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Technical Memorandum

To: Dave Ford – Town of Wolfeboro, NH File No. 2286.08
Cc: Keith Pratt, Ross Baker – Underwood Engineers
From: David J. Mercier, P.E. 
Date: March 14, 2019 (Draft); September 30, 2019 (Final)
Subject: **WOLFEBORO 2018 I/I TV INSPECTION SUMMARY**

BACKGROUND:

In recent years, the Town of Wolfeboro, New Hampshire (the Town) has been working to assess its wastewater collection system, identify infiltration and inflow (I/I) sources, and create an Asset Management Program. At this point, the Asset Management Program has been created, the entire collection system has been flow isolated, and all manholes (with the exception of twelve) have been inspected. In 2018 the Town retained Underwood Engineers (UE) to perform additional TV inspections of sewers to continue progression of inspecting the entire system, and in hopes of identifying additional I/I sources to address. Including the 2018 data, 33,550 out of 59,000 linear feet of Town sewer has been TV inspected.

Based on past I/I evaluations performed by UE, a map was generated highlighting prioritized areas for CCTV inspection. Areas selected for the 2018 I/I inspection were located in the Mill Street and Lehner Street Pump Station sub basins and can be seen on the map found in *Appendix A*. The areas mainly consisted of sewer located on Mill Street, Depot Street, School Street, Railroad Ave, Christian Ridge Easement, and Kingswood Regional High School property. Approximately 6,550 LF of pipe was inspected, with pipe diameters ranging from 6 in. to 12 in.

EVALUATION:

Manhole Inspections

Although official manhole inspections were not part of the scope of work, Eastern Pipe Service did include manhole defects where observed in their sewer CCTV inspection logs in April 2018. A summary table is provided in *Appendix B* which includes manhole I/I, structural observations, and remarks that were noted during the CCTV inspection. Note: since the aggressive I/I investigation project completed in 2016, all of the Wolfeboro manholes have been officially inspected except for twelve (12) which were either paved over or could not be located.

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Flow Isolation Testing

Although flow isolation was not performed as part of the 2018 investigations, Flow Assessment Services performed flow isolation testing during the 2015 and 2016 I & I investigations. A map of testing completed to date is provided in *Appendix C*, which indicates that between 2015 and 2016, 100% of the Wolfeboro collection system has been tested with flow isolation. Also provided in *Appendix C* is the 2015 CCTV and flow isolation testing summary tables for the Lehner St. and Mill St. sub basins, as well as the 2016 flow isolation testing summary table for the Sewall Rd., Elm St., Clark Rd., and Mill St. sub basins.

Sewer Mainline CCTV

Eastern Pipe Service performed CCTV inspection of mainline sewers on April 11th through April 13th 2018. In all, 6,549 linear feet was evaluated noting mainline defects, active I/I, signs of previous I/I, and suspected I/I from service laterals. A map of the areas in the collection system that were CCTV inspected is provided in *Appendix A*, and a summary of the inspection and testing results is provided in *Appendix B*. This 2018 sewer TV inspection along with the previous 2016 inspections sum to 33,550 LF of sewer that has been CCTV'd or 57% of the gravity sewer collection system.

WWTF Flows During CCTV Investigations

WWTF flows remained fairly constant during the 2018 CCTV inspections. The early April time frame was selected for CCTV because it typically corresponds with high flow in the system and offers CCTV operators opportunity to directly observe I/I. Although April 2018 had a total of 4.8 inches of rain, the influent WWTF flows remained relatively low and constant during the sewer CCTV inspection as indicated in the following table based on WWTF Daily Operations Reports.

Table 1 – WWTF Influent Flow – During Gravity Sewer CCTV

Date	Investigation Description	Precipitation (in)	Daily WWTF Influent Flow (MGD)
4/11/18	Sewer CCTV	0.04	0.245
4/12/18	Sewer CCTV	0.00	0.250
4/13/18	Sewer CCTV	0.24	0.247

Based on recent WWTF flow records, annual average WWTF flows generally range between 0.26 – 0.32 MGD. Low flow periods (Fall, Winter) average around 0.2 MGD. The highest 2018 WWTF influent flows peaked to 0.4 to 0.5 MGD due to heavy rainfall during the months of July, August, and November. Because groundwater conditions were not ideal for directly observing I/I during the 2018 CCTV investigations, we relied on signs of previous leakage (stains, mineral

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deposits, etc.) as part of our analysis in addition to directly observed I/I to formulate our recommendations.

CCTV Findings

A summary of our findings including defects for each area are attached in *Appendix B*. The estimated I/I from mainline defects (public) and suspected I/I from service laterals (private) observed during mainline CCTV investigations is summarized in the following table.

Table 2 – Estimated Private and Public I/I Summary

Study Area	Estimated Public I/I (gpm)	Estimated Private I/I (gpm)	Total (gpm)
Lehner St. PS Basin	1.3	0	1.3
Mill St. PS Basin	1.4	0.2	1.6
Subtotal	2.7	0.2	2.9
Percent of Total	93%	7%	100%

*Note: Table includes observed public I/I, observed private I/I, and estimated public I/I based on signs of previous leakage

Given that overall wastewater flows were low despite the April time frame, only minimal active I/I was observed. Key observations from the TV investigations include:

Mainline Defects (in 6,549 linear feet of sewer)

- Eleven (11) mainline defects were visually observed with active infiltration.
- Twenty (20) mainline defects were observed that exhibited signs of previous leakage, such as stains or mineral deposits.
- Forty-Seven (47) mainline defects such as cracks were observed that did not show signs of previous leakage.

Service Related Defects

- Three (3) services exhibited active suspected I/I or signs of previous leakage during mainline CCTV including one “infiltration runner” with an estimated flow of 1 gpm.
- Six (6) other service defects were also observed that did not exhibit signs of previous leakage.

Manhole Related Defects

- Nearly all of the manholes were composed of precast concrete or have already been lined.
- One (1) manhole exhibited I/I.
- One (1) manhole was buried.

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- One (1) manhole was obstructed.

CONCLUSIONS:

Most of the observed mainline defects did not rate high enough under PACP coding to trigger immediate action, although some defects exhibited some active I/I or signs of previous I/I. However, small defects can deteriorate over time and infiltration migration can occur when only limited rehabilitation is performed in an area. It should be noted that this same infiltration migration phenomenon can also occur when only mainline defects are repaired and lateral defects remain.

The 2018 phase of I/I investigation found somewhat lower I/I than previous investigations. This is due to the fact that the target area (*Appendix A*) for this study had less severe mainline defects that were actively leaking, as well as a smaller number of previous signs of I/I. The study area did find many lower priority defects such as cracks or grease deposits, with some pipe exhibiting defects along their entire length. In total, the investigation concluded that there is approximately 3,888 GPD of public I/I, and 288 GPD of private I/I being contributed in the area investigated. The areas of most concern are those with defect ratings of 4 or 5 as shown in the summary table in *Appendix B* and listed below:

- Depot St. - MH 75A to MH 61
- Depot St. - MH 75 to MH 61A
- Depot St. - MH 61B to MH 59
- Glendon St. - MH 76B to MH 63A
- Railroad Ave. - MH 62 to MH 61A
- Railroad Ave. - MH 62B to MH 62A
- Lehner St. - MH 67A to the Lehner St. Pump Station
- Crescent Lake Ave. - MH 6 to MH 4B
- Christian Ridge Easement - MH 4 to MH 5
- Kingswood Regional High School - MH 23 to MH 22
- Kingswood Regional High School - MH 22 to MH 21

RECOMMENDATIONS:

Budgetary costs for the recommended sewer rehabilitation for each area inspected is provided in *Appendix B*. The total budgetary costs for these improvements are approximately **\$203,700**. The different types of recommended repairs are summarized in the following tables. Note: **Tables 3 and 4** present raw construction costs only.



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Table 3 - Budgetary Mainline Rehabilitation Costs

Area	Total Length of CCTV	Root Removal \$500	Mainline Point Repair for Actively Leaking or SPL \$2,000	Mainline Point Repair for Other Mainline Defects \$2,000	CIPP Line Pipe from MH to MH \$100/LF	Excavation Repair \$300/LF	Lateral/Break-In Rehab \$2,500	Install 2-way C/O and Investigate from Lateral \$2,500	AREA TOTALS
Lehner St. PS Basin	2,861	1	2	23	81	0	7	2	\$81,100
Mill St. PS Basin	3,689	0	4	26	335	42	3	2	\$118,600
Totals	6,549	\$500	\$12,000	\$98,000	\$41,600	\$12,600	\$25,000	\$10,000	\$199,700

Table 4 - Budgetary Manhole Rehabilitation Costs

	Reset Frame & Cover, Replace Corbel EA \$1,500	Grout Leaks VF \$250	Grout Leaking MH Pipe Con. EA \$1,000
Totals	1	10	0
Total Cost:	\$1,500	\$2,500	\$0

It is important that we put the 2018 recommended I/I rehabilitation projects into perspective with the previously recommended I/I rehabilitation projects before making recommendations for the proposed 2019 I/I rehabilitation design project. **Table 5** includes the 2015 and 2016 recommended rehabilitation projects identified as projects A-O, and the 2018 recommended rehabilitation projects are shown as P-R, with each project location distinguished by manhole reaches. A map showing the 2015, 2016, and 2018 investigation project locations can be found in *Appendix D*. From **Table 5**, it can be seen that the projects from the 2018 investigations do not rank very high on the list of potential I/I projects, since the 2018 projects P, Q, and R are ranked 9th, 12th, and 17th respectively. The Town has requested that Underwood Engineers design an I/I Rehabilitation Project in 2019 for \$400K worth of work. As the highest ranked project was completed in 2018 (Project A1), this could include projects ranked 2-9 and part of project 10. This makes financial sense as projects 2-10 are all projected to cost less than \$40/gal for the I/I removed. This compares to the cost for new treatment facilities which ranges from \$20 to \$40/gal for smaller plants.



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Table 5
Town of Wolfeboro, NH
Recommended I/I Removal Projects - Mill St and Lehner St Pumping Station Basins

Project A/R	Description	Project Investigation Year	Project Location	Mainline Costs	Manhole Costs	Total Repair Costs	Erg. Dsn & Const. 25%	Contingency 20%	Total Project Cost	Total Sewer Length LF	Adder for all laterals	Flow Isolation Area I/I GPD	Projected I/I Removal %	Projected I/I Removal GPD	Cost/gal Removed at High Groundwater Condition \$/GPD	Relative Rank 1-17
Sewer Replacement Projects																
A1	Dockside VC Replacement ¹	2015	MH 58 - MH 60	\$ 39,700	\$ 14,850	\$ 75,350	\$ 18,900	\$ 16,000	\$ 110,250	92		30960	70%	21672	\$ 5.1	1
M	Edwood Tee, AC Stub Replacement	2015	MH 19 - Lateral	\$ 12,050	\$ 3,100	\$ 15,150	\$ 3,100	\$ 3,000	\$ 18,150	13		1440	70%	1006	\$ 18.0	4
A	South Main St. VC Replacement	2015	MH 56 - MH 143B	\$ 728,600	\$ 20,425	\$ 749,025	\$ 187,300	\$ 150,000	\$ 1,086,325	2131		18720	70%	13104	\$ 82.9	14
I	Railroad Ave Sewer Replacement	2015	MH 162 - MH 62B	\$ 46,900	\$ 1,500	\$ 48,400	\$ 12,100	\$ 10,000	\$ 70,500	134		720	70%	504	\$ 139.9	15
G	King St. VC Replacement	2015	MH 115 - MH 122	\$ 191,350	\$ 6,900	\$ 198,250	\$ 49,600	\$ 40,000	\$ 287,850	461		2160	70%	1512	\$ 190.4	16
A2	South Main St. VC Replacement	2016	MH 55A (Buried) - MH 65	\$ 671,350	\$ 11,340	\$ 682,690	\$ 170,700	\$ 137,000	\$ 990,390	1511		4260	70%	2992	\$ 332.1	18
F	N. Main St./Rte. 109 VC Replacement	2015	MH 185 - MH 160 MH 53 - MH 51 MH 51 - MH 50A MH 51 - MH 50B MH 51 - MH 50C	\$ 414,500	\$ 7,125	\$ 421,625	\$ 105,500	\$ 85,000	\$ 612,125	1857		1152	54%	622	\$ 984.0	20
Sewer Rehabilitation Projects																
H	Brewster Academy VC Replacement	2015	MH 174 - MH 173	\$ 60,000	\$ 1,500	\$ 61,500	\$ 15,400	\$ 13,000	\$ 89,900	1079	\$ 90,000	7920	40%	3168	\$ 6.4	2
N	Sewall Rd. Open Cut Repairs	2016	MH 144 - MH 162	\$ 6,000	\$ 4,700	\$ 10,700	\$ 2,700	\$ 3,000	\$ 16,400	438		2880	30%	864	\$ 19.0	5
C	North Main St. Lateral Rehab. 1	2015	MH 16 - MH 18A MH 21 - MH 24A MH 24 - SMH	\$ 61,010	\$ 7,830	\$ 68,840	\$ 22,300	\$ 18,000	\$ 129,140	1990	\$ 290,000	12300	40%	4920	\$ 26.2	6
L	South Main St. ROW Mainline Rehab.	2015	MH 149 - MH 156	\$ 20,000	\$ 9,620	\$ 29,620	\$ 7,400	\$ 6,000	\$ 42,920	693	\$ 70,000	3600	40%	1440	\$ 29.8	7
E	North Main St. Lateral Rehab. 2	2015	MH 138A - MH 129 MH 129 - MH 134 MH 86A - MH 80A MH 80A - MH 80B MH 80A - MH 67 MH 66B - MH 66C MH 66B - MH 66F MH 66 - MH 67	\$ 100,000	\$ 5,100	\$ 105,100	\$ 26,300	\$ 22,000	\$ 153,400	775	\$ 50,000	10800	40%	4320	\$ 35.5	8
B	Mill St./Libbey St. Lateral Rehab.	2015	MH 2A - MH 5 MH 2A - MH 2C MH 33 - MH 34 MH 32 - MH 32A MH 34 - MH 36	\$ 107,250	\$ 12,400	\$ 119,650	\$ 30,000	\$ 24,000	\$ 173,650	3101	\$ 140,000	11088	40%	4435	\$ 39.2	10
J	Center St. Lateral Rehab.	2015	Various MH 144 - MH 145 MH 145 - MH 146.1 MH 146.1 - MH 146	\$ 36,750	\$ 12,430	\$ 49,180	\$ 12,300	\$ 10,000	\$ 71,480	1014	\$ 130,000	2880	40%	1152	\$ 62.0	13
I/I Projects from 2018 Investigations																
K	S. Main St./Green St./Clark Rd. Lateral Rehab.	2015	Various	\$ 12,600	\$ -	\$ 12,600	\$ 3,200	\$ 3,000	\$ 18,800	42		720	70%	504	\$ 37.3	9
O	Trenchless Rehab Project (Various Places)	2016	MH 62B - MH 62A MH 124 - MH 126 MH 126 - MH 128A MH 14 - MH 5	\$ 10,000	\$ -	\$ 10,000	\$ 2,500	\$ 2,000	\$ 14,500	624		720	40%	288	\$ 50.3	12
D	Endicott St. lateral Rehab & Mainline Investigation	2015	Various	\$ 177,100	\$ 4,000	\$ 181,100	\$ 45,300	\$ 37,000	\$ 263,400	5883		3312	40%	1325	\$ 198.8	17
P	Railroad Ave DJF Replacement ²	2018	Various	\$ 3,423,530	\$ 781,700	\$ 4,205,230	\$ 634,000	\$ 4,539,230	\$ 4,539,230	23,264	\$ 770,000	151,920	52%	78,681	\$ 57.7	
Q	Mill St./Bay St./Christian Ridge Lateral Rehab ³	2018	Various													
R	Trenchless Rehab Project (Various Places) ⁴	2018	Various													
Total																

Notes
1 Docksides VC Replacement has been completed.
2 For Project P from the 2018 investigations, the flow isolation value from the 2016 investigations was used, since no flow isolation was performed in 2018.
3 For the Projects Q & R from the 2018 investigations, the flow isolation values were assumed based on the visually observed and estimated I&I flows, since no flow isolation was performed in 2018.

APPENDIX A

APPENDIX A-5

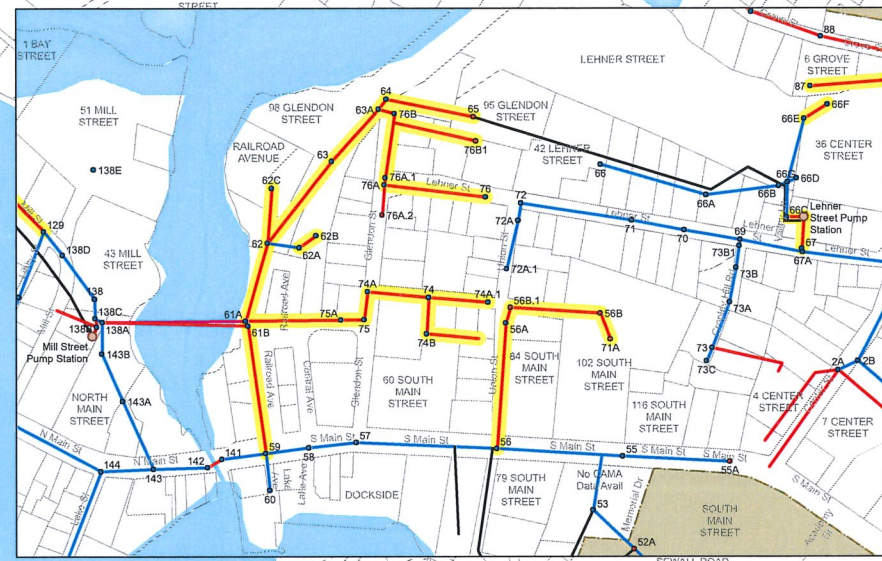
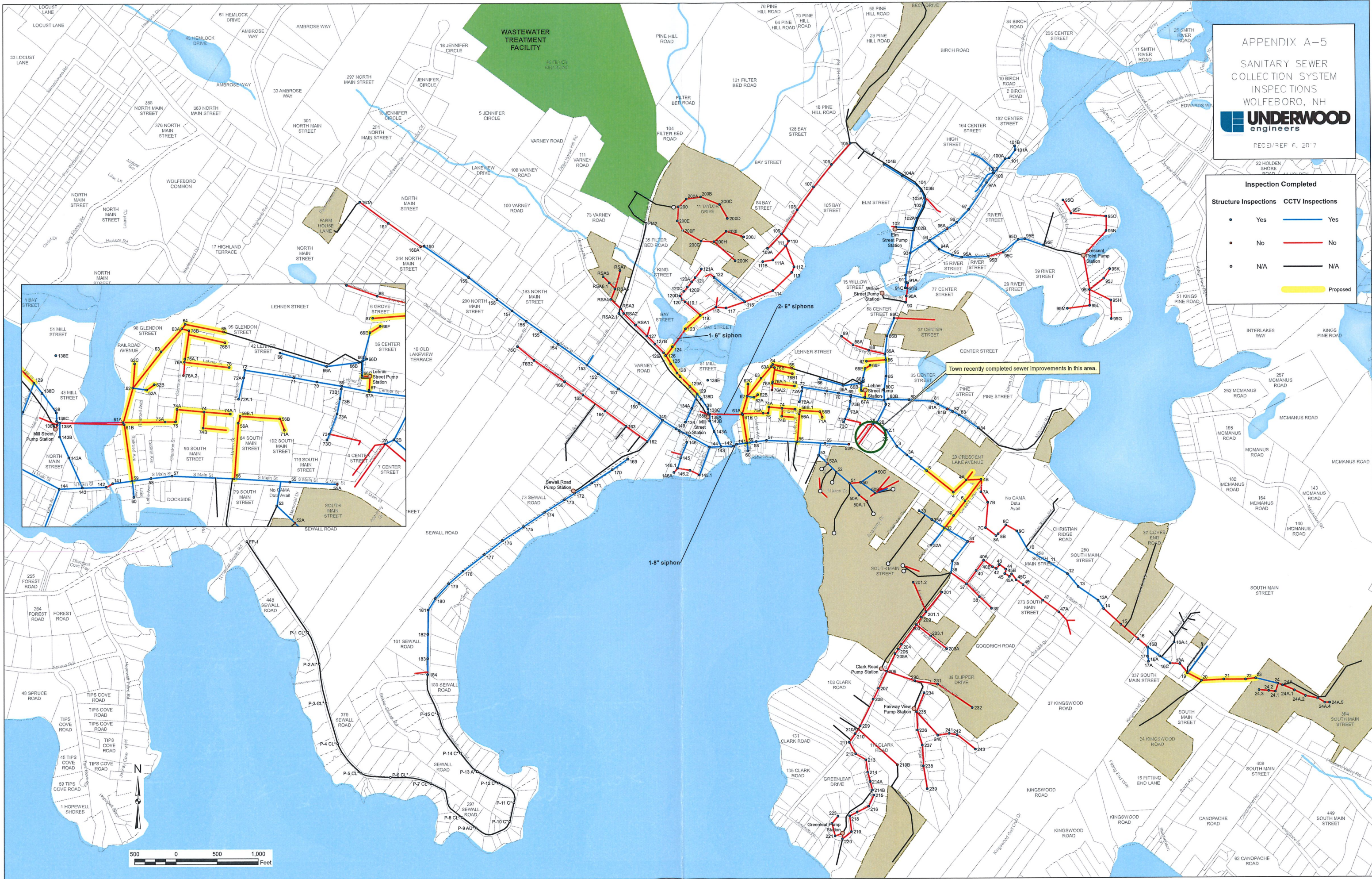
SANITARY SEWER COLLECTION SYSTEM INSPECTIONS
WOLFEBORO, NH



DECEMBER 6, 2017

Inspection Completed

Structure Inspections	CCTV Inspections
• Yes	— Yes
• No	— No
• N/A	— N/A
	— Proposed



APPENDIX B

Wolfeboro, NH
CCTV Summary of Observations
Suspected I I Areas April 2018

General Reach Information						CCTV Information			Mainline Taps					"Private" Defects		"Public" Defects			Visually Observed I/I		Calculated SPL I/I		Rating	Recommended Rehab										Comments Including PACP Ratings																
Location Code	Location	Direction	From MH	To MH	Diameter	Mainline Length	Pipe Material	Surveyed Length	Total Service Taps	Status		Condition			Services with CRW	Services with SPL (minerals/stain)	Service Tap Defects Actively Leaking	Service Tap Defects Other	Mainline Defects Active Leaking	Mainline Defects SPL (minerals/stain)	Mainline Defects - Longitudinal Cracks and/or Other	Public I/I	Private I/I	Public I/I	Private I/I	Wolfeboro Rating System	Root Removal \$500	Mainline Point Repair			Suspected Private I/I				Manhole Repair															
										Live Service Taps	Capped Service Taps	Factory Taps	Tap Saddle / Tap Break in	Actively Leaking or SPL \$2,000														Other Mainline Defects \$2,000	Lateral/ Break-In Rehab \$2,500	Install 2-way Clean Out & Investigate I/I from Lateral \$2,500	Allowance for Lateral Repair \$7,500	Excavation Repair \$300	CIPP Line Pipe MH to \$100		Reset Frame & Cover, Replace Corbel \$1,500	Grout & Waterplug Leaking Pipe Connection \$1,000	Grout & Waterplug Leaks \$250													
Unit	Unit	#	#	(in)	LF	LF	LF														(GPM)	(GPM)	(GPM)	(GPM)		EA	EA	EA	EA	EA	ALLOW	LF	LF	EA	Per Connection	VF														
Mill	Bay St.	D	119	123	10	252.6	PVC	252.6	2	2		2																																		No defects seen.				
Mill	Bay St.	U	124	126	10	143.6	PVC	143.6	3	2	1	2	1	1		1	1	1				0.1							1																		Taps: 1 factory capped, 1 factory with structural joint angular medium (rating 3), 1 saddle defective due to infil. with encrustation. Mainline: 1 lateral infiltration weeper (rating 3), 1 misc. water level sag (rating 3)			
Mill	Mill St.	D	126	125	10	111.55	PVC	111.55	2	1	1	1	1			1	1		1	1								1																		Taps: 1 factory cap, 1 tap saddle capped and defective. Mainline: 1 misc. water level sag (structural, rating 2), 1 infil. stain connection at tap saddle (rating 1).				
Mill	Mill St.	D	125	128	10	130	PVC	130	1	1		1																																	No defects seen.					
Mill	Mill St.	D	128	128A	10	69.75	PVC	69.75	1	1		1			1					1																										Tap: 1 factory, lateral weeper infil. (rating 2). Mainline: Deposits attached encrustation (rating 2).				
Mill	Mill St.	D	128A	129A	10	160.8	PVC	160.8	2	2		2																																	No defects seen.					
Mill	Mill St.	D	129A	129	10	134.5	PVC	134.5	1	1		1																																	No defects seen.					
Mill	School St.	U	74C	74	8	147.6	AC	147.6	5	1	4	5					1																													Taps: 4 tap factory capped, 1 tap factory. First tap (at 140.5 ft. 9') has structural point repair replacement and joint separated medium (rating 3).				
Mill	School St.	D	74	74A	8	156.2	PVC/AC	156.2	2		2	2																																		2 Taps: 2 factory taps, both capped. Mainline: misc. material change at 3.6 ft (PVC to AC)				
Mill	School St.	U	74B	74	8	44.05	PVC	44.05	1	1		1																																	1	T4B manhole buried.				
Mill	Glendon St.	U	74A	75	8	71.35	AC	71.35	1	1		1																																	No defects seen.					
Mill	Depot St.	D	75	75A	8	29.4	AC	29.4																																						No defects seen.				
Mill	Depot St.	D	75A	81	8	90.7	AC	90.7	2	2		2					2																														Taps: 2 tap break in (intruding and hammer defective, both rating 3). Mainline: structural joint angular medium (rating 3), hole soil visible (rating 5) at tap intrusion, line left (rating 4), line right (rating 4)			
Mill	Lehner St.	U	76	76A	8	276.25	AC	276.25	5	4	1	5																																				Taps: All factory taps, 1 capped. Mainline: 1 structural joint offset (rating 3), 1 misc. water level sag (rating 2).		
Mill	Glendon St.	D	76A	76A.1	8	29.15	AC	29.15																																								Mainline: 7.6 ft of point repair PVC replacement starting at joint offset (large, rating 4).		
Mill	Glendon St.	D	76A.1	76B	8	157.5	AC	157.5	4	4		3	1																																	No defects seen.				
Mill	Glendon St.	D	76B	63A	8	26.6	AC	26.6																																								Mainline: 2 joint structural angular (rating 3), 1 line left (rating 4) at second joint repair. MISC : camera under water at 26.6 ft, survey abandoned.		
Mill	Railroad Ave.	D	63A	63	12	192.8	PVC	192.8																																								Misc. water mark at 2.6 ft. No defects seen.		
Mill	Railroad Ave.	D	63	62	12	290.8	PVC	290.8	1		1	1																																				Mainline: 2.3 ft of settled gravel deposits (rating 4), misc. water mark at manhole 63.		
Mill	Railroad Ave.	U	64	63A	12	32.7	PVC	32.7																																							No defects seen.			
Mill	Railroad Ave.	D	62	61A	12	208.3	PVC	208.35	1	1		1																																				Tap: 1 factory, no defects seen. Mainline: 48.4 ft of attached grease deposits, 2 more points of attached grease at 63 ft and 194.5 ft (all rating 2), 1 point of settled gravel at 199.2 ft (rating 3). At 1.4 ft, joint separated structural medium (rating 3).		
Mill	Railroad Ave.	D	61A	61B	12	26.1	PVC	26.1																																									Mainline: 16.4 ft of attached grease (rating 2).	
Mill	Railroad Ave.	U	62C	62	8	4.05	PVC	4.05																																								Mainline: at 2.3 ft, line right up and line left (rating 4). At manhole 62C, misc. survey abandoned (camera doesn't do bend fittings.)		
Mill	Depot St.	U	75	61A	8	187.25	PVC	187.25	3	3		1	2																																				Mainline: 187.3 ft misc. survey abandoned (camera doesn't do bends). 187.2 ft line right (rating 4), 186.9 ft line left (rating 4), 117.8 ft structural hole (rating 4), 3.4 ft joint angular structural medium (rating 3), line right down (rating 4), and misc. material change (AC).	
Mill	Depot St.	D	61B	59	10	335	DIP	335	4	4		3	1				1	7	6	2	1.1																													Manhole 59 has infiltration. 4 Taps: 3 factory, 1 tap break in intruding. Mainline: attached encrustation deposits for 74.1 ft, 193.8 ft, 21.9 ft, 30.4 ft, 4.3 ft, and a point. 3 misc. material changes, 2 circumference cracks, 6 weeper joints, 1 dripper joint.
Lehner	Union St.	D	56B.1	56A	8	46.35	PVC	46.35																																									No defects seen.	
Mill	Union St.	D	56A	56	8	338.6	AC	338.6	8	6	2	6	2																																					Taps: 2 saddle, 6 factory, 2 capped factory. Mainline: 3 sections of deposits attached for 17.7, 10.8, and 225.4 ft. (rating 2). 1 obstruction wedged in joint at manhole at 334.8 ft.
Lehner	School St.	U	56B	56B.1	8	250.1	PVC	250.1	1	1		1																																						Mainline: 2 misc. material change, 1 joint separated medium (rating 3), 1 joint offset medium (rating 3), 1 misc. water level sag (rating 2).
Lehner	Center St.	U	87	86	8	4.2	ABS	4.2																																									Mainline: misc. material change and misc. shape/size change. Survey abandoned at 4.2 ft, camera can't get over drop and 6" x 8" transition.	
Lehner	Lehner St.	D	67A	LSPS	10	80.85	VCP	80.85											1	1	2	0.1																												Mainline: Infiltration weeper joint from 2 ft to 30.4 ft (rating 2). Joint angular medium (rating 3), misc. material change, deposits attached at 30.4 ft to 80.8 ft (rating 2), line right at 79.3 ft (rating 4).
Lehner	Green St.	D	32	30	8	185.6	AC	185.6	1	1		1																																				No defects seen.		
Lehner	Crescent Lake Ave.	D	30	6	8	228.7	AC	228.7	1	1		1																																				No defects seen.		
Lehner	Crescent Lake Ave.	U	6	4B	8	326.05	AC	326.05	3	3		3					1		1			1																												Taps: 3 break-in taps, 1 defective (rating 3), 1 infiltration runner connection (rating 4) at 10 ft on defective tap.

Wolfeboro, NH
CCTV Summary of Observations
Suspected I I Areas April 2018

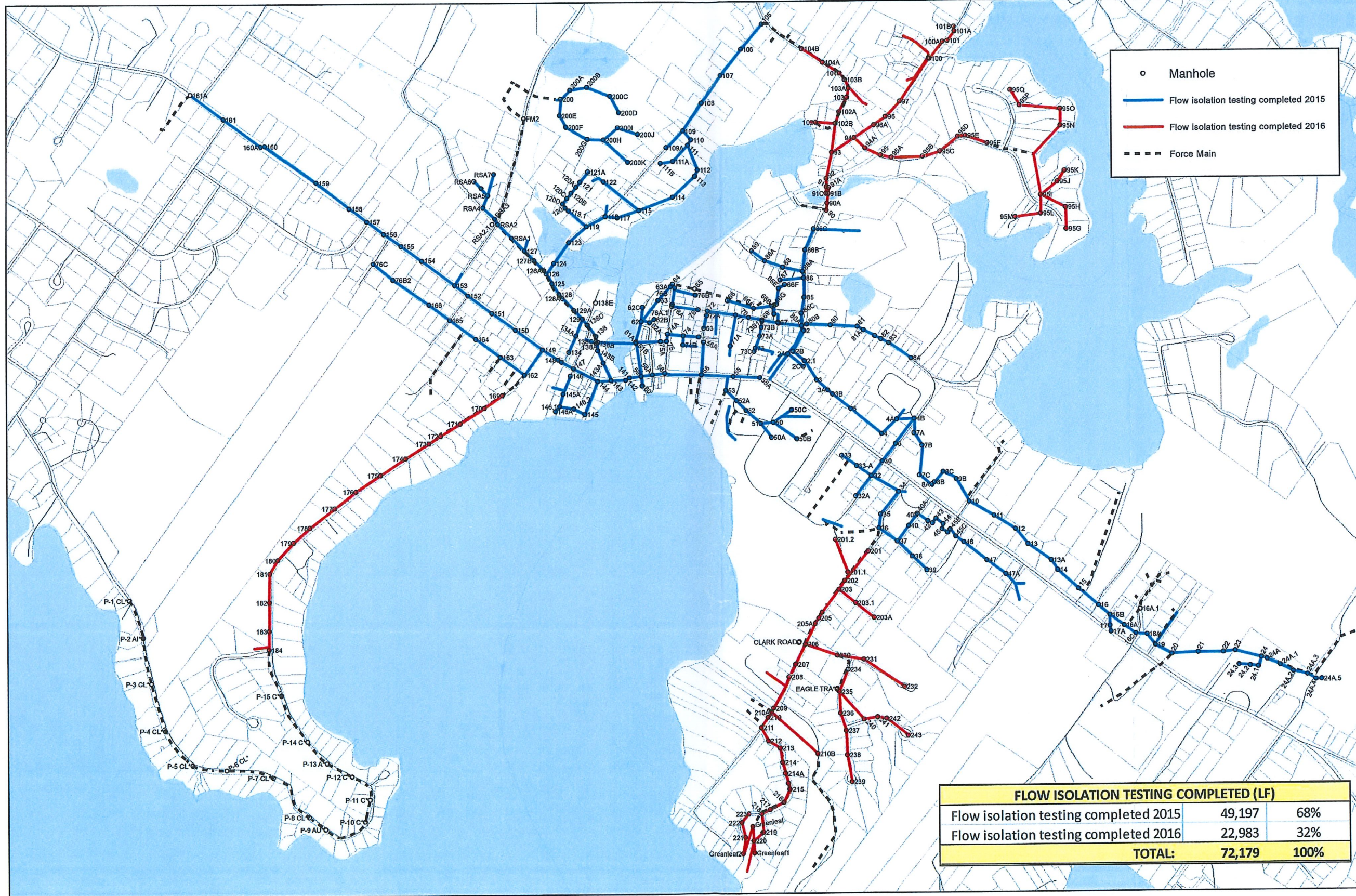
General Reach Information						CCTV Information			Mainline Taps					"Private" Defects			"Public" Defects			Visually Observed I/I		Calculated SPL I/I		Rating	Recommended Rehab										Comments		
Location Code	Location	Direction	From MH	To MH	Diameter	Mainline Length	Pipe Material	Surveyed Length	Status		Condition			Services with CRW	Services with SPL (minerals/stain)	Service Tap Defects Actively Leaking	Service Tap Defects Other	Mainline Defects Active Leaking	Mainline Defects SPL (minerals/stain)	Mainline Defects - Longitudinal Cracks and/or Other	Public I/I	Private I/I	Public I/I	Private I/I	Wolfeboro Rating System	Root Removal \$500	Mainline Point Repair			Suspected Private I/I			CIPP Line Pipe MH to MH \$100	Reset Frame & Cover, Replace Corbel \$1,500	Grout & Waterplug Leaking Pipe Connection \$1,000	Grout & Waterplug Leaks \$250	Comments Including PACP Ratings
									Total Service Taps	Live Service Taps	Capped Service Taps	Factory Taps	Tap Saddle / Tap Break in														Actively Leaking or SPL \$2,000	Other Mainline Defects \$2,000	Lateral/ Break-In Rehab \$2,500	Install 2-way Clean Out & Investigate I/I from Lateral \$2,500	Allowance for Lateral Repair \$7,500	Excavation Repair \$300					
Lehner	Lehner St. Pump Station Driveway	D	66B	LSPS	8	24.45	AC	24.45																													No defects seen.
Lehner	School St.	U	71A	56B	8	88	PVC	88.05	1	1		1																									No defects seen.
Lehner (Private)	Christian Ridge Parking Lot Entrance	D	4B	4A	10	191.45	AC	191.45																													No defects seen.
Lehner	Christian Ridge Easement	D	4A	4	10	219.1	AC	219.1																													No defects seen.
Lehner	Christian Ridge Easement	D	4	5	10	410	AC	410	5	5		5		2				1	3			0.2					2		4		2					Taps: All factory taps, 2 may have possible infiltration. Mainline: at 161.7 ft, intruding sealing material sealing ring (rating 2). Surface damage missing wall (rating 5). At 187.4 ft, point repair other (service fitting cut in). At 349.2 ft deposits attached (rating 2).	
Lehner	Edgewood Ter. Easement	U	20	19	8	161.5	AC	161.5	1	1																										Taps: 1 saddle tap, no defects. Mainline: at 161.3 ft line left (rating 4), at 3.9 ft line right (rating 1). Misc. survey abandoned at 161.5 due to 45 fitting from manhole.	
Lehner	Kingswood Regional High School	D	23	22	8	169.85	AC	169.85																1												Mainline: at 0 ft, roots medium connection (rating 3), at 148.4 ft joint angular medium (rating 3), at 159.7 ft point repair replacement (structural), at 161.4 ft obstruction wedged in joint (rating 3).	
Lehner	Kingswood Regional High School	D	22	21	8	247.5	AC	247.5																												Mainline: 1 misc. water level sag (rating 2), 5 joint angular medium (rating 3), 2 point repair replacement (structural), 1 line left (rating 4).	
Lehner	Kingswood Regional High School	D	21	20	8	158.85	AC	158.85																												Mainline: 4.2 ft long point repairs, at 2 ft misc. water level sag (rating 2).	
Mill	Railroad Ave.	D	62B	62A	6	41.35	DIP	41.35																												Mainline: From 0 ft to 41.4 ft of surface damage corrosion (rating 3), at 22.5 ft infiltration weeper joint (rating 2), at 40.7 ft deposits attached ragging (rating 2).	
Lehner (Private)	Christian Ridge	U	CR	4A	6	67.95	AC	67.95																												Mainline: 60.3 ft of surface damage corrosion (rating 3), at 66.4 ft line right (rating 4), at 7.4 ft line right down (rating 4), at 7.4 ft misc. material change, at 68 ft misc. survey abandoned (22 fitting).	
TOTALS:						6,549		6,549	62	50	12	47	15	4	0	3	6	11	20	47	2.3	0.2	0.4	0.0		1	6	49	10	4	0	42	416	1	0	10	
TOTAL COST:						203,700																				\$500	\$12,000	\$98,000	\$25,000	\$10,000	\$0	\$12,600	\$41,600	\$1,500	\$0	\$2,500	

Open Cut Total = \$12,600
Trenchless Total = \$297,100

Notes: - Entire length of pipe has defects

Infiltration Flow KEY
Gusher 10 GPM
Runner 1 GPM
Dripper 0.5 GPM
Weeper 0.1 GPM
Stains (Previous Leakage) 0.1 GPM

APPENDIX C



○ Manhole

— Flow isolation testing completed 2015

— Flow isolation testing completed 2016

- - - Force Main

N

W — + — E

S

1 inch = 1,000 feet

0 250 500 1,000 Feet

WOLFBORO, NEW HAMPSHIRE
WASTEWATER COLLECTION SYSTEM
AGGRESSIVE I/I MITIGATION PROGRAM
FLOW ISOLATION TESTING



FLOW ISOLATION TESTING COMPLETED (LF)		
Flow isolation testing completed 2015	49,197	68%
Flow isolation testing completed 2016	22,983	32%
TOTAL:	72,179	100%

DATE:
12/30/2016

PROJECT:
2027-05

Table 8
Wolfeboro, NH
CCTV Summary of Observations
Mill Street PS Subbasin May 2015

>1,500 gpd/idm (less than 4,000 gpd/idm)
>4,000 gpd/idm
Brewster Academy

General Reach Information						Flow Isolation Information				CCTV Information		Mainline Taps					"Private" Defects		"Public" Defects					Visually Estimated I/I		Recommended Rehab							Comments			
Project Area	Location	Inspection Log/ Setup	From MH	To MH	Pipe Size	Length	Net Line Flow	Net Line Flow	gpd/idm	Pipe Material	CCTV Length	Total Service Taps	Live Service Taps	Capped Service Taps	Factory Taps	Break-in Taps	Services with CRW	Services with SPL (minerals /stain)	Service Tap Defects Actively Leaking	Service Tap Defects Other	Mainline Defects Active Leaking	Mainline Defects SPL (minerals /stain)	Mainline Defects - Longitudinal Cracks and/or Other	Visually Estimated "Public" I/I	Visually Estimated Suspected "Private" I/I	Root Removal \$500	Actively Leaking or SPL \$2,000	Other Mainline Defects \$2,000	Lateral/ Break-In Rehab \$2,500	Install 2-way Clean Out & Investigate I/I from lateral (Note 1) \$2,500	Allowance for Lateral Repair \$7,500	Excavation Repair \$350		CCTV Inspect & Allowance for Repair \$50		
Unit	#	#	#	(in)	LF	(GPM)	(GPD)		LF															(GPM)	(GPM)	EA	EA	EA	EA	EA	ALLOW	LF		ALLOW/LF		
A1	South Main Street R.O.W.	24	60	59	6	92	21.5	30960	296139	VC	77.5 ^(Note 2)	1	1		1																				Replace 6". Multiple sags, leaky joints & breaks. Offset joint stops CCTV	
C	North Main Street	12	149	148	8	187	*	*		AC	199	2	2			2			1	1														Defective lateral, grease maintenance issues in laterals & mainline		
C	North Main Street	13	148	147A	8	35	*	*		AC	45	2	1	1	2				1															One defective tap		
C	North Main Street	14	147A	147	8	138	*	*		AC	146	0	0																					Grease maintenance issues.		
C	North Main Street	15	147	144	8	273	12.5	18000	18768	AC	285	8	7	1	8		1		1															Defective (leaking) saddle & lateral SPL		
C	North Main Street	16	144	143	8	133	2	2880	14292	AC	143	1	1		1																			Surface spalling entire reach. Grease, sag into MH143. Monitor spalling. I/I from flow iso likely from laterals. Confirm lateral is abandoned. 3 long. Cracks, sags, grease in mainline & lateral. MH 143A paved over.		
A	Mill Street PS R.O.W.	27	143	143A	10	193	*	*		AC/VC	210	3	3		3		1																	Corrosion & Teberculatation entire length		
A	Mill Street PS R.O.W.	32	143A	143B	10	132	*	*		CI	136	0	0																					Sags & grease 50'-86' of pipe		
A	Mill Street PS R.O.W.	30	143B	138A	10	77	7	10080	13239	CI	86	0	0																					Sags & grease 50'-86' of pipe		
A	South Main Street	25	59	141	10	117	*	*		VC	124	1	1		1		1																	VC pipe. Offset joint & sags. Leaky joints & lateral. grease.		
A	North Main Street	Not CCTV'd	141	142	10	36	*	*		Unknown																								36	No CCTV log	
A	North Main Street	26	142	143	10	138	2.5	3600	6532	VC	148	8	7	1	8		4	1	1	1	1	1	7	0.5	6.1									Heavy flow from laterals. VC pipe, longitudinal cracks, sags, grease, defective tap		
C	Sewall Road	21	162	149	8	313	2	2880	6073	AC	326	5	3	2	5																			AC surface spalling entire length. I/I from flow iso likely from laterals.		
E	Friend Street	18	153	Stub	6		*	*		VC	28.6	0	0																					28.6	VC pipe. 20% deformed - stops CCTV @ 28.6'	
E	North Main Street	8	153	152	8	168	*	*		AC	183	6	4	2	6																				offset joint inside lateral @ 114'	
E	North Main Street	9	152	151	8	301	*	*		AC	310	7	7		7			2																Offset joints & roots inside laterals.		
E	North Main Street	10	151	150	8	296	*	*		AC	304	5	5		5			2																Offset joints inside laterals.		
E	North Main Street	11	150	149	8	341	5.5	7920	4726	AC	349	5	5		5			1																Offset joint with hole inside lateral @ 189'		
E	North Main Street	6 & 7	154	153	8	419	2	2880	4537	AC	298+136	13	7	6	12	1			2	2					2.1	0								Laeky laterals & roots. Defective cap & break- in		
B	Mill Street	28	129	138D	10	73	*	*		PVC	68	1	1		1																				No defects observed	
B	Mill Street	29	138D	138	10	138	*	*		PVC	144	3	3		3		1																		2GPM leak inside lateral. Sags	
B	Mill Street	33	138	138C	10	52	*	*		PVC	76	0	0																						No defects observed	
B	Mill Street	34	138C	138A	10	12	1.5	2160	4147	PVC	10	0	0																						No defects observed	
G	King Street	22	122	115	6	461	1.5	2160	4123	VC	425 ^(Note 2)	4	4		4																				VC pipe/AC pipe. Many defects & roots. Root ball stops CCTV	
A	South Main Street	19	56	57 58	8	314	*	*		VC	382	6	6		6		3	2																	MH 57 not found. Confirm abandoned service. Many cracks, joint stains, & leaks. Investigate I/I from laterals.	
A	South Main Street	20	57 58	58 58A	8	49	*	*		VC	122	4	4		4					1															VC pipe with multiple fractures & roots. Roots & debris in laterals. Offset in lateral @ 68'. MH58A buried - raise to grade.	
A	South Main Street	23	58 58A	59	8	236	2.5	3600	3967	VC	126	0	0																						AC/VC. Sags. Joint separated + long crack.	
I	Railroad Avenue	Not CCTV'd	62B	62A	8	56	*	*		Unknown																									56	No CCTV log
I	Railroad Avenue	40	62A	62	8	78	0.5	720	3546	PVC	4 ^(Note 2)																									45 fitting stops CCTV @ 4'
B	Libby Street	36	134	134A	8	177	*	*		AC	190	4	4		4		1																			Constant leak up one lateral
B	Libby Street	35	134A	129	8	181	1	1440	2655	AC	178	1	1		1																				50% offset joint & alignment issue.	
F	North Main Street	15 & 16	160	159	6	654	*	*		VC	44+272	5	5		5					5															VC/PVC pipe. Multiple cracks, roots, & offset joints. Multiple break-in taps, sags. Possible orangeburg laterals. CCTV stopped both sides.	
F	North Main Street	17	159	158	6	429	2	2880	2340	VC	160 ^(Note 2)	2	2		1	1																			VC pipe. Roots throughout. Sags & cracks. Debris stops CCTV	
F	North Main Street	1	158	157	8	221	*	*		VC	230	7	7		7			1																	Confirm abandoned laterals. Roots & debris in laterals. Roots & offset in pipe.	
F	North Main Street	2	157	156	8	207	*	*		VC	216	5	4	1	5					1															Roots inside lateral. Defective cap, onser joint. Capped lateral with possible leak - line over.	
E	North Main Street	3	156	155	8	208	*	*		AC	215	2	2		2																				No defects observed	
E	North Main Street	4 & 5	155	154	8	257	2	2880	2129	AC	250+18	4	4		3	1																			Break-in @ 18' stops CCTV. Confirm abandoned lateral.	
D	Endicott Street	22	146	145 (A)	8	196	*	*		AC	222	6	4	2	6																				No defects observed	
D	Endicott Street	47	145 (A)	146.1	8	125	*	*		AC	158	3	2	1	3																				Stains up lateral @ 21'. End Manhole (MH146.1?) Paved over. Raise to Grade.	
D	Endicott Street	Not CCTV'd	146A	146.1	8	67	*	*		Unknown																									67	No CCTV Log. Manholes paved over.

* Value Below Applies

Table 8
Wolfeboro, NH
CCTV Summary of Observations
Mill Street PS Subbasin May 2015

General Reach Information						Flow Isolation Information				CCTV Information		Mainline Taps					"Private" Defects		"Public" Defects			Visually Estimated I/I		Recommended Rehab							Comments							
Project Area	Location	Inspection Log/ Setup	From MH	To MH	Pipe Size	Length	Net Line Flow	Net Line Flow	gpd/idm	Pipe Material	CCTV Length	Total Service Taps	Live Service Taps	Capped Service Taps	Factory Taps	Break-in Taps	Services with CRW	Services with SPL (minerals /stain)	Service Tap Defects Actively Leaking	Service Tap Defects Other	Mainline Defects Active Leaking	Mainline Defects SPL (minerals /stain)	Mainline defects - Longitudinal Cracks and/or Other	Visually Estimated "Public" I/I	Visually Estimated Suspected "Private" I/I	Root Removal \$500	Actively Leaking or SPL \$2,000	Other Mainline Defects \$2,000	Lateral/ Break-In Rehab \$2,500	install 2-way Clean Out & Investigate I/I from lateral (Note 1) \$2,500		Allowance for Lateral Repair \$7,500	Excavation Repair \$350	CCTV Inspect & Allowance for Repair \$50				
Unit		#	#	#	(in)	LF	(GPM)	(GPD)		LF														(GPM)	(GPM)	EA	EA	EA	EA	EA		ALLOW	LF	ALLOW/LF				
D	Endicott Street	Not CCTV'd	146.1	146.2	8	148	*	*		Unknown																							148	No CCTV Log. Manholes paved over.				
D	Endicott Street	Not CCTV'd	146.2	145	8	120	*	*		Unknown																							120	No CCTV Log. Manholes paved over.				
D	Endicott Street	17	144	145	8	358	2	2880	1875	AC	369	11	9	2	11		1						1		1										Surface spalling of pipe. One actively leaking lateral (up lateral). Infiltration weeper @ 3'. Unable to get up line stops CCTV @ 50'			
H	Academy Drive R.O.W.	4	Stub SE	50B	6	200	0.1	144	634	PVC	50										1			0.1		1								100	No CCTV log			
H	Academy Drive R.O.W.	Not CCTV'd	Stub N	50B	6	100	0.1	144	1267	Unknown																									Lateral fitting Fractured. Cracks & roots throughout. Root ball stops CCTV @ 198'			
H	Academy Drive R.O.W.	2	50B	50	6	283	0	0	0	VC	198 ^(Note 2)	1	1		1					1		45								1	283			No CCTV log				
H	Academy Drive R.O.W.	Not CCTV'd	Stub E	TEE	6	274	*	*		Unknown																										Pipe changes size to 8" @ 208'. No defects observed.		
H	Academy Drive R.O.W.	3	50C	50	6	226	0.1	144	253	PVC	221	0	0																							No CCTV log		
H	Academy Drive R.O.W.	Not CCTV'd	50	TEE	6	105	*	*		Unknown																											Multiple PVC/VC transitions. Roots, sag.	
H	Academy Drive R.O.W.	1	50A	51	6	176	*	*		PVC/VC	181	1	1		1																					VC Transition @ 14' from MH52 with roots at joint.		
H	Academy Drive R.O.W.	5	51	52	6	203	*	*		PVC/VC	196	1	1		1							1														Sag in pipe. Section of VC pipe repaired/replaced with PVC. Unknown MH52A. Buried? Raise to grade.		
H	Academy Drive R.O.W.	6	52	52A	6					PVC/VC	40	0	0										1														45 bend stopped CCTV @ 5'.	
H	Academy Drive R.O.W.	7	52 52A	53	6	290	0.5	720	819	PVC/VC	5 ^(Note 2)	1	1		1																						45 bend stopped CCTV @ 5'.	
A	South Main Street R.O.W.	8	53	TEE	6	146	*	*		PVC	5 ^(Note 2)	Unknown																										Crack. Transitions to PVC 4' from MH55
A	South Main Street R.O.W.	18	55	56	8	330	*	*		VC	342	5	3	2	5																							
A	South Main Street R.O.W.	19 & 20 (see above)	56	57	8	314	*	*																														
A	South Main Street R.O.W.	20 & 21 (see above)	57	58	8	49	1	1440	1184																													
TOTALS:						10,902	70	100,512	6482		8,651	144	123	21	134	10		12	11	6	13	20	15	130	27.3	32.1	2	1	0	12	14	68	4732.6	471				
TOTAL COST:																											\$1,000	\$2,000	\$0	\$30,000	\$35,000	\$510,000	\$1,656,410	\$23,550				

Open Cut Total = \$1,656,410
Trenchless Total = \$603,550

Notes:

- 1 Cost estimate assume installation of 2-way clean-out at ROW and Future CCTV from new CO
- 2 CCTV was not able to survey entire length of reach. See CCTV logs for more information.
- 3 Replacement of Sewer main between MH 59 & MH 60 is included in the scope and cost estimate for the S. Main St / Dockside Sewer Replacement. No cost is carried for this replacement in this table. See Figure 9 and Appendix E for S. Main St / Dockside Sewer Replacement extents and estimated costs.

Table 9
Wolfeboro, NH
CCTV Summary of Observations
Lehner Street PS Subbasin May 2015

>1,500 gpd/ldm (less than 4,000 gpd/ldm)
>4,000 gpd/ldm
Brewster Academy

General Reach Information					Flow Isolation Information				CCTV Information		Mainline Taps					"Private" Defects		"Public" Defects					Visually Estimated I/I		Recommended Rehab							Comments												
Project Area	Location	Inspection Log/ Setup	From MH	To MH	Pipe Size	Length	Net Line Flow	Net Line Flow	gpd/ldm	Pipe Material	CCTV Length	Total Service Taps	Status		Condition			Services with CRW	Services with SPL (minerals /stain)	Service Tap Defects Actively Leaking	Service Tap Defects Other	Mainline Defects Active Leaking	Mainline Defects SPL (minerals /stain)	Mainline Defects - Longitudinal Cracks and/or Other	Visually Estimated "Public" I/I	Visually Estimated Suspected "Private" I/I	Root Removal \$500	Mainline Point Repair			Suspected Private I/I		Excavation Repair \$350	CCTV Inspect & Allowance for Repair \$50										
													Live Service Taps	Capped Service Taps	Factory Taps	Break-in Taps	Actively Leaking or SPL \$2,000											Other Mainline Defects \$2,000	Lateral/ Break-In Rehab \$2,500	Install 2-way Clean Out & Investigate I/I from lateral (Note 1) \$2,500	Allowance for Lateral Repair \$7,500				ALLOW	LF	ALLOW/LF							
Unit	#	#	#	(in)	LF	(GPM)	(GPD)			LF																																		
M	Edgewood Terrace	42	Stub SW	19	8	4	1	1440	237600	AC	13	1	1		1																		Roots at joint @ 4' Stub end full of roots											
J	R.O.W. North of Lehner Street PS	41	66G	66C	8	91	2.5	3600	26110	PVC	91	1	1		1																		Infiltration leak @ MH66C connection. See Manhole Table for recommended rehab. Leaky service (up service). Sags.											
L	South Main Street R.O.W. NE	43	17A	17	8	65	*	*		PVC	65	0	0																			Fernco joint in pipe												
L	South Main Street R.O.W. NE	44	17	16B	8	103	1.5	2160	8486	PVC	6 ^(Note 2)	Unknown →																			Changes to 6" @ 4' with Fernco. Active leak @ 6'. Offset joint stopped CCTV @ 6'													
J	Center Street R.O.W.		86A	86	8	62	*	*		AC	67	1	0	1	1																		No new CCTV. Repair recommended based on CCTV inspection performed April 2013. See Note 3.											
J	Center Street R.O.W.		86	85	8	112	*	*		AC	132	4	3	1	4																		No new CCTV. Repair recommended based on CCTV inspection performed April 2013. See Note 3.											
J	Center Street R.O.W.		85	80C	8	159	*	*		AC	153	5	3	2	5																		No new CCTV. Repair recommended based on CCTV inspection performed April 2013. See Note 3.											
J	Center Street R.O.W.		80C	80A	8	122	4	5760	8355	AC	140	1	1		1																		No new CCTV. Repair recommended based on CCTV inspection performed April 2013. See Note 3.											
J	Lehner Street	39	80A	67A	8	229	1	1440	4150	AC	238	8	7	1	8																		3 Chimney services with CRW drips. 2 with large mineral deposits.											
K	Center Street		Stub SW	2A	6	288	*	*		Unknown	→																															MH 2A Paved over. No CCTV log		
K	Center Street		Stub SW	2A	6	319	*	*		Unknown	→																																MH 2A Paved over. No CCTV log	
K	Center Street		2C	2A	6	193	*	*		Unknown	→																																	MH 2A Paved over. No CCTV log
K	Center Street	20	2A	2B	8	55	2	2880	2902	PVC	56	0	0																						No defects observed.									
K	Green Street R.O.W.	11	33A	32	8					AC	159	2	2		2																				Medium offset joint & change to PVC @ 152'. Unknown MH 33A (159' from MH32)									
K	Green Street R.O.W.	12	33	32	8	363	1	1440	2618	PVC	130	1	1		1																				No defects observed.									
K	Green Street	13	32A	32	8	258	0.7	1008	2579	PVC	273	3	3		3																				No defects observed. I/I from flow iso likely from laterals.									
K	South Main Street R.O.W. NE	45	5	3B	10	234	*	*		AC	250	3	3		3																				Joint separation with Fernco leaking. Grout repair in pipe. Leaky service									
K	South Main Street R.O.W. NE	46	3B	3A	10	60	*	*		AC	70	0	0																						One grout repair @ 52'. No defects observed.									
K	South Main Street R.O.W. NE	37	3A	3	10	152	*	*		AC	165	2	2		2																				PVC/ AC Transition @ 4'									
K	South Main Street R.O.W. NE	38	3	2.1	10	227	*	*		AC	234	5	3	2	5																				No defects observed.									
K	South Main Street R.O.W. NE	21	2.1	2B	10	142	2.5	3600	2332	AC	157	2		2	2																				Two capped services. No defects observed.									
K	Clark Road	14	36	35	8	139	*	*		PVC	148	2	2		2																				No defects observed.									
K	Clark Road	9	35	34	8	290	*	*		PVC	285	2	2		2																				Actively leaking lateral									
K	Clark Road		Stub E	34	8	65	*	*		Unknown	→																																No CCTV log	
K	Clark Road	10	34	32	8	316	1.5	2160	1760	PVC	321	2	2		2																					Sags in pipe. Deformed 25% @ MH32 connection. See Manhole Table for recommended rehab.								
L	South Main Street R.O.W. NE	31	24	23	8	270	0.5	720	1760	DI	280	0	0																						No defects observed.									
TOTALS:					4,318	18	26,208	4002		2,941	45	36	9	45	0	12	2	0	0	3	1	4	2.1	8.5	0	2	3	0	16	17	13	865												
TOTAL COST:																										\$0	\$4,000	\$6,000	\$0	\$40,000	\$127,500	\$4,550	\$43,250											

Open Cut Total = \$4,550
Trenchless Total = \$230,750

Notes:

- 1 Cost estimate assume installation of 2-way clean-out at ROW and Future CCTV from new CO
- 2 CCTV was not able to survey entire length of reach. See CCTV logs for more information.
- 3 CCTV of Center Street MH86A - MH80A performed in April 2013 as part of UEI's 2013 Infiltration & Inflow Study so no new CCTV survey was performed for this study. Mainline repairs recommended for this section were completed in summer of 2015. At the time of this report, recommended lateral repairs have not been completed and so are included in this table.

Table 1
Wolfeboro, NH
CCTV Target Areas
Summary of Observations
April 2016

>4,000 gpd/ftm
>1,500 gpd/ftm (less than 4,000 gpd/ftm)
Additional CCTV Areas

General Reach Information				Flow Isolation Information			CCTV Information		Mainline Taps					"Private" Defects		"Public" Defects					Visually Estimated I/I		Recommended Rehab							Comments			
Date	Location	From MH	To MH	Pipe Size	Length	Net Line Flow	gpd/ftm	Pipe Material	CCTV Length	Total Service Taps	Live Service Taps	Capped Service Taps	Factory Taps	Break-in / Saddle Taps	Services with CRW	Services with SPL (minerals /stain)	Service Tap Defects Actively Leaking	Service Tap Defects Other	Mainline Defects Active Leaking	Mainline Defects SPL (minerals /stain)	Mainline Defects - Longitudinal Cracks and/or Other	Visually Estimated "Public" I/I	Visually Estimated "Private" I/I	Root Removal \$500	Actively Leaking or SPL \$2,000	Other Mainline Defects \$2,000	Lateral/ Break-in Rehab \$2,500	Install 2-way Clean Out & Investigate I/I from lateral (Note 1) \$2,500	Allowance for Lateral Repair \$7,500		Excavation Repair \$350	CCTV Inspect & Allowance for Repair \$50	
#	#	#	#	(in)	LF	(GPD)		LF														(GPM)	(GPM)	EA	EA	EA	EA	EA	ALLOW		LF	ALLOW/LF	
SEWALL ROAD PUMP STATION BASIN																																	
3/17/2016	Sewall Road	174	173	10	278	10,800	20,512	PVC	294.9	4	4	0	4	0	2		2																Two (2) taps at 12 o'clock were defective. Services appeared to be driven into pipe causing deformation of main and defective laterals. Deformation was observed ~3' upstream of tap. 1 tap with a dripper (220' from MH-174) from up lateral and 1 with a gusher (~243' from MH-173) from around connection and possibly from up lateral.
3/17/2016	Sewall Road		184	Observations:																													Force main goes into MH184 and there was a lot of activity on the incoming force main with a lot of cold clear water around 1AM to 2:30AM
3/17/2016	Sewall Road	180	179	Observations:																												Mineral deposits on walls - See Photo#3366	
ELM STREET PUMP STATION BASIN																																	
3/16/2016	Elm Street	103	102A	8	162	1,440	5,867	AC	168.4	3	3	0	3	0				1								1	2					MH 102A: Incoming line has a pipe connection leak of 1.1GPM. Defective liner repair at 33' from MH-103 (peeling up). Significant grout in services at 85' from MH-103, possible CRW around 1. Grout debris on floor of pipe.	
3/16/2016	Center Street	94	93	8	273	1,440	3,481	AC	281.35	3	2	1	3	0														2	2			No defects observed. I/I observed from Flow Isolation suspected to be from laterals.	
3/16/2016	Center Street	96	96A	8	131	*	*	AC	134.85	1	1	0	0	1				1								1	1					Multiple cracks at 5.25' from MH-96. Several sags. Defective saddle tap at 54.3' from MH-96; lateral is poorly connected and soil is visible.	
3/16/2016	Center Street	96A	94	8	234	1,440	4,062	AC	88.05+ 252.35	6	6	0	3	3	2											1	1	2	2			Intruding lateral at 88' from MH-96A - CCTV completed from both directions. Intruding lateral with CRW ~0.5GPM from in/around lateral. 1 other lateral with CRW ~0.5GPM (98' from MH-94). Defective short liner at 67' from MH-96A.	
3/16/2016	Center Street	97	96	8	206	720	2,307	AC	134.45	1	1	0	0	1					1							1						Circumferential fracture around entire pipe with infiltration dripper (110' from MH-97). Crack is within 1' of a saddle tap which may have caused fracture.	
3/16/2016	Center Street River Street	100A 95A	100 95B	8 8	213 315	720	2,231																									Incorrect reach surveyed. To be inspected in summer 2016	
CLARK ROAD PUMP STATION BASIN																																	
3/17/2016	Clipper Drive	ESE	232	8	150	11,232	49,421	PVC	126.95	0	0	0	0	0																			7.8GPM observed during flow iso. CCTV revealed significant clear running water. No defects observed and bend in pipe caused survey to be abandoned. Genesis Health Care Maintenance Supervisor noted that they have multiple leaking sinks that they are unable to repair as there are no isolation valves in the building and main water shut-off appears to be filled with sand.
3/17/2016	Clark Road	208	207	Observations:																													Hole in wall of MH-207- See Photo#s 3367,3368 - 1 gpm incoming
MILL STREET PUMP STATION BASIN																																	
4/29/2015	North Main Street	141	142	10	36		6,532																										Siphon. Gpd/ftm listed is average over 3 reaches. Inspection delayed until summer 2016
	South Main Street	55A (Buried)	55	Unk	300			VC	320.05	4	4	0	4	0					5		8							4		320		Unmapped sewer reach to unknown buried manhole. Joint separation throughout reach, several sections of cut in pipe repairs of various materials. 5 joints noted with visible infiltration. Recommend replace entire reach and install 2-way cleanouts for all services (4).	
	Dockside Parking Lot	60	Icecream Bar Service	6				VC	81.55	2	2	0	2	0					1	10							2 ⁽¹⁾		81.55 ⁽¹⁾			82' stub with two services entering. Replace 6" pipe in it's entirety. Multiple sags, leaky joints and breaks. Heavy grease deposits. 1 service appears clogged with grease. Investigate if it is still active. Install 2-way cleanouts for all services (2).	
	Dockside Parking Lot	60	Additional Service	6																													To be inspected in summer 2016
	Town Hall Parallel Sewer Line	Test Pit	Town Hall	8				VC	252.55	4	4	0	0	4					4														See email on Town Hall Foundation Drain investigation dated 4/14/16
	Mill St / Railroad Ave.	61B	138A	6	360																												Siphon 1. Length is assumed. Inspection delayed until summer 2016
	Mill St / Railroad Ave.	61B	138A	6	360																												Siphon 2. Length is assumed. Inspection delayed until summer 2016
	Huggins Hospital Lot	9B	10	10	262			PVC																									To be inspected in summer 2016
TOTALS:					3,018	28,004		2,135	28	27	1	19	9	4	0	2	8	16	0	15	9.9	8.8	0	1	3	4	10	6	345	0			

Notes:
1 Replacement of this reach is included in the Dockside Sewer Design Project separately and so no cost is carried for this work here. For further information refer to UEI's letter report *Dockside Sewer I/I Investigations* dated 9/30/2016. A copy of this report is included in Appendix X.

APPENDIX D

Wolfeboro, NH Recommended I&I Rehabilitation Projects from 2015, 2016, & 2018 Investigations

MAP KEY

- 2015 Projects
- 2016 Projects
- 2018 Projects

* Note: Projects O & R for Various Trenchless Rehab not shown for clarity.

