Proposed Residential Development
Land off Bishopstone Road
Stone, Aylesbury
Buckinghamshire

Flood Risk Assessment

Cedar Barn, White Lodge,
Walgrave,
Northampton,
NN6 9PY

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JPP Consulting Ltd., Cedar Barn, White Lodge, Walgrave, Northampton, NN6 9PY

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Report Reference	R-FRA-S7326PM-01-0
Date	December 2014

Report Originators

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Contents

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 (9,725m^2). 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.

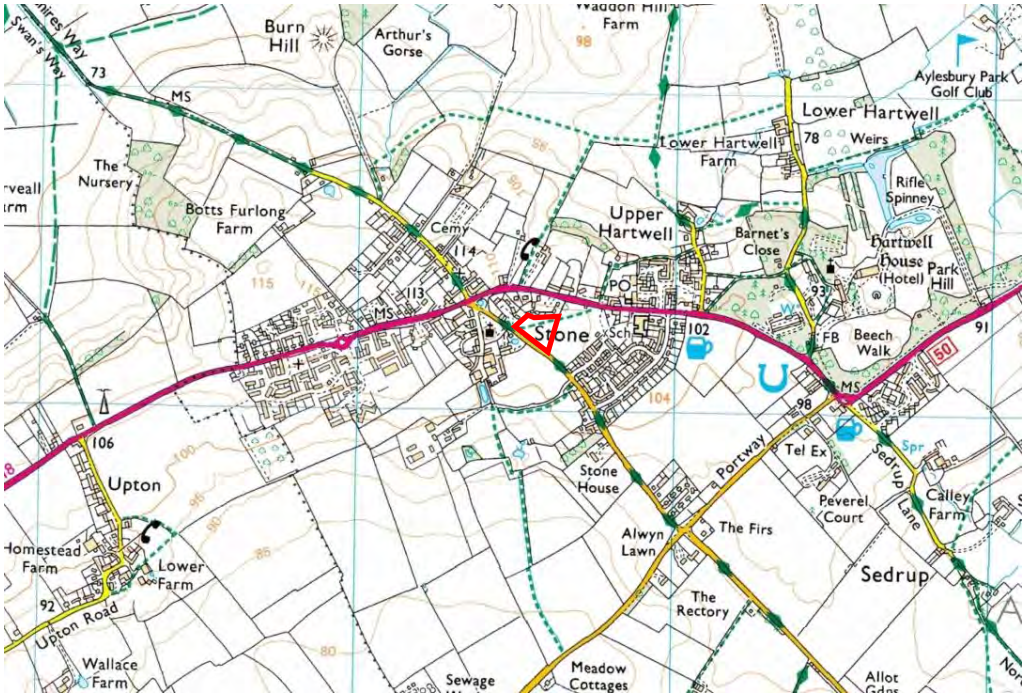

Figure 1.1 Site location plan.

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.

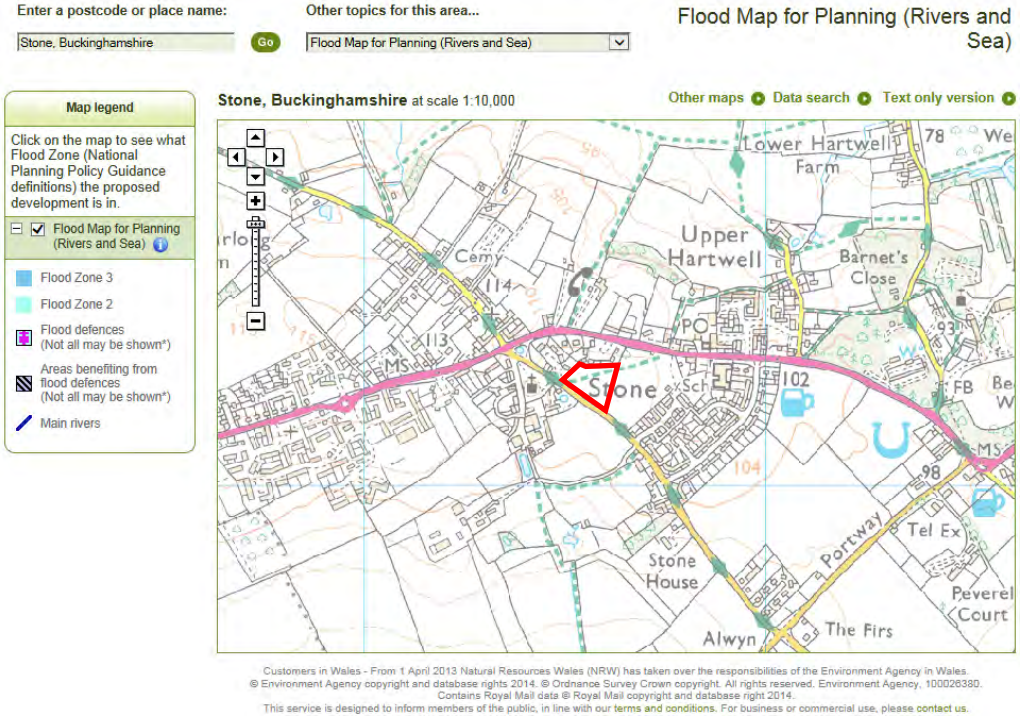

Figure 3.1 – Flood Map for Planning (Rivers and Sea)
Source: Environment Agency web site – 17th November 2014

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

3.2 Flooding from groundwater

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.

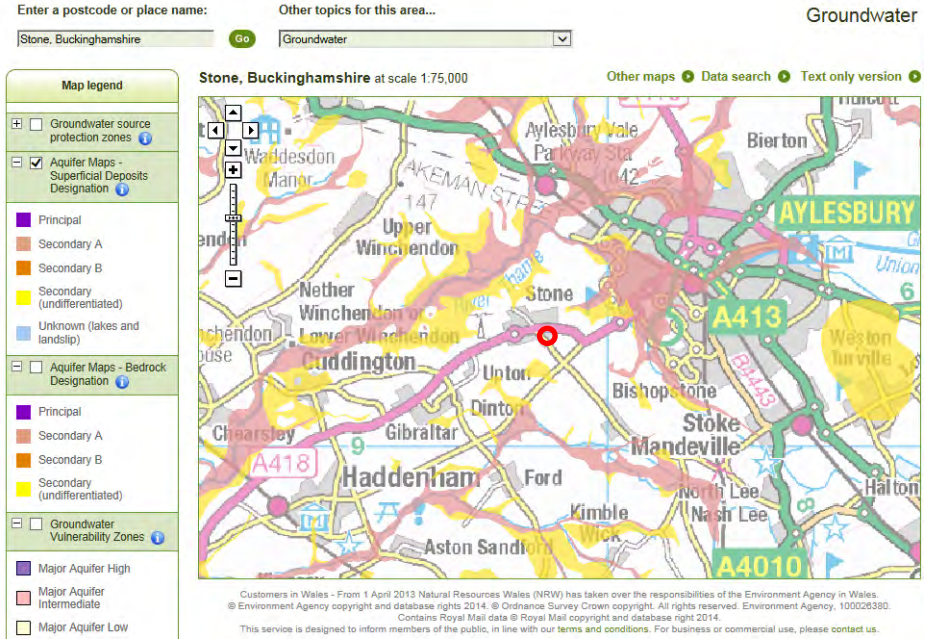

Figure 3.2 – Groundwater – Superficial Designation
Source: Environment Agency web site – 17th November 2014

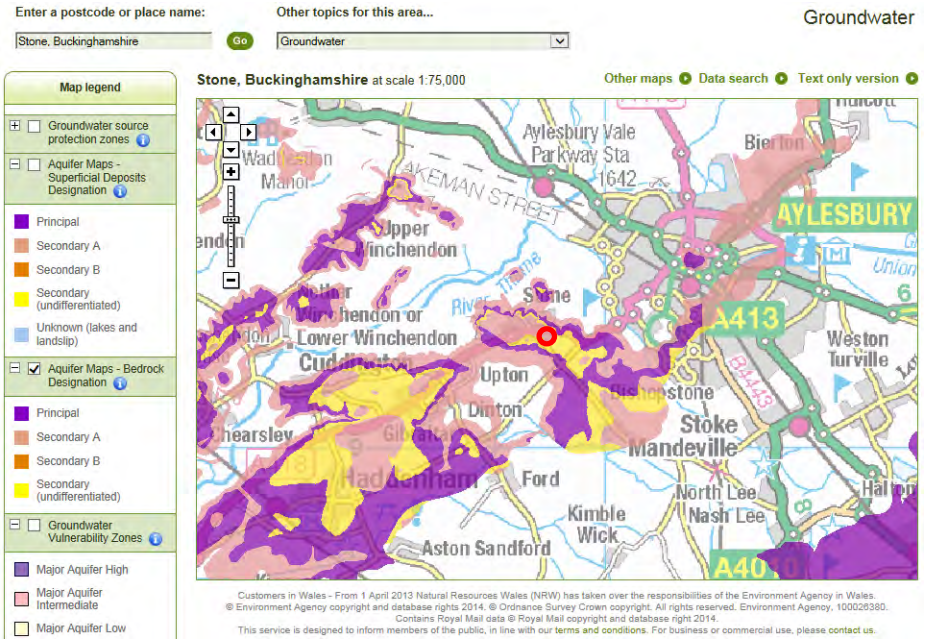

Figure 3.3 – Groundwater – Bedrock Designation
Source: Environment Agency web site – 17th November 2014

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.

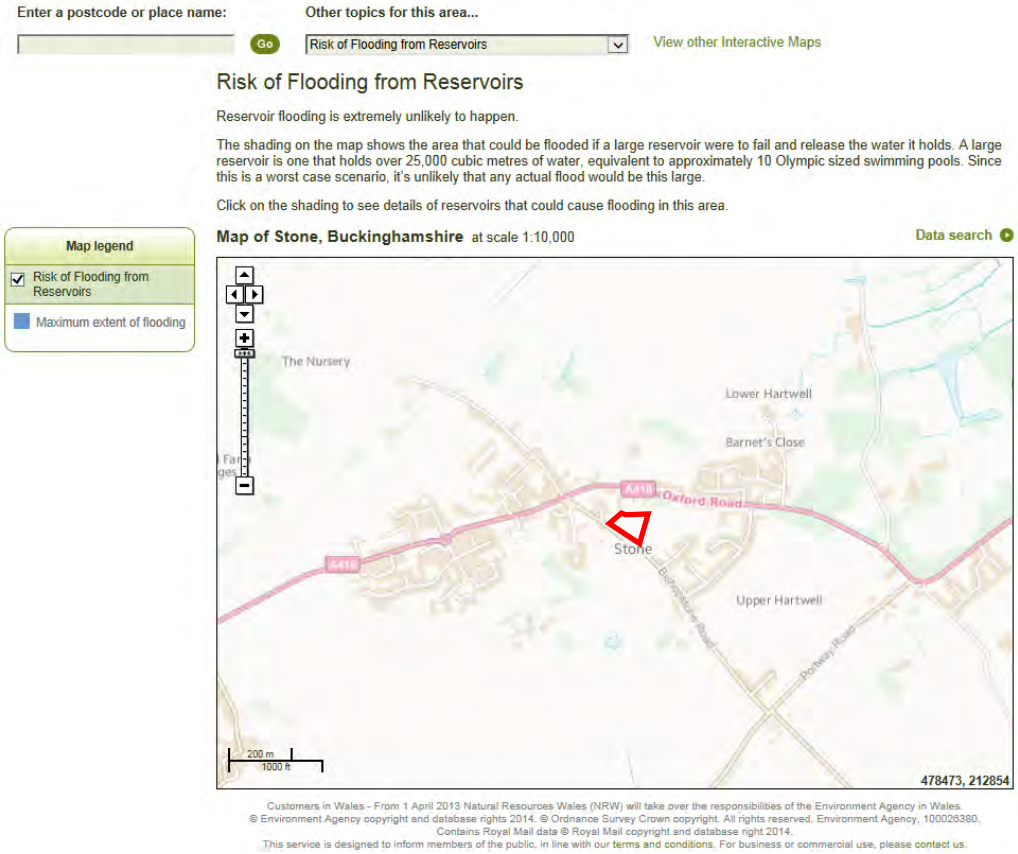

Figure 3.4 – Risk of Flooding from Reservoirs
Source: Environment Agency web site – 17th November 2014

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	✓	✓	✓	✓	✓
Zone 2	✓	✓	Exception Test required	✓	✓
Zone 3a	Exception Test required	✓	X	Exception Test required	✓
Zone 3b	Exception Test required	✓	X	X	X

✓ = Development is appropriate X = Development should not be permitted

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.

4.0 Management of surface water

4.1 Current conditions

4.1.1 The site is currently open and is fully permeable and therefore considered a greenfield 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

4.2.1 It is a requirement of the The Building Regulations (2010), Drainage and Waste 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 3,469m^2, 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 river flow, offshore wind speed and wave height

Parameter	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
Peak rainfall Intensity	+5%	+10%	+20%	+30%
Peak river flow	+10%	+20%	+20%	+20%
Offshore wind speed	+5%	+5%	+10%	+10%
Extreme wave height	+5%	+5%	+10%	+10%

Table 4.4 – Source: Environment Agency - 2013

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

Client	MANOR OAK HOMES			Date NOVEMBER 2014	jpp consulting Civil & Structural Engineers
Project	PROPOSED RESIDENTIAL DEVELOPMENT BISHOPSTONE ROAD, STONE, BUCKS			Drawn by KEJ	
Title	SITE PLAN			Checked by MJA	
Project ref S7326PM		Drawing no. FRA01	Revision	Scale at A4 1:10000	

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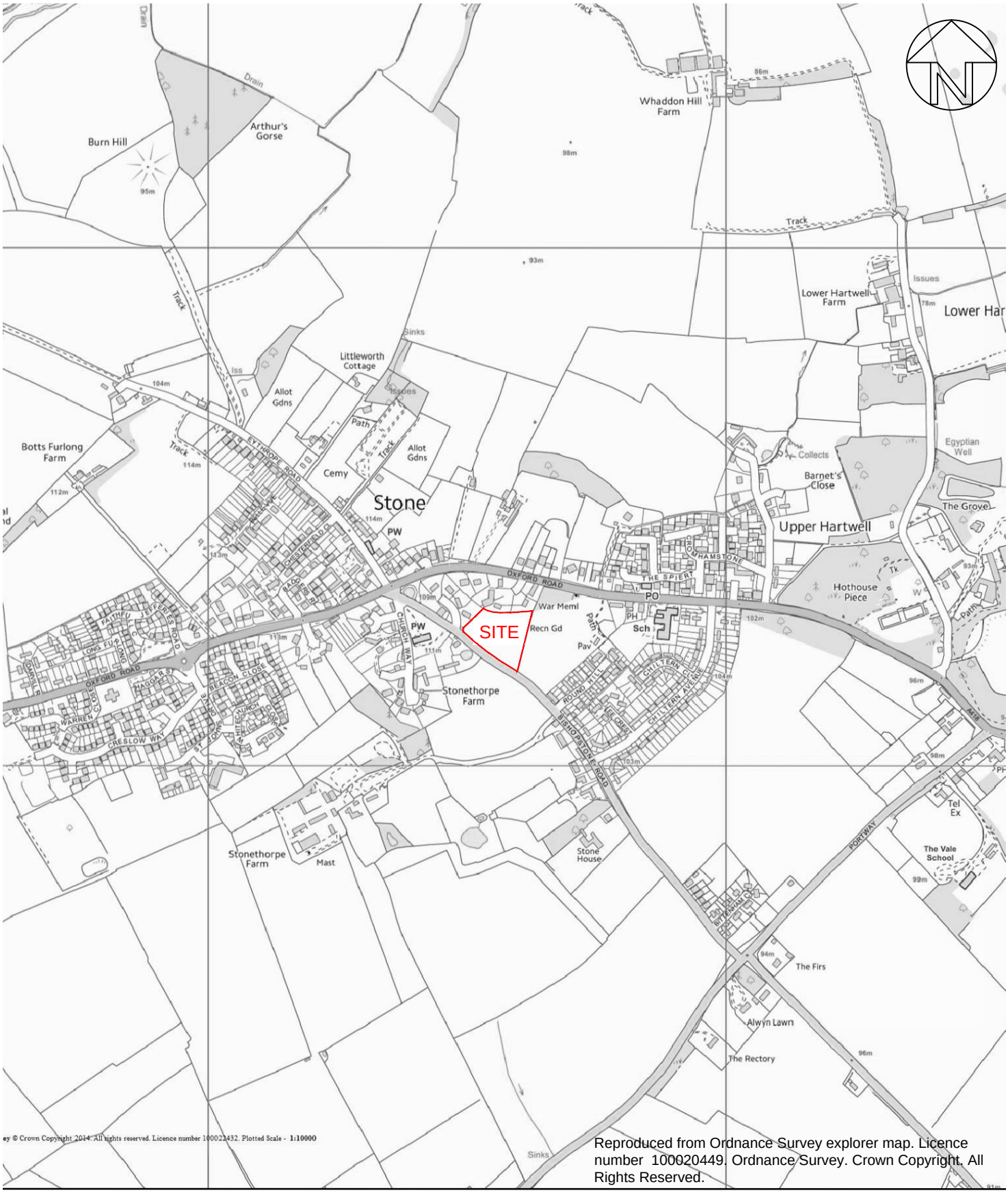


Appendix B

Landscape Masterplan

First Environment drawing no. 5353/LM.03

KEY

- Site Boundary
- Existing Tree
- Existing Shrub
- Proposed Tree
- Proposed Shrub
- Proposed Hedge
- Proposed Feature Shrub
- Wildflower Meadow
- Grass

N

0m 5m 10m 20m

Scale 1:500 @A3

REV	DATE	NOTES	DRAWN	CHK'D

First Environment Ltd
The Studios
Sugarswell Business Park
Shenington
Oxfordshire
OX15 6HW
T: 01295 477077

Project/Client:

Stone
Landscape Masterplan
Manor Oak Homes

Based On: MBC LHG 00000-101

Drawing No: 5353 / LM.03

Date: 31.10.14 | Drawn: PvW | Checked: SP

Note: The original of this drawing was produced in colour - a monochrome copy should not be relied upon.

Appendix C
Soakaway Investigation

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 (inter-bedded 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

Appendices:
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.

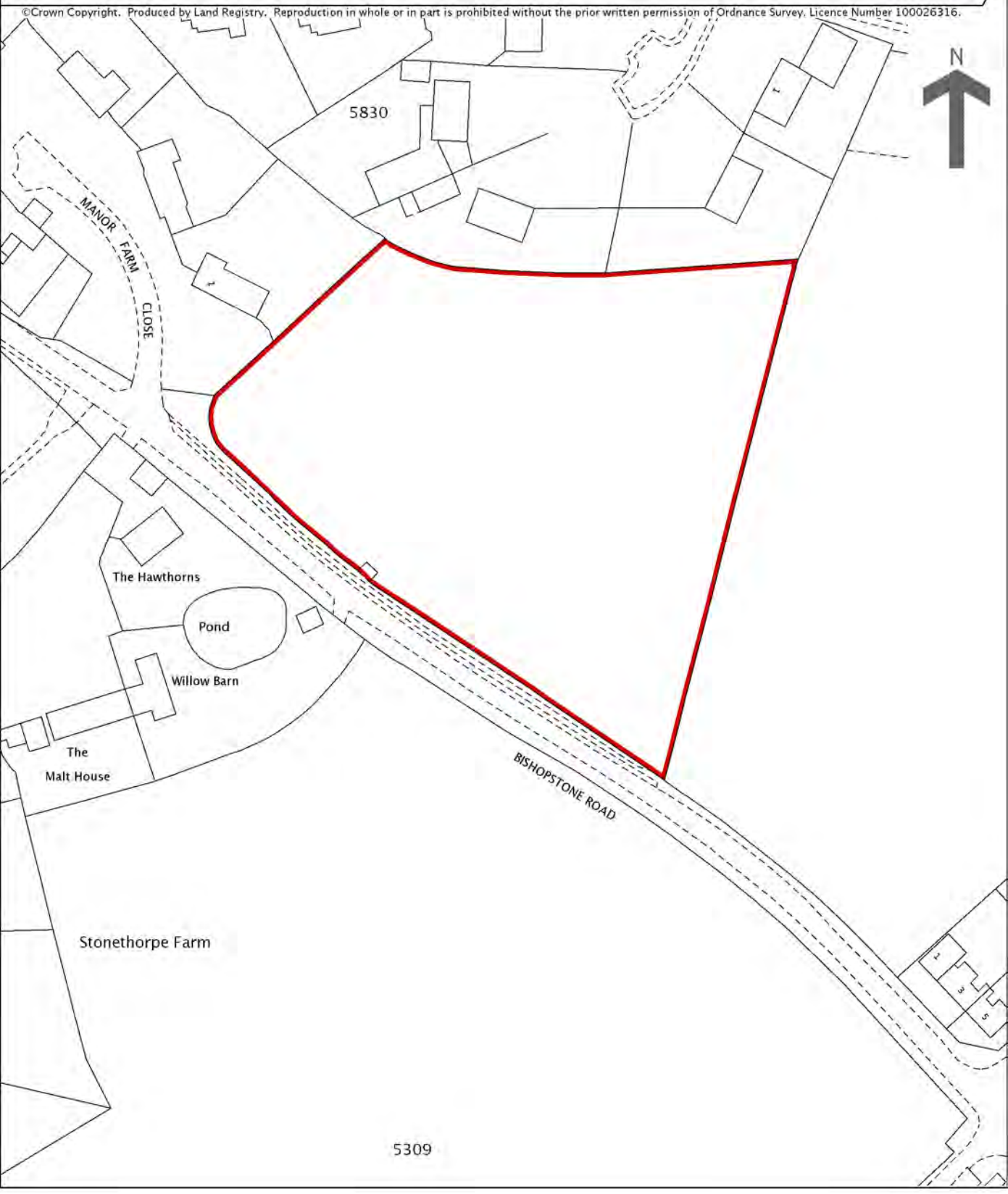
This official copy was delivered electronically and when printed will not be to scale. You can obtain a paper official copy by ordering one from Land Registry.

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 - Ryazanian

Bedrock and Faults

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
	PB	PURBECK GROUP	Limestone and Mudstone, Interbedded	Berriasian - Tithonian
	POST	Portland Stone Formation	Limestone and [Subequal/Subordinate] Sandstone, Interbedded	Tithonian - Tithonian
	POSA	Portland Sand Formation	Mudstone and Limestone, Interbedded	Tithonian - Tithonian
	KC	Kimmeridge Clay Formation	Sandstone	Kimmeridgian - Kimmeridgian
	KC	Kimmeridge Clay Formation	Mudstone and Limestone, Interbedded	Kimmeridgian - Kimmeridgian
	Fault			

Envirocheck® Geology

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.

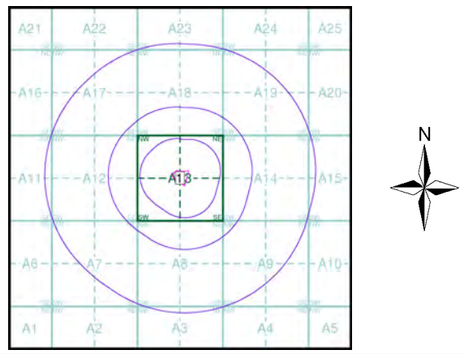
The various geological layers - artificial and landslip deposits, superficial geology and solid (bedrock) geology are displayed in separate maps, but superimposed on the final 'Combined Surface Geology' map. All map legends feature on this page.

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: 1
Map Name: SP71SE
Map Date: 1989
Bedrock Geology: Available
Superficial Geology: Available
Artificial Geology: Available
Faults: Not Supplied
Landslip: Not Available
Rock Segments: Not Supplied

Geology 1:10,000 Maps - Slice A



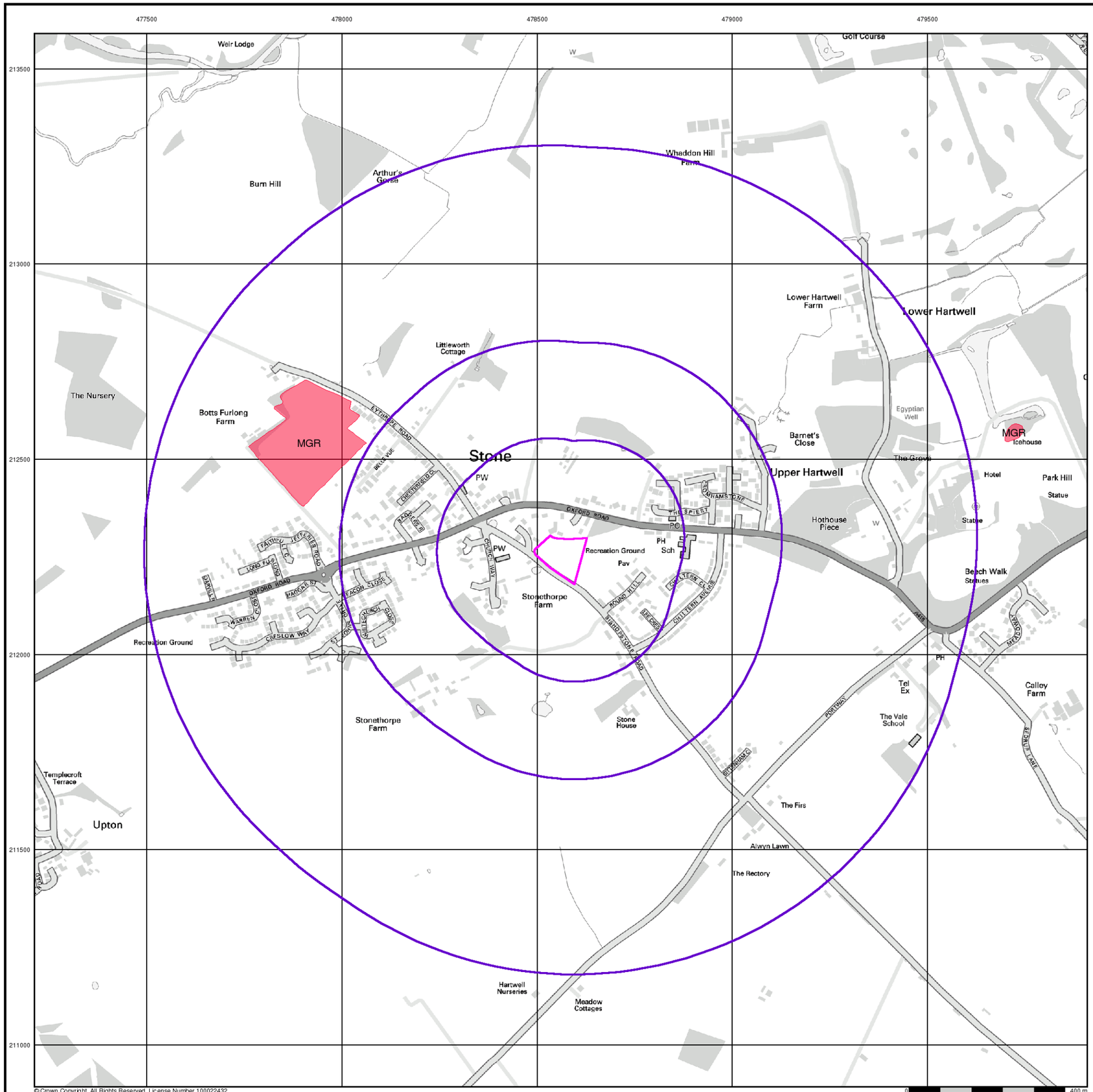
Order Details

Order Number: 61717650_1_1
Customer Ref: EMS4727
National Grid Reference: 478570, 212250
Slice: A
Site Area (Ha): 0.97
Search Buffer (m): 1000

Site Details

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

Landmark Information Group
Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



Envirocheck® Geology

Artificial Ground and Landslip

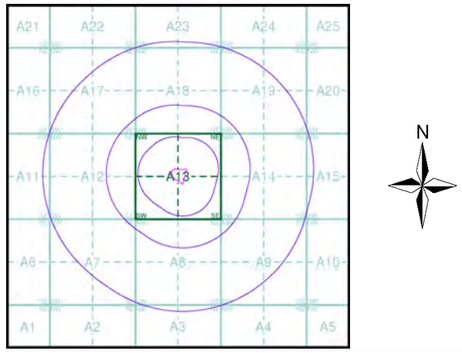
Artificial ground is a term used by BGS for those areas where the ground surface has been significantly modified by human activity. Information about previously developed ground is especially important, as it is often associated with potentially contaminated material, unpredictable engineering conditions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

Artificial Ground and Landslip Map - Slice A



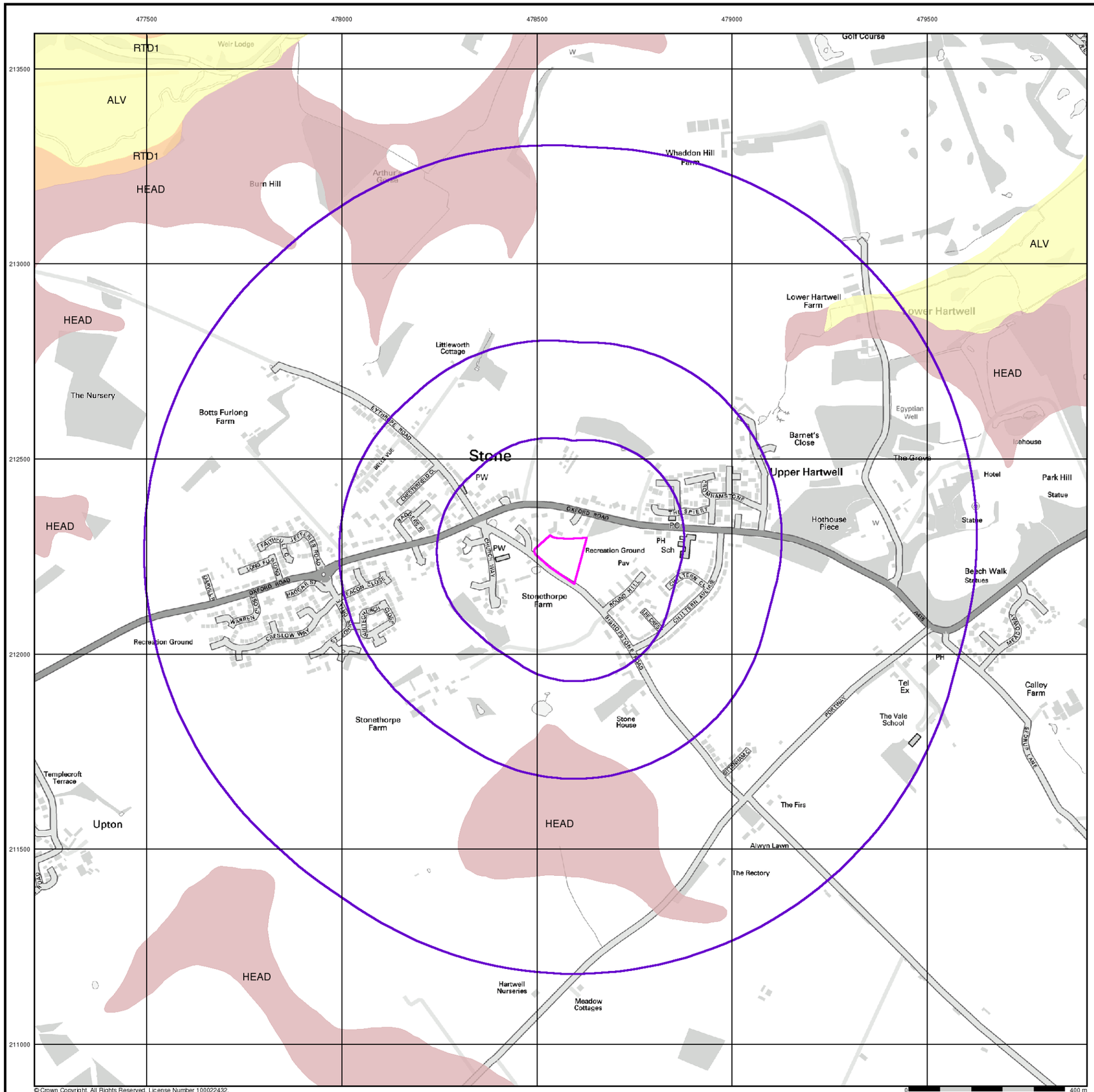
Order Details

Order Number:	61717650_1_1
Customer Ref:	EMS4727
National Grid Reference:	478570, 212250
Slice:	A
Site Area (Ha):	0.97
Search Buffer (m):	1000

Site Details

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

Landmark Information Group
Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



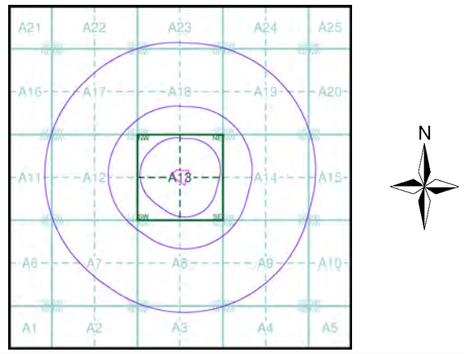
Superficial Geology

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



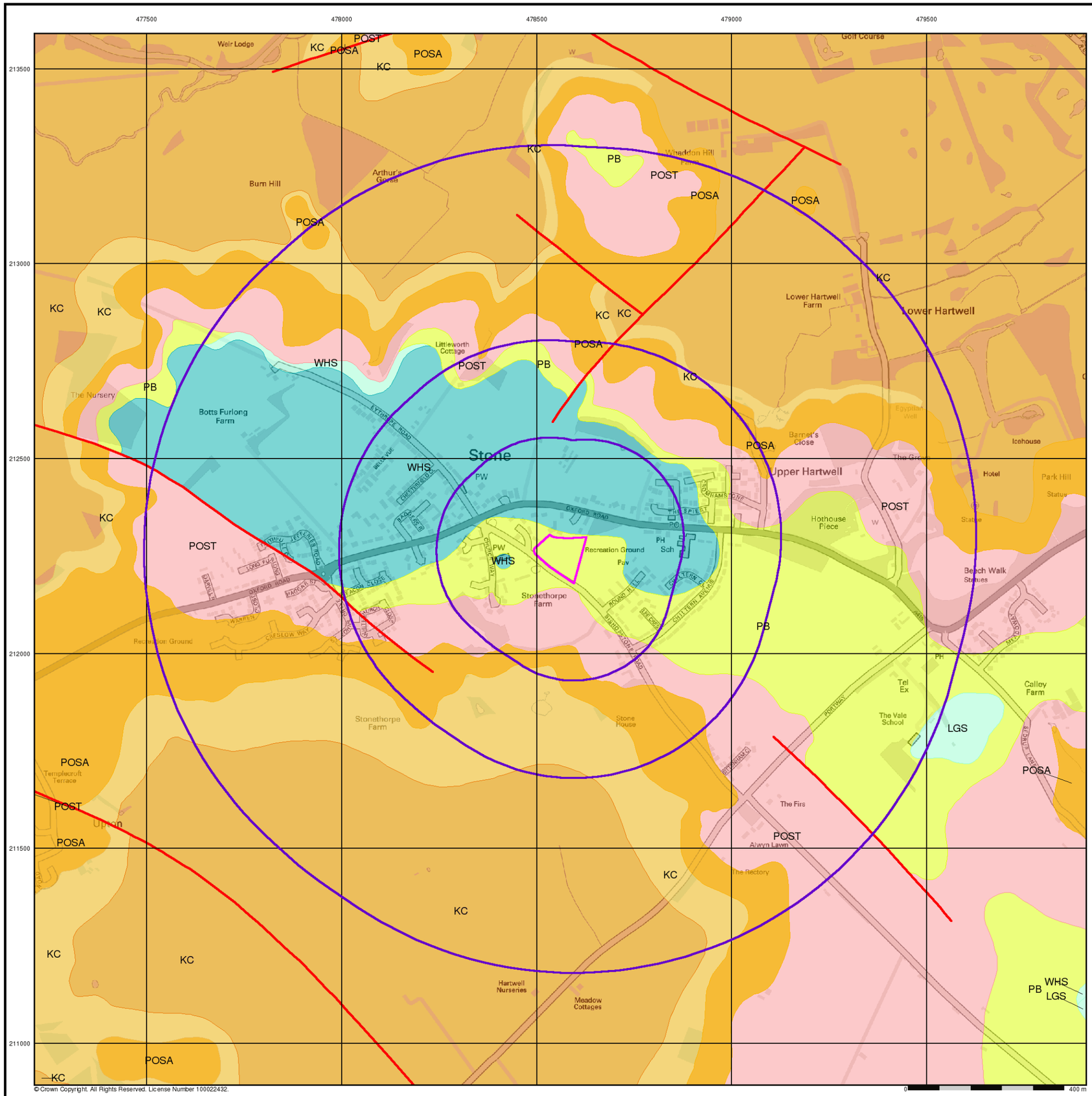
Order Details

Order Number:	61717650_1_1
Customer Ref:	EMS4727
National Grid Reference:	478570, 212250
Slice:	A
Site Area (Ha):	0.97
Search Buffer (m):	1000

Site Details

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

Landmark Information Group
Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



Bedrock and Faults

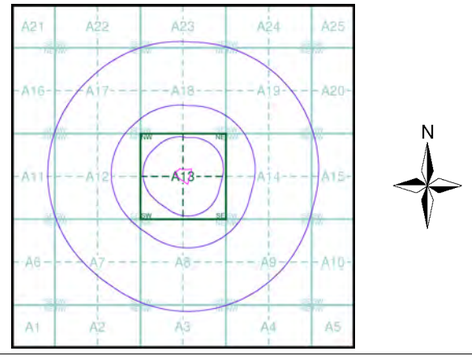
Bedrock geology is a term used for the main mass of rocks forming the Earth and are present everywhere, whether exposed at the surface in outcrops or concealed beneath superficial deposits or water.

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.

Bedrock and Faults Map - Slice A



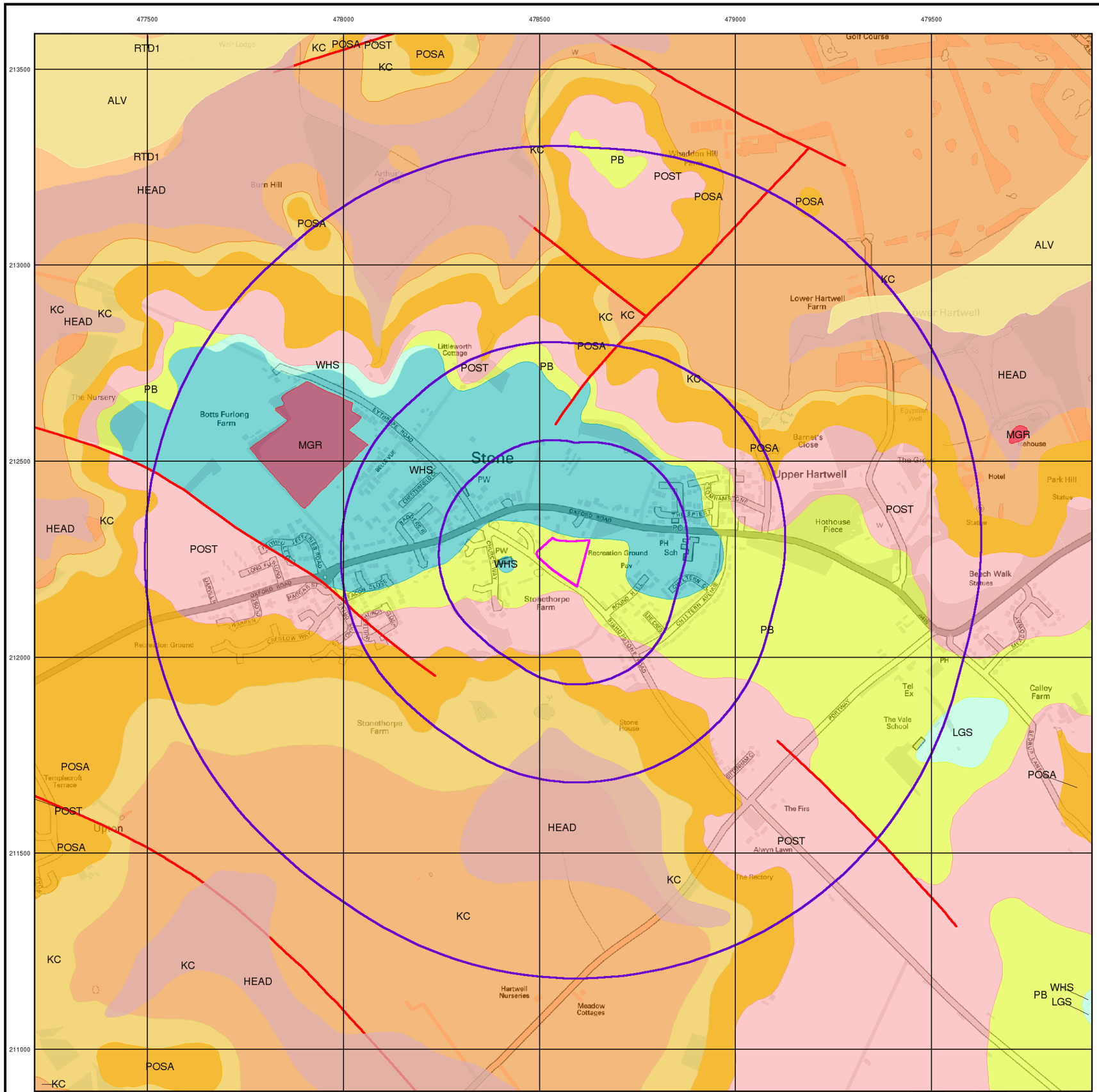
Order Details

Order Number:	61717650_1_1
Customer Ref:	EMS4727
National Grid Reference:	478570, 212250
Slice:	A
Site Area (Ha):	0.97
Search Buffer (m):	1000

Site Details

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

Landmark Information Group
Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



Envirocheck® Geology

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.

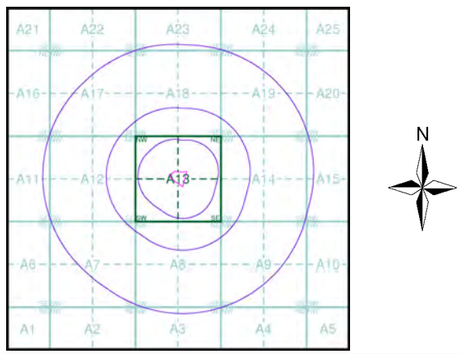
Additional Information

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:	61717650_1_1
Customer Ref:	EMS4727
National Grid Reference:	478570, 212250
Slice:	A
Site Area (Ha):	0.97
Search Buffer (m):	1000

Site Details

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

Appendix C – Exploratory Hole Location Plan

ENVIRONMENTAL MANAGEMENT SOLUTIONS

EMS4727 – Land off Bishopstone Road, Stone

Exploratory Hole Location Plan

Appendix D – Trial Pit Logs

ENVIRONMENTAL MANAGEMENT SOLUTIONS

Environmental Management Solutions Limited

EXPLORATORY HOLE LOG

Project				HOLE No
Land off Bishopstone Road, Stone				**SA01**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
EMS4727	19-10-14			
Contractor				Sheet
				1 of 1

SAMPLES & TESTS		STRATA							
Depth	Sample No.	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
					(0.20) 0.20	Dark brown organic very clayey fine to medium SAND (topsoil).		
					(0.20) 0.40	Firm brown slightly organic sandy CLAY. (Purbeck Group)		
					(1.00) 1.40	Very weak to moderately weak cream/pale brown LIMESTONE with much sandy clay weathering product. Recovered as clayey sandy angular fine to coarse gravel and cobbles. (Purbeck Group)		
					(0.50) 1.90	Firm pale grey and pale brown extremely closely fissured gravelly CLAY. Gravel is angular fine to coarse mudstone and limestone. Some angular limestone cobbles. (Purbeck Group)		
					2.00	Stiff grey CLAY. (Purbeck Group)		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	1. Trial pit utilised for soakaway infiltration testing. 2. No groundwater entries occurred.

All dimensions in metres Scale 1:18.75	Client Manor Oak Homes	Method/ Plant Used Hydraulic excavator	Logged By JPW

EXPLORATORY HOLE LOG EMS4727.GPJ GINT STD AGS 3_1.GDT 3/11/14

ENVIRONMENTAL MANAGEMENT SOLUTIONS

Environmental Management Solutions Limited

EXPLORATORY HOLE LOG

Project				HOLE No
Land off Bishopstone Road, Stone				**SA02**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
EMS4727	19-10-14			
Contractor				Sheet
				1 of 1

SAMPLES & TESTS		STRATA							
Depth	Sample No.	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
					(0.25) 0.25	Dark brown organic very clayey fine to medium SAND (topsoil).		
					(0.45) 0.70	Firm brown slightly organic sandy CLAY. (Purbeck Group)		
					0.80	Firm cream and brown slightly sandy gravelly CLAY. Gravel is angular coarse limestone. Occasional limestone cobbles. (Purbeck Group)		

Boring Progress and Water Observations						Chiselling			Water Added	
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To

GENERAL REMARKS

1. Trial pit utilised for soakaway infiltration testing.
2. No groundwater entries occurred.

All dimensions in metres Scale 1:18.75	Client Manor Oak Homes	Method/ Plant Used Hydraulic excavator	Logged By JPW

EXPLORATORY HOLE LOG EMS4727.GPJ GINT STD AGS 3_1.GDT 3/11/14

ENVIRONMENTAL MANAGEMENT SOLUTIONS

Environmental Management Solutions Limited

EXPLORATORY HOLE LOG

Project				HOLE No
Land off Bishopstone Road, Stone				SA03
Job No	Date	Ground Level (m)	Co-Ordinates ()	
EMS4727	19-10-14			
Contractor				Sheet
				1 of 1

SAMPLES & TESTS		Water	STRATA					Geology	Instrument/ Backfill
Depth	Sample No.		Reduced Level	Legend	Depth (Thick-ness)		DESCRIPTION		
					(0.20)	0.20	Dark brown organic very clayey fine to medium SAND (topsoil).		
					(0.55)	0.75	Firm and stiff brown slightly sandy slightly gravelly CLAY. Gravel is angular fine to medium limestone.		
					(0.25)	1.00	Firm white and brown gravelly CLAY. Gravel is angular fine to coarse limestone. (Purbeck Group)		
					(0.60)	1.60	Very weak and weak pale cream LIMESTONE. Recovered as very sandy angular fine to coarse gravel and occasional cobbles. (Possible Portland Stone Formation) 1.40 - becoming very difficult to excavate.		

Boring Progress and Water Observations						Chiselling			Water Added	
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To

GENERAL REMARKS

1. Trial pit utilised for soakaway infiltration testing.
2. No groundwater entries occurred.

All dimensions in metres Scale 1:18.75	Client Manor Oak Homes	Method/ Plant Used Hydraulic excavator	Logged By JPW

EXPLORATORY HOLE LOG EMS4727.GPJ GINT STD AGS 3_1.GDT 3/11/14

ENVIRONMENTAL MANAGEMENT SOLUTIONS

Environmental Management Solutions Limited

EXPLORATORY HOLE LOG

Project				HOLE No
Land off Bishopstone Road, Stone				**SA04**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
EMS4727	19-10-14			
Contractor				Sheet
				1 of 1

SAMPLES & TESTS		Water	STRATA					Geology	Instrument/ Backfill
Depth	Sample No.		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION			
					(0.25) 0.25	Dark brown organic very clayey fine to medium SAND (topsoil).			
					(0.65) 0.90	Firm and stiff brown slightly sandy slightly gravelly CLAY. Gravel is angular fine to medium limestone. (Purbeck Group)			

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	1. Trial pit utilised for soakaway infiltration testing. 2. No groundwater entries occurred.

All dimensions in metres Scale 1:18.75	Client Manor Oak Homes	Method/ Plant Used Hydraulic excavator	Logged By JPW

EXPLORATORY HOLE LOG EMS4727.GPJ GINT STD AGS 3_1.GDT 3/11/14

Appendix E – Trial Pit Photographs

SA01

SA01

SA02

SA02

SA03

SA03

SA04

SA04

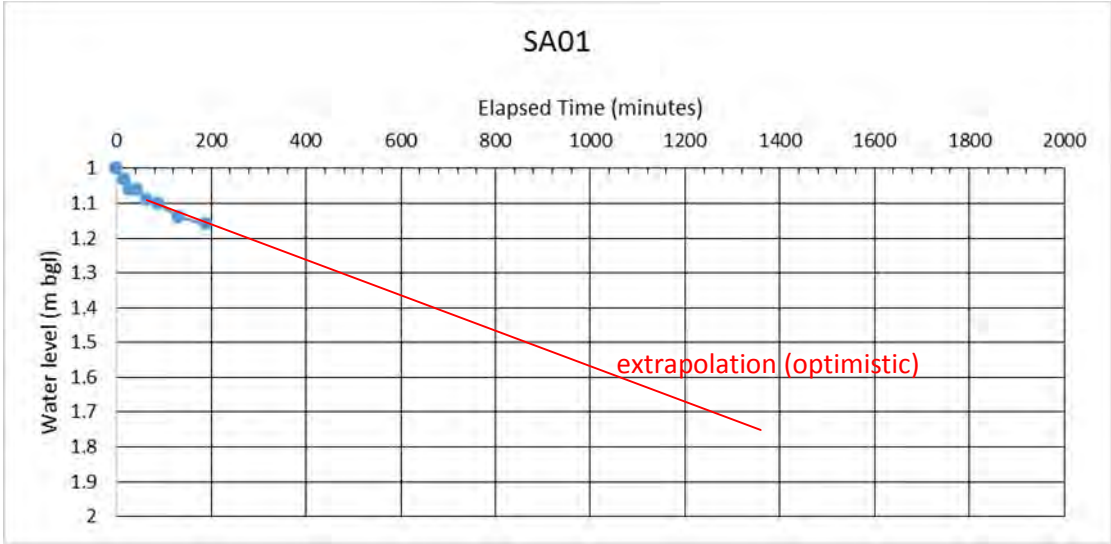
Appendix F – Soakaway Test Results

ENVIRONMENTAL MANAGEMENT SOLUTIONS

Soakaway Test Result Sheet

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 (minutes)	Water level (m below 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)

Test undertaken in general accordance with BRE Digest 365: Soakaway Design.

ENVIRONMENTAL MANAGEMENT SOLUTIONS

Soakaway Test Result Sheet

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 (minutes)	Water level (m below 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 x 10^{-5} m/s

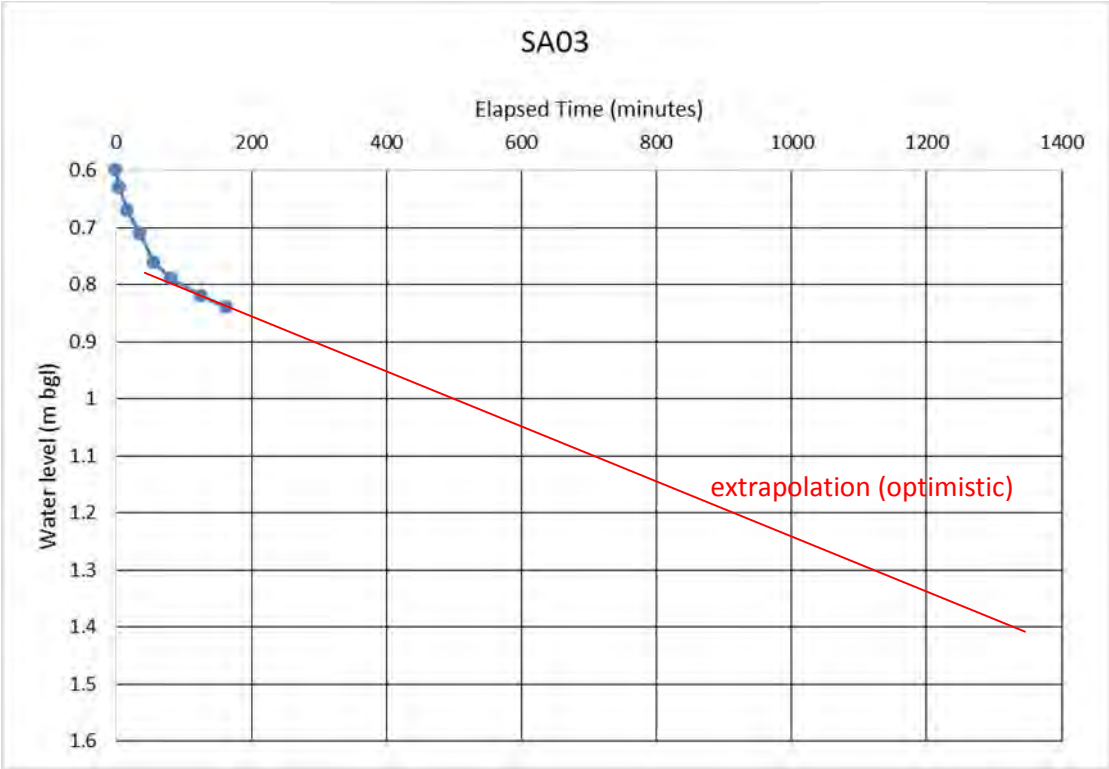
Test undertaken in general accordance with BRE Digest 365: Soakaway Design.

ENVIRONMENTAL MANAGEMENT SOLUTIONS

Soakaway Test Result Sheet

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 (minutes)	Water level (m below 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)

Test undertaken in general accordance with BRE Digest 365: Soakaway Design.

ENVIRONMENTAL MANAGEMENT SOLUTIONS

Soakaway Test Result Sheet

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 (minutes)	Water level (m below 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

V_{p75-25} = 0.1575
a_{p50} = 1.555
t_{p75-25} = 200 minutes

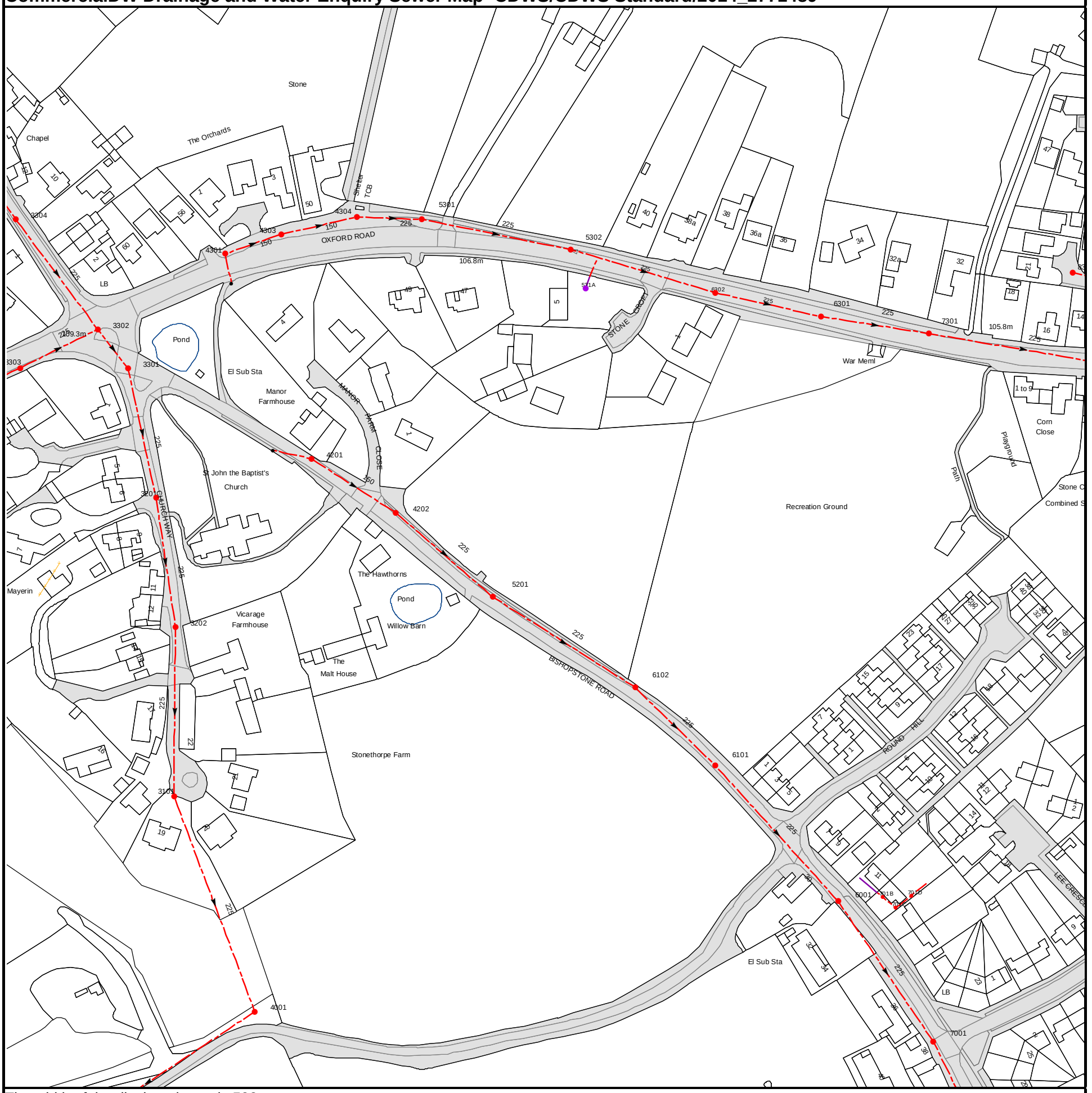
f (soil infiltration rate) = 8.4 x 10^{-6} m/s

Test undertaken in general accordance with BRE Digest 365: Soakaway Design.

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

CommercialDW Drainage and Water Enquiry Sewer Map- CDWS/CDWS Standard/2014_2771489



The width of the displayed area is 500m

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.

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	105.17	103.43
5201	104.73	102.97
6102	104.02	102.39
6101	104.04	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.

Sewer Key - Commercial Drainage and Water Enquiry

Public Sewer Types (Operated & Maintained by Thames Water)

Foul: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

Surface Water: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

Combined: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

Trunk Surface Water

Trunk Foul

Storm Relief

Trunk Combined

Vent Pipe

Bio-solids (Sludge)

Proposed Thames Surface Water Sewer

Proposed Thames Water Foul Sewer

Gallery

Foul Rising Main

Surface Water Rising Main

Combined Rising Main

Sludge Rising Main

Proposed Thames Water Rising Main

Vacuum

Sewer Fittings

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

Fitting

Meter

Vent Column

Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

Control Valve

Drop Pipe

Ancillary

Weir

End Items

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 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.

Outfall

Undefined End

Inlet

Other Symbols

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

Public/Private Pumping Station

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

Invert Level

Summit

Areas

Lines denoting areas of underground surveys, etc.

Agreement

Operational Site

Chamber

Tunnel

Conduit Bridge

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

Foul Sewer

Surface Water Sewer

Combined Sewer

Gulley

Culverted Watercourse

Proposed

Abandoned Sewer

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.

Appendix E

Proposed Impermeable Area
JPP drawing no. S7326PM-FRA02

KEY

Site Boundary = 9,725m^2

Proposed Impermeable Area = 3,469m^2

jpp consulting
Civil & Structural Engineers

Cedar Barn, White Lodge, Walgrave,
Northampton NN6 9PY

T: (01604) 781811 E: mail@jppuk.net
F: (01604) 781999 W: www.jppuk.net

Client	MANOR OAK HOMES
Project	HOUSING DEVELOPMENT, BISHOPSTONE ROAD STONE, AYLESBURY
Title	PROPOSED IMPERMEABLE AREA DRAWING

Scale at A3	1:500	Drawn by	KEJ	Checked by	MJA	Date	NOVEMBER 2014

Status	Project ref	Drawing no.	Revision
	S7326PM	FRA02	

Appendix F
Typical Permeable Paving Calculations

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 126 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	99.779	0.279	0.8	8.0	Flood Risk
30 min Summer	99.804	0.304	0.8	8.8	Flood Risk
60 min Summer	99.815	0.315	0.8	9.1	Flood Risk
120 min Summer	99.801	0.301	0.8	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	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	0.8	5.0	O K
720 min Summer	99.648	0.148	0.8	4.3	O K
960 min Summer	99.605	0.105	0.8	3.0	O K
1440 min Summer	99.556	0.056	0.8	1.6	O K
2160 min Summer	99.540	0.040	0.6	1.1	O K
2880 min Summer	99.532	0.032	0.5	0.9	O K
4320 min Summer	99.523	0.023	0.4	0.7	O K
5760 min Summer	99.518	0.018	0.3	0.5	O K
7200 min Summer	99.515	0.015	0.2	0.4	O K
8640 min Summer	99.513	0.013	0.2	0.4	O K
10080 min Summer	99.512	0.012	0.2	0.3	O K
15 min Winter	99.816	0.316	0.8	9.1	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	202.718	0.0	18
30 min Summer	115.067	0.0	32
60 min Summer	65.314	0.0	62
120 min Summer	37.074	0.0	100
180 min Summer	26.619	0.0	130
240 min Summer	21.044	0.0	164
360 min Summer	15.110	0.0	232
480 min Summer	11.945	0.0	298
600 min Summer	9.954	0.0	362
720 min Summer	8.577	0.0	422
960 min Summer	6.739	0.0	540
1440 min Summer	4.798	0.0	752
2160 min Summer	3.416	0.0	1104
2880 min Summer	2.684	0.0	1468
4320 min Summer	1.926	0.0	2196
5760 min Summer	1.521	0.0	2936
7200 min Summer	1.267	0.0	3616
8640 min Summer	1.091	0.0	4368
10080 min Summer	0.962	0.0	5072
15 min Winter	202.718	0.0	18

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	99.846	0.346	0.8	10.0	Flood Risk
60 min Winter	99.863	0.363	0.8	10.5	Flood Risk
120 min Winter	99.851	0.351	0.8	10.1	Flood Risk
180 min Winter	99.827	0.327	0.8	9.4	Flood Risk
240 min Winter	99.803	0.303	0.8	8.7	Flood Risk
360 min Winter	99.753	0.253	0.8	7.3	Flood Risk
480 min Winter	99.706	0.206	0.8	5.9	Flood Risk
600 min Winter	99.664	0.164	0.8	4.7	O K
720 min Winter	99.627	0.127	0.8	3.7	O K
960 min Winter	99.570	0.070	0.8	2.0	O K
1440 min Winter	99.541	0.041	0.7	1.2	O K
2160 min Winter	99.530	0.030	0.5	0.9	O K
2880 min Winter	99.523	0.023	0.4	0.7	O K
4320 min Winter	99.517	0.017	0.3	0.5	O K
5760 min Winter	99.513	0.013	0.2	0.4	O K
7200 min Winter	99.511	0.011	0.2	0.3	O K
8640 min Winter	99.510	0.010	0.2	0.3	O K
10080 min Winter	99.508	0.008	0.1	0.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	115.067	0.0	32
60 min Winter	65.314	0.0	60
120 min Winter	37.074	0.0	114
180 min Winter	26.619	0.0	142
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	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

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
Site Location	479250 212850 SP 79250 12850
C (1km)	-0.025
D1 (1km)	0.298
D2 (1km)	0.277
D3 (1km)	0.296
E (1km)	0.308
F (1km)	2.500
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.024

Time (mins) From:	To:	Area (ha)
0	4	0.024

Model Details

Storage is Online Cover Level (m) 100.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.03024	Width (m)	9.8
Membrane Percolation (mm/hr)	1000	Length (m)	9.8
Max Percolation (l/s)	26.7	Slope (1:X)	0.0
Safety Factor	1.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	99.500	Cap Volume Depth (m)	0.000