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FLOOD RISK ASSESSMENT & DRAINAGE STRATEGY

FOR

THAXTED ROAD
LAND SOUTH OF SAFFRON WALDEN

PROJECT NUMBER:	22-0222
DOCUMENT REFERENCE:	220222-RGL-ZZ-XX-RP-C-0002
REVISION:	S2-P04

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REVISION

REVISION	ISSUE DATE	REASON FOR ISSUE
S2-P01	16.11.2022	Information
S2-P02	25.11.2022	Re-issued as Drawing in Appendix B has been updated
S2-P03	25.11.2022	Small update to foul water section
S2-P04	13.01.2023	Updated to suit LLFA Comments

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CONTENTS

PREFACE

a) The Flood Risk Assessment and Drainage Strategy and/or opinion has been prepared for the specific purpose stated therein.

b) The Flood Risk Assessment Drainage Strategy has been prepared for the exclusive use by:-

Kier Ventures Ltd

c) This document is issued only to the persons stated above and on the understanding that this Practice is not held responsible for the actions of others who obtain any unauthorised disclosure of its contents, or place reliance on any part of its findings, facts or opinions, be they specifically stated or implied.

d) This study is a risk based assessment of potential flooding issues at the study site and the information presented and the conclusions drawn are for guidance only and provide no guarantee against flooding.

1.0 INTRODUCTION

This Flood Risk Assessment has been prepared on behalf of Kier Ventures Ltd in support of their outline planning Application for a residential development for up to 170 dwellings on the site Land West of Thaxted Road, Saffron Walden.

This report has been written and formatted generally in accordance with the requirements outlined in National Planning Policy Framework (NPPF) and its technical guidance. To further assist the checking process included in Appendix E is a checklist and its location within the report.

This report has been updated to suit comments raised by the LLFA in their letter dates 29th December 2022.

2.0 SITE SUMMARY

The proposed site is situated to the west of Thaxted Road, Saffron Walden and is centred approximately on National Grid Reference 554750, 237320.

The planning application site boundary and the extent of development area is approximately 8.35 hectares with existing ground that slopes in a north easterly direction.

The site is bounded by existing hedge lines and field boundaries to most sides. The ground conditions have been assessed from an initial desk study to contain undifferentiated Lewes Nodular Chalk Formation and Seaford Chalk Formation of the White Chalk Subgroup overlain by Head to the north-east and Lowestoft Formation toward the south-eastern end. Tributaries of the Slade system pass through the site although there are no other water bodies within the catchment and no historic ground water flooding has been identified.

Location plans of the site are included in **Appendix A**.

3.0 SITE LEVELS – EXISTING AND PROPOSED

3.1 EXISTING LEVELS

The general topography of the site, prior to development, consists of ground levels across the extent of the site varying quite sharply and also feature more local undulations, falling from approximately 103mAOD in the south west to 77mAOD in the north east.

Drawing 220222-RGL-ZZ-XX-DR-C-120-0001 Proposed Drainage Strategy Layout in **Appendix B** indicates the existing levels of the proposed site in the background of the proposed layout. A copy of the topographical survey drawings are included in **Appendix C** of this report.

3.2 PROPOSED LEVELS

The proposed development will mirror the existing site topography with the general fall across the site being maintained.

All levels are based on the Ordnance Datum, provided by Kier Group dated April 2022

4.0 EXISTING SITE DRAINAGE SYSTEM

The overall site has no formal drainage system and therefore surface water run-off flows off of the site at the Greenfield run-off rate via overland flow routes to the existing field boundary and ditches located to the north east of the site. A system of field ditches pass through the northern section of the site and ultimately connect into The Slade System main River which is located beyond the northern boundary to the north of the Lord Butler Fitness and Leisure Centre.

5.0 HYDRAULIC INFLUENCES

The key features of the existing site drainage infrastructure, which influence the hydrology of the site, are detailed below.

5.1 FIELD DRAINAGE DITCHES

From the topographic survey and site walkover the location of field drainage ditches on the site have been determined. These appear to be a combination of naturally occurring and purposefully constructed field drainage ditches which are fed by flows from the site, as well as offsite flows from the adjacent fields to the south west of the site. As part of the proposed scheme, the reinstated/maintained ditch network will require some culverts for reasons of access.

It is not anticipated that the proposed levels adjacent to these ditches will be adjusted significantly and as the proposed site levels will be similar to the existing site levels, any out of bank flooding would be directed towards the existing flow route which will be maintained to match the current situation. Levels to the plots will be designed to ensure that flows will be directed towards the drainage ditches and in the event of overtopping, surface water will not flow towards the buildings.

5.2 GROUND CONDITIONS

The published British Geological Survey (BGS) map for the area (Sheet 222 'Great Dunmow') and the BGS GeoIndex website show the site to be underlain by superficial deposits of the Lowestoft Formation (diamicton) at the far western extent of the site, and Head at the far eastern extent of the site. Superficial deposits are not shown to be present across the the central portion of the site. The underlying solid geology is indicated to comprise of the undifferentiated Lewes Nodular Chalk Formation and Seaford Chalk Formation of the White Chalk Subgroup.

Soakaway testing has been carried out by Rolton Group (RGL) in accordance with BRE Digest 365. The locations of investigative positions were selected to target proposed locations of attenuation ponds, under drained swales, dwelling soakaway locations and available access. A total of ten pits were excavated, ref. SA101A, SA101B, SA102 to SA109, between the 10th and 12th of October 2022. The pits were formed using a backhoe excavator to depths between 0.97mbgl and 3.45mbgl. The excavations were recorded by a Rolton Group engineer and shown in document 220222-RGL-ZZ-XX-CO-Z-0004.

Soil permeability tests were completed in all the pits in accordance with BRE Digest DG 365 2016: Soakaway design. The soakaway tests included each pit being partially filled with water, with the subsequent drop in water level measured at regular intervals. Depending on the rate of infiltration, where possible the test was repeated twice more. The report, 220222-RGL-ZZ-XX-CO-Z-0004, can be found in **Appendix D**.

For the preliminary drainage design seen in **Appendix B** and calculations included in **Appendix F**, an infiltration rate of $1x10^{-5}$m/s has been used.

6.0 IDENTIFICATION OF POTENTIAL FLOODING SOURCES

6.1 WATERCOURSES

The flood plain associated with the Slade System identifies that the site is located within flood zone 1, **Appendix E**. However, the tributaries upstream of the main River are not mapped as part of the main River modelling and therefore do not contribute to the flood zones. The surface water flooding map identifies that there is a risk of surface water flooding along the routes of the tributaries, particularly to the northern section of the site.

The tributary channels within the site are largely overgrown and poorly maintained and are therefore generating a larger surface water flood area. The entrance to the site off Thaxted Road will cross the surface water flow route, therefore this will need to be considered in order to ensure the flow route is maintained following the development of the site.

As part of this outline planning application, pre-application advice was sort from the Lead Local Flood Authority, where they said that the proposed development is not located within a Critical Drainage Area. As such it is not proposed to model the tributary channels, however this could be carried out as part of a reserved matters application if required.

6.2 RAINFALL

As the site is currently agricultural fields with the majority of rainfall being absorbed into the ground, the proposed development will keep this status quo. Infiltration rates calculated as part of the soakaway testing investigation show areas that are suitable for infiltration, as such surface water will be directed to these areas, being cleaned along the way by utilising under drained swales, permeable paving and the infiltration ponds themselves. Levels across the site will be designed to ensure that surface water flows, as a result of rainfall, will flow away from the buildings and towards permeable paving, under drained swales and open areas to provide active drainage.

6.3 SEA

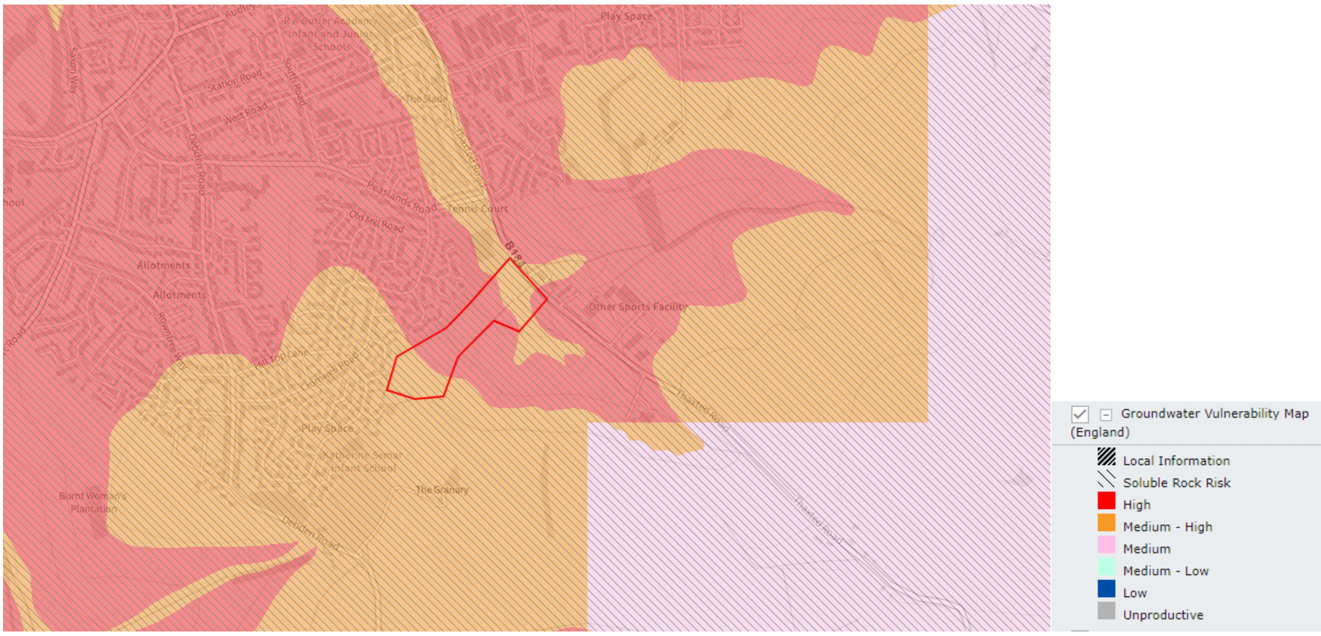
As the site is a significant distance from the sea and at a level significantly above sea level, the potential of flooding from the sea to affect the site is very low.

6.4 GROUND WATER

During the infiltration tests in October, no ground water was observed. The infiltration pits were excavated to a depth between 0.97mbgl and 3.45mbgl.

According to BGS mapping accessed via the DEFRA online Magic Map application, the site ground conditions have EA aquifer classifications of Principal aquifer for bedrock and Secondary (Undifferentiated) aquifer for Superficial Drift. However, although the site is within a groundwater source protection zone 3, this is associated with the active groundwater abstraction at a significant distance, approximately 6.0km from the site near Puckeridge.

The site is indicated to have the High and Medium-High for Groundwater vulnerability as indicated on the Magic map extract below with a Soluble Rock Risk.



6.5 SURFACE WATER RUN-OFF/SEWERS

The surface water run-off from the site will be directed towards and drained by areas of permeable paving, under drained swales, attenuation ponds and an infiltration basin. The current surface water flood risk maps produced by the EA indicates that a small area proposed for residential development falls within an area of surface water flood risk. The EA surface water maps are derived from a rainfall event falling onto the land (not taking account any infiltration/permeability of the soils), and accumulating in low spots, hence why drainage channels/water courses are shown in dark blue and being at high risk. The area in the northern half of the site will drain via infiltration permeable paving, located in private drives and shared driveways. Surface water from the roofs of the proposed apartments and the run off form other impermeable surfaces will all drain into the permeable paving, which will have an approximate subbase depth of 400mm catering for the 100 year rainfall event including climate change and an allowance for urban creep, and making sure the surface water in this area is manged in a sustainable way.

A copy of the flood risk map for surface water flooding can be found below. The preliminary drainage layout (**Appendix B)**, also has the EA surface water map extent shown on it.

In the event of surface water flooding as indicated in the above map, flood water will be routed through the development via designated flow route areas, conveyance swales and storage areas to the north eastern corner of the site where flood water currently flows to and leaves the site according to the flood risk mapping. Where the conveyance areas/swales cross proposed roads and highways, culverts will be designed and installed to ensure surface water conveyance without disrupting use of the roads. Refer to drawing 220222-RGL-ZZ-XX-DR-D-120-0001 found in **Appendix B** of this report for areas designated as conveyance routes and arrows indicating the direction of overland flow routes.

6.6 RESERVOIRS

There are no reservoirs in the vicinity of the site, therefore, this risk is considered to be very low.

6.7 ARTIFICIAL SOURCES

There are no other known artificial sources of potential flooding adjacent to the site.

7.0 EXISTING FLOOD RISKS

Included in **Appendix E** are the Environment Agency's flood maps covering the site, which identifies the proposed area for residential development as being outside of any area at risk of flooding from rivers or the sea, or from reservoirs.

As stated in section 6.4 of this report, it is expected that potential of flooding from groundwater is considered to be very low due to no ground water being observed on site during the infiltration testing.

8.0 ANALYSIS OF PROPOSED DEVELOPMENT AND SURFACE WATER DRAINAGE SYSTEM

8.1 PROPOSED DEVELOPMENT

The proposed development is for a residential development for up to 170 dwellings, landscaping, including open spaces, SuDS features, parking and access.

8.2 SURFACE WATER DRAINAGE

All developments should seek to dispose of surface water via infiltration before discharge to watercourses or local sewers. The site drainage strategy to dispose surface water has considered this concept and all surface water runoff will be discharged by direct infiltration. As indicated in section 5.2, the ground conditions are favourable for surface water infiltration, 10 No. infiltration tests were carried out by RGL in 2022, refer to **Appendix D** for exploratory hole layout and infiltration testing results.

It is proposed that in the southern part of the site, surface water from residential plots, driveways and the access road will be conveyed to the attenuation basins, prior to outfalling into the infiltration basin located in the northern area of the site.

In the northern portion of the site the residential plots will have individual soakaways, where ground conditions allow. Shared surfaces as well as the apartment building roofs will drain into areas of permeable paving which will be able to drain via infiltration.

Utilising permeable paving, both Type A and B, surface water will be cleaned prior to discharge to the ground and will also allow for some attenuation within the subbase. It is also proposed that during the detailed design, raingardens and tree pits are considered, to increase the benefits to the site.

In line with the updated 2020 Essex County Council SuDS Design Guide, rainwater re-use should be considered as part of any development. Discussions have considered using the attenuated surface water held in the ponds/basin for irrigation of the landscaped areas, which will likely require the use of pumping, this can be explored further in the detailed design stages. It is proposed that water butts be utilised for all residential units as part of the detailed design stage.

8.3 PRELIMINARY DRAINAGE/SUDS DESIGN

The preliminary drainage design below is split into quantity (flow and volume) and quality in accordance with the latest CIRIA, EA and ECC guidance. SuDS are an approach to managing rainwater and surface water that replicates natural drainage, the key objective being to manage flow rate and volume of runoff to reduce the risk of flooding.
Due to the high level of this outline design it has not been possible to show exact locations of the under drained swales. It is the intension of the proposed development to have under drained swales where possible and these will form part of the detailed design once the layout is fixed. We didn't want to propose under drained swales in locations where they then may not be able to be sited due to any changes in the layout and/or levels.

8.3.1 DESIGN TO LIMIT FLOW AND VOLUME

The site has been split into four catchments;

- Eastern Catchment – Individual Soakaways and permeable paving (Type A),
- Central Catchment - Individual Soakaways and permeable paving (Type A),
- Western Catchment - Individual Soakaways and permeable paving (Type A),
- Southern Catchment – The storm water will be conveyed to areas of permeable paving (Type B, allowing for limited infiltration) and under drained swales where possible, although a piped network will likely be required as well, then onto the attenuation ponds before finally getting to the infiltration basin.

The individual house soakaways have been designed based on a 60sqm roof area with an infiltration rate based on the value ($1x10^{-5}$m/s), requiring a cellular soakaway size of 2.5sqm and 1m depth. Refer to **Appendix F** for calculations. These soakaways have been designed and modelled so that the half drain time for each soakaway is less than 24 hours.

The infiltration basin has been designed to be 1 meter deep, with crates under that to provide extra storage. The crates will be 2m deep, at the closest trial pit SA106 no ground water was encountered.

All of the private property driveways are proposed to be constructed using permeable paving or designed to fall towards shared permeable driveways, to allow any surface water run off to be drained. Rainwater pipes from the plots themselves, will be drained into the porous subbase of the permeable paving where possible.

The surface water from the wider development drains to the north east area of the site where infiltration is at its best. In times of heavy rainfall events, surface water will back up within the drainage system and be attenuated in the areas of permeable paving, under drained swales and the attenuation and infiltration ponds.

The overall drainage strategy provides a solution that incorporates both above and below ground drainage system for conveying storm water. The storage requirements for the worst-case duration storm event (1 in 100) identifies a solution for attenuation ponds with a combined storage volume of approximately 3000m^3, maximum depth of 1m and 1 in 3 side slopes with a minimum freeboard of 300mm.

The final detailed design requirement for the scheme will need to provide storage through a mixture of attenuation ponds, under drained swales, permeable paving, and infiltration basins to ensure the drainage can be adopted for future maintenance purposes. Storage will need to accommodate the worst case 1 in 100-year rainfall event including 40% climate change and a 10% allowance for urban creep. As per the ECC guidance, the roof areas have all had a 10% increase to account for this and drainage network modelling has included an additional flow of 10%.

Calculations for the infiltration basin network indicate that a half drain time cannot be calculated. Due to this, the network will also need to accommodate a 1 in 10-year storm event, 24hrs following the design event. Proposed infiltration systems will need to ensure they half empty within 24 hours in preparation for any back to back storm events.

The preliminary drainage layout for the site can be found in **Appendix B**.

8.3.2 DESIGN TO ENSURE WATER QUALITY

The pollution hazard indices for different land use classifications, as identified in table 26.2 of the SuDS manual, are as follows:-

LAND USE	POLLUTION HAZARD LEVEL	TOTAL SUSPENDED SOLIDS (TSS)	METALS	HYDROCARBONS
Residential Roofs	Very Low	0.2	0.2	0.05
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways	Medium	0.7	0.6	0.7

Table 1 – Pollution Hazard

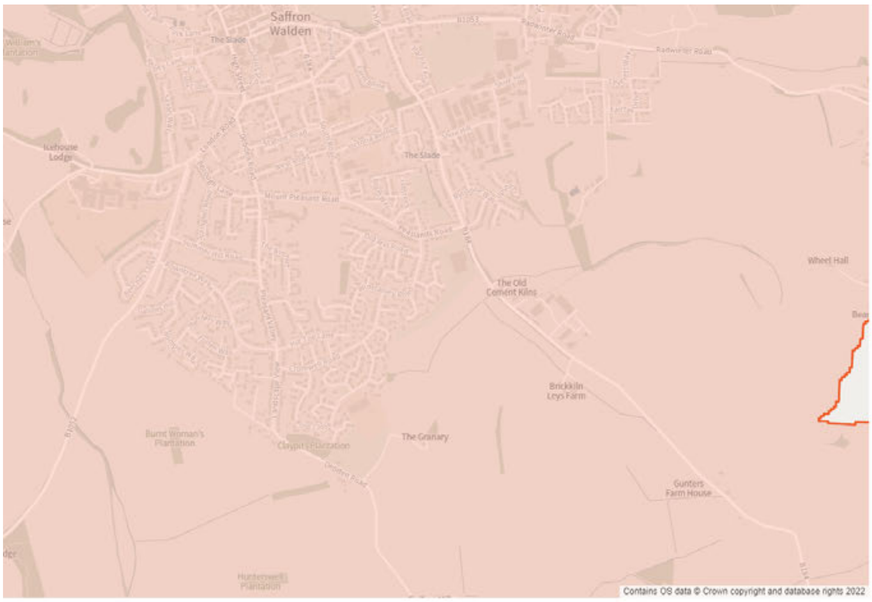
Therefore, based on the use of permeable paving, under drained swales and attenuation features including the infiltration basin, the indicative SuDS mitigation indices as identified in table 26.4 of the SuDS manual, for discharges to groundwater (together with totals) are as follows:-

SUDS FEATURE	TSS	METALS	HYDROCARBONS
Permeable paving	0.7	0.6	0.7
Under Drained Swales	N/A	N/A	N/A
Detention Basin	0.5	0.5	0.6
Infiltration Basin	0.4	0.3	0.3
TOTAL (Min.) dived by 3	1.3	1.2	1.3

Table 2 – SuDS

8.3.3 CLIMATE CHANGE AND DILAPIDATION

National Planning Policy Framework (which sets out the government requirements for the management and reduction of flood risk in the land use planning process) requires the investigation of climate change on the proposed development. The online climate change allowances indicate that up to 2115 the climate change allowance should be 25-40%.



Cam and Ely Ouse Management Catchment peak rainfall allowances

3.3% annual exceedance rainfall event

Epoch	Central allowance	Upper end allowance
2050s	20%	35%
2070s	20%	35%

1% annual exceedance rainfall event

Epoch	Central allowance	Upper end allowance
2050s	20%	40%
2070s	25%	40%

*Use '2050s' for development with a lifetime up 2060 and use the 2070s epoch for development with a lifetime between 2061 and 2125.

This map contains information generated by Met Office Hadley Centre (2019): UKCP Local Projections on a 5km grid over the UK for 1980-2080. Centre for Environmental Data Analysis, 2022

The full 40% climate change allowance has been included in the proposed storage design and this should be retained through the detailed design.

8.3.4 MAINTENANCE OF DRAINAGE FEATURES

The proposed external drainage system will consist of a piped drainage network, soakaways, under drained swales, storage tanks (if required), flow control chambers, permeable paving, attenuation basins and infiltration basins. Subject to detailed design, it is recommended that the piped storage system including flow control should be adopted by Anglian Water under a S104 agreement and the estate roads should be adopted by ECC under a S38 agreement. The shared private drainage system, private storage and attenuation areas will be maintained by a management company and the individual private drainage and permeable paving would be maintained by the property owners.

The recommended maintenance regime for the main surface water assets are set out in **Appendix G**.

9.0 ASSESSMENT, PROBABILITY AND RATE OF POTENTIAL FLOODING

As the development is a residential use, it is deemed a "more vulnerable" category to table 2 of the NPPF. Due to its location within flood zone 1 the development is appropriate in accordance with table 3 of the NPPF as indicated below:-

Table 3: Flood risk vulnerability and flood zone 'compatibility'

Paragraph: 067 Reference ID: 7-067-20140306

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	Exception Test required †	✗	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	✗	✗	✗	✓ *

Key:

✓ Development is appropriate

✗ Development should not be permitted.

As the site is located within flood zone 1, the sequential test is not required as the site is sequentially preferable within flood zone 1. Also, in accordance with table 2 the exception test is not applicable.

10.0 FOUL WATER DRIANAGE SYSTEM

The proposed below ground foul drainage system will be designed in accordance with the Building Regulations approved Document H and the Design and Construction Guide (2020).

Foul water, or effluent, flows from the site will be managed in a new sewer system which will connect to the existing public foul sewer network, which is understood to have been extended to serve the recent Bellway development to the east of the site and is also understood to have been designed to serve the development at Knights Park, **Appendix B.**

Foul drainage should be disposed of by connecting to the extended sewer in agreement with the relevant asset owner.

During the detailed design stage for the development, this existing sewer will be investigated and the invert levels surveyed. If the invert level of the existing sewer would not allow for a gravity connection, a pump station designed to adoptable standards would need to be considered.

11.0 CONCLUSION

In conclusion, this FRA and Drainage Strategy has been undertaken in accordance with National Planning Policy in relation to development and Flood Risk in respect of the proposed residential development at land west of Thaxted Road, Saffron Walden.

The ground conditions show infiltration will work on site. SuDS will be used throughout the proposed development to slow, clean and attenuate surface water, and surface water flood risk will be managed on site and not increase risk to the development or third parties.

12.0 REFERENCES

- National Planning Policy Framework (NPPF) dated July 2021 by Ministry of Housing, Communities and Local Government.
- Online Planning Practice Guidance to the National Planning Policy Framework dated June 2021 by Department for Communities and Local Government.
- FRA Guidance Note 1 by the EA
- EA/DEFRA document W5-074/A/TR/1 revision E 'preliminary rainfall runoff management for new developments' dated January 2012
- HR Wallingford UK SuDS Greenfield Run Off Rate Estimation tool
- Ciria C753 SuDS Manual 2015
- Department for Environment Food and Rural Affairs Climate Change Allowances
- Online Gov.uk Long Term Flood Risk checking tool

APPENDIX A - LOCATION PLAN

0 m 50 m 100 m 200 m
SCALE

N

KIER

Client: Kier Group	Drawing Title: Location Plan
Project: Land South of Saffron Walden	Scale: 1:1250 @ A1

Revision	Drawn	Check	Date
A	RB	JH	28.03.22
B	RB	JH	24.05.22

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Project No'	Class	Dwg No'	Status	Rev
3118	A	1000	PR	B

APPENDIX B – PROPOSED DEVELOPMENT PLAN AND DRAINAGE LAYOUT

Notes

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2. This drawing and its contents shall not be reproduced or reused in whole or in part without Rolton Group's express permission in writing and Rolton Group accepts no liability for any damages, costs, losses, claims, proceedings or expenses arising from such use.
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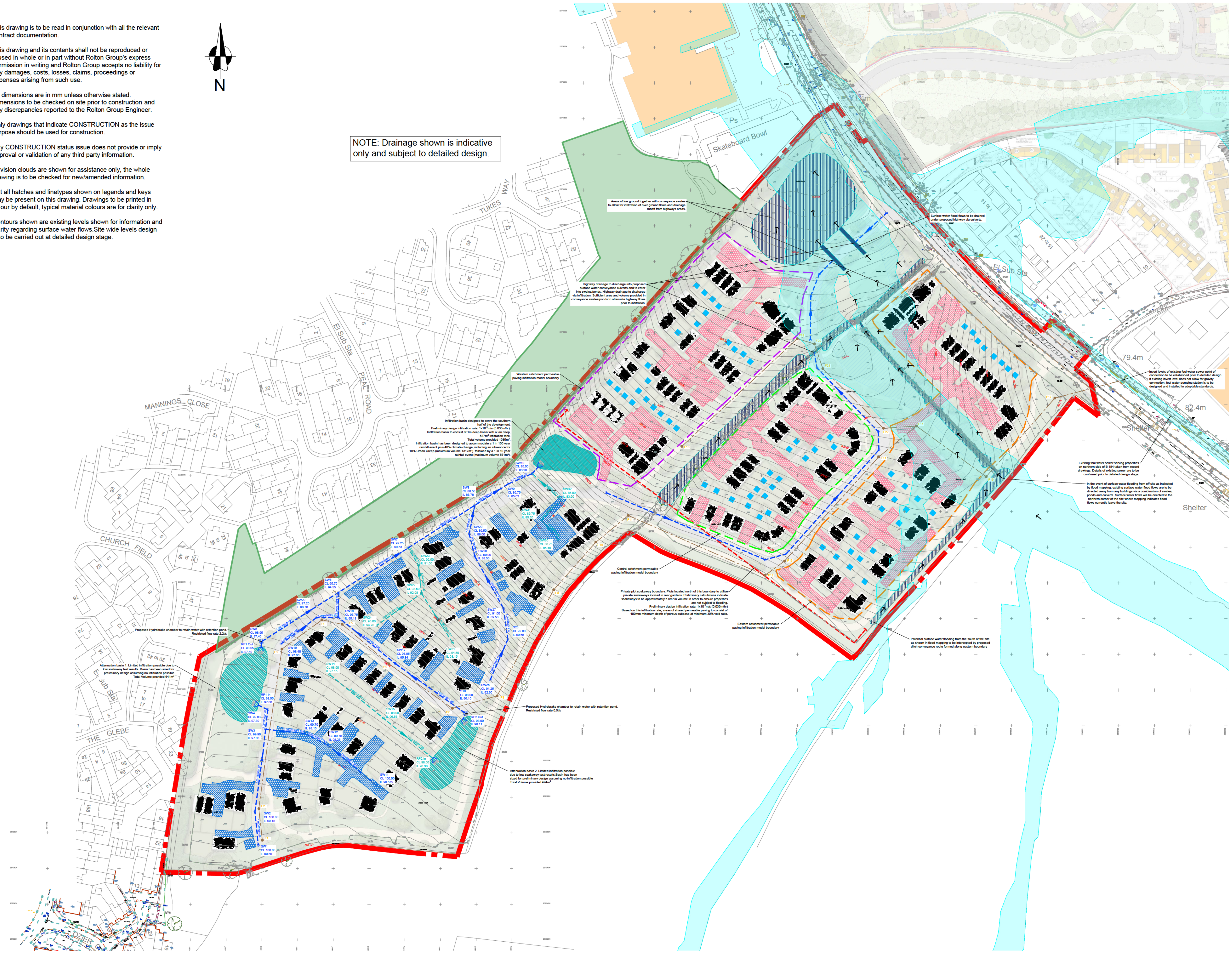
7. Not all hatches and linetypes shown on legends and keys may be present on this drawing. Drawings to be printed in colour by default, typical material colours are for clarity only.
8. Contours shown are existing levels shown for information and clarity regarding surface water flows.Site wide levels design is to be carried out at detailed design stage.



Standard construction hazards that a competent contractor would be aware of have not been identified on this drawing. Risks that may not be immediately apparent are listed below:

1

2

Status	Date	Description	Dwn	Eng	Chkd	Veri
S2-P01	16.11.22	Information issue	BH	BH	AJL	AJL
S2-P02	25.11.22	Site plan updated	BH	BH	AJL	AJL
S2-P03	13.01.23	Drawing amended for clarity	BH	BH	AC	AC

PROPOSED SEWER TYPE KEY

- Proposed Storm Water Gravity Sewer
- Proposed Foul Water Gravity Sewer
- Existing Storm Water Gravity Sewer
- Existing Foul Water Gravity Sewer
- Private Surface Water Sewer
- Private Foul Water Sewer
- Adoptable Road Gully
- Private Plot Soakaway Tank
- Type A Permeable Paving
- Type B Permeable Paving
- Retention Pond - No Infiltration
- Retention Pond - Full Infiltration
- Existing Surface Water Flood Risk Extent
- Surface Water Flooding Conveyance and Storage Areas
- Surface Water Flooding and Run Off Flow Route Direction
- Headwall (shown NTS)

1.000/600Ø/1 50

Drainage Model Pipe Reference
Sewer Diameter
Sewer Gradient

PROPOSED MANHOLE/INSPECTION CHAMBER TYPE KEY

Adoptable
Private

- Storm Water PPIC
- Foul Water PPIC
- Foul Water PCC MH
- Storm Water PCC MH/CP
- Surface Water Hydrobrake Chamber
- Surface Water PCC MH with Backdrop Connection
- Foul Water PPC MH with Backdrop Connection

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Project:
Land South of Saffron Walden, off Thaxted Road

Drawing Title:
Preliminary Drainage Layout

RGL Project Ref:	Scale@A1	Scale@A3
22-0222	1:1000	1:2000

Specification(s):

Drawing Number:
220222-RGL-ZZ-XX-DR-D-120-0001
Project-Originator-Zone-Level-Type-Role-Classification-Number

Issue Purpose: INFORMATION

Status: S2-P03
Suitability-Revision

APPENDIX C - TOPOGRAPHICAL SURVEY

Notes:

Whilst every effort has been made to correctly identify species of trees on the site, we advise that an arborologist be consulted before any final decisions are made.

All information contained in this drawing (including digital data) should be checked and verified prior to any fabrication or construction.

Grid coordinates are based on an OS GNSS system on a plane grid with a scale factor of 1.0000.

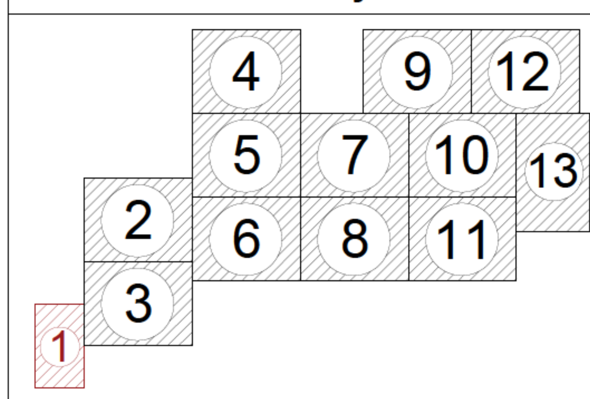
Contours only shown across open spaces.

2D survey data may differ slightly to 3D data due to edits made across the drawing within AutoCAD.

Drainage shown should be checked and verified as a high volume of manholes were flooded which proved difficult to establish accurate depths, pipe sizes and to sound connections.

Legend:

Sheet Layout



Rev. Suffix	Date	Initial	Revision Details

Surveyor	LH, LW	Verified By	LH, LW	CAD Operator	AP	Approved By	AL	Date	07.04.22

Levelling GNSS Datum OSGB36

To an OS GNSS Datum

Client

KIER GROUP

Location

Thaxted Road
Saffron Walden

Drawing Title

Topographical Survey Sheet 1 of 13

Job No. 2203015
Old Job No.

Drawing Number
K/2203015/1

Revision Suffix

Scale
1:200m (A1)

Date
April 2022

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237080N
237040N
237020N
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554580E
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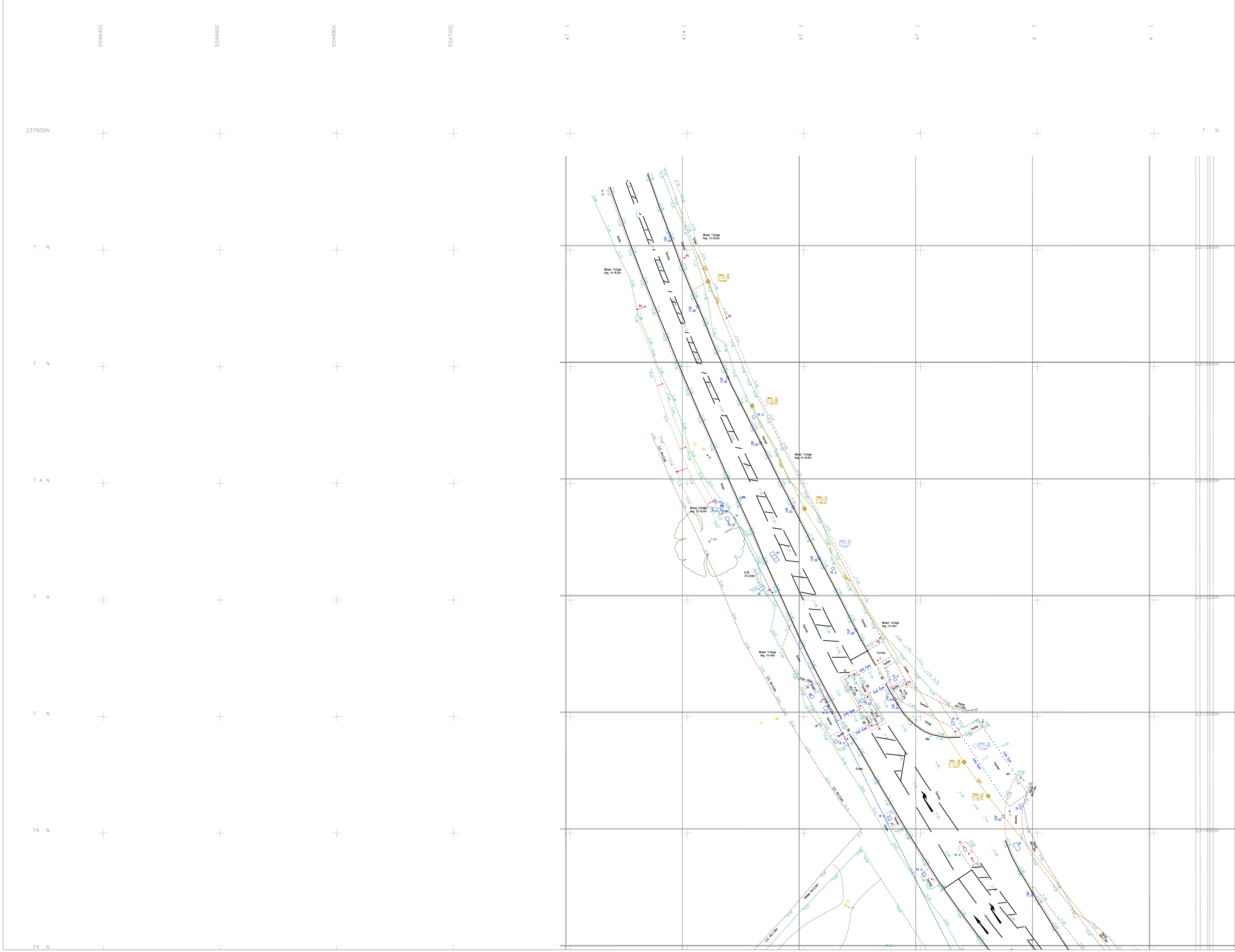

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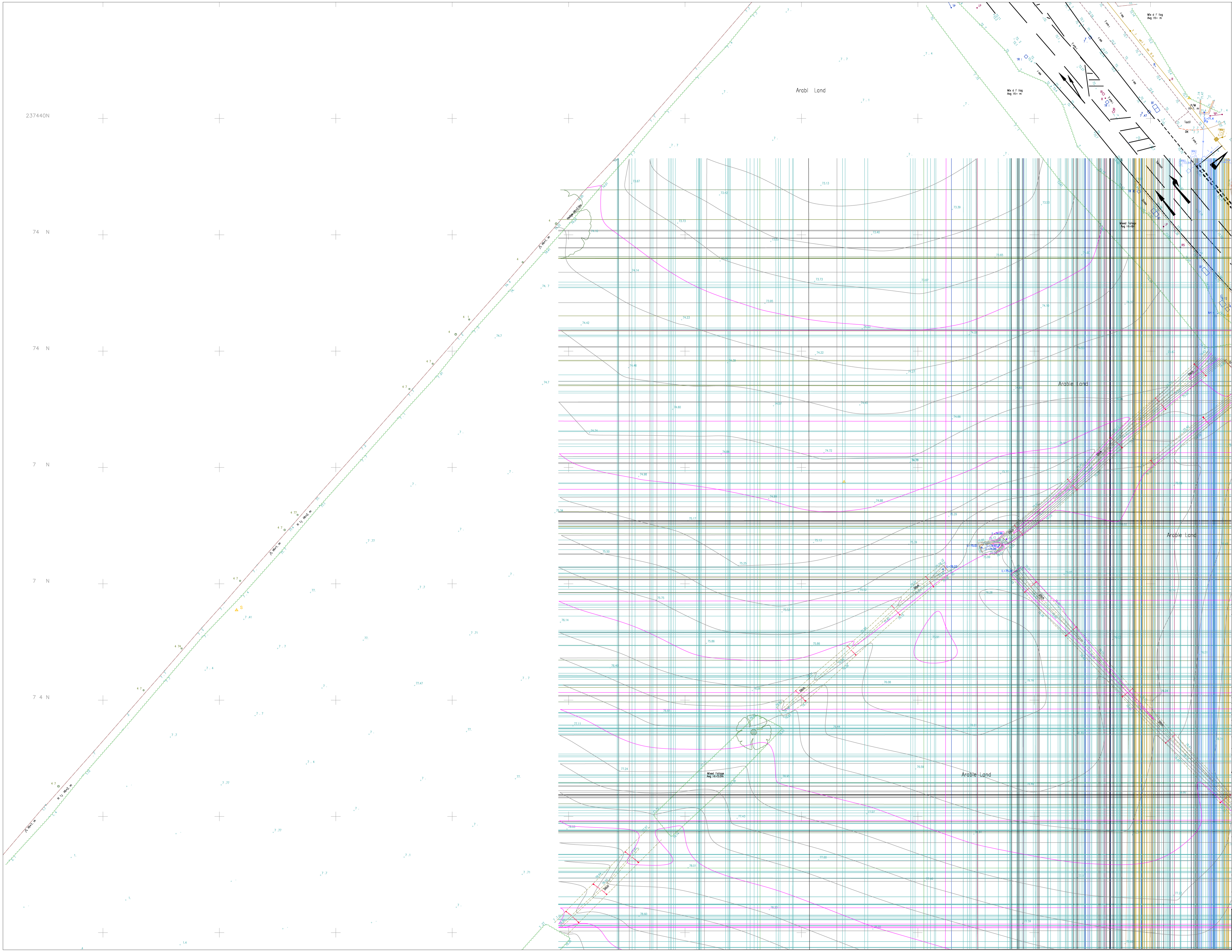

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Land
Mixed Foliage
Avg Ht=5.0m
Arable Land
Mixed foliage
Avg Ht=8.0m
CD SURVEYS LTD
LAND, BUILDING & SITE ENGINEERING


554840E
554860E
554880E
554900E
554920E
Arabl Land
Arill Lin l
Mixed Foliage
Culvert
Wall
CD SURVEYS LTD
LAND, BUILDING & SITE ENGINEERING


Arable Land
Mixed Foliage
Avg Ht=8.0m
CD SURVEYS LTD
LAND, BUILDING & SITE ENGINEERING


554980E
555000E
555020E
555040E
237600N
Arable Land
CD SURVEYS LTD
LAND, BUILDING & SITE ENGINEERING


Arable Land
Mixed Foliage
Gate
Grass
Tarmac
CD SURVEYS LTD
LAND, BUILDING & SITE ENGINEERING


Mixed Foliage
Avg H=6m
Tarmac
Grass
237140N
237160N
237180N
CD SURVEYS LTD
LAND, BUILDING & SITE ENGINEERING


555180E
555200E
555220E
555240E
555260E
237580N
237560N
237540N
237460N
CD SURVEYS LTD
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237440N
237420N
237400N
237380N
Arabl Land
Arable Land
CD SURVEYS LTD
LAND, BUILDING & SITE ENGINEERING

APPENDIX D – INFILTRATION TESTING REPORT

Nicholas Sommerville
Kier Ventures Ltd
Optimum House
Clippers Quay
Salfrod
England
M50 3XP

21st October 2022
Our Ref: 220222-RGL-ZZ-XX-CO-Z-0004

Via email – Nicholas.Sommerville@kier.co.uk

Dear Nicholas,

SOAKAWAY TESTING AT LAND OFF THAXTED ROAD, SAFFRON WALDEN, CAMBRIDGESHIRE

1.0 INTRODUCTION

Kier Ventures (the Client) propose to develop a parcel of land in Saffron Walden, Cambridgeshire. It is understood that current proposals are to develop the site with approx. 150-180 residential properties consisting of apartments, terraced, semi-detached and detached dwellings with associated access roads, gardens and areas of Public Open Space (POS). The following briefly summarises the likely development:

- A residential housing development with new roads and areas of POS
- Access to the development will be off Thaxted Road via a newly created opening that will be required to meet highways standards
- Some localised re-profiling of the site levels would likely be required for the planned development.

The purpose of this investigation was to establish the ground conditions, complete soakaway tests in general accordance with BRE 365 and provide comments.

Previous reports for the site include Rolton Group (RG) a Phase I contaminated land desk study, ref. 220222-RGL-ZZ-XX-RP-G-0001, October 2022, that should be read in conjunction with this report.

2.0 SITE DETAILS

The site is situated to the west of Thaxted Road, approximately 1km south of Saffron Walden town centre in a semi-rural area. The site is irregular in shape, centered at national grid reference 554715, 237307 covering approximately 8.3 hectres. The site measures some 250m north-south and 500m east-west.

The site was currently in use as agricultural land, with a covering of crop stubble. The various site boundaries were marked by mature hedgerows, trees and drainage ditches. Ground levels across the extent of the site varied quite sharply and also feature more local undulations, falling from approximately 103mAOD in the south west to 77mAOD in the north east.

The published British Geological Survey (BGS) map for the area (Sheet 222 'Great Dunmow') and the BGS GeoIndex website show the site to be underlain by superficial deposits of the Lowestoft Formation (diamicton) at the far western extent of the site, and Head at the far eastern extent of the site. Superficial deposits are not shown to be present across the the central portion of the site. The underlying solid geology is indicated to comprise of the undifferentiated Lewes Nodular Chalk Formation and Seaford Chalk Formation of the White Chalk Subgroup.

A site location plan is appended to this report.

3.0 FIELDWORK AND SOAKAWAY TESTING

The locations of investigative positions were selected to target possible locations of proposed attenuation ponds, swales and soakaway locations for dwellings, and available access. Prior to excavaton, buried service plans were consulted and a cable avoidance tool (CAT) was used to confirm each location was clear of detectable services.

A total of ten pits were excavated, ref. SA101A, SA101B, SA102 to SA109, between 10th and 12th October 2022. The pits were formed using a backhoe excavator to depths between 0.97mbgl and 3.45mbgl. The excavations were recorded by an RG engineer.

Soil permeability tests were completed in all the pits generally in accordance with BRE Digest DG 365 2016: Soakaway design. The soakaway tests included each pit being partially filled with water, with the subsequent drop in water level measured at regular intervals. Depending on the rate of infiltration, where possible the test was repeated twice more. Water used for the tests was provided with a bowser. Following completion of the tests the trial pit was backfilled.

Trial pit logs and soakaway test records are appended to this report.

4.0 ENCOUNTERED GROUND CONDITIONS AND SOAKAWAY TEST RESULTS

The encountered ground conditions and soakaway test results are summarised and dicussed below.

4.1 ENCOUNTERED GROUND CONDITIONS

The encounterd ground conditions initially comprised topsoil of greyish brown, slightly gravelly, clayey, organic sand, the gravel fraction being flint, quartzite, brick and chalk, to depths between 0.30mbgl to 0.45mbgl.

The topsoil was underlain by Head or the Lowestoft Formation that comprised firm or stiff, brown or light brown and locally bluish grey and greyish brown, variably sandy and gravelly, locally silty, clay with locallised sand leses; the gravel comprised angular to rounded flint, quartzite, chalk, sandstone. Pits SA101B and SA107 were completed in the superficial deposits at depths of 0.97m and 2.85m respectively. In the remaining pits these strata were proved to depths between 0.80mbgl to 2.45mbgl.

The undifferentiated Lewes Nodular Chalk Formation and Seaford Chalk Formation solid geology was encountered beneath the Head deposits and initially comprised structurless chalk composed of gravelly, slightly sandy silt with occasional flint gravel (CIRIA C574 Grade Dm). Below between 2.80m and 3.20m in pits SA104 and SA105 the structureless chalk was composed of slightly sandy, silty chalk gravel (Grade Dc). The pits were completed in the chalk at depths between 2.58mbgl to 3.45mbgl.

The pits remained dry during excavation and their sides were stable.

4.2 SOAKAWAY TEST RESULTS

The results fo the soakaway tests are summarised in Table 1 and discussed below..

LOCATION	STRATA TESTED	INFILTRATION RATE (M/S)		
		CYCLE 1	CYCLE 2	CYCLE 3
SA101A	Chalk	Insufficient soakage.		
SA101B	Head	5.07×10^{-5}	1.53×10^{-5}	-
SA102	Chalk	4.22×10^{-5}	2.58×10^{-5}	-
SA103	Chalk	6.89×10^{-6}	-	-
SA104	Chalk	8.08×10^{-5}	6.13×10^{-5}	6.09×10^{-5}
SA105	Head and chalk	3.76×10^{-5}	3.36×10^{-5}	-
SA106	Chalk	5.45×10^{-6}	-	-
SA107	Lowestoft Formation	Insufficient soakage.		
SA108	Chalk	Insufficient soakage.		
SA109	Chalk	1.19×10^{-5}	-	-

Table 1. Summary of Soakaway Test Results

In summary, the tests indicated an infiltration rate of between 5.1×10^{-5}m/s and 1.5×10^{-5}m/s for Head where tested at a single location, and for chalk a rate between 8.1×10^{-5}m/s and 5.5×10^{-6}m/s or locally the infiltration was too slow to allow a rate to be calculated, expected to be where the chalk was weathered to a silt. At the single location where tested, the infiltration rate was too slow to allow a rate to be calculated for the Lowestoft Formation.

Based on the rest results, a conservative rate of infiltration of 5×10^{-6}m/s for chalk may be adopted for soakaway design, however, this rate is likely to increase to 10^{-5}m/s when deepened into the predominantly gravel chalk (Grade Dc).

Once soakaway locations are confirmed it is recommended that additional testing be completed to confirm the soil infiltration rate is as, or better than, that assumed in design. Additional soakaway testing should be completed to confirm the infiltration rate for Head deposits. Soakaways in chalk should be positioned at least 10m from foundations or other structure/features and consideration should also be given to the use of silt traps along with interceptors for road and car park run-off. Groundwater levels may vary; consideration may be given to monitoring to confirm groundwater depths will not affect soakaway performance. Additional guidance is provided in BRE 365 and CIRIA C574. It is recommended that the Local Authority be contacted at an early stage to discuss drainage proposals.

Should you have any queries please do not hesitate to contact the undersigned.

Yours sincerely
for and on behalf of Rolton Group Ltd

[redacted]

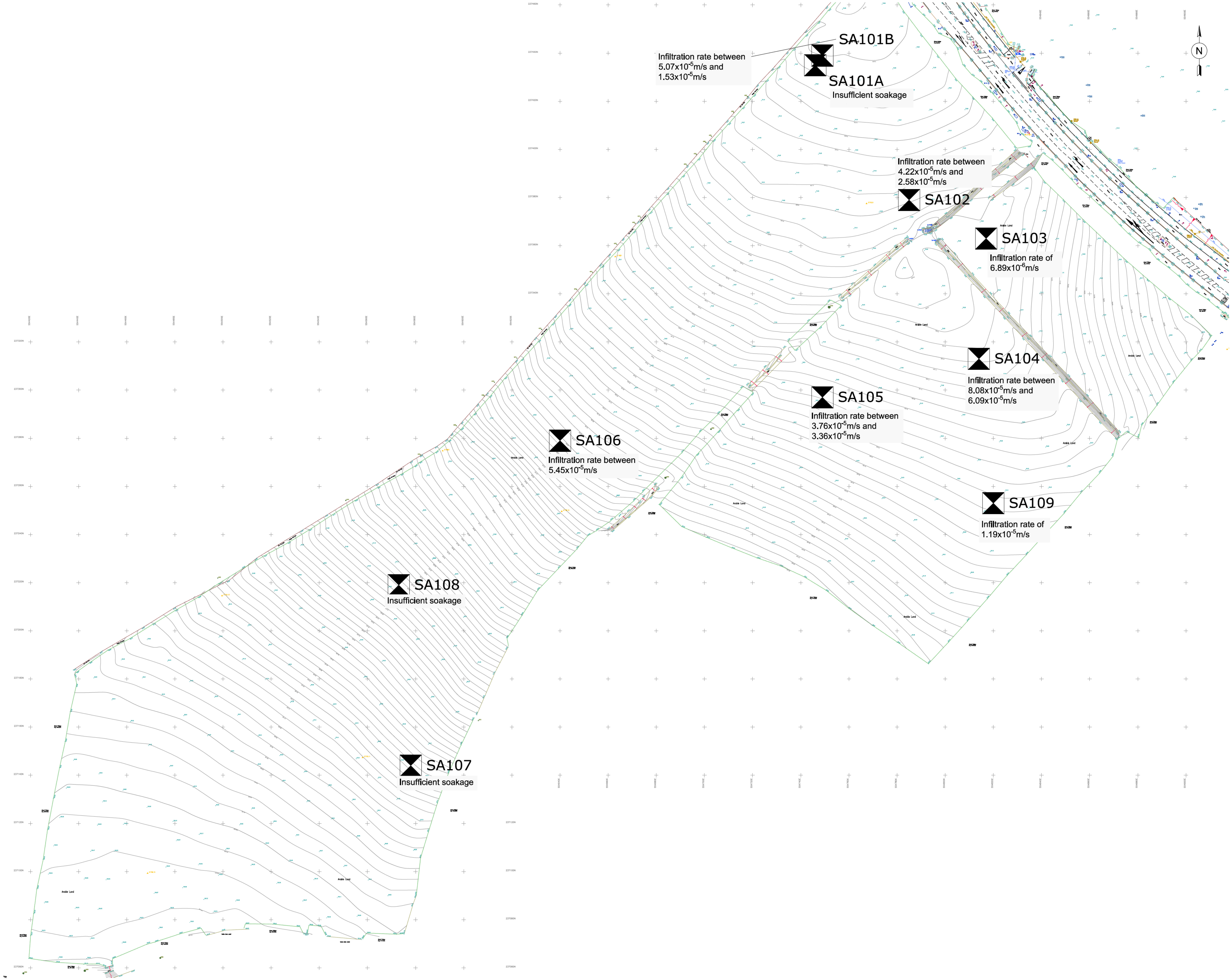
Martin Gill | Project Engineer
[redacted]
Mob. [redacted]

Encs. Site Photographs
Exploratory Hole Location Layout
Infiltration Testing Results

Photo 1 Example of ground conditions in SA105 and view across site.

Photo 2 Pit SA101A : Example of Head deposit.

Photo 3 Pit SA107 : Example of Lowestoft Formation.



DO NOT SCALE

Standard construction hazards that a competent contractor would be aware of have not been identified on this drawing. Risks that may not be immediately apparent are listed below:

Status	Date	Description	Dwn	Eng	Chkd	Veri
S2-P01	19.10.22	Issued for Information	MG	MG	AC	AC

Key

Denotes location of Rolton Group Soakaway pits in October 2022

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Project:
Kier Ventures Ltd
Land off Thaxted Road,
Saffron Walden

Drawing Title:
Exploratory Hole
Location Layout

RGL Project Ref:	Scale@A1	Scale@A3
22-0222	NTS	NTS

Specification(s):

Drawing Number:
22-0222-RGL-ZZ-XX-DR-G-900-0001
Project-Originator-Zone-Level-Type-Role-Classification-Number

Issue Purpose: INFORMATION

Status: S2-P01
Suitability-Revision

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SOAKAWAY TESTING SCHEDULE

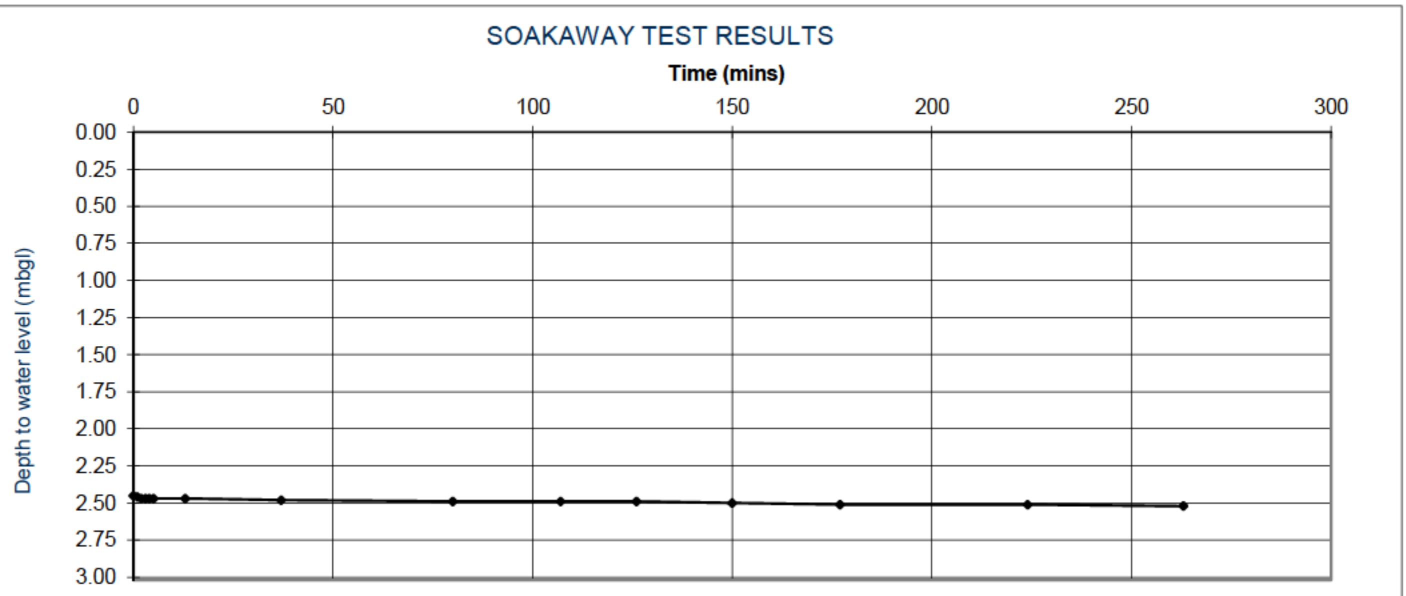
PROJECT NO :	22-0222
PROJECT:	Land off Thaxted Road, Saffron Walden, Camb
DOC REF:	220222-RGL-ZZ-XX-SH-G-500-0001

Trial Pit Dimensions (m)	Width	Length	Depth to Base
	0.80	2.90	3.02

Test Date 10/10/2022

Soakaway No. SA101A - Cycle 1

Calculation of Infiltration Rate in Accordance with BRE Digest 365.



Calculation of Soil Infiltration Rate (f):

where

$$f = \frac{VP75\text{-}25}{ap50 \times tp75\text{-}25}$$

using

VP75-25 = Volume outflowing between 75% and 25% of effective depth.

ap50 = Mean surface area through which the outflow occurs.

tp75-25 = Time for the outflow between 75% and 25% of the effective depth.

VP75-25 = 0.6612 m³

ap50 = 4.429 m²

tp75-25 = N/A min

General Geological Profile :

0.00 - 0.40	[Loose] greyish brown slightly gravelly clayey organic SAND. Gravel of angular to rounded flint, quartzite, brick and chalk. (TOPSOIL)
0.40 - 2.30	Firm brown sandy slightly gravelly CLAY. Gravel of angular to rounded flint, quartzite and chalk. (HEAD)
2.30 - 3.02	Structureless CHALK composed of gravelly slightly sandy SILT with occasional cobbles of angular flint. Gravel is very weak low density chalk with frequent brown staining and black speckling to faces, clean white when broken. Matrix is uncompact brown mottled white. (LEWIS NODULAR CHALK FORMATION, GRADE Dm)

Infiltration rate was insufficient to be calculated in accordance with BRE 365 (2016).

			Permeability Guideline (m/s)		
Soil Infiltration Rate (f) =	**N/A**	m/s	Good	Poor	Practically Impervious
			10^{-3} - 10^{-5}	10^{-6} - 10^{-7}	10^{-8} - 10^{-10}

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SOAKAWAY TESTING SCHEDULE

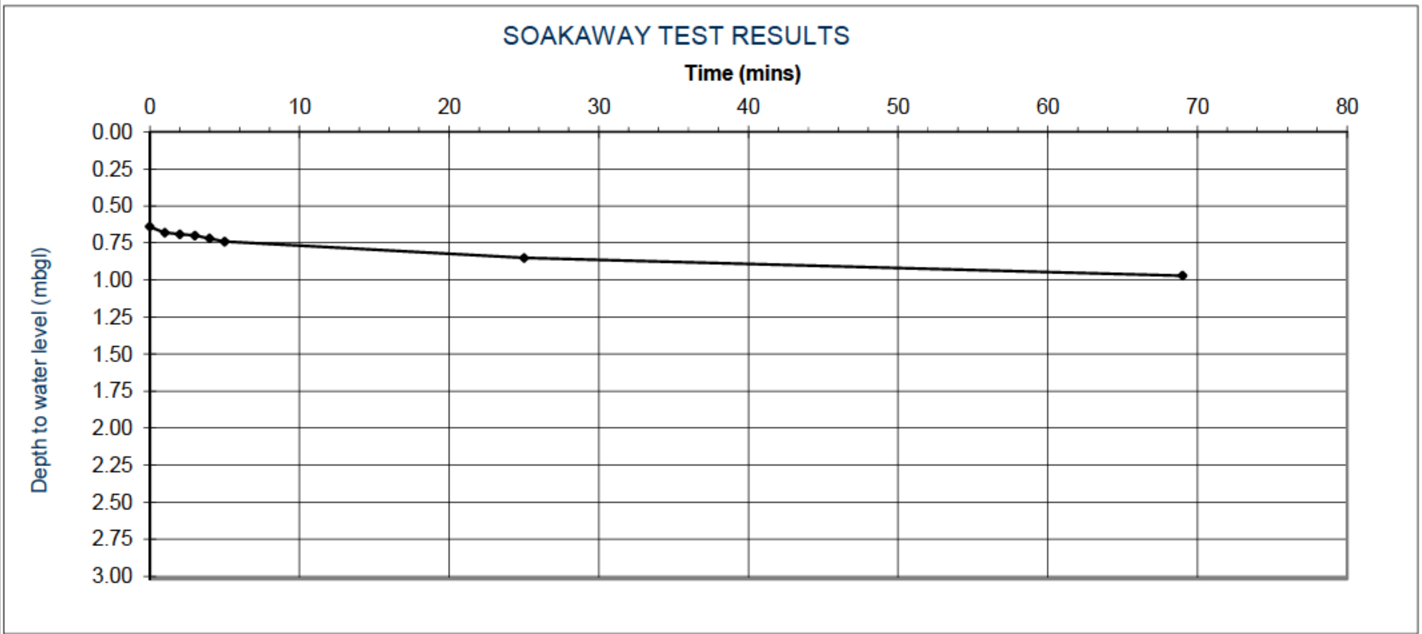
PROJECT NO :	22-0222
PROJECT:	Land off Thaxted Road, Saffron Walden, Camb
DOC REF:	220222-RGL-ZZ-XX-SH-G-500-0002

Trial Pit Dimensions (m)	Width	Length	Depth to Base
	0.70	1.90	0.97

Test Date 10/10/2022

Soakaway No. SA101B - Cycle 1

Calculation of Infiltration Rate in Accordance with BRE Digest 365.



Calculation of Soil Infiltration Rate (f):

where

$$f = \frac{VP75\text{-}25}{ap50 \times tp75\text{-}25}$$

using

VP75-25 = Volume outflowing between 75% and 25% of effective depth.

ap50 = Mean surface area through which the outflow occurs.

tp75-25 = Time for the outflow between 75% and 25% of the effective depth.

VP75-25 = 0.21945 m³

ap50 = 2.188 m²

tp75-25 = 33.0 min

General Geological Profile :

0.00 - 0.45	[Loose] greyish brown slightly gravelly clayey organic SAND. Gravel of angular to rounded flint, quartzite, brick and chalk. (TOPSOIL)
0.45 - 0.97	Firm brown sandy slightly gravelly CLAY. Gravel of angular to rounded flint, quartzite and chalk. (HEAD)

Soil Infiltration Rate (f) = **5.07E-05** m/s

Permeability Guideline (m/s)		
Good	Poor	Practically Impervious
10^{-3} - 10^{-5}	10^{-6} - 10^{-7}	10^{-8} - 10^{-10}

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SOAKAWAY TESTING SCHEDULE

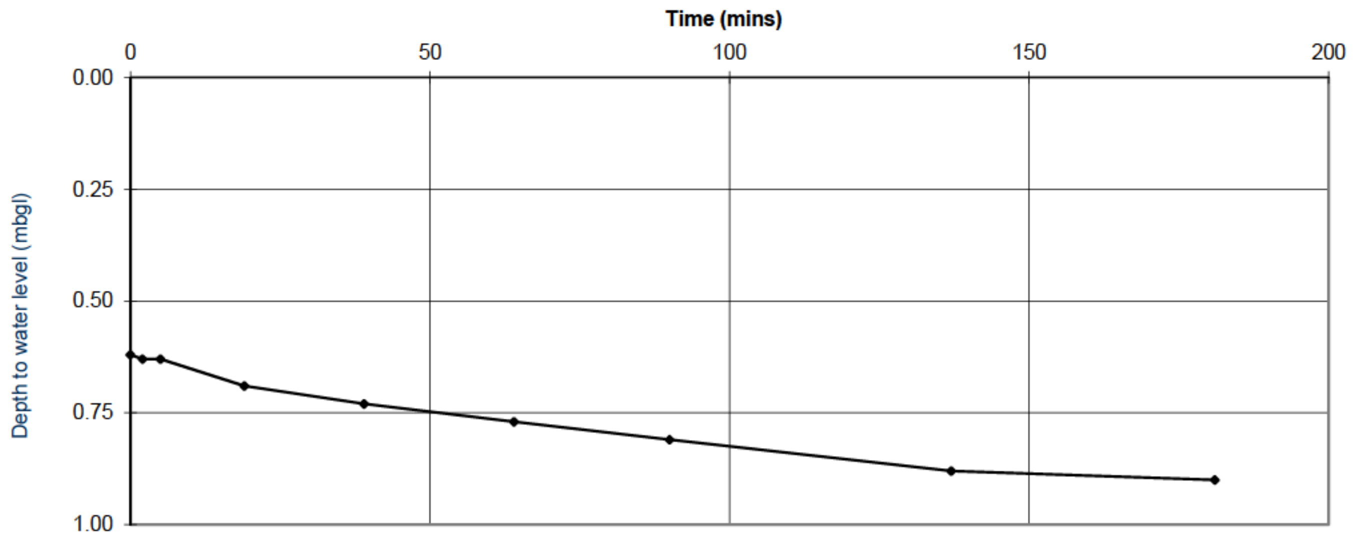
PROJECT NO :	22-0222
PROJECT:	Land off Thaxted Road, Saffron Walden, Camb
DOC REF:	220222-RGL-ZZ-XX-SH-G-500-0003

Trial Pit Dimensions (m)	Width	Length	Depth to Base
	0.70	1.90	0.97

Test Date 10/10/2022

Soakaway No. SA101B - Cycle 2

Calculation of Infiltration Rate in Accordance with BRE Digest 365.



Calculation of Soil Infiltration Rate (f):

where

$$f = \frac{VP75\text{-}25}{ap50 \times tp75\text{-}25}$$

using

VP75-25 = Volume outflowing between 75% and 25% of effective depth.

ap50 = Mean surface area through which the outflow occurs.

tp75-25 = Time for the outflow between 75% and 25% of the effective depth.

VP75-25 = 0.23275 m³

ap50 = 2.24 m²

tp75-25 = N/A min

General Geological Profile :

0.00 - 0.45	[Loose] greyish brown slightly gravelly clayey organic SAND. Gravel of angular to rounded flint, quartzite, brick and chalk. (TOPSOIL)
0.45 - 0.97	Firm brown sandy slightly gravelly CLAY. Gravel of angular to rounded flint, quartzite and chalk. (HEAD)

Soil Infiltration Rate (f) = **1.53E-05** m/s

Permeability Guideline (m/s)		
Good	Poor	Practically Impervious
10^{-3} - 10^{-5}	10^{-6} - 10^{-7}	10^{-8} - 10^{-10}

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SOAKAWAY TESTING SCHEDULE

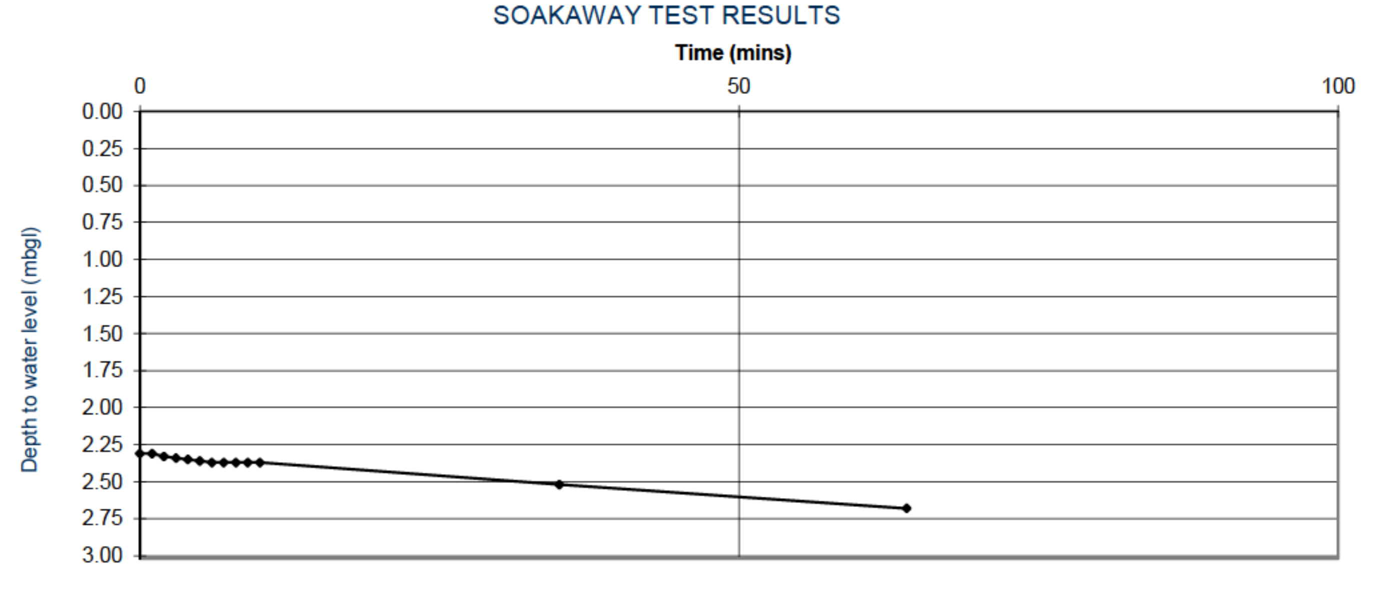
PROJECT NO :	22-0222
PROJECT:	Land off Thaxted Road, Saffron Walden, Camb
DOC REF:	220222-RGL-ZZ-XX-SH-G-500-0004

Trial Pit Dimensions (m)	Width	Length	Depth to Base
	0.70	2.50	2.92

Test Date 10/10/2022

Soakaway No. SA102 - Cycle 1

Calculation of Infiltration Rate in Accordance with BRE Digest 365.



Calculation of Soil Infiltration Rate (f):

where

$$f = \frac{VP75\text{-}25}{ap50 \times tp75\text{-}25}$$

using

VP75-25 = Volume outflowing between 75% and 25% of effective depth.

ap50 = Mean surface area through which the outflow occurs.

tp75-25 = Time for the outflow between 75% and 25% of the effective depth.

VP75-25 = 0.53375 m³

ap50 = 3.702 m²

tp75-25 = 57.0 min

General Geological Profile :

0.00 - 0.30	[Loose] greyish brown slightly gravelly clayey organic SAND. Gravel of angular to rounded flint, quartzite, brick and chalk. (TOPSOIL)
0.30 - 1.50	Firm brown sandy slightly gravelly CLAY. Gravel of angular to rounded flint, quartzite and chalk. (HEAD)
1.50 - 2.92	Structureless CHALK composed of gravelly slightly sandy SILT with occasional cobbles of angular flint. Gravel is very weak low density chalk with frequent brown staining and black speckling to faces, clean white when broken. Matrix is uncompact brown mottled white. (LEWIS NODULAR CHALK FORMATION, GRADE Dm)

Infiltration rate was extrapolated based on a constant rate of dissipation

Soil Infiltration Rate (f) = **4.22E-05** m/s

Permeability Guideline (m/s)		
Good	Poor	Practically Impervious
10^{-3} - 10^{-5}	10^{-6} - 10^{-7}	10^{-8} - 10^{-10}

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SOAKAWAY TESTING SCHEDULE

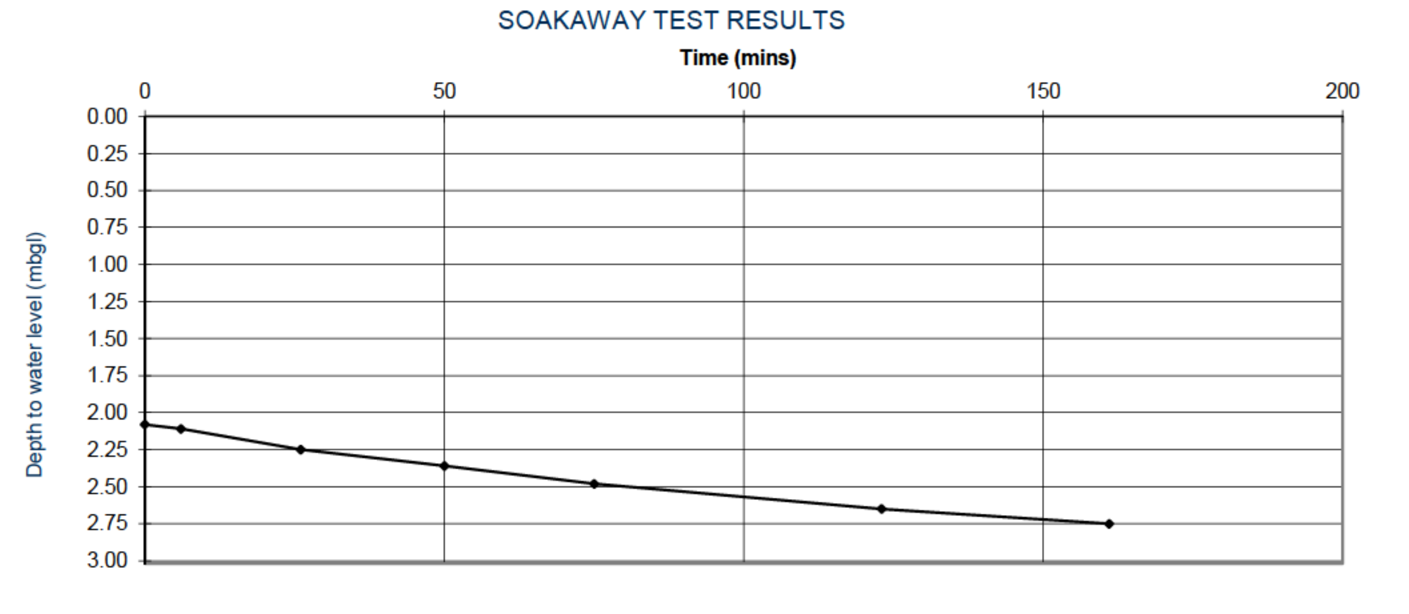
PROJECT NO :	22-0222
PROJECT:	Land off Thaxted Road, Saffron Walden, Camb
DOC REF:	220222-RGL-ZZ-XX-SH-G-500-0005

Trial Pit Dimensions (m)	Width	Length	Depth to Base
	0.70	2.50	2.92

Test Date 10/10/2022

Soakaway No. SA102 - Cycle 2

Calculation of Infiltration Rate in Accordance with BRE Digest 365.



Calculation of Soil Infiltration Rate (f):

where

$$f = \frac{VP75\text{-}25}{ap50 \times tp75\text{-}25}$$

using

VP75-25 = Volume outflowing between 75% and 25% of effective depth.
ap50 = Mean surface area through which the outflow occurs.
tp75-25 = Time for the outflow between 75% and 25% of the effective depth.

VP75-25 = 0.735 m^3
ap50 = 4.438 m^2
tp75-25 = 107.0 min

General Geological Profile :

0.00 - 0.30	[Loose] greyish brown slightly gravelly clayey organic SAND. Gravel of angular to rounded flint, quartzite, brick and chalk. (TOPSOIL)
0.30 - 1.50	Firm brown sandy slightly gravelly CLAY. Gravel of angular to rounded flint, quartzite and chalk.(HEAD)
1.50 - 2.92	Structureless CHALK composed of gravelly slightly sandy SILT with occasional cobbles of angular flint. Gravel is very weak low density chalk with frequent brown staining and black speckling to faces, clean white when broken. Matrix is uncompact brown mottled white.(LEWIS NODULAR CHALK FORMATION, GRADE Dm)

Soil Infiltration Rate (f) = **2.58E-05** m/s

Permeability Guideline (m/s)		
Good	Poor	Practically Impervious
10^{-3} - 10^{-5}	10^{-6} - 10^{-7}	10^{-8} - 10^{-10}

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SOAKAWAY TESTING SCHEDULE

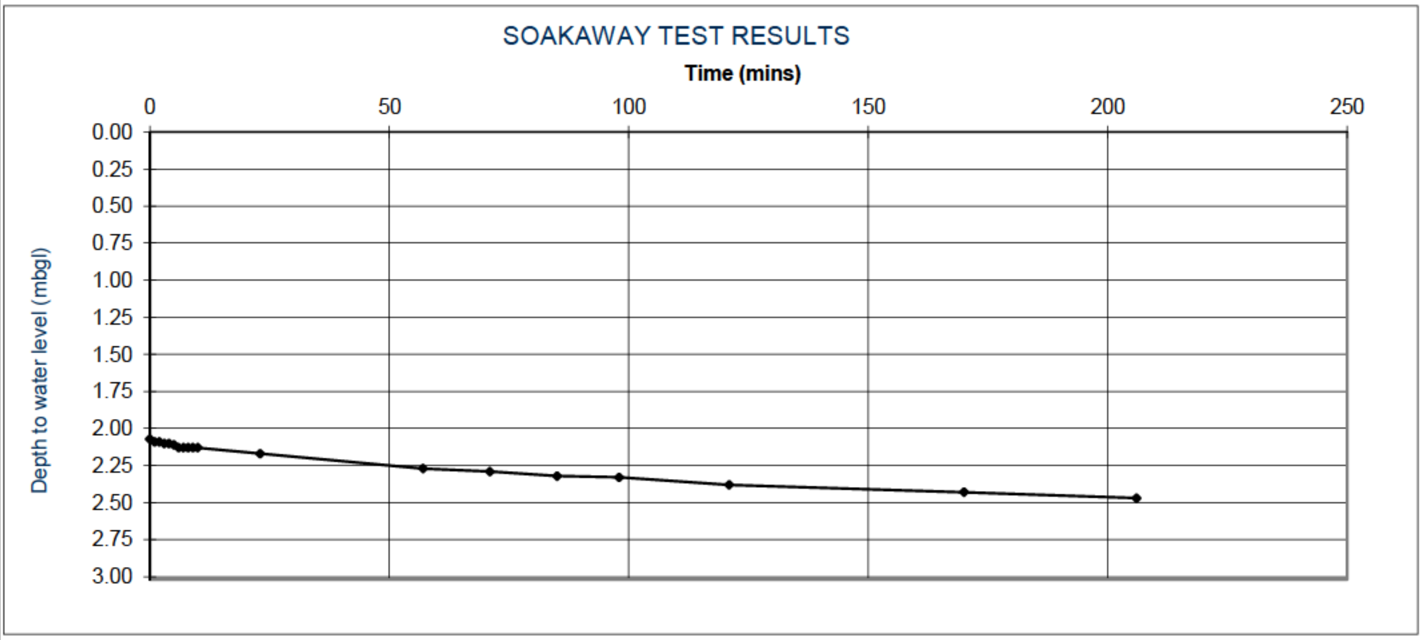
PROJECT NO :	22-0222
PROJECT:	Land off Thaxted Road, Saffron Walden, Camb
DOC REF:	220222-RGL-ZZ-XX-SH-G-500-0006

Trial Pit Dimensions (m)	Width	Length	Depth to Base
	0.70	2.50	3.02

Test Date 10/10/2022

Soakaway No. SA103 - Cycle 1

Calculation of Infiltration Rate in Accordance with BRE Digest 365.



Calculation of Soil Infiltration Rate (f):

where

$$f = \frac{VP75\text{-}25}{ap50 \times tp75\text{-}25}$$

using

VP75-25 = Volume outflowing between 75% and 25% of effective depth.

ap50 = Mean surface area through which the outflow occurs.

tp75-25 = Time for the outflow between 75% and 25% of the effective depth.

VP75-25 = 0.83125 m^3

ap50 = 4.79 m^2

tp75-25 = 420.0 min

General Geological Profile :

0.00 - 0.45	[Loose] greyish brown slightly gravelly clayey organic SAND. Gravel of angular to rounded flint, quartzite, brick and chalk. (TOPSOIL)
0.45 - 1.15	Firm brown sandy slightly gravelly CLAY. Gravel of angular to rounded flint, quartzite and chalk.(HEAD)
1.15 - 2.60	Structureless CHALK composed of gravelly slightly sandy SILT with occasional cobbles of angular flint. Gravel is very weak low density chalk with frequent brown staining and black speckling to faces, clean white when broken. Matrix is uncompact brown mottled white.(LEWIS NODULAR CHALK FORMATION, GRADE Dm)
2.60 - 3.02	Structureless CHALK composed of sandy slightly gravelly clayey SILT with occasional cobbles. Gravel and cobbles are very weak low density chalk and flint chalk gravel is white and clean when broken.(LEWIS NODULAR CHALK FORMATION, GRADE Dm)

Infiltration rate was extrapolated assuming a constant rate of dissipation

			Permeability Guideline (m/s)		
Soil Infiltration Rate (f) =	**6.89E-06**	m/s	Good	Poor	Practically Impervious
			10^{-3} - 10^{-5}	10^{-6} - 10^{-7}	10^{-8} - 10^{-10}

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SOAKAWAY TESTING SCHEDULE

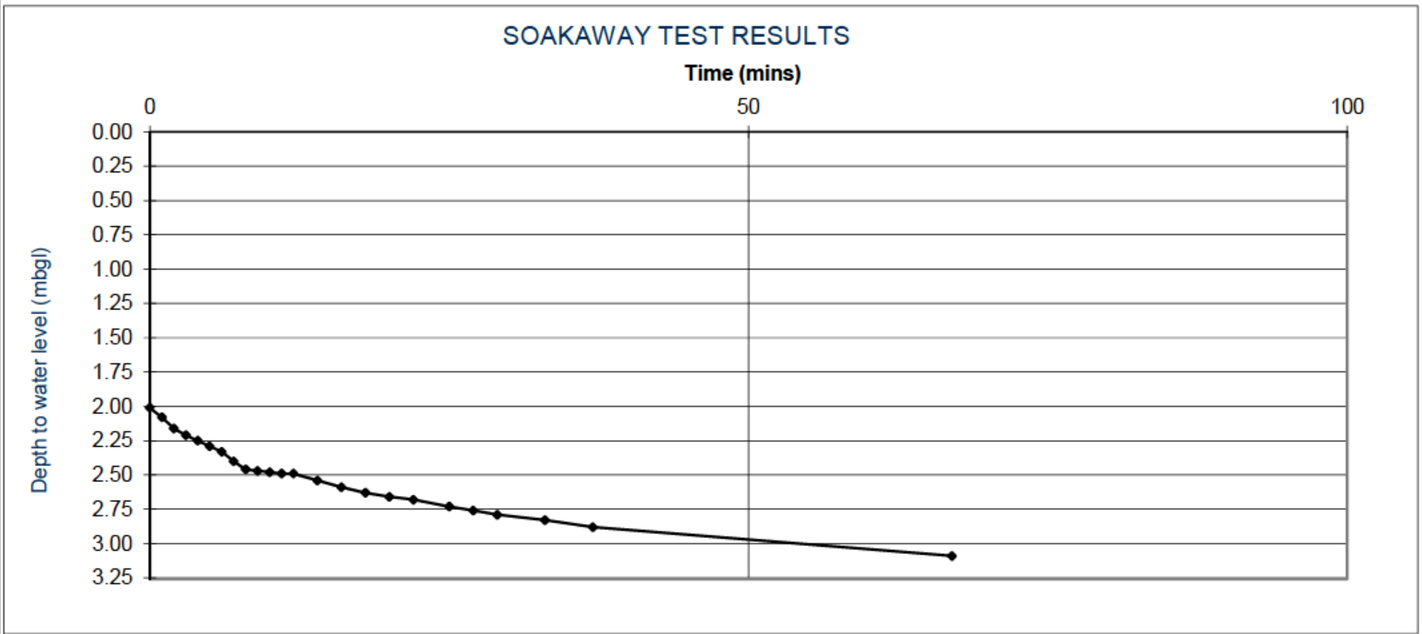
PROJECT NO :	22-0222
PROJECT:	Land off Thaxted Road, Saffron Walden, Camb
DOC REF:	220222-RGL-ZZ-XX-SH-G-500-0007

Trial Pit Dimensions (m)	Width	Length	Depth to Base
	0.70	2.40	3.26

Test Date 11/10/2022

Soakaway No. SA104 - Cycle 1

Calculation of Infiltration Rate in Accordance with BRE Digest 365.



Calculation of Soil Infiltration Rate (f):

where

$$f = \frac{VP75\text{-}25}{ap50 \times tp75\text{-}25}$$

using

VP75-25 = Volume outflowing between 75% and 25% of effective depth.

ap50 = Mean surface area through which the outflow occurs.

tp75-25 = Time for the outflow between 75% and 25% of the effective depth.

VP75-25 = 1.05 m^3

ap50 = 5.555 m^2

tp75-25 = 39.0 min

General Geological Profile :

0.00 - 0.35	[Loose] greyish brown slightly gravelly clayey organic SAND. Gravel of angular to rounded flint, quartzite, brick and chalk. (TOPSOIL)
0.35 - 1.00	Firm brown sandy slightly gravelly CLAY. Gravel of angular to rounded flint, quartzite and chalk.(HEAD)
1.00 - 2.20	Structureless CHALK composed of gravelly slightly sandy SILT with occasional cobbles of angular flint. Gravel is very weak low density chalk with frequent brown staining and black speckling to faces, clean white when broken. Matrix is uncompact brown mottled white.(LEWIS NODULAR CHALK FORMATION, GRADE Dm)
2.20 - 2.80	Structureless CHALK composed of sandy slightly gravelly clayey SILT with occasional cobbles. Gravel and cobbles are very weak low density chalk and flint chalk gravel is white and clean when broken.(LEWIS NODULAR CHALK FORMATION, GRADE Dm)
2.80 - 3.26	Structureless CHALK composed of slightly sandy silty subangular to rounded mainly medium and coarse GRAVEL with many rounded cobbles. Gravel is very weak low density white with frequent black specks. Cobbles are weak medium density white with occasional black specks. Matrix is uncompact white.(LEWES NODULAR CHALK FORMATION, GRADE Dc)

Soil Infiltration Rate (f) = **8.08E-05** m/s

Permeability Guideline (m/s)		
Good	Poor	Practically Impervious
10^{-3} - 10^{-5}	10^{-6} - 10^{-7}	10^{-8} - 10^{-10}

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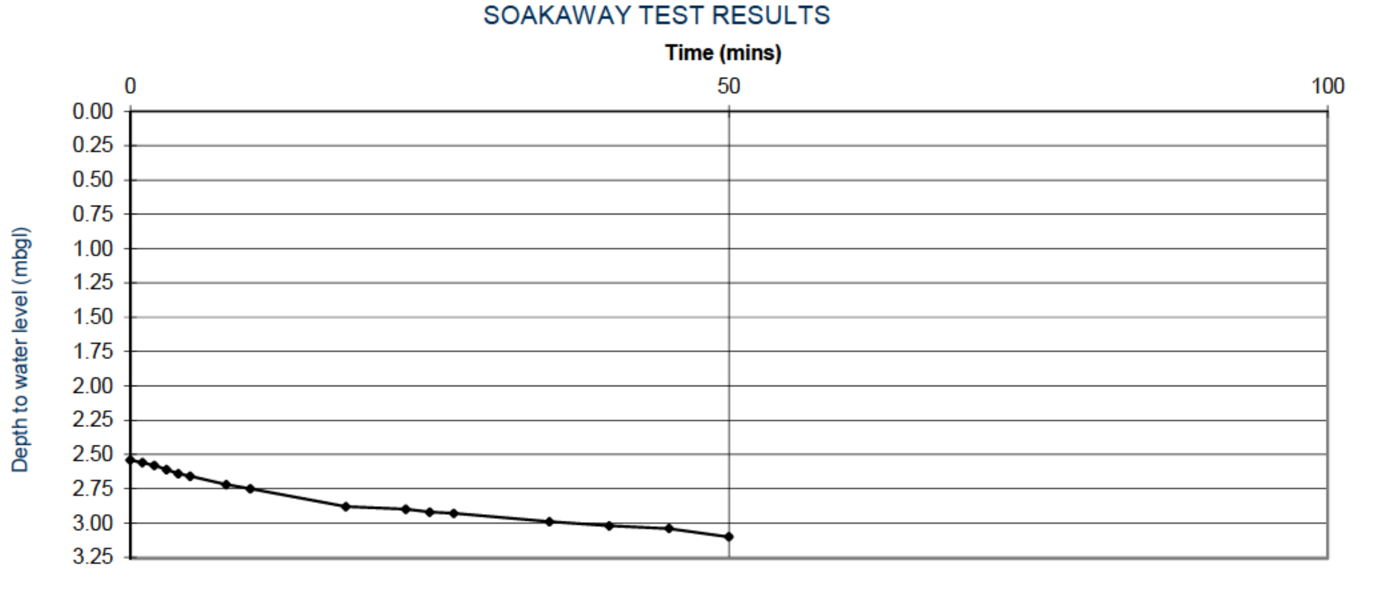
SOAKAWAY TESTING SCHEDULE

PROJECT NO :	22-0222
PROJECT:	Land off Thaxted Road, Saffron Walden, Camb
DOC REF:	220222-RGL-ZZ-XX-SH-G-500-0008

Trial Pit Dimensions (m)	Width	Length	Depth to Base
	0.70	2.40	3.26

Test Date 11/10/2022
Soakaway No. SA104 - Cycle 2

Calculation of Infiltration Rate in Accordance with BRE Digest 365.



Calculation of Soil Infiltration Rate (f):

where

$$f = \frac{VP75\text{-}25}{ap50 \times tp75\text{-}25}$$

using
VP75-25 = Volume outflowing between 75% and 25% of effective depth.
ap50 = Mean surface area through which the outflow occurs.
tp75-25 = Time for the outflow between 75% and 25% of the effective depth.

VP75-25 = 0.6048 m³
ap50 = 3.912 m²
tp75-25 = 42.0 min

General Geological Profile :

0.00 - 0.35	[Loose] greyish brown slightly gravelly clayey organic SAND. Gravel of angular to rounded flint, quartzite, brick and chalk. (TOPSOIL)
0.35 - 1.00	Firm brown sandy slightly gravelly CLAY. Gravel of angular to rounded flint, quartzite and chalk.(HEAD)
1.00 - 2.20	Structureless CHALK composed of gravelly slightly sandy SILT with occasional cobbles of angular flint. Gravel is very weak low density chalk with frequent brown staining and black speckling to faces, clean white when broken. Matrix is uncompact brown mottled white.(LEWIS NODULAR CHALK FORMATION, GRADE Dm)
2.20 - 2.80	Structureless CHALK composed of sandy slightly gravelly clayey SILT with occasional cobbles. Gravel and cobbles are very weak low density chalk and flint chalk gravel is white and clean when broken.(LEWIS NODULAR CHALK FORMATION, GRADE Dm)
2.80 - 3.26	Structureless CHALK composed of slightly sandy silty subangular to rounded mainly medium and coarse GRAVEL with many rounded cobbles. Gravel is very weak low density white with frequent black specks. Cobbles are weak medium density white with occasional black specks. Matrix is uncompact white.(LEWES NODULAR CHALK FORMATION, GRADE Dc)

Soil Infiltration Rate (f) = **6.13E-05** m/s

Permeability Guideline (m/s)		
Good	Poor	Practically Impervious
10^{-3} - 10^{-5}	10^{-6} - 10^{-7}	10^{-8} - 10^{-10}

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SOAKAWAY TESTING SCHEDULE

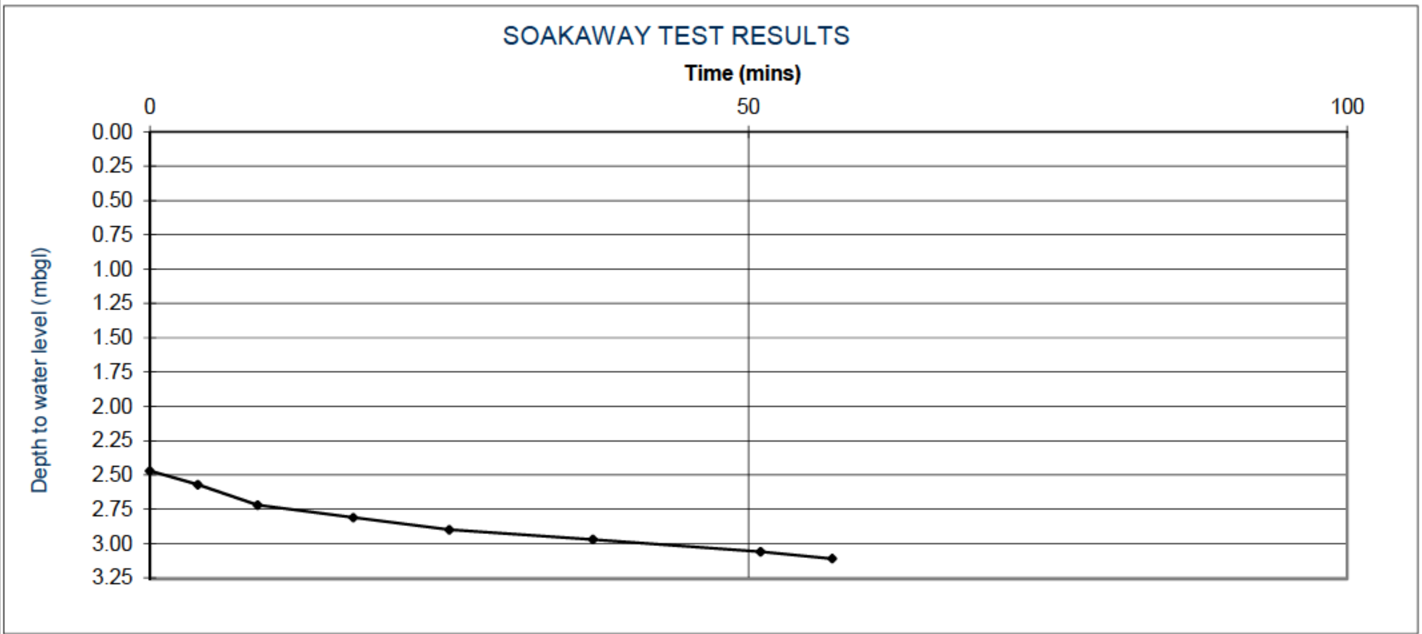
PROJECT NO :	22-0222
PROJECT:	Land off Thaxted Road, Saffron Walden, Camb
DOC REF:	220222-RGL-ZZ-XX-SH-G-500-0009

Trial Pit Dimensions (m)	Width	Length	Depth to Base
	0.70	2.40	3.26

Test Date 11/10/2022

Soakaway No. SA104 - Cycle 3

Calculation of Infiltration Rate in Accordance with BRE Digest 365.



Calculation of Soil Infiltration Rate (f):

where

$$f = \frac{VP75\text{-}25}{ap50 \times tp75\text{-}25}$$

using

VP75-25 = Volume outflowing between 75% and 25% of effective depth.

ap50 = Mean surface area through which the outflow occurs.

tp75-25 = Time for the outflow between 75% and 25% of the effective depth.

VP75-25 = 0.6636 m³

ap50 = 4.129 m²

tp75-25 = 44.0 min

General Geological Profile :

0.00 - 0.35	[Loose] greyish brown slightly gravelly clayey organic SAND. Gravel of angular to rounded flint, quartzite, brick and chalk. (TOPSOIL)
0.35 - 1.00	Firm brown sandy slightly gravelly CLAY. Gravel of angular to rounded flint, quartzite and chalk.(HEAD)
1.00 - 2.20	Structureless CHALK composed of gravelly slightly sandy SILT with occasional cobbles of angular flint. Gravel is very weak low density chalk with frequent brown staining and black speckling to faces, clean white when broken. Matrix is uncompact brown mottled white.(LEWIS NODULAR CHALK FORMATION, GRADE Dm)
2.20 - 2.80	Structureless CHALK composed of sandy slightly gravelly clayey SILT with occasional cobbles. Gravel and cobbles are very weak low density chalk and flint chalk gravel is white and clean when broken.(LEWIS NODULAR CHALK FORMATION, GRADE Dm)
2.80 - 3.26	Structureless CHALK composed of slightly sandy silty subangular to rounded mainly medium and coarse GRAVEL with many rounded cobbles. Gravel is very weak low density white with frequent black specks. Cobbles are weak medium density white with occasional black specks. Matrix is uncompact white.(LEWES NODULAR CHALK FORMATION, GRADE Dc)

			Permeability Guideline (m/s)		
Soil Infiltration Rate (f) =	**6.09E-05**	m/s	Good	Poor	Practically Impervious
			10^{-3} - 10^{-5}	10^{-6} - 10^{-7}	10^{-8} - 10^{-10}

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SOAKAWAY TESTING SCHEDULE

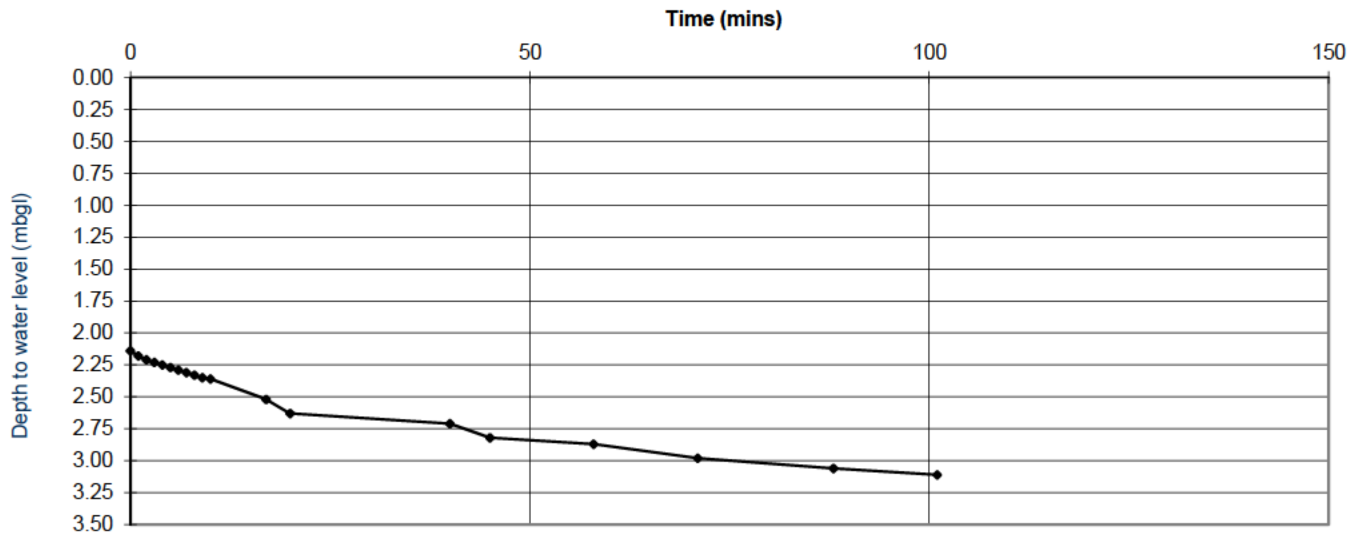
PROJECT NO :	22-0222
PROJECT:	Land off Thaxted Road, Saffron Walden, Camb
DOC REF:	220222-RGL-ZZ-XX-SH-G-500-0010

Trial Pit Dimensions (m)	Width	Length	Depth to Base
	0.70	2.60	3.45

Test Date 11/10/2022

Soakaway No. SA105- Cycle 1

Calculation of Infiltration Rate in Accordance with BRE Digest 365.



Calculation of Soil Infiltration Rate (f):

where

$$f = \frac{VP75\text{-}25}{ap50 \times tp75\text{-}25}$$

using

VP75-25 = Volume outflowing between 75% and 25% of effective depth.

ap50 = Mean surface area through which the outflow occurs.

tp75-25 = Time for the outflow between 75% and 25% of the effective depth.

VP75-25 = 1.1921 m^3

ap50 = 6.143 m^2

tp75-25 = 86.0 min

General Geological Profile :

0.00 - 0.35	[Loose] greyish brown slightly gravelly clayey organic SAND. Gravel of angular to rounded flint, quartzite, brick and chalk. (TOPSOIL)
0.35 - 1.10	Firm brown sandy slightly gravelly CLAY. Gravel of angular to rounded flint, quartzite and chalk. (HEAD)
1.10 - 2.45	Firm light brown sandy slightly gravelly CLAY. Gravel of angular to rounded flint, quartzite and chalk. (HEAD)
2.45 - 3.20	Structureless CHALK composed of sandy slightly gravelly clayey SILT with occasional cobbles. Gravel and cobbles are very weak low density chalk and flint chalk gravel is white and clean when broken.(LEWIS NODULAR CHALK FORMATION, GRADE Dm)
3.20 - 3.40	Structureless CHALK composed of slightly sandy silty subangular to rounded mainly medium and coarse GRAVEL with many rounded cobbles. Gravel is very weak low density white with frequent black specks. Cobbles are weak medium density white with occasional black specks. Matrix is uncompact white.(LEWES NODULAR CHALK FORMATION, GRADE Dc)

Soil Infiltration Rate (f) = **3.76E-05** m/s

Permeability Guideline (m/s)		
Good	Poor	Practically Impervious
10^{-3} - 10^{-5}	10^{-6} - 10^{-7}	10^{-8} - 10^{-10}

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SOAKAWAY TESTING SCHEDULE

PROJECT NO :	22-0222
PROJECT:	Land off Thaxted Road, Saffron Walden, Camb
DOC REF:	220222-RGL-ZZ-XX-SH-G-500-0011

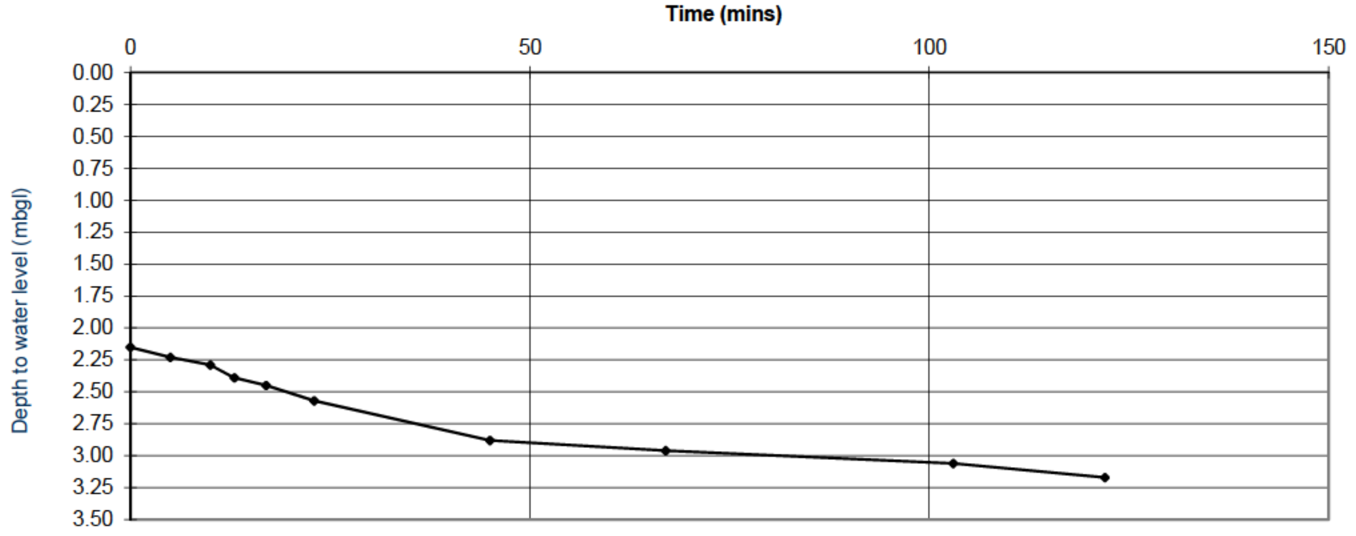
Trial Pit Dimensions (m)	Width	Length	Depth to Base
	0.70	2.60	3.45

Test Date 11/10/2022

Soakaway No. SA105- Cycle 2

Calculation of Infiltration Rate in Accordance with BRE Digest 365.

SOAKAWAY TEST RESULTS



Calculation of Soil Infiltration Rate (f):

where

$$f = \frac{VP_{75-25}}{ap_{50} \times tp_{75-25}}$$

using

VP75-25 = Volume outflowing between 75% and 25% of effective depth.

ap50 = Mean surface area through which the outflow occurs.

tp75-25 = Time for the outflow between 75% and 25% of the effective depth.

VP75-25 = 1.183 m³

ap50 = 6.11 m²

tp75-25 = 96.0 min

General Geological Profile :

0.00 - 0.35	[Loose] greyish brown slightly gravelly clayey organic SAND. Gravel of angular to rounded flint, quartzite, brick and chalk. (TOPSOIL)
0.35 - 1.10	Firm brown sandy slightly gravelly CLAY. Gravel of angular to rounded flint, quartzite and chalk.(HEAD)
1.10 - 2.45	Firm light brown sandy slightly gravelly CLAY. Gravel of angular to rounded flint, quartzite and chalk.(HEAD)
2.45 - 3.20	Structureless CHALK composed of sandy slightly gravelly clayey SILT with occasional cobbles. Gravel and cobbles are very weak low density chalk and flint chalk gravel is white and clean when broken.(LEWIS NODULAR CHALK FORMATION, GRADE Dm)
3.20 - 3.40	Structureless CHALK composed of slightly sandy silty subangular to rounded mainly medium and coarse GRAVEL with many rounded cobbles. Gravel is very weak low density white with frequent black specks. Cobbles are weak medium density white with occasional black specks. Matrix is uncompact white.(LEWES NODULAR CHALK FORMATION, GRADE Dc)

Soil Infiltration Rate (f) = **3.36E-05** m/s

Permeability Guideline (m/s)		
Good	Poor	Practically Impervious
10^{-3} - 10^{-5}	10^{-6} - 10^{-7}	10^{-8} - 10^{-10}

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SOAKAWAY TESTING SCHEDULE

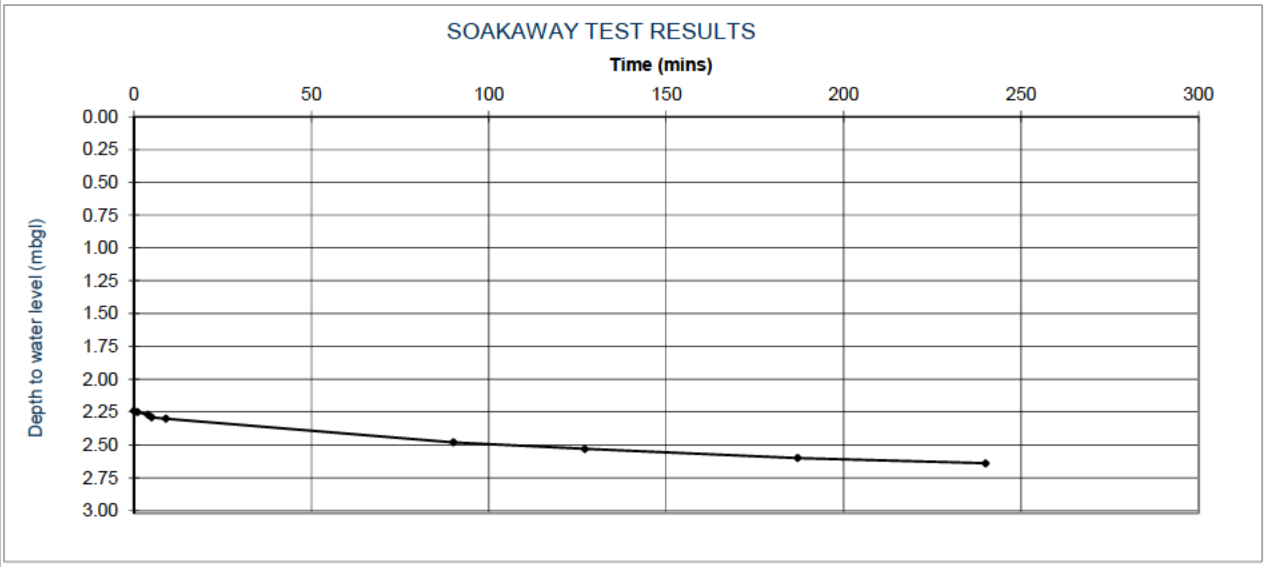
PROJECT NO :	22-0222
PROJECT:	Land off Thaxted Road, Saffron Walden, Cambridgeshire
DOC REF:	220222-RGL-ZZ-XX-SH-G-500-0012

Trial Pit Dimensions (m)	Width	Length	Depth to Base
	0.70	2.70	3.21

Test Date 12/10/2022

Soakaway No. SA106 - Cycle 1

Calculation of Infiltration Rate in Accordance with BRE Digest 365.



Calculation of Soil Infiltration Rate (f):

where

$$f = \frac{VP75\text{-}25}{ap50 \times tp75\text{-}25}$$

using

VP75-25 = Volume outflowing between 75% and 25% of effective depth.

ap50 = Mean surface area through which the outflow occurs.

tp75-25 = Time for the outflow between 75% and 25% of the effective depth.

VP75-25 = 0.91665 m^3

ap50 = 5.188 m^2

tp75-25 = 540.0 min

General Geological Profile :

0.00 - 0.40	[Loose] greyish brown slightly gravelly clayey organic SAND. Gravel of angular to rounded flint, quartzite, brick and chalk. (TOPSOIL)
0.40 - 0.80	Firm brown sandy slightly gravelly CLAY. Gravel of angular to rounded flint, quartzite and chalk.(HEAD)
0.80 - 1.90	Structureless CHALK composed of sandy slightly gravelly clayey SILT with occasional cobbles. Gravel and cobbles are very weak low density chalk and flint chalk gravel is white and clean when broken.(LEWIS NODULAR CHALK FORMATION, GRADE Dm)
1.90 - 2.90	Structureless CHALK composed of gravelly slightly sandy SILT with occasional cobbles of angular flint. Gravel is very weak low density chalk with frequent brown staining and black speckling to faces, clean white when broken. Matrix is uncompact brown mottled white.(LEWIS NODULAR CHALK FORMATION, GRADE Dm)

Soil Infiltration Rate (f) = **5.45E-06** m/s

Permeability Guideline (m/s)		
Good	Poor	Practically Impervious
10^{-3} - 10^{-5}	10^{-6} - 10^{-7}	10^{-8} - 10^{-10}

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SOAKAWAY TESTING SCHEDULE

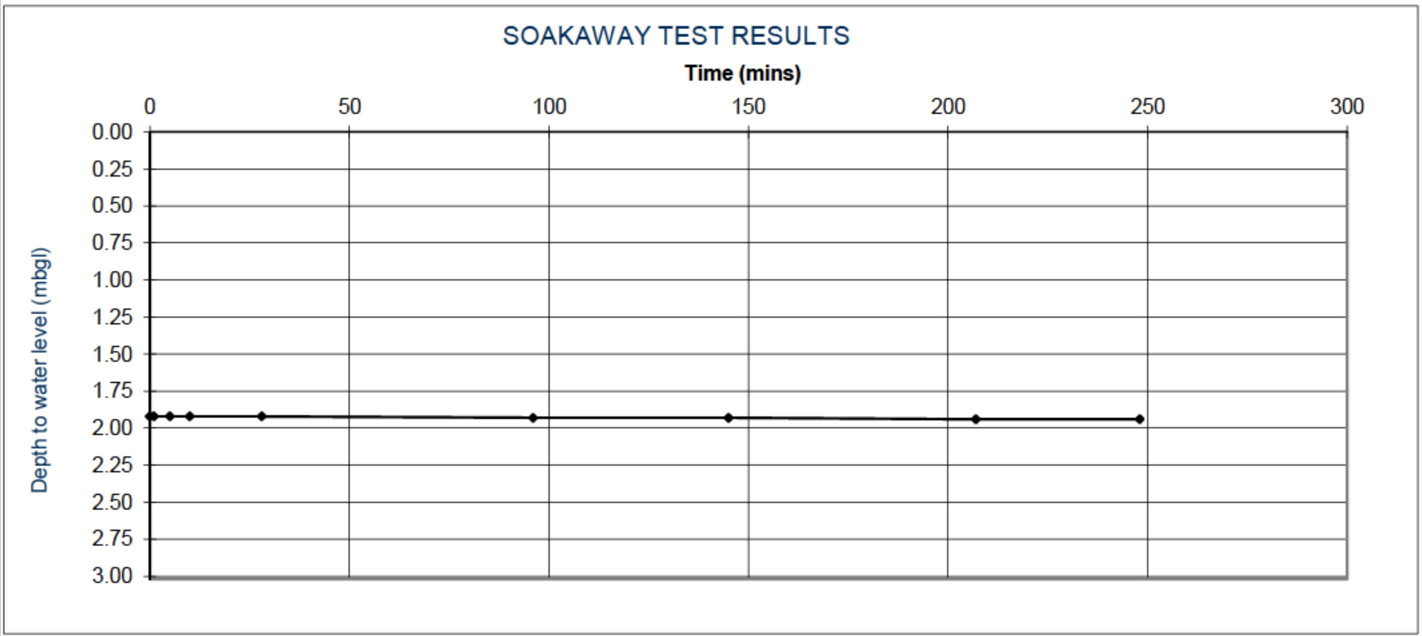
PROJECT NO :	22-0222
PROJECT:	Land off Thaxted Road, Saffron Walden, Camb
DOC REF:	220222-RGL-ZZ-XX-SH-G-500-00013

Trial Pit Dimensions (m)	Width	Length	Depth to Base
	0.70	2.80	2.85

Test Date 12/10/2022

Soakaway No. SA107 - Cycle 1

Calculation of Infiltration Rate in Accordance with BRE Digest 365.



Calculation of Soil Infiltration Rate (f):

where

$$f = \frac{VP75\text{-}25}{ap50 \times tp75\text{-}25}$$

using

VP75-25 = Volume outflowing between 75% and 25% of effective depth.

ap50 = Mean surface area through which the outflow occurs.

tp75-25 = Time for the outflow between 75% and 25% of the effective depth.

VP75-25 = 0.9114 m³

ap50 = 5.215 m²

tp75-25 = N/A min

General Geological Profile :

0.00 - 0.30	[Loose] greyish brown slightly gravelly clayey organic SAND. Gravel of angular to rounded flint, quartzite, brick and chalk. (TOPSOIL)
0.30 - 0.90	Stiff brown slightly sandy gravelly silty CLAY. Gravel of fine to medium well rounded flint, quartzite and chalk. Occasional 100mm lenses of orange brown sand throughout.(LOWESTOFT FORMATION)
0.90 - 2.00	Stiff bluish grey mottled greyish brown slightly sandy gravelly silty CLAY. Gravel of fine to medium well rounded flint, quartzite and sandstone.(LOWESTOFT FORMATION)
2.00 - 2.90	Very stiff bluish grey mottled greyish brown slightly sandy gravelly silty CLAY. Gravel of fine to medium well rounded flint, quartzite and sandstone.(LOWESTOFT FORMATION)

Infiltration rate was insufficient to be calculated in accordance with BRE 365 (2016).

			Permeability Guideline (m/s)		
Soil Infiltration Rate (f) =	**N/A**	m/s	Good	Poor	Practically Impervious
			10^{-3} - 10^{-5}	10^{-6} - 10^{-7}	10^{-8} - 10^{-10}

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SOAKAWAY TESTING SCHEDULE

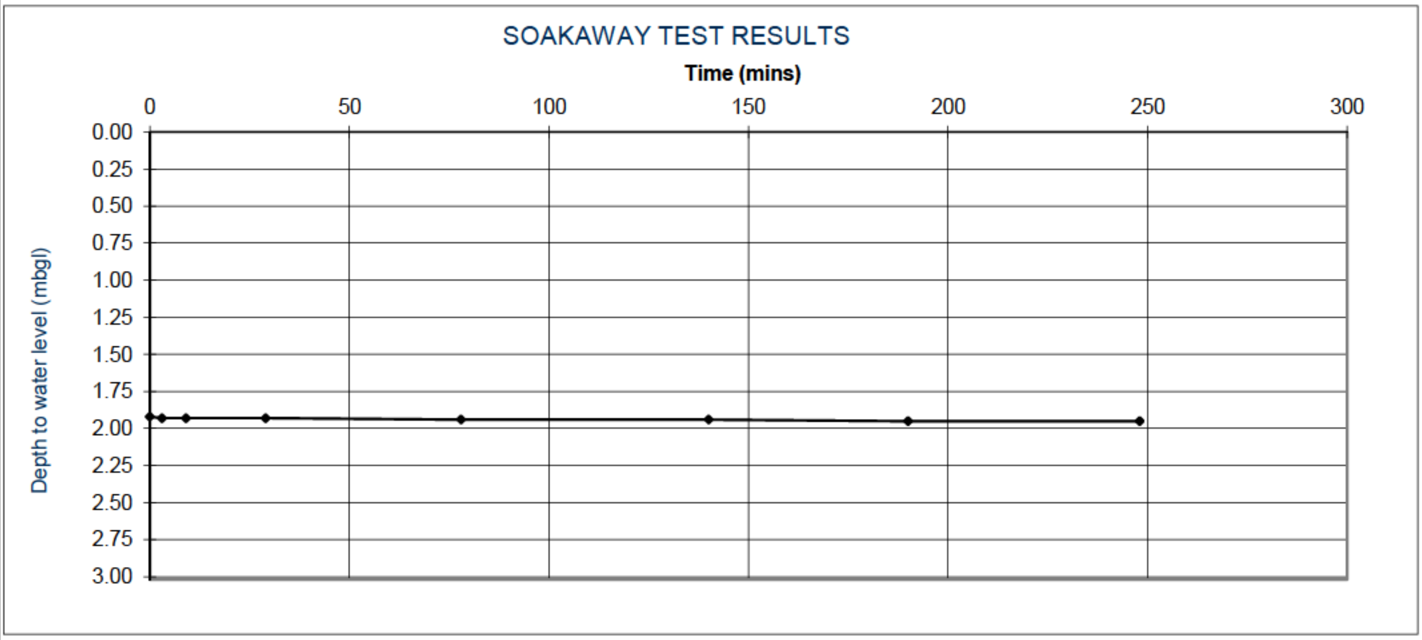
PROJECT NO :	22-0222
PROJECT:	Land off Thaxted Road, Saffron Walden, Camb
DOC REF:	220222-RGL-ZZ-XX-SH-G-500-0014

Trial Pit Dimensions (m)	Width	Length	Depth to Base
	0.70	2.40	2.58

Test Date 12/10/2022

Soakaway No. SA108 - Cycle 1

Calculation of Infiltration Rate in Accordance with BRE Digest 365.



Calculation of Soil Infiltration Rate (f):

where

$$f = \frac{VP75\text{-}25}{ap50 \times tp75\text{-}25}$$

VP75-25 = 0.5544 m³

ap50 = 3.726 m²

tp75-25 = N/A min

using

VP75-25 = Volume outflowing between 75% and 25% of effective depth.

ap50 = Mean surface area through which the outflow occurs.

tp75-25 = Time for the outflow between 75% and 25% of the effective depth.

General Geological Profile :

0.00 - 0.30	[Loose] greyish brown slightly gravelly clayey organic SAND. Gravel of angular to rounded flint, quartzite, brick and chalk. (TOPSOIL)
0.30 - 1.10	Firm brown sandy slightly gravelly CLAY. Gravel of angular to rounded flint, quartzite and chalk.(HEAD)
1.10 - 2.60	Structureless CHALK composed of sandy slightly gravelly clayey SILT with occasional cobbles. Gravel and cobbles are very weak low density chalk and flint chalk gravel is white and clean when broken.(LEWIS NODULAR CHALK FORMATION, GRADE Dm)

Infiltration rate was insufficient to be calculated in accordance with BRE 365 (2016).

			Permeability Guideline (m/s)		
Soil Infiltration Rate (f) =	**N/A**	m/s	Good	Poor	Practically Impervious
			10^{-3} - 10^{-5}	10^{-6} - 10^{-7}	10^{-8} - 10^{-10}

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SOAKAWAY TESTING SCHEDULE

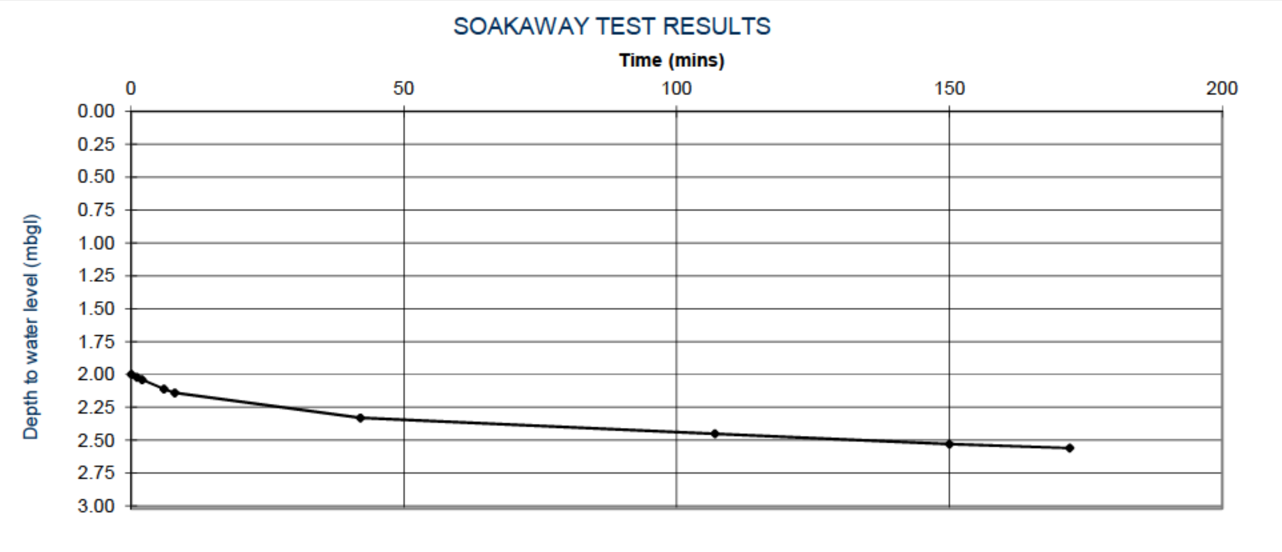
PROJECT NO :	22-0222
PROJECT:	Land off Thaxted Road, Saffron Walden, Cambridgeshire
DOC REF:	220222-RGL-ZZ-XX-SH-G-500-0015

Trial Pit Dimensions (m)	Width	Length	Depth to Base
	0.70	2.30	2.94

Test Date 12/10/2022

Soakaway No. SA109 - Cycle 1

Calculation of Infiltration Rate in Accordance with BRE Digest 365.



Calculation of Soil Infiltration Rate (f):

where

$$f = \frac{VP75\text{-}25}{ap50 \times tp75\text{-}25}$$

using

VP75-25 = Volume outflowing between 75% and 25% of effective depth.

ap50 = Mean surface area through which the outflow occurs.

tp75-25 = Time for the outflow between 75% and 25% of the effective depth.

VP75-25 = 0.7567 m³

ap50 = 4.43 m²

tp75-25 = 240.0 min

General Geological Profile :

0.00 - 0.40	[Loose] greyish brown slightly gravelly clayey organic SAND. Gravel of angular to rounded flint, quartzite, brick and chalk. (TOPSOIL)
0.40 - 1.00	Firm brown sandy slightly gravelly CLAY. Gravel of angular to rounded flint, quartzite and chalk.(HEAD)
1.00 - 1.60	Firm light brown sandy slightly gravelly CLAY. Gravel of angular to rounded flint, quartzite and chalk.(HEAD)
1.60 - 2.00	Structureless CHALK composed of gravelly slightly sandy SILT with occasional cobbles of angular flint. Gravel is very weak low density chalk with frequent brown staining and black speckling to faces, clean white when broken. Matrix is uncompact brown mottled white.(LEWIS NODULAR CHALK FORMATION, GRADE Dm)
2.00 - 2.95	Structureless CHALK composed of slightly sandy silty subangular to rounded mainly medium and coarse GRAVEL with many rounded cobbles. Gravel is very weak low density white with frequent black specks. Cobbles are weak medium density white with occasional black specks. Matrix is uncompact white.(LEWES NODULAR CHALK FORMATION, GRADE Dc)

Infiltration rate was extrapolated assuming a constant rate of dissipation.

			Permeability Guideline (m/s)		
Soil Infiltration Rate (f) =	**1.19E-05**	m/s	Good	Poor	Practically Impervious
			10^{-3} - 10^{-5}	10^{-6} - 10^{-7}	10^{-8} - 10^{-10}

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Trial Pit Log

Trialpit No	SA101A
Sheet	1 of 1
Project Name:	Land off Thaxted Road, Saffron Walden, Cambridgeshire
Project No.	22-0222
Co-ords:	554746.00 - 237435.00
Level:	
Date	10/10/2022
Location:	Land off Thaxted Road, Saffron Walden, Cambridgeshire
Dimensions (m):	2.9 × 0.8
Depth	3.02
Scale	1:30
Client:	Kier Ventures Ltd
Logged	MG

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.40			[Loose] greyish brown slightly gravelly clayey organic SAND. Gravel of angular to rounded flint, quartzite, brick and chalk. (TOPSOIL)
				2.30			Firm brown sandy slightly gravelly CLAY. Gravel of angular to rounded flint, quartzite and chalk. (HEAD)
				3.02			Structureless CHALK composed of gravelly slightly sandy SILT with occasional cobbles of angular flint. Gravel is very weak low density chalk with frequent brown staining and black speckling to faces, clean white when broken. Matrix is uncompact brown mottled white. (LEWIS NODULAR CHALK FORMATION, GRADE Dm)

End of pit at 3.02 m

Remarks: No groundwater encountered.

Stability: Sides were stable for short period the pit was open.

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Trial Pit Log

Trialpit No	SA101B
Sheet	1 of 1
Project Name:	Land off Thaxted Road, Saffron Walden, Cambridgeshire
Project No.	22-0222
Co-ords:	554749.00 - 237439.00
Level:	
Date	10/10/2022
Location:	Land off Thaxted Road, Saffron Walden, Cambridgeshire
Dimensions (m):	1.9 x 0.7
Depth	0.97
Scale	1:30
Client:	Kier Ventures Ltd
Logged	MG

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.45			[Loose] greyish brown slightly gravelly clayey organic SAND. Gravel of angular to rounded flint, quartzite, brick and chalk. (TOPSOIL)
				0.97			Firm brown sandy slightly gravelly CLAY. Gravel of angular to rounded flint, quartzite and chalk. (HEAD)
							End of pit at 0.97 m

Remarks: No groundwater encountered.

Stability: Sides were stable for short period the pit was open.

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Trial Pit Log

Trialpit No	SA102	Sheet 1 of 1		
Project Name:	Land off Thaxted Road, Saffron Walden, Cambridgeshire	Project No. 22-0222	Co-ords: 554785.00 - 237379.00 Level:	Date 10/10/2022
Location:	Land off Thaxted Road, Saffron Walden, Cambridgeshire		Dimensions (m): 2.5 x 0.7; Depth 2.92	Scale 1:30
Client:	Kier Ventures Ltd			Logged MG

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.30			[Loose] greyish brown slightly gravelly clayey organic SAND. Gravel of angular to rounded flint, quartzite, brick and chalk. (TOPSOIL)
				1.50			Firm brown sandy slightly gravelly CLAY. Gravel of angular to rounded flint, quartzite and chalk. (HEAD)
				2.92			Structureless CHALK composed of gravelly slightly sandy SILT with occasional cobbles of angular flint. Gravel is very weak low density chalk with frequent brown staining and black speckling to faces, clean white when broken. Matrix is uncompact brown mottled white. (LEWIS NODULAR CHALK FORMATION, GRADE Dm)
							End of pit at 2.92 m

Depth scale: 1, 2, 3, 4, 5, 6

Remarks: No groundwater encountered.

Stability: Sides were stable for short period the pit was open.

Rolton Group Limited The Charles Parker Building Midland Road Higham Ferrers Northants NN10 8DN	# Trial Pit Log	Trialpit No **SA103** Sheet 1 of 1

Project Name: Land off Thaxted Road, Saffron Walden, Cambridgeshire	Project No. 22-0222	Co-ords: 554814.00 - 237313.00 Level:	Date 10/10/2022
Location: Land off Thaxted Road, Saffron Walden, Cambridgeshire		Dimensions (m): 2.5 x 0.7 Depth 3.02	Scale 1:30
Client: Kier Ventures Ltd			Logged MG

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.45			[Loose] greyish brown slightly gravelly clayey organic SAND. Gravel of angular to rounded flint, quartzite, brick and chalk. (TOPSOIL)
				1.15			Firm brown sandy slightly gravelly CLAY. Gravel of angular to rounded flint, quartzite and chalk. (HEAD)
				2.60			Structureless CHALK composed of gravelly slightly sandy SILT with occasional cobbles of angular flint. Gravel is very weak low density chalk with frequent brown staining and black speckling to faces, clean white when broken. Matrix is uncompact brown mottled white. (LEWIS NODULAR CHALK FORMATION, GRADE Dm)
				3.02			Structureless CHALK composed of sandy slightly gravelly clayey SILT with occasional cobbles. Gravel and cobbles are very weak low density chalk and flint chalk gravel is white and clean when broken. (LEWIS NODULAR CHALK FORMATION, GRADE Dm)
							End of pit at 3.02 m

Remarks: No groundwater encountered.

Stability: Sides were stable for short period the pit was open.

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Trial Pit Log

Trialpit No	SA104
Sheet	1 of 1
Project Name:	Land off Thaxted Road, Saffron Walden, Cambridgeshire
Project No.	22-0222
Co-ords:	554817.00 - 237363.00
Level:	
Date	11/10/2022
Location:	Land off Thaxted Road, Saffron Walden, Cambridgeshire
Dimensions (m):	2.4 x 0.7
Depth	3.26
Scale	1:30
Client:	Kier Ventures Ltd
Logged	MG

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.35			[Loose] greyish brown slightly gravelly clayey organic SAND. Gravel of angular to rounded flint, quartzite, brick and chalk. (TOPSOIL)
				1.00			Firm brown sandy slightly gravelly CLAY. Gravel of angular to rounded flint, quartzite and chalk. (HEAD)
				2.20			Structureless CHALK composed of gravelly slightly sandy SILT with occasional cobbles of angular flint. Gravel is very weak low density chalk with frequent brown staining and black speckling to faces, clean white when broken. Matrix is uncompact brown mottled white. (LEWIS NODULAR CHALK FORMATION, GRADE Dm)
				2.80			Structureless CHALK composed of sandy slightly gravelly clayey SILT with occasional cobbles. Gravel and cobbles are very weak low density chalk and flint chalk gravel is white and clean when broken. (LEWIS NODULAR CHALK FORMATION, GRADE Dm)
				3.26			Structureless CHALK composed of slightly sandy silty subangular to rounded mainly medium and coarse GRAVEL with many rounded cobbles. Gravel is very weak low density white with frequent black specks. Cobbles are weak medium density white with occasional black specks. Matrix is uncompact white. (LEWES NODULAR CHALK FORMATION, GRADE Dc)

End of pit at 3.26 m

1
2
3
4
5
6

Remarks: No groundwater encountered.

Stability: Sides were stable for short period the pit was open.

Rolton Group Limited
The Charles Parker Building
Midland Road
Higham Ferrers
Northants
NN10 8DN

Trial Pit Log

Trialpit No **SA105**

Sheet 1 of 1

Project Name: Land off Thaxted Road, Saffron Walden, Cambridgeshire	Project No. 22-0222	Co-ords: 554749.00 - 237297.00 Level:	Date 11/10/2022
Location: Land off Thaxted Road, Saffron Walden, Cambridgeshire		Dimensions (m): 3.45 x 0.7 Depth 3.45	Scale 1:30
Client: Kier Ventures Ltd			Logged MG

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.35			[Loose] greyish brown slightly gravelly clayey organic SAND. Gravel of angular to rounded flint, quartzite, brick and chalk. (TOPSOIL)
				1.10			Firm brown sandy slightly gravelly CLAY. Gravel of angular to rounded flint, quartzite and chalk. (HEAD)
				2.45			Firm light brown sandy slightly gravelly CLAY. Gravel of angular to rounded flint, quartzite and chalk. (HEAD)
				3.20			Structureless CHALK composed of sandy slightly gravelly clayey SILT with occasional cobbles. Gravel and cobbles are very weak low density chalk and flint chalk gravel is white and clean when broken. (LEWIS NODULAR CHALK FORMATION, GRADE Dm)
				3.45			Structureless CHALK composed of slightly sandy silty subangular to rounded mainly medium and coarse GRAVEL with many rounded cobbles. Gravel is very weak low density white with frequent black specks. Cobbles are weak medium density white with occasional black specks. Matrix is uncompact white. (LEWES NODULAR CHALK FORMATION, GRADE Dc)

End of pit at 3.45 m

Remarks: No groundwater encountered.

Stability: Sides were stable for short period the pit was open.

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Northants
NN10 8DN

Trial Pit Log

Trialpit No **SA106**

Project Name: Land off Thaxted Road, Saffron Walden, Cambridgeshire	Project No. 22-0222	Co-ords: 554640.00 - 237279.00 Level:	Date 12/10/2022
Location: Land off Thaxted Road, Saffron Walden, Cambridgeshire		Dimensions (m): 2.7 x 0.7 Depth 3.21	Scale 1:30
Client: Kier Ventures Ltd			Logged MG

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.40			[Loose] greyish brown slightly gravelly clayey organic SAND. Gravel of angular to rounded flint, quartzite, brick and chalk. (TOPSOIL)
				0.80			Firm brown sandy slightly gravelly CLAY. Gravel of angular to rounded flint, quartzite and chalk. (HEAD)
				1.90			Structureless CHALK composed of sandy slightly gravelly clayey SILT with occasional cobbles. Gravel and cobbles are very weak low density chalk and flint chalk gravel is white and clean when broken. (LEWIS NODULAR CHALK FORMATION, GRADE Dm)
				3.21			Structureless CHALK composed of gravelly slightly sandy SILT with occasional cobbles of angular flint. Gravel is very weak low density chalk with frequent brown staining and black speckling to faces, clean white when broken. Matrix is uncompact brown mottled white. (LEWIS NODULAR CHALK FORMATION, GRADE Dm)

End of pit at 3.21 m

Remarks: No groundwater encountered.

Stability: Sides were stable for short period the pit was open.

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Northants
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Trial Pit Log

Trialpit No **SA107**
Sheet 1 of 1

Project Name: Land off Thaxted Road, Saffron Walden, Cambridgeshire	Project No. 22-0222	Co-ords: 554578.00 - 237144.00 Level:	Date 12/10/2022
Location: Land off Thaxted Road, Saffron Walden, Cambridgeshire		Dimensions (m): 2.8 × 0.7 Depth 2.85	Scale 1:30
Client: Kier Ventures Ltd			Logged MG

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.30			[Loose] greyish brown slightly gravelly clayey organic SAND. Gravel of angular to rounded flint, quartzite, brick and chalk. (TOPSOIL)
				0.90			Stiff brown slightly sandy gravelly silty CLAY. Gravel of fine to medium well rounded flint, quartzite and chalk. Occasional 100mm lenses of orange brown sand throughout. (LOWESTOFT FORMATION)
				2.00			Stiff bluish grey mottled greyish brown slightly sandy gravelly silty CLAY. Gravel of fine to medium well rounded flint, quartzite and sandstone. (LOWESTOFT FORMATION)
				2.85			Very stiff bluish grey mottled greyish brown slightly sandy gravelly silty CLAY. Gravel of fine to medium well rounded flint, quartzite and sandstone. (LOWESTOFT FORMATION)

End of pit at 2.85 m

Remarks: No groundwater encountered.

Stability: Sides were stable for short period the pit was open.

Rolton Group Limited The Charles Parker Building Midland Road Higham Ferrers Northants NN10 8DN	# Trial Pit Log		Trialpit No **SA108** Sheet 1 of 1
Project Name: Land off Thaxted Road, Saffron Walden, Cambridgeshire	Project No. 22-0222	Co-ords: 554573.00 - 237219.00 Level:	Date 12/10/2022
Location: Land off Thaxted Road, Saffron Walden, Cambridgeshire		Dimensions (m): 2.58 × 0.7 Depth 2.58	Scale 1:30
Client: Kier Ventures Ltd			Logged MG

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.30			[Loose] greyish brown slightly gravelly clayey organic SAND. Gravel of angular to rounded flint, quartzite, brick and chalk. (TOPSOIL)
				1.10			Firm brown sandy slightly gravelly CLAY. Gravel of angular to rounded flint, quartzite and chalk. (HEAD)
				2.58			Structureless CHALK composed of sandy slightly gravelly clayey SILT with occasional cobbles. Gravel and cobbles are very weak low density chalk and flint chalk gravel is white and clean when broken. (LEWIS NODULAR CHALK FORMATION, GRADE Dm)
							End of pit at 2.58 m

Depth scale (m): 1, 2, 3, 4, 5, 6

Remarks: No groundwater encountered.

Stability: Sides were stable for short period the pit was open.

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NN10 8DN

Trial Pit Log

Trialpit No **SA109**

Sheet 1 of 1

Project Name: Land off Thaxted Road, Saffron Walden, Cambridgeshire	Project No. 22-0222	Co-ords: 554820.00 - 237253.00 Level:	Date 12/10/2022
Location: Land off Thaxted Road, Saffron Walden, Cambridgeshire		Dimensions (m): 2.3 x 0.7 Depth 2.94	Scale 1:30
Client: Kier Ventures Ltd			Logged MG

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.40			[Loose] greyish brown slightly gravelly clayey organic SAND. Gravel of angular to rounded flint, quartzite, brick and chalk. (TOPSOIL)
				1.00			Firm brown sandy slightly gravelly CLAY. Gravel of angular to rounded flint, quartzite and chalk. (HEAD)
				1.60			Firm light brown sandy slightly gravelly CLAY. Gravel of angular to rounded flint, quartzite and chalk. (HEAD)
				2.00			Structureless CHALK composed of gravelly slightly sandy SILT with occasional cobbles of angular flint. Gravel is very weak low density chalk with frequent brown staining and black speckling to faces, clean white when broken. Matrix is uncompact brown mottled white. (LEWIS NODULAR CHALK FORMATION, GRADE Dm)
				2.94			Structureless CHALK composed of slightly sandy silty subangular to rounded mainly medium and coarse GRAVEL with many rounded cobbles. Gravel is very weak low density white with frequent black specks. Cobbles are weak medium density white with occasional black specks. Matrix is uncompact white. (LEWES NODULAR CHALK FORMATION, GRADE Dc)
							End of pit at 2 94 m

1
2
3
4
5
6

Remarks: No groundwater encountered.

Stability: Sides were stable for short period the pit was open.

APPENDIX E – ENVIRONMENT AGENCY’S PRODUCT 4 INFORMATION

Environment Agency

Product 4 Request - EAn/2022/255032							
Unique ID (Label)	Easting	Northing	Standard of Protection (Return Period)	Overall Condition Grade	Statutory Defence Level	Upstream Crest Level	Downstream Crest Level
172191	554650	237697	1 in 25 (4%)	3	Not Known	Not Known	Not Known
172195	554756	237499	1 in 25 (4%)	3	Not Known	Not Known	Not Known
173422	554760	237496	1 in 25 (4%)	3	Not Known	Not Known	Not Known
173631	554602	237770	1 in 25 (4%)	3	Not Known	Not Known	Not Known
174840	554604	237759	1 in 25 (4%)	3	Not Known	Not Known	Not Known
174841	554608	237750	1 in 25 (4%)	3	Not Known	Not Known	Not Known
174842	554649	237695	1 in 25 (4%)	3	Not Known	Not Known	Not Known

255032 Product 4 Map - (3rd Party Defences)

Legend

Defences (3rd party maintained)

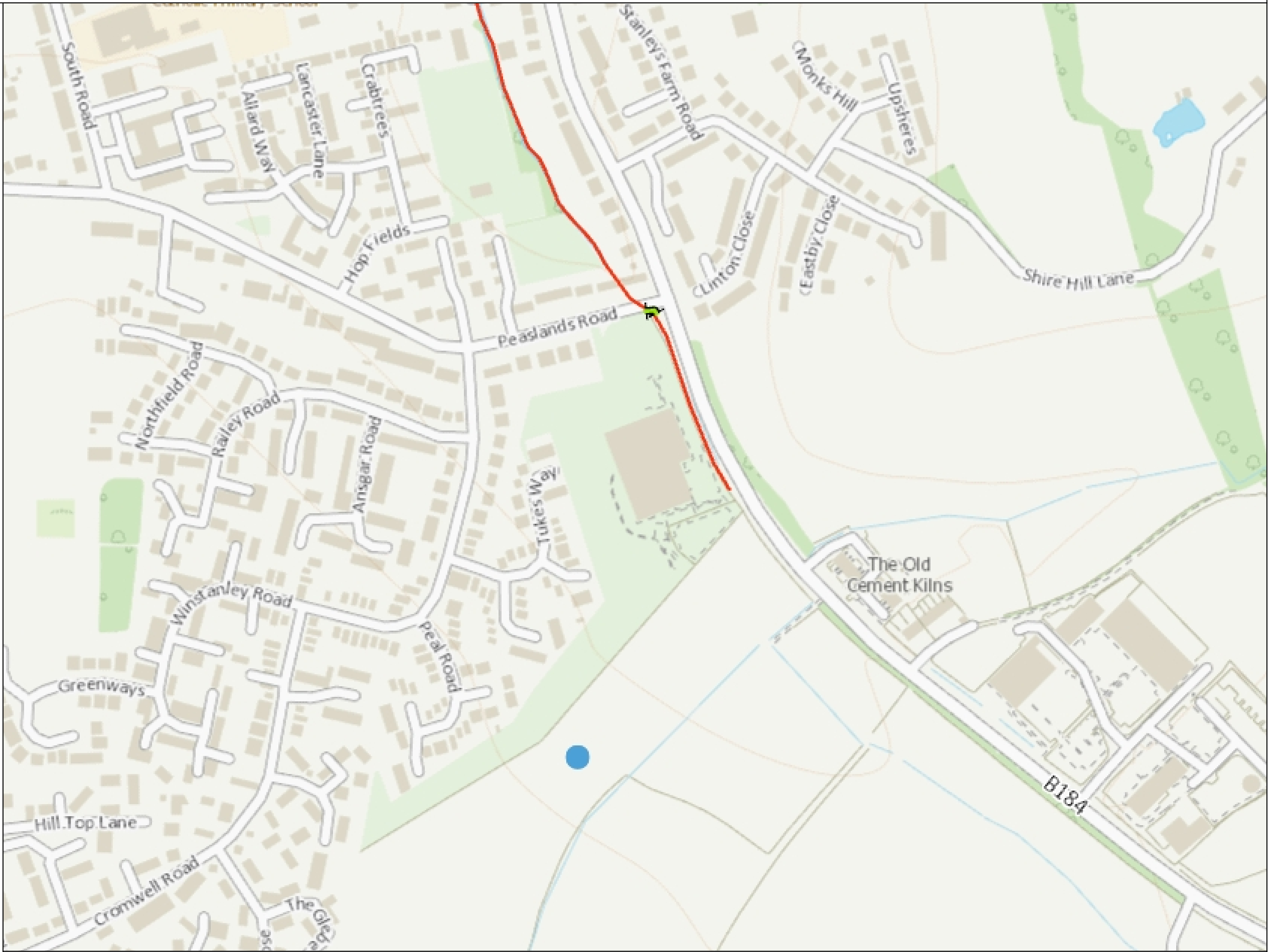
- Embankment
- Wall
- Flood Gate
- Demountable Defence
- Bridge Abutment
- Engineered High Ground
- Natural High Ground
- Cliff
- Promenade
- Quay
- Beach
- Barrier Beach
- Dunes
- Spillway

Statutory Main Rivers

1: 5,000

0 125

Metres



255032 Product 4 Map

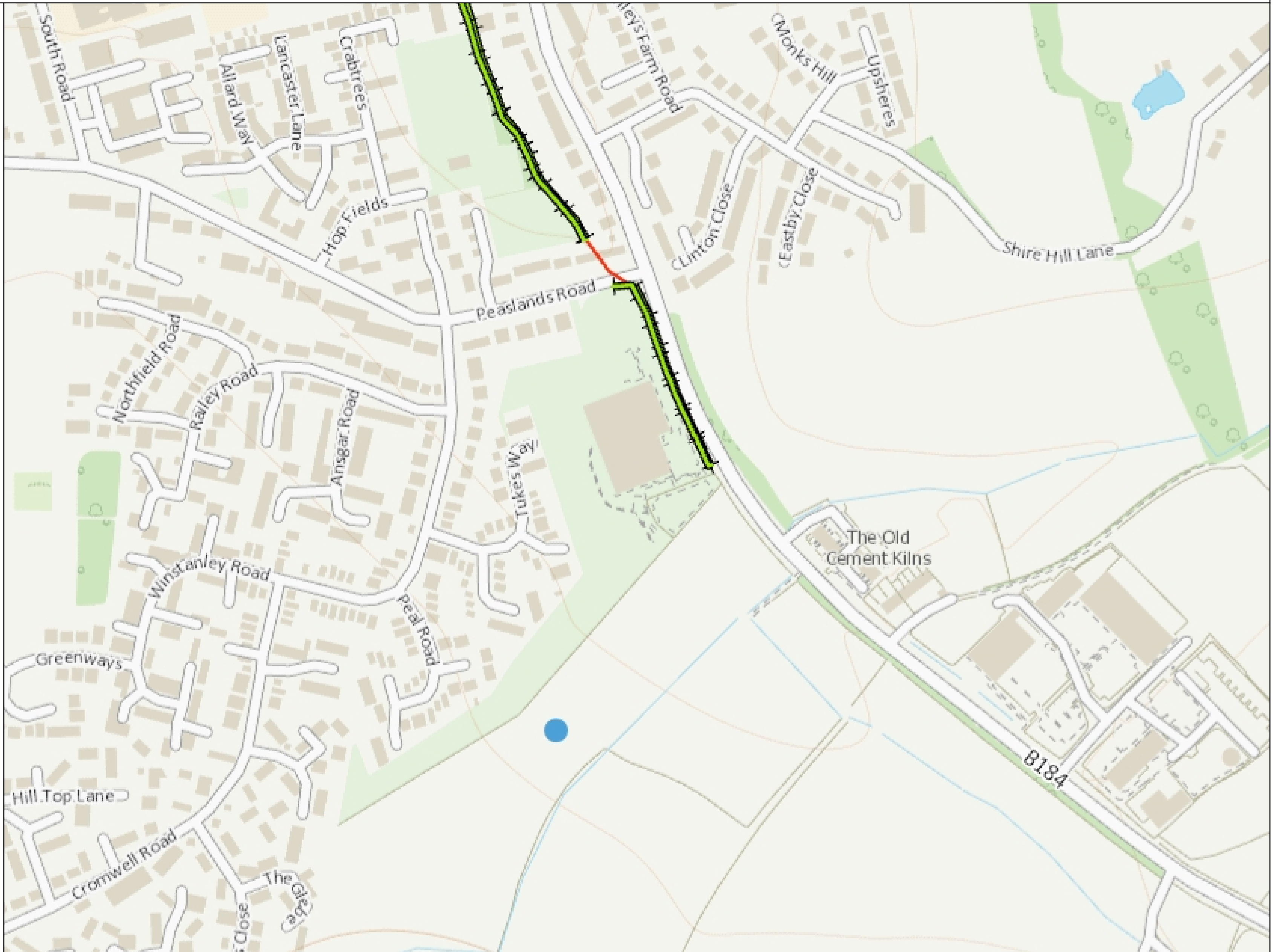
Environment Agency

Legend

Defences (EA maintained)

- Embankment
- Wall
- Flood Gate
- Demountable Defence
- Bridge Abutment
- Engineered High Ground
- Natural High Ground
- Cliff
- Promenade
- Quay
- Beach
- Barrier Beach
- Dunes
- Spillway

Statutory Main Rivers



1: 5,000

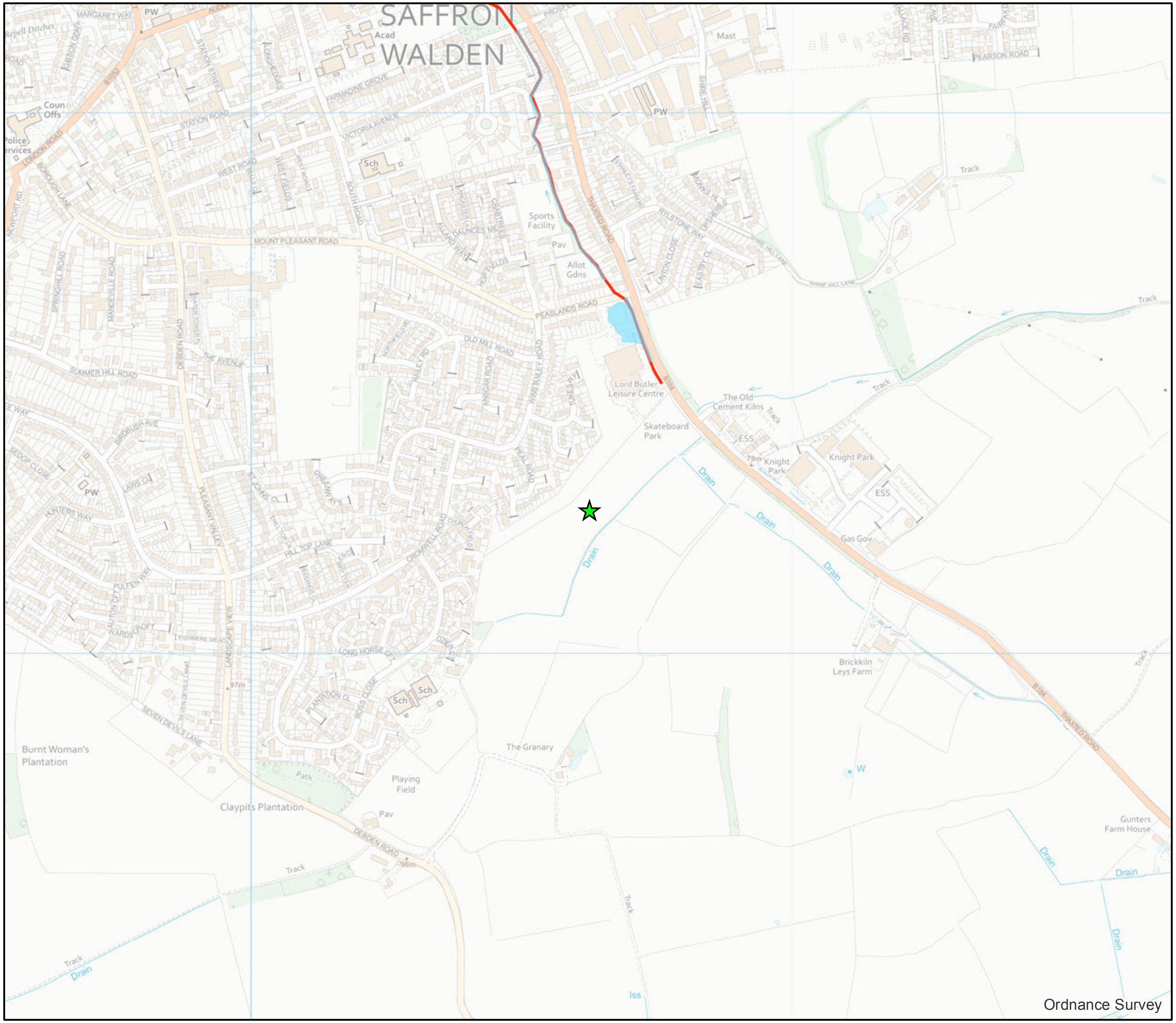
0 125

Metres

N W E S

Defended Climate Change Model Flood Outlines centred on Tukes Way, Pleasant Valley, Saffron Walden, Uttlesford, Essex CB11 3ES

NGR TL5462637265
Ref 255032
Created 05/04/2022



Environment Agency
Bromholme Lane,
Brampton,
Cambridgeshire
PE28 4NE

Legend

- Site
- 1% AEP + 20CC
- Main river

0 0.125 0.25 0.5 km

Information

Model Tolerance - Any data included in this product is subject to a standard modelling tollerance of +/- 150mm.The fluvial models used to produce these results are intended for strategic scale use only.

Flood Risk Assessments - The Environment Agency recommends any Flood Risk Assessment should only consider these results in the context of a site specific assessment.

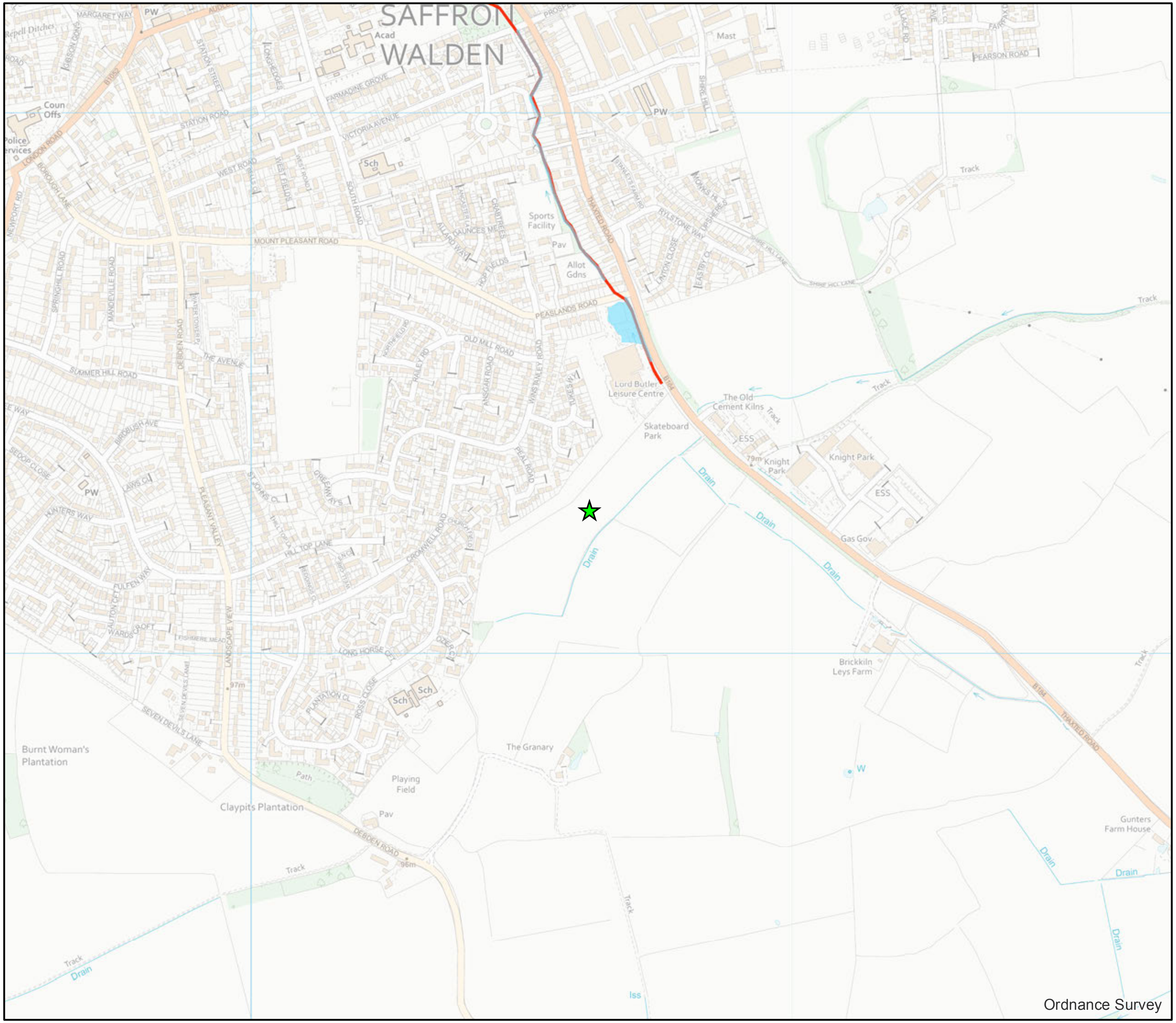
AEP - Annual Exceedance Probability - The probability of a given event occurring in any one year. Please note this is not a return period.

Strategic Scale Model - This model has been designed for catchment wide flood risk mapping. It should be noted that it was not created to produce flood levels for specific development sites within the catchment. Modelled outlines take into account catchment wide defences if present.

Contact Us: National Customer Contact Centre, PO Box 544, Ro herham, S60 1BY Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Defended Climate Change Model Flood Outlines centred on Tukes Way, Pleasant Valley, Saffron Walden, Uttlesford, Essex CB11 3ES

NGR TL5462637265
Ref 255032
Created 05/04/2022



Environment Agency
Bromholme Lane,
Brampton,
Cambridgeshire
PE28 4NE

Legend

- Site
- 1% AEP + 20CC
- Main river

0 0.125 0.25 0.5 km

Information

Model Tolerance - Any data included in this product is subject to a standard modelling tollerance of +/- 150mm.The fluvial models used to produce these results are intended for strategic scale use only.

Flood Risk Assessments - The Environment Agency recommends any Flood Risk Assessment should only consider these results in the context of a site specific assessment.

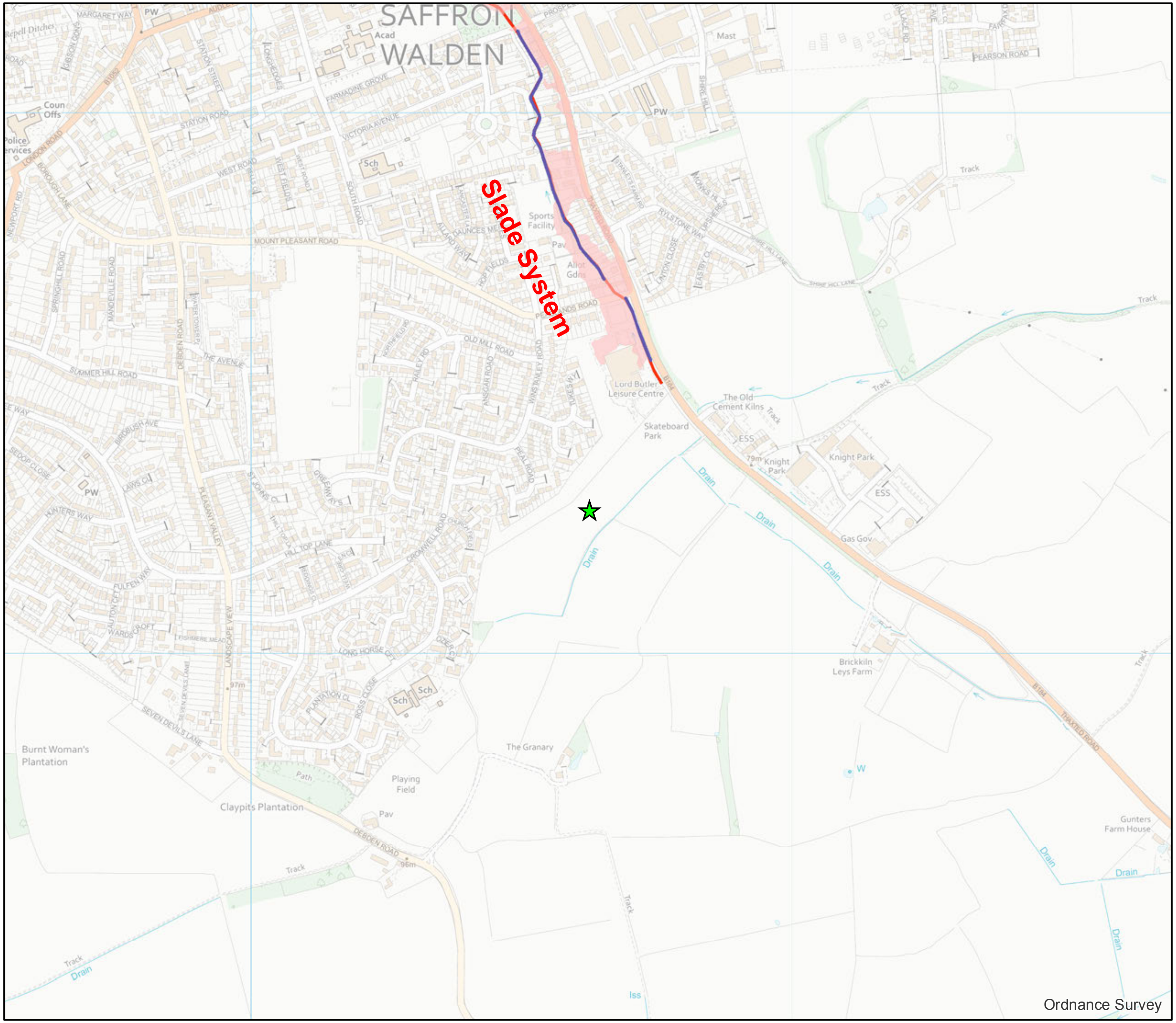
AEP - Annual Exceedance Probability - The probability of a given event occurring in any one year. Please note this is not a return period.

Strategic Scale Model - This model has been designed for catchment wide flood risk mapping. It should be noted that it was not created to produce flood levels for specific development sites within the catchment. Modelled outlines take into account catchment wide defences if present.

Contact Us: National Customer Contact Centre, PO Box 544, Ro herham, S60 1BY Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Defended Model Flood Outlines
centred on Tukes Way, Pleasant Valley, Saffron Walden, Uttlesford, Essex CB11 3ES

NGR TL5462637265
Ref 255032
Created 05/04/2022



Environment Agency
Bromholme Lane,
Brampton,
Cambridgeshire
PE28 4NE

Environment Agency

Legend

- ★ Site
- 5% AEP
- 1% AEP
- 0.1% AEP
- Main river

0 0.125 0.25 0.5 km

Information

Model Tolerance - Any data included in this product is subject to a standard modelling tollerance of +/- 150mm.The fluvial models used to produce these results are intended for strategic scale use only.

Flood Risk Assessments - The Environment Agency recommends any Flood Risk Assessment should only consider these results in the context of a site specific assessment.

AEP - Annual Exceedance Probability - The probability of a given event occurring in any one year. Please note this is not a return period.

Strategic Scale Model - This model has been designed for catchment wide flood risk mapping. It should be noted that it was not created to produce flood levels for specific development sites within the catchment. Modelled outlines take into account catchment wide defences if present.

Contact Us: National Customer Contact Centre, PO Box 544, Ro herham, S60 1BY Tel: 03708 506 506 (Mon-Fri 8-6).
Email: enquiries@environment-agency.gov.uk

Flood risk assessments: Climate change allowances

Application of the allowances and local considerations

East Anglia; Essex, Norfolk, Suffolk, Cambridgeshire and Bedfordshire

1) The climate change allowances

The National Planning Practice Guidance refers planners, developers and advisors to the Environment Agency guidance on considering climate change in Flood Risk Assessments (FRAs). This guidance was updated in October 2021 and is available on Gov.uk. The guidance can be used for planning applications, local plans, neighbourhood plans and other projects. It provides climate change allowances for peak river flow, peak rainfall, sea level rise, wind speed and wave height. The guidance provides a range of allowances to assess fluvial flooding, rather than a single national allowance. It advises on what allowances to use for assessment based on vulnerability classification, flood zone and development lifetime.

2) Assessment of climate change impacts on fluvial flooding

Where existing EA flood risk datasets and models do not provide the required climate change allowances, it is up to developers to undertake any work needed to appropriately assess the impacts of climate change on flood risk. They can do this by using the approaches in **Table A** below:

Table A below indicates the level of technical assessment of climate change impacts on fluvial flooding appropriate for new developments depending on their scale and location. This should be used as **a guide only**. Ultimately, the agreed approach should be based on expert local knowledge of flood risk conditions, local sensitivities and other influences. **For these reasons, we recommend that applicants and / or their consultants should contact the Environment Agency at the pre-planning application stage to confirm the assessment approach, on a case by case basis**. The email addresses for our Sustainable Places teams at our respective offices can be found in Section 8 below.

Table A defines three possible approaches to account for flood risk impacts due to climate change, in new development proposals:

- **Basic:** Developer can add an allowance to the 'design flood' (i.e. 1% annual probability) peak levels to account for potential climate change impacts. The allowance should be derived and agreed locally by Environment Agency teams.
- **Intermediate:** Developer can use existing modelled flood and flow data to construct a stage-discharge rating curve, which can be used to interpolate a flood level based on the required peak flow allowance being applied to the 'design flood' flow.
- **Detailed:** Perform detailed hydraulic modelling, either through re-running Environment Agency hydraulic models (if available) or construction of a new model by the developer.

Table A – Indicative guide to assessment approach

VULNERABILITY CLASSIFICATION	FLOOD ZONE	DEVELOPMENT TYPE		
		NON-MAJOR	SMALL-MAJOR	LARGE-MAJOR
ESSENTIAL INFRASTRUCTURE	Zone 2	Detailed		
	Zone 3a	Detailed		
	Zone 3b	Detailed		
HIGHLY VULNERABLE	Zone 2	Intermediate/ Basic	Intermediate/ Basic	Detailed
	Zone 3a	Not appropriate development		
	Zone 3b	Not appropriate development		
MORE VULNERABLE	Zone 2	Basic	Basic	Intermediate/ Basic
	Zone 3a	Intermediate/ Basic	Detailed	Detailed
	Zone 3b	Not appropriate development		
LESS VULNERABLE	Zone 2	Basic	Basic	Intermediate/ Basic
	Zone 3a	Basic	Basic	Detailed
	Zone 3b	Not appropriate development		
WATER COMPATIBLE	Zone 2	None		
	Zone 3a	Intermediate/ Basic		
	Zone 3b	Detailed		

Note: Where the table states 'not appropriate development', this is in line with national planning policy. If in exceptional circumstances such development types are proposed in these locations, we would expect a detailed modelling approach to be used.

NOTES:

- Non-Major: 1-9 dwellings/ less than 0.5 ha | Office / light industrial under 1ha | General industrial under 1 ha | Retail under 1 ha | Gypsy/traveller site between 0 and 9 pitches
- Small-Major: 10 to 30 dwellings | Office / light industrial 1ha to 5ha | General industrial 1ha to 5ha | Retail over 1ha to 5ha | Gypsy/traveller site over 10 to 30 pitches
- Large-Major: 30+ dwellings | Office / light industrial 5ha+ | General industrial 5ha+ | Retail 5ha+ | Gypsy/traveler site over 30+ pitches | any other development that creates a non-residential building or development over 1000 sq m.

The assessment approach should be agreed with the Environment Agency as part of pre-planning application discussions to avoid abortive work.

3) Specific local considerations

Where the Environment Agency and the applicant and / or their consultant has agreed that a '**basic**´ level of assessment is appropriate, the figures in Table B below can be used as a precautionary allowance for potential climate change impacts on peak 'design' (i.e. 1% annual probability) fluvial flood level rather than undertaking detailed modelling.

Table B – Local precautionary allowances for potential climate change impacts

Essex, Norfolk and Suffolk

Hydraulic Model (Watercourse)	Precautionary allowance (basic approach)
Blackwater & Brain - Blackwater between TL7520925623 and TL7820324314 Brain between TL7373323312 and TL7683821321	500mm
Other main rivers, tributaries and ordinary watercourses	For other main rivers, tributaries and ordinary watercourses that are not stated above, basic allowances have not been calculated. In this instance you can either: • If flow data is available you can request this data from us and can conduct an intermediate assessment yourself • Or alternatively, you can choose to undertake a Detailed Assessment and "perform detailed hydraulic modelling, through either re-running our hydraulic models (if available) or constructing a new model

Cambridgeshire and Bedfordshire

Watercourse / Model	Precautionary allowance (basic approach)
Alconbury Brook	600mm
River Kym	
Lower Ouse (Model Extent)	700mm
Mid Ouse (Cold Brayfield to Bromham – between SP9156852223 and TL0132950919)	700mm
Mid Ouse (East of Bedford to Roxton – between TL0791848903 and TL1618854543)	700mm
River Hiz and River Purwell	400mm
River Ivel	500mm
Pix Brook	450mm
Potton Brook	500mm
River Cam and tributaries (excluding the Cam Lodes and the Slade System)	450mm
Great Barford (ordinary watercourses)	500mm
Bromham (ordinary watercourse)	550mm

NOTES:

Urban areas excluded from the 'basic' approach: St Ives, Holywell, Godmanchester, Swavesey, Over, Bedford, Newport Pagnell, Buckingham and Leighton Buzzard. More detailed assessment of climate change allowances will need to be undertaken in these locations.

Use of these allowances will only be accepted after discussion with the Environment Agency.

4) Fluvial flood risk mitigation

For planning consultations where we are a statutory consultee and our Flood risk standing advice **does not** apply we use the following benchmarks to inform flood risk mitigation for different vulnerability classifications. **These are a guide only**. **We strongly recommend you contact us at the pre-planning application stage to confirm this on a case by case basis.** For planning consultations where we are not a statutory consultee or our Flood risk Standing advice applies, we recommend that local planning authorities and developers use these benchmarks but we do not expect to be consulted.

- For development classed as '**essential infrastructure**' our benchmark for flood risk mitigation is for it to be designed to the '**higher central**' climate change allowance for the epoch that most closely represents the lifetime of the development, including decommissioning. Please note that nationally significant infrastructure projects (NSIPs) may also need to assess a **credible maximum climate change scenario** by applying the '**upper end**' allowance for peak river flow as a sensitivity test. This will help to determine how sensitive the development is to changes in the climate and to ensure that it can be adapted to large-scale climate change over its lifetime.

- For **highly vulnerable, more vulnerable, less vulnerable and water compatible** developments in flood zones 2 and 3a, the '**central**' climate change allowance is our minimum benchmark for flood risk mitigation. For large urban settlement extensions or developments that form new communities, the credible maximum climate change scenario must be assessed; in these circumstances, you should use the '**upper end'** allowance.

- For **water compatible** development in flood zone 3b, the '**central**' climate change allowance for the epoch that most closely represents the lifetime of the development is our minimum benchmark for flood risk mitigation.

For peak river flow allowances and a visual representation of the above, please see Tables 1 and 2 below.

Table 1 peak river flow allowances by Management Catchment (use 1961 to 1990 baseline)				
Management Catchment	**Allowance category**	**Total potential change anticipated for '2020s' (2015 to 39)**	**Total potential change anticipated for '2050s' (2040 to 2069)**	**Total potential change anticipated for '2080s' (2070 to 2125)**
Upper and Bedford Ouse	**Upper end**	24%	30%	58%
	Higher central	10%	11%	30%
	Central	5%	4%	19%
Cam and Ely Ouse	**Upper End**	21%	22%	45%
	Higher Central	7%	5%	19%
	Central	2%	-2%	9%
Old Bedford and Middle Level	**Upper End**	23%	22%	39%
	Higher central	9%	4%	15%
	Central	3%	-3%	6%
North West Norfolk	**Upper End**	30%	34%	57%
	Higher central	18%	18%	33%
	Central	13%	11%	23%
North Norfolk Rivers	**Upper End**	26%	27%	48%
	Higher central	13%	11%	24%
	Central	7%	4%	14%
Broadland Rivers	**Upper End**	27%	27%	44%
	Higher central	14%	10%	20%
	Central	8%	3%	11%
East Suffolk	**Upper End**	25%	29%	54%
	Higher central	13%	13%	29%
	Central	8%	7%	19%
Combined Essex	**Upper End**	27%	37%	72%
	Higher central	13%	16%	38%
	Central	7%	8%	25%

South Essex	**Upper End**	22%	27%	48%
	Higher central	11%	11%	26%
	Central	6%	5%	17%

If you are not sure which management catchment your site falls within, please use the guidance and link to the peak river flow map, which can be found at: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances#peak-river-flow-allowances

Table 2: Using peak river flow allowances for flood risk assessments					
Flood Zone	**Essential Infrastructure**	**Highly Vulnerable**	**More Vulnerable**	**Less Vulnerable**	**Water Compatible**
2	higher central[1]	central[2]	central[2]	central	central
3a	higher central[1]	**X**	central[2]	central	central
3b	higher central[1]	**X**	**X**	**X**	central

X – Development should not be permitted
If (exceptionally) development is considered appropriate when not in accordance with flood zone vulnerability categories, then it would be appropriate to use the higher central allowance.

[1] For NSIPs, the 'upper end' allowance should be used to assess a credible maximum climate change scenario.

[2] For large urban settlement extensions or developments that form new communities, the credible maximum climate change scenario must be assessed. In these circumstances, you should use the 'upper end' allowance.

There may be circumstances where local evidence supports the use of other data or allowances. Where you think this is the case we may want to check this data and how you propose to use it.

Assessing off-site impacts and calculating floodplain compensation

The appropriate allowance to assess off-site impacts and calculation floodplain compensation requirements depends on the land uses in affected areas.

The '**central'** allowance should be used in most cases. However, the '**higher central'** allowance should be used when the affected area contains essential infrastructure.

5) Development in tidal flood risk areas

For flood risk assessments and strategic flood risk assessments, assess both the **higher central** and **upper end** allowances for all development vulnerability classes (see table 3 below).

For NSIPs and large urban settlement extensions or developments that form new communities, the **credible maximum climate change scenario** should be assessed (sea level rise and sensitivity test allowances for offshore wind speed and extreme wave height and storm surge uplift). To assess the flood risk from a high impact climate change scenario, you should use the H^{++} allowance of 1.9m for the total sea level rise to 2100.

Table 3: sea level allowances for each epoch in mm for each year (based on a 1981 to 2000 baseline) – the total sea level risk for each epoch is in brackets

Area of England	Allowance	2000 to 2035 (mm)	2036 to 2065 (mm)	2066 to 2095 (mm)	2096 to 2125 (mm)	Cumulative rise 2000 to 2125 (metres)
Anglian	Higher central	5.8 (203)	8.7 (261)	11.6 (348)	13 (390)	1.20
Anglian	Upper end	7 (245)	11.3 (339)	15.8 (474)	18.1 (543)	1.60
South east	Higher central	5.7 (200)	8.7 (261)	11.6 (348)	13.1 (393)	1.20
South east	Upper end	6.9 (242)	11.3 (339)	15.8 (474)	18.2 (546)	1.60

6) Tidal flood risk mitigation

For planning consultations where we are a statutory consultee and our flood risk standing advice does not apply, we use the following benchmarks to inform flood risk mitigation for different vulnerability classifications. **These are a guide only. We strongly recommend you contact us at the pre-planning application stage to confirm this on a case by case basis. Please note you may be charged for this advice.** For planning consultations where we are not a statutory consultee or our flood risk standing advice applies, we recommend that local planning authorities and developers use these benchmarks but we do not expect to be consulted.

- For development classed as essential Infrastructure, highly vulnerable development and more vulnerable development, our minimum benchmark for flood risk mitigation is the **'upper end'** climate change allowance for the development lifetime (including decommissioning where relevant).

- For water compatible or less vulnerable development (e.g. commercial), our minimum benchmark for flood risk mitigation is the **'higher central'** climate change allowance for the development lifetime. In sensitive locations it may be necessary to use the **'upper end'** allowance to inform built in resilience.

If you are using our 2018 Coastal Flood Modelling Data outputs:
The **upper end** allowance become progressively higher each year than the climate change flood level outputs used in our current 2018 coastal flood model. So as an approximation we recommend that the following uplift values are added on to the on-site climate change flood levels provided in the Product 4:

- For development lifetimes extending to 2122, add 0.34m
- For development lifetimes extending to 2123, add 0.36m
- For development lifetimes extending to 2124, add 0.38m
- For development lifetimes extending to 2125, add 0.40m

If the proposed development is greater than 30 houses and the flood zone is in an open-coast location, we recommend that a more accurate impact of the increased upper end flood levels on the overtopping on-site flood levels is modelled by rerunning our coastal overtopping model with the new flood levels; you can obtain the model from us with a Product 6 and 7 request. If the site is located within a small or constrained tidal or coastal floodplain then regardless of the size of the development, you may also need to undertake remodelling of the flood levels to obtain an accurate assessment of the impacts of climate change; please contact us for advice (contact details in Section 8 below).

If you are using our Broads 2008 Flood Modelling Data outputs:
For the **upper end** allowance, please add the following uplift values onto the climate change flood levels provided in the Product 4:

- For development lifetimes extending to 2122, add 0.34m
- For development lifetimes extending to 2123, add 0.36m
- For development lifetimes extending to 2124, add 0.38m
- For development lifetimes extending to 2125, add 0.40m

If you are using our 2008 Thames Flood Modelling Data outputs:
Please add the appropriate climate change allowances for the South East River Basin District onto the present day flood levels obtained in the Product 4, starting from a base year of 2005. The allowances should be applied to the year appropriate to the respective development lifetime for residential or commercial developments.
***** note**:** We anticipate that there will be updated flood modelling outputs available for the Thames Estuary in mid-2022. Developers preparing Flood Risk Assessments for developments in this area should check for availability of new data with the East Anglia (East) PSO team (contact details in Section 8 below).*

There may be circumstances where local evidence supports the use of other data or allowances. Where you think this is the case, we may want to check this data and how you propose to use it.

7) Assessment of climate change impacts for Surface Water Management

Please see the latest advice on the use of Peak Rainfall Intensity climate change allowances, which can be found here: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

The Environment Agency is not a statutory consultee to the land use planning system for the consideration of surface water flood risk and management. We therefore recommend that you contact the relevant Lead Local Flood Authority (contact details listed below) to discuss Flood Risk Assessment requirements to support your development's surface water management proposals.

Cambridgeshire County Council - fr.planning@cambridgeshire.gov.uk
Central Bedfordshire Council – floodrisk@centralbedfordshire.gov.uk
Bedford Borough Council – floodrisk@bedford.gov.uk
Milton Keynes Council – llfa@milton-keynes.gov.uk
Buckinghamshire County Council - floodmanagement@buckscc.gov.uk
Herts County Council - floodandwatermanagement@hertscc.gov.uk
Northamptonshire County Council - floodandwater@northamptonshire.gov.uk
Norfolk County Council – llfa@norfolk.gov.uk
Suffolk County Council – floods@suffolk.gov.uk
Essex County Council – suds@essex.gov.uk
Thurrock Council – TransportDevelopment@thurrock.gov.uk
Southend-on-Sea Council – llfa@southend.gov.uk

8) Our Service

Non-chargeable service

We will give a free opinion on:

- What climate change allowance to apply to a particular development type
- Which technical approach is suitable in the FRA

Chargeable service:

- Review of climate change impacts using intermediate and detailed technical approaches (i.e. modelling review)
- Assessment and review of proposals for managed adaptation.

Contact Details

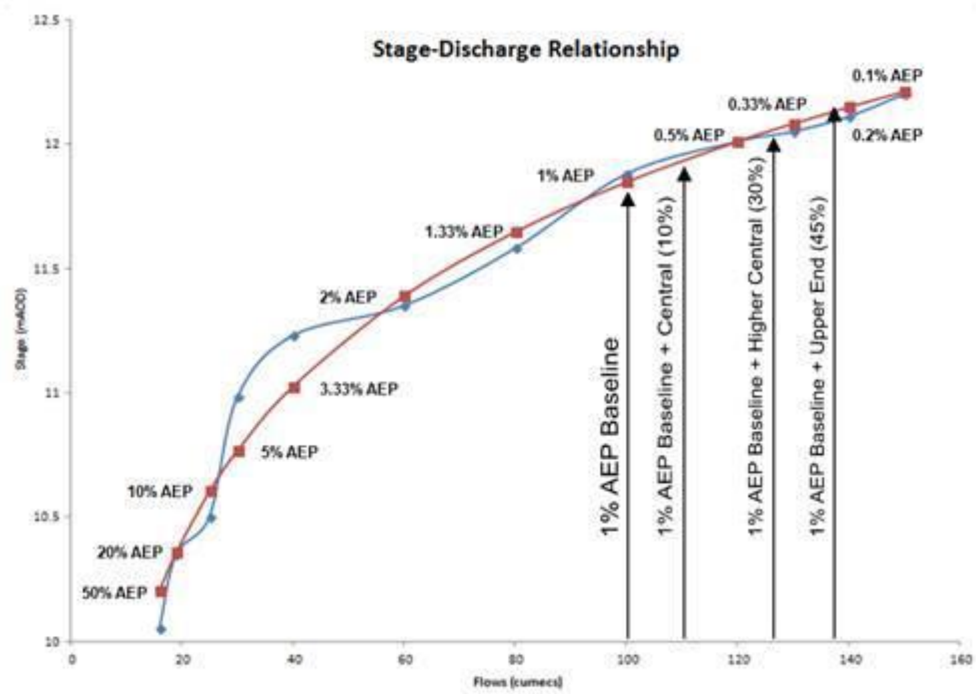
For East Anglia (Great Ouse Catchment): planning.brampton@environment-agency.gov.uk

For East Anglia (East): planning.ipswich@environment-agency.gov.uk

Appendix 1 – Further information on the Intermediate approach.

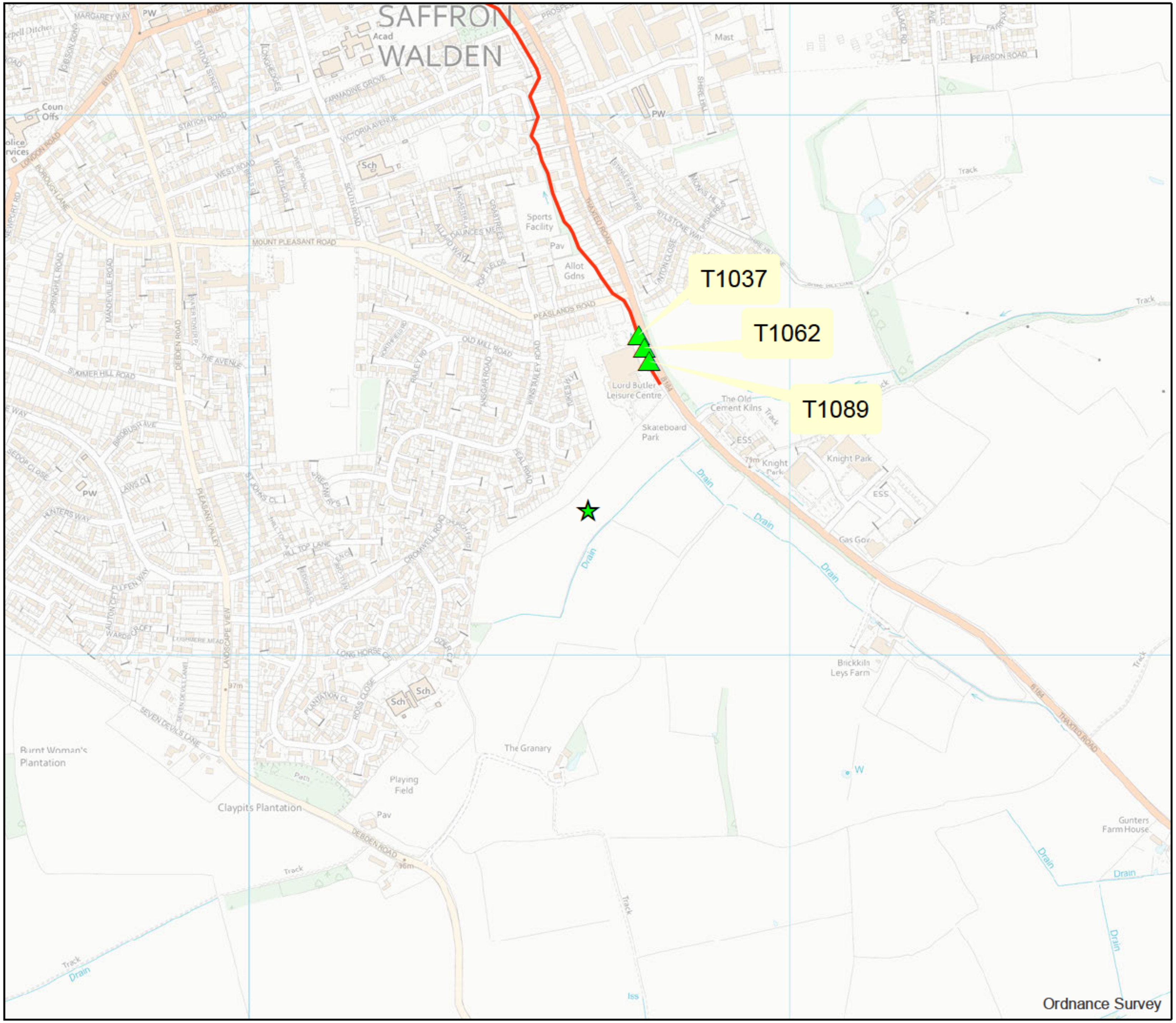
1) The methodology the chart is based on does not produce an accurate stage-discharge rating and is a simplified methodology for producing flood levels that can be applied in low risk small-scale development situations.
2) The method should not be applied where there is existing detailed modelled climate change outputs that use the new allowances. In such circumstances, the ‘with climate change’ modelled scenarios should be applied.

An example stage-discharge relationship is shown below.



Modelled Node Point Locations
centred on Tukes Way, Pleasant Valley, Saffron Walden, Uttlesford, Essex CB11 3ES

NGR TL5462637265
Ref 255032
Created 05/04/2022



Environment Agency
Bromholme Lane,
Brampton,
Cambridgeshire
PE28 4NE

Environment Agency

Legend

- Site
- Node Points selection
- Main river

0 0.125 0.25 0.5 km

Information

Model Tolerance - Any data included in this product is subject to a standard modelling tollerance of +/- 150mm.The fluvial models used to produce these results are intended for strategic scale use only.

Flood Risk Assessments - The Environment Agency recommends any Flood Risk Assessment should only consider these results in the context of a site specific assessment.

AEP - Annual Exceedance Probability - The probability of a given event occurring in any one year. Please note this is not a return period.

Strategic Scale Model - This model has been designed for catchment wide flood risk mapping. It should be noted that it was not created to produce flood levels for specific development sites within the catchment. Modelled outlines take into account catchment wide defences if present.

Contact Us: National Customer Contact Centre, PO Box 544, Ro herham, S60 1BY Tel: 03708 506 506 (Mon-Fri 8-6).
Email: enquiries@environment-agency.gov.uk

Datasheet - Product 4

05 April 2022

Reference Number	255032
Site	Tukes Way, Pleasant Valley, Saffron Walden, Uttlesford, Essex CB11 3ES
Customer	Tracey Mehew
NGR	TL5462637265

This datasheet provides supporting information for your Product 4. It will be clearly indicated if we are unable to provide information to fulfil any part of your request.

Model Summary

Model Name	Model Code
Cam Phase 2	EA052344
Cam Phase 2	EA052344

Important Information

The following information should considered when using the material provided to fulfil this request.

Information	
Limited Modelled Extents Provided	We have only provided a limited number of modelled flood extents for clarity. If you require further extents we will be happy to provide them.
Climate Change Allowances	The 1%+CC AEP flood level in the tables will be based on the 1% annual probability flood event including an additional 20% increase in peak flows to account for climate change impacts. Guidance on climate change allowances for the purpose of flood risk assessments is available on our website at https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances. You may need to undertake further assessment / modelling of future flood risk using different climate change allowances to ensure your assessment of future flood risk is based on the best available evidence.
No Product 8 Data	Unfortunately we do not have any breach data at this location.

Modelled Water Levels and Flows

The following tables provide modelled in channel water level and flow values. Values are provided for Annual Exceedence Probability (AEP) events, which is the probability of a given event occurring in any one year. This is not a return period.

The fluvial models used to produce these results are intended for strategic scale use only.

If the tables show a value of -9999, this indicates that we have no level or flow data for that particular AEP or node point.

Level Data

Level values are measured in metres above Ordnance Datum (m aOD).

All level data included are subject to standard modelling tolerance of +/-150 millimetres.

Present Day Levels

Node	Model	Easting	Northing	20%	10%	5%	4%	2%	1.33%	1%	0.5%	0.1%
T1037	EA052344	554720	237591	70.95	71.02	71.09	71.12	71.2	71.26	71.3	71.38	71.51
T1062	EA052344	554729	237566	71.14	71.21	71.27	71.3	71.37	71.42	71.45	71.53	71.66
T1089	EA052344	554739	237542	71.27	71.34	71.4	71.42	71.5	71.54	71.58	71.66	71.81

Climate Change Levels

Node	Model	Easting	Northing	1%+20%cc	1%+25%cc	1%+35%cc	1%+65%cc	0.5%+20%cc	0.1%+20%cc
T1037	EA052344	554720	237591	71.39	-9999	-9999	-9999	-9999	-9999
T1062	EA052344	554729	237566	71.53	-9999	-9999	-9999	-9999	-9999
T1089	EA052344	554739	237542	71.66	-9999	-9999	-9999	-9999	-9999

Flow Data

Flow values are measured in cubic metres per second (cumecs - m3/s).

Present Day Flows

Node	Model	Easting	Northing	20%	10%	5%	4%	2%	1.33%	1%	0.5%	0.1%
T1037	EA052344	554720	237591	5.2	5.39	5.65	5.73	5.91	6	6.15	6.38	7.36
T1062	EA052344	554729	237566	5.2	5.39	5.65	5.73	5.91	6	6.15	6.38	7.36
T1089	EA052344	554739	237542	5.2	5.39	5.65	5.73	5.91	6	6.15	6.38	7.36

Climate Change Flows

Node	Model	Easting	Northing	1%+20%cc	1%+25%cc	1%+35%cc	1%+65%cc	0.5%+20%cc	0.1%+20%cc
T1037	EA052344	554720	237591	6.38	-9999	-9999	-9999	-9999	-9999
T1062	EA052344	554729	237566	6.38	-9999	-9999	-9999	-9999	-9999
T1089	EA052344	554739	237542	6.38	-9999	-9999	-9999	-9999	-9999

Recorded Flood Events

Where included, the Recorded Flood Event Outlines map provides an indication of areas which have flooded. Not all properties shown to be within the outline will have flooded.

Flood Event	Start	End	Source	Cause
None			N/A	We have no historic flood event information for this area. It is possible that other flooding may have occurred that we do not have records for, and other organisations such as: local authorities or IDBs may have records.

General Information

Flood Map for Planning (Rivers and Sea)

The Flood Map for Planning (Rivers and Sea) indicates the area at risk of flooding for a flood event with a 0.5% chance of occurring in any year for flooding from the sea, or a 1% chance of occurring in any year for fluvial (river) flooding (Flood Zone 3).

It also shows the extent of the Extreme Flood Outlines (Flood Zone 2) which represents the extent of a flood event with a 0.1% chance of occurring in any year, or the highest recorded historic extent if greater. The Flood Zones refer to the land at risk of flooding and do not refer to individual properties.

The Flood Map for Planning (Rivers and Sea) can be viewed and downloaded as a PDF file on GOV.UK by following this link: https://flood-map-for-planning.service.gov.uk or downloaded in GIS format under an open data licence from the following address: https://data.gov.uk/publisher/environment-agency

The Flood Map is updated on a quarterly basis to account for any amendments required.

Surface Water, Ordinary Watercourses and Groundwater Flooding

Lead Local Flood Authorities (LLFA) are responsible for managing local flood risk from ordinary watercourses, surface water flooding and groundwater flooding. You should check with the LLFA as they may have more up to date information regarding this type of flooding.

The Risk of Flooding from Surface Water Flood Map can be viewed and downloaded as a PDF file on GOV.UK by following this link: https://flood-warning-information.service.gov.uk/long-term-flood-risk

Information on how to reduce the impact of flooding from groundwater can be found online by the following link: https://www.gov.uk/government/publications/flooding-from-groundwater

Flooding from Reservoirs

The Risk of Flooding from Reservoirs Flood Map can be viewed and downloaded as a PDF file on GOV.UK by following this link: https://flood-warning-information.service.gov.uk/long-term-flood-risk

Sewer Flooding

Your local water company may have information on sewage flooding in your area of interest.

Areas Benefitting from Defences

Areas Benefitting from Defences show the area benefiting from defences from a 1 in 100 (1% AEP) year fluvial event or a 1 in 200 (0.5% AEP) tidal/coastal event. The associated dataset can be downloaded in GIS from the following link: https://data.gov.uk/dataset/flood-map-for-planning-rivers-and-sea-areas-benefiting-from-defences

APPENDIX F - SITE WIDE SURFACE WATER DRAINAGE CALCULATIONS

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

Half Drain Time : 653 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	88.382	0.382	0.1	2.5	O K
30 min Summer	88.490	0.490	0.1	3.1	O K
60 min Summer	88.591	0.591	0.1	3.8	O K
120 min Summer	88.680	0.680	0.1	4.4	O K
180 min Summer	88.719	0.719	0.1	4.6	O K
240 min Summer	88.738	0.738	0.1	4.7	O K
360 min Summer	88.747	0.747	0.1	4.8	O K
480 min Summer	88.741	0.741	0.1	4.8	O K
600 min Summer	88.732	0.732	0.1	4.7	O K
720 min Summer	88.721	0.721	0.1	4.6	O K
960 min Summer	88.700	0.700	0.1	4.5	O K
1440 min Summer	88.656	0.656	0.1	4.2	O K
2160 min Summer	88.594	0.594	0.1	3.8	O K
2880 min Summer	88.541	0.541	0.1	3.5	O K
4320 min Summer	88.450	0.450	0.1	2.9	O K
5760 min Summer	88.375	0.375	0.1	2.4	O K
7200 min Summer	88.313	0.313	0.1	2.0	O K
8640 min Summer	88.261	0.261	0.0	1.7	O K
10080 min Summer	88.217	0.217	0.0	1.4	O K
15 min Winter	88.382	0.382	0.1	2.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	142.716	0.0	19
30 min Summer	92.222	0.0	34
60 min Summer	56.713	0.0	64
120 min Summer	33.722	0.0	122
180 min Summer	24.576	0.0	182
240 min Summer	19.534	0.0	242
360 min Summer	14.061	0.0	360
480 min Summer	11.142	0.0	468
600 min Summer	9.297	0.0	518
720 min Summer	8.015	0.0	576
960 min Summer	6.338	0.0	702
1440 min Summer	4.546	0.0	980
2160 min Summer	3.257	0.0	1388
2880 min Summer	2.568	0.0	1792
4320 min Summer	1.836	0.0	2596
5760 min Summer	1.445	0.0	3352
7200 min Summer	1.200	0.0	4112
8640 min Summer	1.031	0.0	4848
10080 min Summer	0.906	0.0	5552
15 min Winter	142.716	0.0	19

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	88.490	0.490	0.1	3.1	O K
60 min Winter	88.592	0.592	0.1	3.8	O K
120 min Winter	88.681	0.681	0.1	4.4	O K
180 min Winter	88.721	0.721	0.1	4.6	O K
240 min Winter	88.741	0.741	0.1	4.8	O K
360 min Winter	88.752	0.752	0.1	4.8	O K
480 min Winter	88.749	0.749	0.1	4.8	O K
600 min Winter	88.738	0.738	0.1	4.7	O K
720 min Winter	88.724	0.724	0.1	4.6	O K
960 min Winter	88.700	0.700	0.1	4.5	O K
1440 min Winter	88.645	0.645	0.1	4.1	O K
2160 min Winter	88.564	0.564	0.1	3.6	O K
2880 min Winter	88.493	0.493	0.1	3.2	O K
4320 min Winter	88.374	0.374	0.1	2.4	O K
5760 min Winter	88.281	0.281	0.0	1.8	O K
7200 min Winter	88.207	0.207	0.0	1.3	O K
8640 min Winter	88.147	0.147	0.0	0.9	O K
10080 min Winter	88.101	0.101	0.0	0.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	92.222	0.0	33
60 min Winter	56.713	0.0	62
120 min Winter	33.722	0.0	120
180 min Winter	24.576	0.0	178
240 min Winter	19.534	0.0	236
360 min Winter	14.061	0.0	350
480 min Winter	11.142	0.0	458
600 min Winter	9.297	0.0	560
720 min Winter	8.015	0.0	590
960 min Winter	6.338	0.0	734
1440 min Winter	4.546	0.0	1040
2160 min Winter	3.257	0.0	1492
2880 min Winter	2.568	0.0	1928
4320 min Winter	1.836	0.0	2728
5760 min Winter	1.445	0.0	3520
7200 min Winter	1.200	0.0	4256
8640 min Winter	1.031	0.0	5008
10080 min Winter	0.906	0.0	5648

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	1.000
Region	England and Wales	Cv (Winter)	1.000
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.439	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.007

Time From:	**(mins) To:**	**Area (ha)**
0	4	0.007

Model Details

Storage is Online Cover Level (m) 90.000

House Soakaway Structure

Infiltration Coefficient Base (m/hr)	0.03600	Pit Width (m)	2.600
Infiltration Coefficient Side (m/hr)	0.03600	Number Required	1
Safety Factor	2.0	Cap Volume Depth (m)	0.000
Porosity	0.95	Cap Infiltration Depth (m)	0.000
Invert Level (m)	88.000		

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

Half Drain Time : 747 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	76.702	0.252	2.3	91.2	Flood Risk
30 min Summer	76.745	0.295	2.3	120.5	Flood Risk
60 min Summer	76.786	0.336	2.3	148.9	Flood Risk
120 min Summer	76.823	0.373	2.3	174.5	Flood Risk
180 min Summer	76.841	0.391	2.3	187.0	Flood Risk
240 min Summer	76.852	0.402	2.3	194.0	Flood Risk
360 min Summer	76.861	0.411	2.3	200.2	Flood Risk
480 min Summer	76.863	0.413	2.3	202.1	Flood Risk
600 min Summer	76.862	0.412	2.3	201.2	Flood Risk
720 min Summer	76.859	0.409	2.3	198.9	Flood Risk
960 min Summer	76.852	0.402	2.3	194.3	Flood Risk
1440 min Summer	76.837	0.387	2.3	184.2	Flood Risk
2160 min Summer	76.814	0.364	2.3	168.1	Flood Risk
2880 min Summer	76.791	0.341	2.3	152.3	Flood Risk
4320 min Summer	76.750	0.300	2.3	124.1	Flood Risk
5760 min Summer	76.717	0.267	2.3	101.1	Flood Risk
7200 min Summer	76.691	0.241	2.3	83.8	O K
8640 min Summer	76.674	0.224	2.1	72.3	O K
10080 min Summer	76.659	0.209	2.0	62.9	O K
15 min Winter	76.702	0.252	2.3	91.3	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	142.716	0.0	26
30 min Summer	92.222	0.0	41
60 min Summer	56.713	0.0	70
120 min Summer	33.722	0.0	128
180 min Summer	24.576	0.0	188
240 min Summer	19.534	0.0	246
360 min Summer	14.061	0.0	364
480 min Summer	11.142	0.0	482
600 min Summer	9.297	0.0	600
720 min Summer	8.015	0.0	664
960 min Summer	6.338	0.0	770
1440 min Summer	4.546	0.0	1022
2160 min Summer	3.257	0.0	1428
2880 min Summer	2.568	0.0	1824
4320 min Summer	1.836	0.0	2600
5760 min Summer	1.445	0.0	3344
7200 min Summer	1.200	0.0	4040
8640 min Summer	1.031	0.0	4760
10080 min Summer	0.906	0.0	5456
15 min Winter	142.716	0.0	26

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	76.745	0.295	2.3	120.6	Flood Risk
60 min Winter	76.786	0.336	2.3	148.9	Flood Risk
120 min Winter	76.823	0.373	2.3	174.6	Flood Risk
180 min Winter	76.842	0.392	2.3	187.2	Flood Risk
240 min Winter	76.852	0.402	2.3	194.2	Flood Risk
360 min Winter	76.861	0.411	2.3	200.4	Flood Risk
480 min Winter	76.864	0.414	2.3	202.4	Flood Risk
600 min Winter	76.863	0.413	2.3	201.8	Flood Risk
720 min Winter	76.860	0.410	2.3	199.5	Flood Risk
960 min Winter	76.850	0.400	2.3	192.6	Flood Risk
1440 min Winter	76.831	0.381	2.3	179.8	Flood Risk
2160 min Winter	76.799	0.349	2.3	157.7	Flood Risk
2880 min Winter	76.767	0.317	2.3	135.9	Flood Risk
4320 min Winter	76.713	0.263	2.3	98.8	Flood Risk
5760 min Winter	76.679	0.229	2.2	75.1	O K
7200 min Winter	76.654	0.204	2.0	59.9	O K
8640 min Winter	76.634	0.184	1.8	48.6	O K
10080 min Winter	76.617	0.167	1.6	40.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	92.222	0.0	40
60 min Winter	56.713	0.0	68
120 min Winter	33.722	0.0	126
180 min Winter	24.576	0.0	184
240 min Winter	19.534	0.0	242
360 min Winter	14.061	0.0	356
480 min Winter	11.142	0.0	470
600 min Winter	9.297	0.0	580
720 min Winter	8.015	0.0	686
960 min Winter	6.338	0.0	790
1440 min Winter	4.546	0.0	1082
2160 min Winter	3.257	0.0	1524
2880 min Winter	2.568	0.0	1940
4320 min Winter	1.836	0.0	2692
5760 min Winter	1.445	0.0	3408
7200 min Winter	1.200	0.0	4120
8640 min Winter	1.031	0.0	4848
10080 min Winter	0.906	0.0	5552

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	1.000
Region	England and Wales	Cv (Winter)	1.000
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.439	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.294

Time From:	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**
0	4	0.098	4	8	0.098	8	12	0.098

Model Details

Storage is Online Cover Level (m) 77.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.03600	Width (m)	47.9
Membrane Percolation (mm/hr)	1000	Length (m)	47.9
Max Percolation (l/s)	637.3	Slope (1:X)	200.0
Safety Factor	10.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	76.450	Cap Volume Depth (m)	0.420

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

Half Drain Time : 795 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	78.695	0.225	1.1	46.9	O K
30 min Summer	78.741	0.271	1.1	61.9	Flood Risk
60 min Summer	78.785	0.315	1.1	76.4	Flood Risk
120 min Summer	78.825	0.355	1.1	89.5	Flood Risk
180 min Summer	78.845	0.375	1.1	95.9	Flood Risk
240 min Summer	78.856	0.386	1.1	99.5	Flood Risk
360 min Summer	78.865	0.395	1.1	102.8	Flood Risk
480 min Summer	78.869	0.399	1.1	103.8	Flood Risk
600 min Summer	78.868	0.398	1.1	103.5	Flood Risk
720 min Summer	78.864	0.394	1.1	102.2	Flood Risk
960 min Summer	78.856	0.386	1.1	99.5	Flood Risk
1440 min Summer	78.839	0.369	1.1	93.9	Flood Risk
2160 min Summer	78.812	0.342	1.1	85.4	Flood Risk
2880 min Summer	78.787	0.317	1.1	77.1	Flood Risk
4320 min Summer	78.743	0.273	1.1	62.4	Flood Risk
5760 min Summer	78.705	0.235	1.1	50.1	Flood Risk
7200 min Summer	78.675	0.205	1.1	40.1	O K
8640 min Summer	78.651	0.181	1.1	32.4	O K
10080 min Summer	78.634	0.164	1.1	26.9	O K
15 min Winter	78.696	0.226	1.1	46.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	142.716	0.0	26
30 min Summer	92.222	0.0	41
60 min Summer	56.713	0.0	70
120 min Summer	33.722	0.0	130
180 min Summer	24.576	0.0	188
240 min Summer	19.534	0.0	246
360 min Summer	14.061	0.0	364
480 min Summer	11.142	0.0	482
600 min Summer	9.297	0.0	602
720 min Summer	8.015	0.0	698
960 min Summer	6.338	0.0	798
1440 min Summer	4.546	0.0	1042
2160 min Summer	3.257	0.0	1448
2880 min Summer	2.568	0.0	1848
4320 min Summer	1.836	0.0	2640
5760 min Summer	1.445	0.0	3360
7200 min Summer	1.200	0.0	4104
8640 min Summer	1.031	0.0	4760
10080 min Summer	0.906	0.0	5440
15 min Winter	142.716	0.0	26

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	78.741	0.271	1.1	61.9	Flood Risk
60 min Winter	78.785	0.315	1.1	76.4	Flood Risk
120 min Winter	78.825	0.355	1.1	89.6	Flood Risk
180 min Winter	78.845	0.375	1.1	96.0	Flood Risk
240 min Winter	78.856	0.386	1.1	99.6	Flood Risk
360 min Winter	78.866	0.396	1.1	102.9	Flood Risk
480 min Winter	78.869	0.399	1.1	104.0	Flood Risk
600 min Winter	78.869	0.399	1.1	103.8	Flood Risk
720 min Winter	78.865	0.395	1.1	102.7	Flood Risk
960 min Winter	78.854	0.384	1.1	99.1	Flood Risk
1440 min Winter	78.833	0.363	1.1	92.0	Flood Risk
2160 min Winter	78.798	0.328	1.1	80.5	Flood Risk
2880 min Winter	78.763	0.293	1.1	69.1	Flood Risk
4320 min Winter	78.702	0.232	1.1	48.9	Flood Risk
5760 min Winter	78.655	0.185	1.1	33.7	O K
7200 min Winter	78.628	0.158	1.0	24.9	O K
8640 min Winter	78.611	0.141	0.9	19.9	O K
10080 min Winter	78.597	0.127	0.8	16.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	92.222	0.0	40
60 min Winter	56.713	0.0	70
120 min Winter	33.722	0.0	126
180 min Winter	24.576	0.0	184
240 min Winter	19.534	0.0	242
360 min Winter	14.061	0.0	358
480 min Winter	11.142	0.0	472
600 min Winter	9.297	0.0	582
720 min Winter	8.015	0.0	690
960 min Winter	6.338	0.0	884
1440 min Winter	4.546	0.0	1096
2160 min Winter	3.257	0.0	1540
2880 min Winter	2.568	0.0	1968
4320 min Winter	1.836	0.0	2764
5760 min Winter	1.445	0.0	3416
7200 min Winter	1.200	0.0	4048
8640 min Winter	1.031	0.0	4760
10080 min Winter	0.906	0.0	5456

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	1.000
Region	England and Wales	Cv (Winter)	1.000
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.439	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.150

Time From:	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**
0	4	0.050	4	8	0.050	8	12	0.050

Model Details

Storage is Online Cover Level (m) 79.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.03600	Width (m)	33.1
Membrane Percolation (mm/hr)	1000	Length (m)	33.1
Max Percolation (l/s)	304.3	Slope (1:X)	200.0
Safety Factor	10.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	78.470	Cap Volume Depth (m)	0.400

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

Half Drain Time : 719 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	77.706	0.256	2.6	100.2	Flood Risk
30 min Summer	77.747	0.297	2.6	132.4	Flood Risk
60 min Summer	77.787	0.337	2.6	163.6	Flood Risk
120 min Summer	77.823	0.373	2.6	191.8	Flood Risk
180 min Summer	77.841	0.391	2.6	205.5	Flood Risk
240 min Summer	77.850	0.400	2.6	213.0	Flood Risk
360 min Summer	77.859	0.409	2.6	219.6	Flood Risk
480 min Summer	77.861	0.411	2.6	221.5	Flood Risk
600 min Summer	77.860	0.410	2.6	220.3	Flood Risk
720 min Summer	77.857	0.407	2.6	217.8	Flood Risk
960 min Summer	77.850	0.400	2.6	212.9	Flood Risk
1440 min Summer	77.836	0.386	2.6	202.0	Flood Risk
2160 min Summer	77.814	0.364	2.6	184.2	Flood Risk
2880 min Summer	77.791	0.341	2.6	166.7	Flood Risk
4320 min Summer	77.751	0.301	2.6	135.8	Flood Risk
5760 min Summer	77.720	0.270	2.6	111.0	Flood Risk
7200 min Summer	77.697	0.247	2.5	93.7	O K
8640 min Summer	77.680	0.230	2.3	81.0	O K
10080 min Summer	77.665	0.215	2.2	70.6	O K
15 min Winter	77.706	0.256	2.6	100.2	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	142.716	0.0	26
30 min Summer	92.222	0.0	41
60 min Summer	56.713	0.0	70
120 min Summer	33.722	0.0	128
180 min Summer	24.576	0.0	188
240 min Summer	19.534	0.0	246
360 min Summer	14.061	0.0	364
480 min Summer	11.142	0.0	482
600 min Summer	9.297	0.0	600
720 min Summer	8.015	0.0	650
960 min Summer	6.338	0.0	764
1440 min Summer	4.546	0.0	1014
2160 min Summer	3.257	0.0	1416
2880 min Summer	2.568	0.0	1820
4320 min Summer	1.836	0.0	2596
5760 min Summer	1.445	0.0	3336
7200 min Summer	1.200	0.0	4040
8640 min Summer	1.031	0.0	4760
10080 min Summer	0.906	0.0	5456
15 min Winter	142.716	0.0	26

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	77.747	0.297	2.6	132.5	Flood Risk
60 min Winter	77.787	0.337	2.6	163.6	Flood Risk
120 min Winter	77.823	0.373	2.6	191.9	Flood Risk
180 min Winter	77.841	0.391	2.6	205.6	Flood Risk
240 min Winter	77.851	0.401	2.6	213.2	Flood Risk
360 min Winter	77.859	0.409	2.6	219.9	Flood Risk
480 min Winter	77.862	0.412	2.6	222.0	Flood Risk
600 min Winter	77.861	0.411	2.6	221.0	Flood Risk
720 min Winter	77.857	0.407	2.6	218.3	Flood Risk
960 min Winter	77.848	0.398	2.6	211.0	Flood Risk
1440 min Winter	77.830	0.380	2.6	196.7	Flood Risk
2160 min Winter	77.798	0.348	2.6	172.3	Flood Risk
2880 min Winter	77.768	0.318	2.6	148.4	Flood Risk
4320 min Winter	77.717	0.267	2.6	108.6	Flood Risk
5760 min Winter	77.685	0.235	2.4	84.3	O K
7200 min Winter	77.660	0.210	2.1	67.3	O K
8640 min Winter	77.639	0.189	1.9	54.7	O K
10080 min Winter	77.622	0.172	1.8	45.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	92.222	0.0	40
60 min Winter	56.713	0.0	68
120 min Winter	33.722	0.0	126
180 min Winter	24.576	0.0	184
240 min Winter	19.534	0.0	242
360 min Winter	14.061	0.0	356
480 min Winter	11.142	0.0	470
600 min Winter	9.297	0.0	578
720 min Winter	8.015	0.0	684
960 min Winter	6.338	0.0	778
1440 min Winter	4.546	0.0	1076
2160 min Winter	3.257	0.0	1516
2880 min Winter	2.568	0.0	1936
4320 min Winter	1.836	0.0	2684
5760 min Winter	1.445	0.0	3408
7200 min Winter	1.200	0.0	4176
8640 min Winter	1.031	0.0	4848
10080 min Winter	0.906	0.0	5552

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	1.000
Region	England and Wales	Cv (Winter)	1.000
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.439	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.324

Time From:	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**
0	4	0.108	4	8	0.108	8	12	0.108

Model Details

Storage is Online Cover Level (m) 78.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.03600	Width (m)	51.0
Membrane Percolation (mm/hr)	1000	Length (m)	51.0
Max Percolation (l/s)	722.5	Slope (1:X)	200.0
Safety Factor	10.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	77.450	Cap Volume Depth (m)	0.420

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	20.000	Add Flow / Climate Change (%)	10
Ratio R	0.439	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	550	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	1.000	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Free Flowing Outfall Details for Storm

Outfall Pipe Number	**Outfall Name**	**C. Level (m)**	**I. Level (m)**	**Min I. Level (m)**	**D,L (mm)**	**W (mm)**
S1.014	S	83.000	82.028	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	1.000	Additional Flow - % of Total Flow	10.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	0.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	21600
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	15

Number of Input Hydrographs	0	Number of Storage Structures	3
Number of Online Controls	3	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	100	Cv (Summer)	1.000
Region	England and Wales	Cv (Winter)	1.000
M5-60 (mm)	20.000	Storm Duration (mins)	8640
Ratio R	0.439		

Online Controls for Storm

Hydro-Brake® Optimum Manhole: SSW5, DS/PN: S1.007, Volume (m^3): 3.3

Unit Reference	MD-SHE-0065-2200-1400-2200
Design Head (m)	1.400
Design Flow (l/s)	2.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	65
Invert Level (m)	97.464
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.400	2.2
Flush-Flo™	0.284	1.8
Kick-Flo®	0.580	1.5
Mean Flow over Head Range	-	1.7

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.5	1.200	2.0	3.000	3.1	7.000	4.6
0.200	1.8	1.400	2.2	3.500	3.3	7.500	4.8
0.300	1.8	1.600	2.3	4.000	3.6	8.000	4.9
0.400	1.8	1.800	2.5	4.500	3.8	8.500	5.1
0.500	1.7	2.000	2.6	5.000	4.0	9.000	5.2
0.600	1.5	2.200	2.7	5.500	4.1	9.500	5.3
0.800	1.7	2.400	2.8	6.000	4.3		
1.000	1.9	2.600	2.9	6.500	4.5		

Hydro-Brake® Optimum Manhole: SSW16, DS/PN: S3.005, Volume (m^3): 2.8

Unit Reference	MD-SHE-0031-5000-1157-5000
Design Head (m)	1.157
Design Flow (l/s)	0.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	31
Invert Level (m)	96.098
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Hydro-Brake® Optimum Manhole: SSW16, DS/PN: S3.005, Volume (m³): 2.8

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.157	0.5
Flush-Flo™	0.138	0.3
Kick-Flo®	0.278	0.3
Mean Flow over Head Range	-	0.4

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.3	1.200	0.5	3.000	0.8	7.000	1.1
0.200	0.3	1.400	0.5	3.500	0.8	7.500	1.2
0.300	0.3	1.600	0.6	4.000	0.9	8.000	1.2
0.400	0.3	1.800	0.6	4.500	0.9	8.500	1.2
0.500	0.3	2.000	0.6	5.000	1.0	9.000	1.3
0.600	0.4	2.200	0.7	5.500	1.0	9.500	1.3
0.800	0.4	2.400	0.7	6.000	1.0		
1.000	0.5	2.600	0.7	6.500	1.1		

Pump Manhole: SNo Outlet, DS/PN: S1.014, Volume (m³): 4.9

Invert Level (m) 82.037

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.0000	0.900	0.0000	1.700	0.0000	2.500	0.0000
0.200	0.0000	1.000	0.0000	1.800	0.0000	2.600	0.0000
0.300	0.0000	1.100	0.0000	1.900	0.0000	2.700	0.0000
0.400	0.0000	1.200	0.0000	2.000	0.0000	2.800	0.0000
0.500	0.0000	1.300	0.0000	2.100	0.0000	2.900	0.0000
0.600	0.0000	1.400	0.0000	2.200	0.0000	3.000	0.0000
0.700	0.0000	1.500	0.0000	2.300	0.0000		
0.800	0.0000	1.600	0.0000	2.400	0.0000		

Storage Structures for Storm

Tank or Pond Manhole: SRP1, DS/PN: S1.005

Invert Level (m) 97.551

Depth (m)	**Area (m²)**	**Depth (m)**	**Area (m²)**
0.000	497.0	1.000	797.0

Tank or Pond Manhole: SRP2, DS/PN: S3.003

Invert Level (m) 96.272

Depth (m)	**Area (m²)**	**Depth (m)**	**Area (m²)**
0.000	280.0	1.000	587.0

Complex Manhole: SIP, DS/PN: S1.013

Cellular Storage

Invert Level (m) 80.000 Safety Factor 10.0
Infiltration Coefficient Base (m/hr) 0.03600 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.03600

Depth (m)	**Area (m²)**	**Inf. Area (m²)**	**Depth (m)**	**Area (m²)**	**Inf. Area (m²)**
0.000	537.0	537.0	1.500	537.0	676.0
0.500	537.0	583.0	2.000	537.0	722.0
1.000	537.0	629.0			

Infiltration Basin

Invert Level (m) 82.000 Safety Factor 10.0
Infiltration Coefficient Base (m/hr) 0.03600 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.03600

Depth (m)	**Area (m²)**	**Depth (m)**	**Area (m²)**
0.000	285.0	1.000	537.0

Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	10.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	3
Number of Online Controls	3	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.439
Region	England and Wales	Cv (Summer)	1.000
M5-60 (mm)	20.000	Cv (Winter)	1.000

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1
Climate Change (%)	0

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Overflow (l/s)
S1.000	SSW1	15 minute 1 year Summer I+0%	100.850	99.559	-0.166	0.000	
S1.001	SSW2	15 minute 1 year Summer I+0%	100.600	99.269	-0.206	0.000	
S2.000	SSW11	15 minute 1 year Summer I+0%	100.000	98.684	-0.191	0.000	
S2.001	SSW12	15 minute 1 year Summer I+0%	99.750	98.374	-0.251	0.000	
S2.002	SSW13	15 minute 1 year Summer I+0%	99.750	98.269	-0.254	0.000	
S1.002	SSW3	15 minute 1 year Summer I+0%	99.900	98.050	-0.314	0.000	
S1.003	SSW4	15 minute 1 year Summer I+0%	99.630	97.965	-0.365	0.000	
S1.004	SRP1 In	15 minute 1 year Summer I+0%	98.551	97.817	-0.308	0.000	
S1.005	SRP1	240 minute 1 year Winter I+0%	98.551	97.670	-0.406	0.000	
S1.006	SRP1 Out	360 minute 1 year Winter I+0%	98.551	97.671	-0.342	0.000	
S1.007	SSW5	240 minute 1 year Summer I+0%	98.551	97.672	-0.317	0.000	
S3.000	SSW14	15 minute 1 year Summer I+0%	98.500	97.218	-0.157	0.000	
S3.001	SSW15	15 minute 1 year Summer I+0%	98.000	96.678	-0.197	0.000	
S3.002	SRP2 In	15 minute 1 year Summer I+0%	98.000	96.468	-0.193	0.000	
S3.003	SRP2	1440 minute 1 year Winter I+0%	97.272	96.370	-0.203	0.000	

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Maximum Vol (m^3)	Maximum Velocity (m/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S1.000	SSW1	0.061	1.0		8.2	OK
S1.001	SSW2	0.102	1.5		27.2	OK
S2.000	SSW11	0.118	1.1		24.1	OK
S2.001	SSW12	0.211	0.9		29.4	OK
S2.002	SSW13	0.359	1.1		33.0	OK
S1.002	SSW3	0.408	0.7		60.3	OK
S1.003	SSW4	0.588	1.3		71.1	OK
S1.004	SRP1 In	0.541	0.8		70.7	OK
S1.005	SRP1	61.242	0.3		3.8	OK
S1.006	SRP1 Out	1.082	0.2		2.2	OK
S1.007	SSW5	0.684	0.3		1.8	OK
S3.000	SSW14	0.071	1.1		10.9	OK
S3.001	SSW15	0.113	0.9		20.0	OK
S3.002	SRP2 In	0.269	0.9		20.0	OK
S3.003	SRP2	28.831	0.4		6.0	OK

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S3.004	SRP2 Out	480 minute 1 year Winter I+0%	98.000	96.400	-0.082	0.000
S3.005	SSW16	1440 minute 1 year Winter I+0%	98.000	96.433	-0.040	0.000
S3.006	SSW17	15 minute 1 year Summer I+0%	96.850	95.888	-0.329	0.000
S4.000	SSW19	15 minute 1 year Summer I+0%	98.400	97.044	-0.106	0.000
S4.001	SSW20	15 minute 1 year Summer I+0%	97.250	96.790	-0.119	0.000
S3.007	SSW18	15 minute 1 year Summer I+0%	96.750	95.222	-0.328	0.000
S1.008	SSW6	15 minute 1 year Summer I+0%	95.750	94.568	-0.503	0.000
S5.000	SSW21	15 minute 1 year Summer I+0%	94.500	93.210	-0.165	0.000
S6.000	SSW24	15 minute 1 year Summer I+0%	96.000	94.730	-0.070	0.000
S5.001	SSW22	15 minute 1 year Summer I+0%	93.500	92.150	-0.150	0.000
S5.002	SSW23	15 minute 1 year Summer I+0%	92.500	91.097	-0.203	0.000
S1.009	SSW7	15 minute 1 year Summer I+0%	92.250	90.586	-0.464	0.000
S7.000	SSW25	15 minute 1 year Summer I+0%	94.250	92.984	-0.066	0.000
S7.001	SSW26	15 minute 1 year Summer I+0%	92.000	90.690	-0.110	0.000
S7.002	SSW30	15 minute 1 year Summer I+0%	91.000	89.569	-0.231	0.000
S7.003	SSW31	15 minute 1 year Summer I+0%	90.000	88.576	-0.224	0.000
S7.004	SSW32	15 minute 1 year Summer I+0%	89.500	88.069	-0.231	0.000
S1.010	SSW8	15 minute 1 year Summer I+0%	88.500	86.863	-0.437	0.000
S1.011	SSW9	15 minute 1 year Summer I+0%	86.750	85.116	-0.434	0.000
S8.000	SSW33	15 minute 1 year Summer I+0%	86.750	85.486	-0.139	0.000
S8.001	SSW34	15 minute 1 year Summer I+0%	86.750	85.318	-0.162	0.000
S8.002	SSW34	15 minute 1 year Summer I+0%	85.000	83.619	-0.256	0.000
S1.012	SSW10	15 minute 1 year Summer I+0%	85.000	83.334	-0.394	0.000
S1.013	SIP	4320 minute 1 year Winter I+0%	83.000	80.647	-2.228	0.000
S1.014	SNo Outlet	15 minute 1 year Summer I+0%	83.000	82.037	-0.825	0.000

PN	US/MH Name	Overflow (l/s)	Maximum Vol (m³)	Maximum Velocity (m/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S3.004	SRP2 Out		0.976	0.2		3.6	OK
S3.005	SSW16		0.559	0.1		0.3	OK
S3.006	SSW17		0.129	0.7		5.2	OK
S4.000	SSW19		0.045	0.7		3.2	OK
S4.001	SSW20		0.043	1.9		4.8	OK
S3.007	SSW18		0.060	1.3		10.1	OK
S1.008	SSW6		0.030	1.9		10.7	OK
S5.000	SSW21		0.062	1.6		13.7	OK
S6.000	SSW24		0.028	1.7		3.2	OK
S5.001	SSW22		0.080	2.4		28.2	OK
S5.002	SSW23		0.104	1.4		28.0	OK
S1.009	SSW7		0.098	2.8		38.6	OK
S7.000	SSW25		0.033	1.9		4.4	OK
S7.001	SSW26		0.040	1.7		6.3	OK
S7.002	SSW30		0.073	1.7		21.4	OK
S7.003	SSW31		0.100	1.8		25.7	OK
S7.004	SSW32		0.085	2.3		27.5	OK
S1.010	SSW8		0.157	2.8		66.4	OK

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Overflow (l/s)	Maximum Vol (m³)	Maximum Velocity (m/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S1.011	SSW9		0.163	2.8		70.6	OK
S8.000	SSW33		0.091	1.0		14.1	OK
S8.001	SSW34		0.104	2.9		25.9	OK
S8.002	SSW34		0.163	1.0		29.8	OK
S1.012	SSW10		0.234	2.4		100.6	OK
S1.013	SIP		331.642	0.0		0.0	OK
S1.014	SNo Outlet		0.000	0.0		0.0	OK

Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 10.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 0.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 3
Number of Online Controls 3 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.439
Region England and Wales Cv (Summer) 1.000
M5-60 (mm) 20.000 Cv (Winter) 1.000

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status OFF
Inertia Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 10
Climate Change (%) 0

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Overflow (l/s)
S1.000	SSW1	15 minute 10 year Summer I+0%	100.850	99.584	-0.141	0.000	
S1.001	SSW2	15 minute 10 year Summer I+0%	100.600	99.327	-0.148	0.000	
S2.000	SSW11	15 minute 10 year Summer I+0%	100.000	98.735	-0.140	0.000	
S2.001	SSW12	15 minute 10 year Summer I+0%	99.750	98.435	-0.190	0.000	
S2.002	SSW13	15 minute 10 year Summer I+0%	99.750	98.332	-0.191	0.000	
S1.002	SSW3	15 minute 10 year Summer I+0%	99.900	98.181	-0.182	0.000	
S1.003	SSW4	15 minute 10 year Summer I+0%	99.630	98.056	-0.273	0.000	
S1.004	SRP1 In	15 minute 10 year Summer I+0%	98.551	97.959	-0.166	0.000	
S1.005	SRP1	360 minute 10 year Winter I+0%	98.551	97.783	-0.293	0.000	
S1.006	SRP1 Out	360 minute 10 year Winter I+0%	98.551	97.787	-0.226	0.000	
S1.007	SSW5	240 minute 10 year Winter I+0%	98.551	97.788	-0.201	0.000	
S3.000	SSW14	15 minute 10 year Summer I+0%	98.500	97.246	-0.129	0.000	
S3.001	SSW15	15 minute 10 year Summer I+0%	98.000	96.738	-0.137	0.000	
S3.002	SRP2 In	15 minute 10 year Summer I+0%	98.000	96.532	-0.129	0.000	
S3.003	SRP2	960 minute 10 year Winter I+0%	97.272	96.443	-0.130	0.000	

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Maximum Vol (m³)	Maximum Velocity (m/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S1.000	SSW1	0.089	1.2		15.9	OK
S1.001	SSW2	0.207	1.8		64.9	OK
S2.000	SSW11	0.175	1.2		46.6	OK
S2.001	SSW12	0.417	1.1		59.0	OK
S2.002	SSW13	0.705	1.3		67.6	OK
S1.002	SSW3	1.186	0.9		132.1	OK
S1.003	SSW4	1.139	1.6		158.3	OK
S1.004	SRP1 In	1.102	1.0		159.1	OK
S1.005	SRP1	123.884	0.3		9.4	OK
S1.006	SRP1 Out	2.318	0.2		6.8	OK
S1.007	SSW5	1.261	0.3		1.8	OK
S3.000	SSW14	0.103	1.3		21.0	OK
S3.001	SSW15	0.233	1.2		43.2	OK
S3.002	SRP2 In	0.703	1.1		43.8	OK
S3.003	SRP2	52.142	0.3		5.8	OK

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S3.004	SRP2 Out	7200 minute 10 year Summer I+0%	98.000	96.509	0.027	0.000
S3.005	SSW16	7200 minute 10 year Summer I+0%	98.000	96.549	0.076	0.000
S3.006	SSW17	15 minute 10 year Summer I+0%	96.850	95.917	-0.301	0.000
S4.000	SSW19	15 minute 10 year Summer I+0%	98.400	97.063	-0.087	0.000
S4.001	SSW20	15 minute 10 year Summer I+0%	97.250	96.805	-0.104	0.000
S3.007	SSW18	15 minute 10 year Summer I+0%	96.750	95.249	-0.301	0.000
S1.008	SSW6	15 minute 10 year Summer I+0%	95.750	94.597	-0.474	0.000
S5.000	SSW21	15 minute 10 year Summer I+0%	94.500	93.236	-0.139	0.000
S6.000	SSW24	15 minute 10 year Summer I+0%	96.000	94.742	-0.058	0.000
S5.001	SSW22	15 minute 10 year Summer I+0%	93.500	92.192	-0.108	0.000
S5.002	SSW23	15 minute 10 year Summer I+0%	92.500	91.149	-0.151	0.000
S1.009	SSW7	15 minute 10 year Summer I+0%	92.250	90.615	-0.435	0.000
S7.000	SSW25	15 minute 10 year Summer I+0%	94.250	92.999	-0.051	0.000
S7.001	SSW26	15 minute 10 year Summer I+0%	92.000	90.710	-0.090	0.000
S7.002	SSW27	15 minute 10 year Summer I+0%	91.000	89.611	-0.189	0.000
S7.003	SSW28	15 minute 10 year Summer I+0%	90.000	88.624	-0.176	0.000
S7.004	SSW29	15 minute 10 year Summer I+0%	89.500	88.111	-0.189	0.000
S1.010	SSW8	15 minute 10 year Summer I+0%	88.500	86.911	-0.389	0.000
S1.011	SSW9	15 minute 10 year Summer I+0%	86.750	85.166	-0.384	0.000
S8.000	SSW30	15 minute 10 year Summer I+0%	86.750	85.526	-0.099	0.000
S8.001	SSW31	15 minute 10 year Summer I+0%	86.750	85.352	-0.128	0.000
S8.002	SSW32	15 minute 10 year Summer I+0%	85.000	83.687	-0.188	0.000
S1.012	SSW10	15 minute 10 year Summer I+0%	85.000	83.410	-0.318	0.000
S1.013	SIP	7200 minute 10 year Winter I+0%	83.000	81.132	-1.743	0.000
S1.014	SNo Outlet	15 minute 10 year Summer I+0%	83.000	82.037	-0.825	0.000

PN	US/MH Name	Overflow (l/s)	Maximum Vol (m³)	Maximum Velocity (m/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S3.004	SRP2 Out		1.493	0.1		6.1	SURCHARGED
S3.005	SSW16		0.743	0.1		0.3	SURCHARGED
S3.006	SSW17		0.220	0.8		12.9	OK
S4.000	SSW19		0.066	0.9		6.1	OK
S4.001	SSW20		0.068	2.3		10.4	OK
S3.007	SSW18		0.099	1.5		23.1	OK
S1.008	SSW6		0.081	2.6		24.4	OK
S5.000	SSW21		0.091	1.9		26.4	OK
S6.000	SSW24		0.042	2.0		6.2	OK
S5.001	SSW22		0.132	3.0		61.6	OK
S5.002	SSW23		0.171	1.8		61.4	OK
S1.009	SSW7		0.151	3.5		84.2	OK
S7.000	SSW25		0.050	2.3		8.5	OK
S7.001	SSW26		0.062	2.0		13.3	OK
S7.002	SSW27		0.120	2.2		52.0	OK
S7.003	SSW28		0.184	2.3		63.3	OK
S7.004	SSW29		0.145	2.9		68.4	OK
S1.010	SSW8		0.264	3.5		151.4	OK

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Overflow (l/s)	Maximum Vol (m³)	Maximum Velocity (m/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S1.011	SSW9		0.276	3.5		161.3	OK
S8.000	SSW30		0.137	1.2		27.2	OK
S8.001	SSW31		0.164	3.5		57.5	OK
S8.002	SSW32		0.262	1.2		67.9	OK
S1.012	SSW10		0.406	2.9		228.7	OK
S1.013	SIP		580.500	0.0		0.0	OK
S1.014	SNo Outlet		0.000	0.0		0.0	OK

Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	10.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	3
Number of Online Controls	3	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.439
Region	England and Wales	Cv (Summer)	1.000
M5-60 (mm)	20.000	Cv (Winter)	1.000

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	30
Climate Change (%)	35

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S1.000	SSW1	15 minute 30 year Summer I+35%	100.850	99.614	-0.111	0.000
S1.001	SSW2	15 minute 30 year Summer I+35%	100.600	99.393	-0.082	0.000
S2.000	SSW11	15 minute 30 year Summer I+35%	100.000	98.807	-0.068	0.000
S2.001	SSW12	15 minute 30 year Summer I+35%	99.750	98.531	-0.094	0.000
S2.002	SSW13	15 minute 30 year Summer I+35%	99.750	98.470	-0.053	0.000
S1.002	SSW3	15 minute 30 year Winter I+35%	99.900	98.364	0.000	0.000
S1.003	SSW4	15 minute 30 year Summer I+35%	99.630	98.290	-0.040	0.000
S1.004	SRP1 In	15 minute 30 year Summer I+35%	98.551	98.167	0.042	0.000
S1.005	SRP1	720 minute 30 year Winter I+35%	98.551	97.980	-0.096	0.000
S1.006	SRP1 Out	720 minute 30 year Winter I+35%	98.551	97.989	-0.025	0.000
S1.007	SSW5	720 minute 30 year Winter I+35%	98.551	97.989	0.000	0.000
S3.000	SSW14	15 minute 30 year Summer I+35%	98.500	97.283	-0.092	0.000
S3.001	SSW15	15 minute 30 year Summer I+35%	98.000	96.815	-0.060	0.000
S3.002	SRP2 In	15 minute 30 year Summer I+35%	98.000	96.626	-0.035	0.000
S3.003	SRP2	2160 minute 30 year Winter I+35%	97.272	96.577	0.004	0.000

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Overflow (l/s)	Maximum Vol (m³)	Maximum Velocity (m/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S1.000	SSW1		0.123	1.4		27.3	OK
S1.001	SSW2		0.355	2.0		111.2	OK
S2.000	SSW11		0.257	1.4		79.8	OK
S2.001	SSW12		1.036	1.2		101.2	OK
S2.002	SSW13		1.530	1.3		115.4	OK
S1.002	SSW3		2.749	0.9		203.0	OK
S1.003	SSW4		2.631	1.6		265.7	OK
S1.004	SRP1 In		1.888	1.2		264.6	SURCHARGED
S1.005	SRP1		241.292	0.3		5.8	OK
S1.006	SRP1 Out		4.448	0.2		3.2	OK
S1.007	SSW5		2.182	0.3		1.8	SURCHARGED
S3.000	SSW14		0.145	1.5		36.0	OK
S3.001	SSW15		0.441	1.3		73.9	OK
S3.002	SRP2 In		1.557	1.2		71.6	OK
S3.003	SRP2		98.674	0.3		9.2	SURCHARGED

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S3.004	SRP2 Out	2160 minute 30 year Winter I+35%	98.000	96.670	0.188	0.000
S3.005	SSW16	2160 minute 30 year Winter I+35%	98.000	96.687	0.213	0.000
S3.006	SSW17	15 minute 30 year Summer I+35%	96.850	95.938	-0.279	0.000
S4.000	SSW19	15 minute 30 year Summer I+35%	98.400	97.087	-0.063	0.000
S4.001	SSW20	15 minute 30 year Summer I+35%	97.250	96.820	-0.089	0.000
S3.007	SSW18	15 minute 30 year Summer I+35%	96.750	95.271	-0.279	0.000
S1.008	SSW6	15 minute 30 year Summer I+35%	95.750	94.609	-0.462	0.000
S5.000	SSW21	15 minute 30 year Summer I+35%	94.500	93.267	-0.108	0.000
S6.000	SSW24	15 minute 30 year Summer I+35%	96.000	94.758	-0.042	0.000
S5.001	SSW22	15 minute 30 year Summer I+35%	93.500	92.244	-0.056	0.000
S5.002	SSW23	15 minute 30 year Summer I+35%	92.500	91.213	-0.087	0.000
S1.009	SSW7	15 minute 30 year Summer I+35%	92.250	90.645	-0.405	0.000
S7.000	SSW25	15 minute 30 year Summer I+35%	94.250	93.020	-0.030	0.000
S7.001	SSW26	15 minute 30 year Summer I+35%	92.000	90.732	-0.068	0.000
S7.002	SSW30	15 minute 30 year Summer I+35%	91.000	89.651	-0.149	0.000
S7.003	SSW31	15 minute 30 year Summer I+35%	90.000	88.670	-0.130	0.000
S7.004	SSW32	15 minute 30 year Summer I+35%	89.500	88.152	-0.148	0.000
S1.010	SSW8	15 minute 30 year Summer I+35%	88.500	86.957	-0.343	0.000
S1.011	SSW9	15 minute 30 year Summer I+35%	86.750	85.213	-0.337	0.000
S8.000	SSW33	15 minute 30 year Summer I+35%	86.750	85.626	0.001	0.000
S8.001	SSW34	15 minute 30 year Summer I+35%	86.750	85.389	-0.091	0.000
S8.002	SSW34	15 minute 30 year Summer I+35%	85.000	83.765	-0.110	0.000
S1.012	SSW10	15 minute 30 year Summer I+35%	85.000	83.485	-0.243	0.000
S1.013	SIP	8640 minute 30 year Winter I+35%	83.000	82.009	-0.866	0.000
S1.014	SNo Outlet	15 minute 30 year Summer I+35%	83.000	82.037	-0.825	0.000

PN	US/MH Name	Overflow (l/s)	Maximum Vol (m³)	Maximum Velocity (m/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S3.004	SRP2 Out		1.782	0.1		3.3	SURCHARGED
S3.005	SSW16		0.942	0.1		0.3	SURCHARGED
S3.006	SSW17		0.287	1.0		22.0	OK
S4.000	SSW19		0.093	1.0		10.5	OK
S4.001	SSW20		0.093	2.7		17.8	OK
S3.007	SSW18		0.130	1.8		39.7	OK
S1.008	SSW6		0.103	2.8		40.8	OK
S5.000	SSW21		0.127	2.2		45.3	OK
S6.000	SSW24		0.060	2.3		10.7	OK
S5.001	SSW22		0.212	3.3		105.6	OK
S5.002	SSW23		0.257	2.0		105.2	OK
S1.009	SSW7		0.203	4.0		144.8	OK
S7.000	SSW25		0.073	2.5		14.6	OK
S7.001	SSW26		0.087	2.3		22.7	OK
S7.002	SSW30		0.166	2.5		89.2	OK
S7.003	SSW31		0.289	2.6		108.5	OK
S7.004	SSW32		0.224	3.3		117.3	OK
S1.010	SSW8		0.371	4.0		260.3	OK

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Overflow (l/s)	Maximum Vol (m³)	Maximum Velocity (m/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S1.011	SSW9		0.388	4.1		276.0	OK
S8.000	SSW33		0.250	1.3		46.0	SURCHARGED
S8.001	SSW34		0.281	4.0		98.0	OK
S8.002	SSW34		0.382	1.4		116.0	OK
S1.012	SSW10		0.831	3.4		391.5	OK
S1.013	SIP		1032.639	0.0		0.0	OK
S1.014	SNo Outlet		0.000	0.0		0.0	OK

Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	10.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	3
Number of Online Controls	3	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.439
Region	England and Wales	Cv (Summer)	1.000
M5-60 (mm)	20.000	Cv (Winter)	1.000

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	100
Climate Change (%)	40

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S1.000	SSW1	15 minute 100 year Summer I+40%	100.850	99.805	0.080	0.000
S1.001	SSW2	15 minute 100 year Summer I+40%	100.600	99.696	0.221	0.000
S2.000	SSW11	15 minute 100 year Summer I+40%	100.000	99.235	0.360	0.000
S2.001	SSW12	15 minute 100 year Summer I+40%	99.750	98.861	0.236	0.000
S2.002	SSW13	15 minute 100 year Summer I+40%	99.750	98.750	0.227	0.000
S1.002	SSW3	15 minute 100 year Summer I+40%	99.900	98.584	0.220	0.000
S1.003	SSW4	15 minute 100 year Summer I+40%	99.630	98.446	0.116	0.000
S1.004	SRP1 In	15 minute 100 year Summer I+40%	98.551	98.248	0.123	0.000
S1.005	SRP1	720 minute 100 year Winter I+40%	98.551	98.141	0.065	0.000
S1.006	SRP1 Out	720 minute 100 year Winter I+40%	98.551	98.444	0.430	0.000
S1.007	SSW5	720 minute 100 year Winter I+40%	98.551	98.494	0.505	0.000
S3.000	SSW14	15 minute 100 year Summer I+40%	98.500	97.416	0.041	0.000
S3.001	SSW15	15 minute 100 year Summer I+40%	98.000	97.048	0.173	0.000
S3.002	SRP2 In	15 minute 100 year Summer I+40%	98.000	96.717	0.056	0.000
S3.003	SRP2	1440 minute 100 year Summer I+40%	97.272	96.678	0.106	0.000

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Overflow (l/s)	Maximum Vol (m³)	Maximum Velocity (m/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S1.000	SSW1		0.340	1.4		38.4	SURCHARGED
S1.001	SSW2		1.277	2.1		142.9	SURCHARGED
S2.000	SSW11		0.741	1.5		104.6	SURCHARGED
S2.001	SSW12		3.276	1.2		127.9	SURCHARGED
S2.002	SSW13		2.300	1.3		143.6	SURCHARGED
S1.002	SSW3		3.672	1.3		282.5	SURCHARGED
S1.003	SSW4		3.184	1.6		336.5	SURCHARGED
S1.004	SRP1 In		2.106	1.6		334.1	SURCHARGED
S1.005	SRP1		345.577	0.4		40.7	SURCHARGED
S1.006	SRP1 Out		5.674	0.2		19.4	FLOOD RISK
S1.007	SSW5		3.181	0.3		1.8	FLOOD RISK
S3.000	SSW14		0.296	1.6		48.1	SURCHARGED
S3.001	SSW15		1.366	1.4		96.3	SURCHARGED
S3.002	SRP2 In		2.348	1.4		95.2	SURCHARGED
S3.003	SRP2		137.174	0.3		4.1	SURCHARGED

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
S3.004	SRP2 Out	1440 minute 100 year Summer I+40%	98.000	96.837	0.355	0.000
S3.005	SSW16	1440 minute 100 year Summer I+40%	98.000	96.865	0.392	0.000
S3.006	SSW17	15 minute 100 year Summer I+40%	96.850	95.955	-0.262	0.000
S4.000	SSW19	15 minute 100 year Summer I+40%	98.400	97.107	-0.043	0.000
S4.001	SSW20	15 minute 100 year Summer I+40%	97.250	96.831	-0.077	0.000
S3.007	SSW18	15 minute 100 year Summer I+40%	96.750	95.288	-0.262	0.000
S1.008	SSW6	15 minute 100 year Summer I+40%	95.750	94.618	-0.453	0.000
S5.000	SSW21	15 minute 100 year Summer I+40%	94.500	93.292	-0.083	0.000
S6.000	SSW24	15 minute 100 year Summer I+40%	96.000	94.771	-0.029	0.000
S5.001	SSW22	15 minute 100 year Summer I+40%	93.500	92.768	0.468	0.000
S5.002	SSW23	15 minute 100 year Summer I+40%	92.500	91.337	0.037	0.000
S1.009	SSW7	15 minute 100 year Summer I+40%	92.250	90.662	-0.388	0.000
S7.000	SSW25	15 minute 100 year Summer I+40%	94.250	93.210	0.160	0.000
S7.001	SSW26	15 minute 100 year Summer I+40%	92.000	90.746	-0.054	0.000
S7.002	SSW30	15 minute 100 year Summer I+40%	91.000	89.680	-0.120	0.000
S7.003	SSW31	15 minute 100 year Summer I+40%	90.000	88.707	-0.093	0.000
S7.004	SSW32	15 minute 100 year Summer I+40%	89.500	88.182	-0.118	0.000
S1.010	SSW8	15 minute 100 year Summer I+40%	88.500	86.987	-0.313	0.000
S1.011	SSW9	15 minute 100 year Summer I+40%	86.750	85.244	-0.306	0.000
S8.000	SSW33	15 minute 100 year Summer I+40%	86.750	85.749	0.124	0.000
S8.001	SSW34	15 minute 100 year Summer I+40%	86.750	85.422	-0.058	0.000
S8.002	SSW34	15 minute 100 year Summer I+40%	85.000	83.904	0.029	0.000
S1.012	SSW10	15 minute 100 year Summer I+40%	85.000	83.542	-0.187	0.000
S1.013	SIP	8640 minute 100 year Winter I+40%	83.000	82.348	-0.527	0.000
S1.014	SNo Outlet	8640 minute 100 year Winter I+40%	83.000	82.377	-0.485	0.000

PN	US/MH Name	Overflow (l/s)	Maximum Vol (m³)	Maximum Velocity (m/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S3.004	SRP2 Out		2.021	0.1		1.5	SURCHARGED
S3.005	SSW16		1.197	0.1		0.4	SURCHARGED
S3.006	SSW17		0.388	1.1		29.4	OK
S4.000	SSW19		0.116	1.1		14.1	OK
S4.001	SSW20		0.112	2.9		24.0	OK
S3.007	SSW18		0.155	1.9		53.0	OK
S1.008	SSW6		0.119	3.1		54.6	OK
S5.000	SSW21		0.155	2.3		61.1	OK
S6.000	SSW24		0.075	2.4		14.4	OK
S5.001	SSW22		1.456	3.4		136.4	SURCHARGED
S5.002	SSW23		0.459	2.0		137.1	SURCHARGED
S1.009	SSW7		0.233	4.3		191.9	OK
S7.000	SSW25		0.289	2.6		18.4	SURCHARGED
S7.001	SSW26		0.104	2.5		29.1	OK
S7.002	SSW30		0.200	2.7		118.7	OK
S7.003	SSW31		0.375	2.8		144.8	OK
S7.004	SSW32		0.282	3.5		156.7	OK
S1.010	SSW8		0.446	4.2		340.2	OK

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Overflow (l/s)	Maximum Vol (m³)	Maximum Velocity (m/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S1.011	SSW9		0.470	4.3		364.2	OK
S8.000	SSW33		0.389	1.6		62.5	SURCHARGED
S8.001	SSW34		0.394	4.2		132.5	OK
S8.002	SSW34		0.618	1.4		155.8	SURCHARGED
S1.012	SSW10		1.284	3.6		519.3	OK
S1.013	SIP		1316.570	0.0		3.3	OK
S1.014	SNo Outlet		1.492	0.0		0.0	OK

APPENDIX G - MAINTENANCE SCHEDULE

A maintenance company will be appointed to ensure that regular inspection of the drainage systems are carried out, the inspections are logged and any remedial work necessary at the time of inspection is completed to ensure continued satisfactory operation of the designed system.

PLANNED PREVENTATIVE MAINTENANCE

As a minimum the appointed maintenance company, should complete the following scope of works during the planned bi-annual preventative maintenance inspection for the following Surface Water features:

- Swales
- Permeable Paving
- Attenuation/Infiltration Tank
- Pond/Detention Basins
- Soakaways

SWALES

MAINTENANCE SCHEDULE	REQUIRED ACTION	TYPICAL FREQUENCY
Regular Maintenance	Remove litter including leaf litter and debris from swale surface, access chambers and pre-treatment devices	Monthly (or as required)
	Inspect swale surface, inlet/outlet pipework and control systems for blockages, clogging, standing water and structural damage	Monthly
	Inspect pre-treatment systems, inlets and perforated pipework for silt accumulation, and establish appropriate silt removal frequencies	Six monthly
	Remove sediment from pre-treatment devices	Six monthly, or as required
Occasional Maintenance	Remove or control tree roots where they are encroaching the sides of the swale, using recommended methods (eg NJUG, 2007 or BS 3998:2010)	As required
	At locations with high pollution loads, remove surface geotextile and replace, and wash or replace overlying filter medium	Five yearly, or as required
	Clear perforated pipework of blockages	As required

PERMEABLE PAVING

MAINTENANCE SCHEDULE	REQUIRED ACTION	TYPICAL FREQUENCY
Regular Maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturers recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional Maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required
Monitoring	Initial inspection	Monthly for 3 months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Prepared By:	Andrew Leadbetter	Date:	10.11.22	Verified By:	Bryan Hoadley	Date:	14.11.22

ATTENUATION/INFILTRATION TANKS

MAINTENANCE SCHEDULE	REQUIRED ACTION	TYPICAL FREQUENCY
Regular Maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary.	Annually
Remedial Action	Repair/rehabilitate inlets, outlet, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required

INFILTRATION/DETENTION BASINS

MAINTENANCE SCHEDULE	REQUIRED ACTION	TYPICAL FREQUENCY
Regular Maintenance	Remove litter and debris	Monthly
	Cut grass – for spillways and access routes	Monthly (during growing season), or as required
	Cut grass – meadow grass in and around basin	Half yearly (spring – before nesting season, and autumn)
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly
	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Monthly (for first year), then annually or as required
	Check any penstocks and other mechanical devices	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets, outlet and forebay	Annually (or as required)
	Manage wetland plants in outlet pool – where provided	Annually (or as required)
Occasional Maintenance	Reseed areas of poor vegetation growth	As required
	Prune and trim any trees and remove cuttings	Every 2 years, or as required
	Remove sediment from inlets, outlets, forebay and main basin when required	Every 5 years, or as required (likely to be minimal requirements where effective upstream source control is provided)
Remedial Actions	Repair erosion or other damage by reseeding or re-turfing	As required
	Realignment of rip-rap	As required
	Repair/rehabilitation of inlets, outlets and overflows	As required
	Relevel uneven surfaces and reinstate design levels	As required

SOAKAWAYS

MAINTENANCE SCHEDULE	REQUIRED ACTION	TYPICAL FREQUENCY
Regular Maintenance	Inspect for sediment and debris in pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings	Annually
	Trimming any roots that may be causing blockages	Annually (or as required)
Occasional Maintenance	Remove sediment and debris from pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings	As required, based on inspections
Remedial Actions	Reconstruct soakaway and/or replace or clean void fill, if performance deteriorates or failure occurs	As required
	Replacement of clogged geotextile (will require reconstruction of soakaway	As required
Monitoring	Inspect silt traps and note rate of sediment accumulation	Monthly in the first year and then annually
	Check soakaway to ensure emptying is occurring	Annually

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The Development: Land West of Thaxted Road, Saffron Walden

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