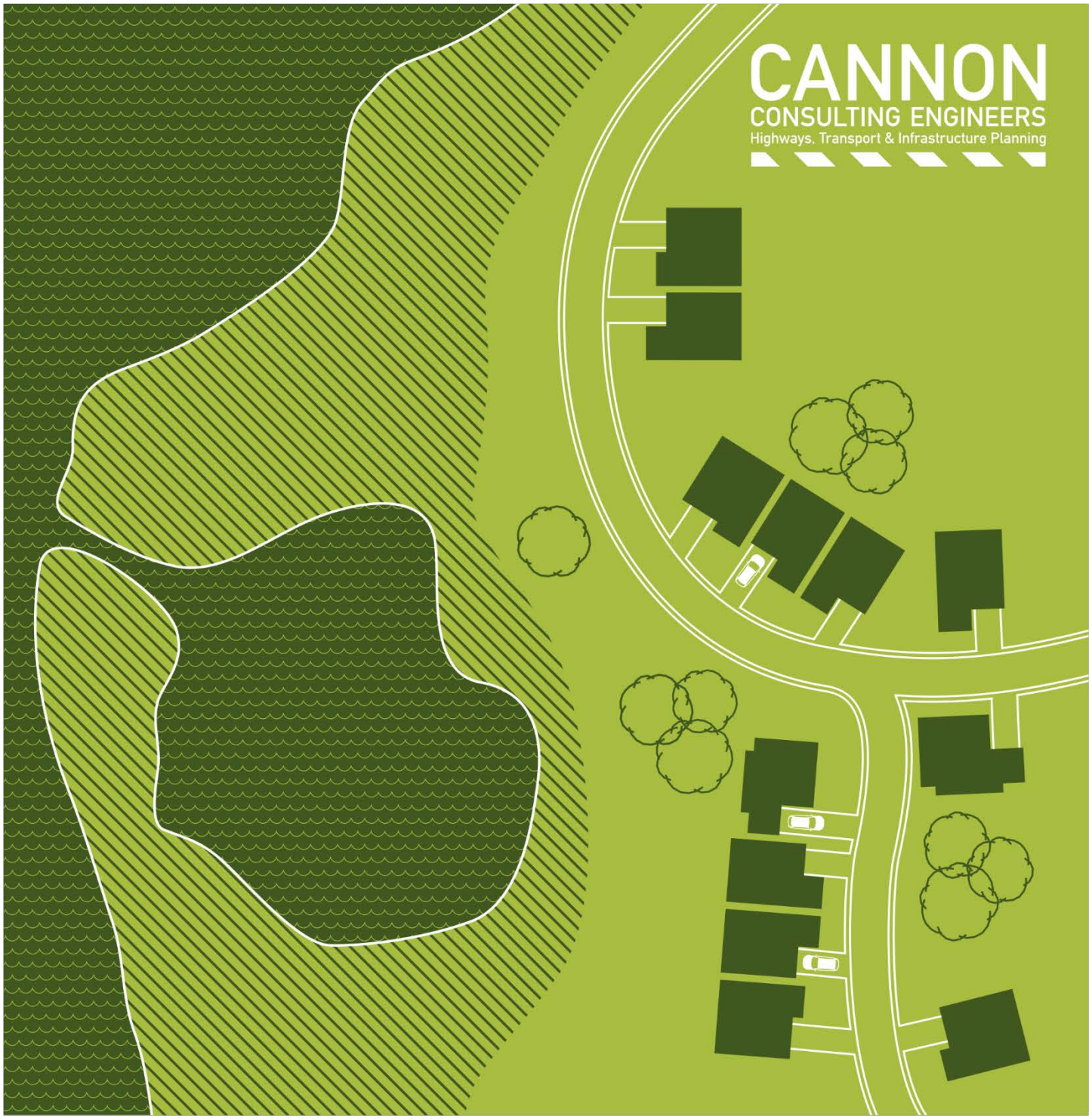

flood risk assessment

Land off Forest Road,
Onehouse, Suffolk

CCE/ZC291/FRA-01

August 2021

For
Harris Strategic Land

Document Review Sheet

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Reference	Date	Author	Checked
CCE/ZC291/FRA-01	August 2021	JH	RT

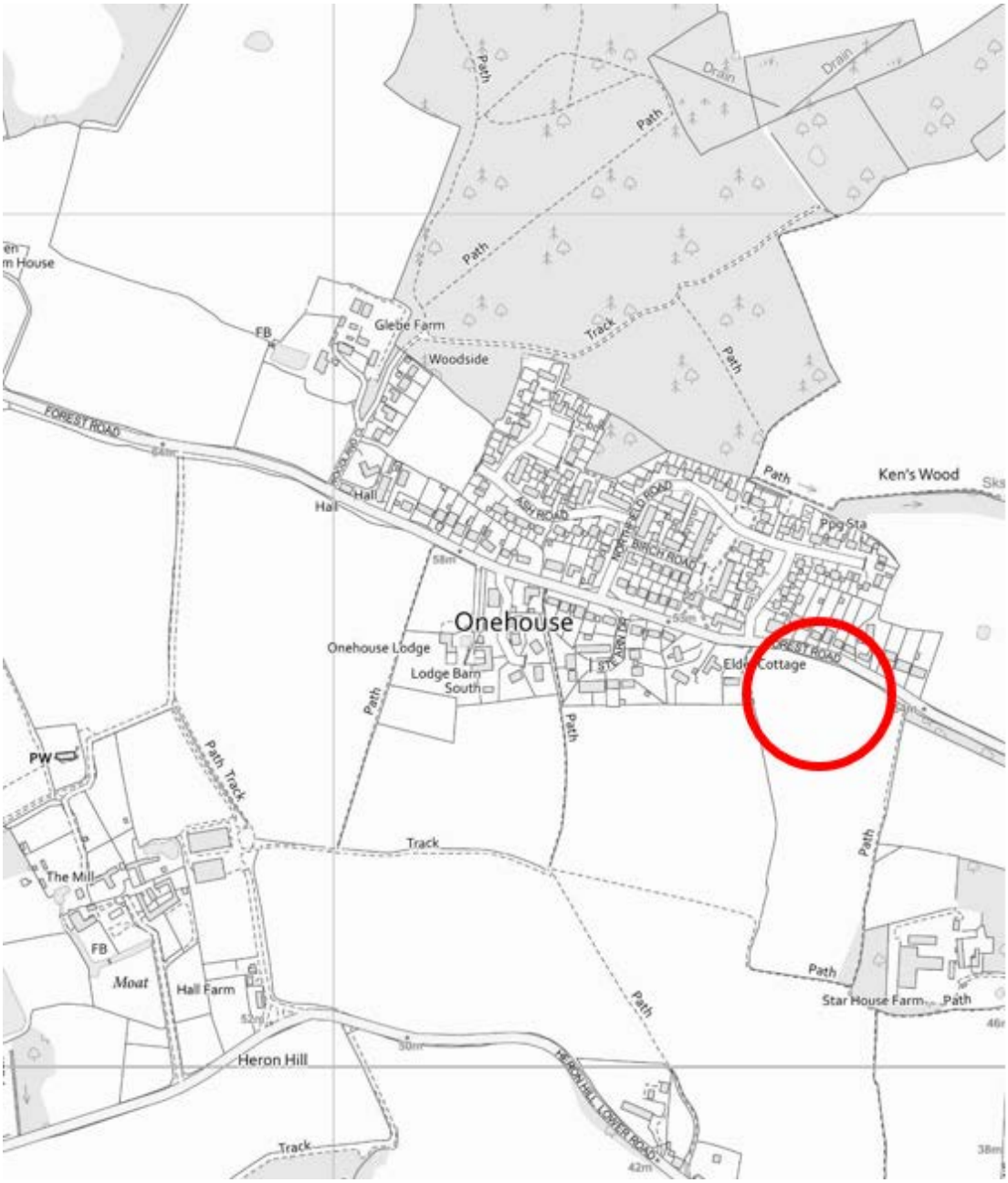
Contents

Summary Table

Site location	South of Forest Road, Onehouse, Stowmarket, Suffolk, IP14 3EW Grid reference 602583, 259443.
Planning application	Outline
Existing site	Undeveloped
Site area	Approximately 1.37 ha
Proposed development	Residential.
Flood Zone	1
Reservoir Inundation Zone	None
Surface water flooding	Very small patches of low risk in the north (on Forest Road).
Surface water management	On-site treatment and attenuation with restricted discharge to boundary ditch.

1.0 Introduction

1.1 This Flood Risk Assessment (FRA) has been prepared for the use of Harris Strategic Land to support an outline planning application for the residential development of land to the south of Forest Road in Onehouse, Stowmarket, Suffolk.



Approximate site location © Crown copyright and database rights 2021 Ordnance Survey 100047325

1.2 The site is covered by draft policy LS01 (067) of Babergh and Mid Suffolk Council's Joint Local Plan which is currently being examined.

1.3 The proposed development is for 20 residential dwellings with associated hard and soft landscaping and surface water management. An illustrative layout is included in Appendix B.

1.4 This assessment takes account of the National Planning Policy Framework (NPPF) and the definitions of sources of flooding within the Flood and Water Management Act (FWMA) 2010.

1.5 The report has been prepared following a site visit, infiltration testing and pre application discussions with Suffolk's Lead Local Flood Authority (LLFA).

1.6 The site is approximately 1.37 ha and is centred on Ordnance Survey grid reference 602583, 259443. The site is currently undeveloped arable farmland. There is a ditch running along the northern site boundary (alongside Forest Road) and a ditch on the eastern boundary (which in the context of the surrounding topography runs southwards).

1.7 The site is relatively level with no notable dominant slope, although levels in the east of the site are generally lower than the west. A topographical survey of the site and surrounding area is included in Appendix A. The land to the south and east of the site generally falls away from the site (sloping down towards the Rattlesden River).

1.8 The northern boundary ditch (and any associated drainage infrastructure) will be left in place (subject to some improvements).

1.9 The northern boundary is formed by Forest Road (with residential development beyond), the land to the west is residential and land to the east and south is open and undeveloped.

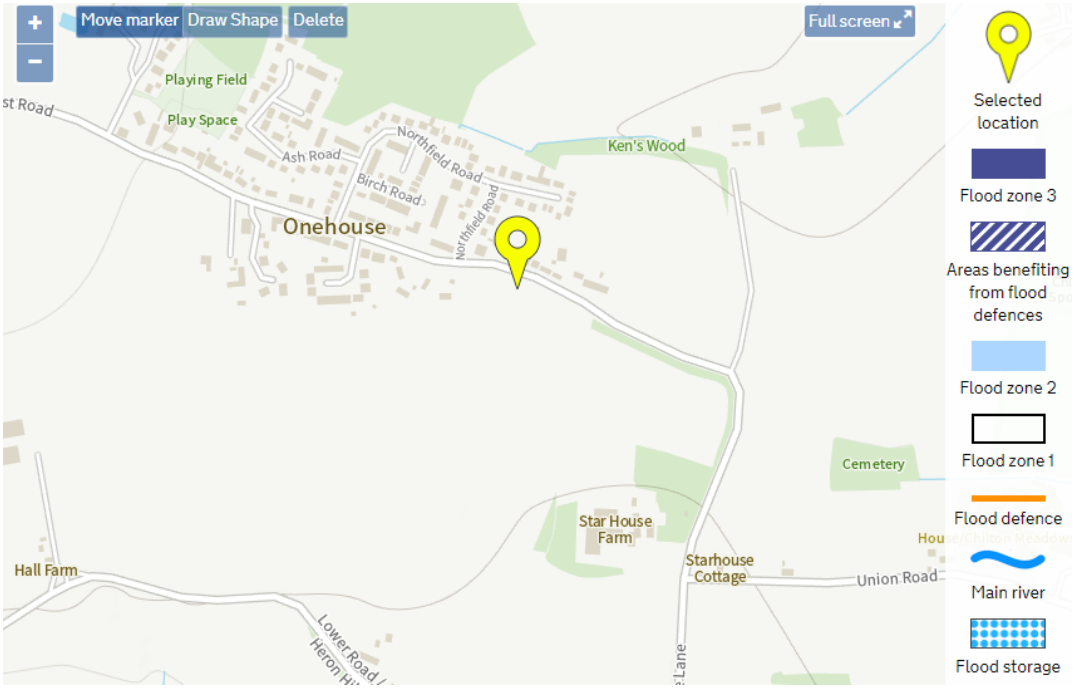
1.10 The site lies in Flood Zone 1 (the low probability flood area).

1.11 British Geological Survey (BGS) mapping (see Appendix A) shows the site is underlain by Boulder Clay (Lowestoft Formation Diamicton) over Crag. Excavations during on-site infiltration testing (see Appendix A) found topsoil some shallow head deposits (clayey sand) over the Lowestoft Formation. Groundwater was not encountered during the infiltration testing.

2.0 Forms of Flooding

Watercourses

2.1 As discussed and shown below on the Flood Map for Planning extract the site sits in Flood Zone 1 (the low probability flood area) and is not considered likely to flood as the result of overtopping from a named or significantly sized watercourse.



Flood map for planning extract © Crown copyright and database rights 2021 Ordnance Survey 100047325

Surface water flooding

2.2 Surface water flood mapping (see image overleaf) shows only minor spots of low risk/low probability flooding on the northern boundary (likely associated with the local low spots along Forest Road) which are not considered to pose a notable or unmanageable risk to the development.

2.3 Opportunities to regrade the northern ditch, as well as improving its maintenance to stop the localised pooling of surface water on the road will be further considered as part of the later planning/design stages. The two measures currently being considered are lowering the bed of the ditch near to the existing road gulley and drainage grip to facilitate the onward flow of water (eastwards) through the ditch. This should help to address the flooding note around the gulley and grip which is noted on the topographical survey (see Appendix A).

Surface water flooding map extract (depths for the low probability event)

Surface Water Sewers

2.4 Anglian Water sewer plans (included in Appendix A) show no adopted surface water or combined sewers in the area and hence no associated flood risk.

Groundwater

2.5 Groundwater was not encountered during the infiltration testing and the BGS report in Appendix A suggests that shallow groundwater is unlikely to be present. If groundwater were able to break the surface at the site then any resulting water would tend to flow

Reservoirs

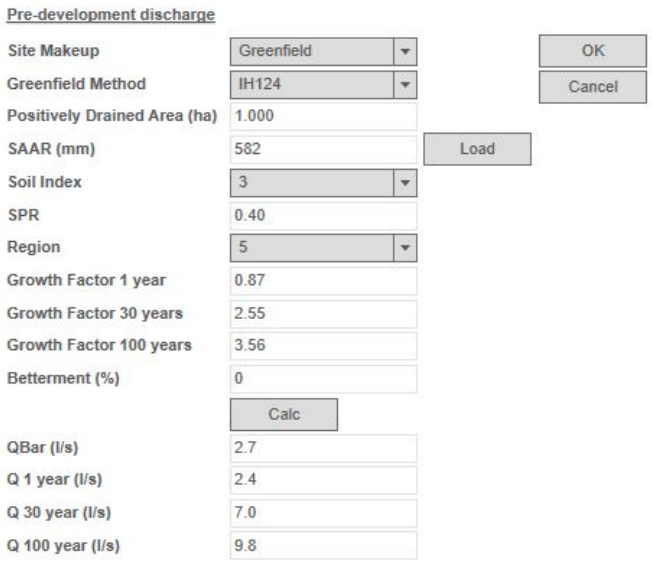
2.6 The site does not lie in a reservoir inundation area (see image overleaf).

Reservoir inundation map extract (showing no flooding)

3.0 Surface Water Management

3.1 Neither of the two infiltration tests at the site were successful with both failing to meet the minimum conditions to allow a rate to be calculated (refer to Appendix A for the results). Infiltration drainage is therefore not supported by the site geology.

3.2 As infiltration has been ruled out, the proposed outline surface water management scheme (see drawings and calculations in Appendix B) relies on an attenuated discharge to the boundary ditch. Discharge will be limited to the mean annual greenfield rate of 2.7 l/s/ha (see below). Applied to the approximate impermeable catchment of 0.44 ha this equates to an allowable discharge of circa 1.2 l/s. The outline attenuation is sized to manage the 1 in 100 storm plus 40 %, and has been tested for creep. At this outline stage creep has been applied as a 5% increase in the total area to represent the quoted upper end 10 % increase in the 'on curtilage' impermeable area.



3.3 The proposed attenuation relies on two basins (1 in 4 side slopes, 600 mm storage depth) and a stone blanket (300 mm deep/thick with 30 % void) beneath the majority of the permeably paved access road which links the two. The maximum modelled water depth (see calculations in Appendix B) is a little less than 600 mm. The smaller basin in the west is approximately 1.0 m deep, the eastern basin is 600 mm deep plus circa 200 mm or so for the small micropool or micropools in its base).

3.4 The appended calculations show that the attenuation volume required for the 1 in 30 storm is approximately half of the attenuation volume required for the 1 in 100 storm plus climate change (meaning that approximately half of the total storage volume is available during the critical 1 in 30 storm.

3.5 The proposed micropools will help to promote a longer term water presence and provide an ephemeral water habitat but are surplus to the required attenuation volume. Given the minimal impact resulting from exceedance (runoff would tend to flow southwards across the surrounding fields) freeboard is not considered essential. The SuDS Manual does not discuss freeboard in the chapter which deals with basins but the chapter on ponds suggests (from context) that for small ponds where the impact of exceedance water is limited (as it would be here) then freeboard may not be needed. If freeboard is considered necessary (at the later detailed design stages) then it will be a relatively trivial matter to include a low bund/landscaping feature around the basins or wider area.

Treatment

3.6 Based on Table 26.2 in the SuDS Manual the highest pollution hazard level for the site would be low. The treatment provided by the permeable paving, blankets, and basins is therefore suitable.

Maintenance

3.7 The ongoing maintenance of the surface water management scheme will likely be carried out by a communally funded private management company (as the size and scale of the site mean that adoption by Anglian Water is unlikely). Suggested maintenance activities are include in Appendix B.

4.0 Conclusions

4.1 The proposed development is not considered to be subject to significant or unmanageable flooding from the sources identified in the Flood and Water Management Act 2010 (FWMA).

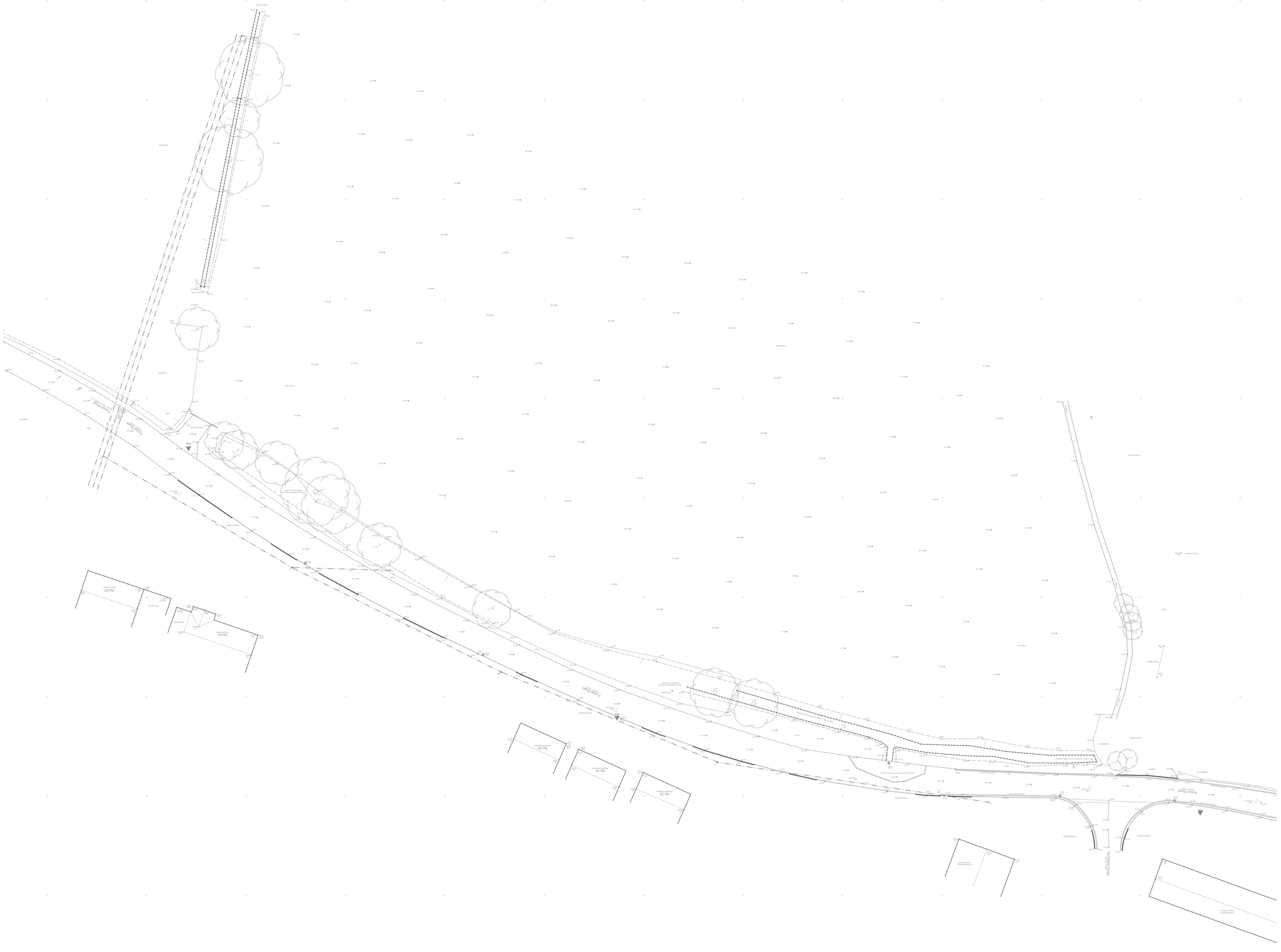
4.2 The surface water management strategy relies on restricted discharge to the boundary watercourse.

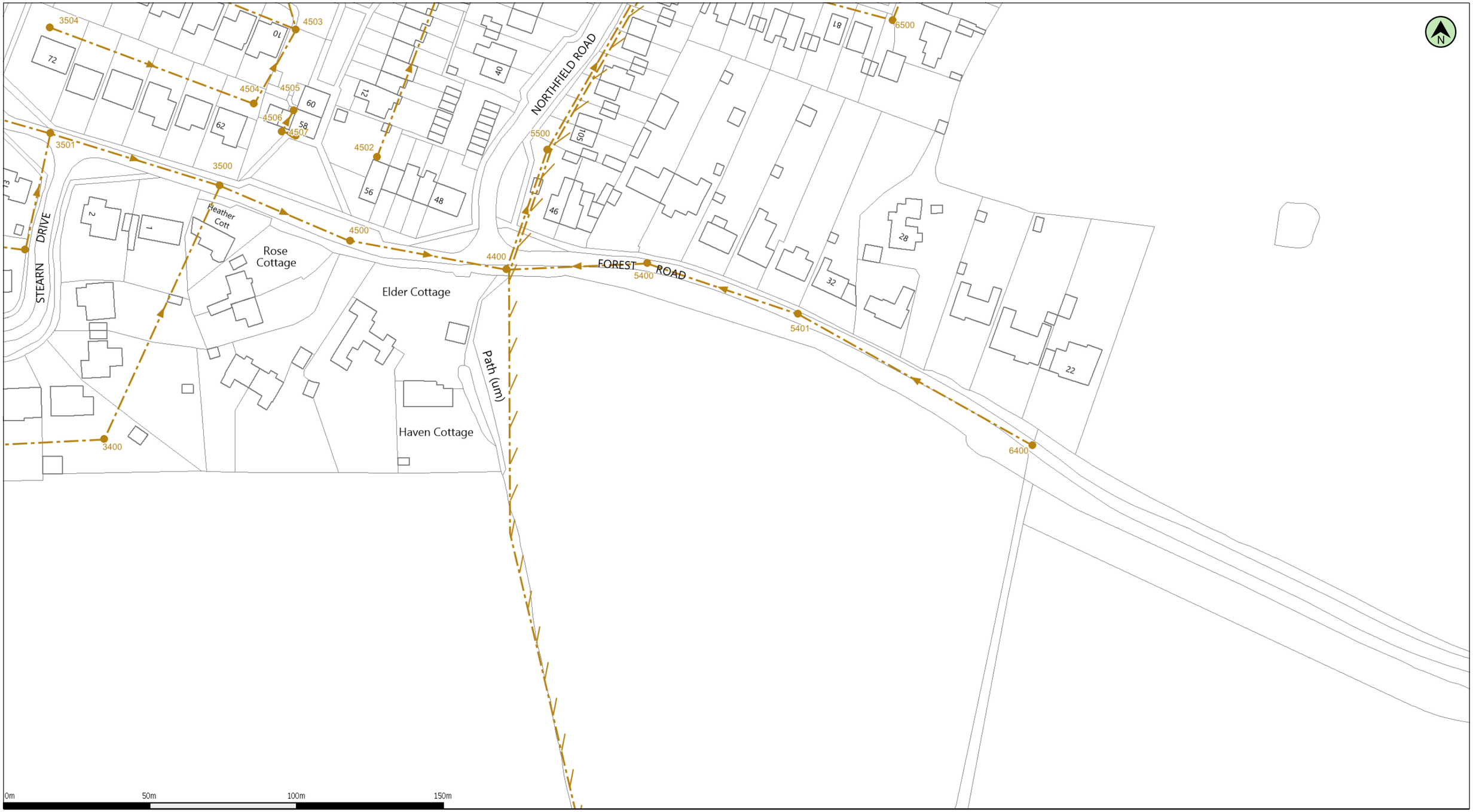
4.3 The outline surface water management scheme provides sufficient on-site attenuation to manage the 1 in 100 annual probability storm plus 40 % climate change allowance.

4.4 The proposed features provide a suitable level of treatment for the proposed land uses.

A. Existing Site

Topographical survey
Anglian Water sewer plans
Infiltration testing
BGS infiltration report


Forest Road
Forest Road
No.22
No.24
No.26
No.32
No.34
No.36



(c) Crown copyright and database rights 2021 Ordnance Survey 100022432 | Date: 13/05/21 | Scale: 1:1250 | Map Centre: 602571,259448 | Data updated: 30/04/21 | Our Ref: 557607 - 2 | Wastewater Plan A3

This plan is provided by Anglian Water pursuant its obligations under the Water Industry Act 1991 sections 198 or 199. It must be used in conjunction with any search results attached. The information on this plan is based on data currently recorded but position must be regarded as approximate. Service pipes, private sewers and drains are generally not shown. Users of this map are strongly advised to commission their own survey of the area shown on the plan before carrying out any works. The actual position of all apparatus MUST be established by trial holes. No liability whatsoever, including liability for negligence, is accepted by Anglian Water for any error or inaccuracy or omission, including the failure to accurately record, or record at all, the location of any water main, discharge pipe, sewer or disposal main or any item of apparatus. This information is valid for the date printed. This plan is produced by Anglian Water Services Limited (c) Crown copyright and database rights 2021 Ordnance Survey 100022432.This map is to be used for the purposes of viewing the location of Anglian Water plant only. Any other uses of the map data or further copies is not permitted. This notice is not intended to exclude or restrict liability for death or personal injury resulting from negligence.

- Foul Sewer
- Surface Sewer
- Combined Sewer
- Final Effluent
- Rising Main*
- Private Sewer*
- Decommissioned Sewer*
- Outfall*
- Inlet*
- Manhole*
- Sewage Treatment Works
- Public Pumping Station
- Decommissioned Pumping Station

*(Colour denotes effluent type)

jenni.askew@cannonce.co.uk
Onehouse

love every drop anglianwater

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
3400	F	55.087	53.797	1.29
3500	F	53.355	52.423	0.932
3501	F	54.114	52.666	1.448
3502	F	54.702	53.127	1.575
3504	F	-	-	-
4400	F	54.335	51.843	2.492
4500	F	54.181	52.01	2.171
4502	F	-	-	-
4503	F	-	-	-
4504	F	-	-	-
4505	F	-	-	-
4506	F	-	-	-
4507	F	-	-	-
5400	F	54.081	52.084	1.997
5401	F	54.565	52.331	2.234
5500	F	54.346	51.676	2.67
6400	F	54.2	52.822	1.378
6500	F	-	-	-

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

GeoReports

British Geological Survey

Cannon Consulting Engineers
Cambridge House
Lanwades Business Park
Kennett
Newmarket
CB8 7PN

Infiltration SuDS GeoReport:

This report provides information on the suitability of the subsurface for the installation of infiltration sustainable drainage systems (SuDS). It provides information on the properties of the subsurface with respect to significant constraints, drainage, ground stability and groundwater quality protection.

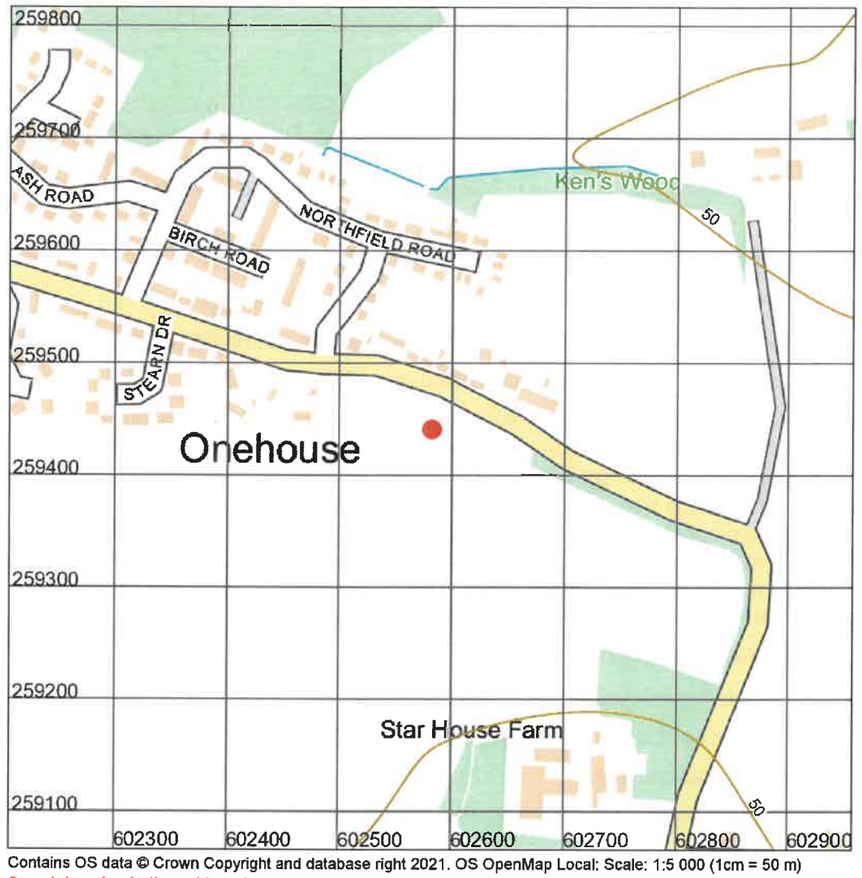
Report Id: *BGS_315527/20208*

Client reference: Cannon Consulting Engineers

GeoReports

British Geological Survey

Search location



Contains OS data © Crown Copyright and database right 2021. OS OpenMap Local: Scale: 1:5 000 (1cm = 50 m)
Search location indicated in red

Point centred at: 602582,259441

Assessment for an infiltration sustainable drainage system

Introduction

Sustainable drainage systems (SuDS) are drainage solutions that manage the volume and quality of surface water close to where it falls as rain. They aim to reduce flow rates to rivers, increase local water storage capacity and reduce the transport of pollutants to the water environment. There are four main types of SuDS, which are often designed to be used in sequence. They comprise:

- **source control:** systems that control the rate of runoff
- **pre-treatment:** systems that remove sediments and pollutants
- **retention:** systems that delay the discharge of water by providing surface storage
- **infiltration:** systems that mimic natural recharge to the ground.

This report focuses on infiltration SuDS. It provides subsurface information on the properties of the ground with respect to drainage, ground stability and groundwater quality protection. It is intended principally for those involved in the preliminary assessment of the suitability of the ground for infiltration SuDS, and those involved in assessing proposals from others for sustainable drainage, but it may also be useful to help house-holders judge whether or not further professional advice should be sought. If in doubt, users should consult a suitably-qualified professional about the results in this report before making any decisions based upon it.

This GeoReport is structured in two parts:

- **Part 1. Summary data**.

  Comprises three maps that summarise the data contained within Part 2.

- **Part 2. Detailed data**.

  Comprises a further 24 maps in four thematic sections:

  - **Very significant constraints.** Maps highlight areas where infiltration may result in adverse impacts due to factors including: ground instability (soluble rocks, non-coal shallow mining and landslide hazards); persistent shallow groundwater, or the presence of made ground, which may represent a ground stability or contamination hazard.
  - **Drainage potential**. Maps indicate the drainage potential of the ground, by considering subsurface permeability, depth to groundwater and the presence of floodplain deposits.
  - **Ground stability**. Maps indicate the presence of hazards that have the potential to cause ground instability resulting in damage to some buildings and structures, if water is infiltrated to the ground.
  - **Groundwater protection**. Maps provide key indicators to help determine whether the groundwater may be susceptible to deterioration in quality as a result of infiltration.

GeoReports

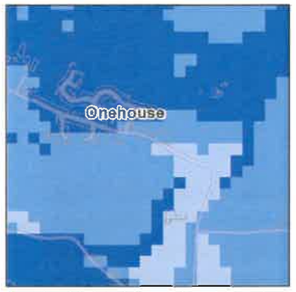
This report considers the suitability of the subsurface for the installation of infiltration SuDS, such as soakaways, infiltration basins or permeable pavements. It provides subsurface data to indicate whether, and which type of infiltration system may be appropriate. It does not state that infiltration SuDS are, or are not, appropriate as this is highly dependent on the design of the individual system. This report therefore describes the subsurface conditions at the site, allowing the reader to determine the suitability of the site for infiltration SuDS.

The map and text data in this report is similar to that provided in the '*Infiltration SuDS Map: Detailed*' national map product. For further information about the data, consult the '*User Guide for the Infiltration SuDS Map: Detailed*', available from http://nora.nerc.ac.uk/16618/.

PART 1: SUMMARY DATA

This section provides a summary of the data.

In terms of the drainage potential, is the ground suitable for infiltration SuDS?



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- Highly compatible for infiltration SuDS. The subsurface is likely to be suitable for free-draining infiltration SuDS.
- Probably compatible for infiltration SuDS. The subsurface is probably suitable although the design may be influenced by the ground conditions.
- Opportunities for bespoke infiltration SuDS. The subsurface is potentially suitable although the design will be influenced by the ground conditions.
- Very significant constraints are indicated. There is a very significant potential for one or more hazards associated with infiltration.

Is ground instability likely to be a problem?

Contains OS data © Crown Copyright and database right **2021**

- Increased infiltration is very unlikely to result in ground instability.
- Ground instability problems may be present or anticipated, but increased infiltration is unlikely to result in ground instability.
- Ground instability problems are probably present. Increased infiltration may result in ground instability.
- There is a very significant potential for one or more geohazards associated with infiltration.

Is the groundwater susceptible to deterioration in quality?

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- The groundwater is not expected to be especially vulnerable to contamination.
- The groundwater may be vulnerable to contamination.
- The groundwater is likely to be vulnerable to contaminants.
- Made ground is present at the surface. Infiltration may increase the possibility of remobilising pollutants.

GeoReports

PART 2: DETAILED DATA

This section provides further information about the properties of the ground and will help assess the suitability of the ground for infiltration SuDS.

Section 1. Very significant constraints

Where maps are overlain by grey polygons, geological or hydrogeological hazards may exist that could be made worse by infiltration. The following hazards are considered:

- soluble rocks
- landslides
- shallow mining
- shallow groundwater
- made ground

For more information read 'Explanation of terms' at the end of this report.

Soluble rock hazard

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- Very significant soluble rock hazard.
  Soluble rocks are present with a very significant possibility of localised subsidence that could be initiated or made worse by infiltration. The site investigation should consider whether the potential for or the consequences of subsidence as a result of infiltration are significant.
- Very significant soluble rock hazards are not present; however this hazard may still need to be considered. See Part 3.

Landslide hazard

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- Very significant landslide hazard.
  Slope instability problems are almost certainly present and may be active. An increase in moisture content as a result of infiltration may cause the slope to fail. The site investigation should consider whether the potential for or the consequences of landslide as a result of infiltration are significant.
- Very significant landslide hazards are not present; however this hazard may still need to be considered. See Part 3.

Shallow mining hazard

- [ ] Very significant mining hazard.
  Shallow mining is likely to be present with a very significant possibility of localised subsidence that could be initiated or made worse by increased infiltration. Also, infiltration may increase the possibility of remobilising pollutants. The site investigation should consider whether the potential for or consequences of subsidence and/or remobilisation of pollutants as a result of infiltration are significant.
- [ ] Very significant mining hazards are not present; however this hazard may still need to be considered. See Part 3.

Persistent shallow groundwater

- [ ] Very high likelihood of persistent or seasonally shallow groundwater.
  Persistent or seasonally shallow groundwater is likely to be present. Infiltration may increase the likelihood of soakaway inundation, or groundwater emergence at the surface. The site investigation should consider whether the potential for or the consequences of groundwater level rise as a result of infiltration are significant.
- [ ] See Part 2 for the likely depth to water table.

Made ground

- [ ] Made ground present.
  Made ground is present at the surface. Infiltration may affect ground stability or increase the possibility of remobilising pollutants. The site investigation should consider whether the potential for or consequences of ground instability and/or pollutant leaching as a result of infiltration are significant.
- [ ] None recorded

GeoReports

Section 2. Drainage potential

The following pages contain maps that will help you assess the drainage potential of the ground by considering the:

- depth to water table
- permeability of the superficial deposits
- thickness of the superficial deposits
- permeability of the bedrock
- presence of floodplains

Superficial deposits are not present everywhere and therefore some areas of the *superficial deposit permeability* map may not be coloured. Where this is the case, the *bedrock permeability* map shows the likely permeability of the ground. Superficial deposits in some places are very thin and hence in these places you may wish to consider both the permeability of the superficial deposits and the permeability of the bedrock. The *superficial thickness* map will tell you whether the superficial deposits are thin (< 3 m thick) or thick (>3 m). Where they are over 3 m thick, the permeability of the bedrock may not be relevant.

For more information read 'Explanation of terms' at the end of this report.

Depth to groundwater table

- Groundwater is likely to be **more than 5 m** below the ground surface throughout the year.
- Groundwater is likely to be between **3 and 5 m** below the ground surface for at least part of the year.
- Groundwater is likely to be **less than 3 m** below the ground surface for at least part of the year.

Superficial deposit permeability

Superficial deposits are likely to be **free-draining**.

The superficial deposit permeability is **spatially variable**, but likely to permit moderate infiltration.

Superficial deposits are likely to be **poorly draining**.

These maps show the permeability range that is summarised above.

- Very Low
- Low
- Moderate
- High
- Very High

Minimum

Maximum

Superficial deposit thickness

The thickness of superficial deposits is **< 3 m** and hence the permeability of the ground may be dependent on both the superficial deposits (where present) and underlying bedrock (see below).

The thickness of superficial deposits is **> 3 m** and hence the permeability of the superficial deposits is likely to determine the permeability of the ground.

GeoReports

British Geological Survey

Bedrock permeability

Bedrock deposits are likely to be **free-draining**.

The bedrock permeability is **spatially variable**, but likely to permit moderate infiltration.

Bedrock deposits are likely to be **poorly draining**.

These maps show the permeability range that is summarised above.

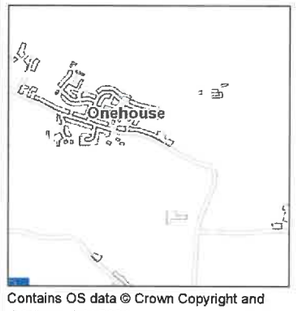
Key

- Very Low
- Low
- Moderate
- High
- Very High

Minimum

Maximum

Geological indicators of flooding



Superficial floodplain deposits or low-lying coastal areas have been identified. Groundwater levels may rise in response to high river or tide levels, potentially causing inundation of subsurface infiltration SuDS.

Section 3. Ground stability

The following pages contain maps that will help you assess whether infiltration may impact the stability of the ground. They consider hazards associated with:

- soluble rocks
- landslides
- shallow mining
- running sands
- swelling clays
- compressible ground, and
- collapsible ground

In the following maps, geohazards that are identified in green are unlikely to prevent infiltration SuDS from being installed, but they should be considered during design. For more information read 'Explanation of terms' at the end of this report.

Soluble rocks

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- Increased infiltration is unlikely to result in subsidence.
- Increased infiltration is unlikely to cause localised subsidence, but potential impacts should be considered.
- Increased infiltration may result in localised subsidence. The potential for or the consequences of subsidence associated with soluble rocks should be considered.
- Very significant possibility of localised subsidence that could be initiated or made worse by infiltration.

GeoReports

British Geological Survey

Landslides

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- Increased infiltration is unlikely to lead to slope instability.
- Slope instability problems may be present or anticipated, but increased infiltration is unlikely to cause instability
- Slope instability problems are probably present or have occurred in the past, and increased infiltration may result in slope instability.
- Slope instability problems are almost certainly present and may be active. An increase in moisture content as a result of infiltration may cause the slope to fail.

Shallow mining

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- Increased infiltration is unlikely to lead to subsidence.
- Shallow mining is possibly present. Increased infiltration is unlikely to cause a geohazard, but potential impacts should be considered.
- Shallow mining could be present with a significant possibility that localised subsidence could be initiated or made worse by increased infiltration.
- Shallow mining is likely to be present, with a very significant possibility that localised subsidence may be initiated or made worse by increased infiltration.

Running sand

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- Increased infiltration is unlikely to cause ground collapse associated with running sands.
- Running sand is possibly present. Increased infiltration is unlikely to cause a geohazard, but potential impacts should be considered.
- Significant possibility for running sand problems. Increased infiltration may result in a geohazard.

Swelling clays

- Increased infiltration is unlikely to cause shrink-swell ground movement.
- Ground is susceptible to shrink-swell ground movement. Increased infiltration is unlikely to cause a geohazard, but potential impacts should be considered.
- Ground is susceptible to shrink-swell ground movement. Increased infiltration may result in a geohazard.

Compressible ground

- Increased infiltration is unlikely to lead to ground compression.
- Compressibility and uneven settlement hazards are probably present. Increased infiltration may result in a geohazard.

Collapsible ground

- Increased infiltration is unlikely to result in subsidence.
- Deposits with potential to collapse when loaded and saturated are possibly present in places. Increased infiltration is unlikely to cause a geohazard, but potential impacts should be considered.
- Deposits with potential to collapse when loaded and saturated are probably present in places. Increased infiltration may result in a geohazard.

GeoReports

British Geological Survey

Section 4. Groundwater quality protection

The following pages contain maps showing some of the information required to ensure the protection of groundwater quality. Data presented includes:

- groundwater source protection zones (Environment Agency data)
- predominant flow mechanism
- made ground

For more information read 'Explanation of terms' at the end of this report.

Groundwater source protection zones

Derived in part from Source Protection Zone data provided under licence from the Environment Agency © Environment Agency 2021.

- Groundwater is not within a source protection zone.
- Source protection zone IV
- Source protection zone III
- Source protection zone II
- Source protection zone I

Predominant flow mechanism

- Water is likely to percolate through the unsaturated zone to the groundwater through either the pore space in granular media or through porespace and fractures; these processes have some potential for contaminant removal and breakdown.
- Water is likely to percolate through the unsaturated zone to the groundwater through fractures, a process which has little potential for contaminant removal and breakdown.

Made ground

Made ground is present at the surface. Infiltration may increase the possibility of remobilising pollutants.

Section 5. Geological Maps

The following maps show the artificial, superficial and bedrock geology within the area of interest.

Artificial deposits

Superficial deposits

Bedrock

Fault

Coal, ironstone or mineral vein

Note: Faults and Coals, ironstone & mineral veins are shown for illustration and to aid interpretation of the map. Not all such features are shown and their absence on the map face does not necessarily mean that none are present

Key to Artificial deposits:
No deposits recorded by BGS in the search area

Key to Superficial deposits:

Map colour	Computer Code	Rock name	Rock type
	ALV-XCZ	ALLUVIUM	CLAY AND SILT
	LOFT-XSV	LOWESTOFT FORMATION	SAND AND GRAVEL
	LOFT-XCZ	LOWESTOFT FORMATION	CLAY AND SILT
	LOFT-DMTN	LOWESTOFT FORMATION	DIAMICTON
	HEAD-XCZSV	HEAD	CLAY, SILT, SAND AND GRAVEL

Key to Bedrock geology:

Map colour	Computer Code	Rock name	Rock type
	CRAG-S	CRAG GROUP	SAND

GeoReports

Limitations of this report:

- This report is concerned with the potential for infiltration-to-the-ground to be used as a SuDS technique at the site described. It only considers the subsurface beneath the search area and does NOT consider potential surface or subsurface impacts outside of that area.
- This report is NOT an alternative for an on-site investigation or soakaway test, which might reach a different conclusion.
- This report must NOT be used to justify disposal of foul waste or grey water.
- This report is based on and limited to an interpretation of the records held by the British Geological Survey (BGS) at the time the search is performed. The datasets used (with the exception of that showing depth to water table) are based on 1:50 000 digital geological maps and not site-specific data.
- Other more specific and detailed ground instability information for the site may be held by BGS, and an assessment of this could result in a modified assessment.
- To interpret the maps correctly, the report must be viewed and printed in colour.
- The search does NOT consider the suitability of sites with regard to:
    - previous land use,
    - potential for, or presence of contaminated land
    - presence of perched water tables
    - shallow mining hazards relating to coal mining. Searches of coal mining should be carried out via The Coal Authority Mine Reports Service: www.coalminingreports.co.uk.
    - made ground, where not recorded
    - proximity to landfill sites (searches for landfill sites or contaminated land should be carried out through consultation with local authorities/Environment Agency)
    - zones around private water supply boreholes that are susceptible to groundwater contamination.
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Date: 08 March 2021
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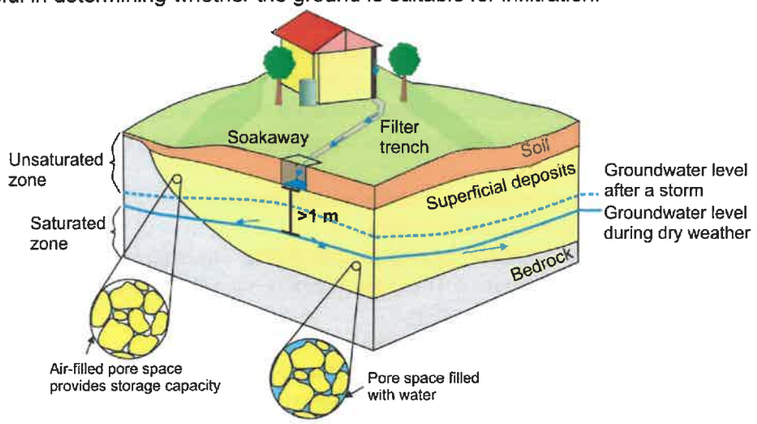
BGS_315527/20208

Explanation of terms

Depth to groundwater

In the shallow subsurface, the ground is commonly unsaturated with respect to water. Air fills the spaces within the soil and the underlying superficial deposits and bedrock. At some depth below the ground surface, there is a level below which these spaces are full of water. This level is known as the groundwater level, and the water below it is termed the groundwater. When water is infiltrated, the groundwater level may rise temporarily. To ensure that there is space in the unsaturated zone to accommodate this, there should be a minimum thickness of 1 m between the base of the infiltration system and the water table. An estimate of the *depth to groundwater* is therefore useful in determining whether the ground is suitable for infiltration.



Groundwater flooding

Groundwater flooding occurs when a rise in groundwater level results in very shallow groundwater or the emergence of groundwater at the surface. If infiltration systems are installed in areas that are susceptible to groundwater flooding, it is possible that the system could become inundated. The susceptibility map seeks to identify areas where the geological conditions and water tables indicate that groundwater level rise could occur under certain circumstances. A high susceptibility to groundwater flooding classification does not mean that groundwater flooding has ever occurred in the past, or will do so in the future as the susceptibility maps do not contain information on how often flooding may occur. The susceptibility maps are designed for planning; identifying areas where groundwater flooding might be an issue that needs to be taken into account.

Geological indicators of flooding

In floodplain deposits, groundwater level can be influenced by the water level in the adjacent river. Groundwater level may increase during periods of fluvial flood and therefore this should be taken into account when designing infiltration systems on such deposits. The *geological indicators of flooding* dataset shows where there is geological evidence (floodplain deposits) that flooding has occurred in the past.

For further information on flood-risk, the likely frequency of its recurrence in relation to any proposed development of the site, and the status of any flood prevention measures in place, you are advised to contact the local office of the Environment Agency (England and Wales) at www.environment-agency.gov.uk/ or the Scottish Environment Protection Agency (Scotland) at www.sepa.org.uk.

Artificial ground

Artificial ground comprises deposits and excavations that have been created or modified by human activity. It includes ground that is worked (quarries and road cuttings), infilled (back-filled quarries), landscaped (surface re-shaping), disturbed (near surface mineral workings) or classified as made ground (embankments and spoil heaps). The composition and properties of artificial ground are often unknown. In particular, the permeability and chemical composition of the artificial ground should be determined to ensure that the ground will drain and that any contaminants present will not be remobilised.

Superficial permeability

Superficial deposits are those geological deposits that were formed during the most recent period of geological time (as old as 2.6 million years before present). They generally comprise relatively thin deposits of gravel, sand, silt and clay and are present beneath the pedological soil in patches or larger spreads over much of Britain. The ease with which water can percolate through these deposits is controlled by their permeability and varies widely depending on their composition. Those deposits comprising clays and silts are less permeable and thus infiltration is likely to be slow, such that water may pool on the surface. In comparison, deposits comprising sands and gravels are more permeable allowing water to percolate freely.

Bedrock permeability

Bedrock forms the main mass of rock forming the Earth. It is present everywhere, commonly beneath superficial deposits. Where the superficial deposits are thin or absent, the ease with which water will percolate into the ground depends on the permeability of the bedrock.

Natural ground instability
Natural ground instability refers to the propensity for upward, lateral or downward movement of the ground that can be caused by a number of natural geological hazards (e.g. ground dissolution/compressible ground). Some movements associated with particular hazards may be gradual and of millimetre or centimetre scale, whilst others may be sudden and of metre or tens of metres scale. Significant natural ground instability has the potential to cause damage to buildings and structures, especially when the drainage characteristics of a site are altered. It should be noted, however, that many buildings, particularly more modern ones, are built to such a standard that they can remain unaffected in areas of significant ground movement.

Shrink-swell
A shrinking and swelling clay changes volume significantly according to how much water it contains. All clay deposits change volume as their water content varies, typically swelling in winter and shrinking in summer, but some do so to a greater extent than others. Contributory circumstances could include drought, leaking service pipes, tree roots drying-out the ground or changes to local drainage patterns, such as the creation of soakaways. Shrinkage may remove support from the foundations of buildings and structures, whereas clay expansion may lead to uplift (heave) or lateral stress on part or all of a structure; any such movements may cause cracking and distortion.

Landslides (slope stability)
A landslide is a relatively rapid outward and downward movement of a mass of ground on a slope, due to the force of gravity. A slope is under stress from gravity but will not move if its strength is greater than this stress. If the balance is altered so that the stress exceeds the strength, then movement will occur. The stability of a slope can be reduced by removing ground at the base of the slope, by placing material on the slope, especially at the top, or by increasing the water content of the materials forming the slope. Increase in subsurface water content beneath a soakaway could increase susceptibility to landslide hazards. The assessment of landslide hazard refers to the stability of the present land surface. It does not encompass a consideration of the stability of excavations.

Soluble rocks (dissolution)
Some rocks are soluble in water and can be progressively removed by the flow of water through the ground. This process tends to create cavities, potentially leading to the collapse of overlying materials and possibly subsidence at the surface. The release of water into the subsurface from infiltration systems may increase the dissolution of rock or destabilise material above or within a cavity. Dissolution cavities may create a pathway for rapid transport of contaminated water to an aquifer or water course.

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Compressible ground
Many ground materials contain water-filled pores (the spaces between solid particles). Ground is compressible if a building (or other load) can cause the water in the pore space to be squeezed out, causing the ground to decrease in thickness. If ground is extremely compressible the building may sink. If the ground is not uniformly compressible, different parts of the building may sink by different amounts, possibly causing tilting, cracking or distortion. The compressibility of the ground may alter as a result of changes in subsurface water content caused by the release of water from soakaways.

Collapsible deposits
Collapsible ground comprises certain fine-grained materials with large pore spaces (the spaces between solid particles). It can collapse when it becomes saturated by water and/or a building (or other structure) places too great a load on it. If the material below a building collapses it may cause the building to sink. If the collapsible ground is variable in thickness or distribution, different parts of the building may sink by different amounts, possibly causing tilting, cracking or distortion. The subsurface underlying a soakaway will experience an increase in water content that may affect the stability of the ground. This hazard is most likely to be encountered only in parts of southern England.

Running sand
Running sand conditions occur when loosely-packed sand, saturated with water, flows into an excavation, borehole or other type of void. The pressure of the water filling the spaces between the sand grains reduces the contact between the grains and they are carried along by the flow. This can lead to subsidence of the surrounding ground. Running sand is potentially hazardous during the drainage system installation. During installation, excavation of the ground may create a space into which sand can flow, potentially causing subsidence of surrounding ground.

Shallow mining hazards (non coal)
Current or past underground mining for coal or for other commodities can give rise to cavities at shallow or intermediate depths, which may cause fracturing, general settlement, or the formation of crown-holes in the ground above. Spoil from mineral workings may also present a pollution hazard. The release of water into the subsurface from soakaways may destabilise material above or within a cavity. Cavities arising as a consequence of mining may also create a pathway for rapid transport of contaminated water to an aquifer or watercourse. The mining hazards map is derived from the geological map and considers the potential for subsidence associated with mining on the basis of geology type. Therefore if mining is known to occur within a certain rock, the map will highlight the potential for a hazard within the area covered by that geology.

For more information regarding underground and opencast **coal mining**, the location of mine entries (shafts and adits) and matters relating to subsidence or other ground movement induced by **coal mining** please contact the Coal Authority, Mining Reports, 200 Lichfield Lane, Mansfield, Nottinghamshire, NG18 4RG; telephone 0845 762 6848 or at www.coal.gov.uk. For more information regarding other types of mining (i.e. non-coal), please contact the British Geological Survey.

Groundwater source protection zones

In England and Wales, the Environment Agency has defined areas around wells, boreholes and springs that are used for the abstraction of public drinking water as source protection zones. In conjunction with Groundwater Protection Policy the zones are used to restrict activities that may impact groundwater quality, thereby preventing pollution of underlying aquifers, such that drinking water quality is upheld. The Environment Agency can provide advice on the location and implications of source protection zones in your area (www.environment-agency.gov.uk/)

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Date: 08 March 2021
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BGS_315527/20208

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- Raw data may have been transcribed from analogue to digital format, or may have been acquired by means of automated measuring techniques. Although such processes are subjected to quality control to ensure reliability where possible, some raw data may have been processed without human intervention and may in consequence contain undetected errors.
- Detail, which is clearly defined and accurately depicted on large-scale maps, may be lost when small-scale maps are derived from them.
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- The most appropriate techniques for copying original records are used, but there may be some loss of detail and dimensional distortion when such records are copied.
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- The topography shown on any map extracts is based on the latest OS mapping and is not necessarily the same as that used in the original compilation of the BGS geological map, and to which the geological linework available at that time was fitted.
- Note that for some sites, the latest available records may be historical in nature, and while every effort is made to place the analysis in a modern geological context, it is possible in some cases that the detailed geology at a site may differ from that described.

Report issued by
BGS Enquiry Service

GEOSPHERE ENVIRONMENTAL

Our Ref: 5632,SK/LTR/AH,GF/25-06-21/V1

Your Ref: 5632,SK

Cannon Consulting Engineers
Cambridge House
Lanwades Business Park
Kentford
Newmarket,
Suffolk
CB8 7PN

For the attention of Mr Rob Ward

By Email:
Rob.Ward@cannonce.co.uk

Dear Mr Ward,

INFILTRATION TESTING AT LAND OFF FOREST ROAD, ONEHOUSE, STOWMARKET, SUFFOLK

1. Introduction

This letter report has been prepared for Cannon Consulting Engineers, on behalf of Harris Strategic Land Ltd.

The primary objective of this ground investigation was to assess the infiltration potential of the natural soils beneath the site.

This was achieved by:

- Excavating two machine-dug trial pits across the site;
- Undertaking soakage testing in line with BRE Digest 365 guidance; and
- Undertaking infiltration calculations to allow for an assessment of the suitability of soakaways or infiltration techniques for the future development of the site.

It is understood that the proposed development will comprise a number of residential dwellings along with associated private gardens, vehicle parking and infrastructure. A Proposed Development Plan, provided by Cannon Consulting Engineers, Drawing ref. 5398 by CSA Environmental, dated 27 April 2021, is provided within Appendix 4 at the end of this letter report.

A Site Location Plan, Drawing ref. 5632,SK/001/Rev0, is presented at the end of this letter report in Appendix 4.

The purpose of this letter report is to provide factual data only.

2. Site Works

2.1 Methodology

This ground investigation was carried out on the basis of the practices set out in BRE Digest 365, 'Soakaway Design'. 2016, which requires, in summary, a total of three infiltration tests to be undertaken in succession over a 24-hour period or tests to be undertaken on consecutive days.

The exploratory holes were positioned in locations provided by the consulting engineers to enable targeted testing for the proposed development.

In general, where a test location showed limited or no infiltration, it was allowed to continue for circa 24 hours, the data obtained and the test ceased following the client's instruction to do so.

2.2 Scope

Site works were carried out on 24 and 25 May 2021, and comprised the following:

- Excavation of two machine excavated trial pits, (SK01 and SK02), to depths ranging from 1.20 to 2.0mbgl;
- Undertaking infiltration testing in line with BRE Digest 365 guidance; and
- Undertaking infiltration calculations to allow for an assessment of the suitability of soakaways for the future development of the site.

An Exploratory Hole Location Plan, Drawing ref. 5632,SK/002/Rev0, is presented at the end of this letter report in Appendix 4.

2.3 Ground Conditions Encountered

The sequence of the strata encountered during the investigation generally confirms the anticipated geology as interpreted from geological mapping.

The sequence and indicative thickness of strata are summarised in Table 1 below, with the Exploratory Hole Logs provided in Appendix 2:

Table 1 - Ground Conditions

Strata	Depth Encountered (mbgl)		Strata Thickness (m)	Location and Composition
	From	To		
Topsoil.	0.00	0.40	0.40	All exploratory holes: Dark brown slightly clayey organic sand with rare flint gravel.
Head Deposits .	0.40	0.70	0.30	All exploratory holes: Brown slightly clayey sand with rare flint gravel and occasional orangish brown staining.
Lowestoft Formation.	0.70	1.20 to 2.00	Unproven	All exploratory holes: Orange brown and light grey mottled slightly sandy gravelly clay with chalk and flint gravel and cobbles.

2.4 Groundwater

No groundwater was encountered in any of the exploratory holes during the intrusive investigation.

2.5 Infiltration Testing Results

Soil infiltration testing was undertaken in accordance with BRE 365, 2016. The results are summarised in Table 2 below and are provided in full in Appendix 3, presented at the end of this letter report:

Table 2 - Summary of Soil Infiltration Results

Location	Test 1 (m/s)	Test 2 (m/s)	Test 3 (m/s)	Notes
SK01	N/A	-	-	75% infiltration not achieved in 24hr period. Test terminated at request from client.
SK02	N/A	-	-	25% infiltration not achieved in 24hr period. Test terminated at request from client.

We trust the above is clear and acceptable. If you have any questions, please do not hesitate to contact us.

Yours sincerely

Ayden Hassan
Senior Engineering Geologist
Geosphere Environmental Ltd
Ayden@geosphere-environmental.co.uk

Enclosures:
Appendix 1 – Report Limitations and Conditions
Appendix 2 – Exploratory Hole Logs
Appendix 3 – Infiltration Testing Results
Appendix 4 – Drawings

Copy to: Rik Totman – Cannon Consulting Engineers
Email: Rik.Totman@cannonce.co.uk

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APPENDICES

GEOSPHERE ENVIRONMENTAL LTD

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APPENDIX 1 – REPORT LIMITATIONS AND CONDITIONS

This report refers, within the limitations stated, to the condition of the site at the time of the inspections. No warranty is given as to the possibility of future changes in the condition of the site.

This report has been prepared for the sole use of the Client for the purposes described and no extended duty of care to any third party is implied or offered. Third parties using any information contained within this report do so at their own risk.

This report is prepared and written for the use stated herein; it should not be used for any other purposes without reference to Geosphere Environmental Limited. The report has been prepared in relation to the proposed end-use, should another end-use be intended, a further re-assessment may be required. It is likely that over time practises will improve and the relevant guidance and legislation be amended or superseded, which may necessitate a re-assessment of the site.

The accuracy of any map extracts cannot be guaranteed. It is possible that different conditions existed onsite, between and subsequent to the various map surveys appended.

Whilst the report may express an opinion on possible configurations of strata between or beyond exploratory holes discussed or on the possible presence of features based upon visual, verbal or published evidence, this is for guidance only and no liability can be accepted for its accuracy.

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APPENDIX 2 – EXPLORATORY HOLE LOGS

Trial Pit Logs
(TP01 and TP02)

Geosphere Environmental Ltd
Brightwell Barns, Ipswich Road
Brightwell, Suffolk, IP10 0BJ
Telephone: 01603 298076

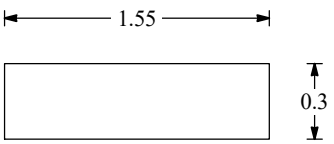
TRIAL PIT LOG

Project	Client	TRIAL PIT No
Forest Road, Onehouse, Stowemarket	Cannon Consulting Engineers	**SK01**

Job No	Date	Ground Level (m)	Coordinates ()
5632,SK	24-05-21 25-05-21		,

Fieldwork By	Logged By	Sheet
GEL	AH	1 of 1

Depth	DESCRIPTION	Legend	Depth	No	Remarks/Tests
0.00-0.40	Dark brown slightly gravelly slightly clayey ORGANIC SAND. Gravel is fine and medium chert. (TOPSOIL)				
0.40-0.70	Brown slightly gravelly clayey SAND. Gravel is fine and medium chert.				
0.70-2.00	Orangish brown mottled light grey silty slightly sandy gravelly CLAY with a medium cobble content. Sand is fine. Gravel is subangular and subrounded fine to coarse chalk and flint. Cobbles are flint and chalk.				
2.00	End of Exploratory Hole. Target depth achieved.				



Shoring/Support: Gravel Filled
Stability: Stable

All dimensions in metres Scale 1:25	Method Trial Pit/trench	Plant Used MECHANICAL EXCAVATOR	Checked By GF

Geosphere Environmental Ltd
Brightwell Barns, Ipswich Road
Brightwell, Suffolk, IP10 0BJ
Telephone: 01603 298076

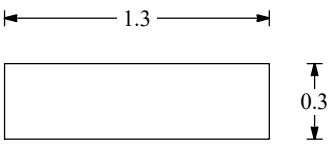
TRIAL PIT LOG

Project	Client	TRIAL PIT No
Forest Road, Onehouse, Stowemarket	Cannon Consulting Engineers	**SK02**

Job No	Date	Ground Level (m)	Coordinates ()
5632,SK	24-05-21 25-05-21		,

Fieldwork By	Logged By	Sheet
GEL	AH	1 of 1

Depth	DESCRIPTION	Legend	Depth	No	Remarks/Tests
0.00-0.40	Dark brown slightly gravelly slightly clayey ORGANIC SAND. Gravel is fine and medium chert. (TOPSOIL)				
0.40-0.70	Brown slightly gravelly slightly clayey SAND. Gravel is fine and medium chert. Frequent orangish brown staining.				
0.70-1.20	Light greyish brown slightly sandy gravelly CLAY. Sand is fine. Gravel is subangular and subrounded fine to coarse chalk and flint.				
1.20	End of Exploratory Hole. Target depth achieved.				



Shoring/Support: Gravel Filled
Stability: Stable

All dimensions in metres Scale 1:25	Method Trial Pit/trench	Plant Used MECHANICAL EXCAVATOR	Checked By GF

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APPENDIX 3 – INFILTRATION TEST RESULTS

(TP01 and TP02)

TRIAL PIT INFILTRATION TEST - BRE DIGEST 365

Project Number: 5632 SK

Date: 22/06/2021

Project Name: Forest Road, Onehouse, Stowmarket

Time [min]	Depth to Water [mbgl]
0	1.20
1	1.18
2	1.18
3	1.18
4	1.18
5	1.18
26	1.19
127	1.195
146	1.210
190	1.215
1018	1.210
1080	1.200
1141	1.200
1203	1.200
1250	1.200

Pit Size [m]		
Length	**Width**	**Depth**
1.55	0.30	2.00

Infiltration Rate Calculations		
Parameter	**Unit**	**Result**
height		
h_{75}	[m]	1.800
h_{25}	[m]	1.400
h_{75}-h_{25}	[m]	0.400
time		
t_{75}	[s]	N/A
t_{25}	[s]	N/A
t_{75} - t_{25}	[s]	N/A
effective volume		
v_{75-25}	[m^3]	0.056
effective area		
ap_{50}	[m^2]	1.945
soil infiltration rate		
f	[m/s]	N/A

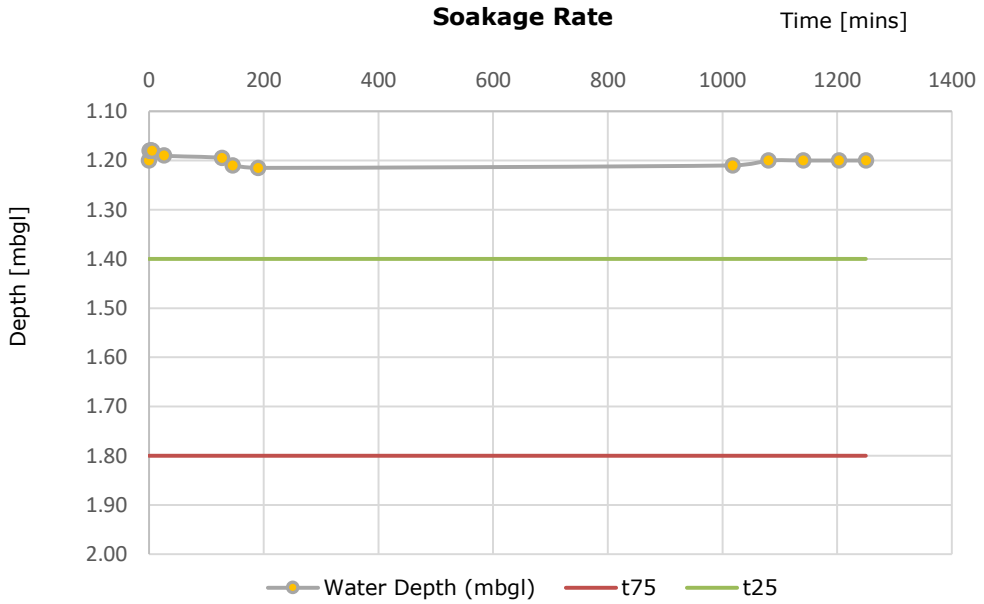
Trial Pit TP01

Run 1 of 1

Test Date 24-25/05/2021

Groundwater Encountered: N/A

Remarks: Gravel backfilled pit to ensure stability. Voids ratio of 0.3 adopted. 25% not reached in 24 hours. Terminated at client request.



Calculated by: TA

Checked by: AH

TRIAL PIT INFILTRATION TEST - BRE DIGEST 365

Project Number: 5632 SK

Project Name: Forest Road, Onehouse, Stowmarket

Date: 22/06/2021

Time [min]	Depth to Water [mbgl]
0	0.71
1	0.72
3	0.73
4	0.73
5	0.72
42	0.76
84	0.78
158	0.815
206	0.830
1221	1.010
1282	1.010
1341	1.015
1404	1.015
1442	1.020

Pit Size [m]		
Length	**Width**	**Depth**
1.30	0.30	1.20

Infiltration Rate Calculations		
Parameter	**Unit**	**Result**
height		
h_{75}	[m]	1.078
h_{25}	[m]	0.833
h_{75}-h_{25}	[m]	0.245
time		
t_{75}	[s]	N/A
t_{25}	[s]	12600.00
t_{75} - t_{25}	[s]	N/A
effective volume		
v_{75-25}	[m^3]	0.029
effective area		
ap_{50}	[m^2]	1.174
soil infiltration rate		
f	[m/s]	N/A

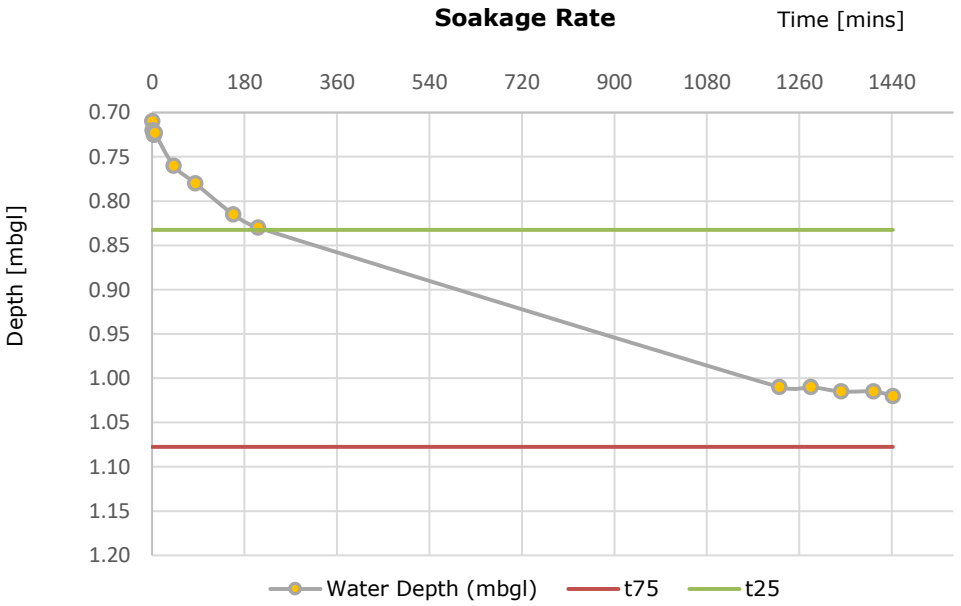
Trial Pit TP02

Run 1 of 1

Test Date 24-25/05/2021

Groundwater Encountered: N/A

Remarks: Gravel backfilled pit to ensure stability. Voids ratio of 0.3 adopted. 25% not reached in 24 hours. Terminated at client request.



Calculated by: TA

Checked by: AH

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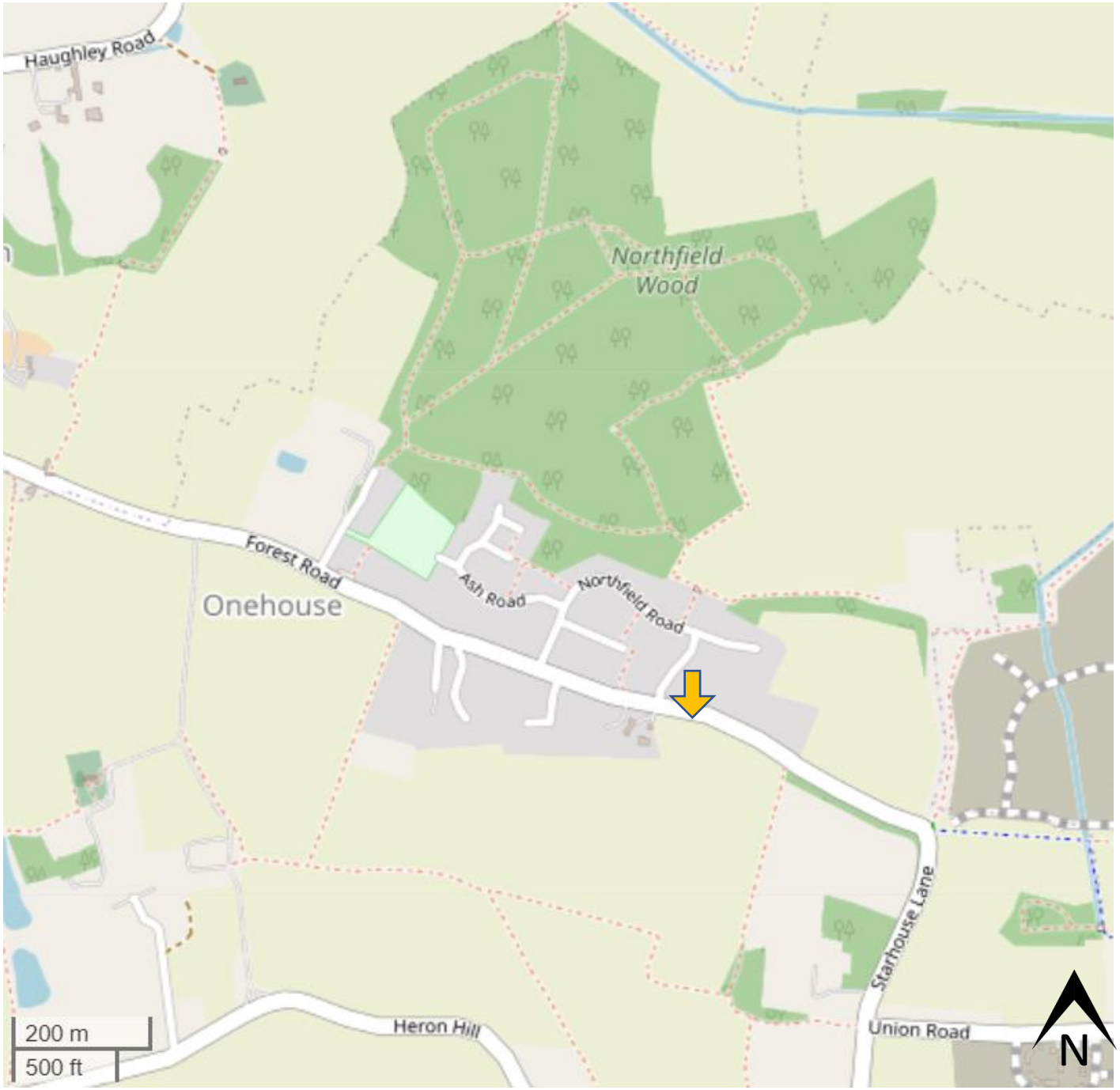
APPENDIX 4 – DRAWINGS

Site Location Plan - Drawing ref. 5632,SK/001/Rev0

Exploratory Hole Location Plan – Drawing ref. 5632,SK/002/Rev0

Proposed Development Plan, provided by Cannon Consulting Engineers, Drawing ref. 5398 by CSA Environmental, dated 27 April 2021



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LEGEND

Site Location

SOURCE

© OpenStreetMap contributors

PROJECT

Land off Forest Road, Onehouse, Stowemarket, Suffolk

TITLE

Site Location Plan

DRAWING NUMBER

5632,SK/001/Rev0

SCALE	DATE
As Marked	23/06/2021
DRAWN BY	**CHECKED BY**
AH	GF

GEOSPHERE ENVIRONMENTAL

LEGEND

Site boundary

Infiltration Test Pit

SOURCE

Client supplied background image

PROJECT

Land off Forest Road, Onehouse, Stowemarket, Suffolk

TITLE

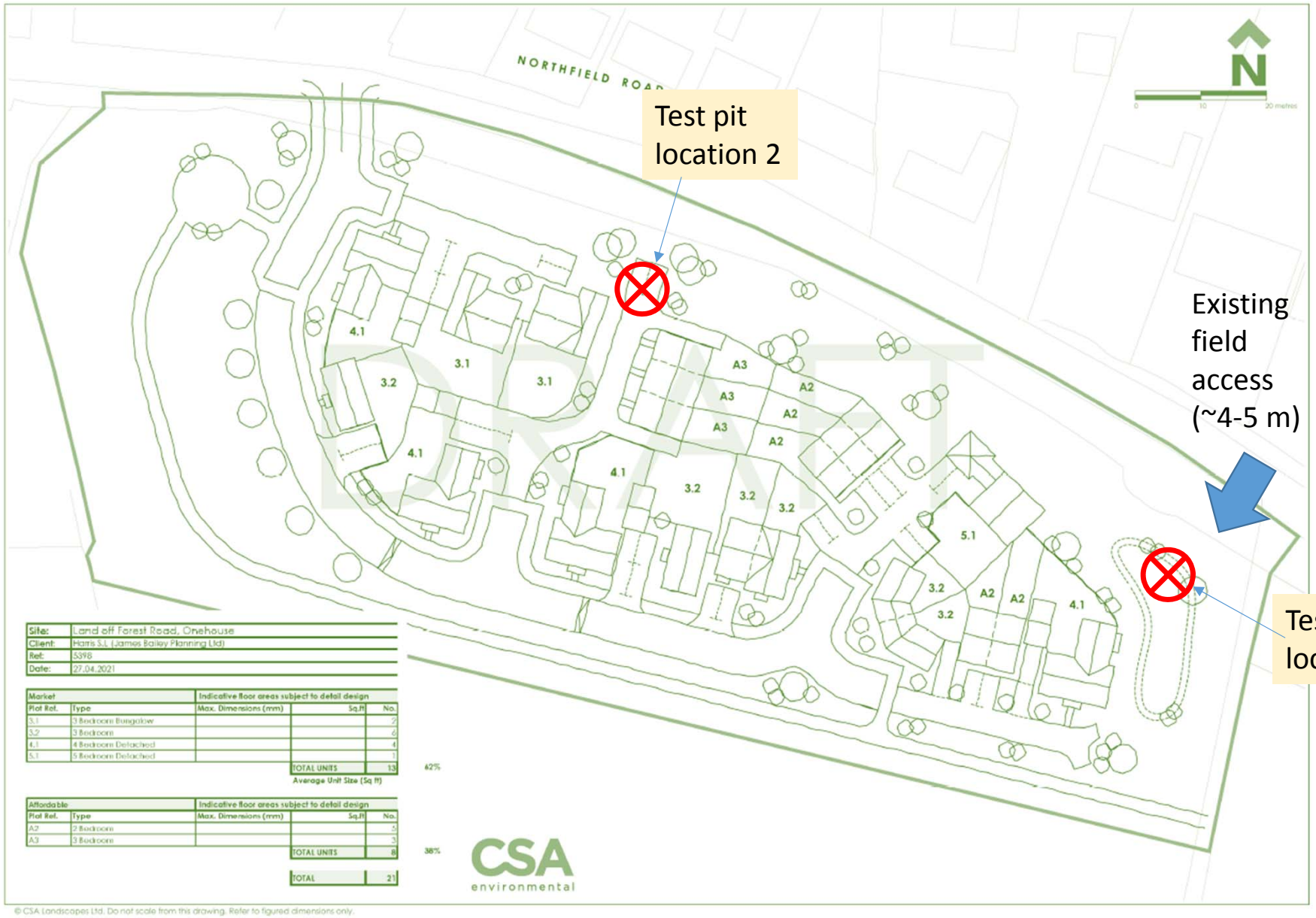
Exploratory Hole Location Plan

DRAWING NUMBER

5632,SK/002/Rev0

SCALE	DATE
NTS	23/06/2021
DRAWN BY	**CHECKED BY**
AH	GF

N


NORTHFIELD ROAD
Test pit location 2
Existing field access (~4-5 m)
Test pit location 1
N
0
10
20 metres
DRAFT
4.1
3.1
3.2
A3
A2
5.1
Site: Land off Forest Road, Onehouse
Client: Harris S.L (James Bailey Planning Ltd)
Ref: 5398
Date: 27.04.2021
Market
Indicative floor areas subject to detail design
Plot Ref. | Type | Max. Dimensions (mm) | Sq.ft | No.
5.1 | 3 Bedroom Bungalow | 2
5.2 | 3 Bedroom | 6
4.1 | 4 Bedroom Detached | 4
5.1 | 5 Bedroom Detached | 1
TOTAL UNITS | 13
62%
Average Unit Size (Sq ft)
Affordable
Indicative floor areas subject to detail design
Plot Ref. | Type | Max. Dimensions (mm) | Sq.ft | No.
A2 | 2 Bedroom | 5
A3 | 3 Bedroom | 3
TOTAL UNITS | 8
38%
TOTAL | 21
CSA environmental
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GEOSPHERE ENVIRONMENTAL

Ec Ecology.

Fr Flood Risk.

Ge Geotechnical.

En Environmental.

Kw Knotweed.

GEOSPHERE ENVIRONMENTAL LTD

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B. Proposed Site

Illustrative layout

Indicative surface water management strategy

Surface water calculations

Suggested maintenance activities

New houses to be set back from the western development boundary behind an area of public open space to respect the setting of the adjacent Grade II Listed Building.

The western part of the development is to be left open in order to preserve glimpsed views southwards to countryside from Forest Road and Sustrans Route (51).

Within the new development, bat and bird boxes could be implemented within the external walls, to further promote habitat creation and roosting potential. Hedgehog gaps in new rear garden fencing will promote habitat connectivity across and within the development.

Incorporation of native plants and those of wildlife importance into the landscaping scheme will provide foraging opportunities for birds, invertebrates and bats.

Retention of existing hedgerow along the development frontage, will reduce the visual effects on the adjoining residential properties along Forest Road, as well as retaining habitat value.

To promote adherence with the NPPF and Babergh and Mid Suffolk local policy, micro-pools will be created within the Basin, promoting a longer term water presence, enhanced with aquatic planting to provide new aquatic habitats and increase biodiversity.

Existing Public Footpath to be retained in its current alignment. A new recreational route along the development's southern boundary will connect into this.

Proposed children's play area will be designed with a natural character and will incorporate grass mounds, boulders and logs to complement its rural setting.

A recreational footway will meander through the public open space. The footway will be formed of a self-binding hoggin gravel, in a natural colour to reflect the informal / semi-natural setting.

Proposed hedgerows to be enhanced with supplementary planting to reinforce their function as wildlife corridors, and habitats of interest in their own right.

Site:	Land off Forest Road, **Onehouse**
Client:	Harris S.L (James Bailey Planning Ltd)
Ref:	5398 - Schedule of Accommodation (SoA)
Date:	26.08.2021

Market		
Plot Ref.	**Type**	**No.**
2.1	2b4p	3
3.1	3b5p (Bungalow)	2
3.2	3b5p	5
3.3	3b6p	2
4.1	4b6p	1
	TOTAL UNITS	**13**

65% Market Housing

Affordable		
Plot Ref.	**Type**	**No.**
AR1	1b2p	2
AR2	2b2p	2
SO2	2b4p	1
AR3	3b5p	1
SO3	3b5p	1
	TOTAL UNITS	**7**

35% Affordable Housing

TOTAL	**20**

SoA Glossary:

b - Bedroom
p - Person
AR - Affordable Rent
SO - Shared Ownership

Proposed new hedgerow and tree planting along southern boundary of the development, will improve connectivity for wildlife and will soften views of the development from vantage points further south. A gap will be left at the western end to retain views southwards to countryside.

1.8m high brick walls to boundaries of new homes which overlook the public realm will be detailed to create an interesting street scene.

Proposed housing set back from eastern boundary to retain farm access and the existing public footpath along current alignment. This will also help in mitigating the visual effects of the development on users of the footpath.

The proposals allow for the retention of the existing farm access along the development's eastern boundary.

N

0 10 20 m

EXISTING

- Application Site Boundary: **1.37ha**
- Existing Vegetation (Retained)
- Sustrans Route 51
- Public Footpath

- New Homes
- 20 Plot Number
- Parking Space & Number
- 3.1 House Type
- Visitor Parking **(0.25 per Total Dwellings)**
- 1 Vehicular, Pedestrian and Cycle Access
- 2 Farm Access
- Route of Farm Access to Field to South
- 3 Connection with Public Footpath
- Public Open Space, to include Benches
- Street Tree and Native Hedgerow Planting
- New native tree and wildflower planting
- 1.8m High Brick Walls **(Overlooking Key Public Realm Public or Open Space)**

PROPOSED

- 4 Children's Play Area
- 5 SuDS Basins **(to include micro-pools) and Swales**

Rev	Date	By	Description
C	27.08.21	JC	Updated Layout
B	02.08.21	JC	Amended SoA
A	30.07.21	JC	Updated to reflect Pre-App comments

Drawing Status
FOR PLANNING

CSA environmental

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Project	Land off Forest Road **ONEHOUSE**
Drawing Title	Illustrative Masterplan & Proving Layout
Client	Harris Strategic Land
Scale @ A2	1:500
Drawing No.	CSA/5398/107
Date	May 2021
Rev	C
Drawn	JC
Checked	RR

N

FOREST ROAD

BASIN 1

300 mm BUND MAY BE RE□UIRED IF 300 mm FREEBOARD ON THE 600 mm DEEP BASIN 2 IS RE□UIRED)

OUTFALL TO EXISTING DITCH T.B.C.

ATTENUATION FACILITIES
IMPERMEABLE AREA 0.44 ha
BASIN 1 VOLUME - 51m³
BASIN 1 STORAGE DEPTH - 0.6m
BASIN 2 VOLUME - 334m³
BASIN 2 DEPTH - 0.6m
BASIN SIDE SLOPES - 1 in 4
BLANKET STORAGE VOLUME - 89m³ (990 m² 0.3 m THICK□30 □ VOID)
OUTFALL RATE (□$_{BAR}$) - 2.7l/s/ha

KEY

- ATTENUATION BASIN
- SWALE□GRASSED FILTER DRAIN
- STORAGE BLANKET (0.3 m DEEP 30 □ VOID)
- DEBRIS FILTER
- ORIFICE CONTROL CHAMBER & OUTFALL

NOTES

REV	DESCRIPTION	DE	DR	CH	DATE
P02	REVISED TO SUIT NEW MASTERPLAN		DP		27/08/21
P01	CRATES REPLACED		□H		16/07/21

DESIGNED BY	DRAWN BY	CHECKED BY
-	DP	-

SCALE □ A1 SIZE
D.N.S.

DATE
13/05/2021

PRO□ECT TITLE
LAND OFF FOREST ROAD□ONEHOUSE

DRAWING TITLE
OUTLINE SURFACE WATER MANAGEMENT STRATEGY

CLIENT
HARRIS STRATEGIC LAND

CANNON CONSULTING ENGINEERS
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DRAWING NUMBER
ZC291 - PL - SK - 300

REV.
P02

M:\ZC291 Land off Forest Road Onehouse\3 PLANS,DRAWINGS\CURRENT DRGS\ZC291 - PL - SK - 300 - SW STRATEGY P02

Summary of Results for 30 year Return Period

Half Drain Time : 2929 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control Σ (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	99.508	0.108	0.0	0.4	0.4	80.6	O K
30 min Summer	99.539	0.139	0.0	0.5	0.5	104.3	O K
60 min Summer	99.569	0.169	0.0	0.6	0.6	128.6	O K
120 min Summer	99.604	0.204	0.0	0.6	0.6	157.9	O K
180 min Summer	99.624	0.224	0.0	0.6	0.6	174.1	O K
240 min Summer	99.636	0.236	0.0	0.7	0.7	184.7	O K
360 min Summer	99.651	0.251	0.0	0.7	0.7	197.3	O K
480 min Summer	99.659	0.259	0.0	0.7	0.7	204.3	O K
600 min Summer	99.664	0.264	0.0	0.7	0.7	208.6	O K
720 min Summer	99.667	0.267	0.0	0.7	0.7	211.2	O K
960 min Summer	99.670	0.270	0.0	0.7	0.7	213.6	O K
1440 min Summer	99.670	0.270	0.0	0.7	0.7	213.9	O K
2160 min Summer	99.665	0.265	0.0	0.7	0.7	209.4	O K
2880 min Summer	99.661	0.261	0.0	0.7	0.7	205.8	O K
4320 min Summer	99.657	0.257	0.0	0.7	0.7	202.6	O K
5760 min Summer	99.655	0.255	0.0	0.7	0.7	200.9	O K
7200 min Summer	99.654	0.254	0.0	0.7	0.7	199.8	O K
8640 min Summer	99.653	0.253	0.0	0.7	0.7	199.0	O K
10080 min Summer	99.652	0.252	0.0	0.7	0.7	198.5	O K
15 min Winter	99.508	0.108	0.0	0.4	0.4	80.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	77.440	0.0	32.7	23
30 min Summer	50.219	0.0	38.2	38
60 min Summer	31.059	0.0	77.3	68
120 min Summer	19.209	0.0	87.9	128
180 min Summer	14.224	0.0	93.1	188
240 min Summer	11.392	0.0	96.1	246
360 min Summer	8.223	0.0	99.3	366
480 min Summer	6.473	0.0	100.5	486
600 min Summer	5.358	0.0	100.9	606
720 min Summer	4.582	0.0	100.8	724
960 min Summer	3.569	0.0	99.5	964
1440 min Summer	2.511	0.0	95.4	1442
2160 min Summer	1.772	0.0	182.5	2056
2880 min Summer	1.391	0.0	179.2	2364
4320 min Summer	1.005	0.0	168.1	3112
5760 min Summer	0.808	0.0	299.9	3920
7200 min Summer	0.689	0.0	305.7	4760
8640 min Summer	0.608	0.0	305.9	5616
10080 min Summer	0.550	0.0	300.7	6448
15 min Winter	77.440	0.0	32.7	23

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	99.539	0.139	0.0	0.5	0.5	104.3	O K
60 min Winter	99.569	0.169	0.0	0.6	0.6	128.5	O K
120 min Winter	99.604	0.204	0.0	0.6	0.6	157.9	O K
180 min Winter	99.624	0.224	0.0	0.6	0.6	174.2	O K
240 min Winter	99.636	0.236	0.0	0.7	0.7	184.7	O K
360 min Winter	99.651	0.251	0.0	0.7	0.7	197.4	O K
480 min Winter	99.659	0.259	0.0	0.7	0.7	204.4	O K
600 min Winter	99.664	0.264	0.0	0.7	0.7	208.8	O K
720 min Winter	99.667	0.267	0.0	0.7	0.7	211.5	O K
960 min Winter	99.670	0.270	0.0	0.7	0.7	214.0	O K
1440 min Winter	99.671	0.271	0.0	0.7	0.7	214.6	O K
2160 min Winter	99.667	0.267	0.0	0.7	0.7	211.0	O K
2880 min Winter	99.661	0.261	0.0	0.7	0.7	205.9	O K
4320 min Winter	99.655	0.255	0.0	0.7	0.7	201.1	O K
5760 min Winter	99.651	0.251	0.0	0.7	0.7	197.1	O K
7200 min Winter	99.647	0.247	0.0	0.7	0.7	193.7	O K
8640 min Winter	99.643	0.243	0.0	0.7	0.7	190.5	O K
10080 min Winter	99.640	0.240	0.0	0.7	0.7	187.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	50.219	0.0	38.2	38
60 min Winter	31.059	0.0	77.3	68
120 min Winter	19.209	0.0	87.9	126
180 min Winter	14.224	0.0	93.1	184
240 min Winter	11.392	0.0	96.2	244
360 min Winter	8.223	0.0	99.3	362
480 min Winter	6.473	0.0	100.6	478
600 min Winter	5.358	0.0	101.0	596
720 min Winter	4.582	0.0	100.9	712
960 min Winter	3.569	0.0	99.7	944
1440 min Winter	2.511	0.0	95.6	1400
2160 min Winter	1.772	0.0	182.7	2056
2880 min Winter	1.391	0.0	179.5	2624
4320 min Winter	1.005	0.0	168.6	3284
5760 min Winter	0.808	0.0	300.1	4208
7200 min Winter	0.689	0.0	306.1	5112
8640 min Winter	0.608	0.0	306.5	5976
10080 min Winter	0.550	0.0	301.6	6864

Rainfall Details

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	2013
Site Location	GB 602700 258600 TM 02700 58600
Data Type	Catchment
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.950
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.440

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.220	4	8	0.220

Model Details

Storage is Online Cover Level (m) 100.000

Note that cover level is for modelling purposes to avoid understimating storage - ground levels may be higher throughout the system

Complex Structure

Infiltration Blanket

Infiltration Coefficient Base (m/hr) 0.00000 Diameter/Width (m) 10.0
Safety Factor 2.0 Length (m) 90.0
Porosity 0.30 Cap Volume Depth (m) 0.300
Invert Level (m) 99.400

Tank or Pond

Invert Level (m) 99.400

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	412.0	0.600	700.0

Tank or Pond

Invert Level (m) 99.400

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	32.0	0.600	147.0

Orifice Outflow Control

Diameter (m) 0.026 Discharge Coefficient 0.600 Invert Level (m) 99.400

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

Half Drain Time : 4052 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	99.589	0.189	0.0	0.6	0.6	145.3	O K
30 min Summer	99.643	0.243	0.0	0.7	0.7	190.5	O K
60 min Summer	99.695	0.295	0.0	0.7	0.7	236.4	O K
120 min Summer	99.776	0.376	0.0	0.8	0.8	289.9	Flood Risk
180 min Summer	99.824	0.424	0.0	0.9	0.9	323.2	Flood Risk
240 min Summer	99.856	0.456	0.0	0.9	0.9	346.3	Flood Risk
360 min Summer	99.895	0.495	0.0	1.0	1.0	375.5	Flood Risk
480 min Summer	99.917	0.517	0.0	1.0	1.0	393.0	Flood Risk
600 min Summer	99.932	0.532	0.0	1.0	1.0	404.2	Flood Risk
720 min Summer	99.941	0.541	0.0	1.0	1.0	411.6	Flood Risk
960 min Summer	99.950	0.550	0.0	1.0	1.0	419.3	Flood Risk
1440 min Summer	99.955	0.555	0.0	1.0	1.0	422.8	Flood Risk
2160 min Summer	99.946	0.546	0.0	1.0	1.0	415.5	Flood Risk
2880 min Summer	99.931	0.531	0.0	1.0	1.0	404.1	Flood Risk
4320 min Summer	99.911	0.511	0.0	1.0	1.0	388.3	Flood Risk
5760 min Summer	99.898	0.498	0.0	1.0	1.0	378.0	Flood Risk
7200 min Summer	99.890	0.490	0.0	1.0	1.0	371.6	Flood Risk
8640 min Summer	99.883	0.483	0.0	1.0	1.0	366.8	Flood Risk
10080 min Summer	99.879	0.479	0.0	1.0	1.0	363.3	Flood Risk
15 min Winter	99.589	0.189	0.0	0.6	0.6	145.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	139.440	0.0	46.4	23
30 min Summer	91.560	0.0	53.7	38
60 min Summer	56.980	0.0	111.9	68
120 min Summer	35.140	0.0	125.6	128
180 min Summer	26.257	0.0	133.6	188
240 min Summer	21.210	0.0	138.9	248
360 min Summer	15.493	0.0	144.9	366
480 min Summer	12.285	0.0	147.7	486
600 min Summer	10.209	0.0	148.8	606
720 min Summer	8.750	0.0	148.8	726
960 min Summer	6.821	0.0	147.2	964
1440 min Summer	4.772	0.0	140.6	1444
2160 min Summer	3.320	0.0	274.7	2160
2880 min Summer	2.570	0.0	266.9	2744
4320 min Summer	1.806	0.0	245.5	3416
5760 min Summer	1.417	0.0	464.8	4152
7200 min Summer	1.186	0.0	458.9	4968
8640 min Summer	1.031	0.0	448.5	5792
10080 min Summer	0.921	0.0	433.7	6648
15 min Winter	139.440	0.0	46.4	23

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	99.643	0.243	0.0	0.7	0.7	190.5	O K
60 min Winter	99.695	0.295	0.0	0.7	0.7	236.4	O K
120 min Winter	99.776	0.376	0.0	0.9	0.9	290.0	Flood Risk
180 min Winter	99.824	0.424	0.0	0.9	0.9	323.3	Flood Risk
240 min Winter	99.856	0.456	0.0	0.9	0.9	346.4	Flood Risk
360 min Winter	99.895	0.495	0.0	1.0	1.0	375.7	Flood Risk
480 min Winter	99.918	0.518	0.0	1.0	1.0	393.3	Flood Risk
600 min Winter	99.932	0.532	0.0	1.0	1.0	404.5	Flood Risk
720 min Winter	99.941	0.541	0.0	1.0	1.0	411.9	Flood Risk
960 min Winter	99.951	0.551	0.0	1.0	1.0	419.9	Flood Risk
1440 min Winter	99.956	0.556	0.0	1.0	1.0	423.8	Flood Risk
2160 min Winter	99.948	0.548	0.0	1.0	1.0	417.6	Flood Risk
2880 min Winter	99.936	0.536	0.0	1.0	1.0	407.5	Flood Risk
4320 min Winter	99.911	0.511	0.0	1.0	1.0	388.1	Flood Risk
5760 min Winter	99.895	0.495	0.0	1.0	1.0	375.9	Flood Risk
7200 min Winter	99.883	0.483	0.0	1.0	1.0	366.5	Flood Risk
8640 min Winter	99.872	0.472	0.0	1.0	1.0	358.6	Flood Risk
10080 min Winter	99.863	0.463	0.0	0.9	0.9	351.8	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	91.560	0.0	53.7	38
60 min Winter	56.980	0.0	111.9	68
120 min Winter	35.140	0.0	125.6	126
180 min Winter	26.257	0.0	133.6	184
240 min Winter	21.210	0.0	138.9	244
360 min Winter	15.493	0.0	144.9	362
480 min Winter	12.285	0.0	147.8	480
600 min Winter	10.209	0.0	148.8	598
720 min Winter	8.750	0.0	148.9	716
960 min Winter	6.821	0.0	147.2	950
1440 min Winter	4.772	0.0	140.7	1414
2160 min Winter	3.320	0.0	274.8	2096
2880 min Winter	2.570	0.0	267.0	2740
4320 min Winter	1.806	0.0	245.8	3464
5760 min Winter	1.418	0.0	465.0	4376
7200 min Winter	1.186	0.0	459.3	5264
8640 min Winter	1.031	0.0	449.0	6224
10080 min Winter	0.921	0.0	434.4	7064

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 602700 258600 TM 02700 58600
Data Type	Catchment
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.950
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.440

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.220	4	8	0.220

Model Details

Storage is Online Cover Level (m) 100.000

Note that cover level is for modelling purposes to avoid understimating storage - ground levels may be higher throughout the system

Complex Structure

Tank or Pond

Invert Level (m) 99.400

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	32.0	0.600	147.0

Tank or Pond

Invert Level (m) 99.400

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	412.0	0.600	700.0

Infiltration Blanket

Infiltration Coefficient Base (m/hr) 0.00000 Diameter/Width (m) 10.0
Safety Factor 2.0 Length (m) 90.0
Porosity 0.30 Cap Volume Depth (m) 0.300
Invert Level (m) 99.400

Orifice Outflow Control

Diameter (m) 0.026 Discharge Coefficient 0.600 Invert Level (m) 99.400

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

Half Drain Time : 4170 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	99.598	0.198	0.0	0.6	0.6	152.5	O K
30 min Summer	99.654	0.254	0.0	0.7	0.7	200.0	O K
60 min Summer	99.712	0.312	0.0	0.8	0.8	248.2	Flood Risk
120 min Summer	99.797	0.397	0.0	0.9	0.9	304.5	Flood Risk
180 min Summer	99.846	0.446	0.0	0.9	0.9	339.5	Flood Risk
240 min Summer	99.879	0.479	0.0	1.0	1.0	363.8	Flood Risk
360 min Summer	99.919	0.519	0.0	1.0	1.0	394.6	Flood Risk
480 min Summer	99.943	0.543	0.0	1.0	1.0	413.1	Flood Risk
600 min Summer	99.957	0.557	0.0	1.0	1.0	424.9	Flood Risk
720 min Summer	99.967	0.567	0.0	1.1	1.1	432.8	Flood Risk
960 min Summer	99.977	0.577	0.0	1.1	1.1	441.1	Flood Risk
1440 min Summer	99.982	0.582	0.0	1.1	1.1	445.2	Flood Risk
2160 min Summer	99.974	0.574	0.0	1.1	1.1	438.2	Flood Risk
2880 min Summer	99.959	0.559	0.0	1.0	1.0	426.7	Flood Risk
4320 min Summer	99.939	0.539	0.0	1.0	1.0	410.0	Flood Risk
5760 min Summer	99.925	0.525	0.0	1.0	1.0	399.3	Flood Risk
7200 min Summer	99.917	0.517	0.0	1.0	1.0	392.9	Flood Risk
8640 min Summer	99.911	0.511	0.0	1.0	1.0	388.1	Flood Risk
10080 min Summer	99.907	0.507	0.0	1.0	1.0	384.6	Flood Risk
15 min Winter	99.598	0.198	0.0	0.6	0.6	152.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	139.440	0.0	47.7	23
30 min Summer	91.560	0.0	55.1	38
60 min Summer	56.980	0.0	115.1	68
120 min Summer	35.140	0.0	129.3	128
180 min Summer	26.257	0.0	137.7	188
240 min Summer	21.210	0.0	143.2	248
360 min Summer	15.493	0.0	149.4	366
480 min Summer	12.285	0.0	152.1	486
600 min Summer	10.209	0.0	153.1	606
720 min Summer	8.750	0.0	153.1	726
960 min Summer	6.821	0.0	151.3	964
1440 min Summer	4.772	0.0	144.5	1444
2160 min Summer	3.320	0.0	283.5	2160
2880 min Summer	2.570	0.0	275.3	2800
4320 min Summer	1.806	0.0	253.0	3420
5760 min Summer	1.417	0.0	481.5	4160
7200 min Summer	1.186	0.0	475.1	4976
8640 min Summer	1.031	0.0	464.2	5800
10080 min Summer	0.921	0.0	448.8	6656
15 min Winter	139.440	0.0	47.7	23

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	99.654	0.254	0.0	0.7	0.7	200.0	O K
60 min Winter	99.712	0.312	0.0	0.8	0.8	248.2	Flood Risk
120 min Winter	99.797	0.397	0.0	0.9	0.9	304.5	Flood Risk
180 min Winter	99.847	0.447	0.0	0.9	0.9	339.6	Flood Risk
240 min Winter	99.879	0.479	0.0	1.0	1.0	363.9	Flood Risk
360 min Winter	99.920	0.520	0.0	1.0	1.0	394.8	Flood Risk
480 min Winter	99.943	0.543	0.0	1.0	1.0	413.3	Flood Risk
600 min Winter	99.958	0.558	0.0	1.0	1.0	425.2	Flood Risk
720 min Winter	99.967	0.567	0.0	1.1	1.1	433.1	Flood Risk
960 min Winter	99.978	0.578	0.0	1.1	1.1	441.7	Flood Risk
1440 min Winter	99.983	0.583	0.0	1.1	1.1	446.2	Flood Risk
2160 min Winter	99.976	0.576	0.0	1.1	1.1	440.3	Flood Risk
2880 min Winter	99.964	0.564	0.0	1.0	1.0	430.2	Flood Risk
4320 min Winter	99.939	0.539	0.0	1.0	1.0	409.9	Flood Risk
5760 min Winter	99.923	0.523	0.0	1.0	1.0	397.4	Flood Risk
7200 min Winter	99.911	0.511	0.0	1.0	1.0	387.9	Flood Risk
8640 min Winter	99.900	0.500	0.0	1.0	1.0	379.9	Flood Risk
10080 min Winter	99.892	0.492	0.0	1.0	1.0	373.1	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	91.560	0.0	55.1	38
60 min Winter	56.980	0.0	115.1	68
120 min Winter	35.140	0.0	129.3	126
180 min Winter	26.257	0.0	137.7	184
240 min Winter	21.210	0.0	143.2	244
360 min Winter	15.493	0.0	149.4	362
480 min Winter	12.285	0.0	152.2	480
600 min Winter	10.209	0.0	153.2	598
720 min Winter	8.750	0.0	153.1	716
960 min Winter	6.821	0.0	151.4	950
1440 min Winter	4.772	0.0	144.6	1414
2160 min Winter	3.320	0.0	283.6	2096
2880 min Winter	2.570	0.0	275.4	2740
4320 min Winter	1.806	0.0	253.3	3504
5760 min Winter	1.418	0.0	481.8	4384
7200 min Winter	1.186	0.0	475.5	5328
8640 min Winter	1.031	0.0	464.7	6224
10080 min Winter	0.921	0.0	449.6	7152

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 602700 258600 TM 02700 58600
Data Type	Catchment
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.950
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.462

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.232	4	8	0.230

Model Details

Storage is Online Cover Level (m) 100.000

Note that cover level is for modelling purposes to avoid understimating storage - ground levels may be higher throughout the system

Complex Structure

Infiltration Blanket

Infiltration Coefficient Base (m/hr) 0.00000 Diameter/Width (m) 10.0
Safety Factor 2.0 Length (m) 90.0
Porosity 0.30 Cap Volume Depth (m) 0.300
Invert Level (m) 99.400

Tank or Pond

Invert Level (m) 99.400

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	412.0	0.600	700.0

Tank or Pond

Invert Level (m) 99.400

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	32.0	0.600	147.0

Orifice Outflow Control

Diameter (m) 0.026 Discharge Coefficient 0.600 Invert Level (m) 99.400

Basin Maintenance

Maintenance schedule	Required action	Frequency
Regular maintenance	Removal of litter and debris	Monthly
	Cut grass	Half yearly
	Manage other vegetation	Monthly then as required
	Inspect and clear inlets, outlets, overflows etc	Monthly
	Inspect and repair banks, pipes, headwalls etc	Monthly
	Inspect inlets and basin for silt accumulation	Monthly until able to establish the required silt removal frequency, then in accordance with established frequency
	Manage vegetation in wetter areas (micro-pools etc)	Annually or as established by ecologist/landscape architect
	Tidy dead growth	Annually (as per growing season)
	Remove sediment from traps, forebays etc	Annually
Occasional maintenance	Reseed	As required.
	Prune adjacent trees	Every 2 years, or as otherwise advised
	Silt removal	Every 5 years (depending on the requirement for regular maintenance)
Remedial actions	Repair erosion or other damage	As required
	Repair inlets, outlets and overflows	As required

(Based on advice in CIRIA C753)

Infiltration Blanket/Trench

Maintenance schedule	Required action	Frequency
	Inspect traps/chambers for sediment accumulation and remove	Six monthly, until a pattern of accumulation is established, then as required
	Remove sediment from traps	Annually/as required
Remedial actions	Repair/replace inlets	As required.
Occasional Maintenance	Check inlets functioning as intended	Annually
	Check for root ingress to blanket/trench and trim as necessary (in accordance with appropriate guidance on vegetation management)	Annually or less frequently depending on proximity and type of planting

(Based on advice in CIRIA C753)

Filter Drain Maintenance

Maintenance schedule	Required action	Frequency
Regular maintenance	Litter and debris removal	Monthly, as required
	Inspect surface, inlet and outlets and controls for waterlogging/pooling, silt build up/clogs, and damage	Monthly
	Inspect pre-treatment systems, inlets, perforated pipes for silt (to establish the required silt removal regime)	6 monthly
	Remove silt	6 monthly or as required (see above)
Remedial actions	Remove/control tree roots should they threaten the filter drain	As required.
	Replace and/or clean geotextiles, stone filter layer from areas which demonstrate high pollution loads	Five yearly, or as required (established via inspection).
	Clear perforated pipes of any blockages	As required.

(Based on advice in CIRIA C753)