PROPOSED STORAGE WAREHOUSE AT GLENSIDE NORTH, PINCHBECK, SPALDING, PE11 3SD

FLOOD RISK ASSESSMENT



View looking south from Northgate towards proposed site

S M Hemmings B Sc C Eng MICE MIWEM,

13 Lea Gardens

Peterborough

PE3 6BY

This flood risk assessment has been prepared solely to support the planning application for a storage building at Glenside North, 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

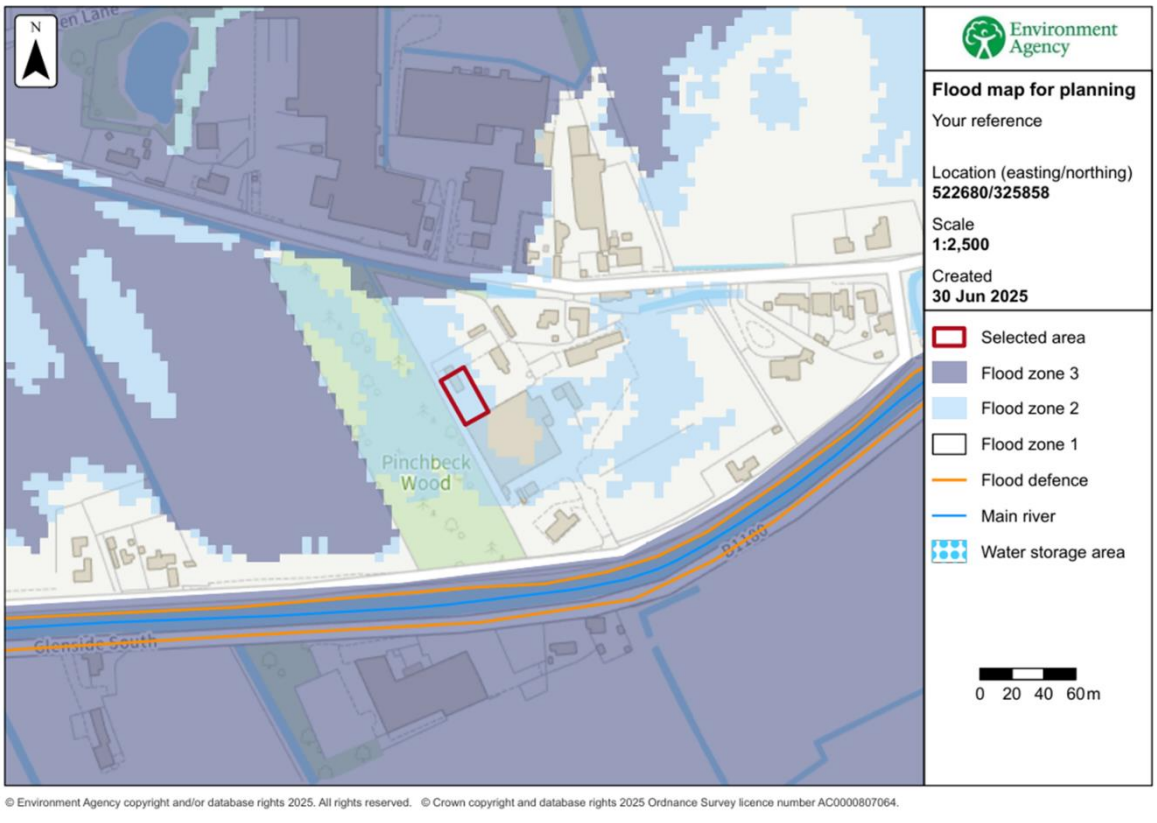
A planning application is due to be submitted to South Holland District Council for permission to demolish the existing building on the site north of Glenside North, Pinchbeck, Spalding, PE11 3SD and construct a storage warehouse on the site. The site is situated on the western side of the village of Pinchbeck and is located north of the River Glen.

The site is within Flood Zone 2 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 Black Sluice 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.



© Environment Agency copyright and/or database rights 2025. All rights reserved. © Crown copyright and database rights 2025 Ordnance Survey licence number AC0000807064.

It can be seen that the site is in flood zone 2.

Application Site

The site is located directly south of the Graft Drain on the southern side of Northgate and the National Grid Reference of the site is 522680 325860.

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

Referring to the flood risk vulnerability classification in Table 2 of the Guidance, a storage building can be categorised 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	✓*

It can be seen that “Less Vulnerable” development is considered satisfactory in flood zone 2.

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 most of this area immediately north of the River Glen is in flood zones 1 and 2.

This report will demonstrate that the proposed storage building will be acceptable with regard to the flood risk to the site.

Strategic Flood Risk Assessment

The Strategic Flood Risk Assessment (SFRA) written for the South Holland District Council (SHDC) in 2010 provides details of the actual flood risk in the Council's area. This information has not been updated and reference to the maps in this document give the following information for the actual flood risk and hazard at the site for the 1% fluvial event and 0.5% tidal event.

For present day
Depth of flooding … zero
Extent of flooding .. zero
Velocity ……... Nil

For year 2115
Depth of flooding … 0 – 500mm
Extent of flooding …high
Velocity ……. 0 – 0.1 m/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 present day
Depth of flooding ... zero
Extent of flooding … low or medium
Hazard ……. zero
Velocity ……. zero

For year 2115
Depth of flooding..... 0 - 250mm
Extent of flooding .. High probability
Hazard ……. 0 – 0.75 (low hazard)
Velocity …….. 0 – 0.3 m/sec

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 6.6 km.

	2007	2115
Peak 1 in 100 year flood level	4.40m OD	4.72m OD
Peak 1 in 1,000 year flood level	4.59m OD	4.80m OD

The table in the SFRA states that the crest level of the earth bank on this section of the northern side of the River Glen is 5.28m 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 (2016). The reference of this information is CCN-2022-261149.

	2007	2115
Peak 1 in 100 year flood level	4.41m OD	4.51m OD
Peak 1 in 1,000 year flood level	4.88m OD	5.03m OD

The predicted fluvial levels supplied by the Environment Agency are reproduced on page 12 of this report.

Information on Surface Water Flooding on Environment Agency Website

The map on the next page shows the predicted areas of surface water flooding in a 1 in 1000 year event in this area of between Glenside North and Northgate.



The above map predicts that there is a possibility of surface water flooding on the site. The latest maps on the Environment Agency website do not specify the depth of the flooding, but it can be assumed that as the site is level the depth of flood water would not exceed 250mm.

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 160 metres north of the bank of the River Glen which is maintained by the Environment Agency.

The site is located approximately 3.1 km from the tidal section of the River Welland, which is maintained by the Environment Agency.

There are additional smaller watercourses in the area that are maintained by Black Sluice IDB.

Existing Ground Levels

The level of Northgate west of the site is approximately 3.400m OD and the site is at approximately at the same level.

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. Flooding from the IDB drainage system.
4. Surface Water Flooding
5. Surface water flooding

1. Failure or overtopping of tidal defences

The site is not considered to be at risk from tidal flooding.

2. Failure or overtopping of the River Glen

The predicted maximum 1 in 100 year water level shown in the advice from the Environment Agency at the present time is 4.86m OD and in 2115 with 20% increase in flow allowed for climate change the predicted level is 4.98m OD. These predicted levels are lower than the defence levels on this section of the bank of the River Glen which are approximately 5.30m ODN.

Although the actual risk is extremely low there is still a residual risk of flooding to the proposed annex if the bank were to fail directly south of the site. The possible maximum flood level that could occur on the site if a breach developed in the section of bank directly south of the site will be investigated later in this report.

The most common first stage of the formation of a breach is overtopping of a bank, which then leads to erosion of the back of the bank. The bank of the River Glen south of the site has a road located along the top and the slope from the road at the top of the bank to the ground level is very shallow. Therefore the risk of failure of the bank

of the River Glen south of the site can be considered to extremely low, and this source of flooding can be considered to be adequately mitigated.

3. **Failure or overtopping of the South Forty Foot Drain**

The South Forty Foot Drain is located 5.3km west of the site. This watercourse is maintained by the Environment Agency. The Drain is embanked from the southern end at Black Hole Drove Pumping station to north of Donington. The SFRA states that the maximum predicted water level in the Drain in a 1 in 100 year event in 2115 is 3.41m OD. However later reports by the EA have concluded that the watercourse only has a standard of service between 1 in 25 and 1 in 50 years and overtopping will occur in events larger than these.

As the proposed ground level on the site is 3.40m OD then this source of flooding can be considered to be adequately mitigated.

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

This area west of Pinchbeck is drained by the IDB drainage channel which is located on the southern side of Northgate. This drain flows westwards and discharges into the Drain west of Beck Bank which flows northwards and then eastwards to the South Forty Foot Drain. All of these watercourses are maintained by Black Sluice IDB. The water levels in this drain are controlled by Gosberton Fen Pumping Station which is approximately 7km north west of the development. The water is lifted into the South Forty Foot Drain which flows northwards to discharge into the Haven at Boston.

Drainage channels maintained by the Black Sluice 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 proposed ground floor levels of the proposed storage building will be approximately 3.55m OD then this source of flooding can be considered to be adequately mitigated.

5. **Surface Water Flooding**

As the proposed ground floor level of the building will be higher than the existing ground level on the site the risk of surface water flooding to the site can be considered to be adequately mitigated.

Extent of known Flooding

During the preparation of this assessment, no evidence was discovered of the site or any of the adjoining properties being flooded in the past fifty 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 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 13 to 16). It is concluded that no extra mitigation measures are necessary to comply with the new guidance on climate change.

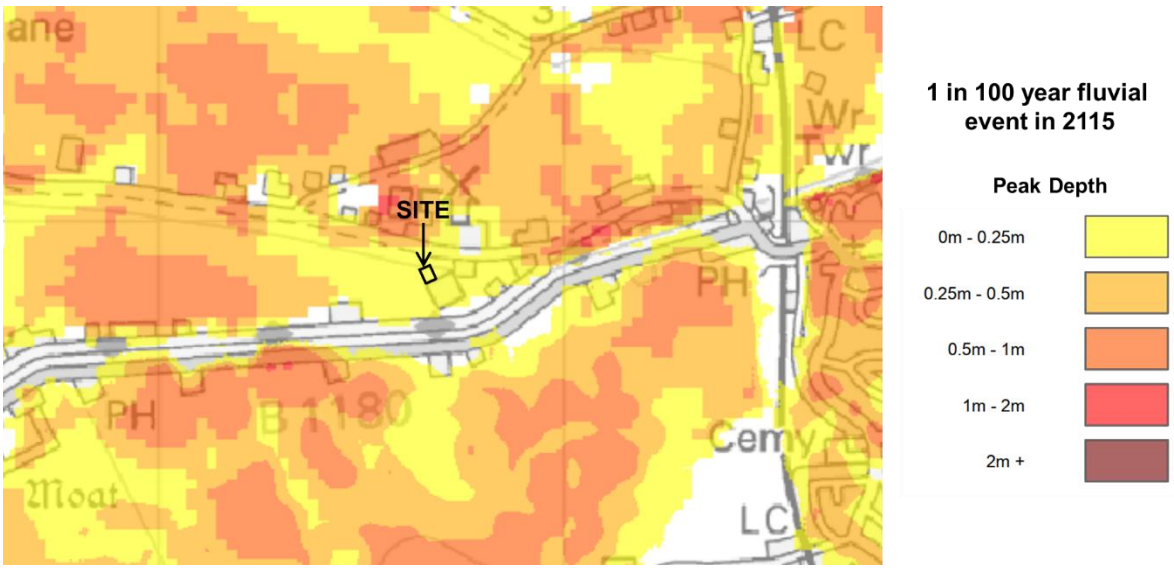
South East Lincs Advice Matrix

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

As the development is in flood zone 2 and the flood hazard is 0 – 0.75 (low hazard) reference should be made to Category F4 which shows that the standing advice in the matrix for this category is “No Comment”.

Conclusions and Proposed Mitigation

The map on the South East Lincolnshire Planning website showing the residual flood depths in a 1 in 200 year coastal or a 1 in 100 year fluvial event in 2115 predicts that the maximum depth of flooding on the site would be between 250mm. The relevant part of this map is shown below:



It is assumed that this flooding will result from overtopping of the River Glen at a location immediately south of the site.

The risk of any flood water from any IDB sources increasing above the proposed ground floor level can be considered remote.

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

Recommendations

The developer proposes to raise the level of the concrete floor of the building 150mm above the existing ground level on the site, which is considered satisfactory.

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

In an extreme fluvial event water levels in the River Glen would rise slowly and would only reach the peak after a minimum of 24 hours. The Environment Agency would issue warnings hours before the event, and all occupiers would be aware of the situation.

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

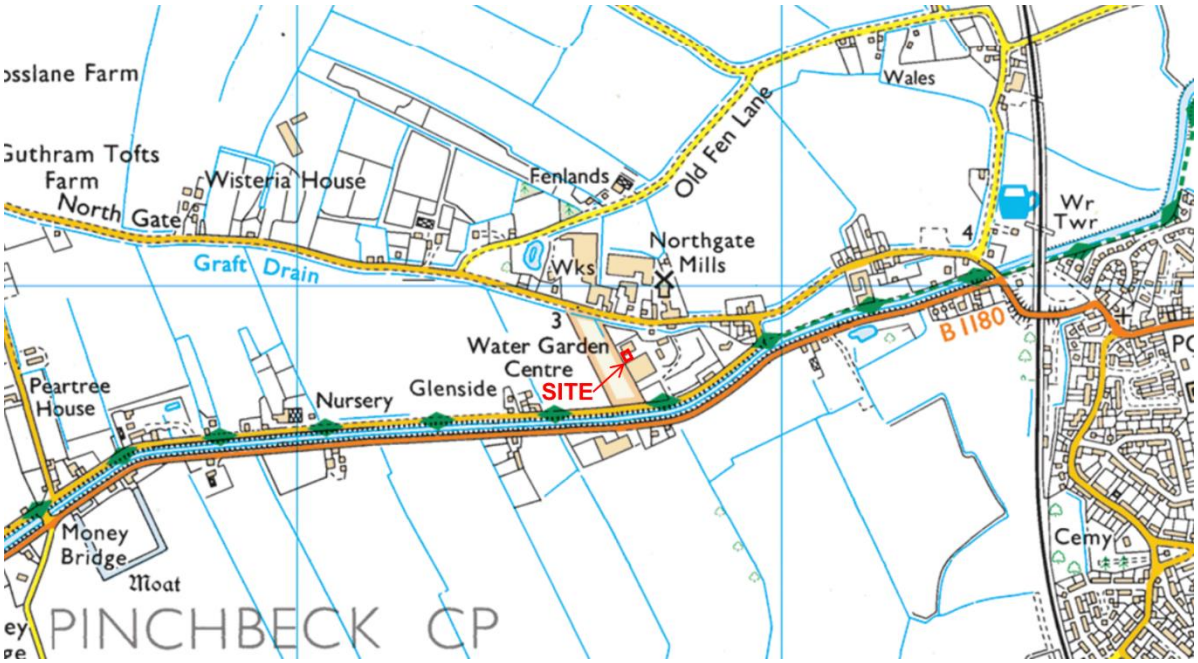
It is recommended that all electrical sockets and electrical circuits should be a minimum of 600mm above the ground floor level of the building. Any permanent electrical equipment should also be 600mm above the ground floor level.

S M HEMMINGS B Sc C Eng MICE MIWEM

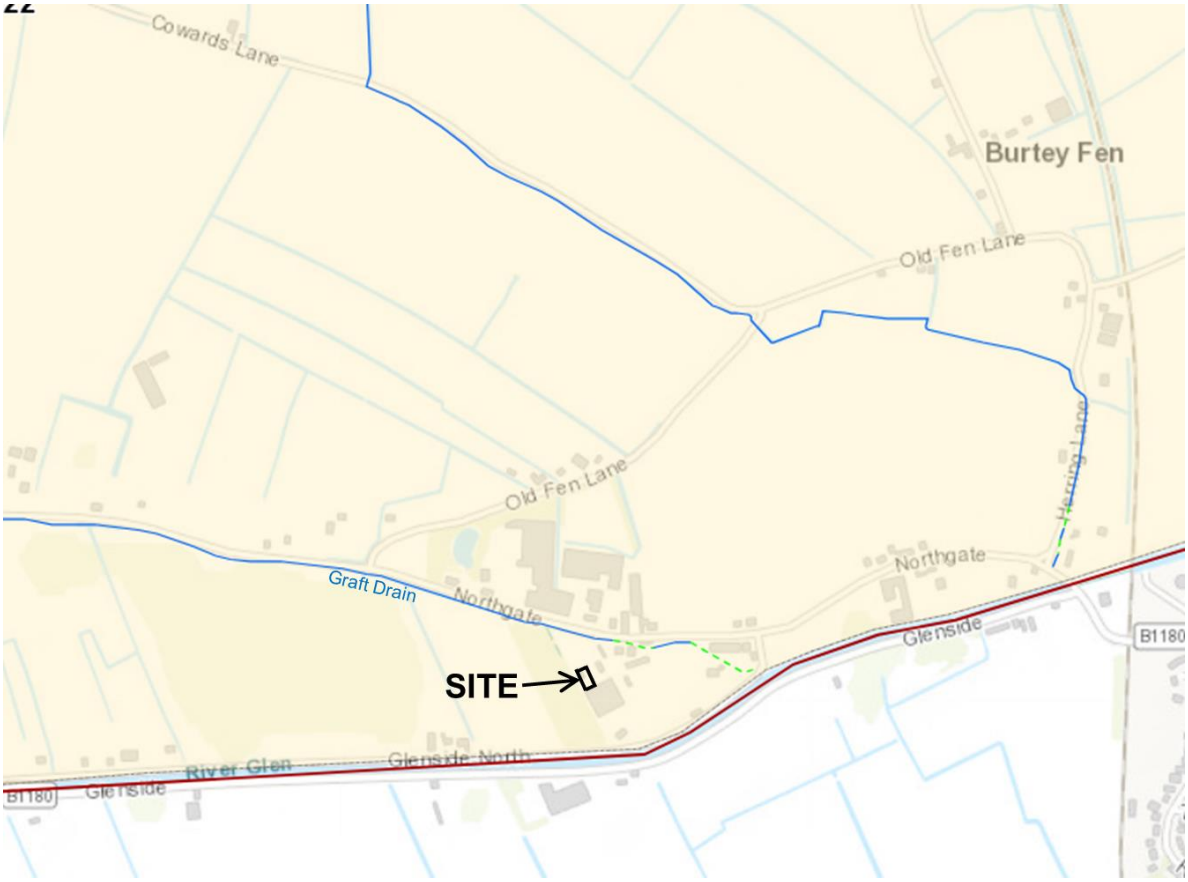
stuart.hemmings@btinternet.com

1st July 2025.

LOCATION PLAN



PLAN OF IDB DRAINS



BLOCK PLAN OF PROPOSED DEVELOPMENT



Environment Agency

Datasheet [Ref: CCN-2022-261149] **Model Name: Welland Catchment Strategic Model** **Model Date: 2016**

Fluvial Flood Levels (mODN)

The fluvial flood levels for the model nodes shown on the attached map are set out in the table below. They are measured in metres above Ordnance Datum Newlyn (mODN).

			Annual Exceedance Probability - Maximum Water Levels (mODN)											
Node Label	Easting	Northing	50% (1 in 2)	20% (1 in 5)	10% (1 in 10)	5% (1 in 20)	4% (1 in 25)	2% (1 in 50)	1.33% (1 in 75)	1% (1 in 100)	1% (1 in 100) inc 20% Climate Change	0.5% (1 in 200)	0.1% (1 in 1000)	0.1% (1 in 1000) inc 20% Climate Change
GLEN 6685	523603	326081	4.01	4.16	4.23	4.31	4.32	4.34	4.35	4.38	4.44	4.60	4.84	4.94
GLEN 6837	523459	326033	4.02	4.16	4.24	4.31	4.32	4.34	4.36	4.38	4.45	4.63	4.85	4.95
GLEN 6884	523414	326020	4.03	4.17	4.25	4.32	4.33	4.35	4.37	4.39	4.47	4.66	4.86	4.98
GLEN 7082	523224	325963	4.04	4.17	4.25	4.32	4.34	4.36	4.39	4.41	4.49	4.70	4.87	5.01
GLEN 7280	523035	325904	4.04	4.18	4.26	4.33	4.35	4.38	4.40	4.41	4.51	4.72	4.88	5.03

Fluvial Flood Flows (m^3/s)

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

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 more vulnerable development in flood zone 2 the central and higher central figure 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 SFRA predicts that there will be flooding to the proposed development site up to a depth of 500mm in a 1 in 100 year fluvial or 1 in 200 year tidal event in 2115. 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.

Therefore the small increase in the maximum level of tidal flooding will not change the conclusion of this flood risk assessment.

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 2 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.

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 25% and 35% in this river systems 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 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.

Black Sluice 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 Black Sluice 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 building, with the recommendation that the ground floor levels should be raised 150mm above the existing ground level, is considered satisfactory.