PROPOSED RESIDENTIAL DEVELOPMENT
BEHIND 28 HAWTHORNE BANK, SPALDING, PE11 1JH
FLOOD RISK ASSESSMENT



View of rear of back garden of 28 Hawthorne Bank

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 residential development at 28 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

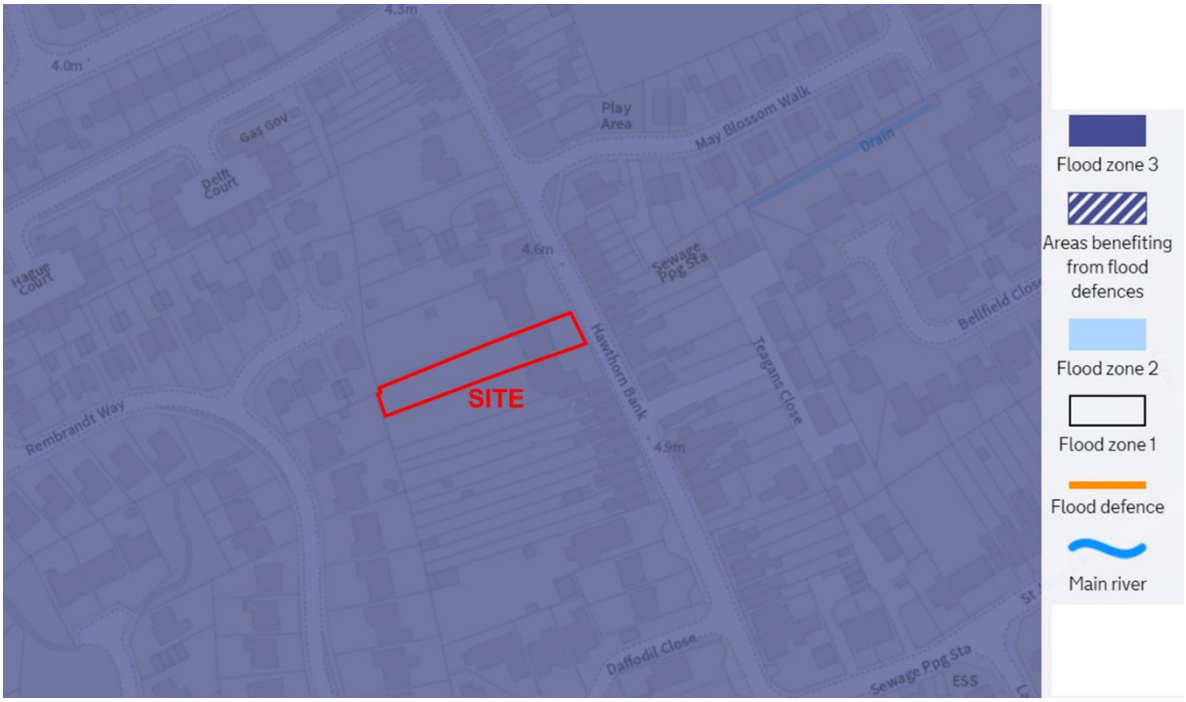
A planning application is due to be submitted to South Holland DC to build a two storey dwelling west of the existing house at 28 Hawthorne Bank, Spalding, PE11 1JH. The site is at present part of the rear garden to this property.

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 all of the site is in Flood Zone 3.

Application Site

The site is located 950 metres from the fluvial section of the River Welland and 2.7 km from the tidal section of the River Welland. The National Grid Reference of the site is 523690 322180.

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 considered to be within Flood Zone 3(a) as defined in Table 1 of the Technical Guidance.

Applying the flood risk vulnerability classification in Table 2 of the Guidance, a 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 †	✗	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	✗	✗	✗	✓*

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 the whole of this area on the west side of Spalding is in Flood Zone 3(a).

Taking into account the guidance, it can be seen that it is extremely unlikely that an alternative site with a lower flood risk could be found in this area of Spalding. The safety of the development will be delivered by ensuring the floor level of the proposed new dwelling is above predicted residual flood levels 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 land 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 land 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

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
	Flood Hazard…….Zero
	Peak Velocity ……. Nil
For year 2115	Depth of flooding … Zero
	Extent of flooding…. Low or medium flood probability
	Flood Hazard…….Zero
	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 hazards are as follows for the 1% fluvial or 0.5% tidal event probability:

For the present day
Depth of flooding …Zero
Extent of flooding .. Low or medium flood probability
Flood Hazard…….Zero
Peak Velocity …… Nil

For the year 2115
Depth of flooding …Zero
Extent of flooding .. Low or medium flood probability
Flood Hazard…….Zero
Peak Velocity …… Nil

Figure 16 of the general maps show that the site is not within the rapid inundation zone for the present day and in 2115.

Tables in the SFRA show the following details of the defences on the west side of the fluvial section of the River Welland north of Bridge Street, at chainage 2.7km.

	2007	2115
Peak 1 in 100 year fluvial level	4.43m OD	4.67m OD
Peak 1 in 1,000 year fluvial level	4.45m OD	4.68m OD

The bank levels on the west side of the River Welland at this location vary between 5.2m OD and 6.10m OD.

Tables in the SFRA show the following details of the defence bank on the west side of the tidal section of the River Welland north of Fulney Lock at chainage 22.0km.

	2007	2055	2115
Peak 1 in 200 year extreme tide level	5.98m OD	6.31m OD	7.12m OD
Peak 1 in 1,000 year extreme tide level	6.32m OD	6.65m OD	7.46m OD

The crest levels of the defences, which are earth banks along this length, vary between 6.97 and 7.30 m OD. With a minimum crest level of 7.00m OD the freeboards are as follows:

	2007	2055	2115
Peak 1 in 200 year freeboard	1020mm	690mm	-120mm
Peak 1 in 1,000 year freeboard	680mm	350mm	-460mm

Tables in the SFRA show the following details for the predicted flood levels in Vernatt's drain at chainage 7.1 km.

	2007	2115
Peak 1 in 100 year flood level	3.86m OD	3.86m OD
Peak 1 in 1,000 year flood level	3.86m OD	3.86m OD

The level of the earth banks on this section of the southern side of Vernatt's Drain vary between 4.25m OD and 4.65m OD.

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 950 metres from the fluvial section of the River Welland, which is maintained by the Environment Agency. There are no raised banks along this section of the River.

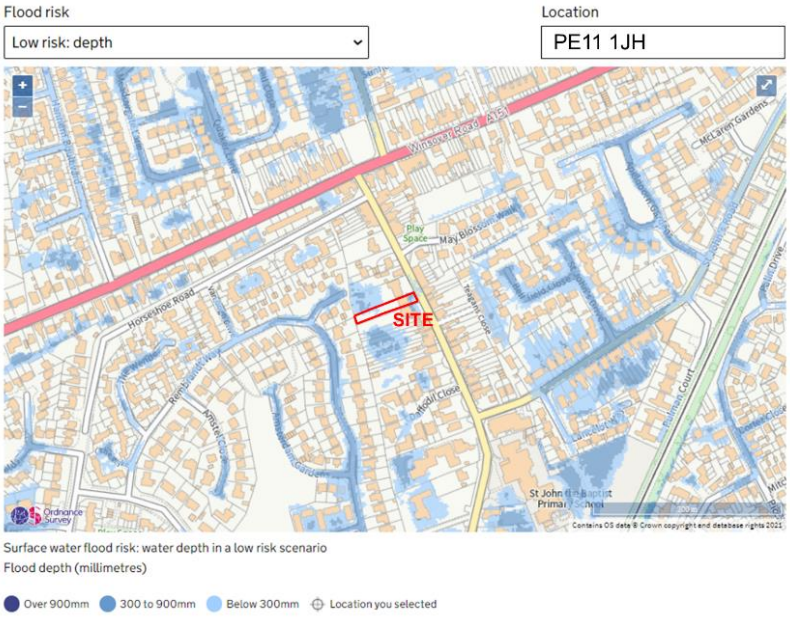
The site is located approximately 2.7 km from the tidal section of the River Welland, which has a tidal defence bank which is maintained by the Environment Agency.

The site is located 1200 metres south of Vernatt's Drain which is maintained by Welland and Deepings IDB.

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

Information on Surface Water Flooding on Environment Agency Website

The following map shows areas around the site where there is a low risk of surface water flooding. 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 no predicted risk of surface water flooding at the site of the proposed dwelling.

Existing Ground Levels

A survey of the ground levels at this site has been produced and is shown on page 12 of this report. The level of the footpath on the west side of Hawthorne Bank in front of the property is approximately 4.75m OD. The ground floor level of the existing house is 4.31m ODN and the level of the rear of the garden where the development is proposed is approximately 3.25m ODN.

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 of the fluvial section of the River Welland.
3. Failure or overtopping of the banks of the Vernatt's Drain.
4. Failure of Pode Hole Pumping Station (IDB).
5. Blockages in IDB drains or culverts
6. Surface Water Flooding

1. Failure or overtopping of tidal defences

As shown above, the west bank of the River Welland, which is approximately 2.7 km north east of the site, does not provide a 1 in 200 year standard of protection in 2115. However the maps in the SFRA do not predict any flooding will occur to the site of the development in the 1 in 1000 year event in 2115.

It is assumed that the Environment Agency will review the bank levels within the next 100 years and if necessary raise the banks to protect the substantial infrastructure on the west side of the river.

Therefore it can be concluded the risk of flooding to the building from this source in a 1 in 1000 year event in 2115 is not predicted in the SFRA.

2. Overtopping of the fluvial section of the River Welland

The maximum fluvial flood level in the River Welland south east of the site is 4.68m OD in a 1 in 100 year event in 2115 and 4.69m OD for a 1 in 1000 year event in 2115.

The bank levels on the west side of the river are at a level of 5.20m OD, and there is no raised defence along this section.

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

3. Failure or overtopping of the banks of Vernatt's Drain

The SFRA states that the maximum predicted flood level in Vernatt's Drain is 3.86m OD for a 1 in 1000 year event in 2115. As the crest level of the banks are at a level of 4.31m OD, the risk of overtopping is extremely low.

There is however the risk that the banks could fail when water levels are very high and this could cause flooding at the location of the proposed development. If a breach were to occur in Vernatt's Drain with water levels at the maximum predicted level of 3.87m OD Welland and Deepings IDB would be able very quickly to reduce water levels in the Drain by switching off a number of the pumps at Pode Hole Pumping Station. This would reduce the consequence of flooding from this source.

As the proposed ground floor level of the houses is 3.56m OD which is only 310mm below the predicted maximum flood level in Vernatt's Drain the risk of flooding from this source can be considered to be adequately mitigated.

4. <u>Failure of Pode Hole Pumping Station</u>

The water levels in this area, are controlled by Pode Hole Pumping Station which is maintained by Welland and Deepings IDB (W & D IDB). 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.

As ground levels are approximately 3.00m OD at this location and the proposed ground floor level of the new buildings is 3.70m OD the risk of flooding from this source can be considered to be remote.

W & D IDB keep all the pumps at Pode Hole in good condition in readiness to deal with extreme events. Therefore the risk of flooding from this source can be considered to be adequately mitigated.

5. <u>Blockages in IDB drains and culverts</u>

Welland and Deepings IDB maintain a number of piped watercourses which convey the surface water from this residential area westwards into the Pode Hole drainage system. The Welland and Deepings IDB have a regular maintenance programme which ensures that drains and culverts are regularly inspected and any blockages in the system are quickly rectified. The risk of a large blockage in the system causing very high water levels which would flood the proposed development is extremely low.

Therefore the risk of the building being flooded from this source can be considered to be adequately mitigated.

6. <u>Surface Water Flooding</u>

There is a risk that surface water that has accumulated on Hawthorne Bank could flood into the proposed development. However the map of predicted surface water flooding (low risk) on the Environment Agency website does not predict any flooding to the site.

As the proposed ground floor level of the building is approximately 300mm above the ground level on the site the risk of flooding from this source can be considered to be 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. 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.

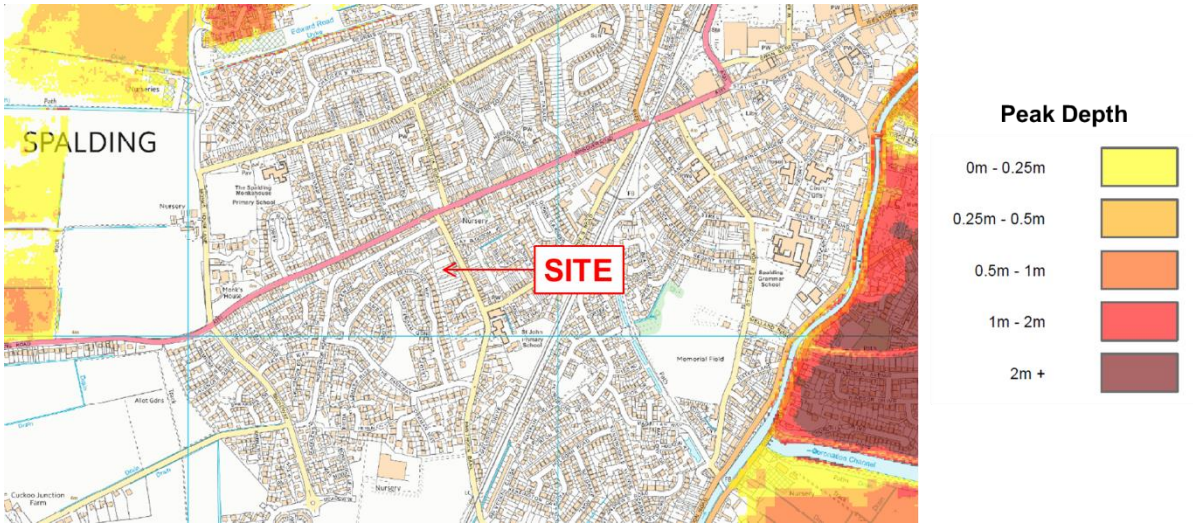
Climate Change

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.

Conclusions

The maps in the SFRA do not predict any actual or residual flooding will occur in this area of Spalding in a 1 in 1000 year coastal or fluvial event in 2115.

A plan of the residual peak depth in 2115 in a 1 in 100 year fluvial and 1 in 200 year tidal event in 2115 is shown below:



The map shows some flooding, probably from Vernatt's Drain, 600metres north west of the site. Therefore although the area around Hawthorne Bank is classified in flood zone 3 these latest maps indicate the flood risk is very low and acceptable for residential development in this area.

Therefore it can be concluded that the proposed ground floor level of the new dwelling should be a minimum of 300mm above the existing ground levels on the site.

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 an area where there is a flood risk, however small, it is preferable that new dwellings should be of two story construction designed with all sleeping accommodation located on the first floor.

It is recommended that the ground floor level of the proposed dwelling should be at a level of at least 3.56m OD which is 300mm above the existing ground levels on the site.

If any flooding did occur due to an extreme event it would happen extremely slowly over many hours and the Local Authorities and emergency services would have adequate time to warn residents that flooding might occur, and residents would have adequate time to prepare themselves for the event.

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

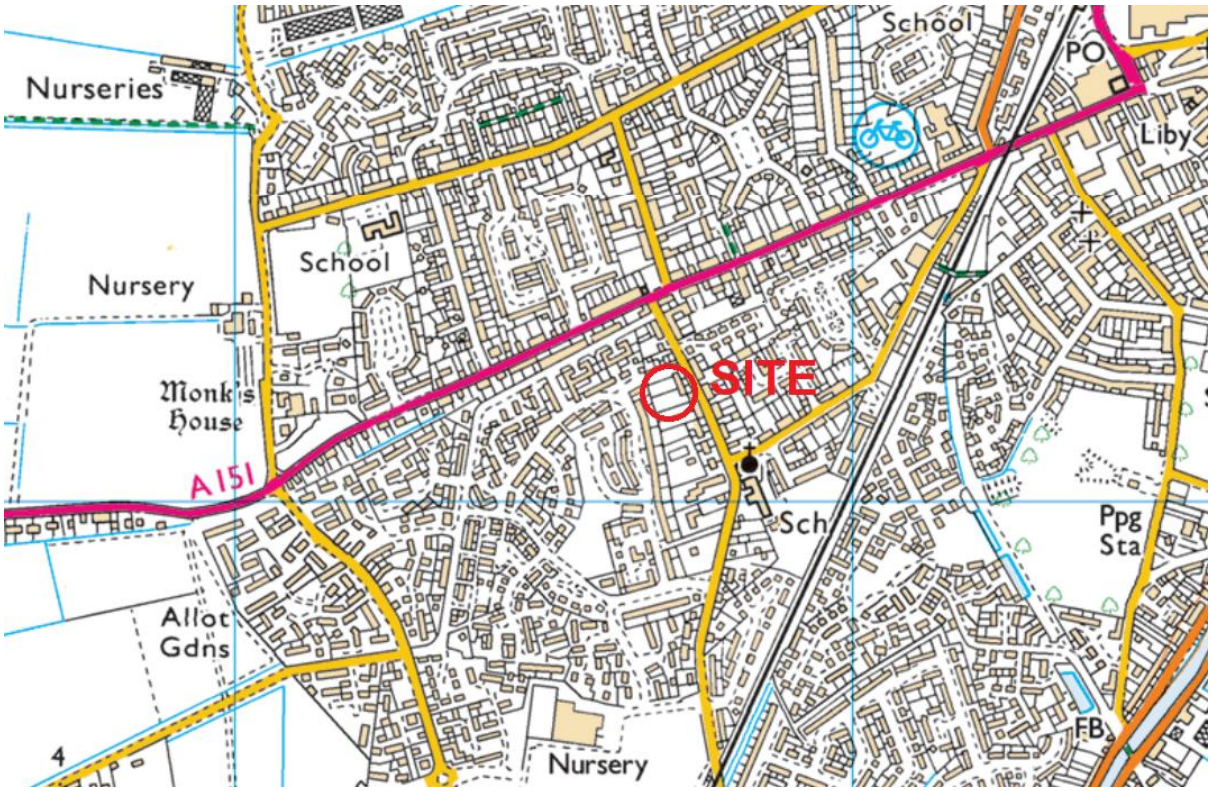
The surface water drainage from the roof of the proposed dwelling should be discharged into soakaways and these should be designed to BRE Digest 365 and approved under Building regulations.

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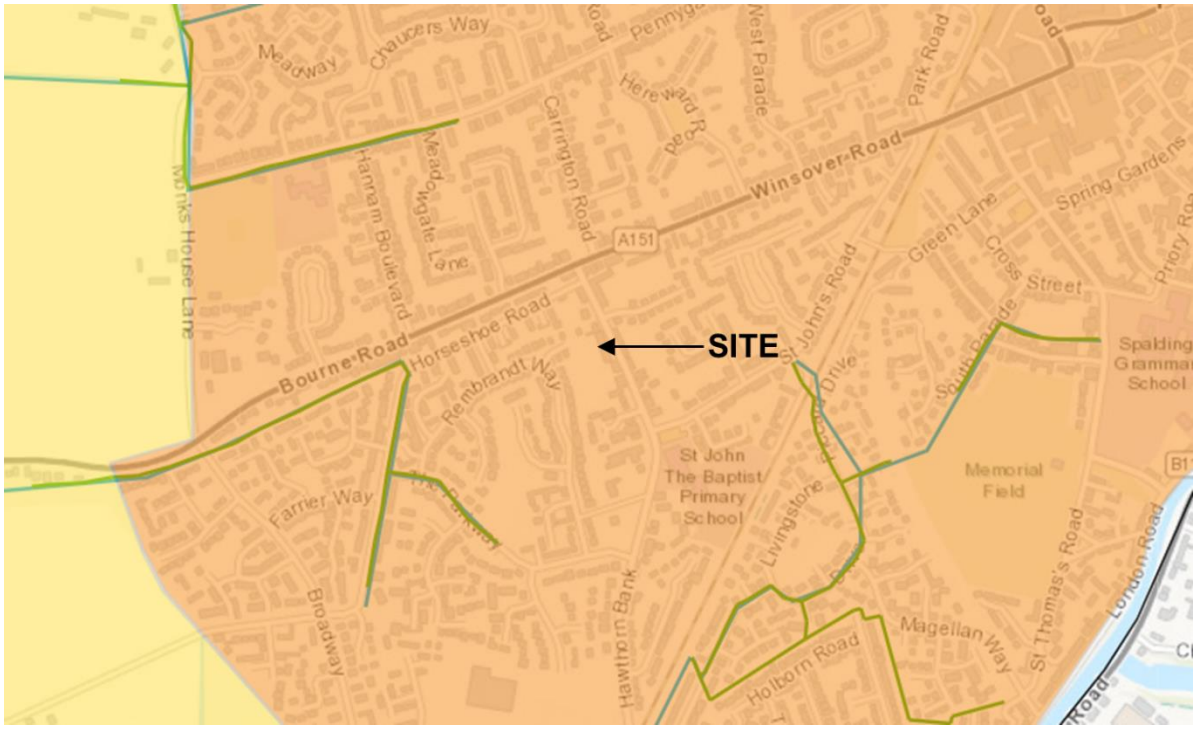
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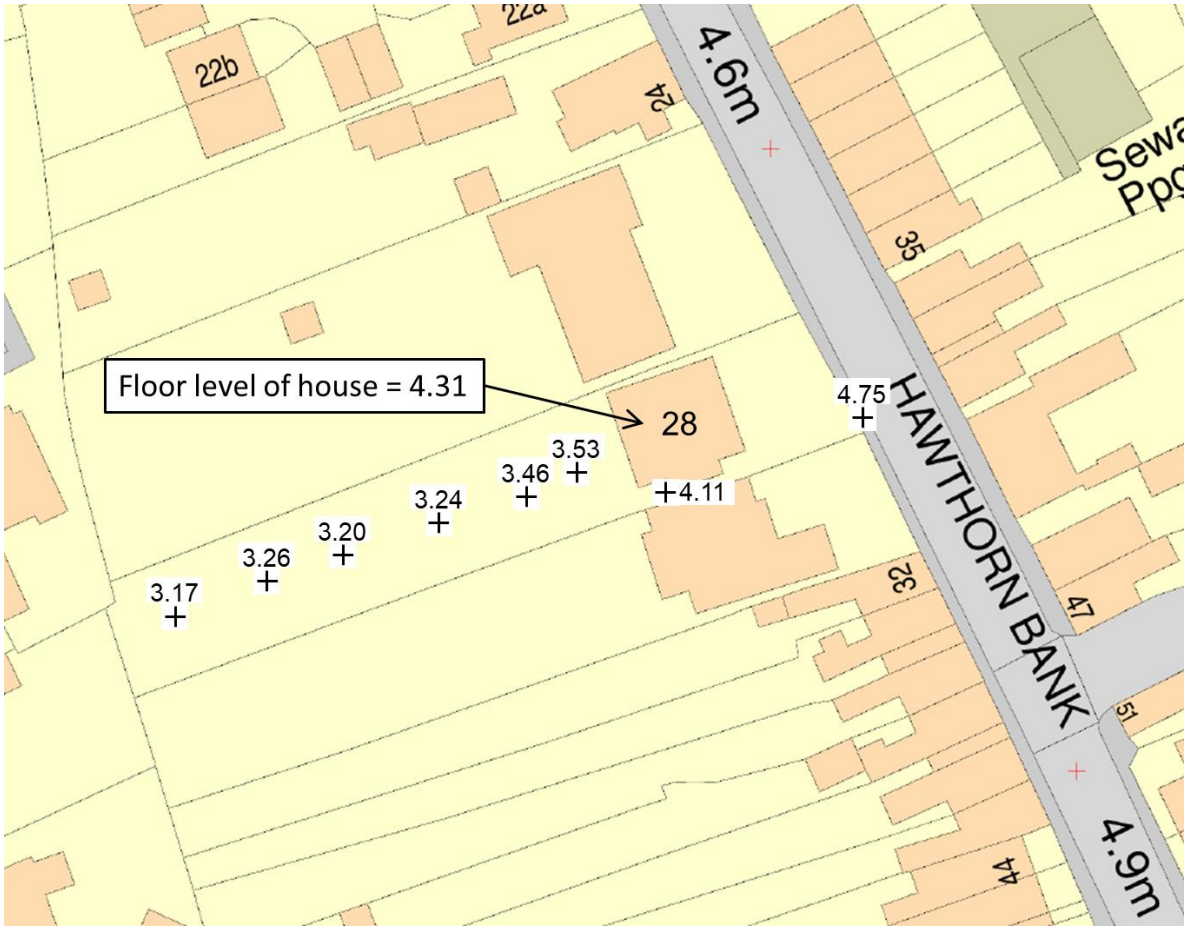
LOCATION PLAN



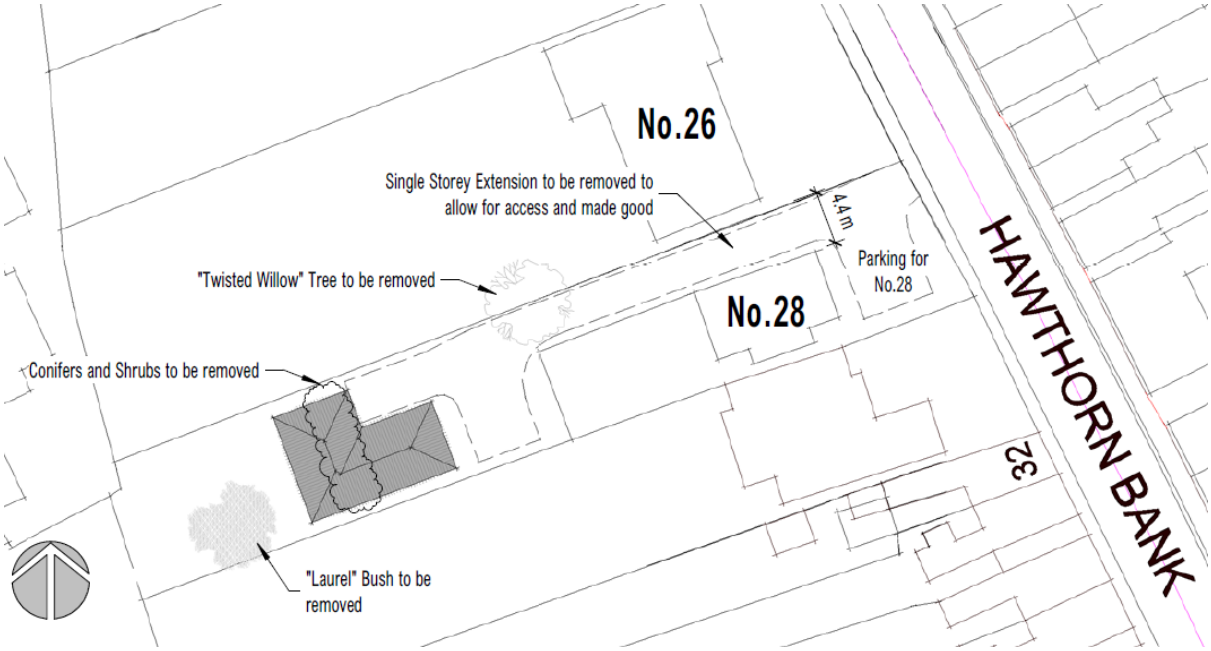
PLAN OF IDB DRAINS



PLAN SHOWING SITE LEVELS



PLAN OF PROPOSED DEVELOPMENT



APPENDIX A CLIMATE CHANGE

The Environment Agency has issued revised guidance on climate change and have now stated that the new predictions should be considered and incorporated into all flood risk assessments produced after 19th February 2016.

Listed below are the climate change allowances in three documents:

- South Holland SFRA
- EA guidance (2013)
- Revised EA guidance

The recommendations in each document are shown below.

2010 South Holland DC SFRA

The SHDC SFRA states that the the following allowances have been made for climate change:

4.4 Climate Change

Scenarios for the years 2055 and 2115 include for climate change contingency allowances to the amount suggested by PPS25[1]. These allowances are expressed in *Table 2*. Percentage increases are relative to the present-day.

Table 2 – Adopted Climate change contingency allowances

Parameter	Year 2055	Year 2115
Sea level rise (m)	+ 0.33	+ 1.14
Extreme wave height	+ 10%	+ 10%
Peak river flow and volume	+ 20%	+ 20%
Peak rainfall intensity	+ 20%	+30%

Where flows arise from pumping rather than natural run-off, notably in the Vernatt's Drain and for the Fenland subcatchments of the South Forty Foot Drain, peak flow rates for future eras have been taken as equal to current rates since this SFRA assumes all flood risk management measures will remain in their current state.

2013 Guidance to Planners

Guidance to planners was issued by EA in September 2013

Table 1: Recommended contingency allowances for net sea level rises (Net sea level rise (mm per year) relative to 1990)

	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
East of England, east midlands, London, south-east England (south of Flamborough Head)	4.0	8.5	12.0	15.0
South-west England	3.5	8.0	11.5	14.5
North-west England, north-east England (north of Flamborough Head)	2.5	7.0	10.0	13.0

document is out of date

Table 2: Recommended national precautionary sensitivity ranges for peak rainfall intensity, peak river flow, offshore wind speed and wave height

Parameter	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
Peak rainfall intensity	+5%	+10%	+20%	+30%
Peak river flow	+10%	+20%		
Offshore wind speed	+5%		+10%	
Extreme wave height	+5%		+10%	

s been withdrawn (19

Revised 2016 EA Guidance

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

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

For more vulnerable development in flood zone 3(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 Welland, Vernatts Drain and other IDB drains

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 flooding will occur in this area of Woolram Wygate in a 1 in 1000 year fluvial or tidal event in 2115. It has been concluded that one of the

two possible sources of flood risk to the site is most likely to be tidal flooding from the River Welland.

It can be seen that the revised guidance increases the maximum allowance for sea rise in 2115 by 100mm. However this is only likely to increase flood levels at the extreme edge of the flood water by 10mm and may slightly increase the risk of a breach occurring in the tidal bank north of the site. However it will not change the conclusions and recommendations in this report.

Fluvial Flooding.

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 considered. After considering the effects of this increase the upper end allowance, which is 65%, should be considered to assess the effect of this.

Maximum flood levels in the River Welland will not be increased by the increase in flows projected in the new climate change allowances. If flows increase by 65% in these systems it will have the affect of flooding over the long sections of bank between Spalding and Market Deeping and the maximum levels will not increase significantly.

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.

The report has concluded that as the main flow in Vernatt's Drain is from the discharge from Pode Hole Pumping Station then there will be no increases due to climate change unless the pumping capacity at this pumping station is increased.

Therefore it is considered that raising the ground floor level of the new dwelling by a minimum of 300mm above ground level will provide acceptable mitigation against flooding to the proposed development.