CASE STUDIES OF ENGINEERED SYSTEMS FOR SITE LIMITATIONS IN ON-SITE SOIL TREATMENT SYSTEMS

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The opinions expressed are that of the authors and not that of NOWRA

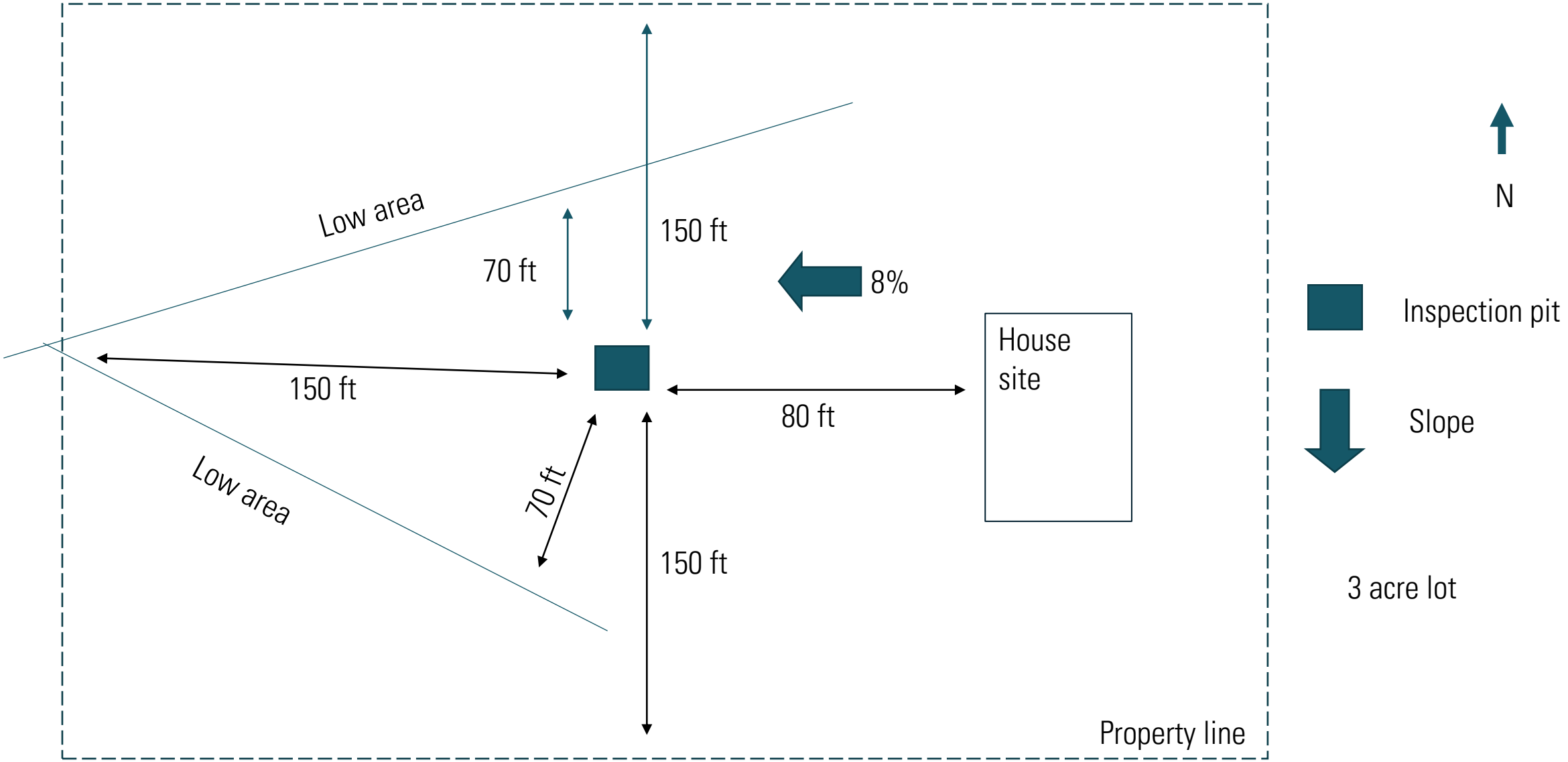
SITE LIMITATIONS

- Available Space
- Slope
- Landscape position
- Soil texture
- Soil structure
- Soil wetness
- Flooding
- Surface drainage limitations
- Bedrock
- Sinkholes/Karst

POTENTIAL SYSTEM DESIGNS

- Lagoon
- Gravity feed
  - Chambers
  - 10” Gravel Less
- Low Pressure Pipe
  - Septic Tank
- Drip Irrigation
  - ATU


CASE 1. CLAYPAN AT 24 INCHES AND
TWO DRAINWAYS ON LOT


Low area
70 ft
150 ft
8%
150 ft
House site
80 ft
Low area
70 ft
150 ft
Property line
N
Inspection pit
Slope
3 acre lot

SOIL PROFILE DESCRIPTION

Owner: Case study 1 Date:

SOIL CHARACTERISTICS Excavation Depth: 54 inch Pit (required for new installation) or Core #: 1A

Vegetation: grass Parent Material: loess/colluvium/pedisediment

Suitability (S, PS, U)	Horizon		Munsell Color (moist)	Redoximorphic Features (2)	Texture		% Coarse Fragments by volume		Consistence (4)	Structure (5)	Roots /Pores (6)	Shrink /Swell	Soil Group	Application Rate	
	Designation	Depth / Boundary (1)			USDA (3)	% Clay	<3"	>3"						Conv. (Table 13)	LPP (Table 14
PS	Ap	0-5 / as	10YR3/3	--	sil	22	-	-	fr	3,c gr	mf / mm	L	III	0.5	0.25
PS	E	5-11 / cs	10YR4/3	--	sil	20	-	-	fr	2,m,sbk	mf / mm	L	III	0.5	0.25
PS	Bt1	11-24 / cs	10YR4/6	--	sicl	30	-	-	fr	2,c,sbk	cf / cm	M	III	0.35	0.18
U	Bt2	24-34 / gs	10YR5/3		sic	50	-	-	fi	2,c,sbk	ff / ff	H	IVb	**	**
U	Bt3	34-43 / gs	10YR5/8	c,3,P RMX 10YR5/2	sic	50	-	-	fi	2,c,sbk	ff / ff	H	IVb	**	**
U	2Bt4	43-54	10YR6/8	c,3,D RMX 10YR6/1	sic	45	15*	-	fi	1,c,sbk	- / ff	H	IVb	**	**

Notes * very fine gravels ** drip irrigation rate is 0.05

SITE CLASSIFICATION for
ONSITE SEWAGE SYSTEM – 19 CSR 20-3.060(2) & (7)

Owner: Case study 1 Pit/Core #: 1A Date:

Suitability See recommendations below S – Suitable; PS – Provisionally Suitable; U – Unsuitable; for conventional system.

S **LANDSCAPE POSITION:** SIDESLOPE Slope aspect: W

Flooding frequency: None ☒ Rare ☐ Occasional ☐ Frequent ☐ Surface depression(s) in evaluated area? Y

S **& TOPOGRAPHY** Percent Slope: 8 Slope Type: Uniform ☒ Complex ☐

Shape across (contour): CONVEX Shape down (profile): LINEAR

SOIL CHARACTERISTICS (See Profile Description for details)

U PS **TEXTURE** to a depth of 24 inches Depth of unsuitable texture 24+ inches

S **STRUCTURE** to a depth of inches Depth of unsuitable structure inches

PS **SOIL DRAINAGE** Type of water table: Depth to water table inches

S Surface drainage limitations: NONE Runoff slope length 400 feet

S **SOIL THICKNESS** Depth of bedrock: > 48 inches Rock outcrops? NONE

U **RESTRICTIVE HORIZON** Type: CLAYPAN Depth: 24 Thickness:

PS **AVAILABLE SPACE** Estimated space available: 100 X 100

Adequate for a conventional system? Y an alternative system? Y replacement area? N?***

OTHER FACTORS Note any environmental hazards:

High groundwater contamination potential? (If yes, indicate reason):

Sinkhole ☐ Rapid permeability ☐ Depth to highly permeable bedrock ☐ Fill material /depth ☐

U **OVERALL** Notes: HIGH CLAY, SOME LANDSCAPE ISSUES

Overall site classification will be determined by the lowest of the uncorrectable characteristics.

- **S** An overall site classification of **suitable** indicates soil and site conditions favorable for the operation of a conventional absorption system.
- **PS** Sites classified as **provisionally suitable** require some modifications and careful planning, design, and installation for a conventional system or alternative system to function satisfactorily.
- **U** Sites originally classified as **unsuitable** may possibly be reclassified as **provisionally suitable** according to subsection (7)(K).
- An **unsuitable** site may be used for soil absorption systems, provided engineering, hydrogeologic and soil studies indicate to the administrative authority that a conventional or alternative system could be expected to function satisfactorily. These sites may be reclassified as **provisionally suitable** upon meeting the requirements of the administrative authority according to subsection (6)(K).

Recommendations* associated with Provisionally Suitable or Unsuitable classifications:

Trenches must not be dug when wet to prevent damaging soil/trench surfaces.

Surface water diversion is needed.

An interceptor drain should be installed upslope at a depth of inches.

Shallow or modified shallow placed trenches should be installed at a depth of inches.

XX An alternative/engineered system is needed to overcome site limitations.

*** TWO SHALLOW DITCHES ON LOT RESTRICT AVAILABLE SPACE

CASE STUDY 1

Owner: Date

Comments/Recommendations

Sloping lot with two drainways cutting down the slope, which will lead to some limitations on system placement.

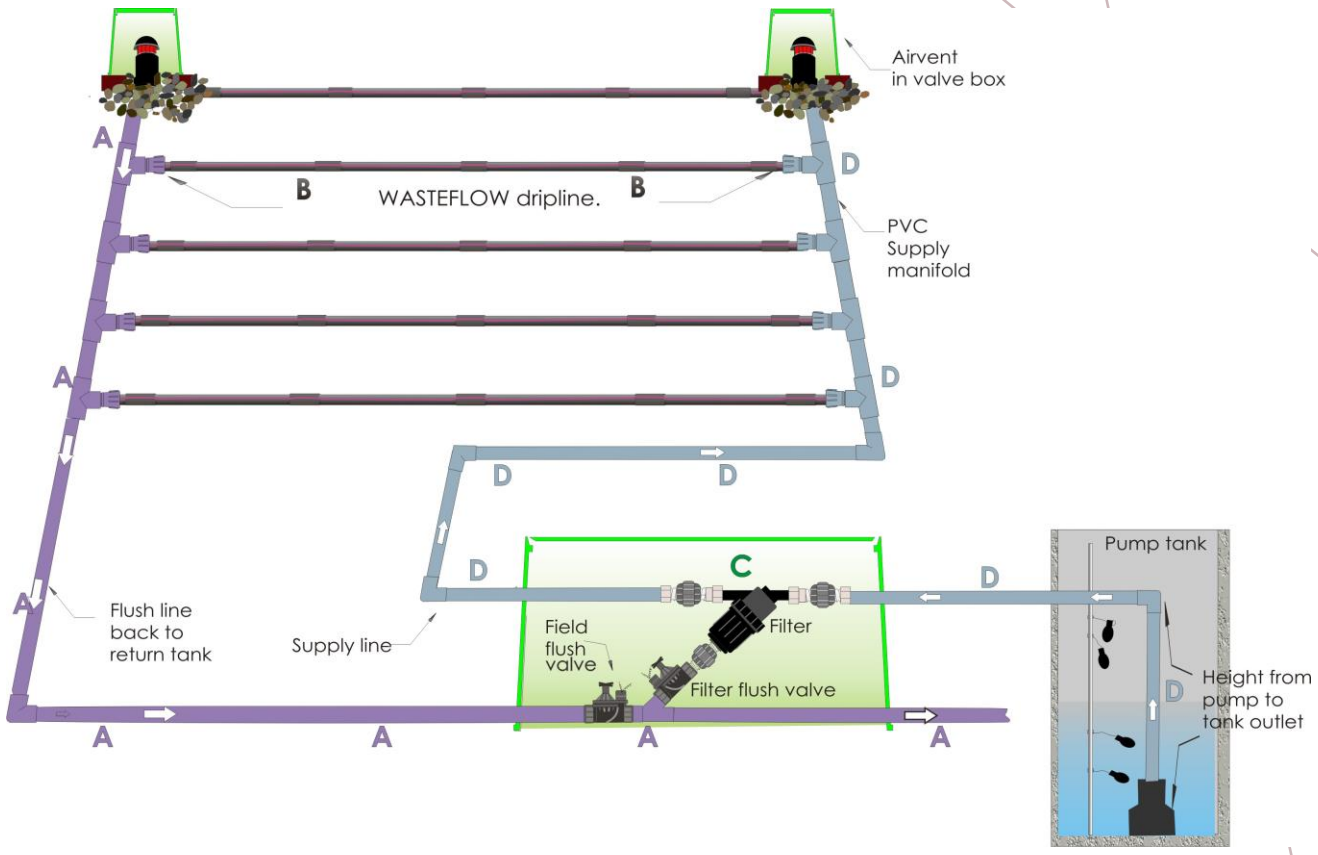
Soil is high in clay at 24+ inches and somewhat poorly drained due to clays. Site needs an engineered system.

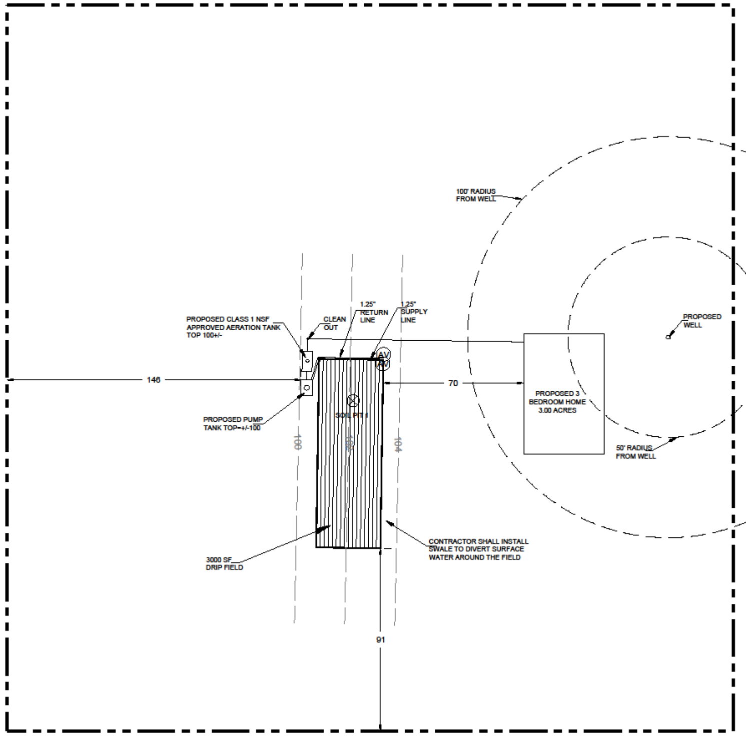
*Recommendations are to assist the property owner, and their agents in complying with the standards, and are subject to approval by the administrative authority.

I, the undersigned, hereby certify that the site evaluation was made in accordance with the requirements of Sections 701.025-701.059 RSMo and 19 CSR 20-3.060 and 19 CSR 20-3.080, and that the data recorded is correct to the best of my knowledge.

System Design – Drip Irrigation

- Why Drip?
- Depth of Suitability
- Depth of Water Table
- Location of Drainage
- Curtain Drain?
- Loading Rate
- Design Flow – Bedrooms? Occupancy?
- Location of water service/well(s)

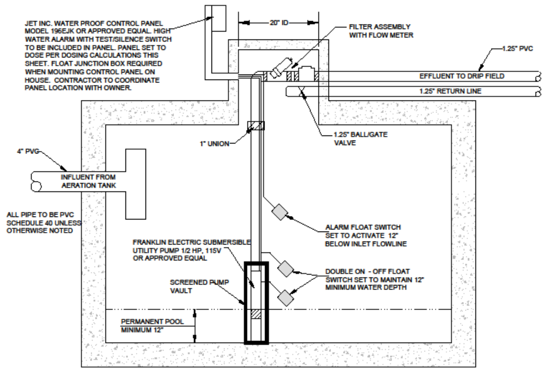




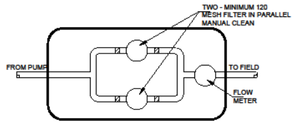
LEGEND

PROPERTY LINE

CONTOUR

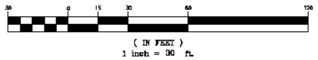


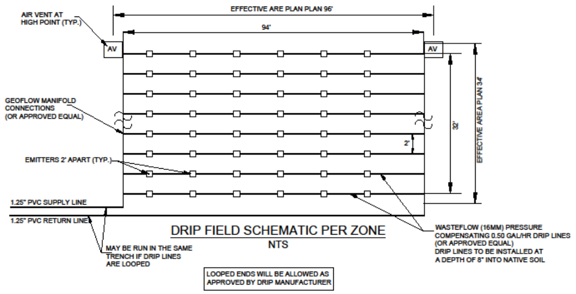
1000 GALLON PUMP TANK
NTS



FILTER ASSEMBLY WITH METER
NTS

GRAPHIC SCALE





DRIP FIELD SCHEMATIC PER ZONE
NTS

NOTES

1. ONE CLEANOUT MINIMUM REQUIRED BETWEEN HOUSE AND AERATION TANK. ALSO EVERY 100 FEET AND EVERY CHANGE IN DIRECTION IF MORE THAN 45 DEGREES.
2. DRIP LINES SHALL FOLLOW CONTOURS OF PROPERTY
3. AIR VENTS SHALL BE INSTALLED AT HIGH POINTS OF DRIP SYSTEM AT BOTH ENDS.
4. WATER SOFTNER BACKWASH AND SWIMMING POOL FILTER SYSTEMS SHALL NOT ENTER THE ONSITE WASTE WATER TREATMENT PLANT AND SHALL BE DISCHARGED PROPERLY
5. PIPE ENTERING AND EXITING THE AERATION TANK SHALL BE SCHEDULE 40 PVC AND SHALL EXTEND A MINIMUM OF 5 FEET BEYOND THE EXCAVATION FOR THE SEWAGE AERATION TANK
6. DRAINFIELD SHALL BE LOCATED A MINIMUM OF 10 FEET FROM ALL PROPERTY LINES AND A MINIMUM OF 25 FEET FROM BASEMENT
7. SPECIAL CARE SHALL BE TAKEN TO PREVENT STORM WATER FROM FLOWING OVER DRIP FIELD
8. DRIP FIELD LOCATION TO BE SEEDED AND STRAWED IMMEDIATELY AFTER INSTALLATION

UTILITY NOTE:

UNDERGROUND FACILITIES, STRUCTURES AND UTILITIES HAVE BEEN PLOTTED FROM AVAILABLE SURVEYS, RECORDS AND INFORMATION, AND , THEREFORE DO NOT NECESSARILY REFLECT THE ACTUAL EXISTENCE, NON-EXISTENCE, SIZE, TYPE, NUMBER, OR LOCATION OF THESE FACILITIES, STRUCTURES AND UTILITIES. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING THE ACTUAL LOCATION OF ALL UNDERGROUND FACILITIES, STRUCTURES, AND UTILITIES, EITHER SHOWN OR NOT SHOWN ON THESE PLANS. THE UNDERGROUND FACILITIES, STRUCTURES, AND UTILITIES SHALL BE LOCATED IN THE FIELD PRIOR TO ANY GRADING, EXCAVATION OR CONSTRUCTION OF IMPROVEMENTS. THESE PROVISIONS SHALL IN NO WAY ABSOLVE ANY PARTY FROM COMPLYING WITH THE UNDERGROUND FACILITY SAFETY AND DAMAGE PREVENTION ACT, CHAPTER 319 RSMo.

GANEY ENGINEERING LLC AND THE UNDERSIGNED ENGINEER HAVE NO RESPONSIBILITY FOR SERVICES PROVIDED BY OTHERS TO IMPLEMENT THE IMPROVEMENTS SHOWN ON THIS PLAN AND ALL OTHER DRAWINGS WHERE THE UNDERSIGNED ENGINEER'S SEAL APPEARS. THE CONSTRUCTION MEANS AND METHODS ARE THE SOLE RESPONSIBILITY OF THE OWNER AND CONTRACTOR. KING SEPTIC SERVICE ENGINEERING HAS NO RESPONSIBILITY TO VERIFY FINAL IMPROVEMENTS AS SHOWN ON THIS PLAN UNLESS SPECIFICALLY ENGAGED AND AUTHORIZED TO DO SO BY THE OWNER OR CONTRACTOR.

PREPARED FOR:
NOWRA

Ganey Engineering LLC Drip Flow Calculations

Job Description:	Case Study #1
Contact:	NOWRA
Prepared by:	Paul Ganey
Date:	29-Sep-22

Please fill in the shaded areas and drop down menus:
This spreadsheet serves as a guide, and is not a complete hydraulic design.

Worksheet 1- Field Flow

Total field

Total Quantity of effluent to be disposed per day	360	gallons / day
Hydraulic loading rate	0.15	gallons / sq.ft. / day
Minimum Dispersal Field Area	2,400	square ft.
Total Dispersal Field Area	3,000	square ft.

Flow per zone

Number of Zones	1	zone(s)
Dispersal area per zone	3,000	square ft.
Choose line spacing between WASTEFLOW lines	2	ft.
Choose emitter spacing between WASTEFLOW emitters	2	ft.
Total linear ft per zone (minimum required)	1,500	ft. per zone
Total number of emitters per zone	750	emitters per zone
Select Wasteflow dripline (16mm)	Wasteflow PC - 1/2gph	dripline
Pressure at the beginning of the dripfield	20	psi
Feet of Head at the beginning of the dripfield	46.2	ft.
What is the flowrate per emitter in gph?	0.53	gph
Dose flow per zone	6.63	gpm

If required, choose flush velocity	1	ft/sec
How many lines of WASTEFLOW per zone?	16	lines
Fill in the *actual* length of longest dripline lateral	91	ft.
Equivalent length including flush requirement	281.3178774	
Flush flow required at the end of each dripline	0.74	gpm
Total Flow per zone- worst case scenario	18.47	gpm

Select Filters and zone valves

Select Filter Type	Vortex Screen Filter	
Recommended Filter (item no.)	AP4E-1F	1" Screen Filter 0-20gpm
Select Zone Valve Type	Hydraulic	-
Recommended Zone Valve (item no.)	0	0

Note minimum pressure of 25 psi required for Hydraulic valves.Check pressure in Cell D28 above.

Dosing

Number of doses per day / zone:	12	doses
Timer ON, Pump run time per dose/ zone:	4:32	mins:secs
Timer OFF, Pump off time between doses	1:56	hrs:mins
Per Zone - Pump run time per day/zone:	0:54	hrs:mins
All Zones - Number of doses per day / all zones	12	doses / day
Allow time for field to pressurize	0:00:30	hrs:mins:secs
Filter flush time	0:00:20	hrs:mins:secs
Drain timer	0:05:00	hrs:mins:secs
Field flush timer	0:01:00	hrs:mins:secs
Field flush counter	3	cycles
Time required to complete all functions per day	2:16	hrs:mins
Dose volume per zone	30	gallons per dose

JEFFERSON COUNTY, MO

LOCATION MAP
(NOT TO SCALE)

FOOD ZONE X
F.I.R.M. 29099C0065E APRIL 5, 2006

GENERAL NOTES

1. CONSTRUCTION OF THE ONSITE SEWAGE DISPOSAL SYSTEM SHALL COMPLY WITH THE MISSOURI DEPARTMENT OF HEALTH AND SENIOR SERVICES AS AMENDED BY JEFFERSON COUNTY AND THE SOILS REPORT BY KERRY CLARK 09/07/2022
2. SIZE, LOCATION, AND TYPE OF DISPOSAL SYSTEM SHALL NOT BE MODIFIED WITHOUT AUTHORIZATION FROM THE ENGINEER AND JEFFERSON COUNTY.
3. CONTOURS AND ELEVATIONS WERE SET BASED ON A TEMPORARY BENCH MARK (TBM) ELEVATION OF 100.
4. TOPO PERFORMED BY GANEY ENGINEERING LLC IS NOT A LEGAL SURVEY.
5. PLANS FOR THE ONSITE DISPOSAL SYSTEM WERE PREPARED TO MEET MINIMUM STANDARDS PER STATE AND COUNTY REQUIREMENTS. GANEY ENGINEERING LLC DOES NOT REPRESENT NOR WARRANT PROPER OPERATION OR FUNCTION OF INSTALLED SYSTEM FOR ANY PERIOD OF TIME.
6. ALL STORM WATER RUNOFF FROM THE DWELLING AND SURFACE RUNOFF SHALL BE DIVERTED AROUND AND NOT BE ALLOWED TO ENTER THE SYSTEM.

ONSITE WASTEWATER TREATMENT OPERATION AND MAINTENANCE

PROPER OPERATION AND MAINTENANCE IS REQUIRED FOR THE ONSITE WASTEWATER TREATMENT SYSTEM TO FUNCTION PROPERLY. GANEY ENGINEERING LLC RECOMMENDS A MAINTENANCE AGREEMENT WITH A QUALIFIED PROVIDER. OWNER IS EXPECTED TO FOLLOW GUIDELINE LOCATED WITHIN THE AERATION TANK SERVICE MANUAL

SOIL EVALUATION

KERRY CLARK, COPY ATTACHED
SEPTEMBER 7, 2022

ONSITE WASTEWATER TREATMENT DESIGN

APPLICATION RATE OF 0.15 GAL/SF/DAY FOR AN ALTERNATIVE ABSORPTION SYSTEM
PROPOSED 3 BEDROOM HOME = 3 X 120 GAL/DAY = 360 GAL/DAY
(360 GAL/DAY) / (0.15 GAL/SF/DAY) = 2000 SF OF DRIP FIELD REQUIRED
3000 SF DRIP FIELD PROPOSED
SEE TABLES BELOW FOR CALCULATIONS FOR PROPOSED DRIP FIELD
PROPOSED CLASS #1 NSF 40 500 GAL/DAY JET AERATION TANK (OR APPROVED EQUAL)

GEOFLOW SUBSURFACE DRIP — Pump Size

Job Description:	Case Study #1
Contact:	NOWRA
Prepared by:	Paul Ganey
Date:	9/29/2022

Pressure losses may be grossly overstated, particularly if designing with WASTEFLOW Classic.
The letters on the diagram (right) match the letters in section 2 below.

Worksheet - Pump Sizing

Section 1 - Summary from Worksheet 1

Flow required to dose field	6.63	gpm
Flow required to flush field	11.84	gpm
Flow required to dose & flush field	18.47	gpm
Filter	AP4E-1F	
No. of Zones	1	zones
Zone valve	-	
Dripline	Wasteflow PC - 1/2gph	
Dripline longest lateral	93.75	ft.

Section 2	Ft of head	Pressure
A. Flush line - Losses through return line		
Size of flush line in inches	1.25 inch	
Length of return line	45 ft.	
Equivalent length of fittings	5 ft.	
Elevation change. (if downhill enter 0)	0 ft.	
Pressure loss in 100 ft of pipe	3.67 ft.	1.59 psi
Total pressure loss from end of dripline to return tank	1.8 ft.	0.79 psi
B. Dripline - Losses through Wasteflow dripline		
Length of longest dripline lateral	94 ft.	
Minimum dosing pressure required at end of dripline	23.10 ft.	10.00 psi
Loss through dripline during flushing	8.45 ft.	3.65 psi
Total minimum required dripline pressure	31.55 ft.	3.65 psi
A+B. Minimum Pressure required at beginning of dripfield		
CALCULATED pressure required at beginning of dripfield	33.39 ft.	14.45 psi
SPECIFIED pressure at beginning of dripfield (from worksht 1)	46.2 ft.	20.00 psi
Great! SPECIFIED Pressure is greater than CALCULATED Pressure requirement. Go to next step		
C. Drip components - Losses through headworks		
Filter	23.7 ft.	10.25 psi
Zone valve pressure loss (not in diagram)	- ft.	- psi
Flow meter pressure loss (not in diagram)	ft.	- psi
Other pressure losses	ft.	- psi
Total loss through drip components	23.68 ft.	10.25 psi
D. Supply line - Minimum Pressure head required to get from pump tank to top of dripfie		
Size of supply line in inches	1.25 inch	
Length of supply line	45 ft.	
Equivalent length of fittings	5 ft.	
Height from pump to tank outlet	5 ft.	
Elevation change. (if downhill enter 0)	5 ft.	
Pressure loss/gain in 100 ft. of pipe	8.35 ft	3.62 psi
Total gain or loss from pump to field	12.2 ft.	5.27 psi
Total dynamic head	82.1 ft.	35.52 psi
Pump capacity *	18.5 gpm	
Pump Model Number	Franklin Electric 20 gpm	
Voltz / Hp / phase	120 V 0.50 HP Single Phase	

PAUL R. GANEY
MO# PE-2010019544

GANEY ENGINEERING LLC
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IMPERIAL, MO 63052
PH. (314) 973-0377
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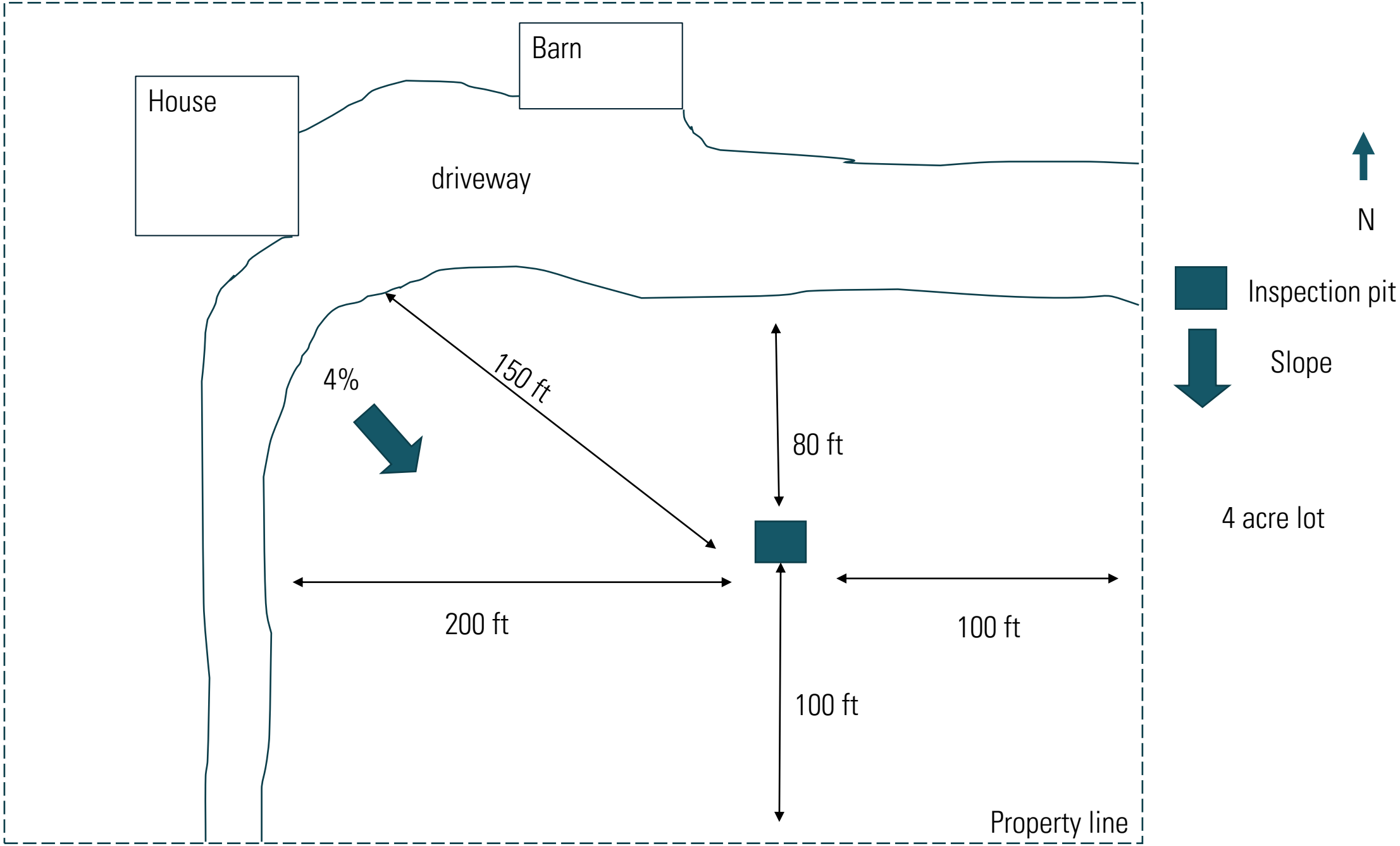
CASE STUDY #1

JOB# 222-XXXX

SITE PLAN

09/29/2022

CASE 2. CLAYPAN AT 36 INCHES


Barn
House
driveway
N
Inspection pit
Slope
4%
150 ft
80 ft
4 acre lot
200 ft
100 ft
100 ft
Property line

SOIL PROFILE DESCRIPTION

Owner: Case study 2

SOIL CHARACTERISTICS Date:

Vegetation: Grass Excavation Depth: 48 in Pit (required for new installation) or Core #: 1A

Parent Material: Loess

Suitability (S, PS, U)	Horizon		Munsell Color (moist)	Redoximorphic Features [2]	Texture		% Coarse Fragments by volume		Consistence [4]	Structure [5]	Roots /Pores [6]	Shrink /Swell	Soil Group	Application Rate	
	Designation	Depth / Boundary [1]			USDA [3]	% Clay	<3"	>3"						Conv. (Table 13)	LPP (Table 14)
PS	A1	0-8 cs	10YR3/2	-	sil	15	-	-	fr	3,c,gr	mf mm	L	III	0.55	0.28
PS	A2	8-16 cs	10YR3/3	-	sil	15	-	-	fr	2,m,sbk	cf mm	L	III	0.55	0.28
PS	Bt1	16-24 cs	10YR4/3	c,1,f FMM 10YR5/6	sil	25	-	-	fr	2,m,sbk	cf mm	L	III	0.45	0.23
PS	Bt2	24-36 cs	10YR5/6	c,2,P FMM 5YR4/6	sicl	30	-	-	fr	2,c,sbk	cf cm	M	III	0.35	0.18
U	Bt3	36-48	10YR5/6	-	c	60	-	-	vfi	2,c,sbk	ff ff	H	IVb	**	**

Notes ** Drip irrigation rate is 0.05

SITE CLASSIFICATION for
ONSITE SEWAGE SYSTEM – 19 CSR 20-3.060(2) & (7)

Owner: Case study 2 Pit/Core #: 1A Date:

Suitability See recommendations below S – Suitable; PS – Provisionally Suitable; U – Unsuitable; for conventional system.

S **LANDSCAPE POSITION:** SIDESLOPE Slope aspect: SE/E

Flooding frequency: None ☒ Rare ☐ Occasional ☐ Frequent ☐ Surface depression(s) in evaluated area?

S **& TOPOGRAPHY** Percent Slope: 4 Slope Type: Uniform ☒ Complex ☐

Shape across (contour): LINEAR Shape down (profile): LINEAR

SOIL CHARACTERISTICS (See Profile Description for details)

U PS **TEXTURE** to a depth of 36 inches Depth of unsuitable texture 36+ inches

S **STRUCTURE** to a depth of inches Depth of unsuitable structure inches

S **SOIL DRAINAGE** Type of water table: Depth to water table inches

S Surface drainage limitations: NONE Runoff slope length 400 feet

S **SOIL THICKNESS** Depth of bedrock: >48 inches Rock outcrops? NONE

U **RESTRICTIVE HORIZON** Type: CLAYPAN Depth: 36 Thickness:

S **AVAILABLE SPACE** Estimated space available: 100 X 100

Adequate for a conventional system? Y an alternative system? Y replacement area? Y

OTHER FACTORS Note any environmental hazards:

High groundwater contamination potential? (If yes, indicate reason):

Sinkhole ☐ Rapid permeability ☐ Depth to highly permeable bedrock ☐ Fill material /depth ☐

U **OVERALL** Notes: Claypan at 36 inches

Overall site classification will be determined by the lowest of the uncorrectable characteristics.

- **S** An overall site classification of **suitable** indicates soil and site conditions favorable for the operation of a conventional absorption system.
- **PS** Sites classified as **provisionally suitable** require some modifications and careful planning, design, and installation for a conventional system or alternative system to function satisfactorily.
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Recommendations* associated with Provisionally Suitable or Unsuitable classifications:

Trenches must not be dug when wet to prevent damaging soil/trench surfaces.

Surface water diversion is needed.

An interceptor drain should be installed upslope at a depth of inches.

Shallow or modified shallow placed trenches should be installed at a depth of inches.

XX An alternative/engineered system is needed to overcome site limitations.

Owner: Case study 2 Date

Comments/Recommendations

Site is well drained to 24 inches and has low to moderate clay to 36 inches. Very high clay at 36 inches.

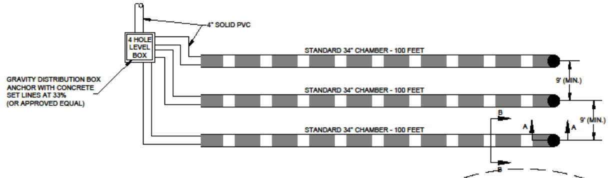
Site will need an engineered system or lagoon due to poor permeability of clay at 36 inches.

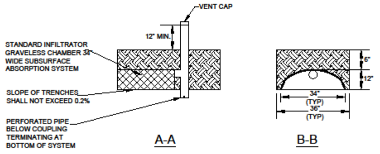
*Recommendations are to assist the property owner, and their agents in complying with the standards, and are subject to approval by the administrative authority.

I, the undersigned, hereby certify that the site evaluation was made in accordance with the requirements of Sections 701.025-701.059 RSMo and 19 CSR 20-3.060 and 19 CSR 20-3.080, and that the data recorded is correct to the best of my knowledge.

System Design – Gravel Less Chambers

- Why Chambers?
- Depth of Suitability
- Depth of Water Table
- Location of Drainage
- Curtain Drain?
- Loading Rate
- Design Flow – Bedrooms? Occupancy?
- Location of water service/well(s)

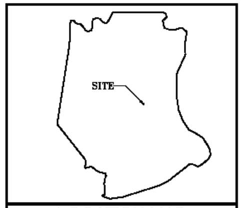




GRAVELLESS CHAMBER ABSORPTION FIELD

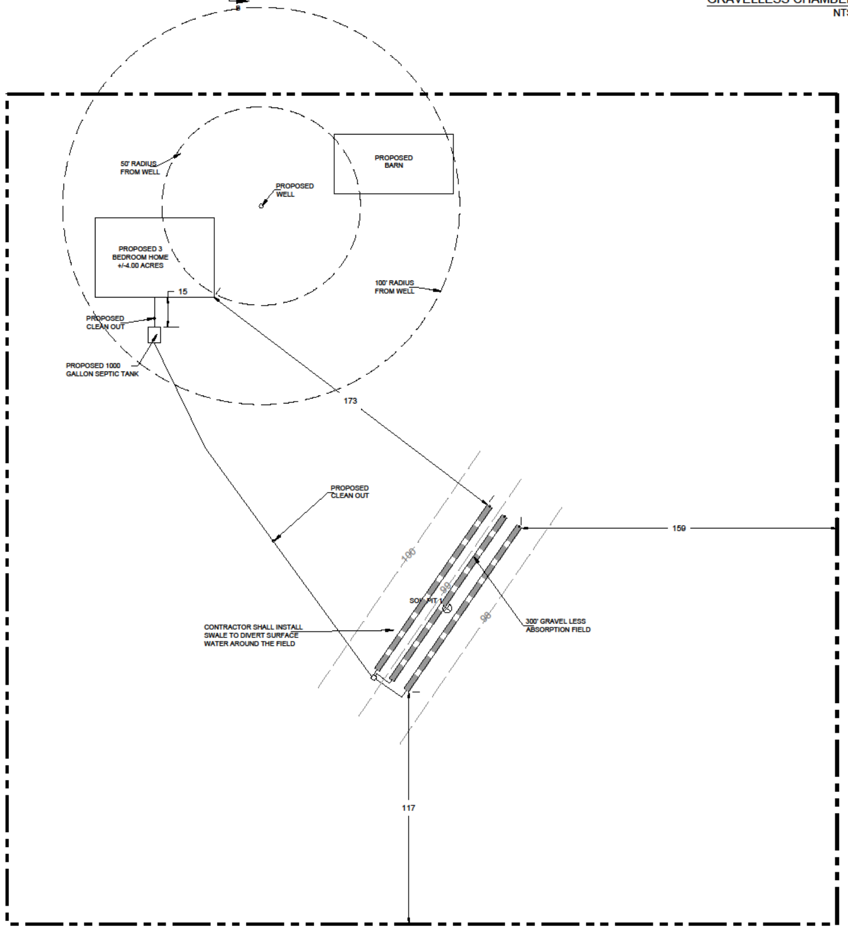
NTS

JEFFERSON COUNTY, MO



LOCATION MAP

FOOD ZONE X
F.I.R.M. 29099C0065E APRIL 5, 2006



LEGEND

PROPERTY LINE

CONTOUR

GENERAL NOTES

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3. CONTOURS AND ELEVATIONS WERE SET BASED ON A TEMPORARY BENCH MARK (TBM) ELEVATION OF 100.
4. TOPO PERFORMED BY GANEY ENGINEERING LLC IS NOT A LEGAL SURVEY.
5. PLANS FOR THE ONSITE DISPOSAL SYSTEM WERE PREPARED TO MEET MINIMUM STANDARDS PER STATE AND COUNTY REQUIREMENTS. GANEY ENGINEERING LLC DOES NOT REPRESENT NOR WARRANT PROPER OPERATION OR FUNCTION OF INSTALLED SYSTEM FOR ANY PERIOD OF TIME.
6. ALL STORM WATER RUNOFF FROM THE DWELLING AND SURFACE RUNOFF SHALL BE DIVERTED AROUND AND NOT BE ALLOWED TO ENTER THE SYSTEM.

ONSITE WASTEWATER TREATMENT OPERATION AND MAINTENANCE

PROPER OPERATION AND MAINTENANCE IS REQUIRED FOR THE ONSITE WASTEWATER TREATMENT SYSTEM TO FUNCTION PROPERLY. GANEY ENGINEERING LLC RECOMMENDS A MAINTENANCE AGREEMENT WITH A QUALIFIED PROVIDER. OWNER IS EXPECTED TO FOLLOW GUIDELINE LOCATED WITHIN THE AERATION TANK SERVICE MANUAL

SOIL EVALUATION

KERRY CLARK, COPY ATTACHED
SEPTEMBER 7, 2022

ONSITE WASTEWATER TREATMENT DESIGN

APPLICATION RATE OF 0.35 GAL/SF/DAY FOR A CONVENTIONAL ABSORPTION SYSTEM WITH EVEN DISTRIBUTION.
PROPOSED 3 BEDROOM HOME = 120 GAL/DAY X 3 = 360 GAL/DAY
34" CHAMBER (42" EFFECTIVE TRENCH WIDTH)
(360 GAL/DAY) / (0.35 GAL/SF/DAY X 3.5 FT) = 294 FT OF CHAMBERS REQUIRED
3 TRENCHES AT 100 FT = 300 FT OF CHAMBERS PROPOSED
PROPOSED 1000 GALLON SEPTIC TANK

GRAPHIC SCALE

(IN FEET)
1 inch = 30 ft.

NOTES

1. ONE CLEANOUT MINIMUM REQUIRED BETWEEN HOUSE AND AERATION TANK.
2. DRAINFIELD LINES SHALL FOLLOW CONTOURS OF PROPERTY
3. ONE CLEANOUT SHALL BE INSTALLED AT THE END OF EACH DRAINFIELD LINE
4. WATER SOFTNER BACKWASH AND SWIMMING POOL FILTER SYSTEMS SHALL NOT ENTER THE ONSITE WASTE WATER TREATMENT PLANT AND SHALL BE DISCHARGED PROPERLY
5. TRENCHES SHALL BE OVERFILLED WITH BACKFILL MATERIAL TO ALLOW FOR SETTLEMENT
6. PIPE ENTERING AND EXITING THE AERATION TANK SHALL BE SCHEDULE 40 PVC AND SHALL EXTEND A MINIMUM OF 5 FEET BEYOND THE EXCAVATION FOR THE SEWAGE AERATION TANK
7. DRAINFIELD SHALL BE LOCATED A MINIMUM OF 25 FEET FROM ALL PROPERTY LINES LOCATION, SIZE, AND CONDITION OF THE EXISTING FIELD IS UNKNOWN
8. EXISTING SEWER LINE FROM HOUSE TO CLEANOUT SHALL BE INSPECTED AND REPLACED IF NECESSARY

PREPARED FOR:
NOWRA

UTILITY NOTE:

UNDERGROUND FACILITIES, STRUCTURES AND UTILITIES HAVE BEEN PLOTTED FROM AVAILABLE SURVEYS, RECORDS AND INFORMATION, AND , THEREFORE DO NOT NECESSARILY REFLECT THE ACTUAL EXISTENCE, NON-EXISTENCE, SIZE, TYPE, NUMBER, OR LOCATION OF THESE FACILITIES, STRUCTURES AND UTILITIES. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING THE ACTUAL LOCATION OF ALL UNDERGROUND FACILITIES, STRUCTURES, AND UTILITIES, EITHER SHOWN OR NOT SHOWN ON THESE PLANS. THE UNDERGROUND FACILITIES, STRUCTURES, AND UTILITIES SHALL BE LOCATED IN THE FIELD PRIOR TO ANY GRADING, EXCAVATION OR CONSTRUCTION OF IMPROVEMENTS. THESE PROVISIONS SHALL IN NO WAY ABSOLVE ANY PARTY FROM COMPLYING WITH THE UNDERGROUND FACILITY SAFETY AND DAMAGE PREVENTION ACT, CHAPTER 319 RSMo.

GANEY ENGINEERING LLC AND THE UNDERSIGNED ENGINEER HAVE NO RESPONSIBILITY FOR SERVICES PROVIDED BY OTHERS TO IMPLEMENT THE IMPROVEMENTS SHOWN ON THIS PLAN AND ALL OTHER DRAWINGS WHERE THE UNDERSIGNED ENGINEER'S SEAL APPEARS. THE CONSTRUCTION MEANS AND METHODS ARE THE SOLE RESPONSIBILITY OF THE OWNER AND CONTRACTOR. KING SEPTIC SERVICE ENGINEERING HAS NO RESPONSIBILITY TO VERIFY FINAL IMPROVEMENTS AS SHOWN ON THIS PLAN UNLESS SPECIFICALLY ENGAGED AND AUTHORIZED TO DO SO BY THE OWNER OR CONTRACTOR.

PAUL R. GANEY
MO# PE-2010019544

GANEY ENGINEERING LLC
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IMPERIAL, MO 63052
PH. (314) 973-0377
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CASE STUDY #2

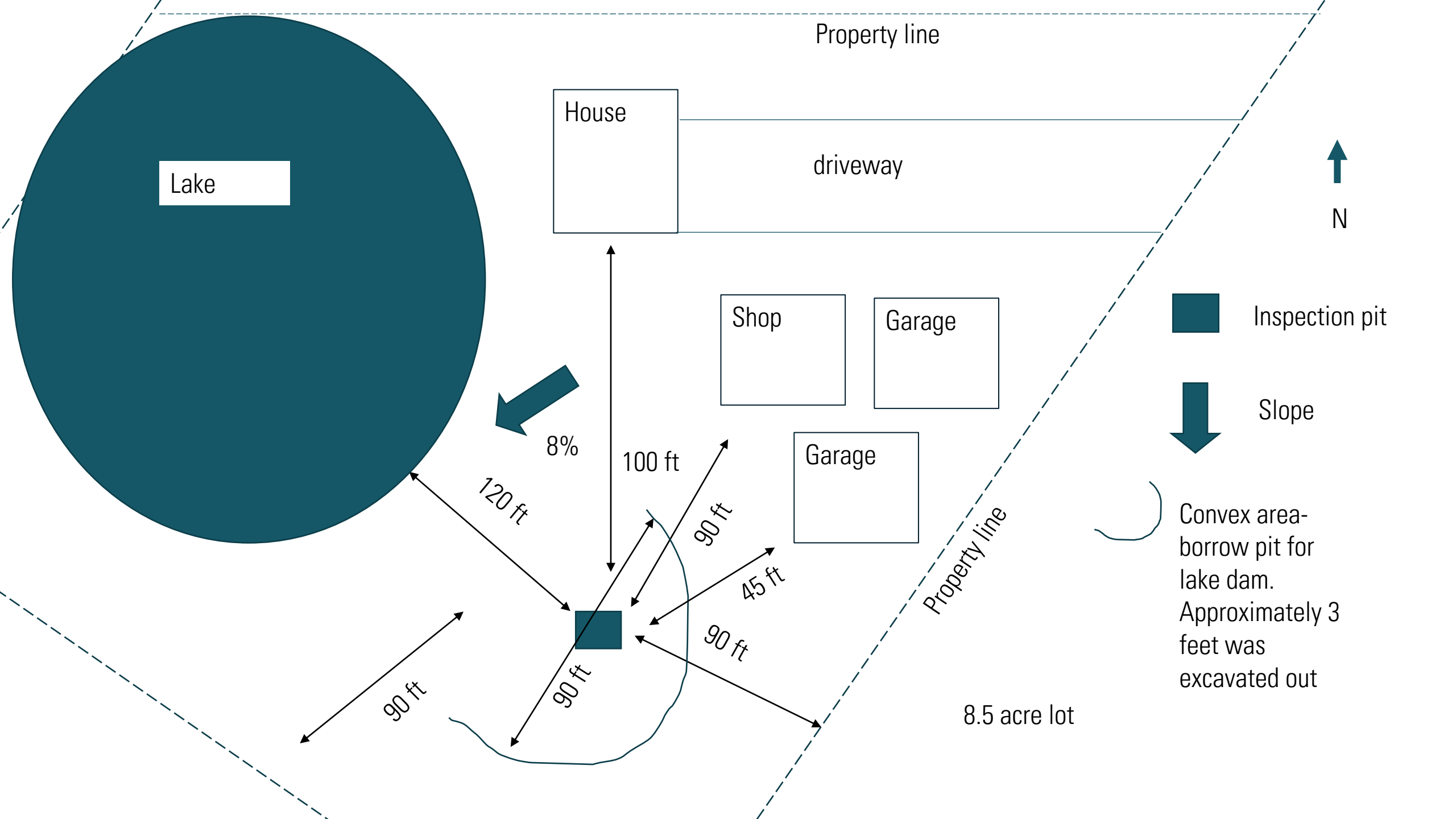
JOB# 222-XXXX

SITE PLAN

09/29/2022

1 of 1

Case 3. Bedrock at 35 inches with clay at 9 inches and saprolite at 13 inches


Property line
House
driveway
Lake
N
Shop
Garage
Garage
Inspection pit
Slope
8%
100 ft
120 ft
90 ft
45 ft
90 ft
90 ft
90 ft
Property line
Convex area-
borrow pit for
lake dam.
Approximately 3
feet was
excavated out
8.5 acre lot

SOIL PROFILE DESCRIPTION

Owner: Case study 3 Date:

SOIL CHARACTERISTICS Excavation Depth: 48 inch Pit (required for new installation) or Core #: 1A

Vegetation: trees Parent Material: colluvium/residuum

Suitability (S, PS, U)	Horizon		Munsell Color (moist)	Redoximorphic Features (2)	Texture		% Coarse Fragments by volume		Consistence (4)	Structure (5)	Roots /Pores (6)	Shrink /Swell	Soil Group	Application Rate	
	Designation	Depth / Boundary (1)			USDA (3)	% Clay	<3"	>3"						Conv. (Table 13)	LPP (Table 14)
PS	A	0-1 / as	10YR3/2	-	sil	25	5		fr	2,f,sbk	cm / mm	L	III	0.45	0.23
PS	Bt1	1-9 / cs	10YR4/6	-	sicl	30	15	5	fl	2,m,sbk	mf / cm	M	III	0.35	0.18
U	Bt2	9-13 / as	5YR4/6	many manganese	sic	40	15	2	vfi	3,c,pr	mf / cm	H	IVb	**	**
PS	2BC1	13-27 / cs	5Y7/1*	-	sicl	30	20	5	fr	3.c.pr	ff / ff	M	III	0.35	0.18
PS	2BC2	27-32 / as	5Y6/1*	-	sicl	35	20	5	fr	2,c,sbk	- / ff	H	IVb	**	**
PS	2BC3	32-35 / as	7.5YR5/8	many manganese	sicl	30	5	-	fi	1,c,sbk	- / ff	M	III	0.35	0.18
U	R	35+	Bedrock											**	**

Notes * colors are from limestone

** drip irrigation rate is 0.05

Notations used on Soil Profile Description

(1) **Boundary**: distinctness: A-abrupt, C-clear, G-gradual, S-gradual, W-wavy, I-irregular

SITE CLASSIFICATION for
ONSITE SEWAGE SYSTEM – 19 CSR 20-3.060(2) & (7)

Owner: case study 3 Pit/Core #: 1A Date:

Suitability See recommendations below S – Suitable; PS – Provisionally Suitable; U – Unsuitable; for conventional system.

U **LANDSCAPE POSITION:** BOWL Slope aspect: W

Flooding frequency: None ☒ Rare ☐ Occasional ☐ Frequent ☐ Surface depression(s) in evaluated area?

U **& TOPOGRAPHY** Percent Slope: 8% Slope Type: Uniform ☒ Complex ☐

Shape across (contour): CONVEX Shape down (profile): CONVEX

SOIL CHARACTERISTICS (See Profile Description for details)

U PS **TEXTURE** to a depth of 9 inches Depth of unsuitable texture inches

S **STRUCTURE** to a depth of inches Depth of unsuitable structure inches

S **SOIL DRAINAGE** Type of water table: Depth to water table inches

S Surface drainage limitations: NONE Runoff slope length 200 feet

U **SOIL THICKNESS** Depth of bedrock: 35 inches Rock outcrops? NONE

U **RESTRICTIVE HORIZON** Type: CLAYPAN Depth: 9 Thickness:

U **AVAILABLE SPACE** Estimated space available: limited due to lake

Adequate for a conventional system? N an alternative system? Y replacement area? N

OTHER FACTORS Note any environmental hazards:

High groundwater contamination potential? (If yes, indicate reason):

Sinkhole ☐ Rapid permeability ☐ Depth to highly permeable bedrock ☐ Fill material /depth ☐

U **OVERALL** Notes: Bedrock, clay, topography

Overall site classification will be determined by the lowest of the uncorrectable characteristics.

- **S** An overall site classification of **suitable** indicates soil and site conditions favorable for the operation of a conventional absorption system.
- **PS** Sites classified as **provisionally suitable** require some modifications and careful planning, design, and installation for a conventional system or alternative system to function satisfactorily.
- **U** Sites originally classified as **unsuitable** may possibly be reclassified as **provisionally suitable** according to subsection (7)(K).
- An **unsuitable** site may be used for soil absorption systems, provided engineering, hydrogeologic and soil studies indicate to the administrative authority that a conventional or alternative system could be expected to function satisfactorily. These sites may be reclassified as **provisionally suitable** upon meeting the requirements of the administrative authority according to subsection (6)(K).

Recommendations* associated with Provisionally Suitable or Unsuitable classifications:

Trenches must not be dug when wet to prevent damaging soil/trench surfaces.

Surface water diversion is needed.

An interceptor drain should be installed upslope at a depth of inches.

Shallow or modified shallow placed trenches should be installed at a depth of inches.

XX An alternative/engineered system is needed to overcome site limitations.

Owner: Case study 3 Date

Comments/Recommendations

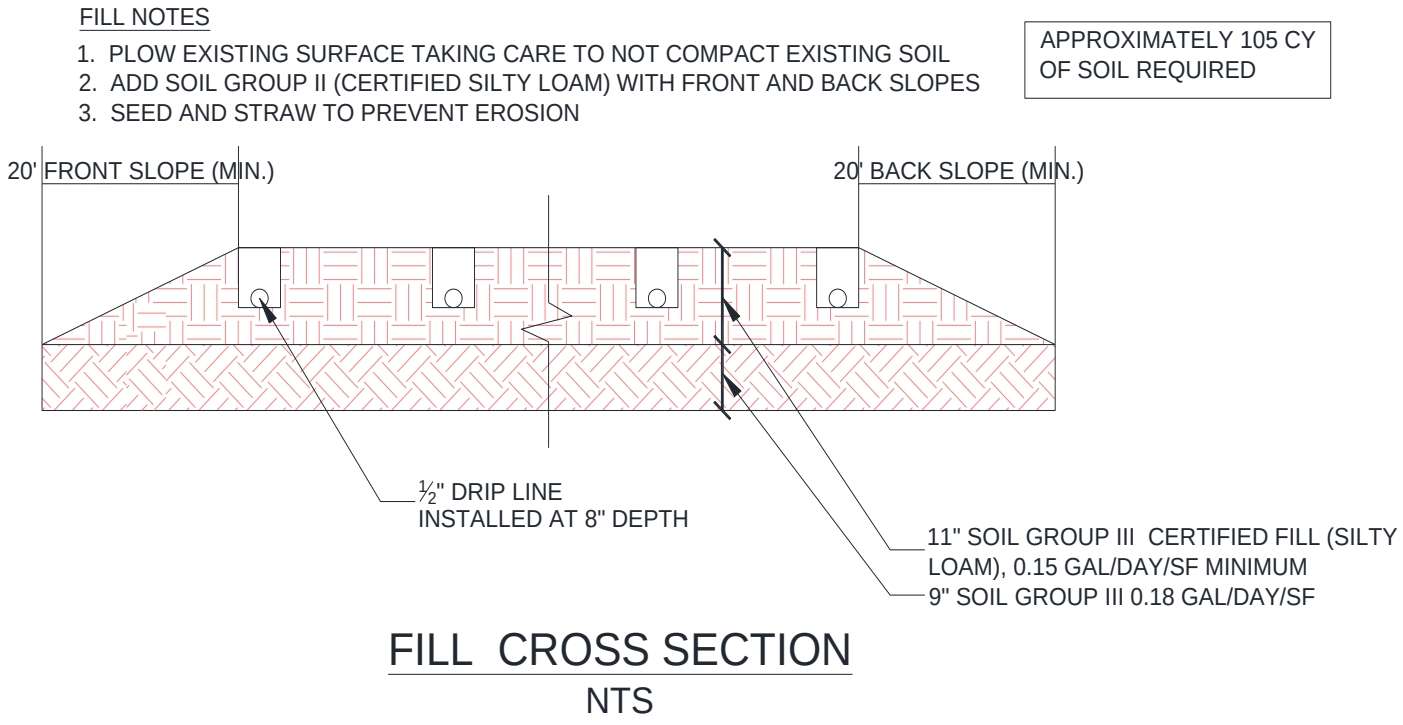
Inspection pit was dug in area previously used as a borrow pit for lake dam. This exposed bedrock at a shallow depth and removed approximately 3 feet of topsoil. Site is space limited. due to lake and buildings, which is why inspection pit was placed in a bowl shaped area. Site needs an engineered system and will likely require some soil replacement

*Recommendations are to assist the property owner, and their agents in complying with the standards, and are subject to approval by the administrative authority.

I, the undersigned, hereby certify that the site evaluation was made in accordance with the requirements of Sections 701.025-701.059 RSMo and 19 CSR 20-3.060 and 19 CSR 20-3.080, and that the data recorded is correct to the best of my knowledge.

System Design – Drip Irrigation

- Why Drip?
- Depth of Suitability
- Import Soil?
- Two Zone Field?
- Depth of Water Table
- Location of Drainage
- Curtain Drain?
- Loading Rate – IVB
- Design Flow – Bedrooms? Occupancy?
- Location of water service/well(s)



FILL CROSS SECTION

NTS

Ganey Engineering LLC Drip Flow Calculations

Job Description:	*Case Study #3*
Contact:	*NOWRA*
Prepared by:	*Paul Ganey*
Date:	*29-Sep-22*

Please fill in the shaded areas and drop down menus:
This spreadsheet serves as a guide, and is not a complete hydraulic design.

Worksheet 1- Field Flow

Total field

Total Quantity of effluent to be disposed per day	360	gallons / day
Hydraulic loading rate	0.075	gallons / sq.ft. / day
Minimum Dispersal Field Area	4,800	square ft.
Total Dispersal Field Area	4,800	square ft.

Flow per zone

Number of Zones	2	zone(s)
Dispersal area per zone	2,400	square ft.
Choose line spacing between WASTEFLOW lines	2	ft.
Choose emitter spacing between WASTEFLOW emitters	2	ft.
Total linear ft per zone (minimum required)	1,200	ft. per zone
Total number of emitters per zone	600	emitters per zone
Select Wasteflow dripline (16mm)	Wasteflow PC - 1/2gph	dripline
Pressure at the beginning of the dripfield	25	psi
Feet of Head at the beginning of the dripfield	57.75	ft.
What is the flow rate per emitter in gph?	0.53	gph
Dose flow per zone	5.30	gpm

If required, choose flush velocity	1	ft/sec
How many lines of WASTEFLOW per zone?	12	lines
Fill in the *actual* length of longest dripline lateral	100	ft.
Equivalent length including flush requirement	267.5678774	
Flush flow required at the end of each dripline	0.74	gpm
Total Flow per zone- worst case scenario	14.18	gpm

Select Filters and zone valves

Select Filter Type	Vortex Screen Filter	
Recommended Filter (item no.)	AP4E-1F	1" Screen Filter 0-20gpm
Select Zone Valve Type	Hydraulic	-
Recommended Zone Valve (item no.)	HT-4402	ex valve 1.25x1.25", 25-75p

Note minimum pressure of 25 psi required for Hydraulic valves.Check pressure in Cell D28 above.

Dosing

Number of doses per day / zone:	12	doses
Timer ON. Pump run time per dose/zone:	2.50	mins:secs
Timer OFF. Pump off time between doses	1:57	hrs:mins
Per Zone - Pump run time per day/zone:	0:33	hrs:mins
All Zones - Number of doses per day / all zones	24	doses / day

GEOFLOW SUBSURFACE DRIP — Pump Size

Job Description:	Case Study #3
Contact:	NOWRA
Prepared by:	Paul Ganey
Date:	9/29/2022

Pressure losses may be grossly overstated, particularly if designing with WASTEFLOW Classic
The letters on the diagram(right) match the letters in section 2 below.

Worksheet - Pump Sizing

Section 1 - Summary from Worksheet 1

Flow required to dose field	5.30	gpm
Flow required to flush field	8.88	gpm
Flow required to dose & flush field	14.18	gpm
Filter	AP4E-1F	
No. of Zones	2	zones
Zone valve	HT-4402	
Dripline	Wasteflow PC - 1/2gph	
Dripline longest lateral	100.00	ft.

Section 2	Ft of head	Pressure
A. Flush line - Losses through return line		
Size of flush line in inches	1.25 inch	
Length of return line	60 ft.	
Equivalent length of fittings	5 ft.	
Elevation change. (if downhill enter 0)	0 ft.	
Pressure loss in 100 ft of pipe	2.15 ft.	0.93 psi
Total pressure loss from end of dripline to return tank	*1.4 ft.*	0.61 psi
B. Dripline - Losses through Wasteflow dripline		
Length of longest dripline lateral	100 ft.	
Minimum dosing pressure required at end of dripline	23.10 ft.	10.00 psi
Loss through dripline during flushing	8.45 ft.	3.66 psi
Total minimum required dripline pressure	*31.55 ft.*	3.66 *psi*
A+B. Minimum Pressure required at beginning of dripfield		
CALCULATED pressure required at beginning of dripfield	*32.95 ft.*	14.27 *psi*
SPECIFIED pressure at beginning of dripfield (from worksht 1)	57.8 ft.	25.00 *psi*
Great! SPECIFIED Pressure is greater than CALCULATED Pressure requirement. Go to next step		
C. Drip components - Losses through headworks		
Filter	15.0 ft.	6.50 psi
Zone valve pressure loss (not in diagram)	6.93 ft.	See T3-1psi
Flow meter pressure loss (not in diagram)	ft.	- psi
Other pressure losses	ft.	- psi
Total loss through drip components	21.95 ft.	6.50 psi
D. Supply line - Minimum Pressure head required to get from pump tank to top of dripfield		
Size of supply line in inches	1.25 inch	
Length of supply line	60 ft.	
Equivalent length of fittings	5 ft.	
Height from pump to tank outlet	5 ft.	
Elevation change. (if downhill enter 0)	5 ft.	
Pressure loss/gain in 100 ft. of pipe	5.12 ft.	2.22 psi
Total gain or loss from pump to field	*13.3 ft.*	5.77 psi
Total dynamic head	**83.0 ft.**	40.27 *psi*
Pump capacity *	**14.2 gpm**	
Pump Model Number	**Franklin Electric 20 gpm**	
Volts / Hp / phase	**120 V 0.50 HP Single Phase**	

* Note: Pump capacity flow assumes flow in dripline does not change during a dose cycle. With Wasteflow
For more accurate flows please see Geoflow's **Flushing worksheet**.

CONCLUSION:

- Many site limitations exist for onsite wastewater systems and should be investigated by a qualified soil scientist
- Site limitations can be overcome with engineering solutions
- Different site limitations can utilize different solutions

- Questions?