

# PUMP STATION and DISPOSAL FIELD DESIGN COMPUTATIONS

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7-Bedroom Failed Wastewater Remediation

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Project Location:

*286 Prindle Road  
Charlotte, VT*

Project Name:

Hindsdale

Applicant:

*Hindsdale*

Date:

*October 25, 2017*

Revised 11-16-17

Project No.:

*17-124*



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

**DISPOSAL AREA COMPUTATIONS**

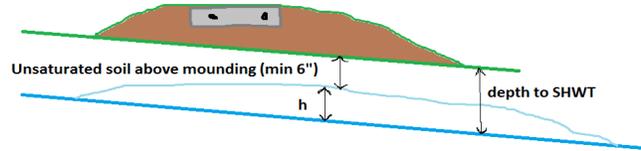
For: 286 Prindle Road  
 Date: Revised 11-16-17

Project No. 17-124  
 Calculated by: ALR  
 Checked by: NTH

**Mound System Simplified Mounding Analysis**

Depth to SHWT 16 inches

Minimum Available Soil to  
 Groundwater Mounding (h) 0.8 feet



Type of Soil **Fine Sandy Loam** slope category  
 Natural Ground Slope **6.6** **D**

System Design Flow 700 gpd  
 Loading Rate 1.0 gal/day/sf  
 Minimum System Area 700 sf

Check minimum length using linear loading rate:

LLR = (h)(f)  
 h = 0.8 the soil thickness available for groundwater mounding  
 f = 10.5 the LLR Factor from Table 1 Appendix 7-A EPR  
 LLR = 8.8

Minimum Length Required per Linear Loading Rate:

$\frac{700}{8.8} = 80$  feet

System Info:

System Width 4 feet  
 System Length 90 feet  
 # of Infiltration Areas 2  
 System Area 720

Actual Linear Loading Rate = System Flow / Total System Length

LLR (actual) = 7.78 gpd/lf

Re-Solve for soil thickness available for groundwater mounding

LLR/f = 0.741 ft  
 h (actual) = 9 inches

Unsaturated soil above induced mounding

depth to SHWT - 7 inches > 6 OK  
 h (actual) =

Depth to ledge on-site	use 48 if no ledge to depth	=	48 inches	assumed
Required distance between bottom of trench ledge		=	48 inches	
Required distance between bottom of trench and induced SHWT		=	36 inches	App. 7-A Background
Distance between ground surface and induced SHWT		=	7 inches	
Minimum mound sand required		=	12 inches	
Mound sand required		=	29 inches	

Septic Tank  
 1050

# PUMP STATION DESIGN COMPUTATIONS

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## DESIGN DATA:

<b>DESIGN FLOW:</b>	<b>700</b>	<b>Gal/Day</b>
NUMBER OF DOSES PER DAY:	5	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:

<b>DIMENSIONS:</b>	LENGTH: (Inside)	87.00	inches	=	7.25	feet
	WIDTH: (Inside)	57.00	inches	=	4.75	feet
	DEPTH: (inside)	56.00	inches	=	4.67	feet

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

<b>STORAGE:</b>	VOL PER FOOT:	258	gal/ft	=	21	gal/in
	PRIMARY VOLUME (between on & off)	142	gal/dose			
	RESERVE VOLUME (above on float)	701	gal	=	1.0	days
	VOL. IN PIPE RUN (used with weep only)	0	gal			

<b>TOTAL STORAGE ABOVE ALARM</b>	<b>701</b>	<b>gal</b>
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**ELEVATIONS:**                  PUMP STATION INLET      **436.53** feet

	<u>Float Elevations</u>	<u>Float Settings</u>
ALARM	433.81 feet	<b>2.75</b> " above on
ON	433.58 feet	<b>6.50</b> " above off
OFF	433.03 feet	<b>6</b> " above sump
SUCTION	432.53 feet	

Depth of Sump:                  **8** inches

## **FIELD INFORMATION:**

DISPOSAL AREA ELEVATION	<b>456.0</b> feet
DEPTH OF STONE IN TRENCH	<b>12.0</b> inches

## CALCULATE STATIC HEAD:

DISCHARGE ELEVATION	458.0	feet
PUMP OFF ELEVATION	<u>433.0</u>	feet

<b>TOTAL STATIC HEAD</b>	⇒	<b>25.0</b>	<b>feet</b>
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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**

Dia:	1.5	2	2.5	3	4
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
1	2	12.0	tee	12.0	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
				<b>340.0</b>	FT
				372.0	FT

**LENGTH OF RUN**     $\bar{O}$

EQUIVALENT LENGTH:    372.0    FT    **340.0**    FT

**TOTAL EQUIVALENT LENGTH:    ⇒    457    FT**

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## PRESSURE DISTRIBUTION SYSTEM PARAMETERS:

	<u>Unit</u>	<u>Value</u>	<u>Comment</u>
<b>GENERAL INFO:</b>			
Min. Volume per Dose	gallons	142	
No. of Laterals		4	count each pipe off of manifold
System Width	feet	4	
System Length	feet	90	
Number of Infiltration Areas		2	
Total System Area	sq feet	720	
<b>FORCE MAIN:</b>			
Total Equivalent Length	feet	457	
Inside Diameter	inches	2	
<b>MANIFOLD:</b>			
No. of Segments		1	
Segment Equiv. Length	feet	8	
Inside Diameter	inches	2	
<b>EACH LATERAL:</b>			
Equivalent Length	feet	43	
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
<b>SYSTEM:</b>			
Minimum No. of Orifices		29	within system
No. of Orifices		34	within system
No. of Orifices per Lateral		8.5	per lateral
Orifice Spacing	inches	64.50	5' 4 4/8"

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### **PRESSURE DIFFERENTIAL PER LATERAL:**

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

<b>L</b> Length of Lateral	<b>43</b> FT
<b>Q</b> Per Lateral	<b>10.85</b> GPM
<b>C</b> Coefficient of Friction	<b>140</b>
<b>D</b> Diameter of Pipe	<b>2</b> inches
<b>P</b> Pressure	<b>3.0</b> FT

<b>hL =</b>	0.0649 FT
<b>hL final = hL / P</b>	<b>2.164</b> %

### **SYSTEM PERFORMANCE SUMMARY:**

#### **FLOW VELOCITY:**

Force Main	ft/sec	4.4	
Manifold	ft/sec	2.2	
Laterals	ft/sec	0.6	
<b>ORIFICE DISCHARGE</b> ( per orifice)	gal/min	1.28	
<b>NETWORK VOLUME</b>	gallons	29	laterals and manifold
<b>MIN. DOSE VOL./NETWORK VOL.</b>		5	minimum allowable = 5
<b>NETWORK DISCHARGE</b>	gal/min	<b>43</b>	minimum pump discharge

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**PRESSURE DISTRIBUTION NETWORK SYSTEM CURVE:**

Pump Off Elev.	433.0	Hazen-Williams "C" Value	140
Manifold Invert Elev.	458.00	K Factor for C > 100	0.54
Lateral Invert Elev.	458.00		

**FORCE MAIN**

Flow (gpm)	Velocity (fps)	H <sub>f</sub> /100 (ft./100 ft.)	Friction Loss (feet)
45	4.6	4.4	19.9
55	5.6	6.3	28.9
65	6.6	8.6	39.4
75	7.7	11.2	51.3
85	8.7	14.2	64.7
95	9.7	17.4	79.5
105	10.7	20.9	95.7
115	11.7	24.8	113.2
125	12.8	28.9	132.1

**MANIFOLD (EACH SEGMENT)**

Flow (gpm)	Velocity (fps)	H <sub>f</sub> /100 (ft./100 ft.)	Friction Loss (feet)
45.0	4.6	4.4	0.35
55.0	5.6	6.3	0.51
65.0	6.6	8.6	0.69
75.0	7.7	11.2	0.90
85.0	8.7	14.2	1.13
95.0	9.7	17.4	1.39
105.0	10.7	20.9	1.67
115.0	11.7	24.8	1.98
125.0	12.8	28.9	2.31

**EACH LATERAL**

Flow (gpm)	Velocity (fps)	H <sub>f</sub> /100 (ft./100 ft.)	Friction Loss (feet)
11.3	1.1	0.3	0.14
13.8	1.4	0.5	0.21
16.3	1.7	0.7	0.28
18.8	1.9	0.9	0.37
21.3	2.2	1.1	0.47
23.8	2.4	1.3	0.57
26.3	2.7	1.6	0.69
28.8	2.9	1.9	0.82
31.3	3.2	2.2	0.95

## COMPOSITE SYSTEM CURVE

Flow (gpm)	Static Head (feet)	Residual Press. at Distal End	TDH (feet)
45	25.0	3.0	48.4
55	25.0	3.0	57.6
65	25.0	3.0	68.3
75	25.0	3.0	80.5
85	25.0	3.0	94.3
95	25.0	3.0	109.4
105	25.0	3.0	126.0
115	25.0	3.0	144.0
125	25.0	3.0	163.4

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.

**57 gpm @**

**60 TDH**

Run time: **2.5 min.**

### SUBMERSIBLE PUMP SPECIFICATIONS:

MANUFACTURER:	<b>Goulds</b>	DISCHARGE:	<b>2" NPT</b>
MODEL #:	<b>WE1512H</b>	SPEED (RPM):	<b>3450</b>
HORSEPOWER:	<b>1.5</b>	VOLTAGE:	<b>230</b>
IMPELLER DIAMETER:	<b>4.56"</b>	PHASE:	<b>1</b>
SOLIDS HANDLING:	<b>3/4"</b>		

### Pressurized Disposal Pump Requirement Curve

