REPORT

Phase 2:
Sanitary Sewer Evaluation Survey
Mystic Area Investigations and Report

Town of Stonington, CT

Water Pollution Control Authority

DRAFT FOR DEEP REVIEW
JULY 2023

CDM Smith

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Section 1

Introduction

1.1 Purpose

Since 2018, the average flow to the Mystic Water Pollution Control Facility (WPCF) has risen above the average annual permit flow of 0.8 million gallons per day (MGD). The Mystic WPCF is one of three WPCFs located in Stonington, Connecticut (CT). The Town of Stonington (the Town) completed a high flow bypass, which will allow up to 0.3 MGD of flow to be diverted from the Mystic WPCF to the Borough WPCF to help address high flows. In addition to the construction of the bypass, the Town has begun investigation of high levels of inflow and infiltration (I/I) in the collection system. The Mystic Area of Stonington and surrounding towns are shown in **Figure 1-1**.

Beginning in 2021, the Mystic Area was studied to evaluate I/I. During the first phase of this I/I study, the Mystic Area was divided into fourteen smaller sewersheds, as shown in **Figure 1-2**. Related work was summarized in the "Phase I: Flow Meter/Data Acquisition (FMDA) Report and Cost-Effective Analysis (CEA)" dated November 2021 by CDM Smith.

The FMDA Report and CEA identified areas that warranted further investigations in the form of a sewer system evaluation survey (SSES). **Figure 1-3**, following this section, illustrates the areas recommended for further I/I investigation from the FMDA Report and CEA. Additional information on the field work completed during the SSES can be found below. The purpose of this report is to summarize the results of the SSES in the Mystic Area and make recommendations for future sewer and manhole rehabilitation.

1.2 Recommended Plan from FMDA Report and CEA

This section compiles recommendations from Section 6 of the November 2021 FMDA Report and CEA. It also discusses progress made to date on each of the recommendations from the report.

1.2.1 System Data Results and Recommendations

At the time the FMDA Report and CEA was submitted, the GIS was missing pipe attribute data for approximately 50 percent of pipes by length in the Mystic collection system. Since pipe age, material, and diameter are necessary information to design rehabilitation contracts and confirm cost-effective accurate data, CDM Smith recommended that additional data be collected and the GIS mapping updated. Since compiling the FMDA Report and CEA, CDM Smith received 48 additional record drawings from the Town. **Figure 1-4** shows locations of pipes with available record drawings. CDM Smith added attribute data, including pipe diameter, material, slope, and manhole inverts into GIS from the record drawings. Approximately three percent of pipes by length in the Mystic collection system are currently missing attribute data. CDM Smith will continue to update missing data as field work is completed.

In the FMDA Report and CEA, CDM Smith recommended that manhole and pipe IDs be generated for the collection system, in order to link data to GIS and for general asset management. CDM

Smith generated manhole and pipe IDs for all pipes and manholes within the Mystic collection system in early 2022.

Additionally, in the FMDA Report and CEA, many manholes in Mystic were inaccessible during field investigations and required the Town to locate, unbury, or provide access. This included 10 buried or paved over manholes, which CDM Smith recommended the Town should locate and raise. It also included 16 manholes with bolted or locking covers, which the Town needed to provide CDM Smith access to during future manhole inspections. The Town prioritized and resolved eight manholes that were previously inaccessible in sewershed M-01. CDM Smith completed manhole inspections after they were unburied by the Town. As of CDM Smith completing inspections, there were 18 manholes identified in the FMDA Report and CEA that were still inaccessible, two of which are buried or paved over. The remaining 16 manholes had bolted or locking covers. Additional information on the status and locations of manhole inspections can be found in Section 3 of this report.

1.2.2 Flow Analysis Results and Recommendations

Based on the analysis of the flow meter data, four areas are contributing 76 percent of the total I/I identified in the system. These four areas are M-01, M-05, M-08, and M-09. In the FMDA Report and CEA, CDM Smith recommended these four areas for CCTV inspection in the SSES program. With approval from Connecticut Department of Energy and Environmental Protection (CT DEEP), it is believed the majority of the issues within the M-05, M-08, and M-10 areas are related to the Route 27 / Route 1 interceptor and focused on CCTV inspections of the interceptor under the SSES Report. Additional information on the location of CCTV inspections and results can be found in Section 2 of this report.

As noted in the FMDA Report and CEA, the hydrographs for M-08 and M-09 indicate that I/I increases as groundwater level increases, which CDM Smith believed is caused by sump pumps. In the FMDA Report and CEA, CDM Smith recommended performing building inspections in M-08 and M-09. Building inspections were performed in M-01, M-09, and a portion of M-08 under the SSES Program. More information on building inspections can be found in Section 5 of this report.

CDM Smith recommended using temporary meters prior to sewer rehabilitation in M-01 to help identify the source of the high flows. One level meter was recommended to be placed in the original meter location of M-01. Another meter was recommended to be placed upstream and to be relocated as needed to locate the source of flow. During periods of high flow and high tides (at least 1 foot NAVD), a specific conductivity or salinity probe was recommended to be used to measure the specific conductance or salinity of the flow in manholes in the sewershed to determine if saline water is entering the system. These results were recommended to be compared to measured data in the Mystic River near the intersection of Mill Street and Main Street and compared to Town tap water. Since the writing of the FMDA Report and CEA, the Town identified and stopped a source of inflow in the M-01 sewershed area. The source was located at the Old Mystic Mill at 11 Main Street, where an open six-inch pipe was allowing a significant amount of water to enter the sewer system during high tides and storms. The day after the pipe was plugged in November 2021, the flows at the Mystic WPCF decreased by eight percent. Temporary meters were not installed and other testing was not completed in M-01 since the source of high flows was identified through other methods.

1.2.3 Cost Effective Analysis Results and Recommendations

In the FMDA Report and CEA, CDM Smith recommended five areas for sewer rehabilitation, M-01, M-05, M-08, M-09 and M-10. Two areas, M-05 and M-10, were recommended for limited sewer rehabilitation, which includes lining unlined sewer mains and manholes. CDM Smith recommended the remaining three areas, M-01, M-08, and M-09, for comprehensive rehabilitation, which includes lining of unlined sewer mains and manholes, lining the full length of laterals and removing private I/I.

The FMDA Report and CEA also recommended CCTV and manhole inspections in each of the five areas prior to rehabilitation to identify defects and verify if the pipe or manhole is currently lined. CCTV inspections and recommendations are discussed in Section 2 of this report. Manhole inspections and recommendations are found in Section 3.

The report also recommended smoke testing in areas M-01, M-08, and M-09 prior to rehabilitation. Select dye testing was also recommended, based on building inspection and smoke testing results. Smoke testing was performed in M-09 and a portion of M-08 under the SSES Report. More information on smoke testing can be found in Section 4.

The FMDA Report and CEA recommended building inspections be completed in M-09 prior to rehabilitation. The report recommended if many sources of private inflow were found during building inspections in M-09, building inspections should be attempted in M-01 and M-08. Building inspections were performed in M-01, M-09, and a portion of M-08 under the SSES Report. See Section 5 of this report for more information on building inspections.

Table 1-1 below shows the five recommended areas for rehabilitation from the FMDA Report and CEA. CDM Smith recommended the phasing shown in **Table 1-1** for sewer rehabilitation.

Table 1-1 Phasing and Costs of Sewer Rehabilitation from FMDA Report and CEA

Phase	Area	I/I Reduction Scenario	Estimated Cost on Public Property	Estimated Cost on Private Property	Estimated Total Rehabilitation Cost	Estimated Total Cost of Phase
1	M-05	10%	$1,200,000	$0	$1,200,000	$2,140,000
	M-10	10%	$940,000	$0	$940,000	
2	M-01	50%	$300,000	$600,000	$900,000	$900,000
3	M-09	50%	$320,000	$700,000	$1,020,000	$1,020,000
4	M-08	50%	$3,710,000	$2,540,000	$6,250,000	$6,250,000
Total			**$6,470,000**	**$3,840,000**	**$10,310,000**	**$10,310,000**

Phase 1 includes M-05 and M-10 and is recommended for sewer rehabilitation under the 10 percent I/I reduction scenario, which includes lining unlined sewer mains and unlined manholes. Phase 2, Phase 3, and Phase 4 each include one area and are recommended for a 50 percent I/I reduction scenario, which includes cured-in-place pipe (CIPP) lining unlined mainlines, cementitious lining unlined manholes, CIPP lining service laterals from the sewer main to the building, and removing private I/I.

All rehabilitation costs include an additional 45% allowance for design, construction services, and contingencies. The costs in **Table 1-1** are rounded to the nearest $10,000. The costs are based on data available during the FMDA Report and CEA and will need to be refined after additional field investigations are completed.

1.3 2022 Field Work and SSES Report

As discussed above, to identify specific sources of I/I, the FMDA Report and CEA recommended that the Town perform an SSES. This consisted of various types of field investigations described below.

CCTV inspections were conducted to locate specific infiltration sources or any issues that may hinder CIPP lining. The CCTV results and corresponding recommendations can be found in Section 2 of this report.

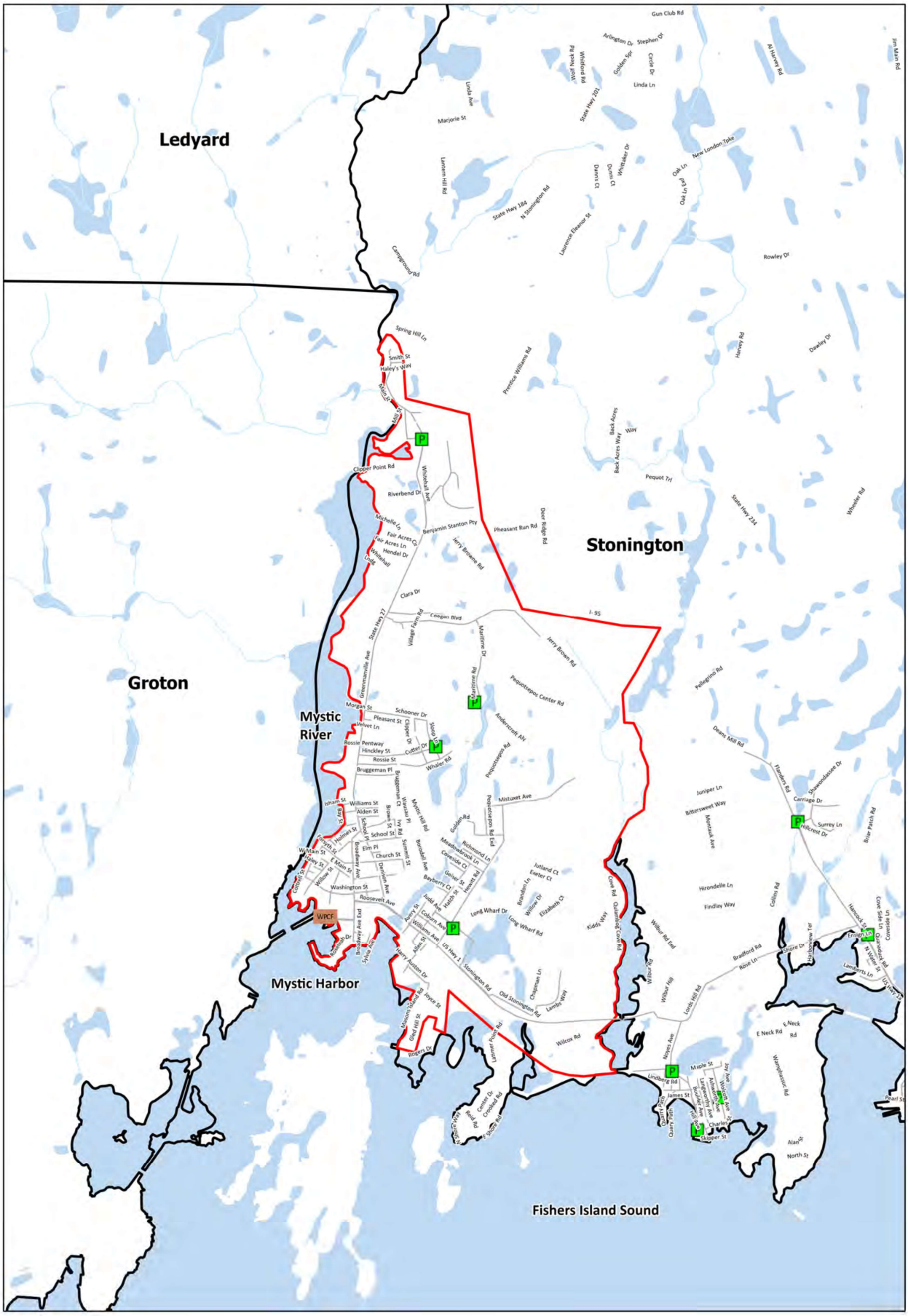
Additionally, CDM Smith performed manhole inspections to evaluate I/I and assess the overall condition of the manholes in the Mystic Area. The process and results of this program are discussed in Section 3.

Smoke testing was performed in two sewershed areas, M-08 and M-09, to identify inflow sources. The results of the smoke testing program can be found in Section 4.

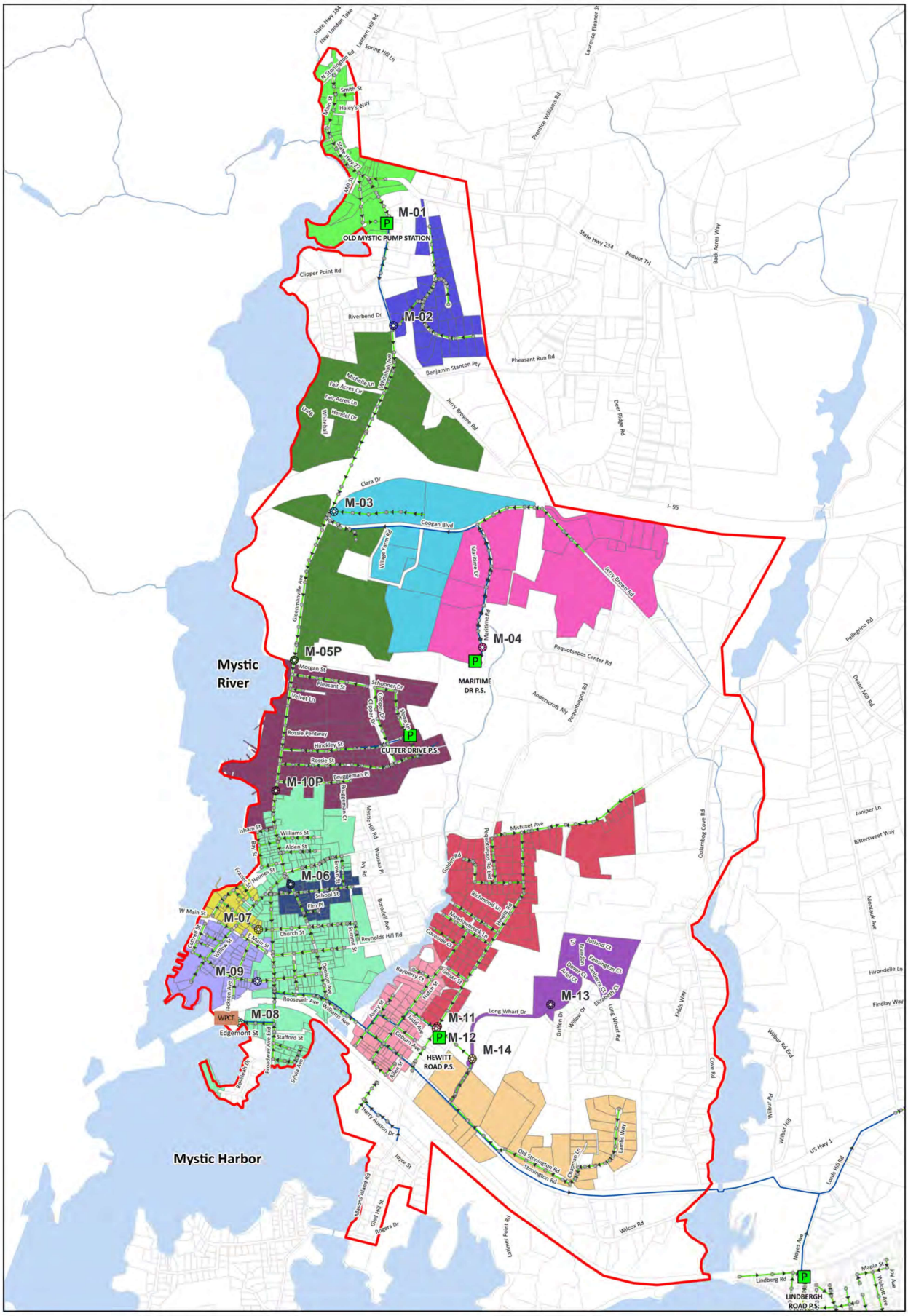
Based on the results of the FMDA Report and CEA, three sewersheds were identified to be large contributors of inflow and were targeted for building inspections. The results of building inspections are discussed in Section 5.

Nine properties with suspected inflow sources identified during building inspections were dye water tested. The results of dye water testing can be found in Section 6 of this report.

CDM Smith performed a financial evaluation, which is discussed in Section 7 of this report. Lastly, Section 8 of this report discusses the revised recommended plan for rehabilitation, which was developed based on the results of field work.

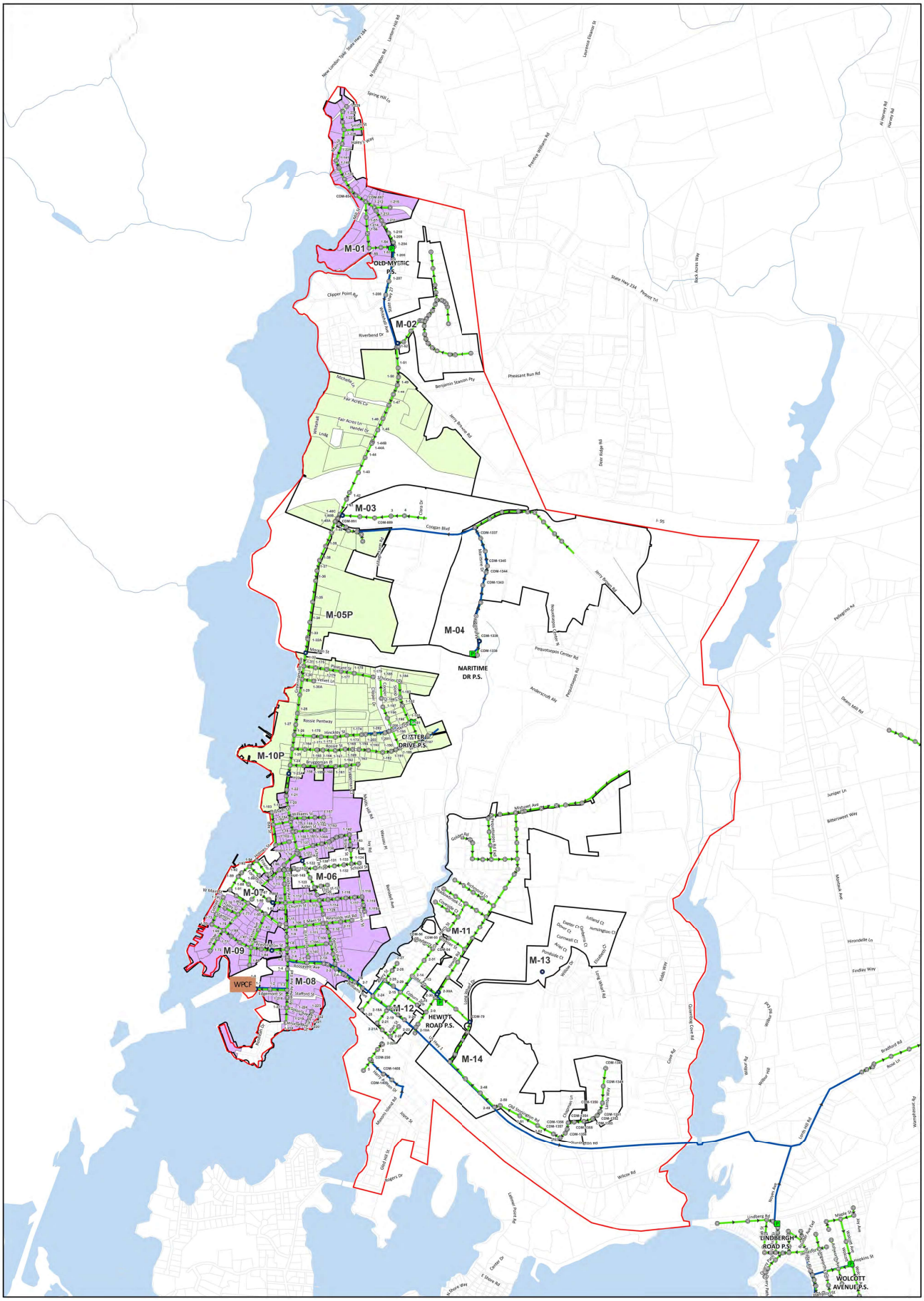


Town of Stonington, Connecticut
Overview Map of Mystic
Sanitary Sewer Evaluation Survey
July 2023
Figure 1-1



CDM Smith

Town of Stonington, Connecticut
Sewershed Areas
Sanitary Sewer Evaluation Survey
July 2023
Figure 1-2



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Legend

- 10% I/I Reduction Recommended
- 50% I/I Reduction Recommended
- WPCF Water Pollution Control Facility
- Mystic
- Pump Station
- Meter
- Sewer Manhole
- Force Main
- Gravity Main
- Parcels
- Metershed Border

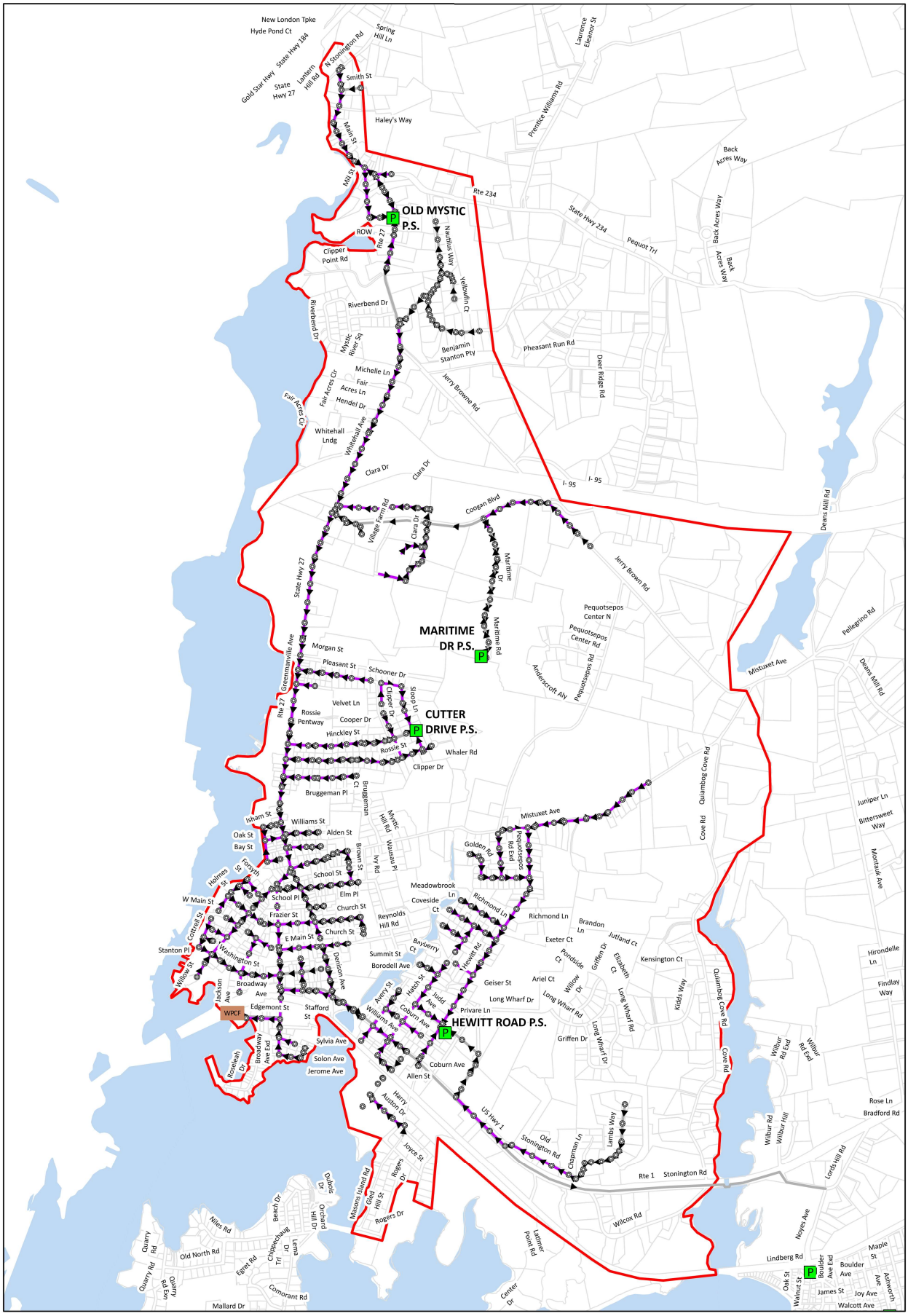
Scale

1 inch = 750 feet

0 375 750 1,500 Feet

N

Town of Stonington, Connecticut
Infiltration and Inflow Recommendations
Sanitary Sewer Evaluation Survey
July 2023
Figure 1-3



Legend

- Record Drawings Available
- Sewer Mains
- Sewer Manhole
- WPCF Water Pollution Control Facility
- Mystic
- P Pump Station

1 inch = 1,500 feet

N

0 375 750 1,500 Feet

Town of Stonington, Connecticut

Record Drawing Locations
Sanitary Sewer Evaluation Survey
July 2023
Figure 1-4

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Section 2

Closed Circuit Television (CCTV) Inspection Program

2.1 Introduction

As discussed in Section 1, sewersheds M-01, M-05, M-08, M-09, and M-10 were identified in the FMDA Report and CEA as contributing a large amount of I/I in the system. It is believed the majority of the issues within the M-05, M-08, and M-10 areas are related to the Route 27 / Route 1 interceptor and wanted to focus on inspection of this area, instead of M-01 and M-09. To identify specific sources of infiltration, identify defects and verify if a pipe is currently lined, CCTV inspections were performed within the Route 27 / Route 1 interceptor.

The sanitary sewer pipes in the Route 27 / Route 1 interceptor that were CCTV inspected are mainly reinforced concrete pipe. Pipes were installed from 1969 to 1972 and range in diameter from 8 inches to 30 inches. National Water Main Cleaning Company performed CCTV inspections in the Route 27 / Route 1 interceptor in August and September 2022. CDM Smith reviewed the CCTV inspections to assess the condition of the pipe and to determine if rehabilitation is needed. **Table 2-1** below shows the total length of sewer pipe within the three sewershed areas and the length and percentage that has been inspected in the Route 27 / Route 1 interceptor area.

Table 2-1 CCTV Progress by Sewershed Area

Sewershed Area	Total Length (LF)	Length Inspected by CCTV (LF)	Percent CCTV Inspected
M-05	8,017	2,527	32%
M-08	18,020	4,439	25%
M-10	12,473	2,501	20%
Total	**38,510**	**9,467**	**25%**

2.2 PACP Coding

National Water Main Cleaning Company coded the inspection videos according to National Association of Sewer Service Companies (NASSCO) Pipeline Assessment Certification Program (PACP) codes. PACP is an internationally accepted method for recording pipeline defects and observations in a standardized fashion. Standardizing the coding system creates more consistent data gathering and assessment of pipe condition and the need for increased operation and maintenance. In PACP, defects and observations are divided into four families of codes:

- Operation and Maintenance – such as grease, roots, infiltration

- Structural – such as cracks, surface damage, collapsed pipe
- Construction Features – such as taps, sealing material, access points
- Miscellaneous Features – such as material change, joint change, water mark

Another feature of PACP is the Quick Rating system. The PACP Quick Rating is a four-digit code that summarizes the number of occurrences for the two highest severity grades observed in a pipe (i.e. 3323 or 1H00). The first number is the highest severity grade and the second number is the number of occurrences for that grade. The third number is the second highest severity grade and the fourth number is the number of occurrences for that grade. If the number of occurrences exceeds nine, alphabetic characters are used instead of a number for occurrences, where A = 10 to 14 occurrences, B = 15 to 19 occurrences, C = 20 to 24 occurrences, etc.

The example of 3323 corresponds to a pipe with three defects of a 3 rating and three defects of a 2 rating. The second example of 1H00 corresponds to a pipe with 45 to 49 defects of a 1 rating and no other defects. In general, the higher the Quick Rating, the worse the condition of the pipe. The PACP coded logs for the pipe segments inspected in the Route 27 / Route 1 interceptor area can be found in Appendix A.

2.2.1 Operational and Maintenance (O&M) Results

At the end of Section 2, **Table 2-4** contains a complete list of O&M PACP Quick Ratings and corresponding recommendations for each pipe segment. The table is sorted by sewershed area and phase of sewer rehabilitation. The summary of O&M results is shown in **Table 2-2** below.

Table 2-2 Summary of O&M Results

Highest Rating in Pipe Segment	Number of Segments	Percent of Total
0	9	21%
1	6	14%
2	8	18%
3	1	2%
4	15	34%
5	5	11%

Forty-five percent of the pipes had a rating of 4 and above, which means the pipe has significant defects. Pipes with significant defects were recommended for repairs in the near future. The following paragraphs discuss O&M observations that are coded as a 4 or 5 rating.

An O&M rating of 4 or 5 can correspond to a pipe with at least 30 percent of the pipe being obstructed by deposits or obstacles, including silt/sand, gravel, encrustation, grease, or rags. A large amount of deposits decreases the pipe capacity. An O&M rating of 4 of 5 can also correspond

to a medium sized root or a rootball located in the mainline. Eleven percent of pipe segments had observed roots. I/I can occur as a result of roots causing a separation in a joint or cracked sewer pipe.

Thirty pipe segments had observed infiltration. A rating of 4 or 5 can correspond to infiltration that was observed in the form of a runner or gusher. Fourteen pipe segments were observed to have a runner as the most severe infiltration, which is water continuously flowing into the sewer, usually through a faulty joint or the pipe wall. In addition, four pipe segments were observed to have a gusher as the most severe infiltration, which is high pressurized water that is continuously flowing into the sewer. The pipe segments with gushers are 1-14:1-13, 1-16:1-15, 1-24:1-23A and 1-25:1-24.

CDM Smith also found infiltration stains, weepers, and drippers. Unlike runners and gushers discussed above, these types of infiltration have O&M ratings below 4. CDM Smith found two segments where drippers were present as the most severe infiltration, defined as a steady drip of water entering the pipe. Three pipe segments had a weeper as the most severe form of infiltration, which is a slow ingress of water through a joint or wall. Infiltration staining was the most severe infiltration on an additional seven segments. Although each pipe segment was assigned a particular severity in the field, the severity of each infiltration source can increase during conditions of higher ground water and result in a higher rating than what was previously observed.

Finally, an O&M rating of 4 or 5 can include construction features, such as significantly intruding taps and issues with seal materials. Only one of the pipe segments had an intruding tap.

2.2.2 Structural Results

Table 2-4 at the end of Section 2 contains a complete list of Structural PACP Quick Ratings and recommendations for individual pipe segments. **Table 2-3** below shows an abbreviated summary of structural results.

Table 2-3 Summary of Structural Results

Highest Rating in Pipe Segment	Number of Segments	Percent of Total
0	1	3%
1	24	55%
2	11	25%
3	4	9%
4	2	4%
5	2	4%

Eight percent of the pipe segments have ratings of 4 or 5, which means the pipe has significant structural defects. Pipes with significant structural defects are recommended for repairs in the near future. The following paragraphs discuss structural observations that are coded as a 4 or 5 rating.

A structural rating of 4 or 5 can correspond to a hinge crack or fracture, or a fracture multiple. A hinge crack or fracture occurs when more than one longitudinal crack or fracture occurs at the same footage at the 3, 6, 9, or 12 clock positions. Five pipe segments had cracks but none of those were significant enough to have a rating of 4 or 5. A rating below 4 corresponds to a minor or moderate defect during the time of inspection, but these defects can further degrade over time. These sections should be monitored for future deterioration that can transition into more significant defects. A rating of 4 or more also includes a broken pipe or hole with soil or a void visible. One pipe segment was found to have a hole with visible soil. I/I can occur through a separation in a joint or pipe under certain conditions, which can be a result of cracks, fractures, breaks, and holes.

A rating of 4 or more can also correspond to a collapsed or deformed pipe. There were no collapsed or deformed pipes observed in the pipes that were CCTV inspected. This rating also includes surface damage where reinforcement is visible or projecting. Two pipes were observed to have reinforcement visible and one pipe was observed to have reinforcement projecting. Finally, a rating of 4 or 5 includes a defective point repair with a patch repair, localized pipe liner, or replacement pipe. No pipe segments had defective lining or point repairs.

2.3 Recommendations

CDM Smith reviewed pipe segments that were CCTV inspected to determine if they had infiltration or other issues and created phased recommendations. **Table 2-4** shows the pipe segments in Route 27 / Route 1 interceptor area with their corresponding recommendations and phase. These are sorted by phase of sewer rehabilitation, then sewershed area, and then numerically by pipe segment.

Thirty-one pipes are recommended for CIPP lining. The remaining 15 pipes shown on **Table 2-4** are not recommended for rehabilitation. CDM Smith and the Town recently completed the construction phase for the Select Route 27 / Route 1 project, which includes the pipes with the most severe deficiencies observed. This project includes CIPP lining of four of the pipe segments, as noted on **Table 2-4**. CDM Smith recommends the remaining 27 pipes that are not included in the Select Route 27 / Route 1 project should be rehabilitated in Phase 1: Interceptor Pipe and Manhole Rehabilitation. It is estimated that pipe rehabilitation will remove approximately 0.07 MGD of infiltration.

Recommendations suggested for future rehabilitation work are discussed further in Section 8. CDM Smith recommends that as the Town has available funds, the pipes should be rehabilitated in order by phase. The Town should complete CCTV inspections throughout the remaining pipes in the sewersheds M-08 and M-09 prior to rehabilitation to identify defects, verify if a pipe is currently lined and determine if there are any issues that may hinder CIPP lining. CCTV inspections of sewershed M-09 is recommended in Phase 2 and inspections of sewershed M-08 is recommended in Phase 4.

Table 2-4
Town of Stonington, CT Mystic Area SSES
CCTV Recommendations

Sewershed Area	Phase of Sewer Rehabilitation	Pipe ID	Upstream Manhole	Downstream Manhole	Street Name	Diameter (in)	Material	GIS Length (ft)	Approx. Length (ft, from NWMCC CCTV)	National Water Main's Video Name	Structural PACP Quick Rating	O&M PACP Quick Rating	Approx. Number of Active Service Connections	Observations	Recommendations	No Recommendations	CIPP Lining
M-05	Select RT 27 / RT 1	1-33:1-32A	1-33	1-32A	Route 27 / Greenmanville Ave	18	RCP	26	21	MH 1-33_MH 1-32A_2022-08-24	3323	0000	0	Surface Damage Corrosion (7.1' to 20'), Surface Damage Aggregate Visible (7.2' to 20')	CIPP Lining - included in Select RT 27 / RT 1 Sewer Rehabilitation Design		X
M-05	Select RT 27 / RT 1	1-40A:1-40	1-40A	1-40	Route 27 / Greenmanville Ave	18	RCP	273	274	MH 1-40A_MH 1-40_2022-08-22	513I	2100	2	Surface Damage Corrosion (0' to 273.9'), Hole Soil Visible at 5', Rubber Seal Obstruction at 5'	CIPP Lining - included in Select RT 27 / RT 1 Sewer Rehabilitation Design		X
M-08	Select RT 27 / RT 1	1-5:1-4	1-5	1-4	Broadway Ave Ext	30	RCP	134	162	MH 1-05_MH 1-04_2022-08-31	441D	4121	0	Surface Damage Reinforcement Visible (1.2' to 20'), Rubber Seal Obstruction in Joint (9.5'), Surface Spalling of Damage Coating (20' to 128', 132' to 158.8'), Infiltration Stain Joint (32.5' to 128'), Infiltration Runner Joint (11.1'), Infiltration Stain Barrel (113.4'), Unknown Manhole (130.9'), Pipe Partially under Railroad	CIPP Lining - included in Select RT 27 / RT 1 Sewer Rehabilitation Design		X
M-08	Select RT 27 / RT 1	1-6:1-5	1-6	1-5	Route 1 / Broadway Ave Ext	24	RCP	61	59	MH 1-06_MH 1-05_2022-08-31	511A	1100	0	Surface Spalling of Damage Coating (3' to 57.4'), Infiltration Stain Joint (13.6'), Surface Damage Reinforcement Projecting (51.9')	CIPP Lining - included in Select RT 27 / RT 1 Sewer Rehabilitation Design		X
M-05	1: Interceptor Pipe and Manhole Rehab.	1-32A:1-32	1-32A	1-32	Route 27 / Greenmanville Ave	18	RCP	257	249	MH 1-32A_MH 1-32_2022-08-24	1H00	0000	0	Surface Damage Roughness Increased (0' to 246.9')	CIPP Lining		X
M-05	1: Interceptor Pipe and Manhole Rehab.	1-34:1-33	1-34	1-33	Route 27 / Greenmanville Ave	18	RCP	262	255	MH 1-34_MH 1-33_2022-08-23	1I00	4111	2	Miscellaneous Survey Abandoned at drop connection (254.9'). Surface Damage Roughness Increased (1.8' to 254.8'), Roots Fine Lateral (11'), Infiltration Lateral Runner (11.1')	CIPP Lining		X
M-05	1: Interceptor Pipe and Manhole Rehab.	1-39:1-38	1-39	1-38	Route 27 / Greenmanville Ave	18	RCP	251	251	MH 1-39_MH 1-38_2022-08-23	3I00	2200	1	Surface Damage Corrosion (0' to 250.7'), Deposits Attached Grease (13'), Roots Fine Barrel (185.1')	CIPP Lining		X
M-05	1: Interceptor Pipe and Manhole Rehab.	1-40:1-39	1-40	1-39	Route 27 / Greenmanville Ave	18	RCP	255	247	MH 1-40_MH 1-39_2022-08-22	4G3H	4100	2	Surface Damage Corrosion (1.2' to 246.1'), Surface Damage Reinforcement Visible (33.5' to 246.1'), Infiltration Runner Connection (6.2')	CIPP Lining		X

Table 2-4
Town of Stonington, CT Mystic Area SSES
CCTV Recommendations

Sewershed Area	Phase of Sewer Rehabilitation	Pipe ID	Upstream Manhole	Downstream Manhole	Street Name	Diameter (in)	Material	GIS Length (ft)	Approx. Length (ft, from NWMCC CCTV)	National Water Main's Video Name	Structural PACP Quick Rating	O&M PACP Quick Rating	Approx. Number of Active Service Connections	Observations	Recommendations	No Recommendations	CIPP Lining
M-08	1: Interceptor Pipe and Manhole Rehab.	1-2:1-1	1-2	1-1	Edgemont St	30	RCP	253	230	MH 1-02_MH 1-01_2022-09-01	1G00	4E21	1	Surface Spalling of Damage Coating (2.1' to 224.3'), Infiltration Runner Joint (36.7' to 157.5', 189.2' to 224.3'), Deposits Attached Encrustation (22.3'), Infiltration Runner Lateral (22.3'), Infiltration Stain Joint (141.3', 221.4')	CIPP Lining		X
M-08	1: Interceptor Pipe and Manhole Rehab.	1-3:1-2	1-3	1-2	Edgemont St	30	RCP	306	328	MH 1-03_MH 1-02_2022-09-01	1L00	5144	4	Surface Spalling of Damage Coating (0' to 324.4'), Infiltration Stain Joint (62.9', 192.4'), Deposits Attached Encrustation (77.3', 145.6', 222.6'), Infiltration Runner Lateral (77.3', 145.6', 222.6'), Infiltration Stain Joint (192.4'), Infiltration Dripper Lateral (287.3')	CIPP Lining		X
M-08	1: Interceptor Pipe and Manhole Rehab.	1-4:1-3	1-4	1-3	Broadway Ave Ext	30	RCP	352	328	MH 1-04_MH 1-03_2022-09-01	1K00	4132	2	Surface Spalling of Damage Coating (7.3' to 325.4'), Infiltration Dripper Lateral (18.1', 147.4'), Deposits Attached Encrustation (147.4'), Infiltration Stain Joint (193.9')	CIPP Lining		X
M-08	1: Interceptor Pipe and Manhole Rehab.	1-7:1-6	1-7	1-6	Route 1 / Broadway Ave	24	RCP	192	187	MH 1-07_MH 1-06_2022-08-31	3123	3121	2	Surface Spalling of Damage Coating (0' to 184.4'), Infiltration Stain Joint (35.7' to 181.5'), Crack Longitudinal (14.5', 118', 134.6'), Infiltration Weeper Joint (76.1'), Infiltration Dripper Lateral (93.8'), Crack Multiple (133.9'), Infiltration Stain Barrel (137')	CIPP Lining		X
M-08	1: Interceptor Pipe and Manhole Rehab.	1-9:1-8	1-9	1-8	Route 1 / Broadway Ave	24	RCP	208	187	MH 1-09_MH 1-08_2022-08-31	1F00	2112	2	Surface Spalling of Damage Coating (1.3' to 184.5'), Deposits Attached Grease (47.3'), Infiltration Stain Joint (53.2', 93.4'), 2018 CCTV shows an Infiltration Gusher Connection (48.0') *note that this defect is stated as 10' in the video itself	CIPP Lining		X
M-08	1: Interceptor Pipe and Manhole Rehab.	1-10:1-9	1-10	1-9	Route 1 / Broadway Ave	24	RCP	192	206	MH 1-10_MH 1-09_2022-08-31	2G00	4121	1	Surface Damage Surface Spalling (2.0' to 202.9'), Infiltration Stain Joint (28.4', 48.9' to 202.9'), Deposits Attached Grease (111.6'), Infiltration Runner Joint (176.8')	CIPP Lining		X

Table 2-4
Town of Stonington, CT Mystic Area SSES
CCTV Recommendations

Sewershed Area	Phase of Sewer Rehabilitation	Pipe ID	Upstream Manhole	Downstream Manhole	Street Name	Diameter (in)	Material	GIS Length (ft)	Approx. Length (ft, from NWMCC CCTV)	National Water Main's Video Name	Structural PACP Quick Rating	O&M PACP Quick Rating	Approx. Number of Active Service Connections	Observations	Recommendations	No Recommendations	CIPP Lining
M-08	1: Interceptor Pipe and Manhole Rehab.	1-12:1-11	1-12	1-11	Broadway Ave	24	RCP	381	406	MH 1-12_MH 1-11_2022-08-31	1Z00	4231	4	Surface Spalling of Damage Coating (0' to 402.3'), Infiltration Runner Joint (52.1', 253.7'), Infiltration Stain Barrel (94.2'), Surface Damage Roughness Increased (94.2' to 402.2'), Infiltration Stain Joint (132.7' to 397.7'), Deposits Attached Encrustation (279.5'), Infiltration Dripper Lateral (279.5')	CIPP Lining		X
M-08	1: Interceptor Pipe and Manhole Rehab.	1-13:1-12	1-13	1-12	Broadway Ave	24	RCP	303	300	MH 1-13_MH 1-12_2022-08-30	211J	4232	5	Surface Damage Roughness Increased (2.0' to 294.5'), Infiltration Stain Joint (4.3' to 294.5'), Deposits Attached Encrustation (54.3'), Infiltration Dripper Lateral (54.3', 167.4'), Infiltration Stain Lateral (86.6'), Infiltration Runner Lateral (118.8'), Crack Longitudinal (212.0')	CIPP Lining		X
M-08	1: Interceptor Pipe and Manhole Rehab.	1-14:1-13	1-14	1-13	Broadway Ave	24	RCP	291	293	MH 1-14_MH 1-13_2022-08-30	221J	5341	4	Surface Damage Roughness Increased (1.4' to 288.2'), Infiltration Stain Joint (175' to 288.2'), Infiltration Gusher Joint (46.1', 245.4'), Infiltration Stain Lateral (72.0', 160.5', 237.3'), Crack Longitudinal (193.5', 194.4'), Infiltration Runner Joint (198.6')	CIPP Lining		X
M-08	1: Interceptor Pipe and Manhole Rehab.	1-15:1-14	1-15	1-14	Broadway Ave	24	RCP	80	78	MH 1-15_MH 1-14_2022-08-30	221A	4133	1	Surface Damage Roughness Increased (7.0' to 74.2'), Surface Damage Aggregate Visible (29.8'), Infiltration Runner Barrel (29.8'), Infiltration Dripper Joint (39.9' to 53.5'), Infiltration Stain Joint (39.9' to 74.2'), Surface Damage Surface Spalling (41.2')	CIPP Lining		X
M-08	1: Interceptor Pipe and Manhole Rehab.	1-16:1-15	1-16	1-15	Willow St	24	RCP	294	302	MH 1-16_MH 1-15_2022-08-30	1J00	5141	4	Surface Damage Roughness Increased (7.0' to 299.2'), Infiltration Stain Joint (8.4' to 299.2'), Infiltration Stain Lateral (66.1', 259.1'), Infiltration Gusher Joint (142.7'), Infiltration Runner Joint (168.6')	CIPP Lining		X
M-08	1: Interceptor Pipe and Manhole Rehab.	1-17:1-16	1-17	1-16	Willow St, Route 27 / Greenmanville Ave	24	RCP	57	61	MH 1-17_MH 1-16_2022-08-30	311A	1900	0	Surface Damage Roughness Increased (1.9' to 57.3'), Infiltration Stain Joint (14.8' to 57.3'), Crack Multiple (49.3')	CIPP Lining		X

Table 2-4
Town of Stonington, CT Mystic Area SSES
CCTV Recommendations

Sewershed Area	Phase of Sewer Rehabilitation	Pipe ID	Upstream Manhole	Downstream Manhole	Street Name	Diameter (in)	Material	GIS Length (ft)	Approx. Length (ft, from NWMCC CCTV)	National Water Main's Video Name	Structural PACP Quick Rating	O&M PACP Quick Rating	Approx. Number of Active Service Connections	Observations	Recommendations	No Recommendations	CIPP Lining
M-08	1: Interceptor Pipe and Manhole Rehab.	1-18:1-17	1-18	1-17	Route 27 / Greenmanville Ave	24	RCP	354	347	MH 1-18_MH 1-17_2022-08-30	1L00	4133	7	Surface Damaged Roughness Increased (0' to 342.8'), Infiltration Stain Lateral (18.9', 103.6'), Infiltration Dripper Lateral (35', 292.3', 332.4'), Infiltration Stain Joint (49.3' to 343.8'), Deposits Settled Hard/Compacted (89.2'), Infiltration Runner Lateral (155.5'), Deposits Attached Encrustation (292.3')	CIPP Lining		X
M-08	1: Interceptor Pipe and Manhole Rehab.	1-19:1-18	1-19	1-18	Route 27 / Greenmanville Ave	24	RCP	189	181	MH 1-19_MH 1-18_2022-08-30	1F00	2613	2	Surface Damage Roughness Increased (0' to 177.4'), Infiltration Stain Lateral (72.4'), Infiltration Stain Joint (126.9'), Infiltration Weeper Joint (142.8', 150.8' to 177.4')	CIPP Lining		X
M-08	1: Interceptor Pipe and Manhole Rehab.	1-20:1-19	1-20	1-19	Route 27 / Greenmanville Ave	24	RCP	248	227	MH 1-20_MH 1-19_2022-08-29	1H00	1100	3	Surface Damage Roughness Increased (1.7' to 224.4'), Infiltration Stain Barrel (199.6'), 2018 CCTV shows an Infiltration Runner Connection (73.0'), Infiltration Dripper Connection (187.1'), Infiltration Runner Joint (205.7')	CIPP Lining		X
M-10	1: Interceptor Pipe and Manhole Rehab.	1-23:1-22	1-23	1-22	Route 27 / Greenmanville Ave	24	RCP	270	283	MH 1-23_MH 1-22_2022-08-29	241J	2100	2	Surface Damage Roughness Increased (7.1' to 281.2'), Miscellaneous Water Sag (250' to 267.8'), Infiltration Weeper Joint (131.3')	CIPP Lining		X
M-10	1: Interceptor Pipe and Manhole Rehab.	1-24:1-23A	1-24	1-23A	Route 27 / Greenmanville Ave	24	RCP	166	171	MH 1-24_MH 1-23A_2022-08-25	251E	5241	3	Surface Damage Roughness Increased (0' to 168.5'), Infiltration Gusher Joint (16.3', 88.8'), Infiltration Runner Joint (161.1'), Miscellaneous Water Level Sag (143' to 168.5')	CIPP Lining		X
M-10	1: Interceptor Pipe and Manhole Rehab.	1-25:1-24	1-25	1-24	Route 27 / Greenmanville Ave	24	RCP	294	289	MH 1-25_MH 1-24_2022-08-25	1J00	5111	3	Surface Damage Roughness Increased (0' to 286'), Roots Fine Lateral (171.4'), Infiltration Gusher Joint (209.7')	CIPP Lining		X
M-10	1: Interceptor Pipe and Manhole Rehab.	1-27:1-26	1-27	1-26	Route 27 / Greenmanville Ave	24	RCP	185	194	MH 1-27_MH 1-26_2022-08-24	1F00	4131	3	Surface Damage Roughness Increased (1.8' to 192.3'), Deposits Attached Grease (21.2'), Roots Ball Connection (22.1'), Deposits Attached Encrustation (36.1'), Infiltration Dripper Connection (46.3'), Infiltration Stain Joint (68.6')	CIPP Lining		X

Table 2-4
Town of Stonington, CT Mystic Area SSES
CCTV Recommendations

Sewershed Area	Phase of Sewer Rehabilitation	Pipe ID	Upstream Manhole	Downstream Manhole	Street Name	Diameter (in)	Material	GIS Length (ft)	Approx. Length (ft, from NWMCC CCTV)	National Water Main's Video Name	Structural PACP Quick Rating	O&M PACP Quick Rating	Approx. Number of Active Service Connections	Observations	Recommendations	No Recommendations	CIPP Lining
M-10	1: Interceptor Pipe and Manhole Rehab.	1-29:1-28	1-29	1-28	Route 27 / Greenmanville Ave	24	RCP	333	314	MH 1-29_MH 1-28_2022-08-24	1K00	432K	2	Surface Damage Roughness Increased (0' to 311.6'), Deposits Attached Grease (8.7' to 311.6'), Infiltration Runner Joint (81', 90.7', 130.8')	CIPP Lining		X
M-10	1: Interceptor Pipe and Manhole Rehab.	1-30:1-29	1-30	1-29	Route 27 / Greenmanville Ave	24	RCP	280	283	MH 1-30_MH 1-29_2022-08-24	2B1J	4116	1	Surface Damage Roughness Increased (1.5' to 280.8'), Infiltration Stain Joint (157.5' to 188.6'), Miscellaneous Water Sag (179.9' to 258.8'), Infiltration Runner Joint (68.6')	CIPP Lining		X
M-10	1: Interceptor Pipe and Manhole Rehab.	1-31:1-30	1-31	1-30	Route 27 / Greenmanville Ave	24	RCP	238	251	MH 1-31_MH 1-30_2022-08-24	2B1H	4111	4	Surface Damage Roughness Increased (1.2' to 246.5'), Miscellaneous Water Sag (73.6' to 160'), Roots Fine Lateral (142.5'), Infiltration Runner Joint (220.6')	CIPP Lining		X
M-10	1: Interceptor Pipe and Manhole Rehab.	1-32:1-31	1-32	1-31	Route 27 / Greenmanville Ave	18	RCP	241	238	MH 1-32_MH 1-31_2022-08-24	1H00	452B	2	Surface Damage Roughness Increased (1' to 236.3'), Infiltration Stain Joint (1.8'), Infiltration Runner Joint (96', 104.5', 112.3', 127.7'), Crack Circumferential (124.2'), Infiltration Runner (124.2'), Infiltration Weeper Joint (144.4' to 232.6')	CIPP Lining		X
M-05	N/A	1-35:1-34	1-35	1-34	Route 27 / Greenmanville Ave	18	RCP	351	350	MH 1-35_MH 1-34_2022-08-23	1L00	0000	3	Surface Damage Roughness Increased (0' to 346')	None	X	
M-05	N/A	1-36:1-35	1-36	1-35	Route 27 / Greenmanville Ave	18	RCP	298	333	MH 1-36_MH 1-35_2022-08-23	1L00	0000	0	Surface Damage Roughness Increased (4.8' to 329.5')	None	X	
M-05	N/A	1-37:1-36	1-37	1-36	Route 27 / Greenmanville Ave	18	RCP	305	300	MH 1-37_MH 1-36_2022-08-23	1J00	0000	0	Surface Damage Roughness Increased (0' to 297')	None	X	
M-05	N/A	1-38:1-37	1-38	1-37	Route 27 / Greenmanville Ave	18	RCP	167	171	MH 1-38_MH 1-37_2022-08-23	1E00	2100	0	Surface Damage Roughness Increased (0.9' to 168.7'), Deposits Attached Grease (1.9')	None	X	
M-05	N/A	1-40A:1-40B	1-40A	1-40B	Route 27 / Greenmanville Ave	8	CI	75	N/A	None	N/A	N/A	0	No CCTV Inspection	None	X	
M-05	N/A	1-40B:1-40A	1-40B	1-40A	Route 27 / Greenmanville Ave	10	RCP	75	N/A	None	N/A	N/A	0	No CCTV Inspection	None	X	
M-05	N/A	1-40C:1-40B	1-40C	1-40B	Route 27 / Greenmanville Ave	18	RCP	86	74	MH 1-40C_MH 1-40B_2022-08-22	0000	2100	1	Tap Break-In Intruding (9.7')	None	X	
M-08	N/A	1-1:1-0	1-1	1-0	Edgemont St Cross-Country	30	RCP	154	137	MH 1-01_MH 1-0_2022-09-01	1D00	0000	0	Surface Spalling of Damage Coating (0' to 134.7')	None	X	

Table 2-4
Town of Stonington, CT Mystic Area SSES
CCTV Recommendations

Sewershed Area	Phase of Sewer Rehabilitation	Pipe ID	Upstream Manhole	Downstream Manhole	Street Name	Diameter (in)	Material	GIS Length (ft)	Approx. Length (ft, from NWMCC CCTV)	National Water Main's Video Name	Structural PACP Quick Rating	O&M PACP Quick Rating	Approx. Number of Active Service Connections	Observations	Recommendations	No Recommendations	CIPP Lining
M-08	N/A	1-8:1-7	1-8	1-7	Route 1 / Broadway Ave	24	RCP	22	44	MH 1-08_MH 1-07_2022-08-31	1800	1400	0	Surface Spalling of Damage Coating (0' to 41'), Infiltration Stain Joint (7.6' to 29.6')	None	X	
M-08	N/A	1-11:1-10	1-11	1-10	Route 1 / Broadway Ave	24	RCP	53	46	MH 1-11_MH 1-10_2022-08-31	2800	0000	0	Surface Damage Surface Spalling (4.2' to 44.9')	None	X	
M-08	N/A	1-21:1-20	1-21	1-20	Route 27 / Greenmanville Ave	24	RCP	215	226	MH 1-21_MH 1-20_2022-08-29	221H	1100	2	Surface Damage Roughness Increased (0' to 224.8'), Miscellaneous Water Level Sag (172.7' to 181.4'), Infiltration Stain Joint (29.5')	None	X	
M-08	N/A	1-22:1-21	1-22	1-21	Route 27 / Greenmanville Ave	24	RCP	108	106	MH 1-22_MH 1-21_2022-08-29	271C	0000	1	Surface Damage Roughness Increased (2' to 101.9'), Miscellaneous Water Level Sag (66.3' to 101.9')	None	X	
M-10	N/A	1-23A:1-23	1-23A	1-23	Route 27 / Greenmanville Ave	24	RCP	11	12	MH 1-23A_MH 1-23_2022-08-29	1200	0000	0	Surface Damage Roughness Increased (0' to 10.7')	None	X	
M-10	N/A	1-26:1-25	1-26	1-25	Route 27 / Greenmanville Ave	24	RCP	255	249	MH 1-26_MH 1-25_2022-08-25	1I00	1100	1	Surface Damage Roughness Increased (0' to 248.1'), Infiltration Stain Joint (235.8')	None	X	
M-10	N/A	1-28:1-27	1-28	1-27	Route 27 / Greenmanville Ave	24	RCP	211	217	MH 1-28_MH 1-27_2022-08-24	1G00	2100	0	Surface Damage Roughness Increased (1.1' to 214.2'), Deposits Attached Grease (99.7')	None	X	
															Total =	**15**	**31**

Acronyms:
CI = Cast Iron
CIPP = Cured-in-Place Pipe
MH = Manhole
RCP = Reinforced Concrete Pipe

Section 3

Manhole Inspection Program

3.1 Introduction

CDM Smith performed a manhole inspection program throughout the Mystic Area to identify sources of infiltration, inflow, and other defects. Field crews used a customized tablet application that uploaded the data to the collection system GIS in real-time. In addition to logging the condition data into GIS, the application enabled field crews to GPS locate the manholes to verify accuracy of the mapping and add new manholes to the map when necessary.

Based upon the FMDA Report and CEA, specific sewershed areas with the highest I/I volumes were identified for additional SSES work. Special focus was given to these areas to determine if defects in these manholes could be contributing to the excessive I/I volumes. The I/I sewershed areas included areas M-01, M-05, M-08, M-09 and M-10. These sewershed areas can be seen on **Figure 1-2**. A list of all inspected manholes and their sewershed areas can be seen in **Table 3-3** at the end of Section 3.

CDM Smith identified infiltration (both active and signs of prior infiltration or staining) on many manholes in the Mystic Area, as well as manhole covers with vent holes that can contribute to inflow. In total, 234 manhole inspections were attempted. Thirty-one manholes could not be located or opened. The remaining 203 manholes were inspected. Approximately 60 percent of manholes in the five sewersheds were recommended for at least one repair. This section explains the methodology, results, and recommendations.

3.2 Manhole Components

For the purpose of this report, manholes have been described as having the following components. From top of the manhole to bottom:

Table 3-1 Manhole Components

Component	Descriptions
Frame/Cover	Casting at grade, including cover
Rim	Top of manhole frame
Metal Ring	Used to extend the height of the frame without excavation
Chimney	Brick, block, or mortar, used to adjust frame and to grade
Cone	Transition between chimney and wall
Wall	Vertical barrel portion, including cones and transition sections
Joint	Connection between precast wall and/or cone sections
Steps	Used to aid ingress and egress for maintenance and inspection
Internal/External Drop	Directs incoming flow to the channel at a lower elevation
Bench	Brick or concrete bottom
Pipe Seal	Seals manhole from infiltration between pipe connection and the bench/wall
Invert/Channel	Hydraulically shaped channel in bench for connecting inlet and outlet pipes
Base	Structural base of the manhole; wall, bench, and channel are built on the base

Figure 3-1 shows an illustration of the definitions presented above.

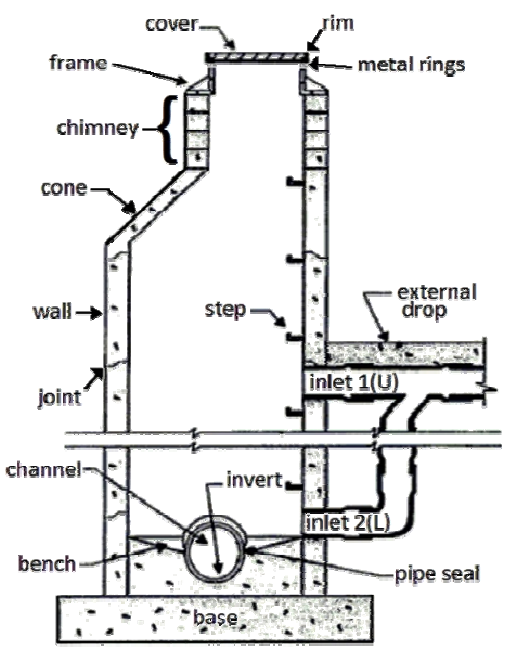


Figure 3-1
Typical Precast Manhole Cross Section (no scale)

3.3 Inspection Data

Manholes were inspected from the surface without entry. The information documented during the inspections included:

- Date of inspection
- Manhole number
- Street and location
- Height, rim to invert
- Grade to rim
- Pipe connections, including estimated size and material
- Signs of infiltration (active or prior)
- Signs of mineral deposit
- Signs of blockage and/or surcharge
- Manhole defects such as corrosion and cracks
- Surface asphalt condition
- Digital photographs of manhole
- Signs of potential inflow such as multiple vent holes in the covers or low-lying locations

The above information was entered into a manhole inspection log for each manhole. An example of a blank manhole inspection form is provided in **Figure 3-2** at the end of this section.

3.4 Reported Defects

CDM Smith inspected 203 manholes in five sewersheds within the Mystic Area (M-01, M-05, M-08, M-09 and M-10). An additional 17 were not accessible and 14 manholes were shown on the mapping but were not found. A map of the inspected manholes was made for each of the five sewersheds. The inspected manholes are shown on **Figure 3-3** through **Figure 3-7** at the end of this section. Copies of the completed inspection logs and photos are included in Appendix B.

Approximately 70 percent of the manholes inspected in the Mystic Area are brick construction. Reported defects in the manholes range from those with minor cosmetic defects to those needing major repairs. The most common defects were infiltration and corroded frame and covers. **Table 3-2** on the following page provides a summary of the manhole component repairs that were recommended at the time of the inspection. This table lists recommended repairs, the number of manholes they occurred in, and the percentage of total manholes this represents.

The most common repair recommendations were monolithic manhole lining, replace frame and cover, and raise cover to grade. As noted above, 17 manholes were not accessible and 14

manholes were not found during initial inspections. If a manhole was not found during the inspection or was not made accessible by the Town or Town's contractor since the initial inspection, CDM Smith recommends that these be located or investigated (totaling 29 manholes). The FMDA Report and CEA recommended monolithic lining in all unlined manholes within sewersheds M-01, M-05, M-08, M-09, and M-10. No inspected manholes within the five sewersheds were found to already be lined so all manholes are recommended for monolithic lining. It should be noted that some manholes had more than one repair recommendation.

Table 3-2 Manhole Condition Observations

Component Repair Recommendation	Number of Manholes	Percentage of Manholes
Locate/Investigate	29	12%
Raise Cover to Grade	31	13%
Replace Frame and Cover	55	24%
Replace Watertight Seal/Insert	7	3%
Rebuild Chimney	19	8%
Rebuild Bench/Channel	2	1%
Manhole Monolithic Lining	68	29%

3.4.1 Frame and Cover

CDM Smith found various types of covers throughout this area. Most of the frames and covers in the Mystic Area were in good condition during inspections, but approximately 24 percent were recommended for a frame and cover replacement. Frame and cover issues included corroded, cracked with active inflow or staining, broken, buried, and misaligned frames and covers. Vent holes can be a source of inflow if the manholes are subject to ponding, especially around the time of a rain event.

CDM Smith found 26 sanitary sewer manholes with two or more vent holes in the cover. These manholes were recommended for a cover replacement. Additionally, CDM Smith identified 36 frames and covers with active inflow in the form of weepers; None of these were inspected during rainy conditions. CDM Smith identified an additional 52 frame and covers with stains, indicating recent inflow. Seven of the 52 manholes with stains in the frame and cover were inspected during light rain. The remaining were inspected during dry conditions.

3.4.2 Chimney

Chimneys are usually constructed of brick and mortar and are intended to raise the manhole cover and frame to the grade of the road. Chimneys are the manhole component most often subjected to traffic impact loading and to degradation from freeze/thaw cycles. Defects in chimneys are primarily attributed to missing bricks and/or mortar. Deteriorated chimneys provide an easy path for groundwater and surface water seepage to flow through. This inflow can

allow fine sediments to migrate from the road subbase to the collection system, resulting in differential settling of the road. Approximately eight percent of the chimneys in the Mystic Area were recommended for repair by CDM Smith. These repair recommendations included rebuilding the chimney of a manhole. CDM Smith found four chimneys with active infiltration in the form of weepers, which were all inspected during dry weather. Thirteen additional manholes were found to have stains in the chimney during inspections. One manhole with a stain was inspected during light rain, one was inspected during dry weather but wet ground, and the remaining 11 were inspected during dry weather.

3.4.3 Cone

CDM Smith did not recommend any specific repairs for the manhole cones inspected. It was noted that the cone of manhole 1-207 should be recommended for sealing due to its field conditions, however comprehensive lining encompasses this recommendation and a separate distinguishment was not made. Defects in the cones included root intrusions, mineral deposits, hydrogen sulfide corrosion, and general deterioration. CDM Smith found two cones that had active infiltration in the form of weepers and both were inspected during dry weather. An additional seven manholes were found to have stains in the cone and were all found during dry weather.

3.4.4 Wall

The majority of the walls throughout the Mystic Area were in good condition, with only one manhole, 1-20, noted to require sealing due to field conditions. Similar to the situation in Section 3.4.3, sealing the wall was not acknowledged individually, as comprehensive lining encompasses this recommendation. Defects in the walls include missing material, root intrusions, mineral deposits, and general deterioration. Active infiltration in the form of weepers, drippers, runners, and gushers were found in 21 walls with all 21 manholes being inspected during dry weather. An additional 31 manhole walls were noted as having stains during inspection. Two manholes with a stain were inspected during light rain, one was inspected during dry weather but wet ground, and the remaining 28 were inspected during dry weather.

3.4.5 Bench

The benches in most of the Mystic Area manholes were in good condition, with only one manhole receiving a repair recommendation. The repair recommended is rebuilding the bench. Defects in the bench are typically due to missing and deteriorated mortar between the bricks and at the seam where the manhole wall meets the shelf. CDM Smith did not find active infiltration in any of the benches inspected but found a stain in the bench of one manhole.

3.4.6 Invert/Channel

Most of the inverts/channels in the Mystic Area were in fair to good condition. CDM Smith recommended a repair to one invert inspected, which is rebuilding the invert. Defects in the inverts consisted of cracking, displacement, deterioration, and a buildup of debris. Active infiltration in the form of a runner was found in one of the inverts that was inspected.

3.4.7 Other Repairs

Additional manhole repair recommendations included manhole monolithic lining. Lining was recommended in the field when a manhole component had evidence of corrosion, minor structural defects (such as a crack), or active infiltration that was equivalent to a weeper or more severe. Additionally, the FMDA Report and CEA recommended monolithic lining in all unlined manholes within sewersheds M-01, M-05, M-08, M-09, and M-10.

3.5 Summary

The manhole inspection program showed that there is a potential for I/I to occur in the Town's manholes; 60 percent of manholes inspected had at least one defect. CDM Smith also found 26 sanitary sewer manholes with at least two vent holes in the cover. These covers can contribute inflow if the area is prone to flooding.

Infiltration from manholes can be significant during periods of high groundwater and after periods of rainfall due to rainfall-induced infiltration. The Town's wastewater collection system is susceptible to high groundwater infiltration and rainfall-induced infiltration due to the number of frames, covers, chimneys, cones, and walls in fair and poor condition. CDM Smith observed 63 manholes with infiltration and 89 manholes with inflow.

Overall, the manholes within the Mystic Area are showing signs of deterioration, mainly due to age. Evidence of active infiltration and staining on numerous components indicates that deterioration is allowing infiltration into the collection system. Many manhole frames and covers have vent holes and defective covers that could allow inflow into the system. Implementing a manhole rehabilitation program in the Mystic Area should reduce extraneous flow in the system.

3.6 Recommendations

Following CDM Smith's manhole inspections, the Town notified CDM Smith that some manholes had been rehabilitated. In March 2023, the Town notified CDM Smith that the following manholes had frame and cover replaced and/or reset to grade: 1-20, 1-32, 1-33, 1-35, 1-36, 1-39, 1-40A, 1-40B, 1-41, 1-42, 1-43, 1-46, 1-47, 1-51, 1-204, 1-209, 1-212, 1-213, 1-215, 1-225, 1-226, 1-228, 1-229, 1-230, 1-231, 1-232, 1-233, and 1-264. CDM Smith updated manhole rehabilitation recommendations in this report to account for these changes since manhole inspections were completed.

Table 3-3 at the end of this section summarizes the manholes that were inspected, as well as the recommended repairs and their phasing.

CDM Smith recommends 33 manholes for repairs under Phase 1: Interceptor Pipe and Manhole Rehabilitation of sewer rehabilitation program. Defects in these manholes include structural issues in the chimney and wall, corroded frames and covers, and infiltration in the form of stains, weepers, runner, and gushers. These repairs mainly include lining manholes, replacing frames and covers, and raising covers to grade. It is estimated that this manhole rehabilitation will remove approximately 0.005 MGD of infiltration.

CDM Smith also suggests the 20 manholes within Phase 3: M-09 Remaining Pipe and Manhole Rehabilitation and the 51 manholes within Phase 5: M-08 Remaining Pipe and Manhole

Rehabilitation are completed as soon as possible, depending on the Town's available funds. Phase 3 and Phase 5 would rehabilitate defects including structural issues in chimneys, corroded frames and covers, and infiltration in the form of stains, weepers, and drippers. The remaining manholes with recommendations are shown on **Table 3-3** and should be considered for future manhole rehabilitation by the Town.

Additionally, CDM Smith recommends 29 manholes are investigated and raised to grade prior to rehabilitation being completed in the manhole's corresponding phase.

Figure 3-2: Example Manhole Inspection Form

CDM Smith

Town of Stonington, Connecticut

Manhole Inspection Form

Manhole Information

Inspector:
Date:
Weather:

GIS MH No:
Type of Manhole:
Inspection Status:

Street:
Location:

Rim to Invert (ft):
Grade to Rim (in):

Manhole Infiltration

Surcharge:
Infiltration:

Number of Holes:
Metal Riser:

Manhole Characteristics

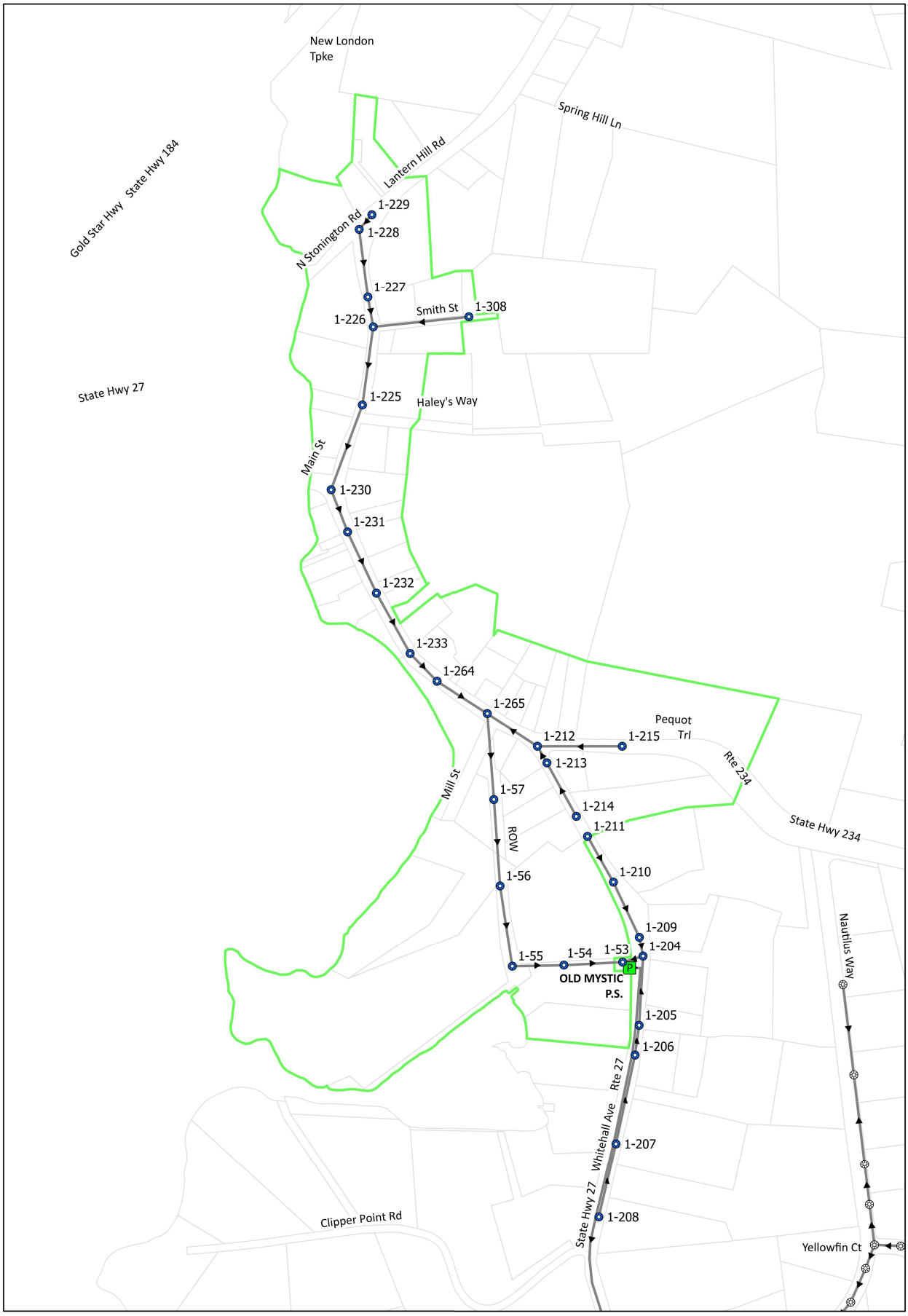
Location in MH	Mtrl. Code	Infil. Code	Cond. Code	Repair Codes	Comments
Frame/Cover					
Chimney					
Cone					
Wall					
Bench					
Invert/Channel					

Invert Information

Pipe	Direction	Rim to Invert	Pipe Dia. (in)	Pipe Mtrl. Code	Clock Position*	Comments
Pipe 1						
Pipe 2						
Pipe 3						
Pipe 4						
Pipe 5						

Additional Comments

*6:00 is outlet



Legend

- Inspected
- Not Found
- No Access
- Sewer Manhole
- Sewer Mains
- Pump Station
- WPCF Water Pollution Control Facility
- Railroads
- M-01
- M-05
- M-08
- M-09
- M-10

1 inch = 300 feet

N

0 150 300 Feet

Town of Stonington, Connecticut

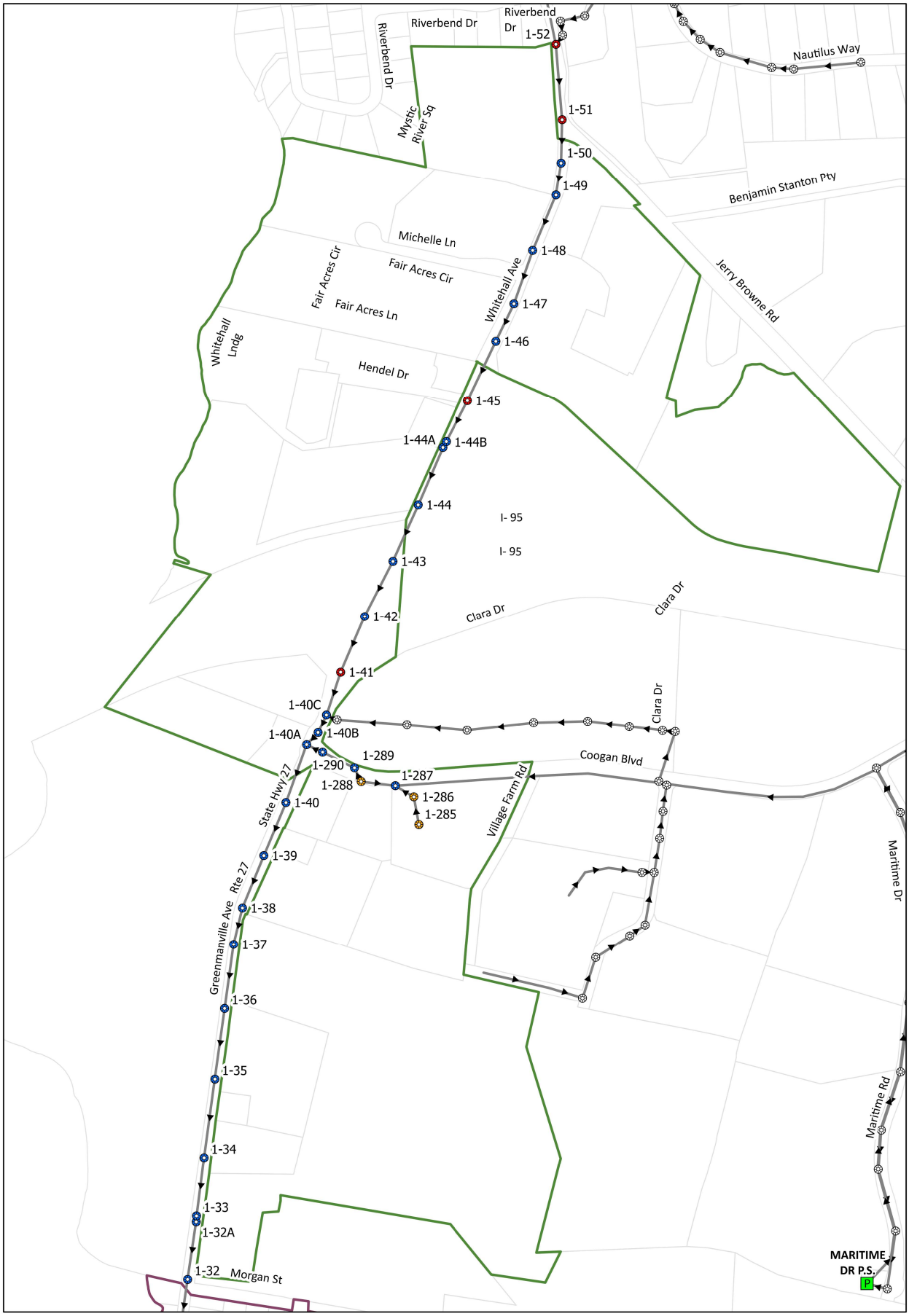
Manhole Inspection Locations in Sewershed M-01

Sanitary Sewer Evaluation Survey

July 2023

Figure 3-3

CDM Smith



Legend

- Inspected
- Not Found
- No Access
- Sewer Manhole
- Sewer Mains
- Pump Station
- WPCF Water Pollution Control Facility
- Railroads
- M-01
- M-05
- M-08
- M-09
- M-10

1 inch = 400 feet

N

0 200 400 Feet

Town of Stonington, Connecticut

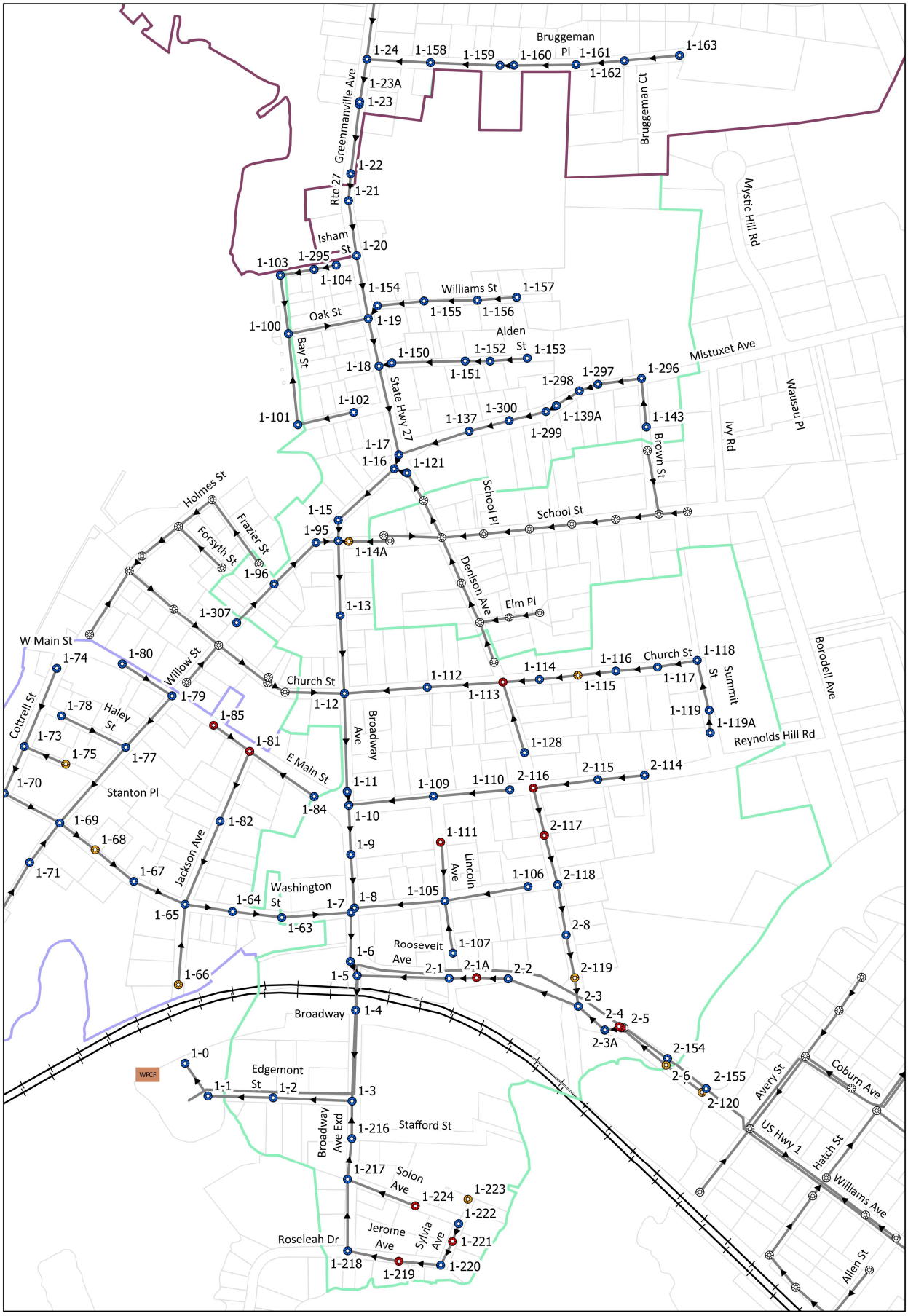
Manhole Inspection Locations in Sewershed M-05

Sanitary Sewer Evaluation Survey

July 2023

Figure 3-4

CDM Smith



Legend

- Inspected
- Not Found
- No Access
- Sewer Manhole
- Sewer Mains
- Pump Station
- WPCF Water Pollution Control Facility
- Railroads
- M-01
- M-05
- M-08
- M-09
- M-10

1 inch = 350 feet

N

0 175 350 Feet

Town of Stonington, Connecticut

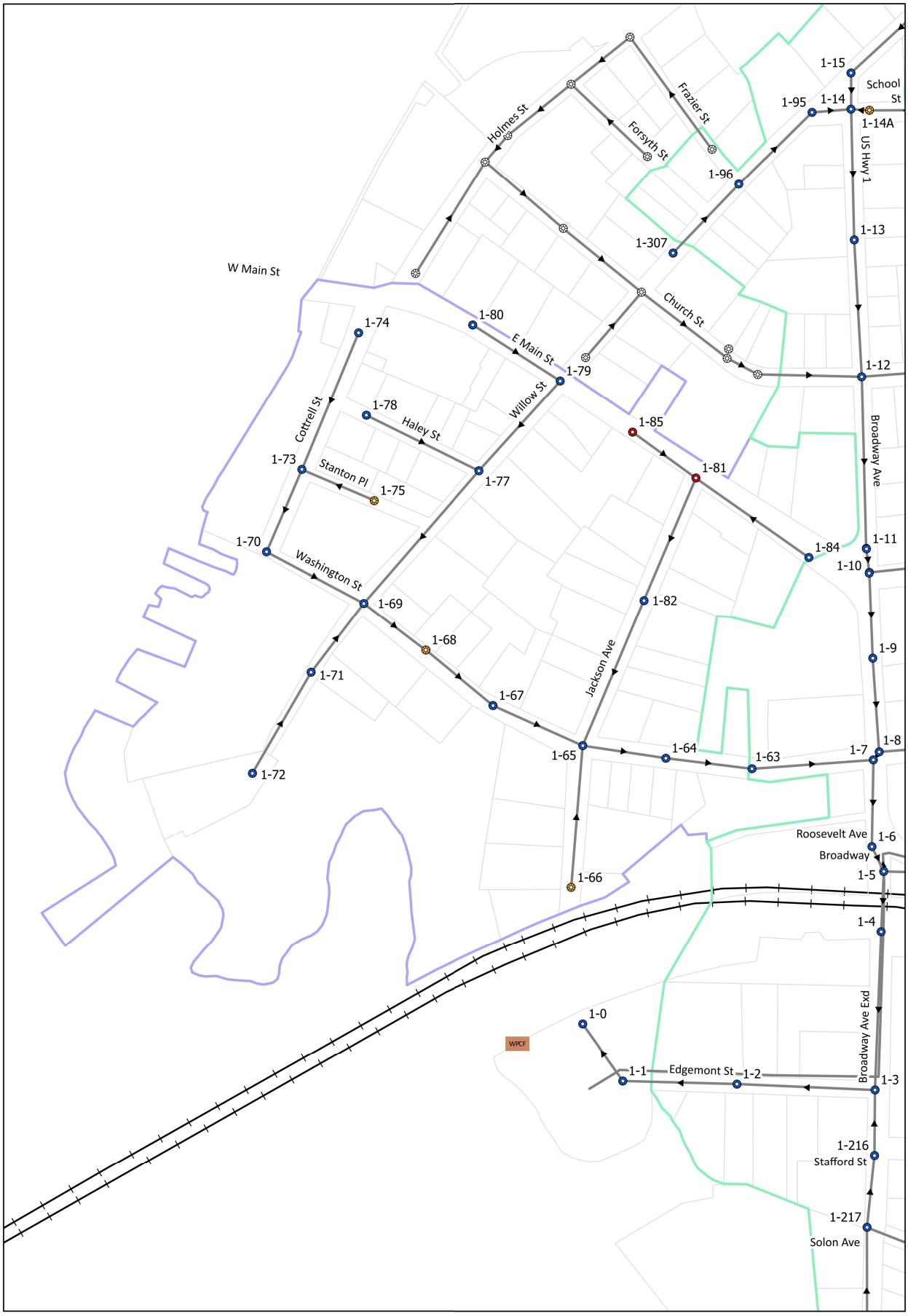
Manhole Inspection Locations in Sewershed M-08

Sanitary Sewer Evaluation Survey

July 2023

Figure 3-5

CDM Smith



Legend

- Inspected
- Not Found
- No Access
- Sewer Manhole
- Sewer Mains
- Pump Station
- WPCF Water Pollution Control Facility
- Railroads
- M-01
- M-05
- M-08
- M-09
- M-10

1 inch = 200 feet

N

0 100 200 Feet

Town of Stonington, Connecticut

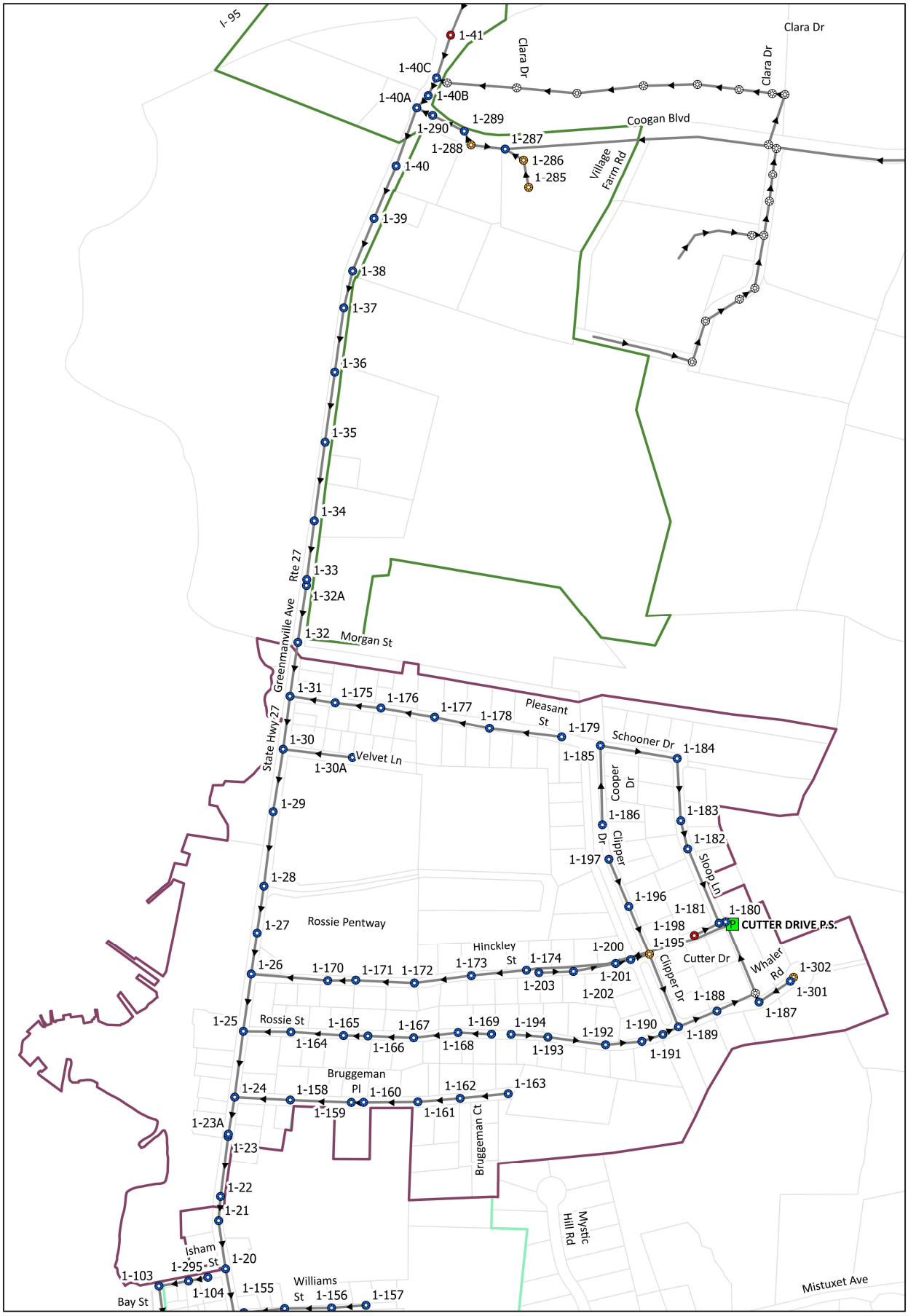
Manhole Inspection Locations in Sewershed M-09

Sanitary Sewer Evaluation Survey

July 2023

Figure 3-6

CDM Smith



Legend

- Inspected
- Not Found
- No Access
- Sewer Manhole
- Sewer Mains
- Pump Station
- WPCF Water Pollution Control Facility
- Railroads
- M-01
- M-05
- M-08
- M-09
- M-10

1 inch = 400 feet

N

0 200 400 Feet

Town of Stonington, Connecticut

Manhole Inspection Locations in Sewershed M-10

Sanitary Sewer Evaluation Survey

July 2023

Figure 3-7

CDM Smith

Table 3-3
Town of Stonington, CT Mystic Area SSES
Manhole Rehabilitation

Sewershed Area	Revised Phase of Sewer Rehabilitation	Manhole Number	Approximate Manhole Depth (vf)	Infiltration Observed	Inflow Observed	No Recommendation	Town to Locate/Investigate	Raise Cover to Grade	Replace Frame/Cover	Replace Watertight Seal/Insert	Rebuild Chimney	Rebuild Bench/Channel	Monolithic Line Manhole	Comments
M-05	1: Interceptor Pipe and Manhole Rehab.	1-33	9	X									X	Infiltration Runner in the Wall
M-05	1: Interceptor Pipe and Manhole Rehab.	1-38	14										X	Structural Issues in the Wall
M-05	1: Interceptor Pipe and Manhole Rehab.	1-40A	12										X	Structural Issues in the Wall
M-05	1: Interceptor Pipe and Manhole Rehab.	1-40C	9						X					
M-05	1: Interceptor Pipe and Manhole Rehab.	1-45	9				X	X						
M-05	1: Interceptor Pipe and Manhole Rehab.	1-52	7				X	X						
M-08	1: Interceptor Pipe and Manhole Rehab.	1-0	16						X					
M-08	1: Interceptor Pipe and Manhole Rehab.	1-1	15						X					
M-08	1: Interceptor Pipe and Manhole Rehab.	1-2	14	X					X				X	Infiltration Weeper in the Wall
M-08	1: Interceptor Pipe and Manhole Rehab.	1-3	14	X					X				X	Infiltration Stains in the Wall
M-08	1: Interceptor Pipe and Manhole Rehab.	1-5	15	X					X				X	Infiltration Weeper in the Wall
M-08	1: Interceptor Pipe and Manhole Rehab.	1-6	15	X							X		X	Infiltration Stains in the Chimney and Wall
M-08	1: Interceptor Pipe and Manhole Rehab.	1-7	13	X									X	Infiltration Stains in the Wall
M-08	1: Interceptor Pipe and Manhole Rehab.	1-8	13	X					X				X	Infiltration Runner in the Wall
M-08	1: Interceptor Pipe and Manhole Rehab.	1-9	14	X									X	Infiltration Weeper in the Wall
M-08	1: Interceptor Pipe and Manhole Rehab.	1-11	12	X	X				X				X	Infiltration Stains
M-08	1: Interceptor Pipe and Manhole Rehab.	1-12	12	X									X	Infiltration Stains in the Chimney and Wall
M-08	1: Interceptor Pipe and Manhole Rehab.	1-13	13	X									X	Infiltration Stains in the Chimney and a Gusher in the Wall

Table 3-3
Town of Stonington, CT Mystic Area SSES
Manhole Rehabilitation

Sewershed Area	Revised Phase of Sewer Rehabilitation	Manhole Number	Approximate Manhole Depth (vf)	Infiltration Observed	Inflow Observed	No Recommendation	Town to Locate/Investigate	Raise Cover to Grade	Replace Frame/Cover	Replace Watertight Seal/Insert	Rebuild Chimney	Rebuild Bench/Channel	Monolithic Line Manhole	Comments
M-08	1: Interceptor Pipe and Manhole Rehab.	1-14	14	X	X								X	Infiltration Stains
M-08	1: Interceptor Pipe and Manhole Rehab.	1-15	13	X	X				X				X	Infiltration Stains
M-08	1: Interceptor Pipe and Manhole Rehab.	1-16	14	X									X	Infiltration Stains in the Cone
M-08	1: Interceptor Pipe and Manhole Rehab.	1-17	13	X	X				X		X		X	Infiltration Stains
M-08	1: Interceptor Pipe and Manhole Rehab.	1-18	13	X	X				X				X	Infiltration Stains
M-08	1: Interceptor Pipe and Manhole Rehab.	1-19	13		X				X					
M-08	1: Interceptor Pipe and Manhole Rehab.	1-20	14	X									X	Infiltration Weeper in the Wall
M-08	1: Interceptor Pipe and Manhole Rehab.	1-21	11	X					X				X	Infiltration Stains in the Chimney and Wall
M-08	1: Interceptor Pipe and Manhole Rehab.	1-23	11	X									X	Infiltration Weeper in the Chimney
M-10	1: Interceptor Pipe and Manhole Rehab.	1-23A	11	X					X				X	Infiltration Stains in the Chimney
M-10	1: Interceptor Pipe and Manhole Rehab.	1-24	13	X									X	Infiltration Weeper in the Chimney and Stain in the Bench
M-10	1: Interceptor Pipe and Manhole Rehab.	1-25	17	X									X	Infiltration Stains in the Chimney and Wall
M-10	1: Interceptor Pipe and Manhole Rehab.	1-26	16	X									X	Infiltration Weeper in the Chimney
M-10	1: Interceptor Pipe and Manhole Rehab.	1-28	9						X				X	Structural Issues in the Chimney and Wall
M-10	1: Interceptor Pipe and Manhole Rehab.	1-31	10	X					X				X	Infiltration Stains in the Chimney and a Weeper in the Wall
M-09	3: M-09 Remaining Pipe and Manhole Rehab.	1-63	11	X					X				X	Infiltration Weeper in the Wall
M-09	3: M-09 Remaining Pipe and Manhole Rehab.	1-64	9	X					X				X	Infiltration Weeper in the Cone and Wall
M-09	3: M-09 Remaining Pipe and Manhole Rehab.	1-66	7				X	X						

Table 3-3
Town of Stonington, CT Mystic Area SSES
Manhole Rehabilitation

Sewershed Area	Revised Phase of Sewer Rehabilitation	Manhole Number	Approximate Manhole Depth (vf)	Infiltration Observed	Inflow Observed	No Recommendation	Town to Locate/Investigate	Raise Cover to Grade	Replace Frame/Cover	Replace Watertight Seal/Insert	Rebuild Chimney	Rebuild Bench/Channel	Monolithic Line Manhole	Comments
M-09	3: M-09 Remaining Pipe and Manhole Rehab.	1-67	8		X				X					
M-09	3: M-09 Remaining Pipe and Manhole Rehab.	1-68	8				X	X						
M-09	3: M-09 Remaining Pipe and Manhole Rehab.	1-69	8						X					
M-09	3: M-09 Remaining Pipe and Manhole Rehab.	1-70	6						X					
M-09	3: M-09 Remaining Pipe and Manhole Rehab.	1-71	6						X					
M-09	3: M-09 Remaining Pipe and Manhole Rehab.	1-72	6	X					X				X	Infiltration Stains in the Cone and Wall
M-09	3: M-09 Remaining Pipe and Manhole Rehab.	1-73	6						X					
M-09	3: M-09 Remaining Pipe and Manhole Rehab.	1-74	6	X									X	Infiltration Stains in the Cone and Wall
M-09	3: M-09 Remaining Pipe and Manhole Rehab.	1-75	6				X	X						
M-09	3: M-09 Remaining Pipe and Manhole Rehab.	1-77	5	X									X	Infiltration Stains in the Wall
M-09	3: M-09 Remaining Pipe and Manhole Rehab.	1-78	7		X				X					
M-09	3: M-09 Remaining Pipe and Manhole Rehab.	1-79	8								X			
M-09	3: M-09 Remaining Pipe and Manhole Rehab.	1-80	6		X						X			
M-09	3: M-09 Remaining Pipe and Manhole Rehab.	1-81	8				X	X						
M-09	3: M-09 Remaining Pipe and Manhole Rehab.	1-82	10	X									X	Infiltration Stains in the Wall
M-09	3: M-09 Remaining Pipe and Manhole Rehab.	1-84	7	X	X				X				X	Infiltration Stains in the Wall
M-09	3: M-09 Remaining Pipe and Manhole Rehab.	1-85	7				X	X						
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	1-14A	6				X	X						

Table 3-3
Town of Stonington, CT Mystic Area SSES
Manhole Rehabilitation

Sewershed Area	Revised Phase of Sewer Rehabilitation	Manhole Number	Approximate Manhole Depth (vf)	Infiltration Observed	Inflow Observed	No Recommendation	Town to Locate/Investigate	Raise Cover to Grade	Replace Frame/Cover	Replace Watertight Seal/Insert	Rebuild Chimney	Rebuild Bench/Channel	Monolithic Line Manhole	Comments
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	1-100	8								X			
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	1-101	7							X				
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	1-103	6	X					X	X			X	Infiltration Stains in the Wall
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	1-104	6	X					X		X		X	Infiltration Stains in the Chimney
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	1-107	6	X									X	Infiltration Stains in the Wall
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	1-109	8		X						X			
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	1-110	7		X				X					
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	1-111	7				X	X						
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	1-112	8	X	X								X	Infiltration Weeper in the Wall
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	1-113	8				X	X						
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	1-115	8				X	X						
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	1-118	9		X						X			
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	1-119A	5		X						X			
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	1-121	11		X				X					
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	1-128	8		X				X					
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	1-137	9								X			
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	1-139A	10		X						X			
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	1-151	7						X	X				

Table 3-3
Town of Stonington, CT Mystic Area SSES
Manhole Rehabilitation

Sewershed Area	Revised Phase of Sewer Rehabilitation	Manhole Number	Approximate Manhole Depth (vf)	Infiltration Observed	Inflow Observed	No Recommendation	Town to Locate/Investigate	Raise Cover to Grade	Replace Frame/Cover	Replace Watertight Seal/Insert	Rebuild Chimney	Rebuild Bench/Channel	Monolithic Line Manhole	Comments
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	1-154	10	X									X	Infiltration Weeper in the Wall
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	1-155	8	X	X				X				X	Infiltration Weeper in the Cone and Wall
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	1-216	12	X					X	X			X	Infiltration Stains in the Wall
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	1-217	11						X	X				
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	1-218	8	X	X				X	X			X	Infiltration Stains in the Wall
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	1-219	8				X	X						
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	1-220	8	X									X	Infiltration Runner in the Wall
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	1-221	7				X	X						
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	1-222	7								X			
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	1-223	7				X	X						
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	1-224	7				X	X						
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	1-295	7	X									X	Infiltration Stains in the Wall
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	1-296	8		X						X			
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	1-297	4						X					
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	1-299	11		X						X			
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	1-300	11		X						X			
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	1-307	9		X				X					
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	2-1	8	X					X			X	X	Infiltration Runner in the Channel

Table 3-3
Town of Stonington, CT Mystic Area SSES
Manhole Rehabilitation

Sewershed Area	Revised Phase of Sewer Rehabilitation	Manhole Number	Approximate Manhole Depth (vf)	Infiltration Observed	Inflow Observed	No Recommendation	Town to Locate/Investigate	Raise Cover to Grade	Replace Frame/Cover	Replace Watertight Seal/Insert	Rebuild Chimney	Rebuild Bench/Channel	Monolithic Line Manhole	Comments
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	2-1A	8				X	X						
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	2-2	9	X									X	Infiltration Weeper in the Wall
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	2-3A	13	X					X				X	Infiltration Weeper in the Wall
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	2-4	13				X	X						
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	2-5	13				X	X						
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	2-6	9				X	X						
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	2-8	7		X				X					
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	2-114	7	X									X	Infiltration Stains in the Cone and Wall
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	2-116	8				X	X						
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	2-117	9				X	X						
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	2-118	8		X				X					
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	2-119	8				X	X						
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	2-120	9				X	X						
M-08	5: M-08 Remaining Pipe and Manhole Rehab.	2-155	10						X					
M-01	N/A	1-53	17	X									X	Infiltration Weeper in the Wall
M-01	N/A	1-54	11	X									X	Infiltration Dripper in the Wall
M-01	N/A	1-55	8			X								Infiltration Stains in the Wall
M-01	N/A	1-56	13	X	X				X				X	Infiltration Stains in the Wall
M-01	N/A	1-57	10	X									X	
M-01	N/A	1-204	12	X	X						X		X	Infiltration Stains in the Chimney
M-01	N/A	1-205	8			X								
M-01	N/A	1-206	8			X								
M-01	N/A	1-207	9	X					X				X	Infiltration Stains in the Cone

Table 3-3
Town of Stonington, CT Mystic Area SSES
Manhole Rehabilitation

Sewershed Area	Revised Phase of Sewer Rehabilitation	Manhole Number	Approximate Manhole Depth (vf)	Infiltration Observed	Inflow Observed	No Recommendation	Town to Locate/Investigate	Raise Cover to Grade	Replace Frame/Cover	Replace Watertight Seal/Insert	Rebuild Chimney	Rebuild Bench/Channel	Monolithic Line Manhole	Comments
M-01	N/A	1-208	8	X	X								X	Infiltration Stains in the Wall
M-01	N/A	1-209	8			X								
M-01	N/A	1-210	8	X									X	Infiltration Stains in the Wall
M-01	N/A	1-211	7						X					
M-01	N/A	1-212	10			X								
M-01	N/A	1-213	9		X	X								
M-01	N/A	1-214	7						X					
M-01	N/A	1-215	9			X								
M-01	N/A	1-225	8			X								
M-01	N/A	1-226	8	X	X								X	Infiltration Stains in the Chimney and Wall
M-01	N/A	1-227	8	X	X								X	Infiltration Stains in the Wall
M-01	N/A	1-228	10		X	X								
M-01	N/A	1-229	9		X	X								
M-01	N/A	1-230	8	X									X	Infiltration Stains in the Chimney and a Runner in the Wall
M-01	N/A	1-231	7			X								
M-01	N/A	1-232	7			X								
M-01	N/A	1-233	7			X								
M-01	N/A	1-264	7			X								
M-01	N/A	1-265	9			X								
M-01	N/A	1-308	5						X					
M-05	N/A	1-32	7			X								
M-05	N/A	1-32A	9			X								
M-05	N/A	1-34	12			X								
M-05	N/A	1-35	10			X								
M-05	N/A	1-36	7			X								
M-05	N/A	1-37	10			X								
M-05	N/A	1-39	14			X								
M-05	N/A	1-40	13			X								
M-05	N/A	1-40B	10			X								
M-05	N/A	1-41	9			X								
M-05	N/A	1-42	10			X								
M-05	N/A	1-43	9			X								
M-05	N/A	1-44	7		X	X								
M-05	N/A	1-44A	9			X								
M-05	N/A	1-44B	8			X								

Table 3-3
Town of Stonington, CT Mystic Area SSES
Manhole Rehabilitation

Sewershed Area	Revised Phase of Sewer Rehabilitation	Manhole Number	Approximate Manhole Depth (vf)	Infiltration Observed	Inflow Observed	No Recommendation	Town to Locate/Investigate	Raise Cover to Grade	Replace Frame/Cover	Replace Watertight Seal/Insert	Rebuild Chimney	Rebuild Bench/Channel	Monolithic Line Manhole	Comments
M-05	N/A	1-46	10			X								
M-05	N/A	1-47	11			X								
M-05	N/A	1-48	9		X	X								
M-05	N/A	1-49	7		X	X								
M-05	N/A	1-50	7			X								
M-05	N/A	1-51	12			X								
M-05	N/A	1-285	7				X	X						
M-05	N/A	1-286	8				X	X						
M-05	N/A	1-287	7						X			X	X	Structural Issues in the Cone, Wall, and Bench
M-05	N/A	1-288	7				X	X						
M-05	N/A	1-289	6		X				X				X	Structural Issues in the Chimney, Cone, and Wall
M-05	N/A	1-290	6		X				X					
M-08	N/A	1-4	15		X	X								
M-08	N/A	1-10	14			X								
M-08	N/A	1-22	9			X								
M-08	N/A	1-95	10		X	X								
M-08	N/A	1-96	8		X	X								
M-08	N/A	1-102	9		X	X								
M-08	N/A	1-105	8		X	X								
M-08	N/A	1-106	7		X	X								
M-08	N/A	1-114	9			X								
M-08	N/A	1-116	7		X	X								
M-08	N/A	1-117	8		X	X								
M-08	N/A	1-119	7		X	X								
M-08	N/A	1-143	9		X	X								
M-08	N/A	1-150	9			X								
M-08	N/A	1-152	9			X								
M-08	N/A	1-153	9		X	X								
M-08	N/A	1-156	8		X	X								
M-08	N/A	1-157	9		X	X								
M-08	N/A	1-298	4		X	X								
M-08	N/A	2-3	10			X								
M-08	N/A	2-115	9			X								
M-08	N/A	2-154	13			X								
M-09	N/A	1-65	10			X								

Table 3-3
Town of Stonington, CT Mystic Area SSES
Manhole Rehabilitation

Sewershed Area	Revised Phase of Sewer Rehabilitation	Manhole Number	Approximate Manhole Depth (vf)	Infiltration Observed	Inflow Observed	No Recommendation	Town to Locate/Investigate	Raise Cover to Grade	Replace Frame/Cover	Replace Watertight Seal/Insert	Rebuild Chimney	Rebuild Bench/Channel	Monolithic Line Manhole	Comments
M-10	N/A	1-27	11			X								
M-10	N/A	1-29	13			X								
M-10	N/A	1-30	11			X								
M-10	N/A	1-30A	5			X								
M-10	N/A	1-158	7	X	X					X			X	Infiltration Stains in the Wall
M-10	N/A	1-159	8		X	X								
M-10	N/A	1-160	12		X						X			
M-10	N/A	1-161	9		X	X								
M-10	N/A	1-162	9		X	X								
M-10	N/A	1-163	8			X								
M-10	N/A	1-164	10		X	X								
M-10	N/A	1-165	8			X								
M-10	N/A	1-166	9		X	X								
M-10	N/A	1-167	9		X	X								
M-10	N/A	1-168	9		X	X								
M-10	N/A	1-169	8		X	X								
M-10	N/A	1-170	7		X	X								
M-10	N/A	1-171	10		X	X								
M-10	N/A	1-172	8		X	X								
M-10	N/A	1-173	9			X								
M-10	N/A	1-174	6		X				X					
M-10	N/A	1-175	8		X	X								
M-10	N/A	1-176	9	X	X								X	Infiltration Weeper in the Chimney
M-10	N/A	1-177	9		X			X						
M-10	N/A	1-178	8		X	X								
M-10	N/A	1-179	8	X	X						X		X	Infiltration Runner in the Wall
M-10	N/A	1-180	11			X								
M-10	N/A	1-181	9		X	X								
M-10	N/A	1-182	9		X	X								
M-10	N/A	1-183	8		X	X								
M-10	N/A	1-184	8	X									X	Infiltration Stains in the Wall
M-10	N/A	1-185	9	X	X								X	Infiltration Stains in the Wall
M-10	N/A	1-186	10			X								
M-10	N/A	1-187	11		X	X								
M-10	N/A	1-188	11		X				X					
M-10	N/A	1-189	8	X							X		X	Infiltration Weeper in the Wall

Table 3-3
Town of Stonington, CT Mystic Area SSES
Manhole Rehabilitation

Sewershed Area	Revised Phase of Sewer Rehabilitation	Manhole Number	Approximate Manhole Depth (vf)	Infiltration Observed	Inflow Observed	No Recommendation	Town to Locate/Investigate	Raise Cover to Grade	Replace Frame/Cover	Replace Watertight Seal/Insert	Rebuild Chimney	Rebuild Bench/Channel	Monolithic Line Manhole	Comments
M-10	N/A	1-190	10		X	X								
M-10	N/A	1-191	9		X	X								
M-10	N/A	1-192	9		X	X								
M-10	N/A	1-193	9		X	X								
M-10	N/A	1-194	9		X				X					
M-10	N/A	1-195	9				X	X						
M-10	N/A	1-196	9		X			X						
M-10	N/A	1-197	8		X	X								
M-10	N/A	1-198	9				X	X						
M-10	N/A	1-200	10		X	X								
M-10	N/A	1-201	9		X	X								
M-10	N/A	1-202	9		X	X								
M-10	N/A	1-203	8	X									X	Infiltration Stains in the Wall
M-10	N/A	1-301	5		X				X					
M-10	N/A	1-302	5				X	X						
			Total =	**63**	**89**	**93**	**29**	**31**	**55**	**7**	**19**	**2**	**68**	

Monolithic Lining **697** **vf**

Section 4

Smoke Testing Program

4.1 Introduction

Smoke testing was performed to identify sources of inflow entering into the sanitary sewer system. The FMDA Report and CEA recommended that smoke testing be performed within sewershed areas M-01, M-08 and M-09. In July 2022, smoke testing was completed in sewershed areas M-08 and M-09 by Martinez Couch & Associates with the footages shown in **Table 4-1** below. The scope and budget for smoke testing was not enough to include the footage for all three areas. The discovery and cap of a large source of inflow in sewershed M-01 reduced the criticality of the sewershed to the Town. Smoke testing in sewershed M-09 was given higher priority to sewershed M-08 since it's recommended for an earlier phase of sewer rehabilitation. All footage in sewershed M-09 was smoke tested, while the remaining budget was used to smoke test a portion of sewershed M-08.

Table 4-1 Smoke Testing by Sewershed Area

Sewershed Area	Total Footage in Sewershed Area (LF)	Total Footage Smoke Tested (LF)
M-08	18,021	12,381
M-09	4,968	4,968
Total	**22,989**	**17,349**

This section presents the program methodology and procedures, results, and recommendations of the smoke testing program, completed in conjunction with the sewer system evaluation presented below.

4.2 Procedure

A smoke blower was placed in manholes and smoke (produced by non-toxic smoke candles or liquid smoke) was introduced into the sewer lines. Each smoke test setup was generally two to three sewer reaches in length. Additional smoke candles or liquid smoke were activated, as necessary, to assure sufficient smoke concentration within the smoke test setup. The lines in the upstream and downstream manholes were restricted, as necessary, to concentrate the smoke within the tested sections. Inspectors were careful to overlap areas to make sure that sufficient smoke was being introduced in the area. The inspector then looked for smoke in adjacent catch basins, roof drains, and driveway drains, which indicated connections to the sewer pipe and likely an inflow source was found.

Smoke testing was conducted during periods of low groundwater and after sufficient time had elapsed from any rain event, thereby creating optimum conditions for testing. Prior to initiating

smoke testing, the Police Department, Fire Department, and Director of Water Pollution Control Authority were notified of where testing would be performed that day. In addition, residents were also notified in advance of testing in order to not cause alarm. **Figure 4-1** and **Figure 4-2**, following this section, provides the locations of the pipes that were smoke tested in sewersheds M-08 and M-09, respectively.

4.3 Program Results

During the smoke testing program, various locations were confirmed to have inflow sources where smoke was seen coming from the location. Examples of confirmed sources include driveway drains, stairwell drains, catch basins, drain manholes, sewer service laterals, and yard drains.

Upon review and analysis of the smoke testing data results were categorized into the following two groups:

1. ***Confirmed Direct Connections***: These sources smoked heavily during the program and were very likely directly connected to the sanitary sewer. Direct sources typically include a catch basin, roof leader, and broken cleanouts.

2. ***Confirmed Indirect Connections:*** These sources smoked lightly during the program, indicating a pathway for smoke to travel between the sanitary sewer and storm drainage system exists. An example of an indirect connection is a sewer crossing under a drain that may have cracks. These cracks will allow smoke from the sewer to migrate through the soil and into the drain. These types of connections should still be documented because a considerable amount of groundwater can infiltrate into the sewer through these cracks. Conversely, an indirect source could possibly allow sewage to migrate into the storm drain, which can cause stormwater contamination. Another example is a cracked or broken service lateral as evidenced by smoke at the ground surface.

Table 4-2 below summarizes the smoke testing results. This table is sorted by sewershed, then alphabetically by street name, and then numerically by building number. The peak discharge was calculated for the direct connections using the drainage area estimated during testing, a runoff coefficient of 0.9 for impermeable areas such as paved surfaces and rooftops, a runoff coefficient of 0.3 for grassy areas, and a peak intensity of 0.87 in/hr, which corresponds to a one-year, six-hour storm. The total estimated peak discharge for the two direct inflow sources is approximately 7 gallons per minute (gpm). Both direct inflow sources are both cleanouts, one each found at 5 Brown Street and 56 Washington Street.

Figure 4-3, following this section, provides the locations of the connections. Additional information and corresponding photos can be found in Appendix C. A total of five sources were found, which include two direct sources and three indirect sources.

Table 4-2 Smoke Testing Results

Location	Sewershed Area	Inflow Type	Private/ Public Property	Source of Smoke	Peak Discharge (gpm)
5 Brown Street	M-08	Direct	Private	Clean out	6
13 Mistuxet Avenue	M-08	Indirect	Private	Ground (under porch)	5
4 Reynolds Hill Road	M-08	Indirect	Private	Basement exhaust	N/A
56 Washington Street	M-08	Direct	Private	Clean out	1
29 Cottrell Street	M-09	Indirect	Private	Ground & crawl space window near clean out	2

Inflow sources were identified in both sewershed areas that were tested. Sewershed area M-08 had four sources and one source was discovered in sewershed area M-09. During the previous I/I study, sewershed areas M-08 and M-09 were found to be the highest contributor of inflow. Together, the two sewershed areas contribute over 55 percent of the total I/I in the Town of Stonington.

4.4 Recommendations

The two direct connections are 5 Brown Street and 56 Washington Street. Both sources of inflow are not in the public right-of-way, are on private property and are the responsibility of the owner. CDM Smith recommends the Town contacts the owners of 5 Brown Street and 56 Washington Street to fix the broken cleanouts.

Additionally, smoke testing found three indirect sources on private properties. Building inspections were not previously completed at two of the locations. CDM Smith recommends the Town contacts the owner 13 Mistuxet Avenue and 4 Reynolds Hill Road to complete building inspections in the basement to locate the potential sources. A building inspection was completed at 29 Cottrell Street on May 31, 2022. During the inspection, there was no sump pump and two roof leaders were found going into the ground. CDM Smith recommends the Town contacts the owner of 29 Cottrell Street to request another building inspection to locate additional sources. An overall summary of these recommendations is below in **Table 4-3**. This table is sorted by sewershed, then alphabetically by street name, and then numerically by building number.

Table 4-3 Recommendations Based on Smoke Testing Results

Location	Sewershed Area	Inflow Type	Private/ Public Property	Source of Smoke	Recommendation
5 Brown Street	M-08	Direct	Private	Clean out	Town to notify owner to fix broken cleanout
13 Mistuxet Avenue	M-08	Indirect	Private	Ground (under porch)	No building inspection previously completed, Town to complete building inspection in basement to look for potential source(s)
4 Reynolds Hill Road	M-08	Indirect	Private	Basement exhaust	No building inspection previously completed, Town to complete building inspection in basement to look for potential source(s)
56 Washington Street	M-08	Direct	Private	Clean out	Town to notify owner to fix broken cleanout
29 Cottrell Street	M-09	Indirect	Private	Ground & crawl space window near clean out	Building inspection previously completed, Town to complete additional building inspection in basement to look for potential source(s)

Legend

- Sewer Mains
- Pipe With Completed Smoke Test
- Sewershed M-08
- WPCF Water Pollution Control Facility
- Pump Station
- Railroads
- Sewer Manhole

1 inch = 350 feet

N

0 87.5 175 350 Feet

Town of Stonington, Connecticut

Smoke Testing Locations in Sewershed M-08

Sanitary Sewer Evaluation Survey

July 2023

Figure 4-1

CDM Smith

Legend

- Sewer Mains
- Pipe With Completed Smoke Test
- Sewershed M-09
- WPCF Water Pollution Control Facility
- Pump Station
- Railroads
- Sewer Manhole

1 inch = 200 feet

N

0 50 100 200 Feet

Town of Stonington, Connecticut

Smoke Testing Locations in Sewershed M-09

Sanitary Sewer Evaluation Survey

July 2023

Figure 4-2

CDM Smith

Legend
- Sewer Mains
- Sewershed M-08
- Sewershed M-09
- Direct Source
- Indirect Source
- Water Pollution Control Facility
- Pump Station
- Railroads
- Sewer Manhole

1 inch = 400 feet

N

0 100 200 400 Feet

Town of Stonington, Connecticut

Smoke Testing Results in Sewersheds M-08 and M-09

Sanitary Sewer Evaluation Survey

July 2023

Figure 4-3

CDM Smith

Section 5

Building Inspection Program

5.1 Introduction

The FMDA Report and CEA recommended building inspections in M-01, M-08, and M-09. From April 2022 to July 2022, Hart Consults attempted 252 building inspections within sewershed areas M-01, M-08, and M-09. The scope and budget for building inspections was not enough to include the buildings for all three areas. As discussed in the FMDA Report and CEA, building inspections in sewershed M-09 were given highest priority so building inspections were attempted throughout sewershed M-09. All buildings in sewershed M-01 were attempted, while the remaining budget was used to inspect a portion of sewershed M-08.

5.2 Procedure

Prior to the inspections, the Town mailed a letter to all residential and commercial buildings that were included in the program. This effort was performed to increase public awareness in advance of the building inspection program. The inspector also carried photo identification when attempting inspections.

The inspections were generally conducted Monday through Friday during daytime hours. If the inspector was not able to gain access on Monday through Friday during the day, inspections were completed during the week between the hours of 6 PM and 8 PM and on Saturdays. Up to three entries were attempted for all properties, which were made at different times of the day and included a Saturday.

The inspections included both the interior and exterior of each property. The inspector took notice of any yard drains, patio drains, driveway, sidewalk, or stairwell drains, roof downspouts, and window well drains on the outside of each building. The inspector also noted roof leaders that go into the ground, as well as those that splash onto the ground adjacent to a driveway drain. Inside each building, the inspector looked for and documented the presence of any sump pumps, floor drains, roof leader or foundation drain pipes coming in from outside, and sewer cleanout caps.

The inspector also noted whether any of the potential sources were connected directly to the building's sewer service. If it was not evident where a potential source of inflow was connected to the sewer, the source was still documented as a suspected source.

5.3 Results

Building inspections were attempted at 252 buildings. A complete inspection, which includes an interior and exterior inspection, was completed at a total of 193 properties. Of the 193 properties that are considered completed for an interior inspection, three are houses that have septic tanks and do not connect to the sewer system, one is an empty lot and one is a parking lot. In addition

to the 193 properties with a complete inspection, 21 properties had only an exterior inspection because the interior was not accessible.

Figure 5-1 on the next page shows a summary of the results. Following the figure, **Table 5-1** includes a detailed summary of observations, which includes roof leaders discharging into the ground, drains, and sump pumps. **Table 5-1** is sorted alphabetically by street name and then by address. **Figure 5-2, Figure 5-3 and Figure 5-4** following this section, show the locations and results provided in **Table 5-1** by sewershed. Additional detailed information on building inspections, including sketches and photos, can be found in Appendix D.

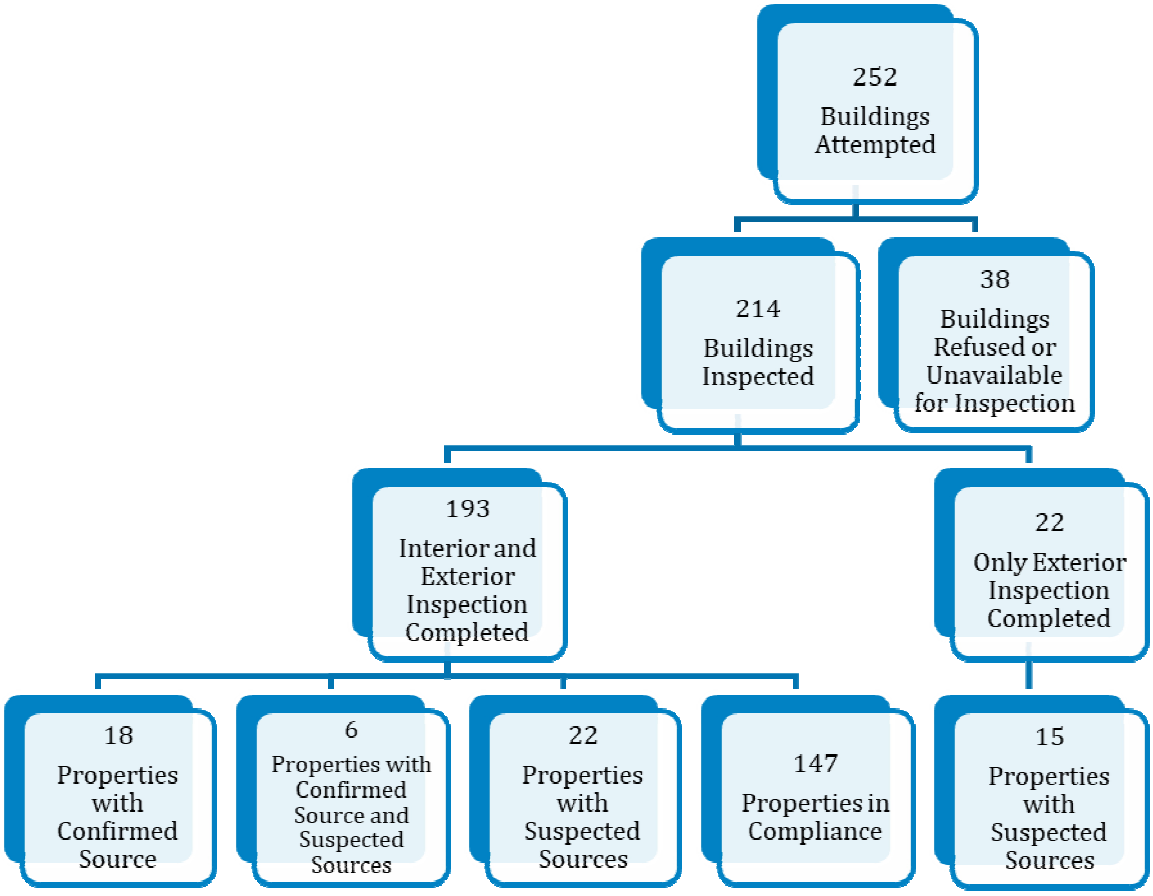


Figure 5-1
Summary of Building Inspections Results

Table 5-1 Building Inspection Observations

Address	Interior Inspection Completed	Yard Drain	Additional Drains	Sump Pump	Roof Leaders	Status
10 Alden Street	Y	N	N	**Y – 1 to sewer**	N	**Confirmed Source**
3 Broadway Avenue	Y	N	N	Y – 1 to unknown	Y – 4 onto ground	Suspected Source
6 Broadway Avenue	Y	N	N	Y – 2 (1 disconnected from sewer, 1 to yard)	Y – 4 (2 into rain barrels, 2 onto ground)	In Compliance
23 Broadway Avenue	Y	N	N	N	Y – 7 (3 into ground, 4 onto ground)	Suspected Source
25 Broadway Avenue	Y	N	N	N	Y – 6 (2 into ground, 4 onto ground)	Suspected Source
27 Broadway Avenue	Y	N	N	Y – 2 to yard	Y – 4 onto ground	In Compliance
28 Broadway Avenue	Y	Y – 1 drywell	N	Y – 1 to dry well	Y – 4 (2 onto ground, 2 to dry well)	In Compliance
30 Broadway Avenue	Y	N	N	N	Y – 2 onto ground	In Compliance
32 Broadway Avenue	Y	N	N	N	N	In Compliance
34 Broadway Avenue	Y	Y – 5 storm drain near fire truck doors	N	N	Y – 8 into ground	Suspected Source
2 Broadway Avenue Ext	Y	N	N	N	Y – 2 onto ground	In Compliance
4 Broadway Avenue Ext	Y	N	N	N	N	In Compliance

Address	Interior Inspection Completed	Yard Drain	Additional Drains	Sump Pump	Roof Leaders	Status
7 Broadway Avenue Ext	Y	N	N	**Y – 2 (1 to sewer, 1 to unknown)**	Y – internally into ground (quantity not visible)	**Confirmed Source**
12 Broadway Avenue Ext	Y	N	N	Y – 2 to yard	Y – 4 onto ground	In Compliance
16 Broadway Avenue Ext	Y	N	N	Y – 1 to yard	Y – 4 onto ground	In Compliance
24 Broadway Avenue Ext	Y	N	N	Y – 2 to yard	Y – 4 onto ground	In Compliance
27 Broadway Avenue Ext	Y	N	N	Y – 2 to yard	N	In Compliance
28 Broadway Avenue Ext	N	N	N	Unknown	Y – 3 onto ground	Interior insp. Not completed
29 Broadway Avenue Ext	Y	N	N	Y – 2 to yard	Y – 5 onto ground	In Compliance
30 Broadway Avenue Ext	N	N	N	Unknown	Y – 3 (1 into ground, 2 onto ground)	Interior insp. Not completed
32 Church Street	Y	N	N	N	Y – 5 onto ground	In Compliance
33 Church Street	Y	N	N	Y – 1 to yard	Y – 4 (1 into ground, 3 onto ground)	Suspected Source
36 Church Street	Y	N	N	N	Y – 6 onto ground	In Compliance
38 Church Street	Y	N	N	Y – 1 to yard	Y – 6 onto ground	In Compliance
40 Church Street	Y	N	N	Y – 1 manual	Y – 6 onto ground	In Compliance
42 Church Street	Y	N	N	N	Y – 2 onto ground	In Compliance

Address	Interior Inspection Completed	Yard Drain	Additional Drains	Sump Pump	Roof Leaders	Status
44 Church Street	Y	N	N	Y – 1 to yard	Y – 3 onto ground	In Compliance
50 Church Street	Y	N	N	Y – 1 to yard	Y – 2 onto ground	In Compliance
51 Church Street	Y	N	N	**Y – 2 to sewer**	Y – 23 onto ground	**Confirmed Source**
54 Church Street	Y	N	N	Y – 1 to yard	Y – 3 (1 into ground, 2 onto ground)	Suspected Source
9 Cottrell Street (empty lot)	Y	N	N	N	Y – 3 onto ground	In Compliance
10 Cottrell Street	Y	N	N	N	Y – 2 onto ground	In Compliance
11 Cottrell Street	Y	N	N	N	Y – 4 onto ground	In Compliance
12 Cottrell Street	Y	N	N	N	Y – 3 onto ground	In Compliance
25 Cottrell Street	Y	N	N	Y – 2 (1 to ground, 1 to catch basin)	Y – 2 onto ground	In Compliance
27 Cottrell Street	Y	N	N	**Y – 1 to sewer**	Y – 2 onto ground	**Confirmed Source**
28 Cottrell Street	Y	N	N	N	Y – 2 onto ground	In Compliance
29 Cottrell Street	Y	N	N	N	Y – 2 onto ground	In Compliance
14 Denison Avenue	Y	Y – 1 drywell	N	**Y – 1 to sewer**	Y – 6 (3 into ground, 3 onto ground)	**Confirmed Source, Suspected Source**
18 Denison Avenue	Y	N	N	**Y – 1 to sewer**	Y – 7 onto ground	**Confirmed Source**

Address	Interior Inspection Completed	Yard Drain	Additional Drains	Sump Pump	Roof Leaders	Status
20 Denison Avenue	Y	N	N	N	Y – 4 onto ground	In Compliance
21 Denison Avenue	Y	N	N	N	Y – 7 (1 into ground, 6 onto ground)	Suspected Source
23 Denison Avenue	Y	N	N	Y – 1 to yard	Y – 4 onto ground	In Compliance
25 Denison Avenue	Y	N	N	Y – 1 to yard	Y – 3 onto ground	In Compliance
26 Denison Avenue	Y	Y – 1 drywell	N	Y – 1 to yard	Y – 5 (3 onto ground, 2 to drywell)	In Compliance
36 Denison Avenue	N	N	N	Unknown	Y – 5 onto ground	Interior insp. not completed, Suspected Source
39 Denison Avenue	Y	N	N	**Y – 1 to sewer**	Y – 2 onto ground	**Confirmed Source**
40 Denison Avenue	Y	N	N	N	Y – 2 (1 perforated into ground, 1 onto ground)	In Compliance
41 Denison Avenue	Y	N	N	Y – 1 to yard	Y – 8 onto ground	In Compliance
42 Denison Avenue	Y	N	N	Y – 1 manual to yard	Y – 7 (4 into ground to drywell, 3 onto ground)	In Compliance
43 Denison Avenue	Y	N	N	Y – 1 to yard	Y – 7 (6 into ground piping then to yard, 1 onto ground)	In Compliance

Address	Interior Inspection Completed	Yard Drain	Additional Drains	Sump Pump	Roof Leaders	Status
44 Denison Avenue	Y	N	N	N	Y – 5 (1 into ground, 4 onto ground)	Suspected Source
48 Denison Avenue	Y	Y – 1 dry well	Y – 1 in basement	Y – 1 to yard (tied to drywell)	Y – 3 into ground (tied to drywell)	In Compliance
54 Denison Avenue	Y	N	N	Y – 1 to yard	Y – 2 onto ground	In Compliance
4 East Main Street	Y	N	N	N	Y – 3 onto ground	In Compliance
20 East Main Street	Y	N	N	Y – 3 to underground discharge system	Y – 4 onto ground or discharge system	In Compliance
22 East Main Street	Y	N	N	**Y – 1 to sewer**	Y – 5 (1 into ground, 4 onto ground)	**Confirmed Source, Suspected Source**
24 East Main Street	N	N	N	Unknown	Y – 2 onto ground	Interior insp. not completed, Suspected Source
28 East Main Street	Y	N	N	N	Y – 5 onto ground	In Compliance
31 East Main Street	Y	N	N	Y – 1 to yard	Y – 2 onto ground	In Compliance
32 East Main Street	Y	N	N	Y – 1 to yard	Y – 8 onto ground	In Compliance
34 East Main Street	Y	N	N	N	Y – 1 onto ground	In Compliance
38 East Main Street	Y	N	N	N	Y – 2 onto ground	In Compliance
39 East Main Street	Y	N	N	N	Y – 5 onto ground	In Compliance

Address	Interior Inspection Completed	Yard Drain	Additional Drains	Sump Pump	Roof Leaders	Status
41 East Main Street	Y	N	N	N	Y – 6 onto ground	In Compliance
45 East Main Street	Y	N	N	Y – 1 to yard	Y – 8 onto ground	In Compliance
54 East Main Street	Y	N	N	Y – 3 to storm system	Y – 6 onto ground	In Compliance
56 East Main Street	Y	N	N	Y – 1 to yard	Y – 4 onto ground	In Compliance
58 East Main Street	Y	N	N	Y – 1 to driveway	Y – 5 onto ground	In Compliance
59 East Main Street	Y	N	N	N	Y – 5 onto ground	In Compliance
61 East Main Street	Y	N	N	N	Y – 7 (3 into ground, 4 onto ground)	Suspected Source
0 Edgemont Street	Y	N	N	N	Y – 3 onto ground	In Compliance
5 Edgemont Street	Y	N	N	N	Y – 1 onto ground	In Compliance
7-9 Edgemont Street	Y	N	N	N	Y – 3 onto ground	In Compliance
11 Edgemont Street	N	N	N	Unknown	Y – 3 onto ground	Interior insp. not completed
14 Edgemont Street	Y	N	N	N	N	In Compliance
15 Edgemont Street	Y	N	N	**Y – 1 to sewer**	Y – 3 onto ground	**Confirmed Source, Suspected Source**
1-3 Haley Street (parking lot)	Y	N	N	N	N	In Compliance
2 Haley Street	Y	N	N	Y – 1 to street	Y – 6 onto ground	In Compliance

Address	Interior Inspection Completed	Yard Drain	Additional Drains	Sump Pump	Roof Leaders	Status
4 Haley Street	Y	N	N	N	Y – 5 onto ground	In Compliance
5 Haley Street	Y	N	N	N	Y – 3 onto ground	In Compliance
6 Haley Street	Y	N	N	N	Y – 7 (1 into ground, 6 onto ground)	Suspected Source
9 Haley Street	Y	N	N	**Y – 1 to sewer**	Y – 4 onto ground	**Confirmed Source**
6 Haley's Way	Y	N	N	N	Y – 5 onto ground	In Compliance
40 Holmes Street	Y	N	Y – 1 dehumidifier drain	Y – 1 to yard	Y – 5 (3 into ground then to nearby water, 2 onto ground)	In Compliance
2 Jackson Avenue	Y	N	N	Y – 1 into catch basin	Y – 9 (2 into catch basin, 7 onto ground)	In Compliance
3 Jackson Avenue	N	N	N	Unknown	Y – 5 onto ground	Interior insp. not completed
5 Jackson Avenue	Y	N	N	Y – 1 to yard	Y – 2 (1 disconnected, 1 into ground)	In Compliance
6 Jackson Avenue	Y	N	N	**Y – 1 to sewer**	Y – 6 (2 into ground, 4 onto ground)	**Confirmed Source, Suspected Source**
7 Jackson Avenue	Y	N	N	N	Y – 4 onto ground	In Compliance

Address	Interior Inspection Completed	Yard Drain	Additional Drains	Sump Pump	Roof Leaders	Status
8 Jackson Avenue	Y	N	N	N	Y – 5 into ground, then piped out	In Compliance
10 Jackson Avenue	Y	N	N	Y – 1 to yard	Y – 3 onto ground	In Compliance
12 Jackson Avenue	Y	N	N	Y – 1 to yard	N	In Compliance
14 Jackson Avenue	Y	N	N	Y – 1 to yard	N	In Compliance
19 Jackson Avenue	Y	N	N	N	Y – 3 onto ground	In Compliance
20 Jackson Avenue	Y	N	N	Y – 1 to yard	Y – 2 onto ground	In Compliance
22 Jackson Avenue	Y	N	N	Y – 2 to yard	Y – 6 onto ground	In Compliance
23 Jackson Avenue	Y	N	N	N	Y – 2 onto ground	In Compliance
24 Jackson Avenue	Y	N	N	Y – 2 to yard	Y – 2 onto ground	In Compliance
4 Jerome Avenue	Y	N	N	N	Y – 2 onto ground	In Compliance
11 Jerome Avenue	Y	N	N	Y – 1 to yard	Y – 3 onto ground	In Compliance
12 Jerome Avenue	Y	N	N	N	N	In Compliance
2 Lincoln Avenue	Y	N	N	**Y – 2 (1 to sewer, 1 manual to driveway)**	Y – 4 onto ground	**Confirmed Source**
5 Lincoln Avenue	Y	N	N	Y – 1 to yard	Y – 1 to rain barrel	In Compliance
6 Lincoln Avenue	Y	N	N	Y – 1 to street	Y – 4 onto ground	In Compliance
24 Lincoln Avenue	Y	N	N	Y – 1 to yard	Y – 4 onto ground	In Compliance

Address	Interior Inspection Completed	Yard Drain	Additional Drains	Sump Pump	Roof Leaders	Status
2 Main Street	N	N	N	Unknown	Y – 3 onto ground	Interior insp. not completed, Suspected Source
3 Main Street	Y	N	N	N	Y – 4 onto ground	In Compliance
4 Main Street	N	N	N	Unknown	Y – 3 disconnecte d	Interior insp. not completed, Suspected Source
6 Main Street	Y	N	N	Y – 1 to yard	Y – 2 onto ground	In Compliance
8 Main Street	Y	N	N	N	N	In Compliance
10 Main Street	Y	N	N	N	Y – 3 onto ground	In Compliance
11 Main Street	Y	N	Y – 1 internal drain	N	Y – 1 into ground	In Compliance
16 Main Street	Y	N	N	N	Y – 4 onto ground	In Compliance
18 Main Street	N	N	N	Unknown	Y – 4 onto ground	Interior insp. not completed, Suspected Source
20 Main Street	Y	N	N	**Y – 1 to sewer**	Y – 2 onto ground	**Confirmed Source**
24 Main Street	Y	N	N	N	Y – 3 onto ground	In Compliance
26 Main Street	Y	N	N	N	Y – 4 onto ground	In Compliance
29 Main Street	Y	N	N	N	N	In Compliance
30 Main Street	Y	N	N	N	Y – 2 onto ground	In Compliance
32 Main Street	N	N	N	Unknown	Y – 3 onto ground	Interior insp. not completed, Suspected Source

Address	Interior Inspection Completed	Yard Drain	Additional Drains	Sump Pump	Roof Leaders	Status
33 Main Street	Y	N	N	N	Y – 2 onto ground	In Compliance
34 Main Street	Y	N	N	Y – 1 to yard	Y – 2 onto ground	In Compliance
35 Main Street	N	N	N	Unknown	N	Interior insp. not completed, Suspected Source
39 Main Street	N	N	N	Unknown	Y – 4 (1 into ground but piped to stream, 3 onto ground)	Interior insp. not completed
40 Main Street	Y	N	N	N	Y – 2 onto ground	In Compliance
41 Main Street	N	N	N	Unknown	Y – 4 into stream	Interior insp. not completed
44 Main Street	N	N	N	Unknown	Y – 5 (1 into ground, 4 onto ground)	Interior insp. not completed, Suspected Source
46-48 Main Street	Y	Y – 1 drywell	N	Y – 2 to dry well	Y – 3 to dry well	In Compliance
47 Main Street	Y	N	N	N	Y – 1 into ground, others to stream	Suspected Source
49-51 Main Street	Y	N	N	N	Y – 1 onto ground	In Compliance
52 Main Street	Y	Y – 1 drywell	Y – 1 in basement	Y – 2 to dry well	Y – 3 to dry well	In Compliance
53 Main Street	Y	N	N	N	Y – 2 onto ground	In Compliance
57 Main Street	Y	N	N	N	Y – 7 onto ground	In Compliance

Address	Interior Inspection Completed	Yard Drain	Additional Drains	Sump Pump	Roof Leaders	Status
58 Main Street	Y	N	N	Y – 1 to yard	Y – 3 onto ground	In Compliance
62 Main Street	Y	N	N	Y – 1 to yard	Y – 3 onto ground	In Compliance
63 Main Street	Y	N	N	N	Y – 6 onto ground	In Compliance
68 Main Street	N	N	N	Unknown	Y – 4 onto ground	Interior insp. not completed, Suspected Source
4 Mill Street	Y	N	N	N	Y – 3 (1 into ground then to pipe near driveway, 2 onto ground)	In Compliance
6 Mill Street	Y	N	N	N	Y – 4 onto ground	In Compliance
8 Mill Street	Y	N	N	N	Y – 7 onto ground	In Compliance
20 Mistuxet Avenue	Y	N	N	Y – 1 to driveway	Y – 5 to street through piping	In Compliance
31 Mistuxet Avenue	Y	N	N	Y – 1 to yard	Y – 3 (1 into ground, 2 onto ground)	Suspected Source
13 N. Stonington Road	Y	N	N	Y – 2 into stream	Y – 4 onto ground	In Compliance
21 N. Stonington Road	Y	N	N	N	Y – 8 (6 into ground, 2 onto ground)	Suspected Source
25 N. Stonington Road (on septic)	Y	N	N	N	N	In Compliance

Address	Interior Inspection Completed	Yard Drain	Additional Drains	Sump Pump	Roof Leaders	Status
1437 Pequot Trail	Y	N	N	N	Y – 2 onto ground	In Compliance
1440 Pequot Trail	N	N	N	Unknown	Y – 5 (3 into ground, 2 onto ground)	Interior insp. not completed, Suspected Source
1443 Pequot Trail	Y	N	Y – 1 floor drain in garage	N	Y – 8 (6 into ground, 2 onto ground)	Suspected Source
1444 Pequot Trail	Y	Y – 1 dry well	N	Y – 1 to yard	Y – 5 (1 into dry well, 4 onto ground)	In Compliance
1446 Pequot Trail	Y	N	N	N	Y – 3 into ground	Suspected Source
8 Reynolds Hill Road	Y	N	N	Y – 1 to yard	Y – 4 onto ground	In Compliance
10 Reynolds Hill Road	Y	N	N	N	Y – 7 onto ground	In Compliance
2 Roosevelt Avenue	Y	N	N	Y – 1 to yard	Y – 3 into ground	Suspected Source
3 Roosevelt Avenue	Y	N	N	N	Y – 2 onto ground	In Compliance
4 Roosevelt Avenue	Y	N	N	**Y – 1 to sewer**	Y – 2 onto ground	**Confirmed Source**
7 Roosevelt Avenue	Y	N	N	N	Y – 3 onto ground	In Compliance
12 Roosevelt Avenue	Y	N	N	**Y – 1 to sewer**	Y – 8 onto ground	**Confirmed Source**
25 Roosevelt Avenue	Y	N	Y – interior drains	Y – 1 up to ceiling	N	In Compliance

Address	Interior Inspection Completed	Yard Drain	Additional Drains	Sump Pump	Roof Leaders	Status
4 Smith Street	Y	N	N	Y – 1 to street	Y – 7 (1 into ground, 6 onto ground)	Suspected Source
7 Smith Street	N	N	N	Unknown	Y – 5 into ground	Interior insp. not completed, Suspected Source
13 Smith Street	Y	N	N	N	N	In Compliance
1 Solon Avenue	Y	N	N	Y – 1 to yard	Y – 6 onto ground	In Compliance
12 Solon Avenue	N	N	N	Unknown	Y – 5 (1 into ground, 4 onto ground)	Interior insp. not completed, Suspected Source
16 Solon Avenue	N	N	N	Unknown	Y – 2 onto ground	Interior insp. not completed, Suspected Source
17 Solon Avenue	Y	N	N	Y – 1 to yard	Y – 1 into ground then piped out	In Compliance
2 Stafford Street	Y	N	N	N	Y – 2 onto ground	In Compliance
8 Stafford Street	Y	N	N	Y – 1 onto street	Y – 5 onto ground	In Compliance
18 Stafford Street	Y	N	N	N	Y – 2 onto ground	In Compliance
18A Stafford Street	Y	N	N	Y – 1 to yard	N	In Compliance
21 Stafford Street	Y	N	N	Y – 1 to yard	N	In Compliance
5 Stanton Place	Y	N	N	Y – 1 to yard	Y – 4 onto ground	In Compliance
1 Summit Street	Y	N	N	Y – 1 to yard	Y – 2 (1 into ground but piped out, 1 onto ground)	In Compliance

Address	Interior Inspection Completed	Yard Drain	Additional Drains	Sump Pump	Roof Leaders	Status
3 Summit Street	Y	N	N	N	Y – 6 (2 into ground, 4 onto ground)	Suspected Source
5 Summit Street	Y	N	N	**Y – 2 to sewer**	Y – 6 onto ground	**Confirmed Source**
8 Summit Street (on septic)	Y	N	N	N	N	In Compliance
1 Sylvia Avenue	Y	N	N	Y – 1 to yard	Y – 3 onto ground	In Compliance
3 Sylvia Avenue	Y	N	N	N	Y – 5 onto ground	In Compliance
5 Sylvia Avenue	Y	N	N	Y – 1 to yard	N	In Compliance
7 Sylvia Avenue	Y	N	N	Y – 1 to yard	N	In Compliance
4 Washington Street (residence)	Y	N	N	Y – 1 to yard	N	In Compliance
4 Washington Street (warehouse)	Y	N	N	N	N	In Compliance
4 Washington Street (restaurant)	Y	N	N	N	Y – 4 to bioretention	In Compliance
10 Washington Street	Y	N	N	N	N	In Compliance
15 Washington Street	Y	N	N	Y – 1 to yard	Y – 2 onto ground	In Compliance
28 Washington Street	N	N	N	Unknown	Y – 4 onto ground	Interior insp. not completed, Suspected Source
30 Washington Street	Y	N	N	Y – 2 to yard	Y – 6 onto ground	In Compliance
34 Washington Street	Y	N	N	Y – 1 to yard	Y – 3 into ground	Suspected Source

Address	Interior Inspection Completed	Yard Drain	Additional Drains	Sump Pump	Roof Leaders	Status
35 Washington Street	Y	Y – 1 storm drain	N	N	Y – 3 into ground	Suspected Source
36 Washington Street	Y	N	N	**Y – 1 to sewer**	Y – 4 onto ground	**Confirmed Source**
51 Washington Street	Y	N	N	**Y – 1 to sewer**	Y – 4 into ground	**Confirmed Source, Suspected Source**
52 Washington Street	Y	N	N	N	Y – 3 onto ground	In Compliance
54 Washington Street	Y	N	N	Y – 1 to yard	Y – 3 onto ground	In Compliance
56 Washington Street	Y	N	N	**Y – 1 to sewer**	Y – 6 onto ground	**Confirmed Source**
58 Washington Street	Y	N	N	**Y – 1 to sewer**	Y – 4 (2 into ground, 2 onto ground)	**Confirmed Source, Suspected Source**
60 Washington Street	Y	N	N	Y – 1 to ground	Y – 4 (2 into ground, 2 onto ground)	In Compliance
62 Washington Street	Y	N	N	Y – 1 to storm system	Y – 4 onto ground	In Compliance
64 Washington Street	Y	N	N	N	Y – 5 onto ground	In Compliance
165 Whitehall Avenue	Y	N	N	N	Y – 4 onto ground	In Compliance
175 Whitehall Avenue	Y	N	N	N	N	In Compliance
187 Whitehall Avenue (on septic)	Y	N	N	N	N	In Compliance
195 Whitehall Avenue	Y	N	N	N	Y – 3 onto ground	In Compliance

Address	Interior Inspection Completed	Yard Drain	Additional Drains	Sump Pump	Roof Leaders	Status
196 Whitehall Avenue	Y	N	N	N	Y – 3 (1 into ground, 2 onto ground)	Suspected Source
199 Whitehall Avenue	Y	N	N	N	Y – 5 onto ground	In Compliance
201 Whitehall Avenue	Y	N	N	N	Y – 2 into rain barrels	In Compliance
207 Whitehall Avenue	N	N	N	Unknown	Y – 4 (2 into ground, 2 onto ground)	Interior insp. not completed, Suspected Source
2 Williams Avenue	Y	N	N	**Y – 1 to sewer**	N	**Confirmed Source**
31 Willow Street	Y	N	N	N	Y – 3 (1 into ground, 2 onto ground)	Suspected Source
32 Willow Street	Y	N	N	**Y – 1 to sewer**	N	**Confirmed Source**
35 Willow Street	Y	N	N	**Y – 1 to sewer**	Y – 6 onto ground	**Confirmed Source**
37 Willow Street	Y	N	N	**Y – 1 to sewer**	Y – 2 onto ground	**Confirmed Source**
41 Willow Street	Y	N	N	Y – 1 to yard	Y – 5 onto ground	In Compliance
55 Willow Street	Y	N	N	Y – 1 to wetlands	Y – 5 into ground, but piping out	In Compliance
60 Willow Street	Y	N	N	N	Y – 2 onto ground	In Compliance
Total properties with source	**193**	**9**	**6**	**102**	**187**	

Twenty-four properties had confirmed sources to the sanitary sewer during building inspections. All properties with confirmed sources were found to have one or more sump pumps that were connected to the sanitary sewer.

Six of the twenty-four properties with a confirmed source also had roof leaders observed connecting into the ground. The inspector found additional properties with suspected sources. Including the six properties with confirmed and suspect sources, the inspector in total found 43 properties with suspected sources. This includes three buildings with yard drains and one building with a floor drain. It also includes 31 properties with roof leaders observed going into the ground, one property with a sump pump connected to an undetermined location and 15 properties where the sump pump may connect to the sewer, but there was no internal building inspection completed.

CDM Smith investigated nine properties with suspected sources from building inspections. The results are discussed in the next section, Section 6, of this report.

5.4 Recommendations

Twenty-four properties were identified with confirmed sources, see **Table 5-2** below. All confirmed sources that were found are sump pumps and a total of 26 sump pumps were found connected to the sewer during building inspections. Two properties had more than one sump pump.

One sump pump is estimated to contribute 5 gpm of inflow. The 26 sump pumps found are estimated to contribute a total of 130 gpm of inflow or 0.19 MGD. These sources are likely significant contributors to inflow and CDM Smith recommends the Town contacts the owners of these buildings to have the sources permanently redirected or removed.

Table 5-2 Confirmed Sources from Building Inspections

Address	Description
10 Alden Street	One sump pump to sanitary sewer
7 Broadway Avenue Ext	One sump pump to sanitary sewer
51 Church Street	Two sump pumps to sanitary sewer
27 Cottrell Street	One sump pump to sanitary sewer
14 Denison Avenue	One sump pump to sanitary sewer
18 Denison Avenue	One sump pump to sanitary sewer
39 Denison Avenue	One sump pump to sanitary sewer
22 East Main Street	One sump pump to sanitary sewer
15 Edgemont Street	One sump pump to sanitary sewer
9 Haley Street	One sump pump to sanitary sewer
6 Jackson Avenue	One sump pump to sanitary sewer
2 Lincoln Avenue	One sump pump to sanitary sewer
20 Main Street	One sump pump to sanitary sewer

Address	Description
4 Roosevelt Avenue	One sump pump to sanitary sewer
12 Roosevelt Avenue	One sump pump to sanitary sewer
5 Summit Street	Two sump pumps to sanitary sewer
36 Washington Street	One sump pump to sanitary sewer
51 Washington Street	One sump pump to sanitary sewer
56 Washington Street	One sump pump to sanitary sewer
58 Washington Street	One sump pump to sanitary sewer
2 Williams Avenue	One sump pump to sanitary sewer
32 Willow Street	One sump pump to sanitary sewer
35 Willow Street	One sump pump to sanitary sewer
37 Willow Street	One sump pump to sanitary sewer

Legend

- Confirmed Source
- Suspected Source
- In Compliance
- Interior Inspection Not Completed
- Sump Pump Connected to Sewer
- Sewer Mains
- Pump Station
- Sewershed M-01
- Not Inspected
- Sewer Manhole

1 inch = 300 feet

N

0 87.5 175 350 Feet

Town of Stonington, Connecticut

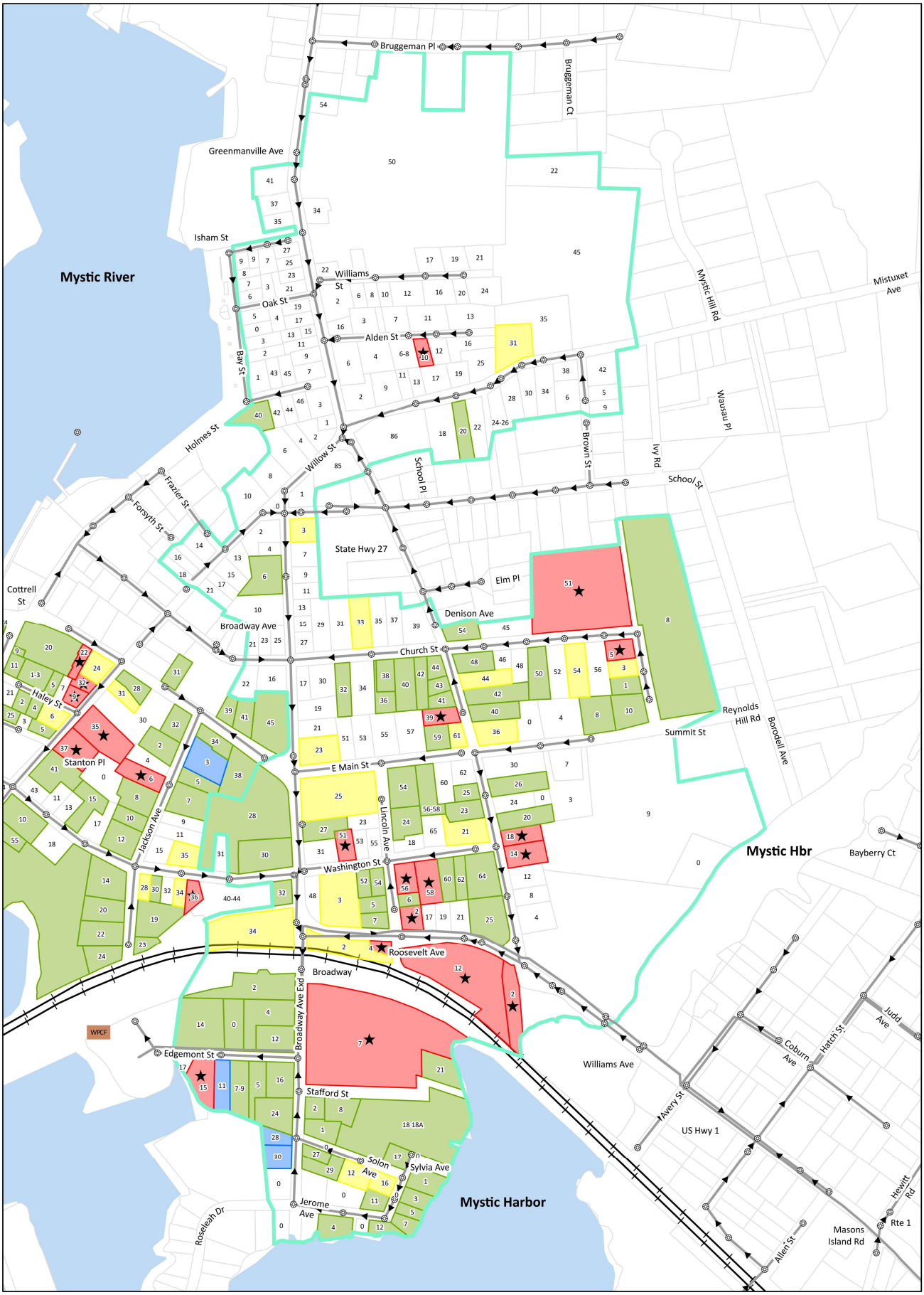
Sanitary Sewer Evaluation Survey

Building Inspection Results in Sewershed M-01

July 2023

Figure 5-2

CDM Smith



Legend

- Confirmed Source
- Suspected Source
- In Compliance
- Interior Inspection Not Completed
- Sump Pump Connected to Sewer
- Water Pollution Control Facility
- Sewershed M-08
- Not Inspected
- Sewer Manhole
- Sewer Mains

1 inch = 350 feet

N

0 87.5 175 350 Feet

Town of Stonington, Connecticut

Sanitary Sewer Evaluation Survey

Building Inspection Results in Sewershed M-08

July 2023

Figure 5-3

CDM Smith

Sump Pump Connected to Sewer

Sewer Manhole

Sewer Mains

CDM Smith

Section 6

Dye Water Testing Program

6.1 Introduction

During building inspections, properties with suspected private inflow sources were identified. Nine properties with suspect sources were dye water tested in October 2022 to determine if a direct connection could be found. CDM Smith focused on dye testing buildings that were identified to have at least one confirmed source through buildings inspections or buildings with drains. Three properties tested were located in sewershed area M-01. In addition, four properties tested were in sewershed area M-08 and two properties tested were in sewershed area M-09.

6.2 Procedure

Dye water testing was conducted by Martinez Couch & Associates at locations suspected of having an illicit connection into the sewer system that were found during the building inspection program. Dye water tests were conducted by filling the suspect source with dyed water. The suspect sources that were tested were roof leaders, yard drains, or other drains. Sanitary manholes were opened and inspected for the presence of the dyed water. National Water Main Cleaning Company was also hired as part of this program and CCTV inspected the sewer to check for dye from the sources.

6.3 Program Results

Figure 6-1, Figure 6-2, and Figure 6-3 at the end of this section shows the locations of properties that were dye tested for sewershed M-01, M-08, and M-09, respectively. **Table 6-1** on the next page summarizes the dye water testing results. Of the nine properties, all nine were tested for suspected roof leaders, two properties were also tested for a suspected yard drain, and three properties were tested for other suspected drains. See **Table 6-1** for more information.

In addition to visual inspections to confirm the presence of dye, four properties also had CCTV inspections conducted on nearby sewer lines to check for dye from the sources. These properties were 21 N. Stonington Road, 1443 Pequot Trail, 35 Washington Street and 196 Whitehall Avenue. During the CCTV inspections, each location's suspect sources were filled with dyed water, but the presence of dye was not observed during any of the video footage. The absence of dye in the sewer confirms that all four properties are in compliance, with no illicit connections.

Overall, dye was not observed in any of the nine properties and all suspect sources were determined to not be connected to the sewer. Appendix E contains photos and sketches for each of the nine properties. The sketches include locations of roof leader and drains tested, manholes opened, and results.

Table 6-1 Dye Water Testing Results

Address	Roof leaders noted into ground during building inspection	Drains noted during building inspection	Components tested	Status following dye test
34 Broadway Avenue (Mystic Fire Department)	12	5 (Vehicle Bay), 1 (Yard Drain)	12 Roof Leaders, 5 Vehicle Bay Drains, 1 Yard Drain (Visual)	In Compliance – all dye observed in nearby catch basins
54 Church Street	1	0	1 Roof Leader (Visual)	In Compliance – dye observed exiting roof leader extension pipe in yard
14 Denison Avenue	4	0	3 Roof Leaders (Visual)	In Compliance – dye observed exiting roof leader extension pipe by driveway
6 Jackson Avenue	2	0	2 Roof Leaders (Visual)	In Compliance – dye observed exiting roof leader extension pipe by driveway
21 N. Stonington Road (Old Mystic Fire Department)	6	2 (Vehicle Bay)	6 Roof Leaders, 2 Vehicle Bay Drains (Visual and CCTV)	In Compliance – dye observed in nearby catch basin from roof leaders, dye observed in oil water separator from vehicle bay drains
1443 Pequot Trail	3	1 (Garage)	3 Roof Leaders, 1 Garage Drain (Visual and CCTV)	In Compliance – dye from roof leaders observed exiting by driveway, dye from garage drain not observed
35 Washington Street (Falck Eye Center)	5	1 (Yard)	5 Roof Leaders, 1 Yard Drain (Visual and CCTV)	In Compliance – all dye observed in nearby catch basin
51 Washington Street	4	0	1 Roof Leader (Visual)	In Compliance – dye was not observed, roof leader extension pipes filled with dirt
196 Whitehall Avenue	1	0	1 Roof Leader (Visual and CCTV)	In Compliance – dye was not observed, but homeowner confirmed that roof leader disperses into yard

6.4 Recommendations

The dye water testing program did not locate any additional roof leaders or drains that contribute inflow to the sanitary sewer system. No additional work is recommended at these nine properties at this time.

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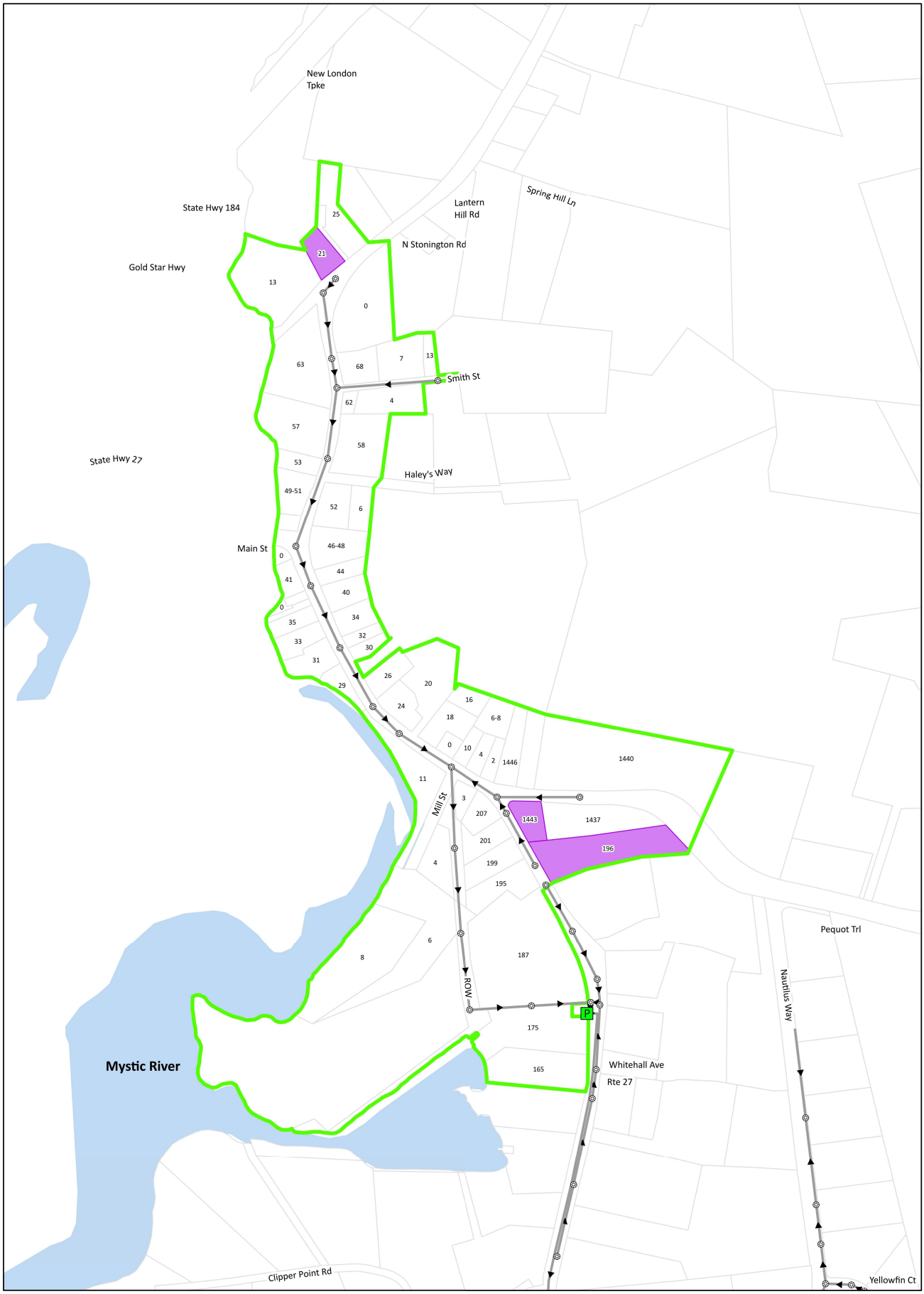


Legend

- Sewer Manhole
- Pump Station
- Sewer Mains
- Sewershed M-01
- Dye Test Location

1 inch = 300 feet

N

0 87.5 175 350 Feet

Town of Stonington, Connecticut

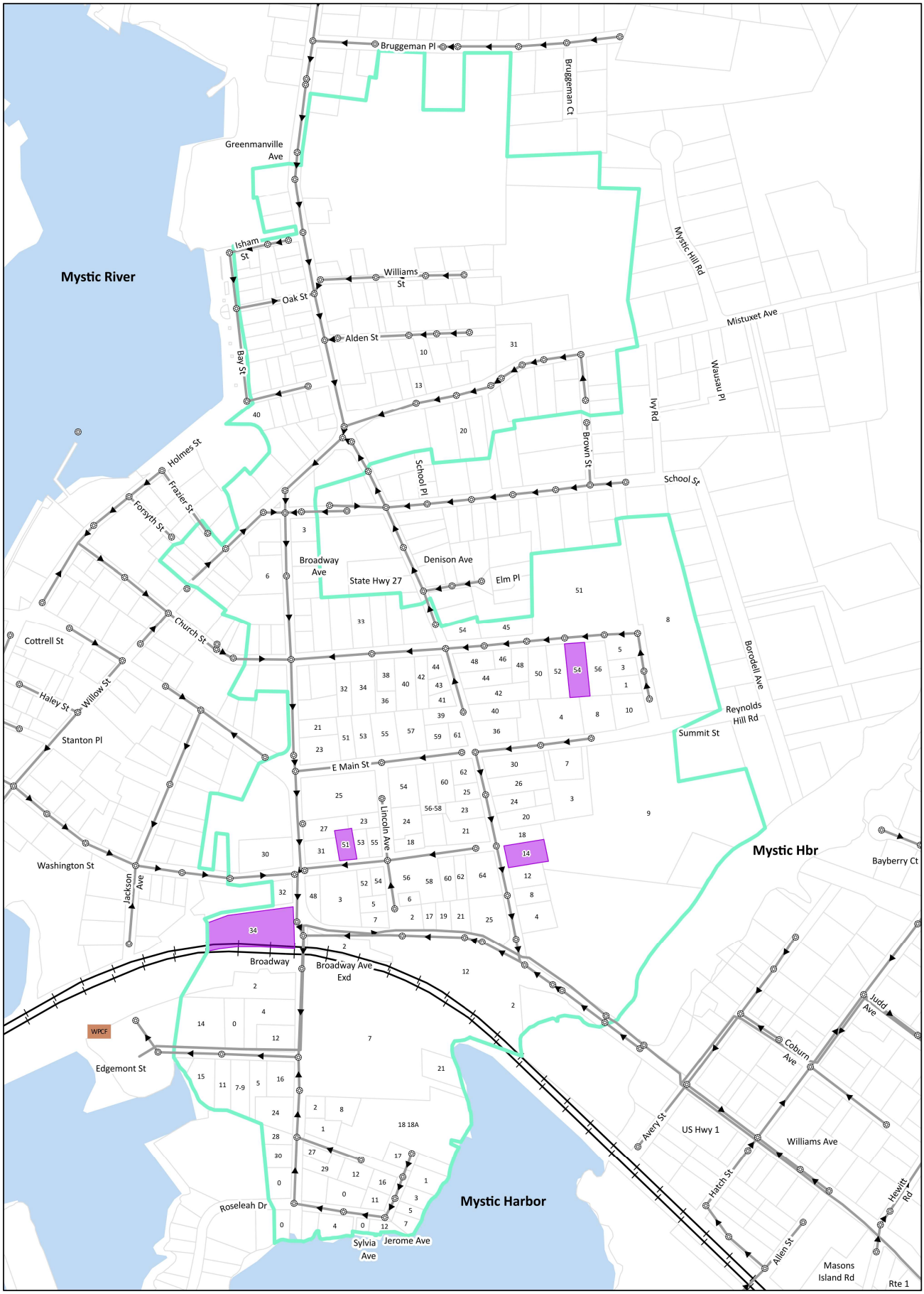
Sanitary Sewer Evaluation Survey

Dye Test Locations in Sewershed M-01

July 2023

Figure 6-1

CDM Smith



Legend

- Sewer Manhole
- WPCF Water Pollution Control Facility
- Sewer Mains
- Sewershed M-08
- Dye Test Location
- Railroads

1 inch = 350 feet

N

0 87.5 175 350 Feet

Town of Stonington, Connecticut

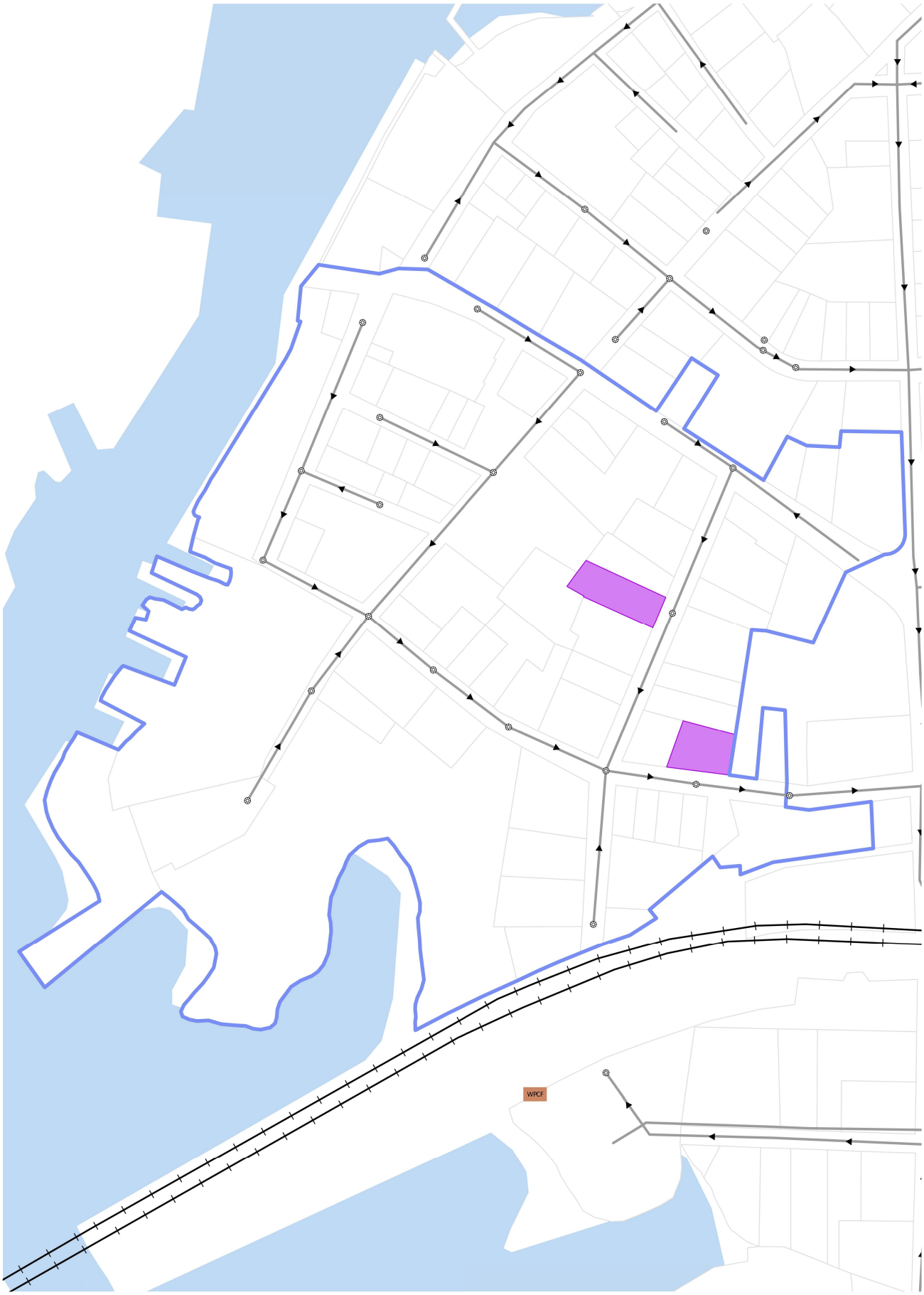
Sanitary Sewer Evaluation Survey

Dye Test Locations in Sewershed M-08

July 2023

Figure 6-2

CDM Smith



CDM Smith

Section 7

Financial Evaluation

7.1 Introduction

The purpose of this financial evaluation is to summarize projected wastewater revenue requirement options for the Town's Water Pollution Control Authority (WPCA), which serves the towns of Mystic, Stonington, and Pawcatuck, Connecticut. The analysis incorporates the estimated capital expenditures related to the upcoming sewer rehabilitation, capital repayment alternatives, and assesses the impact on the Town's wastewater revenue requirements.

Wastewater revenue requirements determine how much wastewater rate revenue a utility will need to generate each year to cover utility expenses. Revenue requirements are calculated as the total of operating expenses, capital expenses, and debt service, less any miscellaneous non-rate revenue.

Projected rate increases are applied to WPCA's sewer consumption rate and single/multifamily well accounts. Projected rate increases are set to a level where projected revenues cover expenses. There has been no consideration for buildup of reserves. This report includes current-state and four alternative projection options.

7.2 Assumptions

The following assumptions were used to develop a five-year wastewater revenue requirement projection:

- The WPCA's approved budget for fiscal year (FY) 2024 was used for the basis for the analysis.
- Operations and maintenance costs are assumed to inflate at an annual rate of 5.0 percent.
- Capital costs are projected to increase at an annual rate of 4.0 percent. The current capital plan is stated in FY 2023 dollars.
- The Town issued a General Obligation (GO) bond in 2021, with $10 million of the proceeds intended to cover WPCA capital projects over a five-year period. It is assumed that the WPCA five-year capital plan is to be funded through those proceeds, with the exception of the upcoming five phases of sewer rehabilitation.
- The WPCA's total loan and non-grant payment responsibility for the five phases of sewer rehabilitation have a total escalated cost of $2.8 million and it is assumed to be financed through state revolving fund (SRF) borrowing. Projections exclude the total grant dollars and are based on the WPCA's responsibility of loan and non-grant funds.
    - SRF loans are assumed to carry an interest rate of 2.5 percent, with a term of 20 years.

- The Town currently pays for outstanding debt service, including WPCA related projects, through the General Fund.
- The Town subsidizes the WPCA with a $150,000 annual transfer. This is assumed to remain constant throughout the projection period, unless indicated otherwise in an alternative.
- General miscellaneous revenue is assumed to remain constant throughout the projection period.
- The analysis incorporates consumption provided by WPCA, adjusted to reconcile billings with projected collections consistent with the approved budget. The total annual consumption utilized for this is analysis is 433,841 hundred cubic feet (HCF). Annual consumption is assumed to remain constant through projections.
- The number of accounts is assumed to remain constant throughout the projection period.
- WPCA current sewer rates are as follows:
  - Consumption rate of $7.06/HCF
  - Annual fixed charge of $341.34 for single family well accounts
  - Annual fixed charge of $511.98 for multi-family well accounts
  - $50.19 minimum charge for no usage accounts
- For these projections, it is assumed that rates for all customers increase at the same annual percent increase.
- There are zero "no usage" accounts assumed.
- Based on discussions with the WPCA, all the alternatives provided capture an approved 10% rate increase in FY 2024.

7.3 Revenue Requirement – Baseline

The baseline projections estimate the annual revenue requirements for the period FY 2024 to FY 2029, assuming no changes to the Town or WPCA's current conditions.

7.3.1 Operations and Maintenance

Stonington WPCA's projected operations and maintenance (O&M) expenses are summarized in **Table 7-1** below.

Table 7-1 Operations and Maintenance (O&M) Expenses

	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029
Labor – Director	$105,000	$110,250	$115,763	$121,551	$127,628	$134,010
Labor – Assistant Director	$77,250	$81,113	$85,168	$89,427	$93,898	$98,593
Service Fee	$2,782,643	$2,921,775	$3,067,864	$3,221,257	$3,382,320	$3,551,436
MRRA	$150,000	$157,500	$165,375	$173,644	$182,326	$191,442
Other Operating Expenses	$189,845	$199,337	$209,304	$219,769	$230,758	$242,296
Total O&M expenses	$3,304,738	$3,469,975	$3,643,474	$3,825,648	$4,016,930	$4,217,777

Total O&M expenditures are projected to grow from $3.3 million in FY 2024 to $4.2 million in FY 2029, summarized above in **Table 7-1**. This represents an average annual cost increase of 5.0 percent, reflecting the impact of estimated inflation. The largest O&M expense is the Service Fee, which represents 84 percent of the total O&M expenses. The service fee is for the WPCA's contracted facilities operator, Veolia. The MRRA fee is associated with the facilities Maintenance, Repair, Replacement and Alterations construction activities performed by Veolia.

7.3.2 Debt Service

Debt service represents annual payments on bond issuances and SRF borrowings. Existing debt service represents the wastewater related debt that is outstanding as of FY 2023. As stated in the assumptions, the Town, not the WPCA, has issued GO bonds to fund WPCA related projects and pays for the annual debt service through the General Fund. The Town has provided a debt service payment schedule for the next five fiscal years.

An SRF loan is a state revolving fund with the purpose of providing low-interest loans for investments in water and sanitation infrastructure. It is anticipated that SRF funding will be secured for the upcoming sewer rehabilitation projects through CT DEEP Clean Water Fund. As stated in the assumptions, for the baseline projection it is assumed the Town, not the WPCA, will repay all anticipated debt service.

Table 7-2 below shows the projected existing and anticipated debt obligations over the next five fiscal years. The table includes the assumed financial repayment responsibility of the Town and the WPCA.

Table 7-2 Existing and Anticipated Debt Service

	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029
Existing Debt Service	$2,006,419	$1,944,984	$1,854,917	$1,771,317	$1,711,350	$1,658,125
Anticipated Debt Service	$124,800	$138,338	$162,523	$188,005	$188,005	$188,005
Total Debt Service	**$2,131,219**	**$2,083,322**	**$2,017,440**	**$1,959,322**	**$1,899,355**	**$1,846,130**
Total paid by WPCA	$0	$0	$0	$0	$0	$0
Total paid by Town	$2,131,219	$2,083,322	$2,017,440	$1,959,322	$1,899,355	$1,846,130

7.3.3 Miscellaneous Revenue

Miscellaneous revenue represents non-rate revenue items that are generated from a source other than wastewater rates. Miscellaneous revenue is assumed to remain constant over the forecast period at approximately $53,000 annually. The Town subsidy is assumed to remain constant over

the forecast period at $150,000 annually. The projected miscellaneous revenue(s) are shown below in **Table 7-3**.

Table 7-3 Projected Miscellaneous Revenue

	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029
General Miscellaneous Revenue	$52,754	$52,754	$52,754	$52,754	$52,754	$52,754
Town Subsidy	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000
Total Miscellaneous Revenue	**$202,754**	**$202,754**	**$202,754**	**$202,754**	**$202,754**	**$202,754**

7.3.4 Revenue Requirement

Revenue requirements are the amount of wastewater rate revenue that needs to be generated to cover annual expenses. The revenue requirement calculation consists of the total of operating expenses and debt service (existing and anticipated), less miscellaneous non-rate revenue.

Table 7-4 shows the total projected revenue requirement for FY 2024 to FY 2029. As noted, consistent with current conditions it is assumed that the Town pays for all outstanding and anticipated debt service. Therefore, debt service is not included as part of the WPCA's rate revenue requirement under this baseline projection.

Table 7-4 Projected Revenue Requirement

	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 202
Total Expenses	$3,304,738	$3,469,975	$3,643,474	$3,825,647	$4,016,930	$4,217,776
Less: Miscellaneous Revenue	($202,754)	($202,754)	($202,754)	($202,754)	($202,754)	($202,754)
Total Revenue Requirement	**$3,101,984**	**$3,267,221**	**$3,440,720**	**$3,622,893**	**$3,814,176**	**$4,015,022**

7.4 Wastewater Rate Projections

The main objective of this evaluation is to project wastewater rates over a five-year period to a level where rates are projected to generate sufficient revenues to meet revenue requirements. As part of this evaluation, five rate projection alternatives were developed. A brief description of the alternatives is as follows:

- Baseline – existing financial conditions:
  - Town pays all existing and anticipated debt service
  - Town provides annual $150,000 subsidy to WPCA
- Alternative 1:
  - Phase all (existing and anticipated) debt service into WPCA revenue requirement, starting in FY 2024
  - Town provides annual $150,000 subsidy to WPCA
- Alternative 2:
  - Town pays all existing debt service

  - WPCA pays for anticipated debt service
  - Town provides annual $150,000 subsidy to WPCA
- Alternative 3:
  - Town pays all existing debt service
  - WPCA pays for anticipated debt service
  - Eliminate annual subsidy of $150,000, phased out over five years, starting in FY 2024
- Alternative 4:
  - Phase all existing Debt Service into WPCA revenue requirement over ten years, starting in FY 2024
    - *Build-up of 10 percent per year*
  - WPCA pays for anticipated debt service
  - Eliminate annual subsidy of $150,000, phased over five years, starting in FY 2024

The remainder of this section summarizes the results of each of the listed alternatives in **Table 7-5** through **Table 7-14** below. Each table of results includes operating expenses, existing debt service, anticipated debt service, debt service paid by the WPCA, debt service paid by the Town, miscellaneous revenue, subsidy transfers, and total revenue requirement. Also included are the percent annual increase in revenue requirement, the percent annual rate increase, and the annual consumption rate.

As previously mentioned, the total revenue requirement is the sum of all expenses (operating, debt service), less the miscellaneous revenues (general miscellaneous, Town subsidy). Each alternative presented contains conditions listed before the table of results. Because of the Town and the WPCA's debt repayment relationship, CDM Smith has included a separate table for each alternative that provides the existing and anticipated debt service, the total debt service, and the split between the Town and the WPCA. The WPCA portion of the split is used in the following revenue requirement calculation table for that alternative.

7.4.1 Baseline Alternative

The baseline alternative projects wastewater rates for the period FY 2024 through FY 2029. This alternative assumes the existing financial policies and conditions:

- Town pays for all debt service
- Town provides annual $150,000 subsidy to WPCA

Table 7-5 Baseline Existing and Anticipated Debt Service Split

	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029
Existing Debt Service	$2,006,419	$1,944,984	$1,854,917	$1,771,317	$1,711,350	$1,658,125
Anticipated Debt Service	$124,800	$138,338	$162,523	$188,005	$188,005	$188,005
Total Debt Service	**$2,131,219**	**$2,083,322**	**$2,017,440**	**$1,959,322**	**$1,899,355**	**$1,846,130**
Debt Service Paid by WPCA	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Debt Service Paid by Town	$2,131,219	$2,083,322	$2,017,440	$1,959,322	$1,899,355	$1,846,130

Table 7-6 Baseline Alternative Revenue Requirement Results

	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029
Total Operating Expenses	$3,304,738	$3,469,975	$3,643,474	$3,825,647	$4,016,930	$4,217,776
Debt Service paid by WPCA	$0	$0	$0	$0	$0	$0
General Miscellaneous Revenue	($52,754)	($52,754)	($52,754)	($52,754)	($52,754)	($52,754)
Transfer from Fund 101 (subsidy)	($150,000)	($150,000)	($150,000)	($150,000)	($150,000)	($150,000)
Total Revenue Requirement	**$3,101,984**	**$3,267,221**	**$3,440,720**	**$3,622,893**	**$3,814,176**	**$4,015,022**
Annual Increase in Revenue Requirement	8.5%	5.3%	5.3%	5.3%	5.3%	5.3%
Total Annual Rate Increase	10.0%	5.3%	5.3%	5.3%	5.3%	5.3%
Consumption Rate	$7.06	$7.44	$7.83	$8.25	$8.68	$9.14
Annual Surplus / (Deficit)	$476	$0	$0	$0	$0	$0

Under current conditions, the average annual rate increase FY 2024 to FY 2029 is relatively consistent at 5.3 percent to cover revenue requirements. Total revenue requirement increases from $3.1 million in FY 2024 to $4.0 million in FY 2029, which equals an average increase of approximately 5.3 percent. There is an approved rate increase in FY 2024 of 10 percent, which created a surplus in FY 2024 of $476.

7.4.2 Alternative 1

Alternative 1 projects wastewater rates for the period FY 2024 through FY 2029, using the baseline model with the following updated conditions:

- Transfer responsibility for all (existing and anticipated) debt service into WPCA revenue requirement, starting year FY 2024
- Town provides annual $150,000 subsidy to WPCA

Table 7-7 Alternative 1 Existing and Anticipated Debt Service Split

	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029
Existing Debt Service	$2,006,419	$1,944,984	$1,854,917	$1,771,317	$1,711,350	$1,658,125
Anticipated Debt Service	$124,800	$138,338	$162,523	$188,005	$188,005	$188,005
Total Debt Service	**$2,131,219**	**$2,083,322**	**$2,017,440**	**$1,959,322**	**$1,899,355**	**$1,846,130**
Debt Service Paid by WPCA	**$2,131,219**	**$2,083,322**	**$2,017,440**	**$1,959,322**	**$1,899,355**	**$1,846,130**
Debt Service Paid by Town	$0	$0	$0	$0	$0	$0

Table 7-8 Alternative 1 Revenue Requirements Results

	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029
Total Operating Expenses	$3,304,738	$3,469,975	$3,643,474	$3,825,647	$4,016,930	$4,217,776
Debt Service paid by WPCA	$2,131,218	$2,083,323	$2,017,440	$1,959,322	$1,899,355	$1,846,130
Total Miscellaneous Revenue	($52,754)	($52,754)	($52,754)	($52,754)	($52,754)	($52,754)
Transfer from Fund 101 (subsidy)	($150,000)	($150,000)	($150,000)	($150,000)	($150,000)	($150,000)
Total Revenue Requirement	**$5,233,202**	**$5,350,544**	**$5,458,160**	**$5,582,215**	**$5,713,531**	**$5,861,152**
Annual Increase in Revenue Requirement	83.1%	2.2%	2.0%	2.3%	2.4%	2.6%
Total Annual Rate Increase	85.5%	2.2%	2.0%	2.3%	2.4%	2.6%
Consumption Rate	$11.91	$12.18	$12.42	$12.71	$13.01	$13.34
Annual Surplus / (Deficit)	$0	$0	$0	$0	$0	$0

The FY 2024 rate increase of 85.5 percent is set so that the WPCA begins to repay all existing and anticipated debt service, instead of the Town, through rate revenue. If the WPCA increases the rate revenue only by the approved 10 percent for FY 2024, there would be a deficit of $2.1 million with this alternative. The WPCA still receives a $150,000 subsidy from the Town in this alternative. In subsequent years, from 2025 through 2029, the average annual rate increase is 2.3 percent.

7.4.3 Alternative 2

Alternative 2 projects wastewater rates for the period FY 2024 through FY 2029 using the baseline model with the following updated conditions:

- Town pays all existing debt service
- WPCA pays for future anticipated debt service starting in FY 2024
- Town provides annual $150,000 subsidy to WPCA

Table 7-9 Alternative 2 Existing and Anticipated Debt Service Split

	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029
Existing Debt Service	$2,006,419	$1,944,984	$1,854,917	$1,771,317	$1,711,350	$1,658,125
Anticipated Debt Service	$124,800	$138,338	$162,523	$188,005	$188,005	$188,005
Total Debt Service	**$2,131,219**	**$2,083,322**	**$2,017,440**	**$1,959,322**	**$1,899,355**	**$1,846,130**
Debt Service Paid by WPCA	**$124,800**	**$138,338**	**$162,523**	**$188,005**	**$188,005**	**$188,005**
Debt Service Paid by Town	$2,006,419	$1,944,984	$1,854,917	$1,771,317	$1,711,350	$1,658,125

Table 7-10 Alternative 2 Revenue Requirement Results

	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029
Total Operating Expenses	$3,304,738	$3,469,975	$3,643,474	$3,825,647	$4,016,930	$4,217,776
Debt Service paid by WPCA	$124,800	$138,338	$162,523	$188,005	$188,005	$188,005
Total Miscellaneous Revenue	($52,754)	($52,754)	($52,754)	($52,754)	($52,754)	($52,754)
Transfer from Fund 101 (subsidy)	($150,000)	($150,000)	($150,000)	($150,000)	($150,000)	($150,000)
Total Revenue Requirement	**$3,226,784**	**$3,405,559**	**$3,603,243**	**$3,810,898**	**$4,002,181**	**$4,203,027**
Annual Increase in Revenue Requirement	12.9%	5.5%	5.8%	5.8%	5.0%	5.0%
Total Annual Rate Increase	14.4%	5.5%	5.8%	5.8%	5.0%	5.0%
Consumption Rate	$7.34	$7.75	$8.20	$8.67	$9.11	$9.57
Annual Surplus / (Deficit)	$0	$0	$0	$0	$0	$0

The average annual rate increase for the period FY 2025 to FY 2029 is 5.4 percent under this alternative. The FY 2024 rate increase of 14.4 percent is set so that the WPCA begins to repay all anticipated debt service, instead of the Town, through rate revenue. The WPCA still receives a $150,000 subsidy from the Town in this alternative.

7.4.4 Alternative 3

Alternative 3 projects wastewater rates for the period FY 2024 through FY 2029 using the baseline model with the following updated conditions:

- Town pays all existing debt service
- WPCA pays for anticipated debt service starting in FY 2024
- Eliminate annual subsidy of $150,000, phased out over five years, starting in FY 2024

Table 7-11 Alternative 3 Existing and Anticipated Debt Service Split

	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029
Existing Debt Service	$2,006,419	$1,944,984	$1,854,917	$1,771,317	$1,711,350	$1,658,125
Anticipated Debt Service	$124,800	$138,338	$162,523	$188,005	$188,005	$188,005
Total Debt Service	**$2,131,219**	**$2,083,322**	**$2,017,440**	**$1,959,322**	**$1,899,355**	**$1,846,130**
Debt Service Paid by WPCA	**$124,800**	**$138,338**	**$162,523**	**$188,005**	**$188,005**	**$188,005**
Debt Service Paid by Town	$2,006,419	$1,944,984	$1,854,917	$1,771,317	$1,711,350	$1,658,125

Table 7-12 Alternative 3 Revenue Requirement Results

	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029
Total Operating Expenses	$3,304,738	$3,469,975	$3,643,474	$3,825,647	$4,016,930	$4,217,776
Debt Service paid by WPCA	$124,800	$138,338	$162,523	$188,005	$188,005	$188,005
Total Miscellaneous Revenue	($52,754)	($52,754)	($52,754)	($52,754)	($52,754)	($52,754)
Transfer from Fund 101 (subsidy)	($150,000)	($125,000)	($100,000)	($75,000)	($50,000)	($25,000)
Total Revenue Requirement	**$3,226,784**	**$3,430,559**	**$3,653,243**	**$3,885,898**	**$4,102,181**	**$4,328,027**
Annual Increase in Revenue Requirement	12.9%	6.3%	6.5%	6.4%	5.6%	5.5%
Total Annual Rate Increase	14.4%	6.3%	6.5%	6.4%	5.6%	5.5%
Consumption Rate	$7.34	$7.81	$8.32	$8.85	$9.34	$9.85
Annual Surplus / (Deficit)	$0	$0	$0	($0)	$0	$0

The average annual rate increase for the period FY 2025 to FY 2029 is 6.0 percent under this alternative. The FY 2024 rate increase of 14.4 percent is set so that the WPCA begins to repay all anticipated debt service, instead of the Town, through rate revenue. The annual subsidy received by the WPCA has been phased out over five years in this alternative.

7.4.5 Alternative 4

Alternative 4 projects wastewater rates for the period FY 2024 through FY 2029 using the baseline model with the following updated conditions:

- All anticipated debt service is paid by WPCA starting in FY 2024
- Phase all existing debt service into WPCA revenue requirement over ten years, starting in FY 2024
  - Buildup of 10 percent per year
- Eliminate annual subsidy of $150,000, phased out over five years, starting in FY 2024

Table 7-13 Alternative 4 Existing and Anticipated Debt Service Split

	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029
Existing Debt Service	$2,006,419	$1,944,984	$1,854,917	$1,771,317	$1,711,350	$1,658,125
Anticipated Debt Service	$124,800	$138,338	$162,523	$188,005	$188,005	$188,005
Total Debt Service	**$2,131,219**	**$2,083,322**	**$2,017,440**	**$1,959,322**	**$1,899,355**	**$1,846,130**
Debt Service Paid by WPCA	**$325,442**	**$527,335**	**$718,998**	**$896,532**	**$1,043,680**	**$1,182,880**
Debt Service Paid by Town	$1,805,777	$1,555,987	$1,298,442	$1,062,790	$855,675	$663,250

Table 7-14 Alternative 4 Revenue Requirement Results

	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029
Total Operating Expenses	$3,304,738	$3,469,975	$3,643,474	$3,825,647	$4,016,930	$4,217,776
Debt Service paid by WPCA	$325,442	$527,335	$718,998	$896,532	$1,043,680	$1,182,880
Total Miscellaneous Revenue	($52,754)	($52,754)	($52,754)	($52,754)	($52,754)	($52,754)
Transfer from Fund 101 (subsidy)	($150,000)	($125,000)	($100,000)	($75,000)	($50,000)	($25,000)
Total Revenue Requirement	**$3,427,426**	**$3,819,556**	**$4,209,718**	**$4,594,425**	**$4,957,856**	**$5,322,902**
Annual Increase in Revenue Requirement	19.9%	11.4%	10.2%	9.1%	7.9%	7.4%
Total Annual Rate Increase	21.5%	11.4%	10.2%	9.1%	7.9%	7.4%
Consumption Rate	$7.80	$8.69	$9.58	$10.46	$11.29	$12.12
Annual Surplus / (Deficit)	$0	$0	$0	$0	$0	$0

The average annual rate increase for the period FY 2025 to FY 2029 is 9.2 percent under this alternative. The FY 2024 rate increase of 21.5 percent reflects the rate to support WPCA repaying existing debt service related to the $10 million GO bond issuance to support WPCA projects (with a ten-year phase in period), as well as anticipated debt service on assumed SRF borrowing with payback starting in FY 2024. The existing debt service repayment is set to increase 10 percent each year over the ten years. The annual subsidy received by the WPCA has been phased out over five years in this alternative.

Table 7-15 summarizes the annual percentage rate increases and projected rates in one summary for comparison purposes. The magnitude of the rate increases varies significantly depending on the potential shift of debt service to the WPCA revenue requirement. The Town should compare the descriptions and corresponding rate increases for the baseline and alternatives to determine which scenario they would like to use in the future.

Table 7-15 – Alternative Rates and Rate Percent Increases

	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029
	Rate	**Rate**	**Rate**	**Rate**	**Rate**	**Rate**
Baseline	$7.06	$7.44	$7.83	$8.25	$8.68	$9.14
Alternative 1	$11.91	$12.18	$12.42	$12.71	$13.01	$13.34
Alternative 2	$7.34	$7.75	$8.20	$8.67	$9.11	$9.57
Alternative 3	$7.34	$7.81	$8.32	$8.85	$9.34	$9.85
Alternative 4	$7.80	$8.69	$9.58	$10.46	$11.29	$12.12
	FY 2024	**FY 2025**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**
	Rate Increase	**Rate Increase**	**Rate Increase**	**Rate Increase**	**Rate Increase**	**Rate Increase**
Baseline	10.0%[1]	5.3%	5.3%	5.3%	5.3%	5.3%
Alternative 1	85.5%	2.2%	2.0%	2.3%	2.4%	2.6%
Alternative 2	14.4%	5.5%	5.8%	5.8%	5.0%	5.0%
Alternative 3	14.4%	6.3%	6.5%	6.4%	5.6%	5.5%
Alternative 4	21.5%	11.4%	10.2%	9.1%	7.9%	7.4%

[1] Approved rate increase for FY 2024.

Section 8

Recommended Plan

8.1 Prior Recommendations from FMDA Report and CEA

CDM Smith completed the FMDA Report and CEA in November 2021. A CEA was completed under that report in all thirteen sewersheds for 0 percent, 10 percent, 30 percent, and 50 percent I/I reduction scenarios. Based on the CEA and other analyses, CDM Smith recommended five sewershed areas for sewer rehabilitation, M-01, M-05, M-08, M-09 and M-10. Two areas, M-05 and M-10, were recommended for 10 percent I/I reduction or limited sewer rehabilitation, which includes lining unlined sewer mains and manholes. CDM Smith recommended the remaining three areas, M-01, M-08, and M-09, for 50 percent I/I reduction or comprehensive rehabilitation, which includes lining of unlined sewer mains and manholes, lining the full length of laterals and removing private I/I.

Using the findings from the SSES Report, CDM Smith worked with the Town to prioritize the recommendations from the FMDA Report and CEA based on the Town's budget and I/I reduction goals. As discussed above, five sewershed areas (M-01, M-05, M-08, M-09 and M-10) were recommended for rehabilitation in the FMDA Report and CEA. The Town identified a source of inflow in the M-01 sewershed area since the writing of the FMDA Report and CEA. The source was located at the Old Mystic Mill at 11 Main Street, where an open six-inch pipe was allowing a significant amount of water to enter the sewer system during high tides and storms. The day after the pipe was plugged in November 2021, the flows at the Mystic WPCF decreased by eight percent. It is believed that this source was triggering high I/I in the M-01 metering results and additional rehabilitation is not needed in sewershed M-01. Additionally, it is believed that the majority of the issues within sewersheds M-05, M-08, and M-10 are related to the Route 27 / Route 1 interceptor and should focus on rehabilitating these sewershed areas along the interceptor. Rehabilitation in sewershed areas M-05 and M-10 outside of the interceptor may be considered in the future.

Based on I/I found during manhole inspections within sewershed M-08, it is recommended to proceed with CCTV inspections, select pipe rehabilitation, and select manhole rehabilitation throughout sewershed M-08 and not only within the interceptor. Additionally, it is recommended to proceed with CCTV inspections, select pipe rehabilitation, and select manhole rehabilitation throughout sewersheds M-09. The current phasing is shown in **Figure 8-1** at the end of this section. More details can be found below.

8.2 Pipe Rehabilitation

CDM Smith reviewed pipe segments within the three sewersheds related to the Route 27 / Route 1 interceptor that were CCTV inspected to determine if they showed signs of infiltration or other issues. **Table 2-4** at the end of Section 2 shows the pipe segments in the three sewershed areas with their corresponding recommendations and phase. These are sorted by phase of sewer rehabilitation, then sewershed area, and then numerically by pipe segment.

Thirty-one pipes that were CCTV inspected are recommended for CIPP lining. The remaining 15 pipes shown on **Table 2-4** are not recommended for rehabilitation. CDM Smith and the Town recently completed the construction phase for the Select Route 27 / Route 1 project to rehabilitate the most significant defects. This project includes CIPP lining of four of the pipe segments, as noted on **Table 2-4**. CDM Smith recommends the remaining 27 pipes identified for CIPP lining in **Table 2-4** and not included in the Select Route 27 / Route 1 project be rehabilitated in Phase 1: Interceptor Pipe and Manhole Rehabilitation. It is estimated that pipe rehabilitation will remove approximately 0.07 MGD of infiltration.

Recommendations suggested for additional future rehabilitation work are discussed further in this section. CDM Smith recommends that as the Town has available funds, the pipes should be rehabilitated in order by phase. The Town should complete CCTV inspections throughout the remaining pipes in sewersheds M-08 and M-09 prior to rehabilitation to identify defects, verify which pipes are currently lined and determine if there are any issues that may hinder CIPP lining. CCTV inspections of sewershed M-09 is recommended in Phase 2 and inspections of sewershed M-08 is recommended in Phase 4.

Any pipe rehabilitation found during Phase 2: CCTV Inspection in M-08 should be included in Phase 3: M-09 Remaining Pipe and Manhole Rehabilitation. Similarly, any pipe rehabilitation found during Phase 4: CCTV Inspection in M-08 should be included in Phase 5: M-08 Remaining Pipe and Manhole Rehabilitation.

8.3 Manhole Rehabilitation

CDM Smith performed a manhole inspection program throughout the Mystic Area to identify sources of infiltration, inflow, and other defects. **Table 3-3** at the end of Section 3 lists the manhole inspection results, phases, and associated recommendations. CDM Smith recommends 33 manholes for repairs under Phase 1: Interceptor Pipe and Manhole Rehabilitation of sewer rehabilitation program. Defects in these manholes include structural issues in the chimney and wall, corroded frames and covers, and infiltration in the form of stains, weepers, runner, and gushers. These repairs mainly include lining manholes, replacing frames and covers, and raising covers to grade. It is estimated that this manhole rehabilitation will remove approximately 0.005 MGD of infiltration.

CDM Smith also recommends the 20 manholes within Phase 3: M-09 Remaining Pipe and Manhole Rehabilitation and the 51 manholes within Phase 5: M-08 Remaining Pipe and Manhole Rehabilitation are rehabilitated as soon as possible, depending on the Town's available funds. Phase 3 and Phase 5 would rehabilitate defects including structural issues in chimneys, corroded frames and covers, and infiltration in the form of stains, weepers, and drippers. The remaining manholes with recommendations are shown on **Table 3-3** and should be considered for future manhole rehabilitation by the Town.

Additionally, CDM Smith recommends the Town investigates 29 manholes and raise the manholes to grade prior to rehabilitation being completed in the manhole's corresponding phase.

8.4 Smoke Testing Results

Six connections were found through the smoke testing program, which included a combination of indirect and direct sources, on private property. The table below summarizes the results and recommendations for these connections.

Table 8-1 Recommendations Based on Smoke Testing Results

Location	Sewershed Area	Inflow Type	Private/ Public Property	Source of Smoke	Peak Discharge (gpm)	Recommendation
5 Brown Street	M-08	Direct	Private	Clean out	6	Town to notify owner to fix broken cleanout
13 Mistuxet Avenue	M-08	Indirect	Private	Ground (under porch)	5	No building inspection previously completed, Town to complete building inspection in basement to look for potential source(s)
4 Reynolds Hill Road	M-08	Indirect	Private	Basement exhaust	N/A	No building inspection previously completed, Town to complete building inspection in basement to look for potential source(s)
56 Washington Street	M-08	Direct	Private	Clean out	1	Town to notify owner to fix broken cleanout
29 Cottrell Street	M-09	Indirect	Private	Ground & crawl space window near clean out	2	Building inspection previously completed, Town to complete additional building inspection in basement to look for potential source(s)

8.5 Private Inflow Removal

Twenty-four properties were identified with confirmed inflow sources, see **Table 8-2** below. All confirmed sources that were found are sump pumps and a total of 26 sump pumps were found connected to the sewer during building inspections. Two properties had more than one sump pump.

One sump pump is estimated to contribute 5 gpm of inflow. The 26 sump pumps found are estimated to contribute a total of 130 gpm of inflow or 0.19 MGD. These sources are likely significant contributors to inflow and CDM Smith recommends that the Town contact the owners of these buildings to have the sources permanently redirected, removed, or repaired.

Table 8-2 Confirmed Sources from Building Inspections

Address	Descriptions
10 Alden Street	One sump pump to sanitary sewer
7 Broadway Avenue Ext	One sump pump to sanitary sewer
51 Church Street	Two sump pumps to sanitary sewer
27 Cottrell Street	One sump pump to sanitary sewer
14 Denison Avenue	One sump pump to sanitary sewer
18 Denison Avenue	One sump pump to sanitary sewer
39 Denison Avenue	One sump pump to sanitary sewer
22 East Main Street	One sump pump to sanitary sewer
15 Edgemont Street	One sump pump to sanitary sewer
9 Haley Street	One sump pump to sanitary sewer
6 Jackson Avenue	One sump pump to sanitary sewer
2 Lincoln Avenue	One sump pump to sanitary sewer
20 Main Street	One sump pump to sanitary sewer
4 Roosevelt Avenue	One sump pump to sanitary sewer
12 Roosevelt Avenue	One sump pump to sanitary sewer
5 Summit Street	Two sump pumps to sanitary sewer
36 Washington Street	One sump pump to sanitary sewer
51 Washington Street	One sump pump to sanitary sewer
56 Washington Street	One sump pump to sanitary sewer
58 Washington Street	One sump pump to sanitary sewer
2 Williams Avenue	One sump pump to sanitary sewer
32 Willow Street	One sump pump to sanitary sewer
35 Willow Street	One sump pump to sanitary sewer
37 Willow Street	One sump pump to sanitary sewer

8.7 Financial Evaluation Results

CDM Smith performed a financial evaluation to summarize the projected wastewater revenue requirement options for the Town's WPCA. The objective was to project rates over a five-year period to levels where rates were projected to generate sufficient revenues to meet revenue requirements. As part of this evaluation, five rate project alternatives were developed, including one baseline with the existing financial conditions. The baseline and alternative scenarios are presented in Section 7 of this report.

8.8 Implementation Schedule

As mentioned earlier in this section, CDM Smith has worked with the Town to modify the recommendations from the FMDA Report and CEA, based on findings from the SSES Report and the Town's budget, I/I reduction, and priorities. The current phasing is shown in **Figure 8-1** at the end of this section. **Table 8-3** below shows the five recommended phases for sewer rehabilitation along with their estimated costs. The proposed implementation schedule is also presented in **Table 8-3**. Adjustments to the schedule may be made as dictated by implementation and funding requirements. The design and construction costs have been escalated, based on the proposed implementation year in **Table 8-3**. The costs will need to be escalated further if the schedule is delayed.

All rehabilitation costs include an additional 35% allowance for construction services and contingencies. The costs in **Table 8-3** are rounded to the nearest $10,000. The costs are based on currently available data and will need to be refined after additional field investigations are completed. Remaining CCTV and manhole inspections are recommended prior to rehabilitation to identify defects and verify if the pipe or manhole is currently lined. More specific information related to each phase is discussed below.

Table 8-3 Phasing and Revised Costs of Sewer Rehabilitation

Proposed Fiscal Year	Type of Work	Phase	Estimated Cost with Escalation	Estimated Total Cost by Year
2024	Design	1: Interceptor Pipe and Manhole Rehab.	$220,000	$2,440,000
	Construction	1: Interceptor Pipe and Manhole Rehab.	$2,200,000	
	CCTV inspections	2: CCTV Inspection in M-09	$20,000	
2025	Design	3: M-09 Remaining Pipe and Manhole Rehab.	$30,000	$310,000
	Construction	3: M-09 Remaining Pipe and Manhole Rehab.	$230,000	
	CCTV inspections	4: CCTV Inspection in M-08	$50,000	
2026	Design	Portion of 5: M-08 Remaining Pipe and Manhole Rehab.	$40,000	$460,000
	Construction	Portion of 5: M-08 Remaining Pipe and Manhole Rehab.	$420,000	
2027	Design	Portion of 5: M-08 Remaining Pipe and Manhole Rehab.	$50,000	$480,000
	Construction	Portion of 5: M-08 Remaining Pipe and Manhole Rehab.	$430,000	
Total			**$3,690,000**	**$3,690,000**

CDM Smith and the Town recently completed the construction phase for the Select Route 27 / Route 1 project to rehabilitate the most significant defects. This project includes CIPP lining of four of the pipe segments. Additional rehabilitation on Route 27 / Route 1 is recommended as the next phase, Phase 1: Interceptor Pipe and Manhole Rehabilitation. Phase 1 includes CIPP lining 27 pipes and rehabilitating 33 manholes. Two manholes in Phase 1 were not found during inspections. The Town needs to locate and raise these manholes to grade prior to rehabilitation

so an inspection can be completed. Phase 1: Interceptor Pipe and Manhole Rehabilitation is estimated to remove approximately 0.07 MGD of infiltration.

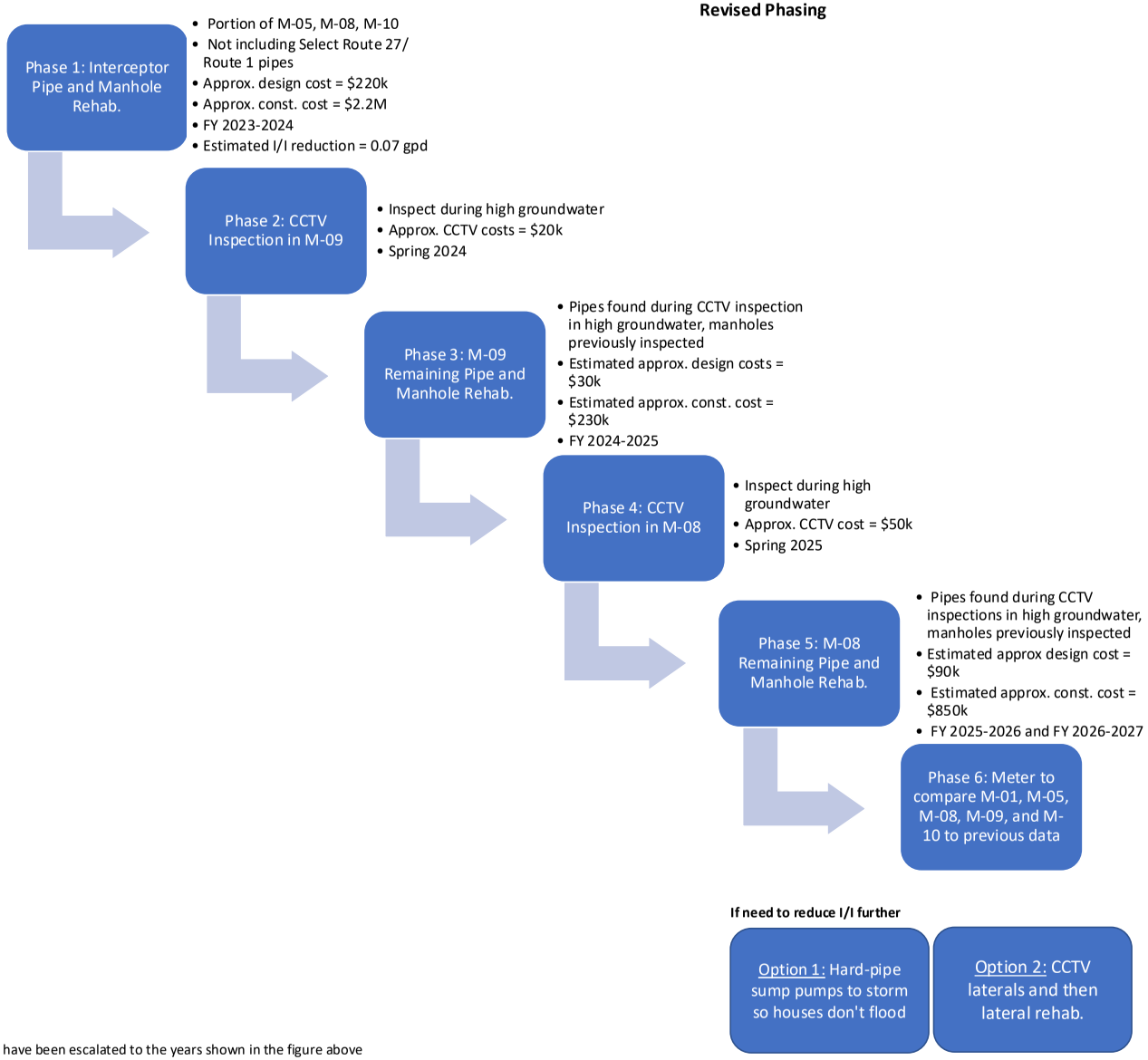
The next two phases will occur in sewershed M-09. Phase 2: CCTV Inspection in M-09 should be completed during high groundwater and is suggested for spring 2024. Phase 2 includes approximately 5,000 ft of CCTV inspections of pipes that have not been previously inspected. Phase 3: M-09 Remaining Pipe and Manhole Rehabilitation should include any pipe rehabilitation found during Phase 2 and the 20 manholes already recommended for rehabilitation under M-09. CDM Smith was unable to inspect five manholes in Phase 3. The Town should locate and raise these manholes to grade prior to rehabilitation so an inspection can be completed.

Similarly, the next two phases will occur in sewershed M-08. Phase 4: CCTV Inspection in M-08 should be completed during high groundwater and is suggested for spring 2025. Phase 5 includes approximately 14,000 ft of CCTV inspections of pipes that have not been previously inspected. Phase 5: M-08 Remaining Pipe and Manhole Rehabilitation should include any pipe rehabilitation found during Phase 4 and the 51 manholes already recommended for rehabilitation under M-08. Sixteen manholes in Phase 5 were not found during inspections. The Town needs to locate and raise these manholes to grade prior to rehabilitation so an inspection can be completed.

As phases are completed, the Town should monitor flows at the Mystic WPCF and perform an analysis of the effectiveness for each phase. Following field investigations and sewer rehabilitation in the first five phases, CDM Smith recommends Phase 6 to meter sewersheds identified in the FMDA Report and CEA to be contributing the largest amounts of I/I. These sewersheds are M-01, M-05, M-08, M-09, and M-10. The results should be compared to results in the FMDA Report and CEA. If I/I needs to be reduced further, the Town can reroute previously identified sump pumps currently connecting to the sewer by hard-piping the sump pumps to the storm system, CCTV inspect and rehabilitate laterals, or resolve other I/I issues identified in this report.

CDM Smith and the Town will complete the field work and first design of the previously discussed sewer rehabilitation recommendations within one year of approval of this report by CT DEEP and EPA. The construction of the first design will be completed within a year of the completion of the first design.

Figure 8-1
Town of Stonington, CT Mystic Area SSES
Revised Phasing



Note: These costs have been escalated to the years shown in the figure above