Report

Town of Northbridge, MA

Letter Report
Sewer Infrastructure Assessment

PROJECT NO: 2090242.A

October 2009

Weston & Sampson

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Town of Northbridge, Massachusetts
Weston & Sampson Project No. 2090242.A

October 15, 2009

Mr. R. Gary Bechtholdt II
Town Planner
Town Hall
7 Main Street
Whitinsville, MA 01588

Re: Letter Report
Sewer Infrastructure Assessment

Dear Mr. Bechtholdt:

In accordance with our April 28, 2009 letter agreement, Weston & Sampson is pleased to submit our report on the assessment of the wastewater infrastructure in the Linwood Mill area of Northbridge.

Project Background

The town of Northbridge retained Weston & Sampson in Spring 2009 to perform an assessment of the wastewater infrastructure in the Linwood Mill area of Northbridge. The old Linwood Mill site is a Priority Development Site for the town. Redevelopment of the site requires a sewer infrastructure assessment to determine available system capacity, the condition of the downstream collection system, and potential build-out of the 120,000 square foot Linwood Mill complex. The project area is included in Figure 1 in Appendix A.

Weston & Sampson has conducted a site investigation of the area downstream of the mill including limited manhole and pipeline inspections using our CUES Quick ZoomCAM camera. The subject pipeline is limited to the area between Linwood Avenue and Union Street, where the sewer connects to the recently upgraded 24-inch interceptor sewer. The project also includes a hydraulic capacity analysis, and estimating existing wastewater flow based on water use data provided by the Northbridge Department of Public works, and physical observations.

The following assumptions were made when performing this hydraulic capacity analysis.

- The existing pump station and force main from the Linwood Mill are not included in the assessment.
- The actual sewer lines that flow to the interceptor, including pipelines on Maple Court and those on and east of Providence Highway, will only be included to the extent that they transmit flow to the subject interceptor sewer, and not be included in the pipeline condition assessment.

- The subject pipeline is limited to the area between Linwood Avenue (Railroad Avenue on plans) and Union Street, where the sewer connects to the recently upgraded 24-inch interceptor sewer.
- Record drawings provided by the town of sewers in the project area were used in the analysis. Pipeline data (elevations, slope, pipe material, etc) from record drawings is assumed to be correct. ***The Heritage Design Group – Linwood Business Park Site Plan – states that the pipes are 12-inch PVC but the town confirmed that the pipes are actually 8-inch PVC. In addition, slope inconsistencies between the 1913 record drawings and these record drawings exist.*** We have made assumptions to account for these inconsistencies which are described in the Hydraulic Capacity Analysis (Table 1).
- Based on record drawings, the slopes of the pipe sections shown on the record drawings were used in the Manning's design capacity calculations. Inverts and pipe lengths were not used to calculate slopes.
- Sections of the pipeline also have underdrains (sub-drains) that may affect wastewater flows. According to town staff, these underdrains do not connect with the subject sewer, and therefore do not introduce extraneous flows to the sewer system. Testing to confirm this was not conducted as part of this investigation.

VISUAL OBSERVATIONS

The field investigation work was performed on June 11, 2009 and included approximately 2,822 lf of sanitary sewers and 15 sanitary manholes.

Topside Manhole Inspections

Manhole inspections consist of a topside visual inspection of sanitary sewer manholes performed on June 11, 2009. The groundwater during this time was slightly lower than typical springtime levels, as recorded by the USGS groundwater gauge in Northbridge, Massachusetts.

Weston & Sampson inspected 13 sewer manholes to observe flow and general manhole conditions. The results of the manhole inspections are summarized in the notes column of the Hydraulic Capacity Analysis, Table 1, in Appendix B.

Two (2) manholes were not inspected because they could not be located (CNL) at the time of inspection. These manholes were later located/uncovered and inspected by Department of Public Works personnel. Normal flow conditions were observed in these manholes and no manholes were surcharged. However, there were signs of previous surcharging in manholes 2A (service manhole for Chinese restaurant located approximately 200 feet downstream from manhole 2) and manhole 3. Roots were observed in manholes 8 and 10.

ZoomCAM Inspection

A ZoomCAM inspection was conducted to locate and document pipeline defects and to make direct observations of infiltration rates. The ZoomCAM is a compact high resolution zoom camera assembly used for topside video inspection of pipelines.

Weston & Sampson and a Department of Public Works employee used the ZoomCAM to inspect approximately 20 feet upstream and downstream of each manhole in the project area to examine

flow and pipe condition. Observations for each line segment are provided in the Hydraulic Capacity Analysis, Table 1, in Appendix B. All pipes were flowing at approximate depths up to four inches and approximate velocities up to one foot per second (fps).

All 2,822 feet of sewers in the project area are recommended for cleaning and television inspection to verify pipe condition (See Table 1 in Appendix B). Grease build-up and/or roots were noted in some of these manholes and pipes.

Please note that the invert at manhole 3A is approximately four inches wide and likely too small to fit camera equipment. The typical camera size for 8 inch diameter pipe inspections is about four inches wide and 20 inches in length. The invert may need to be enlarged to perform the inspection.

Hydraulic Capacity Analysis

As part of this project, a hydraulic capacity evaluation was performed on portions of the sanitary sewer to provide capacity information for sewers downstream of the Linwood Mill Area. This information can be used to identify deficient segments that may require rehabilitation or upgrades to accommodate flow. The information may also be used to identify hydraulic deficiencies which may affect upstream sewers. Sudden drops in capacity from one line segment to the next may be of concern because upstream flow can back up due to the change (decrease) in hydraulic capacity. This drop in capacity may allow debris to settle and accumulate in upstream sewer segments, and could eventually lead to backups and/or overflows. The capacity analysis is important in determining whether the town has adequate capacity to accommodate the Linwood Mill Development site and estimate the amount of additional flow that can be added to the system without causing overflows or backups.

Weston & Sampson evaluated the hydraulic capacity of approximately 2,822 lf of sewers. The pipes included in the hydraulic capacity analysis are highlighted in orange in Figure 1 in Appendix A.

Weston & Sampson compared the total design capacity to the theoretical total flow estimated from water use data provided by the town. The total design capacity was calculated using Manning's equation for open channel flow assuming a clean, circular, non-obtrusive pipe flowing 80 percent full. Existing flow estimates consist of peak sanitary flow (wastewater component multiplied by peak flow on maximum day factor obtained from ASCE Manual of Engineering Practice No. 37) plus an estimated infiltration/inflow (I/I) component. Information on town-wide I/I was not available, so Weston & Sampson assumed an I/I component equal to that of average daily sanitary flow. It is fairly common in Massachusetts communities for I/I flows to comprise nearly 50% of wastewater flow. An estimated 500 gallons per day per inch mile (gpdim) of infiltration was applied to each pipe segment within the subject sewers. This is an estimate typically applied to new sewers when accounting for I/I flows. Estimated existing flows are displayed in the Hydraulic Capacity Analysis, Table 1, in Appendix B.

Manning's *'n'* values were chosen based on the pipe material for normal flow conditions. A value of 0.013 was used for vitrified clay and cast iron pipe, and 0.011 for PVC pipe.

All of the pipes in this analysis have less than minimum design slopes. This accounts for lower than minimum capacities (8 through 12-inch diameter). The minimum design slope is 0.004 for 8-inch, 0.0028 for 10-inch and 0.0022 for 12-inch pipes.

The hydraulic capacity analysis was performed on sewers ranging from 8 to 12 inches in diameter on Maple Court through the Railroad Easement to Union Street. The hydraulic design capacity remains generally consistent or increases from Maple Court through the Railroad Crossing Easement until there is a decrease in capacity at manhole 3F due to a decrease in slope. This is an area of concern because there is a 90 degree bend that occurs approximately 6 feet downstream of manhole 7 heading downstream (under the railroad tracks) to manhole 8. The 90 degree bend is comprised of two 45 degree angles of PVC piping (according to town personnel and the property owner). This piping configuration is shown in Figure 2, Appendix A. Flow in the pipe appeared to be without turbulence when observed with the ZoomCAM, however, some grease build up was evident. According to town personnel, this is known to be a problem area.

The hydraulic capacity then remains consistent to manhole 8 on the Railroad Crossing Easement where there is an increase in capacity of more than 50 percent due to an increase in pipe diameter through to manhole 11 near Union Street. The analysis ends at manhole 11 where it connects to the 24-inch interceptor sewer.

The hydraulic design capacities were compared to the estimated existing flows described above. The existing flow estimates are considered conservative values. In each line segment there is over 30 percent design capacity remaining. The minimum design capacity remaining is 103,714 gallons per day (gpd) located in the pipe segment from manholes 2 to 3 on Maple Court. All the other pipes in this analysis may accommodate at least this amount of design capacity.

Conclusions & Recommendations

This report summarizes the results of manhole and pipeline observations, estimated existing wastewater flow based on water use data, physical observations, and hydraulic capacity analysis to asses the wastewater infrastructure in the Linwood Mill area of Northbridge.

Based on observations documented during the limited sewer and manhole inspections, Weston & Sampson has developed recommendations for the rehabilitation of identified defects and sources of I/I within the pipelines and manholes inspected. Additional I/I investigation recommendations have been provided for sewers tributary to the project area. The recommendations below should be completed prior to development of the site and permitting of the sewer connection.

- Root treat and rehabilitate manholes 8 and 10 - $3,000
- Enlarge invert in manhole 3A for access purposes - $600
- Clean and televise all 2,822 feet of sewers downstream of the discharge point of the redeveloped site to verify pipe condition (See Table 1 in Appendix B) – Town forces, or sewer service contractor at approximately $2.00 to $5.00 per lf.
- Perform an I/I analysis of sewers tributary to the project area. The analysis should include manhole and television inspections and pre- and post-construction flow isolation. This work should be conducted during a period of high groundwater and includes approximately 3,880 feet of sewers and 24 manholes (See Figure 1 in Appendix A).

- Perform pipeline and manhole repairs identified during the I/I analysis to comply with the Town's four to one I/I removal rate. If sufficient I/I is not identified in this area it may be necessary to conduct additional investigations in other parts of the Northbridge collection system.
- Install access manhole at 90 degree bend downstream of manhole 7 in the Railroad Crossing Easement.

After comparing the design capacities to the estimated existing flows in the project area, there is over 30 percent design capacity remaining for each pipe segment. ***The minimum design capacity remaining is 103,714 gpd*** (pipe segment from manholes 2 to 3 on Maple Court). This represents available peak capacity (peak hourly flow). All of the other pipes in the project area may accommodate a minimum of this amount of design capacity. Since there will be a pump station on the redeveloped site, the pump-rate will need to be designed ***not to exceed the 103,714 gpd minimum capacity*** remaining which is equivalent to a ***maximum discharge rate of 72 gallons per minute (gpm).*** Please note that this assumes ideal pipe conditions for theoretical flows using Manning's equation. It does not account for obstructions, grease, roots, sags, broken pipe, sediment, offset joints or anything else that may affect flow in the system. There is a greater likelihood for surcharging conditions in pipes with any such obstructions. It is important that the town televise all 2,822 feet of sewers included in the project area listed in Table 1, in Appendix B to observe actual conditions.

It is also recommended that the town perform an inspection of the grease handling procedures and/or grease interceptors at restaurants in the study area. Grease was observed in the subject pipelines and is known by town personnel to be a problem in these areas. If assistance is required in performing these inspections, or creating a comprehensive town-wide Fat, Oil and Grease (FOG) management program, we are available to discuss this. At a minimum this area should be included with the town's routine "grease cleaning program."

We wish to thank you and members of the Department of Public Works and Wastewater Treatment Plant staff, particularly Mark Kuras, for providing assistance to us while completing this project. We are available to meet with you at your earliest convenience to discuss this report. Please do not hesitate to contact me at (978) 532-1900 with any questions or comments you may have.

Very truly yours,

WESTON & SAMPSON ENGINEERS, INC.

Hillary Lacirignola, P.E.
Project Manager

cc: Richard Sasseville
Mark Kuras

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APPENDIX A
FIGURES

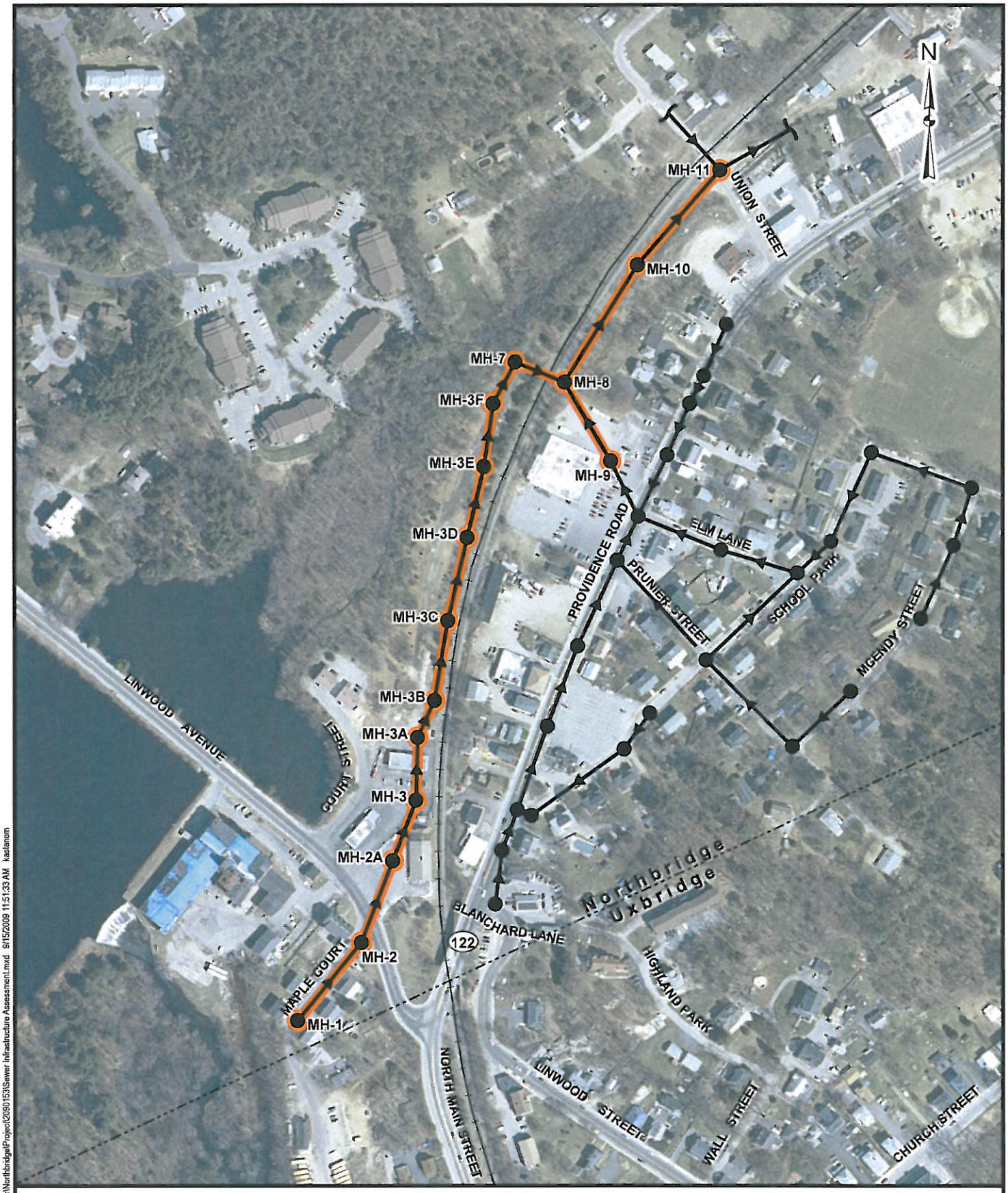

FIGURE 1
TOWN OF NORTHBRIDGE, MASSACHUSETTS

SEWER INFRASTRUCTURE ASSESSMENT
HYDRAULIC CAPACITY ANALYSIS

Hydraulic Capacity Analysis Pipes

NOT TO SCALE

Weston & Sampson

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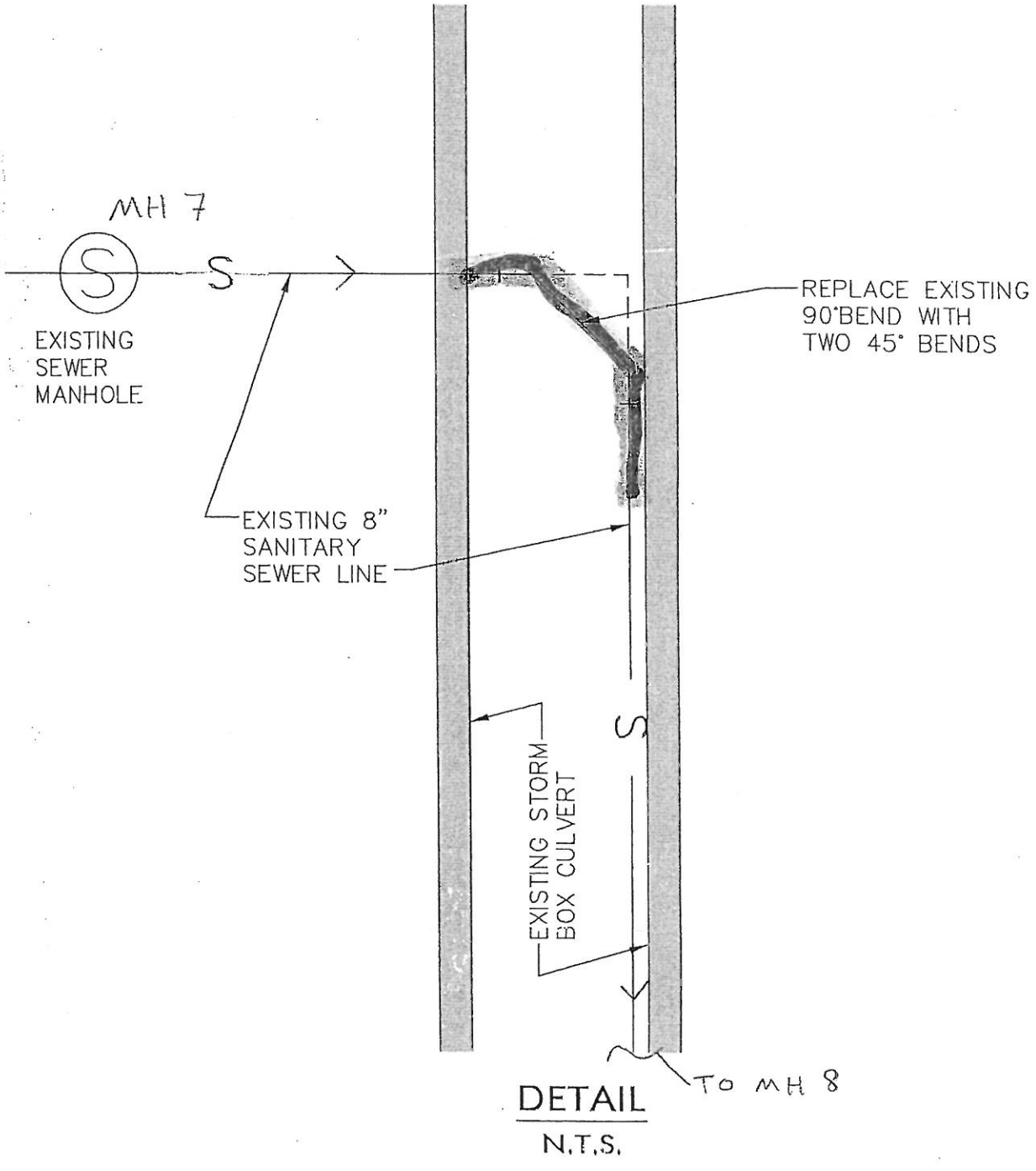
FIGURE 2
TOWN OF NORTHBRIDGE MASSACHUSETTS
SEWER INFRASTRUCTURE ASSESSMENT
PIPE CONFIGURATION DETAIL



DETAIL
N.T.S.

APPENDIX B
TABLE 1

Table
Northbridge Massachusetts Sewe
Linwood Mill Sewer Evaluation F

Location	Upstream MH	Downstream MH	Approximate Installation Year	Underdrain Status	Sheet Number	Time of Inspections on 6/11/09	Estimate Flow Rate ft/sec	Estimate Flow Depth (in)	Pipe Condition	Notes	Diameter (Inches)	M
Maple Court	1	2	1913	N/A	Maple Street Outlet Sheet 40	8am	<1	<1	Good		8	
Railroad Easement	2	3	1913	N/A	Maple Street Outlet Sheet 40	8:15am	<1	<1	Good. Unable to fit zoom camera into invert in MH 2A. Light grease in pipe.	Previous Surcharging in MH 2A due to Chinese Restaurant SVC that enters MH. Heavy grease output to sewer from Restaurant MH2A not on record drawings. Depth 2.6 feet taken in field. MH2A approximately 201 feet downstream from MH2. MH3 is approximately 134 feet downstream from MH2A. Possible previous surcharging in MH3.	8	
Railroad Easement	3	3A	1913	N/A	Heritage Design Group - Linwood Business Park Site Plan - Maple Street Outlet Sheet 40	9:00am	1	1.0	Good	Slope assumed to be .001 based on 1913 Record Drawings which on 2006 Heritage/Linwood plan state "to remain" .001.MH3 connects to MH3A located behind car wash bays. New pvc sewer around storage buildings begins here. MH3A approximately 121 feet downstream from MH3	8	
Railroad Easement	3A	3B	2006	N/A	Heritage Design Group - Linwood Business Park Site Plan	9:15am	<1	1.5	Unable to fit zoom camera into invert in MH3A.	No invert in MH3A. Previous surcharging in MH3A. MH3B depth is 4.8 feet taken in field.	8	
Railroad Easement	3B	3C	2006	N/A	Heritage Design Group - Linwood Business Park Site Plan	9:30am	<1	1.5	Good. Light grease in pipe	MH3C depth is 5.3 feet taken in field	8	
Railroad Easement	3C	3D	2006	N/A	Heritage Design Group - Linwood Business Park Site Plan	9:45am	<1	1.5	Good. Light grease in pipe		8	
Railroad Easement	3D	3E	2006	N/A	Heritage Design Group - Linwood Business Park Site Plan	N/A	unknown	unknown	N/A	MH3D and MH3E Uncovered by town. Normal flows observed.	8	
Railroad Easement	3E	3F	2006	N/A	Heritage Design Group - Linwood Business Park Site Plan	10:30am	<1	3.0	Good. Moderate Grease	Flow depth increases due to grease build up in downstream line. MH3F depth is 6.45 feet taken in field.	8	
Railroad Easement	3F	7	2006	N/A	Heritage Design Group - Linwood Business Park Site Plan - Maple Street Outlet Sheet 40	10:45am	<1	3.5	Good. Moderate Grease	MH7 is approximately 80 feet downstream from MH3F. Signs of previous surcharge in MH3.	8	
Railroad Crossing	7	8	1913	5-inch underdrain	Maple Street Outlet Sheet 40	11:00am	<1	4.0	Good, Moderate Grease	Grease build up in pipe. PVC 45 degree angle approximately 6 feet outside of MH7 to MH8. Moderate roots in MH8.	8	
Railroad Easement	8	10	1913	N/A	Maple Street Outlet Sheet 39 and 40	12:00pm	<1	3.5	Good	Possible additional MH 5 feet downstream of MH8.	12	
Railroad Easement	10	11	1913	5-inch underdrain	Maple Street Outlet Sheet 39	12:30pm	1	3.0	Good	Light roots in MH10.	12	
Railroad Easement	9	8	1913	5-inch underdrain	Maple Street Outlet Sheet 39	11:30am	<1	2.5	Good	MH9 located outside corner of Salvation Army in parking lot. Roots in MH8 invert causing minor backup.	10	

[1]Stated on Record Drawings (not calculated)