Wormald Burrows Partnership Limited
Civil Engineering Consultants

LUTTERWORTH ROAD, BLABY, LEICESTERSHIRE

FLOOD RISK ASSESSMENT

November 2021

E3646-FRA-1121-rev0

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LUTTERWORTH ROAD
BLABY, LEICESTERSHIRE

FLOOD RISK ASSESSMENT

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Date: November 2021

Original Ref: E3646-FRA-1121-rev0

Written By:	Checked By:	Approved By:
[redacted]	[redacted]	[redacted]
Nick Kohli *Managing Director*	Andrew Chipchase *Associate Director*	Nick Kohli *Managing Director*

Status: Draft

REGISTRATION OF AMENDMENTS

Revision	Date	Amendment Details	Prepared by	Checked by
Rev 0	Nov 21	First Issue	N. Kohli	A.Chipchase

CONTENTS

APPENDICES

1 INTRODUCTION

1.1 Wormald Burrows Partnership Limited (WBPL) has been appointed by Davidsons Developments Ltd (DDL) to produce a Flood Risk Assessment (FRA) to support a planning application for a proposed development of approximately 53 dwellings on land off Lutterworth Road, Blaby, Leicestershire.

1.2 This FRA report has been prepared in accordance with the requirements contained within the National Planning Policy Framework (NNPF) July 2021 and the Planning Policy Guidance – Flood Risk and Coastal Change (PPG) 2014.

1.3 A number of Strategic Flood Risk Assessments (SFRA) have been undertaken by JBA Consulting covering the Blaby area. The report considers these assessments and concludes that they do not identify the site to be at risk from flooding.

1.4 This report will demonstrate that the development proposals will not increase the risk from flooding of the site or for land upstream or downstream.

1.5 The report also refers to the principles of surface water drainage and outlines how surface water runoff will be managed in a sustainable manner. All drainage measures will be designed to manage a 1 in 100 year storm event with an allowance to cater for the predicted effect of climate change.

1.6 Wormald Burrows Partnership Limited are consulting civil engineers with significant experience in flood risk studies and a long and successful track record of producing FRA reports and drainage strategies and assessments.

2 EXISTING SITE CONDITIONS

2.1 Site Description

2.1.1 The proposed development site is located on the southern side of Blaby, on land to the east of Lutterworth Road. The site is centred on NGR SP 56538 96623. The nearest postcode is LE8 4BB.

2.1.2 The site is approximately 1.9 hectares (4.695 acres) and at present is greenfield, comprising of areas of dense vegetation and trees to the north and Golf course fairway to the south.

2.1.3 To the north the site is bounded by the rear gardens to existing properties and to the east is a relatively new residential development. To the south of the site is Blaby Golf Centre; this comprising of a main course, a pitch & putt and a crazy golf course. To the west, the site is bounded by Lutterworth Road, beyond which is Lutterworth Lions Rugby ground to the south and new residential development to the north. This is shown in Figure 1 below and a location plan that is included in Appendix A.

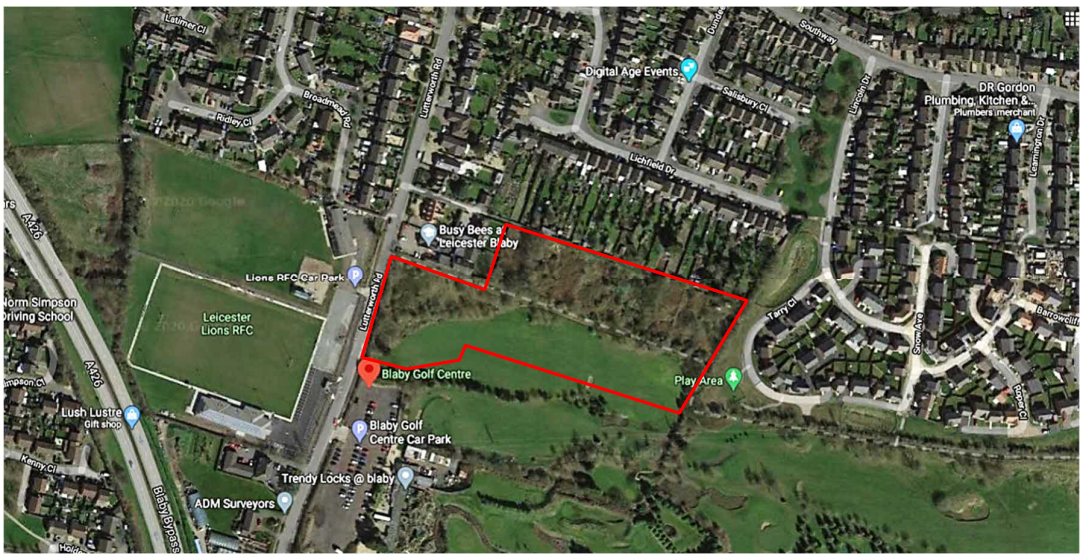


Figure 1 – Aerial view of the site

2.2 Topography

2.2.1 A topographical survey was carried out by Phoenix Survey Services Ltd, dated 22nd June 2016. This survey was last updated on 29th October 2020, when additional information was added regarding the ditch adjacent to Lutterworth Road and the receiving downstream drainage system to the north. A copy is attached in

Appendix B.

2.2.2 The survey shows that levels rise towards the eastern site boundary with high points in the north east and south east corners of c 78.78m AOD The site falls to a low point of 75.69m AOD towards the western site boundary, resulting in an approximate gradient of 1 in 75 from east to west.

2.2.3 The survey shows that Lutterworth Road sits approximately 0.7m above the existing site levels.

2.2.4 There is an existing ditch that runs along the boundary between Lutterworth Road, which is approximately 0.5m deep. It is assumed that overland flows from the site drain to this ditch and that part of Lutterworth Road may also discharge to the ditch. The survey highlights its downstream route to the north, in the eastern verge adjacent to Lutterworth Road.

2.3 Geological ground conditions

2.3.1 A desktop site investigation was carried out by GRM Development Solutions Limited, dated February 2017. In the report it states that the British Geological Survey (BGS) geological sheets for this area show the ground close to the site comprises cohesive deposits of Glacial Till and Weathered Branscombe Mudstone Formation Strata.

2.3.2 The report states, 'Given the anticipated geology the adoption of a soakaway drainage system is considered unlikely'. The report text in included in **Appendix C.**

2.3.3 A copy of the BGS borehole records close to the site are included in **Appendix D**.

2.4 Existing surface and foul water management

2.4.1 A review of Severn Trent Water (STW) sewer records, attached in **Appendix E**, show that there is an existing foul water sewer within Lutterworth Road to the west of the site.

2.4.2 To the east of the site, there are foul and surface water networks within the new residential development. These sewers are currently under a Section 104 agreement with STW.

2.4.3 There is an existing ditch that runs along Lutterworth Road adjacent to the western

site boundary. It is assumed that overland flows from the site drain to this ditch. The length of Lutterworth Road adjacent the ditch may also discharge into the ditch. The topographical survey highlights its downstream route to the north, in the eastern verge adjacent to Lutterworth Road.

3 POLICY CONTEXT FOR PROPOSED DEVELOPMENT

3.1 The National Planning Policy Framework (NPPF) 2018 and the Planning Policy Guidance - Flood Risk and Coastal Change (PPG) 2014

3.1.1 Vulnerability Classification

3.1.2 The proposed development complies with the following principles:

Environment Agency (EA) flood maps show that the site is located within an area having a less than 1 in 1000 annual probability of fluvial flooding, hence placing the site within Flood Zone 1 (**Appendix F**).

The proposed residential elements of the development are classified as 'more vulnerable' with reference to Table 2 of the PPG (extract reproduced below).

Vulnerability	Site Elements
More Vulnerable	Hospitals Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels Buildings used for dwelling houses; student halls of residence, drinking establishments, nightclubs and hotels. Non–residential uses for health services, nurseries and educational establishments Landfill and sites used for waste management facilities for hazardous waste. Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
Less Vulnerable	Police, ambulance and fire stations which are not required to be operational during flooding. Buildings used for shops; financial, professional and other services, restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non-residential institutions not included in "more vulnerable", and assembly and leisure. Land and buildings used for agriculture and forestry. Waste treatment (except landfill and hazardous waste facilities). Minerals working and processing (except for sand and gravel working).

Vulnerability	Site Elements
	Water treatment plants and sewage treatment plants (if adequate pollution control measures are in place).

Notes
1) This classification is based partly on Defra/Environment Agency research on Flood Risks to People (FD2321/TR2)21 and also on the need of some uses to keep functior during flooding.
2) Buildings that combine a mixture of uses should be placed into the higher of the relevant classes of flood risk sensitivity. Developments that allow uses to be distributed over the site may fall within several classes of flood risk sensitivity.
3) The impact of a flood on the particular uses identified within this flood risk vulnerability classification will vary within each vulnerability class. Therefore, the flood risk management infrastructure and other risk mitigation measures needed to ensure the development is safe may differ between uses within a particular vulnerability classification.

Extract of Table 2 of the PPG - Flood Risk Vulnerability Classification

Vulnerability Classification		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less vulnerable
Flood Zone	Zone 1	√	√	√	√	√
	Zone 2	√	√	Exception Test	√	√
	Zone 3	Exception Test	√	X	Exception Test	√
	Zone 3b	Exception Test	√	X	X	√

Key
√ Development is appropriate
X Development should not be permitted

Extract of Table 3 of the PPG - Flood Risk Vulnerability and Flood Zone Compatibility

3.1.3 The proposed development is appropriate in accordance with Table 3 of the PPG, reproduced above.

3.1.4 Sequential Test.

3.1.5 The National Planning Policy Framework (NPPF) requires that at all stages of planning, a Sequential Test is completed with the aim of steering new development to areas at the lowest probability of flooding (Flood Zone 1). The Sequential Test would normally be completed by the Local Planning Authority (LPA) to inform the preparation of the Local Development Framework (LDF), where one exists. However, where this process has not yet been completed, the onus for the

provision of evidence demonstrating successful application of the Sequential Test falls to the developer, or promoter of the site.

3.1.6 In this instance, as the site is located in Flood Zone 1, the Sequential Test can be deemed to be passed. Notwithstanding the above, the NPPF also requires the layout of the site to be sequentially tested. However, as the site is located entirely within Flood Zone 1, it is also not necessary to sequentially test the development layout.

3.1.7 Exception Test

3.1.8 Application of the Sequential Test aims to steer all development towards areas of lowest risk. However, the NPPF acknowledges that in some circumstances it may not be possible to locate development in areas of low or appropriate (considering development vulnerability) flood risk, or that there may be other valid reasons for a development to take place within the floodplain. In these circumstances, it is necessary to clearly demonstrate that the benefits for development of a site outweigh the flood risks to the development and its occupants. In addition, it may be necessary to apply the Exception Test where the Sequential Test alone cannot deliver acceptable sites.

3.1.9 Table 3 of the PPG indicates when the Exception Test is required and reference to this table outlines that 'More' vulnerable uses in Flood Zone 1 do not require the application of the Exception Test.

3.2 Strategic Flood Risk Assessment (SFRA)

3.2.1 A Level 1 Strategic Flood Risk Assessment (SFRA) was undertaken for Hinckley and Bosworth Borough Council by JBA Consulting in July 2019. The report provided an update to the Joint 2014 SFRA for Hinckley and Bosworth, Blaby and Oadby and Wigston Borough Councils, as well as an update to the Leicestershire and Leicester City 2017 SFRA.

3.2.2 The earlier SFRAs not only contained data relevant to Hinckley and Bosworth but also data from a much larger area that included additional Local Authorities, such as Blaby. The 2019 SFRA provides a comprehensive and robust evidence base to support the new Hinckley and Bosworth Borough Council Local Plan however, the study area does not include the application site and so reference will be made

to the earlier FRA reports mentioned in paragraph 3.2.1 above.

3.2.3 These SFRA reports do not show the site to be at risk of flooding from rivers or the sea, thus placing it in Flood Zone 1.

3.2.4 They do however show a risk of ground water flooding of between 50% and 75%. A copy of the flood map for surface water and a map of the area susceptible to groundwater flooding is included in **Appendix G.**

3.2.5 A Level 2 SFRA was undertaken by JBA in 2019. This was prepared to assess sites identified in the Strategic Housing and Economic Land Availability Assessment undertaken by Hinckley and Bosworth Borough Council. Like the 2019 Level 1 SFRA, the application site was not included in this list.

4 DEVELOPMENT PROPOSALS

4.1 Development Layout

4.1.1 A proposed Feasibility Layout prepared by nineteen 47 (drawing n1063/007 Rev A) is included in **Appendix H**.

4.1.2 The proposed development will comprise approximately 53 dwellings with garages, car parking, gardens and landscaping.

4.1.3 Vehicular access is to be taken from a new access created from Lutterworth Road.

5 PROBABILITY OF FLOODING

5.1 Sources of Flooding

5.1.1 The PPG points out that for the purposes of applying the National Planning Policy Framework, "flood risk" is a combination of the probability and the potential consequences of flooding from all sources including: -

Flooding from rivers (fluvial flooding);

Flooding from the sea (tidal flooding);

Flooding from land;

Flooding from sewers:

Flooding from groundwater; and

Flooding from reservoirs, canals and other artificial sources.

5.2 How Flooding May Occur

5.2.1 Flooding from rivers and sea

5.2.2 The Environment Agency (EA) Flood Map identifying flooding from rivers and seas is attached in **Appendix F**. It shows the site to be outside the areas at risk of flooding from these sources.

5.2.3 Flooding from Land

5.2.4 The EA flood map identifying the risk of flooding from surface water is included within **Appendix I**. It shows that the majority of the site has a very low risk of flooding. However, there are areas of low risk across the site and the map also identifies an area at high risk; this meaning that each year this area has a greater than 3.3% risk of flooding. Flooding from surface water can be hard to predict as local features can affect the chance and severity of flooding.

5.2.5 Flooding from sewers

5.2.6 The SFRA contains records of flooding from sewers as provided by Severn Trent and Anglian Water. The report did not identify any instances of flooding from

sewers within the vicinity of the site.

5.2.7 Flooding from Groundwater

5.2.8 The map taken from the SFRA, attached in Appendix G, shows that the site has a risk of groundwater flooding of 50%-75%. It is recommended that trial pits and boreholes are dug on site to confirm the presence and level of any groundwater.

5.2.9 Flooding from reservoirs, canals and other artificial sources

5.2.10 The EA map for risk of flooding from reservoirs, included in Appendix J, shows that there are no reservoirs within the vicinity of the site. The closest canal to the site is the Grand Union Canal and is approximately 1.93km from the site at its closes point.

5.3 Flood Zone

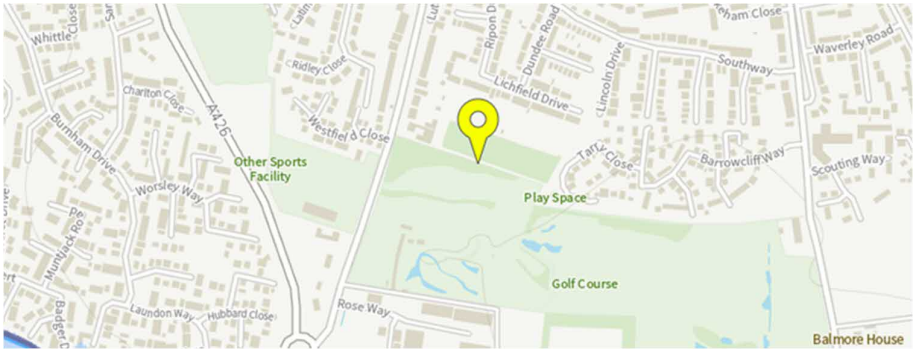
5.3.1 The assessment of flood risk in this report is based on the definitions in Table 1 of the PPG, which recognises the following Flood Zones: -

Flood Zone 1 (Low Probability) - Land having a less than 1 in 1,000 annual probability of river or sea flooding.

Flood Zone 2 (Medium Probability) - Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding.

Flood Zone 3a – (High Probability) - This zone comprises land where water must flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency.

5.3.2 As outlined in paragraph 5.2.1 above and shown below in the extract from the EA's flood maps below, the site is in Flood Zone 1.



6 SURFACE WATER MANAGEMENT

6.1 Surface Water Drainage

6.1.1 The total area of the site is approximately 1.9 ha and is currently all greenfield.

6.1.2 An estimation of the greenfield runoff rate for the site has been calculated using the ICP SuDS method on Micodrainage. This generated a Qbar rate of 8.3l/s for the site and a copy of the calculations is included in **Appendix K**.

6.1.3 Given the anticipated ground conditions, as stated in the desktop ground investigation carried out by GRM Development Solutions Limited, infiltration rates are likely to be poor and thus soakaways are not likely to be viable as a means for the disposal of surface water runoff.

6.1.4 However, it is recommended that a further assessment be undertaken by a geotechnical engineer and if considered appropriate, infiltration tests be carried out in line with BRE Digest 365 to confirm the soakage rate. Should the soakage rate be better than expected, infiltration should be used as this is the preferred method of surface water disposal.

6.1.5 As outlined above in Section 2.4.2, Severn Trent Water's sewer records (**Appendix E**) show that there are no surface water sewers in Lutterworth Road but that there is, in a new development to the east of the proposed development site, a surface water sewer currently under a Section 104 agreement. However, this drainage system is at a higher level than the application site and thus surface water would need to be pumped if it were to outfall in this direction.

6.1.6 The topographical survey, attached in **Appendix B**, shows an existing ditch that runs along the western site boundary, adjacent to Lutterworth road. Survey works have identified that the ditch continues to the north in a 225mm diameter pipe. As discussed in paragraph 2.2.2 above, the survey also demonstrates that the site falls in this direction.

6.1.7 It is therefore proposed, if indeed infiltration is not possible, that surface water runoff be directed by gravity to the western site boundary and discharged at a controlled rate to the existing ditch.

6.1.8 A Drainage Strategy Plan drawing (E3646/500) has been prepared and is included in **Appendix L**.

6.1.9 It is proposed that the surface water runoff from roads will be drained via a traditional gully and pipe network, and directed to a detention basin, which will be used to provide attenuation and water quality treatment.

6.1.10 Flows will then be restricted to the QBar greenfield rate of 8.3 l/s by a flow control device before being discharged to the existing ditch on the site's western boundary.

6.1.11 The attenuation pond and surface water network has been modelled in Microdrainage and a copy of the calculations is attached in Appendix M. As there is no proposed detailed housing layout, the Microdrainage calculations are based on a conservative value of 60% impermeable area for the housing areas.

6.2 The Effect on Flood Risk Elsewhere

6.2.1 The drainage system will be designed to accommodate all rainfall events up to and including a 1 in 100 year storm event will an additional allowance of 40% for climate control.

6.2.2 Existing levels on the site fall towards the west. Should the drainage design parameters be exceeded, proposed levels will be designed to follow the existing ground and direct excess flows away from the houses and towards the basin and existing ditch on the site's western boundary.

6.3 Climate Change

6.3.1 Climate change will result in more intense storm events over time. This will be allowed for in the design by including an allowance of 40% increase in rainfall for the design 1 in 100 year storm event.

6.4 Water Quality

6.4.1 The CIRIA Simple Index Tool has been used to assess levels of pollution and mitigation measures and it can be seen from the results determined by this tool included in **Appendix N** that the levels of mitigation are sufficient to address the levels of potential pollution generated by different parts of the development.

6.5 Maintenance

6.5.1 The main drainage system will be offered to Severn Trent Water for adoption under

a Section 104 agreement.

6.5.2 Those parts of the drainage system that serve more than one property, but which are not adopted, will be maintained by a suitably experienced and qualified management company.

6.5.3 Any part of the proposed drainage system that remains in individual private ownership will be maintained by respective property owners, who will be provided with a maintenance schedule.

7 FOUL WATER MANAGEMENT

7.1 Severn Trent Water (STW) sewer records, attached in Appendix E, show that there is an existing 150mm diameter foul water sewer within Lutterworth Road.

7.2 A pre-development enquiry was made to STW in May 2017 and a copy of this is attached in Appendix O. It states that a connection to the existing foul water network could be accommodated via a new connection at manhole MH4701.

7.3 Drawing E3646/500, The Drainage Strategy Plan, attached in Appendix L, therefore shows a route for the foul drainage to be discharged via gravity into the existing foul water network in Lutterworth Road.

7.4 Whilst STW has an obligation to accommodate foul water flows from the development, it is recommended that an updated pre-development enquiry be obtained from them to re-confirm capacity and their preferred point of connection to the existing sewerage system.

7.5 The main foul water drainage system will be offered to STW for adoption under a Section 104 agreement.

8 CONCLUSIONS

8.1 Environment Agency flood maps determine the site to be in Flood Zone 1. The National Planning Policy Framework confirms that a site within Flood Zone 1 is suitable for residential development.

8.2 Underlying ground conditions are likely to make the site unsuitable for infiltration drainage systems. However, it is recommended that further geotechnical advice is sought to further assess the possibility of infiltration. Subject to this advice, testing may be undertaken to establish if soakaways could indeed be viable.

8.3 Therefore, assuming that infiltration is not possible, it is proposed that surface water runoff be directed by gravity to a detention basin from which flows will be restricted to greenfield rates before being discharged to the existing ditch on the site's western boundary. The drainage system will be designed to accommodate all storms up to an including the 1 in 100 year plus 40% climate change event.

8.4 It is proposed that the foul water will discharge via gravity to the existing Severn Trent Water foul water network within Lutterworth Road.

8.5 Whilst Severn Trent Water has an obligation to accommodate foul water flows, it is recommended that an updated pre-planning report be obtained from them to confirm the exact location and outfall rate for foul water flows.

8.6 The main foul and surface water drainage systems will be offered to Severn Trent Water for adoption under a Section 104 agreement.

APPENDICES

APPENDIX A

E 456538
N 296623
Nearest Postcode LE8 4DP

SITE

Digital Age Events
Busy Bees at Leicester Blaby
Lions RFC Car Park
Leicester Lions RFC
Blaby Golf Centre
Play Area
Blaby Golf Centre Car Park
Trendy Locks @ blaby
ADM Surveyors

Rev	Description	Date	Drawn	Checked

Drawing Approval Status:-

N/A Section 104 N/A Section 38 N/A Section 278

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Certified by Afnor UK

Scale: NTS @ A3

Project: Proposed Development at: Lutterworth Road, Balaby

Drawing Description: Location Plan

Drawing Number: E3646/100/A

Client Reference:

Designed By: Date:

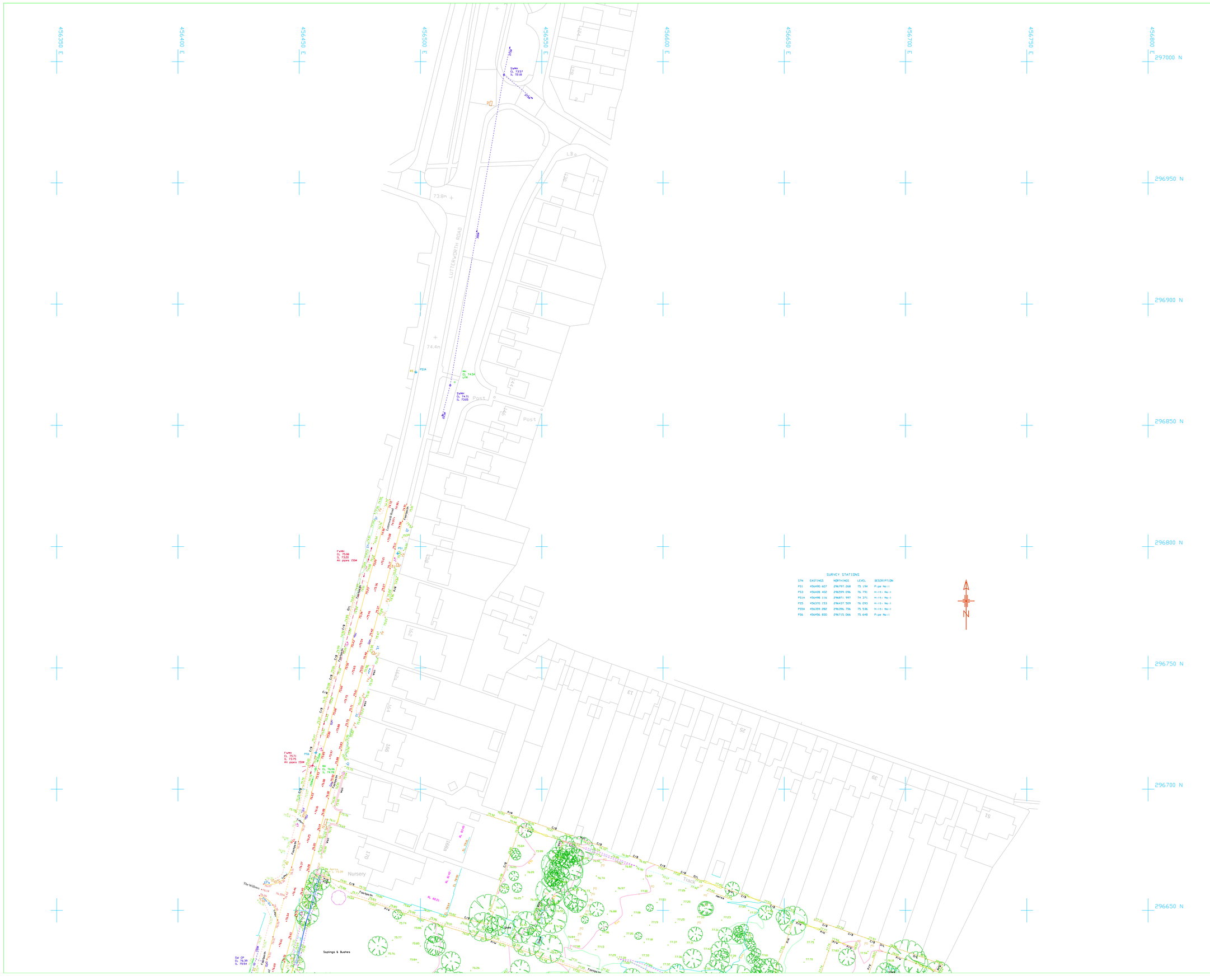
Drawn By: NJB Date: 09/07/19

Checked By: Date:

Client: DAVIDSONS HOMES

Davidsons Group
Wilson House
Leicester Road
Ibstock
Leicestershire, LE67 6HP

APPENDIX B



SURVEY NOTES

1. THE SURVEY GRID (OSGB36) WAS ESTABLISHED WITH GPS AND THEN A ONE POINT SITE CENTRED TRANSFORMATION CARRIED OUT TO ELIMINATE SCALE FACTOR IN ORDER TO RE-ESTABLISH THE SITE GRID THEN THE EXISTING SURVEY CONTROL STATIONS SHOWN MUST BE USED

2. SURVEY LEVELS ESTABLISHED BY GPS TO OS DATUM

SURVEY KEY

- Building
- Survey Control Station
- Wall
- Hedge
- Kerbline
- R/Wall — Retaining Wall
- Verge/Edge of Track etc
- F/W — Fence (with description)
- Overhead Line
- Footpath
- Sewer Line
- Water/Ditch etc
- Gate
- Stile
- Individual Tree

Chestnut Paling C/P
Close Boarded C/B
Corrugated Iron C/I
Chain Link C/L
Crash Barrier CB
Concrete Panel Con/P
Hit and Miss H/M
Interwoven Iwn
Paling Pal
Post & Wire P/W
Post & Rail P/R
Post & Chain P/C
Post & Mesh P/M
Iron Railings I/R
Post & Barbed Wire P/Bw
Electric El
Hoarding Hrd
Post & Wire Mesh P/M
Picket (Wooden) P/K
Trip Rail T/R
Trellis Fence T/F
Palisade Fence P/F
Floor Level FL
Eaves Level EL
Ridge Level RL
Tarmac Surface Tarmac
Grass/Lawn Grass
Paving Slabs Paving
Tactile Paving T/Pav

Unable To Raise U/R
Fire Escape F/Esc
Drop Kerb DK
Stone Surface Stone
Gravel Surface Gravel
Concrete Surface Conc
Rough Ground R/Grnd
Granite Setts/Cobbles Cobbles

STREET FURNITURE

Beacon (Beacon) BB
Borehole BH
Bollard BL
Bus Stop BS
Drain D
Electric Pole EP
Flood Light FL
Flagstaff FS
Gate Post GP
Gully GU
Gas Valve GV
Inspection Cover IC
Kiosk K
Lamp Post LP
Traffic Light TL
Manhole MH
Name Plate NP
Fire Hydrant FH
Wash Out WO
Water Meter WM
Cable Television TV
Earth Rod ER
Speed Camera SPD
Cellar Light CeL

Marker Post Mkr
Mile Post MP
Pillar Box PB
Pipe Pi
Parking Meter PM
Post PO
Rodding Eye RE
Reflector Post RP
Road Sign RS
Stop Cock SC
Stop Tap ST
Sign SI
Soil Vent SV
Stop Valve SV
Telegram Pole TP
Vent Pipe VP
Telecommunication TC
Water Tap Tap
Kerb Outlet KO
Air Valve Air
Tel Call Box TCB
Trial Pit T/P
Closed Circuit TV CT
Multi Utility Pole (EP,LP&TP) MUP

TECHNICAL NOTES

- INFORMATION SHOWN ON THIS DRAWING IS SURVEYED TO THE ACCURACY OF THE BASE SCALE SHOWN IN THE LEGEND
- MAN ENTRY TO SEWERS HAS NOT BEEN UNDERTAKEN, DEPTHS, PIPE SIZES ARE MEASURED/ESTIMATED FROM THE GROUND. ALL SEWER DETAILS TO BE CHECKED WITH LOCAL AUTHORITY RECORDS OR ON SITE PRIOR TO COMMENCEMENT OF WORKS
- BOUNDARIES SHOWN ARE PHYSICAL FEATURES AND MAY NOT REPRESENT LEGALLY CONVEYED OWNERSHIP
- ALL TREE HEIGHTS AND SPREADS ARE APPROXIMATE. TREE TYPES WHICH HAVE BEEN IDENTIFIED SHOULD BE CHECKED BY A TREE SPECIALIST
- WHERE ADJACENT BUILDINGS HAVE BEEN SURVEYED REMOTELY NOT ALL EXTERNAL WALLS MAYBE SHOWN DUE TO OBSTRUCTIONS ALONG LINE OF SIGHT

REV	DATE	DESCRIPTION	BY	APP.
E	29/10/20	DITCH EXTENDED AND DOWN STREAM MH's ADDED.	GRA	ALB
D	29/10/20	LUTTERWORTH ROAD UPDATED	GRA	ALB
C	23/03/20	COMPLETION OF THE ALLOTMENT AREA ADDED	GRA	ALB
B	15/03/17	CLEARED AREAS OF THE ALLOTMENTS ADDED	GRA	ALB
A	21/09/16	GOLF COURSE AREA ADDED	GRA	ALB

Phoenix Survey Services Ltd.
49 William Road, Long Buckby, Northampton NN6 7YS
Tel 07876 658389 or 07810 752133
Email info@phoenixsurveyservices.co.uk

Client: DAVIDSONS

Project Title: Lutterworth Road Blaby

Drawing Title: Topographical Survey Sheet 2 of 2

Drawn	Checked	Approved
GRA	ALB	GRA
Date: 22/06/2016	Scale: 1/500	Sheet Size: A0
Drg. No.: S4071-02		Rev: E

APPENDIX C

GRM Development Solutions
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First Avenue
Centrum 100
Burton upon Trent
Staffordshire, DE14 2WH
www.grm-uk.com

t. 01283 551249

e. info@grm-uk.com

Report type:	Phase I Site Appraisal (Desk Study)
Site:	Lichfield Drive / Golf Course, Blaby
Client's Agent:	Andrew Granger & Co. Ltd
Ref:	GRM/P7791/DS.1
Date:	February 2017

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LAND OFF LICHFIELD DRIVE / GOLF COURSE, BLABY

PHASE I DESK STUDY
FOR
ANDREW GRANGER AND CO. LTD

Project Ref:
P7791

Date:
February 2017

Prepared for:
Andrew Granger and Co Ltd
Phoenix House
52 High Street
Market Harborough
Leicestershire
LE16 7AF

This report has been prepared in accordance with GRM's Accredited Quality Procedures.

If you have any queries regarding this report please contact the project manager in the first instance.

Prepared by:	Reviewed by:	Approved by:
Courtney Blockley-Campton MGeol FGS (Acting Senior Engineering Geologist) *Project Manager* courtney.campton@grm-uk.com	**Matthew Tomkins** BSc PGDip FGS (Acting Principal Engineering Geologist) matt.tomkins@grm-uk.com	**Geoffrey Beckett** FGS CGeol (Director) geoff.beckett@grm-uk.com
When required in-house geological, geotechnical, environmental, structural and civil staff helped to produce this document.		
Issue	Description of Revision	Signature

TABLE OF CONTENTS

APPENDICES

1 INTRODUCTION

1.1 PREAMBLE

GRM Development Solutions Limited (GRM) has been appointed by Andrew Granger & Co. Ltd (Client's Agent) on behalf of Davidson's Developments (Client) to undertake a Phase I Site Appraisal (desk study). The desk study and site inspection form Phase I of the assessment and allow the geotechnical and geo-environmental setting of the site to be determined and the identification of areas of particular concern that require targeted investigation.

This site appraisal is intended to provide information that will assist decision making by identifying potential ground engineering and contamination issues.

GRM Standard Limitations of Reporting are provided in Appendix A of this report.

The Client proposes to develop the site with residential properties and associated infrastructure. The proposed end use includes gardens and soft landscaping. A proposed development plan is not available at this stage.

1.2 OBJECTIVES OF THE SITE APPRAISAL

The principal aims of the Phase I Site Appraisal (desk study) are as follows:

a) Obtain information, from easily accessible sources, about the soil and groundwater conditions within the area of the site.

b) Determine the possible ground related geotechnical and contamination hazards within the site boundaries that may affect the proposed development.

c) Provide preliminary development recommendations.

d) Provide advice on further works required for the cost-effective reduction of risks to the development and procedures likely to satisfy regulators.

Whilst every effort has been made to pre-empt the likely requirements of the Local Authority and the Environment Agency, they are likely to have specific requirements that will need to be discussed and addressed at a later date.

2 PHASE I DESK STUDY AND SITE OBSERVATIONS

2.1 INFORMATION SOURCES

In addition to the general sources of information listed in Appendix A (i) the Client has supplied the following information that has been used in the assessment of the site:

- The location of the site.
- Present site usage.

2.2 SITE DESCRIPTION

2.2.1 Geographical Setting

The site is located approximately 0.75km south of Blaby town centre. The National Grid Reference (NGR) for the approximate centre of the site is SP 566 966. A Site Location and Boundary Plan is presented in Appendix B.

The northern boundary is formed by gardens of properties along Lichfield Drive, the western boundary by Lutterworth Road with a rugby club beyond, the southern boundary by a golf course and the eastern boundary by a recent residential development.

The site topography is flat lying.

2.2.2 Site Inspection Observations

The Site Features Plan/General Site Photographs presented in Appendix C illustrate the salient observations made during a site inspection on 26th January 2017

The site is presently used as a working golf course in the south and abandoned allotment gardens in the north. A public footpath runs through the centre of the site (east west), and the site covers an area of approximately 2 hectares.

The southern half of the site comprises 'Hole 1' of Blaby golf course which is well maintained. The westernmost part of the site is thickly covered with vegetation including trees and bushes but is still accessible.

The northern half of the site comprises abandoned allotment gardens, and is densely covered with vegetation such as brambles and shrubs making the majority of it inaccessible at this stage without clearance works. There are several old sheds across this area, one of which (adjacent to the footpath in the westernmost part of the allotment gardens) appears to be constructed of potential asbestos containing cement sheeting in a poor condition.

The access for the southern area is through the entrance of the golf course and access for the northern abandoned allotment gardens is down a track north of the golf course off Lutterworth Road. There were no services observed during the site visit however buried services often use footpaths and golf courses often have private water outlets throughout.

Significant Features identified during site inspection:
Potential Asbestos Containing Materials – Source of contamination. Current land use (golf course) – Potential use of pesticides. Past land use (allotment gardens) – Potential source of pesticides. Northern half of site overgrown and inaccessible – Will require site clearance prior to ground investigation. Trees (in association with cohesive strata) – Deepened foundations. Potential services – require disconnection prior to development.

2.3 HISTORICAL DEVELOPMENT OF THE SITE

A review of the available historical Ordnance Survey (OS) maps gives an insight into the development of the site and can highlight potential hazards. Extracts of the maps reviewed are provided in Appendix D.

The summary below identifies the historical features identified on the historical mapping data considered likely to have the potential to affect the site.

Date from and to	Identified On-site Hazard	Identified Off-site Hazard
1884 - 1902	The site comprises two fields separated by an east to west trending boundary. A footpath runs along the southern boundary of the site.	Small ponds are shown 90m and 130m to the north east. An area of marshy ground is shown 40m to the north.
1904 - 1928	The northern half of the site is labelled as allotment gardens.	The land to the north is also labelled as allotment gardens.
1930	A small structure is shown in the eastern part of the site from 1930 onwards.	A building inferred to be a glass house appears in the land directly west of the site. The footpath now runs diagonally across the southern half of the site.
1957	The northern half of the site is divided by minor boundaries. Small structures are present across the site.	A number of residential properties are shown to the northwest. A sports ground is shown to the west.
1969	An additional structure appears in the northern site area.	Extensive residential developments beyond the northern boundary. An electricity pylon runs east to west beyond the southern boundary. The ponds are no longer present and presumed to be infilled.
1974 - 1992	The southern half of the site forms part of a nursery. A additional structure appears in the northern area.	No significant changes.
1994 - 2014	The footpath now runs east to west through the centre of	A golf course is shown directly south of the site.

	the site. The southern half off the site is still indicated to be a nursey, and the northern half as allotment gardens with one of the buildings no longer present.	

Significant Features identified on OS Maps:
Allotment structures (Potential Asbestos Containing Materials) – Source of contamination. Small structures – Localised presence of made ground (limited thickness). Historic land uses (allotment gardens and nursery) – Potential shallow soil contamination, including use of pesticides. Off-site infilled ponds – Potential source of ground gas (negligible risk due to cohesive strata).

2.4 ANTICIPATED GEOLOGY

The BGS Geological Sheet for this area shows:

- Superficial deposits of Glacial Till in the eastern section of the site, generally comprising gravelly clay.

- Solid geology of Branscombe Mudstone Formation comprising mudstone, likely to be weathered to clay at close to the ground surface. This stratum has the potential to contain locally elevated concentrations of sulphate.

There are no relevant BGS borehole records in close proximity to the site.

The site is not indicated to be directly affected by faulting; and no faults are indicated within 500m.

Localised areas of made ground, including limited buried foundations, can be expected due to the presence of small buildings (both existing and demolished) from its past development as allotment gardens.

Significant Features identified from geological data:
Cohesive Strata (in association with trees) – Deepened foundations. Variable strata – Deepened foundations. Potential elevated sulphate – Appropriate concrete class. Potential made ground – Source of contamination.

2.5 HYDROGEOLOGICAL INFORMATION

The Environment Agency has classified the underlying Superficial Strata (Glacial Till) as a Secondary Undifferentiated Aquifer, and the underlying Solid Geology (Branscombe Mudstone Formation) as a Secondary B Aquifer.

The Glacial Till is considered likely to be predominantly cohesive in nature and unlikely to contain significant amounts of groundwater. The Branscombe Mudstone

Formation strata are also considered likely to be predominantly cohesive in nature with thin water bearing horizons. The cohesive nature of these strata should restrict the migration of any contamination.

There are no recorded groundwater abstraction licenses within 500m of the site, and the site is not recorded to be within a Groundwater Source Protection Zone.

Information available at this stage suggests minor volumes of perched groundwater may be present within the granular pockets of the Glacial Till, and water bearing horizons within the Branscombe Mudstone Formation.

Due to the presence of predominantly cohesive strata, hydraulic continuity is not expected between ground level and the water bearing horizons within the underlying aquifers.

Significant Features identified from hydrogeological data:
Secondary Aquifers – Low risk.

2.6 HYDROLOGICAL INFORMATION

The only local surface water feature is a drain classified as a secondary river is shown 490m south west of the site, leading directly into Whetstone Brook (Primary River) 550m to the south west. Given the distance from the site and presence of cohesive strata this is not considered to be a potential surface water receptor.

No pollution incidents have been recorded within 500m of the site.

There are no surface water abstraction licenses within 2km of the site.

Significant Features identified from hydrological data:
None identified.

2.7 FLOOD RISK

The BGS suggests the site is within an area of potential groundwater flooding related to Superficial Deposits Flooding (shallow unconsolidated sedimentary aquifers overlying unproductive aquifers) and that the confidence level is high. A Phase II ground investigation would assess the risk, but any risk would be catered for within the development infrastructure design.

The site is not recorded to be within 250m of an indicative fluvial floodplain, and the Environment Agency's Internet based flood risk maps suggest there is no risk from river flooding.

A flood risk assessment is required as the site area is in excess of 1ha.

Significant Flood Risk Features identified:
Site area >1ha – Flood Risk Assessment Required.

2.8 MINING

The site is not within an area recorded to require a Coal Authority mining report and no shallow coal seams are recorded, therefore, the risk from coal mining is considered to be negligible.

Significant Mining Risks:
None identified.

2.9 QUARRYING

There is no evidence of any non-coal mineral extraction having taken place within, or close to, the site area.

Significant Quarrying Risks:
None identified.

2.10 ENVIRONMENTAL INFORMATION

An Environmental Report has been acquired for the site. The full report is presented in Appendix E. A summary of the relevant information not included elsewhere in this report is presented below:

- There are no recorded landfill sites within 1km of the site boundary.
- There are a number of industrial land uses within 250m of the site, including a motor products store 119m to the southwest. However; none of these are considered likely to directly affect the site.

No significant environmental hazards, that are considered likely to pose a potential risk to the site, have been identified from the available information.

Significant Features identified from Environmental data:
None identified.

2.11 ARCHAEOLOGY

Archaeological information has not been sought as part of this desk study and has not been identified as an issue by the Client. Some Local Authorities require at least an initial archaeological appraisal for development sites. GRM can undertake such appraisals if required. Archaeological investigations occasionally reveal ground-related problems from ancient times (prior to the 1st Edition OS maps) and can occasionally cause foundation and contamination development hazards.

Archaeological Hazards:
Not researched.

2.12 INVASIVE PLANT SPECIES/ECOLOGY

GRM is not a specialist in this topic and has not conducted such a survey; however, we will endeavour to report easily recognisable issues such as Japanese Knotweed, Giant Hogweed, badger sets etc, when seen on site. No such issues were observed during the walkover; however, an ecological specialist should be consulted.

Invasive Plant Species/Ecological Hazards:
None identified.

2.13 RADON ASSESSMENT

The site has been assessed following the guidelines in 'Radon: guidance on protective measures for new dwellings' (BR211 2015). The site is not within an area recorded to require radon protection measures.

Radon Hazard:
None.

2.14 SUMMARY OF POTENTIAL GEOTECHNICAL/GENERAL HAZARDS

Potential geotechnical/general hazards have been identified in earlier sections and are summarised below.

Potential Hazard	Potential Consequence	Action
Live services.	Danger to personnel.	Inform relevant parties for disconnection / diversion.
Dense vegetation.	Access constraint.	Site clearance prior to ground investigation.
Existing minor structures / buildings.	Buried structures.	Ground investigation.
Localised made ground associated with allotment land use.	Deepened foundations.	Ground investigation.
Cohesive strata (poor draining).	Poor trafficability during inclement weather.	Possible need to improve near surface strata.
Flood risk / groundwater flooding.	Damage to properties or infrastructure.	Flood Risk Assessment and appropriate infrastructure design.
Variable strata.	Deepened foundations.	Ground investigation.
Shrinkable clay/trees	Deepened foundations.	Ground investigation plasticity testing/tree survey.
Potentially elevated levels of sulphate and / or acidic ground conditions.	Danger to buried concrete.	Soil testing and adoption of appropriate concrete specification.

Potential sources, pathways and receptors are summarised in the Phase I Conceptual Model in Section 3, which is based on current relevant guidance, the principles of which are set out in Appendix A (iii).

Where appropriate potential hazards to the proposed development are shown on the site features plan presented in Appendix C.

2.15 CONTAMINANTS OF CONCERN

In addition to the general contaminants listed in Appendix A (ii), the following site specific contaminants have been identified:

- PAHs associated with allotment garden activities e.g. bonfires.
- Pesticides associated with nursery, allotment gardens and golf course land uses.
- Asbestos associated with allotment garden structures.

3 PHASE I CONCEPTUAL SITE MODEL

HUMAN HEALTH			
Source	**Pathway**	**Receptor**	**Level of Risk**
Potentially contaminated made ground associated with previous allotment development.	Indoor and outdoor inhalation of soil dust, the ingestion of, and dermal contact with, contaminated soil and soil dust, ingestion of vegetables that have taken up contamination and contaminated soil attached to vegetables.	End users.	Low.
Pesticides associated with historical site use.		Construction and Maintenance Workers.	
Made ground.	Inhalation of ground gas.	End users.	Very low (Based on BS8576), and as only a limited thickness is anticipated.
Asbestos containing materials associated with allotment buildings.	Inhalation of asbestos fibres.	Construction and Maintenance Workers.	Moderate.
Made ground / allotment chemicals.	Water pipes.	End users.	Very Low.

CONTROLLED WATERS			
Made ground.	Leaching of contaminants and vertical migration to the groundwater. (Restricted due to suspected presence of cohesive strata).	Secondary Aquifers.	Low.

4 CONTAMINATION / REMEDIATION RECOMMENDATIONS

The risk of ground contamination is considered low to moderate.

The risk from ground gas is considered to be very low.

Prior to development a ground investigation will be required, the scope of which is outlined in Section 6; However, at this stage based on the desk study information available it is considered that allowance be made for the following:

- A suitable capping system in 50% of soft landscaped areas in northern site area (former allotment gardens).
- Removal of contamination hot spots.
- Upgraded water pipes (protecta line or similar).
- If a significant thickness of made ground is identified, gas protection measures comprising under floor venting (i.e. beam and block floors), gas barrier membrane fully sealed around service entries and extended across cavities.

5 PRELIMINARY GEOTECHNICAL ASSESSMENT

It should be noted that the following comments and recommendations are based on the findings of this desk study which may not give a true indication of a soils actual engineering properties (i.e. stability, mass structure etc). Prior to development a ground investigation will be required to confirm the initial recommendations outlined below, the scope of which is outlined in Section 6. However, at this stage based on the desk based information available it is considered:

- The ground conditions are likely to comprise cohesive deposits of Glacial Till and Weathered Branscombe Mudstone Formation strata. Rock is not expected to be present at shallow depth.
- Due to the suspected presence of cohesive soils and the presence of trees, particularly around the margins and north of the site, allowance should be made for deepening foundations in accordance with NHBC standards. At this stage it should be assumed that 80% of plots will require some degree of deepening below minimum depth. Approximately 50% of the site will need to be piled, and providing deep made ground and/or soft or loose materials are not present the remaining 50% of the site may be suitable for the use of traditional trench fill foundations.
- Due to effects of tree influence across the site, at this stage an allowance should be made for the use of suspended voided floors (such as beam and block) throughout the development.
- If elevated concentrations of sulphate are identified, an upgraded concrete class will be required.
- Given the anticipated geology the adoption of a soakaway drainage system is considered unlikely.
- Given the anticipated geology CBR values of approximately 2% are considered likely in shallow cohesive soils.

6 FURTHER INVESTIGATION

A Phase II ground investigation is recommended to determine more accurately the effect of the identified hazards on the development. Initially, this should include:

- A ground investigation designed to BS10175:2011 and BS5930:2015 comprising window sampling and trial pitting will be required to confirm ground conditions and collect samples for analysis. Based on a site area of 2.0Ha and an investigation on a 50m grid, 15No. exploratory holes are envisaged. Subsequent cable percussive boreholes may be required for pile design information.
- Chemical analysis of soils followed by risk assessment so that the risk to human health and controlled waters can be determined.
- Based on the Phase I Conceptual Model (Section 3) the ground gas risk has been assessed as very low. If a source of ground gas is identified a ground gas investigation designed to BS8576:2013 will be required, to determine the ground gas regime beneath the site and allow any necessary mitigation measures to be recommended. At this stage allowance for 6 visits over 3 months should be made to assess potential liabilities.
- Geotechnical soils testing of the founding strata to assess its character and suitable grades of buried concrete.
- A Tree Survey is recommended to accurately determine foundation depths in line with NHBC Standards Chapter 4.2.
- Flood Risk Assessment.
- Asbestos Survey prior to site clearance.

Following your review of this document, a copy of it should be submitted to the Planning Department of the Local Authority for comment and approval prior to any ground investigation works being undertaken, as this is often a condition of planning.

7 CONCLUSIONS

This Phase I Site Appraisal has shown the site is suitable for the proposed development, assuming compliance with all the recommendations contained within this report.

APPENDIX D


British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL
Geology of Britain viewer
Try the Beta version of our 3D Geology of Britain viewer
More BGS map viewers
Surface Geology
3D Models
Borehole Scans
Earthquake Timeline
Go to Location
Switch Basemap
100%
0%
Geology Transparency
Grid Ref: 456043, 297207
Borehole Scans
Click on a borehole to view scan.
Borehole depth
0 - 10m
10 - 30m
30m+
Unknown
Confidential or Restricted
More on boreholes
SP59NE13
SP59NE14
SP59NE16
SP59NE17
SP59NE151
SP59NE215
SP59NE216
SP59NE217
SP59NE218
SP59NE21
SP59NE22
SP59NE23
SP59NE24
SP59NE25
SP59NE26
SP59NE27
SP59NE28
SP59NE29
SP59NE31
SP59NE52
SP59NE58
SP59NE66
Willow Road
Cherry Road
Maple Avenue
Hawthorn Drive
Cedar Road
Wykeham Close
Southway
Lichfield Drive
Winchester Road
Wynton Close
Waverley Road
Hospital Lane
Barrowcliff Way
Roper Close
Scouting Way
Lutterworth Road
Blaby By Pass
A426
Hind Close
Whittle Close
Woolton Close
Ridley Close
Hunter Road
Badgerbrook Primary School
Oliver Park
Charles Way
Bigg's Close
Upex Close
Dog and Gun Lane
Peacock Drive
Cooper Crescent
Hoffler Close
Albert Road
Scalborough Close
Borrowcup Close
Tebbs Close
Clarke Crescent
The Whittle Industrial Estate
Cambridge Road
Bruce Way
200m

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Version 2.0.6

BGS ID: 339372 : BGS Reference: SP59NE13
British National Grid (27700) : 455660,296740
Report an issue with this borehole

GEOLOGICAL SURVEY OF GREAT BRITAIN

RECORD OF SHAFT OR BORE FOR MINERALS

(For Survey use only)
6-inch Map Registered No.
SP 59 NE/13

Name of Shaft or Bore given by Geological Survey:

Name and Number given by owner: N°11

For whom made English Electric Company.

Town or Village & Whetstone County Leics.

Exact site

Attach a tracing from a map, or a sketch-map, if possible.

Purpose for which made Trial

Nat. Grid Reference 5566.9674

1" N.S.Map No.	1" O.S.Map No.	Confidential or not
170		

Ground Level at ~~shaft~~ bore relative to O.D. 230' (70.10m)

If not ground level give O.D. of beginning of shaft bore

Made by

Date of sinking

Information from E.E.Co.

Date received

Examined by

SPECIMEN NUMBERS AND ADDITIONAL NOTES

1500 yds at 288° from Willow Farm, Blaby.

(For Survey use only) Geological Classification	Description of Strata		Thickness Ft.	Thickness In.	Depth Ft.	Depth In.
Drift	Top Soil	(0.30)	1	0	(0.30) 1	0
	Hard brown sandy boulder clay	(2.13)	7	0	(2.44) 8	0
	Hard grey boulder clay	(2.59)	8	4	(5.03) 16	6
	Sand & stones	(1.07)	3	6	(6.10) 20	0
Keuper Marl	Hard Red Marl	(14.02)	46	0	(20.12) 66	0
	Hard Grey marly clay	(0.91)	3	0	(21.03) 69	0
	Hard marl	(1.83)	6	0	(22.86) 75	0
Keuper Sandstone	Hard grey mudstone & shale	(3.96)	13	0	(26.82) 88	0
	Hard grey & red shale	(3.05)	10	0	(29.87) 98	0
	Hard grey sandstone	(0.61)	2	0	(30.48) 100	0

Ed. Gp.863


(5412) Wt.32837/PS.154 2m 10/64 G.W.B.L
British Geological Survey
British Geological Survey
British Geological Survey
British Geological Survey
British Geological Survey
British Geological Survey

Version 2.0.6

BGS ID: 339373 : BGS Reference: SP59NE14
British National Grid (27700) : 455640,296680
Report an issue with this borehole

GEOLOGICAL SURVEY OF GREAT BRITAIN

RECORD OF SHAFT OR BORE FOR MINERALS

(For Survey use only)
6-inch Map Registered No.
SP 59 NE/14

Name of Shaft or Bore given by Geological Survey:

Name and Number given by owner: No 12

Nat. Grid Reference 5564 9668

For whom made English Electric Company

Town or Village Swhetstone County Leics

Exact site ... Attach a tracing from a map, or a sketch-map, if possible.

1" N.S.Map No.	1" O.S.Map No.	Confidential or not
170		

Purpose for which made Trial

Ground Level at shaft bore relative to O.D. 230' If not ground level give O.D. of beginning of shaft bore

Made by (T.L.P.) Date of sinking

Information from E.E. Co. Date received

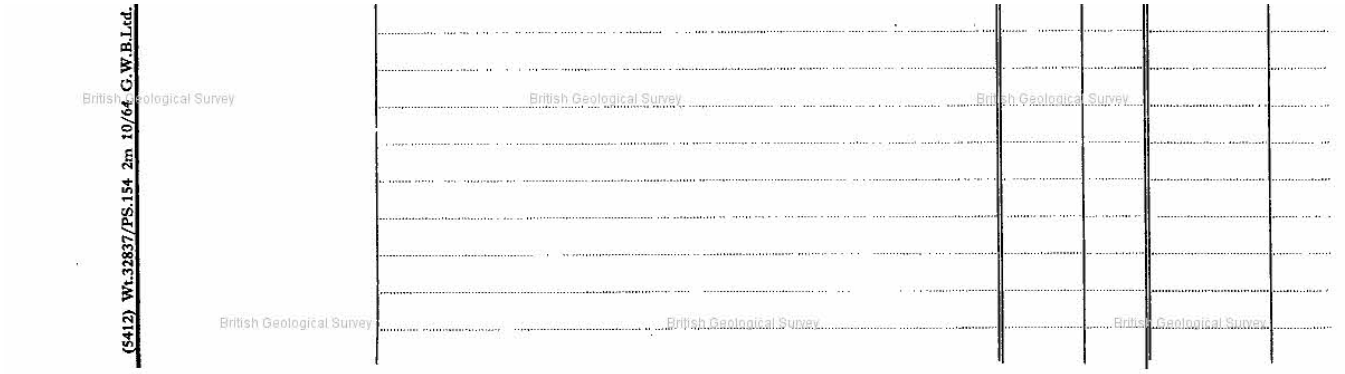
Examined by

SPECIMEN NUMBERS AND ADDITIONAL NOTES

1510 yds from Willow Farm, Blaby
at 285°

(For Survey use only) Geological Classification	Description of Strata		Thickness Ft.	Thickness In.	Depth Ft.	Depth In.
	Topsoil	(0.61)	2		d(0.61) 2	0
	Brown Clay	(0.61)	2		d(1.22) 4	0
	Stiff blue clay	(0.76)	2	6	(1.98) 6	6
	Hard blue boulder clay	(2.59)	8		(4.57) 15	0
	Hard brown sandy boulder clay	(1.98)	6		d(6.55) 21	6
Kemper Marl	Hard red marly clay	(3.20)	10		(9.75) 32	0
	Hard red marl	(2.44)	8		d(12.19) 40	0

Gp.863



British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Version 2.0.6

BGS ID: 19398714 : BGS Reference: SP59NE216
British National Grid (27700) : 455875,296209
Report an issue with this borehole

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Site	Number
Badgerbrook School Extension, Whetstone, Leicestershire	WS2

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Window Sampler		68.69	Structural Design Consultants	P3885(b)
	Location	**Dates**	**Engineer**	**Sheet**
	455875.47 E 296209.74 N	06/04/2006		1/1

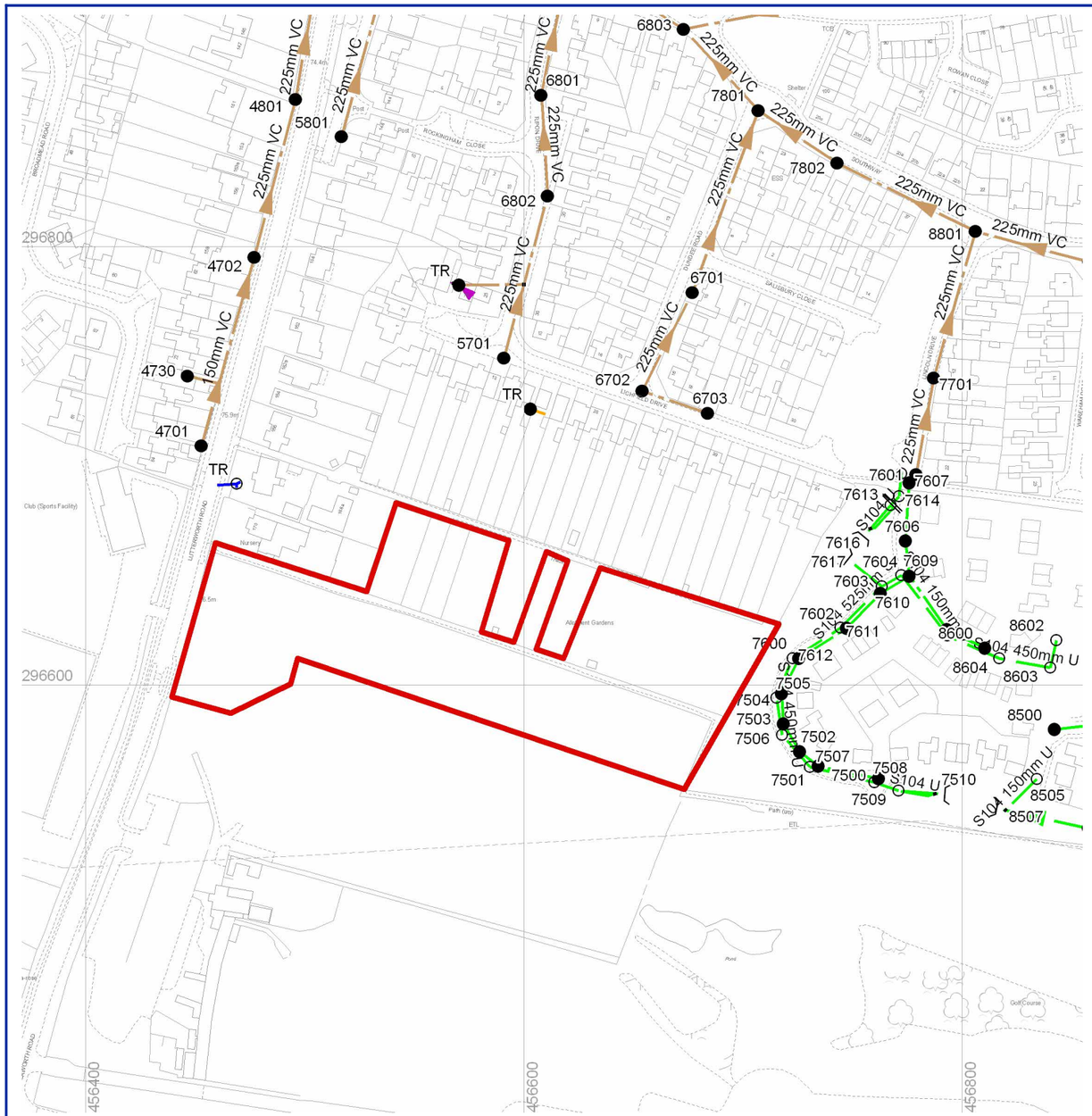
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.30-0.30	D01					Grass over orange-brown slightly clayey gravelly SAND. Gravel is subrounded to rounded fine to coarse quartz, sandstone and angular to subangular grey sandstone and flint. (PROBABLE MADE GROUND)		
0.50-0.50	B01				(1.00)	Below 0.60m bgl, becoming clayey.		
1.00-1.45	SPT N=20		2,2/3,5,5,7	67.69	1.00			
1.10-1.10	D01				(0.20)	Stiff fissured red-brown and green-grey, occasional weathered black slightly sandy slightly gravelly CLAY. Gravel is subangular to rounded fine quartz and mudstone. (GLACIAL TILL)		
1.50-1.50	I01			67.49	1.20			
1.50-1.50	D02				(0.50)			
1.60-1.60	I02		06/04/2006:	66.99	1.70	Stiff to very stiff fissured red-brown mottled black and some green-grey slightly sandy CLAY. (MERCIA MUDSTONE GROUP)		
1.65-1.65	I03							
1.70-2.15	SPT N=39		3,6/8,9,10,12			Complete at 1.70m		

Remarks
1. Hand dug service pit to 1.0m bgl. 2. Borehole remained dry during excavation. 3. Backfilled with arisings on completion.

Scale (approx)	Logged By
1:50	AC/KT

Figure No.

APPENDIX E



Sewer Node / Sewer Pipe Data

REFERENCE	COVER LEVEL	INV LEVEL UPSTR	INV LEVEL DOWNSTR	PURP	MATL	SHAPE	MAX SIZE	MIN SIZE	GRADIENT	YEAR LAID
SP56964701	75.64	73.74	73.16	F	VC	C	150	nil	156.65	nill
SP56964702	75.02	73.15	72.52	F	VC	C	225	nil	118.19	nill
SP56964730	nil	nil	nil	F	nil	C	nil	nil	0.00	nill
SP56964801	74.19	72.51	71.36	F	VC	C	225	nil	67.04	nill
SP56965701	75.45	73.18	72.80	F	VC	C	225	nil	201.74	nill
SP56965801	74.54	72.59	71.91	F	VC	C	225	nil	121.64	nill
SP56966701	75.88	74.27	73.64	F	VC	C	225	nil	137.91	nill
SP56966702	76.31	74.73	74.29	F	VC	C	225	nil	114.86	nill
SP56966703	76.72	75.11	74.73	F	VC	C	225	nil	83.21	nill
SP56966801	74.44	72.45	71.89	F	VC	C	225	nil	114.88	nill
SP56966802	75.00	72.79	72.47	F	VC	C	225	nil	144.06	nill
SP56966803	74.94	73.20	71.88	F	VC	C	225	nil	47.02	nill
SP56967500	nil	nil	nil	F	U	C	150	nil	0.00	nill
SP56967501	nil	nil	nil	F	U	C	150	nil	0.00	nill
SP56967502	nil	nil	nil	F	U	C	150	nil	0.00	nill
SP56967503	nil	nil	nil	F	U	C	150	nil	0.00	nill
SP56967504	nil	nil	nil	F	U	C	150	nil	0.00	nill
SP56967505	nil	nil	nil	S	U	C	450	nil	0.00	nill
SP56967506	nil	nil	nil	S	U	C	450	nil	0.00	nill
SP56967507	nil	nil	nil	S	U	C	450	nil	0.00	nill
SP56967508	nil	nil	nil	S	U	C	450	nil	0.00	nill
SP56967509	nil	nil	nil	S	U	C	450	nil	0.00	nill
SP56967600	nil	nil	nil	F	U	C	150	nil	0.00	nill
SP56967601	77.95	76.24	75.87	F	VC	C	225	nil	120.86	nill
SP56967602	nil	nil	nil	F	U	C	150	nil	0.00	nill
SP56967603	nil	nil	nil	F	U	C	150	nil	0.00	nill
SP56967604	nil	nil	nil	F	U	C	150	nil	0.00	nill
SP56967605	nil	nil	nil	F	U	C	150	nil	0.00	nill
SP56967606	nil	nil	nil	F	U	C	150	nil	0.00	nill
SP56967607	nil	nil	nil	F	U	C	150	nil	0.00	nill
SP56967608	nil	nil	nil	S	U	C	450	nil	0.00	nill
SP56967609	nil	nil	nil	S	U	C	525	nil	0.00	nill
SP56967610	nil	nil	nil	S	U	C	600	nil	0.00	nill
SP56967611	nil	nil	nil	S	U	C	525	nil	0.00	nill
SP56967612	nil	nil	nil	S	U	C	525	nil	0.00	nill
SP56967613	nil	nil	nil	S	U	C	300	nil	0.00	nill
SP56967614	nil	nil	nil	S	U	C	300	nil	0.00	nill
SP56967701	77.43	75.85	74.38	F	VC	C	225	nil	47.37	nill
SP56967801	75.36	73.60	73.22	F	VC	C	225	nil	128.85	nill
SP56967802	75.66	73.84	73.66	F	VC	C	225	nil	240.39	nill
SP56968500	nil	nil	nil	F	U	C	150	nil	0.00	nill
SP56968505	nil	nil	nil	S	U	C	150	nil	0.00	nill
SP56968600	nil	nil	nil	F	U	C	150	nil	0.00	nill
SP56968602	nil	nil	nil	S	U	C	300	nil	0.00	nill

- Abandoned Gravity Sewer
- Private Combined Gravity Sewer
- Private Foul Gravity Sewer
- Private Surface Water Gravity Sewer
- Public Combined Gravity Sewer
- Public Foul Gravity Sewer
- Public Surface Water Gravity Sewer
- Trunk Combined Gravity Sewer
- Trunk Foul Use Gravity Sewer
- Trunk Surface Water Gravity Sewer
- Combined Use Pressurised Sewer
- Foul Use Pressurised Sewer
- Surface Water Pressurised Sewer
- Highway Drain
- Combined Lateral Drain (SS)
- Foul Lateral Drain (SS)
- Surface Water Lateral Drain (SS)

All Private Sewers are shown in magenta
All section 104 sewers are shown in green
All Sewers that have been transferred to Severn Trent Water after the 1st October 2011, but have not been surveyed and confirmed by Severn Trent Water are shown in orange

- Culverted Watercourse
- Cable, Earthing
- Cable Junction
- Cable, Optical Fibre/Instrumentation
- Cable, Low Voltage
- Cable, High Voltage
- Cable, Other
- Housing, Building
- Housing, Kiosk
- Disposal Site
- Sewage Treatment Works
- Housing, Other
- Pipe Support Structure
- Sewage Pumping Facility
- Sewer Facility Connection Inlet / Outlet

- Blind Shaft
- Combined Use Manhole
- Flushing Chamber
- Foul Use Manhole
- Grease Trap
- Head Node
- Hydrobrake
- Lamphole
- Outfall
- Overflow
- Penstock
- Petrol Interceptor

- Sewer Chemical Injection Point
- Sewer Junction
- Sewerage Air Valve
- Sewerage Hatch Box Point
- Sewerage Isolation Valve
- Soakaway
- Surface Water Manhole
- Vent Column
- Waste Water Storage
- Pre-1937 Properties

TABULAR KEY
Sewer pipe data refers to downstream sewer pipe.
Where the node bifurcates (splits) X and Y indicates downstream sewer pipe.
Gradient is stated a 1 in...

A.
B.
C.

MATERIALS

- - NONE
AC - ASBESTOS CEMENT
BR - BRICK
CC - CONCRETE BOX CULVERT
CI - CAST IRON
CO - CONCRETE
CSB - CONCRETE SEGMENTS (BOLTED)
CSU - CONCRETE SEGMENTS (UNBOLTED)
DI - DUCTILE IRON
GRC - GLASS REINFORCED CONCRETE
GRP - GLASS REINFORCED PLASTIC
MAC - MASONRY IN REGULAR COURSES
MAR - MASONRY RANDOMLY COURSED
PE - POLYETHLENE
PF - PITCH
PP - POLYPROPYLENE
PSC - PLASTIC STEEL COMPOSITE
PVC - POLYVINYL CHLORIDE
RPM - REINFORCED PLASTIC MATRIX
SI - SPUN (GREY) IRON
ST - STEEL
U - UNKNOWN
VC - VITRIFIED CLAY
XXX - OTHER

SHAPE

C - CIRCULAR
E - EGG SHAPED
O - OTHER
R - RECTANGLE
S - SQUARE
T - TRAPEZOIDAL
U - UNKNOWN

PURPOSE

C - COMBINED
E - FINAL EFFLUENT
F - FOUL
L - SLUDGE
S - SURFACE WATER

CATEGORIES

W - WEIR
C - CASCADE
DB - DAMBOARD
SE - SIDE ENTRY
FV - FLAP VALVE
BD - BACK DROP
S - SIPHON
HD - HIGHWAY DRAIN
S104 - SECTION 104

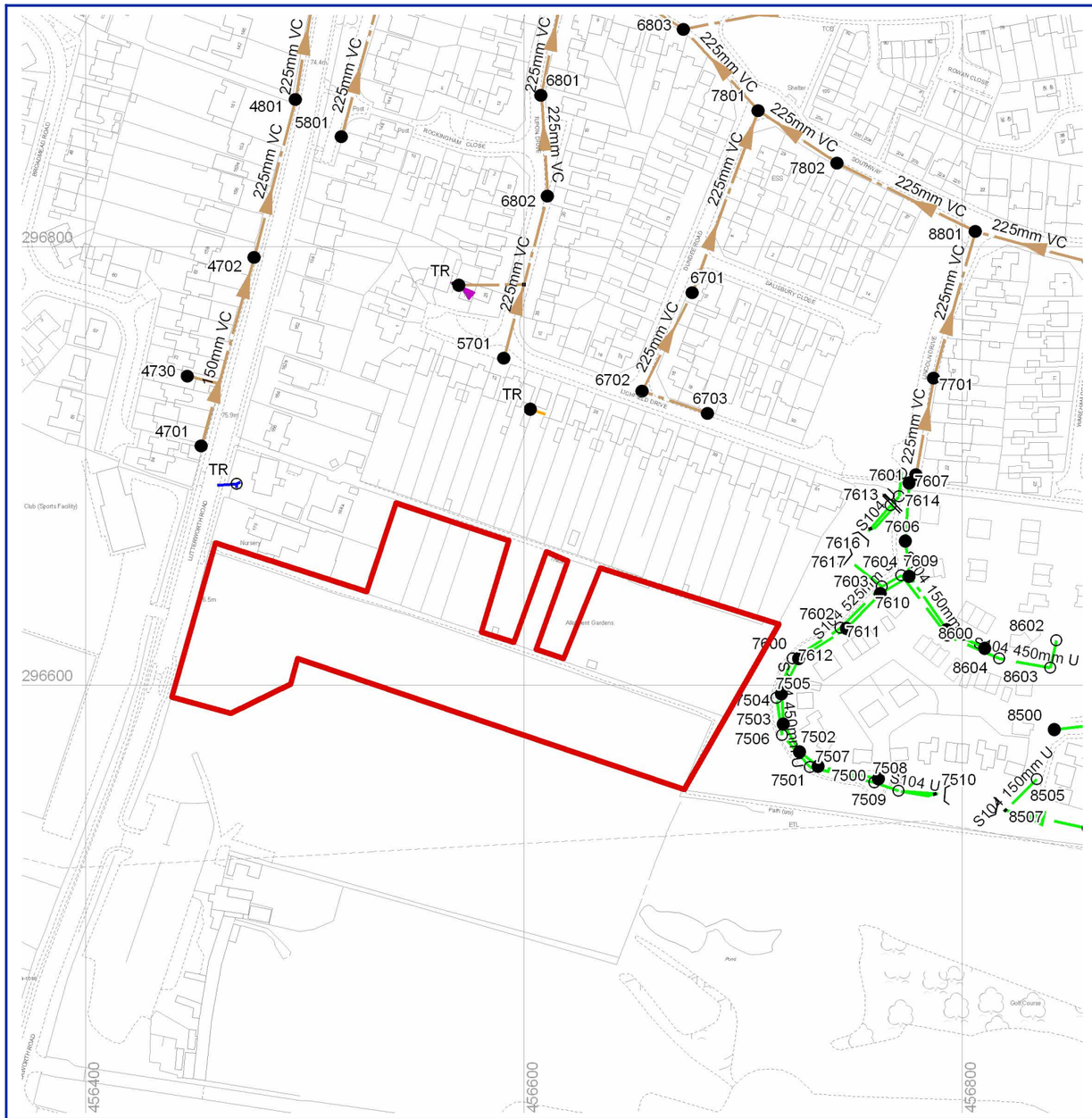
SEVERN TRENT WATER

Severn Trent Water Limited
Asset Data Management
PO Box 5344
Coventry
CV3 9FT
Telephone: 0845 601 6616

SEWER RECORD (Tabular)

O/S Map scale: 1:2500
Date of issue: 24.05.17
Sheet No. 1 of 2

This map is centred upon:
O / S Grid reference:
x : 456613
y : 296655



Sewer Node / Sewer Pipe Data

REFERENCE	COVER LEVEL	INV LEVEL UPSTR	INV LEVEL DOWNSTR	PURP	MATL	SHAPE	MAX SIZE	MIN SIZE	GRADIENT	YEAR LAID
SP56968603	nil	nil	nil	S	U	C	450	nil	0.00	nill
SP56968604	nil	nil	nil	S	U	C	450	nil	0.00	nill
SP56968801	76.35	74.35	73.86	F	VC	C	225	nil	143.29	nill
nil	nil	nil	nil	F	VC	nil	nil	nil	0.00	nill
nil	nil	nil	nil	F	VC	nil	nil	nil	0.00	nill

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- Private Surface Water Gravity Sewer
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- Disposal Site
- Sewage Treatment Works
- Housing, Other
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- Sewage Pumping Facility
- Sewer Facility Connection Inlet / Outlet

- Blind Shaft
- Combined Use Manhole
- Flushing Chamber
- Foul Use Manhole
- Grease Trap
- Head Node
- Hydrobrake
- Lamphole
- Outfall
- Overflow
- Penstock
- Petrol Interceptor

- Sewer Chemical Injection Point
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- Surface Water Manhole
- Vent Column
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- Pre-1937 Properties

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GRP - GLASS REINFORCED PLASTIC
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PF - PITCH
PP - POLYPROPYLENE
PSC - PLASTIC STEEL COMPOSITE
PVC - POLYVINYL CHLORIDE
RPM - REINFORCED PLASTIC MATRIX
SI - SPUN (GREY) IRON
ST - STEEL
U - UNKNOWN
VC - VITRIFIED CLAY
XXX - OTHER

SHAPE

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E - EGG SHAPED
O - OTHER
R - RECTANGLE
S - SQUARE
T - TRAPEZOIDAL
U - UNKNOWN

PURPOSE

C - COMBINED
E - FINAL EFFLUENT
F - FOUL
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CATEGORIES

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DB - DAMBOARD
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S104 - SECTION 104

SEVERN TRENT WATER

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SEWER RECORD (Tabular)

O/S Map scale:	1:2500
Date of issue:	24.05.17
Sheet No.	2 of 2

This map is centred upon:
O / S Grid reference:
x : 456613
y : 296655

APPENDIX F

Flood map for planning

Your reference	Location (easting/northing)	Created
E3646 - Blaby	**456584/296616**	**6 Dec 2021 12:19**

Your selected location is in flood zone 1, an area with a low probability of flooding.

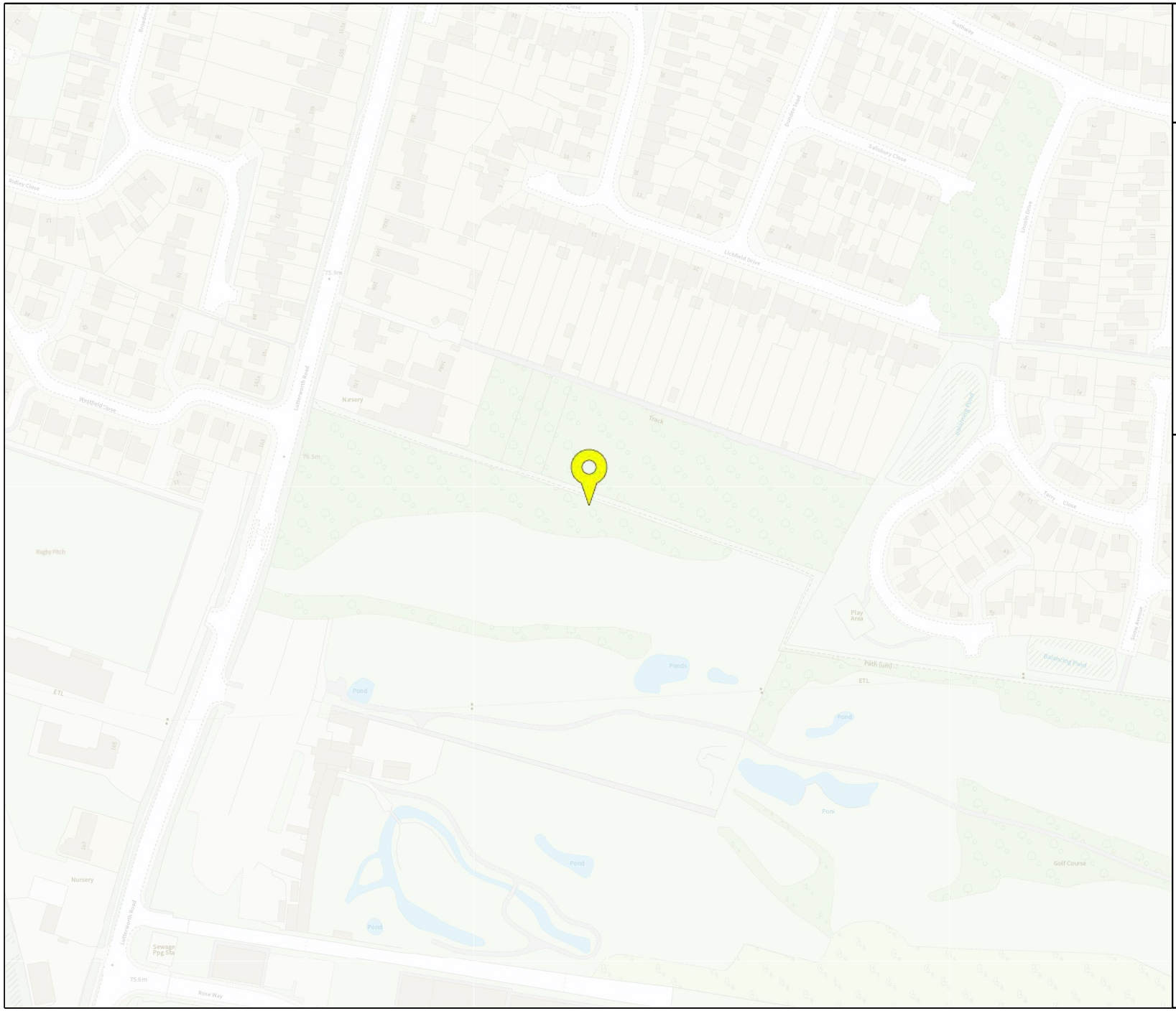
This means:

- you don't need to do a flood risk assessment if your development is smaller than 1 hectare and not affected by other sources of flooding
- you may need to do a flood risk assessment if your development is larger than 1 hectare or affected by other sources of flooding or in an area with critical drainage problems

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.



Environment Agency

Flood map for planning

Your reference
E3646 - Blaby

Location (easting/northing)
456584/296616

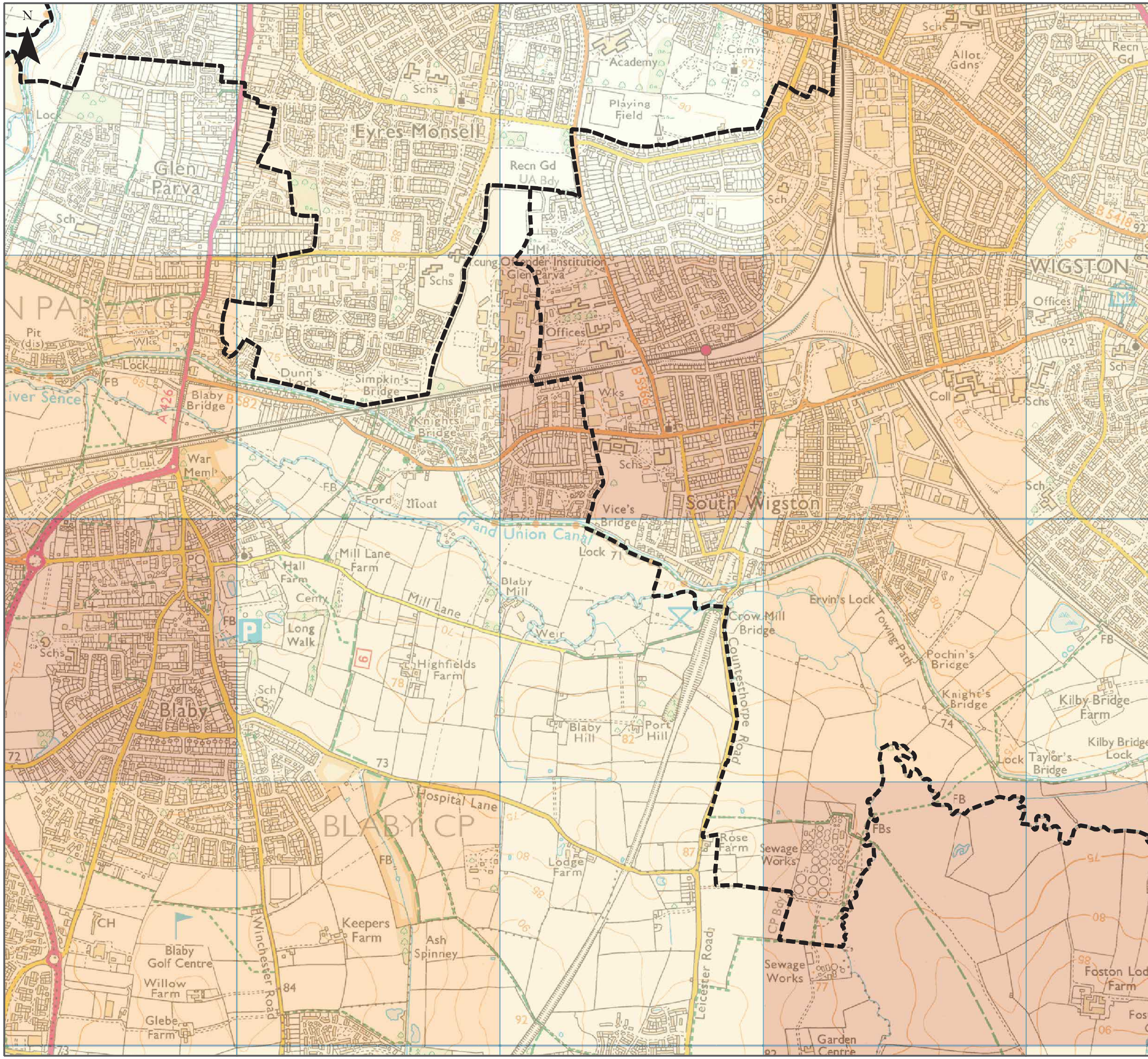
Scale
1:2500

Created
6 Dec 2021 12:19

- Selected point
- Flood zone 3
- Flood zone 3: areas benefitting from flood defences
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Flood storage area

0 20 40 60m

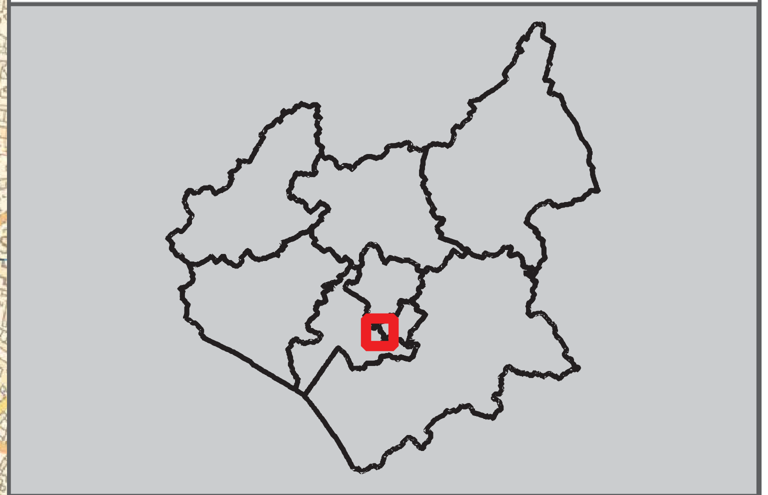
APPENDIX G



STRATEGIC FLOOD RISK ASSESSMENT LEVEL 1

APPENDIX A: FLOOD RISK MAPPING

INDEX GRID: 49



LEGEND

Authority Information
- Study boundary
- Main River
- Detailed River Network

Climate Change (2080s)
- 1% AEP Climate Change Lower
- 1% AEP Climate Change Central
- 1% AEP Climate Change Upper

Flood Zones
- Flood Zone 3b
- Flood Zone 3a
- Flood Zone 2

Surface Water
- 3.3% RoFSW AEP
- 1% AEP RoFSW
- 0.1% AEP RoFSW

Ordinary Watercourse Modelling
- 3% AEP
- 1% AEP
- 0.1% AEP

Areas Susceptible to Groundwater Flooding
- ✔ >= 75%
- >= 50% <75%
- >= 25% <50%
- < 25%

Reservoir Inundation
- Reservoir Inundation

Mapping Supporting Information

Return to Index Map

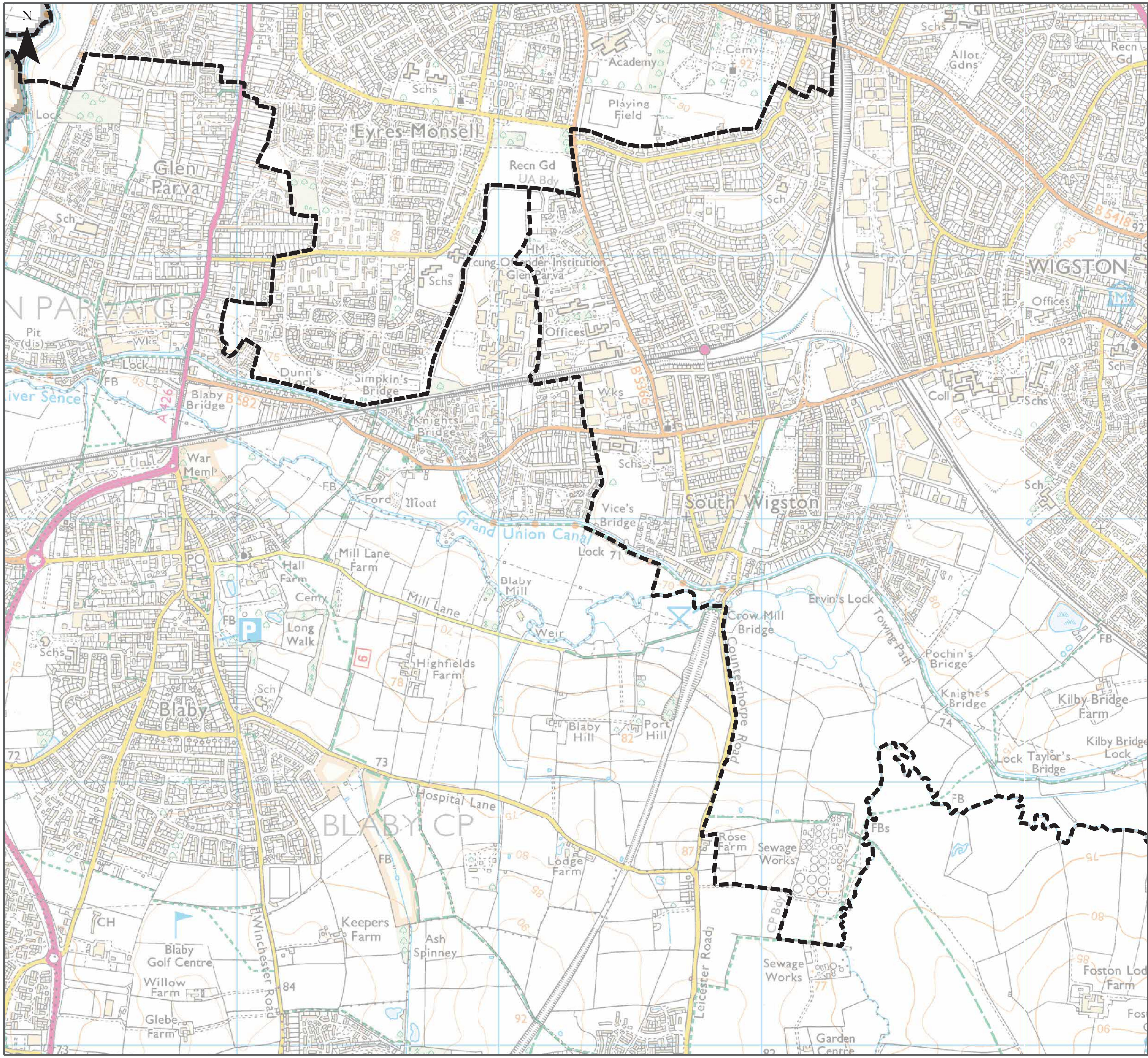
0 12.5 25 50 75 100 km

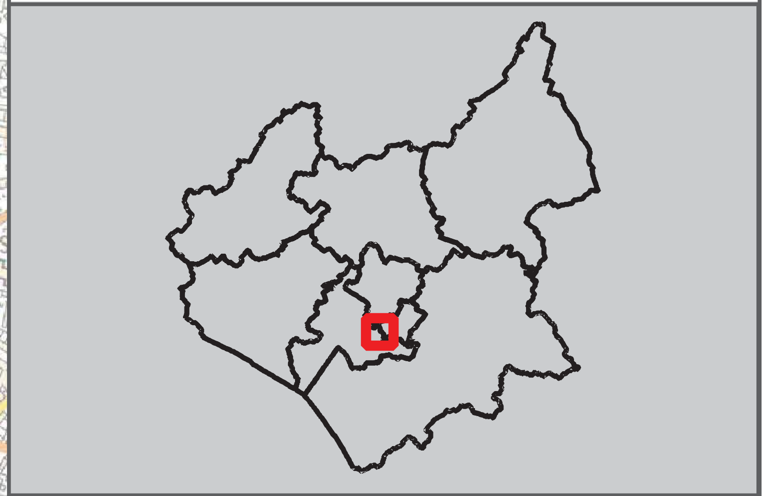
JBA consulting

STRATEGIC FLOOD RISK ASSESSMENT LEVEL 1

APPENDIX A: FLOOD RISK MAPPING

INDEX GRID: 49





LEGEND

Authority Information
- Study boundary
- Main Rivers
- Detailed River Network

Flood Zones
- Flood Zone 3b
- Flood Zone 3a
- Flood Zone 2

Ordinary Watercourse Modelling
- AEP 3%
- AEP 1%
- AEP 0.1%

Reservoir Inundation
- ✔ Reservoir Inundation

Climate Change (2080s)
- Climate AEP 1% Change Lower
- Climate AEP 1% Change Central
- Climate AEP 1% Change Upper

Surface Water
- RoFSW 3.3% AEP
- RoFSW 1% AEP
- RoFSW 0.1% AEP

Areas Susceptible to Groundwater Flooding
- >= 75%
- >= 50% <75%
- >= 25% <50%
- < 25%

Mapping Supporting information

Return to Index Map

0 12.5 25 50 75 100 km

JBA consulting

APPENDIX H

House Type	No. of Bedrooms	Nr	House Sq Ft	Total Sq Ft
Affordable				
SH16BR-4	1 Bedroom Maisonette	2	526	1,052
SB21	2 Bedroom Bungalow	1	627	627
SH24	2 Bedroom Semi Detached	7	732	5,124
SH34	3 Bedroom Semi Detached	1	900	900
SH35BG-3	3 Bedroom Semi Detached	2	847	1,694
Sub Total		13		9,397
Market				
DB21	2 Bedroom Bungalow	4	627	2,508
DH200GE-4	2 Bedroom Semi Detached	6	728	4,368
DH201B-4	2 Bedroom Semi Detached	2	776	1,552
DH314	3 Bedroom Semi Detached	2	1,020	2,040
DH313B/R-4	3 Bedroom Detached	4	1,025	4,100
DH316B-4	3 Bedroom Detached	1	1,046	1,046
DH320R-4	3 Bedroom Detached	4	1,053	4,212
DH308GE-4	3 Bedroom Detached Link	4	1,066	4,264
DH301GE-4	3 Bedroom Semi Detached	6	1,098	6,588
DH342	3 Bedroom Semi Detached	1	1,060	1,060
DH425G/GH-4	4 Bedroom Detached	3	1,435	4,305
DH421GR/X/G-4	4 Bedroom Detached	1	1,677	1,677
DH501G-4	5 Bedroom Detached	2	2,274	4,548
Sub Total		40		42,268
Total		53		51,665

3	23%	
7	54%	
3	23%	
13	25%	
12	30%	
22	55%	
6	15%	
40	75%	

Average market house type size	1,057 sq ft
Net Dev	3.345 acres
Coverage	15445 sq ft/acre

0 10 20 m

DAVIDSONS HOMES

nineteen47
CHARTERED TOWN PLANNERS & URBAN DESIGNERS

Project
Lutterworth Road, Blaby

Drawing Title
Feasibility Layout

Project Code	Drawing Nr	Rev
n1063	007	A
Date	Drawing Scale	
14.07.2021	1:500 @ A1	

APPENDIX I

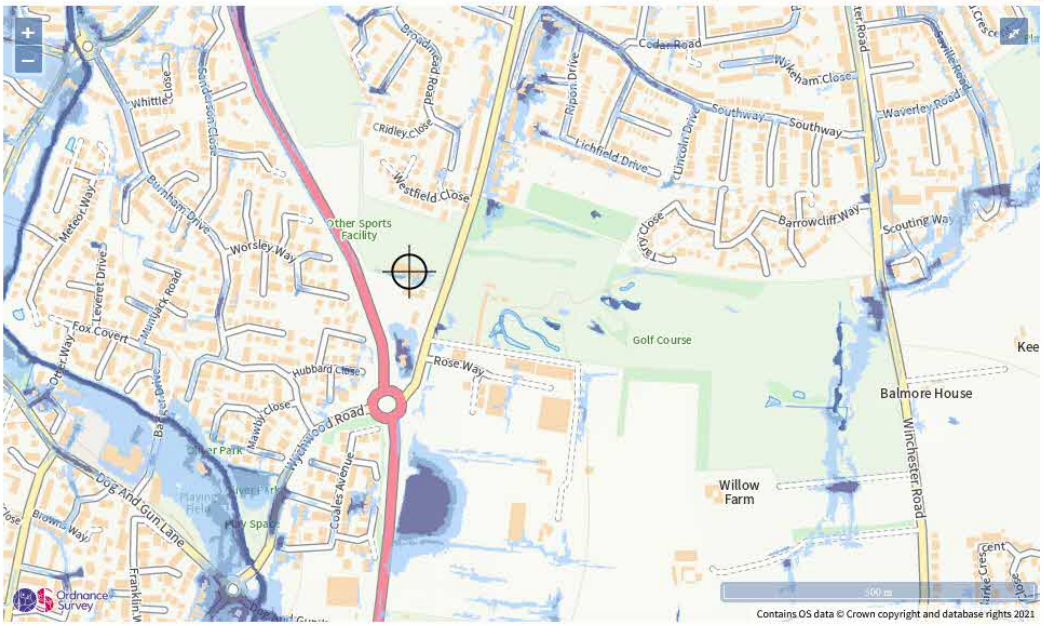
EA Map of Flooding from Surface Water

Flood risk

Extent of flooding

Location

le84dp



Extent of flooding from surface water

High Medium Low Very low Location you selected

APPENDIX J

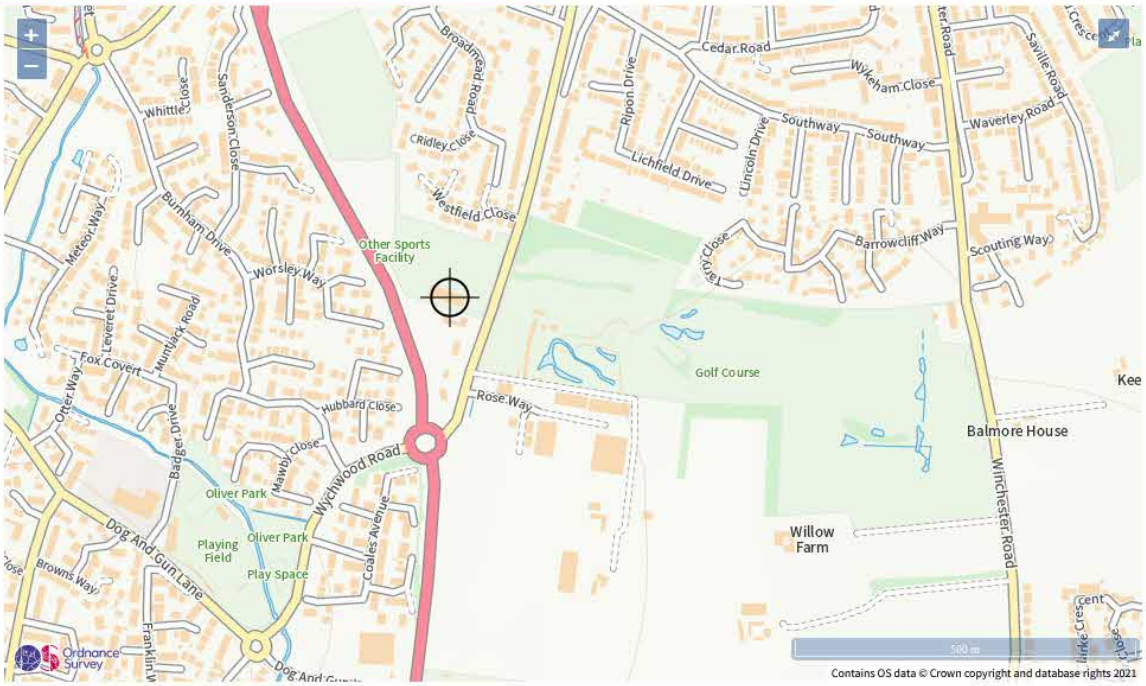
EA Map of Flooding from Reservoirs

Flood risk

Extent of flooding

Location

le84dp



Maximum extent of flooding from reservoirs:

when river levels are normal | when there is also flooding from rivers | Location you selected

APPENDIX K

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.450
Area (ha)	1.900	Urban	0.000
SAAR (mm)	700	Region Number	Region 4

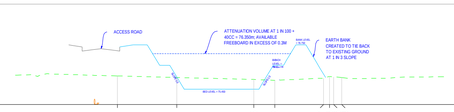
Results l/s

QBAR Rural	8.3
QBAR Urban	8.3
Q100 years	21.5
Q1 year	6.9
Q30 years	16.4
Q100 years	21.5

APPENDIX L

A-A

Datum: 75.000M AOD



| | | |

APPENDIX M

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Surface Network 2

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	60
M5-60 (mm)	20.000	Add Flow / Climate Change (%)	0
Ratio R	0.403	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
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.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Surface Network 2

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	34.460	0.172	200.0	0.032	5.00	0.0	0.600	o	300	Pipe/Conduit	
2.000	19.858	0.099	200.6	0.032	5.00	0.0	0.600	o	300	Pipe/Conduit	
1.001	38.545	0.193	200.0	0.032	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.002	39.405	0.263	150.0	0.088	0.00	0.0	0.600	o	300	Pipe/Conduit	
3.000	53.862	0.359	150.0	0.101	5.00	0.0	0.600	o	300	Pipe/Conduit	
1.003	27.919	0.140	200.0	0.056	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.004	9.536	0.048	200.0	0.026	0.00	0.0	0.600	o	375	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.52	77.637	0.032	0.0	0.0	0.0	1.11	78.3	4.3
2.000	50.00	5.30	77.383	0.032	0.0	0.0	0.0	1.11	78.2	4.3
1.001	50.00	6.10	77.284	0.095	0.0	0.0	0.0	1.11	78.3	12.9
1.002	50.00	6.61	77.091	0.183	0.0	0.0	0.0	1.28	90.6	24.8
3.000	50.00	5.70	76.867	0.101	0.0	0.0	0.0	1.28	90.6	13.7
1.003	50.00	6.97	76.433	0.340	0.0	0.0	0.0	1.28	141.1	46.1
1.004	50.00	7.10	76.293	0.367	0.0	0.0	0.0	1.28	141.1	49.6

Network Design Table for Surface Network 2

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.005	11.484	0.308	37.3	0.026	0.00	0.0	0.600	o	375	Pipe/Conduit	
4.000	24.421	0.163	150.0	0.020	5.00	0.0	0.600	o	225	Pipe/Conduit	
5.000	21.043	0.141	149.5	0.020	5.00	0.0	0.600	o	225	Pipe/Conduit	
4.001	14.566	0.058	250.0	0.020	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.006	26.655	0.089	300.5	0.026	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.007	37.105	0.124	299.6	0.047	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.008	21.499	0.143	150.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
6.000	15.752	0.105	150.0	0.034	5.00	0.0	0.600	o	225	Pipe/Conduit	
6.001	30.479	0.203	150.1	0.034	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.009	11.624	0.046	250.0	0.034	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.010	27.876	0.014	2000.0	0.000	0.00	0.0	0.600	o	900	Pipe/Conduit	
1.011	11.125	0.056	200.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.012	3.195	0.016	199.7	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.005	50.00	7.16	76.246	0.393	0.0	0.0	0.0	2.97	328.4	53.2
4.000	50.00	5.38	76.234	0.020	0.0	0.0	0.0	1.07	42.4	2.8
5.000	50.00	5.33	76.212	0.020	0.0	0.0	0.0	1.07	42.4	2.8
4.001	50.00	5.59	75.921	0.061	0.0	0.0	0.0	1.14	126.1	8.2
1.006	50.00	7.54	75.863	0.479	0.0	0.0	0.0	1.17	185.7	64.9
1.007	50.00	8.07	75.774	0.527	0.0	0.0	0.0	1.17	186.0	71.3
1.008	50.00	8.29	75.650	0.527	0.0	0.0	0.0	1.66	263.6	71.3
6.000	50.00	5.25	75.815	0.034	0.0	0.0	0.0	1.07	42.4	4.5
6.001	50.00	5.72	75.710	0.067	0.0	0.0	0.0	1.06	42.3	9.1
1.009	50.00	8.44	75.507	0.628	0.0	0.0	0.0	1.28	203.8	85.1
1.010	50.00	9.11	75.461	0.628	0.0	0.0	0.0	0.69	439.7	85.1
1.011	50.00	9.24	75.447	0.628	0.0	0.0	0.0	1.43	228.1	85.1
1.012	50.00	9.30	75.393	0.628	0.0	0.0	0.0	0.92	36.6«	85.1

Manhole Schedules for Surface Network 2

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdr (mm)
1	78.862	1.225	Open Manhole	1050	1.000	77.637	300				
2	78.385	1.002	Open Manhole	1050	2.000	77.383	300				
2	78.517	1.233	Open Manhole	1050	1.001	77.284	300	1.000	77.465	300	18
								2.000	77.284	300	
3	78.261	1.170	Open Manhole	1050	1.002	77.091	300	1.001	77.091	300	
4	78.517	1.650	Open Manhole	1050	3.000	76.867	300				
4	77.998	1.565	Open Manhole	1350	1.003	76.433	375	1.002	76.828	300	32
								3.000	76.508	300	
5	77.597	1.304	Open Manhole	1350	1.004	76.293	375	1.003	76.293	375	
6	77.463	1.217	Open Manhole	1350	1.005	76.246	375	1.004	76.246	375	
13	77.300	1.066	Open Manhole	1050	4.000	76.234	225				
15	77.200	0.988	Open Manhole	1050	5.000	76.212	225				
14	77.300	1.379	Open Manhole	1350	4.001	75.921	375	4.000	76.071	225	
								5.000	76.071	225	
7	77.300	1.437	Open Manhole	1350	1.006	75.863	450	1.005	75.938	375	
								4.001	75.863	375	
8	77.100	1.326	Open Manhole	1350	1.007	75.774	450	1.006	75.774	450	
9	76.925	1.275	Open Manhole	1350	1.008	75.650	450	1.007	75.650	450	
16	77.100	1.285	Open Manhole	1050	6.000	75.815	225				
11	76.600	0.890	Open Manhole	1050	6.001	75.710	225	6.000	75.710	225	
10	76.695	1.188	Open Manhole	1350	1.009	75.507	450	1.008	75.507	450	
								6.001	75.507	225	
HWP1	76.750	1.289	Open Manhole	1800	1.010	75.461	900	1.009	75.461	450	
HWP2	76.750	1.303	Open Manhole	1800	1.011	75.447	450	1.010	75.447	900	
HYDROBRAKE	76.750	1.359	Open Manhole	1350	1.012	75.393	225	1.011	75.391	450	
HW0UT	76.750	1.373	Open Manhole	0		OUTFALL		1.012	75.377	225	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
1	456676.244	296573.197	456676.244	296573.197	Required	
2	456692.907	296624.894	456692.907	296624.894	Required	
2	456686.936	296605.956	456686.936	296605.956	Required	

Manhole Schedules for Surface Network 2

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
3	456651.156	296620.291	456651.156	296620.291	Required	
4	456596.515	296581.566	456596.515	296581.566	Required	
4	456613.725	296632.605	456613.725	296632.605	Required	
5	456586.784	296639.931	456586.784	296639.931	Required	
6	456577.454	296637.959	456577.454	296637.959	Required	
13	456534.450	296649.626	456534.450	296649.626	Required	
15	456564.498	296663.281	456564.498	296663.281	Required	
14	456558.026	296643.258	456558.026	296643.258	Required	
7	456567.514	296632.207	456567.514	296632.207	Required	
8	456544.556	296618.664	456544.556	296618.664	Required	
9	456507.935	296612.692	456507.935	296612.692	Required	
16	456454.129	296611.805	456454.129	296611.805	Required	
11	456457.991	296627.076	456457.991	296627.076	Required	
10	456487.185	296618.320	456487.185	296618.320	Required	
HWP1	456487.466	296629.940	456487.466	296629.940	Required	

Manhole Schedules for Surface Network 2

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
HWP2	456465.440	296647.026	456465.440	296647.026	Required	
HYDROBRAKE	456459.935	296656.694	456459.935	296656.694	Required	
HW0UT	456458.264	296659.418			No Entry	

PIPELINE SCHEDULES for Surface Network 2

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	300	1	78.862	77.637	0.925	Open Manhole	1050
2.000	o	300	2	78.385	77.383	0.702	Open Manhole	1050
1.001	o	300	2	78.517	77.284	0.933	Open Manhole	1050
1.002	o	300	3	78.261	77.091	0.870	Open Manhole	1050
3.000	o	300	4	78.517	76.867	1.350	Open Manhole	1050
1.003	o	375	4	77.998	76.433	1.190	Open Manhole	1350
1.004	o	375	5	77.597	76.293	0.929	Open Manhole	1350
1.005	o	375	6	77.463	76.246	0.842	Open Manhole	1350
4.000	o	225	13	77.300	76.234	0.841	Open Manhole	1050
5.000	o	225	15	77.200	76.212	0.763	Open Manhole	1050
4.001	o	375	14	77.300	75.921	1.004	Open Manhole	1350
1.006	o	450	7	77.300	75.863	0.987	Open Manhole	1350
1.007	o	450	8	77.100	75.774	0.876	Open Manhole	1350

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	34.460	200.0	2	78.517	77.465	0.752	Open Manhole	1050
2.000	19.858	200.6	2	78.517	77.284	0.933	Open Manhole	1050
1.001	38.545	200.0	3	78.261	77.091	0.870	Open Manhole	1050
1.002	39.405	150.0	4	77.998	76.828	0.870	Open Manhole	1350
3.000	53.862	150.0	4	77.998	76.508	1.190	Open Manhole	1350
1.003	27.919	200.0	5	77.597	76.293	0.929	Open Manhole	1350
1.004	9.536	200.0	6	77.463	76.246	0.842	Open Manhole	1350
1.005	11.484	37.3	7	77.300	75.938	0.987	Open Manhole	1350
4.000	24.421	150.0	14	77.300	76.071	1.004	Open Manhole	1350
5.000	21.043	149.5	14	77.300	76.071	1.004	Open Manhole	1350
4.001	14.566	250.0	7	77.300	75.863	1.062	Open Manhole	1350
1.006	26.655	300.5	8	77.100	75.774	0.876	Open Manhole	1350
1.007	37.105	299.6	9	76.925	75.650	0.825	Open Manhole	1350

PIPELINE SCHEDULES for Surface Network 2

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.008	o	450	9	76.925	75.650	0.825	Open Manhole	1350
6.000	o	225	16	77.100	75.815	1.060	Open Manhole	1050
6.001	o	225	11	76.600	75.710	0.665	Open Manhole	1050
1.009	o	450	10	76.695	75.507	0.738	Open Manhole	1350
1.010	o	900	HWP1	76.750	75.461	0.389	Open Manhole	1800
1.011	o	450	HWP2	76.750	75.447	0.853	Open Manhole	1800
1.012	o	225	HYDROBRAKE	76.750	75.393	1.132	Open Manhole	1350

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.008	21.499	150.0	10	76.695	75.507	0.738	Open Manhole	1350
6.000	15.752	150.0	11	76.600	75.710	0.665	Open Manhole	1050
6.001	30.479	150.1	10	76.695	75.507	0.963	Open Manhole	1350
1.009	11.624	250.0	HWP1	76.750	75.461	0.839	Open Manhole	1800
1.010	27.876	2000.0	HWP2	76.750	75.447	0.403	Open Manhole	1800
1.011	11.125	200.0	HYDROBRAKE	76.750	75.391	0.909	Open Manhole	1350
1.012	3.195	199.7	HW0UT	76.750	75.377	1.148	Open Manhole	0

Free Flowing Outfall Details for Surface Network 2

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.012	HW0UT	76.750	75.377	0.000	0	0

Simulation Criteria for Surface Network 2

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
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)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Simulation Criteria for Surface Network 2

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Storm Duration (mins)	30
Ratio R	0.403		

Online Controls for Surface Network 2

Hydro-Brake® Optimum Manhole: HWP1, DS/PN: 1.010, Volume (m³): 4.9

Unit Reference	MD-SHE-0098-4600-1200-4600
Design Head (m)	1.200
Design Flow (l/s)	4.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	98
Invert Level (m)	75.461
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	4.6
Flush-Flo™	0.357	4.6
Kick-Flo®	0.744	3.7
Mean Flow over Head Range	-	4.0

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	3.2	1.200	4.6	3.000	7.1	7.000	10.5
0.200	4.3	1.400	4.9	3.500	7.6	7.500	10.9
0.300	4.6	1.600	5.3	4.000	8.1	8.000	11.2
0.400	4.6	1.800	5.6	4.500	8.5	8.500	11.6
0.500	4.5	2.000	5.8	5.000	9.0	9.000	11.9
0.600	4.3	2.200	6.1	5.500	9.4	9.500	12.2
0.800	3.8	2.400	6.4	6.000	9.8		
1.000	4.2	2.600	6.6	6.500	10.2		

Storage Structures for Surface Network 2

Tank or Pond Manhole: HWP1, DS/PN: 1.010

Invert Level (m) 75.461

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	340.0	0.700	522.0	0.701	669.0	1.300	864.0

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 2

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
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	1
Number of Online Controls	1	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	0.403
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	20.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	ON
DTS Status	ON		

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)	2, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	2	+0%					77.694
2.000	2	15 Winter	2	+0%					77.442
1.001	2	15 Winter	2	+0%	100/15 Winter				77.380
1.002	3	15 Winter	2	+0%	100/15 Summer				77.213
3.000	4	15 Winter	2	+0%	100/15 Summer				76.961
1.003	4	15 Winter	2	+0%	100/15 Summer				76.607
1.004	5	15 Winter	2	+0%	30/15 Winter				76.494
1.005	6	15 Winter	2	+0%	100/15 Summer				76.381
4.000	13	15 Winter	2	+0%	100/15 Summer				76.280
5.000	15	15 Winter	2	+0%	100/15 Summer				76.259
4.001	14	15 Winter	2	+0%	100/15 Summer				76.085
1.006	7	15 Winter	2	+0%	100/15 Summer				76.080
1.007	8	15 Winter	2	+0%	100/15 Summer				75.994
1.008	9	15 Winter	2	+0%	100/15 Summer				75.838
6.000	16	15 Winter	2	+0%	100/15 Summer				75.876
6.001	11	15 Winter	2	+0%	30/15 Winter				75.792
1.009	10	15 Winter	2	+0%	100/15 Summer				75.759
1.010	HWP1	360 Winter	2	+0%					75.704
1.011	HWP2	360 Winter	2	+0%					75.496

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 2

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.243	0.000	0.08		5.7	OK	
2.000	2	-0.241	0.000	0.08		5.6	OK	
1.001	2	-0.204	0.000	0.22		16.0	OK	
1.002	3	-0.178	0.000	0.34		28.8	OK	
3.000	4	-0.206	0.000	0.21		17.8	OK	
1.003	4	-0.201	0.000	0.44		53.9	OK	
1.004	5	-0.174	0.000	0.56		57.6	OK	
1.005	6	-0.240	0.000	0.28		61.0	OK	
4.000	13	-0.179	0.000	0.09		3.6	OK	
5.000	15	-0.178	0.000	0.09		3.6	OK	
4.001	14	-0.211	0.000	0.10		9.8	OK	
1.006	7	-0.233	0.000	0.46		72.6	OK	
1.007	8	-0.231	0.000	0.47		77.3	OK	
1.008	9	-0.262	0.000	0.36		77.7	OK	
6.000	16	-0.164	0.000	0.16		6.0	OK	
6.001	11	-0.143	0.000	0.28		11.1	OK	
1.009	10	-0.198	0.000	0.60		88.8	OK	
1.010	HWP1	-0.657	0.000	0.01		4.4	OK	
1.011	HWP2	-0.401	0.000	0.03		4.4	OK	

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 2

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.012	HYDROBRAKE	360 Winter	2	+0%					75.454

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.012	HYDROBRAKE	-0.164	0.000	0.16		4.4	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 2

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
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	1
Number of Online Controls	1	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	0.403
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	20.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	ON
DTS Status	ON		

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)	2, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	30	+0%					77.715
2.000	2	15 Winter	30	+0%					77.471
1.001	2	15 Winter	30	+0%	100/15 Winter				77.426
1.002	3	15 Winter	30	+0%	100/15 Summer				77.285
3.000	4	15 Winter	30	+0%	100/15 Summer				77.000
1.003	4	15 Winter	30	+0%	100/15 Summer				76.782
1.004	5	15 Winter	30	+0%	30/15 Winter				76.682
1.005	6	15 Winter	30	+0%	100/15 Summer				76.442
4.000	13	15 Winter	30	+0%	100/15 Summer				76.298
5.000	15	15 Winter	30	+0%	100/15 Summer				76.277
4.001	14	15 Winter	30	+0%	100/15 Summer				76.205
1.006	7	15 Winter	30	+0%	100/15 Summer				76.195
1.007	8	15 Winter	30	+0%	100/15 Summer				76.111
1.008	9	15 Winter	30	+0%	100/15 Summer				76.024
6.000	16	15 Winter	30	+0%	100/15 Summer				75.998
6.001	11	15 Winter	30	+0%	30/15 Winter				75.986
1.009	10	15 Winter	30	+0%	100/15 Summer				75.957
1.010	HWP1	360 Winter	30	+0%					75.909
1.011	HWP2	180 Winter	30	+0%					75.497

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 2

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.222	0.000	0.15		10.8	OK	
2.000	2	-0.212	0.000	0.16		10.7	OK	
1.001	2	-0.158	0.000	0.44		32.1	OK	
1.002	3	-0.106	0.000	0.73		61.7	OK	
3.000	4	-0.167	0.000	0.39		33.8	OK	
1.003	4	-0.026	0.000	0.84		104.2	OK	
1.004	5	0.014	0.000	1.07		109.7	SURCHARGED	
1.005	6	-0.179	0.000	0.53		114.9	OK	
4.000	13	-0.161	0.000	0.18		6.8	OK	
5.000	15	-0.160	0.000	0.18		6.9	OK	
4.001	14	-0.091	0.000	0.19		19.0	OK	
1.006	7	-0.118	0.000	0.88		137.6	OK	
1.007	8	-0.114	0.000	0.89		146.6	OK	
1.008	9	-0.077	0.000	0.67		142.0	OK	
6.000	16	-0.042	0.000	0.30		11.2	OK	
6.001	11	0.051	0.000	0.51		20.0	SURCHARGED	
1.009	10	0.000	0.000	1.06		155.6	OK	
1.010	HWP1	-0.452	0.000	0.01		4.6	OK	
1.011	HWP2	-0.400	0.000	0.03		4.6	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 2

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.012	HYDROBRAKE	360 Winter	30	+0%					75.455

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.012	HYDROBRAKE	-0.163	0.000	0.17		4.6	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 2

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
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	1
Number of Online Controls	1	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	0.403
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	20.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	ON
DTS Status	ON		

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)	2, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	100	+40%					77.744
2.000	2	15 Winter	100	+40%					77.647
1.001	2	15 Winter	100	+40%	100/15 Winter				77.631
1.002	3	15 Winter	100	+40%	100/15 Summer				77.564
3.000	4	15 Winter	100	+40%	100/15 Summer				77.434
1.003	4	15 Winter	100	+40%	100/15 Summer				77.315
1.004	5	15 Winter	100	+40%	30/15 Winter				77.094
1.005	6	15 Winter	100	+40%	100/15 Summer				76.910
4.000	13	15 Winter	100	+40%	100/15 Summer				76.733
5.000	15	15 Winter	100	+40%	100/15 Summer				76.732
4.001	14	15 Winter	100	+40%	100/15 Summer				76.712
1.006	7	15 Winter	100	+40%	100/15 Summer				76.698
1.007	8	15 Winter	100	+40%	100/15 Summer				76.533
1.008	9	15 Winter	100	+40%	100/15 Summer				76.287
6.000	16	15 Winter	100	+40%	100/15 Summer				76.324
6.001	11	15 Winter	100	+40%	30/15 Winter				76.288
1.009	10	480 Winter	100	+40%	100/15 Summer				76.260
1.010	HWP1	480 Winter	100	+40%					76.259
1.011	HWP2	960 Summer	100	+40%					75.497

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 2

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.193	0.000	0.27		19.4	OK	
2.000	2	-0.036	0.000	0.27		18.1	OK	
1.001	2	0.047	0.000	0.68		49.4	SURCHARGED	
1.002	3	0.173	0.000	1.14		95.5	SURCHARGED	
3.000	4	0.267	0.000	0.66		56.3	SURCHARGED	
1.003	4	0.507	0.000	1.28		158.3	SURCHARGED	
1.004	5	0.426	0.000	1.62		167.0	SURCHARGED	
1.005	6	0.289	0.000	0.82		177.2	SURCHARGED	
4.000	13	0.274	0.000	0.28		10.9	SURCHARGED	
5.000	15	0.295	0.000	0.28		10.8	SURCHARGED	
4.001	14	0.416	0.000	0.27		26.7	SURCHARGED	
1.006	7	0.385	0.000	1.35		212.3	SURCHARGED	
1.007	8	0.309	0.000	1.38		227.1	SURCHARGED	
1.008	9	0.186	0.000	1.06		227.2	SURCHARGED	
6.000	16	0.284	0.000	0.49		18.3	SURCHARGED	
6.001	11	0.353	0.000	0.90		35.8	SURCHARGED	
1.009	10	0.303	0.000	0.27		39.5	SURCHARGED	
1.010	HWP1	-0.102	0.000	0.01		4.6	OK	
1.011	HWP2	-0.400	0.000	0.03		4.6	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 2

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.012	HYDROBRAKE	480 Summer	100	+40%					75.455

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.012	HYDROBRAKE	-0.163	0.000	0.17		4.6	OK	

APPENDIX N

SIMPLE INDEX APPROACH: TOOL

1. The steps set out in the tool should be applied for each inflow or 'runoff area' (ie each impermeable surface area separately discharging to a SuDS component).

2. The supporting 'Design Conditions' stated by the tool must be fully considered and implemented in all cases.

3. The process that is automated in this tool is described in the SuDS Manual, Chapter 26 (Section 26.7)

3. Relevant design examples are included in the SuDS Manual Appendix C.

4. Each of the steps below are part of the process set out in the flowchart on Sheet 3.

5. Sheet 4 summarises the selections made below and indicates the acceptability of the proposed SuDS components.

6. Interception should be delivered for all upstream impermeable areas as part of the strategy for water quantity and quality control for the site. This is required in order to deliver both of the water quality criteria set out in Chapter 4 of the SuDS Manual

DROP DOWN LIST — RELEVANT INPUTS NEED TO BE SELECTED FROM THESE LISTS, FOR EACH STEP

USER ENTRY — USER ENTRY CELLS ARE ONLY REQUIRED WHERE INDICATED BY THE TOOL

STEP 1: Determine the Pollution Hazard Index for the runoff area discharging to the proposed SuDS scheme

This step requires the user to select the appropriate land use type for the area from which the runoff is occurring

If the land use varies across the 'runoff area', either:

- use the land use type with the highest Pollution Hazard Index

- apply the approach for each of the land use types to determine whether the proposed SuDS design is sufficient for all. If it is not, consider collecting more hazardous runoff separately and providing additional treatment.

If the generic land use types suggested are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in the row below the drop down lists.

	Runoff Area Land Use Description	Hazard Level	Pollution Hazard Indices: Total Suspended Solids	Metals	Hydrocarbons
Select land use type from the drop down list (or 'Other' if none applicable): →	Low traffic roads (e.g. residential roads and general access roads, <300 traffic movements/day)	Low	0.5	0.4	0.4
If the generic land use types in the drop down list above are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in this row:					
	Landuse Pollution Hazard Index	**Low**	**0.5**	**0.4**	**0.4**

DESIGN CONDITIONS: 1 | 2

STEP 2A: Determine the Pollution Mitigation Index for the proposed SuDS components

This step requires the user to select the proposed SuDS components that will be used to treat runoff - before it is discharged to a receiving surface waterbody or downstream infiltration component

If the runoff is discharged directly to an infiltration component, without upstream treatment, select 'None' for each of the 3 SuDS components and move to Step 2B

This step should be applied to evaluate the water quality protection provided by proposed SuDS components For discharges to receiving surface waters or downstream infiltration components (note: in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design).

If you have fewer than 3 components, select 'None' for the components that are not required

If the proposed component is bespoke and/or a proprietary treatment product and not generically described by the suggested components, then 'Proprietary treatment system' or 'User defined indices' should be selected and a description of the component and agreed user defined indices should be entered in the rows below the drop down lists

	SuDS Component Description	Pollution Mitigation Indices: Total Suspended Solids	Metals	Hydrocarbons
Select SuDS Component 1 (i.e. the upstream SuDS component) from the drop down list: →	Detention basin	0.5	0.5	0.6
Select SuDS Component 2 (i.e. the second SuDS component in a series) from the drop down list: →	Pond or wetland	0.7	0.7	0.5
Select SuDS Component 3 (i.e. the third SuDS component in a series) from the drop down list: →	Pond or wetland	0.7	0.7	0.5
If the proposed SuDS components are bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary treatment system' or 'User defined indices' and enter component descriptions and agreed user defined indices in these rows:				
	Aggregated Surface Water Pollution Mitigation Index	**>0.95**	**>0.95**	**>0.95**

DESIGN CONDITIONS: 1 | 2 | 3

	1	2	3
SuDS components can only be assumed to deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters of the SuDS Manual. See also checklists in Appendix B	Detention basins should be designed to ensure the effective retention and management of sediment, such that the sediment will not be re-suspended and washed out in subsequent events	
SuDS components can only be assumed to deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters of the SuDS Manual. See also checklists in Appendix B	Ponds/wetlands should be preceded by an upstream component(s) that trap(s) silt, or designed specifically to retain sediment in a separate zone, easily accessible for maintenance, such that the sediment will not be re-suspended in subsequent events	
SuDS components can only be assumed to deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters of the SuDS Manual. See also checklists in Appendix B	Ponds/wetlands should be preceded by an upstream component(s) that trap(s) silt, or designed specifically to retain sediment in a separate zone, easily accessible for maintenance, such that the sediment will not be re-suspended in subsequent events	

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at ">0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification).

Is the runoff now discharged to an infiltration component?

Yes ? Go to Step 3B

No ? Go to Step 3C

STEP 2B: Determine the Pollution Mitigation Index for the proposed Groundwater Protection

This step requires the user to select the type of groundwater protection that is either part of the SuDS component or that lies between the component and the groundwater

This step should be applied where a SuDS component is specifically designed to infiltrate runoff (note: in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design).

'Groundwater protection' describes the proposed depth of soil or other material through which runoff will flow between the runoff surface and the underlying groundwater.

Where the discharge is to surface waters and risks to groundwater need not be considered, select 'None'

If the proposed groundwater protection is bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary product' or 'User defined indices' and enter a description of the protection and agreed user defined indices in this row:

	Pollution Mitigation Indices: Total Suspended Solids	Metals	Hydrocarbons
Select type of groundwater protection from the drop down list: → None			
If the proposed groundwater protection is bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary product' or 'User defined indices' and enter a description of the protection and agreed user defined indices in this row:			
Groundwater Protection Pollution Mitigation Index	**0**	**0**	**0**

DESIGN CONDITIONS: 1 | 2 | 3 | 4

STEP 2C: Determine the Combined Pollution Mitigation Indices for the Runoff Area

This is an automatic step which combines the proposed SuDS Pollution Mitigation Indices with any Groundwater Protection Pollution Mitigation Indices

	Combined Pollution Mitigation Indices: Total Suspended Solids	Metals	Hydrocarbons
Combined Pollution Mitigation Indices for the Runoff Area	**>0.95**	**>0.95**	**>0.95**

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at ">0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification).

STEP 2D: Determine Sufficiency of Pollution Mitigation Indices for Selected SuDS Components

This is an automatic step which compares the Combined Pollution Mitigation Indices with the Land Use Hazard Indices, to determine whether the proposed components are sufficient to manage each pollutant category type

When the combined mitigation index exceeds the land use pollution hazard index, then the proposed components are considered sufficient in providing pollution risk mitigation.

In England and Wales, where the discharge is to protected surface waters or groundwater, an additional treatment component (ie over and above that required for standard discharges), or other equivalent protection, is required that provides environmental protection in the event of an unexpected pollution event or poor system performance. Protected surface waters are those designated for drinking water abstraction. In England and Wales, protected groundwater resources are defined as Source Protection Zone 1. In Northern Ireland, a more precautionary approach may be required and this should be checked with the environmental regulator on a site by site basis.

Note: In order to meet both Water Quality criteria set out in the SuDS Manual (Chapter 4), interception should be delivered for all impermeable areas wherever possible. Interception delivery and treatment may be met by the same components, but interception requires separate evaluation.

	Sufficiency of Pollution Mitigation Indices: Total Suspended Solids	Metals	Hydrocarbons
	Sufficient	**Sufficient**	**Sufficient**

DESIGN CONDITIONS: 1

1
Reference to local planning documents should also be made to identify any additional protection required for sites due to habitat conservation (see Chapter 7 The SuDS design process). The implications of developments on or within close proximity to an area with an environmental designation, such as a Site of Special Scientific Interest (SSSI), should be considered via consultation with relevant conservation bodies such as Natural England

SIMPLE INDEX APPROACH: TOOL

1. The steps set out in the tool should be applied for each inflow or 'runoff area' (ie each impermeable surface area separately discharging to a SuDS component).

2. The supporting 'Design Conditions' stated by the tool must be fully considered and implemented in all cases.

3. The process that is automated in this tool is described in the SuDS Manual, Chapter 26 (Section 26.7)

3. Relevant design examples are included in the SuDS Manual Appendix C.

4. Each of the steps below are part of the process set out in the flowchart on Sheet 3.

5. Sheet 4 summarises the selections made below and indicates the acceptability of the proposed SuDS components.

6. Interception should be delivered for all upstream impermeable areas as part of the strategy for water quantity and quality control for the site. This is required in order to deliver both of the water quality criteria set out in Chapter 4 of the SuDS Manual

DROP DOWN LIST RELEVANT INPUTS NEED TO BE SELECTED FROM THESE LISTS, FOR EACH STEP

USER ENTRY USER ENTRY CELLS ARE ONLY REQUIRED WHERE INDICATED BY THE TOOL

STEP 1: Determine the Pollution Hazard Index for the runoff area discharging to the proposed SuDS scheme

This step requires the user to select the appropriate land use type for the area from which the runoff is occurring

If the land use varies across the 'runoff area', either:

- use the land use type with the highest Pollution Hazard Index

- apply the approach for each of the land use types to determine whether the proposed SuDS design is sufficient for all. If it is not, consider collecting more hazardous runoff separately and providing additional treatment.

If the generic land use types suggested are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in the row below the drop down lists.

	Runoff Area Land Use Description	Hazard Level	Pollution Hazard Indices: Total Suspended Solids	Metals	Hydrocarbons
Select land use type from the drop down list (or 'Other' if none applicable): →	Residential parking	Low	0.5	0.4	0.4
If the generic land use types in the drop down list above are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in this row:					
	Landuse Pollution Hazard Index	**Low**	**0.5**	**0.4**	**0.4**

DESIGN CONDITIONS: 1 | 2

STEP 2A: Determine the Pollution Mitigation Index for the proposed SuDS components

This step requires the user to select the proposed SuDS components that will be used to treat runoff - before it is discharged to a receiving surface waterbody or downstream infiltration component

If the runoff is discharged directly to an infiltration component, without upstream treatment, select 'None' for each of the 3 SuDS components and move to Step 2B

This step should be applied to evaluate the water quality protection provided by proposed SuDS components For discharges to receiving surface waters or downstream infiltration components (note: in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design).

If you have fewer than 3 components, select 'None' for the components that are not required

If the proposed component is bespoke and/or a proprietary treatment product and not generically described by the suggested components, then 'Proprietary treatment system' or 'User defined indices' should be selected and a description of the component and agreed user defined indices should be entered in the rows below the drop down lists

	SuDS Component Description	Pollution Mitigation Indices: Total Suspended Solids	Metals	Hydrocarbons
Select SuDS Component 1 (i.e. the upstream SuDS component) from the drop down list: →	Detention basin	0.5	0.5	0.6
Select SuDS Component 2 (i.e. the second SuDS component in a series) from the drop down list: →	Pond or wetland	0.7	0.7	0.5
Select SuDS Component 3 (i.e. the third SuDS component in a series) from the drop down list: →	Pond or wetland	0.7	0.7	0.5
If the proposed SuDS components are bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary treatment system' or 'User defined indices' and enter component descriptions and agreed user defined indices in these rows:				
	Aggregated Surface Water Pollution Mitigation Index	**>0.95**	**>0.95**	**>0.95**

DESIGN CONDITIONS: 1 | 2 | 3

1	2	3
SuDS components can only be assumed to deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters of the SuDS Manual. See also checklists in Appendix B	Detention basins should be designed to ensure the effective retention and management of sediment, such that the sediment will not be re-suspended and washed out in subsequent events	
SuDS components can only be assumed to deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters of the SuDS Manual. See also checklists in Appendix B	Ponds/wetlands should be preceded by an upstream component(s) that trap(s) silt, or designed specifically to retain sediment in a separate zone, easily accessible for maintenance, such that the sediment will not be re-suspended in subsequent events	
SuDS components can only be assumed to deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters of the SuDS Manual. See also checklists in Appendix B	Ponds/wetlands should be preceded by an upstream component(s) that trap(s) silt, or designed specifically to retain sediment in a separate zone, easily accessible for maintenance, such that the sediment will not be re-suspended in subsequent events	

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at ">0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification).

Is the runoff now discharged to an infiltration component?

Yes ? Go to Step 3B

No ? Go to Step 2C

STEP 2B: Determine the Pollution Mitigation Index for the proposed Groundwater Protection

This step requires the user to select the type of groundwater protection that is either part of the SuDS component or that lies between the component and the groundwater

This step should be applied where a SuDS component is specifically designed to infiltrate runoff (note: in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design).

'Groundwater protection' describes the proposed depth of soil or other material through which runoff will flow between the runoff surface and the underlying groundwater.

Where the discharge is to surface waters and risks to groundwater need not be considered, select 'None'

If the proposed groundwater protection is bespoke and/or a proprietary product and not generically described by the suggested measures, then a description of the protection and agreed user defined indices should be entered in the row below the drop down list

	Pollution Mitigation Indices: Total Suspended Solids	Metals	Hydrocarbons
Select type of groundwater protection from the drop down list: → None			
If the proposed groundwater protection is bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary product' or 'User defined indices' and enter a description of the protection and agreed user defined indices in this row:			
Groundwater Protection Pollution Mitigation Index	**0**	**0**	**0**

DESIGN CONDITIONS: 1 | 2 | 3 | 4

STEP 2C: Determine the Combined Pollution Mitigation Indices for the Runoff Area

This is an automatic step which combines the proposed SuDS Pollution Mitigation Indices with any Groundwater Protection Pollution Mitigation Indices

	Combined Pollution Mitigation Indices: Total Suspended Solids	Metals	Hydrocarbons
Combined Pollution Mitigation Indices for the Runoff Area	**>0.95**	**>0.95**	**>0.95**

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at ">0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification).

STEP 2D: Determine Sufficiency of Pollution Mitigation Indices for Selected SuDS Components

This is an automatic step which compares the Combined Pollution Mitigation Indices with the Land Use Hazard Indices, to determine whether the proposed components are sufficient to manage each pollutant category type

When the combined mitigation index exceeds the land use pollution hazard index, then the proposed components are considered sufficient in providing pollution risk mitigation.

In England and Wales, where the discharge is to protected surface waters or groundwater, an additional treatment component (ie over and above that required for standard discharges), or other equivalent protection, is required that provides environmental protection in the event of an unexpected pollution event or poor system performance. Protected surface waters are those designated for drinking water abstraction. In England and Wales, protected groundwater resources are defined as Source Protection Zone 1. In Northern Ireland, a more precautionary approach may be required and this should be checked with the environmental regulator on a site by site basis.

Note: In order to meet both Water Quality criteria set out in the SuDS Manual (Chapter 4), interception should be delivered for all impermeable areas wherever possible. Interception delivery and treatment may be met by the same components, but interception requires separate evaluation.

	Sufficiency of Pollution Mitigation Indices: Total Suspended Solids	Metals	Hydrocarbons
	Sufficient	**Sufficient**	**Sufficient**

DESIGN CONDITIONS: 1

1
Reference to local planning documents should also be made to identify any additional protection required for sites due to habitat conservation (see Chapter 7 The SuDS design process). The implications of developments on or within close proximity to an area with an environmental designation, such as a Site of Special Scientific Interest (SSSI), should be considered via consultation with relevant conservation bodies such as Natural England

APPENDIX O

Wormald Burrows Partnership Ltd,
Office Suite 1,
5th Floor Offices,
Pera Business Park,
Nottingham Road,
Melton Mowbray,
LE13 0PB.

FAO Rasik Limbachia,

Severn Trent Water
Severn Trent Water Ltd
Leicester Water Centre
Gorse Hill
Anstey
Leicester
LE7 7GU

Tel: 024 777 16843

www.stwater.co.uk
net.dev.east@severntrent.co.uk

24th May 2017

Dear Mr Limbachia,

Our ref: 8267590

Proposed Residential Development (55 new dwellings) at: Allotments & Golf Course, Lutterworth Road, Blaby, Leicestershire, LE8 4DP.
X: 456479 / Y: 296640

I refer to your Development Enquiry Request submitted in respect of the above site. Please find enclosed the sewer records that are included in the fee together with the Supplementary Guidance Notes (SGN) referred to below.

Public Sewers in Site – Required Protection

There are no public sewers crossing the proposed site. However, due to a change in legislation on 1 October 2011 there may be former private sewers on the site which have transferred to the responsibility of Severn Trent Water Ltd, which are not shown on the statutory sewer records, but are located in your client's land. These sewers would have protective strips that we will not allow to be built over. If such sewers are identified to be present on the site, please contact us for further guidance.

Foul Water Drainage

The enclosed sewer record extract shows a 150mm diameter public foul water sewer north west of the site on Lutterworth Road. According to our calculations the discharge rate for 55 new dwellings would be approximately 0.9 litres/second. A foul connection for this could be accommodated in this sewer. Please be advised that a new connection to this sewer at MH4701 or to a new manhole within this area would be ok subject to a formal S106 connection approval (see later). Please submit foul water drainage proposals based on these comments for review when available.

Severn Trent Water

Surface Water Drainage

Under the terms of Section H of the Building Regulations 2000, the disposal of surface water by means of soakaways should be considered as the primary method. If this is not practical and no watercourse is available as an alternative, the use of sewerage should be considered. In addition, other sustainable drainage methods should also be explored before a discharge to the public sewerage system is considered.

If these are found to be unsuitable, satisfactory evidence will need to be submitted. The evidence should be either percolation test results or a statement from the SI consultant (extract or a supplementary letter).

No surface water discharge to a public sewer will be accepted until all alternative options have been considered. The Local Lead Flood Authority should be consulted regarding suitable SW drainage of the site.

Any flows generated by the site in excess of the permitted discharge rate will have to be attenuated within the development site, subject to LLFA/EA requirements or Severn Trent Water where a discharge to a public sewer is the only option.

The enclosed sewer record extract shows a 450mm surface water sewer east of the site under an adoption agreement. Subject to the above, a surface water connection to the available public surface water sewer would be acceptable subject to formal S106 approval (see later) with the discharge rate requested to be restricted to 5 litres / second / hectare as SGN3 (Greenfield site). Any flows exceeding this would need to be appropriately attenuated on site and discharged at a controlled rate. Please submit surface water drainage proposals based on these comments for review when available.

New Connections

For any new connections (including the re-use of existing connections) to the public sewerage system, you will need to submit a Section 106 application form. Our New Connections department are responsible for handling all such enquiries and applications. To contact them for an application form and associated guidance notes please call 0800 7076600 or download from www.stwater.co.uk.

Please quote 8267590 in any future correspondence (including e-mails) with STW Limited. Please note that 'Development Enquiry' responses are only valid for 6 months from the date of this letter.

Yours sincerely,

[redacted]

Severn Trent Water

Emma Nowak.
Asset Protection East.
Asset Management.
Wholesale Operations.