PROPOSED BARN DEVELOPMENT AT PANTON HOUSE BARN, HEDGEFIELD HURN, GOSBERTON, SPALDING, PE11 4JE.
FLOOD RISK ASSESSMENT



View of barn

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 development at Hedgefield Hurn, 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 purposes other than for which it was originally commissioned.

Introduction

This revised flood risk assessment has been written for the conversion of a barn called Panton House Barn at Hedgefield Hurn, Gosberton, Spalding, PE11 4JE. An application (reference no H08-0967-16) for planning permission to carry out the conversion was approved South Holland District Council on 9th December 2016. As the time limit for the development to commence is within 3 years then a new application, with an updated flood risk assessment is required.

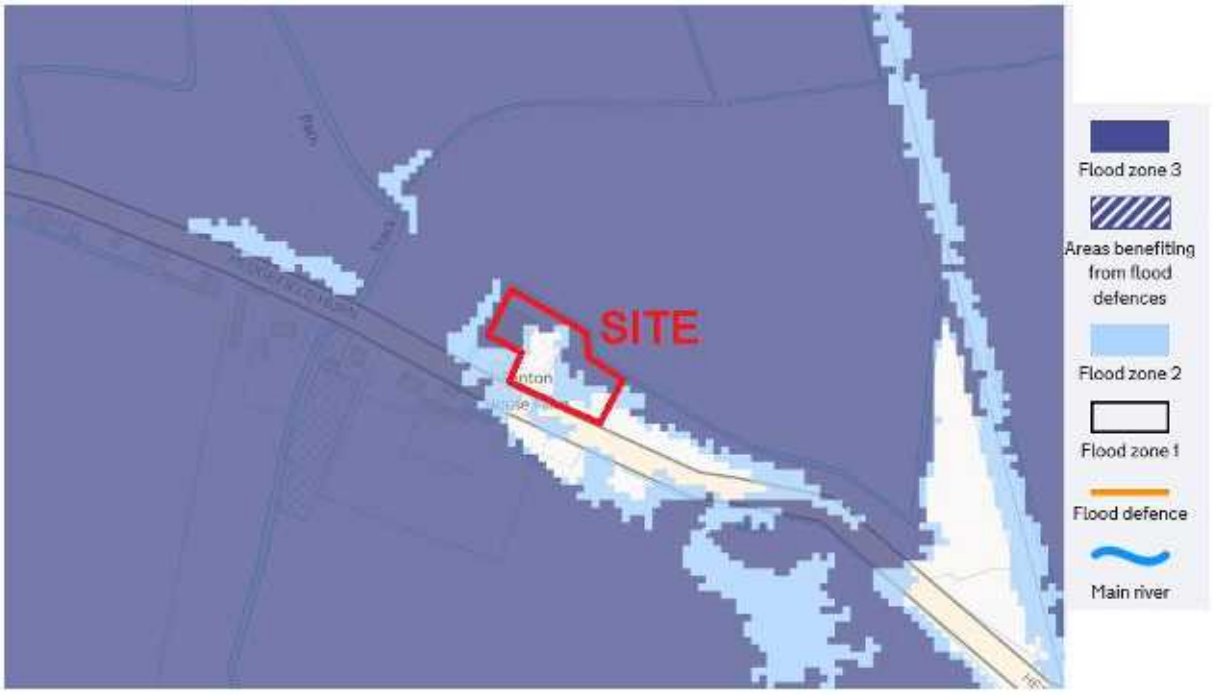
The previous flood risk assessment compiled by RM Assocoiates, and the planning approval specified that floor levels should be set no lower than 3.30m ODN.

As part of the site is within flood zone 3 the Planning Application therefore requires a Flood Risk Assessment to be carried out as required in the Planning Practice Guidance to the National Planning Policy Framework.

The site is shown within the defended area of 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 EA website and shows the flood zones in the area.



It can be seen that the southern part of the site is within flood zones 1 and 2 but parts of the north side of the site where the barn is located are within flood zone 3.

Application Site

The development is located 2.8 km west of the village of Gosberton and the National Grid Reference of the site is 522100 329610.

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 and is not in the functional flood plain the parts of the site within flood zone 3 can be designated 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, residential development is classified as “more vulnerable”. Reference to Table 3 (shown below) of the Guidance informs us that more vulnerable development is only satisfactory in Flood Zone 3(a) after the Sequential and Exception Test has been passed.

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 *	✗	✗	✗	✓*

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 refined 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.

Although part of the site is within flood zone 3, the area of the development can be seen to be slightly higher than the surrounding area on the map, which is all within flood zone 3. Therefore the flood risk is not as high as the surrounding area.

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.

The South Holland District Council Core Strategy allows for the redundant buildings such as these to be brought forward for conversion to residential use.

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

A Strategic Flood Risk Assessment (SFRA) was produced for the South Holland District Council (SHDC) in 2010. 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 actual flood risk and hazard at the site for the 1% fluvial event and 0.5% tidal 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 showing the residual flood risk and 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 area as follows for the 1% fluvial event and 0.5% tidal event:

For the present day	Depth of flooding …zero	
	Extent of flooding ..	Low or medium flood probability
	Hazard……..	None
	Peak Velocity ..	Nil
For the year 2115	Depth of flooding …zero	
	Extent of flooding ..	Low or medium flood probability
	Hazard…….	None
	Peak Velocity ..	Nil

Figure 16 of the general maps shows that the site is not within the rapid inundation zone.

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 River Glen outfall sluice, between chainage 15.0km and 16.1km.

	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

With an average defence crest level between 7.50 and 7.70 m OD, apart from one low recorded level of 7.30m OD, the minimum freeboards are as follows:

	2007	2055	2115
Peak 1 in 200 year freeboard	1510mm	1180mm	370mm
Peak 1 in 1,000 year freeboard	1180mm	850mm	40mm

Maximum flood level and bank levels in the South Forty Foot Drain

Maximum flood levels in the South Forty Foot drain south of Kingston Bridge at chainage 26.5 km are shown in the reports as follows:

	Present	2115 (20% climate change allowance)
1 in 100 year	3.37	3.41

The earth bank level is shown to be 4.91m OD at this location, however it is widely known that there are sections of the bank south of Kingston Bridge where levels are no higher than 3.00m OD

Maximum flood and bank levels in the River Glen

Maximum flood levels in the River Glen at chainage 10.2 km are shown in the reports as follows on the next page:

	Present	Including Climate Change
1 in 100 year	4.66	4.93
1 in 1,000 year	4.94	5.16

The defences west of the A151 bridge consist of earth banks with minimum levels of 5.70m OD and some higher levels of up to 6.20m OD.

Information from the Environment Agency

The Environment Agency has provided predicted flood levels for the River Glen. The levels quoted below are approximately 100 metres downstream of the road bridge at West Pinchbeck.

	2007	2115
Peak 1 in 100 year flood level	4.68m OD	5.23m OD
Peak 1 in 1,000 year flood level	4.96m OD	5.49m OD

The Environment Agency has provided the following predicted fluvial flood flows measured in cumecs for the River Glen at the same location.

	2007	2115
Peak 1 in 100 year flow	32.35	39.11
Peak 1 in 1,000 year flow	39.83	49.54

Information on Surface Water Flooding on Environment Agency Website

The following map shows areas around the site where there is a low risk of surface water flooding. The light blue areas indicate the low risk of up to 300mm of surface water flooding, and the darker blue areas indicate that between 300mm and 900mm of surface water flooding could occur.



It can be seen there no predicted risk of surface water flooding around the building.

Site levels

The levels around the barn vary between 2.91m and 3.17m ODN. Levels are higher towards the road at between 3.15m and 3.38m ODN and the level of the road is 3.10m ODN.

A plan showing all these levels is shown on page 10 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". The area is considered to be passive until such time that a flood greater than the defences can withstand occurs. The likelihood of flooding due to overtopping or failures of the defences to the River Welland is very low.

The site is approximately 6.0 km east of the South Forty Foot Drain, which is main river and maintained by the Environment Agency.

The site is approximately 4.0 km north of the River Glen, which is main river and maintained by the Environment Agency.

The site is approximately 5.7 km west of the tidal River Welland, which is main river and maintained by the Environment Agency.

Potential Sources of Flooding

The following sources of flooding have been identified:

1) Failure or overtopping of South Forty Foot Drain
2) Failure or overtopping of tidal defences of the River Welland
3) Failure or overtopping of the River Glen
4) Overtopping of IDB drainage systems.
5) Flooding from local surface water systems.

1) Failure or Overtopping of South Forty Foot Drain

The South Forty Foot Drain is located 6.0km 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. Therefore in practice the water level will not exceed 3.0m OD. in any event, and flooding will occur with overtopping of the banks of the Drain and the embanked highland watercourses that lead into the Drain from the west.

As the proposed ground floor level of the barn conversion is recommended to be 3.30m ODN then this source of flooding can be considered to be adequately mitigated.

2) Failure or overtopping of tidal defences of the River Welland

The tidal defences of the River Welland are approximately 5.7 km east of the development site. The SFRA does not predict that flood water from this source will extend as far as the site. The maps indicate that flood water could extend as far as the railway line between Gosberton and Risegate, which is 200 metres from the development site, but is unlikely to extend further westwards.

Therefore this source of flooding can be considered to be adequately mitigated.

3) Failure or overtopping of the River Glen

The River Glen is approximately 4.0 km south of the site. If a breach occurred in the bank in a 1 in 100 year event in 2115 flood water would flow northwards and flood low land around Northgate and Burtey Fen. The map in the SFRA showing flood depths in a 1 in 100 year residual event in 2115 indicates the flooding would extend into the low areas of land in Burtey Fen but the flood water would not extend to within 1.0km of the site.

Therefore the raising of the ground floor level to 3.30m OD will provide adequate mitigation against this risk.

4) Overtopping of IDB Systems

The nearest IDB drain is the Latham Lode Newbury which is 75 metres north west of the site. The dyke immediately north of the site flows into this drain. The drain then flows into the Duke of York Arm which flows north to the Risegate Eau on the north side of Risegate Road which is 600 metres north of the site.

This section of Risegate Eau flows in easterly direction and the water level in this drain is controlled at the outfall near Fosdyke Bridge with an outfall sluice and a pumping station, which is 10km east of the development site.

Risegate Eau provides drainage for the whole fen area of Gosberton and Quadring. For most situations the water is discharged into the tidal River Welland through the sluices at low tide. However in high flow situations after heavy rainfall the pumps need to be operated to control the water levels in the catchment.

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 site of the development is unlikely to flood. The normal water level in the Risegate Eau is 0.00m OD at the outfall, and the water level in this section of the drain is approximately 1.10m OD. The maximum design level in the Risegate Eau at Wargate Bridge, which is 2.0 km east of the development site is 1.05m OD and it is estimated that the water level in Risegate Eau at Carters Bridge could rise to as high as 2.50m OD in a 1 in 100 year event.

5) Flooding from local foul or surface water systems

It is assumed that the foul water from the proposed development will be discharged into a septic tank or a package treatment unit, or a similar system. As the proposed level of the ground floor will be raised above the ground level outside any malfunction of this or an accumulation of surface water around the building would not cause any flooding to the proposed dwellings.

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.

Probabilities and Trends of Flooding

The probability of this development flooding from Environment Agency main river is very low. However in an extreme event at this location water levels could rise quickly and residents would need to take refuge in the upper floors of the building.

Residual Risk – Extreme Events

The residual risk from extreme events is very low on this site.

There are no records of this area north of Hedgefield Hurn having been flooded in the last 60 years.

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 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 a spreadsheet on the South East Lincolnshire website.

As the development is in flood zone 3 and there is no flood hazard reference should be made to Category G8 which shows that the matrix reference for this category is “No Comment”.

Summary of Risk of Flooding to the Site

There are no records of the site ever having been flooded in the past.

The map in the SFRA (an extract of which is shown on the next page) indicates that no flooding is predicted to take place in a 1 in 100 year fluvial or a 1 in 200 year tidal residual event in 2115.



The mitigation of raising the floor level of the new buildings at least 300mm above the existing ground level is considered acceptable.

Conclusions

The proposed development is not in a functional flood plain as defined by PPS25.

The risk of the site flooding from any Environment Agency watercourse is very low.

The risk of flooding from IDB watercourses is also extremely low.

Recommendations

In any area where there is a risk of flooding, although the risk at this site is low, it is preferable to construct new residential buildings with two stories with all sleeping accommodation on the first floor, in order that the first floor can provide a safe refuge if any flooding were to occur. The proposals provide all of the sleeping accommodation on the first floor.

The ground floor level of the converted barn should be at least 300mm above the existing ground level, at a minimum level of 3.30m OD.

Occupiers of the properties should register with the Environment Agency's Floodline Warnings Direct Service to receive automated early warnings of potential flooding.

Although the risk of flooding is extremely low, if through any set of circumstances acting together any flooding did to begin to occur, this would happen very slowly and residents would have adequate time to evacuate the area and remain safe.

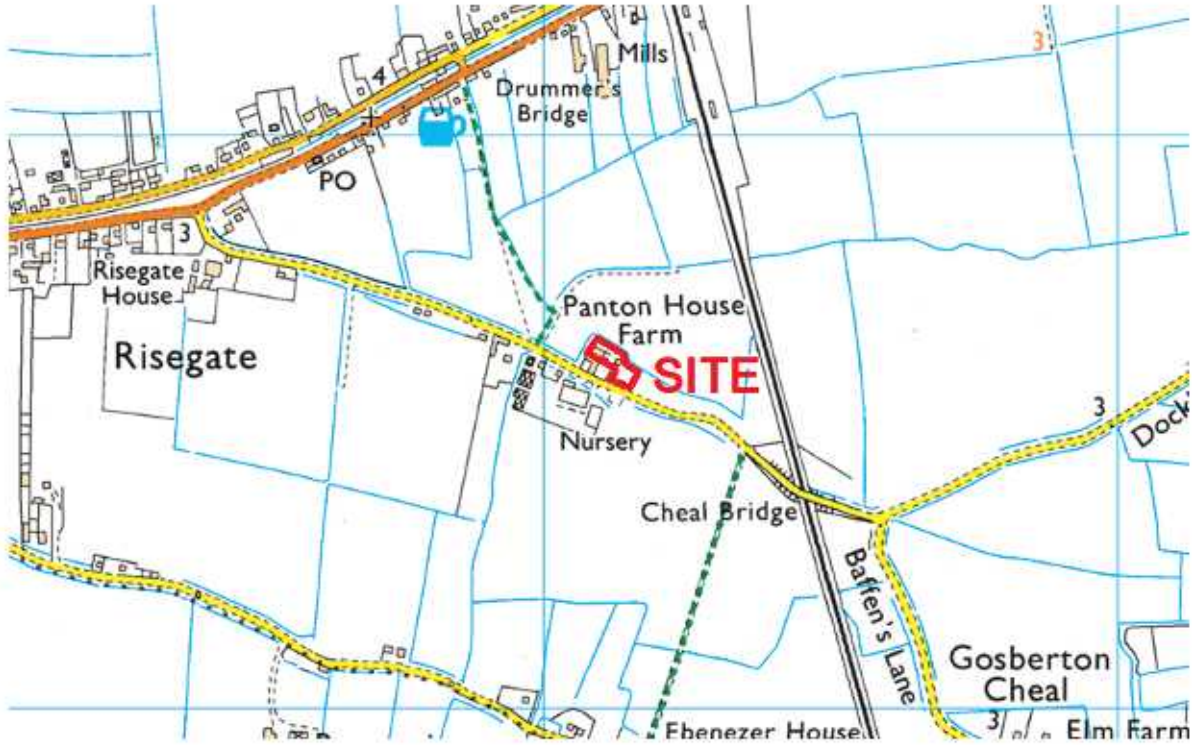
On site surface water drainage will be discharged into soakaways and these should be designed to BRE Digest 365 and approved under Building regulations.

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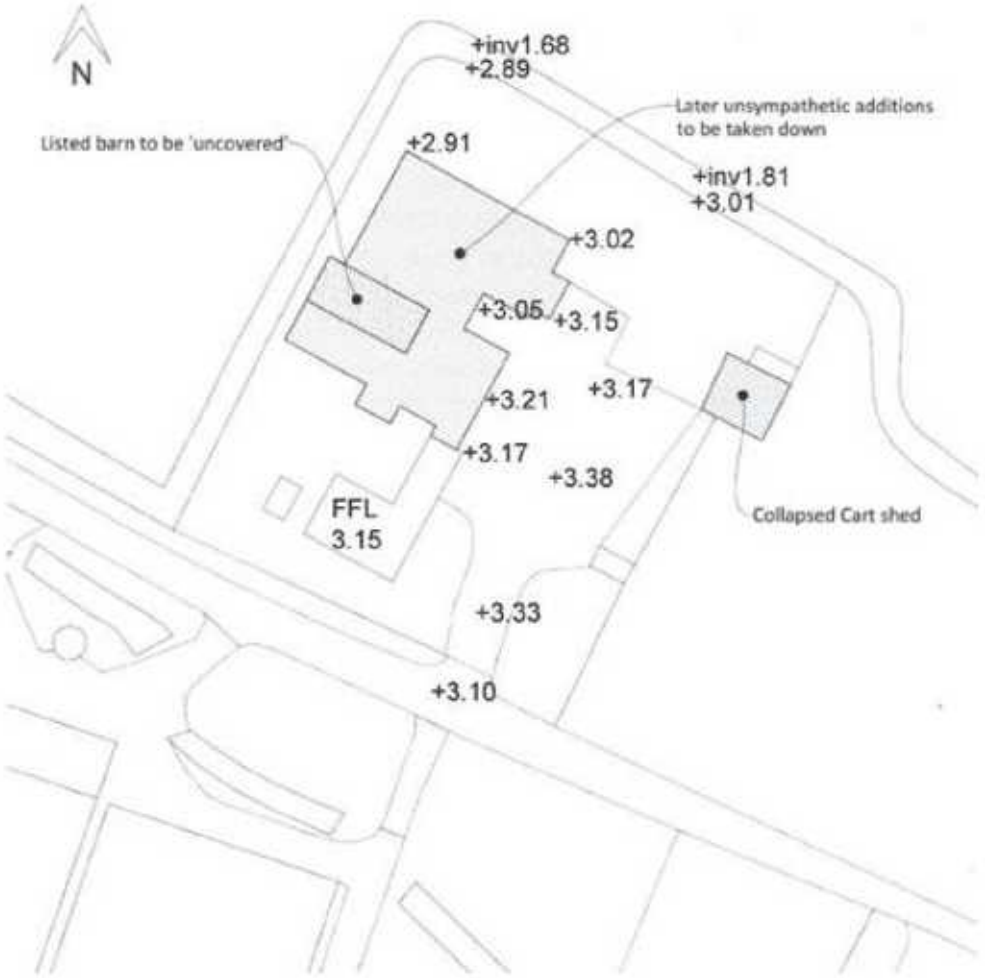
stuart.hemmings@btinternet.com

16th June 2020

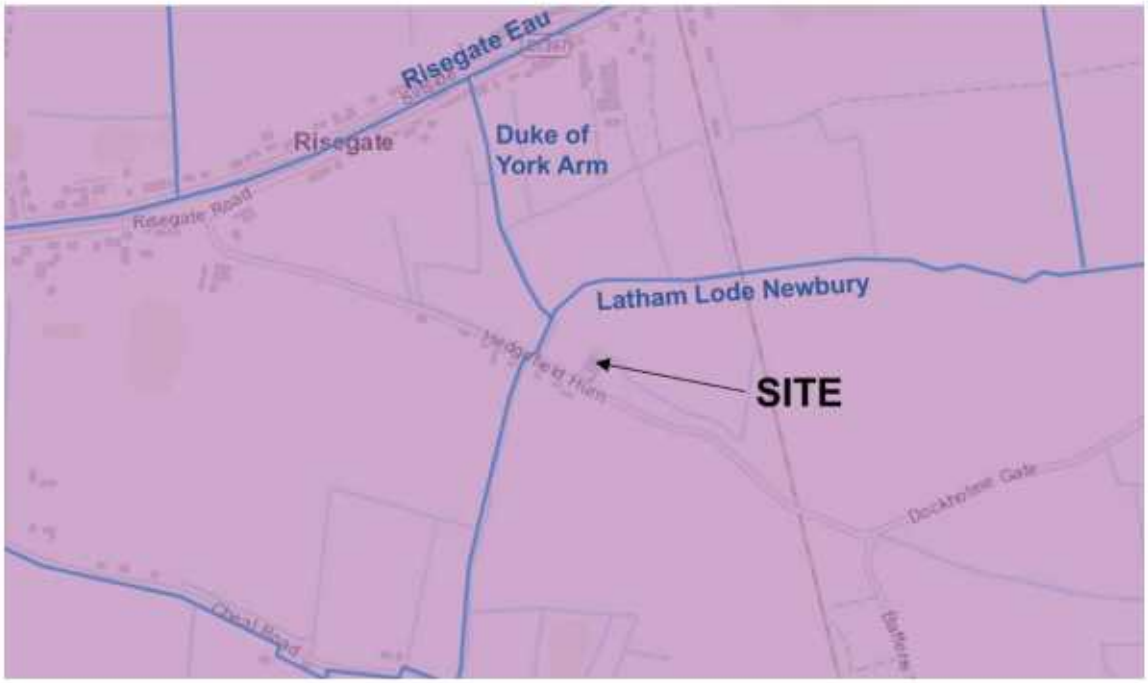
LOCATION PLAN



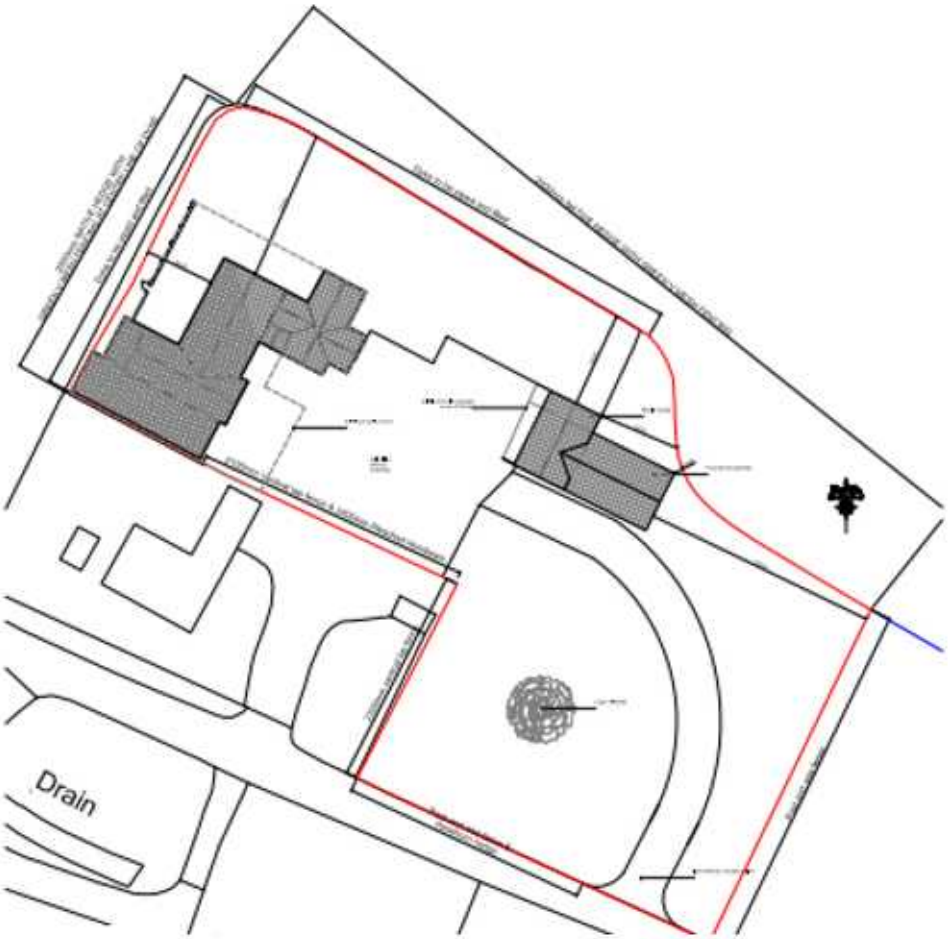
PLAN OF SITE LEVELS



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

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 3(a) the higher central and upper end should be used to assess the range of allowances.

Table 2 peak rainfall intensity allowance in small and urban catchments (use 1961 to 1990 baseline)

Applies across all of England	Total potential change anticipated for 2010 to 2039	Total potential change anticipated for 2040 to 2059	Total potential change anticipated for 2060 to 2115
Upper end	10%	20%	40%
Central	5%	10%	20%

Table 3 sea level allowance for each epoch in millimetres (mm) per year with cumulative sea level rise for each epoch in brackets (use 1990 baseline)

Area of England	1990 to 2025	2026 to 2050	2051 to 2080	2081 to 2115	Cumulative rise 1990 to 2115 / metres (m)
East, east midlands, London, south east	4 (140 mm)	8.5 (212.5 mm)	12 (360 mm)	15 (525 mm)	1.24 m

Table 4 offshore wind speed and extreme wave height allowance (use 1990 baseline)

Applies around all the English coast	1990 to 2050	2051 to 2115
Offshore wind speed allowance	+5%	+10%
Offshore wind speed sensitivity test	+10%	+10%
Extreme wave height allowance	+5%	+10%
Extreme wave height sensitivity test	+10%	+10%

Effects on Predictions of Flood Risk in FRA

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

1) Flooding from the tidal River Welland
2) Flooding from South Forty Foot Drain and River Glen
3) Flooding from IDB drainage system

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

Therefore it can be seen that the revised guidance increases the maximum allowance for sea rise in 2115 by 100mm. This will not have the effect of increasing the maximum flood levels in a 1 in 200 year breach event in 2115 by 100mm or the extent of the flooding. The largest increase in the flood depth will probably be between 10mm and 50mm, and this will be near to the location of the breach. Therefore this small increase will not affect the conclusions and recommendations in the report.

Fluvial Flooding from the River Glen or the South Forty Foot Drain(SFFD).

As the development is in flood zone 3 and is classed as more vulnerable, the upper end climate change allowance, which is 35%, should first 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.

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 35% will not significantly change the conclusion in the SFRA of what might happen if a breach occurred in the bank of the River Glen or the SFFD. If there are additional flows along this part of the River Glen, or the SFFD, it will lead to overtopping of banks in numerous places on both of these watercourses. This will prevent the water level rising significantly above the predicted levels for the present day and with 20% allowance for climate change.

The upper end allowance predicting a 65% increase in flows above the 1 in 100 year predicted flows now needs to be considered. This level of predicted river flows again will not lead to increased river levels as the river will be overtopping the banks in numerous places.

Effect on IDB Systems

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 any refurbishments adequate arrangements will be made to incorporate the latest climate change projections in order that Board continues to provide the same standard of service as the present day.

Therefore it is considered that the mitigation proposed for the development, with the recommendation that the floor levels should be at least 300mm above existing ground levels on the site is satisfactory.