

GREY WATER SYSTEM PLANS.

RECOMMENDED FOR USE
ALONGSIDE CLIVUS COMPOST
TOILET SYSTEMS.

The following greywater disposal system has been approved by the Health Department of WA as an alternative to conventional drains. This system is one that is recommended to the people who purchase a CLIVUS composting toilet and who wish to install an environmentally-friendly greywater disposal system as well.

Guidelines calculating the required length of drain based on soil type, loading infiltration rate and size of house/number of bedrooms are as included here. These calculations are subject to the soil being suitable as per Schedule 8 of the Treatment of Sewage and Disposal of Effluent and Liquid Waste Regulations (1985).

Typical examples of these determinations and calculations are given below to illustrate to clients what is required before approval for this system is granted by the Health Department.

Method of determining absorptive capacity of soil

Dig a hole 300 mm square and 400 mm deep. Remove all loose material such as roots and stones. Carefully scarify the sides and base of the hole to provide a natural surface into which water may percolate. Add 50 mm blue metal aggregate to protect the bottom from scouring. Fill the hole with water and allow it to soak overnight. The next day, fill again and allow it to soak away. Record the time for the water level to drop at least 25 mm. Use the following table to classify your soil type.

Time for drainage (minutes)	Soil type	Loading infiltration rate L/m ² per day
less than 5	sand	30
5 -60	loams or gravels	20
more than 60	impervious clays	* see below

* This soil type is unsuitable for the proposed drain system. Other systems such as evapotranspiration systems may be more appropriate. Contact the Health Department to discuss the system design or site modifications to justify the loading rate which could be carried out.

Note: While the drain area will rely on absorption, it should also be planted out with small shrubs and trees to increase the disposal by transpiration. A list of suitable plants are included in the appendix.

Calculations of drain size

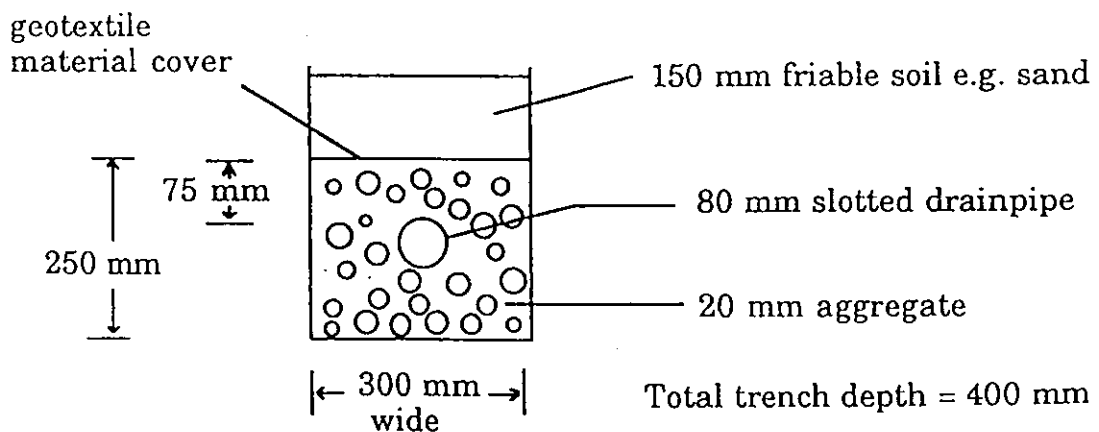
To calculate the total length of drain required for greywater disposal you will need to know how many bedrooms the house will/does contain, the loading infiltration rate (LIR) [as determined from the test and table on the previous page] and the proposed drain width and height.

The following calculations are used as an example of a four bedroom house and a LIR = 20.

- trenches 400 (D) X 300 (W) mm
 - 1500 mm spacing between trenches. A plan of the drain layout is attached.
 - house contains four bedrooms @ 180 L each = 720 L (greywater volume only).
 ___loading infiltration rate = 20 L/m².
- $$\frac{720}{20} = 36\text{m}$$
- surface area of drain required = 36m
 - taking surface of 250 x 300 drain (sides and base) = 0.65 m/lineal length
- $$\frac{36}{0.65} = 55\text{m}$$
- design proposed has a total length of drain = 55 m.
 - drain to contain 250 mm of 20 mm aggregate, capped with 150 mm sand or friable soil with a geotextile membrane between the two. Commercial 80 or 100 mm subsoil pipe will be placed in the upper portion of the aggregate along the complete length of each drain.

The size of the drain must be calculated on its effective depth i.e. to the invert of the inlet pipe. For simplicity, the diagrams that follow assume that the inlet pipe flows into the top of the drain, not below the surface. Drain cross-section is shown below.

Figure 1 Typical construction and cross-section of drain

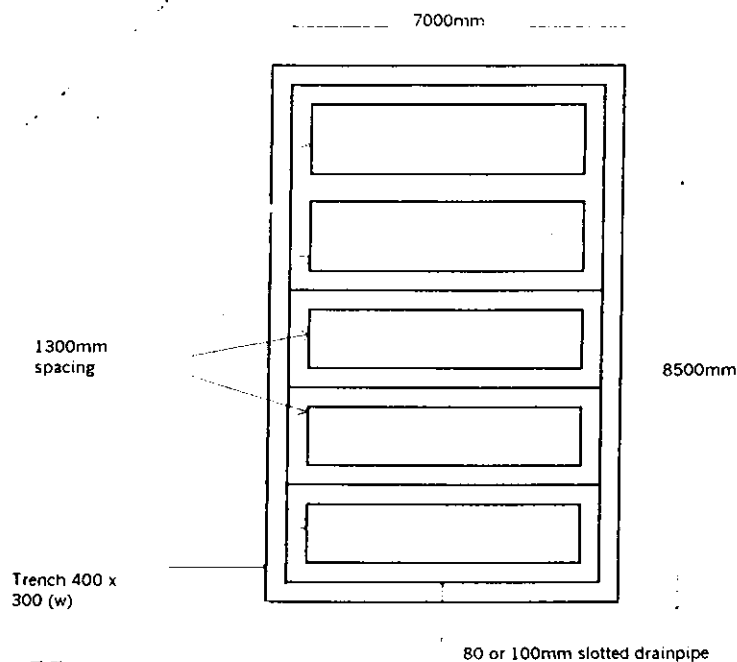


Drain infiltration area

The size of the disposal area and the length of drains mainly depends on soil type in the example discussed above, if sand were present in the disposal area the loading infiltration rate could be 30 L/m² per day.

In the previous calculations for a house containing the same number of bedrooms, the length of drain would be 37 m, instead of 55 m for the heavier soil type. Furthermore, if the drains were placed closer together the actual disposal area would be reduced. It is possible to place drains with spacings from one to two metres. However, Health Department regulations specify drains to be no less than one metre apart. The closer the drains the less total surface area required.

Figure 2 Typical layout for non-alternating greywater disposal area.

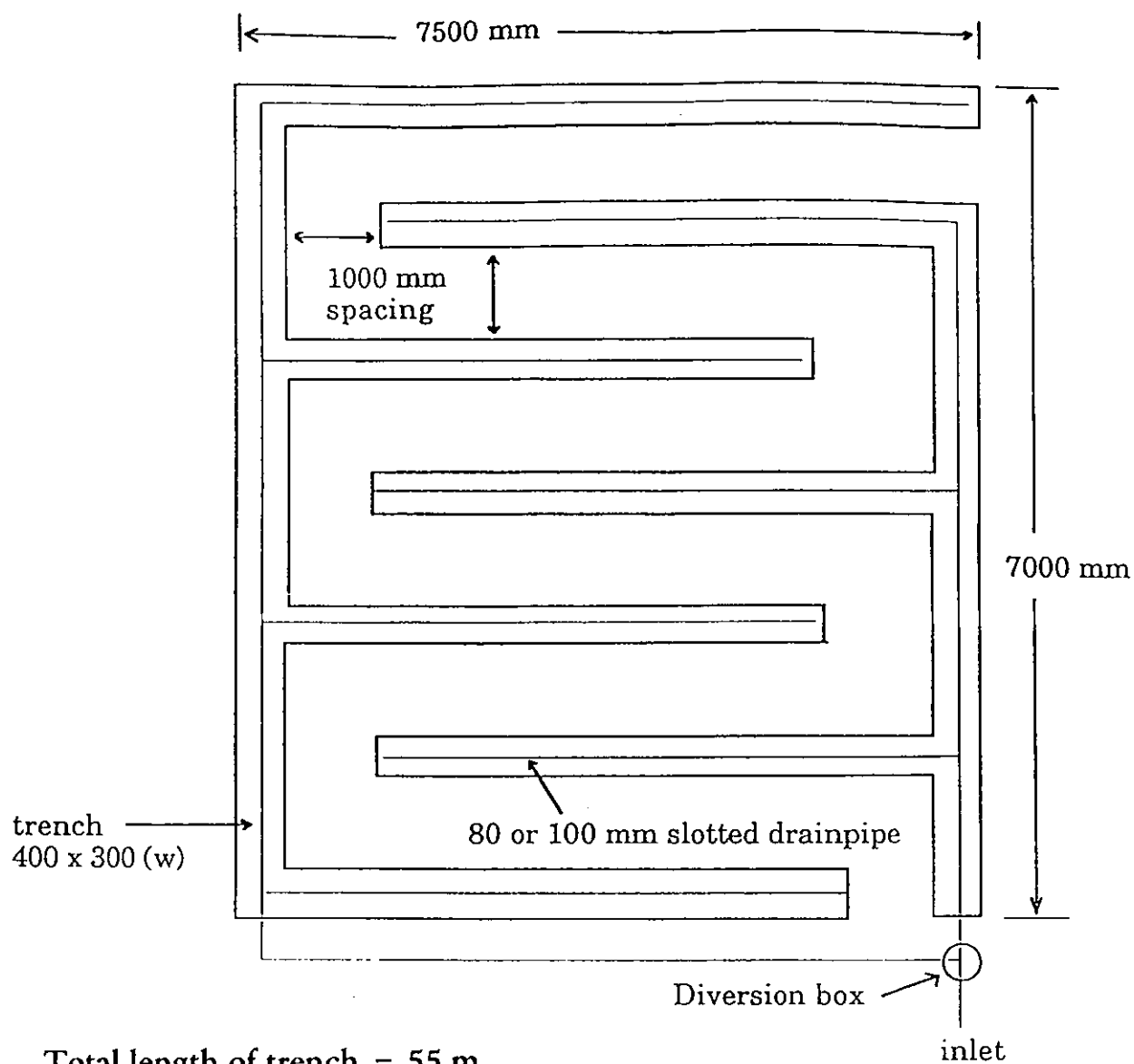


Total length of trench = 55 m

The above diagram is a typical disposal area layout showing the size of drains and the arrangement of these drains to achieve the recommended total drain length for disposal.

The piped trenches should be laid level to ensure an even distribution of effluent. The installation of the piped trenches should also satisfy the same groundwater separation requirements as specified for other conventional drain systems. i.e. minimum 1.2 m separation between the base of the trenches and the highest known groundwater level. If the drains are installed non-alternating, such as in Figure 2, then the Loading Infiltration Rate (LIR) permitted is only half that allowed for alternating drains. For example, for sandy soils 30 L/m² for non-alternating. Consequently, twice the length of the drain will be required if drains are non-alternating. The length of drain in the example described above on page 2 would have to be longer.

An example of an alternating system is shown in the next diagram. The original plan of the infiltration area is modified so that valves/taps can be opened or closed to regulate the direction of the greywater flow into one trench system or the other. The normal practice is to change the valve/tap in the direction box so that one trench system is used and the other is rested.



Total length of trench = 55 m

Figure 3 Typical layout for alternating greywater disposal trenches.

In the alternating drain system there is minimum spacing between the drains (one metre) so that the overall disposal area is similar to the non-alternating system. Furthermore, the total length of the drains is similar in both cases. The alternating drain system minimizes the area needed for disposal (from about 60 to 50 m²).

Settling tank

All greywater should initially pass into a settling tank before pumped or gravity fed into the disposal area. This tank is essentially a septic or sullage tank. A baffle may be incorporated into the tank but is not essential. However, if a baffle is placed inside, the opening will need to be located so that sludge build-up does not block off the opening. Typical commercially-produced baffles have the opening at the bottom which are unsuitable in this system. One type of tank which is suitable and available is illustrated on the next page.

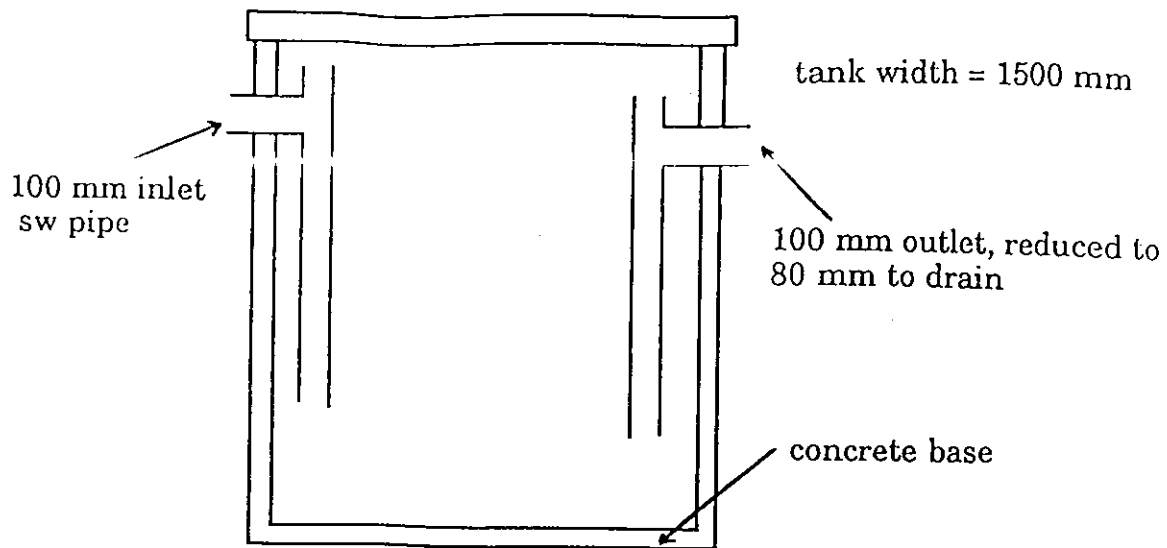


Figure 4 Typical settling tank

Appendix 1 Plants suitable for greywater infiltration area

These plants, mainly natives, can tolerate wet soils. It should be noted, under current health regulations, that no food crops or fruit and nut trees can be planted in this area. Most of the species listed below have other useful functions, such as screen and windbreak, firewood and timber sources, bee attracting (and honey production), aesthetic looking and bird attracting.

(a) Climbers

Native wisteria *Hardenbergia comptoniana*
 Black coral pea *Kennedia nigricans* *Hibbertia scandens*

(b) Grasses

Common reed, Feather grass *Phragmites australis*
 Vetiver grass *Vetiveria zizanioides*

(c) Reeds and rushes

Jointed twig rush *Baumea articulata* *Pale rush Juncus pallidus*
 Lake club rush *Schoenoplectus validis*

(d) Herbs and shrubs

Canna lily Canna flaccida *Sydney wattle Acacia lonifolia*
Bog sage Salvia uliginosa *Spearwood Kunzea ericifolia*
Coastal rosemary Westringia fruitcosa *Astartea Astartea fascicularis*
Tantoon tea tree Leptospermum flavescens *Comfrey Symphytum officinale*
Lemon scented bottlebrush Callistemon citrinus
Swamp paperbark Melaleuca ericifolia *Grey honey myrtle Melaleuca incana*
Western tea myrtle, Showy honey myrtle *Melaleuca nesophila*

(e) Small to medium sized Trees

Swamp sheoak Casuarina obesa *Swamp oak Casuarina glauca*
River sheoak Casuarina cunninghamiana *Mountain oak*
Snowstorm Melaleuca linariifolia *Blackwood oak*
Bracelet honey myrtle Melaleuca armillaris
Broad-leaved paperbark Melaleuca quinquenervia

CONDITIONS OF APPROVAL
Candle light Farm Permaculture Greywater Disposal System

The system approved consists of the following components:

- 1) A settling/sedimentation tank.
- 2) A piped trench sub-surface disposal system that complies with Australian Standard AS 1547-1994 *Disposal Systems for Effluent from Domestic Premises*.

In addition, the following conditions of approval will apply:

- The settling/sedimentation tank must comply with the requirements of the *Treatment of Sewage and Disposal of Effluent and Liquid Waste Regulations*.
- A minimum of 1 m clearance must be provided between drains.
- The length of drain required should be calculated in accordance with the *Treatment of Sewage and Disposal of Effluent and Liquid Waste Regulations*.
- Drains may be either alternating or non-alternating, however, the Loading Infiltration Rate (LIR) permitted for non-alternating drains will be half that allowed for alternating drains.
- A minimum separation of 1.2 m must be provided between the base of the trench and the highest known groundwater level.