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To:	Aaron Miklosko, Director Town of Maynard DPW	From:	Victor A. Olson Burlington MA Office
File:	195110237	Date:	August 22, 2017

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**Reference: Review of Powder Mill Place Development 2,4,12,18 Powder Mill Road, Acton Massachusetts 112,114,116,118 Powder Mill Road, Maynard, Massachusetts - Sewer Impact Analysis and Condition Assessment Recommendations**

This memorandum summarizes the results of Stantec's analysis to evaluate the downstream impacts to the sewerage capacity from development of Powder Mill Place. Stantec also completed review of closed circuit television (CCTV) work completed by others to assess condition of existing sewers and analyze impacts of the future flows from the Powder Mill Place Development.

### **Summary of Hydraulic Modeling**

Stantec created a hydraulic model to evaluate the impact of the proposed development at Powder Mill Place on the town of Maynard Sanitary Sewer System. The hydraulic model represents the main collector sewers in Sewer Area B that discharge to the wet well at the Powdermill Pump Station. The modeling software selected for these evaluations was Innowyze's InfoWorks CS version 14.5.

The model was created using Maynard's GIS database to determine manhole locations. Manhole rims and inverts were determined from the towns record drawing information. Pipe information was also a combination of record drawing information, manhole inspections and video inspection for condition.

Sewer Area B was divided into smaller sewersheds from property lines. Each subcatchment is tributary to the closest MH of the same name. The total wastewater flow for a Sewer Area was proportioned to these smaller sewersheds based on the sewershed's percent of the total Sewer Area sanitary sewer subcatchments. For residential properties we used Maynard 2010 census figures which indicated 2.38 persons per household. We added population for each catchment to the model and assigned 70 gallons per day per person. We made assumptions for commercial property flow from Google street view and assessors information. All of this is summarized in the attached spreadsheet Sanitary Flows for model table Attachment A, which summarizes sanitary sewer flows for the model. The model was run for existing flow conditions and for future flow conditions with the proposed development contributing to sanitary flows. Currently the office building formerly occupied by Stratus Technologies at 111 Powdermill Road is not occupied and is not contributing to existing flows significantly. There is discussion of this building becoming occupied with a change of use as a boarding school.

We included 3,000 gpd/idm for infiltration just to include some infiltration. The area hasn't been flagged as a high I/I area in previous studies.

We also used the same diurnal curve for residential sanitary that we used for previous evaluations completed recently in Maynard. For the commercial properties the flows were spread out over the 12 hour period from 8 AM to 8 PM and other times are zero.

### **Design with community in mind**

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112,114,116,118 Powder Mill Road, Maynard, Massachusetts - Sewer Impact Analysis and Condition  
Assessment Recommendations**

The proposed development at Powder Mill Place adds 600 people or 42,000 gallon per day (gpd).

Results are also presented in the attached spreadsheets. We included a plot of the existing conditions Hydraulic Grade Line (HGL), and adding the proposed development, without the office building flows, indicated that the line has sufficient capacity however, with the addition of flows of the fully occupied office building or boarding school it would put the 8-inch line near capacity with the proposed Powder Mill Place Development.

### **Condition Assessment of Existing Sewers**

Stantec performed a detailed review of CCTV tapes and reports that were completed by Wayne's Drains on July 6<sup>th</sup> and 7<sup>th</sup>, 2017. We assessed the general condition of existing sewers and included a summary of existing conditions and recommended system improvements in attached table.

In general, these lines are all 8-inch diameter and only serve the local subcatchment Area B. They are showing some signs of wear that would be exacerbated with the proposed increase in flows. Cracks were noted, a few holes, a couple of obstacles and numerous minor sags.

Broken Pipe: The section of sewer between SMH1 (B11) to SMH2(B11A) has a 6-foot long section that is broken and severely out of alignment which will require it to be excavated and replaced for approximately 12 feet. There are other numerous cracks and minor roots that should be addressed by completely cleaning and lining the entire 132 feet of this pipeline with a cured in place liner across the excavated point repair to preserve the structural integrity of this segment to carry additional future flows. SMH2(B11A) is in poor condition and the invert should be completely rebuilt and rehabilitated.

Collapsing pipe: The section of sewer between SMH9(B6) to SMH10(B5) has sections that are out of round with hinge cracking showing early signs of collapse, holes in pipe and sags and generally poor condition. It is only 84 feet long and should be replaced prior to increasing flows to this segment.

Corroding pipe: The section of sewer between SMH14(2A) to Powdermill Pump Station shows signs of severe corrosion. The CCTV inspection report and video indicates that this section of sewer is made up of vitrified clay pipe, but upon further inspection Stantec believes that this could be an asbestos cement pipe. This segment of sewer also tends to build up with grease and may require additional cleaning and maintenance. The line at a minimum should be cleaned and lined with a cured in place structural liner. This segment of 8-inch diameter sewer is at a flatter slope than the upstream sewer segments. Stantec recommends that due to the presence of severe corrosion, grease build up and future capacity issues that this segment be upsized to a 12-inch diameter sewer. It is only 61 feet long and should be replaced prior to increasing flows to this segment.

Pipes segments with cracks and sags: The other 11 segments of sewers totaling 1,850 linear feet that have cracks and some minor sags are recommended to be cleaned and lined with a cured in place liner prior to increasing flows to preserve their structural integrity. Lining the sewer manholes in addition to any structural repairs should be completed when the sewers are lined.

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**Conclusions and Recommendation:**

As stated above we have the following recommendations:

1. Lining 1,982 linear feet of 8-inch diameter sewer
2. Replacing 84 linear feet of 8-inch diameter sewer with new 8-inch diameter poly vinyl chloride PVC pipe.
3. Replacing 61 linear feet of 8-inch diameter sewer with new 12-inch diameter poly vinyl chloride PVC pipe.

See Attachment C for a Summary of Existing Conditions and Recommended System Improvements and See Attachment D for a Summary of Proposed Work and Costs.

Please contact us if you have any questions regarding this memo.

Respectfully Submitted,

**Stantec Consulting Services Inc.**

*Victor A Olson*

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Attachment A: Sanitary Flows for Sewer Model Table

Attachment B: Hydraulic Modelling Summary and Hydraulic Grade Line Plots

Attachment C: Summary of Existing Conditions and Recommended System Improvements Table

Attachment D: Summary of Proposed Work and Costs Table

**Design with community in mind**



PROJECT: Powdermill Place Development  
 SUBJECT: Attachment A  
 Sanitary Flows for model

Project No: 195110237  
 Computed By: KAK  
 Date: 08/10/17  
 Checked By:  
 Date:

Sub-catchment ID	Node ID	Assessor Parcel Number	Residential Units	Residential Population <sup>1</sup>	Commercial Units	Estimated Comm Flow	Total Comm San <sup>2</sup> (MGD)	Notes	Assumptions
B01	B01	010.0-0000-0098.0			2	20		Auto Repair	2 employees
		010.0-0000-0099.0			1	65		Industrial building	5 employees
		010.0-0000-0100.0			1	100		Bank	10 employees
		2 additional parcels	2					Single Family Residential	
		<b>TOTAL</b>	2	5	4	185	0.0002		
B03	B03	<b>TOTAL</b>	1	2					
B04	B04	010.0-0000-0097.0			6	990		Auto Supply, stores, restaurant x2	24 emp/250 meals
		8 additional parcels	8					Single Family Residential	
		<b>TOTAL</b>	8	19	6	990	0.0010		
B05	B05	<b>TOTAL</b>	2	5					
B06	B06	011.0-0000-0001.0			1	20		Retail store	2 employees
		011.0-0000-0003.0			1	100		BANK	10 employees
		9 additional parcels	9					Single Family Residential	
		<b>TOTAL</b>	9	21	1	120	0.0001		
B07	B07	<b>TOTAL</b>	11	26					
B08	B08	011.0-0000-0004.0	56					7 buildings w/ 8 units each	
		9 additional parcels	9					Single Family Residential	
		<b>TOTAL</b>	65	155					
B09	B09	011.0-0000-0005.0	2					2 Family Residential	
		9 additional parcels	9					Single Family Residential	
		<b>TOTAL</b>	11	26					
B09A	B09A	016.0-0000-0001.0	78		6	990		12 buildings w/78 units	
		3 additional parcels	3					Single Family Residential	
		<b>TOTAL</b>	81	193					
B10	B10	<b>TOTAL</b>	2	5					
B10A	B10A	011.0-0000-0016.0			1	1,880		Restaurant	8 emp/600 meals
		011.0-0000-0017.0			2	20		Warehouse	2 employees
		010.0-0000-0064.0						Empty office building	0 employees
		<b>TOTAL</b>			3	1,900	0.0019		
B11	B11	<b>TOTAL</b>	2	5					
B19	B19	010.0-0000-0101.0	0		1	20		Retail store	2 employees
		010.0-0000-0103.0	2		0	0		Two family res	
		010.0-0000-0104.0	1		1	20		1 Res unit with comm office	2 employees
		010.0-0000-0110.0	32		0	0		32 Apartments in 6 buildings	
		010.0-0000-0143.0	64		0	0		64 Apartments in 4 buildings	
		15 additional parcels	15		0	0		Single Family Residential	
		<b>TOTAL</b>	114	271	40	0.0001			100gpd is comm minimum in model
			733						

1: Massachusetts 2010 demographic profile for Maynard states average household size = 2.38 people

2: Typical wastewater flowrates from commercial sources (Metcalf & Eddy - Wastewater Engineering, Treatment, Disposal, Reuse, 3rd Edition, 1991)

Facility	Unit	Range	Typical
Office	Employee	7	13
Industrial Building	Employee	7	16
Restaurant	Meal	2	4
Small Store	Employee	8	12

Powder Mill Place adds 254 Residential Units, but removes 2 Single Family Houses (Net = 252)

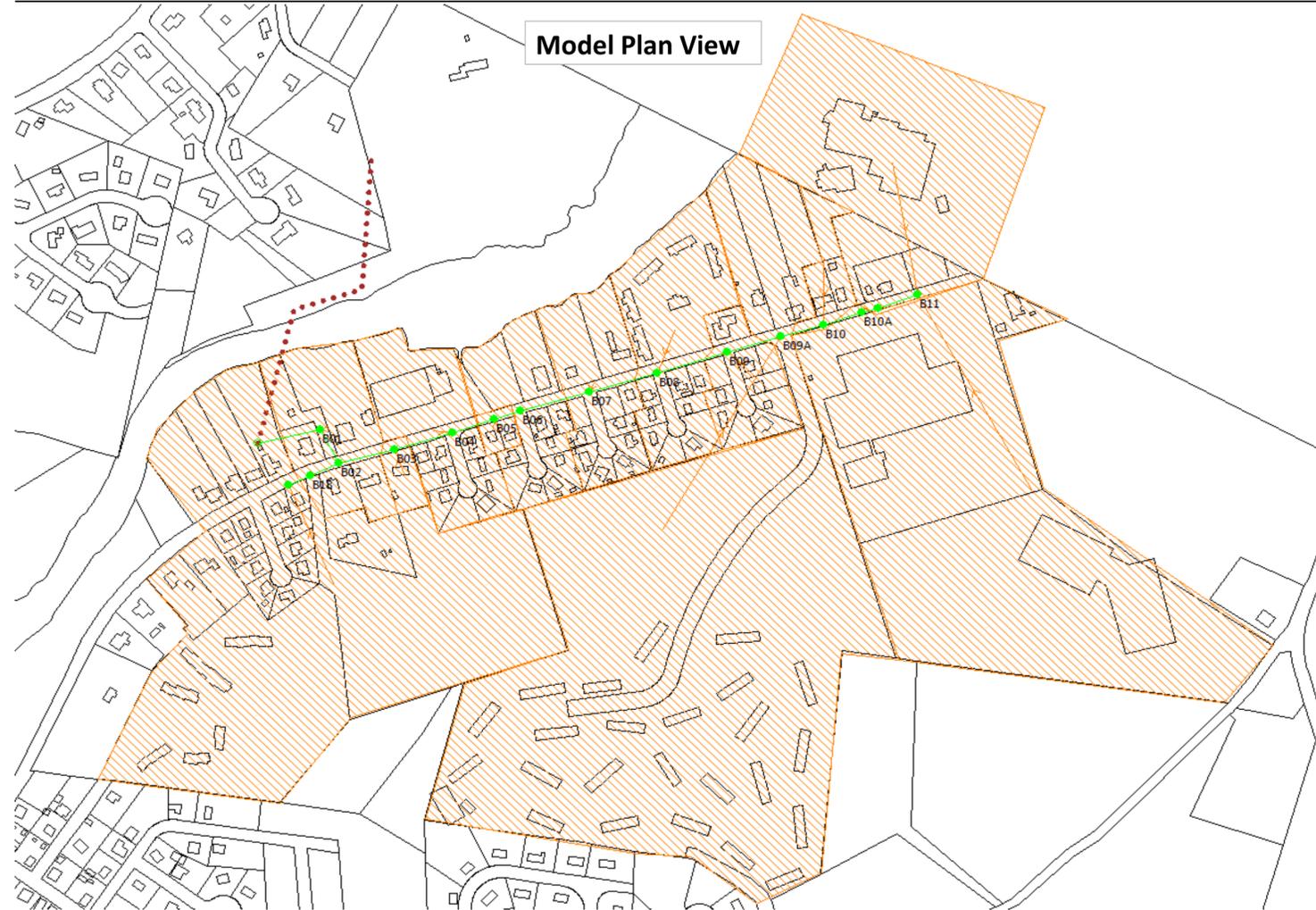
B11	B11	<b>TOTAL</b>	252	600	New Development
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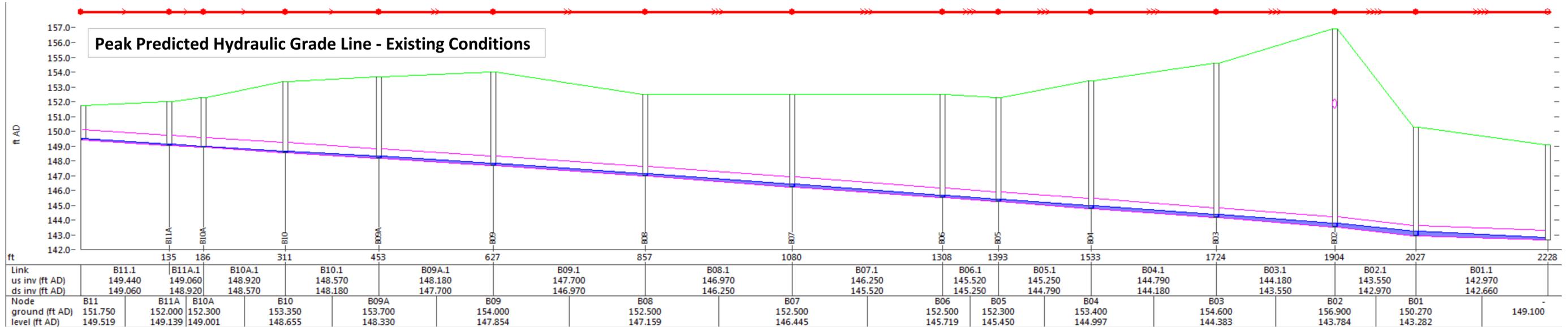
\\us1552-f01\workgroup\1951\active\195110237\Powdermill Place Development\Hydraulic Model\Hydraulic Modeling Summary.xlsx Sanitary Flows



PROJECT: Powdermill Place Development  
SUBJECT: Existing System Results

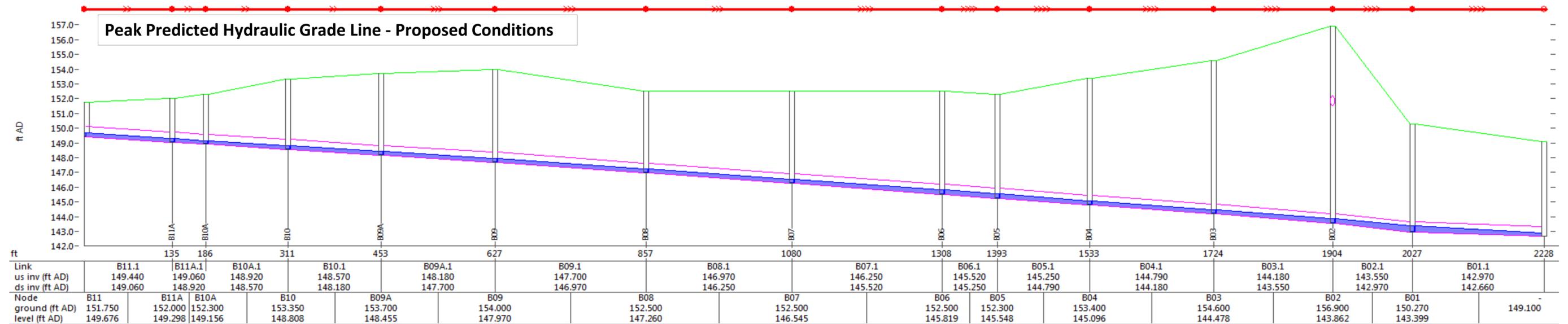
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Date: 08/15/17  
Checked By: \_\_\_\_\_  
Date: \_\_\_\_\_





**EXISTING CONDITIONS**

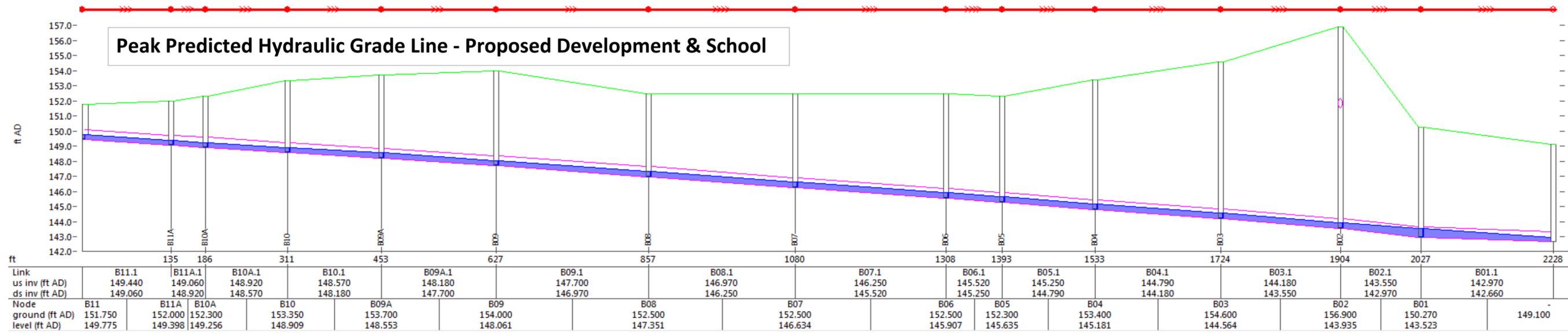
US Node ID	DS Node ID	Length (ft)	Diameter (in)	Manning's Roughness	US Invert (ft AD)	DS Invert (ft AD)	Infiltration (MGD)	Gradient (%)	Conduit full capacity (MGD)	Max DS Depth (ft)	Depth/Diameter	Max DS Flow (MGD)	Flow/Capacity	Max DS Velocity (ft/s)
B11	B11A	134.50	8.00	0.015	149.44	149.06	0.0004	0.283	0.360	0.08	11.91%	0.0030	0.84%	0.199
B11A	B10A	52.00	8.00	0.015	149.06	148.92	0.0002	0.269	0.350	0.08	12.08%	0.0032	0.91%	0.205
B10A	B10	124.90	8.00	0.015	148.92	148.57	0.0004	0.280	0.360	0.08	12.68%	0.0036	0.99%	0.214
B10	B09A	141.90	8.00	0.015	148.57	148.18	0.0004	0.275	0.350	0.15	22.50%	0.0047	1.34%	0.183
B09A	B09	173.60	8.00	0.015	148.18	147.70	0.0005	0.276	0.360	0.15	23.10%	0.0329	9.14%	0.837
B09	B08	230.40	8.00	0.015	147.70	146.97	0.0007	0.317	0.380	0.19	28.35%	0.0373	9.82%	0.707
B08	B07	222.50	8.00	0.015	146.97	146.25	0.0007	0.324	0.390	0.20	29.25%	0.0600	15.38%	1.092
B07	B06	228.40	8.00	0.015	146.25	145.52	0.0007	0.320	0.380	0.20	29.85%	0.0643	16.92%	1.136
B06	B05	84.50	8.00	0.015	145.52	145.25	0.0003	0.320	0.380	0.20	30.00%	0.0676	17.79%	1.191
B05	B04	140.40	8.00	0.015	145.25	144.79	0.0004	0.328	0.390	0.21	31.05%	0.0687	17.62%	1.151
B04	B03	190.50	8.00	0.015	144.79	144.18	0.0006	0.320	0.380	0.20	30.45%	0.0729	19.18%	1.250
B03	B02	180.60	8.00	0.015	144.18	143.55	0.0005	0.349	0.400	0.23	35.10%	0.0737	18.43%	1.048
B02	B01	122.10	8.00	0.015	142.97	142.97	0.0004	0.475	0.470	0.31	46.80%	0.1128	24.00%	1.088
B01	B21 (PUM)	201.00	8.00	0.015	142.66	142.66	0.0006	0.154	0.270	0.20	29.55%	0.1142	42.30%	2.043



**RESULTS WITH POWDER MILL PLACE DEVELOPMENT**

US Node ID	DS Node ID	Length (ft)	Diameter (in)	Manning's Roughness	US Invert (ft AD)	DS Invert (ft AD)	Infiltration (MGD)	Gradient (%)	Conduit full capacity (MGD)	Max DS Depth (ft)	Depth/Diameter	Max DS Flow (MGD)	Flow/Capacity	Max DS Velocity (ft/s)
B11	B11A	134.50	8.00	0.015	149.44	149.06	0.0004	0.283	0.360	0.24	35.66%	0.0885	24.58%	1.226
B11A	B10A	52.00	8.00	0.015	149.06	148.92	0.0002	0.269	0.350	0.24	35.46%	0.0886	25.32%	1.237
B10A	B10	124.90	8.00	0.015	148.92	148.57	0.0004	0.280	0.360	0.24	35.75%	0.0889	24.70%	1.227
B10	B09A	141.90	8.00	0.015	148.57	148.18	0.0004	0.275	0.350	0.28	41.25%	0.0900	25.71%	1.025
B09A	B09	173.60	8.00	0.015	148.18	147.70	0.0005	0.276	0.360	0.27	40.50%	0.1179	32.75%	1.373
B09	B08	230.40	8.00	0.015	147.70	146.97	0.0007	0.317	0.380	0.29	43.50%	0.1222	32.16%	1.297
B08	B07	222.50	8.00	0.015	146.97	146.25	0.0007	0.324	0.390	0.30	44.25%	0.1446	37.08%	1.500
B07	B06	228.40	8.00	0.015	146.25	145.52	0.0007	0.320	0.380	0.30	44.85%	0.1489	39.18%	1.520
B06	B05	84.50	8.00	0.015	145.52	145.25	0.0003	0.320	0.380	0.30	44.70%	0.1521	40.03%	1.559
B05	B04	140.40	8.00	0.015	145.25	144.79	0.0004	0.328	0.390	0.31	45.90%	0.1532	39.28%	1.519
B04	B03	190.50	8.00	0.015	144.79	144.18	0.0006	0.320	0.380	0.30	44.70%	0.1573	41.39%	1.612
B03	B02	180.60	8.00	0.015	144.18	143.55	0.0005	0.349	0.400	0.31	46.80%	0.1581	39.53%	1.532
B02	B01	122.10	8.00	0.015	142.97	142.97	0.0004	0.475	0.470	0.43	64.35%	0.1963	41.77%	1.280
B01	B21 (PUM)	201.00	8.00	0.015	142.66	142.66	0.0006	0.154	0.270	0.26	39.00%	0.1978	73.26%	2.431

\\us1552-f01\workgroup\1951\active\195110237\Powdermill Place Development\Hydraulic Model\Hydraulic Modeling Summary.xlsx Existing Pipe Capacity Results



Link	B11.1	B11A.1	B10A.1	B10.1	B09A.1	B09.1	B08.1	B07.1	B06.1	B05.1	B04.1	B03.1	B02.1	B01.1
us inv (ft AD)	149.440	149.060	148.920	148.570	148.180	147.700	146.970	146.250	145.520	144.790	144.180	143.550	142.970	142.660
ds inv (ft AD)	149.060	148.920	148.570	148.180	147.700	146.970	146.250	145.520	144.790	144.180	143.550	142.970	142.660	-

**TOWN OF MAYNARD, MA  
POWDERMILL ROAD - SEWER EVALUATION**

**ATTACHMENT C - SUMMARY OF EXISTING CONDITIONS AND RECOMMENDED SYSTEM IMPROVEMENTS**

Street	Town Disc Number	System	Stantec Pipe Rating*	Structural PACP Pipe Rating	O&M PACP Pipe Rating	Overall PACP Pipe Rating	Manhole No.			Pipe Material	Pipe Diameter (inches)	Distance (feet)	No. of Point Repairs (Excavated)	Point Repair Locations **	No. of Point Repairs (Trenchless)	Point Repair Locations **	Recommended Rehabilitation		Notes
							Direction	Start	End								Line (feet)	Replace (feet)	
POWDERMILL RD	V:Drive	Sewer	4	22	19	41	Downstream	SMH 1 (B11)	SMH 2 (B11A)	VCP	8	132	1	108.0' to 114.0'			132	-	Spiral cracking at 2.0'. Longitudinal cracking at 2.0'. Spiral cracking at 7.6'. Spiral cracking at 9.2'. Deposits settled fine at 38.6'. Roots fine joint at 39.0', 42.6' 46.9', and 51.1'. Roots medium joint at 61.0', 62.9' and 63.3'. Line down at 108.6'. Broken pipe at 111.9'. SMH 2 looks to be in poor structural condition. A root cutter was used to remove roots in this pipeline.
POWDERMILL RD	V:Drive	Sewer	4	10	0	10	Downstream	SMH 2 (B11A)	SMH3 (B10A)	VCP	8	51					51	-	Spiral cracking at 1.6' and 4.2'. Longitudinal cracking at 19.0'. Sag in the pipeline from 37.3' to 47.1'.
POWDERMILL RD	V:Drive	Sewer	4	5	0	5	Downstream	SMH 3 (B10A)	SMH 4 (B10)	VCP	8	127					127	-	Hole with void visible at 4.6'.
POWDERMILL RD	V:Drive	Sewer	4	16	0	16	Upstream	SMH 5 (B23)	SMH 4 (B10)	VCP	8	102					102	-	Sag in the pipeline from 36.4' to 44.6'. Hole with void visible at 37.4'. Spiral cracking at 37.4'. Hole with void visible at 38.3'. Survey abandoned at 101.4' due to a brick being lodged within the pipeline. Brick will need to be removed.
POWDERMILL RD	V:Drive	Sewer	4	8	5	13	Upstream	SMH 4 (B10)	SMH 5 (B23)	VCP	8	31					31	-	Spiral cracking at 6.1'. Longitudinal cracking at 6.1'. Spiral cracking at 7.5'. Survey abandoned at 31.0' due to a brick being lodged within the pipeline. Brick will need to be removed.
POWDERMILL RD	V:Drive	Sewer	4	4	5	9	Downstream	SMH 5 (B23)	SMH 6 (B9)	VCP	8	167					167	-	Intruding service at 36.7'. Spiral cracking at 71.9'.
POWDERMILL RD	V:Drive	Sewer	4	14	5	19	Downstream	SMH 6 (B9)	SMH 7 (B8)	VCP	8	224					224	-	Spiral cracking at 0.5'. Intruding lateral at 12.9'. Several sags in the pipeline that should not impact the installation of a CIPP liner.
POWDERMILL RD	V:Drive	Sewer	4	0	0	0	Downstream	SMH 7 (B8)	SMH 8 (B7)	VCP	8	222					222	-	Some sags in the pipeline but should not impact the installation of a CIPP liner.
POWDERMILL RD	V:Drive	Sewer	4	10	1	11	Downstream	SMH 8 (B7)	SMH 9 (B6)	VCP	8	226					226	-	Some sags in the pipeline but should not impact the installation of a CIPP liner. Roots fine joint at 26.8'.
POWDERMILL RD	V:Drive	Sewer	5	24	0	24	Downstream	SMH 9 (B6)	SMH 10 (B5)	VCP	8	84					NRR	84	Hole with void visible at 2.0'. Hinge cracking at 2.0'. Spiral cracking at 2.0', 3.1', and 3.9'. Longitudinal cracking at 2.0'. Point repair at 28.7'. Sags in the pipeline.
POWDERMILL RD	V:Drive	Sewer	4	2	0	2	Downstream	SMH 10 (B5)	SMH 11 (B4)	VCP	8	142					142	-	Some sags in the pipeline but should not impact the installation of a CIPP liner.
POWDERMILL RD	V:Drive	Sewer	4	N/A	N/A	N/A	Downstream	SMH 11 (B4)	SMH 12 (B3)	VCP	8	187					187	-	Some sags in the pipeline but should not impact the installation of a CIPP liner. Signs of infiltration found through out.
POWDERMILL RD	V:Drive	Sewer	4	29	18	47	Downstream	SMH 12 (B3)	SMH 13 (B2)	VCP	8	195					195	-	Some sags in the pipeline but should not impact the installation of a CIPP liner. Intruding services at 22.9' and 104.9'. Signs of infiltration found through out. Longitudinal cracking at 47.2'. Spiral cracking at 154.6'.
POWDERMILL RD	V:Drive	Sewer	4	27	21	48	Downstream	SMH 13 (B2)	SMH 14 (2A)	VCP	8	176					176	-	Some sags in the pipeline but should not impact the installation of a CIPP liner. Signs of infiltration found through out. Spiral cracking at 11.9', 12.3' and 12.7'. Hole with void visible and roots at 116.2'. Roots fine joint at 117.8' and 119.8'. Material change to PVC at 166.9'.
POWDERMILL RD	V:Drive	Sewer	5	26	33	59	Downstream	SMH 14 (2A)	Pump Station	VCP/AC (?)	8	61					NRR	61	Some sags in the pipeline but should not impact the installation of a CIPP liner. Grease deposits at 5.1' and 60.9'. This pipe may be AC pipe. The Record Plans provided did not indicate material.
<b>Subtotal</b>												<b>2,127</b>	<b>1</b>				<b>1,982</b>	<b>145</b>	
<b>TOTAL</b>												<b>2,127</b>	<b>1</b>				<b>1,982</b>	<b>145</b>	

\* 1 (Excellent Condition) - 5 (Severe Deterioration)  
\*\* Distance from Starting Manhole in feet

- Replacement
- Incomplete Video
- CIPP Lining
- CIPP Lining with Point Repair
- Upsizing

