

**PROPOSED RESIDENTIAL DEVELOPMENT AT BURTON CORNER,**  
**SIBSEY ROAD, BOSTON, PE21 9QR**  
**FLOOD RISK ASSESSMENT**



View of site

S M Hemmings B Sc C Eng MICE MIWEM,  
13 Lea Gardens  
Peterborough  
PE3 6BY

This flood risk assessment has been prepared solely to support the planning application for a residential development at Burton Corner, Sibsey Road, Boston. The author has made every effort to provide an accurate assessment of the flood risk but accepts no liability should the information be found to be incorrect or incomplete, or if it is used for any other purposes other than for which it was originally commissioned.

## **Introduction**

An application is due to be made to Boston Borough Council for planning permission to construct a residential building at Burton Corner, Sibsey Road, Boston, PE21 9QR. The site is situated approximately 1.0 km north of the centre of Boston.

The site is within Flood Zone 3 as shown on the Environment Agency's Flood Zone map. The flood zone maps do not take into account existing flood defences.

The Planning Application requires a flood risk assessment to be carried out as specified in the Practice Guidance to the National Planning Policy Framework Development and Flood Risk. The site is within a defended area as specified in the Boston Borough Council's Strategic Flood Risk Assessment (SHDC SFRA) map and is located in the Witham Fourth Internal Drainage Board District.

## **Environment Agency (EA) Flood Zones**

The map below is taken from the Environment Agency website and shows the flood zones in this area.



It can be seen that all of the Boston area is in Flood Zone 3.

## **Application Site**

The site is located 2.5km north of the tidal section of the Haven at Skirbeck. The National Grid Reference of the site is 533950 345420.

The position and extent of the site is shown on the plan at the end of this document.

As the site is within a defended area the proposed development can be considered to be within Flood Zone 3(a) as defined in Table 1 of the Technical Guidance.

Applying the flood risk vulnerability classification in Table 2 of the Guidance, residential dwelling houses are classified as “more vulnerable”.

Table 3 of the Guidance is shown below:

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

It can be seen that for “More Vulnerable” development the sequential and the exception tests need to be applied to the development.

### **Sequential Test**

The aim of the Sequential Test, as set out in the Planning Practice Guidance, is to ensure that a sequential approach is followed to steer new development to areas with the lowest probability of flooding. The flood zones as defined in the Strategic Flood Risk Assessment for the area provide the basis for applying the Test. The aim is to steer new development to Flood Zone 1 (areas with a low probability of river or sea flooding). Where there are no reasonably available sites in Flood Zone 1, local planning authorities in their decision making should take into account the flood risk vulnerability of land uses and consider reasonably available sites in Flood Zone 2 (areas with a medium probability of river or sea flooding), applying the Exception Test if required. Only where there are no reasonably available sites in Flood Zones 1 or 2 should the suitability of sites in Flood Zone 3 (areas with a high probability of river or sea flooding) be considered, taking into account the flood risk vulnerability of land uses and applying the Exception Test if required.

As can be seen from the map on page 2 of this report all of this area on the northern side of Boston is in Flood Zone 3. Therefore it would be difficult to find a similar site for the development that is in a lower flood risk zone. Most of the urban areas within Boston Borough which have already been allocated for development and are included within the SELLP are within flood zone 3(a). It can be shown that there are 12 allocated sites within the Borough that have a greater predicted flood depth than the proposal site and that there are 10 allocated sites which have an equal predicted flood depth. Sequentially the proposal site has a better predicted flood depth than many sites allocated within the latest Local Plan.

If we take into account the specific maximum hazard for each of the allocated sites, 11 of these are classed as Danger to All, 12 are classed as Danger to Most, 3 are classed as Danger to Some, 3 have a Low Hazard and 7 have no hazard at all. The

site of the proposed building has a hazard rating of danger for most, meaning that it is better than 11 sites that have been allocated within the district.

The safety of the development will be delivered by ensuring the ground floor level of the proposed new house is above the predicted residual flood level in a 1 in 200 year event in 2115 for this area.

The Boston Borough Council Core Strategy states that there is a limited number of sites in the Boston BC area available for residential development. Some further sites will need to be identified to enable the Council to meet the RSS and Structure Plan requirement for 2021. Therefore there is a requirement for further sites to be brought forward and used for residential development.

Therefore taking into account the above I consider that the sequential test for this site has been passed.

### **Exception Test**

The Sequential Test has demonstrated that it is not possible, consistent with wider sustainability objectives, for the development to be located in zones with a lower probability of flooding. Therefore the Exception Test must be applied and for this to be passed:

- It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risks, informed by the Strategic Flood Risk Assessment; and
- A site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking into account of the vulnerability of its users, without increasing flood risk elsewhere, and where possible will reduce flood risk overall.

Both parts of this test must be satisfied in order for the development to be considered appropriate in terms of flood risk. There must be robust evidence in support of every part of the test.

The first section will be demonstrated by the Supporting Planning Statement and compliance with Boston Borough Council's planning policies.

This flood risk assessment will demonstrate that the development will be safe for its lifetime and it will not increase flood risk elsewhere.

### **Strategic Flood Risk Assessment**

Consultants produced a Strategic Flood Risk Assessment (SFRA) for the Boston Borough Council (SHDC) in January 2010. This document provided details of the flood risk in the Council's area. This was superseded by the Strategic Flood Risk Assessment carried out by the South East Lincolnshire Planning Committee (issued March 2017) and is shown on their website.

Both SFRA's contain maps showing the predicted hazard from flooding in the northern part of Boston. These maps show that the greatest hazard is from a potential breach or overtopping of the bank of the Haven 2.5 km south of the site.

The SFRA also give more general maps on the relative probability of flooding in this area. As there is now available more detailed mapping from the Environment Agency these will be considered in detail.

### **Information Supplied by the Environment Agency**

The Environment Agency have provided maps showing the maximum hazard, depth of flooding and velocity for the 1 in 200 year and 1 in 1000 year breaching events in 2006 and 2115, and the results of these are shown below:

	Hazard	Flood Depth	Velocity
1 in 200 year event in 2006	0.75 – 2.0	0 – 1.0m	0 – 1.0m/sec
1 in 1000 year event in 2006	0.75 – 2.0	0 – 1.0m	0 – 1.0m/sec
1 in 200 year event in 2115	0.75 – 2.0	250mm – 1.0m	0 – 1.0m/sec
1 in 1000 year event in 2115	1.25 – 2.0	500mm – 1.0m	0 – 1.0m/sec

The Agency have also provided maps showing the maximum hazard, depth of flooding and velocity for the 1 in 200 year and 1 in 1000 year overtopping events in 2115, and the results of these are shown below:

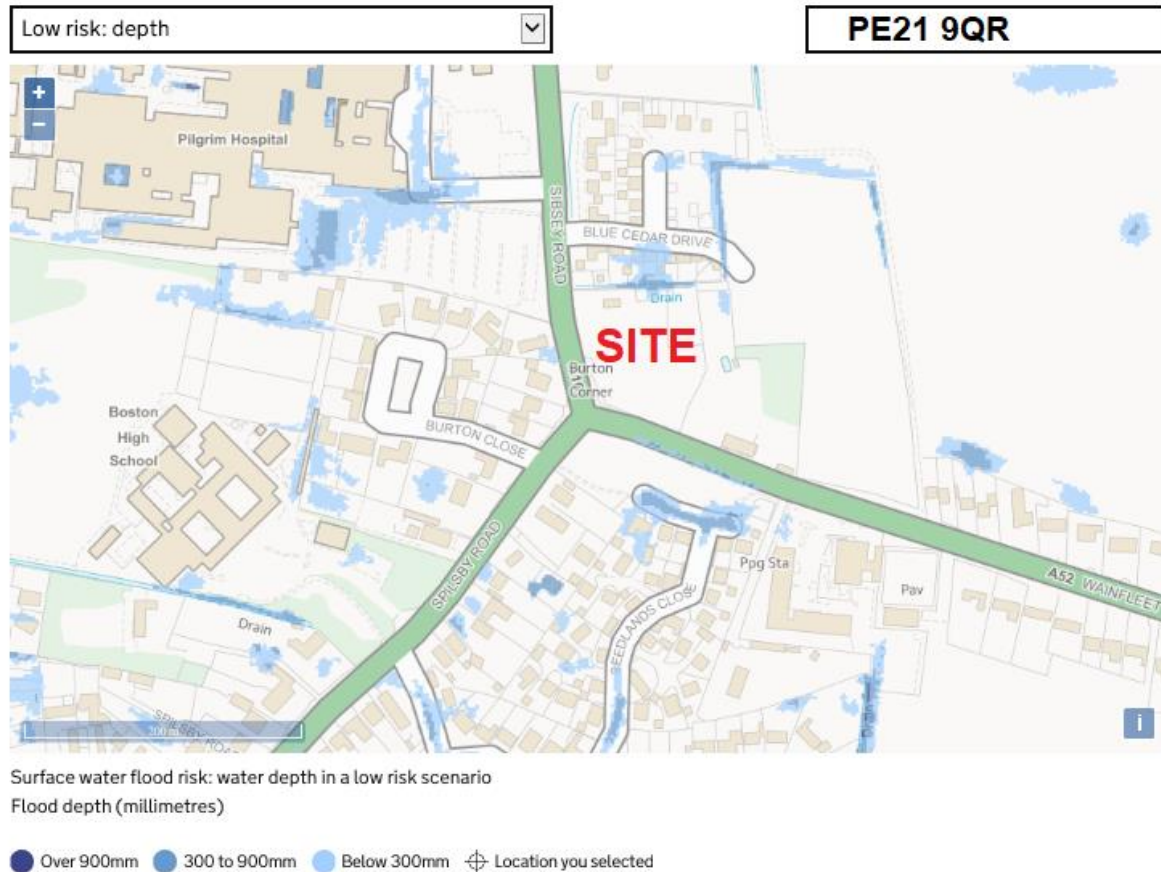
	Hazard	Flood Depth	Velocity
1 in 200 year event in 2115	0.75 – 2.0	250mm – 1.0m	0 – 0.3m/sec
1 in 1000 year event in 2115	Greater than 2.0	500mm - 1.6m	0.3 – 1.0m/sec

The maps of the flood risk supplied by the Environment Agency are reproduced on pages 15 – 20 of this report.

### **Information on Surface Water Flooding on Environment Agency Website**

The following map shows areas around the site where there is a low risk of surface water flooding. The light blue areas indicate the low risk of up to 300mm of surface water flooding, and the darker blue areas indicate that between 300mm and 900mm of surface water flooding could occur.





It can be seen there is a low risk of up to 300mm depth of surface water flooding around the dyke on the northern boundary of the site, but no predicted flooding elsewhere on the site.

### **Existing Flood Alleviation Measures**

The site is within a defended flood plain, as defined in Appendix 1 of the Environment Agency's "Policy and Practice for the Protection of Flood Plains", which is considered to be passive until such time that a flood greater than the defences can withstand occurs. The likelihood of flooding occurring due to overtopping or failures of the defences is considered to be very low.

The site is located approximately 2.5km from the northern tidal sea bank of the Haven at Skirbeck and 7.1km west of the tidal sea bank at Freiston Shore which are both maintained by the Environment Agency.

The site is located 570 metres south of the Cowbridge Drain which joins the Hobhole Drain 2.5km east of the site, both of which are maintained by Witham Fourth IDB.

The Maud Foster Drain (to the north it is called the Stonebridge Drain) is 900 metres west of the site.

## **Existing Ground Levels**

A topographical survey of the site has been carried out and part of this is shown on page 12 of this report. The survey drawing will be submitted with the planning application.

Levels on the site vary from approximately 3.0m OD around the western and southern boundaries to a lowest level of 2.019m ODN near the northern end of the site. The area where the house is located, in the centre of the site is at a level of between 2.25m and 2.30m ODN. The levels of Sibsey Road and Wainfleet Road are above 3.00m OD.

## **Potential Sources of Flooding**

The following sources of flooding have been identified:

- 1) Tidal flooding due to overtopping or breaching of the sea tidal defences of the Haven.
- 2) Fluvial flooding from the Maud Foster Drain
- 3) Flooding due to high water levels in the Cowbridge and Hobhole Drains.
- 4) Surface Water Flooding.

### **1. Tidal Flooding due to overtopping or breaching of the north bank of the Haven**

The north bank of the Haven is 2.5km south of the site. The Environment Agency have stated that the predicted tide levels (50% confidence level) along this section of coastline are as shown below.

	1 in 200 year event	1 in 1000 year event
Gibraltar Point	5.10	5.41
Hobhole	6.04	6.31
Boston Barrier	6.09	6.26

The maps produced by the Environment Agency predict that flood depths on the site would be a maximum of 1.0 metre in the 1 in 200 year breaching event in 2115. Further investigation which is detailed later in this report will calculate an actual maximum flood level for the site. The maps assume that no improvements are carried out to the defences over the next one hundred years.

The Environment Agency have agreed a one hundred year strategy for the length of the Haven from Tabs Head as far as Grand Sluice. This involves the construction of a Barrier to prevent flooding upstream of Black Sluice Pumping Station, and the raising of bank levels along the Haven as predicted tide levels increase with climate change to ensure that there is always a minimum 1 in 200 year standard of defence along both banks of the Haven.

Mitigation against tidal flooding will be provided by raising the ground floor level of the proposed building to be above the predicted 1 in 200 year flood level in 2115.

## **2. Fluvial Flooding from the Maud Foster Drain**

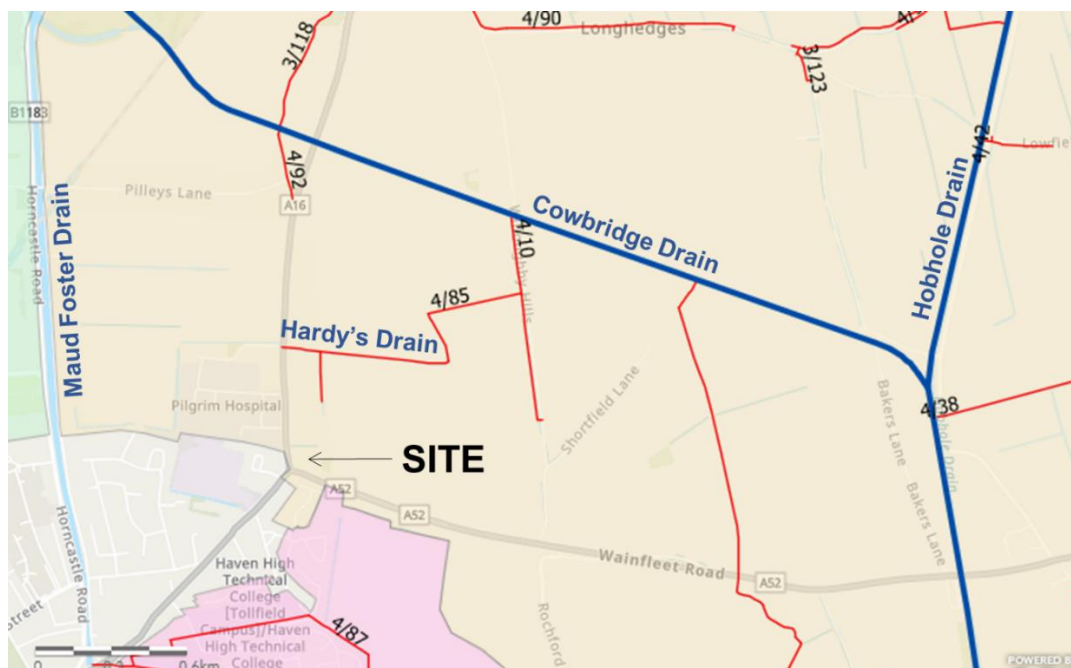
The Maud Foster Drain is 900 metres west of the site. The Environment Agency have advised that the maximum predicted flood level in a 1 in 100 year event in 2115 is 2.24m OD. This level is approximately 700mm lower than the proposed ground floor level of the new building.

This will provide adequate mitigation against this risk of flooding from this source of flooding.

## **3. Flooding due to High Water Levels in the Hobhole Drain.**

Witham Fourth IDB has stated that their modelling predicts a maximum water level of 0.62m ODN for a 1:100 year event plus climate change for this section of the Cowbridge Drain and the Hobhole Drain.

The dyke north of the site connects into Hardy's Drain which flows northwards into the Cowbridge Drain. The IDB drains are shown on the map below.



The Board have also stated that they have no record of any flooding at this location.

Therefore adequate mitigation against the risk of flooding from IDB drains will be provided by raising the ground floor level of the proposed building above existing ground levels on the site.

## **4. Surface Water Flooding**

There is a risk of surface water flooding from the following sources:

- Flooding from Sibsey Road and Wainfleet Road
- Flooding from overtopping of the dyke on the northern boundary of the site.
- Flooding from on site drainage being overwhelmed



As the house will be raised approximately 700mm above the ground level there will be adequate storage of flood water which would prevent the proposed house from being flooded. The risk from surface water flooding would be short term and any excess surface water would eventually flow into the IDB system.

Therefore it can be considered that this source of flooding is adequately mitigated.

### **Extent of known Flooding**

During the preparation of this assessment, no evidence was discovered of the site or any of the adjoining properties being flooded in the last thirty years.

### **Probabilities and Trends of Flooding**

The probability of this development flooding from Environment Agency main river is very low.

### **Residual Risk – Extreme Events**

The residual risk from extreme events is very low on this site. The major risk to the site is from a breach or overtopping of the tidal defences

### **Climate Change**

The recommendations for flood depths for this flood risk assessment use information provided by the Environment Agency which was produced in 2006. The EA have issued new guidance on recommended contingency allowances for predicted sea rises, fluvial flows and rainfall intensities which from 19<sup>th</sup> February 2016 needs to be considered in the FRA. The effects of these new recommendations are considered in Appendix A of this report (pages 21 to 24). It is concluded that no extra mitigation measures are necessary to comply with the new guidance on climate change.

### **South East Lincs Advice Matrix**

Advice can be found on the recommended mitigation required by referring to the standing advice matrix on the South East Lincolnshire website. As the development is in flood zone 3 and the flood hazard is between 1.25 and 2.0 (danger for most) the category to be considered in the matrix is D8, and the following mitigation is recommended.

*The NPPF requires that the proposal is accompanied by a Flood Risk Assessment which contains evidence that appropriate mitigation measures / flood resilience techniques have been incorporated into the development.*

*Finished floor levels (FFL's) should be informed by the predicted flood depth maps (refer to the relevant 2115 1% fluvial and 0.5% tidal maximum depth map) and set as required below (single storey proposals must use the 0.1% event 2115 scenario for setting FFL's).*

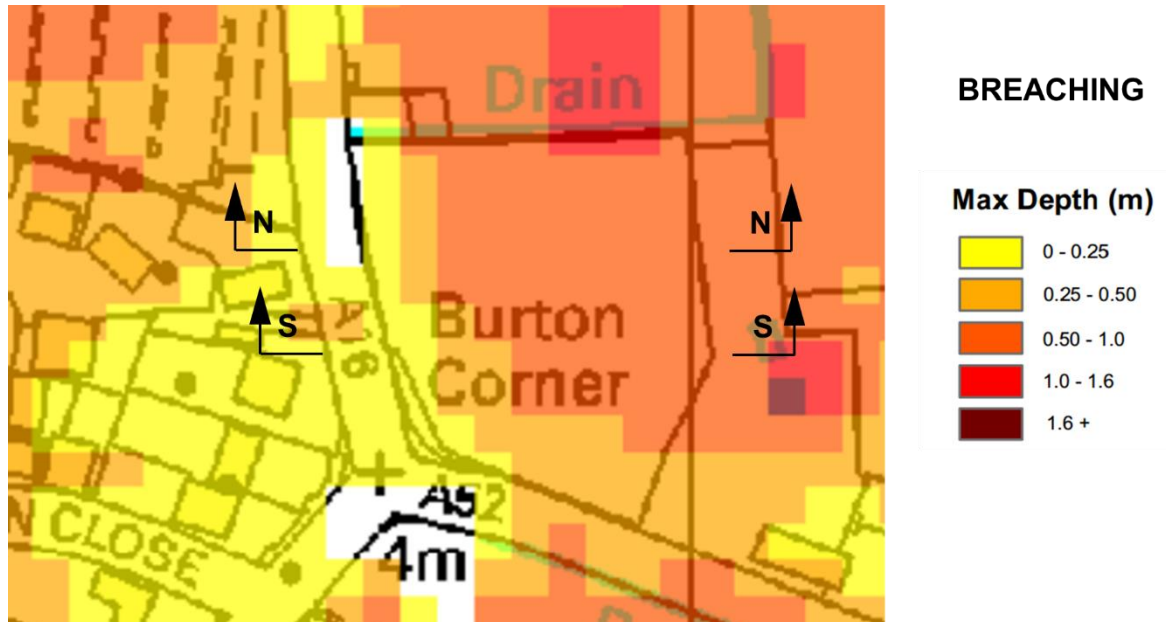
*Flood depths of 500mm – 1.0 metre*

*FFL set a minimum of 1.0 metre above ground level with flood resilient construction to a height of 300mm above the predicted flood depth.*

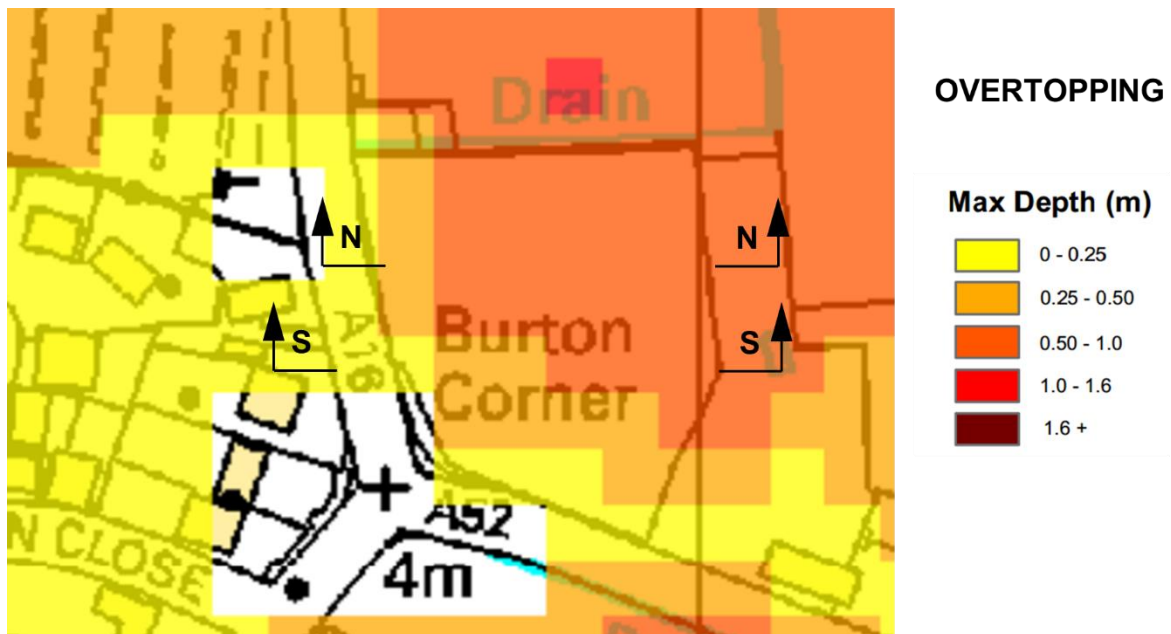
### Summary of Risk of Flooding to the Site

The proposed development is not in a functional flood plain as defined by PPS 25.

The Environment Agency map of the predicted flood depth in a 1 in 200 year event in 2115 due to a breach in the flood defences is shown below.



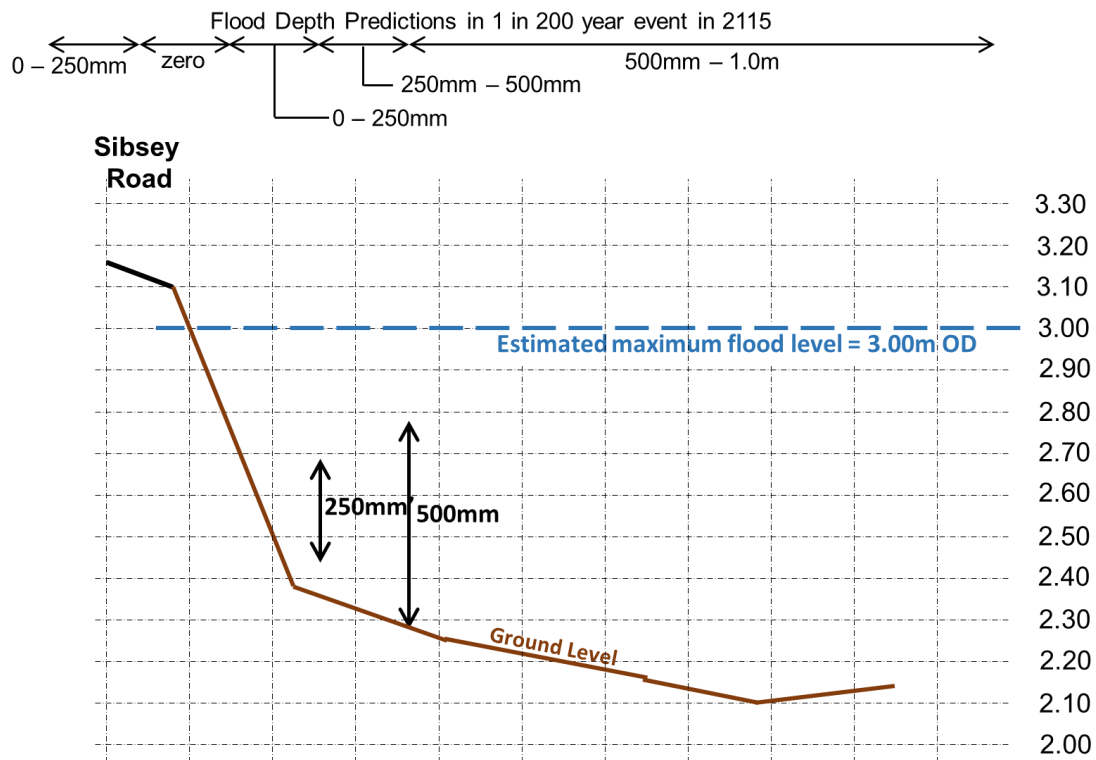
The Environment Agency map of the predicted flood depth in a 1 in 200 year event in 2115 due to overtopping of the flood defences is shown below.



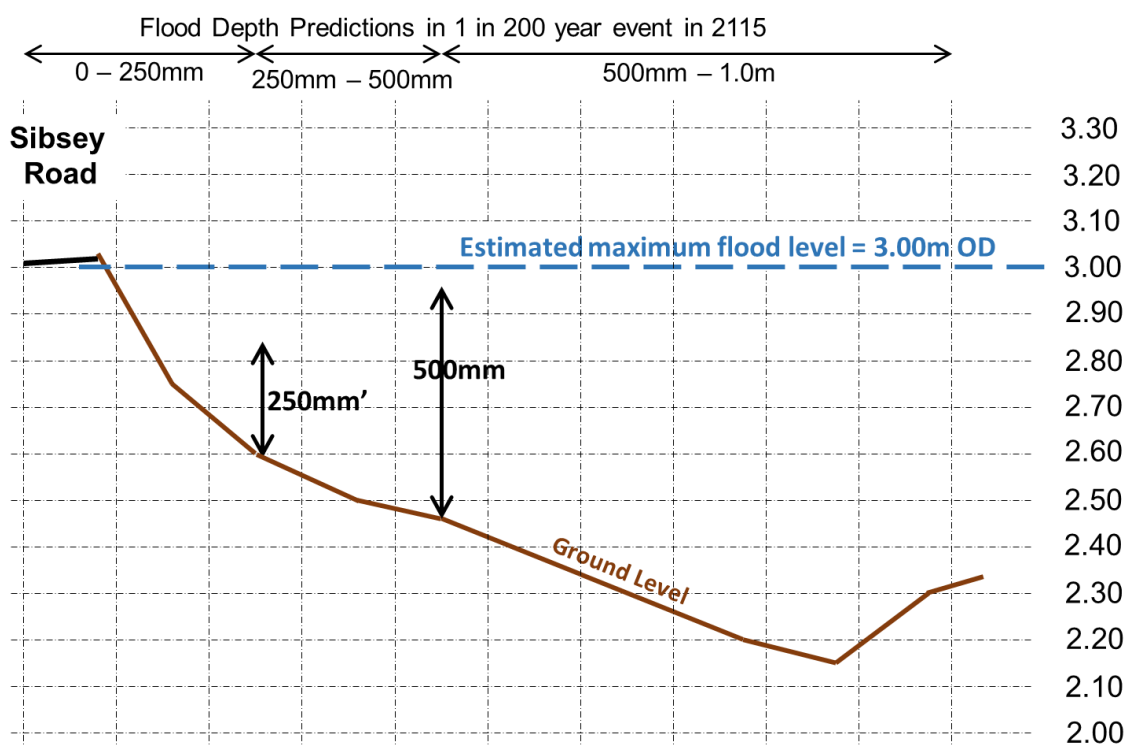
Both maps indicate that the predicted flood depth will be between 500mm and 1.0 metre over a greater part of the site. The map showing the predicted flood depths due to a breach shows a greater area with the 500mm to 1.0 metre and will be considered to be the worst case of the two.

Two cross sections have been drawn across the site. The land levels have been taken from the topographical survey and the predicted flood depths taken from the Environment Agency map of breaching shown on the previous page. The location of the cross sections is also shown on the map on the previous page.

Northern cross section:



Southern cross section



The lowest land level on the site is below 2.10m ODN near the northern boundary of the site. It can also be seen that there is lower land north of the site, which will be lower than 2.00m ODN, that is within the band on the flood depth map where predicted flood depths are between 1.0 and 1.6 metres. Therefore it has been estimated that the maximum flood level in a 1 in 200 year event in 2115 is 3.00m ODN.

It is noted that the areas of flood depths do not correlate with the levels of the land. The levels have been measured on site but the areas of flood depths are taken from much smaller scale maps and so cannot be as accurate as the topographical study. However the predicted flood maps do take into account that land levels on the western and southern boundaries of the site are higher than the general level of the site.

### **Recommendations**

In this area where the flood risk is high the new dwelling should have two stories with all of the sleeping accommodation located on the first floor. This is to provide a refuge for residents if the building were to become flooded after a major breach of the tidal bank, and ensure there is no danger to residents when they are asleep.

The finished ground floor level of the proposed building should be raised by approximately 700mm above the existing ground level on the site and shall have a minimum level of 3.10m ODN.

Flood resilient construction should be included to a height of 300mm above the predicted flood depth.

The owner and occupier of the property should register with the Environment Agency's Floodline Warnings Direct Service.

Surface water from the roofs of the buildings should be discharged into soakaways and these should be designed in line with the methodology in BRE Digest 365 and approved under the Building Regulations.

**S M HEMMINGS B Sc C Eng MICE MIWEM**

[stuart.hemmings@btinternet.com](mailto:stuart.hemmings@btinternet.com)

19<sup>th</sup> August 2020

The map shows the Burton area in Lincolnshire. The 'SITE' is marked in red at Burton Corner Hall. Other labeled locations include Mafeking Cottages, Willoughby House, Rochford House, Sewage Ppg Sta, Hospital, Hospice, School, Allot Gdns, Windmill, and Hotel. The A16 and A52 roads are shown in pink. The map is oriented with North at the top.

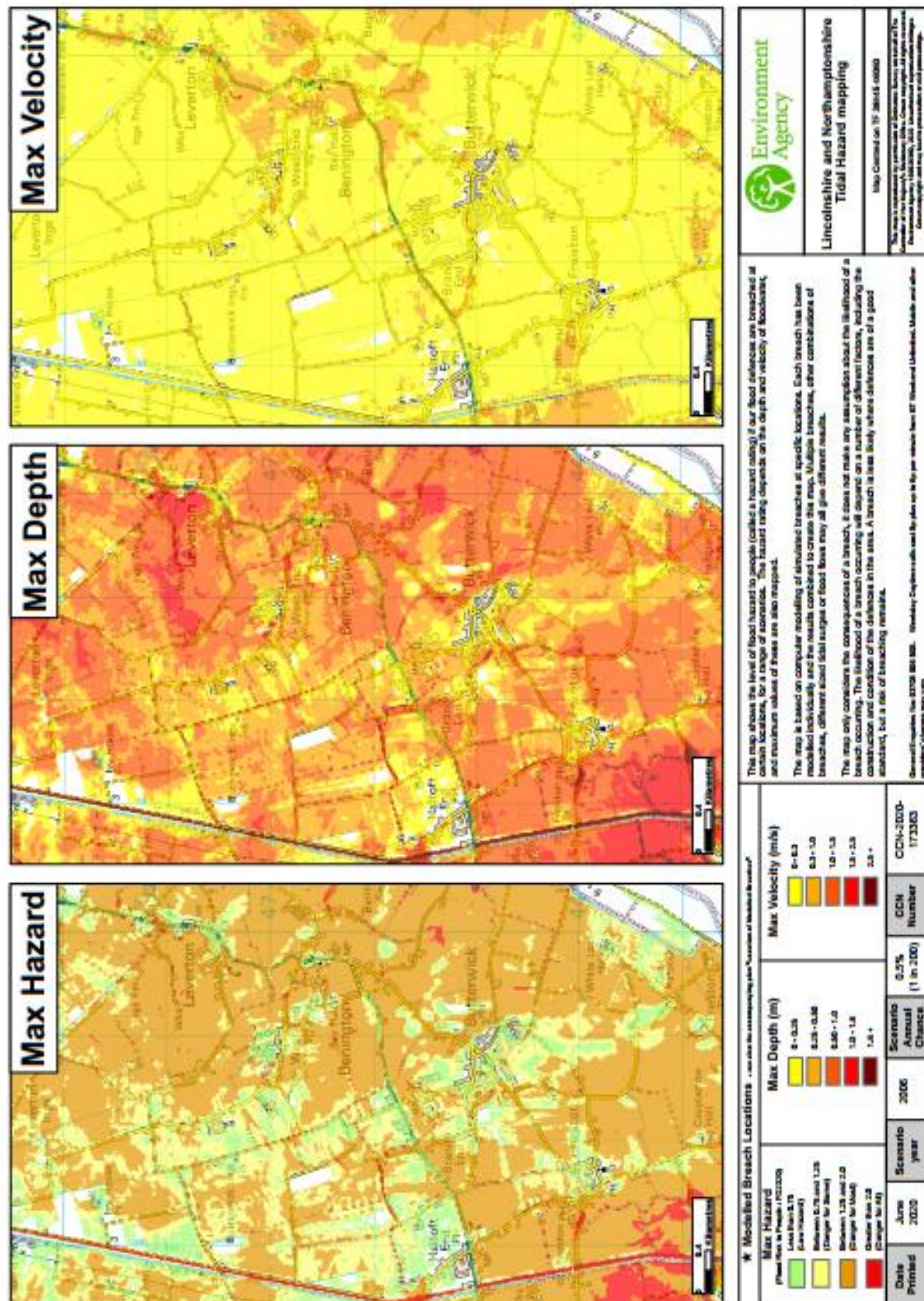


## Proposed Site Plan



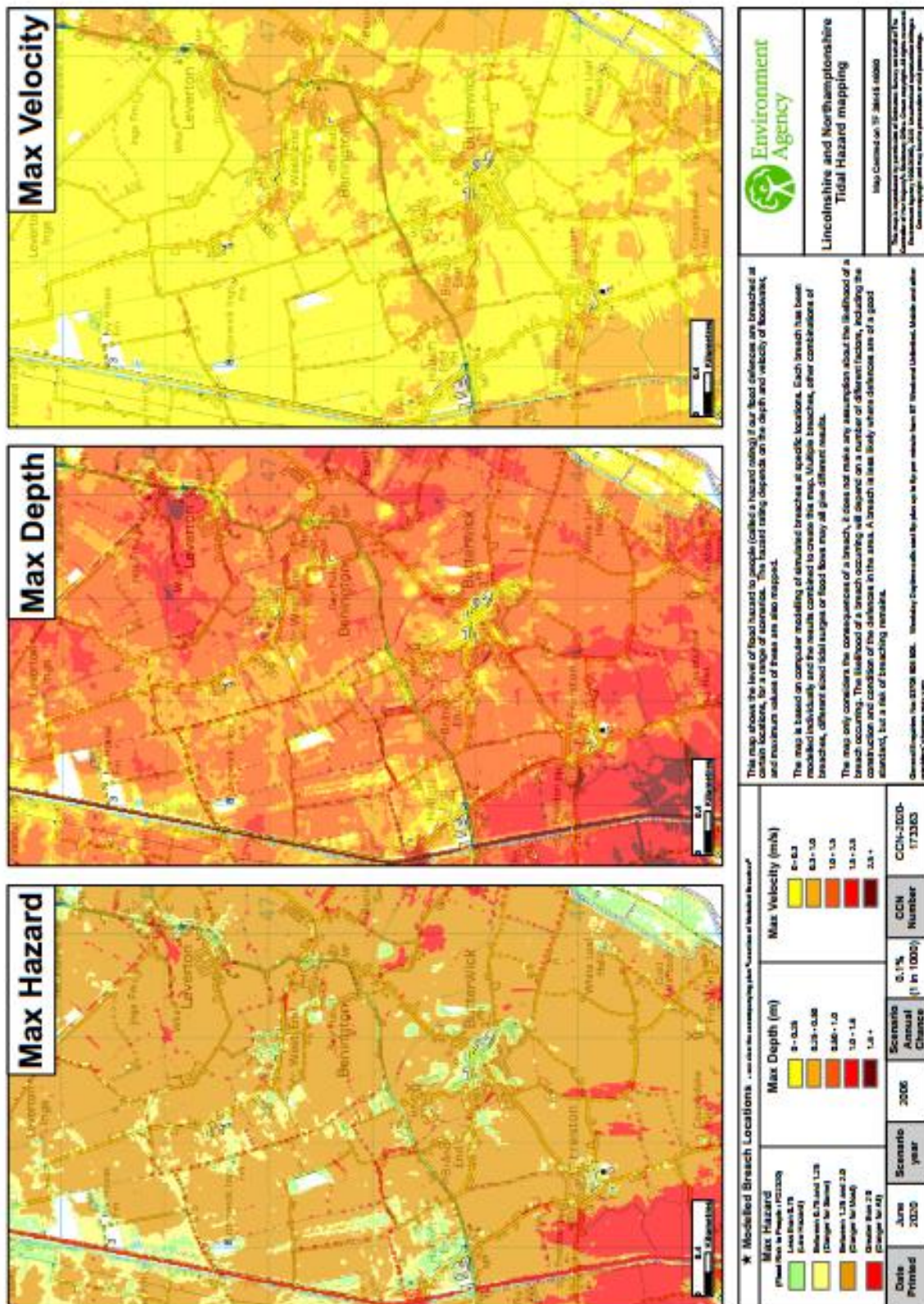
# EA MAP OF HISTORIC FLOODING

## 1 in 200 year Flood Risk from Breaching in 2006



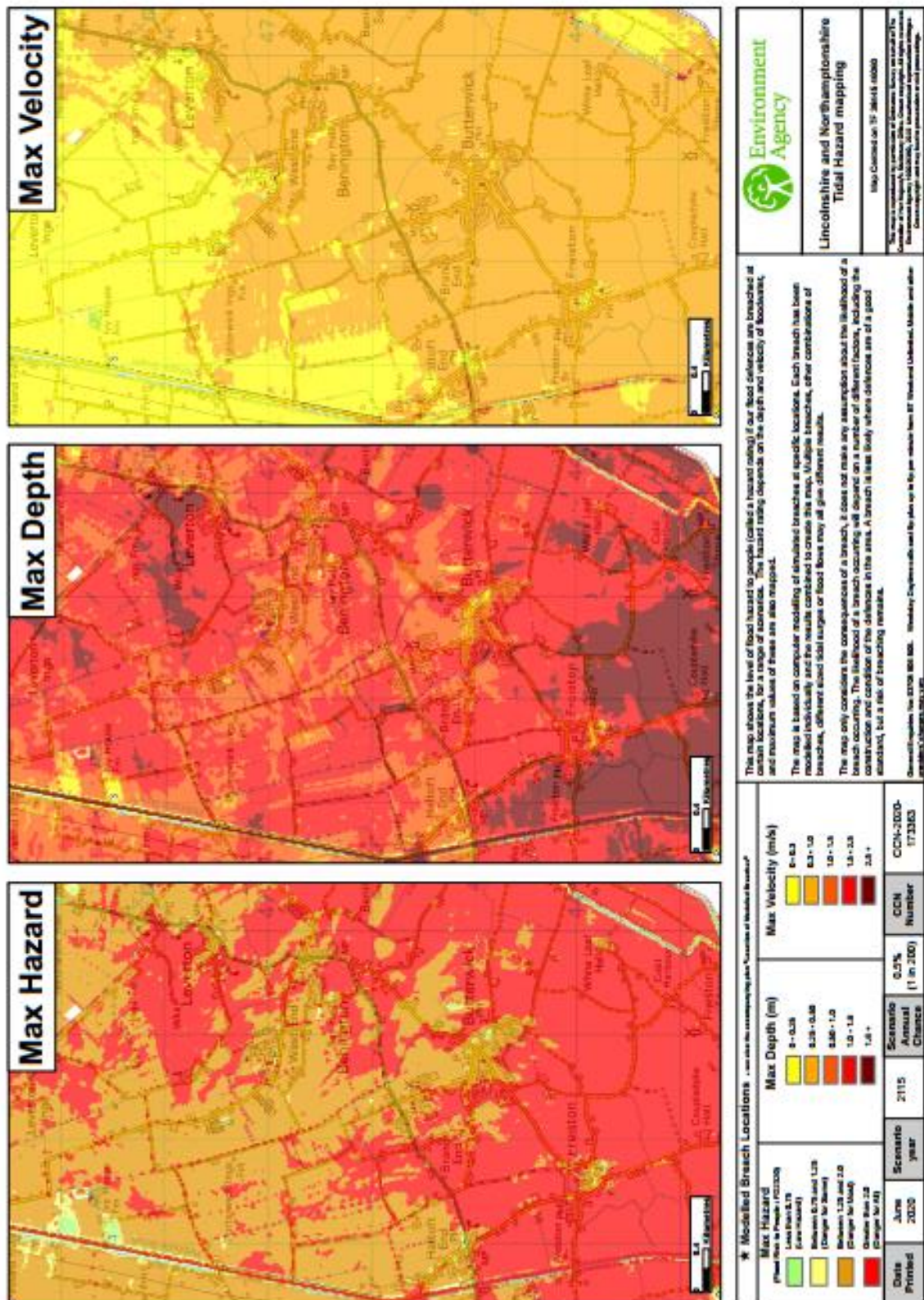


# 1 in 1000 year Flood Risk from Breaching in 2006



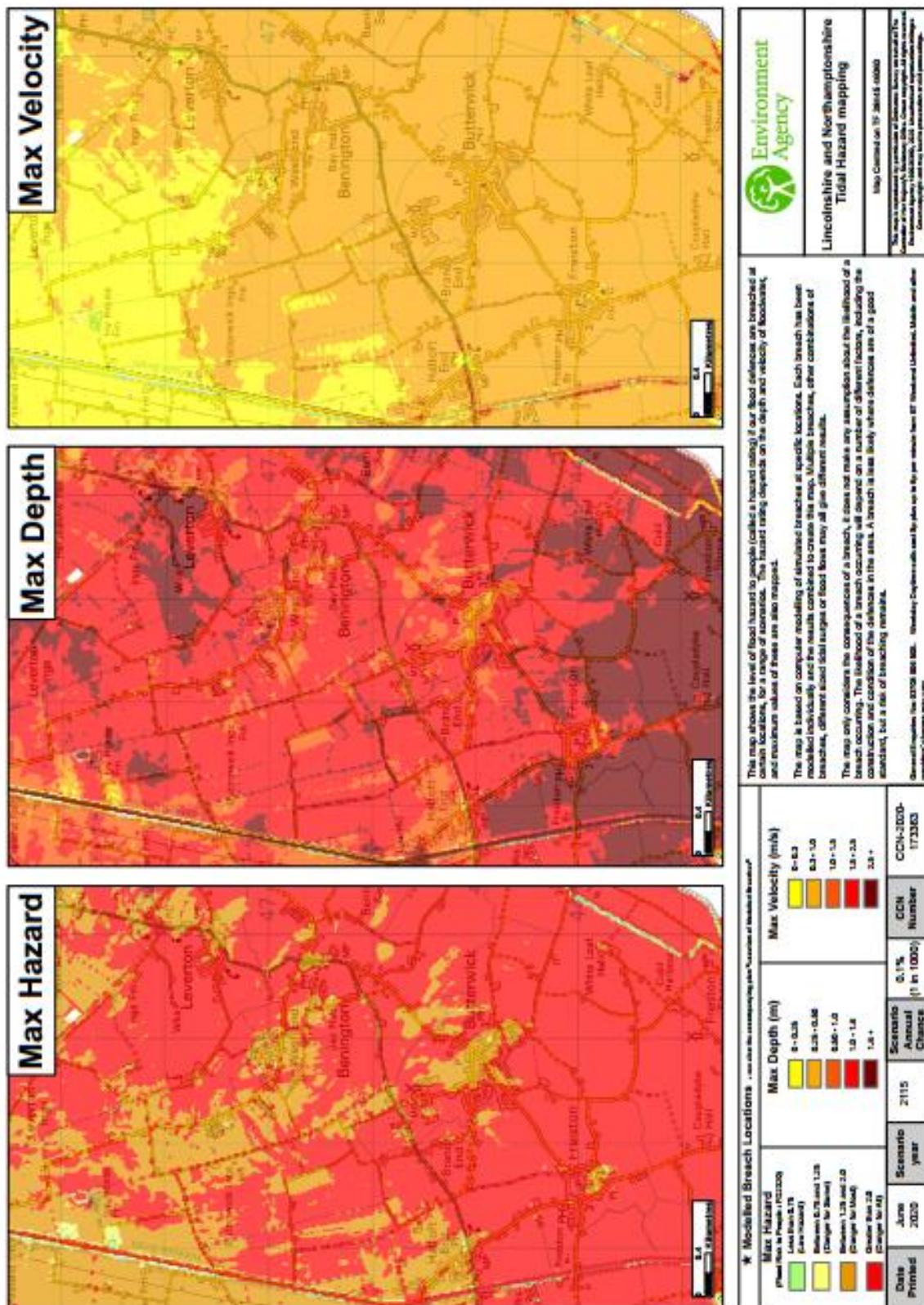


# 1 in 200 year Flood Risk from Breaching in 2115



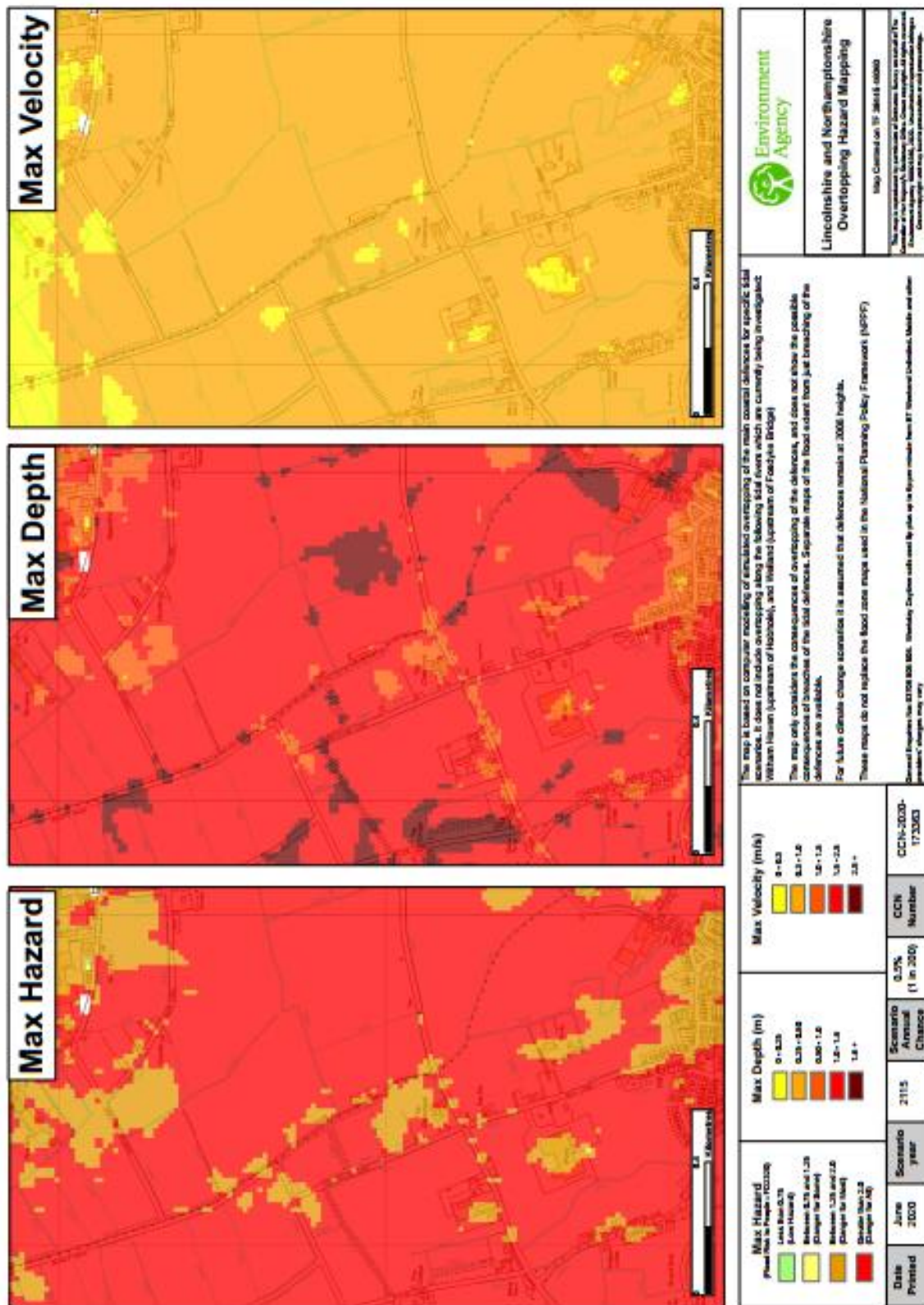


# 1 in 1000 year Flood Risk from Breaching in 2115

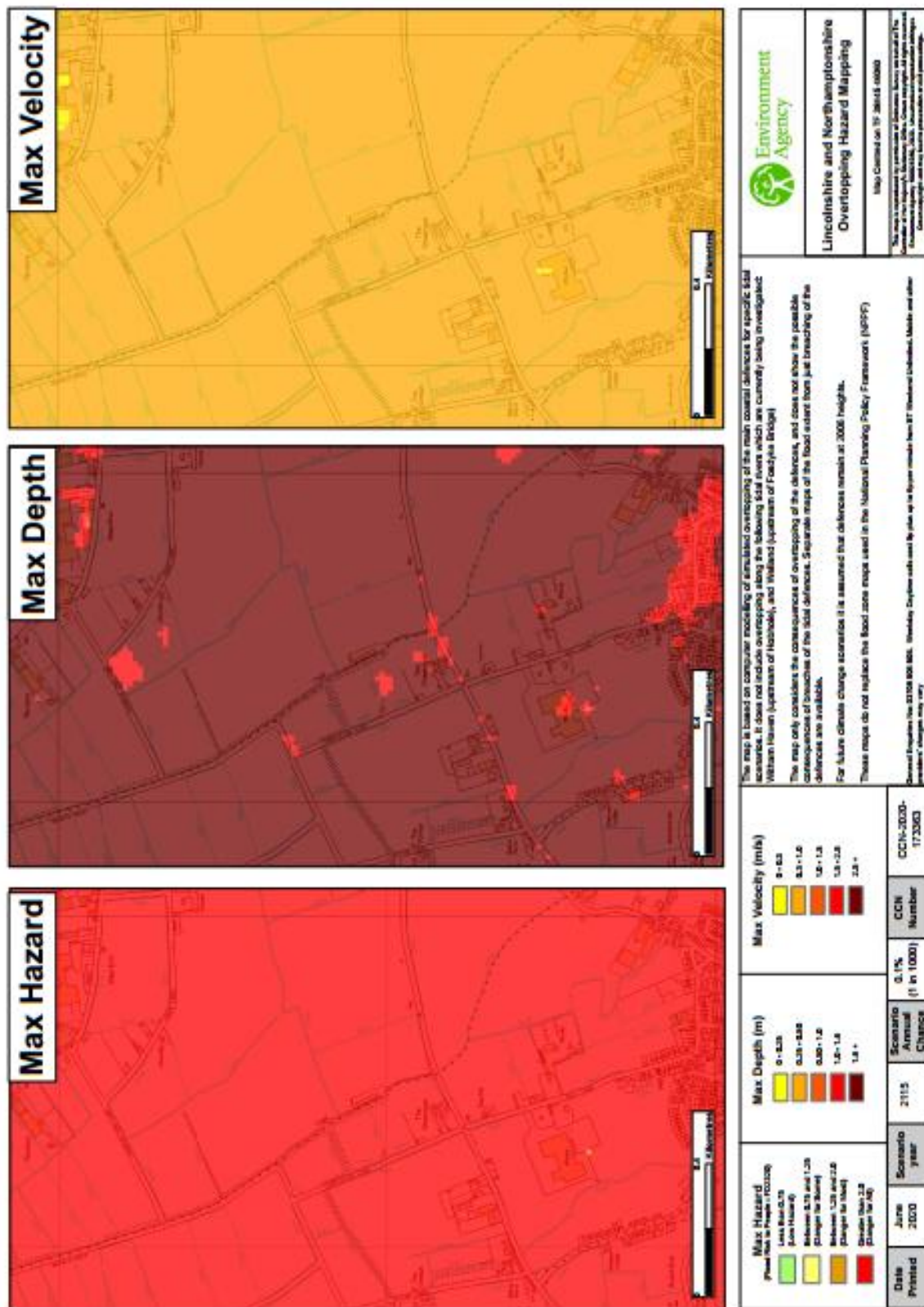




# 1 in 200 year Flood Risk from Overtopping in 2115



### 1 in 1000 year Flood Risk from Overtopping in 2115



## **APPENDIX A CLIMATE CHANGE**

The Environment Agency has issued revised guidance on climate change and have now stated that the new predictions should be considered and incorporated into all flood risk assessments produced after 19<sup>th</sup> February 2016.

The maps issued by the EA were produced in 2006 and used the climate change impacts published by Defra in October 2006 which are reproduced below.

**Table 1: Regional net sea level rise allowances**

<i><b>Administrative or Devolved Region</b></i>	<i><b>Assumed Vertical Land Movement (mm/yr)</b></i>	<i><b>Net Sea-Level Rise (mm/yr)</b></i>				<i><b>Previous allowances</b></i>
		<i><b>1990-2025</b></i>	<i><b>2025-2055</b></i>	<i><b>2055-2085</b></i>	<i><b>2085-2115</b></i>	
East of England, East Midlands, London, SE England (south of Flamborough Head)	-0.8	4.0	8.5	12.0	15.0	6mm/yr* constant

**Table 2: Indicative Sensitivity Ranges**

<i><b>Parameter</b></i>	<i><b>1990-2025</b></i>	<i><b>2025-2055</b></i>	<i><b>2055-2085</b></i>	<i><b>2085-2115</b></i>
Peak rainfall intensity (preferably for small catchments)	+5%	<b>+10%</b>	+20%	+30%
Peak river flow (preferably for larger catchments)	+10%	<b>+20%</b>		
Offshore wind speed	+5%		<b>+10%</b>	+10%
Extreme wave height	+5%		<b>+10%</b>	+10%

## **Revised 2016 EA Guidance**

**Table 1 peak river flow allowances by river basin district (use 1961 to 1990 baseline)**

River basin district	Allowance category	Total potential change anticipated for '2020s' (2015 to 39)	Total potential change anticipated for '2050s' (2040 to 2069)	Total potential change anticipated for '2080s' (2070 to 2115)
Anglian	Upper end	25%	35%	65%
	Higher central	15%	20%	35%
	Central	10%	15%	25%

For more vulnerable development in flood zone 3(a) the higher central and upper end should be used to assess the range of allowances.

**Table 2 peak rainfall intensity allowance in small and urban catchments (use 1961 to 1990 baseline)**

Applies across all of England	Total potential change anticipated for 2010 to 2039	Total potential change anticipated for 2040 to 2059	Total potential change anticipated for 2060 to 2115
Upper end	10%	20%	40%
Central	5%	10%	20%

**Table 3 sea level allowance for each epoch in millimetres (mm) per year with cumulative sea level rise for each epoch in brackets (use 1990 baseline)**

<a href="#">Area of England</a>	1990 to 2025	2026 to 2050	2051 to 2080	2081 to 2115	Cumulative rise 1990 to 2115 / metres (m)
East, east midlands, London, south east	4 (140 mm)	8.5 (212.5 mm)	12 (360 mm)	15 (525 mm)	1.24 m



**Table 4 offshore wind speed and extreme wave height allowance (use 1990 baseline)**

Applies around all the English coast	1990 to 2050	2051 to 2115
Offshore wind speed allowance	+5%	+10%
Offshore wind speed sensitivity test	+10%	+10%
Extreme wave height allowance	+5%	+10%
Extreme wave height sensitivity test	+10%	+10%

### **Effects on Predictions of Flood Risk in FRA**

The FRA has identified two sources of flooding where the new climate change recommendations could affect the predictions of flood levels in 2115 at the development site:

- 1) Tidal Flooding due to overtopping of the tidal defences
- 2) Fluvial Flooding from the Maud Foster and IDB drains

#### **1. Tidal Flooding due to overtopping of the sea defences**

The contingency allowance in metres for the years 2055 and 2115 using 1990 as a baseline in the SFRA compared with the guidelines is as follows

Year	2006 guidance	Revised 2016 guidance
2055	0.395	0.412
2115	1.205	1.24

It is unlikely that an increase of 35mm in maximum levels in the Wash will have a significant impact on the predicted flood levels for the development site. The range of predicted flooding on the site is between 500mm and 1.0 metre, and a very small increase in the maximum flood level in the Wash is not going to change this prediction significantly.

#### **2. Fluvial Flooding from the Maud Foster and IDB drains**

As the development is in flood zone 3 and is classed as more vulnerable, the upper end climate change allowance, which is 35%, should first be considered. After considering the effects of this increase the upper end allowance, which is 65%, should be considered to assess the effect of this.

##### **a) Maud Foster Drain:**

The EA have been using an allowance of 20% for climate change over the past few years in their assessments and modelling of their systems. The SFRA also has used



this figure of 20%. The increase to 35% will not significantly change the predictions of the water levels in the Maud Foster Drain at this location. The main flows in the Drain are from highland flows which are discharged into the drain at least 10 miles north of Boston. Any additional flows will overtop the upper reaches of the drain and no significant extra flows will be seen at the outfall.

The upper end allowance predicting a 65% increase in flows above the 1 in 100 year predicted flows now needs to be considered. It is unlikely that there will be any significant increase in the water level in the Drain. Therefore the maximum predicted water levels will not increase significantly above the levels predicted by the EA.

b) IDB Drains:

IDB's have been using an allowance of 20% for climate change over the past few years in their assessments and modelling of their systems. Generally IDB's are happy that their systems provide a 1 in 100 year standard to most urban areas at the present time.

Witham Fourth IDB, and all IDB's, are aware that climate change will affect the operations of pumping stations, sluices and drainage channels. Pumping stations and sluices only have a 30 year life and will need to be refurbished or rebuilt within this timespan. It is assumed that Witham Fourth IDB will continue to review the modelling they have already carried out and when the Board consider these refurbishments adequate arrangements will be made to incorporate the latest climate change projections in order that the Board continues to provide the same standard of service as the present day.

Therefore it is considered that the mitigation proposed for the development, with the recommendation that the proposed ground floor level should be raised to a minimum level of 3.10m ODN is satisfactory.