

**PROPOSED CONVERSION OF A BUILDING NORTH OF
MAIN ROAD (A52), BUTTERWICK, BOSTON, PE22 0JH**
FLOOD RISK ASSESSMENT



View from south

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 conversion of an existing building north of Main Road (A52), Butterwick, 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 convert the existing buildings north of Main Road (A52), Butterwick, Boston, PE22 0JH to a residential centre for autistic children. The site is situated approximately 1.2 km north of Butterwick and 6.3km east of the centre of Boston.

The southern and northern parts of the existing building will be demolished and new parts of the building will be constructed with the ground floor level 1.0 metre above the existing ground level. On the ground floor there will be a pool in the southern building with therapy rooms and meeting rooms in both buildings. The first floor of both buildings will be sleeping accommodation for the children and their carers. The ground and first floor plans are shown on page 14 and 15 of this report.

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 400 metres from the tidal section of the Haven. The National Grid Reference of the site is 538445 346060.

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,

More vulnerable

- Hospitals
- Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels.
- Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels.
- Non-residential uses for health services, nurseries and educational establishments.
- Landfill* and sites used for waste management facilities for hazardous waste.
- Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.

Less vulnerable

- Police, ambulance and fire stations which are not required to be operational during flooding.
- Buildings used for shops; financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the 'more vulnerable' class; and assembly and leisure.
- Land and buildings used for agriculture and forestry.
- Waste treatment (except landfill* and hazardous waste facilities).
- Minerals working and processing (except for sand and gravel working).
- Water treatment works which do not need to remain operational during times of flood.
- Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place.

Residential institutions and dwelling houses are classified as "more vulnerable".

Offices, general industry and storage are considered "less vulnerable".

Table 3 of the Guidance is shown on the next page:

| <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 | ✓* |

Therefore 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 proposed development is the conversion of an existing building, and as such cannot be located anywhere else except at this location north of Butterwick.

The guidance gives the following advice where an alternative location is not possible, which can be also applied to developments such as these:

When applying the Sequential Test, a pragmatic approach on the availability of alternatives should be taken. For example, in considering planning applications for extensions to existing business premises it might be impractical to suggest that there are more suitable alternative locations for that development elsewhere. For nationally or regionally important infrastructure the area of search to which the Sequential Test could be applied will be wider than the local planning authority boundary.

The proposed development complies with all Boston Borough Council’s planning policies, and there is a requirement for facilities for the disabled in the Borough area.

Therefore I consider that the sequential test 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 Butterwick area. These maps show that the greatest hazard north of Butterwick is from a potential breach or overtopping of the sea bank 3.7 km east 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 – 1.25 | 250 – 500mm | 0 – 0.3m/sec |
| 1 in 1000 year event in 2006 | 1.25 – 2.0 | 250 – 500mm | 0 – 0.3m/sec |
| 1 in 200 year event in 2115 | 1.25 – 2.0 | 500mm – 1.0m | 0.3 – 1.0m/sec |
| 1 in 1000 year event in 2115 | 1.25 – 2.0 | 1.0 – 1.6m | 0.3 – 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 | Greater than 2.0 | 1.0 – 1.6m | 0.3 – 1.0m/sec |
| 1 in 1000 year event in 2115 | Greater than 2.0 | Greater than 1.6m | 0.3 – 1.0m/sec |

The maps of the flood risk supplied by the Environment Agency are reproduced on pages 15 – 21 of this report.

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 3.7km from the tidal sea bank east of Butterwick and 5.3km north of the tidal bank of the Haven which are both maintained by the Environment Agency.

The site is located 2.0 km from the Hobhole Drain which is maintained by Witham Fourth IDB.

Existing Ground Levels

The level of the Main Road south of the site is approximately 2.90m OD and the site itself is probably slightly lower at a level of 2.70m OD.

The ground floor level of the existing buildings and the gravel hardstanding are at the same level.

Potential Sources of Flooding

The following sources of flooding have been identified:

- 1) Tidal Flooding due to overtopping or breaching of the sea defences or the tidal defences of the Wash.
- 2) Flooding due to high water levels in the Hobhole Drain.
- 3) Flooding due to high water levels in the IDB drain on the western boundary of the site.

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

The sea bank protecting this area from flooding is located 3.7km east of the site. The Environment Agency have stated that the predicted tide levels along this section of coastline are as shown on the next page.

| | 1 in 200 year event | 1 in 1000 year event |
|--------------|---------------------|----------------------|
| Burgh Sluice | 5.03 | 5.34 |
| Hobhole | 5.93 | 6.27 |

The maps produced by the Environment Agency predict that flood depths would be in excess of 1.6 metres in the 1 in 1000 year overtopping event in 2115. The overtopping maps assume that no improvements are carried out to the defences over the next one hundred years.

Mitigation against flooding will be provided by raising ground floor levels of the building and providing 600mm high demountable defences.

2. 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 for the Hobhole Drain.

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

3. Flooding from the IDB drain on the Western Boundary of the site

There is an IDB drain (reference 4/34) on the western boundary of the site.



As can be seen on the map on the previous page the drain flows northwards and then flows westwards to discharge into the Hobhole Drain 2km west of the site. 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 part of the Hobhole Drain.

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 19th February 2016 needs to be considered in the FRA. The effects of these new recommendations are considered in Appendix A of this report (pages 22 to 25). 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. The development is in flood zone 3 and the flood hazards shown on the Environment Agency flood map are as follows:

| Hazard | Return Period | Flood Hazard | |
|-------------|----------------|----------------------|-----------------|
| Breaching | 1 in 200 year | 80% 1.25 – 2.0 | Danger for most |
| | | 20% Greater than 2.0 | Danger for all |
| Breaching | 1 in 1000 year | 20% 1.25 – 2.0 | Danger for most |
| | | 80% Greater than 2.0 | Danger for all |
| Overtopping | 1 in 200 year | 50% 1.25 – 2.0 | Danger for most |
| | | 50% Greater than 2.0 | Danger for all |
| Overtopping | 1 in 1000 year | Greater than 2.0 | Danger for all |

For “**More vulnerable**” development reference to the table the recommended mitigation can be found under Category D8 for a hazard rating 1.25 – 2.0 (danger for most) and Category C8 for a hazard rating of greater than 2.0 (danger for all):

Category D8: (Hazard rating 1.25 - 2.0):

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 1.0 – 1.6 metres

Proposals must have a minimum of 2 storeys, with FFL set a minimum of 1.0 metre

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.

Category C8 (Hazard rating greater than 2.0):

The Environment Agency requires direct consultation on proposals in this hazard zone. 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.

The applicant is advised to refer to the document “Improving Flood Performance of New Buildings Flood Resilient Construction (DCLG2007).

Finished floor levels (FFL) should be informed by the predicted flood depth maps and set as required below (single storey proposals must use the 0.1% event, 2115 scenario, for setting FFLs).

Flood depths of greater than 1.6 metres

It is unlikely that mitigation measures would prevent flood water from entering the building at ground floor level. Therefore proposals should have a minimum of 2 storeys with no ground floor habitable accommodation. The first floor living accommodation must be above the highest predicted flood depth.

Flood depths of 1.0 – 1.6 metres

Proposals must have a minimum of 2 storeys, with FFL set a minimum of 1.0 metre above existing ground level, flood resilient construction to a height of 300mm above the predicted flood depth, and demountable defences to 600mm above FFL.

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.

*For “**Less vulnerable**” development reference to the table the recommended mitigation can be found under Category D4 for a hazard rating 1.25 – 2.0 (danger for most) and Category C4 for a hazard rating of greater than 2.0 (danger for all):*

Category D4: (Hazard rating 1.25 - 2.0):

The Environment Agency recommends that the following mitigation is incorporated into the development.

The finished floor levels should be raised as high as practicable (minimum 300mm above existing ground level). The Environment Agency recommends that appropriate mitigation measures/flood resilience techniques are incorporated into the development. The applicant is advised to refer to the document “Improving Flood Performance of New Buildings Flood Resilient Construction (DCLG2007).

Single storey buildings should be built with FFL’s above the predicted flood depth (refer to the relevant 2115 1% fluvial and 0.5% tidal maximum depth map). If this is not practicable an area of safe refuge will need to be provided or an appropriate flood

warning and evacuation plan will need to demonstrate how this risk will be managed. It is the responsibility of the Local Planning Authority to determine the adequacy of the plan.

Category C4 (Hazard rating greater than 2.0):

The proposal must be referred to the Environment Agency with a supporting Flood Risk Assessment, which contains evidence to justify the chosen finished floor level. This should be as high as practicable (minimum 300mm above the existing ground level).

The Flood Risk Assessment should also include confirmation that appropriate mitigation measures/flood resilience techniques are incorporated into the development.

Please refer to the following document for information on flood resilience and resistant techniques to be included. "Improving Flood Performance of New Buildings Flood Resilient Construction (DCLG2007).

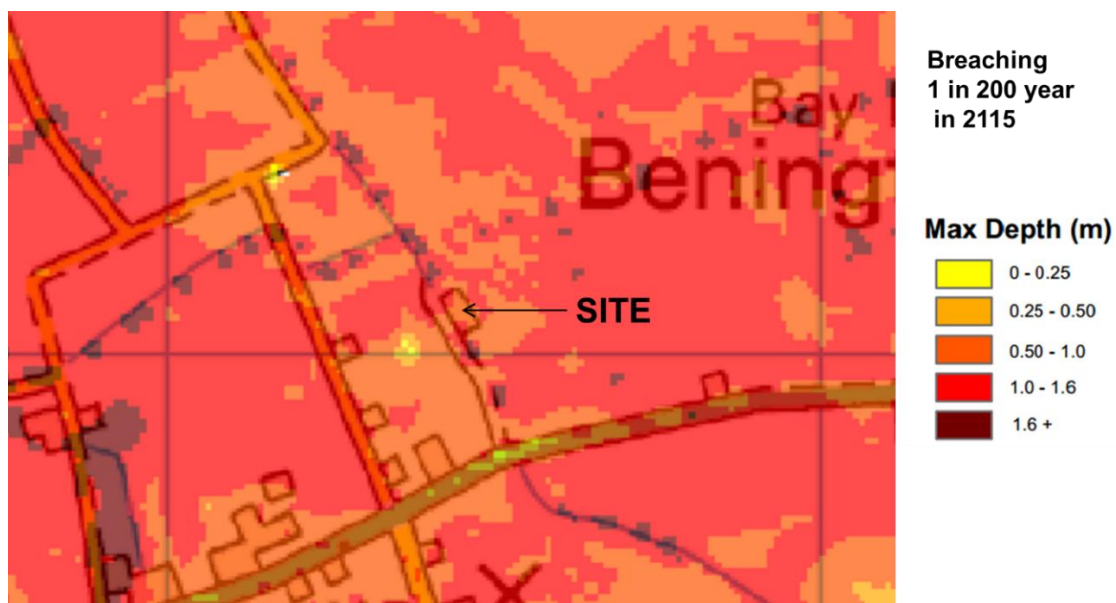
Single storey buildings should be built with FFL's above the predicted flood depth (refer to the relevant 2115 1% fluvial and 0.5% tidal maximum depth map). If this is not practicable an area of safe refuge will need to be provided or an appropriate flood warning and evacuation plan will need to demonstrate how this risk will be managed. It is the responsibility of the Local Planning Authority to determine the adequacy of the plan.

It is recommended that proposals are referred to the Environment Agency at the pre-application stage in the process.

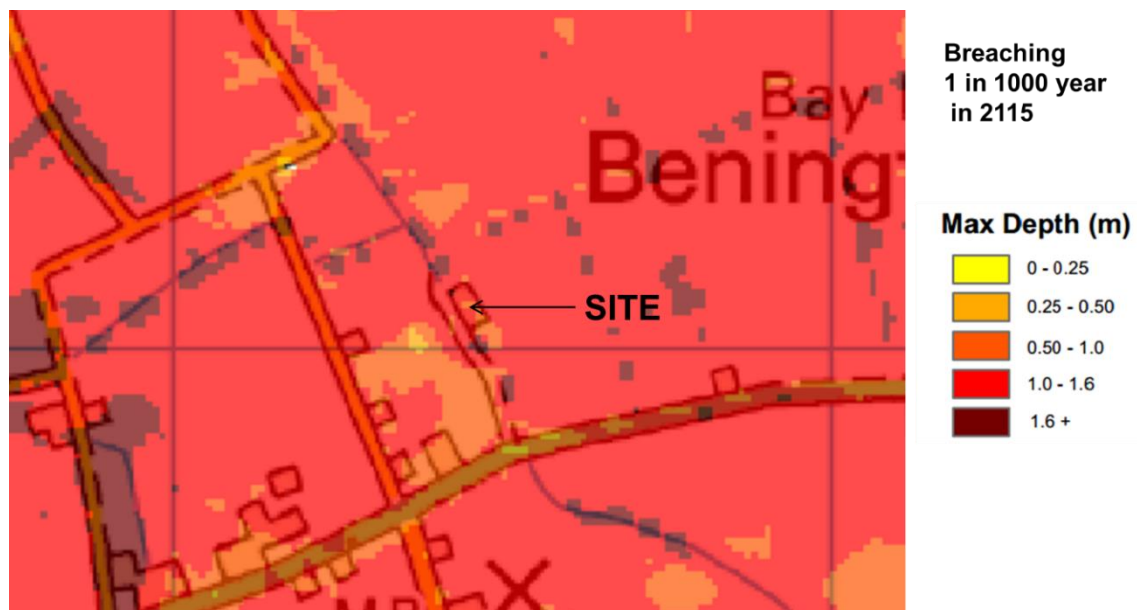
Summary of Risk of Flooding to the Site

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

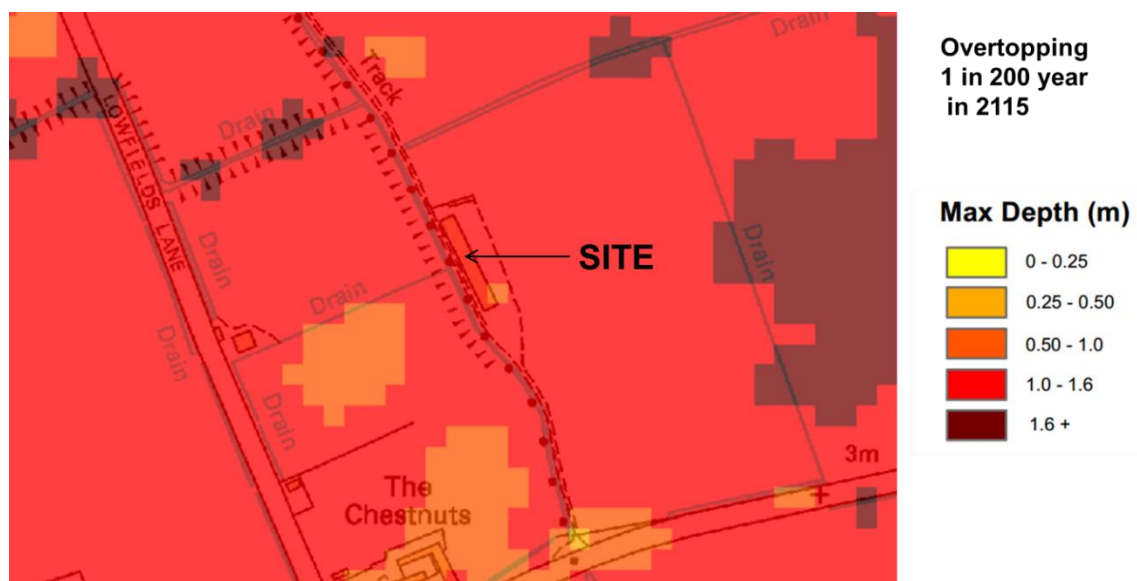
The Environment Agency map of the predicted flood depth in a 1 in 200 year event in 2115 due to a breach in the flood defences is shown below.



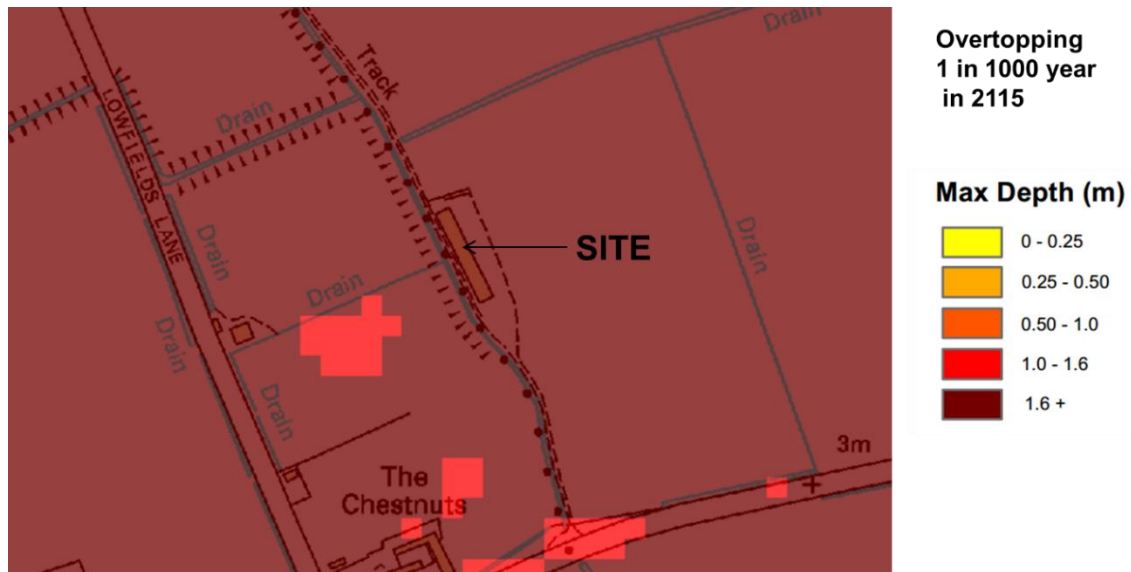
The Environment Agency map of the predicted flood depth in a 1 in 1000 year event in 2115 due to a breach in the flood defences is shown below.



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.



The Environment Agency map of the predicted flood depth in a 1 in 1000 year event in 2115 due to overtopping of the flood defences is shown on the next page.



The map above shows that flood depth in a 1 in 1000 year overtopping event is predicted to be in excess of 1.6 metres in depth. The hazard rating for this event is greater than 2.0 (danger for all). The recommended mitigation on the South East Lincolnshire website for this scenario states:

It is unlikely that mitigation measures would prevent flood water from entering the building at ground floor level. Therefore proposals should have a minimum of 2 storeys with no ground floor habitable accommodation. The first floor living accommodation must be above the highest predicted flood depth.

Therefore it is concluded that any residential accommodation should have all sleeping accommodation on the first floor.

Recommendations

In this area where there is a flood risk the residential part of the accommodation 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 becomes 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 1.0 metre above the existing ground level on the site.

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

Demountable defences should be installed to every external doorway to protect the building up to a depth of 600mm above finished floor level.

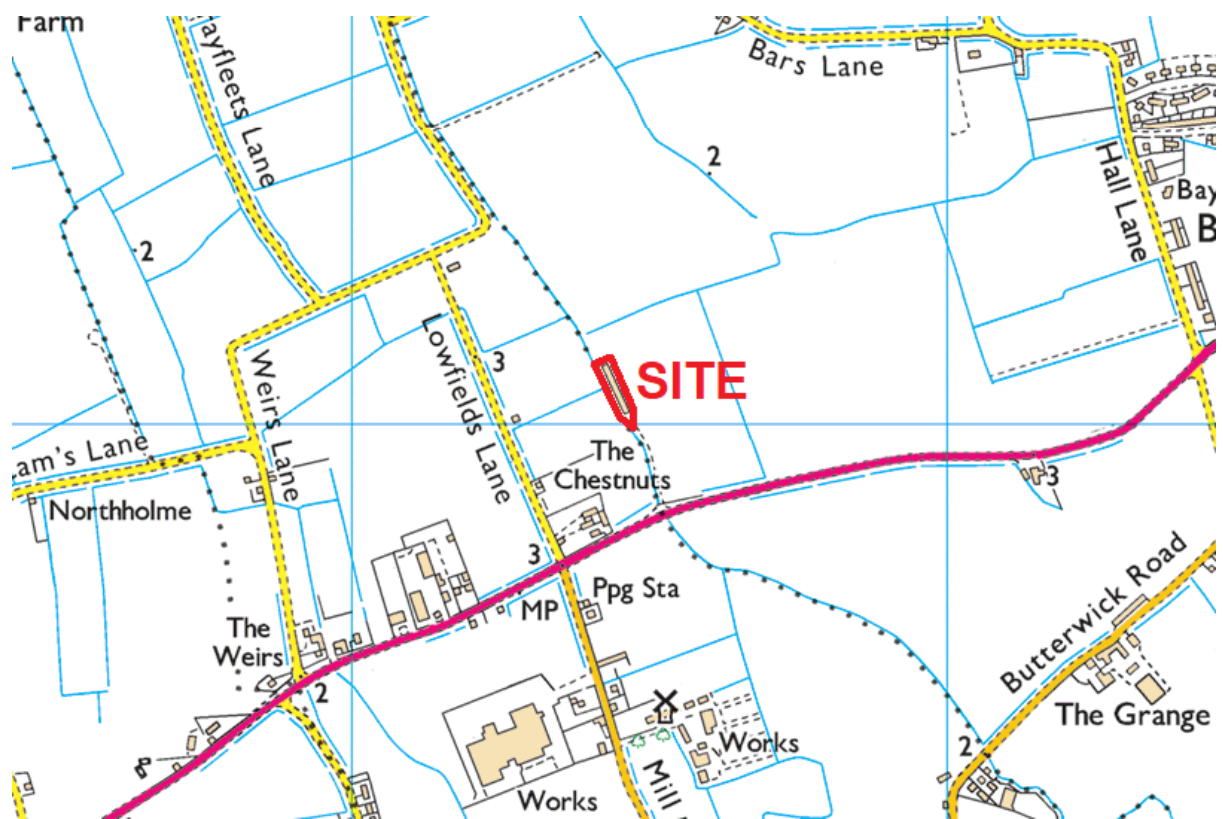
The operator of the property should register with the Environment Agency's Floodline Warnings Direct Service and should have a flood plan detailing what measures should be taken in the event of each stage of warnings issued by the Environment Agency.

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30th September 2020

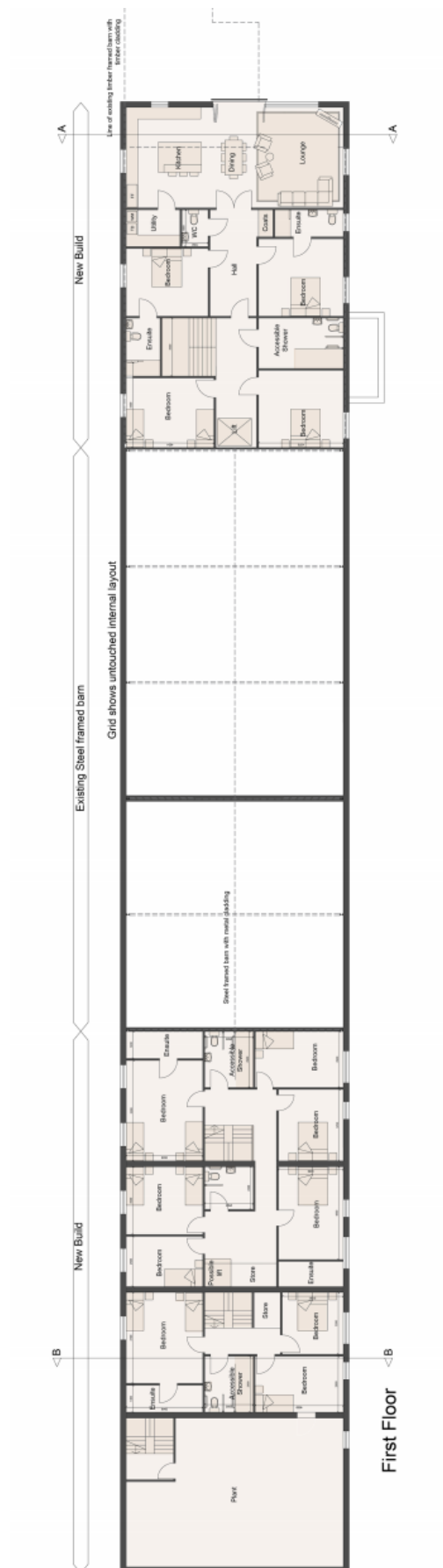
Location Plan



Proposed Ground Floor Plan of Building

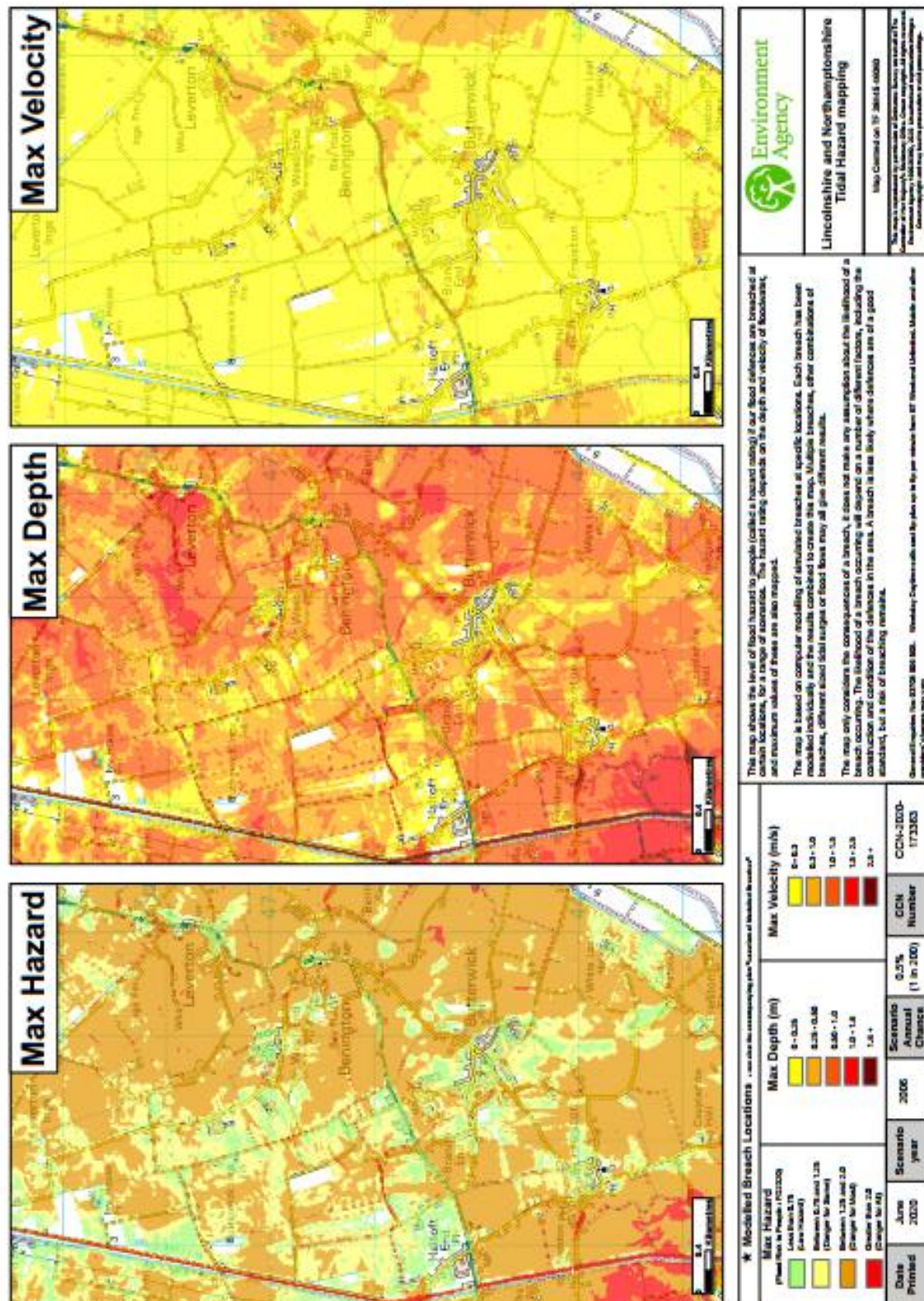


Proposed First Floor Plan of Building

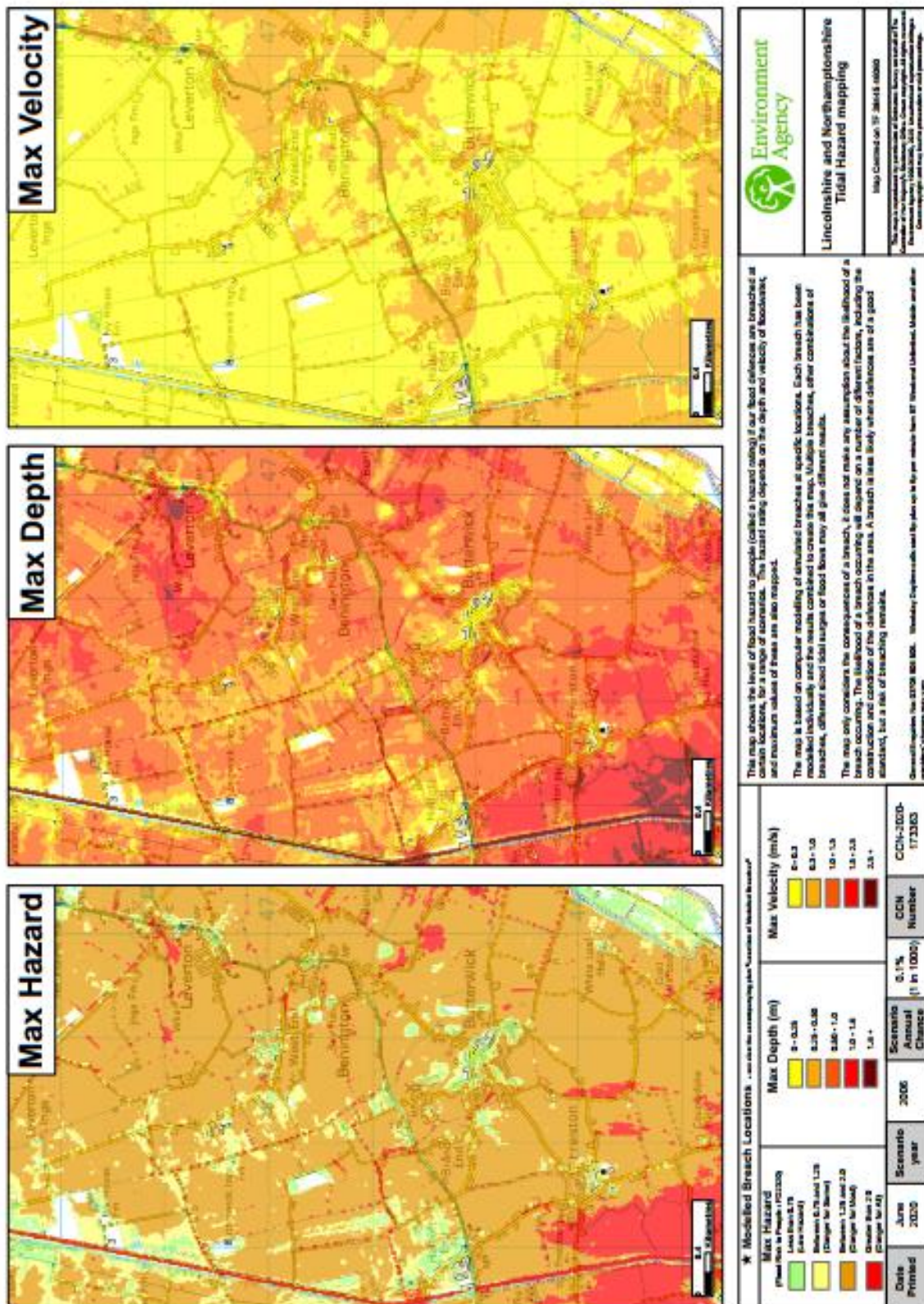


EA MAP OF HISTORIC FLOODING

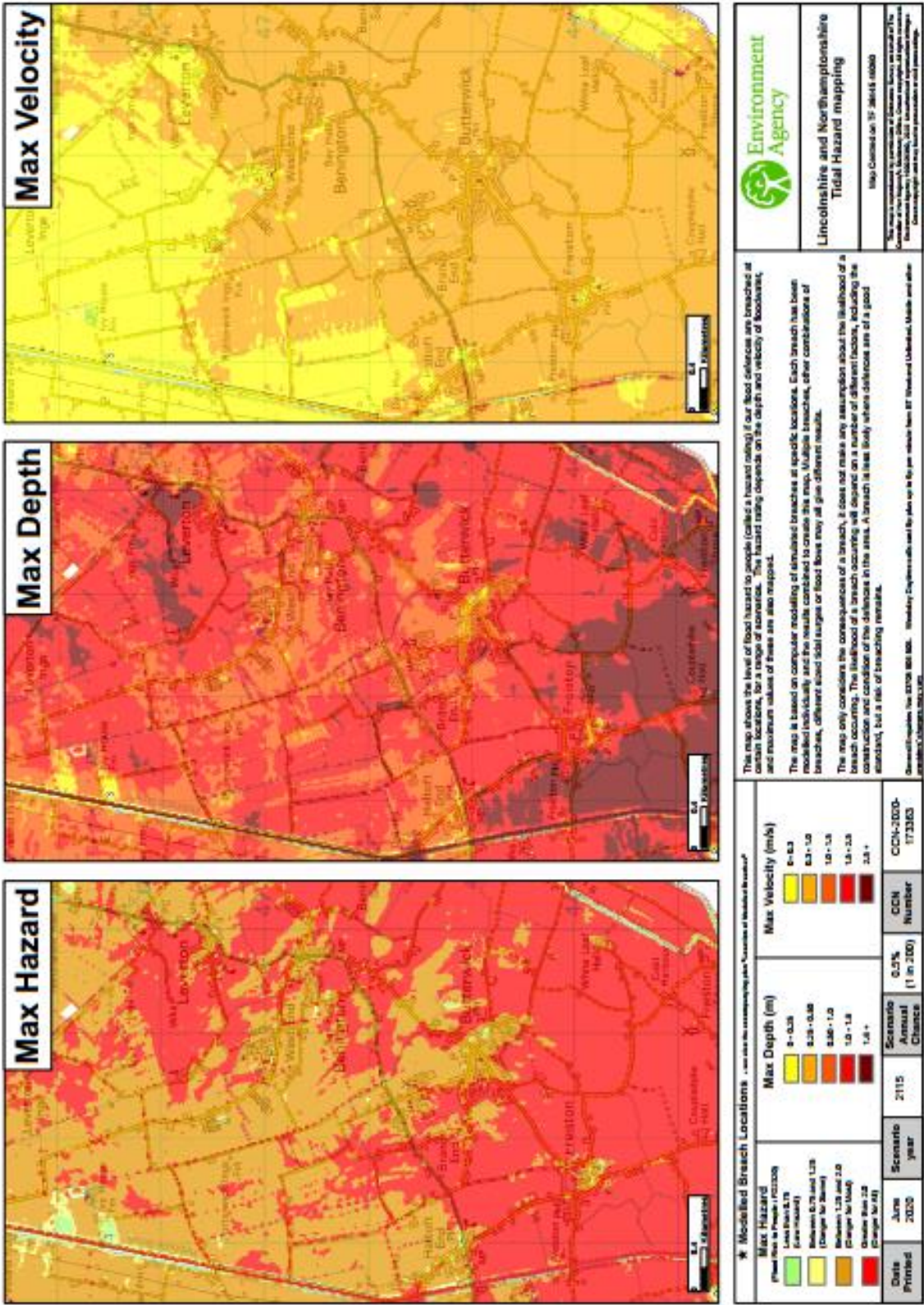
1 in 200 year Flood Risk from Breaching in 2006



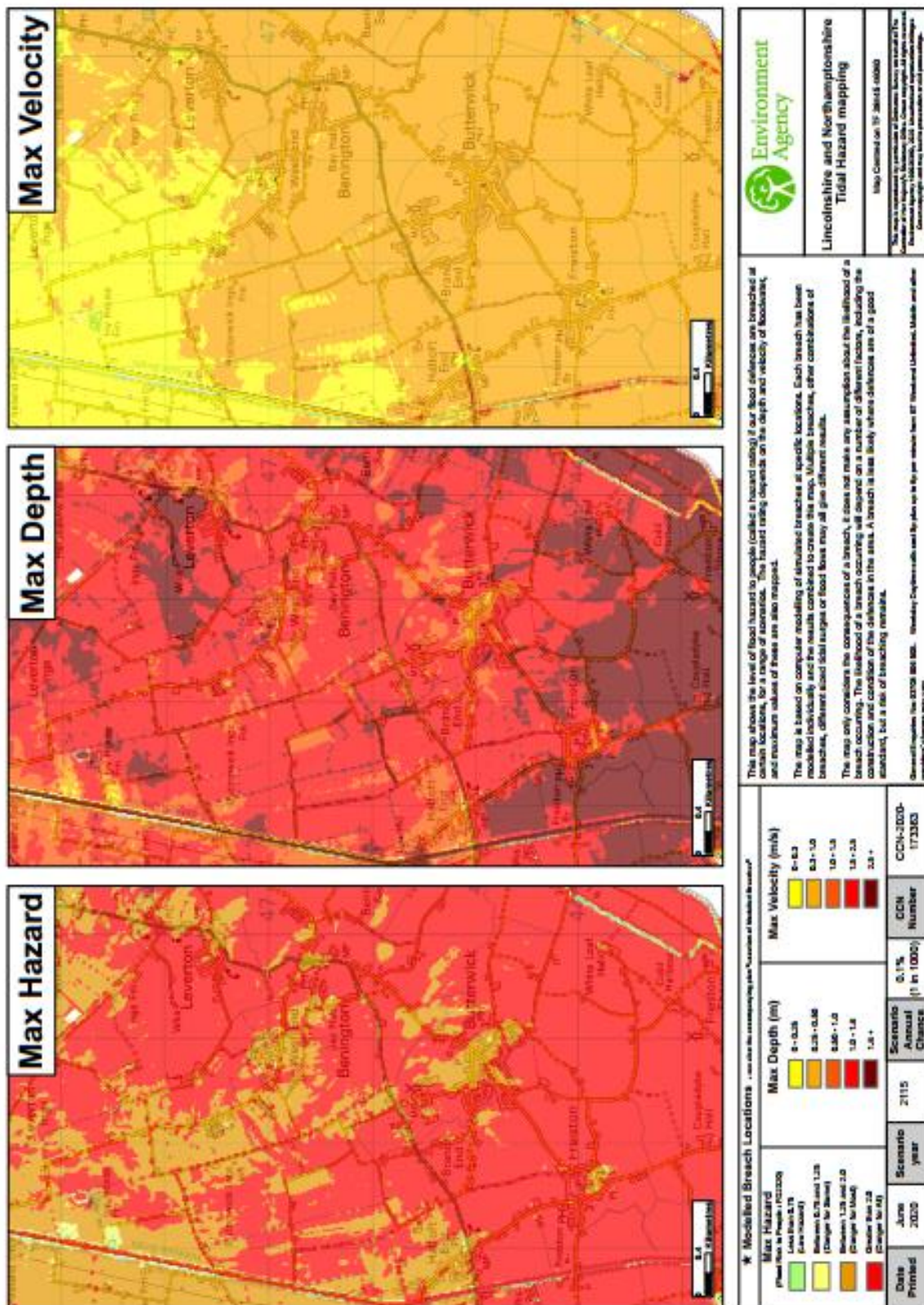
1 in 1000 year Flood Risk from Breaching in 2006



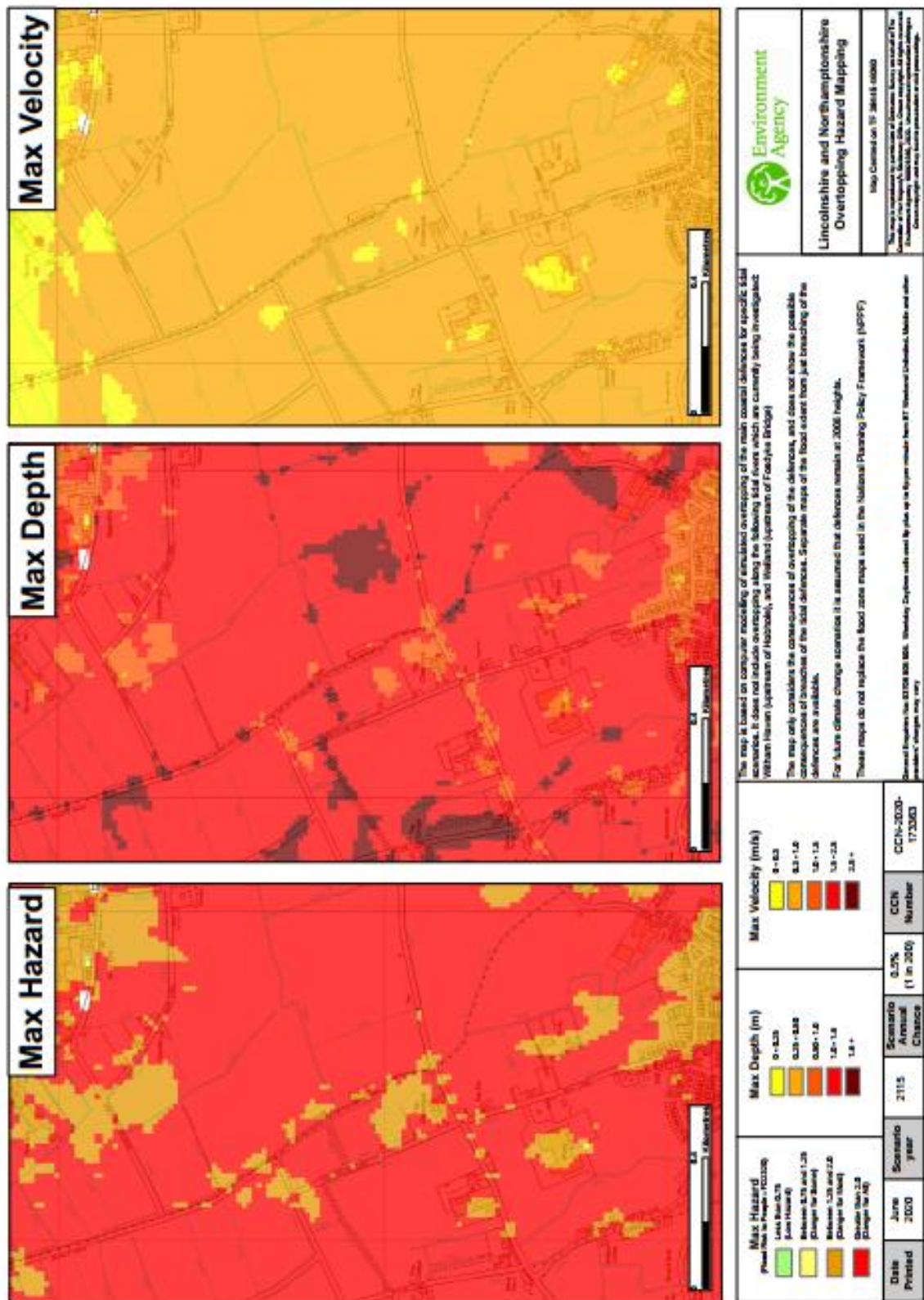
1 in 200 year Flood Risk from Breaching in 2115



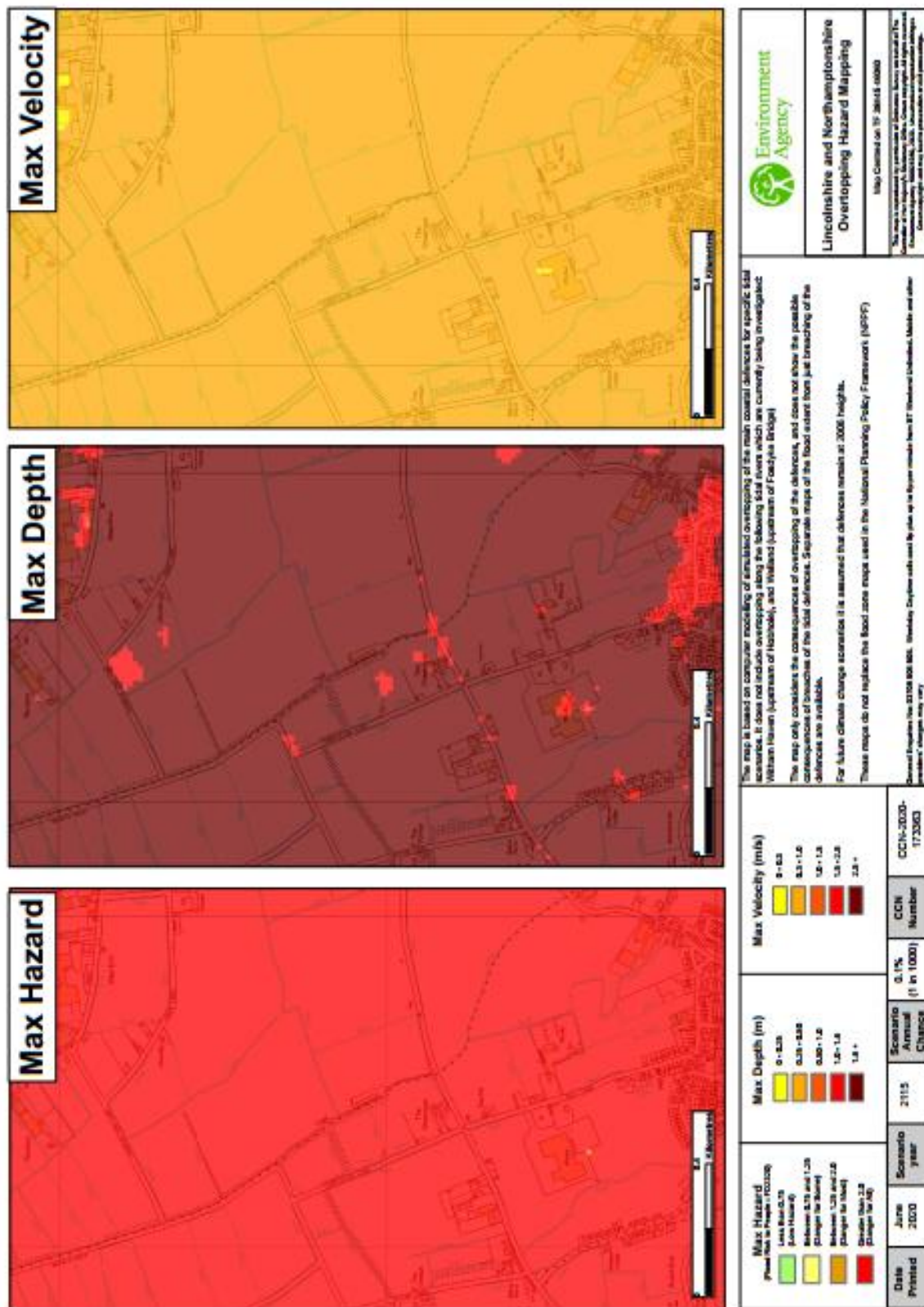
1 in 1000 year Flood Risk from Breaching in 2115



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 19th 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>Administrative or Devolved Region</i> | <i>Assumed Vertical Land Movement (mm/yr)</i> | <i>Net Sea-Level Rise (mm/yr)</i> | | | | <i>Previous allowances</i> |
|---|--|--|-------------------------|-------------------------|-------------------------|-----------------------------------|
| | | <i>1990-2025</i> | <i>2025-2055</i> | <i>2055-2085</i> | <i>2085-2115</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>Parameter</i> | <i>1990-2025</i> | <i>2025-2055</i> | <i>2055-2085</i> | <i>2085-2115</i> |
|---|-------------------------|-------------------------|-------------------------|-------------------------|
| Peak rainfall intensity (preferably for small catchments) | +5% | +10% | +20% | +30% |
| Peak river flow (preferably for larger catchments) | +10% | +20% | | |
| Offshore wind speed | +5% | | +10% | +10% |
| Extreme wave height | +5% | | +10% | +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)

| Area of England | 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 sea defences
- 2) Flooding from the IDB drains (Fluvial)

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. Flooding from the IDB drains

Witham Fourth IDB, and all IDB's, are aware that climate change will affect the operations of pumping stations, sluices and drainage channels in the next 100 years. 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 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 floor level of the proposed new buildings should be raised by 1.0 metre above the existing ground level is satisfactory.