

Ekelund Excavating Inc

50414 Lily Ave McGregor MN 55760

218-426-4285

Lic#L552

George Haapoja

45621 St Hwy 65 McGregor MN 55760

Parcel# 14-0-000402

Sewer Design

MOUND DESIGN WORK SHEET (For Flows up to 1200 gpd)

A. Average Design FLOW

Estimated 450 gpd (see figure A-1)
 or measured _____ x 1.5 (safety factor) = _____ gpd

A-1: Estimated Sewage Flows in Gallons per Day

number of bedrooms	Class I	Class II	Class III	Class IV
2	300	225	180	60%
3	450	300	218	of the
4	600	375	256	values
5	750	450	294	in the
6	900	525	332	Class I,
7	1050	600	370	II, or III
8	1200	675	408	columns.

B. SEPTIC TANK Capacity

1000 gallons (see figure C-1)

C-1: Septic Tank Capacities (in gallons)

Number of Bedrooms	Minimum Liquid Capacity	Liquid capacity with garbage disposal	Liquid capacity with disposal & lift inside
2 or less	750	1125	1500
3 or 4	1000	1500	2000
5 or 6	1500	2250	3000
7, 8 or 9	2000	3000	4000

C. SOILS (refer to site evaluation)

- Depth to restricting layer = < 1' feet
- Depth of percolation tests = MA feet
- Texture Sandy loam
 Percolation rate _____ mpi
- Soil loading rate _____ gpd/sqft (see figure D-33)
- Percent land slope < 1% %

D. ROCK LAYER DIMENSIONS

- Multiply average design flow (A) by 0.83 to obtain required rock layer area.
450 gpd x 0.83 sqft/gpd = 373.5 sqft
- Determine rock layer width = 0.83 sqft/gpd x linear Loading Rate (LLR)
 0.83 sqft/gpd x 12 gpd/sqft = 4.96 ft
- Length of rock layer = area ÷ width =
373.5 sqft (D1) ÷ 4.96 ft (D2) = 37.5 ft

Mound LLR

< 120 MPI ≤ 12
 ≥ 120 MPI < 6

E. ROCK VOLUME

- Multiply rock area (D1) by rock depth of 1 ft to get cubic feet of rock
380 sqft x 1 ft = 380 cuft
- Divide cuft by 27 cuft/cuyd to get cubic yards
380 cuft ÷ 27 cuft/cuyd = 14 cuyd
- Multiply cubic yards by 1.4 to get weight of rock in tons
14 cuyd x 1.4 ton/cuyd = 19.6 tons

F. SEWAGE ABSORPTION WIDTH

Absorption width equals absorption ratio (See Figure D-33) times rock layer width (D2)

10 x 2.67 ft = 27 ft

D-33: Absorption Width Sizing Table

Percolation Rate in Minutes per Inch (MPI)	Soil Texture	Loading Rate Gallons per day per square foot	Absorption Ratio
Faster than 5	Coarse Sand Medium Sand Loamy Sand Fine Sand	1.20	1.00
6 to 15	Sandy Loam	0.72	1.50
16 to 30	Loam	0.60	2.00
31 to 45	Silt Loam	0.50	2.40
46 to 60	Silty Clay Loam Silty Clay Loam Clay Loam	0.45	2.67
61 to 120	Silty Clay Sandy Clay Clay	0.24	5.00
Slower than 120*			

*System designed for these soils must be other or performance

<= 1% land slope

G. Mound Slope Width and Length
(land slope less than or equal to 1%)

1. Absorption width (F) 27 ft.

2. Calculate mound size

a. Determine depth of clean sand fill

at upslope edge of rock layer = 3 ft

minus the distance to restricting layer (C1)

3 ft - 0 ft = 3 ft

b. Mound height at the upslope edge of rock layer = depth of clean sand for separation (G2a)

at upslope edge plus depth of rock layer (1 ft) plus depth of cover (1 ft)

3 ft + 1ft + 1ft = 5 ft

c. Berm width = upslope mound height (G2b) times 4 (4 is recommended, but could be 3-12)

5 x 4 = 20 ft

d. The total landscape width is the sum of berm (G2c) width plus rock layer width (D2) plus berm width (G2c): 20 ft + 10 ft + 20 ft = 50 ft

e. Additional width necessary for absorption = absorption width (F) minus the landscape width (G2d)

27 ft - 50 ft = -23 ft, if number is negative (<0) skip to g

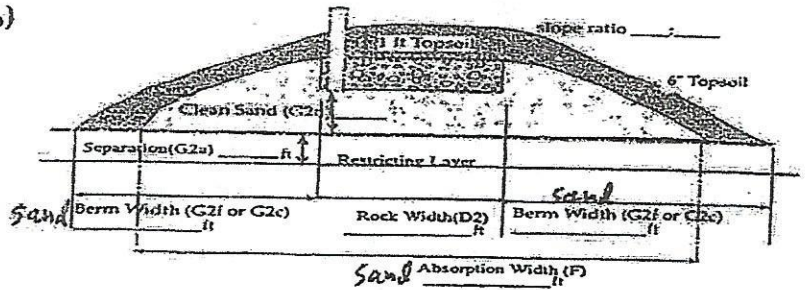
f. Final berm width = additional width (G2e) plus the berm width (G2c)

 ft + ft = ft

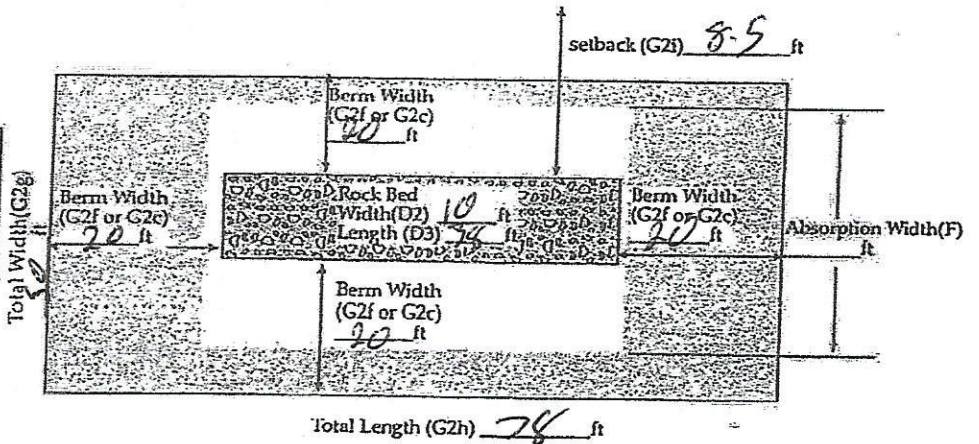
g. Total mound width is the sum of berm width (G2f or G2c) plus rock layer width (D2) plus berm width (G2f or G2c): 20 ft + 10 ft + 20 ft = 50 ft

h. Total mound length is the sum of berm (G2f or G2c) plus rock layer length (D3) plus berm (G2f or G2c): 20 ft + 34 ft + 20 ft = 74 ft

i. Setbacks from the rockbed are calculated as follows: the absorption width (F) minus the rock bed width (D2) divided by 2: (27 ft - 10 ft) ÷ 2 = 8.5 ft



Final Dimensions:
50 x 74



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PRESSURE DISTRIBUTION SYSTEM

- Select number of perforated laterals 3
- Select perforation spacing = 3 ft
- Since perforations should not be placed closer than 1 foot to the edge of the rock layer (see diagram), subtract 2 feet from the rock layer length.

$$\frac{38}{\text{Rock layer length}} - 2 \text{ ft} = 36 \text{ ft}$$

- Determine the number of spaces between perforations. Divide the length (3) by perforation spacing (2) and round down to nearest whole number.

$$\text{Perforation spacing} = \frac{36 \text{ ft}}{3 \text{ ft}} = 12 \text{ spaces}$$

- Number of perforations is equal to one plus the number of perforation spaces(4). Check figure E-4 to assure the number of perforations per lateral guarantees <10% discharge variation.

$$12 \text{ spaces} + 1 = 13 \text{ perforations/lateral}$$

- A. Total number of perforations = perforations per lateral (5) times number of laterals (1)

$$13 \text{ perfs/lat} \times 3 \text{ lat} = 39 \text{ perforations}$$

- B. Calculate the square footage per perforation.

Should be 6-10 sqft/perf. Does not apply to at-grades.

Rock bed area = rock width (ft) x rock length (ft)

$$10 \text{ ft} \times 36 \text{ ft} = 360 \text{ sqft}$$

Square foot per perforation = Rock bed area ÷ number of perfs (6)

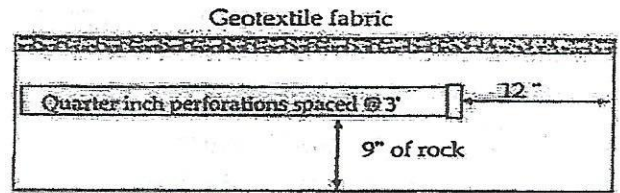
$$360 \text{ sqft} \div 39 \text{ perfs} = 9.2 \text{ sqft/perf}$$

- Determine required flow rate by multiplying the total number of perforations (6A) by flow per perforation (see figure E-6)

$$39 \text{ perfs} \times .80 \text{ gpm/perfs} = 31.2 \text{ gpm}$$

- If laterals are connected to header pipe as shown on upper example, to select minimum required lateral diameter; enter figure E-4 with perforation spacing (2) and number of perforations per lateral (5) Select minimum diameter for perforated lateral = 1 1/4 inches.

- If perforated lateral system is attached to manifold pipe near the center, lower diagram, perforated lateral length (3) and number of perforations per lateral (5) will be approximately one half of that in step 8. Using these values, select minimum diameter for perforated lateral = 1 inches.



Perf Sizing 3/16" - 1/4"
Perf Spacing 1.5' - 5'

E-4: Maximum allowable number of 1/4-inch perforations per lateral to guarantee <10% discharge variation

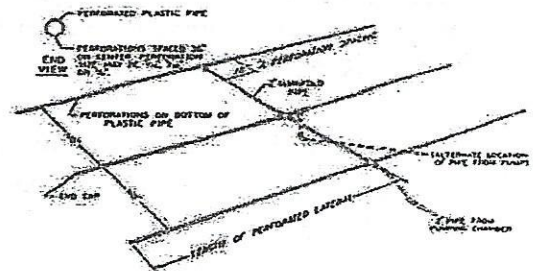
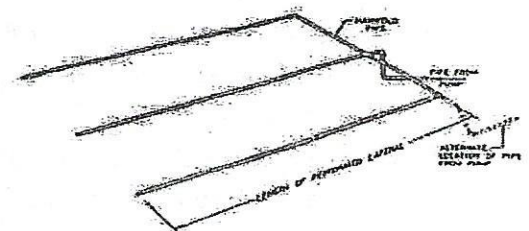
perforation spacing (feet)	1 inch	1.25 inch	1.5 inch	2.0 inch
2.5	8	14	18	28
<u>3.0</u>	8	13	<u>17</u>	26
3.3	7	12	16	25
4.0	7	11	15	23
5.0	6	10	14	22

E-6: Perforation Discharge in gpm

head (feet)	perforation diameter (inches)			
	1/8	3/16	7/32	1/4
1.0 ^a	0.18	0.42	0.56	0.74
2.0 ^b	0.26	0.59	0.80	1.04
5.0	0.41	0.94	1.26	1.65

^a Use 1.0 foot for single-family homes.
^b Use 2.0 feet for anything else.

MANIFOLD LOCATED AT END OF PRESSURE DISTRIBUTION SYSTEM



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PUMP SELECTION PROCEDURE

1. Determine pump capacity:

A. Gravity distribution

1. Minimum required discharge is 10 gpm
2. Maximum suggested discharge is 45 gpm. For other establishments at least 10% greater than the water supply rate, but no faster than the rate at which effluent will flow out of the distribution device.

B. Pressure distribution

See pressure distribution work sheet

From A or B Selected pump capacity: 32 gpm

2. Determine pump head requirements:

A. Elevation difference between pump and point of discharge?

9 feet:

B. Special head requirement? (See Figure at right - Special Head Requirements)

5 feet

C. Calculate Friction loss

1. Select pipe diameter 1.5 in
2. Enter Figure E-9 with gpm (1A or B) and pipe diameter (C1).

Read friction loss in feet per 100 feet from Figure E-9

Friction Loss = 6.96 ft/100ft of pipe

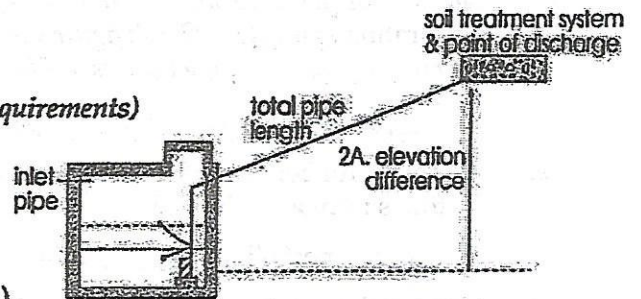
3. Determine total pipe length from pump discharge to soil treatment discharge point. Estimate by adding 25 percent to pipe length for fitting loss. Total pipe length times 1.25 = equivalent pipe length
40 feet x 1.25 = 50 feet

4. Calculate total friction loss by multiplying friction loss (C2) in ft/100 ft by the equivalent pipe length (C3) and divide by 100.
= 6.96 ft/100ft x 50 ÷ 100 = 3.48 ft

D. Total head required is the sum of elevation difference (A), special head requirements (B), and total friction loss (C4)

9 ft + 5 ft + 3.48 ft =

Total head: 17.4 feet



Special Head Requirements	
Gravity Distribution	0 ft
Pressure Distribution	5 ft

flow rate gpm	E-9: Friction Loss in Plastic Pipe Per 100 feet		
	nominal pipe diameter		
	1.5"	2"	3"
20	2.47	0.73	0.11
25	3.73	1.11	0.16
30	5.23	1.55	0.23
35	<u>6.96</u>	2.06	0.30
40	8.91	2.64	0.39
45	11.07	3.28	0.48
50	13.46	3.99	0.58
55		4.76	0.70
60		5.60	0.82
65		6.48	0.95
70		7.44	1.09

3. Pump selection

A pump must be selected to deliver at least 32 gpm (1A or B) with at least 17.5 feet of total head (2D)

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(signature)

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(license #)

5/20/10

(date)

DOSING CHAMBER SIZING

1. Determine area

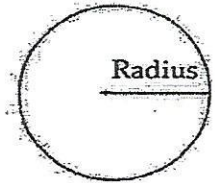
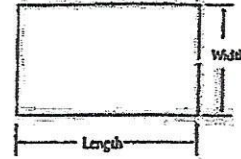
A. Rectangle area = $L \times W$

_____ x _____ = _____ square feet

B. Circle area = $\pi (3.14) \times \text{radius in feet} \times \text{radius in feet}$

$3.14 \times$ _____ $\text{ft} \times$ _____ $\text{ft} =$ _____ sqft

C. Get area from manufacturer _____ sqft



2. Calculate gallons per inch

There are 7.5 gallons per cubic foot of volume, therefore multiply the area (1A, B or C) times the conversion factor and divide by 12 inches per foot to calculate gallon per inch.

Area $\times 7.5 \div 12 =$ _____ $\text{sqft} \times 7.5 \div 12 \text{ in/ft} =$ 12.69 gallon per inch

3. Calculate total tank volume

A. Depth from bottom of inlet pipe to tank bottom _____ in

B. Total tank volume = depth from bottom of inlet pipe to tank bottom (3A) \times gal/in (2)
= _____ in \times _____ gal/in = 500 gal

Legal Tank:
500 gallons or
100% the Daily flow
or
Alternating Pumps

4. Calculate gallons to cover pump (with 2-3 inches of water covering pump)

(Pump and block height (inch) + 2 inch) \times gallon/inch

(13 in + 2 in) \times 12.69 gal/in = 190.35 gallon

number of bedrooms	Class I	Class II	Class III	Class IV
2	300	225	180	60%
3	450	300	218	of the
4	600	375	256	volumes
5	750	450	294	in the
6	900	525	332	Class I,
7	1050	600	370	II, or III
8	1200	675	408	columns.

5. Calculate total pumpout volume

A. Select pump size for 4-5 does per day. Gallon per dose = gpd (see figure A-1)
/ doses per day = 450 gpd \div 4 doses/day = 112.5 gallons

B. Calculate drainback

1. Determine total pipe length, 40 feet

2. Determine liquid volume of pipe, .11 gal per ft (see figure E-20)

3. Drainback quantity = 40 ft (5B1) \times .11 gal per ft (5B2) = 4.4 gal

C. Total pump out volume = dose volume (5A) + drainback (5B3)

112.5 gal + 4.5 gal = 117 Total gallon

Pipe Diameter inches	Gallons per foot
1	0.045
1.25	0.078
1.5	0.11
2	0.17
2.5	0.25
3	0.38
4	0.66

6. Float separation distance (using total pumpout volume)

Total pumpout volume (5C) \div gal/inch (2)

117 gal \div 12.69 gal/in = 9.2 inch

7. Calculate volume for alarm (typically 2 to 3 inches)

Alarm depth (inch) \times gallon/inch (2) = 3 in \times 12.69 gal/in = 38 gal

8. Calculate total gallon = gallons over pump (4) + gallons pumpout (5C) + gallons alarm (7)

190 gal + 117 gal + 38 gal = 374 gallons

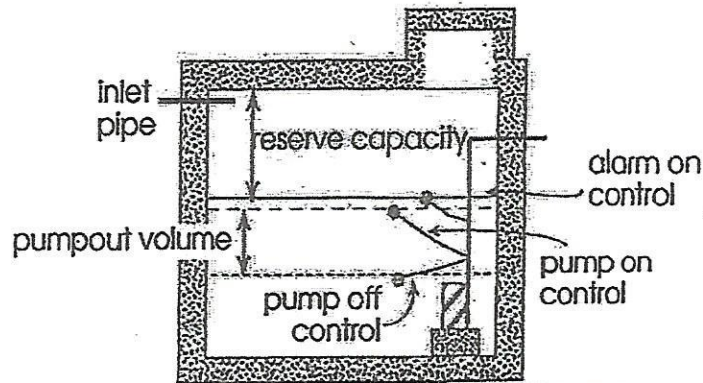
9. Total Tank Depth = total gallon (8) \div gallon/inch (2)

374 gal \div 12.69 gal/in = 21.5 in

Recommended:

Calculate reserve capacity (75% the daily flow)

Daily flow $\times .75 =$ 450 $\times .75 =$ 337 gallons



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5/20/16 (date)

SOILS CHARTS FOR BOTH PROPOSED AND ALTERNATE SITES

1 (PROPOSED) SOILS DATA

DEPTH (INCHES)	TEXTURE	MUNSELL COLOR
0-6	Topsoil	
6-10"	Sandy loam	7.5 YR 5/6 mottled

2 (PROPOSED) SOILS DATA

DEPTH (INCHES)	TEXTURE	MUNSELL COLOR
0-6"	Topsoil	
6"-12"	Sandy loam	7.5 YR 5/6 mottled

1 (ALTERNATE) SOILS DATA

DEPTH (INCHES)	TEXTURE	MUNSELL COLOR

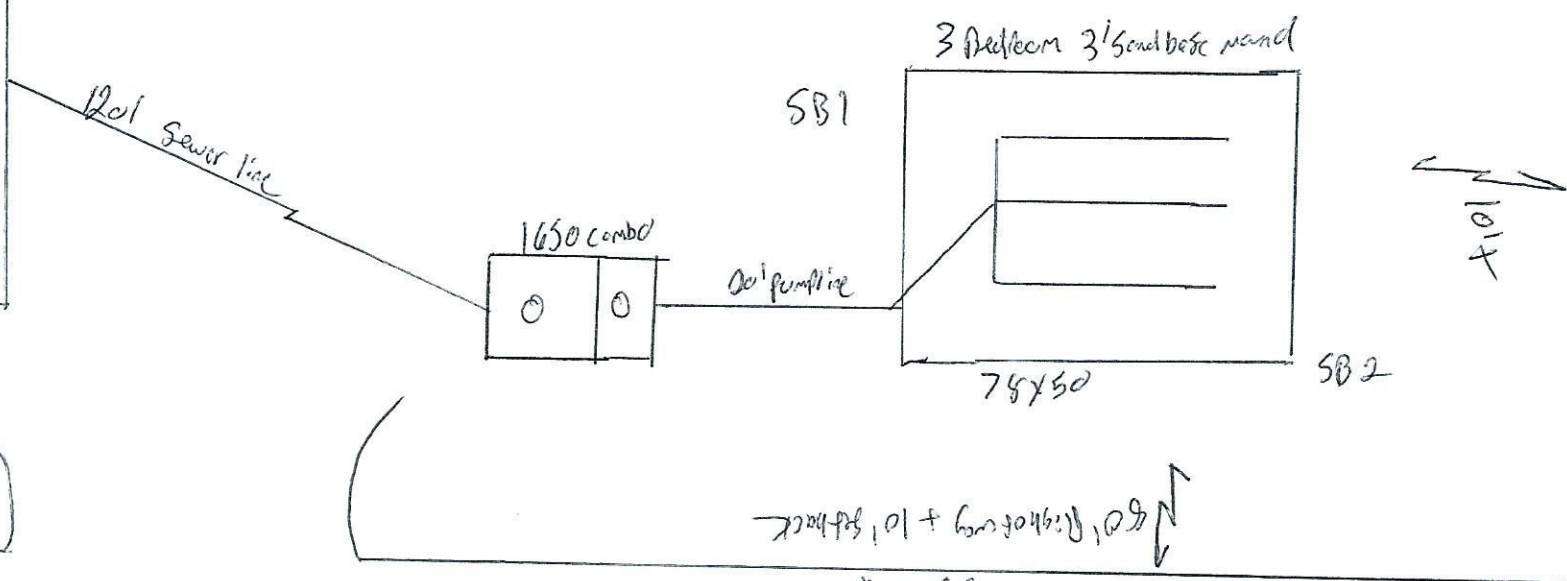
2 (ALTERNATE) SOILS DATA

DEPTH (INCHES)	TEXTURE	MUNSELL COLOR

ADDITIONAL SOIL BORINGS MAY BE REQUIRED

Shower well

Produce line



Aug 65

ELEVATIONS :

BENCH MARK	100'
SEWER LINE @ HOUSE	99'
TANK INLET	97'
BOTTOM OF ROCK	102'
RESTRICTIVE LAYER	94'
PUMP	93.7'
DISTRIBUTION DEVICE	103'
DIFFERENCE BETWEEN PUMP & DISCHARGE	10'
TOTAL PIPE LENGTH	30'

SOIL BORINGS

#1 #2

NAME George Harboja
PARCEL # 14-0-000 402

Subsurface Sewage Treatment System Management Plan

Property Owner: George Haala Phone: 218-820-3412 Date: 5/20/16
Mailing Address: _____ City: _____ Zip: _____
Site Address: 45621 Sandway 65 City: McGeog Zip: 55760

This management plan will identify the operation and maintenance activities necessary to ensure long-term performance of your septic system. Some of these activities must be performed by you, the homeowner. Other tasks must be performed by a licensed septic service provider.

System Designer: check every 48 months.
Local Government: check every _____ months.
State Requirement: check every 36 months.

My System needs to be checked every _____ months.

(State requirements are based on MN Rules Chapter 7080.2450, Subp. 2 & 3)

Homeowner Management Tasks

- Leaks** – Check (look, listen) for leaks in toilets and dripping faucets. Repair leaks promptly.
- Surfacing sewage** – Regularly check for wet or spongy soil around your soil treatment area.
- Effluent filter** – Inspect and clean twice a year or more.
- Alarms** – Alarm signals when there is a problem. Contact a service provider any time an alarm signals.
- Event counter or water meter** – Record your water use.
-recommend meter readings be conducted (circle one: DAILY WEEKLY MONTHLY)

Professional Management Tasks

- Check to make sure tank is not leaking
- Check and clean the in-tank effluent filter
- Check the sludge/scum layer levels in all septic tanks
- Recommend if tank should be pumped
- Check inlet and outlet baffles
- Check the drainfield effluent levels in the rock layer
- Check the pump and alarm system functions
- Check wiring for corrosion and function
- Check dissolved oxygen and effluent temperature in tank
- Provide homeowner with list of results and any action to be taken
- Flush and clean laterals if cleanouts exist

"I understand it is my responsibility to properly operate and maintain the sewage treatment system on this property, utilizing the Management Plan. If requirements in the Management Plan are not met, I will promptly notify the permitting authority and take necessary corrective actions. If I have a new system, I agree to adequately protect the reserve area for future use as a soil treatment system."

Property Owner Signature: George Haala Date: 5-20-16
Designer Signature: [Signature] Date: 5/20/16

See Reverse Side for Management Log