PROPOSED RESIDENTIAL DEVELOPMENT BEHIND 175 HAWTHORNE BANK, SPALDING, PE11 2UN. FLOOD RISK ASSESSMENT



View from rear of property

S M Hemmings B Sc C Eng MICE MIWEM,
40 Celta Road,
Peterborough,
PE3 9JD

This flood risk assessment has been prepared solely to support the planning application for the proposed development behind 175 Hawthorne Bank, 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 other purposes other than for which it was originally commissioned.

Introduction

An application is due to be submitted to South Holland District Council for Planning Permission to carry out a residential development behind 175 Hawthorne Bank, Spalding, PE11 2UN.

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 Technical Guidance to the National Planning Policy Framework Development and Flood Risk states that if a development lies within Flood Zone 3 a Flood Risk Assessment should be carried out to accompany any Planning Application.

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 all of this area south of the central area of Spalding is in Flood Zone 3.

Application Site

The development is located on the western side of the River Welland. The National Grid Reference of the site is 524185 321380.

The position and extent of the site is shown on the plan at the end of this document.

As the site of the proposed development is within a defended area it can be considered to be within Flood Zone 3(a) "High Probability", 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 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.

The map on page 2 of this report shows that all of this area of Spalding is in Flood Zone 3(a). The whole of the southern and western side of Spalding west of the River Welland is within this zone. As the area around Hawthorne Bank is higher than other areas all of the flood risk maps show the flood risk in this area is less than other areas in Spalding. Therefore this windfall site can be considered to be more satisfactory than others in Spalding.

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 in a 1 in 1000 year event in 2115 for this area.

The South Holland District Council Core Strategy states that there is a limited number of sites in the South Holland DC area available for residential development. Some further sites will need to be identified to enable the Council to meet the RSS and Structure Plan requirement for 2021. Therefore there is a requirement for further sites to be brought forward and used for residential development.

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

Map 16 indicates the site is not within the rapid inundation zone for both the present day and 2115.

1. **Flood Maps Table D1**

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

For the present day	Depth of flooding ... zero
	Extent of flooding .. Low
	Hazard .... None
	Velocity ... Zero
For year 2115	Depth of flooding ... Zero

Extent of flooding .. Low
Hazard ... None
Velocity .. Zero

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:-

a) For the 1% fluvial or 0.5% tidal event probability:

For the present day
Depth of flooding.... zero
Extent of flooding ...low
Hazard ..... none
Velocity ..... zero

For the year 2115
Depth of flooding ....zero
Extent of flooding ...low
Hazard ..... None
Velocity ..... zero

b) For the 0.1% fluvial or tidal event probability:

For the present day
Depth of flooding.... zero
Extent of flooding ... Low
Hazard ..... None
Velocity ..... zero

For the year 2115
Depth of flooding ....zero
Extent of flooding ...Medium or High
Hazard ..... None
Velocity ..... zero

2. **The maximum flood levels in the fluvial section of the Spalding Welland is shown in the reports as follows:**

	Peak 1 in 100 year		Peak 1 in 1000 year	
Year	2007	2115	2007	2115
Level	4.42	4.67	4.43	4.68

The chainage of the River Welland directly east of the development site is 3.1km. The top of bank levels is approximately 5.20m OD at this point.

3. **The extreme tide levels in the section of the River Welland north of Fulney Lock is shown in the report as follows:**

	2007	2055	2115
1 in 100 year	5.98	6.31	7.12
1 in 1,000 year	6.32	6.65	7.46

The lowest bank level occurs 200 metres north of Fulney Lock, where a section 300 metres long has a minimum level of 6.98m OD.

Information from the Environment Agency

The Environment Agency has provided predicted flood levels for the River Welland approximately 1 km north of the site, which are taken from the Welland Catchment Model. The levels will be very similar in the river immediately east of the site.

	Present Day	Present day with 20% increase of flow for climate change
Peak 1 in 100 year flood level	4.39m OD	4.68m OD
Peak 1 in 1,000 year flood level	4.40m OD	4.68m OD

Site Levels

The level of Hawthorne Bank south of the proposed development site is 3.67m OD, and the level of the ground floor of the existing property is 3.78m OD. The level of the rear garden varies between 3.00m and 3.30m OD, and this is higher than the gardens in the properties to the west and the north of this part of the garden, which are at a level of approximately 2.50m OD.

There is a dyke on the western boundary alongside 173 Hawthorne Bank only. The bed level of the bed of the dyke is 1.96m OD on the northern end and 2.46m OD at the southern end.

A plan showing all the levels taken on the site, and the location of the dyke, are shown on page 12 of this report.

Existing Flood Alleviation Measures

The site is within a defended flood plain, as defined in Appendix 1 of the Environment Agency's "Policy and Practice for the Protection of Flood Plains" and 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 is considered to be very low.

The development is approximately 110 metres from the west bank of the River Welland, which is main river and maintained by the Environment Agency.

The development is approximately 3.3km south of the tidal section of the River Welland, which is main river and maintained by the Environment Agency.

This area south of the centre of Spalding is drained by watercourses maintained by Welland and Deepings Internal Drainage Board. The water levels in the IDB channels are controlled by the water level in South Drove Drain which also is operated by Welland and Deepings IDB.

Potential Sources of Flooding

The following sources of flooding have been identified:

1. Failure or overtopping of the tidal defences.
2. Overtopping of the River Welland.
3. Flooding from IDB drainage channels
4. Flooding from Dyke on Western Boundary
5. Blockages in local surface water sewers (highway or Anglian Water)

1. Failure or overtopping of tidal defences.

The River Welland is tidal north of Fulney Lock, which is more than 3.3km north of the site. The SFRA states that the defences are adequate to withstand a 1 in 200 year (0.5%) probability event for present day. In the future in 2115 some of the banks could be overtopped with a 0.5% probability event. However one would expect that during the next one hundred years defences will be raised to maintain a 1 in 200 year standard of defence.

If overtopping or a breach allowed water to flow south westwards from the tidal Welland lower land to the west of the River Welland would be flooded and the central area of Spalding would remain unaffected. Therefore if flood water from this source were to affect the development site it would have to flow south westwards towards Pode Hole then south eastwards towards this area of Spalding. The railway line to the west would be a final barrier to any substantial amount of flood water reaching the site.

Therefore the risk of flooding from this source can be considered to be remote and adequately mitigated.

2. Overtopping of the River Welland.

The west bank of the River Welland is at a level of above 5.20m O.D. directly east of the development site. There is no raised defence at this point. The ground levels gradually fall over 100 metres to the approximate site level of 3.00m OD.

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

3. Flooding from IDB watercourses

This area of Little London is drained by surface water sewers and highway drains which drain westwards into the IDB drainage system. These systems drain into both the Campbells Close Drain and the Little London Drain which both flow westwards into the South Drove Drain. These drains are all maintained by Welland and Deepings IDB (W & D IDB).

The water level in North and South Drove Drain, which is maintained by W & D IDB is controlled by Pode Hole Pumping Station. There are both electrically operated and diesel powered pumps which are operated at this location to control water levels. W & D IDB have stated that the normal pumping level is -1.20m OD and the maximum design water level in a 1 in 100 year event would be 0.18m OD. With climate change this could increase to around 0.7m OD.

However you would expect the IDB to increase capacity to keep pace with climate change over the next one hundred years.

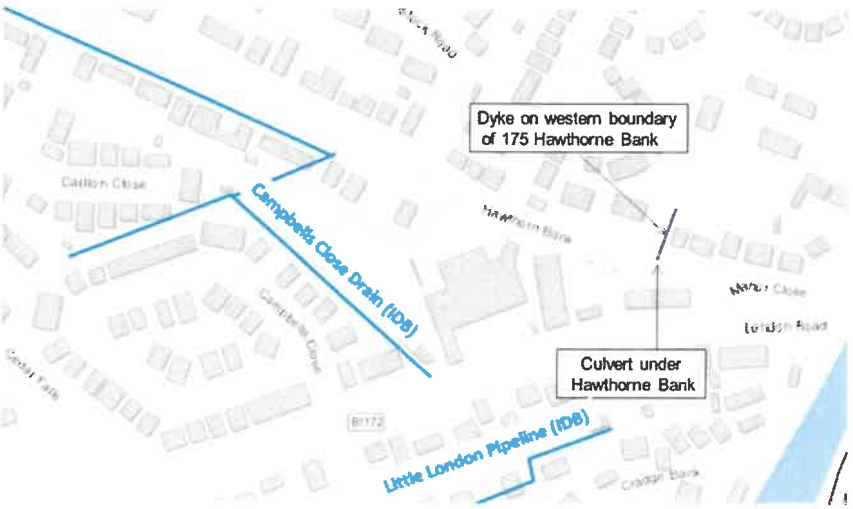
Although the likelihood of the water level rising to 2.00m OD in the North and South Drove Drain is remote, and if this happened low land around Deeping St Nicholas would start to flood and so the level in the Drain would be unlikely to increase further.

Therefore this source of flooding can be considered to be adequately mitigated as the level of the site is between 3.00m and 3.20m OD.

4. Flooding from Dyke on Western Boundary

There is a length of open dyke between numbers 173 and 175 Hawthorne Bank, a length of approximately 35 metres. It is possible to see the top of a culvert pipe at the southern end of the dyke and there is a grating which allows discharge into this culvert, which presumably is under Hawthorne Bank and eventually drains into Campbells Close Drain.

There is a risk that this could become blocked and the dyke could fill with water. However the risk of flooding to the proposed properties will be adequately mitigated by raising the ground floor levels of the proposed properties by at least 300mm above the existing ground level, which will be approximately 900mm above the existing ground level of the gardens west of the site.



5. Blockages in local surface water drainage systems

The maps on the Environment Agency website do not indicate any risk of surface water flooding to this site. There is no flooding indicated on the development site on the high risk, medium risk or low risk maps. The low risk map is reproduced on page 13 of this report.

Highway drainage systems along this section of Hawthorne Bank could become blocked and surface water could flow onto the development site. However as the road levels are lower west of the site, and the proposed finished ground floor level is recommended to be 300mm above the existing ground level this will ensure that flooding from this source 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 floors of the building.

Residual Risk – Extreme Events

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

There are no records of this area of Little London 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 this FRA. The effects of these new recommendations are considered in Appendix A of this report (pages 14 to 17). It is concluded that no extra mitigation measures are necessary to comply with the new guidance on climate change.

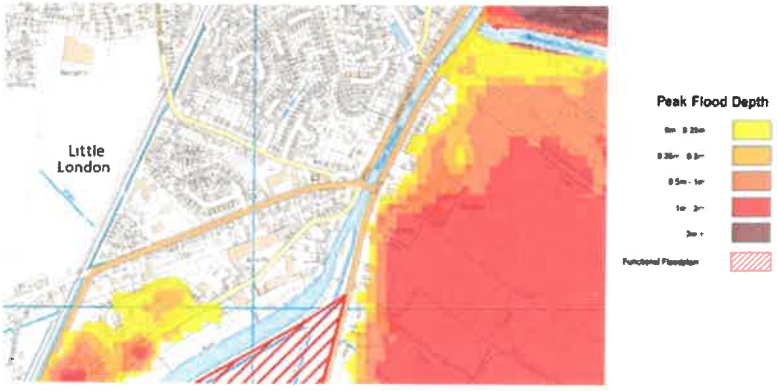
South East Lincs Advice Matrix

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 G7 which shows that the matrix reference for this category is "No Comment".

Summary of Risk of Flooding to the Site

The relevant part of the map in the updated SFRA issued in March 2017 on the South East Lincolnshire Joint Strategic Planning Committee Website showing the residual peak depths for Spalding in 2115 in a 0.1% fluvial and tidal event probability is shown below.



The extract from the map shown on the previous page taken from the SFRA (2017) does not predict any flooding at the site of the proposed development in a 1 in 1000 year event in 2115.

Conclusions

The following conclusions can be made:

The proposed development is not in a functional flood plain as defined by the Technical Guidance.

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

The risk of flooding from the River Welland east of the site is very low.

The risk of the site becoming flooded from any other source is extremely low.

In a flood risk area there is always a risk of an event occurring of greater magnitude than has been considered in this flood risk assessment.

Recommendations

In any area at risk of flooding it is recommended that new residential buildings 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 recommended that the finished ground floor level of the new buildings should be raised 300mm above the existing ground level at a level of approximately 3.60m OD.

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

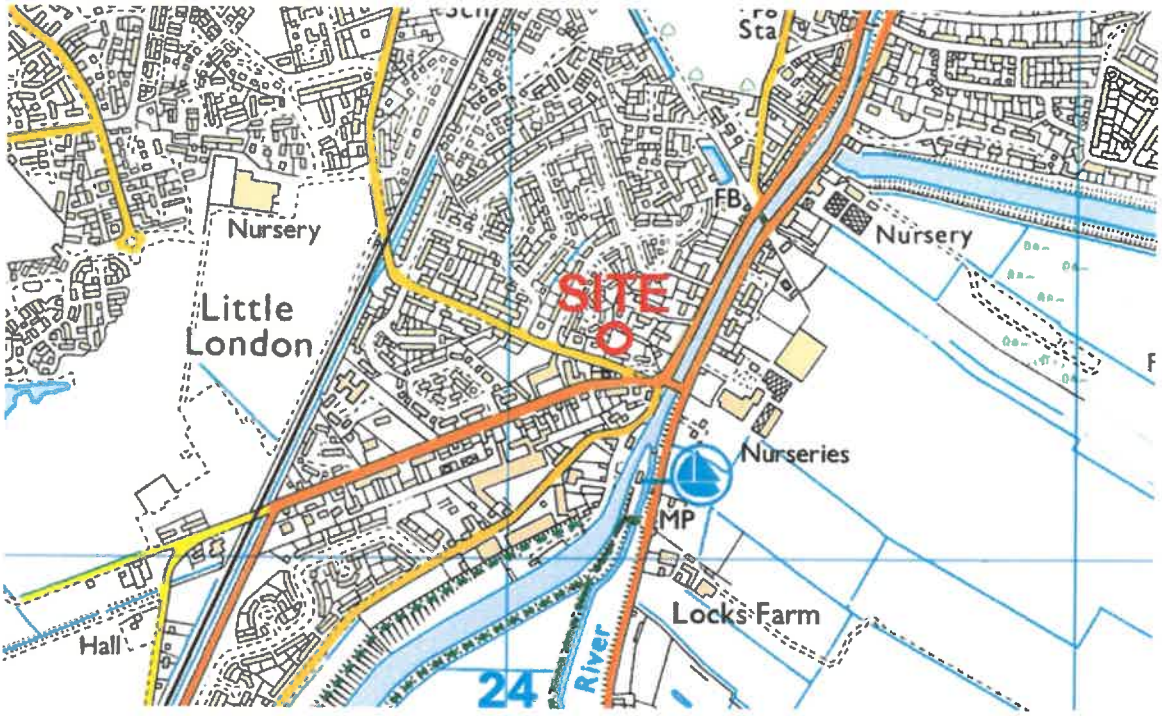
The surface water from the roofs of the new properties should be disposed of by discharging the water into soakaways and these should be designed to BRE Digest 365 and approved under Building regulations. The surface water from the existing house discharges into the dyke on the western boundary. If soakaway drainage is not possible on this site then the surface water from the new properties should be discharged into the dyke, subject to the consent from the Welland and Deepings IDB.

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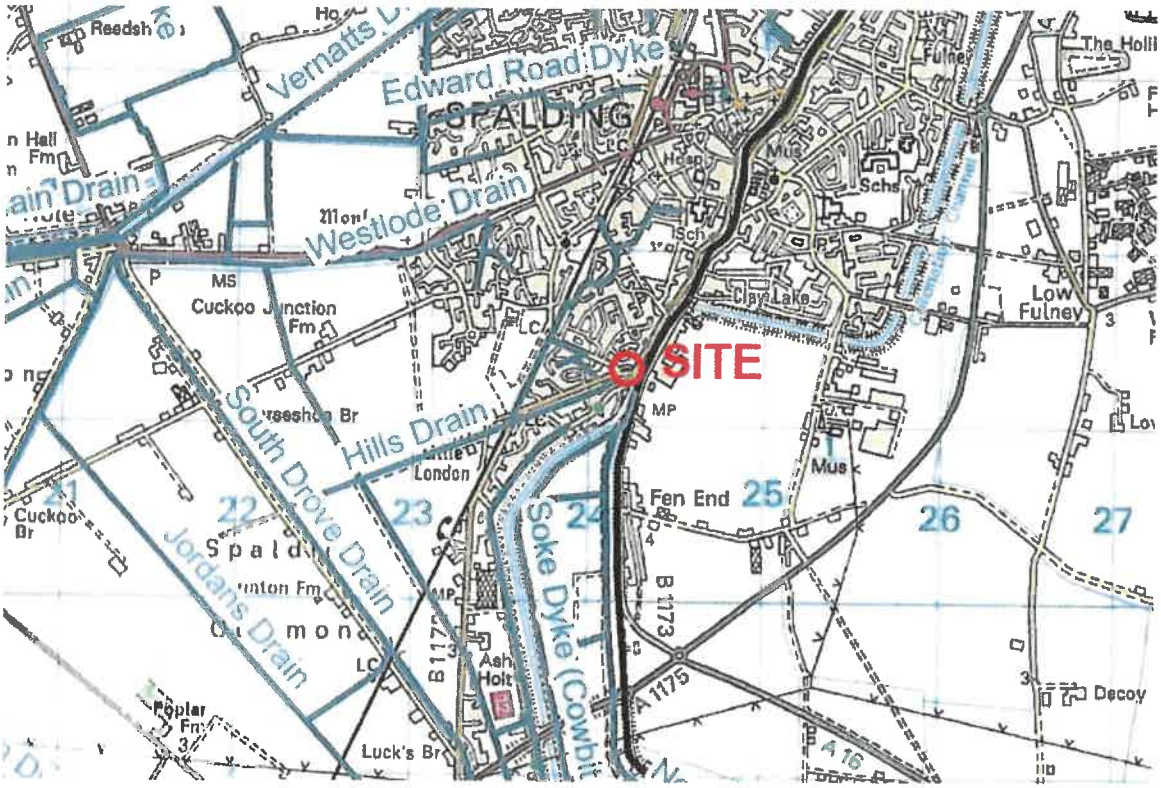
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5th June 2019

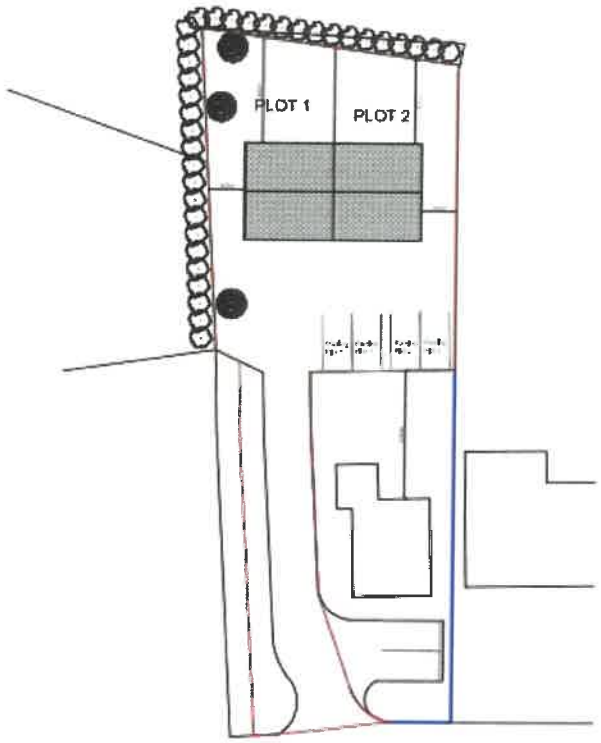
LOCATION PLAN



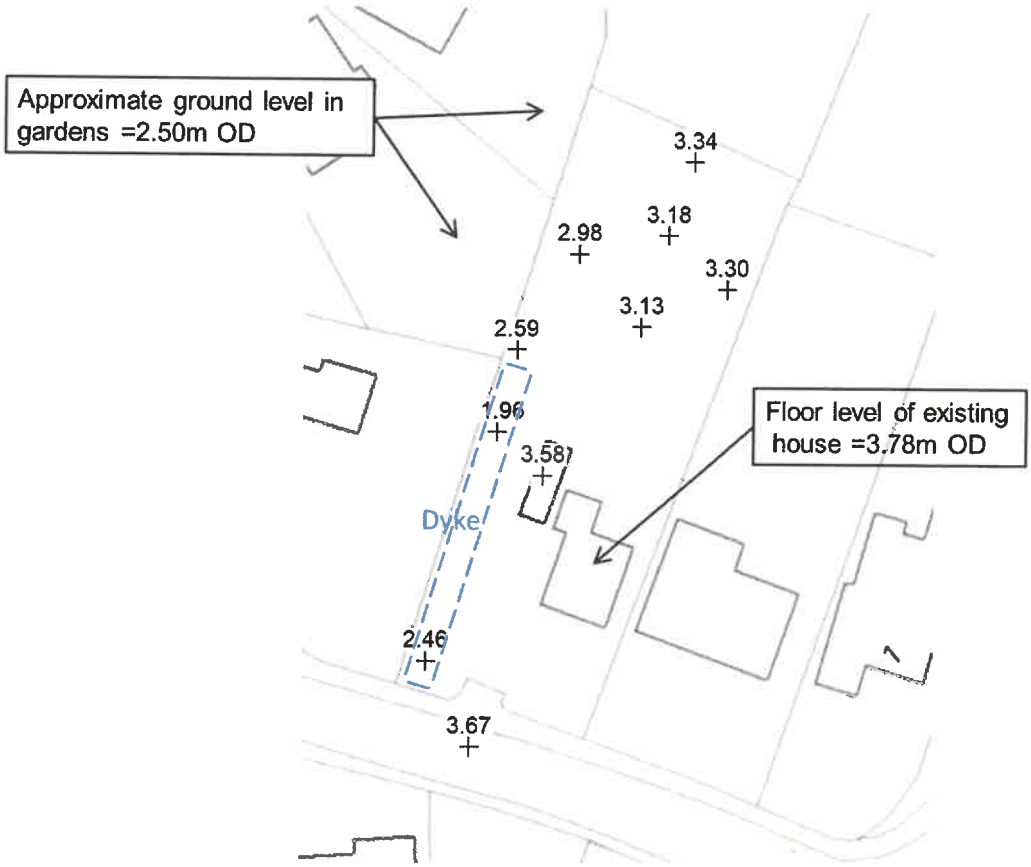
PLAN OF IDB DRAINS



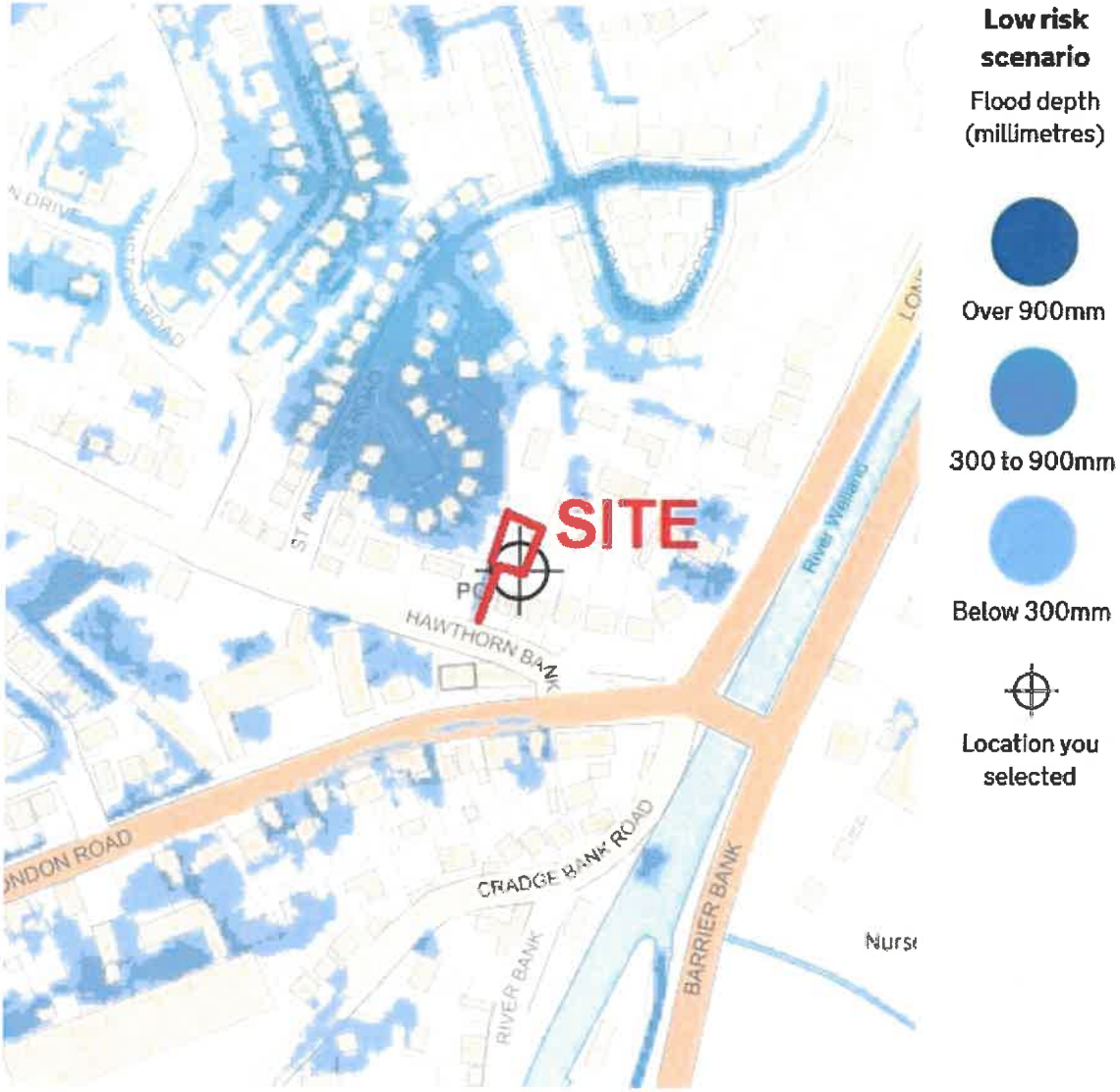
BLOCK PLAN OF SITE



PLAN SHOWING SITE LEVELS



ENVIRONMENT AGENCY MAP OF SURFACE WATER FLOODING LOW RISK



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%	

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 upper end and the higher central 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

Fluvial Flooding from River Welland.

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 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 SHDC SFRA also has used this figure of 20%. 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 Welland. If there are additional flows along this part of the River Welland it will lead to the storage systems of the Cowbit and Crowland Washes operating and 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 Welland is an embanked

watercourse between Spalding and Market Deeping. There are flood reservoirs on the east side of the River called the Cowbit and the Crowland Washes. Excess water would flow into these Washes through two large syphons. In this scenario the Washes would fill up and also water would be flooding over lower banks of the River. The increases in rainfall leading to this would also lead to significant flooding in the upper part of the River Welland Catchment. 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.

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 these 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 of the proposed development should be raised by 300mm is satisfactory.