

PROPOSED DEVELOPMENT
AT COBGATE, WHAPLODE, SPALDING, PE12 6UL
FLOOD RISK ASSESSMENT



View from eastern boundary of the site

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This flood risk assessment has been prepared solely to support the planning application for a development at Cobgate, Whaplode. 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.

Introduction

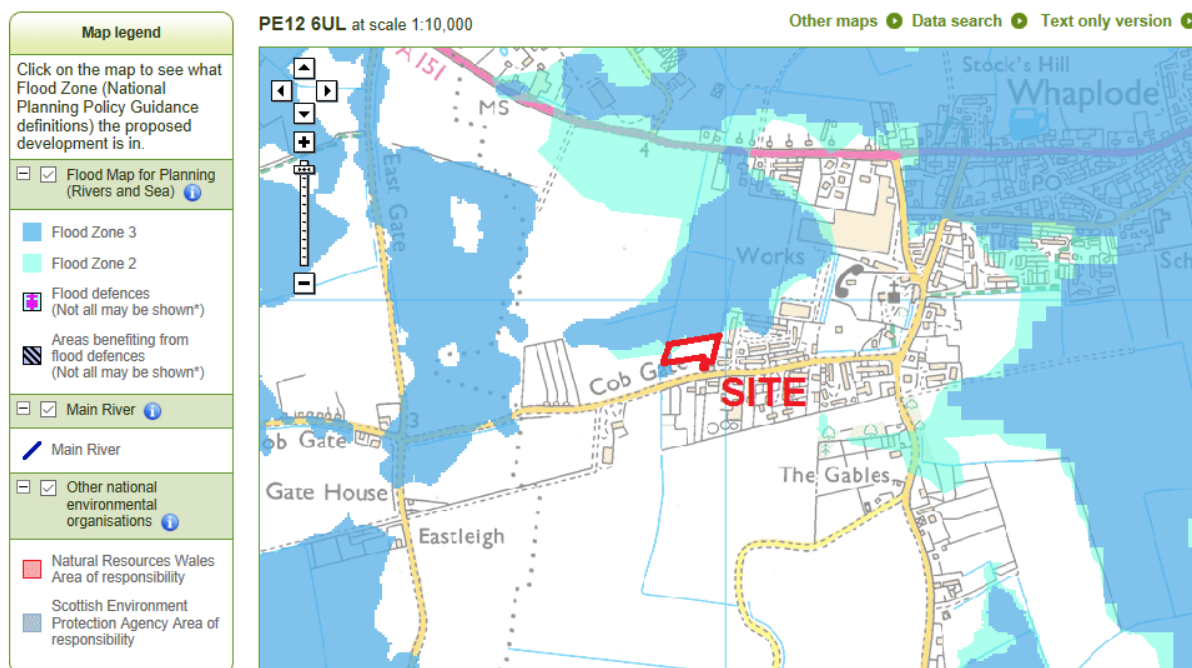
It is proposed to construct a new development north of numbers 70 to 84 Cobgate, Whaplode, PE12 6UL. The site is at present part of a field north of the properties and an access has been left next to 70 Cobgate. The site is on the south western side of Whaplode and is approximately 5 km from Spalding.

All of the site is within Flood Zone 1 as shown on the Environment Agency's Flood Zone map.

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 on the South Holland District Council's Strategic Flood Risk Assessment (SHDC SFRA) map and is located in the South Holland 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 the area north of the site lies within flood zone 3 but a greater part of the site is within flood zone 1. There is a very small area on the west side of the site that may just be within flood zone 3 but as it is proposed to leave a 9.0 metre wide access on the western side of the field then the whole site will be taken to be within flood zone 1.

Application Site

The National Grid Reference of the site is 531920 323880.

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

Applying the flood risk vulnerability classification in Table 2 of the Guidance, a development of a dwelling house is 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	✓*

Therefore it can be seen all classifications of development are appropriate in flood zone 1.

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). As this development is located in flood zone 1, and much of the area around Whaplode is classified in flood zones 2 or 3, it can be concluded that the proposed location for this development is ideal when flood risk is considered,

Strategic Flood Risk Assessment

Consultants have produced a Strategic Flood Risk Assessment (SFRA) for the South Holland District Council (SHDC). This document provides details of the flood risk in the Council's area. Reference to the maps in this document give the following information for the flood risk and hazard at the site.

The maps illustrate the actual flood hazard for the 1% fluvial event and 0.5% tidal event, and for the 0.1% event.

For the present day	Depth of flooding ... zero
	Extent of flooding .. Low or medium flood probability
	Peak Velocity Nil

For year 2115 Depth of flooding ... zero
 Extent of flooding.... Low or medium flood probability
 Peak Velocity Nil

The maps also illustrate the residual flood hazard which is as follows:-

For the present day Depth of flooding ...zero
 Extent of flooding .. Low or medium flood probability
 Peak Velocity .. Nil

For the year 2115 Depth of flooding ... zero
 Extent of flooding .. Low or medium flood probability
 Hazard rating..... Nil

Figure 16 of the general maps show that the site is not within the rapid inundation zone for the present day and 2115.

Maximum flood level and bank levels in the River Welland

Tables in the SFRA show the following details of the defence bank on the east side of the tidal section of the River Welland north of the A16 road bridge and 5.9km west of the development site, between chainage 19.8km and 20.8km.

	2007	2055	2115
Peak 1 in 200 year extreme tide level	5.98m OD	6.31m OD	7.12m OD
Peak 1 in 1,000 year extreme tide level	6.27m OD	6.60m OD	7.41m OD

With an average defence crest level between 7.80 and 7.90 m OD the freeboards are as follows:

	2007	2055	2115
Peak 1 in 200 year freeboard	1870mm	1540mm	730mm
Peak 1 in 1,000 year freeboard	1580mm	1250mm	440mm

Tables in the SFRA show the following details for the defence bank on the east side of the Coronation Channel between chainage 0 km and 2.0 km.

	2007	2115
Peak 1 in 100 year flood level	4.32m OD	4.69m OD
Peak 1 in 1,000 year flood level	4.34m OD	4.69m OD

The bank levels on this section vary between 5.35m OD and 6.0m OD. Therefore it can be seen there is a minimum freeboard of 650mm to the predicted design maximum levels in 2115.

The Wash banks are at least 12.0 km north of the site. The tidal defences are earth banks with an average level of 7.80m OD. The maximum predicted 1 in 200 year tide level in 2115 in the SFRA is 7.11m OD.

The tidal section of the River Nene is approximately 15.0km east of the site. The tidal defences are earth banks with an average level of 6.95m OD. The maximum predicted 1 in 200 year tide level in 2115 in the SFRA is 7.00m OD.

Environment Agency Tidal Breach Hazard Mapping

The Environment Agency has published mapping which predicts the depths, velocities and hazard following a breach in the tidal defences for a 1 in 200 and 1 in 1000 year event in 2115. The maps have been produced by modelling breaches along the whole length of the tidal defences and combining these into one map.

Both the 1 in 200 year and the 1 in 1000 year map for 2115 shows that no flooding is predicted to the development site following a breach in the tidal defences. These maps are reproduced on pages 12 and 13 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 5.9 km south of the tidal section of the River Welland, which has a tidal defence bank which is maintained by the Environment Agency.

The site is located approximately 5.9 km from the west bank of the Coronation Channel which is maintained by the Environment Agency.

The watercourse on the western side of the field is a watercourse which is maintained by South Holland IDB.

Existing Ground Levels

The ground levels on the main area of the site vary between 2.92m OD and 3.11m OD, with the higher levels being on the western side of the site. The level of Cob Gate near the site entrance is 3.27m OD, and the level further west along the road in front of the existing houses is 3.13m OD.

A full topographical study has been carried out for this area and a simplified plan showing some of these levels is shown on page 11 of this report.

Potential Sources of Flooding

The potential sources of flooding to the site are:-

1. Failure or overtopping of tidal defences of the River Welland or the Wash
2. Failure or Overtopping of the Coronation Channel
3. High water levels in IDB drainage channels.
4. Localised flooding in the area.

1. Failure or overtopping of tidal defences of the River Welland or the Wash

As shown above, the east bank of the River Welland, which is approximately 5.9 km from the site, provides at a 1 in 200 year standard of protection in 2115. The latest EA maps indicate that if there is a breach in the tidal defences no flooding would occur at the site in a 1 in 1000 year event in 2115.

Therefore it can be concluded that flooding is not predicted in a 1 in 1000 year event with 20% allowance for climate change.

2. Failure or Overtopping of the Coronation Channel

The SFRA states that the maximum design level in the Coronation Channel is 4.69m OD. The minimum crest level of the east bank of the Channel is 5.14m OD, which gives a minimum freeboard of 450mm. However, generally there is a freeboard of 600 mm along this bank of the Channel.

If the Channel were to breach water would flow eastwards towards the site. However, it would be retained for a short time by the A16 which is higher than the surrounding land. The SFRA indicates that with a serious breach water would not reach the site in a 1 in 100 year event.

With the site being 5.9 km from the Coronation Channel the risk from this source is so low it can almost be discounted.

3. High Water Levels in IDB drains

Although the whole of this area is below high tide level and levels in the rivers, the retained water levels in the drainage channels ensure that the risk of flooding is extremely low. South Holland IDB maintains a system of sluices, pumping stations, and drainage channels which convey surface water into the River Welland, the Wash and the River Nene to control water levels throughout the South Holland IDB area.

The watercourse on the western boundary of the field (shown in the picture on the next page) is maintained by the South Holland IDB as a Board's drain.



The water flows southwards to connect with a drain on the east side of Thorpe's Lane. This discharges into the IDB drain called Whaplode River which flows southwards on the east side of Mill Gate. The Whaplode River discharges into the Little South Holland drain 200 metres east of Catherines Bridge. The level of the Little South Holland Drain is controlled by Little Holland Pumping Station which is 5.5 km east of Catherines Bridge and 8 km south east of the development site. The South Holland IDB have advised that the maximum 1 in 100 year predicted level at the pumping station is 0.30m OD. and the maximum 1 in 100 year level in IDB drainage channels near the site is not likely to exceed 2.00m OD.

Little Holland Pumping Station is operated and maintained in excellent condition by South Holland IDB and the likelihood of flooding due to this source is low. IDB systems are designed to provide a freeboard of between 600mm and 1000mm to all land in a 1 in 10 year return period rainfall event. South Holland IDB watercourses generally state that their watercourses provide a standard of 1 in 100 years with a freeboard of 300mm in urban areas. In an extreme event water levels will rise but this will be a slow process and it would be at least 24 hours before levels were high enough to begin to flood low land in the area, and after this the level of the flood water would need to rise another 1.0 metre before the development site would be affected.

The channels maintained by South Holland IDB in urban areas are classified as high priority watercourses and as such receive a higher maintenance priority.

There are possibilities of failure of outfall sluices, but these are mitigated by the high level of maintenance given to these structures by the IDB. If a failure did occur the IDB would immediately be warned of the problem by their telemetry system and take action to repair the fault or to bring in temporary pumps to reduce the risk of any flooding in the area. Similarly any failures of culverts or other blockages would be dealt with immediately.

Therefore the risk of flooding from IDB drainage channels can be considered to be extremely low.

4. Localised Flooding in the area

A suitable surface water disposal system will be designed for the development site which will dispose of the water into soakaways or attenuate the flows before they are discharged into the IDB drain on the western boundary of the field.

The raising of the ground floor levels approximately 300mm above ground level and the location of the IDB drain adjacent to the site will mitigate any risk of flooding from this source.

Extent of known Flooding

During the preparation of this assessment, no evidence was discovered of the existing house or garden or any of the adjoining properties having been flooded in the past.

Probabilities and Trends of Flooding

The probability of this development flooding from Environment Agency main river is very low. In an extreme event any effect on this location would not be sudden and there would be time for residents to take precautionary measures to limit the impact of any flooding that may occur.

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

The risk of this happening in this case is low and the hazard from any flooding is also low.

Climate Change

The recommendations for flood depths for this flood risk assessment use information mostly taken from the South Holland DC SFRA which was last updated in 2010. 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 14 to 17). It is concluded that no extra mitigation measures are necessary to comply with the new guidance on climate change.

Conclusions

The site is in flood zone 1, which indicates that the land has a less than 1 in 1,000 annual probability of river or sea flooding.

The plans of predicted areas of flooding in the SFRA do not show any flooding in a 1 in 100 year fluvial or 1 in 200 year tidal event in 2115.

The plans of predicted areas of flooding in the maps supplied by the EA and reproduced on pages 12 and 13 of this report do not show any flooding in a 1 in 1000 year fluvial or tidal event in 2115.

The Environment Agency have stated that their policy is to continue to maintain tidal banks in the future with at least a 1 in 200 year standard of service.

The risk of flooding to the building from IDB drains can be considered low, especially as the floor levels will be raised by approximately 300mm.

The IDB have adequate arrangements to bring in contractors and use their own staff if a failure of any part of the sluices occurred. If drains become full any flooding that would occur would happen very slowly and affect land at levels between 2.50m OD and 3.0m OD before the development site. It would be very unlikely to reach a level above 3.00m OD and flood the proposed development.

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

Recommendations

In any area at risk of flooding it is preferable that new dwellings should be of two story construction with all bedrooms at first floor level. This is to provide a refuge for residents if the buildings were to become flooded after a major breach of the tidal bank, and ensure there is no danger to residents when they are asleep. However in this case as the site is within flood zone 1 and the flood risk is very low it is considered that bungalows with bedrooms on the first floor would also be satisfactory.

The ground floor level of the proposed dwellings should be approximately 300mm above the average existing ground levels.

The developer should advise owners and occupiers of the properties to register with the Environment Agency's Floodline Warnings Direct Service.

Rainwater from the roofs of the buildings should be discharged if possible into soakaways and these should be designed to BRE Digest 365 and approved under Building regulations. Hardstandings around the buildings should be constructed with permeable paving.

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12th December 2016

Water Level in IDB drain = 1.30m OD

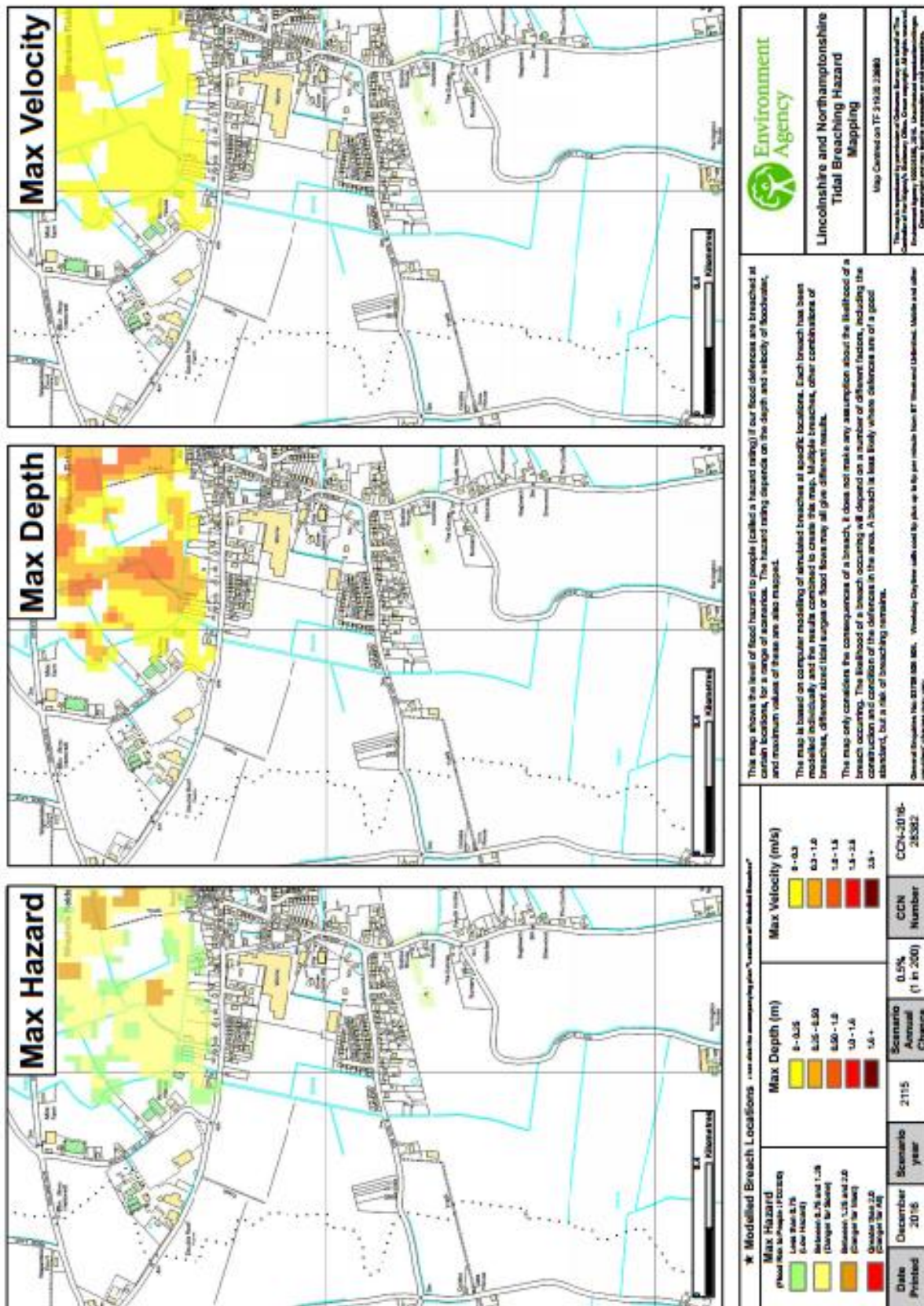
FIELD ACCESS min. 9.0m WIDE

Boundary of proposed site

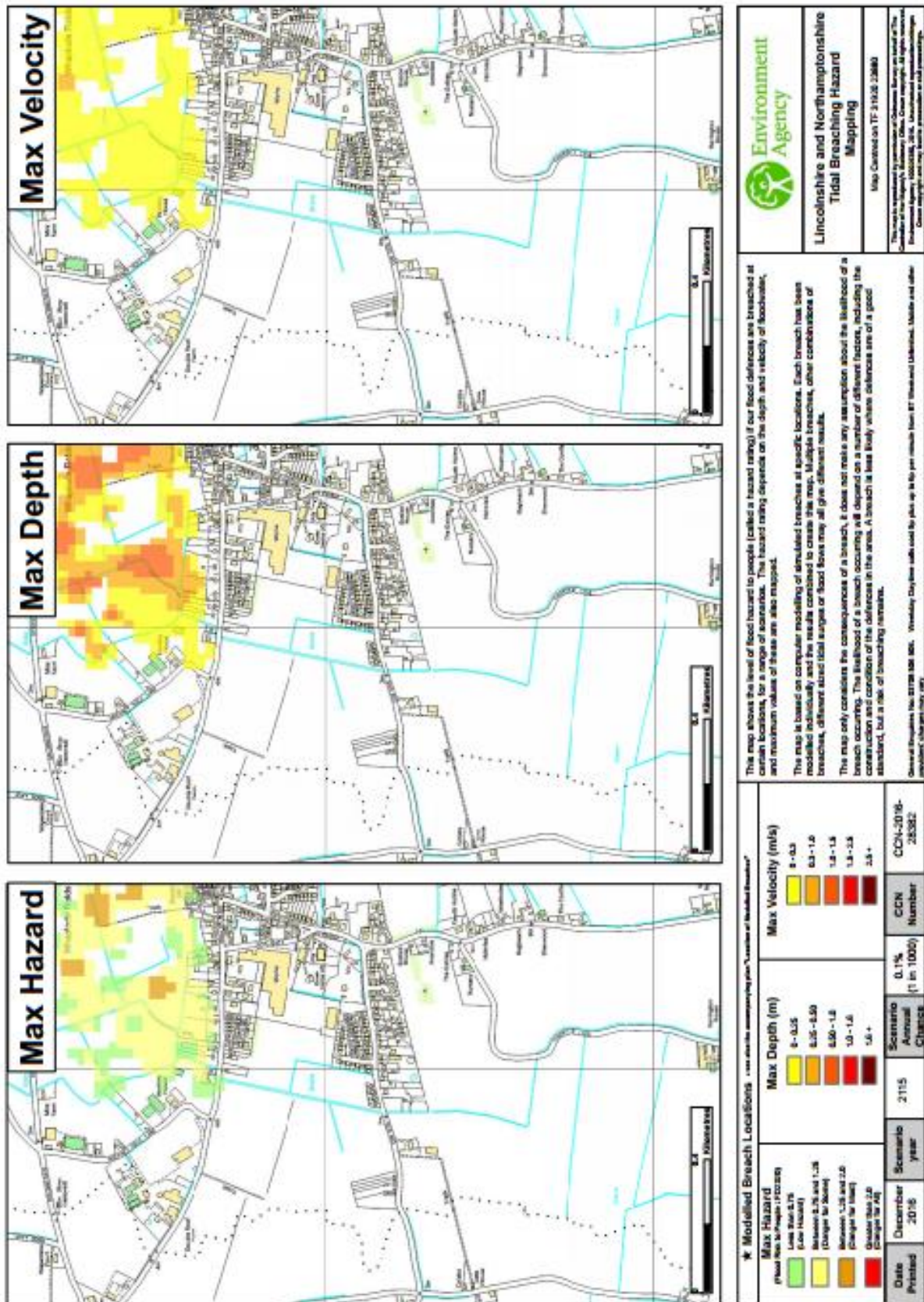
COB GATE

Spot heights: 3.10, 3.11, 2.96, 2.95, 3.00, 2.92, 2.83, 3.27, 3.23

EA MAP SHOWING TIDAL BREACHING HAZARDS IN
1 in 200 YEAR EVENT IN 2115



EA MAP SHOWING TIDAL BREACHING HAZARDS IN 1 in 1000 YEAR EVENT 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.

Listed below are the climate change allowances in three documents:

- South Holland SFRA
- EA guidance (2013)
- Revised EA guidance

The recommendations in each document are shown below.

2010 South Holland DC SFRA

The SHDC SFRA states that the the following allowances have been made for climate change:

4.4 Climate Change

Scenarios for the years 2055 and 2115 include for climate change contingency allowances to the amount suggested by PPS25¹. These allowances are expressed in Table 2. Percentage increases are relative to the present-day.

Table 2 – Adopted Climate change contingency allowances

Parameter	Year 2055	Year 2115
Sea level rise (m)	+ 0.33	+ 1.14
Extreme wave height	+ 10%	+ 10%
Peak river flow and volume	+ 20%	+ 20%
Peak rainfall intensity	+ 20%	+30%

Where flows arise from pumping rather than natural run-off, notably in the Vernatt's Drain and for the Fenland subcatchments of the South Forty Foot Drain, peak flow rates for future eras have been taken as equal to current rates since this SFRA assumes all flood risk management measures will remain in their current state.

2013 Guidance to Planners

Guidance to planners was issued by EA in September 2013

Table 1: Recommended contingency allowances for net sea level rises (Net sea level rise (mm per year) relative to 1990)

	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
East of England, east midlands, London, south-east England (south of Flamborough Head)	4.0	8.5	12.0	15.0
South-west England	3.5	8.0	11.5	14.5
North-west England, north-east England (north of Flamborough Head)	2.5	7.0	10.0	13.0

Table 2: Recommended national precautionary sensitivity ranges for peak rainfall intensity, peak river flow, offshore wind speed and wave height

Parameter	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
Peak rainfall intensity	+5%	+10%	+20%	+30%
Peak river flow	+10%	+20%		
Offshore wind speed	+5%		+10%	
Extreme wave height	+5%		+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

1) Flooding from Tidal River Welland

The FRA has identified the main source of flooding where the new climate change recommendations could affect the predictions of flood levels in 2115 at the development site is flooding from the tidal River Welland.

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	SFRA	2013 guidance	Revised 2016 guidance
2055	0.33	0.395	0.412
2115	1.14	1.205	1.24

Therefore it can be seen that the revised guidance increases the maximum allowance for sea rise in 2115 by 100mm for the maps in the SFRA and 40mm for maps issued by the Environment Agency. The EA maps indicate that flood water from a breach in the tidal banks in a 1 in 1000 year event in 2115 will only reach the northern side of

the A151 road which is 350 metres north of the site. Therefore a small increase will not change this map significantly and cause any flooding on the site in this event.

2) Flooding from Coronation Channel and the IDB drainage system

As the development is in flood zone 1 and is classed as more vulnerable, the central climate change allowance, which is 25%, should be considered. After considering the effects of this increase the higher central, which is 35%, should be considered to assess the effect of this.

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 SHDC SFRA also has used this figure of 20%. The increase to 25% and 35% will not significantly change the conclusion in the SFRA of what might happen if a breach occurred in the bank of the Coronation Channel. If there are additional flows along this part of the Coronation channel and River Welland it will lead to the storage systems of the Cowbit and Crowland Washes operating and additional overtopping over lower banks rather than any significant increase in levels in the river.

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.

South Holland 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 South Holland 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 floor levels should be raised by approximately 300mm is satisfactory.