ROY LOBLEY CONSULTING
Specialists in Flood Risk Management

FLOOD RISK ASSESSMENT

Replacement Dwelling
Tattershall Road Billinghay

Mr P Lonsdale
November 2017

DOCUMENT ISSUE RECORD

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EXECUTIVE SUMMARY

This Flood Risk Assessment is compliant with the requirements set out in the National Planning Policy Framework and the associated online Planning Practice Guidance. It has been produced on behalf of Mr P Lonsdale. The site is located at grid reference TF1704955280.

Policy

Development Type	Flood Zone	Vulnerability	Sequential Test
Residential Establishment	2	More Vulnerable	Not Required

Climate Change Allowance

Peak River Flow

ANGLIAN RIVER BASIN DISTRICT	
Allowance Category	Percentage Increase
Higher Central	35
Central	25

Flood Risk and Mitigation

Source	Level of Risk	Proposed Mitigation
Fluvial Breach	High	FFL at breach level, 0.60m above ground level. Flood resilient construction 0.30m above FFL.
Tidal	None	
Pluvial	None	
Groundwater	Low	
Sewers	None	
Reservoir	None	
Canal/Artificial	Low	

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.

CONTENTS PAGE

1.0 INTRODUCTION

1.1 This Flood Risk Assessment, (FRA), is compliant with the requirements set out in the National Planning Policy Framework, (NPPF), and the associated online Planning Practice Guidance.

1.1 The FRA has been produced on behalf of Mr P Lonsdale in respect of a planning application for a replacement dwelling at Tattershall Road, Billinghay.

Data Used

1.1 This FRA is based on the following information:

LiDAR 2m DTM
British Geological Survey Drift & Geology Maps
Environment Agency Consultation
Environment Agency Data
British Geological Survey Hydrogeology Data
Site visit undertaken on 20th October 2017

Existing Site

1.1 The site is located to the east of Billinghay at grid reference TF1704955280 as shown in Figure 1.1.

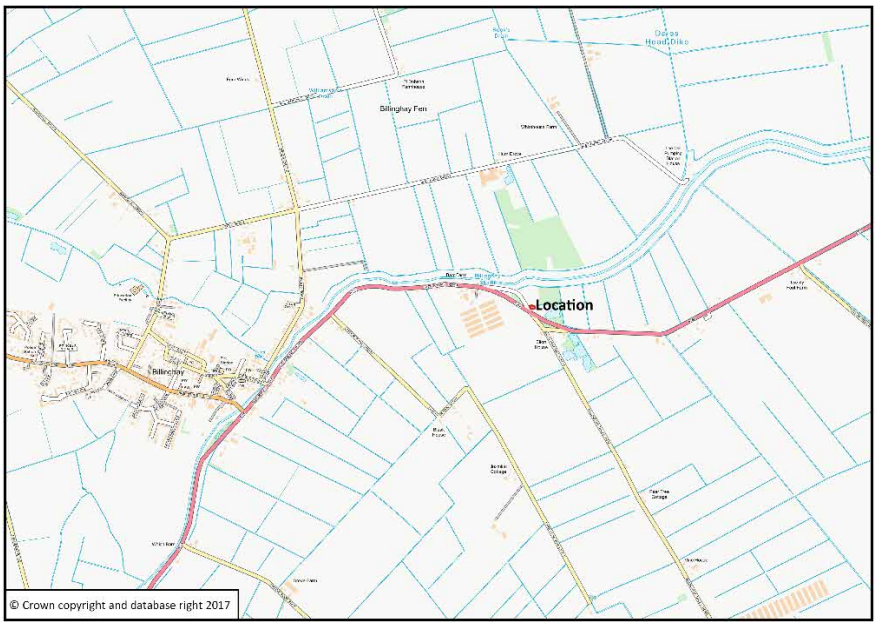


Figure 1.1 Site Location

1.1 The site consists of one bungalow. The online British Geological Survey maps indicates that the site is located on clay over mudstone and sandstone

Proposed Development

1.1 The proposed development consists of a replacement dwelling in the form of a bungalow.

2.0 FLOOD RISK PLANNING POLICY

National Planning Policy Framework

1.1 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.

1.1 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

1.1 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 great 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.

1.1 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.

2.4 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.

2.4 The guidance also sets out the vulnerability to flooding of different land uses and these are detailed below.

Flood Risk Vulnerability Classification

Essential Infrastructure	Transport Infrastructure; Utility Infrastructure.
Water Compatible	Flood Control Infrastructure; Water and Sewage infrastructure; Navigation Facilities.
Highly Vulnerable	Emergency Services which are required in times of flood; Basement Dwellings; Mobile Home parks; Installations requiring hazardous substances consent.
More Vulnerable	Hospitals and other health services; Residential establishments; Educational establishments; Landfill and hazardous waste management facilities; Caravan and camping sites.
Less Vulnerable	Commercial establishments; Emergency services not required in times of flood; Agriculture and forestry land.

Appropriate Development

2.4 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.

1.1 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.

2.11 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

2.11 The proposed development consists of a residential establishment.

Flood Zones

2.10 The Flood Zones are shown on Figure 2.1 below which shows most of the site to be in Flood Zone 2.

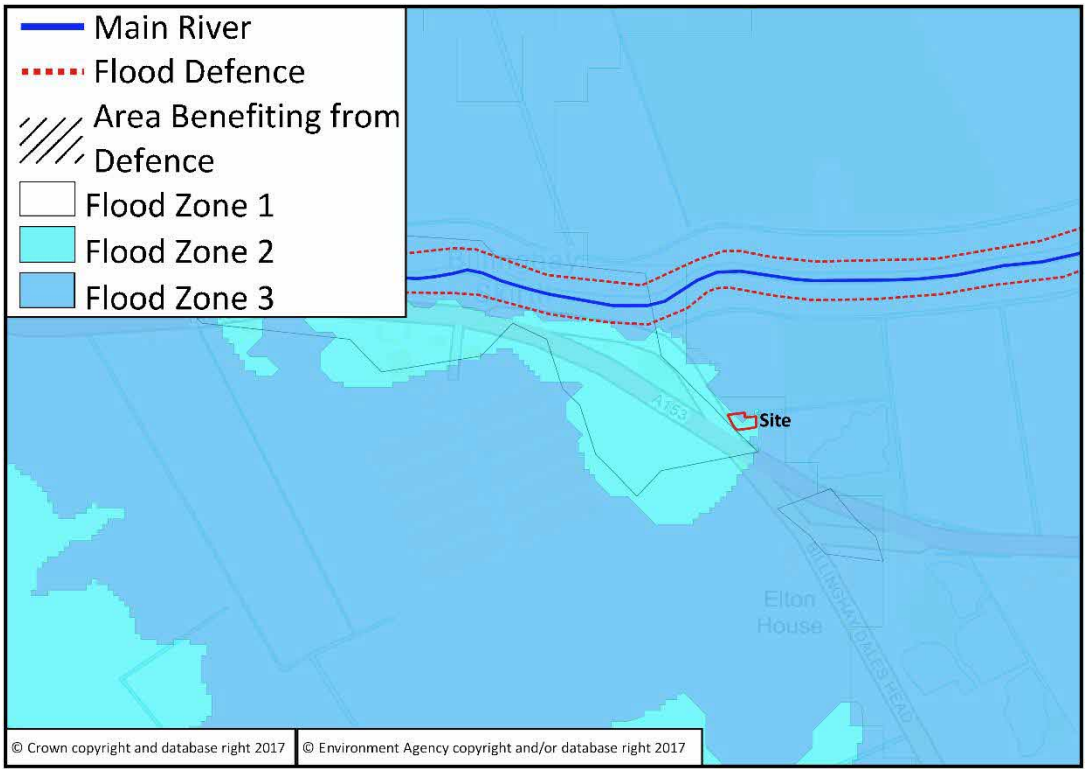


Figure 2.1 Flood Zones

Development Vulnerability

2.11 Residential establishments are more vulnerable.

Site Sequential Test

2.11 The proposed development is for a replacement dwelling and therefore not subjected to the Sequential and Exception Tests.

Exception Test

2.11 Whilst the development is considered appropriate 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

2.4 The NPPF sets out how the planning system should help minimise vulnerability and provide resilience to the impacts of climate change.

2.4 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.

2.4 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

2.4 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.

2.4 This proposed development is in the Anglian RBD.

2.4 The appropriate allowance depends on the Flood Zone and vulnerability classification of the development and for this proposal it is appropriate to use central and higher central allowances.

2.4 The allowances 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.

2.4 The following climate change allowances in peak river flows therefore need to be applied:

ANGLIAN RIVER BASIN DISTRICT	
Allowance Category	Percentage Increase
Higher Central	35
Central	25

Table 3.1 Climate Change Allowances for Peak River Flow

Peak Rainfall Intensity Allowance

2.4 Increased rainfall affects river levels and land and urban drainage and should be applied to surface water drainage systems. However, the proposed development does not increase the impermeable area enough for these allowances to apply.

Sea Level Allowances

2.10 There is a single regional allowance in mm per year for four time periods for sea level rise. However, this site is not affect from tidal sources, see section 4.

4.0 FLOOD RISK SOURCES

2.4 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

2.4 The nearest EA Main River to the site is the Billinghay Skirth which is approximately 100m to the north.

2.4 Information provided by the EA, and included in Appendix 1, gives the following modelled, in-channel, flood levels:

Return Period	Level (m AOD)
1.0% (1 in 100)	3.96
1.0% (1 in 100) + 20%	3.98
0.1% (1 in 1000)	3.97
0.1% (1 in 1000) + 20%	3.98

Table 4.1 Billinghay Skirth Flood Levels

Climate Change

4.4 The above results have a climate change increase of 20% added to the peak river flows whereas the guidance now indicates that 25% and 35% should be added for residential developments in Anglian RBD.

2.4 Given the scale and nature of the proposed development it is considered that additional hydraulic modelling is not appropriate to determine the revised river levels. Therefore, a linear interpolation of the river levels has been used which gives the following;

1.0% (1:100)

Increase in level for 20% climate change	0.02m
Increase in level for 1% increase in climate change	0.001m
Increase in level for 35% climate change	0.035m
Increase in level for 25% climate change	0.025m

4.4 This gives the following revised flood levels.

Scenario	Level (m AOD)
Higher Central	4.00
Central	3.99

Table 4.2 1.0% (1:100) Interpolated Flood Levels

0.1% (1:1000)

Increase in level for 20% climate change	0.01m
Increase in level for 1% increase in climate change	0.0005m
Increase in level for 35% climate change	0.0175m
Increase in level for 25% climate change	0.0125m

4.4 This gives the following revised flood levels.

Scenario	Level (m AOD)
Higher Central	3.99
Central	3.98

Table 4.3 0.1% (1:1000) Interpolated Flood Levels

Hazard

4.4 The site is protected from flooding from the Billinghay Skirth by defences, including a raised defence. Information provided by the EA, and included in Appendix 1, shows that with those defences the site is only affected by a 0.1% (1:1000) event.

2.4 However, if that defence was to be overtopped or breached then flooding could occur but hazard mapping is not currently available for this site.

4.10 Standard broad crested weir calculations have been used to establish the flood depths, velocity and hazard rating at the site should a breach in the defences occur.

2.10 The site is 100m from the defence and land levels taken from LiDAR 2m DTM are shown below.

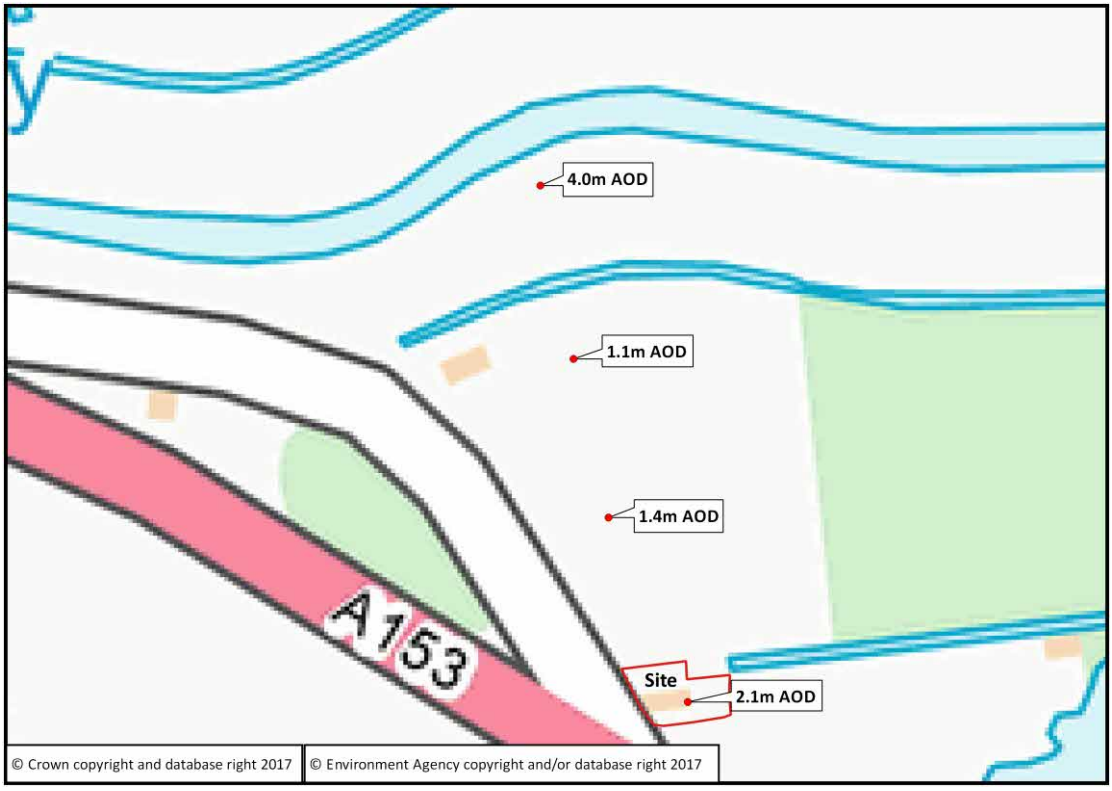


Figure 4.1 LiDAR Land Levels

2.10 The levels in the floodplain rise to the general site level of approximately 2.10m AOD.

2.10 It has been assumed that a breach in the defences will act as a broad crested weir where the quantity calculation is;

$Q = 1.7b \times H^{3/2}$

Q = quantity of water flowing through the breach (m^3/sec).
b = breach width (m).
H = height of breach (m).

Velocity = Q/b x H (m/sec).

4.10 Assuming a breach width of 40m and a depth of breach from the worst-case Climate Change flood level of 4.00m AOD to the site level of 2.10m AOD = 1.9m then;

$Q = 178.09m^3$/sec

2.10 Assuming the breach width propagates at 45^o then as the site is 100m away the effective width of the breach at the site is 240m. With the same quantity of water as before, Q = $178.09m^3$/sec, then the depth of flooding at the site, (H), is;

$H = (Q/1.7b)^{2/3}$

H = 0.58m

Velocity =1.29m/sec

2.10 The flood level on the site is therefore 2.10m AOD +0.58m = 2.68m AOD

2.10 The hazard rating, (HR), is calculated as;

HR = d x (v+n)+DF

d = depth of flooding.
v = velocity
n = constant of 0.5
DF = debris factor = 0.5 where d <= 0.25m and 1.0 where d > 0.25m.

HR = 2.03 which is significant and Dangerous for most people.

2.10 Flood risk from a breach in the Billinghay Skirth is high and will require mitigation.

Ordinary Watercourses

2.10 The site lies within the district of the Witham First Internal Drainage Board and the Boards maintained watercourse is located adjacent to the Billinghay Skirth.

4.10 Flood risk from this watercourse is considered low.

Tidal

2.10 The site is over 30km from the east coast and therefore not at risk from tidal sources.

Pluvial

2.10 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.

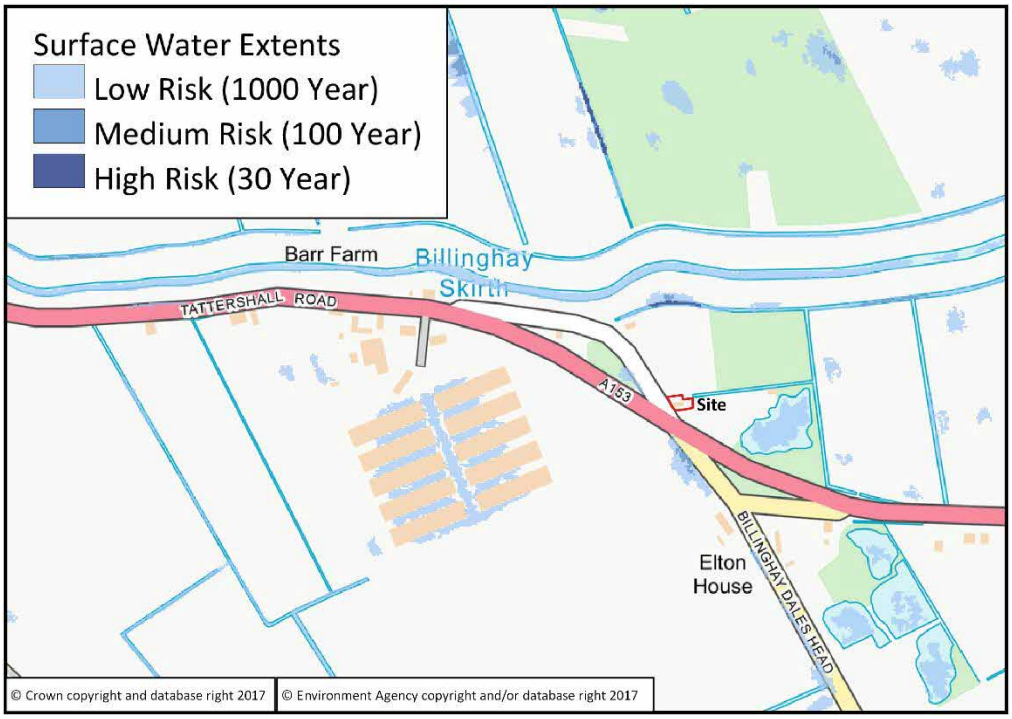


Figure 4.2 Surface Water Flooding Extents

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

Groundwater

4.10 The site is located on geology which essentially contains no groundwater as shown on the British Geological Survey hydrogeology map and there are no known instances of groundwater flooding in the area.

2.10 The risk of flooding from groundwater is low.

Sewers

2.10 There are no public sewers in the area.

Reservoirs

2.10 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.

2.10 The site is not at risk of flooding from reservoirs.

Canals and Artificial Water Bodies

2.10 The site is not at risk of flooding from canals.

5.0 MITIGATION

2.4 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.

Site Layout

2.4 The site is at residual flood risk from a breach in the Billinghay Skirth defences.

2.4 As the proposed dwelling is a bungalow it is proposed that the minimum finished floor levels, (FFL), are set at the worst-case climate change breach level on the site.

2.4 Minimum FFLs will therefore be 2.70m AOD, which is 0.60m above surround ground levels.

2.4 An additional 0.30m of flood resilient construction will be incorporated into the building above the FFL.

2.4 The above will significantly reduce the risk of flooding compared to the existing bungalow.

Floodplain Compensation

2.4 As the main flood risk to the site is from a breach in the defences compensation for loss of floodplain storage is not considered necessary.

6.0 CONCLUSIONS

2.4 This FRA is compliant with the requirements set out in the NPPF and the associated online Planning Practice Guidance.

2.4 The FRA has been produced on behalf of Mr P Lonsdale.

2.4 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.

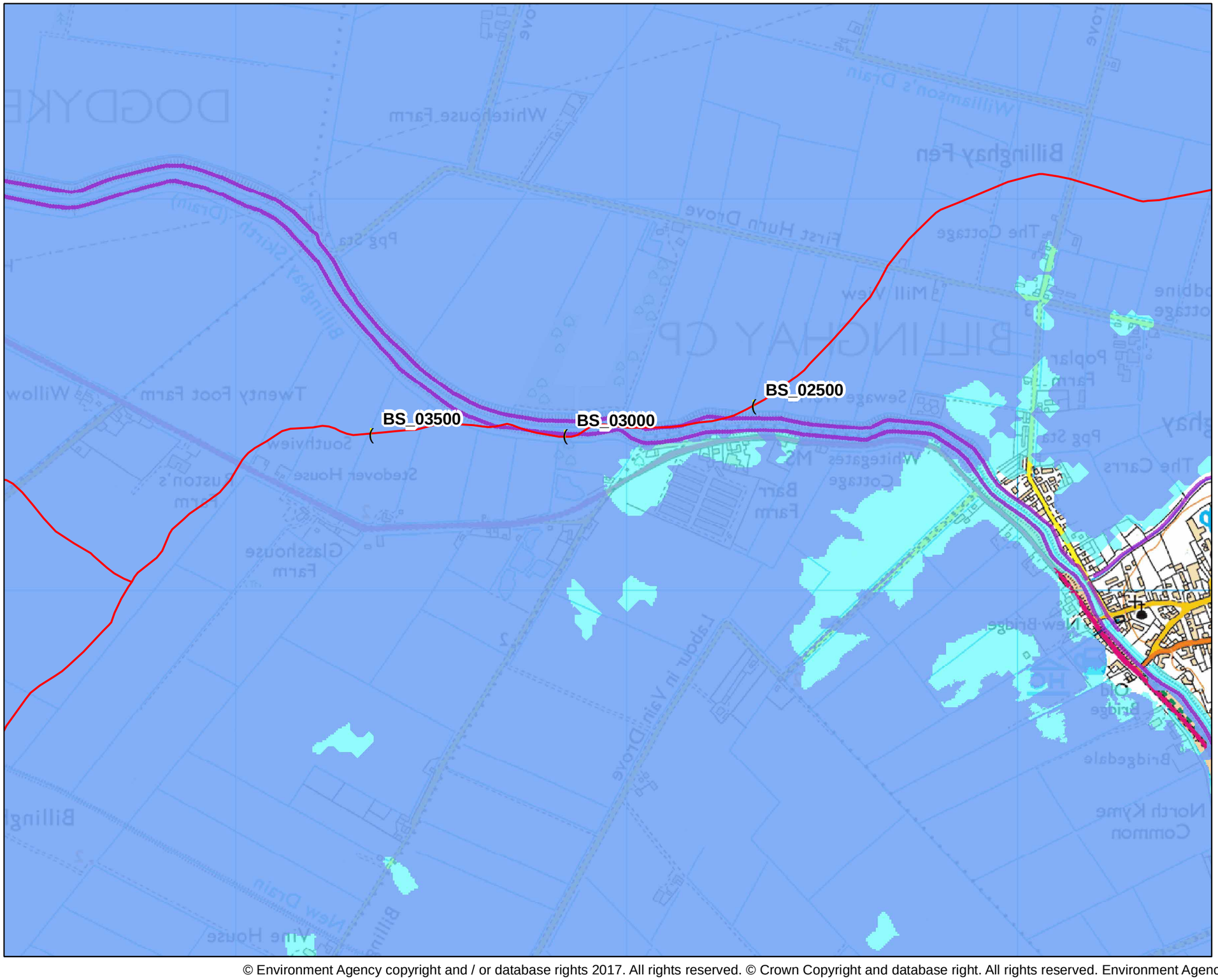
2.4 The identified risks and mitigation measures are summarised below;

Source	Level of Risk	Proposed Mitigation
Fluvial Breach	High	FFL at breach level, 0.60m above ground level. Flood resilient construction 0.30m above FFL.
Tidal	None	
Pluvial	None	
Groundwater	Low	
Sewers	None	
Reservoir	None	
Canal/Artificial	Low	

Table 6.1 Summary of Risk and Mitigation

Appendix 1
Environment Agency Data

Flood Map centred on TF 17049 55280 - October 2017 [Ref: CCN-2017- 62090]



Environment Agency

Scale 1:10,000

- Nodes
- Main River
- Raised Defences
- Flood Storage Areas
- Area at Risk of Flooding from Rivers or The Sea
- Extreme Flood Outline

Created by the Partnerships and Strategic Overview Team, Lincoln

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Datasheet [Ref: CCN-2017-62090] Data Model – Lower Witham - Dated 2009

Fluvial Flood Levels (mODN)

The fluvial flood levels for the model nodes shown on the attached map are set out in the table below. They are measured in metres above Ordnance Datum Newlyn (mODN).

			Annual Exceedance Probability - Maximum Water Levels (mODN)											
Node Label	**Easting**	**Northing**	**50% (1 in 2)**	**20% (1 in 5)**	**10% (1 in 10)**	**5% (1 in 20)**	**4% (1 in 25)**	**2% (1 in 50)**	**1.33% (1 in 75)**	**1% (1 in 100)**	**1% (1 in 100) inc 20% Climate Change**	**0.5% (1 in 200)**	**0.1% (1 in 1000)**	**0.1% (1 in 1000) inc 20% Climate Change**
BS_02500	517431	355473	3.67	3.90	3.94	3.94	3.95	3.96	3.97	3.96	3.97	3.98	3.96	3.97
BS_03000	516948	355395	3.67	3.91	3.96	3.95	3.96	3.97	3.98	3.96	3.98	3.99	3.97	3.98
BS_03500	516452	355399	3.67	3.90	3.95	3.95	3.96	3.97	3.98	3.96	3.97	3.98	3.97	3.98

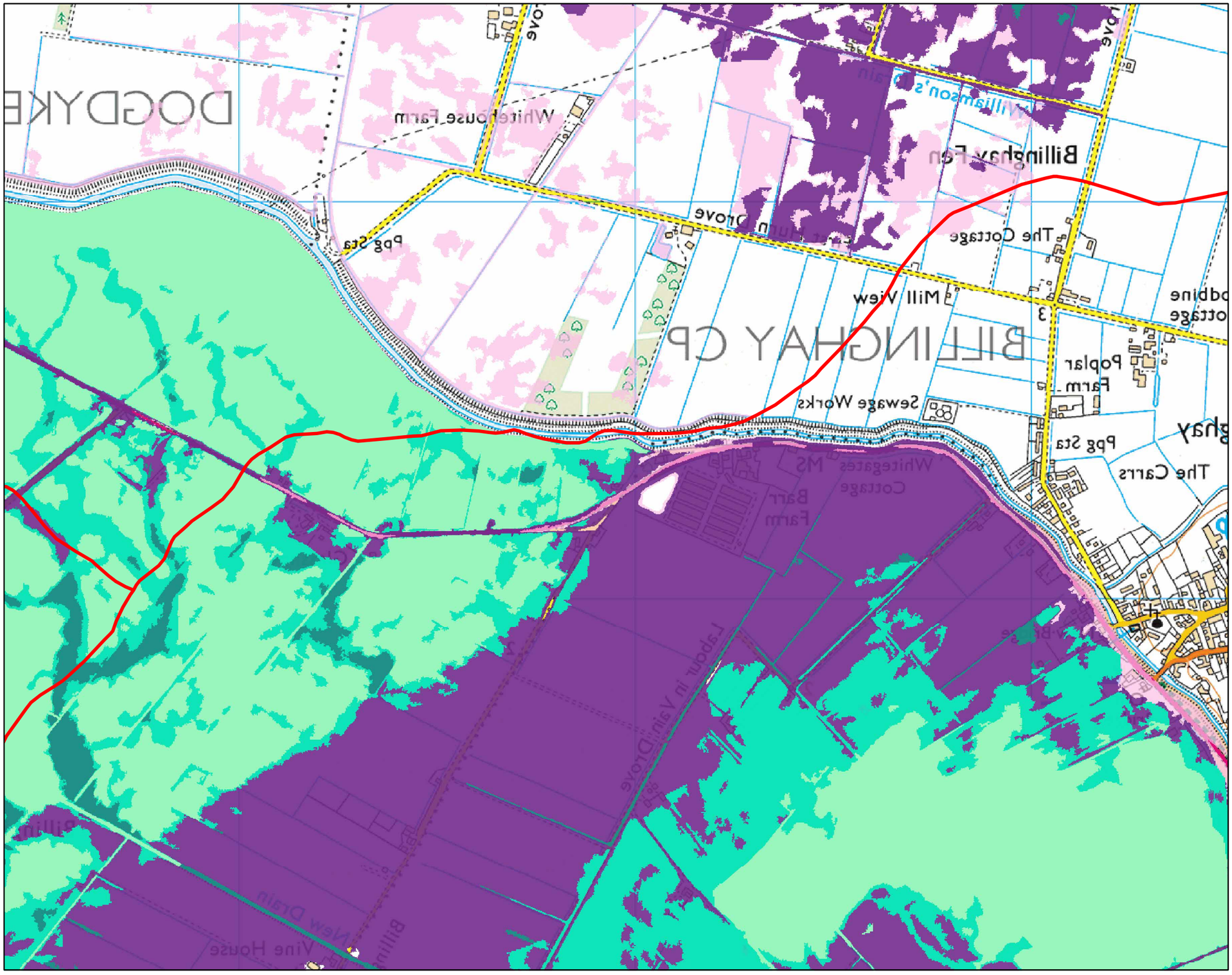
Fluvial Flood Flows (m^3/s)

The fluvial flood flows for the model nodes shown on the attached map are set out in the table below. They are measured in metres cubed per second (m^3/s).

			Annual Exceedance Probability - Maximum Flows (m^3/s)											
Node Label	**Easting**	**Northing**	**50% (1 in 2)**	**20% (1 in 5)**	**10% (1 in 10)**	**5% (1 in 20)**	**4% (1 in 25)**	**2% (1 in 50)**	**1.33% (1 in 75)**	**1% (1 in 100)**	**1% (1 in 100) inc 20% Climate Change**	**0.5% (1 in 200)**	**0.1% (1 in 1000)**	**0.1% (1 in 1000) inc 20% Climate Change**
BS_02500	517431	355473	7.47	8.19	8.41	9.08	9.32	9.55	9.96	10.04	10.78	10.47	13.28	13.33
BS_03000	516948	355395	7.34	7.96	8.23	8.93	9.18	9.33	9.82	9.86	10.67	10.33	13.23	13.27
BS_03500	516452	355399	7.23	7.88	8.20	8.82	9.09	9.29	9.74	9.86	10.65	10.23	13.18	13.24

Modelled Flood Extents (with defences) Model Lower Witham Dated 2009

Map centred on TF 17049 55280 - created October 2017 [Ref: CCN-2017-62090]



Environment Agency

Scale 1:10,000

Modelled Flood Extents (with defences)

- Main River
- 5% (1 in 20) Fluvial Event
- 1% (1 in 100) Fluvial Event
- 1% (1 in 100) Fluvial Event inc Climate Change
- 0.1% (1 in 1000) Fluvial Event
- 0.1% (1 in 1000) Fluvial Event inc Climate Change

Created by the Partnerships and Strategic Overview Team, Lincoln

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