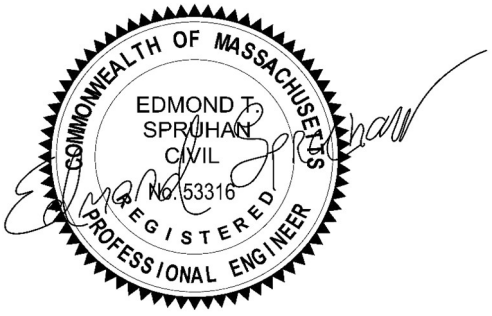
SPRUHAN ENGINEERING, P.C.

PIPE FLOW CALCULATIONS

500 SCHOOL ST, MANSFIELD, MA



Prepared By: Spruhan Engineering

Date: July 28th, 2020. ; Revised: September 1st, 2020.

To whom it may concern:

The following information prepared by **Spruhan Engineering, P.C.** presents the pipe flow calculations for the proposed development located at 500 School St, Mansfield, Massachusetts.

Roof:

The pipe under evaluation is a 12" PVC Blue Brute drainage pipe, which has a Manning's roughness coefficient of 0.009, and it must be capable of transferring water collected from the building roof with a drainage area of 44,266 S.F. and a Flow Rate of 5.75 cfs to a subsurface infiltration system.

Total Required Flow Rate = 5.75 Cfs / 2 pipes = 2.87 cfs

Pipe provided Volume = 4.69 cfs (See Appendix A for Calculations)

Driveway:

The pipe under evaluation is a 12" RCP drainage pipe, which has a Manning's roughness coefficient of 0.012, and it must be capable of transferring water collected from 2 driveways with a drainage area of 10,814 S.F. and a Flow Rate of 1.41Cfs to a subsurface infiltration system.

Total Required Flow Rate = 1.41 cfs / 2 pipes = .7 cfs

Pipe provided Volume = 2.48 cfs (See Appendix A for Calculations)

Parking:

The pipe under evaluation is a 12" RCP drainage pipe, which has a Manning's roughness coefficient of 0.012, and it must be capable of transferring water collected from a paved parking with a drainage area of 16,774 S.F. and a Flow rate of 2.18 cfs to a subsurface infiltration system.

Total Required Flow Rate = 2.18 cfs

Pipe provided Volume = 2.48 cfs (See Appendix A for Calculations)

HydroCAD was used to calculate the peak discharge and a spreadsheet that uses Manning's equation to calculate pipe flow capacity. These calculations were carried out using a rainfall intensity of 5.6 inches/hour for a 25 Year Storm Event to show that the proposed pipe can cope with peak discharge from the two driveways at 75% capacity and the minimum Slope to be more conservative, therefore Spruhan Engineering, P.C. recommend the use of this pipe, further information is shown in Appendix A below.

APPENDIX A

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Inputs:

Pipe Diameter, d_o	12.0000	in
Manning Roughness, n	0.0120	
Pressure slope (possibly equal to pipe slope), S_o	0.5000	% slope
Percent of (or ratio to) full depth (100% or 1 if flowing full)	0.7500	fraction

Results:

Flow, Q	2.4886	ft^3/s
Velocity, v	1.2005	m/s
Velocity head, hv	0.0735	m
Flow Area, A	0.0587	m^2
Wetted Perimeter, P	0.6384	m
Hydraulic Radius	0.0920	m
Top Width, T	0.2640	m
Froude Number, F	0.81	
Shear Stress (tractive force), τ	11.2083	N/m^2

Version 2.0 (20 June 2017)
HawsEDC Calculators

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Inputs:

Pipe Diameter, d_o	12.0000	in
Manning Roughness, n	0.0090	
Pressure slope (possibly equal to pipe slope), S_o	1.0000	% slope
Percent of (or ratio to) full depth (100% or 1 if flowing full)	0.7500	fraction

Results:

Flow, Q	4.6925	ft^3/s
Velocity, v	2.2636	m/s
Velocity head, hv	0.2613	m
Flow Area, A	0.0587	m^2
Wetted Perimeter, P	0.6384	m
Hydraulic Radius	0.0920	m
Top Width, T	0.2640	m
Froude Number, F	1.53	
Shear Stress (tractive force), τ	22.4165	N/m^2

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HawsEDC Calculators