

**Town of Linden**

A2H Contract No. 21506

**TOWN OF LINDEN PRELIMINARY ENGINEERING  
REPORT  
WASTEWATER SYSTEM IMPROVEMENTS  
AMERICAN RESCUE PLAN**

Perry County, Tennessee



March 28, 2024

PROJECT

**COLLECTION SYSTEM AND LAGOON REHABILITATION**

**PRELIMINARY ENGINEERING REPORT**

TOWN OF LINDEN

Perry County, Tennessee

A2H # 21506

PREPARED FOR

**Town of Linden**

216 E Main Street

Linden, TN 37096

PREPARED BY

**A2H, Inc.**

3009 Davies Plantation Road

Lakeland, TN 38002

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## 1 GENERAL

### 1.1 PURPOSE

The purpose of this report is to document the existing wastewater collection and treatment system of the Town of Linden and to make recommendations for associated projects. Funding for these projects are being sought through the American Rescue Plan Non-Competitive Grant Funding.

### 1.2 AREA TO BE SERVED

The Town of Linden can be found in the central region of Perry County, situated in middle Tennessee and close to the Tennessee River (refer to Figure 1 in the Appendix). Serving as a regional center, Linden offers various retail, commercial, and government services, catering to a local population of around 1,100 residents. Additionally, Linden serves as the county seat for Perry County, providing administrative support for both the town and the county. The growth and scale of the city are illustrated in the Table below.

TABLE A – POPULATION DATA	
DATE	POPULATION
1940	641
1950	854
1960	1,086
1970	1,062
1980	1,087
1990	1,099
2000	1,015
2010	908
2024	1,150

### 1.3 EXISTING WASTEWATER COLLECTION SYSTEM

The existing sewer system in the Town of Linden primarily caters to the town limits and comprises around 50,000 linear feet of gravity sewer line, 110 manholes, and 4 lift stations. The system currently serves 550 customers, including 42 commercial or industrial connections.

The high I&I rate poses a significant challenge for the aging sewer system, leading to increased stress on the treatment plant and potential overflow issues during heavy rainfall. To address this, the Town of Linden has initiated a comprehensive sewer system rehabilitation and maintenance program, focusing on identifying and repairing deteriorating pipes, manholes, and lift stations. Additionally, the town is implementing a public education campaign to raise awareness about the impact of I&I and encourage residents and businesses to take proactive measures to reduce their contribution to the problem.

### 1.4 CONDITION OF WASTEWATER TREATMENT FACILITY

The wastewater treatment plant is a four-cell lagoon system with an average design flow of 0.32 MGD and discharges to the Buffalo River. The Buffalo River is listed as an Exceptional Water of the State. The basis of inclusion being "Buffalo River and tributaries in Lawrence county designated by USFWS as Critical Habitat for federal and state threatened Slackwater Darter. Populations of federal and state threatened Spottfin Chub, state threatened Coppercheek Darter, Saddled Madtom, Ashy Darter and Longhead Darter. Portion is a state Scenic River. Portions flow through Natchez Trace Parkway NP and Hugh Link Farm State Archaeological Area". In 2022, there were 159 days in the 12 month period shown where the City was forced to exceed discharge limits to prevent an overflow at the lagoon. Of those 159 instances, 119 fell within the wet month period and 40 in the dry month period.

Data collected over the period of July 2020 through June 2021 indicates that the average flow into the wastewater treatment plant is 0.45 million gallons per day (MGD). Months with total rainfalls greater than 3.0-inches produce a peak daily maximum of 1.3 MGD. The increase in flow is seen almost simultaneously with the rainfall and typically returns to normal within 72-hours after the rainfall event. As stated previously, the treatment plant has a design capacity of 0.32 MGD. Monthly summary reports show that as little as 0.2 inches of rainfall has caused the system to exceed its design capacity and at times, almost five times the allowable discharge.

The lagoon is also showing an extremely high sludge level in Cell #1. If excessive accumulation of sludge in wastewater lagoons is not removed, it can disrupt the treatment process by reducing the lagoon's water holding capacity, thus decreasing the amount of time available for proper treatment. As a result, there can be an increase in the concentrations of BOD and TSS in the effluent. In certain cases, the anaerobic digestion of sludge can even result in the release of ammonia into the lagoon's water column. This can lead to a situation where the concentration of ammonia in the effluent is higher than that in the influent.



*Figure 1 - Existing Cell #1*

## 1.5 NEEDS ADDRESSED WITH THIS REPORT

The purpose of this report is to address the issues with inflow and infiltration and excessive sludge in the initial lagoon cell. The I&I issue is a critical need issue for the collection system and affects the treatment process. The sludge accumulation has made cell #1 aerators near inoperable due to the depth.

## 2 RECOMMENDATIONS

### 2.1 WASTEWATER COLLECTION SYSTEM INFLOW & INFILTRATION

The alternatives for addressing the wastewater collection system inflow & infiltration are described as follows:

- A. Do Nothing – The “Do-Nothing” approach is typically considered in operational improvement discussions; however, if the inflow and infiltration issues are not addressed, the unit processes will cease to function adequately, and effluent discharge violations will continue to occur. The “Do-Nothing” approach is not an acceptable alternative.
  
- B. Open Cut & Replace Sewer Mains – One potential option for replacing deteriorated sewer mains would be to open cut, remove the existing lines and install new sewer mains. Although this would correct the problem; it would be extremely disruptive to the surrounding residents and streets. The cost for laying new pipe is comparable to rehabilitative methods, however the additional cost for gravel and asphalt repair would make this option vastly more expensive. Therefore, due to the disruptive affects and increased cost, open cutting and replacing the mains is not the best alternative.
  
- C. Rehabilitate collections lines and manholes – The existing collection system can be rehabilitated through several measures. Sewer mains can be lined by cured in place pipe or by pipe bursting. Where CIPP is used, taps are lined simultaneously with the sewer main. Service laterals in this method will only be replaced where smoke testing has indicated a leak exists within the right of way. Where pipe bursting is used, the taps will be excavated and replaced. For manholes, the structure is cleaned, patched and then a cured in place liner is applied. The cost of lining or pipe bursting is very similar to laying

pipe but does not require the cost of excavation, asphalt repair or gravel. The equal longevity and reduced cost makes this the best alternative option.

## 2.2 LAGOON SLUDGE REMOVAL

The alternatives for addressing the lagoon sludge removal are described as follows:

- A. Do Nothing – The “Do-Nothing” approach typically considered in operational improvement discussions; however, if the lagoon function is not addressed, the processes will cease to function adequately and effluent discharge violations will continue to occur. The “Do-Nothing” approach is not an acceptable alternative.
  
- B. Sludge removal – The project proposed will pump and remove the excess sludge from cell #1. Linden’s wastewater treatment plant utilizes a lagoon system that is over 30 years old. Sludge removal is needed to maintain a state of good repair for the treatment plant and to remain in compliance with state wastewater regulations. This need has been identified by TDEC inspections and the immediate need is evident by the photo below shown previously in this report.

## 3 COST SUMMARY

The proposed project cost as submitted with the Towns ARPA fund allocation request to the Tennessee Department of Environment and Conservation have been included in Attachment II.

## 4 CRITICAL CONDITIONS ADDRESSED

The proposed I&I project addresses the Town’s critical need to lower its inflow and infiltration rate. The attached scorecard shows the rate at 69%. The rehabilitation efforts will also address the percentage of sewer lines over 50 years in age category. The proposed project will rehabilitate approximately 32,000 LF of sewer mains which is 64% of the total system.

## 5 COMMUNITY INFORMATION

### 5.1 SCORECARD

The Town’s scorecard is included in Attachment III. The scorecard shows critical needs for sewer I&I rate, GIS mapping, percentage of water and sewer lines over 50 years in age, and a drinking

water violation. The critical items being addressed are listed above. The drinking water violation was a minor infraction for failing to public the annual water quality report in the local newspaper.

## 5.2 MAP

A map showing the existing Linden sewer collection system has been included as Attachment I. The Town is also currently working on GIS mapping both the water and sewer system.

## 5.3 PROJECT DESCRIPTION

Submitted as a complimentary document to this PER is the Inflow and Infiltration Reduction Plan developed as part of the planning for this document. The Town has completed multiple projects for CCTV, manhole inspection and smoke testing. The assessment was completed employing a set of coding standards and a digital database to document and analyze sewer line conditions known as the Pipeline Assessment and Certification Program (PACP). Technicians used specialized software to input data about the pipe's condition, including defects such as cracks, fractures, and root intrusions. The software then assigns a severity rating to each defect, providing a clear picture of the overall condition of the sewer line. This data-driven approach allows maintenance teams to prioritize repairs based on the severity of the issues identified. The use of standardized coding ensures consistency and clarity in the assessment process. It also enables the comparison of data across different inspections and locations. This data will be used to create the next phase of rehabilitation to sewer mains and manholes to reduce the inflow and infiltration to the system.

The second part of the project will be to remove sludge from Cell #1. The lagoon will be pumped and then dewatered. The contractor will be responsible for transporting the sludge offsite to a permitted disposal area.

## 5.4 REQUIRED PERMITS

No specific permits will be required for either project. The sewer system rehabilitation project will be submitted to the Tennessee Department of Environment and Conservation Engineering Services Unit for review and approval.

## 5.5 PROJECT SCHEDULE

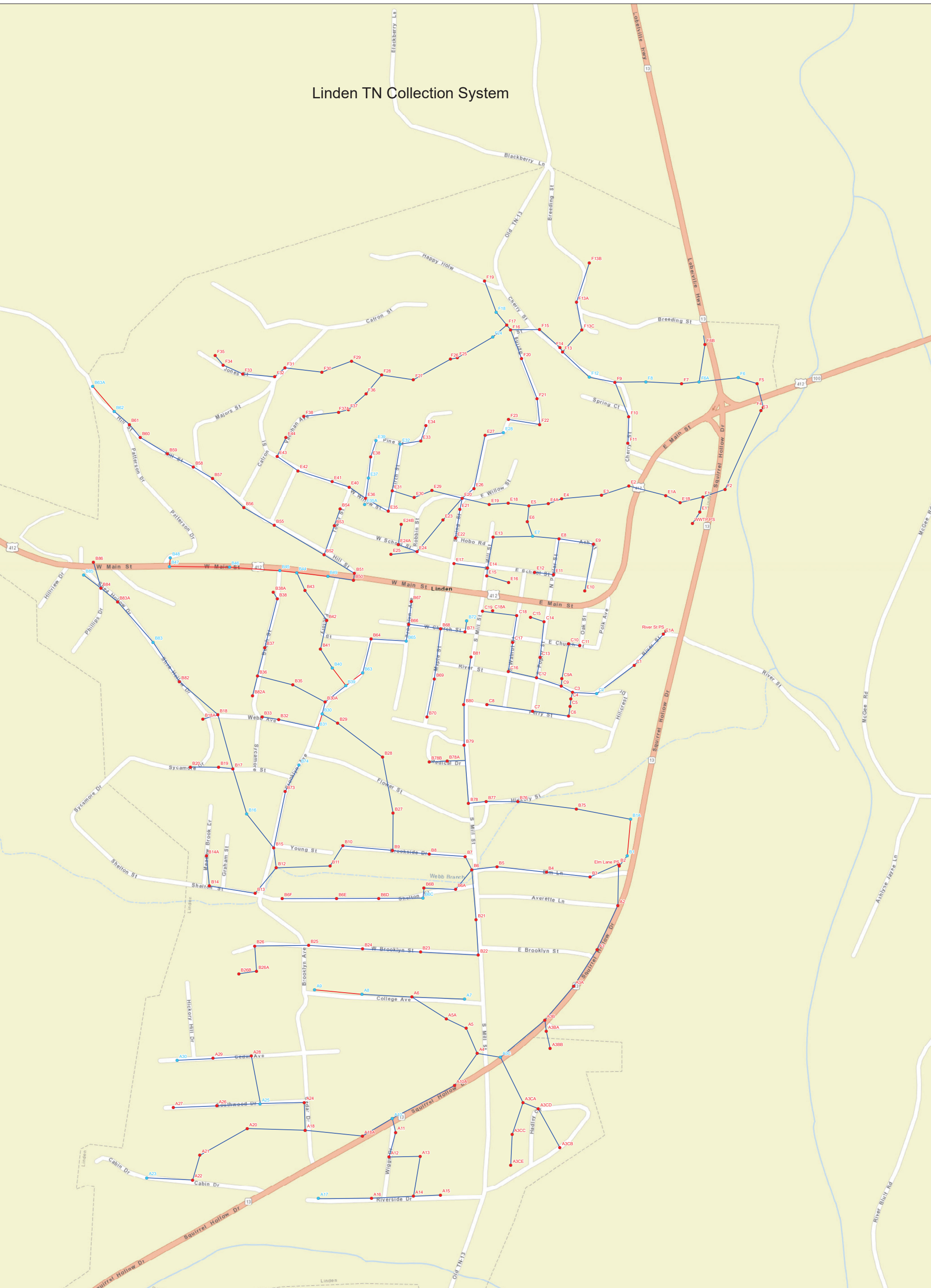
The following schedule is anticipated for the proposed project:

Submittal of PER	March 2024
Completion of Design (All Projects)	April 2024
TDEC Plan Approval & Permits	April 2024
Project Bidding	May 2024
Award	June 2024
Construction Begins (All Projects)	July 2024
Construction End (All Projects)	December 2024
Close Out	February 2025

**Attachment I – Wastewater Collection System Map**



# Linden TN Collection System



# UTILITY TECHNOLOGIES

Flow Monitoring Studies & Installations Sewer Evaluation Surveys I/I Analysis

## **Attachment II – Project Budgets**

**Town of Linden**

**Sewer Collection Rehabilitation**

**Opinion of Probable Cost**

**24-Jan-24**

**Sewer Collection Rehabilitation**

<u>No.</u>	<u>Description</u>	<u>Qty</u>	<u>Unit</u>	<u>Cost/Unit</u>	<u>Total</u>
1	Mobilization	1	LS	\$50,000.00	\$50,000.00
2	8-Inch CIPP	17250	LF	\$70.00	\$1,207,500.00
3	8-inch Pipe Burst	5800	LF	\$100.00	\$580,000.00
4	Service Replacements	30	EA	\$5,000.00	\$150,000.00
5	Sewer Manhole Lining	250	VF	\$400.00	\$100,000.00
6	Point Repair	46	EA	\$5,000.00	\$230,000.00
7	Adjust SMH Access to Finish Grade	6	EA	\$2,500.00	\$15,000.00
				<b>Subtotal</b>	<b>\$2,332,500.00</b>
				Design	\$ 180,000.00
				Inspection	\$ 75,000.00
				Other	\$ 2,750.00
				Advertising	\$ 250.00
				GA	\$ 50,000.00
				<b>Total</b>	<b>\$2,640,500.00</b>

**Lagoon Improvement**

<u>No.</u>	<u>Description</u>	<u>Qty</u>	<u>Unit</u>	<u>Cost/Unit</u>	<u>Total</u>
1	Mobilization	1	LS	\$ 10,000.00	\$ 10,000.00
2	Sludge Survey	1	LS	\$ 5,000.00	\$ 5,000.00
3	Sludge Removal	1	LS	\$ 200,000.00	\$ 200,000.00
4	Contingency	1	LS	\$ 20,000.00	\$ 20,000.00
				<b>Subtotal</b>	<b>\$ 235,000.00</b>
				Design	\$ 10,000.00
				Inspection	\$ 5,000.00
				Other	\$ 10,000.00
				Advertising	\$ 250.00
				GA	\$ 4,250.00
				<b>Total</b>	<b>\$ 264,500.00</b>

**Attachment III – 2022 Utility Scorecard**

## WATER INFRASTRUCTURE SUMMARY

Name of Entity:	Linden		
Office Address:	216 East Main Street		
City:	Linden	State:	TN
		Zip Code:	37096
County:	Perry		
Primary Community Served:	Linden	Population:	1,199
ATPI:	10		
Utility Type:	Municipal		
Number of Water Connections:	2,800	Total Connections:	2,800
Number of Wastewater Connections:	550		
Number of Employees:	15 Full-time		1 Part-Time
	<b>PWSID</b> 0000404		<b>NPDES</b> 0064394

### UTILITY CONTACT LIST

Name	Title	Phone	Email
Wess Ward	Mayor	9312090585	mayorward2016@gmail.com

### REPORTING REQUIREMENTS

Entity Fiscal Year:	June
Date of Last Audit:	July 2021
Adverse Audit Findings:	No
Notes:	

### REGIONALIZATION

Has the system considered any regional cooperative efforts?	Yes
Does the system have written or verbal agreements with neighboring utilities?	Yes

ASSET MANAGEMENT	WATER LOSS		
Asset Mangement Plan	Yes	<b>Unaccounted Water Loss</b>	32%
GIS Mapping	25-50%	Millions of Gallons/year	54.34
Inventory and Condition Assessment	Yes	Production Cost/year	\$541,769.80
		INFLOW and INFILTRATION	
Planned O&M and Work Order System	Yes	<b>Inflow and Infiltration</b>	69%
Meter Testing & Changeouts	Yes	Millions of Gallons/year	111.69
Captital Improvement Plan & Budget	Yes	Treatment Cost/year	\$139,612.50
IT Infrastructure	Yes		
MODERNIZATION			
Drinking Water Plant >80% Capacity	No	Wastewater Plant >80% Capacity	No
Age of Drinking Water Plant	50+ years	Age of Wastewater Treatment Plant	30-50 years
Percentage of lines older than 50 years	0-25%	Percentage of lines older than 50 years	>50%
COMPLIANCE			
Drinking Water Violations	Yes	Meeting Wastewater Permit Requirements	Yes
State Mandated Compliance Order (Water)	No	State Mandated Compliance Order (WW)	No
Meeting Order Requirements (Water)	NA	Meeting Order Requirements (WW)	NA
STORMWATER			
Stormwater Management Plan			N/A
System-Wide Map			N/A

**Attachment IV –  
Prioritized Wastewater Collection Line Rehabilitation Schedule**

## Linden Camera Log Summary

Upstream MH	Downstream MH	Date	Street	Size	Material	Total Length	Structural Rating	Maintenance Rating
F31	F30	2/3/2022	MAJOR ST	8	PVC	180.70	5300	4200
A8	A6	4/22/2021	College Ave	6	VCP	386.80	5141	411B
C1	C1A	7/8/2021	RIVER ST	8	VCP	291.60	5141	3312
B16	B15	6/24/2021	Brooklyn Ave	8	PVC	402.60	5132	0000
C19	C18	7/7/2021	S MILL ST	8	VCP	238.20	5131	0000
A28	A28A	4/14/2021	Cedar Ave	8	VCP	134.10	5100	1100
B85	B84	6/23/2021	Shea Hollow Dr	8	VCP	340.00	5100	0000
B60	B59	7/1/2021	HILL ST	8	VCP	215.10	5100	4238
B52	B51	7/6/2021	HILL ST	8	VCP	244.50	5100	0000
E25	E24	4/23/2021	W School St	8	VCP	181.50	4136	1300
B83	B82	6/23/2021	Shea Hollow Dr	8	VCP	329.00	4133	0000
F11	F10L	2/2/2022	CHERRY ST	8	VCP	224.10	4132	4334
B21	B6	2/9/2022	N MILL ST	8	VCP	347.00	4132	5100
C12	C9	7/8/2021	RIVER ST	8	VCP	177.40	4131	0000
B86	B84	6/23/2021	Shea Hollow Dr	8	PVC	187.50	4121	0000
A17	A16	4/20/2021	Riverside Dr	8	VCP	367.60	4100	0000
A11	A10	4/21/2021	Wiggs Dr	8	VCP	122.20	4100	2100
A10A	A4	4/21/2021	Squirrel Hollow Dr	8	DIP	271.40	4100	4100
A2	PS	4/22/2021	Squirrel Hollow Dr	8	VCP	303.50	4100	4100
E4	E4A	4/23/2021	E Main St	6	PE	100.50	4100	0000
E3	E4	4/23/2021	E Main St	6	PE	125.00	4100	0000
C10	C9A	7/8/2021	E CHURCH ST	8	VCP	99.80	4100	5100
B73	B15	6/24/2021	Brooklyn Ave	8	VCP	394.60	3322	1100
B23	B22	4/14/2021	W Brooklyn St	8	PVC	400.30	3300	0000
A22	A21	4/20/2021	Cabin Dr	8	VCP	166.70	3221	1400
B53	B52	7/6/2021	TOWER ST	8	VCP	212.30	3200	1100
E22	E21	2/1/2022	SPRING ST	8	VCP	200.00	3200	0000
E17	E14	2/7/2022	E SCHOOL ST	8	VCP	230.00	3200	0000
B22	B21	2/9/2022	S MILL ST/BROOKLYN S	8	VCP	239.20	3125	4334
A13	A12	4/21/2021	Wiggs Dr	8	VCP	209.40	3123	4432
B20	B19	6/24/2021	Sycamore St	8	VCP	134.20	3122	0000
F23	F22	2/1/2022	SPRING ST	8	VCP	212.30	3122	0000
B19	B17	6/24/2021	Sycamore St	8	VCP	96.60	3121	4112
B37	B36	6/30/2021	Beech St	8	VCP	197.90	3121	4131
F33	F32	2/3/2022	JONES ST	8	PVC	221.50	3121	0000
C2	C1 (rev)	7/8/2021	RIVER ST	8	VCP	369.00	3121	0000
E14	E13	2/7/2022	N MILL ST	8	VCP	100.30	3111	3112
B26	B25	4/13/2021	W Brooklyn St	8	VCP	374.30	3100	0000
A29	A28	4/14/2021	Cedar Ave	8	VCP	265.00	3100	4112
B25A	B25	4/22/2021	Brooklyn Ave	6	VCP	224.70	3100	4200
B6F	B6E	6/29/2021	Shelton St	8	VCP/PVC	376.10	3100	4100
B6E	B6D	6/29/2021	Shelton St	8	VCP	268.40	3100	4111

## Linden Camera Log Summary

Upstream MH	Downstream MH	Date	Street	Size	Material	Total Length	Structural Rating	Maintenance Rating
B6D	B6C	6/29/2021	Shelton St	8	PVC	307.10	3100	0000
B64	B63	7/1/2021	Brooklyn Ave	8	VCP	240.00	3100	3716
C16	C12	7/8/2021	RIVER ST	8	VCP	201.90	3100	0000
E40	E36	7/13/2021	W WILLOW ST	8	VCP	133.40	3100	0000
A3C	A3B	4/22/2021	Squirrel Hollow Dr	8	DIP	399.10	2311	0000
A14	A13	4/21/2021	Riverside Dr	8	VCP	274.30	2200	1100
B71	B68	6/30/2021	W Church St	8	VCP	170.10	2200	0000
B65	B64	7/1/2021	Factory St	8	VCP	247.40	2200	0000
C11	C10	7/8/2021	E CHURCH ST	8	VCP	74.80	2200	0000
E27	E26(B)	2/1/2022	SPRING ST	8	VCP	355.40	2200	3714
E7	E6L	2/8/2022	N POPULAR ST	8	VCP	73.20	2200	3121
A28A	A25	4/14/2021	Cedar Ave	8	VCP	196.00	2100	1200
A21	A20	4/20/2021	Cabin Dr	8	VCP	378.00	2100	1100
A15	A14	4/20/2021	Riverside Dr	8	VCP	183.80	2100	0000
A3CA	A3C	4/21/2021	Hadley Cir	8	PVC	315.80	2100	2100
A3BA	A3A	4/22/2021	Squirrel Hollow Dr	8	VCP	306.00	2100	0000
A3A	A3	4/22/2021	Squirrel Hollow Dr	8	VCP	300.40	2100	1100
B25B	B25A	4/22/2021	College Ave	8	VCP	126.80	2100	0000
B84	B83A	6/23/2021	Shea Hollow Dr	8	VCP	149.00	2100	1200
B11	B10	6/25/2021	Brookside Dr	8	PVC	162.60	2100	0000
B54	B53	7/6/2021	TOWER ST	8	VCP	121.00	2100	0000
E26	E20	2/1/2022	SPRING ST	8	VCP	101.70	2100	0000
E9	E8	2/7/2022	ASH ST	8	VCP	239.00	2100	1700
E8	E7L	2/8/2022	N POPULAR/ASH ST	8	VCP	225.40	2100	3321



## Linden Camera Log Summary

Upstream MH	Downstream MH	Date	Street	Size	Material	Total Length	Structural Rating	Maintenance Rating
B33	B32	7/1/2021	Webb Ave	8	VCP	115.20	0000	3C17
E33	E32	1/31/2022	PINE ST	8	VCP	255.60	0000	1H00
F22	F21	2/1/2022	SPRING ST	8	VCP	166.50	0000	5641
F20	F16	2/1/2022	SPRING ST	8	VCP	212.00	0000	5333
F35	F34	2/3/2022	JONES ST	8	PVC	83.00	0000	5200
B38	B37	6/30/2021	Beech St	8	VCP	337.30	0000	5143
F34	F33	2/3/2022	JONES ST	8	PVC	146.20	0000	5100
E42	E41	7/13/2021	W WILLOW ST	8	VCP	247.00	0000	4733
B68	B66	6/30/2021	W Church St	8	VCP	203.70	0000	4434
B83A	B83	6/23/2021	Shea Hollow Dr	8	VCP	349.50	0000	4417
A6	A7	4/13/2021	College Ave	6	VCP	29.50	0000	4400
F15	F14L	2/2/2022	SPRING ST	8	VCP	190.10	0000	4400
B58	B57	7/1/2021	HILL ST	8	VCP	153.20	0000	4333
B36	B35	6/30/2021	Beech St	8	VCP	147.90	0000	4236
E32	E31	1/31/2022	BIRCH ST	8	VCP	216.70	0000	4236
C7	C6	7/7/2021	PERRY ST	8	VCP	212.40	0000	4234
F13B	F13A	2/2/2022	BREEDING ST	8	VCP	283.70	1100	4233
E39	E38	7/13/2021	PINE ST	8	VCP	89.00	0000	4231
E38	E37	7/13/2021	PINE ST	8	VCP	47.10	0000	4231
E31	E30	1/31/2022	BIRCH/ROBBINS ST	8	VCP	151.30	0000	4231
F16	F15L	2/1/2022	SPRING ST	8	PVC	200.10	0000	4231
C15	C14	7/8/2021	S POPULAR ST	8	VCP	69.00	0000	4231
B24	B23	4/13/2021	W Brooklyn St	8	VCP	395.80	0000	4213
E16	E15	2/7/2022	E SCHOOL ST	8	VCP	47.00	1200	4200
B6	B5	2/8/2022	ELM LN	8	PE	173.60	0000	4200
B69	B68	6/30/2021	Maple St	8	VCP	59.60	0000	4139
B59	B58	7/1/2021	HILL ST	8	VCP	127.80	0000	4134
B57	B56	7/2/2021	HILL ST	8	VCP	257.40	0000	4132
E10	E9	2/7/2022	E SCHOOL ST/ ASH ST	8	VCP	249.30	0000	4123
A30	A29	4/14/2021	Cedar Ave	8	VCP	248.60	0000	4113
B82	B18	6/24/2021	Shea Hollow Dr	8	VCP	346.30	0000	4111
C3	C2	7/8/2021	RIVER ST	8	VCP	125.40	0000	4111
E43	E42	7/13/2021	W WILLOW ST	8	VCP	172.40	0000	4111
E35A	E35	7/13/2021	W WILLOW ST	8	VCP	105.10	0000	4111
B25	B24	4/13/2021	W Brooklyn St	8	PVC	373.30	0000	4100
B6B	B6C	6/29/2021	Shelton St	8	VCP	68.60	0000	4100
B5	B4	2/8/2022	ELM LN	10	PE	346.10	0000	4100
C8	C7	7/7/2021	PERRY ST	8	VCP	318.40	0000	3512
F21	F20	2/1/2022	SPRING ST	8	VCP	34.10	0000	3511
C9	C3	7/8/2021	RIVER ST	8	VCP	90.20	1100	3413
A23	A22	4/22/2021	Cabin Dr	8	VCP	60.00	0000	3400
B35	B30A	7/1/2021	Brooklyn Ave	8	VCP	198.30	0000	3317

### Linden Manhole Inspection Report

Manhole Number	Street Address/Location	Manhole Depth (ft)	Subject to Ponding	Lid Type	Frame Seal Condition	Manhole Material	Manhole Condition	Comments
A35	2597 Squirrel Hollow Rd. - in grass near road.	10.2	None	Pick	Good	Precast	Needs Attention	15 GPM Pipe@ PCL, evidence of surcharge.
A40	2660 Squirrel Hollow Rd. - in grass.	9.7	None	Pick	Offset & Loose	Precast	Needs Attention	Broken frame and lid.
A42	2760 Squirrel Hollow Rd. - in grass near fence.	5.1	Flooding	Pick	Offset & Loose	Precast	Needs Attention	Frame is severely broken.
A5	104 College Ave. - in storm ditch.	5.2	Runoff	Solid	Offset & Loose	Precast	Needs Attention	No frameseal, frame offset. Recommend water tight lid.
B21	301 S. Mill St. - in sidewalk.	6.3	None	Pick	Offset & Loose	Brick	Needs Attention	Broken brickwork around cone and chimney.
B76	106 Hickory St. - In grass.	8.1	None	Pick	Good	Brick	Needs Attention	Surcharge evidence; +/- 5 GPM leak throughout. Gushing and weeping around wall.
B83A	89 Shea Hollow Dr. - in grass.	6.3	None	Solid	Loose	Precast	Needs Attention	Broken lid, broken frame (severe).
C9A	206 River St. - near storm culvert.	8	Flooding	Solid	Loose	Brick	Needs Attention	Frame, lid, and chimney are severely broken.
E1	Easement near WWTP pump station.	8.8	None		Good	Brick	Needs Attention	Missing lid, in flood plane.
F33	116 Jones St. - in road near fire hydrant.	7.5	Runoff	Pick	Loose	Precast	Needs Attention	estimated 15 gpm.
F6B	65 Hwy. 13 - edge of road	9.8	Runoff	Pick	Good	Brick & Precast	Needs Attention	Lid is broken in half.
F9	203 Cherry St. - in road	6.9	None	Pick	Good	Liner	Needs Attention	Heavy roots blocking flow; roots throughout; liner through causing poor flow and catching debris.
A12	101 Wiggs Dr. - in road.	6.2	None	Solid	Good	Precast	Poor	Heavy roots throughout.
A27	236 Southwood Dr. - in grass.	5.2	None	Solid	Loose	Precast	Poor	Broken frame, I/I staining at lower wall joint.
A29	223 Cedar Ave. - in road.	5.8	None	Solid	Good	Precast	Poor	Roots, soil, I/I staining at line2 PCN.
B11	110 Young St. - in back yard.	5.5	None	Pick	Good	Liner	Poor	Heavy roots throughout.
B13	200 Shelton St. - in road.	8.5	None	Pick	Good	Liner	Poor	5 gpm leak at PCN1.
B18A	277 Shea Hollow Dr. - in front yard.	4.5	Ponding	Pick	Good	Precast	Poor	Heavy debris assumed from upstream.
B75	157 Elm Ln. - in crop field near ditch.	4.9	Ponding	Pick	Loose	Precast	Poor	Heavy debris, I/I staining, below grade.
B78	Intersection of S. Mill St. and Hickory St. - In grass.	6.3	None	Pick	Offset & Loose	Brick	Poor	Broken frame seal, broken brickwork.

**Linden Manhole Inspection Report**

Manhole Number	Street Address/Location	Manhole Depth (ft)	Subject to Ponding	Lid Type	Frame Seal Condition	Manhole Material	Manhole Condition	Comments
B80	Intersection of Perry St. and S. Mill St. - in sidewalk.	5	None	Pick	Good	Brick	Poor	Roots and broken brick throughout.
E12	123 E. School St. - In road.	6.9	None	Pick	Loose	Brick	Poor	Staining and silt on bench and trough.
E14	Intersection of N. Mill St. and E. School St. - In road.	9.1	Runoff	Pick	Good	Brick	Poor	Soil and staining throughout.
E24	Intersection of Robbin St. and W. School St. - In road.	7.9	Runoff	Pick	Good	Liner	Poor	Broken trough; +/- 10 GPM leak @ L4 w/ 90% clarity.
E33	274 Pine St. - Across road in grass.	5.9	None	Solid	Good	Brick	Poor	Surcharge evidence.
E38	213 Pine St. - In road.	5.6	Runoff	Pick	Loose	Brick	Poor	Broken brickwork.
E4	Spring St. Easement	11.2	None	Solid	Loose	Brick	Poor	Heavy surcharge evidence; holes in ground near MH; I/I evidence throughout.
E41	207 Willow St. - In road.	5.2	Runoff	Pick	Loose	Brick	Poor	Heavy soil throughout.
E5	Spring St. Easement	8.8	None	Pick	Loose	Brick	Poor	Loose frame/risers; staining from I/I.
F13	319 Cherry St. - near driveway.	5.4	None	Solid	Good	Precast	Poor	Soil visible at wall/bench joint.
F14	319 Cherry St. - near ditch.	6.6	None	Pick	Good	Brick	Poor	Lid broken; roots at Line2 PCN as well as the bench and wall.
F15	Spring St. and Cherry St. - edge of road.	6.8	Flooding	Solid	Loose	Brick	Poor	Heavy debris throughout, bad frame, surchargs out of manhole.
F22	302 Sping St. - in grass.	5.3	Ponding	Pick	Good	Brick	Poor	Roots and I/I evidence throughout.
F34	116 Jones St. - in ditch.	8.1	Flooding	Pick	Loose	Precast	Poor	Heavy I/I staining throughout.
F35	123 Jones St. - in yard/ditch.	10.2	Flooding	Pick	Loose	Precast	Poor	Bottom wall joint leaking around 80% of joint.
A10A	990 Squirrel Hollow Rd. - shoulder of road.	5.1	Ponding	Solid	Good	Precast	Fair	NVP
A11	1071 Squirrel Hollow Rd. - in road.	6.4	None	Solid	Good	Precast	Fair	NVP
A14	121 Riverside Dr. - in front yard.	7.8	None	Solid	Good	Precast	Fair	Heavy trough debris.
A16	135 Riverside Dr. - in road.	6.5	None	Solid	Good	Precast	Fair	Roots around frame seal.
A18A	1132 Squirrel Hollow Rd. - across the street.	6.1	None	Pick	Loose	Precast	Fair	Frame and chimney cracked, on evidence of infiltration.
A18	1220 Squirrel Hollow Rd. - back entrance.	9.1	None	Solid	Loose	Precast	Fair	Crack in frame.
A2	Squirrel Hollow Dr. and Averett Ln.	5.6	Runoff	Pick	Good	Brick	Fair	Roots at line 2.
A21	127 Cabin Dr. - back yard.	8	None	Solid	Good	Precast	Fair	Light staining throughout.
A22	127 Cabin Dr. - in road.	8.7	Ponding	Solid	Loose	Precast	Fair	NVP

**Linden Manhole Inspection Report**

Manhole Number	Street Address/Location	Manhole Depth (ft)	Subject to Ponding	Lid Type	Frame Seal Condition	Manhole Material	Manhole Condition	Comments
A24	415 Cedar St. - in road.	7.2	Ponding	Solid	Good	Precast	Fair	Moderate staining at cone.
A28	202 Cedar Ave. - in road.	14.3	None	Solid	Good	Precast	Fair	NVP
A3	Hwy 13 and E. Brooklyn St. - in road.	5	None	Solid	Loose	Brick	Fair	NVP
A32	134 Bethel Rd. - in grass near driveway.	9.1	None	Solid	Good	Precast	Fair	Surcharges to top of manhole.
A36	2691 Squirrel Hollow Rd. - in grass near road.	9.9	None	Pick	Good	Precast	Fair	NVP
A3A	(Hens & Hogs) 837 Squirrel Hollow Rd. - across street.	5.4	None	Pick	Good	Brick	Fair	NVP
A3B	857 Squirrel Hollow Rd. - shoulder of road.	6.4	None	Vented	Good	Brick	Fair	Brickwork on chimney needs work.
A3CC	402 S. Mill St. - in field near tree line.	6	None	Solid	Loose	Precast	Fair	No frameseal, wrong lid for frame.
A3CE	103 Hadley Circle - in grass by tree.	4.7	None	Solid	Loose	Precast	Fair	Major frame offset, debris in manhole.
A4	968 Squirrel Hollow Rd. - near traffic light.	3	Ponding	Pick	Good	Brick	Fair	Broken handle on lid, brickwork, and some staining.
A41	2718 Squirrel Hollow Dr. - in parking space near building.	4.3	None	Pick	Good	Precast	Fair	Manhole was surcharged. Blockage between A41 and A40.
A5A	104 College Ave. - in grass behind school.	4.1	Runoff	Pick	Good	Brick	Fair	No trough, frame is broken.
A6	115 College Ave. - in street.	6.1	None	Pick	Good	Brick	Fair	NVP
B12	102 Young St. - in woods near creek.	6.7	Flooding	Pick	Good	Liner	Fair	Broken bench.
B15	239 Brooklyn Ave. - in road.	4.8	None	Pick	Good	Brick	Fair	NVP
B18	224 Webb Ave. - in grass near driveway.	4.7	None	Solid	Good	Liner	Fair	Very clear flow from lines 2, 3, and 4.
B19	222 Sycamore Dr. - in road.	6.3	Runoff	Pick	Good	Brick	Fair	NVP
B2	Elm Ln. pump station - outside gate.	7.8	None	Solid	Good	Precast	Fair	Debris on bench.
B20	303 Sycamore Dr. - in road.	4.7	Runoff	Pick	Good	Brick	Fair	Brickwork on chimney needs work.
B22	Intersection of W. Brooklyn St. and S. Mill St. - in road.	4.7	None	Pick	Good	Brick	Fair	Soil and silt throughout.
B25	Intersection of W. Brooklyn St. and Brooklyn Ave. - in road.	7	Runoff	Pick	Good	Brick	Fair	Soil around frame and chimney.
B26	171 W. Brooklyn St. - entrance to lot.	5.7	Ponding	Pick	Good	Brick	Fair	Trough debris.
B26A	171 Brooklyn St. - in parking lot of BLDG A.	6.7	None	Pick	Good	Precast	Fair	Light roots at Pipe2 PCN.
B27	126 Flower St. - In front yard.	5	None	Solid	Good	Brick	Fair	Manhole discharges.
B29	147 Brooklyn Ave. - in back yard.	8.4	Ponding	Solid	Good	Liner	Fair	NVP
B35	211 Webb Ave. - in field near tree line.	8.8	Flooding	Solid	Good	Brick	Fair	Surcharges to top of manhole.

**Linden Manhole Inspection Report**

Manhole Number	Street Address/Location	Manhole Depth (ft)	Subject to Ponding	Lid Type	Frame Seal Condition	Manhole Material	Manhole Condition	Comments
B36	130 Beech St. - in road.	7.4	None	Pick	Good	Brick	Fair	NVP
B37	Near 127 Beech St. - in road.	6.5	None	Pick	Good	Brick	Fair	Evidence of past surcharge.
B38	113 Factory, in Beech St. behind property - in road.	4.5	None	Pick	Good	Brick	Fair	NVP
B41	121 Factory St. - in yard near tree line.	11.3	None	Pick	Loose	Liner	Fair	Offset & Offset frame.
B51	Intersection of Hill St. and W. Main St.	3.3	None	Pick	Good	Brick	Fair	NVP
B55	215 Hill St. - in road.	8	None	Pick	Good	Brick	Fair	NVP
B57	Near intersection of Hill St. and Majors St.	5.5	None	Pick	Good	Brick	Fair	NVP
B58	North of Hill St. and Majors St.	5.8	None	Pick	Good	Brick	Fair	Inflow dish present.
B6	Near creek opposite of Elm Ln. and S. Mill St.	6.4	Flooding	Bolted	Loose	Liner	Fair	Missing bolts.
B61	403 Hill St. - in grass.	3.4	None	Pick	Good	Brick	Fair	Frame offset, light roots at PCN1.
B68	Intersection of Brooklyn Ave. and Maple St.	5.6	None	Pick	Good	Brick	Fair	NVP
B6A	301 S. Mill St. - in grass near fence.	7.7	Ponding	Solid	Good	Liner	Fair	In drainage ditch.
B6B	115 Shelton St. - in grass.	5.4	None	Solid	Good	Liner	Fair	Roots on bench and trough.
B6D	126 Shelton St. - in road.	5.2	None	Pick	Good	Brick	Fair	Roots - fine.
B6E	136 Shelton St. - in road.	5.3	None	Pick	Good	Brick	Fair	Roots - fine.
B71	119 S. Mill St. - in road.	5.3	None	Pick	Good	Brick	Fair	NVP
B77	101 Hickory St. - In road.	6.8	None	Pick	Loose	Brick	Fair	Offset & Surcharges, heavy debris.
B78A	92 Medical Dr. - in parking lot.	5.5	None	Pick	Good	Precast	Fair	Roots medium from Pipe2.
B78B	92 Medical Dr. - in grass near power pole.	4.9	None	Solid	Loose	Precast	Fair	MH is surcharged, blockage in out going pipe.
B79	Intersection of Medical Dr. and S. Mill St. - In grass.	5.2	None	Pick	Good	Brick	Fair	Broken brick and debris throughout.
B81	123 S. Mill St. - in sidewalk.	5.2	Runoff	Pick	Good	Brick	Fair	Some soil visible.
B82	134 Beech St. - in road.	6.2	None	Pick	Good	Brick	Fair	NVP
B82A	219 Shea Hollow Dr. - in road.	6.3	Ponding	Solid	Good	Precast	Fair	Broken frame and roots at frame seal.
B84	102 Hill View Dr. - on Shea Hollow Dr.	6.8	Ponding	Solid	Good	Liner	Fair	Broken lid.
C1	223 River St. - 1 manhole upstream from pump station.	5.6	None	Pick	Good	Brick	Fair	NVP
C14	112 S. Poplar St. - In road.	4.2	Ponding	Solid	Good	Brick	Fair	NVP
C15	124 E. Main St. - Behind building.	4.4	None	Vented	Good	Brick	Fair	Trough debris L2-4; L1 blockage.

**Linden Manhole Inspection Report**

Manhole Number	Street Address/Location	Manhole Depth (ft)	Subject to Ponding	Lid Type	Frame Seal Condition	Manhole Material	Manhole Condition	Comments
C16	Intersection of Walnut St. and River St. - In road.	7.6	None	Pick	Good	Brick	Fair	NVP
C17	Intersection of Walnut and Church - In road.	5.2	None	Pick	Loose	Brick	Fair	NVP
C18	111 Church St. - In road.	9.5	None	Pick	Good	Brick	Fair	Bench Debris.
C18A	96 E. Main St. - behind building in grass.	2.7	None	Pick	Good	Brick	Fair	NVP
C3	217 River St. - In road.	6.2	None	Pick	Loose	Brick	Fair	NVP
C6	206 Perry St. - In road.	5.6	None	Pick	Loose	Brick	Fair	NVP
C7	Intersection of Poplar and Perry	7.7	None	Pick	Good	Brick	Fair	NVP
C9	206 River St. - In road.	6.5	None	Pick	Good	Brick	Fair	NVP
E10	215 E. Main St. - near bush/gazebo.	5.5	Runoff	Pick	Loose	Brick	Fair	Multiple risers loose.
E11	N. Poplar St. and E. School St. - In road.	6.4	None	Pick	Good	Brick	Fair	Wall staining.
E13	122 N. Mill St. - In grass near driveway.	4.6	None	Pick	Good	Brick	Fair	Surcharge evidence.
E15	105 W. Main St. - Back corner.	6	None	Pick	Good	Brick	Fair	Brickwork on chimney needs work.
E16	111 N. Walnut St. - In back lot.	5.7	None	Solid	Good	Brick	Fair	NVP
E17	Intersection of W. School St. and Spring St. - In road.	6	None	Pick	Good	Brick	Fair	NVP
E18	Spring St. Easement	8.4	None	Solid	Good	Brick	Fair	NVP
E19	Spring St. Easement	6.3	None	Solid	Loose	Liner	Fair	Bad frame seal.
E1B	WWTP pump station easement.	6.7	Ponding	Pick	Good	Precast	Fair	NVP
E2	E. Main St. Easement	6.4	Flooding	Solid	Loose	Brick	Fair	Heavy surcharge evidence in and around manhole.
E20	Intersection of Willow St. and Spring St. - In road.	6.6	None	Pick	Good	Liner	Fair	NVP
E22	121 Spring St. - In road.	4	Runoff	Pick	Good	Liner	Fair	NVP
E24B	141 W. School St. - in grass @ unit D-1.	4.3	None	Solid	Loose	Precast	Fair	Wrong lid for frame, poor fit.
E26	214 Spring St. - edge of road.	6.3	None	Solid	Good	Brick	Fair	NVP
E3	E. Main St. Easement	6.1	Flooding	Solid	Loose	Brick	Fair	Heavy surcharge evidence outside manhole, directly into adjacent creek.
E30	200 Birch St. - in grass.	8.9	None	Solid	Good	Liner	Fair	NVP
E35	149 W. School St. - In brush beside road.	4.8	Flooding	Pick	Loose	Brick	Fair	Approximate 6" frame offset.
E36	123 Willow St. - In road.	6.3	None	Pick	Good	Brick	Fair	NVP
E40	205 Willow St. - Near driveway.	4.9	Runoff	Pick	Loose	Brick	Fair	Loose risers.

**Linden Manhole Inspection Report**

Manhole Number	Street Address/Location	Manhole Depth (ft)	Subject to Ponding	Lid Type	Frame Seal Condition	Manhole Material	Manhole Condition	Comments
E42	Intersection of Vaughan Ave. and W. Willow St. - In road.	5	Runoff	Pick	Loose	Brick	Fair	NVP
E43	Intersection of Vaughan Ave. and W. Willow St. - In road.	10	None	Pick	Good	Brick	Fair	Heavy soil throughout.
E44	201 Vaughan Ave. - In road.	4.6	Ponding	Pick	Good	Brick	Fair	Debris throughout.
E4A	Spring St. Easement	8.2	None	Solid	Good	Brick	Fair	NVP
E6	Old 911 building.	4.9	None	Pick	Good	Brick	Fair	Light roots, heavy roots previously removed by city. Causes surcharge.
E8	203 Ash St. - In street.	9.5	None	Pick	Good	Brick	Fair	Light surcharge due to downstream blockage.
E9	221 Ash St. - in grass near ditch.	8.2	None	Solid	Good	Brick	Fair	Light surcharge due to downstream blockage.
F1	Easement near WWTP pump station.	10.2	Flooding	Pick	Good	Precast	Fair	Heavy surcharge evidence in and around manhole.
F10	219 Cherry St. - in road.	8	None	Pick	Good	Brick	Fair	Debris on bench.
F11	263 E. Main St. - in Cherry St.	6	None	Pick	Good	Brick	Fair	NVP
F16	325 Spring St. - in dirt driveway.	10.7	Runoff	Pick	Good	Liner	Fair	NVP
F17	Spring St. Easement	9	None	Pick	Good	Precast	Fair	NVP
F19	104 Happy Hollow - in road.	6.1	None	Pick	Good	Liner	Fair	NVP
F2	Squirrel Hollow Dr. easement - near WWTP pump station	7.9	Flooding	Watertight	Good	Brick	Fair	Roots at frame and wall; heavy surcharge evidence.
F21	311 Spring St. - in road.	5.5	None	Pick	Good	Brick	Fair	Potential sag in Line1, poor grade in trough.
F23	225 Spring St. - in road.	5	None	Pick	Good	Brick	Fair	Heavy Hydrogen Sulfide evidence.
F25	Spring St. Easement	7.8	None	Pick	Good	Precast	Fair	NVP
F26	Spring St. Easement	8.3	None	Pick	Good	Precast	Fair	NVP
F27	Spring St. Easement	6.6	None	Pick	Good	Precast	Fair	NVP
F28	Spring St. Easement	8.1	None	Pick	Good	Precast	Fair	NVP
F29	Catron St. Easement	6.2	None	Pick	Good	Precast	Fair	NVP
F31	200 Catron St.	8.3	Flooding	Pick	Good	Precast	Fair	Chipped manhole frame.
F36	Vaughn Ave. Easement	7.1	None	Pick	Good	Precast	Fair	NVP
F37	Vaughn Ave. Easement	12.8	None	Pick	Good	Precast	Fair	NVP
F4	354 E. Main St. - near boat ramp (North)	5.1	Ponding	Watertight	Good	Brick	Fair	Heavy surcharge evidence in and around manhole.
F5	20 State Route 100 - off dirt road.	5.4	None	Solid	Good	Brick	Fair	Evidence of past surcharge.
A13	121 Riverside Dr. - in back yard.	9.7	None	Solid	Good	Precast	Good	NVP

**Linden Manhole Inspection Report**

Manhole Number	Street Address/Location	Manhole Depth (ft)	Subject to Ponding	Lid Type	Frame Seal Condition	Manhole Material	Manhole Condition	Comments
A15	113 Riverside Dr. - in front yard near driveway.	4.4	None	Solid	Good	Precast	Good	NVP
A20	214 Southwood Dr. - behind shed.	4.9	Runoff	Solid	Good	Precast	Good	NVP
A26	222 Southwood Dr. - in grass.	5.1	None	Solid	Good	Precast	Good	NVP
A31	2529 Squirrel Hollow Rd. - in grass near pump station.	8.1	Ponding	Solid	Good	Precast	Good	Backs up from pump station, discharges from MH.
A33	187 Bethel Rd. - across street in grass.	6.2	Flooding	Solid	Good	Precast	Good	NVP
A34	2529 Squirrel Hollow Rd. - in grass near pump station.	13.1	Ponding	Solid	Good	Precast	Good	Backs up from pump station.
A37	2673 Squirrel Hollow Rd. - in grass near building.	5.1	None	Vented	Good	Precast	Good	NVP
A37A	2691 Squirrel Hollow Rd. - in grass near ditch.	6.5	Flooding	Watertight	Good	Precast	Good	Small leak @ Lin1 PCN.
A38	2673 Squirrel Hollow Rd. - in grass near building.	7.8	None	Pick	Good	Precast	Good	NVP
A39	2673 Squirrel Hollow Rd. - in grass near building.	6.9	Ponding	Vented	Good	Brick	Good	NVP
A3BA	853 Squirrel Hollow Dr. - in parking lot.	6.4	None	Solid	Good	Brick	Good	NVP
A3BB	857 Squirrel Hollow Rd. - in parking lot of Dollar General.	4.5	None	Vented	Good	Precast	Good	NVP
A3CA	138 Hadley Circle - in field.	3.3	Ponding	Solid	Loose	Precast	Good	Rocks in trough.
A3CB	114 Hadley Circle - in road.	8.8	None	Solid	Good	Precast	Good	NVP
A3CD	136 Hadley Circle - in road.	4.2	None	Solid	Good	Precast	Good	NVP
B10	129 Brookside Dr. - in road.	9.3	None	Pick	Good	Brick	Good	NVP
B14	214 Shelton St. - in road.	5.2	None	Pick	Good	Brick	Good	NVP
B14A	240 Meadowbrook Dr. - in road.	3.8	None	Pick	Good	Brick	Good	NVP
B17	238 Webb Ave. - in front yard near driveway.	4.5	None	Pick	Good	Liner	Good	NVP
B23	114 W. Brooklyn St. - in grass near road.	5.8	Runoff	Pick	Good	Brick	Good	NVP
B24	130 W. Brooklyn Ave. - in ditch.	6.6	None	Pick	Good	Brick	Good	NVP
B26B	171 Brooklyn St. - in parking lot of BLDG D.	4.1	None	Vented	Good	Precast	Good	NVP
B28	125 Flower St. - In driveway.	7.6	None	Solid	Good	Liner	Good	NVP
B3	130 Elm Ln. - In road.	8.9	None	Pick	Good	Liner	Good	NVP
B30A	147 Brooklyn Ave. - in grass.	6.3	Ponding	Pick	Good	Brick	Good	NVP



### Linden Manhole Inspection Report

Manhole Number	Street Address/Location	Manhole Depth (ft)	Subject to Ponding	Lid Type	Frame Seal Condition	Manhole Material	Manhole Condition	Comments
B32	206 Webb Ave. - in road.	4.3	None	Pick	Good	Brick	Good	NVP
B33	Corner of Webb Ave. and Sycamore St.	5.3	None	Pick	Good	Brick	Good	NVP
B38A	105 Beech St. - in grass near driveway.	5	None	Solid	Good	Precast	Good	NVP
B4	118 Elm Ln. - in road.	6.1	None	Pick	Loose	Liner	Good	NVP
B42	113 Factory St. - in road.	8.5	None	Pick	Good	Liner	Good	NVP
B43	113 Factory Dr. - near tennis courts.	11.4	None	Solid	Good	Liner	Good	NVP
B5	100 Elm Ln. - edge of road.	5.1	None	Pick	Good	Liner	Good	Surcharges, debris in trough.
B50	368 W. Main St. - in road near curb.	5.4	None	Pick	Good	Brick	Good	NVP
B52	201 Hill St. - in road.	7.7	None	Pick	Good	Brick	Good	NVP
B53	113 Tower St. - in road.	4.3	None	Pick	Good	Brick	Good	NVP
B54	119 Tower St. - in road.	8.8	None	Pick	Good	Brick	Good	NVP
B56	226 Hill St. - in road.	4.8	None	Pick	Good	Brick	Good	NVP
B59	314 Hill St. - in road.	3.8	None	Pick	Good	Brick	Good	Roots inside pipe 2.
B60	324 Hill St. - in road.	5.2	None	Pick	Good	Brick	Good	Light roots at PCN1.
B64	113 Brooklyn Ave. - in road.	7	None	Pick	Good	Brick	Good	NVP
B66	Intersection of Brooklyn Ave. and W. Church St.	6.6	None	Pick	Good	Brick	Good	NVP
B67	111 Brooklyn Ave. - in street	6	None	Pick	Good	Brick	Good	NVP
B69	Near intersection of River St. and Maple St.	6.3	None	Pick	Good	Brick	Good	NVP
B6F	152 Shelton St. - in road.	4.6	Runoff	Pick	Good	Brick	Good	NVP
B7	Intersection of S. Mill St. and Brookside Dr. - in grass.	6.4	None	Pick	Good	Brick	Good	NVP
B70	141 Maple St. - in road.	7.1	None	Pick	Good	Brick	Good	NVP
B73	220 Brookllyn Ave. - in road.	7.5	None	Pick	Good	Brick	Good	NVP
B8	110 Brookside Dr. - in road.	4.4	None	Pick	Good	Brick	Good	NVP
B86	325 W. Main St. - near edge of storm ditch.	6.4	Flooding	Pick	Good	Precast	Good	NVP
B87	111 Brooklyn Ave. - in road.	6	None	Pick	Good	Brick	Good	NVP
B9	116 Brookside Dr. - in road.	4.6	None	Pick	Good	Liner	Good	NVP
C10	E. Church St - In front of firehouse.	6	None	Pick	Good	Brick	Good	NVP
C11	Intersection of Church St. and Oak St. - In road.	4.6	None	Pick	Good	Brick	Good	NVP
C12	Intersection of S. Poplar and River	7.1	None	Pick	Good	Brick	Good	NVP
C13	S. Poplar St - In road - Church of Christ	7.1	None	Pick	Good	Brick	Good	NVP
C19	104 S. Mill St. - Entrance to alley.	4.5	Runoff	Pick	Good	Brick	Good	NVP

**Linden Manhole Inspection Report**

Manhole Number	Street Address/Location	Manhole Depth (ft)	Subject to Ponding	Lid Type	Frame Seal Condition	Manhole Material	Manhole Condition	Comments
C1A	River St. Pump Station - Extra manhole	9.8	Ponding	Solid	Good	Precast	Good	Manhole surcharges.
C4	207 Perry St. - In treeline near River St.	5.8	Runoff	Solid	Good	Brick	Good	Wrong lid for frame, poor fit.
C5	211 Perry St. - In road.	4.2	None	Solid	Good	Brick	Good	NVP
C8	104 Perry St. - In road.	5.2	None	Pick	Good	Brick	Good	NVP
E1A	Easement near WWTP pump station.	10.7	None	Pick	Good	Precast	Good	NVP
E21	126 Spring St. - In road.	5.8	None	Pick	Good	Liner	Good	Trough debris.
E23	121 Spring St. - in woods.	8.4	None	Solid	Good	Liner	Good	NVP
E24A	168 W. School St. - in grass near ditch.	2.5	Flooding	Pick	Good	Precast	Good	NVP
E25	147 W. Main St. - In back yard.	5.6	None	Solid	Good	Brick	Good	NVP
E27	215 Spring St. - In driveway.	6.5	Runoff	Pick	Good	Brick	Good	NVP
E29	107 Willow St. - in grass near tree line.	9.7	None	Solid	Good	Liner	Good	NVP
E31	120 W. Willow St. - In road.	6.6	None	Pick	Good	Liner	Good	NVP
E34	233 Pine St. - In road.	11.7	None	Pick	Good	Brick	Good	NVP
F13A	318 Breeding Ln. - in road.	11.9	None	Solid	Good	Precast	Good	NVP
F13B	323 Breeding St. - in road @ Breeding Ln.	11.7	None	Solid	Good	Precast	Good	NVP
F13C	191 Breeding Ln. - on hill beside house.	6.2	None	Solid	Good	Precast	Good	NVP
F20	319 Spring St. - in road.	7.1	None	Pick	Good	Brick	Good	NVP
F3	354 E. Main St. - near boat ramp (South)	7.5	None	Watertight	Good	Precast	Good	Manhole surcharges to top.
F30	206 Catron St. - in woods behind house.	9.3	None	Pick	Good	Precast	Good	NVP
F32	101 Jones St. - at Catron St.	5.8	None	Pick	Good	Precast	Good	NVP
F37A	223 Vaughn Ave. - back yard	16.3	None	Pick	Good	Precast	Good	NVP
F38	215 Vaughn Ave. - near driveway	12	None	Pick	Good	Precast	Good	NVP
F7	Hwy 13 - substation easement	4.2	None	Solid	Good	Liner	Good	Lid is broken.
A10	Near 1071 Squirrel Hollow Rd.							
A17	Near 141 Riverside Dr.							NVP
A23	Near 124 Cabin Dr. - possibly paved.							
A25	Near 208 Southwood Dr. - paved not verified.							
A30	Near 23 Cedar Ave.							
A3C	892 Squirrel Hollow Rd							
A7	Near Perry County Public Library on College Ave.							
A8	Near Perry County High School							
A9	Near Linden Elementary School							

Linden Manhole Inspection Report

Manhole Number	Street Address/Location	Manhole Depth (ft)	Subject to Ponding	Lid Type	Frame Seal Condition	Manhole Material	Manhole Condition	Comments
B1	In ravine near Elm Ln. pump station.							
B16	Near 223 Brooklyn Ave.							
B1A	In ravine near Elm Ln. pump station.							
B30	Near 148 Brooklyn Ave.							
B31	Near 204 Brooklyn Ave							Paved, Verified, painted.
B39	Near 136 Brooklyn Ave.							Paved, verified.
B40	Near 135 Brooklyn Ave.							
B44	Near 215 W. Main St.							
B45	Near intersection of Beech St. and W. Main St.							
B46	Near 226 W. Main St.							
B47	Near 240 W. Main St.							
B48	Near 103 Patterson Dr.							
B49	Near W. Main St and Factory St.							NVP
B62	Near 407 Hill St.							
B63	Near 128 Brooklyn Ave.							Paved, verified.
B63A	Near 407 Hill St.							
B65	Near 112 Brooklyn Ave.							
B6C	110 Shelton St. - in gravel.							
B72	115 S. Mill St. - in alley							
B74	Near 210 Brooklyn Ave.							Paved, verified.
B83	131 Shea Hollow Dr. - in road.		None	Pick	Can't Open Lid	Brick		Lid frozen shut.
B85	102 Hill View Dr. - on Shea Hollow Dr.							Buried, verified.
C2	Intersection of Hillcrest & River							
E28	Near 215 Spring St. - Possibly paved.							
E32	Near Pine St. and Birch St. - Possibly paved.							
E35A	149 W. School St. - in parking lot.		None	Pick	Good	Brick		Broken down vehicle parked on MH lid.
E37	Near 210 Pine St. - Possibly paved.							
E39	Near 215 Pine St. - Possibly paved.							NVP
E7	Near 123 W. School St.							
F12	Near 215 Spring Ct.							
F18	Near Cherry St. and Happy Hollow.							NVP
F24	Near Cherry St. and Happy Hollow.							NVP

Linden Manhole Inspection Report

Manhole Number	Street Address/Location	Manhole Depth (ft)	Subject to Ponding	Lid Type	Frame Seal Condition	Manhole Material	Manhole Condition	Comments
F6	Near 30 Lobelville Hwy. - behind Shell station							
F6A	Hwy 13 - substation easement							
F8	Hwy 13 - substation easement							NVP

## Linden Camera Log Summary

Upstream MH	Downstream MH	Date	Street	Size	Material	Total Length	Structural Rating	Maintenance Rating
B77	B76	7/9/2021	HICKORY ST	8	VCP	214.60	0000	3312
C5	C4	7/7/2021	PERRY ST	8	VCP	63.50	0000	3300
F10	F9	2/2/2022	CHERRY ST	8	VCP	254.70	0000	3222
E44	E43	7/13/2021	VAUGHAN ST	8	VCP	142.50	0000	3215
F13A	F13C	2/2/2022	BREEDING ST	8	VCP	195.00	0000	3213
B61	B60	7/1/2021	Hill St	8	VCP	114.40	0000	3114
A23	A22	4/20/2021	Cabin Dr	8	VCP	140.00	0000	3100
B55	B52	7/2/2021	HILL ST	8	VCP	400.70	0000	3100
C6	C5	7/7/2021	PERRY ST	8	VCP	67.80	0000	2100
A6	A5A	4/13/2021	College Ave	6	VCP	279.50	0000	1200
B79	B78	7/9/2021	S MILL ST	8	VCP	400.90	0000	1200
A25	A24	4/14/2021	Southwood Dr	8	VCP	301.40	0000	1100
A20	A19	4/20/2021	Cabin Dr	8	VCP	342.40	0000	1100
A16	A14	4/20/2021	Riverside Dr	8	VCP	291.10	0000	1100
A18A	A10	4/21/2021	Squirrel Hollow Dr	8	VCP	301.00	0000	1100
E34	E33	7/13/2021	PINE ST	8	VCP	109.80	0000	1100
A5A	A5	4/13/2021	College Ave	8	PVC	150.80	0000	0000
A5	A4	4/13/2021	College Ave	8	PVC	188.30	0000	0000
A6	A7	4/13/2021	College Ave	6	VCP	43.50	0000	0000
A6	A8	4/13/2021	College Ave	6	VCP	60.00	0000	0000
B26B	B26A	4/13/2021	W Brooklyn St	8	PVC	121.90	0000	0000
B26A	B26A	4/13/2021	W Brooklyn St	8	PVC	173.20	0000	0000
A27	A26	4/14/2021	Southwood Dr	8	VCP	300.00	0000	0000
A26	A25	4/14/2021	Southwood Dr	8	VCP	297.00	0000	0000
A24	A18	4/14/2021	Cedar Ave	8	VCP	192.10	0000	0000
A19	A18	4/20/2021	Cedar Ave	8	PVC	57.00	0000	0000
A18	A18A	4/20/2021	Cedar Ave	8	VCP	400.00	0000	0000
A12	A11	4/21/2021	Wiggs Dr	8	VCP	173.20	0000	0000
A10	A10A	4/21/2021	Squirrel Hollow Dr	8	VCP	426.00	0000	0000
A4	A3C	4/21/2021	Squirrel Hollow Dr	8	VCP	162.00	0000	0000
X	A3CB	4/21/2021	Hadley Cir	8	PVC	290.70	0000	0000
A3CB	A3CD	4/21/2021	Hadley Cir	8	PVC	307.00	0000	0000
Z	A3CD	4/21/2021	Hadley Cir	8	VCP	345.00	0000	0000
A3CD	A3CD1	4/21/2021	Hadley Cir	8	PVC	65.00	0000	0000
A3CD1	A3CA	4/21/2021	Hadley Cir	8	PVC	60.50	0000	0000
A3BA	A3B	4/22/2021	Squirrel Hollow Dr	8	DIP	53.80	0000	0000
A3	A2	4/22/2021	Squirrel Hollow Dr	8	VCP	335.40	0000	0000
A3BB	A3BA	4/23/2021	Squirrel Hollow Dr	6	PVC	123.00	0000	0000
ZZ	A3BA	4/23/2021	Squirrel Hollow Dr	6	PVC	211.00	0000	0000
E4A	E5	4/23/2021	E Main St	6	PE	277.50	0000	0000
A6a	A6	5/24/2021	College Ave	6	VCP	226.20	0000	0000
B18A	B18	6/24/2021	Webb Ave	8	PVC	106.90	0000	0000

## Linden Camera Log Summary

Upstream MH	Downstream MH	Date	Street	Size	Material	Total Length	Structural Rating	Maintenance Rating
B18	B17	6/24/2021	Webb Ave	6	PE	388.00	0000	0000
B17	B16	6/24/2021	Sycamore St	6	PE	248.40	0000	0000
B74	B73	6/24/2021	Brooklyn Ave	8	VCP	203.30	0000	0000
B14A	B14	6/25/2021	Meadow Brook Dr	6	PVC	221.30	0000	0000
B14	B13	6/25/2021	Shelton St	8	VCP	313.20	0000	0000
B13	B12	6/25/2021	Shelton St	8	PVC	192.10	0000	0000
B15	B12	6/25/2021	Brooklyn Ave	8	PVC	136.80	0000	0000
B10	B9	6/25/2021	Brookside Dr	8	VCP	347.00	0000	0000
B9	B8	6/25/2021	Brookside Dr	8	VCP	257.00	0000	0000
B8	B7	6/29/2021	Brookside Dr	8	VCP	248.20	0000	0000
B7	B6	6/29/2021	Brookside Dr	8	VCP/DIP	99.40	0000	0000
B6B	B6A	6/29/2021	Shelton St	6	PE	218.30	0000	0000
B6A	B6	6/29/2021	Shelton St	8	PVC	176.00	0000	0000
B38A	B38	6/30/2021	Beech St	6	VCP/PVC	40.70	0000	0000
B82	B36	6/30/2021	Beech St	8	VCP	1.00	0000	0000
B71	B72	6/30/2021	W Church St	8	VCP	104.70	0000	0000
B67	B66	7/1/2021	Brooklyn Ave	8	VCP	158.30	0000	0000
B66	B65	7/1/2021	Brooklyn Ave	8	VCP	116.50	0000	0000
B32	B31	7/1/2021	Webb Ave	8	VCP	274.80	0000	0000
B30A	B30	7/1/2021	Brooklyn Ave	8	VCP	83.50	0000	0000
B56	B55	7/2/2021	HILL ST	8	VCP	243.20	0000	0000
B51	B50	7/6/2021	HILL ST	8	VCP	45.10	0000	0000
C4	C3	7/7/2021	RIVER ST	8	VCP	11.70	0000	0000
C18	C17	7/8/2021	WALNUT ST	8	VCP	185.10	0000	0000
C17	C16	7/8/2021	WALNUT ST	8	VCP	200.50	0000	0000
C14	C13	7/8/2021	S POPULAR ST	8	VCP	250.00	0000	0000
C13	C12	7/8/2021	S POPULAR ST	8	VCP	139.00	0000	0000
B81	B80	7/9/2021	S MILL ST	8	PVC	334.00	0000	0000
B80	B79	7/9/2021	S MILL ST	8	PVC	281.60	0000	0000
E41	E40	7/13/2021	W WILLOW ST	8	VCP	123.50	0000	0000
E37	E36	7/13/2021	PINE ST	8	VCP	168.30	0000	0000
E36	E35A	7/13/2021	W WILLOW ST	8	VCP	40.00	0000	0000
E29	E20	1/31/2022	WILLOW ST	10	PE	212.10	0000	0000
F14	F13L	2/2/2022	CHERRY ST	8	VCP	27.20	0000	0000
F32	F31	2/3/2022	MAJOR ST	8	PVC	97.00	0000	0000
E15	E14	2/7/2022	N MILL ST	8	VCP	52.00	0000	0000
E12	E11	2/8/2022	E SCHOOL ST	8	VCP	130.00	0000	0000
E11	E8	2/8/2022	N POPULAR ST	8	VCP	246.30	0000	0000
B4	B3	2/8/2022	ELM LN	10	PE	305.00	0000	0000
B3	ELPS	2/9/2022	ELM LN	10	PE	218.00	0000	0000
C9A	C9	7/8/2021	RIVER ST	8	VCP	50.60	0000	0000

**Attachment IV –  
Prioritized Wastewater Collection Line Rehabilitation Schedule**



ENGINEERS • ARCHITECTS • PLANNERS

# **Infiltration & Inflow Reduction Plan**

**Town of Linden, Tennessee**



## **Infiltration & Inflow Reduction Plan**

### **Prepared for the Town of Linden, Tennessee**

This report has been completed as a collaborative effort including the Town of Linden Mayor's Office, Public Works, and Sewer Department. The plan development was funded by the State of Tennessee and reviewed by the Tennessee Department of Environment and Conservation.

#### Mayor's Office

Mayor Wess Ward

#### Public Works

Brad Burgess

#### Board of Aldermen

Mr. Dean Heady – Vice Mayor

Mr. Patrick Denton

Mr. Joey Mackin

Mr. Bart Rosson

Mr. Billy Ray Yarbro

Mr. Bart Young

#### Wastewater Manager

Vacant

#### Consultant

Travis Martin, P.E.

A2H, Inc.

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Attachment I – Sewer System Map

Attachment II – 2022 Utility Scorecard

Attachment III – Prioritized Sewer Main Rehabilitation Schedule

Attachment IV – Smoke Test Results

Attachment V – Prioritized Manhole Rehabilitation Schedule

Attachment VI – 2018 Flow Monitoring Study

## **I. Project Planning**

### **A. Introduction**

As part of the allocation of American Rescue Plan (ARP) and the State Water Infrastructure Grant Program (SWIG) funds to the Town of Linden in Tennessee, a comprehensive Inflow & Infiltration (I&I) Reduction Plan has been created to address extraneous wet weather induced wastewater flows. With support from A2H, Inc., the Town has formulated this plan to systematically identify and reduce sources of I&I, recognizing the importance of a structured program for their wastewater system. Additionally, the plan outlines a schedule for ongoing efforts to eliminate these sources in the future.

### **B. Purpose**

The Town of Linden prioritizes addressing Inflow and Infiltration in the wastewater system. Reducing sewer system inflow and infiltration offers numerous benefits for both the environment and the community. Inflow and infiltration refer to the excess water that enters the sewer system, often due to heavy rainfall or groundwater seepage. This additional water can overwhelm the system, leading to sanitary sewer overflows, increased treatment costs, and environmental contamination. By implementing measures to reduce inflow and infiltration, such as repairing deteriorated pipes, sealing manholes, and improving system capacity, municipalities can mitigate these issues.

One of the primary benefits of reducing inflow and infiltration is the prevention of sanitary sewer overflows. Excessive water entering the system can exceed its capacity, causing untreated sewage to overflow into streets, water bodies, and even residential properties. This poses significant health risks and environmental harm. Additionally, by reducing the volume of water entering the system, treatment costs can be lowered, as less water requires processing. This not only saves money but also reduces the strain on treatment facilities.

Furthermore, addressing inflow and infiltration helps to prolong the lifespan of sewer infrastructure. By preventing excess water from entering the system, the frequency of pipe deterioration and corrosion decreases, extending the longevity of the infrastructure. This, in turn, reduces maintenance and repair costs over

time. Overall, reducing inflow and infiltration not only benefits the environment by safeguarding water quality but also contributes to the efficient and sustainable management of sewer systems for the well-being of communities.

### **C. Location**

Located in the heart of Perry County, Linden, TN is a small town just east of the Tennessee River. The town is strategically positioned at the intersections of major highways, making it easily accessible from various parts of the state. Linden lies at the crossroads of US Route 412 and State Route 100, which connect it to neighboring towns and cities.

## **II. Existing Facilities**

### **A. Sewer Collection System**

The existing sewer system in the Town of Linden primarily caters to the town limits and comprises around 50,000 linear feet of gravity sewer line, 110 manholes, and 4 lift stations. The system currently serves 550 customers, including 42 commercial or industrial connections.

The high I&I rate poses a significant challenge for the aging sewer system, leading to increased stress on the treatment plant and potential overflow issues during heavy rainfall. To address this, the Town of Linden has initiated a comprehensive sewer system rehabilitation and maintenance program, focusing on identifying and repairing deteriorating pipes, manholes, and lift stations. Additionally, the town is implementing a public education campaign to raise awareness about the impact of I&I and encourage residents and businesses to take proactive measures to reduce their contribution to the problem.

### **B. Wastewater Treatment Facility**

The wastewater treatment plant is a four-cell lagoon system with an average design flow of 0.32 MGD and discharges to the Buffalo River. The Buffalo River is listed as an Exceptional Water of the State. The basis of inclusion being "Buffalo River and tributaries in Lawrence county designated by USFWS as Critical Habitat for federal and state threatened Slackwater Darter. Populations of federal and state threatened Spottfin Chub, state threatened Coppercheek Darter,

Saddled Madtom, Ashy Darter and Longhead Darter. Portion is a state Scenic River. Portions flow through Natchez Trace Parkway NP and Hugh Link Farm State Archaeological Area". In 2022, there were 159 days in the 12 month period shown where the City was forced to exceed discharge limits to prevent an overflow at the lagoon. Of those 159 instances, 119 fell within the wet month period and 40 in the dry month period.

Data collected over the period of July 2020 through June 2021 indicates that the average flow into the wastewater treatment plant is 0.45 million gallons per day (MGD). Months with total rainfalls greater than 3.0-inches produce a peak daily maximum of 1.3 MGD. The increase in flow is seen almost simultaneously with the rainfall and typically returns to normal within 72-hours after the rainfall event. As stated previously, the treatment plant has a design capacity of 0.32 MGD. Monthly summary reports show that as little as 0.2 inches of rainfall has caused the system to exceed its design capacity and at times, almost five times the allowable discharge.

### III. Need for Project

#### A. Current Inflow & Infiltration Conditions

As per the 2022 data, the system registered an average daily flow of 310,000 GPD, an average daily dry weather flow of 140,000 GPD, and an annual total influent of 162.79 MGD at the wastewater treatment plant. These figures indicate an estimated average daily I&I rate of 310,000 GPD or a 69% Inflow and Infiltration.

a. ADDWF=Average of lowest 7 contiguous days average daily flow: 0.14 MGD

b. ADF= Average Daily influent Flow: 0.45 MGD

c. ATF= Annual Total influent Flow: 162.79 MGY

d. Annual I/I =  $((ADF-ADDWF)*365/ATF)*100$ : 69.5%

#### B. Completed Projects

The City of Linden has identified problems associated with infiltration into the older portion of the sanitary sewer system. The largest portions of the original

sewer lines were installed in 1960. Increased flows during rainfall events and problems associated with sewer line integrity were originally identified in 1987 when a small rehabilitation project was completed. The project mainly focused on applying grout to failed line sections, cleaning and air testing the lines. Again in 1994, a small section of the system was identified for root removal and cleaning; however, no lines were replaced.

In 2017 the City purchased equipment to clean, remove roots and camera pipelines. With its own manpower, the City has made some improvements and identified areas that must be addressed by more substantial means.

In 2020, The City received a CDBG Grant to perform CCTV investigations and complete a first phase of rehabilitation. Approximately 78% of the system was completed with camera logs during that phase and approximately 2,000 LF of sewer line was rehabilitated by pipe bursting. Also during this project, a flow monitoring study was completed by the Town to install flow monitors in strategic locations within the collection system in order to better assess the nature and magnitude of the I/I problem.

#### **IV. Inflow & Infiltration Identification**

##### **A. Assessment**

The attached document, labeled Attachment I, served as a reference for the 2020 rehabilitation project by providing an overview of the sewer system. It was utilized to track the identification numbers of manholes and also served as a base map. The creation of this map was a result of the flow monitoring activities carried out in 2019.

Attachment II contains the Wastewater System Assessment and Utility Summary, which was completed as part of the TDEC Scorecard in 2022. This assessment offers an extensive collection of data pertaining to the wastewater collection system and treatment facility. It includes information on overflows, quantities of various infrastructure elements, flow data, and more.

The assessment was completed employing a set of coding standards and a digital database to document and analyze sewer line conditions known as the Pipeline Assessment and Certification Program (PACP). Technicians used specialized software to input data about the pipe's condition, including defects such as cracks, fractures, and root intrusions. The software then assigns a severity rating to each defect, providing a clear picture of the overall condition of the sewer line. This data-driven approach allows maintenance teams to prioritize repairs based on the severity of the issues identified. The use of standardized coding ensures consistency and clarity in the assessment process. It also enables the comparison of data across different inspections and locations.

The PACP inspection process involves several key steps that ensure a thorough assessment of sewer line conditions. The process begins with the identification and preparation of the inspection site. Technicians located the access points to the sewer line and ensure that they are clear and safe for entry. They also gather information about the pipe, such as its material, diameter, and length, which helps in the accurate assessment of its condition. Once the site is prepared, technicians use specialized equipment to enter the sewer line and conduct the inspection. They typically employ closed-circuit television (CCTV) cameras mounted on robotic crawlers to navigate through the pipe. These cameras capture high-resolution footage of the pipe's interior, allowing technicians to identify defects and collect data.

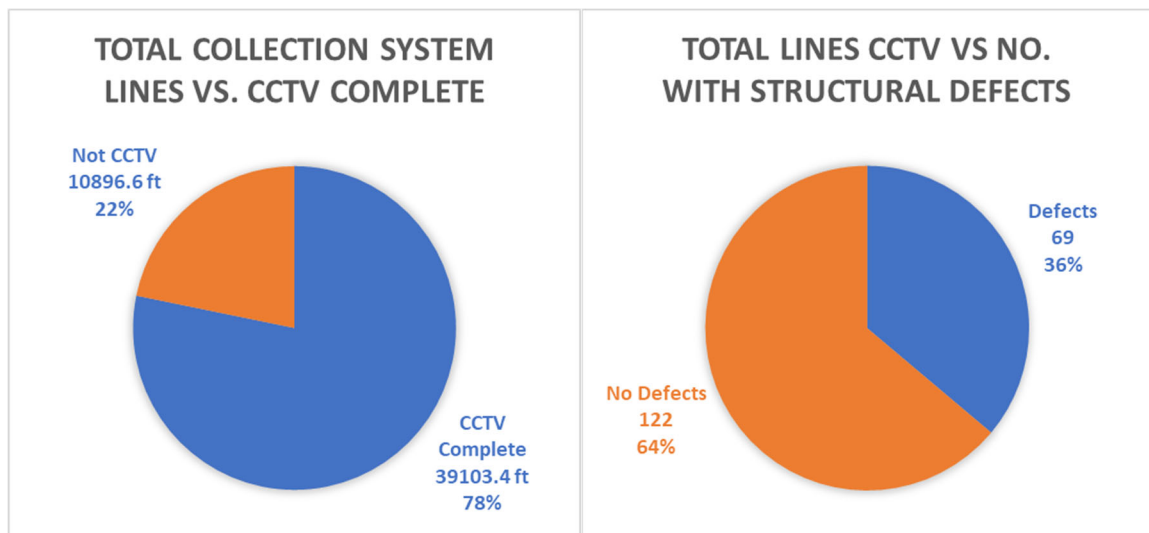
During the inspection, technicians use the PACP coding system to document and rate defects accurately. This system assigns severity ratings based on the impact of the defect on the structural integrity and performance of the sewer line. The coding system also includes detailed descriptions and classifications for different types of defects, ensuring consistency and clarity in the assessment process.

Once the inspection is complete, technicians upload the data collected during the assessment to the PACP software. This software analyzes the data and generates comprehensive reports. These reports serve as valuable tools for

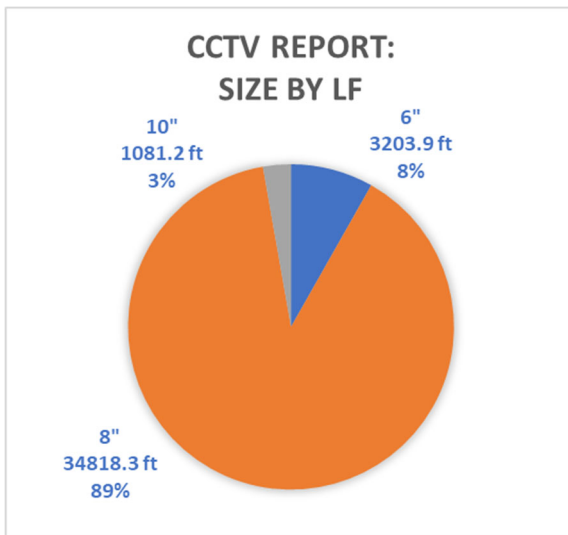
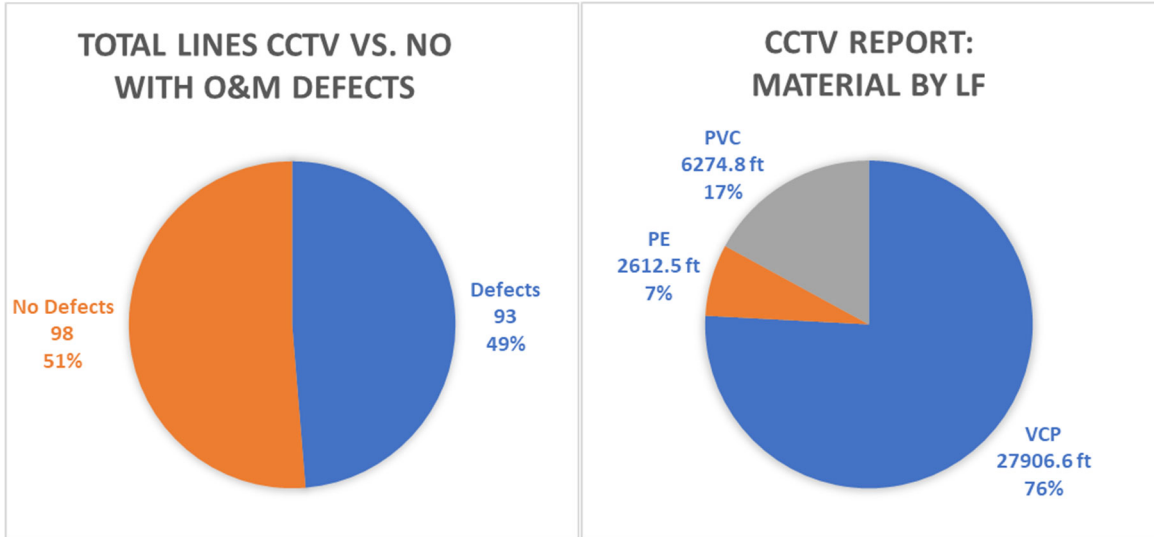
decision-making, enabling the Engineer to prioritize repairs and plan rehabilitation projects effectively.

**B. Cleaning & Camera Investigation**

As mentioned earlier in the report, the collection system underwent inspection and evaluation in 2020 using camera logging technology. The following data represents the findings from the inspection. A total of 39,103.4 feet of gravity sewer line was examined. Out of this footage, 76% consisted of clay pipe, 17% was PVC, and 7% was PE pipe. The pipe sizes varied from 6" to 10", with 89% being 8", 8% being 6", and 3% being 10". Among the 191 collection lines inspected, 69 of them (36%) exhibited structural defects. These defects indicate damage to the pipe, such as cracks, breaks, protruding taps, break-ins, holes, or joint offsets. Additionally, 93 lines (49%) showed maintenance defects, including the presence of roots that require removal. See Attachment III for the Prioritized Sewer Main Rehabilitation Schedule.

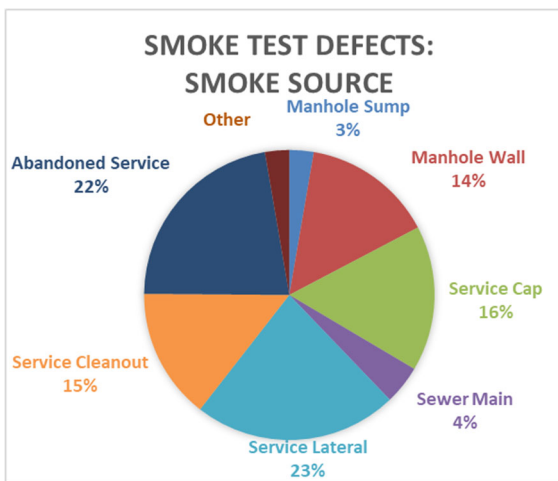
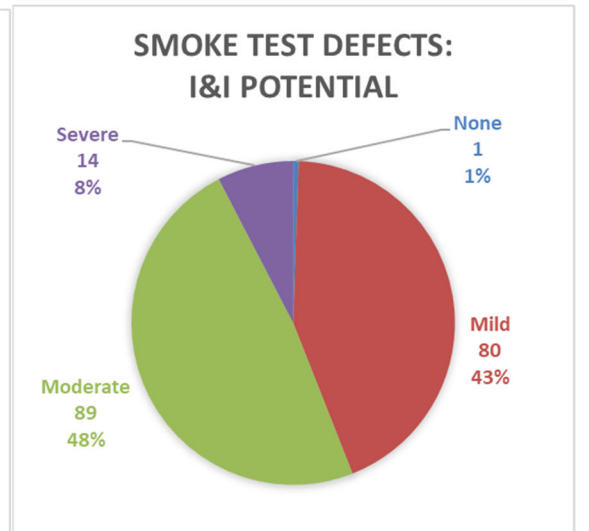
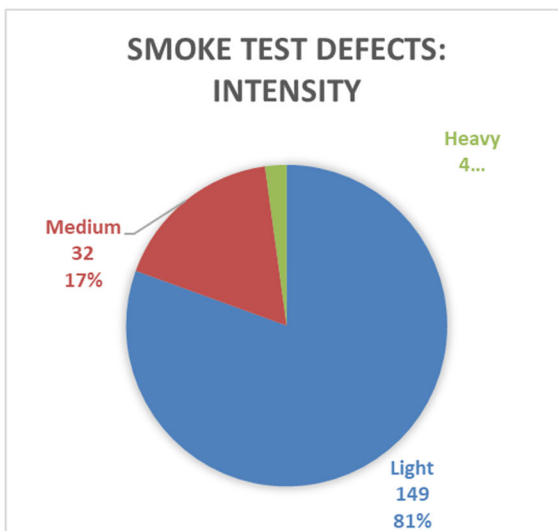
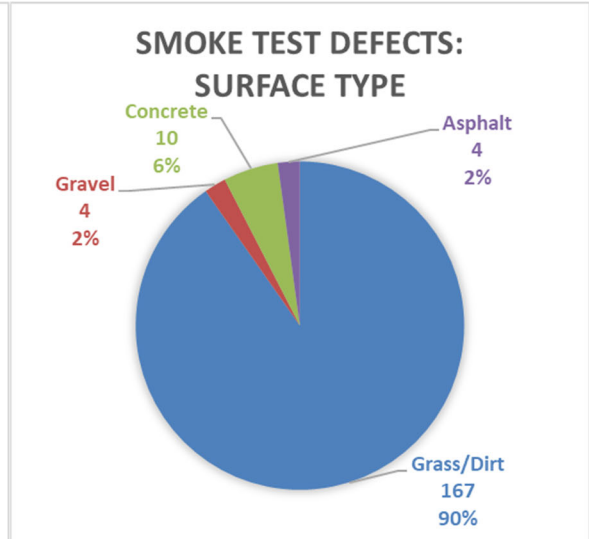
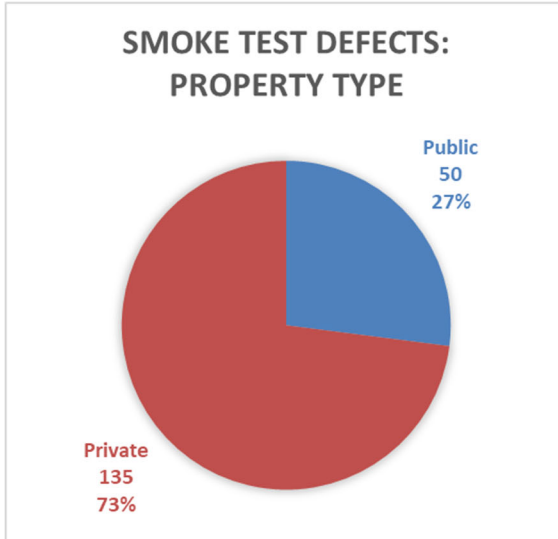






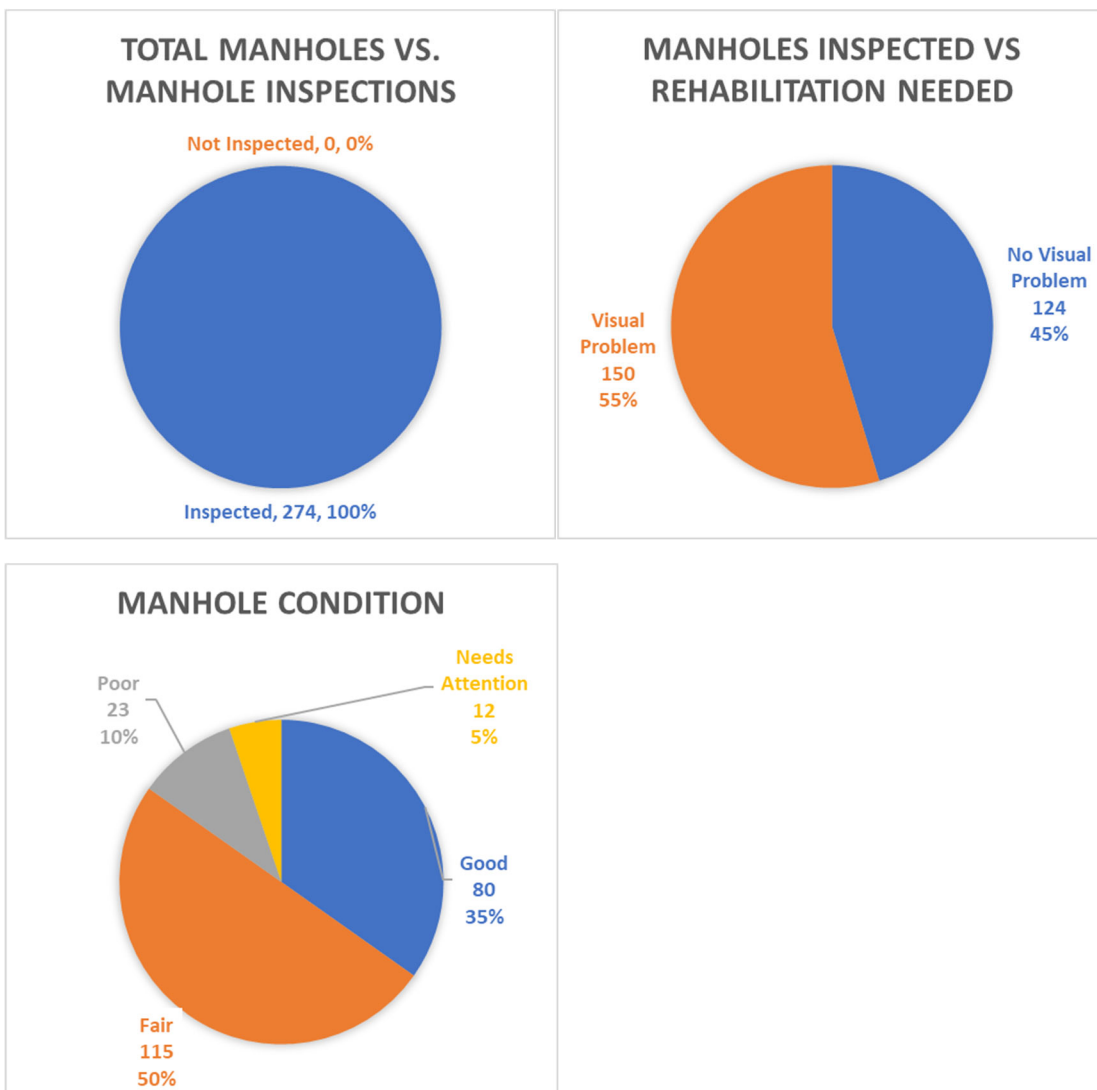
**C. Smoke Testing**

The following data represents the findings from the smoke testing completed in 2020. There were 185 locations where smoke was detected coming from the sewer system. Of those 185 locations, 50 (27%) were located on private property and 135 (73%) were located on public property. See Attachment IV for Smoke Test Results.



### D. Manhole Inspections

The following data represents the findings from the manhole inspections completed in 2020. All 274 manholes in the sewer collection system were inspected. Of those 274, 150 (55%) recorded some rehabilitation is needed based on the inspection. The manholes were classified Good, Fair, Poor, or Needs Attention. The graph below shows that only 80 (35%) were found to be in good condition. Leaving a balance of 194 (65%) falling into the Fair, Poor, or Needs Attention categories. See Attachment V for the Prioritized Sewer Manhole Rehabilitation Schedule.



**E. Flow Monitoring**

As stated above, the Town of Linden completed a flow study using a consultant, Utility Technologies. The study monitored flow for approximately two months, collecting rainfall daily and comparing wet weather flows to dry conditions. This information was used to evaluate drainage basins within the system to determine their vulnerability to inflow and infiltration. A copy of the study has been included as Attachment VI.

**V. Short Term Actions (1-5 Years)**

**A. Investigation**

Short Term Actions for investigation should include CCTV investigations for the remainder of the collection system. This work includes approximately 11,000 LF or 22% of the total system. The cost associated with this work is estimated at \$50,000 and can be done over multiple years.

**B. Monitoring**

Short term actions for monitoring should be continuing to record influent daily values at the wastewater treatment plant. To do so, a flow meter should be installed or updated to accurately record the influent data. This data should be provided to the Town's Engineer to calculate the I&I rate annually to monitor progress made by rehabilitation efforts and identify when a new issue has occurred.

**C. Rehabilitation**

During the preparation of this report, the Town has applied for funds through the State Water Infrastructure Grant Program to address inflow and infiltration in the sewer system. Using previous investigative work, a project has been prepared for construction rehabilitation work that includes approximately 17,250 LF of Cured in Place Pipe line rehabilitation, 5,800 LF of pipe bursting, 67 point repairs, 46 new service taps/cleanouts, 250 VF of manhole lining, and the replacement of 38 manhole lids. This works is planned to bid in 2024 pending approval of the State of Tennessee.

Additionally, the Town has applied for Community Development Block Grant to complete another 325 VF of manhole lining and replace 38 manhole lids and frames.

This rehabilitation work will cover approximately 90% of all the sewer mains found to have structural and maintenance defects. The manhole rehabilitation will address 100% of the manhole structures that fall within the “Needs Attention” or “Poor” categories and will address many within the “Fair” category that have small infiltration stains or are in need of a new lid and frame. Both of these projects will be completed by the end of 2026.

#### **D. Funding**

As stated above the Town has applied for rehabilitation funding through the American Rescue Plan (ARP) and the State Water Infrastructure Grant Program (SWIG) as well as a Community Development Block Grant from the State of Tennessee Department of Economic and Community Development. Both of these funding requests have been approved and will be used to carry out the rehabilitation efforts described above.

### **VI. Long Term Actions (5-20 Years)**

#### **A. Investigation**

At the end of the 5-year short term actions, all collection lines will have been investigated or rehabilitated. The life span of the proposed rehabilitations are 50 years. Any lines not rehabilitated should be investigated with CCTV every 5 years to identify maintenance needs or structural damage that has occurred.

#### **B. Monitoring**

Continuing the short term actions for monitoring, the Town should continue to record influent daily values at the wastewater treatment plant. This data should be provided to the Town’s Engineer to calculate the I&I rate annually to verify the rate is at an acceptable rate and no major events have created an I&I increase.

### **C. Rehabilitation**

As investigations are conducted on the remaining lines that have not been rehabilitated, the Town should coordinate these inspections with the Town's Engineer to review the reports and identify any repairs that need to be made.

Additionally, many of the smoke test findings (27%) are located on private property. These findings represent approximately (35%) of the total findings. In most situations, the Town cannot perform repairs on private property, however, the inflow coming into the system from broken or missing cleanouts and service lines on private property can be significant.

One consideration would be for the Town to participate in a service line and cleanout replacement program designed to systematically replace service lines on homes. The program should begin with the oldest homes within the Town, specifically homes older than 20 years in age. In some programs seen across the country, the Town provides the materials needed for the repairs to the customer for no cost. The homeowner is then responsible for the labor to make the replacement and the Town inspects the work prior to completion. Where the customer is unable to afford the cost of the repair, the Town may contract the work, then add the cost to the customer's bill over an agreed to term. The action called for in this report is only for the Town to consider options of how to address the needed service line repairs, research successful programs in other communities, and seek legal advice from the Town Attorney prior to committing to a plan of action.

### **D. Funding**

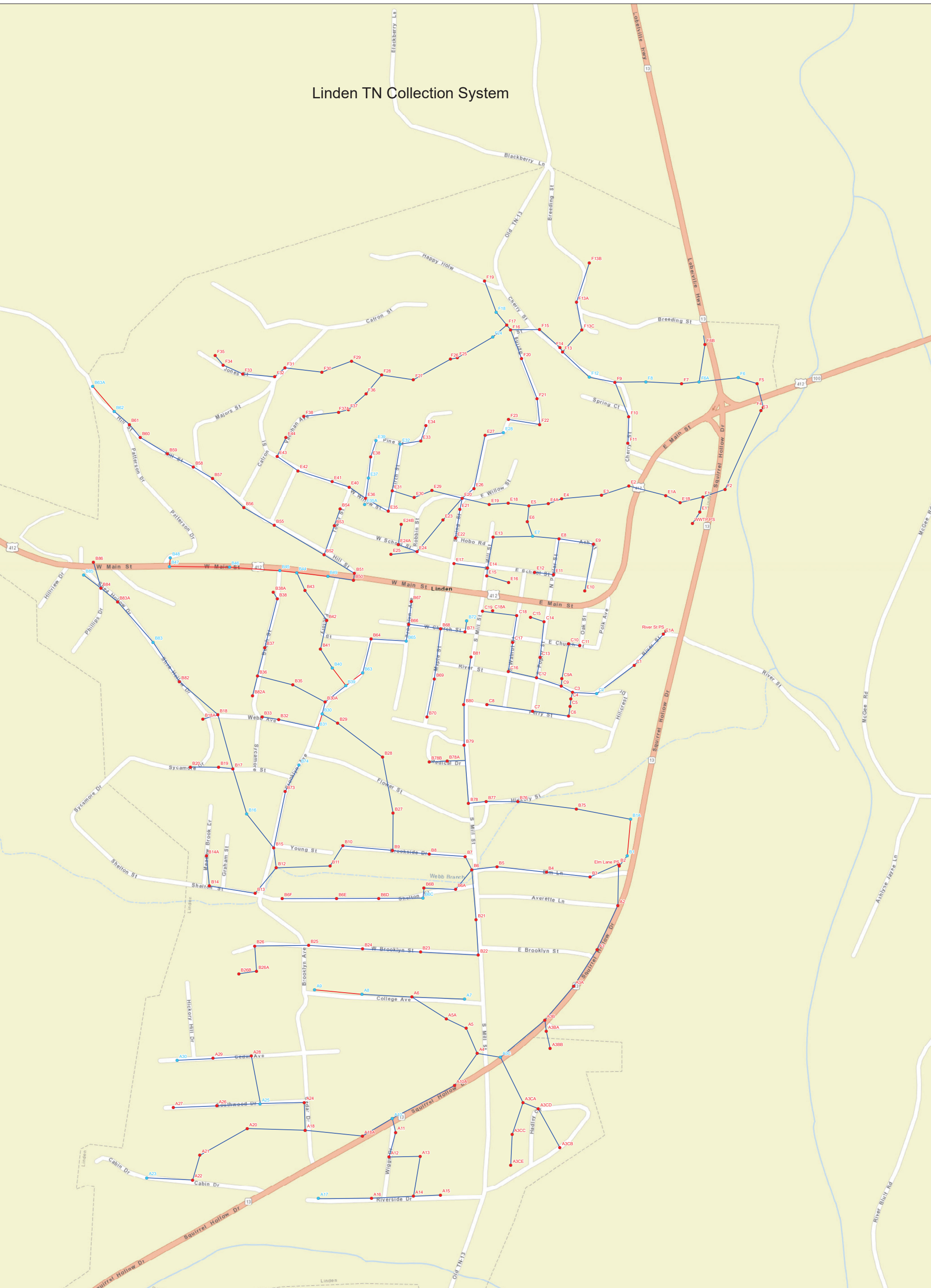
The best source of funding for rehabilitation efforts will be Community Development Block Grants from the State of Tennessee. However, as the I&I rate decreases and the sewer collection system is more contained, the fundability of these projects will decrease. For that reason, the Town should begin to allocate a percentage of the annual sewer fund to capital improvements. The amount may vary over the years; however, through monitoring and a regular investigation schedule, the repairs needed will be identified in a manner that the

Town can plan for them years in advance, divide the cost over multiple budget cycles, and perform minor repairs with staff.

**Attachment I – Sewer System Map**



# Linden TN Collection System



# UTILITY TECHNOLOGIES

Flow Monitoring Studies & Installations   Sewer Evaluation Surveys   I/I Analysis

## **Attachment II – 2022 Utility Scorecard**

## WATER INFRASTRUCTURE SUMMARY

Name of Entity:		Linden							
Office Address:		216 East Main Street							
City:	Linden	State:	TN	Zip Code:	37096				
County:	Perry								
Primary Community Served:	Linden	Population:	1,199						
ATPI:	10								
Utility Type:	Municipal								
Number of Water Connections:	2,800			Total Connections:	2,800				
Number of Wastewater Connections:	550								
Number of Employees:	15 Full-time		1 Part-Time						
<table border="1" style="margin: auto;"> <tr><td><b>PWSID</b></td></tr> <tr><td>0000404</td></tr> </table>			<b>PWSID</b>	0000404	<table border="1" style="margin: auto;"> <tr><td><b>NPDES</b></td></tr> <tr><td>0064394</td></tr> </table>			<b>NPDES</b>	0064394
<b>PWSID</b>									
0000404									
<b>NPDES</b>									
0064394									

### UTILITY CONTACT LIST

Name	Title	Phone	Email
Wess Ward	Mayor	9312090585	mayorward2016@gmail.com

### REPORTING REQUIREMENTS

Entity Fiscal Year:	June
Date of Last Audit:	July 2021
Adverse Audit Findings:	No
Notes:	

### REGIONALIZATION

Has the system considered any regional cooperative efforts?	Yes
Does the system have written or verbal agreements with neighboring utilities?	Yes

ASSET MANAGEMENT		WATER LOSS	
Asset Mangement Plan	Yes	<b>Unaccounted Water Loss</b>	32%
GIS Mapping	25-50%	Millions of Gallons/year	54.34
Inventory and Condition Assessment	Yes	Production Cost/year	\$541,769.80
		INFLOW and INFILTRATION	
Planned O&M and Work Order System	Yes	<b>Inflow and Infiltration</b>	69%
Meter Testing & Changeouts	Yes	Millions of Gallons/year	111.69
Captital Improvement Plan & Budget	Yes	Treatment Cost/year	\$139,612.50
IT Infrastructure	Yes		
MODERNIZATION			
Drinking Water Plant >80% Capacity	No	Wastewater Plant >80% Capacity	No
Age of Drinking Water Plant	50+ years	Age of Wastewater Treatment Plant	30-50 years
Percentage of lines older than 50 years	0-25%	Percentage of lines older than 50 years	>50%
COMPLIANCE			
Drinking Water Violations	Yes	Meeting Wastewater Permit Requirements	Yes
State Mandated Compliance Order (Water)	No	State Mandated Compliance Order (WW)	No
Meeting Order Requirements (Water)	NA	Meeting Order Requirements (WW)	NA
STORMWATER			
Stormwater Management Plan			N/A
System-Wide Map			N/A

**Attachment III – Prioritized Sewer Main Rehabilitation  
Schedule**

## Linden Camera Log Summary

Upstream MH	Downstream MH	Date	Street	Size	Material	Total Length	Structural Rating	Maintenance Rating
F31	F30	2/3/2022	MAJOR ST	8	PVC	180.70	5300	4200
A8	A6	4/22/2021	College Ave	6	VCP	386.80	5141	411B
C1	C1A	7/8/2021	RIVER ST	8	VCP	291.60	5141	3312
B16	B15	6/24/2021	Brooklyn Ave	8	PVC	402.60	5132	0000
C19	C18	7/7/2021	S MILL ST	8	VCP	238.20	5131	0000
A28	A28A	4/14/2021	Cedar Ave	8	VCP	134.10	5100	1100
B85	B84	6/23/2021	Shea Hollow Dr	8	VCP	340.00	5100	0000
B60	B59	7/1/2021	HILL ST	8	VCP	215.10	5100	4238
B52	B51	7/6/2021	HILL ST	8	VCP	244.50	5100	0000
E25	E24	4/23/2021	W School St	8	VCP	181.50	4136	1300
B83	B82	6/23/2021	Shea Hollow Dr	8	VCP	329.00	4133	0000
F11	F10L	2/2/2022	CHERRY ST	8	VCP	224.10	4132	4334
B21	B6	2/9/2022	N MILL ST	8	VCP	347.00	4132	5100
C12	C9	7/8/2021	RIVER ST	8	VCP	177.40	4131	0000
B86	B84	6/23/2021	Shea Hollow Dr	8	PVC	187.50	4121	0000
A17	A16	4/20/2021	Riverside Dr	8	VCP	367.60	4100	0000
A11	A10	4/21/2021	Wiggs Dr	8	VCP	122.20	4100	2100
A10A	A4	4/21/2021	Squirrel Hollow Dr	8	DIP	271.40	4100	4100
A2	PS	4/22/2021	Squirrel Hollow Dr	8	VCP	303.50	4100	4100
E4	E4A	4/23/2021	E Main St	6	PE	100.50	4100	0000
E3	E4	4/23/2021	E Main St	6	PE	125.00	4100	0000
C10	C9A	7/8/2021	E CHURCH ST	8	VCP	99.80	4100	5100
B73	B15	6/24/2021	Brooklyn Ave	8	VCP	394.60	3322	1100
B23	B22	4/14/2021	W Brooklyn St	8	PVC	400.30	3300	0000
A22	A21	4/20/2021	Cabin Dr	8	VCP	166.70	3221	1400
B53	B52	7/6/2021	TOWER ST	8	VCP	212.30	3200	1100
E22	E21	2/1/2022	SPRING ST	8	VCP	200.00	3200	0000
E17	E14	2/7/2022	E SCHOOL ST	8	VCP	230.00	3200	0000
B22	B21	2/9/2022	S MILL ST/BROOKLYN S	8	VCP	239.20	3125	4334
A13	A12	4/21/2021	Wiggs Dr	8	VCP	209.40	3123	4432
B20	B19	6/24/2021	Sycamore St	8	VCP	134.20	3122	0000
F23	F22	2/1/2022	SPRING ST	8	VCP	212.30	3122	0000
B19	B17	6/24/2021	Sycamore St	8	VCP	96.60	3121	4112
B37	B36	6/30/2021	Beech St	8	VCP	197.90	3121	4131
F33	F32	2/3/2022	JONES ST	8	PVC	221.50	3121	0000
C2	C1 (rev)	7/8/2021	RIVER ST	8	VCP	369.00	3121	0000
E14	E13	2/7/2022	N MILL ST	8	VCP	100.30	3111	3112
B26	B25	4/13/2021	W Brooklyn St	8	VCP	374.30	3100	0000
A29	A28	4/14/2021	Cedar Ave	8	VCP	265.00	3100	4112
B25A	B25	4/22/2021	Brooklyn Ave	6	VCP	224.70	3100	4200
B6F	B6E	6/29/2021	Shelton St	8	VCP/PVC	376.10	3100	4100
B6E	B6D	6/29/2021	Shelton St	8	VCP	268.40	3100	4111

## Linden Camera Log Summary

Upstream MH	Downstream MH	Date	Street	Size	Material	Total Length	Structural Rating	Maintenance Rating
B33	B32	7/1/2021	Webb Ave	8	VCP	115.20	0000	3C17
E33	E32	1/31/2022	PINE ST	8	VCP	255.60	0000	1H00
F22	F21	2/1/2022	SPRING ST	8	VCP	166.50	0000	5641
F20	F16	2/1/2022	SPRING ST	8	VCP	212.00	0000	5333
F35	F34	2/3/2022	JONES ST	8	PVC	83.00	0000	5200
B38	B37	6/30/2021	Beech St	8	VCP	337.30	0000	5143
F34	F33	2/3/2022	JONES ST	8	PVC	146.20	0000	5100
E42	E41	7/13/2021	W WILLOW ST	8	VCP	247.00	0000	4733
B68	B66	6/30/2021	W Church St	8	VCP	203.70	0000	4434
B83A	B83	6/23/2021	Shea Hollow Dr	8	VCP	349.50	0000	4417
A6	A7	4/13/2021	College Ave	6	VCP	29.50	0000	4400
F15	F14L	2/2/2022	SPRING ST	8	VCP	190.10	0000	4400
B58	B57	7/1/2021	HILL ST	8	VCP	153.20	0000	4333
B36	B35	6/30/2021	Beech St	8	VCP	147.90	0000	4236
E32	E31	1/31/2022	BIRCH ST	8	VCP	216.70	0000	4236
C7	C6	7/7/2021	PERRY ST	8	VCP	212.40	0000	4234
F13B	F13A	2/2/2022	BREEDING ST	8	VCP	283.70	1100	4233
E39	E38	7/13/2021	PINE ST	8	VCP	89.00	0000	4231
E38	E37	7/13/2021	PINE ST	8	VCP	47.10	0000	4231
E31	E30	1/31/2022	BIRCH/ROBBINS ST	8	VCP	151.30	0000	4231
F16	F15L	2/1/2022	SPRING ST	8	PVC	200.10	0000	4231
C15	C14	7/8/2021	S POPULAR ST	8	VCP	69.00	0000	4231
B24	B23	4/13/2021	W Brooklyn St	8	VCP	395.80	0000	4213
E16	E15	2/7/2022	E SCHOOL ST	8	VCP	47.00	1200	4200
B6	B5	2/8/2022	ELM LN	8	PE	173.60	0000	4200
B69	B68	6/30/2021	Maple St	8	VCP	59.60	0000	4139
B59	B58	7/1/2021	HILL ST	8	VCP	127.80	0000	4134
B57	B56	7/2/2021	HILL ST	8	VCP	257.40	0000	4132
E10	E9	2/7/2022	E SCHOOL ST/ ASH ST	8	VCP	249.30	0000	4123
A30	A29	4/14/2021	Cedar Ave	8	VCP	248.60	0000	4113
B82	B18	6/24/2021	Shea Hollow Dr	8	VCP	346.30	0000	4111
C3	C2	7/8/2021	RIVER ST	8	VCP	125.40	0000	4111
E43	E42	7/13/2021	W WILLOW ST	8	VCP	172.40	0000	4111
E35A	E35	7/13/2021	W WILLOW ST	8	VCP	105.10	0000	4111
B25	B24	4/13/2021	W Brooklyn St	8	PVC	373.30	0000	4100
B6B	B6C	6/29/2021	Shelton St	8	VCP	68.60	0000	4100
B5	B4	2/8/2022	ELM LN	10	PE	346.10	0000	4100
C8	C7	7/7/2021	PERRY ST	8	VCP	318.40	0000	3512
F21	F20	2/1/2022	SPRING ST	8	VCP	34.10	0000	3511
C9	C3	7/8/2021	RIVER ST	8	VCP	90.20	1100	3413
A23	A22	4/22/2021	Cabin Dr	8	VCP	60.00	0000	3400
B35	B30A	7/1/2021	Brooklyn Ave	8	VCP	198.30	0000	3317

## Linden Camera Log Summary

Upstream MH	Downstream MH	Date	Street	Size	Material	Total Length	Structural Rating	Maintenance Rating
B77	B76	7/9/2021	HICKORY ST	8	VCP	214.60	0000	3312
C5	C4	7/7/2021	PERRY ST	8	VCP	63.50	0000	3300
F10	F9	2/2/2022	CHERRY ST	8	VCP	254.70	0000	3222
E44	E43	7/13/2021	VAUGHAN ST	8	VCP	142.50	0000	3215
F13A	F13C	2/2/2022	BREEDING ST	8	VCP	195.00	0000	3213
B61	B60	7/1/2021	Hill St	8	VCP	114.40	0000	3114
A23	A22	4/20/2021	Cabin Dr	8	VCP	140.00	0000	3100
B55	B52	7/2/2021	HILL ST	8	VCP	400.70	0000	3100
C6	C5	7/7/2021	PERRY ST	8	VCP	67.80	0000	2100
A6	A5A	4/13/2021	College Ave	6	VCP	279.50	0000	1200
B79	B78	7/9/2021	S MILL ST	8	VCP	400.90	0000	1200
A25	A24	4/14/2021	Southwood Dr	8	VCP	301.40	0000	1100
A20	A19	4/20/2021	Cabin Dr	8	VCP	342.40	0000	1100
A16	A14	4/20/2021	Riverside Dr	8	VCP	291.10	0000	1100
A18A	A10	4/21/2021	Squirrel Hollow Dr	8	VCP	301.00	0000	1100
E34	E33	7/13/2021	PINE ST	8	VCP	109.80	0000	1100
A5A	A5	4/13/2021	College Ave	8	PVC	150.80	0000	0000
A5	A4	4/13/2021	College Ave	8	PVC	188.30	0000	0000
A6	A7	4/13/2021	College Ave	6	VCP	43.50	0000	0000
A6	A8	4/13/2021	College Ave	6	VCP	60.00	0000	0000
B26B	B26A	4/13/2021	W Brooklyn St	8	PVC	121.90	0000	0000
B26A	B26A	4/13/2021	W Brooklyn St	8	PVC	173.20	0000	0000
A27	A26	4/14/2021	Southwood Dr	8	VCP	300.00	0000	0000
A26	A25	4/14/2021	Southwood Dr	8	VCP	297.00	0000	0000
A24	A18	4/14/2021	Cedar Ave	8	VCP	192.10	0000	0000
A19	A18	4/20/2021	Cedar Ave	8	PVC	57.00	0000	0000
A18	A18A	4/20/2021	Cedar Ave	8	VCP	400.00	0000	0000
A12	A11	4/21/2021	Wiggs Dr	8	VCP	173.20	0000	0000
A10	A10A	4/21/2021	Squirrel Hollow Dr	8	VCP	426.00	0000	0000
A4	A3C	4/21/2021	Squirrel Hollow Dr	8	VCP	162.00	0000	0000
X	A3CB	4/21/2021	Hadley Cir	8	PVC	290.70	0000	0000
A3CB	A3CD	4/21/2021	Hadley Cir	8	PVC	307.00	0000	0000
Z	A3CD	4/21/2021	Hadley Cir	8	VCP	345.00	0000	0000
A3CD	A3CD1	4/21/2021	Hadley Cir	8	PVC	65.00	0000	0000
A3CD1	A3CA	4/21/2021	Hadley Cir	8	PVC	60.50	0000	0000
A3BA	A3B	4/22/2021	Squirrel Hollow Dr	8	DIP	53.80	0000	0000
A3	A2	4/22/2021	Squirrel Hollow Dr	8	VCP	335.40	0000	0000
A3BB	A3BA	4/23/2021	Squirrel Hollow Dr	6	PVC	123.00	0000	0000
ZZ	A3BA	4/23/2021	Squirrel Hollow Dr	6	PVC	211.00	0000	0000
E4A	E5	4/23/2021	E Main St	6	PE	277.50	0000	0000
A6a	A6	5/24/2021	College Ave	6	VCP	226.20	0000	0000
B18A	B18	6/24/2021	Webb Ave	8	PVC	106.90	0000	0000

## Linden Camera Log Summary

Upstream MH	Downstream MH	Date	Street	Size	Material	Total Length	Structural Rating	Maintenance Rating
B18	B17	6/24/2021	Webb Ave	6	PE	388.00	0000	0000
B17	B16	6/24/2021	Sycamore St	6	PE	248.40	0000	0000
B74	B73	6/24/2021	Brooklyn Ave	8	VCP	203.30	0000	0000
B14A	B14	6/25/2021	Meadow Brook Dr	6	PVC	221.30	0000	0000
B14	B13	6/25/2021	Shelton St	8	VCP	313.20	0000	0000
B13	B12	6/25/2021	Shelton St	8	PVC	192.10	0000	0000
B15	B12	6/25/2021	Brooklyn Ave	8	PVC	136.80	0000	0000
B10	B9	6/25/2021	Brookside Dr	8	VCP	347.00	0000	0000
B9	B8	6/25/2021	Brookside Dr	8	VCP	257.00	0000	0000
B8	B7	6/29/2021	Brookside Dr	8	VCP	248.20	0000	0000
B7	B6	6/29/2021	Brookside Dr	8	VCP/DIP	99.40	0000	0000
B6B	B6A	6/29/2021	Shelton St	6	PE	218.30	0000	0000
B6A	B6	6/29/2021	Shelton St	8	PVC	176.00	0000	0000
B38A	B38	6/30/2021	Beech St	6	VCP/PVC	40.70	0000	0000
B82	B36	6/30/2021	Beech St	8	VCP	1.00	0000	0000
B71	B72	6/30/2021	W Church St	8	VCP	104.70	0000	0000
B67	B66	7/1/2021	Brooklyn Ave	8	VCP	158.30	0000	0000
B66	B65	7/1/2021	Brooklyn Ave	8	VCP	116.50	0000	0000
B32	B31	7/1/2021	Webb Ave	8	VCP	274.80	0000	0000
B30A	B30	7/1/2021	Brooklyn Ave	8	VCP	83.50	0000	0000
B56	B55	7/2/2021	HILL ST	8	VCP	243.20	0000	0000
B51	B50	7/6/2021	HILL ST	8	VCP	45.10	0000	0000
C4	C3	7/7/2021	RIVER ST	8	VCP	11.70	0000	0000
C18	C17	7/8/2021	WALNUT ST	8	VCP	185.10	0000	0000
C17	C16	7/8/2021	WALNUT ST	8	VCP	200.50	0000	0000
C14	C13	7/8/2021	S POPULAR ST	8	VCP	250.00	0000	0000
C13	C12	7/8/2021	S POPULAR ST	8	VCP	139.00	0000	0000
B81	B80	7/9/2021	S MILL ST	8	PVC	334.00	0000	0000
B80	B79	7/9/2021	S MILL ST	8	PVC	281.60	0000	0000
E41	E40	7/13/2021	W WILLOW ST	8	VCP	123.50	0000	0000
E37	E36	7/13/2021	PINE ST	8	VCP	168.30	0000	0000
E36	E35A	7/13/2021	W WILLOW ST	8	VCP	40.00	0000	0000
E29	E20	1/31/2022	WILLOW ST	10	PE	212.10	0000	0000
F14	F13L	2/2/2022	CHERRY ST	8	VCP	27.20	0000	0000
F32	F31	2/3/2022	MAJOR ST	8	PVC	97.00	0000	0000
E15	E14	2/7/2022	N MILL ST	8	VCP	52.00	0000	0000
E12	E11	2/8/2022	E SCHOOL ST	8	VCP	130.00	0000	0000
E11	E8	2/8/2022	N POPULAR ST	8	VCP	246.30	0000	0000
B4	B3	2/8/2022	ELM LN	10	PE	305.00	0000	0000
B3	ELPS	2/9/2022	ELM LN	10	PE	218.00	0000	0000
C9A	C9	7/8/2021	RIVER ST	8	VCP	50.60	0000	0000



## Linden Camera Log Summary

Upstream MH	Downstream MH	Date	Street	Size	Material	Total Length	Structural Rating	Maintenance Rating
B6D	B6C	6/29/2021	Shelton St	8	PVC	307.10	3100	0000
B64	B63	7/1/2021	Brooklyn Ave	8	VCP	240.00	3100	3716
C16	C12	7/8/2021	RIVER ST	8	VCP	201.90	3100	0000
E40	E36	7/13/2021	W WILLOW ST	8	VCP	133.40	3100	0000
A3C	A3B	4/22/2021	Squirrel Hollow Dr	8	DIP	399.10	2311	0000
A14	A13	4/21/2021	Riverside Dr	8	VCP	274.30	2200	1100
B71	B68	6/30/2021	W Church St	8	VCP	170.10	2200	0000
B65	B64	7/1/2021	Factory St	8	VCP	247.40	2200	0000
C11	C10	7/8/2021	E CHURCH ST	8	VCP	74.80	2200	0000
E27	E26(B)	2/1/2022	SPRING ST	8	VCP	355.40	2200	3714
E7	E6L	2/8/2022	N POPULAR ST	8	VCP	73.20	2200	3121
A28A	A25	4/14/2021	Cedar Ave	8	VCP	196.00	2100	1200
A21	A20	4/20/2021	Cabin Dr	8	VCP	378.00	2100	1100
A15	A14	4/20/2021	Riverside Dr	8	VCP	183.80	2100	0000
A3CA	A3C	4/21/2021	Hadley Cir	8	PVC	315.80	2100	2100
A3BA	A3A	4/22/2021	Squirrel Hollow Dr	8	VCP	306.00	2100	0000
A3A	A3	4/22/2021	Squirrel Hollow Dr	8	VCP	300.40	2100	1100
B25B	B25A	4/22/2021	College Ave	8	VCP	126.80	2100	0000
B84	B83A	6/23/2021	Shea Hollow Dr	8	VCP	149.00	2100	1200
B11	B10	6/25/2021	Brookside Dr	8	PVC	162.60	2100	0000
B54	B53	7/6/2021	TOWER ST	8	VCP	121.00	2100	0000
E26	E20	2/1/2022	SPRING ST	8	VCP	101.70	2100	0000
E9	E8	2/7/2022	ASH ST	8	VCP	239.00	2100	1700
E8	E7L	2/8/2022	N POPULAR/ASH ST	8	VCP	225.40	2100	3321

## **Attachment IV – Smoke Test Results**

Linden Smoke Testing Results

Date Observed	Defect Number	Defect Address	Upstream MH Number	Defect Location	Property Type	Smoke Source	Surface Type	Intensity	I/I Potential	Notes:	X	Y
8/25/2020	1	325 W Main St.	B86	ditch	public	usnhwalldown	grassdirt	medium	moderate	Smoke from frame seal and ground around manhole.	-87.8479297	35.6175751
8/25/2020	2	123 Shea Hollow Dr.	B83A	frontyard	public	usmhchimneyup	grassdirt	medium	none	Smoke from broken frame.	-87.8473607	35.6168248
8/25/2020	3	224 Webb Ave.	B18	sideyard	private	svcconeedscap	grassdirt	light	moderate	Cleanout needs cap and collar broken below grade.	-87.8447558	35.6144498
8/25/2020	4	224 Webb Ave.	B19	ditch	public	sewermainline	gravel	light	moderate	Smoke from mainline.	-87.844735	35.6136639
8/25/2020	5	220 Shelton St.	B14	sideyard	private	svclateral	grassdirt	light	moderate	Smoke from ground near house.	-87.8451904	35.6112534
8/25/2020	6	246 Meadow Brooke Dr.	B14A	sideyard	private	svcconeedscap	grassdirt	light	mild	Cleanout needs cap and collar.	-87.8450499	35.6116399
8/25/2020	7	204 Shelton St.	B14	backyard	private	svcconeedscap	grassdirt	light	mild	Cleanout needs cap.	-87.8446081	35.6111467
8/25/2020	8	102 Young St.	B12	woods	public	usmhchimneyup	grassdirt	medium	mild	Smoke from frame seal, manhole lid was cocked open.	-87.8436674	35.6117856
8/25/2020	9	102 Young St.	B13	woods	public	sewermainline	grassdirt	light	moderate	Smoke from ground. over mainline near storm ditch	-87.8436936	35.6117638
8/25/2020	10	223 Brooklyn Ave.	B73	ditch	public	svclateral	grassdirt	light	moderate	Smoke from culvert near lateral.	-87.8437504	35.6123528
8/25/2020	11	219 Brooklyn Ave.	B74	frontyard	private	svccleanout	grassdirt	light	moderate	Broken collar below grade.	-87.8430548	35.6135205
8/25/2020	12	219 Brooklyn Ave.	B74	sideyard	private	svccleanout	grassdirt	light	moderate	Broken collar below grade.	-87.8438759	35.6134602
8/25/2020	13	Corner of Hill and Patterson	B61	frontyard	public	usmhchimneyup	grassdirt	light	mild	Smoke from frame seal.	-87.8470956	35.6201822
8/25/2020	14	324 Hill St.	B60	frontyard	private	svcconeedscap	grassdirt	light	moderate	Broken cleanout cap and collar.	-87.8467066	35.6197506
8/25/2020	15	324 Hill St	B60	sidewalk	private	svclateral	grassdirt	medium	moderate	Smoke from ground over service	-87.8467269	35.6197293
8/25/2020	16	324 Hill St	B60	frontyard	private	svclateral	grassdirt	light	moderate	Smoke from ground over service.	-87.8466802	35.6197948
8/25/2020	17	303 Hill St	B57	frontyard	private	abandonedsvc	grassdirt	light	moderate	Smoke from abandoned service.	-87.8444963	35.6191926
8/25/2020	18	303 Hill St	B57	sideyard	private	abandonedsvc	grassdirt	light	moderate	Smoke from abandoned service.	-87.844808	35.6193193
8/25/2020	19	215 Main St.	B55	frontyard	private	abandonedsvc	grassdirt	light	moderate	Smoke from ground over abandoned service, low spot.	-87.8431789	35.6179146
8/25/2020	20	Intersection of Tower St. and W. School St.	B54	ditch	public	sewermainline	grassdirt	light	moderate	Smoke from area drain near main line. Between manhole B53 and B54.	-87.8423217	35.6182869
8/25/2020	21	201 Hill St.	B53	ditch	private	svclateral	grassdirt	medium	severe	Smoke from ground in ditch over service line. Point taken in center of 20' span.	-87.8425536	35.6182525
8/25/2020	22	201 Hill St.	B54	backyard	private	abandonedsvc	grassdirt	light	moderate	Smoke from abandoned service, smoke from ground.	-87.8426846	35.6184296
8/25/2020	23	200 West Main St.	B44	ditch	public	usmhchimneyup	grassdirt	light	mild	Smoke from broken frame.	-87.8431914	35.6173731
8/25/2020	24	112 S Mill St.	B72	backyard	private	svccleanout	grassdirt	light	mild	Smoke from water meter box.	-87.839207	35.6165917
8/25/2020	25	112 S Mill St.	B72	backyard	private	svccleanout	grassdirt	light	mild	Smoke from water box, and ground.	-87.8392291	35.6164532
8/25/2020	26	119 S Mill St.	B71	backyard	private	abandonedsvc	grassdirt	light	moderate	Smoke from ground, abandoned service.	-87.8396184	35.6161314
8/25/2020	27	111 Brooklyn Ave.	B65	frontyard	private	abandonedsvc	grassdirt	light	moderate	Smoke from ground around abandoned service.	-87.8412818	35.6162399
8/25/2020	28	127 Beech St.	B82	ditch	public	svcconeedscap	grassdirt	light	mild	Broken cleanout needs cap.	-87.8441635	35.6153549
8/25/2020	29	147 Brooklyn Ave.	B35	backyard	private	abandonedsvc	grassdirt	light	moderate	Smoke from ground around abandoned service.	-87.8428764	35.6151451
8/25/2020	30	147 Brooklyn Ave.	B35	backyard	private	abandonedsvc	grassdirt	medium	moderate	Smoke from ground around abandoned service	-87.8431105	35.6152042
8/25/2020	31	147 Brooklyn Ave.	B35	frontyard	private	abandonedsvc	grassdirt	light	moderate	Smoke from ground around abandoned service.	-87.8428126	35.6153736
8/25/2020	32	147 Brooklyn Ave.	B35	frontyard	private	abandonedsvc	grassdirt	light	moderate	Smoke from ground around abandoned service.	-87.842671	35.6151144

Linden Smoke Testing Results

Date Observed	Defect Number	Defect Address	Upstream MH Number	Defect Location	Property Type	Smoke Source	Surface Type	Intensity	I/I Potential	Notes:	X	Y
8/25/2020	33	147 Brooklyn Ave.	B39	frontyard	private	abandonedsvc	grassdirt	light	moderate	Smoke from ground around abandoned service.	-87.842333	35.6152424
8/25/2020	34	209 Webb Ave.	B33	frontyard	private	svcconeedscap	grassdirt	light	mild	Cleanout needs cap.	-87.8435817	35.6148015
8/26/2020	35	171 W Brooklyn Ave., Bldg A	B26A	frontyard	private	svcconeedscap	grassdirt	light	mild	Cleanout with vented cap.	-87.8440316	35.6100991
8/26/2020	36	170 Brooklyn Ave., Bldg A	B26A	frontyard	private	svcconeedscap	grassdirt	light	moderate	Smoke from broken cleanout, broken cap.	-87.8440052	35.6099653
8/26/2020	37	171 Brooklyn Ave., Bldg D	B26B	frontyard	private	svcconeedscap	grassdirt	light	mild	Cleanout needs cap.	-87.8443547	35.609924
8/26/2020	38	171 Brooklyn Ave., Bldg D	B26B	frontyard	private	svcconeedscap	grassdirt	light	mild	Cleanout needs cap.	-87.8445621	35.6099045
8/26/2020	39	171 Brooklyn Ave., at entrance	B26A	ditch	private	sewermainline	grassdirt	light	moderate	Smoke from ground near ditch suspected mainline leak.	-87.8441284	35.6102618
8/26/2020	40	106 Brooklyn Ave.	B23	sideyard	private	svcconeedscap	grassdirt	light	mild	Smoke from ground around cleanout, coffee can covering cleanout.	-87.8395747	35.6100082
8/26/2020	41	130 Brooklyn Ave.	B24	frontyard	public	usnhwalldown	grassdirt	light	mild	Smoke from ground. Near manhole, likely wall leak.	-87.8416517	35.6102432
8/26/2020	42	301 S Mill St.	B21	sidewalk	public	usmhchimneyup	concrete	light	moderate	Smoke from ground at edge of sidewalk from manhole, 20' span.	-87.8390288	35.6107933
8/26/2020	43	Intersection of S. Mill St. and Elm Lane near creek.	B6	ditch	public	usnhwalldown	grassdirt	light	severe	Smoke from manhole near creeks edge.	-87.8391138	35.6117504
8/26/2020	44	148 Shelton St.	B6F	sideyard	private	svccleanout	grassdirt	light	mild	Broken cleanout.	-87.8432262	35.6109734
8/26/2020	45	152 Shelton St.	B6F	backyard	private	svclateral	grassdirt	light	severe	Smoke from ground over service, 40' span. Point taken in center of span.	-87.8435536	35.6110758
8/26/2020	46	140 Shelton St.	B6F	frontyard	private	svccleanout	grassdirt	light	mild	Smoke from ground near cleanout.	-87.8426592	35.6110962
8/26/2020	47	139 Shelton St.	B6F	frontyard	private	abandonedsvc	grassdirt	light	mild	Smoke from ground around abandoned service.	-87.8423687	35.6114328
8/26/2020	48	123 Shelton St.	B6D	sideyard	private	svccleanout	grassdirt	light	mild	Smoke from ground around broken cleanout.	-87.8411707	35.6114234
8/26/2020	49	122 Shelton St.	B6D	backyard	private	svcconeedscap	grassdirt	light	mild	Cleanout with broken cap.	-87.8412735	35.6109529
8/26/2020	50	112 Brookside Dr.	B9	frontyard	private	svcconeedscap	grassdirt	light	mild	Broken cleanout cap and collar.	-87.8404013	35.611994
8/26/2020	51	116 Brookside Dr.	B8	frontyard	private	abandonedsvc	grassdirt	light	moderate	Smoke from ground at abandoned service.	-87.839878	35.6117954
8/26/2020	52	106 Brookside Dr.	B8	frontyard	private	abandonedsvc	grassdirt	light	moderate	Smoke from ground around abandoned service.	-87.8397818	35.6117851
8/26/2020	53	106 Brookside Dr.	B8	frontyard	private	abandonedsvc	grassdirt	light	moderate	Smoke from ground around abandoned service.	-87.839672	35.6117784
8/26/2020	54	106 Brookside Dr.	B8	frontyard	private	abandonedsvc	grassdirt	light	moderate	Smoke from ground around abandoned service.	-87.8395582	35.611766
8/26/2020	55	107 Elm Lane	B6	frontyard	private	abandonedsvc	grassdirt	light	mild	Smoke from ground around abandoned service.	-87.8385652	35.6119292
8/26/2020	56	107 Elm Lane	B5	frontyard	private	svccleanout	grassdirt	medium	mild	Smoke from ground around cleanout.	-87.8382904	35.6118949
8/26/2020	57	106 Elm Lane	B5	frontyard	private	svccleanout	grassdirt	light	mild	Smoke from ground, likely cleanout.	-87.8383349	35.6115821
8/26/2020	58	31 Medical Dr.	B78B	sideyard	private	svcconeedscap	grassdirt	light	mild	Cleanout needs cap.	-87.8399663	35.6138885
8/26/2020	59	258 S. Mill St.	B79	sideyard	public	svclateral	grassdirt	light	moderate	Smoke from ground over service.	-87.8391377	35.6136951
8/26/2020	60	245 S. Mill St.	B80	sideyard	private	svclateral	grassdirt	medium	moderate	Broken service. Point at center 20' span.	-87.8394722	35.6145737
8/26/2020	61	245 S. Mill St.	B80	sideyard	private	svccleanout	grassdirt	light	mild	Smoke from ground.	-87.8395219	35.614617

Linden Smoke Testing Results

Date Observed	Defect Number	Defect Address	Upstream MH Number	Defect Location	Property Type	Smoke Source	Surface Type	Intensity	I/I Potential	Notes:	X	Y
8/26/2020	62	245 S. Mill St.	B80	sideyard	private	svclateral	grassdirt	light	mild	Smoke from ground near lateral.	-87.839526	35.614704
8/26/2020	63	254 S. Mill St.	B80	sidewalk	public	usmhchimneyup	concrete	light	mild	Smoke from frame seal.	-87.8392992	35.6148702
8/26/2020	64	Intersection of S. Mill St. and Hickory St.	B78	sidewalk	public	usmhchimneyup	concrete	light	mild	Smoke from concrete around manhole.	-87.8391866	35.6130033
8/26/2020	65	104 Hickory Lane	B77	frontyard	private	svccneedsdap	grassdirt	light	mild	Cleanout with broken cap.	-87.8384991	35.6127495
8/26/2020	66	104 Hickory Lane	B77	backyard	private	svclateral	grassdirt	light	moderate	Smoke from ground around broken service.	-87.8385092	35.6125236
8/26/2020	67	111 Hickory Lane	B77	sideyard	private	svccleanout	grassdirt	light	moderate	Cleanout broken below grade.	-87.8384797	35.613224
8/26/2020	68	119 Hickory Lane	B76	frontyard	private	abandonedsvc	grassdirt	light	moderate	Smoke from ground around abandoned service.	-87.8376924	35.6132557
8/26/2020	69	111 Hickory Lane	B76	woods	private	svccleanout	grassdirt	light	mild	Smoke from ground around broken cleanout.	-87.8379742	35.6132198
8/26/2020	70	223 Cedar Ave.	A30	frontyard	private	abandonedsvc	grassdirt	light	moderate	Smoke from abandoned service.	-87.845542	35.6083219
8/26/2020	71	223 Cedar Ave.	A30	frontyard	private	abandonedsvc	grassdirt	medium	moderate	Smoke from hole in ground, likely abandoned service.	-87.8455468	35.6082898
8/26/2020	72	223 Cedar Ave.	A30	frontyard	private	svclateral	grassdirt	light	moderate	Smoke from ground over lateral.	-87.845953	35.6082303
8/26/2020	73	228 Cedar Ave.	A29	frontyard	private	svclateral	grassdirt	light	moderate	Stump over service line.	-87.8450669	35.6080416
8/26/2020	74	228 Cedar Ave.	A29	backyard	private	abandonedsvc	grassdirt	light	moderate	Smoke from hole in ground.	-87.8451155	35.6079443
8/26/2020	75	223 Cedar Ave.	A29	backyard	private	abandonedsvc	grassdirt	light	moderate	Smoke from abandoned service, basement.	-87.8448742	35.6078938
8/26/2020	76	121 Cabin Dr.	A21	backyard	public	usmhchimneyup	grassdirt	light	mild	Smoke from frame seal.	-87.8454359	35.6063138
8/26/2020	77	119 Cabin Dr.	A21	backyard	private	svccleanout	grassdirt	light	mild	Cleanout needs cap.	-87.8447867	35.6063196
8/26/2020	78	119 Cabin Dr.	A21	backyard	private	svccleanout	grassdirt	light	mild	Broken cleanout cap.	-87.8447429	35.6061072
8/26/2020	79	1128 Squirrel Hollow Dr.	A18A	ditch	public	usmhchimneyup	grassdirt	light	mild	Broken frame on manhole.	-87.8416638	35.6067045
8/26/2020	80	108 Riverside Dr.	A15	sideyard	private	svccleanout	grassdirt	light	mild	Smoke from ground, probable cleanout.	-87.8398551	35.6052203
8/26/2020	81	108 Riverside Dr.	A15	ditch	public	svclateral	grassdirt	light	moderate	Smoke from ground in ditch over service.	-87.8398967	35.6054987
8/26/2020	82	113 Riverside Dr.	A13	backyard	public	usmhchimneyup	grassdirt	light	mild	Smoke from frame seal.	-87.8403152	35.6063165
8/26/2020	83	58 Wiggs Dr.	A13	backyard	private	svccneedsdap	grassdirt	light	moderate	Smoke from open cleanout below grade.	-87.8401383	35.6064667
8/26/2020	84	101 Wiggs Dr.	A12	sidewalk	private	svccneedsdap	concrete	light	moderate	Smoke from broken concrete pad.	-87.841108	35.606476
8/26/2020	85	123 College Ave.	A8	sideyard	private	svccneedsdap	grassdirt	light	mild	Cleanout needs cap.	-87.8409499	35.6095031
8/26/2020	86	113 College Ave.	A6	backyard	private	svclateral	grassdirt	medium	moderate	Smoke from ground around broken service.	-87.840158	35.6094776
8/26/2020	87	104 College Ave.	A6	sideyard	public	sewermainline	grassdirt	light	severe	Smoke from water meter boxes, over mainline.	-87.8399676	35.6090774
8/26/2020	88	104 College Ave.	A5A	ditch	private	svccneedsdap	grassdirt	medium	moderate	Open cleanout near ditch.	-87.8392841	35.6087706
8/26/2020	89	104 College Ave.	A5	ditch	public	usmhchimneyup	grassdirt	medium	moderate	Smoke from frame seal, in ditch.	-87.8392472	35.6087396
8/26/2020	90	373 S Mills St.	A5	backyard	private	svccleanout	grassdirt	light	mild	Smoke from cleanout box.	-87.8393734	35.608408
8/26/2020	91	130 Elm Lane	A3	sideyard	private	svccleanout	gravel	light	mild	Broken cleanout below grade.	-87.836017	35.6110121
8/27/2020	92	94 E. Main St. - door on S. Mill St.	C19	sidewalk	private	svccleanout	concrete	heavy	mild	Open cleanout in sidewalk.	-87.8388173	35.6167776
8/27/2020	93	102 E. Main St. - alley behind brick shed.	C19	alley	private	svccleanout	grassdirt	light	mild	Smoke from ground near building.	-87.8386109	35.6166243
8/27/2020	94	102 E. Main St. - alley behind building.	C19	alley	private	svclateral	grassdirt	light	mild	From ground near natural gas meter.	-87.8385692	35.6166332

Linden Smoke Testing Results

Date Observed	Defect Number	Defect Address	Upstream MH Number	Defect Location	Property Type	Smoke Source	Surface Type	Intensity	I/I Potential	Notes:	X	Y
8/27/2020	95	102 E. Main St. - near back door.	C19	alley	private	svclateral	grassdirt	light	mild	Ground near wall and back door.	-87.8385622	35.6166739
8/27/2020	96	102 E. Main St. - near back door.	C18A	alley	private	svclateral	concrete	light	mild	From ground near downspout.	-87.838625	35.6167018
8/27/2020	97	111 S. Walnut St.	C18	frontyard	private	abandonedsvc	grassdirt	light	mild	Smoke from ground in yard.	-87.8378793	35.6162443
8/27/2020	98	119 S. Poplar St.	C14	backyard	private	svcconeedscap	grassdirt	medium	moderate	Cleanout needs cap, near downspout.	-87.8377454	35.6159006
8/27/2020	99	107 E. Main St.	C15	backyard	public	usmhchimneyup	grassdirt	light	mild	Smoke from manhole frame seal.	-87.8377416	35.6165313
8/27/2020	100	126 E. Main St.	C15	alley	private	svclateral	concrete	medium	moderate	Smoke from under concrete slab.	-87.8376043	35.6164999
8/27/2020	101	128 E. Main St.	C15	sideyard	private	svclateral	grassdirt	light	moderate	Smoke from ground over service line.	-87.8374814	35.6165138
8/27/2020	102	200 E. Main St.	C14	backyard	private	svclateral	grassdirt	light	moderate	Smoke from ground over service line, referenced to middle of 30' span.	-87.8370974	35.6164626
8/27/2020	103	124 S. Poplar St.	C10	driveway	private	svclateral	asphalt	light	moderate	Smoke from service line at edge of asphalt.	-87.836901	35.6159407
8/27/2020	104	112 S. Poplar St.	C10	sideyard	private	svclateral	grassdirt	medium	moderate	From ground over service line, reference to middle of 25' span near power pole	-87.8369573	35.6160664
8/27/2020	105	206 River St.	C9A	woods	public	usmhchimneyup	grassdirt	heavy	moderate	Smoke from broken frame below storm pipe.	-87.8370121	35.6153723
8/27/2020	106	106 Perry St.	C8	sideyard	private	abandonedsvc	grassdirt	medium	mild	Near carport.	-87.8383171	35.614663
8/27/2020	107	106 Perry St.	C8	backyard	private	abandonedsvc	grassdirt	medium	moderate	Back of empty lot.	-87.8384025	35.6145978
8/27/2020	108	Empty lot at Perry St. and S. Mill St.	C8	backyard	private	abandonedsvc	grassdirt	light	mild	Smoke from ground above service line	-87.8388331	35.6151447
8/27/2020	109	Empty lot at Perry St. and S. Walnut St.	C8	sideyard	private	abandonedsvc	grassdirt	light	mild	Smoke from ground over service line.	-87.8385921	35.6150794
8/27/2020	118	115 Perry St.	C8	backyard	private	abandonedsvc	grassdirt	medium	moderate	From ground over service line.	-87.838081	35.6149907
8/27/2020	110	115 Perry St.	C7	backyard	private	abandonedsvc	grassdirt	light	mild	Smoke from open abandoned service line.	-87.8373589	35.6149077
8/27/2020	111	112 Perry St.	C8	sideyard	private	svclateral	grassdirt	medium	moderate	Smoke from ground near downspout.	-87.8378528	35.6145477
8/27/2020	112	202 Perry St.	C7	sideyard	private	svclateral	grassdirt	light	mild	Smoke from ground around exposed service line.	-87.8374457	35.6145737
8/27/2020	113	River St. at Hillcrest Dr.	C3	backyard	private	svclateral	grassdirt	light	mild	Smoke from ground over service line.	-87.8363123	35.6150104
8/27/2020	114	217 River St.	C2	sideyard	private	svclateral	grassdirt	medium	mild	Smoke from ground over service, reference to middle of 10' circle.	-87.8360845	35.6153186
8/27/2020	115	217 River St.	C2	backyard	private	svclateral	grassdirt	medium	moderate	Smoke from ground over service near house.	-87.8360239	35.615387
8/27/2020	116	223 River St.	C1	ditch	public	svclateral	grassdirt	heavy	severe	Smoke from broken service line in storm drainage ditch.	-87.8350432	35.6158301
8/27/2020	117	River St. Pump Station	C1A	sideyard	public	other	grassdirt	medium	moderate	Smoke from hole in ground next to wet well.	-87.8345863	35.616268
9/9/2020	119	200 Vaughan Ave.	E44	sideyard	private	svcconeedscap	grassdirt	light	mild	Cleanout needs cap and collar	-87.843303	35.6200294
9/9/2020	120	106 Catron St.	E43	sideyard	private	abandonedsvc	grassdirt	light	moderate	Smoke from ground around abandoned service.	-87.8438979	35.6193131
9/9/2020	121	202 Willow St.	E43	frontyard	private	abandonedsvc	grassdirt	medium	moderate	Smoke from 2 holes in ground, point taken between both.	-87.8436294	35.6193902
9/9/2020	122	211 Willow St.	E42	woods	private	abandonedsvc	grassdirt	light	moderate	Smoke from ground around abandoned service.	-87.8427674	35.6192649
9/9/2020	123	208 Pine St.	E40	sideyard	private	abandonedsvc	grassdirt	light	moderate	Abandoned service, smoke from exposed pipe.	-87.8418748	35.619066
9/9/2020	124	119 Tower St.	E41	sideyard	private	svclateral	grassdirt	light	moderate	Smoke from hole in ground near service.	-87.842229	35.6189546

Linden Smoke Testing Results

Date Observed	Defect Number	Defect Address	Upstream MH Number	Defect Location	Property Type	Smoke Source	Surface Type	Intensity	I/I Potential	Notes:	X	Y
9/9/2020	125	119 Tower St.	E41	sideyard	private	svccleanout	grassdirt	light	moderate	Cleanout broken below grade.	-87.8422587	35.6189585
9/9/2020	126	149 School St.	E35	ditch	public	usmhchimneyup	grassdirt	light	moderate	Smoke from ground near manhole in ditch.	-87.8410611	35.6185318
9/9/2020	127	236 Pine St.	E33	woods	private	abandonedsvc	grassdirt	medium	moderate	Smoke from ground around abandoned service.	-87.8403572	35.6198372
9/9/2020	128	219 Spring St.	E28	woods	private	svcconeedscap	grassdirt	light	mild	Cleanout needs cap.	-87.8384012	35.6199664
9/9/2020	129	148 W. Main St.	E25	backyard	public	other	grassdirt	light	severe	Smoke from storm pipe.	-87.8409251	35.6176966
9/9/2020	130	121 W. Main St.	E24	woods	private	svclateral	grassdirt	light	moderate	Smoke from hole in ground over service. Possible post in service pipe.	-87.8397444	35.6183071
9/9/2020	131	141 W. Main St.	E25	ditch	public	svclateral	grassdirt	light	moderate	Smoke from ground may originate from upstream service, near storm ditch.	-87.8403919	35.6177013
9/9/2020	132	101 E. Willow St.	E19	ditch	public	usmhchimneyup	grassdirt	light	moderate	Smoke from ground near manhole.	-87.8386789	35.6186742
5/9/2020	133	E. Willow St. Easement	E18	woods	public	usnhwalldown	grassdirt	light	mild	Smoke could originate from service, smoke from ground. Upstream manhole lid was off.	-87.8382504	35.6186891
9/9/2020	134	E. Willow St. Easement	E5	woods	public	usmhchimneyup	grassdirt	light	mild	Smoke from loose frame seal.	-87.8378205	35.6186411
9/9/2020	135	E. Willow St. Easement	E5	woods	public	sewermainline	grassdirt	light	severe	Smoke from creek. bed near mainline, possible service leak.	-87.8377379	35.6187275
9/9/2020	136	E. Willow St. Easement	E5	woods	public	sewermainline	grassdirt	light	severe	Smoke from creek bed near mainline, possible service leak.	-87.8376679	35.6187209
9/9/2020	137	E. Willow St. Easement, near creek.	E3	woods	public	usmhchimneyup	grassdirt	light	severe	Open lid actively discharging into adjacent creek.	-87.8360914	35.6188439
9/9/2020	138	111 E Main St.	E16	backyard	private	svccleanout	grassdirt	light	moderate	Smoke from water box.	-87.838243	35.6171767
9/9/2020	139	111 E Main St.	E16	backyard	private	roofdrain	gravel	light	mild	Smoke from roof drain.	-87.8383088	35.6171841
9/9/2020	140	111 E. Main St.	E16	backyard	private	svcconeedscap	gravel	light	mild	Smoke from broken roof drain, cleanout. Open cleanout, possibly an abandoned service.	-87.8385459	35.617236
9/9/2020	141	101 W. Main St.	E17	driveway	private	svcconeedscap	asphalt	light	mild		-87.8389909	35.6173049
9/9/2020	142	101 W. Main St.	E17	driveway	private	svcconeedscap	concrete	light	mild	Smoke from broken cleanout cap.	-87.8389638	35.6174043
9/9/2020	143	107 W. Main St.	E17	backyard	private	svclateral	asphalt	light	mild	Smoke from asphalt, likely from service.	-87.8393629	35.6174947
9/9/2020	144	102 N. Mill St.	E14	sideyard	public	catchbasin	asphalt	light	moderate	Smoke from ground around catch basin.	-87.8387088	35.6175729
9/9/2020	145	121 E. Main St.	E12	sideyard	public	svcconeedscap	grassdirt	light	mild	Cleanout needs cap.	-87.8377774	35.6170786
9/9/2020	146	205 E. School St.	E11	backyard	private	privatedrain	grassdirt	light	mild	Smoke from broken private drain.	-87.8370371	35.6175852
9/9/2020	147	201 E. School St.	E11	sidewalk	private	svclateral	concrete	light	moderate	Smoke from crack in sidewalk, likely originating from service.	-87.8368911	35.6173843
9/9/2020	148	508 Jones St.	F35	backyard	private	abandonedsvc	grassdirt	medium	moderate	Smoke from ground near abandoned service.	-87.8454685	35.6213683
9/9/2020	149	206 Catron St.	F30	backyard	private	abandonedsvc	grassdirt	medium	moderate	Smoke from hole in ground, abandoned service below grade.	-87.8426227	35.6213474
9/9/2020	150	325 Spring St.	F17	woods	private	svcconeedscap	grassdirt	light	mild	Cleanout needs cap.	-87.8382714	35.6220852
9/9/2020	151	263 Vaughn Ave.	F38	backyard	private	svccleanout	grassdirt	heavy	moderate	smoke from cleanout, needs cap and collar.	-87.8432584	35.6205233
9/9/2020	152	In woods behind 219 Pine St.	F36	woods	public	usmhchimneyup	grassdirt	medium	moderate	Smoke from manhole frame seal.	-87.8415762	35.6207629
9/9/2020	153	In woods behind 219 Pine St.	F36	woods	public	sewermainline	grassdirt	light	moderate	Smoke from ground over mainline, referenced to middle of 4' span	-87.8414356	35.6209025
9/10/2020	154	222 Spring St.	F23	frontyard	private	abandonedsvc	grassdirt	light	moderate	Smoke from ground around abandoned service.	-87.838173	35.6202227

Linden Smoke Testing Results

Date Observed	Defect Number	Defect Address	Upstream MH Number	Defect Location	Property Type	Smoke Source	Surface Type	Intensity	I/I Potential	Notes:	X	Y
9/10/2020	155	222 Spring St.	F23	frontyard	private	abandonedsvc	grassdirt	medium	moderate	Smoke from ground around abandoned service.	-87.8381624	35.620197
9/10/2020	156	225 Spring St.	F23	sideyard	private	svccleanout	grassdirt	medium	moderate	Smoke from ground around cleanout.	-87.8384165	35.6204235
9/10/2020	157	227 Spring St.	F23	frontyard	private	abandonedsvc	grassdirt	light	moderate	Smoke from ground around abandoned service. Point taken in center of defect.	-87.8382494	35.6204129
9/10/2020	158	227 Spring St	F23	sideyard	private	abandonedsvc	grassdirt	medium	moderate	Smoke from ground around abandoned service. Point taken at center of smoke sources.	-87.8380996	35.6204035
9/10/2020	159	386 Cherry St.	F15	ditch	public	usmhchimneyup	grassdirt	medium	severe	Smoke from ground around manhole near drainage ditch.	-87.8375343	35.6219775
9/10/2020	160	319 Spring St.	F20	ditch	public	svclateral	grassdirt	light	moderate	Smoke from ground near ditch.	-87.8380902	35.6216746
9/10/2020	161	102 Happy Hollow Dr.	F19	sideyard	private	abandonedsvc	grassdirt	light	moderate	Smoke from ground around abandoned service.	-87.8388284	35.6225532
9/10/2020	162	102 Happy Hollow Dr.	F19	sideyard	private	svclateral	grassdirt	light	mild	Smoke from ground near service.	-87.8387354	35.6225275
9/10/2020	163	409 Cherry St.	F19	backyard	private	svccleanout	grassdirt	light	mild	Smoke from ground around broken cleanout, broken below grade.	-87.8384151	35.6225639
9/10/2020	164	318 Breeding Dr.	F13B	sideyard	private	svclateral	concrete	light	mild	Smoke from ground near side walk.	-87.8363682	35.6226207
9/10/2020	165	191 Breedind St.	F13C	sideyard	public	usmhchimneyup	grassdirt	light	mild	Smoke from frame seal.	-87.8365467	35.6219769
9/10/2020	166	919 Breeding St.	F13C	backyard	private	svccleanout	grassdirt	light	mild	Broken cleanout below grade.	-87.8362959	35.6219594
9/10/2020	167	279 E. Main St.	F7	backyard	private	svclateral	grassdirt	light	severe	Smoke from holes in ground over service covering 20 foot span. Point taken at center of span.	-87.8340462	35.6207838
9/10/2020	168	205 Cherry St.	F11	frontyard	private	svclateral	grassdirt	medium	severe	Smoke from multiple holes in ground over service, 125 foot span, point taken at center of span.	-87.835735	35.6194317
9/10/2020	169	263 E. Main St.	F11	sideyard	private	svclateral	grassdirt	light	moderate	Smoke from ground likely from service.	-87.8354183	35.6198171
9/10/2020	170	219 Cherry St.	F10	sideyard	private	svccleanout	grassdirt	light	moderate	Smoke from ground around cleanout.	-87.8356823	35.6203917
9/10/2020	171	37 E. Main St.	F3	woods	public	usmhchimneyup	grassdirt	light	mild	Smoke from frame seal.	-87.8323767	35.6204279
9/10/2020	172	201 Cherry St.	E4	sideyard	private	svclateral	grassdirt	light	mild	Smoke from hole in ground over service.	-87.8369678	35.6188059
9/10/2020	173	201 Cherry St.	E4	ditch	public	usnhwalldown	grassdirt	light	severe	Smoke from holes in ground around manhole. Point taken in middle.	-87.8370394	35.618797
9/10/2020	174	20 State Route 41	E3	ditch	private	svclateral	grassdirt	light	moderate	Smoke from ground over service.	-87.8359254	35.6187412
9/10/2020	175	Cherry St.	E2	woods	public	usmhchimneyup	grassdirt	light	mild	Smoke from ground around frame seal	-87.8354654	35.6190203
9/10/2020	176	WWTP Pump Station	E1B	woods	public	usmhchimneyup	grassdirt	light	mild	Smoke from frame seal and pick hole.	-87.8342602	35.6187012
9/10/2020	177	WWTP Pump Station	E1	ditch	public	usmhchimneyup	grassdirt	light	severe	Missing lid in flood plane.	-87.8337993	35.6185209
9/10/2020	178	402 S. Mill St.	A3CC	backyard	private	svccneedsdap	grassdirt	light	mild	Smoke from open cleanout, needs cap.	-87.8382731	35.607019
9/10/2020	179	103 Hadley Circle	A3CE	sideyard	public	usmhchimneyup	grassdirt	light	mild	Smoke from ground around manhole.	-87.8382177	35.6061541
9/10/2020	180	120 Handley Circle	A3CD	frontyard	private	svccneedsdap	grassdirt	light	mild	Broken cleanout collar and cap.	-87.8363984	35.6072905
9/10/2020	181	165 Handley Circle	A3CC	frontyard	private	svclateral	grassdirt	light	mild	Smoke from ground, possibly from service.	-87.8380242	35.6070198
9/10/2020	182	905 Squirrel Hollow Rd.	A3CA	backyard	private	svccneedsdap	grassdirt	light	mild	Smoke from cleanout, needs cap.	-87.8381761	35.6075242
9/10/2020	183	2758 Squirrel Hollow Rd.	A42	frontyard	public	usmhchimneyup	grassdirt	light	moderate	Smoke from broken frame.	-87.8637394	35.5910351
9/10/2020	184	Squirrel Hollow Rd.	A36	frontyard	public	usmhchimneyup	grassdirt	light	mild	Smoke from frame seal.	-87.862173	35.592485
9/29/2020	185	279 E. Main St.	F8	backyard	private	svccleanout	grassdirt	light	wflood	smoke from ground, likely clean out.	-87.8345477	35.6207638



**Attachment V – Prioritized Sewer Manhole  
Rehabilitation Schedule**

### Linden Manhole Inspection Report

Manhole Number	Street Address/Location	Manhole Depth (ft)	Subject to Ponding	Lid Type	Frame Seal Condition	Manhole Material	Manhole Condition	Comments
A35	2597 Squirrel Hollow Rd. - in grass near road.	10.2	None	Pick	Good	Precast	Needs Attention	15 GPM Pipe@ PCL, evidence of surcharge.
A40	2660 Squirrel Hollow Rd. - in grass.	9.7	None	Pick	Offset & Loose	Precast	Needs Attention	Broken frame and lid.
A42	2760 Squirrel Hollow Rd. - in grass near fence.	5.1	Flooding	Pick	Offset & Loose	Precast	Needs Attention	Frame is severely broken.
A5	104 College Ave. - in storm ditch.	5.2	Runoff	Solid	Offset & Loose	Precast	Needs Attention	No frameseal, frame offset. Recommend water tight lid.
B21	301 S. Mill St. - in sidewalk.	6.3	None	Pick	Offset & Loose	Brick	Needs Attention	Broken brickwork around cone and chimney.
B76	106 Hickory St. - In grass.	8.1	None	Pick	Good	Brick	Needs Attention	Surcharge evidence; +/- 5 GPM leak throughout. Gushing and weeping around wall.
B83A	89 Shea Hollow Dr. - in grass.	6.3	None	Solid	Loose	Precast	Needs Attention	Broken lid, broken frame (severe).
C9A	206 River St. - near storm culvert.	8	Flooding	Solid	Loose	Brick	Needs Attention	Frame, lid, and chimney are severely broken.
E1	Easement near WWTP pump station.	8.8	None		Good	Brick	Needs Attention	Missing lid, in flood plane.
F33	116 Jones St. - in road near fire hydrant.	7.5	Runoff	Pick	Loose	Precast	Needs Attention	estimated 15 gpm.
F6B	65 Hwy. 13 - edge of road	9.8	Runoff	Pick	Good	Brick & Precast	Needs Attention	Lid is broken in half.
F9	203 Cherry St. - in road	6.9	None	Pick	Good	Liner	Needs Attention	Heavy roots blocking flow; roots throughout; liner through causing poor flow and catching debris.
A12	101 Wiggs Dr. - in road.	6.2	None	Solid	Good	Precast	Poor	Heavy roots throughout.
A27	236 Southwood Dr. - in grass.	5.2	None	Solid	Loose	Precast	Poor	Broken frame, I/I staining at lower wall joint.
A29	223 Cedar Ave. - in road.	5.8	None	Solid	Good	Precast	Poor	Roots, soil, I/I staining at line2 PCN.
B11	110 Young St. - in back yard.	5.5	None	Pick	Good	Liner	Poor	Heavy roots throughout.
B13	200 Shelton St. - in road.	8.5	None	Pick	Good	Liner	Poor	5 gpm leak at PCN1.
B18A	277 Shea Hollow Dr. - in front yard.	4.5	Ponding	Pick	Good	Precast	Poor	Heavy debris assumed from upstream.
B75	157 Elm Ln. - in crop field near ditch.	4.9	Ponding	Pick	Loose	Precast	Poor	Heavy debris, I/I staining, below grade.
B78	Intersection of S. Mill St. and Hickory St. - In grass.	6.3	None	Pick	Offset & Loose	Brick	Poor	Broken frame seal, broken brickwork.

**Linden Manhole Inspection Report**

Manhole Number	Street Address/Location	Manhole Depth (ft)	Subject to Ponding	Lid Type	Frame Seal Condition	Manhole Material	Manhole Condition	Comments
B80	Intersection of Perry St. and S. Mill St. - in sidewalk.	5	None	Pick	Good	Brick	Poor	Roots and broken brick throughout.
E12	123 E. School St. - In road.	6.9	None	Pick	Loose	Brick	Poor	Staining and silt on bench and trough.
E14	Intersection of N. Mill St. and E. School St. - In road.	9.1	Runoff	Pick	Good	Brick	Poor	Soil and staining throughout.
E24	Intersection of Robbin St. and W. School St. - In road.	7.9	Runoff	Pick	Good	Liner	Poor	Broken trough; +/- 10 GPM leak @ L4 w/ 90% clarity.
E33	274 Pine St. - Across road in grass.	5.9	None	Solid	Good	Brick	Poor	Surcharge evidence.
E38	213 Pine St. - In road.	5.6	Runoff	Pick	Loose	Brick	Poor	Broken brickwork.
E4	Spring St. Easement	11.2	None	Solid	Loose	Brick	Poor	Heavy surcharge evidence; holes in ground near MH; I/I evidence throughout.
E41	207 Willow St. - In road.	5.2	Runoff	Pick	Loose	Brick	Poor	Heavy soil throughout.
E5	Spring St. Easement	8.8	None	Pick	Loose	Brick	Poor	Loose frame/risers; staining from I/I.
F13	319 Cherry St. - near driveway.	5.4	None	Solid	Good	Precast	Poor	Soil visible at wall/bench joint.
F14	319 Cherry St. - near ditch.	6.6	None	Pick	Good	Brick	Poor	Lid broken; roots at Line2 PCN as well as the bench and wall.
F15	Spring St. and Cherry St. - edge of road.	6.8	Flooding	Solid	Loose	Brick	Poor	Heavy debris throughout, bad frame, surchargs out of manhole.
F22	302 Sping St. - in grass.	5.3	Ponding	Pick	Good	Brick	Poor	Roots and I/I evidence throughout.
F34	116 Jones St. - in ditch.	8.1	Flooding	Pick	Loose	Precast	Poor	Heavy I/I staining throughout.
F35	123 Jones St. - in yard/ditch.	10.2	Flooding	Pick	Loose	Precast	Poor	Bottom wall joint leaking around 80% of joint.
A10A	990 Squirrel Hollow Rd. - shoulder of road.	5.1	Ponding	Solid	Good	Precast	Fair	NVP
A11	1071 Squirrel Hollow Rd. - in road.	6.4	None	Solid	Good	Precast	Fair	NVP
A14	121 Riverside Dr. - in front yard.	7.8	None	Solid	Good	Precast	Fair	Heavy trough debris.
A16	135 Riverside Dr. - in road.	6.5	None	Solid	Good	Precast	Fair	Roots around frame seal.
A18A	1132 Squirrel Hollow Rd. - across the street.	6.1	None	Pick	Loose	Precast	Fair	Frame and chimney cracked, on evidence of infiltration.
A18	1220 Squirrel Hollow Rd. - back entrance.	9.1	None	Solid	Loose	Precast	Fair	Crack in frame.
A2	Squirrel Hollow Dr. and Averett Ln.	5.6	Runoff	Pick	Good	Brick	Fair	Roots at line 2.
A21	127 Cabin Dr. - back yard.	8	None	Solid	Good	Precast	Fair	Light staining throughout.
A22	127 Cabin Dr. - in road.	8.7	Ponding	Solid	Loose	Precast	Fair	NVP

**Linden Manhole Inspection Report**

Manhole Number	Street Address/Location	Manhole Depth (ft)	Subject to Ponding	Lid Type	Frame Seal Condition	Manhole Material	Manhole Condition	Comments
A24	415 Cedar St. - in road.	7.2	Ponding	Solid	Good	Precast	Fair	Moderate staining at cone.
A28	202 Cedar Ave. - in road.	14.3	None	Solid	Good	Precast	Fair	NVP
A3	Hwy 13 and E. Brooklyn St. - in road.	5	None	Solid	Loose	Brick	Fair	NVP
A32	134 Bethel Rd. - in grass near driveway.	9.1	None	Solid	Good	Precast	Fair	Surcharges to top of manhole.
A36	2691 Squirrel Hollow Rd. - in grass near road.	9.9	None	Pick	Good	Precast	Fair	NVP
A3A	(Hens & Hogs) 837 Squirrel Hollow Rd. - across street.	5.4	None	Pick	Good	Brick	Fair	NVP
A3B	857 Squirrel Hollow Rd. - shoulder of road.	6.4	None	Vented	Good	Brick	Fair	Brickwork on chimney needs work.
A3CC	402 S. Mill St. - in field near tree line.	6	None	Solid	Loose	Precast	Fair	No frameseal, wrong lid for frame.
A3CE	103 Hadley Circle - in grass by tree.	4.7	None	Solid	Loose	Precast	Fair	Major frame offset, debris in manhole.
A4	968 Squirrel Hollow Rd. - near traffic light.	3	Ponding	Pick	Good	Brick	Fair	Broken handle on lid, brickwork, and some staining.
A41	2718 Squirrel Hollow Dr. - in parking space near building.	4.3	None	Pick	Good	Precast	Fair	Manhole was surcharged. Blockage between A41 and A40.
A5A	104 College Ave. - in grass behind school.	4.1	Runoff	Pick	Good	Brick	Fair	No trough, frame is broken.
A6	115 College Ave. - in street.	6.1	None	Pick	Good	Brick	Fair	NVP
B12	102 Young St. - in woods near creek.	6.7	Flooding	Pick	Good	Liner	Fair	Broken bench.
B15	239 Brooklyn Ave. - in road.	4.8	None	Pick	Good	Brick	Fair	NVP
B18	224 Webb Ave. - in grass near driveway.	4.7	None	Solid	Good	Liner	Fair	Very clear flow from lines 2, 3, and 4.
B19	222 Sycamore Dr. - in road.	6.3	Runoff	Pick	Good	Brick	Fair	NVP
B2	Elm Ln. pump station - outside gate.	7.8	None	Solid	Good	Precast	Fair	Debris on bench.
B20	303 Sycamore Dr. - in road.	4.7	Runoff	Pick	Good	Brick	Fair	Brickwork on chimney needs work.
B22	Intersection of W. Brooklyn St. and S. Mill St. - in road.	4.7	None	Pick	Good	Brick	Fair	Soil and silt throughout.
B25	Intersection of W. Brooklyn St. and Brooklyn Ave. - in road.	7	Runoff	Pick	Good	Brick	Fair	Soil around frame and chimney.
B26	171 W. Brooklyn St. - entrance to lot.	5.7	Ponding	Pick	Good	Brick	Fair	Trough debris.
B26A	171 Brooklyn St. - in parking lot of BLDG A.	6.7	None	Pick	Good	Precast	Fair	Light roots at Pipe2 PCN.
B27	126 Flower St. - In front yard.	5	None	Solid	Good	Brick	Fair	Manhole discharges.
B29	147 Brooklyn Ave. - in back yard.	8.4	Ponding	Solid	Good	Liner	Fair	NVP
B35	211 Webb Ave. - in field near tree line.	8.8	Flooding	Solid	Good	Brick	Fair	Surcharges to top of manhole.

**Linden Manhole Inspection Report**

Manhole Number	Street Address/Location	Manhole Depth (ft)	Subject to Ponding	Lid Type	Frame Seal Condition	Manhole Material	Manhole Condition	Comments
B36	130 Beech St. - in road.	7.4	None	Pick	Good	Brick	Fair	NVP
B37	Near 127 Beech St. - in road.	6.5	None	Pick	Good	Brick	Fair	Evidence of past surcharge.
B38	113 Factory, in Beech St. behind property - in road.	4.5	None	Pick	Good	Brick	Fair	NVP
B41	121 Factory St. - in yard near tree line.	11.3	None	Pick	Loose	Liner	Fair	Offset & Offset frame.
B51	Intersection of Hill St. and W. Main St.	3.3	None	Pick	Good	Brick	Fair	NVP
B55	215 Hill St. - in road.	8	None	Pick	Good	Brick	Fair	NVP
B57	Near intersection of Hill St. and Majors St.	5.5	None	Pick	Good	Brick	Fair	NVP
B58	North of Hill St. and Majors St.	5.8	None	Pick	Good	Brick	Fair	Inflow dish present.
B6	Near creek opposite of Elm Ln. and S. Mill St.	6.4	Flooding	Bolted	Loose	Liner	Fair	Missing bolts.
B61	403 Hill St. - in grass.	3.4	None	Pick	Good	Brick	Fair	Frame offset, light roots at PCN1.
B68	Intersection of Brooklyn Ave. and Maple St.	5.6	None	Pick	Good	Brick	Fair	NVP
B6A	301 S. Mill St. - in grass near fence.	7.7	Ponding	Solid	Good	Liner	Fair	In drainage ditch.
B6B	115 Shelton St. - in grass.	5.4	None	Solid	Good	Liner	Fair	Roots on bench and trough.
B6D	126 Shelton St. - in road.	5.2	None	Pick	Good	Brick	Fair	Roots - fine.
B6E	136 Shelton St. - in road.	5.3	None	Pick	Good	Brick	Fair	Roots - fine.
B71	119 S. Mill St. - in road.	5.3	None	Pick	Good	Brick	Fair	NVP
B77	101 Hickory St. - In road.	6.8	None	Pick	Loose	Brick	Fair	Offset & Surcharges, heavy debris.
B78A	92 Medical Dr. - in parking lot.	5.5	None	Pick	Good	Precast	Fair	Roots medium from Pipe2.
B78B	92 Medical Dr. - in grass near power pole.	4.9	None	Solid	Loose	Precast	Fair	MH is surcharged, blockage in out going pipe.
B79	Intersection of Medical Dr. and S. Mill St. - In grass.	5.2	None	Pick	Good	Brick	Fair	Broken brick and debris throughout.
B81	123 S. Mill St. - in sidewalk.	5.2	Runoff	Pick	Good	Brick	Fair	Some soil visible.
B82	134 Beech St. - in road.	6.2	None	Pick	Good	Brick	Fair	NVP
B82A	219 Shea Hollow Dr. - in road.	6.3	Ponding	Solid	Good	Precast	Fair	Broken frame and roots at frame seal.
B84	102 Hill View Dr. - on Shea Hollow Dr.	6.8	Ponding	Solid	Good	Liner	Fair	Broken lid.
C1	223 River St. - 1 manhole upstream from pump station.	5.6	None	Pick	Good	Brick	Fair	NVP
C14	112 S. Poplar St. - In road.	4.2	Ponding	Solid	Good	Brick	Fair	NVP
C15	124 E. Main St. - Behind building.	4.4	None	Vented	Good	Brick	Fair	Trough debris L2-4; L1 blockage.

**Linden Manhole Inspection Report**

Manhole Number	Street Address/Location	Manhole Depth (ft)	Subject to Ponding	Lid Type	Frame Seal Condition	Manhole Material	Manhole Condition	Comments
C16	Intersection of Walnut St. and River St. - In road.	7.6	None	Pick	Good	Brick	Fair	NVP
C17	Intersection of Walnut and Church - In road.	5.2	None	Pick	Loose	Brick	Fair	NVP
C18	111 Church St. - In road.	9.5	None	Pick	Good	Brick	Fair	Bench Debris.
C18A	96 E. Main St. - behind building in grass.	2.7	None	Pick	Good	Brick	Fair	NVP
C3	217 River St. - In road.	6.2	None	Pick	Loose	Brick	Fair	NVP
C6	206 Perry St. - In road.	5.6	None	Pick	Loose	Brick	Fair	NVP
C7	Intersection of Poplar and Perry	7.7	None	Pick	Good	Brick	Fair	NVP
C9	206 River St. - In road.	6.5	None	Pick	Good	Brick	Fair	NVP
E10	215 E. Main St. - near bush/gazebo.	5.5	Runoff	Pick	Loose	Brick	Fair	Multiple risers loose.
E11	N. Poplar St. and E. School St. - In road.	6.4	None	Pick	Good	Brick	Fair	Wall staining.
E13	122 N. Mill St. - In grass near driveway.	4.6	None	Pick	Good	Brick	Fair	Surcharge evidence.
E15	105 W. Main St. - Back corner.	6	None	Pick	Good	Brick	Fair	Brickwork on chimney needs work.
E16	111 N. Walnut St. - In back lot.	5.7	None	Solid	Good	Brick	Fair	NVP
E17	Intersection of W. School St. and Spring St. - In road.	6	None	Pick	Good	Brick	Fair	NVP
E18	Spring St. Easement	8.4	None	Solid	Good	Brick	Fair	NVP
E19	Spring St. Easement	6.3	None	Solid	Loose	Liner	Fair	Bad frame seal.
E1B	WWTP pump station easement.	6.7	Ponding	Pick	Good	Precast	Fair	NVP
E2	E. Main St. Easement	6.4	Flooding	Solid	Loose	Brick	Fair	Heavy surcharge evidence in and around manhole.
E20	Intersection of Willow St. and Spring St. - In road.	6.6	None	Pick	Good	Liner	Fair	NVP
E22	121 Spring St. - In road.	4	Runoff	Pick	Good	Liner	Fair	NVP
E24B	141 W. School St. - in grass @ unit D-1.	4.3	None	Solid	Loose	Precast	Fair	Wrong lid for frame, poor fit.
E26	214 Spring St. - edge of road.	6.3	None	Solid	Good	Brick	Fair	NVP
E3	E. Main St. Easement	6.1	Flooding	Solid	Loose	Brick	Fair	Heavy surcharge evidence outside manhole, directly into adjacent creek.
E30	200 Birch St. - in grass.	8.9	None	Solid	Good	Liner	Fair	NVP
E35	149 W. School St. - In brush beside road.	4.8	Flooding	Pick	Loose	Brick	Fair	Approximate 6" frame offset.
E36	123 Willow St. - In road.	6.3	None	Pick	Good	Brick	Fair	NVP
E40	205 Willow St. - Near driveway.	4.9	Runoff	Pick	Loose	Brick	Fair	Loose risers.

**Linden Manhole Inspection Report**

Manhole Number	Street Address/Location	Manhole Depth (ft)	Subject to Ponding	Lid Type	Frame Seal Condition	Manhole Material	Manhole Condition	Comments
E42	Intersection of Vaughan Ave. and W. Willow St. - In road.	5	Runoff	Pick	Loose	Brick	Fair	NVP
E43	Intersection of Vaughan Ave. and W. Willow St. - In road.	10	None	Pick	Good	Brick	Fair	Heavy soil throughout.
E44	201 Vaughan Ave. - In road.	4.6	Ponding	Pick	Good	Brick	Fair	Debris throughout.
E4A	Spring St. Easement	8.2	None	Solid	Good	Brick	Fair	NVP
E6	Old 911 building.	4.9	None	Pick	Good	Brick	Fair	Light roots, heavy roots previously removed by city. Causes surcharge.
E8	203 Ash St. - In street.	9.5	None	Pick	Good	Brick	Fair	Light surcharge due to downstream blockage.
E9	221 Ash St. - in grass near ditch.	8.2	None	Solid	Good	Brick	Fair	Light surcharge due to downstream blockage.
F1	Easement near WWTP pump station.	10.2	Flooding	Pick	Good	Precast	Fair	Heavy surcharge evidence in and around manhole.
F10	219 Cherry St. - in road.	8	None	Pick	Good	Brick	Fair	Debris on bench.
F11	263 E. Main St. - in Cherry St.	6	None	Pick	Good	Brick	Fair	NVP
F16	325 Spring St. - in dirt driveway.	10.7	Runoff	Pick	Good	Liner	Fair	NVP
F17	Spring St. Easement	9	None	Pick	Good	Precast	Fair	NVP
F19	104 Happy Hollow - in road.	6.1	None	Pick	Good	Liner	Fair	NVP
F2	Squirrel Hollow Dr. easement - near WWTP pump station	7.9	Flooding	Watertight	Good	Brick	Fair	Roots at frame and wall; heavy surcharge evidence.
F21	311 Spring St. - in road.	5.5	None	Pick	Good	Brick	Fair	Potential sag in Line1, poor grade in trough.
F23	225 Spring St. - in road.	5	None	Pick	Good	Brick	Fair	Heavy Hydrogen Sulfide evidence.
F25	Spring St. Easement	7.8	None	Pick	Good	Precast	Fair	NVP
F26	Spring St. Easement	8.3	None	Pick	Good	Precast	Fair	NVP
F27	Spring St. Easement	6.6	None	Pick	Good	Precast	Fair	NVP
F28	Spring St. Easement	8.1	None	Pick	Good	Precast	Fair	NVP
F29	Catron St. Easement	6.2	None	Pick	Good	Precast	Fair	NVP
F31	200 Catron St.	8.3	Flooding	Pick	Good	Precast	Fair	Chipped manhole frame.
F36	Vaughn Ave. Easement	7.1	None	Pick	Good	Precast	Fair	NVP
F37	Vaughn Ave. Easement	12.8	None	Pick	Good	Precast	Fair	NVP
F4	354 E. Main St. - near boat ramp (North)	5.1	Ponding	Watertight	Good	Brick	Fair	Heavy surcharge evidence in and around manhole.
F5	20 State Route 100 - off dirt road.	5.4	None	Solid	Good	Brick	Fair	Evidence of past surcharge.
A13	121 Riverside Dr. - in back yard.	9.7	None	Solid	Good	Precast	Good	NVP

**Linden Manhole Inspection Report**

Manhole Number	Street Address/Location	Manhole Depth (ft)	Subject to Ponding	Lid Type	Frame Seal Condition	Manhole Material	Manhole Condition	Comments
A15	113 Riverside Dr. - in front yard near driveway.	4.4	None	Solid	Good	Precast	Good	NVP
A20	214 Southwood Dr. - behind shed.	4.9	Runoff	Solid	Good	Precast	Good	NVP
A26	222 Southwood Dr. - in grass.	5.1	None	Solid	Good	Precast	Good	NVP
A31	2529 Squirrel Hollow Rd. - in grass near pump station.	8.1	Ponding	Solid	Good	Precast	Good	Backs up from pump station, discharges from MH.
A33	187 Bethel Rd. - across street in grass.	6.2	Flooding	Solid	Good	Precast	Good	NVP
A34	2529 Squirrel Hollow Rd. - in grass near pump station.	13.1	Ponding	Solid	Good	Precast	Good	Backs up from pump station.
A37	2673 Squirrel Hollow Rd. - in grass near building.	5.1	None	Vented	Good	Precast	Good	NVP
A37A	2691 Squirrel Hollow Rd. - in grass near ditch.	6.5	Flooding	Watertight	Good	Precast	Good	Small leak @ Lin1 PCN.
A38	2673 Squirrel Hollow Rd. - in grass near building.	7.8	None	Pick	Good	Precast	Good	NVP
A39	2673 Squirrel Hollow Rd. - in grass near building.	6.9	Ponding	Vented	Good	Brick	Good	NVP
A3BA	853 Squirrel Hollow Dr. - in parking lot.	6.4	None	Solid	Good	Brick	Good	NVP
A3BB	857 Squirrel Hollow Rd. - in parking lot of Dollar General.	4.5	None	Vented	Good	Precast	Good	NVP
A3CA	138 Hadley Circle - in field.	3.3	Ponding	Solid	Loose	Precast	Good	Rocks in trough.
A3CB	114 Hadley Circle - in road.	8.8	None	Solid	Good	Precast	Good	NVP
A3CD	136 Hadley Circle - in road.	4.2	None	Solid	Good	Precast	Good	NVP
B10	129 Brookside Dr. - in road.	9.3	None	Pick	Good	Brick	Good	NVP
B14	214 Shelton St. - in road.	5.2	None	Pick	Good	Brick	Good	NVP
B14A	240 Meadowbrook Dr. - in road.	3.8	None	Pick	Good	Brick	Good	NVP
B17	238 Webb Ave. - in front yard near driveway.	4.5	None	Pick	Good	Liner	Good	NVP
B23	114 W. Brooklyn St. - in grass near road.	5.8	Runoff	Pick	Good	Brick	Good	NVP
B24	130 W. Brooklyn Ave. - in ditch.	6.6	None	Pick	Good	Brick	Good	NVP
B26B	171 Brooklyn St. - in parking lot of BLDG D.	4.1	None	Vented	Good	Precast	Good	NVP
B28	125 Flower St. - In driveway.	7.6	None	Solid	Good	Liner	Good	NVP
B3	130 Elm Ln. - In road.	8.9	None	Pick	Good	Liner	Good	NVP
B30A	147 Brooklyn Ave. - in grass.	6.3	Ponding	Pick	Good	Brick	Good	NVP



**Linden Manhole Inspection Report**

<b>Manhole Number</b>	<b>Street Address/Location</b>	<b>Manhole Depth (ft)</b>	<b>Subject to Ponding</b>	<b>Lid Type</b>	<b>Frame Seal Condition</b>	<b>Manhole Material</b>	<b>Manhole Condition</b>	<b>Comments</b>
B32	206 Webb Ave. - in road.	4.3	None	Pick	Good	Brick	Good	NVP
B33	Corner of Webb Ave. and Sycamore St.	5.3	None	Pick	Good	Brick	Good	NVP
B38A	105 Beech St. - in grass near driveway.	5	None	Solid	Good	Precast	Good	NVP
B4	118 Elm Ln. - in road.	6.1	None	Pick	Loose	Liner	Good	NVP
B42	113 Factory St. - in road.	8.5	None	Pick	Good	Liner	Good	NVP
B43	113 Factory Dr. - near tennis courts.	11.4	None	Solid	Good	Liner	Good	NVP
B5	100 Elm Ln. - edge of road.	5.1	None	Pick	Good	Liner	Good	Surcharges, debris in trough.
B50	368 W. Main St. - in road near curb.	5.4	None	Pick	Good	Brick	Good	NVP
B52	201 Hill St. - in road.	7.7	None	Pick	Good	Brick	Good	NVP
B53	113 Tower St. - in road.	4.3	None	Pick	Good	Brick	Good	NVP
B54	119 Tower St. - in road.	8.8	None	Pick	Good	Brick	Good	NVP
B56	226 Hill St. - in road.	4.8	None	Pick	Good	Brick	Good	NVP
B59	314 Hill St. - in road.	3.8	None	Pick	Good	Brick	Good	Roots inside pipe 2.
B60	324 Hill St. - in road.	5.2	None	Pick	Good	Brick	Good	Light roots at PCN1.
B64	113 Brooklyn Ave. - in road.	7	None	Pick	Good	Brick	Good	NVP
B66	Intersection of Brooklyn Ave. and W. Church St.	6.6	None	Pick	Good	Brick	Good	NVP
B67	111 Brooklyn Ave. - in street	6	None	Pick	Good	Brick	Good	NVP
B69	Near intersection of River St. and Maple St.	6.3	None	Pick	Good	Brick	Good	NVP
B6F	152 Shelton St. - in road.	4.6	Runoff	Pick	Good	Brick	Good	NVP
B7	Intersection of S. Mill St. and Brookside Dr. - in grass.	6.4	None	Pick	Good	Brick	Good	NVP
B70	141 Maple St. - in road.	7.1	None	Pick	Good	Brick	Good	NVP
B73	220 Brookllyn Ave. - in road.	7.5	None	Pick	Good	Brick	Good	NVP
B8	110 Brookside Dr. - in road.	4.4	None	Pick	Good	Brick	Good	NVP
B86	325 W. Main St. - near edge of storm ditch.	6.4	Flooding	Pick	Good	Precast	Good	NVP
B87	111 Brooklyn Ave. - in road.	6	None	Pick	Good	Brick	Good	NVP
B9	116 Brookside Dr. - in road.	4.6	None	Pick	Good	Liner	Good	NVP
C10	E. Church St - In front of firehouse.	6	None	Pick	Good	Brick	Good	NVP
C11	Intersection of Church St. and Oak St. - In road.	4.6	None	Pick	Good	Brick	Good	NVP
C12	Intersection of S. Poplar and River	7.1	None	Pick	Good	Brick	Good	NVP
C13	S. Poplar St - In road - Church of Christ	7.1	None	Pick	Good	Brick	Good	NVP
C19	104 S. Mill St. - Entrance to alley.	4.5	Runoff	Pick	Good	Brick	Good	NVP

**Linden Manhole Inspection Report**

Manhole Number	Street Address/Location	Manhole Depth (ft)	Subject to Ponding	Lid Type	Frame Seal Condition	Manhole Material	Manhole Condition	Comments
C1A	River St. Pump Station - Extra manhole	9.8	Ponding	Solid	Good	Precast	Good	Manhole surcharges.
C4	207 Perry St. - In treeline near River St.	5.8	Runoff	Solid	Good	Brick	Good	Wrong lid for frame, poor fit.
C5	211 Perry St. - In road.	4.2	None	Solid	Good	Brick	Good	NVP
C8	104 Perry St. - In road.	5.2	None	Pick	Good	Brick	Good	NVP
E1A	Easement near WWTP pump station.	10.7	None	Pick	Good	Precast	Good	NVP
E21	126 Spring St. - In road.	5.8	None	Pick	Good	Liner	Good	Trough debris.
E23	121 Spring St. - in woods.	8.4	None	Solid	Good	Liner	Good	NVP
E24A	168 W. School St. - in grass near ditch.	2.5	Flooding	Pick	Good	Precast	Good	NVP
E25	147 W. Main St. - In back yard.	5.6	None	Solid	Good	Brick	Good	NVP
E27	215 Spring St. - In driveway.	6.5	Runoff	Pick	Good	Brick	Good	NVP
E29	107 Willow St. - in grass near tree line.	9.7	None	Solid	Good	Liner	Good	NVP
E31	120 W. Willow St. - In road.	6.6	None	Pick	Good	Liner	Good	NVP
E34	233 Pine St. - In road.	11.7	None	Pick	Good	Brick	Good	NVP
F13A	318 Breeding Ln. - in road.	11.9	None	Solid	Good	Precast	Good	NVP
F13B	323 Breeding St. - in road @ Breeding Ln.	11.7	None	Solid	Good	Precast	Good	NVP
F13C	191 Breeding Ln. - on hill beside house.	6.2	None	Solid	Good	Precast	Good	NVP
F20	319 Spring St. - in road.	7.1	None	Pick	Good	Brick	Good	NVP
F3	354 E. Main St. - near boat ramp (South)	7.5	None	Watertight	Good	Precast	Good	Manhole surcharges to top.
F30	206 Catron St. - in woods behind house.	9.3	None	Pick	Good	Precast	Good	NVP
F32	101 Jones St. - at Catron St.	5.8	None	Pick	Good	Precast	Good	NVP
F37A	223 Vaughn Ave. - back yard	16.3	None	Pick	Good	Precast	Good	NVP
F38	215 Vaughn Ave. - near driveway	12	None	Pick	Good	Precast	Good	NVP
F7	Hwy 13 - substation easement	4.2	None	Solid	Good	Liner	Good	Lid is broken.
A10	Near 1071 Squirrel Hollow Rd.							
A17	Near 141 Riverside Dr.							NVP
A23	Near 124 Cabin Dr. - possibly paved.							
A25	Near 208 Southwood Dr. - paved not verified.							
A30	Near 23 Cedar Ave.							
A3C	892 Squirrel Hollow Rd							
A7	Near Perry County Public Library on College Ave.							
A8	Near Perry County High School							
A9	Near Linden Elementary School							

Linden Manhole Inspection Report

Manhole Number	Street Address/Location	Manhole Depth (ft)	Subject to Ponding	Lid Type	Frame Seal Condition	Manhole Material	Manhole Condition	Comments
B1	In ravine near Elm Ln. pump station.							
B16	Near 223 Brooklyn Ave.							
B1A	In ravine near Elm Ln. pump station.							
B30	Near 148 Brooklyn Ave.							
B31	Near 204 Brooklyn Ave							Paved, Verified, painted.
B39	Near 136 Brooklyn Ave.							Paved, verified.
B40	Near 135 Brooklyn Ave.							
B44	Near 215 W. Main St.							
B45	Near intersection of Beech St. and W. Main St.							
B46	Near 226 W. Main St.							
B47	Near 240 W. Main St.							
B48	Near 103 Patterson Dr.							
B49	Near W. Main St and Factory St.							NVP
B62	Near 407 Hill St.							
B63	Near 128 Brooklyn Ave.							Paved, verified.
B63A	Near 407 Hill St.							
B65	Near 112 Brooklyn Ave.							
B6C	110 Shelton St. - in gravel.							
B72	115 S. Mill St. - in alley							
B74	Near 210 Brooklyn Ave.							Paved, verified.
B83	131 Shea Hollow Dr. - in road.		None	Pick	Can't Open Lid	Brick		Lid frozen shut.
B85	102 Hill View Dr. - on Shea Hollow Dr.							Buried, verified.
C2	Intersection of Hillcrest & River							
E28	Near 215 Spring St. - Possibly paved.							
E32	Near Pine St. and Birch St. - Possibly paved.							
E35A	149 W. School St. - in parking lot.		None	Pick	Good	Brick		Broken down vehicle parked on MH lid.
E37	Near 210 Pine St. - Possibly paved.							
E39	Near 215 Pine St. - Possibly paved.							NVP
E7	Near 123 W. School St.							
F12	Near 215 Spring Ct.							
F18	Near Cherry St. and Happy Hollow.							NVP
F24	Near Cherry St. and Happy Hollow.							NVP

Linden Manhole Inspection Report

Manhole Number	Street Address/Location	Manhole Depth (ft)	Subject to Ponding	Lid Type	Frame Seal Condition	Manhole Material	Manhole Condition	Comments
F6	Near 30 Lobelville Hwy. - behind Shell station							
F6A	Hwy 13 - substation easement							
F8	Hwy 13 - substation easement							NVP

## **Attachment VI – 2018 Flow Monitoring Study**

# FINAL REPORT



## Town of Linden, TN Temporary Flow Monitoring

Spring 2020

# UTILITY TECHNOLOGIES

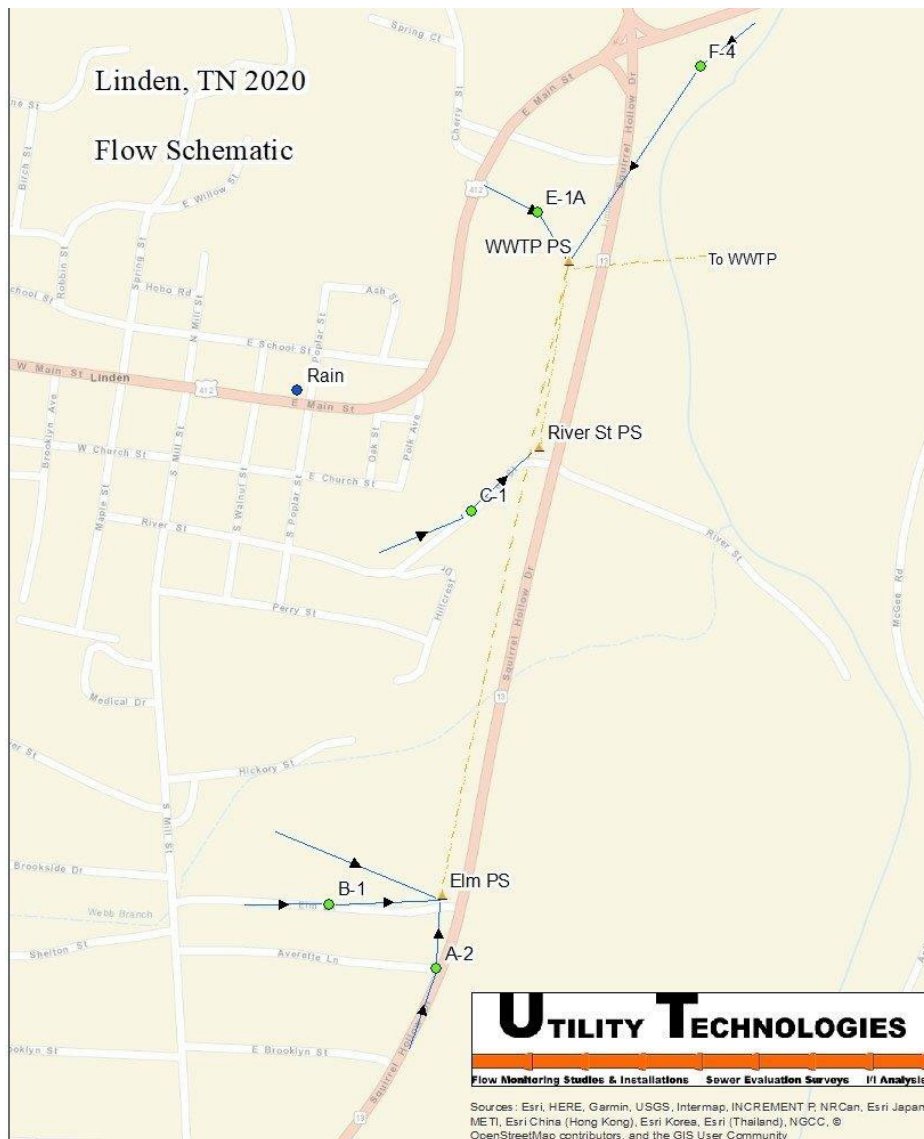


Flow Monitoring Studies & Installations   Sewer Evaluation Surveys   I/I Analysis

## INTRODUCTION

The Town of Linden, Tennessee manages a sewer collection system and pumping facilities which serves its local residents and businesses. During periods of heavy rainfall, excessive inflow/infiltration (I/I) enters the system sometimes resulting in overflows. The Town's consultant, TLM Associates, contracted with Utility Technologies (UT) to install flow monitors in strategic locations within the collection system in order to better assess the nature and magnitude of the I/I problem.

UT installed five flow monitors and one rain gauge on February 19, 2020. Locations are identified on the Flow Schematic at the bottom of this page. Equipment was maintained and collected regularly until being removed on April 22, 2020. Several significant rainfall events were recorded during this period.



## RESULTS

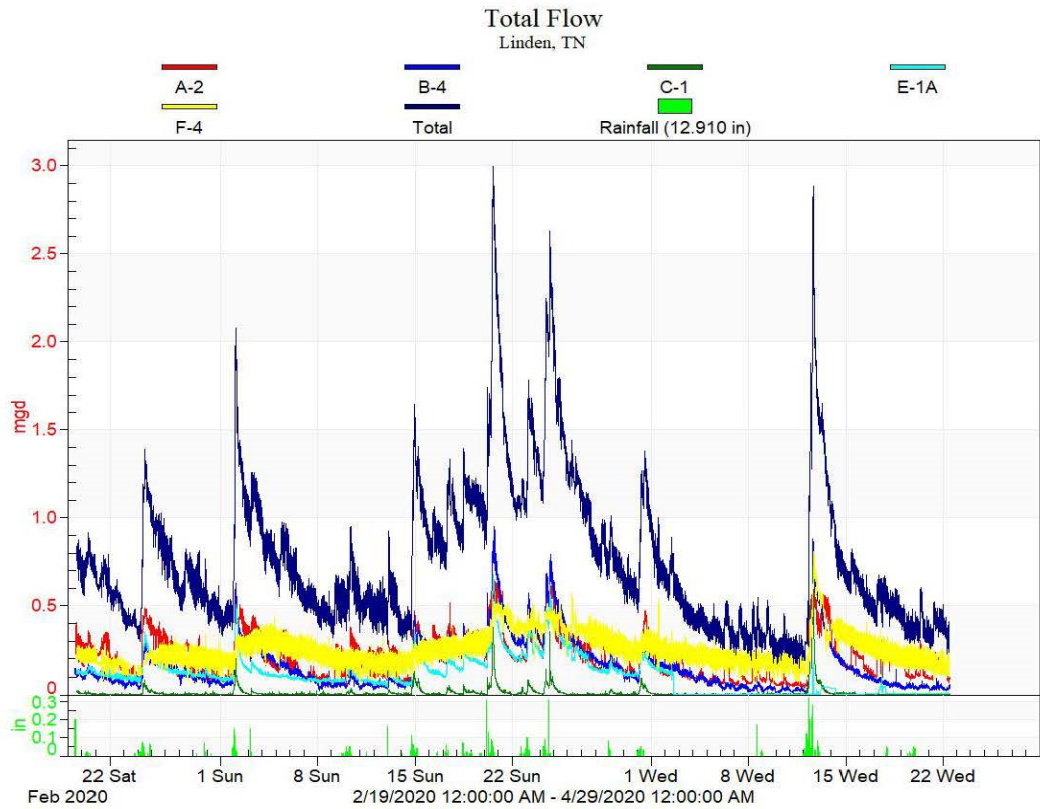
Almost 13 inches of rainfall was recorded during the study period. Eight rain events were greater than ½ inch and are further detailed in the below table.

<b>Rainfall Summary Town of Linden, TN</b>		
<b>Date</b>	<b>Total</b>	<b>Peak 15-minute</b>
February 23-24, 2020	0.70	0.07
March 01-02, 2020	1.01	0.15
March 14-15, 2020	0.92	0.11
March 20, 2020	1.23	0.31
March 22-23, 2020	0.69	0.10
March 24, 2020	1.02	0.31
March 31, 2020	0.78	0.05
April 12-13, 2020	3.25	0.32

Each of these rain events caused noticeable reactions at all of the monitored locations. The Total Flow graph presented on the following page illustrates flow data for each site as well as their combined total flow. Each monitor in the Linden study was independent of each other (i.e., no monitored location flowed into another monitored location). Daily flow rates near 0.350 MGD during drier periods increased to near 3.0 MGD during peak rainfall periods. All monitored locations surcharged during most (if not all) the above rain events except for Site C-1 (the manhole's elevation is significantly higher than the downstream pump station).

Data quality was considered generally good at all locations. Site C-1 had such low flow during the drier portions of the study period that the sensor was not covered but still recorded reasonable velocities. Two items of note occurred which had negligible impact on data quality but are, nonetheless, worthy of discussion. Site E-1A's flows abruptly fell from near 0.120 MGD to near zero on April 2, 2020 and never returned to normal for the remainder of the study period (it surcharged during the April 12-13 rain event due to backwater from the Treatment Plant PS). The decrease in flow may be due to an upstream blockage. Depths at Site F-4 were only 3.5 inches deep during installation and first round data collect. Late April 21, however, the site surcharged to 45+ inches. Except for a few very brief periods, F-4 remained surcharged for the rest of the study. The surcharged depths are likely due to raised pumping elevations at the downstream Treatment Plant PS (maintenance on the PS was being performed during the few non-surge periods?).





A brief commentary is provided for each monitored location in the Flow Data section.

## **FLOW DATA**

Site Information Sheets and Data Graphs are presented for each monitored location on the following pages. The Site Information Sheets provide critical information and photographs pertaining to each monitor's location, manhole depth, pipe diameter, and hydraulic conditions. The Data Graphs illustrate recorded depth, velocity, and flow data for each monitor. Also, a brief commentary is provided for the location.

All Graphs and Sheets are also provided electronically. Recorded depth, velocity, and flow data is provided in Excel format.

## Site Information Sheet

**Project Name:** Linden, TN 2020

**Site Name:** A-2

**Address:** Hwy 13 Bypass at Averett Lane

**Location Comments:** In street.

**Manhole Number:** A-2

**Area Sketch**



**Area Photograph**



**Down Photograph**



**Pipe Photograph**



**Pipe Type:** PVC

**Pipe Diameter:** 7.88" x 7.63"

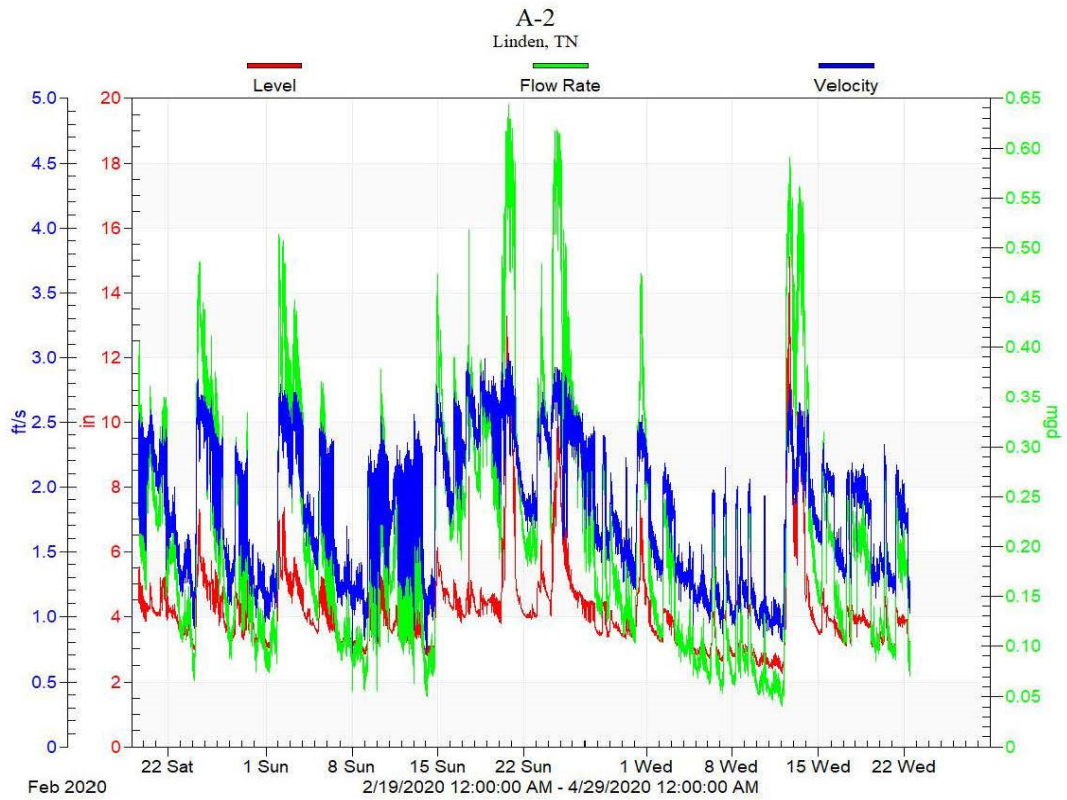
**MH Depth:** 5.5'

**Depth/Velocity:** 5.38" @ 2.82 fps

**Hydraulic Comments:** Slightly choppy, swift flow. Starts backing up when upstream force main is active.

**Safety Comments:** Road site use cones.

**Other Site Comments:** No special precautions.



Site A-2 measured flows from the southern-most portion of the Town and was one of two monitors measuring flow to the Elm Lane PS (a third tributary to the PS was not monitored). Flow rates near 0.094 MGD increased to over 0.600 MGD during peak wet weather conditions. Dry weather depths and velocities averaged 3.0 inches at 1.0 fps in an 8-inch pipe; peak recorded depths were 15 inches.



# Site Information Sheet

**Project Name:** Linden, TN 2020

**Site Name:** B-4

**Address:** 118 Elm Street

**Location Comments:** In street near edge of road.

**Manhole Number:** B-4

**Area Sketch**



**Area Photograph**



**Down Photograph**



**Pipe Photograph**



**Pipe Type:** Slipliner

**Pipe Diameter:** 9.38" RND

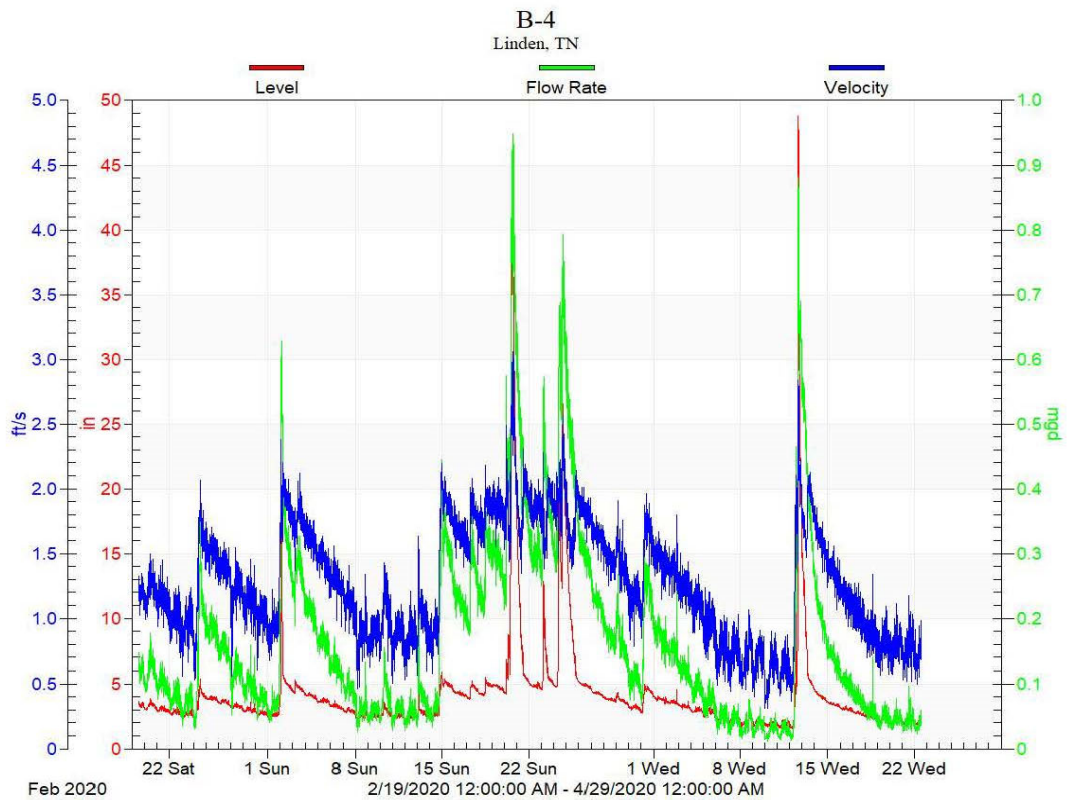
**MH Depth:** 6.0'

**Depth/Velocity:** 3.27" @ 1.5 fps

**Hydraulic Comments:** Smooth, steady flow.

**Safety Comments:** Road site use cones.

**Other Site Comments:** No special precautions.



Site B-4 measured flows from the Shelton St/Brookside Dr area and was one of two monitors measuring flow to the Elm Lane PS (a third tributary to the PS was not monitored). Flow rates near 0.035 MGD increased to over 0.900 MGD during peak wet weather conditions. Dry weather depths and velocities averaged 2.10 inches at 0.7 fps in a 10-inch pipe; peak recorded depths were 49 inches.

# Site Information Sheet

**Project Name:** Linden, TN 2020

**Site Name:** C-1

**Address:** 223 River Street.

**Location Comments:** In street.

**Manhole Number:** C-1

**Area Sketch**



**Area Photograph**



**Down Photograph**



**Pipe Photograph**



**Pipe Type:** VCP

**Pipe Diameter:** 7.75" H x 7.63" W

**MH Depth:** 5.3'

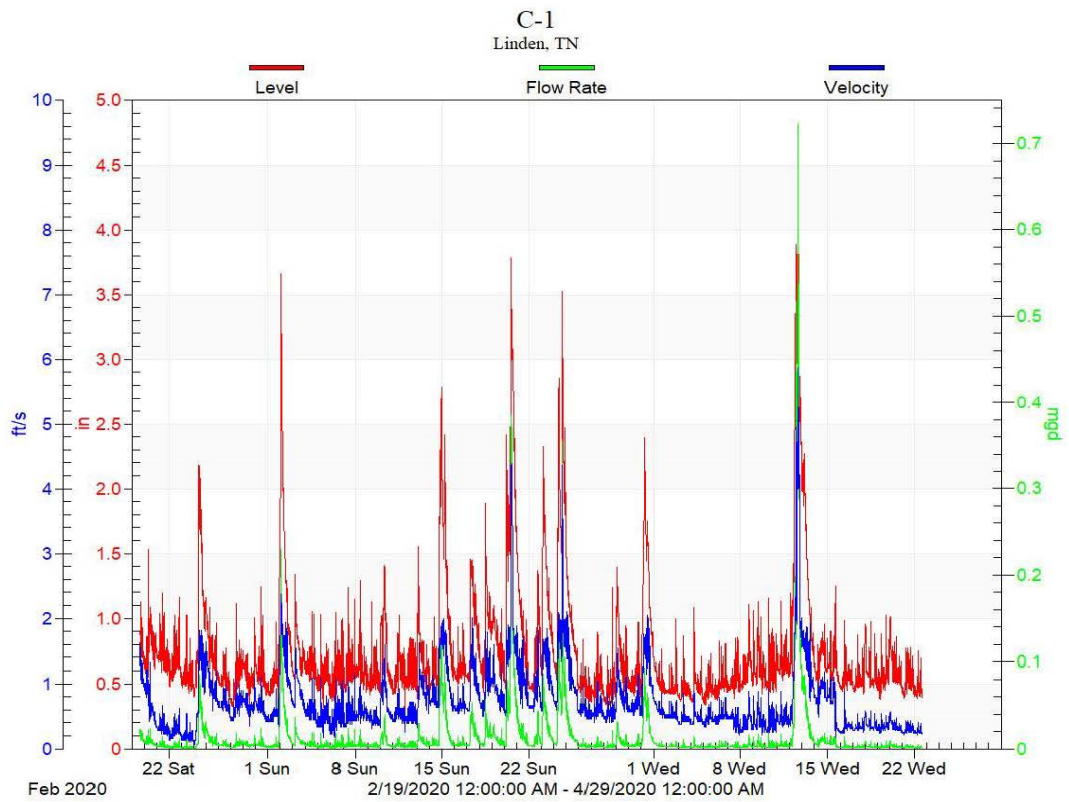
**Depth/Velocity:** 0.88" @ 1.5 fps

**Hydraulic Comments:** Shallow, smooth flow.

**Safety Comments:** Road site use cones.

**Other Site Comments:** No special precautions.





Site C-1 measured flows tributary to the River Street PS. Very low flow rates near 0.003 MGD increased to over 0.700 MGD during peak wet weather conditions. Dry weather depths and velocities averaged 0.5 inches at 0.5 fps in an 8-inch pipe; peak recorded depths were 4.5 inches.



# Site Information Sheet

**Project Name:** Linden, TN 2020

**Site Name:** E-1A

**Address:** Hwy 13 bypass

**Location Comments:** Behind old WWTP

**Manhole Number:** E-1A

**Area Sketch**



**Area Photograph**



**Down Photograph**



**Pipe Photograph**



**Pipe Type:** VCP

**Pipe Diameter:** 6.75" RND

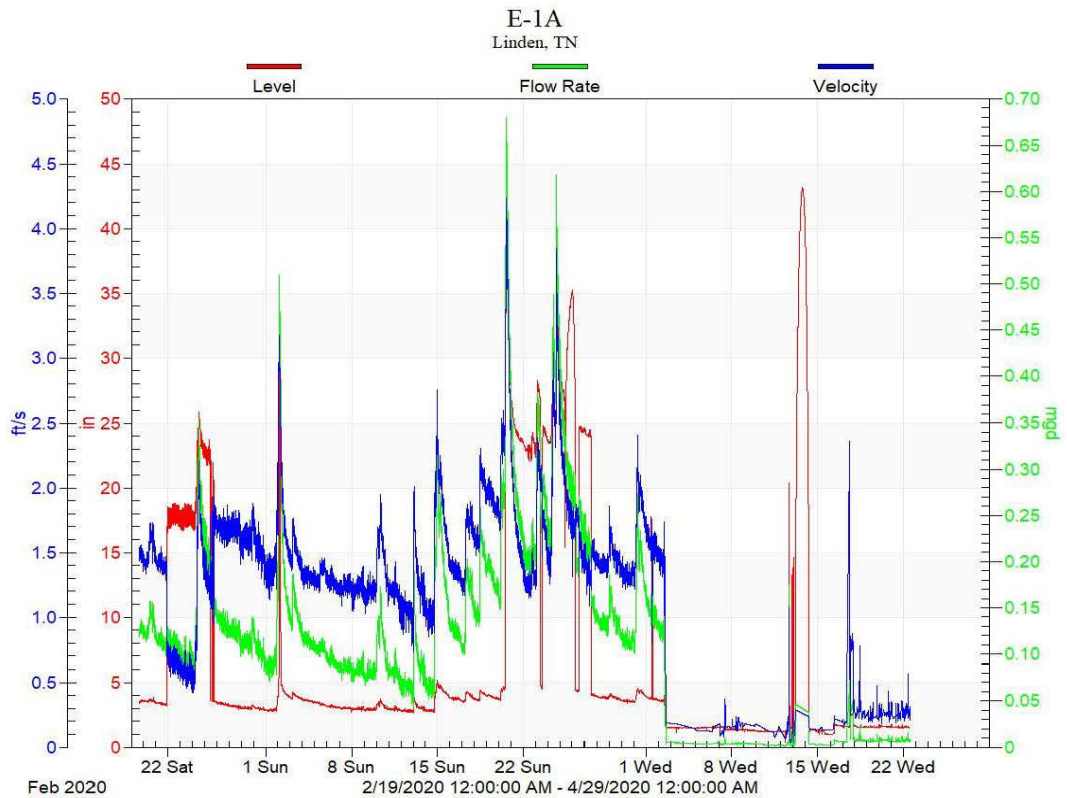
**MH Depth:** 9.5'

**Depth/Velocity:** 3.38" @ 1.25 fps

**Hydraulic Comments:** Smooth, steady flow.

**Safety Comments:** Egress to site is steep, use caution.

**Other Site Comments:** No special precautions.



Site E-1A measured flows from the downtown/School St portion of the Town and was one of two monitors measuring flow to the Treatment Plant PS. Flow rates near 0.072 MGD increased to almost 0.700 MGD during peak wet weather conditions. Drier weather depths and velocities averaged 2.7 inches at 1.1 fps in an 8-inch pipe; peak recorded depths were near 43 inches.

Site E-1A's flows abruptly fell from near 0.120 MGD to near zero on April 2, 2020 and never returned to normal for the remainder of the study period (it surcharged during the April 12-13 rain event due to backwater from the Treatment Plant PS). This latter portion of the study period contained both the lowest and highest flows at other locations, so the above-stated dry and peak flow rates may not be totally comparable with other locations.

# Site Information Sheet

**Project Name:** Linden, TN 2020

**Site Name:** F-4

**Address:** Hwy 100 at Buffalo River access.

**Location Comments:** Near Buffalo River access road.

**Manhole Number:** F-4

**Area Sketch**



North

**Area Photograph**



**Down Photograph**



**Pipe Photograph**



**Pipe Type:** CIPP

**Pipe Diameter:** 9.38" H x 9.50" W

**MH Depth:** 5.1'

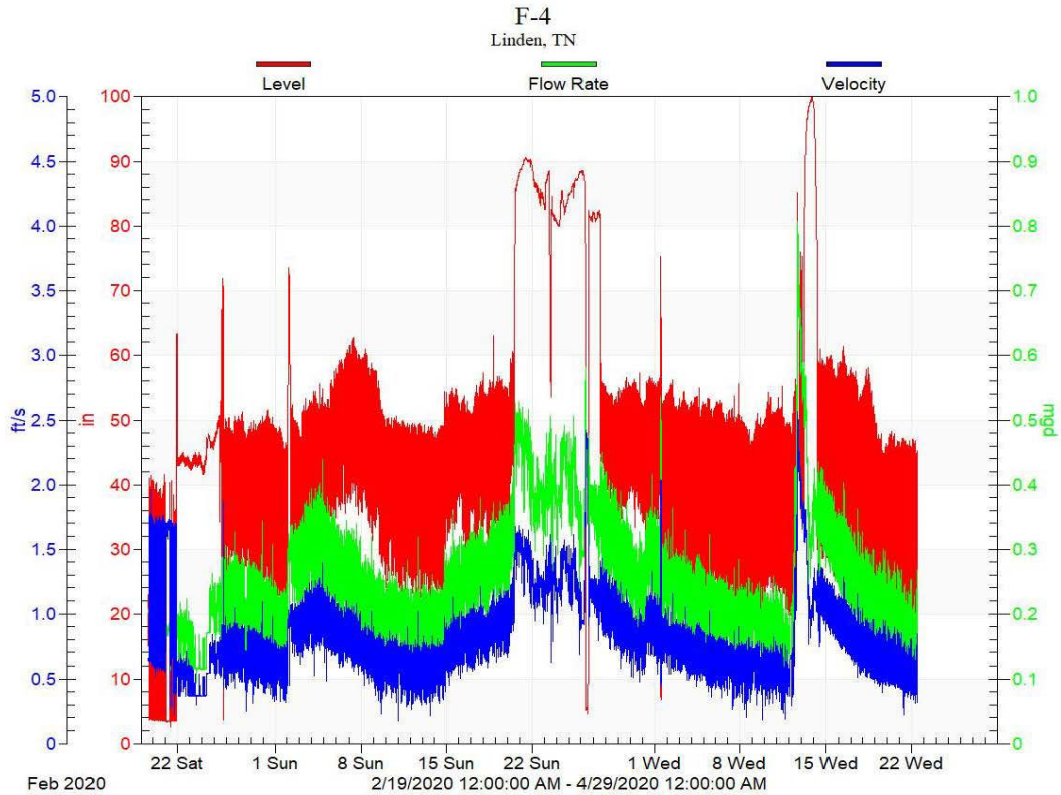
**Depth/Velocity:** 3.63" @ 1.81 fps

**Hydraulic Comments:** Slightly choppy, swift when flowing. Backs up from Old WWTP pump station.

**Safety Comments:** No special precautions.

**Other Site Comments:**





Site F-4 measured flows from the northern-most portion of the Town and was one of two monitors measuring flow to the Treatment Plant PS. Flow rates near 0.164 MGD increased to near 0.800 MGD during peak wet weather conditions. Dry weather depths and velocities averaged 31 inches (surcharged) at 0.5 fps in a 10-inch pipe; peak recorded depths were 100 inches (the manhole is only 61 inches deep).

Depths at Site F-4 were only 3.5 inches deep during installation and first round data collect. Late April 21, however, the site surcharged to 45+ inches. Except for a few very brief periods, F-4 remained surcharged for the rest of the study. The surcharged depths are likely due to raised pumping elevations at the downstream Treatment Plant PS.

# Site Information Sheet

**Project Name:** Linden, TN 2020

**Site Name:** Linden Rain

**Address:** City Hall

**Location Comments:** Maintenance lot behind building.

**Manhole Number:** N/A

**Area Sketch**



**Area Photograph**



**Down Photograph**



**Pipe Photograph**



**Pipe Type:** N/A

**Pipe Diameter:** N/A

**MH Depth:** N/A

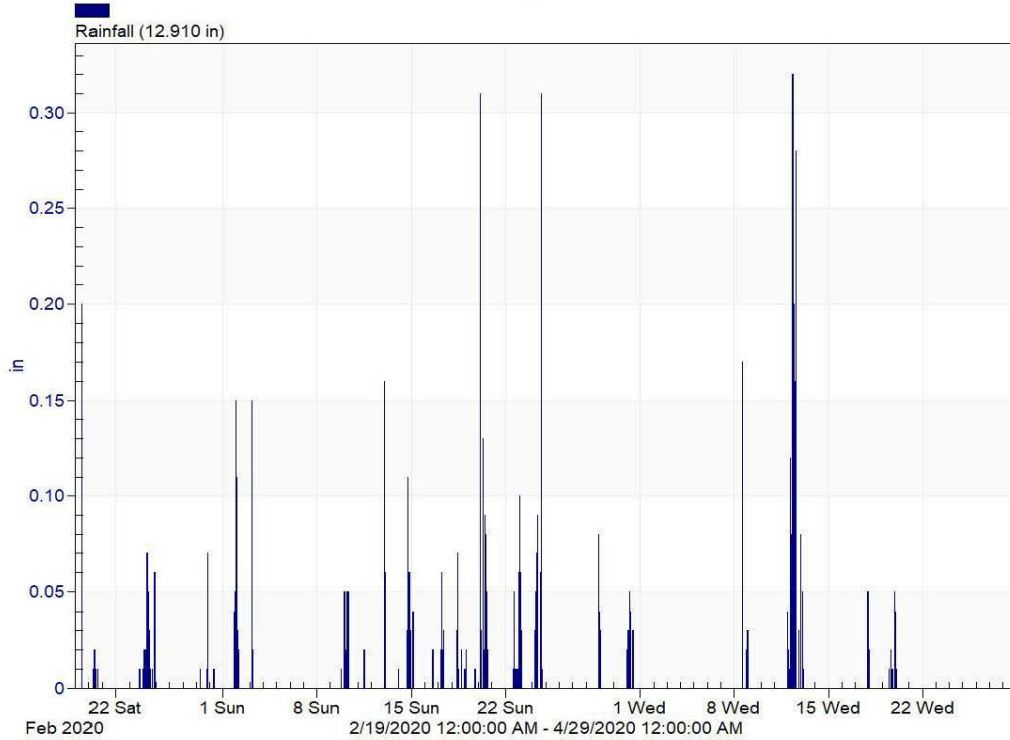
**Depth/Velocity:** N/A

**Hydraulic Comments:** N/A

**Safety Comments:** No special precautions.

**Other Site Comments:**

Linden Rain  
Linden, TN



Almost 13 inches of rainfall was recorded during the study period. Eight rain events were greater than ½ inch and are further detailed in the below table.

Rainfall Summary Town of Linden, TN		
Date	Total	Peak 15-minute
February 23-24, 2020	0.70	0.07
March 01-02, 2020	1.01	0.15
March 14-15, 2020	0.92	0.11
March 20, 2020	1.23	0.31
March 22-23, 2020	0.69	0.10
March 24, 2020	1.02	0.31
March 31, 2020	0.78	0.05
April 12-13, 2020	3.25	0.32