Yukon
Health and Social Services

DESIGN SPECIFICATIONS FOR THE SEPTIC TANK AND SOIL ABSORPTION SYSTEM

This document is intended as a supplement to the booklet:

SEPTIC SYSTEMS in the YUKON - A Guide to their Design and Maintenance

A how-to video, ***Septic Systems North of 60°*** is also available at the community public library.

A **SEPTIC SYSTEM** consists of two main components:
SEPTIC TANK and **SOIL ABSORPTION SYSTEM**.

SEPTIC TANKS

The septic tank shall receive all discharges from toilets, and the waste from baths, washbasins, showers, sinks and washing machines. Surface water from roofs, yards and foundation drainage, together with spring run-off, are to be excluded from the septic tank.

Septic tanks shall meet national construction and installation standards as per CAN/CSA-B66-M-90; and shall be designed and constructed to withstand pressures/forces to which it will be subjected.

Tanks with less than 1.2 m (4 ft.) of soil cover shall be insulated with a minimum of 50 mm (2 in.) of sprayed on polyurethane insulation.

Septic Tanks must not be less than 1.5m (5 ft.) from a parcel boundary or from any building; 5m (16 ft.) from the edge of any road access or driveway; 15m (50 ft.) from any source of potable water, or natural boundary or high water level of any water body; and 60 m (200 ft.) from any community well. Septic tanks shall be located both vertically and laterally, so as to be accessable for eduction (the pump out of septage/sludge).

The septic tank capacity requirements (volume of septic tank below the outlet) for normal household requirements are outlined in the following table:

TABLE 1
SEPTIC TANK SIZES FOR SINGLE-FAMILY DWELLINGS

# of Bedrooms	Minimum Liquid Capacity (exclusive of siphon)			Minimum Total Rated Capacity (*prefab. 2 chamber including siphon)	
	Litres	Imp. Gallons		Litres	Imp. Gallons
2 or less	2747	(600)	or	3409	(750)
3	3409	(750)	or	4546	(1000)
4	4091	(900)	or	5682	(1250)
5	4773	(1050)	or	5682	(1250)
6	5455	(1200)	or	6819	(1500)

*** Actual size may differ depending on manufacturer's specifications**

For larger systems (6+ bedrooms), or systems other than residential, the tank is to be sized according to the estimated sewage flow (see Appendix A). The following formula is used:

V (in litres) = 0.75 x Q (in litres) + 5100 Where: V = min. liquid capacity exclusive of siphon
Q = estimated sewage flow in a 24 hour period

SOIL ABSORPTION SYSTEMS

SITE INVESTIGATION

The main features that must be investigated include **SLOPES, OUTCROPS, WATERCOURSES, VEGETATION AND TRAFFIC AREAS**. The maximum **SLOPES** allowable for various types of absorption systems are outlined in the design criteria in the following section.

Rock **OUTCROPS** may indicate limited soil cover over the bedrock. In all cases, a soil absorption system must be at least 1.2 m (4 ft.) above any bedrock, clay or permafrost.

The **SYSTEM** must be situated such that it will not cause contamination of **DRINKING WATER SOURCES** such as wells, and **SURFACE WATERS** such as ponds, streams or lakes.

VEGETATION cover may give a preliminary indication of the type of soil beneath.

A sewage system should be situated where there will never be any possibility of future **VEHICULAR TRAFFIC**, driveways, parking or storage areas. An undisturbed snow cover will help to keep the system from freezing during winter.

Once the site is chosen, a soils investigation (e.g. test pit) and percolation test is to be performed at the future disposal field site (refer to the handout *Guidelines for Soils Investigations and Percolation Tests* available at the Environmental Health Services Office).

TYPES

There are two main types of soil absorption systems that are generally used, each having different characteristics and applications. The absorption bed and the absorption trench (wide or deep) are depicted and described in the booklet, *SEPTIC SYSTEMS in the YUKON: A Guide to their Design and Maintenance.*

The most suitable system will depend on such factors as the percolation rate, depth of soil absorption system, availability of materials, economics and method of operation. Following are the designs specifications for each system plus an example on how to determine the size of the absorption field.

Certain minimum requirements such as earth cover over pipes, insulation, vertical clearances from groundwater and bedrock, and horizontal clearances, may be varied at the discretion of the Environmental Health Officer in addressing local challenges associated with locale, climate, soil conditions, operation, etc.. The overriding consideration in varying a requirement is the protection of human health and the application of sound environmental health principles.

SPECIFICATIONS THAT APPLY TO ALL SOIL ABSORPTION SYSTEMS

Refer to diagrams in the booklet: ***Septic Systems in the Yukon***

1. A soil absorption system shall be located not less than 5 m (16 ft.) from a parcel boundary and any road or driveway; 6 m (20 ft.) from any building; 30 m (100 ft.) from any source of potable water, or natural boundary or high water level of any water body; and 60 m (200 ft.) from any community well.
2. Minimum soil cover over system is 1.2 m (4 ft.) without insulation. With a minimum of 50 mm (2 in.) of approved rigid insulation, soil cover may be reduced to a minimum of 0.6 m (2 ft.).
3. Minimum of 0.6 m (2 ft.) of the accepting soil below the bed bottom (beneath the drainrock).
4. There must be a minimum of 1.2 m (4 ft.) of vertical separation between the bottom of a bed and the seasonally high groundwater table and/or impermeable barrier such as bedrock, fractured or weathered bedrock, clay or permafrost.
5. Drainrock must be clean with no more than 3% fines (0.080 mm screen) residual after screening, and be between 20 to 65 mm (3/4 to 2-1/2 in.) in size. Drainrock is to cover the entire absorption area, and surround the perforation pipes with minimum of 2 inches placed over the pipe. To calculate amount of drainrock required, refer to “DETERMINING THE QUANTITY OF DRAINROCK” on page 9.
6. Perforated pipe must be installed level or to a maximum slope of 0.3% with perforation holes at 4 and 8 o'clock. One additional 13 mm (1/2 in.) hole should be drilled through the bottom of each pipe length, about every 3 m (10 ft.), to allow for complete drainage of the pipes.
7. All piping and fittings must meet appropriate CSA standards (e.g. 4” PVC solid and perforated pipes).
8. Maximum length of perforated pipe runs is 20 m (66 ft.).
9. The sewage disposal system shall be so designed and constructed as to promote even distribution of effluent throughout the soil absorption area.
10. Monitoring standpipes should be installed and are to extend to the bottom of the bed, unattached from the rest of the system. This pipe is to be a minimum of 100 mm (4 in.) in diameter with holes drilled in part of pipe embedded in the drainrock, extend above the ground surface, and be capped.
11. Cleanout Standpipes are to be a minimum of 100 mm (4 in.) in diameter, extend above the ground surface, and be capped. These pipes extend vertically up from the closed-system of lateral pipes used in transporting the sewage effluent throughout the field.
12. All solid piping with less than 1.2 m (4 ft.) of cover must be insulated with minimum 50 mm (2 in.) of rigid polystyrene or polyurethane insulation around the pipe.
13. A silt barrier (geotextile or ridged insulation) must be installed between the top of the drainrock and the native soil backfill in order to keep the drainrock free of fines.
14. Bottom of bed must be level throughout.

***SPECIFICATIONS* cont.**

15. The finished grade over the bed must be mounded to prevent the formation of a depression after settling, and allow for the run off of surface water.

ABSORPTION BEDS ONLY

16. Maximum allowable ground slope in area of bed is 10%.
17. Drainrock depth below pipe must be a minimum 150 mm (6 in.).
18. Distance between runs of perforated pipes is 1.8 m (6 ft.). The edge distance between the outside pipe and the edge of the bed must be one half the pipe spacing or 0.9 m (3 ft.).
19. One monitoring stand pipe should be installed and located near the centre of the bed.
20. Two cleanout standpipes are to be located diagonally, which also will aid in determining the location of the drainfield.
21. Only the bottom area of a bed may be considered in determining the total absorption area.
22. The bottom of a bed must be scarified or raked before placement of drainrock.

WIDE TRENCH ONLY

See Specifications 1 to 15 listed on page 3 in this handout.

23. Maximum allowable ground slope in area of drainfield is 25%.
24. Drainfield must be installed parallel to the slope contour across slope of the land.
25. Drainfield width must be 0.9 to 1.5 m (3 to 5 ft) wide unless otherwise approved by a Health Officer.
26. When two or more drainfield trenches are being used, the horizontal distance between the trench walls must be 3 times the depth of drainrock below the perforated pipe or 3 m (10 ft.), whichever is greater.
27. The depth of drainrock below the perforated pipe must be not less than 0.3 m (1 ft.) or greater than 1.2 m (4 ft.).
28. A monitoring standpipe should be installed near the end of each trench, separate from the rest of the distribution pipes.
29. A cleanout standpipe is to be installed at the end of each run of perforated pipe.
30. The bottom and sides of a wide drainfield trench must be scarified or raked before placement of drainrock.
31. The side wall and bottom area of the trench will be used in determining the absorption area. A reduction factor (see Table 3) to the total area will apply.

SPECIFICATIONS **cont.**

DEEP TRENCH ONLY

See Specifications 1 to 15 listed on page 3 of this handout.

32. Maximum allowable ground slope in area of drainfield is 25%.

33. Trench must be installed parallel to the slope contour.

34. Depth of drainrock below pipe must be a minimum 1.0 m (3.3 ft).

35. A monitoring standpipe should be installed near the end of each lateral trench, unattached from the rest of the system.

36. A cleanout standpipe is to be installed at the end of each run of perforated pipe.

37. The sides of the trench walls must be scarified or raked before placement of drainrock.

39. The absorbing soil strata must be a least 1.2 m (4 ft.) thick.

40. Only the sidewall area of a deep trench may be considered in determining the total absorption area. The bottom of the trench shall also be within acceptable percolation rates.

41. The maximum allowable depth of a deep trench is 4 m (13 ft.).

42. When two or more trenches are being used, the horizontal distance between the trench walls must be 3 times the depth of drainrock below the perforated pipe or 3.7 m (12 ft.), whichever is greater.

Hazard Alert

Trenches Can Be Dangerous

Each year many workers in Canada are severely injured or killed in trenches and excavations because of inadequate cutbacks or improper shoring. Most fatal cave-ins occur on small jobs of short duration. Too often people think that these jobs are not hazardous enough to require safeguards against collapse. The three basic methods of protecting yourself from cave-ins are sloping, shoring and trench boxes.

Cutting Back the Walls

(3/4 x	TRENCH DEPTH	x 2) +	BOTTOM WIDTH	=	TOTAL WIDTH

Further information can be obtained from
Occupational Health and Safety at
(867) 667-5450 or
toll-free 1-800-661-0408, ext. 5450.

SIZING YOUR ABSORPTION BED OR TRENCH

After the average percolation rate (see handout *GUIDELINES for SOILS INVESTIGATION and PERCOLATION TESTS*) and the type of soil absorption system has been determined, the minimum surface area required for your sewage disposal system can be obtained by using Appendix B. This area is based on the number of bedrooms in a standard household, assuming a water usage of
570 litres (L) per bedroom (125 Imperial gallons per bedroom).

If you have used the formula on page 1 to determine the estimated volume of sewage flow in a 24 hour period, divide by 570 L to obtain the bedroom equivalent.

TOTAL AREA REQUIRED = AREA FOR ONE BEDROOM x # OF BEDROOMS
(from Appendix B)

ABSORPTION BED

Example 1
For a 1 bedroom dwelling with a 10 min./ 25 mm percolation (perc.) rate, the minimum total area required for an absorption bed system would be 23 m_ or 248 ft_ (refer to Appendix B).

Then, divide the desired width into the total area required to determine the length of the absorption bed, given,

1 run	of perforated pipe requires a width of	1.8 m	(6 ft.)
2 runs		3.6 m	(12 ft.)
4 runs		7.3 m	(24 ft.)

If 1 run was chosen, then,

23.0 m_ (248 ft_) ÷ 1.8 m (6 ft.) = 12.8 m (42 ft.)
Total Area Width Length

Example 2
Given the same perc. rate with a dwelling having 3 bedrooms, then, times the total area required for 1 bedroom by 3.

23.0 m_ (248 ft.) per bedroom x 3 bedrooms = 69 m_ (744 ft_)

If 4 runs was chosen, then,

69 m_ (744 ft_) ÷ 7.3 m (24 ft.) = 9.5 m (31 ft.)
Total Area Width Length

To determine the length of the perforated pipe for each run, subtract 1.8 m (6 ft.) from the length, as the pipes commence and end 0.9 m (3 ft.) from the edge of the absorption bed.

To determine the length of the solid footer and header pipes, subtract 1.8 m (6 ft.) from the width.

SIZING YOUR ABSORPTION BED OR TRENCH cont.

WIDE TRENCH

Given that the bottom and sidewall area of the drainfield will be used in determining the total absorption area, then a reduction factor (see Table 2) is applied.

TABLE 2

LENGTH REDUCTION FACTORS (RF) FOR WIDE ABSORPTION TRENCHES

Depth of Drainrock below Pipe		Trench Width		
mm	(in.)	0.9 m (3 ft.)	1.2 m (4 ft.)	1.5 m (5 ft.)
300	(12)	.83	.86	.87
450	(18)	.71	.75	.78
600	(24)	.62	.66	.70
750	(30)	.55	.60	.64
900	(36)	.50	.54	.58
1060	(42)	.45	.50	.54
1200	(48)	.41	.46	.50

For trenches having width not shown in the above table, the percent of length reduction may be extrapolated.

Example 1
For a 1 bedroom dwelling with a 10 min./ 25 mm percolation rate, the minimum total area required for a wide trench system would be 15.3 m_ or 165 ft_ (refer to Appendix B).

If 600 mm (24 in.) of drainrock below the pipe and a width of
1.5 m (5 ft.) were chosen, then, a reduction factor (RF) of .70 would be applied.

15.3 m_ (165 ft_) x .70 = 10.7 m_ (115.5 ft_)
Area Required from Appendix B — RF — Adjusted Total Area Required

Then, divide the chosen width (1500 mm or 5 ft.) into the total area required to determine the length of the trench.

10.7 m_ (115.5 ft_) ÷ 1.5 m (5 ft.) = 7.1 m (23 ft.)
Total Area — Width — Length

SIZING YOUR ABSORPTION BED OR TRENCH cont.

WIDE TRENCH cont.

Example 2
Given the same percolation rate (10 min./ 25 mm), depth of drainrock (24 inches) and width of trench (5 ft.) with a dwelling having 4 bedrooms, times the total area required for 1 bedroom by 4.

10.7 m_ (115.5 ft_) per bedroom x 4 bedrooms = 42.8 m_ (462 ft_)

42.8 m_ (462 ft_) ÷ 1.5 m (5 ft.) = 28.5 m (92.4 ft.)
Total Area Width Length

Length of pipe is determined by subtracting 1.8 m (6 ft.) from the length of the trench.

As the length of the pipe exceeds 20 m (66 ft.) then the total area required is to be evenly divided into 2. The length of each trench will then be 14.25 m (46.2 ft). The edge of each trench will have minimum of 3 m (10 ft.) distance between them.

DEEP TRENCH

Since only the side walls of the soil absorption area are taken into consideration the following formula applies:

$$\frac{\text{Total Area Required (from Appendix B)} \times \text{No. of Bedrooms}}{2 \times \text{Depth of Drainrock Below Pipe}} = \text{Length of Trench}$$

Example 1
For a 1 bedroom dwelling with a 10 min./ 25 mm percolation rate, the minimum total absorption area required for a deep trench system would be 15.3 m_ or 165 ft_ (refer to Appendix B).

If 1.2 m (4 ft) of drain rock was placed below the pipe, then,

$$\frac{15.3\ m\_\ (165\ ft\_) \times 1\ \text{bedroom}}{2 \times 4\ \text{ft.}} = 6.3\ m\ (20.6\ ft.)$$

Example 2
Given the same percolation rate, and depth of drainrock with a dwelling having 4 bedrooms, then, times the total area required for 1 bedroom by 4.

$$\frac{15.3\ m\_\ (165\ ft\_) \times 4\ \text{bedrooms}}{2 \times 4\ \text{ft.}} = 25.5\ m\ (82.5\ ft.)$$

Length of pipe is determined by subtracting 1.8 m (6 ft.) from the length of the trench.

As the length of the pipe exceeds 20 m (66 ft.) then the total area required is to be evenly divided into 2. The length of each trench will then be 12.45 m (41.25 ft). The edge of each trench will have minimum of 3.7 m (12 ft.) distance between them.

DETERMINING THE QUANTITY OF DRAINROCK

To determine the amount of drainrock needed for a soil absorption system, the following formula (imperial measure only) may be used:

$$\frac{\text{length (ft.) x width (ft.) x depth (ft.) of area to be filled with drainrock}}{27} = \text{amount in cubic yards}$$

One truck load is approximately 12 cubic yards.

Example 1
The size of the absorption bed is 7.3 m (24 ft.) x 14 m (46 ft.) and depth of drainrock required (including pipe cover) is 0.3 m (1 ft.), then the calculation would be:

$\frac{24 \text{ ft. x } 46 \text{ ft. x } 1 \text{ ft.}}{27}$ = 40.8 cubic yards Approximately 3_ truck loads.

Example 2
The length of each 1.5 m (5 ft.) wide trench is 14 m (46 ft.) and depth of drainrock required (including pipe cover) is 0.76 m (2.5 ft.), then the calculation would be:

$\frac{46 \text{ ft. x } 5 \text{ ft. x } 2.5 \text{ ft.}}{27}$ x 2 trenches = 42.5 cubic yards Approximately 3_ truck loads.

GENERAL

Alternate sewage system designs may be approved by a Health Officer. These systems may require plans which have an engineer's seal, before approval will be considered.

Further information on the design and sizing of your sewage system is available from:

Environmental Health Services
#2 Hospital Road
Whitehorse, Yukon
Y1A 3H8

Phone: (867) 667-8391
Toll-free (within Yukon) 1-800-661-0408, ext. 8391
Fax: (867) 667-8322
E-mail: environmental.health@gov.yk.ca

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APPENDIX A

*ESTIMATED SEWAGE FLOWS PER DAY

Establishment	Litres	Imperial Gallons	
CHURCHES	22	5	per sanctuary seat
CAMPS:			
Campground			
(central comfort station)	130	29	per camper
(flush toilets-no showers)	90	20	per camper
Construction Camps			
(semi-permanent)	90	20	per person
Day Camps	55	12	per person
COTTAGES and SMALL DWELLINGS			
(seasonal occupancy)	160	35	per person
DWELLINGS:			
Boarding houses	160	35	per person
Apartments (multi-family)	200	44	per person
Rooming houses	150	33	per person
Single family	570	125	per bedroom
FACTORIES:			
No showers	110	24	per employee
With showers	150	33	per employee
FOOD SERVICE OPERATIONS:			
Ordinary restaurant	150	33	per seat
24 hour restaurant	225	49	per seat
Tavern	90	20	per seat
Curb service	220	48	per car space
HOTELS (private bath)	200	44	per double room
LAUNDRIES (coin operated)	1700	374	per machine
MOTELS	180	40	per double unit
NURSING and REST HOMES	450	99	per person
OFFICE BUILDINGS	90	20	per employee
PICNIC PARKS (bathhouse)	40	9	per picnicker
RECREATIONAL VEHICLES PARKS (addition info available from Environ. Health Office)	200	44	per R.V. space
SCHOOLS:			
Elementary	45	10	per pupil
Jr./Sr. High	70	15	per pupil
SWIMMING POOLS	31	7	per swimmer

The above estimated sewage flows per day should be used as a guide and represent average figures for various types of establishments. Actual values may vary, depending on site-specific conditions and usage factors.

APPENDIX B

CALCULATING THE SOIL ABSORPTION AREA BASED ON THE PERCOLATION TEST

PERCOLATION RATE [minutes per 25 mm (1 in.)]

0.1 to 5 Absorption bed system may require a minimum of 0.6 m (2 ft.) of sand filter [see Appendix C] with a percolation rate of 5 min./25 mm (1 in.) placed below the drainrock. Soil is too coarse for the trench system.

PERCOLATON RATE	MINIMUM SOIL ABSORPTION AREA REQUIRED			
	Absorption Bed		Wide & Deep Trench	
minutes/25 mm (1 in.)	m_ / bedroom /	ft_	m_ / bedroom /	ft_
5	17.4	188	11.6	125
6	18.8	203	12.5	135
7	20.0	215	13.3	143
8	21.0	227	14.0	151
9	22.1	237	14.7	158
10	23.0	248	15.3	165
11	23.7	255	15.8	170
12	24.5	263	16.3	175
13	25.1	270	16.7	180
14	25.8	278	17.2	185
15	26.4	285	17.6	190
16	27.5	296	18.6	200
17	28.1	302	19.1	206
18	28.5	308	19.7	212
19	29.1	314	20.4	220
20	29.7	320	20.9	225
21	30.3	326	21.5	231
22	30.6	330	22.0	237
23	31.2	336	22.6	243
24	31.8	342	23.2	250
25	32.4	348	23.8	256
26	32.7	353	24.3	262
27	33.3	359	24.9	268
28	33.8	363	25.6	275
29	34.4	369	26.1	281
30	34.8	375	26.7	287
31	35.3	380	27.2	293
32	35.9	386	27.8	299
33	36.3	390	28.4	306
34	36.8	396	29.0	312
35	37.5	401	29.6	318
36	37.7	405	30.1	324
37	38.3	411	30.8	331
38	38.6	416	31.3	337
39	39.2	422	31.9	343
40	39.6	426	32.4	349
41	40.1	431	33.0	355
42	40.5	435	33.6	362
43	40.8	440	34.2	368
44	41.3	444	34.8	374
45	41.7	449	35.3	380
46	42.2	453	35.9	386
47	42.5	458	36.3	391
48	42.8	461	36.9	397
49	43.2	465	37.5	403
50	43.5	468	37.8	407
51	43.8	471	38.2	411
52	44.1	474	38.6	415
53	44.4	477	38.9	419
54	44.6	480	39.4	424
55	44.9	483	39.7	427
56	45.2	486	40.1	431
57	45.5	489	40.3	434
58	45.8	492	40.7	438
59	45.9	494	41.0	441
60	46.1	495	41.4	445
Slower than 60	Soil absorption system may not be used.			

APPENDIX C

ABSORPTION BED / SAND FILTER

In a soil formation with a percolation rate between 0.1 and 5 minutes/25 mm (1 in.), 0.6 m (2 ft.) of filter sand is to be installed below the drainrock. This sand (accepting soil) is to meet the following gradation:

Sieve Size (mm)	Percent Finer by Weight
4.75 (#4 sieve)	100
2.00 (#10 sieve)	75 - 100
0.25 (#60 sieve)	5 - 75
0.08 (#200 sieve)	0 - 15

Different graded material may be used if the percolation rate is limited to 5 min./25 mm (1 in.). This is equivalent to a design rate of 60 lpd/m_ (1 gpd/ft_). The intent of this is that the said layer will ensure that wastewater does not exit the layer too quickly to permit the organic mat to complete treatment. Where a filter is required, a bed system must be used which uses the bottom area only for percolation.