

PROPOSED RESIDENTIAL DEVELOPMENT AT LOW GATE
GOSBERTON, PE11 4NL
FLOOD RISK ASSESSMENT



View of site looking south from Low Gate

S M Hemmings B Sc C Eng MICE MIWEM,
13 Lea Gardens
Peterborough
PE3 6BY

This flood risk assessment has been prepared solely to support the planning application for a development at Low Gate, 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, of if it is used for any other purposes other than for which it was originally commissioned.

Introduction

A residential development is proposed on a site north and west of Low Gate and east of York Gardens in the village of Gosberton. The site is located on the north east side of Gosberton and the land is at present an agricultural field.

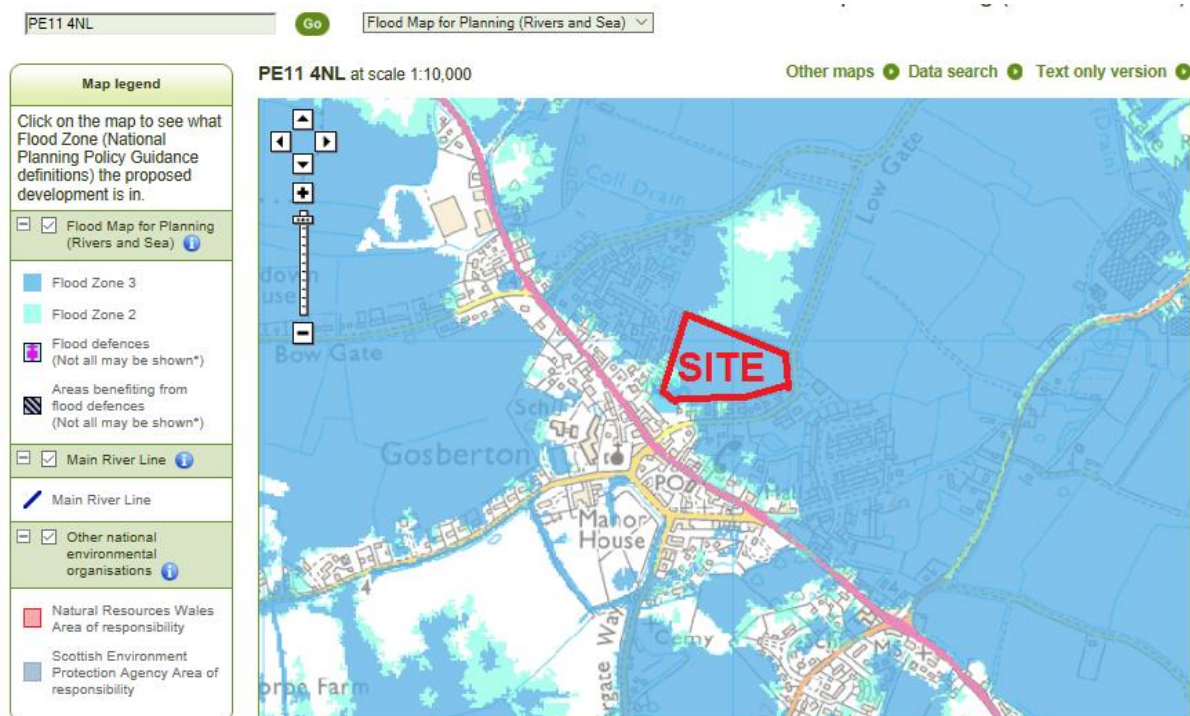
An outline planning application (reference no H08-1154-16) was approved for this development on 6th February 2018 by South Holland District Council. A new planning application now needs to be submitted to the Council for this site and this report is a revised flood risk assessment based on the original report dated 22nd September 2016.

The site is within Flood Zone 3 as shown on the Environment Agency's Flood Zone map. The flood zone maps do not take into account existing flood defences.

The Planning Application requires a flood risk assessment to be carried out as specified in the Practice Guidance to the National Planning Policy Framework Development and Flood Risk. The site is within a defended area as specified on the South Holland District Council's Strategic Flood Risk Assessment (SHDC SFRA) map and is located in the 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 a greater part of the site is in Flood Zone 3, with a very small area along the western boundary within flood zone 2.

Application Site

The site is located 5.1 km from the tidal section of the River Welland. The National Grid Reference of the site is 523975 331975.

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 proposed development 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:

<u>Flood Zones</u>	<u>Flood Risk Vulnerability Classification</u>				
	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	✓*

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 east of Gosberton 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.

The site is a designated site for development in the South East Lincolnshire Local Plan adopted by South Holland District Council in March 2019 (site reference Gos001). This document considered all of the planning issues, including flood risk, and therefore the site can now be considered to pass the sequential test.

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

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

For 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 for the 1% fluvial or 0.5% tidal event probability are as follows:-

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

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 2016 Welland Glen Catchment Model. The predicted flood levels for the 1 in 100 year and 1 in 1000 year scenarios are tabulated below.

	2007	2115
Peak 1 in 100 year flood level	4.25m OD	4.78m OD
Peak 1 in 1,000 year flood level	4.36m OD	4.82m OD

The Environment Agency has provided a map showing the predicted flood extents in an area south of Donington and north of Surfleet. There is a small area between Gosberton Cheal and Surfleet Seas End where flooding is predicted in a 1 in 1000 year event with climate change. There is no predicted flooding in any scenario within 5km of the village of Gosberton. This map is reproduced on page 14 of this report.

Information on Surface Water Flooding on Environment Agency Website

The map below shows the predicted depths of surface water flooding in this area of Gosberton. 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 a predicted risk of surface water flooding mainly in the centre of the site. Reference to the topographical study shows a small area of lower land coinciding with the area shown on the above plan. The risk of surface water flooding will be adequately mitigated by raising ground floor level of the proposed dwellings

and the design and construction of an adequate surface water drainage system for the site.

Existing Ground Levels

A topographical survey has been carried out and the plan with levels of the site will be included as part of the planning application. A plan with a summary of the levels is shown on page 11 of this report.

Land levels are highest in the south western corner of the site where levels are approximately 3.30m OD. Land levels are lower in the north western corner where the average level is 3.00m OD. The centre of the site is at approximately the same level (3.00m OD) although levels are lower on the northern boundary adjacent to the dyke. The site generally slopes to the eastern end where land levels are approximately 2.55m OD. The road at the eastern end of the site (Low Gate) is at a level of approximately 2.75m OD which is higher than the levels on the eastern side of the site.

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 5.1 km from the tidal section of the River Welland, which has a tidal defence bank which is maintained by the Environment Agency.

The site is located 3.8 km north of the River Glen 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. Failure or overtopping of tidal defences of the River Welland.
2. Overtopping or breach in the River Glen.
3. Flooding from watercourses maintained by Welland and Deepings IDB
4. Flooding due to excess surface water run off from the development.

1. Failure or overtopping of tidal defences

The east bank of the tidal River Welland, which is approximately 5.1 km south east of the site, has at least a 1 in 200 year standard of protection. It is extremely unlikely that flood water from a breach in the west bank of the River Welland south of the outfall sluice from the River Glen would cause flooding to the development site. The higher land and old sea banks, as well as Vernatt's Drain, would prevent flood water reaching the new A16. It is possible that flood water from a breach in the River Welland north

of the outfall sluice could flow westwards but it is unlikely to extend as far as the site in Gosberton.

The map provided by the Environment Agency does not predict any residual flooding in the area of Gosberton in a 1 in 200 year event in 2115.

From the information provided by the Environment Agency the risk of flooding from this source to this part of Gosberton can be considered to be adequately mitigated.

2. Failure or overtopping of the banks of the River Glen

The Environment Agency have provided predicted maximum levels for the River Glen of 4.78m OD and 4.82m 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 to be 4.80m OD and vary between 4.60m OD and 5.1m OD.

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.

If flood water flowed northwards from a breach in the north bank of the River Glen, it would be intercepted by the Risegate Eau Drain before it reached the southern side of Gosberton. Therefore even in an event greater than 1 in 1000 years in 2115 flood water from this source is extremely unlikely to affect the proposed development site, and the risk of flooding from this source to this part of Gosberton can be considered to be adequately mitigated.

3. Flooding from IDB watercourses

This area on the eastern side of Gosberton village is drained by an IDB drain which flows in a northerly direction and is located on the western side of the field immediately north of the site. This drain discharges into the IDB drain alongside the road which flows in a easterly direction and discharges 1 km east of the site into the Risegate Eau.

Risegate Eau provides drainage for the whole fen area of Gosberton and Quadring. The water level in Risegate Eau is controlled at the outfall near Fosdyke Bridge with an outfall sluice and a pumping station. 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 proposed house at Boston Road site would be unlikely to flood. The normal water level in the Risegate Eau is 0.00m OD at the outfall. The maximum design level in the Risegate Eau at Wargate Bridge, which is 1.5km south west of the centre of Gosberton, is 1.05m OD which is 2.2 metres below the recommended ground floor level of the proposed house.

Therefore the risk of flooding from the main IDB system can be discounted.

4. Flooding due to excess surface water run off from the development

There is a risk with a site that slopes away from the outfall that after very heavy rainfall excess surface water could flow to the lowest area of the development and start to flood lower properties on the eastern part of the site. An adequate drainage system will be designed and constructed which will provide adequate mitigation against flooding from this source.

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. 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 predicted flood levels and depths in this flood risk assessment use information mostly taken from studies and maps that use the climate change allowances used prior to 2016. The EA issued new guidance on the 19th February 2016 on recommended contingency allowances for predicted sea rises, fluvial flows and rainfall intensities which need to be considered in this 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 G9 which gives the following standing advice for this development.

The Environment Agency requires direct consultation on proposals in this hazard zone. The NPPF requires that proposals are accompanied by a Flood Risk Assessment which contains evidence that appropriate mitigation measures / flood resilience techniques have been incorporated into the development.

The applicant is advised to refer to the document "Improving Flood Performance of New Buildings Flood Resilient Construction (DCLG2007).

Finished floor levels (FFL) should be set 300mm above ground level.

The Flood Risk Assessment must also include details of surface water drainage arrangements and demonstrate that the proposal will not increase flood risk elsewhere – the LPA should seek the advice of the LLFA with respect to the adequacy of this element of the assessment.

Conclusions

The flood extents maps supplied by the Environment Agency do not predict any flooding to any part of the area around Gosberton in a 1 in 1000 year fluvial event or tidal event in 2115.

The site is 5.1km from the tidal defences of the River Welland and therefore the risk of flooding if a bank breached in a 1 in 100 year event in 2115 is extremely low.

The risk of flooding if a breach were to occur in the north bank of the River Glen is mitigated by the location of the Risegate Eau, which is 1.1km south of the development site and will prevent flood water from this source from reaching the site.

The risk of flooding from IDB drains can be considered low, because the minimum recommended floor level of the proposed dwellings is at least 2.0 metres above the normal level of the Risegate Eau and its tributaries.

If Risegate Eau 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 1.00m 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.

The risk of excess water levels on the site after extreme levels needs to be considered to ensure no flooding can be caused to dwellings in this scenario. After heavy rainfall surface water could follow the slope of the site and accumulate at the eastern end near Low Gate.

The ground floor levels of the houses at the eastern end of the site should have a minimum level of 3.00m OD.

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

Although all of the site is in flood zone 3, the actual risk of the site flooding from any Environment Agency or IDB watercourse is very low.

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 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 approximately 300mm above existing ground levels and the minimum floor level for houses with all sleeping accommodation on the first floor should be 3.00m OD.

The Environment Agency have stated that the ground floor level of single story properties with sleeping accommodation on the ground floor should be 300mm above the 1 in 1000 year flood level in 2115. It is recommended that the ground floor level of any bungalows on the site should also be at a minimum level of 3.00m OD.

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

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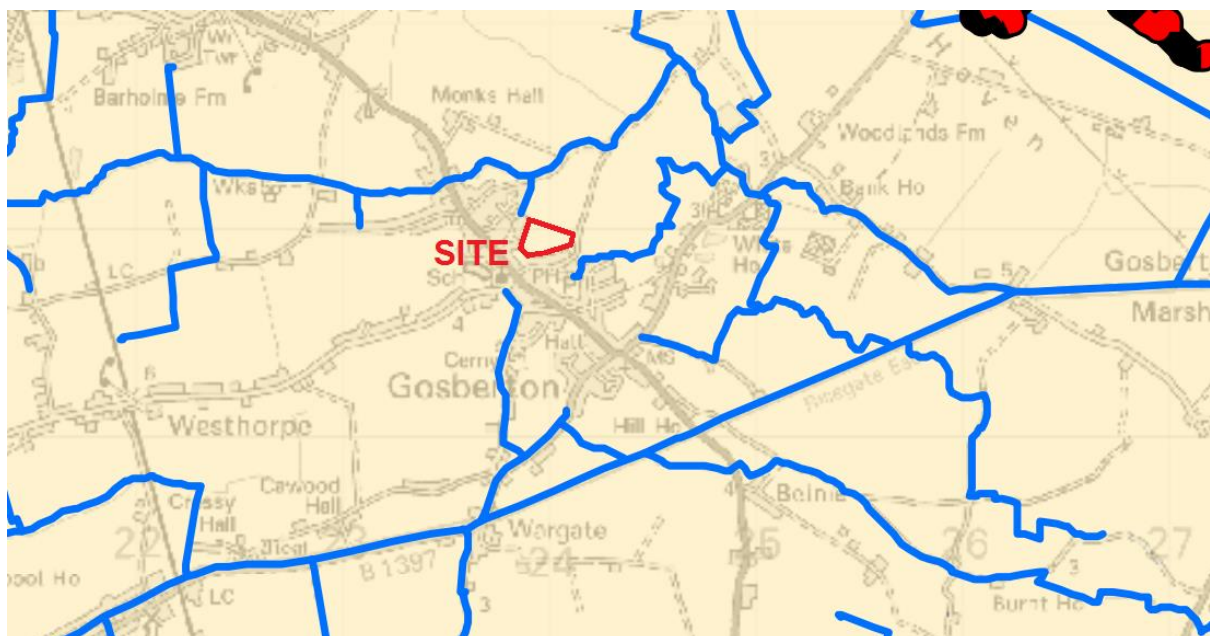
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8th September 2021

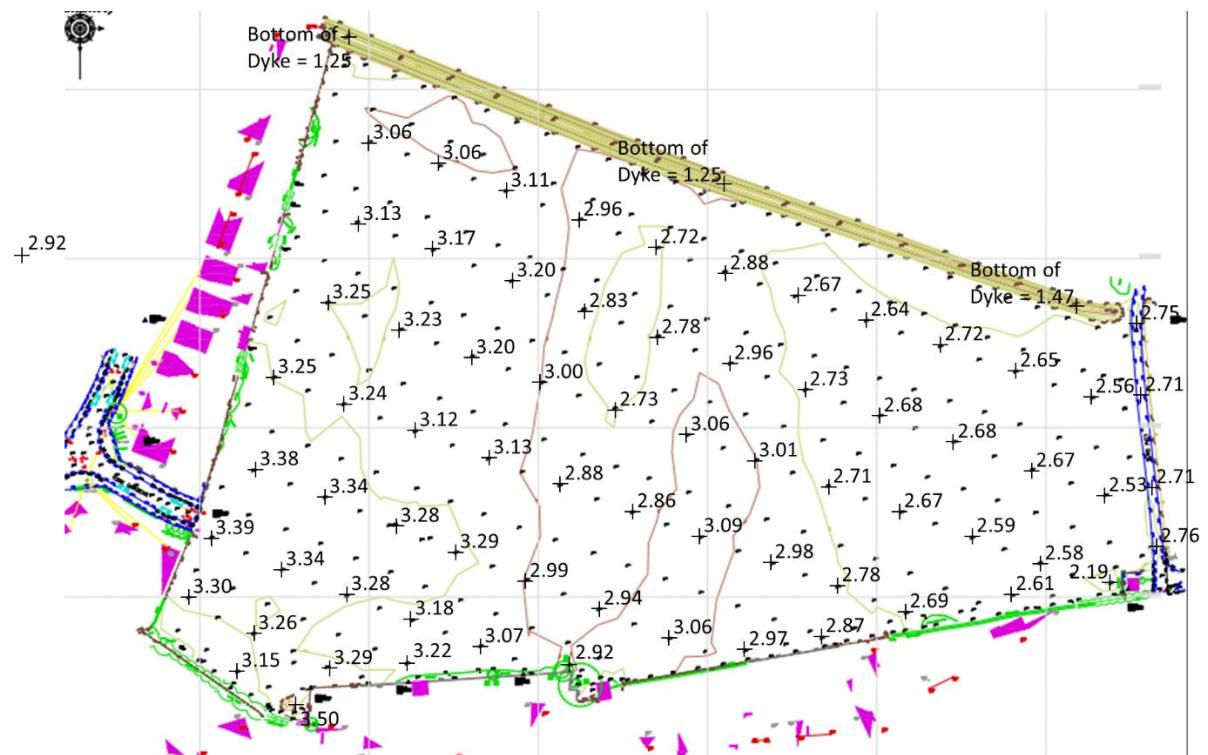
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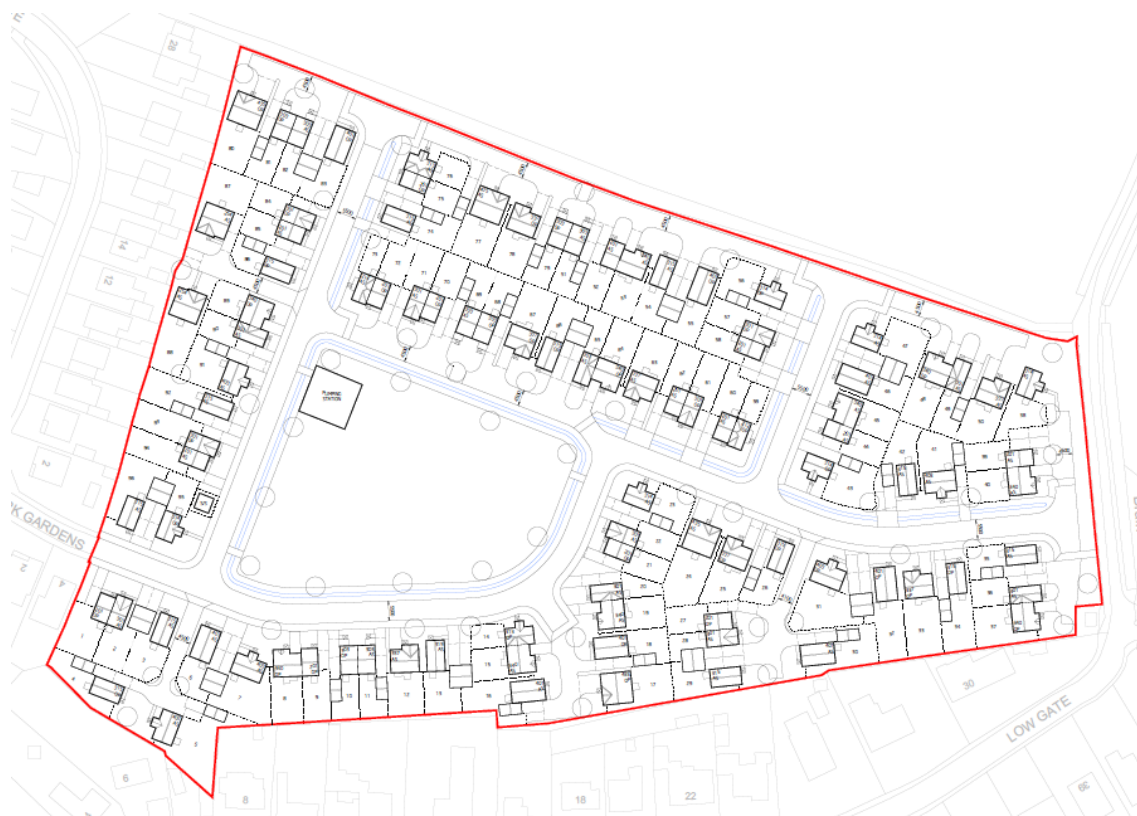
PLAN OF IDB DRAINS



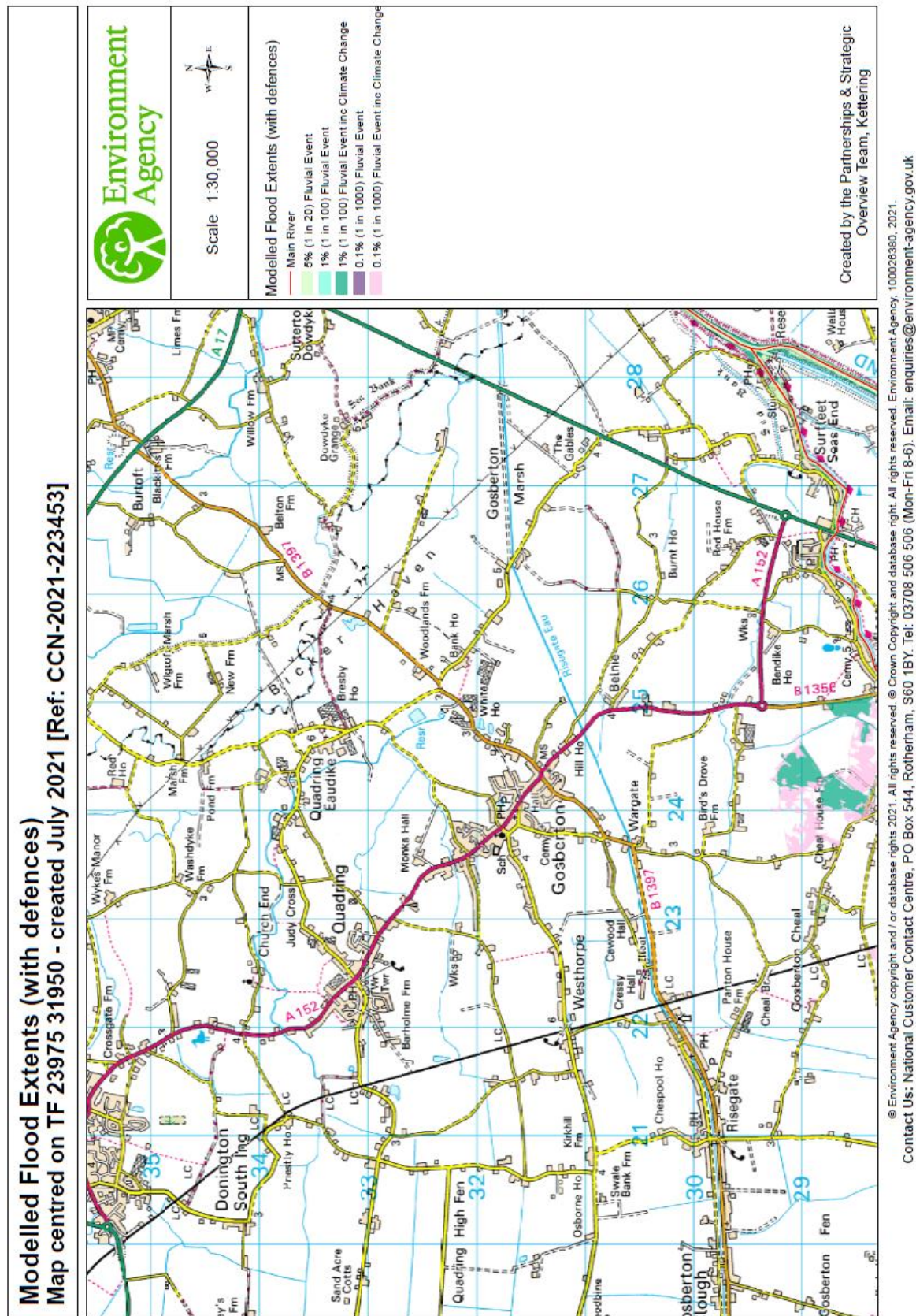
PLAN SHOWING SITE LEVELS



PROPOSED PLAN OF DEVELOPMENT



ENVIRONMENT AGENCY MODELLED FLOOD EXTENTS WITH DEFENCE



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 PPS25¹. 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

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%	

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 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 SFRA does not predict any residual flooding on any part 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 3.00m OD and bungalows 3.30m OD 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 3.00m OD is satisfactory.