

Private Sewage System Design Document Example/Template

Open Discharge

PREFACE

This is an example Design Document for a septic tank and open discharge system. It reflects the information needed to demonstrate the design considerations for the particular site and system required by the Private Sewage Standard of Practice 2009 (Standard) have been made. Considerations needed for a particular site may go beyond those used as an example in this document.

This example document can be used as a template by editing or adding critical information to suit the particular site and system.

While it is preferable to use a consistent format to facilitate quick review, other formats of the design document may be accepted by the Safety Codes Officer (SCO), if the document includes the required information that shows the necessary design considerations were made.

A design is required in support of a permit application. It includes drawings and supporting information as it applies to the specific design. This is the information a SCO will review to evaluate whether design considerations required by the Standard have been adequately made prior to issuing the permit.

Including this design in the operation and maintenance manual that must be provided to the owner, will simplify development of the operation and maintenance manual.

PRIVATE SEWAGE SYSTEM DESIGN EXAMPLE - OPEN DISCHARGE

Joe Smith
 Box 1,
 Somewhere, Alberta

Legal Description of Property: NW Sec 31, Twp 36, Rge. 28, W of 4 Mer.
 Lot 1; Blk 1; Plan 123450
Municipal Address: 19035 - Rge. Rd. 28

The sewage system includes a septic tank and open discharge system. This system is suitable for the site and soil conditions of this property. The design reflected in the following applies, and meets, the requirements of the current Alberta Private Sewage Systems Standard of Practice (Standard) to achieve effective treatment of the wastewater from this residence.

This sewage system serves a 4-bedroom single family dwelling. Based on the characteristics of the home identified during our review, the total peak wastewater flow that must be used for this design is 461 Imp. gallons per day. Although peak flow used in the design is 461 Imp. gal/day, an average operating flow of 300 Imp. gal/day is expected.

1 Wastewater Characteristics

1.1. Wastewater Peak flow

The development served is a 4-bedroom single-family dwelling. The total plumbing fixture unit load in this residence is 21 based on a review of the building. This requires 11 Imp. gal/day be added to the base peak daily flow. Fixture unit load is as follows:

- Main bath = 6 fixture units
- Bathroom with shower off master bedroom = 6 fixture units
- Kitchen sink = 1.5 fixture units
- Laundry stand pipe = 1.5 fixture units
- Bathroom in basement = 6 fixture units

No high-volume plumbing fixtures were identified in the review of this development.

Total peak daily flow used in the design is:	461 Imp. gal/day
Base flow : 450 Imp. gal	
Additional flow : 11 Imp. gal	

1.2. Wastewater Strength

Characteristics of the development were considered to assess sewage strength. No garbage grinders or other characteristics were identified that would cause typical wastewater strength to be exceeded.

Projected wastewater strength for the design is:	BOD 220 mg/L TSS 220 mg/L Oil and Grease 50 mg/L
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1.3. Wastewater Flow Variation Considerations

The characteristics of this development indicate wastewater flow volumes will not vary substantially during the day or from day to day. No flow variation management is needed.

2 Site Evaluation Findings

2.1 Site Evaluation

The lot is 4 hectares (9.88 acres) in area. The dimensions of the property are shown in the drawing attached in Appendix A. The adjacent property is undeveloped farm land.

The proposed site has been reviewed as to consider the restrictions set out in Section 8.6.2.2 for prohibited open discharge installations. It has been confirmed that the number of subdivided parcels does not exceed 4, excluding the remnant parcel, as set out in the SOP.

The property has a 2% slope toward the north property line. Line locates confirmed there are existing utilities in along the north property line and an easement is in place.

The site evaluation assessed the area within in a 100 m (330 ft) radius of all components of the system design. No water courses or other setback constraints were noted. Pertinent features identified during the site review and the required setback distances are noted on the site plan in Appendix A.

2.2 Soils Evaluation

Two soil excavations were investigated on this site. Test Pit 1 is located at the proposed location of the open discharge outlet. The excavation for the basement was the second soil profile investigated. As these soil profiles show little variability they are adequate for design purposes. The location of test pit 1 is shown on the site plan in Appendix A. Soil profile descriptions are attached in Appendix B.

The area selected for the system must be kept clear of any utilities to be installed and no disturbance of the soil in that area can occur.

3 Key Soil Characteristics

3.1. Design Soil Conditions

- Redoximorphic features (mottling/gleying) that indicate saturated soil are not present to a depth of 6 feet below surface.
- To a depth of 5 feet the dominate soil is a fine sandy loam with blocky grade 2 structure.

3.2. Limiting Soil Condition

No limiting condition encountered.

3.3. Effluent Linear Loading Rate Design Consideration

The open discharge system design considered the 2% ground slope. Landscaping at the point of discharge will be done to encourage spreading of the effluent.

4 Initial Treatment Component Design Details

Details of the initial treatment components required for this design are attached in Appendix C.

4.1 Septic Tank and Dose Tank

4.1.1 Septic Tank

The working capacity of the septic tank specified for this design is 1218 Imperial gallons. Specifications for the Model ST 1218 Septic Tank used in this design are shown in Appendix C.

The minimum working capacity required for this development is 951 Imp. gallons based on Table 4.2.2.2 of the 2009 SOP for a 4 bedroom house (940 Imp. gal/day plus the additional flow of 11 Imp. gal.)

Burial depth of the septic tank at finished grading will be 4ft 6 inches above the top of the tank. This tank is rated for a maximum burial depth of 9 ft.10 inches. Insulation of the tank is not required as the burial depth exceeds 4 feet.

4.1.2 Dose Tank

The dose chamber is integral to the septic tank. It has a total capacity of 670 Imp. gal. This is sufficient capacity to deliver the 111 Imp. gal required for each dose of effluent. It also provides 220 Imp. gal emergency storage above the high effluent alarm setting. Specifications are shown in Appendix C.

4.1.3 High Liquid Level Alarm

An Alarm Tech Inc JB Series 1000T high level alarm is specified for this system. It shall be set to activate at 30.5 inches above the floor of the dose tank.

4.1.4 Effluent Filter

An inline 2 inch diameter Sim/Tech[®] model STF-100 effluent filter having an effective opening of less than 3.2 mm (1/8") is used. It creates a head loss of 0.5 feet at its rated flow of 80 Imp. gal/min. A 5.5 foot pressure head allowance has been included in the pump selection to allow for partially clogged conditions. A one year service interval is expected with typical flow volumes and wastewater characteristics.

5 Effluent Discharge Pipe Design Detail

5.1 Effluent Discharge Pipe

The open discharge delivery pressure piping design calculations are provided in detail in Appendix E. The open discharge system schematic drawing is included in Appendix D.

Pressure head loss due to friction

The friction loss through the 290 feet of piping and filter at the flow of 13 Imp. gal/min is 12 feet of head pressure.

Pressure head to meet vertical lift requirements include:

- Lift distance of effluent from the low effluent level in the tank to the end of the open discharge pipe is 11feet.
- The design pressure head at end of open discharge pipe is 2 feet.

Vertical lift and friction loss results in a **total pressure head** requirement of **25 ft.**

Pump specifications:

Demands for this pressure effluent line are **13 Imp. gal/min (15 U.S. gal/min) at 25 feet** of pressure head.

A Myers model ME3F effluent pump (1/3 hp) is specified for this system. The pump specifications with the effluent distribution system demands plotted on the pump curve are included in Appendix C.

5.2 Effluent Dosing Volume and Control settings.

The volume of effluent discharged in a single dose event will be approximately 20% of the peak flow which is 92 gallons.

Liquid volume in 100 feet of 1 ¼ inch polyethylene pipe = 6.48 gallons.

For 290 feet of pipe the volume is 19 Imp. gallons

Total dose volume between on and off float settings =

92 Imp. gallons + 19 Imp. gallons = 111 Imp. gallons.

Total individual dose volume determining float settings is **111 Imp. gal in order to deliver 92 gallons per dose** to the end of the open discharge pipe.

Effluent Level Float Control Settings

The dose tank dimensions result in 12 Imp. gallons per inch of depth. The float control elevations shall be set at:

- 9 inches between float off and on elevations [111 Imp. gal ÷ 12 Imp. gal/inch].
- Off: 19 inches off floor of dose tank
- On: 28 inches off floor of dose tank
- Alarm set at 1.5 inches above pump on elevation (29.5 inches off floor based on float elevations set out in this design).

Redundant off float control is not required by this design. No manual pump on switch is included in the system. The effluent level control floats will be attached to a 1 inch PVC pipe independent float mast that will withstand the dose tank environment.

5.3 Effluent Quality Sampling

Effluent samples can be taken from the effluent dose tank if required.

6 Initial operational set up parameters

The following activities need to be conducted to commission the system:

- Clean the septic tank of any construction debris and flush effluent delivery line.
- Confirm the residual 2 foot head is achieved and the discharge is effectively controlled and directed to prevent erosion.
- Confirm float levels are set to deliver the dose volume required by this design.

7 Operation and Maintenance Manual

The Owner's Manual detailing the design, operation, and maintenance of the installed system will be provided to the owner in accordance with Article 2.1.2.8 of the Standard of Practice.

Signature and closing by the designer/Installer.

Attachments: **Appendix A – Site Information [Site Plan, Drawings, etc.]**
 Appendix B – Soil Information, Soil Profiles, Laboratory Soil Analysis, etc.
 Appendix C – Specifications for System Components
 Appendix D – Detailed System Schematics, Drawings and Worksheets

This design has been developed by (name of certified person and company name). This design meets the requirements of the Alberta Private Sewage Systems Standard of Practice 2009 unless specifically noted otherwise and in such case special approval is to be obtained prior to proceeding with installation of this design. (*Carry on with any other qualifications or limitations that in your opinion as the designer/installer are needed.*)

Appendix A – Site Information

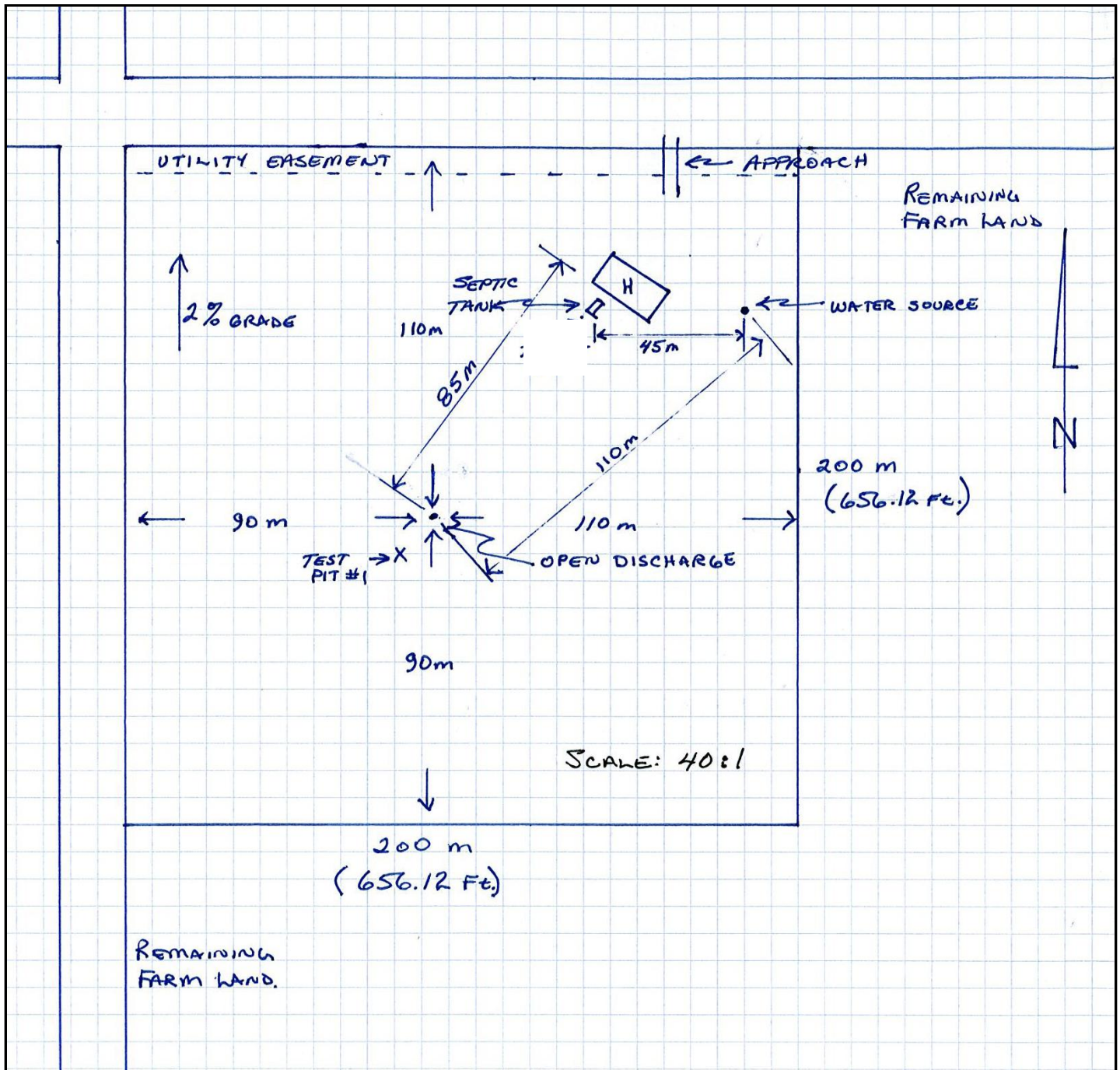


Figure A1 – Detailed Site Plan

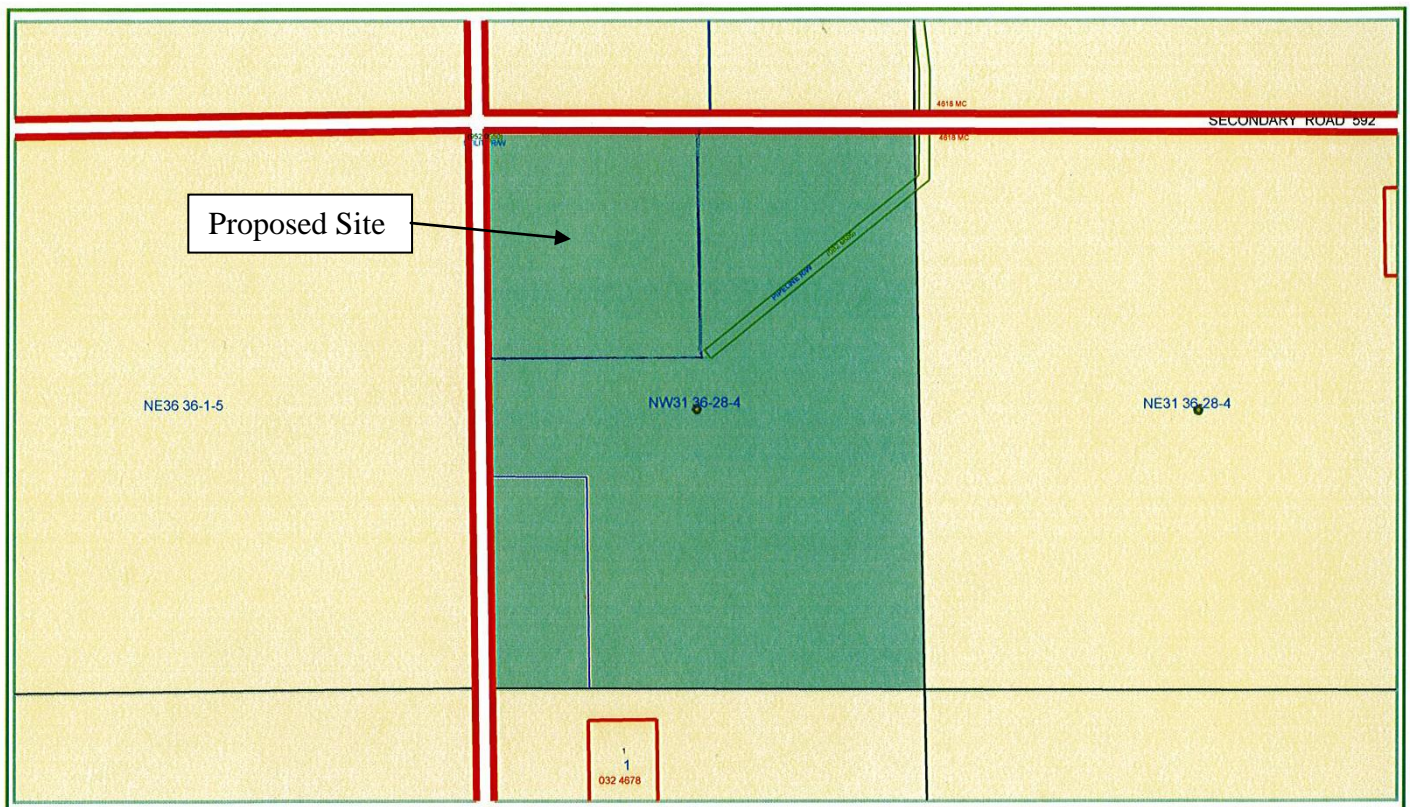


Figure A2 – Subdivision Plan

Appendix B - Alberta Private Sewage Treatment System Soil Profile Log Form

Smith Residence Soil Assessment											
Legal Land Location								Test Pit GPS Coordinates			
LSD-1/4	Sec	Twp	Rg	Mer	Lot	Block	Plan	Easting	Northing		
NW	31	36	28	W4M	12	1	123450	65024	34535		
Investigation Date: May 17 th , 2011.		Vegetation notes: Prairie grasses.				Overall site slope		2% at open discharge site.			
						Slope position of test pit:		Upslope position of property			
Test hole No.	Soil Subgroup	Parent Material	Drainage	Depth of Lab sample #1	Depth of Lab sample #2						
Test Pit #1				30 - 36 in.							
Hori-zon	Depth (cm) (in)	Texture	Lab or HT	Colour	Gleying	Mottling	Structure	Grade	Consistence	Moisture	% Coarse Fragments
A	Surface to 24 in.	Fine Sandy Loam (FSL)	HT	Dark brown.	None.	None.	Granular	2	Friable	Moist	20%
B	24 to 60 in.	Fine Sandy Loam (FSL)	HT and Lab	Light brown.	None.	None.	Blocky	3	Friable	Moist to dry.	5%
B	60 to 84 in.	Silt Loam (SIL)	HT	Light brownish grey.	None.	None.	Prismatic	2	Friable to firm.	Moist.	<1%
C	84 to 96 at end of test pit.	Sandy clay (SC)	HT	Light to dark grey.	At 7.5 ft saturated and gleyed.	7 to 7.5 ft Many distinct prominent mottles.	Massive	0	Firm	Moist to wet.	<5%
Depth to Groundwater		7.5 feet.			Restricting Soil Layer Characteristic			Massive Structured Sandy Clay restricts downward effluent movement.			
Depth to Seasonally Saturated Soil		7 feet.			Depth to restrictive Soil Layer			7 feet.			
Site Topography		Slightly undulating.			Depth to Highly Permeable Layer Limiting Design			Not encountered in this soils assessment and design.			
Key Soil Characteristics applied to system design effluent loading		The lab grain size analysis of the sand portion in the Fine Sandy loam soil from 24 to 60 inches determined the sand fraction is fine grained. This is the key soil horizon the system design must consider.									
Weather Condition notes: Slightly overcast with moderate wind - no rain or other conditions that would impact soils assessment were encountered.											
Comments (such as root depth and abundance or other pertinent observations): Roots extend to 5 feet (very fine at that depth) indicating no obvious limiting characteristic in the soil.											

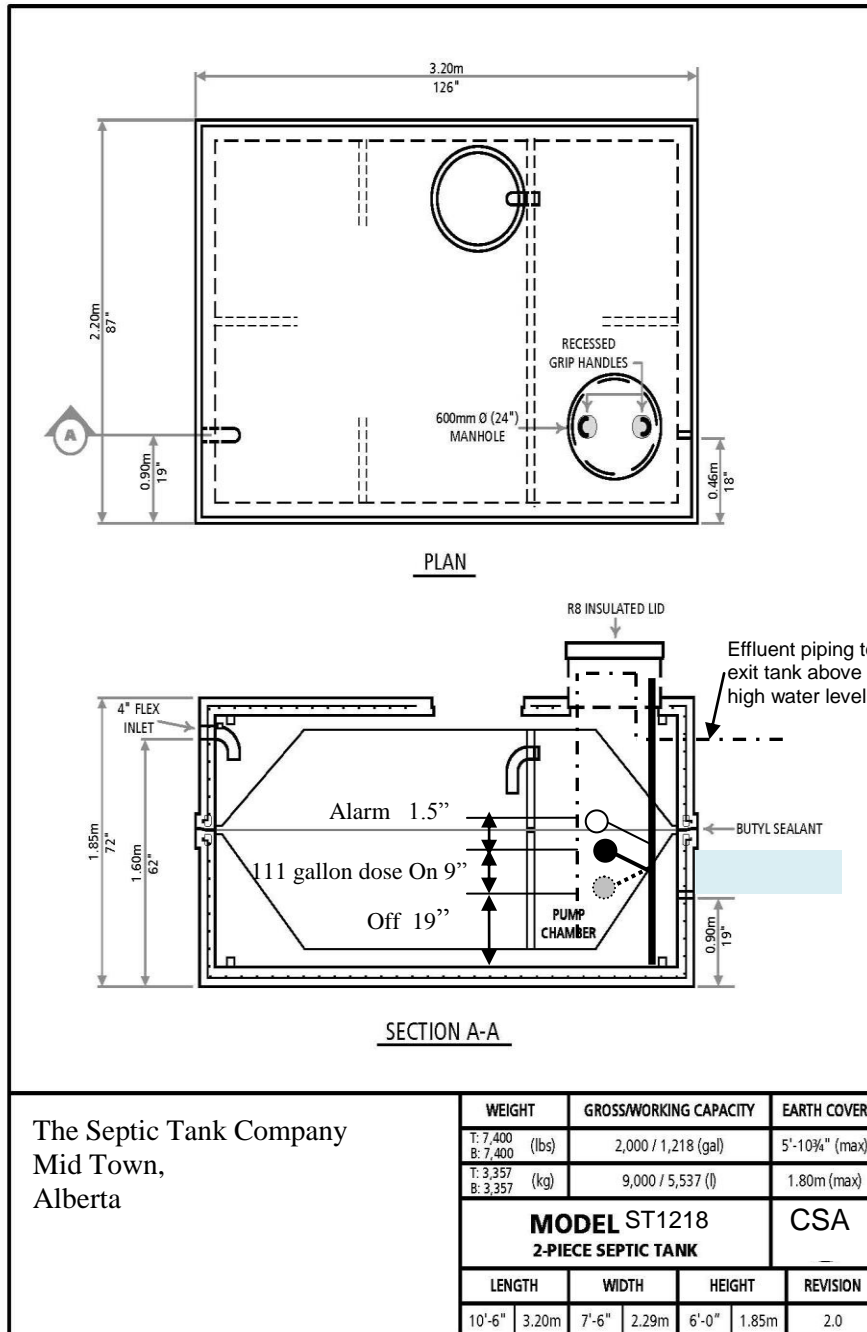
Appendix B - Alberta Private Sewage Treatment System Soil Profile Log Form

Smith Residence Soil Assessment											
Legal Land Location								Test Pit GPS Coordinates			
LSD-1/4	Sec	Twp	Rg	Mer	Lot	Block	Plan	Easting	Northing		
NW	31	36	28	W4M	12	1	123450	64964	34557		
Investigation Date: May 17 th , 2011.			Vegetation notes: Prairie grasses.			Overall site slope 2%			variable across site.		
						Slope position of test pit:			Nominally flat.		
Test hole No.	Soil Subgroup		Parent Material		Drainage		Depth of Lab sample #1		Depth of Lab sample #2		
Basement excavation							35 to 45 in.				
Hori-zon	Depth (cm) (in)	Texture	Lab or HT	Colour	Gleying	Mottling	Structure	Grade	Consistence	Moisture	% Coarse Fragments
A	Surface to 22 in.	Fine Sandy Loam (FSL)	HT	Dark brown.	None.	None.	Granular	2	Friable	Moist	25%
B1	22 to 63 in.	Fine Sandy Loam (FSL)	HT and Lab	Light brown.	None.	None.	Blocky	3	Friable	Moist to dry.	5%
B2	63 to 84 in.	Silt Loam (SIL)	HT	Light brownish grey.	None.	None.	Prismatic	2	Slightly friable.	Moist to dry.	4%
C	84 to 96 in.	Sandy clay (SC)	HT	Light to dark grey.	At 7.5 ft is saturated and gleyed.	At 7 to 7.5 ft many prominent distinct mottles	Massive	0	Firm	Moist to wet.	<2%
Depth to Groundwater		7.5 feet.		Restricting Soil Layer Characteristic			Sandy clay massive structure restricts downward effluent movement.				
Depth to Seasonally Saturated Soil		7 feet.		Depth to restrictive Soil Layer			7 feet.				
Site Topography		Slightly undulating.		Depth to Highly Permeable Layer Limiting Design			Not encountered in this soils assessment and design.				
Key Soil Characteristics applied to system design effluent loading		The lab grain size analysis of the sand portion in the Fine Sandy loam soil from 22 to 63 inches determined the sand fraction is fine grained. This is the key soil horizon the system design must use.									
Weather Condition notes: Slightly overcast with moderate wind - no rain or other conditions that would impact soils assessment were encountered.											
Comments (such as root depth and abundance or other pertinent observations): Fine roots were observed to a depth of 5.5 ft.											

**Insert lab analysis results of soil samples taken
for determining soil texture!**

Appendix C - Manufacturer's and Design Specifications for System Components

Septic Tank Specifications and Float Setting Details.



The Septic Tank Company
Mid Town,
Alberta

WEIGHT		GROSS/WORKING CAPACITY		EARTH COVER	
T: 7,400	(lbs)	2,000 / 1,218 (gal)		5'-10¾" (max)	
T: 3,357	(kg)	9,000 / 5,537 (l)		1.80m (max)	
MODEL ST1218				CSA	
2-PIECE SEPTIC TANK					
LENGTH	WIDTH	HEIGHT	REVISION		
10'-6"	3.20m	7'-6"	2.29m	6'-0"	1.85m
2.0					

Printed 02/01/10

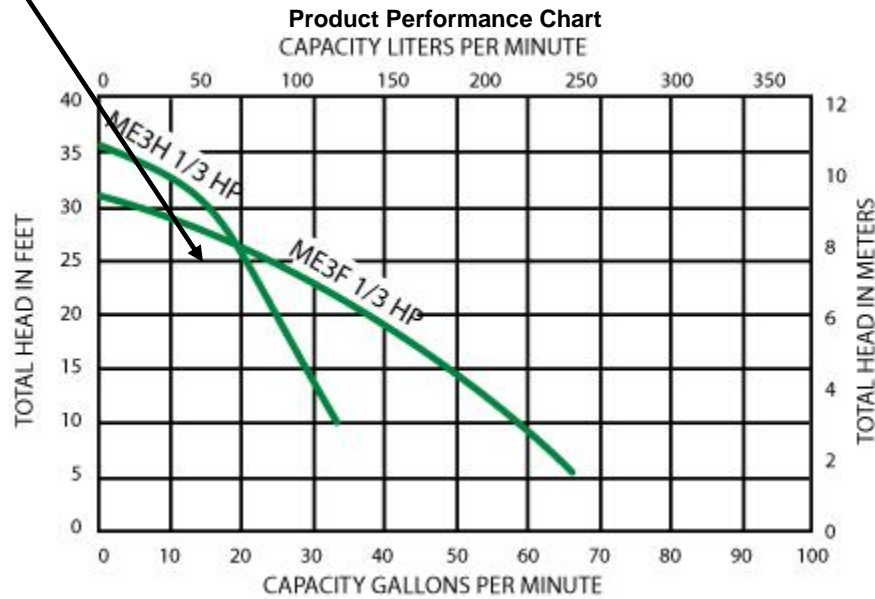
Pump Specifications

Myers Model ME3F Selected

Product Capabilities

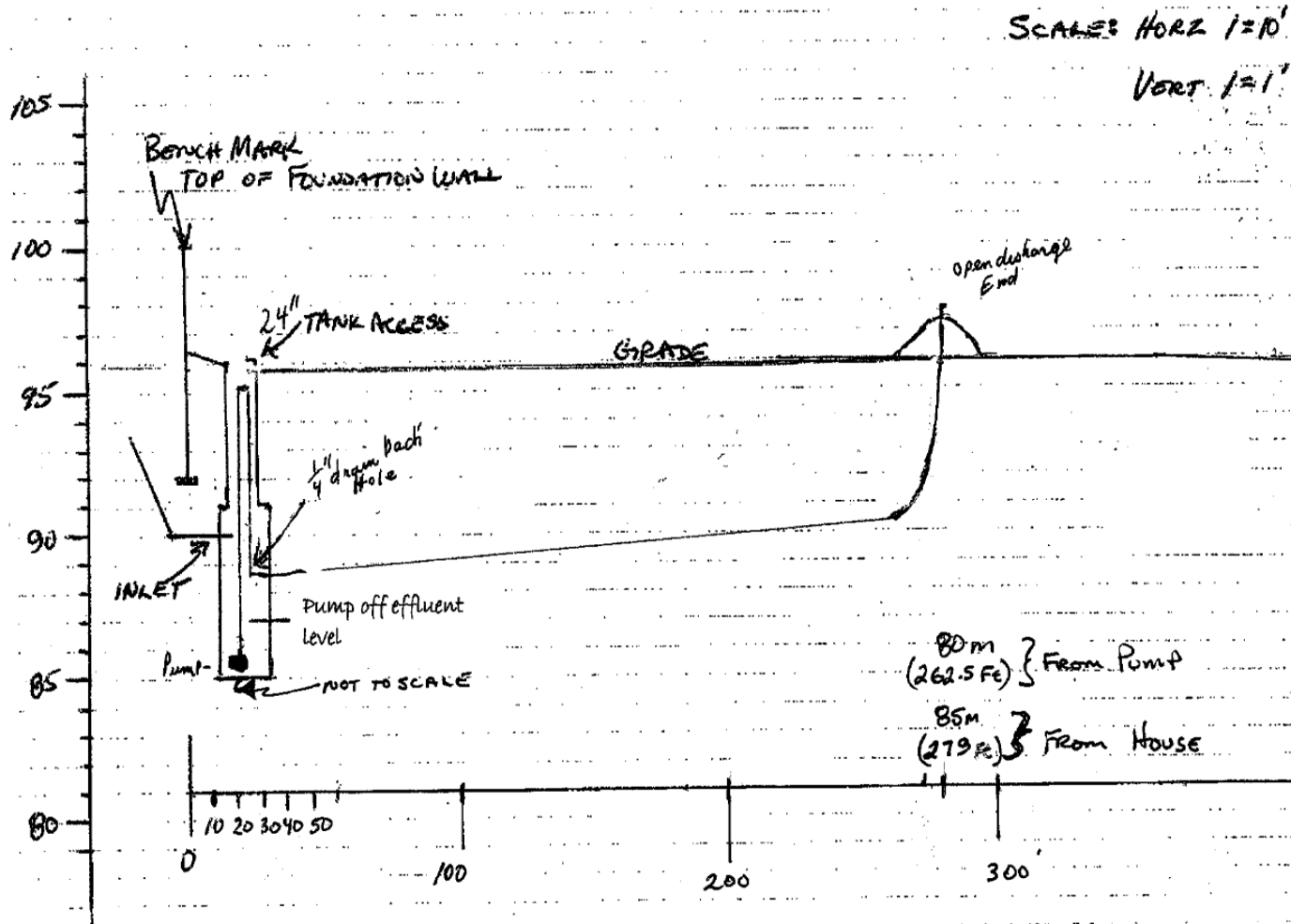
Capacities:	ME3H ME3F	36 GPM 66 GPM	136 LPM 249 LPM
Shut-Off Head:	ME3H ME3F	35 ft. 31 ft.	10.7 m 9.5 m
Max. Spherical Solids:		3/4 in.	19 mm
Liquids Handling:	domestic effluent and drain water		
Intermittent Liquid Temp.:		up to 140°F	up to 60°C
Motor Electrical Data:	1/3 HP, 1550 RPM, shaded pole, oil-filled, 115V, 12A, 1Ø, 60Hz; 230V, 6A, 1Ø, 60Hz		
Housing:	heavy cast iron		
Acceptable pH Range:	6–9		
Specific Gravity:	.9–1.1		
Viscosity:	28–35 SSU		
Discharge, NPT:		1-1/2 in.	38.1 mm
Min. Sump Diameter:	Simplex Duplex	24 in. 36 in.	61 cm 91.4 cm
Power Cord:	20 in., 16/3, SJTW		

Smith residence system demand: 13 imp gal/min. (15 US gal/min) at 25 foot pressure head.



Appendix D- Detailed System Schematics and Drawings

ELEVATIONS & SYSTEM CROSS-SECTION



Pressure Distribution, Orifice, Pipe & Pump Sizing

This design worksheet was developed by Alberta Municipal Affairs and Alberta Onsite Wastewater Management Association.

The completed installation is to comply with Alberta Private Sewage Standard of Practice 2009.

This worksheet is for use in Alberta to: size the orifices in distribution lateral pipes, size effluent delivery piping, and to calculate the required capacity and pressure head capability of the effluent pump.

It can be used for: calculating delivery of effluent to laterals in disposal fields, mounds and sand filters.

This worksheet does NOT consider all of the mandatory requirements of the Standard. It is intended for use by persons having training in the private sewage discipline.

Note: Page numbers refer to the Private Sewage Systems Standard of Practice 2009.

Use only Imperial units of measurement throughout (feet, inches, Imperial gallons, etc...).

Step 1) Select the pressure head to be maintained at the orifices:

Minimum pressure at the orifice:

3/16" or less orifice = 5 ft. Minimum - 2.6.2.5 (1), (p 48)

larger than 3/16" orifice = 2 ft. Minimum - 2.6.2.5 (1) (p 48)

Design pressure at Lateral Orifices ft. 2 ft above pipe end ft. P1

Note: worksheet will not provide an adequate design if laterals are at different elevations. Differing elevations will result in a different pressure head and volume of discharge at the orifices in each lateral. Additional considerations must be made f

Step 2) Select the size of orifice in the laterals:

Minimum size: 2.6.1.5. (1)(e) p. 46 1/8" Orifice Diameter selected not applicable/na in. P2

Note: larger sizes are less likely to plug.

Step. 3) Select the spacing of orifices and determine the number of orifices to be installed in distribution laterals:

Length of Distribution Lateral From system design drawings		Spacing of Orifices selected for design				Resulting number of orifices per lateral	
na	ft.	÷	na	ft.	=	na	P3a

Select a spacing of orifices to attain even distribution over the treatment area:

Maximum spacings are determined for :

* 5 ft. Primary treated effluent: 2.6.1.5 (e) (pp. 46 - 47)

* 3 ft. Secondary treated effluent: 8.1.1.8 & 2.6.2.2 (c) (pp 98 & 47 - 48)

* 3 ft. On sandy textured soils: 8.1.1.8 (p. 98)

na	X	na	=	na	P3b
From P3a		Number of Laterals		Total Number of Orifices All Laterals	

If laterals are of differing lengths, calculate each separately and add the number of orifices together.

Step 4) Determine the minimum pipe size of the distribution laterals:

Enter the system design information into the 3 boxes below. If distribution laterals are of differing lengths, each lateral must be considered separately.

Orifice Diameter		Length of Distribution Lateral		Total Orifices Each Lateral
1.25	in.	na	ft.	1
From P2		From System Design Drawings		From P3a

Use Table A.1.A. (pp 140 - 143) when applying the information entered in this step to determine the minimum size of the distribution lateral pipe.

Size of Distribution Lateral Pipe			
From Table A.1.A.	na	in.	P4

Step 5) Determine the total flow from end of discharge pipe:

Total Number of Orifices in all laterals		Gal/min for each Orifice at Head Pressure selected		Total flow from all lateral orifices			
1	X	10	Imp. gal /min.	=	10	Imp. gal /min.	P5
From P3b		From Table A.1.B. (pp 144 & 145)					

Step 6) Select the type and size of effluent delivery pipe:

Use Tables A.1.C.1 to A.1.C.4 (pp 146 - 149) to aid in decision. A larger pipe will reduce pressure loss.

Type of pipe used for effluent delivery	Pipe size selected		
polyethylene	1 1/4	inch - NPS	P6

Choose a friction loss from Tables A.1.C.1 to A.1.C.4 in between the bolded lines to ensure a flow velocity between 2 to 5 feet per second. The pipe size selected will affect the amount of friction loss the pump must overcome to deliver effluent.

Step 7) Calculate the equivalent length of pipe for pressure loss due to fittings:

Equivalent Length of All Fittings		
Insert total from Worksheet "A" on last page (p.5) of this Pressure Distribution Worksheet	19.8	ft.
	For Pressure Loss	
		P7

Step 8) Calculate the equivalent length of pipe from pump to the farthest end of header of distribution laterals for pressure loss:

Length of Piping (ft)		Equivalent Length of Fittings (ft)		Length of Pipe for Friction Loss (ft)	
290	+	19.8	=	310	P8
Length from pump to end of open discharge piping.		Equivalent fitting length from P7.		Used to determine total pressure head loss due to friction loss in piping.	

Step 9) Calculate the pressure head loss in delivery pipe including fittings:

Total Length of Pipe for Friction Loss		Friction Loss per 100 feet of pipe		Delivery Piping Pressure Head Loss	
310	x	2.11 ft	divide 100 =	6.54	ft. P9
From P8					
Don't forget to divide the length by 100 feet to match the factors in the tables.		Use Tables A.1.C. On pp 146 - 150 using flow volume from P5.			

Step 10) Calculate the total pressure head required at pump:

Delivery piping pressure loss	6.54	ft.	From P9
	+		
Lift distance of effluent from effluent tank level to open discharge pipe	11	ft.	Measure from lowest effluent level in tank to elevation of open discharge point.
	+		
Design pressure at open discharge end	2	ft.	From P1
	+		
Head loss allowed if an inline filter is used in pressure piping	5.48	ft.	Explain Pressure Loss Allowed if Applied A pressure loss of 0.48ft across filter and 5 ft until alarm goes off
	+		
Total minimum pressure head pump must provide at Imp. gal/min required to supply orifices	25.02	ft.	P10

Step 11) Select the size of the drain back orifice if used and determine the flow from the drain back orifice. Then calculate total flow requirement for pump:

Size of Drain Back Orifice		Determine flow using Head Pressure at Drain Back Orifice		Design Flow from End of Discharge Pipe		Total Imp. Gallons per Minute from the pump				
1/4	in.	3.03	Imp. gal /min	+	10	Imp. gal /min	=	13.03	Imp. gal /min	P11
		Use pressure head from P10 to find flow from Extended Table A.1.B.1			From P5					

Step 12) Details of the pump specifications required:

Required Flow Rate (Imp. gal/min)		Required Pressure Head (ft)	
13.03	@	25.02	
From P11		From P10	
		Required Flow Rate (US gal/min)	
Imp. gal (P11) multiplied by 1.2 = U.S. gallons		15.6	
			Select the appropriate pump by reviewing the pump curve of available pumps. Select a pump that exceeds the requirements set out in this step by approximately 10% considering both pressure head and volume.

Step 13) Consider the pumping demands of the system. If they are considered excessive, redesign the pressure distribution system and recalculate the pump demands.

Worksheet "Appendix A" Determine Equivalent Length of Pipe due to fittings in piping system.					
Determine the equivalent length of pipe to allow for friction loss due to fittings in the piping system:					
	Number of Fittings		Friction loss as per Table A.1.C.5 or 6	=	Total
90° Elbows	3	x	3.8	=	11.4
					+
45° Elbows		x		=	
					+
Gate and Ball Valves		x		=	
					+
Tee-on-Branch (TOB)		x		=	
					+
Tee-on-Runs (TOR)		x		=	
					+
Male Iron pipe Adaptors (M/F Threaded Adaptors)	3	x	2.8	=	8.4
					=
Total Equivalent Length of pipe to allow for fittings in piping system			(Enter this total, Box P7)		19.8