PROPOSED RESIDENTIAL DEVELOPMENT AT 20, GOSBERTON ROAD, SURFLEET, SPALDING, PE11 4AB
FLOOD RISK ASSESSMENT

View looking from rear of site

S M Hemmings B Sc C Eng MICE MIWEM,

69 Charlotte Way

Peterborough

PE39ER

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

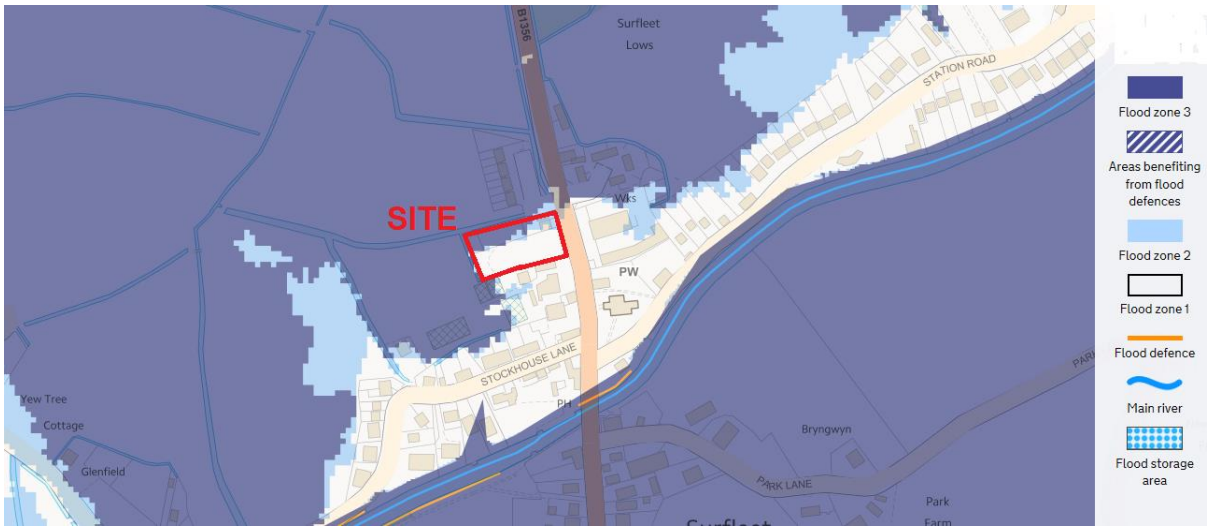
A residential development is proposed on a site at 20, Gosberton Road, Surfleet, Spalding. The southern part of the site, which is at present a car and lorry parking area, is higher than the northern part of the site, which is the house and the rear garden of 20 Gosberton Road. The house will be demolished as part of the development.

The southern half of the site is within Flood Zone 1 and the garden at the rear of the house is in flood zone 3. The flood zone maps do not take into account existing flood defences.

The Planning Application requires a flood risk assessment to be carried out as specified in the Practice Guidance to the National Planning Policy Framework Development and Flood Risk. The site is within a defended area as specified on the South Holland District Council's Strategic Flood Risk Assessment (SHDC SFRA) map and is located in the Welland and Deepings Internal Drainage Board District.

Environment Agency (EA) Flood Zones

The map below is taken from the Environment agency website and shows the flood zones in this area.



It can be seen that all of the southern part of the site is in Flood Zone 1, the house is in flood zone 2 and the garden is within flood zone 3.

Application Site

The site is located 3.6 km from the tidal section of the River Welland. The National Grid Reference of the site is 525040 328290.

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 northern half of proposed development site can be defined as being within Flood Zone 3(a) as detailed on the Environment

Agency's flood zone maps without defences, as defined in Table 1 of the Technical Guidance.

Applying the flood risk vulnerability classification in Table 2 of the Guidance, a residential development is classified as "more vulnerable".

Table 3 of the Guidance is shown below:

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	Exception Test required †	✗	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	✗	✗	✗	✓*

From the table above 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 much of the area north of the River Glen in Surfleet is within flood zone 3(a). The village itself is higher and therefore in flood zones 1 and 2. Therefore it would be difficult to find a similar site for development that is in a lower flood zone, as only part of the site is within flood zone 3(a) and the remaining part of the site is within flood zone 1.

The safety of the development will be delivered by ensuring the floor level of the proposed new dwelling is above the predicted residual flood levels for this area.

The Design and Access statement will confirm that the proposed development is in accordance with the relevant South Holland District Council Core Strategy policies.

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) in 2010 for the South Holland District Council (SHDC). The residual flood maps in the SFRA were updated early in 2017. This document provides details of the flood risk in the Council's area. Reference to the maps in this document give the following information for the flood risk and hazard at the site for the 1% fluvial event and 0.5% tidal event.

The maps illustrate the actual flood hazard which is as follows:

For the present day	Depth of flooding … zero
	Extent of flooding .. Low or medium flood probability
	Peak Velocity ……. Nil
For year 2115	Depth of flooding … 0 – 500mm
	Extent of flooding….high
	Peak Velocity …… 0 – 0.1 m/sec

The maps also illustrate the residual flood hazard as shown on the updated maps available on the South East Lincolnshire website as follows:-

For the present day	Depth of flooding …	zero
	Extent of flooding ..	Low or medium flood probability
	Hazard ……..	zero
	Peak Velocity ..	Nil
For the year 2115	Depth of flooding …	0 – 250mm
	Extent of flooding ..	High
	Hazard ……	Low hazard (less than 0.75)
	Peak Velocity ..	0 – 0.3 m/sec

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

Tables in the SFRA show the following details for the predicted flood levels in the River Glen at chainage 3.8 km.

	2007	2115
Peak 1 in 100 year flood level	4.25m OD	4.65m OD
Peak 1 in 1,000 year flood level	4.38m OD	4.68m OD

The bank levels on this section vary between 4.33m OD and 5.3m OD on this length of the River Glen. Therefore it can be seen there is a risk of overtopping of some of the lower lengths of bank of the River Glen overtopping in the 1 in 100 year event in 2115.

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.

	2007	2115
Peak 1 in 100 year flood level	4.25m OD	5.09m OD
Peak 1 in 1,000 year flood level	4.38m OD	5.23m OD

The predicted flood levels for 2115 seem to have been computed ignoring any effect of overtopping that will occur between Bourne and the outfall once the river levels rise above 4.80m OD.

Existing Ground Levels

The site of the proposed development at present consists of a parking area on the southern half of the site and a house and garden on the northern half of the site. The house is due to be demolished as part of the development.

The southern part of the site has presumably been raised in level at some time in the past. Gosberton Road is at levels of between 3.80m and 4.10m OD on the east side of this part of the site, and the parking area is at levels between 4.10m and 4.30m OD.

The house on the northern part of the site has a floor level of approximately 3.70m OD, with surrounding paved areas and garden at a level of 3.50m OD. The long rear garden behind the house which is laid down to grass slopes down westwards from 3.40m OD to below 3.00m OD at the north western corner.

Gosberton Road slopes down northwards from 4.15m OD on the south to 3.60m OD adjacent to the northern boundary of the house.

A topographical study has been carried out which will be submitted with the planning application.

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

The site is located approximately 3.6 km west of the tidal section of the River Welland, which has a tidal defence bank which is maintained by the Environment Agency.

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

Potential Sources of Flooding

The potential sources of flooding to the site are:-

1. Overtopping or breach in the River Glen.
2. Failure or overtopping of tidal defences of the River Welland.
3. Flooding from watercourses maintained by Welland and Deeepings IDB
4. Flooding due to excess surface water run off from the development.

1. **Failure or overtopping of the banks of the River Glen**

The site is located 130 metres north of the River Glen.

The SFRA gives predicted levels for the River Glen of 4.65m OD and 4.68m OD for the 1 in 100 year and 1 in 1000 year events in 2115. However the Environment Agency advise that the levels will be much higher at 5.09 and 5.23m OD for the 1 in 100 year and 1 in 1000 year events in 2115.

The levels of the earth bank on the north side of the River Glen between chainage 3.5km and 4.0 km, which is directly south of the development site are shown below:

Chainage (km)	3.5	3.6	3.7	3.8	3.9	4.0
Bank level (m OD)	4.71	4.40	4.89	4.33	4.59	5.14

The level of the earth bank directly south of the site has been estimated at 4.80m OD. And vary between 4.60m OD and 5.1m OD. Therefore it would seem very unlikely that maximum levels in the River Glen could actually rise to the levels above 5.00m OD predicted by the EA.

Peak water levels occur in the River Glen when the outfall into the tidal River Welland is tide locked. During this time the levels in the River Welland are higher than levels in the River Glen, even when the latter levels are very high. This closes the large timber doors at the sluices and prevents discharge from the River Glen into the River Welland for approximately 3 to 4 hours. Immediately upstream of the sluices is an area called Surfleet Reservoir where the area between the banks is much wider where excess water is stored.

The updated map for Surfleet showing the 1 in 200 year residual flood depths in 2115 indicate the only flooding to the site will be in the north western corner of the site, and this will be depths of up to 250mm. An extract from this map is shown on page 9 of this report.

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

The west bank of the tidal River Welland, which is approximately 3.6 km east of the site, has at least a 1 in 200 year standard of protection. It is possible that flood water from a breach in the River Welland north of the outfall sluice could flow westwards and may just affect the site, but it is more likely to affect lower land north of Surfleet.

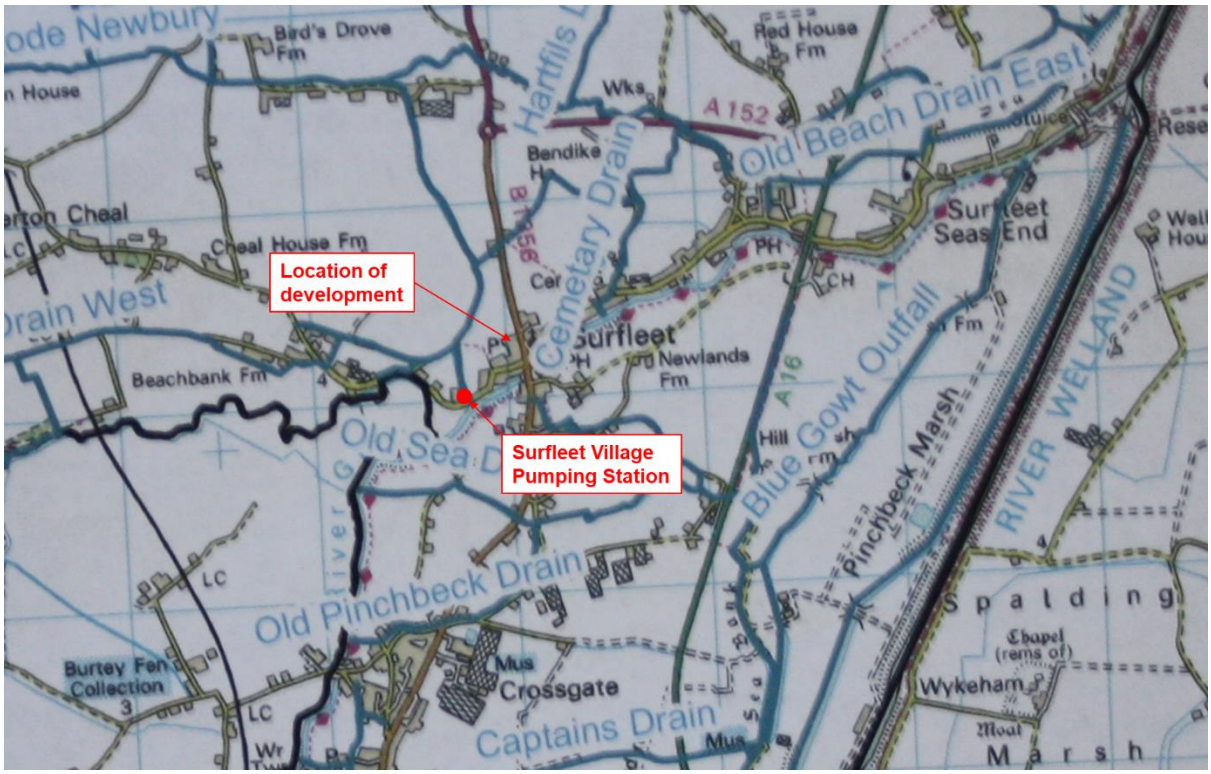
The SFRA does not predict any residual flooding in the area of Gosberton in a 1 in 200 year event in 2115.

From the information available in the SFRA the level of risk to this site in Surfleet is satisfactory for the residential development proposed.

3. **Flooding from IDB watercourses**

The water level in the IDB Drain approximately 100 metres west of the development is controlled by Surfleet Village Pumping Station which is located north of Stockhouse Lane. The water level in the drain early in July was 1.7m OD. Welland and Deepings

IDB have advised that the pumping range at this pumping station is from 1.80m OD down to 1.50m OD, and the design maximum flood level is approximately 2.00m OD.



Therefore as the proposed ground floor levels will be above 3.00m OD the flood risk from IDB drains and pumping stations is adequately mitigated.

4. **<u>Flooding due to excess surface water run off from the development</u>**

There is a risk that surface water could flow off Gosberton Road and along with surface water from area of the development this could accumulate in lower areas of the development.

Mitigation will be provided by ensuring that a suitable surface water drainage system is designed with if necessary attenuation and a discharge is made into the IDB drainage system, subject to the approval of Welland and Deepings IDB.

<u>Extent of known Flooding</u>

During the preparation of this assessment, no evidence was discovered of the site or any of the adjoining properties being flooded.

<u>Probabilities and Trends of Flooding</u>

The probability of this development flooding from Environment Agency main river is very low. In an extreme event any effect on this location would not be sudden and there would be time for residents to take precautionary measures to limit the impact of any flooding that may occur.

Residual Risk – Extreme Events

The residual risk from extreme events is very low on this site. The major risk to the site is from a breach or overtopping of the tidal defences

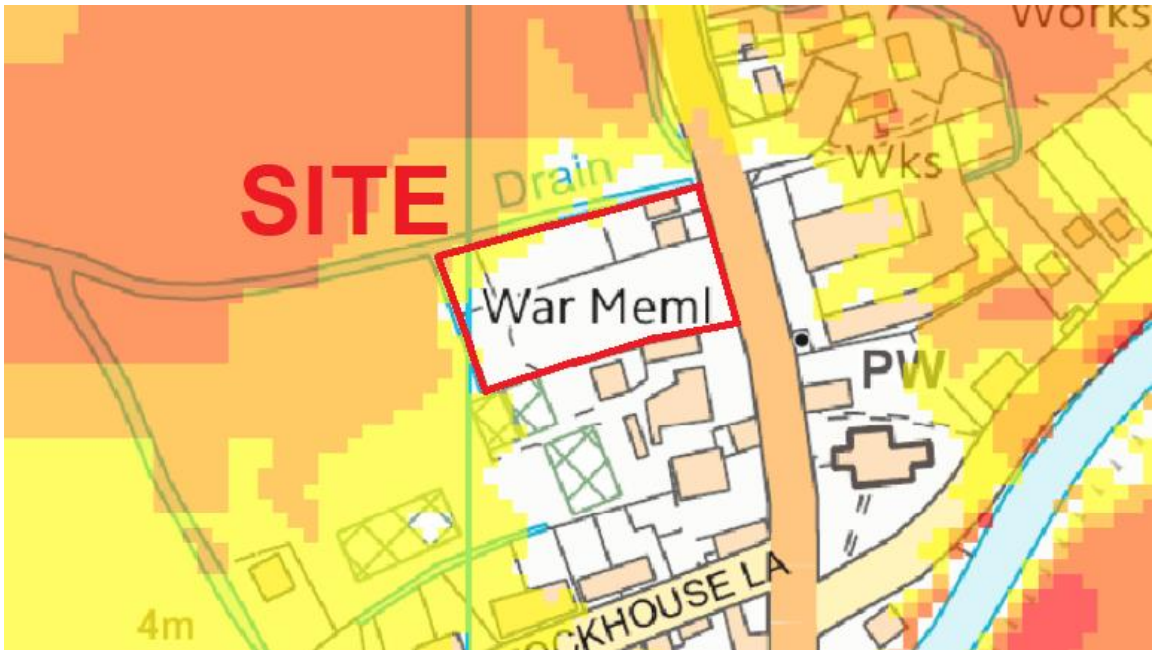
The risk of this happening in this case is low and the hazard from any flooding is also low.

Climate Change

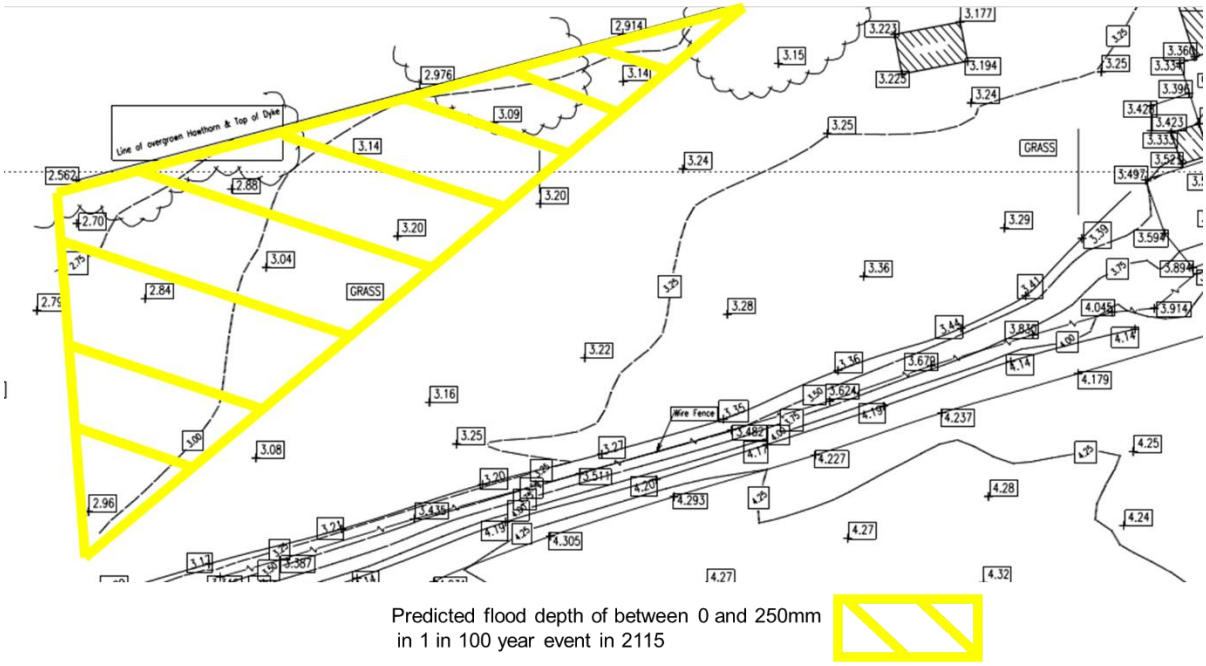
The recommendations for flood depths for this flood risk assessment use information mostly taken from the South Holland DC SFRA which was last updated in 2010. The EA have issued new guidance on recommended contingency allowances for predicted sea rises, fluvial flows and rainfall intensities which from 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.

Summary of Risk of Flooding to the Site

The map in the updated SFRA (shown below) indicates the residual peak depth for the 1% (1 in 100 year) event probability in 2115 and shows the extent of the flooding in this area, which is the result of a breach or overtopping of the River Glen which is approximately 130 metres south of the site.



The area shown yellow across the north western corner of the site indicates that the flood depth in this area is between zero and 250mm in depth. This area is superimposed onto the levels of this corner in the topographical study and the result is shown on the plan below.



From this we can see that the maximum predicted flood level for the 1% (1 in 100 year) event probability in 2115 is approximately 3.20m OD.

Conclusions

The updated maps in the SFRA predict a maximum flood depth of 250mm on this site in a 1 in 100 year fluvial event or a 1 in 200 year tidal event in 2115.

The site is 3.6km from the tidal defences of the River Welland and therefore the risk of flooding if a bank breached in a 1 in 200 year event in 2115 is extremely low.

The risk of flooding if a breach or overtopping were to occur in the north bank of the River Glen south of the site, is presumed to be the highest risk to the site of the development.

The risk of flooding from IDB drains can be considered low, because the minimum recommended floor level of the proposed dwellings is at least 1.3 metres above the maximum predicted level in the Pump drain which leads to Surfleet Village Pumping Station.

If Surfleet Village Pumping Station were to fail then the IDB have adequate arrangements to operate pumps with alternative motive power, or to bring in mobile pumps. Welland and Deepings IDB have advised that the 1 in 100 year predicted level at this pumping station is unlikely to exceed 2.00m OD in a 1 in 100 year event. It can be assumed that the IDB will continue to monitor predicted water levels in the drain and carry out improvements to the system over the next 100 years to retain the present standard.

As only the north western area of the site is in flood zone 3, the raising of floor levels in the north west corner of the site will adequate mitigate the risk.

Recommendations

In any area at risk of flooding it is preferable that new dwellings should be of two story construction with all bedrooms at first floor level. This is to provide a refuge for residents if the building becomes flooded in the unlikely event of flood water from a serious failure of the bank of the River Welland or the River Glen reaching the site and ensure there is no danger to residents when they are asleep.

The ground floor level of the proposed houses should be at a minimum level of 3.30m OD. As the ground levels on the southern part of the site are at least 4.00m OD it is presumed that the developer will raise the levels on the north side of the site to above 3.30m OD.

The surface water from the roofs of the proposed buildings and the roads should be discharged into a surface water system that will be designed with oversized pipework to provide attenuation. This should be discharged at a low rate into either:-

a) The IDB piped drainage system west of the site subject to the agreement of the Welland and Deepings IDB.

b) The highway drainage system in Gosberton Road, subject to the agreement of Lincolnshire County Council and Anglian Water.

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

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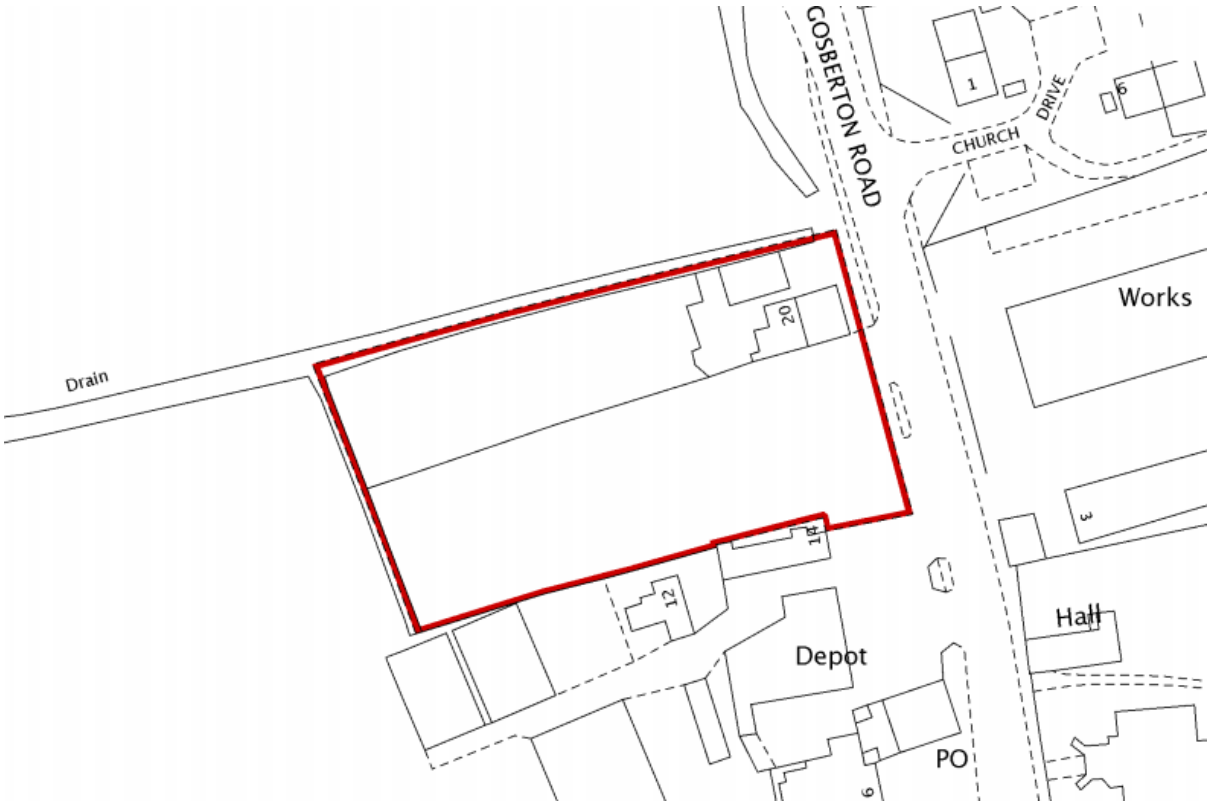
24th August 2017

LOCATION PLAN

PLAN OF SITE



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%	

has been withdrawn (19

Revised 2016 EA Guidance

Table 1 peak river flow allowances by river basin district (use 1961 to 1990 baseline)

River basin district	Allowance category	Total potential change anticipated for '2020s' (2015 to 39)	Total potential change anticipated for '2050s' (2040 to 2069)	Total potential change anticipated for '2080s' (2070 to 2115)
Anglian	Upper end	25%	35%	65%
	Higher central	15%	20%	35%
	Central	10%	15%	25%

For more vulnerable development in flood zone 3(a) the higher central and upper end should be used to assess the range of allowances.

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

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

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

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

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

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

Effects on Predictions of Flood Risk in FRA

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 IDB systems.

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

The updated SFRA predicts maximum flood depths of 250mm in the north western corner of the site in a 1 in 200 year event in 2115. The risk of flooding from the tidal River Welland is extremely low due to the reasons set out on page 7 of this report.

An increase of 100mm in maximum tidal levels is only likely to increase the maximum flood depths by around 10mm at the location of the development site, and is unlikely to significantly change the predicted flood depths indicated on the maps in the SFRA.

The precaution of recommending that the proposed houses should have a minimum ground floor level of 3.30m OD and should still ensure that the risk of flooding is extremely low in a 1 in 200 year event in 2115.

2) Flooding from the River Glen

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. If there are additional flows along this part of the River Glen it will lead to additional overtopping over lower banks rather than any significant increase in levels in the river.

The upper end allowance predicting a 65% increase in flows above the 1 in 100 year predicted flows now needs to be considered. The River Glen is an embanked watercourse between Spalding and Bourne. It is unlikely that there will be any significant increase in the water level in the River. Therefore the consequence will not be significantly different to the maps produced in the SFRA.

3) Flooding from 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 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 a minimum level of 3.30m OD is satisfactory.