PROPOSED CONVERSION OF A BARN TO RESIDENTIAL USE AT 182 MAIN ROAD, QUADRING, SPALDING, PE11 4PT.

FLOOD RISK ASSESSMENT



View of site from Main Road

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 conversion of the barn at 182 Main Road, Quadring. 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

An application is due to be made to South Holland District Council for planning permission to convert a barn into a residential building in the grounds of 182, Main Road, Quadring, Spalding, PE11 4PT.

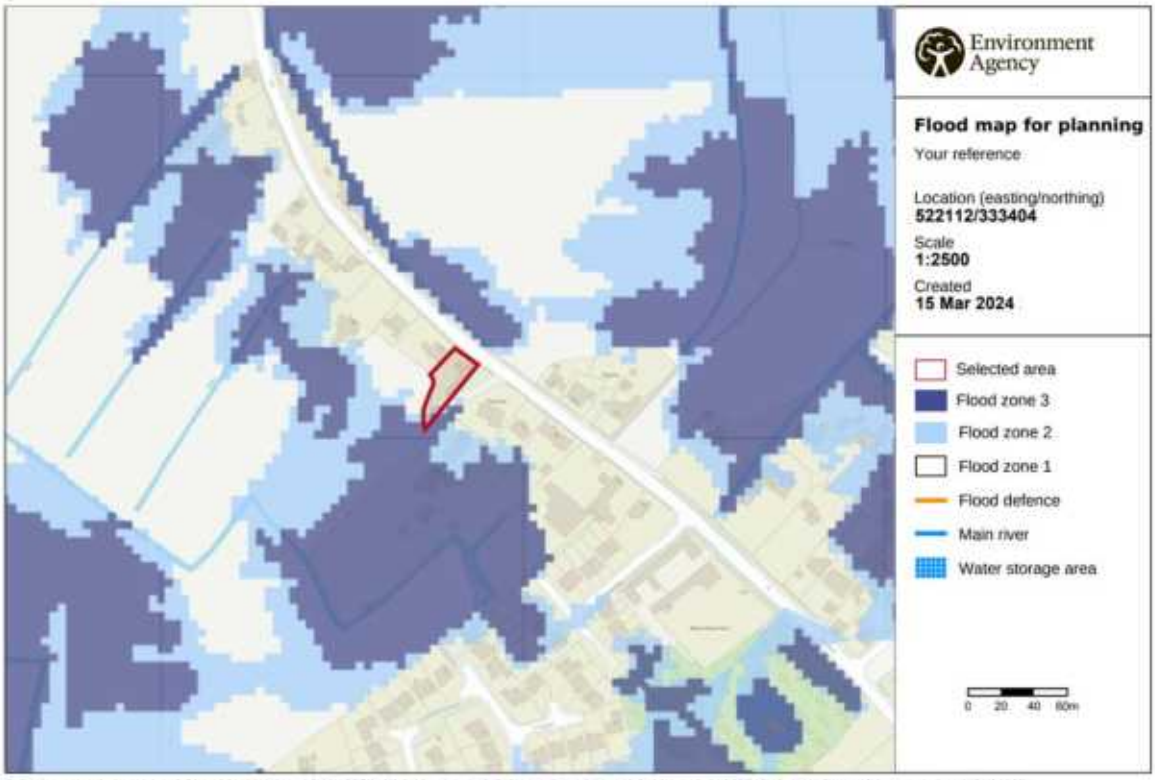
Most of the site and this existing building is within Flood Zone 1 as shown on the Environment Agency's Flood Zone Map. These maps do not take into account existing flood defences.

The Planning Authority have requested that a Flood Risk Assessment should 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 Environment agency website and shows the flood zones in this area.



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It can be seen that most of this site is within Flood Zone 1. The south western corner of the site is within flood zone 3.

Application Site

The development is located 1.0 km north west of the village of Quadring and the National Grid Reference of the site is 522110, 333405.

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 small part of the site that is within flood zone 3 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 †	X	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	X	X	X	✓*

Therefore it can be seen that for “More vulnerable” development in flood zone 3(a) 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 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.

A greater part of the site including the area where the barn is situated is within flood zone 1 with a very small area in the south western corner only in flood zone 3.

The site of this proposed development is within the village boundary and the South East Lincolnshire Local Plan adopted in March 2019 recognises in paragraph 5.3.5 that infill and speculative applications will come forward within the South Holland

District Council area. It states that there will be numerous opportunities for infill developments which it is not practical to identify, and the plan encourages these type of developments provided that the material considerations of the Local Plan and particular sites are met.

Policy 22 of the Local Plan states that replacement dwellings in the country side will be permitted provided that the building has not been abandoned or has become completely derelict, and the replacement building will be a high standard and on the same footprint as the existing building.

The safety of the development will be delivered by demonstrating that the ground floor level of the proposed building are above the predicted flood levels in 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 produced a Strategic Flood Risk Assessment (SFRA) for the South Holland District Council (SHDC) dated January 2010. This document provides details of the flood risk in the Council's area.

The maps in this report illustrate the following actual flood hazard 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 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 residual hazards are as follows for the 1% fluvial or 0.5% tidal event probability:

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 levels 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:

	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 map below shows the predicted depths of surface water flooding in this area of Quadring.



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 is no predicted risk of surface water flooding to this site.

Site levels

The level of Main Road north east of the proposed development site is 3.80m ODN. The existing ground floor level of the building is approximately 4.00m ODN.

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 7.4 km west of the tidal River Welland, which is main river and maintained by the Environment Agency.

The site is approximately 5.0 km east of the South Forty Foot Drain, which is main river and maintained by the Environment Agency.

The site is approximately 6.2 km north of the River Glen, which is main river and maintained by the Environment Agency.

The site is approximately 3.2 km north of the Risegate Eau, which is maintained by Welland and Deepings IDB.

Potential Sources of Flooding

The following sources of flooding have been identified:

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

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

The tidal defences of the River Welland are approximately 7.4 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 no flooding is predicted in the area between Gosberton and Donington in a 1 in 200 year event in 2115. The defence banks of the River Welland are considered adequate for the present day and up to 2115.

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

2) Failure or overtopping of the River Glen

The River Glen is approximately 6.2 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 towards Gosberton. The map in the SFRA showing flood depths in a 1 in 100 year residual event in 2115 indicates the flooding would not extend any further than Gosberton and the site would not be flooded in this event.

Therefore the proposed mitigation of raising the ground floor level to 4.10m ODN will provide adequate mitigation against this risk.

3) Failure or Overtopping of South Forty Foot Drain

The South Forty Foot Drain is located 5.0km 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.

As the proposed floor level will be approximately 4.1m ODN, which is 700mm higher than the maximum water level predicted in the South Forty Foot Drain, the risk of flooding from this source can be considered to be adequately mitigated.

4) Overtopping of IDB Systems

The dyke on the north east side of Main Road flows northwards to discharge into the Marlode Drain which is approximately 430 metres north of the site. This drain flows eastwards then southwards to discharge into the Risegate Eau.

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 approximately 10km east of the development site. Chesboule Lane is the boundary between Welland and Deepings and Black Sluice IDB areas.

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 ODN and therefore even if the pumps fail to operate for a considerable time during a rainfall event the building is unlikely to flood. The normal water level in the Risegate Eau is 0.00m OD at the outfall, and the water level in the drain south of the development site on 5th January was 1.13m ODN. The maximum design level in the Risegate Eau at Wargate Bridge, which is south of Gosberton, is 1.05m OD.

Therefore the mitigation of raising the ground floor level of the building to a level of approximately 4.10m ODN will provide adequate mitigation against this risk.

5) Surface Water Flooding

The Environment Agency map of surface water flood risk (see page 7 of this report) does not show any risk of flooding on the site.

Main Road north east of the site is adequately drained by road gullies on the north east of the road and it is presumed that these drain into the dyke which is located north east of the road.

The surface water from the building will be discharged into soakaways located on each individual plot. Soakaways are mostly acceptable for the disposal of roof drainage in the Quadring area.

Therefore this source of flooding is 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.

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 floor of the building.

Residual Risk – Extreme Events

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

There are no records of the area north of Quadring 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 15 to 18). It is concluded that no extra mitigation measures are necessary to comply with the new guidance on climate change.

South East Lincs Advice Matrix

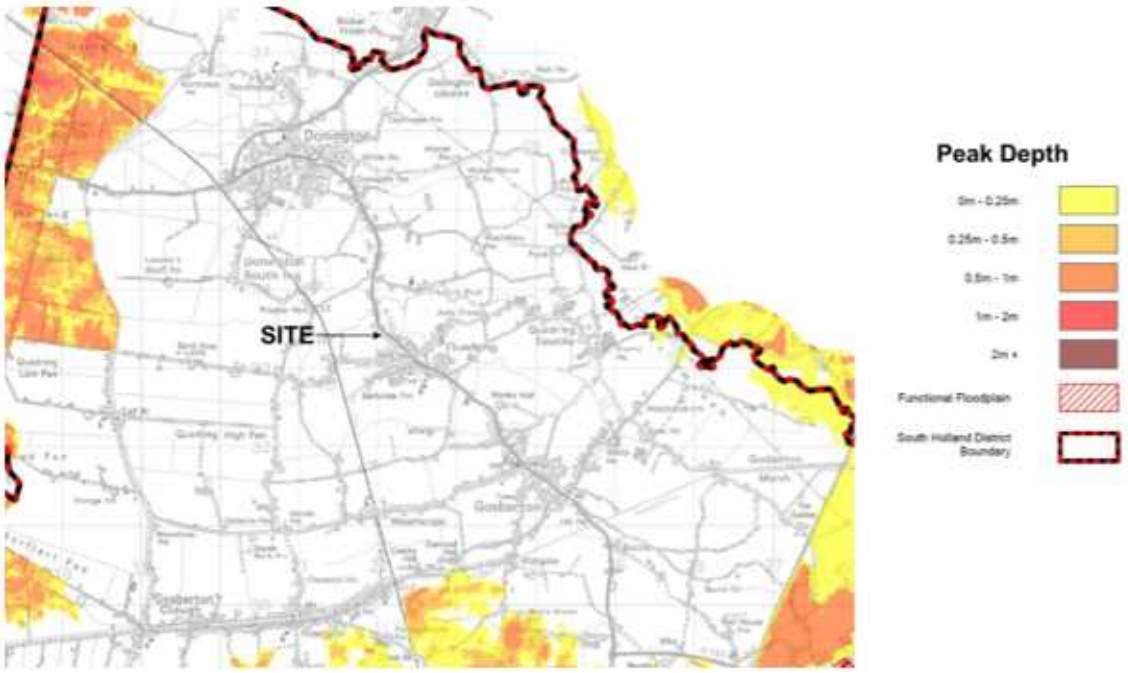
Advice can be found on the recommended mitigation required by referring to a spreadsheet on the South East Lincolnshire website.

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 below) 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 advice in the South East Lincolnshire Matrix states that the ground floor level of buildings with all sleeping accommodation on the first floor should be above the predicted 1 in 100 year fluvial and 1 in 200 year tidal flood levels in 2115.

Conclusions

The Environment Agency Flood Zone Map shows that at least 90% of the site is within flood zone 1 which indicates that the annual flood risk to the site is less than 0.1% (1 in 1000 years) from rivers and the sea.

The risk of tidal flooding in a 1 in 200 year event in 2115 is not predicted on the map shown on the South East Lincolnshire Planning website.

The risk of flooding from the River Glen in a 1 in 100 year event in 2115 is not predicted on the maps produced by the Environment Agency.

The maximum predicted flood level in the South Forty Foot Drain in a 1 in 100 year event in 2115 is 700mm below the proposed ground floor level of the building.

The proposed ground floor level of the building is at least 1.0 metre above any known maximum water levels in the nearby IDB watercourses.

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

Recommendations

In any area where there is a risk of flooding, although the risk at this site is low, it is preferable new and refurbished buildings with two stories should have all sleeping accommodation on the first floor, so that a safe refuge is provided if any flooding were to occur.

The ground floor level of the proposed refurbished property with all bedrooms on the first floor should be at least 200mm above the existing ground level on the site, which will be a minimum of 100mm above the existing floor level of the building.

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

If the existing guttering and downpipes on the building are replaced then the surface water from these should be discharged into soakaways and these should be designed to BRE Digest 365 and approved under Building regulations.

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2nd April 2024

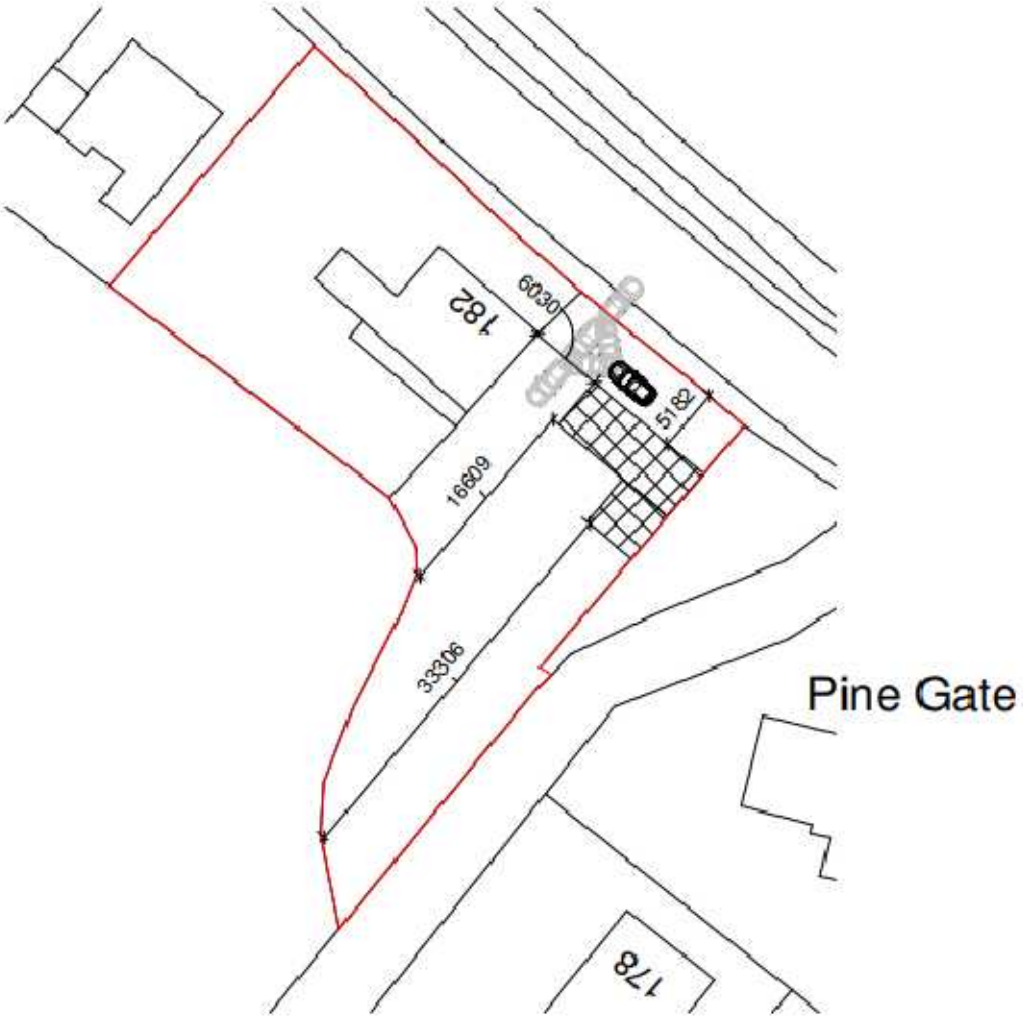
LOCATION PLAN



PLAN OF IDB DRAINAGE CHANNELS



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 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 higher central climate change allowance, which is 35%, should first be considered. After considering the effects of this increase the upper end, 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 level should be at least 200mm above existing ground levels on the site is satisfactory.