FUSS & O'NEILL
One Financial Plaza, 15th Floor
Hartford, CT 06103
860.646.2469
www.fando.com

Corrective Actions and Further Investigation Recommendations
Hockanum Sewershed I/I Investigation

Ellington, Connecticut

June 2026

DRAFT

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Corrective Actions and Further Investigation Recommendations
Ellington I/I Investigation - Hockanum Sewershed

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Section 1. Summary Discussion

Section 1. Summary Discussion

- Recommendations by F&O are based upon the Flow Screening and Dye Dilution Sampling portions of the ongoing Infiltration and Inflow (I/I) investigations of the Hockanum Sewershed in the Town of Ellington. Approximately 79,500 LF of mainline sewer and 364 manholes are contained within the study area. The investigation included 2 nights of manhole screening inspections and 2 nights of flow dilution sampling. Approximately 56,700 LF mainline sewer was directly accessed during the flow dilution sampling with screening activities occurring in a portion of the remaining area.

- Within the study area where F&O conducted I/I investigations, only minor notable I/I was identified, limited to approximately 3,900 LF across three pipe runs - indicating strong overall integrity of the remaining sewer infrastructure in Ellington.

- In the southwestern portion of the Town, the following residential housing developments: Gasek Farms, Deer Valley Townhomes, and Stonebridge, a combination of sump pump and wastewater pump cycling was evident and is shown red shaded area on Figure ES-2.
    - As result of the observed varying flow from pumping activity, dye dilution sampling was not conducted in these areas, and further comprehensive flow monitoring and investigation is recommended in this area.
        - The evident extraneous flows derive from unknown sources including I/I, sump pump flows, portions of low pressure sewer, and small amounts of sewer use. F&O has no means of establishing how often the pumps cycle or if all sump pumps present were pumping during the investigation period.

- Recently the Ellington WPCA performed a camera inspection of the main trunk line along Windermere Ave. and the cross-country easement adjacent to the Hockanum River south of Windermere Avenue.
    - In an effort to confirm the CCTV observations, dye dilution sampling was conducted in a portion of the area.
        - Initially the injection pump was set up at MH 282A just east of the Windermere Ave. bridge crossing of the Hockanum River. The results of the downstream dye dilution sampling of the 20-inch pipe were sporadic and varied above and below the initial reading, which was attributed to the lack of a thorough mixing of the dye with sewer effluent.
        - To overcome this condition, the injection pump was relocated to MH 251 east to a location west of the Lower Butcher Road crossing of the Hockanum River approximately 2,200 ft upstream. The sampling results from along Windermere Avenue were also sporadic that was attributed to the laminar pipe flow. Proper mixing did not occur until the flow turned the corner to proceed downstream along the river. The concentrations attributed to the proper mixing described can be seen in Setups A5 and A8 in Table ES-1 below.
            - Concentrations of Setups A5 and A8 were nearly the same, thus showing that minimal to no infiltration was occurring. This substantiates the flow observed in the CCTV investigation carried out by the WPCA.

Table ES-1 - Setup A - Dye Dilution Concentrations	
Setup ID	**Upstream Concentration** *(Sensor Reading in parts per billion)*
SETUP A - MH251 - Outlet	
A1 - MH252	2.30
A2 - MH278	2.55
A3 - MH279	8.03
A4 -MH281	12.25
A5 - MH283	3.30
A6 - MH288	2.70
A7 - MH289	2.40
A8 - MH290	3.50

Computed flow – TR-16 Upper Value Allowable Flow = Extraneous flow

- Utilizing TR-16 guidelines to establish acceptable levels I&I, F&O computed the various flows in each pipe segment, then subtracted the TR-16's upper value allowable flow, which results in establishing the potential extraneous flow (I&I), to be removed from that segment.
- Because of the way the dye dilution samples are taken by scooping the effluent from the pipe, the dye dilution readings can vary. When the flow less the upper value allowable I&I is a positive number, corrected action may be warranted. If the flow less the upper value allowable I&I is a negative number, then no corrective action is needed because the TR-16 guide allows more I&I than the I&I that was determined.
    - Dye dilution result values are shown in *Table 1*. Dye dilution calculations and lengths of pipe segments measured as part of the dye dilution can be referred to in *Tables 2 and 3*.

- The weather plays an important role in observing I&I. When groundwater levels are high, the flow of I&I also increases. Included as background data is the weather data for the 3 months prior the field work and the month of the fieldwork. This documents rainfall events and local stream gauges during the time of the field work.

Recommended I/I Corrective Actions and Further Investigations

- The extraneous flow that was discovered via Screening and Dye Dilution investigations can be seen in the data (*Figures 1-5 and Tables 1-3*) observed under the following areas:

    - Setup B4 – Suspected source of flow anticipated between Manhole 732 to 733, a 310-foot segment of 8-inch pipe on Brookmeadow Lane.
        - Total extraneous flow above TR-16 upper value was 1,461 GPD.

    - Setup C1 and C2 – Suspected source of flow anticipated at Manhole 634, which was observed to have a leak around the base joint.
        - Total extraneous flow above TR-16 upper value was 2,632 GPD.

- The suggested recommendations for the 37 manholes screened (as shown in Sections 4 and 11) fall into categories described below:

1. Repair Visible Leaks
    a. MH634 – Screening Day 1 #6: Leak around base joint (1 & 2 O'clock)
    b. MH612 - Screening Day 1 #10: Trickle infiltration with wet table (7 O'clock)
    c. MH252 – Screening Day 1 #23: Two moderate leaks present around lower barrel near table (7 and 8 O'clock)
    d. MH878 – Screening Day 2 #7: Minor leak at invert of pipe from MH1109
    e. MH601 – Screening Day 2 #10: Trickle (4 O'clock)

2. Remove Debris from Manhole Inverts
    a. MH 606 – Screening Day 1 #5: Excess debris buildup
    b. MH 546 – Screening Day 2 #3: Excess debris at inlet from MH 547. This manhole also contains H2S buildup which is recommended to be cleaned, re-lined, and monitored.
    c. MH 679 – Screening Day 2 #11: Heavy grease and roots
    d. MH 690 – Screening Day 2 #14: (3 O'clock): Moderate roots

3. Additional Screening and CCTV Investigations - Includes investigating other manholes in surrounding area dependent on conditions observed when visited. Additional investigation is warranted to evaluate the housing developments mentioned below, which includes gathering record drawings and pump/flow records to be able to develop a theoretical vs. an actual sewer discharge volume for the following areas. Respective Housing Development authorities are recommended to expose castings to grade in order to allow for additional information to be obtained. From the development of this data, additional flow screening and dye dilution can be conducted at a later time:

    a. Figure ES-1:
        i. Pinney Hill and Cornfield Apartments – See **Section 4** / Screening Day 2 #9: Excessive flow observed from MH596
        ii. MHs 609 to 615 – See **Section 5**. Based off Dye Dilution Setup C1, excessive flow expected in this area
        iii. MHs 604 to 653 – See **Section 5**. Based off Dye Dilution Setup C1 and Screening Day 1 observations, excessive flow expected in this area

    b. Figure ES-2:
        i. Stonebridge Housing Development – MHs 559 to 1115
        ii. Deer Valley Townhomes Development – Buried manholes within this area are recommended to be located
        iii. Gasek Farms Housing Development
            1. MH557 to 558
            2. MH1102 to 561
            3. MH551 to 552
            4. MH546 to 550

SEGMENT FOR FUTURE INVESTIGATATION

Legend

Pipe Material

- Concrete Cylinder Pipe (CCP)
- Ductile Iron Pipe (DIP)
- Poly Vinyl Chloride (PVC)
- Unknown Material (UNK)

Pipe Size

- 4 in
- 8 in
- 10 in
- 12 in
- 18 in
- 20 in
- Unknown

- Active Manholes

1,000 500 0 1,000 Feet

N

TOWN OF ELLINGTON
I&I INVESTIGATION
FURTHER INVESTIGATION RECOMMENDATIONS

FIGURE ES-1
MAP 1C

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Legend

Pipe Material

- Concrete Cylinder Pipe (CCP)
- Poly Vinyl Chloride (PVC)
- Unknown Material (UNK)

Pipe Size

- 2.5 in
- 4 in
- 6 in
- 8 in
- 10 in
- 18 in
- 20 in
- Unknown
- Active Manholes



SEGMENT FOR FUTURE INVESTIGATATION

STONEBRIDGE HOUSING DEVELOPMENT

GASEK FARMS HOUSING DEVELOPMENT

DEER VALLEY TOWNHOMES

BURIED

RIDGEVIEW DR NO 1

RIDGEVIEW DR NO 2

CAMIDE KNOLL

ALLERIDGE DR

ANTHONY WAY

GASEK FARMS RD

ABBOTT RD

ELLRIDGE PL

STANDISH RD

SETTLERS WAY

OLD COUNTRY LA

PINNEY RD

WINDSORVILLE RD

WOODLAND TR

WINDERMERE AV

LOWER BUTCHER RD

VILLAGE ST

NUTMEG DR

282A

286

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800 400 0 800 Feet

N

TOWN OF ELLINGTON
I&I INVESTIGATION
FURTHER INVESTIGATION RECOMMENDATIONS

FIGURE ES-2
MAP 2

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Section 2. Hockanum Sewershed Infiltration/Inflow Investigation Process

Section 2. Hockanum Sewershed Infiltration/Inflow Investigation Process

Background

- The Town of Ellington wastewater collection system is composed of two (2) distinct sewersheds: The Crystal Lake Sewershed that flows into the adjoining community of Stafford and the Hockanum Sewershed that flows into the Town of Vernon. The Hockanum Sewershed is the focus of this investigation.

- Historically the documented dry weather wastewater flows have been significantly lower than the wet weather flows which indicate extraneous water flows are entering the wastewater collection system. The project area targets an older portion of the wastewater system and is generally described as the area bounded on the south by the Town of Vernon, and to the west by the limits of the sewer service area, to the north by Ellridge Place, Ridge View Way, and Stone Bridge Apartments, and to the east by Pinney Brook, Marsh Brook, and the Hockanum River.

Overview

- The investigation is a multi-step process with field work implemented during the overnight hours when residential-generated wastewater flows are the lowest.

    1. Meet with the WPCA Administrator to obtain the historical background of the area.
    2. Perform 2 nights of visual flow screening within the project area.
    3. Perform 2 nights of non-toxic dye dilution testing.
    4. Summarize and present the observations.
    5. Develop suggested recommendations and next steps.

Workflow

- Each step of the investigative process increased awareness of the wastewater system conditions.

    1. The manhole screening plan provided an investigation starting point. Based on the evening's observations, the screening plan was adjusted to follow high infiltration flows. The visual screening provided two conclusions: "yes", there is flow to be investigated, or "no", there is no flow to investigate further (refer to *Figures 1 and 2* in *Section 7* for the screening locations and results).

    2. Dye dilution testing requires an equipment setup at a high point in the sewershed to be investigated (refer to *Figures 3, 5 and 7* in *Section 7* for setup and sampling locations). The dye is injected into to the sewer at a constant rate to combine with the extraneous flow, which is then measured at various points downstream. The dye readings provide a computational basis for developing infiltration and inflow (I&I) flowrates (refer to *Figures 4, 6 and 8* in *Attachment 7* for observations made during sampling/screening and implied flowrates).

    3. Within the project setup sewershed, all of the upstream pipe lengths were tabulated. Based upon TR-16 allowances (250 GPD to 500 GPD per inch of diameter per mile as an acceptable range of I&I flow based on sewerage and condition) flow rates were then applied to the total lengths of upstream pipe.

4. Table 2 was developed, which computes the I&I flow values by sewershed for a high and low range (recommended by TR-16) when multiplied by the pipe lengths established in *Table 3*. If a delta value is above that of the TR-16 range of allowable flow and the computed I&I flow, it is in need of remedial action.

Interpretation of Data

The dye dilution results collected during this I&I Investigation require interpretation within the context of field conditions and hydraulic variables present during sampling. Both negative and positive flow deltas appear in Table 2; however, these values do not represent actual reductions or increases in flow. Instead, they reflect the inherent limitations of the dye dilution method, which operates as a mass-balance system. Minor variations in measured dye concentration - whether higher or lower between sampling points - can occur due to incomplete dye mixing, background sewer usage, and the hydraulic characteristics of the collection system.

Because of these factors, a small concentration difference falls within the expected range of measurement variability and do not indicate the presence of inflow and infiltration. The following sections summarize the conditions and conclusions for each setup.

Setup A

Dye dilution results for Setup A indicate negligible I&I, despite the presence of both negative and positive flow deltas in Table 2. Several hydraulic and operational factors influenced the accuracy of concentration measurements:

- The monitored interceptor is a 20-inch pipe flowing approximately half-full, producing substantial background flow volume and turbulence that inhibit uniform dye mixing.
- Minor, unavoidable sewer usage occurred during the sampling window.
- The mass-balance nature of dye dilution means that a slightly lower concentration at one point may mathematically appear as added flow at another, even when no I&I is present.

Given these conditions, the measured concentrations (e.g., 3.30 ppb at A5 vs. 3.50 ppb at A8) are considered hydraulically equivalent for the purposes of I&I evaluation. These values fall within the expected variability range for a large interceptor under active flow, supporting the conclusion of no measurable I&I contribution in Setup A.

Setup B:

Setup B results are more straightforward due to the smaller system scale and favorable hydraulic conditions:

- All sewer mains in this area are 8 inches in diameter, resulting in lower flow volumes and improved dye mixing.
- Very low nighttime sewer usage was observed during sampling, reducing background variability.
- Concentration values in Table 2 exhibit consistent trends with minimal deviation.

These conditions provide a high level of confidence that the dye dilution results accurately reflect system behavior, and the data indicates that measurable I&I was observed within at Setup B4.

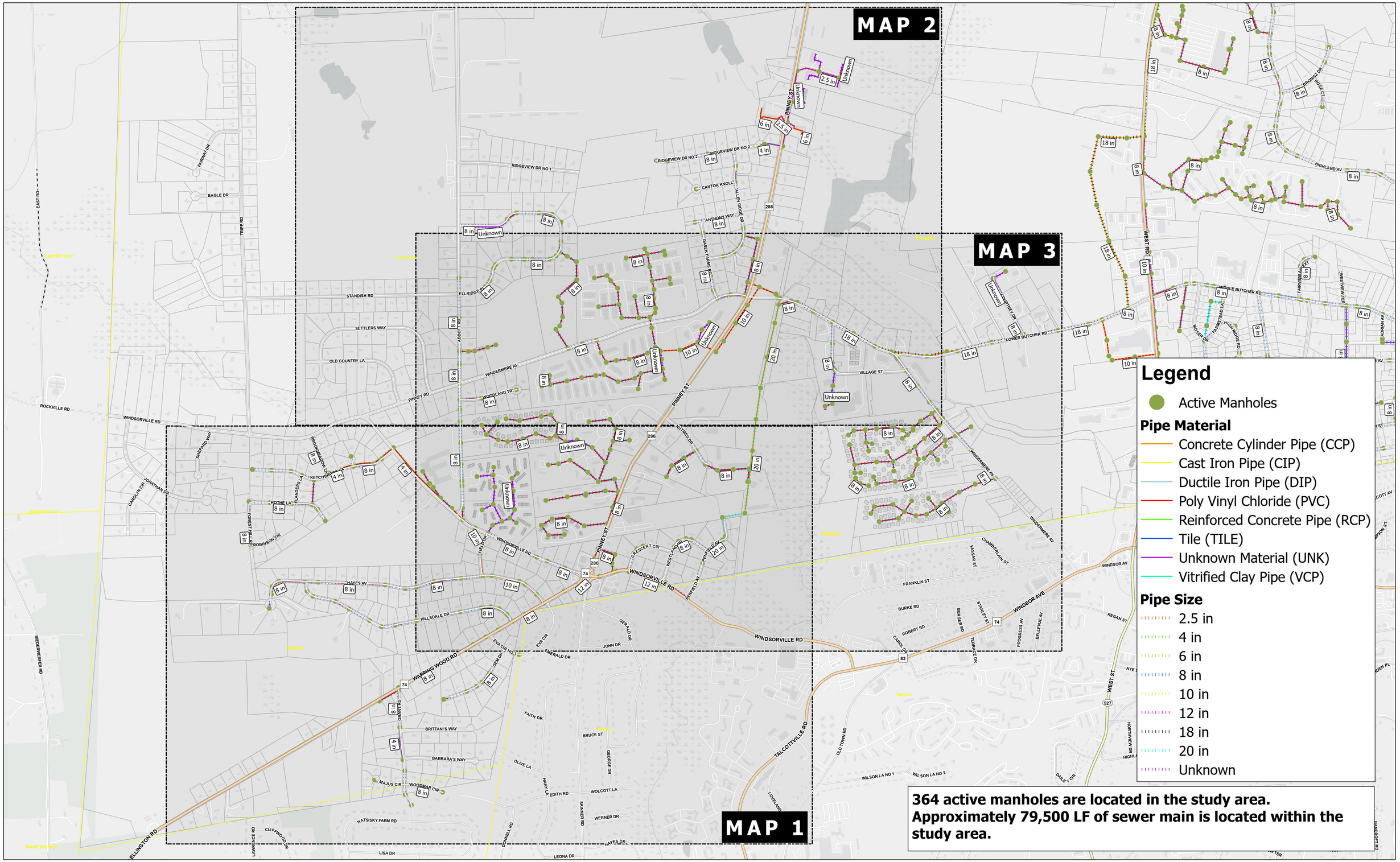
Setup C:

Setup C includes a combination of conditions observed in both Setups A and B, with several locations affected by large pipe diameters, deep manhole structures, and debris that limited dye homogeneity.

1. Setups C1 and C2
    - Dye dilution results correlate with findings from the manhole screening investigation, which identified a leak at Manhole 634.
    - The dye data confirm this location as a verifiable inflow source, consistent with pre-dilution observations.

2. Setups C3 through C6
    - These locations involve larger diameter pipes at depths exceeding 20 feet, along with manholes containing debris and shallow slopes (notably Manhole 606), all of which hindered uniform dye mixing.
    - Despite these limitations, the measured concentrations (16.80 vs. 17.50 ppb) are considered hydraulically equivalent for dye dilution purposes.
    - Visual flow assessments conducted during sampling further support the conclusion that these segments represent negligible I&I sources.

Section 3. Figure 1 – I&I Investigation Overview Map



Legend

- Active Manholes

Pipe Material

- Concrete Cylinder Pipe (CCP)
- Cast Iron Pipe (CIP)
- Ductile Iron Pipe (DIP)
- Poly Vinyl Chloride (PVC)
- Reinforced Concrete Pipe (RCP)
- Tile (TILE)
- Unknown Material (UNK)
- Vitrified Clay Pipe (VCP)

Pipe Size

- 2.5 in
- 4 in
- 6 in
- 8 in
- 10 in
- 12 in
- 18 in
- 20 in
- Unknown

364 active manholes are located in the study area.
Approximately 79,500 LF of sewer main is located within the study area.

1,600 800 0 1,600 Feet

N

TOWN OF ELLINGTON
I&I INVESTIGATION
OVERVIEW MAP

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Section 4. Figures 2 & 3 – Manhole Screening Investigations

SLIGHT DAMPNESS
UPSTREAM TOWARDS MH751

UNABLE TO ACCESS

TRICKLE INFILTRATION &
WET TABLE (7 O'CLOCK)

LEAK AROUND BASE
JOINT (1 & 2 O'CLOCK)

EXCESS DEBRIS BUILDUP

FLOW OBSERVED UPSTREAM
TOWARDS MH651

EXCESSIVE FLOW OBSERVED
UPSTREAM TOWARDS MH597

12 KETCHBROOK PUMP STATION

Legend

Pipe Material

- Concrete Cylinder Pipe (CCP)
- Ductile Iron Pipe (DIP)
- Poly Vinyl Chloride (PVC)
- Unknown Material (UNK)

Pipe Size

- 4 in
- 8 in
- 10 in
- 12 in
- 20 in
- Unknown

- Active Manholes

[#] ORDER NUMBER OF SCREENED MANHOLE
REFER TO SECTION 11 FOR PHOTOS

800 400 0 800 Feet

N

TOWN OF ELLINGTON
I&I INVESTIGATION
DAY 1 - SCREENING PART 1 - 4/1/26

FIGURE 2-1
MAP 1

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Legend

Pipe Material

- Concrete Cylinder Pipe (CCP)
- Poly Vinyl Chloride (PVC)
- Unknown Material (UNK)

Pipe Size

- 2.5 in
- 4 in
- 6 in
- 8 in
- 10 in
- 18 in
- 20 in
- Unknown

- Active Manholes

[#] ORDER NUMBER OF SCREENED MANHOLE
REFER TO SECTION 11 FOR PHOTOS

TWO MODERATE LEAKS PRESENT AT LOWER BARREL NEAR TABLE (7 & 8 O'CLOCK)

800 400 0 800 Feet

N

TOWN OF ELLINGTON
I&I INVESTIGATION
DAY 1 - SCREENING PART 1 - 4/1/26

FIGURE 2-2
MAP 2

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Legend

Pipe Material

- Concrete Cylinder Pipe (CCP)
- Poly Vinyl Chloride (PVC)
- Unknown Material (UNK)

Pipe Size

- 2.5 in
- 4 in
- 6 in
- 8 in
- 10 in
- 18 in
- 20 in
- Unknown

- Active Manholes

[#] ORDER NUMBER OF SCREENED MANHOLE
REFER TO SECTION 11 FOR PHOTOS

TRICKLE FLOW OBSERVED FROM MH531 AND MH376

FLOW AT MH519 (4) OBSERVED TO VISUALLY MATCH FLOW PRESENT AT MH530 (6) WHICH IMPLIES NO ADDITIONAL I&I AT THIS TIME

H2S ACCUMULATION IN MH546 BARREL

MODERATE DEBRIS AT MH547 INLET

MINOR LEAK AT PIPE INVERT FROM MH1109 (SOUTH)

EVIDENCE OF FLOW SURGES FROM PUMP CYCLING FROM MULTIPLE DIRECTIONS. ESTIMATED CHANGE FROM 3/4" TO 3".

RIDGEVIEW DR NO 1
RIDGEVIEW DR NO 2
ABBOTT RD
ELLRIDGE PL
STANDISH RD
SETTLERS WAY
OLD COUNTRY LA
PINNEY RD
WINDSORVILLE RD
WOODLAND TR
WINDERMERE AV
CAMIDE KNOLL
ALLERTON DR
ANTHONY WAY
OASIS FARMS RD
WINDERMERE AV
LOWER BUTCHER RD
VILLAGE ST
NUTMEG DR
282A

800 400 0 800 Feet

N

TOWN OF ELLINGTON
I&I INVESTIGATION
DAY 4 - SCREENING PART 2 - 4/9/26

FIGURE 3-1
MAP 2

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MODERATE ROOTS
(3 O'CLOCK)

HEAVY GREASE
& ROOTS

TRICKLE (4 O'CLOCK)

EXCESS FLOW
OBSERVED
FROM MH597

13
14
12
11
10
9

282A

ORDER NUMBER OF SCREENED MANHOLE
REFER TO SECTION 11 FOR PHOTOS

Legend

- Active Manholes

Pipe Material

- Concrete Cylinder Pipe (CCP)
- Ductile Iron Pipe (DIP)
- Poly Vinyl Chloride (PVC)
- Unknown Material (UNK)

Pipe Size

- 4 in
- 8 in
- 10 in
- 12 in
- 18 in
- 20 in
- Unknown

800 400 0 800 Feet

N

TOWN OF ELLINGTON
I&I INVESTIGATION
DAY 4 - SCREENING PART 2

FIGURE 3-2
MAP 3

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Section 5. Figures 4 & 5 – Dye Dilution Setups A, B, and C

MINIMAL INCREASE OF I&I

MEASURABLE INCREASE OF I&I

UNKNOWN PROBABILITY OF I&I

C = DYE CONCENTRATION READING IN PARTS PER BILLION

Δ = DELTA FLOW IN GALLONS PER DAY & GALLONS PER DAY PER INCH DIAMETER MILE FROM PREVIOUS SAMPLE POINT

A5 - MH 283:
C = 3.30 ppb

A4 - MH 281:
C= 12.25 ppb

A3 - MH 279:
C= 8.03 ppb (AFTER BRANCH)

A2 - MH 278:
C= 5.20 ppb

A1 - MH 252:
C = 2.30 ppb

SETUP A

A6 - MH 288:
C= 2.70 ppb

A7 - MH 289:
C= 2.40 ppb

A8 - MH 290:
C= 3.50 ppb

282A

Legend

- Active Manholes

Pipe Material

- Concrete Cylinder Pipe (CCP)
- Cast Iron Pipe (CIP)
- Ductile Iron Pipe (DIP)
- Poly Vinyl Chloride (PVC)
- Reinforced Concrete Pipe (RCP)
- Unknown Material (UNK)
- Vitrified Clay Pipe (VCP)

Pipe Size

- 2.5 in
- 4 in
- 6 in
- 8 in
- 10 in
- 18 in
- 20 in
- Unknown

1,000 500 0 1,000 Feet

N

TOWN OF ELLINGTON
I&I INVESTIGATION
DYE DILUTION SETUP A

FIGURE 4-1
MAP 3A

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4 - KETCHBROOK PUMP STATION WETWELL:
C = 68 ppb
Δ = 1,696 GPD
3,610 GPD/in*dia*mi

3 - MH 732:
C = 145 ppb
Δ = 10 GPD
23 GPD/in*dia*mi

2 - MH 731:
C = 146 ppb
Δ = 375 GPD
98 GPD/in*dia*mi

1 - MH 740:
C = 195.25 ppb
Minimal Flow Observed
Δ = 0 GPD
0 GPD/in*dia*mi

SETUP B - MH 746

WINDSORVILLE RD
TRIPP RD
KETCHBROOK LA
ROTHE LA
FLANDERS LA
FOREST HILL RD
ROBINSON CIR
Ellington



Legend

Pipe Material
- Poly Vinyl Chloride (PVC)
- Unknown Material (UNK)

Pipe Size
- 4 in
- 8 in
- Active Manholes

MINIMAL INCREASE OF I&I
MEASURABLE INCREASE OF I&I
UNKNOWN PROBABILITY OF I&I

C = DYE CONCENTRATION READING IN PARTS PER BILLION

Δ = DELTA FLOW IN GALLONS PER DAY & GALLONS PER DAY PER INCH DIAMETER MILE FROM PREVIOUS SAMPLE POINT

250 125 0 250 Feet

N

TOWN OF ELLINGTON
I&I INVESTIGATION
DYE DILUTION SETUP B

FIGURE 5-1
MAP 1A

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B4 - KETCHBROOK PUMP STATION WETWELL:

C = 68 ppb

Δ = 1,696 GPD

3,610 GPD/in*dia*mi

B3 - MH 732:

C = 145 ppb

Δ = 10 GPD

23 GPD/in*dia*mi

B2 - MH 731:

C = 146 ppb

Δ = 375 GPD

98 GPD/in*dia*mi

B1 - MH 740:

C = 195.25 ppb

Minimal Flow Observed

Δ = 0 GPD

0 GPD/in*dia*mi

SETUP B - MH 746

C1 - MH 611:

C= 22.30 ppb

Δ = 6,544 GPD

213 GPD/in*dia*mi

SETUP C

C6 - MH 596:

C= 17.50 ppb

Δ = N/A

C5 - MH 604:

C= 18.50 ppb

Δ = N/A

C2 - MH 609:

C= 19.50 ppb

Δ = 1,398 GPD

1,513 GPD/in*dia*mi

C3 - MH 606:

C= 16.80 ppb

Δ = 1,790 GPD

251 GPD/in*dia*mi

C4 - MH 607:

C= 17.00 ppb

Δ = N/A

MINIMAL INCREASE OF I&I

MEASURABLE INCREASE OF I&I

UNKNOWN PROBABILITY OF I&I

C = DYE CONCENTRATION READING IN PARTS PER BILLION

Δ = DELTA FLOW IN GALLONS PER DAY & GALLONS PER DAY PER INCH DIAMETER MILE FROM PREVIOUS SAMPLE POINT

Legend

Pipe Material

- Concrete Cylinder Pipe (CCP)
- Ductile Iron Pipe (DIP)
- Poly Vinyl Chloride (PVC)
- Unknown Material (UNK)

Pipe Size

- 4 in
- 8 in
- 10 in
- 12 in
- 18 in
- 20 in
- Unknown
- Active Manholes

1,000 500 0 1,000 Feet

N

TOWN OF ELLINGTON
I&I INVESTIGATION
DYE DILUTION SETUP B & C

FIGURE 5-2
MAP 1C

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Section 6. Table 1 – Allowable I&I

TABLE 1 - ALLOWABLE I&I

		(A) Delta Flow in Pipe Segment		(B) TR-16 Upper Value Allowable Flow[1]		(A-B) Extraneous Flow Above TR-16 Upper Value		Notes
Setup	Sample #	GPM	GPD	GPM	GPD	GPM	GPD	
Setup B	B1	-	-	-	-	-	-	Initial Flow Determination
	B2	0.3	375	1.3	1,915	*N/A*	*N/A*	A-B is <0: No Action Needed
	B3	0.01	10	0.2	222	*N/A*	*N/A*	A-B is <0: No Action Needed
	B4	1.2	1,696	0.2	235	1.0	1,461	Potential source of I&I
Setup C	C1	-	-	-	-	-	-	Initial Flow Determination
	C2	1.0	1,398	0.1	95	0.9	1,304	Potential source of I&I
	C3	1.2	1,790	0.3	462	0.9	1,328	Potential source of I&I
	[2]C4	0.0	0.0	1.5	2,200	*N/A*	*N/A*	A-B is <0: No Action Needed
	[2]C5	0.0	0.0	0.6	814	*N/A*	*N/A*	A-B is <0: No Action Needed
	[2]C6	0.0	0.0	5.3	7,649	*N/A*	*N/A*	A-B is <0: No Action Needed

Notes:

1: TR-16 Upper Value Allowable Flow: 0.35 (GPM/In-dia-mi) / 500 (GPD/In-dia-mi)

2: Delta Flow values (A) are rounded because dye concentration readings in Setup C4 to C6 were slightly higher than Setup C3; these variations fall within expected instrument tolerance.

3: For readability, all flows in the table are presented directly in GPM and GPD, even though TR16 limits are expressed in GPM/GPD per (in-dia-mi).

Section 7. Table 2 – Dye Dilution Calculations

TABLE 2 - DYE DILUTION CALCULATIONS

Date	Setup ID	Upstream Concentration (Sensor Reading) (ppb)	Upstream Flow Rate Q (mL/min)	Upstream Flow Rate Q (GPM)	Delta (GPM)	Delta (GPD)	Section Pipe Length (feet)	Section Pipe Length (mi)	Section Pipe Diameter(s) (in)	in dia*mi	Delta (GPD/ in dia*mi)	Notes
4/6/2026	**SETUP A** - MH251 - Outlet											
	A1 - MH252	2.30										
	A2 - MH278	2.55										
	A3 - MH279	8.03										
	A4 -MH281	12.25										Refer to
	A5 - MH283	3.30										Section 1 - Summary Discussion
	A6 - MH288	2.70										
	A7 - MH289	2.40										
	A8 - MH290	3.50										
4/8/2026	**SETUP B** - MH746 - Outlet			0.8								
	B1 - MH740	195.25	2970.55	0.8	0.0	-	2125.00	0.402	8	3.22	0	
	B2 - MH731	146.00	3972.60	1.0	0.3	375	2528.00	0.479	8	3.83	98	
	B3 - MH732	145.00	4000.00	1.0	0.01	10	293.00	0.055	8	0.44	23	
	B4 - Ketchbrook Pump Station Wetwell Inlet	68.00	8529.41	2.2	1.2	1,696	310.00	0.059	8	0.47	3,610	Potential source of I&I - See Table 1
4/8/2026	**SETUP C -** MH612 - W Drop Inlet			6.8								
	C1 - MH611	22.30	26008.97	6.8	0.0	-	125.0	0.024	8	0.19	0	
	C2 - MH609	19.50	29743.59	7.7	1.0	1,398	488.0	0.092	10	0.92	1,513	Potential source of I&I - See Table 1
	C3 - MH606 - Post-Drop Inlet	16.80	34523.81	9.0	1.2	1,790	3134.0	0.594	4/8	4.40	407	Potential source of I&I - See Table 1
	C4 - MH607	17.00	34117.65	8.9	(0.1)	(152)	333.0	0.063	12	0.76	(201)	Rounded to 0 as seen in Table 1
	C5 - MH604	18.50	31351.35	8.2	(0.7)	(1,036)	897.0	0.170	8/12	1.63	(636)	Rounded to 0 as seen in Table 1
	C6 - MH596	17.50	33142.86	8.6	0.9	1,273	10097.0	1.912	8	15.30	83	Rounded to 0 as seen in Table 1

Dye Feed Rate	400	mL/min
Tank Dye Concentration	1450	ppb
Refer to Table 3 for Pipe Length Breakdown		

Section 8. Table 3 – Dye Dilution Setup Pipe Lengths

TABLE 3 - DYE DILUTION SETUP PIPE LENGTHS				
Location	**Length of Pipe (ft)**	**Length of Pipe (mi)**	**Pipe Size (in.)**	**in*dia*mi**
Setup A				
A1 - MH252	504	0.10	18	1.72
	11451	2.17	8	17.35
Total	11955	2.26	8/18	**19.07**
A2 - MH278	582	0.11	18	**1.98**
A3 - MH279	337	0.06	18	1.15
	1266	0.24	8	1.92
Total	1603	0.30	8/18	**3.07**
A4 - MH281	266	0.05	8	**0.40**
A5 - MH283	90	0.02	20	0.34
	2441	0.46	10	4.62
	18071	3.42	8	27.38
	447	0.08	4	0.34
Total	21049	3.99	4/8/10/20	**32.68**
A6 - MH288	258	0.05	18	**0.88**
A7 - MH289	476	0.09	20	**1.80**
A8 - MH290	434	0.08	20	**1.64**
Setup B				
B1 - MH746	2125	0.40	8	**3.22**
B2 - MH731	2528	0.48	8	**3.83**
B3 - MH732	293	0.06	8	**0.44**
B4 - KBPSWW	310	0.06	8	**0.47**
Setup C				
C1 - MH611	125	0.02	8	0.19
C2 - MH609	488	0.09	10	**0.92**
C3 - MH606	459	0.09	4	0.35
	2675	0.51	8	4.05
Total	3134	0.59	4/8	**4.40**
C4 - MH607	333	0.06	12	**0.76**
C5 - MH604	354	0.07	12	0.80
	543	0.10	8	0.82
Total	897	0.17	8/12	**1.63**
C6 - MH596	10097	1.91	8	**15.30**

Section 9. Rainfall Data

Bradley International Airport Station KCTWINDS53
January 2026 – April 2026

Elev **82** ft, **41.93** °N, **72.63** °W

LRG Weather - KCTWINDS94

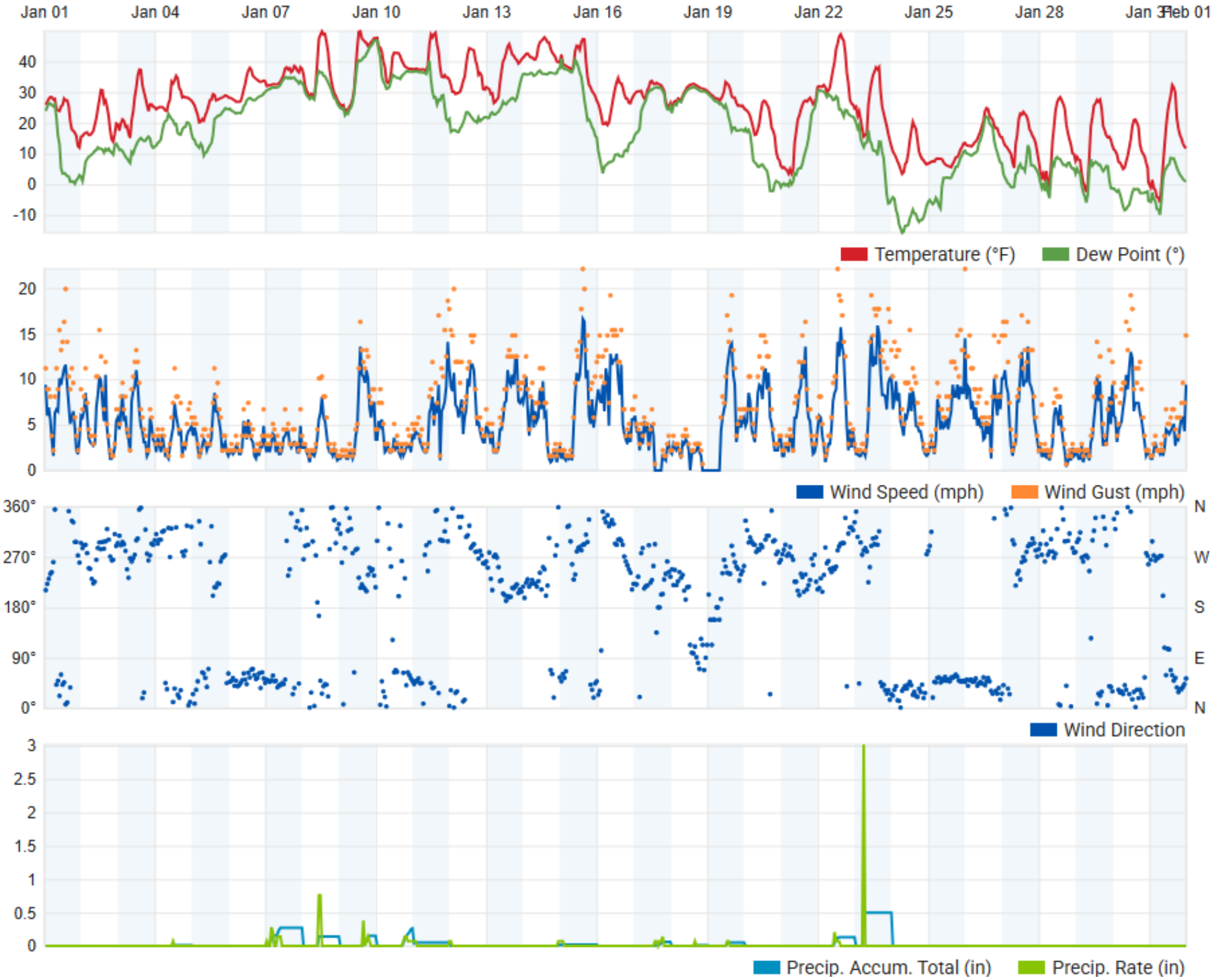
FORECAST FOR WINDSOR LOCKS, CT

January 1, 2026 - January 31, 2026

	High	Low	Average
Temperature	**49.8** °F	**-8.2** °F	**25.1** °F
Dew Point	**46.8** °F	**-16.8** °F	**16.0** °F
Humidity	**97** %	**25** %	**70** %
Precipitation	**1.68** in	--	--

	High	Low	Average
Wind Speed	**16.6** mph	**0.0** mph	**2.1** mph
Wind Gust	**22.1** mph	--	**2.9** mph
Wind Direction	--	--	**SSW**
Pressure	**30.70** in	**29.31** in	--

January 1, 2026 - January 31, 2026



Elev **82** ft, **41.93** °N, **72.63** °W

LRG Weather - KCTWINDS94

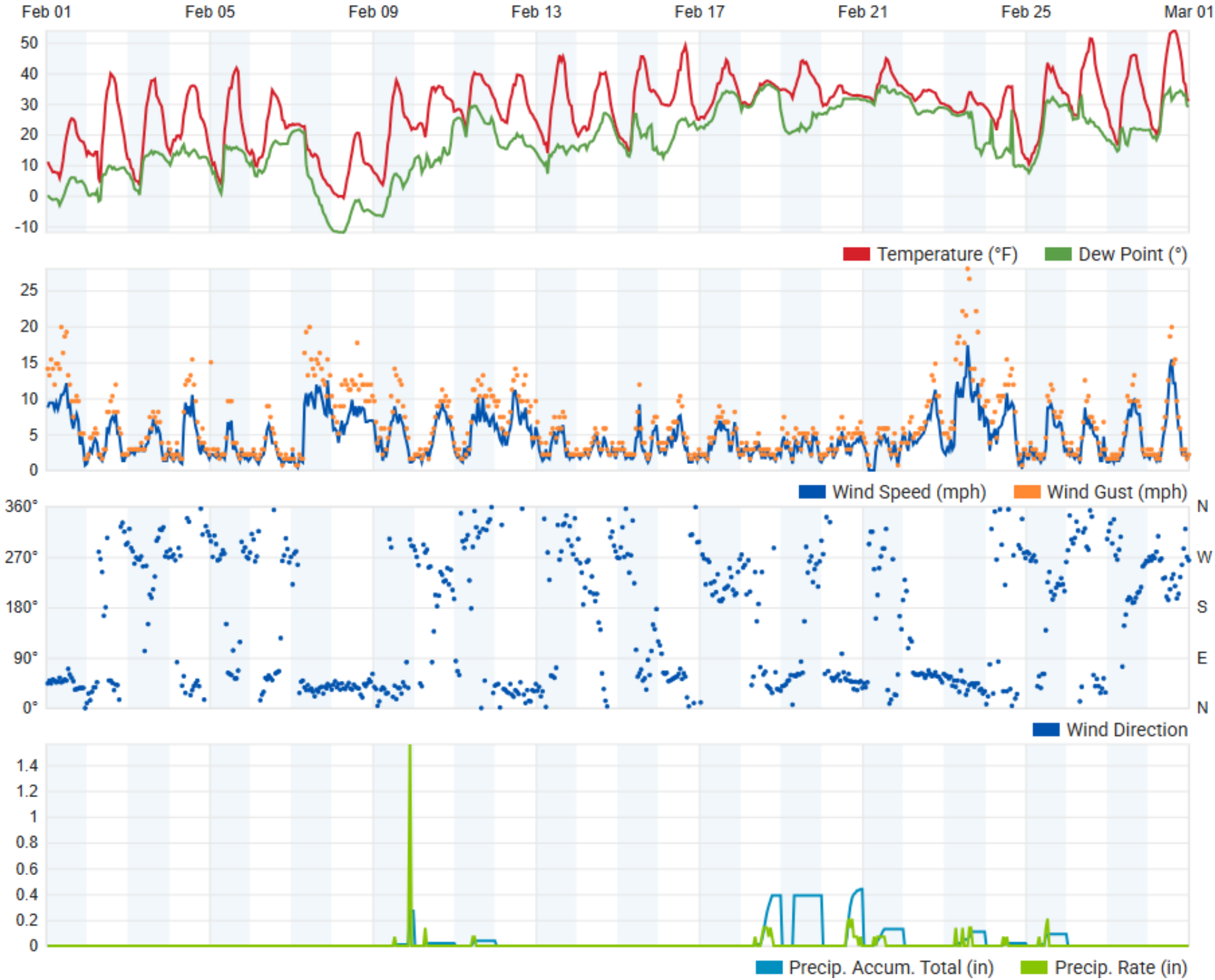
FORECAST FOR WINDSOR LOCKS, CT

February 1, 2026 - February 28, 2026

	High	Low	Average
Temperature	**53.8** °F	**-1.2** °F	**26.8** °F
Dew Point	**36.3** °F	**-12.5** °F	**16.5** °F
Humidity	**99** %	**26** %	**68** %
Precipitation	**1.90** in	--	--

	High	Low	Average
Wind Speed	**17.4** mph	**0.0** mph	**1.8** mph
Wind Gust	**28.0** mph	--	**2.6** mph
Wind Direction	--	--	**SE**
Pressure	**30.53** in	**29.50** in	--

February 1, 2026 - February 28, 2026



Elev **82** ft, **41.93** °N, **72.63** °W

LRG Weather - KCTWINDS94

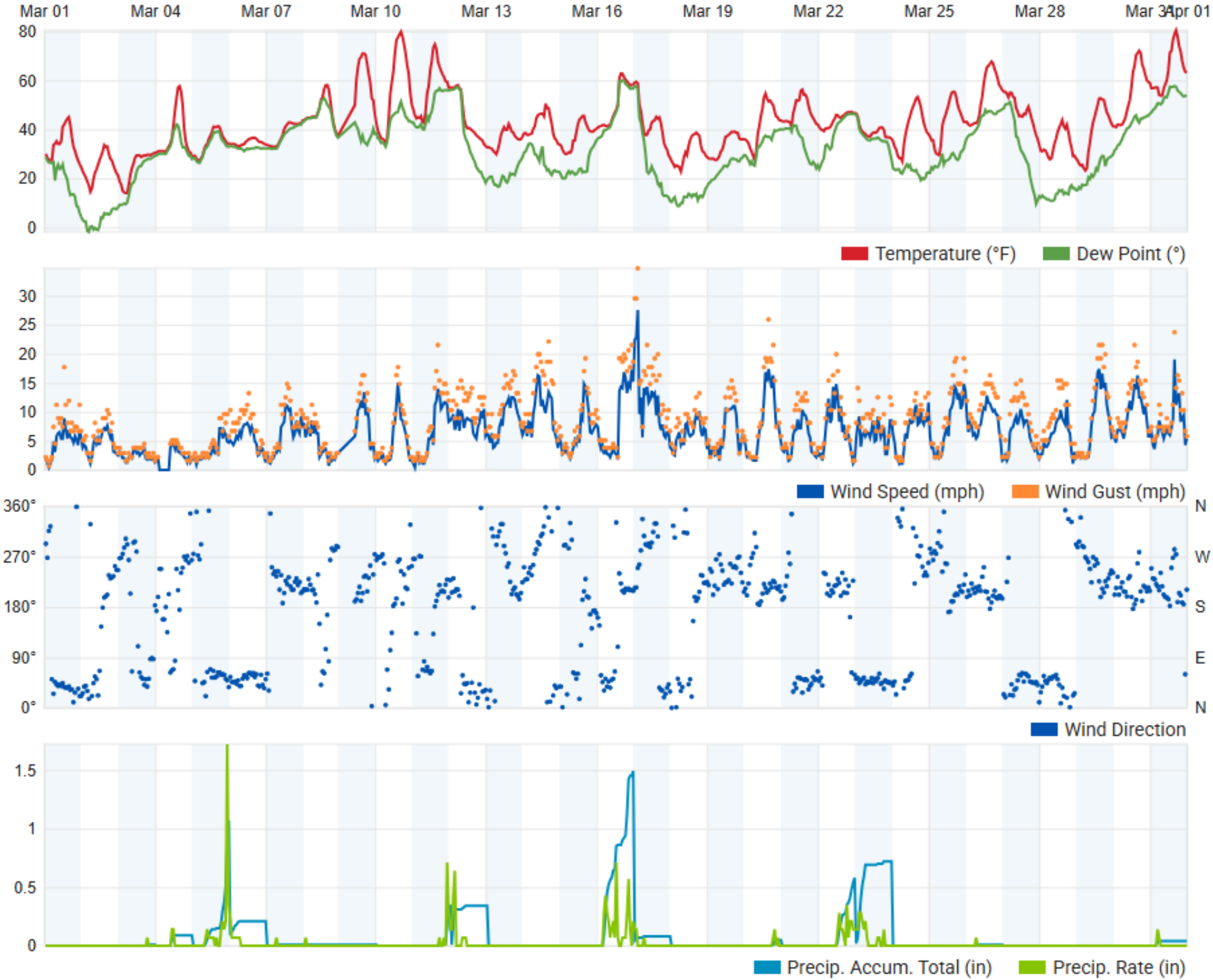
FORECAST FOR WINDSOR LOCKS, CT

March 1, 2026 - March 31, 2026

	High	Low	Average
Temperature	**80.4** °F	**11.6** °F	**41.1** °F
Dew Point	**60.0** °F	**-6.2** °F	**30.2** °F
Humidity	**99** %	**23** %	**68** %
Precipitation	**5.38** in	--	--

	High	Low	Average
Wind Speed	**27.5** mph	**0.0** mph	**3.1** mph
Wind Gust	**34.7** mph	--	**4.0** mph
Wind Direction	--	--	**SSE**
Pressure	**31.05** in	**29.57** in	--

March 1, 2026 - March 31, 2026



Elev **82** ft, **41.93** °N, **72.63** °W

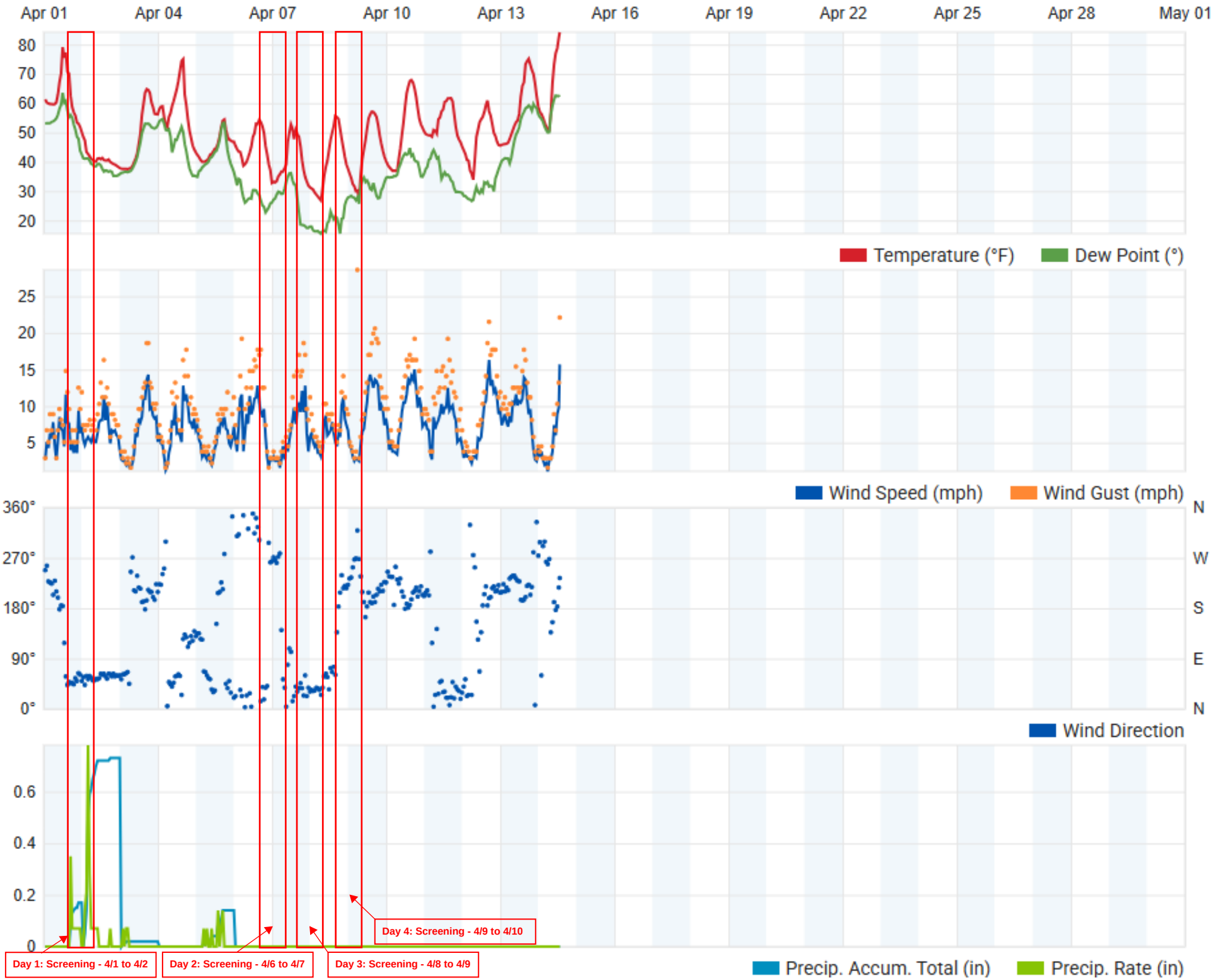
LRG Weather - KCTWINDS94

FORECAST FOR WINDSOR LOCKS, CT

April 1, 2026 - April 30, 2026

	High	Low	Average
Temperature	**84.2** °F	**24.4** °F	**48.8** °F
Dew Point	**63.5** °F	**11.0** °F	**37.4** °F
Humidity	**97** %	**18** %	**68** %
Precipitation	**1.06** in	--	--

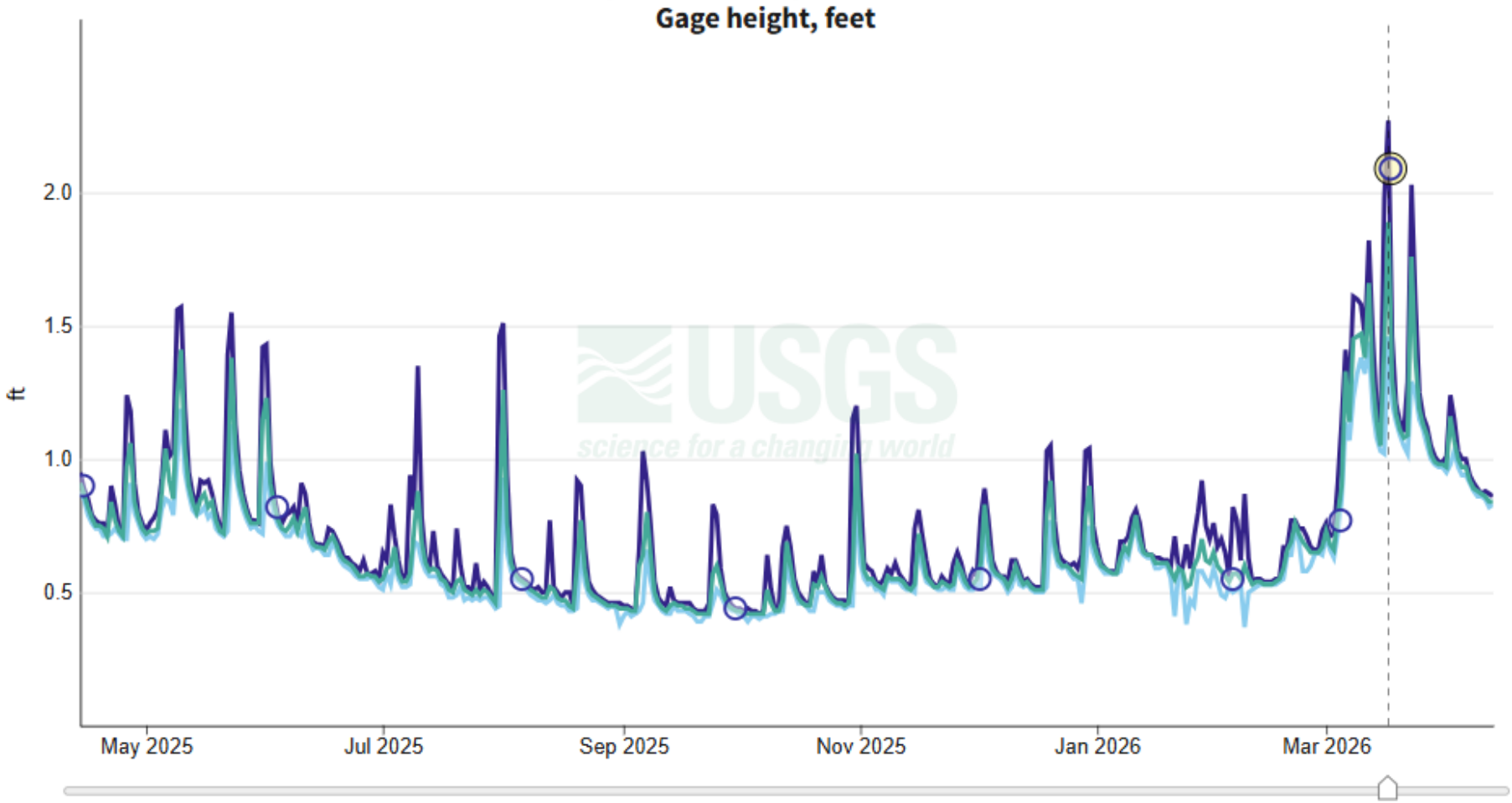
	High	Low	Average
Wind Speed	**16.3** mph	**0.0** mph	**3.4** mph
Wind Gust	**28.6** mph	--	**4.4** mph
Wind Direction	--	--	**SSE**
Pressure	**31.01** in	**30.02** in	--


April 1, 2026 - April 30, 2026
Apr 01
Apr 04
Apr 07
Apr 10
Apr 13
Apr 16
Apr 19
Apr 22
Apr 25
Apr 28
May 01
80
70
60
50
40
30
20
Temperature (°F)
Dew Point (°)
25
20
15
10
5
Wind Speed (mph)
Wind Gust (mph)
360°
270°
180°
90°
0°
N
W
S
E
N
Wind Direction
0.6
0.4
0.2
0
Precip. Accum. Total (in)
Precip. Rate (in)
Day 1: Screening - 4/1 to 4/2
Day 2: Screening - 4/6 to 4/7
Day 3: Screening - 4/8 to 4/9
Day 4: Screening - 4/9 to 4/10

Section 10. River Gage Data

Broad Brook Discharge & Gage Height at Broad Brook, CT
January 2026 – April 2026
Hockanum River Discharge & Gage Height at East Hartford, CT
January 2026 – April 2026

Broad Brook at Broad Brook, CT - USGS-01184490



IMPORTANT Data may be provisional

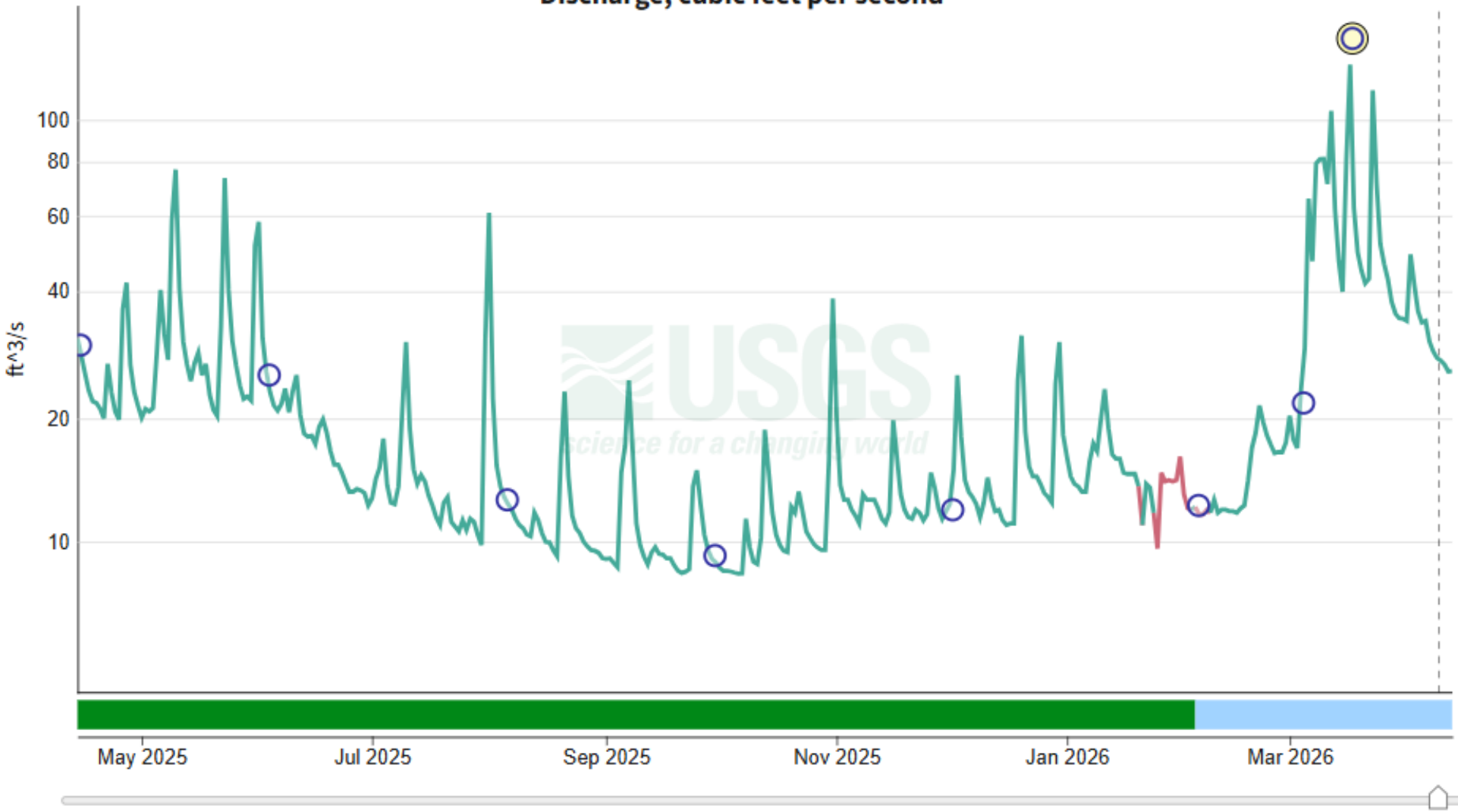
Show legend

Hide graph details

	Value	Status	Date
Maximum	2.27 ft	Provisional	March 17, 2026
Minimum	1.46 ft	Provisional	March 17, 2026
Mean	1.89 ft	Provisional	March 17, 2026
Selected field measurement	2.09 ft	Provisional	March 17, 2026

Broad Brook at Broad Brook, CT - USGS-01184490

Discharge, cubic feet per second



IMPORTANT Data may be provisional

Show legend

Hide graph details

	Value	Status	Date
Mean	27.5 ft^3/s	Provisional	April 10, 2026
Selected field measurement	154 ft^3/s	Provisional	March 17, 2026

Hockanum River Near East Hartford, CT - USGS-01192500

Gage height, feet



IMPORTANT Data may be provisional

Show legend

Hide graph details

	Value	Status	Time
● Latest value	2.45 ft	Provisional	Apr 14, 2026 03:30:00 PM EDT

Hockanum River Near East Hartford, CT - USGS-01192500

Discharge, cubic feet per second



IMPORTANT Data may be provisional

Show legend

Hide graph details

	Value	Status	Time
● Latest value	100 ft^3/s	Provisional	Apr 14, 2026 03:30:00 PM EDT

Section 11. Site Photographs

Section 11. Town of Ellington I&I Investigation Site Photographs

Screening Day 1 – April 1st, 2026



1 - Manhole 589



2 - Manhole 595

NOTE: ALL PHOTOS TAKEN NORTH SIDE FACING UP



3 - Manhole 604



4 - Manhole 676

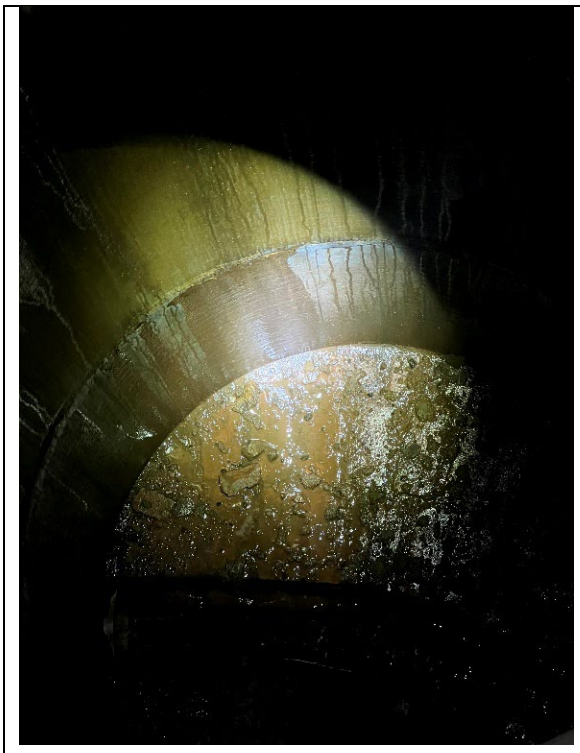
NOTE: ALL PHOTOS TAKEN NORTH SIDE FACING UP

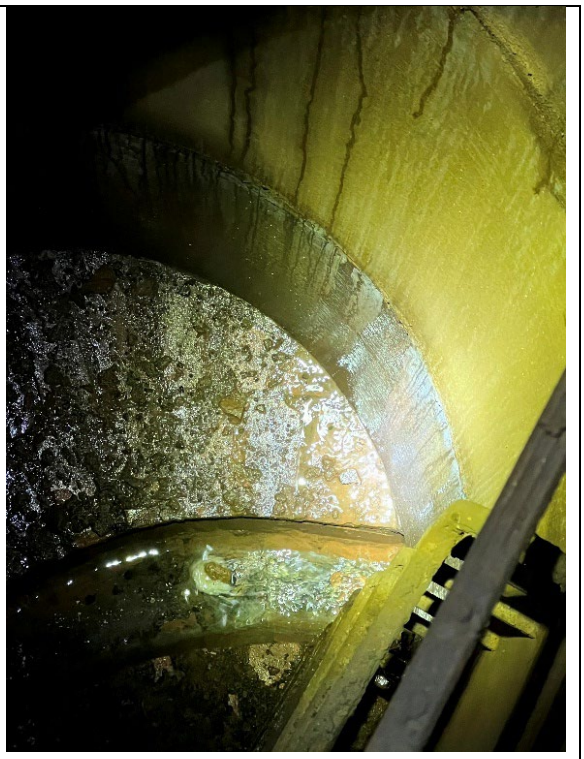




5 - Manhole 606

NOTE: ALL PHOTOS TAKEN NORTH SIDE FACING UP







6 – Manhole 634

NOTE: ALL PHOTOS TAKEN NORTH SIDE FACING UP



7 - Manhole 636



8 - Manhole 844

NOTE: ALL PHOTOS TAKEN NORTH SIDE FACING UP

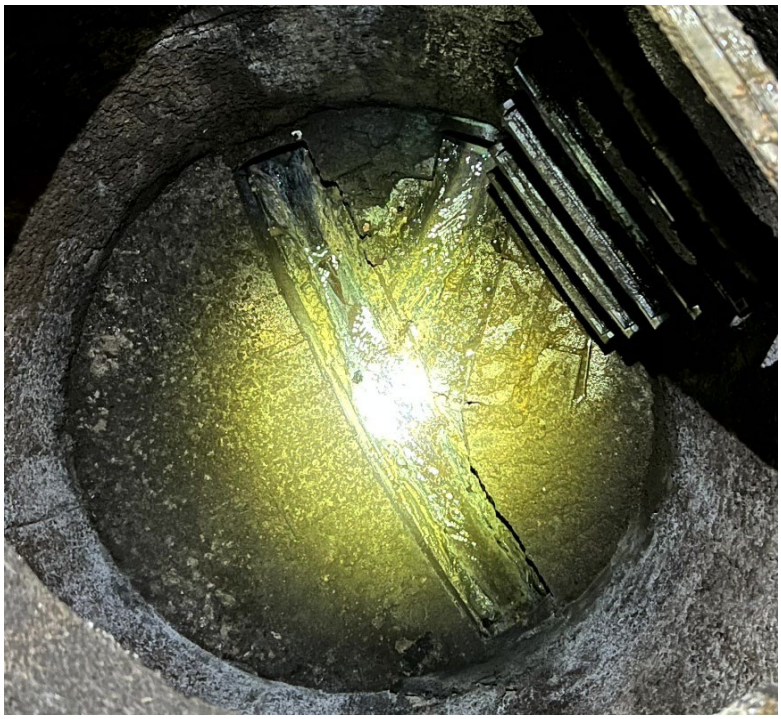


9 - Manhole 633



10 - Manhole 612

NOTE: ALL PHOTOS TAKEN NORTH SIDE FACING UP



11 - Manhole 720



12 – Ketchbrook Pump Station Stormwater Inlet

NOTE: ALL PHOTOS TAKEN NORTH SIDE FACING UP



13 - Manhole 734



14 - Manhole 731

NOTE: ALL PHOTOS TAKEN NORTH SIDE FACING UP



15 - Manhole 546



16 - Manhole 551

NOTE: ALL PHOTOS TAKEN NORTH SIDE FACING UP



17 - Manhole 1102



18 - Manhole 557

NOTE: ALL PHOTOS TAKEN NORTH SIDE FACING UP



19 - Manhole 536



20 - Manhole 285

NOTE: ALL PHOTOS TAKEN NORTH SIDE FACING UP



21 - Manhole 282A



22 - Manhole 279

NOTE: ALL PHOTOS TAKEN NORTH SIDE FACING UP



23 - Manhole 252

Screening Day 2 – April 9th, 2026



1 - Manhole 285

NOTE: ALL PHOTOS TAKEN NORTH SIDE FACING UP



2 - Manhole 366



3 - Manhole 546

NOTE: ALL PHOTOS TAKEN NORTH SIDE FACING UP



4 - Manhole 519



5 - Manhole 847

NOTE: ALL PHOTOS TAKEN NORTH SIDE FACING UP

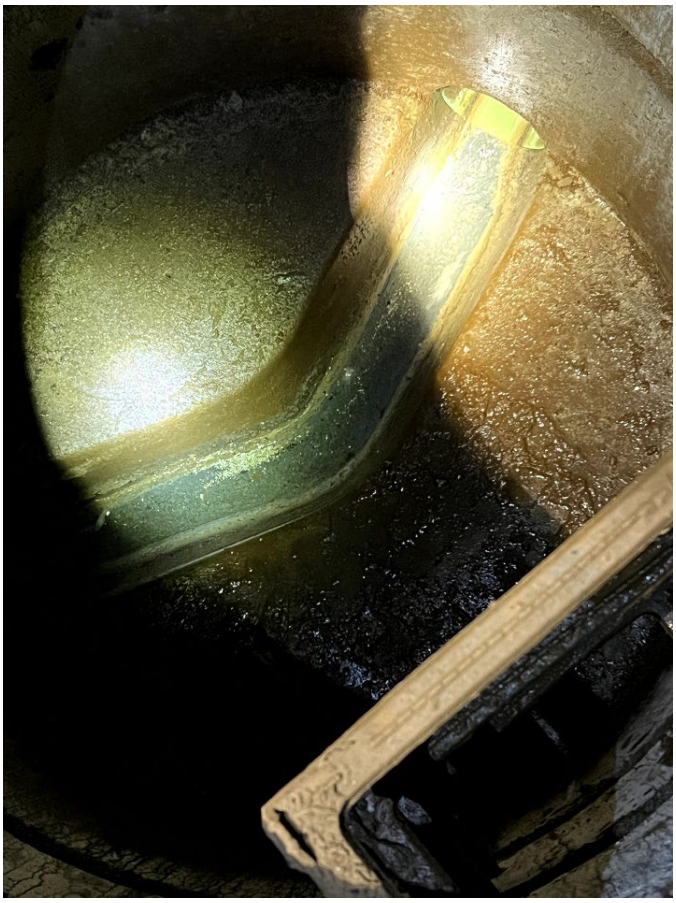


6 - Manhole 530



7 - Manhole 878

NOTE: ALL PHOTOS TAKEN NORTH SIDE FACING UP

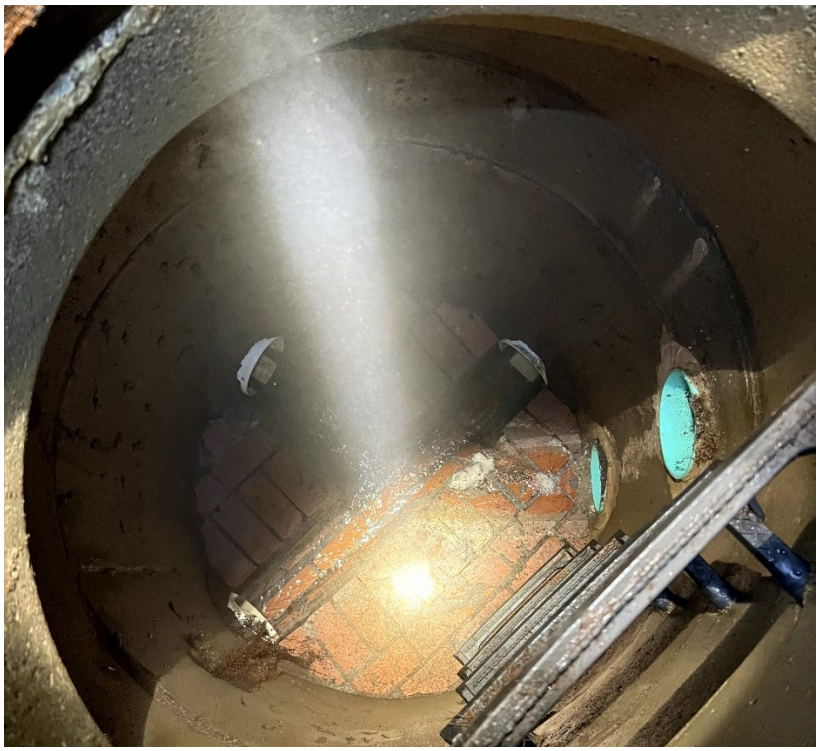


8 - Manhole 1229



9 - Manhole 596

NOTE: ALL PHOTOS TAKEN NORTH SIDE FACING UP

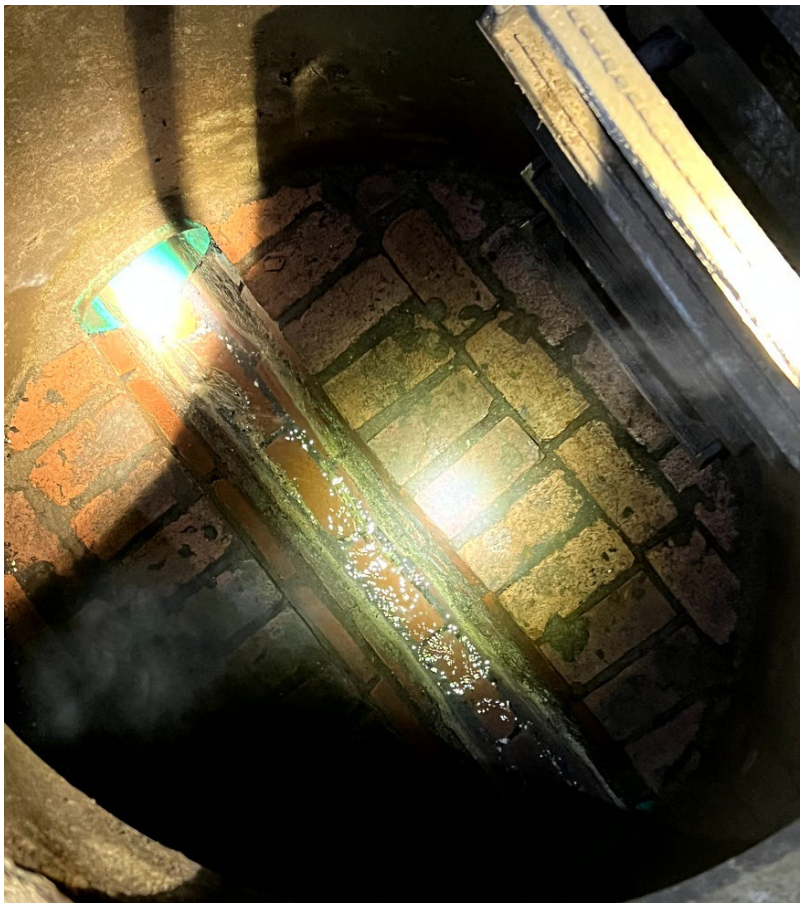


10 - Manhole 601



11 - Manhole 679

NOTE: ALL PHOTOS TAKEN NORTH SIDE FACING UP



12 - Manhole 682



13 - Manhole 687

NOTE: ALL PHOTOS TAKEN NORTH SIDE FACING UP



14 - Manhole 690

NOTE: ALL PHOTOS TAKEN NORTH SIDE FACING UP