

Our Ref: SHF.1132.260.HY.L.001.A

Date: 14th October 2022

Your Ref: SBC/2021/087161

FAO: Tom Hawes

Email: suds@kent.gov.uk

Dear Tom,

Consultation Response – 21/505498/OUT Land Off Swanstree Avenue, Sittingbourne, Kent, ME10 4LU

Introduction

Enzygo Ltd produced a Flood Risk Assessment (FRA - Reference: SHF.1132.260.HY.R.001.B, October 2021) in support of a planning application (Reference: 21/505498/OUT) for a proposed residential development located on land at the above 'Site'.

Following submission of the FRA, the Lead Local Flood Authority (LLFA – Kent County Council) issued a consultation response letter with comments (included in Attachment 1) requiring the submission of further information.

- Whilst it is appreciated that infiltration testing has been completed to BRE Digest 365, if infiltration was to be used at the BH1 location then the lowest infiltration rate measured there would be the 2.92x10⁻⁵m/s test and we would expect to see this used as a side infiltration coefficient not a base.***

The BH soakaway tests were carried out at varying depths. For BH1 these depths were 5, 8, and 10m below ground level (mBGL) see Attachment 2. As the drainage strategy proposes 15m deep BH soakaways, all three results have been inputted as side infiltration rates at the corresponding height from the borehole invert.

Soakaway Test Depth (mBGL)	Height above BH Invert (m)	Side Infiltration Rate (m/hr)
5	6.8	0.105
8	3.8	0.612
10	0	1.548

The base infiltration rate is set to 0.0 m/hr.

- The half drain time for the 1 in 100 year plus 40% Climate Change event is excessive at 39.33hrs. The calculations for the 1 in 2 and 1 in 30 year storms should also be provided to assess the half drain times in these events.***

Updating the base and side infiltration rates has reduced the half drain time to 779 minutes, the updated calculations are included in Attachment 3. This is less than the 24-hour half drain guidance therefore, the calculations for the 1 in 2 and 1 in 30- year storms are no longer required.

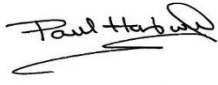
- As mentioned in Section 6.5.14 and as per KCC Pre-Application advice, we would expect to see details of other SuDS features at the next stage when a detailed layout has been produced.***

Once a detailed layout has been provided, Enzygo will be able to advise other suitable SuDS features to manage surface water runoff at source and conveyance through the Site.

Closure

We trust that the details presented herein are sufficient to remove the holding objection. If, for any reason you should have any queries or comments, please contact me.

Yours sincerely,



Dr Paul Hardwick *PhD, BSc (Hons), FGS, FRSA*

Technical Director

Enzygo Ltd

Attachment 1 – Kent County Council Letter



Emma Gore
Swale Borough Council
Swale House
East Street
Sittingbourne
Kent
ME10 3HT

Flood and Water Management
Invicta House
Maidstone
Kent
ME14 1XX
Website: www.kent.gov.uk/flooding
Email: suds@kent.gov.uk
Tel: 03000 41 41 41
Our Ref: SBC/2021/087161
Date: 11 November 2021

Application No: 21/505498/OUT

Location: Land Off Swanstree Avenue Sittingbourne Kent ME10 4LU

Proposal: Outline planning application for up to 135no. dwellings with public open space, landscaping and sustainable drainage system (SuDS) and vehicular access point (All matters reserved except for means of access).

Thank you for your consultation on the above referenced planning application.

This application is supported by a Flood Risk Assessment produced by Enzygo (September 2021). The method of discharging surface water is via infiltration using deep bore soakaways.

Kent County Council as Lead Local Flood Authority have the following comments:

1. Whilst it is appreciated that infiltration testing has been completed to BRE Digest 365, if infiltration was to be used at the BH1 location then the lowest infiltration rate measured there would be the $2.92 \times 10^{-5} \text{m/s}$ test and we would expect to see this used as a side infiltration coefficient not a base.
2. The half drain time for the 1 in 100 year plus 40% Climate Change event is excessive at 39.33hrs. The calculations for the 1 in 2 and 1 in 30 year storms should also be provided to assess the half drain times in these events.
3. As mentioned in Section 6.5.14 and as per KCC Pre-Application advice, we would expect to see details of other SuDS features at the next stage when a detailed layout has been produced.

We would recommend that further information is provided to respond to the comments above before the condition is approved.

This response has been provided using the best knowledge and information submitted as part of the planning application at the time of responding and is reliant on the accuracy of that information.

Yours faithfully,

Tom Hawes

Flood Risk Project Officer
Flood and Water Management

Attachment 2 – Borehole soakaway testing



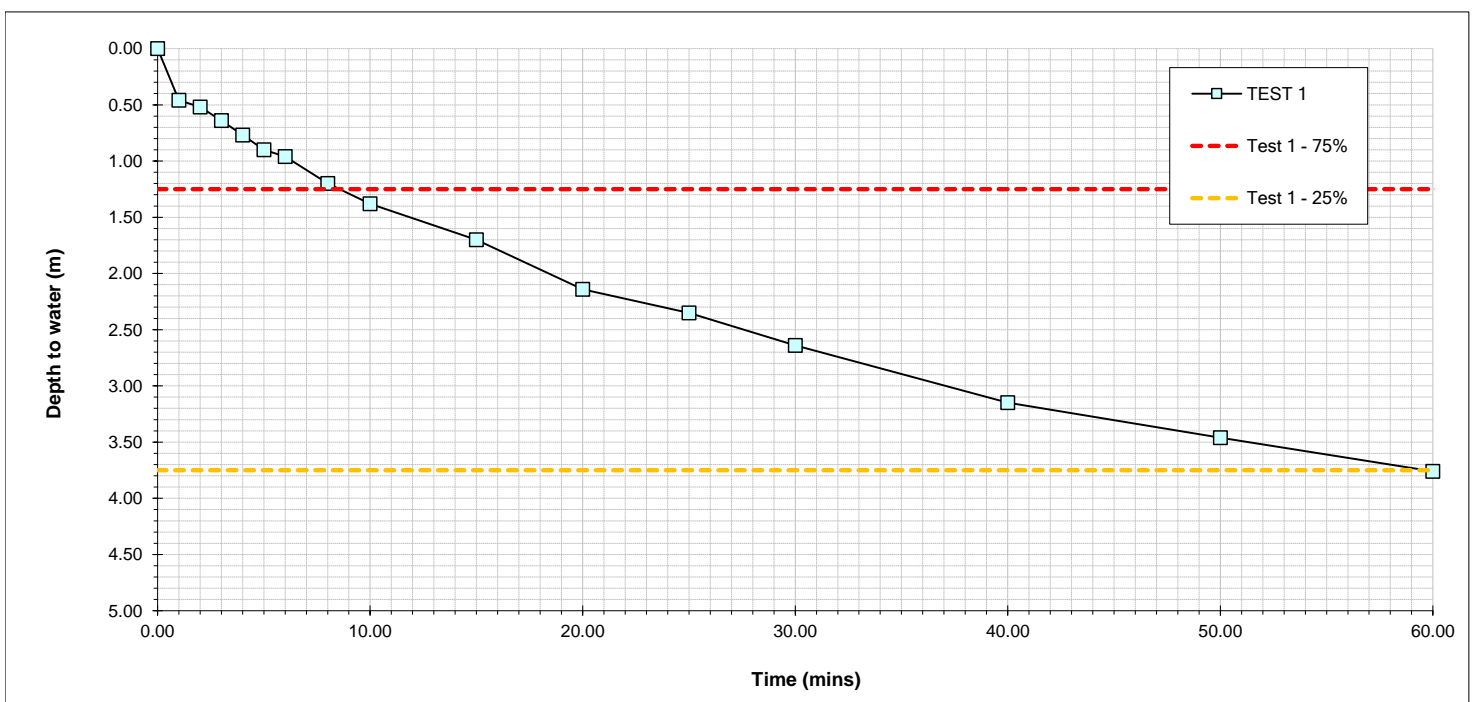
Site..... Swanstree Avenue
 Job Number..... SHF.1132.260
 Date of Test..... 26/07/2021

Soakaway Number..... BH1-1
 Diameter 0.15 m
 Casing Depth 4.00 m
 Borehole Depth..... 5.00 m
 Groundwater Level..... Dry m

BOREHOLE SOIL INFILTRATION RATE TEST
 See B.R.E. Digest 365, 1991, Soakaway Design.

Remarks - Please refer to BH1 log for ground conditions.	TEST 1		TEST 2		TEST 3	
	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
	0.0	0.00				
	1.0	0.46				
	2.0	0.52				
	3.0	0.64				
	4.0	0.77				
	5.0	0.90				
	6.0	0.96				
	8.0	1.20				
	10.0	1.38				
	15.0	1.70				
	20.0	2.14				
	25.0	2.35				
	30.0	2.64				
	40.0	3.15				
	50.0	3.46				
	60.0	3.76				
Effective Storage Depth	m	5.00				
75% Effective Storage Depth (i.e. depth below GL)	m	3.75				
25% Effective Storage Depth (i.e. depth below GL)	m	1.25				
Effective Storage Depth 75%-25%	m	2.50				
Time to fall to 75% effective depth	mins	8.50				
Time to fall to 25% effective depth	mins	60.00				
V (75%-25%)	m3	0.04				
a	m2	0.49				
t (75%-25%)	mins	51.50				
SOIL INFILTRATION RATE	m/s	2.92E-05				

DESIGN SOIL INFILTRATION RATE, f	n/a	m/s
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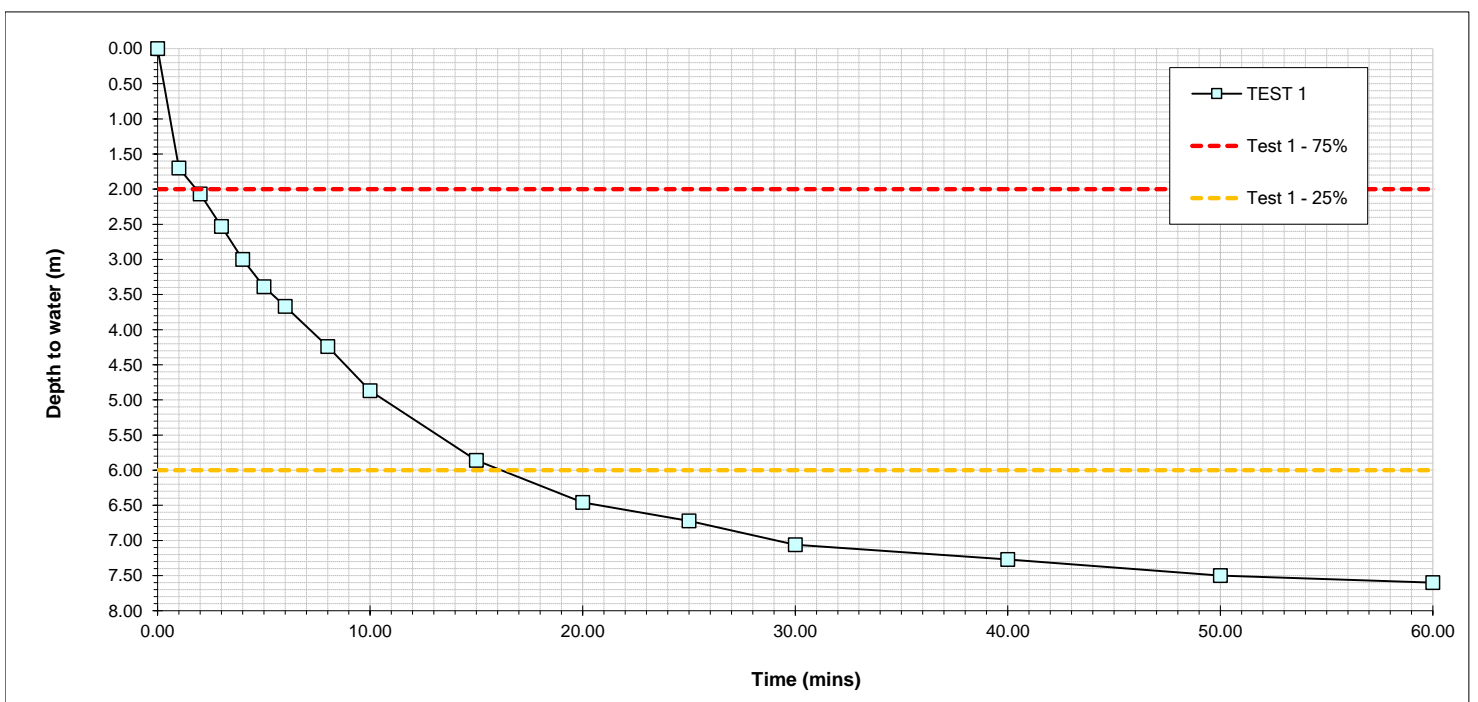
Site..... Swanstree Avenue
 Job Number..... SHF.1132.260
 Date of Test..... 26/07/2021

Soakaway Number..... BH1-2
 Diameter..... 0.15 m
 Casing Depth..... 7.00 m
 Borehole Depth..... 8.00 m
 Groundwater Level..... Dry m

BOREHOLE SOIL INFILTRATION RATE TEST
 See B.R.E. Digest 365, 1991, Soakaway Design.

Remarks - Please refer to BH1 log for ground conditions.	TEST 1		TEST 2		TEST 3	
	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
	0.0	0.00				
	1.0	1.70				
	2.0	2.07				
	3.0	2.53				
	4.0	3.00				
	5.0	3.39				
	6.0	3.67				
	8.0	4.24				
	10.0	4.87				
	15.0	5.86				
	20.0	6.46				
	25.0	6.72				
	30.0	7.06				
	40.0	7.27				
	50.0	7.50				
	60.0	7.60				
Effective Storage Depth	m	8.00				
75% Effective Storage Depth (i.e. depth below GL)	m	6.00				
25% Effective Storage Depth (i.e. depth below GL)	m	2.00				
Effective Storage Depth 75%-25%	m	2.00				
Effective Storage Depth 75%-25%	m	6.00				
Time to fall to 75% effective depth	mins	1.80				
Time to fall to 25% effective depth	mins	16.00				
V (75%-25%)	m3	0.07				
a	m2	0.49				
t (75%-25%)	mins	14.20				
SOIL INFILTRATION RATE	m/s	1.70E-04				

DESIGN SOIL INFILTRATION RATE, f	n/a	m/s
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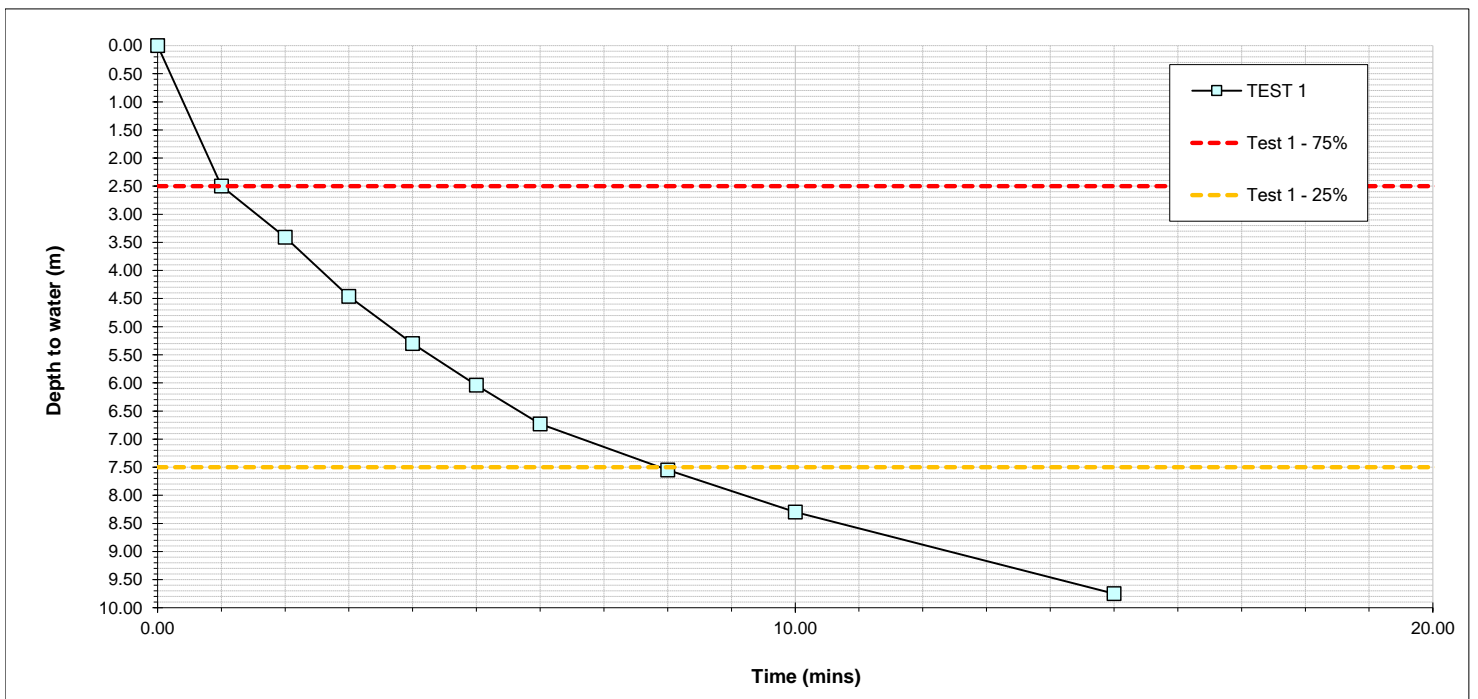
Site..... Swanstree Avenue
 Job Number..... SHF.1132.260
 Date of Test..... 26/07/2021

Soakaway Number..... BH1-3
 Diameter 0.15 m
 Casing Depth 9.00 m
 Borehole Depth..... 10.00 m
 Groundwater Level..... Dry m

BOREHOLE SOIL INFILTRATION RATE TEST
 See B.R.E. Digest 365, 1991, Soakaway Design.

Remarks - Please refer to BH1 log for ground conditions.	TEST 1		TEST 2		TEST 3	
	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
	0.0	0.00				
	1.0	2.50				
	2.0	3.41				
	3.0	4.46				
	4.0	5.30				
	5.0	6.04				
	6.0	6.73				
	8.0	7.55				
	10.0	8.30				
	15.0	9.75				
Effective Storage Depth m		10.00				
75% Effective Storage Depth m		7.50				
(i.e. depth below GL) m		2.50				
25% Effective Storage Depth m		2.50				
(i.e. depth below GL) m		7.50				
Effective Storage Depth 75%-25% m		5.00				
Time to fall to 75% effective depth mins		1.00				
Time to fall to 25% effective depth mins		8.00				
V (75%-25%) m3		0.09				
a m2		0.49				
t (75%-25%) mins		7.00				
SOIL INFILTRATION RATE m/s		4.30E-04				

DESIGN SOIL INFILTRATION RATE, f	n/a	m/s
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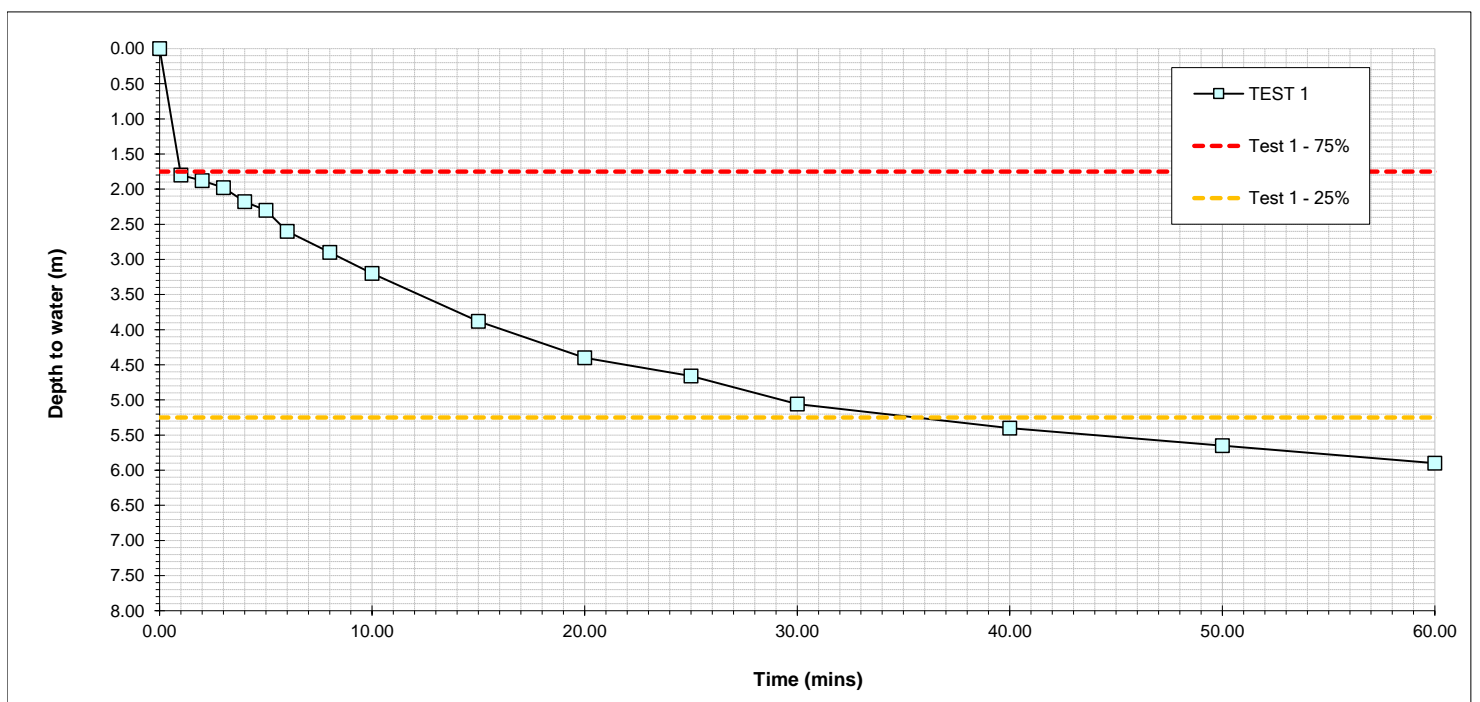
Site..... Swanstree Avenue
 Job Number..... SHF.1132.260
 Date of Test..... 26/07/2021

Soakaway Number..... BH2-1
 Diameter..... 0.15 m
 Casing Depth..... 5.00 m
 Borehole Depth..... 7.00 m
 Groundwater Level..... Dry m

BOREHOLE SOIL INFILTRATION RATE TEST
 See B.R.E. Digest 365, 1991, Soakaway Design.

Remarks - Please refer to BH2 log for ground conditions.	TEST 1		TEST 2		TEST 3	
	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
	0.0	0.00				
	1.0	1.80				
	2.0	1.88				
	3.0	1.98				
	4.0	2.18				
	5.0	2.30				
	6.0	2.60				
	8.0	2.90				
	10.0	3.20				
	15.0	3.88				
	20.0	4.40				
	25.0	4.66				
	30.0	5.06				
	40.0	5.40				
	50.0	5.65				
	60.0	5.90				
Effective Storage Depth	m	7.00				
75% Effective Storage Depth (i.e. depth below GL)	m	5.25				
25% Effective Storage Depth (i.e. depth below GL)	m	1.75				
Effective Storage Depth 75%-25%	m	3.50				
Time to fall to 75% effective depth	mins	1.00				
Time to fall to 25% effective depth	mins	36.00				
V (75%-25%)	m3	0.06				
a	m2	0.96				
t (75%-25%)	mins	35.00				
SOIL INFILTRATION RATE	m/s	3.07E-05				

DESIGN SOIL INFILTRATION RATE, f	n/a	m/s
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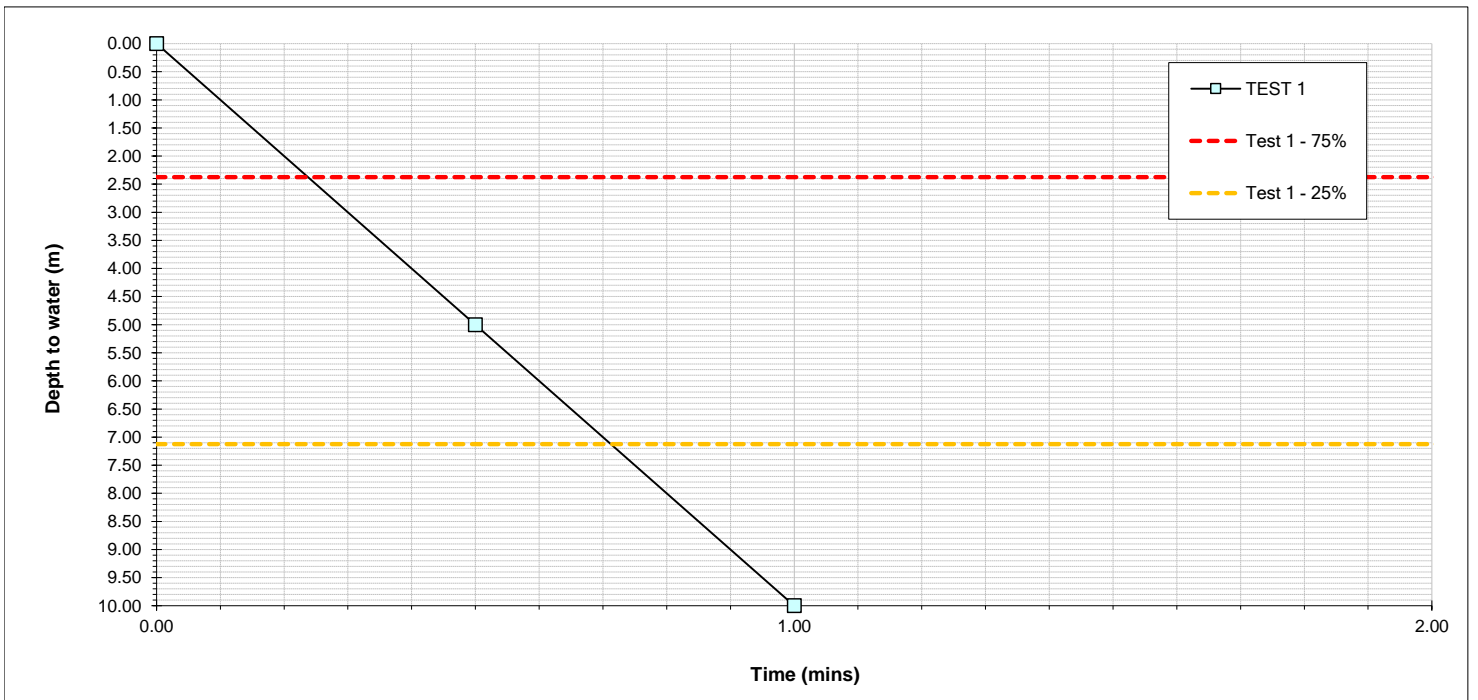
Site..... Swanstree Avenue
 Job Number..... SHF.1132.260
 Date of Test..... 26/07/2021

Soakaway Number..... BH2-2
 Diameter..... 0.15 m
 Casing Depth..... 7.50 m
 Borehole Depth..... 9.50 m
 Groundwater Level..... Dry m

BOREHOLE SOIL INFILTRATION RATE TEST
 See B.R.E. Digest 365, 1991, Soakaway Design.

Remarks - Please refer to BH3 log for ground conditions.	TEST 1		TEST 2		TEST 3	
	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
	0.0	0.00				
	0.5	5.00				
	1.0	10.00				
Effective Storage Depth	m	9.50				
75% Effective Storage Depth (i.e. depth below GL)	m	7.13				
25% Effective Storage Depth (i.e. depth below GL)	m	2.38				
Effective Storage Depth 75%-25%	m	4.75				
Time to fall to 75% effective depth	mins	2.30				
Time to fall to 25% effective depth	mins	7.20				
V (75%-25%)	m3	0.08				
a	m2	0.96				
t (75%-25%)	mins	4.90				
SOIL INFILTRATION RATE	m/s	2.97E-04				

DESIGN SOIL INFILTRATION RATE, f	n/a	m/s
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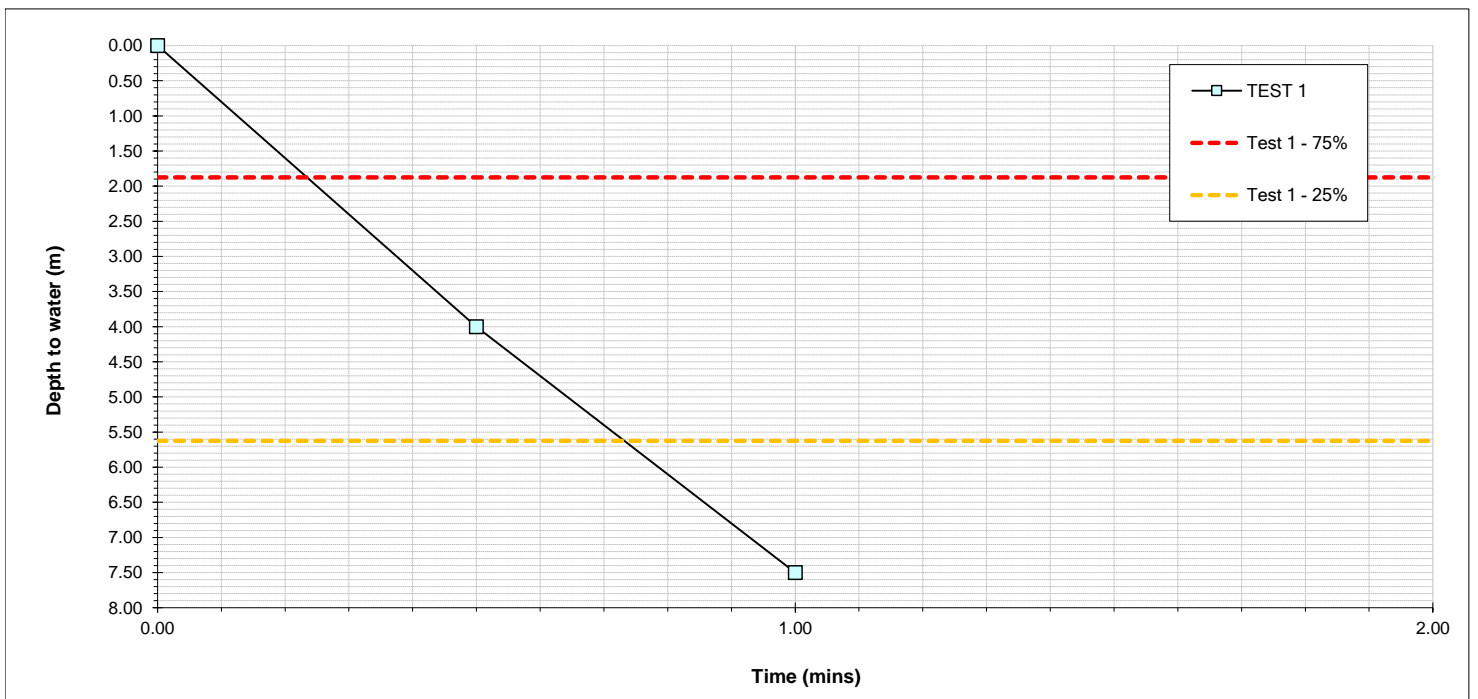
Site..... Swanstree Avenue
 Job Number..... SHF.1132.260
 Date of Test..... 26/07/2021

Soakaway Number..... BH3-1
 Diameter..... 0.15 m
 Casing Depth..... 5.50 m
 Borehole Depth..... 7.50 m
 Groundwater Level..... Dry m

BOREHOLE SOIL INFILTRATION RATE TEST
 See B.R.E. Digest 365, 1991, Soakaway Design.

Remarks - Please refer to BH3 log for ground conditions.	TEST 1		TEST 2		TEST 3	
	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
	0.0	0.00				
	0.5	4.00				
	1.0	7.50				
Effective Storage Depth	m	7.50				
75% Effective Storage Depth (i.e. depth below GL)	m	5.63				
25% Effective Storage Depth (i.e. depth below GL)	m	1.88				
Effective Storage Depth 75%-25%	m	3.75				
Time to fall to 75% effective depth	mins	0.24				
Time to fall to 25% effective depth	mins	0.74				
V (75%-25%)	m3	0.07				
a	m2	0.96				
t (75%-25%)	mins	0.50				
SOIL INFILTRATION RATE	m/s	2.30E-03				

DESIGN SOIL INFILTRATION RATE, f	n/a	m/s
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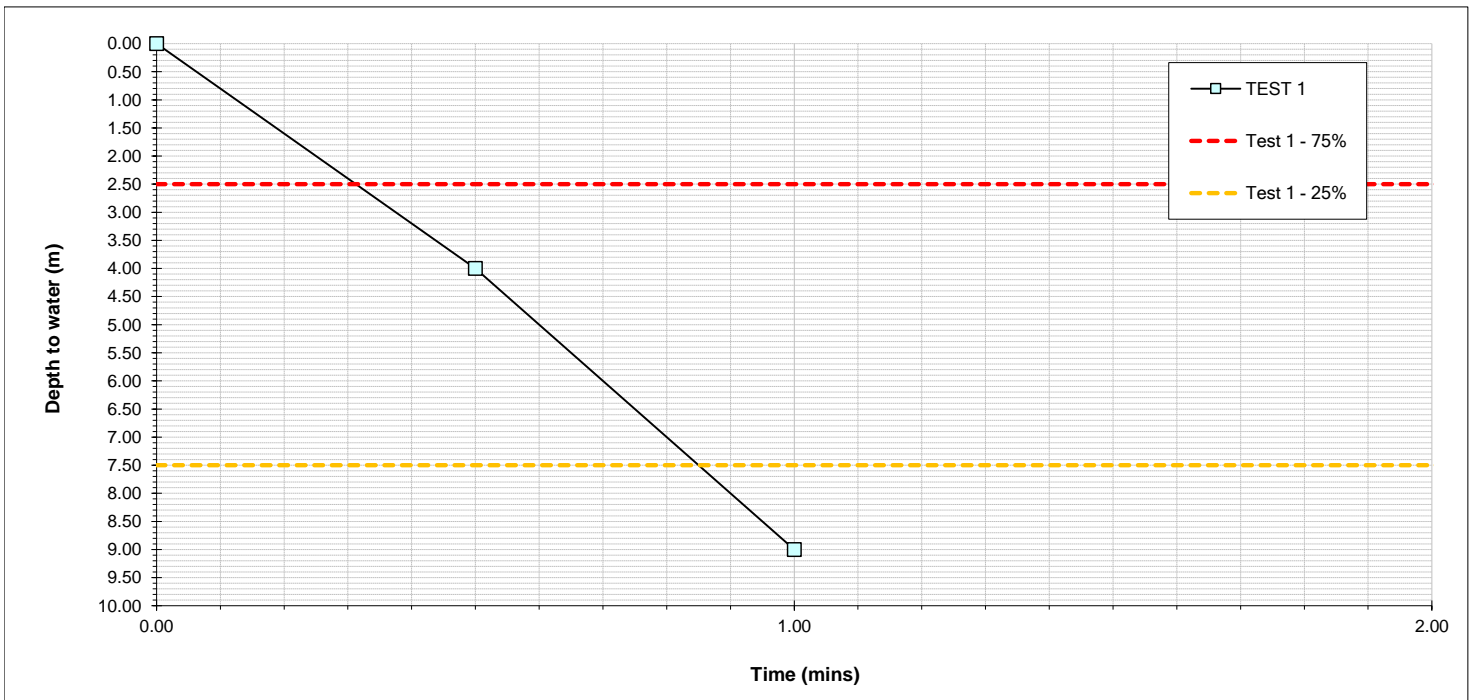
Site..... Swanstree Avenue
 Job Number..... SHF.1132.260
 Date of Test..... 26/07/2021


Soakaway Number..... BH3-2
 Diameter..... 0.15 m
 Casing Depth..... 8.50 m
 Borehole Depth..... 10.00 m
 Groundwater Level..... Dry m

BOREHOLE SOIL INFILTRATION RATE TEST
 See B.R.E. Digest 365, 1991, Soakaway Design.

Remarks - Please refer to BH3 log for ground conditions.	TEST 1		TEST 2		TEST 3	
	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
	0.0	0.00				
	0.5	4.00				
	1.0	9.00				
Effective Storage Depth	m	10.00				
75% Effective Storage Depth (i.e. depth below GL)	m	7.50				
25% Effective Storage Depth (i.e. depth below GL)	m	2.50				
Effective Storage Depth 75%-25%	m	2.50				
Time to fall to 75% effective depth	mins	0.31				
Time to fall to 25% effective depth	mins	0.85				
V (75%-25%)	m3	0.09				
a	m2	0.72				
t (75%-25%)	mins	0.54				
SOIL INFILTRATION RATE	m/s	3.76E-03				

DESIGN SOIL INFILTRATION RATE, f	n/a	m/s
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Samuel House 5 Fox Valley Way Stocksbridge Sheffield S36...	Swanstree Ave, Sittingbourne Deep Bore Soakaway Northern Section	
Date 14/10/2022 11:16 File DBSA NORTHERN REV B.SRCX	Designed by LA Checked by	
XP Solutions	Source Control 2020.1.3	

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

Half Drain Time : 779 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m ³)	Status
15 min Summer	28.243	10.243	17.9	520.2	O K
30 min Summer	28.370	10.370	17.9	685.7	O K
60 min Summer	28.493	10.493	17.9	844.9	O K
120 min Summer	28.617	10.617	17.9	1006.3	O K
180 min Summer	28.698	10.698	17.9	1111.1	O K
240 min Summer	28.757	10.757	17.9	1188.0	O K
360 min Summer	28.838	10.838	17.9	1294.1	O K
480 min Summer	28.889	10.889	17.9	1360.5	O K
600 min Summer	28.917	10.917	17.9	1396.4	O K
720 min Summer	28.930	10.930	17.9	1413.9	O K
960 min Summer	28.935	10.935	17.9	1419.5	O K
1440 min Summer	28.898	10.898	17.9	1371.2	O K
2160 min Summer	28.808	10.808	17.9	1254.7	O K
2880 min Summer	28.710	10.710	17.9	1127.9	O K
4320 min Summer	28.516	10.516	17.9	875.5	O K
5760 min Summer	28.355	10.355	17.9	665.2	O K
7200 min Summer	28.229	10.229	17.9	501.8	O K
8640 min Summer	28.133	10.133	17.9	377.0	O K
10080 min Summer	28.061	10.061	17.9	283.8	O K
15 min Winter	28.294	10.294	17.9	586.5	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Time-Peak (mins)
15 min Summer	138.005	0.0	43
30 min Summer	90.843	0.0	56
60 min Summer	56.736	0.0	84
120 min Summer	34.984	0.0	140
180 min Summer	26.611	0.0	196
240 min Summer	22.006	0.0	254
360 min Summer	16.919	0.0	368
480 min Summer	14.068	0.0	484
600 min Summer	12.163	0.0	600
720 min Summer	10.774	0.0	660
960 min Summer	8.831	0.0	786
1440 min Summer	6.558	0.0	1044
2160 min Summer	4.785	0.0	1452
2880 min Summer	3.794	0.0	1856
4320 min Summer	2.701	0.0	2644
5760 min Summer	2.125	0.0	3376
7200 min Summer	1.774	0.0	4104
8640 min Summer	1.537	0.0	4768
10080 min Summer	1.367	0.0	5448
15 min Winter	138.005	0.0	43

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Samuel House 5 Fox Valley Way Stocksbridge Sheffield S36...	Swanstree Ave, Sittingbourne Deep Bore Soakaway Northern Section	
Date 14/10/2022 11:16 File DBSA NORTHERN REV B.SRCX	Designed by LA Checked by	
XP Solutions	Source Control 2020.1.3	

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m ³)	Status
30 min Winter	28.438	10.438	17.9	773.1	O K
60 min Winter	28.577	10.577	17.9	954.1	O K
120 min Winter	28.721	10.721	17.9	1141.9	O K
180 min Winter	28.817	10.817	17.9	1266.6	O K
240 min Winter	28.889	10.889	17.9	1360.1	O K
360 min Winter	28.992	10.992	17.9	1493.6	O K
480 min Winter	29.060	11.060	17.9	1582.2	O K
600 min Winter	29.101	11.101	17.9	1636.1	O K
720 min Winter	29.124	11.124	17.9	1665.5	O K
960 min Winter	29.128	11.128	17.9	1670.2	O K
1440 min Winter	29.073	11.073	17.9	1599.2	O K
2160 min Winter	28.943	10.943	17.9	1430.0	O K
2880 min Winter	28.796	10.796	17.9	1239.4	O K
4320 min Winter	28.506	10.506	17.9	861.8	O K
5760 min Winter	28.269	10.269	17.9	554.4	O K
7200 min Winter	28.098	10.098	17.9	331.1	O K
8640 min Winter	27.487	9.487	17.8	193.8	O K
10080 min Winter	24.630	6.630	16.9	135.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Time-Peak (mins)
30 min Winter	90.843	0.0	56
60 min Winter	56.736	0.0	84
120 min Winter	34.984	0.0	140
180 min Winter	26.611	0.0	196
240 min Winter	22.006	0.0	252
360 min Winter	16.919	0.0	364
480 min Winter	14.068	0.0	478
600 min Winter	12.163	0.0	590
720 min Winter	10.774	0.0	700
960 min Winter	8.831	0.0	906
1440 min Winter	6.558	0.0	1126
2160 min Winter	4.785	0.0	1584
2880 min Winter	3.794	0.0	2020
4320 min Winter	2.701	0.0	2828
5760 min Winter	2.125	0.0	3552
7200 min Winter	1.774	0.0	4192
8640 min Winter	1.537	0.0	4760
10080 min Winter	1.367	0.0	5256

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Samuel House 5 Fox Valley Way Stocksbridge Sheffield S36...	Swanstree Ave, Sittingbourne Deep Bore Soakaway Northern Section	
Date 14/10/2022 11:16 File DBSA NORTHERN REV B.SRCX	Designed by LA Checked by	
XP Solutions	Source Control 2020.1.3	

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 591132 162629 TQ 91132 62629
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 2.150

Time (mins) Area			Time (mins) Area			Time (mins) Area		
From:	To:	(ha)	From:	To:	(ha)	From:	To:	(ha)
0	5	0.360	10	15	0.358	20	25	0.358
5	10	0.358	15	20	0.358	25	30	0.358

