PROPOSED DEVELOPMENT ALONGSIDE ALDERGROVE
DOZENS BANK, WEST PINCHBECK, SPALDING, PE11 3NF
FLOOD RISK ASSESSMENT

View from Dozens Bank looking west

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 development at Dozens Bank, West Pinchbeck, Spalding. 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 purposes other than for which it was originally commissioned.

Introduction

A planning application is due to be made to South Holland District Council for permission to construct a house on the south eastern side of a property called Aldergrove at Dozens Bank, West Pinchbeck, Spalding, PE11 3NF. The site is situated approximately 5.2 km west 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 approximately 220 metres from the River Glen. The National Grid Reference of the site is 520275 324315.

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 residential development is classified as “more 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 †	✗	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	✗	✗	✗	✓*

It can be seen from Table 3 above 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 the whole of this area of West Pinchbeck and north Spalding is in Flood Zone 3. Therefore it would be difficult to find a similar site for development that is in a lower flood zone. The site can be considered to be a windfall site within an existing residential area and as such complies with South Holland DC policies for development.

Taking into account the guidance, it can be seen that it is extremely unlikely that an alternative site can be found which is available with a lower flood risk in this area of West Pinchbeck.

The safety of the development will be delivered by ensuring the floor level of the proposed new dwelling is above predicted residual flood levels for this 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 South Holland District 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 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 ..	Nil
	Flood Hazard……	None
	Peak Velocity ……	None
For year 2115	Depth of flooding ..	0 – 500mm
	Extent of flooding ..	High
	Flood Hazard……	Low
	Peak Velocity ……	0.1 – 0.25m/sec

The maps showing the residual flood hazard were revised in the 2016 update of the South Holland District Council Strategic Flood Risk Assessment which can be found on the website of the South East Lincolnshire Joint Planning Committee. The hazards are as follows for the 1% fluvial or 0.5% tidal event probability:

For the present day	Depth of flooding……..	0 – 250mm
	Extent of flooding ……	High
	Hazard ……..	Low Hazard (0 – 0.75)
	Velocity …….....	0 – 0.3m/sec
For the year 2115	Depth of flooding …….	0 – 250mm
	Extent of flooding ……	High
	Hazard …….	Low Hazard (0 – 0.75)
	Velocity ……	0 – 0.3m/sec

Figure 16 of the general maps shows that the site is within the rapid inundation zone for the present day and for 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 Fulney Lock at chainage 22.0km.

	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	6.32m 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 7.00m OD the freeboards are as follows:

	2007	2055	2115
Peak 1 in 200 year freeboard	1020mm	690mm	-120mm
Peak 1 in 1,000 year freeboard	680mm	350mm	-460mm

Tables in the SFRA show the following details for the predicted flood levels in the River Glen at chainage 10.3 km.

	2007	2115
Peak 1 in 100 year flood level	4.68m OD	4.94m OD
Peak 1 in 1,000 year flood level	4.96m OD	5.19m OD

The table in the SFRA states that the defence level, which is the top of the wall on the north side of the road, from chainage 8.6km to the A151 New Bridge at chainage 10.4km is 5.95m OD.

Tables in the SFRA show the following details for the predicted flood levels in Vernatt's drain at chainage 10.5 km near Pode Hole.

	2007	2115
Peak 1 in 100 year flood level	3.96m OD	3.96m OD
Peak 1 in 1,000 year flood level	3.96m OD	3.96m OD

The level of the earth banks on this section of the northern side of Vernatt's Drain are 4.39m 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.

	Present Day	Present Day with 20% climate change
Peak 1 in 100 year flood level	4.61m OD	4.75m OD
Peak 1 in 1,000 year flood level	5.03m OD	5.34m OD

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 220 metres south east of Glenside South which is on the top of the bank on the south side of the River Glen which is maintained by the Environment Agency.

The site is located approximately 5.9 km from the tidal section of the River Welland, which is maintained by the Environment Agency.

The site is located 2.3km north of Vernatt's Drain which is maintained by Welland and Deepings IDB.

There are additional smaller watercourses in the area that are maintained by Welland and Deepings IDB.

Existing Ground Levels

The level Glenside South, the road on the top of the south bank of the River Glen north of the development is approximately 4.90m ODN. Dozens Bank slopes down from the bank and is slightly higher than the existing house but at approximately the same level in front of the development site, which is at a level of approximately 3.00m ODN.

Potential Sources of Flooding

The potential sources of flooding to the site are:-

1. Failure or overtopping of tidal defences of the River Welland.
2. Failure or overtopping of the River Glen.
3. Failure or overtopping of the banks of the Vernatt's Drain.
4. Flooding from the IDB drainage system.
5. Surface Water Flooding from Dozens Bank.

1. **Failure or overtopping of tidal defences**

The tidal River Welland is 5.9km east of the site. The predicted levels in the river show that the defences could be overtopped in a 1 in 200 year event in 2115. There is a section of the western bank of the tidal River Welland 500 metres in length between Marsh Road Sluice and the power station where the SFRA advises that the bank levels are only 7.00m OD. North of this section the bank levels are all higher than 7.50m OD. If a breach occurred in the west bank of the tidal Welland water would flow westwards and would flow into Vernatt's Drain. This will hold up the flow until the water level reaches 4.25m OD then water would flow out of Vernatt's Drain and start to flow westwards towards the development site. The railway line west of the B1356 road from Spalding to Pinchbeck would then further hold up the water from flowing further westwards and affecting the site of the development.

Therefore it is very unlikely that flood water from this source would flow as far as the development site and as the floor level of the development will be raised above the existing ground level. The risk of flooding from this source can be considered to be extremely low.

The maps in the updated SFRA indicate that the maximum predicted depth of flooding is 250mm to the development site in a 1 in 200 year event in 2115.

As the ground floor level of the proposed development will be raised by a minimum of 300mm above ground level this will provide adequate mitigation to the risk of flooding.

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

The predicted maximum 1 in 100 year water level as advised in the SFRA at the present time is 4.61m OD. These predicted levels are lower than the defence levels on this section of the bank of the River Glen which are approximately 4.90m OD.

Predicted water levels with an allowance of 20% for climate change as advised in the SFRA are 4.75m OD for the 1 in 100 year event This is also below the level of the road on top of the south bank of the river.

The latest advice from the Environment Agency is that the predicted level in a 1 in 100 year event in 2115 (assuming 20% allowance for climate change) will be 5.34m OD, which is again lower than the defence level.

Although the actual risk is extremely low the risk of the bank failing directly north of the site needs to be considered. It is very unlikely that the whole bank would fail at this location. The most common first stage for formation of breaches is overtopping of a bank, which then leads to erosion of the back of the bank. This type of failure is more likely to happen at locations to the east and west of Pinchbeck West where there are earth banks, rather than at a location where there is a road on top of the bank and the gradient of the rear of the bank is very low, as is the case with this bank.

There is a risk that the wall could fail allowing some flood water to flow over the road and flow southwards, which could flood the site of the proposed development. However the likelihood of the whole bank failing would still be very low.

Although the likelihood of a breach occurring at this location is extremely low, this source of flooding is the greatest risk to the site, and the hazards will be reviewed later in this report.

3. **Failure or overtopping of the banks of Vernatt's Drain**

The SFRA states that the maximum predicted flood level in Vernatt's Drain is 3.96m OD for a 1 in 1000 year event in 2115. As the crest level of the banks are at a level of 4.39m OD, the risk of overtopping is extremely low.

There is the risk that the banks could fail when water levels are very high and this could cause flooding to land south of the proposed development. However the Welland and Deepings IDB would monitor the situation and reduce the flow in the Drain by switching off the pumps at Pode Hole Pumping Station which will reduce the risk of very high levels of flood water from occurring.

Therefore as ground floor levels of the proposed house will be raised by 300mm above the existing ground level this source of flooding can be considered to be adequately mitigated.

4. **Flooding from the IDB Drainage System**

This area east of Pinchbeck West is drained by the Fengate Drain approximately 50 metres south of the site. This flows eastwards into the Blue Gowt No 1 Drain. Both of these watercourses are maintained by Welland and Deepings IDB. The water levels in this drain are controlled by Pinchbeck Pumping Station which is approximately 3km west of the development. The water is lifted into the Blue Gowt outfall which discharges into the River Glen near the outfall sluice at Surfleet Seas End. Welland and Deepings IDB stated that although this system operates well at the present time if more development is approved in the area further improvements will be carried out to ensure that the standard of drainage is maintained in the future.

Drainage channels maintained by the Welland and Deeping IDB generally have a 1 in 10 year standard with up to 1.0 metre of freeboard, which generally provides between 1 in 50 and 1 in 100 year standard against flooding.

As the ground floor level of the proposed development will be raised by a minimum of 300mm above ground level this will provide adequate mitigation to the risk of flooding from this source.

5. **Surface Water Flooding from Dozens Bank.**

There is a risk that excess surface water following heavy rainfall could flow onto the site if surface water drainage systems in Dozens Bank become blocked.

As the ground floor level of the proposed development will be raised by a minimum of 300mm above ground level this will provide adequate mitigation to the risk of flooding from this source.

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. 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 the failure of the flood wall which provides the flood defence along this section of the River Glen.

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 this 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.

South East Lincs Advice Matrix

Advice can be found on the recommended mitigation required by referring to a spreadsheet on the South East Lincolnshire website.

As the development is in flood zone 3 and the flood hazard is low (0 – 0.75) reference should be made to Category F8 which shows the following recommended mitigation:

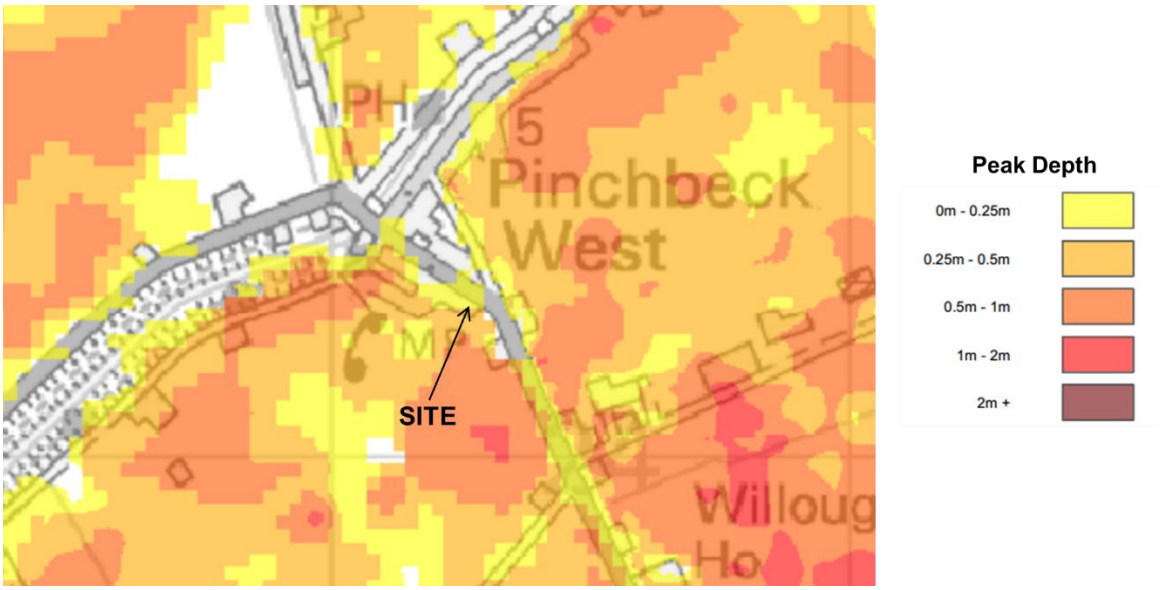
The NPPF requires that the proposal is accompanied by a Flood Risk Assessment which contains evidence that appropriate mitigation measures / flood resilience techniques have been incorporated into the development.

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

FFL must be set 300mm above ground level for 2 storey proposals. Single storey proposals must set finished floor levels above the 0.1% event breach depth in the 2115 scenario.

Conclusions

The map in the SFRA showing the peak residual flood depths in a 1 in 100 year coastal or fluvial event in 2115 does not predict any flooding on the site. An extract of this map is shown below.



There is a risk of flooding to the site if the wall which provides the flood defence between the road and the river were to fail. However this would only occur if the river level rose above 4.90m OD. At this level the river would be starting to overflow long lengths of bank between Bourne and Surfleet, and therefore the risk of flooding at this location is extremely unlikely. The above map predicts the maximum depth of flooding on the site will be 250mm in a 1 in 200 year event in 2115.

The risk of flooding from Vernatt's Drain can be considered very low because the recommended floor level of the proposed development is only 500mm below the predicted flood level in this watercourse.

The risk of any flood water from any IDB sources increasing above a level of approximately 3.00m OD can be considered to be very low.

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

Although all of the site is in flood zone 3, the actual risk of the site flooding from any Environment Agency or IDB watercourse is very low.

Recommendations

In an area where there is a flood risk, however small, it is preferable that new dwellings should be of two story construction designed with all sleeping accommodation located on the first floor.

The ground floor level of the proposed two story building should be raised at least 300mm above the ground level on the site and 300mm above the road level in front of the property.

If very high water levels were predicted in the River Glen the Local Authorities and emergency services would have adequate time to warn residents that flooding might occur, and residents would have adequate time to prepare themselves for the event.

On site surface water drainage will be discharged into soakaways and these should be designed to BRE Digest 365 and approved under Building regulations.

All future owners and occupiers of the properties should register with the Environment Agency's Floodline Warnings Direct Service.

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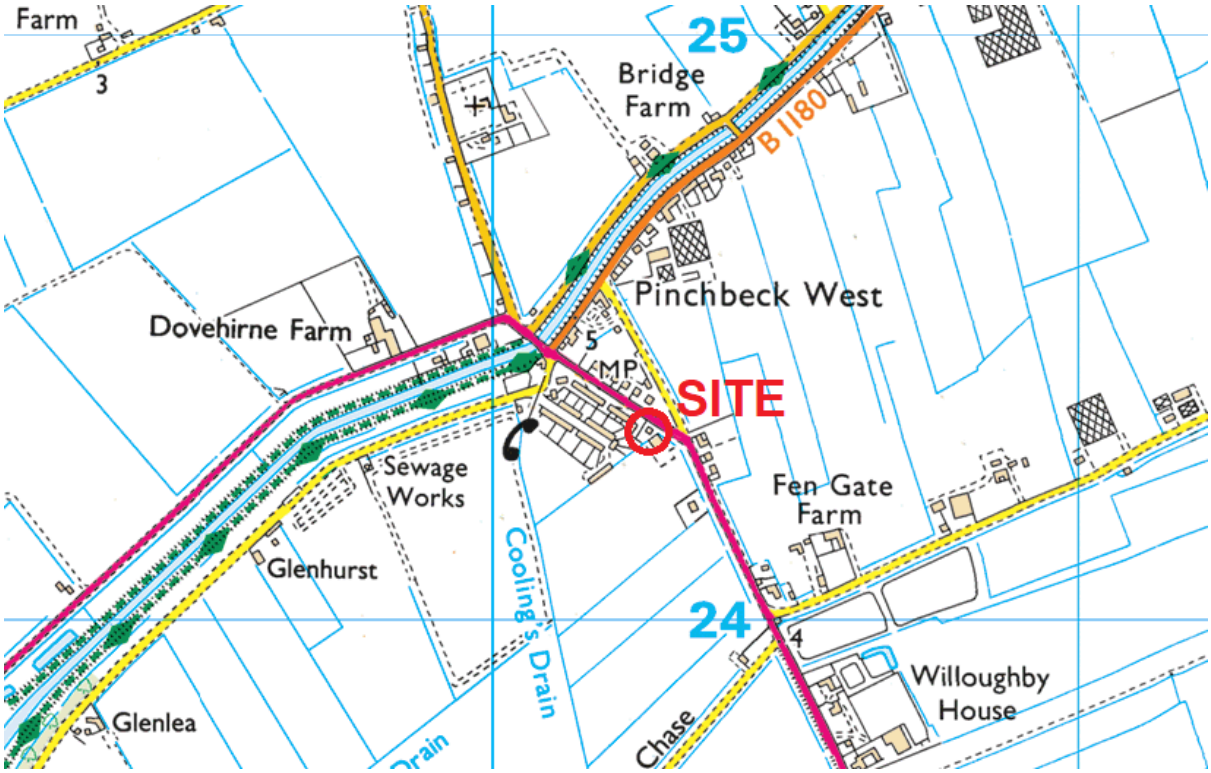
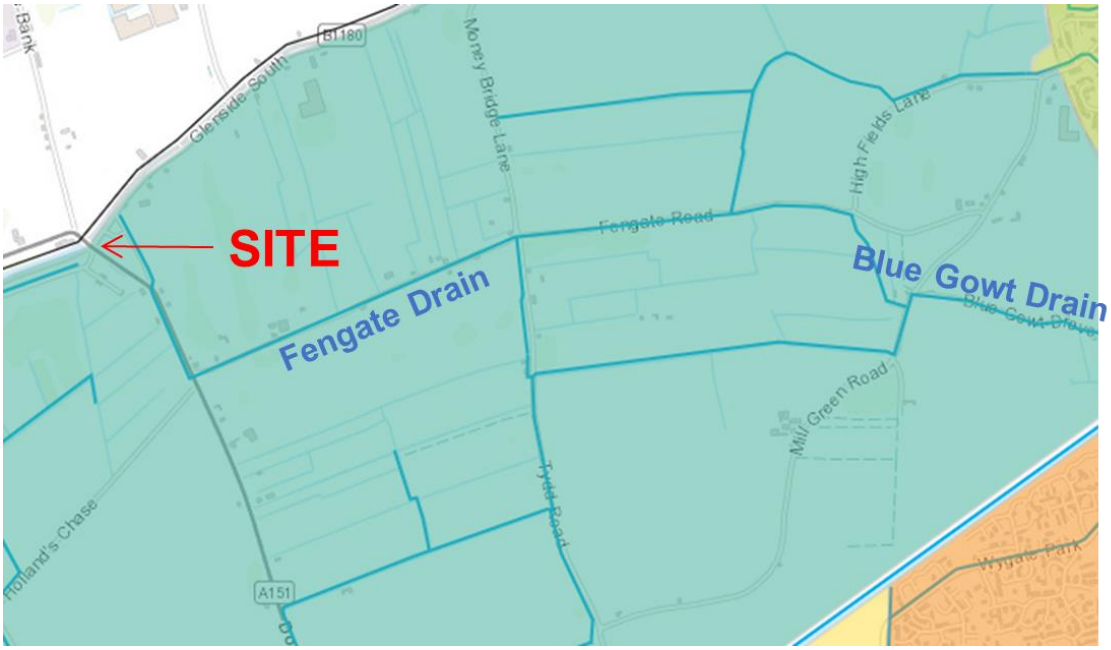
19th September 2020

LOCATION PLAN



PLAN OF IDB DRAINS



PLAN OF PROPOSED DEVELOPMENT

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
- South East Lincolnshire SFRA (March 2017)

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

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%	

has 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 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%

South East Lincolnshire SFRA (March 2017)

The SE Lincs SFRA states that all FRA's should refer to the revised guidance issued by the EA in 2016.

Effects on Predictions of Flood Risk in FRA

The SFRA does not predict any flooding to the proposed development site up in a 1 in 100 year fluvial or 1 in 200 year tidal event in 2115. However it does predict up to 500mm depth of flooding in areas east and west of the site at a similar level. It has been concluded that the major flood risk to the site is most likely to be fluvial flooding from the River Glen to the north of the site.

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

1) Flooding from the tidal River Welland
2) Flooding from the River Glen
3) Flooding from the Vernatts Drain and other IDB drains

1) 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

It can be seen that the revised guidance increases the maximum allowance for sea rise in 2115 by 100mm. This will only have the effect of increasing flood levels by between 10mm and 20mm at the most. This may slightly increase the risk of a breach occurring in the tidal bank north of the site.

As the maps in the updated SFRA do not predict any flooding in a 1 in 100 year event in 2115 it can be concluded that the small increase in the predicted sea level will not change the conclusions in the report.

2) Fluvial Flooding from the River Glen.

Fluvial flooding from the River Glen is considered to be the major flood risk to the site. As the development is in flood zone 3 and is classed as more vulnerable, the advice from the Environment Agency is that the higher central climate change allowance, which is 35%, should 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.

Maximum flood levels in the River Glen will not be increased by the increase in flows projected in the new climate change allowances. If flows increase by between 35% and 65% in this river system it will have the effect of flooding over the long sections of bank between Bourne and Surfleet Reservoir and the maximum levels will not increase significantly.

3) Flooding from the Vernatts Drain and other 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.

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, with the recommendation that the ground floor level of the proposed buildings should be a minimum of 300mm above ground level is considered satisfactory.