SLOVENSKI STANDARD
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Male čistilne naprave do 50 PE – 2. del: Sistemi za infiltracijo v zemljo

Small wastewater treatment systems for up to 50 PT - Part 2: Soil infiltration systems

Kleinkläranlagen für bis zu 50 EW - Teil 2: Bodeninfiltrationssysteme

Petites installations de traitement des eaux usées jusqu'a 50 PTE - Partie 2: Systemes d'infiltration dans le sol

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13.060.30 Odpadna voda Sewage water

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Small wastewater treatment systems for up to 50 PT - Part 2: Soil infiltration systems

Petites installations de traitement des eaux usées jusqu'à 50 PTE - Partie 2: Systèmes d'infiltration dans le sol

Kleinkläranlagen für bis zu 50 EW - Teil 2: Bodeninfiltrationssysteme

This Technical Report was approved by CEN on 19 December 2004. It has been drawn up by the Technical Committee CEN/TC 165.

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Foreword

This document (CEN/TR 12566-2:2005) has been prepared by Technical Committee CEN/TC 165 “Wastewater engineering”, the secretariat of which is held by DIN.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document is considered as Code of Practice and provides the general requirements for packaged and/or site assembled treatment plants used for domestic wastewater treatment for a total number of inhabitants and population equivalents (PT) ≤ 50 PT (see Clause 1).

EN 12566 with the generic title "Small wastewater treatment systems up to 50 PT" consists of the following parts:

— Part 1: Prefabricated septic tanks (specifies the requirements and laboratory test method for prefabricated septic tank units. Requirements and tests for treatment efficiency are not specified),

— Part 2: Soil infiltration systems (applies for in-situ constructed soil infiltration systems. No treatment requirements are specified; Technical Report),

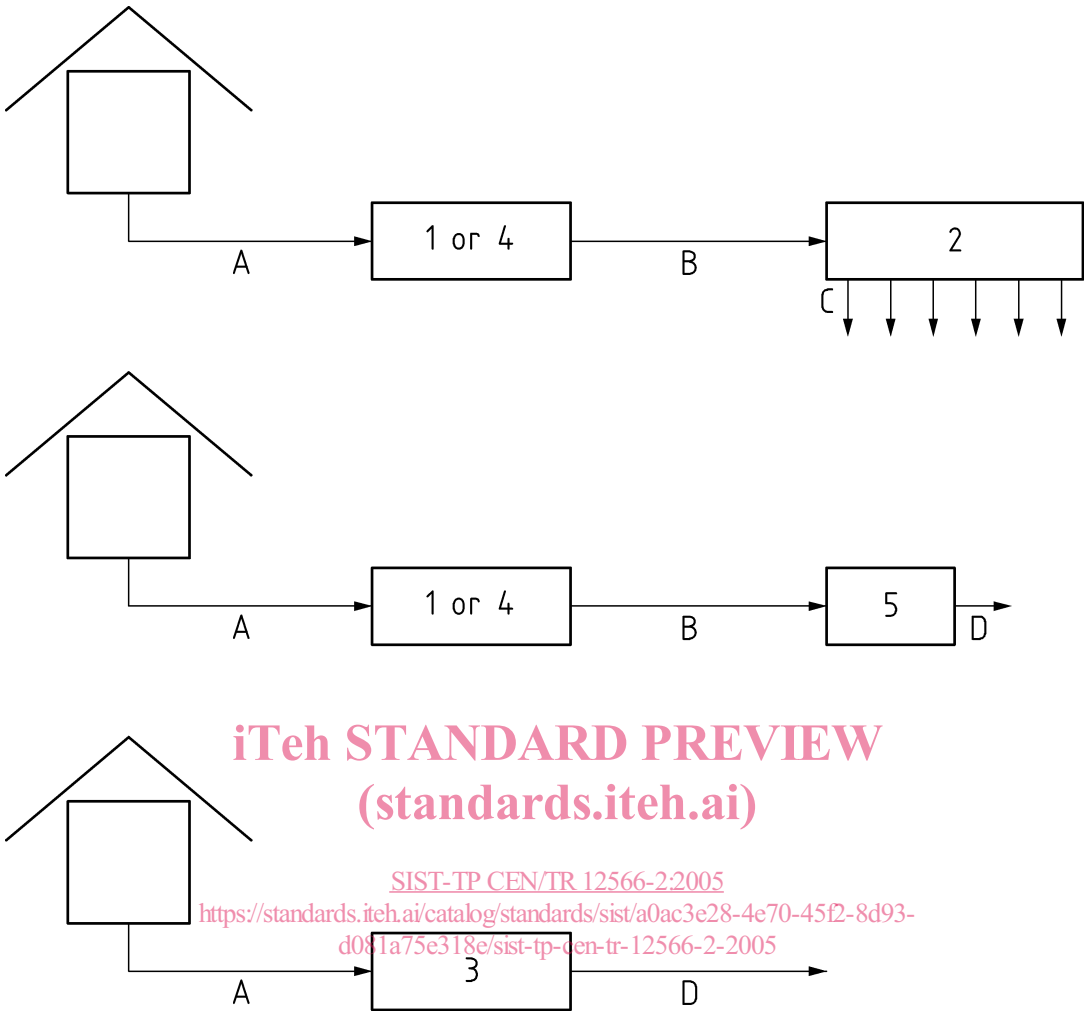
— Part 3: Packaged and/or site assembled domestic wastewater treatment plants (specifies the requirements and laboratory test method used to evaluate packaged wastewater treatment plants, which are required to treat sewage to a predetermined standard),

— Part 4: Septic tanks built in situ from pre-fabricated kits - Execution standard (in preparation),

— Part 5: Filtration systems (including sand filters) (in preparation),

— Part 6: Test methods for the evaluation of the effectiveness of treatment on users site.

The application of the parts of EN 12566 is shown in the following scheme:



Key

A Domestic wastewater (influent)

B Pre-treated wastewater

C Infiltration into the ground

D Outlet of treated wastewater (effluent)

1 Prefabricated septic tank (see EN 12566-1)

2 Infiltration system (into the ground) (see CEN/TR 12566-2; in preparation)

3 Wastewater treatment plant (see prEN 12566-3)

4 Septic tank built in situ (see prEN 12566-4)

5 Filtration systems (see prEN 12566-5)

NOTE National regulations may specify different arrangements between the products described in the standards series EN 12566.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to announce this Technical Report: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

This document gives guidance for soil infiltration systems which can be used together with small waste water systems according to EN 12566-1, prEN 12566-3 or prEN 12566-4 in places of use where legally provisions for soil infiltration systems do not exist.

National forewords of this document may give information on provisions for soil infiltration in the place of use (see Clause 5).

1 Scope

This document specifies the recommended requirements for soil infiltration systems ranging in size from a single house to 50 PT receiving domestic wastewater from septic tanks manufactured according to the requirements given in EN 12566-1 and prEN 12566-4.

This document gives design parameters, construction details, installation and component requirements for soil infiltration systems.

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.

EN 1085, *Waste water treatment – Vocabulary*

EN 12566-1, *Small wastewater treatment systems for up to 50 PT — Part 1: Prefabricated septic tanks*

prEN 12566-4, *Small wastewater systems for up to 50 PT — Part 4: Septic tanks assembled in situ from prefabricated kits*

EN 12056-2, *Gravity drainage systems inside buildings - Part 2: Sanitary pipework, layout and calculation*

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

3 Terms and definitions

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

3.1
biological layer
biological film 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 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

3.6
dosing chamber
small tank receiving pre-treated effluent and containing a dosing device e.g. a pump, a hydraulic siphon or a tipping trough, which automatically discharges the desired quantity

3.7
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. The connecting fittings may incorporate ventilation and access provision.

3.8
filter material
granular inert material, usually sand, placed beneath the distribution layer, the purpose of which is to provide a degree of filtration to the pre-treated effluent

3.9
geotextile
fabric, which is permeable to liquid and air but prevents solid particles from passing through it and is resistant to decomposition

3.10
granular fill material
inert material in which the infiltration pipes are placed in the distribution layer

3.11
impermeable film
inert membrane, which is impermeable to liquid

3.12
infiltration
percolation of effluent around the point at which it is discharged

3.13
infiltration bed
wide excavation in which a number of infiltration pipes are placed in parallel and surrounded by fill material

3.14
infiltration pipes
perforated pipes through which the pre-treated effluent is discharged to the infiltration trench or bed

3.15
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

3.16
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

3.17
land drains
surface or subsurface channels for the transportation of rain water. They are used to dewater ground and divert the natural flow of surface and subsurface water away from infiltration area

3.18
long Term Acceptance Rate
LTAR
amount of pre-treated effluent which the system can infiltrate during its lifetime without water logging or clogging ($l/m^2/d$)

3.19
mesh
fabric, which is permeable to liquid and air but prevents rough solid particles from passing through it and which is resistant to decomposition. The hole diameters are approximately 1 mm.

3.20
permeability coefficient
k
measure of the percolation ability of the soil (m/d)

3.21
prefilter
device that helps to prevent clogging of infiltration system

3.22
pre-treated effluent
wastewater that has undergone at least primary treatment

3.23
subsoil
unconsolidated material beneath the topsoil and above the bedrock

3.24
topsoil
upper layer of soil

3.25
water table
level below which the soil is saturated with water

3.26
water table level
surface of the groundwater when related to the ground level or other point of reference

4 Symbols and abbreviations

k Darcy's permeability coefficient determined from small tube permeable test (m/d)

k_N Normalised permeability coefficient determined from falling head percolation test (m/d)

k_C Constant permeability coefficient determined from constant head percolation test (m/d)

5 General

Infiltration systems provide a measure of treatment when constructed according to this document or to appropriate national regulations; their effectiveness is usually not measured.

The systems described are intended to illustrate the main principles of construction and are subject to national variation. Provisions in the place of use shall be taken into account. The regulatory authorities shall be contacted.

6 Design parameters

6.1 General

To ensure that a sustainable solution is achieved each site shall be assessed (see Annex A and Annex B). The choice of infiltration system will depend upon the site considerations detailed in 6.2. The preferential order of systems is:

— Infiltration trench (see 10.2),

— Shallow infiltration bed (see 10.3.1),

— Vertical infiltration bed (see 10.3.2),

— Infiltration mound (see 10.3.3).

Pre-treated effluent discharging to unsuitable sub-soils may result in system failure.

6.2 Site considerations

6.2.1 Climatic conditions

When designing, constructing and locating the soil infiltration system, climatic conditions in the area such as extremes of temperature, rainfall, snow shall be taken into consideration.

6.2.2 Water table

The seasonally highest groundwater table shall be determined in the disposal area, prior to the construction.

Unless specified in national regulations or guidance, a minimum of 1,0 m of unsaturated soil and/or filter material shall be present above the determined seasonally highest level of the groundwater table.

Where these dimensions cannot be accommodated, alternative arrangements (e.g. raised disposal area) shall be adopted to achieve these dimensions (see 10.3.3).

6.2.3 Location

6.2.3.1 General

In order to take into consideration all relevant site features when locating the disposal areas a detailed site investigation shall be carried out. Annex A lists the site considerations which should be assessed as part of the site investigation; all or some of these considerations may be defined by the national authorities.

In absence of any national regulations or guidance, the disposal area shall be located according to the following minimum criteria:

— No part of the soil disposal area shall be closer than 4 m to the nearest point of the nearest habitable dwelling.

— No part of the disposal area shall be within 4 m of the nearest road boundary or ditch nor within 2 m of the boundary of the adjoining site. Disposal areas in the vicinity of small water courses shall be at least 10 m from the highest level. Larger water courses will need special considerations.

— The growth of any type of tree or plant which develops an extensive root system is limited to a minimum distance of 3 m from the infiltration system. This restriction 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.

— Water supply pipes or underground services other than those required by the infiltration system itself shall not be located within the disposal area.

— Access roads, driveways or paved areas shall not be located within the disposal area.

6.2.3.2 Groundwater protection

Groundwater, in particular any water to be used for drinking shall be protected.

The risk of polluting groundwater is minimised when the disposal area is hydraulically downslope of groundwater sources.

NOTE The direction of the groundwater flow may be estimated from a trial hole test (see Annex B) and also from the topography, wells and local knowledge.

Distances are based chiefly on the most important geological and hydrogeological factors, e. g. the type and depth of subsoil and the depth to the water table, all of which can be assessed as part of the detailed site investigations.

It is not possible to specify with certainty the minimum safe distance between disposal areas and any system, which collects drinking water. As a guide for countries where no national regulations or guidance exists a minimum distance of 30 m may be used. However local conditions may require a far greater distance.

6.3 Dimensioning

The biological layer restricts the infiltration into the subsoil. The layer's properties depend on the permeability of the soil, the loading rate (hydraulic and organic) and oxygen conditions.

Soil properties such as grain size distribution (soil type), relative compaction, discontinuities and saturation (Table 1 and Annex B) affect the permeability.

Table 1 — Relations between K-values and LTAR

Soil type	k m/d(m/s)	k_N m/d	k_C m/d	LTAR (l/m^2/d)
Medium and coarse gravel	> 100 (> 1×10^{-3})	> 12	Not applicable	Direct infiltration is not permitted
Mixtures of fine gravel and coarse sand	1 to 100 (1×10^{-5} to 1×10^{-3})	0,8 to 12	1,5 to 12	20 to 50
Fine or silty sand or till	0,5 to 10 (6×10^{-6} to 1×10^{-4})	0,6 to 2	0,5 to 1,2	15 to 30
Silt or sandy silt	0,1 to 1 (1×10^{-7} to 1×10^{-5})	0,4 to 0,8	0,15 to 0,5	10 to 15
Silty clay loam	0,01 to 0,1 (1×10^{-7} to 1×10^{-6})	0,1 to 0,4	0,15	10
Silty clay or clay	< 0,001 (< 1×10^{-8})	< 0,1	< 0,15	Direct infiltration not possible

The Figures 1 to 3 show maximum recommended values for LTAR depending on the k coefficient type.

National regulations or guidance may determine which evaluation method should be used and the acceptable criteria. From the determined LTAR and the anticipated loading, the area of any infiltration system can be calculated in accordance with equation 1.

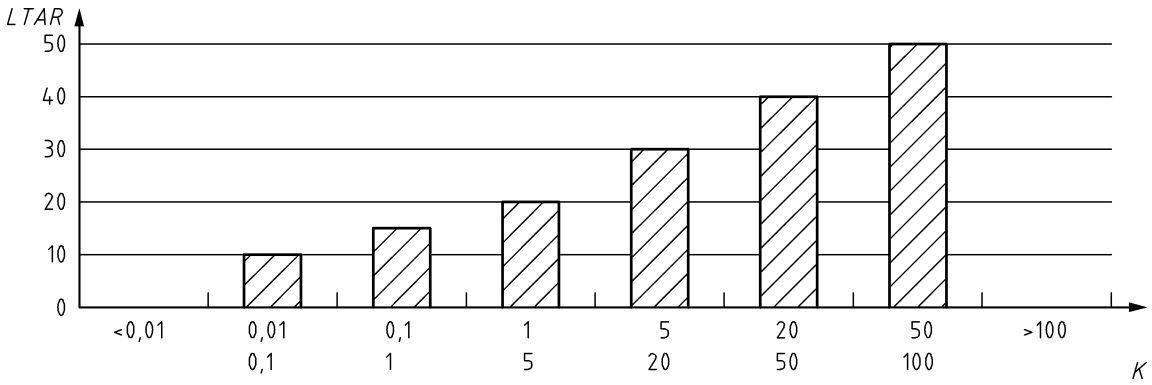


Figure 1 — Relation between LTAR and k

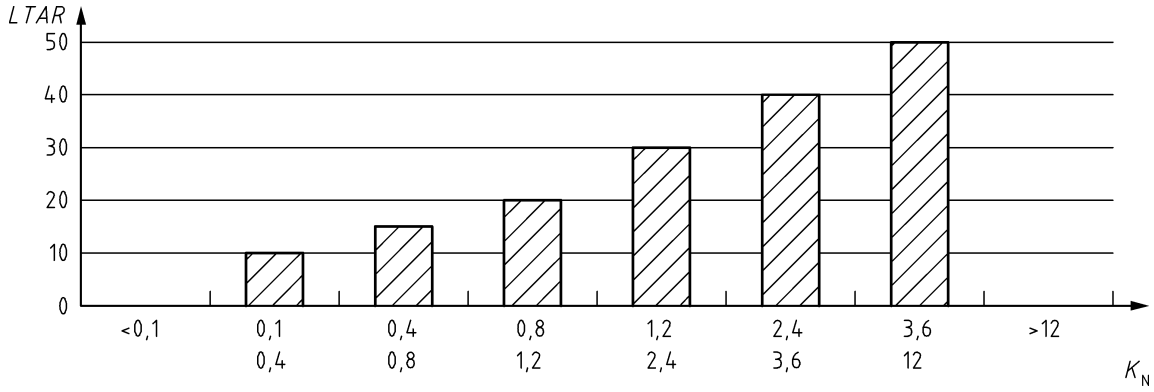


Figure 2 — Relation between LTAR and k_N

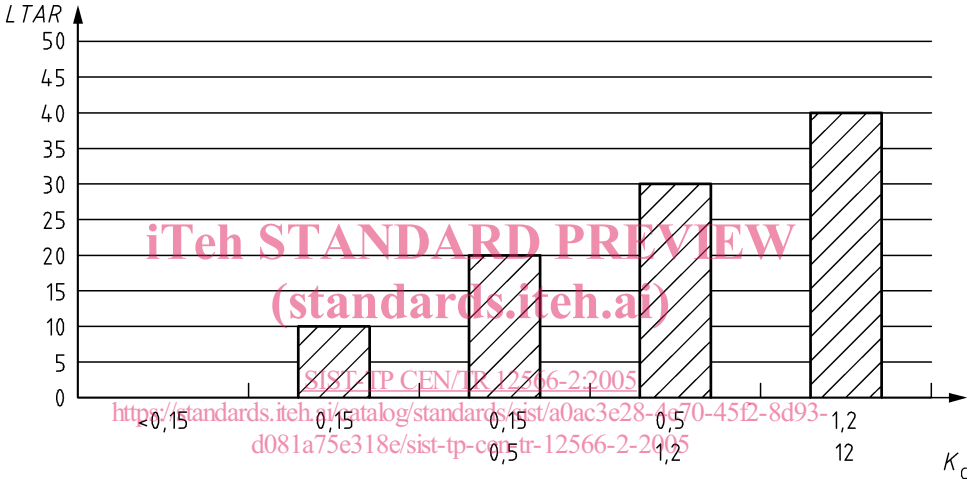


Figure 3 — Relation between LTAR and k_C

$$A = Q_d / \text{LTAR} \quad (1)$$

where

A is the infiltration system area (m²);

LTAR is the value given either from Table 1 or Figures 1 to 3 or Annex B (B.3.1) ($m^3/m^2/d$);

Q_d is the total daily flow (m^3/d).

Annex B describes some methods of how the soil parameters could be determined and gives some information about the determination of LTAR.

6.4 Influent parameters

The infiltration system shall be designed to accept the total daily flow from at least one house.

The infiltration systems are intended to receive only domestic wastewater (without any other water such as rainwater) pre-treated in a septic tank. Systems to treat commercial wastewater (restaurants, hotels, etc.) require different design.

In the absence of national regulation or guidance or other reliable data, a minimum value of 150 l per day and per inhabitant may be used for loading calculation.

6.5 Selection of infiltration system

Start with LTAR and progress across the Table 2 considering each parameter in turn. See also informative annexes.

Table 2 — Infiltration system basic selection matrix

Measured LTAR	Water table level	Soil stability	Fissured rock	Slope	Replace native soil	System type
Good	Low	Good	No	—	No	Infiltration trench
Good	Low	Bad	No	Shallow	No	Shallow infiltration bed
Low	Low	—	Yes	Shallow or steep	Yes	Vertical infiltration bed
Very high or very low	High or none	—	Yes	—	Yes	Infiltration mound

7 Components

7.1 General

In the absence of any national regulation or guidance the following requirements apply.

7.2 Pipes

7.2.1 General

All pipes shall be manufactured in accordance with the requirements of the relevant EN, if available or, in their absence, with the specifications valid in the place of use.

7.2.2 Distribution pipe

The following specific requirements shall be complied with:

— The nominal diameter of the distribution pipe located between the septic tank and the distribution chamber, shall at least be equal to the diameter of the outlet of the septic tank.

— For the distribution pipes following the distribution chamber, the minimum internal diameter (ID) shall be 80 mm for gravity systems and 32 mm for pressure systems.

7.2.3 Infiltration pipe

7.2.3.1 General

Fields drainpipes shall not be used.

7.2.3.2 Infiltration pipe diameter

The minimum internal diameter of the infiltration pipes shall be 80 mm for gravity systems and 32 mm for pressure systems

7.2.3.3 Infiltration pipe perforation

The infiltration pipes shall have holes or slots and a smooth internal inner surface.

The perforations shall be dimensioned and spaced to ensure that granular fill cannot enter the infiltration pipe and that effluent can flow easily through the perforation without clogging.

7.3 Granular fill material

Granular fill materials used in Europe vary greatly, however it is usually sand in the range of 2 mm to 8 mm or gravel in the range of 8 mm to 32 mm.

Granular fill shall be inert, washed and graded.

7.4 Geotextile and mesh

Infiltration pipes shall be covered, with a suitable geotextile T (Table 3) to prevent contamination of the granular fill material e.g. by fine particles of soil. In fissured rock, to avoid sand from being washed out into the ground, a more porous geotextile B (Table 3) or mesh X shall be used.

Geotextile shall be in accordance with EN ISO 10319.

Table 3 — Geotextile and mesh properties

Characteristics	Geotextile T	Geotextile B	Mesh X [a]
Tensile strength	≥ 12 kN/m	≥ 6 kN/m	≥ 6 kN/m
Permittivity	≥ 0,05 s^{-1}	≥ 0,03 s^{-1}	≥ 0,03 s^{-1}
Filtration porosity	≤ 125 µm	> 140 µm	> 140 µm
Class	1	1	-
[a] geomesh can replace geotextile B			

7.5 Impermeable film

Impermeable film may be used on the sides of the infiltration system to prevent lateral flow.

This film shall be at least 200 µm thick HDPE or an alternative material of an equivalent strength, which will not puncture or tear.

7.6 Effluent pumping systems

Effluent pumping systems may be used to transport effluent to remote infiltration systems, to raise effluent from deep septic tanks and/or for pressure infiltration systems.

Effluent pumps shall not be installed directly in septic tanks but in a separate pumping chamber, which may be constructed as part of other structures on site.

Suitable wastewater pumps with a minimum free passage of 10 mm should be used.

7.7 Dosing system

To provide efficient distribution of the effluent over the full length of the infiltration pipes, the use of a dosing system is highly recommended.

7.8 Chambers

Chambers shall be watertight, smooth on the inside and be fitted with a removable cover to facilitate maintenance and inspection.

Dosing and distribution chambers may be combined into a single structure.