

FLOOD RISK ASSESSMENT

**Residential Development
Baptist Farm,
Slippery Gowt Lane, Boston**

**Chestnut Homes
December 2020**

DOCUMENT ISSUE RECORD

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Limitations

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The information in this report is based on statistical data and qualitative analysis which are for guidance purposes only. This study provides no guarantee against flooding or of the absolute accuracy of water levels, flows and associated probabilities.

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EXECUTIVE SUMMARY

This Flood Risk Assessment is compliant with the requirements set out in the National Planning Policy Framework 2019, and the associated online Planning Practice Guidance. It has been produced on behalf of Chestnut Homes. This report demonstrates that the proposed development is not at significant flood risk, and will not increase flood risk to others, subject to the recommended flood mitigation strategies being implemented.

Policy

Size	Development Type	Flood Zone	Vulnerability
0.73ha	Dwelling Houses	3	More Vulnerable

Climate Change Allowance

Peak Rainfall Intensity

Allowance Category	Percentage Increase
Upper End	40
Central	20

Sea Level Rise

Area of England	Allowance	2000-2035 (mm/year)	2036-2065 (mm/year)	2066-2095 (mm)/year	2096-2125 (mm/year)
Anglian	Higher Central	5.8	8.7	11.6	13.0
	Upper End	7.0	11.3	15.8	18.1

Flood Risk and Mitigation

Flood Risk Source	Level of Risk Without Mitigation	Proposed Mitigation
Residual (Tidal)	High	Mitigation based on a breach in the tidal defences. FFL raised to breach level or FFL raised minimum of 1.00m above ground level and flood resilient methods incorporated.
Fluvial Tidal Groundwater Sewers	Low	
Pluvial Reservoir Canal/Artificial	None	

CONTENTS PAGE

DOCUMENT ISSUE RECORD	i
EXECUTIVE SUMMARY	ii
Policy	ii
Climate Change Allowance	ii
Flood Risk and Mitigation	ii
CONTENTS PAGE	iii
1.0 INTRODUCTION	1
Data Used	1
Existing Site	1
Proposed Development	2
2.0 FLOOD RISK PLANNING POLICY	3
National Planning Policy Framework 2019	3
Sequential Test	3
Flood Zone Definition	3
Flood Risk Vulnerability Classification	4
Appropriate Development	4
Exception Test	4
Development Proposals	5
3.0 CLIMATE CHANGE	6
Peak River Flow Allowances	6
Peak Rainfall Intensity Allowance	6
Sea Level Allowances	7
4.0 FLOOD RISK SOURCES	8
Fluvial	8
Tidal	8
Residual Risk	8
Pluvial	11
Groundwater	12
Sewers	12
Reservoirs	12
Canals and Artificial Water Bodies	12
Development Foul & Surface Water	12
5.0 MITIGATION	13
Flood Resistant and Resilient Construction	13
Site Layout	13
Floodplain Compensation	14
6.0 CONCLUSIONS	15

TABLES

Table 3.1 Climate Change Allowances for Peak Rainfall Intensity	6
Table 3.2 Climate Change Allowances for Sea Level Rise	7
Table 6.1 Summary of Risk and Mitigation	15

FIGURES

Figure 1.1 Site Location	1
Figure 1.2 Proposed Plan	2
Figure 2.1 Flood Zones.....	5
Figure 4.1 Hazard Mapping for 0.5% (1:200) 2115 Climate Change Event.....	9
Figure 4.2 Hazard Mapping for 0.1% (1:1000) 2115 Climate Change Event.....	9
Figure 4.3 Depth of Flooding for 0.5% (1:200) 2115 Climate Change Event	10
Figure 4.4 Depth of Flooding for 0.1% (1:1000) 2115 Climate Change Event	10
Figure 4.5 Surface Water Flooding Extents	11

APPENDICES

Appendix 1 Topographic Survey	
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1.0 INTRODUCTION

- 1.1 This Flood Risk Assessment, (FRA), is compliant with the requirements set out in the National Planning Policy Framework 2019, (NPPF), and the associated online Planning Practice Guidance.
- 1.2 The FRA has been produced on behalf of Chestnut Homes in respect of a planning application for a residential development at Baptist Farm, Slippery Gowt Lane, Boston.

Data Used

- 1.3 This FRA is based on the following information:
- Topographic Survey
 - Proposed Plans
 - British Geological Survey Drift & Geology Maps
 - Environment Agency Consultation
 - Environment Agency Data
 - British Geological Survey Hydrogeology Data

Existing Site

- 1.4 The site is located at grid reference TF3335941688 as shown in **Figure 1.1** below and covers an area of approximately 0.73ha.

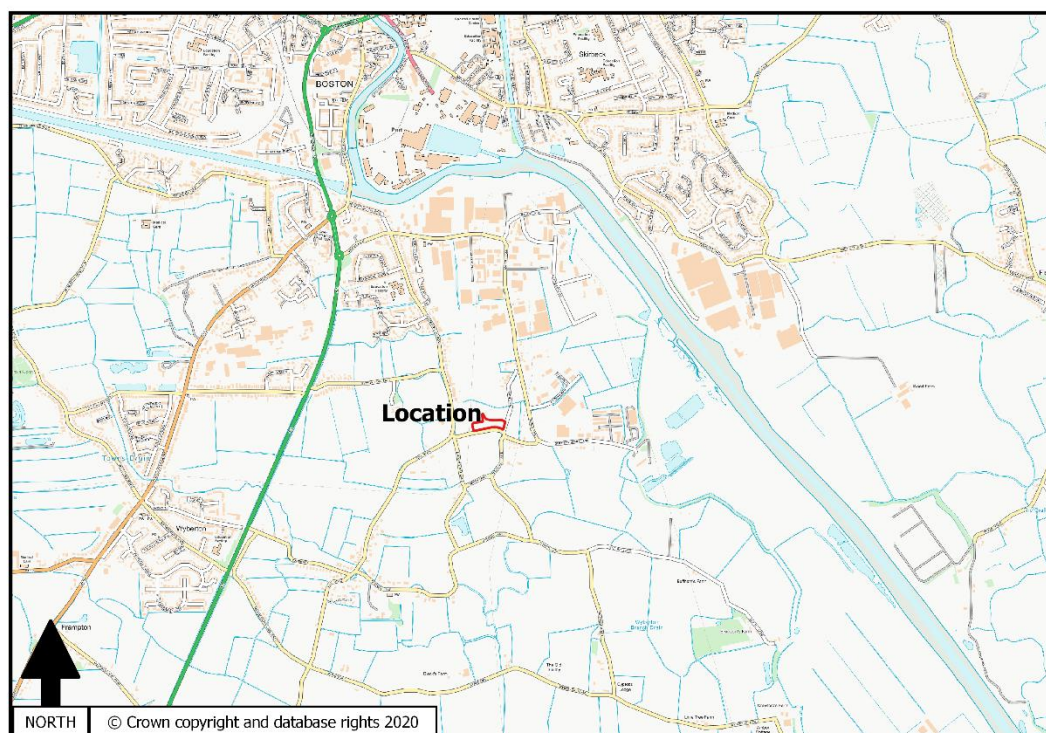


Figure 1.1 Site Location

- 1.5 The site is adjacent to an adjacent residential development currently under construction.
- 1.6 A full topographic survey is included as **Appendix 1** and generally the land levels are approximately 2.50m AOD.
- 1.7 The online British Geological Survey maps indicates that the site is located on a bedrock geology of clay.

Proposed Development

- 1.8 The proposed development consists of a residential development as shown on the extract of the proposed plan below in **Figure 1.2**



Figure 1.2 Proposed Plan

2.0 FLOOD RISK PLANNING POLICY

National Planning Policy Framework 2019

- 2.1 The NPPF sets out the Government's national policies on different aspects of land use planning in England in relation to flood risk. A supporting web-based Planning Practice Guidance is also available.
- 2.2 The guidance uses four Flood Zones to characterise flood risk which refer to the probability of river and sea flooding, ignoring the presence of defences.

Sequential Test

- 2.3 The NPPF requires the application of a Sequential Test to ensure that new development is in areas with the lowest probability of flooding and the Flood Zones provide the basis for applying the Test.

Flood Zone Definition

Flood Zone 1	Low probability (1 in 1000 annual probability of river or sea flooding (<0.1%)).
Flood Zone 2	Medium probability (between 1 in 100 and 1 in 1000 annual probability of river flooding (1.0%-.0.1%) or between 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5%-.0.1%) in any given year).
Flood Zone 3a	High probability (1 in 100 or greater annual probability of river flooding (>1.0%) or 1 in 200 or greater annual probability of sea flooding (>0.5%) in any given year).
Flood Zone 3b	This zone comprises land where water must flow or be stored in times of flood. Land which would flood with an annual probability of 1 in 20 (5.0%), or is designed to flood in an extreme flood (0.1%) should provide a starting point for discussions to identify functional floodplain.

- 2.4 The Flood Zones do not consider the projected effects of climate change and may not represent potential flooding from smaller watercourses.
- 2.5 The aim is to steer new development to Flood Zone 1 and where there are no reasonably available sites in Flood Zone 1, local planning authorities in their decision making should consider the flood risk vulnerability of land uses and consider reasonably available sites in Flood Zone 2, applying the Exception Test if required.
- 2.6 Only where there are no reasonably available sites in Flood Zones 1 or 2 should the suitability of sites in Flood Zone 3 be considered, considering the flood risk vulnerability of land uses and applying the Exception Test if required.
- 2.7 The guidance also sets out the vulnerability to flooding of different land uses and some of these are detailed below.

Flood Risk Vulnerability Classification

Essential Infrastructure	Transport Infrastructure; Utility Infrastructure; Wind Turbines.
Water Compatible	Flood Control Infrastructure; Water and Sewage Infrastructure; Navigation Facilities.
Highly Vulnerable	Emergency Services (which are required in times of flood); Basement Dwellings; Caravans, Mobile Homes and Park Homes, (intended for permanent residential use); Installations requiring Hazardous Substances Consent.
More Vulnerable	Hospitals and other Health Services; Residential Institutions; Dwelling Houses, Drinking Establishments; Nightclubs; Hotels; Non-residential uses for Health Services; Nurseries; Educational Establishments; Landfill and Hazardous Waste Management Facilities; Sites used for Holiday or short-let Caravan and Camping sites, (subject to a specific warning and evacuation plan).
Less Vulnerable	Commercial Establishments; Emergency Services not required in times of flood; Land and Buildings used for Agriculture and Forestry. Waste Treatment; Minerals Working; Water Treatment Works; Sewage Treatment Works.

Appropriate Development

- 2.8 Based on the vulnerability of a development the guidance states what Flood Zone(s) the development is appropriate within. The flood risk compatibility is summarised below.

Flood Zone 1	Appropriate Development – All.
Flood Zone 2	Exception Test - Highly vulnerable. Appropriate Development - Essential Infrastructure; More vulnerable; Less vulnerable and Water Compatible.
Flood Zone 3a	Should not be permitted – Highly vulnerable. Exception Test – Essential Infrastructure, More vulnerable. Appropriate Development – Less vulnerable; Water compatible.
Flood Zone 3b	Should not be permitted – Highly vulnerable; More vulnerable; Less vulnerable. Exception Test – Essential Infrastructure. Appropriate Development – Water compatible.

- 2.9 The Planning Practice Guidance also states that all sources of flooding should be considered when preparing a FRA.

Exception Test

- 2.10 The Exception Test is a method to demonstrate and help ensure that flood risk to people and property will be managed satisfactorily, while allowing necessary development to go ahead in situations where suitable sites at lower risk of flooding are not available.
- 2.11 The first part of the Exception Test is to show that the proposed development will provide wider sustainability benefits to the community that outweigh flood risk. The second part is the requirement for a FRA to demonstrate that it will be safe for its lifetime, without increasing flood risk elsewhere and where possible reduce flood risk overall.

Development Proposals

- 2.12 The proposed development consists of Dwelling Houses.

Flood Zones

- 2.13 The Flood Zones are shown on **Figure 2.1** below which shows the site to be in Flood Zone 3.

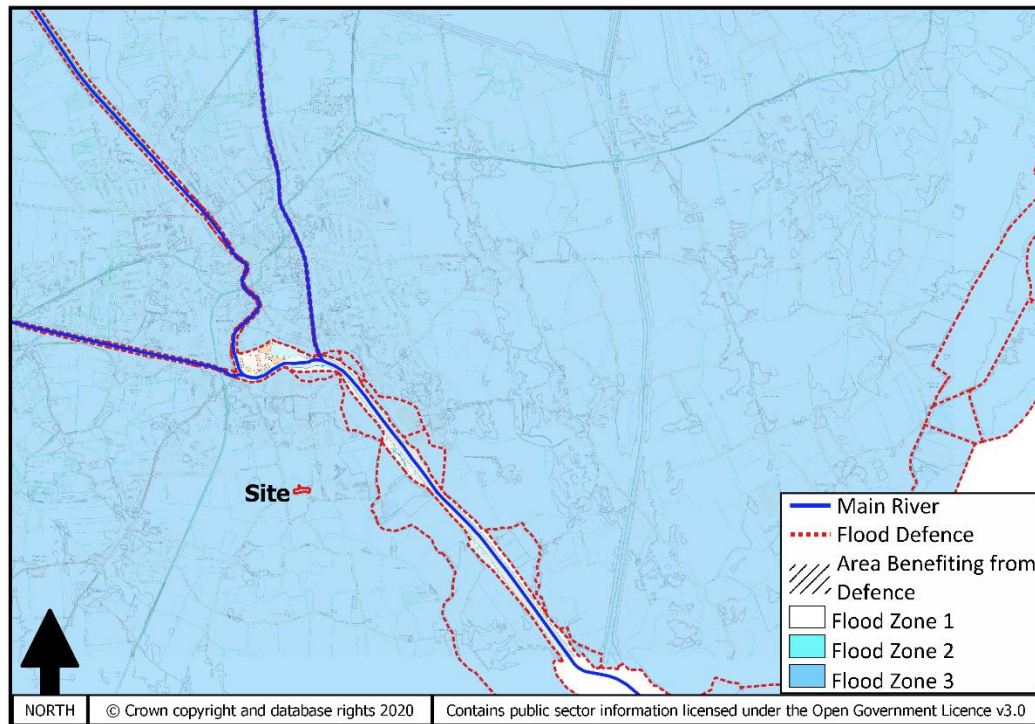


Figure 2.1 Flood Zones

Development Vulnerability

- 2.14 Dwelling Houses are More Vulnerable.

Exception Test

- 2.15 A FRA is required to ensure the development will remain safe over its lifetime from all sources of flooding and not increase flood risk elsewhere.

3.0 CLIMATE CHANGE

- 3.1 The NPPF sets out how the planning system should help minimise vulnerability and provide resilience to the impacts of climate change.
- 3.2 As the Government's expert on flood risk on 19th February 2016 the Environment Agency, (EA), published revised climate change allowances to support the NPPF. The sea level rise allowances were further revised on the 17th December 2019.
- 3.3 The climate change allowances are based on projections and different scenarios of carbon dioxide (CO₂) emissions to the atmosphere and provide predictions of anticipated change for:
- peak river flow by river basin district;
 - peak rainfall intensity;
 - sea level rise;
 - offshore wind speed and extreme wave height.

Peak River Flow Allowances

- 3.4 The peak river flow allowances show the anticipated changes to peak flow by River Basin District, (RBD), with three allowances; central; higher central and upper end. However, whilst this proposed development is Flood Zone 3 the major source of flooding is tidal, see Section 4, and therefore this allowance is not applicable.

Peak Rainfall Intensity Allowance

- 3.5 Increased rainfall affects river levels and land and urban drainage and should be applied to surface water drainage systems.
- 3.6 These allowances are uniform across England and change over three periods of time over the next century. The appropriate period should be chosen based on the expected lifetime of the development and for residential that is 100 years
- 3.7 Surface water drainage strategies and detailed designs need to assess both the central and upper end allowances to understand the range of impact. The following climate change allowances in peak rainfall intensity therefore need to be applied to subsequent studies:

Allowance Category	Percentage Increase
Upper End	40
Central	20

Table 3.1 Climate Change Allowances for Peak Rainfall Intensity

Sea Level Allowances

- 3.8 There is a range of allowances for each region and epoch or time frame for sea level rise as follows:

Area of England	Allowance	2000-2035 (mm/year)	2036-2065 (mm/year)	2066-2095 (mm)/year	2096-2125 (mm/year)
Anglian	Higher Central	5.8	8.7	11.6	13.0
	Upper End	7.0	11.3	15.8	18.1

Table 3.2 Climate Change Allowances for Sea Level Rise

4.0 FLOOD RISK SOURCES

- 4.1 The following flood risk sources have been identified and where mitigation is required to reduce the flood risk this is discussed in **Section 5**.

Fluvial

Main River

- 4.2 The nearest EA Main River to the site is the South Forty Foot Drain, over 1km to the north west.

Ordinary Watercourses

- 4.3 The site lies within the district of the Black Sluice Internal Drainage Board, (IDB), and an IDB maintained watercourse is located on the southern boundary of the site.
- 4.4 For the adjacent residential development currently under construction a meeting was held with the Boards officers on 26th January 2017. The main points of that meeting were;
- A Board maintained watercourse is located on part of the western and southern boundaries of the site and is well maintained. The IDB maintained watercourses are shown in green below on Figure 4.1.
 - The IDB would prefer any surface water discharge to the southern watercourse.
 - The IDB have no record/information of the watercourse through the centre of the site and if this was to be utilised for surface water discharge then further investigation of existing flows would be needed.
 - Surface water to be restricted to greenfield runoff and attenuation on site; or the Board would consider an increase in discharge combined with a contribution from the developer for ongoing maintenance of their watercourse.
 - Any works within 6m of a Board maintained watercourse will require their prior consent.

- 4.5 The risk of flooding from fluvial sources is low.

Tidal

- 4.6 The site is over 5km from the east coast.
- 4.7 Information provided by the EA states that the tidal defences protecting this site consist of earth embankments. They are in good condition and reduce the risk of flooding (at the defence) to a 0.67% (1 in 150) chance of occurring in any year. The EA inspect these defences routinely to ensure potential defects are identified.
- 4.8 The risk of flooding from tidal sources is low.

Residual Risk

- 4.9 The site is protected from flooding by raised defences. However, if those defences were to be overtopped or breached then flooding could occur.

- Max Hazard**

Max Depth

Max Velocity

*** Modified Breach Locations**

Max Hazard
 (based on a 10m surge)
 Less than 0.5
 0.5 - 1.0
 Between 1.0 and 1.5
 Between 1.5 and 2.0
 Between 2.0 and 2.5
 Greater than 2.5
 (Based on 10m)

Max Depth (m)
 3 - 0.5
 0.5 - 1.0
 1.0 - 1.5
 1.5 - 2.0
 2.0 - 2.5
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Max Hazard

Max Depth

Max Velocity

*** Modelled Breach Locations**

Max Hazard
(derived from a 'worst case' scenario)
 Green: None
 Yellow: Minor
 Orange: Moderate
 Red: Major
 Dark Red: Extreme

Max Depth (m)
 0-0.5
 0.5-1
 1-1.5
 1.5-2
 2-2.5

Max Velocity (m/s)
 <0.5
 0.5-1
 1-1.5
 1.5-2
 2-2.5

Date Prepared November 2002
Scenario Year 2150
Scenario Annual Chance 0.1% (1 in 1000)
GCN Number CCN-2200-100740

Environment Agency
 Lincolnshire and Northamptonshire
 Hazard mapping
 VNF Contract ref: 11/0008/1000

The map shows the level of flood damage to crops in 'worst case' scenario. The flood damage is based on a range of factors. The highest risk depends on the depth and velocity of flooding and the nature of the crops. The map shows the level of flood damage to crops in 'worst case' scenario. The flood damage is based on a range of factors. The highest risk depends on the depth and velocity of flooding and the nature of the crops. The map shows the level of flood damage to crops in 'worst case' scenario. The flood damage is based on a range of factors. The highest risk depends on the depth and velocity of flooding and the nature of the crops.

4.11 In both events the hazard rating is “Danger for All” due to the deep flood depths.

4.12 **Figures 4.3 and 4.4** below show the range of flood depths on, and adjacent to, the site.

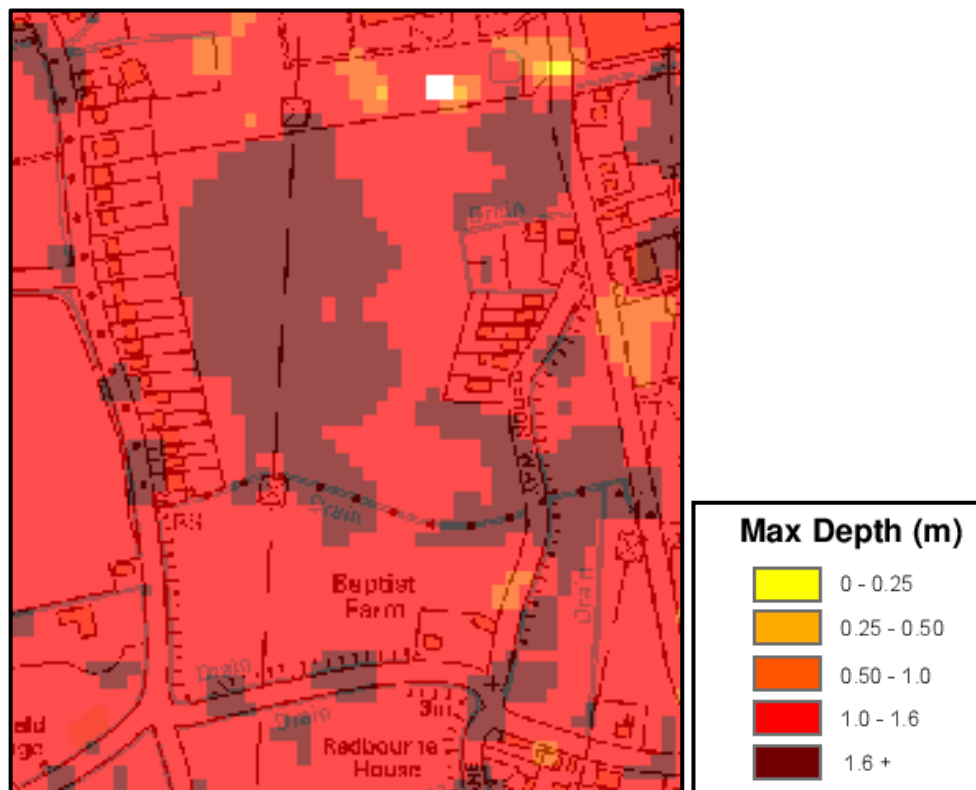


Figure 4.3 Depth of Flooding for 0.5% (1:200) 2115 Climate Change Event

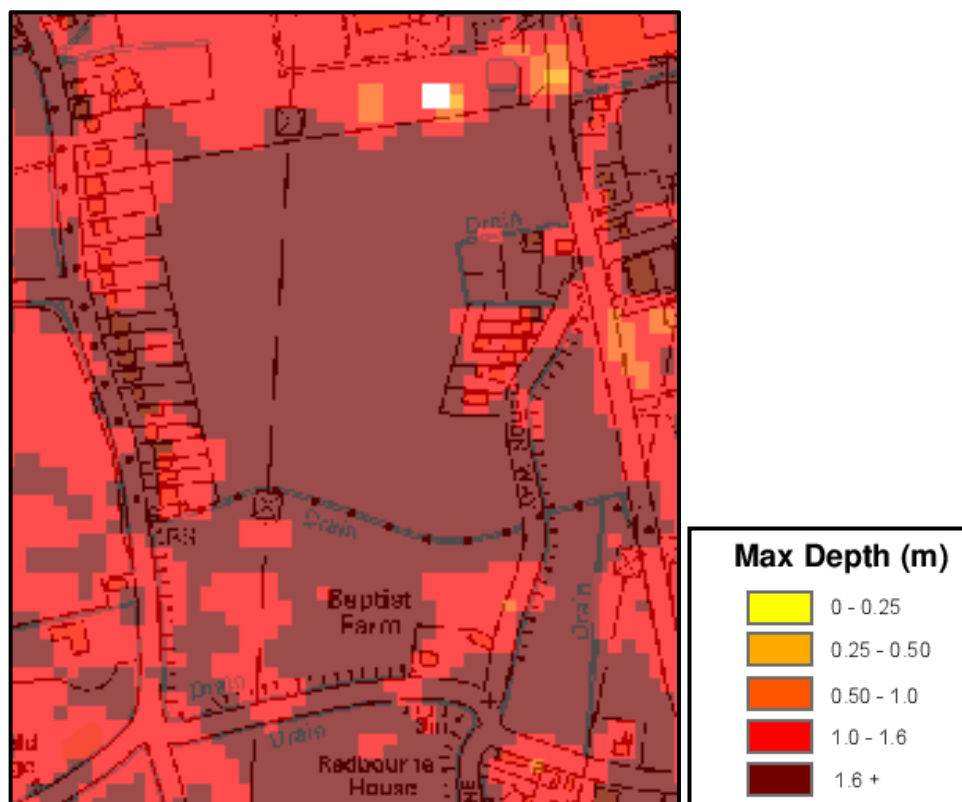


Figure 4.4 Depth of Flooding for 0.1% (1:1000) 2115 Climate Change Event

4.13 By comparing the range of flood depths to the land levels from the topographic survey it was agreed for the adjacent residential development currently under construction that the flood levels are;

- 0.5% + Climate Change Flood Level 4.00m AOD
- 0.1% + Climate Change Flood Level 4.10m AOD

4.14 The risk of flooding from tidal sources is high and will require mitigation.

Pluvial

4.15 The EA have produced maps showing flooding when rainwater lies or flows over the ground. The surface water flooding extents are shown below in **Figure 4.5**. Unlike the fluvial mapping, which is based on a detailed hydraulic model, this mapping is based purely on applying rainfall to a digital terrain model. As such this mapping serves to represent a worst-case scenario which may well overstate the actual probability of flooding in this area.

4.16 There is a caveat, as to the use of these maps and that they are not to be used to identify that an individual property will flood. Because of the way they have been produced and the fact that they are indicative these maps are not appropriate to act as the sole evidence for any specific planning or regulatory decision or assessment of risk in relation to flooding at any scale without further supporting studies or evidence.

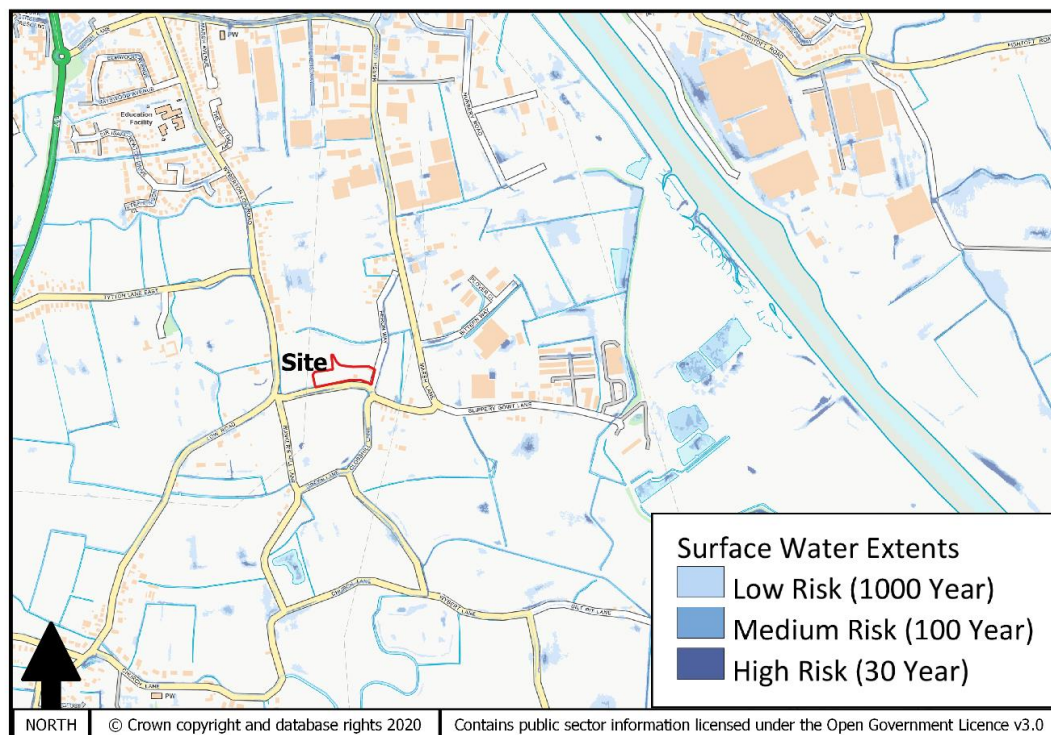


Figure 4.5 Surface Water Flooding Extents

4.17 The site is not at risk of flooding from pluvial sources.

Groundwater

- 4.18 The site is located on rocks with essentially no groundwater and there are no known instances of groundwater flooding in the area.
- 4.19 The risk of flooding from groundwater is low.

Sewers

- 4.20 Public maintained sewers run adjacent to the site but are unlikely to pose a significant flood risk as they are well maintained.
- 4.21 The risk of flooding from existing sewers is low.

Reservoirs

- 4.22 The EA has prepared reservoir failure flood risk mapping to show the largest area that might be flooded if a reservoir were to fail and release the water it holds. The mapping displays a worst-case scenario and is only intended as a guide.
- 4.23 The site is not at risk of flooding from reservoirs.

Canals and Artificial Water Bodies

- 4.24 The site is not at risk of flooding from canals.

Development Foul & Surface Water

- 4.25 The proposed development will require the disposal of foul and surface water which could impact on existing systems and developments.

5.0 MITIGATION

- 5.1 Section 4.0 has identified the sources of flooding which could potentially pose a risk to the site and the proposed development. This section of the FRA sets out the mitigation measures which are to be incorporated within the proposed development to address and reduce the risk of flooding to within acceptable levels.

Flood Resistant and Resilient Construction

- 5.2 The flood risk management strategy is to exclude water from the More Vulnerable elements of the development, as far as practicable, incorporating where appropriate the use of flood resistant measures.
- 5.3 To provide suitable flexibility for the development of the site the mitigation will be achieved by adopting either of the two following mitigation measures;
- Raising FFL a minimum of 1.00m above ground level and to within 0.60m of the breach level and include permanent resistance measure of water resistant external doors together with water resisting airbricks, backwater valves and non-return valves; or,
 - Raising FFL to the breach level.
- 5.4 The use of either of the above will depend on the individual circumstances for each plot and the need for a practical/viable approach to be adopted. Details of the proposed finished floor levels will be submitted on a phased basis to indicate the specific mitigation measures to be used for each plot.
- 5.5 Additional flood resilient measures will be incorporated for the residual flood risk in the form of construction which will include all electrical installation to be above breach level.
- 4.18 The strategy will ensure the properties will remain dry and the residents safe

Site Layout

- 5.6 As identified in section 4 the flood levels on the site are;
- 0.5% + Climate Change Flood Level 4.00m AOD
 - 0.1% + Climate Change Flood Level 4.10m AOD
- 5.7 The adjacent residential development currently under construction has adopted the following approach, which is generally in line with the EA advice to Boston Borough Council, and it is suggested that a suitably worded condition is applied to the overall development proposals based on the following mitigation;

Single storey and self-contained ground floor apartments:

- Minimum FFL to be raised above the maximum tidal breach depths from the 0.1% event including climate change. FFL to be 4.10m AOD.

Ground floor apartments with internal access to first floor safe refuge area:

- Minimum FFL to be based on the maximum tidal breach depths from the 0.1% event including climate change.

- FFL raised a minimum of 1.00m above ground level and to within 0.60m of the flood level. Construction to include water resistant external doors, water resisting airbricks, backwater valves, non-return valves and all electrical installation to be above 4.10m AOD; or alternatively,
- FFL 4.10m AOD.

Two/three storey houses with habitable rooms on ground floor and apartments above ground floor:

- Minimum FFL to be based on the maximum tidal breach depths from the 0.5% event including climate change.
- FFL raised a minimum of 1.00m above ground level and to within 0.60m of the flood level. Construction to include water resistant external doors, water resisting airbricks, backwater valves, non-return valves and all electrical installation to be above 4.00m AOD; or alternatively,
- FFL 4.00m AOD.

Three storey houses with only non-habitable rooms on ground floor:

- Non-habitable rooms at ground level
- Habitable FFL 4.00m AOD.

Floodplain Compensation

- 5.8 Given the size of the proposed development in relation to the area potentially impacted during a breach event, the significance of any impact of new buildings on flood flows and flood risk to surrounding areas is low.

6.0 CONCLUSIONS

- 6.1 This FRA is compliant with the requirements set out in the NPPF and the associated online Planning Practice Guidance.
- 6.2 The FRA has been produced on behalf of Chestnut Homes.
- 6.3 This report demonstrates that the proposed development is not at significant flood risk, and will not increase flood risk to others, subject to the recommended flood mitigation strategies being implemented.
- 6.4 The identified risks and mitigation measures are summarised below;

Flood Risk Source	Level of Risk Without Mitigation	Proposed Mitigation
Residual (Tidal)	High	Mitigation based on a breach in the tidal defences. FFL raised to breach level or FFL raised minimum of 1.00m above ground level and flood resilient methods incorporated.
Fluvial Tidal Groundwater Sewers	Low	
Pluvial Reservoir Canal/Artificial	None	

Table 6.1 Summary of Risk and Mitigation

Appendix 1

Topographic Survey

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Client: CHESTNUT HOMES LTD.

Project Title:

CHESNUT HOMES Ltd.

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