Project:				Document Number	
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Calculation Front Cover

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Foul Water Drainage Calculations for New Agricultural Buildings at Marcholws, Peniel Carmarthenshire SA32 7AA

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		Page	
	Design Summary	DS/01	
	NRW Compliance Considerations	CP/01	
	Foul Water	FW/01 - 03	
	Sewage Treatment Plant Sizing	ST/01 - 02	
	Drainage Field Sizing	DF/01 - 04	

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Design Summary

REF			OUTPUT
	BS Codes	BSEN 752	
	Building Regulations	Part H, Building Regulations 2015	
		BS 6297-2007-Drainage-Fields	
	CIRIA	CIRIA C756 SUDS Design Manual	
	Foul Drainage Design Rate	Refer to calcs for maximum flow rate for Office/Workshop	

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NRW Compliance

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NRW Guidance Notes:

According to Natural Resources Wales (NRW), the use of private domestic sewage treatment in a sewered area is only permissible if connection to the public sewer is not feasible.

Generally, if the boundary of a single property (external walls) is within 30 metres of a public sewer, it is considered feasible to connect.

For larger developments, the number of properties is multiplied by 30 to calculate the distance at which it is still feasible to connect.

NRW Guidance CL.3.1.8

NRW Guidance for the registration of small sewage effluent discharges (Page 19)

The point from which the distance to the foul sewer is measured is the point at which the drain leaves the building that it serves.

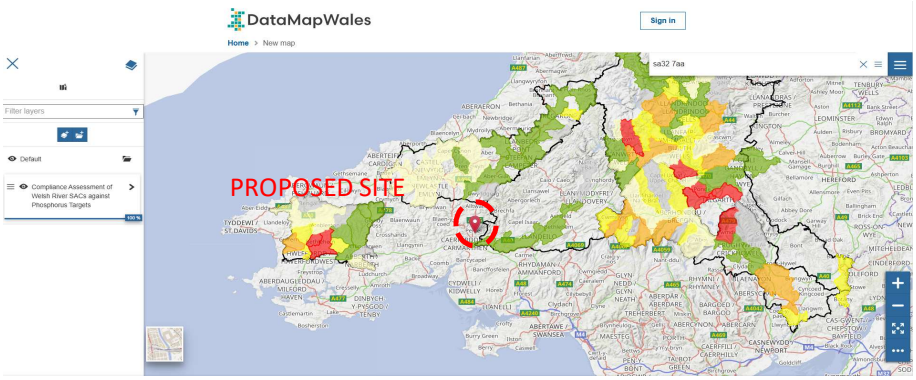
Proposed Site Location

Number of properties proposed within the development = 1

NRW Guidance Radius from development at which a sewered connection is considered feasible = 30m

Existing sewer is outside a 30m radius from the development area, consider discharge to ground or assess the feasibility of a connection greater than 30m.

PROPOSED FW DISCHARGE: **TO GROUND**



NOTE: **Proposed development is not located within a Phosphate Mitigation Area. Therefore, provide a PTP & discharge to ground via a Drainage Field**

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Foul Water Design UNIT A

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H1 Cl. 2.32

2.32 Appliances are seldom in use simultaneously and the minimum drain sizes in normal use are capable of carrying the flow from quite large numbers of appliances. Table 5 shows approximate flow rates resulting from the typical household group of 1 WC, 1 bath, 1 or 2 washbasins, 1 sink and 1 washing machine used for design purposes in BS EN 12056.

2.33 A drain carrying foul water should have an internal diameter of at least 75mm. A drain carrying effluent from a WC or trade effluent should have an internal diameter of at least 100mm.

Table 5 **Flow rates from dwellings**

Number of dwellings	Flow rate (litres/sec)
1	2.5
5	3.5
10	4.1
15	4.6
20	5.1
25	5.4
30	5.8

H1, Diag. 9 T.5 & T.6

For a single dwelling; from Clause 2.32 provide 1 No. 100mm diamater foul drainage pipe for connection from bathroom. Lay pipe at minimum 1:80 gradient.
Max Capacity = 6.3l/s > 2.5 l/s for one dwelling, therefore ok.

H1, Diag. 9 T.6

Connections from non-effluent sources can be 75mm diameter pipe laid at 1:80.
Maximum flow from one dwelling = 2.5 l/s. Maximum capacity of 75mm diameter pipe laid at 1:80 = 2.8 l/s. Maximum capacity of 75mm diameter pipe laid at 1:80 > maximum flow from one dwelling, therefore OK for non-effluent connections.

Lateral Drain

To comply with Sewers for Adoption 7th Edition, use 100mm dia. Pipe at minimum 1:80 gradient for lateral drain to achieve self cleansing velocity.

Diagram 9 **Discharge capacities of foul drains running 0.75 proportional depth**

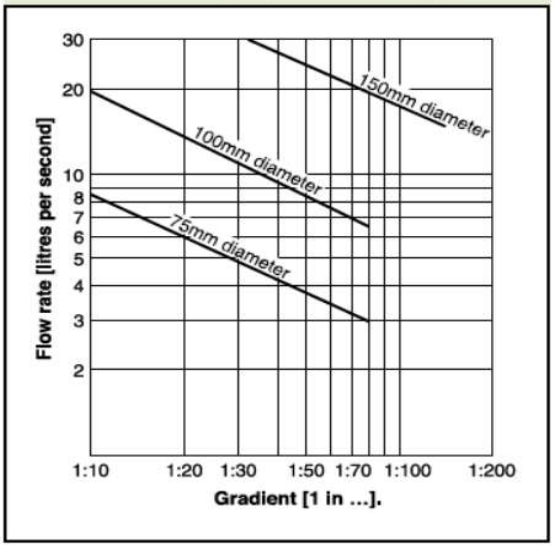

Table 6 **Recommended minimum gradients for foul drains**

Peak flow (litres/sec)	Pipe size (mm)	Minimum gradient (1 in ...)	Maximum capacity (litres/sec)
< 1	75	1:40	4.1
	100	1:40	9.2
> 1	75	1:80	2.8
	100	1:80*	6.3
	150	1:150†	15.0

Notes:
* Minimum of 1 WC
† Minimum of 5 WCs

H1, 2.30

For sewers serving more than 10 dwellings, provide 150mm diameter foul drainage pipe laid at a minimum gradient of 1:150.

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Pipe Schedule

Line no.	Start MH	End MH	Total no. of WC's	Prob no. in use	Flow rate	Pipe Size (mm)	Minimum gradient	Capacity
1	UNIT A	PTP	2	2	4.6	100	1:80	6.3
2			1	2	4.6	100	1:80	6.3
3			1	2	4.6	100	1:80	6.3
4			1	2	4.6	100	1:80	6.3
5			1	2	4.6	100	1:80	6.3
6			1	2	4.6	150	1:150	15
7			1	2	4.6	150	1:150	15
8			1	2	4.6	100	1:80	6.3
9			1	2	4.6	150	1:150	15
10			1	2	4.6	150	1:150	15
11			1	2	4.6	150	1:150	15
12			1	2	4.6	150	1:150	15
13			1	2	4.6	150	1:150	15
14			1	2	4.6	150	1:150	15
15			1	2	4.6	150	1:150	15

Diagram 8 Pipe runs near buildings

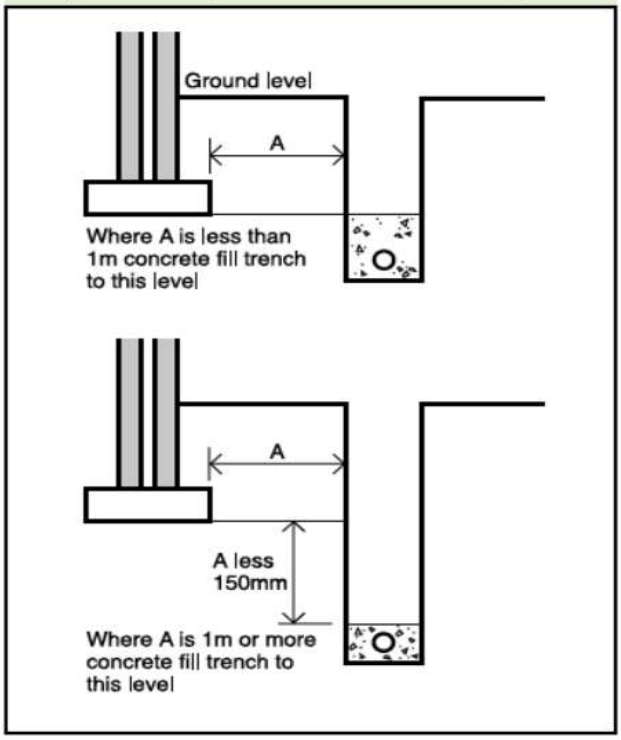
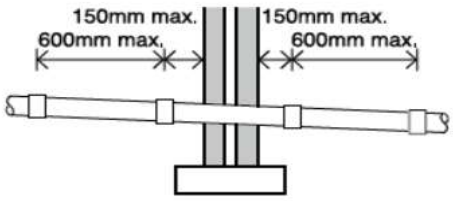
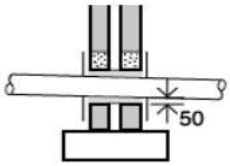


Diagram 7 Pipes penetrating walls

(a) Short length of pipe bedded in wall, joints formed within 150mm of either wallface. Adjacent rocker pipes of max. length 600mm with flexible joints



(b) Arch or lintelled opening to give 50mm space all round the pipe



Mask opening both sides with rigid sheet material to prevent entry of fill or vermin

Important Fill void with compressible sealant to prevent entry of gas

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Foul Water Design

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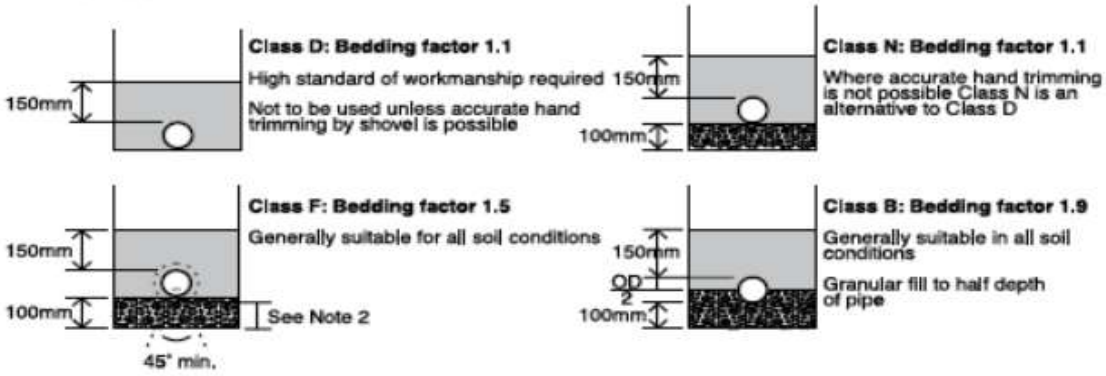
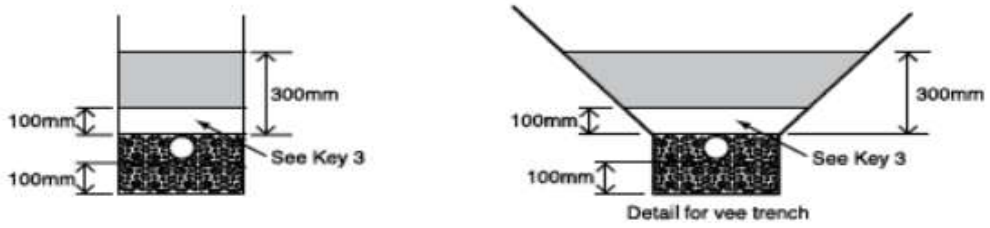
H1 Pipe Bedding Material as per recommendation H1 clause 2.41 - 2.45

Diagram 10 Bedding for pipes

a) Rigid pipes



b) Flexible pipes



Key

1 Selected fill: free from stones larger than 40mm, lumps of clay over 100mm, timber, frozen material, vegetable matter.

2 Granular material – For rigid pipes the granular material should conform to BS EN 1610 Annex B Table B.15 and should be single size material or graded material from 5mm up to a maximum size of 10mm for 100mm pipes, 14mm for 150mm pipes, 20mm for pipes from 150mm up to 600mm diameter and 40mm for pipes more than 600mm diameter. Compaction fraction maximum 0.3 for class N or B and 0.15 for class F.

3 Selected fill or granular fill free from stones larger than 40mm.

Notes:

1. Provision may be required to prevent groundwater flow in trenches with class N, F or B type bedding.
2. Where the pipe has sockets and Class D bedding is used, holes which should be as short as is practicable should be prepared in the trench bottom to give a clearance of 50mm beneath the socket.
3. Where the pipe has sockets and Class F or N bedding is used, the sockets should be not less than 50mm above the floor of the trench.
4. All dimensions are in mm.

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Sewage Treatment Plant Sizing

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British Water Flow & Loads

STP Waste Flow Loadings Assesment

		Flow litres/Day		BOD gm/Day		Ammonia As N	
Source of Waste	**Occupants**	**Per Head**	**Total**	**Per Head**	**Total**	**Per Head**	**Total**
Office / Factory without canteen	10	50	500	25	250	5	50
Total	**10**		**500**		**250**		**50**

Kingspan Klargester BioDisc Sewage Treatment Plant (Compiled) Technical Datasheet

Model Reference	BA	BA-X	BB	BC	BD	BE	BF	BG	BH	BJ
Population Equivalent (Std Flow)	6	9	12	18	25	35	50	70	75	100
Maximum Daily Flow	0.36	0.54	0.72	1.08	1.5	2.1	3	4.2	4.5	6
Maximum Daily Flow (m3)	1.2	1.8	2.4	3.6	5	7	10	14	15	20
Ø/ width (mm)	1995	1995	1995	2450	2450	2.45	2450	2450	2450	2450
Length (mm)	-	-	-	-	3340	3340	4345	5235	7755	7755
Inlet Invert depth (mm)	450/750/1250	450/750/1250	450/750/1250	600/1100	600/1100	600/1100	600/1100	600/1100	600/1000	600/1000
Depth Below Inlet Invert (mm)	1400	1400	1400	1820	1820	1820	1820	1820	1790	1790
Outlet Invert Depth (mm)	1315	1315	1315	1735	685/1185	685/1185	700/1200	700/1200	750/1150	750/1150
Overall Height (mm)	2160/2460/2960	2160/2460/2960	2160/2460/2960	2825/3325	2825/3325	2825/3325	2825/3325	2825/3325	2830/3230	2830/3230
Height to Rim of Cover (mm)	1945/2245/2745	1945/2245/2745	1945/2245/2745	2485/2985	2485/2985	2485/2985	2485/2985	2485/2985	2490/2890	2490/2890
Empty Weight (kg)	310/325/380	310/325/380	335/350/405	650/750	1100/1200	1200/1300	1315/1465	1660/1810	3000/3020	3100/3120
Standard Power Supply	1 phase	1 phase	1 phase	1 phase	1 phase	1 phase	1 phase	1 phase	1 phase	1 phase
Motor Rating - 1 Phase (Watts)	50	50	50	75	75	75	120	180	250	250
Full Load Current Phase (amps)	0.51	0.51	0.51	1.1	1.1	1.1	1.3	1.6	1.5	1.5
Optional Power Supply	N/A	N/A	N/A	3 phase	3 phase	3 phase	3 phase	3 phase	3 phase	3 phase
Motor Rating • 3 Phase (Watts)	N/A	N/A	N/A	90	90	90	120	180	250	250
Full Load Current 3 Phase (amps)	N/A	N/A	N/A	0.38	0.38	0.38	0.42	0.63	0.88	0.88
Sludge Return pump Rating (watts)	250	250	250	250	250	250	250	250	250	250

The office occupancy has been assessed in accordance with the Workplace (Health, Safety and Welfare) Regulations 1992 guidance, which recommends a minimum workspace volume of 11m³ per person. Based on the available floor area of 48.2m² and a typical office ceiling height, the maximum occupancy has been limited to 10 persons, allowing adequate space for circulation, furniture and general office use.

Bio-Disc BA Unit

Max. Allowable BOD Daily	=	360	grams	***Therefore, okay (>=250grams)***
Max Allowable Daily Flow	=	1200	litres	***Therefore, okay (>=500Litres)***

USE: Kingspan Klargester BioDisc BA Unit

Note:

Unit to have storage volume of 100% x1 Day Volume
Unit to have Backup Power
Unit to have alarm level sensors and fault detection

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Foul Water Design - British Water Table of Loadings

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British Water Flow and Loads - 4

BRITISH WATER
expertise worldwide

Table of Loadings for Sewage Treatment Systems

Per person / activity / day (unless otherwise specified)	FLOW (Litres)	BOD (Grams)	Ammonia as N (Grams)
DOMESTIC DWELLINGS			
Standard residential	150	60	8
Mobile home type caravans with full services	150	60	8
INDUSTRIAL			
Office / Factory without canteen	50	25	5
Office / Factory with canteen	100	38	5
Open industrial site, e.g. construction, quarry, without canteen	60	25	5
*Full-time Day Staff	90	38	5
*Part-time Staff (4 hr shift)	45	25	3
SCHOOLS			
Non-residential with canteen cooking on site	90	38	5
Non-residential without a canteen	50	25	5
Boarding school (i) residents	175	60	8
(ii) day staff (inc. mid-day meal)	90	38	5
HOTELS, PUBS & CLUBS			
Hotel Guests (Prestige hotels)	300	105	12
Hotel Guests (3* & 4* hotels)	250	94	10
Guests (Bedroom only – no meals)	80	50	6
Residential Training/Conference Guest (inclusive all meals)	350	150	15
Non residential Conference Guest	60	25	2.5
Drinkers	12	15	5
Holiday camp chalet resident	227	94	10
Resident Staff	180	75	10
Restaurants - Full Meals - luxury catering	30	38	4
- pre-prepared catering	25	30	2.5
- Snack Bars & bar meals	15	19	2.5
- Function Rooms including buffets	15	19	2.5
- Fast Food i.e. (roadside restaurants)	12	12	2.5
- Fast Food Meal (burger chain and similar)	12	15	4
Students (Accommodation only)	100	60	8
AMENITY SITES			
Toilet Blocks (per use)	10	12	2.5
Toilet (WC) (per use)	10	12	2.5
Toilet (Urinal) (per use)	5	12	2.5
Toilet Blocks in long stay car parks/lorry parks (per use)	10	19	4
Shower (per use)	40	19	2
Golf Club	20	19	5
Local community sports club, e.g. squash, rugby & football	40	25	6
Swimming (where a separate pool exists without an associated sports centre)	10	12	2.5
Health Club/Sports Centre	50	19	4
Tent sites	75	44	8
Caravan Sites - (i) Touring not serviced	100	44	8
(ii) Static not serviced	100	44	8
(iii) Static fully serviced	150	60	8
HOSPITALS & RESIDENTIAL CARE HOMES			
Residential old people / nursing	350	110	13
Small hospitals	450	140	Assess
Large hospitals	Assess individually		

*Staff figures also apply to other applications

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Vp Calculations and Drainage Field Sizing

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Trial Pit	Test 1					
	SD (mm)	75% T (s)	75% D (mm)	25% T (s)	25% D (mm)	Vp (s/mm)
TP/01	TBC	TBC	TBC	TBC	TBC	TBC

Trial Pit	Test 2					
	SD (mm)	75% T (s)	75% D (mm)	25% T (s)	25% D (mm)	Vp (s/mm)
TP/01	TBC	TBC	TBC	TBC	TBC	TBC

Trial Pit	Test 3					
	SD (mm)	75% T (s)	75% D (mm)	25% T (s)	25% D (mm)	Vp (s/mm)
TP/01	TBC	TBC	TBC	TBC	TBC	TBC

S = Start
T = Time
D = Depth

Trial Pit	Invert of Trial Pit (m)	Average Vp (s/mm)
TP01	0.90	30.00
AVERAGE Vp		30.00

NOTE
For PAC - an infiltration Vp of 30 has been assumed. For detailed design FW infiltration testing will be required

Acceptable Vp between 12 & 100 s/mm
BUILDING REGS part H

Vp (Average time in seconds for water to drop 1mm) =	30	s		
Number of persons served by treatment plant per dwelling =	3.33			
Floor area of drainage field required (At=p*Vp*0.2) =	20	m^2		
Number of dwellings =	1			
Total required area =	20	m^2		
Proposed distribution layer width (W_2) =	0.9	m		
Total length required =	23	m		
Length of each row =	8	m		
Number of rows required =	2.88	=	3	*(Rounded Up)*
Total Width of drainage Field =	5.7	m		

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Drainage Field Details

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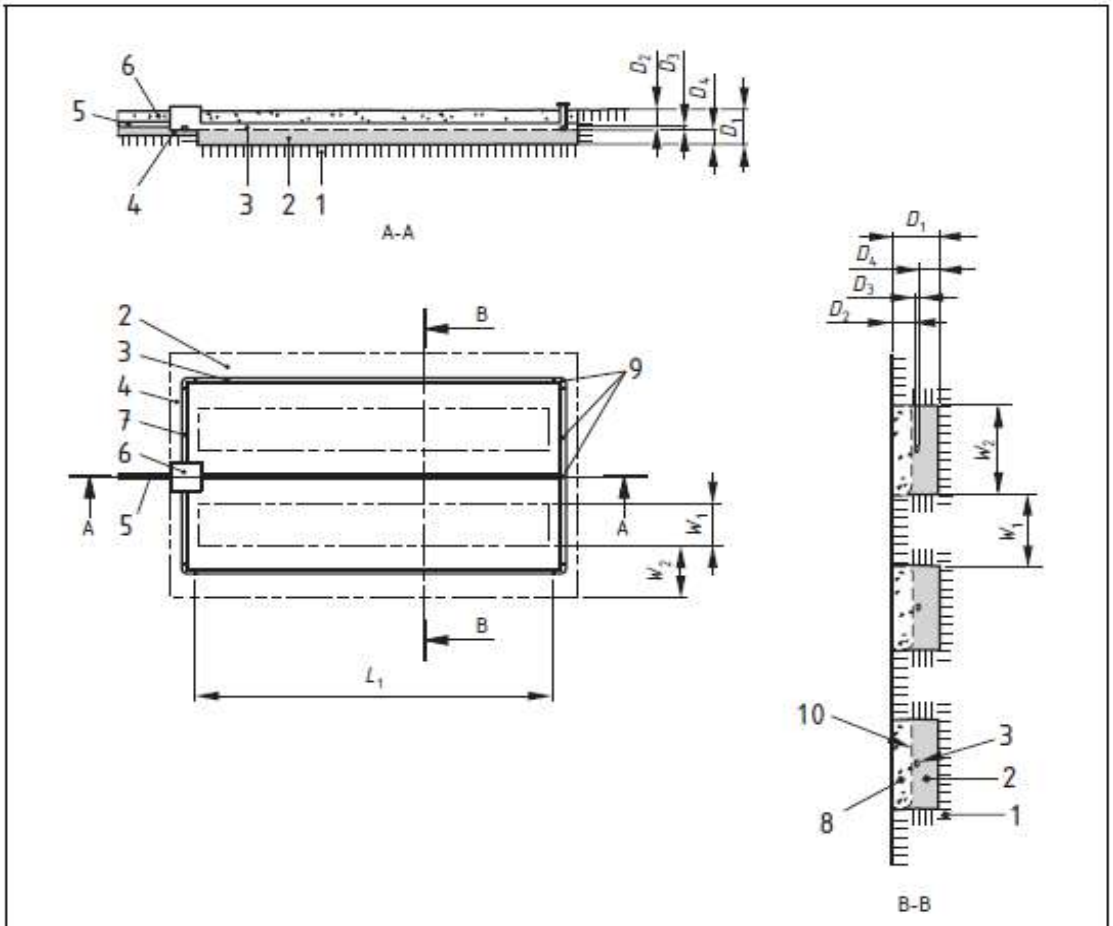
Figure 4 Cross-section of an infiltration trench, example with three trenches



Key

A	Longitudinal cross-section	9	End connection with ventilation and access, if necessary
B	Plan	10	Geotextile membrane
1	Subsoil	D_1	Total depth $\leqslant$ 1.0 m
2	Distribution layer	D_2	Backfill depth $\geqslant$ 0.2 m
3	Infiltration pipe	D_3	Infiltration pipe diameter + 0 m to 0.1 m of granular fill material (same as in the distribution layer)
4	Sand layer, if necessary to level distribution chamber and pipework	D_4	Distribution layer thickness beneath infiltration pipe, 0.2 m to 0.3 m
5	Connection pipe		
6	Distribution chamber		
7	Distribution pipe	W_1	Natural ground width between trenches $\geqslant$ 1 m
8	Backfill	W_2	Distribution layer width 0.3 m to 0.9 m
		L_1	Distribution layer length $\leqslant$ 30 m

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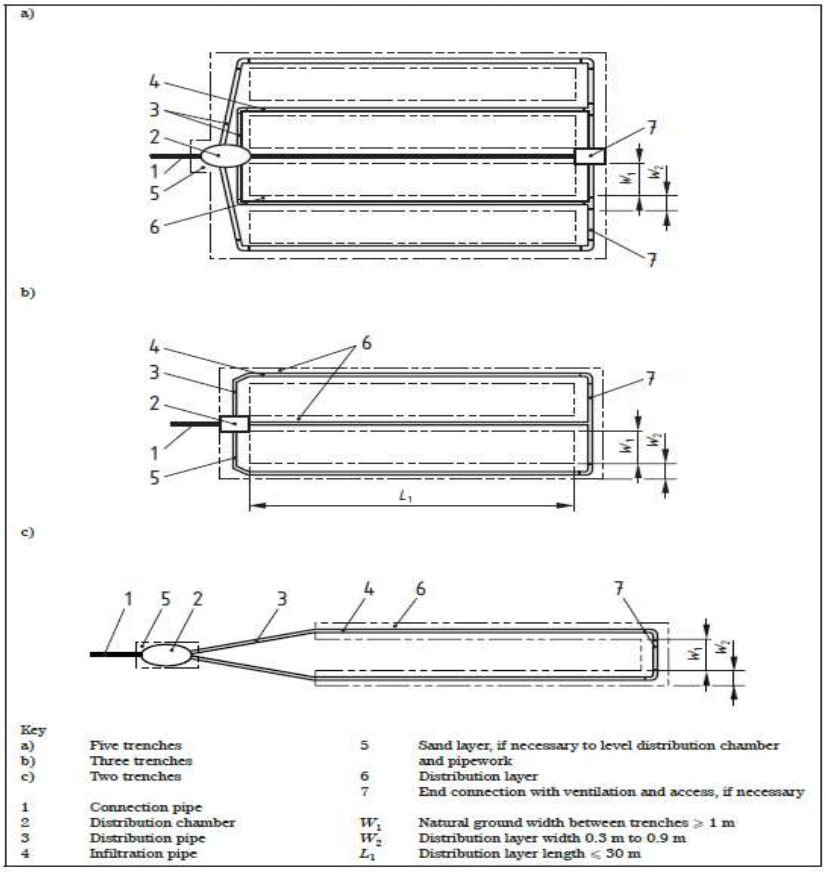
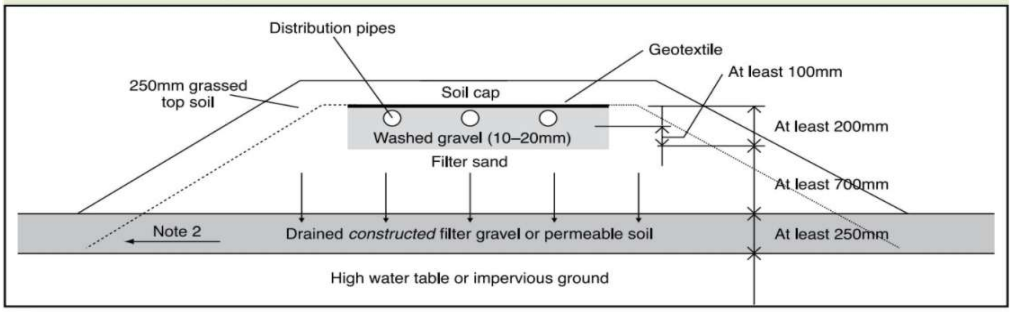
Figure 5 Infiltration trench, alternate layout examples



Key

a)	Five trenches	5	Sand layer, if necessary to level distribution chamber and pipework
b)	Three trenches	6	Distribution layer
c)	Two trenches	7	End connection with ventilation and access, if necessary
1	Connection pipe		
2	Distribution chamber	W_1	Natural ground width between trenches ⩾ 1 m
3	Distribution pipe	W_2	Distribution layer width 0.3 m to 0.9 m
4	Infiltration pipe	L_1	Distribution layer length ⩽ 30 m

Diagram 2 **Drainage mound**



Notes:

1. To provide venting of the filter, the upstream ends of the distribution pipes may be extended vertically above mound level and capped with a cowl or grille.
2. Surface water runoff and uncontaminated seepage from the surrounding soil may be cut off by shallow interceptor drains and diverted away from the mound. There must be no seepage of wastewater to such an interceptor drain.
3. Where the permeable soil is slow draining and overlaid on an impervious layer, the mound filter system should be constructed on a gently sloping site.

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By	RD	1841	C&S	DF / 4	C01	
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Rev	Date	Details				Tel: 01792 805010

Part

Field Location Plan

REF

OUTPUT