Sewage Treatment

A GUIDE TO CESSPITS, SEPTIC TANKS AND SEWAGE TREATMENT PLANTS

This leaflet about cesspits, septic tanks and sewage treatment plants has been prepared by Breckland Council and is aimed at providing information and guidance on foul water drainage systems, the problems that may occur and solutions available for the improvement of these systems.

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Breckland COUNCIL

contents

2	introduction
2	A cesspool
3	A septic tank
4	Problems with septic tanks
4	A few things to remember
5	Methods of improving foul drainage systems
5	Sewage treatment plants
6	Improving land drain layouts
6	Gravity fed system
7	Pump fed system
7	Appendix A: Percolation testing

introduction

There are two types of sewage or foul water drainage systems within the Breckland Council area:

Firstly, is the mains sewerage system which predominates in the towns and larger villages. Effluent from a large number of houses drains through a network of pipes to a sewage treatment works operated by Anglian Water Services Limited. (In a new development where a public main foul sewer is available within 30 metres (100 feet), there is a mandatory requirement for new properties to be connected to such a sewer.)

Secondly, cesspits, septic tanks and small sewage treatment plants which serve individual or small groups of properties in villages or rural settings. In some cases, a small sewage treatment plant, described below, may have been adopted for maintenance by Anglian Water, in which cases, the household will be charged normal sewerage rates. This second type of drainage system takes the form of drainage pipes leading to a collection tank, which may in turn lead to either bacteriological treatment of the liquid effluent, as in the case of a sewage treatment plant, or effluent dispersal into the subsoil around the collection tank as with a septic tank.

a cesspool

a cesspool A cesspool or cesspit is a sealed underground tank with an inlet pipe into which all the foul effluent from a building drain. The cesspool stores sewage and other wastewater until the time of disposal. Cesspools must be watertight to prevent the leakage of foul water or the ingress of groundwater. Older cesspools will be constructed from brick, while modern ones are made of fibreglass. Cesspools must be emptied frequently, so to alleviate such problems as overflowing. The frequency of this is dependent on the tank size and obviously how much effluent is draining into it Remember:

- Check the level in your cesspool regularly
- Have your cesspool emptied at frequent intervals
- Check for any leakage or ingress of groundwater

a septic tank

A septic tank is a mini sewage system in which effluent is treated naturally. The effectiveness of the septic tank system to drain foul effluent is very dependant on the ability of the subsoil surrounding it to absorb liquid effluent. The tank will either be constructed from concrete/brick (older types) which is then rendered internally and externally to make it watertight in order to contain the effluent or is a large plastic/ fiberglass watertight bottle tank which has been sunk into the ground and surrounded by concrete.

Both the older brick and the newer fiberglass tanks work in the same way.

The primary purpose of the tank is to separate solids from the liquids, as wastewater flows through it, and to help to break down contaminants. There may be three layers in the tank:

- a scum layer of floating solids
- the liquid sewage from which solids are settled out
- a bottom sludge layer which is 'digested' to some extent by naturally occurring bacteria.

Foul water (sink, washing machine, bath, toilet) enters the tank via an inlet pipe. The tank retains sewage from a property for a sufficient amount of time to allow the solids from the sewage to breakdown, forming a crust on the top of the effluent and a sludge at the base of the tank. The remaining untreated liquid in the tank then drains from the tank by means of an outlet pipe to a soakaway or a series of land drains. Such a system of land drains will splay out across the ground in a 'herring bone' pattern in the top section subsoil which is well drained and will allow efficient dispersal of effluent.

The sludge in the tank needs to be removed only when necessary – usually once a year and the emptying of the tank should be carried out by a licensed contractor.

It is important not to let roof or surface water enter the tank, as this will affect the process within the tank, solid matter would not be effectively digested, and this could cause the drains to block. Septic tanks, like cesspools, should be watertight and adequately ventilated. The soakaway drains are usually located within 1metre of the ground surface. All new soakaways or improvements to existing soakaways require the prior consent of the Environment Agency.

problems with septic tanks

The common indicators of a septic tank not working properly are:

- the downstairs toilet failing to drain properly, i.e. the water in the bowl rises rather than falls.
- dirty water or effluent overflows from outside foul water gullies or manholes.
- effluent overflows from the top of the septic tank itself. This problem should not be confused with a correctly working septic tank which will have effluent at a level just below the top of the tank manhole

Drainage problems with septic tanks generally are a result of the surrounding soil's inability to properly drain away/absorb the liquid effluent.

The main reason for this is due to land drains having been laid incorrectly, i.e. where they are either draining into the subsoil containing a high level of impervious clay (very typical in the Norfolk area) or within ground where the water table is very high - subsoil water may even drain back down the land drains filling up the septic tank; both of these problems will not allow the effluent to disperse. It is very rare to find that the septic tank itself is not working correctly.

In certain cases, effluent from septic tanks may cause smell or pollution problems in ditches or watercourses and, in such situations, legal action may be taken against the owners of these tanks by either this authority or the Environment Agency.

a few things to remember:

Do:

- Put all wastewaters from your home into the system - any of these can contain environmental pollutants
- Use bleaches and disinfectants sparingly, these could kill the useful bacteria that help to digest the waste in your septic tank. Some brands of domestic cleaner is ‘septic tank friendly’ and are preferred.
- Try to avoid excessive discharges from washing machines, use the ‘halfload’ setting. If possible, use showers instead of baths.
- Inspect the system at least once a month.
- Empty the tank whenever necessary.
- Ensure that air vents are not blocked, and all covers are secured and are easily accessible.
- Act immediately if you find a blockage or any sign of pollution

Do Not:

- Use your toilet or kitchen sink as a bin.
- Put disposable nappies, sanitary items, plastic or other large solids, which may cause blockages.
- Empty chemical toilets into the drains of the septic tank.
- Pour paints, solvents, oils, fats or heavy greases into the drains of the septic tank, these should be kept in their original containers and disposed of properly.
- Allow roof or surface water into the septic tank.

methods of improving foul drainage systems

Options open to the owner of an inoperative septic tank to put their drainage back in working order may take the form of either simple improvement of the land drain system or entirely replacing the system with a package sewage treatment plant below.

sewage treatment plants

Sewage treatment plants are ideal for use in very wet land areas where the drainage of surface water is poor. Such a plant allows treated effluent to be discharged to a ditch system, which obviously takes this water away from the property, removing or reducing problems of ineffective septic tanks or flooding of land/gardens.

There are a number of package sewage treatment plants on the market which, subject to the correct siting requirements being provided, can be purchased and installed relatively easily either as a total replacement of the septic tank or as a filtration unit after the outlet of the septic tank, using the tank as a large primary settlement tank. This treatment plant will then treat the effluent to an acceptable quality which can then be discharged to a ditch or watercourse subject to Environment Agency approval. This approval will be in respect of the quality of the effluent only; this will not constitute an express permission to use a specific ditch for that purpose. Permission of the landowner on whose land the ditch lies must therefore be received before any treated effluent is discharged into it.

A sewage treatment plant firstly has a primary settlement tank which separates off the solid part of the waste (this tank may require emptying every six to twelve months); the liquid part of the effluent is then circulated over a bacterial filter medium which filters out a large proportion of the waste material, until it is of an

acceptable quality to be discharged to a ditch.
There are financial implications for such a system including the initial outlay of several thousands of pounds, the need for a continual electrical power supply, yearly maintenance to ensure correct operation and obviously an available ditch or watercourse to discharge to. There may also be additional costs for Building Regulation/Planning approvals dependent upon the type of installation.

improving land drain layouts

In general, the best section of soil for foul effluent drainage is the zone from ground level down to around 450mm (18 inches) deep. Below this level, soils, particularly those with a high clay content, tend to become waterlogged during the winter months or at times of excessive rainfall. The specific usable depth for drainage is obviously dependent on the results from the porosity tests as described in Appendix A.
* Before any land drainage works are begun, it is advised that porosity tests are carried out so as to avoid using land containing a soil type which may be totally unsuitable for efficient drainage.
If the porosity test suggests that the soil has sufficient drainage capabilities, then a new set of land drains, constructed of porous or perforated pipe, can be laid within this 450mm zone either by relaying a new gravity fed system direct from the outlet of the septic tank or by pumping the effluent to a new system of drains in an area of your land which is well drained as follows:

gravity fed system

The effectiveness of such a system will be dependent on the depth of the septic tank outlet and the drainage capabilities of the soil in the immediate surroundings of the tank. Obviously, if the tank outlet is below the acceptable drainage depth of 450mm, the laying of land drains with even the smallest fall on the pipe would be unlikely to be effective.
With tank outlets that fall either above or within the top part of the drainage zone then the land drains should laid as follows:
1. Excavate a series of trenches 600mm wide and 600mm deep in either a herring bone or zigzag pattern with each trench being at least 1 metre apart.
2. 100mm rigid plastic land drain pipe drilled with 5mm diameter holes over its surface should then be laid on a bed of either 50mm reject stone or 5mm whole stone and connected to the outlet of the septic tank.
3. The base of the trench should be covered with a minimum 100mm of stone and the pipe laid on top of this. The amount of stone used in the trench will vary in order that the pipe is laid to a maximum fall of 1 in 200 within the zone of 150mm to 450mm below ground level. The pipe should be laid no higher than 150mm below ground level so that it is not adversely affected by ground frost.
4. The trench should then be backfilled with stone to a level of 100mm below ground level and the stone compacted down.
5. The stone should then be covered by a sheet of plastic to prevent silt from being washed down into it, before the topsoil / turf is reinstated.

* This method assumes that the garden will be finished by turfing, as digging would not be possible with land drains laid very close to the surface.

pump fed system

In this system, a set of land drains is constructed as described above for the gravity fed system, but they can be positioned anywhere in the garden where the soil has a sufficient capability to drain the produced effluent as determined by the porosity tests. This method also gets around the problem where the septic tank

was installed incorrectly with its outlet too low in the ground.
Two brick built manholes, which are sealed internally with concrete render, should be constructed, each approximately to a depth of 450mm (dependent upon the depth of the septic tank outlet pipe) below ground level. The first should be constructed and joined to the outlet pipe of the septic tank to collect the discharging effluent and the second should be positioned at the start of the new set of land drains so that effluent contained within it will slowly discharge into the drainage pipes.
A submersible pump operated by a float switch can then be installed within the first manhole to pump the effluent to the second manhole via a 50mm diameter plastic pipe (generally of alkathene, UPVC or polyethylene). This pipe should be located at least 300mm below ground level in order to avoid freezing in winter and damage from digging in the soil above.

APPENDIX A
percolation testing

Before any work is carried out to construct or improve a septic tank system, particularly with the land drain system, it is necessary to carry out a series of percolation tests, in order that the efficiency or capacity of a piece of land to absorb liquid effluent can be determined.
The following percolation test method is taken from BS 6297: 1983. Care should be taken to avoid abnormal weather conditions (i.e. frost, heavy rainfall or drought) when carrying out the tests, as these may severely affect the accuracy of the results.
1. Select at least three locations in the piece of land or garden where it is intended that a new set of land drains are to be positioned.
2. Dig a hole at each site 300mm (one foot) square and to a depth of 250mm below the proposed invert level of the land drain.
3. Fill all the holes to the top with water and leave overnight to drain out.
4. The next morning refill each hole with 250mm of water. Using the table opposite, time and record in minutes how long it takes for the water to drain away completely. The time for the water to soak away in minutes should then be divided by the number 10 and the average of the three holes will give the time required for the water to drop by 25mm or 1 inch.

In a large proportion of areas within Norfolk, the soil conditions are very poor for land drainage and, therefore, the results obtained for the above porosity tests may well exceed the quoted drainage times. In these cases, specific guidance should be sought from the Environmental Health Department at Breckland Council.

porosity test results

	Hole 1	Hole 2	Hole 3
1)Time for water to drop 250mm			
2)Time for water to drop 25mm (value in (1) divided by 10)			
3)Average time for water drop across the three holes (values for (2) added together and divided by 3)			

The average value given by (3) in the results can then be put into the following table to give the total minimum area required for a new or improved irrigation pipe system:

irrigation drainage pipe formulation table

Time for water to fall 25mm (minutes)	Total linear length of drainage pipe in a 600mm wide trench		
	3-4 persons	5-6 persons	7-10 persons
0 - 2	20	30	50
2 - 5	30	40	70
5 - 10	40	60	85
10 - 15	50	75	100