Proposed Foul & Surface Water Drainage Report

FSWDR-001

Land Adjacent Methodist Church, Moresby Parks, Whitehaven, Cumbria, CA28 8XG

Proposed 5No Dwelling

24/07/2021

Document Control

Date	Issue Number	Change/Amendment	Author:
24/07/2021	First Issue	Following request of planning condition 4/18/2044/0F1	

Contents

Surface & Foul Water Drainage Report
Proposed Planning Application - 4/18/2044/0f1 Surface Water Drainage Design and Supporting Information

1. Site History

The site is classified as a Brownfield site with no known history of any site contamination as per the phase 1 & 2 desktop study and ground investigation report, the site was previously the former Catholic Chapel and part of the grounds of the Methodist Chapel use for worship only. The site is approximately 1930m² sloping to the west of the site that parallels the former railway line.

2. Ground Conditions

We excavated several holes around the site to determine the ground conditions throughout the site. The tests were carried out in brown clay which will provide substrata for forming the soakaways, also we have had a phase ground investigation report conducted confirming consistent ground conditions throughout the site with the proposed soakaway being set at 1000mm below finish ground level.
133.00

3. Weather Conditions

The percolation tests were carried out on the 21st July 2021 with the weather being above average for the time of year and dry throughout the week.

4. Percolation Test

The tests and data used where carried out and formulated using Approved Document Part H & BRE 365 Soakaway Design.

5. Drainage

Option 1 – traditional Soakaway designed in accordance with Part H & BRE365
Option 2 – connect to the existing surface water system (Not connecting to the main combined sewerage system) – still to be located

6. Option 1

This was the preferred SUDS drainage system as the existing connection has not been established
Percolation test data (Approved Document Part H)
4no test holes at 300mm x 300mm set below incoming flow level, the water was timed between 75% & 25% in seconds as below;

1. **Vp**
   Test 1 – 170:44 mins
   Test 2 – 110:12 mins
   Test 3 – 128:55 mins
   Test 4 – 164:25 mins
   Average percolation time – 143 min
   Vp - 143 x 60 / 150 = 57 sec per mm

2. **Roof area**

Based on a property with a floor area of 75m² (based on Type A largest including conservatory)
A x 1.29 (roof pitch factor)
Surface water - 75m² x 1.29 = 96.75m²

3. Incoming Water

Based upon 20mm total rainfall
96.75m² x 0.020 = 1.93m³ (surface water)
Total Incoming water = 1.93m³

4. Soil filtration

f= 10-3
3Vp
0.001 = **5.84m³**
(3x57)171

5. Outfall Volume

f = Soil filtration – **d** = Duration of storm in minutes
$O = as^{50} \times f \times d$
O = .0135 x 5.84 x 60 = **4.73m³**

6. Soakaway Volume

1.93m³ + 4.73m³ = **6.63m³**

7. Soakaway Required

Part H Design – 6.63m³ + 5% voids = **6.96m³**
BRE Design (see attached calcs) = **9.07m³**

Soakaway Tank Calculations

House Type A (Tank Size – 2.4m x 3.0m x 1.26m) - **9.070m²** (Calcs cover plots 2, 3, 4 and 5.)
House Type B (Tank Size – 2.4m x 2.4m x 1.26m) **- 7.250m²**
Road Area (Tank Size - 7.2m x 3.0m x 1.26m) - **26.200m²**

Soakaway trial holes taken from the edges and middle of the site – see drainage plan in appendix

8. Proposed drainage

Surface Water

In light of the above information it is proposed that the 9.07m³ soakaway will be situated within the rear gardens a minimum of 5m away from the dwelling.
Geotextile membrane wrapped trench filled Rainbox 3S Cells as manufactures recommendations providing 95% clear volume. All new surface water connections will be formed via proprietary connectors and solid drainage pipe around the dwelling Water fall intensity chart BRE 365

Foul Water

The foul water layout will be as the drainage plan consisting of the following;

- Utilise existing site 100mm foul sewer connection as approved at planning stage
- 100mm waving plastic drainage system
- 100mm concrete encasement (where required for protection)
- 1-80 falls minimum
- 450mm PPIC Inspection chambers at change of gradient and direction
- 4-bedroom dwelling = 6 people x 200lt per person per day = Total 1200lt per day norm average
- 1200lt per day norm average x 5no dwellings = 6000lts per day

ALL DRAINAGE WILL BE INSTALL AS UNITIED UTILITIES & APPROVED DOCUMENT PART H

9. Drainage levels, gradient and pipe sizes

Foul Inspection Chamber	Cover Level	Invert Level	Distance between chambers	Gradient
FIC 1	133.00	132.00	Existing	
FIC 2	133.00	132.15	9.100	1/60
FIC 2.1	133.50	132.30	11.000	1/73
FIC 2.2	133.50	132.40	4.600	1/46
FIC 3	133.00	132.20	2.000	1/40
FIC 3.1	133.50	132.35	8.900	1/59
FIC 3.2	133.50	132.45	4.500	1/45
FIC 4	133.00	132.40	12.000	1/60
FIC 4.1	133.50	132.55	8.000	1/53
FIC 4.2	133.50	132.65	4.500	1/45
FIC 5	133.00	132.60	13.500	1/68
FIC 5.1	133.50	132.75	8.600	1/57
FIC 5.2	133.50	132.90	4.000	1/26
FIC 5.3	133.50	133.00	4.500	1/45
FIC 6	133.50	132.70	3.000	1/60
FIC 7	134.05	133.00	19.500	1/65
FIC 7.1	134.85	133.50	11.000	1/22
FIC 7.2	134.85	134.00	17.200	1/17
FIC 7.3	134.85	134.30	6.300	1/21
Surface Inspection Chamber	**Cover Level**	**Invert Level**	**Distance between chambers**	**Gradient**
SIC 1	134.40	134.00		
SIC 2	133.00	132.60		
SIC 2.1	133.50	132.90	18.800	1/62
SIC 3	133.00	132.60		
SIC 3.1	133.50	132.80	15.500	1/77
SIC 4	133.00	132.60		
SIC 4.1	133.50	132.90	17.000	1/57
SIC 5	133.00	132.60		
SIC 5.1	133.50	132.90	19.000	1/63
RSIC 1	133.75	133.80		
RSIC 2	133.90	133.80	10.200	1/51
RSIC 3	134.05	134.00	9.200	1/61
RSIC 4	134.65	134.15	13.600	1/68
RSIC 5	134.85	134.35		

10. Drainage Management

Each dwelling will be responsible for its own drainage due to the drainage design it allows clear demarcation of responsibility, most of the foul water drainage system will be adopted as a lateral drain by United Utilities as it takes more than one dwelling and elsewhere each dwelling will be responsible for its on drainage until such point.
Surface water has been designed so that each dwelling is responsible for its own surface water management having its own plot soakaway, the common areas have been (road) has been designed for permeable sets of the private shared access and will be the responsibility of the managements company legally appointed to manage the maintenance and upkeep of these areas.
It should be noted that the design of the drains is fully compliant with the building regulation and British Standards and as such should surpass the life span of the buildings. (60 years)
The drains shall be jetted, cleaned & CCTV inspected on a 5-yearly basis with any findings or recommendation fully implemented by the management company or the drain/plot owner.

11. Appendix

Fig 1 – Cross section A of Soakaway

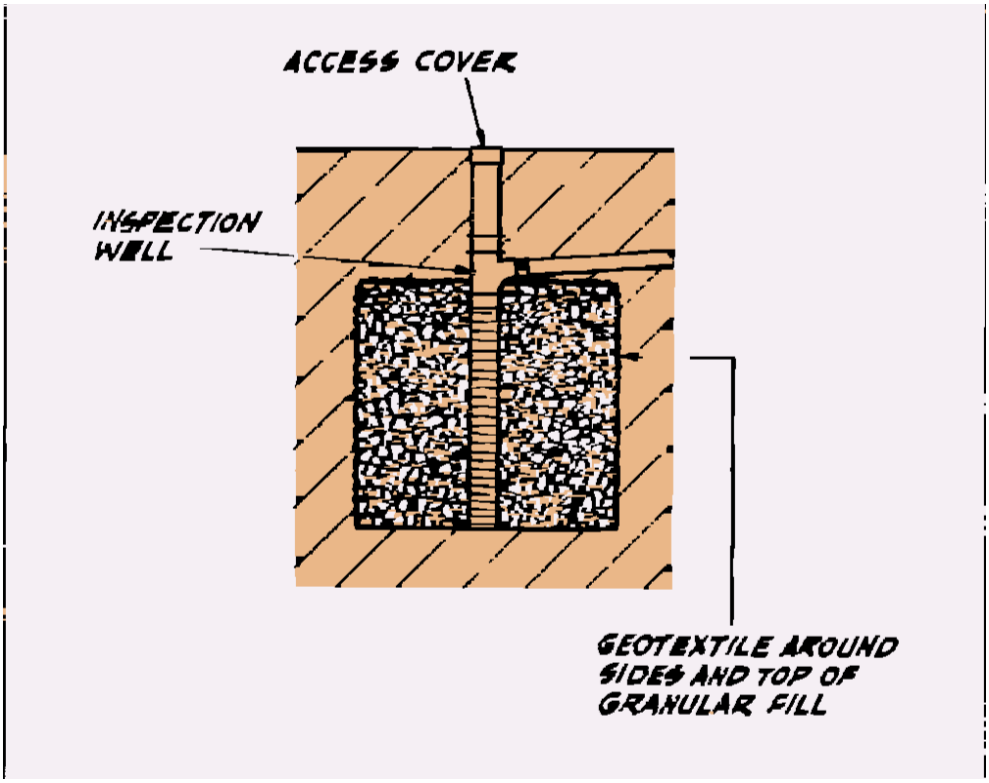


Fig 2 - Cross Section B of Soakaway

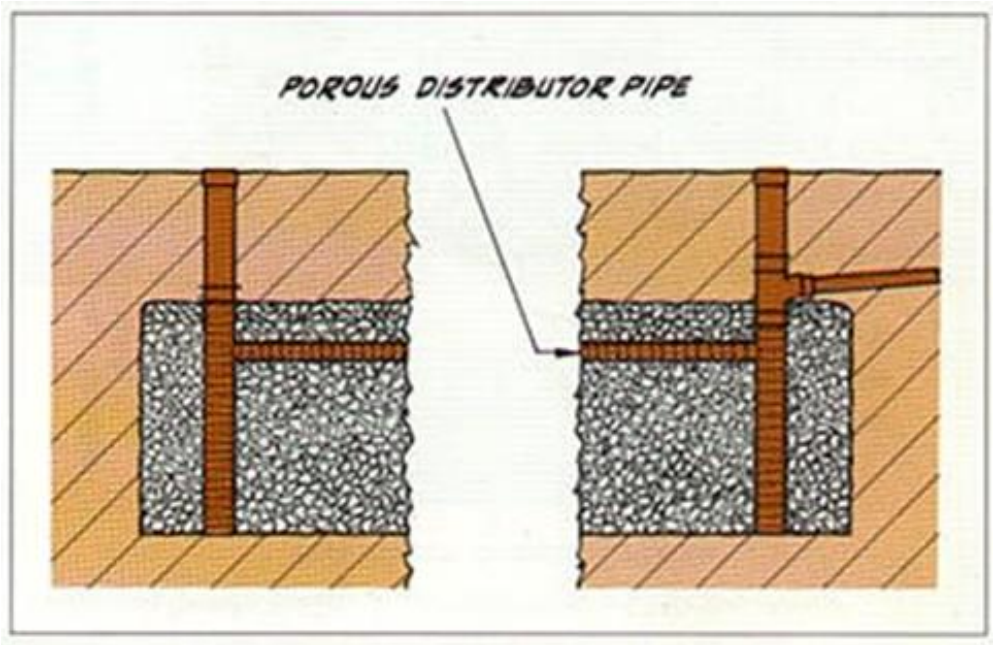


Fig 3 – National rainfall tables

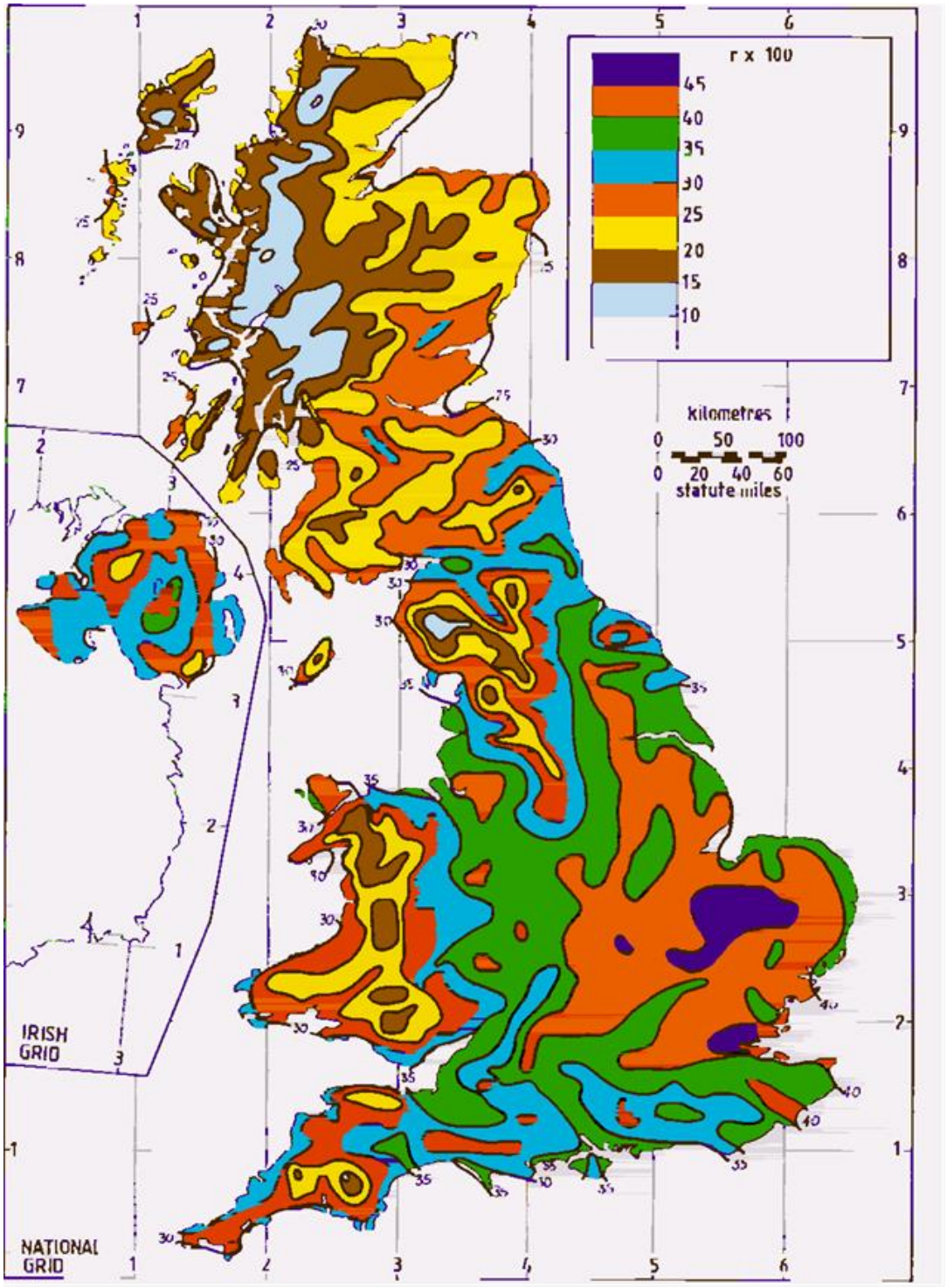
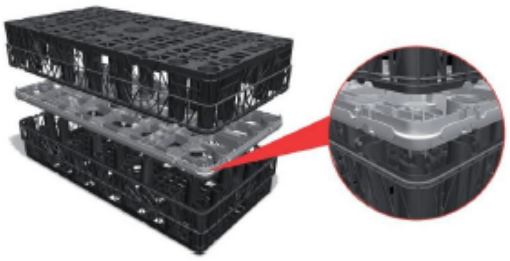


Fig 4 – Rainbox 3S/core surface water attenuation/Soakaway system

rainbox® 3S

Technical Data Sheet

The RAINBOX® 3S crate consists of two half-boxes and a centre plate; assemble these prior to their installation within the crate structure.



Dimensions:	1200 x 600 x 420mm
Gross Volume:	302 L
Storage Volume:	290 L
Void ratio:	96 %
Materials:	Polypropylene
Recyclable:	100 %
Approximate weight:	11.5 Kg
Inspectable:	Yes

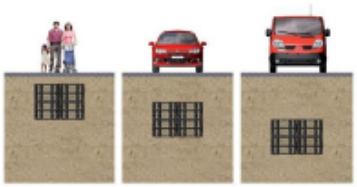
Crates are linked by clips

Connection Options

The RAINBOX® 3S comes with pre-formed cut-outs for connecting pipework up to 160mm OD. For larger sizes, up to 400mm OD, specially made adaptor plates can be used.

Design & Installation Guidance

Vertical loading to the crate structure is determined by the cumulative loads associated with the backfill and any loads linked to operations (vehicular loads (live loads) or permanent structures (dead loads)). Horizontally loading is determined by the pressure exerted by the earth.



The resulting information determines the minimum and maximum covering height and the maximum excavation depth.
Table 1 shows the parameters for different applications.

Table 1

(For Guidance Only*)

	Load (GVW)		
	Pedestrians	Small Vehicles ≤ 3T	Vehicles ≤ 12T**
Coverage in m (based on backfill φ' 30° and density 20kN/m³)			
Min.	0.30	0.50	1.20
Max.	2.50	2.20	2.00
Max Excavation Depth in m			
with backfill φ' 20°	2.90	2.90	2.90
with backfill φ' 25°	3.80	3.80	3.50
with backfill φ' 30°	4.00	4.00	4.00

* The installer of the Rainbox 3S system should ensure that a structural design check in line with CIRIA C680 has been carried out prior to work commencing.
** Use by heavier vehicles may be permissible depending on site conditions. Please contact JDP Technical Support for more information.

JDP Technical Support – Tel: 01228 794426; E-mail: technical@jdpipes.co.uk

JDP reserve the right to make alterations to this document without prior notice or update. Information correct as of 1st August 2017.

rainbox® 3S

BBA Agrément Certificate 17/5489

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BBA APPROVAL INSPECTION TESTING CERTIFICATION
TECHNICAL APPROVALS FOR CONSTRUCTION

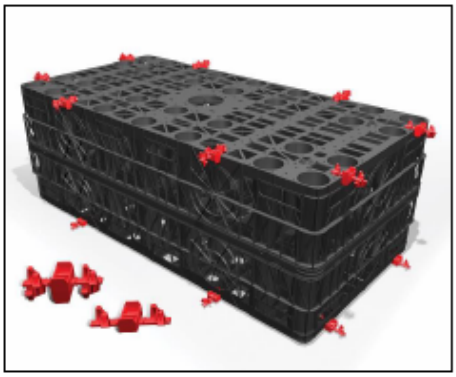
Agrément Certificate
17/5469
Product Sheet 1

DYKA STORMWATER MANAGEMENT SYSTEMS

DYKA RAINBOX 3S STORMWATER MANAGEMENT SYSTEM

This Agrément Certificate Product Sheet[1] relates to the DYKA Rainbox 3S[2] Stormwater Management System, comprising polypropylene modules which can be used to construct below-ground water storage attenuation tanks or soakaways, to manage stormwater run-off from impermeable surfaces.

(1) Hereinafter referred to as 'Certificate'.
(2) Rainbox 3S is a registered trademark.



CERTIFICATION INCLUDES:

- factors relating to compliance with Building Regulations where applicable
- factors relating to additional non-regulatory information where applicable
- independently verified technical specification
- assessment criteria and technical investigations
- design considerations
- installation guidance
- regular surveillance of production
- formal three-yearly review.

KEY FACTORS ASSESSED

Hydraulic design — data are provided in this Certificate to assist in the design of a below-ground stormwater management system using DYKA Rainbox 3S (see section 6).

Structural performance — the system has adequate strength and stiffness to resist short- and long-term loading when used in accordance with this Certificate (see section 7).

Maintenance — data are provided in this Certificate to assist in planning the maintenance of a completed DYKA Rainbox 3S Stormwater Management System installation (see section 11).

Durability — the system will have a life in excess of 50 years when installed in accordance with this Certificate (see section 12).

The BBA has awarded this Certificate to the company named above for the system described herein. This system has been assessed by the BBA as being fit for its intended use provided it is installed, used and maintained as set out in this Certificate.

On behalf of the British Board of Agrément

Date of First issue: 12 January 2018

Paul Valentine
Technical Exellence director

Claire Curtis-Thomas
Chief Executive

The BBA is a UKAS accredited certification body – Number 113.
The schedule of the current scope of accreditation for product certification is available in pdf format via the UKAS link on the BBA website at www.bbacerts.co.uk
Readers are advised to check the validity and latest issue number of this Agrément Certificate by either referring to the BBA website or contacting the BBA direct.

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www.bbacerts.co.uk

Regulations

In the opinion of the BBA, the DYKA Rainbox 35 Stormwater Management System, if installed, used and maintained in accordance with this Certificate, can satisfy or contribute to satisfying the relevant requirements of the following Building Regulations (the presence of a UK map indicates that the subject is related to the Building Regulations in the region or regions of the UK depicted):

The Building Regulations 2010 (England and Wales) (as amended)

Requirement:	**H3(3)**	**Rainwater drainage**
Comment:		The system can be used in a construction to satisfy this Requirement. See section 6 of this Certificate.
Regulation:	**7**	**Materials and workmanship**
Comment:		The system is acceptable. See section 12 and the *Installation* part of this Certificate.

The Building (Scotland) Regulations 2004 (as amended)

Regulation:	**8(1)(2)**	**Durability, workmanship and fitness of materials**
Comment:		The system can contribute to satisfying this Regulation. See sections 11 and 12 and the *Installation* part of this Certificate.
Regulation:	**9**	**Building standards applicable to construction**
Standard:	3.6	Surface water drainage
Comment:		The system can contribute to a construction satisfying this Standard, with reference to clauses 3.6.1[(1)(2)] to 3.6.5[(1)(2)]. See section 6 of this Certificate.
Standard:	7.1(a)(b)	Statement of sustainability
Comment:		The system can contribute to satisfying the relevant requirements of Regulation 9, Standards 1 to 6, and therefore will contribute to a construction meeting a bronze level of sustainability as defined in this Standard.
Regulation:	**12**	**Building standards applicable to conversions**
Comment:		Comments in relation to the system under Regulation 9, Standards 1 to 6 also apply to this Regulation, with reference to clause 0.12.1[(1)(2)] and Schedule 6[(1)(2)].

(1) Technical Handbook (Domestic).
(2) Technical Handbook (Non-Domestic).

The Building Regulations (Northern Ireland) 2012 (as amended)

Regulation:	**23(a)(i)(iii)(b)**	**Fitness of materials and workmanship**
Comment:		The system is acceptable. See section 12 and the *Installation* part of this Certificate.
Regulation:	**82**	**Rainwater drainage**
Comment:		The system can be used in a construction to satisfy this Regulation. See section 6 of this Certificate.

Construction (Design and Management) Regulations 2015
Construction (Design and Management) Regulations (Northern Ireland) 2016

Information in this Certificate may assist the client, designer (including Principal Designer) and contractor (including Principal Contractor) to address their obligations under these Regulations.

See sections: 1 *Description* (1.1), 3 *Delivery and site handling* (3.3, 3.5 and 3.6) and 15 *Procedure* (15.1 and 15.10) of this Certificate.

Technical Specification

1 Description

1.1 The DYKA Rainbox 35 Stormwater Management System comprises modular units manufactured from polypropylene (see Table 1 and Figure 1) that clip together on site to form tanks of the required dimension. The units have pre-formed sockets to enable connection with 110 and 160 mm diameter pipework (to BS EN 1401-1 : 2009).

Table 1 Characteristics of units

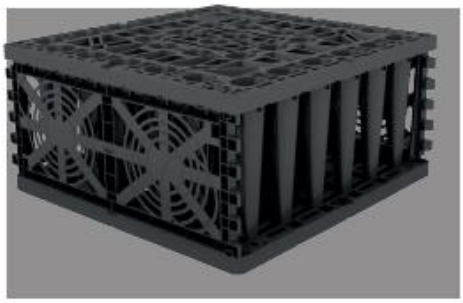
Characteristic (unit)	Value
Dimensions (nominal) (l x w x h) (mm)	1200 x 600 x 420
Volume (nominal) (m^3)	0.3024
Storage volume (nominal) (m^3)	0.2903
Porosity (%)	96
Nominal mass per cell (kg)	11

1.2 Half and Full Click Connectors are manufactured from red polypropylene and used to secure the units together (see Figure 1).

RAINBOX CORE

Stormwater Management Systems

JDP Nature's Network



	Crate	Baseplate
Dimensions (mm)	800 x 800 x 350	800 x 800 x 40
Gross Volume (m3)	0.225m3	0.025m3
Net Volume (m3)	0.217m3	0.020m3
Material	Polypropylene	Polypropylene
Weight	9kg	4kg
Void Ratio	>96% depending on number of layers	
Inspectable	Yes, when combined with RAINBOX CUBE	
*UCS Vertical	340 kN/m2	
*UCS Lateral	110 kN/m2	

**Ultimate Compressive Strength*

Load				
	<3T	12T	30T	40T
Based on backfill φ' 300 density 20kN/m2 and tank of 0.74m (2 crates deep)				
*Cover in m **				
Min. Cover	0.26	0.62	0.68	0.82
Max. Cover	3.65	3.40	3.40	3.40
*Max. Installation Depth in m **				
With Backfill φ' 260	3.93	3.67	3.67	3.67
With Backfill φ' 300	4.86	4.58	4.58	4.58
With Backfill φ' 340	5.10	4.82	4.82	4.82
With Backfill φ' 380	4.88	4.61	4.61	4.61

**It is advised that structural design calculations are carried out prior to work commencing.*
***Installation depths and loadings outside of the information in this table may be permissible depending on site conditions. Contact JDP for more information*

Endeavour Drive, Basildon (UK)

Housing Estate, Aberdeenshire (UK)

Tel 0800 195 1212 or Email contact@jdpipes.co.uk or visit www.jdpipes.co.uk

Fig 5 – Environment Agency Flood Maps

Environment Agency

Flood map for planning

Your reference	Location (easting/northing)	Created
Mr M Jordan	**299732/519219**	**4 Jul 2021 19:18**

Your selected location is in flood zone 1, an area with a low probability of flooding.

This means:

- you don't need to do a flood risk assessment if your development is smaller than 1 hectare and not affected by other sources of flooding
- you may need to do a flood risk assessment if your development is larger than 1 hectare or affected by other sources of flooding or in an area with critical drainage problems

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

The Open Government Licence sets out the terms and conditions for using government data. https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/

Page 1 of 2

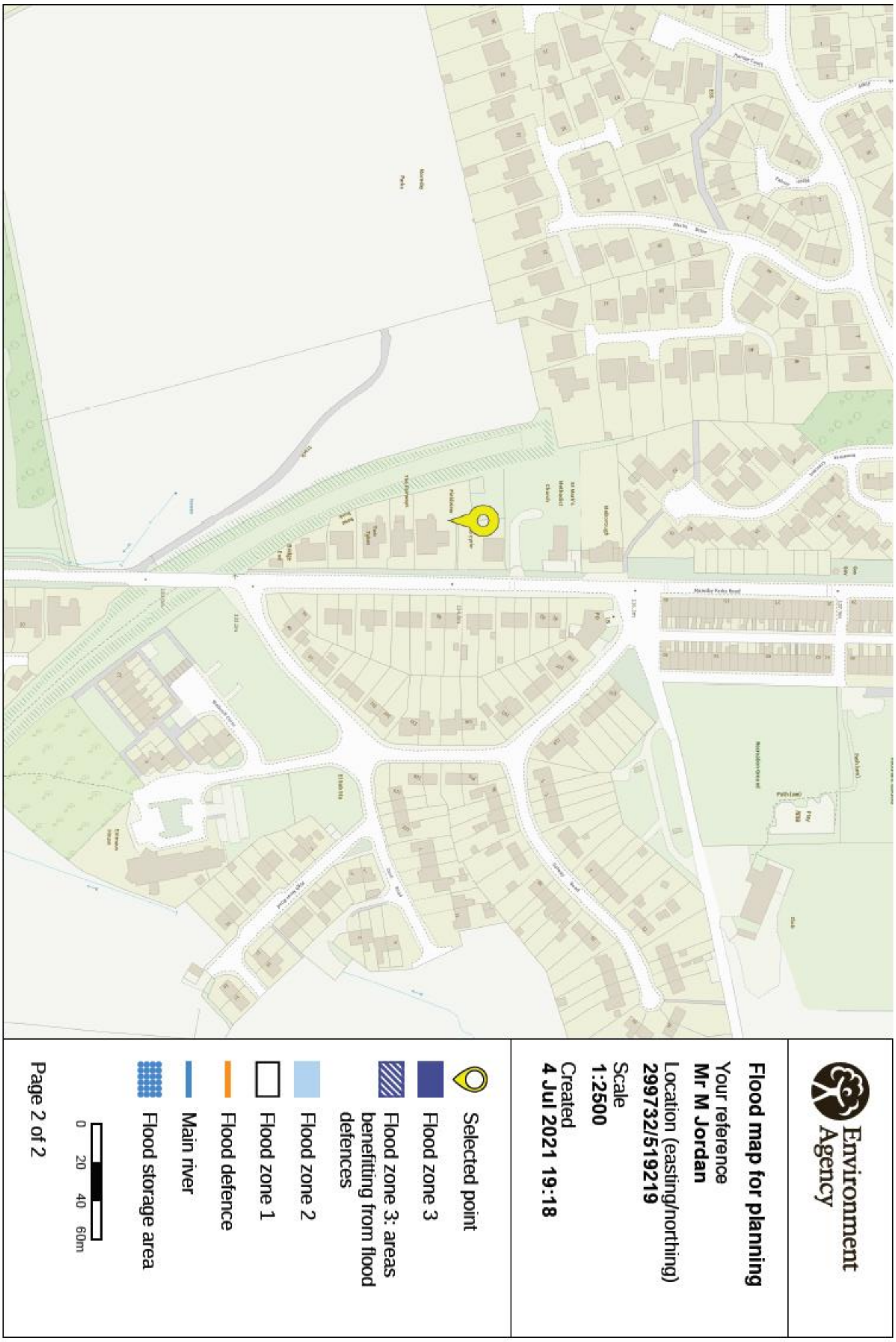


Fig 6 – Percolation Calculation Methodology - BRE

Percolation test method to calculate area of drainage field for Septic tanks or sewage treatment systems.

Step 1: Excavate a test hole 300mm square x 300mm deep below proposed invert level of the drainage field trench bottom
Step 2: Fill the test hole with water and allow drain away over night
Step 3: Refill to a depth of 300mm and note time taken in seconds to drain away from 75% full to 25% full (i.e. 150mm drop in level from 225mm to 75mm)
Step 4: Repeat the procedure in two more test holes and calculate the average of the three results as follows: $\frac{\text{test 1 + test 2+ test 3}}{3}$ = **average time taken**
Step 5: Calculate the Vp (average time in seconds for the water to drop 1mm) as follows:
For example: If average time above took 2700 seconds
(i) Divide 2700 seconds by 150mm depth of water
(ii) $\frac{2700}{150}$ = 18 Vp* (see note below*)
(iii) Area of trench = number of persons to use property X Vp X 0.25
Therefore: 5 persons X 18 X 0.25 = 13.5m2 of effluent drain required.
(iv) To calculate actual length of trench divide 13.5 by width of the trench required therefore: $\frac{13.5\text{m}2}{0.6\text{m wide}}$ = **22m (Minimum permitted area is 30m long x 0.6m wide)**

* Vp should range between 12 and 100 to be successful; otherwise the system should be designed by a drainage specialist.

Typical section through a septic tank/sewage treatment system effluent drainage field (not to scale)

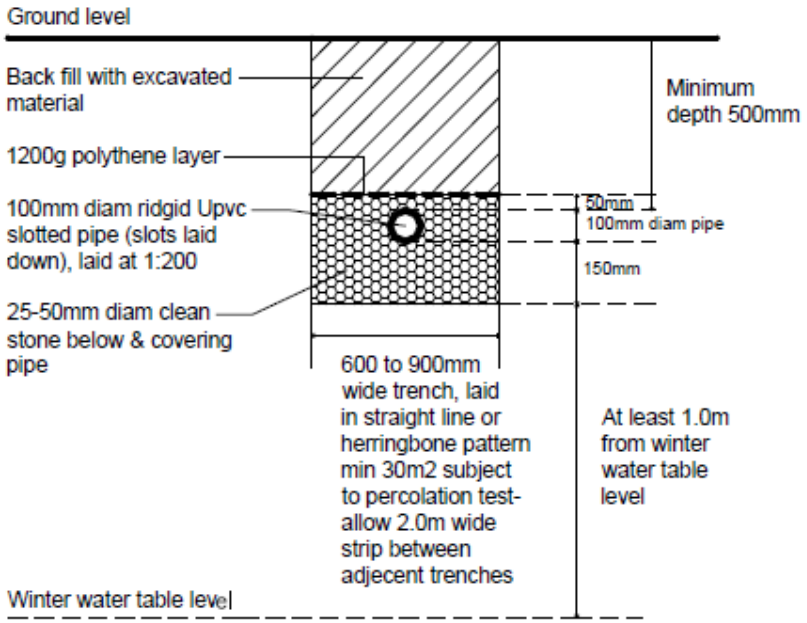


Fig 7 – BRE Soakaway Design – JDP Roof Type A

J D P Limited		Page 1
Townfoot Longtown, Carlisle Cumbria CA6 5LY	2107-a101 - Roof A Moresby Parks, CA28 8XG Tank Size: 2.4m x 3.0m x 1.26m	Micro Drainage
Date 28/07/21 File 2107-A101LAND ADJACENT ...	Designed by GA Checked by	
Micro Drainage	Source Control 2014.1	

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 903 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	8.302	0.302	0.0	2.1	O K
30 min Summer	8.427	0.427	0.1	2.9	O K
60 min Summer	8.575	0.575	0.1	3.9	O K
120 min Summer	8.741	0.741	0.1	5.1	O K
180 min Summer	8.839	0.839	0.1	5.7	O K
240 min Summer	8.903	0.903	0.1	6.2	O K
360 min Summer	8.977	0.977	0.1	6.7	O K
480 min Summer	9.022	1.022	0.1	7.0	O K
600 min Summer	9.048	1.048	0.1	7.2	O K
720 min Summer	9.063	1.063	0.1	7.3	O K
960 min Summer	9.083	1.083	0.1	7.4	O K
1440 min Summer	9.096	1.096	0.1	7.5	O K
2160 min Summer	9.080	1.080	0.1	7.4	O K
2880 min Summer	9.048	1.048	0.1	7.2	O K
4320 min Summer	8.977	0.977	0.1	6.7	O K
5760 min Summer	8.912	0.912	0.1	6.2	O K
7200 min Summer	8.852	0.852	0.1	5.8	O K
8640 min Summer	8.796	0.796	0.1	5.4	O K
10080 min Summer	8.746	0.746	0.1	5.1	O K
15 min Winter	8.302	0.302	0.0	2.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	93.237	0.0	19
30 min Summer	66.524	0.0	34
60 min Summer	45.415	0.0	64
120 min Summer	30.048	0.0	122
180 min Summer	23.229	0.0	182
240 min Summer	19.181	0.0	242
360 min Summer	14.497	0.0	362
480 min Summer	11.886	0.0	480
600 min Summer	10.176	0.0	600
720 min Summer	8.956	0.0	658
960 min Summer	7.312	0.0	776
1440 min Summer	5.477	0.0	1038
2160 min Summer	4.088	0.0	1452
2880 min Summer	3.315	0.0	1872
4320 min Summer	2.463	0.0	2684
5760 min Summer	1.998	0.0	3512
7200 min Summer	1.699	0.0	4320
8640 min Summer	1.489	0.0	5096
10080 min Summer	1.332	0.0	5848
15 min Winter	93.237	0.0	19

J D P Limited		Page 2
Townfoot Longtown, Carlisle Cumbria CA6 5LY	2107-a101 - Roof A Moresby Parks, CA28 8XG Tank Size: 2.4m x 3.0m x 1.26m	
Date 28/07/21 File 2107-A101LAND ADJACENT ...	Designed by GA Checked by	
Micro Drainage	Source Control 2014.1	

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	8.427	0.427	0.1	2.9	O K
60 min Winter	8.575	0.575	0.1	3.9	O K
120 min Winter	8.743	0.743	0.1	5.1	O K
180 min Winter	8.841	0.841	0.1	5.8	O K
240 min Winter	8.905	0.905	0.1	6.2	O K
360 min Winter	8.982	0.982	0.1	6.7	O K
480 min Winter	9.029	1.029	0.1	7.0	O K
600 min Winter	9.058	1.058	0.1	7.2	O K
720 min Winter	9.075	1.075	0.1	7.3	O K
960 min Winter	9.087	1.087	0.1	7.4	O K
1440 min Winter	9.094	1.094	0.1	7.5	O K
2160 min Winter	9.062	1.062	0.1	7.3	O K
2880 min Winter	9.011	1.011	0.1	6.9	O K
4320 min Winter	8.906	0.906	0.1	6.2	O K
5760 min Winter	8.812	0.812	0.1	5.6	O K
7200 min Winter	8.729	0.729	0.1	5.0	O K
8640 min Winter	8.654	0.654	0.1	4.5	O K
10080 min Winter	8.588	0.588	0.1	4.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	66.524	0.0	33
60 min Winter	45.415	0.0	62
120 min Winter	30.048	0.0	120
180 min Winter	23.229	0.0	180
240 min Winter	19.181	0.0	238
360 min Winter	14.497	0.0	352
480 min Winter	11.886	0.0	466
600 min Winter	10.176	0.0	576
720 min Winter	8.956	0.0	682
960 min Winter	7.312	0.0	798
1440 min Winter	5.477	0.0	1094
2160 min Winter	4.088	0.0	1556
2880 min Winter	3.315	0.0	2016
4320 min Winter	2.463	0.0	2892
5760 min Winter	1.998	0.0	3696
7200 min Winter	1.699	0.0	4536
8640 min Winter	1.489	0.0	5352
10080 min Winter	1.332	0.0	6144

J D P Limited		Page 3
Townfoot Longtown, Carlisle Cumbria CA6 5LY	2107-a101 - Roof A Moresby Parks, CA28 8XG Tank Size: 2.4m x 3.0m x 1.26m	Micro Drainage
Date 28/07/21 File 2107-A101LAND ADJACENT ...	Designed by GA Checked by	
Micro Drainage	Source Control 2014.1	

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	1.000
Region	England and Wales	Cv (Winter)	1.000
M5-60 (mm)	16.200	Shortest Storm (mins)	15
Ratio R	0.256	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.009

Time (mins) From:	To:	Area (ha)
0	4	0.009

J D P Limited		Page 4
Townfoot Longtown, Carlisle Cumbria CA6 5LY	2107-a101 - Roof A Moresby Parks, CA28 8XG Tank Size: 2.4m x 3.0m x 1.26m	Micro Drainage
Date 28/07/21 File 2107-A101LAND ADJACENT ...	Designed by GA Checked by	
Micro Drainage	Source Control 2014.1	

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 8.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.03077 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.03077

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	7.2	7.2	1.261	0.0	21.2
1.260	7.2	21.2			

Fig 8 – BRE Soakaway Design – JDP Roof Type B

J D P Limited		Page 1
Townfoot Longtown, Carlisle Cumbria CA6 5LY	2107-a101 - Roof B Moresby Parks, CA28 8XG Tank Size: 2.4m x 2.4m x 1.26m	Micro Drainage
Date 28/07/21 File 2107-a101Land Adjacent ...	Designed by GA Checked by	
Micro Drainage	Source Control 2014.1	

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 890 minutes.

	Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15	min Summer	8.334	0.334	0.0	1.8	O K
30	min Summer	8.473	0.473	0.0	2.6	O K
60	min Summer	8.637	0.637	0.1	3.5	O K
120	min Summer	8.822	0.822	0.1	4.5	O K
180	min Summer	8.930	0.930	0.1	5.1	O K
240	min Summer	9.000	1.000	0.1	5.5	O K
360	min Summer	9.082	1.082	0.1	5.9	O K
480	min Summer	9.131	1.131	0.1	6.2	O K
600	min Summer	9.159	1.159	0.1	6.4	O K
720	min Summer	9.176	1.176	0.1	6.5	O K
960	min Summer	9.200	1.200	0.1	6.6	O K
1440	min Summer	9.216	1.216	0.1	6.7	O K
2160	min Summer	9.201	1.201	0.1	6.6	O K
2880	min Summer	9.167	1.167	0.1	6.4	O K
4320	min Summer	9.088	1.088	0.1	6.0	O K
5760	min Summer	9.016	1.016	0.1	5.6	O K
7200	min Summer	8.951	0.951	0.1	5.2	O K
8640	min Summer	8.890	0.890	0.1	4.9	O K
10080	min Summer	8.836	0.836	0.1	4.6	O K
15	min Winter	8.334	0.334	0.0	1.8	O K

	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15	min Summer	93.237	0.0	19
30	min Summer	66.524	0.0	34
60	min Summer	45.415	0.0	64
120	min Summer	30.048	0.0	122
180	min Summer	23.229	0.0	182
240	min Summer	19.181	0.0	242
360	min Summer	14.497	0.0	362
480	min Summer	11.886	0.0	480
600	min Summer	10.176	0.0	596
720	min Summer	8.956	0.0	644
960	min Summer	7.312	0.0	762
1440	min Summer	5.477	0.0	1024
2160	min Summer	4.088	0.0	1448
2880	min Summer	3.315	0.0	1848
4320	min Summer	2.463	0.0	2680
5760	min Summer	1.998	0.0	3464
7200	min Summer	1.699	0.0	4256
8640	min Summer	1.489	0.0	5096
10080	min Summer	1.332	0.0	5848
15	min Winter	93.237	0.0	19

J D P Limited		Page 2
Townfoot Longtown, Carlisle Cumbria CA6 5LY	2107-a101 - Roof B Moresby Parks, CA28 8XG Tank Size: 2.4m x 2.4m x 1.26m	
Date 28/07/21 File 2107-a101Land Adjacent ...	Designed by GA Checked by	
Micro Drainage	Source Control 2014.1	

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	8.474	0.474	0.0	2.6	O K
60 min Winter	8.638	0.638	0.1	3.5	O K
120 min Winter	8.823	0.823	0.1	4.5	O K
180 min Winter	8.932	0.932	0.1	5.1	O K
240 min Winter	9.003	1.003	0.1	5.5	O K
360 min Winter	9.088	1.088	0.1	6.0	O K
480 min Winter	9.140	1.140	0.1	6.3	O K
600 min Winter	9.171	1.171	0.1	6.4	O K
720 min Winter	9.189	1.189	0.1	6.5	O K
960 min Winter	9.204	1.204	0.1	6.6	O K
1440 min Winter	9.213	1.213	0.1	6.7	O K
2160 min Winter	9.179	1.179	0.1	6.5	O K
2880 min Winter	9.124	1.124	0.1	6.2	O K
4320 min Winter	9.008	1.008	0.1	5.5	O K
5760 min Winter	8.907	0.907	0.1	5.0	O K
7200 min Winter	8.817	0.817	0.1	4.5	O K
8640 min Winter	8.738	0.738	0.1	4.1	O K
10080 min Winter	8.668	0.668	0.1	3.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	66.524	0.0	33
60 min Winter	45.415	0.0	62
120 min Winter	30.048	0.0	120
180 min Winter	23.229	0.0	180
240 min Winter	19.181	0.0	238
360 min Winter	14.497	0.0	352
480 min Winter	11.886	0.0	464
600 min Winter	10.176	0.0	574
720 min Winter	8.956	0.0	680
960 min Winter	7.312	0.0	780
1440 min Winter	5.477	0.0	1082
2160 min Winter	4.088	0.0	1540
2880 min Winter	3.315	0.0	1992
4320 min Winter	2.463	0.0	2856
5760 min Winter	1.998	0.0	3696
7200 min Winter	1.699	0.0	4536
8640 min Winter	1.489	0.0	5280
10080 min Winter	1.332	0.0	6056

J D P Limited		Page 3
Townfoot Longtown, Carlisle Cumbria CA6 5LY	2107-a101 - Roof B Moresby Parks, CA28 8XG Tank Size: 2.4m x 2.4m x 1.26m	
Date 28/07/21 File 2107-a101Land Adjacent ...	Designed by GA Checked by	
Micro Drainage	Source Control 2014.1	

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	1.000
Region	England and Wales	Cv (Winter)	1.000
M5-60 (mm)	16.200	Shortest Storm (mins)	15
Ratio R	0.256	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.008

Time (mins) From:	To:	Area (ha)
0	4	0.008

J D P Limited		Page 4
Townfoot Longtown, Carlisle Cumbria CA6 5LY	2107-a101 - Roof B Moresby Parks, CA28 8XG Tank Size: 2.4m x 2.4m x 1.26m	
Date 28/07/21 File 2107-a101Land Adjacent ...	Designed by GA Checked by	
Micro Drainage	Source Control 2014.1	

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 8.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.03077 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.03077

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	5.8	5.8	1.261	0.0	18.2
1.260	5.8	18.2			

Fig 9 – BRE Soakaway Design – JDP Road Soakaway

J D P Limited		Page 1
Townfoot Longtown, Carlisle Cumbria CA6 5LY	2107-a101 - Road Moresby Parks, CA28 8XG Tank Size: 7.2m x 3.0m x 1.26m	
Date 28/07/21 File 2107-a101Land Adjacent ...	Designed by GA Checked by	
Micro Drainage	Source Control 2014.1	

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 1114 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	8.279	0.279	0.1	5.7	O K
30 min Summer	8.396	0.396	0.1	8.1	O K
60 min Summer	8.534	0.534	0.1	11.0	O K
120 min Summer	8.691	0.691	0.2	14.2	O K
180 min Summer	8.785	0.785	0.2	16.1	O K
240 min Summer	8.847	0.847	0.2	17.4	O K
360 min Summer	8.924	0.924	0.2	19.0	O K
480 min Summer	8.974	0.974	0.2	20.0	O K
600 min Summer	9.006	1.006	0.2	20.6	O K
720 min Summer	9.026	1.026	0.2	21.0	O K
960 min Summer	9.045	1.045	0.2	21.4	O K
1440 min Summer	9.060	1.060	0.2	21.7	O K
2160 min Summer	9.051	1.051	0.2	21.6	O K
2880 min Summer	9.026	1.026	0.2	21.1	O K
4320 min Summer	8.969	0.969	0.2	19.9	O K
5760 min Summer	8.913	0.913	0.2	18.7	O K
7200 min Summer	8.860	0.860	0.2	17.6	O K
8640 min Summer	8.809	0.809	0.2	16.6	O K
10080 min Summer	8.760	0.760	0.2	15.6	O K
15 min Winter	8.279	0.279	0.1	5.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	93.237	0.0	19
30 min Summer	66.524	0.0	34
60 min Summer	45.415	0.0	64
120 min Summer	30.048	0.0	124
180 min Summer	23.229	0.0	182
240 min Summer	19.181	0.0	242
360 min Summer	14.497	0.0	362
480 min Summer	11.886	0.0	482
600 min Summer	10.176	0.0	600
720 min Summer	8.956	0.0	720
960 min Summer	7.312	0.0	874
1440 min Summer	5.477	0.0	1112
2160 min Summer	4.088	0.0	1516
2880 min Summer	3.315	0.0	1932
4320 min Summer	2.463	0.0	2768
5760 min Summer	1.998	0.0	3576
7200 min Summer	1.699	0.0	4400
8640 min Summer	1.489	0.0	5192
10080 min Summer	1.332	0.0	5952
15 min Winter	93.237	0.0	19

J D P Limited		Page 2
Townfoot Longtown, Carlisle Cumbria CA6 5LY	2107-a101 - Road Moresby Parks, CA28 8XG Tank Size: 7.2m x 3.0m x 1.26m	
Date 28/07/21 File 2107-a101Land Adjacent ...	Designed by GA Checked by	
Micro Drainage	Source Control 2014.1	

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	8.396	0.396	0.1	8.1	O K
60 min Winter	8.534	0.534	0.1	11.0	O K
120 min Winter	8.692	0.692	0.2	14.2	O K
180 min Winter	8.787	0.787	0.2	16.1	O K
240 min Winter	8.849	0.849	0.2	17.4	O K
360 min Winter	8.928	0.928	0.2	19.0	O K
480 min Winter	8.979	0.979	0.2	20.1	O K
600 min Winter	9.013	1.013	0.2	20.8	O K
720 min Winter	9.035	1.035	0.2	21.2	O K
960 min Winter	9.057	1.057	0.2	21.7	O K
1440 min Winter	9.063	1.063	0.2	21.8	O K
2160 min Winter	9.045	1.045	0.2	21.4	O K
2880 min Winter	9.006	1.006	0.2	20.6	O K
4320 min Winter	8.917	0.917	0.2	18.8	O K
5760 min Winter	8.832	0.832	0.2	17.1	O K
7200 min Winter	8.752	0.752	0.2	15.4	O K
8640 min Winter	8.679	0.679	0.2	13.9	O K
10080 min Winter	8.612	0.612	0.1	12.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	66.524	0.0	33
60 min Winter	45.415	0.0	62
120 min Winter	30.048	0.0	122
180 min Winter	23.229	0.0	180
240 min Winter	19.181	0.0	238
360 min Winter	14.497	0.0	354
480 min Winter	11.886	0.0	470
600 min Winter	10.176	0.0	582
720 min Winter	8.956	0.0	694
960 min Winter	7.312	0.0	906
1440 min Winter	5.477	0.0	1140
2160 min Winter	4.088	0.0	1604
2880 min Winter	3.315	0.0	2076
4320 min Winter	2.463	0.0	2980
5760 min Winter	1.998	0.0	3816
7200 min Winter	1.699	0.0	4680
8640 min Winter	1.489	0.0	5456
10080 min Winter	1.332	0.0	6256

J D P Limited		Page 3
Townfoot Longtown, Carlisle Cumbria CA6 5LY	2107-a101 - Road Moresby Parks, CA28 8XG Tank Size: 7.2m x 3.0m x 1.26m	
Date 28/07/21 File 2107-a101Land Adjacent ...	Designed by GA Checked by	
Micro Drainage	Source Control 2014.1	

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	1.000
Region	England and Wales	Cv (Winter)	1.000
M5-60 (mm)	16.200	Shortest Storm (mins)	15
Ratio R	0.256	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.025

Time (mins) From:	To:	Area (ha)
0	4	0.025

J D P Limited		Page 4
Townfoot Longtown, Carlisle Cumbria CA6 5LY	2107-a101 - Road Moresby Parks, CA28 8XG Tank Size: 7.2m x 3.0m x 1.26m	
Date 28/07/21 File 2107-a101Land Adjacent ...	Designed by GA Checked by	
Micro Drainage	Source Control 2014.1	

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 8.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.03077 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.03077

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	21.6	21.6	1.261	0.0	48.1
1.260	21.6	48.1			

Fig 10 – Marshal Drive Sett Tegula Permeable Paving – Driveways & Shared Private Access

Marshalls

Creating Better Spaces

INSTALLATION DETAILS FOR DRIVESETT TEGULA PRIORA PAVING

General Information

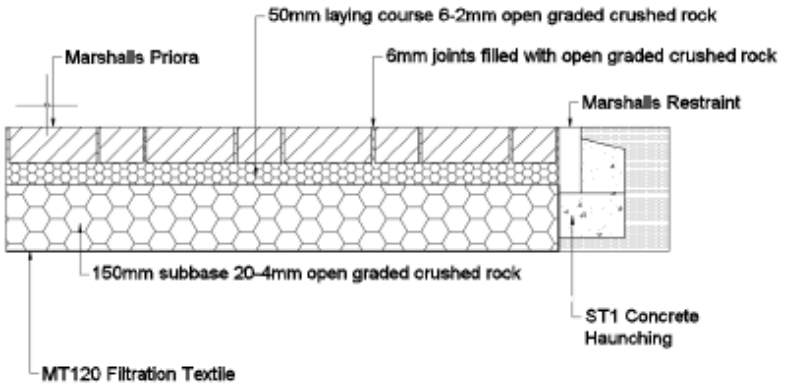
On delivery, the product should be inspected. If there are any issues, please report them immediately and do not commence installation.

Before installation commences a certain amount of sorting of the product may be required to ensure consistency of colour, texture and dimensional tolerance.

Check for services and contact the service provider for advice if gas or electric services run through the intended Priora site. Care must be taken when constructing over sewer, rainwater and water pipes to ensure that the services remain supported for their full length by undisturbed material and are surrounded on the remaining sides by a minimum of 150mm of 4-20mm material.

Health and Safety Information

Safe working practices should be employed at all times during the construction process and all necessary Personal Protective Equipment (PPE) should be worn.



Domestic application only www.marshalls.co.uk Page 1 of 7
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Landscape House, Premier Way, Lowfields Business Park, Elland, HX5 9HT

Aggregates required
1 cubic metre equals 1.8 tonnes

Sqm drive	10	20	30	40	50	60	70	80	90	100
20mm tonne	3.5	7	10.5	14	17.5	21	24.5	28	31.5	35
6mm tonne for laying course	0.9	1.8	2.7	3.6	4.5	5.4	6.3	7.2	8.1	9.0

6mm Jointing Aggregate – 10kg per sqm

- Priora must be laid with a 20-6mm and 6-2mm clean graded angular aggregate (Open Graded Crushed Rock and Open Graded Crushed Gravel)
- The aggregate is available from Hanson Group direct on a dedicated phone line 0845 600 1616

Pavement design
A sub-base of 150mm of 20-4mm clean crushed stone with well defined edges should prove to be sufficient. However the paving design must be based upon the prevalent ground conditions and type and frequency of anticipated loads.

Excavation
To allow the new permeable block paving to be installed correctly, a certain amount of excavation is usually required. The depth of this excavation will be the thickness of the required sub-base plus the laying course and the blocks. An extremely important factor to consider when working out the depth of excavation is that the finished surface level of the blocks must be a minimum of 150mm below the DPC (damp proof course) to prevent problems with rising damp.

Edge restraints
Edge restraints should be sufficiently robust to resist the lateral displacement from imposed loadings place upon the pavement and are installed prior to the installation of the sub-base. The restraint must provide a consistent vertical face to a level below the laying course material.
For steep inclines or gradients, (greater than 1:20) the provision of intermediate restraints should be considered. Their spacing should be related to the severity of incline and overall area of paving.

Construction considerations
The sub-base material should be placed in layers not exceeding 150mm in thickness and should be suitably compacted before the next layer is placed. Each layer should be thoroughly compacted to the thickness required.
Due to the nature of both the sub-layers and the block paving, care should be taken during the construction process to prevent dirt and detritus contaminating the sub-base and compromising the permeability of the system. The trafficking of the sub-base as a site access route should not be undertaken.

Should other construction or maintenance work take place close to the pavement which may affect the infiltration of the pavement, suitable protective measures should be taken.

Laying course

The final target thickness for the laying course should be 50mm.

Tolerances for laying course material are +/-20mm. However, due to the nature of the open-graded material, a reduction in the ability to reduce the thickness of the laying course due to compaction would be experienced when compared to a sand laying course. Therefore, it is important to ensure the initial placing and screeding of the open-graded laying course is as accurate as possible.

It may prove advantageous to trial a small area of open-graded material to ascertain the characteristics of the material under compaction to ensure accurate levels are achieved. Should any disturbance of the screeded laying course material occur prior to the placement of the blocks, the affected area should be re-screeded to ensure consistency between the affected area and the surrounding laying course. When screeding rails are removed on completion of the installation of the laying course, the affected area should be filled and re-screeded with corresponding laying course material and manually compacted. Care should be taken not to disturb adjacent prepared laying course material.

Wearing course

Laying

Paving units should be installed on the laying course material so that the final level is within the permitted surface tolerance. String lines should be utilised as often as required. This is necessary to ensure the bond pattern is maintained and straight lines are achieved in the finished paving.

The manufacturing tolerances of the paving units, profile of the site and frequency of string lines should be taken into consideration during installation.

Paving units should be laid such that the joint profile interlocks with its neighbouring units. Joint widths may be varied slightly in order to achieve straight lines or maintain bond. When laying block paving, the blocks should be mixed simultaneously from a minimum of 3 packs, taking vertically from each slice offered by the pack. This is necessary to ensure an even distribution of both the colours and any manufacturing tolerances offered by the blocks.

Lay whole units first, followed by cut units around obstacles or at edges. No paving unit should be cut down to less than one quarter of its original size to prevent looseness or dislodgement at a later date. Where it appears that only a small section of block will fit, the "inboard cutting" technique should be adopted. The use of a larger or full unit against the edge restraint, allows a small unit to be placed in the resulting space.

Where slopes, gradients or ramps are being constructed, placement of the paving units should commence at the lowest point ie: the bottom of the slope, working upwards. Where there is a risk of lateral movement of the paving units due to the gradient encountered, the provision of additional intermediate restraint should be considered.

Compaction
Compaction should be undertaken with a plate vibrator. Prior to final compaction of the surface, joints should be filled with the same grading of material as that used for the laying course. All joints should remain full of jointing material at all times, with periodic checking and replacing carried out where necessary.

General
The bond pattern should be suited to the application and likely use of the paving. Areas which receive frequent vehicle turning, accelerating or decelerating should be laid in a herringbone pattern. Stretcher bond may be used successfully in very lightly trafficked areas, providing the direction of the traffic is perpendicular to the laying pattern and the paving is not subjected to the above movements. Basket weave patterns should not be used in areas receiving vehicular traffic.

Cutting
Cutting may be carried out using a diamond tipped power saw, a block-splitting guillotine, or hammer and bolster. It must however be noted that the aesthetic finish achieved will depend greatly upon the choice of cutting mechanism and the skill of the installer. Cut blocks should be inserted prior to completion of the working period to prevent any movement of unrestrained blocks. Blocks should be cut such that the resultant joint width remains within the 2-6mm tolerance. When laying to tight curves it may not be always possible to maintain a maximum 6mm joint, in which case, cut or special shaped units may have to be considered.

Maintenance
In brief, Marshalls would recommend:

- Inspect at least twice a year, spring and autumn, and/or after a major storm
- Brush the surface to remove debris and encrusted sediment
- Maintain the area to be free of vegetation
- Replenish the joints when empty
- Ensure that the owner is aware of the pavement construction and the "do's and don'ts" of the system

Further Information
For technical advice on commercial installations, or when confronted by unusual problems or circumstances, please contact Marshalls Technical Advisory Services on 0370 411 2233, or by email on advisory.services@marshalls.co.uk

Silt	Very soft	Exudes between fingers when squeezed seek advice
Sandy Clay Silty Clay Clay		

The CBR of the rock or soil is significantly affected by moisture

Soil permeability

The domestic Priora system is only suitable for soil areas where infiltration applies and the test criteria have been met according to the standard permeability test. For the standard permeability test, a test hole should be dug for every 20m^2 of driveway. There should be a minimum of two holes. Holes/pits should be spaced evenly in relation to the proposed Priora area. The soil test is the key. If the sub-grade soil is not permeable then domestic Priora cannot be installed.

Surface gradient

- The intended Priora area must fall away from the property. The top surface of the driveway should finish at least 150mm below any adjoining DPC level.
- The area should also fall away from all properties and buildings.
- If the intended Priora system falls to the house, then depending on the gradient, water could discharge and pool in and around areas of the house structure. This could lead to damp areas appearing on the masonry leaf.
- If the driveway exceeds 20m in length and has a gradient greater than 1 in 100, then please contact the Technical Advisory Services Department for assistance.
- Depending on the gradient in relation to the length, additional construction processes will be required by the provision of baffles.

Discharge onto roadway

The domestic Priora area must not discharge onto surrounding public roadways and pathways or towards any buildings

Existing foundations

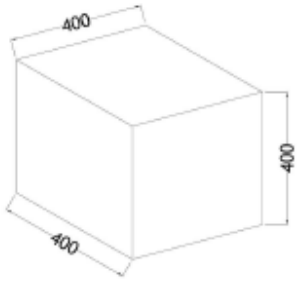
If the property lies adjacent to or is less then 600mm from the proposed domestic Priora driveway area, establish the depth of the house foundation before undertaking any soil test or Priora installation. The house foundation top surface must be a minimum of 600mm below the finished level of the Priora surface. The foundations area must not be disturbed as the integrity of the building may be affected over time. The level of water discharge must be above the level of the foundations to avoid instability at foundation level.

Rainwater catchment area (Driveway area)
No adjoining surfaces areas (rainwater pipes, roof areas etc) must drain onto and into the Priora driveway area. However, small areas, such as door steps and garage areas are acceptable providing that they don't exceed 5% of the driveway area.
If other areas are drained in addition to the driveway area then the hydraulic calculation will dictate the depth, thus increasing the 150mm depth for the 20mm open graded material.

Trees
When installing close to existing trees, tree roots smaller than 25mm diameter may be pruned back, preferably to a side branch, using a suitable pair of secateurs or hand saw. Roots larger than 25mm should only be severed following consultation with an arboriculturist, as they may be essential to the tree's health and stability. Protection of the pavement will also be required, hence the requirement of a permeable root barrier system, such as the Geoweb bio-barrier system (Fiberweb) or similar, which is non-surface protruding, so does not present a trip hazard once installed. Integrity of the pavement installation and intended life may be affected by the ingress of roots.

SOIL PERMEABILITY – based on the BRE Digest 365 test procedure

- Remove topsoil/paving material to exposed sub-grade soil
- Dig hole within sub-grade soil to the size shown below, ensure that all sides and the bottom surface of the hole are trimmed and levelled accordingly



- Fill hole with water and allow to drain away naturally. Repeat this process 3 times. If the water does not drain away at all then the sub-grade soil does not have adequate permeability properties

All pre-test and test work must be carried out for every $20m^2$ of driveway. There should be a minimum of two holes, equally spaced throughout the intended area to be paved. Due to the maximum length of time that the test may take, the time of day should be considered.

Fig 11 –Public Sewer Plan

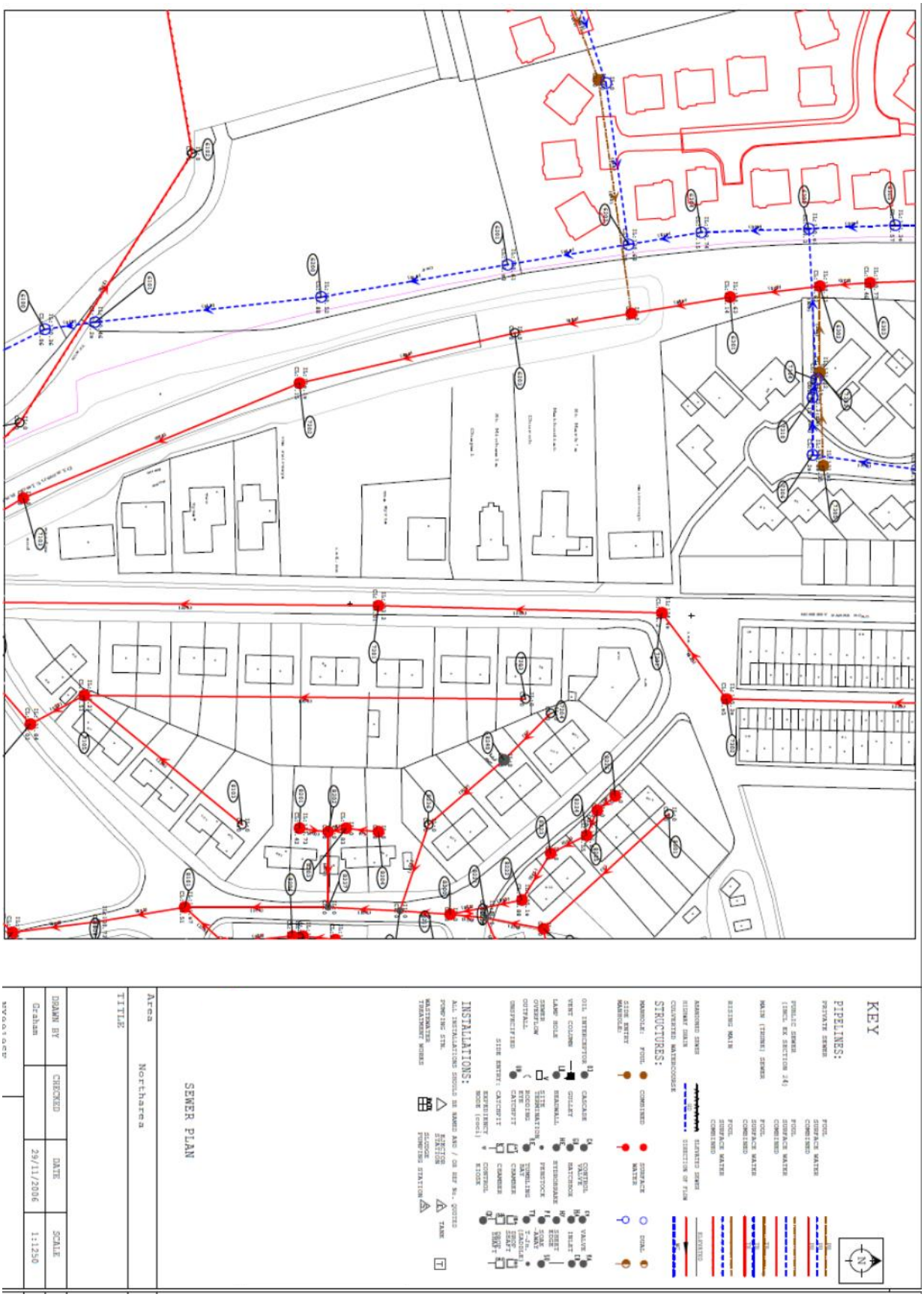
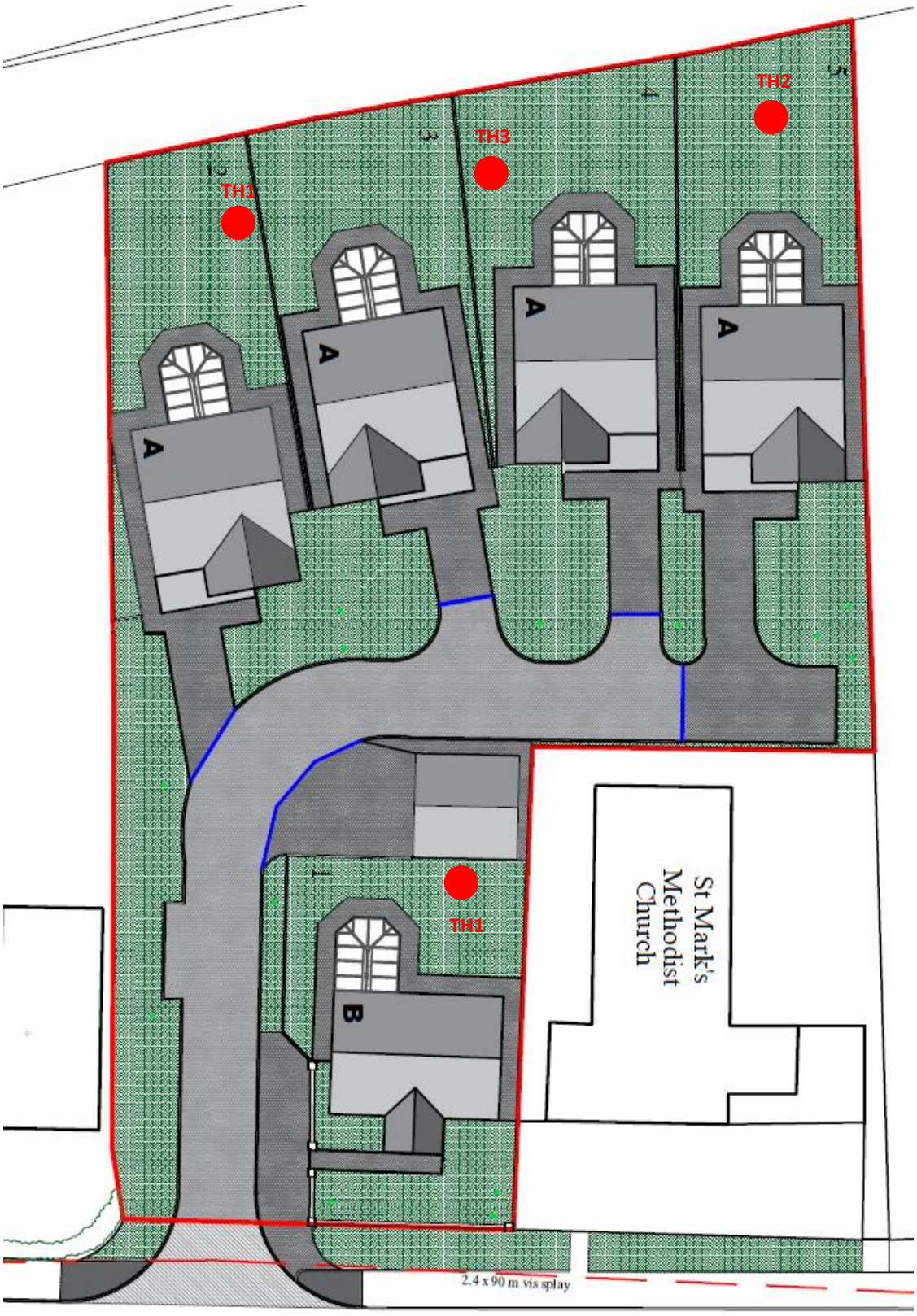


Fig 12 –Soakaway Test Points



THE END