

BRITISH STANDARD

Code of practice for the design and installation of drainage fields for use in wastewater treatment

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C1	August 2008	See key in Figure 2

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This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 36, an inside back cover and a back cover.

Foreword

Publishing information

This British Standard was published by BSI and came into effect on 31 December 2007. It was prepared by Technical Committee B/505, *Wastewater engineering*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

This British Standard supersedes BS 6297:2007, which is withdrawn.

Relationship with other publications

This code of practice encompasses some of the subject matter previously covered by BS 6297:1983 in relation to drainage fields. It is complementary to BS EN 12566, which covers small treatment systems up to 50 population equivalents and BS EN 12255, which covers the design of larger treatment systems.

Much of the text is based on CEN/TR 12566-2:2005¹⁾ [1], so many of its provisions now have the force of this full national British Standard. BS 6297 would be further amended if the current prCEN/TR 12566-5, dealing with pre-treated effluent filtration systems, is published by CEN.

Information about this document

This is a full revision of the standard, and introduces the following principal changes.

It provides advice on the treatment and dispersal of partially treated wastewater effluent so as to minimize environmental, amenity or public health problems which could arise from the inappropriate use of non-mains wastewater systems.

It covers applications from single households to small communities, including holiday parks with up to 250 population equivalents (PE).

It gives guidance for those designing and installing drainage fields and infiltration systems for use in wastewater treatment. It includes designs of the most commonly used drainage fields. However, alternative infiltration systems are acceptable for specific locations and specialist advice can be sought where appropriate. It is not intended for the code of practice to inhibit the development and application of suitable new processes, and where alternative options for disposal are being considered, the environmental regulator can be consulted to ensure suitability.

The long-term performance of these systems will be dependent on appropriate use and the level of maintenance carried out on upstream treatment equipment.

Use of this document

As a code of practice, this British Standard takes the form of guidance and recommendations. It should not be quoted as if it were a specification and particular care should be taken to ensure that claims of compliance are not misleading.

¹⁾ CEN/TR 12566-2:2005 has not been implemented as a British Standard.

Any user claiming compliance with this British Standard is expected to be able to justify any course of action that deviates from its recommendations.

Presentational conventions

The provisions in this standard are presented in roman (i.e. upright) type. Its recommendations are expressed in sentences in which the principal auxiliary verb is “should”.

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

1 Scope

This code of practice gives recommendations and guidance on the design and installation of drainage fields and infiltration systems for use in wastewater treatment. It is applicable to systems for handling discharges from domestic and commercial sources from single households upwards. These sources are typically septic tanks and package treatment plants.

General guidance is given on good design and installation practices. Particular requirements are determined by local conditions. The recommendations are supplemented, as required, by specialist advice.

NOTE Attention is drawn to the environmental regulators Pollution Prevention Guidelines Note 4 [2] and building regulations and standards (see Annex B). These require an adequate system of drainage to carry foul water from appliances within the building to one of the following, listed in order of priority:

- *public sewer*
- *a private sewer communicating with a public sewer*
- *either a package wastewater treatment plant or septic tank, with a discharge to a properly designed drainage field.*

Only where it can be demonstrated that the cost and/or practicability of connection to the public foul sewer is not feasible will alternative options, including use of drainage fields, be considered acceptable.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references only the edition cited applies. For undated references the latest edition of the referenced document (including any amendments) applies.

BS EN 1085, *Waste water treatment – Vocabulary*

BS EN 12566-1, *Small wastewater treatment systems for up to 50 PT – Part 1: Prefabricated septic tank*

BS EN 12566-3, *Small wastewater systems for up to 50 PT – Part 3: Package and or site assembled domestic wastewater treatment plants*

BS EN 12566-4²⁾, *Small wastewater systems for up to 50 PT – Part 4: Prefabricated treatment units for septic tanks assembled in situ from prefabricated kits*

BS EN ISO 10319, *Geotextiles – Wide-width tensile test (ISO 10319:1993)*

²⁾ In preparation at time of publication.

3 Terms and definitions

For the purposes of this document, the terms and definitions given in BS EN 1085 and the following apply.

- 3.1 biological layer**
biological film (or biomat) which grows on the base of the infiltration system or on top of the filter material when pre-treated effluent infiltrates the subsoil or the filter material
- 3.2 connection pipe**
non-perforated pipe used to connect the septic tank to the distribution chamber
- 3.3 disposal area**
total area of the site where the pre-treated effluent is discharged into the ground using a soil infiltration system
- 3.4 distribution chamber**
chamber allowing even gravity distribution of pre-treated effluent via the distribution pipes
- 3.5 distribution layer**
layer of the infiltration system composed of granular fill material in which pre-treated effluent is discharged through infiltration pipes
- 3.6 distribution pipe**
non-perforated pipe used to connect the distribution chamber to a single infiltration pipe
- 3.7 dosing chamber**
small tank receiving pre-treated effluent and containing a dosing device, which automatically discharges the desired quantity
- 3.8 drainage field**
system of infiltration pipes placed in trenches and arranged so that effluent can be discharged to the ground
NOTE The most common design of drainage field is shallow linear infiltration trench.
- 3.9 end connection**
perforated and non-perforated pipes and fittings that connect the lower ends of any parallel infiltration pipes, to enable airflow between infiltration pipes
NOTE The connecting fittings may incorporate ventilation and access provision.
- 3.10 filter material**
granular inert material, usually sand, placed beneath the distribution layer, the purpose of which is to provide a degree of infiltration to the pre-treated effluent
- 3.11 granular fill material**
inert material in which the infiltration pipes are placed in the distribution layer
- 3.12 infiltration**
percolation of effluent around the point at which it is discharged

3.13 infiltration pipe

perforated pipe through which the pre-treated effluent is discharged to the infiltration trench or bed

NOTE Often called a percolation pipe.

3.14 infiltration system

series of infiltration pipes, placed in either single trenches or one large bed, used to discharge effluent in such a way that it percolates into the disposal area

3.15 infiltration trench

trench in which a single infiltration pipe is placed and surrounded by fill material and separated from other infiltration trenches by undisturbed soil

3.16 land drain

surface or subsurface channel for the transportation of rain water, used to drain ground and divert the natural flow of surface and subsurface water away from infiltration area

3.17 geotextile membrane

fabric which is permeable to liquid and air but prevents rough solid particles from passing through it and which is resistant to decomposition

NOTE The hole diameters are approximately 1 mm.

3.18 pre-treated effluent

wastewater that has undergone at least primary treatment

3.19 soakaway

permeable area of ground, or buried structure, designed to speed the drainage of clean surface water into the ground

3.20 subsoil

unconsolidated material beneath the topsoil and above the bedrock

3.21 topsoil

upper layer of soil

3.22 upstream system

septic tank or secondary wastewater treatment system

3.23 water table

level below which the ground is saturated with water

NOTE The water table has seasonal variations.

3.24 trial hole

pit excavated to establish the ground characteristics and depth of water table and bedrock

3.25 percolation test hole

pit excavated to establish soil porosity and trench requirements

4 Drainage fields

NOTE Drainage fields are an important component of the wastewater treatment system. They are used extensively in the UK, particularly in conjunction with septic tanks and small wastewater treatment plants. Drainage fields provide additional treatment in the ground as well as ensuring a means of disposal of the effluent.

In advance of the drainage field, a septic tank or treatment plant conforming to BS EN 12566-1, BS EN 12566-4³⁾, or BS EN 12566-3 should be installed in accordance with the manufacturer's instructions.

NOTE The results from the standards type tests demonstrate the capability to meet the regulators' requirements.

The treatment and dispersal processes that occur within drainage fields take place within trenches in three distinct zones as follows.

- **Infiltration zone:** this is the top few centimetres of soil below the drainage trench, which is biologically active and contributes to the further treatment of effluent. Through continued use, a biological layer builds up within the pipe and the surrounding trench media and provides further treatment of the effluent.
- **Unsaturated zone:** this is located below the infiltration zone. This forms the pathway between the infiltration zone and the saturated zone. This area has the potential to provide additional attenuation depending upon its depth and characteristics. It provides a significant pathway for oxygen diffusion to aid further treatment.
- **Saturated zone:** this is beneath the unsaturated zone. All the voids are filled with ground water. There is further dispersion and dilution of the treated effluent.

Poor design and/or installation of a drainage field in an inappropriate location can lead to public nuisance, cause damage to the environment, and cause harm to human health.

It is essential that regular maintenance of the septic tank or wastewater treatment plant is carried out, and the owner should regularly inspect the entire system and drainage field to ensure continuing satisfactory operation. Well maintained package treatment plants are more likely to extend the life of a drainage field than septic tanks.

Drainage fields do not operate indefinitely and eventually need to be replaced. When designing wastewater treatment systems, whole-life costing of both plant and drainage field design should be carried out and include provision for the future replacement of the drainage field.

Fats, oils and greases should be removed from the wastewater as they can shorten the life of a drainage field if they are not properly isolated or treated.

Traditional soakaways (deep-pit based systems), often filled with bricks and other granular material, should not be used for wastewater effluent disposal as they do not provide sufficient treatment.

³⁾ In preparation at time of publication.

Rainwater or surface water soakaways permit the rapid dispersal of water without any further treatment of pollutants. These are not appropriate for the disposal of wastewater effluent.

Drainage fields should be clearly differentiated from rainwater soakaways.

5 Preliminary planning, site investigation and assessment

5.1 General

The effectiveness of a drainage field to treat and disperse effluent is influenced by groundwater levels and soil moisture content. These vary throughout the year and it is important that the site is able to continue to accommodate a discharge of effluent under the range of possible soil conditions.

The site should be carefully evaluated to assess both the environmental risks and the suitability of the proposed treatment system before installation of the drainage field.

A large amount of information and investigation is required to support a proposal for a drainage field. An assessment of the suitability of the site should include the following:

- preliminary planning (see **5.2**);
- detailed site investigation to identify suitable drainage field locations, including assessment of site characteristics and environmental risks (see **5.3**);
- detailed system design, including percolation testing and determination of trench area and layout (see **5.4** and **6.2**).

5.2 Preliminary planning

The regulator requires a risk-based assessment, which considers the volume, location and sensitivity of the site. This might involve the collection of more comprehensive data and include the services of a professional adviser or hydrogeologist to support the proposal. Some sites will be deemed unsuitable and alternative options will need to be agreed with the regulator.

Legislative requirements relating to the proposed sewerage system should be identified as part of the assessment. Contact should be made with the Planning Authority and, where necessary, the environmental regulator in order to determine whether permission, consent or a licence is required for a treatment unit or drainage field in the proposed area.

5.3 Site investigation

5.3.1 Detailed site investigation

A detailed site investigation should be carried out to identify and document all the relevant site details at the location of the proposed drainage field. This is so that all the risks are identified and considered in relation to the scale of the development.

The amount of information required within the detailed assessment varies with the nature and volume of the discharge, the ground characteristics and the environmental sensitivity of the site. The site investigation should consider:

- the requirements of the regulatory bodies;
- the presence of any environmental receptor, for example wells, boreholes, springs, or sources of water for human consumption or agricultural uses;
- proximity to other receptors, including habitable buildings and watercourses;
- proximity to any existing drain or sewer;
- site topography and site practicalities;
- the soil characteristics, including soil profile and porosity (see 5.4.1, 5.4.2 and 6.2);
- the composition of the effluent and its rate of discharge into the system;
- the distance to other drainage fields and rainwater soakaways.

Table 1 and Table 2 set out many of the criteria that should be considered. Some or all of this information might be required by the regulatory authorities to support the installation and provide evidence to help assess the level of environmental risk.

5.3.2 Protection of drinking water sources

Serious and long-term pollution can occur to groundwater from inappropriately installed drainage fields.

The distance can be significantly increased depending upon the size of the discharge, environmental sensitivity and local site characteristics.

There should be a minimum distance of 50 m between the drainage field and a well, spring, borehole or other source of water supply intended for human consumption.

Where site investigations identify sources of groundwater used or intended for human consumption, it is unlikely to be suitable for a drainage field. The environmental regulator should be consulted before undertaking detailed system design and planning.

A number of geological and hydrogeological factors control the risk to groundwater, including the type and depth of soil and distance to the water table. Other environmental factors that should be considered include but are not limited to:

- risk of health hazard or nuisance;
- impacts on wells, boreholes and other water sources used or intended for human consumption;
- amenity or conservation habitat;
- flooding or waterlogging due to unsuitable drainage characteristics;
- nutrient overloading of surface water catchments.

5.3.3 Visual site inspection

The investigation should consider physical features of the site, including the landscape and slope, and note the established vegetation in the area. This can provide useful information as to the overall site suitability, or areas of the site that are likely to be more or less suitable than others.

Table 1 Required information for site assessment

Description	Required information	User notes
Details of premises	Address. Application details (e.g. residential, domestic, commercial, or hotel, public house, factory). Maximum Population Equivalent (PE) served and anticipated maximum volume of effluent generated from the premises. Method of water supply to premises (e.g. mains supply or local abstraction). Details of any special effluent, e.g. hotels with own laundry, care homes with high proportion of dependent residents.	
Site map showing	Map grid references. Total site or property area. Area available for effluent disposal. Adjacent buildings (existing/proposed). Adjacent roadways. Site boundaries. Site topography. Site elevation (relative to sea level). Location of groundwater sources (wells, springs, etc.) relative to drainage field. Location of underground services. Surface water disposal route(s). Location of adjacent drainage fields or rainwater soakaways. Location of adjacent water courses. Rock outcroppings. Other wastewater discharges.	
Soil characteristics	Soil drainage characteristics. Topsoil type (descriptions, texture, colour). Subsoil type (descriptions, texture, colour). Presence of impermeable soil layer (e.g. clay). Presence of highly permeable layer (e.g. gravel). Depth of winter frost level, if appropriate.	
Bedrock	Depth to bedrock (in trial holes). Bedrock characteristics (e.g. impermeable, fissured, permeable).	
Ground water conditions	Type of aquifer. Presence of shallow groundwater and estimated depth to seasonally highest water table. Groundwater flow direction (based on observed water levels or derived from topography and surface water features). Wells and boreholes used for abstracting groundwater within the likely range of impact. Ditches, springs, watercourses or other surface drainage features that may be fed by groundwater.	
General	Vegetation type. Trees or other plants with extensive root systems.	
Other		

Table 2 **Features influencing the location of wastewater treatment equipment, drainage fields for a single dwelling, good practice and guidelines**

Item	Good practice
Habitable buildings	Position as far away as is practical, consider prevailing wind direction. Recommended minimum: 7 m.
Water course or ditch	Building regulations and PPG4 recommend a minimum of 10 m for a drainage field.
Public road or other access road	Varies with local and national requirements consult Highway and Building Regulations.
Site boundary	No part of the drainage field should be within 2 m of the boundary of the adjoining site.
Trees or other plants with a deep or extensive root systems	Advice to be sought from suitable competent person. <i>NOTE This also applies to the cultivation of crops which would inevitably necessitate the use of machinery (even light machinery) likely to disturb the materials installed at a shallow depth.</i>
Topography	Landscape features that retain or concentrate subsurface flows such as swales or depressions should be avoided.
Water supply pipes or underground services	Other than those required by the infiltration system itself, pipes should not be located within or adjacent to the disposal area.
Access roads, driveways or paved areas	Should not be located within the disposal area.
Other drainage fields	The proximity of other drainage fields or rainwater soakaways should not compromise the drainage characteristics of the proposed site.
Additional considerations	Power supply for mechanical systems Site security Access for desludging, considering local contractor requirements Space for future expansion

NOTE Recommended distances are indicative only and may be more stringent depending on local regulatory or policy positions.

5.4 Assessment

5.4.1 Trial hole

A trial hole is distinguishable from a percolation test hole used to establish soil porosity and trench requirements.

As part of the detailed investigation, a trial hole (see Figure 1) should be safely excavated (see 8.3.7). The hole should be excavated adjacent to the area where the drainage field is to be installed. Consideration should be given to identifying the maximum seasonal groundwater table level.

A trial hole should be used to identify:

- whether shallow groundwater is present and determine groundwater levels;
- soil profiles with textural descriptions;
- appropriate depth below ground level to perform percolation tests;
- the presence of bedrock and investigate its characteristics.