PROPOSED RESIDENTIAL DEVELOPMENT NORTH-WEST OF LITTLEWORTH DROVE, DEEPING ST NICHOLAS, SPALDING PE11 3HA

FLOOD RISK ASSESSMENT



View from Littleworth Drove

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This flood risk assessment has been prepared solely to support the planning application for the proposed residential development north west of Littleworth Drove, Deeping St Nicholas, 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

An application is due to be submitted to South Holland District Council for Planning Permission to construct a residential development north west of Littleworth Drove (A16), Deeping St Nicholas, Spalding, PE11 3EY.

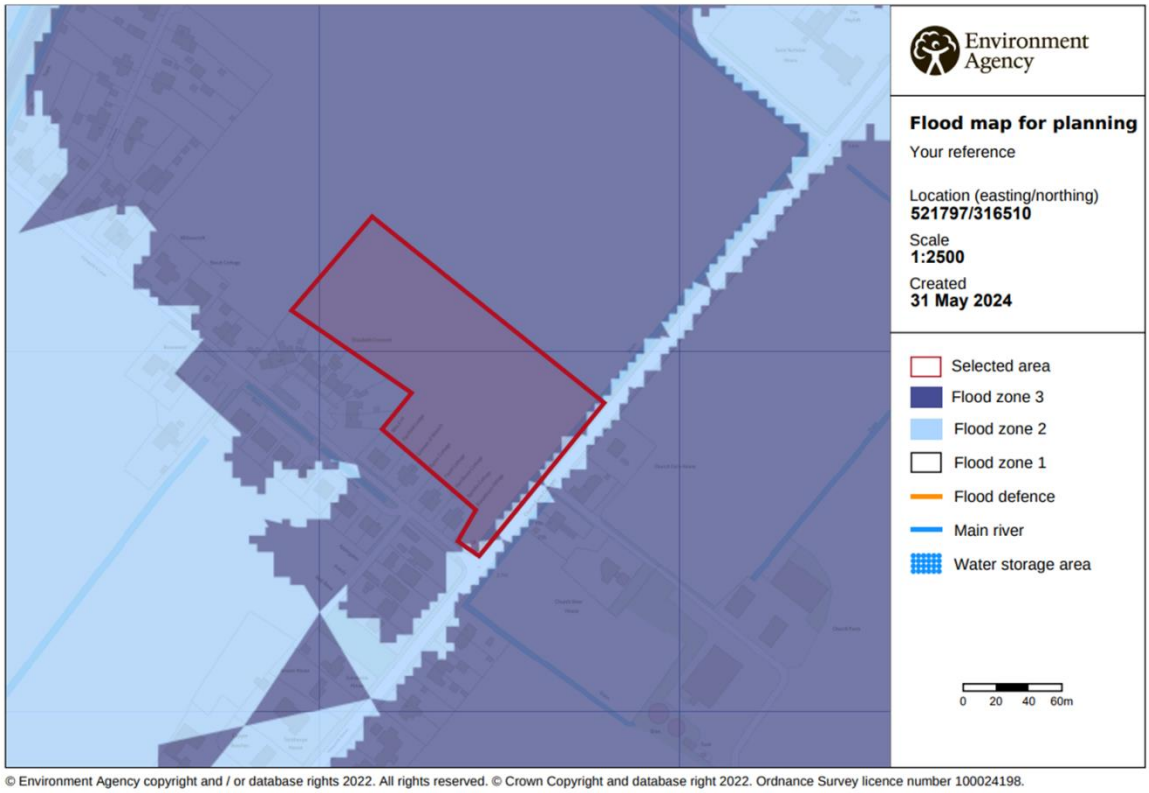
The site is within Flood Zone 3 as shown on the Environment Agency's Flood Zone Map. These maps do not take into account existing flood defences.

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.



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All of the proposed development is within flood zone 3.

Application Site

The development is located north west of Main Road (A16) at Deeping St Nicholas.

The National Grid Reference of the site is 521800 316510.

The location 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 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, the development of dwelling houses is classified as "more vulnerable".

Table 3 of the Guidance is shown below:

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

Therefore it can be seen that for "More Vulnerable" development in flood zone 3(a) 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.

Most of this area on the south west side of Spalding is in Flood Zone 3(a), and as can be seen from the map above all of the area of the proposed development is within flood zone 3(a). The area of Deeping St Nicholas south west of the site is within flood zones 2 and 3(a).

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

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 … 0 – 1.0 metre
	Extent of flooding .. High
	Flood Hazard…….. Maximum 1.25 – 2.0 (danger for most)
	Peak Velocity …… 0 – 0.3 metres/second.
For the year 2115	Depth of flooding … 0.5 – 2.0 metres
	Extent of flooding .. High
	Flood Hazard…… 1.25 – 2.0 (danger for most)
	Peak Velocity …… 0 – 0.3 metres/second.

Figure 16 of the general maps show that the site is not within the rapid inundation zone for the present day and in 2115, as defined on the map shown in the 2010 SFRA.

The maximum flood levels in the fluvial section of the River Welland is shown in the 2010 SFRA report as follows:

	Peak 1 in 100 year		Peak 1 in 1000 year	
Year	2007	2115	2007	2115
Level	4.54	4.67	4.55	4.67

The chainage of the River Welland east of the development site is 4.0km. All of the bank levels between chainage 3 km and 5 km vary between 5.75m OD and 6.15m OD.

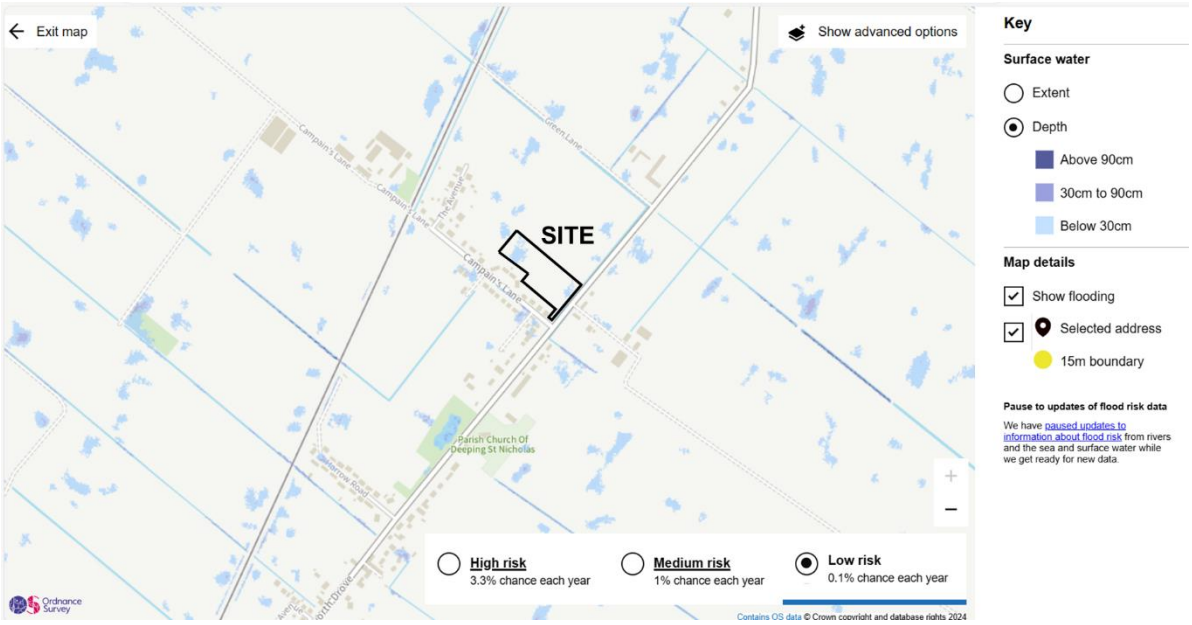
Information from the Environment Agency

The Environment Agency has provided predicted flood levels for a similar location on the River Welland which are taken from the Welland Catchment Strategic Model produced in 2016.

	2007	2115
Peak 1 in 100 year flood level	4.56m OD	4.65m OD
Peak 1 in 1,000 year flood level	4.58m OD	4.66m OD

Information on Surface Water Flooding on Environment Agency Website

The map on the next page 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 is an area with a low predicted risk of surface water flooding with a depth of up to 300mm at the north west end of the site.

Site Levels

The levels on the site vary between 0.86m OD in a lower area at the north western end of the site to 1.65m OD nearer to Littleworth Drove. The level of Littleworth Drove adjacent to the site varies between 2.60m and 2.70m OD.

A full topographical study has been carried out and a plan with levels of the site is shown on page 14 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 site is approximately 2.6 km from the River Welland, which is main river and maintained by the Environment Agency.

This area south west 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 North and South Drove Drains 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 west bank of the River Welland.
2. Failure or overtopping of the tidal defences of the River Welland.
3. Flooding from high water levels in the IDB drainage system.

4. Blockages in local surface water systems

1. Failure or Overtopping of the west bank of the River Welland.

The River Welland is located 2.9 km east of the site.

The maximum predicted level of the River Welland in a 1 in 100 year event in 2115 is 4.67m OD. The minimum level of the west bank of the River Welland at this location is 5.85m OD. Therefore the risk of over topping of this bank is very low.

If the west bank of the River Welland breached at a location due east of the site the flood water would initially flow into the South Drove Drain, which would then rapidly increase levels in the South Drove and the North Drove Drain. Although W & D IDB would operate the pumps at Pode Hole to try to alleviate the situation water levels would rise to 1.5m OD and start to flood onto lower agricultural land located between the River and the A16 road. As the road is higher than the surrounding agricultural land flooding would initially be limited to the eastern side of the road, but if the breach remained open for a number of days then lower land on the western side of the road could be flooded.

The map showing the predicted flood depths in a 1 in 100 year event in 2115 indicates that flood depths of between 500mm and 2.0 metres could occur on the site.

This risk will be adequately mitigated by ensuring the proposed ground floor level of the proposed new dwellings is above this predicted flood level.

2. Failure or Overtopping of the tidal defences of the River Welland.

The nearest tidal defences are the banks of the River Welland north of Spalding, which are 8.0km north east of the site.

The SFRA maps indicate floodwater from a breach in the tidal bank in a 1 in 200 year event in 2115 would probably reach the A151 Spalding to Holbeach Road, but not spread any further south.

Therefore this source of flooding can be considered remote and will be adequately mitigated by ensuring the proposed ground floor level of the proposed new dwellings is above the predicted flood level following a breach in the fluvial defences.

3. High Levels in the IDB Drainage System.

North and South Drove Drains are the main IDB watercourses in this area and these are maintained by Welland and Deepings IDB (W & D IDB). The water levels in these drains is controlled by the electrically operated and diesel powered pumps at Pode Hole Pumping Station. W & D IDB have stated that the normal water level at Pode Hole Pumping Station is -1.20m OD and the design level in a 1 in 100 year event is 0.18m OD.

W & D IDB have a policy of reviewing standards of protection at regular intervals and would carry out improvements over the next 100 years to ensure that all agricultural land and properties in this catchment would continue to have a satisfactory standard,

and therefore it can be assumed that the maximum design level in 2115 will be 0.18m OD.

W & D IDB have a policy of continual maintenance to all the pumps at Pode Hole to ensure that they will operate satisfactorily in a high rainfall event. The Board have contingency plans to operate the pumps if electricity supplies were compromised and have sufficient sources to repair plant and machinery if a breakdown occurred.

Drainage channels maintained by W & D IDB generally have a 1 in 10 year standard with up to 1.0 metre of freeboard, which provides between 1 in 50 year and 1 in 100 year standard against flooding. The risk of water levels in the drains north and south of Campains Lane in a 1 in 100 year event both now and in 2115 is extremely low.

Therefore the risk of flooding from IDB drainage channels can be considered to be extremely low, and will be adequately mitigated by ensuring the proposed ground floor level of the proposed new dwellings is above the predicted flood level.

4. Blockages in local surface water drainage systems

It is anticipated that the surface water from the proposed new dwellings will be discharged into a storage pond and discharged at a low rate into the IDB drainage system. The hardstandings should be constructed with permeable paving or gravel.

Therefore the risk of flooding from surface water 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. However in an extreme event at this location water levels would only rise slowly and residents would have sufficient time to assess the situation and take any action necessary.

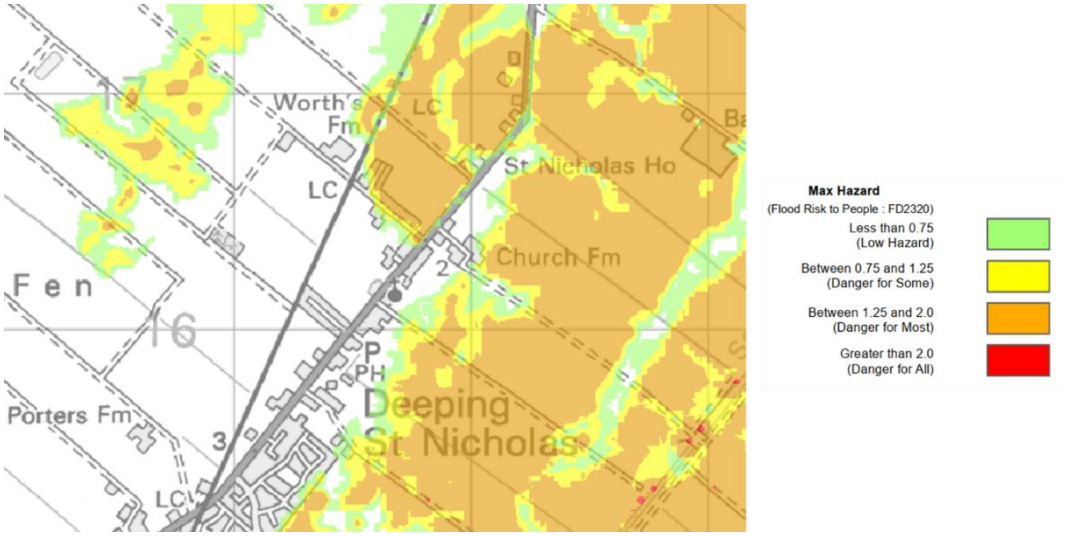
Residual Risk – Extreme Events

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

There are no records of this area of Deeping St Nicholas having been flooded in the last 60 years.

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. An extract from the hazard map on this website is shown below.



As the development is in flood zone 3 and the flood hazard in a 1 in 100 year event is between 1.25 – 2.0 (danger for most) reference should be made to Category D9 in the matrix which shows the advice for this category is as follows:

The Environment Agency requires direct consultation on proposals in this hazard zone. The NPPF requires that the 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 Environment Agency also wish to be consulted on the sequential test evidence. Applicants will need to demonstrate that housing proposals are required to meet an identified local housing need.

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

Finished floor levels (FFL) should be informed by the predicted flood depth maps (refer to the relevant 2115 1% or 0.5% tidal maximum depth map) and set as required below (single storey proposals must use the 0.1% event, 2115 scenario, for setting FFLs).

Depths 1.0m to 1.6m

Proposals must have a minimum of 2 storeys, with FFL set a minimum of 1.0 metre above existing ground level, flood resilient construction to a height of 300mm above the predicted flood depth and demountable defences to 600mm above FFL.

Depths 0.5m to 1.0m

FFL must be set 1m above ground level with flood resilient construction to a height of 300mm above the predicted flood depth.

Depths 0.25m to 0.5m

FFL must be set 500mm above ground level with flood resilient construction to a height of 300mm above the predicted flood depth.

Depths 0m to 0.25m

FFL must be set 300mm above ground level.

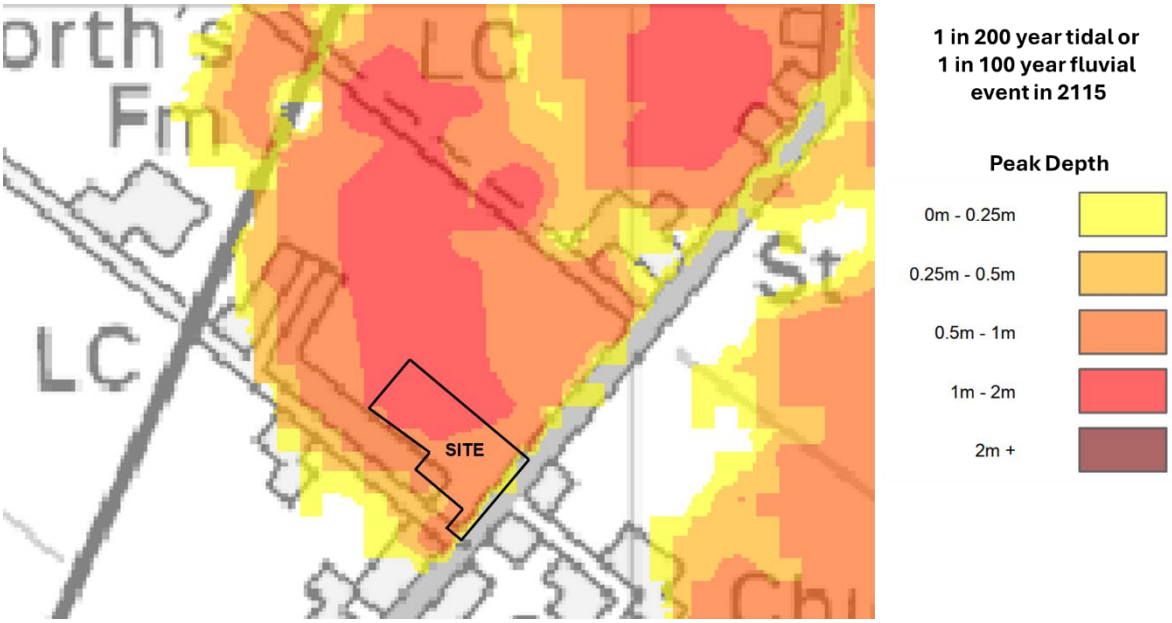
Climate Change

The recommendations for predicted 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 the 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.

Summary of flood risk to the Site.

The major flood risk to the site is if a breach were to occur in the south western bank of the River Welland, which is 2.6km from the site. Flood water would firstly discharge into South Drove Drain which would quickly fill to bank level and would flow southwards and northwards spreading the water over a larger area. Other IDB channels would react in the same way.

Part of the most recent map in the 2017 SFRA showing the predicted peak residual flood depths in 2115 for the 1% fluvial and 0.5% tidal event probability is reproduced below.

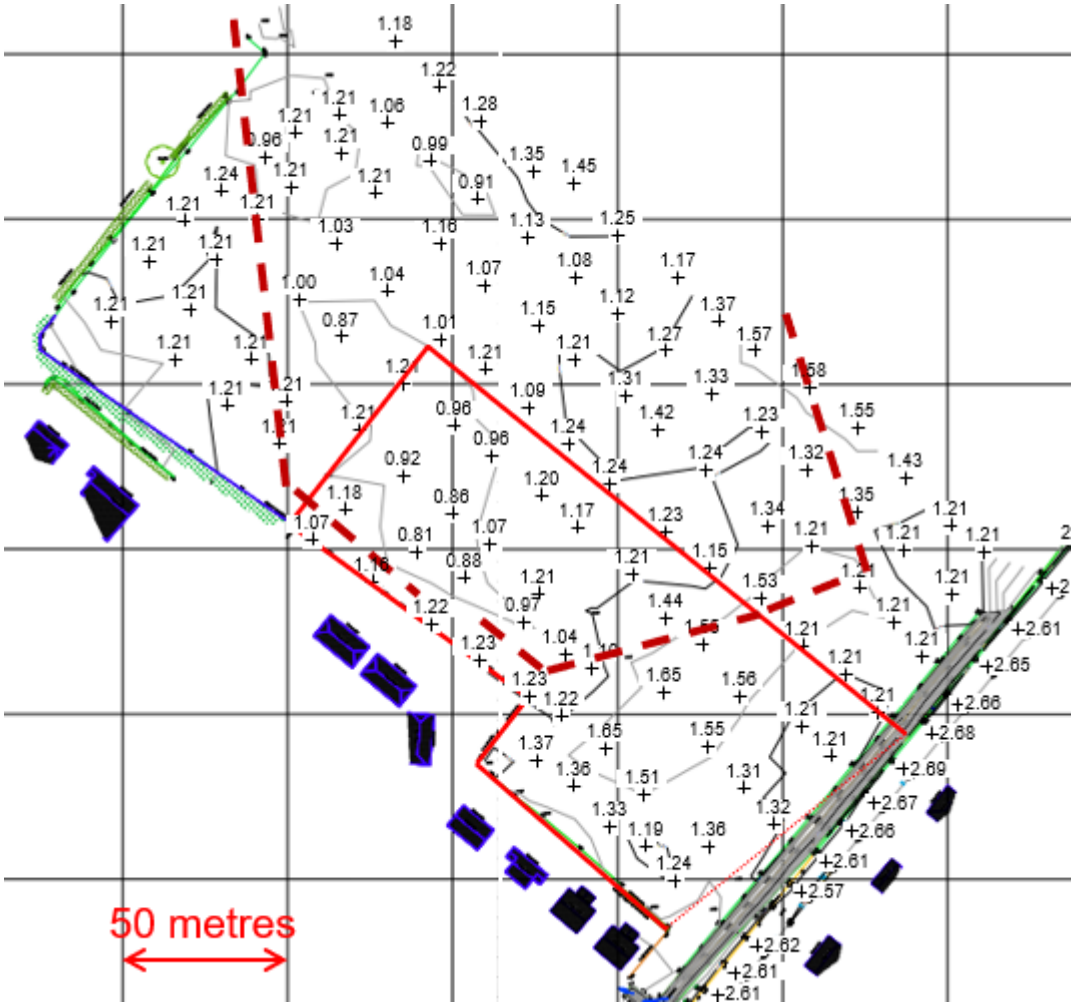


This predicts between 1.0 metre and 2.0 metres depth of flooding on approximately half of the site and between 500mm and 1.0 metre depth of flooding on the southern part of the site.

It can be seen that there is no flooding predicted on Main Road (or Littleworth Drove) south east of the property, or in the fields south east of the road. The level of the road is between 2.60m and 2.70m ODN south east of the site.

Levels from the topographical survey have been reproduced at a different scale and the area of the survey is shown below. The red line denotes the boundary of the

proposed development and the area inside the brown dotted line is the area where the flood depth is predicted to be greater than 1.0 metre in a 1 in 100 year event in 2115. The area outside the brown dotted line is where the predicted flood depth is between 500mm and 1.0 metre.



The best interpretation of map is that most of the levels outside the brown dotted line are above 1.20m ODN and most of the levels inside the line are below 1.20m ODN. Therefore taking the average of levels along the dotted brown line where the predicted flood depth is 1.0 metre to be 1.20m ODN, the predicted flood level in a 1 in 100 year event in 2115 can be taken to be 2.20m ODN.

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 after a major breach of the River Welland, and ensure there is no danger to residents when they are asleep.

All new buildings should be constructed with two storys and with all bedrooms on the first floor. The finished ground floor levels should be set at a minimum level of 2.25m ODN.

The buildings should be designed incorporating flood resistant and resilient techniques to allow it to be refurbished after being flooding to a depth of approximately 300mm above the floor level of the new building.

The dwellings on the northern part of the site where the predicted flood depth is greater than 1.0 metre should also be fitted with demountable defences to 600mm above finished floor level.

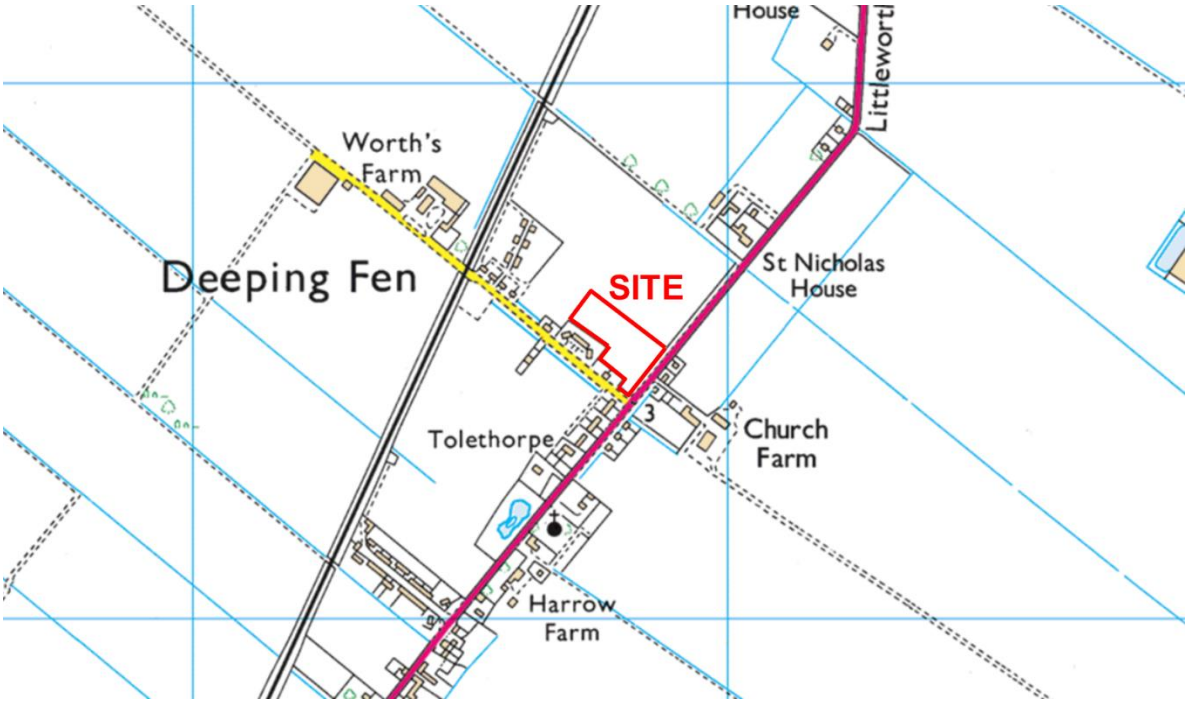
All occupiers of the properties should register with the Environment Agency's Floodline Warnings Direct Service.

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9th July 2024

LOCATION PLAN



PLAN OF IDB DRAINS



PROPOSED SITE PLAN



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'a

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 1 the central and 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

1) Flooding from Tidal River Welland

The FRA has identified the first source of flooding where the new climate change recommendations could affect the predictions of flood levels in 2115 at the development site is flooding from the tidal River Welland.

The contingency allowance in metres for the years 2055 and 2115 using 1990 as a baseline in the SFRA compared with the guidelines is as follows

Year	SFRA	2013 guidance	Revised 2016 guidance
2055	0.33	0.395	0.412
2115	1.14	1.205	1.24

Therefore it can be seen that the revised guidance increases the maximum allowance for sea rise in 2115 by 100mm for the maps in the SFRA and 40mm for maps issued by the Environment Agency. Although the maps in the SFRA indicate flood depths of up to 500mm could occur on the site this report has concluded that it is unlikely to be

the result of tidal flooding. The small increase in maximum tide levels will not change the predictions of flood depth on this site.

2) Flooding from River Welland, Coronation Channel and the IDB drainage system

As the development is in flood zone 3 and is classed as more vulnerable, the central climate change allowance, which is 25%, should firstly be considered. After considering the effects of this increase the higher central, which is 35%, 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 25% and 35% will not significantly change the conclusion in the SFRA of what might happen if a breach occurred in the bank of the Coronation Channel or the Barrier Bank. If there are additional flows along this part of the Coronation Channel and 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.

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.

South Holland 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 South Holland IDB will continue to review the modelling they have already carried out and when the Board consider these refurbishments adequate arrangements will be made to incorporate the latest climate change projections in order that the Board continues to provide the same standard of service as the present day.

Therefore it is considered that the mitigation proposed for the development, with the recommendation that the new buildings should be raised to be a minimum level of 2.250m OD, satisfactory.