

ENVIRONMENT

Richborough Estates Limited and Mr & Mrs Adcock
Land East of Stoke Road and North of Normandy
Way (A47)
Hinckley
Flood Risk Assessment

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EXECUTIVE SUMMARY

This Flood Risk Assessment (FRA) has been prepared in accordance with the requirements set out in the National Planning Policy Framework (NPPF) and the associated Planning Practice Guidance. It has been produced on behalf of Richborough Estates Limited and Mr & Mrs Adcock in respect of a planning application for a proposed residential development at the Land East of Stoke Road and North of Normandy Way, Hinckley, Leicestershire (approximate grid reference: SP419956).

This report demonstrates that the proposed development is not at significant flood risk, subject to the recommended flood mitigation strategies being implemented.

The site is located entirely within Flood Zone 1 (low probability of fluvial flooding). The nearest EA Flood Zone Extents are located approximately 1.3km north west of the site and are attributed to the River Tweed. An Unnamed Ordinary Watercourse (UOW) is shown to flow adjacent to the eastern boundary of the site, ultimately discharging to the River Tweed approximately 2km downstream of the site. The UOW is not represented on the EA's Flood Map for Planning due to its small catchment. A series of ditches/highway drains have also been identified within the western part of the site, following a site visit. Two of the ditches are shown to flow parallel to either side of Stoke Road in a north westerly direction. A further ditch is shown to flow towards Stoke Road from Normandy Way and is assumed to outfall to the ditch that conveys flows immediately east of Stoke Road.

To provide a detailed understanding of flooding at the site, BWB Consulting Ltd have undertaken a hydraulic modelling study and associated hydrological assessment. The baseline modelling shows that the majority of the site is located outside of the 1 in 20-year, 1 in 100-year, 1 in 100-year +22% climate change (CC) and 1 in 1000-year events. During the 1 in 100-year return period and larger magnitude events, it is predicted that flood waters will overtop Normandy Way and be conveyed into the land parcel west of Stoke Road. During the 1 in 20-year event, this land parcel remains largely unaffected except for a small area of localised flooding that is predicted at the interaction between the end of Reach 4 (R4) and Stoke Road. It should be noted that no built development is currently proposed within this part of the site application boundary, as per the illustrative masterplan.

The proposed residential development, contained to the larger land parcel east of Stoke Road, is sequentially located outside of all modelled extents (including the 1 in 100-year +22%CC design event and 1 in 1000-year event).

As part of the development proposals, a roundabout is proposed off Stoke Road to access the site. To minimise the amount of culverting works that are to be required, it is proposed that the river corridor of the existing ditches that flow parallel to Stoke Road are diverted around the roundabout. A small section of culverting will be required within the site where the access road off the roundabout has entered the site. The proposed channel and culvert are to be designed to have sufficient capacity to contain the 1 in 100-year +22%CC flows. As such, it is proposed that dwellings will have finished floor levels set no lower than 600mm above the top of bank of the UOW and ditches. It is also recommended that finished floor levels are generally raised a minimum of 150mm above surrounding ground levels to help mitigate the residual risk of flooding and ground levels should be profiled to encourage pluvial runoff and overland flows away from built development and towards the nearest drainage point.

The proposed development has been reviewed against other potential sources of flood risk including, canals, surface water, sewers, groundwater and reservoirs and large waterbodies. None of these flood sources have been found to represent a potential barrier to development.

To mitigate the development's impact on the current runoff regime, it is proposed to incorporate surface water attenuation and storage as part of the development proposals. It is proposed to drain foul water from the development separately to surface water. Further information regarding the management of surface water runoff and foul water is outlined in the Sustainable Drainage Statement (Ref: HIN-BWB-ZZ-XX-RP-CD-0001_SDS).

In compliance with the requirements of National Planning Policy Framework, and subject to the mitigation measures proposed, the development could proceed without being subject to significant flood risk. Moreover, the development will not increase flood risk to the wider catchment area subject to suitable management of surface water runoff discharging from the site.

CONTENTS

EXECUTIVE SUMMARY	III
1. INTRODUCTION.....	1
Sources of Data	1
Existing Site	2
Local Watercourses	4
Proposed Development	5
2. FLOOD RISK PLANNING POLICY	6
National Planning Policy Framework.....	6
Flood Map for Planning	6
The Design Flood.....	7
Climate Change.....	8
Strategic Flood Risk Assessment	9
Preliminary Flood Risk Assessment.....	9
Local Flood Risk Management Strategy.....	10
Local Plan	10
3. POTENTIAL SOURCES OF FLOOD RISK	11
Fluvial Flood Risk.....	12
Flood Risk from Canals	17
Groundwater Flood Risk.....	18
Flood Risk from Reservoirs & Large Waterbodies	19
Pluvial Flood Risk	21
Flood Risk from Sewers	22
Effect of Development on Wider Catchment	23
4. FLOOD RISK MITIGATION	24
Sequential Arrangement	24
Proposed Scheme	24
Development Levels.....	25
Safe Access and Egress	25
Requirement for Floodplain Compensation.....	26
Surface Water Drainage.....	26
Foul Water Drainage	26
5. CONCLUSIONS AND RECOMMENDATIONS	27

FIGURES

Figure 1.1: Site Location
Figure 1.2: Site Topography
Figure 1.3: Local Watercourses
Figure 2.1: Flood Map for Planning
Figure 3.1: Baseline Modelled Flood Extents
Figure 3.2: Baseline Modelled Flood Extents
Figure 3.3: Baseline Modelled Flood Extents with 2m Contour Intervals
Figure 3.4: BGS Superficial Deposits
Figure 3.5: Reservoir Failure Flood Mapping
Figure 3.6: Surface Water Flood Risk Map
Figure 4.1: Proposed Watercourse Diversion Scheme

TABLES

Table 1.1: Site Summary
Table 2.1: Flood Zone Classifications
Table 2.2: Peak River Flow Allowance for the Tame Anker and Mease Management Catchment within the Humber River Basin District
Table 2.3: Application of the Appropriate Climate Change Allowance
Table 3.1: Pre-Mitigation Sources of Flood Risk
Table 3.2: Baseline Peak Flood Levels (m AOD)
Table 5.1: Summary of Flood Risk Assessment

APPENDICES

Appendix 1: Topographical Survey
Appendix 2: Illustrative Masterplan
Appendix 3: Hydraulic Modelling Report
Appendix 4: Leicestershire County Council Correspondence
Appendix 5: Severn Trent Water Sewer Records
Appendix 6: Severn Trent Water Correspondence

1. INTRODUCTION

- 1.1 This Flood Risk Assessment (FRA) has been prepared in accordance with the requirements set out in the National Planning Policy Framework (NPPF) and the associated Planning Practice Guidance. The FRA has been produced on behalf of Richborough Estates Limited and Mr & Mrs Adcock in respect of a planning application for a proposed residential development at the Land East of Stoke Road and North of Normandy Way, Hinckley, Leicestershire.
- 1.2 This FRA is intended to support an outline planning application and as such the level of detail included is commensurate and subject to the nature of the proposals. Summary information is included as **Table 1.1**.

Table 1.1: Site Summary

Site Name	Land East of Stoke Road and North of Normandy Way (A47)
Location	Hinckley
NGR (approx.)	SP419956
Application Site Area (ha)	25.4 (approx.)
Development Type	Residential
Flood Zone Classification	Flood Zone 1
NPPF Vulnerability	More Vulnerable
Environment Agency Office	East Midlands
Lead Local Flood Authority	Leicestershire County Council
Local Planning Authority	Hinckley & Bosworth Borough Council

Sources of Data

- i. Topographical Survey by Greenhatch Group, reference 42117_T
- ii. Environment Agency consultation
- iii. Leicestershire County Council Consultation
- iv. Environment Agency Surface Water Flood Risk Maps
- v. Hinckley and Bosworth Borough Council Level 1 Strategic Flood Risk Assessment
- vi. Hinckley and Bosworth Borough Council Level 2 Strategic Flood Risk Assessment
- vii. Leicestershire County Council Preliminary Flood Risk Assessment
- viii. Leicestershire County Council Local Flood Risk Management Strategy

- ix. Hinckley and Bosworth Borough Council Draft Local Plan
- x. Site visit undertaken by BWB Consulting Ltd, January 2022
- xi. Hydraulic modelling of the local watercourses and ditches undertaken by BWB Consulting, reference HIN-BWB-ZZ-XX-RP-YE-0002
- xii. Severn Trent Water Sewer Records and Consultation
- xiii. British Geological Survey Drift & Geology Maps

Existing Site

- 1.3 The site is located approximately 1.7km north of Hinckley town centre. The site is bound to the north by agricultural land, to the east by an Unnamed Ordinary Watercourse (UOW), to the south by Normandy Way (A47) and to the west by a pond and further greenfield land. Stoke Road is shown to pass through the site boundary. The site's location is illustrated within **Figure 1.1**.

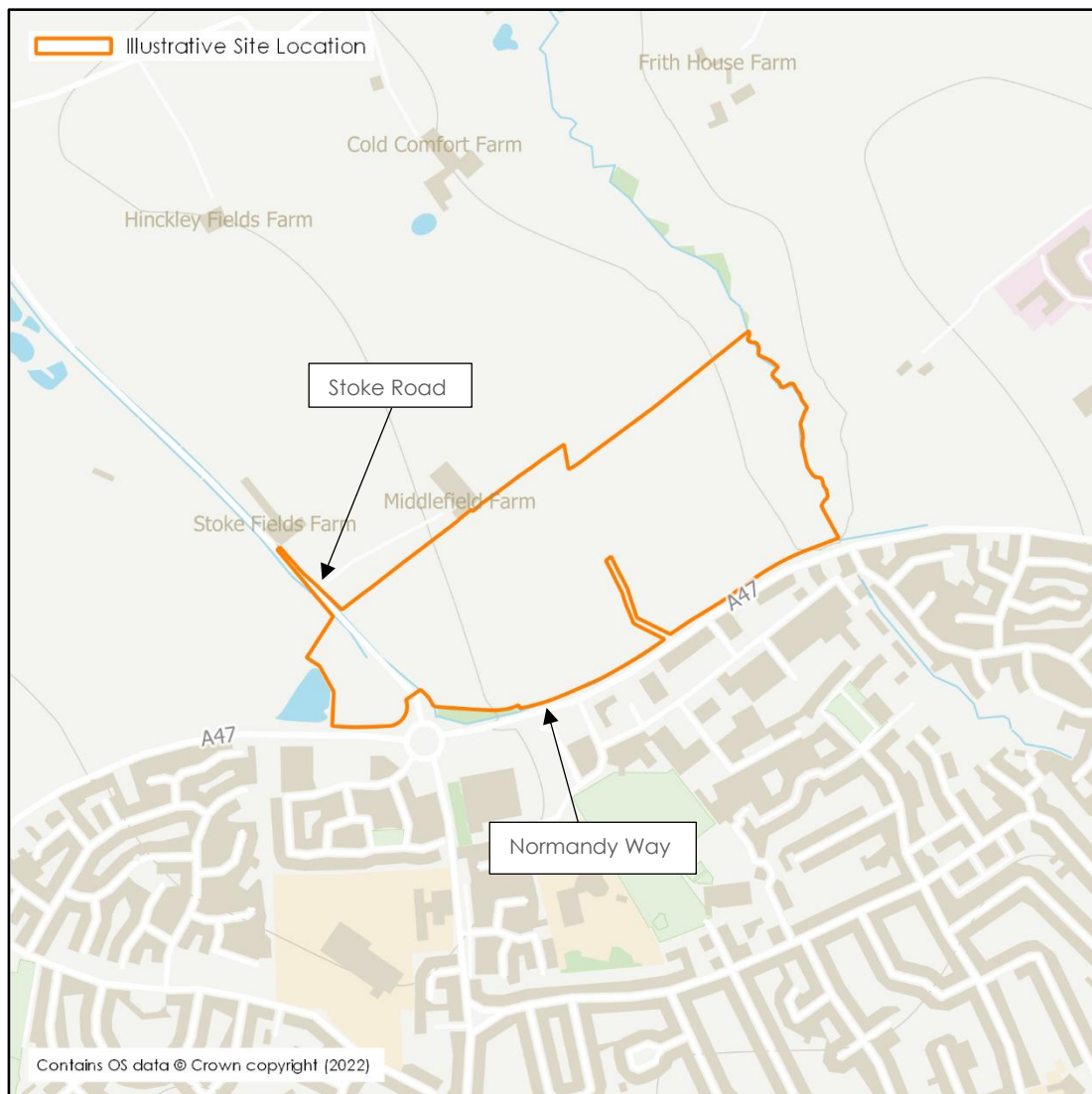


Figure 1.1: Site Location

- 1.4 A topographical survey has been undertaken and is included as **Appendix 1**. The land parcel to the west of Stoke Road is shown to generally fall in a northerly direction. Site levels are shown to range from approximately 106.1m Above Ordnance Datum (AOD) in the south to approximately 104.5m AOD in the north.
- 1.5 The primary land parcel has levels that rise away from Stoke Road to the west and the UOW to the east. The centre of the site subsequently forms a topographical high point, defining a split between two catchments. Site levels within the eastern catchment are shown to range from approximately 119.0m AOD in the centre of the site to approximately 106.5m AOD in the north east. Site levels within the western catchment are shown to range from approximately 119.0m AOD in the centre of the site to 104.8m AOD in the north west. The site contours are displayed in **Figure 1.2**.

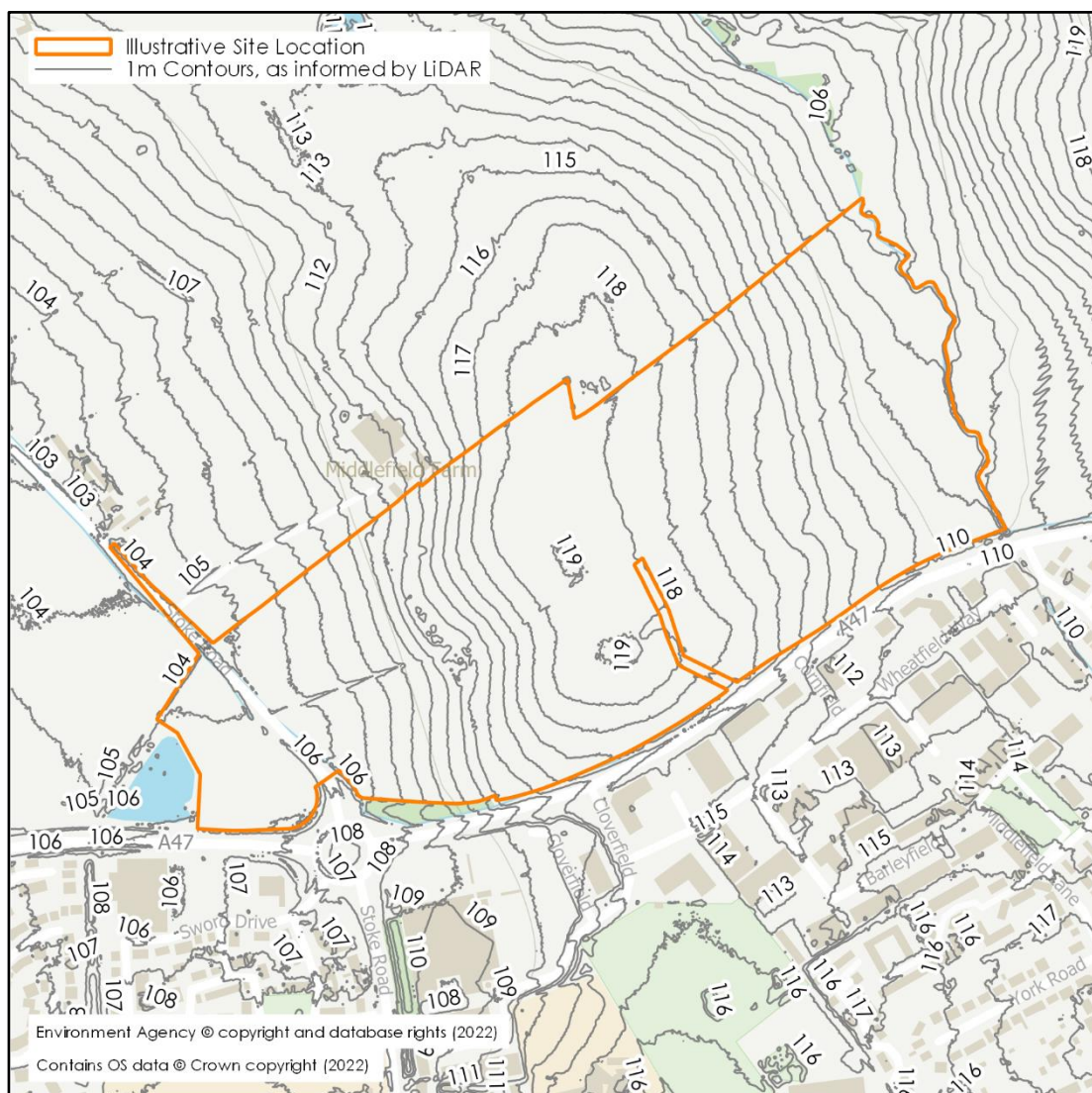


Figure 1.2: Site Topography

Local Watercourses

- 1.6 A UOW flows along the eastern boundary of the site in a northerly direction. The watercourse is a tributary of the River Tweed. The UOW flows from within an area of greenspace located approximately 500m south of Normandy Way. Flows are conveyed northwards into the site via twin 0.5m diameter circular culverts beneath Normandy Way. The UOW then forms the eastern boundary of the site as an open channel. Severn Trent Water sewer records demonstrate that two surface water sewers, that drain residential areas in the upper limits of the catchment, are understood to outfall to the watercourse immediately downstream of Normandy Way.
- 1.7 A series of ditches/highway drains have been identified, following a site visit, to be located within the vicinity of Stoke Road at the western portion of the site boundary. Two of the ditches (R2 & R3) are shown to flow adjacent to either side of Stoke Road in a north westerly direction. A further ditch (R4) is shown to flow towards Stoke Road from Normandy Way and is assumed to outfall to the ditch (R2) immediately east of Stoke Road. The local watercourse network is shown in **Figure 1.3**.

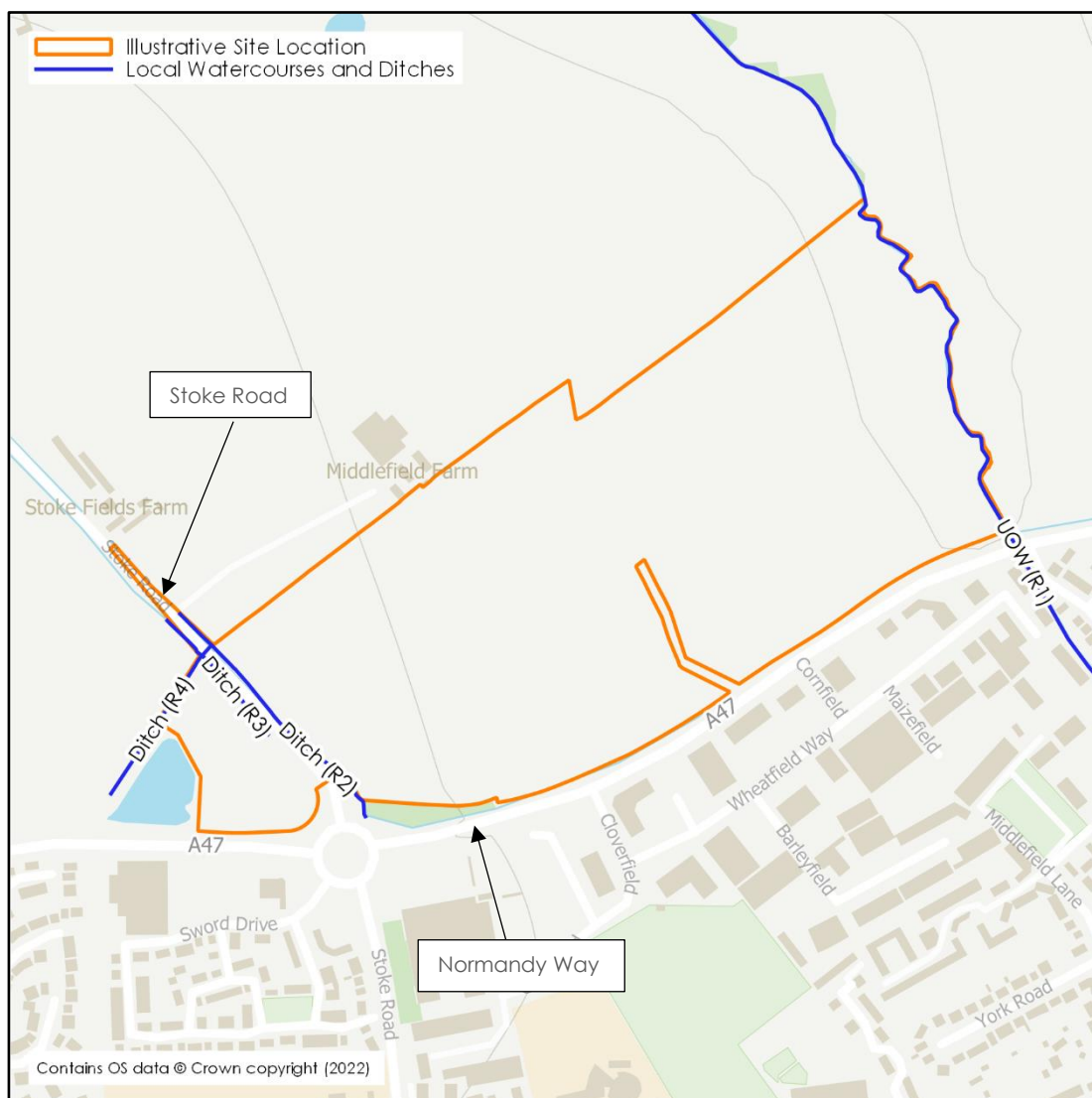


Figure 1.3: Local Watercourses

- 1.8 The ditches are understood to be fed by surface water sewers originating from within the urban development to the south of Normandy Way. As such, the associated flood risk is considered to be more representative of surface water flooding mechanisms.

Proposed Development

- 1.9 It is proposed that the site is to be developed to accommodate 'up to 475 dwellings, including public open space, land reserved for a primary school together with future expansion land (Use Class F1 (a)), landscaping, drainage and associated infrastructure'.
- 1.10 The residential-led development and associated infrastructure is contained to the larger land parcel east of Stoke Road, as per the proposed plans (refer to **Appendix 2**).

2. FLOOD RISK PLANNING POLICY

National Planning Policy Framework

- 2.1 The NPPF¹ sets out the Government's national policies on different aspects of land use planning in England in relation to flood risk. Planning Practice Guidance is also available online².
- 2.2 The Planning Practice Guidance sets out the vulnerability to flooding of different land uses. It encourages development to be located in areas of lower flood risk where possible and stresses the importance of preventing increases in flood risk off site to the wider catchment area.
- 2.3 The Planning Practice Guidance also states that alternative sources of flooding, other than fluvial (river flooding), should be considered when preparing an FRA.
- 2.4 The Planning Practice Guidance includes a series of tables that define Flood Zones (Table 1), the flood risk vulnerability classification of development land uses (Table 2) and 'compatibility' of development within the defined Flood Zones (Table 3).
- 2.5 This FRA is written in accordance with the NPPF and the Planning Practice Guidance.

Flood Map for Planning

- 2.6 With particular reference to planning and development, the Flood Map for Planning identifies Flood Zones in accordance with Table 1 of the Planning Practice Guidance. Further details on the Flood Zone classifications are outlined in **Table 2.1**.

Table 2.1: Flood Zone Classifications

Flood Zone	Description
Flood Zone 1 (Low Probability)	Land having less than a 1 in 1000 annual probability of river or sea flooding (<0.1% Annual Exceedance Probability).
Flood Zone 2 (Medium Probability)	Land having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1% AEP); or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% - 0.1% AEP).
Flood Zone 3a (High Probability)	Land having a 1 in 100 or greater annual probability of river flooding (>1% AEP); or land having a 1 in 200 or greater annual probability of flooding from the sea (>0.5% AEP). This is represented by "Flood Zone 3" on the Flood Map for Planning.
Flood Zone 3b (The Functional Floodplain)	Flood Zone 3b (The Functional Floodplain) is defined as land where water must flow or be stored in times of flood. This is not identified or separately distinguished from Zone 3a on the Flood Map for Planning.

¹ Revised National Planning Policy Framework, Ministry of Housing, Communities & Local Government, amended 2021

² Planning Practice Guidance: <https://www.gov.uk/government/collections/planning-practice-guidance>

2.7 The site is shown to be located entirely within Flood Zone 1, as shown in **Figure 2.1**.

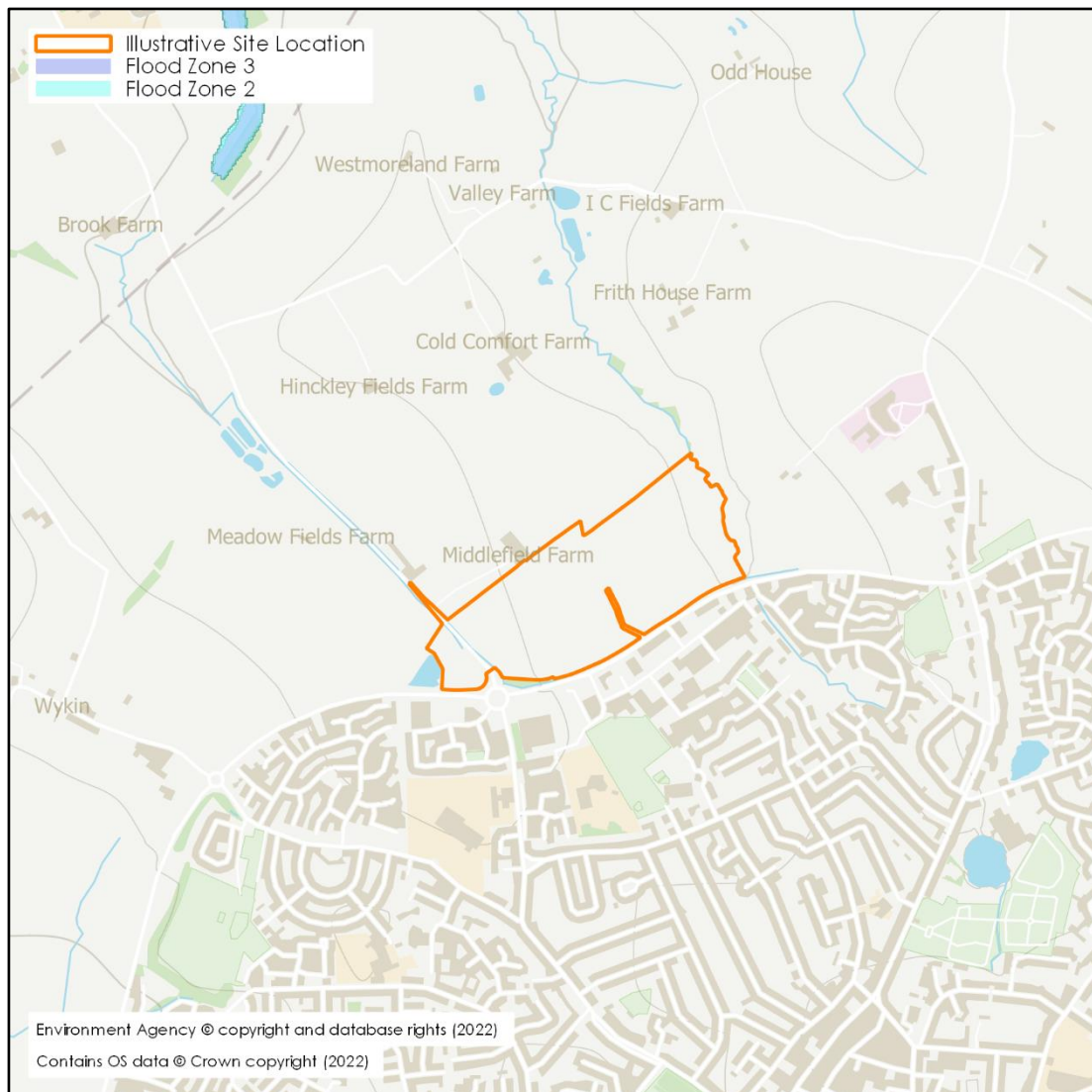


Figure 2.1: Flood Map for Planning

The Design Flood

- 2.8 The Planning Practice Guidance identifies that new developments should be designed to provide adequate flood risk management, mitigation, and resilience against the 'design flood' for their lifetime.
- 2.9 This is a flood event of a given annual flood probability, which is generally taken as fluvial (river) flooding likely to occur with a 1% annual probability (a 1 in 100 chance each year), or tidal flooding with a 0.5% annual probability (1 in 200 chance each year), against which the suitability of a proposed development is assessed and mitigation measures, if any, are designed.

Climate Change

- 2.10 Predicted future changes in peak river flows caused by climate change are provided by the Environment Agency (EA)³, with a range of projections applied to regionalised 'River Basin Districts', which are further subdivided into Management Catchments.
- 2.11 The site falls within the Tame Anker and Mease Management Catchment of the Humber River Basin District. **Table 2.2** identifies the relevant peak river flow allowances from this Management Catchment.

Table 2.2: Peak River Flow Allowance for the Tame Anker and Mease Management Catchment within the Humber River Basin District

Allowance Category	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper End	24%	30%	51%
Higher Central	15%	17%	30%
Central	10%	11%	22%

- 2.12 When determining the appropriate allowance for use in a FRA, the Flood Zone classification, flood risk vulnerability and the anticipated lifespan of the development should be considered. **Table 2.3** provides a matrix summarising the EA's guidance on determining the appropriate allowance(s).

Table 2.3: Application of the Appropriate Climate Change Allowance

Flood Zone	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
1	Use the central allowance where a location may fall within Flood Zone 2 or 3 in the future.				
2	Use the higher central allowance	Use the central allowance			
3a	Use the higher central allowance	Development should not be permitted	Use the central allowance		
3b	Use the higher central allowance	Development should not be permitted			Use the central allowance
If development is considered appropriate by the local authority when not in accordance with Flood Zone vulnerability categories, then it would be appropriate to use the higher central allowance.					

³ Environment Agency, Flood risk assessments: climate change allowances: <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances#table-1>

- 2.13 The site is located entirely within Flood Zone 1, the proposed development is classified as 'More Vulnerable' and has an anticipated lifespan of at least 100 years. Therefore, the Central allowance for the '2080s' epoch will be considered.
- 2.14 To ensure the development is designed adequately for its lifetime, a climate change (CC) allowance of 22% will be applied to the design flood and assessed as part of this FRA.

Strategic Flood Risk Assessment

- 2.15 A Strategic Flood Risk Assessment (SFRA) is a study carried out by one or more local planning authorities to assess the risk to an area from flooding from all sources, now and in the future.
- 2.16 The Hinckley and Bosworth Borough Council Level 1 SFRA⁴ has been reviewed in the production of this FRA. The SFRA provides information specific to the site location in the form of fluvial, surface water and groundwater flood risk mapping, as well as records of historical flooding. Information from the Level 1 SFRA will be referenced within **Section 3** where applicable.
- 2.17 The Hinckley and Bosworth Borough Council Level 2 SFRA⁵ was produced to facilitate the application of Sequential and Exception Tests to screen allocated development sites. The proposed application site is not referenced within the Level 2 SFRA. Information from the Level 2 SFRA will be referenced within **Section 3** where applicable.
- 2.18 The Leicestershire and Leicester City Level 1 SFRA⁶ has also been reviewed in the production of this SFRA as this document provides a comprehensive evidence base to support the production of the Strategic Growth Plan being prepared by the councils in Leicestershire.

Preliminary Flood Risk Assessment

- 2.19 A Preliminary Flood Risk Assessment (PFRA) is an assessment of floods that have taken place in the past and floods that could take place in the future. It generally considers flooding from surface water runoff, groundwater and ordinary watercourses, and is prepared by the Lead Local Flood Authorities.
- 2.20 The Leicestershire County Council PFRA⁷ considers flooding from surface water runoff, groundwater, ordinary watercourses and canals. However, no historical instances of flooding at the site are referenced. Information from the PFRA will be referenced within this report where applicable.

⁴ Level 1 Strategic Flood Risk Assessment (JBA Consulting, July 2019)

⁵ Level 2 Strategic Flood Risk Assessment (JBA Consulting, May 2020)

⁶ Level 1 Strategic Flood Risk Assessment (JBA Consulting, October 2017)

⁷ Preliminary Flood Risk Assessment (Leicestershire County Council, June 2011)

Local Flood Risk Management Strategy

- 2.21 A Local Flood Risk Management Strategy (LFRMS) is prepared by a Lead Local Flood Authority to help understand and manage flood risk at a local level.
- 2.22 The LFRMS aims to ensure that the knowledge of local flood risk issues is communicated effectively so that they can be better managed. The LFRMS also aims to promote sustainable development and environmental protection.
- 2.23 The Leicestershire County Council LFRMS⁸ has been reviewed and will be referenced within this report, where applicable.

Local Plan

- 2.24 Hinckley and Bosworth Borough Council have produced a draft Local Plan⁹ which aims to set out the vision and objectives for the growth of the borough up to 2039.
- 2.25 The draft Local Plan includes Policy CC02 Flood Risk which notes:
- Where development is permitted within flood risk areas, it must demonstrate that, where required, it will reduce fluvial and surface water flood risk and manage residual risk, address the impacts of climate change through appropriate flood mitigation and adaption measures, including enhancements to existing defences.
 - All development proposals should, where possible, include measures to reduce and manage surface water through appropriate Sustainable Drainage Systems (SuDS) so as to minimise and manage flood risk and improve water quality.
- 2.26 The Strategic Housing and Economic Land Availability Assessment (SHELAA) Report¹⁰ provides an assessment of the land within the Borough. The purpose of the document is to support the delivery of sufficient land and potential development sites in suitable locations across the borough, in line with Government objectives and policy. The site is identified and referenced to within this report as Assessment Site 'AS1029 A Land North of A47 and East of Stoke Road, Hinckley'. The site is referenced as being suitable, available and achievable, with an overall assessment of "developable".

⁸ Local Flood Risk Management Strategy (Leicestershire County Council, August 2015)

⁹ Hinckley and Bosworth Local Plan 2020-2039. Consultation Draft Plan (Hinckley and Bosworth Borough Council, June 2021)

¹⁰ Strategic Housing and Economic Land Availability Assessment (SHELAA) Report (Hinckley and Bosworth Borough Council, 2020)

3. POTENTIAL SOURCES OF FLOOD RISK

- 3.1 Flooding can occur from a variety of sources, or a combination of sources, which may be natural or artificial. **Table 3.1** below identifies the potential sources of flood risk to the site in its current condition, and the impacts which the development could have in the wider catchment, prior to mitigation. These are discussed in greater detail in the forthcoming section. The mitigation measures proposed to address flood risk issues and ensure the development is appropriate for its location are discussed within **Section 4**.

Table 3.1: Pre-Mitigation Sources of Flood Risk

Flood Source	Potential Risk				Description
	High	Medium	Low	None	
Fluvial			X		According to the EA's Flood Map for Planning, the site is located entirely within Flood Zone 1.
			X		The baseline model results show that the proposed residential-led development is sequentially located at low risk of fluvial flooding for its lifetime. Flows are predicted to overtop Normandy Way and flow into the land parcel west of Stoke Road. However, flooding mechanisms in this area are considered more representative of pluvial risk.
Coastal				X	None of the watercourses in the vicinity of the site are tidally influenced.
Canals			X		The Ashby Canal is located approximately 1.9km west of the site. The site is removed from the canal network by distance and intervening topography.
Groundwater			X		The site is shown to fall within an area predicted to be at a low susceptibility to groundwater flooding.

Flood Source	Potential Risk				Description
	High	Medium	Low	None	
Reservoirs and waterbodies			X		The site is shown to fall outside of the area at risk of reservoir failure. There are two waterbodies located at the upper limit of the eastern catchment (Little Pit Fishery and a lake to the rear of the Asda superstore). The waterbodies are topographically higher than the site and could pose a risk, if breached. However, the probability of this occurring is considered low.
Pluvial runoff			X		The parcel of land to the east of Stoke Road, where the residential-led development is focused, is largely at a very low risk of surface water flooding. Two pluvial flow routes are present to the east and west of the parcel, attributed to the UOW and roadside ditch.
Sewers			X		Severn Trent Water sewer records do not identify any sewers within the site. In the event of exceedance of the upstream sewer network, water may flow into the western land parcel. Topographic levels in the eastern land parcel rise away from surrounding roads, therefore removing the proposed dwellings from any risk of sewer flooding.
Effect of Development on Wider Catchment	X				Flood water could be displaced as a result of the proposed roundabout, if left unmitigated.
	X				The development will increase the area of impermeable surfaces leading to a potential increase in runoff, if left unmitigated.

Fluvial Flood Risk

- 3.2 Flooding from watercourses occurs when flows exceed the capacity of the channel, or where a restrictive structure is encountered, which leads to water overtopping the banks into the floodplain. This process can be exacerbated when debris is mobilised by high flows and accumulates at structures.

- 3.3 The site is located entirely within Flood Zone 1, which is land defined as having a low probability of flooding from rivers or sea. The nearest EA Flood Extents are located approximately 1.3km north west of the site, attributed to the River Tweed.
- 3.4 An UOW is shown to flow adjacent to the eastern boundary of the site, and outfalls to the River Tweed approximately 2km downstream of the site. The UOW is not represented on the EA's Flood Map for Planning due to its small catchment.
- 3.5 A series of ditches/drains are shown to be located adjacent to and within the western part of the site. Two of the ditches are shown to flow adjacent to Stoke Road in a north westerly direction. A further ditch is shown to flow towards Stoke Road from Normandy Way and is assumed to outfall to the ditch immediately east of Stoke Road.
- 3.6 The ditches are understood to be fed by surface water sewers originating within the urban development to the south of Normandy Way.

Historical Flooding

- 3.7 The EA Historical Flood Map shows the nearest recorded flood outline to be located approximately 6.3km south west of the site attributed to the River Trent in 1992.
- 3.8 The Level 1 SFRA references no instances of fluvial flooding at the site.
- 3.9 Correspondence with Leicestershire County Council, included as **Appendix 4**, notes that there are no reports of flooding of the highway at the site boundary. There has been recorded flooding of the UOW to the north of the site, downstream of Rogues Lane, however it is noted that this would not concern the site.

Hydraulic Modelling

- 3.10 To provide a detailed understanding of fluvial flooding at the site, BWB Consulting Ltd completed a hydraulic modelling study and associated hydrological assessment in February – March 2022. The details of the hydraulic modelling exercise, along with detailed flood maps, are available in the Hydraulic Modelling Report (**Appendix 3**).
- 3.11 The baseline modelling shows that the majority of the site is located outside of the 1 in 20-year, 1 in 100-year, 1 in 100-year +22%CC and 1 in 1000-year events. The flood extents are displayed in **Figure 3.1** below and the associated mechanisms are summarised overleaf.

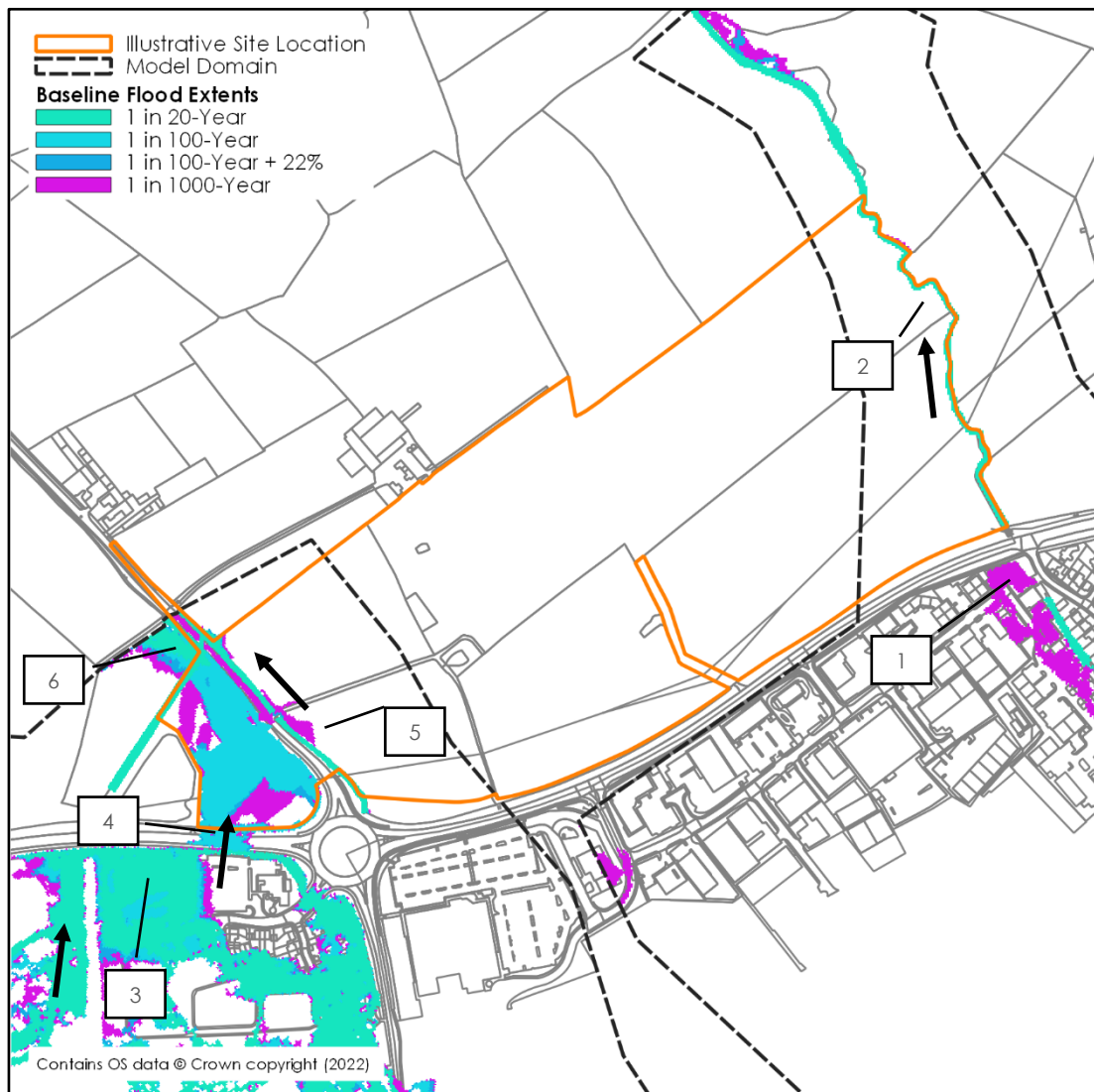


Figure 3.1: Baseline Modelled Flood Extents

1 – The UOW enters the site via twin 0.5m diameter circular piped culverts beneath Normandy Way. The structure is shown to have insufficient capacity to convey peak flows during the 1 in 1000-year event. Subsequently, the pipes become surcharged, resulting in localised flooding predicted immediately upstream.

2 – As the UOW flows adjacent to the site, maximum water levels remain in-channel. Subsequently, the proposed residential development is located outside of all modelled flood extents from this watercourse.

3 – Out of bank flooding is predicted upstream of Normandy Way for all modelled return periods including the 1 in 20-year event. This aligns with known capacity issues in this area that have been raised by Severn Trent Water at the time of consultation.

4 – As a consequence of flood waters accumulating upstream of Normandy Way, the model predicts that the A47 will be overtopped during the 1 in 100-year return period and larger magnitude events. It is subsequently predicted that flood waters will be conveyed into the land parcel west of Stoke Road.

5 – During the 1 in 1000-year event, out of bank flooding is predicted at low levels of the eastern land parcel immediately adjacent to R2. This occurs due to the 600mm diameter culvert having insufficient capacity to convey peak flows for the 1 in 1000-year event without the right bank being overtopped. Ground levels on this bank are lower due to an incoming hedgerow with an associated drainage ditch.

6 – During the 1 in 20-year event, a small area of localised flooding is predicted in the western parcel where R4 reaches Stoke Road. The extent of flooding is more significant during the 1 in 100-year return period and larger magnitude events given that flows overtop Normandy Way and enter the land parcel from the south. It should be noted, however, that no development is currently proposed within this area of risk.

- 3.12 A node location plan is displayed in **Figure 3.2**. Peak flood levels for the 1 in 20-year, 1 in 100-year, 1 in 100-year +22%CC and 1 in 1000-year events are reported at these 1D and 2D locations in **Table 3.2**.

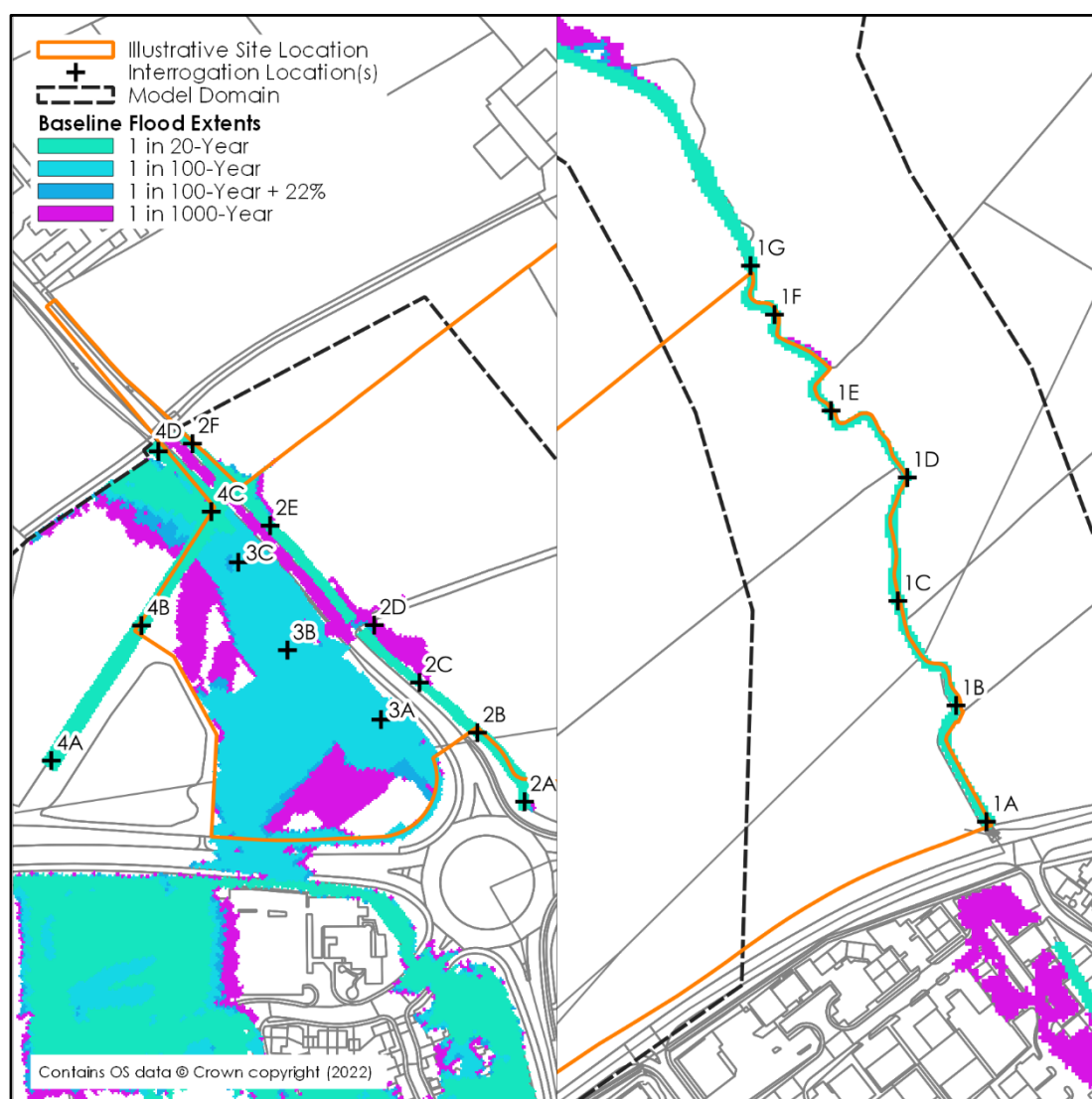


Figure 3.2: Baseline Modelled Flood Extents

Table 3.2: Baseline Peak Flood Levels (m AOD)

ID	1 in 20-Year	1 in 100-Year	1 in 100-Year +22%CC	1 in 1000-Year
1A	108.12	108.20	108.26	108.43
1B	107.23	107.41	107.51	107.73
1C	107.08	107.25	107.34	107.55
1D	106.84	107.00	107.08	107.27
1E	106.51	106.66	106.73	106.91
1F	106.12	106.28	106.35	106.51
1G	105.97	106.10	106.15	106.27
2A	105.71	105.81	105.89	106.00
2B	105.48	105.66	105.78	105.88
2C	105.36	105.58	105.72	105.81
2D	-	-	-	105.74
2E	104.57	104.63	104.66	104.75
2F	104.01	104.02	104.03	104.04
3A	-	105.39	105.40	105.40
3B	-	105.13	105.13	105.14
3C	-	104.72	104.73	104.75
4A	104.57	104.62	104.66	104.75
4B	104.54	104.58	104.60	104.66
4C	104.54	104.57	104.59	104.64
4D	104.10	104.11	104.12	104.12

- 3.13 The proposed masterplan is displayed in **Figure 3.3** with 2m contours based off existing topography. All dwellings are shown to be removed from the modelled floodplain extents. The existing topographic levels also demonstrate that all built development will be located at least 1-2m above the closest 1 in 100-year +22%CC design flood extent. The modelled flood outlines therefore suggest that the site is at low risk of fluvial flooding. The proposed built development has been assessed as being topographically removed from the predicted modelled flood outlines. As such, the development could be considered safe for its lifetime.

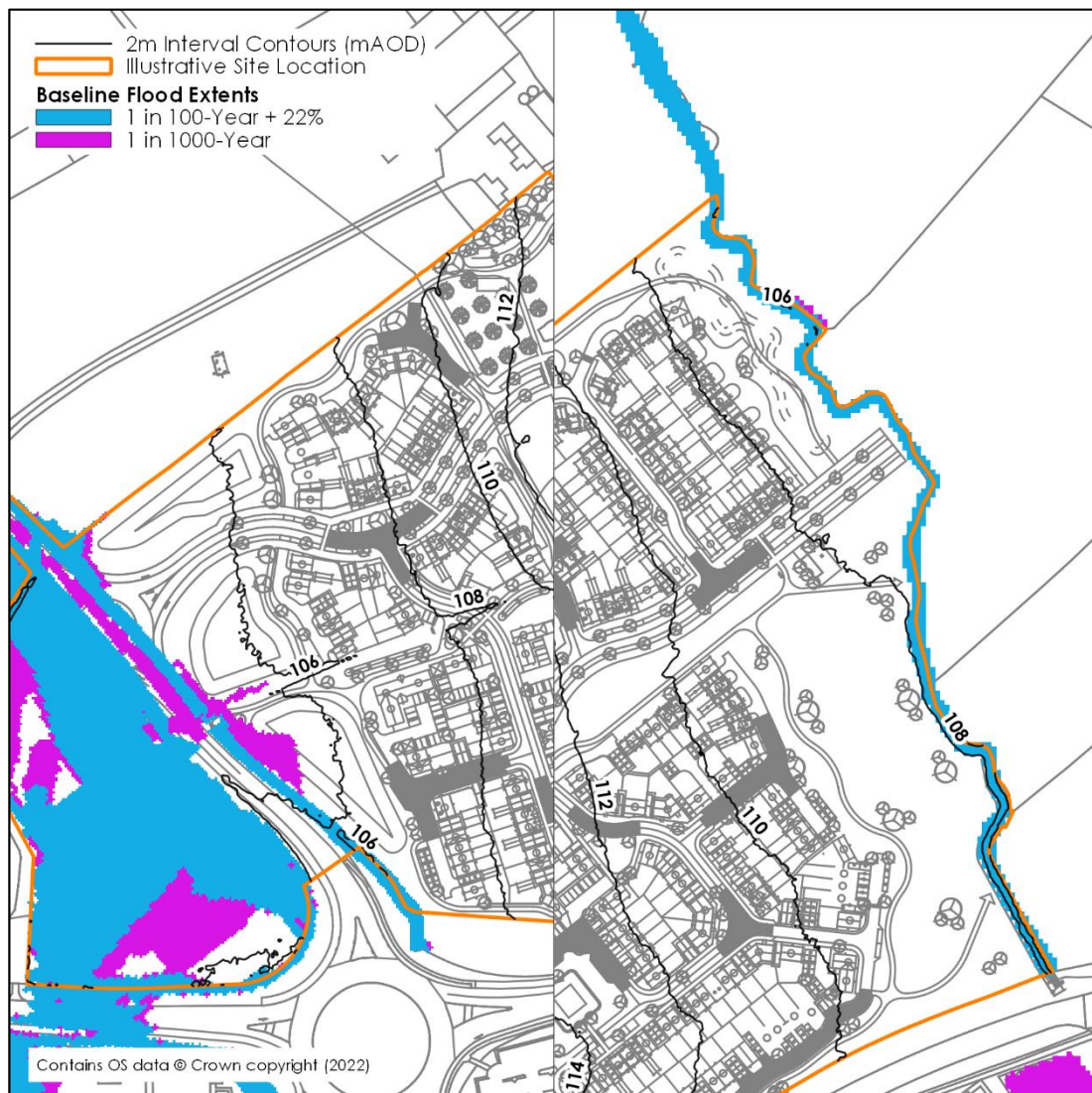


Figure 3.3: Baseline Modelled Flood Extents with 2m Contour Intervals

Flood Risk from Canals

- 3.14 The Canal and River Trust (CRT) generally maintains canal levels using reservoirs, feeders and boreholes and manages water levels by transferring it within the canal system.
- 3.15 Water in a canal is typically maintained at predetermined levels by control weirs. When rainfall or other water enters the canal, the water level rises and flows out over the weir. If the level continues rising it will reach the level of the storm weirs. The control weirs and storm weirs are normally designed to take the water that legally enters the canal under normal conditions. However, it is possible for unexpected water to enter the canal or for the weirs to become obstructed. In such instances the increased water levels could result in water overtopping the towpath and flowing onto the surrounding land.
- 3.16 Flooding can also occur where a canal is impounded above surrounding ground levels and the retaining structure fails.

- 3.17 The Ashby Canal is located approximately 1.9km west of the site and is set at approximately 90mAOD. The site is elevated a minimum of circa 15m above the canal network, therefore, the flood risk associated with canals is low.

Groundwater Flood Risk

- 3.18 Groundwater flooding occurs when the water table rises above ground elevations. It is most likely to happen in low lying areas underlain by permeable geology. This may be regional scale chalk or sandstone aquifers, or localised deposits of sands and gravels underlain by less permeable strata such as that in a river valley.
- 3.19 British Geological Survey (BGS) mapping shows the site to be underlain by Mercia Mudstone Group, which is designated by the EA as a Secondary B Aquifer. Secondary B Aquifers are predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering.
- 3.20 Superficial deposits of Bosworth Clay Member (Clay and Silt), Wolston Sand And Gravel, Oadby Member (Diamicton) and Alluvium (Clay, Silt, Sand and Gravel) are expected to be present throughout the site, as shown in **Figure 3.4**.
- 3.21 The superficial deposits are designated as Secondary A Aquifers, Secondary (undifferentiated) Aquifers and Unproductive Strata. Secondary A Aquifers are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. Secondary (undifferentiated) Aquifers are assigned in cases where it has not been possible to attribute either category A or B to a rock type. Unproductive Strata are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.
- 3.22 A BGS borehole log (reference: SP49NW25) is located to the south east of the site and is shown to be underlain by Mercia Mudstone Group with superficial deposits of Alluvium. Here, slight water seepage was noted at 1.5m below ground level (bgl).
- 3.23 The Hinckley and Bosworth Borough Council SFRA Groundwater Susceptibility mapping shows the site to be located within a 1km² grid tile whereby less than 25% of the area is considered to be susceptible to groundwater flooding.
- 3.24 It should be noted that Groundwater Susceptibility mapping is based on strategic scale mapping that uses a 1km² grid. It identifies areas susceptible to flooding from groundwater at a broad scale on the basis of geological and hydrogeological conditions. Therefore, the classification could potentially be based on another area within the cell.

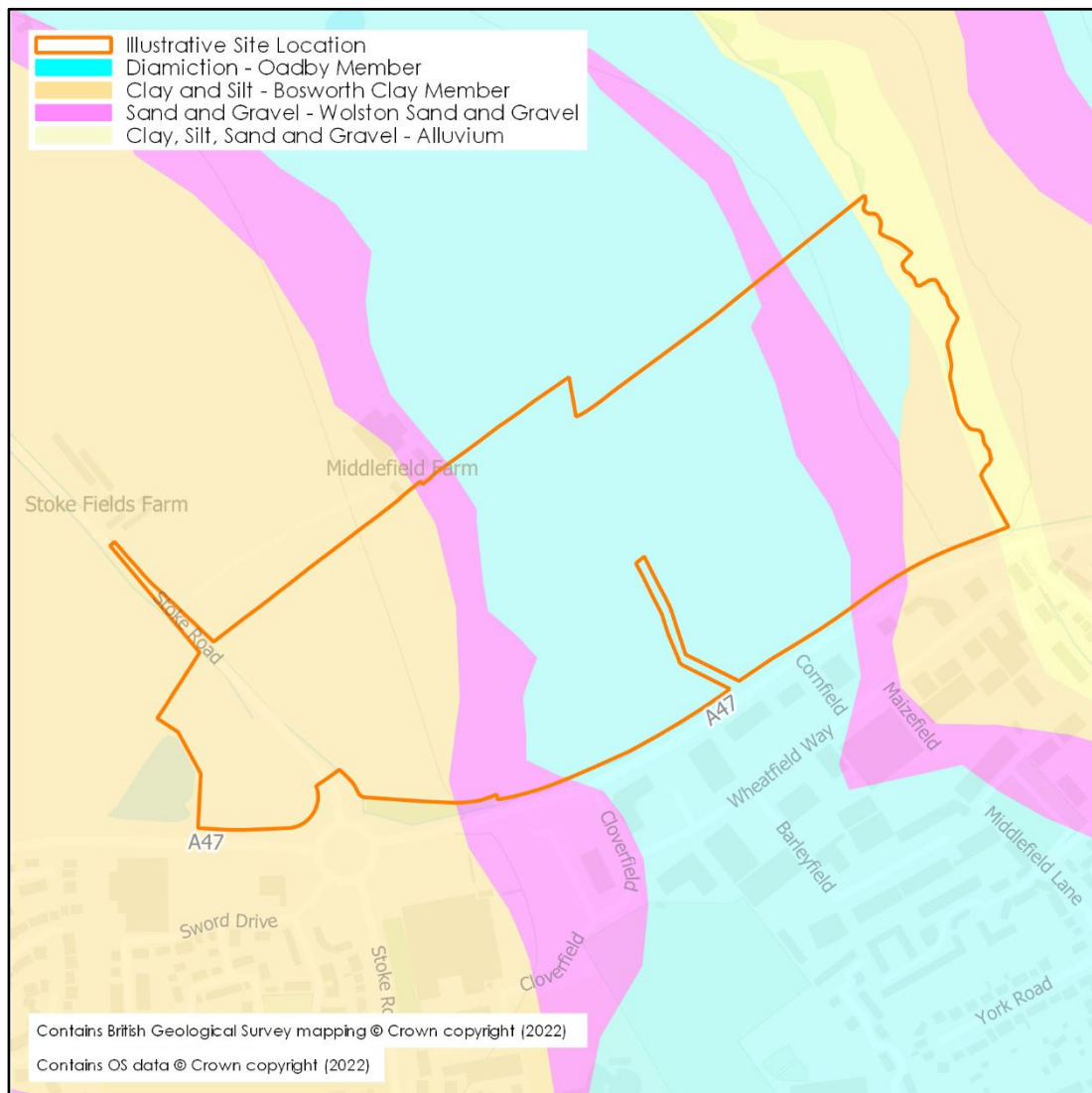


Figure 3.4: BGS Superficial Deposits

- 3.25 The site is shown to be located outside of all EA groundwater source protection zones.
- 3.26 The overall risk of groundwater flooding at the site is considered to be low.

Flood Risk from Reservoirs & Large Waterbodies

- 3.27 Flooding can occur from large waterbodies or reservoirs if they are impounded above the surrounding ground levels or are used to retain water in times of flood. Although unlikely, reservoirs and large waterbodies could overtop or breach leading to rapid inundation of the downstream floodplain.
- 3.28 To help identify this risk, reservoir failure flood risk mapping has been prepared by the EA, this shows the largest area that might be flooded if a reservoir were to fail and release the water it holds. The map displays a worst case scenario and is only intended as a guide. An extract of the mapping is included as **Figure 3.5**

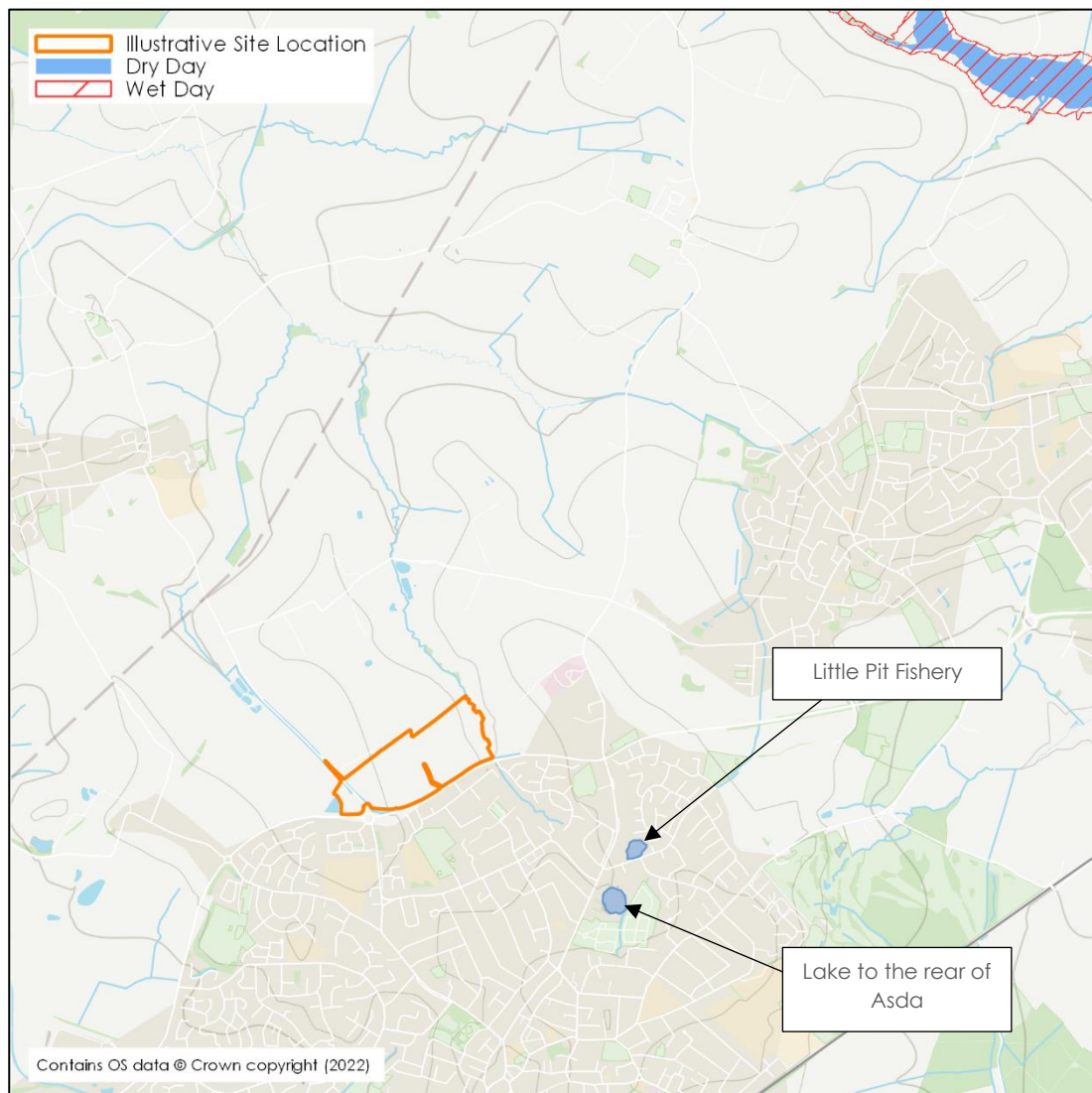


Figure 3.5: Reservoir Failure Flood Mapping

- 3.29 The nearest reservoir failure flood extent is shown to be located approximately 4.1km north east of the site, associated with Mallory Park Large Lake during a 'wet-day'. A 'wet-day' event is where reservoir flooding takes place alongside wider river flooding. The nearest 'dry-day' extent is located approximately 4.2km north east of the site and shows the extent of reservoir flooding with river levels at normal level.
- 3.30 The site is shown to be located outside of the flood extents of any reservoir failure.
- 3.31 A pond is shown to be located immediately west of the western parcel. It is assumed that the pond is utilised as a drainage feature. In the event of overtopping, water may flow into the western parcel, however intervening topography would prevent flows from reaching the main development area to the east of Stoke Road.
- 3.32 Two waterbodies have been identified in the upper limit of the eastern catchment, approximately 1km south of the site (as identified on **Figure 3.5**). These are the Little Pit Fishery and a lake at the rear of the Asda Superstore. The waterbodies are set topographically above the site (approximately 125mAOD). Therefore, there is a residual

risk of flooding to the site in the unlikely event that the lakes are breached. With that said, given the size of the lakes, the distance to the site and the intervening topography, exceedance flows are likely to dissipate as they approach the site and any impact would likely be negligible.

- 3.33 Due to the maintenance responsibilities associated with the ownership of waterbodies, the probability of such an event occurring is considered low. As such, this would not be considered a barrier to development.

Pluvial Flood Risk

- 3.34 Pluvial flooding can occur during prolonged or intense storm events when the infiltration potential of soils, or the capacity of drainage infrastructure is overwhelmed leading to the accumulation of surface water and the generation of overland flow routes.
- 3.35 Risk of flooding from surface water mapping has been prepared by the EA (**Figure 3.6**),

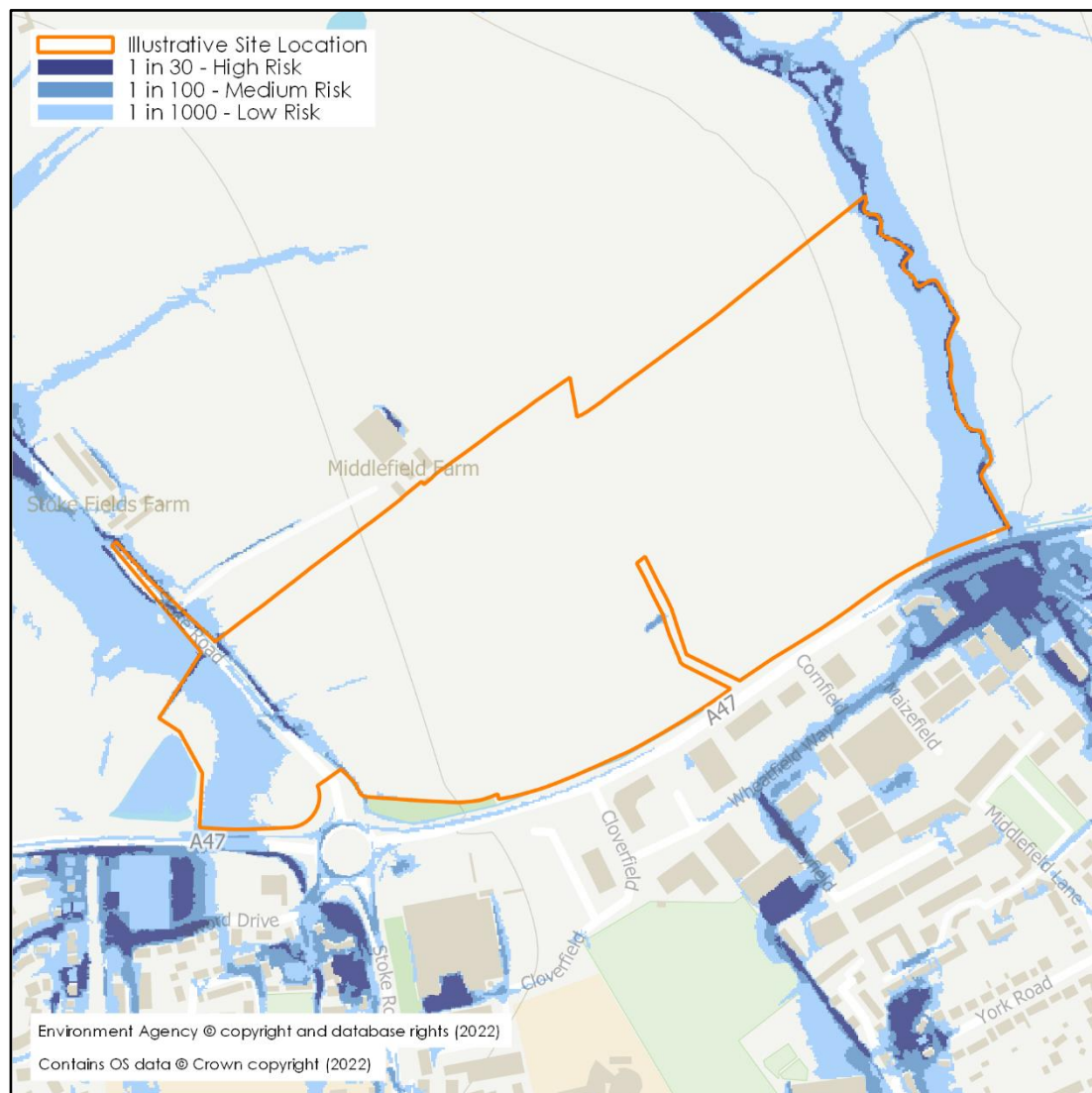


Figure 3.6: Surface Water Flood Risk Map

- 3.36 The EA surface water mapping shows the potential flooding which could occur when rainwater does not drain away through the normal drainage systems or soak into the ground but lies on or flows over the ground instead.
- 3.37 The majority of the site is shown to be at a very low risk of surface water flooding. A pluvial flow route, presenting a low (1 in 1000-year) to high (1 in 30-year) risk is shown to be present along the eastern and western boundaries of the site, thought to be associated with the UOW and ditches. A small, isolated area of low to medium (1 in 100-year) surface water flood risk is shown to be present within the centre of the site, associated with a topographical depression.
- 3.38 The land parcel to the west of Stoke Road is shown to be at a low risk of surface water flooding. Surface water is predicted to overtop the A47 and into the site. Similar flooding mechanisms were confirmed as part of the hydraulic modelling exercise.
- 3.39 Site access and egress from Stoke Road is shown to be at a low risk of flooding, with the ditch presenting a low to high risk. Surface water depth mapping shows depths of below 150mm along Stoke Road during the 1 in 100-year event.
- 3.40 The Level 1 SFRA notes that a surface water overland flow route exists along Stoke Road and is associated with an unnamed drain adjacent to this road, however, there are no historic flooding incidents recorded at the site.
- 3.41 Overall, the site is considered to be at a low risk of flooding from pluvial sources.

Flood Risk from Sewers

- 3.42 Sewer flooding can occur when the capacity of the infrastructure is exceeded by excessive flows, or as a result of a reduction in capacity due to collapse or blockage, or if the downstream system becomes surcharged. This can lead to the sewers flooding onto the surrounding ground via manholes and gullies, which can generate overland flow paths.
- 3.43 The local sewerage undertaker is Severn Trent Water. A copy of their asset records is included as **Appendix 5**.
- 3.44 The nearest public sewer network is shown to be located south of Normandy Way. No sewer networks have been identified within the site or along Stoke Road or Normandy Way. Two public surface water sewers (750mm dia and 900mm dia) are shown to outfall to the UOW to the south east of the site. A 1050mm dia public surface water sewer is shown to outfall to the ditch to the south west of the western parcel.
- 3.45 The hydraulic modelling exercise includes a representation of the sewer networks upstream of the site to understand the capacity of the sewer network during a suite of return periods. The proposed development is shown to be unaffected in the event of sewer exceedance, however, the western land parcel is predicted to be affected from flooding mechanisms previously outlined in the fluvial and pluvial sections of this report (overtopping of the A47 / Normandy Way).

- 3.46 Correspondence with Severn Trent Water, included as **Appendix 6**, notes that there are capacity issues during heavy storm events. The details surrounding any issues regarding capacity are not known. This has been confirmed by the hydraulic modelling exercise.
- 3.47 Topographic levels at the eastern land parcel rise steeply away from the eastern, southern and western boundaries and subsequently, should any sewer system be exceeded, the risk to the proposed development could be considered low.
- 3.48 Overall, the site is considered to be at a medium risk of flooding from sewers due to predicted flooding at the western land parcel. The proposed development could be considered at a low risk.

Effect of Development on Wider Catchment

Displacement of Floodplain

- 3.49 The proposed development is largely shown to be located outside of the 1 in 100-year +22%CC floodplain. However, the proposed roundabout is shown to be located within the flood extents of the baseline 1 in 100-year +22%CC modelled extent. As a result of proposed earthworks, this could, in turn, result in a displacement of flood water and an increase in flood risk elsewhere, if left unmitigated.
- 3.50 Appropriate mitigation measures for addressing the risk of flooding to the site are outlined in **Section 4**. This therefore offers a means of managing flood water displacement.

Development Land Use/Drainage Considerations

- 3.51 The proposed development will increase the area of impermeable surfaces on the site. This will result in an increase in surface water runoff, which could increase flood risk downstream unless properly mitigated. Appropriate surface water management is discussed in **Section 4**.

4. FLOOD RISK MITIGATION

- 4.1 **Section 3** has identified the sources of flooding which could pose a risk to the site and the proposed development. This section sets out the mitigation measures which are to be incorporated to address and reduce the risk of flooding to within acceptable levels.

Sequential Arrangement

- 4.2 The proposed residential development is sequentially located outside of all modelled flood extents, including the 1 in 100-year +22%CC and 1 in 1000-year events.

Proposed Scheme

- 4.3 As part of the development proposals, a roundabout is proposed off Stoke Road to access the site. To mitigate against floodwater displacement and limit the extent of culverting, a watercourse diversion scheme is proposed, as illustrated within **Figure 4.1**.

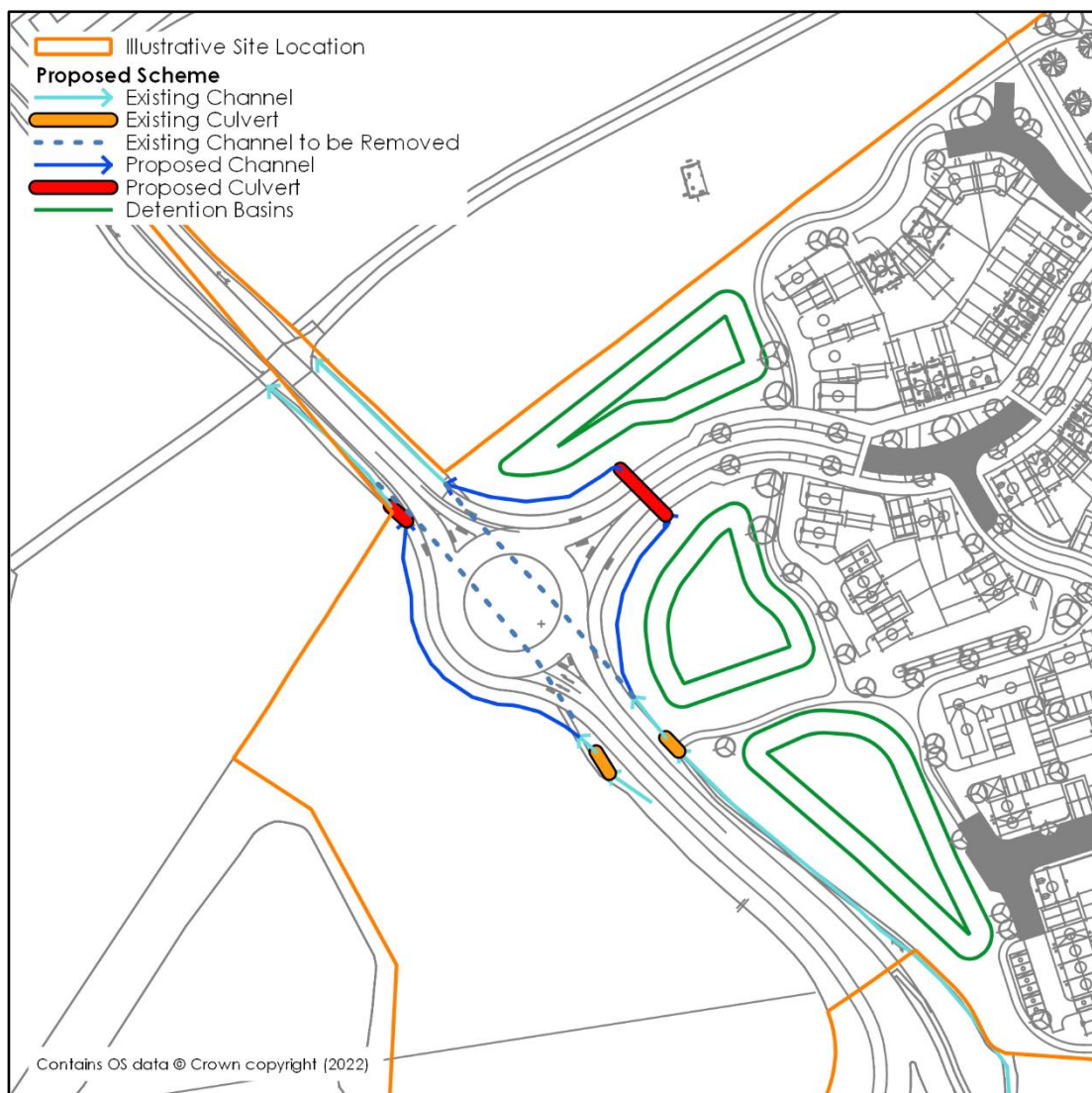


Figure 4.1: Proposed Watercourse Diversion Scheme

- 4.4 Whilst culverting will be limited as a result of the proposed diversion scheme, a small section of culverting will be required within the site where the access road off the roundabout has entered the site.
- 4.5 The ditch to the west of the site is to be culverted to allow a connection into the existing drainage network.
- 4.6 The proposed channel and culverts are to be designed to have sufficient capacity to contain the 1 in 100-year +22%CC flows.

Development Levels

- 4.7 Hinckley and Bosworth Borough Council Level 1 SFRA advises that minimum finished floor levels should be set 600mm above the 1 in 100-year plus climate change (+22%) peak flood level.
- 4.8 The proposed channel and culvert will be designed to have sufficient capacity to contain the 1 in 100-year +22%CC flows. As such, it is proposed that dwellings are to have finished floor levels set no lower than 600mm above the top of bank of the UOW and ditches.
- 4.9 To the eastern side of the development, the nearest dwelling to the UOW is located at 107.5m AOD which is raised approximately 1.2m above the nearest modelled flood level for the 1 in 100-year + #22% event. To the western side of the development, the nearest dwelling to the ditches is located at 107.0m AOD which is raised approximately 1.1m above the nearest modelled flood level. This is illustrated with contour mapping in **Figure 3.3**. The existing topography of the site rises away from the watercourse and ditches and therefore all dwellings are expected to be raised 600mm above the top of banks of the ditches and watercourse.
- 4.10 It is also recommended that finished floor levels are raised a minimum of 150mm above the surrounding ground levels to help mitigate against the residual risk of flooding from surface water runoff.
- 4.11 Ground levels should be profiled to encourage pluvial runoff and overland flows away from the built development and towards the nearest drainage point.

Safe Access and Egress

- 4.12 The proposed channel and culvert will be designed to have sufficient capacity to contain the 1 in 100-year +22%CC flows. Site access and egress from Stoke Road is shown to be at a low risk of surface water flooding. Surface water depth mapping shows depths of below 150mm along Stoke Road during the 1 in 100-year event.
- 4.13 Therefore, access and egress from Stoke Road will be safely achieved.

Requirement for Floodplain Compensation

- 4.14 The proposed channel and culvert will be designed to have sufficient capacity to contain the 1 in 100-year +22%CC flows to ensure that no downstream detriment is caused by the proposed development and the construction of the roundabout. Therefore, floodplain compensation will not be required.

Surface Water Drainage

- 4.15 To mitigate the development's impact on the current runoff regime, it is proposed to incorporate surface water attenuation and storage as part of the development proposals.
- 4.16 Further information on the drainage approach is provided within the accompanying Sustainable Drainage Statement (reference: HIN-BWB-ZZ-XX-RP-CD-0001).
- 4.17 In brief, the development will discharge surface water at the greenfield QBAR rate. Attenuated surface water storage will be provided with capacity for the 1 in 100-year storm with an allowance for climate change.
- 4.18 The majority of on-site storage is to be provided in detention basins that are situated at the eastern and western boundaries of the primary development parcel. It is expected that any shortfall in calculated storage volume is to be provided within the freeboard of the basins, conveyance swales (displayed along the green corridor) and through distributed cellular storage within the fabric of the development. Such storage could be offered in areas of Public Open Space (POS) or beneath shared/private roads and parking areas. It is anticipated that attenuation volumes will reduce as the site progresses through the detailed design stage and further network modelling is undertaken.

Foul Water Drainage

- 4.19 It is proposed to drain foul water from the development separately to surface water.
- 4.20 Further information on the drainage approach is provided within the accompanying Sustainable Drainage Statement (reference: HIN-BWB-ZZ-XX-RP-CD-0001).

5. CONCLUSIONS AND RECOMMENDATIONS

- 5.1 This FRA has been prepared in accordance with requirements set out in the NPPF and the associated Planning Practice Guidance. The FRA has been produced on behalf of Richborough Estates Limited and Mr & Mrs Adcock in respect of a planning application for a proposed residential development at the Land East of Stoke Road and North of Normandy Way, Hinckley, Leicestershire.
- 5.2 This FRA is intended to support an outline planning application and as such the level of detail included is commensurate and subject to the nature of the proposals.
- 5.3 This report demonstrates that the proposed development is not at significant flood risk, subject to the recommended flood mitigation strategies being implemented. The identified risks and mitigation measures are summarised within **Table 5.1**:

Table 5.1: Summary of Flood Risk Assessment

Flood Source	Risk & Proposed Mitigation Measures
Fluvial	The site is shown to be located entirely within Flood Zone 1. A hydraulic modelling exercise has been undertaken to assess the risk of flooding to the site from the UOW and ditches. The modelling has confirmed that the development parcel is at low risk of flooding and located outside of the 1 in 100-year +22%CC design extent. To ensure development is safe for its lifetime, it is recommended that finished floor levels are raised a minimum of 600mm above the top of bank of the UOW / bordering ditch along Stoke Road (R2). As a minimum, floor levels should be set 150mm above surrounding ground levels to help mitigate the residual risk of flooding.
Pluvial runoff and Sewers	EA surface water mapping demonstrates that the proposed development is at low risk of surface water flooding. Whilst no existing sewer records have been identified at the site, Severn Trent Water have confirmed that the sewer network upstream (south of Normandy Way) has known capacity issues. This has been confirmed in the hydraulic modelling exercise by representing the sewer network. The model demonstrates built development is not at risk of sewer exceedance due to the rise in topographic levels away from the surrounding roads. Ground levels should be profiled to encourage runoff and overland flows away from the built development and towards the nearest drainage point. It is also recommended that finished floor levels are raised a minimum of 150mm above surrounding ground levels.
Impact of the Development	The residential development has been sequentially located so as to not encroach or displace any modelled floodplain. A roundabout is proposed as part of the development. To mitigate against the risk of flood water displacement, a watercourse diversion scheme is proposed. This scheme will limit the extent of culverting, which will be designed to have sufficient capacity to contain the 1 in 100-year +22%CC flows.

	Surface water runoff from the development will discharge at the greenfield QBAR rate. Attenuated surface water storage will be provided with capacity for the 1 in 100-year storm with an allowance for climate change. It is expected that any shortfall in calculated storage volume is to be provided within the freeboard of the proposed basins, conveyance swales (displayed along the green corridor) and through distributed cellular storage within the fabric of the development. It is proposed to drain foul water from the development separately to surface water.
This summary should be read in conjunction with BWB's full report. It reflects an assessment of the Site based on information received by BWB at the time of production.	

- 5.4 In compliance with the requirements of NPPF, and subject to the mitigation measures proposed, the development could proceed without being subject to significant flood risk. Moreover, the development will not increase flood risk to the wider catchment area subject to suitable management of surface water runoff discharging from the site.

APPENDICES

Appendix 1: Topographical Survey



OS Note:
This survey has been oriented to the Ordnance Survey (O.S.) National Grid OSG36(15) via Global Navigation Satellite Systems (GNSS) and the O.S. Active Network (OS Net).
A true OSG36 coordinate has been established near to the site centre via a transformation using the OSTN15GB & OSGB15GB transformation modes.
The survey has been correlated to this point and a further one or more OSG36 (15) points established to create a true O.S. bearing for angle orientation.
No scale factor has been applied to the survey therefore the coordinates shown are true OSG36 & not true O.S. Coordinates which have a scale factor applied.
Please refer to Survey Station Table to enable establishment of the on-site grid and datum.

+ 123.666
Levels shown at margins are taken from Ordnance Survey lidar data. Access to third party land unauthorised

Rev	Date	Description	Drawn	Cd	Re
					
greenhatch group					
- Topographical Surveys - Site Engineering - Utility / CCTV Surveys		- Measured Building Surveys 3D Laser Scanning - Revit & BIM Models			
Rowan House Duffield Road Little Eaton Derby DE21 5DR					
Tel (01332) 830044		Fax (01332) 830055			
admin@greenhatch-group.co.uk					
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St Albans		Newcastle		London	
Unit B, The Courtyard St Albans Hertfordshire SG4 1LN		24 Riverside Studios Pinehill Road Newcastle Park Newcastle NE11 7PL		27, Cornhill Terrace Me Regents Park London NW1 5SL	
T: (01727) 854481		T: (01912) 736391		T: (02022) 241806	

PROJECT
Hinckley North
LE10 3EA

SCALE A1@ 1: 2500	DATE Nov 2021
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Level datum	See note
Grid orientation	See note

Comments

This plan should only be used for its original purpose. Greenhatch Group accepts no responsibility for this plan if supplied to any party other than the original client.

All dimensions should be checked on site prior to design and construction.

Drainage information (where applicable) has been visually inspected from the surface and therefore should be treated as approximate only.

Appendix 2: Illustrative Masterplan