PROPOSED RESIDENTIAL DEVELOPMENT AT THE GREETINGS RESERVOIR ROAD, SURFLEET SEAS END, SPALDING, PE11 4DH

FLOOD RISK ASSESSMENT



View from east corner of site

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Peterborough,
PE2 9JD

This flood risk assessment has been prepared solely to support the planning application for a development at Reservoir Road, Surfleet Seas End. 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

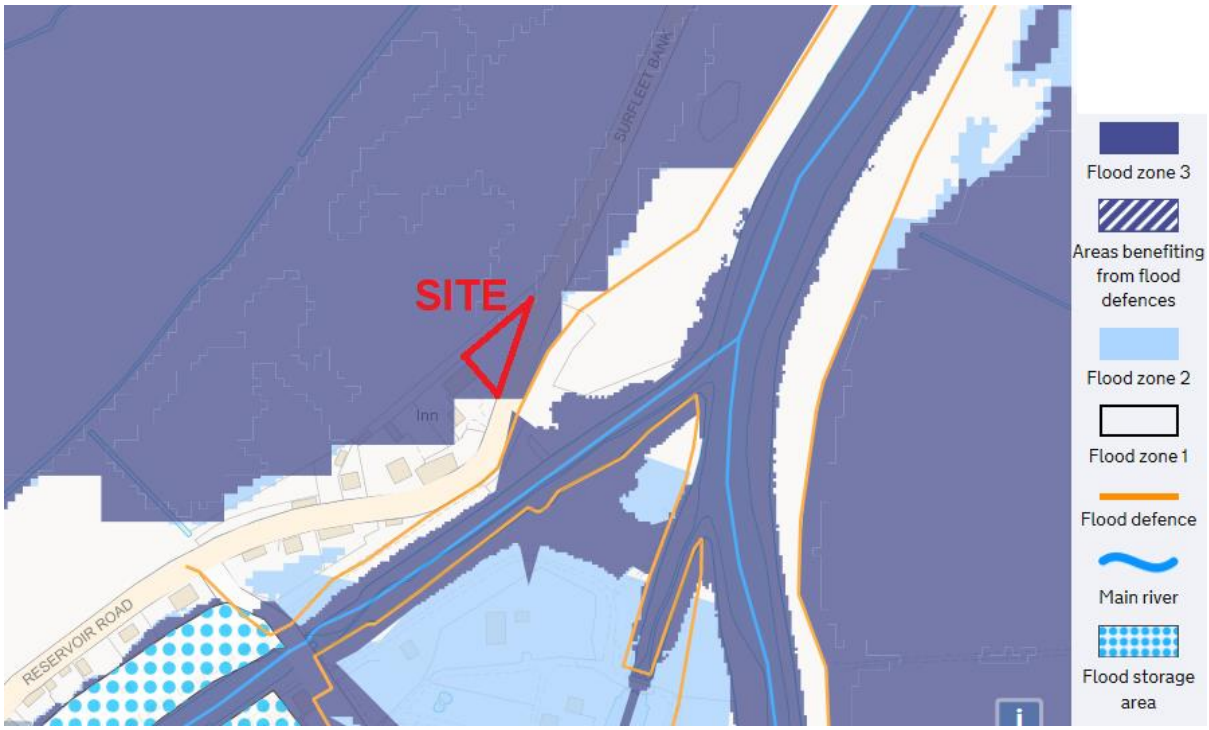
A planning application is due to be made to South Holland District Council for permission to carry out a residential development of two houses on land alongside the property called the Greetings on Reservoir Road in Surfleet Seas End which is 5 miles north of Spalding. The area is at present part of the large side garden to the property.

The site is within Flood Zone 3 as shown on the Environment Agency's Flood Zone Map. These 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 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 the area.



It can be seen that the site of the proposed development is in Flood Zone 3.

Application Site

The development is located at the eastern end of the village of Surfleet Seas End, and is located 40 metres from the short section of the tidal outfall of the River Glen that flows into the tidal River Welland. The National Grid Reference of the site is 528090 329430.

The location of the site is shown on the plan at the end of this document.

Applying the flood risk vulnerability classification in Table 2 of the Guidance, a development consisting of dwelling houses 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 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 all of this area north of the River Glen and west of the River Welland is in flood zone 3. Therefore it would be difficult to find a similar site for development that is in flood zone 1 or 2.

The safety of this development will be delivered by ensuring that the ground floor levels of the proposed dwellings are above the predicted flood levels for this area.

The South Holland District Council Core Strategy states that there is a limited number of sites outside the town of Spalding available for residential development. The site of this development can be considered a an ideal level site within the village boundary in Surfleet. There is a requirement for further land to be brought forward and used for

residential development to enable the Council to meet the RSS and Structure Plan requirement for 2021.

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 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
	Velocity ……. Nil
For year 2115	Depth of flooding … 0 – 500mm
	Extent of flooding .. High
	Peak Velocity …… Greater than 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 …….	Less than 0.75
	Velocity ……..	0 – 0.3m/sec
For the year 2115	Depth of flooding ….	0 – 250mm
	Extent of flooding …	High
	Hazard ……	Less than 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 or in 2115. The SFRA has the following note about this zone.

4.10 Rapid Inundation Zone

As part of the assessment, a rapid inundation zone has been delineated behind all the raised defences. The zone represents the area within which flood water could reach a depth of 0.3m in 30 minutes or less from the onset of flooding. In effect this zone is an area where it may be particularly difficult for people to escape from a flood if they have not had prior warning to do so.

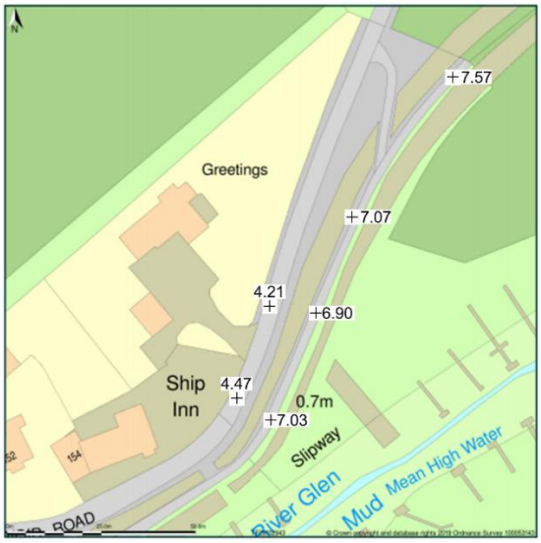
The rapid inundation zone is provided additional to other information on flood depth, flood flow velocity and the likely spread of flood waters with time during an emergency event.

Maximum flood level and bank levels in the River Welland

The maximum levels in this tidal section of the River Glen outfall and the tidal River Welland near the site are as follows:

	2007	2115
Peak 1 in 200 year level	5.99m OD	7.13m OD
Peak 1 in 1000 year level	6.32m OD	7.46m OD

Levels have been taken along the top of the bank east of the site and these are shown below:



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 approximately 40 metres km from the bank of the tidal part of the River Glen where it outfalls into the River Welland, which is maintained by the Environment Agency.

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

Existing Ground Levels

A topographical study has been carried out and the relevant levels have been shown on the plan of the site which has been reproduced on page 12 of this report. The topographical study will be submitted with the planning application.

The level of the site where the two houses will be sited varies between 3.90m and 4.00m OD. The level of the tarmac area south of the existing bungalow is 4.48m OD and the floor level of the existing bungalow (The Greetings) is 4.80m OD.

The road level in front of the existing access is 4.29m OD and the road level is lower at the north end of the site at 3.95m OD. It can be seen that the road level rises in front of the car park to the Ship Inn.

Potential Sources of Flooding

The potential sources of flooding to the site are:-

1. Failure or overtopping of tidal defences of the River Glen or Welland.
2. High water levels in IDB drainage channels.
3. Localised flooding due to failure of highway drainage

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

The site is immediately west of the bank of the River Glen which is tidal at this location. The River Glen flows into the tidal River Welland 150 metres north of the site. The hazard from a breach in the bank of either the tidal River Glen or the tidal River Welland will be considered to be the major risk to the site. The Environment Agency maps state that the predicted flood depth in a 1 in 200 year event in 2115 would be between 0 and 250mm. These maps have been produced by simulating breaches at certain locations along the western bank of the River Welland, but it would seem that no breaches have been simulated along the tidal section of the River Glen.

The risk of a breach developing in this bank can be considered extremely low, as the bank is in good condition as can be seen on the photograph shown below, and is only required to hold back a high tide in extreme conditions, as the lower bank level on the river side is approximately 5.00m OD.



The lowest level of this bank is 6.90m OD and the general level of the bank in front of the Greetings is just above 7.00m OD. It can be seen that the bank level increases to 7.59m OD nearer to the River Welland, and this is the general level of the west bank of the River Welland.

The predicted 1 in 200 year level at this location in the tidal river is 5.99m OD, and with 20% climate change this predicted level in 2115 is 7.13m OD. The mapping assumes no attempt is made to immediately repair the breach. It is also likely that the EA will undertake further bank raising within the next 100 years to ensure that there is a continuing 1 in 200 year defence along the south bank of the tidal River Welland.

Therefore the bank is unlikely to be overtopped at the present time, but in 100 years time there is a risk of overtopping in a 1 in 100 year event. This scenario can lead to scouring of the back of the bank which may eventually lead to a breach forming. If this breach were to develop to the full height of the bank then the flood depth across the development site could be around 1.0 metres deep, if the breach were to occur with a river level of 7.13m OD.

Adequate mitigation could be provided by raising the floor levels of the proposed houses and by the residents evacuating the premises if the Environment Agency predicted a very high tide.

2. **High Water Levels in IDB drains**

Although the whole of this area is below high tide level in the Wash and the River Welland, the retained water levels in the drainage channels ensure that the risk of flooding is extremely low. Welland and Deepings IDB maintains a system of sluices, pumping stations, and drainage channels which convey surface water into the Rivers Welland and control water levels throughout the Welland and Deepings IDB area.

The water level in drainage channels north of the development site is controlled by Surfleet Marsh Pumping Station which is 2.0 km east of the development site. The Welland and Deepings IDB have advised that the pumping range at this pumping

station is from 1.38m OD down to 1.05m OD, and the design maximum flood level is 1.20m OD.

The channels maintained by Welland and Deepings IDB in urban areas are classified as high priority watercourses and as such receive a higher maintenance priority.

There are possibilities of failure of outfall sluices, but these are mitigated by the high level of maintenance given to these structures by the IDB. If a failure did occur the IDB would immediately be warned of the problem by their telemetry system and take action to repair the fault or to bring in temporary pumps to reduce the risk of any flooding in the area. Similarly any failures of culverts or other blockages would be dealt with immediately.

IDB systems are designed to provide a freeboard of between 600mm and 1000mm to all land in a 1 in 10 year return period rainfall event. This normally provides a standard of service of between 1 in 50 years and 1 in 100 years against flooding. In an extreme event water levels will rise but this will be a slow process and it would be at least 24 hours before levels were high enough to begin to flood low land in the area.

Therefore the risk of flooding from IDB drainage channels can be considered to be extremely low, as the existing level of the site is approximately 3.0 metres above the normal water levels in the IDB drains.

3. **Localised Flooding due to failure of highway drainage**

There is a risk that excess surface water from Reservoir Road could flow onto the site. The installation of a satisfactory system of surface water disposal on the site, and the raising of ground floor levels above the level of Reservoir Road will provide adequate mitigation against this source of flooding.

Extent of known Flooding

During the preparation of this assessment, no evidence was discovered of the site or any of the adjoining properties having been flooded in the past.

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 tidal defences.

The risk of this happening in this case is low.

Climate Change

The predictions of flood depths for this flood risk assessment use information provided by the Environment Agency which was produced in 2006. The EA have issued new guidance on recommended contingency allowances for predicted sea level rises,

fluvial flows and rainfall intensities which from 19th February 2016 needs to be considered in the FRA. The effects of these new recommendations are considered in Appendix A of this report (pages 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 the hazard is low (0 – 0.75), reference should be made to Category F8 which shows that the matrix reference for this category is "appropriate Mitigation" which is:

The NPPF requires that proposals are accompanied by a Flood Risk assessment which contains evidence that appropriate mitigation measures and flood resilience techniques have been incorporated into the development.

Please refer to the following document for information on flood resilience and resistance techniques to be included "Improving Flood Performance of New Buildings – Flood Resilient Construction" (DCLG 2007)

FFL must be set 300mm above ground level for two storey proposals. Single storey proposals must set FFL's above the 0.1% event breach depth

Summary of Risk of Flooding to the Site

The main risk of flooding to the site is if a breach were to occur in the north bank of the tidal River Glen outfall into the River Welland. The risk of this happening along this section of bank can be considered to be extremely low. The bank has a wide top and bank slopes are not steep.

The relevant part of the Environment Agency map showing the predicted peak depths in this area if a breach occurred in the south bank of the River Welland in 2115 in a 0.5% tidal event probability is shown below.



The map predicts that there could be up to 250mm of flooding on this site in a 1 in 200 year event in 2115.

The map only predicts a general depth if a breach occurred in a length of west bank of the River Welland. If a breach were to occur in the bank opposite the site then it could lead to flood depths of up to approximately 1000mm in 2115. However the risk of this happening is extremely low.

The risk of flooding from IDB drains can be considered very low. The proposed floor level of 4.50m OD is higher than much of the land in the area which will flood to a depth of at least 1000mm before the house is affected, and this would prevent the level of any flood water from this source from rising above 4.00m OD. If the pumping stations were to fail then the IDB have adequate arrangements to operate pumps with alternative motive power, or to bring in mobile pumps.

Recommendations

In any area at risk of flooding it is recommended that the new dwellings should be of two story construction with all bedrooms at first floor level. This will provide a refuge for residents if the building becomes flooded after a major breach of the tidal bank, and ensure there is no danger to residents when they are asleep.

It is proposed that the ground floor level of the proposed houses should be raised to a minimum level of 4.50m OD.

Flood resilient construction should be incorporated to a minimum height of 300mm above the predicted flood level, and all of the electrical installation should be a similar height above finished floor level.

Occupiers of the property should register with the Environment Agency's Floodline Warnings Direct Service.

Occupiers of the properties should evacuate the buildings if an extremely high tide is predicted.

Surface water from the roofs of the proposed properties should be discharged into soakaways and these should be designed to BRE Digest 365 and approved under Building regulations.

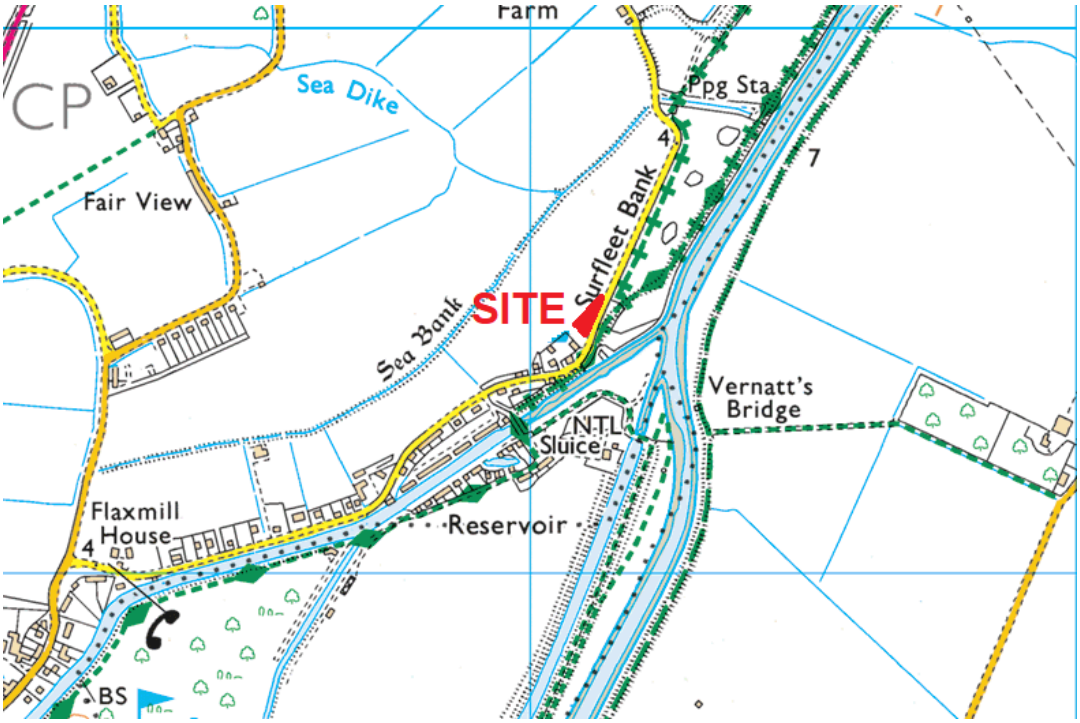
All future owners and occupiers of the new dwellings should be given a copy of the Flood Risk Assessment so that they are fully aware of the risk of flooding in this area.

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4th March 2019

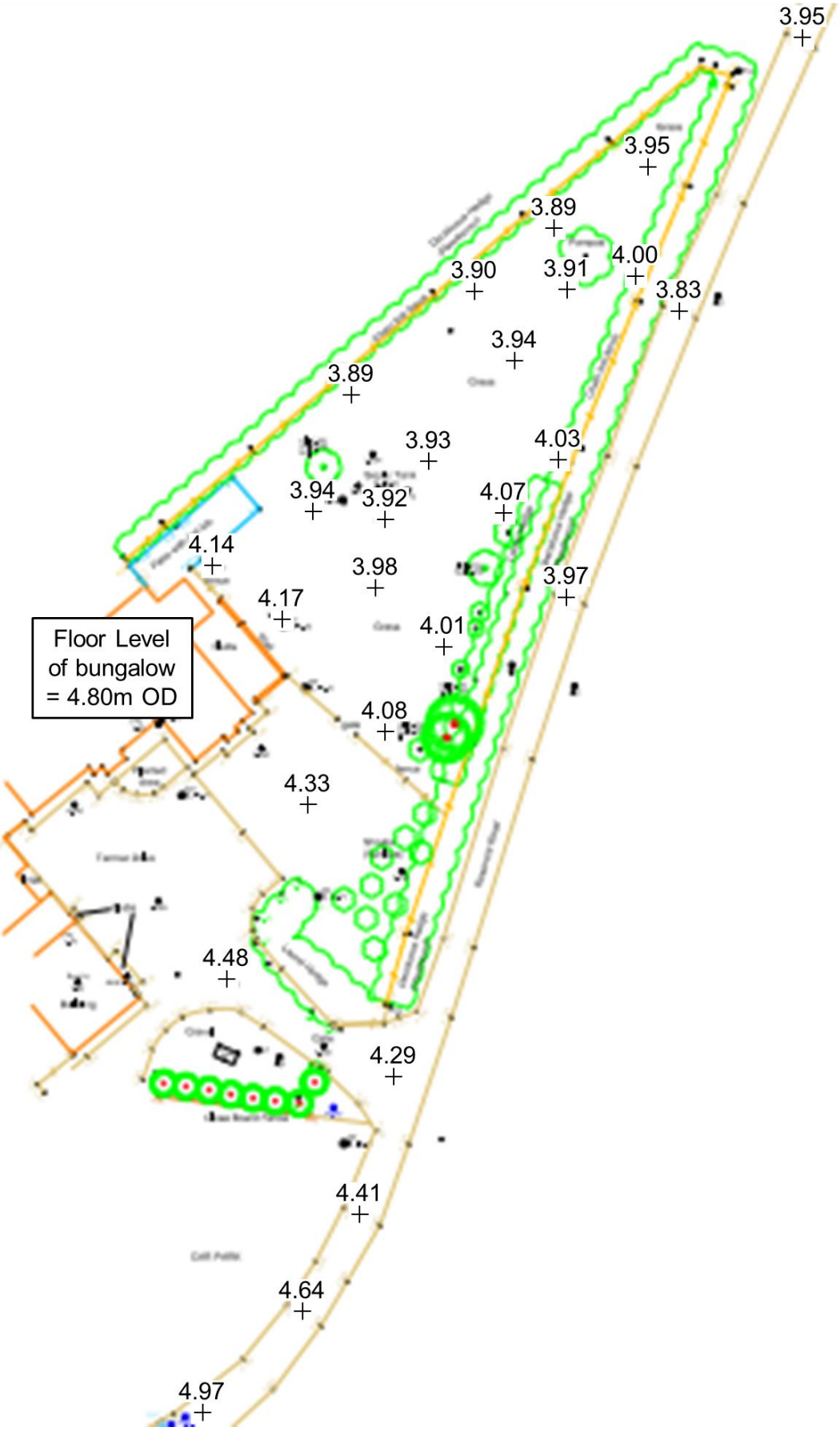
LOCATION PLAN



PLAN OF IDB DRAINS



PLAN SHOWING SITE LEVELS



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 higher central and central percentages should be used to assess the range of allowances.

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

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

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

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

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

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

Effects on Predictions of Flood Risk in FRA

The FRA has identified the main source of flooding where the new climate change recommendations could affect the predictions of flood levels in 2115 at the development site is 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 predicted flood level at the site in a 1 in 200 year breach event in 2115 by the maximum of 100mm, but it will probably be only between 10mm and 50mm. It is unlikely that this increase will significantly change the maps of flood risk at present issued by the Environment Agency.

Flooding from IDB drainage system

As the development is in flood zone 3 and is classed as more vulnerable, the advice from the Environment Agency is that the higher central climate change allowance, which is 35%, should be first considered. After considering the effects of this increase the upper end allowance, which is 65%, should be considered to assess the effect of this.

IDB's have been using an allowance of 20% for climate change over the past few years in their assessments and modelling of their systems. Generally IDB's are happy that their systems provide a 1 in 100 year standard to most urban areas at the present time.

Welland and Deepings IDB, and all IDB's, are aware that climate change will affect the operations of pumping stations, sluices and drainage channels. Pumping stations and sluices only have a 30 year life and will need to be refurbished or rebuilt within this timespan. It is assumed that Welland and Deepings IDB will continue to review the modelling they have already carried out and when the Board consider these refurbishments adequate arrangements will be made to incorporate the latest climate change projections in order that the Board continues to provide the same standard of service as the present day.

Therefore it is considered that the mitigation proposed for the development, with the recommendation that the floor levels should be raised to a minimum level of 4.50m OD, is satisfactory.