septic tanks & drainage fields

what are they?

Septic tanks are settling systems for use with flush toilets (and grey water) to reduce suspended solids prior to disposal and further treatment of the liquid effluent in a drainage field (aka leachfield, percolation area or infiltration area) - an area of ground with perforated pipework to distribute septic tank liquid effluent for treatment in the soil under the pipes. A septic tank and soak pit is insufficient, since the pit introduces effluent at a single point, deep in the ground where the soil can't act as a physical and biological filter.
The septic tank will need to be emptied of solid waste from time to time (typically annually, by a licenced disposal company).

History: evidence for the flush toilets has been found in India (c.3300-1300BCE), Crete (c.2000BCE) and China (c.200BCE to c.20AD). Frenchman Jean-Louis Mouras is credited with building the first septic tank in the 1880s - a concrete unit, termed the 'Mouras Automatic Scavanger'. Donald Cameron brought the technology to England, improved the design and first used the term 'septic tank' for his system in 1895. The system was used in Exeter a couple of years later and in an eminently practical move, the methane from the system was used for heating and lighting at the treatment works.
UK standards were introduced in the 1940s and still rely on the same basic principles. Outside of sewered areas, a septic tank and drainage field is probably the most common sewage treatment system in the UK.

what are the benefits?

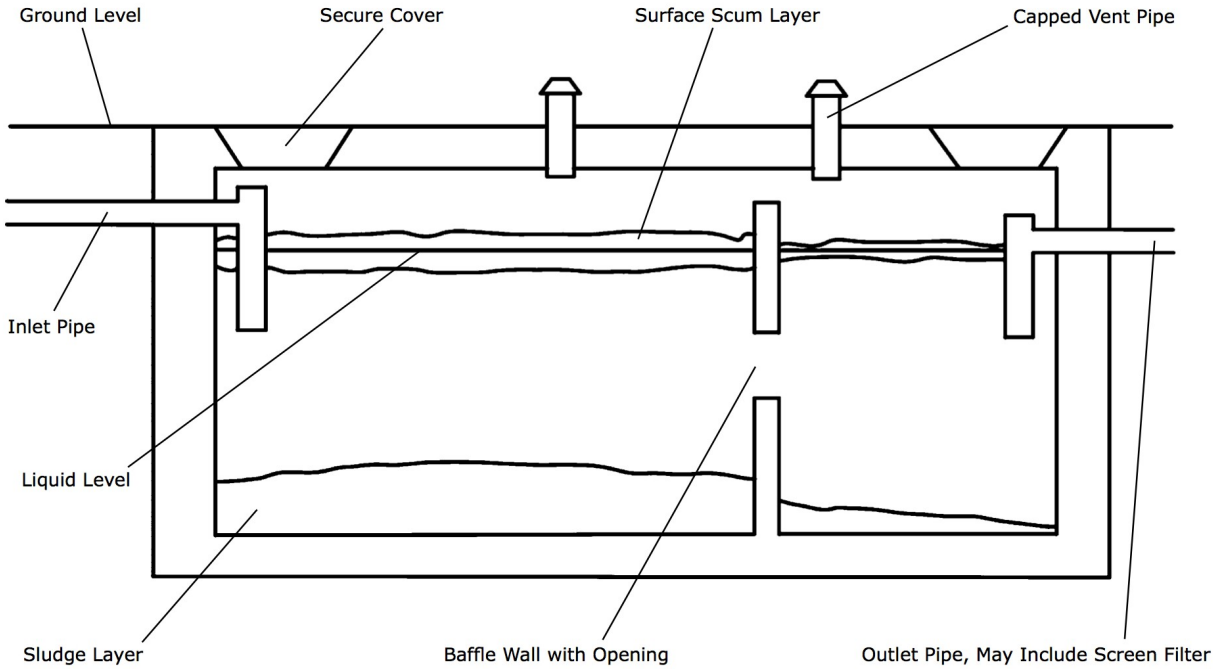
Pros: relatively cheap and don't need electricity where gradient permits; with suitable soil conditions / depths they can provide effective treatment from an environmental perspective, providing the equivalent of secondary treatment (e.g. a mechanical treatment system or reed bed).

Cons: not all soils are suitable. If your soil is too shallow above either bedrock or groundwater, the filtration distance in the drainage field is insufficient, and pollution may occur; proximity to wells, aquifers or water courses can render this form of treatment inadequate; while septic tanks work well at settling solids, you may simply decide that you're not happy with that level of treatment, and decide to install secondary treatment (e.g. a reed bed) or tertiary treatment (e.g. sand filtration or an extended reed bed) rather than a drainage field alone. Note that the septic tank / drainage field are still needed for settlement and disposal.

If you're thinking of repairing or upgrading your system, consider the following pros and cons too:

Pros: less costly than replacement; repair almost always has a lower embodied energy than replacement - particularly for energy-intensive materials like concrete; usually reduces or avoids the disruption of heavy machinery in the garden.

Cons: can be difficult, unpleasant and potentially hazardous to repair septic tanks; doesn't necessarily guarantee full compliance with the relevant codes; tank may be beyond repair after spending time and money trying.



Cross-section of a typical septic tank.

Constructing a drainage field.

what can I do?

Legal considerations: any new sewage treatment system requires planning permission. It's important to follow the standard guidelines (see resources). There are minimum distances from features such as watercourses, bedrock etc.

DIY septic tank: there are specialist contractors, or you can have a go yourself. A septic tank may be built *in situ* using concrete blocks as long as it is well plastered and a plasticizer is used to waterproof the render and prevent leakage. Ensure that no leakage occurs around inlet or outlet piping. The most notable features in any septic tank are:

- T-pieces at the inlet and outlet pipes to prevent disturbance of the surface scum
- Central baffle wall to create two separate settling chambers
- Secure access to the tank
- Vent piping.

The tank must be waterproof and have a safe cover. The size of the tank and drainage field should typically be based on bedroom numbers in the house it serves. Official guidance recommends a minimum tank size of 2700 litres for 4 persons (2 bedroom house) and drainage field calculations based on the percolation value in your soil. The percolation test information is provided in PPG4 if you want to carry this out yourself.

Ensure that there is a steady fall from the house to the tank and then from the tank to the drainage field. If your site topography is unsuitable for using gravity to convey the sewage to the tank, then you may wish to use a dry toilet to avoid using electricity to pump effluent up to your drainage field or tank.

Improving on the standard system: if you want to upgrade your septic tank and drainage field system there are a number of options available to you. To improve the effluent quality you may wish to use a reed bed system prior to the drainage field. To recoup biomass and nutrients you may wish to use a compost toilet and then have a separate drainage field or reed bed for grey water from the sinks and washing machines. To follow the example of Donald Cameron's system in Exeter you may wish to recoup methane as a fuel for cooking or heating. To do this you'll need a modified tank design to allow for insulation and reduced liquid inputs.

One way to recoup biomass and nutrients is to plant a biomass crop over the drainage field. Willow and comfrey are the two plants most recommended. Willows have a high growth rate and an impressive uptake of both liquid and nutrients from sewage effluent. They have been used in Denmark since the mid-1990s to dispose of 100% of the effluent pumped into them. Willows also work well as a filter plant for use within a modified drainage field layout. Modifications are needed to the piping network to prevent root ingress into the pipes causing them to clog up. Comfrey is well known as a nutrient accumulator, drawing up potassium and other nutrients from deep within the soil and making them available in leaf litter or harvested leaves that can be added to a compost heap. It's an excellent plant for use over existing percolation areas as their roots are much less invasive than willows, and yet they can draw up the nutrients that would otherwise be lost to the ground, and ultimately migrate into the groundwater and surrounding environment.

resources

- see lowimpact.org/septic-tanks for more info, courses, links & books, including:
- F Harty, *Septic Tank Options & Alternatives*
- Gerry Hartigan, *Country Plumbing*
- L Kahn, the *Septic Systems Owners' Manual*
- http://ecompendium.sswm.info/sanitation-technologies/septic-tank – online resources
- nesc.wvu.edu/pdf/ww/septic/pl_fall04.pdf – maintaining your system
- gov.uk/permits-you-need-for-septic-tanks – government guidelines