

Proposed Residential Development Land off Bishopstone Road Stone, Aylesbury Buckinghamshire

Flood Risk Assessment

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Proposed Residential Development Land off Bishopstone Road, Stone, Aylesbury, Bucks

Flood Risk Assessment



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1.0 Introduction

1.1 Instructions

1.1.1 This report is a Flood Risk Assessment for a proposed residential development located at land off Bishopstone Road, Stone, Buckinghamshire, as shown in Figure 1.1 and enclosed in Appendix A. Stone is located on the A418 to the west of Aylesbury. The proposed development has a total development area of 0.973ha (9,725m²). The National Grid reference for the site is E478530, N212230. This report has been prepared by JPP Consulting Limited acting on instructions received from Manor Oak Homes.



Figure 1.1 Site location plan.

1.2 Objectives

- 1.2.1 The objective of this report is to advise interested parties in the development to the potential risk of flooding and management of surface water from a drainage perspective. The report both assesses flood risk and describes a strategy to drain the site in respect of surface water drainage.
- 1.2.2 This report has been prepared to support a detailed planning application.



1.3 Reference documents

- 1.3.1 This report has been prepared with reference to the following publications:-
 - Department for Communities and Local Government (March 2012), National Planning Policy Framework
 - Department for Communities and Local Government (March 2014), Planning Practice Guidance 'Flood Risk and Coastal Change'
 - Environment Agency (September 2013), *Climate Change Allowances for Planners: Guidance to support the National Planning Policy Framework*
 - HM Government (2010), *The Building Regulations (2010), Drainage and Waste Disposal, Approved Document H*, The NBS, Newcastle Upon Tyne
 - Wilson, Bray, Cooper (2004), *Sustainable drainage systems: Hydraulic, structural and water quality advise*,C609, CIRIA, London
 - Woods-Ballard et al (2007), The SUDS Manual, C697, CIRIA, London
 - CIRIA Report C624 *Development and flood risk*
 - National SUDS Working Group (2004), Interim Code of Practise for Sustainable Drainage Systems,
 - Institute of Hydrology (1999), *Flood Estimation Handbook*, Institute of Hydrology, Wallingford
 - BS EN 752:2008 Drain and sewer systems outside buildings. Hydraulic design and environmental considerations
 - BS 8533:2011 Assessing and managing flood risk in development Code of Practice
 - CIRIA Report C635 *Designing for exceedance in urban drainage good practice*



2.0 Description and history of the site and development proposals

2.1 Location and description of the site

- 2.1.1 The proposed residential development is located off Bishopstone Road, Stone, as shown on the location plan in Figure 1.1 and enclosed in Appendix A. The proposed development is bound by existing residential developments to the north and north west, sports pitches to the east and Bishopstone Road to the south and south west.
- 2.1.2 The proposed development will comprise 12 residential dwellings with associated highway infrastructure and public open space. The existing public right of way through the top of the site will be maintained. The proposed development layout is shown on the plan enclosed in Appendix B.

2.2 History of the site

2.2.1 The site is undeveloped and currently a grass paddock.

2.3 Geology of the site and ground investigation data

- 2.3.1 Soakaway testing has been completed on site, which identified topsoil overlying Purbeck Group (interbedded mudstone and limestone), which was underlain by Portland Stone Formation (interbedded limestone and sandstone). The topsoil comprised very clayey fine to medium sand and was encountered between depths of 0.20m and 0.25m. The Purbeck Group deposits comprised sandy clay, sandy gravelly clay, limestone and stiff clay. The Portland Stone Formation comprised more competent limestone strata and was encountered between 1.0m and 1.60m.
- 2.3.2 The shallow depth soakaway test results suggest that the use of permeable paving is likely to be acceptable, with recorded permeability rates in the range of 4.3x10⁻⁵ to 8.4x10⁻⁶ m/s. However, deeper tests suggest that deeper soakaway drainage will be very slow, with recorded permeability rates in the range of 1.7x10⁻⁶ to 1.8x10⁻⁶ m/s. It is recommended that further tests are carried out over a period of several days to accurately calculate soil infiltration rates for deeper soakaways, and as such their feasibility cannot be ascertained.
- 2.3.3 A report on the soakaway investigation is enclosed in Appendix C.



2.4 Development proposals and flood risk vulnerability

- 2.4.1 With reference to Table 2 of Planning Practice Guidance to the National Planning Policy Framework, the proposed development for residential dwellings would be classified as More Vulnerable.
- 2.4.2 An extract from Table 2 of the PPG for Flood Risk and Coastal Change is replicated below in Table 2.4 with the proposed development type highlighted.

Flood Risk Vulnerability Classification			
Vulnerability	Development types		
More vulnerable	Hospitals.		
	Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels.		
	Buildings used for dwelling houses , student halls of residence, drinking establishments, night clubs, and hotels.		
	Non-residential uses for health services, nurseries and educational establishments.		
	Landfill and sites used for waste management facilities for hazardous waste.		
	Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.		
Table 2.4 - Source: Planning Practice Guidance - 2014			



3.0 Flood risk

3.1 Fluvial / Tidal flooding

3.1.1 An extract of the Environment Agency flood map for planning (Rivers and Sea) is provided below in Figure 3.1. The flood map was extracted from the Environment Agency's web site on the 17th November 2014. The approximate application site boundary is shown in red. The map indicates that the development site is located within Flood Zone 1 (Low Probability) and as such, the report considers the development to be in Flood Zone 1 and at a low risk of flooding from rivers or the sea. Enter a postcode or place name: Other topics for this area...



Figure 3.1 – Flood Map for Planning (Rivers and Sea) **Source**: Environment Agency web site – 17th November 2014



3.1.2 Table 3.1 is a copy of Table 1 from Planning Practice Guidance for *'Flood Risk and Coastal Change'* to the National Planning Policy Framework which defines Flood Zones. The proposed development, which is located within Flood Zone 1, is assessed as having a less than 1 in 1,000 annual probability of river or sea flooding in any year.

Flood Zone	
Flood Zones	Definition
Zone 1: Low Probability	Land having a less than 1 in 1,000 annual probability of river or sea flooding.
Zone 2: Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or Land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding.
Zone 3a High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding.
Zone 3b The Functional Flood plain	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency.

Table 3.1 - Source: Planning Practice Guidance - 2014



Flooding from groundwater 3.2

Enter a postcode or place name:

3.2.1 From information provided on the Environment Agency's website, see Figure 3.2 and 3.3, the site does not appear to be underlain by an aquifer in the superficial deposits. However, the site appears to be underlain by a Secondary A aquifer in the bedrock layer. We are not aware of any flooding on the site caused by ground water. We would therefore consider the probability of flooding on the site from groundwater as low.



Source: Environment Agency web site – 17th November 2014

Other topics for this area...



Figure 3.3 – Groundwater – Bedrock Designation **Source**: Environment Agency web site – 17th November 2014



3.3 Flooding from sewers

- 3.3.1 There are no sewers located within the site application boundary. We do not have any records of sewer flooding within the vicinity of the proposed development.
- 3.3.2 We therefore do not consider the risk of flooding from sewers to be a significant risk to the proposed development.

3.4 Flooding from reservoirs, canals and other artificial sources

3.4.1 We are not aware of any canals or artificial water sources that may result in flooding of this site.

3.4.2 An extract of the Environment Agency map 'Risk of Flooding from Reservoirs' is provided below in Figure 3.4. It can be seen that the proposed development site, shown in red, is not at a risk of flooding from reservoirs.



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Figure 3.4 – Risk of Flooding from Reservoirs **Source**: Environment Agency web site – 17th November 2014

3.5 Historic flooding

3.5.1 We do not have any records showing historic flood events within the vicinity of the site.



3.6 Flood risk vulnerability and flood zone compatibility

3.6.1 Based on the above assessment of the site being located within Flood Zone 1 and classified as a More Vulnerable development, and with reference to Table 3.6 (Planning Practice Guidance for *'Flood Risk and Coastal Change'* to the National Planning Policy Framework, Table 3), the proposed development of this site would be considered "appropriate". A copy of Table 3 is presented below highlighting the above. No sequential or exception test will be required.

Table 3 - Flood Risk Vulnerability and Flood Zone Compatibility					
Flood risk Vulnerability classification	Essential Infrastructure	Water compatibility	Highly Vulnerable	More Vulnerable	Less Vulnerable
Zone 1	\checkmark	\checkmark	\checkmark	✓	\checkmark
Zone 2	√	V	Exception Test required	\checkmark	~
Zone 3a	Exception Test required	√	Х	Exception Test required	√
Zone 3b	Exception Test required	√	Х	Х	Х
\checkmark = Development is appropriateX = Development should not be permitted					
Table 3.6 – So	Table 3.6 – Source: Planning Practice Guidance - 2014				

3.7 Access and egress

3.7.1 Access and egress to and from this site in the event of flooding will be via the proposed development's access onto Bishopstone Road which will allow residents of the development to move to higher ground.



Management of surface water 4.0

Current conditions 4.1

The site is currently open and is fully permeable and therefore considered a greenfield 4.1.1 site with no existing drainage. Therefore greenfield runoff calculations shall be used to derive the allowable run off rate from the site.

4.2 Surface water drainage outfalls

- It is a requirement of the The Building Regulations (2010), Drainage and Waste 4.2.1 Disposal, Approved Document H, to dispose of surface water collected by a development in the following list of priorities:-
 - 1. Infiltration systems where ground condition permit
 - 2. To watercourses
 - 3. To sewers

Each of these is considered separately below:

4.2.2 Infiltration systems

- 4.2.2.1 The soakaway test results suggest that the use of permeable paving is likely to be acceptable. However, deeper tests suggest that deeper soakaway drainage will be very slow. It is recommended that further tests are carried out over a period of several days to accurately calculate soil infiltration rates for deeper soakaways, and as such their feasibility cannot be ascertained.
- 4.2.2 Permeable paving construction will be used for dwellings, private drives and adopted roads. Further, rain water pipes from dwellings will connect into this permeable strata, thus ensuring all drainage is dealt with using infiltration techniques.

4.2.3 Watercourses / Main river

4.2.3.1 There are no watercourses located within or adjacent to the boundary of the proposed development.

4.2.4 Sewers

4.2.4.1 As infiltration techniques are being utilised, the use of surface water sewers will not be considered further.



4.3 Surface water drainage strategy

- 4.3.1 Surface water from all dwellings, private drives and adopted roads will be drained via permeable paving. Thus, there will be no runoff from the site.
- 4.3.2 The proposed residential development has an impermeable area of 3,469m², as shown on the drawing enclosed in Appendix E.

4.4 Surface water drainage design and management

4.4.1 Proposals are to design the surface water drainage system to accommodate storms up to the 1 in 100 year event and allow for increase in storm intensities up to 30% (design life of the development assumed at greater than 60 years). Table 4.4 below is a copy of Table 2 from the Environment Agency's guidance 'Climate Change Allowances for Planners' to support the National Planning Policy Framework.

National precautionary sensitivity ranges for peak rainfall intensity, peak rive flow, offshore wind speed and wave height				
1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115	
+5%	+10%	+20%	+30%	
+10%	+20%	+20%	+20%	
+5%	+5%	+10%	+10%	
+5%	+5%	+10%	+10%	
	tivity ad speed and wa 1990 to 2025 +5% +10% +5% +5%	Image: sensitivity ranges for peak 1990 to 2025 to 2025 2055 +5% +10% +10% +20% +5% +5%	Ind speed and wave height 1990 to 2025 to 2055 to 2025 2055 2085 +5% +10% +20% +5% +5% +10% +5% +5% +10%	

4.4.2 In addition to the above and where required further surface water management shall be provided to ensure that protection against flooding is provided for a 1 in 100 year storm event plus an allowance of 30% for climate change, in the form of an off line detention basin or similar.



4.5 Typical permeable paving calculations

4.5.1 Typical permeable paving calculations are set out below. This is based on the typical calculation for Plot 1, using worst case infiltration value of 0.03024 m/hr (8.4x10⁻⁶ m/s):

Impermeable area of Plot 1 (House)	= 133m ²
Impermeable area of Plot 1 (Garden and Drive)	= 103m ²
Total impermeable area of Plot 1	= 236m ²
Area of permeable paving for Plot 1	= 97m ² (Private drive)
Worst case infiltration value	= 0.03024 m/hr (8.4x10 ⁻⁶ m/s)
Half Drain Time	= 126 minutes

4.5.2 Full typical permeable paving calculations are enclosed in Appendix F.

4.6 Flood compensation

4.6.1 Flood compensation measures will not be required for this site as it is located within Flood Zone 1.

4.7 Overland flows

4.7.1 Proposals are to design the surface water drainage to accommodate the 1 in 100 year storm event taking into account the predicted future effects of climate change (30% increase in intensity). Clearly there is a risk of this storm event being exceeded, albeit this risk is considered very low. In such an event the proposed drainage systems will become overwhelmed and overland flows could occur. Overland flows will be directed to follow the path that overland flows currently follow.

4.8 Foul water drainage strategy

4.8.1 Foul water will discharge to Thames Water's sewer network located in Bishopstone, see asset plan enclosed in Appendix D. Thames Water have confirmed that their sewer has adequate capacity to accommodate the proposed development.



5.0 Maintenance

5.1 Surface drainage maintenance

5.1.1 The drainage system will be designed to minimise maintenance requirements, however, a full maintenance scheme will be established for those elements not being offered for adoption. The various areas will be maintained as set out in Table 5.1 below.

Maintenance Areas – Surface Water			
Aspect	Maintainer		
Drains	Home owner		
SUDS	SUDS Adoption Authority /		
	Management Company / Home Owner		
Table 5.1			

5.2 Foul drainage maintenance

5.2.1 The drainage system will be designed to minimise maintenance requirements, however a full maintenance scheme will be established for those elements not being offered for adoption. The various areas will be maintained as set out in Table 5.2 below.

Maintenance Areas – Foul Water			
Aspect	Maintainer		
Drains	Home owner		
Sewers	Thames Water		
Table 5.2			



6.0 Conclusions and flood risk from site drainage proposals

- 6.1 The proposed residential development is located off Bishopstone Road, Stone, Buckinghamshire. The proposed development is bound by existing residential developments to the north and north west, sports pitches to the east and Bishopstone Road to the south and south west.
- 6.2 The proposed development will comprise 12 residential dwellings with associated highway infrastructure and public open space.
- 6.3 Surface water from all dwellings, private drives and adopted roads will be drained via permeable paving
- 6.4 The surface water drainage from this site, post development, is such that the surface water will be managed and disposed of within the site boundary, thus complying with the Planning Practice Guidance for *'Flood Risk and Climate Change'* to the National Planning Policy Framework. Based on the above, providing the above strategies are adopted the developed site will not contribute further to flood risk thus satisfying the principles of the National Planning Policy Framework.



Appendix A Site Location Plan JPP drawing no. S7326PM-FRA01

R-FRA-S7326PM-01-0





Appendix B Landscape Masterplan First Environment drawing no. 5353/LM.03

R-FRA-S7326PM-01-0

PROPOSED NATIVE TREES WILL PROVIDE — ADDITIONAL FORAGING GROUND AND SOFTEN POTENTIAL VISUAL IMPACTS ON EXISTING DWELLINGS

A WILDFLOWER MEADOW WILL PROVIDE INCREASE BIODIVERSITY, ATTRACT WILDLIFE AND PROVIDE A GREEN BUFFER TO EXISTING DWELLINGS LOCATED TO THE NORTH

A LINE OF PROPOSED TREES -WILL HIGHLIGHT THE PUBLIC RIGHT OF WAY



BISHOPSTONE ROAD PROPOSED TREES ON ROAD FRONTAGE WILL SOFTEN POTENTIAL IMPACTS OF THE PROPOSED DEVELOPMENT

> RETENTION OF THE EXISTING FIELD —/ BOUNDARY HEDGEROW WILL MAINTAIN A SOFT ROAD FRONTAGE

PUBLIC RIGHT OF WAY

6

10

12

PUBLIC RIGHT OF WAY WILL BE MAINTAINED

RETENTION OF EXISTING BOUNDARY VEGETATION WILL REDUCE POTENTIAL VISUAL IMPACTS ON THE ADJACENT PUBLIC OPEN SPACE

PROPOSED TREES WILL STRENGTHEN THE EXISTING BOUNDARY VEGETATION





Appendix C Soakaway Investigation

R-FRA-S7326PM-01-0



Sigeric House Holme Lacy Road Rotherwas Hereford HR2 6BQ

Manor Oak Homes White Lodge Farm Walgrave Northamptonshire NN6 9PY

3rd November 2014

EMS4727 - Report on soakaway investigation at land off Bishopstone Road, Stone

Background

Environmental Management Solutions Limited (EMS) have been commissioned by Manor Oak Homes (in correspondence dated 7th October 2014) to undertake soakaway testing at a site located to the north of Bishopstone Road, Stone, Buckinghamshire, HP17 8QX. The scope of works was stipulated by JPP Consulting (Civil and Structural Engineers) in correspondence dated 24th September 2014.

The site comprises a grass paddock located to the north of Bishopstone Road, in the southern part of the village of Stone. The site slopes gently downwards towards the road, with a fall estimated visually to be less than two metres over a site length of approximately 100 m. The boundary between the site and Bishopstone Road is marked by a hedge. A ditch concealed within this hedge was dry on the date of this investigation.

1:10,000 scale BGS geological mapping has been obtained for the site and is included as Appendix B. This shows the whole of the site to be underlain by the Purbeck Group (interbedded mudstone and limestone) of Upper Jurassic / Lower Cretaceous age. The Purbeck Group is underlain by the Portland Stone Formation (inter-bedded limestone and sandstone), which is marked close to the southern corner of the site.

Scope of Works

EMS was commissioned to undertake two shallow soakaway tests (for permeable paving design) and two deeper soakaway test (for conventional depth soakaways). The test pits were excavated using a JCB-3CX type excavator with 450 mm wide toothed bucket.

Soakaway test pits SA01 and SA02 were excavated in the west of the site. SA01 was excavated to a depth of 2.00 m and SA02 was excavated to a depth of 0.80 m.

Soakaway test pits SA03 and SA04 were excavated in the south of the site. SA03 was excavated to a depth of 1.60 m and SA04 was excavated to a depth of 0.90 m. The depth of SA03 was limited by the presence of rock strength materials which could not be further penetrated by the excavator.

The locations of the trial pits are shown on the exploratory hole location plan included as Appendix C. Details of the trial pits, including a description of the strata encountered, trial pit depths, and notes on groundwater entries are included on the trial pit logs (Appendix D). Photographs of the trial pits are included as Appendix E.

Soakaway tests were undertaken in all four trial pits. Details of the soakaway tests, and the soakaway test results, including calculated soil infiltration rates, are included as Appendix F.

Ground Conditions

Topsoil

A thickness of between 0.20 m and 0.25 m of dark brown organic very clayey fine to medium sand topsoil was present in all four trial pits.

Purbeck Group

Strata considered to represent the Purbeck Group were encountered beneath the topsoil in all four trial pits. These strata comprised a combination of sandy clay, sandy gravelly clay, limestone with much clay weathering product, and stiff grey clay. The varying layers are considered representative of weathered inter-bedded mudstone and limestone.

Portland Stone Formation

More competent limestone strata encountered from 1.00 m to 1.60 m (the base of the trial pit) within SA03 possibly represents the Portland Stone Formation which published geological maps suggest would underlie the Purbeck Group at shallow depth in this location. This rock material was described as very weak and weak pale cream limestone, and was very difficult to excavate from a depth of 1.40 m.

Groundwater

No groundwater entries occurred in any of the four trial pits.

Soakaway Test Results

The two shallow depth soakaway tests (SA02 and SA04) both reached completion, or near completion, in the allocated time. These soakaway tests recorded soil infiltration rates of 4.3×10^{-5} m/s and 8.4×10^{-6} m/s respectively.

The two deeper soakaway tests (SA01 and SA02) recorded much slower infiltration rates and neither test came close to reaching completion during the allotted time period. Tentative extrapolation (presented on the results sheets) suggests best case infiltration rates of 1.7×10^{-6} m/s and 1.8×10^{-6} m/s. However, it should be noted that infiltration is likely to slow over the period of the test so actual rates could be significantly slower.

Conclusions/Recommendations

The soakaway tests suggest that use of permeable paving is likely to be acceptable at the site – provided ground conditions remain consistent.

The deeper soakaway tests suggest that deeper soakaway drainage will be very slow, at best. If design of full depth soakaway chambers is to be undertaken it is recommended that further tests are run over a period of several days in order to calculate accurate soil infiltration rates.



James Woodier Senior Geo-Environmental Engineer Environmental Management Solutions Limited 07943 899 616 james@ems-asbestos.co.uk

<u>Appendices:</u> Appendix A – Site Plan Appendix B – Geological Data Appendix C – Exploratory Hole Location Plan Appendix D – Trial Pit Logs Appendix E – Trial Pit Photographs Appendix F – Soakaway Test Results Appendix A – Site Plan

These are the notes referred to on the following official copy

The electronic official copy of the title plan follows this message.

Please note that this is the only official copy we will issue. We will not issue a paper official copy.

This official copy was delivered electronically and when printed will not be to scale. You can obtain a paper official copy by ordering one from Land Registry.

This official copy is issued on 02 May 2014 shows the state of this title plan on 02 May 2014 at 10:02:02. It is admissible in evidence to the same extent as the original (s.67 Land Registration Act 2002). This title plan shows the general position, not the exact line, of the boundaries. It may be subject to distortions in scale. Measurements scaled from this plan may not match measurements between the same points on the ground. See Land Registry Public Guide *19 - Title Plans and Boundaries*.

This title is dealt with by the Land Registry, Leicester Office .

Land Registry Official copy of title plan

Title number **BM307280** Ordnance Survey map reference **SP7812SE** Scale **1:1250 enlarged from 1:2500** Administrative area **Buckinghamshire : Aylesbury Vale**





Appendix B – Geological Data

Geology 1:10,000 Maps Legends

Artificial Ground and Landslip

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	MGR	Made Ground (Undivided)	Artificial Deposit	Holocene - Holocene

Superficial Geology

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	ALV	Alluvium	Clay, Silt, Sand and Gravel	Flandrian - Pleistocene
	HEAD	Head	Clay And Sand	Quaternary - Ryazanian
	RTD1	River Terrace Deposits, 1	Clay, Silt, Sand and Gravel	Quaternary - Rvazanian

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	LGS	Lower Greensand Group	Sandstone, Ferruginous	Albian - Aptian
	WHS	Whitchurch Sand Formation	Sandstone, Ferruginous	Valanginian - Valanginian
	WHS	Whitchurch Sand Formation	Mudstone	Valanginian - Valanginian
	РВ	PURBECK GROUP	Limestone and Mudstone, Interbedded	Berriasian - Tithonian
	POST	Portland Stone Formation	Limestone and [Subequal/Subordina te] Sandstone, Interbedded	Tithonian - Tithonian
	POSA	Portland Sand Formation	Mudstone and Limestone, Interbedded	Tithonian - Tithonian
	KC	Kimmeridge Clay Formation	Sandstone	Kimmeridgian - Kimmeridgian
	КС	Kimmeridge Clay Formation	Mudstone and Limestone, Interbedded	Kimmeridgian - Kimmeridgian
	Fault			

Bedrock and Faults

Envirocheck[®]

Geology 1:10,000 Maps

This report contains geological map extracts taken from the BGS Digital Geological map of Great Britain at 1:10,000 scale and is designed for users carrying out preliminary site assessments who require geological maps for the area around a site. This mapping may be more up to date than previously published paper maps.

The various geological layers - artificial and landslip deposits, superficial geology and solid (bedrock) geology are displayed in separate maps, but superimposed on the final 'Combined Surface Geology' map. All map legends feature on this page.

Please Note: Not all of the layers have complete nationwide coverage, so availability of data for relevant map sheets is indicated below.

Geology 1:10,000 Maps Coverage

Map ID:
Map Name:
Map Date:
Bedrock Geology:
Superficial Geology
Artificial Geology:
Faults:
Landslip:
Rock Segments:

1 SP71SE 1989 Available Available Not Supplied Not Available Not Supplied



A Landmark Information Group Service v47.0 03-Nov-2014 Page 1 of 5



Artificial Ground and Landslip

Artificial ground is a term used by BGS for those areas where the ground surface has been significantly modified by human activity. Information about previously developed ground is especially important, as it is often associated with potentially contaminated material, unpredictable engineering conditions and unstable ground.

Artificial ground includes:

- Made ground - man-made deposits such as embankments and spoil heaps on the natural ground surface.

- Worked ground - areas where the ground has been cut away such as guarries and road cuttings.

- Infilled ground - areas where the ground has been cut away then wholly or partially backfilled.

- Landscaped ground - areas where the surface has been reshaped.

- Disturbed ground - areas of ill-defined shallow or near surface mineral workings where it is impracticable to map made and worked ground separately.

Mass movement (landslip) deposits on BGS geological maps are primarily superficial deposits that have moved down slope under gravity to form landslips. These affect bedrock, other superficial deposits and artificial ground. The dataset also includes foundered strata, where the ground has collapsed due to subsidence.



Order Details

Order Number: Customer Ref: National Grid Reference: 478570, 212250 Slice: Site Area (Ha): Search Buffer (m):

61717650_1_1 EMS4727 А 0.97 1000

Site Details

Land off Bishopstone Road, Stone, Aylesbury, HP17 8PA



Tel: Fax: Web

0844 844 9952 0844 844 9951 www.envirocheck.co.uk



Envirocheck[®]

Superficial Geology

BGS 1:10,000 Superficial Deposits are the youngest geological deposits formed during the most recent period of geological time, which extends back about 1.8 million years from the present.

They rest on older deposits or rocks referred to as Bedrock. This dataset contains Superficial deposits that are of natural origin and 'in place'. Other superficial strata may be held in the Mass Movement dataset where they have been moved, or in the Artificial Ground dataset where they are of man-made origin.

Most of these Superficial deposits are unconsolidated sediments such as gravel, sand, silt and clay, and onshore they form relatively thin, often discontinuous patches or larger spreads.

Superficial Geology Map - Slice A



Order Details

Order Number: Customer Ref: National Grid Reference: 478570, 212250 Slice: Site Area (Ha): Search Buffer (m):

61717650_1_1 EMS4727 А 0.97 1000

Site Details

Land off Bishopstone Road, Stone, Aylesbury, HP17 8PA



0844 844 9952

Tel: Fax:

Web:

0844 844 9951 www.envirocheck.co.uk



Envirocheck[®]

Bedrock and Faults

Bedrock geology is a term used for the main mass of rocks forming the Earth and are present everywhere, whether exposed at the surface in outcrops or concealed beneath superficial deposits or water.

The bedrock has formed over vast lengths of geological time ranging from ancient and highly altered rocks of the Proterozoic, some 2500 million years ago, or older, up to the relatively young Pliocene, 1.8 million years ago.

The bedrock geology includes many lithologies, often classified into three types based on origin: igneous, metamorphic and sedimentary.

The BGS Faults and Rock Segments dataset includes geological faults and thin beds mapped as lines such as coal seams and mineral veins. These are not restricted by age and could relate to features of any of the 1:10,000 geology datasets.





Order Details

Order Number: Customer Ref: National Grid Reference: 478570, 212250 Slice: Site Area (Ha): Search Buffer (m):

61717650_1_1 EMS4727 А 0.97 1000

Site Details

Land off Bishopstone Road, Stone, Aylesbury, HP17 8PA



Tel: Fax: Web:

0844 844 9952 0844 844 9951 www.envirocheck.co.uk





Combined Surface Geology

The Combined Surface Geology map combines all the previous maps into one combined geological overview of your site.

Please consult the legends to the previous maps to interpret the Combined "Surface Geology" map.

Additional Information

More information on 1:10,000 Geological mapping and explanations of rock classifications can be found on the BGS website. Using the LEX Codes in this report, further descriptions of rock types can be obtained by interrogating the 'BGS Lexicon of Named Rock Units'. This database can be accessed by following the 'Information and Data' link on the BGS website.

Contact

British Geological Survey Kingsley Dunham Centre Keyworth Nottingham NG12 5GG Telephone: 0115 936 3143 Fax: 0115 936 3276 email: enquiries@bgs.ac.uk website: www.bgs.ac.uk



Combined Geology Map - Slice A

Order Details

Order Number: Customer Ref: National Grid Reference: 478570, 212250 Slice: А Site Area (Ha): Search Buffer (m):

61717650_1_1 EMS4727 0.97 1000

Tel: Fax:

Web:

Site Details

Land off Bishopstone Road, Stone, Aylesbury, HP17 8PA



0844 844 9952 0844 844 9951 www.envirocheck.co.uk

A Landmark Information Group Service v47.0 03-Nov-2014

Appendix C – Exploratory Hole Location Plan



Appendix D – Trial Pit Logs



Project										HOL	E No)
Land off Bish	opstone	e Road, S	tone							SA	01	
Job No	Date	10 10 1	4	Ground L	evel (m)	Co-Ord	linates ()				•••	
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Conductor										1 0	f 1	
SAMPLES & TES	STS					STRAT	ΓA					nt/
	515	ater Reduce	be	Depth		011011					logy	ume
Depth Samp	ole No.	Level	Legend	(Thick- ness)			DESCH	RIPTION			Geo	Instr
				×- (0.20)	Dark brown	organic ve	ry clayey f	fine to medi	um SAND (topsoil).		
			<u></u>	0.20	T . 1	1. 1.1	· · ·					
				(0.20)	(Purbeck Gro	slightly org oup)	sanic sand	Y CLAY.				
				0.40	Verv weak to	moderate	lv weak cr	eam/nale h	rown LIMES	STONE with		-
					much sandy	clay weath	ering prod	uct. Recov	ered as claye	ey sandy		
				-	(Purbeck Gro	oup)		coooles.				
				-								
				- (1.00)								
				-								
				1.40	Eine nala an		harren ar	tuomoly, ala	a alta fi a gama d	onovially.		-
				-	CLAY. Grav	vel is angul	lar fine to	coarse mud	stone and lir	nestone.		
			- <u>-</u> -		(Purbeck Gro	r limestone oup)	e cobbles.					
				- (0.30) -								
				1 00								
			<u>+</u>	2 00	Stiff grey CI	AY.						1
				2.00	(Purbeck Gr	oup)						1
				-								
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				-								
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				-								
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Date Time	Depth	Cas	ing	Water	From	To	Hours	From	To	REMA	RAL RKS	
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										soakaway infilt testing.	ration	
										2. No groundwa occurred.	ater en	tries
All dimensions in metr	es Clie	ent Mai	nor Oak	Homes	Metho	d/		<u> </u>		Logged By		
Scale 1:18.75 Plant Used Hydraulic excavator JPW												



Project HOLE N							E No						
Land off Bishopstone Road, Stone SA0									02				
Job No	Date			Ground L	evel (n	1)	Co-Or	dinates ()				UΖ	
EMS4727		19-10-14		Short									
Contractor											Sneet	f 1	
CAMDLES & TEC	TC						OTD A	Τ Δ			10		7
SAMPLES & TES	15		1	Depth			SIKA	IA				gy	fill
Depth Sampl	e No.	Level	Legend	(Thick- ness)	D 1			DESCH	RIPTION			Geold	Instru Back
-				(0.25)	Dark	brown	organic v	ery clayey i	ine to medi	ium SAND (t	opsoii).		
-				0.25	Firm	brown	slightly or	canic sand	V CLAV				-
-				·[(Purl	beck Gr	oup)	guine sund	y CLATT.				
_				(0.45)									
-													
-			 	0.70									
-			-° 	0.80	Firm angu	cream a lar coar	and browr se limesto	n slightly sa ne. Occasi	ndy gravell onal limeste	y CLAY. Gr one cobbles.	avel 1s		
-				-	\(Purl	beck Gr	oup)				/		
_				-									
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											testing.	ater en	tries
											occurred.		
All dimensions in metre	s Clie	nt Mano	or Oak	Homes		Metho Plant U	d/ Jsed F	Ivdraulie	excavato	r	Logged By	N	
Scale 1.16.75 Frain Useu Fryulfaunc excavator JPW													



Project HOLE							E No)					
Land off Bishopstone Road, Stone SAO								03					
Job No	Date			Ground L	evel (m))	Co-Or	dinates ()				100	
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Contractor												of 1	
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Depth Sam	ple No.	≥ Leve	Legend	(Thick- ness)				DESCI	RIPTION			Geol	Instr Back
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				0.20									
			- <u>°, </u>	-	Firm a angula	and stiff ar fine t	f brown s o mediur	lightly sand n limestone	iy slightly g	ravelly CLA	AY. Gravel is		
			- <u>-</u>	. (0.55)									
			- <u>°. </u>										
				0.75	5	1	11			1. 1	<u> </u>		
				- - - - - - - - - - - - - - - - - - -	limest	white ar	nd brown	gravelly C	LAY. Grav	el 1s angula	r fine to coarse		
				1.00	(Purb	eck Gro	oup)						
-					Very sandy	weak ar angulai	nd weak p r fine to c	oale cream	LIMESTON	NE. Recove sional cobbl	red as very es.		
				-	(Possi	ible Por	tland Sto	ne Formati	on)				
				(0.60)									
					1 40 -	becomi	ing verv	difficult to	excavate				
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Boring Progr	ess and	Water C)bservati	ons		Ch	nisellinį	3	Water	Added	GENE	RAL	
Date Time	Depth	Depth	sing Dia. mm	Water Dpt	Fro	m	То	Hours	From	То	REMA	RKS	
											1. Trial pit utili soakaway infilt	sed for ration	r
											testing. 2. No groundwa	ater en	tries
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Scale 1:18.75 Plant Used Hydraulic excavator JPW													



Project HOLE							E No						
Land off Bish	opston	e Road, S	stone									04	
Job No	Date			Ground L	evel (n	1)	Co-Or	dinates ()					
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Contractor											Sheet	£ 1	
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SAMPLES & TES	STS	ter		Depth			STRA	ΊΑ				gy	ment
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-			$\frac{1}{1/2} \cdot \frac{\sqrt{1}}{\sqrt{1}} \cdot $	(0.25)	Dark	brown	organic v	ery clayey f	ine to medi	ium SAND (topsoil).		
-				0.25	Firm	and sti	ff brown s	lightly can	ly clightly o	ravelly CLA	V Gravel is		-
-				-	angu	lar fine	to medium	n limestone	iy slightly e				
_			- <u>-</u>	-1	(Puit	beck Gi	(oup)						
_			- <u></u>	(0.65)									
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											soakaway infilt testing.	ration	
											2. No groundwa occurred.	ater en	tries
All dimensions in metr	es Cli	ent Ma	nor Oak	Homes		Metho	od/	I			Logged By	1 7	
Scale 1:18.75 Plant Used Hydraulic excavator JPW													

Appendix E – Trial Pit Photographs





SA01







SA02







SA03







SA04



Appendix F – Soakaway Test Results



Project Name: Land off Bishopstone Road, Stone Project Number: EMS4727 Date of Test: 29th October 2014 Test Location: SA01 Depth of pit: 2.00 m Width of pit: 0.50 m Length of pit: 1.60 m The test pit was not filled with gravel.

Elapsed Time	Water level (m below
(minutes)	ground level)
0	1
15	1.03
29	1.06
42	1.06
65	1.09
88	1.10
132	1.14
188	1.16



 $V_{p75-25} = 0.4$ $a_{p50} = 2.9$ $t_{p75-25} = 1350$ minutes (extrapolated)

f (soil infiltration rate) = 1.7 x 10⁻⁶ m/s (extrapolated)



Project Name: Land off Bishopstone Road, Stone Project Number: EMS4727 Date of Test: 29th October 2014 Test Location: SA02 Depth of pit: 0.80 m Width of pit: 0.50 m Length of pit: 1.20 m The test pit was not filled with gravel.

Elapsed Time	Water level (m below
(minutes)	ground level)
0	0.30
3	0.35
17	0.54
32	0.64
45	0.70
68	Dry



 $V_{p75-25} = 0.15$ $a_{p50} = 1.45$ $t_{p75-25} = 40$ minutes

f (soil infiltration rate) = 4.3×10^{-5} m/s



Project Name: Land off Bishopstone Road, Stone Project Number: EMS4727 Date of Test: 29th October 2014 Test Location: SA03 Depth of pit: 2.00 m Width of pit: 0.50 m Length of pit: 1.60 m The test pit was not filled with gravel.

Elapsed Time	Water level (m below
(minutes)	ground level)
0	0.60
4	0.63
17	0.67
36	0.71
55	0.76
82	0.79
126	0.82
163	0.84



 $V_{p75-25} = 0.3825$ $a_{p50} = 2.915$ $t_{p75-25} = 1220$ minutes (extrapolated)

f (soil infiltration rate) = 1.8 x 10⁻⁶ m/s (extrapolated)



Project Name: Land off Bishopstone Road, Stone Project Number: EMS4727 Date of Test: 29th October 2014 Test Location: SA04 Depth of pit: 0.90 m Width of pit: 0.45 m Length of pit: 1.40 m The test pit was not filled with gravel.

Elapsed Time	Water level (m below
(minutes)	ground level)
0	0.40
5	0.50
20	0.59
39	0.62
56	0.66
85	0.70
129	0.72
166	0.76



$$\begin{split} V_{p75\text{-}25} &= 0.1575 \\ a_{p50} &= 1.555 \\ t_{p75\text{-}25} &= 200 \text{ minutes} \end{split}$$

f (soil infiltration rate) = 8.4×10^{-6} m/s

Environmental Management Solutions Ltd. Sigeric Business Park, Holme Lacy Road Rotherwas, Hereford, HR2 6BQ Tel. 01432 263333 Fax. 01432 263355



Appendix D Thames Water Asset Plans

R-FRA-S7326PM-01-0

November 2014



The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

Based on the Ordnance Survey Map with the Sanction of the controller of H.M. Stationery Office, License no. 100019345 Crown Copyright Reserved.

<u>Thames Water Utilities Ltd</u>, Property Searches, PO Box 3189, Slough SL1 4W, DX 151280 Slough 13 T 0845 070 9148 E <u>searches@thameswater.co.uk</u> I <u>www.thameswater-propertysearches.co.uk</u> NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no survey information is available.

Manhole Reference	Manhole Cover Level	Manhole Invert Level				
4202 5201 6102 6101	105.17 104.73 104.02 104.04	103.43 102.97 102.39 102.03				
The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.						

Thames Water Utilities Ltd, Property Searches, PO Box 3189, Slough SL1 4W, DX 151280 Slough 13 T 0845 070 9148 E searches@thameswater.co.uk I www.thameswater-propertysearches.co.uk



Sewer Key - Commercial Drainage and Water Enquiry



Sewer Fittings

Other Symbols

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas. Air Valve * Dam Chase Ø Invert Level Fittina <1Summit Meter Areas Vent Column Lines denoting areas of underground surveys, etc. **Operational Controls** Agreement A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream. **Operational Site** Control Valve Chamber Drop Pipe Tunnel Ancillary Conduit Bridge Weir End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no Foul Sewer ---knowledge of the position of the sewer upstream of that symbol. Outfall on a surface water sewer indicates that the pipe discharges into a stream or river. **Combined Sewer** Outfall Culverted Watercourse Undefined End Inlet

Notes:

- 1) All levels associated with the plans are to Ordnance Datum Newlyn.
- 2) All measurements on the plans are metric.
- 3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.
- 4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.
- 5) 'na' or '0' on a manhole level indicates that data is unavailable.

6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in milimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Searches on 0118 925 1504.

Symbols used on maps which do not fall under other general categories

Public/Private Pumping Station

Change of characteristic indicator (C.O.C.I.)

Other Sewer Types (Not Operated or Maintained by Thames Water)





Appendix E Proposed Impermeable Area JPP drawing no. S7326PM-FRA02

R-FRA-S7326PM-01-0





<u>KEY</u>



Site Boundary = 9,725m²

Proposed Impermeable Area = 3,469m²

ipp consulting Civil & Structural Engineers	Client Project	MANOR OAK HOMES HOUSING DEVELOPMENT, BISHOPSTONE ROAD
Cedar Bam, White Lodge, Walgrave, Northampton: NN6 9PY T: (01804) 781811 E: mail@jopuk.net F: (01804) 781999 W: www.jopuk.net	Title	PROPOSED IMPERMEABLE AREA DRAWING
Scale at A3 1:500 Drawn by KEJ	Checked b	Dy MJA Date NOVEMBER 2014
Status	Project ref S7326	f Drawing no. Revision SPM FRA02



Appendix F Typical Permeable Paving Calculations

R-FRA-S7326PM-01-0

November 2014

J P P Consulting						Page 1	
Cedar Barn							
White Lodge						4	
Northampton NN6 9PY						- Jun	
Date 18/11/2014 16:20	Desi	aned	bv Kath	erineJ	Г	MICIO	
File S7326PM PERMEABLE PAVIN	Chec	kod 1				Drainage	
Micro Drainage	. Cirec	Reu J		01/ 1	1		
	Sour	ce c	SULLOI 2	014.1.	1		
	c 1.0	~			1 (
Summary of Results	for 10	<u>0 ye</u>	<u>ar Retur</u>	n Peri	<u>lod (+30%)</u>		
		1	0.0				
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(m	ı) (m)		(l/s)	(m³)			
15 min Summer 99.	//9 0.279 RAA 0 204	1	0.8	8.0	Flood Risk		
60 min Summer 99.6	315 0.315		0.0	0.0 9.1	Flood Risk		
120 min Summer 99	301 0 301		0.0	2.1 8 7	Flood Risk		
180 min Summer 99.	784 0.284		0.8	8.2	Flood Risk		
240 min Summer 99.	767 0.267	,	0.8	7.7	Flood Risk		
360 min Summer 99.	733 0.233	5	0.8	6.7	Flood Risk		
480 min Summer 99.	701 0.201		0.8	5.8	Flood Risk		
600 min Summer 99.	673 0.173	3	0.8	5.0	O K		
720 min Summer 99.	648 0.148	5	0.8	4.3	O K		
960 min Summer 99.	605 0.105	, ,	0.8	3.0	0 K		
1440 min Summer 99.	556 0.056	5	0.8	1.6	ОК		
2160 min Summer 99.	540 0.040)	0.6	1.1	OK		
2880 min Summer 99.	532 0.032 533 0.033		0.5	0.9	OK		
4320 min Summer 99.	523 0.023 518 0.018) }	0.4	0.7	0 K		
7200 min Summer 99.	515 0.010 515 0.015	,	0.2	0.4	ОК		
8640 min Summer 99.5	513 0.013	}	0.2	0.4	ОК		
10080 min Summer 99.	512 0.012		0.2	0.3	ОК		
15 min Winter 99.8	816 0.316	5	0.8	9.1	Flood Risk		
	-						
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60 min S1	ummer 65	.314	0.0	6	52		
120 min St	ummer 37	.074	0.0	10	00		
180 min St	ummer 26	.619	0.0	13	30		
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400 mill Si 600 min Si	ummer q	.954	0.0	23	52		
720 min St	ummer 8	.577	0.0	42	22		
960 min St	ummer 6	.739	0.0	54	10		
1440 min Su	ummer 4	.798	0.0	75	52		
2160 min St	ummer 3	.416	0.0	110)4		
2880 min St	ummer 2	.684	0.0	146	58		
4320 min St	ummer 1	.926	0.0	219	96		
5760 min St	ummer 1	.521	0.0	293	36		
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0040 min Si 10080 min Si	ununer 1 ummer 0	U91	0.0	430	00 72		
15 min W	inter 202	.718	0.0	1	L8		
©1982-2014 XP Solutions							
L							

Cedar Barn White Lodge Northanpton NN6 9FY Designed by KatherineJ Checked by Disciple of the state of th	J P P Consulting						Page 2
<text></text>	Cedar Barn						
	White Lodge						4
Date 13/11/2014 16:20 File \$7326FM PERMEABLE PATIN Designed by Katherine/ Checked by Source Control 2014.1.1 Bitro Drainage Designed by Katherine/ Checked by Source Control 2014.1.1 Storm Max Max Max Status Storm Tenary of Results for 100 year Return Period (1308) 1.30 Storm Max Max Max Status Storm Max Max Max Status Storm Max Max Max Status Storm Mint P9.863 0.363 0.8 10.0 Flood Risk Storm Storm in Winter 99.863 0.333 0.8 1.7 Flood Risk Storm in Winter 99.700 0.276 0.8 3.7 Flood Risk 200 min Winter 99.700 0.070 Storm in Winter 99.530 0.030 0.5 0.9 Flood Risk 200 min Winter 99.530 0.030 0.5 0.9 K Storm in Winter 99.530 0.030 0.5 0.9 K 0.8 7.7 O K 200 K Storm in Winter 99.530 0.030 0.2 0.3 0.K 7.8 Flood Risk 200 K Storm in Winter 99.530 0.0300 0.2 0.3	Northampton NN6 9PY						~~~
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Pitter Production Pitter Production Micro Drainag Space Control 2014.1.3 Space Control 2014.1.3 <			Charlerd	by 1.aci	ICITICO		Drainage
Micro Drainage Source Control 2014.11.1 Storm Max Max Max Max Status Storm Level Depth Infiltration Volume 0 0 0.161 10.0 Extension Status 30 min Winter 99.863 0.363 0.8 10.0 Extension Status 10 min Winter 99.863 0.363 0.8 10.1 Flood Nisk 10 min Winter 99.823 0.333 0.8 1.5 Flood Nisk 10 min Winter 99.733 0.233 0.8 1.7 0.6 200 min Winter 99.730 0.233 0.8 7.3 Flood Nisk 400 min Winter 99.730 0.233 0.8 7.3 Flood Nisk 700 min Winter 99.530 0.333 0.4 7.0 0.8 200 min Winter 99.530 0.333 0.2 0.5 0.7 0.8 200 min Winter 99.530 0.333 0.2 0.3 0.8 7.0 0.8 200 min Winter 99.530 0.031 0.2 0.3 0.8 7.0	FILE S/326PM PERMEABLE PAVI			1	j-		
<page-header></page-header>	Micro Drainage		Source C	ontrol 2	2014.1.	1	
Start ImageHar LowHar LowHar LowHar LowHar LowStart Low30 min Winter 99,8450.3630.830.80.50.510.5Flood Risk 6060 min Winter 99,8450.2370.689.4Flood Risk 83,00.830.837.00.560 min Winter 99,7530.2530.687.5Flood Risk 83,00.837.00.660 min Winter 99,7530.2700.687.5Flood Risk 83,00.837.00.6700 min Winter 99,7530.2030.637.3Flood Risk 83,00.030.50.67.5700 min Winter 99,5700.0700.682.00.67.00.6700 min Winter 99,5100.0100.20.30.50.6700 min Winter 99,5100.0100.20.30.50.6700 min Winter 99,5100.0100.20.30.50.6700 min Winter 99,5100.0100.20.30.50.6700 min Winter 99,5100.0100.20.30.50.5700 min Winter 99,5100.0100.20.30.50.5700 min Winter 99,5100.0100.20.30.50.5700 min Winter 99,5100.0100.20.30.50.5700 min Winter 99,5100.0100.00.50.50.5700 min Winter 99,5100.0100.00.50.5700 min Winter 99,510	<u>Summary of Resu</u>	<u>ilts fo</u>	<u>or 100 y</u> e	ar Retui	rn Peri	<u>od (+30%)</u>	
Storm Max Max <thmax< th=""> <thmax< td="" td<=""><td></td><td></td><td></td><td></td><td></td><td><u>.</u></td><td></td></thmax<></thmax<>						<u>.</u>	
Levent Levent Levent Levent Levent Chara 30 min Winter 99.846 0.346 0.8 10.0 Flood Risk 10 min Winter 99.845 0.337 0.8 9.4 Flood Risk 10 min Winter 99.821 0.337 0.8 9.4 Flood Risk 10 min Winter 99.706 0.206 0.8 7.0 Flood Risk 100 min Winter 99.706 0.206 0.8 7.0 Flood Risk 100 min Winter 99.706 0.206 0.8 7.7 Flood Risk 100 min Winter 99.706 0.206 0.8 7.7 Flood Risk 100 min Winter 99.511 0.010 0.8 7.0 Flood Risk 100 min Winter 99.511 0.011 0.2 0.4 Flood Risk 100 min Winter 99.513 0.010 0.2 0.4 Flood Risk 100 min Winter 99.513 0.010 0.2 0.3 Flood Risk 100 min Winter 99.513 0.017 0.3 0.5 Flood Risk 1000 min Winter 99.513 0.017	Storm	Max	Max Donth Inf	Max	Max	Status	
10 min Winter 99.863 0.363 0.89 10.5 Flood Risk 110 min Winter 99.863 0.333 0.8 10.5 Flood Risk 120 min Winter 99.803 0.303 0.8 10.1 Flood Risk 130 min Winter 99.803 0.303 0.8 8.7 Flood Risk 140 min Winter 99.803 0.303 0.8 8.7 Flood Risk 150 min Winter 99.803 0.303 0.8 8.7 Flood Risk 160 min Winter 99.807 0.207 0.8 3.7 Flood Risk 160 min Winter 99.807 0.2070 0.8 3.7 Flood Risk 172 min Winter 99.517 0.0170 0.8 3.7 Flood Risk 180 min Winter 99.517 0.0170 0.8 3.7 Flood Risk 190 min Winter 99.517 0.017 0.2 0.4 Flood Risk 1000 min Winter 99.517 0.017 0.2 0.3 0.5 1000 min Winter 99.510 0.010 0.2 0.3 0.5 1000 min Winter 99.500 0.008 0.1 0.2 0.5 10000 min Winter 99.500 0.008 0.1 0.2 0.5 10000 min Winter 99.500 0.008 0.1 0.2 0.5 10000 min Winter 115.	Event	(m)	(m)	(1/s)	(m ³)		
30 min Winter 99.846 0.346 0.8 10.5 Flood Nisk 10 min Winter 99.851 0.331 0.8 10.1 Flood Nisk 10 min Winter 99.803 0.303 0.8 8.7 Flood Nisk 30 min Winter 99.706 0.206 0.8 7.3 Flood Nisk 40 min Winter 99.706 0.206 0.8 7.3 Flood Nisk 60 min Winter 99.570 0.127 0.8 3.7 0.8 70 min Winter 99.570 0.701 0.8 3.7 0.8 70 min Winter 99.570 0.727 0.8 3.7 0.8 70 min Winter 99.570 0.701 0.8 3.7 0.8 70 min Winter 99.570 0.701 0.8 3.7 0.8 700 min Winter 99.573 0.071 0.3 0.5 0.8 7100 min Winter 99.513 0.011 0.2 0.8 0.8 7200 min Winter 99.513 0.011 0.2 0.8 0.6 7000 min Winter 99.508 0.008 0.1 0.2 0.8 7000 min Winter 115.067 0.0 142 0.6 0 7000 min Winter 12.504 0.0		()	(/	(=/ =/	()		
Storm Rain Fload	30 min Winter	99.846	0.346	0.8	10.0	Flood Risk	
120 min Winter 99.827 0.8 9.4 Flood Risk 180 min Winter 99.827 0.8 9.4 Flood Risk 240 min Winter 99.753 0.253 0.8 7.3 Flood Risk 600 min Winter 99.570 0.227 0.8 7.4 Flood Risk 600 min Winter 99.570 0.27 0.8 5.9 Flood Risk 600 min Winter 99.570 0.27 0.8 3.7 0 K 960 min Winter 99.570 0.401 0.7 1.2 0 K 1440 min Winter 99.531 0.030 0.5 0.9 0 K 2880 min Winter 99.510 0.011 0.2 0.3 0 K 7200 min Winter 99.510 0.011 0.2 0.3 0 K 7200 min Winter 99.510 0.010 0.2 0.3 0 K 7200 min Winter 99.508 0.008 0.1 0.2 0 K 10080 min Winter 99.508 0.008 0.1 0.2 0 K 10080 min Winter 115.067 0.0 32 6 6 120 min Winter 6.5144 0.0 142 0 K 240 min Winter 115.067 0.1 142 140 min Winter 1	60 min Winter	99.863	0.363	0.8	10.5	Flood Risk	
190 min winter 99.870 0.327 0.8 9.4 Flood Risk 200 min Winter 99.750 0.253 0.8 7.3 Flood Risk 400 min Winter 99.760 0.206 0.8 5.9 Flood Risk 600 min Winter 99.570 0.070 0.8 4.7 0 K 720 min Winter 99.570 0.070 0.8 3.7 0 K 960 min Winter 99.570 0.070 0.8 2.0 0 K 1440 min Winter 99.530 0.030 0.5 0.3 0 K 2160 min Winter 99.531 0.013 0.2 0.4 0 K 230 min Winter 99.510 0.010 0.2 0.3 0 K 700 min Winter 99.510 0.010 0.2 0.3 0 K 10080 min Winter 99.510 0.010 0.2 0.3 0 K 10080 min Winter 99.510 0.010 0.2 0.3 0 K 10080 min Winter 15.067 0.0 32 0 K 10080 min Winter 22.044 0.0 142 240 min Winter 37.074 0.0 120 min Winter 37.074 0.0 142 240 min Winter 30.0 320 360 min Winter 11.945 0.0 320 600 min Winter 3.0 320 120 min Winter 2.0644 0.0 <td>120 min Winter</td> <td>99.851</td> <td>0.351</td> <td>0.8</td> <td>10.1</td> <td>Flood Risk</td> <td></td>	120 min Winter	99.851	0.351	0.8	10.1	Flood Risk	
360 min Winter 99.753 0.253 0.8 7.7 Flood Risk 480 min Winter 99.760 0.206 0.8 5.9 Flood Risk 600 min Winter 99.670 0.127 0.8 3.7 0 K 960 min Winter 99.571 0.017 0.8 2.0 0 K 1440 min Winter 99.531 0.030 0.5 0.9 0 K 2800 min Winter 99.517 0.017 0.3 0.5 0.7 0 K 2800 min Winter 99.511 0.011 0.2 0.3 0 K 7200 min Winter 99.511 0.011 0.2 0.3 0 K 7200 min Winter 99.510 0.000 0.1 0.2 0 K 10080 min Winter 99.508 0.008 0.1 0.2 0 K 120 min Winter 99.508 0.008 0.1 0.2 0 K 120 min Winter 115.067 0.0 32 66 min Winter 115.067 0.0 120 min Winter 115.067 0.0 32 66 min Winter 115.067 0.0 32 120 min Winter 65.314 0.0 60 102 144 180 120 min Winter 7.04 0.1 142 144 180 144 120 min Winter 7.04 0.1 142 144 <td>180 min Winter</td> <td>99.827</td> <td>0.327</td> <td>0.8</td> <td>9.4</td> <td>Flood Risk</td> <td></td>	180 min Winter	99.827	0.327	0.8	9.4	Flood Risk	
300 min Winter 99.763 0.253 0.8 5.9 Flood Risk 400 min Winter 99.664 0.164 0.8 5.7 0 K 720 min Winter 99.570 0.700 0.8 3.7 0 K 960 min Winter 99.530 0.030 0.5 0.9 0 K 2160 min Winter 99.530 0.030 0.5 0.9 0 K 4320 min Winter 99.531 0.017 0.3 0.5 0.8 4320 min Winter 99.510 0.010 0.2 0.3 0 K 4320 min Winter 99.510 0.011 0.2 0.3 0 K 700 min Winter 99.510 0.010 0.2 0.3 0 K 700 min Winter 99.510 0.010 0.2 0.3 0 K 7000 min Winter 99.510 0.010 0.2 0.3 0 K 10080 min Winter 99.508 0.008 0.1 0.2 0.3 0 K 10080 min Winter 115.067 0.0 32 60 100 142 10080 min Winter 115.067 0.0 32 60 100 142 120 min Winter 115.067 0.0 32 60 100 142 120 min Winter 115.067 0.0 32 60 100 142	240 min Winter	99.803 00 752	0.303	0.8	8./	Flood Risk	
for man winter 99.664 0.64 0.8 3.7 0.8 for min Winter 99.570 0.70 0.8 3.7 0.8 for min Winter 99.570 0.70 0.8 3.7 0.8 for min Winter 99.570 0.030 0.5 0.9 0.8 for min Winter 99.533 0.023 0.4 0.7 0.8 for min Winter 99.513 0.013 0.2 0.4 0.7 0.8 for min Winter 99.513 0.011 0.2 0.3 0.8 10080 min Winter 99.510 for min Winter 99.510 0.010 0.2 0.3 0.8 10080 min Winter 99.510 0.011 0.2 0.3 0.8 for min Winter 99.510 0.010 0.2 0.3 0.8 10080 min Winter 99.510 0.011 0.2 0.3 0.8 for min Winter 99.510 0.010 0.2 0.3 0.8 10080 0.0 10 for min Winter 115.067 0.0 32 60 0.1 0.2 0.5 for min Winter 115.010 0.0 232 60 0.0 144 180 140	360 min Winter	99.153 99.706	0.205	0.8	1.3	Flood Biak	
300 min Winter 99.627 0.127 0.8 2.0 0 K 960 min Winter 99.510 0.010 0.8 2.0 0 K 2160 min Winter 99.533 0.030 0.5 0.9 0 K 2180 min Winter 99.517 0.017 0.3 0.5 0 K 4320 min Winter 99.513 0.013 0.2 0.4 0.7 0 K 5760 min Winter 99.513 0.011 0.2 0.3 0 K 7200 min Winter 99.510 0.010 0.2 0.3 0 K 8640 min Winter 99.510 0.010 0.2 0.3 0 K 10080 min Winter 99.510 0.008 0.1 0.2 0.3 K 10080 min Winter 99.510 0.008 0.1 0.2 0.3 K 10080 min Winter 99.510 0.008 0.1 0.2 0.5 K 10080 min Winter 99.510 0.008 0.1 0.2 0.5 K 10080 min Winter 99.510 0.008 0.1 0.2 0.5 K 10080 min Winter 115.067 0.0 32 60 1142 240 min Winter 115.10 0.0 252 400 min Winter 11.945 0.0 320 600 min Winter 11.954 0.0	400 min Winter 600 min Winter	99.100 99.661	0.200	0.8	5.9 4 7	riouu kisk	
100 min Winter 99.570 0.00 0.8 2.0 0.8 1440 min Winter 99.531 0.010 0.7 1.2 0.8 2160 min Winter 99.532 0.030 0.5 0.9 0.8 2800 min Winter 99.537 0.017 0.3 0.5 0.8 4320 min Winter 99.517 0.013 0.2 0.4 0.8 7200 min Winter 99.510 0.011 0.2 0.3 0.8 8640 min Winter 99.500 0.008 0.1 0.2 0.8 10080 min Winter 115.067 0.0 32 0.0 142 240 min Winter 115.101 0.0 252 400 min Winter 15.110 0.2 254 360 min Winter 11.954 0.0 748 1440	720 min Winter	99.627	0.127	0.0	4./ 3.7	0 K 0 L	
1440 min Winter 99.541 0.041 0.7 1.2 0 K 2160 min Winter 99.530 0.023 0.4 0.7 0 K 2830 min Winter 99.517 0.017 0.3 0.5 0 K 5760 min Winter 99.513 0.013 0.2 0.4 0 K 7200 min Winter 99.510 0.011 0.2 0.3 0 K 8640 min Winter 99.510 0.010 0.2 0.3 0 K 10080 min Winter 99.508 0.008 0.1 0.2 0 K 30 min Winter 115.067 0.0 32 60 min Winter 65.314 0.0 60 120 min Winter 26.619 0.0 142 240 min Winter 15.110 0.2 252 480 min Winter 15.100 0.0 252 480 min Winter 15.100 320 60 600 min Winter 15.100 0.0 320 600 min Winter 4.798 0.0 344 960 min Winter 5.512 0.0 326 600 min Winter 5.512 0.0 248 1440 min Winter 1.926 0.0 144 360 min Winter 6.739 0.0 548 1440 min Winter 1.926 0.0 128 126 120 2856 720 min Winter 1	960 min Winter	99.570	0.070	0.8	2.0	0 K	
2160 min Winter 99.530 0.030 0.5 0.9 0.K 2880 min Winter 99.517 0.017 0.3 0.5 0.8 7200 min Winter 99.510 0.011 0.2 0.3 0.K 8640 min Winter 99.508 0.008 0.1 0.2 0.3 0.K 10080 min Winter 99.508 0.008 0.1 0.2 0.3 0.K 10080 min Winter 99.508 0.008 0.1 0.2 0.3 0.K 10080 min Winter 99.508 0.008 0.1 0.2 0.X 30 min Winter 115.067 0.0 32 60 60 120 min Winter 70.04 0.0 114 180 180 114 180 min Winter 15.100 0.0 252 480 100 100 600 min Winter 15.101 0.0 252 480 100 140 180 min Winter 15.101 0.0 326 326 326 326 600 min Winter 3.577 0.0 444 960 1044 960 1044 960 1044 366 320 1044 366 320 144 1466 340 1468 3220 <t< td=""><td>1440 min Winter</td><td>99.541</td><td>0.041</td><td>0.7</td><td>1.2</td><td>ОК</td><td></td></t<>	1440 min Winter	99.541	0.041	0.7	1.2	ОК	
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4320 min Winter 99.517 0.017 0.3 0.5 0 K 7000 min Winter 99.510 0.010 0.2 0.3 0 K 8640 min Winter 99.510 0.010 0.2 0.3 0 K 10080 min Winter 99.508 0.008 0.1 0.2 0.3 0 K 10080 min Winter 99.508 0.008 0.1 0.2 0 K Minter 115.067 30 min Winter 15.067 0.0 32 60 min Winter 65.314 0.0 60 120 min Winter 15.067 0.0 142 240 min Winter 15.110 0.0 252 480 min Winter 15.110 0.0 320 600 min Winter 15.110 0.0 320 600 min Winter 4.798 0.0 366 720 min Winter 5.773 0.0 444 9660 min Winter 1.521 0.0 2866 720 min Winter 1.526 0.0 2180 5760 min Winter 1.5267 0.0 444 9660 min Winter 1.5261 0.0 2180 5760 min Winter 1.5267 0.0 3672 8640 min Winter 1.526 0.0 2180 5760 min Winter<	2880 min Winter	99.523	0.023	0.4	0.7	ОК	
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240 min Winter 21.044 0.0 180 360 min Winter 15.110 0.0 252 480 min Winter 11.945 0.0 320 600 min Winter 9.954 0.0 386 720 min Winter 8.577 0.0 444 960 min Winter 6.739 0.0 548 1440 min Winter 4.798 0.0 748 2160 min Winter 2.684 0.0 1468 4320 min Winter 1.926 0.0 2180 5760 min Winter 1.521 0.0 2856 7200 min Winter 1.267 0.0 3672 8640 min Winter 1.091 0.0 4416 10080 min Winter 0.962 0.0 4960	120 mi	n Winte	r 26.619	0.0	14	12	
360 min Winter 15.110 0.0 252 480 min Winter 11.945 0.0 320 600 min Winter 9.954 0.0 386 720 min Winter 8.577 0.0 444 960 min Winter 6.739 0.0 548 1440 min Winter 6.739 0.0 748 2160 min Winter 3.416 0.0 1104 2880 min Winter 1.926 0.0 2180 5760 min Winter 1.521 0.0 2856 7200 min Winter 1.267 0.0 3672 8640 min Winter 1.091 0.0 4416 10080 min Winter 0.962 0.0 4960	240 mi	n Winte	r 21.044	0.0	18	30	
480 min Winter 11.945 0.0 320 600 min Winter 9.954 0.0 386 720 min Winter 8.577 0.0 444 960 min Winter 6.739 0.0 548 1440 min Winter 6.739 0.0 748 2160 min Winter 3.416 0.0 1104 2880 min Winter 1.926 0.0 2180 5760 min Winter 1.521 0.0 2856 7200 min Winter 1.267 0.0 3672 8640 min Winter 1.091 0.0 4416 10080 min Winter 0.962 0.0 4960	360 mi	n Winte	r 15.110	0.0	25	52	
600 min Winter 9.954 0.0 386 720 min Winter 8.577 0.0 444 960 min Winter 6.739 0.0 548 1440 min Winter 4.798 0.0 748 2160 min Winter 3.416 0.0 1104 2880 min Winter 2.664 0.0 2180 5760 min Winter 1.521 0.0 2856 7200 min Winter 1.267 0.0 3672 8640 min Winter 1.091 0.0 4416 10080 min Winter 0.962 0.0 4960	480 mi	n Winte	r 11.945	0.0	32	20	
720 min Winter 8.577 0.0 444 960 min Winter 6.739 0.0 548 1440 min Winter 4.798 0.0 748 2160 min Winter 3.416 0.0 1104 2880 min Winter 2.684 0.0 1468 4320 min Winter 1.926 0.0 2180 5760 min Winter 1.521 0.0 2856 7200 min Winter 1.267 0.0 3672 8640 min Winter 1.091 0.0 4416 10080 min Winter 0.962 0.0 4960	600 mi	n Winte	r 9.954	0.0	38	36	
960 min Winter 6.739 0.0 548 1440 min Winter 4.798 0.0 748 2160 min Winter 3.416 0.0 1104 2880 min Winter 2.684 0.0 1468 4320 min Winter 1.926 0.0 2180 5760 min Winter 1.521 0.0 2856 7200 min Winter 1.267 0.0 3672 8640 min Winter 1.091 0.0 4416 10080 min Winter 0.962 0.0 4960	720 mi	n Winte	r 8.577	0.0	44	14	
1440 min Winter 4.798 0.0 748 2160 min Winter 3.416 0.0 1104 2880 min Winter 2.684 0.0 1468 4320 min Winter 1.926 0.0 2180 5760 min Winter 1.521 0.0 2856 7200 min Winter 1.267 0.0 3672 8640 min Winter 1.091 0.0 4416 10080 min Winter 0.962 0.0 4960	960 mi	n Winte	r 6.739	0.0	54	18	
2160 min Winter 3.416 0.0 1104 2880 min Winter 2.684 0.0 1468 4320 min Winter 1.926 0.0 2180 5760 min Winter 1.521 0.0 2856 7200 min Winter 1.267 0.0 3672 8640 min Winter 1.091 0.0 4416 10080 min Winter 0.962 0.0 4960	1440 mi	n Winte	r 4.798	0.0	74	18	
2000 min Winter 2.084 0.0 1468 4320 min Winter 1.926 0.0 2180 5760 min Winter 1.521 0.0 2856 7200 min Winter 1.267 0.0 3672 8640 min Winter 1.091 0.0 4416 10080 min Winter 0.962 0.0 4960	2160 mi	n Winte	r 3.416	0.0	110	14	
5760 min Winter 1.520 0.0 2856 7200 min Winter 1.267 0.0 3672 8640 min Winter 1.091 0.0 4416 10080 min Winter 0.962 0.0 4960	2880 mi 1320 mi	n Winte	r 1 006	0.0	146 010	20	
©1982-2014 XP Solutions	4320 III 5760 mi	n Winte	r 1.520	0.0	210	56	
©1982-2014 XP Solutions	7200 mi	n Winte	r 1.267	0.0	365	12	
10080 min Winter 0.962 0.0 4960 ©1982-2014 XP Solutions	8640 mi	.n Winte	r 1.091	0.0	441	. 6	
©1982-2014 XP Solutions	10080 mi	.n Winte	r 0.962	0.0	496	50	
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J P P Consulting		Page 3			
Cedar Barn					
White Lodge		Y.			
Northampton NN6 9PY		Micro			
Date 18/11/2014 16:20	Designed by KatherineJ				
File S7326PM PERMEABLE PAVIN	Checked by	Diamage			
Micro Drainage	Source Control 2014.1.1				
Ra	<u>infall Details</u>				
Painfall Mo	de] FFH				
Return Period (yea	rs) 100				
Site Locat	ion 479250 212850 SP 79250 12850				
C (1	km) -0.025				
D2 (1	km) 0.277				
D3 (1	km) 0.296				
E (1	km) 0.308				
Summer Sto	rms Yes				
Winter Sto	rms Yes				
Cv (Summ	er) 0.750				
Shortest Storm (mi	ns) 15				
Longest Storm (mi	ns) 10080				
Climate Chang	e % +30				
Tin	ne Area Diagram				
	······································				
Tota	al Area (ha) 0.024				
	mo (minc) Area				
Fr	om: To: (ha)				
	0 4 0.024				
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J P P Consulting	Page 4						
Cedar Barn							
hite Lodge				Ly m			
Northampton NN6 9PY	Mirro						
Date 18/11/2014 16:20	Desig	ned by	Desinado				
File S7326PM PERMEABLE PAVIN	Check	Diamaye					
Micro Drainage	Sourc	e Conti					
<u>Model Details</u> Storage is Online Cover Level (m) 100.000							
<u>Porous Car Park Structure</u>							
Infiltration Coefficient Base (m/hr) 0.03024 Width (m)							
Membrane Percolation (mm/hr)			Length (m)	9.8			
Max Percolation (1/s) 26.7 S			Slope (1:X)	0.0			
Safety Factor 1.0 Depression Storage (mm)				5			
Invert Lev	el (m)	99.500	Cap Volume Depth (m)	0.000			

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