

**PROPOSED DEVELOPMENT AT
CAMPAINS LANE, DEEPING ST NICHOLAS, SPALDING PE11 3EX

FLOOD RISK ASSESSMENT**



View from Road

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

Revision A 16th February 2022 Maps amended and further information added

Revision B 4th March 2022 Appendix A deleted

This flood risk assessment has been prepared solely to support the planning application for the proposed development at Campains Lane, 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 other purposes other than for which it was originally commissioned.

Introduction

An application was submitted to South Holland District Council in 2016 (reference H03-1005-16 for Planning Permission to construct a development of ten dwellings on land on the south west side of Campains Lane, Deeping St Nicholas, Spalding, PE11 3EX. The area is at present part of an agricultural field. The application was granted on appeal on the 13th March 2018. This report has been updated to accompany a new application for this site.

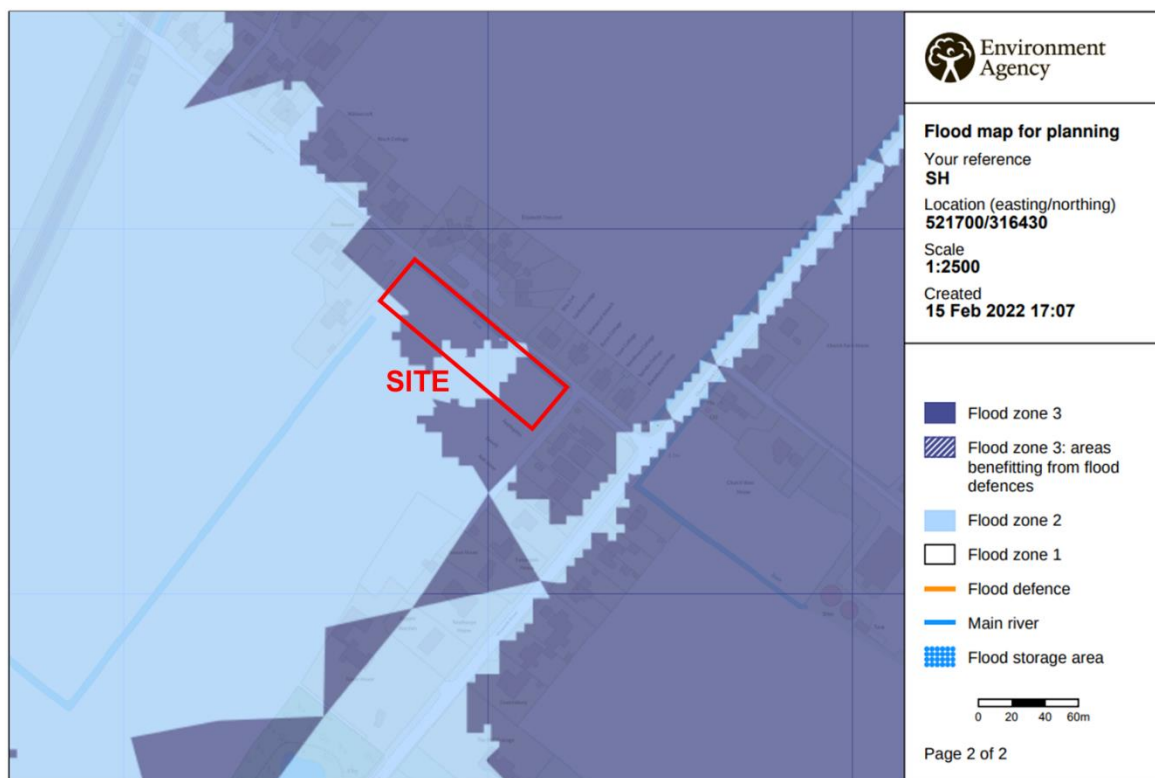
The site is within Flood Zones 2 and 3 as shown on the Environment Agency's Flood Zone Map. These maps do not take into account existing flood defences.

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 a greater part of the site is within flood zone 3 and a smaller part in flood zone 2.

Application Site

The development is located north west of the A16 road at Deeping St Nicholas. The National Grid Reference of the site is 521700 316450.

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 part of the proposed development within flood zone 3 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 a dwelling house is classified as "more vulnerable" and Table 3 of the Guidance states that residential use is only permitted after the sequential and exception test is followed.

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	✓*

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

This development can be classed as a windfall site within the village of Deeping St Nicholas. The development complies with the South Holland District Council's policy on these types of sites. All of the area west of Spalding is classified by the Environment Agency as being in Flood Zone 3(a) and therefore as some of this site is within flood zone 2 and it is likely to be a better site with regard to flood risk.

The principle of the sequential test being passed has been established with the granting of planning permission on the site in 2018.

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 ... 0 – 250mm

Extent of flooding .. High

Flood Hazard..... 0 - 0.75 (low hazard)

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 reports 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.

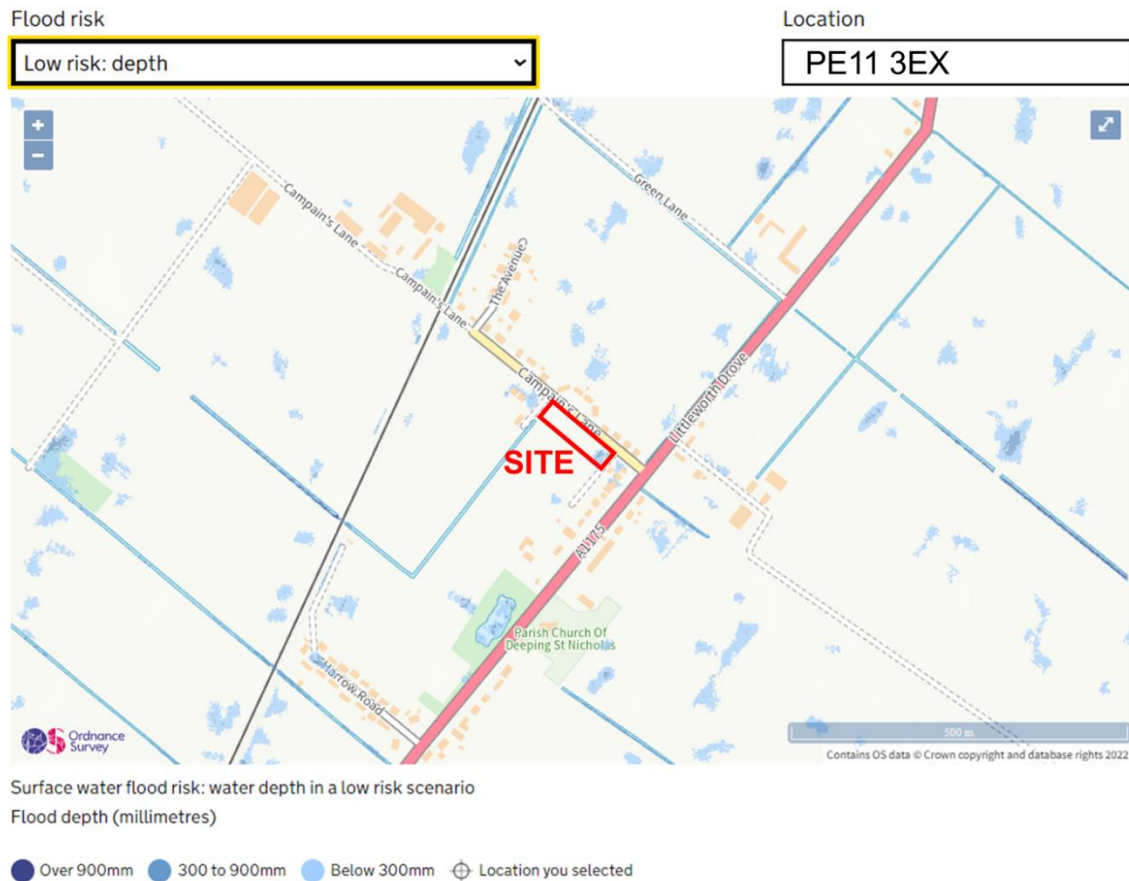
Information from the Environment Agency

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 below 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 a low predicted risk of surface water flooding with a depth of up to 300mm near the south eastern boundary of the site.

Site Levels

The levels on the site vary between 1.18m OD in a low area in the eastern corner to 2.01m OD on the north western boundary. There are two lower areas adjacent to the IDB drain alongside Campains Lane but most of the site is at a level of 1.50m OD and above. The level of Campains Lane varies between 2.10 and 2.30m OD. The floor levels of the existing houses on the north eastern side of the road are approximately 1.80m 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 2.9 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 Drain which also is operated by Welland and Deepings IDB.

Potential Sources of Flooding

The following sources of flooding have been identified:

1. Due to high water levels in the IDB Drainage system
2. Failure or overtopping of the west bank of the River Welland.
3. Failure or overtopping of the tidal defences of the River Welland.
4. Blockages in local surface water systems

1. 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 this source in a 1 in 100 year event both now and in 2115 is adequately mitigated.

2. 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 1 in 1000 design level in the River Welland is 4.67m OD. The minimum level of the west bank of the River Welland at this location is 5.85m OD. Therefore as long as the bank does not fail there is no risk of overtopping of the bank and therefore no risk of flooding to the proposed development.

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. Flooding would then start to take place on lower land north east of the development site and the maps in the SFRA predict that the depth of flooding would be between 0mm and 250mm deep on the development site.

Therefore the flood risk from the River Welland will be adequately mitigated by raising the proposed ground floor levels above the maximum predicted flood level.

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

The tidal defences are 8 km north east of the site, to the north of Spalding. It is most unlikely that flood water from a breach of these defences would flow as far as Deeping St Nicholas. Therefore it can be considered that the food risk from this source is adequately mitigated.

4. Blockages in local surface water drainage systems

There are no surface water sewers or highway drainage systems along Campains Lane that could cause any significant flooding to the development site. Any flood risk from surface water will be adequately mitigated by raising the proposed ground floor levels above the maximum predicted flood level.

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 the area around Campains Lane having been flooded in the last 60 years.

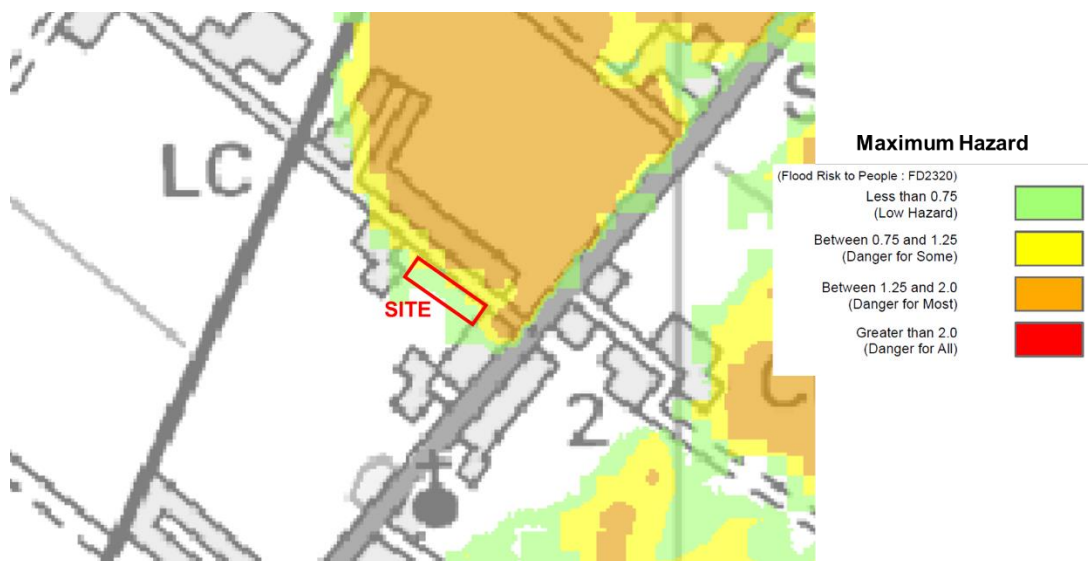
Climate Change

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 the FRA. The effects of these new recommendations are considered in Appendix A of this report (pages 15 to 18).

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.

The map showing the flood hazard in a 1 in 100 year event in 2115 is shown below.



As a greater part of the development is in flood zone 3 and the flood hazard in a 1 in 100 year fluvial or 1 in 200 year tidal event is less than 0.75 (low hazard) reference should be made to Category F8 in the matrix which shows the advice for this category is as follows:

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).

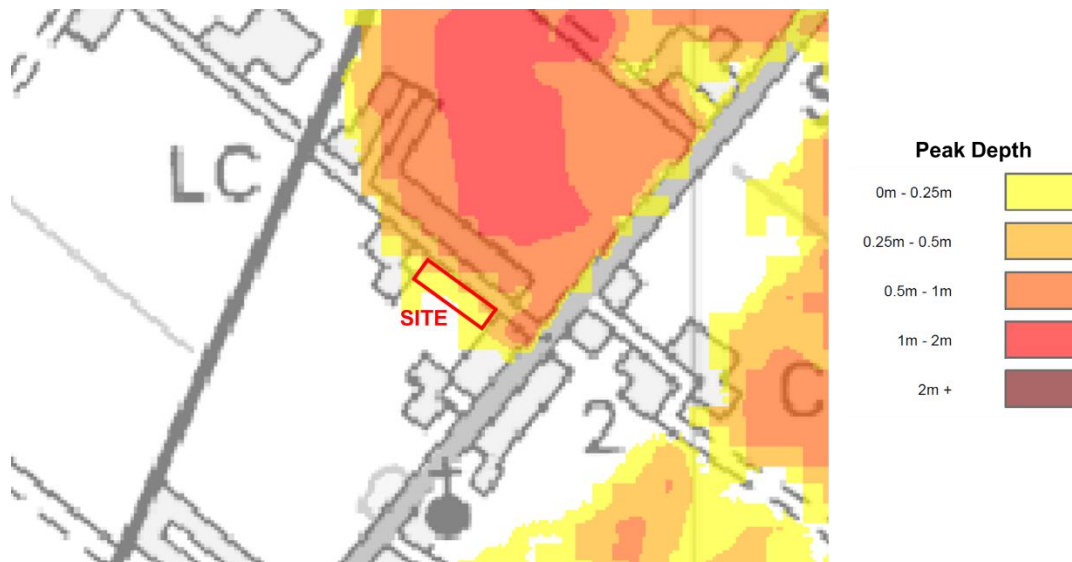
Finished floor levels (FFL) should be set 300mm above ground level for two storey proposals. Single storey proposals must set FFL's above the 0.1% event breach in the 2115 scenario.

Summary of flood risk to the Site.

The major flood risk to the site is if a breach were to occur in the southern bank of the River Welland, which is 2.9km from the site. Flood water would firstly discharge

into South Drove Drain which would as well as quickly filling to bank level 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 peak residual flood depths in 2115 for the 1% fluvial and 0.5% tidal event probability is reproduced below.



This predicts between 0 and 250mm depth of flooding on the site, and between 250mm and 500mm depth of flooding to Campains Lane. The predicted flood depth in the area north of Campains Lane is between 500mm and 1.0 metre.

The level of Campains Lane adjacent to the site is between 1.95m and 2.30m ODN, and the level of the site varies between 1.18m OD and 2.01m OD across the site itself. This range of land levels is predicted to suffer flooding of between 0 and 250mm, according to the map in the 2017 SFRA. If we assume that the LIDAR levels used to produce the SFRA maps have not picked up the low levels in the two low areas we can assume the land levels used to produce this map are between 1.6m and 1.9m OD. It can also be assumed the flood water flowing south westwards from the River Welland will flow over Campains Lane and only flow into the part of the field alongside Campains Lane. From this we can estimate a maximum flood level on the site to be 2.0m OD.

Therefore to provide adequate mitigation for flooding to the site it is recommended that the minimum ground level of the proposed houses should be 2.20m OD.

Conclusions

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

Although the site is in flood zones 2 and 3(a), the actual risk of the site flooding from any Environment Agency watercourse is very low.

There is a residual risk of flooding to the site, which is the risk caused by a breach in the west bank of the River Welland, and the maximum flood level in 2115 is estimated to be 2.00m OD.

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 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

The ground floor level of the proposed buildings should be at a minimum level of 2.20m OD.

If any flooding started to occur residents would be able to escape to the higher level of Littleworth Drove (A16 road) before flood water rose to the level of the Campains Lane, or in an extreme event shelter on the first floor of the building.

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

In this location it is recommended that the developer should consider designing the building to be flood resilient. This type of design would accept that water from a flood would enter the building, but would ensure the structural integrity of the building would be maintained and the building could be easily dried out and cleaned after a flood.

The design of the building should follow the guidance in "Improving the Flood performance of New Buildings" produced in 2007 and available on the Government website.

On site surface water drainage should be discharged into soakaways and these should be designed to BRE Digest 365 and approved under Building regulations.

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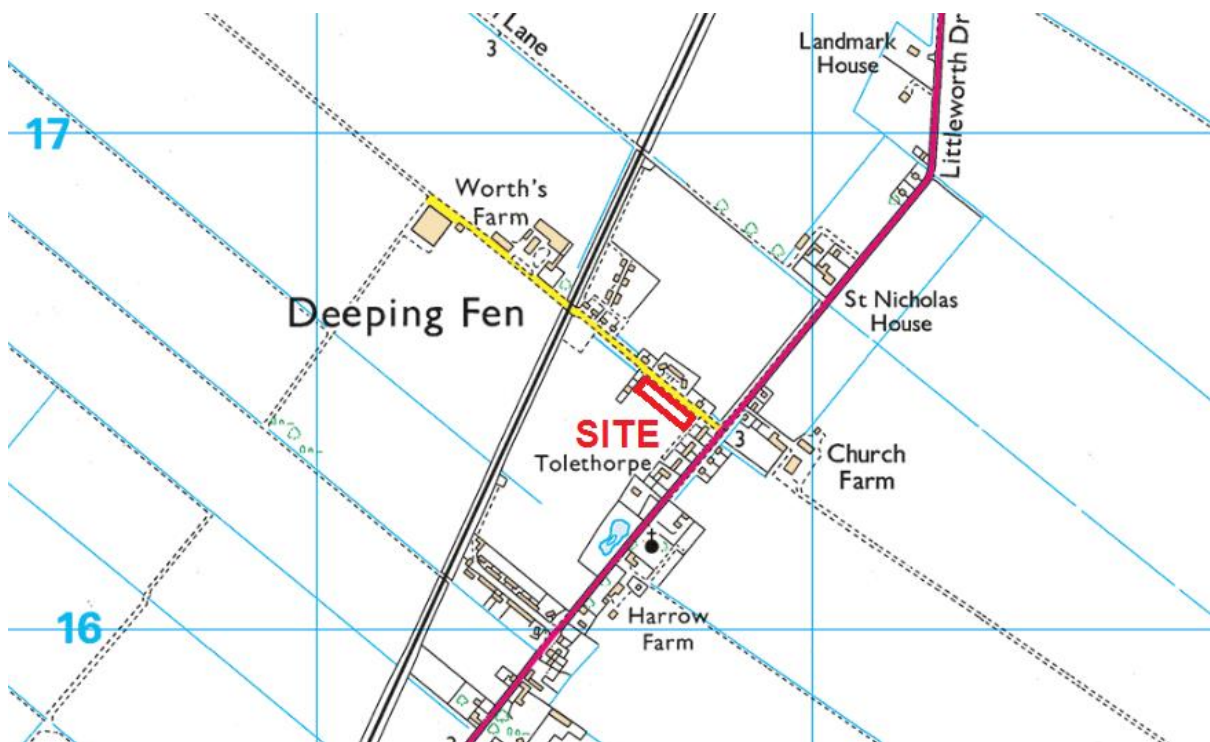
stuart.hemmings@btinternet.com

16th September 2016

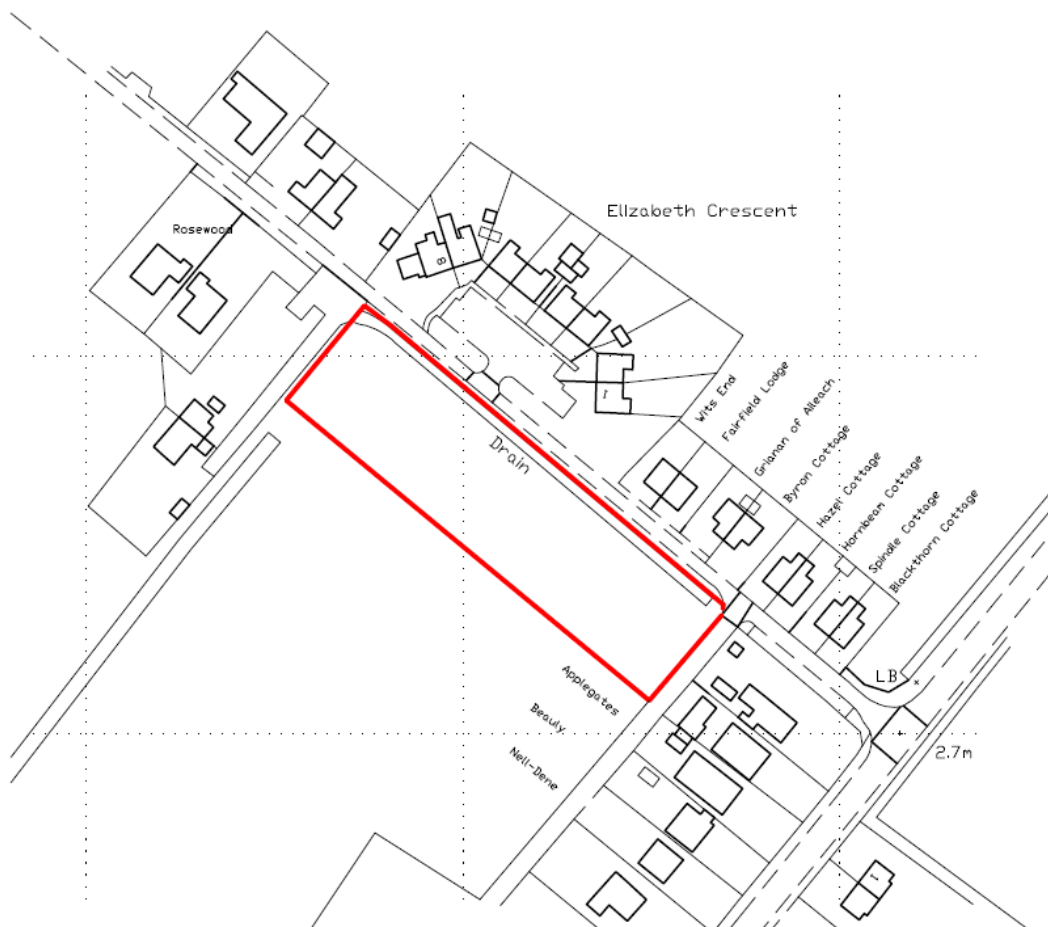
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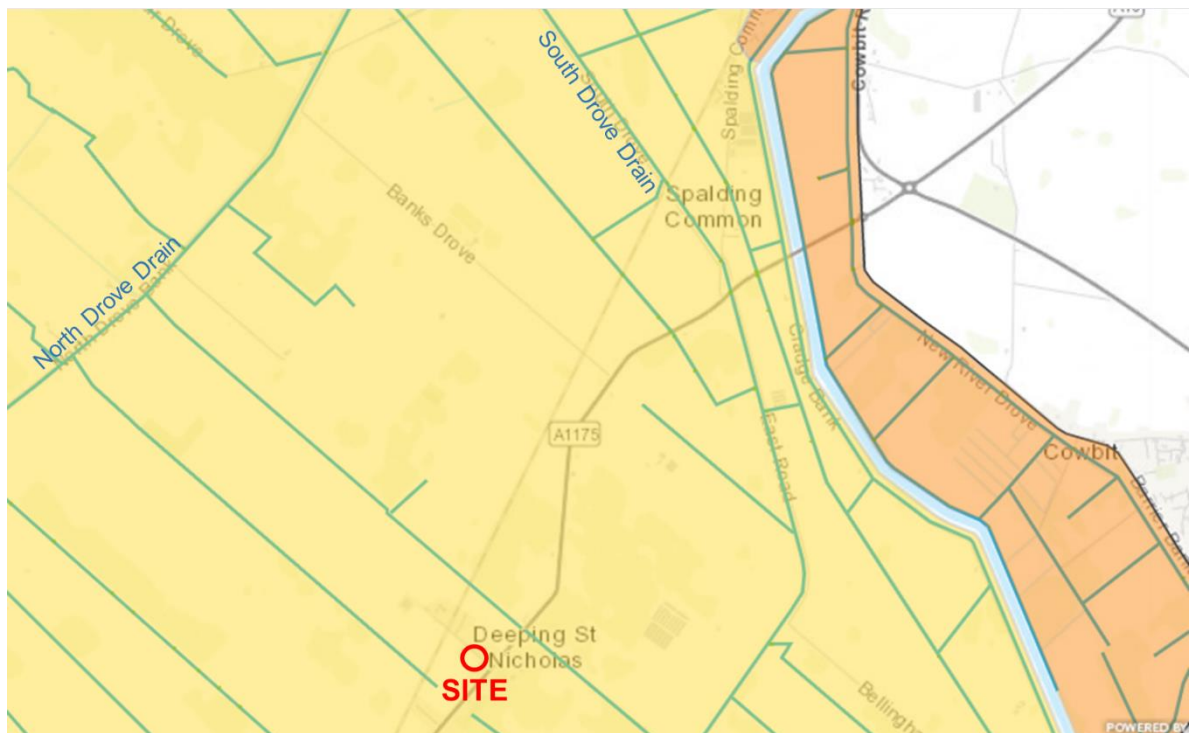
LOCATION PLAN



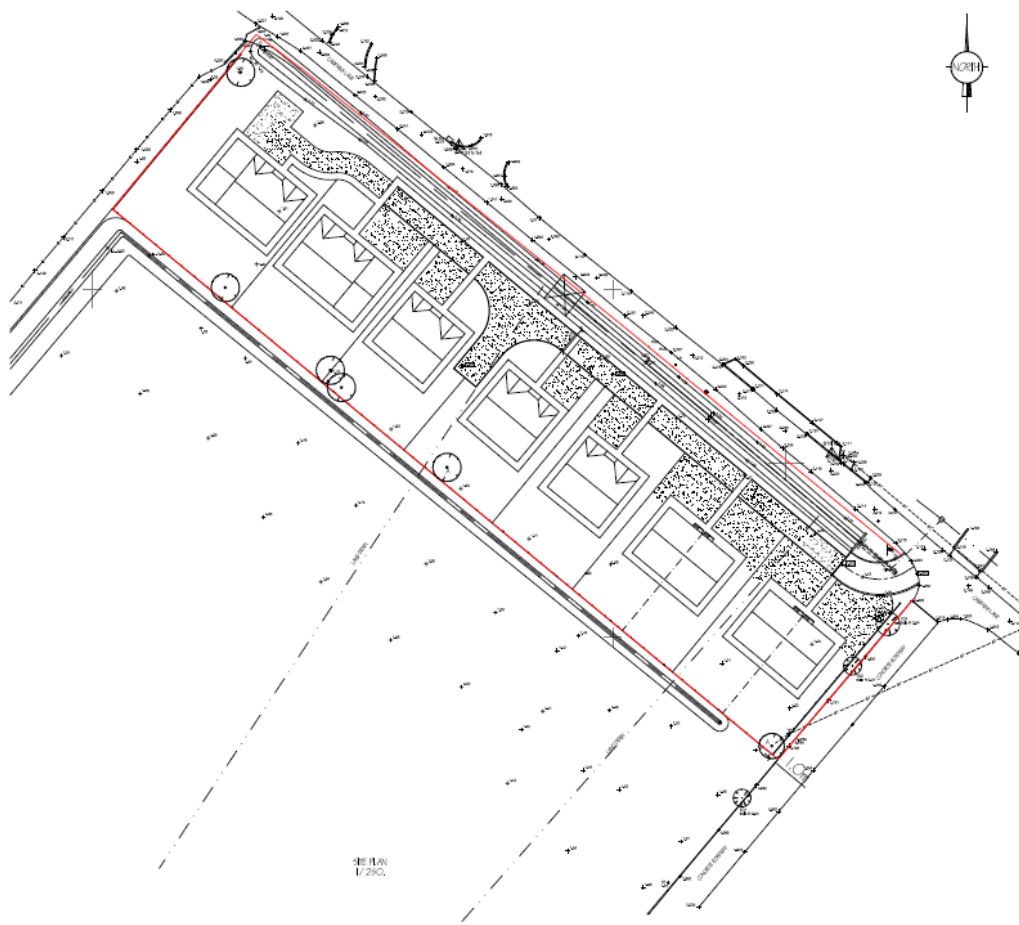
PLAN OF SITE



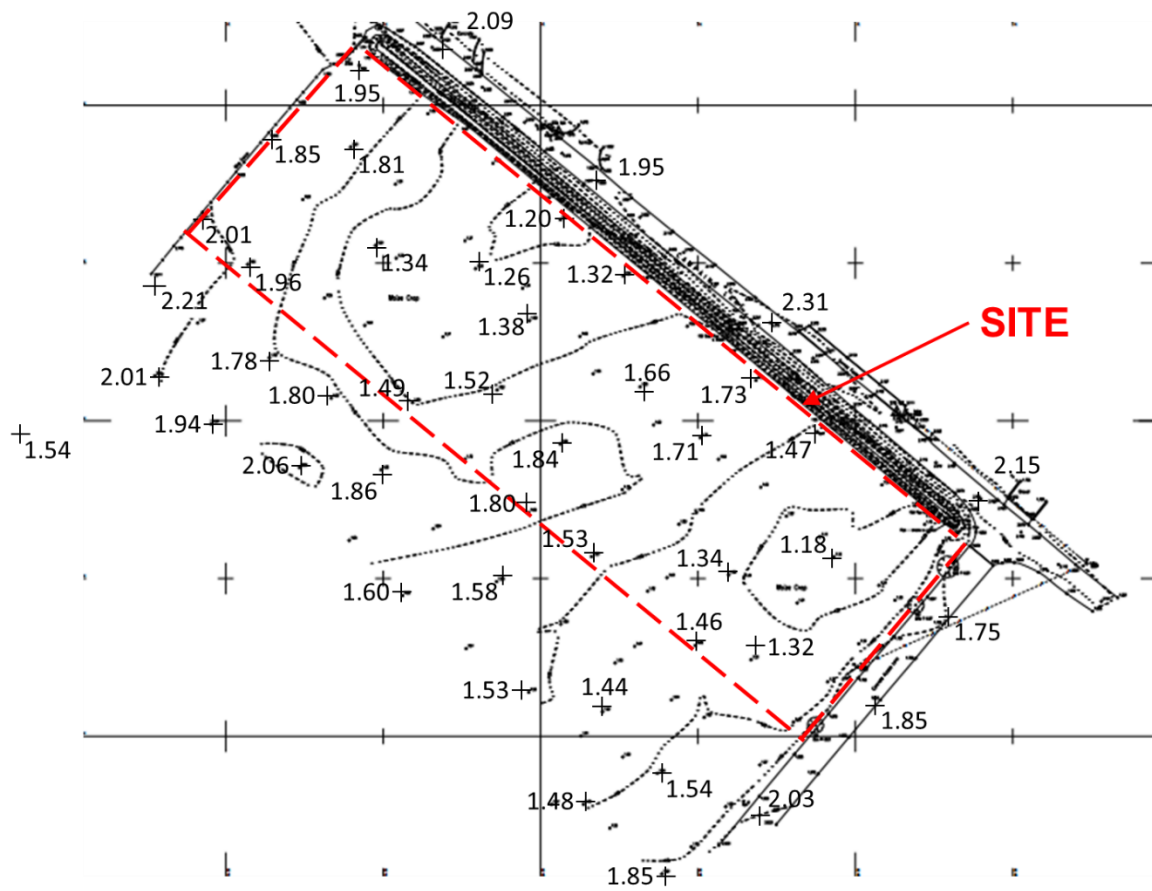
PLAN OF IDB DRAINS



PROPOSED BLOCK PLAN



LEVELS SHOWN ON THE TOPOGRAPHICAL SURVEY



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

Fluvial Flooding from River Welland.

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 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 levels should be a minimum level of 2.20m OD is satisfactory.