

PUMP STATION and DISPOSAL FIELD DESIGN COMPUTATIONS

Barry - Failed Septic

Project Location:

*5697 Ethan Allen Highway
Charlotte, VT 05445*

Project Name:

Barry Wastewater Design

Applicant:

Bruce Barry

Date:

August 6, 2018

Project No.:

18-128



478 Blair Park Road
Williston, VT 05495
VOICE (802) 879-6331

DISPOSAL AREA COMPUTATIONS

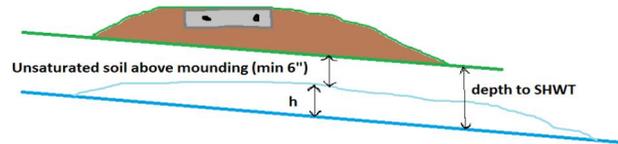
For: 5697 Ethan Allen Highway
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Project No. 18-128
Calculated by: ALR
Checked by: ALR

Filtrate Mound System Simplified Mounding Analysis

Depth to SHWT 12 inches

Minimum Available Soil to
Groundwater Mounding (h) 0.5 feet



Type of Soil **Fine Sandy Loam** slope category
Natural Ground Slope **3** **B**

System Design Flow **420** gpd
Loading Rate **2.0** gal/day/sf
Minimum System Area 210 sf

Check minimum length using linear loading rate:

$$\begin{aligned} \text{LLR} &= (h)(f) \\ h &= \mathbf{0.5} \text{ the soil thickness available for groundwater mounding} \\ f &= \mathbf{4.4} \text{ the LLR Factor from Table 1 Appendix 7-A EPR} \\ \text{LLR} &= 2.2 \end{aligned}$$

Minimum Length Required per Linear Loading Rate:

$$\frac{420}{2.2} = 191 \text{ feet}$$

System Info:

System Width **4.5** feet
System Length **60** feet **ERROR LONGER SYSTEM REQUIRED**
of Infiltration Areas **1** **RESOLVE - Provide Downhill Pad, See Plan**
System Area 270

Actual Linear Loading Rate = System Flow / Total System Length

$$\text{LLR (actual)} = 7.00 \text{ gpd/lf}$$

Re-Solve for soil thickness available for groundwater mounding

$$\begin{aligned} \text{LLR}/f &= 1.591 \text{ ft} \\ h \text{ (actual)} &= 19 \text{ inches} \end{aligned}$$

Unsaturated soil above induced mounding

depth to SHWT - **-7** inches **ERROR INCREASE UNSATURATED SOIL**
h (actual) = **RESOLVE - mounding is 1" into the sand**
provide additional sand @25" total

Depth to ledge on-site	use 48 if no ledge to depth	=	48 inches	assumed
Required distance between bottom of trench ledge		=	24 inches	
Required distance between bottom of trench and induced SHWT		=	18 inches	
Distance between ground surface and induced SHWT		=	-7 inches	
Minimum mound sand required		=	12 inches	
Mound sand required		=	25 inches	

Septic Tank
1,000

Use 1,000 gallon Septic Tank

Civil Engineering Land Surveying Landscape Architecture Environmental Services

478 Blair Park Road Williston, VT 05495 802 879 6331 www.tcevt.com

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DESIGN DATA:

DESIGN FLOW: 420 Gal/Day
NUMBER OF DOSES PER DAY: 4 Minimum of 4
FORCE MAIN DIA. (INCHES): 2 SDR 26 PVC
PUMP STA. PIPE DIA (INCHES): 2 SDR 26 PVC
HAZEN WILLIAMS C-VALUE: 140

PUMP CHAMBER SPECIFICATIONS:

DIMENSIONS: LENGTH: (Inside) 88.00 inches = 7.33 feet
WIDTH: (Inside) 56.00 inches = 4.67 feet
DEPTH: (inside) 56.00 inches = 4.67 feet

Weep hole at pump station? (yes / no) yes

STORAGE: VOL PER FOOT: 256 gal/ft = 21 gal/in
PRIMARY VOLUME (between on & off) 128 gal/dose
RESERVE VOLUME (above on float) 576 gal = 1.4 days
VOL. IN PIPE RUN (used with weep only) 33 gal

TOTAL STORAGE ABOVE ALARM 576 gal

ELEVATIONS: PUMP STATION INLET 260.1 feet

	<u>Float Elevations</u>	<u>Float Settings</u>
ALARM	257.8 feet	3 " above on
ON	257.6 feet	6 " above off
OFF	257.1 feet	12 " above sump
SUMP	256.1 feet	

Depth of Sump: 8 inches

FIELD INFORMATION:

DISPOSAL AREA ELEVATION 260.5 feet
DEPTH OF STONE IN TRENCH 6.0 inches

CALCULATE STATIC HEAD:

DISCHARGE ELEVATION 263.1 feet
PUMP OFF ELEVATION 257.1 feet

TOTAL STATIC HEAD ⇒ 6.0 feet

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CALCULATE EQUIVALENT LENGTH:
FRICION LOSSES IN PUMP CHAMBER:

<u>QTY</u>	<u>DIA (IN)</u>	<u>LOSS/FITTING (FT)</u>	<u>FITTING</u>	<u>TOTAL</u>	
3	2	5.5	90 bend	16.5	FT
0	2	2.5	45 bend	0.0	FT
0	2	12.0	tee	0.0	FT
1	2	13.0	check valve	13.0	FT
1	2	55.0	gate or ball valve	55.0	FT
0	2	2.0	reducer (1 size)	0.0	FT
0	2	1.0	increaser (1 size)	0.0	FT
EQUIVALENT LENGTH:			85.0 FT	84.5	FT

FITTING FRICTION TABLE

<u>Dia:</u>	<u>1.5</u>	<u>2</u>	<u>2.5</u>	<u>3</u>	<u>4</u>
90 bend	4.3	5.5	6.5	8	10.0
45 bend	2	2.5	3	3.8	5.0
tee	9	12	14	17	22.0
check valve	11	13	16	20	26.0
gate valve	43	55	67	82	110.0
reducer (1 size)	1.0	2.0	2.0	3.0	4.0
increaser (1 size)	1.0	1.0	1.0	1.0	1.0

FRICION LOSSES IN PIPE RUN:

<u>QTY</u>	<u>DIA (IN)</u>	<u>LOSS/FITTING (FT)</u>	<u>FITTING</u>	<u>TOTAL</u>	
0	2	5.5	90 bend	0.0	FT
8	2	2.5	45 bend	20.0	FT
3	2	12.0	tee	36.0	FT
0	2	13.0	check valve	0.0	FT
0	2	55.0	gate or ball valve	0.0	FT
0	2	2.0	reducer (1 size)	0.0	FT
0	2	1.0	increaser (1 size)	0.0	FT
			LENGTH OF RUN ⌀	200.0	FT
EQUIVALENT LENGTH:			256.0 FT	256.0	FT

TOTAL EQUIVALENT LENGTH: ⇒ 341 FT

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PRESSURE DISTRIBUTION SYSTEM PARAMETERS:

	<u>Unit</u>	<u>Value</u>	<u>Comment</u>
GENERAL INFO:			
Min. Volume per Dose	gallons	161	
No. of Laterals		4	count each pipe off of manifold
System Width	feet	4.5	
System Length	feet	60	
Number of Infiltration Areas		1	
Total System Area	sq feet	270	
FORCE MAIN:			
Total Equivalent Length	feet	341	
Inside Diameter	inches	2	
MANIFOLD:			
No. of Segments		1	
Segment Equiv. Length	feet	3	
Inside Diameter	inches	2	
EACH LATERAL:			
Equivalent Length	feet	28.5	
Inside Diameter	inches	2	
Design Residual Pressure	feet	3	2.31' = 1 psi
Orifice Diameter	inches	0.2500	0.3125=5/16;0.4375=7/16; 0.5625=9/16 0.1875=3/16
1 Orifice per Square Foot (min.)	sq feet	25	inground 1/25 sand filter 1/4
SYSTEM:			
Minimum No. of Orifices		11	within system
No. of Orifices		26	within system
No. of Orifices per Lateral		6.5	per lateral
Orifice Spacing	inches	57.00	4' 9"

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PRESSURE DIFFERENTIAL PER LATERAL:

$$\text{Friction Loss (hL)} = \frac{4.72 \times L \times Q^{1.875}}{C^{1.85} \times D^{4.87}}$$

L Length of Lateral	28.5 FT
Q Per Lateral	8.30 GPM
C Coefficient of Friction	140
D Diameter of Pipe	2 inches
P Pressure	3.0 FT

$$\text{hL} = 0.0575 \text{ FT}$$

$$\text{hL final} = \text{hL} / \text{P} = 1.9166 \%$$

SYSTEM PERFORMANCE SUMMARY:

FLOW VELOCITY:

Force Main	ft/sec	3.4	
Manifold	ft/sec	1.7	
Laterals	ft/sec	0.4	
ORIFICE DISCHARGE (per orifice)	gal/min	1.28	
NETWORK VOLUME	gallons	19	laterals and manifold
MIN. DOSE VOL./NETWORK VOL.		8	minimum allowable = 5
NETWORK DISCHARGE	gal/min	33	minimum pump discharge

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PRESSURE DISTRIBUTION NETWORK SYSTEM CURVE:

Pump Off Elev.	257.1	Hazen-Williams "C" Value	140
Manifold Invert Elev.	263.09	K Factor for C > 100	0.54
Lateral Invert Elev.	263.09		

FORCE MAIN

Flow (gpm)	Velocity (fps)	H _f /100 (ft./100 ft.)	Friction Loss (feet)
35	3.6	2.7	9.3
45	4.6	4.4	14.9
55	5.6	6.3	21.6
65	6.6	8.6	29.4
75	7.7	11.2	38.3
85	8.7	14.2	48.3
95	9.7	17.4	59.3
105	10.7	20.9	71.4
115	11.7	24.8	84.5

MANIFOLD (EACH SEGMENT)

Flow (gpm)	Velocity (fps)	H _f /100 (ft./100 ft.)	Friction Loss (feet)
35.0	3.6	2.7	0.08
45.0	4.6	4.4	0.13
55.0	5.6	6.3	0.19
65.0	6.6	8.6	0.26
75.0	7.7	11.2	0.34
85.0	8.7	14.2	0.42
95.0	9.7	17.4	0.52
105.0	10.7	20.9	0.63
115.0	11.7	24.8	0.74

EACH LATERAL

Flow (gpm)	Velocity (fps)	H _f /100 (ft./100 ft.)	Friction Loss (feet)
8.8	0.9	0.2	0.06
11.3	1.1	0.3	0.10
13.8	1.4	0.5	0.14
16.3	1.7	0.7	0.19
18.8	1.9	0.9	0.25
21.3	2.2	1.1	0.31
23.8	2.4	1.3	0.38
26.3	2.7	1.6	0.46
28.8	2.9	1.9	0.54

COMPOSITE SYSTEM CURVE

Flow (gpm)	Static Head (feet)	Residual Press. at Distal End	TDH (feet)
35	6.0	3.0	18.5
45	6.0	3.0	24.1
55	6.0	3.0	30.9
65	6.0	3.0	38.8
75	6.0	3.0	47.9
85	6.0	3.0	58.0
95	6.0	3.0	69.2
105	6.0	3.0	81.5
115	6.0	3.0	94.8

Plot Flow and TDH on Pump Curve to determine operating point of pump.

OPERATING POINT (From Attached Pump Curve):

NOTE: PUMP SHALL MEET THE SPECIFICATIONS ABOVE AND BE CAPABLE OF MEETING THE FOLLOWING FLOW AND HEAD CONDITION. ANY CHANGES TO THE PUMP SPECIFICATION SHALL BE APPROVED BY THE ENGINEER.

37 gpm @	20 TDH	Run time:	3.5 min.
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SUBMERSIBLE PUMP SPECIFICATIONS:

MANUFACTURER:	Goulds	DISCHARGE:	2" NPT
MODEL #:	WE0311M	SPEED (RPM):	1750
HORSEPOWER:	0.3	VOLTAGE:	115
IMPELLER DIAMETER:	5.38"	PHASE:	1
SOLIDS HANDLING:	3/4"		