PROPOSED REPLACEMENT AGRICULTURAL SEEDING TRAY BUILDING AT BANK HOUSE FARM, COOKS ROAD, GOSBERTON, PE11 4PE

FLOOD RISK ASSESSMENT



View from east of the 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 the replacement agricultural building at Bank House Farm, Cooks Road, Gosberton. 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 purpose other than for which it was originally commissioned.

Introduction

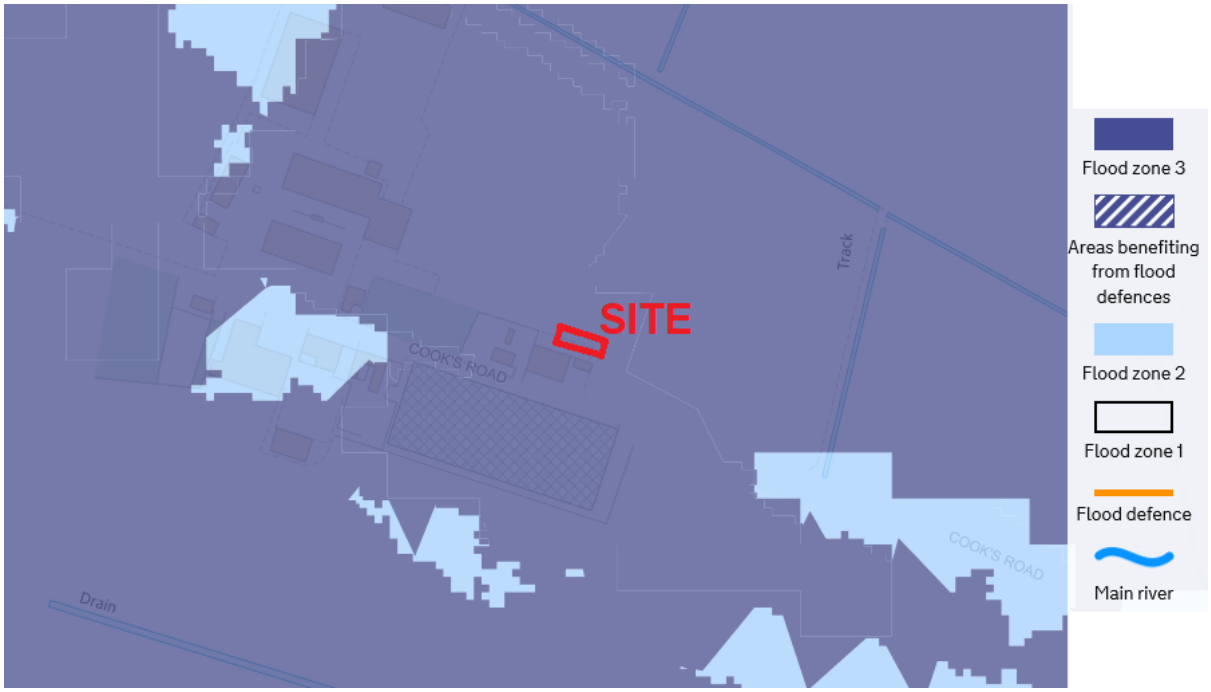
An application is due to be made for planning permission to construct a replacement seeding tray building and demolish the existing building, which is located on the north side of Cooks Road, at Bank House Farm, Gosberton, PE11 4PE. The site is located on the east edge of the area of the farm where all of the farm buildings are located. The site is situated approximately 3km west of Gosberton and 10.5km north of Spalding.

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 on the South Holland District Council's Strategic Flood Risk Assessment (SHDC SFRA) map and is located in the Welland and Deepings 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 site is in Flood Zone 3.

Application Site

The site is located 3km north west of the tidal River Welland and 3.5km north of the River Glen. The National Grid Reference of the site is 526870 332530.

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, a development consisting of an agricultural building is classified as “less vulnerable”.

Table 3 of the Guidance is shown below:

Flood Zones	Flood Risk Vulnerability Classification				
	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 “Less Vulnerable” development is deemed to be satisfactory development in flood zone 3(a).

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.

A greater part of the area of this farm is within flood zone 3, with smaller areas where the land levels are slightly higher within flood zone 2. The existing farm buildings are located either side of Cooks Road, and these have been constructed in a number of phases over the last thirty years. There are now extensive concreted areas to facilitate the movement of forklift trucks, tractors and trailers and lorries around the site. There is now a requirement to build a replacement seeding tray building and this will be located in the same area as the existing buildings for ease of management and security.

The Planning Practice Guidance also advises that 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.

The reason for locating the plant on the proposed site which is in flood zone 3(a) is as follows:-

a) Available Space.

   It is the next available space to extend adjacent to the existing farm building complex.

b) Ease of Access

   It is near to all of the existing facilities on the site.

This report will demonstrate that the risk of flooding to the building will be extremely low and outline the precautions that will be taken to ensure that if flooding occurs in an extreme event this will not cause damage to the building and or more importantly place any personnel in danger.

I therefore consider the sequential test is deemed to be passed.

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 for the 1% fluvial event and 0.5% tidal event.

The maps illustrate the actual flood hazard which is as follows:

For the present day	Depth of flooding … Zero
	Extent of flooding ... Low or medium
	Peak Velocity ……. Zero
For year 2115	Depth of flooding … Zero
	Extent of flooding …Low or medium
	Peak Velocity …… Zero

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
	Peak Velocity …… Zero
For the year 2115	Depth of flooding …Zero
	Extent of flooding .. Low or medium

Peak Velocity …… Zero

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

Tables in the SFRA show the following details of the defence bank on the west side of the tidal section of the River Welland north of Surfleet Sluice at chainage 14.0km.

	2007	2055	2115
Peak 1 in 200 year extreme tide level	5.99m OD	6.32m OD	7.13m OD
Peak 1 in 1,000 year extreme tide level	6.32m OD	6.65m OD	7.46m OD

The crest levels of the defences, which are earth banks along this length, vary between 6.97 and 7.30 m OD. With a minimum crest level of 7.40m OD the freeboards are as follows:

	2007	2055	2115
Peak 1 in 200 year freeboard	1420mm	1090mm	270mm
Peak 1 in 1,000 year freeboard	1080mm	950mm	-60mm

Tables in the SFRA show the following details for the predicted flood levels in the River Glen at chainage 6.3 km.

	2007	2115
Peak 1 in 100 year flood level	4.13m OD	4.65m OD
Peak 1 in 1,000 year flood level	4.19m OD	4.68m OD

The level of the earth banks on this section on the northern side of the River Glen are at a level of approximately 5.10m OD, except for one section at 0.8km where the level is 4.40m OD.

Information from the Environment Agency

The Environment Agency has provided predicted flood levels for the River Glen which are taken from the Welland Catchment Model produced in 2007.

	2007	2115
Peak 1 in 100 year flood level	4.23m OD	5.12m OD
Peak 1 in 1,000 year flood level	4.34m OD	5.26m OD

The Environment Agency has provided the following predicted fluvial flood flows measured in cumecs for the River Glen which are taken from the Welland Catchment Model produced in 2007.

	2007	2115
Peak 1 in 100 year flow	33.76	44.15
Peak 1 in 1,000 year flow	40.21	50.40

The Environment Agency state:-

- The predicted water levels are in channel levels and therefore may not represent the flood level on the flood plain, particularly where the channel is embanked or has raised defences.
- The allowance for climate change in the 2007 model was 20%.

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 3.0km north west 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 3.5km north of the River Glen, which has a fluvial defence bank which is maintained by the Environment Agency.

The site is located 800 metres north of the Risegate Eau which is maintained by the Welland and Deepings IDB.

Existing Ground Levels

The existing ground levels in this area are approximately 4.0m OD.

Potential Sources of Flooding

The potential sources of flooding to the site are:-

1. Failure or overtopping of the tidal defences of the River Welland.
2. Failure or overtopping of the defences of the River Glen.
3. High water levels in the Risegate Eau (IDB)
4. Blockages or problems in local surface water systems

1. Failure or overtopping of tidal defences of River Welland

The embanked fluvial section of the River Welland is approximately 3km west of the development site. At this location the left bank of the River Welland is at a level of between 7.38m OD and 7.65m OD. Therefore in a 1 in 200 year event in 2115 there could be a small amount of overtopping during the few hours of high tide. However this flooding is unlikely to reach the site of the development.

There is extensive land north and south of Cooks Road which is approximately 1.0 metre lower than the level of Cooks Road which will flood before the development site is affected.

Therefore flooding of this area is only likely to occur if a breach forms, and even if this breach occurs the results of the SFRA indicate that flooding would not reach the site.

2. Failure or overtopping of the defences of the River Glen

The SFRA gives predicted levels for the River Glen of 4.65m OD and 4.68m OD for the 1 in 100 year and 1 in 1000 year events in 2115. However the Environment Agency advise that the levels will be much higher at 5.12 and 5.26m OD for the 1 in 100 year and 1 in 1000 year events in 2115.

The levels of the earth bank on the north side of the River Glen are all approximately between 5.00m and 5.20m OD, with some lengths with much lower levels. Therefore it would seem very unlikely that maximum levels in the River Glen could actually rise to the levels above 5.00m OD predicted by the EA.

Peak water levels occur in the River Glen when the outfall into the tidal River Welland is tide locked. During this time the levels in the River Welland are higher than levels in the River Glen, even when the latter levels are very high. This closes the large timber doors at the sluices and prevents discharge from the River Glen into the River Welland for approximately 3 to 4 hours. Immediately upstream of the sluices is an area called Surfleet Reservoir where the area between the banks is much wider where excess water is stored.

What would happen in a 1 in 100 year event in 2115 would be that water would be overtopping the earth banks in numerous places between Surfleet and Bourne which would prevent river levels rising much above the levels predicted in the SFRA.

The SFRA does not predict any flooding at the development site in a 1 in 200 year event in 2115. There is extensive land north and south of Cooks Road which is approximately 1.0 metre lower than the level of Cooks Road which will flood before the development site is affected.

Therefore flooding of this area is only likely to occur if a breach forms, and even if this breach occurs the results of the SFRA indicate that flooding would not reach the site.

3. High water levels in the Risegate Eau

The water level in the Risegate Eau is controlled by Risegate Eau Pumping Station which is 3.5 km west of the development site. The pumps and motors are maintained in excellent condition by Welland and Deepings IDB, who have emergency plans arranged if there is a failure of the plant.

The Welland and Deeping IDB drains have been designed to a 1 in 10 year standard with a freeboard of between 800mm and 1.0 metres. This generally provides a standard of at least 1 in 50 years for flooding of the lowest land. Much of the land in the catchment is below 3.00m OD and therefore even if the pumps fail to operate for a considerable time during a rainfall event the proposed development site would be unlikely to flood. The normal water level in the Risegate Eau is 0.00m OD at the outfall. The maximum design level in the Risegate Eau at Wargate Bridge, which is 1.5km south west of the centre of Gosberton, is 1.05m OD.

Therefore the risk of flooding from the main IDB system can be considered to be adequately mitigated.

4. **Blockages or problems in local surface water systems.**

There is a possibility that some of the dykes around the site could become overgrown and not function satisfactorily. The occupiers of the site should ensure that these dykes are regularly maintained in the future.

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. This has been confirmed by a local resident who has lived in this area all her life.

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

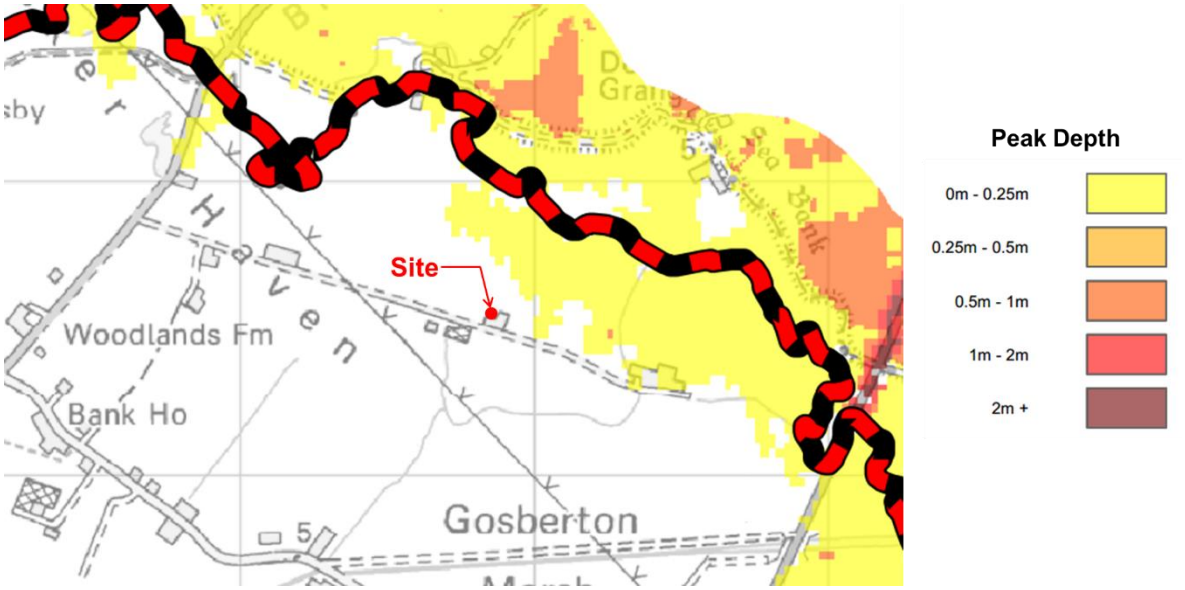
The risk of this happening in this case is low and the hazard from any flooding is also low.

Climate Change

The predictions of flood depths for this flood risk assessment use information in the SHDC SFRA which was produced in 2010, and further information provided by the Environment Agency. The EA have issued new guidance on recommended contingency allowances for predicted sea level 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 12 to 15). It is concluded that no extra mitigation measures are necessary to comply with the new guidance on climate change.

Conclusions

There is a risk of flooding if there is a breach in the west bank of the tidal Witham or the north bank of the fluvial River Glen. However the map of the extent of flooding in a 1 in 200 year tidal or a 1 in 100 year fluvial event shown below indicates that the flooding will not extend as far as Cooks Road.



The risk of flooding from IDB drains can be considered low. If the pumping stations were to fail then the IDB have adequate arrangements to operate pumps with alternative motive power, or to bring in mobile pumps. If drains become full any flooding that occurs would happen very slowly and be unlikely to reach the floor level of the proposed building because there are large areas of land below 3.0m OD which will flood to prevent flood water rising above 3.0m OD.

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

Recommendations

The Farming Company has stated that the ground floor level of the new building will be 50mm above the existing concrete apron, which will be approximately 200mm to 300mm above the level of the field to the south.

Peter C Thorold should register with the Environment Agency's Floodline Warnings Direct Service. The company is likely to be already registered for this service.

On site surface water drainage should be discharged into soakaways located on the northern side of the building and these should be designed to BRE Digest 365 and approved under Building Regulations.

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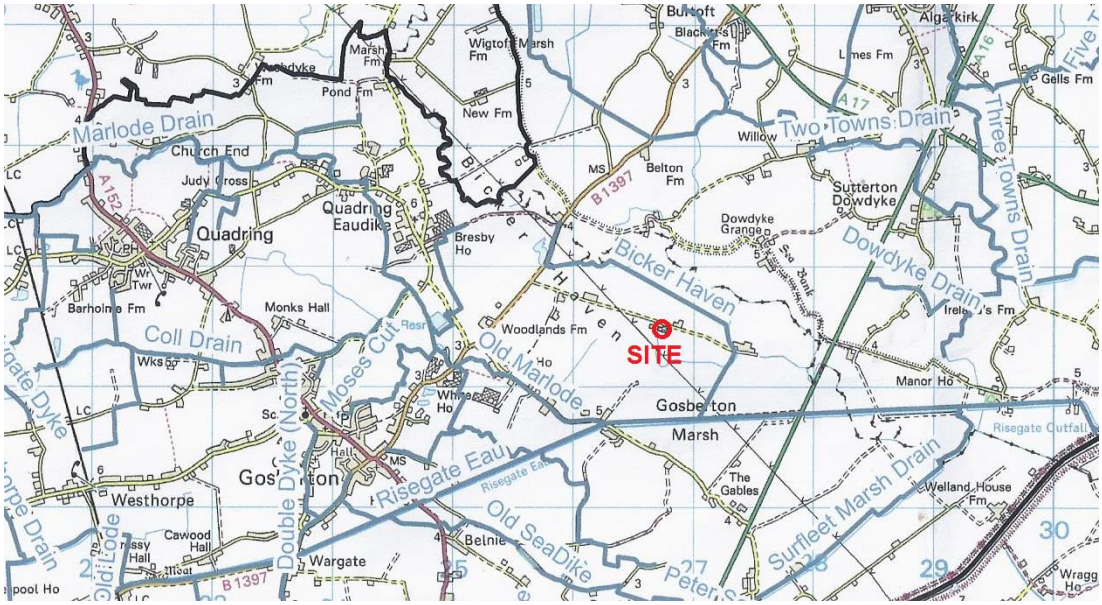
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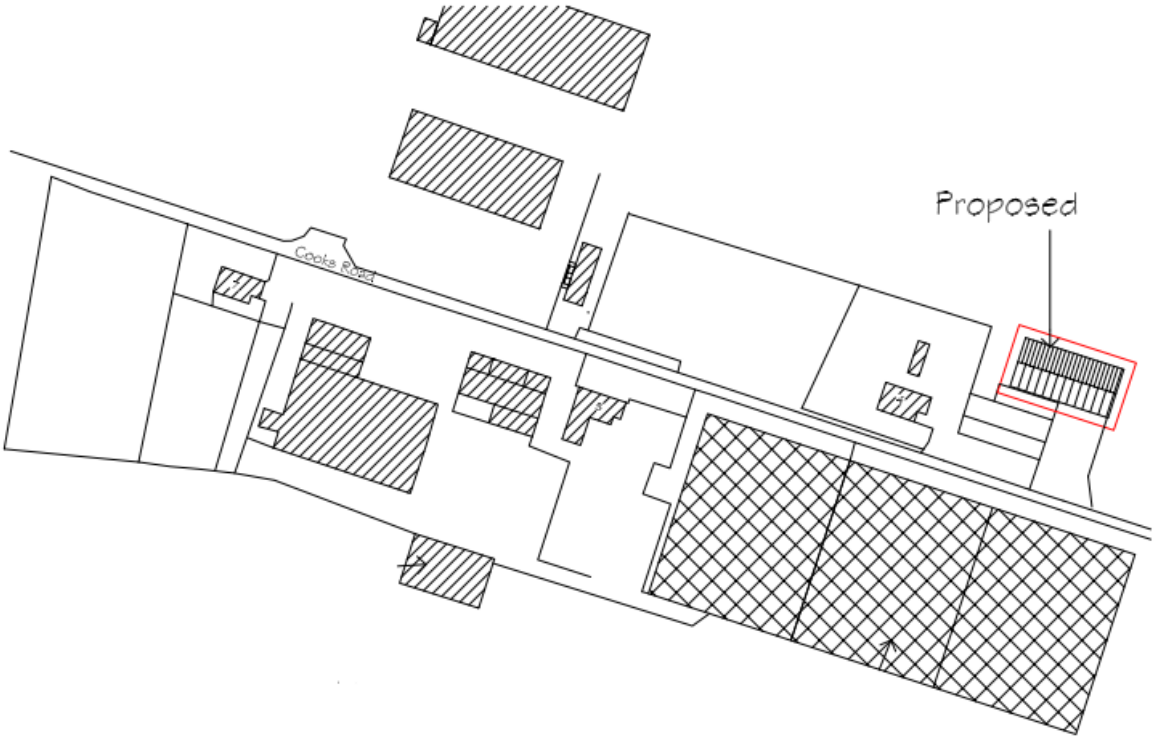
LOCATION PLAN



PLAN OF IDB WATERCOURSES



SITE LOCATION PLAN



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 PPS25[1]. 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

document is out of date'a

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%	

s been withdrawn (19

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 less vulnerable development in flood zone 3(a) the central and higher central percentages 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 the possibilities of both tidal and fluvial flooding at this site. These will be addressed separately below.

Flooding due to failure of the Tidal 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	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. This may have the effect of slightly increasing the predicted flood level at the site in a 1 in 200 year breach event in 2115 by the maximum of 100mm, but it will probably be only between 10mm and 50mm. It is unlikely that

this increase will significantly change the maps of flood risk in the SHDC SFRA, the maps supplied by the Environment Agency or the conclusions in this FRA.

Flooding from the River Glen

Table 1 shown in the EA guidance gives peak river flow allowances for the upper end, higher central and central categories. As the development is in flood zone 3 and is classed as less vulnerable, the central allowance, which is 25%, should first be considered. After considering the effects of this increase the higher central allowance, 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 increase to 25% will not significantly change the conclusion in the SFRA of what might happen if a breach occurred in the bank of the River Glen. If there are additional flows along this part of the River Glen it will lead to additional overtopping over lower banks rather than any significant increase in levels in the river.

The upper end allowance predicting a 35% increase in flows above the 1 in 100 year predicted flows now needs to be considered. The River Glen is an embanked watercourse between Spalding and Bourne. It is unlikely that there will be any significant increase in the water level in the River. Therefore the consequence will not be significantly different to the maps produced in the SFRA.

Flooding from IDB drainage system

As the development is in flood zone 3 and is classed as more vulnerable, the advice from the Environment Agency is that the central climate change allowance, which is 25%, should be considered. After considering the effects of this increase the higher central allowance, which is 35%, should be considered to assess the effect of this.

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.

Welland and Deepings 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 Welland and Deepings 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, and the precautions recommended, will ensure that the proposed building will be safe in the future.