



LAND EAST OF HOOK NORTON, OXFORDSHIRE

Residential development of 43 dwellings with associated access roads and car parking, public open space, landscaping, drainage and other associated infrastructure.

FLOOD RISK ASSESSMENT & DRAINAGE STATEMENT GREYSTOKE LAND LIMITED

January 20201



PFA Consulting
Stratton Park House
Wanborough Road
Swindon
SN3 4HG

Tel: 01793 828000
Fax: 01793 835500
Email: admin@pfapl.com
Web: www.pfapl.com

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Job No	G301	
File Reference	G:\workfiles\G301 HOOK NORTON\REPORTS\G301-DOC01 FRA DRAINAGE STATEMENT.docx	
	Name	Date
Prepared By	G EVES BSc. C Eng. MICE. MCIHT	20 January 2021
Checked By	G EVES BSc. C Eng. MICE. MCIHT	20 January 2021

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1. INTRODUCTION

- 1.1. The flood Risk assessment has been prepared on behalf of Greystoke land in connection with proposals for a development of up to 43 dwellings on land East of Hook Norton, Oxfordshire.
- 1.2. The overall site comprises around 2.3 hectares and is located on the eastern edge of the village and north of Station Road. The approximate grid reference for the centre of the site is 436259, 233702. The location of the site is shown edged red on **Figure 1** below.

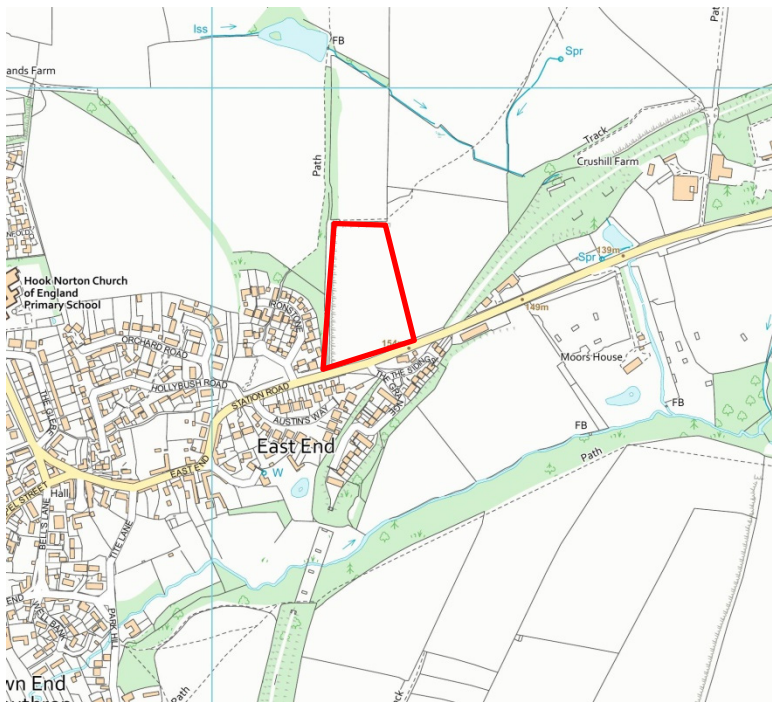


Figure 1: Site Location Plan

- 1.3. As the site area is greater than 1ha the NPPF identifies that a Flood Risk Assessment should accompany any planning application for development.
- 1.4. A previous planning application in 2017 (*Ref 14/01738/OUT*) for 48 dwellings of the same area of land was accompanied by a Flood Risk Assessment and although this application was refused planning permission in 2015 there was no objection to that proposal on flood risk or drainage grounds. This Flood Risk Assessment is therefore an updated document to reflect the presently proposed quantum of development and updated Flood Risk Assessment.
- 1.5. The main purpose therefore of this site specific Flood Risk Assessment is to provide sufficient flood risk information to support this new planning application for development in order to demonstrate that the development would be appropriately safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, would reduce flood risk overall, with the associated drainage strategy setting out general drainage principles for the development of the site.

2. SCOPE OF THE ASSESSMENT

- 2.1. The National Planning Policy Framework (NPPF) 2019 sets out the Government's Planning Policies for England and how these should be applied.
- 2.2. Policy on Planning and Flood Risk in the NPPF is dealt with at Paragraphs 155-165 in Chapter 14 'Meeting the challenge of climate change, flooding and coastal change'.
- 2.3. A Level 1 SFRA was prepared by AECOM in 2017 to inform the Cherwell Local Plan 2011-2031. The SFRA provides an overview of flood risk from all sources and includes record of historic flooding in the district.
- 2.4. The extract from the Environment Agency's Flood Map for Planning, obtained from the GOV.UK website, which shows the Flood Zones in the vicinity of the site, is reproduced as **Figure 2** below.

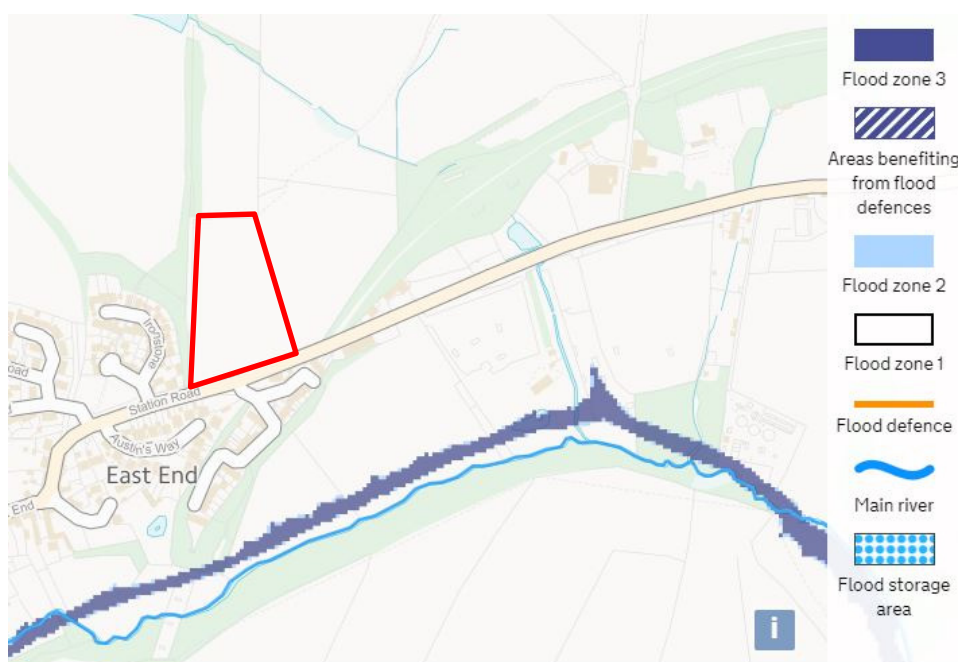


Figure 2: Flood Map for Planning

- 2.5. The red line site boundary has been added to this plan from which it can be seen that the entirety of the site falls within Flood Zone 1 which is land with the lowest (<1 in 1000 year) probability of flooding.

Local Policies

- 2.6. The relevant Local Plan is the Cherwell Local Plan Part 1 adopted in July 2015 (*incorporating Policy Bicester 13 re-adopted in December 2016*) plan. **Policies ESD 6 and 7** of this Plan state:

Policy ESD 6: Sustainable Flood Risk Management

The Council will manage and reduce flood risk in the District through using a sequential approach to development; locating vulnerable developments in areas at lower risk of flooding. Development proposals will be assessed according to the sequential approach and where necessary the exceptions test as set out in the NPPF and NPPG. Development will only be

permitted in areas of flood risk when there are no reasonably available sites in areas of lower flood risk and the benefits of the development outweigh the risks from flooding.

In addition to safeguarding floodplains from development, opportunities will be sought to restore natural river flows and floodplains, increasing their amenity and biodiversity value. Building over or culverting of watercourses should be avoided and the removal of existing culverts will be encouraged.

Existing flood defences will be protected from damaging development and where development is considered appropriate in areas protected by such defences it must allow for the maintenance and management of the defences and be designed to be resilient to flooding.

Site specific flood risk assessments will be required to accompany development proposals in the following situations:

- All development proposals located in flood zones 2 or 3
- Development proposals of 1 hectare or more located in flood zone 1
- Development sites located in an area known to have experienced flooding problems
- Development sites located within 9m of any watercourses.

Flood risk assessments should assess all sources of flood risk and demonstrate that:

- There will be no increase in surface water discharge rates or volumes during storm events up to and including the 1 in 100 year storm event with an allowance for climate change (*the design storm event*)
- Developments will not flood from surface water up to and including the design storm event or any surface water flooding beyond the 1 in 30 year storm event, up to and including the design storm event will be safely contained on site.

Development should be safe and remain operational (*where necessary*) and proposals should demonstrate that surface water will be managed effectively on site and that the development will not increase flood risk elsewhere, including sewer flooding.

Policy ESD 7: Sustainable Drainage Systems (SuDS)

All development will be required to use sustainable drainage systems (*SuDS*) for the management of surface water run-off. Where site specific Flood Risk Assessments are required in association with development proposals, they should be used to determine how SuDS can be used on particular sites and to design appropriate systems.

In considering SuDS solutions, the need to protect ground water quality must be taken into account, especially where infiltration techniques are proposed. Where possible, SuDS should seek to reduce flood risk, reduce pollution and provide landscape and wildlife benefits. SuDS will require the approval of Oxfordshire County Council as LLFA and SuDS Approval Body, and proposals must include an agreement on the future management, maintenance and replacement of the SuDS features.

3. FLOOD RISK ASSESSMENT

Development Site and Location

- 3.1. The site is currently agricultural land.
- 3.2. The Site Location Plan at **Figure 1** above identifies a watercourse (*to some 100m north of the site*), which flows in a south westerly direction, being a tributary of the River Swere.

Development Proposals

- 3.3. The development proposals comprise an outline planning application for a residential development of up to 43 dwellings with associated access roads, car parking and public open space.
- 3.4. A copy of an illustrative Masterplan showing the development proposals is reproduced in **Appendix 1**

Site Levels, Existing Drainage Arrangements and Geology

- 3.5. The site is relatively “flat” lying at a level of about 153m AOD.
- 3.6. There are no surface water drainage features within the site.
- 3.7. The underlying bedrock geology is Marlstone Rock Formation (Ferruginous Limestone and Ironstone) which is a secondary (A) aquifer. An exploratory infiltration test has been carried out, the results of which are attached at **Appendix 2**.
- 3.8. The testing identifies that infiltration techniques will provide an appropriate SuDS arrangement for the disposal of surface water from the site.
- 3.9. The site does not lie within a Groundwater Source Protection Zone.

The Sequential Test

- 3.10. As identified in paragraph 2.5 above, the Environment Agency’s Flood map for Planning indicates that the entirety of the site falls within Flood Zone 1 where all uses of land are appropriate and the Sequential Test is satisfied.

Climate Change

- 3.11. The NPPF requires development to take account of the impacts of climate change. The allowances to be made for climate change effects when assessing flood risk are related to the lifetime of the development and a residential development should be considered for a minimum of 100 years for considering a shorter period.
- 3.12. Guidance published by the Environment agency sets out the climate change allowances to be used for peak river flow by river basin district, peak rainfall intensity, sea level rise, offshore wind speed and extreme wave height.
- 3.13. The peak rainfall intensity allowance to be used when designing urban drainage systems are given in Table 2 of ‘Flood risk assessments: climate change allowances. Both the central (+20%) and upper end (+40%) allowances need to be assessed to understand the range of impact.

- 3.14. In terms of providing an acceptable standard of protection against flooding for new development, no flooding of property should occur as a result of the 'design flood' corresponding to a 1 in 100 year fluvial flood event change.
- 3.15. The Government published its 'Non-statutory technical standards for sustainable drainage systems' in March 2015. Standard 57 states that the drainage system must be designed so that flooding does not occur on any part of the site for a 1 in 30 year rainfall event. Standard S8 goes on to state that the drainage system must be designed so that flooding does not occur during a 1 in 100 year rainfall event I any part of a building (including a basement); or in any utility plant susceptible to water within the development.

Site Specific Flood Risk

- 3.16. In addition to flooding from rivers and the sea it is also necessary to consider the potential consequences of flooding from all other sources, which include directly form rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources where relevant.
- 3.17. The Government's 'Flood risk from surface water' map (*Fig. 3 below*) indicates that the entire site is not at risk of flooding from surface water and no risk of flood from reservoirs. There is an existing foul sewer which runs along the southern boundary of the site (*see Appendix 5*), and accordingly there is a risk that, should this sewer become blocked or overwhelmed, a risk of flooding could arise. However this sewer is maintained by the Water Authority. On this basis the risk of flooding from overwhelmed sewers affecting the development is considered to be low. The underlying bedrock is not considered a significant source of groundwater and the risk of groundwater emergence is assessed as low.



Extent of flooding from surface water

● High ● Medium ● Low ○ Very low

Figure 3: Extract from Flood risk from surface water map

- 3.18. The pre-development potential flood risk to the site from all sources of flooding is considered to be low.

4. DRAINAGE STRATEGY AND WATER MANAGEMENT STATEMENT

- 4.1. This section of the report sets out the general drainage strategy and demonstrates how the site drainage and runoff will be managed in a sustainable way to comply with the provisions of paragraph 165 of the NPPF and Policies ESD 6 and 7 of the Local Plan.
- 4.2. In accordance with the Drainage Hierarchy some limited re-use of rainwater is proposed through the provision of rainwater butts for each dwellings.
- 4.3. Infiltration testing indicates that soakaways will provide a suitable means of disposing of surface water from the site and, together with the use of permeable paving for all roads and private driveway surfaces, will provide “source control”.
- 4.4. The preliminary infiltration testing in accordance with BRE365 methodology suggests that an infiltration rate of 3.31×10^{-5} m/s is appropriate. Whilst it is acknowledged that ground conditions (*and therefore infiltration rates*) may vary slightly across the site, this testing is sufficient to provide confidence that soakaways and permeable paving will provide a suitable means of disposing of surface water.
- 4.5. As identified above the underlying bedrock is classified as a secondary (A) aquifer and the entire area around Hook Norton is identified as a groundwater safeguarded zone, however the area is not within a drinking water source protection zone.
- 4.6. Rainwater from roofs is “clean” and can therefore readily be discharged directly to the ground without any risk to groundwater, whilst the use of permeable paving will ensure that run off from other surfaces will not pose a risk to groundwater.
- 4.7. On this basis preliminary calculations have been carried out (*attached at Appendix 2*) which indicate that a typical size for “lined” house soakaway, with capacity to accommodate a 1 in 100 year storm event (*including a 40% allowance for climate change*), is a 1.2m diameter ring chamber within a 2.4m square “pit”. The outline site layout has sufficient space to accommodate private soakaways to drain the proposed dwellings. Permeable paving together with the use of an infiltration basin will suffice to provide capacity for the same storm event from any roads, driveways or other hard areas within the site. These preliminary calculations demonstrate that infiltration drainage devices are suitable for the disposal of surface water from the proposed development.
- 4.8. When a “Reserved Matters” layout is being prepared, further “focused” infiltration testing will be carried out to verify the design criteria for each dwelling and the hard surfaces, and accordingly, at this outline stage, a condition requiring further infiltration testing to be carried out to inform a detailed surface water drainage surface water drainage scheme to be submitted and approved by the LPA is considered an appropriate and reasonable condition to attach any planning permission.
- 4.9. This drainage strategy is consistent with the options identified in previous acceptable Flood Risk Assessment for the site.
- 4.10. In terms of the maintenance strategy for the proposed drainage measures, homeowners will be responsible for private house soakaways and pervious pavement on private driveways. A Private Estate Management Company will be responsibility for the maintenance of pervious pavement on shared parking areas and private estate roads and the infiltration basin.

- 4.11. The maintenance of the infiltration drainage features will be in accordance with the guidance contained in The SuDS Manual 2015 (CIRIA C753).
- 4.12. The proposed drainage strategy would ensure that surface water arising from the developed site would be managed in a sustainable manner to mimic the surface water flows arising from the site prior to the proposed development, while reducing the flood risk to the site itself and elsewhere, taking climate change into account. The use of infiltration drainage features to dispose of surface water to ground is consistent with the Drainage Hierarchy, provides Source Control SuDS Features and satisfies the requirements of the Government's 'Non-statutory technical standards for sustainable drainage systems'.

Foul Drainage

- 4.13. An existing public foul sewer runs along the southern boundary of the site, running in an easterly direction towards a sewage treatment works to the south east. The foul drainage connection (*or connections*) will therefore be made from the new development into this existing sewer which therefore provides for an appropriate means of disposing of foul water from the development. Under the provisions of Section 143 of the Water Industry Act 1991 (as amended), with effect from 1 April 2018 changes have been made to the charging arrangements for services provided by sewerage undertakers to those developing land and laying new water and sewerage infrastructure and the developer is entitled to make a connection to the nearest practical point on the network where the existing sewer is at least the same diameter as the new sewer required to provide capacity for the development. This is therefore an adequate point of connection for foul flows from the proposed development.

5. SUMMARY AND CONCLUSIONS

- 5.1. The site, which it is proposed to develop for up to 43 dwellings, lies entirely within Flood Zone 1 where all forms of development are suitable.
- 5.2. There are no identified sources of flooding which will give rise to a significant, or material, flood risk to the development.
- 5.3. The geology of the areas is such that infiltration will provide an acceptable means of disposal of surface water and accordingly a SuDS based drainage strategy is proposed whereby soakaways will provide surface water drainage for the dwellings, and permeable paving together with an infiltration basin is proposed for private driveways and roads, so as to ensure that there is no runoff from the site up to and including a 1 in 100 year storm event including an allowance for climate change.
- 5.4. The illustrative master plan demonstrates the principles of how this can be achieved, but, as this is an outline planning application, final details can be secured by means of a planning condition.
- 5.5. Foul water disposal will be to the existing public foul sewer which crosses the southern boundary site.
- 5.6. These details are in accordance with a previously acceptable drainage arrangement option for residential development on the site, and satisfy the requirements of Paragraph 165 of the NPPF and Policies ESD6 and 7 of the Local Plan.
- 5.7. Accordingly, subject to appropriate conditions there can be no drainage or flooding reasons for refusing planning permission.

Scale



HOUSE UNITS						
House Type	Bed Spaces	Storey Heights	Area m2	Area ft2	Number	Mix %
2 Bed	2	2	74	797	9	21
2 Bed	2	2	108	1163	1	2
3 Bed	3	2	89	958	11	26
3 Bed	3	2	102	1098	5	12
3 Bed	3	2	106	1141	4	9
3 Bed	3	2	108	1163	3	7
3 Bed	3	2	150	1615	4	9
4 Bed	4	2	164	1765	6	14
Total					43	

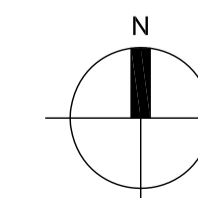


Notes

- 1) Do not scale directly from this drawing.
- 2) This drawing is to be read in conjunction with all other relevant MHP drawings and information supplied by other consultants.
- 3) Hatch patterns displayed on this drawing are indicative only and do not represent actual paving units or material sizes.
- 4) All tree planting in proximity to buildings to be checked by engineers to ensure foundation detailing is appropriate.

A	Additional annotation included	09-11-20	DAL	PSH
Revisions:				
Project: Hook Norton, Station Road				
Client: Grey Stoke Land				
Title: Illustrative layout				
Drawing number:		20147.101		Rev:
Status:		FOR INFORMATION		A
Drawn By:	Checked By:	Date:	Scale @ A1:	
DAL	PSH	09-10-20	1:500	

Hook Norton - Station Road
Illustrative Layout





PFA Consulting
Stratton Park House
Wanborough Road
Swindon
SN3 4HG

Geotechnical Investigations Limited
Unit 1
Far Hill Farm
Fairford
Gloucestershire
GL7 4PZ

12th August 2020

Soakaway tests at Land off Station Road, Hook Norton – GI1727

Geotechnical Investigations Limited (this Company) was instructed via email on the 14th July 2020 by Graham Eves of PFA Consulting (the Client) ref:112321 to undertake a site investigation at the above site.

The sitework was conducted on the 10th August 2020 and comprised the excavation of two trial pits. A soakaway test was carried out in one of these trial pits.

The exploratory hole location reference TP01 was set out according to the site plan provide by the Client and is shown in figure 1.

The trial pit referenced TP01 was excavated for the purpose of carrying out a soakaway test, however upon encountering a 'clean' limestone gravel at 1.80m (possible service?) the pit was terminated at 1.90m and backfilled with arisings.

A second trial pit, reference TP02, was then located 3m to the north-east of TP01 where a soakaway test was conducted.

A further proposed trial pit, situated to the north west of the field, was unfortunately found to be inaccessible due to an unharvested wheat crop and a lack of headland access.

TP02 was carefully excavated and logged by an engineering geologist and the trial pit was 'squared' as much as possible prior to commencing the soakaway test.

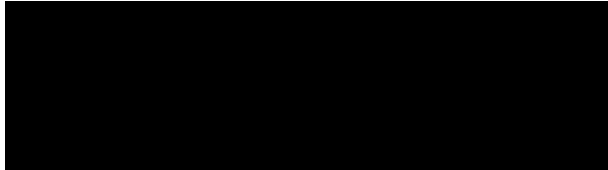
Photographs of the trial pits were taken prior to soakaway testing and are attached to this letter.

A supply of potable water was provided by this company for the works which was used to rapidly fill TP02 with water.

The soakaway test conducted at TP02 was in accordance with BRE DG 365 (2016) and the result for the test is attached.

On completion of the works, the exploratory hole locations were backfilled with material arising and the surface was made good.

This written report has been prepared by Geotechnical Investigations Limited solely for the benefit of PFA Consulting. It shall not be relied upon or transferred to any third party without the prior written authorisation of Geotechnical Investigations Limited.



Robert Ewens BSC (Hons) PGC FGS

Director



**GEOTECHNICAL
INVESTIGATIONS
LIMITED**

CLIENT

PFA Consulting

SITE

Land Off Station Road,
Hook Norton

CONTRACT

GI1727

Figure 1.



GEOTECHNICAL INVESTIGATIONS LIMITED

Trial Pit

CLIENT PFA Consulting
SITE Land off Station Road, Hook Norton
CONTRACT 1727
DATE 10/08/2020
HOLE ID TP01

TEST 1

LENGTH m

BREADTH m

DEPTH 1.90 m

WATER LEVEL PRE TEST Dry

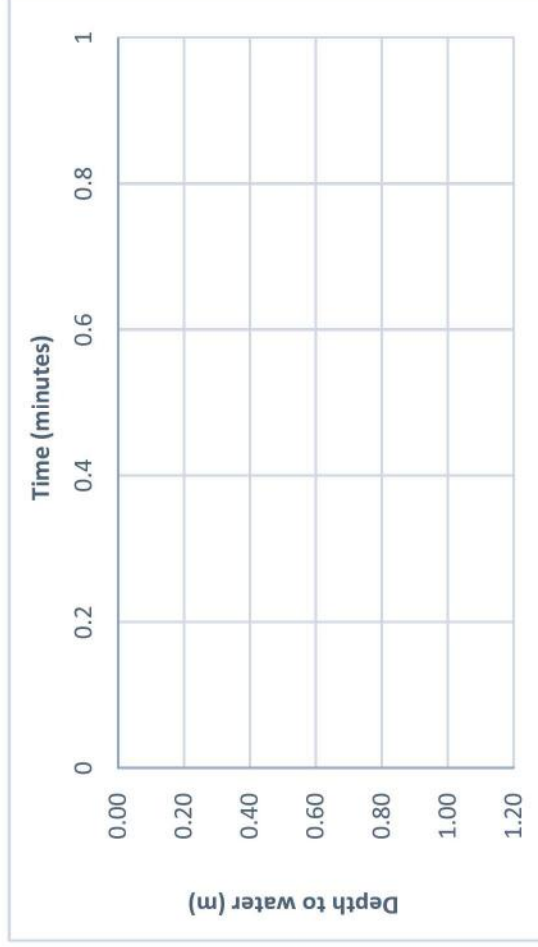
FILL LEVEL To 100% m

V_{p75-25} m³

a_{p50} m²

t_{p75-25} min

soil infiltration rate, $f =$ ms⁻¹



Remarks No soakaway test undertaken.

0.00-0.20m Rough vegetation over orangish-brown very stiff friable dark reddish-brown slightly gravelly CLAY. Gravel is subangular fine to medium mudstone.

Geological Description (BS5930 2015)
 0.20-1.90m Very stiff reddish-brown and orangish-brown slightly gravelly CLAY. Gravel is subangular fine to coarse mudstone. Occasional subangular mudstone cobbles. 1.80-1.85m in south edge of pit subrounded medium limestone gravel (possible service?). Trial pit moved 3m north-east.



GEOTECHNICAL INVESTIGATIONS LIMITED

Soakaway Test

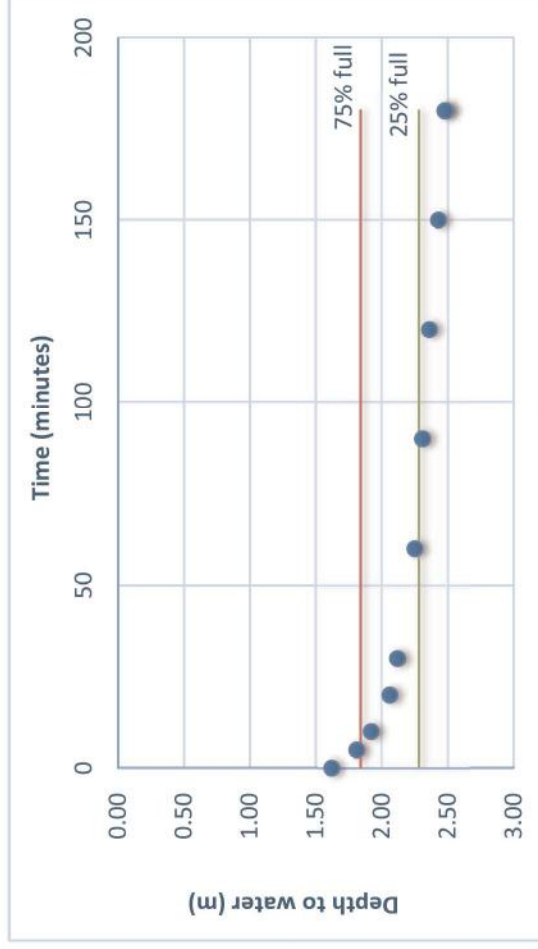
CLIENT PFA Consulting
SITE Land off Station Road, Hook Norton
CONTRACT 1727
DATE 10/08/2020
HOLE ID TP02

TEST 1

LENGTH 1.90 m
BREADTH 0.50 m
DEPTH 2.50 m
WATER LEVEL PRE TEST Dry
FILL LEVEL To 100% 1.62 m

 V_{p75-25} 0.42 m³
 a_{p50} 3.06 m²
 t_{p75-25} 68.6 min

soil infiltration rate, f = 3.31 x 10⁻⁵ ms⁻¹



Remarks

Soakaway test carried out in accordance with BRE DG 365 (2016).

0.00-0.10m Rough vegetation over orangish-brown very stiff friable dark reddish-brown slightly gravelly CLAY. Gravel is subangular fine to medium mudstone.

Geological Description (BS5930 2015)

0.10-1.60m Firm and stiff friable reddish-brown slightly sandy slightly gravelly CLAY. Gravel is subangular fine to coarse mudstone. Occasional subangular cobbles.

1.60-2.50m MUDSTONE: Recovered as orangish-brown locally stained dark reddish-brown clayey angular and subangular fine to coarse gravel size fragments.

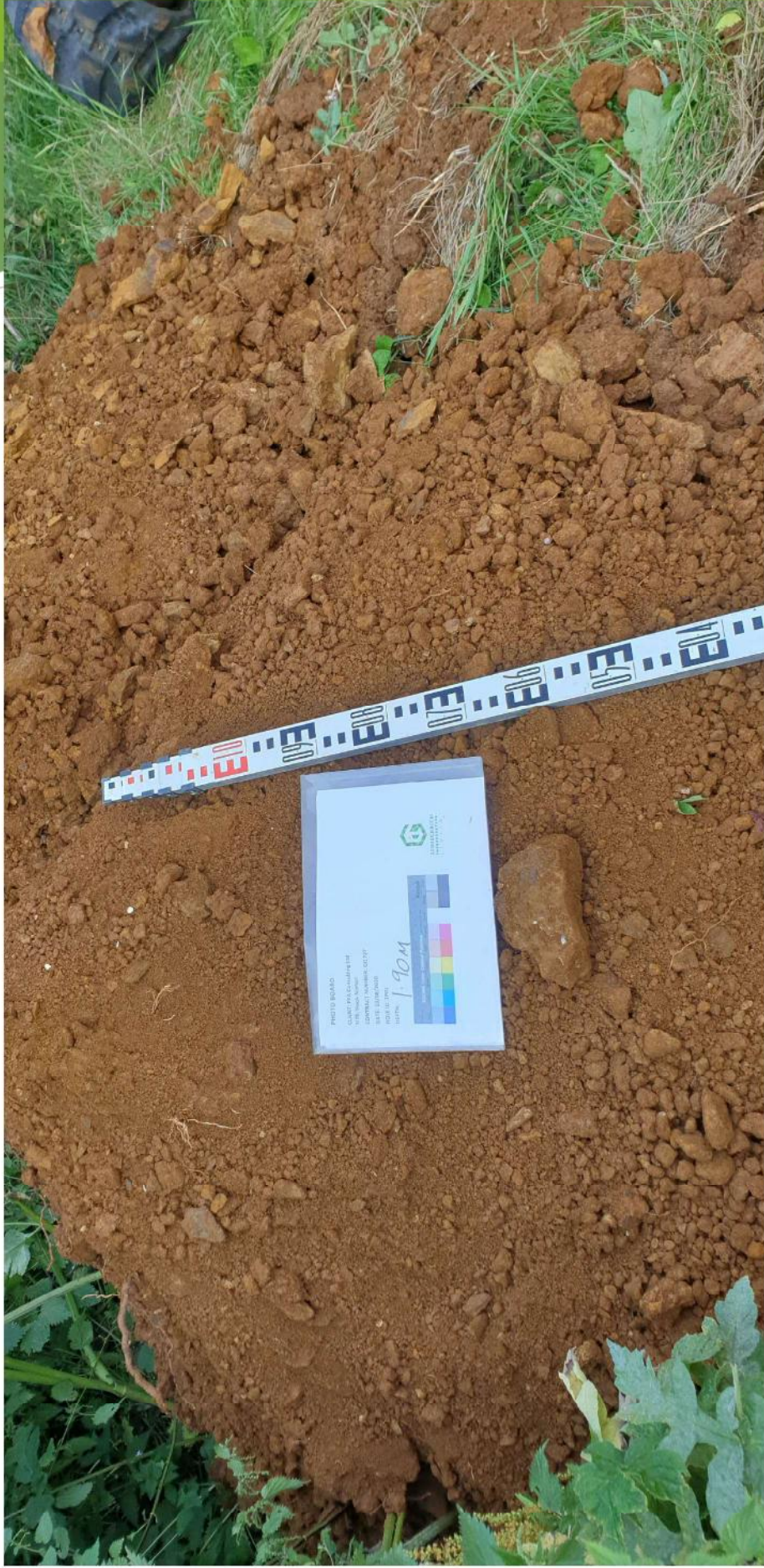


**GEOTECHNICAL
INVESTIGATIONS
L I M I T E D**

CLIENT: PFA Consulting

SITE: Land Off Station Road, Hook Norton

CONTRACT NUMBER: GI1727



TP01 1.90m



TP01A 1.90m






TP02 2.50m



TP02A 2.50m



Stratton Park House Wanborough Road Swindon SN3 4HG	G301: Land off Station Road Hook Norton Infiltration Basin	
Date 01/01/2021 File G301-Infiltration Basin...	Designed by BF Checked by	

XP Solutions	Source Control 2020.1
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Model Details

Storage is Online Cover Level (m) 153.300

Infiltration Basin Structure

Invert Level (m) 152.400 Safety Factor 2.0
 Infiltration Coefficient Base (m/hr) 0.11916 Porosity 1.00
 Infiltration Coefficient Side (m/hr) 0.11916

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	63.7	0.300	129.2	0.600	237.4	0.900	363.4
0.100	82.8	0.400	156.8	0.700	279.2		
0.200	104.6	0.500	189.8	0.800	320.8		

Stratton Park House Wanborough Road Swindon SN3 4HG	G301: Land off Station Road Hook Norton Infiltration Basin	
Date 01/01/2021	Designed by BF	
File G301-Infiltration Basin...	Checked by	

XP Solutions	Source Control 2020.1
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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 436199 233628 SP 36199 33628
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.044

Time (mins)	Area
From: To:	(ha)
0	4 0.044

PFA Consulting Limited		Page 1
Stratton Park House Wanborough Road Swindon SN3 4HG	G301: Land off Station Road Hook Norton Infiltration Basin	
Date 01/01/2021 File G301-Infiltration Basin...	Designed by BF Checked by	

XP Solutions Source Control 2020.1

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

Half Drain Time : 69 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m ³)	Status
15 min Summer	152.539	0.139	2.0	10.7	O K
30 min Summer	152.565	0.165	2.2	13.1	O K
60 min Summer	152.578	0.178	2.3	14.4	O K
120 min Summer	152.579	0.179	2.3	14.5	O K
180 min Summer	152.575	0.175	2.2	14.1	O K
240 min Summer	152.569	0.169	2.2	13.5	O K
360 min Summer	152.555	0.155	2.1	12.2	O K
480 min Summer	152.541	0.141	2.0	10.8	O K
600 min Summer	152.527	0.127	1.9	9.6	O K
720 min Summer	152.515	0.115	1.8	8.5	O K
960 min Summer	152.493	0.093	1.6	6.7	O K
1440 min Summer	152.462	0.062	1.4	4.3	O K
2160 min Summer	152.444	0.044	1.2	3.0	O K
2880 min Summer	152.436	0.036	0.9	2.4	O K
4320 min Summer	152.427	0.027	0.7	1.8	O K
5760 min Summer	152.422	0.022	0.6	1.4	O K
7200 min Summer	152.419	0.019	0.5	1.2	O K
8640 min Summer	152.417	0.017	0.4	1.1	O K
10080 min Summer	152.415	0.015	0.4	1.0	O K
15 min Winter	152.554	0.154	2.1	12.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Time-Peak (mins)
15 min Summer	144.701	0.0	17
30 min Summer	95.076	0.0	31
60 min Summer	59.438	0.0	52
120 min Summer	35.576	0.0	86
180 min Summer	26.357	0.0	120
240 min Summer	21.267	0.0	154
360 min Summer	15.627	0.0	222
480 min Summer	12.476	0.0	286
600 min Summer	10.434	0.0	350
720 min Summer	8.993	0.0	412
960 min Summer	7.076	0.0	532
1440 min Summer	5.006	0.0	766
2160 min Summer	3.521	0.0	1104
2880 min Summer	2.750	0.0	1472
4320 min Summer	1.966	0.0	2204
5760 min Summer	1.566	0.0	2936
7200 min Summer	1.334	0.0	3672
8640 min Summer	1.177	0.0	4400
10080 min Summer	1.063	0.0	5024
15 min Winter	144.701	0.0	17

Stratton Park House
 Wanborough Road
 Swindon SN3 4HG

G301: Land off Station Road
 Hook Norton
 Infiltration Basin



Date 01/01/2021

Designed by BF

File G301-Infiltration Basin...

Checked by

XP Solutions

Source Control 2020.1

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m ³)	Status
30 min Winter	152.583	0.183	2.3	14.9	O K
60 min Winter	152.598	0.198	2.4	16.5	O K
120 min Winter	152.597	0.197	2.4	16.4	O K
180 min Winter	152.590	0.190	2.3	15.6	O K
240 min Winter	152.581	0.181	2.3	14.7	O K
360 min Winter	152.560	0.160	2.1	12.6	O K
480 min Winter	152.539	0.139	2.0	10.7	O K
600 min Winter	152.521	0.121	1.8	9.1	O K
720 min Winter	152.504	0.104	1.7	7.6	O K
960 min Winter	152.476	0.076	1.5	5.3	O K
1440 min Winter	152.447	0.047	1.3	3.2	O K
2160 min Winter	152.434	0.034	0.9	2.3	O K
2880 min Winter	152.427	0.027	0.7	1.8	O K
4320 min Winter	152.420	0.020	0.5	1.3	O K
5760 min Winter	152.416	0.016	0.4	1.0	O K
7200 min Winter	152.414	0.014	0.3	0.9	O K
8640 min Winter	152.412	0.012	0.3	0.8	O K
10080 min Winter	152.411	0.011	0.3	0.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Time-Peak (mins)
30 min Winter	95.076	0.0	31
60 min Winter	59.438	0.0	58
120 min Winter	35.576	0.0	92
180 min Winter	26.357	0.0	130
240 min Winter	21.267	0.0	166
360 min Winter	15.627	0.0	236
480 min Winter	12.476	0.0	304
600 min Winter	10.434	0.0	368
720 min Winter	8.993	0.0	432
960 min Winter	7.076	0.0	550
1440 min Winter	5.006	0.0	752
2160 min Winter	3.521	0.0	1120
2880 min Winter	2.750	0.0	1476
4320 min Winter	1.966	0.0	2196
5760 min Winter	1.566	0.0	2912
7200 min Winter	1.334	0.0	3680
8640 min Winter	1.177	0.0	4408
10080 min Winter	1.063	0.0	5048

Stratton Park House
Wanborough Road
Swindon SN3 4HG

G301: Land off Station Road
Hook Norton
10mLength Pervious Pavement V2



Date 15/01/2021 12:30
File G301-Pervious Pavement ...

Designed by BF
Checked by

XP Solutions Source Control 2020.1

Model Details

Storage is Online Cover Level (m) 170.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.11916	Width (m)	2.4
Membrane Percolation (mm/hr)	1000	Length (m)	10.0
Max Percolation (l/s)	6.7	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	169.450	Cap Volume Depth (m)	0.450

Stratton Park House Wanborough Road Swindon SN3 4HG	G301: Land off Station Road Hook Norton 10mLength Pervious Pavement V2
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Date 15/01/2021 12:30 File G301-Pervious Pavement ...	Designed by BF Checked by
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XP Solutions	Source Control 2020.1
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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 436199 233628 SP 36199 33628
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.009

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

Stratton Park House Wanborough Road Swindon SN3 4HG	G301: Land off Station Road Hook Norton 10mLength Pervious Pavement V2
Date 15/01/2021 12:30 File G301-Pervious Pavement ...	Designed by BF Checked by




XP Solutions Source Control 2020.1

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

Half Drain Time : 78 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m ³)	Status
15 min Summer	169.732	0.282	0.4	2.0	Flood Risk
30 min Summer	169.801	0.351	0.4	2.5	Flood Risk
60 min Summer	169.836	0.386	0.4	2.8	Flood Risk
120 min Summer	169.825	0.375	0.4	2.7	Flood Risk
180 min Summer	169.805	0.355	0.4	2.6	Flood Risk
240 min Summer	169.781	0.331	0.4	2.4	Flood Risk
360 min Summer	169.730	0.280	0.4	2.0	Flood Risk
480 min Summer	169.679	0.229	0.4	1.7	O K
600 min Summer	169.633	0.183	0.4	1.3	O K
720 min Summer	169.593	0.143	0.4	1.0	O K
960 min Summer	169.535	0.085	0.4	0.6	O K
1440 min Summer	169.495	0.045	0.4	0.3	O K
2160 min Summer	169.482	0.032	0.3	0.2	O K
2880 min Summer	169.475	0.025	0.2	0.2	O K
4320 min Summer	169.468	0.018	0.1	0.1	O K
5760 min Summer	169.465	0.015	0.1	0.1	O K
7200 min Summer	169.462	0.012	0.1	0.1	O K
8640 min Summer	169.461	0.011	0.1	0.1	O K
10080 min Summer	169.460	0.010	0.1	0.1	O K
15 min Winter	169.772	0.322	0.4	2.3	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Time-Peak (mins)
15 min Summer	144.701	0.0	17
30 min Summer	95.076	0.0	31
60 min Summer	59.438	0.0	58
120 min Summer	35.576	0.0	88
180 min Summer	26.357	0.0	122
240 min Summer	21.267	0.0	156
360 min Summer	15.627	0.0	224
480 min Summer	12.476	0.0	288
600 min Summer	10.434	0.0	348
720 min Summer	8.993	0.0	406
960 min Summer	7.076	0.0	518
1440 min Summer	5.006	0.0	736
2160 min Summer	3.521	0.0	1100
2880 min Summer	2.750	0.0	1468
4320 min Summer	1.966	0.0	2176
5760 min Summer	1.566	0.0	2928
7200 min Summer	1.334	0.0	3640
8640 min Summer	1.177	0.0	4400
10080 min Summer	1.063	0.0	5048
15 min Winter	144.701	0.0	17


PFA Consulting Limited		Page 2
Stratton Park House Wanborough Road Swindon SN3 4HG	G301: Land off Station Road Hook Norton 10mLength Pervious Pavement V2	
Date 15/01/2021 12:30 File G301-Pervious Pavement ...	Designed by BF Checked by	

XP Solutions Source Control 2020.1

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m ³)	Status
30 min Winter	169.853	0.403	0.4	2.9	Flood Risk
60 min Winter	169.905	0.455	0.4	3.2	Flood Risk
120 min Winter	169.884	0.434	0.4	3.1	Flood Risk
180 min Winter	169.854	0.404	0.4	2.9	Flood Risk
240 min Winter	169.816	0.366	0.4	2.6	Flood Risk
360 min Winter	169.735	0.285	0.4	2.1	Flood Risk
480 min Winter	169.658	0.208	0.4	1.5	O K
600 min Winter	169.591	0.141	0.4	1.0	O K
720 min Winter	169.539	0.089	0.4	0.6	O K
960 min Winter	169.497	0.047	0.4	0.3	O K
1440 min Winter	169.483	0.033	0.3	0.2	O K
2160 min Winter	169.473	0.023	0.2	0.2	O K
2880 min Winter	169.468	0.018	0.1	0.1	O K
4320 min Winter	169.463	0.013	0.1	0.1	O K
5760 min Winter	169.461	0.011	0.1	0.1	O K
7200 min Winter	169.459	0.009	0.1	0.1	O K
8640 min Winter	169.458	0.008	0.1	0.1	O K
10080 min Winter	169.457	0.007	0.1	0.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Time-Peak (mins)
30 min Winter	95.076	0.0	31
60 min Winter	59.438	0.0	58
120 min Winter	35.576	0.0	96
180 min Winter	26.357	0.0	134
240 min Winter	21.267	0.0	170
360 min Winter	15.627	0.0	240
480 min Winter	12.476	0.0	304
600 min Winter	10.434	0.0	362
720 min Winter	8.993	0.0	412
960 min Winter	7.076	0.0	492
1440 min Winter	5.006	0.0	736
2160 min Winter	3.521	0.0	1104
2880 min Winter	2.750	0.0	1468
4320 min Winter	1.966	0.0	2184
5760 min Winter	1.566	0.0	2888
7200 min Winter	1.334	0.0	3680
8640 min Winter	1.177	0.0	4408
10080 min Winter	1.063	0.0	5136

PFA Consulting Ltd		Page 4
Stratton Park House Wanborough Road Swindon SN3 4HG	G301: Land off Station Road Hook Norton Typcial House Soakaway	
Date 16/10/2020 13:47 File G301-House Soakaway V1....	Designed by BF Checked by	


XP Solutions Source Control 2019.1

Model Details

Storage is Online Cover Level (m) 170.000

Lined Soakaway Structure

Infiltration Coefficient Base (m/hr)	0.11916	Ring Diameter (m)	1.20
Infiltration Coefficient Side (m/hr)	0.11916	Pit Multiplier	2.0
Safety Factor	2.0	Number Required	1
Porosity	0.30	Cap Volume Depth (m)	1.500
Invert Level (m)	168.000	Cap Infiltration Depth (m)	1.500

Stratton Park House Wanborough Road Swindon SN3 4HG	G301: Land off Station Road Hook Norton Typcial House Soakaway	
Date 16/10/2020 13:47 File G301-House Soakaway V1....	Designed by BF Checked by	

XP Solutions	Source Control 2019.1
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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 436199 233628 SP 36199 33628
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.009

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

PFA Consulting Ltd		Page 1
Stratton Park House Wanborough Road Swindon SN3 4HG	G301: Land off Station Road Hook Norton Typcial House Soakaway	
Date 16/10/2020 13:47 File G301-House Soakaway V1....	Designed by BF Checked by	

XP Solutions Source Control 2019.1

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

Half Drain Time : 123 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m ³)	Status
15 min Summer	168.902	0.902	0.2	2.3	O K
30 min Summer	169.135	1.135	0.3	2.9	O K
60 min Summer	169.303	1.303	0.3	3.3	O K
120 min Summer	169.346	1.346	0.3	3.4	O K
180 min Summer	169.349	1.349	0.3	3.4	O K
240 min Summer	169.330	1.330	0.3	3.4	O K
360 min Summer	169.264	1.264	0.3	3.2	O K
480 min Summer	169.185	1.185	0.3	3.0	O K
600 min Summer	169.108	1.108	0.3	2.8	O K
720 min Summer	169.036	1.036	0.3	2.6	O K
960 min Summer	168.907	0.907	0.2	2.3	O K
1440 min Summer	168.700	0.700	0.2	1.8	O K
2160 min Summer	168.484	0.484	0.2	1.2	O K
2880 min Summer	168.340	0.340	0.1	0.9	O K
4320 min Summer	168.166	0.166	0.1	0.4	O K
5760 min Summer	168.077	0.077	0.1	0.2	O K
7200 min Summer	168.048	0.048	0.1	0.1	O K
8640 min Summer	168.042	0.042	0.1	0.1	O K
10080 min Summer	168.038	0.038	0.1	0.1	O K
15 min Winter	169.015	1.015	0.3	2.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Time-Peak (mins)
15 min Summer	144.701	0.0	18
30 min Summer	95.076	0.0	32
60 min Summer	59.438	0.0	60
120 min Summer	35.576	0.0	98
180 min Summer	26.357	0.0	130
240 min Summer	21.267	0.0	164
360 min Summer	15.627	0.0	234
480 min Summer	12.476	0.0	302
600 min Summer	10.434	0.0	370
720 min Summer	8.993	0.0	436
960 min Summer	7.076	0.0	568
1440 min Summer	5.006	0.0	822
2160 min Summer	3.521	0.0	1192
2880 min Summer	2.750	0.0	1556
4320 min Summer	1.966	0.0	2252
5760 min Summer	1.566	0.0	2944
7200 min Summer	1.334	0.0	3664
8640 min Summer	1.177	0.0	4384
10080 min Summer	1.063	0.0	5128
15 min Winter	144.701	0.0	18

Stratton Park House Wanborough Road Swindon SN3 4HG	G301: Land off Station Road Hook Norton Typical House Soakaway
Date 16/10/2020 13:47 File G301-House Soakaway V1....	Designed by BF Checked by



XP Solutions Source Control 2019.1

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m ³)	Status
30 min Winter	169.283	1.283	0.3	3.2	O K
60 min Winter	169.483	1.483	0.3	3.7	O K
120 min Winter	169.585	1.585	0.3	3.9	O K
180 min Winter	169.583	1.583	0.3	3.9	O K
240 min Winter	169.505	1.505	0.3	3.8	O K
360 min Winter	169.403	1.403	0.3	3.5	O K
480 min Winter	169.288	1.288	0.3	3.2	O K
600 min Winter	169.177	1.177	0.3	3.0	O K
720 min Winter	169.078	1.078	0.3	2.7	O K
960 min Winter	168.904	0.904	0.2	2.3	O K
1440 min Winter	168.641	0.641	0.2	1.6	O K
2160 min Winter	168.382	0.382	0.2	1.0	O K
2880 min Winter	168.220	0.220	0.1	0.6	O K
4320 min Winter	168.052	0.052	0.1	0.1	O K
5760 min Winter	168.040	0.040	0.1	0.1	O K
7200 min Winter	168.034	0.034	0.1	0.1	O K
8640 min Winter	168.030	0.030	0.1	0.1	O K
10080 min Winter	168.028	0.028	0.1	0.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Time-Peak (mins)
30 min Winter	95.076	0.0	32
60 min Winter	59.438	0.0	60
120 min Winter	35.576	0.0	104
180 min Winter	26.357	0.0	138
240 min Winter	21.267	0.0	176
360 min Winter	15.627	0.0	252
480 min Winter	12.476	0.0	324
600 min Winter	10.434	0.0	396
720 min Winter	8.993	0.0	464
960 min Winter	7.076	0.0	598
1440 min Winter	5.006	0.0	864
2160 min Winter	3.521	0.0	1232
2880 min Winter	2.750	0.0	1588
4320 min Winter	1.966	0.0	2204
5760 min Winter	1.566	0.0	2936
7200 min Winter	1.334	0.0	3672
8640 min Winter	1.177	0.0	4400
10080 min Winter	1.063	0.0	5088



Stratton Park House, Wanborough Road Swindon, SN3 4HG

Telephone 01793 828000

Website www.pfapl.com

For Planning
This drawing is produced for the purposes of supporting a planning application and should not be relied upon for tender, pricing, or construction purposes.

NOTES

- Drawing is based on the Topographical Survey (Drawing No. 4140177-1007_1008) undertaken by Glanville dated September 2014.
- Drawing is based on the Illustrative Layout (Drawing No. 20147.101 Rev A, 09.10.20) produced by MHP.
- Soakaways a minimum of 5m away from buildings. Where private soakaways cannot be achieved due to building offsets shared soakaways or discharging directly into the subbase of the pervious pavement should be considered at the detailed design stage.
- Site levels permit site access and first ~45m of access road to drain to infiltration basin.
- Access road designed in cross fall and permeable sub-base limited to lower area with service corridor for foul drainage on the high side of access road.
- Surface water drainage indicative only and subject to detailed design.

KEY

- House Soakaway (Concrete ring or geocellular)
- Trench Soakaway (where there is limited space)
- Block Paving
- Pervious Block Paving with Permeable sub-base (see note 5)
- Pervious Shared Drives
- Highway Drain
- Highway Gully
- Highway Outfall to Infiltration Basin

Rev	Date	Description	Drawn	Check
#	10/11/20	First issue.	BK	BF
A	15/01/21	Layout revised. Notes added.	MRD	BF
B	19/01/21	Minor Key amendment	DAB	GE

Status **FOR PLANNING**

Client **Greystoke Land LTD**

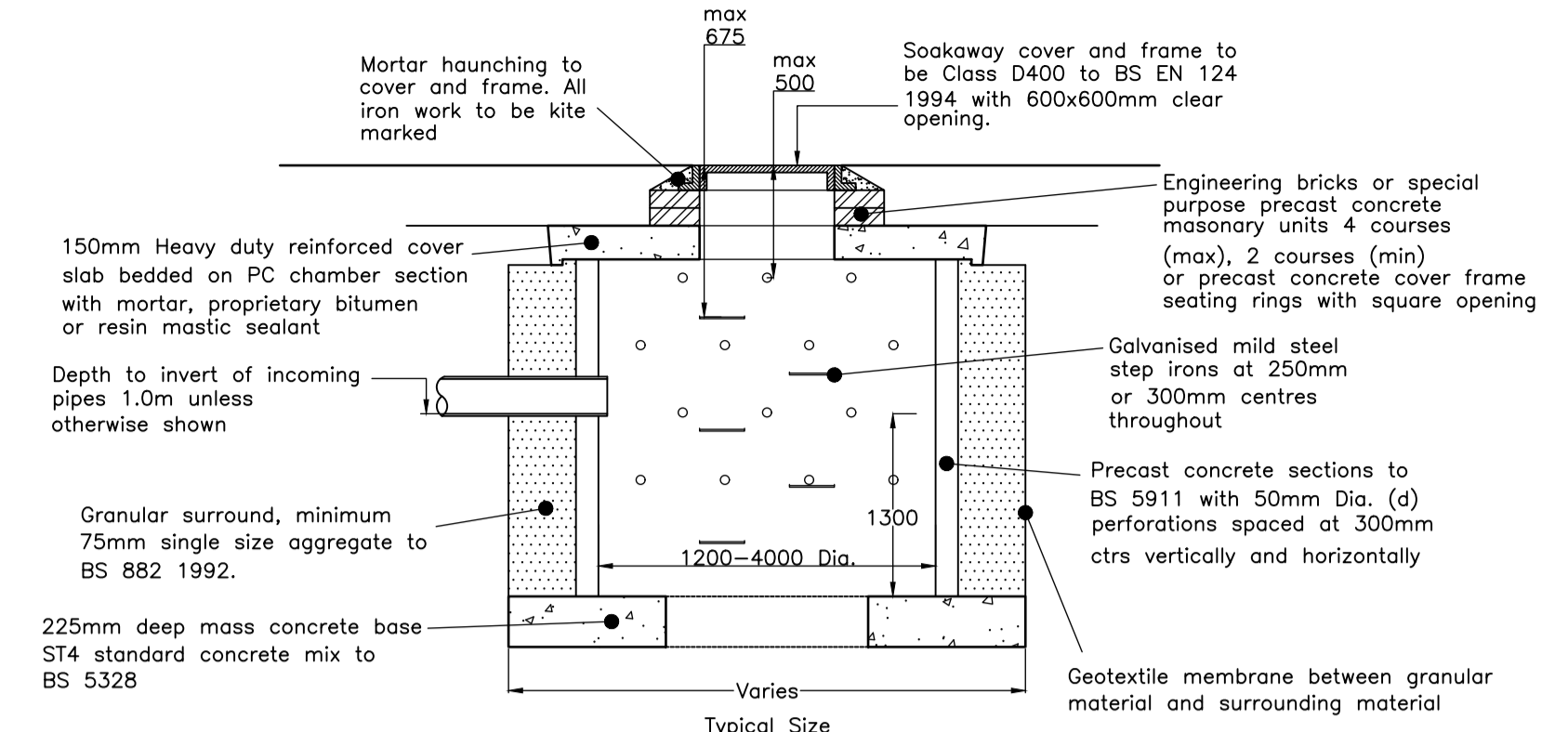
Project **Land East of Hook Norton, Cherwell, Oxfordshire**

Drawing Title **Indicative Surface Water Drainage Arrangements**

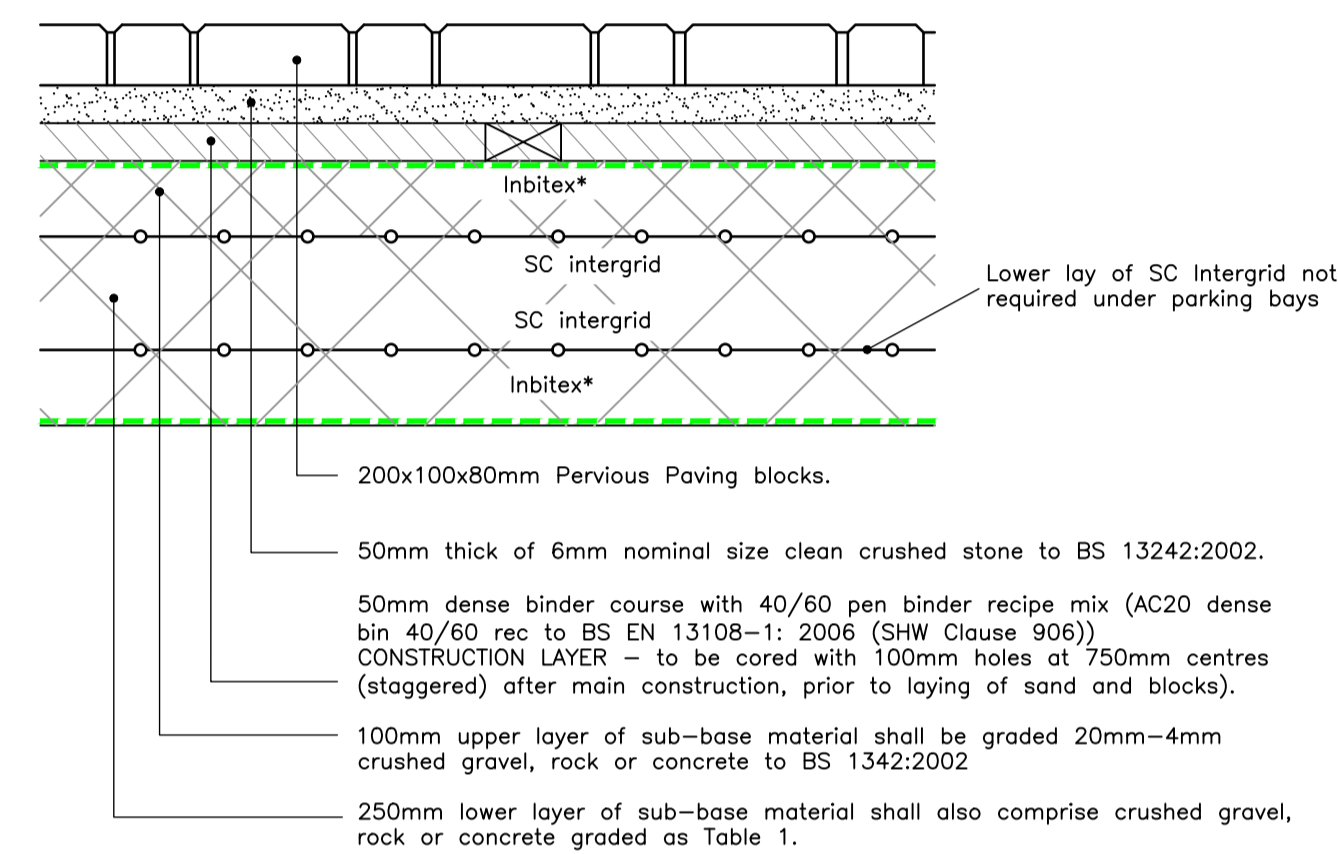
Drawing No. **G301/01** Rev. A

Date: November 2020 Scale: 1:500 @ A1

E-Mail: bclayton@pfapl.com



Typical Concrete Ring House Soakaway Detail Scale 1:50



Typical Pervious Paving Detail Scale: 1:10

Sieve size	% passing
100mm	100
63mm	90-100
37.5mm	60-80
20mm	15-30
10mm	0-5

*Inbitex - Thermally bonded nonwoven geotextile laid on top and bottom of the sub-base overlapping joints by 300mm. Supplied by WTB Geotechnics



0m 10m 20m 30m 40m 50m Scale 1:500