

PROPOSED DEVELOPMENT AT 11a SPALDING COMMON SPALDING PE11 3AS FLOOD RISK ASSESSMENT



View from Road

S M Hemmings B Sc C Eng MICE MIWEM,
69 Charlotte Way,
Peterborough,
PE3 9ER

This flood risk assessment has been prepared solely to support the planning application for the proposed development alongside 11a Spalding Common 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 construct a residential development consisting of four two bedroom terraced houses and one two bedroom bungalow on land at 11a Spalding Common, Spalding, PE11 3AS.

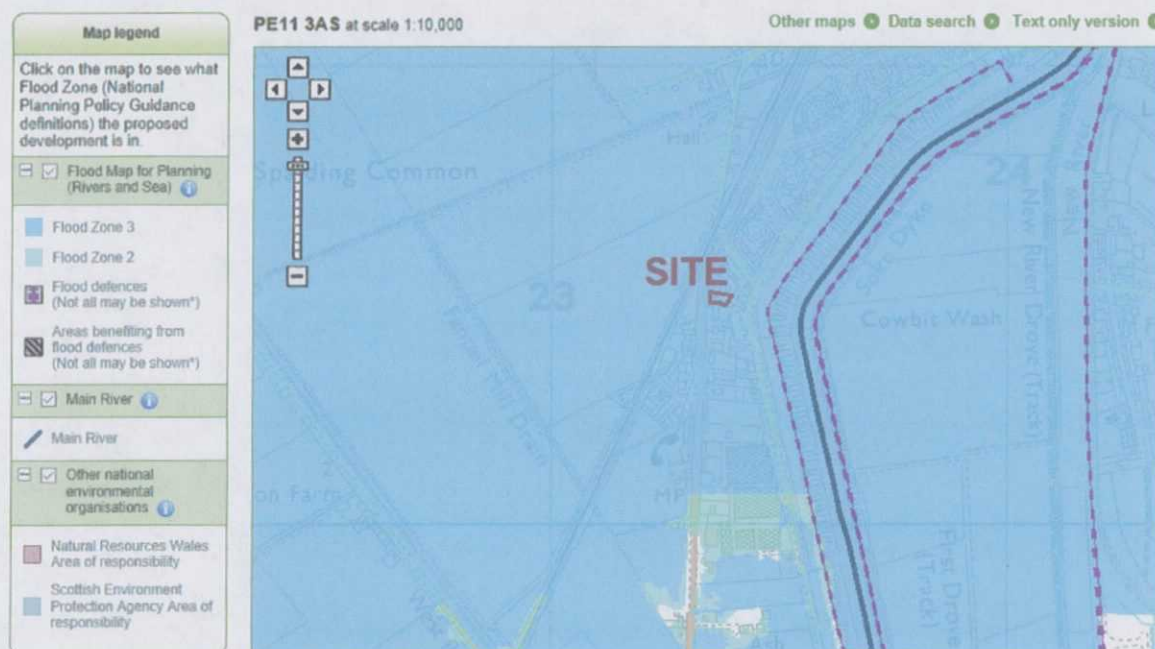
The site is within Flood Zone 3 as shown on the Environment Agency's Flood Zone Map. These maps do not take into account existing flood defences.

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 a greater part of this area south 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 523370 320495.

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 designated to be within Flood Zone 3(a) "High Probability" 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.

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 the area of central Spalding is in Flood Zone 3. Therefore it would be difficult to find a similar site for development that is in a lower flood zone.

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 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 following information about the flood risk to the proposed development has been gained from the maps produced for the South Holland District Council Strategic Flood Risk Assessment:

1. Report Maps

- Map 5 indicates the site to be low or medium risk and protected by flood defences.
- Map 6 indicates the peak depth is zero for the present day 1% fluvial / 0.5% tidal event probability.
- Map 7 indicates the peak velocity is zero for the present day 1% fluvial / 0.5% tidal event probability.
- Map 8 indicates the risk extent is low for the present day 1% fluvial / 0.5% tidal event probability.
- Map 10 indicates the actual risk extent for the 0.1% event probability is zero.
- Map 12 indicates the actual risk extent is zero.
- Map 13 indicates the 1% fluvial / 0.5% tidal event probability for 2115 for the site is low.
- Map 14 indicates the actual risk extent for the year 2115 for the 0.1% event probability is low.
- Map 16 indicates the site is within the rapid inundation zone for both the present day and 2115.

2. 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 also illustrate the residual flood hazard which is as follows:-

For the present day	Depth of flooding.... 0 – 500mm (west) 500mm – 1.0m (east)
	Extent of flooding ... Medium or High
	Hazard Moderate
	Velocity 0 – 0.1m/sec
For the year 2115	Depth of flooding0 – 500mm (west) 500mm – 1.0m (east)
	Extent of flooding ... Medium or High
	Hazard Significant
	Velocity 0 – 0.1m/sec

3. 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	4.49	4.67	4.50	4.68

The chainage of the River Welland directly east of the development site is 2.0km. All of the bank levels between chainage 0.2km at Little London and 2.1km are above 6.0m OD. Further upstream top of bank levels vary between 5.80m OD and 6.00m OD.

4. 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 site of the proposed development slopes from the front where the existing path level is 3.25m OD to an approximate level of 1.95m OD at the rear of the site. There is a small area of lower land where the level is lower at 1.73m OD. These are the levels on the site after all of the buildings have been demolished. The road (Spalding Common) slopes eastwards and the level of the west footpath is 3.68m OD.

A section west to east is shown on page 10 of this report and a plan with levels of the site is shown on page 13 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 eastern boundary of the site is approximately 150 metres from 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. 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 5.0km 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 Spalding Common. The railway line to the west of Spalding Common would be a final barrier to any substantial amount of flood water reaching the site.

Therefore flooding from this source can be discounted for all foreseeable events.

2. Overtopping of the River Welland.

The west bank of the River Welland is at a level of above 6.00m O.D. directly west of the development site. If a breach were to occur in the west bank of the River Welland when the river is at the maximum predicted level in 2115 in a 1 in 100 year event of 4.67m OD then water would flood into the area between the river and the road called Spalding Common. The maps in the SFRA predict that the maximum flood depth would be 1.0 metre. In practice flood water would flow into the area between the river and Spalding Common and the level would rise until the flood water started to flow over the road north and south of this site. The flow over the road would be between 100mm and 200mm deep and from this the maximum level of the flood water can be estimated to be 3.40m OD. This would give a maximum depth of water on the site of between approximately 200mm on the west side of the site near the road to approximately 1.45 metres deep at the rear (east) boundary of the site.

In most cases breaching of river banks is caused by overtopping water eroding the back of the bank and causing failure. In this case the west bank of the River Welland has a freeboard of more than 1.0 metre and the likelihood of overtopping is remote. If the river level approached 5.00m OD two large syphons which discharge water into the Cowbit and Crowland Washes would be activated and this would immediately reduce water levels in the river.

Therefore it can be summarised that although the consequence of a breach is severe the risk of this occurring is extremely low.

3. Flooding from IDB watercourses

This area of Spalding Common is drained by Cradge Bank Drain which is on the eastern side of Cradge Bank. Cradge Bank Drain is maintained by Welland and Deepings IDB (W & D IDB) and flows into South Drove Drain.

The water level in North and South Drove Drain, which is maintained by W & D IDB is controlled by Pote 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 water levels rising to 2.00m OD in North Drove Drain is remote, 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 discounted.

4. Blockages in local surface water drainage systems

Highway drainage systems along Spalding Common could become blocked and water could flow onto the development site. However as the proposed finished ground floor level is approximately 200mm above the level of the footpath on the eastern side of the road this will ensure that flooding will not occur from this source to the proposed building.

Therefore the risk of flooding from this source is can almost be discounted.

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 Spalding Common area 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.

Summary of Risk of Flooding to the Site

The main risk to the site is if a breach were to occur in the west bank of the River Welland. The risk of this happening along this section of bank can be considered to be very low. The bank has a wide top and bank slopes are not steep.

However the hazard if the bank breached is considered as significant at the site as shown on the residual flood hazard map for 2115 in the SFRA. The maps in the SFRA predict that flood depths of between 500mm and 1.0 metres could occur on the site in both a 1 in 100 year and a 1 in 1000 year event in 2115. The relevant parts of the maps are shown below:

a) 1 in 200 year predicted flood depths in 2115

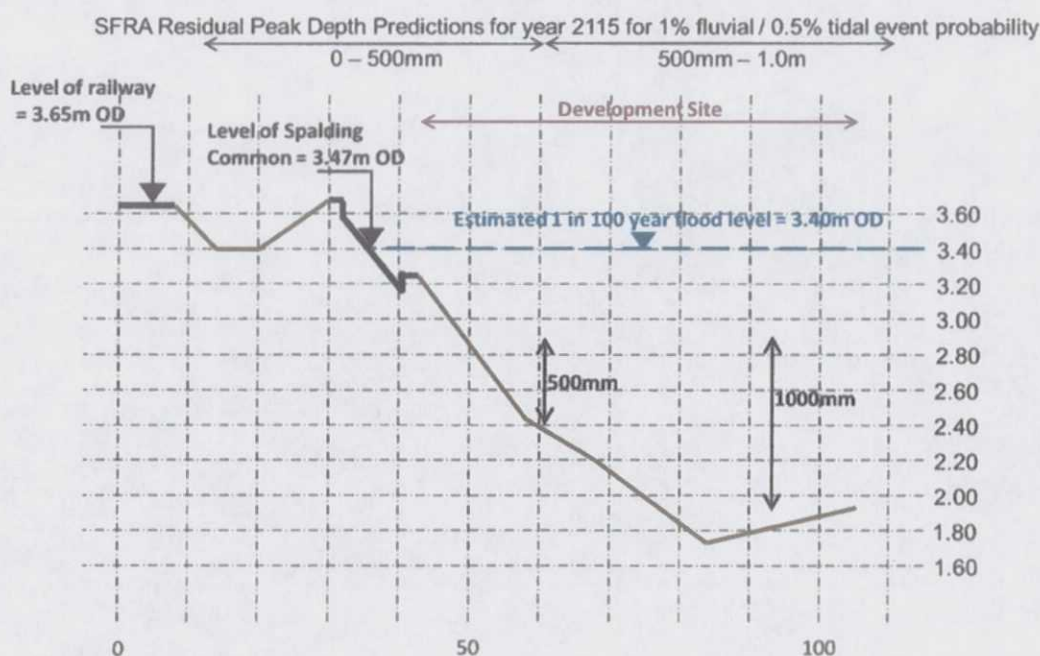


b) 1 in 1000 year predicted flood depths in 2115



Taking flood depths and levels of the site and the road (Spalding Common) the maximum flood level could be at any level between 2.9m and 3.5m OD. Referring back to the description on page 7 of what would happen if a breach occurred the maximum level of flood water would be 3.40m OD at which time it would flow over lengths of the road west of the site which would prevent the level raising further. The flood water flowing southwards between Spalding Common and Cradge Bank would start to discharge into the Welland and Deepings IDB South Drove Drain which would also reduce the risk at the development site.

This level has been shown on the cross section below.



The flood depths in the SFRA seem to underestimate the flood depths shown on the section above. This is probably because the LIDAR levels are not accurate for the site, and possibly the demolition of the bungalow on the site has left the site lower than it was before.

Therefore it is recommended that the minimum floor level of the houses at the front of the site should be 3.40m OD, which is approximately 150mm above the kerb level on the east side of Spalding Common in front of the site. The level of the bungalow should be 300mm higher than this at a level of 3.70m OD which is 450mm above the kerb level on the east side of Spalding Common in front of the site.

With the finished floor levels raised to level of 3.40m OD and 3.70m OD the risk of flooding from IDB drains can be discounted.

Conclusions

The following conclusions can be made:

- The proposed development is not in a functional flood plain as defined by the Technical Guidance.
- Although 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, but the consequence of a breach in the west bank and the flooding that would ensue can be considered significant.
- 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 dwellings 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.
- All two story properties with bedrooms on the first floor should be built with a minimum ground floor level of 3.40m OD, which is approximately 150mm above the kerb level on the east side of Spalding Common in front of the site.
- If single story buildings are proposed then these need constructed with a finished ground floor level of 3.70m OD this is considered to be satisfactory. which is approximately 450mm above the kerb level on the east side of Spalding Common in front of the site.
- If any flooding started to occur residents should escape along Spalding Common before flood water rose to the level of the road, 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.
- 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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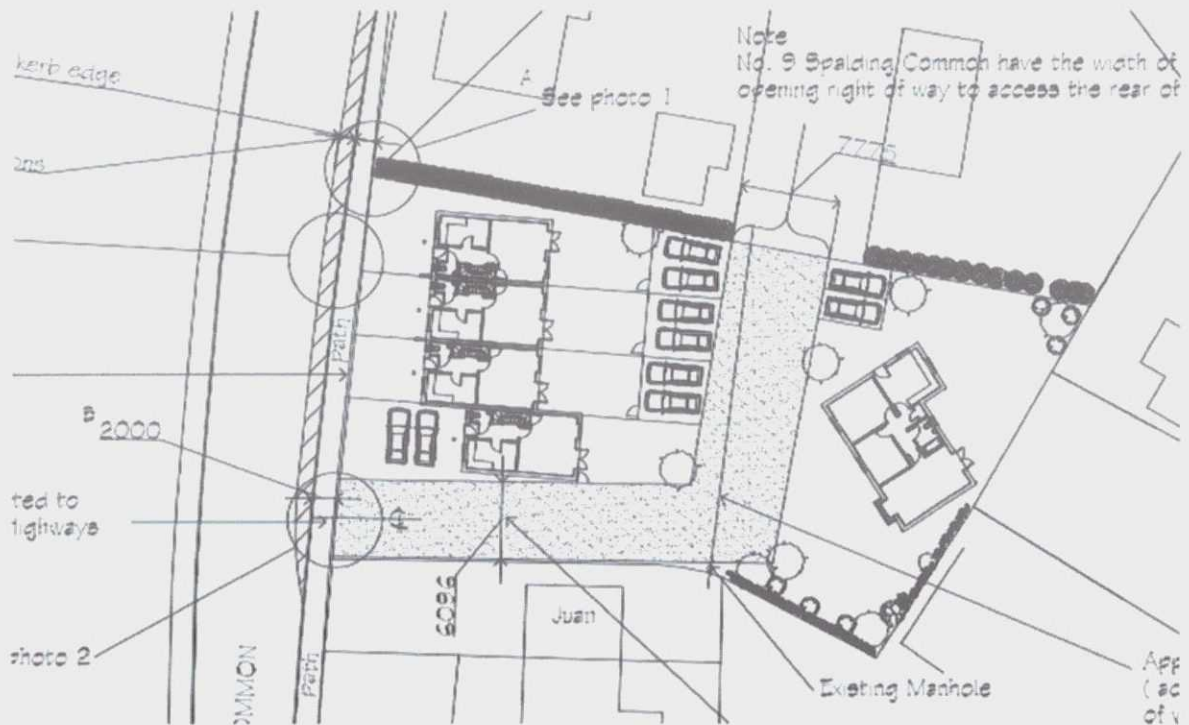
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3rd March 2017

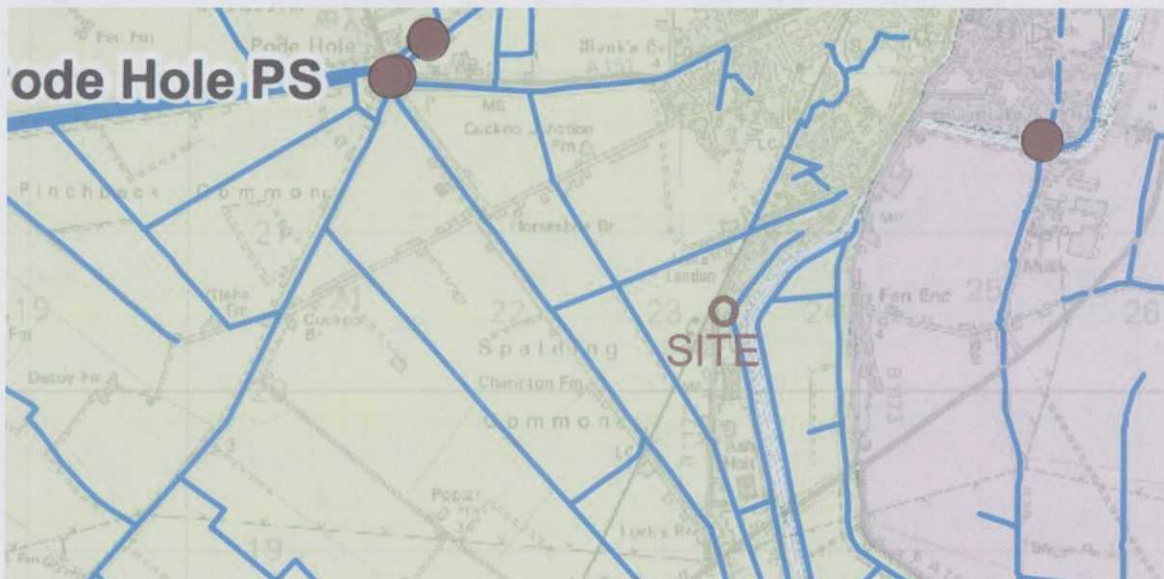
LOCATION PLAN



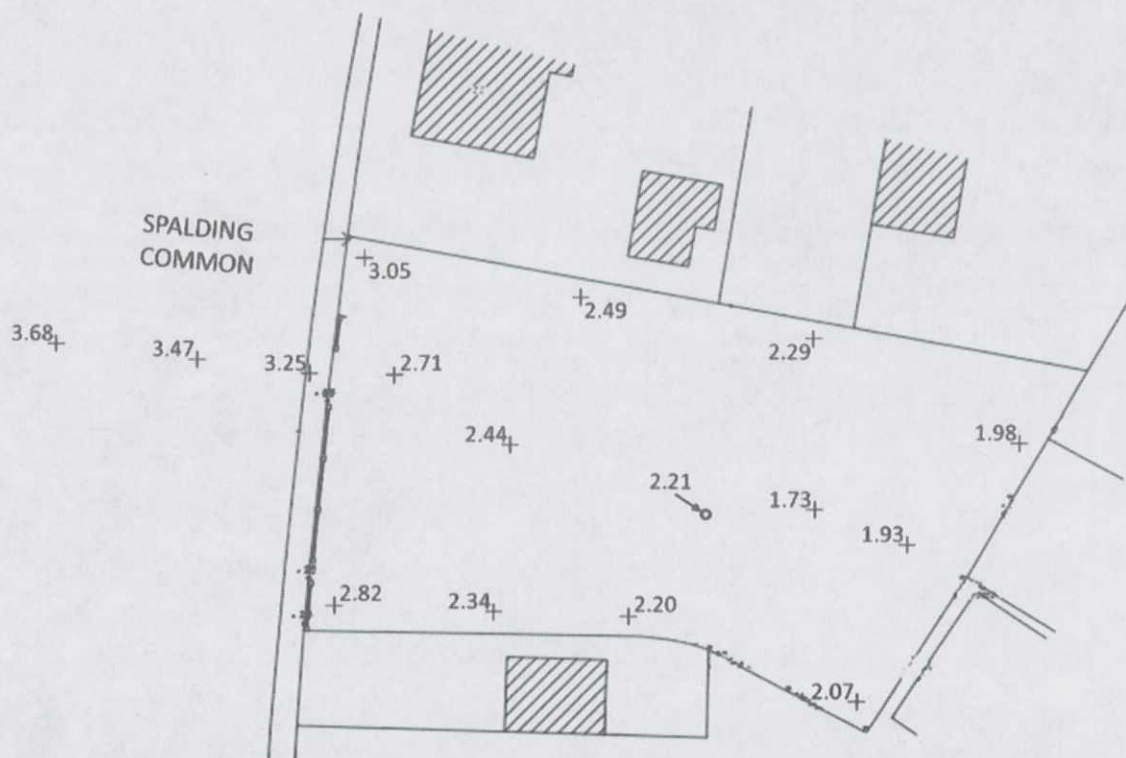
PLAN OF PROPOSED DEVELOPMENT



PLAN OF IDB DRAINS



PLAN OF SITE LEVELS



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)

<u>Area of England</u>	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 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 houses should be a minimum level of 3.40m OD and the floor level of the proposed bungalow should be a minimum level of 3.70m OD is satisfactory.