SITE H3.6 AND S98 HACKTHORNE ROAD DURRINGTON,

FLOOD RISK ASSESSMENT & DRAINAGE STRATEGY

March 2019

Cherry Porter and Carol Whapshare

RESIDENTIAL DEVELOPEMENT
SITE H3.6 AND S98, HACKTHORN ROAD
DURRINGTON

FLOOD RISK ASSESSMENT & DRAINAGE STRATEGY

CONTROLLED DOCUMENT

Document No:	020.5043/FRA/2		
Status:	Original	*Copy No:*	

	Name	*Signature*	*Date*
Prepared by:	Rob Wilson		December 2018
Checked by:	Adam Shepherd		December 2018
Approved by:	Rob Wilson		December 2018

Revision Record

Rev.	*Date*	*By*	*Summary of Changes*	*Chkd*	*Aprvd*
2	March 2019	RW	Title changed	AS	RW

paulbasham associates

Cherry Porter and Carol Whapshare
The Street
Binstead

Paul Basham Associates Ltd
Lancaster Court
8 Barnes Wallis Road
Fareham
Hampshire
PO15 5TU

RESIDENTIAL DEVELOPEMENT
SITE H3.6 AND S98, HACKTHORN ROAD
DURRINGTON

FLOOD RISK ASSESSMENT & DRAINAGE STRATEGY

Contents

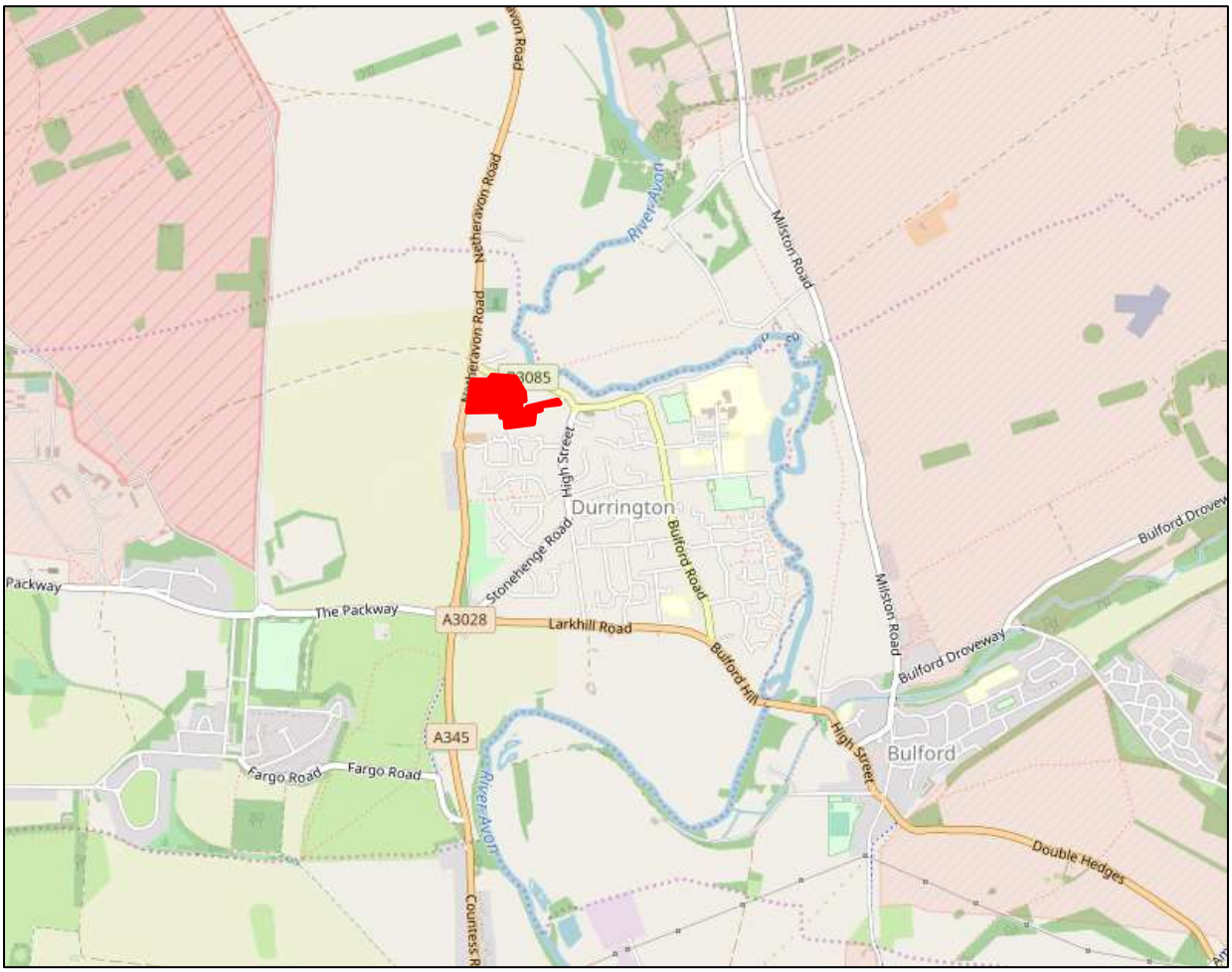
Figures

Tables

Appendices

1. INTRODUCTION

1.1 Paul Basham Associates have been commissioned by **Cherry Porter and Carol Whapshare** to prepare a Flood Risk Assessment (FRA) and Drainage Strategy (DS) for the Site H3.6 And S98, Hackthorn Road Durrington A location plan is provided in **Figure 1.**



© OpenStreetMap

Figure 1 Site Location Plan

1.2 The scope of this document includes both the FRA and a DS and outlines the decision-making process behind the proposals and conclusions.

1.3 This document considers the following:

- The site is currently a green field.
- The topography is such that the site slopes generally North-east to South-west.
- Design parameters.
- The drainage strategy for the site.

1.4 This document has been prepared based on the following information;

- Ground infiltration rates determined by the British Geological Society (BGS) records and the on-site permeability tests commissioned
- Wessex Water drainage records
- Drainage strategy for the Adjacent site application
- Environment Agency Data such as flood risk maps

2. SITE & PROPOSAL DETAILS

2.1 The site covers an area of approximately 4.23 Ha. and is on the outskirts of Durrington, to the south of Hackthorn Road. It is currently a greenfield site and is approximately 2.5 Km north of the A303. The site is also less than 100m South of the river Avon. the overall development proposal layouts can be found in **Appendix A**. The current proposal is for the construction of up to 140 residential units.

2.2 The topographical survey shows that the site is moderately sloped from South to North with a high point of 87.50m AOD and a low point of 78.36m AOD. A copy of the Survey is included in **Appendix B**

Site Geology

2.3 The British Geological Society (BGS) data for the site shows 1:50 000 scale bedrock geology description: Seaford Chalk Formation - Chalk. Sedimentary Bedrock formed approximately 84 to 90 million years ago in the Cretaceous Period. Local environment previously dominated by warm chalk seas see **Figure 2**

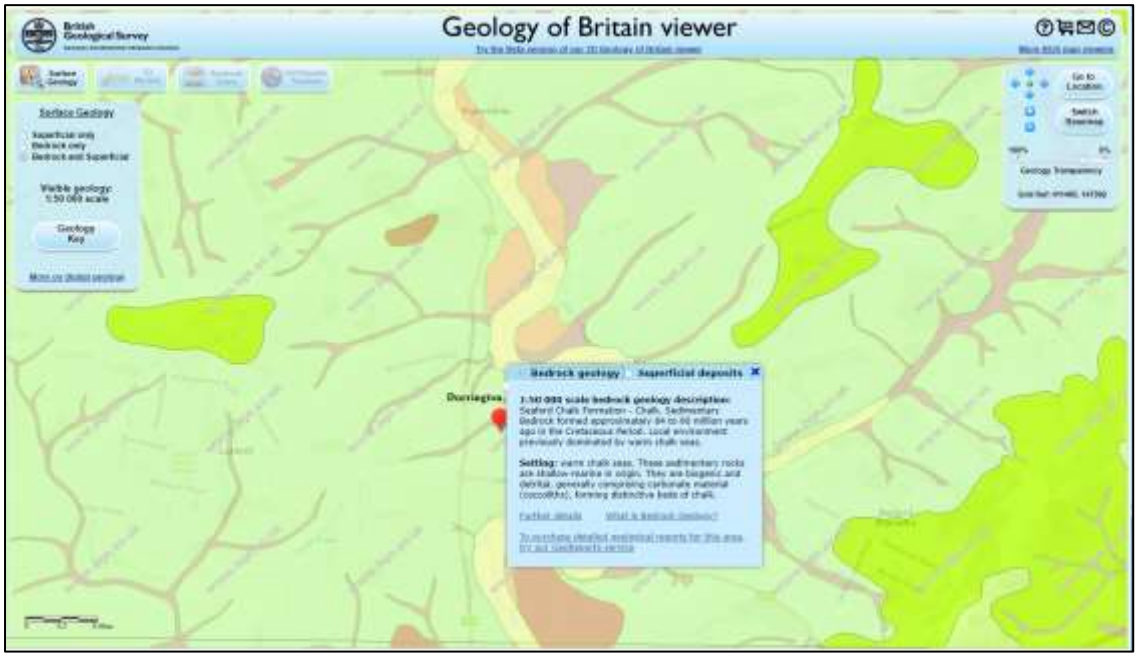


Figure 2 BGS Data

2.4 The site is in a Source Protection Zone (SPZ) with respect to groundwater quality, which is usually enforced where sources of potable water that feed abstraction points are located. See **Figure 3**

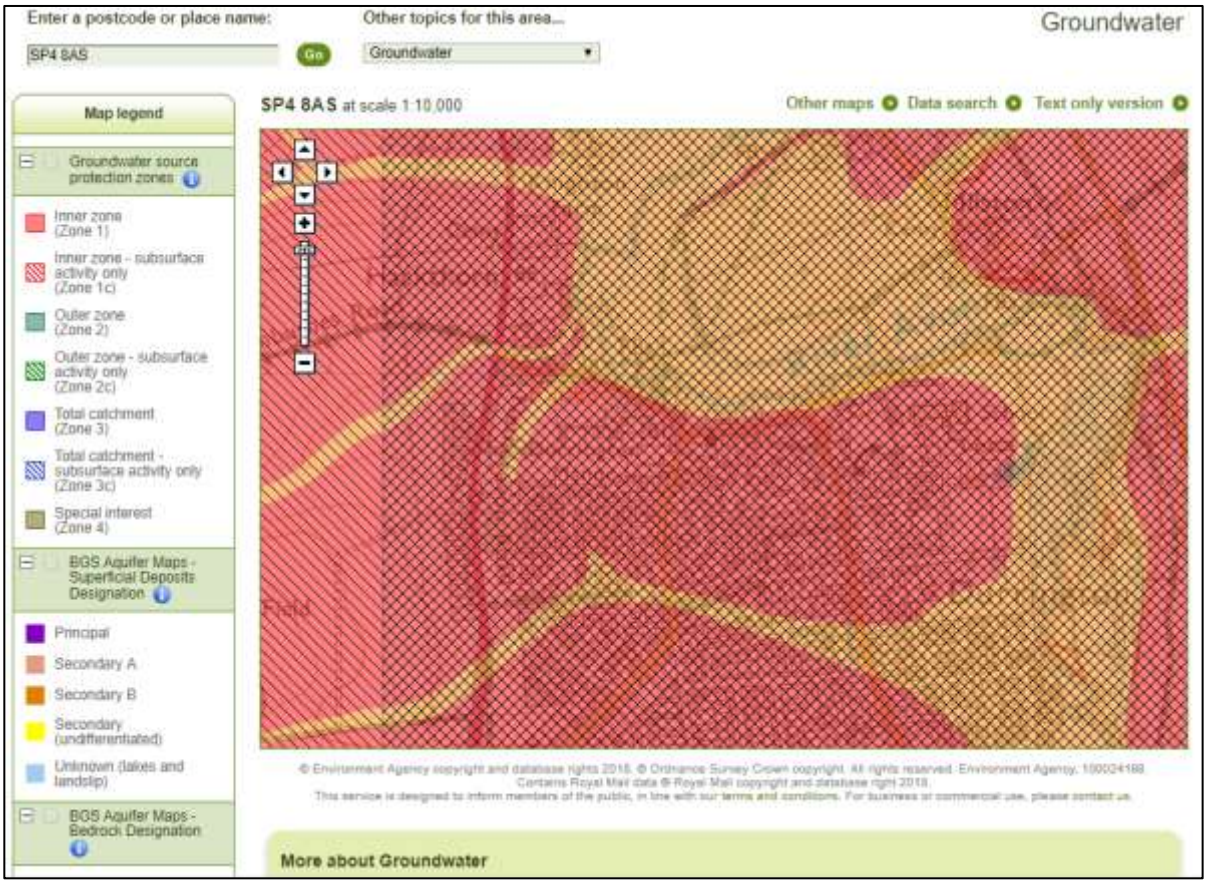


Figure 3 Groundwater Vulnerability Map

3. EXISTING DRAINAGE

Existing Surface Water Drainage

3.1 The surface water run-off of the greenfield site generally follows the contours of the site. The topography is such that the site slopes from South to North towards Hackthorn Road and the River Avon.

Greenfield Run-off Rates

3.2 The greenfield run-off rates for the whole of the existing site have been estimated utilising the UK SuDS online tool, the greenfield run off (Qbar) has been estimated at 0.173 l/s/ha. (This reflects the permeable nature of the subsoil) a copy of the greenfield run off estimate is included in **Appendix C** This rate has been used in the calculations.

Greenfield runoff rates	Default	Edited
Qbar (l/s)	0.74	0.74
1 in 1 year (l/s)	0.63	0.63
1 in 30 years (l/s)	1.71	1.71
1 in 100 years (l/s)	2.37	2.37

Figure 4 Greenfield Run-Off Rates

Existing Sewer System

3.3 A review of the Wessex Water sewer records shows that there are no public surface water sewers in or adjacent to the site.

Existing Foul Water Drainage

3.4 The development site is greenfield and does not currently generate a foul water discharge.

3.5 A review of the Wessex Water sewer records (a copy is included in **Appendix D**) shows that there is a 175mm Dia. Public foul sewer running in an Easterly direction in Hackthorn Road.

4. FLOOD RISK

4.1 The Environment Agency (EA) flood mapping has identified that the site falls entirely within Flood Zone 1, an area with a low risk of flooding due to rivers or tidal waters in any given year. The extract of the EA's Flood Map overlaid with the site boundary is provided in **Figure 5.**

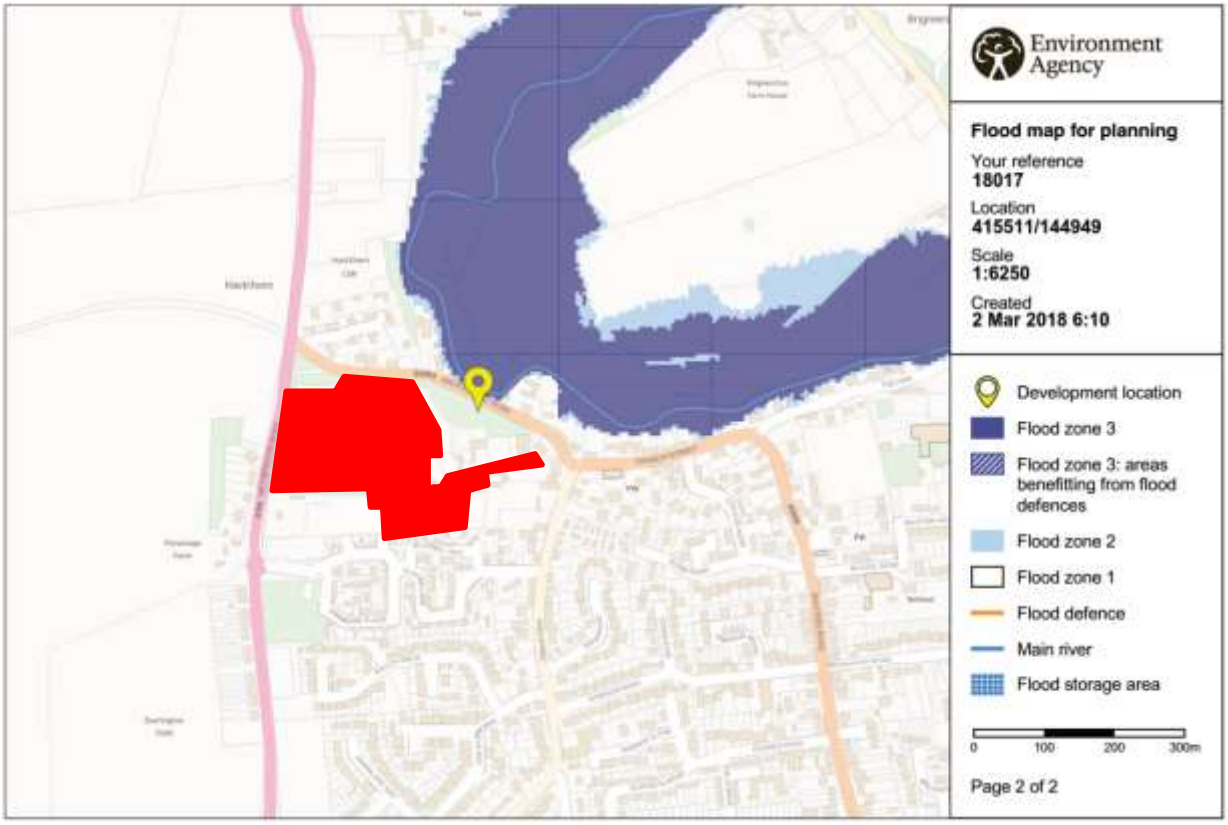


Figure 5 E.A Flood Map Rivers and Sea

4.2 In addition to the above, the E.A Data also indicates that the site is at a very low risk of flooding due to surface water or artificial sources. See **Figure 6.**

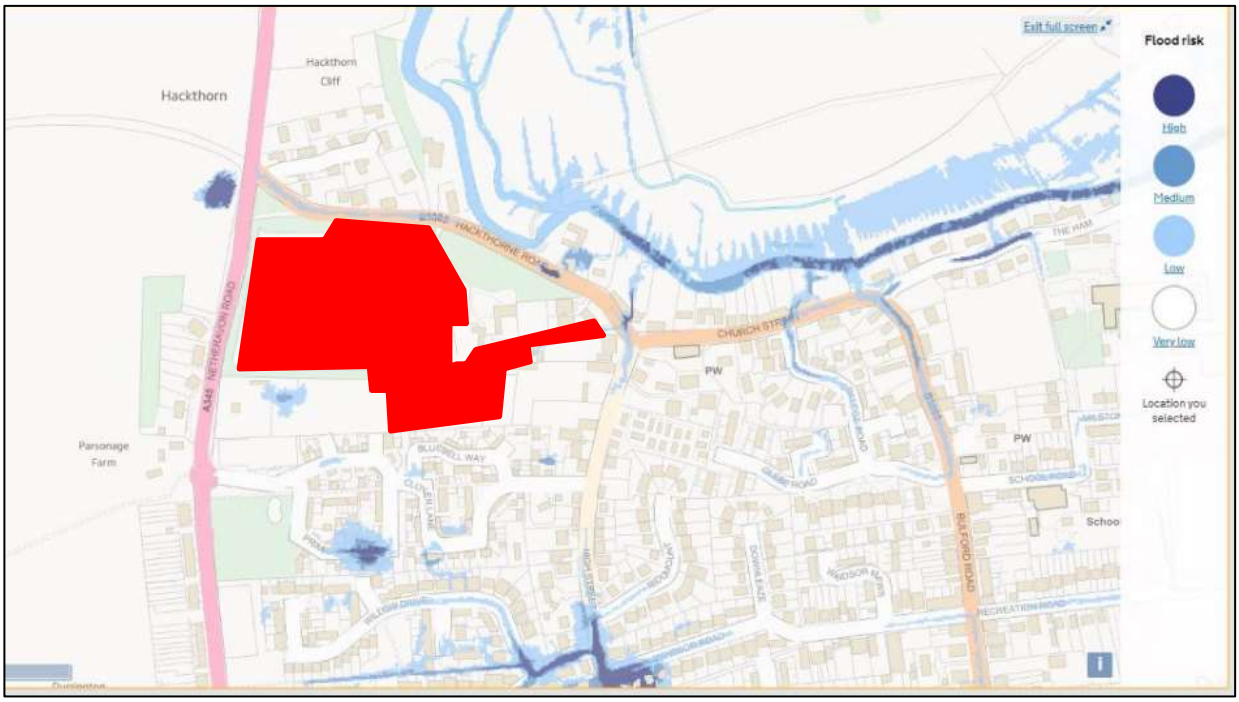


Figure 6 E.A. Surface Water Flood Map.

4.3 This FRA has been prepared taking into account the National Planning Policy Framework (NPPF) Technical Guidance and the EA Flood Risk Standing Advice. This report will seek to quantify the flood risk posed to the site and the proposed development and to identify potential mitigation measures. The drainage of surface water run-off generated by the site is also considered to ensure that the re-development proposals would not pose an adverse effect on the flood risk to the surrounding area.

4.4 Based on Table 3 (shown as **Table 1**) from the National Planning Policy Framework (NPPF) Technical Guidance, the site would be classified as 'Less Vulnerable' as it comprises of commercial units. This table shows that the site is therefore acceptable in Flood Zone 1.

Flood Zones	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	Exception Test required †	X	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	X	X	X	✓*

Key: ✓ Development is appropriate X Development should not be permitted.

Table 1: NPPF Planning Practice Guidance Table – Flood Risk Vulnerability and Flood Zone Compatibility

Notes to table 3

- *This table does not show the application of the Sequential Test which should be applied first to guide development to Flood Zone 1, then Zone 2, and then Zone 3; nor does it reflect the need to avoid flood risk from sources other than rivers and the sea;*
- *The Sequential and Exception Tests do not need to be applied to minor developments and changes of use, except for a change of use to a caravan, camping or chalet site, or to a mobile home or park home site;*
- *Some developments may contain different elements of vulnerability and the highest vulnerability category should be used, unless the development is considered in its component parts.*

† In Flood Zone 3a essential infrastructure should be designed and constructed to remain operational and safe in times of flood.

*" * "In Flood Zone 3b (functional floodplain) essential infrastructure that has to be there and has passed the Exception Test, and water-compatible uses, should be designed and constructed to:*

- *remain operational and safe for users in times of flood;*
- *result in no net loss of floodplain storage;*
- *not impede water flows and not increase flood risk elsewhere*

Minor development means:

- *minor non-residential extensions: industrial/commercial/leisure etc extensions with a footprint less than 250 square metres.*
- *alterations: development that does not increase the size of buildings e.g. alterations to external appearance.*
- *householder development: For example; sheds, garages, games rooms etc within the curtilage of the existing dwelling, in addition to physical extensions to the existing dwelling itself. This definition excludes any proposed development that would create a separate dwelling within the curtilage of the existing dwelling e.g. subdivision of houses into flats.*

4.5 Although the site is classified as Flood Zone 1, a FRA is still required as it is larger than 1 hectare. Therefore, in-line with NPPF Technical Guidance, this report identifies the risks of flooding from all sources, possible mitigation measures, assesses the development impacts on flood risk to the surrounding areas, and provides recommendations to ensure flood risk is not increased off site.

Groundwater Flooding

4.6 Groundwater flooding occurs when groundwater levels increase sufficiently for the water table to intersect the ground surface. Groundwater flooding can occur in a variety of geological settings including valleys, in areas underlain by chalk, and in river valleys with thick deposits of alluvium and river gravels.

Artificial Sources of Flooding

4.7 There are no artificial water sources (canals, reservoirs, etc.) within vicinity of the site that could potentially be the source of flood risk to the site. The EA's Flooding from Reservoirs Map is included as Figure 7 and confirms that there is no risk to the site associated with flooding from artificial sources.

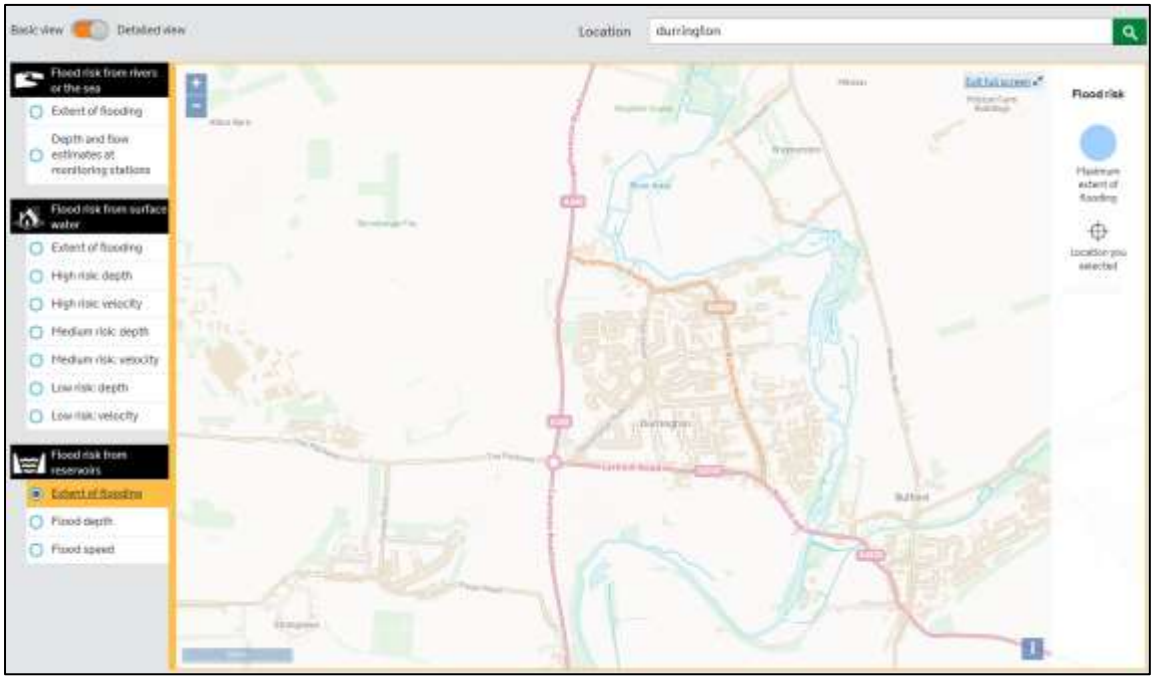


Figure 7 Environment Agency Flooding from Reservoirs Map

4.8 Based on the available information, it is therefore considered that the flood risk posed to the proposed development by surface water would be low. However, it is still recommended that careful consideration should be given throughout the design stages to the use of appropriate drainage slopes of hardstanding areas on the site to ensure that any surface water run-off is directed away from buildings and other critical infrastructure

5. DRAINAGE STRATEGY

Ground Conditions

5.1 In line with the Building Regulations Part H3, surface water shall discharge to one of the following, listed in order of priority:

- An adequate infiltration system: or, where not reasonably practicable,
- A watercourse; or, where not reasonably practicable,
- A sewer.

5.2 For this project, soakage tests have been carried out to BRE 365, a copy of the test results is included in **Appendix E** and a summary of the results is included in **Table 2.** Groundwater was not encountered in the excavations.

Pit Number	Fill 1	Fill 2	Fill 3
Pit 1	1.064×10^{-4}	7.677×10^{-5}	6.774×10^{-5}
Pit 2	3.018×10^{-4}	3.125×10^{-5}	1.519×10^{-4}
Pit 3	5.989×10^{-5}	3.484×10^{-5}	6.429×10^{-5}

Table 2: September 2018 Infiltration Rates

5.3 The test results from March 2018 were carried out to BS6297, which whilst not strictly correct for soakaway design can be interpreted to provide an equivalent rate, the results of this earlier test are also included in **Appendix E** and are summarised below in **Table 3.**

Pit Number	Fill 1	Fill 2	Fill 3
Pit 1	5.2×10^{-3}	6.8×10^{-3}	7.2×10^{-3}

Table 3: March 2018 Infiltration Rates

Surface Water Management

5.4 In this instance given the good permeability of the subsoil, it is anticipated that the run off from the site will be drained via shallow soakaways. For the houses and a series of infiltration basins for the new roads.

5.5 As part of the detailed design further testing will need to be undertaken at various locations around the site in accordance with the specifications given in BRE Digest 365 prior to the detailed design stage. This will determine the infiltration rates of the underlying geology and allow the individual soakaway units to be sized.

5.6 The impermeable area (roofs and hardstanding) created by the new development has been calculated using the proposed site layout in **Appendix A** to be in the order of 2.3 Ha. which includes buildings, roads, patios and other paved area plus an allowance of 10% for urban creep. This equates to approximately 54% of the total site area.

Greenfield Run-off

5.7 Utilising the UK SuDS online tool, the greenfield run off (Qbar) has been estimated at 0.173 l/s/ha. (This reflects the permeable nature of the subsoil) A copy of the greenfield run off estimate is included in **Appendix C.**

5.8 It has been assumed that a combination of permeable pavements, trench soakaways in rear gardens and an infiltration basin for the road drainage would be utilised for the disposal of surface water. The trench soakaways would generally be 2 x 4 x 2.5m deep and the infiltration basin would have a plan area at the base of 570m^2 with 1: side slopes. If the full site were to be drained into this basin, the plan area would be approximately 1365m^2 and maximum water level would be approximately 1.3m and would drain down to empty within approximately 7 hours the calculations for the basin are included in **Appendix F.**

5.9 Preliminary soakaway calculations have been carried out using Microdrainage software for the 1 in 100-year storm event with a 40% increase due to climate change The Microdrainage output is based on a typical plan area of 100 sq.m. and is included in **Appendix F.**

5.10 For the infiltration Basin, a return period of 100 years with an allowance of 40% for climate change has been used to ensure that no flooding of the site will occur.

Surface Water Flow attenuation

5.11 Based on the anticipated use of infiltration for the surface water drainage, the soakaways and basins will be designed with a factor of safety of 2 which will provide a safety margin over and above the design rainfall return period thus no further attenuation is required.

Minimum Ground floor Levels

5.12 Based in the information from the site investigation and the proposed use of soakaways and basins, the minimum finished floor levels should be set at 150mm above the finished ground level. This will mitigate against any localised flooding due to exceedance events and drainage failure. In addition, wherever possible, main entrance paths should slope away from the buildings towards the new road network

Safe Access and Egress

5.13 As the site lies entirely in Flood zone 1 (FZ1) and the main access is also in FZ1, the main access provides for safe access and egress and no further provision is necessary

Overland Flow Paths

5.14 Based on the topographic survey, existing overland flow paths have been modelled using PDS ground modelling software.

5.15 As the final design has yet to be carried out, Indicative overland flow paths for the developed site have been indicated on the drawings a copy of the pre and post development flow paths are included in Appendix G

Off-site Impacts

5.16 Given that the site is anticipated to be drained by infiltration, there should be no off-site impacts

Water Quality

5.17 The following tables have been extracted from the SuDS manual and demonstrate the pollution risks associated with various discharge situations.

TABLE 26.14 Impermeability and pollution indices for different land use types[1]

Land use surface type (LUST)	Impermeability (IMP_{av})	Total suspended soluds pollution index (PI_{TSS})	Organic pollution index (PI_{Org})	Hydrocarbon pollution index (PI_{PAH})	Metals pollution index (PI_{Met})
Roofs					
• industrial/commercial	1.0	0.3	0.3–0.4	0.2	0.4–0.8
• residential	0.9	0.4–0.5	0.6–0.7	0.1	0.2–0.5
Highways					
• motorways	0.8–0.9	0.9	0.7	0.9	0.8
• major arterial highways	0.7–0.8	0.8	0.7	0.8	0.8
• urban distributor roads	0.6–0.7	0.7–0.8	0.5	0.8	0.7
• residential streets	0.4–0.6	0.4	0.6	0.6	0.6
• pavements	0.5–0.6	0.4	0.6	0.3	0.3
Car parks/hardstanding					
• industrial/commercial	0.6–0.8	0.6–0.7	0.6–0.7	0.7	0.4–0.5
• driveways (residential)	0.5	0.5	0.6	0.4	0.3
Open areas					
• gardens (all types)	0.1	0.3	0.2–0.3	0	0.01
• parks/golf courses	0.2	0.2–0.3	0.2	0	0.02
• grassed areas (including verges, all types)	0.1	0.2–0.3	0.2–0.3	0.05	0.05

Note

1 Pollution index values are based on reported land use type EMC distributions and impact potential thresholds from House *et al* (1993), Luker and Montague (1994), Butler and Clark (1995), D'Arcy *et al* (2000), Mitchell (2005) and Moy *et al* (2003).

Table 4 Table 26.14 of the SuDS Manual

TABLE 26.15 Pollution mitigation indices for different SuDS components and conventional pipe drainage

SuDS type	Total suspended solids pollution mitigation index (PMI_{TSS})	Hydrocarbon pollution mitigation index (PMI_{PAH})	Organic pollution mitigation index (PMI_{Org})	Heavy metal pollution mitigation index (PMI_{HM})
Filter drains	0.6	0.8	0.7	0.7
Porous asphalt	0.7	0.9	0.9	0.9
Porous paving	0.2	0.3	0.2	0.3
Sedimentation tank	0.95	0.95	0.95	0.95
Green roof	0.8–0.9	0.9	0.5	0.7–0.9
Filter strip	0.9	0.8	0.8	0.7
Swales	0.7	0.6	0.4	0.4
Soakaways	0.3	0.6	0.5	0.5
Infiltration trench	0.3	0.6	0.5	0.5
Infiltration basin	0.05	0.05	0.01	0.05
Retention pond	0.6	0.5	0.6	0.5
Detention basin	0.7	0.7	0.8	0.6
Extended detention basins	0.4	0.4	0.4	0.4
Lagoons	0.9	0.9	0.9	0.8
Contructed wetlands • subsurface flow • surface flow	 0.2 0.4	 0.1 0.2	 0.1 0.2	 0.1 0.2
Conventional gully and pipe drainage	1.0	1.0	1.0	1.0

Table 5 Table 26.15 of the SuDS Manual

5.18 Based on the Water Quality Toolkit (a copy of the output is included in **Appendix H**) the combination of a standard gully and piped system, together with a soakaway, provides adequate treatment for the run-off from the roads. Based on this information the trench soakaways and permeable pavements will also be adequate for dealing with the roofs and driveways.

5.19 The proposed indicative surface water drainage strategy is shown on Drawing 020.5403-2400 in **Appendix J**. The strategy shown on drawing 020.5403-2400 includes permeable paving for the small courtyards and private drives. It is considered that these areas of permeable paving would mimic the existing natural drainage of the site.

5.20 When the final surface water network layout has been derived during the detailed design stage, it would be modelled using Microdrainage to ensure that the site would not flood for storm events with a return period of 1 in 1 and 1 in 100 years (including climate change).

5.21 It is important to note that the surface water strategy outlined above and on drawing 020.5403-2400 is an indicative scheme that has been derived to demonstrate that technically viable options would be available to manage the surface water run-off generated by the proposed development, based on the information available at present. It is noted that the infiltration rate adopted for this assessment is based on single test location within the site, however, further full scale BRE 365 soakage tests will be carried out for this site prior to detailed design. Preliminary finished floor levels have been assessed as have proposed road levels.

Residual risks

5.22 Based on the results of the investigations, the residual risks are limited to failure or exceedance flows within the site drainage system, these can be dealt with by ensuring the appropriate design standards are followed, together with regular maintenance. Finished surfaces should be designed to route exceedance flows away from buildings and provide sufficiently raised floor levels to prevent water entering buildings.

Proposed Foul Water Drainage

5.23 The anticipated residential development will generate a peak foul flow of 6.5 l/s based on sewers for adoption 7th edition.

5.24 Wessex Water Sewer records have been obtained and it can be seen that there is a 175mm diameter foul sewer running under Hackthorn Road. At this stage we do not have the accurate invert levels for this sewer, however given the topography of the site it appears that a gravity connection to this sewer is feasible.

5.25 The proposed foul water drainage connection is shown on drawing 020.5403-2401 included in Appendix J

5.26 It is understood that the stables and adjoining properties are served by septic tanks, works carried out as part of this development could enable these properties to be connected to the public sewer.

5.27 It has been noted that the area falls within a nutrient management plan area as the River Avon has been subjected to high levels of phosphates. From information we have been able to obtain, it is understood that Wessex water have measure in place to remove phosphates from the treated sewage, as a result of this it is anticipated that a sum of money will be paid per property towards upgrading the treatment works for phosphate removal.

5.28 As an alternative to the above, it would also be possible to set up on-site treatment of the sewage to include phosphate removal, prior to discharge into the public sewer network.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 This Flood Risk Assessment has been prepared by Paul Basham Associates to support a planning application for the proposed residential development of the Site H3.6 And S98, Hackthorn Road Durrington. The site is approximately 4.23 Ha in total area and is currently greenfield. The development proposals would involve the construction of up to 140 residential units.

6.2 It has been identified that the site falls wholly within Flood Zone 1. The site has also been assessed for all sources of flood risk such as rivers, groundwater, canals, reservoirs, surface water (pluvial flooding), and sewers. It was concluded that the site is at a very low risk of flooding from all sources

Surface Water

6.3 In accordance with the Environment Agency, National Planning Policy Framework and current best practice, it is intended to deal with runoff at source using a number of different techniques assisting in the treatment of the runoff discharged to the natural environment. This will be achieved by using a combination of permeable pavements, swales and infiltration basins.

Foul Water

6.4 The development site is expected to generate approximately 3.24 l/s foul water flow which can be connected via gravity to the public sewer network

General

6.5 It is important to note that the surface and foul water strategies outlined in this report may not necessarily form the final design. It is simply a demonstration of the most suitable and technically feasible designs for the proposed development, based on the information available at present. Site constraints and economic appraisals undertaken as part of the design stage may result in suitable amendments to the current strategies. This FRA has been prepared taking into account the National Planning Policy Framework Technical Guidance and the EA Flood Risk Standing Advice. This report has quantified the flood risk posed to the proposed development as being low.

6.6 It is therefore concluded that the proposed development of the site would be acceptable in terms of flood risk and drainage.

Appendix A

Local Urban Context
(1:2,000 @ A3)

Appendix B

Soakaway Calculations

paulbasham associates

Soakaway Test No.	Test Pit 1 Fill 1
Contract:	Manor Park, Durrington
Contract No.	020.5403

Field Test

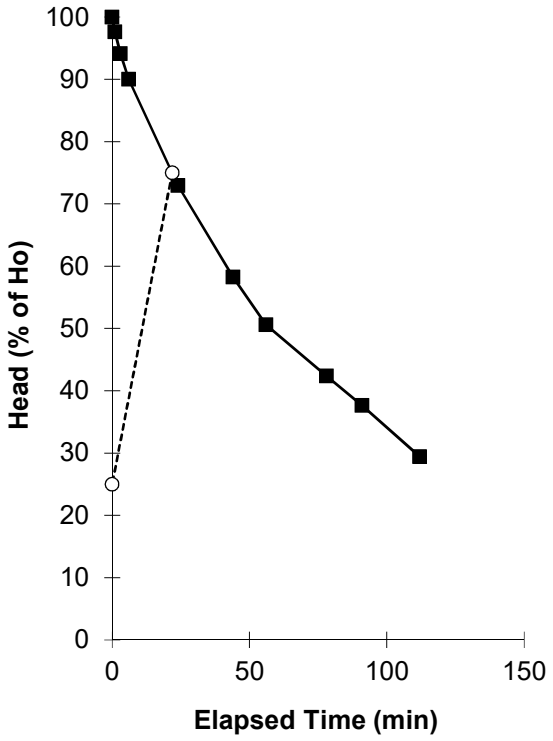
Depth of Pit	2.90	m
Width of Pit	0.40	m
Length of Pit	2.00	m
Depth of Pit Soaked	1.70	m
ap50	4.88	m2
Vp75-25	0.68	m3
t75-25	-21.8	min
water used	1.3600	m3
f	-1.064E-04	m/sec.

Trial Pit Log (include details of groundwater):

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
1.20	0	100	1.70
1.24	1	98	1.66
1.30	3	94	1.60
1.37	6	90	1.53
1.66	24	73	1.24
1.91	44	58	0.99
2.04	56	51	0.86
2.18	78	42	0.72
2.26	91.0	38	0.64
2.40	112.0	29	0.50

T75	21.828	75
T25	0.000	25
T75-25	-21.828	Derived from Best Fit



Comments

Paul Basham Associates

Lancaster Court, 8 Barnes Wallis Road, Fareham, Hampshire, PO15 5TU

Soakaway Calculations

paulbasham associates

Soakaway Test No.	Test Pit 1 fill 2
Contract:	Manor Park, Durrington
Contract No.	020.5403

Field Test

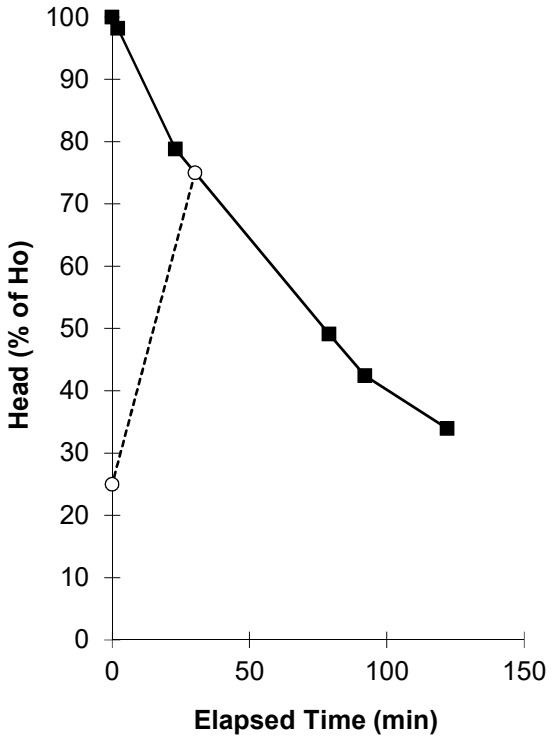
Depth of Pit	2.90	m
Width of Pit	0.40	m
Length of Pit	2.00	m
Depth of Pit Soaked	1.65	m
ap50	4.76	m2
Vp75-25	0.66	m3
t75-25	-30.1	min
water used	1.3200	m3
f	-7.667E-05	m/sec.

Trial Pit Log (include details of groundwater):

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
1.25	0	100	1.65
1.28	2	98	1.62
1.60	23	79	1.30
2.09	79	49	0.81
2.20	92	42	0.70
2.34	122	34	0.56

T75	30.143	75
T25	0.000	25
T75-25	-30.143	Derived from Best Fit



Comments

Paul Basham Associates
Lancaster Court, 8 Barnes Wallis Road, Fareham, Hampshire, PO15 5TU

Soakaway Calculations

paulbasham associates

Soakaway Test No.	Test Pit 1 Fill 3
Contract:	Manor Park, Durrington
Contract No.	020.5403

Field Test

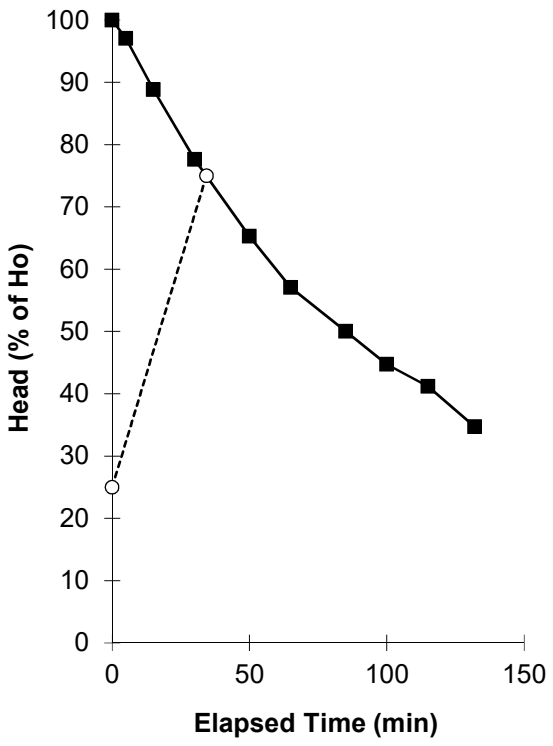
Depth of Pit	2.90	m
Width of Pit	0.40	m
Length of Pit	2.00	m
Depth of Pit Soaked	1.70	m
ap50	4.88	m2
Vp75-25	0.68	m3
t75-25	-34.3	min
water used	1.3600	m3
f	-6.774E-05	m/sec.

Trial Pit Log (include details of groundwater):

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
1.20	0	100	1.70
1.25	5	97	1.65
1.39	15	89	1.51
1.58	30	78	1.32
1.79	50	65	1.11
1.93	65	57	0.97
2.05	85	50	0.85
2.14	100	45	0.76
2.20	115.0	41	0.70
2.31	132.0	35	0.59

T75	34.286	75
T25	0.000	25
T75-25	-34.286	Derived from Best Fit



Comments

Paul Basham Associates
Lancaster Court, 8 Barnes Wallis Road, Fareham, Hampshire, PO15 5TU

Soakaway Calculations

paulbasham associates

Soakaway Test No.	Test Pit 2 Fill 1
Contract:	Manor Park, Durrington
Contract No.	020.5403

Field Test

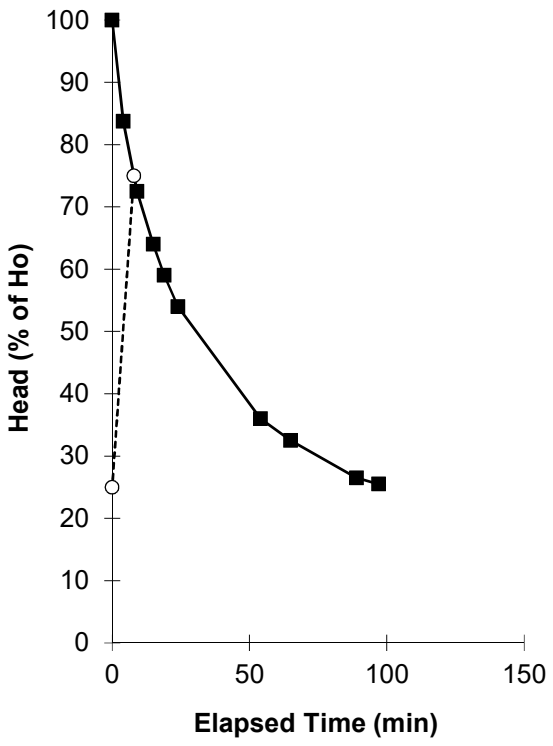
Depth of Pit	2.70	m
Width of Pit	0.40	m
Length of Pit	2.00	m
Depth of Pit Soaked	2.00	m
ap50	5.6	m2
Vp75-25	0.8	m3
t75-25	-7.9	min
water used	1.6000	m3
f	-3.018E-04	m/sec.

Trial Pit Log (include details of groundwater):

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
0.70	0	100	2.00
1.03	4	84	1.68
1.25	9	73	1.45
1.42	15	64	1.28
1.52	19	59	1.18
1.62	24	54	1.08
1.98	54	36	0.72
2.05	65	33	0.65
2.17	89.0	27	0.53
2.19	97.0	26	0.51

T75	7.889	75
T25	0.000	25
T75-25	-7.889	Derived from Best Fit



Comments

Paul Basham Associates

Lancaster Court, 8 Barnes Wallis Road, Fareham, Hampshire, PO15 5TU

Soakaway Calculations

paulbasham associates

Soakaway Test No.	Test Pit 2 Fill 2
Contract:	Manor Park, Durrington
Contract No.	020.5403

Field Test

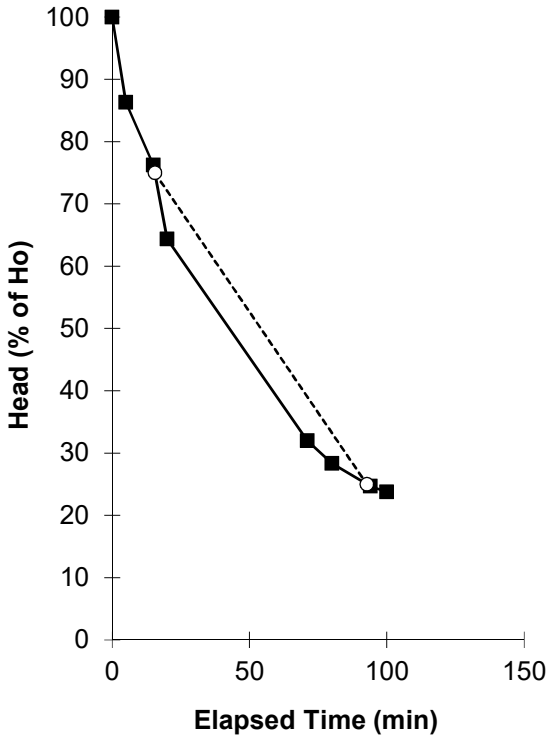
Depth of Pit	2.70	m
Width of Pit	0.40	m
Length of Pit	2.00	m
Depth of Pit Soaked	2.19	m
ap50	6.056	m2
Vp75-25	0.876	m3
t75-25	77.2	min
water used	1.7520	m3
f	3.125E-05	m/sec.

Trial Pit Log (include details of groundwater):

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
0.51	0	100	2.19
0.81	5	86	1.89
1.03	15	76	1.67
1.29	20	64	1.41
2.00	71	32	0.70
2.08	80	28	0.62
2.16	94	25	0.54
2.18	100	24	0.52

T75	15.529	75
T25	92.688	25
T75-25	77.159	Derived from Best Fit



Comments

Paul Basham Associates
Lancaster Court, 8 Barnes Wallis Road, Fareham, Hampshire, PO15 5TU

Soakaway Calculations

paulbasham associates

Soakaway Test No.	Test Pit 2 Fill 3
Contract:	Manor Park, Durrington
Contract No.	020.5403

Field Test

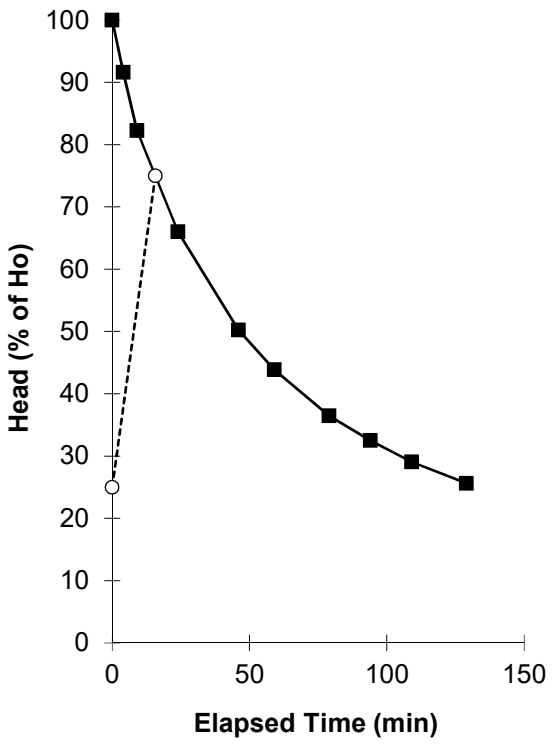
Depth of Pit	2.70	m
Width of Pit	0.40	m
Length of Pit	2.00	m
Depth of Pit Soaked	2.03	m
ap50	5.672	m2
Vp75-25	0.812	m3
t75-25	-15.7	min
water used	1.6240	m3
f	-1.519E-04	m/sec.

Trial Pit Log (include details of groundwater):

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
0.67	0	100	2.03
0.84	4	92	1.86
1.03	9	82	1.67
1.36	24	66	1.34
1.68	46	50	1.02
1.81	59	44	0.89
1.96	79	36	0.74
2.04	94	33	0.66
2.11	109.0	29	0.59
2.18	129.0	26	0.52

T75	15.705	75
T25	0.000	25
T75-25	-15.705	Derived from Best Fit



Comments

Paul Basham Associates
Lancaster Court, 8 Barnes Wallis Road, Fareham, Hampshire, PO15 5TU

Soakaway Calculations

paulbasham associates

Soakaway Test No.	Test Pit 3 Fill 1
Contract:	Manor Park, Durrington
Contract No.	020.5403

Field Test

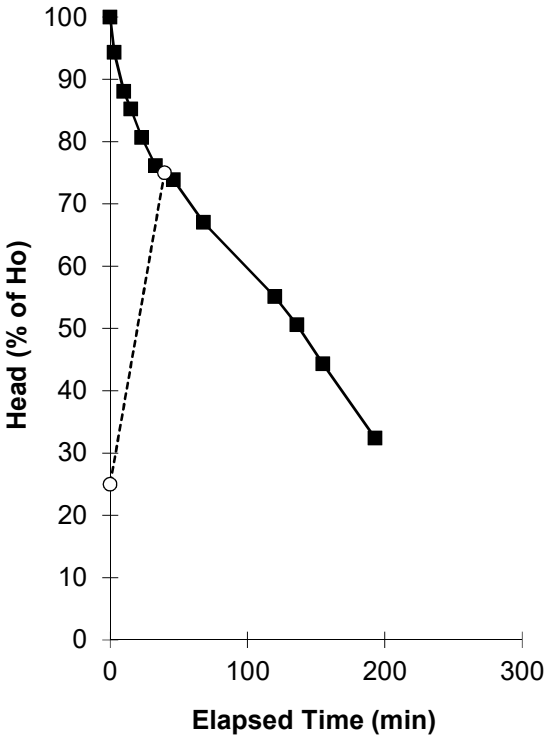
Depth of Pit	2.40	m
Width of Pit	0.40	m
Length of Pit	2.20	m
Depth of Pit Soaked	1.76	m
ap50	5.456	m2
Vp75-25	0.7744	m3
t75-25	-39.5	min
water used	1.5488	m3
f	-5.989E-05	m/sec.

Trial Pit Log (include details of groundwater):

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
0.64	0	100	1.76
0.74	3	94	1.66
0.85	10	88	1.55
0.90	15	85	1.50
0.98	23	81	1.42
1.06	33	76	1.34
1.10	46	74	1.30
1.22	68	67	1.18
1.43	120.0	55	0.97
1.51	136.0	51	0.89
1.62	155.0	44	0.78
1.83	193.0	32	0.57

T75	39.500	75
T25	0.000	25
T75-25	-39.500	Derived from Best Fit



Comments

Soakaway Calculations

paulbasham associates

Soakaway Test No.	Test Pit 3 Fill 2
Contract:	Manor Park, Durrington
Contract No.	020.5403

Field Test

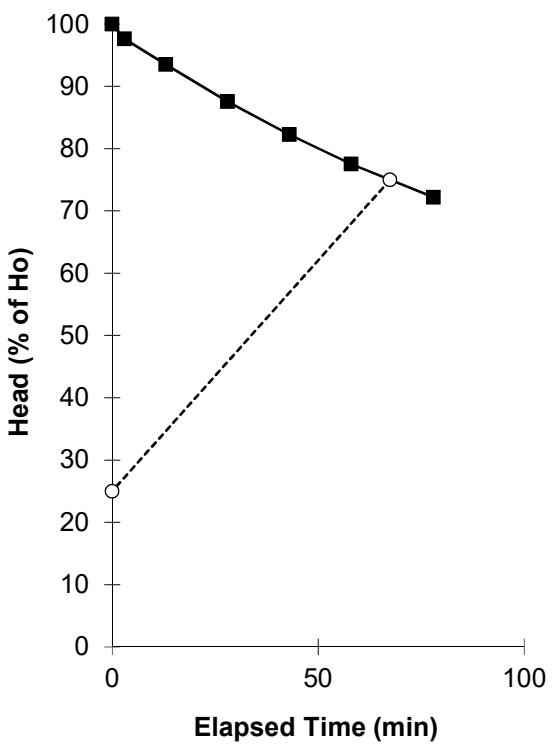
Depth of Pit	2.40	m
Width of Pit	0.40	m
Length of Pit	2.20	m
Depth of Pit Soaked	1.69	m
ap50	5.274	m2
Vp75-25	0.7436	m3
t75-25	-67.4	min
water used	1.4872	m3
f	-3.484E-05	m/sec.

Trial Pit Log (include details of groundwater):

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
0.71	0	100	1.69
0.75	3	98	1.65
0.82	13	93	1.58
0.92	28	88	1.48
1.01	43	82	1.39
1.09	58	78	1.31
1.18	78	72	1.22

T75	67.444	75
T25	0.000	25
T75-25	-67.444	Derived from Best Fit



Comments

Paul Basham Associates
Lancaster Court, 8 Barnes Wallis Road, Fareham, Hampshire, PO15 5TU

Soakaway Calculations

paulbasham associates

Soakaway Test No.	Test Pit 3 Fill 3
Contract:	Manor Park, Durrington
Contract No.	020.5403

Field Test

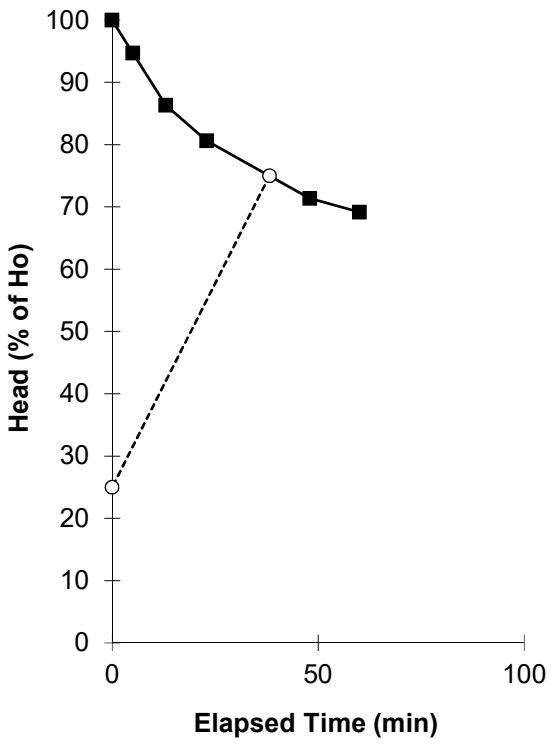
Depth of Pit	2.40	m
Width of Pit	0.40	m
Length of Pit	2.20	m
Depth of Pit Soaked	2.27	m
ap50	6.782	m2
Vp75-25	0.9988	m3
t75-25	-38.2	min
water used	1.9976	m3
f	-6.429E-05	m/sec.

Trial Pit Log (include details of groundwater):

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
0.13	0	100	2.27
0.25	5	95	2.15
0.44	13	86	1.96
0.57	23	81	1.83
0.78	48	71	1.62
0.83	60	69	1.57

T75	38.179	75
T25	0.000	25
T75-25	-38.179	Derived from Best Fit



Comments

Paul Basham Associates

Lancaster Court, 8 Barnes Wallis Road, Fareham, Hampshire, PO15 5TU

INDICATIVE

0 25 50
Metres

LDS Land Development Services

Apothecary House, Fowler's Road, Salisbury, Wilts. SP1 2QU
Tel: 01722 338232 | Fax: 01722 331932
E-Mail: peter@lds-survey.co.uk

15 Moor Road, Broadstone, Poole, Dorset. BH18 8AZ
Tel: 01202 602506 | Fax: 01202 658557
E-Mail: mervyn@lds-survey.co.uk

www.lds-survey.co.uk
LAND, CIVIL ENGINEERING & MEASURED BUILDING SURVEYORS SINCE 1969

RICS THE SURVEY ASSOCIATION

Client:
BENCHMARK DEVELOPMENT PLANNING LTD.

Drawing Title:
TOPOGRAPHIC SURVEY

Project:
LAND ADJACENT TO MANOR FARM DURRINGTON

Levels in metres related to Ordnance Datum Newlyn:

O.S. Bench-mark situated at:
All Saints' Church, Church Street, Durrington
Value 83.73m (Obtained from OS digital mapping data)
Survey is to O.S. grid - i.e. the survey has been overlaid as a 'best fit' on O.S. Superplan Digital Data.

Scale:
1:500
Plotted on A1

Drawing No:
LDS/7739-TP2/A

Appendix C

HR Wallingford
Working with water

Greenfield runoff estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	rob wilson
Site name:	Land off Hackthorn Road
Site location:	Durrington

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site coordinates

Latitude:	51.20325° N
Longitude:	1.78079° W

Reference:	6326945
Date:	2018-03-19T13:01:32

Methodology	IH124

Site characteristics

Total site area (ha)	4.23

Methodology

Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Calculate from SOIL type

	Default	Edited
SOIL type	1	1
HOST class	---	---
SPR/SPRHOST	0.1	0.1

Hydrological characteristics

	Default	Edited
SAAR (mm)	718	718
Hydrological region	7	7
Growth curve factor: 1 year	0.85	0.85
Growth curve factor: 30 year	2.3	2.3
Growth curve factor: 100 year	3.19	3.19

Notes:

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

Normally limiting discharge rates which are less than 2.0 l/s/ha 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 consents are usually set at 5.0l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set in which case blockage work must be 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 may be a requirement for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Qbar (l/s)	0.73	0.73
1 in 1 year (l/s)	0.62	0.62
1 in 30 years (l/s)	1.68	1.68
1 in 100 years (l/s)	2.34	2.34

Appendix D

Land nr Durrington

Durrington, Salisbury

Printed on : 03/03/2016 10:32

WATER MAINS Public Private
Public
Raw Water
Abandoned
Valve Hydrant PRV Meter

SEWERS Public - Section 104 - Private
Foul
Combined
Surface
Abandoned sewers

OTHER WESSEX PIPES
Rising Mains
Effluent Disposal Main
Overflow

NON-WESSEX PIPES
Private Rising Mains
Culverted Water Course
Highway Drain

Information in this plan is provided for identification purposes only. No warranty as to accuracy is given or implied. The precise route of pipe work may not exactly match that shown. Wessex Water does not accept liability for inaccuracies.

Sewers and lateral drains adopted by Wessex Water under the Water Industry (Schemes for Adoption of Private Sewers) Regulations 2011 are to be plotted over time and may not yet be shown.

In carrying out any works, you accept liability for the cost of any repairs to Wessex Water apparatus damaged as a result of your works. You are advised to commence excavations using hand tools only. Mechanical digging equipment should not be used until pipe work has been precisely located.

If you are considering any form of building works and pipe work is shown within the boundary of your property or a property to be purchased (or very close by) a surveyor should plot its exact position prior to commencing works or purchase. Building over or near Wessex Water's apparatus is not normally permitted.

Centre:415410.21 , 144908.94

Scale = 1:1500
Metres 20 40 60 80

Appendix E

Project Name:	Manor Park, Durrington
Document Reference:	020.5403.DTN01
Document Name:	DRAINAGE TECHNICAL NOTE
Prepared By:	Rob Wilson
Checked By:	Adam Shephard
Approved By:	Rob Wilson

1. INTRODUCTION

1.1 This Technical note has been prepared by Paul Basham Associates on behalf of Cherry Porter to support a Planning allocation. The site location is demonstrated within **Figure 1**.

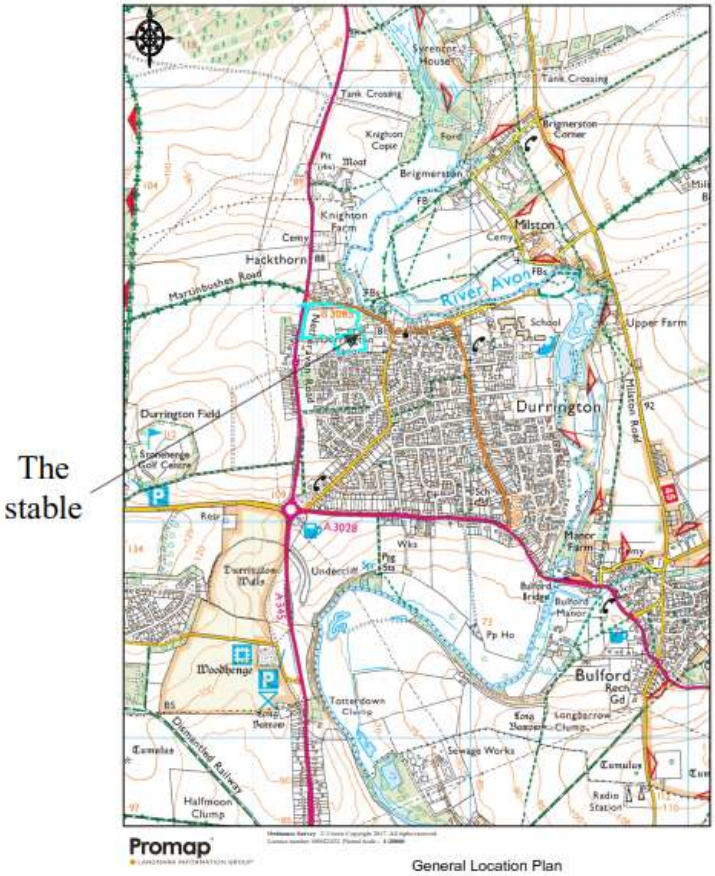


Figure 1: Location Plan

1.2 The Site is gently sloping to the North and is approximately 3.0 Ha in area.

1.3 Following on from the initial technical note produced by Baker Gilbey Associates, soakage tests were carried out on site in September 2018.

1.4 A copy of the topographic survey with the test locations indicated is included in Appendix A.

2. SOAKAGE TESTS

2.1 3 Soakage tests were carried out in the northern area of the site on 13th September 2018, to supplement an earlier test carried out in March 2018.

2.2 The testing was carried out in accordance with BRE 365 and a copy of the results are included in Appendix B

2.3 **Table 1** below shows a summary of the test results from September 2018.

Pit Number	Fill 1	Fill 2	Fill 3
Pit 1	1.064×10^{-4}	7.677×10^{-5}	6.774×10^{-5}
Pit 2	3.018×10^{-4}	3.125×10^{-5}	1.519×10^{-4}
Pit 3	5.989×10^{-5}	3.484×10^{-5}	6.429×10^{-5}

Table 1: September 2018 Infiltration Rates

2.4 The test results from March 2018 were carried out to BS6297, which whilst not strictly correct for soakaway design can be interpreted to provide an equivalent rate, the results of this earlier test are include in Appendix C and are summarised below in **Table *2***.

Pit Number	Fill 1	Fill 2	Fill 3
Pit 1	5.2×10^{-3}	6.8×10^{-3}	7.2×10^{-3}

Table 2: March 2018 Infiltration Rates

3. PROPOSED DRAINAGE STRATEGY

3.1 Based on the previously mentioned drainage strategy, utilising the lowest infiltration rate from **Table 1** above, we have carried out a simulation of the infiltration basin using

Microdrainage software. The results of this analysis (based on an estimated impermeable area of 1.52 ha (40% coverage) are included in Appendix D

3.2 The calculations indicate that by providing a basin with a base area of 570 Sq. m. with 1:3 side slopes, we get a maximum water level in the basin of 807mm and a half drain time of 128 minutes for the 1: 100-year storm event with 40% allowance for climate change.

4. WATER QUALITY

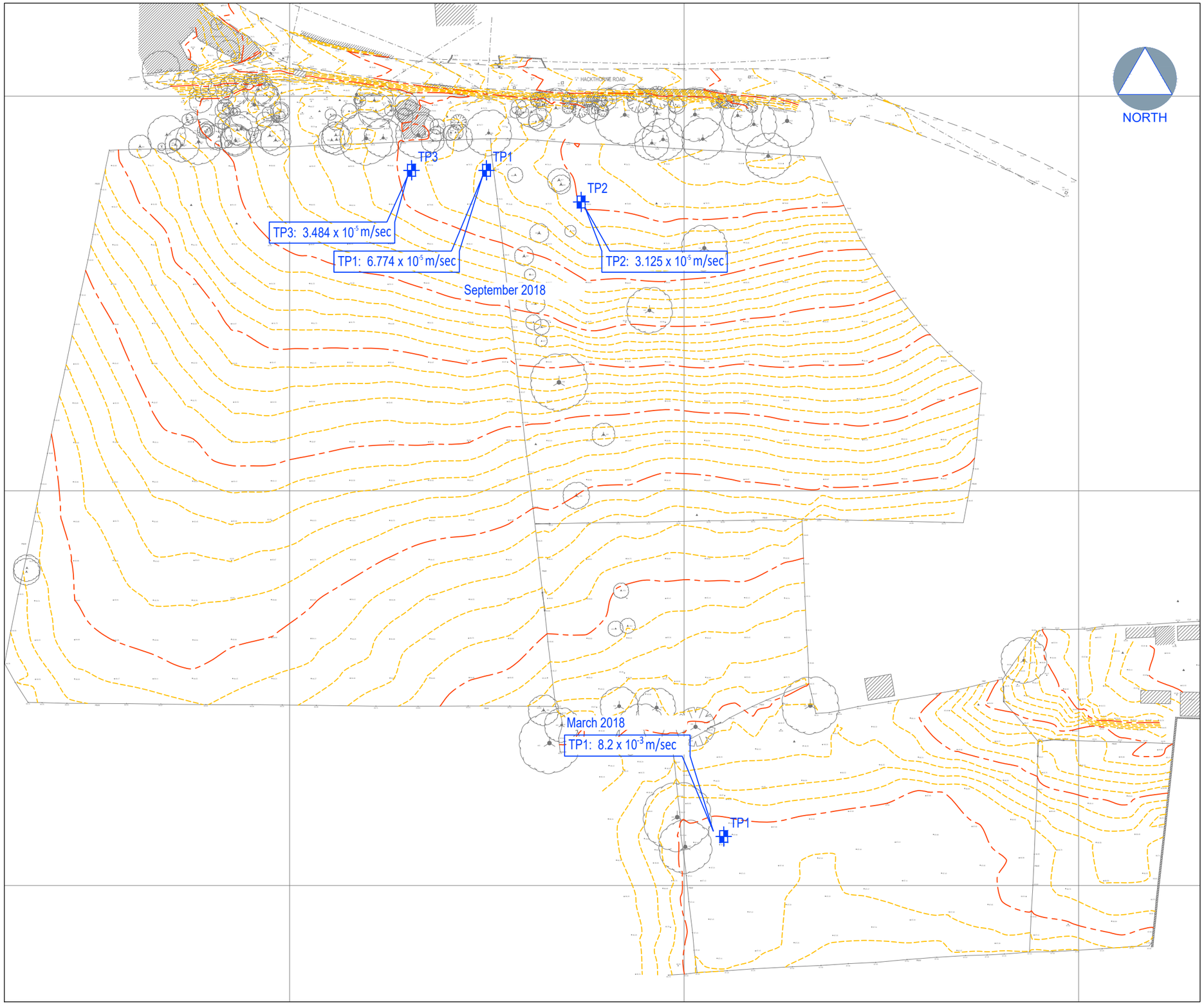
4.1 It has been noted that whilst the site is located in Flood zone 1, the site is within a source protection zone. A full Flood Risk Assessment and drainage strategy will be required to support any planning application.

4.2 Any drainage design will be required to comply with the water quality requirements and this will be dealt with as part of the SuDS management train using the UK SuDS water quality toolkit.

5. SUMMARY AND CONCLUSION

5.1 Based on the above information, it is evident that the site can be developed in such a manner that safeguards the groundwater resources and water quality, however it is anticipated that more detailed measure will be required to accompany any future planning application.

Appendix A



GENERAL NOTES

1. THIS DRAWING IS INTENDED TO BE VIEWED IN COMBINATION WITH ALL RELEVANT ARCHITECTS, ENGINEERS, SERVICES AND SPECIALIST DRAWINGS AND SPECIFICATION.
2. ANY VARIATIONS OR DISCREPANCIES BETWEEN THESE DRAWINGS IN TERMS OF DIMENSIONS OR DETAILS SHOULD BE DRAWN TO THE ATTENTION OF THE ARCHITECT AND/OR THE ENGINEER FOR CLARIFICATION.
3. PAUL BASHAM ASSOCIATES ACCEPTS NO RESPONSIBILITY FOR THE ACCURACY OF BACKGROUND INFORMATION PRODUCED BY THIRD PARTIES – THIS MUST BE TREATED AS INDICATIVE ONLY.
4. ALL DIMENSIONS AND LEVELS ARE IN METRES. DO NOT SCALE THIS DRAWING, PRINT, PLOT OR DISK.
5. THIS DRAWING SHOULD ONLY BE USED FOR CONSTRUCTION IF THE PROJECT PHASE IN THE TITLE FRAME BELOW IS SHOWN AS "CONSTRUCTION". PAUL BASHAM ASSOCIATES TAKE NO RESPONSIBILITY FOR CONSTRUCTION WORKS UNDERTAKEN TO DRAWINGS WHICH ARE NOT MARKED UNDER THIS PHASE.

PRELIMINARY

DRAWING/DESIGN IS STILL 'IN DEVELOPMENT'
YOU ARE ADVISED TO MAKE DUE ALLOWANCE

Rev	Description	Date	By	Chkd
-	-	--.--.--	--	--

Project Name: MANOR PARK DURRINGTON	Title: SOAKAGE TEST LOCATION PLAN	paulbasham associates	Client: PRIVATE CLIENT	Checked By: AS	Checked Date: 19.09.18
Project Phase: PRELIMINARY				Drawn By: RL	Drawn Date: 19.09.18

Paul Basham Associates Ltd
Lancaster Court, 8 Barnes Wallis Road, Fareham, PO15 5TU
01489 668134
info@paulbashamassociates.com www.paulbashamassociates.com

Scale		Client Drawing No.	PBA Drawing No.	Revision
1:1000	(AT A3 SIZE)	-	020.5403.001	-

Appendix B

Soakaway Calculations

paulbasham associates

Soakaway Test No.	Test Pit 1 Fill 1
Contract:	Manor Park, Durrington
Contract No.	020.5403

Field Test

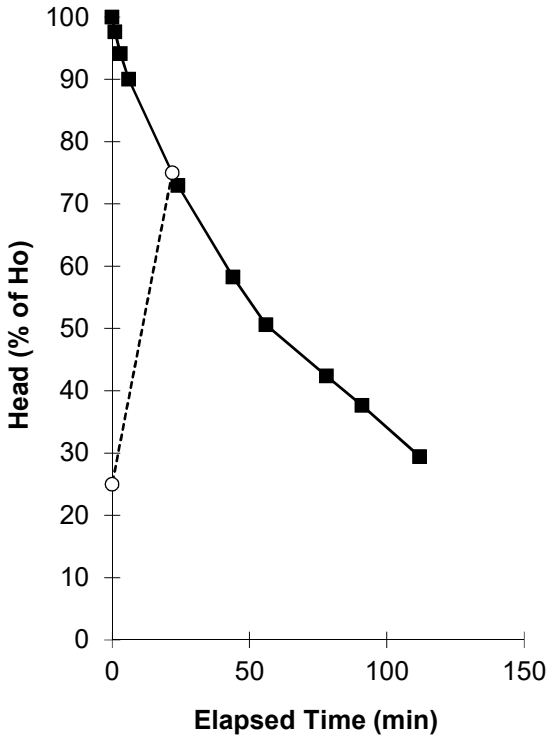
Depth of Pit	2.90	m
Width of Pit	0.40	m
Length of Pit	2.00	m
Depth of Pit Soaked	1.70	m
ap50	4.88	m2
Vp75-25	0.68	m3
t75-25	-21.8	min
water used	1.3600	m3
f	-1.064E-04	m/sec.

Trial Pit Log (include details of groundwater):

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
1.20	0	100	1.70
1.24	1	98	1.66
1.30	3	94	1.60
1.37	6	90	1.53
1.66	24	73	1.24
1.91	44	58	0.99
2.04	56	51	0.86
2.18	78	42	0.72
2.26	91.0	38	0.64
2.40	112.0	29	0.50

T75	21.828	75
T25	0.000	25
T75-25	-21.828	Derived from Best Fit



Comments

Paul Basham Associates

Lancaster Court, 8 Barnes Wallis Road, Fareham, Hampshire, PO15 5TU

Soakaway Calculations

paulbasham associates

Soakaway Test No.	Test Pit 1 fill 2
Contract:	Manor Park, Durrington
Contract No.	020.5403

Field Test

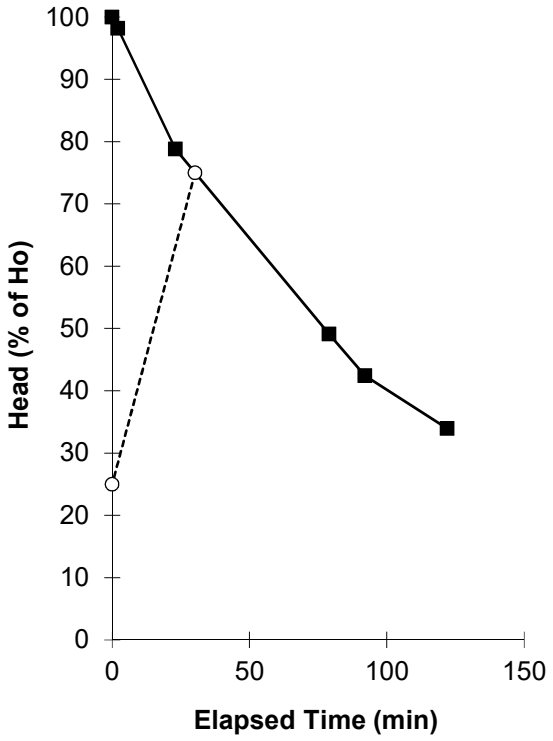
Depth of Pit	2.90	m
Width of Pit	0.40	m
Length of Pit	2.00	m
Depth of Pit Soaked	1.65	m
ap50	4.76	m2
Vp75-25	0.66	m3
t75-25	-30.1	min
water used	1.3200	m3
f	-7.667E-05	m/sec.

Trial Pit Log (include details of groundwater):

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
1.25	0	100	1.65
1.28	2	98	1.62
1.60	23	79	1.30
2.09	79	49	0.81
2.20	92	42	0.70
2.34	122	34	0.56

T75	30.143	75
T25	0.000	25
T75-25	-30.143	Derived from Best Fit



Comments

Paul Basham Associates
Lancaster Court, 8 Barnes Wallis Road, Fareham, Hampshire, PO15 5TU

Soakaway Calculations

paulbasham associates

Soakaway Test No.	Test Pit 1 Fill 3
Contract:	Manor Park, Durrington
Contract No.	020.5403

Field Test

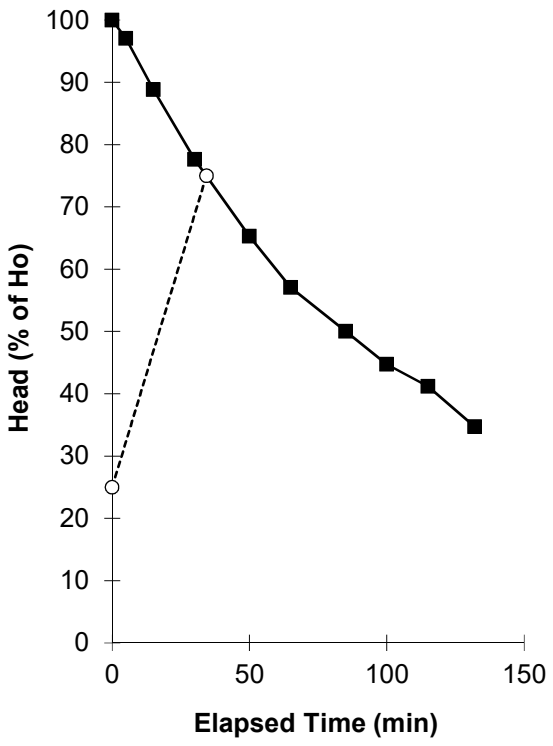
Depth of Pit	2.90	m
Width of Pit	0.40	m
Length of Pit	2.00	m
Depth of Pit Soaked	1.70	m
ap50	4.88	m2
Vp75-25	0.68	m3
t75-25	-34.3	min
water used	1.3600	m3
f	-6.774E-05	m/sec.

Trial Pit Log (include details of groundwater):

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
1.20	0	100	1.70
1.25	5	97	1.65
1.39	15	89	1.51
1.58	30	78	1.32
1.79	50	65	1.11
1.93	65	57	0.97
2.05	85	50	0.85
2.14	100	45	0.76
2.20	115.0	41	0.70
2.31	132.0	35	0.59

T75	34.286	75
T25	0.000	25
T75-25	-34.286	Derived from Best Fit



Comments

Paul Basham Associates
Lancaster Court, 8 Barnes Wallis Road, Fareham, Hampshire, PO15 5TU

Soakaway Calculations

paulbasham associates

Soakaway Test No.	Test Pit 2 Fill 1
Contract:	Manor Park, Durrington
Contract No.	020.5403

Field Test

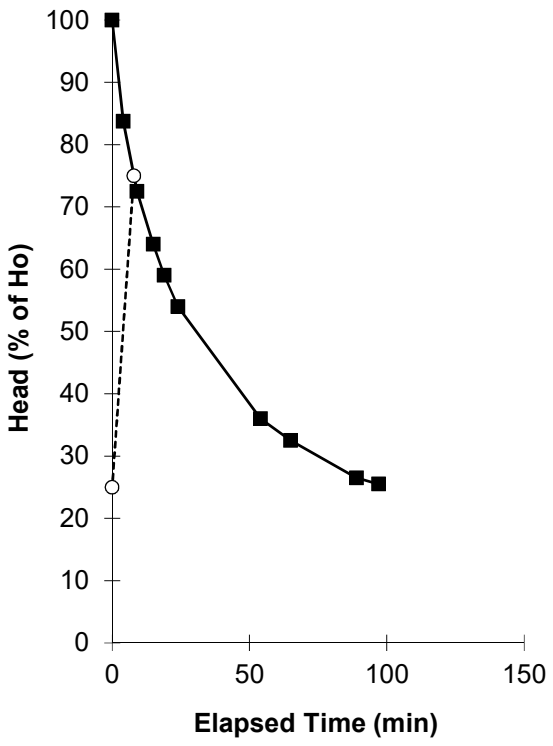
Depth of Pit	2.70	m
Width of Pit	0.40	m
Length of Pit	2.00	m
Depth of Pit Soaked	2.00	m
ap50	5.6	m2
Vp75-25	0.8	m3
t75-25	-7.9	min
water used	1.6000	m3
f	-3.018E-04	m/sec.

Trial Pit Log (include details of groundwater):

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
0.70	0	100	2.00
1.03	4	84	1.68
1.25	9	73	1.45
1.42	15	64	1.28
1.52	19	59	1.18
1.62	24	54	1.08
1.98	54	36	0.72
2.05	65	33	0.65
2.17	89.0	27	0.53
2.19	97.0	26	0.51

T75	7.889	75
T25	0.000	25
T75-25	-7.889	Derived from Best Fit



Comments

Paul Basham Associates

Lancaster Court, 8 Barnes Wallis Road, Fareham, Hampshire, PO15 5TU

Soakaway Calculations

paulbasham associates

Soakaway Test No.	Test Pit 2 Fill 2
Contract:	Manor Park, Durrington
Contract No.	020.5403

Field Test

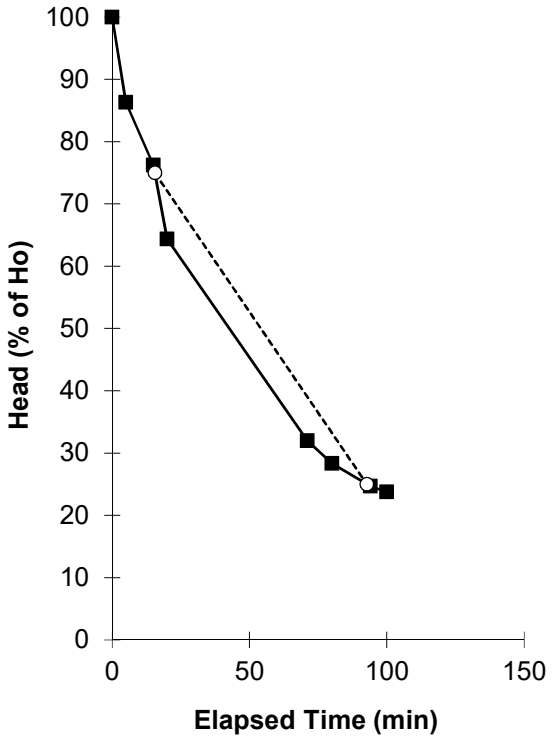
Depth of Pit	2.70	m
Width of Pit	0.40	m
Length of Pit	2.00	m
Depth of Pit Soaked	2.19	m
ap50	6.056	m2
Vp75-25	0.876	m3
t75-25	77.2	min
water used	1.7520	m3
f	3.125E-05	m/sec.

Trial Pit Log (include details of groundwater):

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
0.51	0	100	2.19
0.81	5	86	1.89
1.03	15	76	1.67
1.29	20	64	1.41
2.00	71	32	0.70
2.08	80	28	0.62
2.16	94	25	0.54
2.18	100	24	0.52

T75	15.529	75
T25	92.688	25
T75-25	77.159	Derived from Best Fit



Comments

Paul Basham Associates
Lancaster Court, 8 Barnes Wallis Road, Fareham, Hampshire, PO15 5TU

Soakaway Calculations

paulbasham associates

Soakaway Test No.	Test Pit 2 Fill 3
Contract:	Manor Park, Durrington
Contract No.	020.5403

Field Test

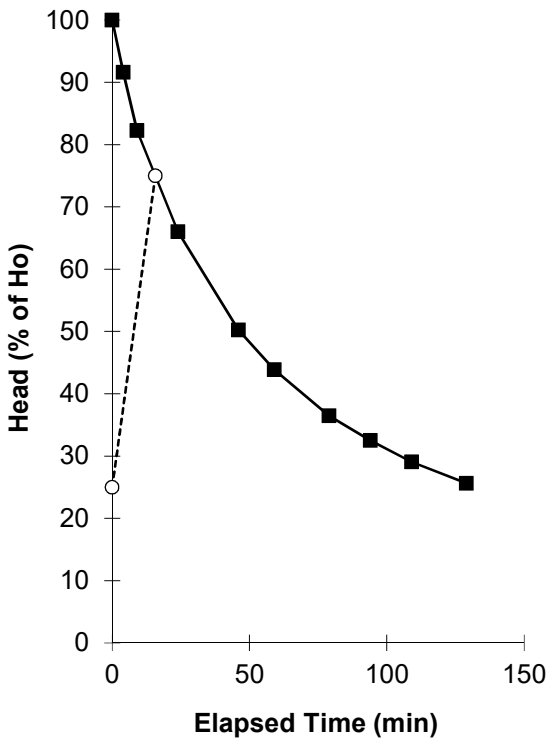
Depth of Pit	2.70	m
Width of Pit	0.40	m
Length of Pit	2.00	m
Depth of Pit Soaked	2.03	m
ap50	5.672	m2
Vp75-25	0.812	m3
t75-25	-15.7	min
water used	1.6240	m3
f	-1.519E-04	m/sec.

Trial Pit Log (include details of groundwater):

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
0.67	0	100	2.03
0.84	4	92	1.86
1.03	9	82	1.67
1.36	24	66	1.34
1.68	46	50	1.02
1.81	59	44	0.89
1.96	79	36	0.74
2.04	94	33	0.66
2.11	109.0	29	0.59
2.18	129.0	26	0.52

T75	15.705	75
T25	0.000	25
T75-25	-15.705	Derived from Best Fit



Comments

Paul Basham Associates
Lancaster Court, 8 Barnes Wallis Road, Fareham, Hampshire, PO15 5TU

Soakaway Calculations

paulbasham associates

Soakaway Test No.	Test Pit 3 Fill 1
Contract:	Manor Park, Durrington
Contract No.	020.5403

Field Test

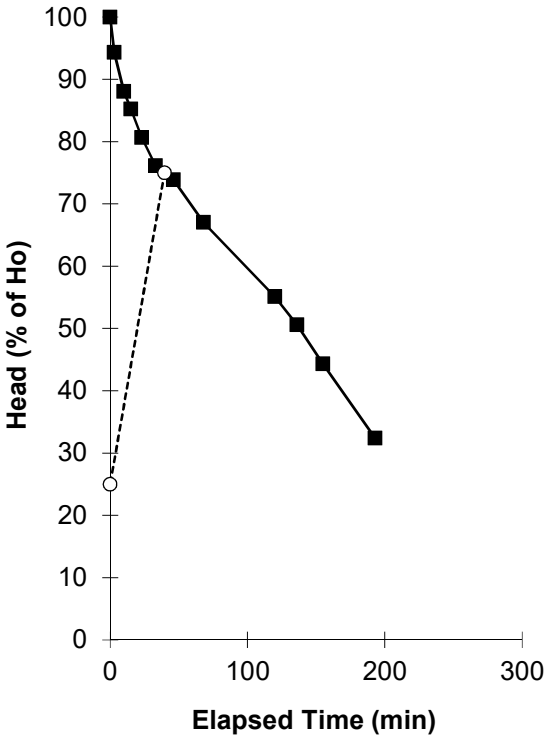
Depth of Pit	2.40	m
Width of Pit	0.40	m
Length of Pit	2.20	m
Depth of Pit Soaked	1.76	m
ap50	5.456	m2
Vp75-25	0.7744	m3
t75-25	-39.5	min
water used	1.5488	m3
f	-5.989E-05	m/sec.

Trial Pit Log (include details of groundwater):

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
0.64	0	100	1.76
0.74	3	94	1.66
0.85	10	88	1.55
0.90	15	85	1.50
0.98	23	81	1.42
1.06	33	76	1.34
1.10	46	74	1.30
1.22	68	67	1.18
1.43	120.0	55	0.97
1.51	136.0	51	0.89
1.62	155.0	44	0.78
1.83	193.0	32	0.57

T75	39.500	75
T25	0.000	25
T75-25	-39.500	Derived from Best Fit



Comments

Soakaway Calculations

paulbasham associates

Soakaway Test No.	Test Pit 3 Fill 2
Contract:	Manor Park, Durrington
Contract No.	020.5403

Field Test

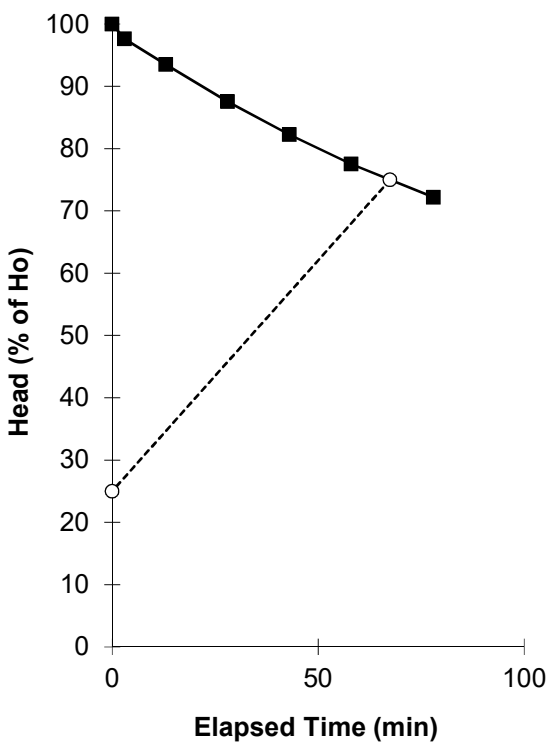
Depth of Pit	2.40	m
Width of Pit	0.40	m
Length of Pit	2.20	m
Depth of Pit Soaked	1.69	m
ap50	5.274	m2
Vp75-25	0.7436	m3
t75-25	-67.4	min
water used	1.4872	m3
f	-3.484E-05	m/sec.

Trial Pit Log (include details of groundwater):

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
0.71	0	100	1.69
0.75	3	98	1.65
0.82	13	93	1.58
0.92	28	88	1.48
1.01	43	82	1.39
1.09	58	78	1.31
1.18	78	72	1.22

T75	67.444	75
T25	0.000	25
T75-25	-67.444	Derived from Best Fit



Comments

Paul Basham Associates
Lancaster Court, 8 Barnes Wallis Road, Fareham, Hampshire, PO15 5TU

Soakaway Calculations

paulbasham associates

Soakaway Test No.	Test Pit 3 Fill 3
Contract:	Manor Park, Durrington
Contract No.	020.5403

Field Test

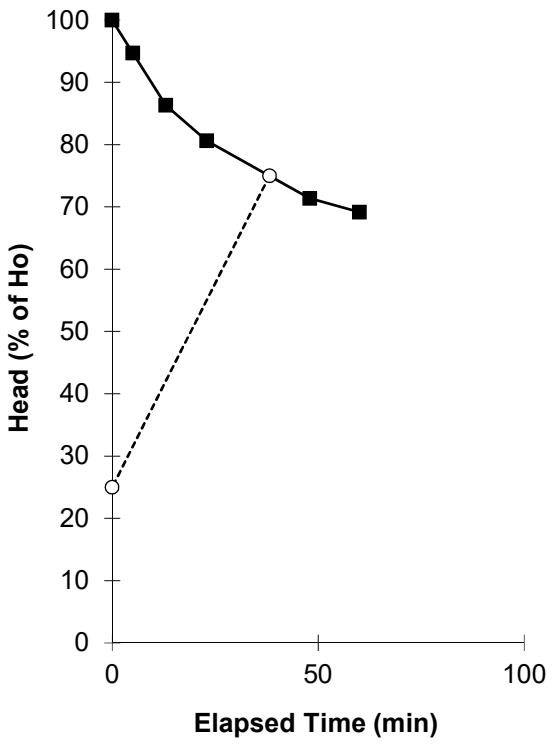
Depth of Pit	2.40	m
Width of Pit	0.40	m
Length of Pit	2.20	m
Depth of Pit Soaked	2.27	m
ap50	6.782	m2
Vp75-25	0.9988	m3
t75-25	-38.2	min
water used	1.9976	m3
f	-6.429E-05	m/sec.

Trial Pit Log (include details of groundwater):

Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
0.13	0	100	2.27
0.25	5	95	2.15
0.44	13	86	1.96
0.57	23	81	1.83
0.78	48	71	1.62
0.83	60	69	1.57

T75	38.179	75
T25	0.000	25
T75-25	-38.179	Derived from Best Fit



Comments

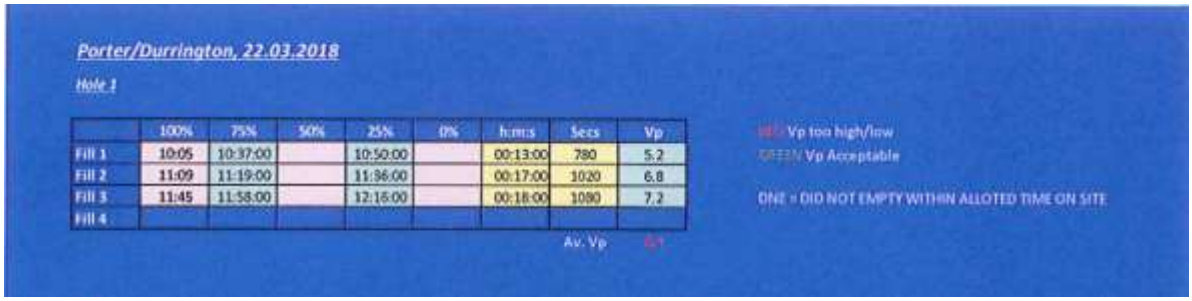
Paul Basham Associates

Lancaster Court, 8 Barnes Wallis Road, Fareham, Hampshire, PO15 5TU

Appendix C

Percolation Test results for test pit 1 from March 2018 carried out using BS6297 type pit.

Results are in mm/s



Porter/Durrington, 22.03.2018

Hole 1

	100%	75%	50%	25%	0%	h:mm:s	Secs	Vp
Fill 1	10:05	10:37:00		10:50:00		00:13:00	780	5.2
Fill 2	11:09	11:19:00		11:36:00		00:17:00	1020	6.8
Fill 3	11:45	11:58:00		12:16:00		00:18:00	1080	7.2
Fill 4								
							Av. Vp	

RED = Vp too high/low

GREEN = Vp Acceptable

ONE = DID NOT EMPTY WITHIN ALLOTED TIME ON SITE

Appendix D

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

Half Drain Time : 164 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	77.191	0.691	44.1	492.0	O K
30 min Summer	77.354	0.854	49.8	638.7	O K
60 min Summer	77.487	0.987	54.5	766.9	O K
120 min Summer	77.558	1.058	57.1	838.7	O K
180 min Summer	77.570	1.070	57.5	850.8	O K
240 min Summer	77.564	1.064	57.3	844.3	O K
360 min Summer	77.532	1.032	56.1	811.9	O K
480 min Summer	77.495	0.995	54.8	775.1	O K
600 min Summer	77.459	0.959	53.5	739.1	O K
720 min Summer	77.424	0.924	52.3	704.7	O K
960 min Summer	77.357	0.857	49.9	641.3	O K
1440 min Summer	77.237	0.737	45.7	532.3	O K
2160 min Summer	77.088	0.588	40.6	406.1	O K
2880 min Summer	76.970	0.470	36.7	312.2	O K
4320 min Summer	76.792	0.292	30.9	183.4	O K
5760 min Summer	76.671	0.171	27.0	103.0	O K
7200 min Summer	76.590	0.090	24.4	52.8	O K
8640 min Summer	76.549	0.049	22.8	28.5	O K
10080 min Summer	76.544	0.044	20.2	25.2	O K
15 min Winter	77.262	0.762	46.6	553.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	121.755	0.0	18
30 min Summer	81.877	0.0	32
60 min Summer	52.595	0.0	62
120 min Summer	32.656	0.0	112
180 min Summer	24.360	0.0	142
240 min Summer	19.652	0.0	174
360 min Summer	14.440	0.0	244
480 min Summer	11.606	0.0	312
600 min Summer	9.789	0.0	380
720 min Summer	8.513	0.0	448
960 min Summer	6.823	0.0	580
1440 min Summer	4.985	0.0	838
2160 min Summer	3.635	0.0	1212
2880 min Summer	2.901	0.0	1584
4320 min Summer	2.107	0.0	2296
5760 min Summer	1.678	0.0	3000
7200 min Summer	1.405	0.0	3680
8640 min Summer	1.215	0.0	4392
10080 min Summer	1.076	0.0	5048
15 min Winter	121.755	0.0	18

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	77.442	0.942	52.9	722.1	O K
60 min Winter	77.590	1.090	58.2	872.3	O K
120 min Winter	77.678	1.178	61.4	965.9	O K
180 min Winter	77.687	1.187	61.7	974.9	O K
240 min Winter	77.679	1.179	61.5	966.8	O K
360 min Winter	77.637	1.137	59.9	921.5	O K
480 min Winter	77.585	1.085	58.1	866.7	O K
600 min Winter	77.531	1.031	56.1	810.7	O K
720 min Winter	77.479	0.979	54.2	759.1	O K
960 min Winter	77.383	0.883	50.8	665.8	O K
1440 min Winter	77.215	0.715	45.0	512.9	O K
2160 min Winter	77.016	0.516	38.2	348.2	O K
2880 min Winter	76.865	0.365	33.2	234.4	O K
4320 min Winter	76.655	0.155	26.5	93.1	O K
5760 min Winter	76.549	0.049	22.8	28.4	O K
7200 min Winter	76.542	0.042	19.3	24.0	O K
8640 min Winter	76.536	0.036	16.7	20.8	O K
10080 min Winter	76.532	0.032	14.8	18.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	81.877	0.0	32
60 min Winter	52.595	0.0	60
120 min Winter	32.656	0.0	116
180 min Winter	24.360	0.0	148
240 min Winter	19.652	0.0	184
360 min Winter	14.440	0.0	262
480 min Winter	11.606	0.0	338
600 min Winter	9.789	0.0	410
720 min Winter	8.513	0.0	482
960 min Winter	6.823	0.0	620
1440 min Winter	4.985	0.0	884
2160 min Winter	3.635	0.0	1272
2880 min Winter	2.901	0.0	1640
4320 min Winter	2.107	0.0	2336
5760 min Winter	1.678	0.0	2872
7200 min Winter	1.405	0.0	3656
8640 min Winter	1.215	0.0	4304
10080 min Winter	1.076	0.0	5088

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.600	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 2.300

Time (mins) From:	To:	Area (ha)
0	4	2.300

Time Area Diagram

Total Area (ha) 0.000

Time (mins) From:	To:	Area (ha)
0	4	0.000

Model Details

Storage is Online Cover Level (m) 78.500

Infiltration Basin Structure

Invert Level (m) 76.500 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.27360 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.27360

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	570.0	1.000	1003.0	2.000	1493.0
0.500	778.0	1.500	1241.0		

Appendix F

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

Half Drain Time : 164 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	77.191	0.691	44.1	492.0	O K
30 min Summer	77.354	0.854	49.8	638.7	O K
60 min Summer	77.487	0.987	54.5	766.9	O K
120 min Summer	77.558	1.058	57.1	838.7	O K
180 min Summer	77.570	1.070	57.5	850.8	O K
240 min Summer	77.564	1.064	57.3	844.3	O K
360 min Summer	77.532	1.032	56.1	811.9	O K
480 min Summer	77.495	0.995	54.8	775.1	O K
600 min Summer	77.459	0.959	53.5	739.1	O K
720 min Summer	77.424	0.924	52.3	704.7	O K
960 min Summer	77.357	0.857	49.9	641.3	O K
1440 min Summer	77.237	0.737	45.7	532.3	O K
2160 min Summer	77.088	0.588	40.6	406.1	O K
2880 min Summer	76.970	0.470	36.7	312.2	O K
4320 min Summer	76.792	0.292	30.9	183.4	O K
5760 min Summer	76.671	0.171	27.0	103.0	O K
7200 min Summer	76.590	0.090	24.4	52.8	O K
8640 min Summer	76.549	0.049	22.8	28.5	O K
10080 min Summer	76.544	0.044	20.2	25.2	O K
15 min Winter	77.262	0.762	46.6	553.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	121.755	0.0	18
30 min Summer	81.877	0.0	32
60 min Summer	52.595	0.0	62
120 min Summer	32.656	0.0	112
180 min Summer	24.360	0.0	142
240 min Summer	19.652	0.0	174
360 min Summer	14.440	0.0	244
480 min Summer	11.606	0.0	312
600 min Summer	9.789	0.0	380
720 min Summer	8.513	0.0	448
960 min Summer	6.823	0.0	580
1440 min Summer	4.985	0.0	838
2160 min Summer	3.635	0.0	1212
2880 min Summer	2.901	0.0	1584
4320 min Summer	2.107	0.0	2296
5760 min Summer	1.678	0.0	3000
7200 min Summer	1.405	0.0	3680
8640 min Summer	1.215	0.0	4392
10080 min Summer	1.076	0.0	5048
15 min Winter	121.755	0.0	18

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	77.442	0.942	52.9	722.1	O K
60 min Winter	77.590	1.090	58.2	872.3	O K
120 min Winter	77.678	1.178	61.4	965.9	O K
180 min Winter	77.687	1.187	61.7	974.9	O K
240 min Winter	77.679	1.179	61.5	966.8	O K
360 min Winter	77.637	1.137	59.9	921.5	O K
480 min Winter	77.585	1.085	58.1	866.7	O K
600 min Winter	77.531	1.031	56.1	810.7	O K
720 min Winter	77.479	0.979	54.2	759.1	O K
960 min Winter	77.383	0.883	50.8	665.8	O K
1440 min Winter	77.215	0.715	45.0	512.9	O K
2160 min Winter	77.016	0.516	38.2	348.2	O K
2880 min Winter	76.865	0.365	33.2	234.4	O K
4320 min Winter	76.655	0.155	26.5	93.1	O K
5760 min Winter	76.549	0.049	22.8	28.4	O K
7200 min Winter	76.542	0.042	19.3	24.0	O K
8640 min Winter	76.536	0.036	16.7	20.8	O K
10080 min Winter	76.532	0.032	14.8	18.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	81.877	0.0	32
60 min Winter	52.595	0.0	60
120 min Winter	32.656	0.0	116
180 min Winter	24.360	0.0	148
240 min Winter	19.652	0.0	184
360 min Winter	14.440	0.0	262
480 min Winter	11.606	0.0	338
600 min Winter	9.789	0.0	410
720 min Winter	8.513	0.0	482
960 min Winter	6.823	0.0	620
1440 min Winter	4.985	0.0	884
2160 min Winter	3.635	0.0	1272
2880 min Winter	2.901	0.0	1640
4320 min Winter	2.107	0.0	2336
5760 min Winter	1.678	0.0	2872
7200 min Winter	1.405	0.0	3656
8640 min Winter	1.215	0.0	4304
10080 min Winter	1.076	0.0	5088

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.600	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 2.300

Time (mins) From:	To:	Area (ha)
0	4	2.300

Time Area Diagram

Total Area (ha) 0.000

Time (mins) From:	To:	Area (ha)
0	4	0.000

Model Details

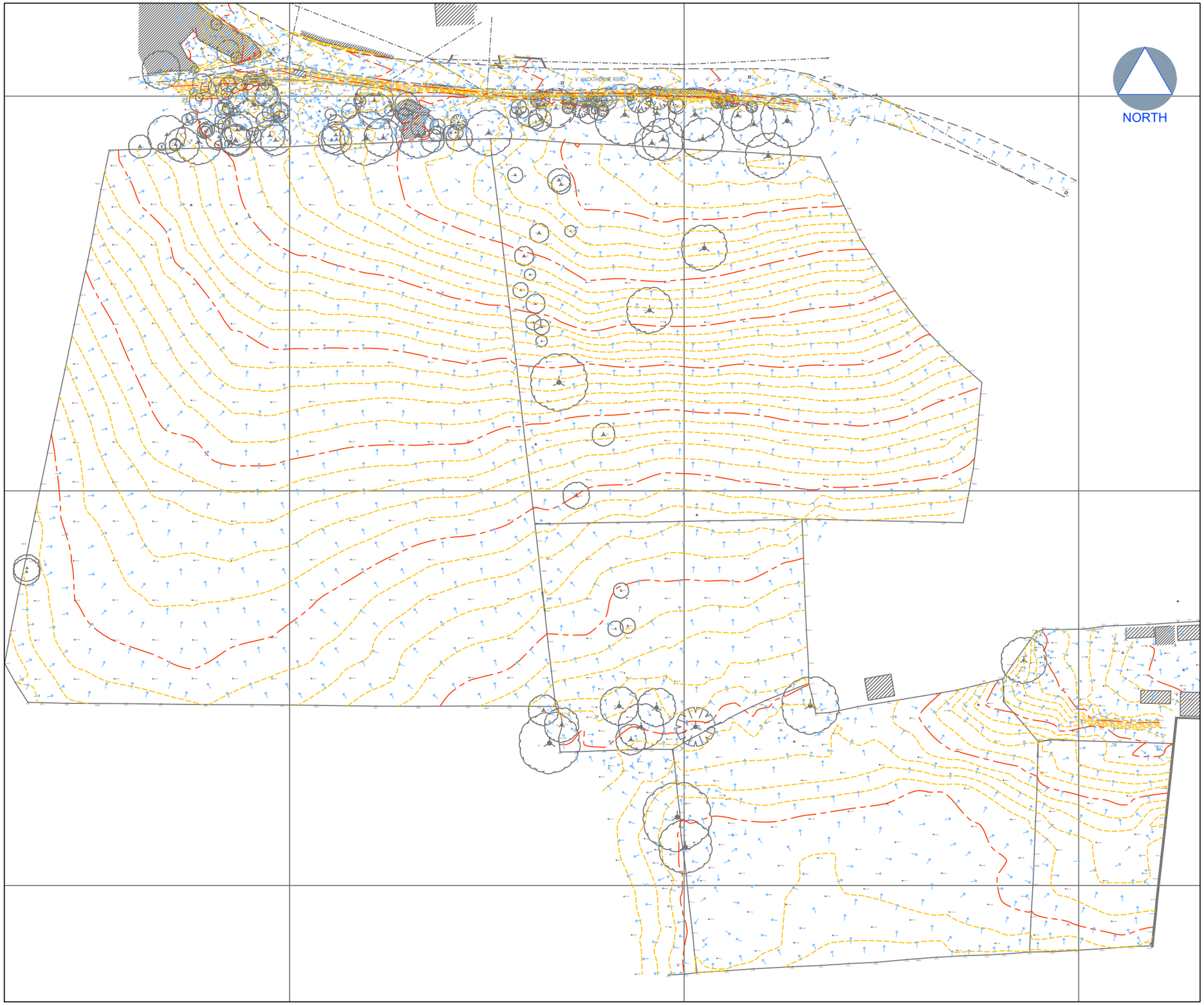
Storage is Online Cover Level (m) 78.500

Infiltration Basin Structure

Invert Level (m) 76.500 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.27360 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.27360

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	570.0	1.000	1003.0	2.000	1493.0
0.500	778.0	1.500	1241.0		

Appendix G



NORTH

GENERAL NOTES

1. THIS DRAWING IS INTENDED TO BE VIEWED IN COMBINATION WITH ALL RELEVANT ARCHITECTS, ENGINEERS, SERVICES AND SPECIALIST DRAWINGS AND SPECIFICATION.
2. ANY VARIATIONS OR DISCREPANCIES BETWEEN THESE DRAWINGS IN TERMS OF DIMENSIONS OR DETAILS SHOULD BE DRAWN TO THE ATTENTION OF THE ARCHITECT AND/OR THE ENGINEER FOR CLARIFICATION.
3. PAUL BASHAM ASSOCIATES ACCEPTS NO RESPONSIBILITY FOR THE ACCURACY OF BACKGROUND INFORMATION PRODUCED BY THIRD PARTIES – THIS MUST BE TREATED AS INDICATIVE ONLY.
4. ALL DIMENSIONS AND LEVELS ARE IN METRES. DO NOT SCALE THIS DRAWING, PRINT, PLOT OR DISK.
5. THIS DRAWING SHOULD ONLY BE USED FOR CONSTRUCTION IF THE PROJECT PHASE IN THE TITLE FRAME BELOW IS SHOWN AS "CONSTRUCTION". PAUL BASHAM ASSOCIATES TAKE NO RESPONSIBILITY FOR CONSTRUCTION WORKS UNDERTAKEN TO DRAWINGS WHICH ARE NOT MARKED UNDER THIS PHASE.

PRELIMINARY

DRAWING/DESIGN IS STILL 'IN DEVELOPMENT'
YOU ARE ADVISED TO MAKE DUE ALLOWANCE

Rev	Description	Date	By	Chkd
-	-	--.--.--	--	--

Project Name: MANOR PARK DURRINGTON	Title: OVERLAND FLOW PATHS	paulbasham associates	Client: PRIVATE CLIENT	Checked By: RW	Checked Date: 19.09.18	Scale: 1:1000 (AT A3 SIZE)
Project Phase: PRELIMINARY				Drawn By: RL	Drawn Date: 19.09.18	Client Drawing No.: -	PBA Drawing No.: 020.5403.002	Revision: -

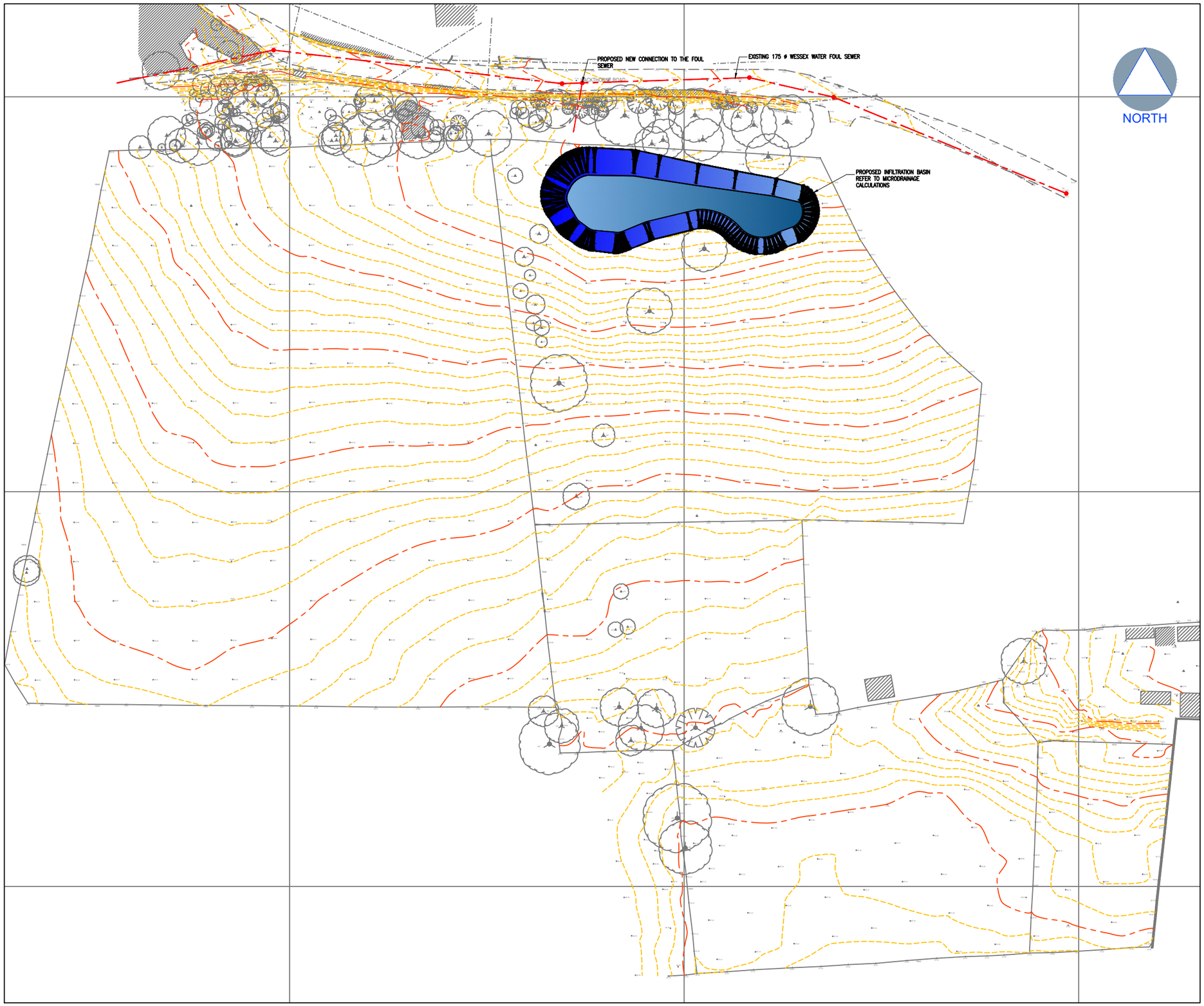
Paul Basham Associates Ltd
Lancaster Court, 8 Barnes Wallis Road, Fareham, PO15 5TU
01489 668134
info@paulbashamassociates.com www.paulbashamassociates.com

Appendix H

SUMMARY TABLE		DESIGN CONDITIONS			
		1	2	3	4
Land Use Type	Low traffic roads (e.g. residential roads and general access roads, < 300 traffic movements/day)				
Pollution Hazard Level	Low				
Pollution Hazard Indices					
TSS	0.5				
Metals	0.4				
Hydrocarbons	0.4				
SuDS components proposed					
Component 1	Pervious pavement (where the pavement is not designed as an infiltration component)	SuDS components can only be assumed to deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters of the SuDS Manual. See also checklists in Appendix B			
Component 2	Conventional gully and piped system (according to Table 26.15 of the SuDS Manual, the indices are 1.0)	Detailed assessment of performance of designed component in reducing inflow concentrations of each pollutant type required as evidence of adopted indices. Enter indices approved by the environmental regulator in appropriate 'User Defined Indices' row below			
Component 3	None				
SuDS Pollution Mitigation Indices					
TSS	>0.95				
Metals	>0.95				
Hydrocarbons	>0.95				
Groundwater protection type	300 mm minimum depth of soils with good contamination attenuation potential	All designs must include a minimum of 1 m unsaturated depth of subsoil or aquifer material between the infiltration surface and the maximum likely groundwater level. Infiltration components should always be preceded by upstream component(s) that trap(s) silt, or designed specifically to retain sediment in a separate lined zone, easily accessible for maintenance, such that the sediment will not be re-suspended in subsequent events	The underlying soils must provide good contaminant attenuation potential (eg as recommended in Sniffer 2008 (a) and (b) / Scott Wilson (2010) or other appropriate guidance). Alternative depth and soil combinations must provide equivalent protection to the underlying groundwater		
Groundwater protection Pollution Mitigation Indices					
TSS	0.4				
Metals	0.3				
Hydrocarbons	0.3				
Combined Pollution Mitigation Indices					
TSS	>0.95	Reference to local planning documents should also be made to identify any additional protection required for sites due to habitat conservation (see Chapter 7 The SuDS design process). The implications of developments on or within close proximity to an area with an environmental designation, such as a Site of Special Scientific Interest (SSSI), should be considered via consultation with relevant conservation bodies such as Natural England			
Metals	>0.95				
Hydrocarbons	>0.95				
Acceptability of Pollution Mitigation					
TSS	Sufficient				
Metals	Sufficient				
Hydrocarbons	Sufficient				

SUMMARY TABLE		DESIGN CONDITIONS			
		1	2	3	4
Land Use Type	Low traffic roads (e.g. residential roads and general access roads, < 300 traffic movements/day)				
Pollution Hazard Level	Low				
Pollution Hazard Indices					
TSS	0.5				
Metals	0.4				
Hydrocarbons	0.4				
SuDS components proposed					
Component 1	Conventional gully and piped system (according to Table 26.15 of the SuDS Manual, the indices are 1.0)	Detailed assessment of performance of designed component in reducing inflow concentrations of each pollutant type required as evidence of adopted indices. Enter indices approved by the environmental regulator in appropriate 'User Defined Indices' row below			
Component 2	Detention basin	SuDS components can only be assumed to deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters of the SuDS Manual. See also checklists in Appendix B			
Component 3	None				
SuDS Pollution Mitigation Indices					
TSS	>0.95				
Metals	>0.95				
Hydrocarbons	>0.95				
Groundwater protection type	300 mm minimum depth of soils with good contamination attenuation potential	All designs must include a minimum of 1 m unsaturated depth of subsoil or aquifer material between the infiltration surface and the maximum likely groundwater level. Infiltration components should always be preceded by upstream component(s) that trap(s) silt, or designed specifically to retain sediment in a separate lined zone, easily accessible for maintenance, such that the sediment will not be re-suspended in subsequent events	The underlying soils must provide good contaminant attenuation potential (eg as recommended in Sniffer 2008 (a) and (b) / Scott Wilson (2010) or other appropriate guidance). Alternative depth and soil combinations must provide equivalent protection to the underlying groundwater		
Groundwater protection Pollution Mitigation Indices					
TSS	0.4				
Metals	0.3				
Hydrocarbons	0.3				
Combined Pollution Mitigation Indices					
TSS	>0.95	Reference to local planning documents should also be made to identify any additional protection required for sites due to habitat conservation (see Chapter 7 The SuDS design process). The implications of developments on or within close proximity to an area with an environmental designation, such as a Site of Special Scientific Interest (SSSI), should be considered via consultation with relevant conservation bodies such as Natural England			
Metals	>0.95				
Hydrocarbons	>0.95				
Acceptability of Pollution Mitigation					
TSS	Sufficient				
Metals	Sufficient				
Hydrocarbons	Sufficient				

Appendix J



GENERAL NOTES

1. THIS DRAWING IS INTENDED TO BE VIEWED IN COMBINATION WITH ALL RELEVANT ARCHITECTS, ENGINEERS, SERVICES AND SPECIALIST DRAWINGS AND SPECIFICATION.
2. ANY VARIATIONS OR DISCREPANCIES BETWEEN THESE DRAWINGS IN TERMS OF DIMENSIONS OR DETAILS SHOULD BE DRAWN TO THE ATTENTION OF THE ARCHITECT AND/OR THE ENGINEER FOR CLARIFICATION.
3. PAUL BASHAM ASSOCIATES ACCEPTS NO RESPONSIBILITY FOR THE ACCURACY OF BACKGROUND INFORMATION PRODUCED BY THIRD PARTIES – THIS MUST BE TREATED AS INDICATIVE ONLY.
4. ALL DIMENSIONS AND LEVELS ARE IN METRES. DO NOT SCALE THIS DRAWING, PRINT, PLOT OR DISK.
5. THIS DRAWING SHOULD ONLY BE USED FOR CONSTRUCTION IF THE PROJECT PHASE IN THE TITLE FRAME BELOW IS SHOWN AS "CONSTRUCTION". PAUL BASHAM ASSOCIATES TAKE NO RESPONSIBILITY FOR CONSTRUCTION WORKS UNDERTAKEN TO DRAWINGS WHICH ARE NOT MARKED UNDER THIS PHASE.

PRELIMINARY

DRAWING/DESIGN IS STILL 'IN DEVELOPMENT'
YOU ARE ADVISED TO MAKE DUE ALLOWANCE

Rev	Description	Date	By	Chkd
-	-	--.--.--	--	--

Project Name: MANOR PARK DURRINGTON	Title: OUTLINE DRAINAGE STRATEGY	paulbasham associates	Client: PRIVATE CLIENT	Checked By: RW	Checked Date: 19.09.18
Project Phase: PRELIMINARY				Drawn By: RL	Drawn Date: 19.09.18

Scale: 1:1000 (AT A3 SIZE)

Client Drawing No.: -

PBA Drawing No.: 020.5403.003

Revision: -

Paul Basham Associates Ltd
Lancaster Court, 8 Barnes Wallis Road, Fareham, PO15 5TU
01489 668134
info@paulbashamassociates.com www.paulbashamassociates.com