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CONSULTING ENGINEERS

flood risk assessment

PROJECT
Former Animal Health Trust Research site

REFERENCE
CCE/ZF261/FRA-02

DATE
May 2025

FOR
Lochailort Kentford Ltd

Document Review Sheet:

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Reference	Date	Author	Checked
CCE/ZF261/FRA-01	February 2025	JH	RT
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Summary Table

Site location	South of Bury Road/B1506, Kentford, Suffolk CB8 7UU. Grid reference – 569420, 266130
Planning application	Full
Existing site	Brownfield
Application site area	Approximately 15.54 ha
Proposed development	Residential (302 dwellings), local store, and community building.
Flooding from rivers and sea	None.
Reservoir Inundation Zone	None.
Other sources of flooding	Areas of high, medium and low risk surface water flooding.
Surface water management	Infiltration sized to manage the 1 in 100 annual probability storm plus climate change and creep allowances.

1.0 Introduction

1.1 This Flood Risk Assessment (FRA) has been prepared on behalf of Lochailort Kentford Ltd to support a full planning application for the redevelopment of the former Animal Health Trust Research site located to the south of Bury Road/the B1506, Kentford, Suffolk CB8 7UU. (refer to Figure 1 for the site location).

1.2 The development proposal comprises:

- 302 Dwellings.
- 1 x Shop 386sq.m.
- 1 x Community Hub (Existing Listed Visitor Centre) 621sq.

1.3 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. The report has been prepared following several site visits, infiltration testing at the site, and the results of other intrusive testing.

1.4 The site lies on the western edge of Kentford village and is approximately centred on Ordnance Survey grid reference 569420, 266130. The site is bounded by Bury Road/the B1506 to the north, Lanwades Hall to the west, residential development and Sire Lane to the east, and open, rural land to the south.

1.5 The site extends to approximately 15.56 ha. The site is currently developed and was formerly the site of the Animal Health Trust (AHT). The site is laid to buildings and hardstanding (comprising formal sealed surfaces and less formal gravelled areas).

1.6 The dominant downward slope direction of the site is northwards, with cross falls 'outwards' to the west and east. Existing ground levels range from approximately 53.6 m AOD in the south-western corner of the site to approximately 33.6 m AOD in the north-eastern corner of the site (at the Sire Lane junction with Bury Road/the B1506). Ground levels at the existing access (Sir Graham Kirkham Avenue) are approximately 36.0 m AOD. Refer to the topographical survey in Appendix A.

1.7 The nearest mapped watercourse is the River Kennett some 500 m to the east of the site. The channel is a designated Main River and flows broadly north-eastwards (from Moulton), through Kentford and beneath the A14 (road). There is a floodplain associated with the watercourse (refer to Figure 2), but this does not affect the site.

1.8 Geological mapping (refer to appended British Geological Survey report) shows that the site is underlain by the Hollywell Chalk formation (bedrock), with a limited area of superficial sands and gravels in the south. Shallow groundwater is not expected to occur throughout the majority of the site.

1.9 An intrusive investigation (refer to the Soiltechnics Ground Investigation Report reference STU5875-R01 Rev B and the trial pit logs in Appendix A of this report) confirmed the presence of the Chalk and superficial deposits (superficial deposits were more extensive than expected based on the published geology) as well as made ground. Groundwater was not encountered in the majority of the excavations. The exception is seepage which was noted in borehole WS07 and attributed to a confined area of permeable material. In the context of this, site groundwater is most likely the result of the saturation of the more granular superficial material rather than true groundwater associated with rising levels in the underlying Chalk.

1.10 The site lies in groundwater source protection zone 3, the total catchment area (refer to Figure 3).

2.0 Forms of Flooding

Watercourses

2.1 The site is not shown to be affected by flooding from a watercourse (refer to Figure 2).

Surface Water

2.2 The surface water flood map for the site (Figure 4) shows limited patches of surface water pooling in the north of the site. The most notable areas are in the north-east. The patches are associated with topographical low spots and are likely the result of relatively localised runoff generated from the site itself. The mapping also shows some pooling around two of the existing buildings. This represents runoff being intercepted by and pooling up against the building walls as it flows from adjacent hardstanding and higher ground.

2.3 Image 2.1 is an extract from the 2040-2060 depth of surface water flooding maps. The extract is from the 200 mm depth data set. It is worth noting that this is labelled as the "up to 200 mm" depth data set on the web based mapping but from context (and discussion with the JBA Consulting flood modelling team) it actually shows the likelihood of depths of 200 mm or more occurring. The image overleaf show that only small areas of the site are expected to experience flood depths of more than 200 mm.

2.4 It is worth noting that predicted surface water flooding will, in part, be managed by the installation of the proposed surface water management strategy (refer to Section 3 and Appendix B). The proposed network will intercept runoff from the developed areas of the site and direct it into the proposed infiltration basin. The overall effect will be to reduce the total catchment area (rural and urban) which can currently contribute to overland flow running northwards through the site.

2.5 Based on the location, extent, depth, and likelihood of the predicted surface wate flooding, combined with the probable reduction associated with installation of a modern surface water drainage network, the risk posed by surface water flooding to the proposed development is not significant.

Image 2.1 chance of flooding (in excess of 200 mm) mm 2040-2060, taken from the long term flood risk maps (February 2025) © Crown copyright and database rights 2025 Ordnance Survey 100047325

Groundwater

2.6 As discussed, the likelihood of 'true' groundwater flooding (i.e. rising groundwater levels in the Chalk) is considered unrealistic.

2.7 In the event that a localised buildup of groundwater in localised pockets of confined permeable material results in groundwater being expressed at the surface, then it would tend to follow ground levels and exit the site as shallow sheet flow rather than entering any buildings.

2.8 In light of the above, groundwater flooding is not considered a notable of unmanageable risk.

Adopted Surface Water Sewers

2.9 Anglian Water records (included in Appendix A) show only wastewater sewers in the area. This is consistent with the ability of the geology to support the disposal of surface water via infiltration (as is the case for the adjacent Larnach Drive development which relies on shared crated soakaways in the rear gardens).

2.10 From observations, Bury Road/the B1506 drains to a highway drainage network (on either side of the road) as well as running overland eastwards. This may contribute to the locally reported pooling of runoff at the Bell Public House during intense rainfall events.

2.11 Neither of the above present a realistic flood risk to the proposed development (or the site) as levels dictate that any floodwater arising from either source would flow away from and past the site, rather than spilling onto the proposed development.

Artificial Water Bodies

2.12 The site does not lie in a reservoir inundation zone (refer to Figure 2).

3.0 Surface Water Management

3.1 Infiltration testing in the north of the site (refer to Appendix A) demonstrates that the Chalk beneath the site will support the disposal of surface water runoff by infiltration. The proposed surface water management scheme therefore relies entirely on infiltration. The testing found infiltration rates of between 9.56 x 10^{-6} and 5.80 x 10^{-4} m/s depending on location. As discussed, based on the investigations to-date, shallow groundwater is not expected at the site (although monitoring would be pursued at the later Discharge of Conditions stage).

3.2 As recommend in the Soiltechnics Ground Investigation Report, no infiltration is proposed within 10 m of existing and proposed buildings and roads.

3.3 The appended calculations have been run for the 1 in 2, 1 in 30, and 1 in 100 annual probability storms. Urban creep has been applied as 5 % to the total catchment area as this is representative of a 10 % urban creep rate being applied to just the residential plots (as per guidance). Climate change of 35 % and 40 % has been applied to the 1 in 30 and 1 in 100 annual probability storms respectively. The calculations assume a runoff coefficient of 1.0 (i.e. no losses from the system).

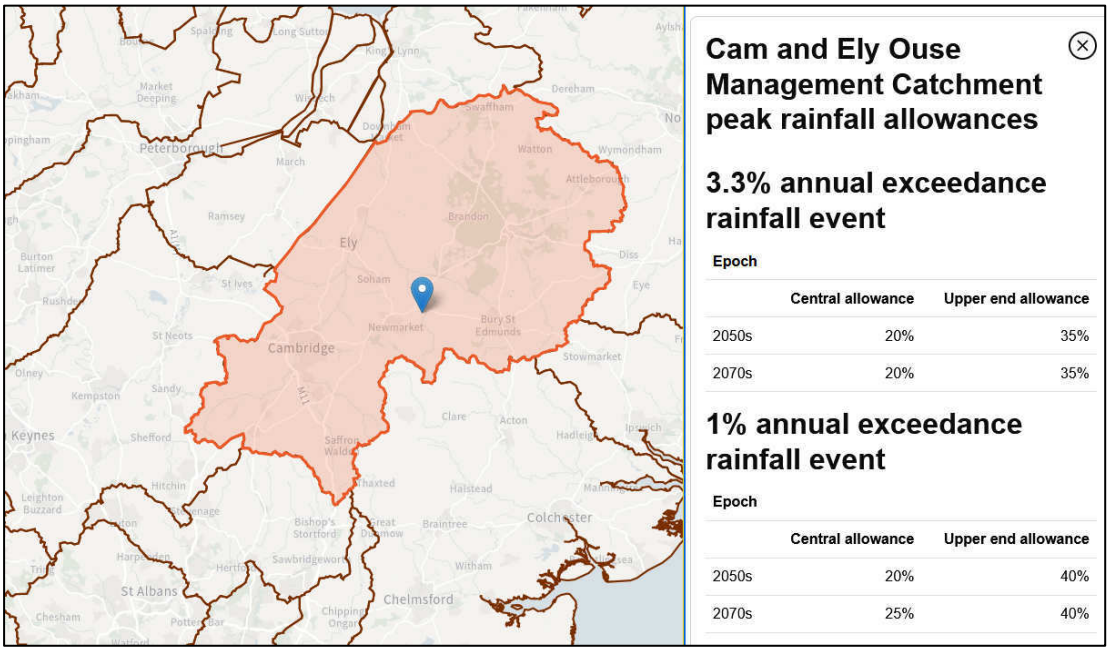

Image 3.1 – extract from the climate change allowances mapping. © Crown copyright and database rights 2025 Ordnance Survey 100047325

3.4 Runoff from the majority of the site will be conveyed to a perforated carrier pipe network through permeable/porous hardstanding. Currently this is proposed as permeable block paving for driveways and parking areas, with porous asphalt for the majority of the proposed roads. Sealed, or impermeably surfaced service strips would be included on the 'high side' of the roads in order to allow for simpler maintenance of services (excavation and replacement of impermeable surfaces being less onerous). Roofwater will either be discharged onto the

permeable surfaces (spilling onto driveways for example) or connected via diffuser boxes, wrapped permeable pipe stubs etc, to the permeable sub-base. Currently it is proposed to line areas of the permeable sub base with an impermeable membrane to prevent infiltration in area other than the basin.

3.5 The exception to the above is the length of existing access road (Graham Kirkham Avenue) which will remain impermeably surfaced (as existing). Currently the road has no apparent formal drainage scheme aside from a number of traditional gullies at the junction with Bury Road/the B1506. As part of the redevelopment of the site a filter drain and shallow rill (500 mm wide by 200 mm deep) will be included along the eastern edge of the road to accept overland flow and convey it northwards. At the northern end of the rill flows will pass through a linear SuDS filter (a planted area of shallow SuDS soil, lined with an impermeable membrane), before entering the infiltration basin in the north of the site.

3.6 The twin outfall from the perforated piped network will be protected with a gabion debris filter.

3.7 The proposed infiltration basin is 1.5 m deep, with a maximum water level of a little over 900 mm in the 1 in 100 annual probability storm with creep and climate change. The basin is a two stage basin (with a 1.5 m wide shelf at 600 mm above the bed) and is augmented by an infiltration blanket wrapping around it's southern edge, to maximise the area over which infiltration can occur. Side slopes within the basin are 1 in 4, with 1 in 3 banking back to surrounding ground levels. The time to half empty is circa 100 minutes. The modelled infiltration rate from the basin is 1.31×10^{-4} m/s (the lowest of the three test results for test location TP01).

Treatment

3.8 The highest pollution hazard level for the site (from Table 26.2 in The SuDS Manual, C753) is Medium. This would be associated with the higher trafficked roads which serve more than circa 50 to 60 dwellings (i.e. more than the 300 vehicle movements).

3.9 The pollution scores for the Medium hazard category (Table 26.2) are 0.7, 0.6, and 0.7 (for suspended solids, metals and hydrocarbons respectively).

3.10 Treatment scores from Table 26.3 are relevant to the SuDS techniques upstream of the infiltration basin and blanket. Treatment scores from Table 26.4 are relevant for the basin and blanket. Scores are summarised below.

- Permeable paving, porous surface – 0.7, 0.6, 0.7
- Filter strip – 0.4, 0.4, 0.5
- Briorention (applicable to the linear SuDS filter) – 0.8, 0.8, 0.8
- Infiltration basin assuming dense vegetation over 'SuDS soil' – 0.6, 0.5, 0.6

- Infiltration blanket fed from the basin and underlain by 300 mm of 'SuDS soil' – 0.4, 0.3, 0.3

3.11 Treatment scores for the proposed combination of SuDS techniques are all greater than the respective pollution scores:

- Permeable paving, porous surface + infiltration basin + blanket = 0.7 + 0.3 (1.0), 0.6 + 0.25 (0.85), 0.7 + 0.3 (1.0)
- Filter strip + rill (no treatment) + linear SuDS filter + basin = 0.4 + 0.4 + 0.3 (1.1), 0.4 + 0.4 + 0.25 (1.05), 0.5 + 0.4 + 0.3 (1.2).

Maintenance

3.12 All proposals are subject to detailed design and the approval of relevant parties. Currently all roads are proposed as remaining unadopted by the County Council and hence they can be permeably surfaced. Maintenance of the private roads would be undertaken by a private management company (communally funded).

3.13 Maintenance of private on-plot features (permeably paved driveways) would be the responsibility of the respective homeowners. This responsibility would be included in the home buyers pack.

3.14 Maintenance of the network, upstream SuDS features, and infiltration basin and blanket, will be undertaken by a private management company and/or the sewerage undertaker or independent body under a NAV.

3.15 Suggested maintenance activities (to be built on at the later discharge of Conditions stage) are included in Appendix B.

4.0 Conclusions

4.1 The site is not at risk of flooding from a watercourse and is not considered to be at a significant or unmanageable risk of flooding from any of the other sources listed in the Flood and Water Management Act.

4.2 Surface water runoff will be treated and discharged via on-site infiltration via a number of sub-catchment SuDS components. The features are sized to manage the 1 in 100 annual probability storm inclusive of 40 % climate change allowance and urban creep. Half drain down times are within the 24 hour recommendation.

4.3 The surface water scheme will be maintained either privately (as part of a communally funded management company) and/or by the sewerage undertaker or independent body under a NAV.

Figures

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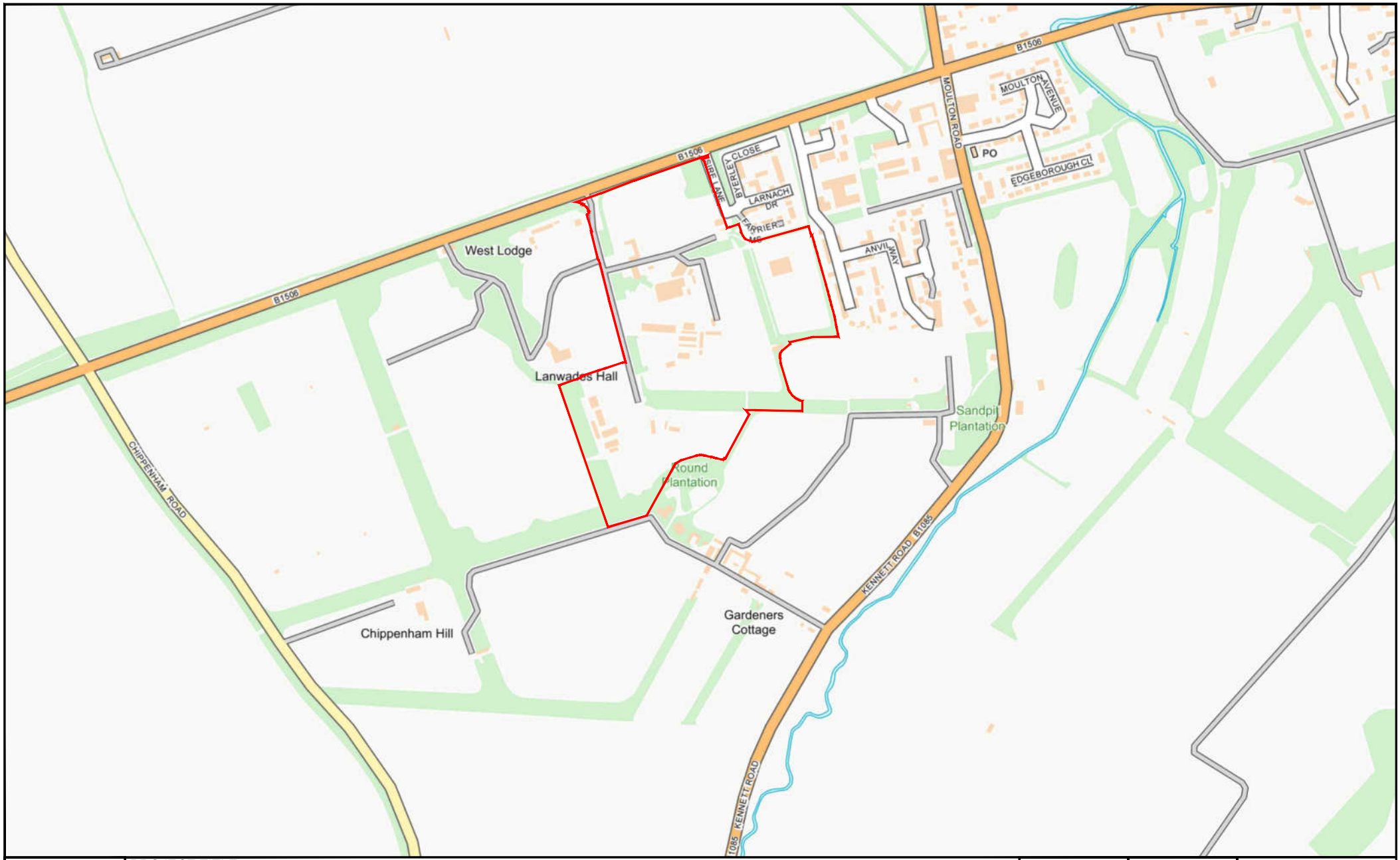

DATE	PROJECT TITLE	FIGURE NUMBER	PROJECTNO.
27.02.25	LANWADES WOODLAND PARK, KENTFORD	1	ZF261
DRAWN BY: JTH	FIGURE TITLE: SITE LOCATION PLAN		
SCALE @ A4 SIZE: D.N.S			

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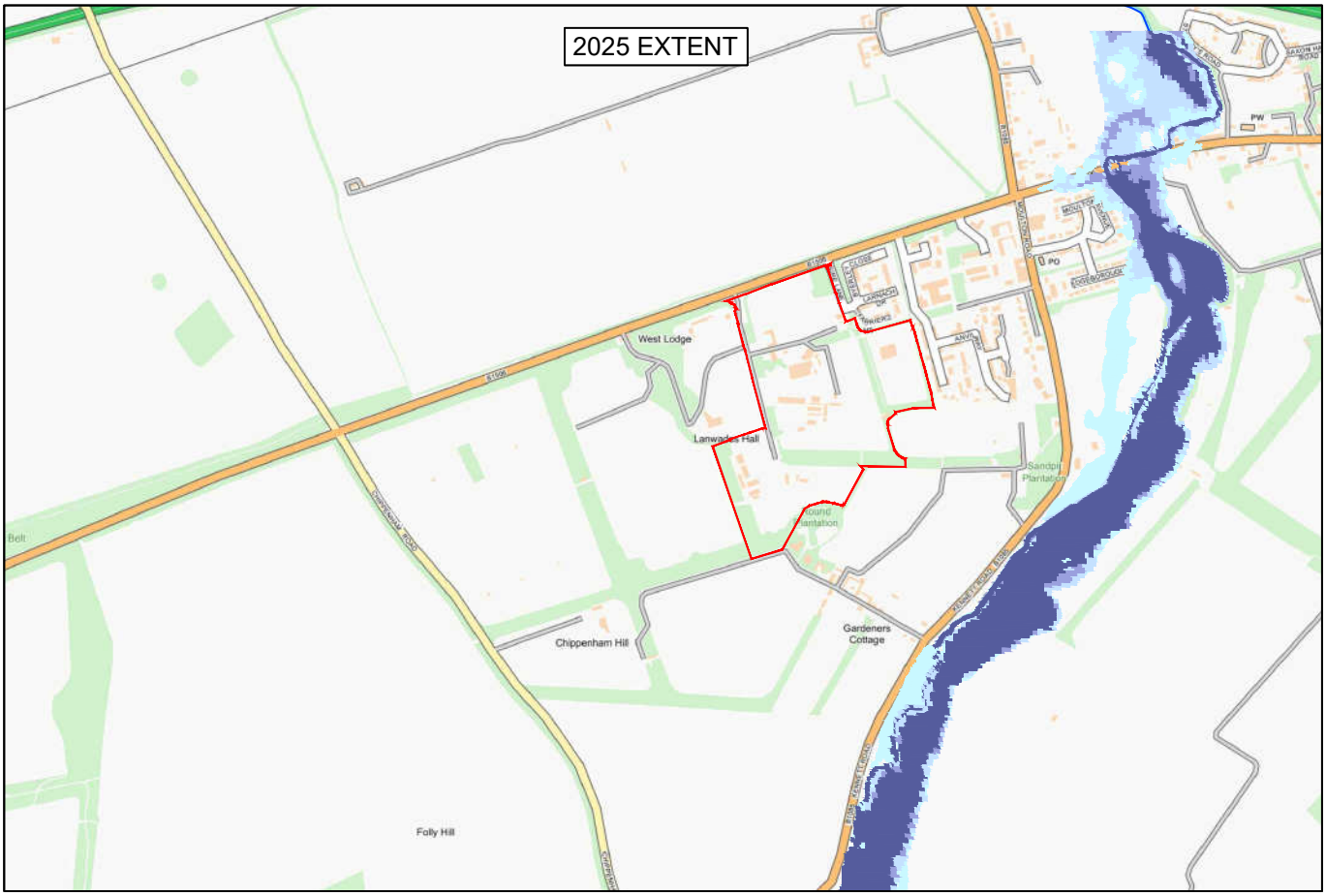

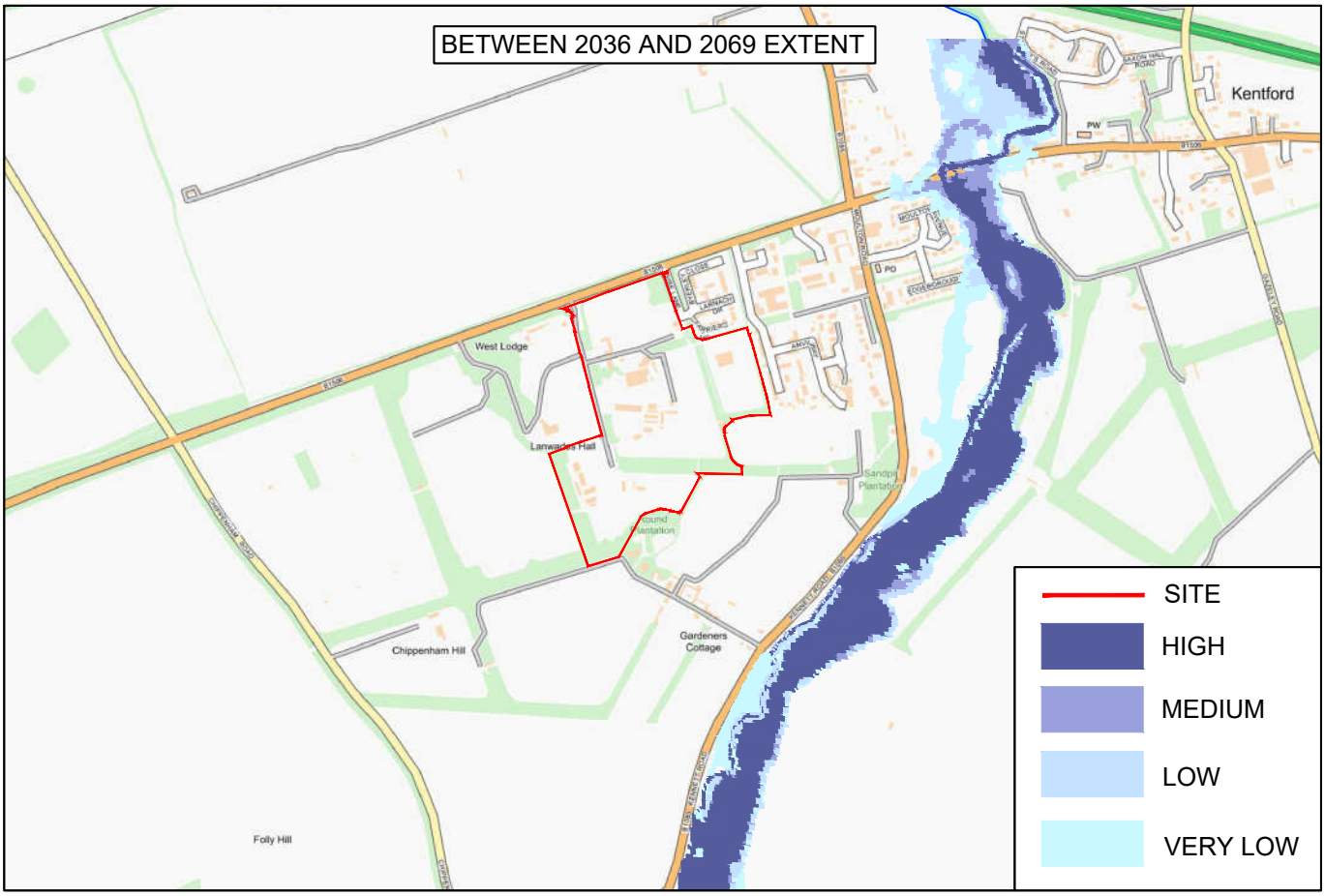

DATE 27.02.25	PROJECT TITLE LANWADES WOODLAND PARK, KENTFORD	DRAWING NUMBER	PROJECT NO.
DRAWN BY JTH	FIGURE TITLE FLOOD FROM RIVERS AND SEA	2	ZF261
SCALE @ A4 SIZE D.N.S			cannon CONSULTING ENGINEERS

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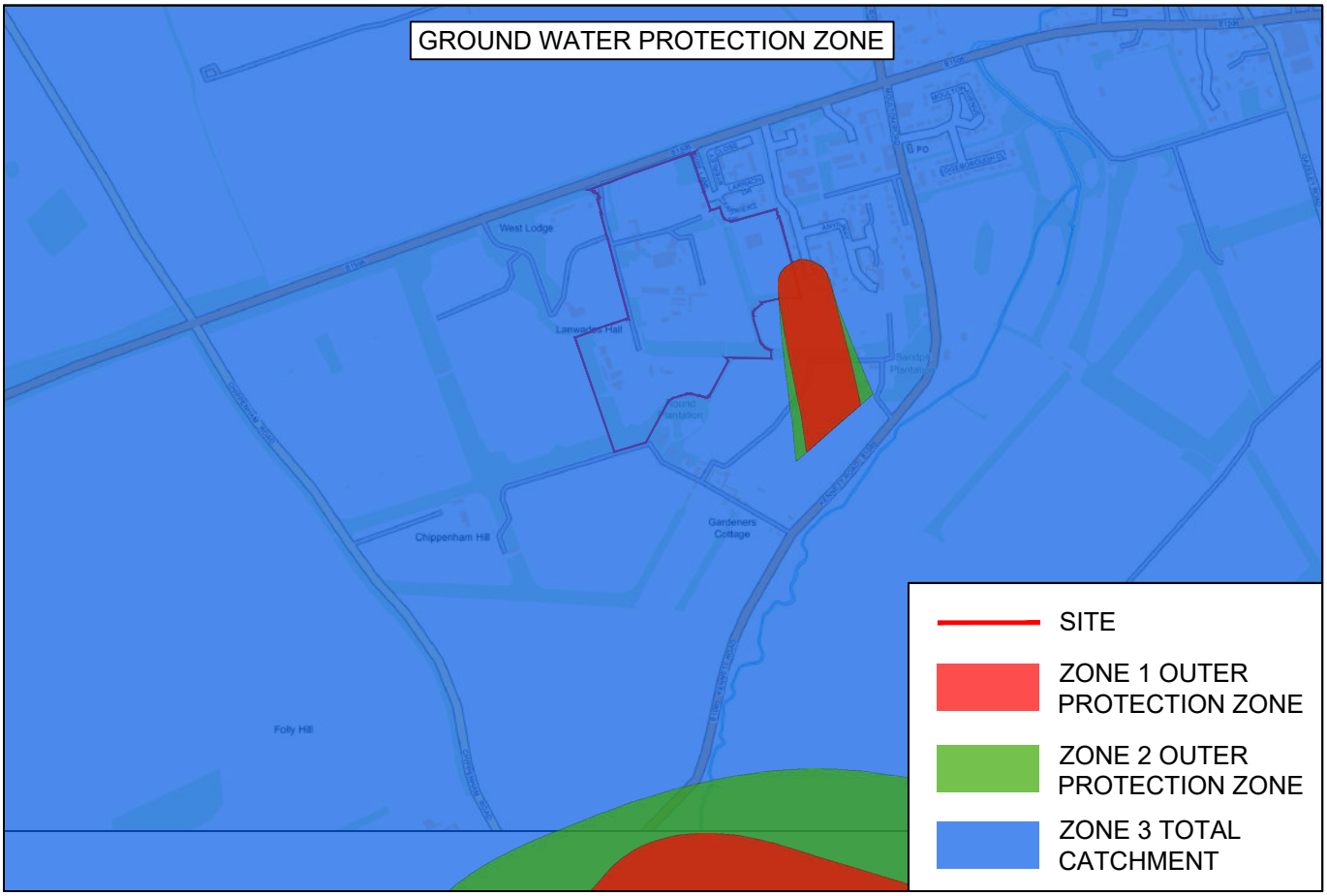

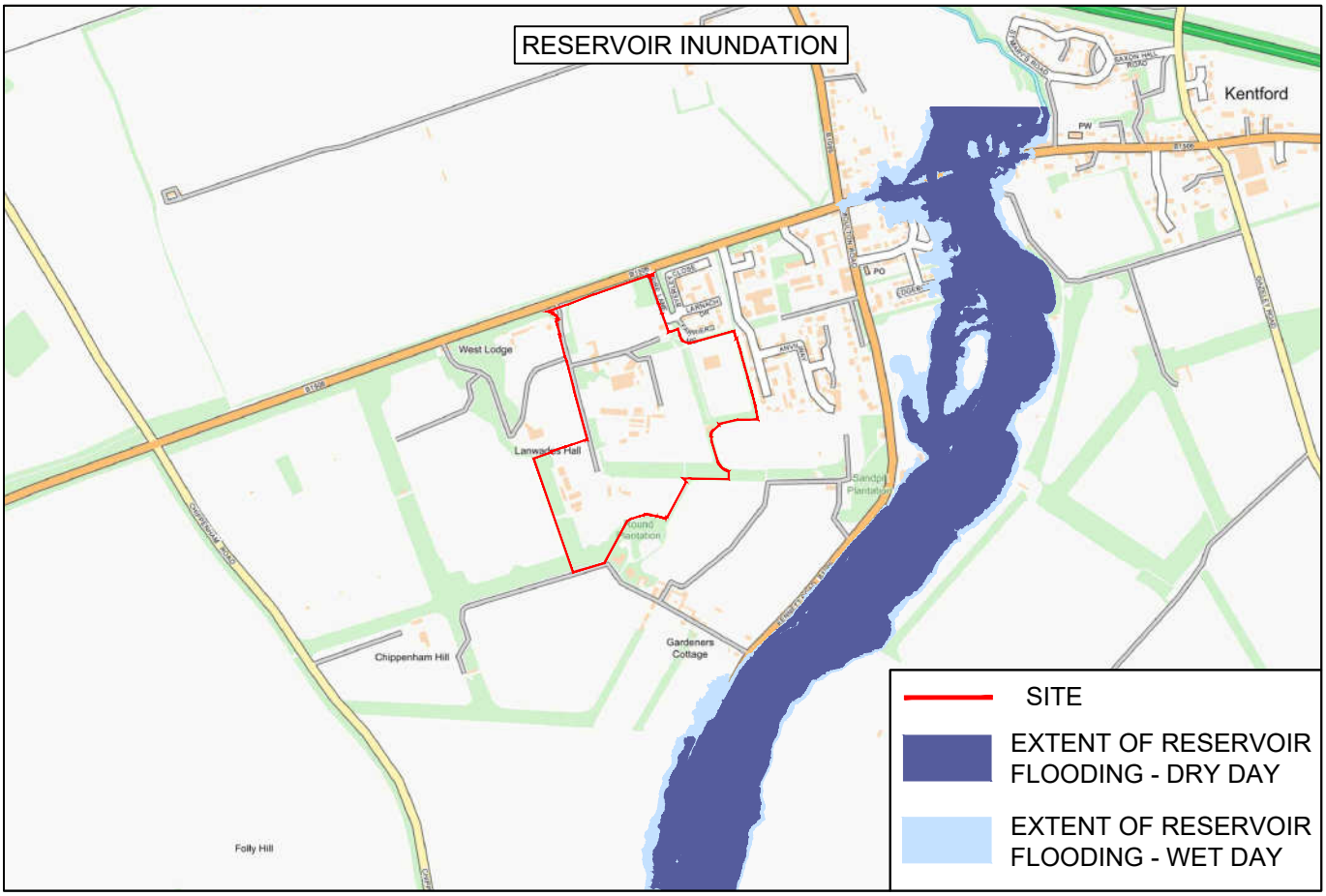

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27.02.25	LANWADES WOODLAND PARK, KENTFORD	3	ZF261	cannon CONSULTING ENGINEERS
DRAWN BY: JTH	FIGURE TITLE: GWSPZ AND RESERVOIR INUNDATION			
SCALE @ A4 SIZE: D.N.S				

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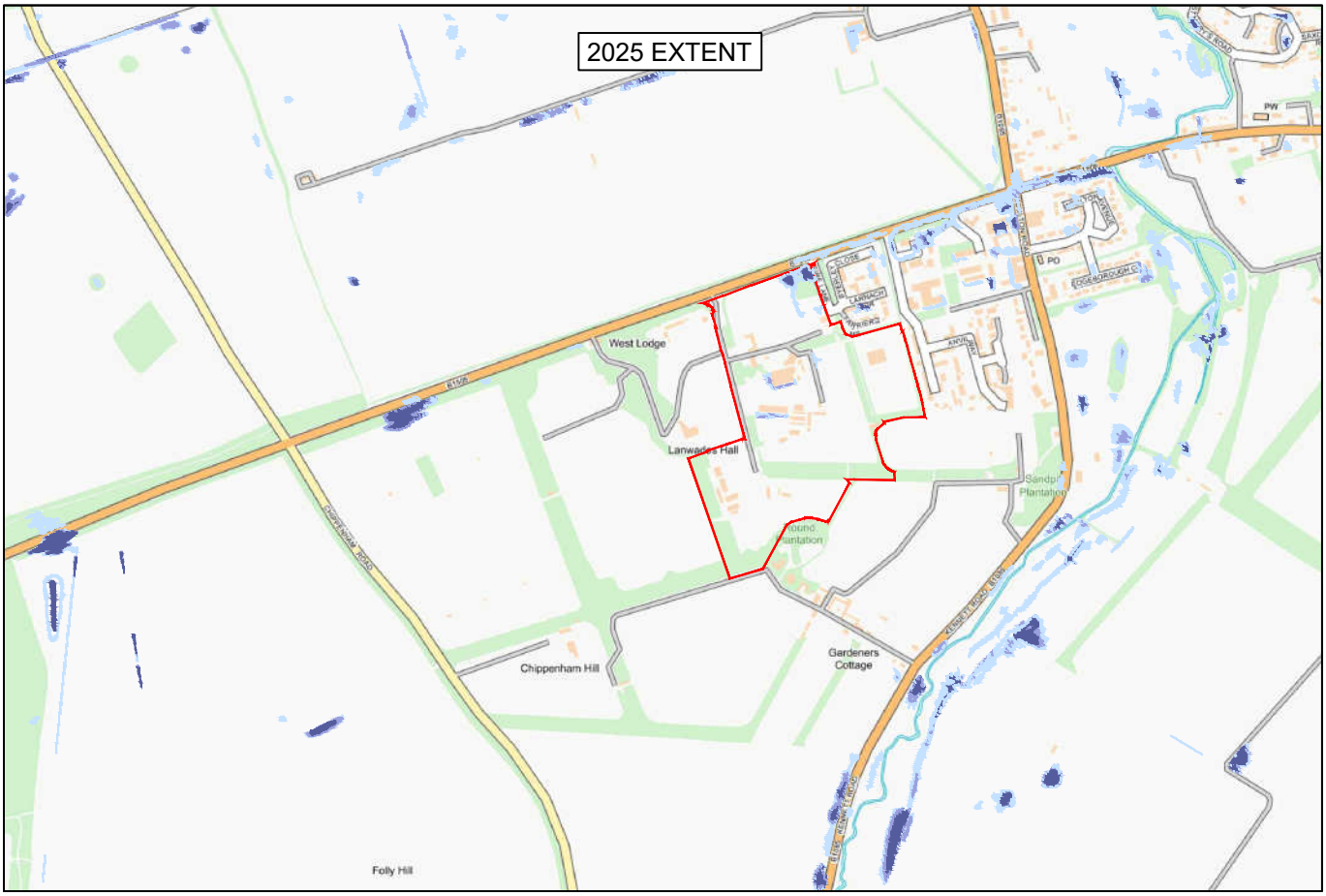

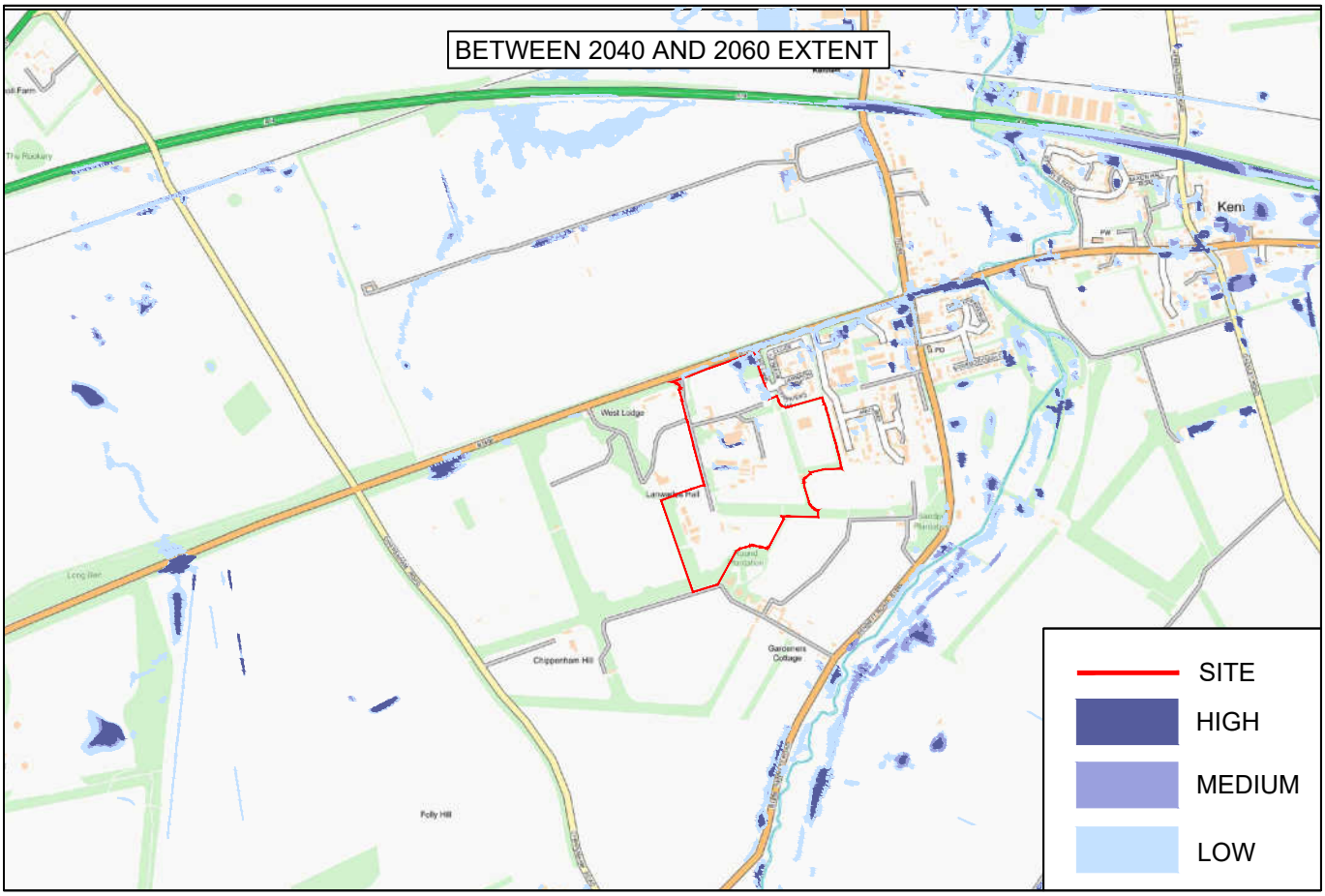

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27.02.25	LANWADES WOODLAND PARK, KENTFORD	4	ZF261	cannon CONSULTING ENGINEERS
DRAWN BY: JTH	FIGURE TITLE: SURFACE WATER FLOOD MAP			
SCALE @ A4 SIZE: D.N.S				

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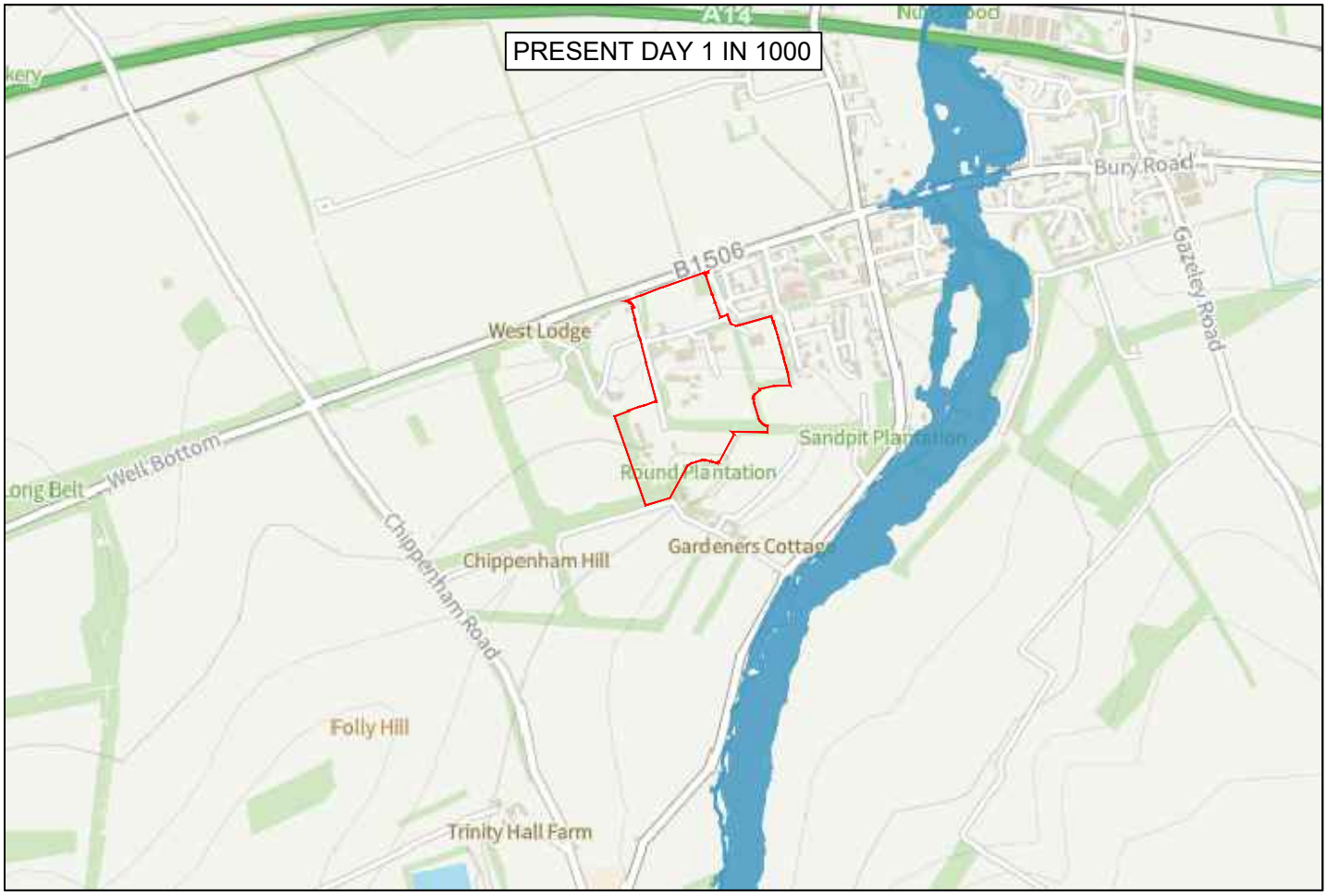

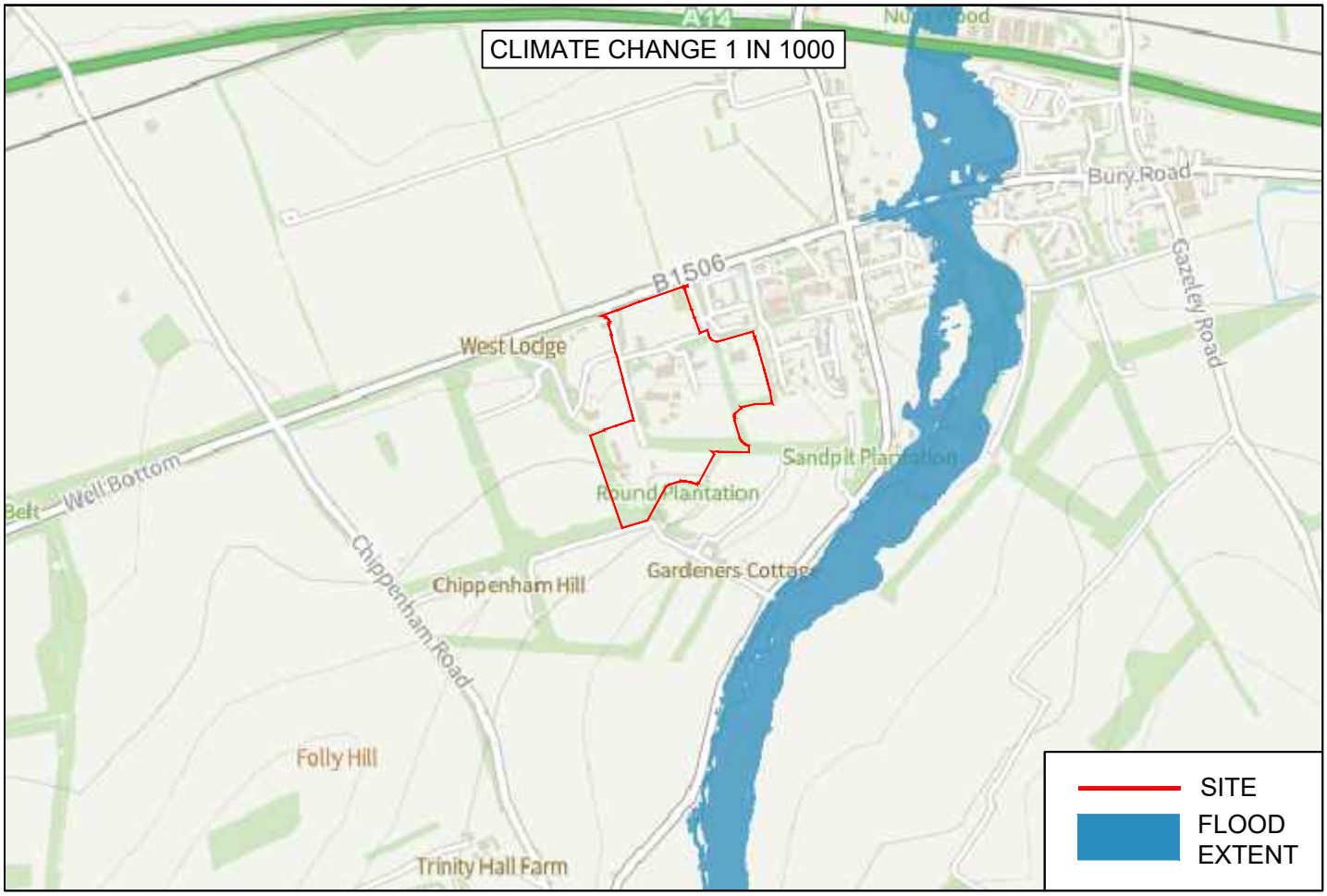

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16.05.25	LANWADES WOODLAND PARK, KENTFORD	5	ZF261
DRAWN BY: JTH	FIGURE TITLE: FLOOD MAP FOR PLANNING RIVER AND SEA		
SCALE @ A4 SIZE: D.N.S			

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Appendix A Existing Site

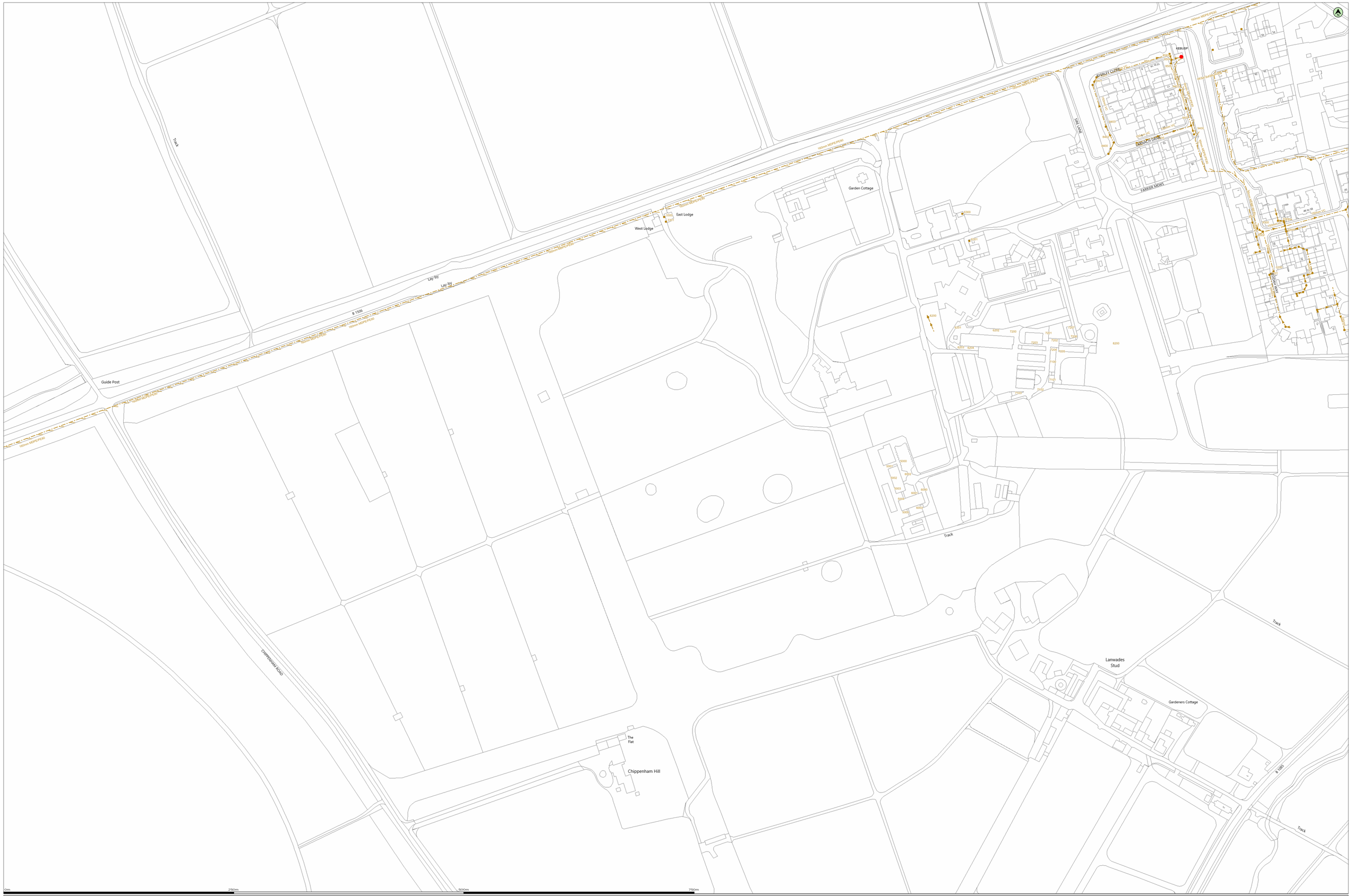
Topographical survey

Adopted sewer plans

Infiltration tests

British Geological Survey report

Lymeswes Business Park
Farm Cottage
Farm Cottage
Farm Cottage
Lymeswes Hall
Lymeswes Hall
Stable Yard
Stable Yard
Stable Yard



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Date: 05/12/24

Scale: 1:1250

Map Centre: 569356,266102

Data updated: 30/11/24

Our Ref: 1634593 - 1

Wastewater Plan AD
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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 loss or damage howsoever arising from the use of this plan. Reference should be made to the relevant Statutory Undertaker for the exact position of any 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 2024 Ordnance Survey AC0000813445. 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	Outfall*	Sewage Treatment Works	
Surface Sewer	Inlet*	Public Pumping Station	
Combined Sewer	Manhole*	Decommissioned Pumping Station	
Final Effluent			
Rising Main*			
Private Sewer*			
Decommissioned Sewer*			

*(Colour denotes effluent type)

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Animal Health Trust

love every drop
anglianwater

GEOSPHERE ENVIRONMENTAL

Our Ref: 9153,SK,Ltr01,JK,RS,24-01-25,V1 - Draft

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INFILTRATION TESTING AT LANWADES COUNTRY PARK, NEWMARKET, CB8 7UU

1. INTRODUCTION

This letter report has been prepared on behalf of Cannon Consulting Engineers for Lochailort Kentford 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 a number of machine-dug trial pits across the site.
- Undertaking soakage testing in line with BRE Digest 365 guidance.
- 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 assumed that the proposed development will comprise residential housing.

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 at Client supplied locations.

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. Where a test exhibited appreciable infiltration and the "75%" infiltration level was achieved, a further infiltration "run", or more was undertaken.

2.2 Scope

Site works were carried out between 8th and 9th January 2025, and comprised the following:

- Excavation of five machine excavated trial pits, (TP01 to TP05), to a maximum depth of 2.00mbgl.
- Undertaking infiltration testing in line with BRE Digest 365 guidance.
- 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. 9153,SK/001/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 overleaf, with the Exploratory Hole Logs provided in Appendix 2:

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Table 1 – Ground Conditions				
Strata	Depth Encountered (mgl)		Strata Thickness (m)	Location and Composition
	From	To		
Topsoil	0.00	0.32 – 0.40	0.32 – 0.40	**All exploratory locations:** A dark brown clayey gravelly organic sand. Gravel of fine and medium sub-angular and sub-rounded flint.
Superficial Deposits (Sand)	0.32 – 0.40	0.60 – 1.10	0.20 – 0.78	**All exploratory locations:** Orangish brown clayey gravelly sand. Gravel of fine and medium sub-angular and sub-rounded flint and chalk.
Chalk	0.60 – 1.10	2.00	Unproven	**All exploratory locations:** White structureless chalk, recovered as a gravel of medium sub-angular and sub-rounded chalk in a clay matrix.

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
TP01	1.91x10-04	1.31x10-04	1.97x10-04	None
TP02	5.83x10-04	7.04x10-04	5.80x10-04	None
TP03	4.31x10-05	3.44x10-05	2.43x10-05	None
TP04	1.77x10-05	1.42x10-05	9.56x10-06	None
TP05	3.26x10-04	2.28x10-04	1.78x10-04	None

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

Yours sincerely

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Enclosures:

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

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APPENDICES

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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 on site, 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 on 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 – TP05

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Geosphere Environmental Ltd
Unit 11 Brightwell Barns
IP10 0BJ
Telephone: 01603 298076

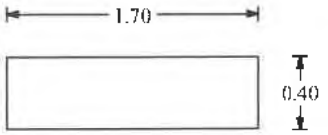
TRIAL PIT LOG

Project	Client	TRIAL PIT No
Lanwades Country Park	Lochailort Kentford Ltd	TP01

Job No	Date	Ground Level (m)	Coordinates/Grid Reference ()
9153,SK	08-01-25	39.00	TL 69705 66458

Fieldwork By	Logged By	Sheet
GEL	FW	1 of 1

Depth	DESCRIPTION	Legend	Depth	No	Remarks/Tests
0.00-0.32	Dark brown slightly silty gravelly ORGANIC SAND. Sand is fine and medium, gravel of fine and medium sub-angular and sub-rounded flint with fine active and inactive roots. [TOPSOIL]				
0.32-1.10	Dark orangish brown slighty gravelly SAND. Sand is fine and medium, gravel of fine and medium sub-rounded and sub-angular flint and chalk.				
1.10-2.00	Off-white structureless CHALK recovered as a slightly clayey sandy gravel of chalk.				
2.00	END OF EXPLORATORY HOLE				



Shoring/Support: GRAVEL
Stability: STABLE

All dimensions in metres Scale 1:20.8333333333333	Method Trial Pit/trench	Plant Used 2.7T Mechanical Excavator	Checked By JK

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GEL AGS TP BETA 9153.SK. LANWADES COUNTRY PARK.GPJ GINT STD AGS 3_1.GDT 24/1/25

Geosphere Environmental Ltd
Unit 11 Brightwell Barns
IP10 0BJ
Telephone: 01603 298076

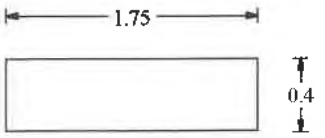
TRIAL PIT LOG

Project	Client	TRIAL PIT No
Lanwades Country Park	Lochailort Kentford Ltd	TP02

Job No	Date	Ground Level (m)	Coordinates/Grid Reference ()
9153,SK	08-01-25	39.00	TL 69626 66433

Fieldwork By	Logged By	Sheet
GEL	FW	1 of 1

Depth	DESCRIPTION	Legend	Depth	No	Remarks/Tests
0.00-0.36	Dark brown slightly silty gravelly ORGANIC SAND. Sand is fine and medium, gravel of fine and medium sub-angular and sub-rounded flint with fine active and inactive roots. [TOPSOIL]				
0.36-0.68	Dark orangish brown slighty gravelly SAND. Sand is fine and medium, gravel of fine and medium sub-rounded and sub-angular flint and chalk.				
0.68-2.00	Off-white and light brown structureless CHALK recovered as a slightly sandy slightly clayey putty matrix. Gravel of fine and medium sub-angular and sub-rounded flint.				
2.00	END OF EXPLORATORY HOLE				



Shoring/Support: GRAVEL
Stability: STABLE

All dimensions in metres Scale 1:20.8333333333333	Method Trial Pit/trench	Plant Used 2.7T Mechanical Excavator	Checked By JK

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GEL AGS TP BETA 9153.SK, LANWADES COUNTRY PARK.GPJ GINT STD AGS 3_1.GDT 24/1/25

Geosphere Environmental Ltd
Unit 11 Brightwell Barns
IP10 0BJ
Telephone: 01603 298076

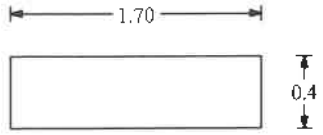
TRIAL PIT LOG

Project	Client	TRIAL PIT No
Lanwades Country Park	Lochailort Kentford Ltd	TP03

Job No	Date	Ground Level (m)	Coordinates/Grid Reference ()
9153,SK	08-01-25	41.00	TL 69301 66285

Fieldwork By	Logged By	Sheet
GEL	FW	1 of 1

Depth	DESCRIPTION	Legend	Depth	No	Remarks/Tests
0.00-0.38	Dark brown slightly gravelly slightly clayey ORGANIC SAND. Sand is fine and medium, gravel of fine and medium sub-angular and sub-rounded flint with fine active and inactive roots. [TOPSOIL]				
0.38-1.00	Light orangish brown slightly clayey gravelly SAND. Sand is fine and medium, gravel of fine to coarse sub-rounded and sub-angular flint and chalk.				
1.00-2.00	Off-white structureless CHALK, recovered as a fine to coarse sub-angular and sub-rounded gravel of chalk in a clay matrix.				
2.00	END OF EXPLORATORY HOLE				



Shoring/Support: GRAVEL
Stability: STABLE

All dimensions in metres Scale 1:20.8333333333333	Method Trial Pit/trench	Plant Used 2.7T Mechanical Excavator	Checked By JK

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Geosphere Environmental Ltd
Unit 11 Brightwell Barns
IP10 0BJ
Telephone: 01603 298076

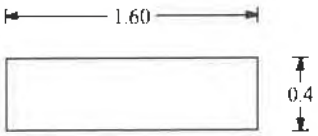
TRIAL PIT LOG

Project	Client	TRIAL PIT No
Lanwades Country Park	Lochailort Kentford Ltd	TP04

Job No	Date	Ground Level (m)	Coordinates/Grid Reference ()
9153,SK	08-01-25	41.00	TL 69030 66179

Fieldwork By	Logged By	Sheet
GEL	FW	1 of 1

Depth	DESCRIPTION	Legend	Depth	No	Remarks/Tests
0.00-0.40	Dark brown slightly gravelly slightly clayey ORGANIC SAND. Sand is fine and medium, gravel of fine and medium sub-angular and sub-rounded flint with fine active and inactive roots. [TOPSOIL]				
0.40-0.60	Dark orangish brown slightly clayey slightly gravelly SAND. Sand is fine and medium, gravel of fine to coarse sub-rounded and sub-angular flint and chalk.				
0.60-1.20	Off white mottled light brown structureless CHALK recovered as a sandy gravel of chalk in a putty matrix. Occasional medium sub-angular and sub-rounded flint gravel.				
1.20-2.00	White structureless CHALK recovered as a gravel of medium sub-angular and sub-rounded chalk in a clay matrix (dm).				
2.00	END OF EXPLORATORY HOLE				



Shoring/Support: GRAVEL
Stability: STABLE

All dimensions in metres Scale 1:20.8333333333333	Method Trial Pit/trench	Plant Used 2.7T Mechanical Excavator	Checked By JK

GEL AGS TP BETA 9153,SK, LANWADES COUNTRY PARK.GPJ GINT STD AGS 3 1.GDT 24/1/25

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Geosphere Environmental Ltd
Unit 11 Brightwell Barns
IP10 0BJ
Telephone: 01603 298076

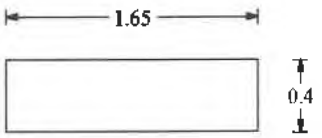
TRIAL PIT LOG

Project	Client	TRIAL PIT No
Lanwades Country Park	Lochailort Kentford Ltd	TP05

Job No	Date	Ground Level (m)	Coordinates/Grid Reference ()
9153,SK	08-01-25	41.00	TL 68865 66121

Fieldwork By	Logged By	Sheet
GEL	FW	1 of 1

Depth	DESCRIPTION	Legend	Depth	No	Remarks/Tests
0.00-0.40	Dark brown slightly gravelly slightly clayey ORGANIC SAND. Sand is fine and medium, gravel of fine and medium sub-angular and sub-rounded flint with fine active and inactive roots. [TOPSOIL]				
0.40-0.60	Dark orangish brown slightly clayey slightly gravelly SAND. Sand is fine and medium, gravel of fine to coarse sub-rounded and sub-angular flint and chalk.				
0.60-1.40	Off white mottled light brown structureless CHALK recovered as a sandy gravel of chalk in a putty matrix. Occasional medium sub-angular and sub-rounded flint gravel.				
1.40-2.00	White structureless CHALK recovered as a gravel of medium sub-angular and sub-rounded chalk in a clay matrix (dm).				
2.00	END OF EXPLORATORY HOLE				



Shoring/Support: GRAVEL
Stability: STABLE

All dimensions in metres Scale 1:20.8333333333333	Method Trial Pit/trench	Plant Used 2.7T Mechanical Excavator	Checked By JK

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GEL AGS TP BETA 9153.SK LANWADES COUNTRY PARK.GPJ GINT STD AGS 3_1.GDT 24/1/25

Appendix 3 – Infiltration Test Results

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TRIAL PIT INFILTRATION TEST - BRE DIGEST 365

Project Number: 9153,SK

Date: 22/01/2025

Project Name: Lanwades Country Park, Newmarket, CB8 7UU

Time [min]	Depth to Water [mbgl]
0	1.50
0.5	1.68
1	1.73
1.5	1.77
2	1.81
2.5	1.84
3	1.88
3.5	1.90
4	1.91

Pit Size [m]		
Length	Width	Depth
1.70	0.40	2.00

Infiltration Rate Calculations		
Parameter	Unit	Result
	height	
h_{75}	[m]	1.875
h_{25}	[m]	1.625
$h_{75}-h_{25}$	[m]	0.250
	time	
t_{75}	[s]	174.00
t_{25}	[s]	19.80
$t_{75} - t_{25}$	[s]	154.20
	effective volume	
v_{75-25}	[m^3]	0.051
	effective area	
ap_{50}	[m^2]	1.730
	soil infiltration rate	
f	[m/s]	1.91E-04

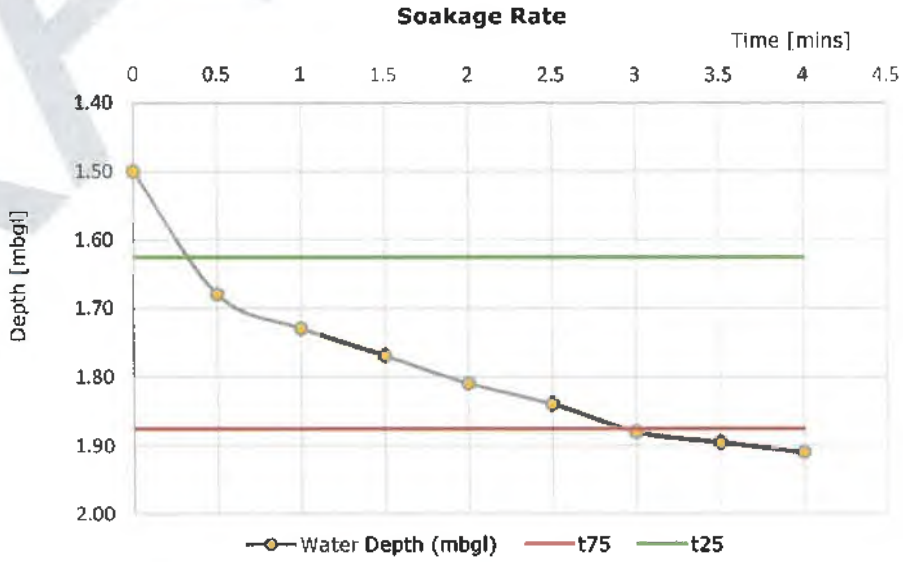
Trial Pit TP01

Run 1 of 3

Test Date 08/01/2025

Groundwater Encountered: N/A

Remarks: Backfilled with gravel. Effective volume multiplied by the voids ratio of the gravel (0.3).



Calculated by: JK

Checked by: RS

DRAFT

TRIAL PIT INFILTRATION TEST - BRE DIGEST 365

Project Number: 9153,SK

Date: 22/01/2025

Project Name: Lanwades Country Park, Newmarket, CB8 7UU

Time [min]	Depth to Water [mbgl]
0	1.50
0.5	1.56
1	1.65
1.5	1.72
2	1.75
2.5	1.79
3	1.82
3.5	1.84
4	1.85
4.5	1.87
5	1.90

Pit Size [m]		
Length	Width	Depth
1.70	0.40	2.00

Infiltration Rate Calculations		
Parameter	Unit	Result
	height	
h_{75}	[m]	1.875
h_{25}	[m]	1.625
$h_{75}-h_{25}$	[m]	0.250
	time	
t_{75}	[s]	276.00
t_{25}	[s]	51.00
$t_{75} - t_{25}$	[s]	225.00
	effective volume	
v_{75-25}	[m³]	0.051
	effective area	
ap_{50}	[m²]	1.730
	soil infiltration rate	
f	[m/s]	1.31E-04

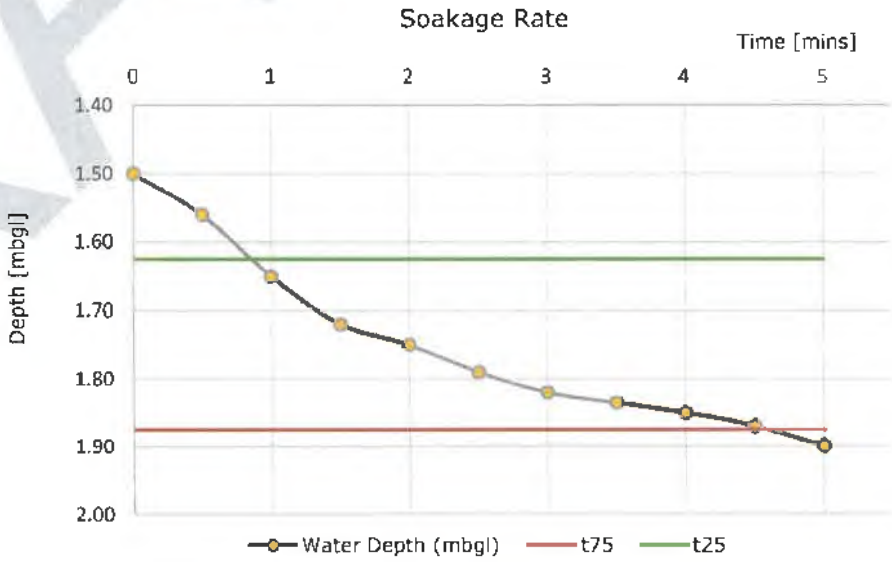
Trial Pit TP01

Run 2 of 3

Test Date 08/01/2025

Groundwater Encountered: N/A

Remarks: Backfilled with gravel. Effective volume multiplied by the voids ratio of the gravel (0.3).



Calculated by: JK

Checked by: RS

DRAFT

TRIAL PIT INFILTRATION TEST - BRE DIGEST 365

GEO

Project Number: 9153,SK

Date: 22/01/2025

Project Name: Lanwades Country Park, Newmarket, CB8 7UU

Time [min]	Depth to Water [mbgl]
0	1.50
0.5	1.56
1	1.65
1.5	1.71
2	1.75
2.5	1.79
3	1.84
3.5	1.89
4	1.92
4.5	1.94

Pit Size [m]		
Length	Width	Depth
1.70	0.40	2.00

Infiltration Rate Calculations		
Parameter	Unit	Result
	height	
h_{75}	[m]	1.875
h_{25}	[m]	1.625
h_{75}-h_{25}	[m]	0.250
	time	
t_{75}	[s]	198.00
t_{25}	[s]	48.00
t_{75} - t_{25}	[s]	150.00
	effective volume	
v_{75-25}	[m^3]	0.051
	effective area	
ap_{50}	[m^2]	1.730
	soil infiltration rate	
f	[m/s]	1.97E-04

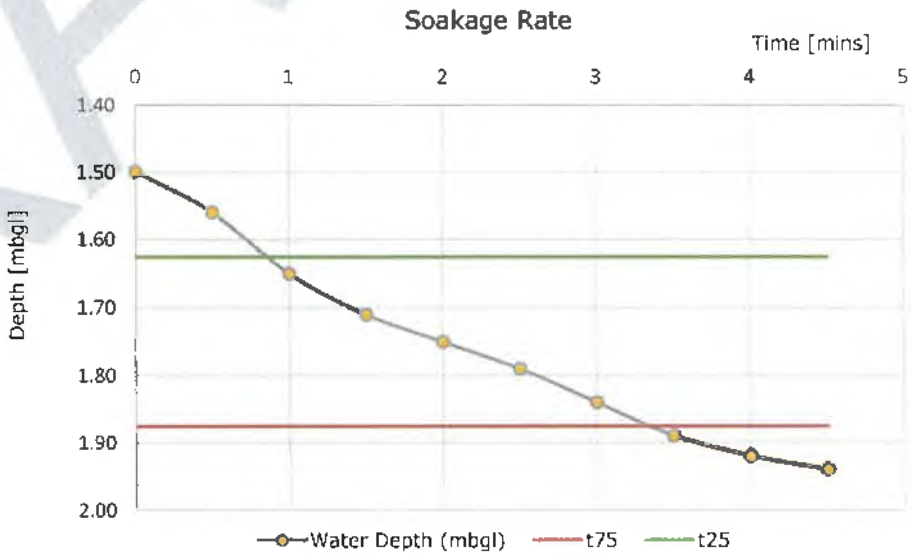
Trial Pit TP01

Run 3 of 3

Test Date 09/01/2025

Groundwater Encountered: N/A

Remarks: Backfilled with gravel. Effective volume multiplied by the voids ratio of the gravel (0.3).



Calculated by: JK

Checked by: RS

DRAFT

TRIAL PIT INFILTRATION TEST - BRE DIGEST 365

Project Number: 9153,SK

Date: 22/01/2025

Project Name: Lanwades Country Park, Newmarket, CB8 7UU

Time [min]	Depth to Water [mbgl]
0	1.50
0.5	1.66
1	1.81
1.5	1.96

Pit Size [m]		
Length	Width	Depth
1.75	0.40	2.00

Infiltration Rate Calculations		
Parameter	Unit	Result
	height	
h_{75}	[m]	1.875
h_{25}	[m]	1.625
h_{75}-h_{25}	[m]	0.250
	time	
t_{75}	[s]	73.50
t_{25}	[s]	22.80
t_{75} - t_{25}	[s]	50.70
	effective volume	
v_{75-25}	[m^3]	0.053
	effective area	
ap_{50}	[m^2]	1.775
	soil infiltration rate	
f	[m/s]	5.83E-04

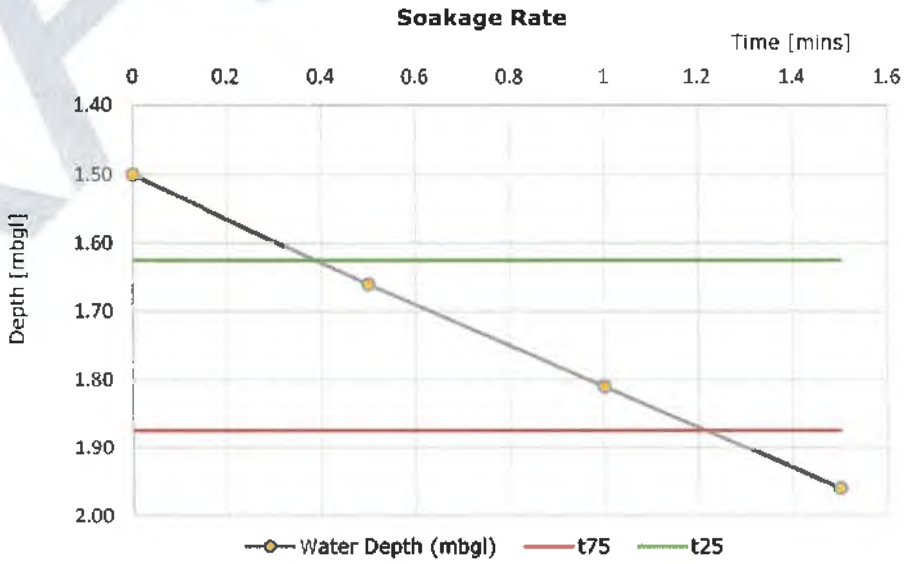
Trial Pit TP02

Run 1 of 3

Test Date 09/01/2025

Groundwater Encountered: N/A

Remarks: Backfilled with gravel. Effective volume multiplied by the voids ratio of the gravel (0.3).



Calculated by: JK

Checked by: RS

DRAFT

TRIAL PIT INFILTRATION TEST - BRE DIGEST 365

Project Number: 9153,SK

Date: 22/01/2025

Project Name: Lanwades Country Park, Newmarket, CB8 7UU

Time [min]	Depth to Water [mbgl]
0	1.50
0.33	1.59
0.66	1.71
1	1.83
1.33	1.94

Pit Size [m]		
Length	Width	Depth
1.75	0.40	2.00

Infiltration Rate Calculations		
Parameter	Unit	Result
height		
h_{75}	[m]	1.875
h_{25}	[m]	1.625
h_{75}-h_{25}	[m]	0.250
time		
t_{75}	[s]	67.20
t_{25}	[s]	25.20
t_{75} - t_{25}	[s]	42.00
effective volume		
V_{75-25}	[m^3]	0.053
effective area		
ap_{50}	[m^2]	1.775
soil infiltration rate		
f	[m/s]	7.04E-04

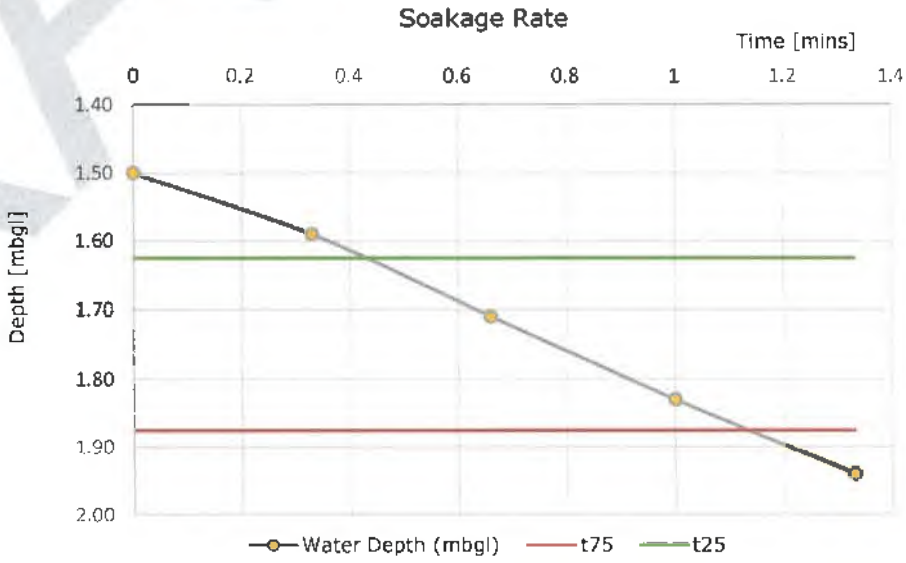
Trial Pit TP02

Run 2 of 3

Test Date 09/01/2025

Groundwater Encountered: N/A

Remarks: Backfilled with gravel. Effective volume multiplied by the voids ratio of the gravel (0.3).



Calculated by: JK

Checked by: RS

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TRIAL PIT INFILTRATION TEST - BRE DIGEST 365

GEO

Project Number: 9153,SK

Date: 22/01/2025

Project Name: Lanwades Country Park, Newmarket, CB8 7UU

Time [min]	Depth to Water [mbgl]
0	1.50
0.16	1.56
0.33	1.62
0.5	1.66
0.66	1.71
0.83	1.76
1	1.81
1.16	1.86
1.33	1.91
1.5	1.96
1.66	2.00

Pit Size [m]		
Length	Width	Depth
1.75	0.40	2.00

Infiltration Rate Calculations		
Parameter	Unit	Result
	height	
h_{75}	[m]	1.875
h_{25}	[m]	1.625
h_{75}-h_{25}	[m]	0.250
	time	
t_{75}	[s]	72.00
t_{25}	[s]	21.00
t_{75} - t_{25}	[s]	51.00
	effective volume	
v_{75-25}	[m^3]	0.053
	effective area	
ap_{50}	[m^2]	1.775
	soil infiltration rate	
f	[m/s]	5.80E-04

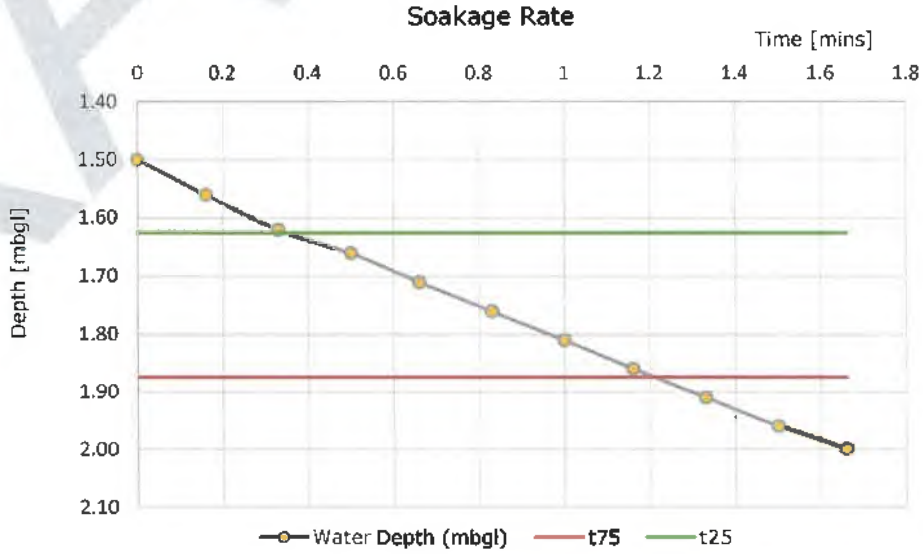
Trial Pit TP02

Run 3 of 3

Test Date 09/01/2025

Groundwater Encountered: N/A

Remarks: Backfilled with gravel. Effective volume multiplied by the voids ratio of the gravel (0.3).



Calculated by: JK

Checked by: RS

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TRIAL PIT INFILTRATION TEST - BRE DIGEST 365

Project Number: 9153,SK

Date: 22/01/2025

Project Name: Lanwades Country Park, Newmarket, CB8 7UU

Time [min]	Depth to Water [mbgl]
0	1.50
0.5	1.58
1	1.62
2	1.67
3	1.72
4	1.75
5	1.77
10	1.85
14	1.89

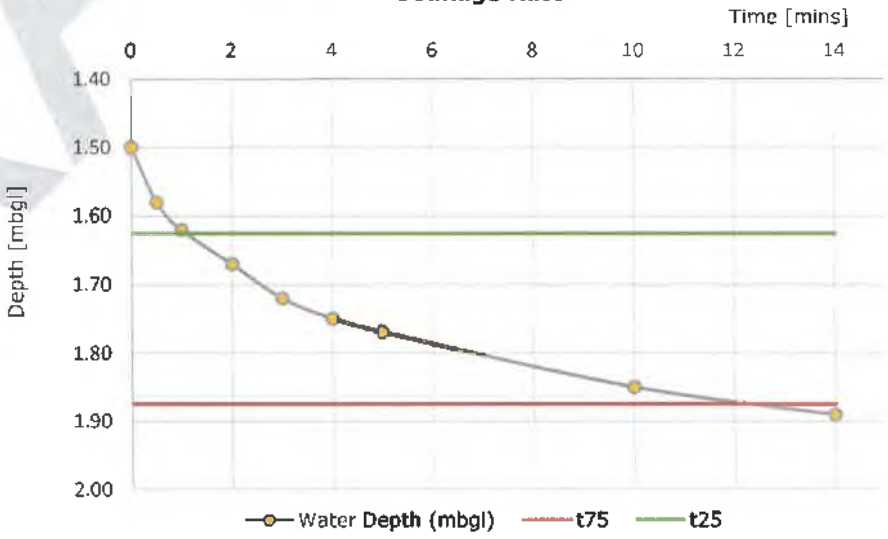
Pit Size [m]		
Length	Width	Depth
1.70	0.40	2.00

Infiltration Rate Calculations		
Parameter	Unit	Result
	height	
h_{75}	[m]	1.875
h_{25}	[m]	1.625
h_{75}-h_{25}	[m]	0.250
	time	
t_{75}	[s]	750.00
t_{25}	[s]	66.00
t_{75} - t_{25}	[s]	684.00
	effective volume	
V_{75-25}	[m³]	0.051
	effective area	
ap_{50}	[m²]	1.730
	soil infiltration rate	
f	[m/s]	4.31E-05

Trial Pit	TP03
Run	1 of 3
Test Date	09/01/2025
Groundwater Encountered:	N/A

Remarks: Backfilled with gravel. Effective volume multiplied by the voids ratio of the gravel (0.3).

Soakage Rate



Calculated by: JK

Checked by: RS

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TRIAL PIT INFILTRATION TEST - BRE DIGEST 365

Project Number: 9153,SK

Date: 22/01/2025

Project Name: Lanwades Country Park, Newmarket, CB8 7UU

Time [min]	Depth to Water [mbgl]
0	1.50
1	1.61
2	1.67
3	1.71
4	1.74
5	1.76
10	1.83
15	1.87
19	1.90

Pit Size [m]		
Length	Width	Depth
1.70	0.40	2.00

Infiltration Rate Calculations		
Parameter	Unit	Result
	height	
h_{75}	[m]	1.875
h_{25}	[m]	1.625
$h_{75}-h_{25}$	[m]	0.250
	time	
t_{75}	[s]	930.00
t_{25}	[s]	72.00
$t_{75} - t_{25}$	[s]	858.00
	effective volume	
v_{75-25}	[m³]	0.051
	effective area	
ap_{50}	[m²]	1.730
	soil infiltration rate	
f	[m/s]	3.44E-05

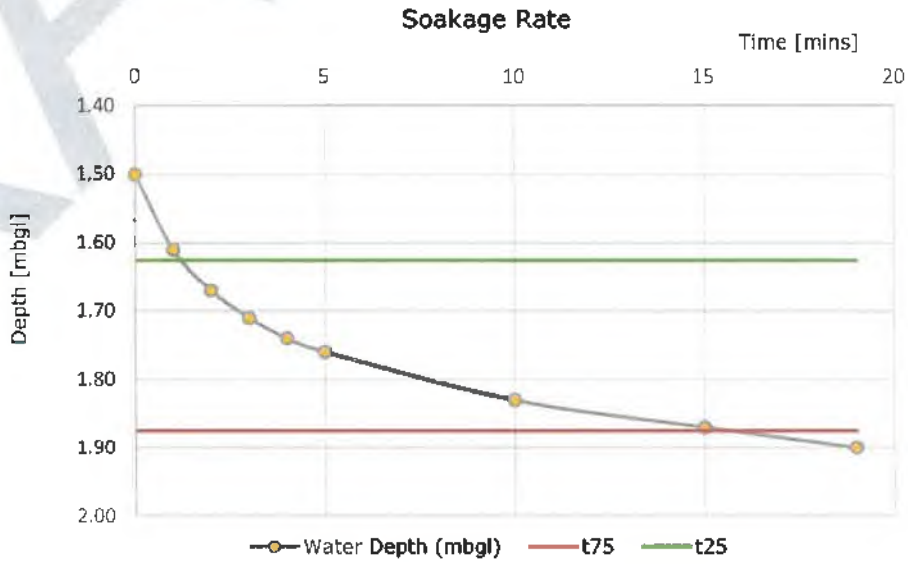
Trial Pit TP03

Run 2 of 3

Test Date 09/01/2025

Groundwater Encountered: N/A

Remarks: Backfilled with gravel. Effective volume multiplied by the voids ratio of the gravel (0.3).



Calculated by: JK

Checked by: RS

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TRIAL PIT INFILTRATION TEST - BRE DIGEST 365

Project Number: 9153,SK

Date: 22/01/2025

Project Name: Lanwades Country Park, Newmarket, CB8 7UU

Time [min]	Depth to Water [mbgl]
0	1.50
1	1.58
2	1.64
3	1.67
4	1.70
5	1.73
10	1.80
15	1.84
20	1.86
25	1.90

Pit Size [m]		
Length	Width	Depth
1.70	0.40	2.00

Infiltration Rate Calculations		
Parameter	Unit	Result
height		
h_{75}	[m]	1.875
h_{25}	[m]	1.625
h_{75}-h_{25}	[m]	0.250
time		
t_{75}	[s]	1320.00
t_{25}	[s]	108.00
t_{75} - t_{25}	[s]	1212.00
effective volume		
V_{75-25}	[m³]	0.051
effective area		
ap_{50}	[m²]	1.730
soil infiltration rate		
f	[m/s]	2.43E-05

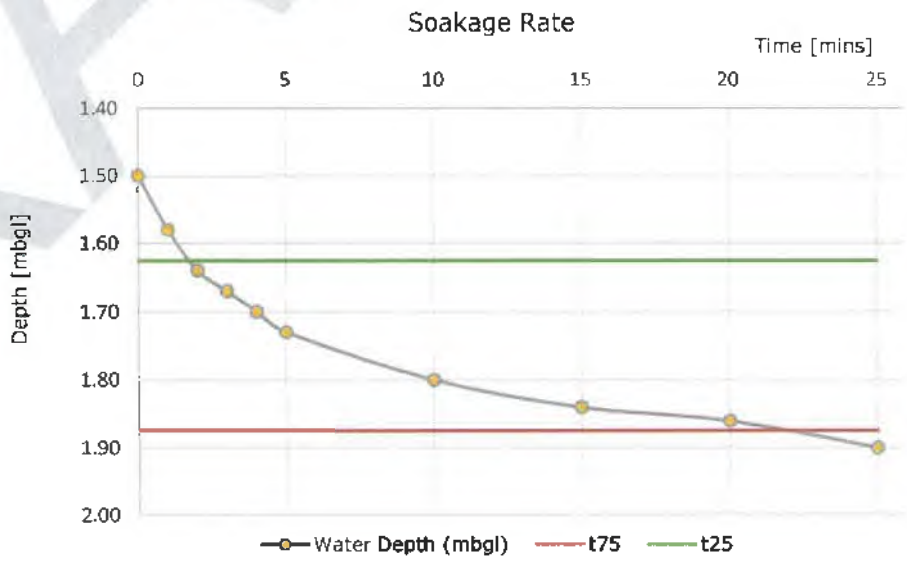
Trial Pit TP03

Run 3 of 3

Test Date 09/01/2025

Groundwater Encountered: N/A

Remarks: Backfilled with gravel. Effective volume multiplied by the voids ratio of the gravel (0.3).



Calculated by: JK

Checked by: RS

DRAFT

TRIAL PIT INFILTRATION TEST - BRE DIGEST 365

GEO

Project Number: 9153,SK

Date: 22/01/2025

Project Name: Lanwades Country Park, Newmarket, CB8 7UU

Time [min]	Depth to Water [mbgl]
0	1.50
1	1.56
2	1.61
3	1.64
4	1.67
5	1.71
10	1.74
15	1.79
20	1.82
25	1.85
30	1.88
32	1.89

Pit Size [m]		
Length	Width	Depth
1.60	0.40	2.00

Infiltration Rate Calculations		
Parameter	Unit	Result
	height	
h_{75}	[m]	1.875
h_{25}	[m]	1.625
$h_{75}-h_{25}$	[m]	0.250
	time	
t_{75}	[s]	1800.00
t_{25}	[s]	150.00
$t_{75} - t_{25}$	[s]	1650.00
	effective volume	
v_{75-25}	[m³]	0.048
	effective area	
ap_{50}	[m²]	1.640
	soil infiltration rate	
f	[m/s]	1.77E-05

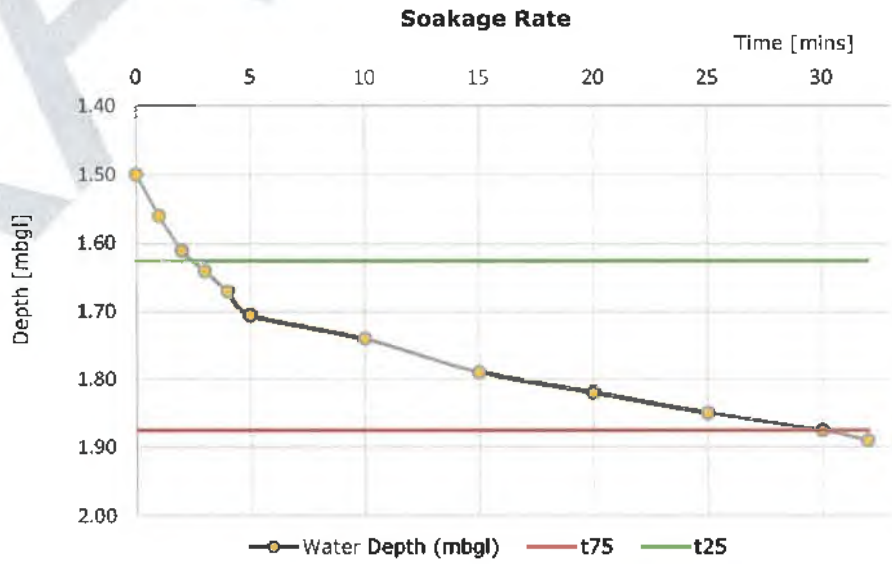
Trial Pit TP04

Run 1 of 3

Test Date 09/01/2025

Groundwater Encountered: N/A

Remarks: Backfilled with gravel. Effective volume multiplied by the voids ratio of the gravel (0.3).



Calculated by: JK

Checked by: RS

DRAFT

TRIAL PIT INFILTRATION TEST - BRE DIGEST 365

Project Number: 9153,SK

Date: 22/01/2025

Project Name: Lanwades Country Park, Newmarket, CB8 7UU

Time [min]	Depth to Water [mbgl]
0	1.50
1	1.56
2	1.60
3	1.64
4	1.66
5	1.68
10	1.72
15	1.76
30	1.85
38	1.88
40	1.90

Pit Size [m]		
Length	Width	Depth
1.60	0.40	2.00

Infiltration Rate Calculations		
Parameter	Unit	Result
height		
h_{75}	[m]	1.875
h_{25}	[m]	1.625
$h_{75}-h_{25}$	[m]	0.250
time		
t_{75}	[s]	2220.00
t_{25}	[s]	156.00
$t_{75} - t_{25}$	[s]	2064.00
effective volume		
v_{75-25}	[m^3]	0.048
effective area		
ap_{50}	[m^2]	1.640
soil infiltration rate		
f	[m/s]	1.42E-05

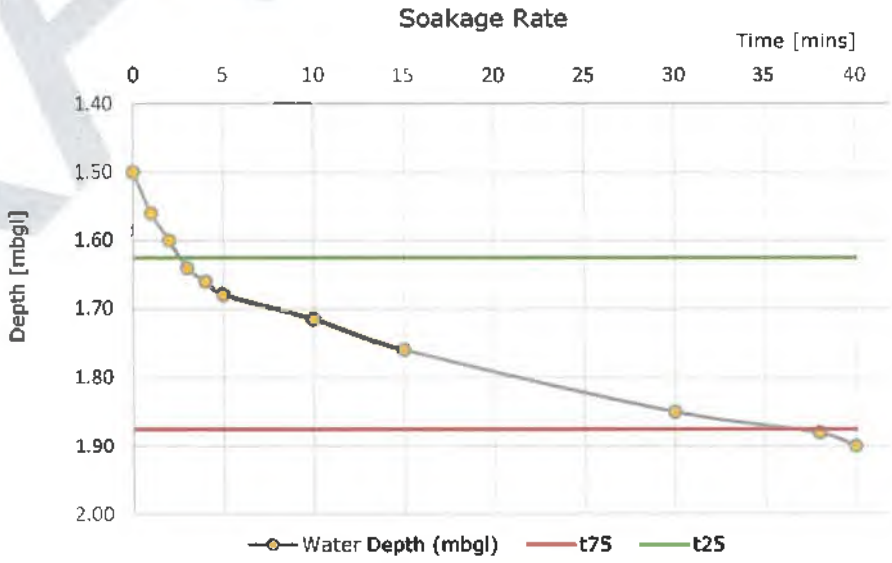
Trial Pit TP04

Run 2 of 3

Test Date 09/01/2025

Groundwater Encountered: N/A

Remarks: Backfilled with gravel. Effective volume multiplied by the voids ratio of the gravel (0.3).



Calculated by: JK

Checked by: RS

DRAFT

TRIAL PIT INFILTRATION TEST - BRE DIGEST 365

Project Number: 9153,SK

Date: 22/01/2025

Project Name: Lanwades Country Park, Newmarket, CB8 7UU

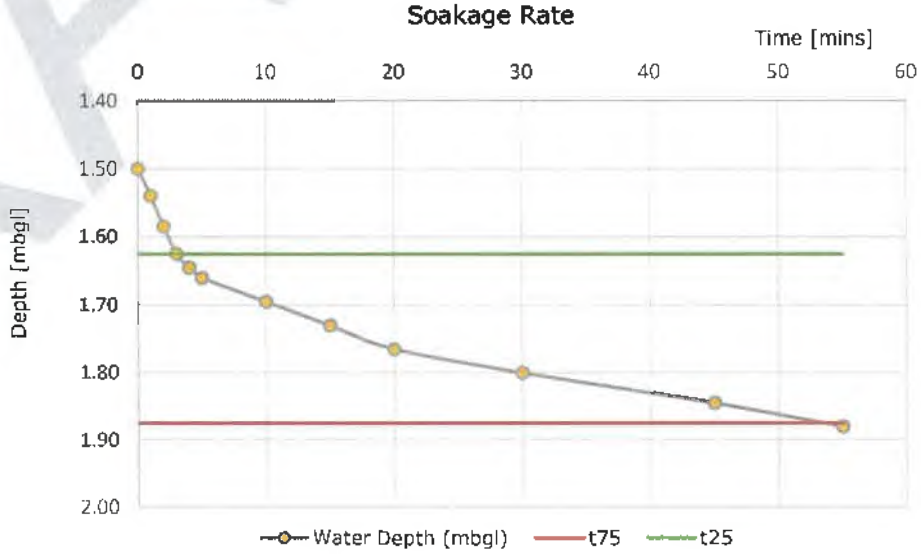
Time [min]	Depth to Water [mbgl]
0	1.50
1	1.54
2	1.59
3	1.63
4	1.65
5	1.66
10	1.70
15	1.73
20	1.77
30	1.80
45	1.85
55	1.88

Pit Size [m]		
Length	Width	Depth
1.60	0.40	2.00

Infiltration Rate Calculations		
Parameter	Unit	Result
	height	
h_{75}	[m]	1.875
h_{25}	[m]	1.625
h_{75}-h_{25}	[m]	0.250
	time	
t_{75}	[s]	3240.00
t_{25}	[s]	180.00
t_{75} - t_{25}	[s]	3060.00
	effective volume	
v_{75-25}	[m^3]	0.048
	effective area	
ap_{50}	[m^2]	1.640
	soil infiltration rate	
f	[m/s]	9.56E-06

Trial Pit	TP04
Run	3 of 3
Test Date	09/01/2025
Groundwater Encountered:	N/A

Remarks: Backfilled with gravel. Effective volume multiplied by the voids ratio of the gravel (0.3).



Calculated by: JK

Checked by: RS

DRAFT

TRIAL PIT INFILTRATION TEST - BRE DIGEST 365

Project Number: 9153,SK

Date: 22/01/2025

Project Name: Lanwades Country Park, Newmarket, CB8 7UU

Time [min]	Depth to Water [mbgl]
0	1.50
0.5	1.69
1	1.77
1.5	1.84
2	1.90
2.5	2.00

Pit Size [m]		
Length	Width	Depth
1.65	0.40	2.00

Infiltration Rate Calculations		
Parameter	Unit	Result
height		
h_{75}	[m]	1.875
h_{25}	[m]	1.625
$h_{75}-h_{25}$	[m]	0.250
time		
t_{75}	[s]	108.00
t_{25}	[s]	18.00
$t_{75} - t_{25}$	[s]	90.00
effective volume		
v_{75-25}	[m^3]	0.050
effective area		
ap_{50}	[m^2]	1.685
soil infiltration rate		
f	[m/s]	3.26E-04

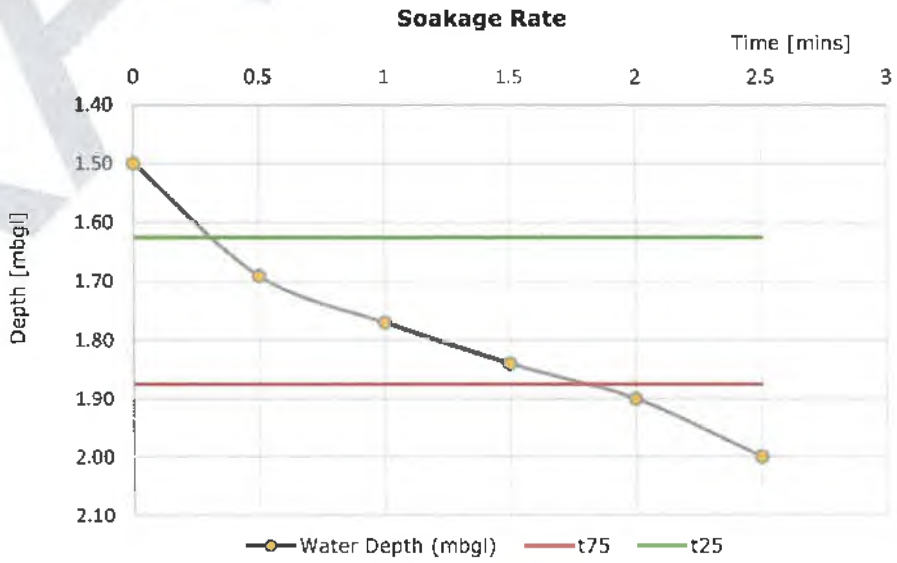
Trial Pit TP05

Run 1 of 3

Test Date 08/01/2025

Groundwater Encountered: N/A

Remarks: Backfilled with gravel. Effective volume multiplied by the voids ratio of the gravel (0.3).



Calculated by: JK

Checked by: RS

DRAFT

TRIAL PIT INFILTRATION TEST - BRE DIGEST 365

GEO

Project Number: 9153,SK

Date: 22/01/2025

Project Name: Lanwades Country Park, Newmarket, CB8 7UU

Time [min]	Depth to Water [mbgl]
0	1.50
0.16	1.53
0.33	1.56
0.5	1.59
0.66	1.62
0.83	1.65
1	1.69
1.16	1.71
1.33	1.73
1.5	1.75
1.66	1.76
1.83	1.78
2	1.80
2.16	1.81
2.33	1.83
2.5	1.84
2.66	1.86
2.83	1.87
3	1.89
3.16	1.90
3.33	1.91
3.5	1.93
3.66	1.94

Pit Size [m]		
Length	Width	Depth
1.65	0.40	2.00

Infiltration Rate Calculations		
Parameter	Unit	Result
height		
h_{75}	[m]	1.875
h_{25}	[m]	1.625
h_{75}-h_{25}	[m]	0.250
time		
t_{75}	[s]	171.00
t_{25}	[s]	42.00
t_{75} - t_{25}	[s]	129.00
effective volume		
v_{75-25}	[m^3]	0.050
effective area		
ap_{50}	[m^2]	1.685
soil infiltration rate		
f	[m/s]	2.28E-04

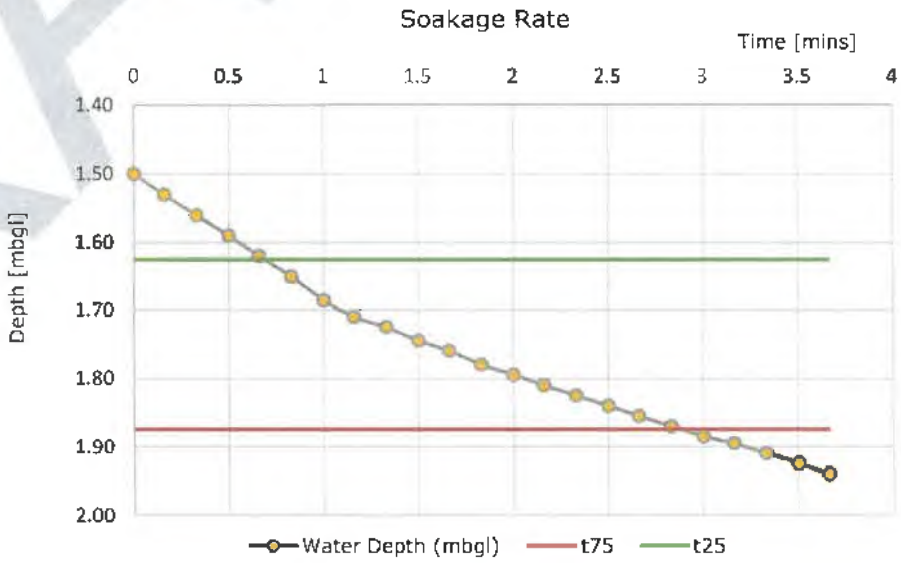
Trial Pit TP05

Run 2 of 3

Test Date 09/01/2025

Groundwater Encountered: N/A

Remarks: Backfilled with gravel. Effective volume multiplied by the voids ratio of the gravel (0.3).



Calculated by: JK

Checked by: RS

DRAFT

TRIAL PIT INFILTRATION TEST - BRE DIGEST 365

Project Number: 9153,SK

Date: 22/01/2025

Project Name: Lanwades Country Park, Newmarket, CB8 7UU

Time [min]	Depth to Water [mbgl]
0	1.50
0.16	1.52
0.33	1.54
0.5	1.56
0.66	1.58
0.83	1.59
1	1.61
1.16	1.62
1.33	1.63
1.5	1.65
1.66	1.67
1.83	1.68
2	1.70
2.16	1.71
2.33	1.73
2.5	1.75
2.66	1.76
2.83	1.77
3	1.78
3.16	1.80
3.33	1.82
3.5	1.83
3.66	1.85
3.83	1.86
4	1.88
4.16	1.89

Pit Size [m]		
Length	Width	Depth
1.65	0.40	2.00

Infiltration Rate Calculations		
Parameter	Unit	Result
	height	
h_{75}	[m]	1.875
h_{25}	[m]	1.625
h_{75}-h_{25}	[m]	0.250
	time	
t_{75}	[s]	240.00
t_{25}	[s]	74.70
t_{75} - t_{25}	[s]	165.30
	effective volume	
v_{75-25}	[m^3]	0.050
	effective area	
ap_{50}	[m^2]	1.685
	soil infiltration rate	
f	[m/s]	1.78E-04

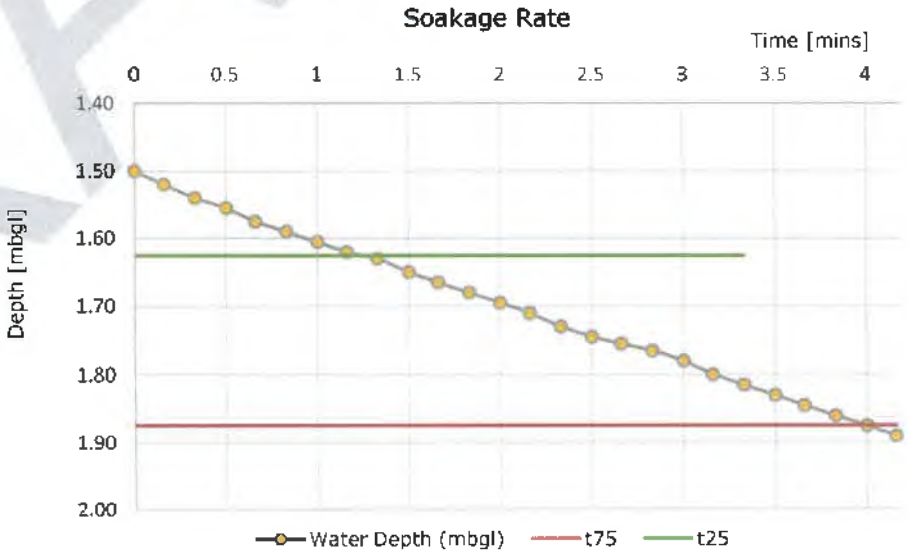
Trial Pit TP05

Run 3 of 3

Test Date 09/01/2025

Groundwater Encountered: N/A

Remarks: Backfilled with gravel. Effective volume multiplied by the voids ratio of the gravel (0.3).



Calculated by: JK

Checked by: RS

DRAFT

Appendix 4 – Drawings

Exploratory Hole Location Plan - Drawing ref. 9153,SK/001/Rev0

DRAFT

Legend

Site Boundary

Infiltration Test Locations

GEO

GEOSPHERE ENVIRONMENTAL

Project

Lanwades Country Park, Newmarket, CB8 7UU

Drawing Title

Exploratory Hole Location Plan

Drawing Number

9153,SK/001/Rev0

Date

22/01/2025

Author / Checked By

JK / FW

Source

Map data ©2025 Imagery ©2025 Airbus, Maxar Technologies

Search location

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Search location indicated in red

Point centred at: 569755,266288

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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.

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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/.

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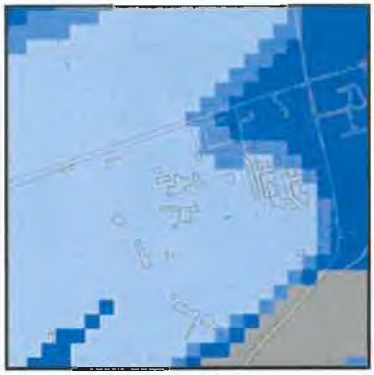
PART 1: SUMMARY DATA

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?

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- 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.

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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 2024	■ 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 2024	■ 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.

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Shallow mining hazard (not including coal)

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- [x] 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

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- [x] 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

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- [x] 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

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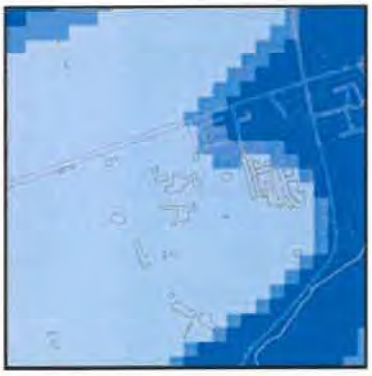
Section 2. Drainage potential

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 2024	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.

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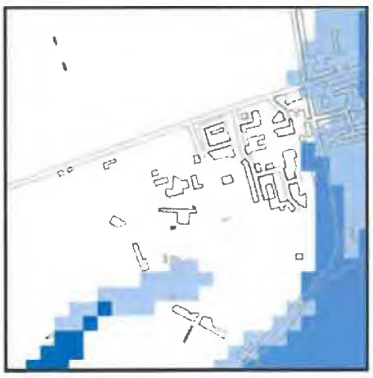
Superficial deposit permeability



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- 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

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Maximum

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Superficial deposit thickness

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- 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.

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Bedrock permeability

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- 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

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Maximum

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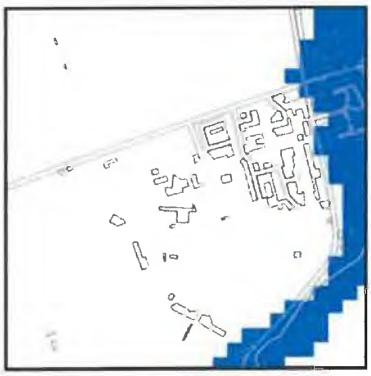
Geological indicators of flooding



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- 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.

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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 2024	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.

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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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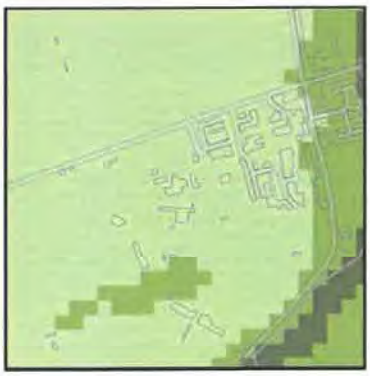
- Increased infiltration is unlikely to lead to subsidence.
- Shallow mining is possibly present. Increased infiltration is unlikely to cause a geohazard, but potential impacts should be considered.
- Shallow mining could be present with a significant possibility that localised subsidence could be initiated 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.

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Swelling clays

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- 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

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- 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

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- 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.

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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

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Derived in part from Source Protection Zone data provided under licence from the Environment Agency © Environment Agency 2024.

- 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

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- 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.

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Made ground

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

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Section 5. Geological Maps

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

Artificial deposits

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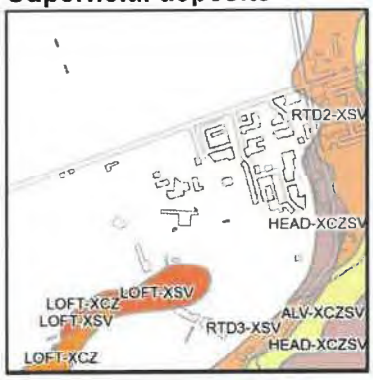
Superficial deposits



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Bedrock

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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-XCZSV	ALLUVIUM	CLAY, SILT, SAND AND GRAVEL
	LOFT-XCZ	LOWESTOFT FORMATION	CLAY AND SILT
	LOFT-XSV	LOWESTOFT FORMATION	SAND AND GRAVEL
	HEAD-XCZSV	HEAD	CLAY, SILT, SAND AND GRAVEL
	RTD2-XSV	RIVER TERRACE DEPOSITS, 2	SAND AND GRAVEL
	RTD3-XSV	RIVER TERRACE DEPOSITS, 3	SAND AND GRAVEL

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Key to Bedrock geology:

Map colour	Computer Code	Rock name	Rock type
	HNCK-CHLK	HOLYWELL NODULAR CHALK FORMATION AND NEW PIT CHALK FORMATION (UNDIFFERENTIATED)	CHALK

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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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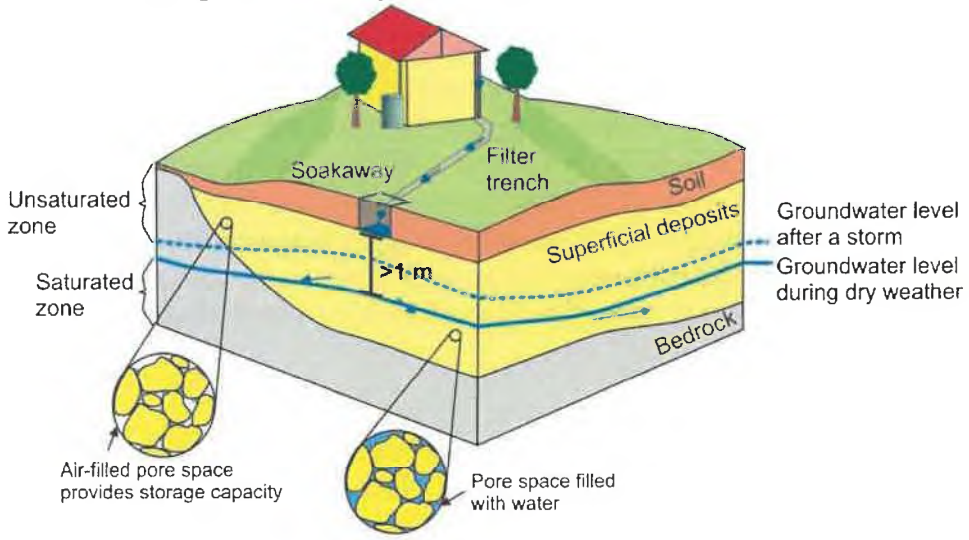
Explanation of terms

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.

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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.

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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.

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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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Appendix B Proposed Site

Proposed layout x 2
Surface water drainage strategy x 3
Catchment plan x 3
Maintenance plan x 3
Contours and exceedance plan x 3
Typical section through infiltration basin
Causeway Flow calculations