Project Name:	Land South of Holt Road, Horsford
Document Reference:	1009.5004/STN/3
Document Name:	Flood Risk and Drainage Technical Note
Prepared By:	Jake Little (March 2026)
Checked By:	David Pearson (March 2026)
Approved By:	Jon Soar (March 2026)

Revision Record				
Rev	Date	By	Summary of Changes	Aprvd
1	26.03.2026	DP	First Issue	JS
2	31.03.2026	DP	Revised to suit comments	JS
3	07.09.2026	JS	Commentary on infiltration potential added and foul drainage options outlined.	DP

Disclaimer

This document has been prepared in accordance with the scope of Paul Basham Associates Ltd's appointment with its client and is subject to the terms of that appointment. It is addressed to and for the sole use and reliance of Paul Basham Associates clients. Paul Basham Associates accepts no liability for any use of this document other than by its client and only for the purposes, stated in the document, for which it was prepared and provided. No person other than the client may copy (in whole or in part), use or rely on the contents of this document, without the prior written permission of a Director of Paul Basham Associates. Any advice, opinions, or recommendations within this document should be read and relied upon only in the context of the document as a whole. The contents of this document are not to be construed as providing legal, business or tax advice or opinion.

© Paul Basham Associates Limited

1. INTRODUCTION

1.1 This Technical Note has been prepared by Paul Basham Associates on behalf of Endurance Estates Land Promotion Ltd to outline the flood risk and drainage work undertaken to date as it relates to Land South of Holt Road, Horsford and to confirm the suitability for the site for sports use from a flood risk and drainage perspective. The site forms a draft allocation in the emerging Horsford Neighbourhood Plan (Regulation 14 Version October 2025), under Policy SS2A, for a Sports Hub with sports pitches a clubhouse and parking on site.

1.2 The plot size is approximately 10.78ha and the land is currently an open arable field of agricultural use.



***Figure 1**: Site Location Plan*

1.3 The proposed development is located south of Holt Road, Horsford, and is indicated by the red line boundary demonstrated within **Figure 1**. The nearest postcode is NR10 3AG.

1.4 Development proposals are for a Sports Hub with sports pitches, a clubhouse and parking on site.

1.5 Following this introduction, this technical note is structured as follows:

- **Chapter 2 Horsford Neighbourhood Plan Regulation 14**: outlines the relevant drainage and flood risk comments from the Lead Local Flood Authority
- **Chapter 3 Site Conditions**: provides a summary of the existing ground and soil conditions
- **Chapter 4 Flood Risk**: provides a summary of the on site flood risks with climate change
- **Chapter 5 Surface Water Drainage**: Outlines the possible surface water drainage solutions for the development
- **Chapter 6 Foul Water Drainage**: summarises our findings in this technical note
- **Chapter 7 Summary and Conclusions**: summarises our findings in this technical note
- **Appendix A** - BGS Infiltration SuDS GeoReport.

2. HORSFORD NEIGHBOURHOOD PLAN REGULATION 14

2.1 Land East of the Village Centre is identified in the Horsford Neighbourhood Plan Regulation 14 version under Policy SS2A and as shown in **Figure 2**.

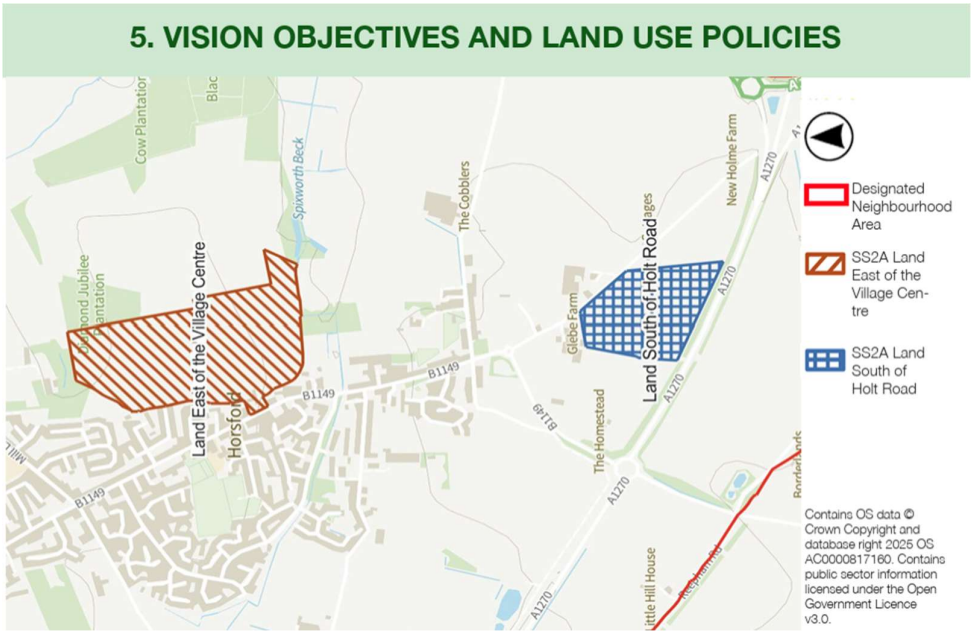


Figure 2: Extract from Horsford Neighbourhood Plan Regulation 14

2.2 Norfolk County Council LLFA provided comments on the Horsford Neighbourhood Plan (Reg 14) document dated 27th November 2025. The main comments raised were:

- *Whilst the LLFA notes the Regulation 14 document states that policies have only been included where they are not already covered in other Development Plan documents, however the LLFA would welcome references be included (either as part of existing relevant policies or within a dedicated policy), to the importance of the consideration of flood risk from all sources when considering the acceptability of new developments, along with highlighting the benefits of the inclusion of Sustainable Drainage Systems (SuDS) within development proposals. Given that the Parish of Horsford also has an Environment Agency Main River (Spixworth Beck) passing through it, areas covered by Flood Zones 2 and 3 and a number of Ordinary Watercourses, reference to these along with the inclusion of mapping identifying the location of these features would also be welcomed.*
- *3.13 We would expect that the Neighbourhood Planning Process provide a robust assessment of the risk of flooding, from all sources, when allocating sites. Whilst the LLFA note that 2 no. housing allocation sites (as part of wider mixed-use development schemes) have been included as part of the Horsford Neighbourhood Plan under Policy SS2A: New Developments, and it is noted by the LLFA that these sites formed part of a number of sites for part of the Call for Sites consultation, it is not evident to the LLFA the extent to which*

this has been undertaken in respect of these two site allocations (and whether this has been based on the most up to date mapping). If a risk of flooding is identified then a sequential test, and exception test where required, should be undertaken. This would be in line with Planning Practice Guidance to ensure that new development is steered to the lowest areas of flood risk. However, any allocated sites will also still be required to provide a flood risk assessment and/or drainage strategy through the development management planning process.

2.3 This technical note provides further information regarding the flood risk for the development and also gives an indication on the possibilities for the proposed drainage strategy.

3. SITE GROUND CONDITIONS

3.1 Lidar data has been downloaded from DEFRA and shows that the site slopes from west to east across the site. The highest point is approximately 38.00m AOD in the west and the lowest point of the site is 33.00m AOD in the east.

3.2 The nearest watercourse is the Spixworth Beck which is approximately 1.1km north of the site. The Spixworth Beck is a main river and tributary of the River Bure.

3.3 A review of the British Geological Survey (BGS) mapping shows that the proposed development is underlain by bedrock Wroxham Crag Formation- Sand and gravel shown in **Figure 3** below.

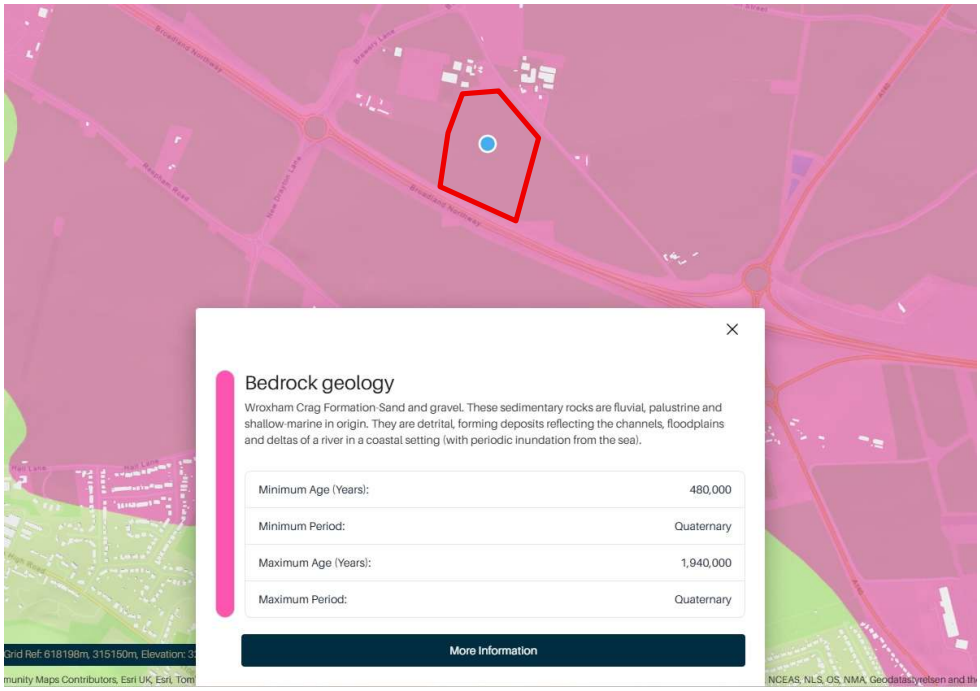


Figure 3: BGS Mapping Extract- Bedrock **Geology**

3.4 A review of the British Geological Survey (BGS) mapping shows that the proposed development is underlain by Sheringham Cliff Formation – sand and gravel shown in **Figure 4** below.

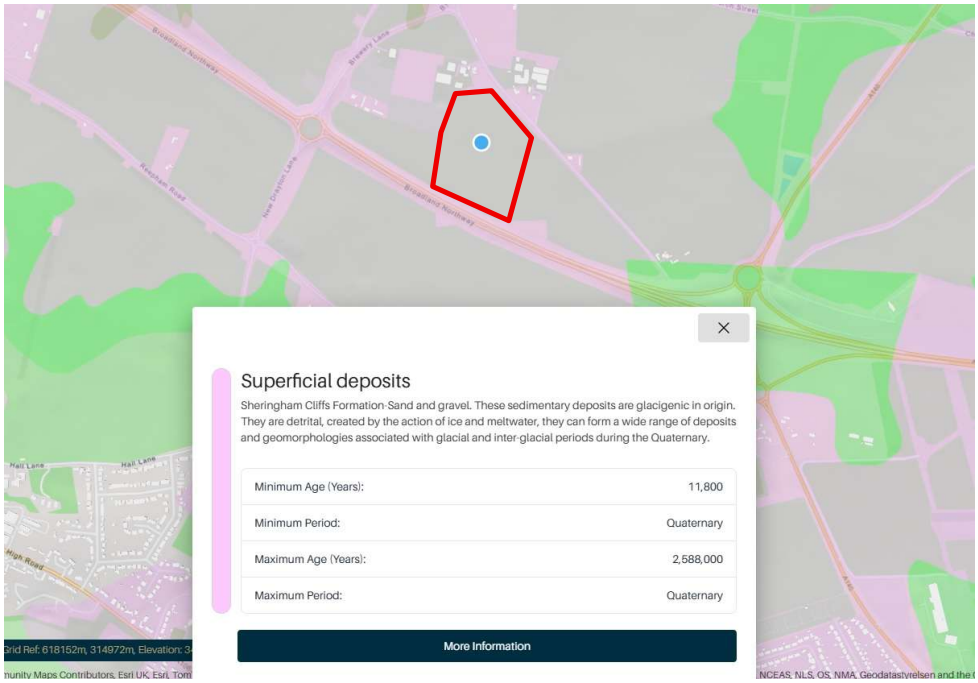


Figure 4: BGS Mapping Extract – Superficial Deposits

3.5 The British Geological Survey (BGS) mapping presents information on the nearest boreholes in and around the site. Borehole TG11SE253, located along the southwest border of the site, indicates predominantly sand and gravel deposits to approximately 7.0–8.0m bgl, becoming silty sand and firm silty sandy clay below approximately 9.0m bgl. Occasional shell fragments are present within the sandy strata, indicating possible marine deposits consistent with regional geology mapped by the British Geological Survey. See in **Figure 5** below.

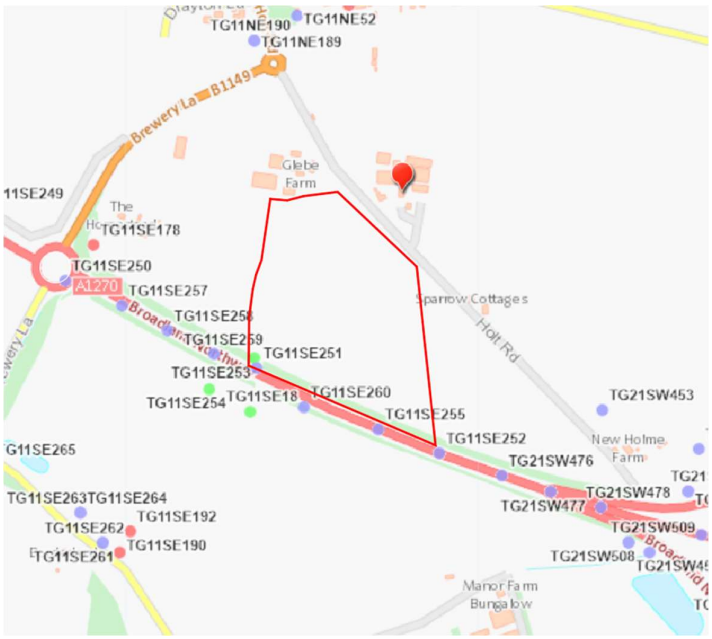


Figure 5: BGS Borehole Mapping

3.6 DEFRA's magic map indicates that the site falls within a Source Protection Zone, Zone III – total catchment, as seen in **Figure 6** below.

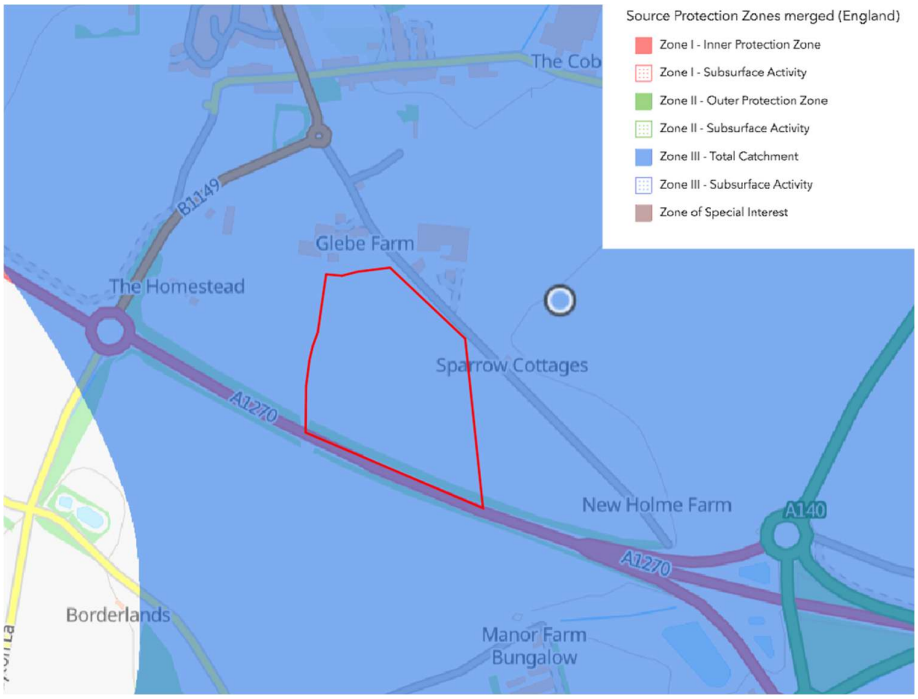


Figure 6: Source protection zones

4. FLOOD RISK

Fluvial flooding

4.1 DEFRA's map for flood risk from Rivers and Seas indicates the proposed site lies outside areas at risk of flooding. This is seen in **Figure 7** below. This means the fluvial flood risk to the development is considered to be very low.

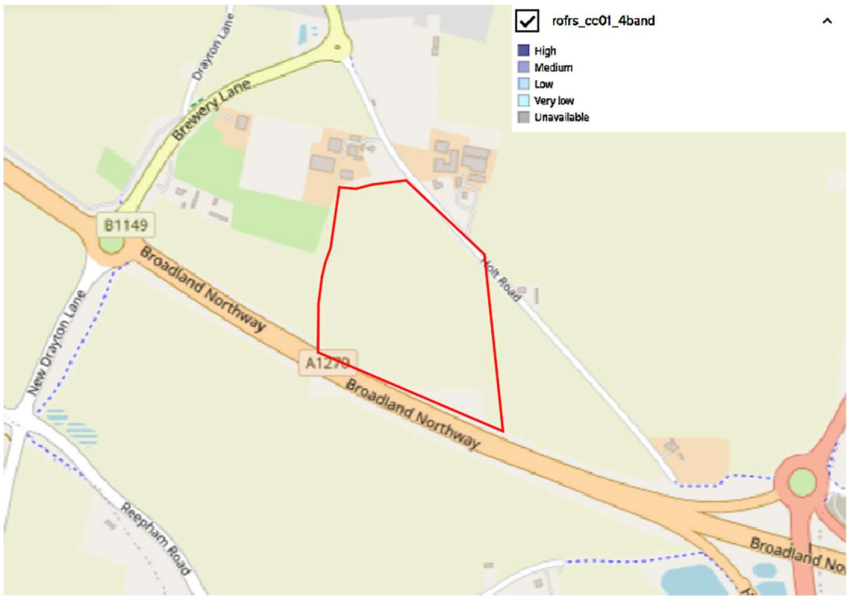


Figure 7:Flood risk from Rivers and Seas

Surace water flooding

4.2 DEFRA's map for flood risk from surface water indicates the majority of the site lies outside areas at risk of flooding. Small localised and isolated pockets of flood risk are identified. This is seen in **Figure 8** below.

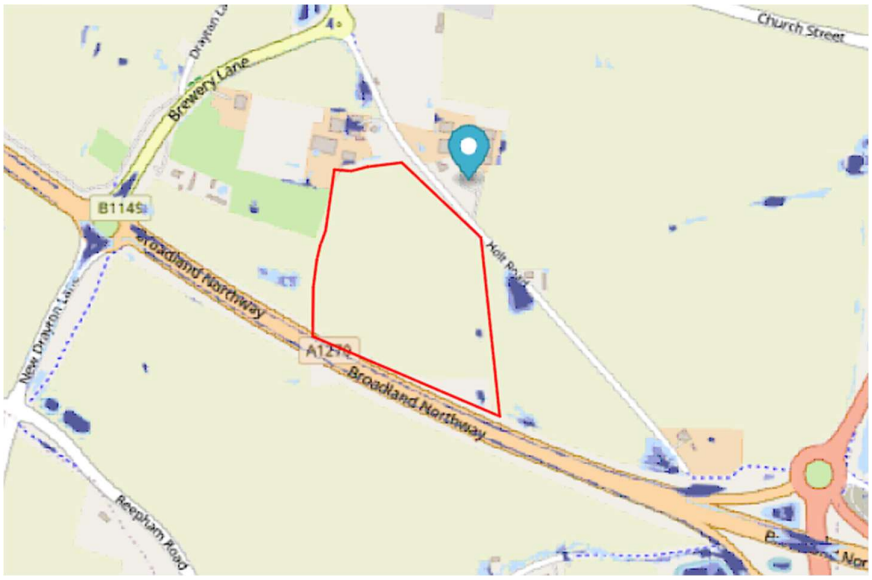


Figure 8: Flood risk from surface water

Surface water flooding – Mitigation Measures and Considerations

4.3 Isolated areas of surface water flooding are encountered but determined to be localised run-off occurring within the site boundary. These areas will be mitigated through the drainage design to serve the proposed development.

Surface water flooding – Residual Risk

4.4 Based on the above information, the site is considered to be very low risk of flooding from surface water.

Reservoir flooding

4.5 The EA's long-term flood risk mapping for flooding due to reservoirs indicates that the site (outlined in red) is not considered to be at risk from reservoir flooding. This is shown in **Figure 9**.

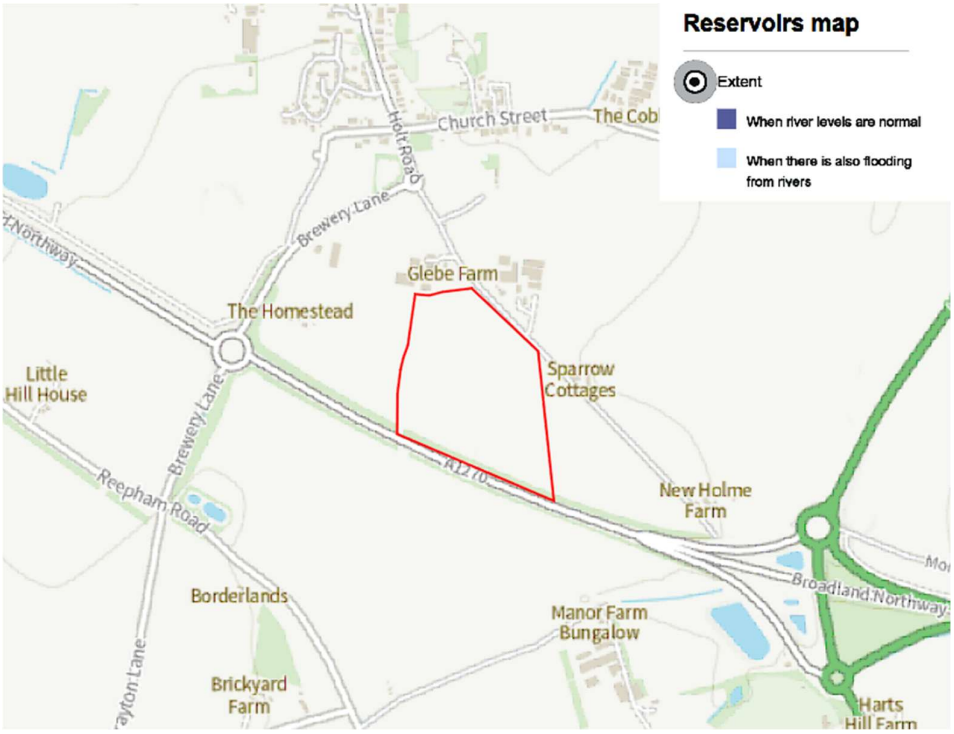


Figure 9: flood risk from reservoirs

Groundwater flooding

4.6 The government's long term Flood Risk page indicates the site is at no risk of flooding due to groundwater, seen in **Figure 10** below.

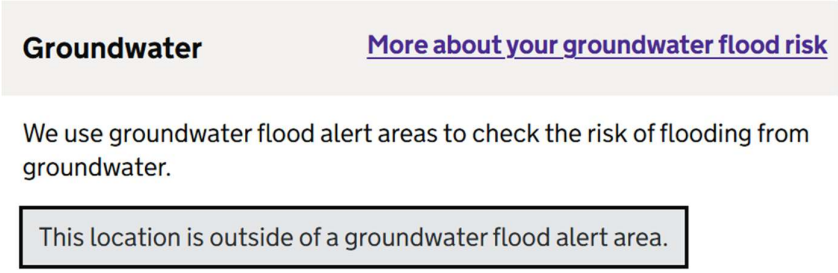


Figure 10: flood risk from groundwater

5. SURFACE WATER DRAINAGE

Sustainable drainage principles

5.1 Sustainable drainage systems (SuDS) are designed to manage storm water as close to its source as possible to mimic natural drainage arrangements and where possible, encourage its infiltration, attenuation and passive treatment. SuDS should be designed to both manage the flood and pollution risks resulting from urban runoff and to contribute wherever possible to environmental enhancement and place making. With this in mind, the multi-functionality and multiple benefits of SuDS should always be considered. There are four pillars of SuDS that should consider the delivery of multiple benefits through design. These are as defined by Figure *11* below.

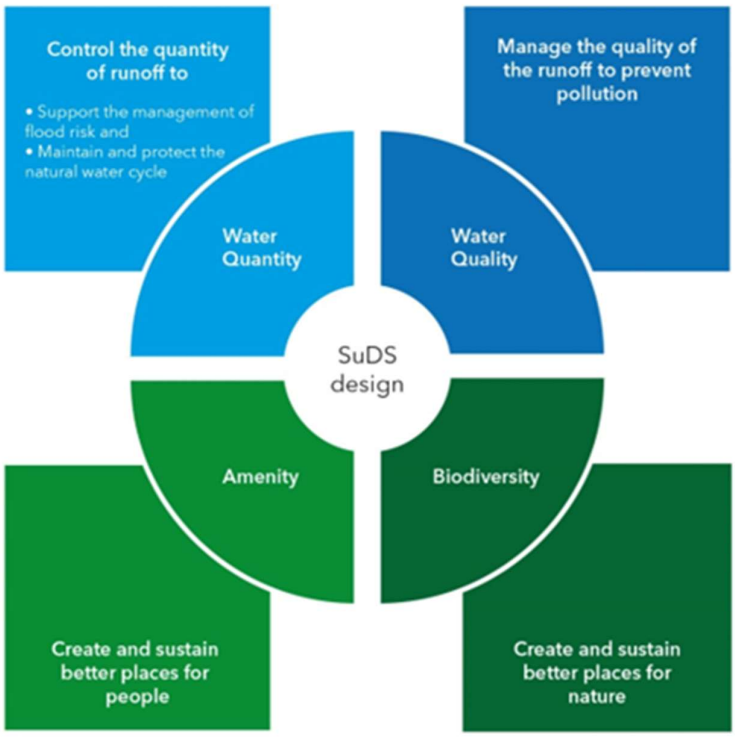


Figure 11: The four pillars of SuDS

5.2 Runoff from development should be discharged to the final destinations in accordance with the National Standards for sustainable drainage systems (NSS) to the hierarchy in order of preference:

- priority 1: collected for non-potable use
- priority 2: infiltrated to ground
- priority 3: discharged to an above ground surface water body
- priority 4: discharged to a surface water sewer, or other piped surface water drainage system
- priority 5: discharged to a combined sewer

5.3 A rainwater harvesting system should be considered for greywater reuse in any associated communal use pavilion building that may be proposed. This may be needed within a planning application to satisfy priority 1 of the National Standards.

SuDS features and disposal

5.4 SuDS principles must be applied for the control, management and storage of all design rainfall events including making allowance for climate change. They should also be used to convey flows towards a point of outfall(s) from the site, prioritising infiltration for disposal where it proves feasible.

5.5 The recommended rate to be considered viable for infiltration should exceed a measured rate of 10mm/hr (2.78 x10^{-6}m/s) in accordance with the recommendation of Norfolk CC's LLFA Guidance Document.

5.6 A BGS Infiltration SuDS GeoReport has been commissioned to support review of the viability for infiltration and indication of potential for groundwater flooding prior to site specific intrusive winter groundwater monitoring. On review of the report we can advise that groundwater is likely to be more than 5.0m below ground level. The report is included in **Appendix A**.

5.7 The BGS Infiltration SuDS GeoReport has indicated that the Superficial deposits permeability ranges from High – Very High on site and is likely to be free draining. The site is highly compatible for infiltration SuDS.

5.8 The BGS Infiltration SuDS GeoReport has indicated the Bedrock deposits permeability ranges from High – Very High on site and is likely to be free draining.

5.9 These findings establish infiltration should be used for the disposal of all surface water runoff but infiltration tests will be required to support the detailed design. Additionally, a regime of winter groundwater monitoring will be required to demonstrate appropriate clearance from the base of infiltration devices to protect receiving groundwaters.

5.10 Given the naturally occurring soil type, infiltration coefficients can be anticipated within the range of 3.0 x 10^{-4} – 1.0 x 10^{-5} m/s. This will need to be confirmed by intrusive investigation for compliant tests in accordance with BRE Digest 365 but is expected to be substantially quicker than the recognised cutoff by Norfolk CC's design guide of 2.7 x 10^{-6} m/s, so all surface water should be disposed via infiltration preventing any runoff from leaving the site.

5.11 Sports pitch drainage would benefit from the naturally occurring high infiltration potential and would be free draining.

6. FOUL WATER DRAINAGE

6.1 The site is greenfield arable land use with no sewers on the site.

6.2 Search of utility records show there is no public sewer within the immediate vicinity of site that would serve the development.

6.3 In order to communicate wastewater flows from the development to the public sewer, the proposed development would have two options:

- A public sewer could be requisitioned under section 98 of the Water Industry Act 1991 for the Water Authority to deliver a public sewer up to the site boundary. This option would be subject to design make a gravity connection.
- Alternatively, a pumped outfall may be required where levels would preclude draining the site by gravity. A rising main to be laid within the public highway would be required to communicate flows and be subject to an application under section 104 of the Water Industry Act 1991 for the Water Authority to adopt.

6.4 Should a pump station be required it would need to be sited close to the site access to minimise the route of rising main leaving the site and facilitate unrestricted maintenance access. Design of the pump station would have to meet Anglia Water's specific pump station design criteria, including provision of emergency storage capacity within the wet well.

Infiltration for disposal

6.5 The identified infiltration parameters above are highly likely to prove conducive to infiltration for disposal of treated wastewater from the development, subject to satisfying the Environment Agency's criteria. Intrusive investigations for compliant tests with Approved Document H : Drainage and waste disposal will separately be required to determine this.

6.6 A field drainage solution for disposal of wastewater would be possible in conjunction with a package sewage treatment plant (STP). The STP would require power and routine maintenance and remain in private ownership for its lifetime.

6.7 The drainage field arrangement would need appropriate space on the site away from buildings, structures and populated spaces e.g. sports pitches, and be sited sufficiently clear of any other infiltration devices but could suitably dispose of treated wastewater.

6.8 Flows and loads would need to be calculated based on the anticipated usage for demonstration of compliance with the Environment Agency's general binding rules (GBR). Were loads to exceed the GBR criteria, a bespoke Environmental Permit may be required.

7. SUMMARY AND CONCLUSION

7.1 This Technical Note has been prepared by Paul Basham Associates on behalf of Endurance Estates Land Promotion Ltd to outline the flood risk and drainage work undertaken to date as it relates to Land South of Holt Road, Horsford and to confirm the suitability for the site for sports use from a flood risk and drainage perspective. The site forms a draft allocation in the emerging Horsford Neighbourhood Plan (Regulation 14 Version October 2025), under Policy SS2A, for a Sports Hub with sports pitches a clubhouse and parking on site.

7.2 The site falls wholly within Flood Zone 1.

7.3 The proposed site has a design lifetime of 70 years. As such, flood risk has been assessed up to 2130.

7.4 Residual flood risk from:

- Fluvial flooding is considered to be very low
- Reservoir flooding is considered to be very low
- Surface water flooding is considered to be very low
- Groundwater flooding is considered to be very low

7.5 The BGS Infiltration SuDS GeoReport has indicated that infiltration should be used for the disposal of all surface water runoff from the development.

7.6 From review of the information as summarised above development proposals can be delivered with no increase to flood risk on or off site. The suggested sports hub development is considered suitable from a flood risk perspective.

Appendix A

GeoReports

British Geological Survey

Paul Basham Associates
The Bothy
Cams Hall Estate
Fareham
PO16 8UT

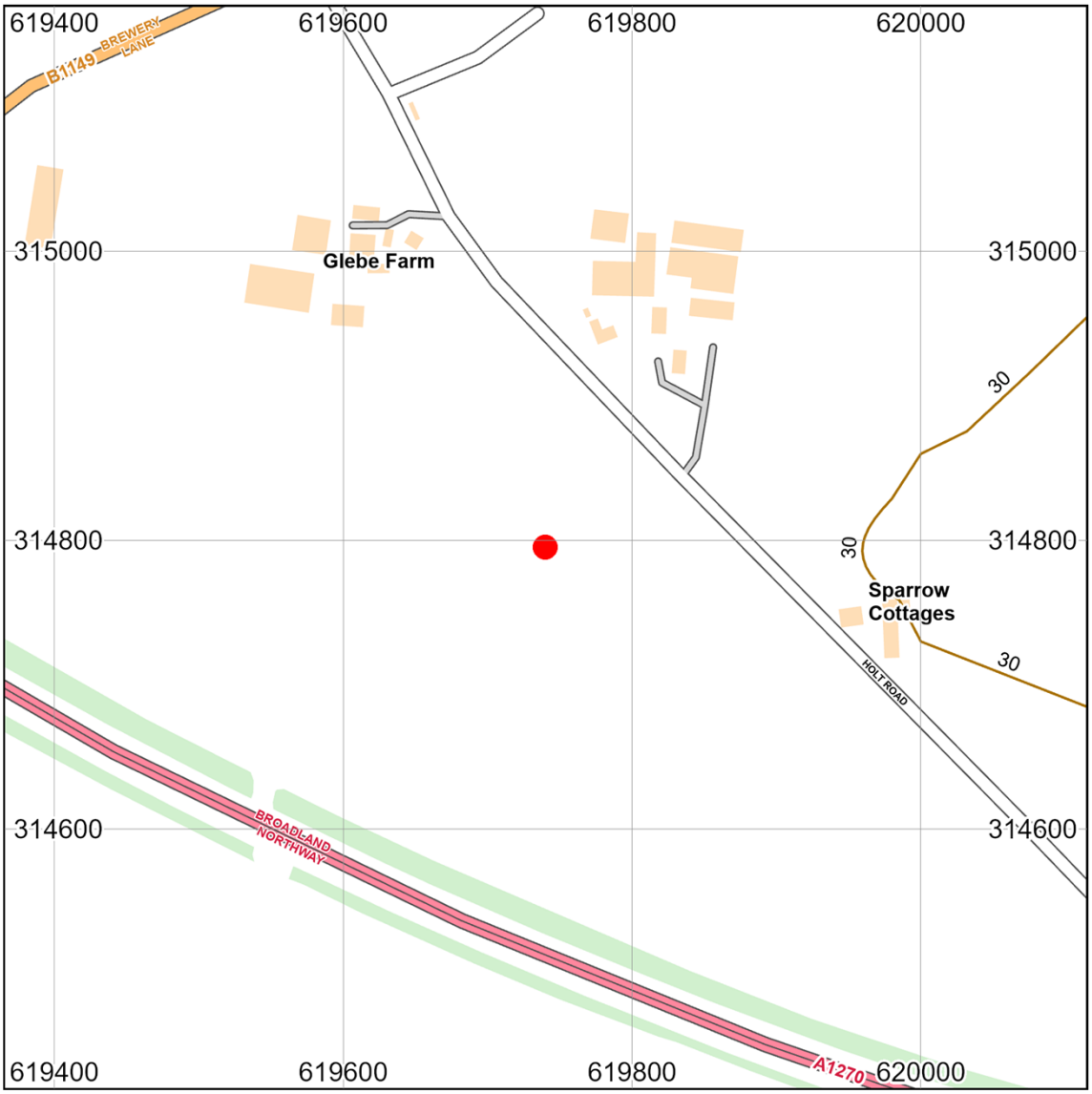
Infiltration SuDS GeoReport:

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_347477/66586***

Client reference: 1009.5004 - Holt Road, Horsford

Search location



Contains OS data © Crown Copyright and database right 2026. OS OpenMap Local:
Search location indicated in red

Point centred at: 619740,314795

© **UKRI, 2026. All rights reserved.**
BGS_347477/66586

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.

© UKRI, 2026. All rights reserved.

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.

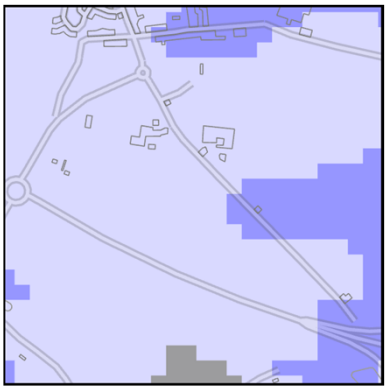
The map and text data in this report is similar to that provided in the '*Infiltration SuDS Map: Detailed'* national map product. For further information about the data, consult the '*User Guide for the Infiltration SuDS Map: Detailed'*, available from http://nora.nerc.ac.uk/16618/.

© UKRI, 2026. All rights reserved.

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?



Contains OS data © Crown Copyright and database right 2026

- 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.

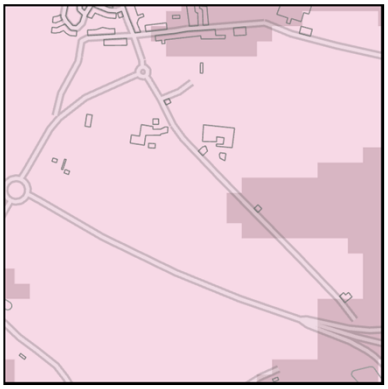
Is ground instability likely to be a problem?



Contains OS data © Crown Copyright and database right **2026**

- 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?



Contains OS data © Crown Copyright and database right 2026

- 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.

© UKRI, 2026. All rights reserved.

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 (not including coal)
- shallow groundwater
- made ground

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

Soluble rock hazard



Contains OS data © Crown Copyright and database right 2026

■ 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



Contains OS data © Crown Copyright and database right 2026

■ 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.

© UKRI, 2026. All rights reserved.

Shallow mining hazard (not including coal)



Contains OS data © Crown Copyright and database right 2026

■ 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



Contains OS data © Crown Copyright and database right 2026

■ 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



Contains OS data © Crown Copyright and database right **2026**

■ 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

© UKRI, 2026. All rights reserved.

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

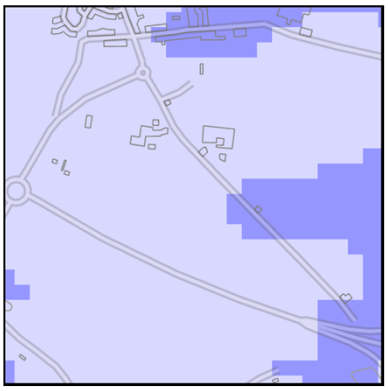
Superficial deposits are not present everywhere and therefore some areas of the *superficial deposit permeability* map may not be coloured. Where this is the case, the *bedrock permeability* map shows the likely permeability of the ground. Superficial deposits in some places are very thin and hence in 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	
 Contains OS data © Crown Copyright and database right 2026	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.

© UKRI, 2026. All rights reserved.

Superficial deposit permeability



Contains OS data © Crown Copyright and database right 2026

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

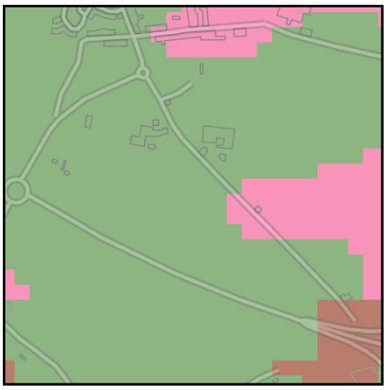
The superficial deposit permeability is **spatially variable**, but likely to permit moderate infiltration.

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

These maps show the permeability range that is summarised above.

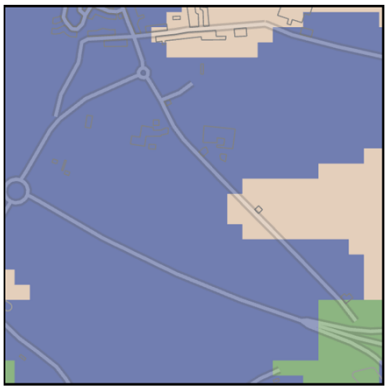
- Very Low
- Low
- Moderate
- High
- Very High

Minimum



Contains OS data © Crown Copyright and database right 2026

Maximum



Contains OS data © Crown Copyright and database right 2026

Superficial deposit thickness



Contains OS data © Crown Copyright and database right 2026

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.

© UKRI, 2026. All rights reserved.

Bedrock permeability



Contains OS data © Crown Copyright and database right **2026**

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



Contains OS data © Crown Copyright and database right 2026

Maximum



Contains OS data © Crown Copyright and database right 2026

Geological indicators of flooding



Contains OS data © Crown Copyright and database right 2026

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.

© UKRI, 2026. All rights reserved.

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



Contains OS data © Crown Copyright and database right 2026

	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.

© UKRI, 2026. All rights reserved.

Landslides



Contains OS data © Crown Copyright and database right 2026

- 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



Contains OS data © Crown Copyright and database right 2026

- 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



Contains OS data © Crown Copyright and database right 2026

- 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.

© UKRI, 2026. All rights reserved.

Swelling clays



Contains OS data © Crown Copyright and database right 2026

- 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



Contains OS data © Crown Copyright and database right 2026

- 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



Contains OS data © Crown Copyright and database right 2026

- 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.

© UKRI, 2026. All rights reserved.

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

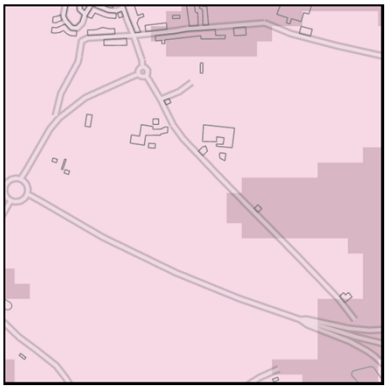


Contains OS data © Crown Copyright and database right 2026

Derived in part from Source Protection Zone data provided under licence from the Environment Agency © Environment Agency 2026.

- 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



Contains OS data © Crown Copyright and database right 2026

- 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.

© UKRI, 2026. All rights reserved.

Made ground



Contains OS data © Crown Copyright and database right 2026

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

© **UKRI, 2026. All rights reserved.**

Section 5. Geological Maps

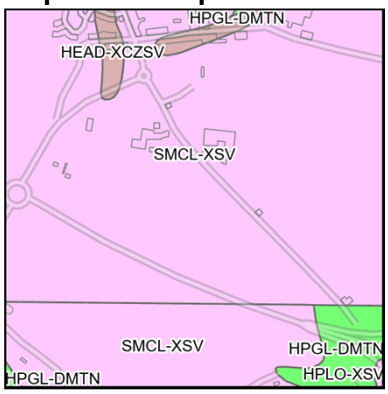
The following maps show the artificial, superficial and bedrock geology within the area of interest.

Artificial deposits



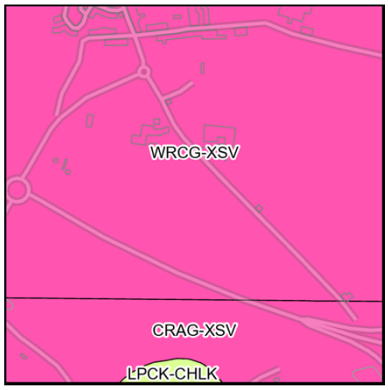
Contains OS data © Crown Copyright and database right 2026

Superficial deposits



Contains OS data © Crown Copyright and database right 2026

Bedrock



Contains OS data © Crown Copyright and database right 2026

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
	HPLO-XSV	Happisburgh Glacigenic Formation And Lowestoft Formation (Undifferentiated)	Sand and gravel
	HPGL-DMTN	Happisburgh Glacigenic Formation	Diamicton
	SMCL-XSV	Sheringham Cliffs Formation	Sand and gravel
	HEAD-XCZSV	Head	Clay, silt, sand and gravel

© UKRI, 2026. All rights reserved.

Key to Bedrock geology:

Map colour	Computer Code	Rock name	Rock type
	WRCG-XSV	Wroxham Crag Formation	Sand and gravel
	CRAG-XSV	Crag Group	Sand and gravel
	LPCK-CHLK	Lewes Nodular Chalk Formation, Seaford Chalk Formation, Newhaven Chalk Formation, Culver Chalk Formation And Portsdown Chalk Formation (Undifferentiated)	Chalk

© **UKRI, 2026. All rights reserved.**

Limitations of this report:

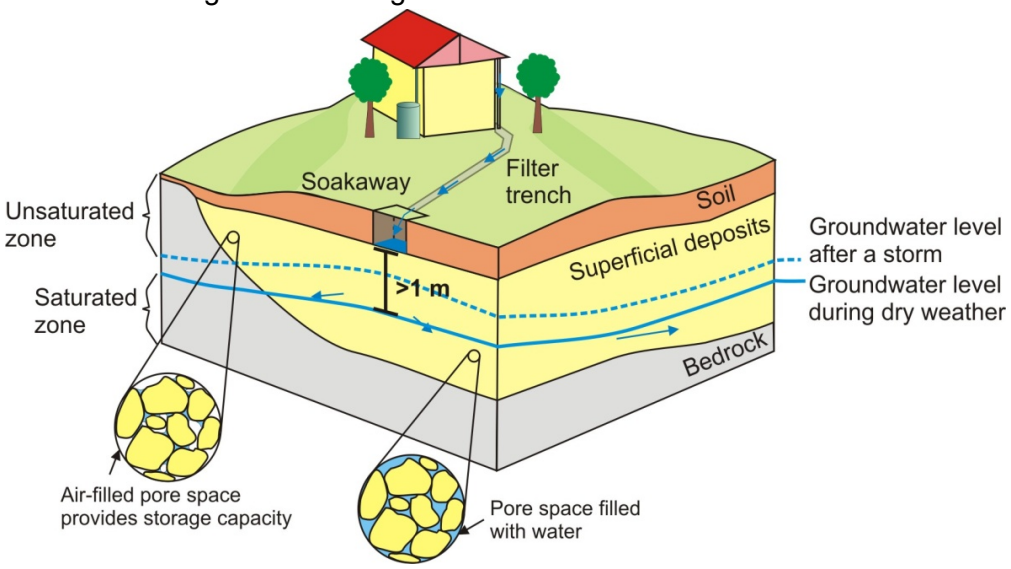
- This report is concerned with the potential for infiltration-to-the-ground to be used as a SuDS technique at the site described. It only considers the subsurface beneath the search area and does NOT consider potential surface or subsurface impacts outside of that area.
- This report is NOT an alternative 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: **https://www.miningremediation.co.uk/miningreports/**.
    - 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.
- This report is supplied in accordance with the GeoReports Terms & Conditions available separately, and the copyright restrictions described at the end of this report

© UKRI, 2026. All rights reserved.

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.

© UKRI, 2026. All rights reserved.

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.

© UKRI, 2026. All rights reserved.

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.

© UKRI, 2026. All rights reserved.

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.

© UKRI, 2026. All rights reserved.

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/)

© UKRI, 2026. All rights reserved.

Contact Details

Keyworth Office
British Geological Survey
Environmental Science Centre
Nicker Hill
Keyworth
Nottingham
NG12 5GG
Tel: 0115 9363100
Email: enquiries@bgs.ac.uk

Edinburgh Office
British Geological Survey
Lyell Centre
Research Avenue South
Edinburgh
EH14 4AP
Tel: 0131 6671000
Email: enquiry@bgs.ac.uk

© UKRI, 2026. All rights reserved.

Terms and Conditions

General Terms & Conditions

This Report is supplied in accordance with the GeoReports Terms & Conditions available on the BGS website at https://shop.bgs.ac.uk/georeports and also available from the BGS Enquiry Service at the above address.

Important notes about this Report

- The data, information and related records supplied in this Report by BGS can only be indicative and should not be taken as a substitute for specialist interpretations, professional advice and/or detailed site investigations. You must seek professional advice before making technical interpretations on the basis of the materials provided.
- Geological observations and interpretations are made according to the prevailing understanding of the subject at the time. The quality of such observations and interpretations may be affected by the availability of new data, by subsequent advances in knowledge, improved methods of interpretation, and better access to sampling locations.
- 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.
- Although samples and records are maintained with all reasonable care, there may be some deterioration in the long term.
- 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.
- Data may be compiled from the disparate sources of information at BGS's disposal, including material donated to BGS by third parties, and may not originally have been subject to any verification or other quality control process.
- Data, information and related records, which have been donated to BGS, have been produced for a specific purpose, and that may affect the type and completeness of the data recorded and any interpretation. The nature and purpose of data collection, and the age of the resultant material may render it unsuitable for certain applications/uses. You must verify the suitability of the material for your intended usage.
- If a report or other output is produced for you on the basis of data you have provided to BGS, or your own data input into a BGS system, please do not rely on it as a source of information about other areas or geological features, as the report may omit important details.
- 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.

Copyright:
Copyright in materials derived from the British Geological Survey's work, is owned by UK Research and Innovation (UKRI) and/ or the authority that commissioned the work. You may not copy or adapt this publication, or provide it to a third party, without first obtaining UKRI's permission, but if you are a consultant purchasing this report solely for the purpose of providing advice to your own individual client you may incorporate it unaltered into your report to that client without further permission, provided you give a full acknowledgement of the source. Please contact the BGS Copyright Manager, British Geological Survey, Environmental Science Centre, Nicker Hill, Keyworth, Nottingham NG12 5GG. Telephone: 0115 936 3100.
© UKRI 2026 All rights reserved.

This product includes mapping data licensed from the Ordnance Survey® with the permission of the Controller of Her Majesty's Stationery Office. © Crown Copyright 2026. All rights reserved. Licence number AC0000824781 EUL

Ordnance Survey

Report issued by
BGS Enquiry Service