
SITE SPECIFIC FLOOD RISK ASSESSMENT WITH DRAINAGE STRATEGY LEVEL 2

Proposed Sheltered Housing Development
108 to 110 Elm Grove
Hayling Island
Hampshire
PO11 9EH

Issue 1

December 2019

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**REFERENCES**

- 1: Crossfield Consulting, Ground Investigation Report. November 2014.

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1.0 INTRODUCTION

1.1 Archibald Shaw were instructed by Hamlet Homes to undertake a Level 2 Flood Risk Assessment [FRA] and Drainage Strategy in accordance with the National Planning Policy Framework on the parcel of land shown overleaf. Herein known as 'the site'.

1.1.1 This report has been written in support of a planning application for a proposed sheltered housing development. The site area totals some 3746m² and lies contiguous and east of Elm Grove, Hayling Island.

1.1.2 Nothing in this report confers or purports to confer on any third party, any benefit or any right to enforce any term of this report pursuant to the Contract (Rights of Third Parties) Act 1999.

1.2 Terms of Reference

1.2.1 This report comprises a Level 2 Flood Risk Assessment and Drainage Strategy in accordance with the requirements and guidance of:

- The National Planning Policy Framework
- Technical Guidance to the National Planning Policy Framework
- Flooding – Engineering Resilience, ICE:
- Flood Risks to People – FD2321/TR2 defra

1.3 Proposed Development

1.3.1 Vehicular and pedestrian access to the proposed development would be from Elm Grove.

1.3.2 According to the Environment Agency's flood mapping, accessible from the internet, the site has a very low risk of river flooding and would be categorised as lying within Flood Zone 1, an area with a less than 0.1% statistical chance of river flooding.

1.3.3 Flood risk from surface water flooding is also low with a statistical chance of flooding between 0.1% and 1.0%.

1.4 Summary of Brief

1.4.1 In accordance with the Client's specific objectives, the purpose of this report is primarily:

- (i) To provide a contemporary record of current flood risks affecting the site and future proposals.
- (ii) To advise on exceptional flooding events that may have an influence on developing the site.
- (iii) To advise on potential methods of mitigating flood risks on site.
- (iv) To form the basis of site based drainage strategy.



Aerial view of site

2.0 SOURCES OF INFORMATION**2.1 Desktop and Site Based Research**

2.1.1 The flood risk assessment research comprised:

Site Information	YES	NO
Review of information supplied by the Client	✓	
Site walkover	✓	
Preliminary discussion with architect/owner/occupier	✓	

Public Domain Information	YES	NO
Geological mapping	✓	
Statutory services information	✓	
Local Authority enquiry		✓
Strategic Flood Risk Assessment	✓	
Topographic site survey	✓	
Internet data	✓	
Anecdotal flooding information	✓	
Aerial photographs	✓	
LIDAR Survey		✓
Historic mapping		✓

Key: NA = Not applicable
 NR = No records available
 AR = Awaiting response

2.2 Response to Enquiries**2.2.1 Environment Agency**

2.2.1.1 Environment Agency's flood mapping indicates the site has a low to very low risk of flooding.

3.0 SITE DETAILS

3.1 Site Location

- 3.1.1 The site is situated to the east and contiguous with Elm Grove, Hayling Island. The street scene offers a mix of commercial units and residential housing. To the east of the site lies allotment gardens. The National Grid Reference for the site is: 472550; 99740.

3.2 Site Description

- 3.2.1 The site of some 3746m² is currently occupied by several redundant buildings, with surfacings comprising macadam and gravels.

3.3 Local Topography and Geology

- 3.3.1 The site lies at a similar level to the highway with boundary levels lying in the order of 6.5m. Levels fall slightly to the east, with levels on the eastern boundary lying in the order of 6.1m AOD.
- 3.3.2 With reference to British Geological Survey mapping the site is underlain by superficial geology of the River Terrace Deposits, and Bedrock geology of the London Clay formation.

River Terrace Deposits

These sedimentary deposits of Clay, Silt and Sand were formed up to 3 million years ago in the Quaternary Period when the local environment was dominated by flood plains and shallow estuaries.

London Clay Formation

This sedimentary bedrock of clay was formed approximately 48 to 56 million years ago in the Palaeogene Period when the local environment was dominated by deep seas.

3.4 Geo-Environmental Assessment ¹

- 3.4.1 This assessment undertaken by Crossfield Consulting confirms soil profiles similar to that described above.
- 3.4.2 Soil strata was summarized as follows:
- i) Made ground comprised brown gravelly clay with brick and porcelain fragments to a maximum depth of 0.4m more typically to 0.2m.

ii) Beneath the Made Ground, variable deposits of River Deposits were recorded to a depth of 4.0m. A band of gravelly sand 0.5 to 0.7m thick was recorded approximately at 2.5m depth.

iii) London Clay lay a depth below

3.4.3 Groundwater was encountered 2.3m below surface level.

3.5 Soil Infiltration Coefficients

3.5.1 On site infiltration testing was undertaken by Your Environment in October 2019. This confirmed that local soils would not support infiltration drainage systems. On 13 November 2019 Groundwater was recorded at a reduced level of 5.2m approximately.

3.6 Greenfield Run-Off

3.6.1 Estimated local greenfield flows for the site are summarized below:

Return Period (years)	Peak flow (l/s)
1	0.89
Q _{bar}	1.05
30	2.41
100	3.34
200	3.92

Table 3.1

4.0 POTENTIAL FLOOD HAZARDS

4.1 Flooding from Rivers

4.1.1 Rivers flood out of bank when the amount of water in them exceeds the flow capacity of the river channel. Flooding can also result when culverts, trash screens and bridges are partially or fully blocked by debris and washload.

4.1.2 The site lies remote and elevated from flood plains.

4.1.3 The risk from river flooding is considered very low.

4.2 Flooding from the Sea

4.2.1 The site is located some 1.1km from the sea.

4.2.2 Noting the site's elevation of 6.5 – 6.1m AOD, it is considered that the risk of flooding from the sea is very low.

4.3 Flooding from Land

4.3.1 Intense rainfall of short duration, which is unable to soak into the ground or enter drainage systems can run off land in sheet flows resulting in local flooding.

4.3.2 Information obtained from the Cranfield Soil and Agrifood Institute database confirm site topsoils and subsoils are loamy with natural high groundwater.

4.3.3 It is considered the risk of flooding from the land is medium to low.

4.4 Flooding from Groundwater

4.4.1 Given the local geology and topography it is considered the risk from groundwater flooding is low.

4.5 Flooding from Sewers

4.5.1 Flooding can result when a sewer is overwhelmed by heavy rainfall, groundwater, becomes blocked or is of inadequate capacity.

4.5.2 It is considered flood risk from such flooding is very low.

4.6 Flooding from Reservoirs, Canals other Manmade Sources

- 4.6.1 Reservoir or canal flooding may occur as a result of the structure being overwhelmed, or as a result of dam and bank failure.
- 4.6.2 There are no local manmade structures which pose a flood risk to this site.
- 4.6.3 The risk of flooding from manmade sources is considered very low.

5.0 DRAINAGE STRATEGY

5.1 General

5.1.1 The development site area totals some 3746m² approximately.

5.1.2 It is proposed to attenuate resultant development surface waters prior to discharging to the local 675mm diameter surface water sewer.

5.2 Design Criteria and Allowances for Climate Change

5.2.1 Sewers for adoption 7th edition requires that surface water drainage systems for new developments should be designed to prevent pipe surcharging during a 1 in 2 year storm event. The system should also accommodate a 1 in 30 year event without surface flooding. During extreme wet weather events, it should be demonstrated that flood waters would be routed away from buildings, and not cause a nuisance elsewhere.

5.2.2 It is proposed that this development is designed to prevent flooding above ground level during a 1 in 100 year storm event with an additional allowance for climate change to the year 2115.

5.3 Applicability of SuDs

5.3.1 Current guidance and advice recommends that surface water run-off shall discharge to one of the following, listed in order of priority:

- a) An adequate soakaway or some other adequate infiltration system, or where that is not reasonably practicable,
- b) A watercourse, or, where that is not reasonably practicable,
- c) A sewer.

5.3.2 A SuDs scheme will be required to control discharge to an acceptable level. SuDs can incorporate some or all of the following:

- source control measures including rainwater recycling, green roofs and permeable pavements;
- wetlands providing both stormwater attenuation and treatment;
- infiltration devices to allow water to soak into the ground, that can include individual soakaways and communal facilities;
- swales, which are vegetated features that hold and drain water downhill mimicking natural drainage patterns;

- filtration, through vegetation, shallow landscaped depressions and a sand bed providing high pollutant removal; and
- detention basins to hold excess water after rainfall which allow controlled discharge to avoid flooding.

5.3.3 In accordance with CIRIA C768 *Guidance on the construction of SuDS*, the application of these options is outlined below.

- (i) The use of porous paving will retain on site local rainfall depths of at least 5mm
- (ii) Roofs and external pavings will require attenuation in order to reduce peak flows close to natural greenfield flow rates prior to discharge to the local adopted sewer.

5.4 Surface Water Strategy

5.4.1 Surface waters will be attenuated on site close to natural greenfield flows prior to being discharged to the local 675mm diameter surface water sewer. Block paving will retain rainfall depth up to 5mm on site which will eventually be lost to atmosphere via evapotranspiration.

5.5 Foul Water Strategy

5.5.1 Foul water flows from site will discharge to the local 300mm diameter foul water sewer.

5.6 Preliminary Surface Water Drainage Design

5.6.1 It is proposed to direct all development waters to the local 675mm diameter surface water sewer via an attenuation structure comprising sub-terranean storage and an orifice flow control. Drawing 30666/SW.01 within appendix D summarizes the proposed general arrangement together with several section details.

6.0 DISCUSSIONS AND CONCLUSIONS

- 6.1 The proposed development will not adversely affect surrounding properties in terms of flood risk.
- 6.2 The site is at a low to very low risk of surface water and river flooding.
- 6.3 Surface water management will utilize porous paving and on site sub-terranean surface water attenuation in order to minimize both volumetric and peak surface waters from site.

Prepared by: 

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Date: 19 December 2019

APPENDICES

- A. Environment Agency Flood Plain Data
- B. Greenfield Run-Off Summary
- C. Your Environment Report
- D. Drawing 30666/SW.01 – SW Attenuation
- E. Surface Water Data

APPENDIX A

Environment Agency Flood Plain Data



Flood risk from rivers or the sea

- ☐ Extent of flooding
- ☐ Depth and flow estimates at monitoring stations



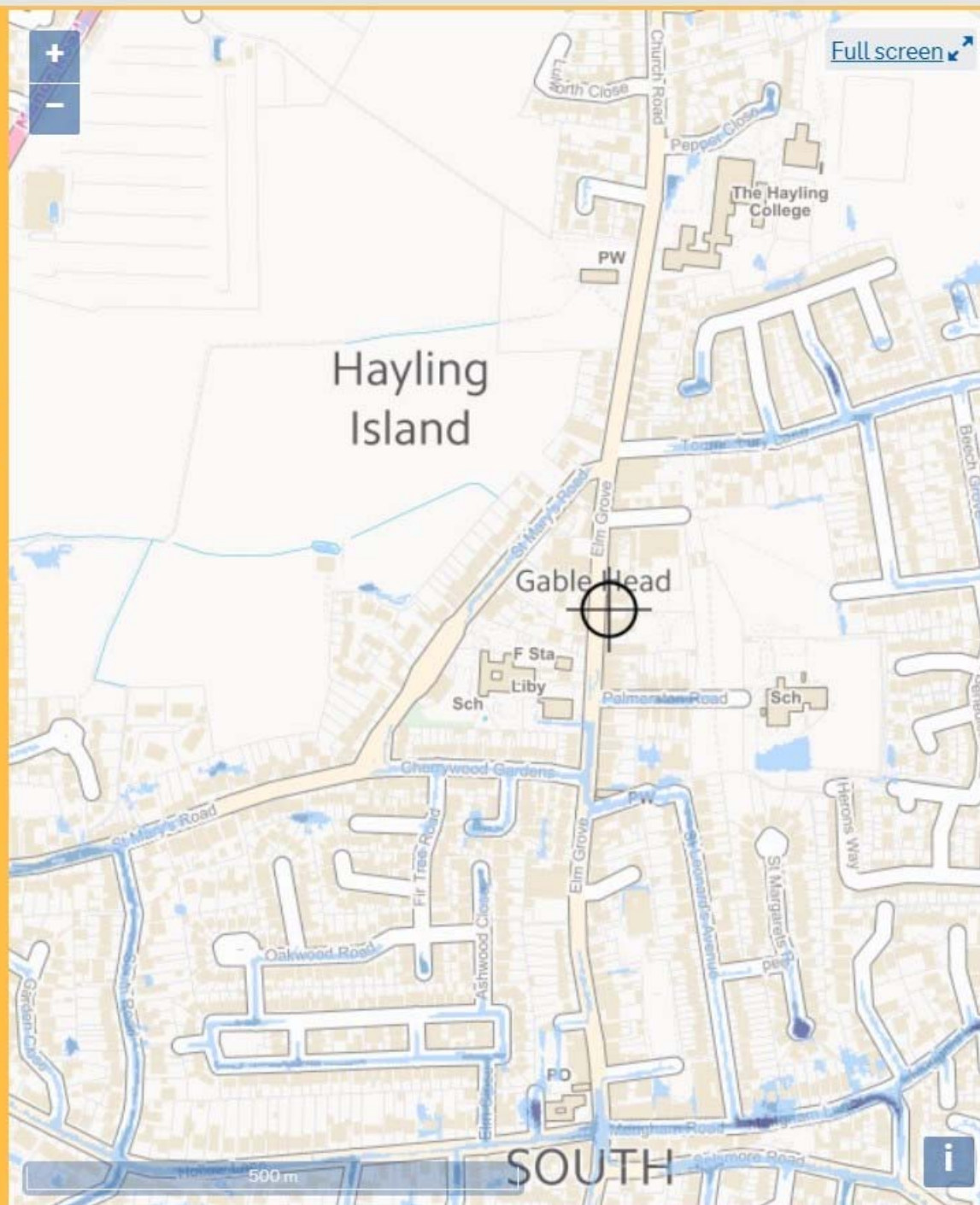
Flood risk from surface water

- ☒ Extent of flooding
- ☐ High risk: depth
- ☐ High risk: velocity
- ☐ Medium risk: depth
- ☐ Medium risk: velocity
- ☐ Low risk: depth
- ☐ Low risk: velocity



Flood risk from reservoirs

- ☐ Extent of flooding
- ☐ Flood depth
- ☐ Flood speed



Flood risk



High



Medium



Low



Very low



Location you selected

Mengham

APPENDIX B

Greenfield Run-Off Summary

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:

Site name:

Site location:

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:

Longitude:

Reference:

Date:

Runoff estimation approach

Site characteristics

Total site area (ha):

Methodology

Q_{BAR} estimation method:

SPR estimation method:

Soil characteristics

SOIL type:

Default	Edited
3	3

HOST class:

Default	Edited
N/A	N/A

SPR/SPRHOST:

Default	Edited
0.37	0.37

Hydrological characteristics

SAAR (mm):

Default	Edited
684	684

Hydrological region:

Default	Edited
7	7

Growth curve factor 1 year:

Default	Edited
0.85	0.85

Growth curve factor 30 years:

Default	Edited
2.3	2.3

Growth curve factor 100 years:

Default	Edited
3.19	3.19

Growth curve factor 200 years:

Default	Edited
3.74	3.74

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q _{BAR} (l/s):	1.05	1.05
1 in 1 year (l/s):	0.89	0.89
1 in 30 years (l/s):	2.41	2.41
1 in 100 year (l/s):	3.34	3.34
1 in 200 years (l/s):	3.92	3.92

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

APPENDIX C

Your Environment Report

Our Ref: YE7669

30th October 2019

For the attention of Hamlet Homes,

Ref: Sheltered Housing Development, Elm Grove, Hayling Island, Hampshire, PO11 9EH

We thank you for your request to undertake permeability testing at the above mentioned site and take pleasure in enclosing the results of this work. The investigation was undertaken on the 29th October 2019 in accordance with your instruction to proceed. This letter describes the work undertaken, presents the data obtained and discusses the results of the tests.

Geology

An examination of the available British Geological Survey data of the area for the site has been examined and indicates that the site has superficial drift deposits composed of the River Terrace Deposits (undifferentiated) (sand, silt and clay) and bedrock deposits recorded as the London Clay Formation (clay, silt and sand).

Fieldworks

The programme of this investigation included the excavation of three trial pits. The locations of the soakaway tests were selected by the client.

During this work, the soils encountered were logged in general accordance with BS 5930: 1990, as amended in 2007, and full descriptions are given on the borehole records, which are also appended to this letter.

Soakaway Tests

During the soakaway tests the water failed to achieve a fall from 75% to 25% of the effective depth of the storage volume in all three trial pits. The results obtained from the soakaway tests are summarised below:

Table 1: Soakaway Test Results

WS	Soakage Dimensions	Area (m)	Depth (m)	Soil Description (Base of TP)	Infiltration Rate (m/sec)	Drainage Characteristics
TP01 test1	1.10 x 0.60		1.50	Soft orangish brown sandy CLAY. Sand is medium - coarse.	N/A	Practically Impermeable
TP02 test1	1.40 x 0.60		1.50	Soft orangish brown sandy CLAY. Sand is medium - coarse.	N/A	Practically impermeable
TP03 test1	1.40 x 0.60		1.50	Soft orangish brown sandy CLAY. Sand is medium - coarse.	N/A	Practically Impermeable

Discussion

The soils encountered beneath the site were found to be predominantly CLAY. The soakage rates obtained during the investigation were found to be practically impermeable. Given the data from the test, it is considered that soakaways are not suitable for this site.

References

Building Research Establishment (BRE) Digest 365, *Soakaway Design*, September 1991.

British Standards Institution (1999) BS5930: *Code of practice for site investigations*, B.S.I., London.

British Standards Institution (2007), Amendment No 1, BS5930: *Code of practice for site investigations*, B.S.I., London.

We trust that this information is of interest and should you have any other requirements do not hesitate to contact us.

For and on behalf of

YourEnvironment

Yours Faithfully,



Nick Hammond

Enc.

Appendix A: Site Investigation Plan

Appendix B: Trial Pit Logs

Appendix C: Soakaway Test Results

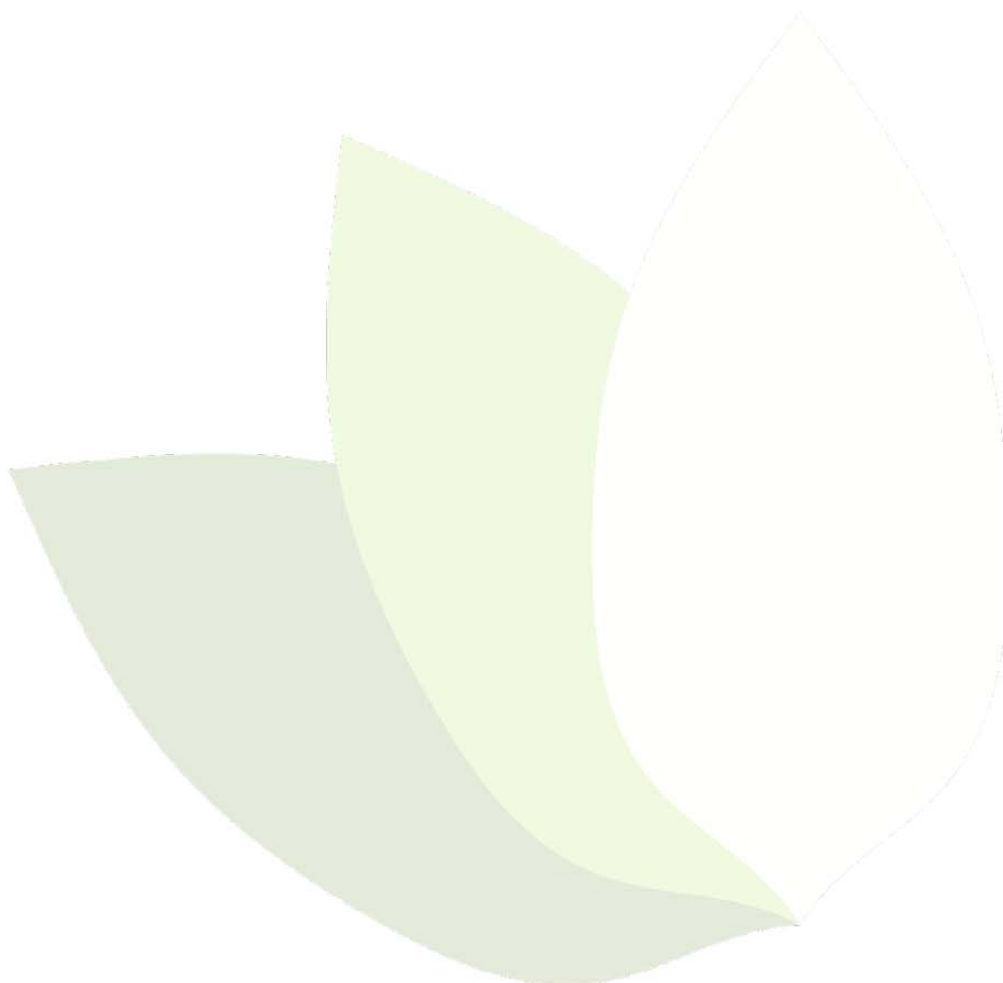
APPENDIX A: Site Investigation Plan



APPENDIX B: Trial Pit Logs



APPENDIX B: Soakaway Test Results

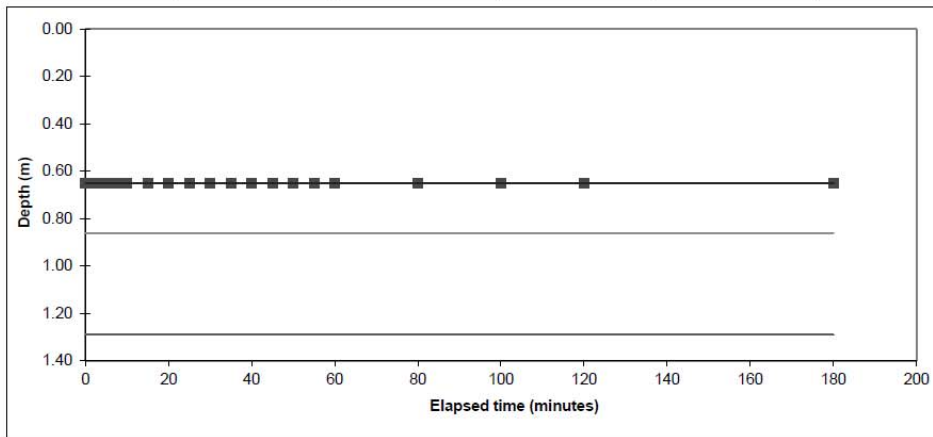


Your Environment

Soakaway Test

Trial Pit No:	TP1	Test No:	1	Date:	29.10.2019
Length (m):	1.100	Datum Height:		0.00 m agl	
Width (m):	0.60	Granular infill:	None		
Depth (m):	1.50	Porosity of infill:	1	(assumed)	

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	0.650	30	0.650
1	0.650	35	0.650
2	0.650	40	0.650
3	0.650	45	0.650
4	0.650	50	0.650
5	0.650	55	0.650
6	0.650	60	0.650
7	0.650	80	0.650
8	0.650	100	0.650
9	0.650	120	0.650
10	0.650	180	0.650
15	0.650		
20	0.650		
25	0.650		



Start water depth for analysis (mbgl)	0.65		
75% effective depth (mbgl):	0.86	Elapsed time (mins):	#N/A
50% effective depth (mbgl):	1.08		
25% effective depth (mbgl):	1.29	Elapsed time (mins):	#N/A
Base of soakage zone (mbgl):	1.50		
Volume outflow between 75% and 25% effective depth (m ³):			
Mean surface area of outflow (m ²):			2.09
(side area at 50% effective depth + base area)			
Time for outflow between 75% and 25% effective depth (mins):			
Soil infiltration rate (m/s):		Test incomplete as 25% effective depth not achieved. Unable to reliably determine soil infiltration rate.	
Remarks	Results processed following BRE 365 (2007).		

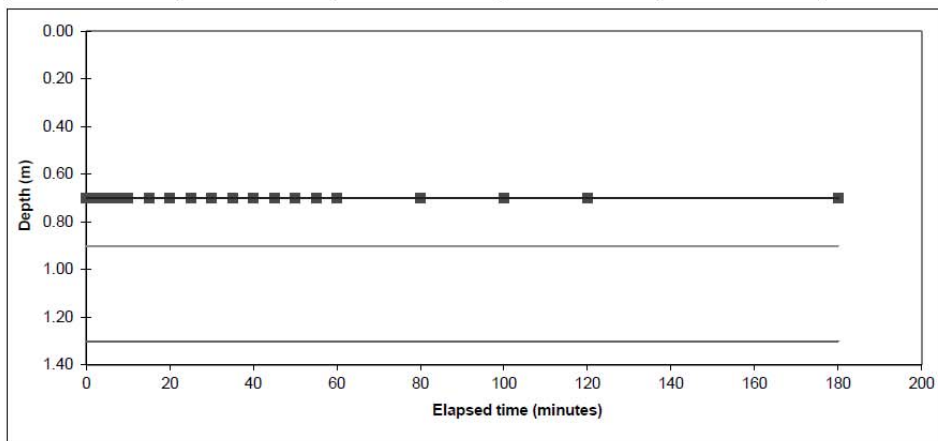
Client:	Hamlet Homes	
Site:	Oaklands, Elm Grove	TP1

Your Environment

Soakaway Test

Trial Pit No:	TP2	Test No:	1	Date:	29.10.2019
Length (m):	1.400	Datum Height:		0.00 m agl	
Width (m):	0.60	Granular infill:	None		
Depth (m):	1.50	Porosity of infill:	1	(assumed)	

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	0.700	30	0.700
1	0.700	35	0.700
2	0.700	40	0.700
3	0.700	45	0.700
4	0.700	50	0.700
5	0.700	55	0.700
6	0.700	60	0.700
7	0.700	80	0.700
8	0.700	100	0.700
9	0.700	120	0.700
10	0.700	180	0.700
15	0.700		
20	0.700		
25	0.700		



Start water depth for analysis (mbgl)	0.70		
75% effective depth (mbgl):	0.90	Elapsed time (mins):	#N/A
50% effective depth (mbgl):	1.10		
25% effective depth (mbgl):	1.30	Elapsed time (mins):	#N/A
Base of soakage zone (mbgl):	1.50		
Volume outflow between 75% and 25% effective depth (m³):			
Mean surface area of outflow (m²):			2.44
(side area at 50% effective depth + base area)			
Time for outflow between 75% and 25% effective depth (mins):			
Soil infiltration rate (m/s):		Test incomplete as 25% effective depth not achieved. Unable to reliably determine soil infiltration rate.	
Remarks	Results processed following BRE 365 (2007).		

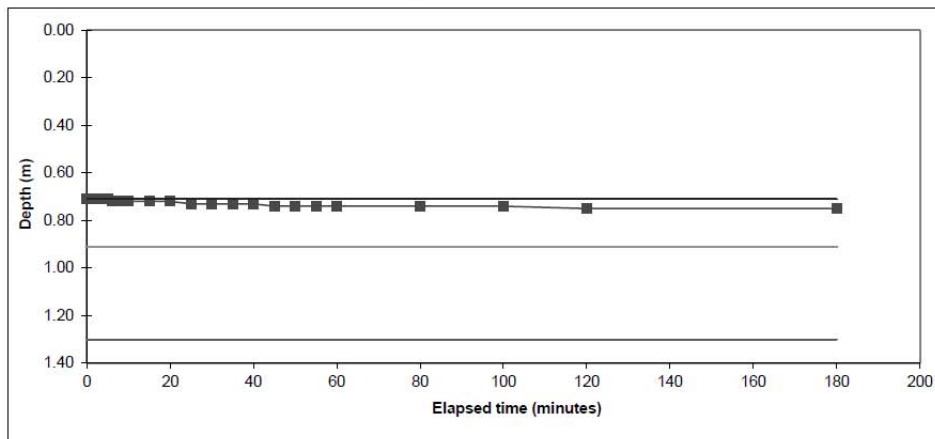
Client:	Hamlet Homes	TP2
Site:	Oaklands, Elm Grove	

Your Environment

Soakaway Test

Trial Pit No:	TP3	Test No:	1	Date:	29.10.2019
Length (m):	1.400	Datum Height:		0.00 m agl	
Width (m):	0.60	Granular infill:	None		
Depth (m):	1.50	Porosity of infill:	1	(assumed)	

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	0.710	30	0.730
1	0.710	35	0.730
2	0.710	40	0.730
3	0.710	45	0.740
4	0.710	50	0.740
5	0.710	55	0.740
6	0.720	60	0.740
7	0.720	80	0.740
8	0.720	100	0.740
9	0.720	120	0.750
10	0.720	180	0.750
15	0.720		
20	0.720		
25	0.730		



Start water depth for analysis (mbgl):	0.71		
75% effective depth (mbgl):	0.91	Elapsed time (mins):	#N/A
50% effective depth (mbgl):	1.11		
25% effective depth (mbgl):	1.30	Elapsed time (mins):	#N/A
Base of soakage zone (mbgl):	1.50		
Volume outflow between 75% and 25% effective depth (m ³):			
Mean surface area of outflow (m ²):			2.40
(side area at 50% effective depth + base area)			
Time for outflow between 75% and 25% effective depth (mins):			

Soil infiltration rate (m/s):	Test incomplete as 25% effective depth not achieved. Unable to reliably determine soil infiltration rate.
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Remarks	Results processed following BRE 365 (2007).
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Client:	Hamlet Homes	
Site:	Oaklands, Elm Grove	TP3

APPENDIX D

Drawing 30666/SW.01 – SW Attenuation



30666 SW,01 P1

APPENDIX E

Surface Water Data

Elm Grove
Hayling Island
M100+40%



Designed By vlc
Checked By

Source Control W.11.2

Half Drain Time : 497 minutes

Storm Duration (mins)	Maximum Control (l/s)	Maximum Filtration (l/s)	Maximum Overflow (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Overflow Volume (m³)	Maximum Volume (m³)	Status
15 Summer	2.7	0.0	0.0	2.7	5.9593	0.1393	0.0	85.3	O K
30 Summer	3.2	0.0	0.0	3.2	6.0072	0.1872	0.0	115.0	O K
60 Summer	3.6	0.0	0.0	3.6	6.0572	0.2372	0.0	145.9	O K
120 Summer	3.9	0.0	0.0	3.9	6.1037	0.2837	0.0	174.7	O K
180 Summer	4.1	0.0	0.0	4.1	6.1247	0.3047	0.0	187.7	O K
240 Summer	4.2	0.0	0.0	4.2	6.1352	0.3152	0.0	193.9	O K
360 Summer	4.2	0.0	0.0	4.2	6.1432	0.3232	0.0	199.1	O K
480 Summer	4.2	0.0	0.0	4.2	6.1462	0.3262	0.0	200.8	O K
600 Summer	4.2	0.0	0.0	4.2	6.1472	0.3272	0.0	201.4	O K
720 Summer	4.2	0.0	0.0	4.2	6.1467	0.3267	0.0	201.0	O K
960 Summer	4.2	0.0	0.0	4.2	6.1427	0.3227	0.0	198.6	O K
1440 Summer	4.1	0.0	0.0	4.1	6.1287	0.3087	0.0	190.1	O K
2160 Summer	3.9	0.0	0.0	3.9	6.1042	0.2842	0.0	174.9	O K
2880 Summer	3.8	0.0	0.0	3.8	6.0802	0.2602	0.0	160.1	O K
4320 Summer	3.4	0.0	0.0	3.4	6.0398	0.2197	0.0	134.8	O K
5760 Summer	3.2	0.0	0.0	3.2	6.0073	0.1872	0.0	115.0	O K
7200 Summer	2.9	0.0	0.0	2.9	5.9828	0.1628	0.0	99.7	O K
8640 Summer	2.7	0.0	0.0	2.7	5.9633	0.1433	0.0	87.5	O K
10080 Summer	2.6	0.0	0.0	2.6	5.9473	0.1273	0.0	77.7	O K
15 Winter	2.9	0.0	0.0	2.9	5.9768	0.1567	0.0	96.2	O K
30 Winter	3.4	0.0	0.0	3.4	6.0307	0.2107	0.0	129.5	O K
60 Winter	3.8	0.0	0.0	3.8	6.0872	0.2672	0.0	164.3	O K
120 Winter	4.2	0.0	0.0	4.2	6.1402	0.3202	0.0	197.2	O K
180 Winter	4.4	0.0	0.0	4.4	6.1652	0.3452	0.0	212.5	O K
240 Winter	4.4	0.0	0.0	4.4	6.1777	0.3577	0.0	220.2	O K
360 Winter	4.5	0.0	0.0	4.5	6.1892	0.3692	0.0	227.5	O K
480 Winter	4.5	0.0	0.0	4.5	6.1907	0.3707	0.0	228.4	O K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
15 Summer	131.85	36
30 Summer	88.57	49
60 Summer	56.71	72
120 Summer	35.00	128
180 Summer	25.97	186
240 Summer	20.88	244
360 Summer	15.37	344
480 Summer	12.34	400
600 Summer	10.40	462
720 Summer	9.04	526
960 Summer	7.24	662
1440 Summer	5.28	938
2160 Summer	3.85	1344
2880 Summer	3.07	1740
4320 Summer	2.23	2512
5760 Summer	1.77	3240
7200 Summer	1.48	3976
8640 Summer	1.28	4688
10080 Summer	1.14	5448
15 Winter	131.85	36
30 Winter	88.57	49
60 Winter	56.71	74
120 Winter	35.00	128
180 Winter	25.97	184
240 Winter	20.88	240
360 Winter	15.37	350
480 Winter	12.34	450

Elm Grove
Hayling Island
M100+40%



Designed By vlc
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Source Control W.11.2

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

Storm Duration (mins)	Maximum Control (l/s)	Maximum Filtration (l/s)	Maximum Overflow (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Overflow Volume (m³)	Maximum Volume (m³)	Status
600 Winter	4.5	0.0	0.0	4.5	6.1902	0.3702	0.0	228.1	O K
720 Winter	4.5	0.0	0.0	4.5	6.1887	0.3687	0.0	227.0	O K
960 Winter	4.5	0.0	0.0	4.5	6.1812	0.3612	0.0	222.4	O K
1440 Winter	4.3	0.0	0.0	4.3	6.1587	0.3387	0.0	208.4	O K
2160 Winter	4.1	0.0	0.0	4.1	6.1207	0.3007	0.0	185.2	O K
2880 Winter	3.8	0.0	0.0	3.8	6.0862	0.2662	0.0	163.8	O K
4320 Winter	3.4	0.0	0.0	3.4	6.0303	0.2102	0.0	129.1	O K
5760 Winter	3.0	0.0	0.0	3.0	5.9893	0.1693	0.0	103.7	O K
7200 Winter	2.7	0.0	0.0	2.7	5.9593	0.1393	0.0	85.1	O K
8640 Winter	2.5	0.0	0.0	2.5	5.9368	0.1168	0.0	71.2	O K
10080 Winter	2.3	0.0	0.0	2.3	5.9198	0.0998	0.0	60.6	O K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
600 Winter	10.40	484
720 Winter	9.04	558
960 Winter	7.24	712
1440 Winter	5.28	1012
2160 Winter	3.85	1444
2880 Winter	3.07	1852
4320 Winter	2.23	2640
5760 Winter	1.77	3400
7200 Winter	1.48	4112
8640 Winter	1.28	4848
10080 Winter	1.14	5552

One Little London
Chichester
Sussex PO19 1PP

Elm Grove
Hayling Island
M100+40%

Date 16.12.2019
File

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Micro Drainage

Source Control W.11.2

Rainfall Details

Region	ENG+WAL	Cv (Summer)	0.750	Summer Storms	Yes
Return Period (years)	100	Cv (Winter)	0.840	Winter Storms	Yes
M5-60 (mm)	20.000	Shortest Storm (mins)	15	Climate Change %	+40
Ratio-R	0.350	Longest Storm (mins)	10080		

Time / Area Diagram

Total Area (ha) = 0.374

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
from:	to:	from:	to:	from:	to:
0	4	0.098	8	12	0.098
4	8	0.098	12	16	0.020
			16	20	0.040

Elm Grove
Hayling Island
M100+40%

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Source Control W.11.2

Infil Coef - Base (m/hr)	0.000000	Invert Level (m)	5.820
Membrane Percolation (mm/hr)	1000	Cover Level (m)	6.400
Safety Factor	1.5	Slope (1:x)	10000.0
Porosity	0.95	Max Percolation (l/s)	180.8
Length (m)	30.0	Depression Storage (mm)	5
Width (m)	21.7	Evaporation (mm/day)	3

Diameter (m) 0.060 Discharge Coefficient 0.600 Invert Level (m) 5.800

Pipe Diameter (m)	0.100	Roughness (mm)	0.600	Invert Level (m)	6.300
Slope (1:x)	50.0	Entry Loss Coef	0.500		
Length (m)	5.000	Coef of Contraction	0.600		