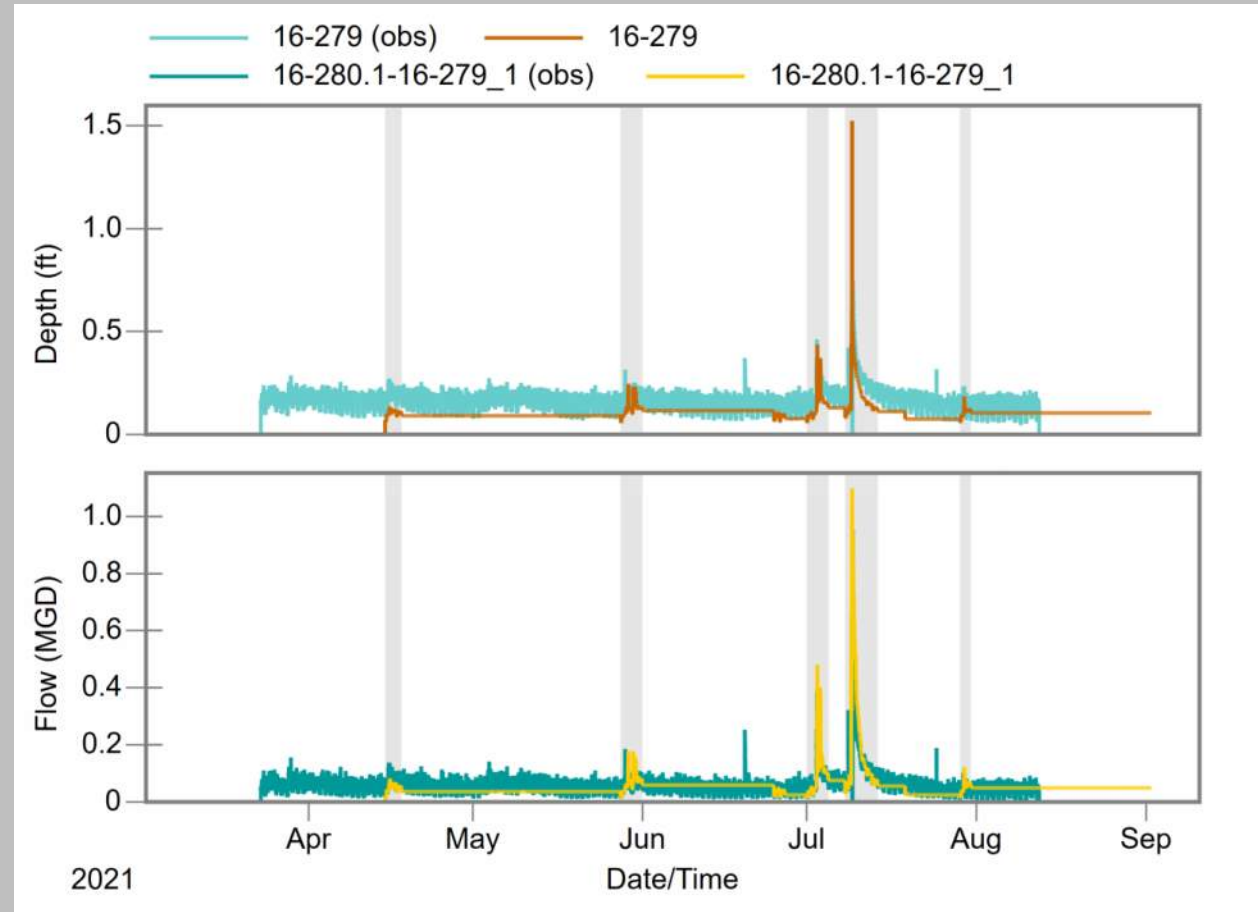
Peaks



Volumes

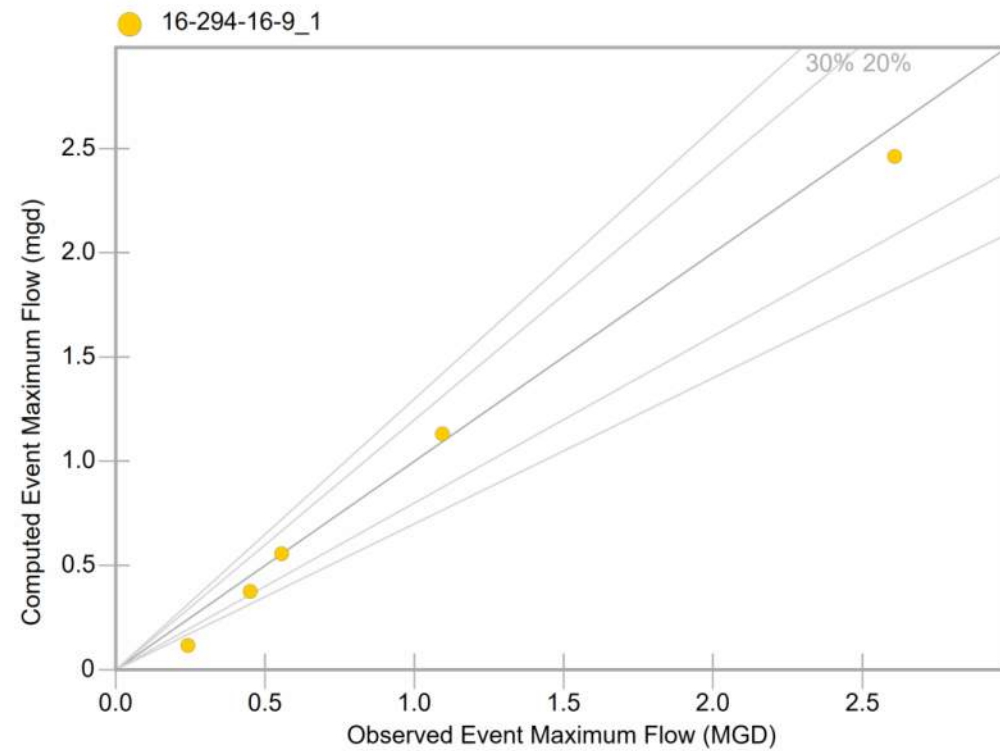


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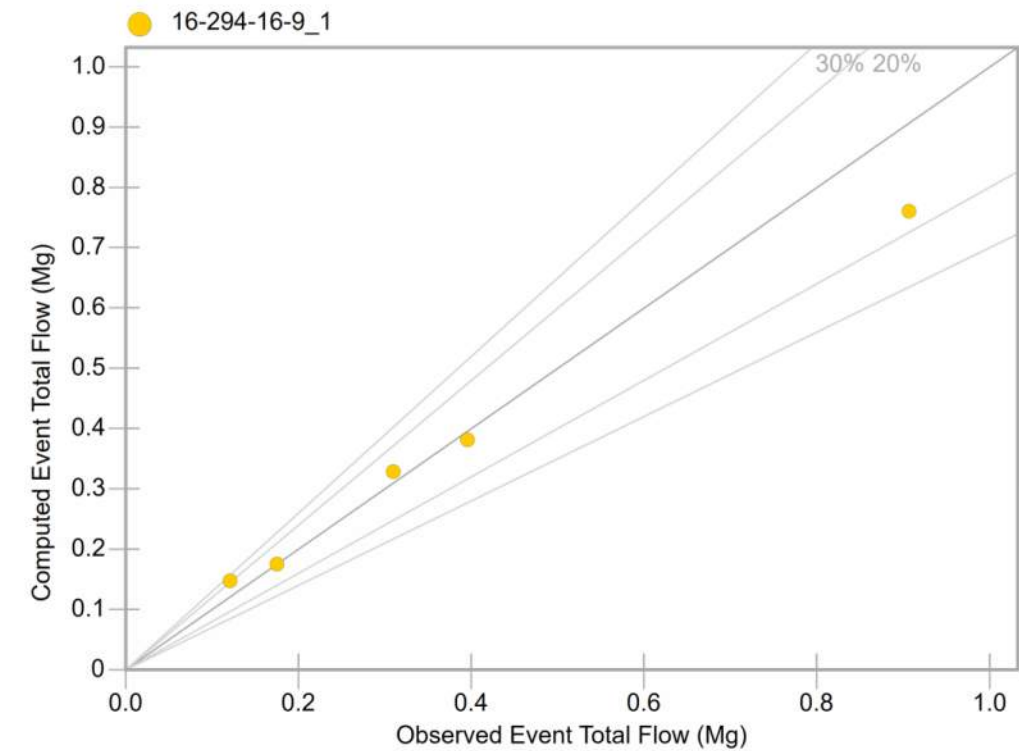


FM_38

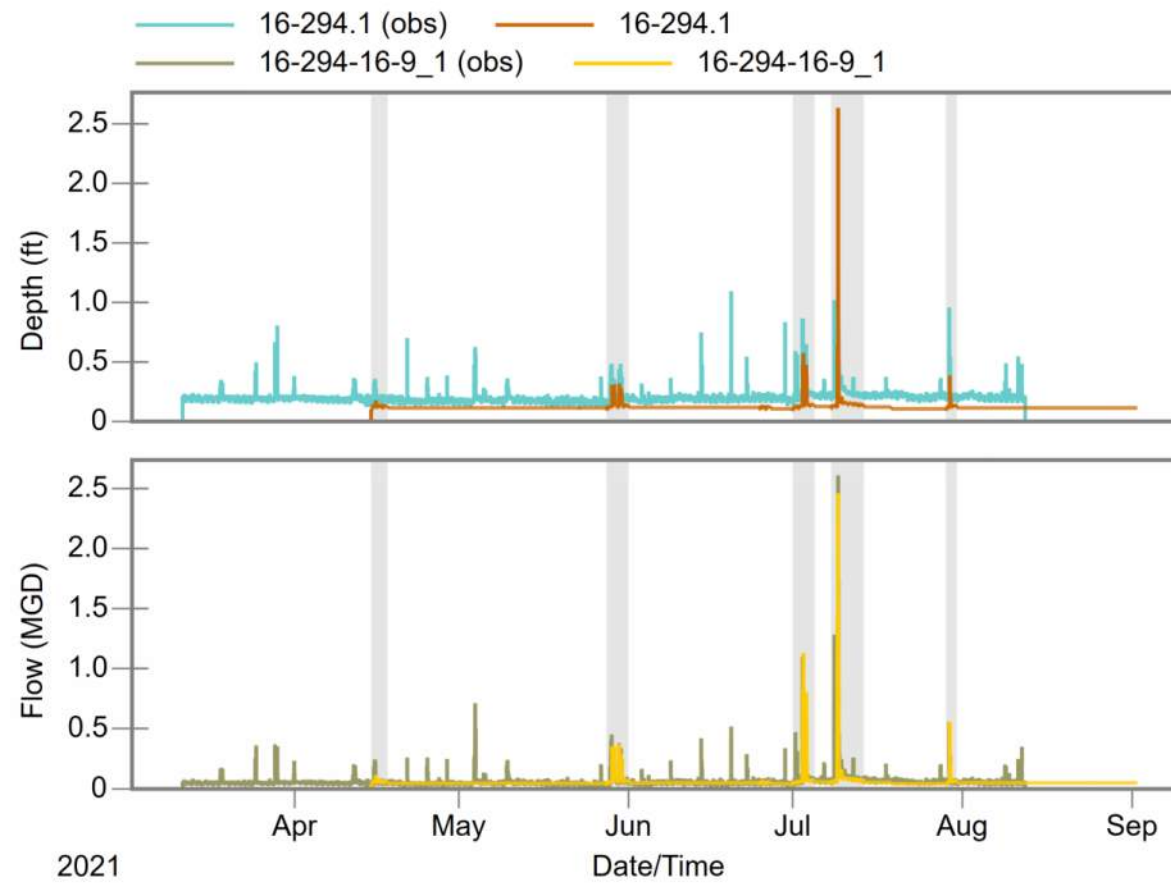
Peaks



Volumes

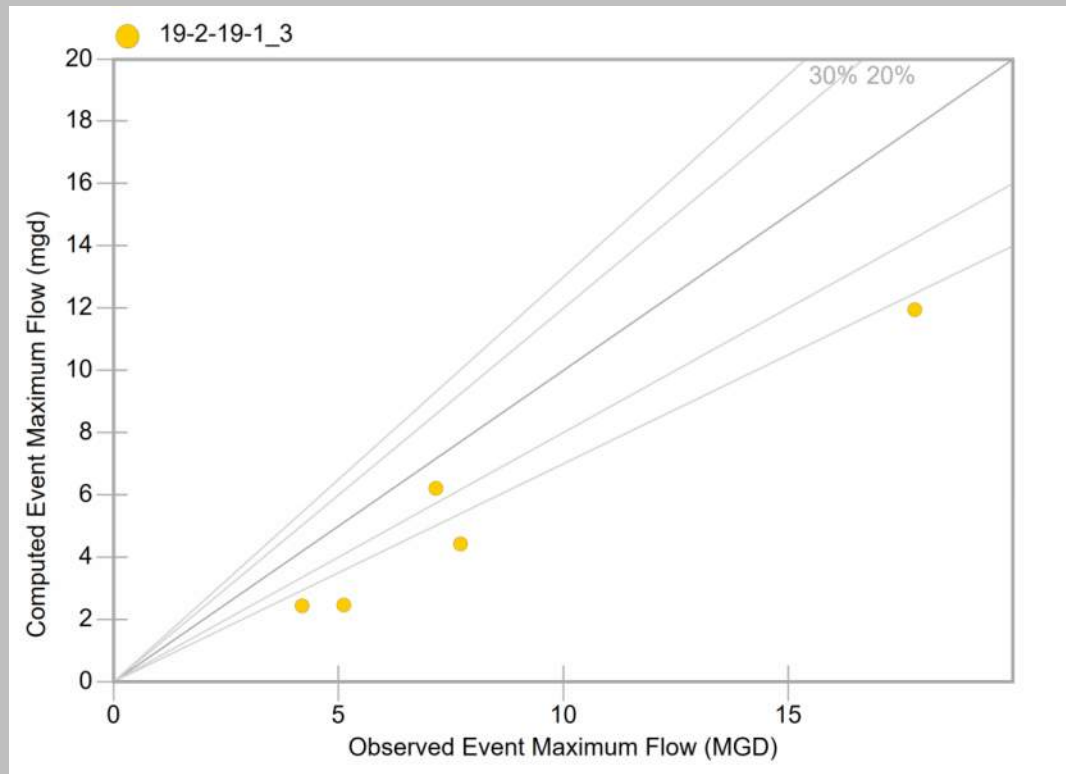


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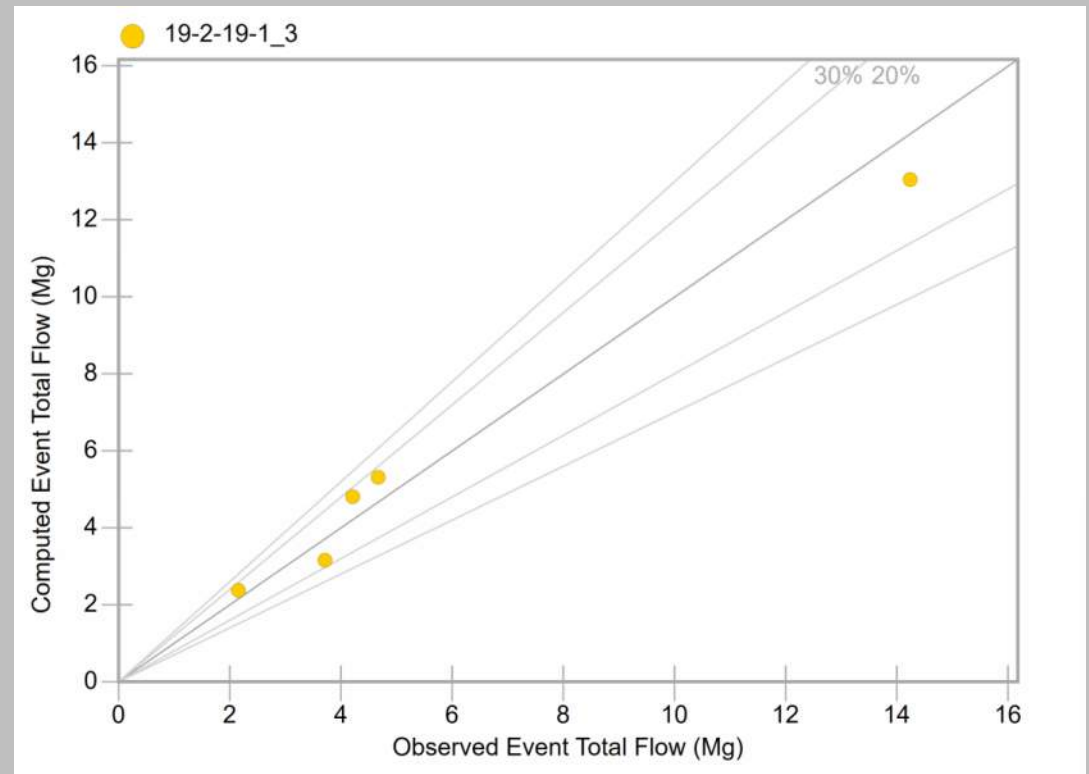


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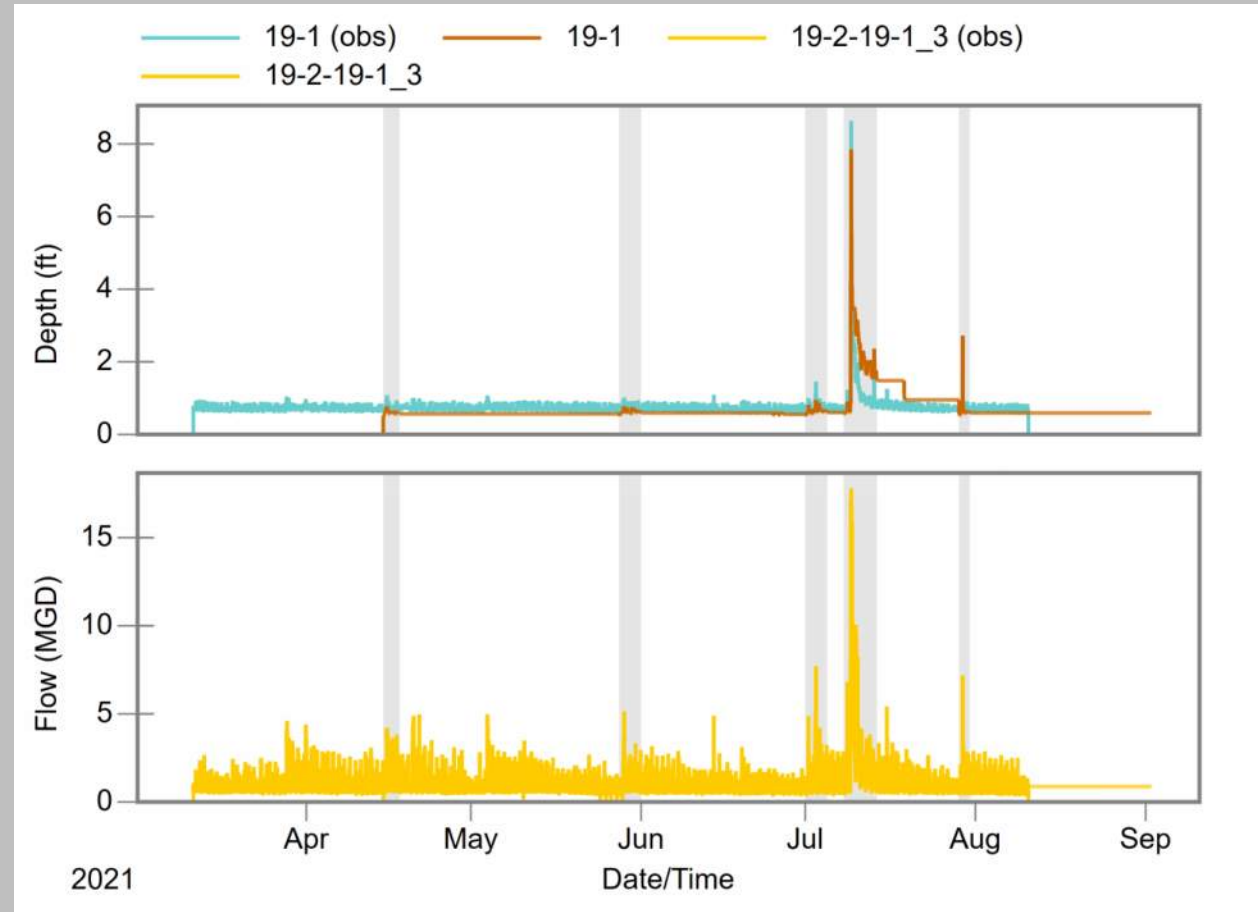
Peaks



Volumes

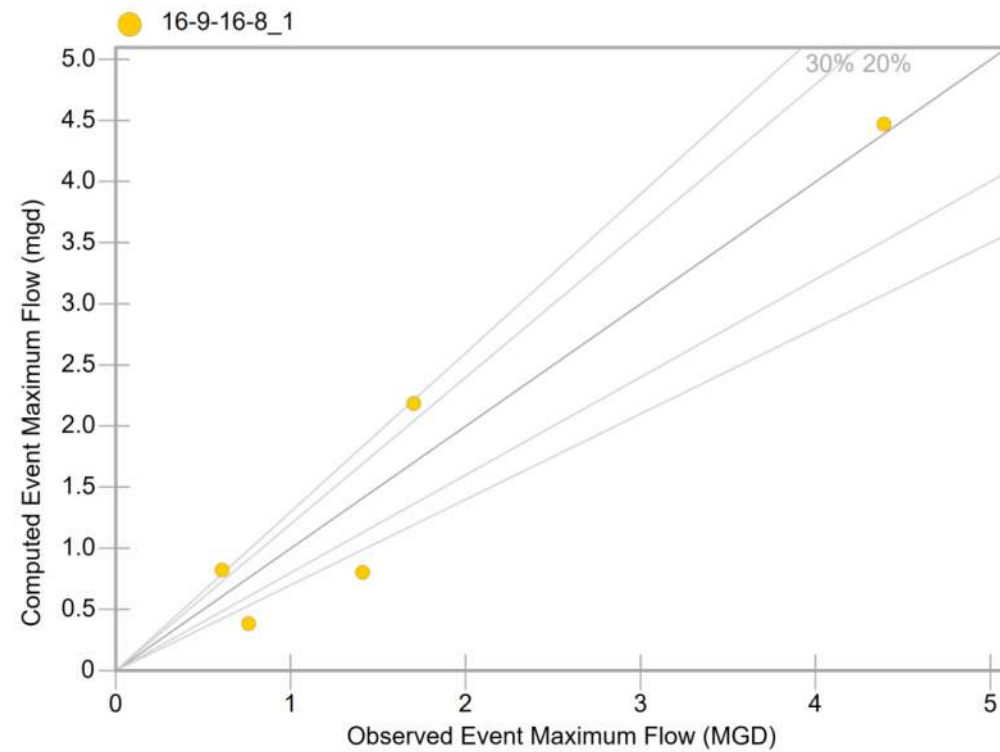


FM_39

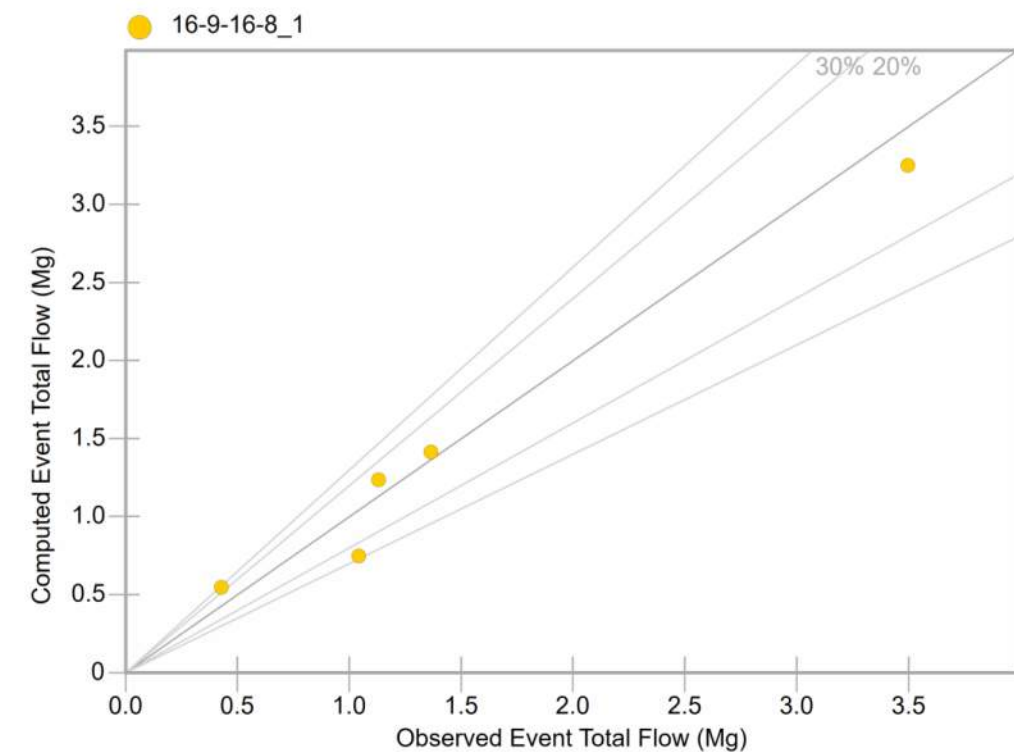


FM_40

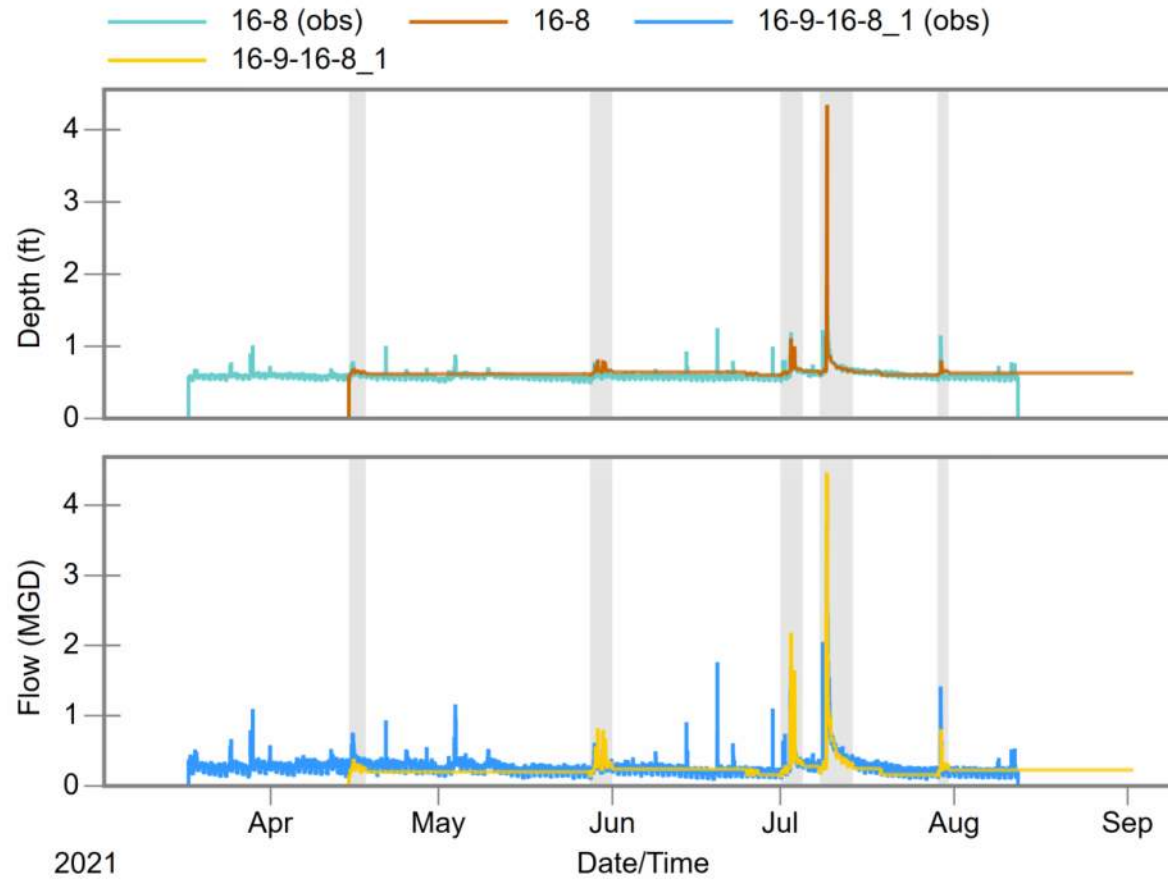
Peaks



Volumes



FM_40



Appendix E: Hubbells Lane Relief Sewer Cost Estimate Summary



Class 5 Cost Estimate			
Hubbells Lane Relief Sewer			
Item	Quantity	Total	Assumptions
Traffic Control	-	\$102,000	One lane traffic control
Demo Asphalt	11,830	\$156,000	13,200 SF
Dewatering	35	\$136,000	35 working days. Assume required for 60" install
36" PVC San	508	\$809,000	508 LF.
Tie-ins	1	\$20,000	1 tie in at siphon junction. New structures elsewhere
72" San Manholes	5	\$230,000	5 structures on 36" pipe (total 67 VF). 2 have 11 VF outside drop
Asphalt Patch	11,830	\$161,000	11830 SF.
Additional Items			
Bypass 36" flows	35	\$675,000	35 working days. 15% of project cost
60" PVC San & Remove ex.	600	\$1,911,000	600 LF.
96" San Manhole	2	\$100,000	2 structures total 24VF
102" San Manhole	1	\$60,000	1 structure 11 VF
15" Storm Sewer	300	\$110,000	300 LF. at \$300/foot plus 2 structures
Misc. Utility Relocation	1	\$100,000	
Total		\$4,570,000	

